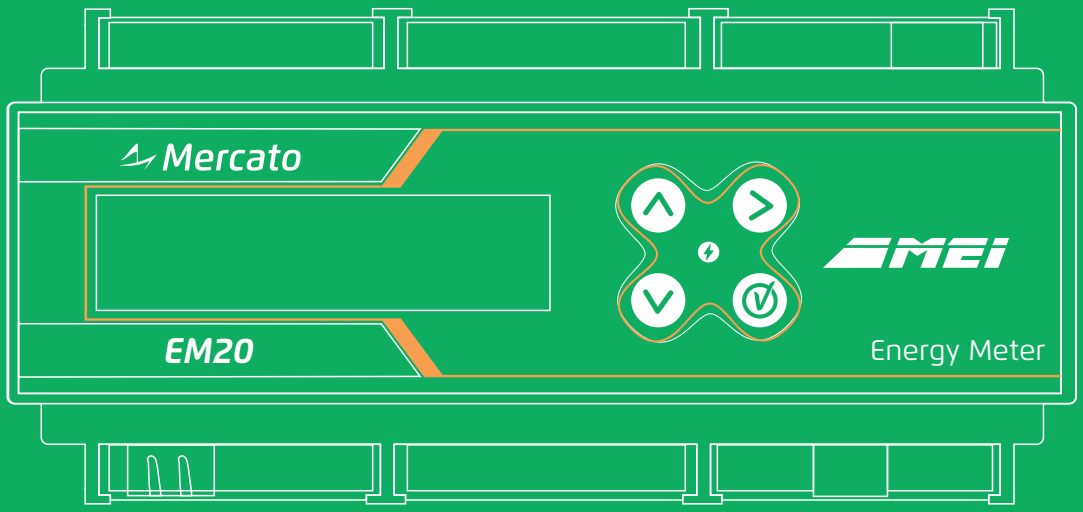
OMNI RATE

Energy metering solutions

EMEI

EM20



User Manual

Mercato

mercatobas.com

OVERVIEW

MEI-EM20 is an electronic energy meter developed for sub-metering applications in building automation. It has several features that makes it the ideal choice for your building.

- Power and energy meter for up to 3 phase systems, with option to use integrated internal CTs (up to 120A) or external CTs (with 0.333V output), software selectable.
- Up to 5 pulse inputs to track consumption of another variables (water, gas, etc).
- Internal memory to trendlog data up to 60 days. (hourly).
- Ethernet (10/100M) and isolated RS485 ports supporting BACnet, Modbus and SNMP protocols (can work simultaneous, in both ports).
- Local interface to ease metering data and basic setup.
- Web interface to complete metering data visualization and parameter settings.
- Two digital outputs (relay) that can be controlled by network or by internal schedules.
- Real-time clock maintained by supercapacitor (no maintenance).

SAFETY WARNINGS

IT IS ESSENTIAL THAT THE USER OF THIS MANUAL IS AWARE OF THE POTENTIAL HAZARDS ASSOCIATED WITH THE UNIT.

ALL OPERATORS SHOULD BE FAMILIAR WITH THE SAFETY PRECAUTIONS AND WARNINGS GIVEN IN THIS SECTION PRIOR TO ATTEMPTING TO OPERATE THE UNIT.

IF THE UNIT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

THE INSTALLER IS RESPONSIBLE FOR CONFORMANCE TO ALL APPLICABLE CODES.

THIS PRODUCT IS NOT INTENDED FOR LIFE OR SAFETY APPLICATIONS.

THIS PRODUCT SHOULDN'T BE INSTALLED IN SWITCH GEARS OR PANELBOARDS.

DO NOT INSTALL THIS PRODUCT IN HAZARDOUS OR CLASSIFIED LOCATIONS.

To reduce risk of electric shock, always open or disconnect circuit from power-distribution system (or service) of building before installing or servicing current-sensing transformers.

De-energize the monitored load (installation on which the current is measured), or adopt safe operating procedures when working on hazardous live installation during application and removal of the current sensors on which the current is measured.

Use copper only wiring!

Connect CT to appropriate terminals on meter using 18-12 AWG copper conductors. If installing on a live circuit, be sure to connect the CT secondary before placing the CT over the live conductor. The current transformers cannot exceed 75% of the wiring space of any cross-sectional area within the panel.

If different circuits are used between power supply and voltage measurement inputs or relay outputs and voltage measurement inputs, installer MUST provide external protection/circuit breakers to limit the voltage between this circuits to 600V_{AC}.

This equipment use double/reinforced isolation.

SETTINGS ACCESS

There are two ways to adjust operational settings of EM20: by local interface or by web interface.

Local interface

Local interface give access to basic settings. To get access to local interface settings menu, keys NEXT and ENTER must be simultaneously pressed for 5 seconds, until menu "Settings" appear. It's necessary to input settings password. Default password is "1111".

To input password, use the key NEXT to change password digit, keys UP/DOWN to change digit's value and key ENTER to confirm. If the password is correct, screen change to first settings item.

To edit a configuration item, you must use ENTER key to enter edit mode. Configuration value starts to blink and can be changed by UP and DOWN keys. To confirm new value, use ENTER key again.

Web interface

The other option to configure EM20 is by web browser access. Just connect EM20 in your ethernet network and type EM20's IP address in any common browser (Chrome, Firefox, Edge, ...). The factory setting of IP configuration is 10.1.1.240 with a netmask of 255.0.0.0. You can see actual IP address in local interface (METER menu). Your PC need to be on same subnet of equipment to work.

You can reset factory setting of IP/Netmask if you power on the equipment with UP key pressed. This configuration is not permanent, if you cycle power of the equipment, the IP configuration is restored.

In web interface, you have access to settings menu. To access you need to use username "config" and settings password. The password factory's default value is "config".

All available configurations will be explained in next topics.

CONNECTIONS

Table 1 shows all wiring connections to MEI-EM20.

POINT	NAME	DESCRIPTION
1	VAC	Power supply connections.
2	VAC	
3	VA	Voltage measurement inputs.
4	VB	
5	VC	
6	NEUTRAL	
7	IA+	External CT inputs ($0.333V_{AC}$).
8	IA-	
9	IB+	
10	IB-	
11	IC+	
12	IC-	
13	DO2_A	Digital outputs (relay contacts).
14	DO2_B	
15	DO1_A	
16	DO1_B	
17	+24V	0-10V or 4-20mA analog input. You can use +24V to feed external sensors.
18	AI_1	
19	GND	
20	DI1/S1	Inputs. Can work in these modes: - Digital (dry-contact) - Pulse input (dry-contact, open drain NPN) - 10k NTC temperature sensor
21	DI2/S2	
22	GND	
23	DI3/S3	
24	DI4/S4	
25	GND	
26	DI5/S5	
27	GND	
28	AO1	0-10V analog output.
29	GND	
30	D+	Isolated RS485 communication port (Modbus RTU or BACnet MS/TP protocols).
31	COM	
32	D-	

Table 1 - Wiring connection points.

POWER SUPPLY

EM20 has independent power supply connections from voltage measurement inputs. It has galvanic isolation from measurement circuits, giving flexibility to power the equipment.

It's possible to power supply equipment with 90 to 277V_{AC} (L-N or L-L). It's recommended to use the same circuit of voltage measurement inputs to power MEI.

If different circuits are used between power supply input and voltage measurement inputs, installer MUST provide external circuit breakers to limit the voltage between this circuits to 600V_{AC}.

It's necessary to use a fuse and/or circuit breaker in power supply inputs. Wiring connections is show in Figure 1. It must be branch circuit type.

Recommended Fuse and Circuit Breaker:
Circuit breaker: 277V_{AC} / 3A
Fuse: 300V_{AC} / 3A

It is necessary to provide external protection in power supply inputs (fuse or circuit-breaker). The protection device must be rated for the available short-circuit current at the connection point. Installer is responsible for ensuring compliance with local requirements.

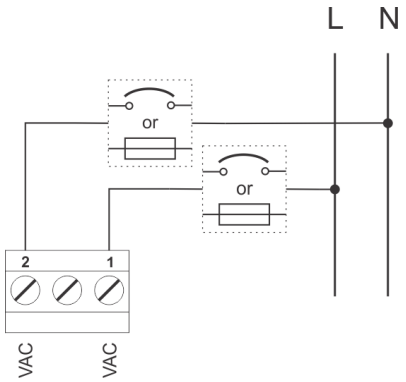


Figure 1 - Power supply wiring.

VOLTAGE AND CURRENT WIRING

EM20 can be use in 1, 2 or 3-phase systems in several measurement modes.

Voltage measurement

Voltage measurement use VA, VB, VC and NEUTRAL inputs. Those inputs can be used in systems with 347V_{AC} L-N (600V_{AC} L-L) maximum voltages. It is necessary to provide external protection to those inputs (fuse or circuit-breaker).

Maximum measurement voltage in delta connections is 347V_{AC} L-L.

Max 347VAC L-L to delta connections.

In systems with voltages above the maximum range of voltage inputs, external PTs can be used. The PT transformer ratio can be configured (PT scale setting). For ease, the scale is configured with two parameters: "primary voltage" and "secondary voltage".

Current measurement

For current measurement, EM20 provide two options: internal or external CTs.

The EM20's enclosure has integrated internal CT's for measurement of currents up to 120A_{AC}. Line wirings must pass through EM20. Maximum wire diameter is 17mm. Observe correct orientation for current measurement in "GRID" and "LOAD" labels in each side.

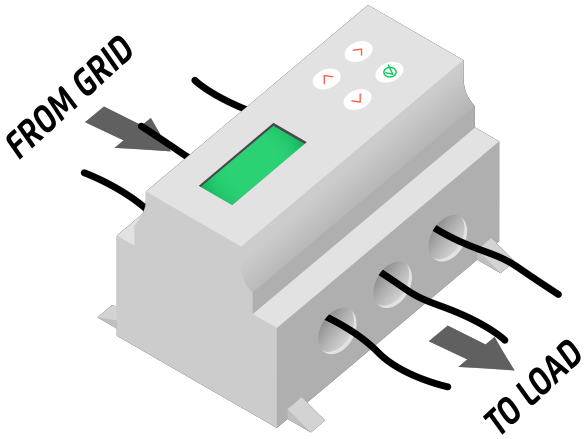


Figure 2 - Internal CTs wiring.

Another option to current measurement is using external CTs. EM20 has IA, IB and IC inputs to use with CTs with 0.333V_{AC} outputs. Observe correct polarity of CTs when wiring. When using external CTs, it's necessary to configure the primary range of CT in parameter "External CT value" of settings menu.

WARNING

Do not use current ouput CTs.
Only voltage (0.333V_{AC} full-scale) is supported.
Use only UL Listed energy monitoring current transformers.

WARNING

External CT negative inputs are internally connected to NEUTRAL point. Do not make any other external connections in this points.

WARNING

External current transformer leads shall be segregated or isolated from different circuits and shall be maintained within the same end-product enclosure.

In settings menu you can choose which type of CTs to use (internal or external). This setting can be change at any time.

Wiring modes

MEI-EM20 can be used in 1, 2 or 3-phase systems, in several wiring modes. Wiring must be done as show in figure 3 for each available mode. In settings menu, you must choose the correspondent "metering mode" parameter. Modes in figure 3 shows number of phase lines plus neutral (if available) and which input connections must be done (inputs A, B, C or N for phases and neutral). For simplicity, in diagrams of figure 3, the CTs are showed as external, but the same apply for internal CTs.

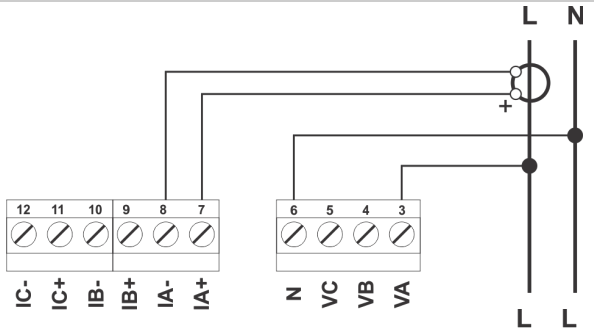
Recommended Fuse and Circuit Breaker:
Circuit breaker: $600V_{AC}$ / 1A
Fuse: $600V_{AC}$ / 1A
Branch circuit type.

It is necessary to provide external protection in voltage measurement inputs (fuse or circuit-breaker). The protection device must be rated for the available short-circuit current at the connection point. Installer is responsible for ensuring compliance with local requirements.

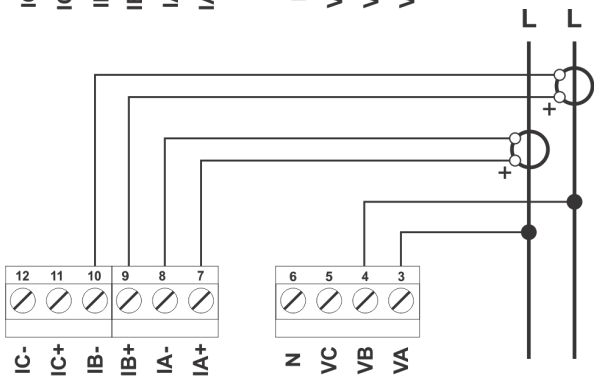
For clarity and simplicity, the diagrams at figure 3 do not show voltage input protections.

If different circuits are used between power supply input and voltage measurement inputs, installer MUST provide external circuit breakers to limit the voltage between this circuits to $600V_{AC}$.

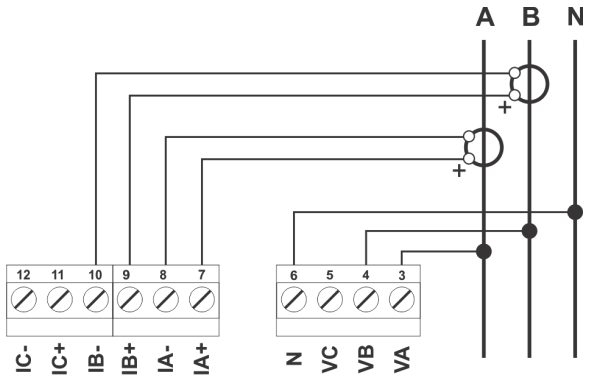
1L+N (AN) MODE:



2L (AB) MODE:

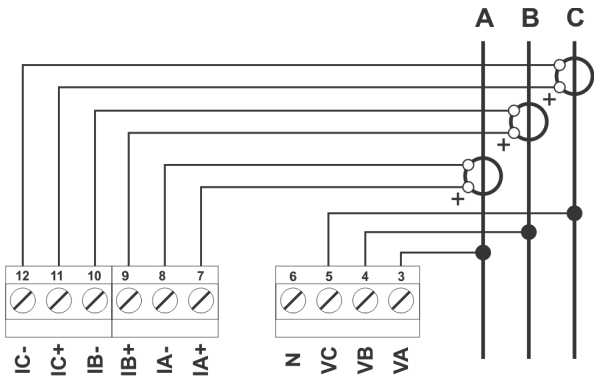


2L+N (ABN) MODE:



3L (ABC) MODE:
DELTA CONNECTION

Max 347V_{AC} L-L in delta connections!



3L+N (ABCN) MODE:
WYE CONNECTION

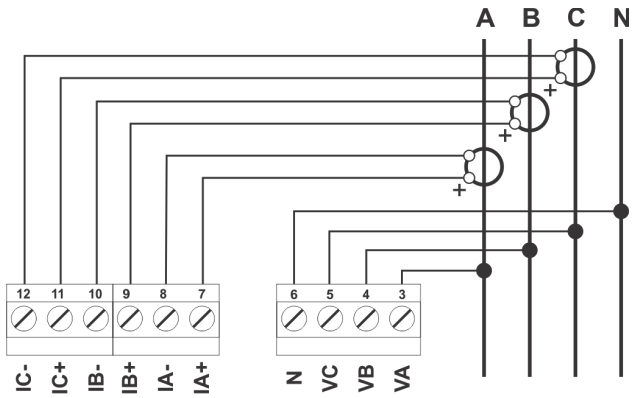


Figure 3 - Wiring diagrams.

INPUTS

MEI-EM20 has 5 inputs that can be configured as digital, pulse counter or temperature and one analog input that can be configured in 0-10V or 0/4-20mA modes.

Digital/pulse input

In digital or pulse mode, input can accept dry-contacts (no potential) or open-collector (NPN) transistors. Wiring must be done as figure 4. All input's GND connection are connected internally and can be swapped for convenience.

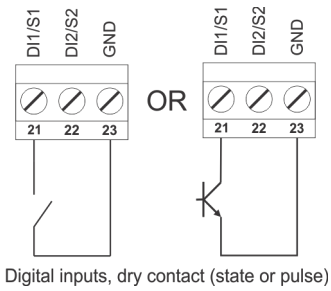
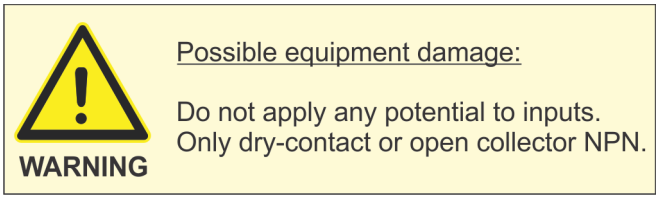


Figure 4 - Digital input wiring.



Digital mode can be used to state monitoring of loads. Input's values can be accessed by network protocols (BACnet, Modbus) for monitoring purposes.

In pulse mode, inputs can be used to count consumption of external meters (electrical energy, water, gas, ...). MEI-EM20 provides total pulse count and historical data, in hourly values.

For pulse mode, settings menu provides configurations for scale of pulse (in units of variable being measured). Parameter "pulse filter" can be used to filter pulse input and ignore pulses with an width lower than the configured value. This parameter give the minimum pulse width necessary to MEI-EM20 consider it in counting. It is configured in steps of 5ms. At each valid input pulse, totalizer is added with "pulse scale" parameter value.

In same settings menu, you can choose a name tag for input. This name tag is shown in local interface to ease input identification. In same way, an unit text can be configured.

NTC input

Inputs can be configured in NTC mode, to temperature measurement. In this mode, it accepts 10k NTC sensor with type II or type III curve. Wiring is done as figure 5.

NTC mode can be used to space temperature monitoring with network access by Modbus or BACnet.

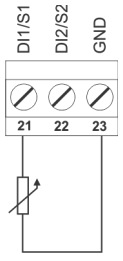


Figure 5 - NTC sensor wiring.

Analog input

MEI-EM20 has one analog input for voltage (0-10V) or current (0-20mA or 4-20mA) modes. It can be used to monitor signals from external sensors and accessed by network (Modbus or BACnet protocols). MEI-EM20 provides an +24V_{DC} supply to feed external sensors or current loop. Wiring diagrams is showed in figure 6.

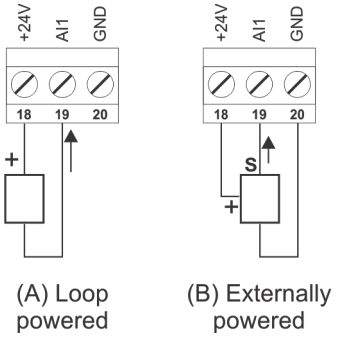


Figure 6 - Analog input wiring.

Observe maximum +24V output current in specifications section.

In settings menu, you can configure analog input mode (0-10V, 0-20mA or 4-20mA). You can configure the range of input in measurement units in parameters "minimum value" and "maximum value". A tag and unit text can be provided to this input. This is used in local display to ease identification of measurement variable.

OUTPUTS

MEI-EM20 has 2 digital outputs (relay) and one analog output (0-10V).

Digital outputs

Digital outputs is relay based, with normally-open contacts available. It can be used to control generic loads (resistive or pilot duty). Contacts are protected with an internal varistor (MOV) devices. Wiring diagram is on figure 7.

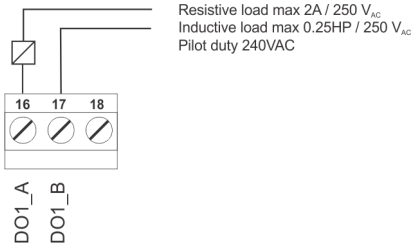


Figure 7 - Digital output wiring.

Each output can be configured with no function to be controlled by network, in Modbus or BACnet protocols. Also, outputs can be configured to be internally controlled by a time schedule. See SCHEDULES section.

Recommended Fuse and Circuit Braker for relays:
Circuit braker: 277V$_{AC}$ / 3A
Fuse: 300V$_{AC}$ / 3A
Branch circuit type.

If different circuits are used between relay outputs and voltage measurement inputs, installer MUST provide external circuit breakers to limit the voltage between this circuits to 600V$_{AC}$.

Analog output

Analog output has fixed type of voltage (0-10V) and need no setting to work. Wiring diagram is on figure 8. It has no internal function and may be controlled by network in Modbus or BACnet protocols.

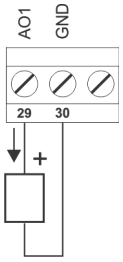


Figure 8 - Analog output wiring.

ETHERNET PORT

MEI-EM20 has one 10/100M ethernet port with standard RJ45 connector. This port can be used with straight or crossed ethernet cables (auto MDI/MDI-X).

MEI-EM20 has an internal webserver that can be accessed by a standard web browser to show all metering data and full configuration of equipment. All standard internet protocols is supported: ARP, IP, ICMP, UDP, TCP and HTTP/1.1.

MEI-EM20 has support for BACnet/IP, BACnet/Ethernet, Modbus/TCP and SNMP protocols in ethernet port. All of these protocols can be used simultaneously. Check next sections for details of each protocol.

In settings menu, you can configure IP address, netmask and default gateway for IP protocol. Ethernet speed can be adjusted to auto, 10M or 100M. Auto is the recommended values, but you can choose lower speed if cable distance is above 100m (328 ft).

RS485 PORT

One isolated RS485 communication port is available.

Wiring diagram is showed in figure 9. For installation, the wiring of the RS485 network should be daisy chained from meter to meter. Bus or star connections should be avoided. The COM signal of port is the isolated power ground of RS485 supply and has no connection with another signals in equipment. The connection between COM signals of RS485 network is recommended in large (long distance and large number of equipments) networks, but may be disconnected in smaller and simpler networks.

The port have 1/8 of standard RS485 unit load, permitting more than 32 equipments of same type in network (maximum of 256 elements with 1/8 unit load). Port have internal bias always connected. In general, because of low speeds (< 115200 bps), it's not necessary to use 120 ohm termination resistors. Hardware of RS485 port is developed to use on long RS485 networks with a large number of equipments.

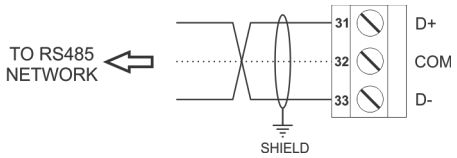
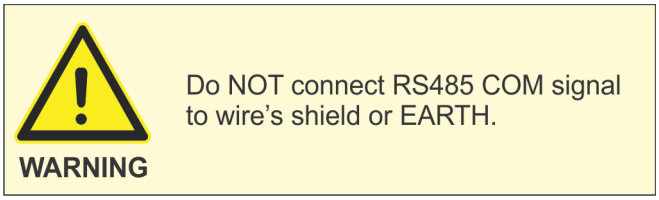


Figure 9 - RS485 wiring.

It's recommended to use shielded and twisted-pair wire in RS485 network. Wire's shield must be panel earthed in both sides.



RS485 port have support to Modbus RTU and BACnet MS/TP protocols. In settings menu, you can choose between the enabled protocol and baudrate of this port. Check protocol sections to additional configurations.

REAL-TIME CLOCK

MEI-EM20 has an internal RTC (real-time clock) that provides calendar dates and time of day. It is used to log timestamped trend data in internal memory. The RTC is maintained by an supercapacitor when meter is powered off. This capacitor has no maintenance.

The capacitor's autonomy is few hours. Check SPECIFICATIONS section with estimated value.

Date and time can be set by local interface, in settings menu or by web interface, in "commands" menu. Another way to date/time adjust is by Modbus or BACnet protocols. Modbus has specific registers for that. Consult MODBUS section for details. BACnet has the standard TimeSync command that can be used.

TRENDLOGS

MEI-EM20 has internal memory dedicated to log metering data (trendlogs). No configuration is necessary, meter is always logging data.

Table 2 shows all available channels, resolution and autonomy.

Variable	Resolution	Autonomy (days)
Imported active energy	1h	60.5 days (1452 records)
Exported active energy	1h	60.5 days (1452 records)
Reactive energy Q1	1h	60.5 days (1452 records)
Reactive energy Q2	1h	60.5 days (1452 records)
Reactive energy Q3	1h	60.5 days (1452 records)
Reactive energy Q4	1h	60.5 days (1452 records)
Pulse input 1	1h	60.5 days (1452 records)
Pulse input 2	1h	60.5 days (1452 records)
Pulse input 3	1h	60.5 days (1452 records)
Pulse input 4	1h	60.5 days (1452 records)
Pulse input 5	1h	60.5 days (1452 records)
A voltage	5min	10 days (2904 records)
B voltage	5min	10 days (2904 records)
C voltage	5min	10 days (2904 records)
CA voltage	5min	10 days (2904 records)
AB voltage	5min	10 days (2904 records)
BC voltage	5min	10 days (2904 records)
Active power demand	15min	60.5 days (5808 records)

Table 2 - Trendlog channels.

Trendlog files are circular. When it's full, new data erase most older data.

For consumption variables, trendlog data represents the consumption in that hour indicated by timestamp value. Timestamp represents the end of period. For example, a record with timestamp equal to 09:00:00 represents the consumption between 08:00 and 09:00.

For voltage channels, each record represents the mean value of the 5 minute period.

Pulse input trendlogs has zero value records if correspondent input is not configured in pulse mode.

Trendlog data can be collected by BACnet protocol, via standard trendlog objects. For Modbus protocol, data can be collected by an proprietary command, explained in Modbus section. Trendlog data can be downloaded manually in CSV format using web interface, in "Trendlogs" menu.

Clearing trendlog data can be done in web interface, in "Commands" menu. The "Erase TRENDLOG data" button erase all stored data in internal memory. It is recommended to execute this operation after installation to erase any invalid data in memory.

In BACnet, you can write zero to record-count property of trendlog object to erase data of that trendlog.

PEAK LIMITS

MEI-EM20 can register peak limits (minimum and maximum) of L-N voltages, L-L voltages, phase currents and total active power. This limits are update each second, with new data and need manual reset.

In local interface, limits can be viewed in PEAK LIMITS menu. Same on web interface.

You can reset peak limits values in one of these ways:

1. In local interface, in settings menu, select "Yes" on "Reset peak lim" parameter.
2. In web interface, "Commands" menu, click on "Reset peak limits" button.
3. In Modbus protocol, write 1 to register 452.
4. In BACnet, write "Reset" (1) to BinaryValue, 3 (Reset peak limits) object.

BACNET PROTOCOL

MEI-EM20 has support to BACnet (ASHRAE 135) protocol in ethernet and RS485 ports. Datalinks BACnet/IP, BACnet/Ethernet (over IEEE 802.3) and BACnet MS/TP are supported.

It's not recommended to use two datalinks at the same time because you can easily create network circularity that is not allowed in BACnet standard. You can use two or more datalinks simultaneously to access meter by different BACnet networks/systems (for instance, BMS system using BACnet/IP and an separated energy management software using BACnet/Ethernet).

Settings

In settings/communication menu, BACnet/IP have only two parameters. You can enable/disable this datalink and select the UDP port to use the protocol. Default value is the standard port 47808 (0xBAC0). IP datalink address is ethernet IP address of meter.

For BACnet/Ethernet datalink, only parameter is to enable or disable this datalink. Ethernet datalink address is MAC address of ethernet port, factory configured and cannot be changed.

For BACnet MS/TP datalink, you need to configure the "station address" parameter that defines meter's address in MS/TP network. The parameter "max master" defines the larger address in MS/TP network. It's recommended to use the default value of 127.

All datalinks share the same Device ID address. This parameter must be different in all BACnet network and can be configured in the range of 0 to 4194302. The default value of 4194303 means unconfigured. With default value, meter does not respond to Who-Is queries.

Supported services

BAcnet protocol implemented in MEI-EM20 has support for this services:

- Acknowledge Alarm
- DeviceCommunicationControl
- I-Am
- GetEventInformation
- ReadProperty
- ReadPropertyMultiple
- ReadRange
- ReinitializeDevice
- TimeSynchronization
- Who-Has
- Who-Is
- WriteProperty
- WritePropertyMultiple

Object table Table 3 shows all objects implemented in current firmware version.

Name	Object type, instance	Unit	Description
MEI-EM20	Device		Device description object
Alarms	NotificationClass, 1		Alarm distribution object
Calendar_1	Calendar, 1		Special dates object (holidays)
NTC_1	AnalogInput, 1	ºC or °F	Temperature input 1 value
NTC_2	AnalogInput, 2	ºC or °F	Temperature input 2 value
NTC_3	AnalogInput, 3	ºC or °F	Temperature input 3 value
NTC_4	AnalogInput, 4	ºC or °F	Temperature input 4 value
NTC_5	AnalogInput, 5	ºC or °F	Temperature input 5 value
AI_1	AnalogInput, 6	%	Analog input 1 value
AO_1	AnalogOutput, 1	%	Analog output 1
A voltage	AnalogValue, 1	V	RMS voltage of A phase
B voltage	AnalogValue, 2	V	RMS voltage of B phase
C voltage	AnalogValue, 3	V	RMS voltage of C phase
CA voltage	AnalogValue, 4	V	L-L RMS voltage of C/A phases
AB voltage	AnalogValue, 5	V	L-L RMS voltage of A/B phases
BC voltage	AnalogValue, 6	V	L-L RMS voltage of B/C phases
A current	AnalogValue, 7	A	RMS current of A phase
B current	AnalogValue, 8	A	RMS current of B phase
C current	AnalogValue, 9	A	RMS current of C phase
A active power	AnalogValue, 10	kW	A phase active power
B active power	AnalogValue, 11	kW	B phase active power
C active power	AnalogValue, 12	kW	C phase active power
A reactive power	AnalogValue, 13	kVAr	A phase reactive power
B reactive power	AnalogValue, 14	kVAr	B phase reactive power
C reactive power	AnalogValue, 15	kVAr	C phase reactive power
A apparent power	AnalogValue, 16	kVA	A phase apparent power
B apparent power	AnalogValue, 17	kVA	B phase apparent power
C apparent power	AnalogValue, 18	kVA	C phase apparent power
Total active power	AnalogValue, 19	kW	Total active power
Total reactive power	AnalogValue, 20	kVAr	Total reactive power
Total apparent power	AnalogValue, 21	kVA	Total apparent power
A PF	AnalogValue, 22		A phase power factor
B PF	AnalogValue, 23		B phase power factor
C PF	AnalogValue, 24		C phase power factor
Total PF	AnalogValue, 25		Total power factor
Frequency	AnalogValue, 26	Hz	A phase frequency
Imported active energy	AnalogValue, 27	kWh	Imported active energy accumulator
Exported active energy	AnalogValue, 28	kWh	Exported active energy accumulator
Net active energy	AnalogValue, 29	kWh	Net (imported - exported) active energy accumulator
Q1 reactive energy	AnalogValue, 30	kVArh	Quadrant 1 reactive energy accumulator
Q2 reactive energy	AnalogValue, 31	kVArh	Quadrant 2 reactive energy accumulator
Q3 reactive energy	AnalogValue, 32	kVArh	Quadrant 3 reactive energy accumulator
Q4 reactive energy	AnalogValue, 33	kVArh	Quadrant 4 reactive energy accumulator
Pulses 1	AnalogValue, 34	User cfg	Pulse 1 input accumulator
Pulses 2	AnalogValue, 35	User cfg	Pulse 2 input accumulator
Pulses 3	AnalogValue, 36	User cfg	Pulse 3 input accumulator
Pulses 4	AnalogValue, 37	User cfg	Pulse 4 input accumulator
Pulses 5	AnalogValue, 38	User cfg	Pulse 5 input accumulator
A voltage min	AnalogValue, 39	V	Minimum value of A voltage
A voltage max	AnalogValue, 40	V	Maximum value of A voltage
B voltage min	AnalogValue, 41	V	Minimum value of B voltage
B voltage max	AnalogValue, 42	V	Maximum value of B voltage
C voltage min	AnalogValue, 43	V	Minimum value of C voltage
C voltage max	AnalogValue, 44	V	Maximum value of C voltage
CA voltage min	AnalogValue, 45	V	Minimum value of CA voltage

CA voltage max	AnalogValue, 46	V	Maximum value of CA voltage
AB voltage min	AnalogValue, 47	V	Minimum value of AB voltage
AB voltage max	AnalogValue, 48	V	Maximum value of AB voltage
BC voltage min	AnalogValue, 49	V	Minimum value of BC voltage
BC voltage min	AnalogValue, 50	V	Maximum value of BC voltage
A current min	AnalogValue, 51	A	Minimum value of A current
A current max	AnalogValue, 52	A	Maximum value of A current
B current min	AnalogValue, 53	A	Minimum value of B current
B current max	AnalogValue, 54	A	Maximum value of B current
C current min	AnalogValue, 55	A	Minimum value of C current
C current max	AnalogValue, 56	A	Maximum value of C current
Active power min	AnalogValue, 57	kW	Minimum value of total active power
Active power max	AnalogValue, 58	kW	Maximum value of total active power
CA phase angle	AnalogValue, 59	°	Angle between C and A phases.
AB phase angle	AnalogValue, 60	°	Angle between A and B phases.
BC phase angle	AnalogValue, 61	º	Angle between B and C phases.
DI_1	BinaryInput, 1		DI_1 state
DI_2	BinaryInput, 2		DI_2 state
DI_3	BinaryInput, 3		DI_3 state
DI_4	BinaryInput, 4		DI_4 state
DI_5	BinaryInput, 5		DI_5 state
DO_1	BinaryOutput, 1		DO_1 state
DO_2	BinaryOutput, 2		DO_2 state
Reset energy counters	BinaryValue, 1		Write "reset" (1) value to clear energy accumulators.
Reset pulse counters	BinaryValue, 2		Write "reset" (1) value to clear pulse input accumulators.
Reset peak limits	BinaryValue, 3		Write "reset" (1) value to clear peak limits.
SCH_1	Schedule, 1		Time schedule 1
SCH_2	Schedule, 2		Time schedule 2
SCH_3	Schedule, 3		Time schedule 3
SCH_4	Schedule, 4		Time schedule 4
Import active energy	Trendlog, 1	kWh	Trend data of imported active energy
Export active energy	Trendlog, 2	kWh	Trend data of exported active energy
Q1 reactive energy	Trendlog, 3	kVArh	Trend data of Q1 reactive energy
Q2 reactive energy	Trendlog, 4	kVArh	Trend data of Q2 reactive energy
Q3 reactive energy	Trendlog, 5	kVArh	Trend data of Q3 reactive energy
Q4 reactive energy	Trendlog, 6	kVArh	Trend data of Q4 reactive energy
Pulse 1	Trendlog, 7	User cfg	Trend data of pulse 1 counter
Pulse 2	Trendlog, 8	User cfg	Trend data of pulse 2 counter
Pulse 3	Trendlog, 9	User cfg	Trend data of pulse 3 counter
Pulse 4	Trendlog, 10	User cfg	Trend data of pulse 4 counter
Pulse 5	Trendlog, 11	User cfg	Trend data of pulse 5 counter
A voltage	Trendlog, 12	V	Trend data of A voltage
B voltage	Trendlog, 13	V	Trend data of B voltage
C voltage	Trendlog, 14	V	Trend data of C voltage
CA voltage	Trendlog, 15	V	Trend data of CA voltage
AB voltage	Trendlog, 16	V	Trend data of AB voltage
BC voltage	Trendlog, 17	V	Trend data of BC voltage
Power demand	Trendlog, 18	kW	Trend data of power demand.

Table 3 - Bacnet object table.

MODBUS PROTOCOL

MEI-EM20 implements Modbus protocol in both communication ports, with Modbus RTU variant in RS485 port and Modbus/TCP and Modbus/UDP variants in ethernet port.

For ethernet port, both variants are always enabled and need no configuration besides IP address. Both TCP and UDP variants are available in the standard 502 TCP/UDP port. Meter ignores the unit-id parameter of these protocols and respond to all communications directed to meter's IP address.

Modbus/TCP has a limit of 2 simultaneous connections. Modbus/UDP has no limitations.

For Modbus/RTU, you must enable the protocol in settings/communications menu and select RS485 port baudrate. You must choose a RTU address from 1 to 247 range. Address 0 is reserved for broadcast communications. Address 254 is universal address. All equipments will respond to requests on this address.

Modbus/RTU use fixed RS485 configurations of 8 data bits, 1 stop bit, no parity.

All Modbus interfaces access the same data and can be used simultaneously.

Supported functions

Supported Modbus functions are described in table 4.

Function	Description
03	Read holding registers
04	Read input registers
06	Write single register
16	Write multiple registers
43	Read device identification
101	Mercato's read trendlog records

Table 4 - Modbus functions supported.

Functions 03 (read holding registers) and 04 (read input registers) access the same set of registers. There's no difference in using one or another. Function 101 is a proprietary function to read trendlog data.

Data types

Modbus variables are provided with several data types, described in table 5. All data that have more than 16 bits are splited in sequential registers. Byte order is always most-significant byte first (MSB).

Type	Description
UINT16	Integer data, no signal, 16 bits
INT16	Integer data, with signal, 16 bits
UINT32	Integer data, no signal, 32 bits (2 registers)
INT32	Integer data with signal, 32 bits (2 registers)
FLOAT	IEEE754 32 bits float (2 registers)

Table 5 - Modbus datatypes.

Modbus table

Table 6 describes all available registers in Modbus. Column R/W indicates with an 'R' when register is read-only. Lines with an 'W' can be written by funcions 06 or 16.

Reg addr	Type	R/W	Unit	Description
0	FLOAT	R	V	A voltage
2	FLOAT	R	V	B voltage
4	FLOAT	R	V	C voltage
6	FLOAT	R	V	CA voltage
8	FLOAT	R	V	AB voltage
10	FLOAT	R	V	BC voltage
12	FLOAT	R	A	A current
14	FLOAT	R	A	B current
16	FLOAT	R	A	C current
18	FLOAT	R	kW	A active power
20	FLOAT	R	kW	B active power
22	FLOAT	R	kW	C active power
24	FLOAT	R	kVAr	A reactive power
26	FLOAT	R	kVAr	B reactive power
28	FLOAT	R	kVAr	C reactive power
30	FLOAT	R	kVA	A apparent power

32	FLOAT	R	kVA	B apparent power
34	FLOAT	R	kVA	C apparent power
36	FLOAT	R		A power factor
38	FLOAT	R		B power factor
40	FLOAT	R		C power factor
42	FLOAT	R	º	CA phase angle
44	FLOAT	R	º	AB phase angle
46	FLOAT	R	º	BC phase angle
48	FLOAT	R	kW	Total active power
50	FLOAT	R	kVAr	Total reactive power
52	FLOAT	R	kVA	Total apparent power
54	FLOAT	R		Total power factor
56	FLOAT	R	Hz	Phase A frequency
100	UINT32	R		Active alarms
300	FLOAT	R	kWh	Imported active energy accumulator
302	FLOAT	R	kWh	Exported active energy accumulator
304	FLOAT	R	kWh	Net (imported - exported) active energy accumulator
306	FLOAT	R	kVArh	Q1 reactive energy accumulator
308	FLOAT	R	kVArh	Q2 reactive energy accumulator
310	FLOAT	R	kVArh	Q3 reactive energy accumulator
312	FLOAT	R	kVArh	Q4 reactive energy accumulator
314	FLOAT	R	User cfg	Pulse input 1 accumulator
316	FLOAT	R	User cfg	Pulse input 2 accumulator
318	FLOAT	R	User cfg	Pulse input 3 accumulator
320	FLOAT	R	User cfg	Pulse input 4 accumulator
322	FLOAT	R	User cfg	Pulse input 5 accumulator
400	UINT32	R	kWh	Imported active energy accumulator
402	UINT32	R	kWh	Exported active energy accumulator
404	UINT32	R	kWh	Net (imported - exported) active energy accumulator
406	UINT32	R	kVArh	Q1 reactive energy accumulator
408	UINT32	R	kVArh	Q2 reactive energy accumulator
410	UINT32	R	kVArh	Q3 reactive energy accumulator
412	UINT32	R	kVArh	Q4 reactive energy accumulator
414	UINT32	R	User cfg	Pulse input 1 accumulator
416	UINT32	R	User cfg	Pulse input 2 accumulator
418	UINT32	R	User cfg	Pulse input 3 accumulator
420	UINT32	R	User cfg	Pulse input 4 accumulator
422	UINT32	R	User cfg	Pulse input 5 accumulator
450	UINT16	W		Write 1 to clear energy accumulators.
451	UINT16	W		Write 1 to clear pulse input accumulators
452	UINT16	W		Write 1 to restart minimum/maximum registers
500	UINT16	R		Clock - day
501	UINT16	R		Clock - month
502	UINT16	R		Clock - year
503	UINT16	R		Clock - hour
504	UINT16	R		Clock - minute
505	UINT16	R		Clock - second
600	UINT16	W		Clock adjust - day
601	UINT16	W		Clock adjust - month
602	UINT16	W		Clock adjust - year
603	UINT16	W		Clock adjust - hour
604	UINT16	W		Clock adjust - minute
605	UINT16	W		Clock adjust - second
606	UINT16	W		Clock adjust - write 12345 to apply clock adjust.
1000	UINT16	R		Modbus schedule 1 output
1001	UINT16	R		Modbus schedule 2 output
1002	UINT16	R		Modbus schedule 3 output
1003	UINT16	R		Modbus schedule 4 output
1100	STRUCT	W		Modbus schedule 1 configuration (see format below)
1200	STRUCT	W		Modbus schedule 2 configuration
1300	STRUCT	W		Modbus schedule 3 configuration
1400	STRUCT	W		Modbus schedule 4 configuration

2000	FLOAT	R	°F/°C	NTC_1 temperature
2002	FLOAT	R	°F/°C	NTC_2 temperature
2004	FLOAT	R	°F/°C	NTC_3 temperature
2006	FLOAT	R	°F/°C	NTC_4 temperature
2008	FLOAT	R	°F/°C	NTC_5 temperature
2010	FLOAT	R	%	AI_1 value.
2012	UINT16	R		DI_1 state (0=off, 1=on)
2013	UINT16	R		DI_2 state (0=off, 1=on)
2014	UINT16	R		DI_3 state (0=off, 1=on)
2015	UINT16	R		DI_4 state (0=off, 1=on)
2016	UINT16	R		DI_5 state (0=off, 1=on)
2100	UINT16	W		DO_1 state
2101	UINT16	W		DO_2 state
2104	FLOAT	W	%	AO_1 value
3000	FLOAT	R	V	Minimum value of A voltage
3002	FLOAT	R	V	Maximum value of A voltage
3004	FLOAT	R	V	Minimum value of B voltage
3006	FLOAT	R	V	Maximum value of B voltage
3008	FLOAT	R	V	Minimum value of C voltage
3010	FLOAT	R	V	Maximum value of C voltage
3012	FLOAT	R	V	Minimum value of CA voltage
3014	FLOAT	R	V	Maximum value of CA voltage
3016	FLOAT	R	V	Minimum value of AB voltage
3018	FLOAT	R	V	Maximum value of AB voltage
3020	FLOAT	R	V	Minimum value of BC voltage
3022	FLOAT	R	V	Maximum value of BC voltage
3024	FLOAT	R	A	Minimum value of A current
3026	FLOAT	R	A	Maximum value of A current
3028	FLOAT	R	A	Minimum value of B current
3030	FLOAT	R	A	Maximum value of B current
3032	FLOAT	R	A	Minimum value of C current
3034	FLOAT	R	A	Maximum value of C current
3036	FLOAT	R	kW	Minimum value of total active power
3038	FLOAT	R	kW	Maximum value of total active power
4000	UINT16	W		Holiday 1: day (0 to disable)
4001	UINT16	W		Holiday 1: month (0 to disable)
4002	UINT16	W		Holiday 2: day
4003	UINT16	W		Holiday 2: month
...	...	...	...	...
4038	UINT16	W		Holiday 20: day
4039	UINT16	W		Holiday 20: month
20000	UINT16	R		Float integer read. See notes below
...				
29999	UINT16	R		
65001	UINT16	R		Firmware version (100 = 1.00)

Table 6 - Modbus registers.

Table notes

1. Registers 300s shows energy accumulators, in float format. The same values are presented in integer format (truncated) in registers 400s.

2. Actual date/time values can be read in 500-505 registers. To set date/time, you must to write new date/time values in registers 600-605 and write value 12345 to register 606. Any different value is ignored and date/time is not changed. You can write all of these values in one single transaction using Modbus function 16.

3. Digital outputs state are available in registers 2100-2101. It can be written by network when output's function is configured to "No function". If output is mapped to one internal function, internal logic takes precedence.

4. All float registers can be read in UINT16 format using registers 20000-29999. Just add original address of float register with 20000 to read in UINT16 format. In this mode, value is multiplied by 10. For example: to read C voltage register in integer format, you must use 20004 address. If register 4 has value 123.4, register 20004 will have 1234 value.

Modbus alarms

Modbus register 100 show active meter alarms. Each bit represents one active alarm, defined in table 7.

BIT	ALARM
0	NTC_1 failure (disconnected sensor)
1	NTC_2 failure
2	NTC_3 failure
3	NTC_4 failure
4	NTC_5 failure
5	AI_1 failure (disconnected loop)
6	Invalid date/time.
7	Calibration error. Contact factory.

Table 7 - Modbus alarms.

Modbus schedules

Modbus registers 1100 to 1400 represents Modbus schedules configuration. There are 4 schedules available that can be mapped to digital outputs or accessed by network in registers 1000-1003.

Each schedule is formed by 4 independent periods. Any period that is valid turn schedule's output on. Each period is configured by 5 registers. The first one indicates period's valid days. Bit 7 to 1 represents Sunday to Saturday respectively. Bit 0 represent holidays. Second/third register configures the hour/minute that period is valid from. Fourth/fifth register configures end time of period. Complete format is show in table 8.

1x00	UINT16	W		Period 1 - valid days
1x01	UINT16	W		Period 1 - start hour (0-23)
1x02	UINT16	W		Period 1 - start minute (0-59)
1x03	UINT16	W		Period 1 - end hour
1x04	UINT16	W		Period 1 - end minute
1x05	UINT16	W		Period 2 - valid days
1x06	UINT16	W		Period 2 - start hour (0-23)
1x07	UINT16	W		Period 2 - start minute (0-59)
1x08	UINT16	W		Period 2 - end hour
1x09	UINT16	W		Period 2 - end minute
1x10	UINT16	W		Period 3 - valid days
1x11	UINT16	W		Period 3 - start hour (0-23)
1x12	UINT16	W		Period 3 - start minute (0-59)
1x13	UINT16	W		Period 3 - end hour
1x14	UINT16	W		Period 3 - end minute
1x15	UINT16	W		Period 4 - valid days
1x16	UINT16	W		Period 4 - start hour (0-23)
1x17	UINT16	W		Period 4 - start minute (0-59)
1x18	UINT16	W		Period 4 - end hour
1x19	UINT16	W		Period 4 - end minute

Table 8 - Modbus schedule format.

SNMP PROTOCOL

MEI-EM20 have support to the Simple Network Management Protocol (SNMP) in version SNMPv2c. Only requests GET and GETNEXT are supported.

The MIB file can be downloaded in webserver, at address (change 10.1.1.240 with MEI-EM20's current IP address):

http://10.1.1.240/MEI.mib

The community string parameter is default "public".

Table 9 presents all objects available in current firmware. All float data is converted to standard Integer32 format, multiplied by the factor in column "scale".

ID	SCALE	UNIT	DESCRIPTION
1	10	V	A voltage
2	10	V	B voltage
3	10	V	C voltage
4	10	V	CA voltage
5	10	V	AB voltage
6	10	V	BC voltage
7	10	A	A current
8	10	A	B current
9	10	A	C current
10	10	kW	A active power
11	10	kW	B active power
12	10	kW	C active power
13	10	kVAr	A reactive power
14	10	kVAr	B reactive power
15	10	kVAr	C reactive power
16	10	kVA	A apparent power
17	10	kVA	B apparent power
18	10	kVA	C apparent power
19	10	kW	Total active power
20	10	kVAr	Total reactive power
21	10	kVA	Total apparent power
22	100		A power factor
23	100		B power factor
24	100		C power factor
25	100		Total power factor
26	10		Frequency (A phase)
27	1	°	CA phase angle
28	1	°	AB phase angle
29	1	°	BC phase angle
30	1	kWh	Imported active energy accumulator
31	1	kWh	Exported active energy accumulator
32	1	kWh	Net (imported - exported) energy accumulator
33	1	kVArh	Q1 reactive energy accumulator
34	1	kVArh	Q2 reactive energy accumulator
35	1	kVArh	Q3 reactive energy accumulator
36	1	kVArh	Q4 reactive energy accumulator
37	10	°F/C	NTC_1 input temperature
38	10	°F/C	NTC_2 input temperature
39	10	°F/C	NTC_3 input temperature
40	10	°F/C	NTC_4 input temperature
41	10	°F/C	NTC_5 input temperature
42	10	%	AI_1 value
43	1	user	Pulse 1 accumulator
44	1	user	Pulse 2 accumulator
45	1	user	Pulse 3 accumulator
46	1	user	Pulse 4 accumulator
47	1	user	Pulse 5 accumulator
48			Digital input 1 state
49			Digital input 2 state
50			Digital input 3 state
51			Digital input 4 state

52			Digital input 5 state
53	10	V	Minimum A voltage value
54	10	V	Maximum A voltage value
55	10	V	Minimum B voltage value
56	10	V	Maximum B voltage value
57	10	V	Minimum C voltage value
58	10	V	Maximum C voltage value
59	10	V	Minimum CA voltage value
60	10	V	Maximum CA voltage value
61	10	V	Minimum AB voltage value
62	10	V	Maximum AB voltage value
63	10	V	Minimum BC voltage value
64	10	V	Maximum BC voltage value
65	10	A	Minimum A current value
66	10	A	Maximum A current value
67	10	A	Minimum B current value
68	10	A	Maximum B current value
69	10	A	Minimum C current value
70	10	A	Maximum C current value
71	10	kW	Minimum total active power value
72	10	kW	Maximum total active power value

Table 9 - SNMP object table.

REGIONAL SETTINGS

MEI-EM20 have support to regional settings (language, unit system, ...). Available parameters are shown in table 10. You can change this parameter by web interface ou local display interface.

Parameter	Description
Language	Select local and web interface language between portuguese, english or spanish.
Units	Define units system to be used: SI or US.
Date format	Select between date visualization in dd/mm/yyyy or mm/dd/yyyy formats.
Time format	Select between 24h or 12h format.
Line frequency	Select mains line frequency (50 or 60Hz)

Table 10 - Regional settings.

When language setting is changed, BACnet object names are also changed to selected language.

LOCAL INTERFACE

MEI-EM20's local interface can be used to quickly see metering values and do basic configuration.

Interface is divided in several menus that can be changed using NEXT key. Menus are circular: when in last menu, NEXT key goes back to first menu. Table 11 shows all available menus in current firmware version.

Menu	Description
ENERGY	Energy and pulse accumulators/totalizers.
ELECTRIC (PHASE)	Electrical phase measurement data.
ELECTRIC (TOTAL)	Electrical total measurement data.
METER	Meter information.
I/O	Input/output states.
ALARMS	Active alarms

Table 11 - Available local interface menus.

After selecting a menu with NEXT, you can enter menu using DOWN key. When in menu, keys UP and DOWN navigate between all available screens. At any time you can use NEXT key to go to the next menu.

To access hidden settings menu, you must press NEXT and ENTER key simultaneous until "Settings" shows up in display.

Table 12 shown all available screens in each menu.

Menu	Screen	Description
ENERGY	Imp active energ	Imported active energy totalizer
	Exp active energ	Exported active energy totalizer
	Net active energ	Net (imported - exported) active energy totalizer
	Q1 react energy	Q1 reactive energy totalizer
	Q2 react energy	Q2 reactive energy totalizer
	Q3 react energy	Q3 reactive energy totalizer
	Q4 react energy	Q4 reactive energy totalizer
	Pulse input 1	Pulse input 1 totalizer[1]
	Pulse input 2	Pulse input 2 totalizer[1]
	Pulse input 3	Pulse input 3 totalizer[1]
	Pulse input 4	Pulse input 4 totalizer[1]
	Pulse input 5	Pulse input 5 totalizer[1]
ELECTRIC (PHASE)	VLN	Line to neutral voltages
	VLL	Line to line voltages
	I	Phase currents
	kW	Phase active power
	kVAr	Phase reactive power
	kVA	Phase apparent power
	PF	Phase power factor
	ANG	Phase to phase angles
	Frequency	Frequency (A phase)
ELECTRIC (TOTAL)	Tot active power	Total active power
	Tot react power	Total reactive power
	Total PF	Total power factor
	Phase sequence	Phase sequence
METER	Date	Current date
	Time	Current time
	PT ratio	PT ratio configuration
	IP address	Current IP address
	Netmask	Current IP netmask
	Gateway	Current IP default gateway
	Ethernet MAC	Factory-configured ethernet address
	Bacnet DeviceID	Current BACnet device-id.
	MS/TP address	Address of meter in MS/TP network.
	Modbus address	Address of meter in Modbus RTU network.
	485 baudrate	Baudrate of RS485 port.
	Firmware version	Installed firmware version.
I/O	NTC 1	NTC 1 temperature
	NTC 2	NTC 2 temperature
	NTC 3	NTC 3 temperature
	NTC 4	NTC 4 temperature
	NTC 5	NTC 5 temperature
	Analog input	AI_1 value (%)
	Digital input 1	DI_1 state
	Digital input 2	DI_2 state
	Digital input 3	DI_3 state
	Digital input 4	DI_4 state
	Digital input 5	DI_5 state
	Ouput 1	DO_1 state
	Output 2	DO_2 state
	Analog output	Analog output value (%)
ALARMS	Alarm	Shows all active alarms.

Table 12 - Local interface screens.

NOTE 1: Pulse inputs descriptions can be changed in web interface input settings menu.

Table 13 show a list of all available configurations in settings menu accessed by local interface.

Config	Description
Language	Defines the interface language (local and web).
Units system	Select to use international system of units os US system.
Date format	Select tha date format (day/month or month/day)
Time format	Select time format of 12 or 24 hours.
Line frequency	Define the mains line frequency (50 or 60Hz)
Metering mode	Select the wiring mode
CT selection	Select internal (integrated) or external CTs to current measurement.
Ext CT value	Defines the external CT primary value (full-scale)
PT ratio primary	If PT used, defines primary (nominal) value
PT ratio second	If PT used, defines secondary (nominal) value
IP Address	Defines IP address of meter.
Netmask	Defines subnet mask of meter on IP network.
Def gateway	Defines default subnet gateway.
BAC/eth enabled	Enables BACnet/Ethernet datalink.
BAC/IP enabled	Enables BACnet/IP datalink.
BACnet/IP port	Defines BACnet/IP datalink UDP port.
BACnet DeviceID	Defines BACnet global Device ID of meter.
485 protocol	Defines protocol enabled on RS485 port.
485 Baudrate	Defines RS485 port baudrate.
MS/TP address	Defines MS/TP station address
Modbus address	Defines address of meter on Modbus RTU network
Pulse 1 scale	Define pulse input 1 scale
Pulse 2 scale	Define pulse input 2 scale
Pulse 3 scale	Define pulse input 3 scale
Pulse 4 scale	Define pulse input 4 scale
Pulse 5 scale	Define pulse input 5 scale
Date set	Set current date
Time set	Set current time
Reset peak lim?	If yes, reset peak limits registers.

Table 13 - Configurations on local interface.

WEB INTERFACE

MEI-EM20's internal web server provides a web interface that makes very easy to see metering data and do full configuration of equipment.

In top menu you can select main pages and on left menu, sub-pages. A list of all menus are shown in table 14.

Top menu	Left menu	Description
Metering data	Energy	Shows energy/pulse totalizers.
	Electrical	Shows all electrical metering data.
	Trendlogs	Permit trendlog data downloads in CSV format.
	Inputs/Outputs	Show input and output states.
	Alarms	Show active alarms.
	Equipment	Meter information.
Commands	Date/time set	Permits date and time adjust.
	Commands	Commands to erase trendlogs or energy totalizers.
Settings	Metering	Settings related to power and energy measurement.
	Inputs	Settings related to meter inputs (digital, pulse or NTC)
	Outputs	Select output functions.
	Communication	Settings related to communication channels.
	Other	Regional and other settings.

Table 14 - Web interface menus.

Table 15 shows all available configurations in web interface.

Group	Subgroup	Setting	Description
Metering	CT setting	CT selection	Select which CTs are used to current measurement (internal or external).
		External CT value	External CT primary full-scale value.
	Metering mode	Mode	Define wiring and measurement mode.
	PT scale	Primary	If PT used, defines primary value
		Secondary	If PT used, defines secondary value
Inputs	Input x	Type	Select input type
		Tag	Select name of input to ease identification.
		Unit	Configure engineering units of input (text).
		Pulse scale	Defines the scale of each pulse in engineering units
		NTC offset	Configure a manual offset for temperature measurement.
		Pulse filter	Define the minimum pulse width to activate input.
	Analog input	Type	Type of analog input.
		Tag	Define the name of analog input, to ease visualization.
		Unit	Define the engineering units of analog input.
		Minimum value	Define value in engineering units at input's minimum value.
		Maximum value	Define value in engineering units at input's maximum value.
Outputs	Output function	Output DO_x	Configure the function for output DO_x
Commu-nication	Ethernet	IP address	Configures the IP address of meter.
		Netmask	Configures the subnet mask of IP network.
		Default gateway	Configures the default gateway's IP for external access of network.
		Ethernet speed	Fix ethernet maximum speed.
	RS485	Baudrate	Configure RS485 baudrate
		Protocol	Select RS485 protocol (Modbus RTU or BACnet MS/TP)
	BACnet	Device ID	Configures global BACnet's device ID.
		Enable BACnet/IP	Enable BACnet/IP datalink.
		Port	Defines BACnet/IP UDP port.
		Enable BACnet/Ethernet	Enable BACnet/Ethernet datalink.
		MAC (Station addr)	Defines address of meter in BACnet MS/TP network.
		Max Master	Defines the maximum address existent on MS/TP network.
	Modbus	Modbus address	Defines the address of meter in Modbus RTU network.
Other	Regional settings	Language	Sets the language of local and web interface.
		Units	Define units system to be used.
		Date format	Select date format (day/month or month/day)
		Time format	Select 12 or 24 hours clock.
		Line frequency	Select mains line frequency (50 or 60Hz)
	Description	Location	Configure a text to ease identification of meter. It shows up in title of web interface.
	Passwords	Settings password	Defines the password for web interface settings menu.

Table 15 - Web interface settings available.

SCHEDULES

MEI-EM20 has internal timing schedules that can be used to control generic loads on digital outputs. There are 2 BACnet schedule objects and 2 Modbus objects, to control each output independently. When using BACnet network protocol, is recommended to use BACnet schedule objects. This permits any BMS software to edit schedule's configuration. In other way, if using Modbus protocol, use Modbus schedules that are editable by network.

BACnet schedule configuration is done only by network. It's a standard schedule object, limited to enum datatype. Schedule support both weekly-schedule and exception-schedule properties. Special dates like holidays can be configured in exception-schedule property or using the calendar object available.

Modbus schedule's configuration are mapped in Modbus registers, in format explained in MODBUS PROTOCOL section. Special dates (holidays) can be configured in holiday table available in registers 4000. In these registers, you have one for configure day of holiday and another for month. You can configure up to 20 holidays. To disable one entry, just write value zero in day and month. Valid holidays does not need to be in sequence (you can have disabled holidays between valid ones).

In settings menu you can choose each output's function. In selection list you can choose any of schedule objects available.

TECHNICAL SPECIFICATIONS

Power supply	90 to 277V_{AC}, 50/60Hz. Overvoltage category III.
Consumption	15 VA maximum
Environmental ratings	Pollution degree 2. Operating ambient temperature: -20 to 60ºC (-4 to 140ºF). Relative humidity: 5 to 95%, non-condensing. Maximum altitude 2000m. Indoor use only.
Wiring	12-18AWG, 600V. **Use copper wire only! Must use 75°C or higher rated insulation**
Connectors torque	Max 0.4Nm (3.5Lb-in).
Voltage inputs	90V_{AC} to 347V_{AC} L-N (600V_{AC} L-L). CAT III instalations.
External CT inputs	For 0.333V_{AC} (full-scale) voltage output CTs only. **Use only UL listed energy monitoring current transformers.**
Digital outputs	Relays. Maximum resistive load: 2A / 250V_{AC}. Maximum inductive load: 0.25HP / 250V_{AC}. Pilot duty 240V_{AC}.
Digital inputs	For dry contact, without power. Current ~200uA. Maximum frequency (pulses): 100Hz.
Temperature Inputs	NTC 10k type sensor Curves available for type II or type III curves.
Analog input	Configurable between: voltage (0-10V) or current (0-20mA or 4-20mA). Resolution 10 bits.
Accuracy	Voltage and current 0.2%, Power and energy 0.5%.
Clock	Maintained by supercapacitor. Autonomy of 10 days.
RS485 port	EIA-485, isolated, with internal power. Insulation 1500V Max 115200 bps.
Ethernet port	10/100Mbps, without cable polarity (Auto MDI/MDI-X). Protocols supported: ARP, IPv4, UDP, TCP, HTTP, DHCP, ModbusTCP, ModbusUDP, BACnet/IP, BACnet/Ethernet.
Mounting	Panel rear, using screws
External dimensions	160 x 112 x 98 mm (L x D x H); Wire opening diameter: 17mm
Compliance information	CAT III UL 61010-1, UL 61010-2-30 CSA C22.2 No. 61010-1-12, CSA C22.2 No. 61010-2-030:18

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