



EKO



PV Blocks


Beyond Accuracy.

The EKO logo is positioned in the upper right corner of the image. It consists of the letters 'EKO' in a white, sans-serif font, with the letter 'O' being a solid white circle.

Introduction

PV Blocks modular
research system for
outdoors PV module
performance evaluation





PV Module performance Outdoors



Monitor performance outdoors (Mpp, Isc, Voc, IV)
Irradiance (GHI, Irr POA, DNI, DHI, Spectral irradiance)
Meteorological parameters (Ta, Tm, RH, P, Ws, Wd)

STC (25°C / 1000W/m²)



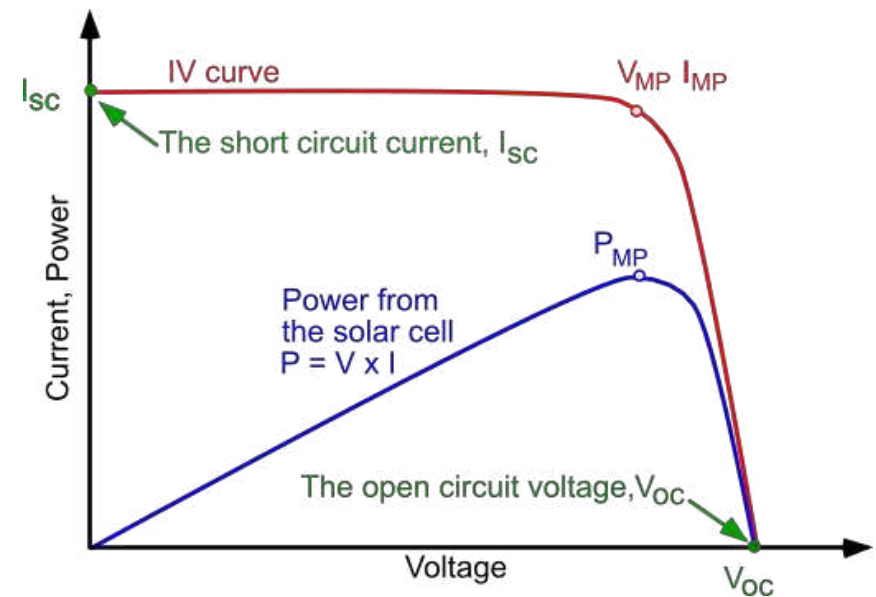
EKO

PV Module Performance

Environmental and atmospheric conditions

- IV (I_{sc} / V_{oc})
- V_p / I_{mp} / P_{max}
- T_{BP}
- I_{rr}

STC is an industry-wide standard to indicate the performance of PV modules and specifies a **cell temperature of 25°C** and an **irradiance of 1000 W/m²** with an **air mass 1.5 (AM1.5)** spectrum. These correspond to the irradiance and spectrum of sunlight incident on a clear day upon a sun-facing 37°-tilted surface with the sun at an angle of 41.81° above the horizon.



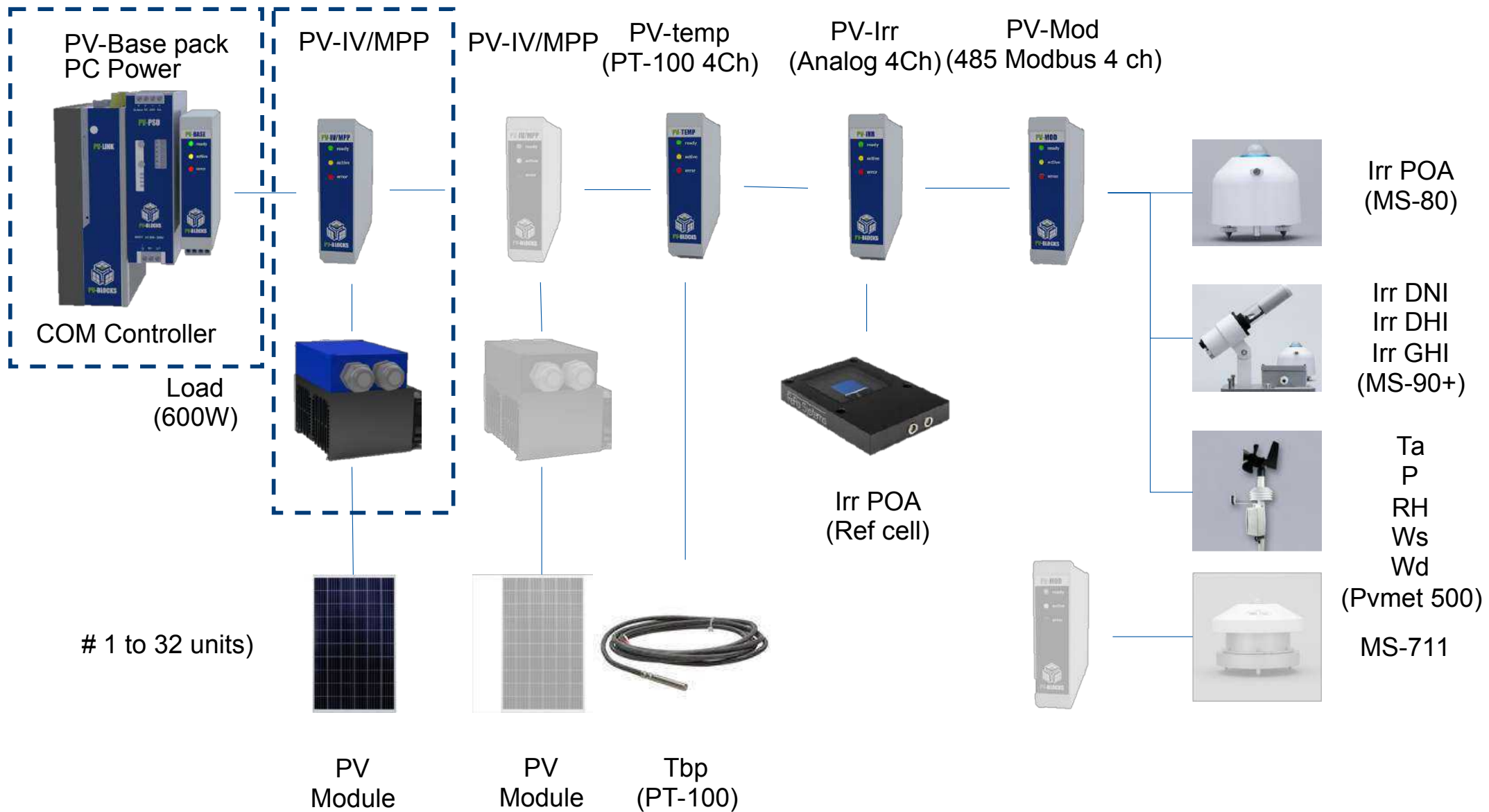


EKO PV-Blocks

The PV-Blocks system consists of different modules called 'PV-Blocks'.

Each PV-Block is targeted to a different measurement task. This can be, for example a current/voltage measurement of the PV panel, the back-panel temperature, the in-plane irradiance or the output of a professional weather station.

Another important feature of the PV-Blocks is the direct integration of controllable loads (up to 600 Watt). These loads allow for full IV-curve measurements and positive voltage biasing.



Configuration



PV Base pack

The PV Blocks system requires the PV Base Pack.

In the PV Base Pack, you find the rugged computer (PV-BLOCKS), the 24VDC power supply (PSU), the logical bus control unit (PV BASE) and an ethernet cable (10m).

PV Base pack

ol software is running on the PV Base computer and accessed using any internet browser. The software scheduling of measurements, storing of data in a local configuration of the system and connected devices. can be easily exported in the most common formats (CII, CSV, Excel, PDF, etc..). A full user management available to control the access levels of different

computer there are 2 ethernet ports, one for a direct connection to, for example a laptop and one to connect to the network (internet). This way the user is free in the use of the interface. When only the local network is used, it is possible for intruders to access any data.

to install the base pack, the user must simply mount the 3 units on a standard T35 DIN-rail and apply AC power (100 – 240VAC) to the power supply. Note that an AC power cable is not

included.



Specifications



PV base

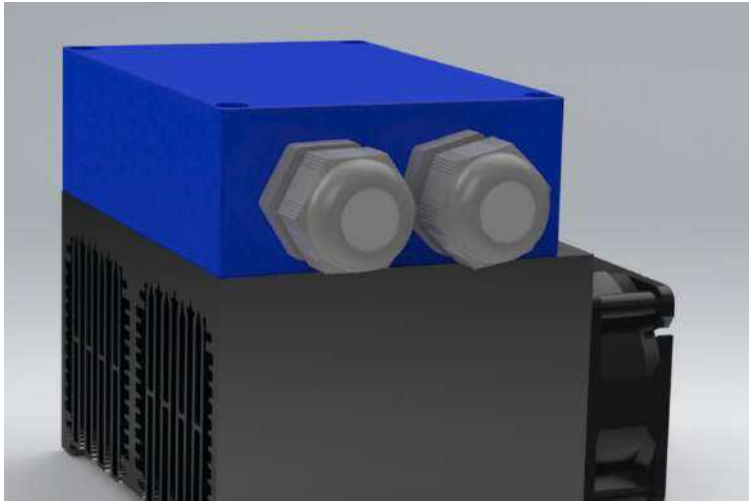
Input voltage	24 V DC
Input power max	
Interface	RS485

Power supply (PSU)

Input voltage range	100 V AC ... 240 V AC (-15 % ... +10 %)
Nominal output voltage	24 V DC
Nominal output current	5 A
Output power	120 W
Ambient temperature operation	-25°C ... 70°C

Computer (PV Link)

Input voltage	9 ... 36 V DC
Input power max	
Memory	4 Gb
Storage	32 Gb SSD
Ambient temperature operation	-25°C ... 70°C



2. PV IV/MPP Pack

The PV IV/MPP Pack is used for the measurement of IV Curves, MPP tracking and specific voltage biasing of PV Panels. The IP 55 protected unit can be installed close to the PV module.

- **Key features:**

- The PV IV/MPP Pack is used for the measurement of IV Curves, MPP tracking and specific voltage biasing of PV Panels.
- IV/MPP PV Block (Installed outdoors)
- Load 600W (Multiple loads for larger capacity > 600W)
- 10 m heatsink measurement cable (between IV/MPP Block and heatsink)
- IV / MPP Measurement and control unit that directly interfaces to an outdoor load. This load is connected close to the module to be measured.
- The measurement speed of an IV curve can be set from 200ms, up to 30 seconds.





2. PV IV/MPP Pack

Range:

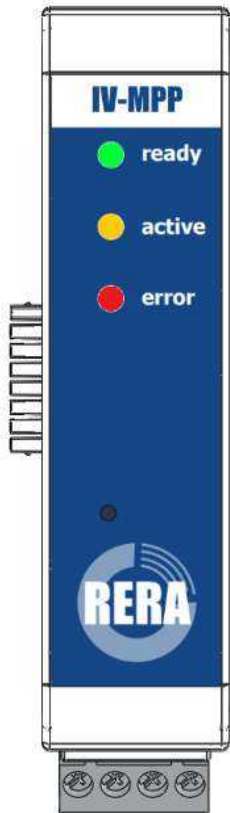
- 0 - 600W
- 1 - 200V
- 0 - 20A

*Range (V)	Resolution	Accuracy (%)
<1 - 5	50 μ V	0.05% + 0.02%
<1 - 50	500 μ V	0.05% + 0.02%
<1 - 100	1 mV	0.1% + 0.02%
<1 - 200	15 mV	0.1% + 0.02%

Range (A)	Resolution	Accuracy (%)
0 - 20	200 μ A	0.1% + 0.02%

* Minimum voltage depend on voltage drop through shunt resistor (40 m Ω)

Specifications



Input voltage	24 V DC
Communication modules	RS 485
Sweep time	0.2 – 30s
Curve direction	Isc – Voc – Isc
Resolution	24 Bits
ADC	Simultaneous
IV points	50, 100, 150



4. PV TEMP

The PV TEMP block handles the measurement of up to 4 temperature sensors connected to the back plane of PV Panels.

Key features:

- Pt100 temperature measurement of PV panels and PV cells
- Up to 4 PT-100 sensors per PV TEMP block
- 3-wire connection

Specifications:

Input voltage	24 VDC
Busload	0.1
Sensor	Pt100
Connection	3-wire
Inputs	4
Accuracy	0.1°C



5. PV IRR

The PV IRR block handles the measurement of up to 4 analog irradiance sensors (Pyranometers and reference cells).

Key features:

- High resolution input for analog sensors: pyranometers, reference cells
- 4 dedicated analog inputs
- High impedance sensor ready

Specifications:

Input voltage	24 VDC
Busload	0.1
Analog input	0 – 100mV
Resolution	24 bits
Inputs	4
Accuracy	0.1 μ V



6. PV MOD

The PV MOD block can be used to integrate external instruments that support the MODBUS RTU protocol.

Key features:

- Modbus RTU connection
- Integration of external EKO sensors (weather stations, DNI sensors, Pyranometers)

Specifications:

Input voltage	24 VDC
Input terminals (A/B)	4
MODBUS	RTU
Baudrate	≤ 115200



7. Load 600W

This additional load can be used to increase the maximum load of your IV/MPP Pack or MPP Pack.

- Range 1 - 200V / 0 - 20A
- Resolution 24 Bit
- Error 10mV / 10mA (Full scale)

Key Features:

- All weather (IP 55)
- Power dissipation up to 600W (forced air) up to 45 °C ambient

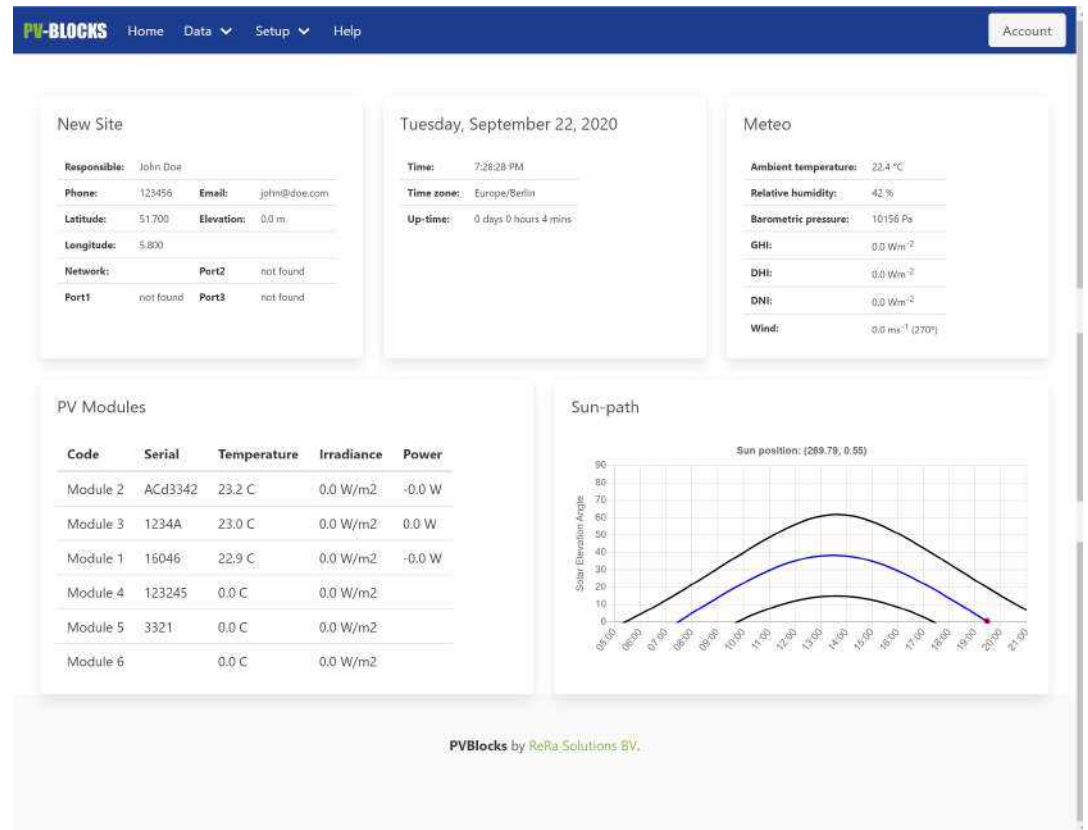
Turn-key

IP-55 outdoor solution
Pre-configured



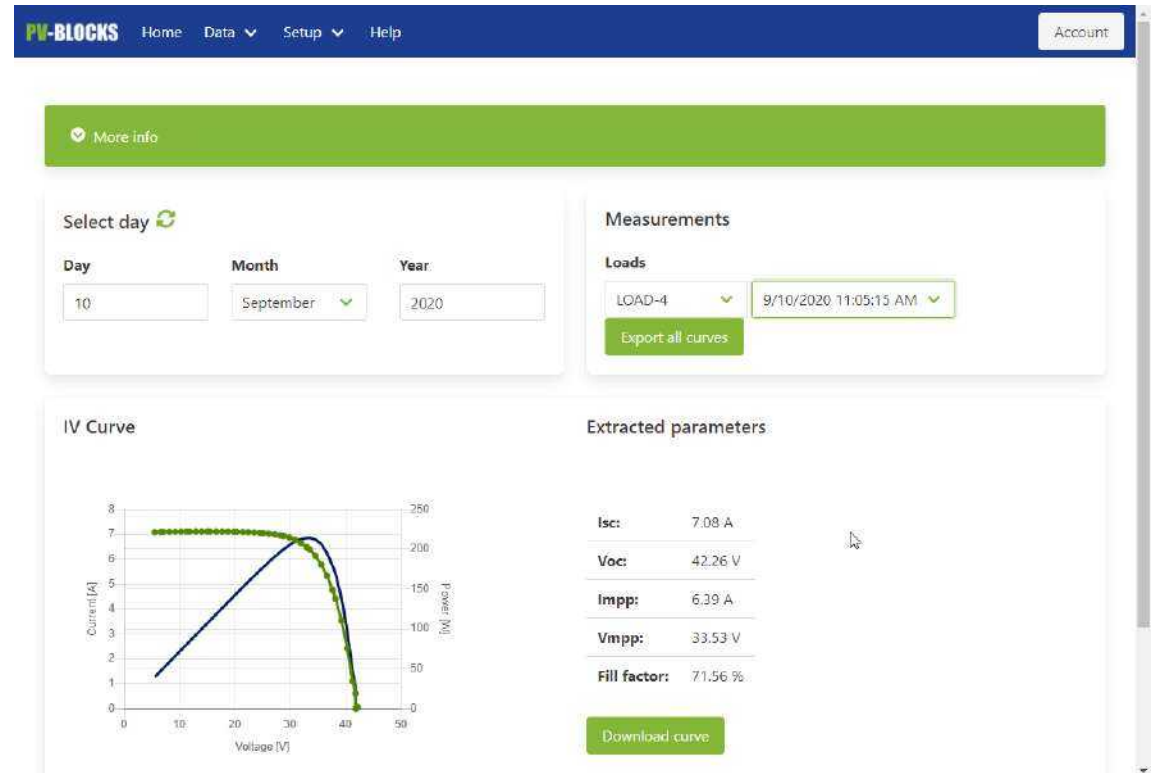
Software

Web-interface



IV Curve

For each PV module



PV Modules

Settings PV modules

PV-BLOCKS



PV Modules

More info

Manufacturer	Panel Code	Serial	Area	Power	Irradiance sensor
JWA	Module 2	ACd3342	1.3	280	
Sunpower	Module 3	1234A	0		
JA Solar	Module 1	16046	1.6	265	
ReRa	Module 4	123245	0	123	
ReRa 2	Module 5	3321	0		
ReRa 3	Module 6		0		

New

Scheduler

Settings PV modules

The screenshot displays the PV-BLOCKS web interface. At the top, there is a navigation bar with the logo 'PV-BLOCKS' and links for 'Home', 'Data', 'Setup', and 'Help'. An 'Account' button is located in the top right corner. A red banner below the navigation bar contains the message: 'The scheduler is paused, no measurements are taken. Go to System Setup / Scheduler to enable it.'

The main content area is divided into two sections:

- Scheduler:** This section contains two buttons and their descriptions:
 - Enable scheduler:** A green button. The description states: 'The scheduler is now paused, no measurements are taken. Use the button to enable the scheduler.'
 - Reset Scheduler:** A blue button. The description states: 'To reset the scheduler, press the button. All scheduler settings will be reset and removed. Do this for example when a new PVBlock is installed.'
- IV-curves:** This section contains a table with the following columns: 'PVBlock', 'Start', 'Stop', 'Mode', and 'Curve Interval'. The table lists eight load configurations (LOAD-1 to LOAD-8), each with a green checkmark icon in the 'Curve Interval' column.

At the bottom of the interface, the text 'PVBlocks by ReRa Solutions BV.' is visible, along with a mouse cursor icon.

Hardware configuration

Settings PV modules

The scheduler is paused, no measurements are taken. Go to System Setup / Scheduler to enable it.

Hardware configuration

Enable scheduler

Hardware configuration

The scheduler is now paused, no measurements are taken. Use the button to enable the scheduler.

Reset Base unit

Reset base unit

Whenever the system is malfunctioning resetting the base unit can provide a solution.

Scan PVBlocks

Scan PVBlocks

The hardware will scan itself to see if there are any new PVBlocks installed. Only use this when the hardware is modified or the first time the system is setup.

Send Trigger

Trigger measurements

This will send a trigger signal to the system, resulting in a synchronous measurement among all pvblocks. This only has to be used for testing purposes.

Direct control

Direct PVBlock control

This will allow for the direct control of the PVBlock modules.

Position	Label	PV-block	Unique ID
1	LOAD-1	IV-MPP	(3746994893856784658)link /Reset
2	LOAD-2	IV-MPP	(5548484744804693570)link /Reset
3	LOAD-3	IV-MPP	(2026418953477529618)link /Reset
4	LOAD-4	IV-MPP	(137630004465128326616)link /Reset
5	LOAD-5	IV-MPP	(9583660010928700690)link /Reset
6	LOAD-6	IV-MPP	(1347477008897620075)link /Reset
7	LOAD-7	IV-MPP	(1419334602935512168)link /Reset
8	LOAD-8	IV-MPP	(4329455646159970578)link /Reset
9	IV-MOD	PV-MOD	(46827436163480219410)link /Reset
10	Temperatures	PV-TEMP	(36749372998)6732946)link /Reset <input checked="" type="checkbox"/>
11	Temperatures	PV-TEMP	(110566869465724275474)link /Reset <input checked="" type="checkbox"/>
12	Irradiances	PV-IRR	(6266010505182176882)link /Reset <input checked="" type="checkbox"/>

Save

Backup

Software updates

The screenshot shows the 'Backup' page in the PV-BLOCKS web application. The page has a dark blue header with the logo and navigation links: Home, Data, Setup, and Help. An 'Account' button is located in the top right corner. The main content area is titled 'Backup' and contains a section for 'Available backups'. This section features a table with the following data:

Name	Date	Download	Restore
psql-data-20200921-113355-d3b71249-bec4-4b3d-b71e-df68a01c5160.tar.gz	21-Sep-2020 11:33:58	Download Backup (5Mb)	

Below the table is a 'New backup' button. Underneath, there is a section for uploading backups from a device, with the text 'Upload backup from your device.' and a sub-instruction: 'Upload a backup from your computer so you can restore it.'

The footer of the page contains the text 'PVBlocks by ReRa Solutions BV.' and a small logo in the bottom right corner.

Summary

PV-Blocks versus MP-160.

	PV-Blocks	MP-160
IV - Channels	1 – 32 (Simultaneous)	1 – 6 – 12 – 18 (Sequential)
MPP	600 W (PmV / Pml)	300W (-)
P / V / I	600W / 200V / 20A	300W / 300V / 10A
Temp	PT-100 (0.15°C)	T-type (1°C)
Irr	4ch	1ch (MI-530 5ch)
Modbus	4ch	-
Application	Outdoor for Outdoor	Indoor for Outdoor
PC	Edge (Linux)	Windows
Software	Web portal (IP)	Windows
SW updates	Automatic	No

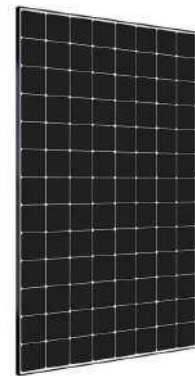
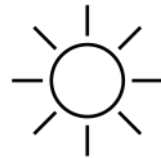
New developments

Connect to the Grid

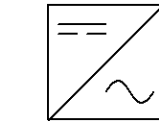
PV-IV switch pack

- Grid connected
- PV Module testing (IV / MPP*)
- Power 0 - 600W
- Voltage 1 - 200V
- Current 0 - 20A

* μ -inverter



PV-Module



μ -Inverter