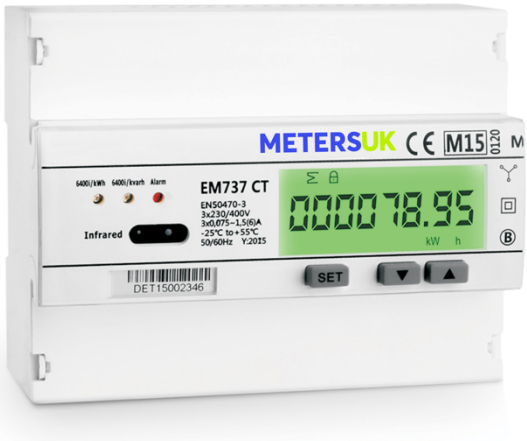
# EM-606CT MBus

Three Phase 4 module energy meter

## KEY FEATURES

The EM-606CT is three phase kWh M-bus meter with an LCD display in a 4 module (70mm) casing, ensuring a high accuracy class (Class1)




Excellent long-term stability which is designed for DIN, IEN and EN standards and 1 year warranty.

MID B approval which ensures the meter is produced to European and International standards and the meter is legally suited for both business and invoicing purposes.
For connection rate of up to 950A.

## METER SPECIFICATION

| Performance Criteria | |
|---|---|
| Operating Humidity | ≤ 75% |
| Storage Humidity | ≤ 95% |
| Operating Temperature | |
| Storage Temperature | -25°C to +55°C |
| International Standard | -30°C to +70°C |
| Active Energy Meters Class 1/B | IEC62053-23\| EN50470-1/3 |
| Reactive Energy Meters Class 2 | IEC62053-23 |
| Voltage, LN & LL (Phase 1,2,3) | ± 0.5% |
| Amps (Phase 1,2,3) | ± 0.5% |
| PF (Phase 1,2,3 & ∑) | ± 0.2% |
| Active Power (Phase 1,2,3 & ∑) | ± 0.5% |
| Reactive Power (Phase 1,2,3 & ∑) | ± 0.5% |
| Apparent Power (Phase 1,2,3 & ∑) | ± 0.5% |
| Frequency | ± 0.2% |
| Active Energy | ± 1% |
| Reactive Energy | ± 1% |
| Accuracy Class | 1/B |
| Protection against penetration of dust and water | IP51 |
| Insulating encased meter of protective class | II |
| The mechanical and electromagnetic environmental classes | B |

| Specifications | |
|---|---|
| Nominal Voltage (Un) | 230/400V AC (3~) |
| Operational Voltage | 161/279 - 300/520V AC (3~) |
| AC voltage withstand | 4KV for 1 minute |
| Impulse voltage withstand | 6KV - 1.2 μ S waveform |
| Basic Current (Ib) | 1.5/10A |
| Max. (Imax) | 6/100A |
| Starting current (Ist) | 0.4% of Ib |
| Imin \| Itr | 5%Ib \| 10% Ib |
| Over current withstand | 30Imax for 0.01s |
| Operational frequency range | 50Hz ±10% \| 60Hz ±10% |
| Internal power consumption | ≤2W /10VA per phase |
| Power consumption on current circuit | ≤ 4VA |
| Test output flash rate (PULSE LED) | 400, 800, 1600 or 3200imp/kWh |
| Test pulse output rate (pins 8 & 9) | 400, 800, 1600 or 3200imp/kWh |
| CT Changing Ratio | 27 ratios to choose |
| Power supply indicator (Phase A, B & C) | Meter is connected. A/B/C voltage power on |
| Consumption indicator (Pulse & SO LED) | Flashing |
| Communication indicator | Communication symbol flashes |
| Data Communication port | Mbus |
| Data Save | 20 years + when power off |
| **Dimensions** | |
| L x W x H (mm) | 112 x 70 x 65 |
| Weight | 1.2kg (net) |

MBus communication specifications:

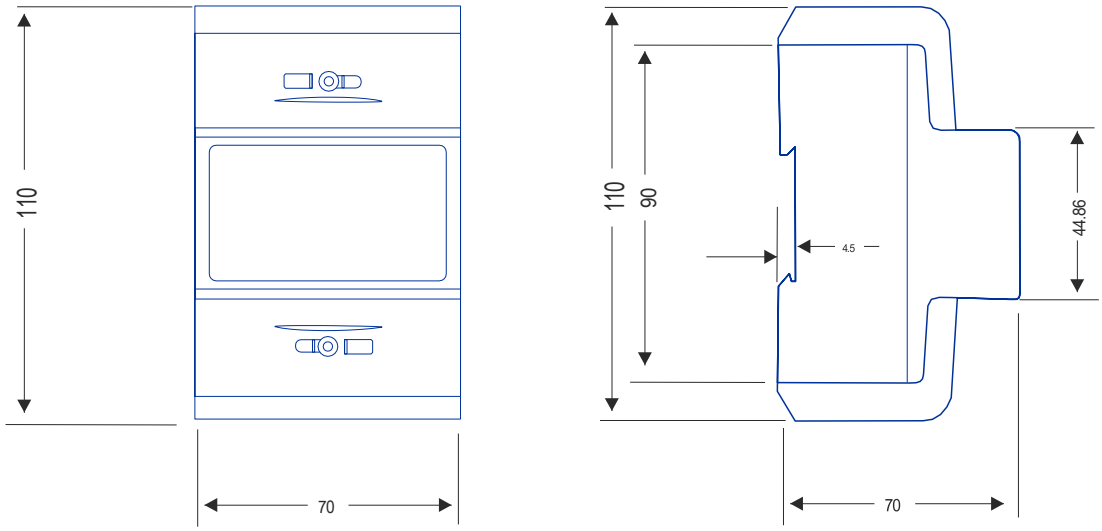
| | |
|---|---|
| Bus type | Mbus |
| baud rate | 300, 2400 (default), 4800, 9600 |
| Range | ≤1000m64PCS* |
| Downlink signal | Master to slave , Voltage modulation |
| Uplink signal | Slave to master , Current modulation |
| Cable | JYSTY （n×2×0.8） |
| Protocol | IEN13757-3 |
| Max. Number of meters | 64* |

*Note that the maximum number of meters is dependent on the converter, baud rate (the higher the baud rate the smaller the number of meters which can be used) and the circumstances under which the meters are installed.

## BASIC ERRORS (with balanced loads)

| Current value | Active Class 1.0 | | Reactive 2.0 | |
|---|---|---|---|---|
| | Power factor COSΦ | Error% | Power factor SINΦ | Error % |
| 0.05Ib≤I<0.1Ib | 1.0 | ±1.5 | 1.0 | ±2.5 |
| 0.1Ib≤I<Imax | 1.0 | ±1.0 | 0.5L or 0.8C | ±2.0 |
| 0.1Ib≤I<0.2Ib | 0.5L or 0.8C | ±1.5 | 1.0 | ±2.5 |
| 0.2Ib≤I<Imax | 0.5L or 0.8C | ±1.0 | 0.5L or 0.8C | ±2.0 |

## DIMENSIONS AND INSTALLATION




Register material: PC inflammable retarding
Case/Terminal Block/Cover: ABS inflammable retarding

## Installation

### Energy Use indicator

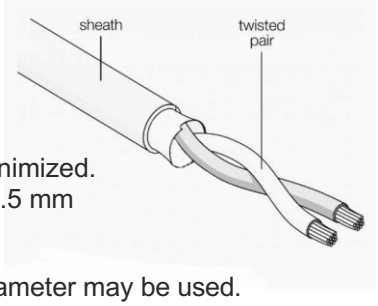
We recommend that the connecting wire which is used to connect the meter to the outside circuit should be sized according to local codes and regulations for the capacity of the circuit breaker or over current device used in the circuit.
An external switch or a circuit-breaker should be installed on the inlet wire, which will be used as a disconnection device for the meter. And there it is recommended that the switch or circuit-breaker is near the meter so that it is more convenience for the operator. The switch or circuit-breaker should comply with the specifications of the building electrical design and all local regulations
An external fuse or thermal cut-off which will be used as an over-current protection device for the meter must be installed on the supply side wire, and it is recommended that the over-current protection device is near the meter so that it is more convenience for the operator. The over-current protection device should comply with the specifications of the buildings electrical design and all local regulations.
This meter can be installed indoor directly, or in a meter box which is waterproof outdoor, subject to local codes and regulations.
To prevent tampering, secure the meter with a padlock or a similar device.
The meter has to be installed against a wall which is fire resistant.
The meter has to be installed in a good ventilated and dry place.
The meter has to be installed in a protection box when placed in dangerous or dusty environment.
The meter can be installed and used after being tested and sealed with a letter press printing.
The meter can be installed on a 35mm DIN rail.
The meter should be installed in an available height so that it is easy to read.
When the meter is installed in an area with frequent surges due to e.g. thunderstorms, welding machines, inverters etc., protect the meter with Surge Protection Devices.
After finishing installation, the meter must be sealed to prevent tampering.
Connection of the wires should be done as below: -

30 Reactive pulse output contact active (-) "-"
32 Active pulse output contact "-"
34 BUS2 (Mbus)

31 Reactive pulse output contact active (+) "+"
33 Active pulse output contact "+"
35 BUS1 (Mbus)

CT CONNECTIONS
27 L1 Phase Wire
25 L2 Phase Wire
27 L3 Phase Wire
N Neutral Wire

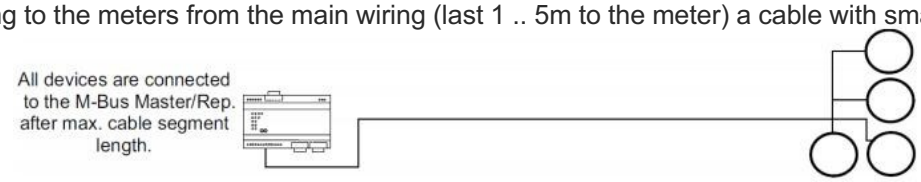
## 5A. TYPE OF CABLE TO USE




The MBus uses two wire cables which are going from the MBus Master / Repeater to each MBus device (bus structure).

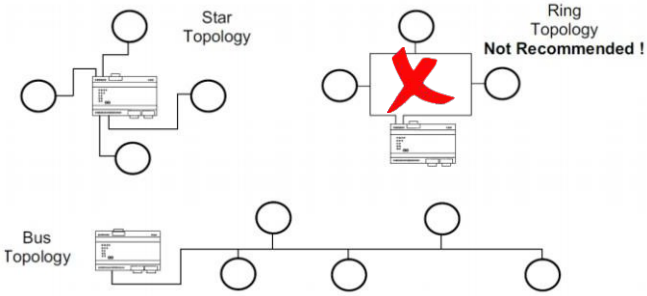
The MBus is polarity independent and needs no line termination resistors at the end of the cables.
Any cable type may be used as long as the cable is suitable for 36 V / 500 mA.
Shielding is not necessary and not recommended since the capacitance of the cable should be minimized.
In most cases a standard telephone cable is used which is a twisted pair wire with a diameter of 0.5 mm each (2 x 0.8 mm is also suitable). This type of cable should be used for the main wiring.

For the wiring to the meters from the main wiring (last 1 .. 5m to the meter) a cable with smaller diameter may be used.




## 5B. MBUS BASICS

The topology of the MBus network is (almost) arbitrary. Only the ring topology as shown should be avoided. In general, the length of the cables should be minimized and a mixture between star and bus topology should be used.




The limiting parameters in MBus networks are mainly the cable resistance and the cable capacitance plus the capacitance of the devices (= bus capacitance). Cable resistance will cause, a bus voltage drop. The maximum drop may not be more than 11 V .. 12 V, as the minimum bus voltage at any device must not be lower than 24 V (36 V – 24 V = 12 V).

The cable resistance, therefore, limits the maximum possible cable length from the MBus Master / Repeater to the device with the largest distance away from it (largest cable segment). The cable segment length is the distance from the MBus Master to the MBus device furthest away.

NOTE: The given maximum cable segment length takes into account only the bus resistance and not the bus capacitance. Therefore, some of the cable lengths in the table may not be possible in reality.

The cable capacitance plus the capacitance of the M-Bus devices (= bus capacitance) is responsible for sloppy signal edges. Therefore, the bus capacitance limits the maximum data transfer rate of the MBus. The MBus Master is able to drive approx. 0,8 µF at a baud rate of 300 baud.

## 5C. BAUD RATE & BIT RATES

Bit rate is a measurement of the number of data bits (that's 0's and 1's) transmitted in one second. A figure of 2400 bits per sec means 2400 zeros or ones can be transmitted in one second, hence the abbreviation 'bps'. Baud rate by definition means the number of times a signal in a communications channel changes state.

Common Settings for Mbus - 300 or 2400. Parity (Error Checking) is EVEN or NONE.
*ALL items MUST have the same settings otherwise they CANNOT communicate.*

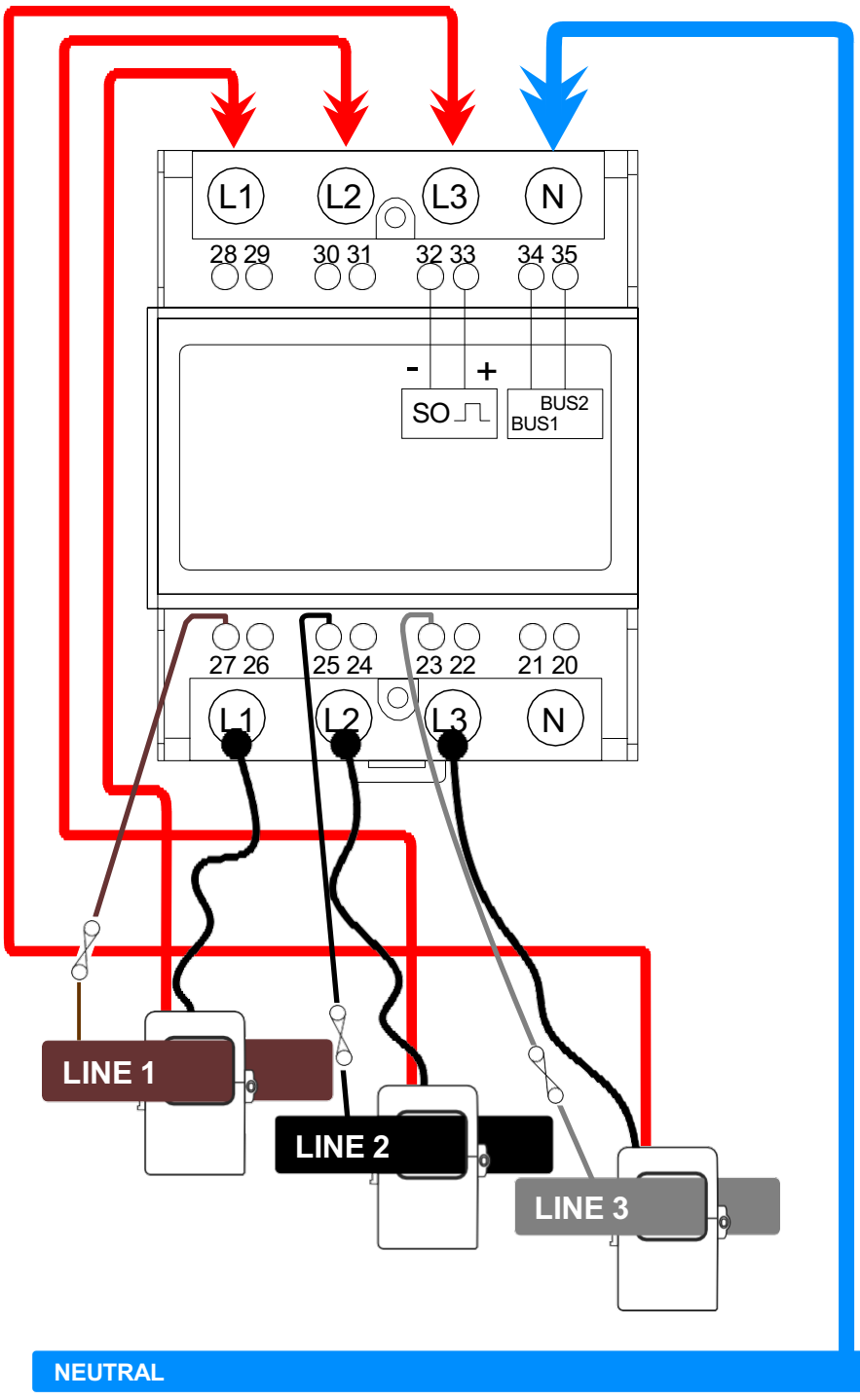
| **Baudrate:** | **300 Baud** |
|---|---|
| Cable Resistance: | 75 Ohm / km |
| Cable Capacitance: | 50 nF / km |
| Current capacitance of one M-Bus device: | 1 nF |
| of one M-Bus Device: | 1.5 mA |

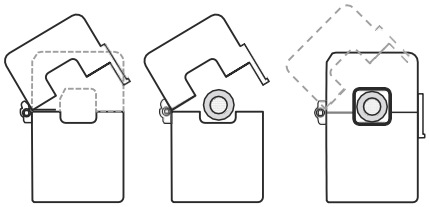
| Number of Devices | Max. Complete Cable Length (Bus Capacitance) | Max. Cable Segment Length (Bus Resistance) |
|---|---|---|
| 1 | 10 km | 100 km |
| 50 | 9 km | 2.1 km |
| 250 | 5 km | 0.42 km |

| **Baudrate:** | **2400 Baud** |
|---|---|
| Cable Resistance: | 75 Ohm / km |
| Cable Capacitance: | 50 nF / km |
| Current capacitance of one M-Bus device: | 1 nF |
| of one M-Bus Device: | 1.5 mA |

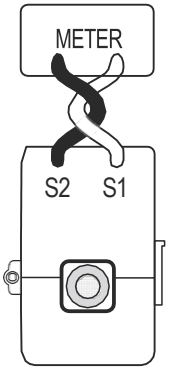
| Number of Devices | Max. Complete Cable Length (Bus Capacitance) | Max. Cable Segment Length (Bus Resistance) |
|---|---|---|
| 1 | 6 km | 100 km |
| 50 | 5 km | 2.1 km |
| 250 | 1 km | 0.42 km |

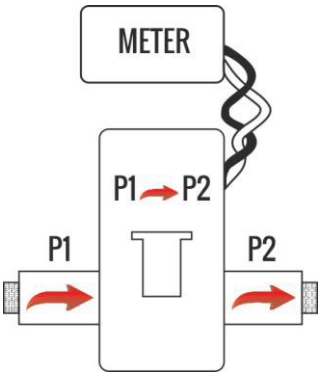
## INSTALLATION DIAGRAM

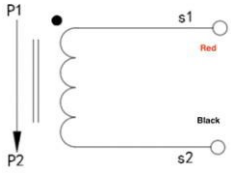


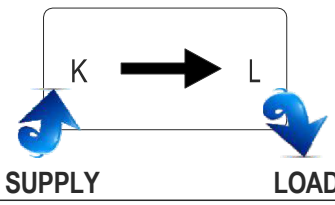





## OPERATING

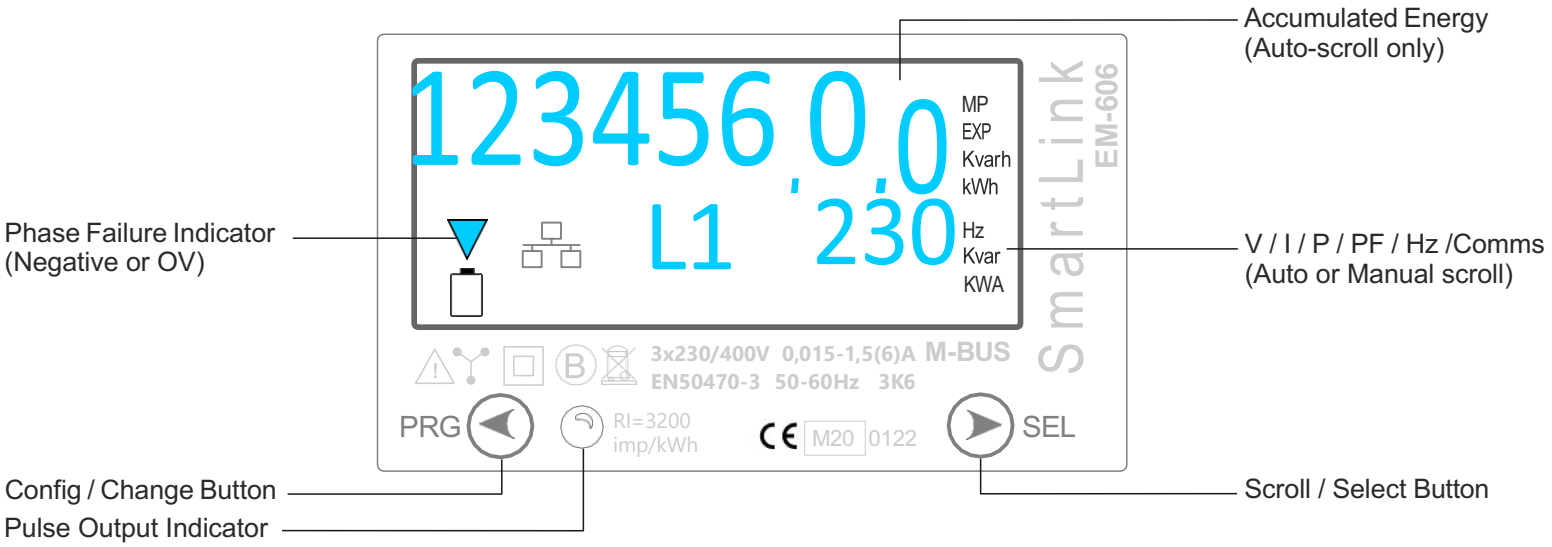
### Energy Usage

The LCD will display L1，L2，L3，the voltage and current bearing

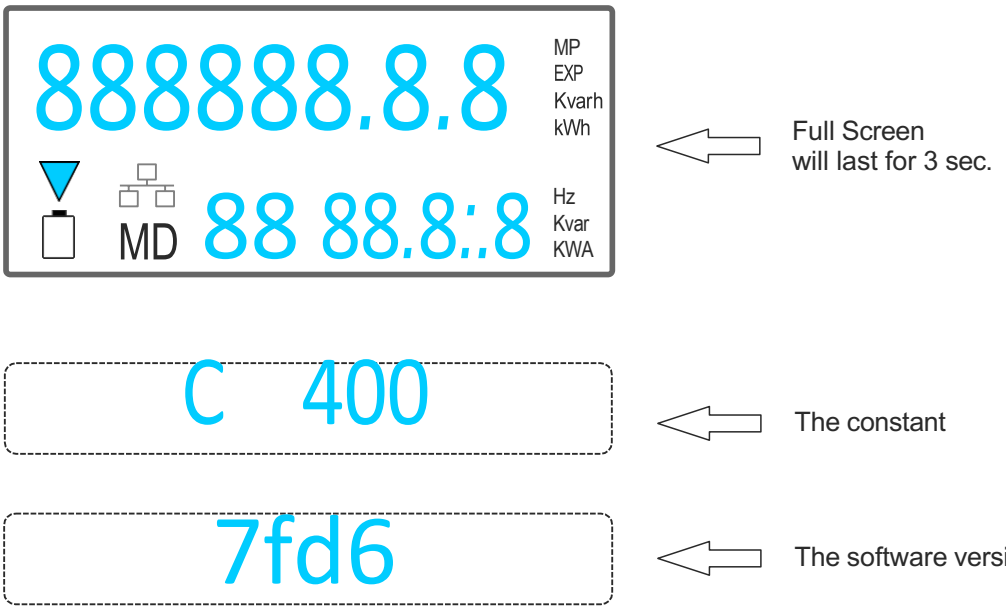
The other indicator is for pulse output. When electricity is used; the LED will flash red. The more quickly LED flashes, the more energy is being used.

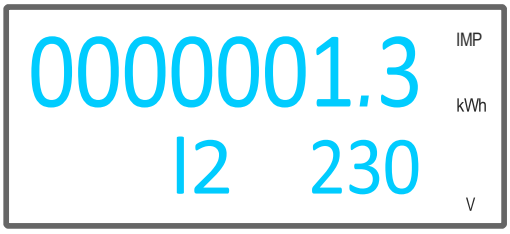
### Reading the Meter

LCD numerical display: 8 (6 + 2). 6 digits for the sub-display items.
NOTE: If you have selected a KWH only meter, the kWh screen is the only one that will show.

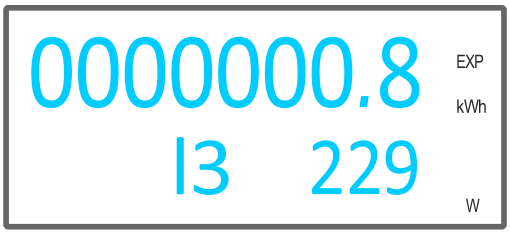



### LCD Display






Forward
Total Active kWh

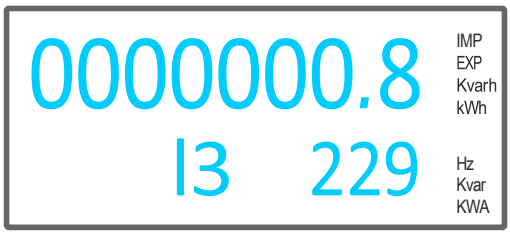



Export
Total Active kWh


Total Reactive kWh

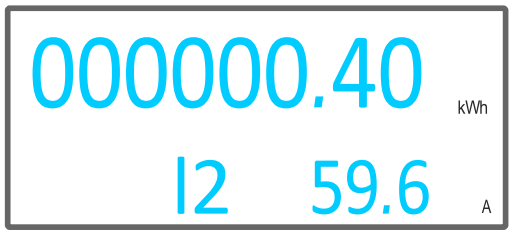

L1 Voltage


L2 Voltage

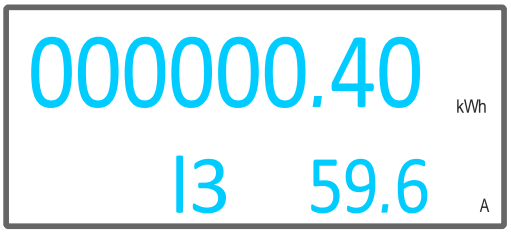



L3 Voltage

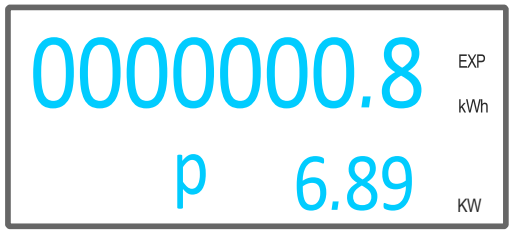

L1 Current



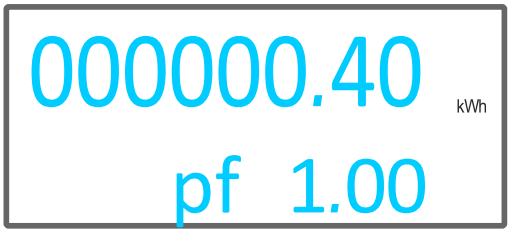

L2 Current




L3 Current

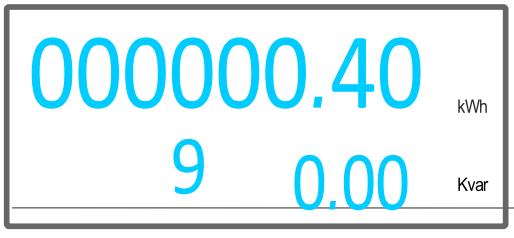



Active Power

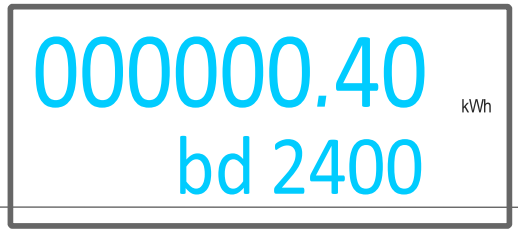



Power Factor


Frequency

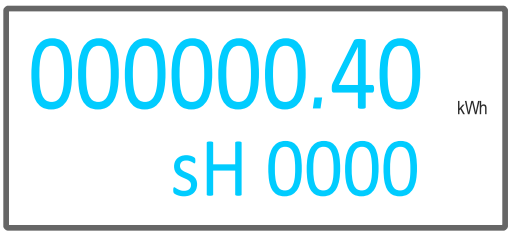



Reactive Power

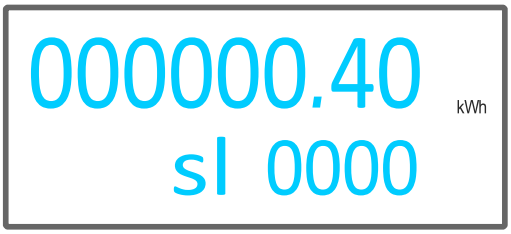



Baud Rate

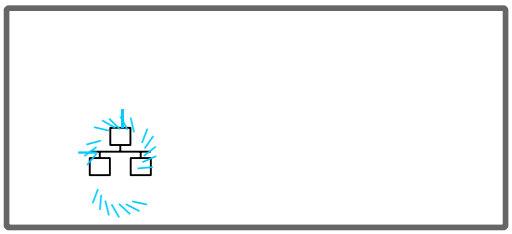

ID Address




Serial number (high digit)

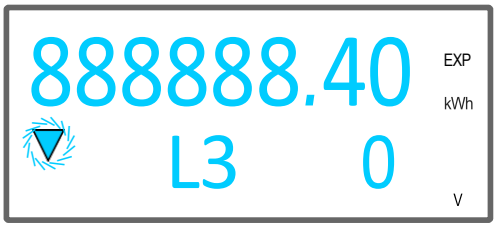



Serial number (low digit)



Communication Display (flashing)


will flash to indicate that the value of current is negative




will flash to indicate that the value of display is zero

It is used as recording consumption and can't be reset to zero. The reading accuracy is 1/100 kWh.

## Button operation:

Right button is selection , left button is program .

Button selection :one short press, lighting the backlight, then press one time show one parameter,

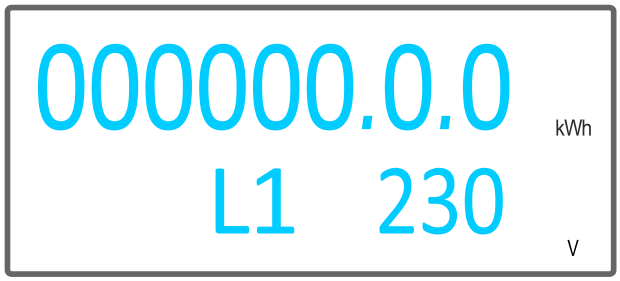
the order is as following: voltage of one phase, current of one phase, active power, reactive power, frequency, baud rate, ID address, serial number, in total 13 parameters, after one minute the backlight will turn off automatically.

Press left button more than 3 seconds enter in code confirmation process, use right button choose the code number then use left button change the digit place, when finish code entering use left button press more than 3 seconds for confirmation then display show ID 01, use left button to change the display item, use right button to change the information. The items can be settled is: 1: ID (set via Mbus command); 2: baud rate, 3: number of display item
(The number of Phase voltage, phase current, active power, reactive power, frequency, communication baud rate, ID address, serial number), 4 CT ratio setting for CT connection meter.

## Pulse output

The EM-606CT Series DIN rail energy meter is equipped with a pulse output which is fully separated from the inside circuit. That generates pulses in proportion to the measured energy for accuracy testing.

## CT RATIO SETTING INSTRUCTIONS




Display once kWh screen shown


Press and hold the PRG button for 5 seconds.


Press the SEL button once and select “1”. The password selected is 0001


Press and hold the PRG button for 5 seconds. The ID setting will display.




Scroll to Cr Screen


Press the SEL button for to set the CT ratios. They can be set at 27 different ratios.
(1,2,5,8,10,12,15, 16,20,24,30,40,50,60,70,80,90,100, 110,120,130,140,150,160,170,180,190)
This value is multiplied by 5 to give the CT current rating.


To check it, turn the meter off and then on again. The 4th screen will display 5--500, meaning: CT Ratio is set to 500A.


Once you have set the CT ratios, press and hold the PRG button for 5 seconds, YES will display showing that the settings are now programmed.

### Notes

1. Press and hold the SEL button to switch on the backlight screen. The screen will automatically turn off after 1 minute. The SEL button, when pressed, will display 14 screens: Phase Voltage (L1, L2, L3), Phase Current (L1, L2, L3), Active Power, Power Factor, Reactive Power, Frequency, Baud Rate, ID, Serial number (high position, low position).

2. Press on hold the PRG button for 5 seconds, the sub display to display P50000; (Press the left PRG button to select the digit position (digit is flashing), right button to select the corresponding digit. Modify the flashing password number--long press left PRG button 5 seconds to confirm (factory password 0001).

3. Long Press left PRG button 5 seconds to enter the settable item: 1-ID; 2-baud rate; 3-set the number of cycle display screens (14 sub-screens); 4- CT ratio, there are 27 ratio settings (CT type default 5:5).

4. Left PRG button to select the corresponding setting item, press the right SEL button to select the sub-item under the setting item. After all the settings are completed, long press the left PRG button 5 seconds to save the setting. The screen displays “YES” to indicate that the setting is successful.

If the setting is in the state of automatic setting, the system defaults to the setting in this state.

## QUICK PROGRAMMING GUIDE

Connect mains power to the meter –
Live to the small terminal labelled 27 at the lower left
Neutral to the large terminal labelled N at the upper right

Switch the power on and wait until the meter completes startup (after it shows the CT ratio)

Press and hold the “PRG” button for 3 seconds – the display will show “PS 0000”
Press the “SEL” button once so that the display changes to “PS 0001”
Press and hold the “PRG” button for 3 seconds to enter the password

If the password was correct (default = 0001) the meter is now in programming mode

The first item is “Id” which is the Mbus address and is in 2-digit hexadecimal format
Modify address via Mbus command, not by buttons

The next item is “bd” which is the Mbus baud rate. There are 5 possible values –
0600, 1200, 2400, 4800 & 9600

The next item is “Sn” which is the number of parameters to show on the scrolling display and is in 2-digit hexadecimal format. The default value is “0E” but due to a software bug the maximum value that can be set when it is altered is “0d”.
Use “SEL” to increment the value and “PRG” to move to the next item

The final item is “Cr” which is the CT ratio. This value is multiplied by 5 to give the CT current rating.
There are 27 possible values –
1, 2, 5, 8, 10, 12, 15, 16, 20, 24, 30, 40, 50, 60, 70, 80, 90,
100, 110, 120, 130, 140, 150, 160, 170, 180 & 190
Use “SEL” to increment the value

Each time the menu is accessed, all the settings must be checked and confirmed.
Press and hold the “PRG” button for 3 seconds to save the settings – the display will show “YES” to confirm that they have been saved.

## TROUBLE SHOOTING

| | | |
|---|---|---|
| The power supply indicators are off. (L1, L2 & L3 LED) | The meter is not connected to a power source<br><br>L1, L2, L3 and N are not connected correctly<br><br>There is no 230V AC between the N and one of the L connections when power is supplied to the meter.<br><br>There is no 400V AC between the L connections when power is supplied to the meter. | Are the fuses or/and surge protection defect?<br><br>Make sure the wires are connected properly and tighten the screws if possible.<br><br>Check if there is 230V AC voltage between N and one of the L connections with a voltage meter.<br><br>Check if there is 400V AC volt between N and one of the L connections with a voltage meter. If the checks above don't solve the problem, please contact technical support. |
| The register doesn't count. | There is almost no load connected to the meter. | Check if the (P-: red or P+: green) consumption led is flashing. 40 flashes of the LED at 400 pulses per kWh equals 0.1kWh. |
| No pulse outputs. | The pulse output is not supplied with DC power.<br><br>The pulse output is not connected correctly. | Check the external voltage source (Ui) is 5-27V DC with a voltage meter<br><br>Check if the connection is correct: the 5-27V DC should be connected to the collector connection (pin 28+ or pin 30+) and the signal wire (S) to the emitter connection (pin 29- or 31-)<br><br>Please contact technical support. |
| The pulse output rate is incorrect | Still no response.<br><br>Please contact technical support. | |
| The consumption LED is not flashing. | The pulse cable is not connected. The<br><br>load on the line is very low. | Connect the pulse cable. Check<br><br>the Ohm meter readings |
| No data received by the MBus communication port. | The ID is not correct.<br><br>The communication distance is too long.<br><br>Too many meters connected.<br><br>The MBus terminals are not connected correctly. | Check the Meter ID by looking for the A in the display. The number in front of the A, for example 15A gives the actual address the meter uses. The default for this meter is 0A.<br><br>Make the distance between the meter and the reading device shorter. Make sure it is no more than ≤1000m<br><br>The number of Mbus devices connected to the meter should not exceed 64.<br><br>Make sure that the Mbus wires are connected to terminals 34 and 35. If the checks above don't solve the problem, please contact technical support for a meter replacement. |