IMPORTANT SAFETY INSTRUCTIONS
This manual contains important safety instructions that must be followed during installation and maintenance of the equipment.

SAVE THESE INSTRUCTIONS!
This manual must be considered as an integral part of the equipment, and must be available at all times to everyone who interacts with the equipment.

The manual must always accompany the equipment, even when it is transferred to another user.

Operators are required to read this manual and scrupulously follow the indications reported in it, since ABB cannot be held responsible for damages caused to people and/or things, or the equipment, if the warranty conditions are not observed.
# Product Manual

**PVI-STRINGCOMB**

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Warranty and Supply Conditions

The warranty conditions are described in a special certificate supplied with the equipment. Furthermore, the warranty conditions are considered to be valid if the customer adheres to the indications in this manual; any conditions deviating from those described herein must be expressly agreed in the purchase order.

The equipment complies with the pertinent legislation currently in force in the country of installation and it has issued the corresponding declaration of conformity.

Not included in the supply

ABB accepts no liability for failure to comply with the instructions for correct installation and will not be held responsible for systems upstream or downstream the equipment it has supplied. It is absolutely forbidden to modify the equipment. Any modification, manipulation, or alteration not expressly agreed with the manufacturer, concerning either hardware or software, shall result in the immediate cancellation of the warranty.

The Customer is fully liable for any modifications made to the system.

Given the countless array of system configurations and installation environments possible, it is essential to check the following: sufficient space suitable for housing the equipment; airborne noise produced depending on the environment; potential flammability hazards.

ABB will NOT be held liable for defects or malfunctions arising from: improper use of the equipment; deterioration resulting from transportation or particular environmental conditions; performing maintenance incorrectly or not at all; tampering or unsafe repairs; use or installation by unqualified persons.

ABB will NOT be held responsible for the disposal of: displays, cables, batteries, accumulators etc. The Customer shall therefore arrange for the disposal of substances potentially harmful to the environment in accordance with the legislation in force in the country of installation.
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The figure shows the appearance of the PVI-STRINGCOMB when closed, in the version with a metal box. When the lock is opened using the key provided, it is possible to open the door and access the interior of the PVI-STRINGCOMB.
The figure shows the appearance of the PVI-STRINGCOMB when closed, in the version with a plastic box. By unfastening the screws on the sides it is possible to remove the cover and access the interior of the PVI-STRINGCOMB.
The document and who it is for

Purpose and structure of the document

This operating and maintenance manual is a useful guide that will enable you to work safely and carry out the operations necessary for keeping the equipment in good working order.

If the equipment is used in a manner not specified in the installer manual, the protection provided by the equipment may be impaired.

The language in which the document was originally written is ITALIAN; therefore, in the event of inconsistencies or doubts please ask the manufacturer for the original document.

List of annexes

In addition to this operating and maintenance manual, (if applicable or on request) the following enclosed documentation is supplied:
- EC declaration of conformity
- quick installation guide
- warranty

WARNING: Part of the information given in this document is taken from the original documents of the suppliers. This document contains only the information considered necessary for the use and routine maintenance of the equipment.

Staff characteristics

The customer must make sure that the operator has the necessary skill and training to do his/her job. Personnel in charge of using and maintaining the equipment must be expert, aware and skilled for the described tasks and must reliably demonstrate their capacity to correctly interpret what is described in the manual.

For safety reasons, only a qualified electrician who has received training and/or demonstrated skills and knowledge on the structure and operation of the unit may install the equipment.

The installation must be performed by qualified installers and/or licensed electricians in accordance with the existing regulations in the country of installation.

The employment of a person who is NOT qualified, is drunk, or on narcotics, is strictly forbidden.

The customer has civil liability for the qualification and mental or physical state of the professional figures who interact with the equipment. They must always use the personal protective equipment required by the laws of the country of destination and whatever is provided by their employer.
Symbols and signs

In the manual and/or in some cases on the equipment, the danger or hazard zones are indicated with signs, labels, symbols or icons.

<table>
<thead>
<tr>
<th><strong>Table: Symbols</strong></th>
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</thead>
<tbody>
<tr>
<td>![Icon] This points out that it is mandatory to consult the manual or original document, which must be available for future use and must not be damaged in any way.</td>
</tr>
<tr>
<td>![Icon] Generic hazard - Important safety information. This points out operations or situations in which staff must be very careful.</td>
</tr>
<tr>
<td>![Icon] Hazardous voltage - This points out operations or situations in which staff must be very careful due to hazardous voltage.</td>
</tr>
<tr>
<td>![Icon] Hot parts - This points out a hazard due to the presence of heated areas or in any case areas that have hot parts (danger of burns).</td>
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<tr>
<td>![Icon] This points out that the examined area must not be entered or that the described operation must not be carried out.</td>
</tr>
<tr>
<td>![Icon] This points out that it is mandatory to carry out the described operations using the clothing and/or personal protective equipment provided by the employer.</td>
</tr>
<tr>
<td>![IP20] ![IP65] This indicates the degree of protection of the equipment according to IEC standard 70-1 (EN 60529 June 1997).</td>
</tr>
<tr>
<td>![Icon] Point of connection for grounding protection.</td>
</tr>
<tr>
<td>![Icon] This indicates the allowed temperature range.</td>
</tr>
<tr>
<td>![Icon] This indicates the risk of electric shock. Time need to discharge stored energy: 5/10 minutes.</td>
</tr>
<tr>
<td>![Icon] Respectively direct current and alternating current.</td>
</tr>
<tr>
<td>![Icon] Isolating transformer present or not present.</td>
</tr>
<tr>
<td>![Icon] Positive pole and negative pole of the input voltage (DC).</td>
</tr>
<tr>
<td>![Icon] This indicates the centre of gravity of the equipment.</td>
</tr>
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</table>
Field of use, general conditions

ABB shall not be liable for any damages whatsoever that may result from incorrect or careless operations.

You may not use the equipment for a use that does not conform to that provided for in the field of use. The equipment MUST NOT be used by inexperienced staff, or even experienced staff if carrying out operations on the equipment that fail to comply with the indications in this manual and enclosed documentation.

Intended or allowed use

This equipment is a device designed for:
connect in parallel, protect in case of brackdown and monitor
the strings of a photovoltaic generator.

Limits in field of use

Only a photovoltaic generator can be connected in the input of the equipment (do not connect batteries or other sources of power supply).
The equipment can be used only in countries for which it has been certified/approved.
The equipment may only be used in compliance with all its technical characteristics.

Improper or prohibited use

IT IS STRICTLY FORBIDDEN TO:
• Install the equipment in environments subject to particular conditions of flammability or in adverse or disallowed environmental conditions, (temperature and humidity).
• Use the equipment with safety devices which are faulty or disabled.
• Use the equipment or parts of the equipment by linking it to other machines or equipment, unless expressly provided for.
• Modify operating parameters that are not accessible to the operator and/or parts of the equipment to vary its performance or change its isolation.
• Clean with corrosive products that could eat into parts of the equipment or generate electrostatic charges.
• Use or install the appliance or parts of it without having read and understood the contents of the user and maintenance manual.
• Heat or dry rags and clothing on the parts in temperature. In addition to being hazardous, doing so would compromise component ventilation and cooling.
General conditions

A description of the characteristics of the equipment is given so as to identify its main components and specify the technical terminology used in the manual. Technical terminology and the fast retrieval system for information, are supported by:

- Contents
- Reference number index

The Characteristics chapter contains information about the models, details of the equipment, characteristics and technical data, overall dimensions and identification of the equipment itself.

The customer/Installer takes full responsibility if, when reading this manual, the chronological order of its presentation established by the manufacturer is not observed. All information is provided considering occasional inclusion of that provided in previous chapters.

In certain cases, there may be a need to separately document software functionality or attach supplementary documentation to this manual intended for more qualified professionals.
# Models and range of equipment

The specific models of PVI-STRINGCOMB that this manual is about are:

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<th>PVI-STRINGCOMB (plastic box)</th>
<th>PVI-STRINGCOMB (metal box)</th>
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<tbody>
<tr>
<td><strong>PVI-STRINGCOMB</strong>:</td>
<td><strong>PVI-STRINGCOMB</strong>:</td>
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<tr>
<td>• Number of input connections: from 10 to 20</td>
<td>• Number of input connections: from 10 to 20</td>
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<tr>
<td>• Input connectors: screw terminal block; cable glands</td>
<td>• Input connectors: screw terminal block; cable glands</td>
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<tr>
<td>• DC Disconnect switch (09): No</td>
<td>• DC Disconnect switch (09): No</td>
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<tr>
<td>• DC overvoltage surge arresters (10): Yes</td>
<td>• DC overvoltage surge arresters (10): Yes</td>
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<tr>
<td>• Rs485 overvoltage surge arresters (11): Yes</td>
<td>• Rs485 overvoltage surge arresters (11): Yes</td>
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<tr>
<td>• String protection fuses: Yes</td>
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<th>PVI-STRINGCOMB-S:</th>
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<th>PVI-STRINGCOMB-MC:</th>
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<tr>
<td>• Number of input connections: from 10 to 20</td>
<td>• Number of input connections: from 10 to 20</td>
</tr>
<tr>
<td>• Input connectors: Quick fit connection (Multi Contact)</td>
<td>• Input connectors: Quick fit connection (Multi Contact)</td>
</tr>
<tr>
<td>• DC Disconnect switch (09): No</td>
<td>• DC Disconnect switch (09): No</td>
</tr>
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</tr>
<tr>
<td>• String protection fuses: Yes</td>
<td>• String protection fuses: Yes</td>
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<th>PVI-STRINGCOMB-S-MC:</th>
<th>PVI-STRINGCOMB-S-MC:</th>
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<tr>
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<td>• String protection fuses: Yes</td>
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<th>PVI-STRINGCOMB-W:</th>
<th>PVI-STRINGCOMB-S-W:</th>
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<tbody>
<tr>
<td>• Number of input connections: from 10 to 20</td>
<td>• Number of input connections: from 10 to 20</td>
</tr>
<tr>
<td>• Input connectors: Quick fit connection (WeidMuller)</td>
<td>• Input connectors: Quick fit connection (WeidMuller)</td>
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<tr>
<td>• DC Disconnect switch (09): No</td>
<td>• DC Disconnect switch (09): No</td>
</tr>
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</tr>
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</tr>
<tr>
<td>• String protection fuses: Yes</td>
<td>• String protection fuses: Yes</td>
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</tbody>
</table>

The choice of model of PVI-STRINGCOMB must be made by a qualified technician who knows about the installation conditions, the devices that will be installed outside the PVI-STRINGCOMB and possible integration with an existing system.
Identification of the equipment and the manufacturer

The technical data shown in this manual do not in any case replace those shown on the labels attached to the equipment.

The labels attached to the equipment must NOT be removed, damaged, dirtied, hidden, etc.

The approval label contains the following information:
1. Manufacturer
2. Model
3. Rating data
4. Certification marks

N.B. The labels must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.); they must be cleaned regularly and kept visible at all times.
In addition to the label showing the specifications of the equipment, there is a part identification label. This label lists the following information:

- **STRINGCOMB model**
- **Week/Year of manufacture**
- **STRINGCOMB Part Number**
- **STRINGCOMB Part Number**
- **STRINGCOMB Serial Number** composed of:
  - YY = Year of manufacture
  - WW = Week of manufacture
  - SSSSSS = Sequential number

The officially required information is located on the approval label. The identification label is an accessory label which shows the information necessary for the identification and characterisation of the PVI-STRINGCOMB by ABB.

N.B. The labels must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.); they must be cleaned regularly and kept visible at all times.
Main PVI-STRINGCOMB components

Table: electrical system components

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Description</th>
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<tbody>
<tr>
<td>07</td>
<td>Connection board for the cables from the positive string Array</td>
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<td>08</td>
<td>Control board.</td>
</tr>
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<td>DC disconnect switch (only -S versions).</td>
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<td>13</td>
<td>Output connection bar</td>
</tr>
<tr>
<td>14</td>
<td>Ground cable connection bar</td>
</tr>
<tr>
<td>15</td>
<td>Connection board for the cables from the negative string Array</td>
</tr>
</tbody>
</table>

Ground bar

Connection for the ground cables from the photovoltaic array is at the bottom of the STRINGCOMB, adjacent to the dedicated ground cable gland. The bar allows connection of a cable, complete with cable lug, destined for the common grounding point inside the inverter.

Positive pole connection board

The positive poles from the photovoltaic array must be connected to the terminal block indicated in the figure. The board foresees ten string current measurement channels. It is possible to connect up to a maximum of 20 strings, that is to say two strings for each measurement channel. The status of every positive pole fuse positioned to protect each channel (one for each channel) is also checked. The system also measures the global voltage of the photovoltaic array via this board. Any anomalies in the system will be displayed via the special monitoring software or on the ABB inverter’s display.
Control board

The control board fits a microcontroller that manages all signals detected in order to display them via the monitoring software. The same data is then transmitted outside through the serial communication line (RS485).

Disconnect switch

PVI-STRINGCOMB is fitted with a charged DC disconnect switch. The disconnect switch fully breaks off connection between the inverter and the strings from the photovoltaic array, so as to allow any required maintenance (e.g.: replacing the fuses). The PVI-STRINGCOMB can be disconnected manually after opening the cover or remotely, without the need to open the door, using the “SOR” triggering current disconnect system with which the device is fitted. The presence of a status contact allows the system to be aware of the switch status.

OVR overvoltage protection devices

PVI-STRINGCOMB has several overvoltage protection devices. There is one protection device on the VDC voltage power line, with respective fuses (A) or with integrated fuses (B), and one device on the RS485 serial line. Both devices comprise removable cartridges that can be replaced if they are broken.
Signal input/output board

The device allows access to signals terminal block with no need to remove the Plexiglas protections, located at the live areas. This section deals entirely with connection, by the user, of the PVI-STRINGCOMB input and output signals.

The signals terminal block must be connected using the individual protective devices, even though the terminal block is at a safety potential SELV. The cables leading to this board must be kept separate from cables under a dangerous voltage.

Negative pole connection board

The negative poles from the photovoltaic array must be connected to the terminal block. It is possible to connect up to a maximum of 20 strings, that is to say two strings for each measurement channel. The status of every negative pole fuse positioned to protect each channel (one for each channel) is also checked. The system also measures the global voltage of the photovoltaic array via this board. Any anomalies in the system will be displayed via the special monitoring software or on the ABB inverter’s display.
Characteristics and technical data

<table>
<thead>
<tr>
<th>Table: Technical Data</th>
<th>PVI-STRINGCOMB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td>Rated DC input voltage</td>
<td>250 – 1000 VDC</td>
</tr>
<tr>
<td>Max. DC input voltage</td>
<td>1000 VDC</td>
</tr>
<tr>
<td>Number of string current measurement channels</td>
<td>10</td>
</tr>
<tr>
<td>Max. IDC current for each channel</td>
<td>20 A</td>
</tr>
<tr>
<td>Number of string input safety fuses</td>
<td>20 [10 positive + 10 negative] (1)</td>
</tr>
<tr>
<td>Max. number of strings that can be connected</td>
<td>20 [two per fuse or measurement channel]</td>
</tr>
<tr>
<td>Type of DC input connection</td>
<td>Multicontact MC4 connectors or M20 cable gland</td>
</tr>
<tr>
<td>Max. Section of string cables</td>
<td>6 mm²</td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>YES [with replaceable cartridges]</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
</tr>
<tr>
<td>Rated DC output voltage</td>
<td>250 – 1000 VDC</td>
</tr>
<tr>
<td>Max. DC output voltage</td>
<td>1000 VDC</td>
</tr>
<tr>
<td>Max. DC output current</td>
<td>125A@40°C with derating 100A@55°C [plastic box]</td>
</tr>
<tr>
<td></td>
<td>150A@40°C with derating 125A@55°C [metal box]</td>
</tr>
<tr>
<td>Max. Type of DC output connection [by pole]</td>
<td>No. 2 x M40 cable gland [M10 185 mm²] (2)</td>
</tr>
<tr>
<td>Max. Ground wire connection type</td>
<td>No. 1 x M25 cable gland [M8 35 mm²] (2)</td>
</tr>
<tr>
<td>Rating of DC disconnect switch</td>
<td>160A@1100V</td>
</tr>
<tr>
<td><strong>Signal Input/Output Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>RS 485</td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>YES [with replaceable cartridges]</td>
</tr>
<tr>
<td>Digital inputs</td>
<td>No.2 [dry contact]</td>
</tr>
<tr>
<td>Analogue inputs</td>
<td>No. 4 [0-10v] or No. 3 [0-10v] if PT100 sensor is enabled</td>
</tr>
<tr>
<td>PT100 sensor input</td>
<td>No. 1</td>
</tr>
<tr>
<td>Supply voltage for external sensors</td>
<td>24VDC@150mA [max]</td>
</tr>
<tr>
<td>Disconnect switch auxiliary status monitoring contact</td>
<td>Dry contact [240Vac@6A or <a href="mailto:125Vdc@1.1A">125Vdc@1.1A</a>]</td>
</tr>
<tr>
<td>Antitheft alarm auxiliary status monitoring contact</td>
<td>Dry contact [50Vdc@1A max]</td>
</tr>
<tr>
<td>Built-in cord-type antitheft device</td>
<td>Connection for the cord-type alarm</td>
</tr>
<tr>
<td>Auxiliary DC input for night mode</td>
<td>24VDC@1A [from external source]</td>
</tr>
<tr>
<td>Remote SOR triggering current emergency OFF</td>
<td>24-30Vac/dc [instant absorption 50 watt&lt;15ms]</td>
</tr>
<tr>
<td>Remote OVR minimum voltage emergency OFF</td>
<td>24-30Vac/dc [permanent absorption 1.5 watt]</td>
</tr>
<tr>
<td><strong>Environmental characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Dimensions [height x width x depth]</td>
<td>560x760x250mm [plastic box]</td>
</tr>
<tr>
<td></td>
<td>650x790x250mm [metal box]</td>
</tr>
<tr>
<td>Weight</td>
<td>20kg [plastic box] / 30kg [metal box]</td>
</tr>
<tr>
<td>Working temperature</td>
<td>-25…+55°C</td>
</tr>
<tr>
<td>Maximum working altitude</td>
<td>1000m.asl</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>from 0 to 100%</td>
</tr>
<tr>
<td>Anti-condensation system</td>
<td>Yes</td>
</tr>
<tr>
<td>Degree of enviromental protection</td>
<td>IP65</td>
</tr>
</tbody>
</table>

1. See Available Fuses
2. See Cable gland clamping range

Remark. Features not specifically listed in the present data sheet are not included in the product
Available fuses

The following table indicates the fuse sizes available for the PVI-STRINGCOMB. The choice of fuse used is made using the order form, based on the equipment working conditions. The table also indicates the maximum current values for each string:

<table>
<thead>
<tr>
<th>Fuse Size</th>
<th>Approximate Maximum string current</th>
</tr>
</thead>
<tbody>
<tr>
<td>10A</td>
<td>8A</td>
</tr>
<tr>
<td>12A</td>
<td>10</td>
</tr>
<tr>
<td>16A</td>
<td>13A</td>
</tr>
<tr>
<td>20A</td>
<td>16A</td>
</tr>
<tr>
<td>25A</td>
<td>20A</td>
</tr>
</tbody>
</table>

Tightening torques and cable cross section

To maintain the IP65 protection of the system and for optimal installation, the following tightening torques must be used:

<table>
<thead>
<tr>
<th>Connectors</th>
<th>Maximum cross-section</th>
<th>Torque (N*m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUND terminal</td>
<td>35mm²</td>
<td>16</td>
</tr>
<tr>
<td>(Connection of the ground wire)</td>
<td>2 AWG</td>
<td></td>
</tr>
<tr>
<td>DC OUTPUT terminal</td>
<td>185mm²</td>
<td>16</td>
</tr>
<tr>
<td>(Connection of the wire to the inverter)</td>
<td>350 AWG</td>
<td></td>
</tr>
<tr>
<td>Input connectors</td>
<td>6mm²</td>
<td>SPRING</td>
</tr>
<tr>
<td>(Connection of the strings)</td>
<td>10 AWG</td>
<td></td>
</tr>
<tr>
<td>Signals terminal block</td>
<td>0.5mm²</td>
<td>0.4</td>
</tr>
<tr>
<td>(Signal connection)</td>
<td>20 AWG</td>
<td></td>
</tr>
</tbody>
</table>

Cable gland clamping range

The following table indicates the clamping ranges for the various cable glands available for connection of the PVI-STRINGCOMB.

<table>
<thead>
<tr>
<th>Cable gland</th>
<th>Torque (N*m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>String input</td>
<td>M16</td>
</tr>
<tr>
<td>Ground connection</td>
<td>M25</td>
</tr>
<tr>
<td>Signal connection</td>
<td>M20</td>
</tr>
<tr>
<td>Ground connection</td>
<td>M20</td>
</tr>
<tr>
<td>Output Connection</td>
<td>M32</td>
</tr>
<tr>
<td>Output Connection</td>
<td>M40</td>
</tr>
<tr>
<td>Output Connection</td>
<td>PG36</td>
</tr>
</tbody>
</table>

1. only -W version
2. M20 with reduction clampin range (specify when ordering)
3. only plastic box
Overall dimensions

The overall dimensions are expressed in mm and in inches.

- Height: 790mm - 31.1”
- Width: 650mm - 25.6”
- Depth: 250mm - 9.84”

- Height: 760mm - 29.9”
- Width: 560mm - 22.0”
- Depth: 250mm - 9.84”
Characteristics of a photovoltaic generator

A PV generator consists of an assembly of photovoltaic panels that transform solar radiation into DC electrical energy and can be made up of:

- **Strings**: X number of PV panels connected in series
- **Array**: group of X strings connected in parallel

**Strings and Arrays**

In order to considerably reduce the cost of installing a photovoltaic system, mainly associated with the problem of wiring on the DC side of the inverter and subsequent distribution on the AC side, the string technology has been developed. A photovoltaic panel consists of many photovoltaic cells mounted on the same support.

- A string consists of a certain number of panels connected in series.
- An array consists of two or more strings connected in parallel.

Large photovoltaic systems can be made up of several arrays, connected to one or more inverters.

By maximizing the number of panels inserted into each string, it is possible to reduce the cost and complexity of the connection system of the photovoltaic system.

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The current of each array must fall within the limits of the inverter.

To work, the inverter must be connected to the national electricity grid since its operation can be equated to a current generator that supplies power in parallel with the grid voltage. That is why inverters cannot support the grid voltage (islanding).
Large pv fields and parallel strings

When speaking of large photovoltaic systems, the immediate image is one of large extensions of solar panels. Since a field (array) is composed of several parallel strings, it is clear that to obtain high power the number must be increased. In this case, particular precautions must be taken in the project / installation phase, otherwise the strings may be damaged due to breakdowns in the strings themselves or to incorrect connections or sizing.

Why use PVI-STRINGCOMB?

Connecting strings in parallel does not entail particular problems as long as the “Uoc” voltage (Open Circuit Voltage) for each string is the same as the other strings. If not, e.g. because of considerable differences in the length of the strings or short circuits in one or more of the solar modules in a string, there can be a considerable difference in the Uoc voltage which can cause an inverted current on the string with the lower voltage (i.e. made up of a lower number of modules connected in series). Contrary to popular opinion, shading has no significant influence on this effect; this is because Bypass diodes have been adopted and they are now standard on all panels.

If the inverted current is greater than the maximum permitted for the panel, it can overheat and/or even be irreparably damaged. Diodes can be inserted in series to each string (string blocking diodes) to prevent this problem. Using these diodes has two disadvantages:

- The string current passes through the diode and consequently the loss of power is not negligible.
- If there is a short circuit in the diode, there is no protection and the phenomenon in figure can occur.

The best solution is to use a fuse for every string. In the event of excessive inverted current, the fuse opens and protects the string itself. If the fuse status is monitored, it is now also possible to remotely check the status of the strings which make up the photovoltaic generator. Moreover, a fuse’s power losses are considerably less than a diode’s. The PVI-STRINGCOMB has fuses both on the positive pole and on the negative pole of each string.

The fuse rating must be chosen by taking into consideration the maximum current that can flow through the fuse (also based on the number of strings connected to the channel in the parallel string panel) and the maximum inverted current that each string can take. The technical data sheets of the photovoltaic modules generally show the “Max Fuse Rating”, i.e. the maximum fuse rating that can be adopted to protect the panel string. Usually the “Max Fuse Rating” is double of the module’s short circuit current. This allows two strings to be connected directly in parallel without running the risk of damage to the panels.
Description of the equipment

The PVI-STRINGCOMB and its variants are devices designed exclusively for parallel connection of the photovoltaic array strings, allowing for protection in the case of breakdown.

Besides connecting the strings, they allow the electrical and other variables of the entire photovoltaic array to be monitored through the following checks:
• Reading the total voltage of the field.
• String currents reading.
• Checking the operation of the internal fuses.
• Checking of the status of the internal protection against overvoltage
• Temperature check.
• General checks on the surrounding environment through external sensors.
• Every device can be powered by an external source (24Vdc). This allows the PVI-STRINGCOMB to remain running during the night as well.

Thanks to the ten reading channels available, each device allows for connecting up to ten strings individually, or 20 strings in parallel pairs. Each channel is also protected by two fuses.

PVI-STRINGCOMB are available in different versions. The differences are the presence or not of the disconnect switch, the string connection type and the type of connection to the inverter.
• Number of strings that can be connected.
• Selection between cable gland or Multicontact MC-4 connector for connection of the input strings.
• Size of fuses.
• Selection of the connection and cable gland size for output to the inverter.
• Selection of the size of the ground cable gland.
• Selection of the model of casing (metal or plastic).
• Selection of the additional kits (fuses, caps, fastening system).

PVI-STRINGCOMB should be configured when placing the order using the configuration model, which can be requested directly from ABB:

Every device features:
• DC switch (model designation -S) specific for disconnection of high voltage direct current (1000Vdc). This can be used to disconnect the group of strings in question from the downstream inverter.
• Remote control for SOR triggering current or UVR minimum voltage disconnection (-S versions only).
• Auxiliary contact for displaying the switch status (-S versions only).
• Input for resistor PT100.
• Analogue and digital inputs to allow for checking external variables, such as, for example, the temperature of the photovoltaic cells, solar irradiation, environmental temperature, wind force, etc.
• Cord-type antitheft device.
• Protection against overvoltage for the serial line RS485.
• An overvoltage protection for the DC line.
Operating diagram

The below figure shows an example of the connection, by means of PVI-STRINGCOMB, of a centralised PLUS inverter to a photovoltaic array composed of 6 arrays (photovoltaic array A, B, C, D, E and F), each in turn consisting of four strings.
Line diagram with indication of connections
Safety instructions and general information

The equipment has been manufactured in accordance with the strictest accident-prevention regulations and supplied with safety devices suitable for the protection of components and operators.

For obvious reasons, it is not possible to anticipate the great number of installations and environments in which the equipment will be installed; it is therefore necessary for the customer to appropriately inform the manufacturer about particular installation conditions.

ABB accepts no liability for failure to comply with the instructions for correct installation are cannot be held responsible for the systems upstream or downstream of the equipment it has supplied.

It is essential to provide operators with correct information. They must therefore read and comply with the technical information given in the manual and in the attached documentation.

The instructions given in the manual do not replace the safety devices and technical data for installation and operation stuck on the product, and they certainly do not replace the safety regulations in force in the country of installation and common sense rules.

The manufacturer is willing to train staff, at its premises or on site, in accordance with conditions to be set out in the contract.

Do not use the equipment if you find any operating anomalies.

Avoid temporary repairs. All repairs should be carried out using only genuine spare parts, which must be installed in accordance with their intended use.

Liabilities arising from commercial components are delegated to the respective manufacturers.
Hazardous areas and operations

Environmental conditions and risks

The equipment can be installed outdoors, but only in environmental conditions that do not prevent its regular operation. These conditions are reported on the technical data and on installation chapter.

ABB CANNOT be held responsible for disposal of the equipment: displays, cables, batteries, accumulators, etc., and therefore the customer must dispose of these substances, which are potentially harmful to the environment, in accordance with the regulations in force in the country of installation.

The same precautions should be adopted for dismantling the equipment.

The equipment is not equipped to operate in environments that have particular flammability or explosive conditions.

The customer and/or installer must appropriately train operators or anyone who may come near the equipment, and highlight, if necessary with notices or other means, the hazardous areas or operations at risk if required: magnetic fields, hazardous voltages, high temperatures, possibility of discharges, generic hazard, etc.

Signs and Labels

The labels attached to the equipment must absolutely NOT be removed, damaged, dirtied, hidden, etc.

The labels must be cleaned regularly and kept visible at all times, that is, they must NOT be hidden with objects and extraneous parts (rags, boxes, equipment, etc.)

The technical data shown in this manual do not in any case replace those shown on the labels attached to the equipment.
**Thermal hazard**

**WARNING:** removal of guards or covers is allowed only 10 minutes after the voltage has been removed; this is to let components cool down and allow any electrostatic charges and parasitic voltages to be discharged.

When the equipment has just been switched, it may have hot parts, as a result of overheating of the surfaces at temperature (e.g.: transformers, accumulators, coils, etc.) so be careful where you touch.

*In the event of fire, use CO₂ extinguishers and use auto extraction systems to fight fire in closed environments.*

**Clothing and protective devices for staff**

**ABB** has eliminated sharp edges and corners, but in some cases it is not possible to do anything, and we therefore advise wearing the clothing and personal protective devices provided by the employer.

*Staff must not wear clothes or accessories that can start fires or generate electrostatic charges or, in general, clothing that can impede personal safety.*

All operations on the equipment should be performed with suitably insulated clothes and instruments.

E.g.: Insulated gloves (class 0, category RC)

Maintenance operations must be carried out with the equipment disconnected from the grid and from the photovoltaic generator.

*Staff must NOT go near the equipment with bare feet or wet hands.*

The maintenance technician must in any case make sure no one else can switch on or operate the equipment during the maintenance operations, and must report any anomaly or damage due to wear or ageing so that the correct safety conditions can be restored.

The installer or maintenance technician must always pay attention to the work environment, so that it is well lit and has sufficient spaces to ensure they have an escape route.

In the installation, consider or make sure the noise emitted based on the environment is not such that it exceeds thresholds allowed by law (less than 80 dBA).
Residual risks

Despite the warnings and safety systems, there are still some residual risks that cannot be eliminated. These risks are listed in the following table with some suggestions to prevent them.

Table of residual risks

<table>
<thead>
<tr>
<th>RISK ANALYSIS AND DESCRIPTION</th>
<th>SUGGESTED REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise pollution due to installation in unsuitable environments or where staff work permanently.</td>
<td>Reassess the environment or the place of installation.</td>
</tr>
<tr>
<td>External weather conditions, such as water seepage, low temperatures, high humidity, etc.</td>
<td>Maintain ambient conditions suitable for the system.</td>
</tr>
<tr>
<td>Overheating of surfaces at temperature (transformers, accumulators, coils, etc.) can cause burns. Also be careful not to block the cooling slits or systems of the equipment.</td>
<td>Use suitable protective equipment or wait for the parts to cool down before switching on the equipment.</td>
</tr>
<tr>
<td>Inadequate cleaning: compromises cooling and does not allow the safety labels to be read.</td>
<td>Clean the equipment, labels and work environment adequately.</td>
</tr>
<tr>
<td>Accumulation of electrostatic energy can generate hazardous discharges.</td>
<td>Ensure the devices have discharged their energy before working on them.</td>
</tr>
<tr>
<td>Inadequate training of staff.</td>
<td>Ask for a supplementary course.</td>
</tr>
<tr>
<td>During installation, temporarily mounting the equipment or its components may be risky.</td>
<td>Be careful about and disallow access to the installation area.</td>
</tr>
<tr>
<td>Accidental disconnections of the quick-fit connectors with the equipment in operation, or wrong connections, may generate electric arcs</td>
<td>Be careful about and disallow access to the installation area.</td>
</tr>
</tbody>
</table>
General conditions

Some recommendations apply only to large-size products or multiple small-size packings.

Transport and handling

Transport of the equipment, especially by road, must be carried out with suitable ways and means for protecting the components (in particular, the electronic components) from violent shocks, humidity, vibration, etc. During handling, do not make any sudden or fast movements that can create dangerous swinging.

Lifting

ABB usually stores and protects individual components by suitable means to make their transport and subsequent handling easier, but as a rule it is necessary to turn to the experience of specialized staff in charge of loading and unloading the components. Where indicated and/or where there is a provision, eyebolts or handles, which can be used as anchorage points, are inserted and/or can be inserted.

The ropes and means used for lifting must be suitable for bearing the weight of the equipment. Do not lift several units or parts of the equipment at the same time, unless otherwise indicated.

Unpacking and checking

We remind you that the packaging elements (cardboard, cellophane, staples, adhesive tape, straps, etc.) may cause cuts and/or injuries if not handled with care. They should be removed by suitable means and not left in the hands of irresponsible people (e.g., children).

The components of the packaging must be disposed of in accordance with the regulations in force in the country of installation.

When you open the package, check that the equipment is undamaged and make sure all the components are present. If you find any defects or damage, stop unpacking and consult the carrier, and also promptly inform the Service ABB.
List of components supplied

Supplied with the PVI-STRINGCOMB are all the components required to correctly install and connect the inverter.

<table>
<thead>
<tr>
<th>Components available for all models</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical documentation</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Components available “metal box” only</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracket for wall mounting</td>
<td>1</td>
</tr>
<tr>
<td>Brackets for pole mounting</td>
<td>4</td>
</tr>
<tr>
<td>Pins</td>
<td>4</td>
</tr>
<tr>
<td>Sundry nuts, bolts and screws</td>
<td></td>
</tr>
</tbody>
</table>

1. This is supplied as standard in the -W version.

Weight of the equipment units

<table>
<thead>
<tr>
<th>Table: Weights</th>
<th>Weight (kg/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVI-STRINGCOMB (Metal box)</td>
<td>30kg / 66lb</td>
</tr>
<tr>
<td>PVI-STRINGCOMB (Plastic box)</td>
<td>20kg / 44lb</td>
</tr>
</tbody>
</table>

If the package is stored correctly, it can withstand a maximum load of 5 pieces of equipment. DO NOT stack with equipment or products other than those indicated.
Lifting points
General conditions

Installation of the equipment is carried out based on the system and the place in which the equipment is installed; therefore, its performance depends on the correctness of the connections.

Staff authorised to carry out the installation must be specialised and experienced in this job; they must also have received suitable training on equipment of this type.

The operation must be carried out by specialised staff; it is in any case advisable to comply with what is written in this manual and adhere to the diagrams and attached documentation.

For Safety reason only a qualified electrician, who has received training and / or has demonstrated skills and knowledge in construction and in operation of this unit, can install this equipment.

The installation is done by qualified installers and/or licensed electrician according to the applicable local code regulations.

When the photovoltaic panels are exposed to light, these supplies a direct current voltage to the equipment.
Environmental checks

- Consult the technical data to check the environmental parameters to be observed (degree of protection, temperature, humidity, altitude, etc.)

- The installation to direct sunlight must be avoided because it may cause:
  - premature aging of electronic/electromechanical components
  - premature aging of mechanical components (gaskets)

- Do not install in small closed rooms where air cannot circulate freely.

- Do not install in places where gases or flammable substances may be present.

- Avoid electromagnetic interference that can compromise the correct operation of electronic equipment, with consequent situations of danger.

The final installation of the equipment should not prevent access to any outside disconnection means. Refer to the warranty conditions to evaluate the possible exclusions from warranty related to improper installation.

Installations above 2000 metres

On account of the rarefaction of the air (at high altitudes), particular conditions may occur that should be considered when choosing the place of installation:

- Reduction in the dielectric resistance of the air that, in the presence of high operating voltages (DC input), can create electric arcs (discharges) that can reach the point of damaging the STRINGCOMB.
  As the altitude increases, the failure rate of some electronic components increases exponentially because of cosmic radiation.

All installations at altitudes of over 2000 metres must be assessed case by case considering the aforesaid criticalities.
Installation position

When choosing the place of installation, comply with the following conditions:

- Install on a wall or strong structure suitable for bearing the weight.
- Install in safe, easy to reach places.
- Install at a height that considers the heaviness of the equipment. If this condition is not complied with, it can create problems in the event of servicing unless suitable means are provided to carry out the operation.
- The device should be positioned vertically with the wire input/output sockets at the bottom.
- To carry out maintenance of the hardware and software of the equipment, remove the covers on the front. Check that there are the correct safety distances for the installation that will allow the normal control and maintenance operations to be carried out.
Wall mounting using fixing holes

• Position the STRINGCOMB perfectly level on the wall and use it as a drilling template.

• Drill the holes required.

• Fix the PVI-STRONCOMB to the wall/surface.

The choice of screws to be used when fixing to the wall, using the fixing holes or using the steel flange is responsibility of the installer, who must decide the type of screw to be used based on the material from which the wall itself is made.

The maximum dimension allowed for fixing screws is M6.
Wall mounting using steel flange (optional-only metal box version)

- Position the bracket perfectly level on the wall and use it as a drilling template.

- Drill the 3 holes required.

- Fix the bracket to the wall with the 3 wall anchors.

- Hook the PVI-STRINGCOMB to the bracket.

The choice of screws to be used when fixing the bracket to the wall, using the fixing holes is responsibility of the installer, who must decide the type of screw to be used based on the material from which the wall itself is made.

The maximum dimension allowed for fixing screws is M6.
Pole mounting (optional-only metal box version)

• Fix the top and bottom pole bracket to the PVI-STRINGCOMB (as in the picture).

• Place the box on the pole and install the retainer bracket (top and bottom)

• Fix the PVI-STRINGCOMB to the pole screwing the nuts up to which the box will be firmly fixed

*The fixing kit allows the STRINGCOMB to be fitted on a pole that can be of a diameter between 70mm and 180mm*
Operations preparatory to PV generator connection

Remove the Plexiglass protection 02, 05 and 06 by unscrewing the supporting screws. It is recommended that you remove all protective screens with the exception of the one on the control board 03 and the disconnect switch 04.

Open all the fuse boxes and check that all the fuses are present and of the correct size. Leave the fuse boxes open while making electrical connections.

Checking the correct polarity of the strings

Using a voltmeter, check that the voltage of each string observes the correct polarity and falls within the input voltage limits accepted by the equipment (see technical data).

Inversion polarity can cause serious damage

If the voltage without load of the string is near the maximum value accepted by the equipment, it must be borne in mind that with low ambient temperatures the string voltage tends to increase (in a different way according to the photovoltaic module used). In this case, it is necessary to carry out a check of the sizing of the system and/or a check on the connections of the modules of the system (e.g.: number of modules in series higher than the design number).

Checking of leakage to ground of the photovoltaic generator

Measure the voltage present between positive and negative pole of each string with respect to ground.

If a voltage is measured between an input pole and ground, it may be that there is a low insulation resistance of the photovoltaic generator and the installer will have to carry out a check to solve the problem.

Do not connect the strings if a leakage to ground has been found because the inverter might not connect to the grid.
Ground connection

Connect the protective ground wire from the inverter, passing it through the dedicated cable gland
A. Metal box, custom version model -W.
B. Metal box (model 3M06).
C. Plastic box (model 3L11).

The grounding resistance of the system is crucial to the system’s safety. This should be established before the system is turned on for the first time. The installer is responsible for sizing the ground conductor based on the characteristics of the inverter used and of the system in order to minimise the grounding resistance, in accordance with the existing legislation.

Obtain a wrench of a suitable size to connect the cable, complete with cable lug, to the ground bar. Make the following connection by loosening the screw, inserting the cable lug at the point indicated and finally tightening the screw.

For the recommended size of cables for grounding of the inverter, please refer to the technical specifications.
Connection of the string cables coming from the photovoltaic array

Each string corresponds to two connection cables: one positive and one negative. These must be connected, respectively, in a clearly defined logical sequence. String number one will have one pole connected to terminal No. 1 on the positive pole board, and the opposite pole connected to terminal No. 1 on the negative pole board. In the same way all the subsequent strings will be connected to their respective inputs, for a maximum total of 20 strings.

Make sure that all the fuse boxes are open and use suitable measurement instruments to make sure there are no dangerous voltages present.

Always use suitable safety devices such as gloves, goggles, etc. when handling live cables from the photovoltaic array.

Before connecting the cables from the strings, it is important that you duly note the configuration of the photovoltaic array and the number of strings in it. The following are some of the possible configurations:

• If the situation is similar to the one illustrated in the figure below, that is to say with 10A strings, we may decide to parallel the strings in pairs on the same measurement channel.
String number one and string number two will have one pole connected to terminal No. 1 in the positive pole board and the opposite pole connected to terminal No. 1 in the negative pole board, string number three and string number four will have one pole connected to terminal No. 2 in the positive pole board and the opposite pole connected to terminal No. 2 in the negative pole board, and so on for all the subsequent strings until reaching a maximum of 20 strings in the ten available terminals (or measurement channels).

- If the situation is like the one illustrated in figure below, that is to say with 20A strings.

In this case, string number one will have one pole connected to terminal No. 1 in the positive pole board and the opposite pole connected to terminal No. 1 in the negative pole board, string number two will have one pole connected to terminal No. 2 in the positive pole board and the opposite pole connected to terminal No. 2 in the negative pole board, and so on for all the subsequent strings until reaching a maximum of ten strings in the ten available terminals (or measurement channels).
**Connection of the positive pole cables**

- Find a slotted screwdriver of a size suited to the slot in the terminal. Make the following connections by loosening the terminal retaining spring, inserting the cable/s and finally removing the screwdriver.

- Connect all the strings with this polarity to the board shown in the figure, before going on to the opposite polarity.

---

**Connection of the negative pole cables**

- Find a slotted screwdriver of a size suited to the slot in the terminal. Make the following connections by loosening the terminal retaining spring, inserting the cable/s and finally removing the screwdriver.

- Connect all the strings with this polarity to the board shown in the figure.

> it is necessary to refer to the technical specifications for indications of the maximum dimension of cables to be used for connection to the input terminal blocks.
Installation procedure for quick fit connectors

On equipment models with which quick fit connectors are supplied, they may be supplied in two different types:

**CAUTION:** To avoid damage to the equipment, when attaching cables, pay particular attention to polarity.

**Weidmüller**
Installation of Weidmuller connectors does not require any special tooling.

- Strip the cable to which you want to apply the connector (after verifying that it complies with the connector limits)

- Insert the wire into the connector until you hear a locking “click”

- Tighten the knurled ring nut for optimal clamping

<table>
<thead>
<tr>
<th>Wire Diameter</th>
<th>For use with</th>
</tr>
</thead>
<tbody>
<tr>
<td>4...6 mm²</td>
<td>15...16.5 mm</td>
</tr>
<tr>
<td>5.5...7.5 mm</td>
<td>15...16.5 mm</td>
</tr>
</tbody>
</table>
MULTICONTACT (or equivalents)
Installation of Multicontact connectors requires crimping to be carried out with suitable equipment.

- Strip the cable to which you want to apply the connector (after verifying that it complies with the connector limits)

- Apply the terminal to the conductor using suitable crimping pliers

- Insert the cable with the terminal into the interior of the connector, until you hear the click indicating that the terminal is locked inside the connector.

- Firmly tighten the cable gland to finish the operation
String protection fuses

Correctly sizing the string fuses to be used for protection against return currents is very important since it can significantly reduce the risk of fire and damage to the PV generator. A “return current” can be generated in the event of a fault and relevant short-circuit at the ends of one or more PV modules of the system; this condition can cause all the current supplied by the strings not involved in the fault, but connected to the same input channel, to pass through the faulty string.

The following 2 conditions must be taken into account when sizing the string fuses:

1. The current rating of the fuse (Irated) may not exceed the maximum rating of the fuse to be used in series with the string (maximum series fuse rating), specified in the technical data of the PV modules, in agreement with standard IEC 61730-2

\[ \text{Irated} < \text{Maximum series fuse rating} \]

2. The rating of the fuse (Irated) must be determined according to the string current and the manufacturer’s sizing guidelines in order to avoid unforeseen failures. As a general guide, based on the short-circuit current (Isc) of the PV modules, the fuse rating may be calculated from the following formula:

\[ \text{Irated} > (1.4 \approx 1.5) \times \text{Isc} \]

The fuse selected must be the standard commercial size closest to the result obtained.

The fuse selected according to the formula described above must take into account adjustments and derating factors such as:
- Increase in the effective incident radiation at the installation site
- Increase in Isc as a result of high temperature in the PV module
- Thermal derating of the fuse
- Maximum return current of the installed PV modules

For effective calculation taking real installation conditions into account, refer to the documents supplied by the fuse manufacturer.
Output cable connection

Connect the output power cables from the inverter, passing it through the dedicated cable glands (A. Plastic Box and B. Metal Box).

- The output cables from the string box (positive pole and negative pole) must comply with the minimum insulation requirements foreseen for a voltage of 1000Vdc.

- If a model of PVI-STRINGCOMB without a disconnect switch is used, an external disconnect switch of a suitable size must be fitted by the installer.

Obtain a wrench of a suitable size to connect the cables, complete with cable lug, to the power bar. Make the following connection by loosening the screw, inserting the cable lug at the point indicated and finally tightening the screw.

For the custom -W model, connect the output power cables from the inverter, passing it through the dedicated cable glands (C. Metal Box -W).

Obtain a hexagon wrench of a suitable size to connect the cables to the power terminals. Make the following connection by loosening the screw terminal, inserting the cables at the points indicated and finally tightening the screw terminal.

For the recommended size of cables for power connection of the inverter, please refer to the technical specifications.
## Signal connection board

<table>
<thead>
<tr>
<th>Connector</th>
<th>Connector line</th>
<th>Pin number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1,J2,J3,J4</td>
<td>A,B,C</td>
<td>1,2</td>
<td>RS 485 serial line communication connection</td>
</tr>
<tr>
<td>J1,J2,J3,J4</td>
<td>A,B,C</td>
<td>9,10,11,12</td>
<td>Analogue inputs connection</td>
</tr>
<tr>
<td>J1,J2,J3,J4</td>
<td>A</td>
<td>4,7,8</td>
<td>Alarm connection</td>
</tr>
<tr>
<td>J1,J2,J3,J4</td>
<td>B,C</td>
<td>5,6</td>
<td>Digital inputs connection</td>
</tr>
<tr>
<td>J1,J2,J3,J4</td>
<td>B,C</td>
<td>3</td>
<td>SOR or UVR remote disconnection</td>
</tr>
<tr>
<td>J1,J2,J3,J4</td>
<td>B,C</td>
<td>7</td>
<td>External 24Vdc power supply connection</td>
</tr>
<tr>
<td>J12</td>
<td></td>
<td>1,2,3</td>
<td>DC disconnect switch auxiliary status contact</td>
</tr>
</tbody>
</table>
Connecting the serial line communication cable

Connect the incoming wires of the RS485 line (+485, -485 and RTN, if present) respectively to terminals A, B, C pin 1 and the outgoing wires to terminals A, B, C pin 2 of the signal connection board.

It is recommended that you use a screened cable for RS485 serial line connection. The metal braiding (screen) on the incoming and outgoing cable MUST NOT be connected to the RTN terminal, but must be joined by an isolated cable lug and only grounded inside the inverter.

Setting the RS485 serial 120Ω termination

If the device is the last of the chain, the serial line termination resistance must be enabled by the special micro-switch.
**Analog inputs**

Connect the wires from the environmental sensors to terminals A, B, C pin 9, 10, 11 and 12 of the signal connection board.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>AUX_IN_3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>+24V</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>24V_RTN</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>AUX_IN_1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>+24V</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>24V_RTN</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>AUX_IN_4</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>+24V</td>
<td>12</td>
</tr>
<tr>
<td>C</td>
<td>24V_RTN</td>
<td>11</td>
</tr>
</tbody>
</table>

The input AUX_IN_2, if connected, can be disabled during the control and the probe PT100 can be used in its place. To do this, use the relevant software.

The auxiliary inputs could also be used for other sensors, other than the indicated ones, provided they output a signal voltage of 0 - 10V.

**PT100 Input**

Connect the PT100 sensor to terminals A, B, C pin13.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PT100_IN+</td>
<td>18</td>
</tr>
<tr>
<td>B</td>
<td>PT100_IN-</td>
<td>19</td>
</tr>
<tr>
<td>C</td>
<td>PT100_SENSE</td>
<td>20</td>
</tr>
</tbody>
</table>

The input PT100, if connected, can be disabled during the control and the analogue input AUX_IN_2 can be used in its place. To do this, use the relevant software.

The signals "PT100_IN-" and "PT100_SENSE" have the same potential.
Antitheft system input/output

Remove the jumper supplied as standard and connecting terminals A pin7, pin8 and connect the antitheft system input wires, from the photovoltaic array, into these terminals. Connect the wires for remote reading of the alarm status to terminals A, B, C pin4.

<table>
<thead>
<tr>
<th>X7</th>
<th></th>
<th>X8</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ALARM_IN-</td>
<td>J10/2-4</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ALARM_NC</td>
</tr>
<tr>
<td>B</td>
<td>ALARM_NO</td>
</tr>
<tr>
<td>C</td>
<td>ALARM_C</td>
</tr>
</tbody>
</table>

The alarm input wire (a normal wire) is not supplied as standard and shall be adjusted according to system complexity.

Make sure that overall conductor resistance is below 400Ω.

As well as the display using the dedicated software, remote signalling can also be used to monitor the state of the alarm. In the event of an alarm, contact X4C and X4B is in short-circuit (closed) and contact X4C and X4A is open.

Digital inputs

Connect the wires from the status sensors (e.g. door access) to terminals B and C pin 5 and 6.

<table>
<thead>
<tr>
<th>X5</th>
<th>J11</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>DIG2_IN-</td>
</tr>
<tr>
<td>C</td>
<td>DIG2_IN+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X6</th>
<th>J11</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>DIG1_IN-</td>
</tr>
<tr>
<td>C</td>
<td>DIG1_IN+</td>
</tr>
</tbody>
</table>

Digital inputs must not be powered nor connected to any power supply.

Short-circuit or open signals DIG1+ and DIG1- (or DIG2+ and DIG2-) to detect the status of an auxiliary contact through the monitoring interface.

The input DIG1, if connected, can be disabled during the control and the DC disconnect switch status control can be used in its place. To do this, use the relevant software.
**SOR or UVR remote disconnection**

The remote disconnection module allows you to trigger the DC disconnect switch. Connect the wires from a power source (24-30VDC/AC) to terminals B and C pin 3.

<table>
<thead>
<tr>
<th></th>
<th>X3</th>
<th>J15</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>SOR/UVR_V+</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>SOR/UVR_V-</td>
<td>1</td>
</tr>
</tbody>
</table>

*The input must be powered by a dedicated power source for this application. The installer is responsible for sizing the power source properly during the project phase.*

The remote disconnection device operates at a continuous VDC or alternating VAC voltage of between 24 and 30 volts. When SOR triggering current type monitoring is used, instantaneous absorption (<15ms) on disconnection is 50 watts. If UVR minimum voltage coil type monitoring is used, permanent absorption is 1.5 watts.

**24Vdc external power supply**

PVI-STRINGCOMB is directly powered by the photovoltaic array, so it is not usually operating during the night. Some PVI-STRINGCOMB functions can be kept active during the night by using an insulated external power supply (24VDC@1A) to power the device.

In this way certain functions, such as antitheft and serial communication will stay active. Connect the wires from the external power source to terminals B and C pin 7.

<table>
<thead>
<tr>
<th></th>
<th>X7</th>
<th>J11</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>+24VEXT</td>
<td>13</td>
</tr>
<tr>
<td>C</td>
<td>24VEXT_RTN</td>
<td>14</td>
</tr>
</tbody>
</table>

*If the PVI-STRINGCOMB is to be used for night-time operation with external power supply, move the selector S3 on the control logic board, to the position 24V-EXT*
**DC disconnect switch auxiliary status contact**

The DC disconnect switch status can be remotely checked through the auxiliary contact.

The status of the contacts refers to the disconnect switch when ON. The corresponding connector to interface with the connector J17 is supplied as standard.

*The installer is responsible for sizing the conductors based on the characteristics of the use to which this application will be put, in accordance with the existing legislation.*
Procedure for connection to a monitoring system

Connect all the units of the RS485 chain in accordance with the "daisy-chain" arrangement ("in-out") observing the correspondence between signals, and activate the termination resistance of the communication line in the last element of the chain.

The communication line must also be terminated on the first element of the chain which normally corresponds to the monitoring device.

It is possible to connect up to 12 PVI-STRINGCOMB on the same line.

PLUS, PLUS-HV and PVI-STRINGCOMB of various types and different sizes can be connected in a daisy-chain.

Use of a computer is not essential for system operation. It is necessary solely in order to assign the FIELD NUMBER function test upon installation.
Monitoring system

For the purpose of monitoring the variables of the entire photovoltaic array through the parallel string panels, the methods to be used to connect the RS485 line from the PVI-STRINGCOMB are as follows.

Connection of the PVI-STRINGCOMB to the PLUS and to the PC.

The computer is connected to the inverter RS485 through the PVI-USB-RS232_485 Converter. The PC must have the CENTRAL-CVI monitoring software installed. This is the fullest configuration in which the PVI-STRINGCOMB are controlled by the inverter.

Remote control connection.

This configuration must be used during installation to set the FIELD NUMBER. In this case, the computer communicates directly with the PVI-STRINGCOMB. The necessary software is the dedicated PVI-STRINGCOMB software.
Stand-Alone connection to the inverter.

When connecting to one or more PLUS inverters, monitoring of the PVI-STRINGCOMB takes place using the “Conversion module” displays or using the touch screen display (if there is one) fitted on the front door of the inverter.
General conditions

One of the first rules for preventing damage to the equipment and to the operator is to have a thorough knowledge of the INSTRUMENTS. We therefore advise you to read this manual carefully. If you are not sure about anything or there is discrepancy in information, please ask for more detailed information.

Do not use the equipment if:
- you do not have suitable qualifications to work on this equipment or similar products;
- you are unable to understand how it works;
- you are not sure what will happen when the buttons or switches are operated;
- you notice any operating anomalies;
- there are doubts or contradictions between your experience, the manual and/or other operators.

ABB cannot be held responsible for damage to the equipment or the operator if it is the result of incompetence, insufficient qualifications or lack of training.
“StringComb Installer” monitoring and configuration software

The software created for PVI-STRINGCOMB allows configuration of the following parameters:
- transmission parameters: setting the communication baud-rate.
- control parameters: setting the current or overcurrent unbalance limits.
- monitoring parameters: reading the electrical variables of the photovoltaic array.

The computer must have a free COM serial port or a USB port to be able to communicate with PVI-STRINGCOMB.

Since the serial transmission standard of the PVI-STRINGCOMB is the RS485, when using a COM port of the computer that uses the RS232 standard, an PVI-RS232-485 adaptor must be used (232/485 Converter). If a USB port is used, a PVI-USB-RS232_485 converter will also be required. Make sure that the configuration is one of those allowed.

Installation of software

Launch the “setup.exe” program, then follow the instructions which come onto the screen.
Afterwards, the program “Aurora StringComb Installer” will appear as an icon on your desktop and in the menu location Start -> Programs -> StringComb Installer.
Further details on use of the string box configuration and monitoring software is given in the next chapter.

Conventions used and Access levels

- [BUTTON]: indicates a button
- (selection list): indicates a list from which an item must be selected.
- Menu name: indicates the name of a menu.
- name: name of the window.

The software allows for two separate access levels:
- Standard (User): this only allows monitoring. Some of the program windows have hidden and/or limited functions.
- Advanced (Technic): this allows for monitoring and other functions are available. All the program functions are enabled except for some which are the exclusive competence of the manufacturer.

The password for advanced access is: aurora
Use of the monitoring program

Click twice on the “Aurora StringComb Installer” program icon and wait for the following window to appear:

- Choose the COM port (COM List) to which the RS485/232 converter is connected.
- Select the communication speed (RS485 baud-rate).
- Press [Configure COM]
- Press [Yes] if you have “PVI-RS232-485 Converter” with serial cable.
- Press [NO] if you have an “PVI-USB-RS232_485 Converter” with USB cable or an adapter from another supplier (in this case is not guarantee compatibility for operation).

The first time you connect to the PVI-STRINGCOMB it is essential to assign the FIELD NUMBER to the various units connected to the system.
If the FIELD NUMBER does not need to be assigned to the various units connected to the system, skip the next chapter and go on to the one after.
**Field Number Assignment**

**What is the Field Number?**

During the installation phase, the serial numbers (S/N) of all the PVI-STRINGCOMB devices of the system have been noted and the creation of an installation map has been suggested, with indication of the identification numbers.

Every PVI-STRINGCOMB must be assigned a Field Number.

The figure shows a system with four PVI-STRINGCOMB installed. The parallel string panels are located in three distinct areas of the system called A, B and C and, as shown in the example, S/N 30 will be associated with FN = 1, S/N 77 with FN = 2, S/N 96 with FN = 3 and S/N 02 with FN = 4.

The Field Number and an installation map allow for identifying the position of the PVI-STRINGCOMB devices which are part of the system.

**Operations for assigning the Field Number**

- Press [FN Assignment] in the window First Installation, then choose (Advanced (Technic)) access mode in the menu Access Mode and press [ACCESS>>].
- Enter the access password.
- Press [ACCESS >>].
- Press [S.Comb Field-Number Assign] in the window StringComb Manager to access the window StringComb field number assignment.
- Press [Scan S.COMB by S/N] and wait a few minutes while the whole system is scanned.

- The StringCombs detected in the system are displayed. Assign the Field Number in the boxes provided for each PSP image detected.

- Press [Set Field N° for S.COMB >>].

- Correctly set N°: 1 on S/N: +4444
- Correctly set N°: 3 on S/N: 503051
- Correctly set N°: 2 on S/N: 505053

- Press [OK].
StringComb Manager

- Press [StringComb access] in the window First installation

- Select the type of visualisation using Access Mode:
  - (Standard (user)): all the visualisation menus and some of the settings and monitoring menus are enabled. Recommended for the customer.
  - (Advanced (Technic)): all the menus are enabled. Recommended for any technical interventions by authorised personnel.

If Standard mode is selected, a wait window will appear. If Advanced mode is selected it will be necessary to enter a password to access monitoring.

- Select standard or advanced access mode and press [ACCESS>>].

S.Comb Baud-Rate Setting (A)

- Press [S.Comb Baud-Rate Setting] in the window StringComb Manager

- Select the PVI-STRINGCOMB communication speed using this window

- Select the speed and press [Configure baud-rate on all S.COMB(s)].

If transmission speed is changed using a different converter, other than the PVI-RS232-485 Converter, it is highly likely that you will no longer be able to communicate with the PVI-STRINGCOMB.

Do not change speed without using an ABB converter.

A WARNING message will appear if a converter other than the PVI-RS232-485 Converter is used.

RS485 Scan for S.COMB (B)

- Press [RS485 Scan for S.COMB] to scan the system. All the PVI-STRINGCOMBs present in the system will be shown in the (S.COMB List) in order of Field Number
**StringComb Global Monitoring (C)**

- Press [Global Monitoring] to access actual monitoring of the parallel string panels.

- The window StringComb Global Monitoring will show a list of all the PVI-STRINGCOMB. Double-clicking on the image of the selected device accesses monitoring of that STRINGCOMB.

1. Monitoring start button. It flashes when monitoring is started.
2. Levels of signals coming from the external sensors. The measurement of these levels can be set from the menu Configuration -> Aux-inputs -> Settings.
3. Digital signals and antitheft warning light status. Indicates the state of the sensors connected to the digital inputs.
4. PVI-STRINGCOMB status. Parameter status indication: green (OK) / red (KO). The status indications are given in detail in the figure.
5. Serial address and number. Shows the Field Number (FN) and the Serial Number of the PVI-STRINGCOMB monitored.
6. Model.: Indicates the type of PVI-STRINGCOMB model monitored (European or American).
7. StringComb Monitor panel menu.
8. Global data. This contains the voltage, the total array current and the internal temperature of the PVI-STRINGCOMB.
9. Fuse status. Fuse status indication: green (OK) / red (KO). The status indications are given in detail in the figure.
10. String current and reading weight. Indicates the string currents and reading weight for each channel.
StringComb Monitor menu

The following images show the structure of the menus and their use.

Access menu

Selection of the access mode

S.COMB Selection menu

Return to the StringComb Manager window or to the Global Monitoring window.

EEeprom menu

Access to memory parameters. Software sections reserved for the sole use of the manufacturer.

DO NOT MODIFY THESE VALUES!

Configuration menu

According to the input mode (standard or advanced) used to access, some of these sub-menus might or might not be available.

- Set Model (only Advanced):

Used to modify the StringComb Monitor display mode.

- Select the model and press [Set Model].

The PVI-STRINGCOMB models present in the serial line are detected automatically during scanning of the photovoltaic array, so it is not necessary to modify this parameter.
- Manufacturing Settings (only advanced)

Used to modify the rated values of the PVI-STRINGCOMB.

- Write the parameter in question in the window provided and press the corresponding [BUTTON] key.

Each PVI-STRINGCOMB has all its rated values set in the factory.

- Inner Calibration (only advanced)

Used to calibrate the array current and voltage readings and the auxiliary input voltage readings.

Every PVI-STRINGCOMB leaves the factory calibrated.

- Alarm Parameters

Used to modify the alarm levels of the PVI-STRINGCOMB.
1. Overcurrent on the string.
2. Maximum internal temperature.
3. Current percentage index to establish conditions of unbalance.
4. Average minimum current above which unbalance is detected.

- Write the parameters and press [Alarm Limits Set]. A confirmation window of the new settings will appear.

- Check that the operation has been carried out correctly and then press [OK]. If there are any errors, press [OK] and then repeat the operation.
- Press  to close the window and return to the StringComb Monitor screen.

- String Current Settings

Before calibrating the current weights, it is absolutely essential for the system planner to check that the current detected for each string complies with the nominal values of the current of the solar panels used.

DO NOT CONFIGURE THESE SETTINGS BEFORE READING AND FULLY UNDERSTANDING THIS PARAGRAPH!
The picture shows that in even lighting conditions the fourth string does not output the nominal current foreseen. In this case, before calibrating the weights, it is necessary to check whether the string in question has any anomalies.

In the figure above, the panel allows for setting the “weight” of the current of every string so that the most accurate unbalance control is possible.

To set the weight of every string, carry out one of the following procedures. Make sure that the calibration operations are carried out in conditions of fixed light so that the parameters will be constant.

1) Automatic method:
- Choose, by selection (using the arrow shown in the figure), a reference string, the weight of which will be maintained always at a value of one (1).
- The program will automatically calculate the weights of all strings present.
- Check that the operation has been carried out correctly and then press [OK]. If there are any errors, press [OK] and then repeat the operation.
- Press \( \) to close the window and return to the StringComb Monitor screen.

2) Manual method:
- Choose, by selection (using the arrow shown in the figure), a reference string, the weight of which will be maintained always at a value of one (1).
- Calculate the weight of the other strings by dividing the current of every string by that of reference.
- Enter the weights of every string on the panel (1), set the weights of any unused strings to zero.
- Press [Set-Factors]. A confirmation window of the new settings will appear.
- Check that the operation has been carried out correctly and then press [OK]. If there are any errors, press [OK] and then repeat the operation.
- Press \( \) to close the window and return to the StringComb Monitor screen.
Aux Inputs Settings

Used to set a scale factor for each of the auxiliary inputs and a possible offset.
- Set the value of the scale factor which will be multiplied by the value of the input voltage.
- If needed, set the offset to be added to the scaled value.
- Press [Set Inputs >>]. A confirmation window of the new settings will appear.
- Check that the operation has been carried out correctly and then press [OK]. If there are any errors, press [OK] and then repeat the operation.
- Press to close the window and return to the StringComb Monitor screen.

AUX_IN_2 input function can be switched and said input can be used for PT100 sensor reading.

- Move cursor to PT100. A window requiring action to confirm the settings will appear.

- On control board, set switch S2 to ON.

- Press [OK].

Carry out the same procedure to restore Generic operation.
After making the selection in the StringComb Monitor control panel the value detected by probe PT100 will be displayed.

**Digital Inputs Settings**

Every PVI-STRINGCOMB controls three digital inputs. ID0 is dedicated to the antitheft alarm, ID1 has dual functions that can be switched from free for external input or to control the status of the DC disconnect switch and ID2 is free for an external input.

- Click on the menu required and set to “DC isolation switch state”. A window requiring action to confirm the settings will appear.

- On control board, set switch S4 to ON.

- Press [OK].

Carry out the same procedure to restore Generic operation. After making the selection in the StringComb Monitor control panel the status of the DC disconnect switch will be displayed.
General conditions

Before checking the operation of the equipment, it is necessary to have a thorough knowledge of the INSTRUMENTS chapter and the functions that have been enabled in the installation.

The equipment operates automatically without the aid of an operator; operating state is controlled through the instruments.

The interpretation or variation of some data is reserved exclusively for specialized and qualified staff.

The incoming voltage must not exceed the maximum values shown in the technical data in order to avoid damaging the equipment.

Consult the technical data for further details.

Even during operation, check that the environmental and logistic conditions are correct (see installation chapter).
Make sure that the said conditions have not changed over time and that the equipment is not exposed to adverse weather conditions and has not been isolated with foreign bodies.
Commissioning

The equipment commissioning procedure is as follows:

• Install all the plexiglass protection

• Close the fuse box 1, the fuse box 11

• Verify that the red LED on the control board starts to flash.

• One by one, close all the other fuse boxes.

Controls and final operations

• Check that the passages for the string cables and those leading to the inverter, at the bottom of the box, have all been made in a workmanlike manner. All the cable passages must be properly sealed with suitable materials.

• If the box in question is the last in the RS485 serial chain, make sure that the 120Ω termination is correctly enabled

• Note down the serial number on the label identifying the PVI-STRINGCOMB string box, as this will be required to assign the FIELD NUMBER.

• Perform any control and reading settings, communicating with a PC via RS485 serial connection and using the special Aurora StringComb Installer software.
• If there are other PVI-STRINGCOMB devices, carry out the same procedures described up to this point before going on to the next step.

• Close the DC switch by pushing the lever upwards and bringing it into the 1-ON position. In this way the strings in the photovoltaic array are connected to the downstream inverter.

• In the case of a metal PVI-STRINGCOMB, close the door by locking with the key provided, and make sure the locks are protected by the caps provided.

• In the case of a plastic PVI-STRINGCOMB, close the cover using the screws, making sure that the gaskets are properly positioned.

### Assigning the FIELD NUMBER

Now that the system is fully connected it is possible to complete installation by assigning an identification number (FIELD NUMBER) to each PVI-STRINGCOMB installed. To do this, a computer containing the monitoring software provided is required, using the direct connection. In general, follow the instructions given in the chapters 6.
General conditions

Checking and maintenance operations must be carried out by specialized staff assigned to carry out this work.

Maintenance operations must be performed with the apparatus disconnected from the grid (power switch open) and the photovoltaic panels obscured or isolated, unless otherwise indicated.

For cleaning, DO NOT use rags made of filamentary material or corrosive products that may corrode parts of the equipment or generate electrostatic charges. Avoid temporary repairs. All repairs should be carried out using only genuine spare parts. The maintenance technician is under an obligation to promptly report any anomalies.

DO NOT allow the equipment to be used if problems of any kind are found, and restore the normal conditions correctly or otherwise make sure that this is done.

Always use the personal protective equipment provided by the employer and comply with the safety conditions of the Accident prevention chapter.
Routine maintenance

Scheduled maintenance operations are not mandatory, but are recommended to preserve the efficiency of the PV plant.

We recommend that maintenance operations be carried out by qualified personnel or by the personnel of ABB (as set forth in a maintenance contract).

The periodicity of the maintenance operations may vary in accordance with local environmental conditions and the installation.

Table: routine maintenance

| Annual visual inspection | • That there has been no drastic change in environmental conditions (direct exposure to solar irradiation and atmospheric agents).  
|                          | • That there are no infiltrations through the front door/covers, that the cable glands and connectors are tight and properly fastened. |
| Annual operations        | • Check that cable glands and connection block screws are tight |
| Annual cleaning          | • Outside of the equipment; the outside casing, with particular care for the upper part where the anticondensation kit is located, if possible using compressed air, a vacuum cleaner or special brushes. |
# Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Software</strong></td>
<td></td>
<td></td>
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</tbody>
</table>
| The serial communication of one or more StringCombs does not work | a) The line is interrupted | Check that: 
  a) There are no interruptions on the line. 
  b) Only the termination of the last element of the chain is enabled. 
  c) There are no two identical addresses. |
| The system signals that one string is not working (No current) | a) The string is not connected 
b) The string is faulty | a) Check that the + and – ends are installed with the correct polarity. 
b) The string has an interruption in the circuit outside the PVI-STRINGCOMB. |
| The system signals that some strings are not working (Current imbalance) | a) The weights set in the software are incorrect. 
b) The strings may not be similar. | a) Check the assignment of the current weights in the software. 
b) Make sure that the solar panels are of the same type. |
| Communication works but the PSP devices are not “visible” from the program scan | a) The baud-rate configuration of the PVI-STRINGCOMB is different from that of the converters. 
b) Incompatible converter | a) Use the default 9600 baud rate configuration. 
b) Use a PVI-USB-RS232_485 converter. |
| Surge arrester OVR out of order | The OVR has been triggered (for excess voltage) | Replace the damaged cartridges. |
| Burnt fuse | Too much current flowed to the string | Change the fuse. 
If the problem arises again, check for anomalies on the string. |
| Individual monitoring does not display any parameter | The [Start StringComb Monitoring] button has not been pressed. | Press the [Start StringComb Monitoring] button. |
| **Environment and Visual Controls** | | |
| Red led On | The Micro is blocked | Contact the supplier. |
| Red led off | a) Board power failure 
b) Probable board fault | a) The board is fed directly from the panels. Check that the environmental conditions are adequate (e.g.: that there is sunlight). 
Also check that at least one string (+ and -) is connected with the correct polarity and that the string fuses are connected. 
b) Contact the supplier. |
| There is water inside the box | a) The box was not correctly closed. 
b) The box is damaged | a) Check correct sealing and that the surface supporting the PVI-STRINGCOMB is not warped. 
b) Contact the supplier. |
| **Inverter** | | |
| The inverter is not getting DC from the panels | a) The switch on the PVI-STRINGCOMB is open. 
b) Interruption on the DC line | a) Close the DC switch inside the PVI-STRINGCOMB. 
b) Are the DC output wires connected? 
Are the string fuses inserted? |
| The inverter signals a generic fault on a stringcomb | Check the cause on the inverter display | Check whether the following points cover this case. 
Otherwise contact the supplier. |
**Disconnection**

If it is necessary to remove the PVI-STRINGCOMB or, in any case, to insulate it completely from the rest of the system, it is absolutely necessary to disconnect the device on both DC sides, i.e. from the photovoltaic array and from the inverter. To do this, the input voltage supplied by the individual strings, connected via the input terminal block to the fuses, and the DC output voltage lines connected to the inverter via the switch must be cut off.

- Turn the inverter connected downstream of the string panel off and disconnect it from the DC side (follow the instructions provided in the inverter operating manual).
- Remove the cover by unfastening the screws (plastic box) or opening the locks using the key provided and opening the door (metal box).
- Turn the PVI-STRINGCOMB DC switch to OFF.

**Disconnecting from the inverter**

- Remove the Plexiglas guard on the output bars.
- Disconnect the output power cables from the inverter, following the indications given below:
  - Find a screwdriver of a size suited to the screw. Disconnect by loosening and removing the screws.
  - Protect the power cables with a suitable insulating cap once they have been disconnected.
  - Extract the cables from the PVI-STRINGCOMB.

**Disconnecting the strings (negative pole)**

- Remove the Plexiglas guard on the output bars.
- Disconnect from the negative board the wires coming from the strings, following the indications given below:
  - Find a slotted screwdriver of a size suited to the terminal. Disconnect the wires by opening the terminal retaining spring.
  - Protect the wires with a suitable insulating cap as they are disconnected.
  - Extract the wires from the PVI-STRINGCOMB.

*In the presence of a PVI-STRINGCOMB with MC4 multicontact connectors, disconnect the strings by releasing the connectors outside the casing.*
**Disconnecting the strings (positive pole)**

- Remove the Plexiglas guard on the output bars.
- Disconnect from the positive board the wires coming from the strings, following the indications given below:
  - Find a slotted screwdriver of a size suited to the terminal. Disconnect the wires by opening the terminal retaining spring.
  - Protect the wires with a suitable insulating cap as they are disconnected.
  - Extract the wires from the PVI-STRINGCOMB.

*In the presence of a PVI-STRINGCOMB with MC4 multicontact connectors, disconnect the strings by releasing the connectors outside the casing.*

**Disconnection of the ground line and signals**

- Disconnect the protective ground wire from the bar to the inverter and the ones from the photovoltaic array.
- Disconnect all the signal cables to and from the PVI-STRINGCOMB from the dedicated terminal block.
At this point the string panel is completely disconnected from the system.
- Replace the Plexiglas guards.
- Close the door using the key provided and protect the locks using the caps (metal box), or replace the cover and fasten the screws (plastic box).
- Remove the PVI-STRINGCOMB.
Replacing the fuses

To replace components, proceed according to the steps listed below and according to the instructions and precautions indicated.

- Turn the inverter connected downstream of the string panel off and disconnect it from the DC side (follow the instructions provided in the inverter operating manual).
- Remove the cover by unfastening the screws (plastic box) or opening the locks using the key provided and opening the door (metal box).
- Turn the PVI-STRINGCOMB DC switch to OFF.

Before opening the door/cover, make sure that there is no residual water that might get into the PVI-STRINGCOMB when it is opened.

- Identify the faulty fuse, indicated by the monitoring software and replace it with a new fuse of the same model (same brand and part number).
- Use the monitoring software to check that no other fuses have blown.
- Repeat the operation for any other faulty fuses.
- Turn the DC switch to ON.
- Close the door using the key provided and protect the locks using the caps (metal box), or replace the cover and fasten the screws (plastic box).
Replacing the RS485 serial line surge arrester

To replace components, proceed according to the steps listed below and according to the instructions and precautions indicated.

The RS485 serial line overvoltage protection device has a cartridge which can be extracted without risk.
- Remove the cover by unfastening the screws (plastic box) or opening the locks using the key provided and opening the door (metal box).
- Turn the PVI-STRINGCOMB

Before opening the door, make sure that there is no residual water that might get into the PVI-STRINGCOMB when it is opened.

- Remove the faulty cartridge (Figure 13-1) and replace it with a new one of the same model (same brand and part number), inserting it with care and pressing it all the way in.
- Turn the DC switch to ON.
- Close the door using the key provided and protect the locks using the caps (metal box), or replace the cover and fasten the screws (plastic box).

Replacing the DC surge arrester

To replace components, proceed according to the steps listed below and according to the instructions and precautions indicated.

The DC power line overvoltage protection device has three cartridges which can be extracted without risk.
- Remove the cover by unfastening the screws (plastic box) or opening the locks using the key provided and opening the door (metal box).
- Turn the PVI-STRINGCOMB DC switch to OFF.

Before opening the door, make sure that there is no residual water that might get into the PVI-STRINGCOMB when it is opened.
Storage and dismantling

Storage of the equipment or prolonged stop

If the equipment is not used immediately or is stored for long periods, check that it is correctly packed and contact ABB for storage instructions. The equipment must be stored in well-ventilated indoor areas that do not have characteristics that might damage the components of the equipment.

Restarting after a long or prolonged stop requires a check and, in some cases, the removal of oxidation and dust that will also have settled inside the equipment if not suitably protected.

Dismantling, decommissioning and disposal

*ABB CANNOT be held responsible for disposal of the equipment: displays, cables, batteries, accumulators, etc., and therefore the customer must dispose of these substances, which are potentially harmful to the environment, in accordance with the regulations in force in the country of installation.*

If the equipment is dismantled, in order to dispose of the products that it is composed of, you must adhere to the regulations in force in the country of destination and in any case avoid causing any kind of pollution.

Dispose of the various types of materials that the parts of the equipment consist of in dumps that are suitable for the purpose.

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>MATERIAL OF CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame, brackets, supports</td>
<td>Arc-welded steel FE37</td>
</tr>
<tr>
<td>Casing or covers</td>
<td>ABS, plastic</td>
</tr>
<tr>
<td>Paint and</td>
<td>RAL</td>
</tr>
<tr>
<td>Gaskets and seals</td>
<td>Rubber / Teflon / Viton</td>
</tr>
<tr>
<td>Electrical cables</td>
<td>Copper / Rubber</td>
</tr>
<tr>
<td>Conduits</td>
<td>Polyethylene / Nylon</td>
</tr>
<tr>
<td>Back-up battery</td>
<td>Nickel / Lead/ Lithium</td>
</tr>
</tbody>
</table>
Further information

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

www.abb.com/solarinverters