ABB SOLAR INVERTERS

PVS800-57B central inverters
Commissioning and maintenance manual
# List of related manuals

<table>
<thead>
<tr>
<th>Hardware manuals and guides</th>
<th>Code (English)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVS800-57B central inverters hardware manual</td>
<td>3AXD50000048300</td>
</tr>
<tr>
<td>PVS800-57B central inverters commissioning and maintenance manual</td>
<td>3AXD50000048331</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Firmware manuals and guides</th>
<th>Code (English)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVS800-57B central inverters firmware manual</td>
<td>3AXD50000048332</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option manuals and guides</th>
<th>Code (English)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS-AP-x Assistant control panels user's manual</td>
<td>3AUA0000085685</td>
</tr>
<tr>
<td>Start-up and maintenance PC tool Drive composer user's manual</td>
<td>3AUA0000094606</td>
</tr>
<tr>
<td>FENA-01/-11/-21 Ethernet adapter module user's manual</td>
<td>3AUA0000093568</td>
</tr>
<tr>
<td>FSCA-01 RS-485 adapter module user's manual</td>
<td>3AUA0000109533</td>
</tr>
</tbody>
</table>
Commissioning and maintenance manual

PVS800-57B central inverters

Table of contents

1. Safety instructions
2. Mechanical installation
3. Electrical installation
4. Start-up and operation

© 2018 ABB Oy. All Rights Reserved.

3AXD5000048331 Rev A
EN
EFFECTIVE: 2018-06-25
# Table of contents

## 1. Safety instructions
- Contents of this chapter ................................................................. 9
- Use of warnings ........................................................................... 9
- Installation and maintenance safety .............................................. 10
  - Electrical safety ....................................................................... 10
  - Performing electrical work ......................................................... 12
  - General safety ........................................................................ 14
- Safe start-up and operation ............................................................ 15

## 2. Introduction to the manual
- Contents of this chapter ................................................................. 17
- Applicability ................................................................................ 17
- Target audience .......................................................................... 17
- Contents of the manual ................................................................. 18
- Related documents ...................................................................... 18
- Categorization by frame size and option code .............................. 18
- Quick installation, commissioning and operation flowchart ........... 19
- Terms and abbreviations ............................................................. 20

## 3. Storing, lifting and transporting
- Contents of this chapter ................................................................. 23
- Moving the inverter .................................................................... 23
- Storing the inverter ..................................................................... 24
- Lifting the inverter in the shipping package .................................. 25
  - With a crane ........................................................................... 25
  - With a forklift truck ............................................................... 26
  - Moving the crate with a forklift .............................................. 27
- Transporting the inverter .............................................................. 28

## 4. Mechanical installation
- Contents of this chapter ................................................................. 29
- Safety .......................................................................................... 29
- Required tools ............................................................................ 29
- Unpacking .................................................................................. 29
- Examining the delivery ................................................................. 30
- Examining the installation site ...................................................... 30
  - Moving the unpacked inverter cabinet .................................... 31
- Fastening the cabinet to the floor and wall or roof ...................... 33
  - General rules .......................................................................... 33
  - Fastening methods ................................................................. 34
  - Clamping ................................................................................. 34
- Miscellaneous ............................................................................ 35
  - Cable duct in the floor below the cabinet ............................... 35
  - Ventilation ............................................................................. 35
5. Electrical installation

Contents of this chapter ................................................. 39
Insulation test .......................................................... 39
  Inverter ............................................................... 39
  AC output cables .................................................... 39
  PV generator ........................................................ 39
  Routing the cables ................................................... 40
Connecting the power cables ........................................... 41
  Connection diagram ................................................ 41
  Connection diagram of a four-conductor system .......... 42
  DC input cable connection procedure ....................... 43
  AC output cable connection procedure .................. 44
Checking the settings of the auxiliary voltage transformer .. 45
  3-phase power output (optional) ......................... 45
Connecting the control cables ........................................ 46
  Default I/O connection diagram .......................... 46
  Connection procedure ............................................ 46
Fast power off circuit ................................................ 47
  Startup after FPO .................................................. 47
Connecting a PC ....................................................... 48
Installing fieldbus adapter modules ............................... 49

6. Installation checklist

Contents of this chapter ................................................. 51
Warnings ............................................................... 51
Checklist ............................................................... 52

7. Start-up and operation

Contents of this chapter ................................................. 53
Start-up procedure ..................................................... 53
  Safety .............................................................. 53
  Primary and ambient conditions .......................... 53
  Set up the insulation monitoring device ................ 54
  Set-up the current transducers (option +G417) for all DC inputs ...................... 54
  Hints on using the assistant control panel ............. 54
  Parameter settings before the first start .............. 54
  First start ......................................................... 54
Starting and stopping the inverter ......................... 55
  Set up fieldbus control .................................... 55
  Register the inverter .......................................... 55

8. Hardware status

Contents of this chapter ................................................. 57
LEDs ................................................................. 57
Warning and fault messages ....................................... 58
9. Maintenance

Contents of this chapter ................................................................. 59
Maintenance intervals ................................................................. 59
  Descriptions of symbols .......................................................... 59
  Recommended annual maintenance actions by the user .................. 60
  Recommended maintenance intervals ....................................... 60
Maintenance tasks ................................................................. 61
  Examining the environment ...................................................... 61
  Cleaning the cabinet .............................................................. 61
  Replacing the cabinet door air filters and cleaning the grilles ...... 62
Fans .................................................................................. 63
  Replacing the power module cooling fans .................................... 63
  Replacing the power module board compartment fan .................. 64
  Replacing the LCL filter cooling fans ......................................... 65
  Replacing the AUX cabinet cooling fan ....................................... 66
  Replacing the DC cabinet cooling fans ....................................... 67
  Replacing the AC cabinet cooling fans ....................................... 68
Replacing the inverter power module ........................................... 69
  Procedure ................................................................. 69
Heat sink cleaning ............................................................... 73
Memory unit ........................................................................ 74
Replacing the BCU control unit battery ....................................... 74
Replacing the control panel battery ............................................. 74
Spare parts ........................................................................ 74
  Storing spare parts ................................................................. 74
  DC circuit capacitors reforming, spare modules, and spare capacitors .... 75

Further information
Safety instructions

Contents of this chapter
This chapter contains the safety instructions which you must obey when you install and operate the inverter and do maintenance on the inverter. Obey these safety instructions to prevent injury or death, or damage to the equipment.

Use of warnings
Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger.

The manual uses these warning symbols:

- **Electricity warning** – Electrical hazards which can cause injury or death, or damage to the equipment.
- **General warning** – Conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.
- **Electrostatic sensitive devices warning** – Risk of electrostatic discharge which can cause damage to the equipment.
- **Hearing loss warning** – Risk of hearing loss due to high volumes. Use hearing protection.
Installation and maintenance safety

Electrical safety

These warnings are for all personnel who do work on the inverter, its input and output cables, the transformer or photovoltaic generator.

**WARNING!** Obey these instructions to prevent injury or death, or damage to the equipment.

- **If you are not a qualified electrician, do not do electrical installation or maintenance work.**
- Obey all installation safety standards. This can require, among other things, the use of personal protection equipment (PPE), such as arc-proof clothing, arc-proof masks, protective footwear, protective gloves, eye protection and hearing protection. High power inverter installations have high fault currents. Select appropriate arc-proof clothing (for example, in the US, a rating of 40 cal/cm² is required, EN531).
- Standard IEC/EN 62109-2 (section 4.8.3.6) requires that, as the inverter is not provided with full protection against shock hazard on the photovoltaic array, you install and use the inverter in a closed electrical operating area. There is no RCD protection inside the inverter.
- Do not do work on the photovoltaic generator, or the inverter or its input or output cables when the inverter is connected to an electrical power system or to the photovoltaic generator.
- Before you do work in the inverter cabinet, isolate the AC line cables and busbars from the electrical power system with the disconnector of the power system transformer. Also, isolate the inverter from the photovoltaic generator with the safety switch of the generator or by other means. The optional AC disconnectors or optional breakers do not isolate the AC output cables and terminals of the inverter from the electrical power system. The DC disconnectors do not isolate the DC input fuses, cables or terminals from the DC voltage supplied by the photovoltaic generator.
- Before you do work in the inverter cabinet, set to off or isolate the auxiliary voltage supply from the inverter.
- The inverter auxiliary power can be supplied from an external source (standard) or from internal auxiliary power transformers. Make sure that also auxiliary power is disconnected.
- Do not operate the inverter with the doors open, even in fault tracking conditions. The inverter doors act as arc hazard protection. If a highly unlikely arc flash incident happens when the inverter doors are open, even the arc-flash proof protection equipment might not provide sufficient protection.
- Before you do work on the inverter, apply a temporary grounding for work (AC and DC side).
- Do not work on the control cables when power is applied to the inverter or to the external control circuits. Externally supplied control circuits can cause dangerous voltages in the inverter even when the main power on the inverter is off.
- Live parts in the inverter cabinet are protected against direct contact when all protective plastic covers and metallic shrouds are in place.
- Do not do insulation or voltage withstand tests on the inverter or inverter modules.
- With the grounding options selected, one of the poles of the photovoltaic generator is grounded, and therefore, the other pole has full voltage against ground (up to 1000 V).
• When the photovoltaic generator cells are exposed to light (even if it is dim), the generator supplies DC voltage to the inverter.

Grounding
These instructions are for all personnel who are responsible for the grounding of the inverter.

WARNING! Obey these instructions to prevent injury or death, damage to the equipment and electromagnetic interference.

• If you are not a qualified electrician, do not do grounding work.
• Always ground the inverter and adjoining equipment with proper PPE on. This is necessary for personnel safety. Correct grounding decreases electromagnetic emissions and interference. Follow the site’s policy on disconnecting the inverter from AC.
• The minimum cross section of the grounding conductor must be at least half of the cross section of the line conductor or fulfill the local regulations. The grounding conductor must withstand 50 kA RMS prospective for time duration of 1 second. Refer to standard IEC 60364-5-54.
• In a multiple-inverter installation, connect each inverter separately to the protective earth (PE) busbar of the switch board or the transformer.
• Avoid grounding loops and keep grounding cables at least 0.5 m away from the AC cables, as current can be generated to a grounding loop by the electromagnetic coupling from the supply cables.
• When you use shielded AC power cables, do a 360° high-frequency grounding of the cable entries at the cabinet lead-through to decrease electromagnetic interference. Connect the cable shields to the protective earth (PE) to meet safety regulations.
• External EMC filters are not permitted at the AC output of the inverter.
• Do not install the inverter on a TN (grounded) system.

Note:
• You can use power cable shields as grounding conductors only if their conductivity is sufficient.
• As the normal touch current of the inverter can be more than 3.5 mA AC or 10 mA DC, use a fixed protective earth connection. Refer to standard IEC/EN 62109, 5.2.5. or IEC62477-1, 4.4.4.3.3.

Electric welding

WARNING! Do not fasten the cabinet by electric welding. ABB does not assume any liability for damages caused by electric welding as the welding circuit can damage electronic circuits in the cabinet.
Performing electrical work

These precautions are for all personnel who do work on the inverter, its input and output cables, the transformer or the photovoltaic generator system.

**WARNING!** Obey these instructions to prevent injury or death, or damage to the equipment. You must be a qualified electrician to do installation and service work. Do these steps before you do installation or maintenance work on the inverter.

1. Clearly identify the work location. Make sure that there is an escape route available in case of an emergency.

2. Disconnect and isolate. (Not all disconnectors provide sufficient isolation against voltage surges.)
   - Disconnect the inverter from the AC supply (normally a disconnector or a breaker on the HV side of the main transformer), because the AC disconnector or breaker of the converter does not remove the voltage from the AC output busbars of the inverter.
   - Disconnect the inverter from the DC power supply (usually the DC circuit breakers of the solar array junction boxes or the DC combiner box) because the optional DC disconnectors do not remove the voltage from the inverter input DC busbars or fuses.
   - Open the AC main disconnection devices (AC breaker or AC switch disconnector) of the inverter (Q2), the DC disconnector of the inverter (Q1), the auxiliary power disconnectors of all the power sections (Q10), the optional 3-phase output switch (F13). If the inverter is supplied from an external auxiliary power, disconnect also that. For auxiliary power switches, note the following disconnection order:
     a. Internal power supply (auxiliary power from main circuit) - open Q30
     b. External power supply 400 VAC - open Q10 (auxiliary power circuit) - open Q30 (BAMU)
     c. External power supply, not 400 VAC - open F12 (auxiliary power supply) - open Q30 (BAMU).
   - Make sure that reconnection is not possible. Lock all of the disconnectors in the open position and attach a warning notice to them.
   - After you disconnect the inverter, wait for at least 5 minutes to let the intermediate circuit capacitors discharge before you continue.

3. Protect any other energized parts in the work location against contact.

4. Take special precautions when you do work near bare conductors.

5. Measure that the installation is not energized.
   - Make sure that the voltage measurement device works correctly by testing the measurement device with a live voltage.
   - Use a voltage measurement device such as a multimeter with an impedance of at least 1 MΩ and voltage measurement range up to 1000 V DC.
   - Make sure that the voltage between the inverter AC output terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
   - Make sure that the voltage between the inverter module UDC+ and UDC- terminals and the grounding (PE) busbar is close to 0 V.
   - Make sure that the voltage between the DC input terminals DC+ and DC- and the grounding (PE) busbar is close to 0 V.
6. Install temporary grounding as required by the local regulations. Connect the AC and DC busbars (in both DC sections) to the PE with a temporary grounding tool. Temporary grounding cables must be dimensioned to withstand the prospective current of the system for time duration until upstream protection device clears the fault current. The temporary grounding cables should be tied tightly to the busbars or the frame of the converter as the forces of the short circuit current can cause the temporary grounding cables to move hazardously.

7. Ask the person in control of the electrical installation work for a permit to work.

8. After you finish the work, make sure that the inverter is clean from inside and that all the tools have been removed from inside the inverter, remove the temporary grounding and tell the person responsible for work about the completed works. After you make sure that the voltage can be connected, close all the doors of the inverter, and close the disconnectors. When connecting voltage back on, do not stand right next to the inverter. Also make sure that there is an escape route available in case of an emergency.
14 Safety instructions

General safety

These instructions are for all personnel who install the inverter and do maintenance work on it.

WARNING! Obey these instructions to prevent injury or death, or damage to the equipment.

- Move the inverter power module carefully:
  - Use safety shoes with a metal toe cap and protective gloves.
  - Use caution when you move an inverter power module. Do not tilt the module. The module is heavy. It can topple over if you handle it carelessly.
  - Obey the instructions in the PVS800-57B central inverters commissioning and maintenance manual (3AXD50000048331 [EN]).
  - Be aware of hot surfaces. Some parts in the inverter cabinet, such as the heat exchangers are hot after you disconnect the electrical supply.
  - Make sure that the debris from the installation work does not go into the inverter. Electrically conductive debris in the unit can cause damage.

Printed circuit boards

WARNING! Use a grounding wristband when you handle the printed circuit boards. Do not touch the boards unnecessarily. The boards have components that are sensitive to electrostatic discharge.

Fiber optic cables

WARNING! Obey these instructions to prevent injury or death, or damage to the equipment.

- Handle the fiber optic cables with care.
- When you disconnect the cables, hold the connector, not the cable.
- Do not touch the ends of the fibers with bare hands as the ends are extremely sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum permitted bend radius is 35 mm (1.4 in.).
Safe start-up and operation

These warnings are for all personnel who commission, plan the operation or operate the inverter converter.

**WARNING!** Obey these instructions to prevent injury or death, or damage to the equipment.

- Keep all doors of the inverter closed when it operates.
- Connect the medium voltage grid to the main transformer.
- Before you start the inverter, close the AC and DC disconnectors (if present), and the internal auxiliary transformer fuse switch F10.
- AC Q2 and DC Q1. Note the point on page 12 about auxiliary power supply.
- When the inverter operates, do not open the AC or DC disconnectors.
- Before you adjust the inverter and put it into service, make sure that all of the equipment is suitable for operation.
- The maximum allowed number of power-ups by applying power is five in ten minutes.
- Do not use the inverter in a manner not specified in this manual.

**Note:**
- If the Start switch is in the ON position, the **Inverter enable** signal is active, and the Start command is active, the inverter converter starts immediately after a fault reset. For more information, see the *PVS800-57B central inverters Firmware manual*.
Safety instructions
Introduction to the manual

Contents of this chapter
This chapter describes the intended audience and contents of the manual. It has a flowchart of the steps to examine the delivery, and install and commission the inverter. The flowchart refers to sections in this manual and in other manuals.

Applicability
This manual is applicable to PVS800-57B central inverters.

Target audience
This manual is intended for persons who plan the installation of, install, commission, use and service the inverter. Read the manual before you do work on the inverter. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.
Contents of the manual

Safety instructions – Safety instructions for the installation, commissioning, operation and maintenance of the inverter.

Introduction to the manual – Introduction to the manual.

Storing, lifting and transporting – How to store, lift and move the inverter.

Mechanical installation – The mechanical installation of the inverter.

Electrical installation – The electrical installation of the inverter.

Installation checklist – A list to check the mechanical and electrical installation of the inverter.

Start-up and operation – The start-up procedure and the operation of the inverter.

Hardware status – The fault tracing possibilities of the inverter.

Maintenance – The preventive maintenance instructions of the inverter.

Related documents

Refer to the inner front cover.

Categorization by frame size and option code

Instructions, technical data, dimensions and weights which concern a certain inverter frame sizes are marked with the frame size (n x R8i). To identify your unit, refer to the type designation labels.

The instructions and technical data which concern optional components are marked with option codes, for example, +K475. The options included in the inverter can be identified from the type designation label.

For information on the type designation labels, refer to the PVS800-57B central inverters hardware manual (3AXD50000048300 [EN]).
## Quick installation, commissioning and operation flowchart

<table>
<thead>
<tr>
<th>Task</th>
<th>Refer to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan the installation.</td>
<td>Technical data and Planning the electrical installation in the PVS800-57B central inverters</td>
</tr>
<tr>
<td>Do a check of the ambient conditions, ratings, required cooling</td>
<td>hardware manual (3AXD50000048300 [EN])</td>
</tr>
<tr>
<td>air flow, input and output power connection, compatibility with the</td>
<td>Option manual (if optional equipment is included)</td>
</tr>
<tr>
<td>solar generator and other technical data.</td>
<td></td>
</tr>
<tr>
<td>Select the cables.</td>
<td></td>
</tr>
<tr>
<td>Unpack and examine the units for damage.</td>
<td>Storing, lifting and transporting (page 23).</td>
</tr>
<tr>
<td>Make sure that all of the optional modules and equipment are</td>
<td>Examining the installation site (page 30)</td>
</tr>
<tr>
<td>present and correct.</td>
<td></td>
</tr>
<tr>
<td>Examine the installation site.</td>
<td></td>
</tr>
<tr>
<td>Route the cables.</td>
<td>Routing the cables (page 40)</td>
</tr>
<tr>
<td>Install the inverter. Connect the power cables.</td>
<td>Mechanical installation (page 29)</td>
</tr>
<tr>
<td>Connect the control and the auxiliary control cables.</td>
<td>Electrical installation (page 39)</td>
</tr>
<tr>
<td>Make sure that the installation is correct.</td>
<td>Installation checklist (page 51)</td>
</tr>
</tbody>
</table>

---

Introduction to the manual   19
## Terms and abbreviations

<table>
<thead>
<tr>
<th>Term/Abbreviation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC500</td>
<td>ABB programmable logic controller (PLC) series</td>
</tr>
<tr>
<td>ACS-AP-I</td>
<td>Control panel type</td>
</tr>
<tr>
<td>BAMU</td>
<td>Auxiliary measuring unit</td>
</tr>
<tr>
<td>BCU</td>
<td>Control unit</td>
</tr>
<tr>
<td>BINT</td>
<td>Power module interface board</td>
</tr>
<tr>
<td>CPU</td>
<td>Central processing unit</td>
</tr>
<tr>
<td>CS</td>
<td>Control section</td>
</tr>
<tr>
<td>DC input</td>
<td>Connection point from solar array to inverter. One input consists of one positive and one negative terminal.</td>
</tr>
<tr>
<td>DDCS</td>
<td>Distributed drives communication system; a protocol used in optical fiber communication inside and between ABB drives and inverters.</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>FENA</td>
<td>Optional Ethernet adapter module for EtherNet/IP, Modbus TCP and PROFINET IO protocols</td>
</tr>
<tr>
<td>Frame (size)</td>
<td>Relates to the construction type of the component in question. The term is often used in reference to a group of components that share a similar mechanical construction.</td>
</tr>
<tr>
<td>FSCA</td>
<td>Optional Modbus RTU adapter module</td>
</tr>
<tr>
<td>HMI</td>
<td>Human-machine interface</td>
</tr>
<tr>
<td>IGBT</td>
<td>Insulated gate bipolar transistor; a voltage-controlled semiconductor type widely used in inverters due to its easy controllability and high switching frequency.</td>
</tr>
<tr>
<td>Inverter</td>
<td>A cabinet-built device containing all inverter modules together with their control electronics, and I/O and auxiliary components. The inverter module converts the DC voltage to AC voltage. Its operation is controlled by switching the IGBTs.</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>MCB</td>
<td>Miniature/Main circuit breaker</td>
</tr>
<tr>
<td>MGND</td>
<td>Solar array and grounding monitoring board</td>
</tr>
<tr>
<td>MIRU</td>
<td>Solar array insulation resistance measuring unit</td>
</tr>
<tr>
<td>MPPT</td>
<td>Maximum power point tracking. Inverter software function that automatically operates the photovoltaic generator at its maximum power point.</td>
</tr>
<tr>
<td>Photovoltaic cell, generator, module, string, array and array junction box</td>
<td>In this manual, solar power system components based on photovoltaic effect are called solar cell, solar module, solar array, solar string and solar array junction box as defined below.</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable logic controller</td>
</tr>
<tr>
<td>PSL2</td>
<td>Protocol used in optical fiber communication inside ABB drives and inverters</td>
</tr>
<tr>
<td>PV</td>
<td>Photovoltaic</td>
</tr>
<tr>
<td>R8i</td>
<td>Inverter power module</td>
</tr>
<tr>
<td>RCD</td>
<td>Residual current device</td>
</tr>
<tr>
<td>Term/Abbreviation</td>
<td>Explanation</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory control and data acquisition</td>
</tr>
<tr>
<td>Solar array</td>
<td>Group of parallel-connected solar strings</td>
</tr>
<tr>
<td>Solar array junction box</td>
<td>Device that connects outputs of multiple solar source circuits (strings) into a combined output circuit or circuits</td>
</tr>
<tr>
<td>Solar cell</td>
<td>Device that converts light directly into electricity by the photovoltaic effect</td>
</tr>
<tr>
<td>Solar generator</td>
<td>The total of all solar strings of a solar power supply system, which are electrically interconnected</td>
</tr>
<tr>
<td>Solar module</td>
<td>Packaged interconnected assembly of solar cells</td>
</tr>
<tr>
<td>Solar string</td>
<td>Circuit of series-connected solar modules</td>
</tr>
<tr>
<td>THD</td>
<td>Total harmonic distortion</td>
</tr>
</tbody>
</table>
Introduction to the manual
Storing, lifting and transporting

Contents of this chapter
This chapter tells you how to store, lift and move the inverter.

Moving the inverter
You can move the inverter with a crane from the lifting beams on the roof or with a fork-lift from the base of the inverter.
Always move the inverter in the upright position.

WARNING! Obey these instructions to prevent physical injury or death, or damage to the equipment:

- Use only authorized lifting equipment and personnel.
- Do not let anybody go under the load.
- Do not stand on the roof when you attach the lifting slings or during lifting.
- Do not allow slings or hooks to fall onto the roof.
Storing the inverter

- To prevent damage to the inverter, keep it in the protective packaging.
- Store the inverter in the upright position. Do not put it on its side or back.
- To prevent condensation in the inverter, store it indoors in a dry (heated) warehouse.
- If the inverter is removed from the protective packaging and condensation is possible in the storage area:
  - Supply power to the internal heaters to keep the inside temperature of the inverter above the outside temperature.
  - If power is not available, add humidity desiccant bags inside the inverter. Use desiccant bags, if the unit is stored for more than two weeks without electric heaters. Use 200 grams of desiccant per week. For example, for four weeks of storage, use 800 g of desiccant bags. Replace the bags with fresh bags every four weeks and do not open the doors unnecessarily during the storage period. Examples of suitable container desiccants: Xdry desiccants “H model” or Clariant “Container Dri®II-Pole”. When it leaves the factory, the inverter has desiccant bags inside.
- The air inlets and outlets of the inverter are sealed. If it is not required, do not open or remove any protective packaging.
- If the inverter is stored outside for an extended period, this can cause damage to the protective packaging.
- Make sure that the ground under the inverter is solid, flat, dry and vegetation-free. Make sure that the ground gives support to the inverter evenly from below. There must be no twisting or stress. Do not put the inverter onto bare ground because this can lead to paint damage and corrosion.
- Keep the inverter on the wooden support beams.
Lifting the inverter in the shipping package

- **With a crane**
  - Lift the inverter in its shipping packaging. If you remove the packaging, protect the inverter from scratches and dents.
  - Make sure that the slings have sufficient loading capacity.
  - The minimum length of each sling is 1.8 m.
  - Adjust the lengths of the lifting slings to make sure that the inverter does not tilt.
  - Attach a guide wire to a bottom corner of the inverter to prevent rotation.

![Diagram of inverter lifting with crane](image)
With a forklift truck

- Lift the inverter in its shipping packaging. If you remove the packaging, protect the inverter from scratches and dents.
- Lift the inverter from the lifting holes on the base of the inverter.
- Make sure that the forklift truck has sufficient loading capacity.
- Always lift the inverter so that its center of mass is centered on the lifting equipment.
- When you lift or move the inverter, make sure that the inverter does not tilt.
- Be careful when you move the unit as the center of gravity of the inverter is high.
Moving the crate with a forklift
Transporting the inverter

**WARNING!** Keep the transportation height as low as possible. Make sure that the total height of the transportation is not above the maximum allowed height for the planned route.

Do not use too much force with cargo straps even when the inverter is in its shipping package. Too much force can cause damage to the inverter frame.

To prevent damage to the inverter, do not put cargo straps over the inverter when it is not in the shipping package.

Do not throw hooks over the roof. This can damage the paint and lead to corrosion.

Obey these instructions:

- Transport the inverter in its shipping packaging. If you remove the packaging, protect the inverter from scratches and dents.

- Transportation on a closed or weather protected space such as a truck trailer is recommended. If you transport it on an open bed, protect the inverter with temporary weather protection.
Mechanical installation

Contents of this chapter
This chapter describes the mechanical installation of the inverter. Obey all local regulations.

Safety
Refer to Safety instructions on page 9.
For instructions on how to move the inverter, refer to Storing, lifting and transporting on page 23.

Required tools
The tools required to move the inverter, fasten it to the foundation and tighten the connections:
• Crane, fork-lift or pallet truck (with sufficient load capacity), and iron bar, jack and rollers.
• Pozidriv and Torx (2.5...6 mm) screwdrivers
• Torque wrench
• Set of wrenches and sockets

Unpacking
Before the delivery check and the installation, unpack the inverter from the transportation and storage package. Be careful to not cause damage to the inverter.
To prevent damage to the inverter, unpack the inverter as late as possible before the installation.
Remove the transport package as follows:

1. Remove the screws that attach the wooden parts of the transport crate together.
2. Remove the wooden parts.
3. Remove screws that attach the clamps that hold the inverter cabinet on the transport pallet. Remove the clamps.
4. Remove the plastic wrapping.

**Examining the delivery**

The inverter delivery contains:

- Inverter cabinet
- Option modules (if ordered)
- Appropriate inverter manuals and option module manuals
- Delivery documents
- Loose items: floor mounting brackets, screw kits, module extraction/installation ramp

Make sure that the delivery has no signs of damage. Mark and record any damage carefully and contact the local ABB representative immediately. Repair any damaged paint.

Manuals and other loose parts are delivered inside the inverter. Before you start to install or operate the inverter, read the type designation label of the inverter to make sure that the delivery is correct. Refer to *PVS800-57B central inverters hardware manual* (3AXD50000048300 [EN]). Record possible deviations carefully and contact the local ABB representative immediately.

**Examining the installation site**

Refer to *PVS800-57B central inverters hardware manual* (3AXD50000048300 [EN]) for the permitted operating conditions and the dimension drawings.

Examine the installation site:

- The installation site has sufficient ventilation and cooling.
- The ambient conditions of the inverter meet the specifications.
- The wall behind the unit is of non-flammable material.
- There is sufficient free space above the inverter to enable cooling air flow, service and maintenance.
- The surface that the unit is installed on is of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. Measure the incline of the floor with a spirit level. The maximum permitted incline is 5 mm for every 3 m. Level the installation site, because the cabinet does not have adjustable feet.

**Note:** The module extraction/installation ramp included with the inverter is only suitable for a height difference of 50 mm maximum (the standard plinth height of the inverter).
Moving the unpacked inverter cabinet

Lifting the cabinet with a crane

Lift the inverter cabinet using its lifting beams. You can remove the lifting beams after the cabinet is in its final position. If you remove the lifting beams, seal their mounting holes to retain the degree of protection.

The distance between the lifting holes in the lifting beam is 2150 mm (7').

The minimum length of the lifting slings is 1600 mm (5’3”).

Moving the cabinet on rollers

Lay the cabinet on the rollers and move it carefully until close to its final location. Lift the unit with a crane, forklift, pallet truck or jack to remove the rollers.
32 Mechanical installation

Moving the cabinet on its back
Support the cabinet from below alongside the cubicle seams.

Final placement of the cabinet
Move the cabinet into its final position with a slate bar (spud bar). Put a piece of wood between the edge of the cabinet and the bar to protect the cabinet frame.
Fastening the cabinet to the floor and wall or roof

**General rules**

- Install the inverter in an upright vertical position.
- You can install the cabinet with its back against a wall (a), or back-to-back with another unit (b).
- To adjust the height of the cabinet, use metal shims between the cabinet bottom and the floor.

- When you remove the lifting beams, fasten the bolts to retain the degree of protection of the cabinet.
Fastening methods

Fasten the cabinet to the floor with the clamps included along the edge of the cabinet bottom.

Clamping

Floor clamping

Insert the clamps into the twin slots along the front and rear edges of the cabinet frame body and fasten them to the floor with a M12 bolt. The recommended maximum distance between the clamps in the front edge is 800 mm (31.5″).

Wall clamping

If floor mounting at the back is not possible, fasten the top of the cabinet to the wall with L-brackets (not included in the delivery) bolted to the lifting bar fastening holes.
Miscellaneous

- **Cable duct in the floor below the cabinet**

You can make a cable duct below the 500 mm wide middle part of the cabinet. The cabinet weight lies on the two 50 mm wide transverse sections which the floor must carry.

Prevent the cooling air flow from the cable duct to the cabinet by bottom plates. To ensure the degree of protection for the cabinet, use the original bottom plates that were delivered with the unit. With user-defined cable entries, take care of the degree of protection, fire protection and EMC compliance.

- **Ventilation**

The air inlets of the installation space must supply a sufficient volume of cooling air. For the minimum air flow values, refer to *PVS800-57B central inverters hardware manual* (3AXD50000048300 [EN]).

> **WARNING!** Make sure that the incoming air is sufficiently clean. If not, dust goes into the cabinet. The outlet filter on the cabinet roof prevents dust from going out. The collected dust can cause inverter malfunction and danger of fire.
■ Preventing the recirculation of hot air

To prevent hot air recirculation outside the inverter, make sure that the exhaust air flows away from the air inlets. Make sure that the hot air from the inverter module cabinet does not flow into the adjacent cabinets.

![Diagram showing the direction of hot air flow away from the inverter](image)

■ Ventilation duct at the air outlet of the cabinet

The ventilation system must keep the static pressure in the air outlet duct sufficiently below the pressure of the room where the inverter is located in order that the cabinet fans can produce the required air flow through the cabinet. Make sure that no dirty or moist air flows back to the inverter, even during off-time or when you do maintenance on the inverter.

Calculating the required static pressure difference

You can calculate the required static pressure difference between the exit air duct and the inverter installation room as follows:

\[
\Delta p_s = (1.5...2) \cdot p_d
\]

where

\[
p_d = 0.5 \cdot \rho \cdot v_m^2
\]

\[
v_m = \frac{q}{A_c}
\]

\[p_d \ \triangleq \text{Dynamic pressure}
\]

\[\rho \ \triangleq \text{Air density (kg/m}^3\text{)}
\]

\[v_m \ \triangleq \text{Average air velocity in the exit duct(s) (m/s)}
\]

\[q \ \triangleq \text{Rated air flow of the inverter (m}^3\text{/s)}
\]

\[A_c \ \triangleq \text{Cross-sectional area of the exit duct(s) (m}^2\text{)}
\]

Example

The cabinet has 3 exit openings of 315 mm diameter. The rated air flow of the cabinet is 4650 m\(^3\)/h = 1.3 m\(^3\)/s.

\[A_c = 3 \cdot 0.315^2 \cdot \frac{\pi}{4} = 0.234 \text{ m}^2\]

\[v_m = \frac{q}{A_c} = \frac{1.3}{0.234} = 5.5 \text{ m/s}\]
$p_d = 0.5 \cdot \rho \cdot v_m^2 = 0.5 \cdot 1.1 \cdot 5.5^2 = 17 \text{ Pa}$

The required pressure in the exit air duct is then, $1.5\ldots 2 \cdot 17 \text{ Pa} = 26\ldots 34 \text{ Pa}$, below the pressure in the room.

For more information: Contact ABB.
Electrical installation

Contents of this chapter
This chapter describes the electrical installation of the inverter.

Insulation test

- **Inverter**
  The inverter is tested for insulation at the factory. Do not perform voltage tolerance or insulation resistance tests on any part of the inverter.

- **AC output cables**
  Make sure that the insulation of the AC output cable obeys the local regulations before you connect it to the inverter.

- **PV generator**
  Make sure that the insulation of the PV generator obeys the local regulations and the manufacturer instructions. The PV generator must be completely disconnected from the inverter during the insulation test.
Routing the cables

When you route the cables:

- Install the DC power, AC power and control cables on separate routes.
- Make sure that the metallic cable trays are electrically bonded to each other and to the ground.
- Make sure that there is 500 mm (20 in) of separation between the power cables and the control cables.
- If the control cables cross the power cables, set them at angle as close to 90 degrees as possible.
- If you use four-conductor AC cabling, install the phase cables symmetrically and near each other. Asymmetrical installation can induce current in the grounding cables and metal structures.
Connecting the power cables

- **Connection diagram**

1) Solar array junction box.

2) If you use shielded cable, 360-degree grounding is recommended at the cabinet entry. Ground the other end of the input cable shield or PE conductor at the transformer.

3), 4) If you use shielded cable (which is recommended) and the conductivity of the shield is < 50% of the conductivity of the phase conductor, use a separate PE cable (3) or a cable with a grounding conductor (4).
Connection diagram of a four-conductor system

Arrange the cables as shown to get a current distribution that is as equal as possible.

Connect single-core cables without concentric protective shielding (armor) as shown.

**WARNING!** Ground all conductive cable supports, cable clamps and individual conductive items close to cables, such as cable trays.
DC input cable connection procedure

Refer to the dimension drawings in the *PVS800-57B central inverters hardware manual* (3AXD50000048300 [EN]).

1. Remove the shroud from the input power terminals.
2. Put the cable(s) into the inside of the cabinet.
3. If it is a shielded cable, connect the shield to the cabinet grounding busbar with a cable lug.
4. Connect the DC- conductor to terminal DC- and the DC+ conductor to terminal DC+.
5. If there is a separate PE conductor, connect it to the cabinet grounding terminal.
6. Refit the shroud onto the input power terminals.

*DC input terminals DC-, DC +*

* a) Cable lead-throughs*
AC output cable connection procedure

Refer to the dimension drawings in the *PVS800-57B central inverters hardware manual* (3AXD50000048300 [EN]).

1. Remove the shroud from the output power terminals.
2. Put the cable(s) into the cabinet.
3. If it is a shielded cable, prepare the cable ends and do the 360° grounding at the cabinet entry. Connect the twisted shield of the AC output cable(s) to the cabinet PE (ground) busbar with a cable lug.
4. Connect the phase conductors to terminals L1, L2 and L3.
5. If it is present, connect the separate PE/grounding conductor to the cabinet PE (ground) busbar.
6. Install the shroud on to the output power terminals.
Checking the settings of the auxiliary voltage transformer

The connections of the optional auxiliary voltage transformer (T10) are made at the factory. Make sure that the connections agree with the selected option code (+G396, +G397). If not, change the connection wire to the correct voltage terminal.

3-phase power output (optional)

The inverter has a 3-phase power output for an auxiliary power transformer when option G429 is selected.

- Voltage: Same as inverter output
- Can be connected only to IT (ungrounded) systems
Connecting the control cables

Default I/O connection diagram

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Type</th>
<th>Rating</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+24 V DC</td>
<td>+24 V DC</td>
<td>Power distribution</td>
</tr>
<tr>
<td></td>
<td>- 0 V DC</td>
<td>0 V DC</td>
<td>Power distribution</td>
</tr>
<tr>
<td>1</td>
<td>User DI1</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>User DI2</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>User DI3</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>User DI4</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>User DI5</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>User DI6</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>User DI7</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>User RO1</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>User AI2</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>User AI2</td>
<td>4–20 mA</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>User AI3</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>User AI3</td>
<td>4–20 mA</td>
<td>-</td>
</tr>
</tbody>
</table>

You can freely configure the I/O signals with different fault names and reactions. Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [EN]).

Connection procedure

360-degree grounding at the cabinet lead-through for the control cables:

Make sure that a proper environmental seal remains after the installation.

1. Cut adequate holes in the rubber grommets in the lead-through plate.
2. Put the cables through the grommets into the cabinet.
3. Strip the plastic sheath of the cable above the lead-through plate just enough to ensure proper connection of the bare shield.

Side view of the cable lead-through

- a) Grommet
- b) EMI conductive cushion
- c) Lead-through plate

Note: If the outer surface of the shield is non-conductive:

- Cut the shield at the midpoint of the bare part. Do not cut the conductors or the grounding wire (if present).
- Turn the shield inside out to expose its conductive surface.
- Cover the turned shield and the stripped cable with copper foil to make the shielding continuous.
Connecting the cables to the I/O terminals

Connect the conductors to the appropriate terminals of the I/O section (refer to Default I/O connection diagram on page 46). At the terminal block, use shrink tubing or insulating tape to contain any stray strands. Especially for multiple shields, you can also terminate the shield with a lug and fasten it with a screw to the nearest grounding clamp. Leave the other end of the shield unconnected or ground it indirectly through a high-frequency capacitor, for example, 3.3 nF/630 V. You can also ground the shield directly at both ends, if they are in the same ground line with no significant voltage drop between the end points. Tighten the screws to secure the connection.

**Note:** Keep signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.

**Fast power off circuit**

The FPO circuit is powered from the 24 V DC circuit which is connected directly to the Fast Power Off switch (S20). The Fast Power Off switch is a locking type (twist release) push button equipped with two N.C. contacts.

The N.C. contact connects to the main contactor enable relays (-K11) through the relay output of the main control board. All of the contactor control signals from the PLC connect to the contactor coils through the enable relay contacts. Power section has an enable relay, which all are in parallel downstream of the common FPO switch.

In addition to the interlockings on the hardware side, the software prevents inverter operation, if the Fast Power Off switch is pushed.

**Startup after FPO**

The startup procedure:

1. Before startup, the FPO switch must be released.
2. Reset the fault, the inverter restarts when all other reconnection conditions are fulfilled.
Connecting a PC

You can connect a PC (for example, using the Drive composer PC tool) to the inverter as follows:

1. Connect an ACS-AP-I control panel to the inverter control unit either with an Ethernet cable, or by inserting the control panel into the panel holder (if present).

   **WARNING!** Do not connect the PC directly to the control panel ethernet connector of the inverter.

2. Open the USB connector cover on the front of the control panel.

3. Connect a USB cable (Type A to Type Mini-B) between the USB connector on the control panel (3a) and a free USB port on the PC (3b).

4. The panel will display an indication when the connection is active.

Refer to the documentation of the PC tool for setup instructions. Refer to *ACS-AP-x assistant control panels user’s manual* (3AUA0000085685 [English]) for instructions on using the control panel.
Installing fieldbus adapter modules

**Note:** Pay attention to the free space required by the cabling or terminals coming to the option modules.

1. Disconnect the inverter from the supply, lock out the disconnecting device, and ensure by measuring that there is no voltage present.

2. Switch off any potentially dangerous control voltages coming to the inverter. Ensure by measuring that the I/O terminals of the control unit (especially the relay output terminals) are safe.

3. Insert the module into a free option module slot on the control unit.

4. Fasten the mounting screw of the module.

5. Connect the necessary wiring to the module following the instructions given in the documentation of the module and section *Connecting the control cables* on page 46.

6. Check the installation and that it is safe to reconnect power.

7. Configure the module. Refer to the instructions given in the documentation of the module as well as the appropriate firmware manual.
50 Electrical installation
Installation checklist

Contents of this chapter

This chapter contains a list for checking the mechanical and electrical installation of the inverter.

Warnings

WARNING! Obey the instructions in chapter Safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.
Checklist

Do the steps in section *Performing electrical work* on page 12 before you start the work. Go through the checklist together with another person.

<table>
<thead>
<tr>
<th>Make sure that …</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical installation</strong> (refer to chapter <em>Mechanical installation</em>)</td>
<td>✓</td>
</tr>
<tr>
<td>There is sufficient free space in front of the unit.</td>
<td>□</td>
</tr>
<tr>
<td>The ambient operating conditions are allowed.</td>
<td>□</td>
</tr>
<tr>
<td>The unit is properly fastened to the floor.</td>
<td>□</td>
</tr>
<tr>
<td>The cooling air is clean and it is able to flow freely in through the inlet air ducts and grilles and out of the exhaust air ducts and grilles.</td>
<td>□</td>
</tr>
<tr>
<td><strong>Electrical installation</strong> (refer to chapter <em>Electrical installation</em>)</td>
<td></td>
</tr>
<tr>
<td>The inverter (including cables) is grounded properly and the earthing electrodes are constructed properly.</td>
<td>□</td>
</tr>
<tr>
<td>The AC line voltage matches the nominal output voltage of the inverter.</td>
<td>□</td>
</tr>
<tr>
<td>The AC transformer is suitable for use with the inverter (refer to the <em>PVS800-57B central inverters hardware manual</em> (3AXD50000048300 [EN])).</td>
<td>□</td>
</tr>
<tr>
<td>The insulation of the assembly is sufficient (refer to <em>Insulation test</em> on page 39).</td>
<td>□</td>
</tr>
<tr>
<td>The AC power system is an IT (ungrounded) system.</td>
<td>□</td>
</tr>
<tr>
<td>The AC power connections at L1, L2 and L3 and their tightening torques are correct.</td>
<td>□</td>
</tr>
<tr>
<td>The DC power cable connections at DC+ and DC– and their tightening torques are correct.</td>
<td>□</td>
</tr>
<tr>
<td>The AC and DC power cable lead throughs are sealed properly.</td>
<td>□</td>
</tr>
<tr>
<td>The auxiliary and control cables are routed away from the power cables (refer to <em>Routing the cables</em> on page 40).</td>
<td>□</td>
</tr>
<tr>
<td>The auxiliary power supply cable connections from the inverter at X1 and X4 and their tightening torques are correct.</td>
<td>□</td>
</tr>
<tr>
<td>The external control connections to the inverter are correct (including the fieldbus and connections at X2).</td>
<td>□</td>
</tr>
<tr>
<td>The cable connections at the junction box and their tightening torques are correct.</td>
<td>□</td>
</tr>
<tr>
<td>There are no tools, foreign objects or dust inside the modules or the cabinet.</td>
<td>□</td>
</tr>
<tr>
<td>All of the shrouds and covers are in place.</td>
<td>□</td>
</tr>
<tr>
<td>All of the doors and door filters are in place.</td>
<td>□</td>
</tr>
<tr>
<td>All of the cooling fan power plugs are connected.</td>
<td>□</td>
</tr>
</tbody>
</table>
Contents of this chapter
This chapter describes the start-up procedure of the inverter.

Start-up procedure
Do a test of the operation of the inverter first in the local control mode with the control panel (ACS-AP-I) or the Drive composer PC tool. Then set the control program parameters.

<table>
<thead>
<tr>
<th>Tasks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety</strong></td>
<td></td>
</tr>
<tr>
<td>![WARNING!] Obey the safety instructions during the installation and start-up procedure. Refer to chapter <em>Safety instructions</em> on page 9.</td>
<td>☑</td>
</tr>
<tr>
<td>Only qualified electricians can install and start-up the inverter.</td>
<td>☑</td>
</tr>
<tr>
<td><strong>Primary and ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Make sure that the mechanical and electrical installation of the inverter is correct. Refer to section <em>Installation checklist</em> on page 51.</td>
<td>☑</td>
</tr>
<tr>
<td>Make sure that the insulation of the assembly is sufficient. Refer to section <em>Insulation test</em> on page 39. If the insulation is not sufficient, the optional insulation resistance monitoring cannot be tuned properly.</td>
<td>☑</td>
</tr>
<tr>
<td>Make sure that the ambient conditions for start-up, temperature, humidity, altitude etc. are within the limits. Refer to <em>PVS800-57B central inverters hardware manual</em> (3AXD50000048300 [EN]).</td>
<td>☑</td>
</tr>
<tr>
<td>Set up the cabinet heater: Set the maximum temperature settings of the thermostats according to the schematic drawings. If the inverter is installed in a very humid environment, and there is a delay before commissioning without auxiliary power, use the cabinet heaters for several days before you do the commissioning.</td>
<td>☑</td>
</tr>
</tbody>
</table>
Start-up and operation

Make sure that there is sufficient light for the inverter to be able to feed power to the AC power system (grid).

There must be enough light so that the solar generator is able to feed power to the inverter. This allows you to make sure that the inverter operates correctly. You can set the parameter during the dark hours. You can do a test of the inverter modulation without power from the photovoltaic arrays.

Make sure that the polarity and voltage of each connected DC solar string is correct:
1. Remove the inverter DC fuses.
2. Measure that the plus pole is connected to the plus terminal.
3. Measure that the minus pole is connected to the minus terminal.
4. Measure that the voltage is correct.
5. Put the DC fuses back into place.
Make a record/document of this polarity and voltage test.

Make sure that the open circuit DC voltage from the solar generator is in the correct range for the inverter (eg. 600…900 V DC).

You can make an estimate of the expected DC voltage: Use the open circuit voltage of the solar modules and the number of modules in a string.

Set up the insulation monitoring device

Make sure that there is only one insulation monitoring for the inverter in the same galvanically connected IT system.

Make sure that the settings of the insulation monitoring device suit the installation and obey the local regulations. The trip limit is adjusted to 30 kohm at the factory. Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [EN]).

More information:
- Circuit diagrams delivered with the inverter.

Set-up the current transducers (option +G417) for all DC inputs

Set up the DC input current monitoring and adjust the monitoring settings. Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [EN]).

Hints on using the assistant control panel

The two commands at the bottom of the display (in the figure on the right, Options and Menu), show the functions of the two softkeys and located below the display.

The commands assigned to the softkeys vary depending on the context.
Use keys (△, □, ●), and ▼ to move the cursor and/or change values depending on the active view.
Key △ shows a context-sensitive help page.
For more information, see ACS-AP-x assistant control panels user’s manual (3AUA0000085685 [English]).

Parameter settings before the first start

Make the parameter settings needed before the first start according to the firmware manual.
Refer to the start-up section of the firmware manual.

First start

Measure and record the DC voltage from the solar generator.
The expected and measured DC voltages should be roughly equal.

Set the auxiliary power to on. Measure the auxiliary power level is correct before switching on the auxiliary circuit breakers of the auxiliary circuit one by one.
The control boards and the control panel should “wake up”. If there are no active faults, the inverter is in the stand-by mode.
There may be faults and warnings on the display. They are reset during the next steps.
Starting and stopping the inverter

The inverter operates automatically based on its measurements and settings. Inverter operation can be enabled and disabled with the parameter 189.01 Inverter operation. When the parameter is set to enable, the inverter starts when all the required conditions are fulfilled.

Status of the inverter conditions can be checked, for example, with the control panel or Drive composer tool from parameters 173.05 Internal inverter inhibitors 1 and 173.06 Internal inverter inhibitors 2.

Inverter operation can also be enabled and disabled through the SCADA interface.

---

<table>
<thead>
<tr>
<th>Close the manual AC and DC main switches.</th>
<th>Release the Fast Power Off button.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units with optional positive/negative grounding (+F282/+F283); Set up the grounding option.</td>
<td></td>
</tr>
<tr>
<td>Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [EN]).</td>
<td></td>
</tr>
<tr>
<td>Reset all faults.</td>
<td></td>
</tr>
<tr>
<td>Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [EN]).</td>
<td></td>
</tr>
<tr>
<td>Make sure that the DC voltage of the solar generator matches the parameter value.</td>
<td></td>
</tr>
<tr>
<td>If the DC voltage is different from the parameter value, do not start the inverter. Contact ABB.</td>
<td></td>
</tr>
<tr>
<td>Enable the inverter operation from parameter 189.1.</td>
<td></td>
</tr>
<tr>
<td>Make sure that the inverter operates properly from the following actual value parameters in the master control program:</td>
<td></td>
</tr>
<tr>
<td>• 101.01 DC Voltage</td>
<td></td>
</tr>
<tr>
<td>• 101.12 POWER</td>
<td></td>
</tr>
<tr>
<td>The DC voltage should have dropped from the open circuit voltage and the active power should match the line current and the AC voltage.</td>
<td></td>
</tr>
<tr>
<td>Disable inverter operation to stop the inverter.</td>
<td></td>
</tr>
</tbody>
</table>

Set up fieldbus control

Set the fieldbus parameters according to the external controller. Refer to the firmware manual and the appropriate fieldbus adapter module manual.

Make sure that the inverter can be seen from the external controller.

Do a test with control and actual values.

Register the inverter


If you cannot access the InstalledBase, submit a Membership Request on the Installed Base main page. Note that InstalledBase is only for ABB internal or ABB partner use.

It is recommended to attach the parameter lists and back-up files of the inverter and master control program to the report.
Start-up and operation
Contents of this chapter

This chapter describes the hardware signals that can be used to track faults. Refer to the *PVS800-57B central inverters firmware manual* for (3AXD5000004834 [EN]) warning and fault descriptions, status parameters, etc.

LEDs

The table tells the location, name, color and meaning of the LED indicators in the inverter.

<table>
<thead>
<tr>
<th>Where</th>
<th>LED</th>
<th>Color</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control panel</td>
<td>Status LED</td>
<td>Green, cont.</td>
<td>The inverter operates normally. The control unit is powered and +24 V is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>flicker</td>
<td>supplied to the control panel.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green,</td>
<td>Data is transferred between the PC tool and the inverter via USB.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>blink</td>
<td>There is an active warning in the inverter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red</td>
<td>There is an active fault in the inverter.</td>
</tr>
<tr>
<td>AUX cabinet door</td>
<td>Push button and status</td>
<td>Green</td>
<td>AC breaker closed / push to close</td>
</tr>
<tr>
<td></td>
<td>LED</td>
<td>Red</td>
<td>AC breaker open / push to open</td>
</tr>
<tr>
<td>Where</td>
<td>LED</td>
<td>Color</td>
<td>Indication</td>
</tr>
<tr>
<td>------------------</td>
<td>-------</td>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Control unit BCU-12</td>
<td>BATT OK</td>
<td>Green</td>
<td>The battery voltage of the real-time clock is OK (more than 2.8 V). When the LED off: • The battery voltage is less than 2.8 V • The battery is missing • The control unit is not powered</td>
</tr>
<tr>
<td></td>
<td>PWR OK</td>
<td>Green</td>
<td>The internal voltage is correct.</td>
</tr>
<tr>
<td></td>
<td>FAULT</td>
<td>Red</td>
<td>The control program indicates that the equipment is faulty. Refer to the firmware manual.</td>
</tr>
<tr>
<td></td>
<td>WRITE</td>
<td>Yellow</td>
<td>Writing to SD card in progress.</td>
</tr>
<tr>
<td>AC500</td>
<td>PWR</td>
<td>Green</td>
<td>The AC500 unit is powered.</td>
</tr>
<tr>
<td></td>
<td>RUN</td>
<td>Green</td>
<td>The AC500 program is running.</td>
</tr>
<tr>
<td></td>
<td>ERR</td>
<td>Red</td>
<td>An error or warning detected by the AC500 firmware.</td>
</tr>
<tr>
<td>MIRU-01</td>
<td>POWER</td>
<td>Green</td>
<td>The MIRU-01 unit is powered.</td>
</tr>
<tr>
<td></td>
<td>ERROR</td>
<td>Red</td>
<td>An error detected by the MIRU-01 firmware.</td>
</tr>
<tr>
<td></td>
<td>STATUS</td>
<td>Green</td>
<td>The status of the insulation resistance measurement: • Slow flash (1/s): Measurement ready • Rapid flash (5/s): Measurement not ready</td>
</tr>
<tr>
<td></td>
<td>DISABLE</td>
<td>Red</td>
<td>Insulation resistance measurement is disabled.</td>
</tr>
<tr>
<td>MGND-01</td>
<td>POWER</td>
<td>Green</td>
<td>The MGND-01 is powered.</td>
</tr>
<tr>
<td></td>
<td>GROUNDING STATUS</td>
<td>Green</td>
<td>The grounding voltage is OK (&lt;50 V DC)</td>
</tr>
<tr>
<td>BAMU-11</td>
<td>POWER</td>
<td>Green</td>
<td>The BAMU-11 unit is powered.</td>
</tr>
<tr>
<td></td>
<td>LINK FAULT</td>
<td>Red</td>
<td>There is an error on the board or an error in the PSL2 link.</td>
</tr>
<tr>
<td></td>
<td>U2 &gt; 60V</td>
<td>Yellow</td>
<td>The input voltages (U2, V2 and W2) are more than 60 V.</td>
</tr>
<tr>
<td></td>
<td>U1 &gt; 60V</td>
<td>Yellow</td>
<td>The input voltages (U1, V1 and W1) are more than 60 V.</td>
</tr>
</tbody>
</table>

**Warning and fault messages**

Refer to the *PVS800-57B central inverters firmware manual* (3AXD50000048332[EN]).
Maintenance

Contents of this chapter
This chapter contains the preventive maintenance instructions of the inverter.

Maintenance intervals
If the inverter is installed in a suitable environment, it requires only minimum maintenance. The tables list the routine maintenance intervals recommended by ABB.

The recommended maintenance intervals and component replacement are based on specified operational and environmental conditions. ABB recommends annual inverter inspections to ensure the highest reliability and optimum performance. For more detailed maintenance information, refer to the maintenance instructions, product manuals and the ABB website: www.abb.com/solarinverters.

Inverter’s designed life time is 25 years. If the inverter is planned to be used longer than its designed life time, additional maintenance and component replacements are recommended. Contact ABB for more details.

After the product warranty expires, you can choose to not follow the recommended preventive maintenance plan. The preventive maintenance plan is, however, a prerequisite for ABB service contracts.

Descriptions of symbols

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Visually examine and do maintenance if it is necessary.</td>
</tr>
<tr>
<td>P</td>
<td>On/off-site work (commissioning, tests, measurements, etc.)</td>
</tr>
<tr>
<td>R</td>
<td>Replace the component.</td>
</tr>
</tbody>
</table>
Recommended annual maintenance actions by the user

ABB recommends that you do these annual inspections to ensure the highest reliability and optimum performance of the inverter.

<table>
<thead>
<tr>
<th>Target / task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connections and environment</td>
<td></td>
</tr>
<tr>
<td>Environment check</td>
<td>I</td>
</tr>
<tr>
<td>Cabinet door filters IP41</td>
<td>R</td>
</tr>
<tr>
<td>Spare parts</td>
<td></td>
</tr>
<tr>
<td>Spare parts</td>
<td>I</td>
</tr>
<tr>
<td>DC circuit capacitors reforming, spare modules and spare capacitors</td>
<td>P</td>
</tr>
<tr>
<td>Inspections by the user</td>
<td></td>
</tr>
<tr>
<td>IP41 air inlet and outlet grills</td>
<td>I</td>
</tr>
<tr>
<td>Inspection of dustiness, corrosion, and temperature inside the cabinet. Cleaning, if needed.</td>
<td>II</td>
</tr>
<tr>
<td>Overall cleanliness of inverter (e.g. cabinet door sealings, function of cooling fans, main circuit terminals)</td>
<td>III</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Air circuit breaker maintenance</td>
<td>I</td>
</tr>
</tbody>
</table>

Recommended maintenance intervals

<table>
<thead>
<tr>
<th>Component</th>
<th>Years from start-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Connections and environment</td>
<td></td>
</tr>
<tr>
<td>Heat sink cleaning (1)</td>
<td>I</td>
</tr>
<tr>
<td>Cleanliness of power connections of the inverter module. Clean if necessary. (1)</td>
<td>I</td>
</tr>
<tr>
<td>Tightness of the AC and DC terminals (2)</td>
<td>I</td>
</tr>
<tr>
<td>Main cooling fans and control</td>
<td></td>
</tr>
<tr>
<td>Main cooling fan, inverter unit</td>
<td>R</td>
</tr>
<tr>
<td>BFPS module internal power supply boards</td>
<td>R</td>
</tr>
<tr>
<td>Cooling fan, LCL-filter unit</td>
<td>R</td>
</tr>
<tr>
<td>Cooling fan of R8i inverter unit PCBs</td>
<td>R</td>
</tr>
<tr>
<td>Cabinet cooling fans</td>
<td></td>
</tr>
<tr>
<td>Cabinet cooling fans</td>
<td>R</td>
</tr>
<tr>
<td>Inverter unit</td>
<td></td>
</tr>
<tr>
<td>BINT, BGDR, BDPS module internal circuit boards</td>
<td>R</td>
</tr>
<tr>
<td>Flat ribbon cables (module internal circuit boards)</td>
<td>R</td>
</tr>
<tr>
<td>Common, control panel and control unit batteries</td>
<td></td>
</tr>
<tr>
<td>BCU control unit battery (Real-time clock)</td>
<td>R</td>
</tr>
<tr>
<td>Control panel battery (Real-time clock)</td>
<td>R</td>
</tr>
<tr>
<td>Buffers and power supplies</td>
<td></td>
</tr>
<tr>
<td>Auxiliary power supplies</td>
<td>R</td>
</tr>
<tr>
<td>Auxiliary buffers</td>
<td>R</td>
</tr>
</tbody>
</table>

1) Always when inverter module is replaced, check the cleanliness and condition of power connection and heat sink. Cleaning if needed.

2) Check the tightness of the main circuit terminals during commissioning. See the recommended tightness in the Hardware manual. If the inverter installation conditions require, check the tightness more often. Obey the local regulations.
Maintenance tasks

- **Examining the environment**
  - Make sure that the installation environment of the inverter is according to the requirements.
  - Make sure that the inverters are installed according to ABB recommendations. For more information, refer to *Mechanical installation* on page 29 and the *PVS800-57B central inverters hardware manual* (3AXD50000048300 [EN]).
  - Make sure that there is sufficient space around the unit for maintenance tasks.
  - Make sure that the unit is correctly fastened to the installation surface.
  - Make sure that the doors are closed.

- **Cleaning the cabinet**

  **WARNING!** Obey the safety instructions, page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

  **WARNING!** Use a vacuum cleaner with an antistatic hose and nozzle. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

1. Stop the inverter and do the steps in *Performing electrical work* on page 12 before you start the work.
2. Clean the interior of the cabinet with a soft brush and a vacuum cleaner.
3. Clean the air inlets of the fans.
4. Examine the air inlet grilles of the cabinet. Replace them when it is necessary.
Replacing the cabinet door air filters and cleaning the grilles

**WARNING!** Obey the safety instructions, page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Stop the inverter and do the steps in *Performing electrical work* on page 12 before you start the work.
2. Remove the grille fasteners.
3. Remove the grilles one by one.
4. Remove the dirty air filters from the grilles.
5. Clean the grilles with a vacuum cleaner.
   Do not use a pressure washer or pressurized air.
6. Wipe the grilles clean and let them dry.
7. Install the new air filters in the grilles.
8. Install the grilles.
Fans

Replacing the power module cooling fans

**WARNING!** Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Performing electrical work* on page 12.
2. Open the cover plates of the ISU cabinet.
3. Remove the screws that hold the cover plate of the fan unit.
4. Lift the cover plate slightly to release it.
5. Disconnect the fan wiring.
6. Remove the power supply unit below the fan unit.
7. Remove the screws from the fan unit.
8. Pull out the fan unit.
9. Install a new fan unit in reverse order.
Replacing the power module board compartment fan

The R8i module has a fan to cool the circuit board compartment. You can access the fan from the front of the module.

**WARNING!** Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Performing electrical work* on page 12.
2. Open the cover plates of the ISU cabinet.
3. Remove the two M4×12 (T20) screws that lock the fan holder.
4. Pull the fan holder out of the module.
5. Disconnect the fan cable.
6. Remove the four M3 (5.5 mm) nuts that hold the fan.
7. Remove the fan from the fan holder.
8. Put the fan onto the threaded studs on the fan holder with the airflow direction arrow pointing towards the fan holder.
9. Install and tighten the four M3 (5.5 mm) nuts that hold the fan.
10. Connect the fan cable.
11. Align and push the fan holder into the module.
12. Install and tighten the two M4×12 (T20) screws.
Replacing the LCL filter cooling fans

WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in Performing electrical work on page 12.
2. Open the ISU cabinet cover plates.
3. Disconnect the power and control cables of the LCL cooling fans.
4. Loosen the locking screws of the LCL cooling fan.
5. Pull the fan out.
6. Install the new LCL cooling fan.
7. Tighten the screws.
8. Connect the power and control cables of the LCL cooling fans.
9. Attach the ISU cabinet cover plates.
10. Apply auxiliary power to the inverter and check that all of the cooling fans start.
Replacing the AUX cabinet cooling fan

**WARNING!** Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Performing electrical work* on page 12.
2. Open the AUX cabinet door.
3. Disconnect the power connector of the cooling fan.
4. Remove the 2 screws that hold the cooling fan and finger guard.
5. Disconnect the fan wiring.
6. Remove the cooling fan.
7. Install the new cooling fan.
8. Install the finger guard and install and tighten the 2 screws.
9. Connect the fan wiring and power connector of the cooling fan.
Replacing the DC cabinet cooling fans

The cooling fans of the DC cabinet are mounted on the protective metal panel in the cabinet. Depending on the number of DC inputs there are two or three cooling fans.

WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in Performing electrical work on page 12.
2. Open the DC cabinet door.
3. Disconnect the power connector of the cooling fan.
4. Remove the 2 screws that hold the cooling fan and finger guard.
5. Disconnect the fan wiring.
6. Remove the cooling fan.
7. Install the new cooling fan.
8. Install the finger guard and install and tighten the 2 screws.
9. Connect the fan wiring and power connector of the cooling fan.
Replacing the AC cabinet cooling fans

The cooling fans of the AC cabinet are mounted on the protective metal panel in the cabinet.

**WARNING!** Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Performing electrical work* on page 12.
2. Open the AC cabinet door.
3. Disconnect the power connector of the cooling fans.
4. Remove the cover of the cable tray above the fan assembly and take out the cables.
5. Remove the 8 screws that hold the fan assembly.
6. Disconnect the fan wiring.
7. Remove the 4 screws that hold each cooling fan and finger guard.
8. Remove the cooling fans.
9. Install the new cooling fans.
10. Install the finger guard and install and tighten the 4 screws for each fan.
11. Connect the fan wiring.
12. Put the fan assembly into position.
13. Install and tighten the 8 screws that hold the fan assembly.
14. Install the cover of the cable tray.
15. Connect the power connector of the cooling fans.
Replacing the inverter power module

The inverter power module can be replaced only by a technician who is authorized by ABB.

Procedure

Removing the inverter module(s)

To allow more room for cabling work, the inverter modules can be removed completely instead of only the fan carriages.

Refer to the drawings below.

---

**WARNING!** Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Do the steps in section *Precautions before electrical work* on page 19 before you start the work.
2. Open the inverter module cubicle door.
3. Remove the shroud at the top of the cubicle.
4. Disconnect the terminal block [X30] at the top of the module.
5. Remove the DC busbars from the module. Make a note of the order and position of the screws and washers.
6. Disconnect the wiring connected to the terminals on the front of the module (including fiber-optic cabling). Move the disconnected wiring aside.
7. Attach the module extraction/installation ramp (included) to the base of the cabinet so that the tabs on the mounting bracket enter the slots on the ramp.

---

**WARNING!** Do not use the ramp included in the inverter delivery with plinth heights over 50 mm.

8. Remove the two screws at the bottom front of the module.

---

**WARNING!** Before you proceed, make sure the cabinet is level, or chock the wheels of the module.

9. Remove the two screws at the top front of the module.
10. Pull the module carefully out along the ramp. While pulling on the handle with your right hand, keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back.
11. Move the module into a safe location outside the immediate work area and make sure it cannot topple over. Chock the wheels of the module if the floor is not completely level.
12. Repeat the procedure for the other inverter modules.

Proceed to *Connecting the motor cables* (page 114).
Re-installing the fan carriage of an inverter module

(If the inverter module was removed completely instead of only the fan carriage, proceed to section Re-inserting the inverter module into the cubicle below.)

The re-installation of the fan carriage is the removal procedure in reverse. See section Removing and reinstalling the fan carriage of an inverter module (page 112).

Re-inserting the inverter module into the cubicle

1. Make sure that there are no tools, debris or any foreign objects in the cubicle.
2. If not already in place, attach the module extraction/installation ramp (included) to the base of the cabinet so that the tabs on the mounting bracket enter the slots on the ramp.
3. Push the module up the ramp and back into the cubicle.
   • Keep your fingers away from the edge of the module front plate to avoid pinching.
   • Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back.
4. Secure the top front of the module with two screws. Tighten to 22 N·m (16 lbf·ft).
5. Secure the bottom front of the module with two screws. Tighten to 22 N·m (16 lbf·ft).
6. Remove the ramp.
7. Attach the DC busbars to the module. Tighten to 70 N·m (52 lbf·ft).
8. Reconnect terminal block [X30] at the top of the module.
9. Reconnect the wiring and fiber optic cables to the terminals on the front of the module.
10. Repeat the procedure for the other inverter modules.
11. Reinstall the shroud near the top of the cubicle.

Heat sink cleaning

Clean the main heat sink of the unit each time that you replace the fan assembly.

Before you start:
1. Remove the fan cover and the optical connector cover (refer to Removable covers).
2. Remove the fan assembly (refer to Speed-controlled main cooling fan or Direct-online main cooling fan).

**WARNING!** Do not use compressed air or a vacuum cleaner on other parts of the unit to prevent ESD damage.

To clean the main heat sink:
1. Blow clean and dry compressed air through the heat sink from bottom to top.
2. Use a vacuum cleaner with an ESD-protected nozzle at the top to catch the dust.
Memory unit

When you replace the BCU-12 control unit, you can move the memory unit to the new control unit to keep the firmware and parameter settings.

⚠️ **WARNING!** Do not remove or insert the memory unit when the control unit is powered.

To remove the memory unit, loosen the fastening screw and pull the memory unit out.

Replacing the BCU control unit battery

Replace the real-time clock battery if the BATT LED is not illuminated when the control unit is powered on.

1. Loosen the fastening screw and remove the battery.
2. Install the new BR2032 battery.
3. Dispose of the old battery according to local disposal rules or applicable laws.
4. Set the real-time clock.

Replacing the control panel battery

1. Turn the lid on the back of the panel counter-clockwise until the lid opens.
2. Replace the battery with a new CR2032 battery.
3. Put the lid back and tighten it by turning it clockwise.
4. Dispose of the old battery according to local disposal rules or applicable laws.

Spare parts

- **Storing spare parts**

Make sure that the spare parts are stored properly.

When not being actively worked on, store the spare parts in their original containers or bags, if it is possible.
DC circuit capacitors reforming, spare modules, and spare capacitors

If there are spare modules or separate spare DC circuit capacitors, ABB recommends that you reform the capacitors annually. See separate instructions on how to reform capacitors.
Further information

For more information on ABB products and services for solar applications, navigate to www.abb.com/solarinverters.