

Manual for Monitoring unit type PCM2



SAFETY INSTRUCTIONS



You must read this manual **before** installation, use or work on the product.



This product contains dangerous voltage that when touched can cause electric shock, burns or death.

The product must be installed by qualified personnel and according to the installation instructions. Service may only be performed by authorised service personnel. The equipment housing may only be removed by authorised personnel when all power has been cut to the equipment for at least five minutes. The protective covers and contact safety devices inside the equipment may only be removed by authorised service personnel.

The power must always be disconnected in a safe way before starting any service/maintenance.

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We reserve the right to make changes to the content of this manual without prior notification.

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1 PRESENTATION

The monitoring unit type PCM2 is designed for monitoring and control of battery based DC systems.

A strict safety approach characterises the whole product. This is evident in things like the well-planned alarm functions, the important control characteristics such as the temperature controlled float charging voltage and an operator panel with graphic clear text display based on a simple and easy to understand menu system and alarm indication with both LEDs and clear text messages.

These instructions above all deal with all operation of the monitoring unit and are therefore chiefly aimed at the personnel that have the day to day responsibility for running the installation, but also to other personnel who have cause to work with the DC system.

It also contains information on installation, commissioning, service, maintenance and technical data that is specific to the monitoring unit and is therefore aimed at the personnel who are responsible for these areas.

The monitoring unit usually works in combination with one or more rectifiers in a complete DC system. For the description of the rectifier and the system in general, we refer you to the general system manual.

2 SAFETY INSTRUCTIONS



This product contains dangerous voltage that when touched can cause electric shock, burns or death.

For safety reasons the affected personnel are classified according to the following requirements for specific skills.

Authorised service personnel:

- Have electrical training and adequate experience to avoid the dangers that electricity can cause.
- Are certified to meet authority requirements for the work in question.
- Have linguistic skills that ensure the content in this description cannot be misunderstood.
- Have undergone a product specific training programme for authorised service personnel that is approved by Kraftelektronik AB.

Qualified personnel:

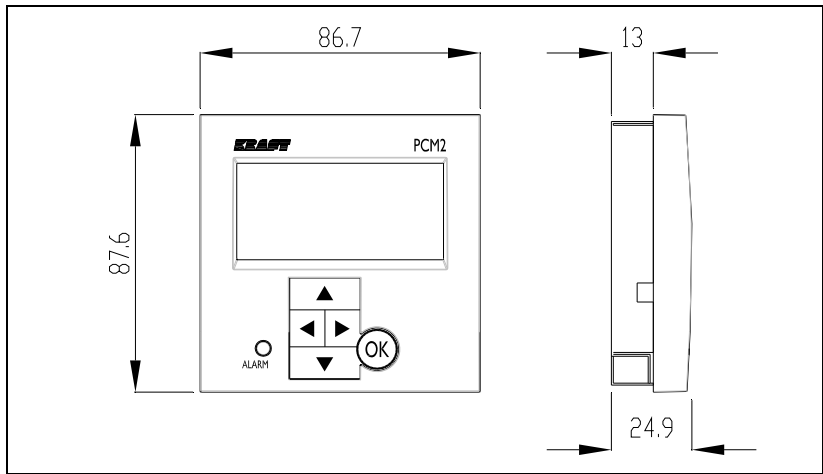
- Have electrical training and adequate experience to avoid the dangers that electricity can cause.
- Are certified to meet authority requirements for the work in question.
- Have linguistic skills that ensure the content in this description cannot be misunderstood.

Installation, service, maintenance and fault tracing may only be carried out by authorised personnel and in accordance with the installation manual.

The protective covers and contact safety devices inside the equipment may only be removed by authorised service personnel.

Mounting For folding into panel

Dimensions See diagram below

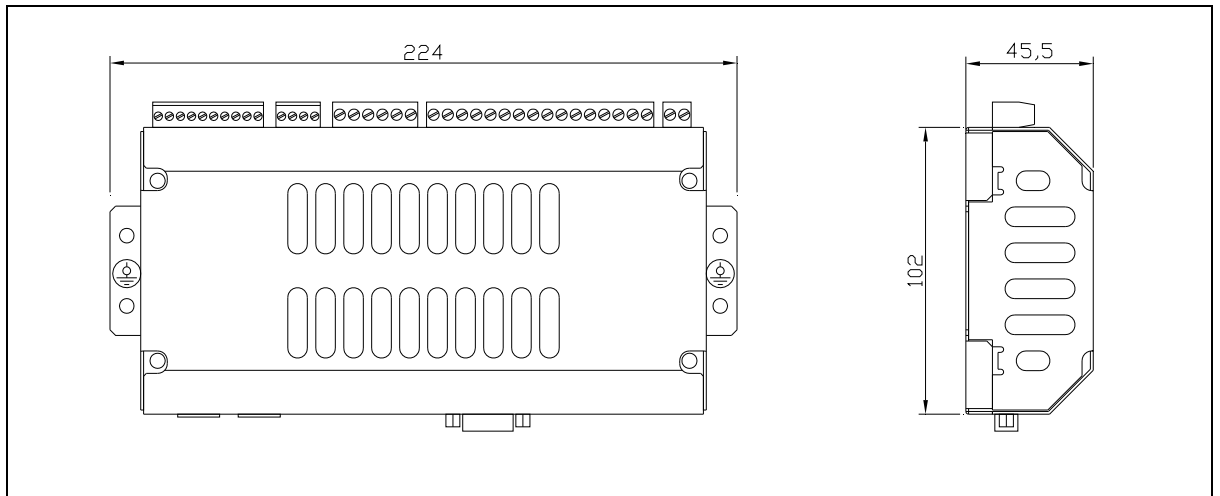


Dimensional draft operator panel

3.3.2 I/O module

Mounting On terminal rail or direct on vertical surface

Dimensions See diagram below



Dimensional draft I/O module

3.4 Conformity with standards

EN 60529..... Class of enclosure IP20

EN 50178..... LVD. Electronic equipment, including power electronics in electrical power installations.

EMC standards Tested in a system context, not as individual product. See relevant system manual.

4 FUNCTIONAL DESCRIPTION

4.1 GENERAL

PCM2 is designed to monitor and to a certain extent control a direct current system that is based on batteries, rectifiers and distribution.

The main functions are:

- Monitoring of system parameters such as voltage, current, earth fault resistance, temperature, and others.
- Alarm management through analysis of own measurement data, automatic tests and collection of data from external units.
- Alarm indication in clear text on display, LED for general alarm and relay outputs for external alarm handling.
- Control of the charging process such as equalizing charging, temperature control float charging voltage and tests with lowered voltage (battery circuit test).
- Operator communications via display, push buttons and LEDs for alarm indication.

A special case is when PCM2 is only used for monitoring without the option of communications with the rectifier. A number of rectifier dependent functions are then superfluous or have no relevance. This is described in more detail in connection with the parameter that controls this function, see section 5.14.4.

4.2 OPERATOR PANEL

The operator panel is the unit used as the user interface. This contains a graphic display, push buttons, LEDs for alarm indication and an internal microprocessor. It is connected firstly to the I/O unit via a RJ45 cable, and secondly to the rectifier via a RJ11 cable.

As an option it is possible to connect another operator panel for use in a control room, for example.

4.3 I/O UNIT

The I/O unit contains an adapter for the external connections required for the monitoring unit. This also contains circuits for digital inputs/outputs, measurement circuits, power supply and microprocessor. It is connected to the operator panel via a RJ45 cable.

4.4 FUNCTIONS

4.4.1 Float charging

Float charging is the normal operating mode determined by the battery. The voltage level is set according to the battery manufacturer instructions.

The rectifier's float charging voltage may have temperature control. This is providing that the monitoring unit is fitted with an external temperature sensor for measurement of the battery's ambient temperature (see section 6.4.3.4). This control is based on a number of parameters based on information from the battery manufacturer, see section 5.13.4.

NOTE: If two temperature controlled direct current systems are connected (see “Double systems”, section 4.4.4), the system that provides the highest voltage (measures the lowest temperature) will determine the total system voltage.

4.4.2 Equalizing charging

4.4.2.1 General

Equalizing charging means charging with raised voltage level for a limited period. For equalizing charging the “FAN” output is activated to start a battery compartment fan if necessary. The output continues to be activated for an additional 60 minutes following a completed equalizing charge to ensure the evacuation of explosive gases.

In certain circumstances, equalization charging may not occur. This could, for example, apply if the flow guard in the battery compartment fan indicates a fault or if a load that cannot withstand the raised voltage is connected. This is handled via the digital input “EQ. BLOCKED”. Open input prevents equalizing charging.

All types of equalizing charging can always be stopped manually via a single press of a button.

Two different types of equalizing charging are available:

1. Manual equalizing charging
2. Automatic 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.

4.4.2.2 Manual equalizing charging

Manuel equalizing charging means that you give a manual request to start equalizing charging with a certain length. Equalizing charging starts immediately after the request and continues for a specified period. See section 5.8.2.

4.4.2.3 Automatic equalizing charging

Automatic equalizing charging takes place following a mains power failure.

During a mains power failure, the time (t) is measured for the voltage remaining below a certain level (*Level 1*). Equalizing charging starts when mains voltage has returned. From the time the system voltage has reached *Level 2*, equalizing charging continues for a further period $t * K$, that is, however, restricted to a max 24 hours.

The *Level 1*, *Level 2* and *K* parameters are specified in the *Functions* menu, see section 5.13.6.

4.4.3 Battery circuit test

4.4.3.1 Simple battery circuit test

A simple battery circuit test is automatically carried out at optional intervals (normally once a day). The test involves checking that the entire battery circuit, i.e. not only the battery block is in working order.

The test is made over a short period of time (about 5 seconds) by lowering the voltage level of the rectifiers to a test level. In order for the test to be approved, the system voltage must not drop below the set alarm level over the period. The alarm that is initiated is the *Battery circuit fault*.

An extra battery circuit test can be started manually. This manually started test works exactly as above and is also based on the same parameters, see section 5.8.3.

4.4.3.2 Advanced battery circuit test

The simple battery circuit test primarily finds faults that are purely of the failure type while more diffuse problems that only give an abnormally high resistance require another type of test. The faults that are the main target of the advanced test are sulphated (aged) battery cells that become evident through an increased inner resistance.

Every seventh occasion a simple battery test is started, usually once a week, this is changed to an advanced test. The advanced test means lowering the output voltage level for a significantly longer period, around 3 minutes, in order for the fault to reveal itself. A certain basic load is required to produce a reliable result. The fault reveals itself by the mid voltage of the battery moving to one of the poles. The alarm that is initiated is *Symmetry fault 2*. This requires that the mid voltage measurement function is installed, see section 6.4.3.2.

The reason for the advanced test not being executed each time is that you should avoid running the battery cycle unnecessarily. Furthermore sulphating is a slow process, as opposed to a failure that may come suddenly.

4.4.4 Double systems

4.4.4.1 General

Double systems mean that there are two separate sub-systems, system A and B, fitted with rectifier and battery. The sub-systems can in certain situations be galvanically connected. In a separated condition, the systems work as two completely independent systems. In a connected state, the sub-systems need to work together in issues concerning earth fault measurement and battery circuit tests etc.

4.4.4.2 Earth fault measuring

There may never be more than one piece of equipment at a time for earth fault measurement connected in one system. In other cases there will be a measurement fault due to them measuring each other's measurement input impedance. In order to prevent this, do as follows:

System B always measures earth faults.

System A, however, only measures earth faults as long as the input "E.F. BLOCKED" is inactive (closed). Active (open) input signals that systems A and B are connected which means that system A closes down its earth fault measurement by galvanically insulating the measurement inputs for earth fault measurement from the control electronics.

4.4.4.3 Battery circuit test

As long as both sub-systems are separated, each sub-system carries out a battery circuit test independent of each other. In a connected state, it is system A that initiates the battery circuit test. The "BATT.TEST" output in system A is connected to input "E.F. BLOCKED (batt.test)" in system B. When system A closes the loop, system B will also lower its voltage.

4.4.4.4 Load sharing

The load sharing between the two connected systems will only take place passively (through the RI compensation that is formed naturally in the cabling between the sub-systems). No active load sharing takes place between the two sub-systems.

4.4.4.5 System setup

One example of the system setup with the connections that are specific to double systems is shown in [Appendix D](#). This is based primarily on the configuration specified in the standard SS4281902 but can also be said to apply to the system diagram specified in KATS 9.1, type station 2 specified in Svenska Elverksföreningens (*Swedish Electricity Distributors*) "Direct current supply of protective systems" and Appendix 1 in Vattenfalls PV-2004/173.

The only thing that actually distinguishes different configurations from the monitoring unit's perspective is the number of distribution boards that can be connected to both sub-systems via cross-connector breakers. Regardless of the complexity in this, there are still only two simple points that need a solution:

1. System A must be notified whether the two sub-systems are connected or not in order to handle the earth fault measurement.
The cross connector breakers are fitted with breaking auxiliary contacts. These are connected to the input "E.F. BLOCKED" in system A. This is organised in such a way that the loop is broken when both sub-systems are connected.
2. Each sub-system must notify whether equalizing charging is to be permitted or not.
The cross connector breakers are fitted with breaking auxiliary contacts. These are connected to the input "EQ BLOCKED" in each sub-system. This is organised in such a way that the loop is broken when the sub-system is connected to any load. If possible, even a fan guard (closing when airflow occurs) is connected in a series with the loop.

5 OPERATION

5.1 General

Communications between the rectifier and operator is made up of a display, a number of push buttons and a LED. The display information is built as a menu system in what is known as a tree structure. On the display, information about system status, parameter settings, alarms etc, is presented. Furthermore, you can adjust parameters for both installation and operation. All settings are made via the display's menu system, i.e. actuators in the form of trimming potentiometers and equivalent are eliminated.

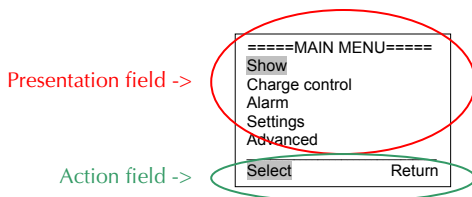
5.2 OPERATOR PANEL

5.2.1 Display

The display is a multi-row graphic clear text display. It is illuminated from the rear and has white text on a clear blue background to produce the best conceivable display in all light conditions.

The text field is in principle divided into two parts:

1. The presentations field for presentation of data, menu options and other selectable options.
2. Action field for choice of action



Selected options or actions are shown in inverted text.

5.2.2 Push buttons

The push buttons are used to provide instructions for the menu system. Their function varies to a certain extent depending on where in the menu system you are. In most situations it is clear from the display which buttons are relevant at each particular time. Their main tasks can be described as follows:

Arrow up/down

These buttons have different functions depending on the menu screen.

1. For selecting vertically listed options in the presentation field.
2. To increase/reduce parameter values.
3. To browse through the alarm queue.

Arrow left/right

These buttons also have different functions depending on the menu screen.

1. For selection of action options in the action field.
2. In a few of the menu screens there is a list of selectable options located horizontally rather than vertically. In these cases you use the left/right arrows. As you cannot do two things at the same time with these buttons, these screens never have more than one option in the action field.

OK button

The OK button is used to carry out a selected action in the action field. The normal procedure is to first select the option or value in the presentation field using arrow up/down, and then selecting the action in the action field using arrow left/right and then finishing with OK.

5.2.3 LED “Alarm”

The alarm-LED is turned off in normal conditions.

A flashing red light indicates that there are alarms that are waiting to be acknowledged.

A permanent red light indicates that there are alarms that have already been acknowledged but are still active, i.e. the alarm condition is still met.

5.3 MENU MANAGEMENT

5.3.1 General

Information exchange with the operator is based on a menu system. It has a tree-like structure with an initial screen at the top and a main menu underneath that is divided into sub-menus.

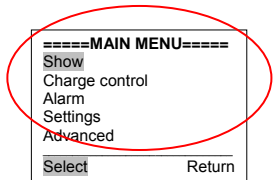
The screen is divided into presentation field and action field, see section 5.2.1.

If the display appears in any other condition than the initial screen, there will be an automatic return to the initial screen after about 1 hour.

5.3.2 Select menu option

Use the “↑” and “↓” buttons to select the menu option and other options in the presentation field. The selected option is marked in inverted text. You change the values and setting options using the “↑” and “↓” buttons. The exception is a few menu options where you use the “←” and “→” buttons for setting options.

Select menu option with ↑ and ↓.



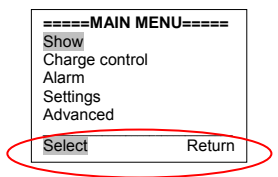
The menu options could be more than the number of available rows in the display. In these situations a “rolling” menu appears. This means that more options appear when you move “outside” the existing rows. It works in principle as if they were printed on a roll that rotates. This also means that you ultimately return to the beginning if you continue to step through the list. A dashed row shows the limit between the beginning and end of the menu options.

5.3.3 Take action

Use the “←” and “→” buttons to select the action to take in the action field. End with OK to execute the selected action.

The *Select* action means that you confirm the option you have selected in the presentation field.

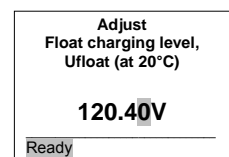
Select action option using ← and →.



The *Return* action means that you leave the existing menu screen and go back a step to the initial screen.

5.3.4 Adjust value

The values are changed one digit at a time. Select number using the “←” and “→” buttons. Now adjust the number up/down using the “↑” and “↓” buttons. End with OK when the value is the one you want.

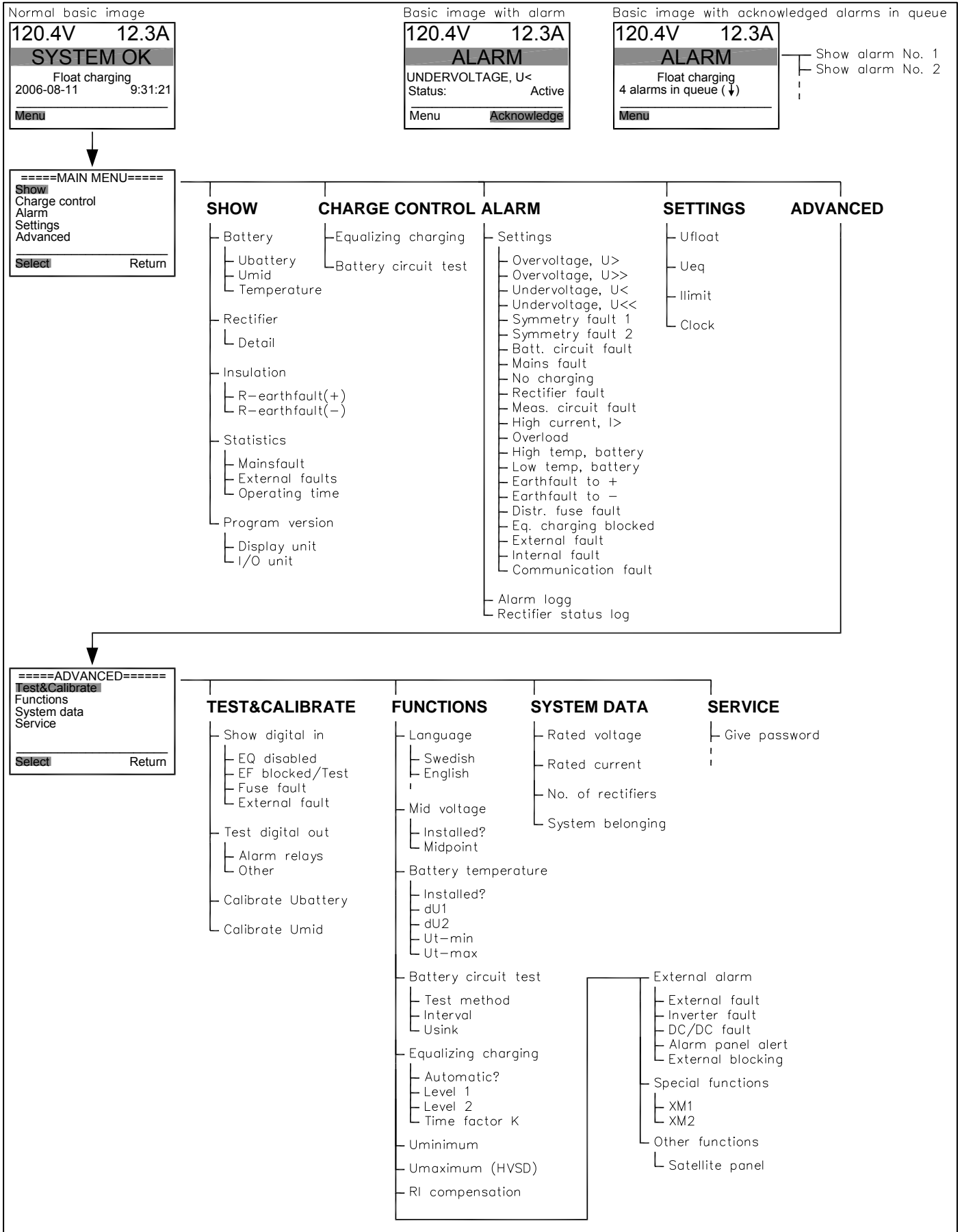


If the set value is not within the permitted limits, this screen appears for a few seconds. The screen above for adjusting the value now reappears, but with the value adjusted to the closest permitted limit value.

Value not within
limits. Adjusted
automatically.

5.4 MENU OVERVIEW

On the next page a complete overview covering all menu options will follow. The sections that then follow in this chapter describe the menu options in detail.



Menu overview, PCM2 (Drawing number 11189c)

5.5 INITIAL SCREEN

5.5.1 General

The initial screen is the screen displayed if no actions are taken. Additionally, the display will automatically return to this state if no button has been pushed within 1 hour.

At the top you can always see the present battery voltage and the total output current from the rectifiers. The next row shows *System OK* if everything is working normally, or *Alarm* if there is an alarm condition in progress.

Select the *Menu* action option and then press the OK button to enter the menu system.

5.5.2 Normal float charging condition

Normal float charging condition is specified with the text *Float charging*. The present date and time are specified on the row underneath.

120.4V	12.3A
SYSTEM OK	
Float charging	
2006-08-11	9:31:21
Menu	

5.5.3 Other charging conditions

The alternative charging conditions are "Equalizing charging", "Testlevel Usink" and "Rectifier switched off".

For equalizing charging the remaining time is also displayed. The exception is at the beginning of an automatic equalizing charging cycle, where data for calculating the charge time is missing.

The action field contains the *Stop* option for cancelling the current equalizing charging.

126.9V	21.6A
SYSTEM OK	
Equalizing charging	
3h24m left	
Menu Stop	

"Testlevel Usink" displays when testing with lowered voltage, e.g. battery circuit test.

"Rectifier switched off" displays when the rectifiers shut down via the digital input *External blocking*.

5.5.4 Alarm

An alarm condition always starts with an alarm message that is awaiting acknowledgment. This is described in more detail in section 5.16 later. As soon as all the relevant alarms are acknowledged, the screen here to the side appears. It shows how many alarms there are in the alarm queue. You can use the "↓" key to start browsing through the alarms in the queue. The alarm queue can store up to 20 alarms including unacknowledged alarms. The alarms are sorted in time order with the most recent alarm first in the queue.

120.4V	12.3A
ALARM	
Float charging	
4 alarms in queue (↓)	
Menu	

Note that in certain cases when acknowledging, it may appear as if the alarm cannot be acknowledged. This is due instead to an alarm with an acknowledge demand having come and gone several times. The result is that this is present in many places in the queue and thereby needs to be acknowledged several times.

5.5.5 Set clock

When starting the monitoring unit following absence of power, e.g. following commissioning or service, the clock must be set to the present date and time. The *Set clock* action option will remain in the action field as long as this is not done.

See section 5.10.5 for setting date and time.

120.4V	12.3A
SYSTEM OK	
Float charging	
2006-08-11	9:31:21
Menu Set clock	

5.6 MAIN MENU

The main menu consists of five main headings *Show*, *Charge control*, *Alarm*, *Settings* and *Advanced*. Use the “↓” and “↑” buttons to browse through the main headings. Ensure that the *Select* action option is highlighted and then press the OK button to continue to the selected main heading.

```
====MAIN MENU====
Show
Charge control
Alarm
Settings
Advanced
Select          Return
```

A set of main headers is concealed behind the *Advanced* main heading. These manage the test and calibration functions and basic selections of functions and basic data.

If PCM2 is used solely as a monitor (number of rectifiers = 0) the *Charge control* option cannot be selected.



WARNING! *The settings under the Advanced heading are critical for the functionality of the system. Start by reading carefully through the instructions in this manual. Then only change if you are absolutely sure about what you are doing!*

5.7 SHOW

5.7.1 General

Under the *Show* header there is a presentation of status in the form of measurement values and other operating data from battery, rectifier and the general system. This includes displaying certain operating statistics.

```
=====SHOW=====
Battery
Rectifier
Insulation
Statistics
Program version
Select          Return
```

If PCM2 is used solely as a monitor (number of rectifiers = 0) the *Rectifier* option cannot be selected.

5.7.2 Show battery related data

Shows battery terminal voltage, battery mid voltage and battery temperature.

The mid voltage and temperature are only shown if relevant measuring sensors are installed. This is controlled in the *Functions* menu, see sections 5.13.3 and 5.13.4.

```
===SHOW/BATTERY===
Ubattery:      120.4V
Umid:          60.2V
Temperature:   +22°C
Return
```

5.7.3 Show rectifier

5.7.3.1 Show voltage and current

Show the voltage and current that each rectifier unit measures and reports to the monitoring unit.

To show more detailed information on a rectifier unit, select the *Detail* action option.

```
=SHOW/RECTIFIER=
Rect1: 120.4V 6.43A
Rect2: 120.4V 6.43A
Rect3: 120.4V 6.43A
Rect4: 120.4V 6.43A
Detail          Return
```

5.7.3.2 Show detailed rectifier data

The available data from the rectifier unit is stored in what is called a RAM variable. The variables are 8 bits long and have an address range from 0 to 255. A table describing the variables can be found in [Appendix C](#).

```
Rectifier No 1:
RAM-variable, addr 0
0000 1000 0000 0111
08      2055      07
Return
```

Select variable address using the “↓” and “↑” buttons. Two variable addresses, i.e. a total of 16 bits are displayed at a time. The lower of these two addresses (even numbers) are displayed as bit no. 0-7 while the higher (odd numbers) are displayed as bit no. 8-15.

The row with individual bits starts with bit no 15 to the left and ends with bit no 0 to the right.

The row underneath shows the variable in decimal format in three ways. In the middle the whole 16 bits value of the two addresses is shown, to the right the 8 bits value of the lower address and to the left the 8 bits value of the higher address.

5.7.4 Show Insulation

Shows the system's earth fault resistance as positive and negative directly in kΩ and MΩ. If the resistance exceeds 5MΩ, >5MΩ is shown instead.

```

==SHOW/INSULATION==
R-earthfault(+) >5MΩ
R-earthfault(-) 487kΩ

Return
    
```

At closed down earth fault measuring (see section 4.4.4.2), “_” is shown instead of the value.

5.7.5 Show statistics

5.7.5.1 Menu option

Select from the menu options *Mains fault*, *External faults* and *Operating time*.

If PCM2 is used solely as a monitor (number of rectifiers = 0) the *Mains fault* option cannot be selected.

```

==SHOW/STATISTICS=
Mainsfault
External faults
Operating time

Select Return
    
```

5.7.5.2 Mains fault

For mains power failure, the total number, when the last fault occurred and how long it lasted are shown.

```

===./MAINSFAULT===
Number of: 13
Latest:
2006-08-03 13:24
Duration: 1h16m14s

Return
    
```

5.7.5.3 External fault

Shows the number of events that have occurred for the digital input for external faults (see section 6.4.4.5).

```

====./EXTFAULT====
No.of ext.faults: 2

Return
    
```

5.7.5.4 Operating time

Shows the following operating times:

1. Total operating time.
2. Total operating time for a battery temperature exceeding +25°C.
3. Total operating time for a battery temperature exceeding +30°C.

```

==./OPERATING TIME=
Total: 561 days
Above 25°C: 15h
Above 30°C: 0h

Return
    
```

5.7.5.5 Program version

Shows the applicable program version in the operator panel and I/O unit.

```

SHOW/PROG.VERSION
Display unit 102
I/O unit 101

Return
    
```

5.8 CHARGE CONTROL

5.8.1 General

Under the *Charge control* you can start and stop equalizing charging and initiate a battery circuit test.

If PCM2 is used solely as a monitor (number of rectifiers = 0) this menu cannot be reached.

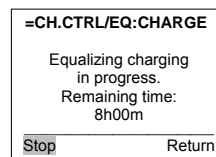
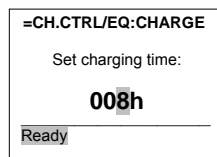
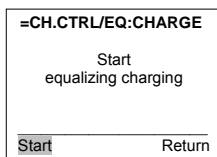
```

==CHARGE CONTROL=
Equalizing charging
Battery circuit test

Select Return
    
```

5.8.2 Start/stop equalizing charging

Start by selecting *Start*. Then set the required charging time in hours and confirm with OK.



The ongoing equalizing charging can be interrupted by selecting the *Stop* action option and then confirming with OK. The equalizing charging can also be stopped when the initial screen appears.

The ongoing equalizing charging can be interrupted by selecting the *Stop* action option and then confirming with OK. The equalizing charging can also be stopped when the initial screen appears.

NOTE: Equalizing charging can be blocked via the digital input *EQ*. *Blocked*. Only when this input is closed is equalizing charging permitted to start.

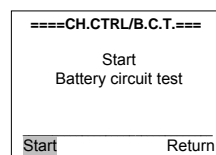
See also sections 6.4.4 [Digital inputs](#) and 4.4.2 [Equalizing charging](#).



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.

5.8.3 Manual battery circuit test

A battery circuit test is carried out automatically at regular intervals (selectable, see section 5.13.5). However you can carry out additional battery circuit tests by selecting the *Start* action option here and confirming with OK. The test is carried out and the results communicated.



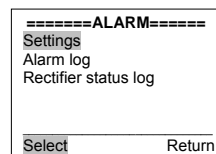
See also section 4.4.3, [Battery circuit test](#).

5.9 ALARM

5.9.1 General

For every alarm type there are a number of settings that can be made. Under the *Settings* heading you can read and change these parameters for each alarm that may appear in the system.

See section 5.16 for a list and description of all the applicable alarm messages.

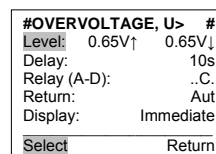
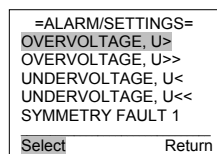


Under the *Alarm log* you will see a list of the alarm events that have occurred.

Under *Rectifier status log*, the alarm history for the rectifiers is shown.

5.9.2 Alarm settings

Select alarm using the “↓” and “↑” buttons. The alarms are in a rolling list which means that more appear when you browse past the first or last in the screen.

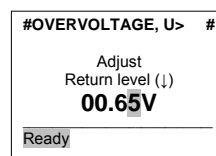
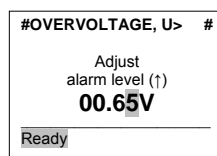


Press OK to view a list of the parameters that belong to the selected alarm option. Each parameter is shown with the associated present setting.

5.9.2.1 Level

There are two levels for each alarm; alarm level and return level.

The alarm level is the limit value that applies in order to

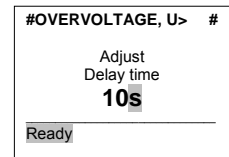


activate the alarm.

The return level is the limit value that applies in order to reset the alarm following activation. The difference between the alarm level and return level is usually termed hysteresis. Normal basic settings are hysteresis = zero, i.e. alarm level = return level.

5.9.2.2 Delay

Alarm delay is the time that must pass with the alarm condition fulfilled for the alarm to trip the alarm relay and be qualified for an acknowledge demand. An alarm that does not fulfil the alarm condition during the whole delay time disappears without leaving any trace behind. The delay time can be set in tenths of seconds, seconds, minutes or hours. It permits delay times from 0.1s to 63 hours.

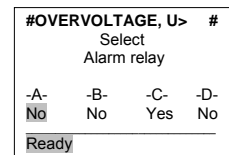


Note that it is not just the time but also the time unit that can be set. Start by placing the cursor on the unit letter and selecting the unit. The options are seconds with one decimal, seconds as whole numbers, minutes and hours.

Now move the cursor to one of the numbers and set the required time.

5.9.2.3 Relay (A-D)

“ABCD” represents each of the four alarm output relays A to D. Under each relay letter you will see Yes or No. The Yes option specifies that the relay will be activated by an alarm. All combinations are permitted, from no relay to all relays at once.



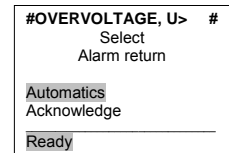
Use the “←” and “→” buttons to move the cursor to the required relay. Now use the “↓” and “↑” buttons to switch between the options Yes and No. Complete the process by pressing OK.

5.9.2.4 Return

The alarm return can be selected to either automatic return or return after acknowledge.

Automatic return is performed as soon as the alarm condition ceases to apply.

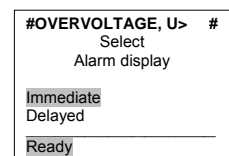
Acknowledge demand means partly that the alarm message remains until the alarm is acknowledged (if the delay time has expired), and partly that the alarm relays return when both the alarm condition has stopped and an acknowledge is performed.



5.9.2.5 Show

The *Immediate* option displays the alarm message on the display directly after the alarm condition starts to apply, which is the normal procedure.

In certain cases it may be desirable to suppress the alarm message during the delay time. In this case select the *Delayed* option.

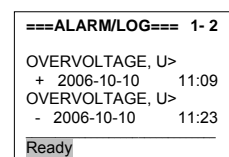


5.9.3 Alarm log

The alarm log shows the last fifty alarm events. Two events are shown at a time. The two positions in the list that are currently shown are specified top right.

The alarm text, type of event and date and time of the event are shown in each instance. The type of events that could occur include:

1. Alarm came, i.e. alarm condition met. Specified with “+”.
2. Alarm went, i.e. alarm condition ended, Specified with “-”.
3. Alarm acknowledged. Specified with “Ack”.



5.9.4 Rectifier status log

Shows rectifier status at the five latest occurrences of the alarm "Rectifier fault", of which the latest on top. For description of separate status bits, see [Appendix C](#).

```
=ALARM/RECTSTATUS=
0000 1000 0000 0111
0000 1000 0000 0111
0000 1000 0000 0111
0000 1000 0000 0111
0000 1000 0000 0111
Return
```

5.10 SETTINGS

5.10.1 General

Under the *Settings* heading you set the rectifier's output voltage for float charging and equalizing charging, and the rectifier level for current limit. There is also the option here for adjusting the built-in clock.

```
====SETTINGS====
Ufloat: 120.4V
Ueq: 126.9V
Ilimit: 100%
Clock: 09:31:21
Select Return
```

If PCM2 is used solely as a monitor (number of rectifiers = 0) the *Ueq* and *Ilimit* options cannot be selected.

5.10.2 Adjust the voltage level for float charging

Set the required voltage level for float charging. If the actual float charging voltage does not appear to match the set value, this is probably due to the float charging voltage being temperature controlled. The value you set here is the level that applies at +20°C.

```
Adjust
float charging level,
Ufloat (at 20°C)

120.40V
Ready
```

If PCM2 is used solely as a monitor (number of rectifiers = 0) this value does not control the voltage level, but is only used as a reference level for monitoring.

Note that the voltage is limited to maximum 1% below the level U_{maximum} , see section 5.13.8.



WARNING! *The batteries will be damaged by an incorrectly set float charging voltage. Always observe the recommendations given by the battery manufacturer.*

5.10.3 Adjust the voltage level for equalizing charging

Set the required voltage level for equalizing charging.

```
Adjust
equalizing charging
level, Ueq

126.90V
Ready
```

The voltage level for equalizing charging is a fixed absolute level, i.e. it is not temperature controlled.

Note that the voltage is limited to maximum 1% below the level U_{maximum} , see section 5.13.8.



WARNING! *Batteries and load can be damaged by incorrectly set equalizing charging voltage. Always observe the recommendations and relevant installation specifications given by the battery manufacturer.*

5.10.4 Adjust the current limit value

Set the required level for the rectifier's current limit. The level is set as a percentage of rated current.

```
Adjust
current limit level
limit

100%
Ready
```

5.10.5 Adjust clock

After all power to the monitoring unit has been cut, the clock must be set, see also section 5.5.5. But even after an extended period of normal operation, the clock may ultimately need to be adjusted.

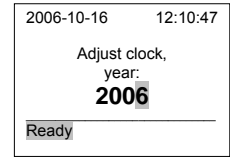
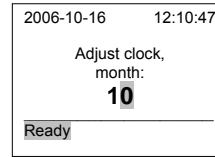
```
2006-10-16 12:10:47
Adjust clock,
minute:
10
Ready
```

```
2006-10-16 12:10:47
Adjust clock,
hour:
12
Ready
```

```
2006-10-16 12:10:47
Adjust clock,
day:
16
Ready
```

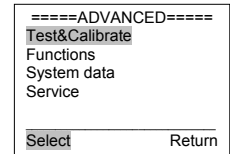
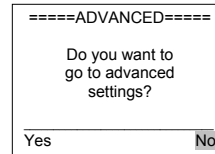
The most important function of the clock is for a time stamp of alarm events. In order for time stamping to be reliable, it is therefore good practise to check that the clock is correct from time to time.

Minute, hour, day, month and year are adjusted individually in sequence.



5.11 ADVANCED

A set of main headers is concealed behind the *Advanced* main heading. These manage the test functions and calibration options, basic selections of functions and basic data and a service condition.

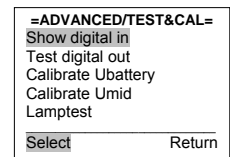


WARNING! *The settings under the Advanced heading are critical for the functionality of the system. Read the manual carefully first. Then only change if you are absolutely sure about what you are doing!*

5.12 TEST & CALIBRATE

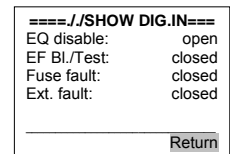
5.12.1 General

The functions under the *Test&Calibrate* are primarily designed for use during commissioning and service.



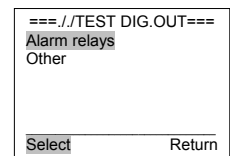
5.12.2 Show status for digital Inputs

Shows the current status for the monitoring unit's digital inputs. The 6.4.4 section has a more detailed description of the digital inputs.



5.12.3 Test digital outputs

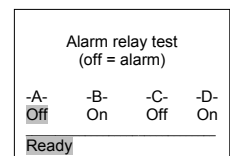
This menu is primarily intended for testing the external alarm circuits without the need of invoking actual alarms, and is designed for use chiefly in connection with installation and commissioning.



In addition to alarm circuits, other digital outputs can be tested in the same way.

5.12.3.1 Test alarm outputs

By manually forcing the alarm relays you can easily test the external alarm circuits.

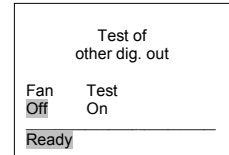


Use the “←” and “→” buttons to move the cursor to the required relay. Now use the “↓” and “↑” buttons to switch between the options *On* and *Off* where *Off* is the condition for an active alarm. Complete the process by pressing OK.

The alarm relays are reset automatically to their ordinary position when you leave this menu.

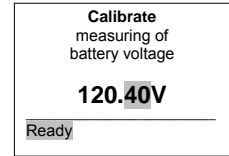
5.12.3.2 Test other outputs

In the same way as the alarm outputs, you can test the external circuits for the digital outputs for the battery compartment fan and test mode request. See also the section 6.4.5 for a more detailed description of the outputs.



5.12.4 Callbrate measuring of battery voltage.

Here you calibrate the monitoring unit's measurement instrument for battery voltage to ensure the measurement value matches the actual battery voltage. This is done on delivery from the factory, but can also be done during the stipulated routine inspections.



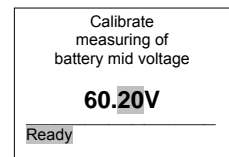
Measure the actual battery voltage using an external voltmeter. The voltmeter must have high ohms, 10MΩ or higher, and have an accuracy of 0.1 % or better. Now slowly adjust the measurement value on the display using the "↓" and "↑" buttons until it matches the voltmeter as closely as possible.

Automatic calibration of the internal voltage reference also takes place in the background at the same time which monitors the functionality of the measurement circuits (see [Internal fault](#), fault code 2).

To facilitate calibration with a stable level of voltage, all voltage regulation (such as temperature control) is temporarily shut down as long as you are in this menu screen. You may therefore experience a voltage level that deviates from the level you had immediately before.

5.12.5 Callbrate measurement of mid voltage

Here you calibrate the monitoring unit's measurement instrument for battery mid voltage to ensure the measurement value matches the actual mid voltage. This is done on delivery from the factory, but can also be done during the stipulated routine inspections.



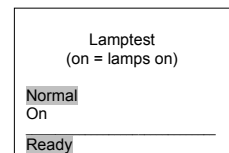
Connect a voltmeter either between the battery's negative terminal and the measurement point of the mid voltage or to the rectifier's connection block for mid voltage measurement. The voltmeter must have high ohms, 10MΩ or higher, and have an accuracy of 0.1 % or better. Now slowly adjust the measurement value on the display using the "↓" and "↑" buttons until it matches the voltmeter as closely as possible.

To facilitate calibration with a stable level of the voltage, all voltage regulation (such as temperature control) is temporarily shut down as long as you are in this menu screen. You may therefore experience a voltage level that deviates from the level you had immediately before.

5.12.6 Lamp test

For test of indication lamps on rectifiers and monitoring unit.

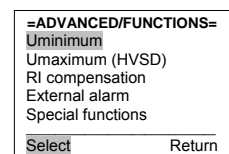
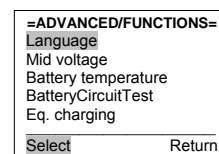
Use the buttons "↓" and "↑" to select between the alternatives *Normal* and *On*, where *On* turns all lamps on. After finishing the test by pressing OK, the lamps will return to normal state.



5.13 FUNCTIONS

5.13.1 General

Here you can select the conditions that are to apply for the functions that are available in the monitoring unit.



If PCM2 is used solely as a monitor (number of rectifiers = 0) the *Battery circuit test, Equalizing charging, Uminimum, Umaximum and RI-compensation* options cannot be selected.

5.13.2 Select language

Select the language to be used for the display.

```
====./LANGUAGE====

Swedish
English
Ready
```

5.13.3 Parameters for mid voltage measurement

Here you enter the conditions that apply for measuring the battery's mid voltage.

Start by specifying whether the measurement input is to be connected to the battery or not. If not, the "Symmetry fault" alarm will lose its function.

```
====./MIDVOLTAGE====
Installed: Yes
Midpoint: 50.00%

Select Return
```

```
Is
battery mid voltage
installed?

Yes
No
Ready
```

As it is not always physically possible to connect to the battery's theoretical midpoint, you must specify where the measurement connection in practice occurs. You do this by specifying as a percentage what proportion of the total battery voltage is expected at the measurement point. First calculate the percentage using the following formula:

```
Real position of
the midpoint

50.00%

Ready
```

$U_{mid} (\%) = 100 \times (\text{number of cells from negative up to the measurement point}) / (\text{total number of cells})$

Example:

A 110 V battery consisting of nine 12 V battery blocks (6 cells per block). The closest midpoint will then be the positive terminal on block no 4 or 5, calculated from the negative. We choose to measure the midpoint in the positive terminal at block no 4. We then have 4 blocks x 6 cells/block = 24 cells, from negative up to the measurement point. The total number of cells is 9 blocks x 6 cells/block = 54 cells. The formula above gives $100 \times 24 / 54 = 44.44 \%$.

Now set the estimated percentage as the midpoint's actual position.

5.13.4 Parameters for measuring battery temperature

For measurement of the battery's ambient temperature, an external temperature sensor must be installed, see section 6.4.3.4. Without sensors, the two alarms "High temperature, battery" and "Low temperature, battery" will lose their function. Additionally you lose the option of using the temperature controlled float charging voltage.

```
===./BATTERYTEMP.==
Installed: Yes
dU1: 216mV/°C
dU2: 180mV/°C
Out-min: 97.20V
Out-max: 127.90V

Select Return
```

```
Is
temperature sensor
installed?

Yes
No
Ready
```

Start by specifying whether the sensor is connected or not.

For temperature control of the float charging voltage, you need to specify a number of parameters. These specify two different slopes to the control curve and the limits for the permitted control range. The data for these parameters is based on information from the battery manufacturer.

In Figure 1: Temperature curve the battery manufacturer's charge curve is shown with a dashed line. This curve is approximated to two straight lines with individual slopes (the thick line). Furthermore, an upper and lower limit is specified for temperature control, $U_{t_{min}}$ and $U_{t_{max}}$. Do as follows to determine the slope of the two lines:

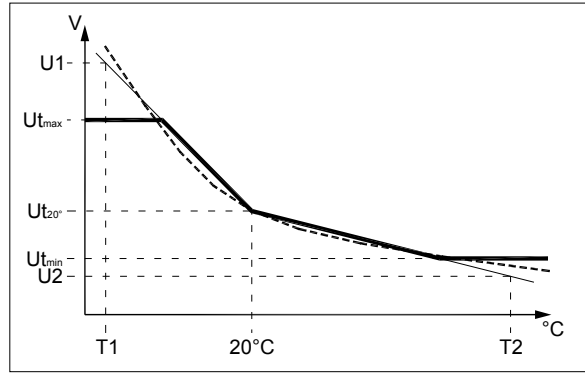


Figure 1: Temperature curve

1. Take the battery manufacturer's recommended charge curve.
2. Draw using a rule a straight line from the 20° point in each direction following the curve as closely as possible.
3. Determine the two points on the drawn lines that correspond to the lowest and highest temperature possible, T1 and T2. Read from the voltage axis the voltages that correspond to the line you have drawn. This gives U1 and U2.
4. Calculate the slopes dU1 and dU2 as follows:

$$dU1 = \text{number of battery cells} \times (U1 - U_{t_{20^\circ}}) / (20^\circ - T1)$$

$$dU2 = \text{number of battery cells} \times (U_{t_{20^\circ}} - U2) / (T2 - 20^\circ)$$
 where the voltages U1, U2 and $U_{t_{20^\circ}}$ are expressed in mV/cell.

As an example of typical values, the slopes are specified for a few standard types of battery. The example uses a 110 V battery with a total of 54 cells.

NOTE: The battery manufacturer's specifications may have changed. These numbers should therefore only be considered as examples.

1. Tudor, type OPzV: $dU1/\text{cell} = 4.00 \text{ mV/}^\circ\text{C} \Rightarrow dU1 = 4.00 \times 54 = 216 \text{ mV}$
 $dU2/\text{cell} = 0.00 \text{ mV/}^\circ\text{C} \Rightarrow dU2 = 0.00 \times 54 = 0 \text{ mV}$
2. Tudor, type OPzS: $dU1/\text{cell} = 4.00 \text{ mV/}^\circ\text{C} \Rightarrow dU1 = 4.00 \times 54 = 216 \text{ mV}$
 $dU2/\text{cell} = 3.33 \text{ mV/}^\circ\text{C} \Rightarrow dU2 = 3.33 \times 54 = 180 \text{ mV}$

Specify the value set as above for the slopes dU1 and dU2. If the temperature control is not required, set $dU1 = 0$ and $dU2 = 0$.

Specify the lower and upper limits for the control range, $U_{t_{min}}$ and $U_{t_{max}}$. If the temperature control is not required, set $U_{t_{min}} = \text{"low"}$ and $U_{t_{max}} = \text{"high"}$. However, you must ensure that the levels are within the margin for what the connected load can handle. Regardless of setting of the lower level, the voltage will never be permitted to fall below the U_{minimum} level, see section 5.13.7. The upper level should be lower than the U_{maximum} (HVSD) level, see section 5.13.8.

Adjust temp regulation slope $dU1 (<20^\circ\text{C})$ 0216mV/°C Ready	Adjust temp regulation slope $dU2 (>20^\circ\text{C})$ 0180mV/°C Ready
Adjust lower limit for regulation 097.2V Ready	Adjust upper limit for regulation 127.9V Ready

5.13.5 Parameters for battery circuit test

Here you specify the required function for automatic battery circuit test. The options are "None", "Basic" and "Extended". The "Battery circuit fault" alarm requires a simple or advanced test in order to work, except for a manually initiated test that always works in full. The "Symmetry fault 2" alarm requires an advanced battery circuit test in order to work. For more information on battery circuit test, see section 4.4.3.

<pre>==./BATT.CIRC.TEST= Test method: Extended Interval: 24h Usink: 15%</pre> Select Return	Select test method None Basic Extended Ready
---	---

Specify the required test interval. The interval is specified in even hours. If the test interval is selected as an even number of days, it may be preferable to schedule the test at a determined time of the day. Synchronisation is made quite simply by accessing this screen at the required time and then leaving it again, with or without changing the time.

Adjust test interval

024h

Ready

During the battery circuit test, the output voltage is lowered relative to the float charging voltage applicable at that time (which could be temperature compensated). Here you specify how large the drop is to be (0-50 %). However, the voltage never falls below the value of the parameter U_{minimum} , see section 5.13.7.

Adjust test voltage sinking rate

15%

Ready

5.13.6 Parameters for equalizing charging

Specify whether the function for automatic equalizing charging, i.e. equalizing charging following mains power failure, is to be used or not. Note that the manual equalizing charging is not affected by these settings. For more information on equalizing charging, see section 4.4.2.

```
===./EQ.CHARGING===
Automatic:          No
Level 1:           110.70V
Level 2:           121.50V
Time factor K:     5
Select             Return
```

Automatic equalizing charging after mains failure?

Yes
No

Ready

For mains power failure, the battery voltage starts to drop. When the voltage drops below *Level 1* a time measurement starts. The time, t_1 , when the voltage is below this level is then measured and used to calculate the time, t_2 , for the coming equalizing charging.

Adjust level1, start of time metering

110.7V

Ready

When the mains voltage returns, the battery voltage starts to increase. *Level2* is the limit value from which the time t_2 for equalizing charging starts to be counted.

Adjust level2, charge time starts to count

121.5V

Ready

K is the factor used to calculate the time t_2 for equalizing charging as per $t_2 = K \times t_1$. The factor can be set in the range 1 - 20. The normal value is 5. The time t_2 is limited to a maximum of 24 hours.

Adjust time factor K for calc. of charge time

05

Ready

5.13.7 Lowest possible voltage level, U_{minimum}

There are a number of parameters that affect the rectifier output voltage, such as temperature control, battery test etc. It may therefore be difficult to know for sure how far the voltage can drop.

In order to ensure the rectifier output voltage never falls below a critical limit, you can specify here a guaranteed minimum level. This setting then overrides all other parameters such as the lower voltage limit for example.

Adjust lowest permitted voltage level

099.0V

Ready

5.13.8 Highest possible voltage level, U_{maximum} (HVSD)

This level is intended as an emergency safeguard to protect the load from harmful overvoltage. The setting is communicated to the rectifier which then takes care of the protection function by itself by shutting down if the limit is exceeded (High Voltage Shut Down).

Adjust level U_{maximum} (HighVoltageShutdown)

129.6V

Ready

The HVSD function is selective which means that for parallel rectifier modules, only the module that causes the overvoltage will trip. This is ensured by the individual module only tripping under the condition that the module supplies current that exceeds around 25 % of its rated current.

Note that the charging voltage (float charging and equalizing charging) will be limited to maximum 1% below U_{maximum} even if the charging voltage is set to a higher level.

5.13.9 Parameters for RI compensation

If for some reason you decide to connect measurement conductors for the battery voltage closer to the rectifier instead of close to the battery, you can compensate for the consequential resistive voltage drop using the “RI compensation” parameter. Up to 3 % voltage drop can be compensated for.

```

Adjust
RI compensation

0.0%

Ready
    
```

5.13.10 Parameters for external alarm

Via the input “EXT. FAULT” (see section 6.4.4.5) there is the option of monitoring an external unit. Here you can specify the most appropriate alarm text to use in the event of an alarm. The alternatives are,

1. External fault
2. Inverter fault
3. Fault in DC/DC
4. Alarm via alarm panel
5. External blocking

```

Select alarm text:
EXTERNAL FAULT
INVERTER FAULT
DC/DC FAULT
ALARM PANEL ALERT
EXTERNAL BLOCKING

Ready
    
```

If you select the fifth option, “External blocking”, an additional function will be added. The input then serves as a remote controlled shut-down function for the rectifier units. Open input means that the rectifier units are shut down, i.e. put in a condition with the DC output shut off, and with the alarm text displayed on screen. A closed input results in normal operation.

5.13.11 Special functions

Certain customised special functions are also built into the standard model. You can use the XM1 and XM2 parameters to activate these functions. For use of these functions, see separate description.

```

===./SPECIALFUNCT.=
XM1 No
XM2 No

Select Return
    
```

5.13.12 Other functions

There is the option of connecting another operator panel, for monitoring in a control room, for example. This unit is called a satellite panel. The satellite panel is exclusively a slave unit for the actual operator panel.

```

=./FUNCTIONS/OTHERS
Satellite panel No

Select Return
    
```

As all display information is continually copied from the actual operator panel via a series channel to the satellite panel, the satellite panel may be perceived as slightly “slow”. Depending on the amount of traffic in the series channel, there may be a delay of up to a few seconds before you get a response from the display when you press the button. Where there is a need of settings and other more advanced use it is therefore recommended that you mainly use the actual operator panel.

Set the value Yes if a satellite panel is connected.

5.14 SYSTEM DATA

5.14.1 General

Under *System data* there are a number of basic parameters that in principle describe the rectifier and design of the installation. These are therefore normally not changed following the installation being taken into service.

```

===ADV./SYSTEM DATA=
Rated voltage: 220V
Rated current: 10A
No.of rectifiers: 1
System belonging: -

Select Return
    
```

If PCM2 is used solely as a monitor (number of rectifiers = 0) the *Rated voltage* and *System belonging* options cannot be selected.

5.14.2 Specify rated voltage

The rated voltage must agree with the system's nominal voltage and with the rated voltage that is found in the equipment's rated plate.

Adjust
rated voltage

110V

Ready

5.14.3 Specify rated current

The specified rated current must agree with the rated current that is present on the rectifier's rated plate. This refers to the total rated current of the rectifier, that is the sum of the rated currents of all the rectifier modules.

Adjust
rated current

010A

Ready

5.14.4 Specify number of rectifiers

Specify the number of rectifier units that are included in the rectifier.

A special case is when PCM2 is only used for monitoring without the option of communications with a rectifier. This is done by setting the number of rectifiers to 0. You then lose the functions that are dependent on the rectifier, such as battery circuit test and equalizing charging. The following alarms also lose their functionality:

- Symmetry fault 2
- Battery circuit fault
- Mains fault
- Rectifier fault
- Measurement circuit fault
- High current, I>
- Overload
- Blocked equalizing charging

Adjust
No. of rectifiers

1

Ready

5.14.5 Specify system affiliation

The most common form of system structure is a simple independent system with a rectifier and a battery. Specify *Single* in this case.

Sometimes it is divided into two separate sub-systems instead, system A and B, each fitted with rectifier and battery. The sub-systems can in certain situations be galvanically connected. (see also section 4.4.4).

Specify *A* if the system in question is the first of two sub-systems.

Specify *B* if the system in question is the second of two sub-systems.

Belongs to system

Single
A
B

Ready

5.15 SERVICE

Service mode is reserved for specially trained service personnel. It is therefore blocked by password.

=ADV./SERVICE=
Password:
0000

Ready

5.16 ALARM MESSAGES

5.16.1 General

An alarm identifies itself in the following ways:

1. Status message on row 2, "SYSTEM OK", is replaced with the text "ALARM".
2. The alarm text appears on row 3.
3. The current status of the alarm (*Delay*, *Active* or *Inactive*) appears on row 4.
4. The action window contains a request for acknowledgment.

5. The "Alarm" lamp on the panel flashes until acknowledged.
6. Following a period of delay the alarm relay or relays are activated that are associated with the type of alarm in question.

After acknowledgment the following happens:

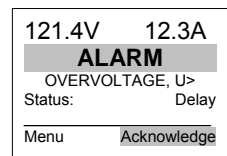
1. The "Alarm" lamp on the panel transfers to lighting with a fixed light until the alarm condition ends.
2. The alarm is placed in an alarm queue and remains there as long as the alarm condition is met.
3. The alarm relay is reset to normal mode (non-alarm) when the alarm condition ends.

It is always the last alarm that is displayed. After the last alarm has been acknowledged and thereby sent to the alarm queue, the next alarm in turn appears for acknowledgment.

In addition to this, all alarm events are collected in an historical alarm log, see section 5.9.3.

5.16.2 Alarm under delay

Alarms can be delayed for the purpose of suppressing short-term variations. Normally only the alarm output relays are affected by the delay. But the *Show* alarm parameter can be used to also delay the alarm message and "Alarm" lamp, see section 5.9.2.5.

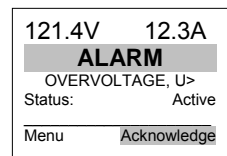


The alarm can already be acknowledged at this stage.

Irrespective of the acknowledgement happening or not, the alarm will disappear without trace if the alarm condition ends before the delay time has expired, regardless of the return option selected.

5.16.3 Active alarm

Active alarm means that the delay period has passed and that the alarm condition is still met.

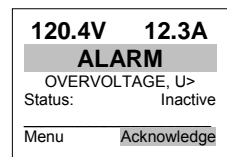


As long as the alarm remains active, the alarm message remains and is waiting for acknowledgment.

As soon as the alarm is acknowledged, it is moved to the alarm queue.

5.16.4 Inactive alarm

Inactive alarm means that the delay period has passed but the alarm condition is no longer met.

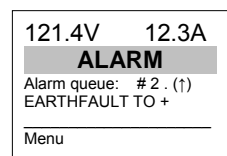
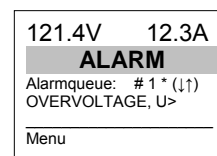
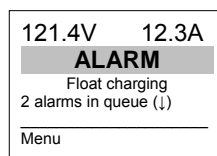


An alarm with the return option *Automatic return*, clears immediately when the alarm condition ends. It will therefore never be shown with the *Inactive* status.

If the alarm has the *Return after acknowledgement* return option instead, the alarm remains until it is acknowledged. Following acknowledgment it is moved to the alarm queue.

5.16.5 Alarm queue

Acknowledged alarms that are still active are collected in an alarm queue. When all alarms have been acknowledged, the initial screen can therefore appear as shown in the left box. You can use the "↓" and "↑" buttons to browse through the alarms in the queue.



After the queue number, a symbol appears that specifies the current alarm status in the following way:

- * Specifies that the alarm is active
- . Specifies that the alarm is under delay
- Blank Specifies that the alarm is inactive

The alarm queue can store up to 20 alarms.

5.16.6 Alarm descriptions

OVERVOLTAGE, U>

- Function: Monitors the float charging voltage's upper limit.
Alarm condition: The system voltage exceeds the set limit value.
Interlocking: The alarm is blocked in the event of equalizing charging.
Other: The limit value is specified as volt deviation (dV) from the set float charging level. If the float charging voltage is temperature controlled, the absolute level of the limit value will thereby vary with the temperature.

OVERVOLTAGE, U>>

- Function: Monitors the system voltage's upper limit.
Alarm condition: The system voltage exceeds the set limit value.
Interlocking: -

UNDERVOLTAGE, U<

- Function: Monitors the float charging voltage's lower limit.
Alarm condition: The system voltage falls below the set limit value.
Interlocking: 1) When testing with lowered voltage, e.g. battery circuit test).
2) If the rectifier works with an output current greater than 90 % of the set current limit. Interlocking can be prevented by using the special function XM1.
Other: The limit value is specified as volts deviation (dV) from the set float charging level. If the float charging voltage is temperature controlled, the absolute level of the limit value will thereby vary with the temperature.

UNDERVOLTAGE, U<<

- Function: Monitors the system voltage's lower limit.
Alarm condition: The system voltage falls below the set limit value.
Interlocking: When testing with lowered voltage, e.g. battery circuit test). Should the test continue for unreasonably long time (ca 10 min), the interlocking will cease.

SYMMETRY FAULT 1

- Function: Compares the battery's upper and lower half by measuring the mid voltage. Handles variances that last for a longer period.
Alarm condition: The difference between the battery's mid voltage and half of the system voltage exceeds the set limit value (specified in % of system voltage).
Interlocking: Mid voltage measurement, and thereby the alarm function, can be deselected in the "Functions" menu.
Fault causes: 1) Disabled battery cell.
2) Uneven charging condition. Equalizing charging may help.
3) New VR batteries can display fairly large cell voltage variation in both fully-charged and uncharged condition despite being totally fault-free. This phenomenon can in certain cases remain for as much as a whole year.
Other: Due to an uneven amount of cells or that the battery block does not have a voltmeter terminal for each cell, the measurement point will deviate from the

actual midpoint. See section 5.13.3 for how you set the percentage of total system voltage that the measured mid voltage corresponds to.

SYMMETRY FAULT 2

- Function: Compares the battery's upper and lower half by measuring the mid voltage during an advanced battery circuit test. Handles variances that occur over the time the test in progress.
- Alarm condition: The difference between the battery's mid voltage and half of the system voltage exceeds the set limit value (specified in % of system voltage).
- Interlocking: Mid voltage measurement and the advanced battery circuit test, and thereby alarm function, see section 5.13.3.
- Fault causes: 1) Sulphated (aged) battery cells.
2) The causes specified for *Symmetry fault 1*.
- Other: The delay time must be shorter than the test time which is around three minutes. Must be set with acknowledge demand as the alarm condition will not last.
See also *Symmetry fault 1*.

BATT.CIRCUIT FAULT

- Function: Tests the entire battery circuit, i.e. the cables, connections, fuses and battery.
- Alarm condition: The charging voltage falls below the set limit value while the test is in progress.
- Interlocking: -
- Fault causes: 1) Fault in the connections and cables
2) Defective battery.
3) Tripped battery fuse.
- Other: Due to its instantaneous nature, this alarm must be set using an acknowledge demand in order to be identified.
See also the *Symmetry fault 2* alarm.

MAINS FAULT

- Function: Monitors incoming mains voltage.
- Alarm condition: One of the rectifier units reports a mains fault.
- Interlocking: -
- Fault causes: 1) Current breaker for feeding mains open.
2) Fault in incoming mains.
3) Defective rectifier unit.

NO CHARGING

- Function: Indicates that the battery is not charging.
- Alarm condition: The system voltage falls below the set limit value.
- Interlocking: 1) When testing with lowered voltage, e.g. battery circuit test).
2) If the rectifier works with an output current greater than 90 % of the set current limit.
3) Due to high temperature, the float charging voltage has been adjusted down to a level close to the alarm limit.
- Other: In the case in point 3 above, the alarm limit is adjusted down in order to maintain a difference of around 2 % between the float charging voltage and the alarm limit.

RECTIFIER FAULT

- Function: Indicates faults in the rectifier unit.
- Alarm condition: Individual rectifier unit reports a fault.
- Interlocking: 1) For mains fault.
2) For external blocking.
- Other: For detailed information on the cause of the alarm, see section 5.7.3.2.

MEAS.CIRCUIT FAULT

- Function: Tests the circuit for measuring system voltage.

- Alarm condition: The difference between the measured battery voltage and the mean value of the output voltage from all rectifier units exceeds the set limit value (specified in % of system voltage).
- Interlocking: 1) When testing with lowered output voltage, e.g. battery circuit test).
2) For mains faults.
3) For rectifier faults.
4) For external blocking.
5) For internal faults.
6) For communications faults.
- Fault causes: 1) Measurement input for battery voltage incorrectly connected.
2) Control fuse in battery distribution unit tripped.
3) The monitoring unit's measurement input for battery voltage defective.
- Other: During the time the alarm condition is met, the common control of the output voltage ceases, i.e. each rectifier unit is individually controlled.

HIGH CURRENT, I>

- Function: Warns that the output current is approaching the maximum capacity of the rectifier.
- Alarm condition: The output current exceeds 90 % of the set current limit.
- Interlocking: -
- Other: As this is not regarded as an actual alarm but more as information, the LED on the panel will not light in connection with this alarm. However, the output relays can be activated as normal.

OVERLOAD

- Function: Warns that the rectifier is overloaded.
- Alarm condition: The condition for the alarm "High current, I>" has been met for the whole of the set delay period, which normally is to be long (typically 24 hours).
- Interlocking: -
- Fault causes: 1) Not enough time to recharge the battery following discharge over the set delay time. This alludes to the rectifier being under dimensioned.
2) A gradual expansion of the load has ultimately created a power requirement that exceeds the original dimensioning of the rectifier.
3) Temporary overload due to fault in the installation.
- Other: The alarm is completely invisible over the delay period. The minimum delay period is 1 minute, although you can set a shorter period.

HIGH TEMP, BATTERY

- Function: Monitors the ambient temperature of the battery.
- Alarm condition: The battery's ambient temperature exceeds the set limit value.
- Interlocking: Temperature measurement can be deselected, see section 5.13.4.
- Other: For alarms any ongoing equalizing charging is interrupted. If the temperature exceeds +49 °C, the sensor is considered to be defective. Indicated by "Internal fault" alarm.

LOW TEMP, BATTERY

- Function: Monitors the ambient temperature of the battery.
- Alarm condition: The battery's ambient temperature drops below the set limit value.
- Interlocking: Temperature measurement can be deselected, see section 5.13.4.
- Other: If the temperature falls below -19 °C, the sensor is considered to be defective. Indicated by "Internal fault" alarm.

EARTHFAULT TO +

- Function: Monitors earth fault resistance.
- Alarm condition: Earth fault resistance to positive falls below the set limit value.
- Interlocking: Digital input for blocking of earth fault measurement *E.F. Blocked*, is open (does not apply in system B).
- Other: The limit value can be set in the range 10kΩ to 2.5MΩ.

EARTHFAULT TO -

Function: Monitors earth fault resistance.
Alarm condition: Earth fault resistance to negative falls below the set limit value.
Interlocking: Digital input for blocking of earth fault measurement *E.F. Blocked*, is open (does not apply in system B).
Other: The limit value can be set in the range 10k Ω to 2.5M Ω .

DISTR.FUSE FAULT

Function: Monitors distribution fuses.
Alarm condition: Digital input for *Fuse fault*, is open.
Fault causes: 1) Tripped fuse.
2) Unused input *Fuse fault* is not strapped.
Interlocking: -

EQ.CHARGING BLOCKED

Function: Warns for illegal request for equalizing charging.
Alarm condition: Equalizing charging requested or in progress at the same time as digital input for blocking of equalizing charging, *EQ. Blocked*, is open.
Interlocking: Digital input for blocking of equalizing charging *E.F. Blocked*, is closed. (i.e. equalizing charging is permitted).
Fault causes: 1) Flow sensor for battery compartment fan indicates a fan fault.
2) Load that is protected against a raised voltage level is connected.
3) Unused input *EQ. Blocked* is not strapped.
Other: The alarm is usually activated following selected alarm delay. This gives any flow sensor time to react, however, the raising of voltage is immediately blocked without delay as long as the digital input for blocking of equalizing charging is open.

EXTERNAL FAULT**INVERTER FAULT****DC/DC FAULT****ALARM PANEL ALARM****EXTERNAL BLOCKING**

Function: 1) Monitors faults in an external unit.
2) Remote control (on/off) of rectifier units.
Alarm condition: Digital input for external faults, *Ext. fault*, is open.
Interlocking: -
Fault causes: 1) External unit indicates faults (for alarm text options 1-4).
2) The rectifier has been shut down by remote control (for alarm text option 5).
3) Unused input *Ext. fault* is not strapped.
Other: The *Functions* menu, section 5.13.10, can be used to select one of the above alarm texts to be displayed for an alarm. Function option no. 1 applies to the first four text options.
Function option no. 2 applies to the *External blocking* text option. This means that the rectifier units are controlled on/off via the digital input. The rectifier units are switched on by closing the input and are switched off by opening the input.

INTERNAL FAULT

Function: Monitors internal functions in the monitoring unit.
Alarm condition: See relevant fault type below.
Interlocking: -
Other: Alarm text followed by a fault code. Each fault type has its own alarm condition. Most internal faults require correcting by qualified service personnel.

FAULT TYPE 01

Alarm condition: The battery temperature drops below -19°C or exceeds +49°C.

- Fault causes:
- 1) The temperature is really so low/high. Fix the cause of the low/high temperature.
 - 2) External temperature sensor missing but temperature measurement is still selected in the *Functions* menu, see section 5.13.4. Install temperature sensor or deselect temperature measurement.
 - 3) Fault in connections or cables to external temperature sensor.
 - 4) Fault in temperature sensor.
 - 5) Internal circuit fault. Send for qualified service personnel.

FAULT TYPE 02

Alarm condition: Internal reference voltage deviates from the permitted margin (0.5 %).

- Fault causes:
- 1) The alarm delay period set too low. Short-term variations may occur without being regarded as faults. Select delay period of at least a few seconds.
 - 2) Recalibration necessary. Carried out automatically in connection with calibration of the battery voltage measurement, see section 5.12.4.
 - 3) Extremely high or low ambient temperature.
 - 4) Internal circuit fault. Send for qualified service personnel.

FAULT TYPE 03

Alarm condition: The monitoring unit's I/O board reports a fault.

- Fault causes:
- 1) Internal circuit fault. Send for qualified service personnel.

COMMUNICATION FAULT

Function: Monitors serial communications with rectifier, I/O unit and any other units.

Alarm condition: A sent message gets no approved response despite ten resend attempts.

Interlocking: -

- Fault causes:
- 1) Fault in the connections and cables.
 - 2) Internal circuit faults in either sending or receiving unit.
 - 3) The Number of rectifiers parameter is incorrectly set.

Other: Together with the fault message, a number is shown that specifies which unit is not responding, as follows:

- 0 General for all the rectifier units.
- 1-8 Specific to individual rectifier unit. The number specifies the unit in question.
- 10 EEPROM, i.e. the circuit that stores parameters (long-term memory).
- 11 I/O unit
- 12 Satellite panel

6 INSTALLATION INSTRUCTIONS

6.1 SAFETY INSTRUCTIONS



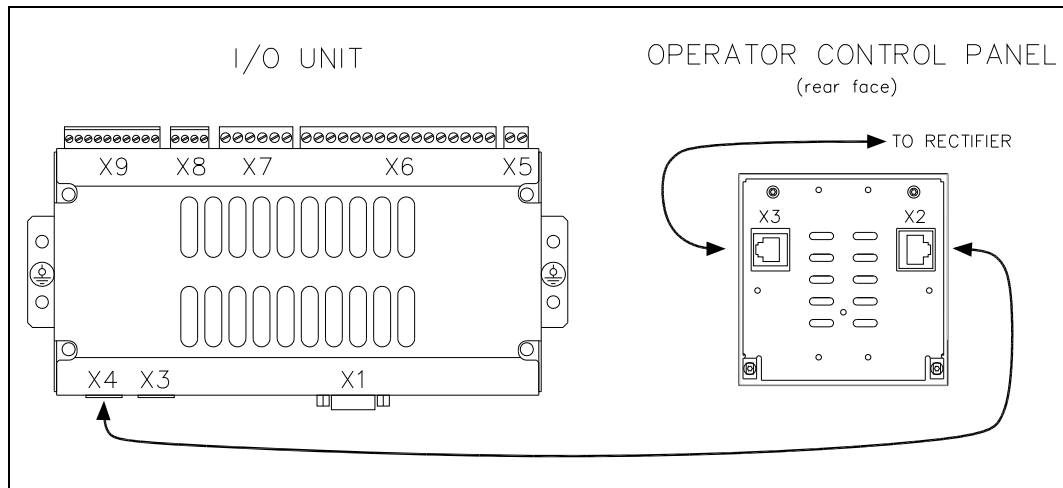
WARNING! This product contains dangerous voltage that when touched can cause electric shock, burns or death. Protective earth must always be connected in a reliable way to avoid the risk of live parts in the equipment in the event of faults. No live parts are permitted during installation. The product must be installed by qualified personnel (see section 2 [SAFETY INSTRUCTIONS](#)).



WARNING! Check both before and after setting-up that the equipment does not have any mechanical damage. Check that the equipment is designed for the existing rated voltage.

6.2 UNITS AND CONNECTIONS

The PCM2 monitoring unit consists of two units, operator panel and the I/O unit. Name and placement for connections to each unit is detailed in the drawing below. Note that it is the rear of the operator panel that is displayed.



Connections PCM2

6.3 OPERATOR PANEL

6.3.1 Ordinary operator panel

Between the operator panel's connector X2 and the I/O unit's X4, an RJ45 cable is connected (normally an 8 pin network cable).

NOTE: If you remove this cable from the I/O unit, make absolutely sure that it is reconnected to X4 and not incorrectly to X3, where it also is physically compatible.

From the operator panel's connector X3, an RJ11 cable is connected (modular cable type 6/4) to the corresponding connector on the backplane of the rectifiers.

Both of these connections are normally ready on delivery.

6.3.2 Satellite panel (option)

A satellite panel is an extra operator panel that can be fitted at a distance from the ordinary panel.

Use screened cable with at least 4 conductors. Maximum length is 50 metres. Use 360° EMC conduit entry at both ends.

Connect one end to the I/O board's screw terminal X8:1-4. Connect the other end in the same way to the corresponding terminal in the satellite panel.

6.4 I/O UNIT

6.4.1 General

The names used for the connections to the I/O unit are also stated directly on the I/O unit.

6.4.2 Power supply

The monitoring unit is powered by battery voltage. This is normally obtained from a fuse in the battery distribution panel.

Connect to input X5:1 "POWER SUPPLY (-)" and X5:2 "POWER SUPPLY (+)".

6.4.3 Measuring Inputs

6.4.3.1 Battery voltage

The battery voltage is normally measured via a fuse in the battery distribution panel. Otherwise it should be measured as close to the battery as possible to avoid the effects of voltage drop in the battery cables.

Connect to X7:3 "U-BATTERY (-)" and X7:5 "U-BATTERY (+)".



WARNING: *Never connect measurement cables directly to the battery. Ensure the measurement point has short circuit protection.*

The connection block (X7) also has blocks for short circuit protected voltmeter terminals for measuring battery voltage. There is a test terminal directly on the block designed for test devices with the diameter 2.0 or 2.3 mm (the terminals X7:1 and X7:6 marked V- and V+ respectively). The test terminal is also move forward to the front on some equipment in the form of terminals designed for 4 mm test devices.



DANGER: *Risk of arcing Always use the short-circuit protected voltmeter terminal when measuring battery voltage.*

6.4.3.2 Mid voltage

The battery's mid voltage is measured directly on the battery.

Connect to input X7:4 "U-BATTERY (1/2)".

For an uneven number of blocks, you cannot connect to the theoretical midpoint. This can be controlled using parameter settings, see section 5.13.3.



WARNING: *The measurement cord must have current limitation via short circuit protection in direct connection to the connection point on the battery. Use the short-circuit protected cables that are normally included.*

If the accompanying cables need extending, there are no special requirements for cables and junction boxes in addition to normal electrical installation directives.

6.4.3.3 Earth fault measuring

Measurement of the monitored earth point is done with high ohms (> 200 kΩ). This resistance keeps the earth point floating at half the battery voltage providing no earth fault occurs.

The monitored earth point is connected to input X7:2 "E.F."

NOTE: For EMC reasons, the monitored earth point must be located on the inside of the enclosure where the I/O unit is located.

6.4.3.4 Battery temperature

Measurement of the battery temperature is done via an enclosed Pt-1000 sensor. It is used both to monitor the temperature level and for temperature control of the float charging voltage. As the sensor is a Pt-1000 model, bipolar measurement is sufficient, as opposed to the more common Pt-100 which often needs four-pole measurement to ensure that conductor resistance does not impact negatively on the measurement results.

Place the sensor where it best represents a mean value for the battery temperature.

Connect the sensor to input X9:1-2 "TEMP SENSOR".

If the sensor cable needs extending, there are no special requirements for cables and junction boxes in addition to normal electrical installation directives. The insulation class is determined by the battery voltage.

The temperature sensor is an option and is therefore only installed where applicable. Check that the parameters for temperature measurement are correctly set, see section 5.13.4.

6.4.4 Digital Inputs

6.4.4.1 General

Closed input is the normal condition Open input is activated condition. This means that the inputs that are not connected must be strapped instead!



WARNING! *The digital inputs are powered from the rectifier's internal auxiliary voltage (around 12VDC). They may only be connected to potential-free contacts.*

6.4.4.2 Blocking of equalizing charging

With the input "EQ. BLOCKED" in open position, equalizing charging is blocked. May, for example, be used to prevent equalizing charging via a flow guard if the battery compartment's evacuation fan is not working, or to prevent equalizing charging with a connected load.

Connect to input X9:3-4 "EQ. BLOCKED".

6.4.4.3 Fuse monitoring

With the "FUSE FAULT" input in open position, the *Distr.fuse fault* is activated. Through series connection of the auxiliary contacts (that break on alarm) any number of fuses can be monitored.

Connect to input X9:5-6 "FUSE FAULT".

6.4.4.4 Blocking of earth fault measuring/battery test

This input is only used in the case of "Double systems" (see section 4.4.4). The input has different functions depending on the sub-system it is included in.

Sub-system A:

Open condition signals that both sub-systems are connected. This means, among other things, that earth fault measurement in sub-system A is disconnected, as two earth fault meters would interfere with each other.

Sub-system B:

Closed condition signals that the voltage is to be lowered to test level as sub-system A has started a battery circuit test. This input is connected to output "BATT.TEST" in sub-system A (see section 6.4.5.4).

Connect to input X9:7-8 "E.F. BLOCKED (batt.test)".

6.4.4.5 External faults

The "EXT. FAULT" input is intended for monitoring external units. Alternative alarm texts can be selected. As a special case, you can use the input for remote controlled shutting down of the rectifier. For more information, see section 5.13.10.

Connect to input X9:9-10 "EXT. FAULT".

6.4.5 Digital outputs

6.4.5.1 General

All outputs fitted with relays have floating relay contacts. For the durability of the relay contacts, see section 3 [TECHNICAL DATA](#).

6.4.5.2 Alarm outputs

There are four alarm outputs, alarm relays A - D.

The outputs' connection blocks are marked C, NC and NO. The significance of this is as follows:

- C - Common point for connection.
- NC - Connection point for normally closed contacts. Closes on alarm.
- NO - Connection point for normally open contacts. Opens on alarm.

The term "normal" (N) here means resting relays, i.e. idle. We recommend using NO mode. This increases reliability as any poor contact action or other breaks in the alarm loop give an alarm indication. To increase reliability still further, all alarm relays have standing current connection, i.e. closed relay indicates normal condition while a relay that is idle gives an alarm. This means, for example, that even a broken relay or the absence of auxiliary voltage gives an alarm indication.

Connect the alarm relays as follows:

- Alarm relay A: C..... Terminal X6:1
NO..... Terminal X6:2
NC Terminal X6:3
- Alarm relay B: C..... Terminal X6:4
NO..... Terminal X6:5
NC Terminal X6:6
- Alarm relay C: C..... Terminal X6:7
NO..... Terminal X6:8
NC Terminal X6:9
- Alarm relay D: C..... Terminal X6:10
NO..... Terminal X6:11
NC Terminal X6:12

6.4.5.3 Fan control

The output for controlling of a battery compartment fan is activated automatically for equalizing charging. In order to ensure that all hydrogen gas is expelled, the output continues to be activated for an additional hour following the completion of equalizing charging.

The relay contact is normally open and closed to start the fan.

Connect to output X6:13-14 "FAN".

6.4.5.4 Battery test

The "BATT.TEST" output is only used in the case of "Double systems" (see section 4.4.4). The output is connected from sub-system A to the corresponding input in sub-system B (see section 6.4.4.4). It is made up of an opto-coupler to give galvanic insulation between the sub-systems.

Connect to output X6:15-16 "BATT TEST".

6.4.6 Internal communications interface

Internally I²C is used between the units.

The connections are described in more detail in section 6.3.

6.4.7 External communications interface

The monitoring unit is prepared for external communications via RS-232, Ethernet and I²C.

6.4.7.1 RS-232

RS-232 (X1) is intended for configuration via PC and connection to certain field bus units.

A special program is required for configuration via PC. The program is used primarily in connection with testing prior to delivery and is not adapted for general use. All configuration handled by the program can also be carried out via the operator panel.



DANGER: Note that the RS232-port is NOT insulated, but is galvanically connected to the DC system's negative terminal. To avoid personal injury, the system's negative terminal must therefore be connected to earth when a PC is connected to the RS232 port. Only use portable PCs with full insulation to the mains side and earth.

The RS232 port is missing in systems for 440/500V.

6.4.7.2 Ethernet

The Ethernet port (X3) is primarily intended for service purposes.

6.4.7.3 I²C

The I²C port (X8) is intended for communications with external accessories for PCM2. Each one of the four connections is parallel connected to the equivalent connections in the external units. Screened cable should be used.

7 COMMISSIONING

7.1 SAFETY INSTRUCTIONS



WARNING! *This product contains dangerous voltage that when touched can cause electric shock, burns or death. All contact safety devices and plates must be fitted when operating.*

7.2 ELECTRIFICATION

The equipment becomes live as soon as there is battery voltage to the I/O unit's connection X5:1-2. After a few seconds, the operator panel display lights up, and after a few more seconds the text appears on the display. All measurement values are initially reset. The measuring begins after around 10 seconds. Any alarms are activated when a total of around 30 seconds has passed.

For start-up in general we refer you to the general system manual.

7.3 CHECK OF SETTINGS

Each time the monitoring unit has been without voltage, the built-in clock must be set with the current date and time, see section 5.5.5.

Check that the measurement values presented agree with the actual position. Check that the parameters for charging voltages, alarms and other parameters conform to the intended function.

7.4 CHECK OF OUTPUTS

The alarm outputs A-D and the output for fan control can be operated manually for simple and smooth control of external circuits, see section 5.12.3.

8 MAINTENANCE

8.1 ANNUAL INSPECTION

8.1.1 General

In addition to these instructions, the instructions in the general system manual must be observed.

8.1.2 Check of measuring Instruments

Check that the monitoring unit's internal measurement instrument (the display) shows the correct value for battery voltage and mid voltage. Follow the instructions as per section 5.12, [TEST AND CALIBRATE](#).

8.1.3 Check of alarm circuits

Check the function of the circuits that are included in the alarm system. Follow the instructions as per section 5.12.3.1, [Test alarm outputs](#).

8.1.4 Check of clock

Check and adjust the time and date where necessary. Follow the instructions as per section 5.10.5, [Adjust clock](#).

9 FAULT TRACING

9.1 SAFETY INSTRUCTIONS



WARNING! *This product contains dangerous voltage that when touched can cause electric shock, burns or death.*

Service/maintenance work that involves working with a removed cover may only be carried out by authorised service personnel (see section 2 [SAFETY INSTRUCTIONS](#)).



WARNING! *In the event of overvoltage, the electrolytic capacitors and varistors may explode. If work must be done when the equipment is powered up and the cover removed, splinter protection must therefore be used (protective goggles and screens).*

9.2 FAULT TRACING FOLLOWING ALARM

When there is an alarm message, fault tracing is primarily executed based on the information given in section 5.16, [ALARM MESSAGES](#). Only then, or if the relevant alarm is missing, should you refer to the instructions in this section.

9.3 OTHER FAULT TRACING

The type of faults that can be directly attributed to the monitoring unit are dealt with here. For faults that are due to rectifiers or the system in general, we refer you to the general system manual.

The display is lit but shows no characters

- Cause 1: This is how it looks a short period after start. If this remains, this is a sign that the display's start sequence has failed for some reason. Restart by cutting the power to the whole monitoring unit (usually by removing a fuse in the battery distribution panel) or simply make the operator panel dead by pulling out and reconnecting the connection (RJ45-cable) between the operator panel and the I/O unit.
- Cause 2: An external form of interference has forced the display into an abnormal mode. Restart by cutting the power to the whole monitoring unit (usually by removing a fuse in the battery distribution panel) or simply make the operator panel dead by pulling out and reconnecting the connection (RJ45-cable) between the operator panel and the I/O unit.
- Cause 3: If the problem still remains, this is a sign that there is an internal circuit fault in the operator panel. Send for authorised service personnel.

The display is off but the system is otherwise working

- Cause 1: The connection (RJ45 cable) between the operator panel and the I/O unit is broken. Reset the connection.
- Cause 2: Internal circuit fault in the operator panel. Send for authorised service personnel.

The display is off and all alarm relays are indicating an alarm

- Cause 1: The power supply to the monitoring unit is cut. First check the fuse that supplies the monitoring unit. Check that there is battery voltage to the I/O unit's connection terminal X5.
- Cause 2: Internal circuit fault in the I/O unit. Send for authorised service personnel.

Nothing happens when pressing the button and/or the display shows illegible characters or has "frozen"

- Cause 1: Indicates that the monitoring unit's microcomputer has been found to be in an abnormal condition due to extraordinary interference. Restart by cutting the power to the whole monitoring unit (usually by removing a fuse in the battery distribution panel)

or simply make the operator panel dead by pulling out and reconnecting the connection (RJ45-cable) between the operator panel and the I/O unit.

Cause 2: Internal circuit fault in the operator panel. Send for authorised service personnel.

The display shows unreasonable measurement values and/or gives totally unjustified alarms

Cause 1: For some reason (manual fault or extraordinary interference) the basic parameters have changed. Go through all the parameter settings thoroughly and adjust where necessary.

The display shows unjustified measurement value = 0

Cause 1: If the "Communication fault" alarm appears, see alarm "Communication fault" in section 5.16.6.

Cause 2: Fault in connections. Measure directly at the I/O unit's terminals and check if the expected measurement value is present. If a fault is present here, it is likely there is a faulty I/O unit, otherwise the fault should be in the external connections.

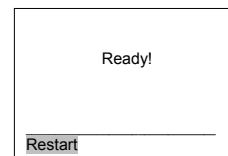
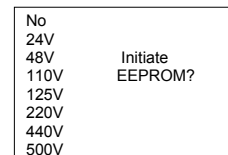
The display shows a "frozen" measurement value

Cause 1: Fault in communication between the operator panel and the I/O unit. The "Communication fault" alarm should be displayed, for action see alarm "Communication fault" in section 5.16.6.

The display shows illegible characters to such an extent that you cannot navigate through the menus

Cause 1: Extreme interference far above the applicable norms can, in highly exceptional cases, mean that the monitoring unit's long-term memory is overwritten with random content. Start by testing with a restart as per previous descriptions. If the problem remains, the long-term memory must be restored to its original state as per the basic settings in [Appendix A](#). Do as follows:

1. Cut the power to the whole monitoring unit (usually by removing a fuse in the battery distribution panel) or simply make the operator panel dead by disconnecting (RJ45 cable) between the operator panel and the I/O unit.
2. Keep the operator panel's "OK" button pressed while the voltage is reset. Continue to keep the button pressed until the text appears in the display.
3. The display will now show a screen with the option for rated voltage. Use the "↑" and "↓" buttons to select the relevant rated voltage.
4. Confirm with the "OK" button.
5. The display shows the text "working..." for about ten seconds.
6. Finally the text "Ready!" displays. Press the "OK" button to request restart. After around 5 seconds a restart will take place.
7. Go through all the parameter settings in detail and adjust to ensure they agree with the position before the problem occurred.



The set parameters do not remain after restart

Cause 1: It takes a minute or so for a change to "take effect", i.e. before it is stored in long-term memory (EEPROM). If the monitoring unit is shut down too soon after a parameter change, it may not have had enough time to be saved. Therefore you should wait at least 5 minutes after the last parameter change before shutting down or restarting the monitoring unit.

Appendix A BASIC SETTINGS FOR ALARMS

Basic settings for alarms in the monitoring unit type PCM2^{*5}

Alarm text	Alarm relay				Alarm delay 0.1s -63h	Ackno wledg ment metho d	Alarm display	Alarm level (for lead acid battery's)								Unit	Equivalent to (V/cell) ^{*6}
	A	B	C	D				Nominal system voltage (number of lead cells)									
								24V (12)	48V (24)	110V (54)	125V (60)	220V (108)	440V (204)	500V (252)			
Overvoltage, U>			X		10s	Aut.	Immediate	0.15	0.29	0.65	0.72	1.30	2.45	3.03	dV	0.012V/c	
Overvoltage, U>>	X				10s	Aut.	Immediate	28.32	56.64	127.4	141.6	254.9	479.4	594.7	V	2.36V/c	
Undervoltage, U<			X		10s	Aut.	Immediate	0.15	0.29	0.65	0.72	1.30	2.45	3.03	dV	0.012V/c	
Undervoltage, U<<	X				10s	Aut.	Immediate	21.60	43.20	97.2	108.0	194.4	420.2	453.6	V	1.8V/c	
Symmetry fault 1			X		10m	Aut.	Immediate	1	1	1	1	1	1	1	%	0.012V/c	
Symmetry fault 2			X		30s	Ack. ^{*1}	Immediate	1	1	1	1	1	1	1	%	0.012V/c	
Battery circuit fault			X		0.1s	Ack. ^{*1}	Immediate	23.52	47.04	105.8	117.6	211.7	399.8	493.9	V	1.96V/c	
Mains fault		X			1s	Aut.	Immediate	-	-	-	-	-	-	-	-	-	
Not charging		X			10s	Aut.	Immediate	25.80	51.60	116.1	129.0	232.2	438.6	541.8	V	2.15V/c	
Rectifier fault		X			10s	Aut.	Immediate	-	-	-	-	-	-	-	-	-	
Measurement circuit fault			X		10s	Aut.	Delayed	10	10	10	10	10	10	10	%	-	
High current, I> ^{*2}					10s	Aut.	Immediate	-	-	-	-	-	-	-	-	-	
Overload ^{*3}			X		24h	Ack.	Delayed	-	-	-	-	-	-	-	-	-	
High temp, battery			X		30m	Aut.	Immediate	30	30	30	30	30	30	30	°C	-	
Low temp, battery			X		30m	Aut.	Immediate	15	15	15	15	15	15	15	°C	-	
Earth fault to +				X	1s	Aut.	Immediate	100	100	100	100	100	100	100	kΩ	-	
Earth fault to -				X	1s	Aut.	Immediate	100	100	100	100	100	100	100	kΩ	-	
Distr. fuse fault			X		1s	Aut.	Immediate	-	-	-	-	-	-	-	-	-	
Blocked eq.charging					30s	Aut.	Immediate	-	-	-	-	-	-	-	-	-	
External fault ^{*4}			X		1s	Aut.	Immediate	-	-	-	-	-	-	-	-	-	
Internal fault			X		30s	Ack. ^{*1}	Delayed	-	-	-	-	-	-	-	-	-	
Communications fault			X		60s	Aut.	Delayed	-	-	-	-	-	-	-	-	-	

*1: Do not change this setting. The alarm condition is floating. Acknowledge demand is therefore necessary to be able to capture the alarm.

*2: Only shown on the display, i.e. no LED indication.

*3: The alarm is not visible at all during the delay time.

*4: Alternative alarm texts available, see alarm External fault in section 5.16.6.

*5: The basic settings are what applies on delivery unless otherwise agreed.

*6: Not exactly for 440V.

Appendix B
BASIC SETTINGS OTHER

Basic settings, other, for monitoring unit type PCM2

Functions and system data	Parameters	Normal setting (for lead-acid battery's)								
		Nominal system voltage (number of lead cells)							Unit	Corresponds to *1
		24V (12)	48V (24)	110V (54)	125V (60)	220V (108)	440V (204)	500V (252)		
Float charging voltage	Ufloat	26.76	53.52	120.4	133.8	240.8	459.0	562.0	V	2.23V/c
Equalizing charging voltage	Ueq	28.20	56.40	126.9	141.0	253.8	481.4	592.2	V	2.35V/c
Current limit	Ilimit	100							%	
Language on display	Language	English								
Mid voltage measurement	Installed	Yes								
	Midpoint	50.00							%	
Battery temperature	Installed	No								
	dU1	0							mV/°C	
	dU2	0							mV/°C	
	Ut-min	21.6	43.2	97.2	108.0	194.4	449.0	453.6	V	1.8V/c
	Ut-max	28.4	56.9	128.0	142.2	256.0	479.4	597.2	V	2.37V/c
Battery circuit test	Testing method	Advanced								
	Range	24							h	
	Usink	15							%	
Automatic equalizing charging	Automatic	No								
	Level 1	24.6	49.2	110.7	123.0	221.4	426.4	516.6	V	2.05V/c
	Level 2	27.0	54.0	121.5	135.0	243.0	468.0	567.0	V	2.25V/c
	Time factor K	5								
Lowest possible charging voltage	Uminimum	21.6	43.2	99.0	112.5	198.0	396.0	450.0	V	Urated- 10%
Highest possible charging voltage (HVSD)	Umaximum	28.8	57.6	129.6	144.0	259.2	499.2	489.6	V	2.4V/c
RI-compensation	RI-compensation	0.0							%	
External alarm	Alarm text	"External alarm"								
Customised special functions	XM1	No								
	XM2	No								
Rated voltage, U _{rated}	Rated voltage	24	48	110	125	220	440	500	V	
Rated current, I _{rated}	Rated current	Model dependent							A	
Number of parallel rectifiers	Number of rectifiers	1								
System affiliation for double systems	System belonging	- (single system)								

*1: Not exactly for 440V.

Appendix C RECTIFIER RAM variables

Rectifier RAM variables

Address	Bit no	Description	Read/Write
0-1	0	1 = DC ready	Read only
	1	1 = Intermediary OK	
	2	1 = AC input voltage OK	
	3	1 = Output closed due to high voltage	
	4	1 = Fan fault	
	5 ¹	1 = Alarm, high ambient temperature	
	6	1 = Alarm, high temperature in cooling body	
	7	1 = Current limit	
	8	1 = Output voltage drops below alarm limit for UV alarm	
	9	1 = Output closed due to low voltage	
	10	Not used	
	11	1 = DC out requested	
	12	1 = Closed due to "remote off" command via I ² C	
	13 ¹	1 = Closed via "module_disable" in backplane connector	
	14 ¹	1 = Closed via "short_pin" in backplane connector (module not sitting properly in place)	
15 ¹	1 = Closed due to timeout in communication with intermediary		
2-3	0	1 = Execute lamp test	Write
	1	1 = Switch on rectifier	
	2	1 = Switch off rectifier	
	3 ¹	1 = Allow outgoing alarm	
	4 ¹	1 = Prevent outgoing alarm	
	5 ¹	1 = Fan only run at full speed	
	6 ¹	1 = Fan run depending on temperature	
	7	Not used	
	8-15	Rectifier module's I ² C address	Read only
4-5		Reserved for internal use	
6-7	0-15	Output voltage in Volt x 100	Read only
8-9	0-15	Output current in Amperes x 100	Read only
10-11	0-15	Reference value for current limit in Amperes x 100	Read/Write
12-13	0-15	Reference value for output voltage in Volts x 100	Read/Write
14-15	0-15	Reference value for Umaximum (High Voltage Shut Down) in Volts x 100	Read/Write
16-121		Reserved for internal use	
122-123 ¹	0-15	Operating time in hours x 2	Read only
124-125 ¹	0-15	Alarm limit for under voltage, UV alarm	Read only
126-255		Reserved for internal use	Read only

1) Only relevant for rectifier modules of the type PCV.

