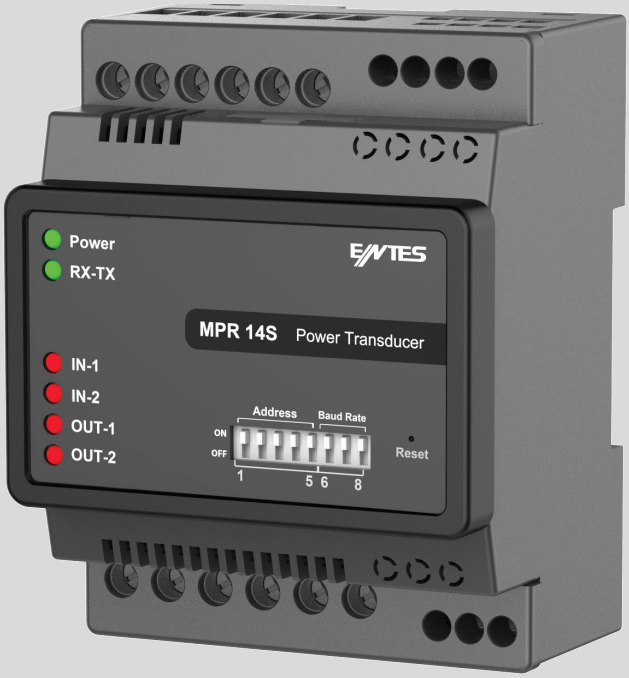
MPR-1X Series

Network Analyzer User Manual



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Index

SAFETY AND WARNING

Attention

If the following instructions are not carefully followed, the circumstances which can cause death and serious injuries might happen.

- The installation of the device must be performed by the qualified and trained personnel.
- Please, cut the whole power while installing the device. Please, use a suitable circuit breaker on the installation terminal.
- You must connect the power lead-ins of the device by using a current transformer. Do not apply direct current connection.
- Never, remove the front panel while the device is connected to the mains.
- Never, clean the device by any solvent or similar material. Only use dry cloth for cleaning it.
- Before, turning on the device, make sure that the connections are correct.
- Please, contact your authorized dealer in case of any problem with your device.
- The device is only for interior panel type assembly. Only the front panel of the device should be accessible from the switchboard.
- The fuse to be used must be CATIII and F type and the current limit value should be 1A
- Current measurement inputs must be connected with auxiliary current transformers which have reinforced insulation.
- The power meter shall not be used for primary protection or applications where its failure can cause harm or death.
- Please de-energize the device before replacing RTC backup battery. It must be Li/MnO2 battery.

The manufacturer firm cannot be held responsible in any way for any circumstance which might arise if the mentioned precautions are not implemented.

Safety

Please, read the entire operating manual before using the device.

- Connect a button or a circuit breaker between the mains and the supply inputs of the device.
- The button or circuit breaker to be connected should be close to the device.
- It should be labeled that the button or circuit breaker to be connected will be used for separating the device from the mains.
- This device is used for analyzing the electricity mains and it must not be used for main protection function.

Guarantee

The guarantee term of the device is 2 (two) years. In case of any problem, the repair of the device must be done only by the manufacturer firm; otherwise, the guarantee of the device becomes invalid.

OPERATING CONDITIONS

Operating Conditions	Value Range
Operating voltage	95-270 VAC/DC (±%10) ,12-50 VDC (for MPR-1X-D)
Frequency Range	50 ~ 60 Hz. (Tolerances up to +/-10%)
Maximum Measured Current	6A, Measurement should not be done without current transformer.
Maximum Measured Voltage	300 VAC (VLN) / 480x VAC (VLL)
Operating Temperature Range	-10 ~ +70 ºC
Storage Temperature Range	-20 ~ +80 ºC
Maximum Ambient Humidity	% 95
Communication Speed	2400 ~ 115200 bps

INTRODUCTION

General Specifications

- Wide supply voltage range (95 – 270 VAC/DC ±-10%, 12-50 VDC for MPR-1X-D series)
- 3 voltage measurement input
- 3 current measurement input
- 4 different language options
- 4 MB Internal Memory
- Real time clock (RTC)
- Alarm
- Time counters (Operating time and overall time)
- Measured parameters via RS-485 (MODBUS):
    - o Current
    - o Neutral current
    - o Voltage (Phase to Phase, Phase neutral)
    - o Active, Reactive and Apparent power
    - o Frequency
    - o Active Power
    - o Reactive Power
    - o Apparent Power
    - o Cos φ
    - o Power Factor
    - o Total Active Power
    - o Total Reactive Power
    - o Total Apparent Power
    - o Total Cos φ
    - o Total Power Factor
    - o Total Harmonic Distortion of the Current (% THD-I)
    - o Total Harmonic Distortion of Phase- Phase Voltages (% THD-VLL)
    - o Total Harmonic Distortion of Phase-Neutral Voltages (% THD-VLN)

Instant minimum and maximum measured parameters::

- o Current
- o Phase to Phase Voltage
- o Phase Neutral Voltage
- o Active Power
- o Reactive Power
- o Apparent Power
- o Frequency
- o Total Harmonic Distortion of the Current
- o Total Harmonic Distortion of Phase - Phase Voltages (% THD-VLL)
- o Total Harmonic Distortion of phase-neutral current (% THD-VLN)

Demand and Maximum Demand parameters measured by integration time:
  - o Current
  - o Active Power
  - o Apparent Power

- Insulated Digital Input and Output, Relay and Analog Output
- Saving 256 event logs
- DIN4 type rack assembly
- Measurement by 5 different connections: 3-phase 4-wire, 3-phase 3-wire, 3-phase Aron, 3-phase 4-wire balanced, 3-phase 3-wire balanced
- Adjustable Demand time
- Summer-Winter time application

Applications

This is a MPR-1 series 3-phase mains analyzer. It is a microprocessor based device which is designed for measuring all parameters of an electricity main; calculate consumptions and transferring desired parameters with Modbus and I/O outputs.

Thanks to the RTC clock chip and flash memory of the device, the operations performed by the operator such as interruption records, time and setting changes, reset operations are recorded in real time. These records can be remotely read and monitored with Modbus RTU protocol over RS-485 communication line.

The current connection is made by connecting it to a 1A or 5A secondary current transformer.

MPR-1 Product Family

Product Code	Dimensions	3xV, 3xI, Frequency, W VAr, VA,ΣP, ΣQ,ΣS, kWh, kVArh, Demand, Max, Min, Cosφ, I nötr	% THD I	% THD V	Ayrı Ayrı Harmonics	RS-485	Digital Input	Digital Output	Analog Output	Relay Output	Number of Samples In one Period	Memory	Current-Voltage Unbalances	X/5,X/1	12-50 VDC	95-270 VAC/DC
95-270 VAC/DC Besleme																
MPR-14S	DIN4	●				●					128	4MB		●		●
MPR-15S-22	DIN4	●	●	●		●	2	2			128	4MB		●		●
MPR-16S-21	DIN4	●	●	●	51	●	2			1	128	4MB	●	●		●
MPR-17S-23	DIN4	●	●	●	51	●	2	2	1		128	4MB	●	●		●
12-50 VDC Besleme																
MPR-14S-D	DIN4	●				●					128	4MB		●	●	
MPR-15S-22-D	DIN4	●	●	●		●	2				128	4MB		●	●	
MPR-16S-21-D	DIN4	●	●	●	51	●	2	2		1	128	4MB	●	●	●	
MPR-17S-23-D	DIN4	●	●	●	51	●	2	2	1		128	4MB	●	●	●	

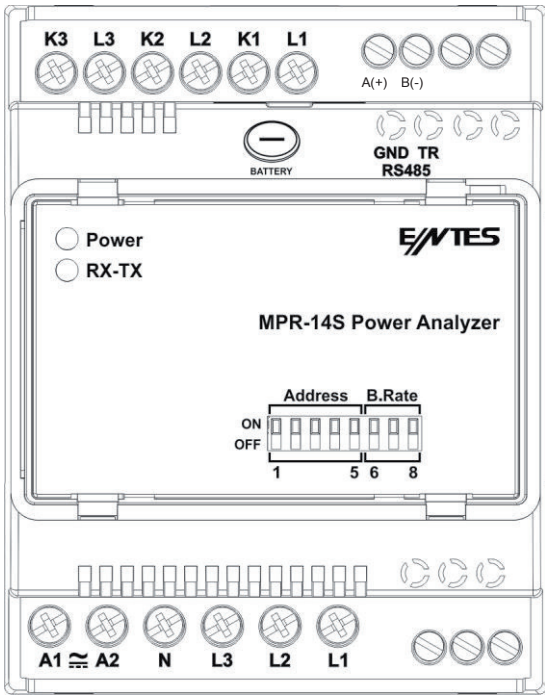
Appearance and Interface

The appearance of the device's front is as below:

Terminal Structures

The terminal structures according to the models are described in this section:

Structure of the MPR-14S Terminal:



Current Terminals: K1, L1, K2, L2, K3, L3
An external current transformer must be used for the 3-phase system connection to these terminals where the current up to 5A can be input.

Supply Terminals: A1, A2
Please, apply 95-270 VAC/DC (12-50 VDC for MPR-1X-D series) supply connection through these terminals.

Voltage Terminals: N, L1, L2, L3
Please, apply 3-phase voltage connection through these terminals.

Communication Terminals: A(+), B(-), GND, TR
RS-485 communication terminals are used for Modbus RTU communication connection. A (+) and B (-) terminals are connected in parallel between devices.

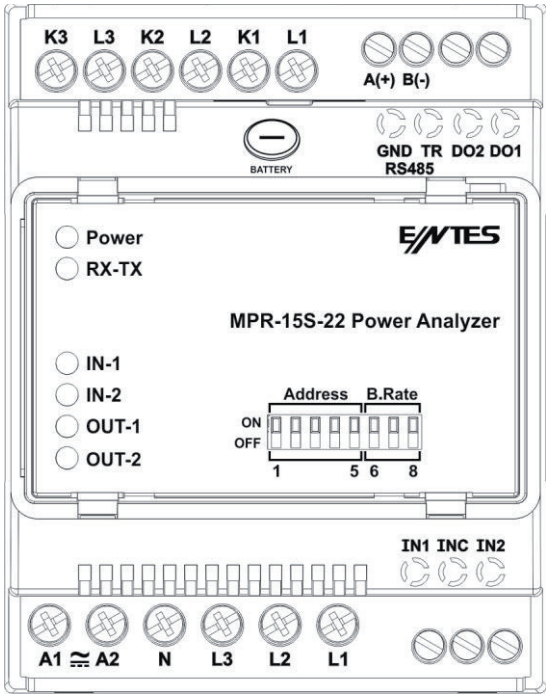
When the communication distance exceeds 10 meters and there are more than one device on the line, communication instability may occur. In this case;

- A 120 Ohm connection resistor from the device box is installed between the A (+) terminal and the B (-) terminal,
- Short circuit between the TR terminal and the A (+) terminal.

In this way, line balancing is done.

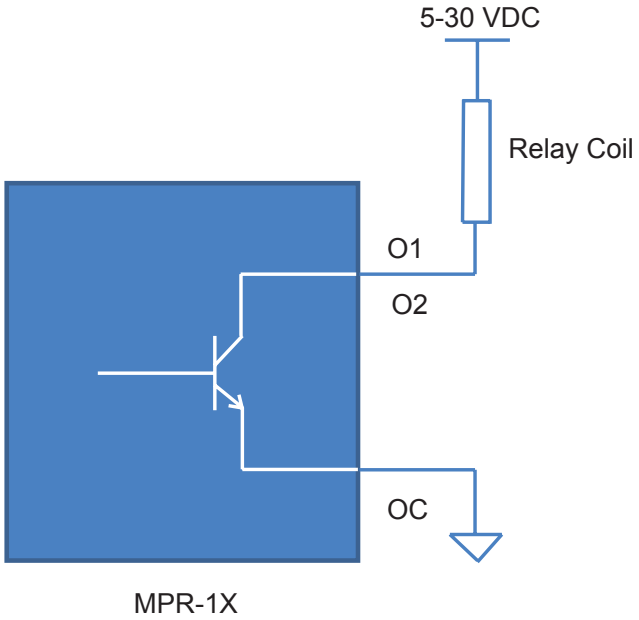
Structure of the MPR-15S-22 Terminal:

DOC terminals is referred to digital output common, digital output reference connection is done with this terminal.DO1 and DO2 is also referred to 1st and 2nd digital output terminals.
INC terminal is referred to Input Common and it is the digital input reference. IN1 and IN2 are also referred 1st and 2nd digital input terminals.



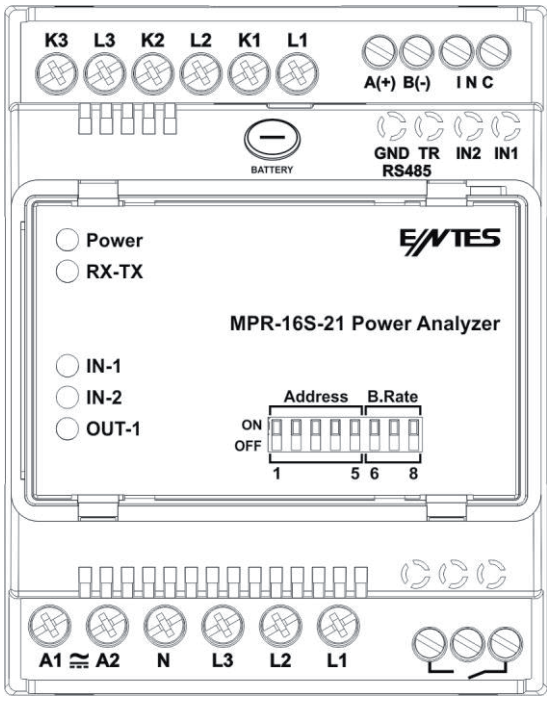
Digital Input Terminals: INC, IN1, IN2
As the INC terminal will be the joint point (reference), the IN1 and IN2 inputs are used as digital inputs between 5-30V. Inputs have 1kV insulation level.

Digital Output Terminals: OC, O1, O2
As the OC terminal will be the joint point (reference), the O1 and O2 terminals are used as insulated outputs. As it can be seen from the following figure, these Open Collector outputs should be fed by an external supply for operation.



Structure of the MPR-16S-21 Terminal:

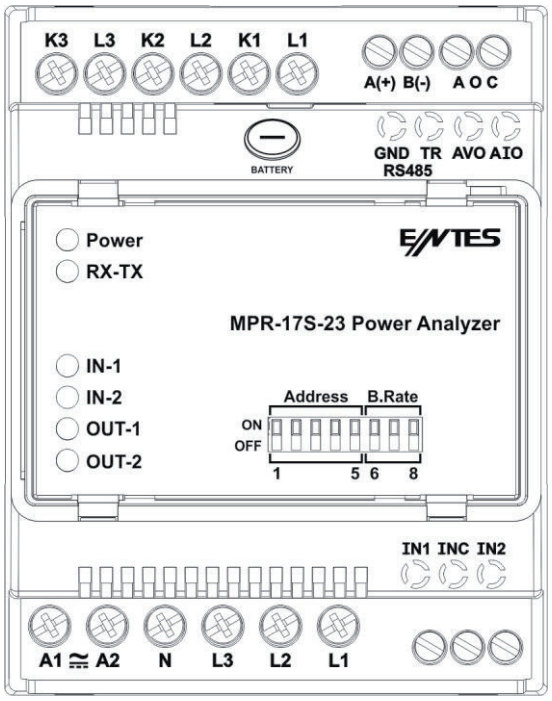
Different from the MPR-16S-21'den these terminals which are used for relay output are the terminals next to the voltage terminals. They are indicated with the key symbol on the front view. The terminal structure of the MPR16S-21 model is as in the following:



Digital Input Terminals: INC, IN1, IN2
As the INC terminal will be the joint point (reference), the IN1 and IN2 inputs are used as digital inputs between 5-30V. Inputs have 1kV insulation level.

Structure of the MPR-17S-23 Terminal:

As the AOC terminal will be the joint point (reference), the analogue current or voltage output is ensured respectively through the AIO and AVO terminals. Only one of the AVO and AIO terminals are used at the same time.



Analog Output Terminals: AOC, AVO, AIO
AOC terminal is the common point (reference), and analog current or voltage output is provided from the AIO and AVO terminals, respectively. Only one of the AVO and AIO terminals is used at the same time.

Digital Input Terminals: INC, IN1, IN2
As the INC terminal will be the joint point (reference), the IN1 and IN2 inputs are used as digital inputs between 5-30V. Inputs have 1kV insulation level.

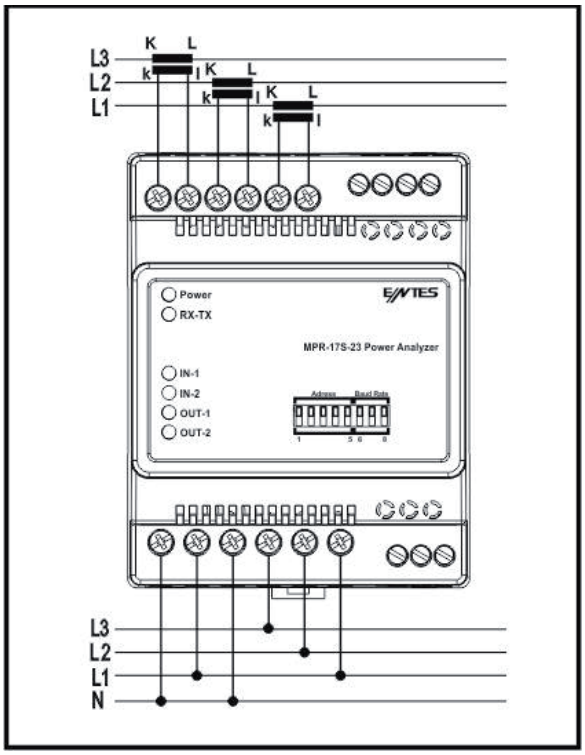
Digital Output Terminals: OC, O1, O2
As the OC terminal will be the joint point (reference), the O1 and O2 terminals are used as insulated outputs. As it can be seen from the following figure, these Open Collector outputs should be fed by an external supply for operation.

CONNECTION TYPES

As there are shunts at the current measurement inputs of the device, it is mandatory to use a current transformer except for the connections of current inputs. If, the device will be used on the same current line by means of analyzers with other shunts, it is recommended that the device is located at the extreme point.
The device has 5 different connection types. These connection types are described in the following schemes:

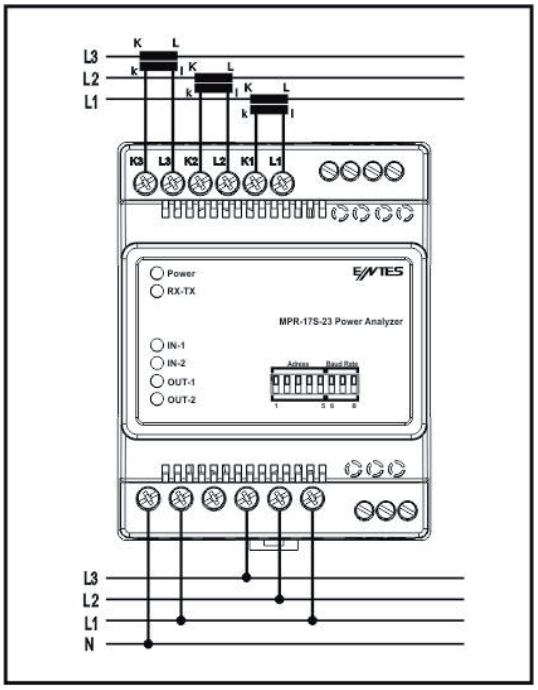
3P4W (Three-Phase Four-Wire) Connection

As it is seen below, four voltage and three current connections including the neutral line are established in this connection type.



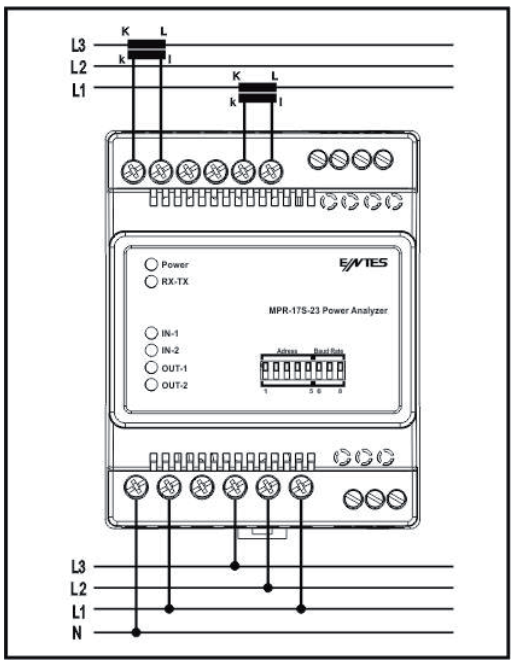
3P3W (Three-Phase Three-Wire) Connection

As it is seen below, three voltage and three current connections are established in this connection type.



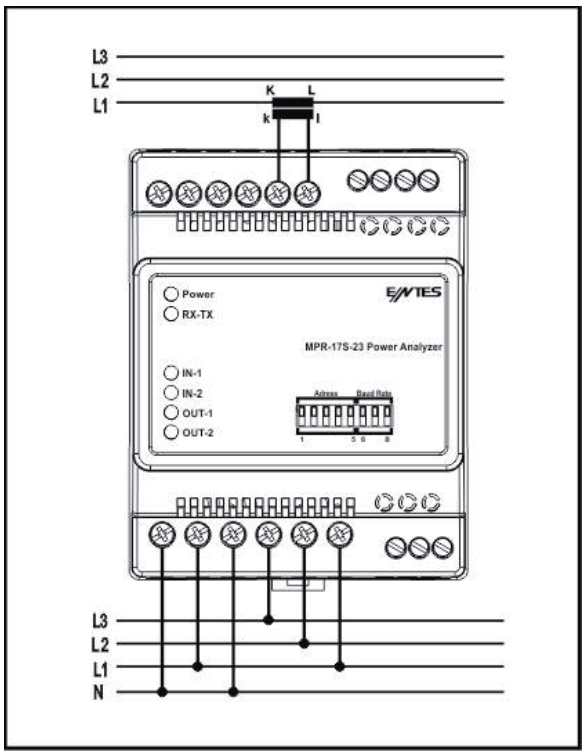
ARON Connection

Three voltage and two current connections are established in this connection type. As it is seen in the following figure, the current connections are established with the 1st and 3rd phases.



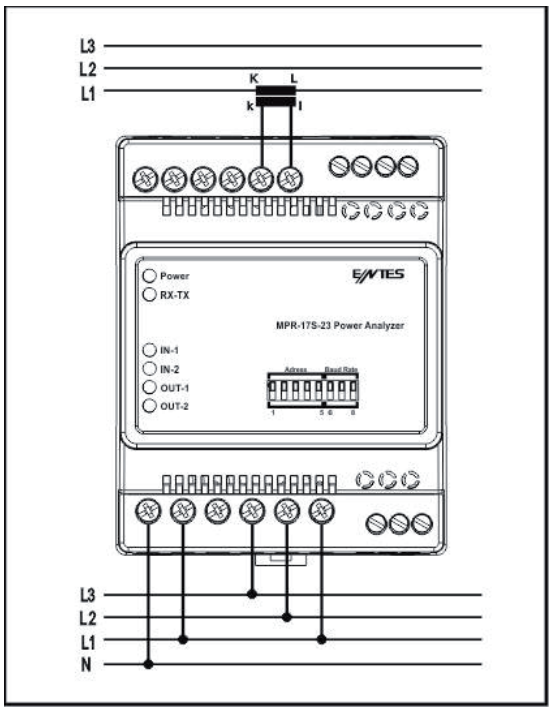
3P4W BLN (Three-Phase Four-Wire Balanced) Connection

Four voltages and one current connection are established in this connection type. The device displays the value measured at the current input connected to the first phase on its screen for other phases in the same value.



3P3W BLN (Three-Phase Three-Wire Balanced) Connection

Three voltage and one current connection are established in this connection type. As it is seen below, the device displays the value measured at the current input connected to the first phase on its screen for other phases in the same value.



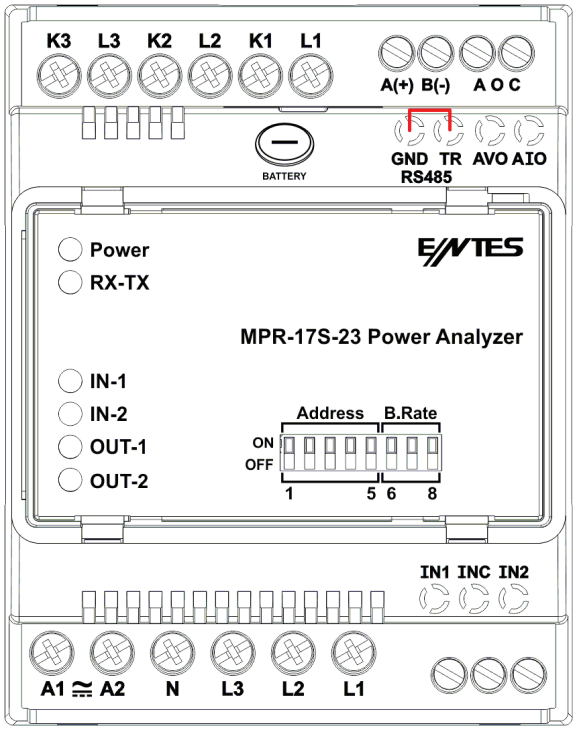
Communication Line Termination Resistance

RS-485 communication terminals are used for Modbus RTU communication connection. A (+) and B (-) terminals are connected in parallel between devices. When the communication distance exceeds 10 meters and there are more than one device on the line, communication instability may occur. In this case;

• 120 Ohm line coming out of the device box between A (+) terminal and B (-) terminal. termination resistor installed,

• Short circuit between the TR terminal and the A (+) terminal.

In this way, line balancing is done.



Device Communication Settings

Device communication address and baud rate settings are adjustable from the DIP switches located at the device's front panel. Devices communication address settings can be done, as shown at the below table.
Number written to the Modbus 17124 address and the DIP switch's 1st and 5th positions determines the devices communication address. Factory settings for Modbus address is 1.

Number written to Modbus 17124 address	DIP switch setting	Address
1	10000	1
1	01000	2
…	…	…
1	11111	31
32	00000	32
32	10000	33
…	…	…
32	11111	63
…	…	…
64	00000	64
64	10000	65
64	01000	66
…	…	…
200	00000	192
200	10000	193
232	00000	224
…	…	…
232	11101	247

Baud rate is determined from DIP switch's 6th, 7th and 8th pins as shown at the below.

Baud rate
000:2400
100:4800
010:9600
110:19200
001:38400
101:57600
011:115200
111:115200

TECHNICAL INFORMATION AND ATTACHMENTS

Technical Information

Technical properties	Value
Dimensions	DIN 4
Voltage measurement range	10~300 VAC(VLN) 10~480 VAC(VLL)
Measurement range with transformer	10V~999 kV
Accuracy	%0.5 ± 1 digit
Input Impedance	1.8 MΩ
Burden (Input Load)	< 0.5 VA
Current measurement accuracy	%0.5 ± 1 digit
Nominal Current	1A, 5A
Lowest current	5 mA
Current measurement range	50 mA ~ 5,5A (Do not use without current transformer)
Measurement range with transformer	50 mA ~ 10 kA
Burden (Input Load)	< 1 VA
Active power accuracy	%1 ± 1 digit
Reactive power accuracy	%1 ± 1 digit
Active energy measurement accuracy	Class 1
Reactive energy measurement accuracy	Class 2
Active power measurement range	0 ~ 1 GW
Reactive power measurement range	0 ~ 1 GVAr
Apparent power measurement range	0 ~ 1 GVA
Power consumption	< 4 VA
Active energy measurement ceiling	9 999 999.9 kWh
Reactive energy measurement ceiling	9 999 999.9 kVArh
Operating voltage	95 - 270 VAC/VDC ,12 – 50 VDC (MPR-1X-D) (Tolerances up to ± 10%)
Operating frequency	45 - 65 Hz.
Max. Voltage / Max. Current (For Relay)	250 VAC / 5A
Digital input processing voltage	5 ~ 30 VDC
Digital input switching current	Max 50 mA
Minimum pulse time	100 ms pulse period, 80 ms pulse width
Operating Temperature Range	-10 ~ +70 ºC
Storage Temperature Range	-20 ~ +80 ºC
Maximum operating humidity	95 %
Assembly	Assembled to the wall box from the front.
Connection terminals	Screw terminal
Connection types	3 phase without neutral (3P3W) 3 phase + neutral (3P4W) 3 phase without neutral (3P3W) balanced 3 phase + neutral (3P4W) balanced 3 phase Aron
Communication Protocol	RS-485 / MODBUS RTU
Communication Speed	2400 ~ 115200 bps

IEC 61557-12 Properties

CONFORMITY IEC 61557-12 Edition 2		
PMD SPECIFICATIONS		
Type of Specification	Examples of possible specification values	Other additional specifications
Supply quality evaluation function (option)	/	/
PMD Classification	SD	/
Set point	K55	/
Humidity + Altitude	/	/
Operating performance class for active power or active energy (if function available)	0,5	/

Symbol for functions	Measurement range	Operating performance class, according to CEU 61557-12 according to KI	Other additional specifications
P	10% to 120% In	0,5	
Qa, Qv	10% to 120% In	1	
Sa, Sv	10% to 120% In	1	
Ea	0 to 99999999 kW/h	0,5	
Era, Erv	0 to 99999999 kVar/h	1	
Eapa	0 to 99999999 kVA/h	0,5	
f	45 to 65 Hz	0,02	
I	10% to 120% In	0,2	
In, Inc	10% to 120% In	0,2	
U	10 to 520Vac ph/ph	0,2	
Pfa, Pfv	0,5 ind to 0,8 cap	0,5	
Udip, Uswl	Unavailable function		
Utr	Unavailable function		
Uint	Unavailable function		
Unba, Unb	Unavailable function		
Uh	Unavailable function		
THDu	Fn=50Hz - range 1 to 50 Fn=60Hz - range 1 to 50	1	
THD-Ru	Unavailable function		
Ih	Unavailable function		
THDi	Fn=50Hz - range 1 to 50 Fn=60Hz - range 1 to 50	1	
THD-Ri	Unavailable function		
Msv	Unavailable function		

Compliance with the Standards

Standard	Year	Title
IEC 61557-12	2008	Electrical safety in low voltage distribution systems up to 1kV (a.a.) and 1,5kV DC(d.a.) – Equipment for testing, measuring or monitoring of protective measures - Part 10: Performance measuring and monitoring arrangements
IEC 61326-1	2005	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General conditions
EN 61000-6-2	2005	Electromagnetic compatibility (EMC) - Part 6-2: General standards - Immunity for industrial environments
IEC 60050(161)	2011	International Electro-technical Vocabulary Chapter 161- Electromagnetic Compatibility
EN 62053-21	2003	Electricity measurement equipment (a.a.) - Special rules - Chapter 21: Static meters for active energy (class 1 and class 2)
EN 62053-23	2003	Electricity measurement equipment (a.a.) - Special rules - Chapter 23: Static meters - Reactive energy (class 2 and class 3)
EN 61000-4-2	1995	Electromagnetic compatibility (EMC) - Part 4-2: Test and measurement techniques - Electrostatic discharge immunity test
EN 61000-4-3	2006	Electromagnetic compatibility (EMC) - Part 4-3: Test and measurement techniques-Radiated, radio- frequency, electromagnetic field immunity test
EN 61000-4-4	2004	Electromagnetic compatibility (EMC) - Part 4-4: Test and measurement techniques - Electrical fast transient/burst immunity test
EN 61000-4-5	2006	Electromagnetic compatibility (EMC) - Part 4-5: Test and measurement techniques - Surge immunity test
EN 61000-4-6	2007	Electromagnetic compatibility (EMC) - Part 4-6: Test and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-8	2010	Electromagnetic compatibility (EMC) - Part 4-8: Test and measurement techniques-Power Frequency Magnetic Field Immunity Test
EN 61000-4-11	2004	Electromagnetic compatibility (EMC) - Part 4-11: Test and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

EN 61000-6-3	2007	Electromagnetic compatibility (EMC) - Chapter 6-3: General standards - Emission Standard for residential, Commercial and light-industrial environments
EN 61000-3-2	2010	Electromagnetic compatibility (EMC) - Part 3-2: Limit values - limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
EN 61000-3-3	2011	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage fluctuations and flicker in low- voltage supply systems for equipment with rated current kleiner 16 A
EN 55016-2-1	2009	Specification for radio disturbance and immunity measuring apparatus and methods - Chapter 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements
EN 60068-2-2	2008	Basic environmental testing procedures Part 2:tests-Test B: Dry heat
EN 60068-2-6	2007	Environment test - Chapter 2-6: Tests - Fc tests: Vibration (sinus formed)
EN 60068-2-30	2008	Environmental testing -- Part 2-30: Tests - test db: Damp heat, cyclic (12 h + 12 h cycle)
EN 60068-2-31	2010	Environmental testing -- Part 2-31: Tests - test ec: Rough handling shocks, primarily for equipment-type specimens
EN 60068-2-75	1997	Basic Environmental Testing Procedures Part 2: Tests - test eh: Hammer tests
BS EN 61010-1	2010	Safety requirements for electrical equipment for measurement, control and laboratory use-Part 1:General requirements
EN 61010-2-030	2010	Safety requirements for electrical equipment for measurement, control and laboratory use-Part 2-030: Specific rules for test and measurement of circuits
EN 62262	2010	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) / Note: Includes Corrigendum of July 2002 (EN 50120 + A1 are renumbered as EN 62262:2002)

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