Electrical energy meter with an integrated serial RS485 Modbus interface allow direct reading of all relevant data, such as energy (total and partial), current and voltage for every phase and active and reactive power for every phase and for the three phases.

Main features:
- 3-phase energy meter, 3 × 230 / 400 VAC 50 Hz
- Measurement through a current transformer up to 1500 A
- Display of active power, voltage and current for every phase
- Display of active power for all phases
- Modbus RTU Interface to query the data
- Reactive power for every and/or all phases available through interface
- cosφ for every phases available through interface
- Up to 247 meters can be connected to the Modbus Interface
- 7-digits display
- Lead seal possible with cap as accessory
- Accuracy class B according to EN50470-3, accuracy class 1 according to IEC62053-21

Order Number
Standard Version: EEM400C-D-MO
MID Version: EEM400C-D-MO-MID

Technical data
- Precision class: B according to EN50470-3, 1 according to IEC62053-21
- Operating voltage: 3 × 230 / 400 VAC, 50 Hz
- Tolerance: –20% / +15%
- Power consumption: Active 0.4 W per phase
- Counting range: 000 000.0…999 999.9
- Display: LCD backlit, digits 6 mm high
- Display without mains power: Capacitor based LCD
- max. 2 times over 10 days

Mounting
- Main circuit connections: Conductor cross-section 1.5 – 16 mm², screwdriver pozidrive no. 1, slot no. 2, torque 1.5 – 2 Nm
- Control circuit connections: Conductor cross-section max. 2.5 mm², screwdriver pozidrive no. 0, slot no. 2, torque 0.8 Nm
- Insulation characteristics:
  - 4 kV / 50 Hz test according to VDE0435 for energy meter part
  - 6 kV / 1.2 μs Surge according to IEC255-4
  - 2 kV / 50 Hz test according to VDE0435 for interface
- Device protection class II
- Ambient temperature: –25°…+55 °C
- Storage temperature: –30°…+85 °C
- Relative humidity: 95% at 25°…+40 °C without condensation
- EMC/interference immunity:
  - Surge according to IEC61000-4-5:
    - on main circuit 4 kV, at Modbus 1 kV
  - Burst according to IEC61000-4-4:
    - on main circuit 4 kV, at Modbus interface 1 kV
  - ESD according to IEC61000-4-2:
    - contact 8 kV, air 15 kV

CT measurement
- Reference/max. current: \( I_{ref} = 5 \, \text{A}, \, I_{max} = 6 \, \text{A} \)
- Starting/minimum current: \( I_s = 10 \, \text{mA}, \, I_{min} = 0.05 \, \text{A} \)
- Converter ratio:
  - 5:5
  - 50:5
  - 100:5
  - 150:5
  - 200:5
  - 250:5
  - 300:5
  - 400:5
  - 500:5
  - 600:5
  - 750:5
  - 1000:5
  - 1500:5
- Pulses per kWh: LED
  - 10 Imp/kWh
## Error display

**Example: Connection error at L3**

<table>
<thead>
<tr>
<th>T1 total</th>
<th>T1 part</th>
<th>CT</th>
<th>Select</th>
<th>P (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error</th>
<th>U (V)</th>
<th>I (A)</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Example: Connection error at L1 and L3**

<table>
<thead>
<tr>
<th>T1 total</th>
<th>T1 part</th>
<th>CT</th>
<th>Select</th>
<th>P (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error</th>
<th>U (V)</th>
<th>I (A)</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Dimension drawings

**Display elements**

- **T1 total (kWh)**: Indicates total consumption
- **T1 part (kWh)**: Indicates partial consumption
- **This value can be reset**
- **CT**: Indicates the setting for the current transformer ratio
- **Select**: When bridge Z1-Z2 is open, the transformer ratio can be adjusted under menu item: Select
- **P (kW)**: Indicates the instantaneous output per phase or for all phases
- **U (V)**: Indicates voltage per phase
- **I (A)**: Indicates current per phase
- **kWh**: Indicates the unit kWh for display of consumption
- **L1 / L2 / L3**: Whenever the display shows P, U, I or Error, the corresponding phase will be indicated
- **Error**: When phase is absent or current direction is wrong. The corresponding phase will also be indicated.
Menu to display the value on LCD

Start

T1 total

> 3 s

T1 partial (T1 part)

> 3 s

Ratio Current Transformer (CT)

> 3 s

EEM400C-D-MO

S ... 1500 A

5.5 50.5 100.5 150.5 200.5 250.5 300.5 400.5 500.5 600.5 750.5 1000.5 1250.5 1500.5

Instan. Power (P)

Instantaneous power

Start

Voltage (U)

Current (I)

Start

Menu to display the value on LCD

Start

T1 total

> 3 s

T1 partial (T1 part)

> 3 s

Ratio Current Transformer (CT)

> 3 s

EEM400C-D-MO

S ... 1500 A

5.5 50.5 100.5 150.5 200.5 250.5 300.5 400.5 500.5 600.5 750.5 1000.5 1250.5 1500.5

Instan. Power (P)

Instantaneous power

Start

Voltage (U)

Current (I)

Start
Wiring diagram

The secondary, mains current transformer connection has to be connected to the phase to be measured and therefore the transformer don't have to be grounded.

Fuse: T 250 mA (3x)
Technical data Modbus

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Modbus RTU according to IDA specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus system</td>
<td>RS485 serial line</td>
</tr>
<tr>
<td>Transmission rate (bps)</td>
<td>1200-2400-4800-9600-19 200-38 400-57 600-115 200. The transmission baud rate is automatically detected</td>
</tr>
<tr>
<td>Bit settings</td>
<td>8 data bits, even parity, 1 Stop bit</td>
</tr>
<tr>
<td>Bus cable</td>
<td>Twisted, shielded, 2 × 0.5 mm², 1200 m max.</td>
</tr>
<tr>
<td>Response time (to system response)</td>
<td>typ. 5 character times max. 60 ms</td>
</tr>
</tbody>
</table>

- The interface works only if the phase 1 is connected.
- The communication is ready 30 seconds after the ‘Power On’.
- Refresh time for the data is 10 seconds. Therefore the delay between reads of the same Data should be at least 10 seconds.
- The use of energy meters in bus with intensive communication can increase the data refresh time.
- 247 devices can be connected to the Modbus. Over 128 devices, a repeater should be used.
- The interface don’t have a terminal resistor, this should be provided external.
- For the following transmission rate changes a restart of the counter is necessary: 1200 ➞ 57 600, 1200 ➞ 115 200 and 2400 ➞ 115 200.
- For a description of the used registers please look at the register page.

Data transmission
- Only «Read Holding Registers [03]/ Write Multiple Registers [16]» instructions are recognized.
- Up to 20 registers can be read at a time.
- The device supports broadcast messages.
- In accordance with the Modbus protocol, a register R is numbered as R - 1 when transmitted.
- The device has a voltage monitoring system. In case of voltage loss, registers are stored in EEPROM (transmission rate, etc.)

Exception Responses
- ILLEGAL FUNCTION [01]: The function code is not implemented.
- ILLEGAL DATA ADDRESS [02]: The address of some requested registers is out of range or more than 20 registers have been requested.
- ILLEGAL DATA VALUE [03]: The value in the data field is invalid for the referenced register.

Change the Modbus address direct on device
- To modify the Modbus address, press 3 sec on ► touch
- In menu, ▼ increase address by 10, ► increase by 1
- Once the address is selected wait for the root menu to come back
## Registers

For double registers (4–5, 16–17, 28–29, 30–31) the high register is sent first (bigEndian). The Partial counter (30–31) can be reset by writing 0 in both registers in the same message.

<table>
<thead>
<tr>
<th>R</th>
<th>Read</th>
<th>Write</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X</td>
<td></td>
<td>Firmware-Version</td>
<td>Ex: 11 = FW 1.1</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td></td>
<td>Modbus com. number of supported registers</td>
<td>Will give 52</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td></td>
<td>Modbus com. number of supported flags</td>
<td>Will give 0</td>
</tr>
</tbody>
</table>
| 4–5| X    |       | Baudrate                                              | Ex: Baudrate High = 1  Baudrate Low = 49664  
1 × 65536 + 49664 = 115 200 bps |
| 6  | X    |       | Not Used                                              | Will give 0                    |
| 7  | X    |       | Type / ASN function                                   | Will give «EE»                  |
| 8  | X    |       | Type / ASN function                                   | Will give «M4»                  |
| 9  | X    |       | Type / ASN function                                   | Will give «00»                  |
| 10 | X    |       | Type / ASN function                                   | Will give «C-»                   |
| 11 | X    |       | Type / ASN function                                   | Will give «D-»                   |
| 12 | X    |       | Type / ASN function                                   | Will give «MO»                   |
| 13 | X    |       | Type / ASN function                                   | Will give « »                     |
| 14 | X    |       | Type / ASN function                                   | Will give « »                     |
| 15 | X    |       | HW vers. Modif.                                       | Ex: 11 = HW 1.1                 |
| 16–17| X  |       | Serial number Low                                     | Ex: «12AB»                      |
| 18 | X    |       | Serial number High                                    | Ex: «HK»                        |
| 19 | X    |       | Not Used                                              | Will give 0                      |
| 20 | X    |       | Not Used                                              | Will give 0                      |
| 21 | X    |       | Not Used                                              | Will give 0                      |
| 22 | X    |       | Status / Protect                                      | 0 = no Problem  
1 = problem with last communication request |
| 23 | X    |       | Modbus Timeout                                        | ms                               |
| 24 | X    |       | Modbus Address                                        | Range 1–247                     |
| 25 | X    |       | Error register                                         | 0 : No error  
1 : Error Phase 1  
2 : Error Phase 2  
3 : Error Phase 1 and 2  
4 : Error Phase 3  
5 : Error Phase 1 and 3  
6 : Error Phase 2 and 3  
7 : Error Phase 1, 2 and 3 |
| 26 | X    |       | Current Transformer Ratio                              | Ex: Transformer 100 / 5 give 20  |
| 27 | X    |       | Not Used                                              | Will give 0                      |
| 28–29| X  |       | WT1 total High Counter Energy Total Tariff 1 High      | 10⁻³ kWh (multiplier 0,1)  
Ex: WT1 total High = 13  WT1 total Low = 60383  
13 x 65536 + 60383 = 912351 = 91235.1 kWh  |
| 30–31| X  |       | WT1 partial Counter Energy Partial Tariff 1            | 10⁻³ kWh (multiplier 0,1)  
Ex:WT1 partial High = 13  WT1 partial Low = 60383  
13 x 65536 + 60383 = 912351 = 91235.1 kWh  |
<p>| 32 | X    |       | Not Used                                              | Will give 0                      |
| 33 | X    |       | Not Used                                              | Will give 0                      |
| 34 | X    |       | Not Used                                              | Will give 0                      |
| 35 | X    |       | Not Used                                              | Will give 0                      |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 36 | X | URMS phase 1  
Effective Voltage of Phase 1 | V  
Ex: 230 = 230 V |
| 37 | X | IRMS phase 1  
Effective Current of Phase 1 | A / Except 5/5 = 10⁻¹ A  
Ex: 314 = 314 A |
| 38 | X | PRMS phase 1  
Effective active Power of Phase 1 | 10⁻¹ kW (multiplier 0,1)  
Ex: 1545 = 154,5 kW |
| 39 | X | QRMS phase 1  
Effective reactive Power of Phase 1 | 10⁻¹ kvar (multiplier 0,1)  
Ex: 1545 = 154,5 kvar |
| 40 | X | cos phi phase 1 | 10⁻² (multiplier 0,01)  
Ex: 67 = 0,67 |
| 41 | X | URMS phase 2  
Effective Voltage of Phase 2 | V  
Ex: 230 = 230 V |
| 42 | X | IRMS phase 2  
Effective Current of Phase 2 | A / Except 5/5 = 10⁻¹ A  
Ex: 314 = 314 A |
| 43 | X | PRMS phase 2  
Effective active Power of Phase 2 | 10⁻¹ kW (multiplier 0,1)  
Ex: 1545 = 154,5 kW |
| 44 | X | QRMS phase 2  
Effective reactive Power of Phase 2 | 10⁻¹ kvar (multiplier 0,1)  
Ex: 1545 = 154,5 kvar |
| 45 | X | cos phi phase 2 | 10⁻² (multiplier 0,01)  
Ex: 67 = 0,67 |
| 46 | X | URMS phase 3  
Effective Voltage of Phase 3 | V  
Ex: 230 = 230 V |
| 47 | X | IRMS phase 3  
Effective Current of Phase 3 | A / Except 5/5 = 10⁻¹ A  
Ex: 314 = 314 A |
| 48 | X | PRMS phase 3  
Effective active Power of Phase 3 | 10⁻¹ kW (multiplier 0,1)  
Ex: 1545 = 154,5 kW |
| 49 | X | QRMS phase 3  
Effective reactive Power of Phase 3 | 10⁻¹ kvar (multiplier 0,1)  
Ex: 1545 = 154,5 kvar |
| 50 | X | cos phi phase 3 | 10⁻² (multiplier 0,01)  
Ex: 67 = 0,67 |
| 51 | X | PRMS total  
Effective active Power of all phases | 10⁻¹ kW (multiplier 0,1)  
Ex: 1545 = 15,45 kW |
| 52 | X | QRMS total  
Effective reactive power of all phases | 10⁻¹ kvar (multiplier 0,1)  
Ex: 1545 = 15,45 kvar |

(1) The Modbus Address register is not writable with a broadcast message.