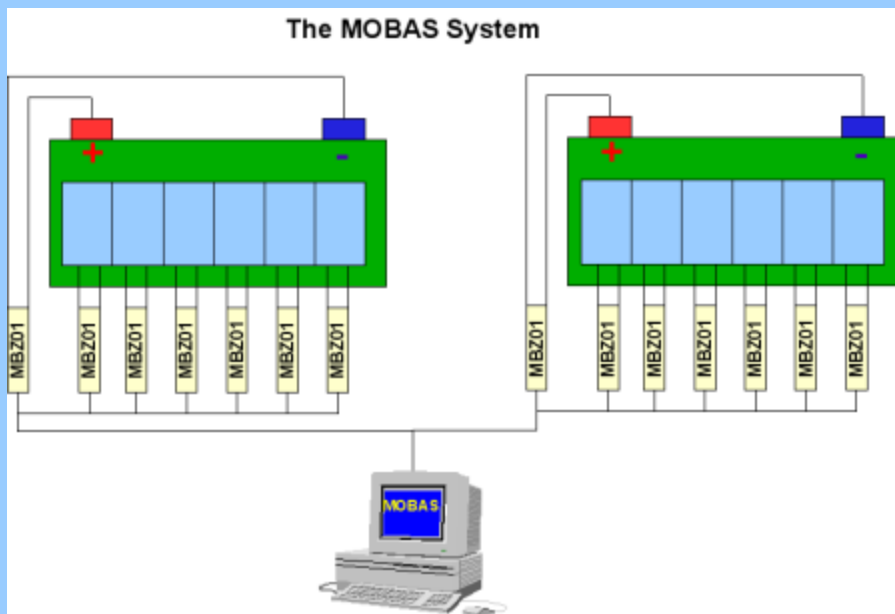


The MOBAS system

- system for stationery battery systems monitoring
- modular system – based on the MBZ01 measure module: it is able to measure voltage and temperature
- battery systems divided in two levels
 - batteries
 - blocks of batteries
- each block of each battery monitored by a particular measure module **MBZ01**
- even entire batteries monitored by a particular measure module **MBZ01** for voltage of a whole battery measuring



- system can be equipped with a special module **MBZ01** and a special convert module connected to a shunt or a Hall probe – it is able to measure current from/to a battery
- all measured data are transferred to a **MOBAS** application running on a central PC
- measure modules are connected to a central PC through a single or multiple RS485 communication lines
- up to 36 batteries with up to 110 blocks (in one configuration)
- battery blocks voltage equalizing function

MOBAS – Configurations, Batteries, Blocks

- A central application **MOBAS** is able to monitor up to 36 batteries in one **configuration**. A configuration matches a running instance of a **MOBAS** application. It is possible to run more instances of a **MOBAS** application on a single PC. A single PC is able to monitor more configurations.
- A configuration contains definition of all monitored batteries and their parameters (name, nominal voltage and capacity, count of cells and blocks, addresses of measure modules, measure ranges, etc.).
- Batteries are collected from cells. The **MOBAS** system monitors blocks of batteries. Block of battery can contain 1, 2, 3 or 6 battery cells. Battery can be divided in up to 110 blocks.
- Battery blocks voltage is measured by a measure module **MBZ01** of a corresponding HW design: 2V, 4V, 6V or 12V. Each measure module **MBZ01** has assigned its specific number corresponding to a communication address (in range 1-255) by which is requested by the **MOBAS** application.
- Voltage of entire battery is measured by a special measure module **MBZ01** designed in accordance with a nominal voltage of the battery. Measure module of entire battery voltage has typically assigned address 201.
- A rate (*voltage of entire battery*) / (*battery blocks count*) indicates an **optimal value of voltage** of particular **battery blocks**.
- An optimal voltage value is used as base with which is compared actual measured values of particular battery blocks voltage. From these differences are evaluated and indicated battery failure statuses and is provided battery blocks voltage equalizing (to the optimal voltage).
- Measure module **MBZ01** for measuring current from/to battery is not necessary for the **MOBAS** system. It gives an additional information to the system whether a battery is charged or loaded and by what current. From this information is the **MOBAS** system able to evaluate spare capacity of a battery. Battery current measure module has typically assigned address 202.
- To be able to measure temperatures of particular battery blocks must be measure modules supplied with temperature sensors. Battery blocks temperature measuring is not necessary for the **MOBAS** system – it gives only additional information. There are evaluated temperature battery failure statuses when a temperature measuring is provided.

MOBAS – Batteries failure statuses

The **MOBAS** application evaluates and indicates failure statuses of monitored batteries according to measured data:

- **Block overvoltage – warning:** voltage of battery block is higher than the optimal block voltage plus overvoltage warning limit (together with other limits defined as a parameter of battery in configuration)
- **Block overvoltage – alarm:** voltage of battery block is higher than the optimal block voltage plus overvoltage alarm limit
- **Block undervoltage – warning:** voltage of battery block is less than the optimal block voltage minus undervoltage warning limit
- **Block undervoltage – alarm:** voltage of battery block is less than the optimal block voltage minus undervoltage alarm limit
- **Cold battery (alarm):** temperature of battery block is less than the cold battery limit
- **Overtemp battery – warning:** temperature of battery block is higher than the overtemp warning limit
- **Overtemp battery – alarm:** temperature of battery block is higher than the overtemp alarm limit
- **Disconnected:** measure module **MBZ01** does not reply the **MOBAS** application requests
- **Battery capacity – warning:** evaluated spare capacity of battery is less than capacity warning limit
- **Battery capacity – alarm:** evaluated spare capacity of battery is less than capacity alarm limit

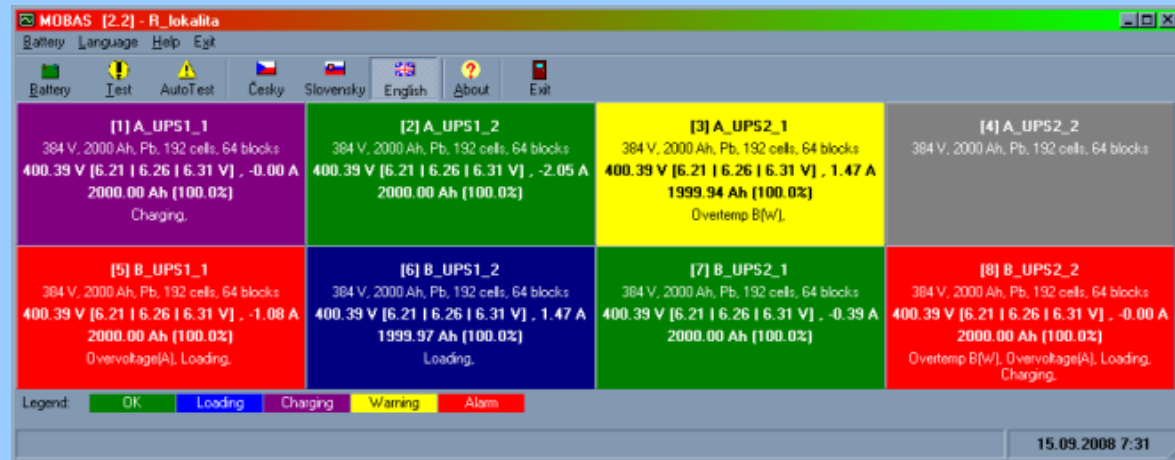
MOBAS – Battery status visualization

The **MOBAS** application:

- is continuously reading informations from **MBZ01** measure modules connected to monitored batteries
- evaluates failure statuses of batteries
- displays status of batteries defined in configuration in it's main window – there is displayed for each battery:
 - name and basic parameters of battery – nominal voltage and capacity, count of cells and blocks
 - actual values of entire battery voltage and current from/to battery (if it is measured) and evaluated spare capacity of battery
 - evaluated optimal voltage of battery block and limit voltage for blocks voltage equalizing
 - actual failure statuses of batteries and battery block voltage equalizing

Status of battery is indicated by the color background of battery:

- **red** color is used to indicate failure statuses - alarms
- **yellow** color is used to indicate failure statuses - warnings
- **purple** color is used to indicate provided battery blocks voltage equalizing up (charging)
- **blue** color is used to indicate provided battery blocks voltage equalizing down (loading)
- **green** color is used to indicate non-failure status of battery



MOBAS – Battery blocks status visualization

By click on the battery in the main window of the **MOBAS** application can be opened a battery blocks window displaying detail informations about blocks of selected battery.

Battery blocks are displayed in tabs and identified by addresses of appropriate **MBZ01** measure modules. There is displayed for each battery block:

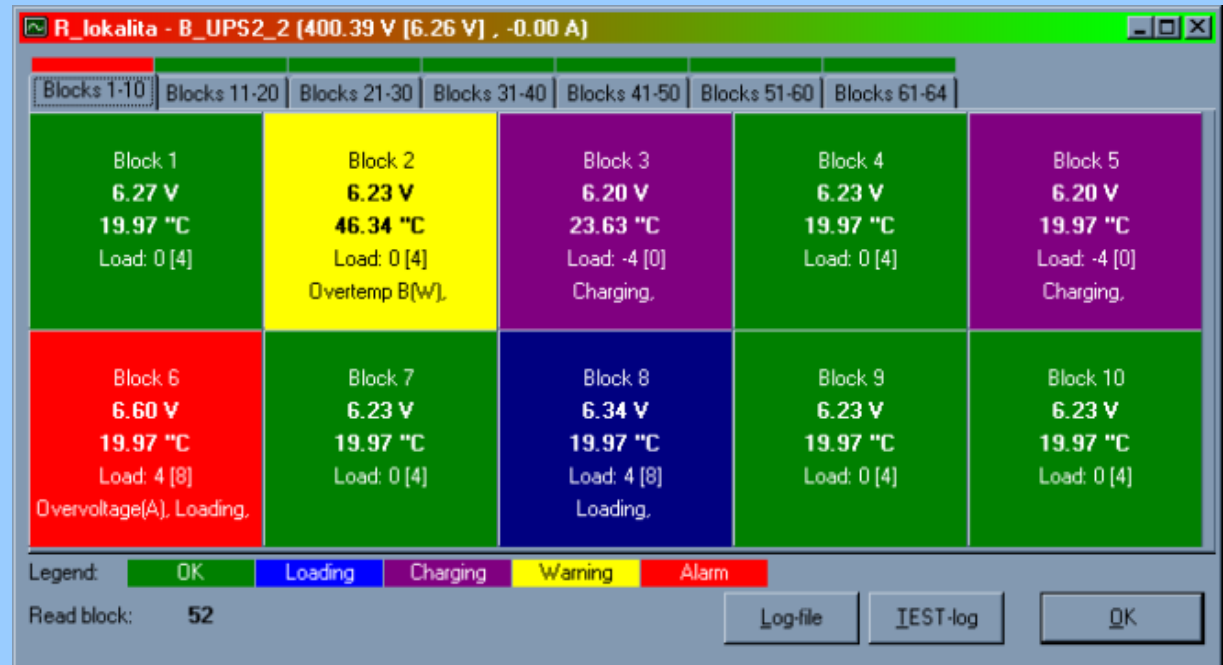
- actual voltage
- actual temperature (if it is measured)
- actually set and real load of battery block (see battery blocks equalizing)
- actual failure statuses of blocks and equalizing of battery blocks voltage

Status of particular blocks is indicated by the background color. Used colors has the same meaning as in case of batteries.

Upon blocks tabs are displayed color indicators of the most important status of blocks displayed in particular tabs.

In the bottom part of window is continuously displayed address of actually read measure block.

By buttons „Log-file“ and „TEST-log“ it is possible to display log event of battery or statistical data stored in the TEST mode.

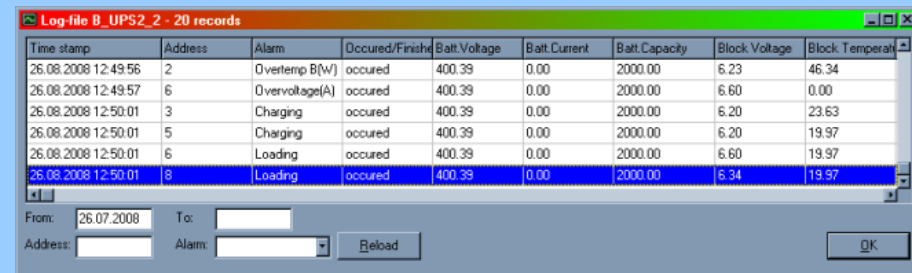


MOBAS – Battery blocks voltage equalising

- Battery blocks voltage equalizing adjusts voltage of each battery block to be in defined limit interval from continuously evaluated optimal (average) value.
- Equalizing is providing by variant selective loading of particular battery blocks. Load of blocks is set by the **MOBAS** application through **MBZ01** measure modules.
- Load of blocks can be set in 256 levels (0-255). The real load corresponding to particular levels is defined by the connected load resistor.
- Load resistors are not necessary part of **MBZ01** measure modules. They could be optionally a part of the **MBZ01** or they could be connected as the other separate modules. The **MOBAS** system can be used even without load resistors. In this case it only monitors batteries.
- There are two types of blocks voltage equalizing: equalizing down (loading) and equalizing up (charging).
- In case of **loading** there are loaded blocks whose voltage is higher than an optimal block voltage plus defined limit. In this case are loaded only these „over limit“ blocks. Set load is displayed as a positive value.
- In case of **charging** there are adjusted blocks whose voltage is less than an optimal block voltage minus defined limit. Charging is proceeding in such a way that there are loaded all other blocks of battery by so called charging load: the block with the lowest voltage (the most charged) has charging load set to zero and the block with the highest voltage has the greatest charging load (*thus: charging means loading of other battery blocks to reach voltage of the weakest blocks*). Set load of charged block is displayed as a negative value.
- **Loading** and **Charging** can be provided in a parallel on the same battery. Sum of loading load and charging load of block is so called **real load** of block.
- Check of blocks voltage and load setting is proceeding in defined time intervals:
 - If there is found block with over- or under limit voltage there is increased by 1 (loading) or decreased by 1 (charging – negative value) value of load.
 - If voltage of a block is within limit interval and there is set non-zero load on this block there is decreased by 1 (loading) or increased by 1 (charging – negative value) value of load.

MOBAS – Battery events log

- The **MOBAS** system logs important events of monitored batteries operation.
- There are logged:
 - occurrence and finish of battery failure statuses (over-voltage, under-voltage, over-temperature, under-temperature, disconnection, low spare capacity)
 - occurrence and finish of battery blocks voltage equalising batterie
- In the log is stored:
 - date and time of event
 - type of event: failure status or type of equalising
 - occurrence or finish of the status
 - address of **MBZ01** measure module of block which invoked logged event (there was e.g. detected over-voltage etc.)
 - actual measured values in time of event invocation: voltage of entire battery, current from/to battery, spare capacity of battery and voltage, temperature and set and real load of block which invoked logged event
- Event log can be stored to text file or to ODBC database.
- Event log of battery can be viewed within the **MOBAS** application or by the **MOBASdata** application – used for MOBAS data manipulation.
- Records of event log can be filtered for viewing – it is possible to display records from-to, only for selected block and/or only selected type of event (e.g. failure status).



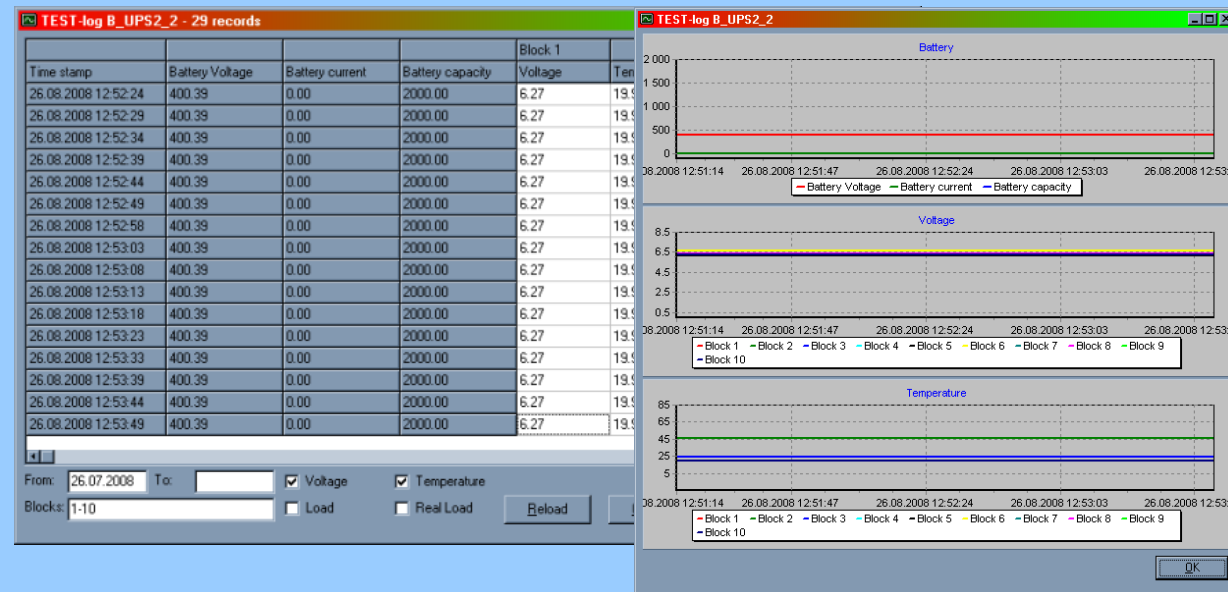
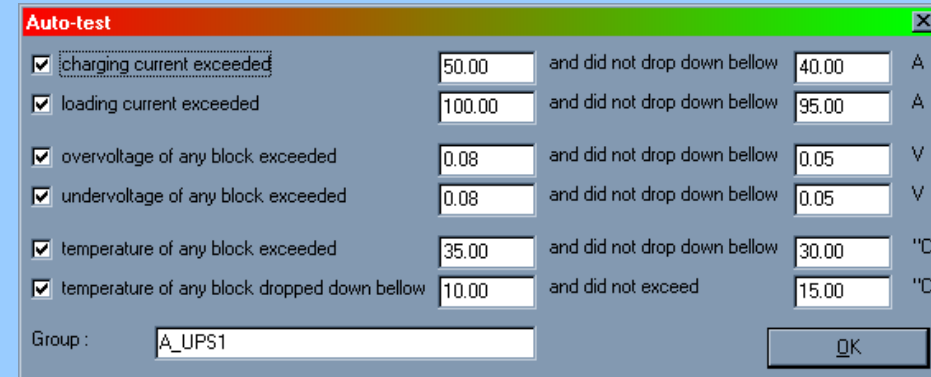
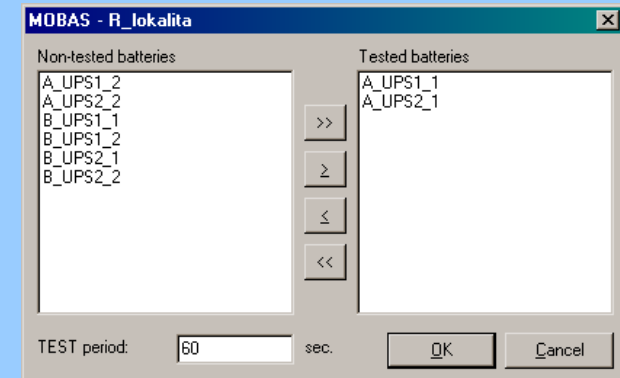
| Time stamp | Address | Alarm | Occured/Finish | Batt.Voltage | Batt.Current | Batt.Capacity | Block Voltage | Block Temperature |
|---------------------|---------|----------------|----------------|--------------|--------------|---------------|---------------|-------------------|
| 26.08.2008 12:49:56 | 2 | Overtemp B(W) | occured | 400.39 | 0.00 | 2000.00 | 6.23 | 46.34 |
| 26.08.2008 12:49:57 | 6 | Overvoltage(A) | occured | 400.39 | 0.00 | 2000.00 | 6.60 | 0.00 |
| 26.08.2008 12:50:01 | 3 | Charging | occured | 400.39 | 0.00 | 2000.00 | 6.20 | 23.63 |
| 26.08.2008 12:50:01 | 5 | Charging | occured | 400.39 | 0.00 | 2000.00 | 6.20 | 19.97 |
| 26.08.2008 12:50:01 | 6 | Loading | occured | 400.39 | 0.00 | 2000.00 | 6.60 | 19.97 |
| 26.08.2008 12:50:01 | 8 | Loading | occured | 400.39 | 0.00 | 2000.00 | 6.34 | 19.97 |

From: 26.07.2008 To:

Address: Alarm:

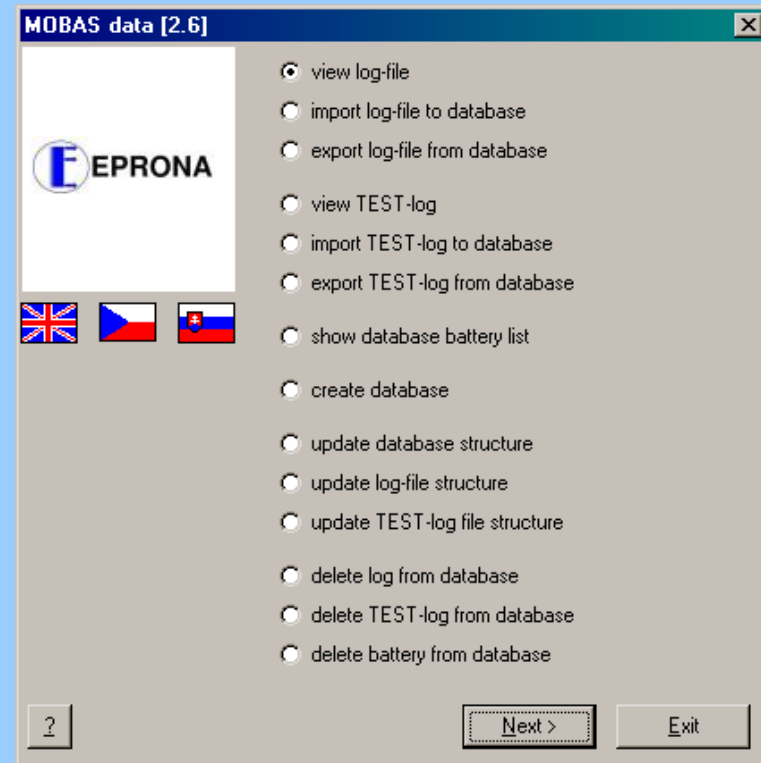
MOBAS – TEST mode – statistical data collection

- The MOBAS system is able to continuously collect and store all data known about battery in the TEST mode:
 - actual voltage of whole battery
 - current from/to battery
 - spare capacity of battery
 - voltages, temperatures and set and real loads of all battery blocks
- Data are continuously (together with actual time stamp) stored within defined time interval to text file (csv) or to ODBC database.
- TEST mode of battery can be started manually (by operator) from the **MOBAS** application or automatically when there is fulfilled any of predefined conditions.
- Stored data can be viewed within the **MOBAS** application or by the **MOBASdata** application – used for MOBAS data manipulation.
- Data can be filtered for viewing – it is possible to display records from-to, only for selected blocks and only selected values.
- It is possible to generate graph of process of each stored value.



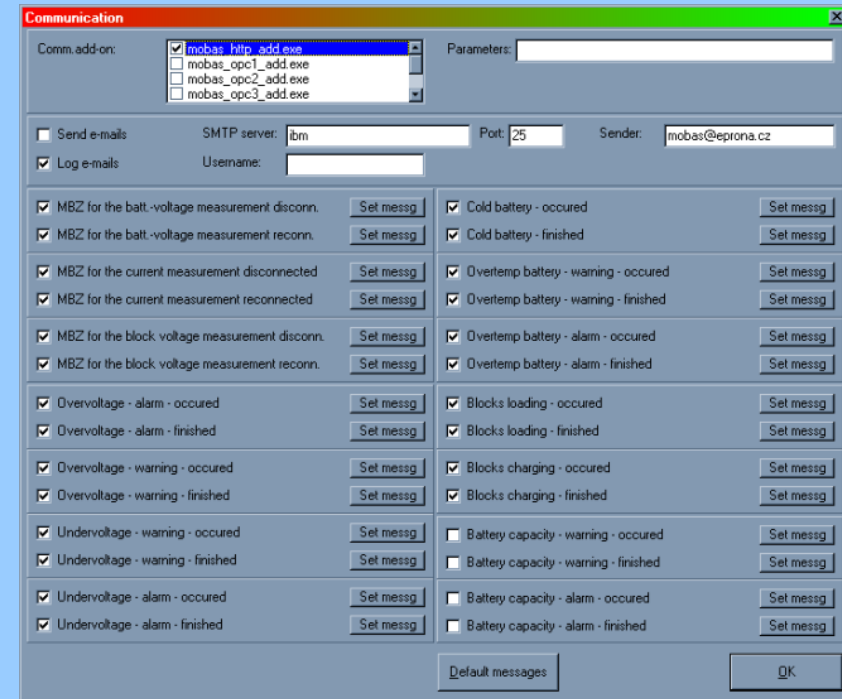
MOBAS – MOBASdata – data manipulation

- The **MOBASdata** application is a part of the **MOBAS** system setup. It is possible to install it separately
- The **MOBASdata** application is designed to view and manipulate data generated by the **MOBAS** system – battery event logs and data collected in the TEST mode.
- Data view – event logs and TEST-logs – is same as in the **MOBAS** application.
- Functions of the **MOBASdata** application:
 - battery event log (stored in text-file or in ODBC database) view
 - import of battery event log from text-file to ODBC database
 - export of battery event log from ODBC database to text-file
 - battery TEST-log (stored in text-file or in ODBC database) view
 - import of battery TEST-log from text-file to ODBC database
 - export of battery TEST-log from ODBC database to text-file
 - **MOBAS** system ODBC database maintenance: create database structure in existing ODBC database, actualize (alter) structure of database and text-files, delete battery event log or TEST-log or all battery data from database
- It is possible to view data of the **MOBAS** system out of central PC by the **MOBASdata** application: by connection to shared database or by data transfer within text-file to other computer.



MOBAS – e-mail alerts

- The **MOBAS** system is able to send e-mail alerts.
- E-mail alerts can be send if some event logged in battery event log occurs (failure status, battery blocks voltage equalizing) and if there is e-mail alert for this event enabled and configured.
- It is possible to define for each alerted event:
 - recipient of e-mail
 - subject and body of e-mail alert
- It is possible to define macros in subject and body of alert message. Those macros are substituted by actual value of corresponding magnitudes in time of alert message creation.
- The **MOBAS** application must be able to connect SMTP server to be able to send e-mail alerts.
- It is possible to log sent e-mail alerts.



Communication

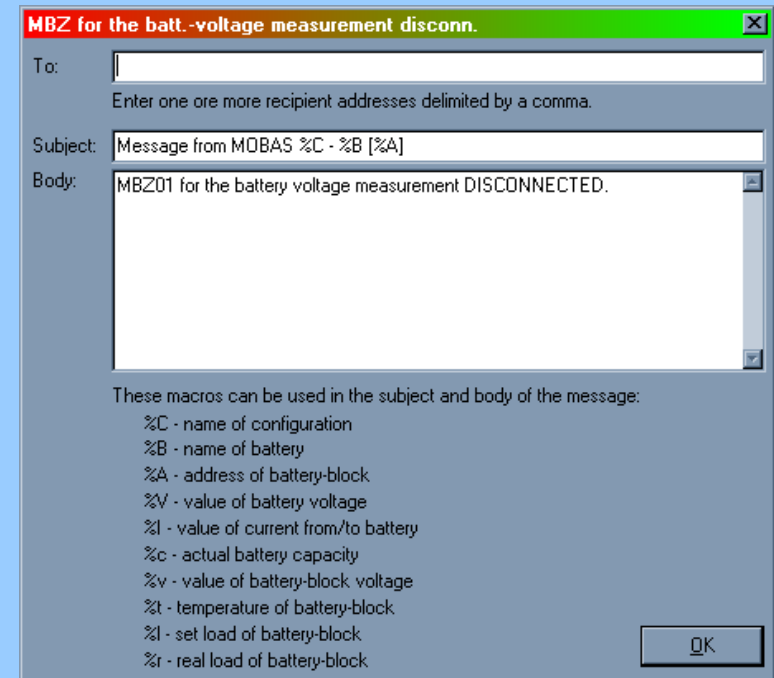
Comm.add-on: mobas_hlp_add.exe
 mobas_opc1_add.exe
 mobas_opc2_add.exe
 mobas_opc3_add.exe

Parameters: _____

Send e-mails SMTP server: ibm Port: 25 Sender: mobas@eprona.cz
 Log e-mails Username: _____

| | | | |
|--|----------|---|----------|
| <input checked="" type="checkbox"/> MBZ for the batt.-voltage measurement disconn. | Set msgg | <input checked="" type="checkbox"/> Cold battery - occured | Set msgg |
| <input checked="" type="checkbox"/> MBZ for the batt.-voltage measurement reconn. | Set msgg | <input checked="" type="checkbox"/> Cold battery - finished | Set msgg |
| <input checked="" type="checkbox"/> MBZ for the current measurement disconnected | Set msgg | <input checked="" type="checkbox"/> Overtemp battery - warning - occured | Set msgg |
| <input checked="" type="checkbox"/> MBZ for the current measurement reconnected | Set msgg | <input checked="" type="checkbox"/> Overtemp battery - warning - finished | Set msgg |
| <input checked="" type="checkbox"/> MBZ for the block voltage measurement disconn. | Set msgg | <input checked="" type="checkbox"/> Overtemp battery - alarm - occured | Set msgg |
| <input checked="" type="checkbox"/> MBZ for the block voltage measurement reconn. | Set msgg | <input checked="" type="checkbox"/> Overtemp battery - alarm - finished | Set msgg |
| <input checked="" type="checkbox"/> Overvoltage - alarm - occured | Set msgg | <input checked="" type="checkbox"/> Blocks loading - occured | Set msgg |
| <input checked="" type="checkbox"/> Overvoltage - alarm - finished | Set msgg | <input checked="" type="checkbox"/> Blocks loading - finished | Set msgg |
| <input checked="" type="checkbox"/> Overvoltage - warning - occured | Set msgg | <input checked="" type="checkbox"/> Blocks charging - occured | Set msgg |
| <input checked="" type="checkbox"/> Overvoltage - warning - finished | Set msgg | <input checked="" type="checkbox"/> Blocks charging - finished | Set msgg |
| <input checked="" type="checkbox"/> Undervoltage - warning - occured | Set msgg | <input type="checkbox"/> Battery capacity - warning - occured | Set msgg |
| <input checked="" type="checkbox"/> Undervoltage - warning - finished | Set msgg | <input type="checkbox"/> Battery capacity - warning - finished | Set msgg |
| <input checked="" type="checkbox"/> Undervoltage - alarm - occured | Set msgg | <input type="checkbox"/> Battery capacity - alarm - occured | Set msgg |
| <input checked="" type="checkbox"/> Undervoltage - alarm - finished | Set msgg | <input type="checkbox"/> Battery capacity - alarm - finished | Set msgg |

Default messages OK



MBZ for the batt.-voltage measurement disconn.

To: _____
 Enter one ore more recipient addresses delimited by a comma.

Subject: Message from MOBAS %C - %B [%A]

Body: MBZ01 for the battery voltage measurement DISCONNECTED.

These macros can be used in the subject and body of the message:

- %C - name of configuration
- %B - name of battery
- %A - address of battery-block
- %V - value of battery voltage
- %I - value of current from/to battery
- %c - actual battery capacity
- %v - value of battery-block voltage
- %t - temperature of battery-block
- %l - set load of battery-block
- %r - real load of battery-block

OK

MOBAS – External communication

- There is implemented an internal communication protocol in the **MOBAS** system. It is possible to connect external programs – communication add-ons – to the MOBAS application through this protocol. Communication add-ons are able to provide communication by any standard communication protocol.
- Communication add-ons are communication bridges between common internal communication protocol of the **MOBAS** system and external standard (well known) communication protocol.
- Communication add-ons works as clients in communication with **MOBAS** application and as servers in communication with external systems.
- The **MOBAS** system offers on-line all known actual informations about all monitored batteries through interface of communication add-ons.
- The **MOBAS** system allows to start or stop the TEST mode of selected battery through interface of communication add-ons.
- Actually exists communication add-ons for two external protocols:
 - **HTTP** – status of monitored batteries can be displayed in www-browser in nearly same form as is presented by the **MOBAS** application.
 - **TCP** – universal communication add-on able to communicate through TCP sockets. There can communicate e.g. **OPC server** (OLE for Process Control) or the remote distributed administration application **MOBAS remote** with this universal add-on.

