PSPowEr.Pl ul. Szafirowa 56, 62-023 Kamionki, tel. 502-355-433, email: biuro@pspower.pl

PSP EVSE v1.0 Controller

Technical documentation

Table of Contents:

Change log

Change in TD:

- v1.0 – First release.
- v1.1: – Prometheus.io/Grafana end points,
  – Single session energy limit
- v1.1.1 – Error correction (EPO_IN<->RELAY_FB_IN) and (LED_1_KATODE<->LED_2_KATODE). Plug lock (NC-> NO)
- …

Introduction

	**Warning!** **Device for professionals use only.**

PSP EVSE v1.0 controller is suitable for to build electric vehicles charging stations supplied from the AC power grid according to standard IEC 61851-1.

Main characteristics of controller are:

- Work in mode 3 case B – integrated socket.
- Work in mode 3 case C – integrated cable with plug.
- Control plug locking device for mode 3 case B.
- Charging current to 32A.
- Single or three phase charging.
- BOOST mode – increase current until the actual session ends.
- Automatic/Manual charging start.
- Built-in algorithm to follow defined power value (OZE, power consumption limit).
- Energy meters support (local RS485 or remote IP).
- Built-in WiFi with infrastructure support (STA) or access point (AP).
- Build-in local WWW service.
- Build-in WebAPI for easy integration with the automation system.
- Prometheus.io (Grafana) endpoints.
- Firmware update OTA.

	**Warning!** **Manufacturer does not guarantee suitability of the product for every application.** **In doubtful cases you should consult application with manufacturer.**

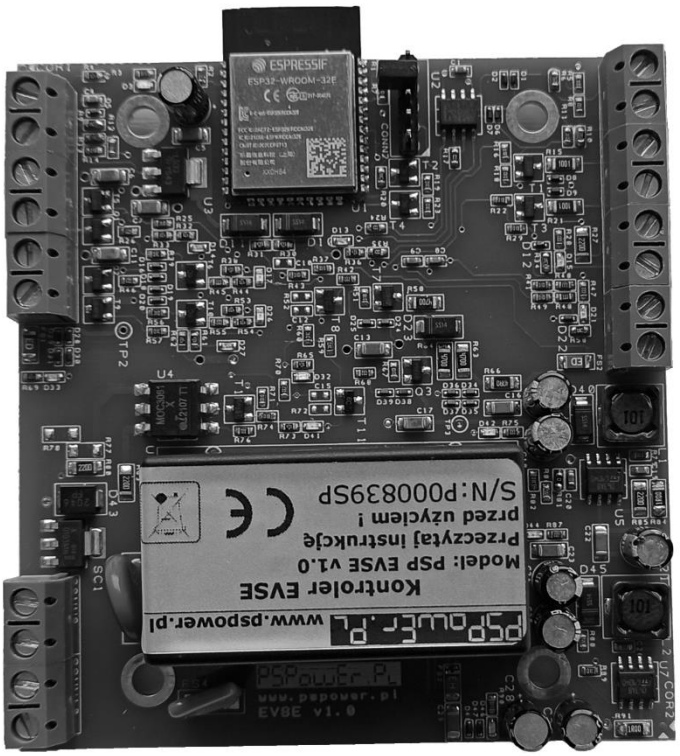
	**Warning!** **Device is component to be built into the system, additional resources might be mandatory for compliance with directives LVD, EMC, RED.**

	**Warning!** **Device is powered by electricity dangerous for health and life, You must absolutely keep all precautions and personal protection measures.**

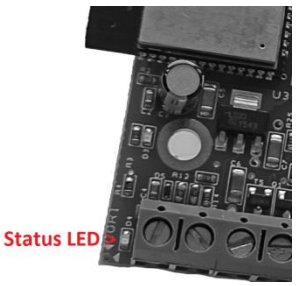
Technical specification

General parameters	Value	Comments
Voltage	85-264 VACrms, 50Hz	Consider the voltage range for the main contactor coil
Power	<2W	
Compatibility EVSE	IEC 61851-1:2019	Every compatible vehicle
Emergency shutdown EPO	NC, 1mA@5VDC	Normally closed
Surge protection device (SPD) required	T1 + T2 or T2	IEC 61643-11 Consider an SPD in main Switchboard
Working temperature	-25…+60°C	
Humidity	<90%	No condensation
Level of protection IP	IP00	
Dedicated case – DIN rail	Kradex Z101 ABS V0	
Signaling LED parameters	**Value**	**Comments**
LED signaling	Two-color, common anode	Recommended blue/red diode(LED 1/LED 2)
Power from controller	5VDC through R = 220R	Terminal: LED_ANODE
External power (option)	5VDC, <200mA	For every channel type „open drain”: LED_1_KATODE / LED_1_KATODE
Cable lock parameters (case B)	**Value**	**Comments**
Voltage	12-24VDC	
Maximum temporary current	1A@1s	
Maximum continuous current	200mA	
Information contact	NO	Normally open
Controlling in servo-motor mode	Pulsed bidirectional, Duty 700ms	
Controlling in solenoid mode	Continuous	
Main contactor parameters	**Value**	**Comments**
Nominal coil voltage	230VACrms, 50Hz	Delivered form controller
Maximum coil temporary current	1AAcrms@100ms	<23VA
Maximum coil continuous current	50mAACrms	<0,575VA
Maximum time for tempering	50ms	
Supporting contactor	NC, 1mA@5VDC	Normally closed
RS485 parameters	**Value**	**Comments**
Standard	TTL 5V	
Maximum bus length	100m	
End terminator	120R	
WiFi parameters	**Value**	**Comments**
Working modes	Infrastructure (STA), Access point(AP)	
Compatibility	2,4GHz; 802.11 b/g/n	
Antenna	Built-in	
Authentication in infrastructure mode	WPA/WPA2 PSK	Password ab to 63 signs
Authentication in access point mode	WPA/WPA2 PSK	SSID: PSP_XX_YY, IP: 192.168.100.1, Factory password: pspower2021
Maximum number simultaneous connections to access point	1	
Addressing	DHCP	
Monitoring parameters	**Value**	**Comments**
Prometheus endpoint EVSE	http://<IP>/EvseMetrics	
Prometheus endpoint for statistics energy meter	http://<IP>/Meter1Metrics	
Prometheus endpoint for control energy meter	http://<IP>/Meter2Metrics	
Minimal data acquisition interval	15s	

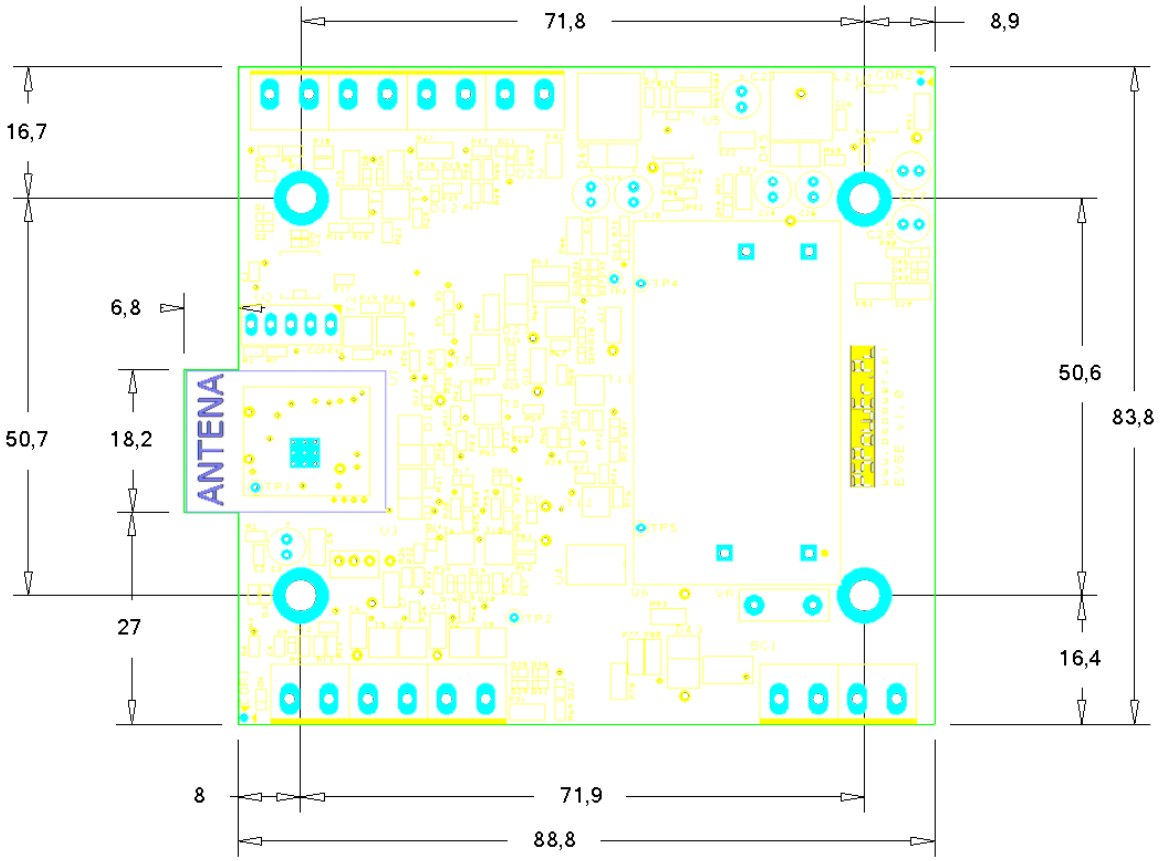
Arrangement of leads \ Diameters



Signal	Description
PE	Main reference potential, PE
PP_IN	Mode 3 Case B: PP Signal input
LOCK_FB_IN	Mode 3 Case B: Locking device feedback signal input
LOCK_OUT_2	Mode 3 Case B: Locking device control output no. 2
LOCK_OUT_1	Mode 3 Case B: Locking device control output no. 1
LOCK_VCC	Mode 3 Case B: Locking device power input
MAIN_RELAY_L	Main contactor coil power output L
MAIN_RELAY_N	Main contactor coil power output N
AC_N	Mains power input AC, N
AC_L	Mains power input AC, L
CP_OUT	CP Signal output
EPO_IN	Signal input from EPO button
RELAY_FB_IN	Feedback contact input of the main contactor
LED_ANODE	Power output for signaling LED
LED_1_KATODE	Input signaling LED no. 1
LED_2_KATODE	Input signaling LED no. 2
RS485_B	RS485 Bus, signal B
RS485_A	RS485 Bus, signal A



Dimensions:



Installation

Installation has to be made according to selected application diagrams (You can find it in document -> „PSP EVSE v1.0 Application diagrams”).
Place of installation should fulfill controller environment requirements and used components.
First setup has to be made with built in WWW user interface.
Check for software update.

Warning!

Project and make of electrical vehicles charging point demands thematic knowledge and pointed in local law permissions.

External signalization

The controller supports two-channel external LED signaling. If there is need to use LED with parameters which are exceeding the controller power ability, you must use external power supply and use only inputs for cathodes.

Signaling LED (colors for recommended diode):

LED 1 (blue)	LED 2 (red)	Description
Turned off	Turned off	Idle state (A1/A2). The charging point is waiting for the vehicle to connect.
Continuous light	Turned off	Vehicle connected (B1/B2).
Flashes with period about 0,6 or 2s	Turned off	Vehicle charging (C1/C2). Faster flashing indicate BOOST function has been activated.
Flashes with period about 1,5s	Turned off	Vehicle ventilates (D1/D2).
Continuous light	Flashes with period about 0,2s	Vehicle diode error. Vehicle error (E).
Continuous light	Continuous light	General vehicle error.
Turned off	Continuous light	Main contactor error (F). Error PP (F). Locking device error (F).
Turned off	Flashes with period about 0,2s	Emergency stop button has been activated (EPO)(F).

LED Status (service status, on the controller PCB):

LED Status	Description
Flashes with period about 1s	The Controller connected with configured WiFi network in infrastructure mode (STA).
Flashes with period about 4s	The Controller in access point mode (AP)
Fast flashes with period about 0,2s	The Controller tries to connect to the currently configured WiFi network. This state should be temporary if it is permanent it means problems with connection.

Emergency shutdown (EPO)

The emergency power off (EPO) has the following roles:
- It stops charging immediately.
- Clears the emergency states of the charging point.
- It is used in service functions.

The EPO switch should be designed as a bistable, individual, normally closed mushroom button.
The EPO switch should be placed in clearly visible place with direct access for servicing the charging point.

Warning!

If is necessary to perform the function of a deterministic disconnection from the power supply by EPO switch, additional device is need in main contactor circuit.

Energy meters

The EVSE controller supports selected energy meters. They are used to acquire measurements in order to run charging statistics (statistical meter) and to control electricity consumption (control meter).

The statistical counter should be installed in a way that it can measure on the electric circuit which it is powering a single charging point.

The control meter should be mounted on the main power supply in the main switchboard so that it measures the power/energy flowing to or from the power system to which the billing object is connected.

Supported energy meters:
- ✓ EASTRON SDM72D-M and derivatives.
- ✓ LUMEL NMID30-2 (EASTRON SDM630), and derivatives.
- ✓ EASTRON SDM120.

Data transmission parameters:
- Modbus address statistical meter: 1.
- Modbus address control meter: 2.
- RS485:
  - speed: 9600,
  - data bits: 8,
  - stop: 1,
  - parity: EVEN,

Energy meters can be connected directly to the EVSE controller using the built-in RS485/Modbus bus or remotely via a dedicated MIpB bridge and WiFi network. If a MIpB bridge is used, the modbus addressing must be retained for the appropriate energy meter function (statistical / control). The controller has built a tool into the WWW service for the configuration of SDM120 type meters. Configuration is done by selective (single) connection of the SDM120 meter to the RS485/Modbus bus and selecting the appropriate tool function for its role. Before starting the role assignment utility function, the connected SDM120 meter must be entered into the setting mode.

Cable lock

In mode 3, case B, it is necessary to apply a blockade for prevent purpose disconnection or inadvertently disconnecting the cable connecting the vehicle to the charging point in powered up state. The lock actuator is powered by an external DC voltage source (LOCK_VCC).

Controller supports lock type:
Solenoid – lock with electromagnetic movement of the locking pin.
Servomotor – lock with servomechanism driven by DC motor.

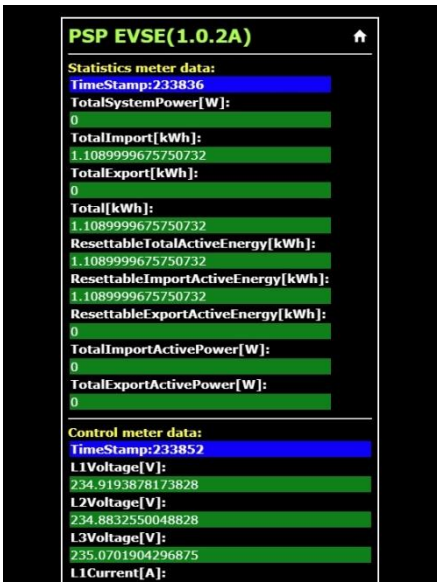
	**Warning!** **In the case of servomotor type blockade you should apply external mechanical system for emergency unlocking in case of grid power lost.**

WWW Interface

Home screen – Status

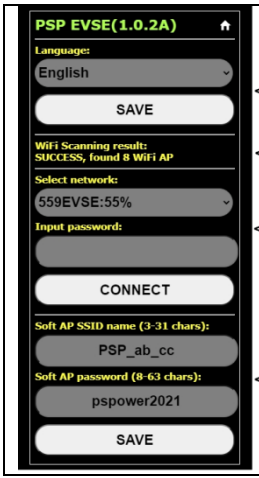
Re1. Status bar: device name (software version), menu or return.
Re2. WiFi information, energy counters, control method, available power.
Re3. Charging status information field. Working state, current / power, session time, energy.
Re4. Charging start / stop button or information about automatic charging start.
Re5. Button for activation / deactivation BOOST function.
Re6. Session history (Charging > 1 minute)

Screen – Energy meters (if connected)

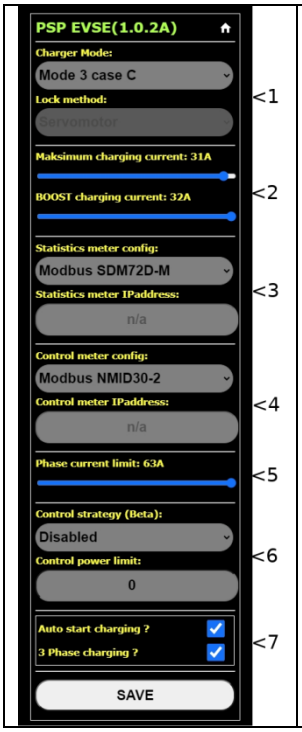


Parameters returned by configured statistic and \ or control counters.
Description and meaning of parameters according to the meter manufacturer's documentation.

Screen – Settings WiFI&WWW

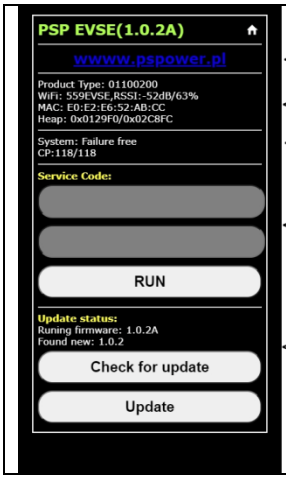
 <1 <2 <3 <4	Re1. WWW interface language configuration. Re2. After scan results for WiFi access points (SSID:Signal strength [%]). Re3. Selection of WiFi networks and entering the password. Re4. Parameters for operation in the access point mode, configured SSID and access password. The default SSID is PSP_XX_YY, where XX, YY are the last MAC bytes.

Screen – System settings



Re1. Configuration operation mode and cable blockade mode for case B
Re2. Setting up maximum charging current in normal mode and BOOST mode.
Re3. Statistical meter configuration (local RS485/Modbus or remote IP).
Re4. Controlling meter configuration (local RS485/Modbus or remote IP).
Re5. Main power supply (switchboard) phase current limit. Active for controlling energy meters that return current measurement.
Re6. Choice of control strategy to optimize / reduce power consumption. Power limit setting.
Re7. Choice of automatic or manual charging start.
Choice of the type of charging configuration - single or three phase.

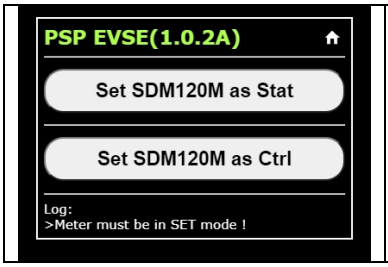
Screen – System information



Re1. Manufacturer website link.
Re2. Information about:
- Product type: <product tag>
- WiFi: SSID:RSSI dB/%
- MAC: <network interface mac address>
- Heap: memory allocation (service data)

Re3. Current health of the system.
Re4. Field for activating service codes.
Re5. Firmware update.

Screen – Tools



Tools settings the configuration of SDM120 energy meters. A Meter for configuration should be connected to the RS485 / Modbus bus, individually assigning a role by selecting the appropriate button.

Warning!

The device is still being improved by remote updates. Individual screens may slightly differ from those presented.

WebAPI

Look for -> document „WebAPI Programming guide”.

Factory settings restoration

Method 1: Service code from menu level „System information”
Run service code „FactoryDefault”.

Method 2: Jumper on the controller PCB.
Procedure:

1. Power off EVSE system,
2. Close the factory reset jumper (pin 3-4, CONN2),
3. Power on the EVSE system,
4. Wait about 20 seconds, while the status LED flashes,
5. Power off EVSE system,
6. Open the factory reset jumper,
7. Once again power on the EVSE system

Method 3: EPO Sequence
Procedure:

1. Power off EVSE system,
2. Make sure that EPO button isn’t in active state,
3. Power off EVSE system,
4. Observe signaling LED,
5. When the signaling LEDs light up, activate the EPO button,
6. When the signaling LEDs go out, deactivate the EPO button,
7. Repeat these steps 5-6 times until the moment when after EPO activation, signaling LED will not go out,
8. Wait about 30 seconds in order to system restore factory settings,
9. Deactivate the EPO button

Warning

After restating farcical settings and system restart, it will boot up in WiFI AP mode.
SSID = PSP_XX_YY.

Limiting power consumption algorithm

By using the power limitation algorithm these goals can be achieved:

- ✓ Limiting the export of energy to the grid from the renewable energy generation installation.
- ✓ Purpose of the assumed amount of energy exporting to the grid.
- ✓ Preventing from trip MCB for Main/local power supply.
- ✓ Installation of multiple vehicle charging points on the limited power supply.

Effect of the power limitation algorithm depends on the power limit setting.

Power EVSE + Power of facility – Renewable Power = Power limit

Case 1: Power limit = 0,
The algorithm ensures that the power balance at the facility power supply from the grid is close to zero. This means that in the case of power consumption by the facility and EVSE, the renewable energy supply system is expected to fully cover the current needs of power.

Power EVSE + Power of facility = Renewable Power

Case 2: Power limit > 0,
The algorithm makes sure that the power balance at facility power supply from the grid does not exceed the set power limit.

Power EVSE + Power of facility – Renewable Power = Power limit
When there is no renewable power, the algorithm makes sure that the connection power to the facility is not exceeded.

Case 3: Power limit < 0,
Guaranteeing energy exports to the grid at the level of the power limit.

Overcurrent protection algorithm

If as controlling energy meter applied device with current measurement phase/phases (e.g. NMID30-2, SDM120M …). EVSE controller will prevent against tripping of MCB on the main power supply to the facility by charging station (EVSE).

Periodic maintenance

Recommended periodic maintenance:

- Verification of protections for the electric circuit (RCD,MCB).
- Verification of electrical connections.
- Verification of software update.

Utilization

Used electric and electronic equipment according to applicable law in Poland, is subject to utilization in strictly defined way. Information about collection points available at www.pspower.pl