

DC Box

PV Arrays Combiner Box

Installation and Commissioning Manual



DC Box

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Installation and Commissioning manual

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 **Electric**

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Information About Your System

As soon as you open your product, record the following information and be sure to keep your proof of purchase.

Serial Number _____

Product Number _____

Purchased From _____

Purchase Date _____

About This Manual

Purpose

This document describes how to install the DC Box (PV Arrays Combiner Box).

Scope

This manual provides safety guidelines and information about installing the DC Box.

Audience

This manual is intended for anyone who needs to install the DC Box. Installers must be familiar with all the safety regulations pertaining to installing high-voltage equipment as dictated by local code. Installers must also have a complete understanding of this equipment's features and functions.

Installation must be performed by **qualified personnel**. Qualified personnel have training, knowledge, and experience in:

- Installing electrical equipment and PV power systems (up to 1000 V).
- Applying all applicable installation codes.
- Analyzing and reducing the hazards involved in performing electrical work.
- Selecting and using Personal Protective Equipment (PPE).

Organization

This manual is organized into the following chapters and appendices:

Chapter 1 contains general information about the features and functions of the DC Box.

Chapter 2 contains a description of the DC Box including packaging, dimensions, layouts, protection and monitoring.

Chapter 3 contains information on requirements that must be met before installing the DC Box.

Chapter 4 contains information on installing the DC Box, including unloading, mounting, and wiring the DC Box.

Chapter 5 contains information on commissioning the DC Box.

Appendix A provides electrical, environmental, and mechanical specifications for the DC Box.

Conventions Used

The following conventions are used in this manual.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, can result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, can result in moderate or minor injury.

NOTICE

NOTICE indicates a potentially hazardous situation, which, if not avoided, can result in equipment damage.

Abbreviations and Acronyms

AB	Array Box
CE	European Conformity mark (European Union standards compliance)
DCB	DC Box
gPV	Photovoltaic-type fuses
IEC	International Electrotechnical Commission
PE	Protective earth (ground)
PPE	Personal Protective Equipment
PV	Photovoltaic
SELV	Safety Extra Low Voltage
STC	Standard test conditions
T°C	Temperature in degrees C
VAC	Volts (alternating current)
VDC	Volts (direct current)

Related Information

You can find more information about Schneider Electric as well as its products and services at www.schneider-electric.com.

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Important Safety Instructions

READ AND SAVE THESE INSTRUCTIONS - DO NOT DISCARD

This manual contains important safety instructions for the DC Box that must be followed during installation.

⚠️ ⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- To be installed and serviced only by qualified personnel equipped with appropriate personal protective equipment and following safe electrical work practices.
- Energized from PV array while exposed to light, backfeed from the DC output circuit, and possibly an auxiliary AC source (if used).
Before servicing, removing any panel or safety barriers:
 - Consult system diagram to identify all sources.
 - De-energize, lock-out and tag-out all sources following the procedure in the Installation manual.
- Verify de-energization using suitably rated meters. Refer to the Installation manual for details.
- Do not energize unless all panels and internal safety barriers (clear plastic covers) are installed.
- To be installed over a non-combustible surface. Refer to the Installation manual for details.

Failure to follow these instructions will result in death or serious injury.

⚠️ ⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

- Do not disconnect fuses under load.
- Use fuses type gPV 1000VDC with a current rating adapted to the installation as described in this manual.

Failure to follow these instructions will result in death or serious injury.

⚠️ ⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

Connect X5 only to SELV circuits as described in this manual.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

Do not install or attempt to operate the DC Box if it has been dropped or has received more than cosmetic damage during transport or shipping. If the DC Box is damaged, or suspected to be damaged, contact customer service.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

LIMITATIONS ON USE

Do not use the DC Box in connection with life support systems or other medical equipment or devices. The DC Box can only be used in PV systems. It is not suitable for any other application areas.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

HAZARD OF CRUSH INJURY AND EQUIPMENT DAMAGE

- Use caution and follow the instructions in the Installation chapter for correct lifting, moving, and mounting of the DC Box as it can easily fall over if it is moved incorrectly.
- The DC Box must be securely attached to the mounting surface after positioning.

Failure to follow these instructions can result in death or serious injury and/or damage to equipment.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, FIRE AND EQUIPMENT DAMAGE

Unsafe conditions and damage to the DC Box may result if the instructions and electrical, physical, and environmental installation specifications in this manual are not obeyed.

Failure to follow these instructions can result in death or serious injury and/or damage to equipment.

⚠ CAUTION

HAZARD OF BURNS

Components become hot during normal operation. Do not touch components inside the DC Box until they have had time to cool down after the DC Box has been de-energized.

Failure to follow these instructions can result in moderate or minor injury.

NOTICE

HAZARD OF OVERHEATING AND EQUIPMENT DAMAGE

- Keep the supply air and exhaust air areas unobstructed.
- Follow the installation, ventilation, and clearance instructions in the Installation chapter.

Failure to follow these instructions can result in damage to equipment.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

DC Box electronics can be destroyed by static charge. Wear static protection gear, and use anti-static tools and procedures when installing and maintaining the DC Box.

Failure to follow these instructions can result in damage to equipment.

Personal Protection

Follow these instructions to help protect yourself while working with the DC Box.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

- Never work alone when installing the DC Box. A team of two is required until external sources are properly de-energized, locked out and tagged out, and verified de-energized with a meter.
- Thoroughly inspect the DC Box prior to energizing. Verify that no tools or materials have inadvertently been left inside the DC Box and that all guards and barriers are properly replaced and secured.

Failure to follow these instructions will result in death or serious injury.

Installation personnel must be equipped with adequately rated, standard personal protective equipment (PPE) including the following:

- Electrically rated protective gloves
- Protective glasses
- Fire resistant clothing
- Ear protection
- Electrically rated protection shoes or boots
- Electrical protection hard hat
- Padlocks and tags (for lock-out and tag-out of disconnects)
- 1000VDC Cat II and 300VAC Cat III volt meters for verifying de-energization of circuits.

Check local safety regulations and applicable workplace safety procedures for additional requirements.

Lock-out and Tag-out Procedure

Lock-out refers to the practice of preventing de-energized circuits from being re-energized by putting locks on the disconnecting devices, holding them open. Tag-out refers to the practice of attaching a tag to the disconnecting device locks warning others not to operate the disconnecting device and containing information relating to the lock-out, such as the person responsible, the reason, and the date and time. Combined these two practices are called the Lock-out and Tag-out (LOTO) procedure.

Follow all steps of this procedure to de-energize all sources of supply external to the DC Box. This allows access to all parts of the cabinet, including behind internal barriers.

To lock-out and tag-out the DC Box:

1. Open, lock-out and tag-out all incoming PV DC input circuits at the external disconnecting means provided as part of the installation. An example of how this can be done is by opening all main switch disconnectors of all PV string combiner boxes (for example, the Array Box) connected to the DC Box and locking and tagging them.
2. Switch off the inverter if it is ON by following the procedure described in the inverter's user manual.
3. Open, lock-out and tag-out the PV disconnect of the inverter's DC cabinet. In the case of a Conext™ Core XC Series, LOTO the PV disconnect (QF11) on the XC Series inverter's DC cabinet door, as described in the Conext™ Core XC Series Inverter Planning and Installation manual.
4. Open, lock-out and tag-out the external auxiliary AC source (if used) connected to X1 terminals.
5. Wearing appropriate PPE and using voltmeters with minimum ratings of 1000 VDC and 300 VAC, verify that all external circuits are de-energized by checking for zero voltage at all of the following locations:
 - a) PV input: measure the voltage from DC+ and DC- to ground and from DC+ to DC- of each DC input coming from the PV arrays in the following order:
 - PV+ output and ground
 - PV- output and ground
 - PV+ output and PV- output

 - PV+ DC input 1 and PV- DC input 1
 - PV+ DC input 1 and ground
 - PV+ DC input 2 and PV- DC input 2
 - PV+ DC input 2 and ground

And so on for all remaining PV inputs.

- PV- DC input 1 and ground
- PV- DC input 2 and ground

And so on for all remaining PV inputs.

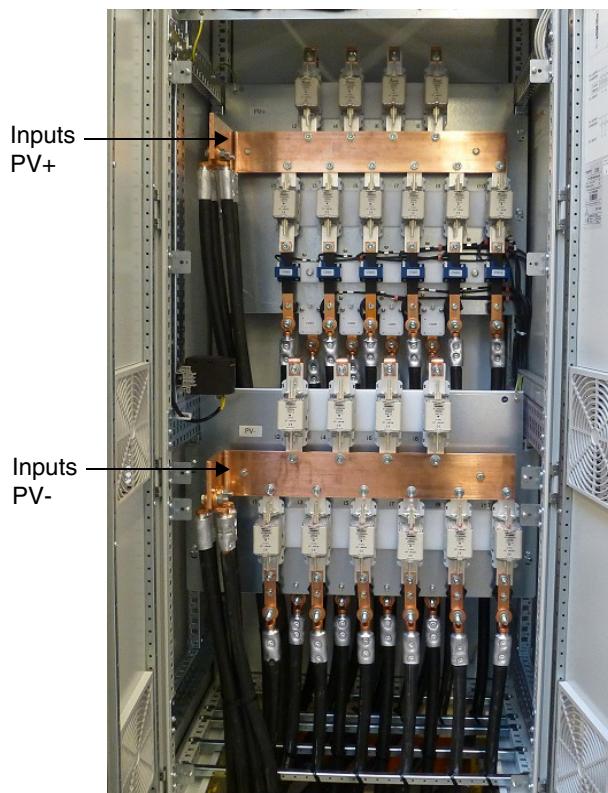


Figure 1-1 Measuring voltage on PV DC inputs

b) External auxiliary AC source (if used): Measure the voltage from each phase to ground and from phase to phase at the AC power source input terminal X1 in the following order:

- Phase (X1:2) and neutral (X1:1)
- Phase (X1:2) and ground (X2:1).

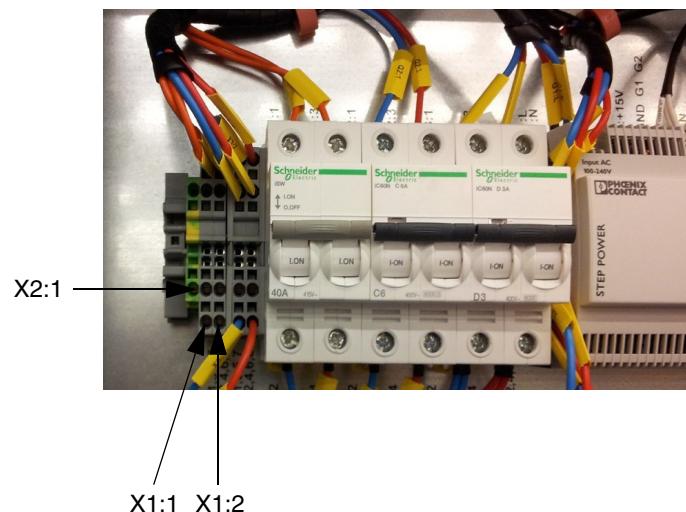


Figure 1-2 Measuring voltage on AC power source input terminal

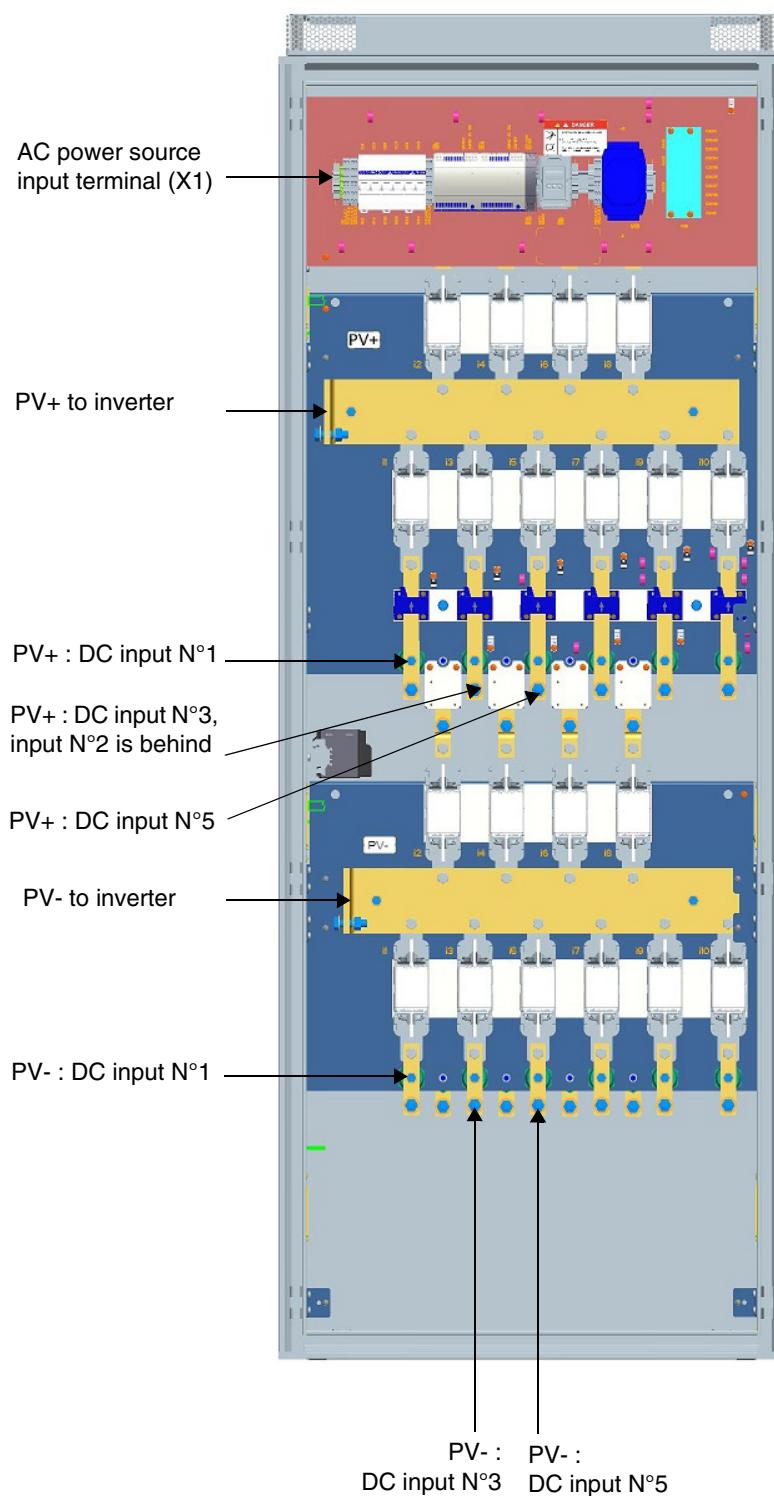


Figure 1-3 Lock-out and tag-out components

1

Introduction

Chapter 1 contains general information about the features and functions of the DC Box.

Overview

The DC Box is a pre-wired cabinet used in large photovoltaic (PV) installations to host all the necessary equipment to interconnect and protect the cabling coming from PV string combiner boxes (e.g. the Array Box) and to optionally monitor DC currents. One or more DC Boxes are contained in a substation PV shelter (such as the PV Box) that also includes PV inverters. One DC Box is in charge of transferring the PV energy to one inverter and thus is always installed close to the DC cabinet of the inverter. Below is an example of configuration:

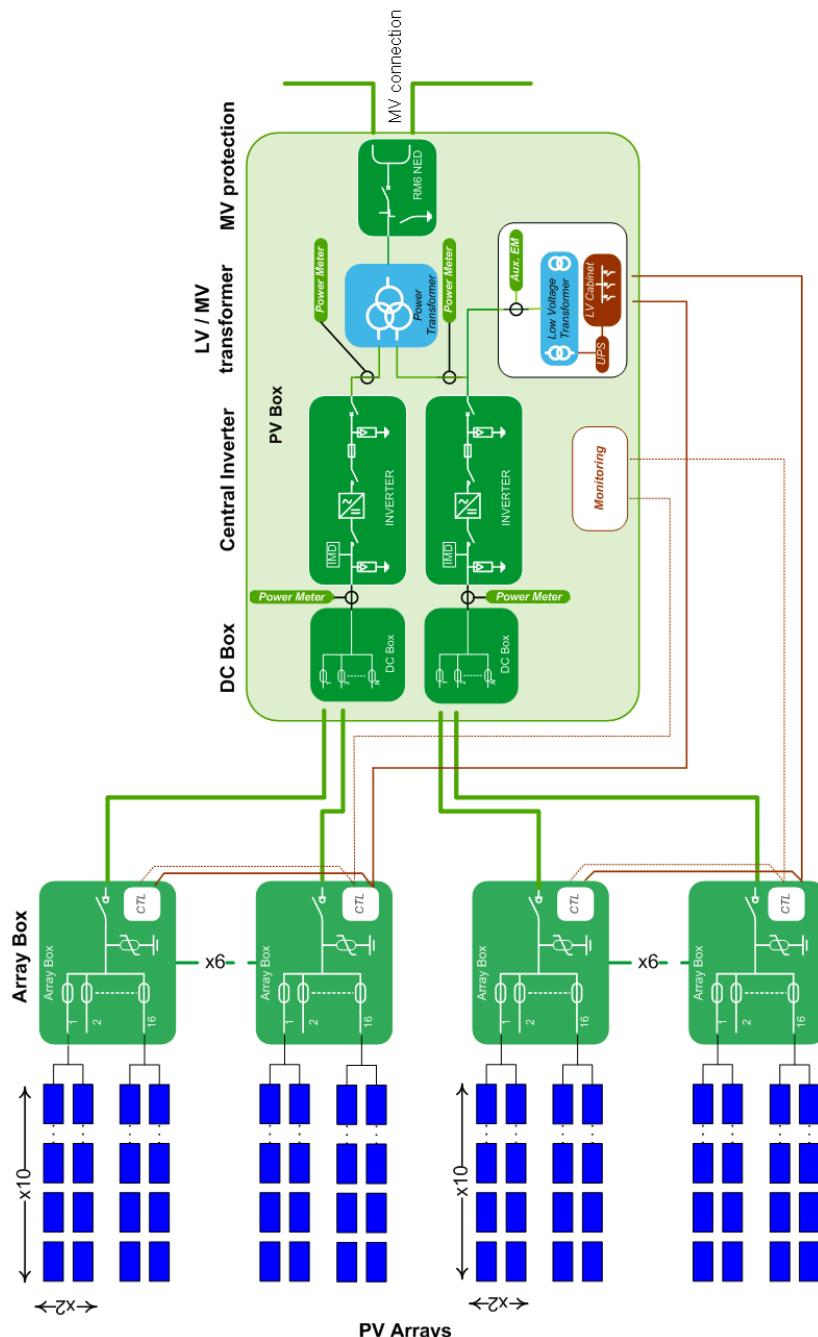


Figure 1-1 PV installation architecture example

Main characteristics

The main characteristics of the DC Box are:

- Range of DC Box with six and ten inputs.
- Indoor use. All enclosures are floor-standing in a PV shelter close to the DC cabinet of the inverter.
- Max DC voltage: 1000 V.
- Available with and without monitoring of input currents.

Protection

- Overcurrent protection.
- Several fuse ratings:
315 A, 355 A, 400 A for DC Box with six inputs.
160 A, 200 A, 250 A for DC Box with ten inputs.
- Electrical shock. Protective Class I.
- Relative humidity control by a heater.

Monitoring

- RS-485 Modbus Communication.
- DC Box input current measurement on PV+ side (six or ten measurements according to DC Box type).

Single-Line Diagram

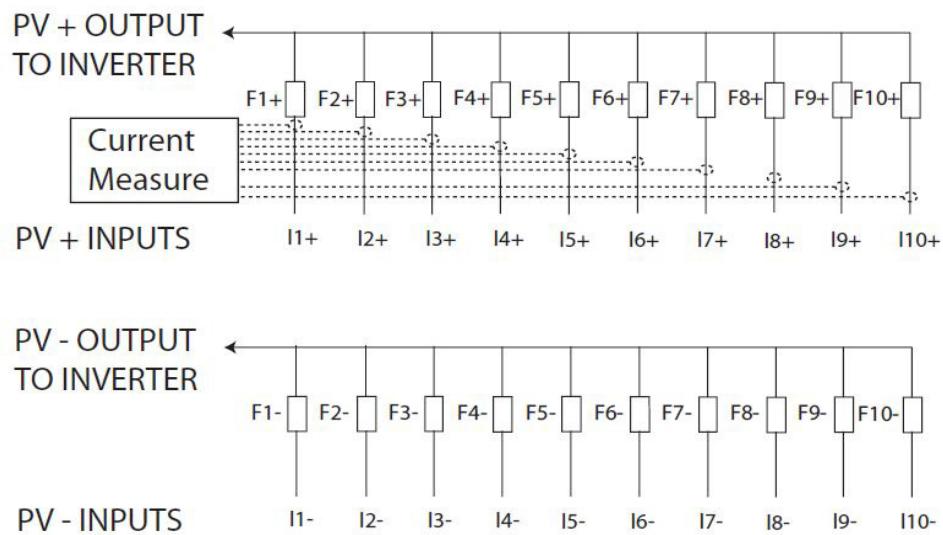


Figure 1-2 Single-line diagram

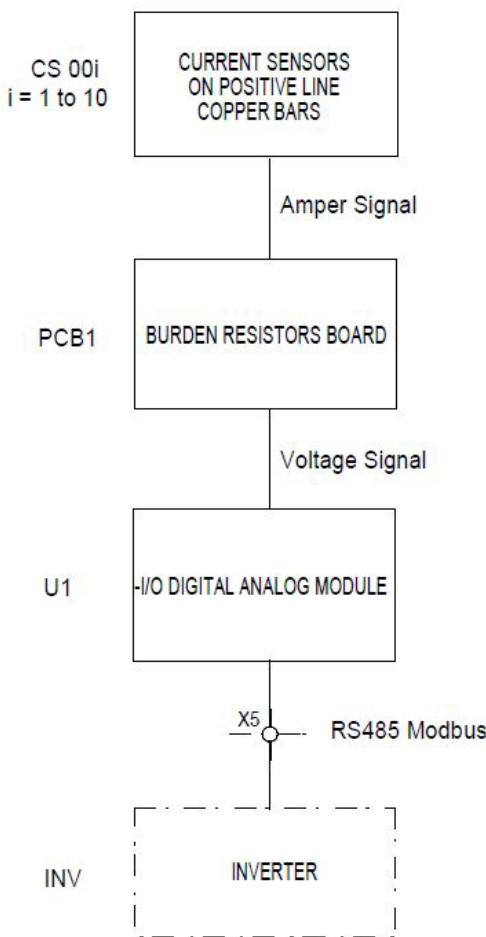


Figure 1-3 Monitoring diagram



Figure 1-4 DC Box cabinet

Range of Products

The DC Box offer is comprised of four models, varying in type (six or ten inputs) and performance level (Protect or Monitored). A range of fuses is also included in the offer.

Performance Levels

The features of the Protect and Monitored DC Boxes are:

- Protect version: protection only. DC input currents not monitored, no communication.
- Monitored version: protection and monitoring. Protect functions plus DC input currents monitored and Modbus communication. The inputs are protected against over-currents with fuses on both polarities.

DC Box Offer

Table 1-1 lists the Schneider Electric part numbers for all the DC Box models.

Table 1-1 DC Box models

DC Box type	Performance level	Fuse ratings	Part number
DC06B	Protect	315 A, 355 A, 400 A	PVSDC31101
	Monitored	315 A, 355 A, 400 A	PVSDC31111
DC10B	Protect	160 A, 200 A, 250 A	PVSDC31201
	Monitored	160 A, 200 A, 250 A	PVSDC31211

Range of Accessories

Fuses

Table 1-2 lists the Schneider Electric part numbers for the range of fuses that can be ordered separately for all the DC Box models.

Table 1-2 DC Box fuses

DC Box type	Fuse ratings	Part number
DC06B	gPV 400 A-1000 V size NH3 Pack of 12 units	PVSDC30201
	gPV 355 A-1000 V size NH3 Pack of 12 units	PVSDC30211
	gPV 315 A-1000 V size NH3 Pack of 12 units	PVSDC30221
DC10B	gPV 250 A-1000 V size NH2 Pack of 20 units	PVSDC30231
	gPV 200 A-1000 V size NH1 Pack of 20 units	PVSDC30241
	gPV 160 A-1000 V size NH1 Pack of 20 units	PVSDC30251

Labels

The safety and identification labels on the DC Box are in English when the DC Box is delivered. To have labels in French, German, Italian, Spanish, or another language, contact your local Schneider Electric service to order them.

Table 1-3 lists the Schneider Electric part numbers for the DC Box labels.

Table 1-3 DC Box labels

Language	Part number
French	PVSDC30101
German	PVSDC30111
Italian	PVSDC30121
Spanish	PVSDC30131

Figure 1-5 shows the location of the safety labels on the DC Box:

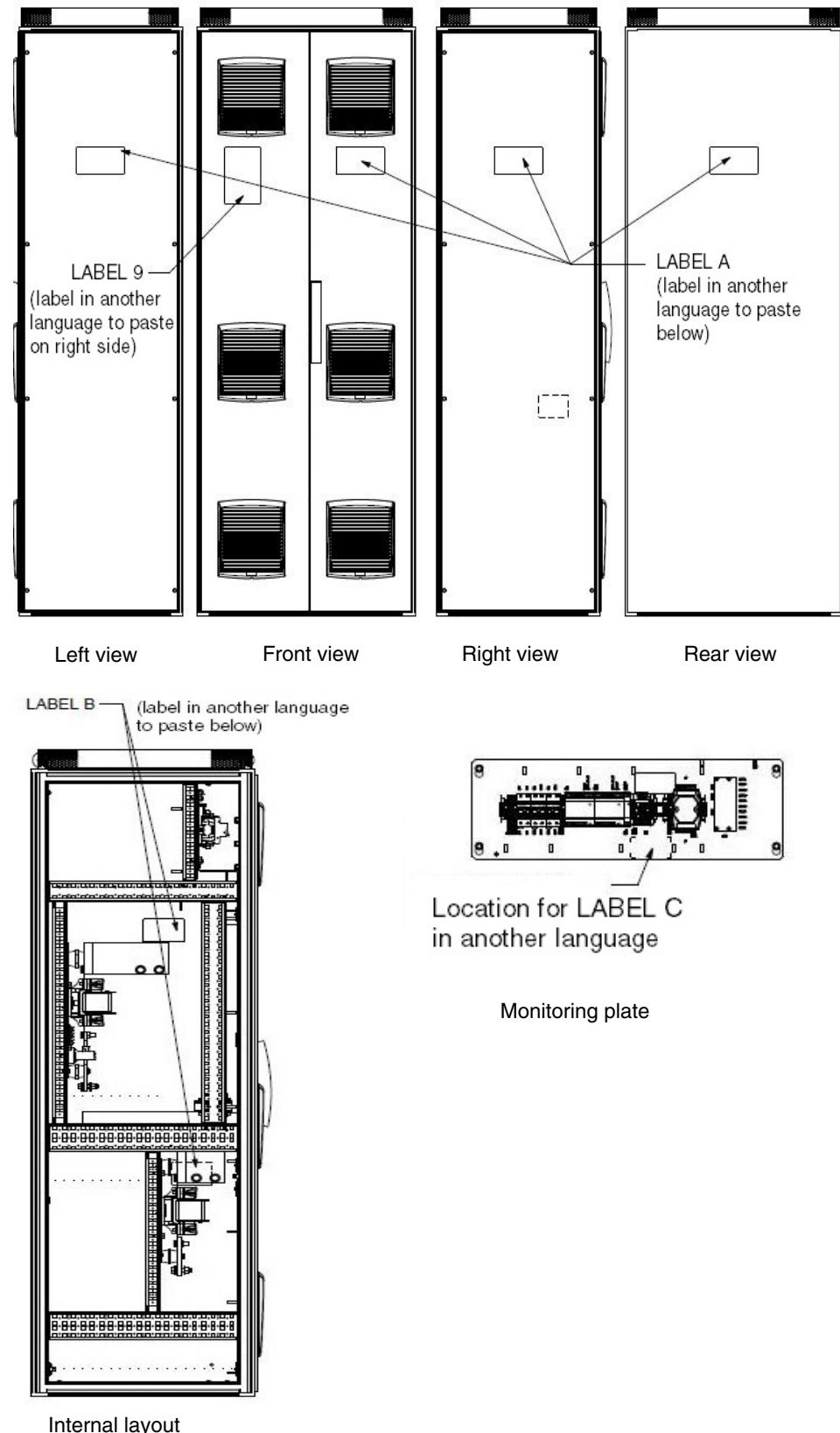


Figure 1-5 Location of safety labels

2

Product Description

Chapter 2 contains a description of the DC Box including packaging, dimensions, layouts, protection and monitoring.

Packaging Content

The DC Box is delivered in a single packing box, fixed on a pallet by four screws. The single packing box also contains the roof accessories and a fuse removal tool, packaged together and delivered inside the cabinet. For unloading and unpacking information, see “Unloading” on page 4–2.

NOTE: Fuses are not supplied with the DC Box and must be ordered separately (see Table 1-2, “DC Box fuses” on page 1–6).



Figure 2-1 DC Box packaging

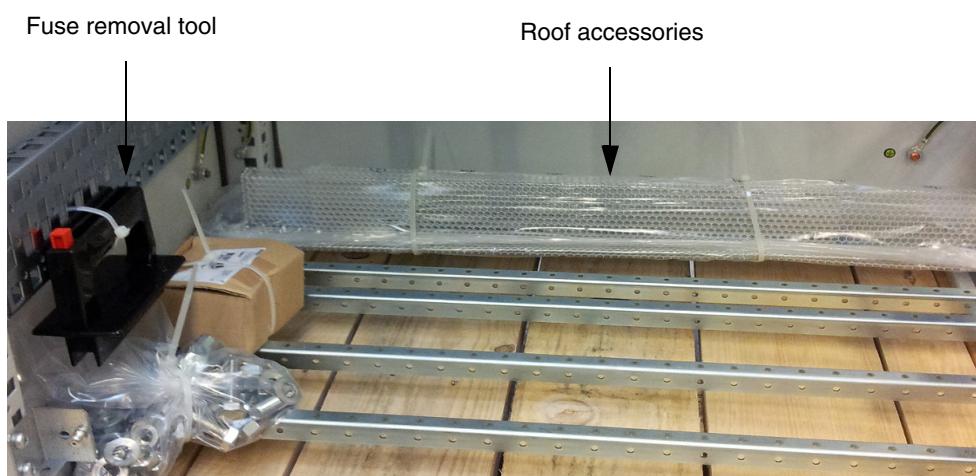


Figure 2-2 DC Box packaging content

Dimensions

Bottom View

Figure 2-3 shows the bottom view of the DC Box with dimensions.

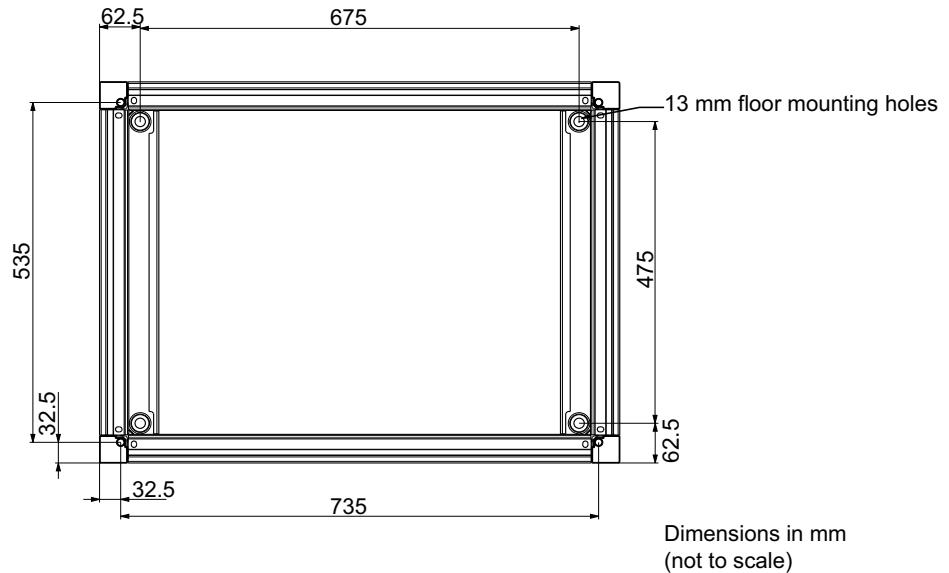
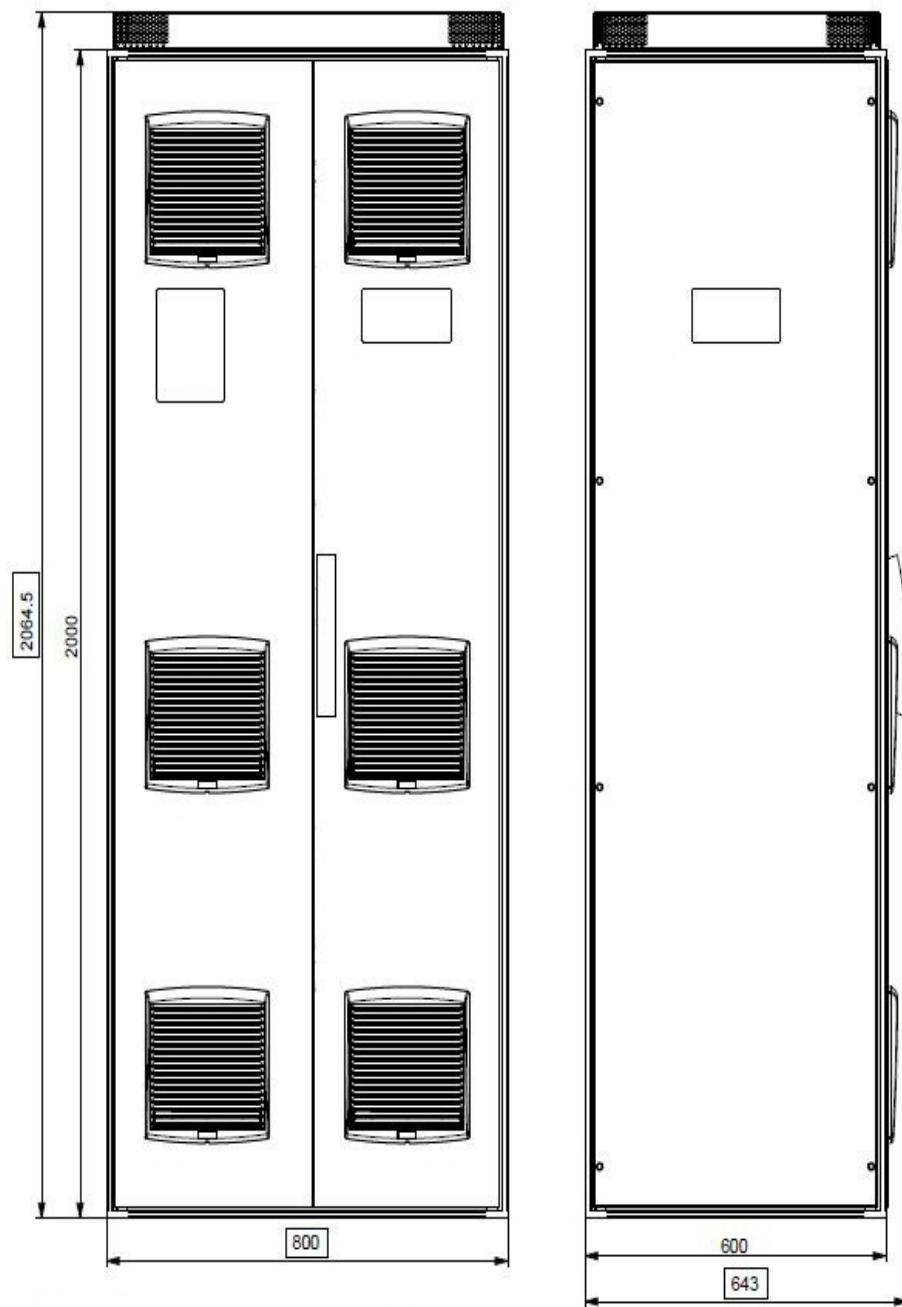


Figure 2-3 DC Box bottom view

Front and Side Views

Figure 2-4 shows the front and side views of the DC Box with dimensions.



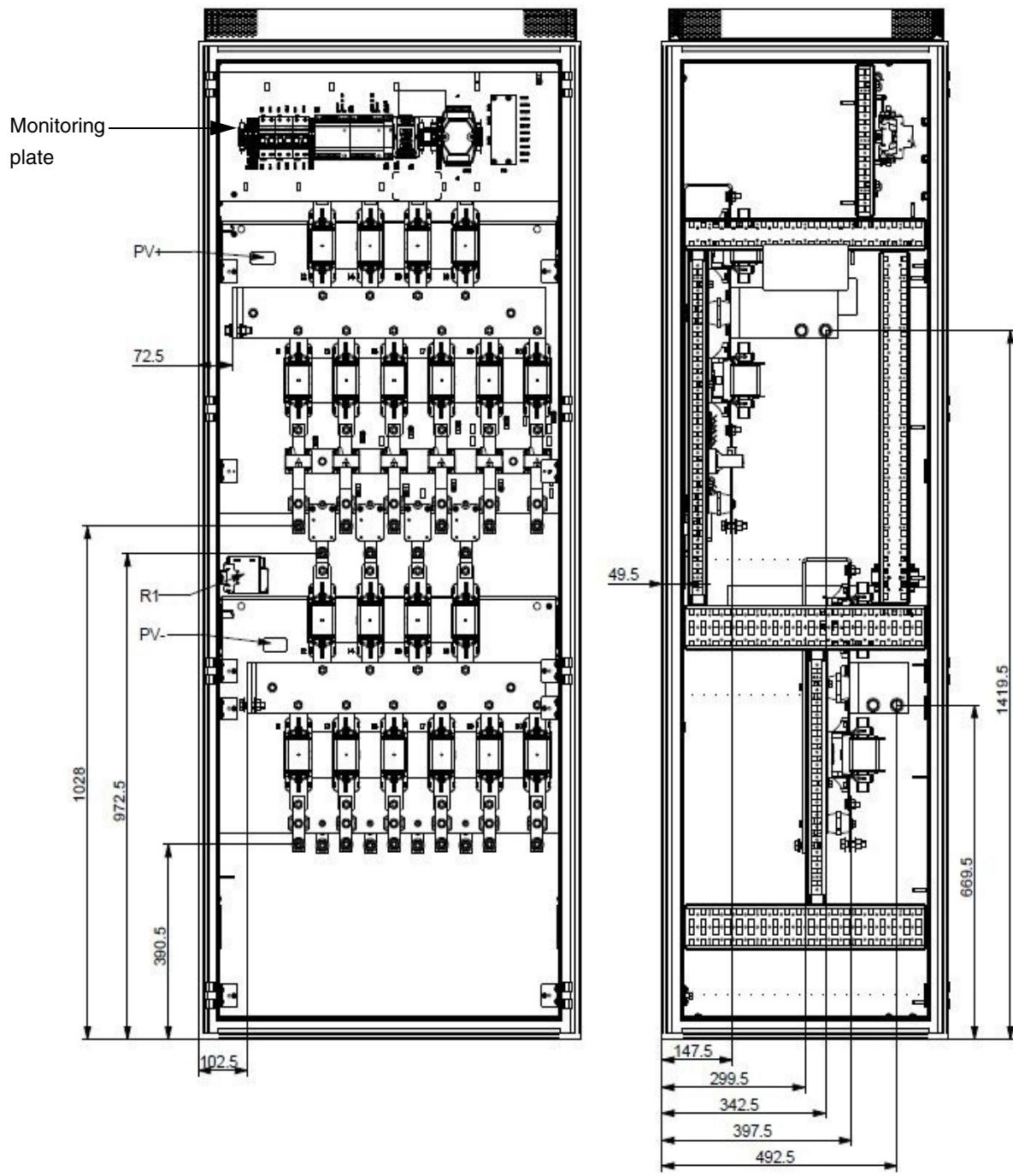
Dimensions in mm
(not to scale)

Figure 2-4 DC Box front and side views

Internal Layout

DC10B Monitored

Figure 2-5 shows the internal layout of the ten-inputs Monitored DC Box.

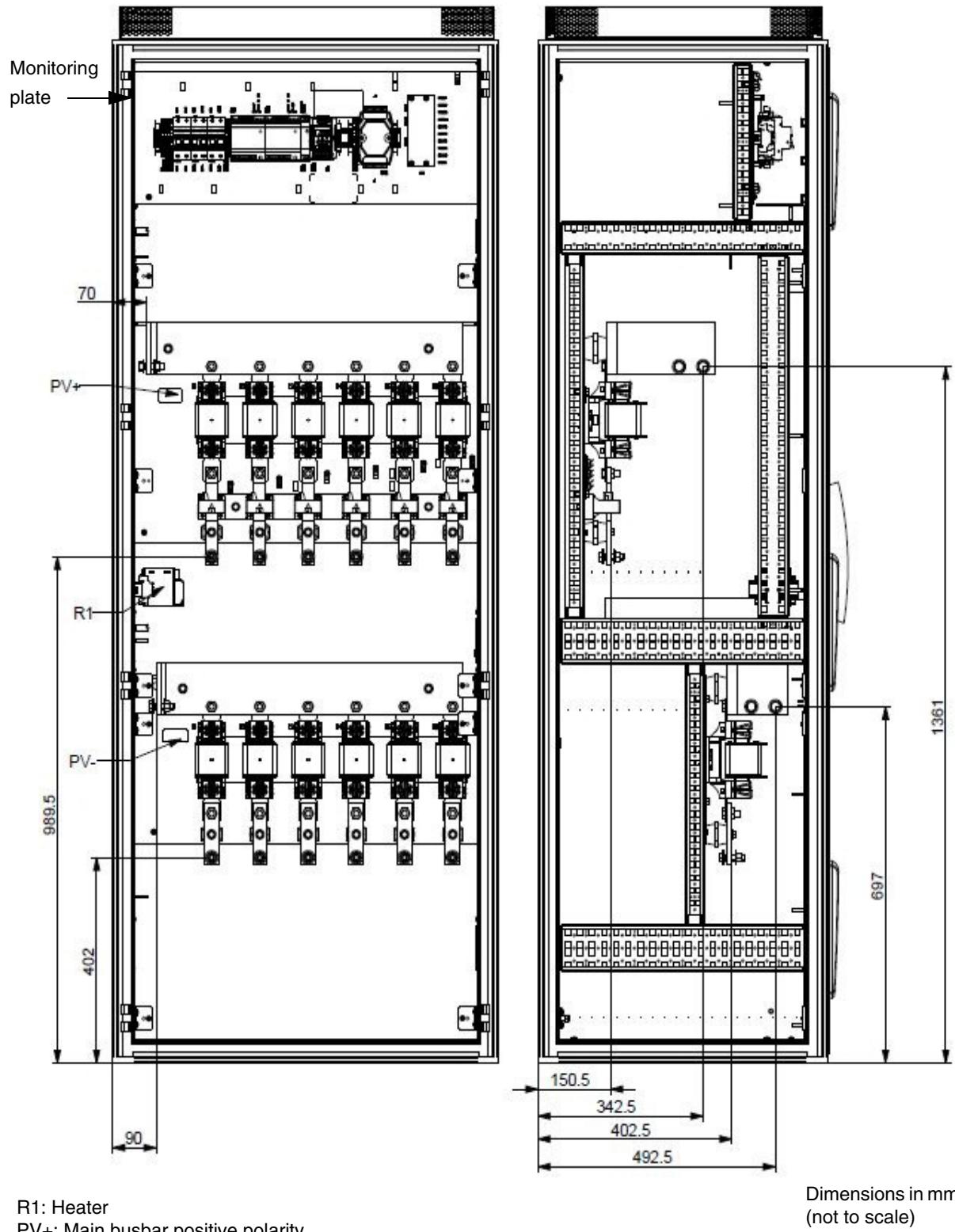


R1: Heater
PV+: Main busbar positive polarity
PV-: Main busbar negative polarity

Figure 2-5 DC10B Monitored internal layout

DC06B Monitored

Figure 2-6 shows the internal layout of the six-inputs Monitored DC Box.



R1: Heater

PV+: Main busbar positive polarity

PV-: Main busbar negative polarity

Figure 2-6 DC06B Monitored internal layout

DC10B Protect

Figure 2-7 shows the internal layout of the ten-inputs Protect DC Box.

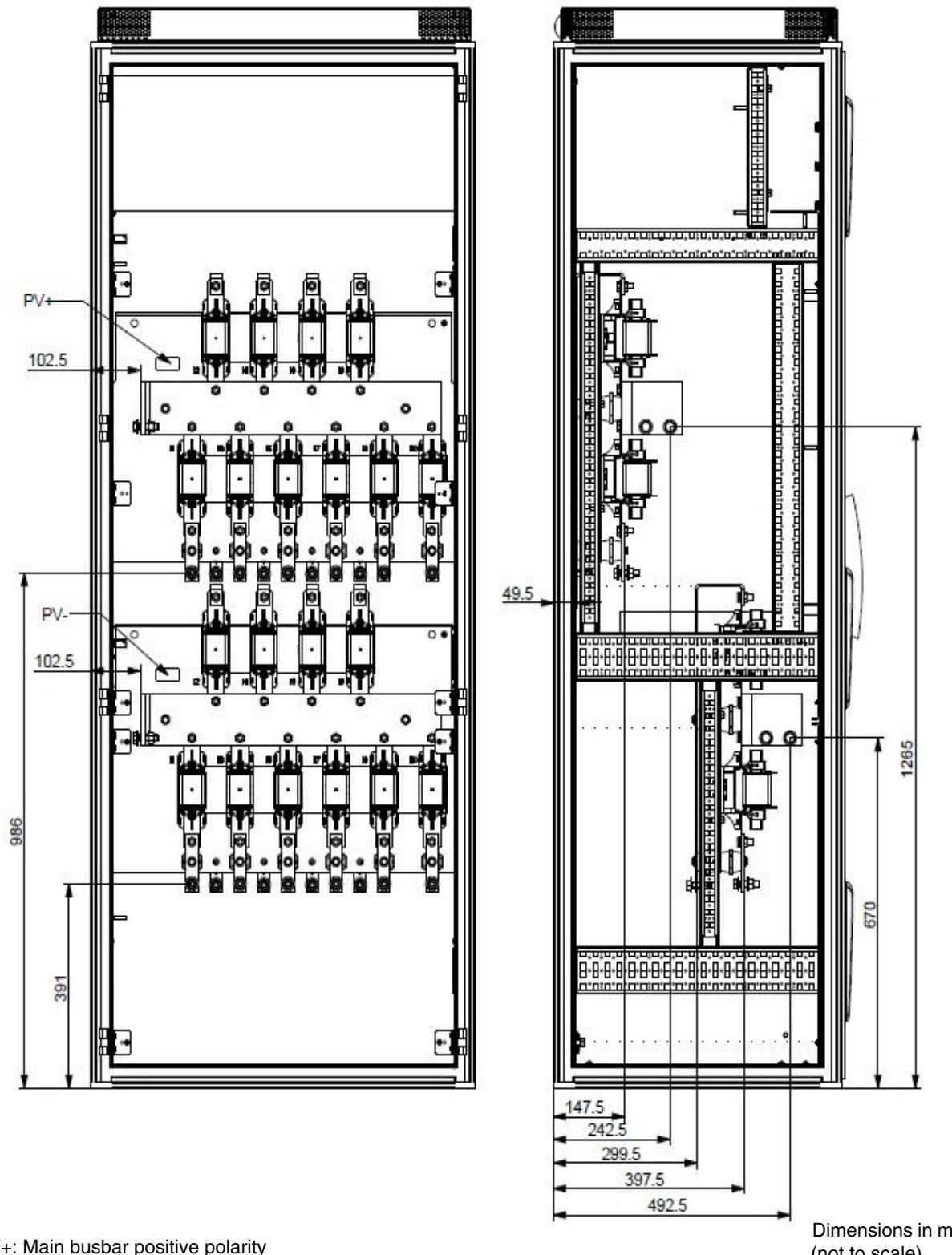


Figure 2-7 DC10B Protect internal layout

DC06B Protect

Figure 2-8 shows the internal layout of the six-inputs Protect DC Box.

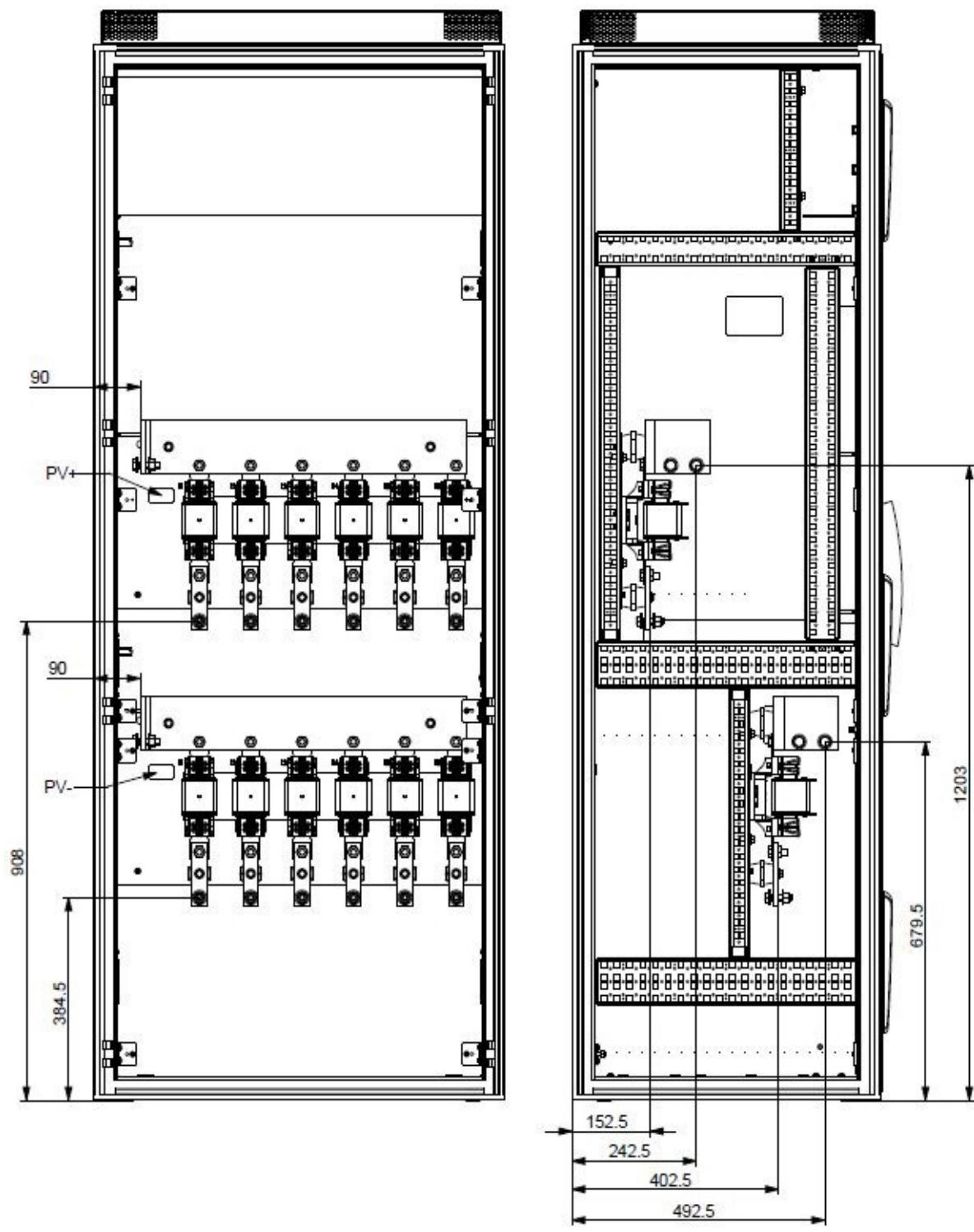


Figure 2-8 DC06B Protect internal layout

Protection

Overcurrent Protection (Array Fuse Protection)

Function	<p>In case of a short-circuit in a PV array (in a string, a string combiner box, or an array cable), a fault current appears in one of the inputs of the DC Box. This fault current is a reverse current that flows from the other PV arrays connected in parallel into the array with the fault current.</p> <ul style="list-style-type: none">• If the short-circuit is in a PV string, the protection integrated in the PV string combiner will operate in the first instance.• If the short-circuit is between the PV string combiner and the DC Box, the fuse protection of the DC Box will become active.
Characteristics	<p>gPV type 1000 VDC fuses designed for photovoltaic applications are fitted in fuse-holders that are located on the negative and positive polarities.</p> <p>The fuse rating must be chosen according to the PV plant characteristics.</p> <p>The DC Box allows the use of 1000 VDC DC gPV fuses from 160 A to 400 A depending on the model.</p>

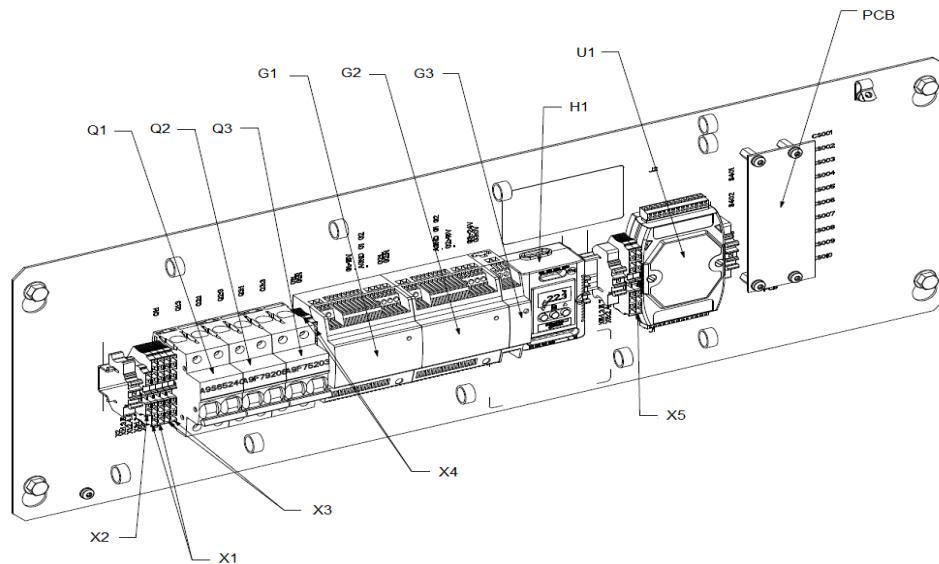
Monitoring

Monitoring Plate

Function

The monitoring plate contains the devices required for the Monitored DC Box models:

- Monitoring module which collects current measurements from sensors located on each positive input and transmits them through a RS485 Modbus communication.
- Hygrotherm to manage the heater function in order to avoid condensation.
- 230 V power supply of these equipments.



X1: 230 VAC auxiliary connection
 X2: Earth terminal for AC power source
 Q1: Main switch for 230 VAC circuit
 Q2: Miniature circuit breaker for auxiliary AC Power
 Q3: Miniature circuit breaker for heater circuit

G1: 15 VDC power supply for current sensors
 G2: 15 VDC power supply for monitoring module
 G3: 24 VDC power supply
 H1: Hygrotherm
 X5: Modbus communication terminal connection
 U1: Monitoring module
 PCB: Connection board for current sensors

Figure 2-9 DC Box monitoring plate

Current sensors

Function Current sensors measure the intensity of the current inside the DC Box. They are supplied by +15 VDC and -15 VDC.

Characteristics

- 0-400 A DC current measuring range
- 0-200 mA signal output
- 2 % full scale accuracy (including all measuring chain).

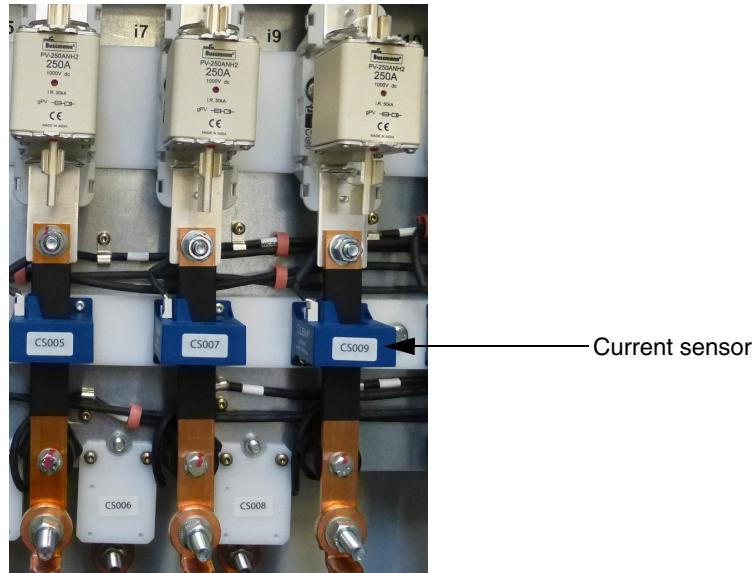


Figure 2-10 Current sensors

Connection Board

Function

The connection board collects the current sensor measurements (0-200 mA signal) and transforms them into a 0-5 V analog signal for the monitoring module input.



Figure 2-11 Connection board

3

Planning

Chapter 3 contains information on requirements that must be met before installing the DC Box.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

- Installation of the DC Box must only be planned and performed by qualified personnel in accordance with all applicable installation codes. See page iii for the definition of qualified personnel.
- The DC Box must be mounted over a non-flammable surface in accordance with the instructions in “Location Requirements” below.

Failure to follow these instructions will result in death or serious injury.

Location Requirements

Before installing the DC Box, check that:

- It is located in a PV shelter, such as the PV Box, next to the DC cabinet of the inverter.
- It is not installed in the vicinity of flammable materials.
- It is fixed to the floor of the PV shelter.

PV Shelter Requirements

Establish and maintain the following conditions to help facilitate safe and efficient installation, operation, and servicing of the DC Box.

Ventilation

The DC Box has open sections in the bottom of the cabinet and six ventilation openings in the front of all cabinets. Additionally, there are exhaust openings at the top of all cabinets.

Flammability

To help reduce the risk of fire, install the DC Box over a non-flammable surface below the cabinet and extending in front of the cabinet for 1 m (39½ in.). That area under and in front of the cabinet must be kept clear of flammable materials while the DC Box is operating.

Clearance

Maintain a minimum clearance of 80 cm (31.50 in.) in front of the DC Box—or more if required by local codes for service clearance—for air intake, maintenance, and serviceability. Maintain a minimum of 300 mm (11¾ in.) clearance above the DC Box.

Accessibility

Make sure the site is fork-lift accessible. A customer-supplied fork-lift and licensed fork-lift operator are required to move the DC Box that is delivered fixed to a pallet.

Cabling

External cabling enters the DC Box from the bottom. Use appropriate conduits and fittings based on local electrical codes.

IP rating

The DC Box has an ingress protection rating of IP20 (except from the bottom plate). The installation location must meet the physical and environmental specifications listed in Table A-3 on page A-3.

Heat load

The heat load of the DC Box is 500 W maximum at full load. External ventilation or air conditioning must be designed to keep the ambient air outside of the cabinet to a maximum of 55 °C (130 °F).

Air intake quality

The intake for the DC Box is located at the bottom and on the front. The intake airflow should meet the requirements of the environmental specifications listed in Table A-3 on page A-3.

Conduit Entry

Conduit and cable entry is from the bottom of the DC Box. Six metal cable support crossbars are placed in the bottom of the cabinet to fix incoming cables. The cable tie bars can be moved according to requirements.

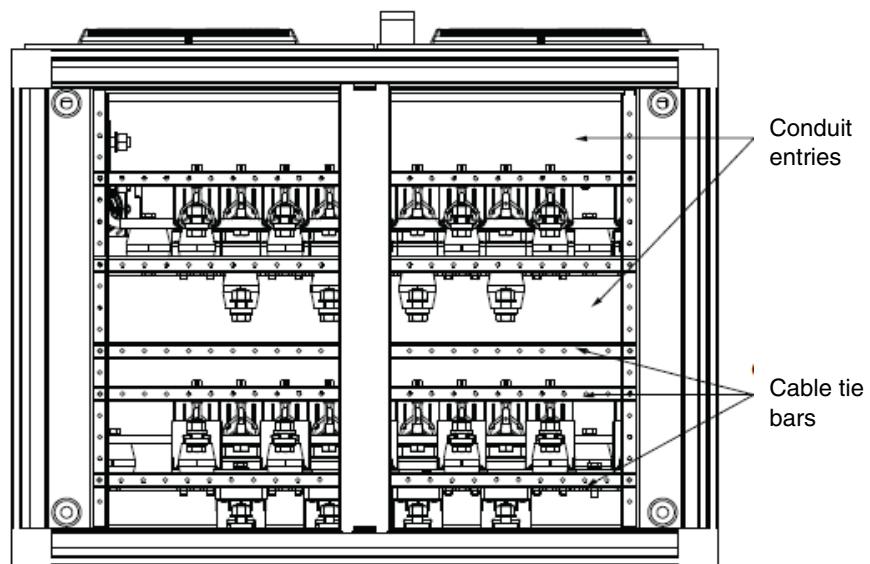


Figure 3-1 DC Box bottom view with conduit entries

Conductor size must be pre-determined when the conduit is installed and must be based on local code requirements.

The dimensions of the trench must take into account bend radius restrictions as specified by the cable supplier.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Ensure that the bend radius of the cables in your installation is compatible with the cables' minimum bend radius specification to ensure that no strain is applied on the cables.
- DC cables must be aligned with the connection point (see Figure 2-5 to Figure 2-8).

Failure to follow these instructions may result in damage to equipment.

  **DANGER**

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- The circuits provided for use with external communications and control equipment are designed to provide isolation from neighboring hazardous circuits within the DC Box. The communications and control circuits are classified as Safety Extra Low Voltage (SELV) and must only be connected to other SELV circuits of the types described in this manual. Separate wire entries must be provided for the communications and control circuits and the PV circuits and all AC circuits. See the DC Box Maintenance Manual for proper maintenance of safety isolation for wiring related to these circuits.
- Physical and electrical separation of the communications and control circuits from non-SELV electrical circuits must be maintained both within the DC Box and external to the DC Box.

Failure to follow these instructions will result in death or serious injury.

4

Installation

Chapter 4 contains information on installing the DC Box, including unloading, mounting, and wiring the DC Box.

DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- To be installed and serviced only by qualified personnel equipped with appropriate personal protective equipment and following safe electrical work practices.
- Energized from PV array while exposed to light, backfeed from the DC output circuit, and possibly an auxiliary AC source (if used).
Before servicing, removing any panel or safety barriers:
 - Consult system diagram to identify all sources.
 - De-energize, lock-out and tag-out all sources following the procedure in the manual.
- Verify de-energization using suitably rated meters. Refer to the DC Box manual for details.
- Do not energize unless all internal safety barriers (clear plastic covers) are installed.
- To be installed over a non-combustible surface. Refer to the DC Box manual for details.

Failure to follow these instructions will result in death or serious injury.

Unloading

⚠ DANGER

HAZARD OF CRUSH INJURY AND EQUIPMENT DAMAGE

- The DC Box weighs approximately 195 kg (430 lb) to 225 kg (496 lb), including the packing crate and pallet (without fuses). Attempting to lift or move the DC Box by other than the recommended lifting points and methods could cause the DC Box to drop unexpectedly or fall over.
- Keep all the doors closed and latched when moving the DC Box.
- Use appropriately rated lifting equipment.

Failure to follow these instructions will result in death or serious injury and/or damage to equipment.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Before proceeding with the installation, determine the location and layout of the components, conduit penetration locations, conductor and conduit sizing, and method for anchoring the DC Box.
- Make sure adequate space is provided for clearance, ventilation and serviceability. See Chapter 3, “Planning” before proceeding.

Failure to follow these instructions will result in damage to the equipment.

Removing the DC Box from a Truck

To load or unload the DC Box from a truck, use a fork-lift to lift the DC Box, inside the packing crate, from either the left or right end.

Removing the DC Box from the Pallet

To remove the DC Box from the pallet:

1. Check the wooden shipping crate for any damage.
2. Disassemble the shipping crate and remove the shrink-wrap and tarpaulin from the DC Box.
3. Open the DC Box using the key provided and remove the packaging contents (roof accessories) from the cabinet (see Figure 2-2, “DC Box packaging content” on page 2-2).

4. Remove the four connecting screws attaching the DC Box to the pallet using a standard Phillips screwdriver n° PZ 2x100.

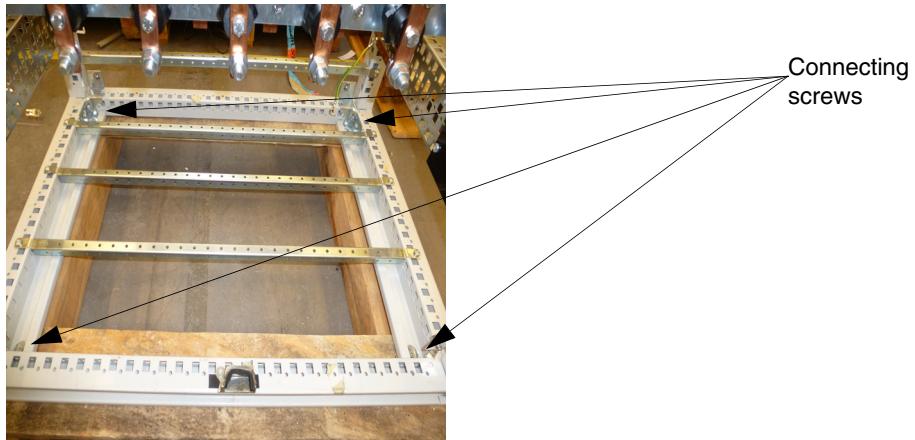


Figure 4-1 Removing the DC Box from the pallet

5. Close and lock the door of the DC Box using the key provided.

Mounting and Anchoring the DC Box

⚠ WARNING

HAZARD OF FIRE

Install the DC Box on a nonflammable surface and anchor it.

Failure to follow these instructions can result in death or serious injury.

The mounting surface upon which the DC Box is anchored must be structurally designed to meet any applicable local codes for weight bearing and seismic requirements.

Four 13 mm (0.52 in.) holes are provided on the bottom of the cabinet for anchoring to the mounting surface. Figure 2-3 on page 2-3 depicts the layout pattern of the DC Box anchoring holes. The mounting surface must either be pre-drilled to accept masonry anchors or have pre-installed anchoring bolts.

To mount and anchor the DC Box:

1. Drill the floor or pad to accept masonry anchors unless it has pre-installed anchoring bolts that will fit the 13 mm (0.52 in.) mounting holes (see Figure 2-3 on page 2-3).
2. After removing the connecting screws, connect an appropriately rated crane to the four lifting eyebolts on the top of the cabinet.
3. Lift the DC Box into place in the PV shelter, following the lifting safety recommendations.

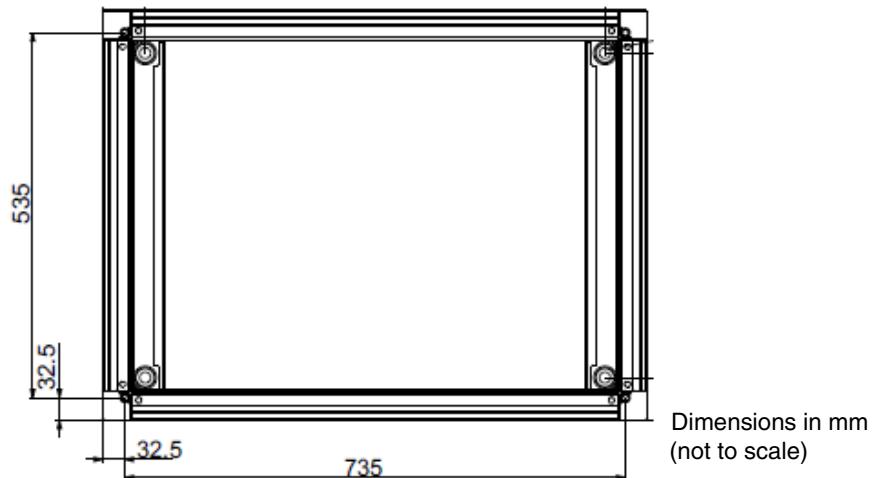


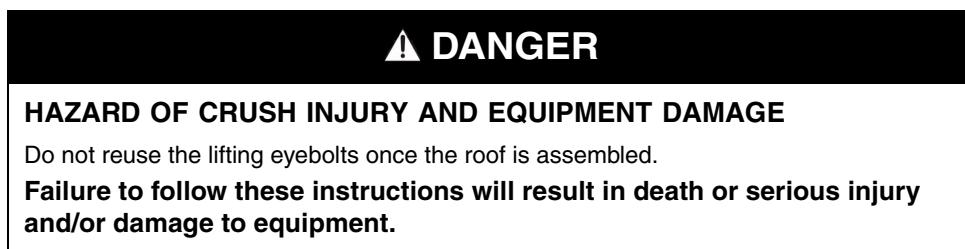
Figure 4-2 Dimensions for lifting the DC Box

4. Secure the cabinet to the floor.
5. Check that the DC Box is horizontally aligned using a spirit level.

Assembling the Roof of the DC Box

To assemble the roof of the DC Box in the PV shelter:

1. Once the DC Box is secured in its final mounting location according to the procedure “Mounting and Anchoring the DC Box” on page 4–3, remove the lifting eyebolts.
2. Remove the shrink-wrap, the fuse removal tool and the fixing screws from the roof accessories (four metal plinths with ventilation holes and four spacers).
3. Assemble the four metal plinths with ventilation holes, four spacers, and roof on the top of the cabinet, as shown in Figure 4-3.



4. Torque to 3 Nm.

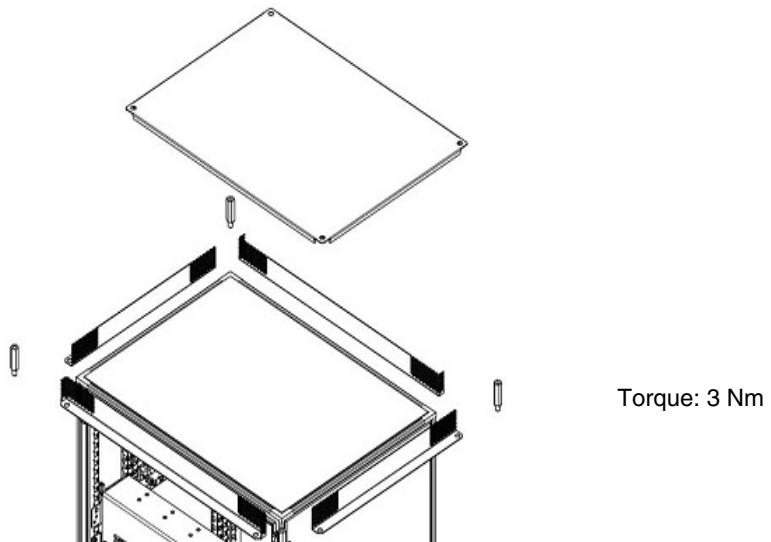


Figure 4-3 Assembling the roof of the DC Box

Wiring Requirements

DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- LOTO the DC Box following the “Lock-out and Tag-out Procedure” on page xviii to ensure that the cables to be connected are de-energized.
- Check that all wiring methods and materials are in accordance with applicable electrical installation codes.

Failure to follow these instructions will result in death or serious injury.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Check that the bend radius of the cables in the DC Box is compatible with the cable's minimum bend radius specification to ensure that no strain is applied on the bus bars.

Failure to follow these instructions may result in damage to equipment.

Conductor Termination

The DC Box has terminals and bus bars to make all wiring connections required for the installation.

Terminals used for making AC connections require the use of a cable with three conductors (L, N, PE), 1.5 to 6 mm² (0.06 to 0.23 sq in.) cross-section, with a minimal voltage rating of 250 VAC and a minimal insulation temperature rating of + 70°C (158 °F).

The bus bars used for making DC connections require the use of single cables up to 300 mm² (11.8 sq in.) cross-section with a minimal voltage rating of 1000 VDC and a minimal insulation temperature rating of + 90 °C (194 °F).

NOTICE

HAZARD OF EQUIPMENT DAMAGE

If the cables are rated 90 °C (194 °F) or higher, base the wire size on the requirements for 70 °C (158 °F) to help prevent excessive heating of the bus bars, terminals and connected devices.

Failure to follow these instructions will result in damage to the equipment.

Auxiliary AC Wiring

The auxiliary AC input wiring connects to the terminals identified as X1 (X1:1 and X1: 2) for line and neutral and to the terminal X2 for PE. These terminals require a crimp-on ferrule properly sized for the wire and accommodate one wire per terminal (see Figure 4-5 on page 4-8 for the location of these terminals and Table A-7 on page A-7 for bolt sizes and torque values).

DC Wiring

The PV wiring connects to the PV bus bars identified as I1 to I10 (+ and -) for the inputs, and as PV+ and PV- for the outputs. These terminals require the use of a crimp-on type ring terminal or compression-type lug properly sized for the wire using a tightening torque of 50 Nm and M12 hardware (delivered with the product=).

Keep the cables close together as much as possible and make sure they pass through the same conduit fittings and entry point in the floor of the cabinet to reduce inductive currents.

Each input bus bar has 1 bolt per pole to connect up to 2 cables. Each output bus bar has 2 bolts per pole, to connect up to 4 cables.

Grounding

The connection point for the DC Box grounding (also known as PE) is a copper stud located at the bottom rear right side of the cabinet and marked with . Connect the earth (ground) isolated cable to the earth (ground) stud using a M8 screw and washer (not supplied with the DC Box).

The ground conductor size depends on the rating or setting of the over-current protection provided for the circuit. Refer to local applicable electrical installation codes for the grounding requirements of your installation.

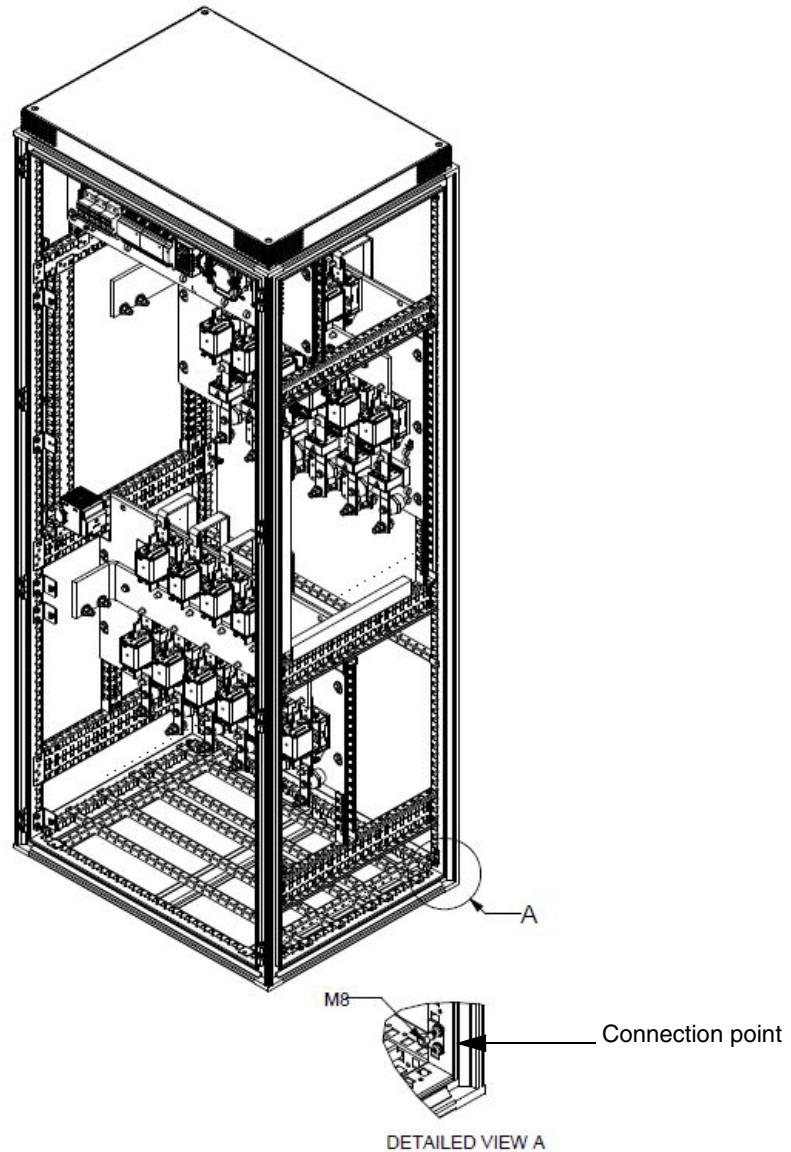


Figure 4-4 Connection point for grounding the DC Box

Connecting the AC External Auxiliary Power Source

The DC Box is supplied with a 230 VAC external auxiliary power source, for example, by an auxiliary power supply cabinet such as the LV Box.

Type of cable X1 terminal has two AC power connection points that accept a conductor with a cross-section of 1 mm² to 6 mm².

Connection **To connect an external auxiliary AC source:**

1. Route the external auxiliary AC source conductors and their ground wire through the access point at the bottom of the cabinet.
2. Connect the external auxiliary AC source ground conductor to the earth (ground) terminal X2 (on the left of X1).
3. Connect neutral external auxiliary AC source conductor to X1:1 and the phase to X1:2.

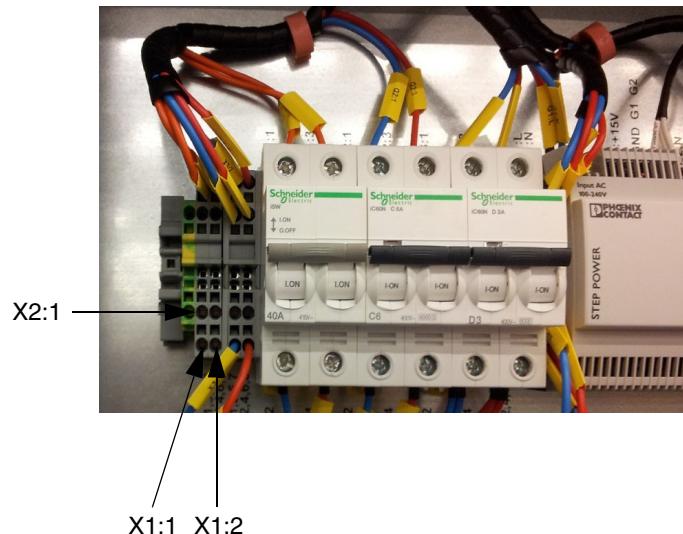


Figure 4-5 Connecting the external auxiliary AC power source

SELV Circuit Connections (Monitored Models Only)

The communication and control circuits are classified as Safety Extra Low Voltage (SELV) and must only be connected to other SELV circuits of the types described in this manual according to the safety guidelines below.

⚠️ ⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- Connect only to SELV circuits.
- The circuits provided for use with external communications and control circuits are designed to provide isolation from neighboring hazardous circuits within the DC Box. The communications and control circuits are classified as Safety Extra Low Voltage (SELV) and must only be connected to other SELV circuits of the types described in this manual. Separate wire entries must be provided for the communications and control circuits and the PV circuits and all AC circuits.
- Physical and electrical separation of the communications and control circuits from non-SELV electrical circuits must be maintained both within the DC Box and external to the DC Box.

Failure to follow these instructions will result in death or serious injury.

Safety Extra-Low Voltage (SELV) is a common designation that refers to a circuit in which the voltages within the circuit and from the circuit to ground have values that are not a shock hazard, under both normal and single fault conditions. This is achieved by the design of the circuits, and by maintaining protective separation (fault-tolerant insulation and isolation) between the SELV circuits and all hazardous voltage circuits, both within the DC Box and in the installation.

Check that the communication and control cables enter the cabinet away from the PV and AC wiring and are routed and mechanically secured away from the PV and AC wiring throughout the length of the communications and control wiring. Maintain no less than 50 mm separation at all points and use the provided cable channels.

⚠️ ⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- Do not attempt to install communication and control circuits wiring in an energized DC Box.
- Follow the LOTO procedure “Lock-out and Tag-out Procedure” on page xviii before proceeding.

Failure to follow these instructions will result in death or serious injury.

Connecting the Communication Cable

⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- Follow the LOTO procedure “Lock-out and Tag-out Procedure” on page xviii before proceeding.

Failure to follow these instructions will result in death or serious injury.

Type of cable RS-485 Modbus communication cable (2-wire shielded twisted pair).

Connection Before connecting the communication cables, read and apply the safety guidelines in the section “Important Safety Instructions” on page xv.

To connect the communication cable:

1. Remove the clear plastic covers.
2. Bare a 2-cm strip on the communication cable.
A wire clip is provided to connect the cable shield to the ground as shown in Figure 4-6 on page 4-11.
3. Connect the D0 and D1 conductors of the Modbus cable on X5. The D0 conductor must be connected on pin 7 and the D1 conductor on pin 8.
4. Use the cable ties to hold the cable in place.
5. Reinstall the clear plastic covers and secure them with the clips.

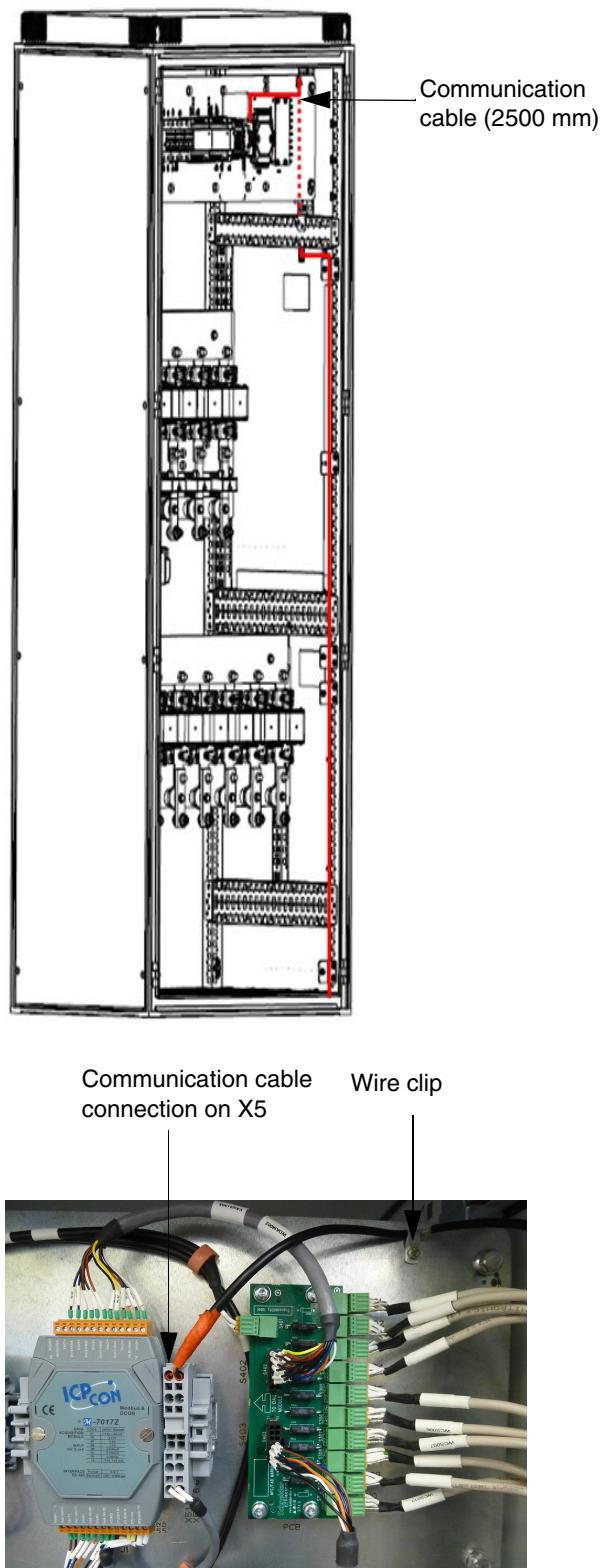


Figure 4-6 Routing the communication cable

Connecting the DC Outputs

Type of cable	Copper or aluminium cable up to 300 mm ² (11.8 sq in.). Up to four cables can be connected per polarity. Voltage rating: 1000 VDC Minimum temperature rating: 90°C
Connection	To connect the DC output cables: <ol style="list-style-type: none">1. Remove the internal safety barriers (clear plastic covers) by unclipping the clips and lifting the barriers up and out.



Figure 4-7 Unclipping the internal safety barriers

2. Route the DC output cables for connection with the inverter DC cabinet through the bottom of the cabinet.
3. Connect the lugs on the cables.
The lugs are not provided with the DC Box. They must be rated for the conductor material (copper or aluminum) and temperature.
4. Connect the cables on the copper bars using M12 screws and washers.

Connecting the DC Inputs

Type of cable	Copper or aluminium cable up to 300 mm ² (11.8 sq in.). If aluminum conductors are used, the installer must provide suitable lugs, rated for aluminum conductors. One or 2 cables can be connected per polarity. Voltage rating: 1000 VDC Minimum temperature rating: 90 °C (194 °F)
---------------	---

Connection

To connect the DC input cables:

1. Remove the internal safety barriers (clear plastic covers) by unclipping the clips and lifting the barriers up and out.
2. Pass the DC input cables coming from the Array Box through the bottom of the cabinet.
3. Connect the lugs on the cables.
4. Connect the cables on the copper bars using M12 screws, nuts and washers. See Appendix A, "Bolt Sizes and Torque Requirements" for torque specifications.

For each pair of Array Box input cables, connect the negative polarity first, and then the positive polarity, taking care to match the Array Box input cables to the same channel.

NOTE: When there are two cables per polarity, connect cables on each side of the input bar, as shown in Figure 4-8.

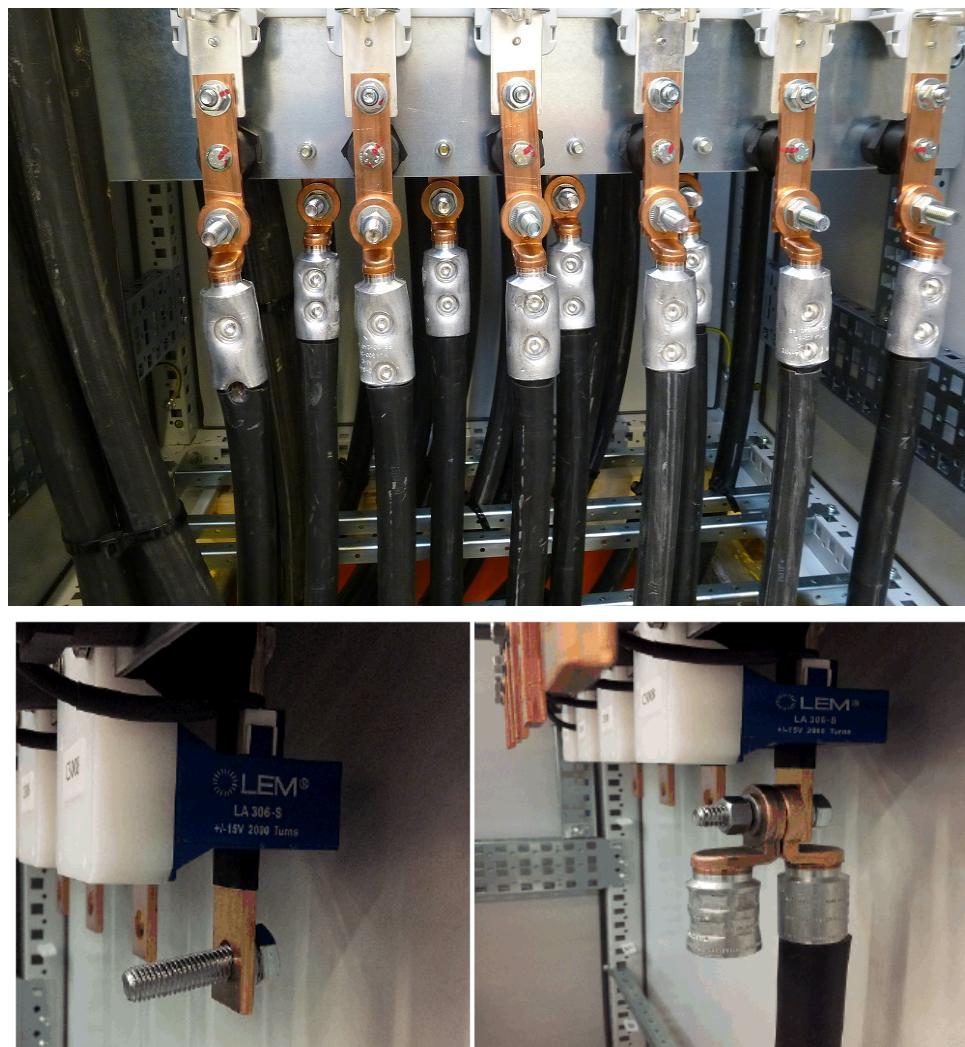


Figure 4-8 Connecting DC input cables

5. Reinstall the internal safety barriers.

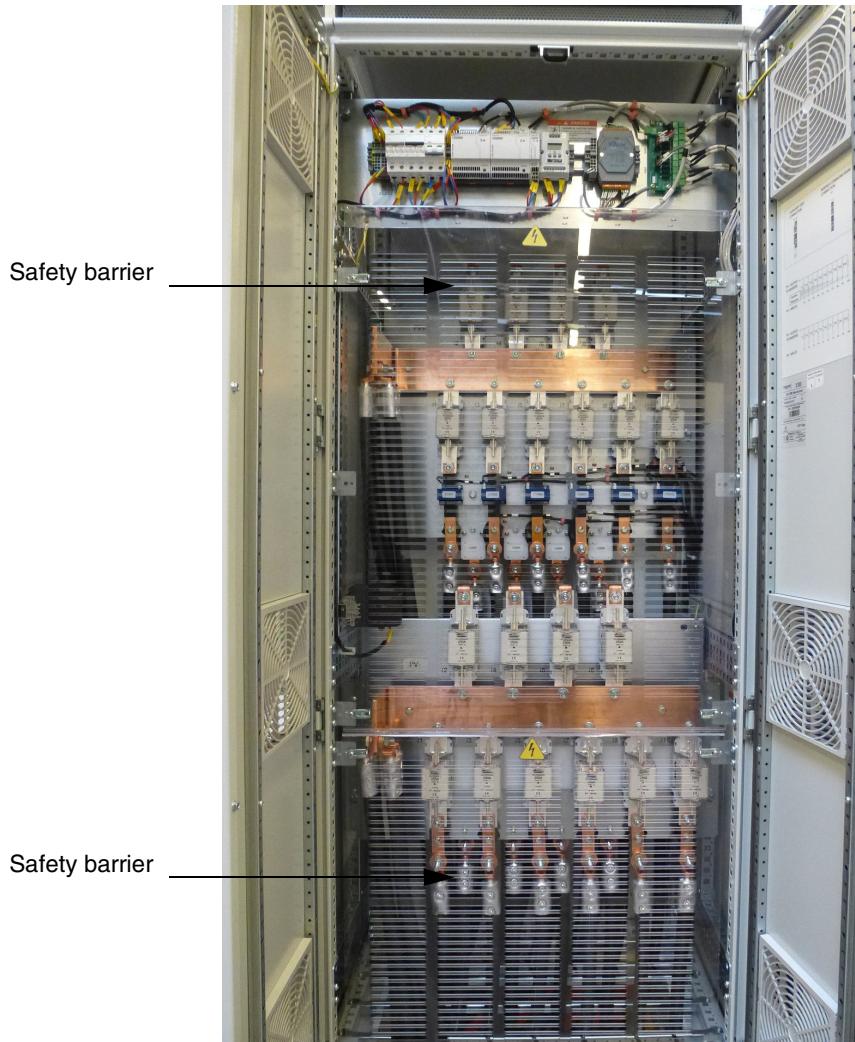


Figure 4-9 Reinstalling the internal safety barriers

5

Commissioning

Chapter 5 contains information on commissioning the DC Box.

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- To be installed and serviced only by qualified personnel equipped with appropriate personal protective equipment and following safe electrical work practices.
- Energized from PV array while exposed to light, backfeed from the DC output circuit, and possibly an auxiliary AC source (if used).
Before servicing, removing any panel or safety barriers:
 - Consult system diagram to identify all sources.
 - De-energize, lock-out and tag-out all sources following the procedure in the DC Box manual.
- Verify de-energization using suitably rated meters. Refer to the DC Box manual for details.
- Do not energize unless all internal safety barriers (clear plastic covers) are installed.

Failure to follow these instructions will result in death or serious injury.

Introduction

This chapter describes how to commission the DC Box. Follow the steps in this chapter sequentially. Do not continue if any of the steps or results are unclear or unsatisfactory. (see chapter 2 “Product Description” on page 1 to identify the DC Box main internal components).

NOTE: The test of the cables connected to the DC input and output is not in the scope of this commissioning procedure. It must be performed by the installer.

Prerequisites

Before commissioning the DC Box, follow the instructions below:

General

Check that:

- The DC box is free of debris or dust
- The commissioning engineer is authorized to access the DC Box
- The auxiliary source is available
- An electrician of the electrical installation company is available
- The Array Boxes are already commissioned and ready to use
- The DC switch at the inverter input is open, locked-out and tagged-out
- Fuses are available but not installed in the DC Box
- Array Box switches are open, locked-out and tagged-out with keys available.

DC Cable Test

Before commissioning, ensure that the DC cables have been tested by the installer. A certificate must be provided with the result of the following controls:

Polarities

Check that each input cable is connected to the corresponding polarity (+ or -) at the connection point of the DC Box input.

Labelling

Check that the polarity and the cable name are indicated as defined in the drawings.

Insulation

Check that the insulation of the cables have been tested.

Torques

Check that the torques from all input and output cables have been checked and marked as defined in the DC Box manual.

Required Tools

Use the following required tools while commissioning the DC Box:

- Complete set of hand tools
- Calibrated torque wrench set with extensions
- DC Current clamp
- Spirit level
- Multimeter with minimum ratings of 600 VAC/CAT IV and 1000 VDC/CAT III
- Test probes intended for use with the selected meter
- Padlocks with 5 mm–8 mm (0.2–0.3 in.) diameter shackle

Commissioning Procedure

This section describes the procedure to correctly commission the DC Box. Several steps are required:

- Recording DC Box identification, see below
- Performing visual inspection, see page 5–4
- Checking AC voltage (monitored models only), see page 5–6
- Configuring the hygrotherm (monitored models only), see page 5–6
- Testing the heater, see page 5–8
- Defining the Modbus address (monitored models only), see page 5–8
- Checking DC voltage, see page 5–8
- Checking temperature, see page 5–10

Record the values measured on the test protocol attached in Appendix A, “Commissioning Test Record”.

Recording DC Box Identification

Record the DC Box identification by writing down the information specified below in the Commissioning test record in Appendix A.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Use only the provided Buss fuse removal tool for manipulating fuses.

Failure to follow these instructions can result in damage to equipment.

To record DC Box identification:

1. Write down the DC Box serial number from the label located on the left door of the cabinet.
2. Write down the site identification which corresponds to the DC Box site location.

Performing Visual Inspection

Perform a visual inspection of the DC Box by checking the points specified below. Write down the result of these checks in Appendix A, "Commissioning Test Record".



To perform visual inspection:

1. Check that there is no external damage on the DC Box.
2. Check that the DC Box is horizontally aligned using a spirit level.
3. Check that the locking system is functional and locking key is present.
4. Check that the safety labels are present and in good condition.
If the labels are in a language other than English, confirm that they have been correctly applied in the right location.
5. Remove the internal protection covers.
6. Inspect the DC Box for internal damage.
7. Check that equipment markings are conform to the installation layout.
8. Check the connection of the grounding system.
9. Inspect the DC Box for loose, disconnected or damaged wires.
Reattach or tighten them if necessary.
10. Check that all power connections have torque marks and that each mark is lined up.

NOTE: A torque mark is a permanent line on a screw, bolt or nut, drawn immediately after the connector is torqued to the correct value.



Figure 5-1 Torque marks

NOTICE**HAZARD OF EQUIPMENT DAMAGE**

If some connectors do not have torque marks or if the torque marks are not lined up, torque and mark them following the specifications in Table A-7, "DC terminal bolt size and torque values" on page A-7.

Failure to follow these instructions can result in damage to equipment.

11. Check all ventilation and serviceability clearances as described in "Ventilation" on page 2 and "Clearance" on page 2.

⚠️ ⚠️ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE**

Do not commission the DC Box if the chassis and the communication cable are not grounded.

Failure to follow these instructions will result in death or serious injury.

For monitored models only:

1. Check that the auxiliary power source wires are connected to X1: 1 and X1: 2.
2. Check that the communication cable is routed correctly and that the cable shield is grounded.

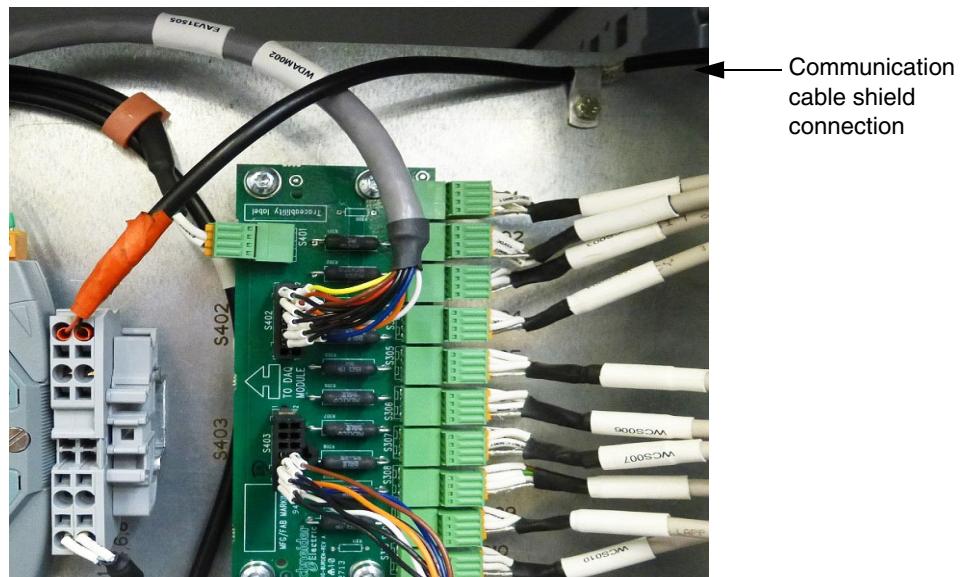


Figure 5-2 Shielding the communication cable

Checking AC Voltage (Monitored Models Only)

Check DC Box AC voltage by following the steps below. Write down the result of these checks in the Appendix A, "Commissioning Test Record".

DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- To be installed and serviced only by qualified personnel equipped with appropriate personal protective equipment and following safe electrical work practices.
- Energized from PV array while exposed to light, backfeed from the DC output circuit, and possibly an auxiliary AC source (if used).
Before servicing, removing any panel or safety barriers:
 - Consult system diagram to identify all sources.
 - De-energize, lock-out and tag-out all sources following the procedure in the DC Box manual.
- Verify de-energization using suitably rated meters. Refer to the DC Box manual for details.
- Do not energize unless all internal safety barriers (clear plastic covers) are installed.
- **Failure to follow these instructions will result in death or serious injury.**

1. Switch on the AC voltage from the external AC source.
2. Check that the voltage is 230 V +/- 10 % on X1: 1 and X1: 2.
3. Close Q1 and Q3.
4. Configure the hygrotherm following the procedure "Configuring the Hygrotherm (Monitored Models Only)" on page 6.

Configuring the Hygrotherm (Monitored Models Only)

The hygrotherm maintains a humidity level compatible with the DC Box internal components by activating the heater when required.

Prerequisites

Before configuring the hygrotherm, check the following points:

- The voltage is 230 V.
- Q1 and Q3 are closed.

NOTE: By default, the hygrotherm is set to operating mode M1 but settings must be changed during commissioning.

Configuration

To configure the hygrotherm:

1. Press the key  for five seconds to access the parameter settings.
2. Using keys  or , select the M1 mode.
3. Press the key  to confirm the value.
M1 is displayed.

NOTE: To exit the settings without saving the changes, wait for 5 seconds without pressing any key.



4. When HF2 is displayed:

- Set the temperature value to -10 °C.
- Set the humidity value to 80 %..

NOTE: Following a mode change, the settings go back to the values entered at the factory. They will be saved as default configuration.

For more information about configuring the hygrotherm, see the related document reference HHH7365840001, section «Operating modes».

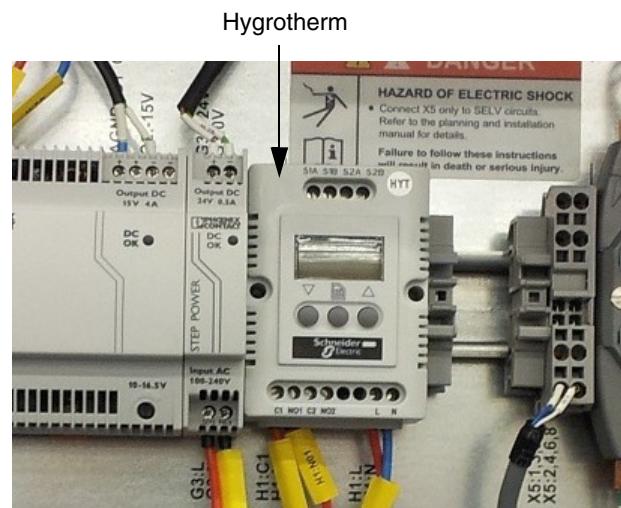


Figure 5-3 Hygrotherm

Testing the Heater (Monitored Models Only)

The heater is connected to the hygrotherm. To test the heater, change its configuration from operating mode to forced manual mode:

1. Press the key . The screen displays the statistics.
2. Press the key  once again and keep the key pressed until you see the «MAn» value on the screen.
3. Press the key  to connect/disconnect the relay 2. The heater is starting.

NOTE: To exit the forced manual mode, press  again.

For more information about testing the heater, refer to the related document reference HHH7365840001, section «Force Manual Operation».

Defining the Modbus Address (Monitored Models Only)

The Modbus address of the DC Box can be set on the Modbus converter from 1 to 247 with the dedicated utility DCON.

NOTE: The default value is pre-configured to 21 (decimal) at the factory.

See Appendix A “Communication Setup (for Monitored Models Only)” on page 8 to configure the Modbus address.

Checking DC Voltage

Check DC voltage by following the steps below:

DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- To be installed and serviced only by qualified personnel equipped with appropriate personal protective equipment and following safe electrical work practices.
- Energized from PV array while exposed to light, backfeed from the DC output circuit, and possibly an auxiliary AC source (if used).
Before servicing, removing any panel or safety barriers:
 - Consult system diagram to identify all sources.
 - De-energize, lock-out and tag-out all sources following the procedure in the DC Box manual.
- Verify de-energization using suitably rated meters. Refer to the DC Box manual for details.
- Do not energize unless all internal safety barriers (clear plastic covers) are installed.

Failure to follow these instructions will result in death or serious injury.

For each Array Box connected to the DC Box:

1. Close the Array Box output DC breaker.
2. Check the polarities DC+ and DC- on the matching DC Box input and the DC voltage with a multimeter with a minimum rating of 1000 VDC/CAT III.

3. Open the Array Box output DC breaker and lock-out and tag-out the Array Box.

Once you have tested all the input cables:

4. Check that there is no voltage on any DC Box input.
5. Mount the fuses using the fuse removal tool (see section “Fuses” on page 6 to select the fuses).
6. Perform the same operations for the next Array Box.

The DC Box is ready to be energized.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Always use the fuse removal tool to mount a fuse in the DC Box.

Failure to follow these instructions can result in damage to equipment.



Figure 5-4 Mounting the fuse

Checking the Temperature

This test aims to detect any possible wrong connections in the DC Box by searching for hot points with a thermal camera. It must be performed when the site is ready for power production.

DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH, EXPLOSION, AND FIRE

- Wear an appropriate personal protective equipment and following safe electrical work practices when approaching live parts in the DC Box.
- Do not approach more than 50 cm (19.7 in.) of any live part while measuring the temperature of the DC Box power connections.
- Do not leave an opened and operating DC Box unattended.
- LOTO the DC Box when installing and removing plastic covers.

Failure to follow these instructions will result in death or serious injury.

Before checking the temperature with the thermal camera, check the following points:

- The clear plastic covers are removed.
- The DC Box is operating at least at 80% of nominal current for the last two hours or more.

To check the temperature:

1. Measure the temperature of each visible power connection with the thermal camera. If some hot points are detected, LOTO the DC Box and check the connection at these points.
2. Replace the clear plastic covers before returning to production.

A

Specifications

Appendix A provides electrical, environmental, and mechanical specifications for the DC Box.

Electrical Specifications

Table A-1 shows the electrical specifications for the DC Box.

Table A-1 Electrical specifications

Specification	DC06B Protect	DC10B Protect	DC06B Monitored	DC10B Monitored
DC Inputs				
Number of inputs	6	10	6	10
Max voltage (in open circuit condition)	1000 V	1000 V	1000 V	1000 V
Max input current (in short circuit condition)	375 A	200 A	375 A	200 A
Max input current @ STC	300 A	160 A	300 A	160 A
DC Output				
Max output current (in short circuit condition)	2000 A	2000 A	2000 A	2000 A
Max output current @ STC	1600 A	1600 A	1600 A	1600 A
Max output current in operation	1280 A	1280 A	1280 A	1280 A
Thermal dissipation in operation @ 1280 A	250 W	250 W	300 W	300 W
AC Supply (for Monitored models)				
Voltage			230/240 V +10/- 15 % @ 50/60 Hz	
Internal consumption (on AC supply)			60 VA 230 VA	
heater not activated				
heater activated				

Regulatory Specifications

Table A-2 shows the regulatory specifications for the DC Box.

Table A-2 Regulatory specifications

Specification	DC06B Protect	DC10B Protect	DC06B Monitored	DC10B Monitored
CE Marking				
LV switchgear assemblies standard			IEC/EN 61439-1 and IEC/EN 61439-2	
LV directive			2006/95/CE	
EMC directive			2004/108/CE	

Environmental Specifications

Table A-3 shows the environmental specifications for the DC Box.

Table A-3 Environmental specifications

Specification	DC06B Protect	DC10B Protect	DC06B Monitored	DC10B Monitored
During Operation				
Ambient temperature	- 10 °C (- 50 °F) to + 55 °C (131 °F) at full power			
Relative humidity	0 to 100 % condensing			
Altitude	0 to 2000 m (78.7 in.) without derating			
Mechanical conditions	Class 3M3 ^a for vibration			
During Transport				
Ambient temperature	-25 °C (-77 °F) to + 55 °C (131 °F)			
Relative humidity	0 to 100 % condensing			
Mechanical conditions	Class 2M2 ^a for vibration			
During Storage				
Ambient temperature	-25 °C (-77 °F) to + 55 °C (131 °F)			
Relative humidity	0 to 100 % condensing			
Mechanical conditions	Class 1 M2 ^a for vibration			

(a): According to IEC/EN 60721 standard series

Mechanical Specifications

Table A-4 shows the mechanical specifications for the DC Box.

Table A-4 Mechanical specifications

Specification	DC06B Protect	DC10B Protect	DC06B Monitored	DC10B Monitored
Enclosure				
Type	Indoor use, metallic cabinet with 2 doors			
Fire withstanding	Self-extinguishing (does not propagate fire during the glow-wire test at 960 °C (1760 °F))			
Color	RAL 7035, grey			
Product				
Dimensions (H x W x D)	2065 x 800 x 600 mm (82 x 32 x 24 in.)	2065 x 800 x 600 mm (82 x 32 x 24 in.)	2065 x 800 x 600 mm (82 x 32 x 24 in.)	2065 x 800 x 600 mm (82 x 32 x 24 in.)
Weight	180 kg (397 lb)	200 kg (441 lb)	190 kg (419 lb)	210 kg (463 lb)
Mounting	Floor-standing in PV shelter			
Degree of protection	IP20			
Resistance to mechanical impacts	IK10			

Functional Specifications

Table A-5 shows the functional specifications for the DC Box.

Table A-5 Functional specifications

Specification	DC06B Protect	DC10B Protect	DC06B Monitored	DC10B Monitored
Protection				
DC inputs overcurrent protection	Protection on both polarities, gPV fuses (fuses not provided with the product, to be ordered separately, see Table 1-2, "DC Box fuses" on page 1-6)			
Overvoltage category	Category II for DC circuit, category III for AC supply			
Electric shock protection	Protective Class I equipment			
Monitoring (for Monitored models)				
DC input currents (one measurement per input)			0 to 400 A, accuracy +/- 2 % full scale	0 to 200 A, accuracy +/- 2 % full scale
Communication	Modbus RTU, RS485			

Connection Specifications

Table A-6 shows the connection specifications for the DC Box.

Table A-6 Connection specifications

Specification	DC06B Protect	DC10B Protect	DC06B Monitored	DC10B Monitored
DC Input				
Cable type	Up to 2 x single cables max per polarity, 300 mm ² (11.8 sq in.) cross-section max			
Connection type	Bolted connection on a bus bar with M12 screws (appropriately rated lugs required for cable conductor material and temperature)			
Wire voltage rating	1000 VDC min			
Wire temperature rating	+ 90 °C (194 °F) min			
Cable entry	From the bottom of the cabinet			
DC Output				
Cable type	Up to 4 x single cables max per polarity, 300 mm ² (11.8 sq in.) cross-section max,			
Connection type	Bolted connection on a bus bar with M12 screws			
Wire voltage rating	1000 VDC min			
Wire temperature rating	+ 90 °C (194 °F) min			
Cable entry	From the bottom of the cabinet			
AC Supply				
Cable type	Cable with 3 conductors (L, N, PE), 1.5 mm ² – 6 mm ² (0.06 – 0.2 sq in.) cross-section			
Connection type	Direct connection on spring terminals X1 for L, N; connection of PE in spring terminal X2			
Wire voltage rating	250 VAC min			
Wire temperature rating	+ 70 °C (158 °F) min			
Cable entry	From the bottom of the cabinet			
Earth (Ground) Terminal				
Cable type	PE cable, 6 mm ² – 25 mm ² (0.2 – 0.9 sq in.)			
Connection type	PE cable connected with M8 lug to earth (ground) stud			
Wire voltage rating	250 VAC min			
Wire temperature rating	+ 70 °C (158 °F) min			
Cable entry	From the bottom of the cabinet			
Modbus Communication				
Cable type	Modbus cable, 1 pair twisted and shielded, diameter 1.5 mm (0.05 in.)			
Connection type	Push-in spring-cage connection, two connections per position, connection on X5, spring terminals			
Wire temperature rating	+ 70 °C (158 °F) min			
Cable entry	From the bottom of the cabinet			

Bolt Sizes and Torque Requirements

Table A-7 shows the bolt sizes and the torques requirements for the DC Box.

Table A-7 DC terminal bolt size and torque values

DC Terminal Connections	# of Terminals	Max # Conductors per Terminal	Bolt (Hardware) Size	Torque Requirements
DC input	Up to 10 (PV+, PV-)	2	<ul style="list-style-type: none">• M12• Use appropriately rated lugs	50 Nm
DC output	2	4	<ul style="list-style-type: none">• M12• Use appropriately rated lugs	50 Nm
Grounding (PE)	1	1	<ul style="list-style-type: none">• M8	

Communication Setup (for Monitored Models Only)

Introduction

The Modbus communication card provides DC current measurements to be read by a monitoring system.

Modbus Functions

Protocol Implementation

The Monitored DC Box supports a Modbus RTU protocol over an RS485 2-wire physical interface.

The Modbus address of the DC Box can be set from 1 to 247 (decimal) with the dedicated utility DCON.

The main communication settings (by default) supported are:

- Speed: 19200 bits/s
- Parity: none
- Bit number 8.

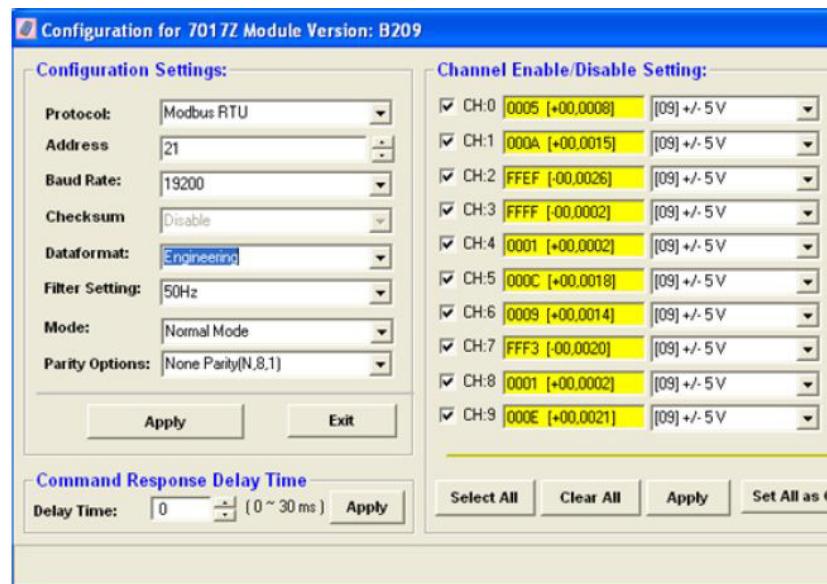


Figure A-1 Communication settings

For more information about the 7017Z converter, visit the website:

- <http://ftp.icpdas.com/pub/cd/8000cd/napdos/7000/manual>

You can download the software from:

- http://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility

Changing the Modbus Address

To change the Modbus address, follow the steps below.

Installing the driver:

1. Connect your PC to X5 connector using the cables included in the part 0J-EAV76337.
2. Download the driver for TCSMCNAM3M002P corresponding to your operating system from the Schneider Electric website.
The Found New Hardware wizard is displayed.
3. Click «Install» from the list or specific location (Advanced).
4. Click «Search» and select the driver to be installed.
5. In the Model menu, select the TSX C USB 485 device.



Figure A-2 TSX C USB 485 device tree-view

If a message is displayed, click «Continue Anyway».

6. Click «Finish». The driver is installed.

Changing the Modbus address:

1. Download the DCON Utility tool from http://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility and install it on your PC.
2. Run the DCON Utility tool.
3. Click the «COM Port» menu.
The screen «Select the COM Port and Baud Rate» is displayed.

4. Select the port assigned to Modbus communications (ex: «COM1»).

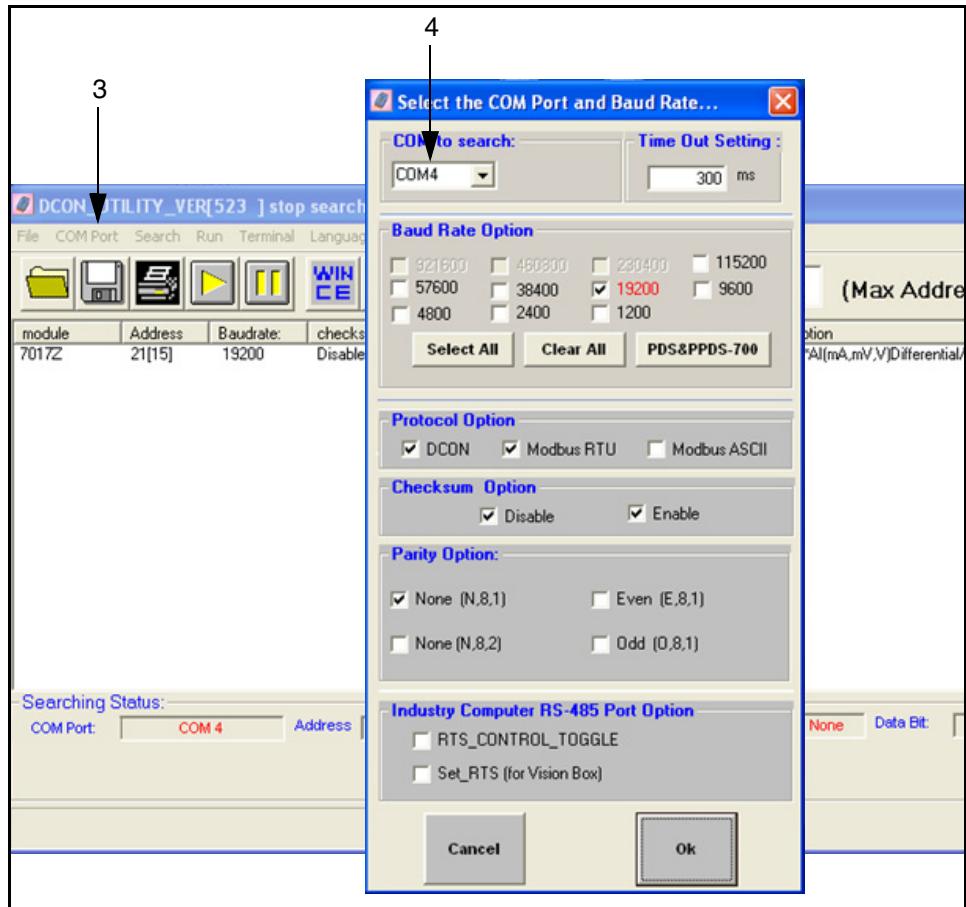


Figure A-3 Selecting the communication port

5. Click «Play» to launch the search.

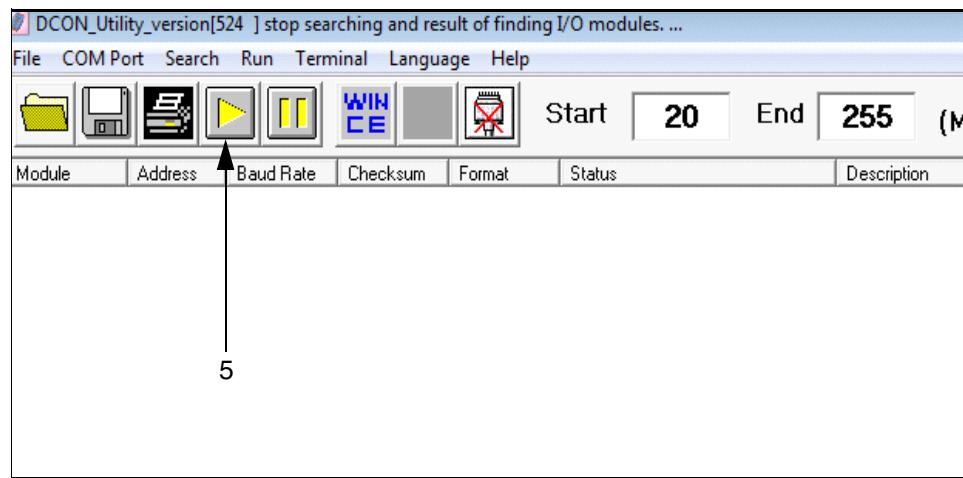


Figure A-4 Launching the search

6. The Modbus converter address appears in the list:

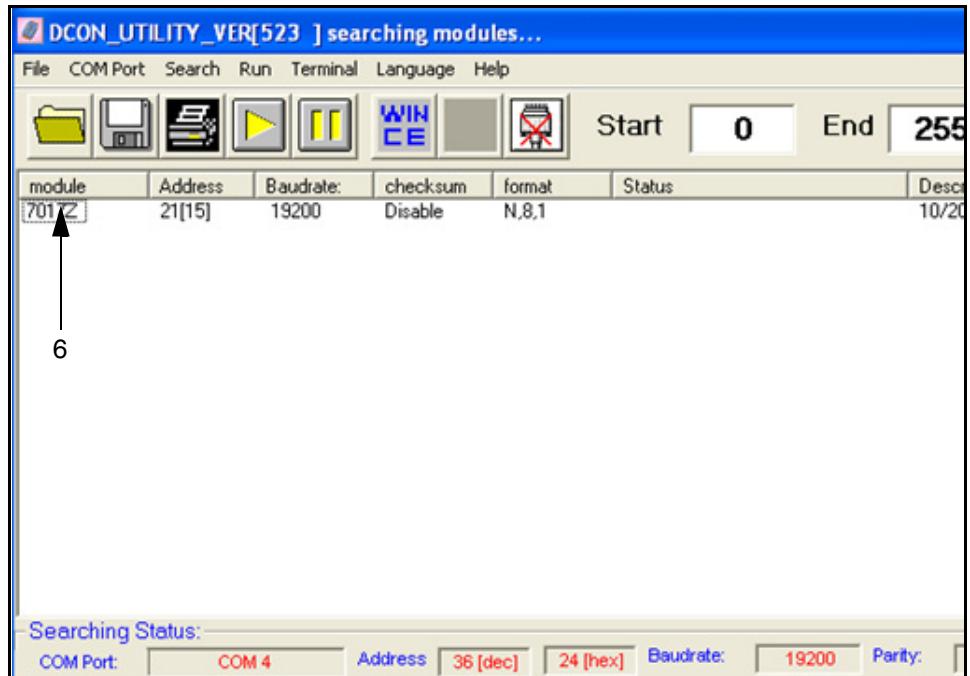


Figure A-5 Modbus converter address

7. Double click the list.
The «Configuration» window is displayed.
8. In the field «Address», enter the corresponding value in decimal format (ex: 21).

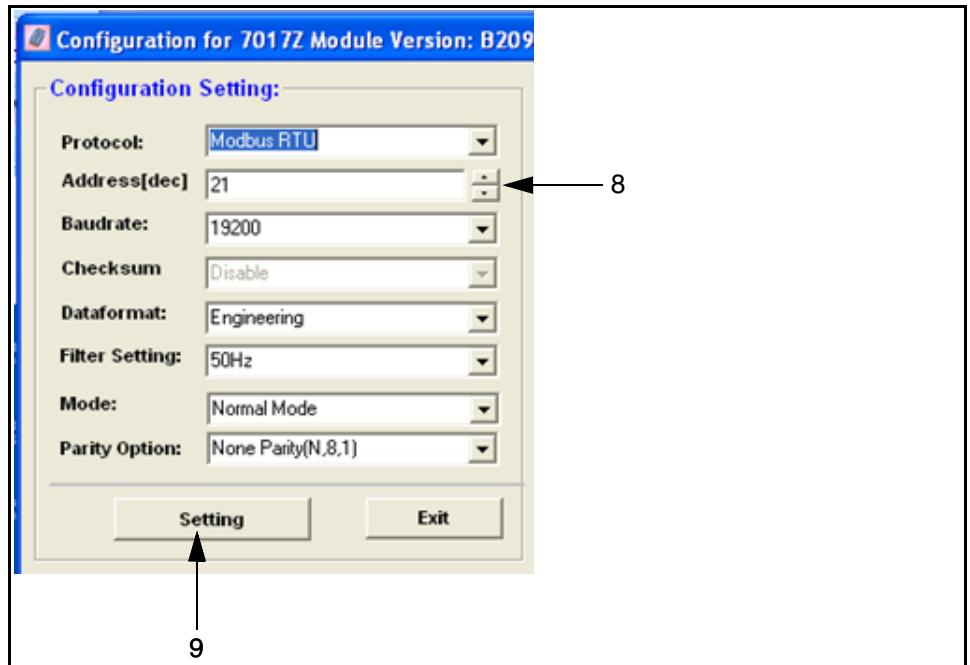


Figure A-6 Configuring the module

9. Click «Setting» to save the settings, then OK in the confirmation popup.

Communication detail

Modbus table

The Modbus table that gives the DC input currents is shown in Table A-8.

Table A-8 Modbus table

Address (decimal)	Description	Attribute																				
10129~ 10138 00129~ 00138	Over/under range status of channel 0 to 9 for 4 ~ 20 mA or 0 ~ 20 mA ranges	R																				
30001~ 30020 40001~ 40020	Analog input value of channel 0 to 19	R																				
40257~ 40276	Type code of channel 0 to 19	R/W																				
40481	Firmware version (low word)	R																				
40482	Firmware version (high word)	R																				
40483	Module name (low word)	R																				
40484	Module name (high word)	R																				
40485	Module address, valid range: 1 ~ 247	R/W																				
40486	Bits 5:0 Baud rate, 0x03 ~ 0x0A <table border="1" style="margin-left: 20px;"> <tr><td>Code</td><td>0x03</td><td>0x04</td><td>0x05</td><td>0x06</td></tr> <tr><td>Baud</td><td>1200</td><td>2400</td><td>4800</td><td>9600</td></tr> <tr><td>Code</td><td>0x07</td><td>0x08</td><td>0x09</td><td>0x0A</td></tr> <tr><td>Baud</td><td>19200</td><td>38400</td><td>57600</td><td>115200</td></tr> </table> Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bits 10: even parity, 1 stop bit 11: odd parity, 1 stop bit	Code	0x03	0x04	0x05	0x06	Baud	1200	2400	4800	9600	Code	0x07	0x08	0x09	0x0A	Baud	19200	38400	57600	115200	R/W
Code	0x03	0x04	0x05	0x06																		
Baud	1200	2400	4800	9600																		
Code	0x07	0x08	0x09	0x0A																		
Baud	19200	38400	57600	115200																		
40488	Modbus response delay time in ms, valid range: 0 ~ 30	R/W																				
40489	Host watchdog timeout value, 0 ~ 255, in 0.1	R/W																				
40490	Channel enable/disable, low word	R/W																				
40492	Host watchdog timeout count, write 0 to clear	R/W																				
40497	Channel enable/disable, high word	R/W																				
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W																				
00259	Filter setting, 0: 60 Hz rejection, 1: 50 Hz rejection	R/W																				
00260	Modbus host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status	R/W																				
00261	1: enable, 0: disable host watchdog	R/W																				

Table A-8 Modbus table (Continued)

00269	Modbus data format, 0: hex, 1: engineering	R/W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status	R/W
00271	1: enable, 0: disable fast mode	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R
00277	1: single-ended mode, 0: differential mode	R/W

NOTE: The measurement per channel is in Volts.

Use the conversion factor x 100 to obtain the measurement in Amperes
(ex: 3 V = 300 A).

Commissioning Test Record

A commissioning test record must be filled out during commissioning operations on site. This tracking sheet indicates the different steps and records to perform.

DC Box Reference	
DC Box Serial Number	
DC Box site ID	

Step 1	Perform Visual Inspection	Yes	No	Details
	DC Box inspected for signs of exterior damage.			
	DC Box inspected for horizontal alignment with a spirit level.			
	Locking system inspected and locking key present.			
	Safety labels inspected for signs of damage.			
	Internal barriers removed.			
	DC Box inspected for signs of interior damage.			
	Equipment markings conform to installation layouts.			
	Grounding system checked.			
	DC Box inspected for loose or disconnected wires.			
	DC Box inspected for damaged wires.			
	Power connections at correct torque values (see "Bolt Sizes and Torque Requirements" on page A-7).			
	Ventilations and serviceability clearances checked.			
	Auxiliary power source wires connected to X1:1 and X1:2 5 (for Monitored versions).			
	Monitored DC Box communication cable routed correctly (for monitored versions).			
Step 2	Environment control	Yes	No	Details
	Heater tested (see "Testing the Heater (Monitored Models Only)" on page 5-8).			
	Hygrotherm configured (see "Configuring the Hygrotherm (Monitored Models Only)" on page 5-6).			
Step 3	Defining the Modbus address	Yes	No	Details
	The voltage is 230 V +/- 10 %.			
	Q1 closed.			
	Default value pre-configured to 21 decimal.			
Step 4	Communication	Yes	No	Details

Modbus address of the board checked.			
Connection of the communication cable checked.			
Temperature tested (see "Checking the Temperature" on page 5–10).			
Step 5	Checking DC voltage	Value	Details

Output cables DC+ and DC-

Routing		
Size		
Number		

Input DC cables from Array Boxes

Input n°1

Size		
Type		
Number		
Polarity test		

Input n°2

Size		
Type		
Number		
Polarity test		

Input n°3

Size		
Type		
Number		
Polarity test		

Input n°4

Size		
Type		
Number		
Polarity test		

Input n°5

Size		
Type		
Number		
Polarity test		

Input n°6

Size		
Type		
Number		
Polarity test		

Input n°7

Size		
------	--	--

Type		
Number		
Polarity test		
Input n°8		
Size		
Type		
Number		
Polarity test		
Input n°9		
Size		
Type		
Number		
Polarity test		
Input n°10		
Size		
Type		
Number		
Polarity test		

Comments

Tested by:		Tested witnessed by (customer):			
Name:		Name		Name:	
Date:		Date		Date:	
Signature:		Signature		Signature:	

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