Manual for
Inverter system
type PCI10

SAFETY INSTRUCTIONS

This manual must be read 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 cubicle may only be opened by authorized personnel. The protective covers and contact safety devices inside the equipment may only be removed by authorized 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.

Manual: 9-1658-A
P/n: 0001104
We reserve the right to make changes to the content of this manual without prior notification.
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1  PRESENTATION

The Inverter system PCI10 is a modular system consisting of a Controller, which controls and monitors the system, a Bypass unit that connects the load to an alternative supply if a fault occurs and one or more Inverter modules.

The system is available with supply voltages between 48-220VDC, output voltage 120-240VAC, frequency 50 or 60Hz and output power between 4-48kVA.

The system is mounted in a hinged frame cabinet, which rooms, apart from the inverter modules, separate MCB’s for each module, connection terminals for power and signals and, in some cases, a manual bypass switch.

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 are approved by KraftPowercon Sweden 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 Product line

<table>
<thead>
<tr>
<th>Input voltage $V_{DC}$ Nominal</th>
<th>Output power $VA$</th>
<th>Output power $W$</th>
<th>Output current $A_{AC}$ @230V</th>
<th>Input current $A_{DC}$ (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48/60 38-72</td>
<td>4000</td>
<td>3200</td>
<td>17</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>8000</td>
<td>6400</td>
<td>34</td>
<td>191</td>
</tr>
<tr>
<td></td>
<td>12000</td>
<td>9600</td>
<td>52</td>
<td>287</td>
</tr>
<tr>
<td></td>
<td>16000</td>
<td>12800</td>
<td>69</td>
<td>383</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>16000</td>
<td>87</td>
<td>478</td>
</tr>
<tr>
<td>110 88-132</td>
<td>4000</td>
<td>3200</td>
<td>17</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>8000</td>
<td>6400</td>
<td>34</td>
<td>83</td>
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<tr>
<td></td>
<td>12000</td>
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<td></td>
<td>16000</td>
<td>12800</td>
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<td>165</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>16000</td>
<td>87</td>
<td>207</td>
</tr>
<tr>
<td>125 88-149</td>
<td>4000</td>
<td>3200</td>
<td>17</td>
<td>41</td>
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<td></td>
<td>8000</td>
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<td>12000</td>
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<td>16000</td>
<td>12800</td>
<td>69</td>
<td>165</td>
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<tr>
<td></td>
<td>20000</td>
<td>16000</td>
<td>87</td>
<td>207</td>
</tr>
<tr>
<td>220 178-264</td>
<td>4000</td>
<td>3200</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>8000</td>
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<tr>
<td></td>
<td>20000</td>
<td>16000</td>
<td>87</td>
<td>102</td>
</tr>
</tbody>
</table>

3.1.2 Common electrical data

Output voltage 230 V ±5%
Frequency........................................50/60 Hz
Distortion..........................................<2%
Power factor........................................0.8
Crest factor.......................................>2.5
Overload capability................................125% 12 seconds, 150% 3 seconds
Short-circuit current (wo bypass)........>2$x$I_n 2.5 seconds
Efficiency..........................................≈85%
3.1.3 Electrical data for Controller
Under-voltage trip................. 38.5 V/86 V/174 V
Restart low......................... 48 V/110 V/220 V
Over-voltage trip............... 75 V/138 V/276 V
Restart high...................... 72 V/132 V/264 V
Synchronisation range.......... ±3 Hz

3.1.4 Electrical data for bypass unit
Rated current ...................... 120 A, 200 A
Ext. fuse energy limit........... 15 000 A’s (120 A)
........................................ 125 000 A’s (200 A)
Switching time ..................... 3ms (controlled switching at overload, under-voltage etc.)
........................................ 20ms (switching off controller)
........................................ 100ms (system off)

3.1.5 Electrical data for built-in manual bypass switch
Type................................. Contactor
Switching time .................... <20ms

3.2 ENVIRONMENTAL DATA
Ingress protection................. IP21 according to EN 60529
Cooling.............................. Speed controlled fans in inverter modules, fan cooled bypass unit,
 other items natural air cooling
Ambient temperature ............ -5 to +40 °C
Storage temperature ............. -40 to +70 °C
Humidity........................... <90 % RH, non-condensing
Altitude (ASL).................... <2000 m
Sound level....................... <60 dB(A)

3.3 MECHANICAL DATA
Type................................. Floor mounted cabinet with 19” combined hinged frame/door
Erection............................. Indoors in dry and clean areas
Weight ................................ 150 kg (8 kVA)
........................................ 195 kg (20 kVA)
........................................ 2.8 kg (controller)
........................................ 7.5/14.5 kg (bypass unit 120/200 A)
........................................ 12 kg (inverter module)
Dimensions.......................... 2100/840/654 mm (h/b/d)
Colour code......................... RAL 7035 light grey
Cable connection.................. From below

3.4 STANDARDS
EN 60529......................... Degree of protection IP21
EN 60950, VDE 0805........... Safety
EN 61000-6-3 .................... EMC (Emission)
EN 61000-6-2 .................... EMC (Immunity)
4 FUNCTIONAL DESCRIPTION

4.1 GENERAL
PCI10 is a modular inverter system consisting of a controller, a bypass unit and one or more inverter modules. The system can also include a manual bypass switch, offering the possibility to maintain also the bypass unit with the load still energized.

4.2 CONTROLLER
The controller controls and monitors the system. It measures DC supply voltage, AC output voltage, alternative mains supply voltage, frequency and total output power. Measured values are used to issue alarms, bypass or switch off parts of the system. The controller display informs about current voltages, output power and current operating mode. With the keypad, you can start and stop the system, select the normal operating mode, read alarm history, acknowledge alarms and set alarms and performance limits.

4.3 BYPASS UNIT
The bypass unit switches from normal to backup supply when the normal supply fails. Switching is normally initiated from the controller but the bypass unit has its own intelligence to cover up for operating conditions where the switching command from the controller is missed.

4.4 INVERTER MODULES
The inverter modules convert the incoming DC supply to alternating voltage. In the input stage the input and output are separated galvanically and at the same time the DC voltage is raised and controlled to a level corresponding to the peak output voltage. The DC voltage is converted to AC in an IGBT based H-bridge. This design offers a robust output with high peak current capability, which ensures low voltage distortion even with nonlinear load.

4.5 MANUAL BYPASS SWITCH
The manual bypass switch bypasses the electronic bypass unit to make it possible to disconnect the latter for maintenance. With this built-in switch the bypass is performed by means of a contactor, which first disconnects the output of the bypass switch and then connects the alternative mains input to the load. The changeover gives a short voltage interruption of about 10ms, which means that the bypass can be made even if the inverter is not synchronized to the alternative mains. However, in order to minimize the risk of disturbances we recommend that the electronic bypass unit is switched to mains mode before changeover (see section 5.4.1). It is also possible to connect an external bypass switch to the system but this must be operated with great caution, otherwise the inverter modules may be damaged. See section 5.4.2.
5  OPERATION

5.1  General

The first section of this chapter describes the operation of the system in general and this is followed by a more detailed description of the controller functions. Please study sections 5.5-5.8 before first start of the system.

5.2  FUSES

Apart from the inverter modules with associated controller and bypass unit, the system includes MCB’s, which simplify maintenance and disconnect the units in case of failure, and, in some cases, a manual bypass switch. The latter makes it possible to switch off the complete system, still keeping the load energized.

The MCB’s have the following functions:

F1.x disconnects the DC supply from the inverter modules and makes it possible to change a module with the system in operation.
F2 fuses the DC supply to the controller and it must not be switched off during operation.
F3-F4 act both as protection and disconnection of the bypass unit. The manual bypass switch should be in mains mode before switching off the MCB’s for maintenance.
F5 fuses the manoeuvre and indication of the manual bypass switch.

For function of fuses with higher numbers, see current circuit diagram.

5.3  START UP

Make sure F1-F5 and the power switches of the controller and all inverter modules are switched off.
Connect DC and AC supplies and check the polarity of both. If polarity is correct, switch on F1-F5.
Switch on the power switch on the controller. The display will show System off.
Switch on the power switch on all inverter modules. Start the system by pushing the OK button on the controller. The start-up sequence is described in section 5.5.3.

5.4  MANUAL BYPASS

5.4.1  Built-In bypass switch

The manual bypass switch is used to release the bypass unit for maintenance on the system.
Manual bypass is done with a short interruption (approximately 10ms) and to reduce the risk of the load being affected the bypass switch should be operated only when the bypass unit is in mains mode.

Manual bypass is performed as follows:

1. Lock the bypass unit in mains mode, using the Controller panel. Choose Setup (OK), Bypass mode (OK), Locked mains (OK). Press OK again and then X twice, until the start panel is displayed.
2. Turn the manual bypass switch to mains mode.
Return to inverter mode:
1. Switch on F3-F4.
2. Check that the controller indicates mains mode (mains plug symbol)
3. Turn the manual bypass switch to inverter mode.
4. Acknowledge any alarms by pushing X.
5. Set the bypass unit to inverter mode, using the Controller panel. Choose Setup (OK), Bypass mode (OK), Normal inverter (OK). Press OK again and then X twice, until the start panel is displayed.

5.4.2 External bypass switch

When an external bypass switch is used, bypass is done without interruption by connecting the alternative mains in parallel with the inverter system before disconnecting. In this case the bypass unit must first be switched to Mains mode, otherwise the inverter modules may be destroyed.

Manual bypass is performed as follows:
1. Lock the bypass unit in mains mode, using the Controller panel. Choose Setup (OK), Bypass mode (OK), Locked mains (OK). Press OK again and then X twice, until the start panel is displayed.
2. Turn on the manual bypass switch (no 2 in figure below)
3. Switch off F4 (no 3).
4. Switch off F3 (no 2)
5.5 CONTROLLER

The system can be controlled locally, by means of the controller keypad and display, or remotely, by connecting a computer with suitable terminal software to the D-sub (RS-232 interface) connector on the controller panel.

5.5.1 Local control

Function of the push buttons:

X – ESC Cancel operation

< and > - LEFT/RIGHT menu step left/right

V – OK Confirm operation

5.5.2 Manual functions

- All displays depend on the user configuration (pls. refer to 5.7, Configuration).
- The upper row of the display shows values and/or messages, whereas
- the lower row of the display shows functions and/or options available.
- Functions or options shown can be chosen (e.g. for alteration) by the ‘OK’ button.
- Additional options are available when the screen shows brackets (</>). They can be selected by pressing the respective button and must be confirmed by the ‘OK’ button.
- By pressing the ‘ESC’ button you can go back to the previous level without saving an option.
5.5.3 Brief Introduction

To start the system, the DC voltage is mandatory (pls. refer to chapter 5.7, Configuration for details).

After assignment of the inverters’ IDs, you can start the system by following the procedure listed below:

- Switch on the controller (ON switch to position I). The controller is ready for operation.
- Switch on all inverters (BATTERY SWITCH to pos. I)
- The bypass module (where applicable) is supplied by the controller, so no switching is necessary.
- Switch on the system by pressing the ‘OK’ button
- The controller starts its boot-up sequence,

- searches for inverters connected,
- initializes the inverter boot sequence,
- checks proper system operation,
- and shows maximum output power.

- With brackets to the left or right, you can choose among different display information, as voltage, power, status, setup mode etc.
- To switch off the inverter AC-outputs, press ‘OK’ when the screen shows ‘OFF’
- Press the > button to confirm the shutdown of the inverter.

5.5.4 Display symbols

- Mode Mains or Mains Voltage
- DC Supply (Voltage)
- Inverter operation (online operation)
- Alternating Current (Voltage)
- Synchronous
- Asynchronous
5.5.5 Remote operation

See section Remote operation in “Technical description – Inverter LavaLINE for Industry and Telecom Applications”.

5.6 CONFIGURATION

Several system limits can be configured to assure optimum performance according to the environment the system is used in. The LavaLINE© system configuration can be altered by four push-buttons via the display on the controller front panel. The menu interface is easy to handle and allows quick and simple alteration.

<table>
<thead>
<tr>
<th>Caution:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The setup mode changes the parameters of the system. The factory defaults comply with standard conditions and/or the parameters the system was ordered with by the customer. Alteration by qualified personnel only! Damage to the system or to connected devices or financial losses due to down times are on sole responsibility of the customer.</td>
</tr>
</tbody>
</table>

5.7 Setup menu and options

To step through the options and parameters, use the buttons on the controller front panel as described in 6.1 Manual operations, and choose 'Setup' from the menu.
5.7.1 Setup menu structure

The setup menu can be entered in 'ON' status as well as in 'OFF' status. Some options can only be selected in 'OFF' status, though. Use the 'RIGHT' button to reach the setup menu. Confirm with 'OK' to enter setup mode.

5.7.2 Inverter setup

Activation or deactivation of a single inverter with the corresponding ID shown in display. Select an ID by using 'LEFT' or 'RIGHT', 'OK' selects between 'active' and 'standby'. Use 'ESC' to leave this menu.

Use 'ESC' to confirm temporary application.

Please note, that internal saving of the inverter configuration does not apply at once. For a permanent storage and for immediate operation, both configuration options have to be confirmed to apply immediately.

5.7.3 Alarm level setup

The level is used to determine if a system state is considered as 'Alarm' or 'Event'. Combined with the internal logfile and remote setup, it can be used to filter certain system states when logging to memory and/or sending states via the external communication device.

Use the 'LEFT' or 'RIGHT' buttons to select the message character.
5.7.4 Logfile setup

The logfile is used to save system alarms and events to memory. The memory can store up to 256 alarms/events in FIFO pattern (first in first out).

Select ‘OK’ to view the logfile.

‘LEFT’ or ‘RIGHT’ will step through the alarms/events. The explicit text is shown, together with the device ID causing the alarm/event, and the alarm code.

‘OK’ will additionally show the date and time the alarm/event occurred.

Select ‘OK’ to erase the entire logfile.

Select ‘OK’ to configure the settings for logging to file. Please refer to 8.2 for additional information.

Press ‘OK’ to have solely alarms logged to file. Depending on the configuration at 8.2, this will result in a much smaller file.

Press ‘OK’ to save alarms as well as events to file.

5.7.5 Clock setup

Select ‘OK’ to set the system clock. Use ‘RIGHT’ or ‘LEFT’ for cursor positioning, ‘OK’ to increase the digit, ‘ESC’ to decrease the digit.

In order to leave the menu, move the cursor to the leftmost position on the display and press ‘LEFT’ to leave the screen.

Pressing ‘OK’ saves the time and date; ‘ESC’ cancels the setting.
5.7.6 Modem setup

With an external modem connected to the controller, the system is able to transmit automatically alarms or logfiles, or it can receive calls to be queried about its state. Use an adequate sequence to initialise your modem. Please refer to the modem manual for the right init sequence.

Use ‘RIGHT’ or ‘LEFT’ for cursor positioning, ‘OK’ to increase the character, ‘ESC’ to decrease the character. Move the cursor to the leftmost position of the display, and press ‘LEFT’ to leave the screen. Pressing ‘OK’ saves the sequence; ‘ESC’ cancels the setting.

The init sequence field can be used if the phone number is not longer than 24 characters. At the end of the init sequence, enter the first few digits of “phone number” (e.g. country or area code), and use the phone number to enter the remainder. The sequence is executed directly before dialling the phone number.

Select ‘OK’ to enter the phone number the system dials. Use ‘RIGHT’ or ‘LEFT’ for cursor positioning, ‘OK’ to increase the digit, ‘ESC’ to decrease the digit. Move the cursor to the leftmost of the display and press ‘LEFT’ to leave the screen. Pressing ‘OK’ saves the sequence; ‘ESC’ cancels the setting. The field phone number has a maximum 24 digits. If more are required, use the init sequence, as described above.

Select ‘OK’ to configure the system’s autodial feature.

With a preset timer, the system calls the number at the defined time and transmits the entire logfile. This can be useful if the timer is set to call at times of low network traffic. Select ‘OK’ to set the timer. Use ‘RIGHT’ or ‘LEFT’ for cursor positioning, ‘OK’ to increase the digit, ‘ESC’ to decrease the digit. When done, move the cursor to the leftmost field of the display, and press ‘LEFT’ to leave the screen. Pressing ‘OK’ saves the timer, ‘ESC’ cancels the setting.
Select ‘OK’ to set the real time dialup. With this feature enabled, the system will call as soon as an alarm occurs. Select ‘OK’ to set the real time dialup to ‘terminal’. The system calls and transmits the alarm in terminal mode, sending plain ASCII code.

Select ‘OK’ to choose the SMS option. The system transmits alarms in SMS mode.

Select ‘OK’ to disable the autodial feature.

Select ‘OK’ to enter a header sent with each transmission. This header can be used to identify the system location or ID in a distributed environment.

Use ‘RIGHT’ or ‘LEFT’ for cursor positioning, ‘OK’ to increase the digit, ‘ESC’ to decrease the digit. When done, move the cursor to the leftmost field of the display, and press ‘LEFT’ to leave the screen. Pressing ‘OK’ saves the header, ‘ESC’ cancels the setting.

**5.7.7 Bypass setup**

Select ‘OK’ to configure the bypass where applicable.

The mode ‘Normal Inverter’ (Online mode) sets the bypass to supply the load from the inverter, and switch over to commercial power line only when a drop in the inverter voltage is detected, e.g. due to discharge of the batteries. This is useful for sensitive loads, where power failures or anomalies of the commercial power line might cause downtimes or damage.
The mode 'Normal Mains' (Offline mode) sets the bypass to supply the load from the commercial power line, and switch over to inverter supply only when a drop in the CPL is detected, or when the CPL frequency runs out of the limits. This mode is useful when the inverter acts as plain backup unit, with low battery capacity.

The 'Locked Inverter' mode sets the bypass to supply the load only from inverter power. Though the detection of power drops is not disabled, the bypass does not switch over to commercial power line in case of failures. This mode should be used when working on the commercial power line and/or distribution, to avoid hazardous voltage at the contacts.

The 'Locked Mains' mode sets the bypass to supply the load only from commercial power line. Though the detection of power drops is not disabled, the bypass does not switch over to inverter power in case of failures. This mode should be used when working on the inverter, to avoid hazardous voltage at the contacts.

The 'Disable' mode is used for systems without electronic Bypass.

'Bypass FAN – Reset error' resets the fan status back to operation after a fan alarm.

### 5.7.8 Relay setup

There are two alarm contacts. These can be configured independently, with the same procedure. The display will show either 'Relais 1' or 'Relais 2'. Select 'OK' to have relay 1 or 2 indicate the loss of the second power source. The second power source is defined as the one the bypass switches to in case of a failure of its primary source. The source corresponds to the 'Bypass Setup' in 5.7.7.
Select 'OK' to indicate 'Battery Low' on relay 1 or 2. The limit for the 'Battery Low' signal can be set in the 'Battery Limits Setup' in 5.7.9.

Select 'OK' to indicate the state of the bypass. It does not indicate the bypass mode as set in 9.8, but the present source the load is supplied from. In case of a failure of the primary source, it will indicate running on second source.

1: load is supplied by inverter
0: load is supplied by commercial power line

Select 'OK' to indicate if an alarm has occurred. The alarm is not farther specified, and can be any alarm defined in 'Logfile Setup' in 5.7.4.

To obtain information as to what sort of alarm has occurred, the system must either be checked by a service technician, or queried via external communication.

Select 'OK' to disable the relay 1 or 2 entirely.

5.7.9 Battery limits setup

For details on the battery limits, please refer to chapter 5.8 Battery Diagram.

To select any of the limits for alteration, press 'OK'.

To change any of the values, use 'LEFT' and 'RIGHT'. The voltage values must be logical to each other. An overlap is not possible.

To leave the menu, press 'ESC'.

To save the limits altered, press 'OK'.

KraftPowercon Sweden AB, Hjalmar Petris väg 49, S-352 46 Växjö, Sweden, Tel: +46 470-705200, Fax: +46 470-705201, www.kraftpowercon.com
5.7.10 AC limit setup

With an optional bypass connected, the voltage tolerances for a switching to a second power source can be adjusted. The monitored voltage corresponds to the setting of the ‘Bypass Setup’ in 5.7.7.

Select ‘OK’ to set the lower voltage limit to -10% of nominal voltage.
Select ‘OK’ to set lower voltage limit to -15% of nominal voltage.

Select ‘OK’ to set lower voltage limit to -20% of nominal voltage.

Select ‘OK’ to set lower voltage limit to -25% of nominal voltage.

Select ‘OK’ to modify the upper voltage limit.

Select ‘OK’ to set upper voltage limit to +10% of nominal voltage.

Select ‘OK’ to set upper voltage limit to +15% of nominal voltage.

Select ‘OK’ to set upper voltage limit to +20% of nominal voltage.

Select ‘OK’ to set upper voltage limit to +25% of nominal voltage.
### 5.7.11 Power limit setup

The maximum output power is automatically detected by the controller; the values can be altered to decrease those limits.

Select ‘OK’ to alter the overload limit of the inverter.

‘LEFT’ decreases the limit, ‘RIGHT’ increases the limit for inverter overload.

Select ‘OK’ to alter the overload limit of the commercial power line of the system.

‘LEFT’ decreases the limit; ‘RIGHT’ increases the limit for mains overload.

The bypass within the system is automatically detected. For a downgrade of the system, that function can be deactivated.

Select ‘OK’ to alter the current limit with a connected bypass.

Max. 50A (12kVA) – out of use!

Max. 120A (24kVA)

Max. 200A (48kVA)
5.7.12 Display

Select 'OK' to change the contrast of the display, use 'LEFT' and 'RIGHT' to alter it.

5.7.13 Restore default setup

Select 'OK' to restore the factory default setup for the system. Please note that after restoring, the customer's setup cannot be retrieved.

The system must be in 'Inverter off' mode to restore the defaults!

If restoring fails, an error message will be displayed.

5.7.14 Frequency setup

By alteration of the frequency, the inverter output frequency is changed, as well as the monitoring frequency of an optional bypass connected.

The system must be in 'Inverter off' mode to restore the defaults!

Select 'OK' to set the inverter output frequency to 50Hz.

Select 'OK' to set the inverter output frequency to 60Hz.
5.7.15 System information

Firmware (software version) of the controller.

Hardware version of the controller.

GSM information (only when connected).

The information screen will show the GSM provider (network name), as determined by the GSM card, and the receptional strength of the network.

5.7.16 Remote setup

Select 'OK' to disable remote option.

Select 'OK' to enable remote option.
5.7.17 Security setup

Select 'OK' to limit the access to the system’s setup and/or to functions via remote operation. By default, no password is required.

If you had set your own password; it has to be entered again for a modification.

First, enter your old password. When done, move the cursor to the leftmost of the display and press ‘LEFT’ to leave the screen.

Second, set the new password. When done, move the cursor to the leftmost of the display and press ‘LEFT’ to leave the screen.

Pressing ‘OK’ saves the password; ‘ESC’ cancels the setting (the former password will be used for verification).

5.7.18 SIM-card PIN code

If you use a GSM modem for external communication, set the PIN code to be able to enter the modem. Please refer to the modem manual and/or the GSM card info for details.

Use ‘RIGHT’ or ‘LEFT’ for cursor positioning, ‘OK’ to increase the character, ‘ESC’ to decrease the character

First, enter your former PIN. When done, move the cursor to the leftmost of the display and press ‘LEFT’ to leave the screen.

Second, set the new PIN. When done, move the cursor to the leftmost of the display and press ‘LEFT’ to leave the screen.

Pressing ‘OK’ saves the PIN; ‘ESC’ cancels the setting (the former PIN will be used for verification).
5.8 BATTERY DIAGRAM

First Start (1):
To start up the entire system, the "First Start" limit has to be reached and exceeded at the battery terminals.

Shutdown UVP (2):
The inverters are shut down when undervoltage protection level "UVP" is reached, in order to avoid deep discharge of the battery cells.

Restart Low (3):
After inverter shut down due to "UVP", the DC level has to reach "Restart Low" level again. The inverters are switched on again.

Shutdown OVP (4):
At voltage level "OVP", all inverters are shut down (overvoltage protection).

Restart High (5):
If the inverters have been shut down due to "OVP", they will be switched on again, after DC voltage has decreased to "Restart High".

Reset (6):
If the inverters are cut off from the batteries (for example, the user switches off the battery switch), the terminal voltage drops below "Reset" voltage limit. The limit for a system restart is reset to "First Start" level.
6 INSTALLATION INSTRUCTIONS

6.1 SAFETY INSTRUCTIONS

DANGER! 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 section 2, SAFETY INSTRUCTIONS).

NOTE! 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 HANDLING

WARNING! The cubicle has a high centre of gravity! This must be kept in mind during all handling of the product. When opening the door there is a risk that the cubicle may tip forward. Keep the cubicle on its pallet as long as possible and secure the cubicle before opening the door.

6.3 STORAGE AND PROTECTION

6.3.1 Enclosure

Storage is to be in a dry area and at a temperature within the -40 to +70 °C range.

6.4 ERECTION

6.4.1 Enclosure

The equipment is intended for placement on floor in a dry, clean environment that is free from conductive dust. At least 100 mm free space to the wall should be left on the rear for ventilation reasons. In the bottom of the enclosure, there are holes prepared for bolting to the floor.

WARNING! The cubicle has a high centre of gravity! Secure the cubicle to the floor or wall to prevent it from falling.

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

For earthing and shielding the earth-bars in the lower part of the cubicle are used.

For equipotential bonding, there is a M8 bolt located on one of the gable profiles near the floor.

6.5.3 Mains voltage

6.5.3.1 External fuse rating

The rating of the mains fuse depends on several factors. The maximum output current of the system is shown in the table in section 3.1. This gives the maximum fuse rating in the following distribution board that can be blown within 2 seconds. The mains fuse is normally chosen so that discrimination is achieved between mains and distribution fuses.
The system normally includes MCB's protecting the bypass unit in case of short-circuit in the output. If not, the mains fuse must be chosen so that the let-through energy is limited according to 3.1.4.

6.5.3.2 Connection
The alternative mains supply is connected to terminals X2:1-2. If the supply is direct grounded (type TN) the neutral shall be connected to X2:2. The load is connected to terminals X2:3 (L) and X2:4 (N).

6.5.4 DC supply

6.5.4.1 Fuse rating
The DC supply fuse rating is normally chosen higher than the maximum input current according to the table in section 3.1.

6.5.4.2 Connection
The DC supply is connected to terminals X1:1 (+) and X1:2 (-). Make sure the polarity is correct!

6.5.5 Signals
The controller Relay 1 has a potential free, change-over contact connected to X3:1-3. Normally the relay is used as alarm relay, X3:1 is common and X3:2 normally open. The relay can be used for other functions, see section 5.7.8, Relay setup.
7 MAINTENANCE

7.1 ANNUAL CHECK

Under normal conditions the inverter system doesn’t need any periodic maintenance but it is still a good idea to check the system regularly to avoid future disturbances.

Check that all fans rotate in the bypass unit and all inverter modules. Check that the air intakes are free from dust and clean when necessary. Listen for abnormal sound from the fan bearings. The fans are chosen so that no replacement is required during the product life and they are therefore not easy to replace on site. We recommend that the units are sent to KraftPowercon Sweden AB in case of fan failure.

Check that the clock shows correct time and date. Adjust if necessary according to 5.7.5.

Check the alarm log to see if any unnoticed events have been recorded. See 5.7.4.

7.2 10 year CHECK

The controller holds a lithium battery as internal clock backup supply. The battery is used only when the controller is without its normal power supply and it has a calculated lifetime of about 10 years. We recommend that the battery is replaced after this time to avoid incorrect time stamps in the alarm log.

7.3 Replacement of an inverter

1. Make sure that there is a Bus Loop connection between the controller and the next unused RJ45 connector following the inverter to be removed. Also make sure, that every preceding inverter is connected to the controller bus.
2. Use the BATTERY SWITCH to switch off (position 0) the inverter.
3. Switch off the DC-circuit breaker (F1.x) connected to the inverter. This is important for the user’s safety.
4. Unscrew the DC-input cable terminals of the inverter.
5. Disconnect the AC-connectors (Phoenix Power CombiCon) from the AC-output. Although the connectors are shock-proof due to electrical isolation, please keep in mind that the connector carries voltage.
6. Disconnect the bus control cable from the inverter.
7. Unscrew the inverter module and pull it out of the rack.
8. Slide it into the rack and fasten it with the mounting screws.
9. Connect the DC-supply with cables to the DC-input terminal blocks of the inverter. Mind the polarity. Control fastening. Do not yet connect the AC or bus cables!
10. Switch on the DC-circuit breaker for the new inverter.
11. Use the BATTERY SWITCH to switch on the new inverter (position I).
12. Use the push button to assign the inverter the correct address. Possible addresses range from 1...12
13. Switch off (position 0) the inverter by using the BATTERY SWITCH.
14. Connect the inverter to the other inverters and to the controller by using the bus cables.
15. Connect the AC-output to the bypass. Keep in mind that the connector carries voltage!
16. Switch on (position I) the inverter by using the BATTERY SWITCH. The controller will automatically detect the new inverter. Confirm any message shown on the controller’s display.

Control output voltage, total power and load sharing. The system should be running together with the new inverter.
### 7.4 Replacement of the controller

The replacement of the controller during operation is possible for systems with a bypass integrated into the data-communication. The controller must be operable via the display. If this is no longer possible, please contact the manufacturer for a replacement during operation.

To replace the controller, follow the procedure listed below:

1. Set the controller to „Locked Mains“ in the menu item „Setup/ Bypass mode“.
2. Switch off the inverters via the menu („Shutdown“).
3. Switch off the controller by pressing the main switch.
4. Switch off the external fuse protection of the controller.
5. Disconnect all wiring of the controller.

The controller can be replaced now.

1. Only connect the DC input of the new controller.
2. Switch on the external fuse protection of the controller.
3. Switch on the controller by pressing the main switch [ON].
4. Set the controller to „Locked Mains“ in the menu item „Setup/ Bypass mode“.
5. Switch off the controller by pressing the main switch again.
6. Reconnect all wiring of the controller.
7. Switch on the controller by pressing the main switch [ON] again.
8. Start the system via the menu functions.
9. Do not forget to reset the system in menu item „Setup/Bypass mode“ and to control all setup functions to the required operating mode in advance.

### 7.5 Replacement of the bypass

The replacement of the bypass during operation is possible, provided that the alternative mains is connected via an internal or external bypass switch. Follow the instructions in section 5.4, Manual bypass.
# 8 TROUBLE SHOOTING

## 8.1 List of alarm messages

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid response ID XX</td>
<td>Communication failure</td>
<td>Please check the connections and double ID. Contact manufacturer or service</td>
</tr>
<tr>
<td>Boot failure ID XX</td>
<td>Inverter failure</td>
<td>Please check the connections and double ID. Contact manufacturer or service</td>
</tr>
<tr>
<td>No inverter</td>
<td>No inverter connected</td>
<td>Connect the inverter</td>
</tr>
<tr>
<td>Bypass error</td>
<td>Bypass is defect or overheated</td>
<td>Please wait approx. 10 min. and switch on again</td>
</tr>
<tr>
<td>Controller error</td>
<td>Internal error</td>
<td>Contact manufacturer or service</td>
</tr>
<tr>
<td>Overload protect</td>
<td>Overload protection</td>
<td>Reduce the load connected</td>
</tr>
<tr>
<td>Inverter fault ID XX</td>
<td>Inverter ID XX is defect or overheated</td>
<td>Please check the connections, contact manufacturer or service</td>
</tr>
<tr>
<td>Linecheck error ID XX</td>
<td>Inverter ID XX or cable is defect</td>
<td>Please check the connections, contact manufacturer or service</td>
</tr>
<tr>
<td>2nd Power fail</td>
<td>Substitute power supply fails</td>
<td>Check the connections, so far as a substitute power supply is available.</td>
</tr>
<tr>
<td>Battery Low</td>
<td>Battery is discharged</td>
<td>Load the battery</td>
</tr>
<tr>
<td>Battery UVP (Inverter down)</td>
<td>Deep discharge protection of the battery</td>
<td>Load the battery</td>
</tr>
<tr>
<td>Battery OVP (Inverter down)</td>
<td>Overvoltage protection of the battery</td>
<td>Check the battery charger</td>
</tr>
<tr>
<td>All inverter off</td>
<td>Controller switches off all inverters</td>
<td>Check the connections to the inverters and their availability</td>
</tr>
<tr>
<td>Inverter UVP (Load bypassed)</td>
<td>Inverter output voltage too low</td>
<td>Contact manufacturer or service</td>
</tr>
<tr>
<td>Mains UVP (Load bypassed)</td>
<td>Mains voltage too low</td>
<td>Check mains</td>
</tr>
<tr>
<td>Inverter OVP (Load bypassed)</td>
<td>Inverter output voltage too high</td>
<td>Contact manufacturer or service</td>
</tr>
<tr>
<td>Mains OVP (Load bypassed)</td>
<td>Mains voltage too high</td>
<td>Check mains</td>
</tr>
<tr>
<td>All inverters off (Load bypassed)</td>
<td>Switch-off by the controller but changeover to bypass mains</td>
<td>Check the connections to the inverters and their availability</td>
</tr>
<tr>
<td>Frequency fault (Load bypassed)</td>
<td>Main frequency fault, changeover to bypass mains</td>
<td>Check mains</td>
</tr>
<tr>
<td>Inverter overload (Load bypassed)</td>
<td>Inverter overload, changeover to bypass mains</td>
<td>Reduce the load connected</td>
</tr>
<tr>
<td>Mains overload (Load bypassed)</td>
<td>Inverter overload, changeover to bypass mains</td>
<td>Reduce the load connected</td>
</tr>
<tr>
<td>EEPROM failure</td>
<td>EEPROM failure</td>
<td>Contact manufacturer or service</td>
</tr>
<tr>
<td>Bypass temp high</td>
<td>Bypass temperature is critical</td>
<td>Check the unhindered air flow into the device, the ambient temperature</td>
</tr>
<tr>
<td>Bypass FAN fault</td>
<td>Fan failure in bypass</td>
<td>Check the fan function and contact the manufacturer</td>
</tr>
<tr>
<td>Inverter temp H</td>
<td>Inverter temperature is critical</td>
<td>Check the unhindered air flow into the device, the fan function and the ambient temperature</td>
</tr>
</tbody>
</table>
## 8.2 ERROR CODES

<table>
<thead>
<tr>
<th>Alarm text</th>
<th>Factory setting</th>
<th>Error Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote mode set</td>
<td>Alarm</td>
<td>E</td>
</tr>
<tr>
<td>Invalid password</td>
<td>E</td>
<td>ID 00 COD 024</td>
</tr>
<tr>
<td>Password saved</td>
<td>E</td>
<td>ID 00 COD 029</td>
</tr>
<tr>
<td>Invalid PIN</td>
<td>E</td>
<td>ID 00 COD 037</td>
</tr>
<tr>
<td>PIN saved</td>
<td>E</td>
<td>ID 00 COD 039</td>
</tr>
<tr>
<td>Shut down by user</td>
<td>E</td>
<td>ID 00 COD 040</td>
</tr>
<tr>
<td>No inverter</td>
<td>A</td>
<td>ID 00 COD 041</td>
</tr>
<tr>
<td>Bypass error</td>
<td>A</td>
<td>ID 00 COD 042</td>
</tr>
<tr>
<td>Controller error</td>
<td>A</td>
<td>ID 00 COD 043</td>
</tr>
<tr>
<td>Overload protect</td>
<td>A</td>
<td>ID 00 COD 044</td>
</tr>
<tr>
<td>Load bypassed</td>
<td>A</td>
<td>ID 00 COD 045</td>
</tr>
<tr>
<td>Bypass temp high</td>
<td>A</td>
<td>ID 00 COD 046</td>
</tr>
<tr>
<td>Bypass FAN fault</td>
<td>A</td>
<td>ID 00 COD 047</td>
</tr>
<tr>
<td>Bypass temp ok</td>
<td>E</td>
<td>ID 00 COD 048</td>
</tr>
<tr>
<td>Inverter fault</td>
<td>A</td>
<td>ID [1 ... 12] COD 050</td>
</tr>
<tr>
<td>Inverter start</td>
<td>E</td>
<td>ID [1 ... 12] COD 051</td>
</tr>
<tr>
<td>Linecheck error</td>
<td>A</td>
<td>ID 00 COD 052</td>
</tr>
<tr>
<td>Inverter temp H</td>
<td>A</td>
<td>ID [1 ... 12] COD 053</td>
</tr>
<tr>
<td>Inverter temp ok</td>
<td>E</td>
<td>ID [1 ... 12] COD 054</td>
</tr>
<tr>
<td>2nd power good</td>
<td>E</td>
<td>ID 00 COD 060</td>
</tr>
<tr>
<td>2nd power UVP</td>
<td>A</td>
<td>ID 00 COD 061</td>
</tr>
<tr>
<td>2nd power OVP</td>
<td>A</td>
<td>ID 00 COD 062</td>
</tr>
<tr>
<td>Battery low</td>
<td>A</td>
<td>ID 00 COD 080</td>
</tr>
<tr>
<td>Battery UVP</td>
<td>A</td>
<td>ID 00 COD 081</td>
</tr>
<tr>
<td>Battery OVP</td>
<td>A</td>
<td>ID 00 COD 082</td>
</tr>
<tr>
<td>All inverter off</td>
<td>A</td>
<td>ID 00 COD 083</td>
</tr>
<tr>
<td>Mains UVP</td>
<td>A</td>
<td>ID 00 COD 090</td>
</tr>
<tr>
<td>Inverter UVP</td>
<td>A</td>
<td>ID 00 COD 091</td>
</tr>
<tr>
<td>Mains OVP</td>
<td>A</td>
<td>ID 00 COD 092</td>
</tr>
<tr>
<td>Inverter OVP</td>
<td>A</td>
<td>ID 00 COD 093</td>
</tr>
<tr>
<td>Frequency fault</td>
<td>A</td>
<td>ID 00 COD 094</td>
</tr>
<tr>
<td>Mains overload</td>
<td>A</td>
<td>ID 00 COD 096</td>
</tr>
<tr>
<td>Inverter overload</td>
<td>A</td>
<td>ID 00 COD 097</td>
</tr>
<tr>
<td>Mains power good</td>
<td>E</td>
<td>ID 00 COD 098</td>
</tr>
<tr>
<td>Inverter power good</td>
<td>E</td>
<td>ID 00 COD 099</td>
</tr>
<tr>
<td>Inverter config set</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Logfile erased</td>
<td>E</td>
<td>ID 00 COD 118</td>
</tr>
<tr>
<td>Log. Config set</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Time saved</td>
<td>E</td>
<td>ID 00 COD 123</td>
</tr>
<tr>
<td>Header saved</td>
<td>E</td>
<td>ID 00 COD 128</td>
</tr>
<tr>
<td>Modern init saved</td>
<td>E</td>
<td>ID 00 COD 143</td>
</tr>
<tr>
<td>Phone-No. Saved</td>
<td>E</td>
<td>ID 00 COD 144</td>
</tr>
<tr>
<td>Modern ATD saved</td>
<td>E</td>
<td>ID 00 COD 145</td>
</tr>
<tr>
<td>Bypass mode set</td>
<td>E</td>
<td>ID 00 COD 156</td>
</tr>
<tr>
<td>Bypass FAN reset</td>
<td>E</td>
<td>ID 00 COD 158</td>
</tr>
<tr>
<td>Rel 1 config set</td>
<td>E</td>
<td>ID 00 COD 166</td>
</tr>
<tr>
<td>Rel 2 config set</td>
<td>E</td>
<td>ID 00 COD 176</td>
</tr>
<tr>
<td>DC limits saved</td>
<td>E</td>
<td>ID 00 COD 198</td>
</tr>
<tr>
<td>AC lower limit set</td>
<td>E</td>
<td>ID 00 COD 209</td>
</tr>
<tr>
<td>Event</td>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>AC upper limit set</td>
<td>E</td>
<td>ID 00 COD 208</td>
</tr>
<tr>
<td>Inv. Limit set</td>
<td>E</td>
<td>ID 00 COD 215</td>
</tr>
<tr>
<td>Mains limit set</td>
<td>E</td>
<td>ID 00 COD 216</td>
</tr>
<tr>
<td>Sys. Current set</td>
<td>E</td>
<td>ID 00 COD 221</td>
</tr>
<tr>
<td>System boot</td>
<td>E</td>
<td>ID 00 COD 230</td>
</tr>
<tr>
<td>Invalid response</td>
<td>A</td>
<td>ID 00 COD 234</td>
</tr>
<tr>
<td>Boot inverter</td>
<td>E</td>
<td>ID [1 ... 12] COD 235</td>
</tr>
<tr>
<td>Boot failure</td>
<td>A</td>
<td>ID [1 ... 12] COD 236</td>
</tr>
<tr>
<td>Setup restored</td>
<td>E</td>
<td>ID 00 COD 243</td>
</tr>
<tr>
<td>Setup error</td>
<td>A</td>
<td>ID 00 COD 244</td>
</tr>
<tr>
<td>Frequency set</td>
<td>E</td>
<td>ID 00 COD 248</td>
</tr>
<tr>
<td>Load defaults</td>
<td></td>
<td>ID 00 COD 241</td>
</tr>
<tr>
<td>Programming</td>
<td></td>
<td>ID 00 COD 242</td>
</tr>
</tbody>
</table>
Appendix B
CIRCUIT DIAGRAM PCI10
## Appendix C
### PARAMETER LIST PCI10

<table>
<thead>
<tr>
<th>CONTROLLER</th>
<th>PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Alternative</td>
</tr>
<tr>
<td>Setup Inverter</td>
<td>-</td>
</tr>
<tr>
<td>Setup Logfile, Config</td>
<td>-</td>
</tr>
<tr>
<td>Setup Clock</td>
<td>-</td>
</tr>
<tr>
<td>Setup Modem Initsequence</td>
<td>-</td>
</tr>
<tr>
<td>Setup Phonenumber</td>
<td>-</td>
</tr>
<tr>
<td>Setup Modem Autodial</td>
<td>-</td>
</tr>
<tr>
<td>Setup Modem Header</td>
<td>-</td>
</tr>
<tr>
<td>Setup Bypass Mode</td>
<td>Normal/Locked Inverter/Mains / Disable</td>
</tr>
<tr>
<td>Setup Relais 1</td>
<td>2nd power fail / Battery low / Bypass state / Alarm / Disable</td>
</tr>
<tr>
<td>Setup Relais 2</td>
<td>Bypass state</td>
</tr>
<tr>
<td>Setup Battery limits: Reset</td>
<td>32,5-36,5</td>
</tr>
<tr>
<td>Setup Battery limits: UVP</td>
<td>34,0-40,5</td>
</tr>
<tr>
<td>Setup Battery limits: First Start</td>
<td>39,0-47,5</td>
</tr>
<tr>
<td>Setup Battery limits: Restart Low</td>
<td>41,0-71,5</td>
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<td>Setup Battery limits: Restart High</td>
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<td>Setup Battery limits: OVP</td>
<td>58,0-79,0</td>
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<tr>
<td>Setup Battery limits: Batt low signal</td>
<td>32,5-47,5</td>
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<tr>
<td>Setup AC limits: Lower limit</td>
<td>-10 / -15%</td>
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<tr>
<td>Setup AC limits: Upper limit</td>
<td>+10 / +15 / +20%</td>
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<tr>
<td>Setup Power limits: Inverter</td>
<td>0-46kW</td>
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<tr>
<td>Setup Power limits: Mains</td>
<td>0-46kW</td>
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<tr>
<td>Setup Power limits: System current</td>
<td>50 / 120 / 200A</td>
</tr>
<tr>
<td>Setup Frequency</td>
<td>50 / 60Hz</td>
</tr>
<tr>
<td>Setup Remote</td>
<td>Disable / Enable</td>
</tr>
<tr>
<td>Setup Security Remote password</td>
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<tr>
<td>Setup Security SIM-Card PIN</td>
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## Appendix D
### ALARM SETTINGS PCI10

<table>
<thead>
<tr>
<th>ALARM</th>
<th>CATEGORY</th>
<th>Normal setting</th>
<th>Current setting</th>
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<tbody>
<tr>
<td>System Boot</td>
<td>Event</td>
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<tr>
<td>Invalid response</td>
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<tr>
<td>Boot Inverter</td>
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<tr>
<td>Boot failure</td>
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<tr>
<td>Shutdown by user</td>
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<tr>
<td>No Inverter</td>
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<tr>
<td>Bypass error</td>
<td>Alarm</td>
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<tr>
<td>Controller Error, Turn power off</td>
<td>Alarm</td>
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<tr>
<td>Overload protect</td>
<td>Alarm</td>
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<tr>
<td>Inverter fault</td>
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<tr>
<td>Inverter start</td>
<td>Event</td>
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<td>Linecheck error</td>
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<td>2nd power fail</td>
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<td>Battery Low</td>
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<tr>
<td>Battery UVP, Inverter down</td>
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<tr>
<td>Battery OVP, Inverter down</td>
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<tr>
<td>All Inverter off</td>
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<tr>
<td>Inverter UVP, Load bypassed</td>
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<td>Mains UVP, Load bypassed</td>
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<td>All Inverter off, Load bypassed</td>
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<td>Frequency fault, Load bypassed</td>
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<td>Inv. overload, Load bypassed</td>
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<td>Modem auto dial saved (Modem ATD)</td>
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<td>Bypass mode set</td>
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<td>Rel.2 config set</td>
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<td>AC lower lim set</td>
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