

Monitoring unit type KraftMaster

Manual 9-1566-A
P/N: 0001036

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APPENDIX

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- B COMPONENT LOCATIONS
 - KM-BAS
 - Connection board KM
- C CIRCUIT DIAGRAMS, double DC system with KraftMaster
- D ADDITIONS AND CHANGES

We retain the rights to make changes to these specifications without further notice.

1 PRESENTATION

1.1 KRAFTMASTER

KraftMaster is a total concept for control and monitoring of un-interruptible power applications. A flexible design based on a communication bus system gives unique possibilities to support still unknown future demands.

The duty of **KraftMaster**, (**KM**), is to monitor chargers, batteries and remaining components in the system in order to ensure the ability to deliver un-interruptible power. Furthermore, the system is expected to facilitate and minimize the time needed for running maintenance.

The brain in KM is the unit *KM-BAS* which is equipped with an operators interface in shape of an alphanumeric display and buttons. Standalone, the *KM-BAS* provides a complete unit to handle one charger, two batteries, distribution, internal and external alarm inputs and alarm outputs. There is also a serial communication port to connect printer or modem for remote operation.

If *KM-BAS* is the brain then *KraftNet* is the nervous system in KraftMaster. *KraftNet* is a local bus for communication with remaining units such as additional chargers, battery voltage monitoring at block or cell level, etc. This gives the system a powerful development potential with flexibility and vital force far into the future because new units and functions can be incorporated at any time.

1.2 KM-BAS

KM-BAS is used either as a complete unit for control and monitoring of a DC system with chargers, battery and distribution, or as a central unit in a bigger system where it communicates with local interface modules.

A number of functions are built in already in the base model, further functions is available as options. Beyond this, most desires can be provided for because the software are written in a high level language. This in turn makes changes and additions go fast and with a maximum of reliability.

The main functions are:

Monitoring of system parameters (voltage, current, earth fault leakage, temperature, etc...), rectifier circuit test, battery circuit test, battery check by analysis of load response, midvoltage measure, block voltage measure, etc.

Alarm handling by response from external units and calculation of internal measure data.

Alarm indication by alarm message on display, LED for general alarm and relay outputs for external alarm handling.

Control of the charging process by equalizing charging, temperature controlled float charging and deep discharge protection by disconnection of battery or load.

Operator communication by menu system with text en clair display and buttons together with remote control by a serial channel.

Statistics for analysis of system load, battery temperature, battery test result, etc...

Some important functions

- * Earth fault resistance are measured to both plus- and minus branch. Displayed directly in k Ω .
- * The mean load of the system is controlled and alarm is given if it exceeds installed capacity.
- * Five different voltage level alarms.
- * Alarm for tripped fuse, mains failure (built in detector for 1-phase, external needed for 3-phase), battery fanflow failure, two inputs for external alarm equipment, etc.
- * Every alarm has individually selection of delay, acknowledge and alarm output.
- * Equalize charging can be done manually or automatically.
- * Battery test can be done manually or automatically.
- * Abnormal battery temperature can give alarm and interrupt the equalize charging.
- * Float charge voltage can be controlled by battery temperature.
- * Load or battery can be disconnected in danger of deep discharge.
- * Regular automatic test of battery and rectifier circuits.
- * Mid voltage measuring to detect battery unbalance, for instance by means of disrupted cell.
- * Monitoring of separate battery blocks or cells by expansion module KM-BI.
- * Handling of double battery strings (mid voltage, current, block voltage).
- * Handling of several parallel chargers by expansion module KM-RI.
- * Serial channel for connection of printer for printouts or modem for remote control.

1.3 KM-RI

KM-BAS alone can handle only one charger. If a DC system has more than one charger, one KM-RI is needed as an interface to each of them.

KM-RI provides an interface between KM-BAS and a charger through the local bus, KraftNet. Its duty is to measure rectifier current, set the temperature compensated charge voltage and select charge voltage level for float charge, battery test and equalizing charging.

KM-RI occurs where appropriate as an integrated part of a charger.

1.4 KM-BI

KM-BI provides an interface to the battery in a DC system where it is appropriate to monitor each cell or block separately.

KM-BI is connected to KM-BAS by the local bus, KraftNet. Its duty is to measure the cell or block voltage levels and thereby maintain maximum control of the battery.

1.5 KRAFTNET

KraftNet is a local network for connection of the units that is a part of the KraftMaster concept. The connection is performed in shape of a serial bus, in this case a simple two wire cable. Units can be connected in parallel on the cable wherever you wish. By this you get a simple installation and high reliability by avoiding a closed loop where a fault in some unit would stop all communication. The electrical interface is a current loop type for maximum interference immunity.

2 OPERATION - MONITORING UNIT

2.0 GENERAL

The information interchange between KraftMaster and the operator is basically made through the text en clair display and a few buttons. The display information is built as a menu system in a so called tree structure. On the display, information about system status, operational statistics, parameter settings, alarms etc, are presented. Further, you can adjust parameters for both installation and operation.

The panel contains a display window, five function buttons, a LED lamp for alarm indication and voltmeter terminals.

The voltmeter terminals are used for system voltage checking by an external voltmeter.

The alarm-LED is turned off in normal conditions. In alarm conditions, the alarm-LED is lit with a firm or flashing light depending on whether the alarms are acknowledged and active.

The display can show 2 rows with 40 characters each. All of, or parts of, the bottom row are used to describe the function of the buttons located just beneath. Display text regarding a button function can be recognized by its location just over the button and that the button text is surrounded by filled downwards positioned arrows.

2.1 MENU METHOD

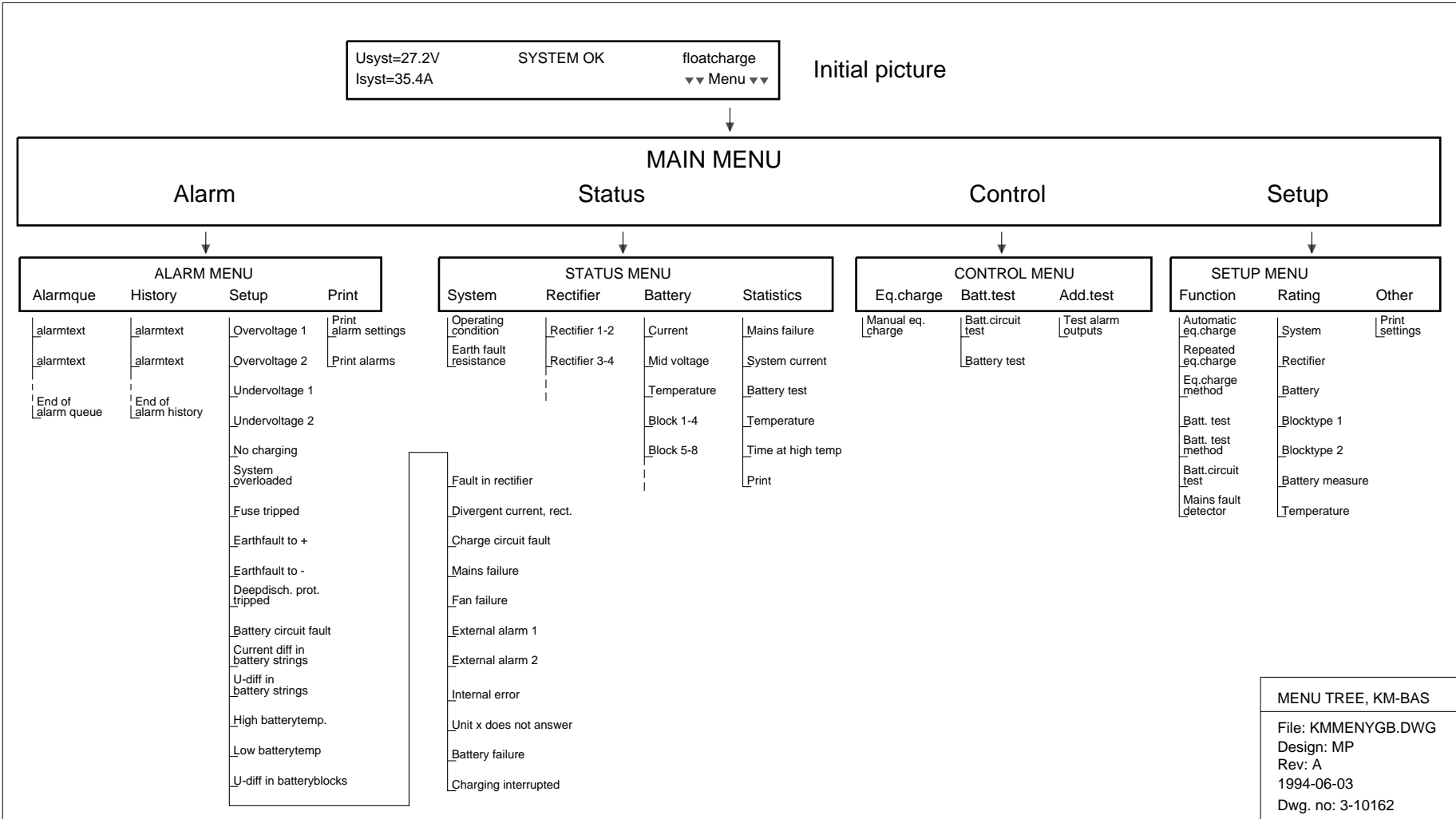
Information interchange between KraftMaster and an operator are based on a menu system. Its structure can be similar to an inverted tree. I.e. that the root at the top is the main menu that, further down, is dividing itself into submenus (branches), and so on.

Reaching the outermost branch in a menu, there are most often a number of pictures to look through. It is done with the button *Next*. With *Return* you can interrupt the looking through and return to the most previous menu. The *Return*-function always gives a return back to previous menu, where the initial picture represent the outermost state. If the display is left in any other state than the initial state, there will be an automatic return to the initial state after about 1 hour.

When there is a possibility to adjust parameters, the display will show the current parameters and the button alternatives *Change-Next-Return*. To adjust parameters, push *Change*. The display will now flash the first adjustable parameter and the button alternatives changes to *Mark-Select-Return*. With *Mark* you select which parameter that you wish to adjust. The marked parameter flashes, and for each push on the *Mark*-button there will be a cyclic rotation between the adjustable parameters. When the parameter you wish to adjust is marked, push *Select*. The display will now show the value of the parameter and the new button alternatives for adjustment of the value. The button alternatives can be either a number of value alternatives or *Increm-Decrem* to increment/decrement the value. When the *Increm-Decrem*-alternatives are available, the button can be kept pushed for a while to cause a fast-stepping of the value. In some cases the selection *Standard* is available. You then get a standard value representing the normal factory setting. You finish with *Save* at which the parameter value is saved and you return to the *Change-Next-Return* state.

2.2 MENU SURVEY

On the next page a complete survey covering all menu alternatives will follow.



2.3 INITIAL PICTURE

2.3.0 General

This picture is normally shown. Additionally, the display will automatically return to this state if no button has been pushed within 1 hour.

```
Usyst=27.2V   SYSTEM OK   floatcharge
Isyst=32.4A                                     ▼▼Menu▼▼
```

SYSTEM OK indicates that everything is ok, i.e. no alarm conditions in presence. At the upper right position the actual charging condition is presented. The alternatives are float charging, equalizing charging, battery test and charge circuit test.

At the left, the system voltage, and in first case system current, are shown. If the system current is neither measured nor calculated, the current from rectifier no 1 is shown instead.

2.3.1 Normal float charging condition

At normal float charge condition, the initial picture as above is shown. To proceed to the main menu, push the *Menu*-button.

2.3.2 Other charging conditions

Every charging condition are indicated. The alternatives, beside float charging, is equalizing charging, battery test and charge circuit test. You can immediately break these charging conditions and return to float charging by pushing *Break*.

```
Usyst=27.2V   SYSTEM OK   eq.charge
Isyst=32.4A                                     ▼Break▼▼▼Menu▼▼
```

2.3.3 Alarm

An alarm condition always starts with an alarm message waiting for acknowledge. This is further described in section *ALARM MESSAGES* below. As soon as all alarms are acknowledged, the picture above is shown. It tells how many alarms there are in the alarm queue. As soon as the alarm queue is empty the display will return to the initial picture.

```
Usyst=27.2V   ALARM ACTIVE   floatcharge
Isyst=32.4A   1 in queue ▼Break▼▼▼▼Menu▼▼
```

2.4 MAIN MENU

From the main menu, you select whether you want to read or setup alarms, read system status from different parts, control the charging process or setup the system. With *Return* you return to the initial picture.

```
MAIN MENU
▼Alarm▼▼▼Status▼Control▼▼▼Setup▼▼Return▼
```

2.5 ALARM MENU

2.5.0 General

An alarm message consists of the parts alarm group, alarm test,

```
ALARM A:OVERVOLTAGE 2, U>> (>2.40V/c)
Active
```

alarm level and alarm status. The alarm group reveals which of 4 alarm output relays (A, B, C, D or blank=none) that are activated. The alarm text reveals the alarm reason. The alarm level is the limit for the alarm event to happen. Alarm status can be *Delay* which reveals that delaying is still going on, or *Active* which reveals that the alarm condition is still maintained and the delay is ready, or *Inactive* which means that the alarm condition is not maintained any more but acknowledge is demanded. This is further described in section *Alarm messages* further ahead and in the *Functional description* under the headline *Alarm handling*.

All current alarms are gathered in an alarm queue. To every alarm type there are a number of settings possible. These settings can be printed out on a printer. Further, you can get continuous alarm logging on a printer.

2.5.1 Alarm queue

The alarm queue can store up to 20 current alarms. An alarm is current as long as the alarm condition is maintained, and further until it has been acknowledged if there is an acknowledge demand.. The alarms are sorted in time order with the most recent alarm first in the queue.

```
ALARM A:OVERVOLTAGE 2, U>> (>2.40V/c)
Aut.      5s      ▼▼Info▼▼▼▼Next▼▼▼Return▼
```

With the button *Info* you get information about how long time that has passed since the alarm came and how long it lasted. Note that *Time since alarm* is counted from the time that the delay ended and the alarm output was activated. That is why the alarm length can be larger than time since alarm. As long as the delay is maintained will *Time since alarm* be replaced by *Delay left*.

2.5.2 History queue

An alarm that has been active until the delay has finished and, after that became inactive and possibly acknowledged, is removed from the alarm queue and moved into the history queue. Here, the latest 20 alarms are gathered with the most recent first in the queue. The button *Info* gives the same information as in the ordinary alarm queue.

2.5.3 Alarm setup

To every alarm type there are a number of settings that can be done. To make a setting, push *Change* and the button alternatives changes to *Mark-Select-Return*. Push *Mark* until the desired parameter flashes, then push *Select*.

```
ALARM A:OVERVOLTAGE 2, U>> (>2.40V/c)
Aut.      5s      ▼Change▼▼▼▼Next▼▼▼Return▼
```

Alarm group reveals which alarm output relay that is activated in case of an alarm. It can be selected to either A, B, C, D or None. Group A is normally the group with the highest priority.

The alarm level is the level that must be reached to trigger the alarm. The level can be adjusted between certain limits. By pushing *Standard* you will get the basic factory setting.

The alarm return can be selected to either automatic return or return after acknowledge. Automatic return is performed as soon as the alarm condition stops. Acknowledge demand means that the alarm message remains until the alarm is acknowledged, and the alarm output relay is deactivated only if both the alarm condition has stopped and an acknowledge is performed.

Alarm delay is the time that must pass with the alarm condition fulfilled for the alarm to be considered as active. An active alarm activates the alarm output relay and is qualified for the history queue. An alarm that does not fulfil the alarm condition during the whole delay time disappears without a leaving a trace behind. The delay time can be set in 10:th of seconds,

can manually initiate a double earth fault measuring by pushing *Double*. Since all capacitors between earth and DC-side now must be recharged, it can take a while before the measuring value is stable. The lowest value of the two measurements is the one that closest to the truth. Push *Single* or *Return* to return to the single earth fault measuring.

2.6.2 Rectifier

For each rectifier/charger in the system you can read the output current and charging condition. In any case of rectifier fault, the fault cause will replace the charging condition text. The fault cause can be *Fault in rectifier*, *Chargecircuitfault* or *Unit x doesn't answer*.

```
Rectifier 1: I=29.8A, floatcharge
                ▼Next▼▼▼▼Return▼
```

If there are several rectifiers in the system, use the button *Next* to reach the next rectifier.

2.6.3 Battery

The battery current for up to two parallel battery strings can be displayed. A not measured string (i.e. measure shunt not installed) is indicated by a dashed line instead of a measurement result. The measurement result can be both positive and negative to indicate charge and discharge respectively.

```
Battery 1: I=+4.93A
Battery 2: I=+4.88A                ▼Next▼▼▼▼Return▼
```

If the midvoltage of the battery is measured, it can be displayed for up to two parallel battery strings. A not measured midvoltage is indicated by a dashed line (compare above).

```
Midvoltage 1: 13.6V
Midvoltage 2: --                ▼▼Next▼▼▼▼Return▼
```

The battery temperature is displayed in °C.

```
Temperature:21.4°C                ▼▼Next▼▼▼▼Return▼
```

This picture is shown only if measuring of block/cell-voltage via KM-BI is performed. Both cells and blocks are named *Block*. Four block voltages are shown at a time. You move forward and backward through the quartets of blocks by pushing the buttons *Increm* and *Decrem*. Block 1-120 are reserved for battery string no 1, while block no 121-240 belongs to battery string no 2. The numbering starts with the block closest to the minus branch as no 1 and in raising order up against the plus branch.

```
BLOCK 1- 4: 2.27V 2.27V 2.27V 2.27V
Increm▼(blockno)▼Decrem▼▼▼▼▼▼▼▼▼▼Return▼
```

2.6.4 Statistics

Mains failure statistics covering number of failures, how long since the last one and how long it lasted.

```
MAINS FAIL: 8 Latest for 113 days
ago, 0h 2m16s long. ▼▼Next▼▼▼▼Return▼
```

The system current (if it is measured or calculated) is shown in the order minimum, mean and maximum value.

```
SYSTEM CURR:Month 0:19.6A<28.3A<33.7A
▼Increm▼(month)▼▼Decrem▼▼▼Next▼▼▼▼Return▼
```

These values are saved monthly since one year back. The month number 0 is the present month while previous months (-1 to -11) are displayed with the buttons *Increm-Decrem*.

Battery test continues until the first of the two limits, maximum time and minimum voltage for battery test, are exceeded. If the time is exceeded before the voltage the result will be OK, else it will be FAIL. Push *Info* for additional information about the result of the latest battery test.

```
Latest battery test result:   OK
                          ▼Inform▼▼▼Next▼▼▼Return▼
```

During the battery test, the discharged capacity is measured (if measure shunt for battery current is installed). Additionally, information of reached final voltage, the test duration and since how long the test was performed.

```
Dischrgd 120Ah to 23.5V after 300min
for 73 days ago.                ▼Return▼
```

The temperature (if it is measured) is shown in the order minimum, mean and maximum value. These values are saved monthly since one year back. The month number 0 is the present month while previous months (-1 to -11) are displayed with the buttons *Increm-Decrem*.

```
TEMP:      Month 0:19.2°C<21.4°C<25.8°C
          ▼Increm▼(month)▼▼Decrem▼▼▼Next▼▼▼Return▼
```

Total operating time during which the alarm condition *High temperature* was active.

```
OPERATING TIME AT HIGH TEMP: 1h 32min
                          ▼▼Next▼▼▼Return▼
```

Printout of measures can be done to a printer connected to the RS232 port (see the functional description, section *External serial channel RS232*). For a single printout, push *Print*. Please observe that the interval printout then will be changed to *Yes*. Push *Yes/No* to restore to *No*. For automatic printout at regular intervals, push *Yes/No* until the text at the right of the upper line is changed to *Yes xx min*. Select desired time interval with *Increm-Decrem*. While printing, display and button functions are frozen.

```
PRINT MEASURES, INTERVAL:    No
          ▼Increm▼▼Decrem▼▼Yes/No▼▼▼Print▼▼Return▼
```

2.7 CONTROL MENU

2.7.0 General

The control menu contains possibilities as equalizing charging, battery test and alarm circuit test.

```
CONTROL MENU
Eq.charge▼▼▼▼Batt.test▼Add.test▼Return▼
```

2.7.1 Equalizing charging

Equalizing charging can be performed in three different ways: Automatic, Repeated and Manual (see further section *Setup functions*). From this picture you can start a manual equalizing charging session by setting the charging time with the *Increm-Decrem* buttons and then push *Start*. When the equalizing charging time has elapsed the charging condition resets to float charging.

```
MANUAL EQ.CHARGE: Charge time 4 hours
          ▼Increm▼(time)▼▼Decrem▼▼▼Start▼▼Return▼
```

While the equalizing charging is in progress, remaining equalizing charging time is displayed instead of the text above. Additionally, you can break the equalizing charging at any time by pushing the *Break*-button. It can also be done in the initial picture.



WARNING: Generally ,batteries of VR-type (vent regulated) should not be subject to equalizing charging. For some battery types equalizing charging could even be harmful to the batteries. Always follow the instructions stated by the battery manufacturer. Specifically for UNO systems the following applies: To prevent from unintentional equalizing charging, the input terminals for air flow sensor is left open. If equalizing charging although should be done, the input terminals for the air flow sensor must be short-circuited (X8:17-18 on connection board KM).

2.7.2 Battery test

Battery circuit test is normally performed automatically once every day (eligible via *Setup functions*). You can also perform an extra battery circuit test by pushing *Start*. The test is then performed and the result is displayed.

```
EXECUTE EXTRA BATTERY CIRCUIT TEST:
      ▼Start▼▼▼▼Next▼▼▼Return▼
```

Battery test can be performed either automatically (eligible via *Setup functions*) or manual as shown here. To start a manual

```
START EXTRA BATTERY TEST:
      ▼Start▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼Return▼
```

battery test, push *Start*. The conditions for the battery test follows the settings according to *Setup functions*. When the first of the conditions maximum test time and final voltage exceeds, the test is stopped, results stored for statistics and operation resets to float charging. While the battery test is in progress, remaining battery test time is displayed instead of the text above. Additionally, you can break the battery test at any time by pushing the *Break*-button. It can also be done in the initial picture.

2.7.3 Additional tests

This test is meant for checking out the external alarm circuits without necessarily force actual alarm conditions. It is aimed to be used primarily at installation. With *Mark* you select the alarm output relay that you want to operate. Selected relay position will flash. By pushing *Norm/Alarm* you toggle between normal and alarm position. When you leave the picture all relays resets to their ordinary position.

```
TEST ALARMOUT:A=Normal B=Normal C=Normal
D=Normal      ▼▼Mark▼▼Norm/Alarm▼Return
```

2.8 SETUP MENU

2.8.0 General

Setup means, in this case, the settings for a number of basic parameters crucial for the operation of the system. We make a distinction between parameters that affects a number of built in functions and parameters that depends on the system design and therefore are called ratings. The latter are aimed to be set once and for all at factory or latest at installation.

```
SETUP MENU
Function▼Rating▼▼Other▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼Return▼
```

2.8.1 Codenumber

Some parameters in the setup menu are so crucial for the system operation that it is absolutely necessary that you know exactly what you are doing before you change anything. That is why it could be desirable to be able to protect against unauthorized trespassing in the setup menu. The protection is realised by a four digit codenumber that has to be given to reach the setup menu.

```
Give codenumber!
▼▼▼▼1▼▼▼▼▼2▼▼▼▼▼3▼▼▼▼▼4▼▼▼▼Return▼
```

The code consists of four digits formed by the digits 1-4. For each answered digit a star will appear on the display instead of the digit so the code will not be betrayed to an observer.

The code number as well as the code number demand is eligible, see section *Change codenumber* further on. Normal factory setting is *No codenumber*.

2.8.2 Setup functions

2.8.2.1 Automatic equalizing charging

The settings of parameters for automatic equalizing charging, i.e. equalizing charging after mains failure.

```
EQ.CHARGE, Automatic:      Level1=2.05V/c
L2=2.25V/c K= 5 ▼Change▼▼▼Next▼▼▼Return▼
```

Level1 is the limit for time measure. Elapsed time below this level is measured and is used to predict the equalizing charging time. The level can be set within the interval 1.90 - 2.20 Volt/cell. Normal level is 2.05 V/cell.

Level2, (L2), is the limit from which the equalizing charging time starts to count. The level can be set within the interval 2.15 - 2.35 V/cell. Normal level is 2.25 V/cell.

The factor *K* multiplied by the time below *Level1* gives as result the remaining time for equalizing charging after *Level2* has been passed. The factor can be set within the interval 1 - 16. Normal level is 5.

2.8.2.2 Repeated equalizing charging

The settings of parameters for repeated equalizing charging, i.e. equalizing charging with a constant, predestinated interval.

```
EQ.CHARGE, Repeated:  Interval= 3weeks
Ch.time= 4h      ▼Change▼▼▼Next▼▼▼Return▼
```

Interval is the time that must pass between each repeated equalizing charging moment. The time can be set within the interval 1 - 99 weeks. Normal level is 3 weeks.

Charge time (Ch.time) is the time during which the equalizing charging continues at each equalizing charging moment. The time can be set within the interval 1 - 24 hours. Normal level is 4 hours.

2.8.2.3 Equalizing charging method

You can select between the equalizing charging methods Only manual, Automatic+Manual, Repeated+Manual and All.

```
EQ.CHARGE METHOD:      Only manual
▼Change▼▼▼Next▼▼▼Return▼
```

2.8.2.4 Battery test

The settings of parameters for battery test.

```
BATT.TEST: Int=26w Time=300m Block=144h
Umin=1.90V/c ▼Change▼▼▼Next▼▼▼Return▼
```

Interval (Int), is the time that will pass between each automatic battery test. The time can be set within the interval 1-52 weeks. Normal level is 26 weeks.

Time is the maximum time during which the battery test continues. The time can be set within the interval 0 - 999 minutes. Normal level is 300 minutes.

Block is the time that must pass after a mains failure before a battery test is permitted. The time can be set within the interval 0 - 255 hours. Normal level is 144 hours.

Umin is the lower limit of the system voltage that will terminate the battery test. The limit can be set within the interval 1.70 - 2.20 Volt/cell. Normal level is 1.90V/cell. Please note that this limit must be set higher than the chargers battery test output voltage.

2.8.2.5 Battery test method

You can select between the battery test methods *Manual*, *Automatic+Manual*, *Remote+Manual* and *All*.

```
BATTERY TEST METHOD: Only manual
▼Change▼▼▼Next▼▼▼Return▼
```

Remote means that the battery test can be remote controlled through a digital input. Is mainly used in systems where two monitoring units are used at the same time.

2.8.2.6 Battery circuit test

You can select between the battery circuit test methods *Manual* and *Automatic+Manual*. If *Automatic+Manual* is selected

```
BATT CIRCUIT TEST:Man+Aut Interval= 24h
▼Change▼▼▼Next▼▼▼Return▼
```

you can also set the time between automatic tests (*Interval*). The time can be set within the interval 1 - 255 hours. Normal level is 24 hours.

2.8.2.7 Charge circuit test

You can select either *Automatic* or *None* charge circuit test. The test is performed by raising the charging voltage about 2.5%. If the load does not permit raised voltage, select *None* to reject the function.

```
CHARGE CIRCUIT TEST:Automatic
▼Change▼▼▼Next▼▼▼Return▼
```

2.8.2.8 Mains fault detector

Mains fault detection can be performed in two ways, one through an internal single phase detector and the other through a digital input connected to an external detector. The input for external detector is always activated and a jumper must be connected between the terminals if it is not to be used. The internal detector, in other hand, can be selected or rejected. The *Internal*-button gives both internal and external detection while the *External*-button rejects the internal detection.

```
MAINS FAULT DETECTOR: Internal+External
▼Change▼▼▼▼▼▼▼▼▼▼Return▼
```

2.8.3 Setup ratings

2.8.3.1 System

Here you can read out the rated voltage of the system and the rating of the shunt for system current measuring. *Rated voltage* is either of 24V, 48V, 110V or 220V. *Shunt* is either the rated current of the shunt at 60mV or *None* if no shunt for system current is installed. The text *No.of shunts* is shown only if any current measuring shunt is installed.

```
SYSTEM:Rated voltage= 24V      Shunt= 300A  
No.of shunts= 2                ▼▼Next▼▼▼Return▼
```

Contact the supplier if the settings must be changed.

2.8.3.2 Rectifier

Here you can read out the number of installed rectifiers in the system, the rated current of the rectifiers and the ratings of the shunt used for measuring the rectifier output current. If the internal KM-RI is not used, it is indicated by a star after the number of rectifiers. *Shunt* is the rated current of the shunt at 60mV.

```
RECTIFIER:  No.of= 1      Rated curr=200A  
Shunt=      300A        ▼▼Next▼▼▼Return▼
```

Contact the supplier if the settings must be changed.

2.8.3.3 Battery

The final (end) voltage level is used mainly to calculate the capacity of the system to then be able to decide whether there is an overload or not. Can be set within the interval 1.50 - 2.00V/cell. Standard setting is 1.80V/cell.

```
BATTERY:      Uend=1.80V/c      Strings=1  
                ▼Change▼▼▼Next▼▼▼Return▼
```

No. of strings in the system can be one or two. Contact the supplier if the settings must be changed.

Selection of number of blocks and number of cells per block of type 1. If two different types of blocks are used, then blocks with the highest number of cells are blocks of type 1. Blocks of type one must be placed starting from the minuspole and upwards.

```
BLOCKTYPE1:  No of cells per block= 3  
No of block= 4 ▼Change▼▼▼Next▼▼▼Return▼
```

Selection of number of blocks and number of cells per block of type 2. Blocks of type 2 are blocks with less number of cells than blocks of type 1. Blocks of type two must be placed closest to the pluspole. Select *No of block = 0* if any blocks of type 2 does not exist.

```
BLOCKTYPE2:  No of celles per block= 1  
No of block= 0 ▼Change▼▼▼Next▼▼▼Return▼
```

Note: If block voltage measuring through KM-BI is used together with battery blocks equipped with cell voltage measuring terminals, then every measure point is considered as a single block. In this case it would mean that "No of blocks of type 1" = total no of cells, "No of cells per block of type 1" = 1 and "No of blocks of type 2" = 0.

2.9 ALARM MESSAGES

2.9.0 General

An alarm message consists of the parts alarm group (A, B, C, D or None) specifying which alarm

ALARM A:OVERVOLTAGE 2, U>> (>2.40V/c) Active ▼Acknowl▼

output relay that is activated by the alarm, the alarm text that describes the fault cause, a possible alarm limit, alarm status (delay, active or inactive) and an acknowledge demand. In the same time the alarm LED on the panel flashes until the alarm has been acknowledged. After acknowledge the LED continues to light steadily until the alarm condition disappears. All alarms that is still active are gathered in the alarm queue from which they can be displayed via the alarm menu. In the initial picture the number of alarms in the queue are displayed. Finished alarms are moved to the history queue.

2.9.1 Alarm descriptions

OVERVOLTAGE 1, U> (>2.29V/c)

The system voltage exceeds the limit for overvoltage 1. The limit for overvoltage 1 is normally lower than for overvoltage 2.

The alarm is interlocked by equalizing charging and charging circuit test.

OVERVOLTAGE 2, U>> (>2.40V/c)

The system voltage exceeds the limit for overvoltage 2. The limit for overvoltage 2 is normally higher than for overvoltage 1.

UNDERVOLTAGE 1, U< (<2.21V/c)

The system voltage falls below the limit for undervoltage 1. The limit for undervoltage 1 is normally higher than for undervoltage 2.

The alarm is interlocked by battery test and also if all rectifiers exceeds 90% of rated current.

UNDERVOLTAGE 2, U<< (<1.85V/c)

The system voltage falls below the limit for undervoltage 2. The limit for undervoltage 2 is normally lower than for undervoltage 1.

The alarm is interlocked by battery test and also if all rectifiers exceeds 90% of rated current.

NO CHARGING (<2.15V/c)

The system voltage falls below the limit for *No charging*.

The alarm is interlocked by battery test and also if all rectifiers exceeds 90% of rated current.

SYSTEM OVERLOADED

The system is loaded above its capacity. If this condition remains there is a risk of system breakdown due to empty batteries. After a mains failure this will be particularly serious because the available charging current will not be enough to recharge the batteries. The load calculation

assumes the worst case, i.e. constant effect independent of voltage. This is mainly the case in switched power supplies which most computers are equipped with.

The alarm is functioning only if measure shunt for system current and/or battery current is installed. The alarm is interlocked during the first 48 hours after a mains failure.

FUSE TRIPPED

Alarm for tripped fuse. Signal from external fuse monitor via digital input.

If this input is not used, its input terminals must be short-circuited.

EARTHFAULT TO + (< 100kΩ)

Measured earth fault resistance to plus pole falls below the limit settings.

EARTHFAULT TO - (< 100kΩ)

Measured earth fault resistance to minus pole falls below the limit settings.

DEEPDISCH.PROT.TRIPPED (<1.70V/c)

The system voltage falls below the limit for damaging battery voltage level. The program demands activation of the output relay for disconnecting load or battery. Before the disconnection is really performed, an independent security circuit must have detected a voltage level below about 1.85V/cell.

BATTERY CIRCUIT FAULT (<1.96V/c)

At battery circuit fault test, automatic or manual, the system voltage have fallen below the limit for alarm. It indicates a fault somewhere in the battery circuit, not necessarily in the battery itself.

NOTE: This alarm condition is momentarily by nature and must therefore be set with acknowledge demand to be able to be discovered !!

CURR.DIFF IN BATT.STRINGS (> 10%)

Current imbalance between the both battery strings has been detected. Measured current in the both battery strings differs more than x% of the larger of the both currents.

The alarm is functioning only if measure shunts for battery current are installed in two parallel battery strings.

U-DIFF IN BATT.STRING 1 (>0.20V)

Voltage imbalance between the two halves in a battery string. The difference exceeds the limit setting.

The alarm is functioning only if mid voltage measuring is installed in the system.

HIGH BATTERYTEMPERATURE (> 30°C)

The limit for high battery temperature has been exceeded. Possibly progressive equalizing charging is stopped.

The alarm is functioning only if temperature measuring is installed in the system.

LOW BATTERYTEMPERATURE (< 15°C)

The battery temperature has been fallen below the limit settings.

If <1°C it is assumed that the temperature sensor is erroneous and the alarm text "TEMPERATURE SENSOR FAULT" is shown instead. Temperature regulated float charging will then be forced to the 20°C level.

The alarm is functioning only if temperature measuring is installed in the system.

U-DIFF IN BATTERYBLOCK 1 (> 5%)

Battery block no x differs more than y% from calculated block voltage. Block in battery string no 1 are numbered 1-120 and blocks in string no 2 are numbered 121-240.

The alarm is functioning only if block voltage measuring via KM-BI is installed in the system. Is interlocked after mains failure and battery test until the alarm "No charging" no longer is active, and also if there is communication faults to any of the KMBI units.

FAULT IN RECTIFIER 1

Rectifier (charger) no x indicates fault.

The alarm is interlocked by mains fault and during battery test.

DIVERGENT CURR, RECT. 1 (>10%)

The current from rectifier no x differs more than y% from the other rectifiers.

The alarm is functioning only if at least two rectifiers are installed in the system. Is interlocked during charge circuit test.

CHARGE CIRC. FAULT, RECT. 1

A fault in a charging circuit belonging to rectifier (charger) no x has been detected by an automatic charging circuit test. The whole charging circuit is tested which means that the fault not necessarily can be found in the rectifier itself.

MAINS FAILURE

Mains failure is indicated either by the internal or by an external detector depending on the settings.

If the input for external detector is not used its input terminals must be short-circuited.

FAN FAILURE

External input from a flow sensor in the battery compartment fan indicates fault during equalizing charging. The equalizing charging is stopped. If no fan flow sensor should be used despite the use of equalizing charging, the external input terminals for the fan flow sensor has to be short-circuited.

NOTE: Has to be set with acknowledge demand to be able to be detected, because the equalizing charging is stopped by the alarm and one of the alarm conditions thereby disappears.

EXTERNAL ALARM NO 1 TRIPPED

External alarm input no 1 for optional use indicates fault.

If this input is not used its input terminals must be short-circuited.

EXTERNAL ALARM NO 2 TRIPPED

External alarm input no 2 for optional use indicates fault.

If this input is not used its input terminals must be short-circuited.

INTERNAL ERROR, CODE 0 (0)

Internal error found during program execution.

Error code 0: Unspecified error.

Error code 1: Error when writing to EEPROM.

Error code 2: Error at plausibility check of parameters in EEPROM.

The number within brackets is only usable for a person who is familiar to the microcomputer program. Note the error code and the number within brackets and call for service.

UNIT x DOES NOT ANSWER

Communication fault in the internal communication net, KraftNet. The unit with address number x does not answer. If the fault remains continuously, call for service.

0 < x < 31: Rectifier (KM-RI) no x, beginning with 0.

32 < x < 33: KM-BI no 1 and 2, respectively.

34 < x < 127: Optional units

The alarm can only occur if the system have more than one rectifier, block voltage measuring through KM-BI or some other unit that communicates via KraftNet.

BATTERY FAILURE alternative BATT. FAIL, BLOCK NO x

During battery test, the system voltage or some single battery block voltage has fallen below the limit U_{min} according to the battery test settings. Progressive battery test is stopped.

Checking of battery block voltages are done only if block voltage measuring via KM-BI is installed.

NOTE: This alarm condition is momentarily by nature and must therefore be set with acknowledge demand to be able to be discovered !!

CHARGING INTERRUPTED

Charging interruption is detected if the system current is "high" in the same time as the rectifier current is "low". Interlocked by mains fault.

The alarm is functioning only if measure shunt for system current is installed.

2.10 CHANGE CODE NUMBER

2.10.0 General

In the *Setup menu* you can change a number of extra parameters that are crucial for the operation of the system. To prevent unintended or unauthorized access to this menu it is possible to protect it by demanding a code number before access is permitted.

Whether code number should be demanded and which code number that should be used in that case, can be selected by the following procedure.

2.10.1 Access to code number menu

You get access to the code number menu by pushing button no 4 from the left while the supply voltage for the monitoring unit is switched on.

2.10.2 Select code number

Answer *Yes* if the code number within brackets should be changed, else answer *No* to leave for the initial picture.

Change codenumber? (1111)
▼▼Yes▼▼▼▼▼▼No▼▼▼

If you answer *Yes*, this picture is displayed. Now select a new code number by giving 4

New codenumber: ****
▼▼▼▼1▼▼▼▼▼▼▼▼2▼▼▼▼▼▼▼▼3▼▼▼▼▼▼▼▼4▼▼▼

numbers, each between 1 and 4. The combination 1111 means that no code number will be demanded which also is the factory setting.

3 FUNCTIONAL DESCRIPTION

3.0 GENERAL

This section contains a description of the functions that is demanded to obtain a correct and effective monitoring and control of the power supply system.

3.1 SYSTEM DESIGN

3.1.0 General

The KraftMaster concept is a modular system starting with a base module, KM-BAS, which then can be expanded by a number of expansion modules like, for instance, KM-RI for connection of additional chargers and KM-BI for block voltage monitoring. The modules is interconnected by the local communication bus, KraftNet.

3.1.1 KM-BAS

KM-BAS is used either as a complete unit for control and monitoring of a DC system with chargers, batteries and distribution. Or the KM-BAS will act as a central unit in a larger system communicating with local interface modules.

3.1.2 KM-RI

KM-RI acts as an interface between KM-BAS and a charger via the local bus, KraftNet. Its purpose is to measure the charger current and to control the output voltage level for different charging conditions. You might say that one KM-RI is built into KM-BAS because the latter, already in base model, can handle one charger.

3.1.3 KM-BI

KM-BI acts as an interface between KM-BAS and a battery via the local bus, KraftNet. Its purpose is to measure the cell or block voltage levels to gain maximum control of the battery.

The measuring units consists of circuit boards (KMBI-MÄT) that can measure up to 12 cell/block voltages. Up to 10 boards can be cascaded for measuring of up to a total of 120 cells/block. The whole series of measuring boards is controlled by a microcomputer equipped board, KMBI-CPU. A measuring scan through all measuring points is done once every minute. The results are sent, via KraftNet, to KM-BAS.

3.1.4 KraftNet

KraftNet is a local area network for interconnection of the units that are parts of a KraftMaster system. The net is connected by using a shielded two-wire cable for parallel connection of the units. This, plus the fact that the interface is of a current loop type, gives a cheap, simple and reliable installation.

3.2 NORMAL OPERATION

Normal operation means that the system operates at float charge level. The level is monitored by KraftMaster while the actual regulation is performed in the chargers. One exception however, is

when the system is equipped with temperature controlled float charging level. In that case, the KraftMaster is permitted to regulate the float charging voltage within a close interval.

During operation, all essential parameters are continuously monitored. Parameters beyond permitted limits will give alarm.

3.3 EQUALIZING CHARGING

3.3.0 General

Equalizing charging means operation at raised voltage level for a limited time. The voltage level is set in the charger, see the functional description for the charging unit.

During equalizing charging, the output for the battery compartment fan is activated. The output continues to be activated for additional 5 minutes after completed equalization charging.

During certain conditions, an equalizing charging is not permitted. Equalizing charging is therefore interlocked if the battery fan flow sensor indicates fault and also if high temperature is detected.

All types of equalizing charging can always be stopped manually by a few button pushes.

There are three types of equalizing charging:

- 1) Automatic equalizing charging.
- 2) Repeated equalizing charging.
- 3) Manual equalizing charging.



WARNING: Generally, batteries of VR-type (vent regulated) should not be subject to equalizing charging. For some battery types equalizing charging could even be harmful to the batteries. Always follow the instructions stated by the battery manufacturer.

Specifically for UNO systems the following applies: To prevent from unintentional equalizing charging, the input terminals for air flow sensor is left open. If equalizing charging although should be done, the input terminals for the air flow sensor must be short-circuited (X8:17-18 on connection board KM).

3.3.1 Automatic equalizing charging

An automatic equalizing charging is performed after a mains failure.

During the mains failure, the time (t) during which the voltage is below a certain level (*Level 1*) is measured. When the mains returns, the equalizing charging will start. From the moment the system voltage has reached *Level 2*, the equalizing charging will continue for another time, $t * K$, which however is limited to 20 hours.

The settings of the parameters *Level1*, *Level2* and *K* are made in *Setup menu*.

3.3.2 Repeated equalizing charging

Repeated equalizing charging operates with preset interval and length. When the time *Interval* has passed since the last repeated equalizing charging, a new repeated equalizing charging is started. It continues during the time *Chargetime*.

The settings of the parameters *Interval* and *Chargetime* are made in *Setup menu*.

3.3.3 Manual equalizing charging

Manual equalizing charging means that you manually request a start of an equalizing charging session with a certain duration. The equalizing charging starts immediately after the request and will last during the time *Chargetime*.

The setting of the parameter *Chargetime* is in this case made in the same moment as the request for start of manual equalizing charging is done.

3.4 BATTERY TEST

3.4.0 General

Battery test means that the chargers are regulated down to a voltage level where the batteries are supposed to take over the load. By analyzing the load response you can get an opinion of the condition of the battery. While the battery test is in progress, the output relay for test load is in active position. It can thereby be used to switch on a known load during the test.

The voltage level setting is done in the charger.

3.4.1 Battery circuit test

A battery circuit test is normally done once every day (choosable interval). The test is aimed to check the whole battery circuit, i.e. not only the battery blocks themselves.

The test is done by, during a short period (about 5 seconds), lowering the output voltage of the chargers down to the test level that is preset in the chargers. To pass the test, the system voltage is not permitted to fall below the preset alarm level.

An extra battery circuit test can be manually issued from the Control menu. This manually issued test is functioning exactly as above, also using the same parameters.

3.4.2 Battery test

Battery test means a test of the battery capacity. The test can be initiated either manually via the Control menu, or by automatic start on preset intervals.

If automatic battery test is selected, it will start automatically with the interval *Int*. If the voltage *Umin* is reached before the time *Time* has passed, the test is stopped and the alarm *BATTERY FAULT* is activated. If the time *Time* manage to pass without reaching the voltage *Umin*, the battery is considered OK and the test ends without further action. It is important that the battery have time to recharge properly after a mains failure. Due to that, no battery tests are permitted until the time *Block* has passed after a mains failure. The result of the battery test is saved for later readout in *Status menu, Statistics*.

The parameters *Interval, Time, Block* and *Umin* are set in the Setup menu.

An extra battery test can be manually issued from the Control menu. This manually issued test is functioning exactly as above, also using the same parameters.

3.4.3 REMOTE CONTROLLED BATTERY TEST

When using double (parallel) systems, it still must be possible to force all rectifiers at the same time to reach battery test level if the battery test should have any meaning. The option that is then used is called "Remote controlled battery test".

Remote controlled battery test is achieved by crosswise connection of the testload output of one of the monitoring units to the input for "external monitor 2" of the other monitoring unit. The option for battery test must also be set to *Remote+Manual* or *All*, see *Operation* section *Setup menu, Battery test*. Since the test load output during battery test always is in active position, it will signal "battery test" to input "external monitor 2" of the other monitoring unit so it will also set its charging voltage level to battery test level.

3.5 CHARGING CIRCUIT TEST

Charging circuit test is performed automatically as soon as a suspected operating condition occurs. The test is aimed to test the whole charging circuit, i.e. not only the charger itself. The test is done automatically every 10 minute as long as the charging current falls below two or three percent of the rated current. The charging voltage is then raised about 2.5%. To pass the test, the charger either have to begin to leave some charging current or at least cause an increased voltage level in the system.

3.6 TEMPERATURE REGULATION

For compensation of changing battery temperature, the float charging voltage can be regulated by temperature.

In the Setup menu under *Ratings, Temperature* you specify two points from the battery manufacturers curve regarding the temperature dependence of the float charging voltage. The two points are the float charging voltage at 0°C and at 40°C. From this data, the float charging voltage for present temperature is calculated. Maximum permitted regulation interval is $\pm 5\%$ from the preset float charging voltage. The preset float charging voltage level is supposed to apply to 20°C!

NOTE: If two temperature regulated DC systems are connected for parallel operation, the system that gives the highest output voltage (measures the lowest temperature) will determine the total system voltage.

Temperature regulation is not installed in base version.

3.7 MID VOLTAGE MEASURING

By measuring the voltage level in the midpoint of the battery and compare the two halves, you can in a simple way catch a number of important faults as unequal charging distribution, short circuited battery cells, etc. Mid voltage measuring can be done in up to two battery strings.

Mid voltage measuring is not installed in base version.

3.8 BLOCK VOLTAGE MEASURING

Block voltage measuring means that the voltage of each battery block or battery cell are measured and monitored. For block voltage measuring, the module KM-BI has to be installed.

Block voltage measuring is not installed in base version.

3.9 EARTH FAULT MEASURING

Earth fault measuring is done by continuously measuring the voltage in a premade midpoint to which the monitored earth point is connected. The resistances in the voltage divider that forms the midpoint is approximately 50k Ω for system voltage 24/48V and 200k Ω for system voltage 110/220V which should exclude all risks for external devices (as relay protections) to be interferred.

Presentation of earth fault resistance and setting of its alarm limits are done directly in k Ω . The measure range is from about 50k Ω to 2M Ω .

Since this type of earth fault measuring doesn't give any response for double earth faults (the same amount of earth fault to both plus and minus at the same time), you can manually initiate a temporary measuring of double earth fault. It is done in the menu *Status* in section *System*. One of the resistors in the voltage divider is then disconnected and will skew the measuring bridge. By comparing with the measuring of single earth fault and after a number of calculations the double earth fault value is provided. If the earth fault is double but not exactly symmetrical, the measures will not give any exact result, but the lowest of the two measures will anyway be close to the real value. Please note that since the measuring bridge is skewed the earth point potential will be changed. It will take a while before the potential and thereby the measuring value will be stable depending on the amount of capacitance the system holds between earth and Dc-side.

3.10 DEEP DISCHARGE PROTECTION

For certain types of valve regulated batteries, deep discharging can damage the batteries. Also certain types of loads can be sensitive to very low voltage levels. One way to obtain a protection of this is to switch off the battery or load before the voltage reaches the injurious level.

The function "Deep discharge protection" means that a tripping of the protection device is demanded if the voltage falls below the alarm level setting during a time exceeding the alarm delay setting. Since this is regarded as an emergency case, the security against unintended tripping must be extra high. That is why there is an additional software independent circuit that also must have detected a voltage level below about 1.85V/cell before the tripping actually is performed.

3.11 MAINS VOLTAGE MONITOR

Mains voltage monitoring can be done in two ways. One via a built in mains voltage monitor that can handle 240V single phase and another via a digital input for connection of an external mains voltage monitor. Which of these that should be active is set in *Setup menu, Function, Mains fault detector*.

3.12 ALARM HANDLING

3.12.0 General

Alarms can be initiated through either digital inputs from external units or as a result of internal analysis of data. An alarm is indicated as alarmtext on display, by an alarm LED on the panel and by the alarm output relays.

The parameters *Group, Acknowledge, Delay* and *Alarm level* can be separately set for each alarm.

3.12.1 Alarm Indication

Alarms are indicated by alarmtext on display, alarm LED on the panel and by the alarm output relays.

The alarm test on the display shows, besides the fault description, also the alarm group, alarm level and alarm status. The alarm status can be either of *Delay, Active* or *Inactive*.

The alarm LED will flash as long as some non-acknowledged alarm are still left, else it will change to a continuous light as long as any active alarm remains left.

The alarm output relays are activated after the alarm delay has passed. The setting of alarm group decides which relay that will be affected by the alarm.

3.12.2 Alarm group

Since alarms can have different priorities, they are divided into four groups: A, B, C and D. The groups are then associated with one alarm output relay each for remote alarm handling. There is also a fifth alternative that means that no output relay are associated with the alarm. Group A is normally considered as the highest priority.

The group can be set separately for each type of alarm, via the Alarm menu.

3.12.3 Delay

The delay time can be set separately for each alarm type. The alarm message on display and the alarm LED are not delayed. Only alarms with duration beyond the alarm delay time affects the alarm output relays and will also be moved to the history queue. In other words, the delay must be passed before the alarm leaves any traces behind.

3.12.4 Acknowledgement

Every alarm type can be separately set for acknowledge demand or automatic return.

Acknowledge demand means that the alarm message, the alarm output relay and the alarm LED continues to indicate alarm until the acknowledge has been done, no matter if the alarm condition is maintained or not.

Automatic return means that the alarm message, the alarm output relay and the alarm LED stops to indicate alarm as soon as the alarm condition no longer is valid.

3.12.5 Alarm queue

There are two kinds of alarm queues, the ordinary alarm queue that keep all the active alarms, and the history queue where the finished alarm are kept. Both queues can keep up to 20 alarms each. The queues can be examined via the Alarm menu.

3.13 EXTERNAL DIGITAL INPUTS

There are five different digital inputs and all of them are alarm inputs. A short-circuit between the two terminal connections means a normal condition. Open circuit means alarm condition.

NOTE: All unused alarm inputs must be short-circuited between the two terminals!!

Fuse monitor indicates that some fuse has tripped.

Fan flow detector indicates fault in the battery compartment fan. Interlocks the equalizing charging.

External mains voltage monitor indicates mains voltage failure.

External alarm 1 is a first auxiliary alarm for optional use.

External alarm 2 is a second auxiliary alarm for optional use. When using remote controlled battery test, this input is used for battery test request.

3.14 EXTERNAL MEASURING INPUTS

There are nine different measuring inputs and they are as follows:

Umeas- is connected to the minus pole of the battery and is a common minus for all voltage measuring. Is also used for the regulation of the charger.

Ubatt1+ is connected to the mid point of the battery string no 1 giving the mid voltage of the battery. If there is an uneven number of batteries, the connection must be done to the midpoint closest to the minus pole. Is only connected if the option for mid voltage measuring is installed, i.e. optional.

Ubatt2+ is connected to the mid point of battery string no 2. Others the same as for *Ubatt1+*.

U_{system} is connected to the plus pole of the battery. Gives the total voltage of the system. Also used for the regulation of the charger.

I_{system} is connected to a 60mV measuring shunt to measure the system current leaving the system. The shunt must be placed in the minus line. Optional.

I_{batt1} is connected to a 60mV measuring shunt to measure the battery current in battery string no 1. The shunt must be placed in the minus line. Optional.

I_{batt2} is connected to a 60mV measuring shunt to measure the battery current in battery string no 2. The shunt must be placed in the minus line. Optional.

Earth sense for earth fault monitoring is connected to the earth point that you want to monitor.

Temperature sensor can be connected for temperature monitoring and float charging voltage regulated by temperature. Optional.

3.15 EXTERNAL DIGITAL OUTPUTS

There are seven digital outputs. They have in common that they provides a zero-potential closing or opening through a relay. Normal closed or normal open is selected separately for each output with jumpers on the connection board KM. The outputs are the following:

Alarm output A is a shared output for all alarms i group A. The relay is energized in normal position and is de-energized by an alarm. It then provides alarm indication even in a dead condition. The output is normally jumpered for opening at alarm.

Alarm output B is a shared output for all alarms i group B. Others are the same as for alarm output A.

Alarm output C is a shared output for all alarms i group C. Others are the same as for alarm output A.

Alarm output D is a shared output for all alarms i group D. Others are the same as for alarm output A.

Fan start is aimed for starting of a battery compartment fan during equalizing charging. The relay is normally de-energized and is energized during fan operation. The output is normally jumpered for closing during fan operation.

Test load is aimed for connection of a dummy load during battery test. The relay is normally de-energized and is energized during battery test. The output is normally jumpered to close for dummy load engaging. Can also be used for request of remote controlled battery test.

Deep discharge protection is aimed to switch off the battery or load at battery voltages that are harmfully low. The relay is normally de-energized and is energized for tripping of the deep discharge protection device. The output is normally jumpered to close for battery or load disconnection.

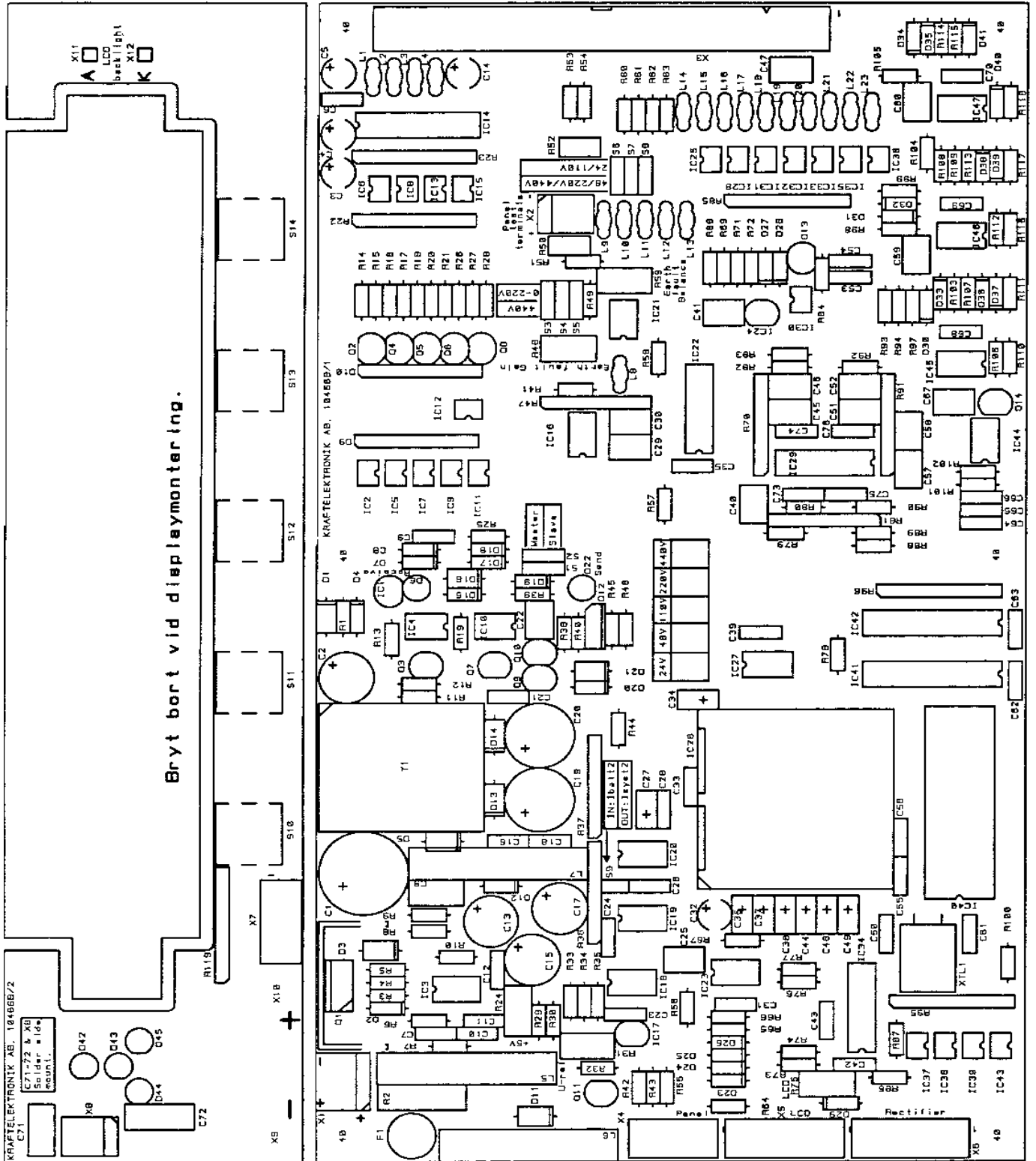
3.16 EXTERNAL SERIAL CHANNEL, RS232

Connection of the external serial channel for RS232 is made through a standard nine-pin D-SUB. The pin-connections conforms to the normal RS232 standard but uses only the pins RxD, TxD, DTR, DSR and GND.

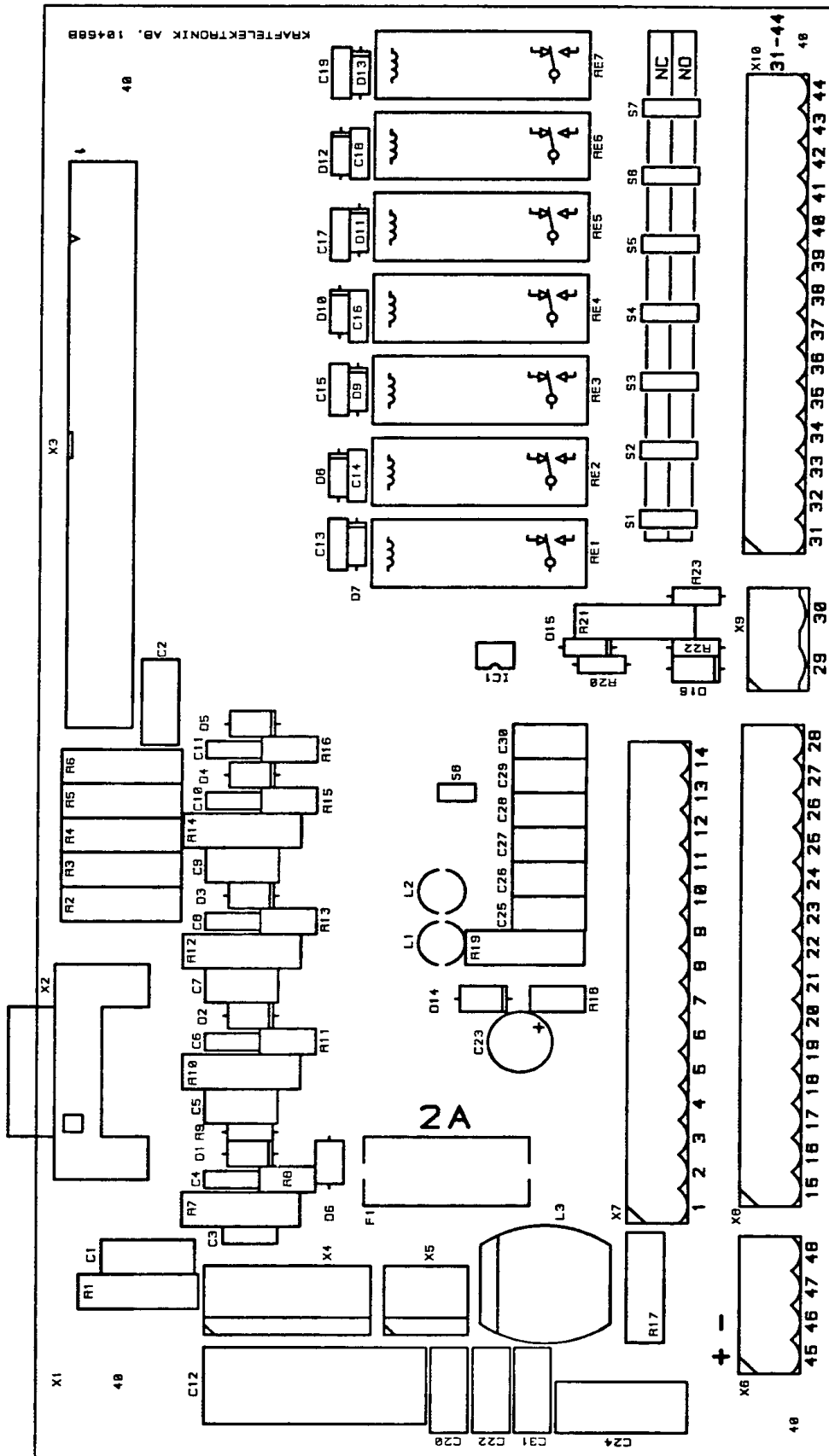
The channel is primarily aimed for a printer or a modem. The data transmission rate is normally 9600 baud.

PROJECT:		UNIT:			
KM-BAS PARAMETER (=Option)	NORMAL SETTINGS		OWN SETTINGS		ALTERNATIVES
	INSTALLED	SETTING	INSTALLED	SETTING	
Rated voltage	--		--		24V/48V/110V/220V
Measuring shunt, system current (60mV)	No	--			5-1200A
Number of rectifiers	--	1	--		1-30
Internal KM-RI	Yes	--		--	Yes/No
Rated current, rectifier	--		--		5-500A
Measuring shunt, rectifier (60mV)	--		--		5-500A
Battery final voltage	--	1.80V/Cell	--		1.50 -2.00V/Cell
Number of battery strings	--	1	--		1-2
Batteryblock type 1, number of cells per block	Yes	1 cell per block	Yes		1-24 cells
Batteryblock type 1, number of blocks	Yes	block	Yes		1-230 block
Batteryblock type 2, number of cells per block	No	1 cell per block			1-24 cells
Batteryblock type 2, number of blocks	No	0 block			0-5 block
Mid voltage measuring	No	--		--	Yes/No
Block voltage measuring	No	--		--	Yes/No
Measuring shunt, battery current (60mV)	No				5-1200A
Temperature measuring	No	--		--	Yes/No
Temperature regulation,charging voltage at 0°C	No	2.35V/Cell			Yes/No, 2.00-2.50V/Cell
Temperature regulation,charging voltage at 40°C	--	2.15V/Cell	--		2.00-2.50V/Cell
Automatic equalizing charging, level 1	--	2.05V/Cell	--		1.90-2.20V/Cell
Automatic equalizing charging, level 2	--	2.25V/Cell	--		2.15-2.35V/Cell
Automatic equalizing charging, K-factor	--	5	--		1-16
Repeated equalizing charging, interval	--	3 weeks	--		1-12 weeks
Repeated equalizing charging, charging time	--	4 hours	--		1-24 hours
Equalizing charging method	--	Manual only	--		Man/Aut/Repeated

ALARM TEXT	NORMAL SETTINGS				OWN SETTINGS			
	GROUP	ACKNOWL.	DELAY	LEVEL	GROUP	ACKNOWL.	DELAY	LEVEL
Overvoltage 1	C	Aut	5s	2.29V/c				
Overvoltage 2	A	Aut	5s	2.40V/c				
Undervoltage 1	C	Aut	5s	2.21V/c				
Undervoltage 2	A	Aut	5s	1.85V/c				
No charging	None	Aut	5s	2.15V/c				
System overloaded	D	Ackn.	60s	--				--
Fuse tripped	B	Ackn.	1.0s	--				--
Earthfault to +	B	Ackn.	1.0s	100kohm				
Earthfault to -	B	Ackn.	1.0s	100kohm				
Deep discharge protection tripped	A	Ackn.	60s	1.70V/c		Ackn.		
Battery circuit fault	B	Ackn.	0.1s	1.96V/c		Ackn.		
Current difference in battery strings	C	Ackn.	10m	10%				
U-difference in battery string	C	Ackn.	10m	0.20V				
High battery temperature	D	Ackn.	60m	30°C				
Low battery temperature	D	Ackn.	60m	15°C				
U-difference in battery block	C	Ackn.	10m	5%				
Fault in rectifier	B	Aut	1.0s	--				--
Divergent current, rectifier	C	Aut	60s	10%				
Charging circuit fault, rectifier	B	Aut	0.1s	--				--
Mains failure	None	Aut	1.0s	--				--
Fan failure	C	Ackn.	30s	--		Ackn.		--
External alarm no 1 tripped	None	Aut	1.0s	--				--
External alarm no 2 tripped	None	Aut	1.0s	--				--
Internal error	B	Ackn.	0.1s	--				--
Unit x doesn't answer	None	Aut	60s	--				--
Battery failure	B	Ackn.	0.1s	--		Ackn.		--
Charging interrupted	B	Aut	60s	--				--

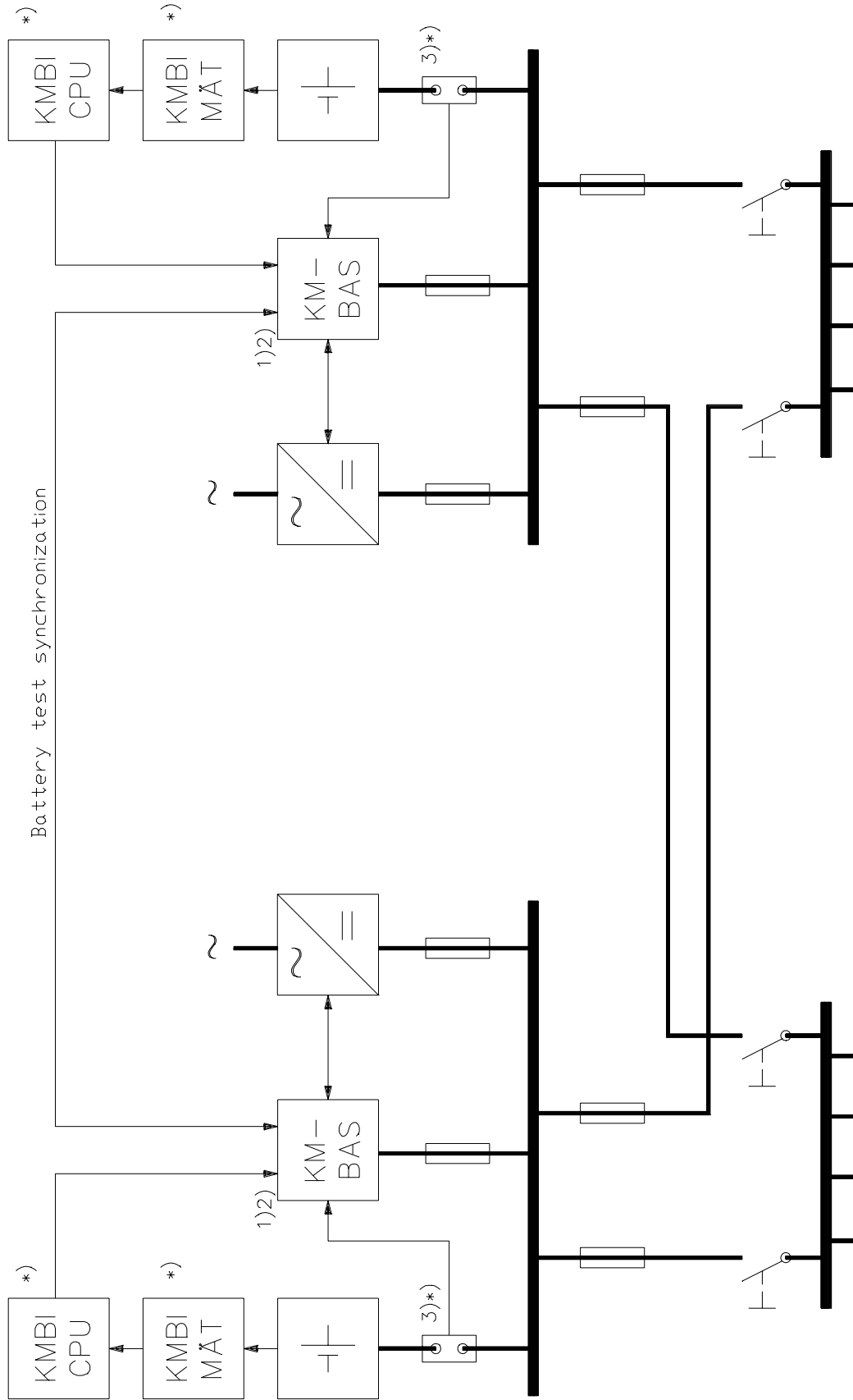


Component location, KM-BAS
 Drawing no: 4-10466-B



Component location, Connection board KM
 Drawing no: 4-10468-B

DC-SYSTEM ACCORDING TO SS4281902 FIGURE 3, WITH KRAFTMASTER



- *) Option.
 1) When there is connection between the system halves, only one earth fault measuring device must be connected. The simplest solution is to disconnect the earth fault measuring terminal from one of the KMBAS units.
 2) KMBAS can either be integrated in the charger (UNIQ) or be standing by itself (KM-19").
 3) Battery current shunt must be placed in the minus-bar.

Appendix D
ADDITIONS AND CHANGES

