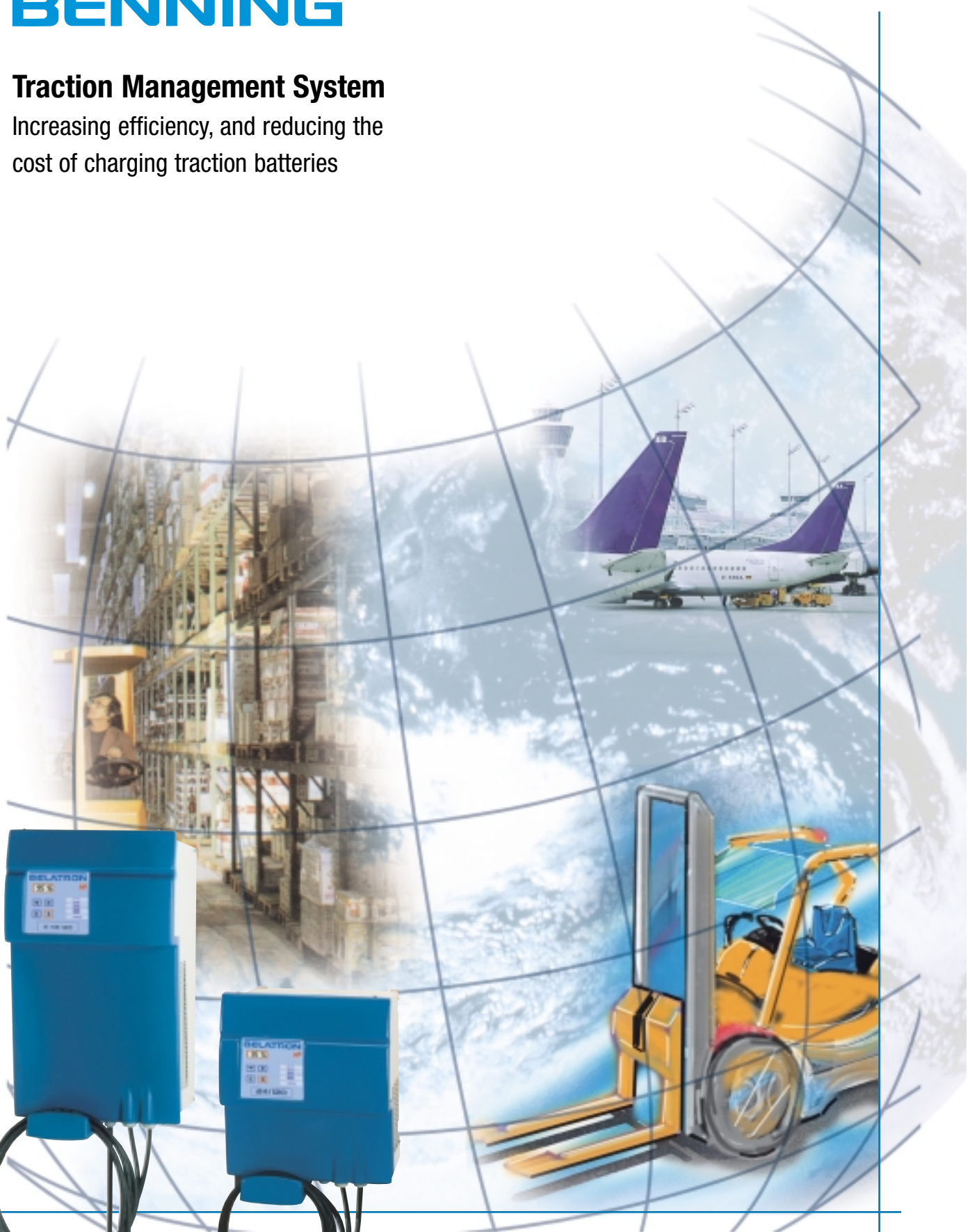


BENNING

Traction Management System

Increasing efficiency, and reducing the cost of charging traction batteries





Traction Management System



Your advantages

Why do you need a BENNING Traction Management System? The BENNING Traction Management System gives you the information you need on the operation, efficiency and costs of your traction batteries, charging units and plant-internal transport vehicles.

individual requirements

In addition, the Management System allows you to adapt the vehicle stations, charging units and batteries to your own individual requirements, thereby saving substantial costs.

The system is installed on a standard computer (operating system Windows™ 95/98 or NT), the so-called management master computer, and can be integrated into any network. All you require is a computer to control and monitor the system, and collect and process all the important data from the vehicles, batteries and chargers. It then becomes possible to access the system from anywhere in the world through virtually any type of network (Ethernet, Token Ring, Intranet, Internet, direct access by modem or ISDN board etc.). Access can of course be limited to certain users.

Worldwide access

Using any computer with access to the Traction Management System and on which the Management Software has been installed, it is possible to check the system status and obtain a summary of the charging state at any time.

The system informs you on the number, age and condition of the vehicles in use, on their batteries and charging systems. This provides the data necessary for the following purposes:

- **Optimisation of vehicle and battery utilisation with consequent reduction in costs**
- **Optimisation of the charging unit**
- **Enabling you to amortise the investment costs for the Traction Management System within a very short space of time.**
- **Easy control of the entire system by computer**
- **Transparent documentation of all the system components**
- **Identical information status at all workstations**
- **Reliable signalling of operation problems, their type and duration**
- **Savings potential through intelligent peak load management**
- **The Management System detects batteries and vehicles which are not fully utilised.**

Cost reduction and efficiency



The capital invested in the Traction-Management-System can be regained after a very short period of time.





The management PC controls the complete system, and monitors all available data for analysis



Hardware

The management master computer is a standard computer with operating system Windows 95/98 or NT, in which an RS-485 interface is installed. It controls and monitors the entire system. The master computer also functions as data server. An optional digital I/O board can also be fitted in the master computer to process potential-free signals for central process control or control signals for the energy-management system. For direct remote control, installation of software updates or remote maintenance, a modem or an ISDN board can also be installed in the master computer.

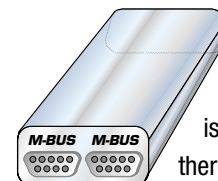
Data flow / bus system

The system can be operated directly from this computer or from a computer workstation with access to the management computer. All group master computers connected are controlled via the serial RS-485 output (M-bus). From here, the data is also passed on to the individual charging units through a serial RS-485 bus (G-bus). Each RS-485 line can be up to 1200 metres in length. To keep wiring to a minimum, an RS-485 2-wire bus system is used to connect the units to one another (G-bus) and to the master (M-bus). Individual lines may also be optical waveguides (LWL). This improves the electromagnetic com-

patibility in more difficult sections. External influences such as overvoltage through switching operations, lightning or interference radiation from industrial production facilities (e.g. electrical welding systems) have no adverse effect on the LWL line. Transfers over large distances can also be carried out easily using LWL technology. Here too, the transfer path is insensitive to electromagnetic interference factors.

Group master

Each group master is responsible for the correct flow of data from up to 31 charging units. Incoming data



transmitted from the master computer to this group is passed on from there to the charging

units. In the other direction, all the data and status information from the charging units is transmitted via the group masters to the management master computer. The group master is installed in a small housing and is fitted with two M-bus and one G-bus interfaces. The group master is supplied with energy through a 230 V AC connection. LEDs indicate the transmission and reception of data.





Vehicle data / BEI III wireless / radio receiver

In vehicles of older types, a battery discharge indicator (BEI III) can be installed to show the current residual capacity. The data is transmitted to the BEI III by radio from the battery controller.

Alternatively, it is also possible to fit a radio receiver without an indicator to the vehicle. This transmits the data directly to the vehicle's electronic system (e.g. in CAN-bus format) if the vehicle possesses this function. This data can then be read off at any time in the vehicle's display. In return, the radio module transmits vehicle-related data to the battery controller.

Battery controller

Summation of charging and discharging data

The drive batteries can also be fitted with an optional battery controller (IBAT ZVEI). The IBAT continuously collects the operating data for the battery during the charging and discharging process. The IBAT is mounted on the battery and measures battery voltage, current, temperature and time (integrated real-time module). An additional tap for the average battery voltage, also allows the battery half voltage to be monitored.

Medium voltage tapping

Using these readings combined with previously programmed system data (battery type, capacity, charging program etc) it is possible to determine and store current and longer-term data. When a battery fitted with a controller is connected to a charger with an IBAT reception unit, the charging characteristic is set automatically.

Automatic set of the charging characteristic

The IBAT controller data is also transmitted to the charging unit. From there, this information is passed on to the management system and can be displayed and processed by any connected PC.

Radio remote module for vehicle data

A radio module integrated in the battery controller also allows vehicle data (vehicle identification, operating hours, fault signals etc.) to be transmitted to the battery controller and important battery data (current residual capacity, battery overheating etc.)

to be sent in the opposite direction. A battery-discharge indicator (BEI III) can either be installed directly in the vehicle or the data is transmitted directly to the vehicle electronics (CAN-bus).

Charge-data management module

All BELATRON HF chargers are capable of operating with management systems. To allow non-controlled or chargers without management capability to be included in the traction-management system, a so-called charge-data management module can be fitted to the charger in question. This module collects the most important data from the chargers (state of unit, charge current, voltage, time etc.) and allows the controller data from the connected battery to be fed into the management system.



Transmission of battery controller information, for the respective battery

Traction management software

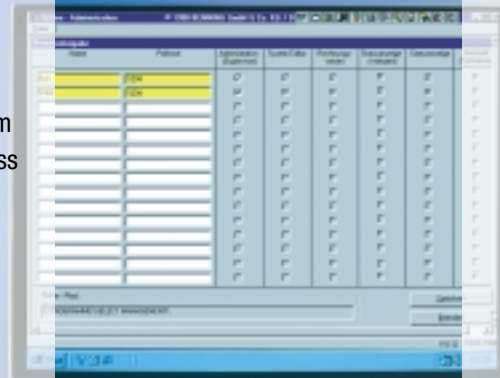
General notes

The BENNING Traction Management Software has a user interface in the familiar Microsoft Windows format. The software can run under Windows™ 95/98 or NT. The master computer can be integrated without difficulty into all standard networks. This means that it is possible to access the Management System from any computer linked to the network. Up to 15 different user profiles can be written and stored.

Through network integration, it is also possible to access several management systems from one single workstation simply by changing only the server path. This in turn permits remote systems to be monitored from one single workstation. An integrated on-line Help feature is also available to answer questions on individual functions.

Administrator

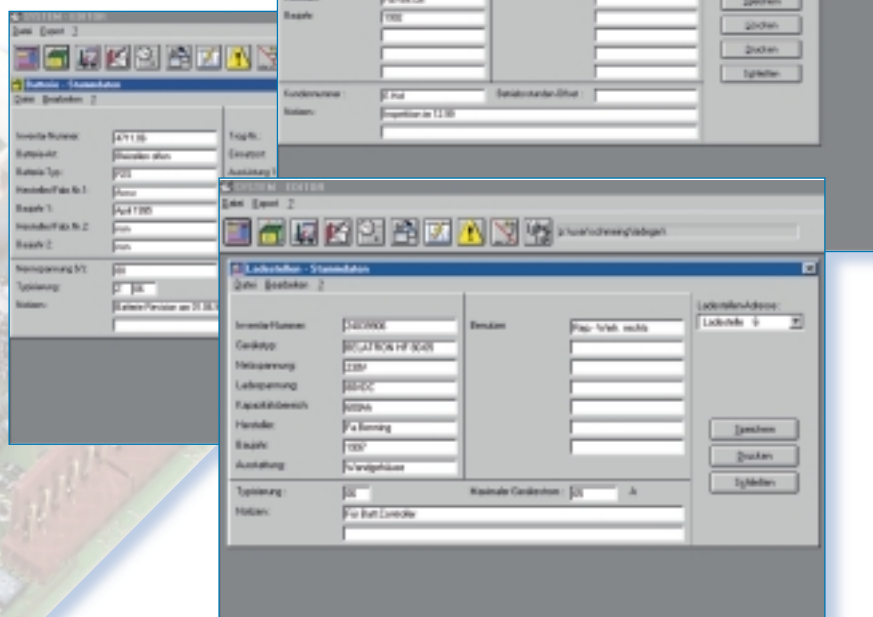
With the Administrator function, users can be given user names and passwords authorising them to use the various software modules. The 15 user profiles can be set for the individual users. This prevents data from being lost or changed through access to the system by unauthorised persons.



The traction management software runs with Windows 95/98 and NT

System editor

The basic data for the system are input and administered by means of the system editor. Four input screens are available for this purpose, i.e. for vehicle, battery, charger and customer data. Fixed and freely-definable data fields allow files to be stored for each vehicle, battery, charger and customer. This function also allows certain vehicles, batteries and chargers to be assigned to certain customers.



Monitoring of all vehicle, battery and charger information

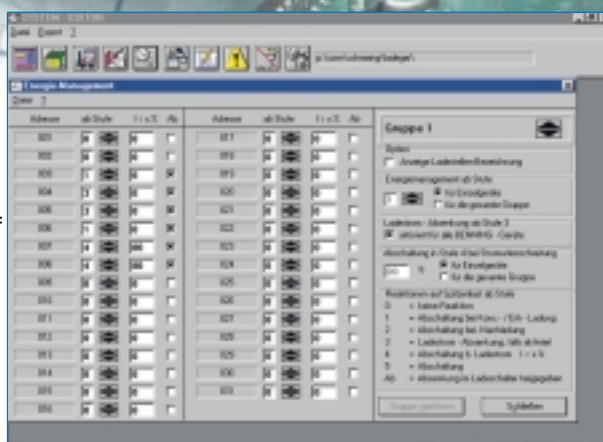
Energy management

By making the appropriate settings in the Energy-Management Table, load peaks created by the charging system (e.g. when all all the vehicles are connected to the system at the end of a shift) can be avoided intelligently, thereby making an important contribution to energy savings.

External potential-free load-reduction signals (at present, 5 signal stages are possible) are received from a digital I/O board. Using the Energy-Management Table, it is possible to program these signals individually to the charging units (in groups or separately for each unit). Each signal represents a reduction stage, which reduces the power of controlled charging units

(BELATRON or BELATRON SELECT) or switches them off according to their charge status.

A freely editable starting table allows individual starting times to be specified for each unit, thereby allowing you, for example, to use the off-peak rates of your power supplier. Start-current peaks can also be avoided directly by offsetting switch-on times.



Energy management table for intelligent control of maximum demand values at load peaks.

Status display

The status display allows you to check the current status of the entire system at any time. The user is shown the status of the chargers by means of coloured symbols. Through a filter feature, it is also possible to display all the units which currently have the same status, e.g. charge in progress, charge concluded or unit malfunction. The following data can be displayed in detail for each charger.

- Unit status to ZVEI Standard (over 20 states can be displayed)
- Graphic or tabular display of current charging sequence
- Charger faults
- Battery data (if battery controller available)
- Vehicle data (if available)

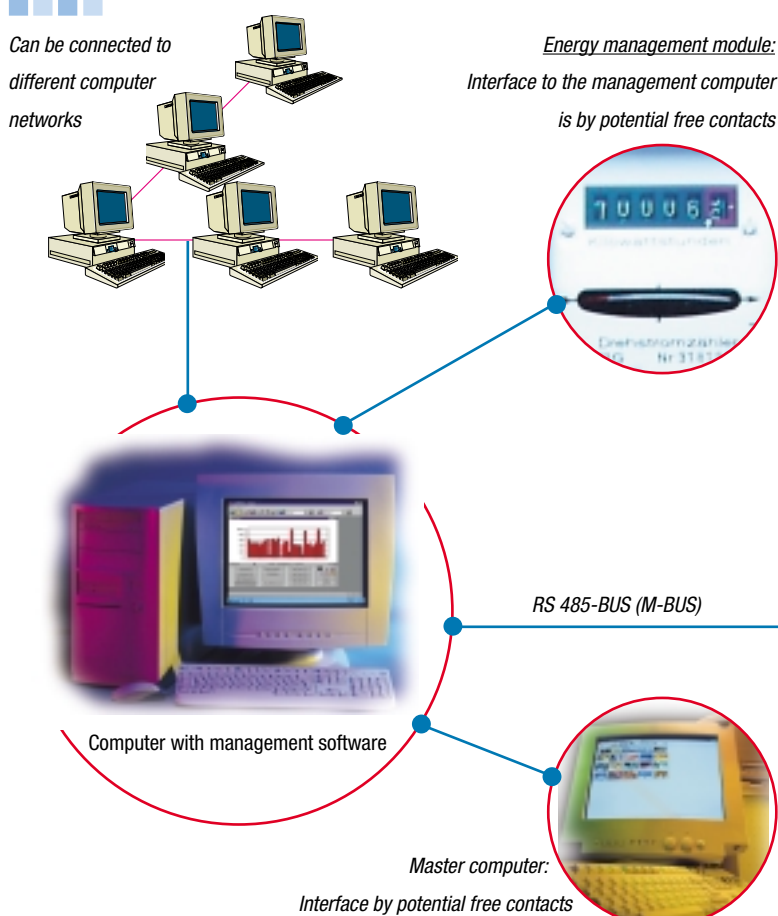
Error reports show the history of the master-computer status (server) or the fault signals for all the chargers.



What can the BENNING Traction Management System do?

- Up to 961 charging units can be connected to one master computer
- The Management System gives information on the status and condition of up to 31 charging units in one window. The status of the system is continuously and automatically updated.
- The structure of the System is simple and is based on the ZVEI Standard (2-wire RS 485 Bus structure)
- Through processing of the data supplied by the system, you can operate your transport system efficiently and economically, e.g. by avoiding errors in operation and adapting the battery capacities of your vehicles to their actual degree of utilisation.
- The energy-management module assists you in reducing load peaks in your charging system by efficient load management.
- The Traction Management System can be integrated into all standard networks. The master computer only needs access to your network. When this is the case, the entire system can be operated from any computer workstation linked to the master unit.
- Through an administrator function it is possible to give each user individual access authorisation.
- The complete history of the system is stored for long-term analysis. All essential data is stored in a data base. An integrated export function allows these data to be exported to any standard MS-Office program such as Excel or Access.
- By means of the battery-leasing module, the energy throughput per battery can be determined and automatically charged to individual customers or cost centres.
- A standard software package can be installed for service purposes and remote diagnosis via modem or ISDN board.

Principle / components /structure /function



The BENNING Traction Management System makes it possible to connect up to 961 charging units to one single master computer. The charging points are linked to the master computer by up to 31 group masters, each of which controls up to 31 charging units.



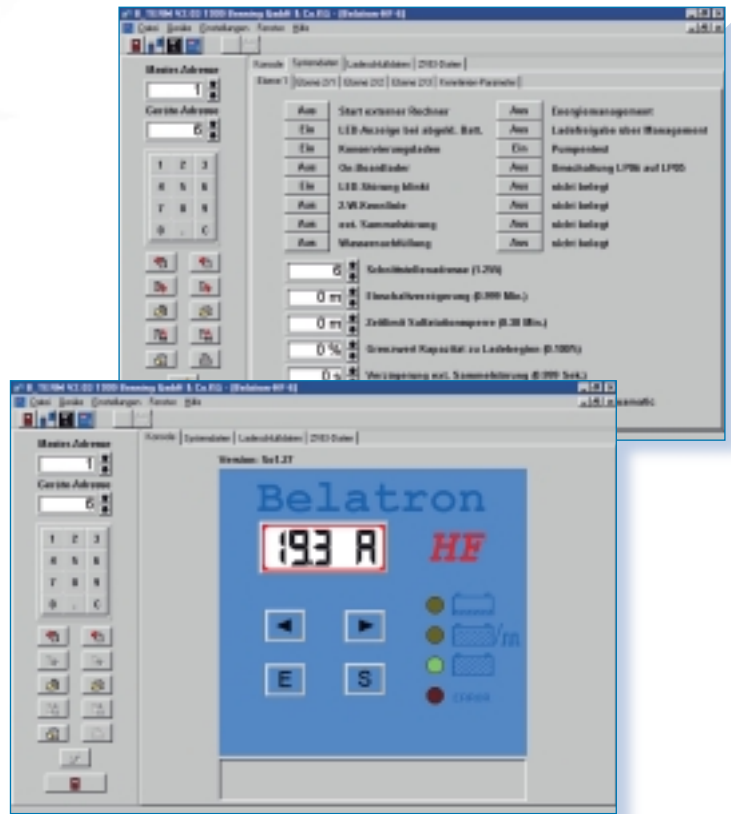
Charging-unit editor program "B_Term32"

The editor program B_Term32 for the charging units allows direct access to charging units with the required features (BELATRON HF, version 1.2 or later). The following data can be displayed:

- current system data for charging unit
- current characteristic data
- 10 sets of charge-end data
- characteristic curve for the last charge (curve and table of figures)
- ZVEI data (status, faults, unit ID etc.)

Besides this, it is also possible to program or edit all system and characteristic data for the unit.

An additional function also automatically stores the system data for all the charging units within a certain group on the hard disk.



Long-term analysis

The long-term analysis module can be used to analyse all the data accumulated in the Management System. This module permits easy analysis of :

- Utilisation statistics for vehicles and batteries
- Graphic analysis of charged and used battery capacity and energy, charge time, discharge time, life span, total discharges, dwell time in 5 different temperature zones per battery (if battery fitted with battery controller).
- Graphic analysis of used battery capacity and energy, average discharge current, battery utilisation in %, operating hours, total discharges and dwell time in 5 different temperature zones
- Charge, discharge and idle times of battery and vehicle
- Charge sequence and faults
- Display of vehicles/batteries without charge over a fixed period of time.

