PVH SOLAR TRACKERS PRODUCT

DBox 5 Operating manual

INTELLIGENCE
BEYOND STEEL

PVH-RD-PD-OPM-0004-05
Rev.: A4

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BY/ POR	APPROVED BY / APROBADO POR	VERSION / VERSIÓN	DATE / FECHA	REASON OF ISSUE/CAMBIOS	
SR	AM	A1	06/2023	First edition	Primera edición
SR	AM	A2	07/2023	Limitation of liability [▸ 5] was updated. DBox 5 dimensions figure was updated.	Se actualiza la sección Limitation of liability [▸ 5]. Se actualiza la figura DBox 5 dimensions.
SR & AL		A3	08/2023	Notices about battery recommendation and battery operation were added. Clarification in Limitation of liability [▸ 5] was added.	Se añaden avisos sobre la recomendación de la batería y el funcionamiento de la batería. Se añade clarificación en Limitation of liability [▸ 5].
SR	AM	A4	11/2023	Content was updated since operation functionalities were defined. Images were updated as well.	Se actualiza el contenido de acuerdo con la definición de funcionalidades. Se actualizan también las imágenes.

Table of Contents

Glossary

DBoard

Electronic board which includes the NFC antenna, EEPROM memory and microcontroller which manages the tracker controller algorithms. It is enclosed in the DBOX.

DBox

PVH tracker controller.

Emergency Stop button

Push-button switch for emergencies situated on the DBox.

EP

Externally powered DBox version.

SCADA

Control system architecture to interface and manage the photovoltaic plant. SCADA enables monitoring and issuing commands through the SCADA computer system.

SP

Self-powered DBox version.

TBox

PVH plant central controller.

Tracker (or solar tracker)

Tracking system considering the structure, photovoltaic panels, and the controller.

Tracker Controller, Controller

Box which manages the motor movement of the solar tracker. Power cables come into the box to feed the motor.

1. Introduction

This document explains all DBox 5 variants:

NOTICE	
	**Read and comply with product installation guide and operational and maintenance manuals.** Otherwise, errors during these processes could occur, leading to personal injuries or product damage.

1.1. Reference documents

CODE	DESCRIPTION
PVH-RD-SY-MAN-0001-01	Controller Solution
PVH-EG-SYS-CONDET-XX.WL.XX-001	Connection Details
PVH-RD-PD-DST-0004-06	DBox 5 Datasheet
PVH-RD-PD-PDT-0004-01	DBox 5 Product description
PVH-RD-PD-ING-0004-01	DBox 5 Installation guide
PVH-RD-PD-SCH-0007-02	Diffuse control kit installation drawings
PVH-RD-PD-MAN-0029-01	Diffuse control kit manual
PVH-RD-PD-MAN-0034-01	Flood kit manual

1.2. Regulatory compliance

Modification statement

PVHARDWARE SOLUTIONS S.L. has not approved any changes or modifications to this device performed by the user. Any changes or modifications could void the user's authority to operate the equipment.

NOTICE	
	**Product regulatory compliance info** Refer to DBox 5 Datasheet for further details about the product certifications.

1.3. Limitation of liability

PVH accepts no liability for erroneous handling or damage to product from PVH or third-party product resulting from disregard of information contained in this documentation.

PVH reserves the right to alter, correct, and/or improve the technical documentation and the products described in this documentation at any time and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress.

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Modifying any of the products or structures by PVH and/or adding external products or infrastructure to them could cause malfunctioning in the system or generate conditions that affect production. In case these recommendations are not followed, PVH does not grant correct functioning and the warranty will be lost.

PVH is not responsible by any means for:

- Damage caused by the erroneous or unnecessary use of the equipment.
- Equipment damaged, dismounted, or manipulated by unauthorized technical service.
- Constant use of loads above the defined in the installation section.
- Damage produced by exceptional temperatures above or below the devices working operating temperatures.
- Lightning, accidents, water, fire, or other situations outside the control of PVH.
- Damage caused by insect infestation or other kinds of infestation or pest, or the action of one or more animals.
- Malfunctioning of tracker system caused by the installation of infrastructure after the construction of the plant.
- Erroneous measurements caused by the poor sensor maintenance and cleaning, and incorrect DBox installation. Consider that this could modify TBox response to adverse weather conditions.

1.4. Handling conditions

When the product is received, before opening it, the condition of its packaging must be verified. In case it is damaged, it must be notified in written form to the transport company or supplier.

When unpackaging, it must be checked that all the requested items are included, and their condition is perfect.

If the unit is not immediately installed, it is convenient to keep it in its original packaging and situated in a ventilated and dry environment.

PVHardware will not be responsible for any improper handling or installation of the devices. Installation must be only executed by trained and professional personnel. Any deviation of this manual will cause personal or device damages and loss of warranty.

Consider that some information in this manual might have been updated, so it is important to be in contact with *PVHardware Support*.

NOTICE	
	**Read and comply with product installation guide and operational and maintenance manuals.** Otherwise, errors during these processes could occur, leading to personal injuries or product damage.

2. Safety information

2.1. Safety messages: danger, warning, caution and notice

- **DANGER** indicates an immediate hazardous situation which, if not avoided, will result in death or serious personal injury.
- **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.
- **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury or damage to the product.
- **NOTICE** indicates a situation where a potential hazard could damage the product. Notice is also used to address practices not related to personal injury but considered as relevant for the system operation.

2.2. Electrical safety

DANGER

Electrical hazard

The voltages used in the Solar Tracking Control System can cause electrical shock or burns and could be lethal. For this reason, precautions must always be taken to the extreme when working with, or adjacent to, the control system equipment. Specific warnings are given throughout this user manual. The user who works with the device must always agree with this manual.

2.3. System assembly warning

The Control System is intended as an ensemble of components for professional incorporation into a complete solar tracking installation.

Close attention to the electrical installation and the system design is required to avoid hazards either in nominal operation or in the event of equipment malfunction.

NOTICE

Technical tasks

Installation, commissioning/start-up, and maintenance must be carried out by personnel with the necessary training and expertise. They must read this safety information and this manual carefully.

2.4. Installation risks

Regarding safety measures during the installation of the equipment:

- If a mechanical or electrical component is damaged, do not use the product and contact your supplier.
- If the installation instructions are not followed correctly, some problems might arise, such as damage to the unit or physical harm.
- The work tools used to install the device should be approved for the job considering the voltage in the system.
- Once the installation has been carried out, the installed units and the cables should not be moved.

- The power cables from the panel to the device cannot be wrongly connected, the connectors are differentiated.
- Use appropriate and well-maintained tools.
- Inspect all equipment regularly for damage. In case the tools are not in good condition, replace them.
- Use personal protective equipment.
- Monitor weather conditions to avoid working during adverse weather.

2.5. Radio Frequency (RF)

In relation to Safety due to the possibility of radio frequency (RF) interference, you must follow all the special regulations that may apply regarding the use of radio equipment. Follow the safety advice given below.

NOTICE

Radio frequency hazard

Operating your device close to other electronic equipment may cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.

2.6. Interference with pacemakers and other medical devices

Potential interference

Radio frequency energy (RF) from cellular devices can interact with some electronic devices. This is electromagnetic interference (EMI). The FDA helped develop a detailed test method to measure EMI of implanted cardiac pacemakers and defibrillators from cellular devices. This test method is part of the Association for the Advancement of Medical Instrumentation (AAMI) standard. This standard allows manufacturers to ensure that cardiac pacemakers and defibrillators are safe from cellular device EMI.

The FDA continues to monitor cellular devices for interactions with other medical devices. If a harmful interference occurs, the FDA will assess the interference and will work to resolve the problem.

Precautions for pacemaker wearers

Based on the current research, devices do not pose a significant health problem for most pacemaker users. However, people with pacemakers may want to take simple precautions to be sure that their device does not cause a problem. If EMI occurs, a pacemaker could be affected in one of the following three ways:

- Stop the pacemaker from delivering the stimulating pulses that regulate the heart rhythm.
- Cause the pacemaker to deliver the pulses irregularly.
- Cause the pacemaker to ignore the heart own rhythm and deliver pulses at a fixed rate.

WARNING

Radio frequency hazard

Keep the device on the opposite side of the pacemaker to add extra distance between the pacemaker and the device. Avoid placing a turned-on device next to the pacemaker.

3. General description

DBox 5 is the next controller generation by PVH, following DBox 4.0. It has been designed to control and monitor the movement of the structure, improving solar tracking and power generation.

NOTICE

DBox 5 information

Refer to DBox 5 data sheet for information on DBox 5 and DBox 5 peripheral devices technical data.

3.1. Physical features

DBox consists of an IP67 electric cabinet prepared for LoRa communications. It has a pressure membrane that ensures the safety of the components inside the enclosure. DBox 5 design allows to reduce both installation and commissioning times.

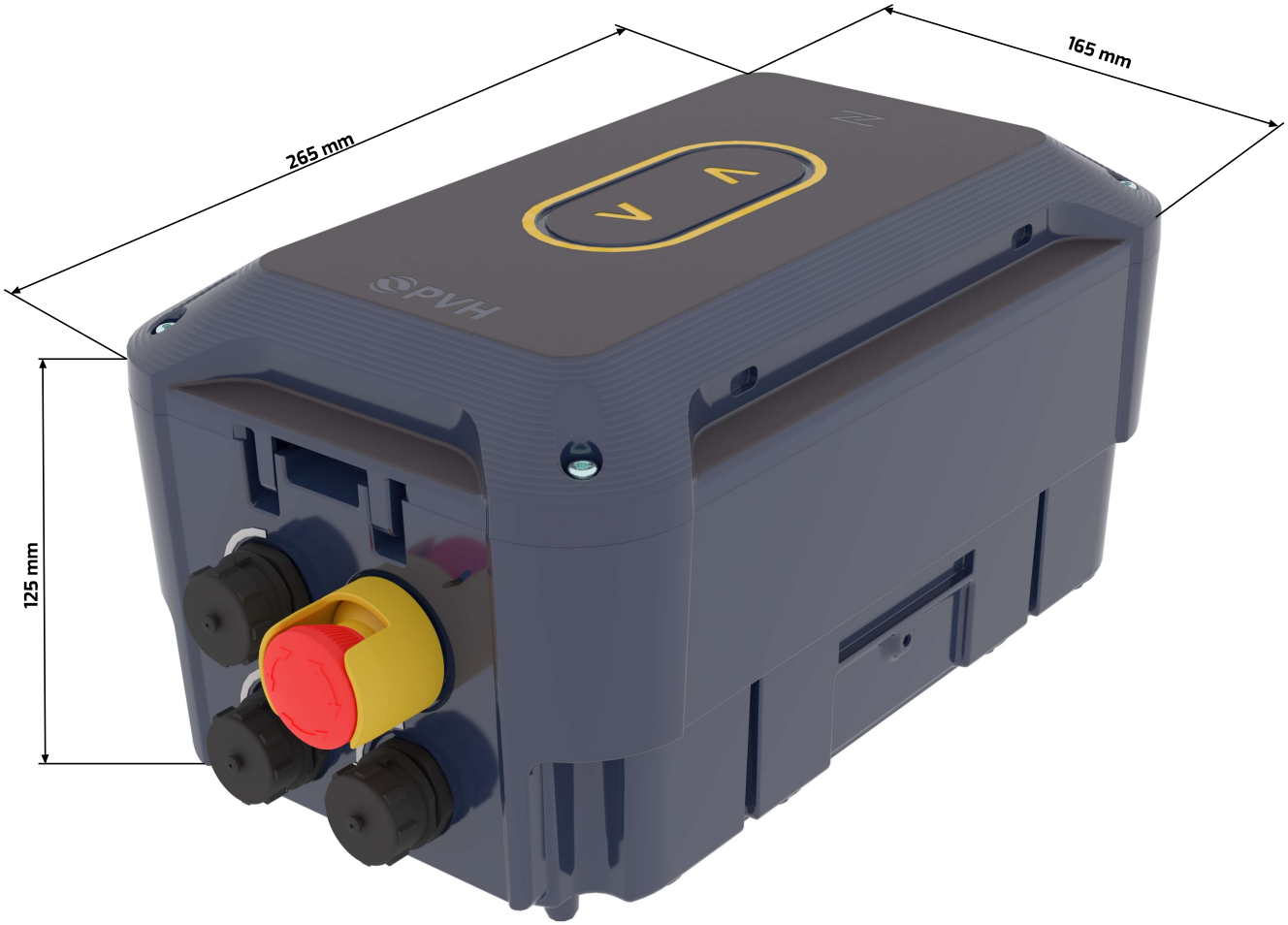


Figure 1. DBox 5 dimensions

Externally, there are two main components: the front panel and the connectors panel.

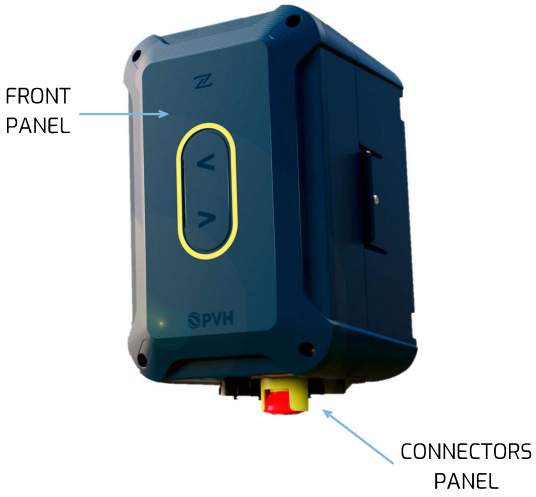


Figure 2. DBox 5 parts

The DBox can operate as a tracker control unit or as a meteorological control unit depending on its commissioning configuration and location on the structure.

Horizontally oriented Front Panel:

- Installed on torque tube.
- DBox functional configuration: tracker controller.

Figure 3. DBox 5 horizontally oriented

Vertically oriented Front Panel:

- Installed on the tower.
- DBox functional configuration: meteorological box.

Figure 4. DBox 5 vertically oriented

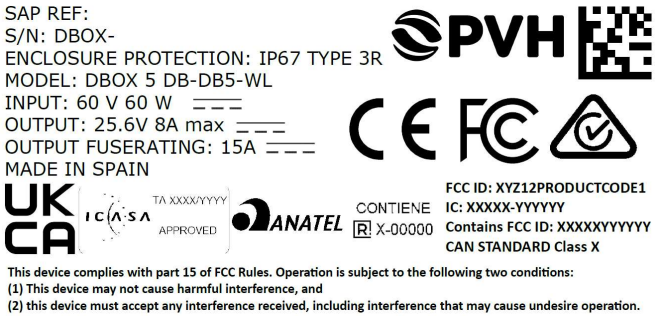
NOTICE

Dbox 5 appearance

The color of DBox 5 casing may vary.

3.1.1. Labelling

DBox 5 label format:



3.1.2. Front panel

The front panel can be vertically or horizontally oriented depending on the DBox functional configuration and location.

It is situated on the cover of the DBox. It is composed of:

1. **Two capacitive buttons** to move the structure (up and down).
2. An **NFC** tag to connect with the Control App which is used as an interface by the user, to control and commission the device by transferring parameters and commands.

NOTICE

PVH app info

Refer to PVH App user manual for information related to the use of the app.

3. **LED indicators** which inform when:
   - An error has occurred.
   - Nominal operation is taking place.
   - The motor is moving.
   - DBox is communicating via LoRa.

NOTICE

LED indicators behavior

The LED indicators behavior is yet to be defined.

Figure 5. DBox 5 front panel parts

1	NFC	2	LED indicators
3	Capacitive button	4	Capacitive button

3.1.3. Connectors panel

The Connectors Panel of the DBox has 3 cable glands for the different cables used to connect the system and a stop button in case of emergency (Red button).

Figure 6. Connectors panel

1	Peripheral device	2	DC motor
3	PV power supply (SP version) / External power supply (EP version)		

3.2. Connections

In **connector 1**, a peripheral device such as an anemometer can be connected through a female connector.

In **connector 2**, the DBox must be connected through a female connector to the motor placed on the structure to move the structure.

In **connector 3**, regardless the DBox 5 version, the power is supplied though a male connector.

Figure 7. Connector