

Manual for charging rectifier type PRM1



SAFETY INSTRUCTIONS



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



This product contains dangerous voltages 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 authorized 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.



Warning for reverse voltage. Power is supplied from several sources.

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

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- [A LAYOUT AND DIMENSION DIAGRAM, PRM1](#)
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1 PRESENTATION

PRM1 is a complete charge rectifier with built-in monitoring, intended for mounting in a 19" rack.

PRM1-W is a variant where PRM1, together with a 19" wall cabinet comprises a complete unit.

PC10 is a complete DC system where PRM1 is a part of the system.

The system is built on a modular basis for easy service and high flexibility. 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. The rectifiers are of "plug-in" type and can be connected in parallel to increase capacity and availability.

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 D.C. system.

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

2 SAFETY INSTRUCTIONS



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

For safety reasons the concerned 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 that the content of 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 that the content of 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 Assortment

PRM1 can be equipped with up to four rectifier modules, depending on the model. The table below also applies to model variant PRM1-W.

PRM1			Rectifier module			
Model designation	U _{NOM} (V _{DC})	I _{RATED} (A)	Number		I _{RATED} (A)	Model designation
			min	max		
PRM1 24/80	24	80	1	4	20	L0500B-IW
PRM1 24/240		240	1	4	60	V1500B
PRM1 48/48	48	48	1	4	12	L0600A-IW
PRM1 48/100		100	1	4	25	L1250A-IW
PRM1 48/200		200	1	4	50	L2500A-IW
PRM1 110/40	110	40	1	4	10	L1250K

3.1.2 Common electrical input data

Rated voltage 110*¹/115*¹/120*¹/220/230/240 V AC 1- phase*²
 Frequency 47 – 63 Hz
 Power factor > 0.95 at 230 V_{AC}, full load
 Connection PRM1 1.5 mm² cable, 2 m included
 Connection PRM1-W / PC10 Screw terminal block, 0.2 – 6 mm²

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

*²: A single rectifier module is supplied from one phase, but several modules can each be supplied from separate phases.

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 PRM1 For rated voltage 24 V: 16 mm² cable, 2 m included
 For rated voltage 48 V: 10 mm² cable, 2 m included
 For rated voltage 110 V: 2.5 mm² cable, 2 m included
 Connection PRM1-W Double screw terminal blocks, 0.75 – 35 mm² each
 Connection PC10..... Internal connection

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	7.2	139

*1: max at 195 V_{AC}

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

3.2 ENVIRONMENTAL DATA

Class of enclosure PRM1	IP20 as per EN 60529
Class of enclosure PRM1-W	IP20 as per EN 60529 (IP21 on request)
Cooling	Temperature controlled fans in rectifier modules
Ambient temperature (spec. data applies).....	0 to +40 °C
Storage temperature	-40 to +70 °C
Humidity	<90 % RH, non-condensed
Altitude a.s.l.....	<2000 m
Noise level, at 25 % load, built into cabinet	<50 dBA, 1 rectifier module <54 dBA, 2 rectifier modules <56 dBA, 3 rectifier modules <57 dBA, 4 rectifier modules

3.3 MECHANICAL DATA

3.3.1 PRM1

Version.....	Rack for 19" frame
Placement	Indoors in dry, clean room
Mounting, rack.....	Mounted in 19" rack
Mounting, I/O module	Mounted on 35 mm guide rails or directly on mounting plate
Weight	18 kg, fully equipped with 4 rectifier modules
Dimensions, rack	3 HU, 133/483/312 mm (h/w/d), see also dimension diagram Appendix A
Dimensions, I/O module	117/224/66 mm (h/w/d), see also dimension diagram Appendix A
Colour, rack	RAL 7035 light grey



3.3.2 PRM1-W

Version.....	Wall mounted cabinet
Placement.....	Indoors in dry, clean room
Weight.....	50 kg, fully equipped with 4 rectifier modules
Dimensions.....	604/600/500 mm (h/w/d), see also dimension diagram Appendix C
Colour.....	RAL 7035 light grey
Cable inlet.....	From below and above



3.4 CONFORMITY WITH STANDARDS

EN 60529.....	Encapsulation class IP20
EN 50178.....	LVD. Electronic equipment, including power electronics in electrical power installations.
EN 61000-6-2.....	EMC. Immunity for industrial electronics
EN 61000-6-4.....	EMC. Emission from equipment in an industrial environment

4 FUNCTIONAL DESCRIPTION

4.1 GENERAL

PRM1 is a complete rectifier unit with built-in monitoring, intended for mounting in a 19" rack.



PRM1 can also be supplied built into a wall mounted cabinet and is then designated PRM1-W.



Another alternative is PRM1 mounted as a part of a complete DC system of type PC10.

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 APPLICATION EXAMPLE

PRM1/PRM1-W is intended for integration in a complete DC system. An example of such is shown in the simplified schematic below.

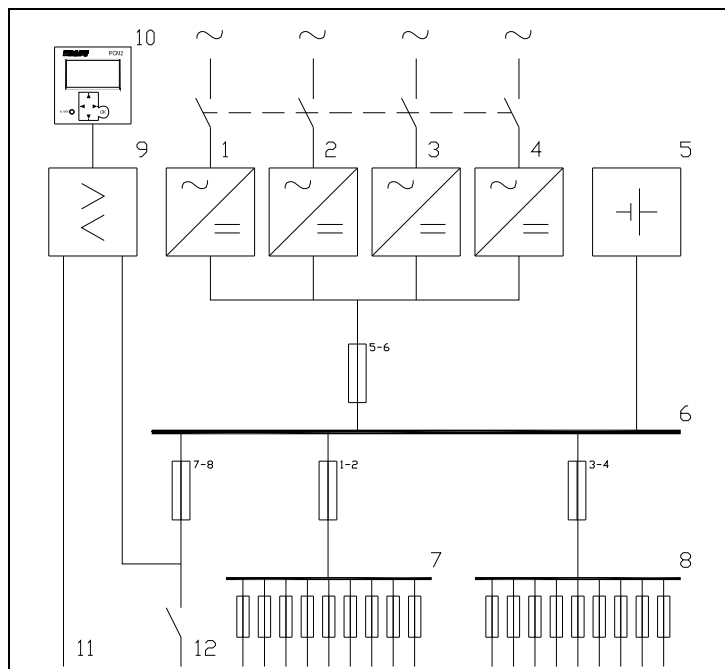


Figure 1 Application example PRM1

- | | | | |
|------|--------------------------------|-----|---------------------------|
| 1-4: | Rectifier modules (T1-4), PRM1 | 9: | I/O unit (K1), PRM1 |
| 5: | Battery | 10: | Operator panel (P1), PRM1 |
| 6: | Battery block | 11: | Alarm outputs |
| 7-8: | Distribution unit | 12: | Capacity test terminals |

4.3 RECTIFIER MODULES

The rectifier modules are of the "plug-in" type and can be replaced during operation. Depending on the model, up to two or four parallel modules can be fitted.

There are three indicator lamps on the front of the module:

- 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 RACK FOR RECTIFIER MODULES AND OPERATOR PANEL

The rack unit contains the operator panel and the rectifier modules.

The operator panel P1 is the unit used as the user interface. It is mounted modularly to the left of the rectifier modules.

The rectifier modules (T1 – T4) are "plug-in" modules. Of the four locations, two or four of them can be equipped, depending on the PRM1 model, see section [TECHNICAL DATA](#).

4.5 TEST CONTACTS

There are short-circuit proof test contacts (X30) alongside the operator panel, for checking the battery voltage. The test contacts accept 4 mm banana plugs.

4.6 I/O UNIT

The I/O unit contains connection terminals for the external connections required for the monitoring unit.

4.7 FUNCTIONS

4.7.1 General

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

4.7.2 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's instructions.

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

4.7.3 Equalization charging

Equalization charging means charging at an increased voltage level over a limited period. It is used partly for the initial charge, and partly for equalizing cell voltages if spreading 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 equalization charging. For some battery types equalization charging could even be harmful to the batteries. Always follow the battery manufacturer's instructions.

4.7.4 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

Most of the operation is associated with the monitoring unit. This is described in the *Manual for monitoring unit PCM2*. Other operation is detailed in this section.

5.2 OPERATOR PANEL

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



5.3 RECTIFIER MODULES

There are three indicator LEDs on the front of the rectifier module with the following functions:

- 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 the cause of the alarm out in detail 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.

5.4 MAINS SUPPLY

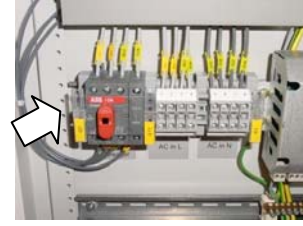
5.4.1 PRM1

PRM1 is supplied with a cable stump (phase, neutral, earth) per rectifier module. The rectifier modules can therefore be supplied either from one common phase or from separate phases.

5.4.2 PRM1-W / PC10

The rectifier module mains breaker Q1 is behind the front plates (behind door in PC10). Only the phase connection is switched, not the neutral connection.

Note that the breaker only switches 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 remove all voltages. To remove all voltages, the battery must also be disconnected.

5.5 TEST CONTACTS

When measuring the battery voltage you should avoid measuring directly on the battery poles, due to the risk of arcing in the event of a possible short circuit. Instead, use the short-circuit protected test contacts just below the operator panel.

The test contacts accept 4 mm insulated safety plugs, and also 4 mm banana plugs. To avoid measurement errors, the voltmeter used should have high internal resistance, 10 Mohm or better.



6 INSTALLATION INSTRUCTIONS

6.1 SAFETY INSTRUCTIONS



WARNING! This product contains dangerous voltages 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 [SAFETY INSTRUCTIONS](#) section 2.)



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. Cables for input and output power must be correctly dimensioned to avoid fire hazard.

6.2 GENERAL

Installation of parts belonging to the monitoring unit is 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 within the -40 to +70 °C range.

6.4 MOUNTING

6.4.1 General

The equipment is intended for placement in a dry, clean environment that is free from conductive dust. For EMC reasons, both rack and I/O unit must be placed within the same metal enclosure.

6.4.2 PRM1

6.4.2.1 Rack

Mount the rack unit in a 19" rack frame. Make sure there is sufficient space for ventilation, see [Appendix A, DIMENSION DIAGRAM](#).

6.4.2.2 I/O Unit

The I/O unit is supplied with adapters for 35 mm guide rails. The unit can also be mounted directly on a flat surface by removing the adapters first. Make sure that the distance between the rack and I/O unit is sufficiently close for the supplied 2 m cable to reach.

6.4.3 PRM1-W

The cabinet is intended for wall mounting. Special wall mountings are supplied to simplify assembly. Undo the screw on the left front edge (see arrow) and open the cabinet. Fix the wall mountings on the back of the cabinet with two screws each. Close the cabinet again and fix with the screw. The cabinet can now be hooked onto suitable attachment screws in the wall.





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.*

6.4.4 PC10

For DC system PC10, the PRM1 unit is already installed.

6.5 ELECTRICAL INSTALLATION

6.5.1 General

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

6.5.2 Earthing

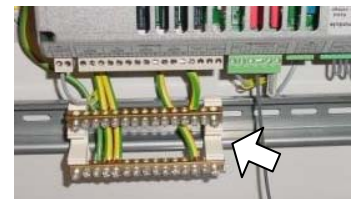
6.5.2.1 PRM1

Earth the rack using the 6 mm² earthing wire connected to the back plane in the rack.
Earth the I/O unit via the 1.5 mm² earthing wire connected to the unit's cover.

6.5.2.2 PRM1-W

The earthing and shielding are to be connected to the earth rail shown on the adjacent figure.

There are 5 mm threaded studs welded on the top inside of the hinged part, for potential equalization.



6.5.2.3 PC10

For earth and shield connections, the earth bar located close to the terminal bar should be used.

6.5.3 Mains voltage

6.5.3.1 External fuse rating

The size of the external primary fuse is selected as follows:

1. Find the maximum mains current for the type of rectifier module in question from the table in section [Electrical data for rectifier module](#).
2. Multiply it by the number of rectifier modules.
3. Choose the next highest fuse rating.

NOTE: If you choose to feed the rectifier modules from different phases (see below), point 2 above must naturally be suitably modified.

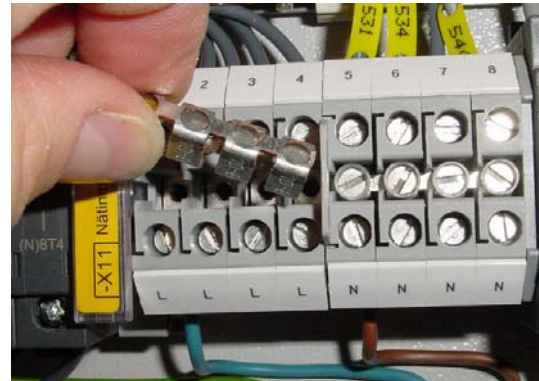
6.5.3.2 Connection PRM1

Each rectifier module has its own wiring for phase and neutral. It is therefore possible to select between feeding the modules from individual phases or to connect two or more modules in parallel to the same phase. The wires are marked Ln for phase and Nn for neutral, where n is the rectifier module number (1-4).

6.5.3.3 Connection PRM1-W /PC10

Each rectifier module has its own terminal blocks for phase and neutral. It is therefore possible to select between feeding the modules from individual phases or to link two or more to the same phase. To simplify this, the terminal blocks are fitted with connection links. The links can be cut to suit the required number of poles. At delivery, all mains inputs are connected in parallel.

NOTE: When cutting the connection links, ensure the "tag" is removed completely, so that the insulation distance is not reduced.



6.5.4 Battery/Load

6.5.4.1 General

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



WARNING! *The rectifier module's DC output does not have an internal fuse. Ensure that there is an external fuse to the battery. Not valid for PC10 though, since it has an internal fuse. Check the polarity carefully before connection, incorrect polarity can damage the rectifier.*

6.5.4.2 PRM1

Each rectifier module has its own wires for DC output. They are marked +n and -n respectively, where n is the number of the rectifier module (1-4). The DC output of the rectifier modules shall be connected in parallel, i.e. all modules are to be connected to a common fuse group at the battery block. Select cables that are dimensioned for handling the rectifier's rated current.

6.5.4.3 PRM1-W

The DC output is connected to the existing DC system (normally to a fuse group in the battery block) via terminal X31. Each pole has double terminal blocks, which are connected in parallel.

Connect the positive pole to one or both terminal blocks X31:1-2 marked "DC out +".

Connect the negative pole to one or both terminal blocks X31:3-4 marked "DC out -".



6.5.4.4 PC10

The DC output is already internally connected to a fuse group in the battery distribution.

6.5.5 Rectifier modules

The rectifier modules are normally packed separately and are to be put in place during the installation. The rack module slots should be equipped with modules starting from the leftmost position and with spare slots to the right.

The modules can in principle be replaced during operation. However, we recommend disconnection of the mains supply first.

Press bottom left (see figure above) to release the module. This releases a handle that can be pulled out to enable the module to be extracted from its position.



The module is installed in reverse order by carefully pushing it into place. Move 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. Equipment with a rated voltage lower than 110V has a mechanical block that prevents a 110V module from being incorrectly fitted to equipment with a lower rated voltage. The block may not be removed.



6.5.6 I/O Unit

6.5.6.1 General

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. Only the connections that are made between the rack unit and I/O unit via the supplied PRM1 wiring are described here, as well as the power supply to the PRM1-W I/O unit (already done in PC10). For other connections to the I/O unit, see *Manual for monitoring unit PCM2*.



6.5.6.2 Communication cable

The supplied RJ45 cable (standard network cable) is already connected to the operator panel in the rack at one end, the other end shall be connected to the I/O unit connector X4. Note that there are two physically identical connectors beside each other; X3 and X4. X4 is closest to the short side of the unit.

This only applies to PRM1. On PRM1-W and PC10, the cable is already connected at delivery.

6.5.6.3 Power supply PRM1

The negative pole cable for the monitoring unit power supply is included and one end is already connected to the back plane card in the rack. Connect the other end marked "Aux-" to the I/O unit screw plinth X5:1.

The monitoring unit positive power supply (screw plinth X5:2) is most suitably connected to a fuse group in the battery distribution board.

6.5.6.4 Power supply PRM1-W

The negative pole cable to the monitoring unit's power supply is already connected.

The monitoring unit positive power supply (screw plinth X5:2) is most suitably connected to a fuse group in the battery distribution board.

6.5.6.5 Power supply PC10

For PC10, this is already taken care of.

6.5.7 Operator panel

The operator panel is already installed at delivery. The following description is mainly intended for service in the future.

To release the operator panel, press the upper part of the panel causing a magnetic lock to disengage (see upper figure).

Pull the upper edge so that the magnet releases and then pull the lower edge free from the spring catch (lower figure). There are two wires on the rear of the panel, if these are released, the panel can be removed completely.

To refit the panel, first connect the two wires. Then check that both the



magnetic lock and the spring lock are extended. Press the lower edge onto the spring lock and then the upper edge onto the magnetic lock until it clicks into place.

6.5.8 Test contacts

6.5.8.1 PRM1

The I/O unit's connection terminal X7 has a contact for a short-circuit proof test contact, used to measure the battery voltage. Use the supplied cable to connect X7:1 and X7:6, marked V- and V+ respectively, to the test contacts located just below the operator panel.

6.5.8.2 PRM1-W / PC10

The short-circuit proof test contact is already connected and ready for use on the front of the equipment.

7 STARTING UP

7.1 SAFETY INSTRUCTIONS



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

7.2 PREPARATORY INSPECTION

7.2.1 General

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 are in place.

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

7.3 POWERING UP

7.3.1 DC

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

After a few seconds, the operator panel display lights up, and after a few more seconds text appears on the display. All measurement values are initially reset. The measurement starts after around 10 seconds. Any alarms are activated first after around 30 seconds have passed.

7.3.2 AC

Turn the mains power on. On PRM1-W and PC10 this is done with breaker Q1 inside the cabinet. 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 CHECKING THE 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 [Checking the charging voltage](#).

7.5 CHECKING THE SETTINGS

Each time the monitoring unit has been powered down, the built-in clock must be reset with the current date and time, see the *Manual for monitoring unit PCM2*.

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

7.6 CHECKING THE 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 Checking the charging voltage

Check that the rectifier's output voltage corresponds to the float charging 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 *Operation, Functions*). Do not forget to reset the parameter for the installed temperature sensor following the 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 Checking the cooling capacity

Check that the rectifier modules' ventilation vents are not clogged with dust or other contaminants. Clean where necessary.

9 FAULT TRACING

9.1 SAFETY INSTRUCTIONS



WARNING! This product contains dangerous voltages 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 excessive voltage, 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 ALARMS

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 system in general are dealt with here. For faults that relate to the monitoring unit see the *Manual for monitoring unit PCM2*.

The primary fuse trips when the rectifier is turned on

Cause 1: Wrong type of external primary fuse. Check that the system is properly fused according to the instructions in section 6.5.3 [External fuse rating](#)

Cause 2: Internal fault in a rectifier module. 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 off

Cause 1: No mains power. Check that there is mains voltage to the mains input terminals and that the mains breaker is closed.

Cause 2: A rectifier module is not fully inserted.

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

Cause 1: Input "EXT. FAULT" is used as external blocking and is in open state.

Cause 2: Fault in external output fuses. 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 off

Cause 1: The rectifier module is probably faulty. Replace the rectifier module.

Cause 2: If the red "ALM" lamp is also lit, the cause may be that the rectifier module has been tripped by high output voltage, HVSD (High Voltage Shut Down). Reset by removing power from the module, most simply by extracting the module for a few seconds until all lamps are off, and then re-inserting it again. If the fault reoccurs, the module is probably faulty. Replace the rectifier 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*.

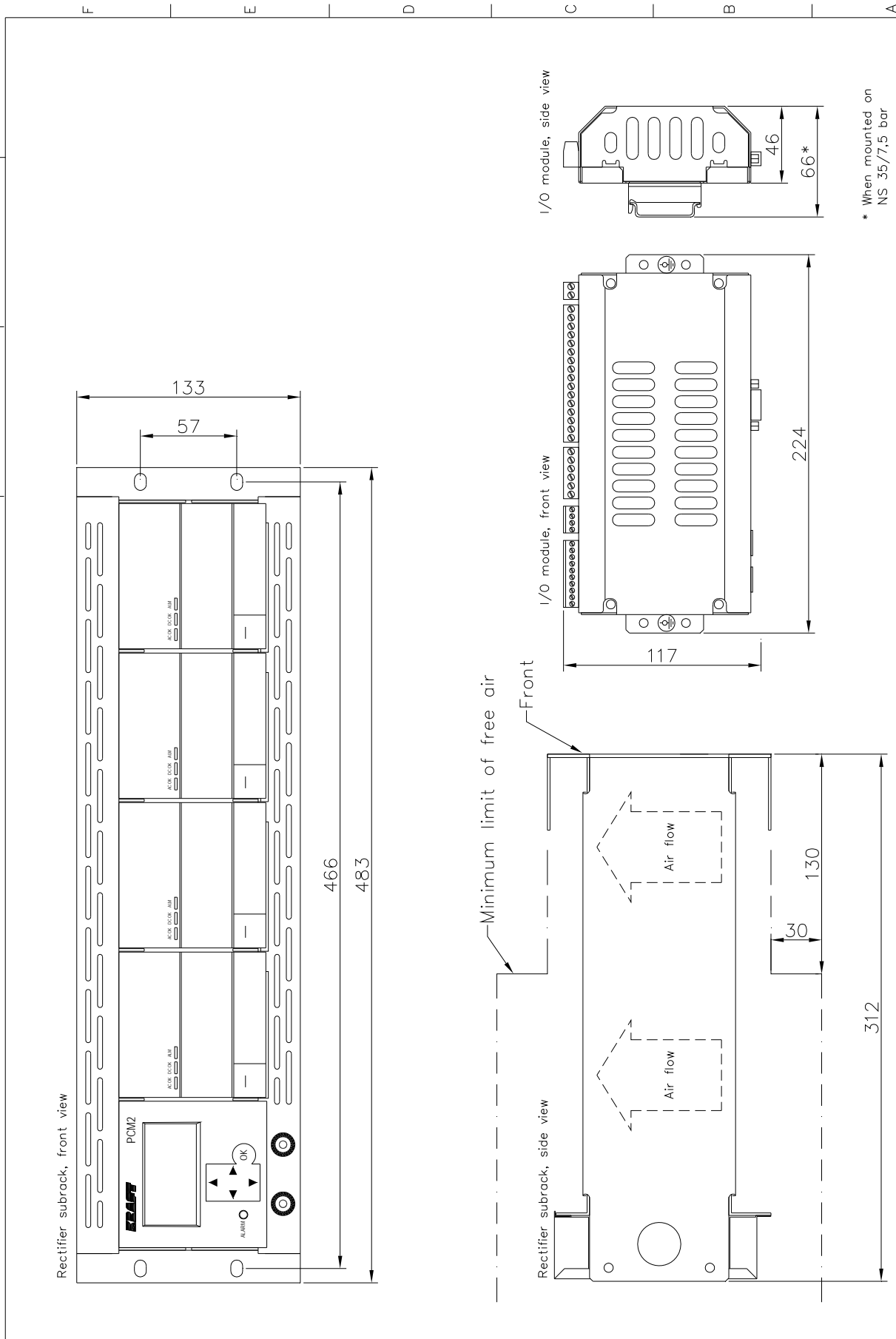
The rectifier output voltage is too low

- Cause 1: The rectifier load is greater than its capacity (rated current). This is usual in connection with recharging following a deep discharge.
- Cause 2: A battery circuit test is in progress. This is a test that is normally executed automatically once a day.
- Cause 3: The selected charging voltage (float charge or equalization charge) is close to or greater than the limit for parameter U_{maximum} . The output voltage cannot exceed $(U_{\text{maximum}} - 1\%)$. If a higher charging voltage is required, the value of U_{maximum} must be increased, see *Manual for monitoring unit PCM2*.
- Cause 4: High temperature in battery/battery room. 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: Incorrect float charging voltage level setting. 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

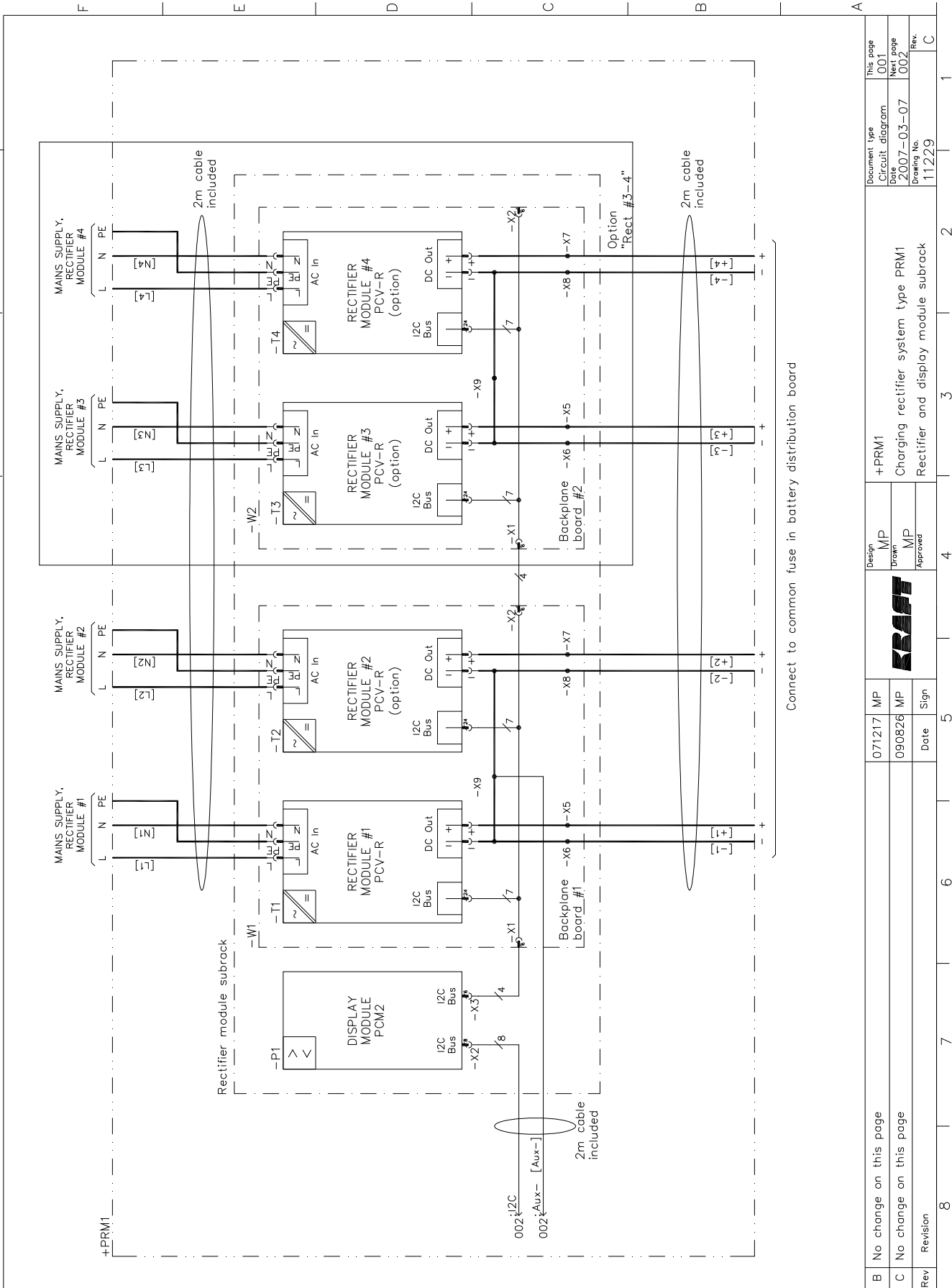
- Cause 1: Equalization charging in progress. This has either been initiated manually or automatically following a power failure.
- Cause 2: Low temperature in battery/battery room. Only applicable if the rectifier controls the temperature of the float charging voltage. There is no fault with the rectifier 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: Incorrect float charging voltage level setting. Adjust the setting.
- Cause 4: Incorrectly calibrated voltage measurement. Recalibrate the monitoring unit's measurement of battery voltage.

Appendix A
DIMENSION DIAGRAM, PRM1

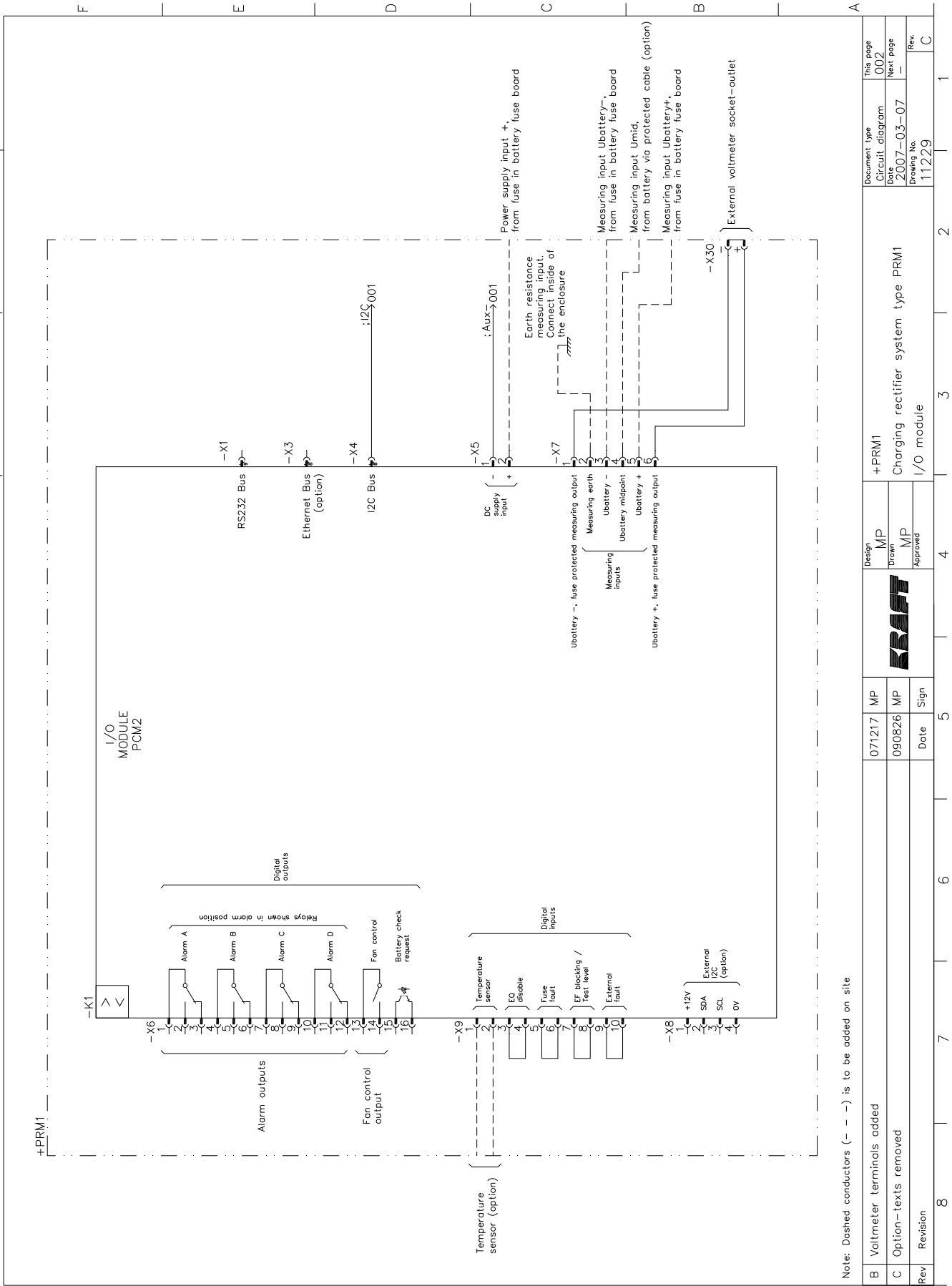


B	Voltmeter sockets added	071217	MP		Design MP	+PRM1	Document type Layout drawing	This page 1
Rev	Revision		Date	Sign	Drawn MP	Charging rectifier system type PRM1	Date 2007-03-07	Next page -
					Approved		Drawing No. 11230	Rev. B

Appendix B CIRCUIT DIAGRAM, PRM1



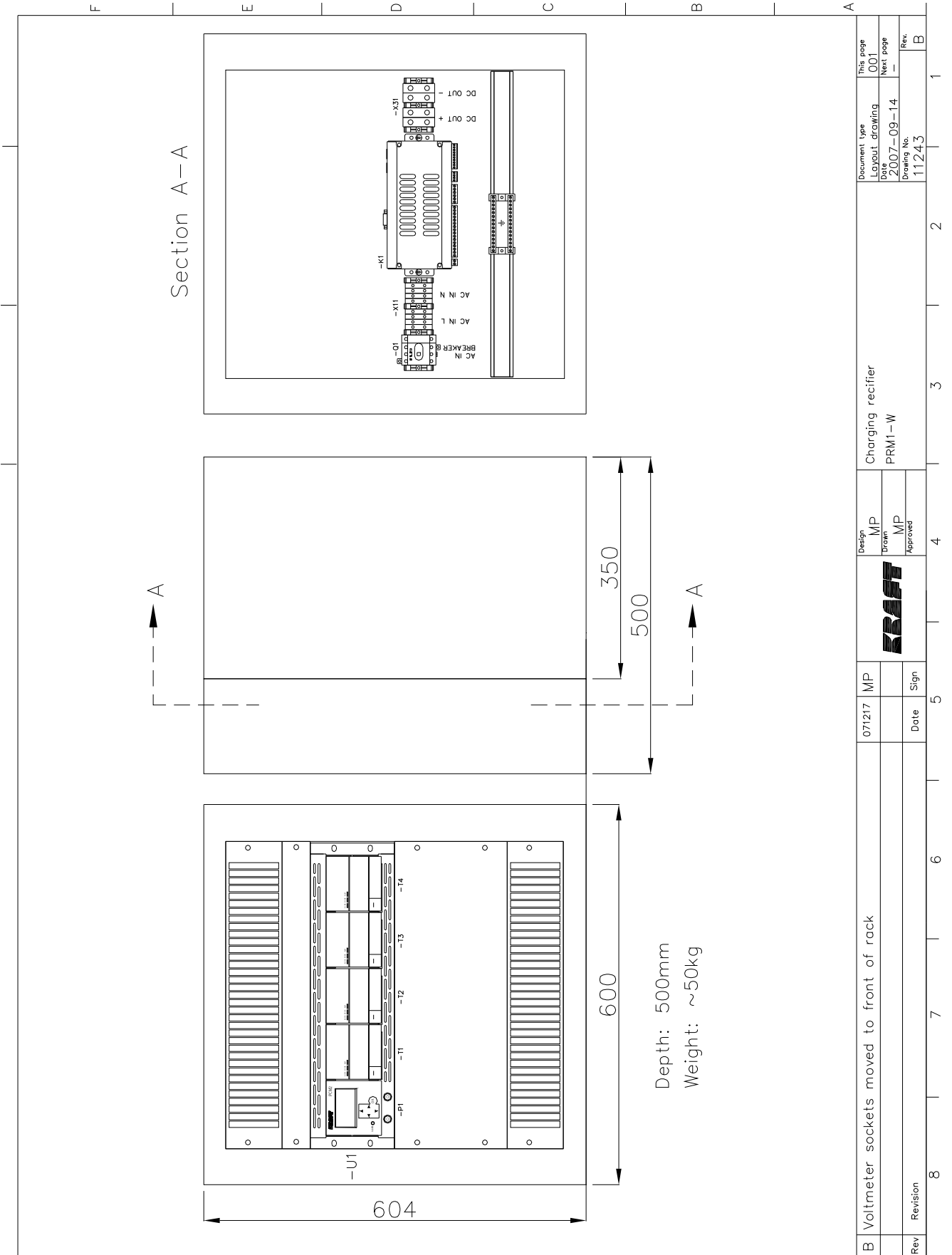
Design	MP	+PRM1	Document type	This page
Drawn	MP	Charging rectifier system type PRM1	Circuit diagram	001
Approved	MP	Rectifier and display module subrack	Date	2007-03-07
			Next page	002
			Drawing No.	11229
			Rev.	C



Note: Dashed conductors (- - -) is to be added on site

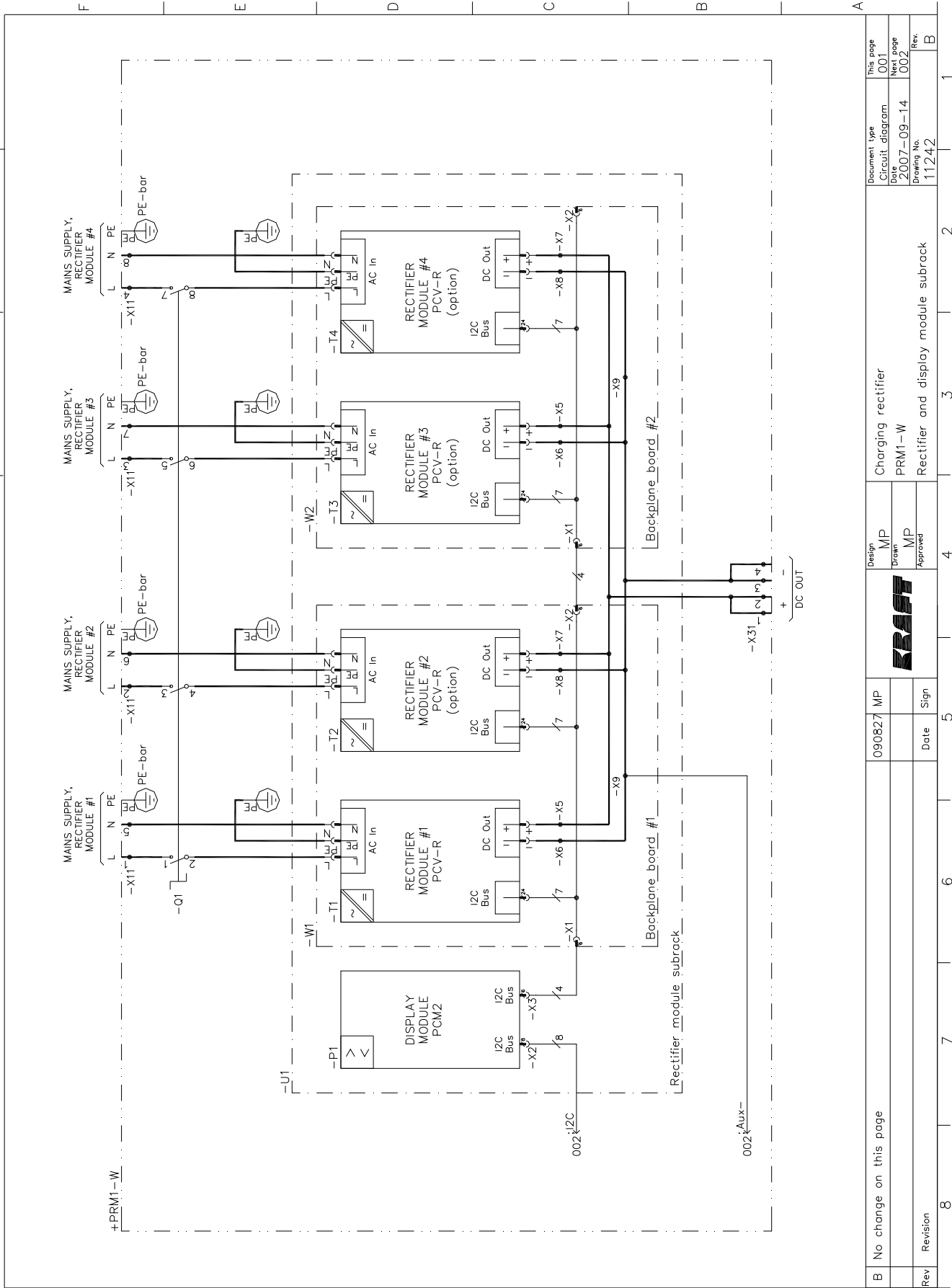
B	Voltmeter terminals added	071217	MP	Design	MP	+PRM1	Document type	This page
C	Option-texts removed	090826	MP	Drawn	MP	Charging rectifier system type PRM1	Circuit diagram	002
Rev	Revision	Date	Sign	Approved		I/O module	Date	2007-03-07
							Drawing No.	11229
							Rev.	C


Appendix C
DIMENSION DIAGRAM, PRM1-W

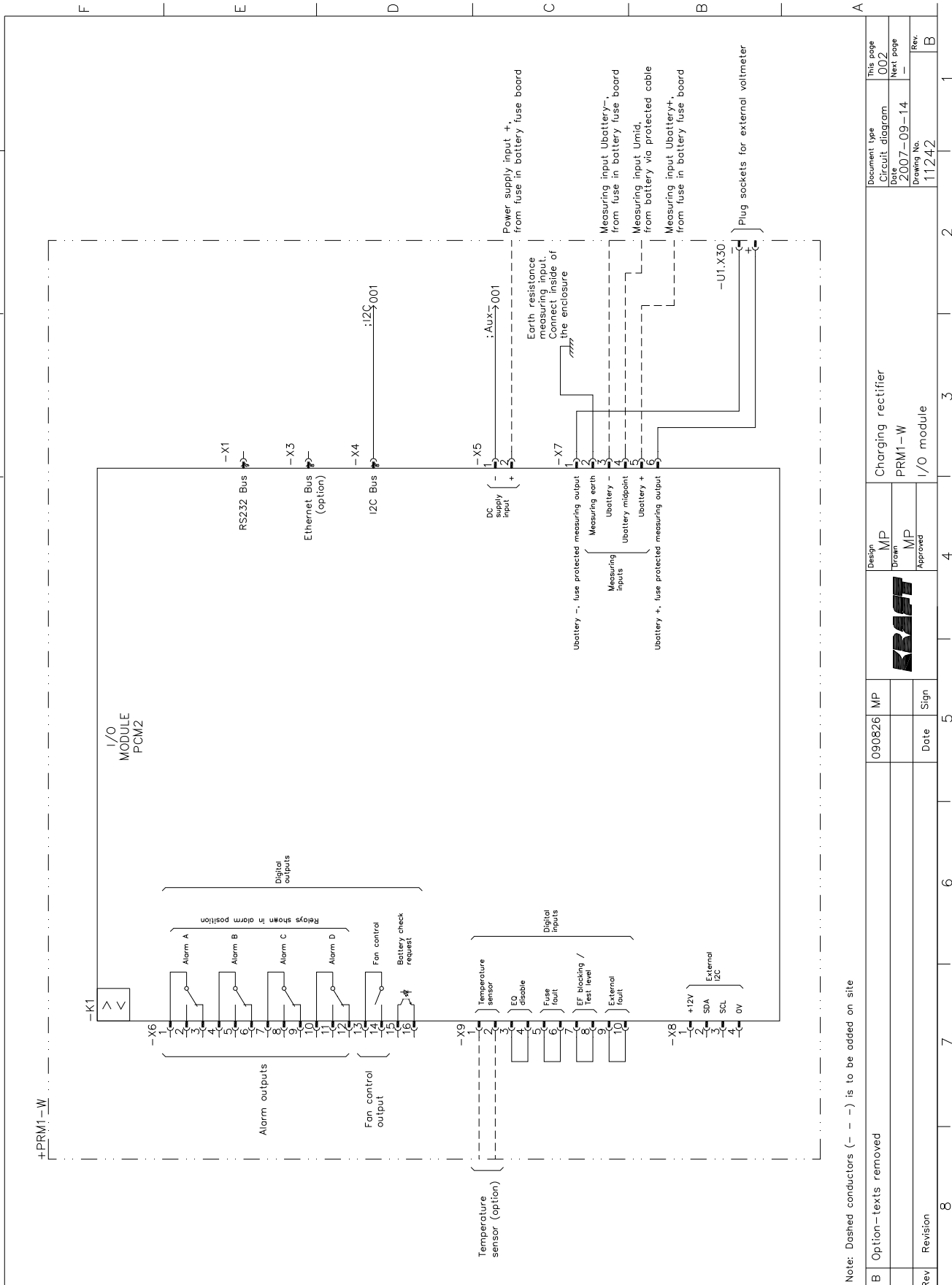


Document type	Layout drawing	This page	001
Date	2007-09-14	Next page	-
Drawing No.	11243	Rev.	B
Charging recifier		Design	MP
PRM1-W		Drawn	MP
		Approved	
		KRAFT	
071217	MP	Date	Sign
Voltmeter sockets moved to front of rack			
Rev	Revision		

Appendix D CIRCUIT DIAGRAM, PRM1-W



B	No change on this page	090827	MP		Design	MP	Charging rectifier PRM1-W Rectifier and display module subblock	Document type	This page	
	Rev	Revision	Date		Sign	Drawn		MP	Circuit diagram	001
	8	7	6		5	4		3	2	1



Note: Dashed conductors (- - -) is to be added on site

Rev	Revision															
B	Option-texts removed															
		090826	MP	Charging rectifier												
			MP	MP												
				MP												

