MMW03-M22CHB

Multimeter and energy analyzer

MMW03-M22CHB

Designed to measure:

- Voltage F-N and F-F;
- Phase and neutral current;
- Frequency;
- cosφ and power factor;
- Active, reactive and apparent power;
- THDv; THDi;
- Voltage and current harmonics from the 1st to the 51st order;

MMW03-M22CHB

General characteristics

- This device has 2 meters identified as "1st tariff" and "2nd tariff". Such meters save/record values of “Imp. Active”, “Exp. Active”, “Import Reactive” and “Export Reactive” energy;
- The energy values of the 1st and 2nd tariffs can be assigned to the digital outputs;
- Keypad access via 4-digit password;
- Connections to star and delta systems;

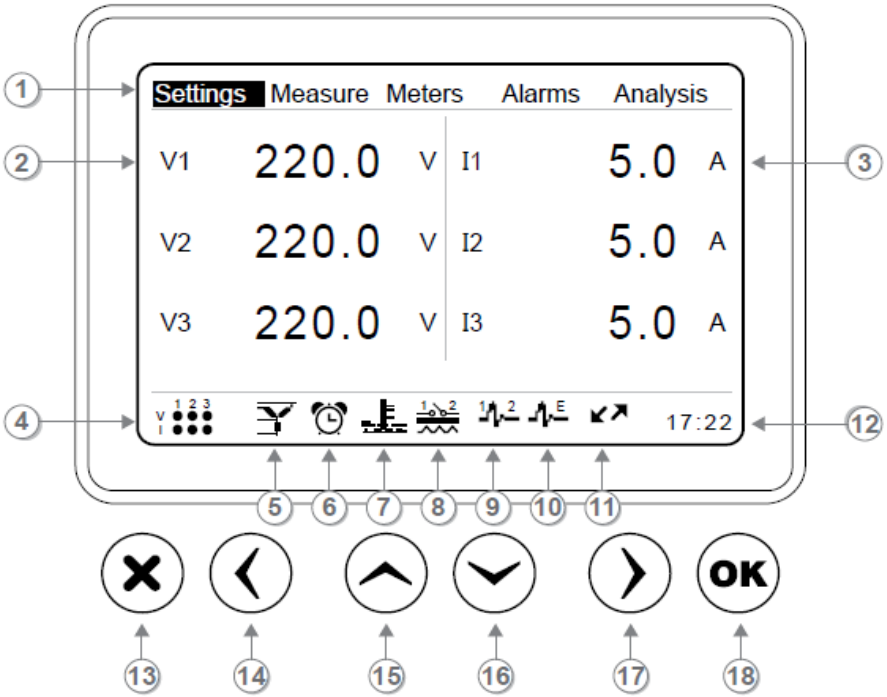
MMW03-M22CHB

General characteristics

- 2 programmable alarm relays;
- 2 digital outputs;
- 2 digital inputs;
- Real time clock;
- Isolated RS485 port, MODBUS RTU protocol

MMW03-M22CHB

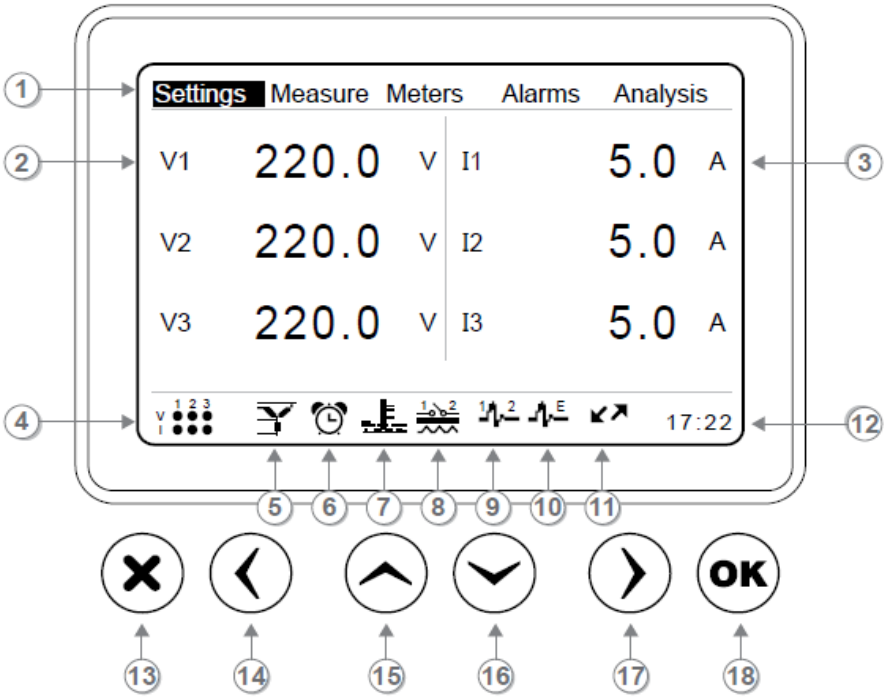
Front panel



1. Menus
2. FN voltage per phase
3. Current per phase
4. Current/voltage presence and phase sequence indicator
5. Selected connection type
6. Alarm status indication
7. Temperature alarm indicator
8. Trip indication of the alarm relays. Marks "1" and "2" indicate which output relay is tripped.

MMW03-M22CHB

Front panel



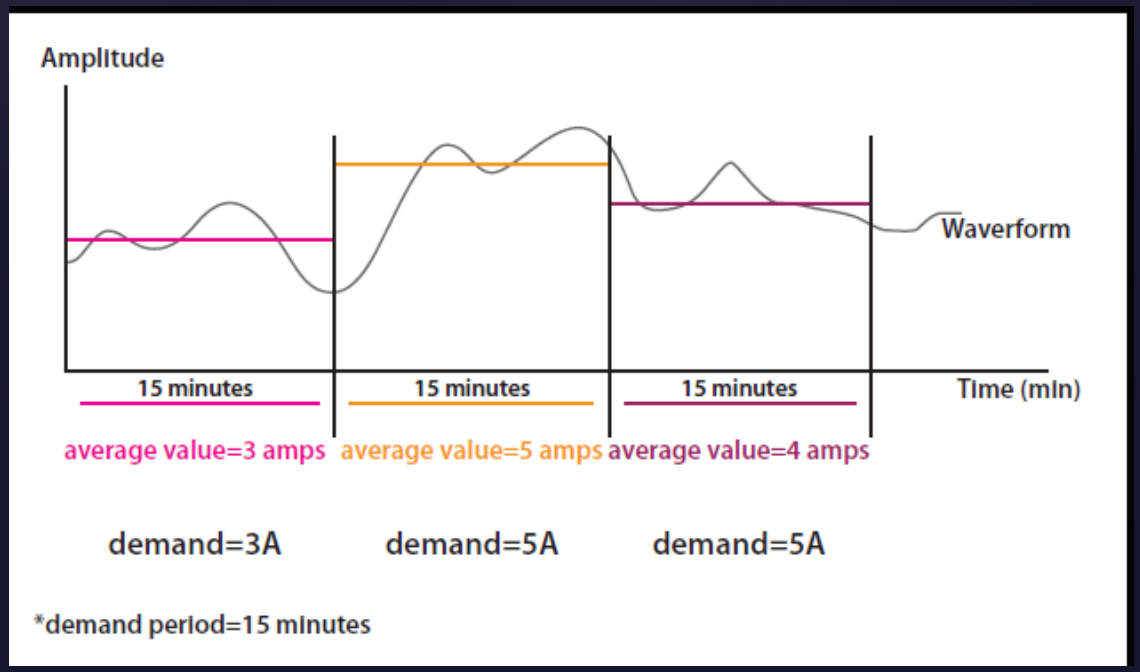
9. Trip indication of the digital output relays. Marks 1 and 2 indicate which relay is tripped;
10. Digital output relay;
11. RS485 communication indication;
12. Real time clock;
13. Key to cancel or return to the previous menu;
14. "Left" key;
15. "Up" key;
16. "Down" key;
17. "Right" key;
18. Key to confirm/save, change or access submenus

MMW03-M22CHB

Overview

MMW03-M22CHB - Demand; Demand period

- Demand = maximum average value within a period of time;
- Demand records = Considering demand measurement time = 15 minutes; the active energy demand of the last month will be the highest value of the maximum average calculated in all measurement cycles 15 minutes of that month.



MMW03-M22CHB - Demand; Demand period

- Why is it necessary?

  To prepare an energy contract where knowing the demand is necessary to define energy supply parameters;

- The demand values of the quantities below referring to the past 4 months with date and time are recorded and available;
  - Current;
  - Active power P;
  - Reactive power Q;
  - Apparent power S;

MMW03-M22CHB - Tariffs

T1 = T1_1 + T1_2 + T1_3

As in the utility company energy meters, the day (24 hours) can be divided into 3 periods for electric tariff:

- Most expensive period;
- Cheap period;
- Cheapest period;

This type of measurement is configurable in the MMW03-M22CHB

MMW03-M22CHB

Alarms and records

The following parameters can be set for alarm:

- Voltage - V (L-N) and (L-L);
- Phase and neutral current - I and IN;
- Active, reactive and apparent powers - P; Q; S;
- cosφ and power factor;
- Frequency;
- Voltage and current harmonics from the 1st to the 51st order;
- Temperature;

For all the parameters above, the last 50 alarms with date and time are saved in the memory;

MMW03-M22CHB

Digital outputs

The 2 digital outputs provide a current signal through a power supply of 30 Vmax.

They are mainly used to:

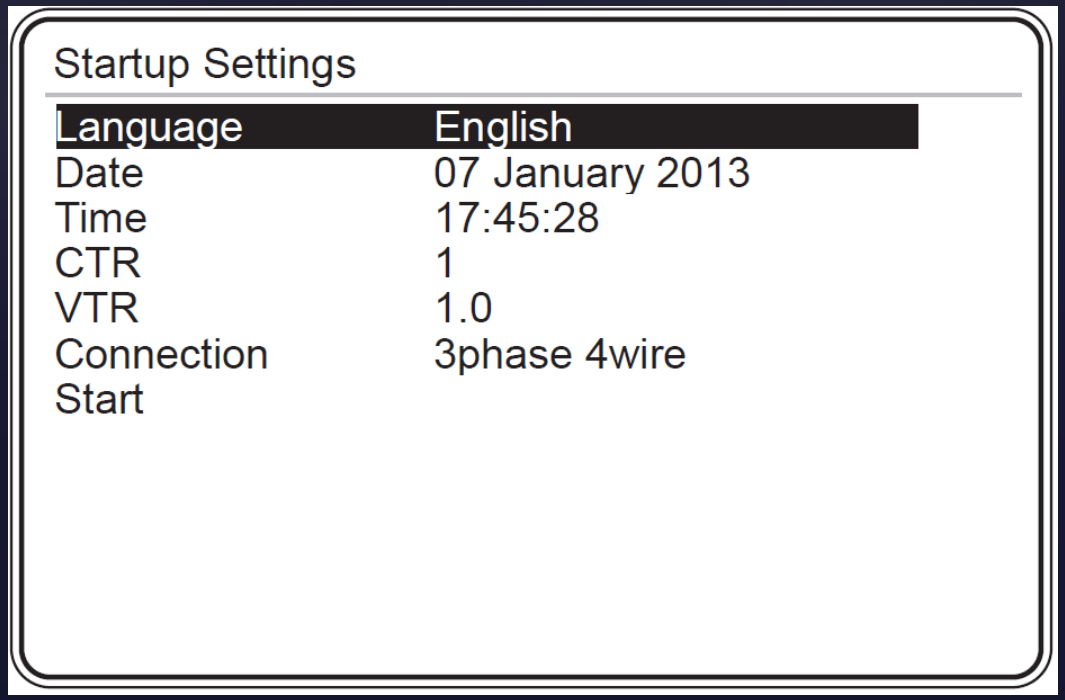
- Provide an input signal to a counter;
- Energize relays;
- Activate different instruments;
- Activate indicators

MMW03-M22CHB

Menus

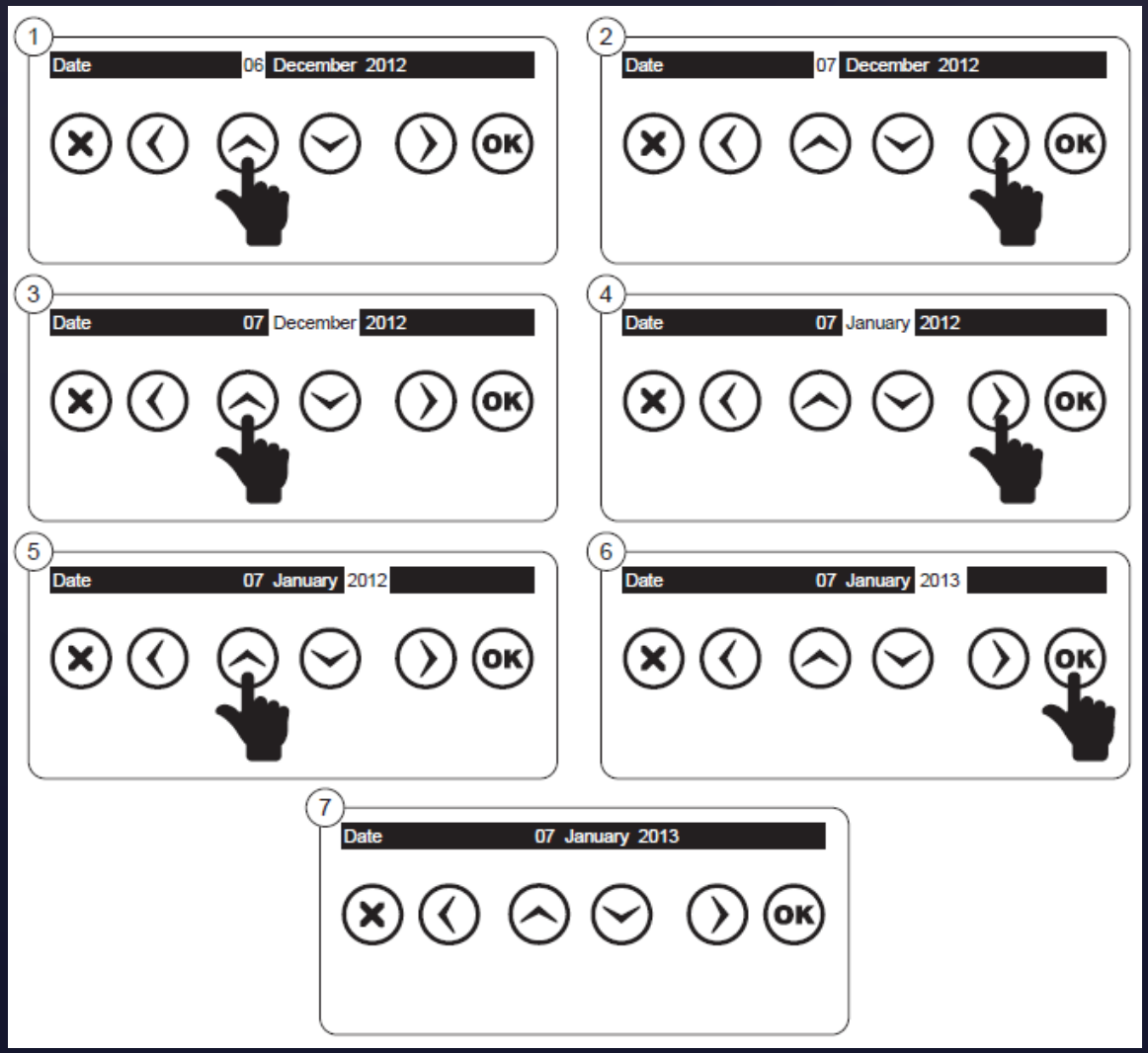
MMW03-M22CHB - Startup settings

The first time the device is turned on, the following screen will be displayed:



MMW03-M22CHB - Startup settings

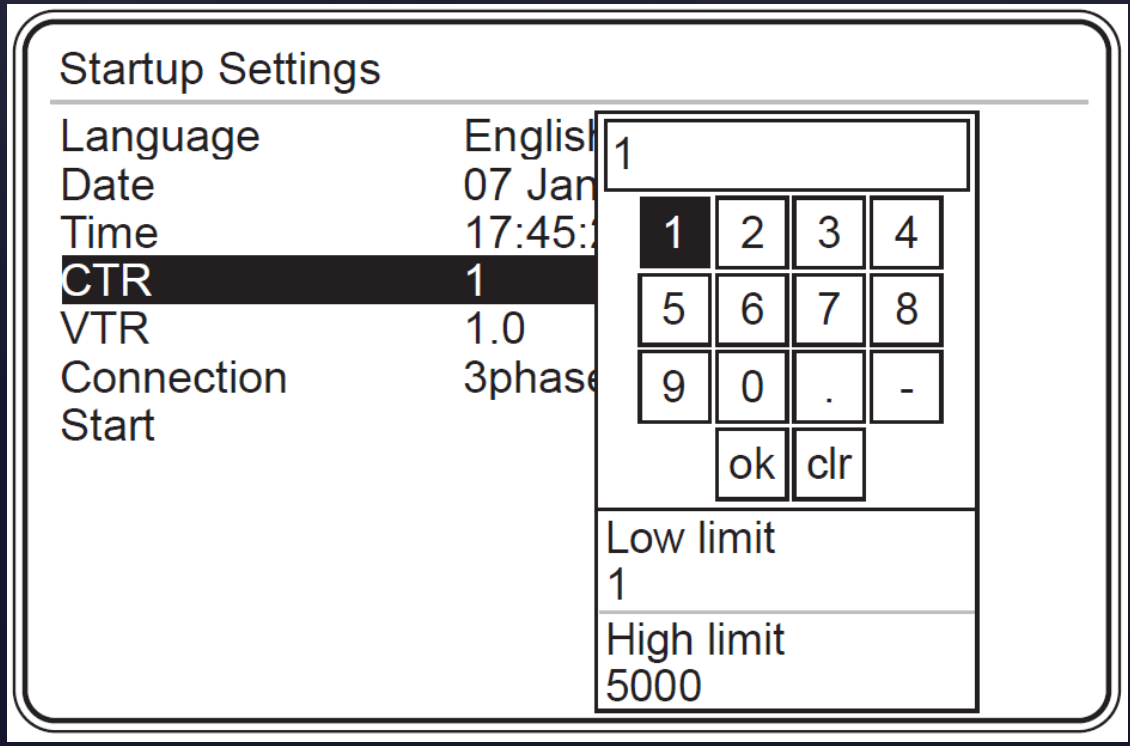
Using the keys to set the date



MMW03-M22CHB - Startup settings

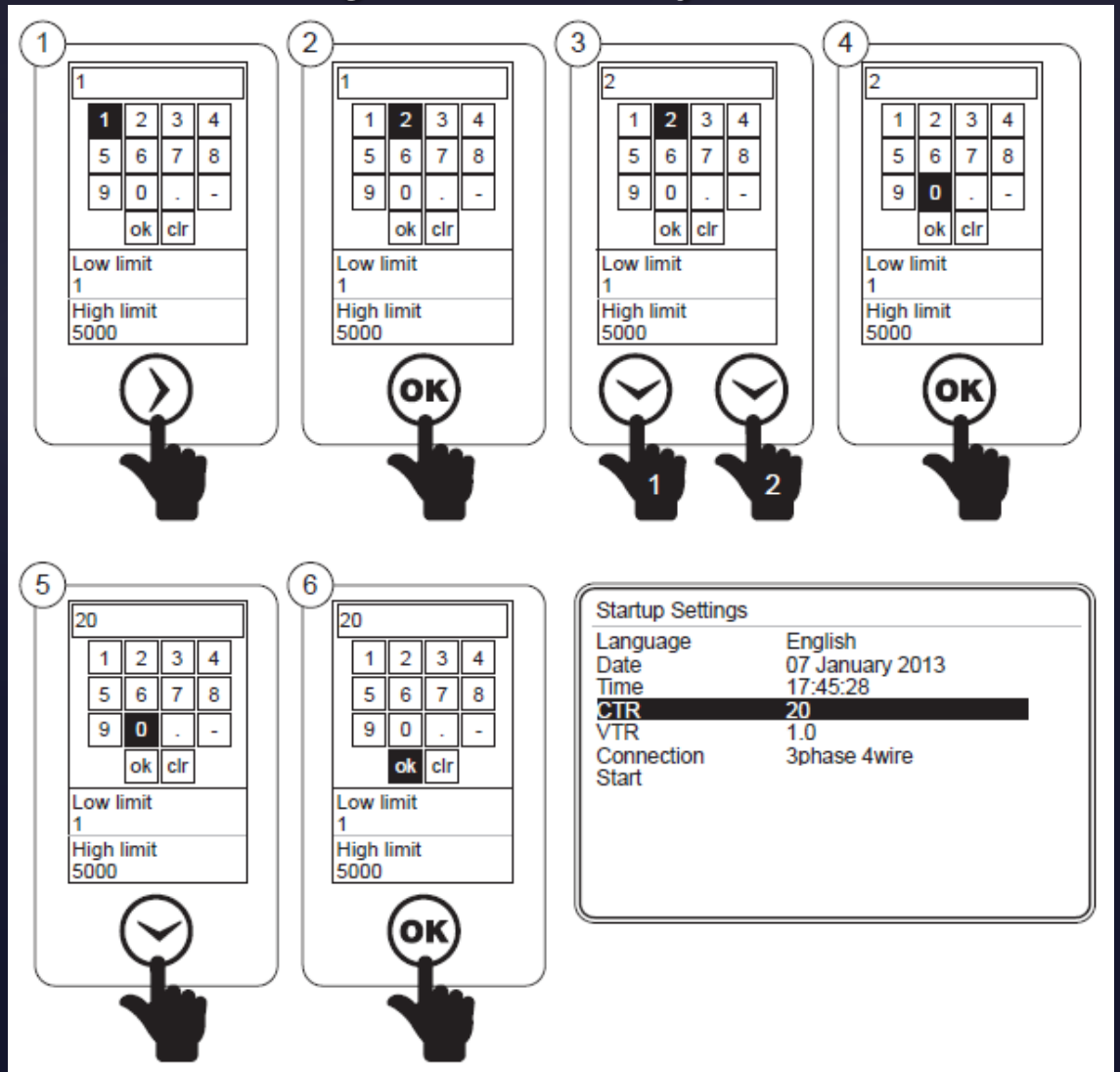
Setting of the CT ratio using the virtual keyboard

- Press "OK" on the virtual keyboard to enter a number.
- After entering the desired numbers, press "OK" to save the value;



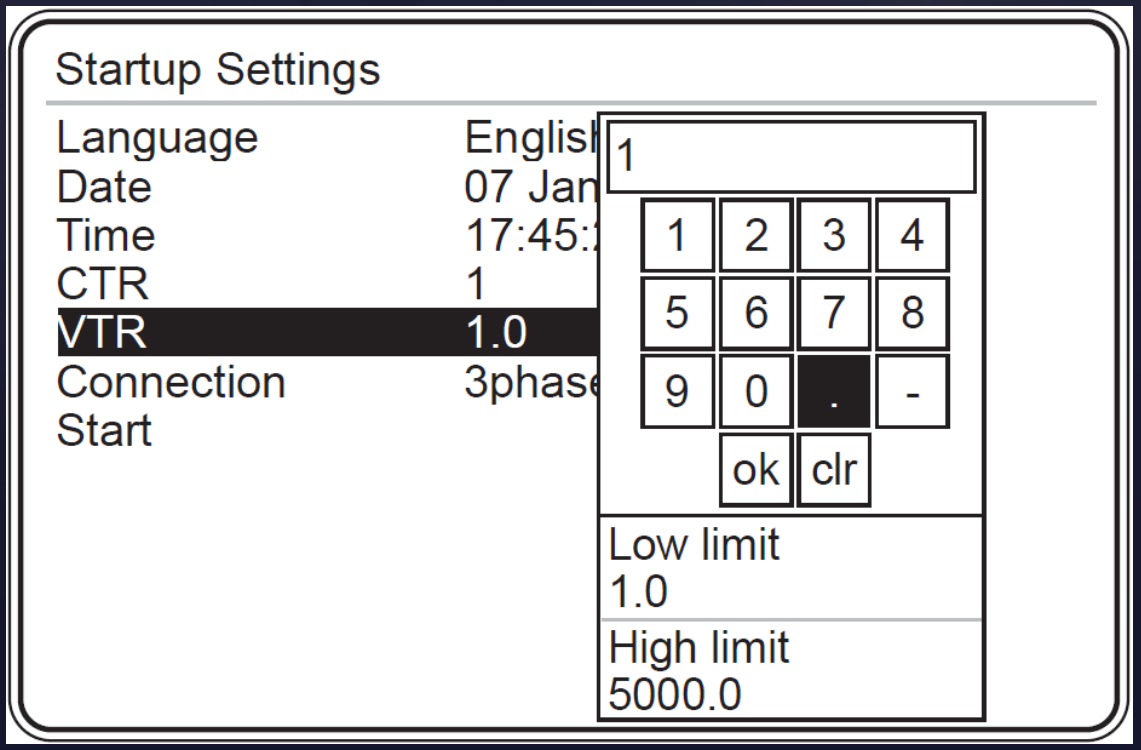
MMW03-M22CHB - Startup settings

Setting of the CT ratio using the virtual keyboard



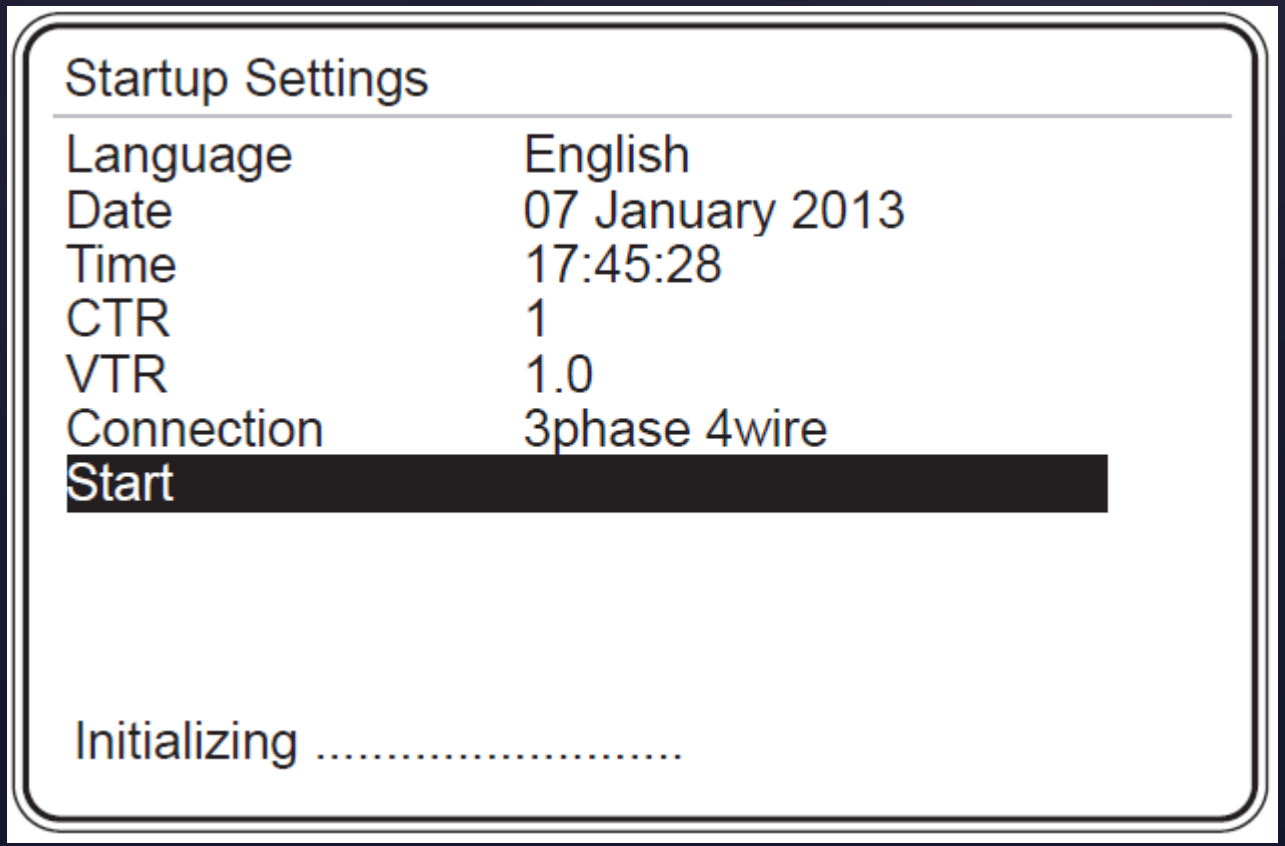
MMW03-M22CHB - Startup settings

For decimal numbers, use the keyboard as indicated below:



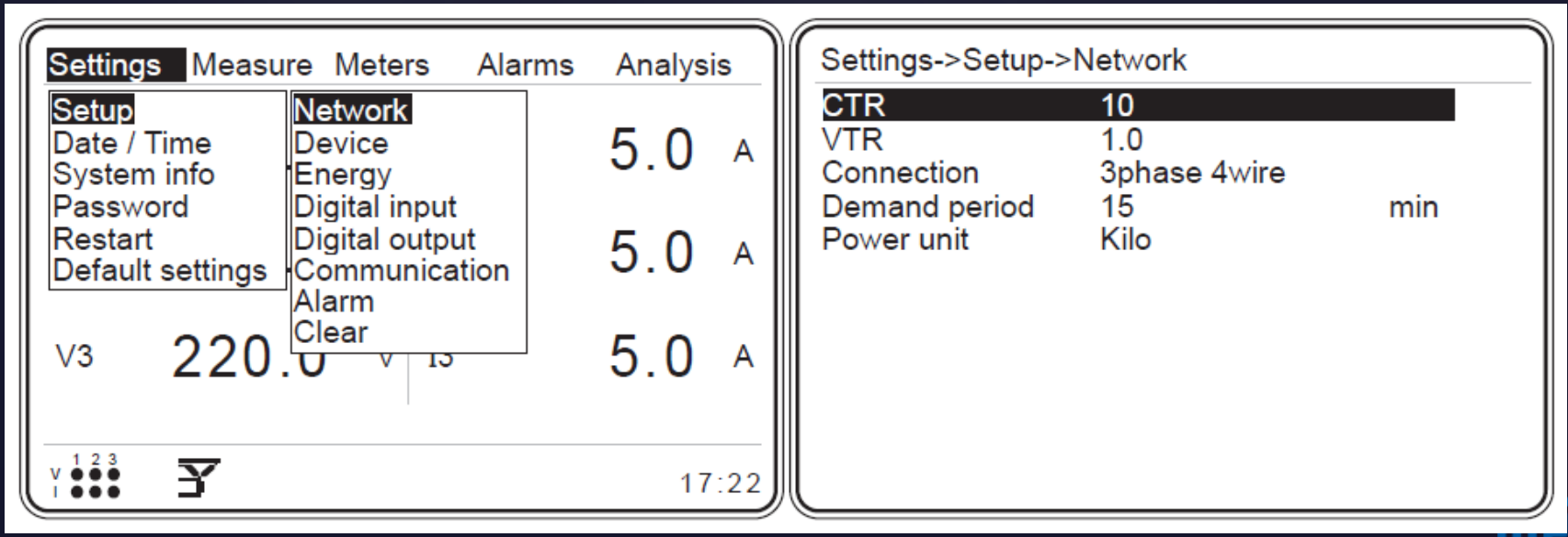
MMW03-M22CHB - Startup settings

End of the startup setting



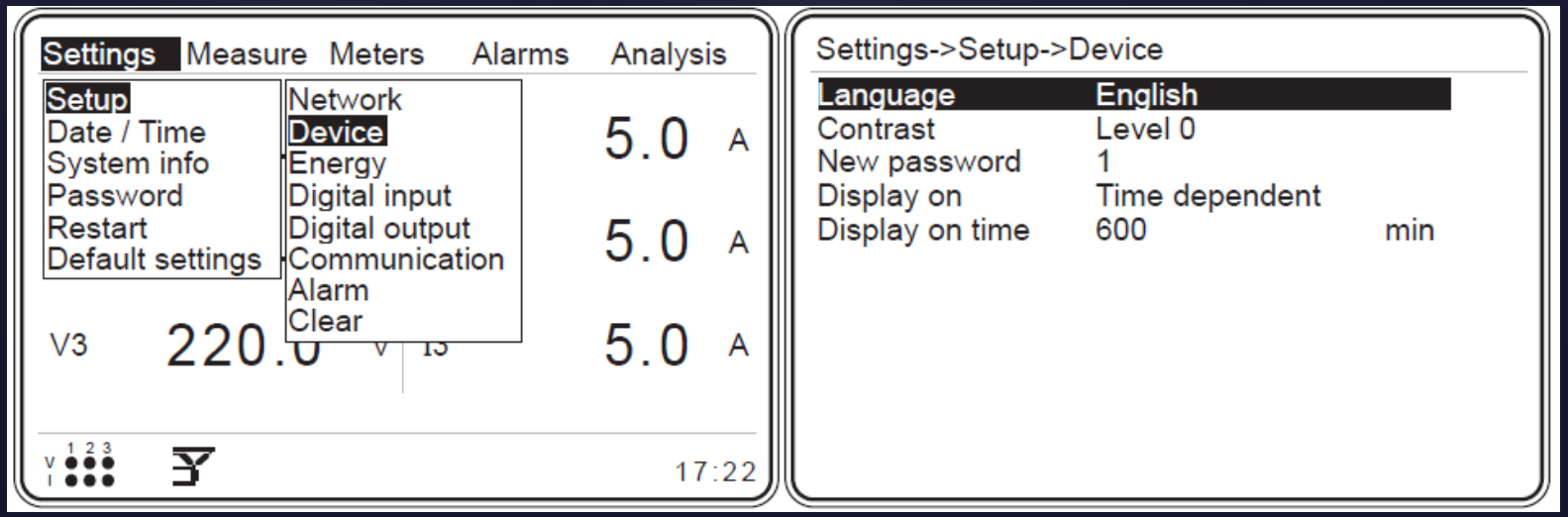
MMW03-M22CHB - System Settings (Network)

- The correct configuration of the input quantities of the electrical system guarantees the reliability of the measurements;
- "Power Unit" is only applicable to total powers and energies;



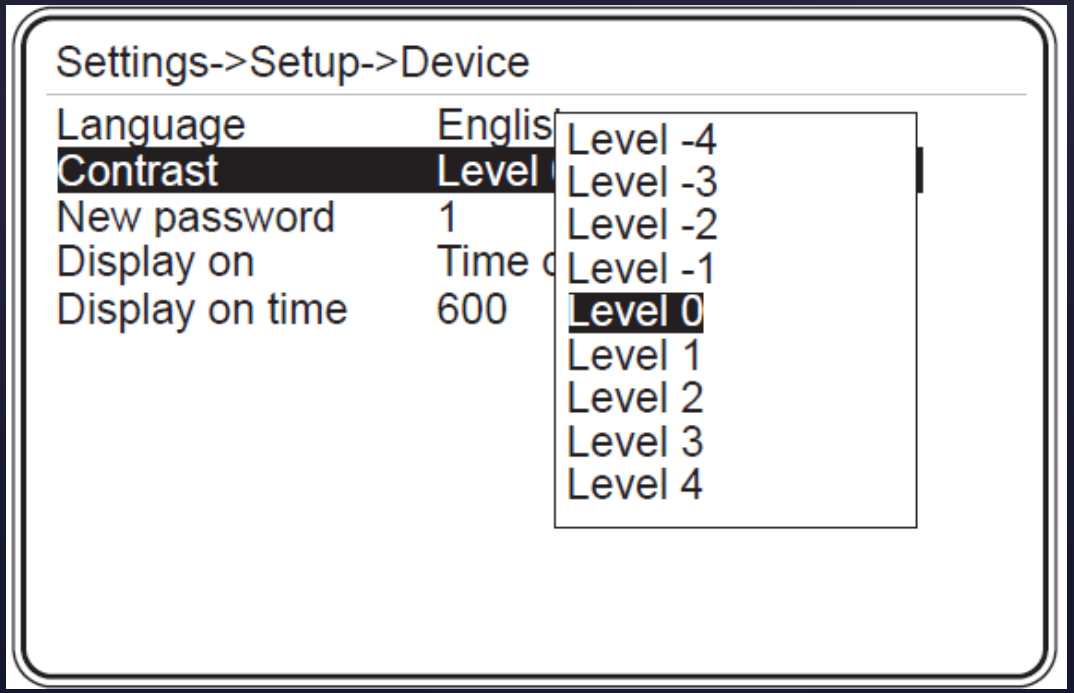
MMW03-M22CHB – Settings

- The device menu guides the user in the setting of the language, contrast, password and display operation mode (permanent ON or time-dependent)
- To keep the display on, the time-dependent setting is recommended



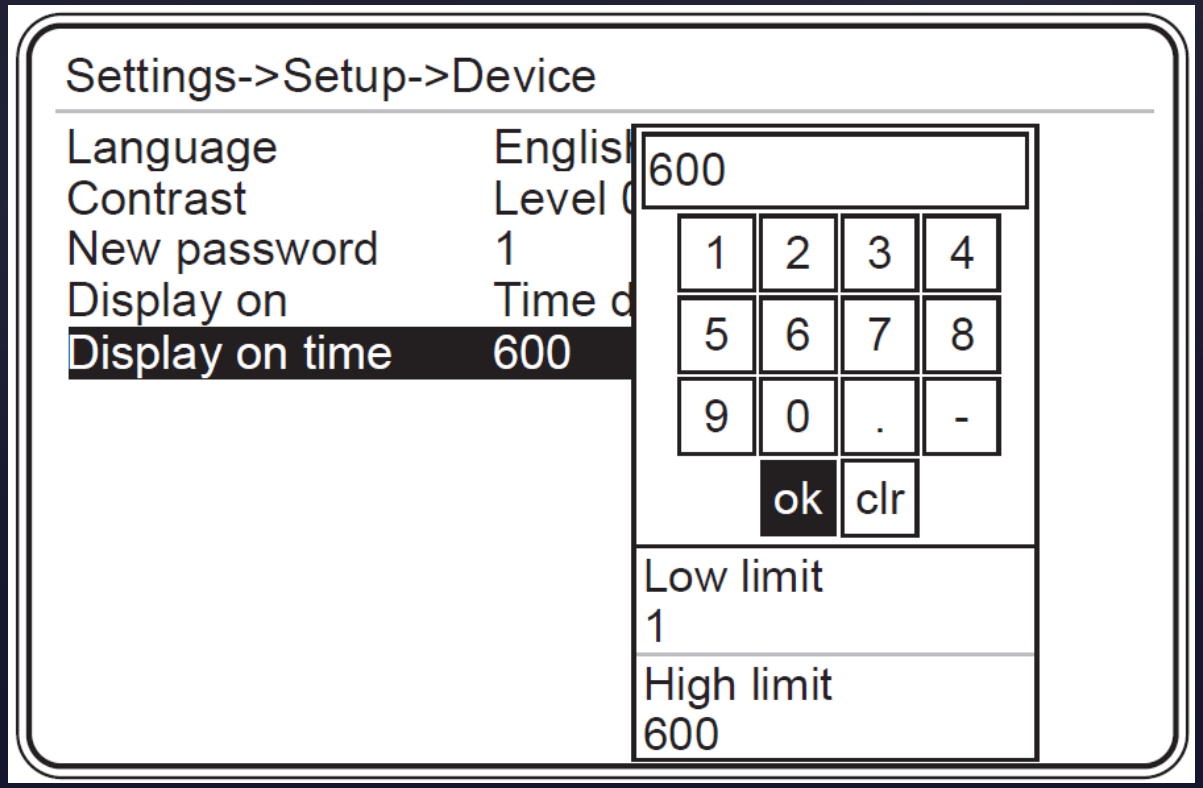
MMW03-M22CHB – Settings

- Display contrast setting



MMW03-M22CHB – Settings

- The display time "On" is limited to 10 minutes



MMW03-M22CHB – Settings - energy

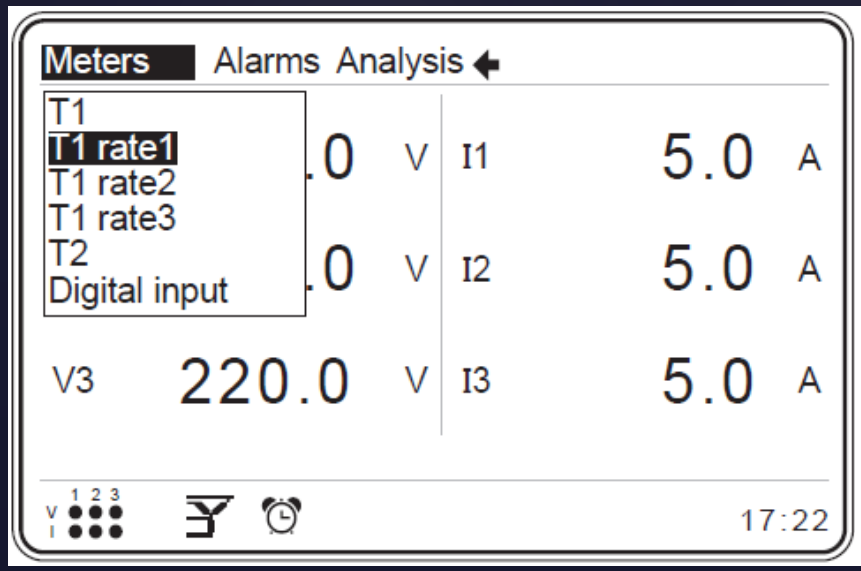
- The starting times of T1_1, T1_2 and T1_3 are important for defining the T1_1, T1_2 and T1_3 meters.

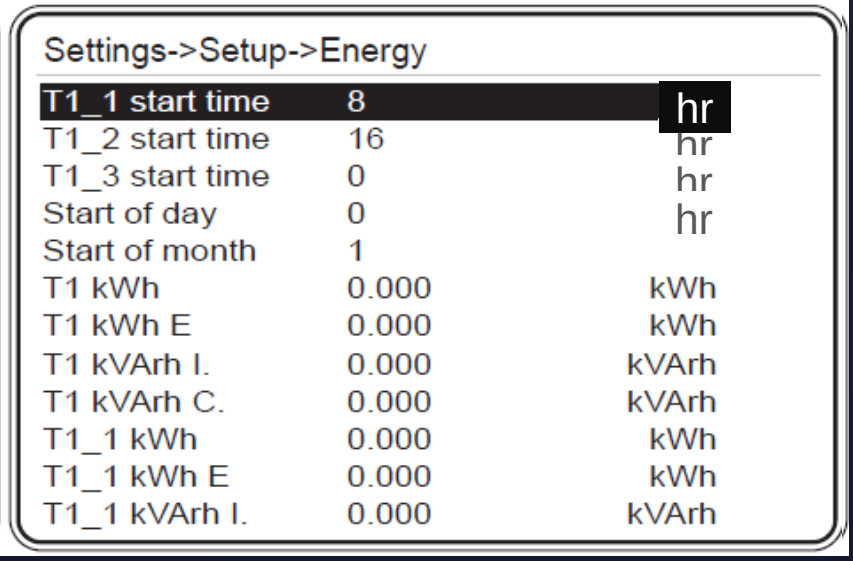
Settings->Setup->Energy

T1_1 start time	8	hr
T1_2 start time	16	hr
T1_3 start time	0	hr
Start of day	0	hr
Start of month	1	
T1 kWh	0.000	kWh
T1 kWh E	0.000	kWh
T1 kVArh I.	0.000	kVArh
T1 kVArh C.	0.000	kVArh
T1_1 kWh	0.000	kWh
T1_1 kWh E	0.000	kWh
T1_1 kVArh I.	0.000	kVArh

MMW03-M22CHB – Settings - energy

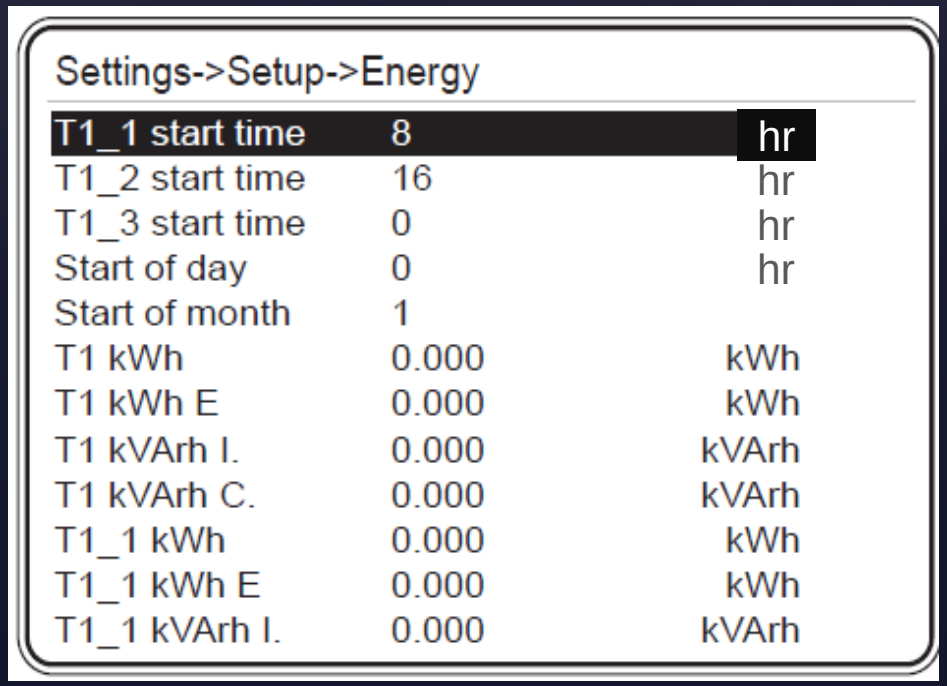
- T1_1 - the energy meter will count from 8:00 am to 4:00 pm
- T1_2 - the energy meter will count from 4:00 pm to midnight.
- T3_3 - the energy meter will count from midnight to 8:00 am.





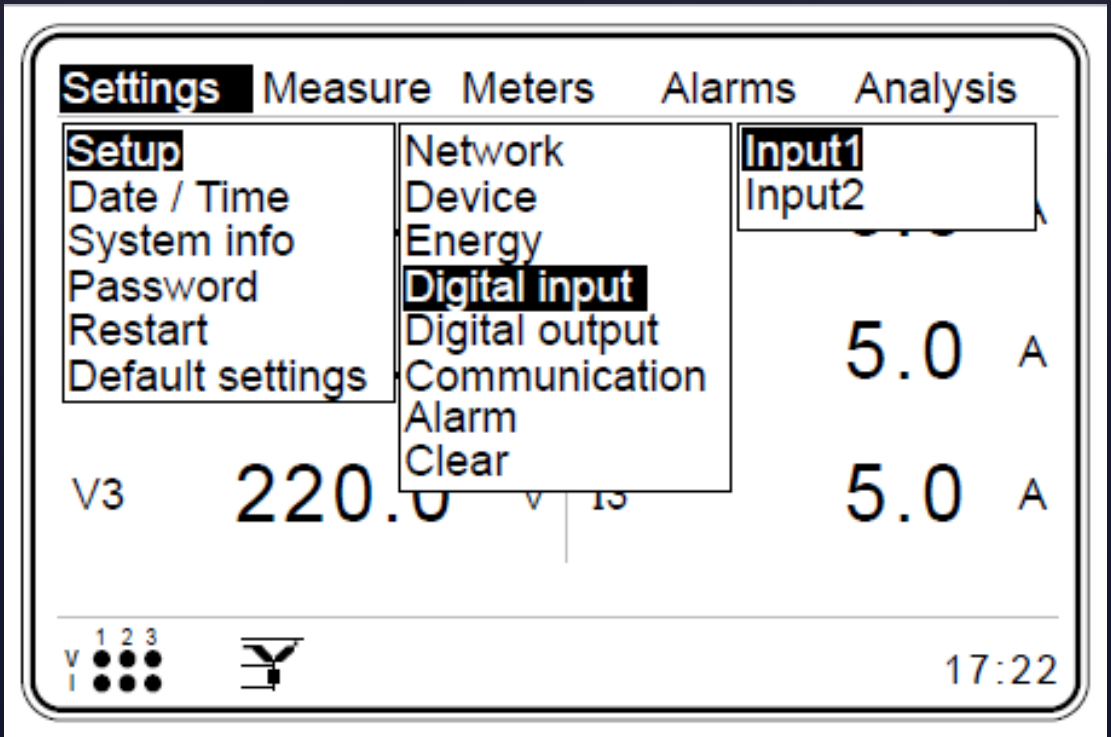
MMW03-M22CHB – Settings - energy

- The initial values of energy are entered into this screen for synchronization with the utility company system, for example.
- Each items below can be set from 0.000 to 1000000.000



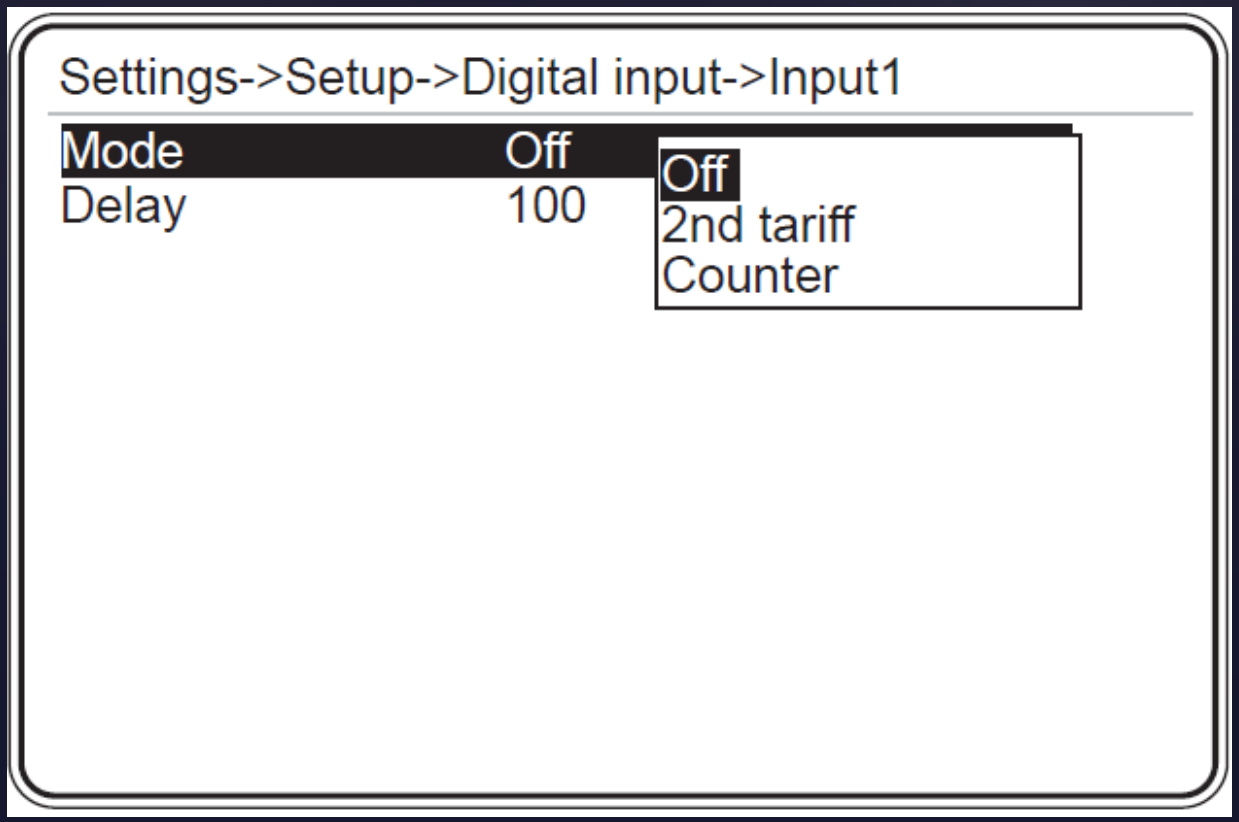
MMW03-M22CHB - Setting the digital inputs

- 2 digital inputs and 2 digital outputs



MMW03-M22CHB - Setting the digital inputs

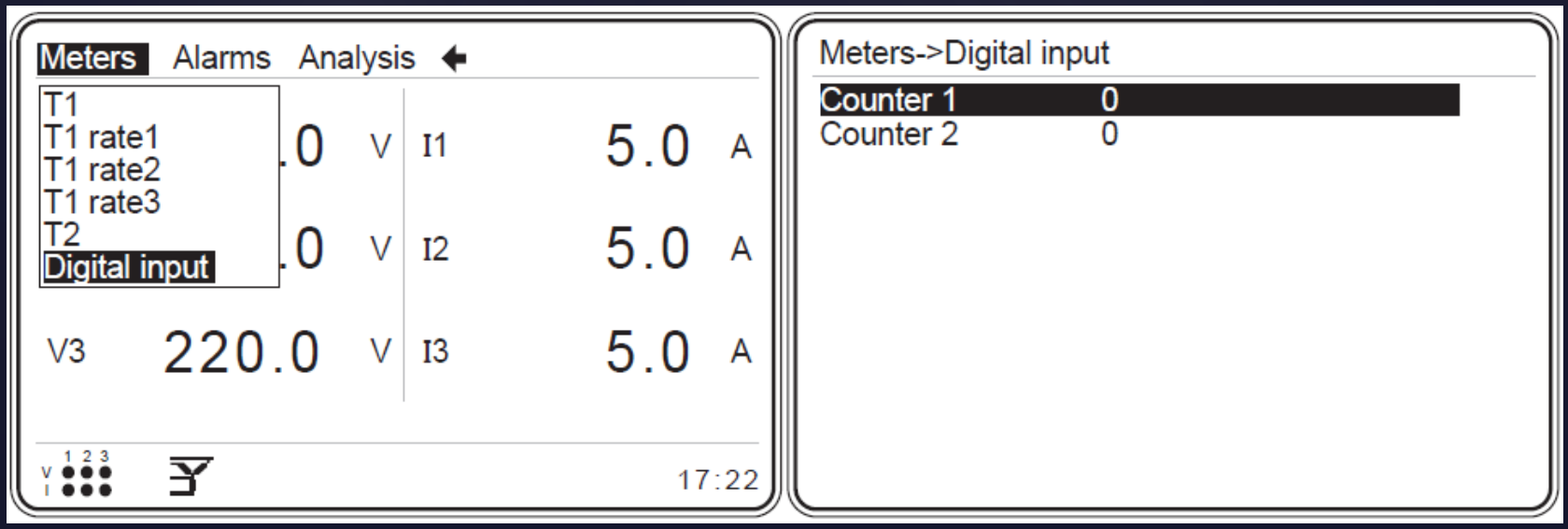
- Input 1 - reading mode: Off; 2nd tariff, meter



MMW03-M22CHB - Setting the digital inputs

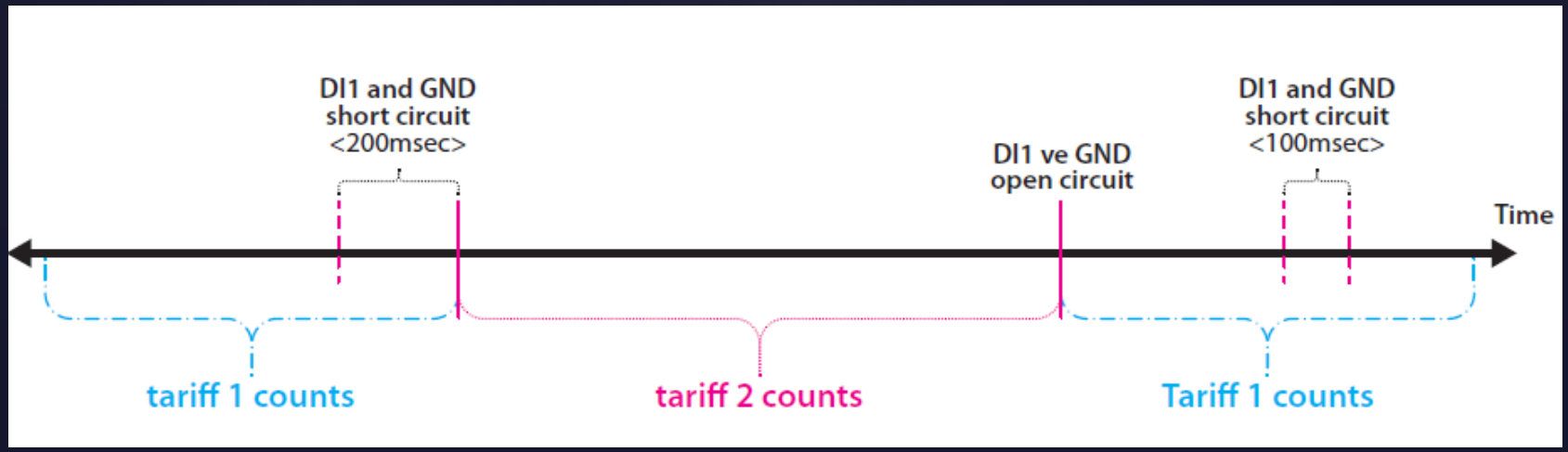
- If the counter is selected - counted values are read from the menu

"Meters - Digital input - counter 1"



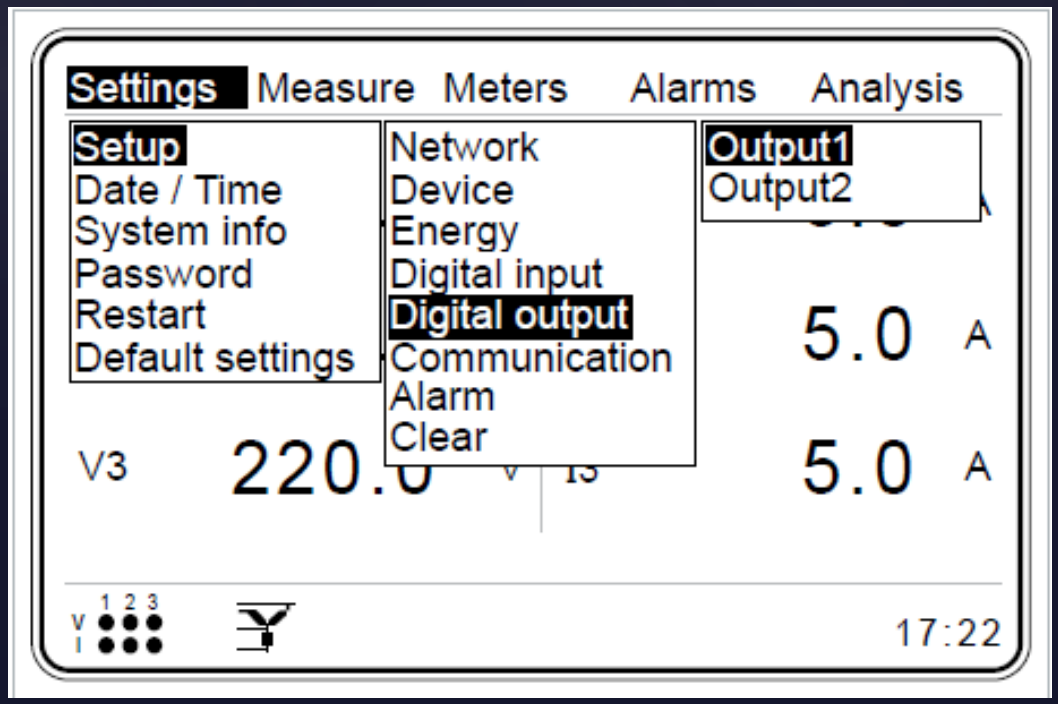
MMW03-M22CHB - Setting the digital inputs

- Count delay - A count delay can be set between 10 and 2000 milliseconds;
- For the "2nd tariff" or "Counter" modes to be enabled, DI1 and GND pins must have a short-circuit time at least equal to the delay time.



MMW03-M22CHB - Setting the digital outputs

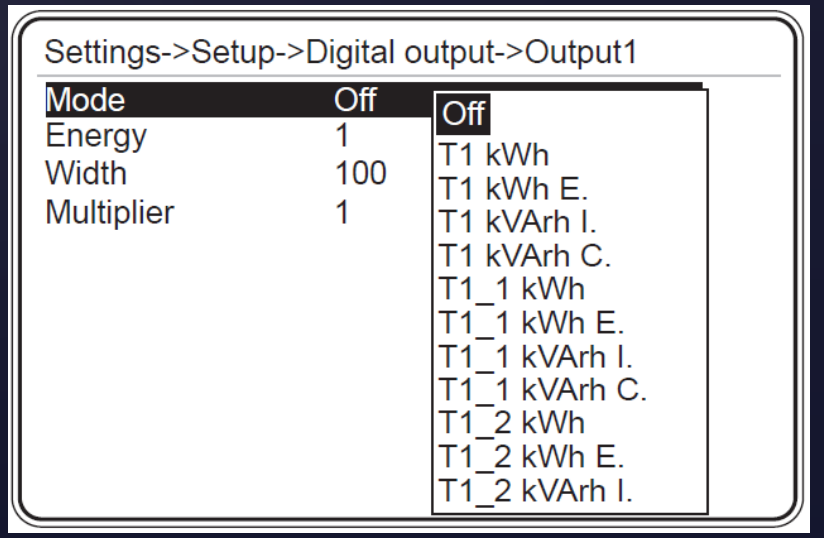
- Digital output 1



MMW03-M22CHB - Setting the digital outputs

"Mode" has the following options:

- Off
- T1 kWh
- T1 kWh E.
- T1 kVArh I.
- T1 kVArh C.
- T1_1 kWh
- T1_1 kWh E.
- T1_1 kVArh I.
- T1_1 kVArh C.
- T1_2 kWh
- T1_2 kWh E.
- T1_2 kVArh I.
- T1_2 kVArh C.
- T1_3 kWh
- T1_3 kWh E.
- T1_3 kVArh I.
- T1_3 kVArh C.
- T2 kWh
- T2 kWh E.
- T2 kVArh I.
- T2 kVArh C.
- Digital Input



MMW03-M22CHB - Setting the digital outputs

Energy: When selecting an energy type in Mode, the growth rate and digital output count is set in Energy.

- **Width:** It is the pulse width time of the digital output.
  Setting from 50 to 2500 milliseconds.
- **Multiplier:** The Multiplier is used when the selected mode is the digital input.
  - The digital output generates a signal according to the digital input and its respective multiplier.
  - Setting from 1 to 10000.

MMW03-M22CHB - Setting the digital outputs

Configuration examples:

Digital output	: Output1
Mode	: T1 kWh
Energy	: 2
Width	: 100 msec

When tariff 1 reaches 2 kWh, a 100-msec pulse will be generated at digital output 1 (DO1- and D01 +).

MMW03-M22CHB - Setting the digital outputs

Configuration examples:

Digital output	: Output1
Mode	: Digital input
Energy	: In this mode, you do not use this menu
Width	: 100 msec
Multiplier	: 100

Digital input 1 is set to counter.

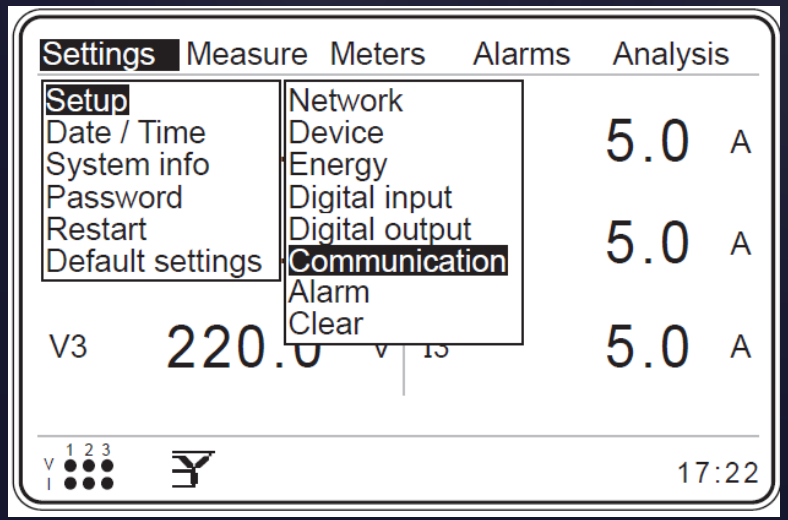
When the input counter reaches 100 or its multiples, an 100-msec pulse will be generated at digital output 1.

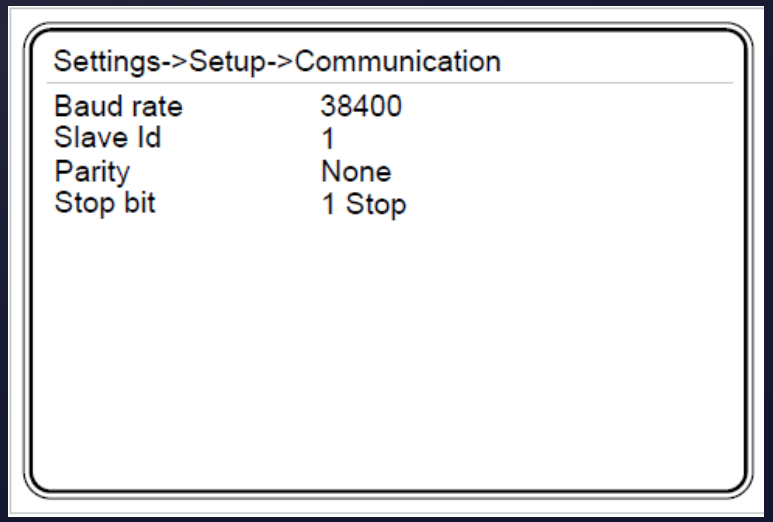
If the digital input value is 35, before setting the digital output multiplier, output 1 will generate a pulse when the digital input counter reaches values 135, 235, 335, 435, and so on.

MMW03-M22CHB - Settings - Communication

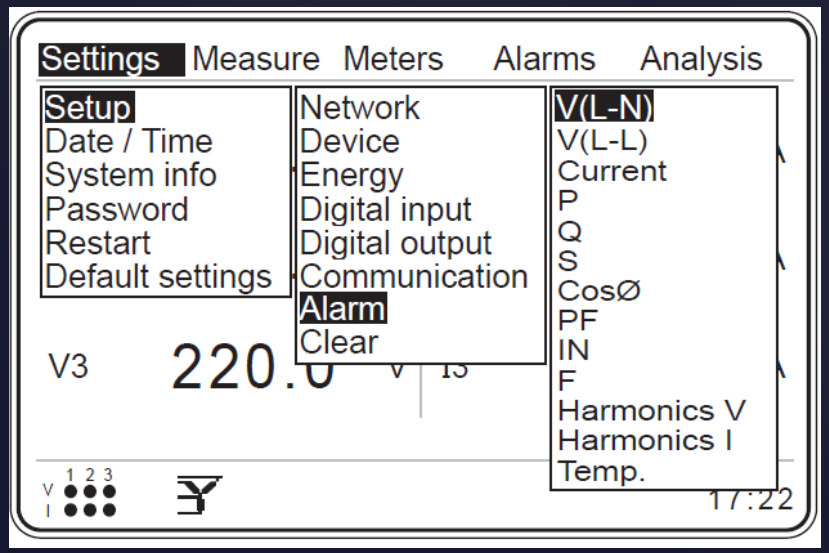
There is an isolated RS 485 port for communication

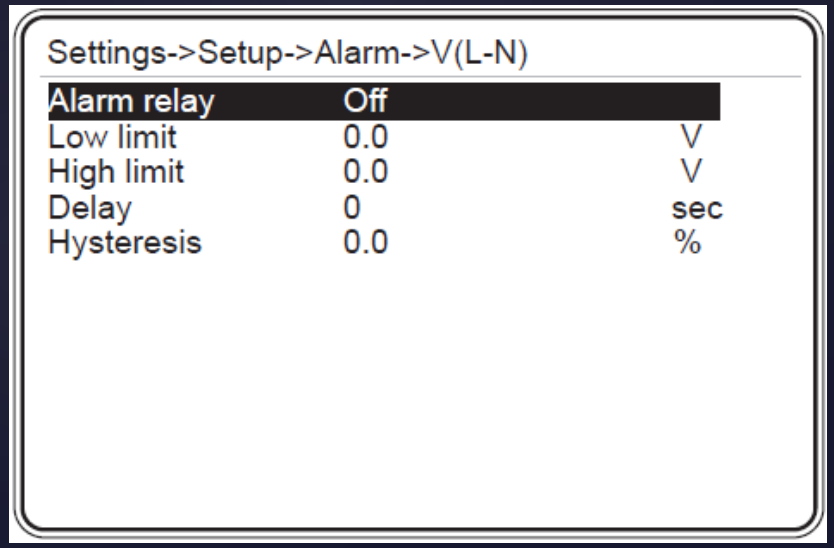
- 4 communication settings
  - Baud Rate
  - Slave ID
  - Parity
  - Stop bit





MMW03-M22CHB – Settings - Alarms





MMW03-M22CHB – Settings - Alarms

Alarm relay:

This menu defines the tripping of the relay in case an alarm occurs.

Available configuration options:

Off : For the V (L-N) alarm, none of the relays will trip;

Relay1 : For the V (L-N) alarm, relay 1 is energized;

Relay2 : For the V (L-N) alarm, relay 1 is energized;

Low Limit:

To define the V (L-N), the user must enter the minimum voltage value to be monitored.

High Limit:

To define the V (L-N), the user must enter the maximum voltage value to be monitored.

MMW03-M22CHB – Settings - Alarms

Delay:

When one of the maximum or minimum values is exceeded, the alarm is activated after the programmed delay.

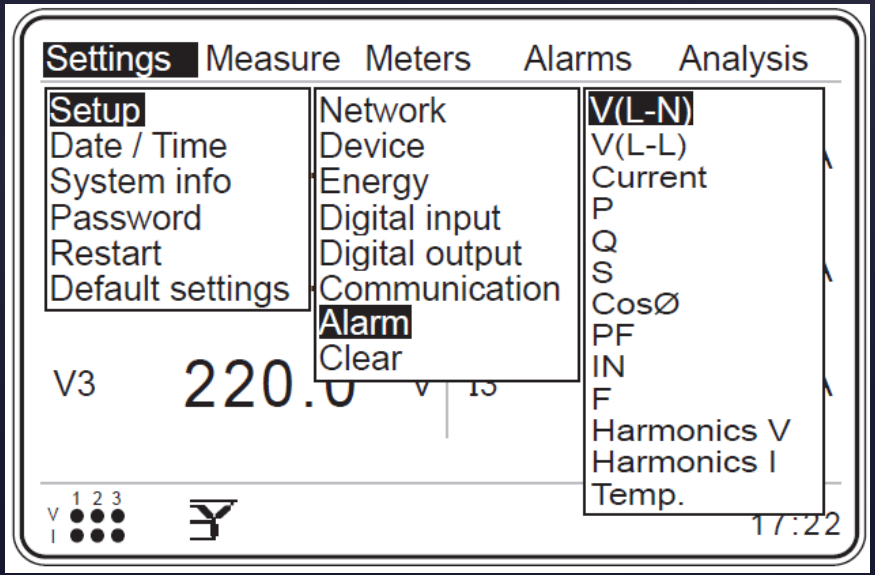
Similarly, when the conditions return to normal, the alarm is canceled after the delay

The delay can be set from 0 to 600 seconds.

MMW03-M22CHB – Settings - Alarms

Hysteresis:

Tolerance for the actuation of the maximum and minimum alarm values; setting from 0 to 20%



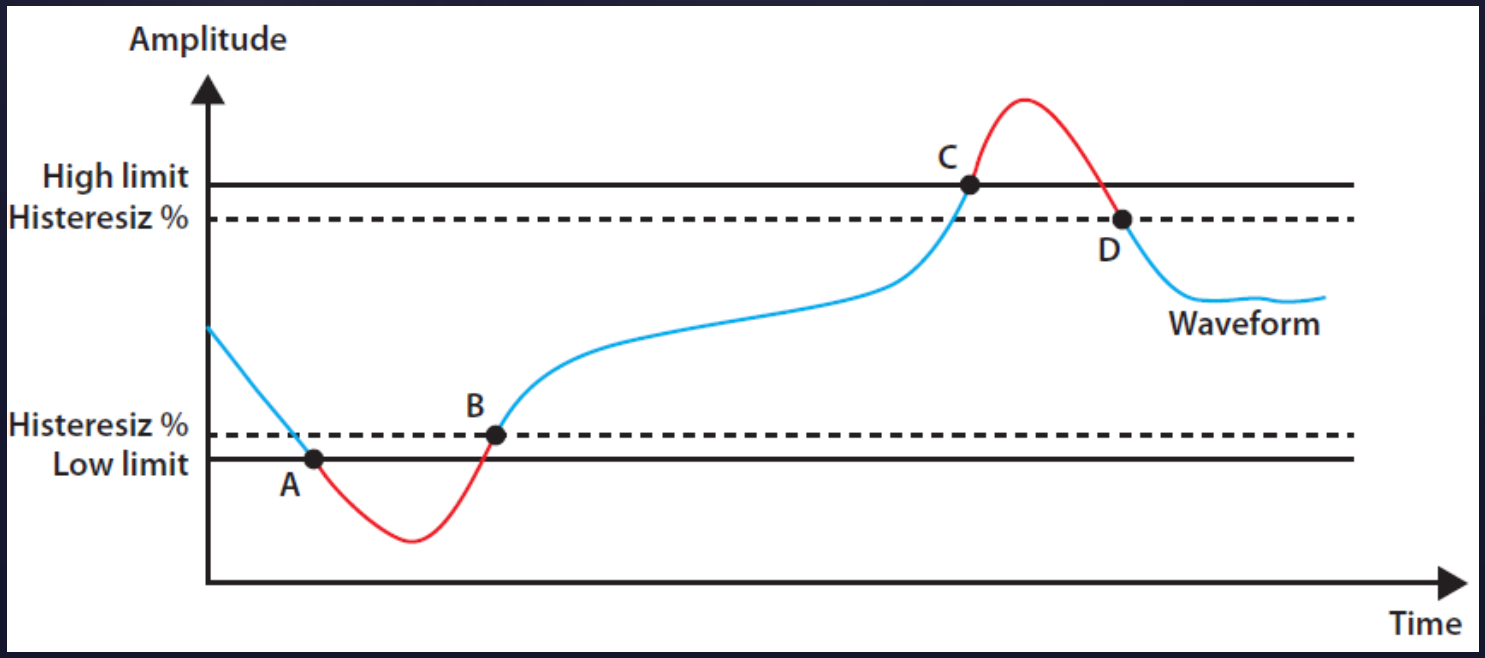
Note: - Quantities = V (L-L) to F (F included) and Temp.

The settings menu for these quantities is the same as for V (L-L).

MMW03-M22CHB – Settings - Alarms

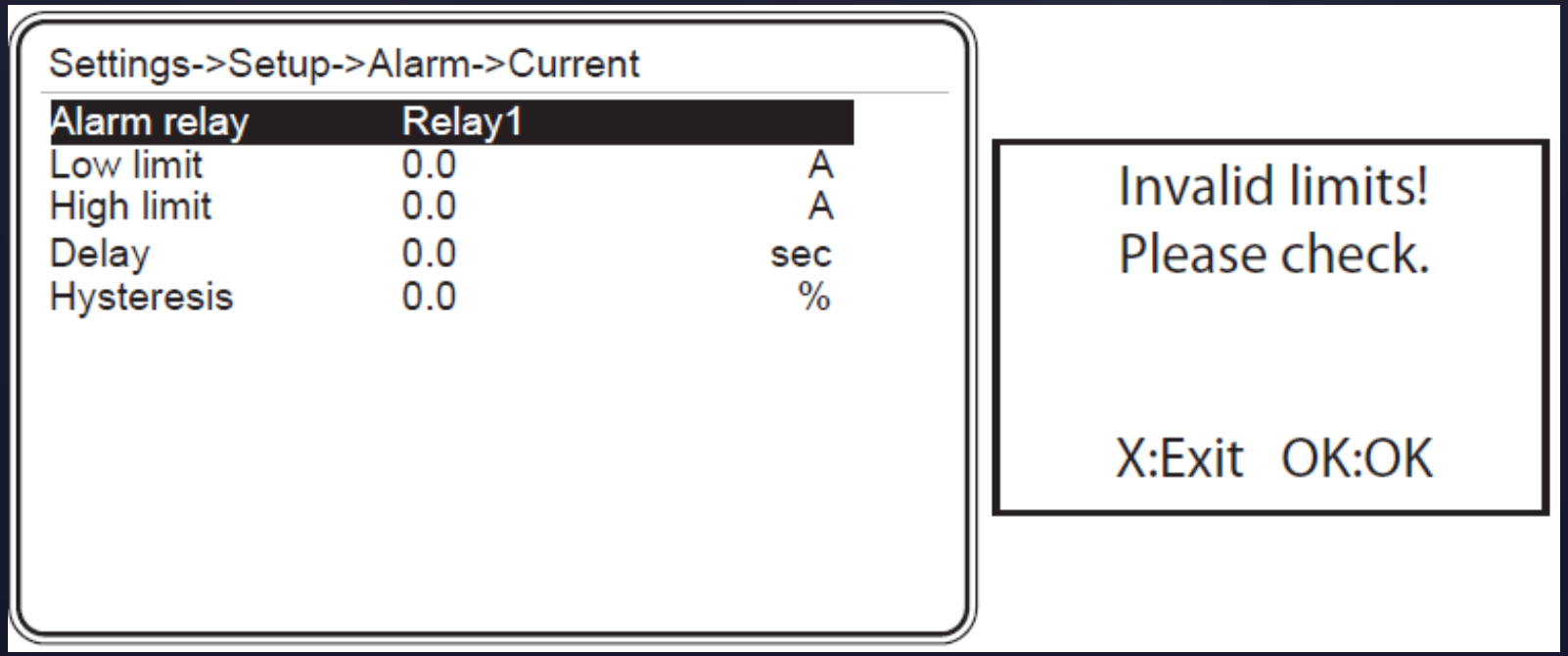
Hysteresis example: Delay set for = 0

- At point A, alarm tripping;
- At point B, alarm off;
- At point C, alarm tripping;
- At point D, alarm tripping;



MMW03-M22CHB – Settings - Alarms

If the lower limit is set above the maximum limit, the message below will be displayed.



MMW03-M22CHB – Settings - Alarms

THDV High Limit:

In the setting of the total harmonic voltage distortion (THDv), the high limit can be set from 0 to 100%.

If set to 0, the alarm will be disabled.

Settings->Setup->Alarm->Harmonics V

Alarm relay	Off	
THDV hi limit	0.0	%
V3 hi limit	0.0	%
V5 hi limit	0.0	%
V7 hi limit	0.0	%
V9 hi limit	0.0	%
V11 hi limit	0.0	%
V13 hi limit	0.0	%
V15 hi limit	0.0	%
V17 hi limit	0.0	%
V19 hi limit	0.0	%
V21 hi limit	0.0	%
Delay	60	sec

MMW03-M22CHB – Settings - Alarms

V3 --- V21 high limit:

“3.”, “5.” … “21.” enter the maximum distortion values.

If the value is "0", its respective alarm will be disabled.

Setting from 1 to 100%.

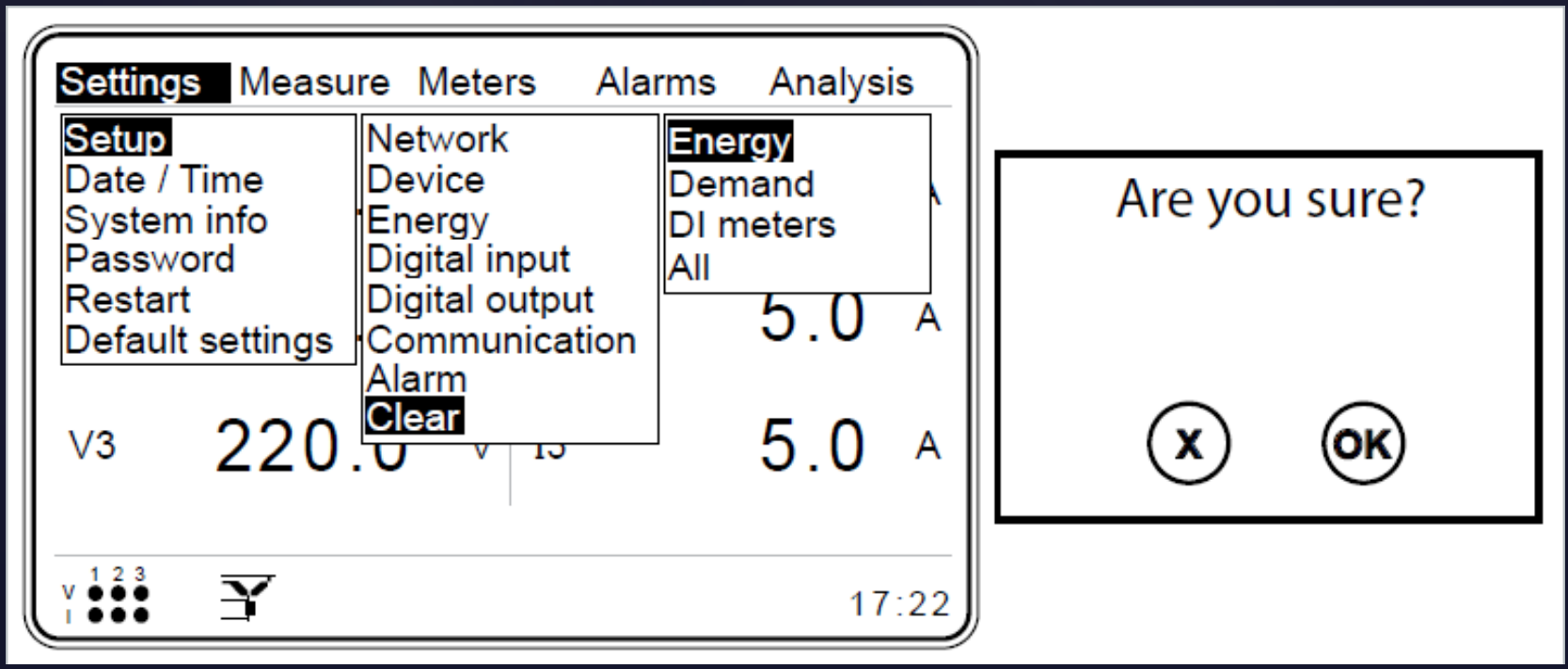
The setting of current Harmonics (Harmonics I) is similar to the voltage harmonics.

MMW03-M22CHB – Settings - Clear

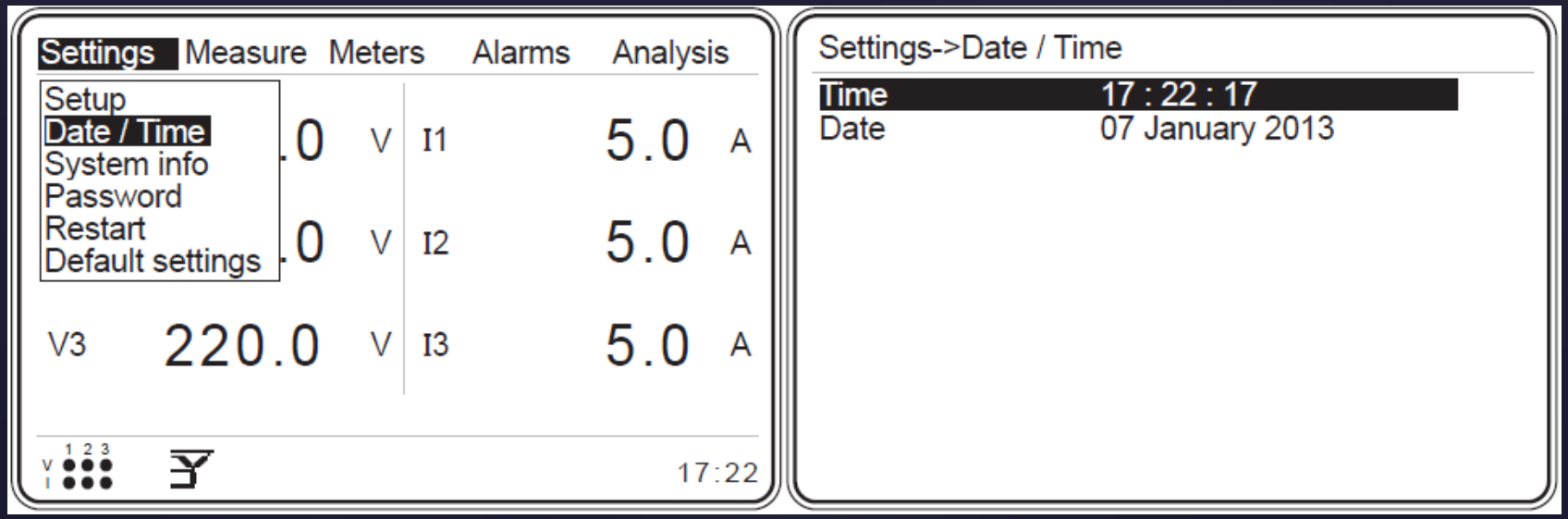
In this menu, the user can clear the demand values, energy values (tariff meter) and digital input counters.

The "All" option clears all values (demand, energy and DI counter);

When the Clear option is activated, the screen below prompts you to confirm.

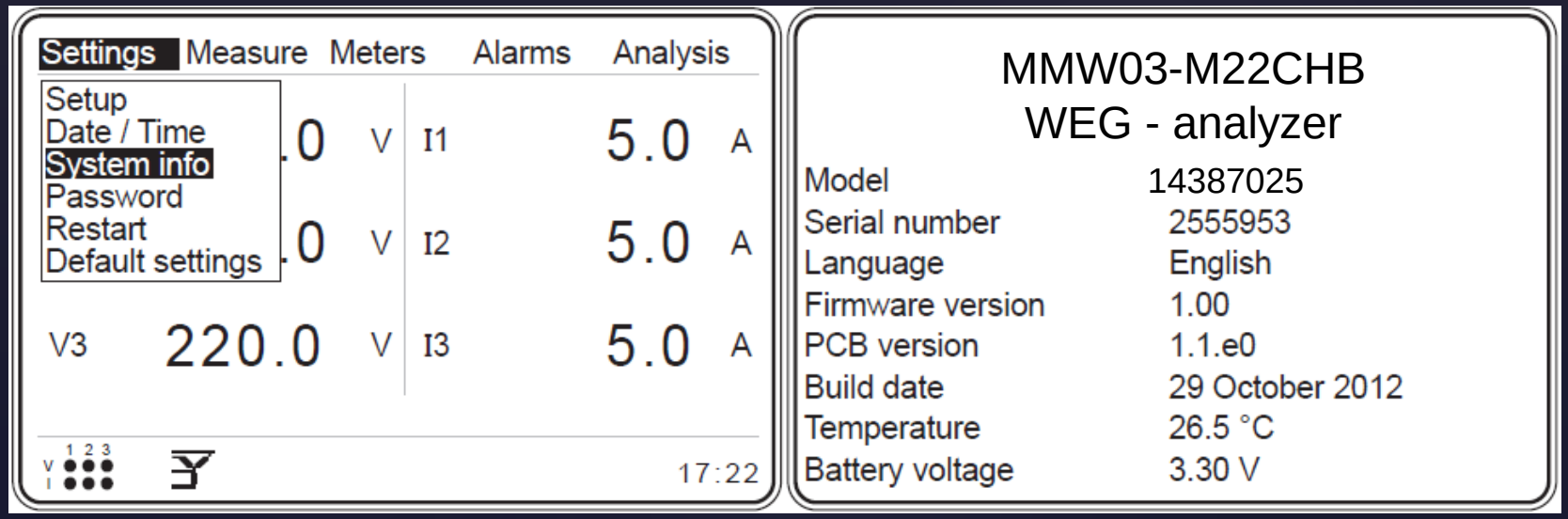


MMW03-M22CHB - Settings - Clock and date



MMW03-M22CHB – Settings - Alarms

This menu provides product information.



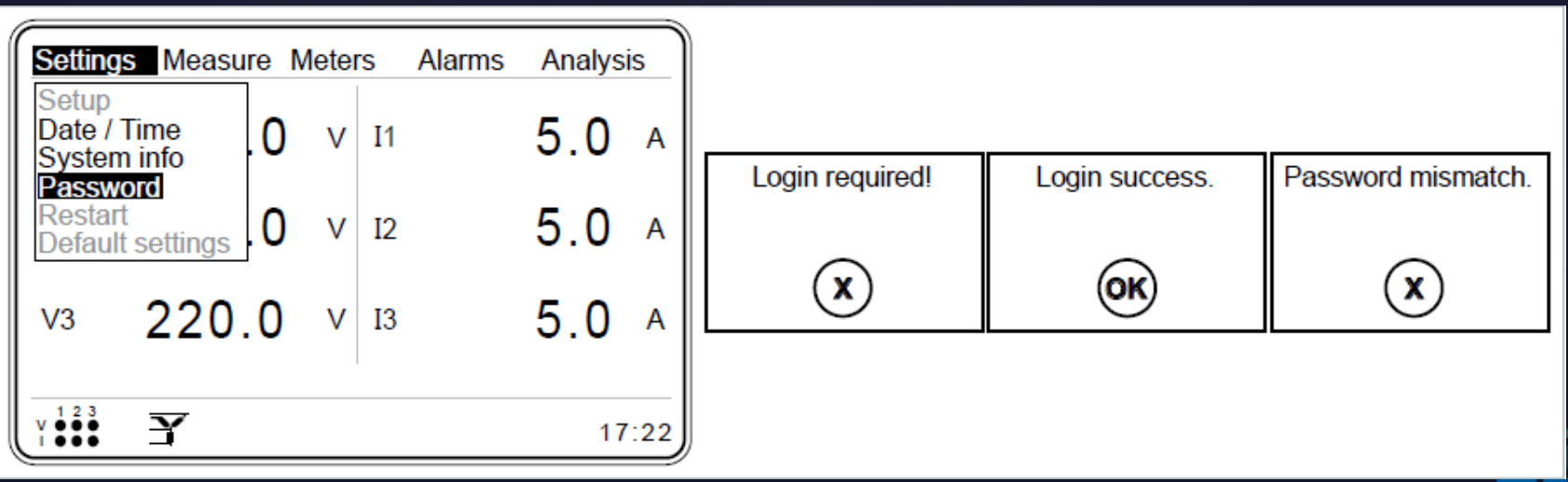
The temperature and voltage of the battery are also available via RS485

MMW03-M22CHB – Settings - Password

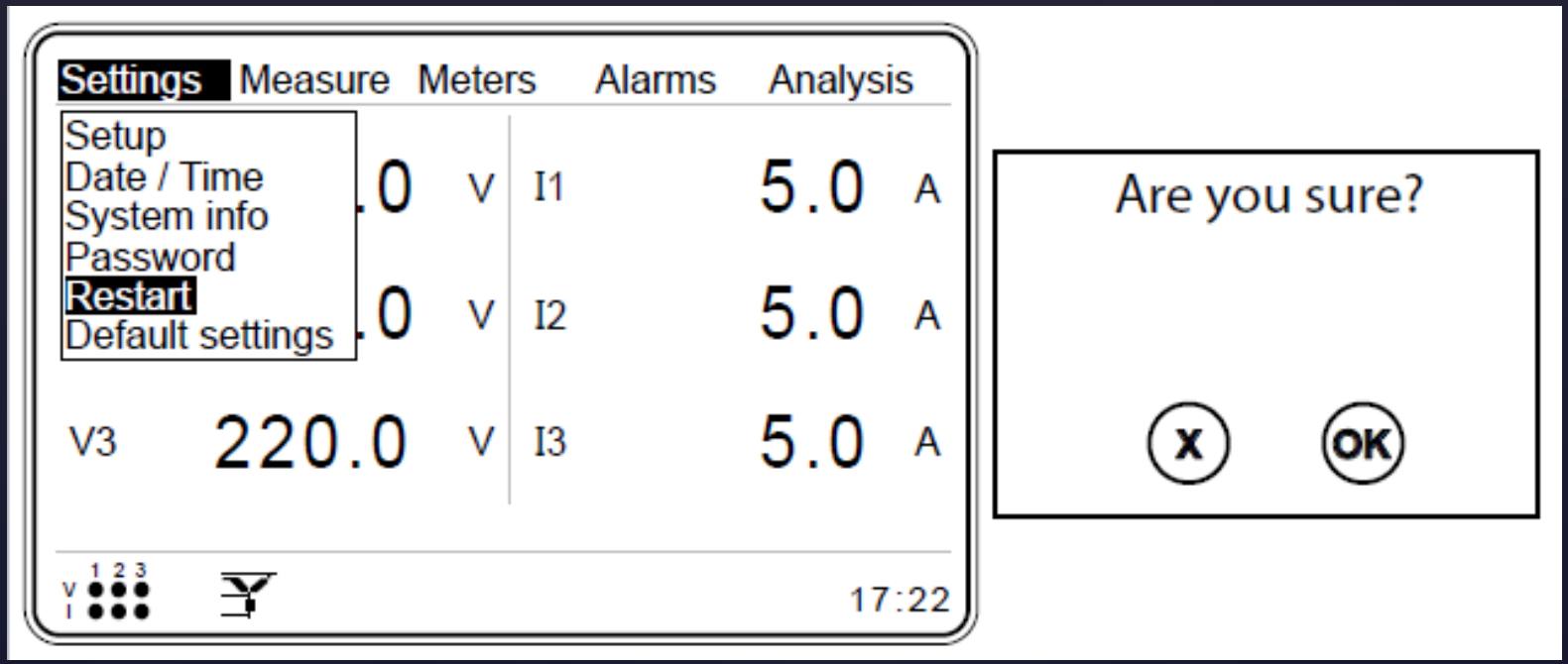
When attempting to access a menu, as below, a password prompt will be displayed and the menu will be gray.

By logging in with the correct password, the screens below will be shown on the display. A successful login message will appear on the screen and gray menu items will turn black.

If the user enters the wrong password, an error message will be displayed.



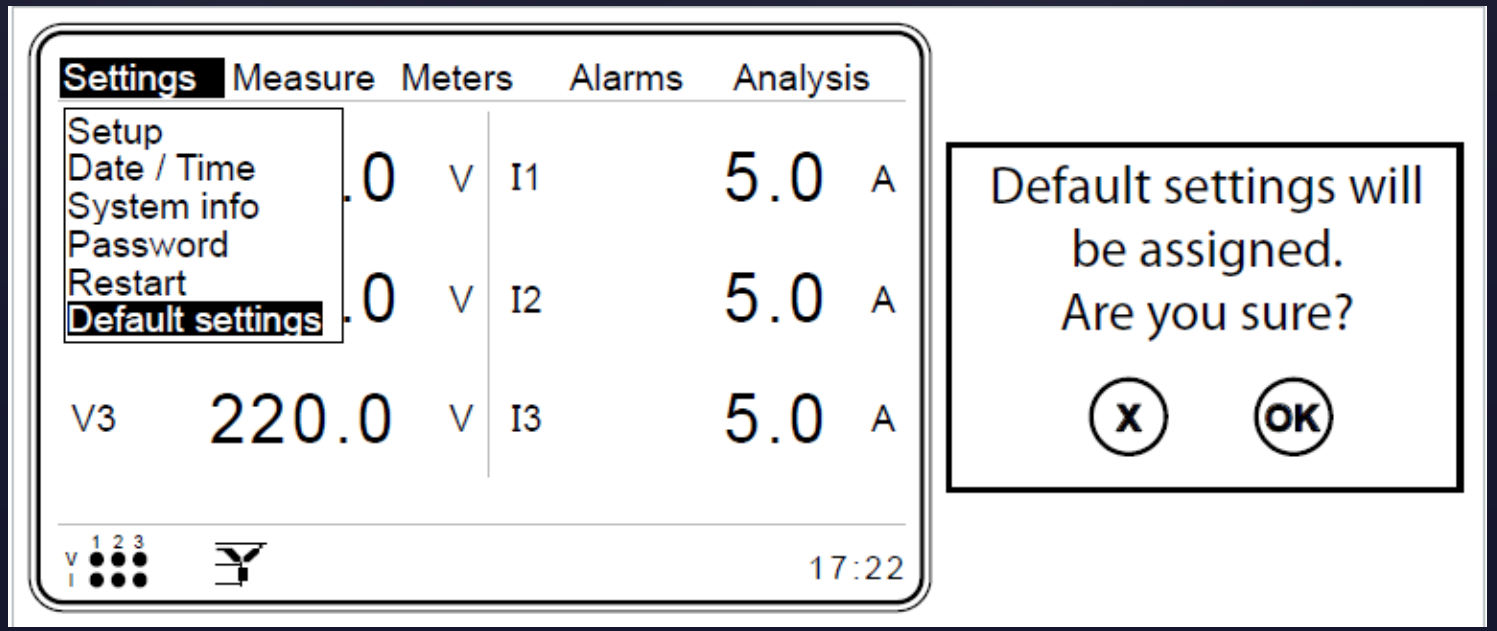
MMW03-M22CHB - Restart



MMW03-M22CHB - Factory settings

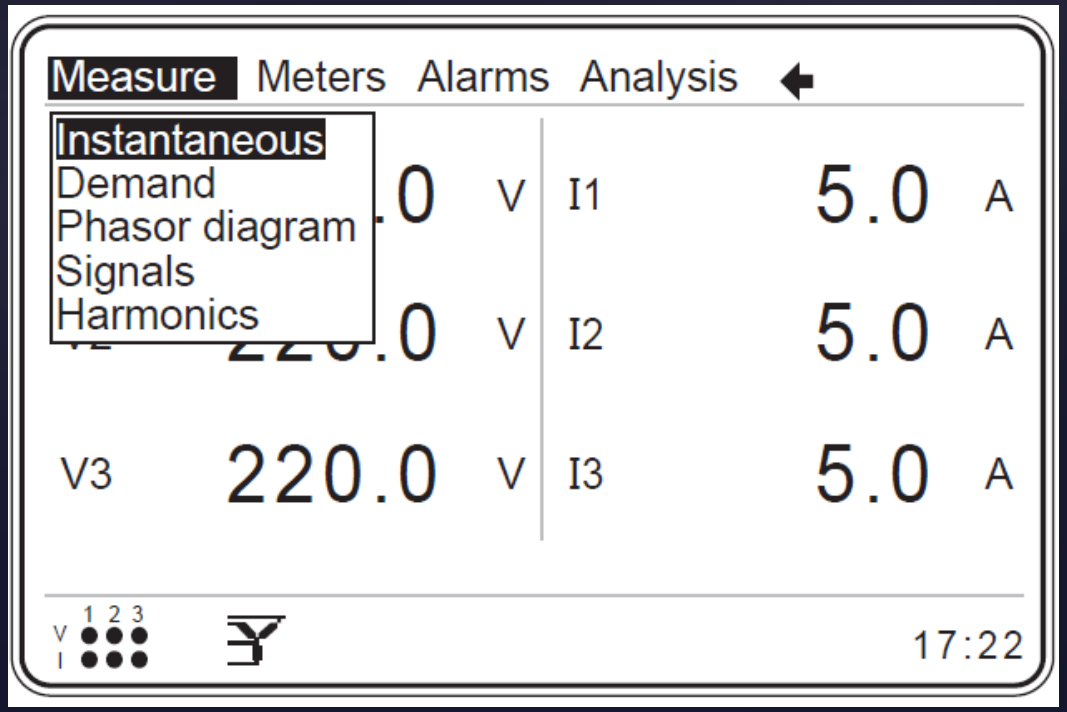
Use this menu to restore the factory settings.

Date and time do not change in this action.



MMW03-M22CHB - Measurements

The submenus below are included in the measurements menu.



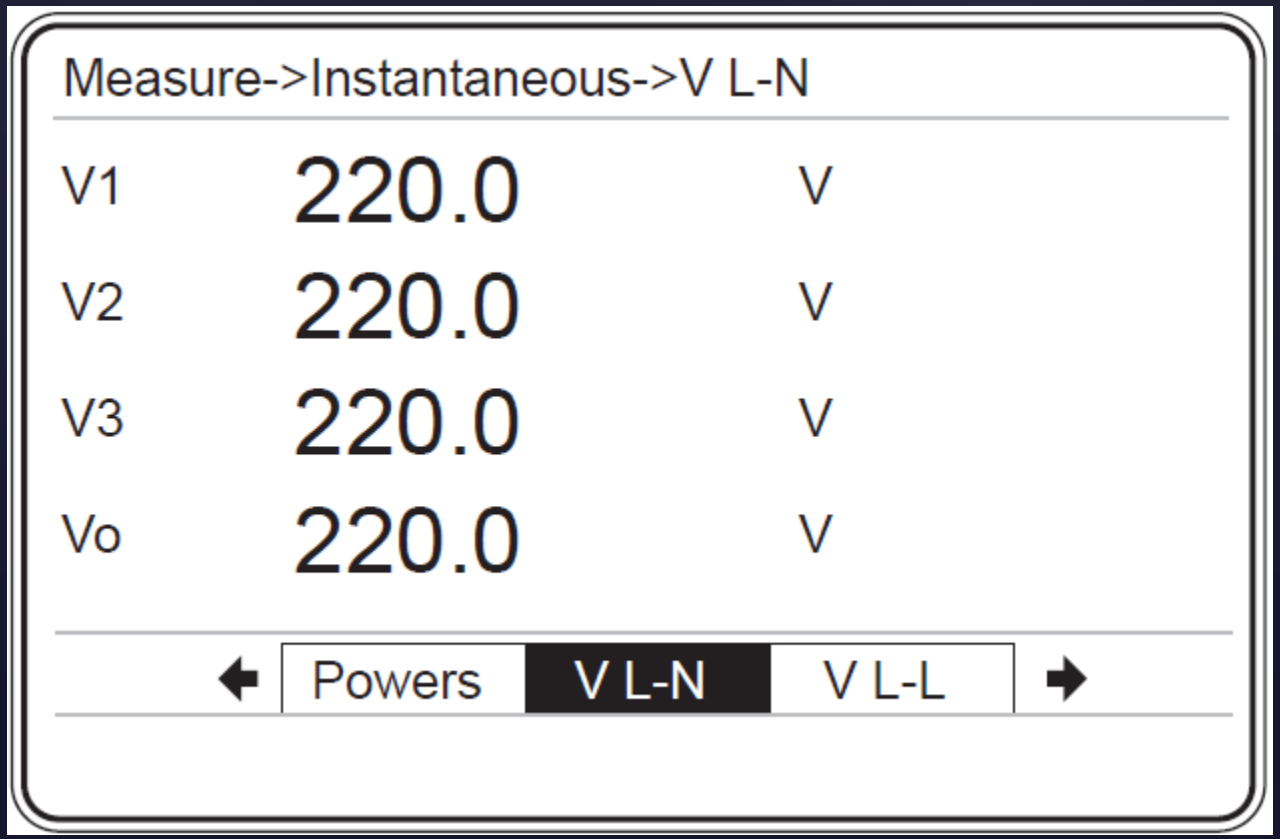
MMW03-M22CHB - Measurements - Instant values

In the instant measurements menu, the following items are available:

- Phase neutral voltage V (L-N) for each phase and the general average;
- Phase-phase voltage V (L-L) for each phase and the general average;
- Current per phase (I) and total;
- Neutral current (IN);
- Cosφ per phase and cosφ of the system;
- Power factor (PF) per phase and power factor (PF) of the system
- Active power (P) per phase and total;
- Reactive power (Q) per phase and total;
- Apparent power (S) per phase and total;
- Frequency (F) per phase;
- THDV per phase and total;
- THDI per phase and total;
- Total energies

MMW03-M22CHB - Measurements - Instant values

To navigate across the instant measurement screens, use the right and left keys

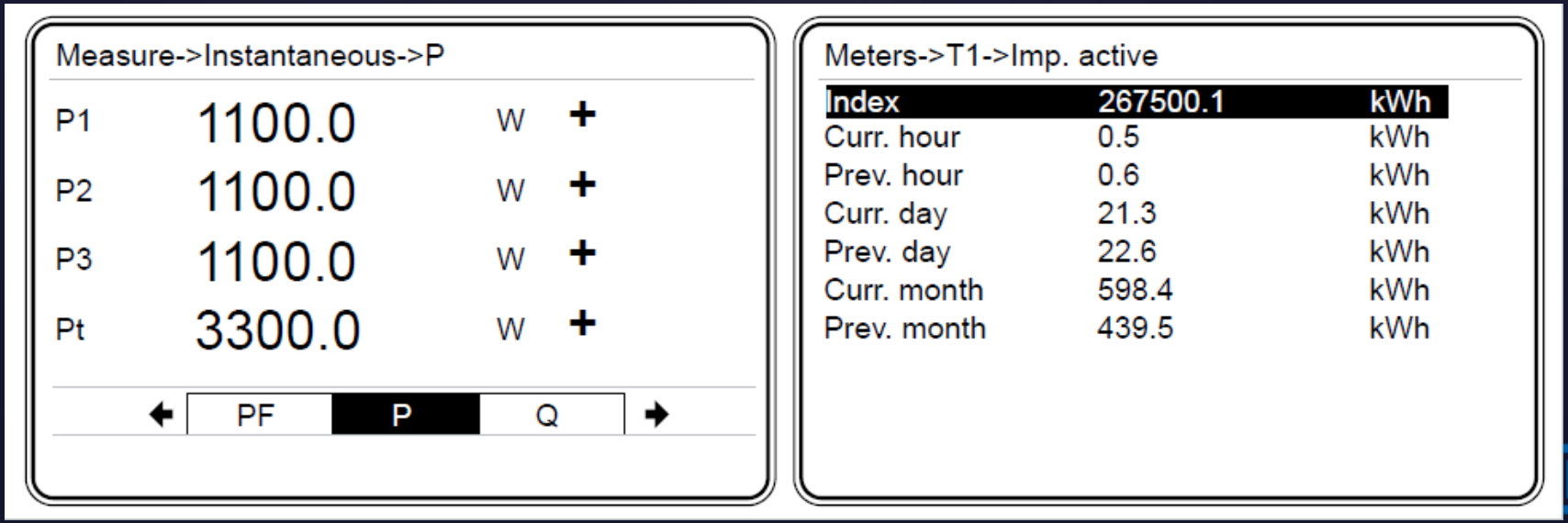


MMW03-M22CHB - Measurements - Instant values

Active power - P:

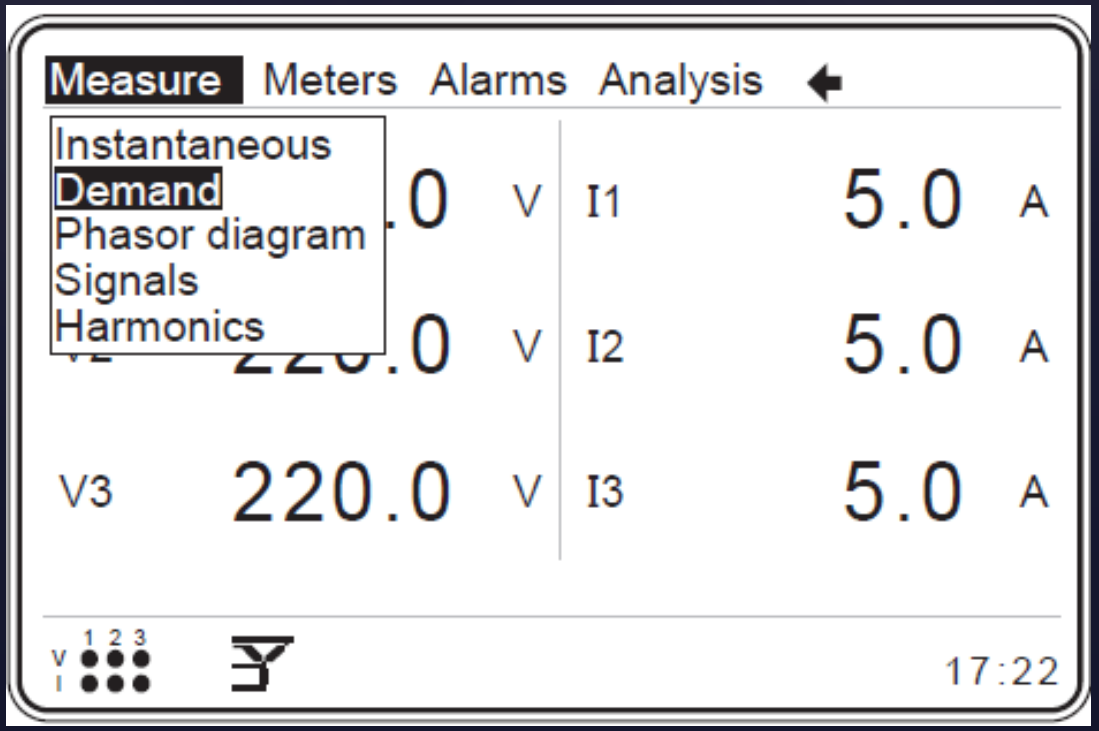
- If the device is measuring consumed active power P (source for load), the instant value measured should be positive (+).
- If the device is measuring the generated active power (generator - source), the instant value measured should be negative (-).

Otherwise, check the CT and device connections. They may be reversed.



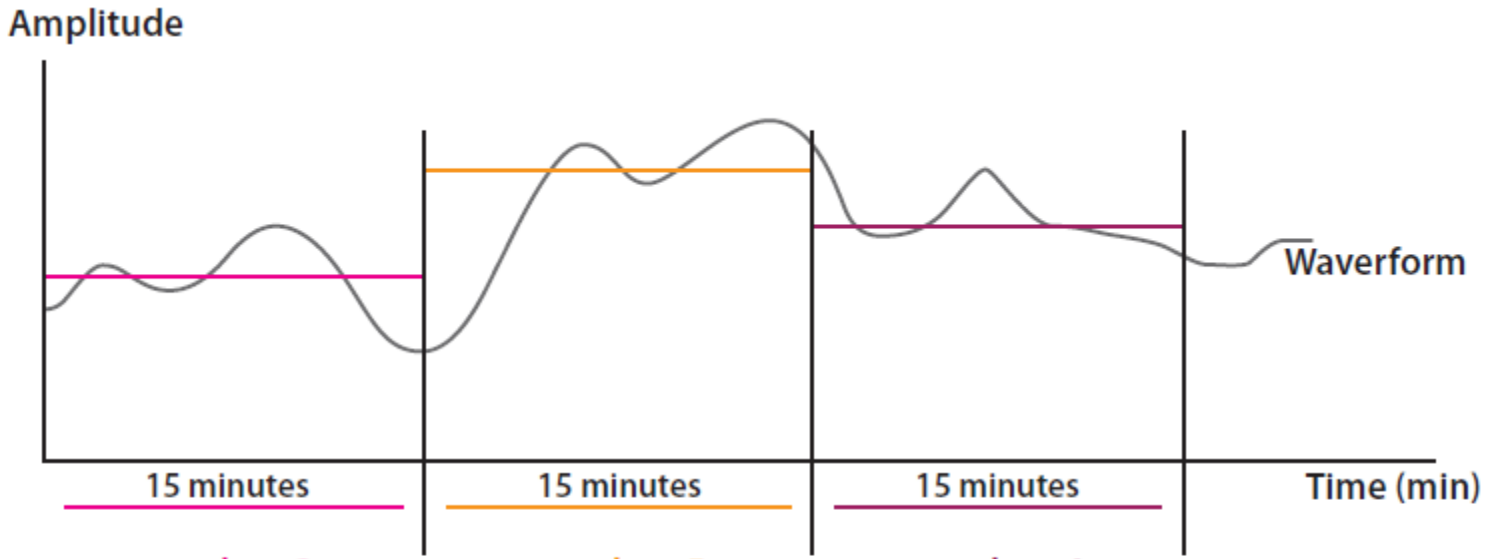
MMW03-M22CHB - Measurements - Demand

During the defined demand period, the device calculates the active, reactive and apparent power and current averages for the 3 phases;
The average maximum values of a defined period are stored with their date and time.



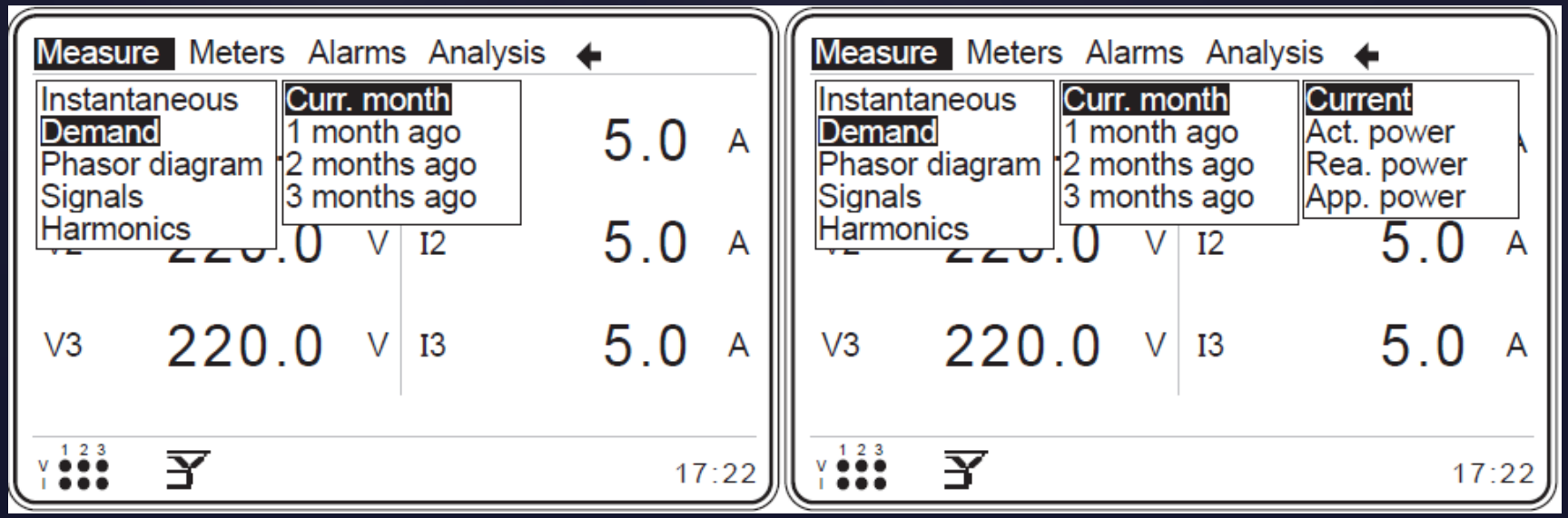
MMW03-M22CHB - Measurements - Demand

Demand calculation example:



MMW03-M22CHB - Measurements - Demand
Current month

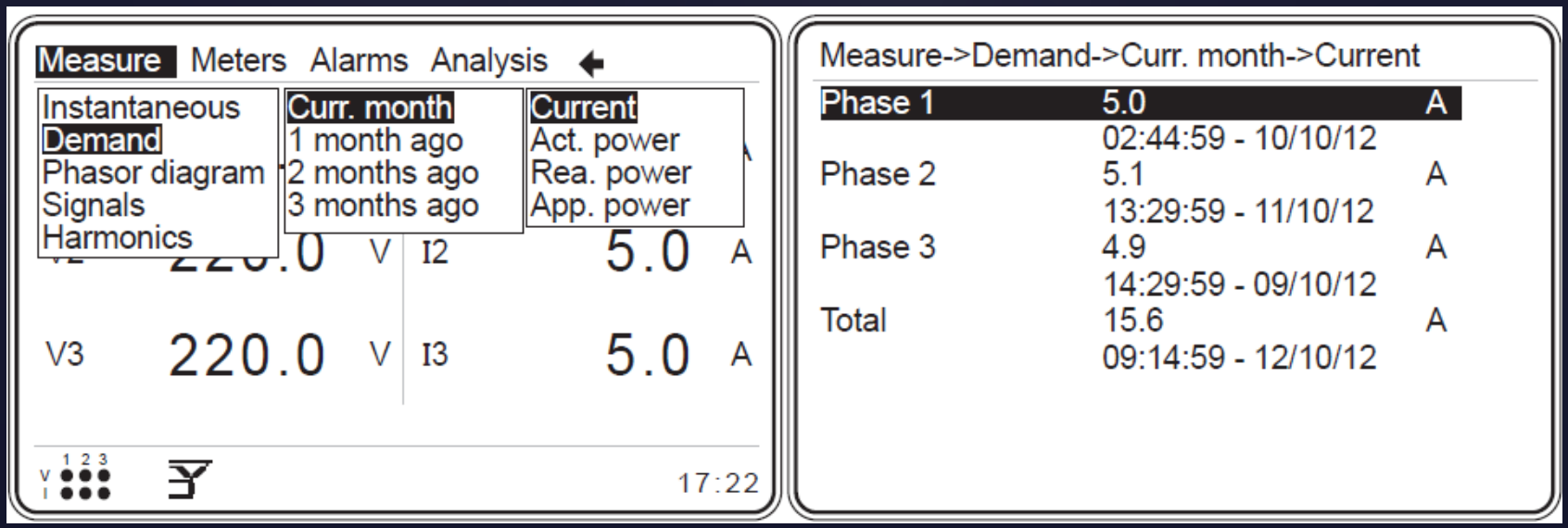
- The "Start of day" and "start of month" are set in the "Settings-> Setup-> Energy" menu;
- The settings above are important for the readings and records that are available in the Demand in its "Curr. Month", "1 month ago", "2 months ago" and "3 months ago" submenus;



MMW03-M22CHB - Measurements - Demand

Example: Considering that the start of the reading of the day is "8" and the start of the reading in the month is "26";
The date and time that will be considered to begin the measurements are: 08:00 am on the 26th of the month;

"Current month" values will be assigned as ➔ values "1 month ago";
Values of "1 month ago" will be assigned as ➔ values "2 months ago";
Values of "2 months ago" will be assigned as ➔ values "3 months ago";
and new values will be saved in the "current month" menu;



MMW03-M22CHB - Measurements - Demand

Important:

In order to correctly register the demand values "1 month ago", "2 months ago" and "3 months ago"; the demand calculation period should be divisible by 60.

That is, adopt 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 or 60 min to set this time.

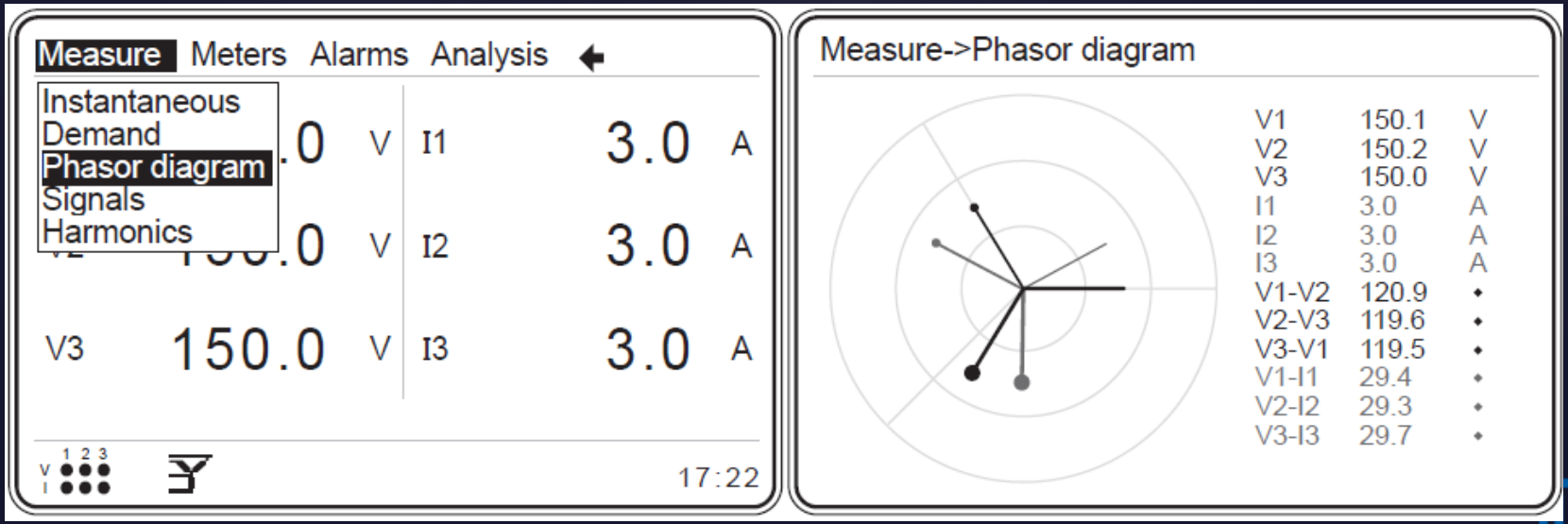
Otherwise, the demand values "1 month ago", "2 months ago" and "3 months ago" will be stored.

MMW03-M22CHB - Measurements - Phasor diagram

On the phasor diagram menu, the following information is available on the right of the diagram:

- Current and voltage phasors
- Phasor phase angle

In the phasor diagram, the currents are drawn with gray lines and the voltages with black lines.
For reference, circles with the standard 120-degree difference were added to the diagram.



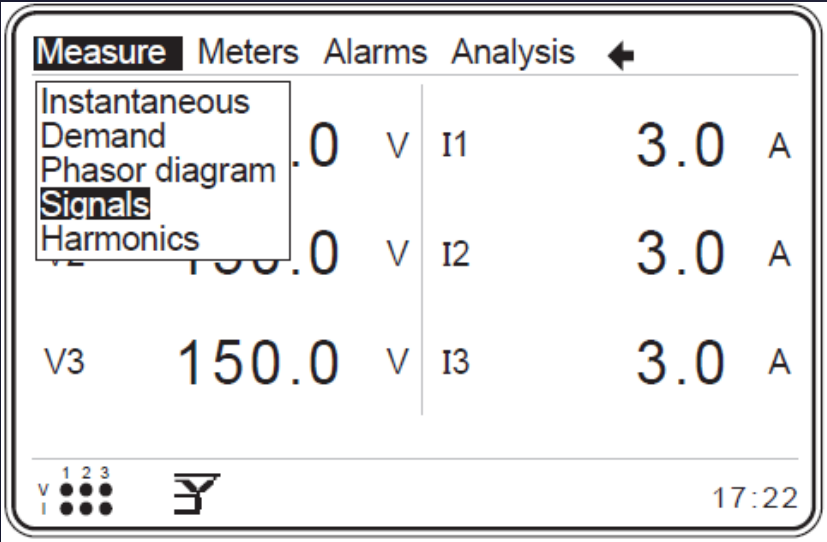
MMW03-M22CHB - Measurements - Waveforms

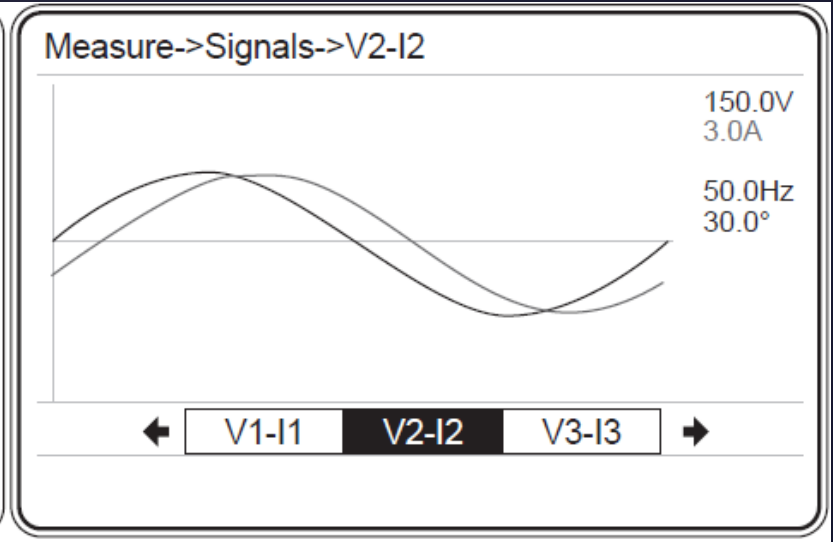
Current and voltage waveforms are displayed in this menu.

The following information is available on this screen:

- Voltage and current values
- Frequency
- Angular phase difference between voltage and current

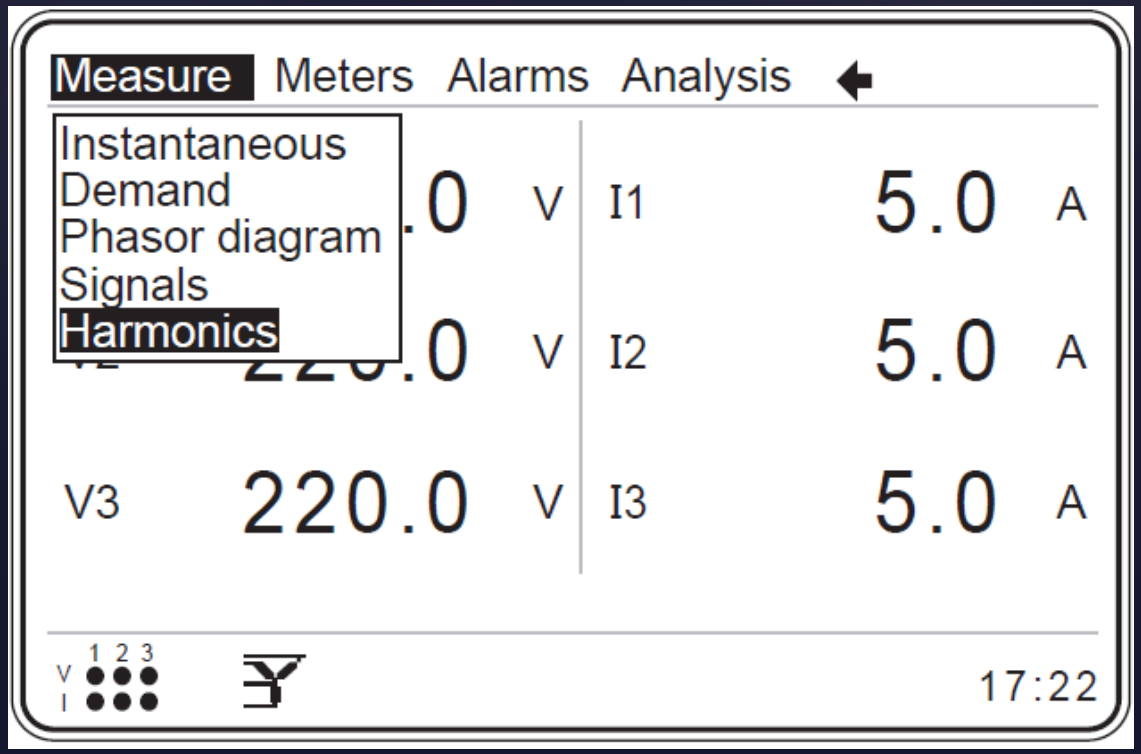
The current signal is gray and the voltage signal is black





MMW03-M22CHB - Measurements - Harmonics

Harmonics are calculated up to the 51st order;
Voltage and current harmonics can be displayed in a table or bar graph.

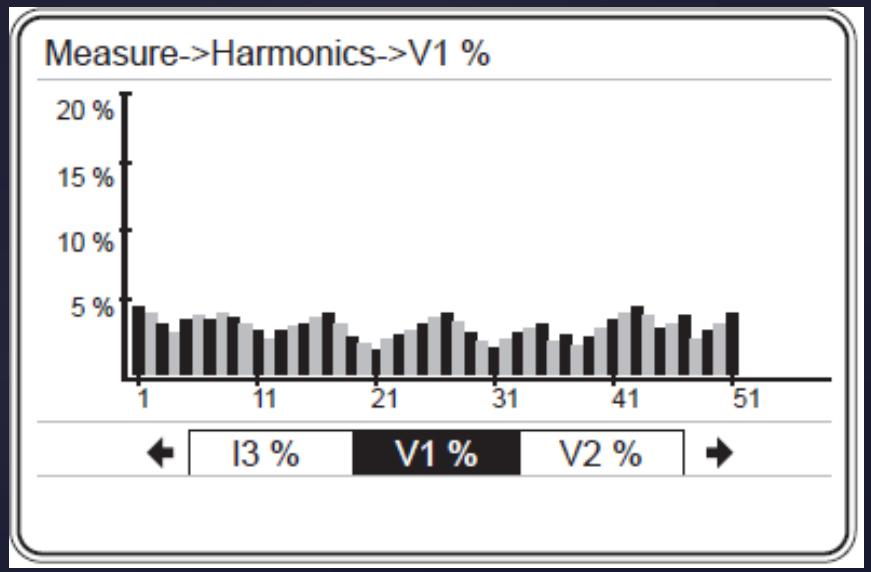


MMW03-M22CHB - Measurements - Harmonics

Measure->Harmonics->V1 %

	1	2	3	4	5
1-5	99.01	0.00	1.02	0.00	0.05
6-10	0.00	2.10	0.00	3.30	0.00
11-15	5.70	0.00	0.75	0.00	0.00
16-20	0.00	0.00	0.00	0.00	0.00
21-25	0.00	0.00	0.00	0.00	0.00
26-30	0.00	0.00	0.00	0.00	0.00
31-35	0.00	0.00	0.00	0.00	0.00
36-40	0.00	0.00	0.00	0.00	0.00
41-45	0.00	0.00	0.00	0.00	0.00
46-50	0.00	0.00	0.00	0.00	0.00

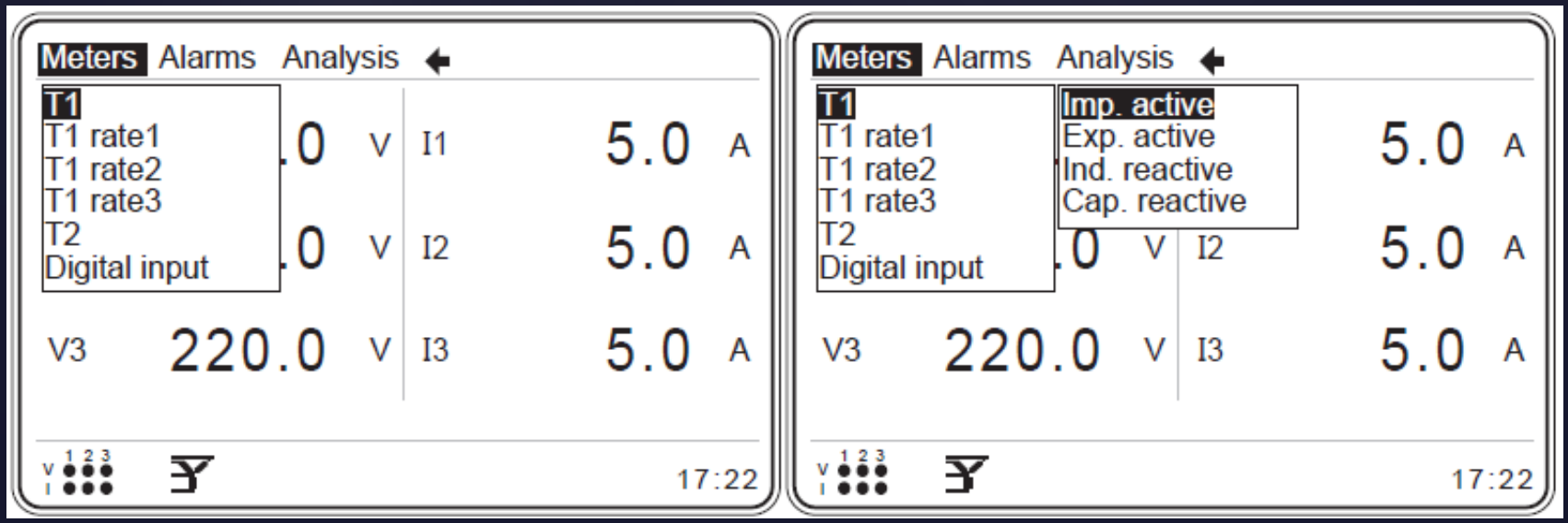
I3 % | V1 % | V2 %



MMW03-M22CHB – Meters

The values of the energy meters of T1, T1 rate1, T1 rate2, T1 rate3 and Tariff 2 are shown as:

- Import active (import active energy)
- Export active (export active energy)
- Inductive reactive (inductive reactive energy)
- Capacitive reactive (capacitive reactive energy)



MMW03-M22CHB - Meters - T1 - Imp. Active

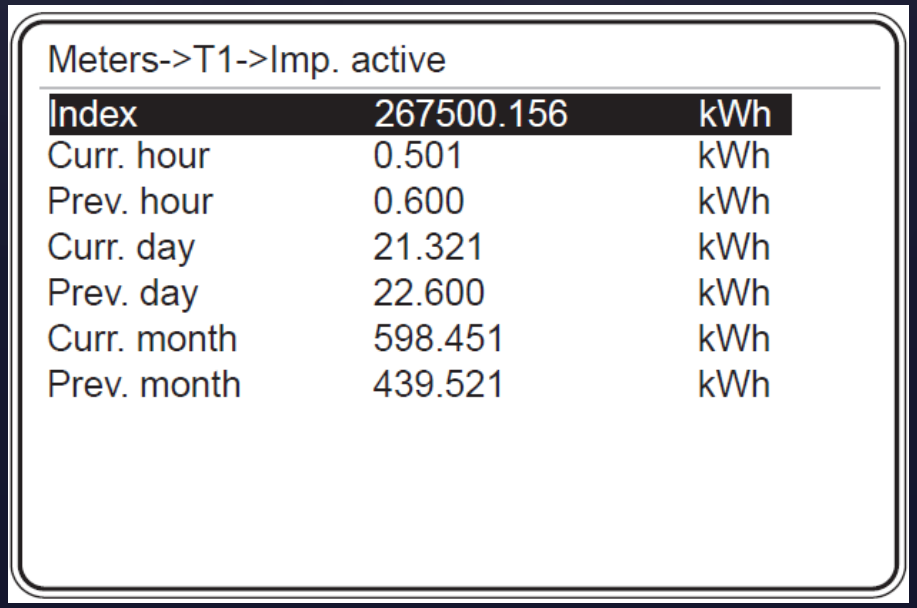
Index = active energy accumulated until the present time;

Curr. hour = active energy consumed from the beginning of the current hour until the present time;

Prev. hour = active energy consumed in the previous hour;

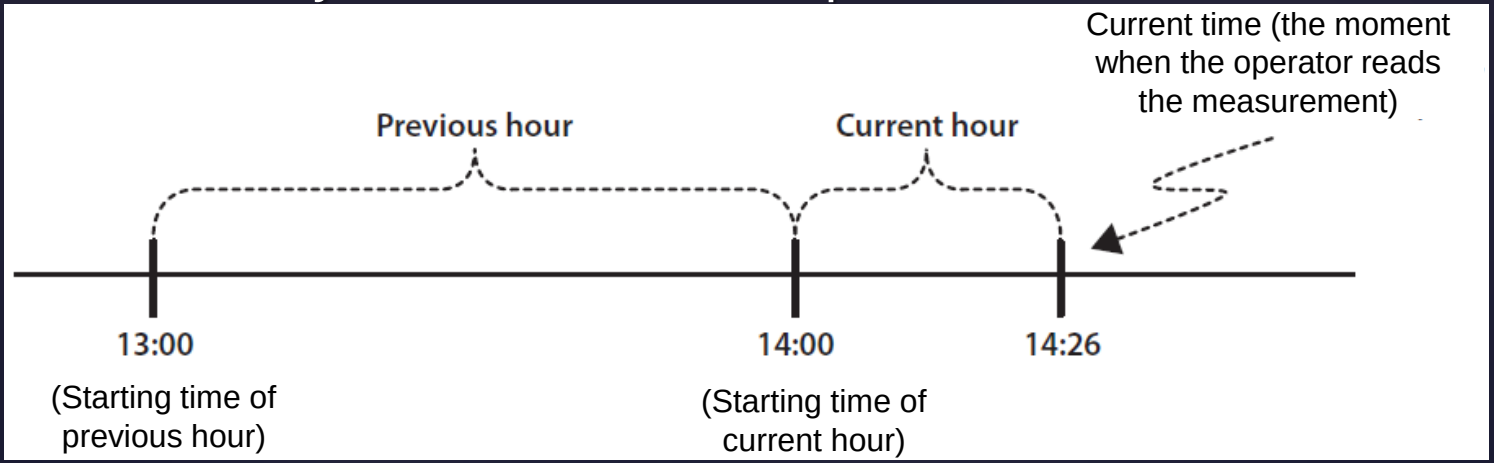
Curr. day = active energy consumed from the "start of day" until the present time;

Prev. day = active energy consumed in the previous day;

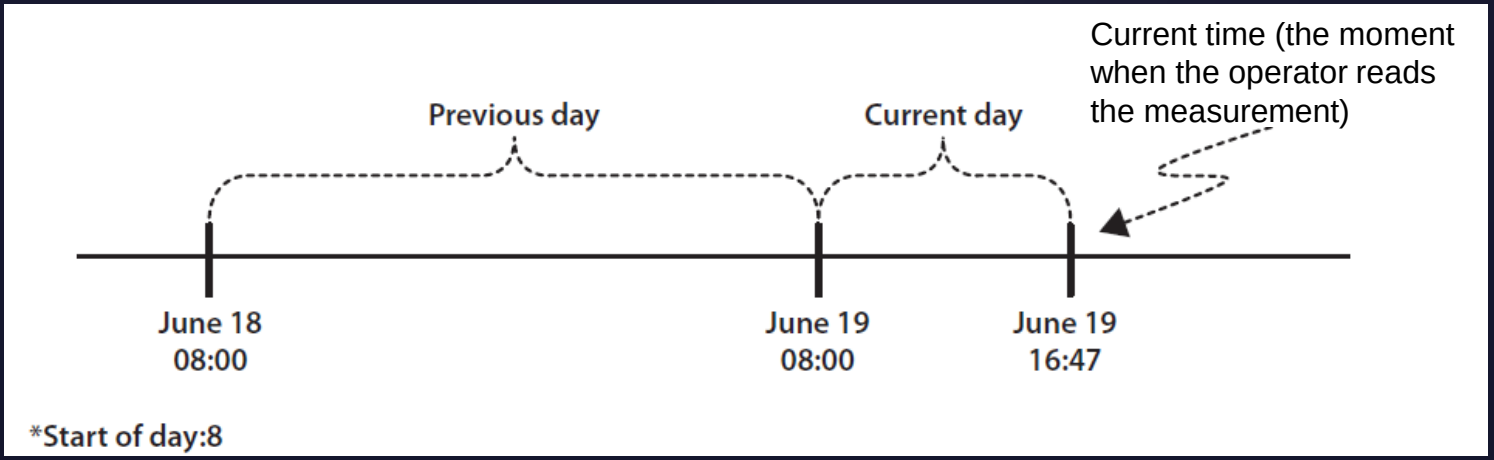


MMW03-M22CHB - Meters - T1 - Imp. Active

Start of hourly measurement example

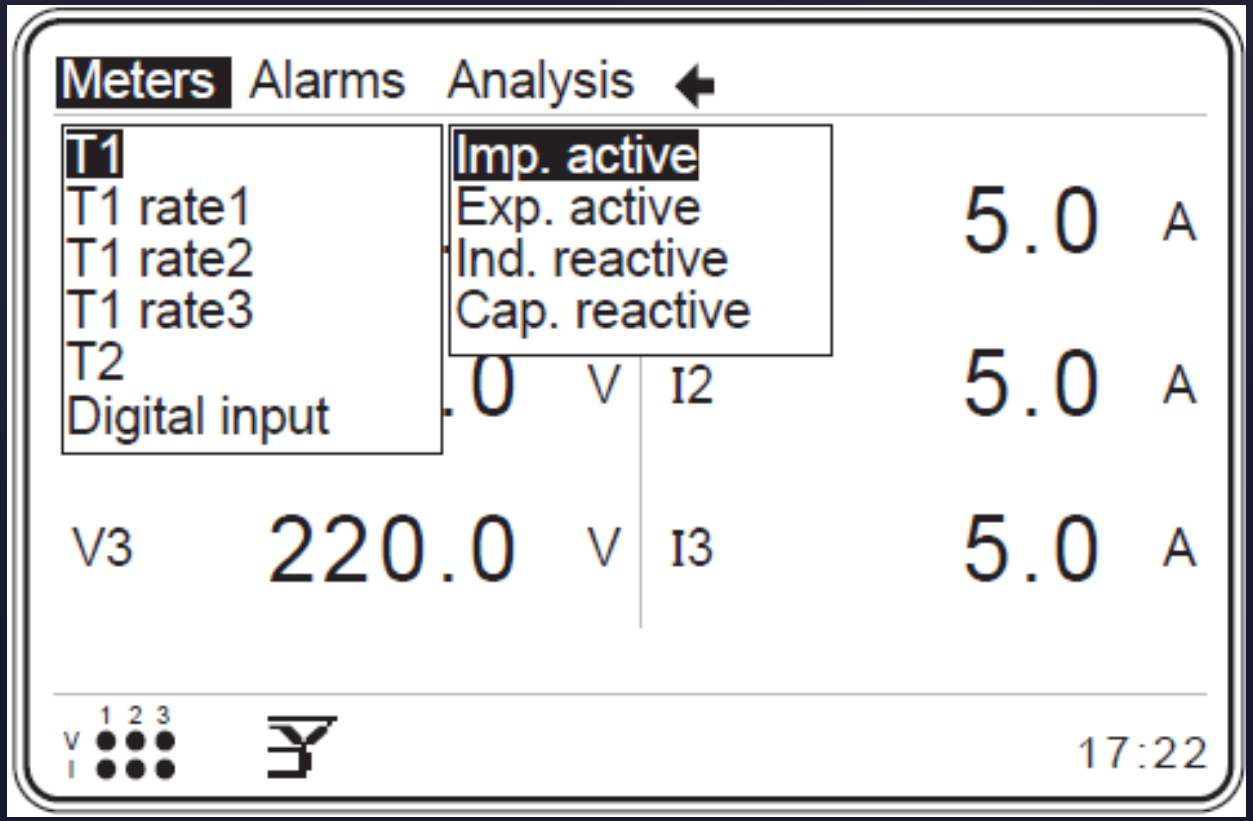


Start of daily measurement example



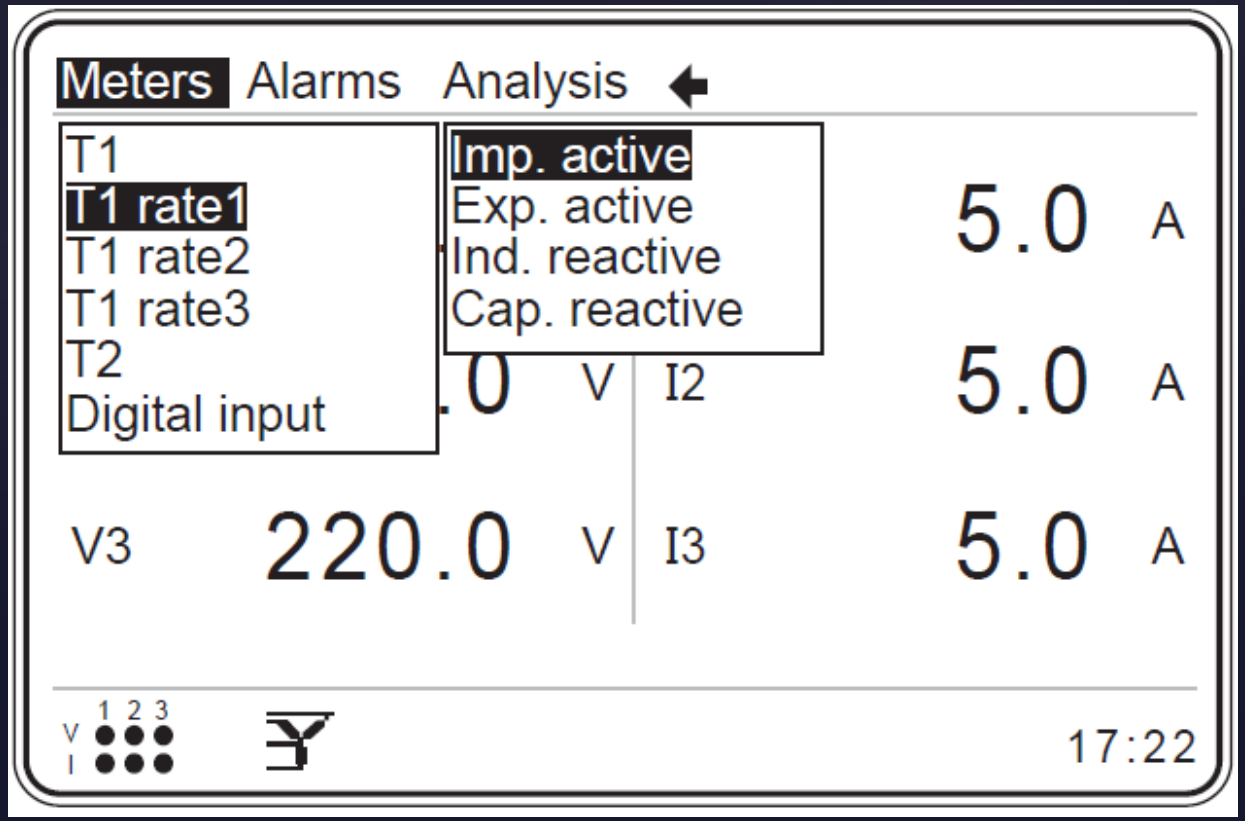
MMW03-M22CHB - Meters - T1 - other submenus

In T1, the other submenus have the same layout as "Imp. active ".



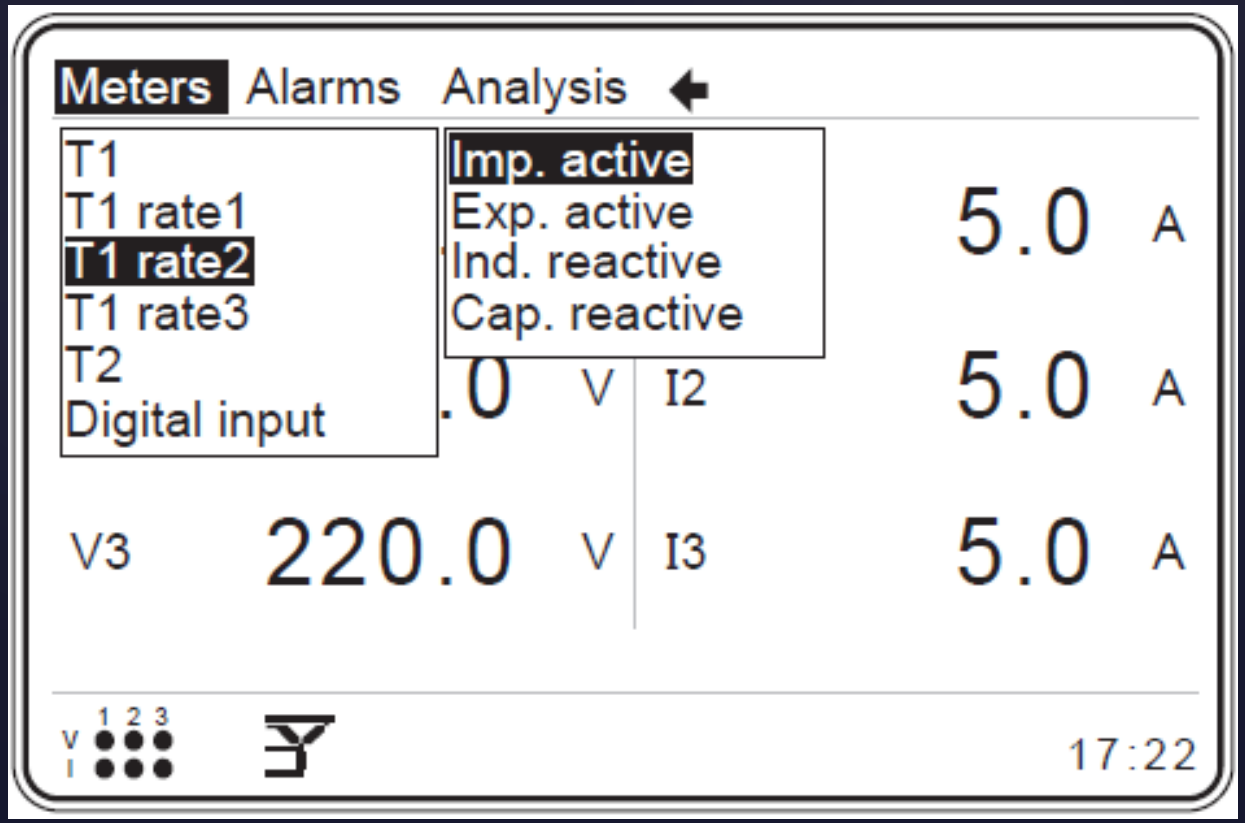
MMW03-M22CHB - Meters - T1 rate 1

The "T1 rate1" meter counts from 'T1_1 start time' and 'T1_2 start time'.



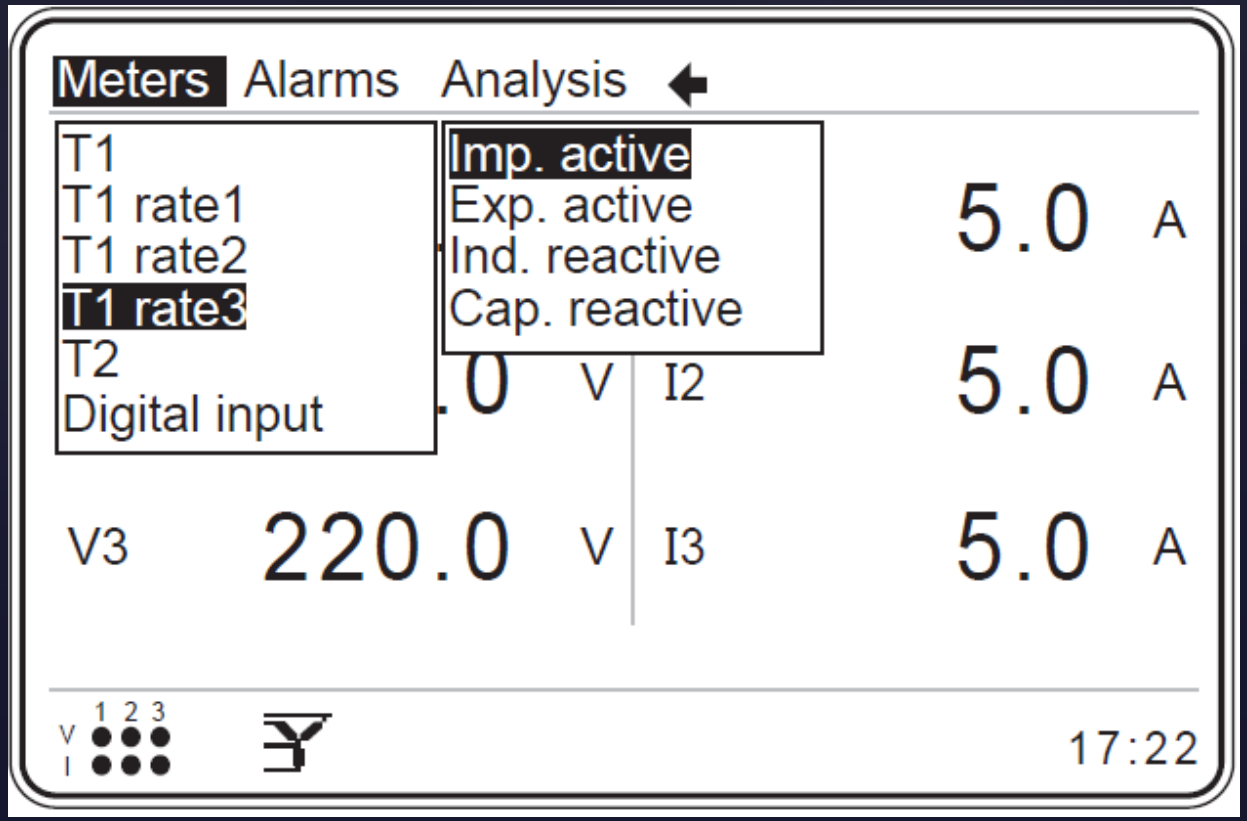
MMW03-M22CHB - Meters - T1 rate 2

The "T1 rate2" meter counts from 'T1_2 start time' and 'T1_3 start time'.

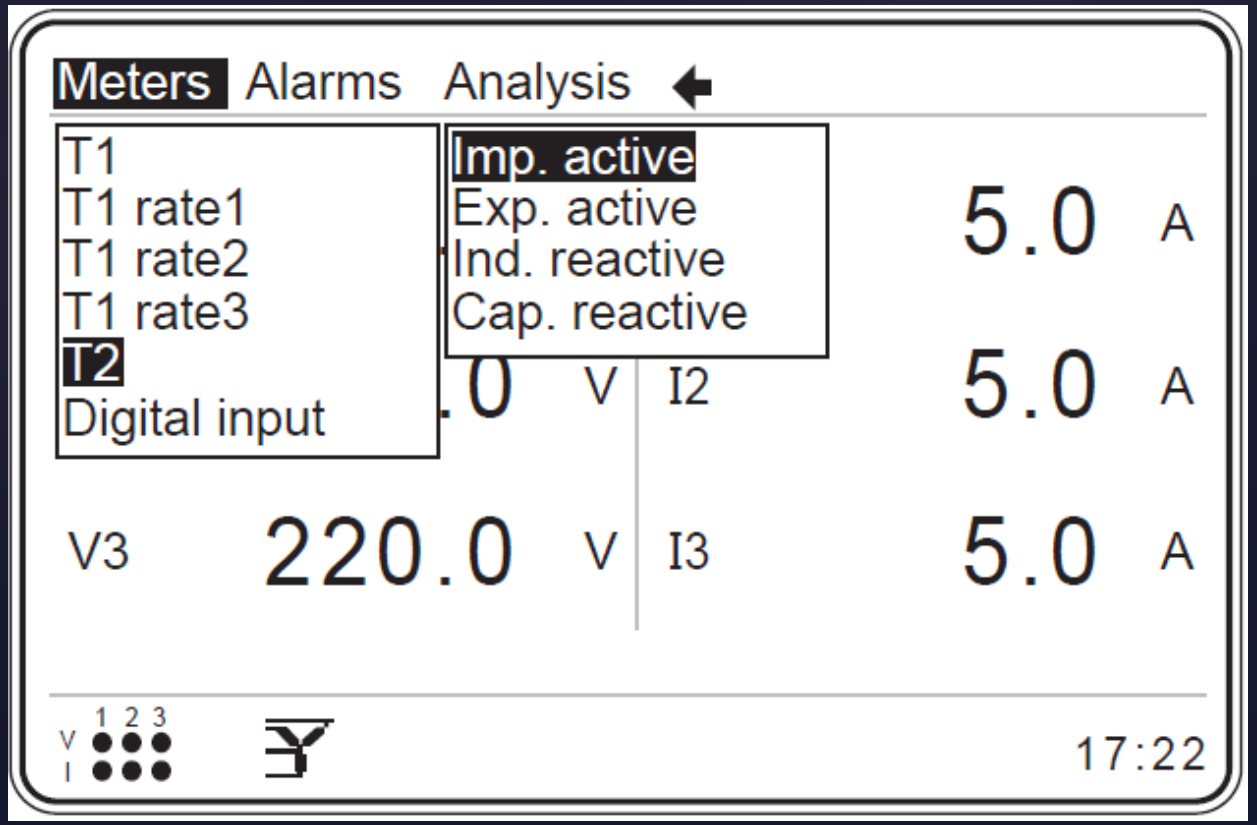


MMW03-M22CHB - Meters - T1 rate 3

The "T1 rate3" meter counts from 'T1_3 start time' and 'T1_1 start time'.



MMW03-M22CHB - Meters - T2



MMW03-M22CHB - Meters - T1 and T2

For T1 and T2 - important

While the Tariff 2 meter is enabled, Tariff 1, T1 rate1, T1 rate2, T1 meters are disabled.

To enable Tariff 2;

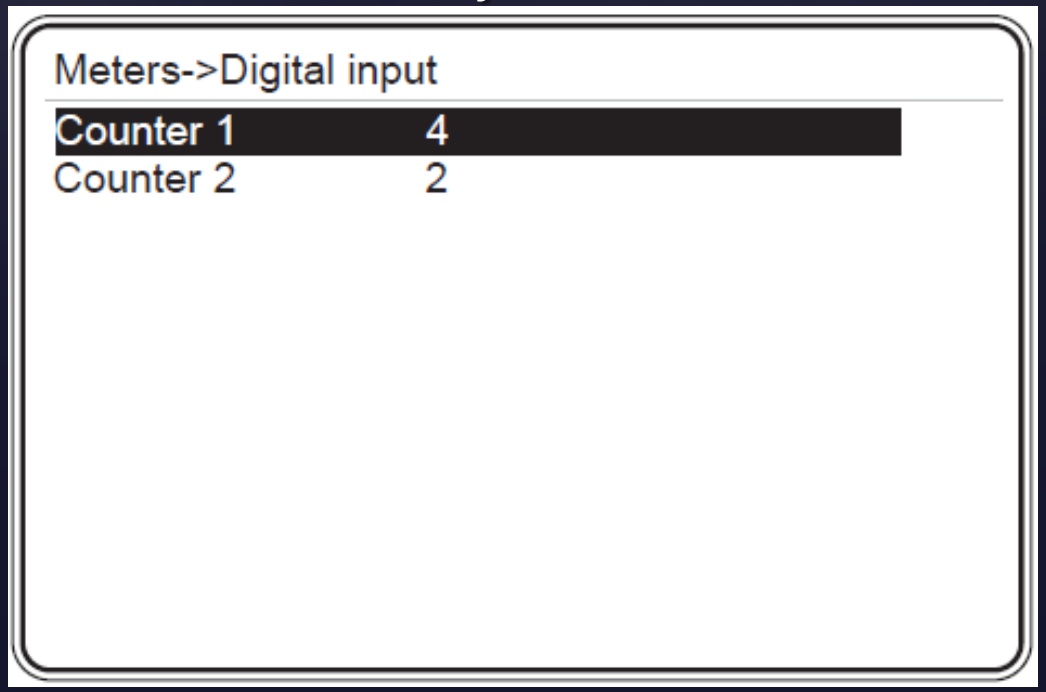
1) Mode "T2" must be selected in the "digital input1" and/or "digital input2" menu;
2) Terminals DI and GND of the selected input must be short-circuited;

MMW03-M22CHB - Meters - Digital input

In this menu, the counters of the respective digital inputs are displayed.

When DI1 and GND are short-circuited, observing the delay, "digital input1 counter" is incremented by "1".

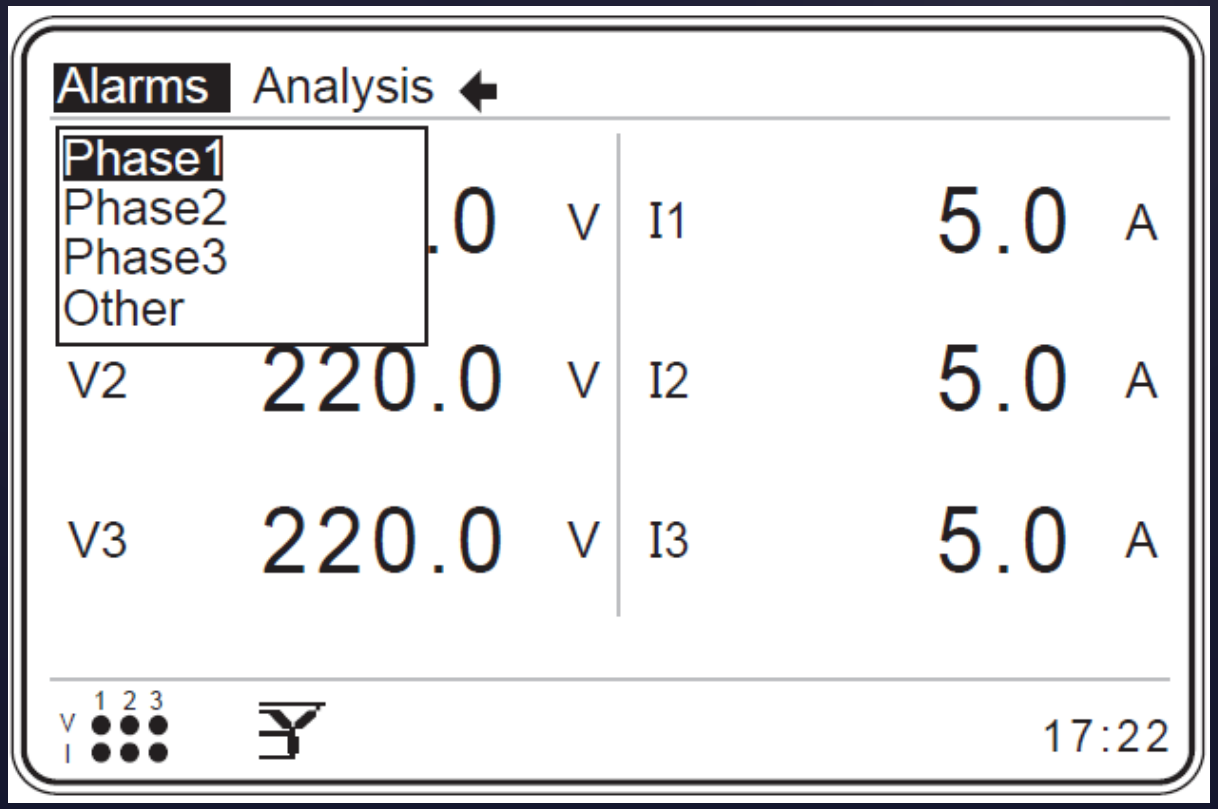
When DI2 and GND are short-circuited, observing the delay, "digital input2 counter" is incremented by "1".



MMW03-M22CHB - Alarms

In this menu the alarms can be monitored.

'Phase1', 'Phase2', 'Phase3' and 'Other' submenus.



MMW03-M22CHB - Alarms

Definitions for the Modbus table

In the Modbus table, up to 50 alarms can be saved. If this number is exceeded, the 51st and following alarms are overwritten starting from the first recorded alarm.

In the Modbus table, the alarm states are:

Alarm with date and time	: Alarm time, 32 bit integer;
Alarm setting	: Alarm flag bit number. See example below;
Alarm state	: Alarm ON or alarm OFF state.
Alarm value	: Value of the related alarm parameter

MMW03-M22CHB - Alarms - Phase 1

Phase1 menu displays the alarm states

"Normal" → No alarm;

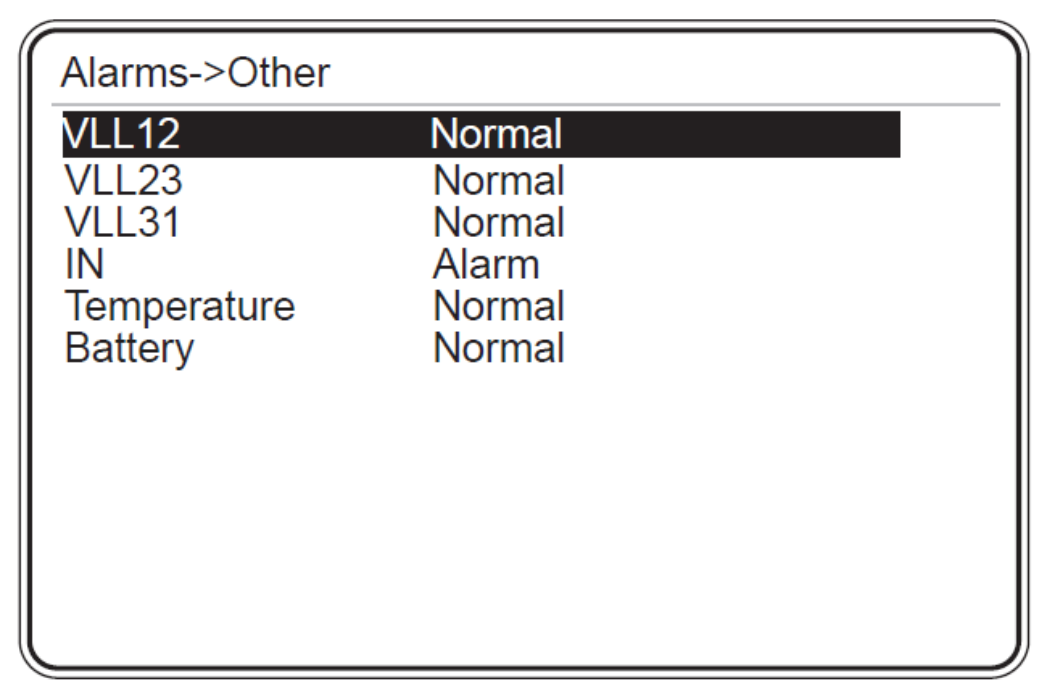
"Alarm" → Alarm - limit value exceeded;

Alarms->Phase1

V	Alarm
I	Normal
P	Normal
Q	Normal
S	Normal
CosØ	Normal
PF	Normal
V harmonics	Normal
THDV	Normal
I harmonics	Normal
THDI	Normal
F	Normal

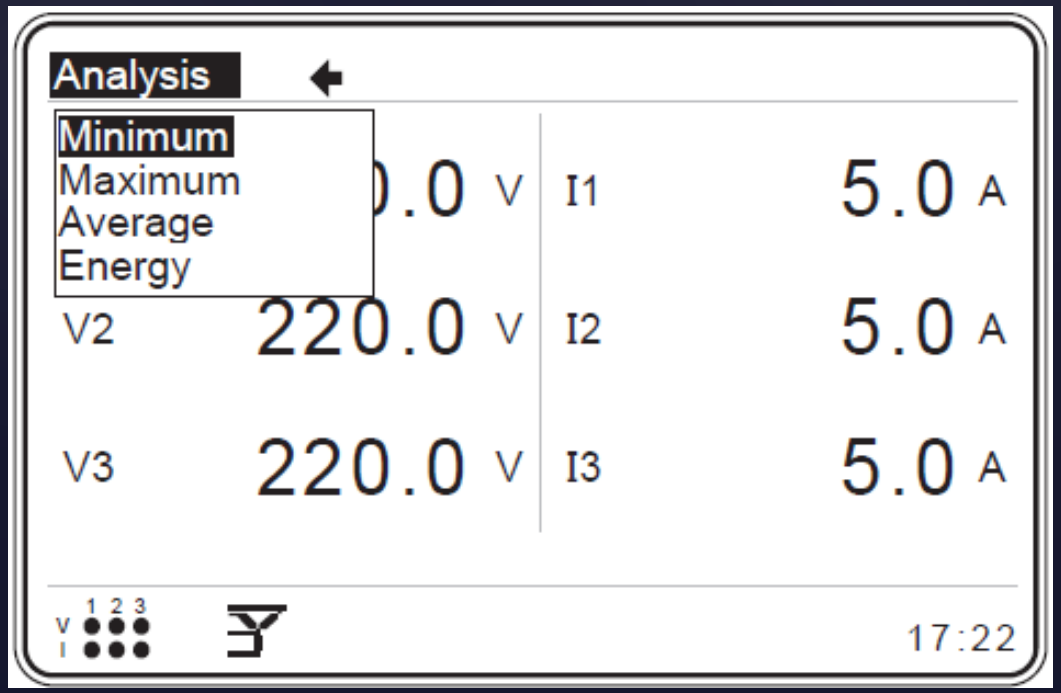
MMW03-M22CHB - Alarms - Phase 2 and Phase 3

- "Phase2" and "Phase3" menus are similar to those of Phase 1;
- In the "Other" menu, the explanations are the same as for the Phase 1 alarm.
- The Other menu has the alarm parameters listed below.



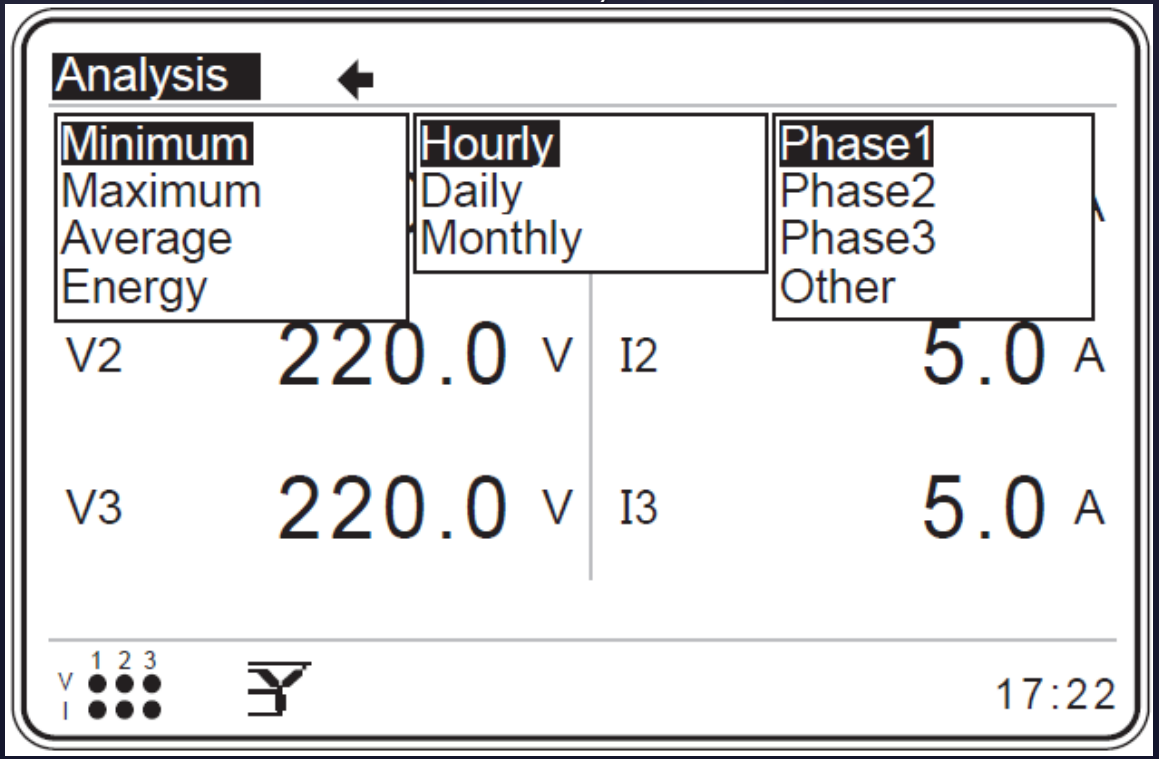
MMW03-M22CHB - Analyses

- The analysis menu can be found via the Modbus network;
- Parameters of this menu are not stored in the device permanent memory. if the device is turned off/de-energized, the values will be lost.



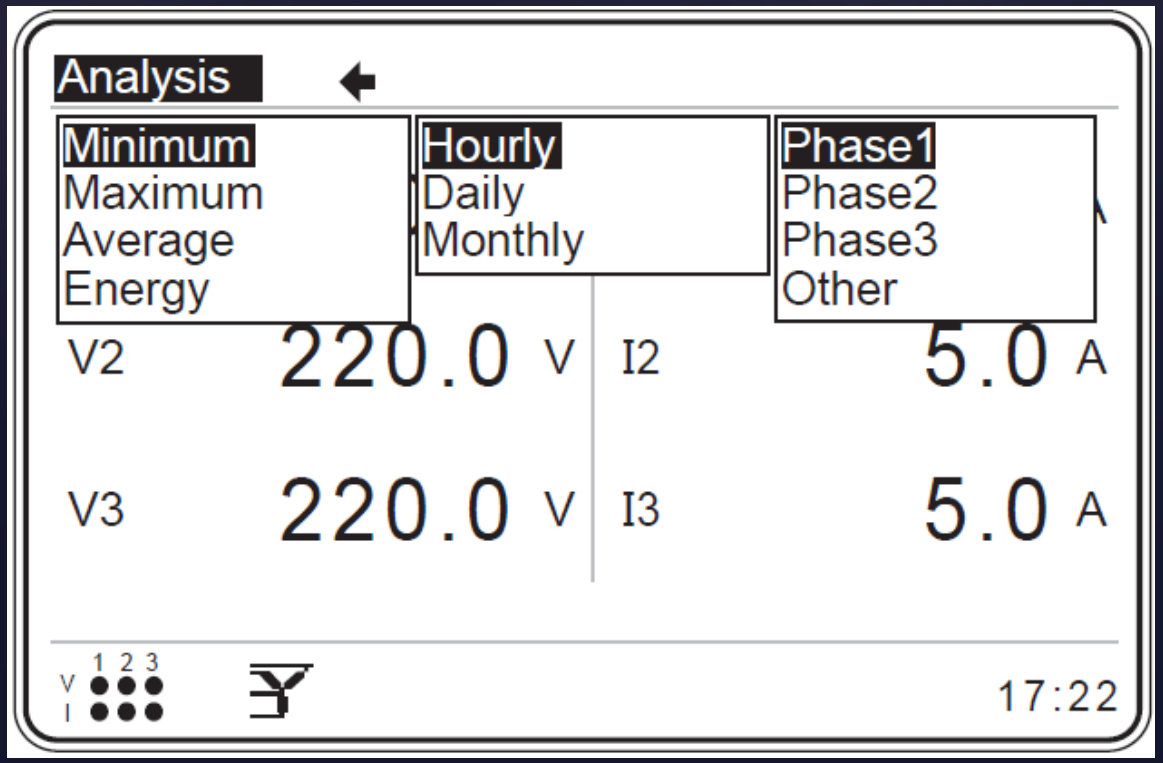
MMW03-M22CHB - Analyses - Minimum - Time

- The Analyses submenu is shown in the figure below;
- The Phase1, Phase2 and Phase3 submenus contain: voltage (V), current (I), active power (P), reactive power (Q), apparent power (S), cos Ø, power factor (PF) and frequency (F).
- The Other submenu contains: VLL12, VLL23 and VLL31



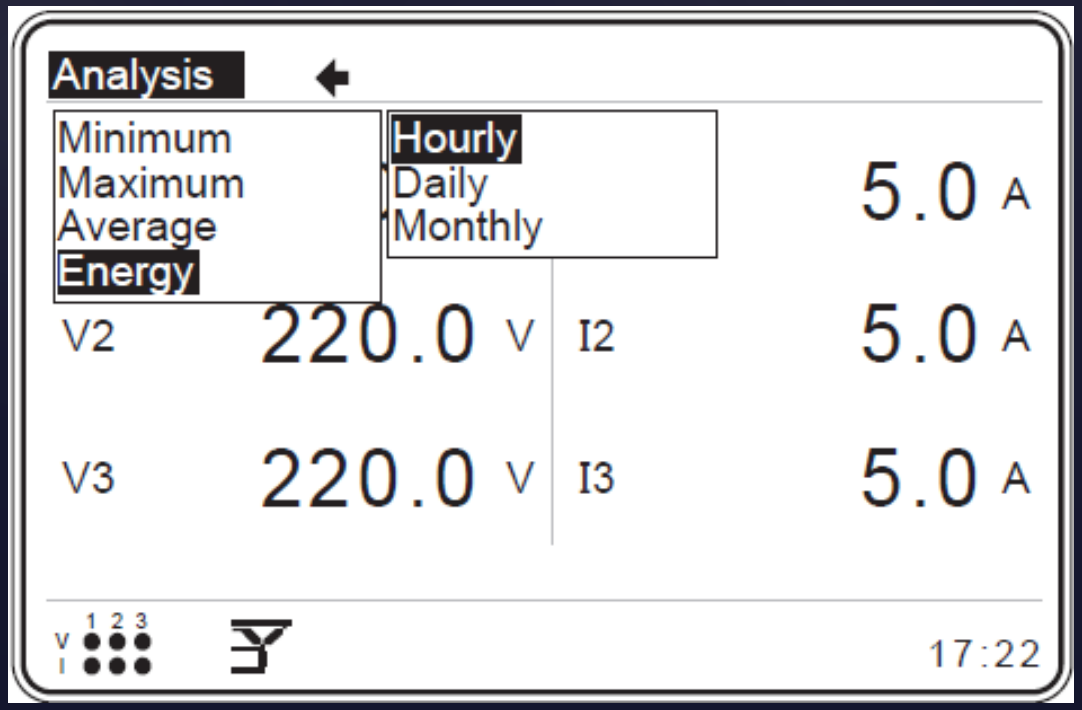
MMW03-M22CHB - Analyses

- In the Analysis-Minimum menu, the Daily and Monthly submenus are the same as the "Analysis-Minimum-Hourly" submenu;
- For the Maximum and Average menus, the submenus are similar to the Minimum submenu;



MMW03-M22CHB - Energy

- This menu displays hourly, daily and monthly values;
- ATTENTION: The Energy menu is only enabled when Tariff 1 is enabled;

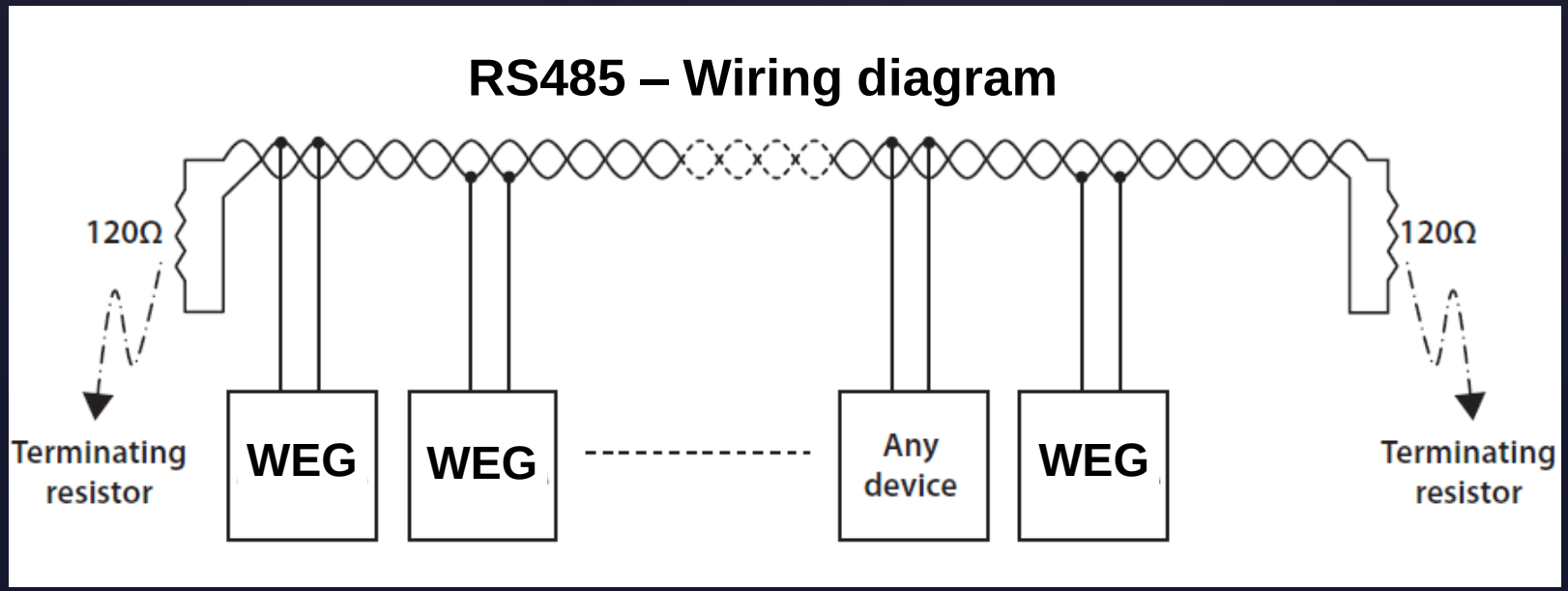


MMW03-M22CHB

MODBUS Protocol

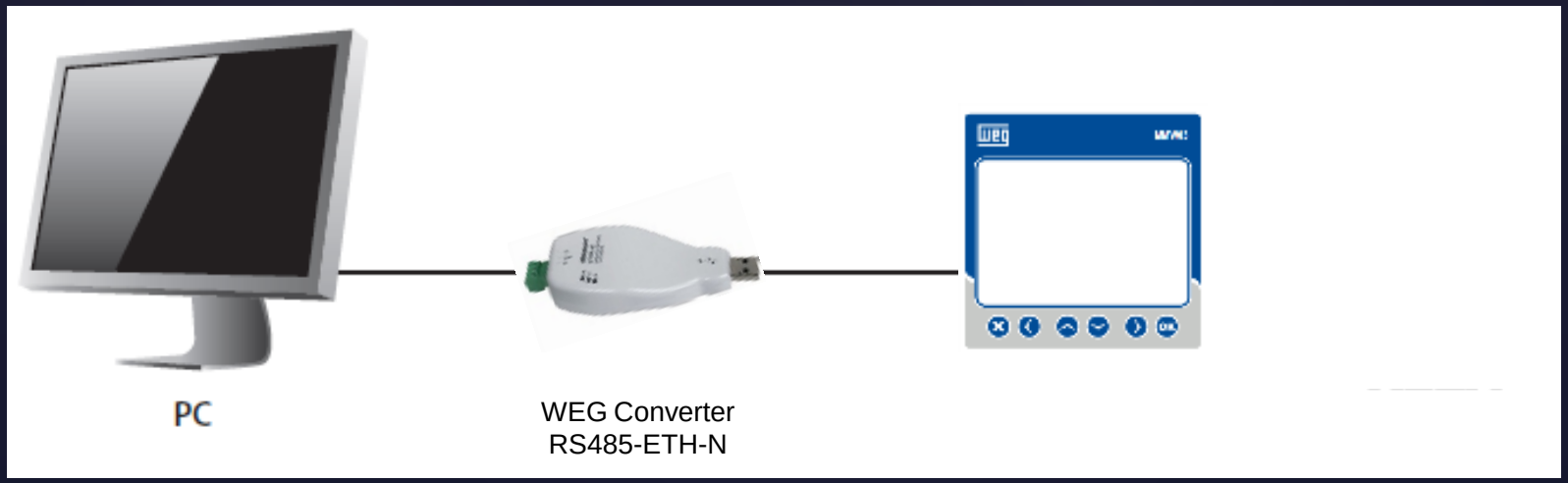
MMW03-M22CHB - MODBUS

- The figure below shows a typical communication diagram with RS485 physical medium;



MMW03-M22CHB - MODBUS

- PC connection example;
- Use the device setting software;



MMW03-M22CHB - MODBUS

- Number of 32-bit read-only variables:
  - 683
- Number of 32-bit read/write variables (configuration) :
  - 185

MMW03-M22CHB - Records / history

- The file records consist of blocks with 68 parameters. Each parameter within the filing block is a 32-bit variable.
- Three types of files are kept:
  - Hourly;
  - Daily;
  - Monthly

MMW03-M22CHB - Records / history

When accessing the records we will have:

Files 1 to 1920 access to HOURLY records;

Files 5001 to 5240 access to DAILY records;

Files 10001 to 10036 access to MONTHLY records;

Up to 1920 time records, 240 hourly records and 36 monthly records can be recorded.

MMW03-M22CHB - CLEAR function via MODBUS

- Via Modbus, the user can delete records stored in the non-volatile memory. The files are:
  - Energy meters (all Tariff 1 and Tariff 2 meters);
  - Demand values;
  - All counters of digital inputs;
  - Hourly records;
  - Daily records;
  - Monthly records;
  - Alarm records;

WEG Drives & Controls

Thank you!