

Manual for charging rectifier type PRX



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 may only be opened by qualified personnel. Work in addition to replacing the rectifier modules may only be carried out when all power has been cut to the equipment and when the mains breaker has been closed 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.



WARNING! Multiple power sources. Dangerous voltage is possible even with mains power shut off. The panel mains power switch does not give a dead condition.

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P/n: 0001078

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

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1 PRESENTATION

PRX is a family of charging rectifiers in single phase configuration with integrated monitoring that are designed for wall mounting.

The charging rectifier is constructed using plug-in rectifier modules for simple maintenance and high flexibility and availability. Its compact design allows it to be used even in confined spaces. The clear display and well-arranged system of menus of the monitoring unit make it easy and pleasant to work with.

This description primarily deals with all installation, commissioning, service, maintenance and technical data and is principally aimed at the personnel who are responsible for these areas. An equivalent description of the parts of the equipment that relate to the monitoring unit are detailed in the *Manual for monitoring unit type PCM2*.

Operation is handled primarily via the monitoring unit described in the *Manual for monitoring unit type PCM2*. This is therefore chiefly aimed at the personnel that have the day to day responsibility for the plant, but also to other personnel who have cause to work with the charging rectifier.

For a complete description, this manual is to be used together with the description for the monitoring unit, *Manual for monitoring unit type PCM2*.

The term "charging rectifier" is replaced henceforth with the shorter term "rectifier".

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 in avoiding 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 are 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 instructions.

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

3 TECHNICAL DATA

3.1 ELECTRICAL DATA

3.1.1 Range

PRX can be equipped with one or two rectifier modules.

PRX							Rectifier module		
Model designation	U _{NOM} (V _{DC})	I _{RATED} (A)	Mains power* ¹ (VA)	Mains current* ¹ (A _{RMS})	Mains fuse* ² (A)	Power loss* ³ (W)	Number of modules	I _{RATED} (A)	Model designation
PRX 24/20	24	20	670	3.4	10	97	1	20	L0500B-IW
PRX 24/40		40	1340	6.8	10	189	2	20	L0500B-IW
PRX 24/60		60	1960	10	16	192	1	60	V1500B
PRX 48/12	48	12	800	4.1	10	97	1	12	L0600A-IW
PRX 48/24		24	1600	8.2	10	189	2	12	L0600A-IW
PRX 48/25		25	1600	8.2	10	161	1	25	L1250A-IW
PRX 48/50-1		50	3150	16.1	20	317	1	50	L2500A-IW
PRX 48/50-2		50	3200	16.4	20	317	2	25	L1250A-IW
PRX 110/10	110	10	1410	7.2	10	144	1	10	L1250K
PRX 110/20		20	2820	14.4	16	283	2	10	L1250K
PRX 125/9	125	9	1410	7.2	10	144	1	10	L1250K
PRX 125/18		18	2820	14.4	16	283	2	10	L1250K

*¹: max at 195 V_{AC}

*²: recommended value

*³: type at 230 VAC and full load. Also includes monitoring unit.

3.1.2 Common electrical input data

Rated voltage 110*¹/115*¹/120*¹/220/230/240 V AC 1- phase

Frequency 47 – 63 Hz

Power factor..... > 0.95 at 230 V_{AC}, full load

Connection screw terminal block..... 0.14 – 4 mm²

*¹: Only applies to certain models, see [Electrical data for rectifier module](#).

3.1.3 Common electrical output data

Voltage regulation (static)..... <±0.5% of nominal output voltage

Voltage regulation (dynamic) <±1% within 3 seconds, 0-100 / 100-10 % load change

Current regulation <±1% of rated current

Setting range, current limit 0 - 100 % of rated current

Ripple voltage <0.1 %_{RMS}

Ripple current <1% of rated current

Efficiency, typical >90 % at 230 V_{AC}

Connection screw terminal block..... 1.5 - 35 mm²

3.1.4 Electrical data for rectifier module

Model designation, rectifier module	Output data			Input data			Power loss ^{*2}
	U _{NOM} (V _{DC})	Setting range (V _{DC})	I _{RATED} (A)	Voltage range (V _{AC})	Mains power ^{*1} (VA)	Mains current ^{*1} (A _{rms})	
L0500B-IW	24	21 - 28	20	85 - 295	670	3.4	92
V1500B			60	180 - 264	1960	10.0	187
L0600A-IW	48	42 - 56	12	85 - 295	800	4.1	92
L1250A-IW			25	85 - 295	1600	8.2	156
L2500A-IW			50	150 - 295	3150	16.1	312
L1250K			110/125	97.5 - 145	10	90 - 300	1410

*1: max at 195 V_{AC}

*2: type at 230 V_{AC} and full load

3.2 Environmental data

Class of enclosure IP21 as per EN 60529
Cooling Temperature controlled fans in rectifier modules
Ambient temperature (specified data applies) 0 to +40 °C
Storage temperature -40 to +70 °C
Humidity <90 % RH, non-condensed
Altitude above sea level <2000 m
Noise level at +20 °C, fully equipped <54 dBA

3.3 Mechanical data

Design Wall cabinet
Arrangement On a wall indoors in dry, clean room
Weight 13 kg, fully equipped
Dimensions 340/245/227 mm (h/w/d), see also dimension diagram [Appendix A](#)
Colour RAL 7035 light grey
Cable inlets From underneath

3.4 Conformity with standards

EN 60529 Class of enclosure IP21
EN 50178 LVD. Electronic equipment, including power electronics in electrical power installations.
EN 50272-2 Safety requirements for secondary batteries and battery installations
EN 61000-6-2 EMC. Immunity for industrial electronics
EN 61000-6-3 EMC. Emission standard for commercial and light-industrial environments

4 FUNCTIONAL DESCRIPTION

4.1 GENERAL

PRX is a complete rectifier with integrated monitoring.

Most functions are handled by the monitoring unit and are described in the *Manual for monitoring unit PCM2*. Only the functions that feature at a general rectifier level are described here.

4.2 FRONT PANEL

The front panel includes the operator panel, mains breaker and voltmeter terminal.

The operator panel is the unit used as the user interface. It is fitted with a display, keypad and indicator lamp for alarm.

The mains breaker handles the mains feed to the rectifier modules.

The voltmeter terminal has short-circuit protection for safe measurement of the battery voltage and is designed for standard 4 mm banana plugs.

4.3 RECTIFIER MODULES

The rectifier modules are of the “plug-in” type and can in principle be replaced during operation. There is room for up to two parallel modules. The rectifier modules can be accessed by folding out the front panel of the equipment.

There are three indicator lamps on the front of the module. These are only visible with the front panel folded out:

- AC OK - Green -> Mains OK
Off -> Mains power failure
 - DC OK - Green -> DC OK
Off -> Low DC voltage
 - ALM - Red -> Alarm
Off -> OK
-

4.4 I/O UNIT

The I/O unit contains an adapter for the external connections required for the monitoring unit. It is fitted directly on the back plate together with the terminal blocks for AC input and DC output.

The I/O unit is also available in a more basic design where certain functions and connections are not included. This design is referred to here as “simplified version”.

4.5 FUNCTIONS

4.5.1 General

Only the most important functions are specified here. For more information, see the *Manual for monitoring unit PCM2*.

4.5.2 Float charging

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

For more information, see the *Manual for monitoring unit PCM2*.

4.5.3 Equalizing charging

Equalizing charging means charging with raised voltage level over a limited period. It is used partly for the initial charge, and partly for equalizing cell voltages if spread has occurred.

For more information, see the *Manual for monitoring unit PCM2*.



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.

4.5.4 Battery circuit test

A 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.

For more information, see the *Manual for monitoring unit PCM2*.

5 OPERATION

5.1 GENERAL

The bulk of the operation is associated to the monitoring unit. This is described in the *Manual for monitoring unit PCM2*. Other operation is detailed in this section.

5.2 MAINS FEED

The mains breaker handles the mains feed to the rectifier modules.

Note that the breaker only cuts the mains feed to the rectifier modules. The monitoring unit, however, is fed from the battery and thereby continues to work.



WARNING: Note that the breaker for mains feed does not make the equipment dead. For a total dead state, the mains feed must also be cut externally and the equipment's DC output disconnected from the battery.



5.3 OPERATOR PANEL

The operator panel is the link between the equipment and the user. It is made up of a display, a keypad and a LED. Operation is described in the *Manual for monitoring unit PCM2*.



5.4 RECTIFIER MODULES

There are three LED indicators on the front of the rectifier module. However, the front panel must be folded out in order for them to be visible. Their function is as follows:

- AC OK - Green -> Mains OK
Off -> Mains power failure
- DC OK - Green -> DC OK
Off -> Low DC voltage
- ALM - Red -> Alarm
Off -> OK



When the module gives an alarm you have the option of finding out in detail the cause of the alarm via the operator panel menus, see the *Manual for monitoring unit PCM2*.

The modules are of the "plug-in" type and can in principle be replaced during operation. For more information, see the [INSTALLATION INSTRUCTIONS](#) section.

5.5 VOLTMETER TERMINALS

When measuring the battery voltage you should avoid measuring directly at the battery terminals due to the risk of arcing in the event of a possible short circuit. Use the short-circuit protected voltmeter terminal on the front panel instead.

The voltmeter terminal fits a standard 4 mm measuring pin. To avoid measurement errors, the voltmeter used should have high ohms, 10 Mohm or better.



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 2 [SAFETY INSTRUCTIONS](#)) section.



WARNING! Check both before and after setting-up that the equipment does not have any mechanical damage. Check that the equipment and individual rectifier modules have the intended rated voltage. Cables for input and output power must be correctly dimensioned to avoid fire hazard.

6.2 GENERAL

Installation of the parts that belong to the monitoring unit are not dealt with in this manual. For complete installation instructions these instructions should therefore be used in combination with the installation instructions included in the *Manual for monitoring unit PCM2*.

6.3 STORAGE AND PROTECTION

Storage is to be in a dry area and at a temperature that does not exceed the -40 to +70 °C range.

6.4 MOUNTING

The equipment is designed for wall mounting indoors in a room that is dry, clean and free from conductive dust. In order to guarantee free air flow for all ventilation openings, at least 40 mm of free space should be left on each side and at least 100 mm on the bottom of the equipment.

Temporarily removing the rectifier modules facilitates assembly considerably, partly through better accessibility, and partly through substantially lower weight.

The rear plate of the equipment has four mounting holes shaped as keyholes. In order to fit the key hole, the screw should have a diameter of a max of 6 mm and the screw head diameter 9.5 - 13.5 mm. See also dimension diagram [Appendix A](#).



WARNING! The equipment may cause personal injury or damage to property if dropped. Use secure lifting aids where appropriate. Make sure the mounting screws and their attachments to the wall can easily and safely handle the weight of the equipment.

6.5 ELECTRICAL INSTALLATION

6.5.1 General

The equipment is designed for permanent installation. Protective earth must be connected before any other installation

For cable inlets there are six "knock-out" holes of which one has a diameter of 37 mm designed for fitting type PG29 and five with a diameter of 22.5 mm designed for fitting type PG16.

In order to increase accessibility and thereby facilitate installation, it is



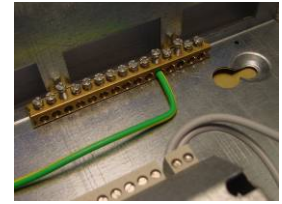
recommended that you remove the rectifier modules when installing.

6.5.2 Earthing

For earth and screen connections, use the earth bar available in the connection area, see adjacent figure.

There is an additional earth terminal specially designed for the incoming mains cable in direct connection to the mains terminal block.

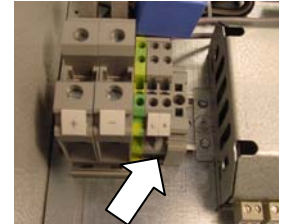
For potential equalization in connection with the cable inlet there is a hole designed for an M8 bolt intended for a ring cable shoe.



6.5.3 Mains voltage

Check that the outer fuse conforms with the recommendations in the [ELECTRICAL DATA](#) section.

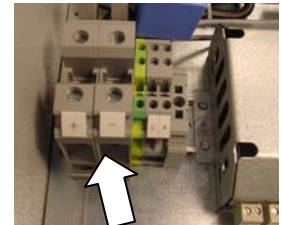
Connect single phase mains voltage to the terminal marked L and N. Connect the earth conductor where possible to the adjacent earth terminal, although this can also be connected to the earth bar.



6.5.4 Battery/Load

Check that the rectifier's rating plate shows the rated voltage that conforms with the battery's nominal voltage.

Connect the DC system to the terminals marked + and -. Select cables that are dimensioned for handling the rectifier's rated current.



WARNING! *The rectifier's DC output does not have an internal fuse. Ensure that there is an external fuse to the battery.*

6.5.5 Rectifier modules

The unit can hold up to two rectifier modules. In case of one single module, use the left position seen from front.

The modules can in principle be replaced during operation. However, it is recommended to start by disconnecting the mains voltage via the mains breaker at the front.

Press bottom left (see figure) to loosen the module. This releases a handle that can be pulled out to enable the module to be pulled out of its position.



The module is installed in reverse order by carefully pushing it into place. Move in the last part by pressing in the handle until it snaps in place.



WARNING! *Check carefully that the rectifier modules have the correct rated voltage. A mechanical block prevents a 110V-module being incorrectly fitted to the equipment with lower rated voltage. The block may not be removed. Do not attempt to force the block by, for example, lifting the module and pushing it at an angle.*

6.5.6 I/O unit

All the connections to the monitoring units are grouped in a unit called the I/O unit. The connectors are pluggable, i.e. they can be removed for better accessibility when installing. For more information on these connections, see the *Manual for monitoring unit PCM2*.



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 must be fitted during operation.*

7.2 PREPERATORY INSPECTION

Check that the equipment is free from damage, correctly fitted and that all the ventilation openings are free from obstacles.

Check that all cable installations, electrical connections and protective earths are correctly implemented.

Check that all contact safety devices and breakers are disconnected.

Check that the rated voltage of the equipment corresponds to the rated voltage of the plant.

7.3 ELECTRIFICATION

7.3.1 DC

Start by connecting the battery by connecting a fuse in the battery circuit, for example. Note that a connection current occurs when the rectifier modules' output capacitors are being charged. This could give rise to some spark formation at the point of connection.

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.



WARNING! *Connection of the battery with wrong polarity may harm the rectifier. At any uncertainty, do this:*

1. *Pull out the rectifier modules.*
2. *Engage the battery circuit and check the polarity on the rectifier DC output terminals.*
3. *Disengage the battery circuit and restore the rectifier modules.*
4. *The continue according to the instructions above*

7.3.2 AC

Close the mains breaker on the front of the equipment. The rectifier modules will then start up.

The battery now starts to charge, and if it was in a state of deep discharge, the charging starts with rated current until the float charging level is reached. Certain types of battery require an initial equalizing charge. Always follow the recommendations given by the battery manufacturer.

7.4 CHECK OF CHARGING VOLTAGE

Check the settings of the monitoring units to ensure the voltage level for float charging and equalizing charging conform to the battery manufacturer's specifications, see *Manual for monitoring unit PCM2*.

When the battery is charged to a level where the “High current” alarm is no longer active, you should check that the actual output voltage conforms with the set float charging voltage, see section 8.1.2 [Check of charging voltage](#).

7.5 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 the *Manual for monitoring unit PCM2*.

Check that the measurement values presented agree with the actual position. Check that the parameters for charging voltages, alarms and other parameters conform with the intended function, see the *Manual for monitoring unit PCM2*.

7.6 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 the *Manual for monitoring unit PCM2*.

8 MAINTENANCE

8.1 ANNUAL INSPECTION

8.1.1 General

In addition to these instructions, you must observe the instructions for maintenance in the *Manual for monitoring unit PCM2* and the battery manufacturer's maintenance instructions.

8.1.2 Check of charging voltage

Connect a measuring instrument to the voltmeter terminal (see section 5.5 [VOLTMETER TERMINAL](#)). Check that the rectifier's output voltage corresponds to the set value.

If the float charging voltage is temperature controlled, it is difficult to determine what the expected output voltage should be. The solution is to temporarily shut down the temperature control. You do this using the menu option *Functions, battery temperature* to specify that the temperature sensor is not installed (see the *Manual for monitoring unit PCM2*, section on *Operation, Functions*). Do not forget to reset the parameter for the installed temperature sensor following a completed measurement!

All control is based on measurement. If charge voltage is found to be in a state of non-conformance it is therefore the voltage measurement that should be calibrated, see the instructions for maintenance in the *Manual for monitoring unit PCM2*.

8.1.3 Check of cooling capacity

Check that the ventilation openings for the equipment and the individual rectifier modules are not clogged with dust or other contamination. Clean where necessary.

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 removed contact protection devices may only be carried out by authorised service personnel (see section 2 [SAFETY INSTRUCTIONS](#)). Before work can commence on the equipment, it must be guaranteed that the internal capacitors are discharged through the following procedure:

1. Disconnect the incoming mains feed.
2. Close the equipment's mains breaker.
3. Wait at least 5 minutes to allow the capacitors to discharge.



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 with exposed circuit boards, splinter protection must therefore be used (protective goggles and screens).

9.2 FAULT TRACING FOLLOWING ALARM

Fault tracing in connection with alarm messages is described in the *Manual for monitoring unit PCM2*.

9.3 OTHER FAULT TRACING

The type of faults that can be attributed to the rectifier in general are dealt with here. For faults that relate to the monitoring unit see the *Manual for monitoring unit PCM2*.

In order to see the indicator lamps of the rectifier modules the front panel must be folded out.

The primary fuse trips when the rectifier is turned on

- Cause 1: Incorrect type of mains fuse. Check that the mains fuse observes the specifications in section 3.1 [ELECTRICAL DATA](#).
- Cause 2: Internal rectifier module fault. Install one module at a time in order to identify the module that is responsible for the problem. Replace the defective module.

The rectifier has no output, green indicator lamp "AC OK" is out

- Cause 1: Mains voltage missing. Check that there is mains voltage to the mains input terminals and that the mains breaker is closed.
- Cause 2: Rectifier modules are not properly inserted.

The rectifier has no output, green indicator lamp "AC OK" and "DC OK" are lit

- Cause 1: Input "EXT. FAULT" is used as external blocking and is in open position.
- Cause 2: Fault in external output fuse. Check that the output fuses are properly dimensioned to handle the rectifier's rated current.

The rectifier module's green indicator lamp "AC OK" is lit and "DC OK" is out

- Cause 1: The rectifier module is probably defective. Replace the rectifier module.
- Cause 2: If the red lamp "ALM" is lit as well, the cause could be that the rectifier module has tripped due to high output voltage, HVSD (High Voltage Shut Down). Reset by making the module dead, which is easiest done pulling out the module for a couple of seconds until all the lamps are off and then the put the module back in place again. If the fault returns, the module is probably out of order. Replace the module.

The rectifier module's red indicator lamp "ALM" is lit

Cause 1: Unless the cause is obvious, e.g. see the alternatives above, you can show the status of the rectifier module in detail via the display on the monitoring unit, see the *Manual for monitoring unit PCM2*.

The rectifier output voltage is too low

Cause 1: The rectifier load is above its capacity (rated current). This is normal in connection with recharging following deep discharge.

Cause 2: Battery circuit test in progress. This is a test that is normally executed automatically once a day.

Cause 3: The requested charging voltage is close to or above the level of the parameter U_{maximum} . The voltage will be limited 1% below this level. If higher voltage is desired, the setting of the parameter U_{maximum} must be increased.

Cause 4: High temperature in the battery/battery compartment. Only applicable if the rectifier controls the temperature of the float charging voltage. There is no fault with the rectifier in this case. Look for the fault in the high temperature instead. Alternatively the temperature sensor could be defective. Check whether the display is reporting the correct battery temperature.

Cause 5: Incorrectly set float charging voltage level. Adjust the setting.

Cause 6: Incorrectly calibrated voltage measurement. Recalibrate the monitoring unit's measurement of battery voltage.

The rectifier output voltage is too high

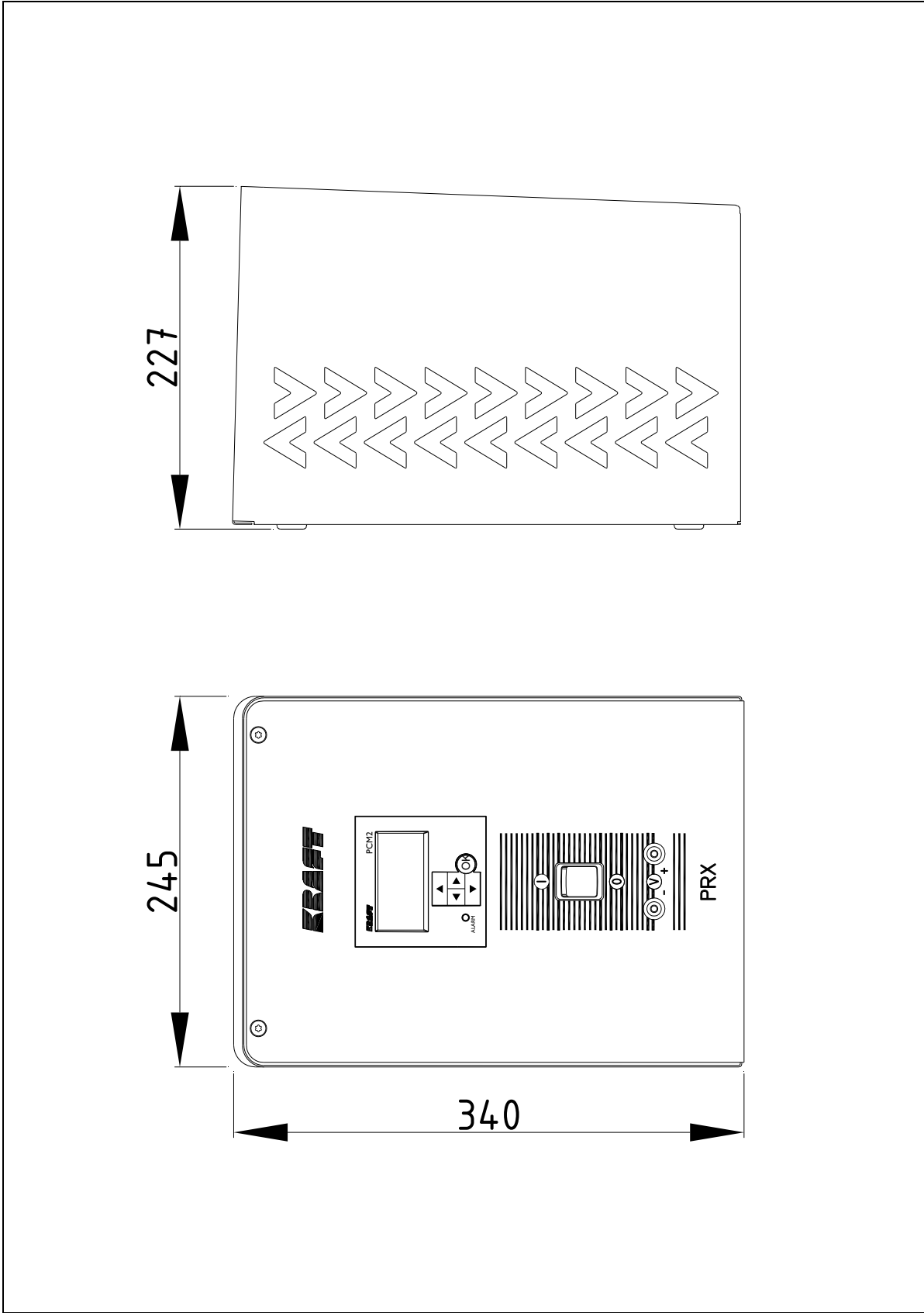
Cause 1: Equalizing charging in progress. This has either been initiated manually or automatically following a power failure.

Cause 2: Low temperature in the battery/battery compartment. Only applicable if the rectifier controls the temperature of the float charging voltage. There is no fault with the rectifier in this case. Look for the fault in the low temperature instead. Alternatively the temperature sensor could be defective. Check whether the display is reporting the correct battery temperature.

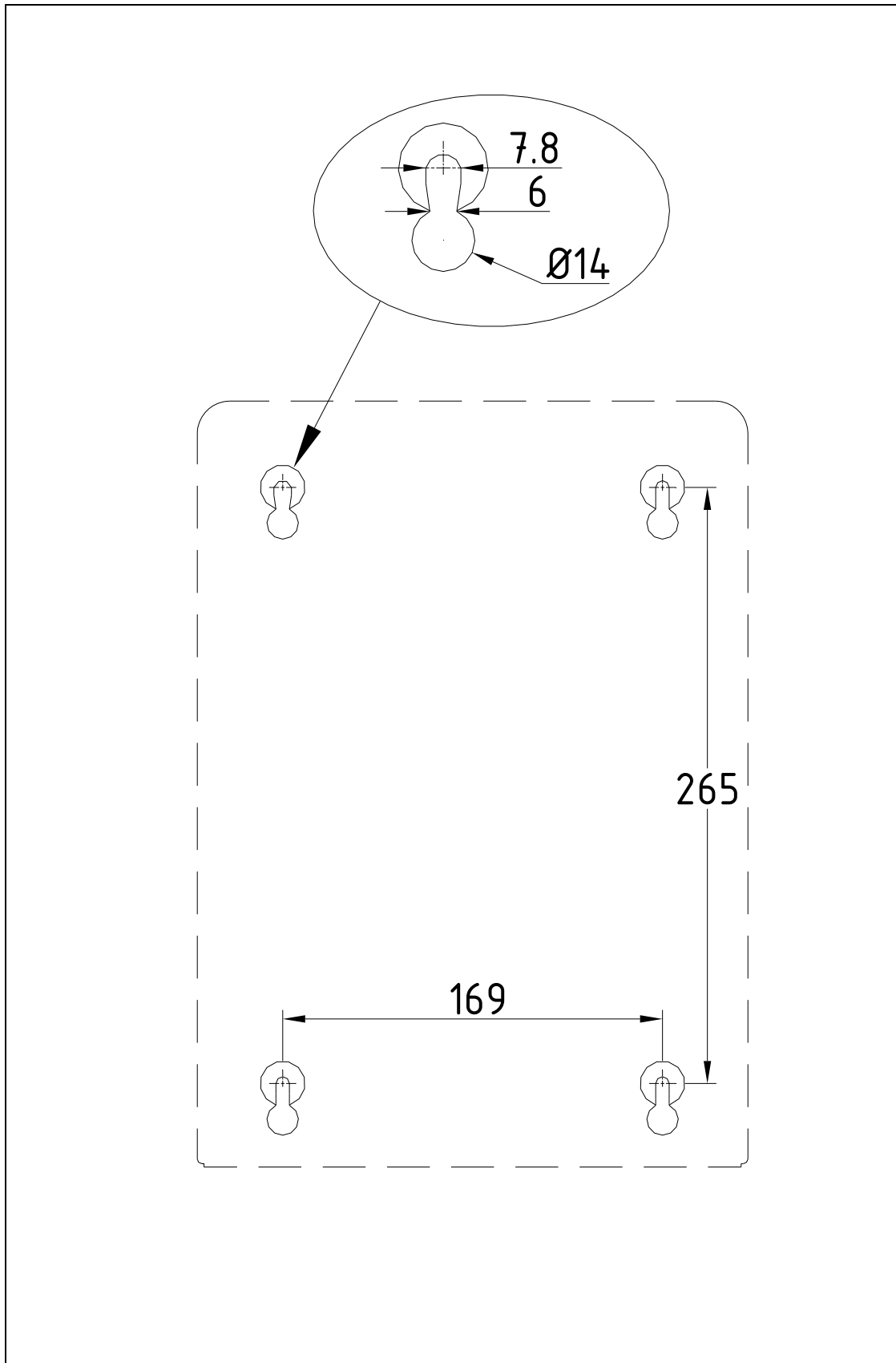
Cause 3: Incorrectly set float charging voltage level. Adjust the setting.

Cause 4: Incorrectly calibrated voltage measurement. Recalibrate the monitoring unit's measurement of battery voltage.

Appendix A
DIMENSION DIAGRAM

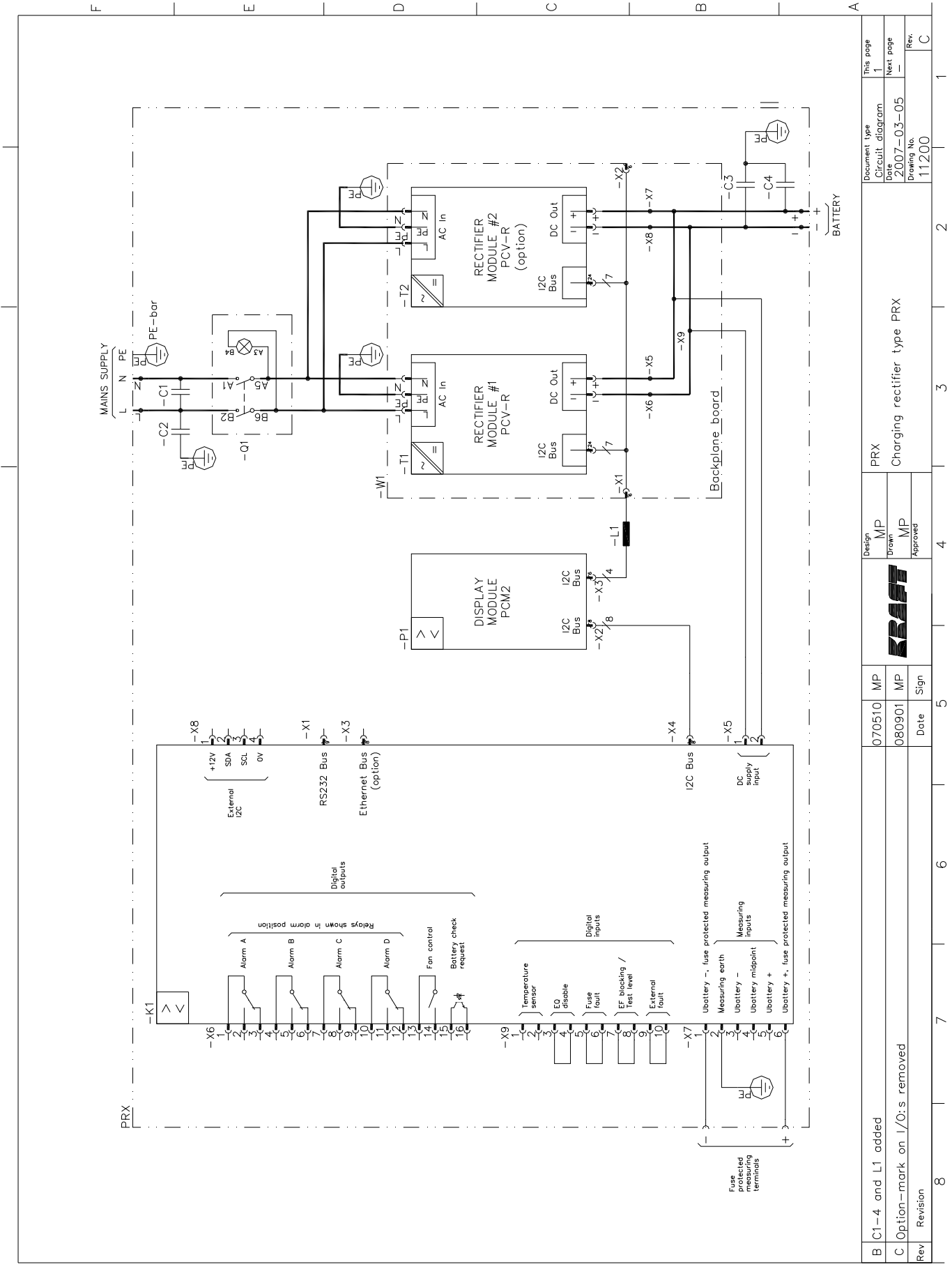


Dimension diagram, external dimensions, PRX



Dimension diagram, mounting holes, PRX

Appendix B CIRCUIT DIAGRAM PRX



Document type	Circuit diagram	This page	1
Date	2007-03-05	Next page	-
Drawing No.	11200	Rev.	C
Design	MP	PRX	
Drawn	MP	Charging rectifier type PRX	
Approved	MP		
070510	MP		
080901	MP		
Date	Sign		
8	7	6	5
Revision			

