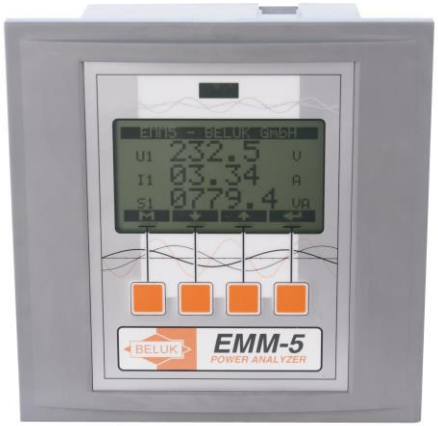

Power Analyzer EMM5

The EMM5 is a multifunctional device for acquisition and calculation of many measurements which are important in 3-phase electrical power distribution circuits. It can be used in low voltage systems or with higher voltages by means of voltage measurement transformers.

Connection

The device needs the following connections:

- Auxiliary voltage for internal power supply (depending on the ordered type, see label).
- Voltage measurement input L1, L2, L3, (N). If neutral N is not connected, it will be artificially generated in the EMM5 from the other three inputs.
- Current measurement via current measurement transformers. The EMM5 is available with 5A or 1A current inputs for use with xxxA/5A or xxxA/1A current transformers. Measurement of currents L1/L2/L3 is always necessary. The neutral current (N) can be measured, or, with slightly less accuracy, it can be calculated from the measurements for L1, L2 and L3.

Optional configurations:

- "m": 2 c/o contacts (voltfree)
- "a": 4 n/o contacts (voltfree)
- "r": 6 n/o contacts (common point)
- "I": 4 pulse outputs for active/react. energy
- "MB": interface RS485 protocol Modbus RTU

(Depending on ordered type also other configurations are possible, respect label)

Measurement functions

The EMM5 measurement system acquires amplitudes and waveforms of up to 4 currents and 3 voltages connected to the measurement inputs. The signal processor of the EMM5 calculates different values from that information.

The following measurement values are available:

- **f:** frequency (calculated from voltage L1-N)
- **T:** ambient temperature
- **ULN:** TRMS for voltages L1-N, L2-N, L3-N
- **ULL:** TRMS for voltages L1-L2, L2-L3, L3-L1
- **I:** TRMS for currents in L1, L2 L3 and N
- **If:** RMS values for fundamental waves of the currents without harmonics
- **S, P, Q:** TRMS values for apparent power, active power and reactive power for all three phases and sum
- **pf:** power factors (|P| / S) for all phases
- **phi:** phase angles between the fundamental waves of current and voltage of each phase
- **cp:** cos φ of the fundamental waves
- **harmonics:** of order 1 - 62 for voltages L-N and all 4 currents
- **THD:** THD - factors for voltages L-N and all 4 currents
- **counters:** for electrical energy (active and reactive work)
- **Ith:** exponentially damped current values with adjustable time constant to simulate thermal measurement
- **Pth:** exponentially damped active power values with adjustable time constant to simulate thermal measurement

Alarm system

The EMM5 allows the flexible programming of the output relays to produce alarms. The alarm system works with two separate facilities:

- The output relays can be separately programmed. The relays receive signals to "activate themselves" from one or more of the 32 configurable alarms.

- A maximum of 32 alarms can be assigned. Each of them continuously compares a value to an assigned limit. If a selectable alarm condition is true (value>limit or value<limit), a delay timer is started. After the selected delay time is over, the alarm sends the activation signals to all output relays, which are programmed as “targets” for this alarm. A second, configurable timeout delay can be set for the time between the reset of the alarm condition and the transmission of the deactivation signals to the output relays. A graphical display message can be used to show the alarms in the LCD of the device. The alarm display message is treated as if it was another output relay (so it can simply be selected as target for an alarm). This display message saves the causing minimum or maximum value and it has to be confirmed.

The high flexibility of this alarm system is achieved due to the following points:

1. One alarm can cause the activation of one or more output relays.

2. One relay can be activated from more than one alarm. If two or more alarms use the same relay as output, a logical OR condition is used: one active alarm suffices to cause the relay to switch.

Usage

The device provides 4 keys to the user to accept any inputs. The actual function of a certain key is changed due to the actual context. The keys function is indicated by small pictograms in the bottom line of the display.
After turning the supply power on, a welcome message will be displayed after some seconds.
The keys, which are labelled with capital letters "M", can be used to switch to the main menu.

Main menu

In the main menu, one can choose between the following possibilities:

- measurement = display measured values
- auto-roll = display measured values with automatic value rotation
- harmonics = display harmonics
- work = display work / energy counters
- setup = device setup sub-menu
- device info = display device information

Use the keys "↑" and "↓" to place the desired entry next to the tiny arrow (">") on the left side. Press the "→" - key to activate the selected entry.

Submenu "measurement"

This menu holds nearly all the measured values. Each value is displayed together with its name (ULN, Ith,...) and its origin (L1, L2, L3, sum, N). The units, together with appropriate unit-prefixes are also available. Use keys "↑" and "↓" to select from the variety of measured values.

The EMM5 stores the maxima and minima for most values. The display can be switched to show them instead of the actual value. The right key is labelled “MIN”, “MAX” or “TRMS”, according to the selected value. Press it to change between them.

In the top line the set of relays (if they are assembled in the device) is shown. A dark number on bright ground represents an inactive relay. Inverse display (bright number on dark ground) indicates an activated relay.

The "M" - key switches back to the main menu.

Submenu "auto-roll"

This menu contains nearly the same set of values as the "measurement" menu, but it features an automatic, timer controlled (10s), switch function to the next value.

Submenu "harmonics"

Harmonics of currents and voltages are displayed up to the 62. order. Key “↔“ selects the data source (voltages, currents), “↑“ and “↓“ move the display to higher and lower harmonics. The index, which is shown with each harmonic, specifies its order (fundamental wave = index 01).

Submenu "work"

This menu contains the work counters for active and reactive electrical energy. The "↔"-key selects between WP-IMP, WP-EXP, WQ-IND und WQ-CAP.

Submenu "setup"

The "setup"-menu is protected from unauthorised usage by means of a password. The password is fixed ("2402"). Because of the huge amount of setup possibilities, a set of submenus is used.

At certain points the user will be confronted with the need to enter numeric values. The EMM5 will prompt with the old or a default value. One digit of this value will be marked with a "-" below it. Now this digit can be changed with the "+" and "-" keys. "→" will switch to the next digit which can then be altered as described. After you have reached the last digit, press the right button once more and the new value will be used by the EMM5.

Submenu "setup – parameter"

System parameters:

- "PT ratio": ratio of a PT
- "CT ratio": ratio of a CT for L1, L2 and L3
- "CT-N ratio": ratio of a CT for N
- "thermic tau": time constant for calculation of Pth and Ith
- calc/meas IN: selection "yes" (calculation with the other 3 currents) or "no" (IN measured)
- "display contrast": display contrast setting

Submenu "setup – alarm"

This menu contains a lot of parameters:

- source: this selects the data source.
- trigger: trigger condition val>limit or val<limit
- limit: selection of the limit value
- T-on: turn-on delay time
- T-off: turn-off delay time
- output: selection of the relays, which shall be activated if alarm condition is true and after T-on is over.

Submenu "setup – impulse"

This menu only appears if the device is equipped with option "I". It contains the settings for the 4 dedicated impulse outputs. The mapping is as follows:

- WP-IMP: active power import (clamp 13/14)
- WP-EXP: active power export (clamp 23/24)
- WQ-IND: reactive power inductive (clamp 33/34)
- WQ-CAP: reactive power capacitive (clamp 43/44)

At maximum 10000 imp/MWh or Mvarh can be adjusted. This setting should be adapted to the application. It should not be too high (max. 4 imp/s), otherwise it can't be guaranteed that all impulses are reliable written out.

Submenu "setup - modbus"

This menu only appears if the device is equipped with option "MB". It contains all settings for the Modbus interface. The following settings can be made:

- address: device address between 1 and 247
- baudrate: adjustable between 1200 and 38400
- parity: select between even, odd, none

Submenu "setup – load defaults"

This resets all relay settings, parameters and alarm settings to standard values. The device has got the delivery status again.

Submenu "setup – reset min/max"

This resets the minimum and maximum values from the "measurement" menu to the actually measured value.

Submenu "setup – reset work"

This resets all work counters to 0.

Submenu "device info"

This menu shows basic information about your device :

- SW = software version
- HW = hardware revision number
- SN = serial number of the device
- FLAGS = options of the device

Key "M" will switch back to main menu.

Important:

The EMM5 needs a certain minimum measurement voltage at input L1-N for synchronisation. If the voltage is too small, the data acquisition system will be deactivated and no measurements will be available!
If, after turning on the device supply, no display contents are visible after some seconds, a wrong display contrast setting may be the cause. In this situation, it would be very difficult to find the correct menu for the display contrast settings because of the missing display content. So, a second possibility to adjust the contrast is included in the welcome screen of the device (after power is turned on) by pressing keys 2 (brighter) or three (darker) repeatedly.

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