Installation Manual for PV Optimization

Introduction

Assumptions

- You run a PV installation with Fronius, Kostal Piko Solar converter or any other PV-inverter measured with an additional iWattMeter
- You have a electrical consumption that does not exceed 100 Ampere per phase
- You want to optimize the own power consumption of your PV production, by switching water boiler and electrical heating with the Watt Analytics PV Optimizer
- You have a WiFi reachable with good signal strength in your circuit breaker compartment and the locations where the switchable devices are located

Shopping List

You need item 1 from the list below and depending on your PV Inverter and devices you want to control items 2 and 3

1. Package Control S, with Premium IoT Cloud: https://watt-analytics.com/en/general/package3/ consists of iWattController or SmartPi + 4 x Current transformer 100 Amp
2. Shelly Plug, Shelly Plug S or Shelly 1PM for each device
3. Optional for PV-inverters other than Fronius, Kostal Piko: Package S for an additional iWattMeter to measure PV production

Upgrade instruction for SmartPi delivered until February 2021

With the March 2021 version of the Watt Analytics system we have upgraded the features of our SmartPi product significantly:

- Improved Security: enforce user authentication on the mosquitto running on the SmartPi
- Integration with 2 types of PV converters and a generic solution for all others
- Integration with 3 different switches
- Integration with 1 smart home solution

To leverage these features please upgrade to a standard or premium account and run the upgrade instructions below. Once you have executed these you can apply all the rest of installations as described in "Installation for iWattController or SmartPi delivered after February 2021", of course skipping the SmartPi installation part.

Install latest version of wa-pi.jar

as described here: https://watt-analytics.com/en/general/package3/ in the section Firmware Update

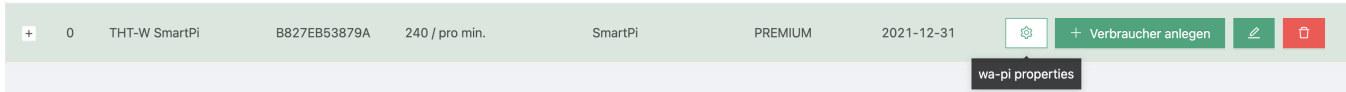### Please set a strong password for your SmartPi.

If you connect IoT devices to it you might enable hackers to obtain control of some devices in your home - please protect your self from this threat with a strong password.

SSH Connect to SmartPi and set passwd

```
ssh pi@<IP of SmartPi>
passwd
```

Enable mosquitto authentication

This puts some level of protection onto the MQTT communication in your local WiFi, all measurement an control commands run over these. Unfortunately many iOT device don't support SSL encryption, there for only UID/PWD authentication is enabled. In the web app go to the Homes tab and select Detail button for your home. There you see the meter list like below:

| + | 0 | THT-W SmartPi | B827EB53879A | 240 / pro min. | SmartPi | PREMIUM | 2021-12-31 | ⚙ | + Verbraucher anlegen | ✎ | 🗑 |

wa-pi properties

Press the "wa-pi.properties" button, this will show you all credentials and settings for your SmartPi. Keep the window open and use the values in the procedure below.

SSH Connect to SmartPi and configure mosquitto passwordfile

```
ssh pi@<IP of SmartPi>
nano passwordfile
        enter '<mqttUser value>:<mqttPasswordIotHub value>'
        press <Ctrl>-X to exit and "y" to save
mosquitto_passwd -U passwordfile
sudo cp passwordfile /etc/mosquitto
sudo nano /etc/mosquitto/mosquitto.conf
        add line 'password_file /etc/mosquitto/passwordfile'
        add line 'allow_anonymous false'
        press <Ctrl>-X to exit and "y" to save
sudo systemctl restart mosquitto.service
```

Configure authentication for the smartpi.service

set smartpi mqtt credentials

```
sudo nano /etc/smartpi
        set 'mqtt_username    = <mqttUser value>'
        set 'mqtt_password    = <mqttPasswordIotHub value>'
        press <Ctrl>-X to exit and "y" to save
sudo systemctl restart smartpi.service
```

Configure authentication for the wa-pi.service

set wa-pi mqtt credentials

```
sudo nano /etc/wa-pi.properties
        add line 'mqttPasswordIotHub=<mqttPasswordIotHub value>'
        press <Ctrl>-X to exit and "y" to save
sudo systemctl restart wa-pi.service
journalctl -f -u wa-pi.service
```

- check the console log that no errors occur
- Validate on the mobile or web app that your SmartPi is sending data.

Installation for iWattController or SmartPi delivered after February 2021

Install the SmartPi hardware according to this installation procedure:

Install the Watt Analytics App on your Apple or Android smart phone
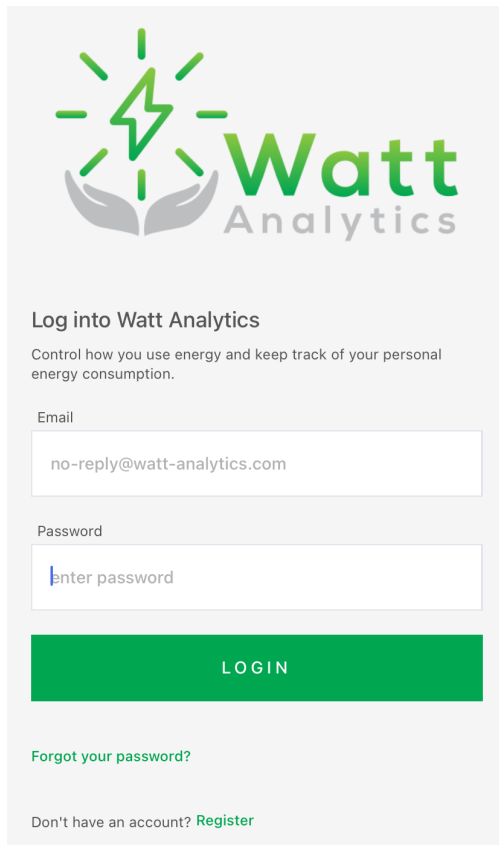
You can find and install Watt-analytics App in App Store (iOS) or Google Play (Android) on your phone.

If you have QR code reader on your phone, you can use images below:

Login to Watt-analytics cloud

After app is installed on your phone, you will see the login screen. If you already have a watt-analytics account, fill the form and press login. Otherwise tap on `Register` at the bottom.

Register a new account:

Register into Watt Analytics

Control how you use energy and keep track of your personal energy consumption.

First name

John

Last name

Doe

Email

no-reply@watt-analytics.com

Password

enter password

Confirm password

confirm password

◯ I agree to Data Protection, Terms and Conditions and to share data in anonymized form with Watt Analytics customers and partners.

REGISTER

Install meter

After successful login, you need to register your meter under your account. In this regard, tap on `Add new watt-meter` and follow the instructions provided by the app step by step.

Test Test
test@watt-analytics.com

You have not yet registered a watt-meter

+ Add new watt-meter

ⓘ Meter list

Switch list

≡ Notifications

⚙ Settings

⏻ Logout

When your meter is installed successfully, you can see your consumption and solar production on main graph.
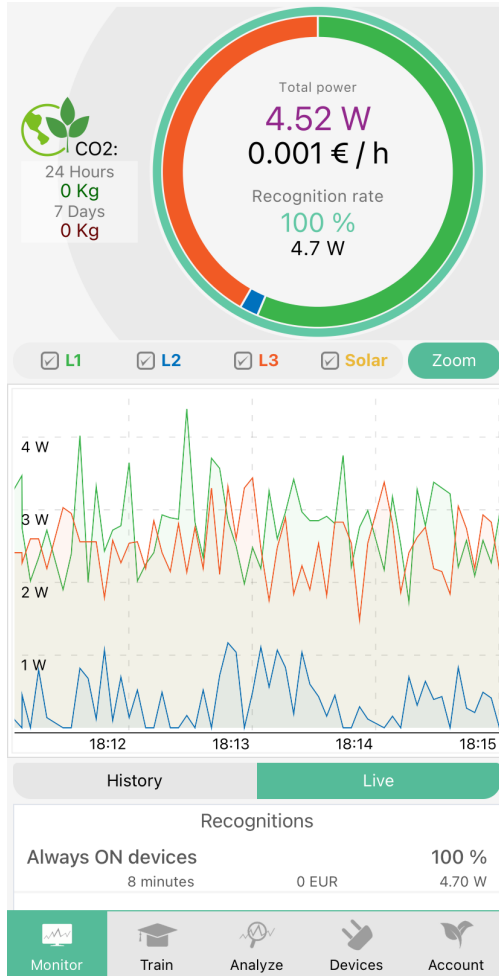
Configure Solar production measurement

Option 1: Fronius

configure pvInverter

```
ssh pi@<IP of iWattController / SmartPi>
sudo systemctl stop wa-pi.service
java -jar /usr/local/bin/wa-pi.jar pvInverterType=fronius pvInverterHost=<IP of fronius>
```

- check the console log that no errors occur
- Press <Ctrl>-C to interrupt the process

restart wa-pi.service

```
sudo systemctl start wa-pi.service
journalctl -f -u wa-pi.service
```

- check the console log that no errors occur
- check that you solar production is displayed in the web and mobile app

Option 2: Kostal Piko

configure pvInverter

```
ssh pi@<IP of iWattController / SmartPi>
sudo systemctl stop wa-pi.service
java -jar /usr/local/bin/wa-pi.jar pvInverterType=kostalpiko pvInverterHost=<IP of kostalpiko>
'pvInverterUser=<userId>' 'pvInverterPass=<Password>'
```

- check the console log that no errors occur
- Press <Ctrl>-C to interrupt the process

restart wa-pi.service

```
sudo systemctl start wa-pi.service
journalctl -f -u wa-pi.service
```

- check the console log that no errors occur
- check that you solar production is displayed in the web and mobile app

Option 3: measurement with iWattMeter

set smartpi mqtt credentials

```
ssh pi@<IP of iWattController / SmartPi>
sudo systemctl stop wa-pi.service
java -jar /usr/local/bin/wa-pi.jar pvInverterType=iwattmeter
```

- check the console log that no errors occur
- Press <Ctrl>-C to interrupt the process

restart wa-pi.service

```
sudo systemctl start wa-pi.service
journalctl -f -u wa-pi.service
```

- check the console log that no errors occur

Get your iWattMeter installed to measure your solar production

- connect to the web frontend of the iWattMeter
- go to the "MQTT Configuration" page

iWattMeter   **[Home](#)**

MQTT Configuration
Installation

Device ID   `B831F8`

Watt-Analytics Data Server

Server   `<IP of iWattController / SmartPi>`

Port   `1884`

User Name   `< mqttUser value>`

Password   `< mqttPasswordIotHub value>|`

Secure (SSL/TLS)   ⬭

[Submit]

[Load]   [Reset]

[**Restart Device**]   [**Set Factory Defaults**]

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Unauthorized use of API voids the product warranty.

Version: 2.1.23

- Press SUBMIT
- Press RESTART DEVICE

Check that you solar production is displayed in the web and mobile app after a few seconds

Option: addProductionToConsumption

- Use this option if you have a solar installation where the solar production is merged into your power network between the consumers.

In such a setup it's not possible to measure pure consumption, but your would install the Watt Analytics power meter close to the utility power meter and measure the mix of production and consumption.

To be able to see the total consumption independent of your production, you set the option to true:
- sudo nano /etc/wa-pi.properties
- add line: addProductionToConsumption=true
- sudo systemctl restart wa-pi.service

  journalctl -f -u wa-pi.service
- check the console log that no errors occur

  check you consumption curve in the web app, it should show all positive values (before they where negative, when you production was higher than the consumption)

Switch Installation

Shelly switch

Install Shelly switch hardware

- For Shelly Plug and Shelly Plug S, you can easily connect it to the power socket and use it as an outlet to connect your device.
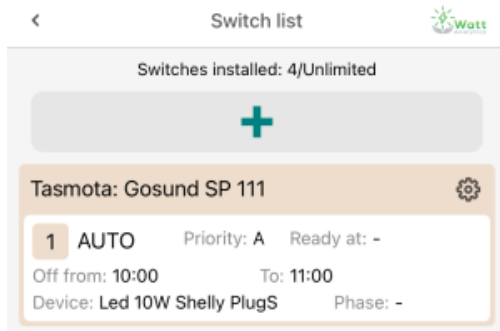
Shelly Plug	Shelly Plug S

- For Shelly 1PM, ask you your electrician to install it for you.

Shelly 1PM

- Register your Shelly switch in the App

- In watt-analytics app, tap on `Account` button at bottom then `Switch list`.
- With the `+` button on top, you can register your switch by following the instruction provided by the app step by step.

- Configure your switch
- In watt-analytics app, under `Account / Switch list`, you can see list of your registered switches with yellow border containing relays in white. Shelly Plug, Shelly Plug S and Shelly 1PM are single relay switches, so there is only one relay attached to them as you see in the image below:
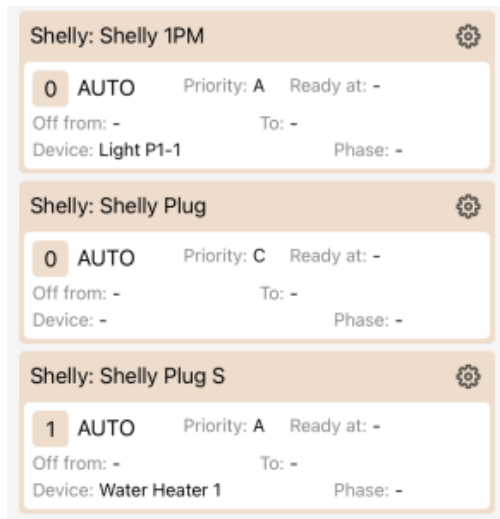
- Use the button on top right of your switch to reconfigure, rename or remove it.
- To assign a device to a relay or change the PV optimiser behaviour, click on relay (white area).

Relay configuration

Each switch may come with 1 or multiple relays depending on the type. In the below setup page you can configure how the Watt Analytics Software will monitor and control your device through the relay.

Edit Relay

CANCEL   EDIT

Mode

AUTO

Device

Please choose one ...

Priority

Please choose one ...

Ready at

Switch off from

Switch off to

There are different properties you can set for each relay:

- mode:
  - AUTO: device is being switched on and off automatically by PV-Optimiser based on your solar production
  - ON: device will always have power
  - OFF: device will always be switched off
  - MAN: (MANUAL) PV-Optimiser will not control your device and you can switch it on or off by physical button or another cloud service
- Device:
  - Device you want to be controlled by PV-Optimiser. For example your Water boiler.
- Phase:
  - If your device uses three power lines, the connected phase also need to be defined here otherwise you do not see this property at all.
- Priority:
  - When you have more than one device switchable by PV-Optimiser and solar production is not enough for all of them, it uses this value to power on your priority one.
- Ready at:
  - PV-Optimiser will make sure your device is ready at this time. (Use 24 hour time format like 21:30)
- Switch off from / to:
  - your device will not be switched on at this period. (Use 24 hour time format like 21:30)

Tips

- If you need to reset a Shelly Plug, please connect to plug to a power socket and hold the button for 10 seconds. Then the LED should flash red briefly and then switch to blue