

Ecosoft

Smart Grid Controller 2

Manual EN

v1.5



Ecosoft

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1 Introduction

The Ecosoft Smart Grid Controller (SGC) is a device that is able to operate a heat pump to keep the heating costs as low as possible, by benefitting from energy price fluctuations during the day. Because cheap energy is more than often green energy (solar and wind energy), there are benefits for the environment as well.

Every day, the SGC creates a planning with “moments to switch” and takes the following into account:

- Your location (where outside temperature and prices depend on)
- The efficiency of your heat pump at certain outside temperatures
- The electricity prices during 24 hours of a day
- The efficiency of your gas boiler (if present)
- The current gas price
- Your preferences filled out in the energy planner.

Example

If at some time during the day, gas consumption is cheaper than the electrical power consumption of the heat pump, the SGC can switch the heat pump in a lower operating state.

Operating the heat pump

The Ecosoft SGC is able to operate the heat pump if your heat pump supports the SG-ready interface or has an EVU blocking contact as an input.

2 Installing the Smart Grid Controller 2

2.1 Installation for operating Heat Pumps

The Smart Grid Controller 2 is designed to operate a heat pump or heat pump boiler via the Smart Grid (SG) interface or via an EVU blocking contact.

The SGC should be installed by an experienced installer with knowledge on electrical installations and heat pumps.

Connect relay 1 and 2 with the SG-ready interface of your heat pump, if present.



When your heat pump only supports EVU, then connect relay 1 (to the EVU connector of the heat pump) and don't configure the modes Boost and Max in the SGC Energy Planner.



2.2 Installation for operating PV-Systems

To switch solar panels, you can connect the SGC to a contactor, and connect the contactor to your PV-System. When the SGC switches automatically when the electricity price is negative, all relays of the contactor will switch off. Feeding electricity back to the grid will then be interrupted.



We recommend to let an experienced installer install the SGC and contactor.

How can you use the SGC for operating solar panels?

There is more than one way to set this up.

For example, use the following configuration:

- Use SGC and a magnetic contactor with make contacts
- Connect contacts NO and COM of relay 1 of the SGC to the contactor
- Don't use relay 2 of the SGC
- Settings in the Energy Planner of the SGC:
Check the checkbox of Heat Pump Control
In state Low: SG1 on (standard)
Low - when electricity costs more than 0
Boost - never
Max - never
Normal - in all other cases

Go to Additional Configuration

Duration:

Low - Shortened duration

Boost - Undetermined

Max – Undetermined

Explanation:

When the state is Low, relay 1 of the SGC will switch. Therefore the make contacts of the relay will be switched on. And thereby electricity will be feed back to the grid by the solar panels. So, only "when electricity costs more than 0"

Note: Are you using a contactor with break contacts? The use the following setting:

In state Low: SG1 off (reversed)

3 Network Configuration

The device can be connected to the network with a network cable or via wireless WiFi. We recommend to use a wired connection.

- Connect the device with an ethernet cable to your network.
- On a computer in your network, open a browser and visit <http://sgc.local>
- If you are asked to login, use these credentials:
Username = **eco**
Password = **power**

As an alternative you can access the device via WiFi:

- On your phone, go to the WiFi settings and connect to the network called "SGC".
- In the browser on your phone, go to <http://192.168.4.1>. This is a temporary address; after configuration the SGC will no longer be reachable at this address.
- When prompted to log on, use these credentials: Username = **eco**
Password = **power**
- The controller shows a list of detected WiFi networks. Select your own WiFi network and fill in the WiFi password that belongs to it.
- Optionally, choose a hostname for the SGC in the network. The default name is "SGC". This name you can use later to access the switch via the browser. If the name remains "SGC", the switch will be accessible via <http://sgc.local>.
- Press Save. It might take a minute before the SGC establishes a connection to your WiFi network. When a connection is successfully made, the browser shows the new IP address that your network has assigned to the SGC. Within a few seconds, the browser will open this address.
- Your phone should be reconnected to your own WiFi network; generally this will happen automatically. If the SGC prompts you to log on again, fill in eco and power, as before.
- If the SGC page doesn't open or the page doesn't prompt you to log on, you can try to reload the page. As an alternative you can access the switch via <http://sgc.local> or by entering the new IP address directly.

4 Using the Smart Grid Controller 2

4.1 Accessing the web interface

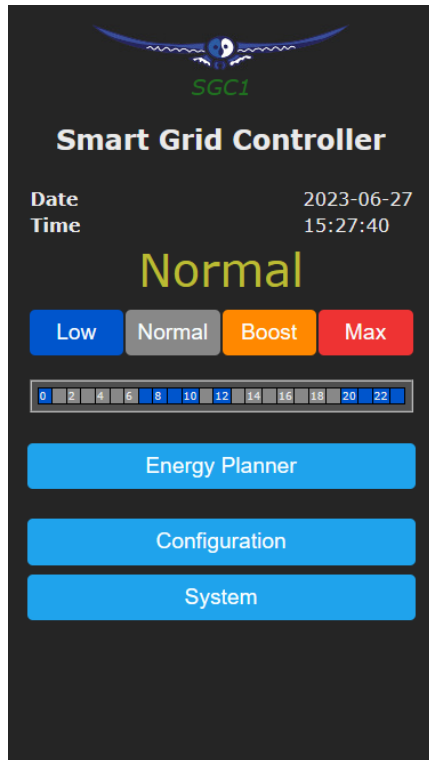
Advice: Settings and tools which are not described in this manual shouldn't be changed or used, because it may cause the system to malfunction.

Sign in
http://sgc1.local
Your connection to this site is not private

Username

Password

The Smart Grid Controller (SGC) is accessible via the assigned IP address or – if your phone supports mDNS – via the hostname of the switch (e.g. <http://sgc.local>). The IP address may change if your WiFi network assigns another IP address to the SGC, for example when the SGC has been disconnected from the outlet for some time, and reboots. The hostname however will remain the same, and might be more convenient to use.



When opening the web interface, you will be prompted to log on. The default credentials are:

Username: eco

Password: power

4.2 The SGC Energy Planner

The Energy Planner of the SGC allows you to fill in the efficiency of the heat pump and the gas boiler. With these data, and the current price data, the SGC can create a planning to benefit from the lowest prices. See the chapter [Using the SGC Energy Planner](#) for a detailed explanation.

4.3 Operating the SGC manually

You can manually switch your heat pump in 4 available SG modes:

- Go to the main menu of the SGC and press on one of the 4 buttons (Low/Normal/Boost/Max) to switch the heat pump to the desired SG-mode.

This mode will stay active until the next switching-event.

Note: If your heat pump is only connected via an EVU blocking contact, only the buttons Low and Normal are applicable.

4.4 Change the network name after installation

The network name of the SGC will determine at which address you can access the SGC via a browser.

- Go to the web interface
- Press Configuration
- Press Configure WiFi
- Fill in another **Hostname**.
- Press Save

4.5 Change the SGC device name

In addition to changing the network name (see previous) you can also change the device name. The device name will be shown at the top of the web interface.

- Press Configure

- Press Configure Web Interface
- Adjust the Device name. Unlike the network name, this device name may contain spaces.
- Press Save

4.6 Change the login credentials of the SGC

It is recommended to change the default password (power) of the web interface. It is not possible to change the username (eco).

- Press Configuration
- Press Configure Web Interface
- Adjust the Web Admin Password. If you want to make the password visible, tick the checkbox.
- Press Save

Note: If you change the password, don't forget it, or store it somewhere. Without the correct password it is not possible to access the web interface of the SGC.

4.7 Install a new version of the firmware

- Go to the web interface of the SGC
- Press System
- Press Firmware Upgrade

The description of the version that is available online will be shown.

- Press Start Upgrade.

The new version will be downloaded and then installed. The device will reboot after that.

- Find the current version number via the menu System, Information.

5 Using the SGC Energy Planner

5.1 Configuration

You can access the SGC Energy Planner via the web interface, by pressing the button “Energy Planner” in the main menu.

The screenshot shows the 'Smart Grid Controller' interface with the 'Energy Planner' tab selected. The configuration fields are as follows:

- License key:** 0000-0000-0000
- Valid until:** 2028-03-10 (1715 days)
- Country:** United Kingdom
- Region:** A (E England) (with a 'Lookup' link)
- City: (weather):** London
- Heating type:** Electric
- Heat pump efficiency:** 3.00 at 10 °C
- Heat pump control:** (checked)
- In state Low:** SG1 on (standard)
- Low:** (checked) when it saves costs
- when electricity costs more than:** £ / kWh
- when electricity is most expensive:** hour
- when heating is most expensive:** hour
- Maximal consecutive halt time:** 2 hour at 10 °C
- Energy loss:** 1.00 % / hour
- Boost:** (unchecked) show all options

License key: The license key is unique for this specific SGC 1. When the key is active, the SGC can retrieve energy prices from the internet and uses them to create plans.

Valid until: The license key is valid until this date. It is possible to buy an extension to the license at our website. Fill in your license key at the “checkout” when purchasing an extension to it.

Country: The selected country will be used to retrieve the electricity prices for the country.

Region: Some countries (UK) are divided in different price regions.

City: The selected city is used to retrieve expected outdoor temperatures, based on the weather forecast for the city. Outdoor temperatures influence the efficiency of heat pumps that use the air from outside as a source.

Heating type: Choose Electric or Hybrid (electric + gas). Your choice influences how the SGC will attempt to minimize the energy consumption costs.

Heat Pump Efficiency: A value of 3.0 means that 1 kWh of electrical energy is converted to 3 kWh of heat energy. The COP of a heat pump advertised by the manufacturer indicates a theoretical efficiency, which in reality will not be reached most of the time. The efficiency depends on the input and output temperature.

Fill in the efficiency of your heat pump at different outdoor temperatures. When you fill in a value for COP and the corresponding outdoor temperature, an extra row with edit boxes will appear. You can fill in up to 5 rows of values. The software interpolates between these values, taking into account the expected outdoor temperature.

Gas boiler efficiency: Fill in here the efficiency of the gas boiler, if present. An efficiency of 100% means that 1 m³ of gas is needed for 9.77 kWh of heat energy. This option is only applicable in a hybrid (gas/electrical) system.

Heat Pump Control:

This setting turns the automatic control of the heat pump on or off. When the automatic control is turned off, the heat pump will stay in the Normal-mode, or the mode that has been chosen manually. If automatic control is on, the heat pump will be operated automatically by the SGC, based on the settings you choose in the Energy Planner.

Heat Pumps can be set to four different states using the SG (Smart Grid) interface. These states are: Low, Normal, Boost, Max. How a heat pump operates during one of these states can often be configured in the heat pump itself.

Using the options of the Energy Planner that are explained below, you can specify when the Smart Grid Controller will switch the heat pump in one of these 4 states.

Some heat pumps only have an EVU connection. In that case, only the states Low and Normal are applicable.

In state Low: SG1 On or Off. With this option you can reverse the operation of the first SG contact (EVU). It will determine if the switch is On or Off when the mode is Low. The default is On. What to choose depends on brand and type of heat pump you have.

Low: The operation of the heat pump can be set to a lower mode (less power consumption). Choose when this should happen.

Never: You can still set the SGC to Low manually, but it will not happen automatically.

When it saves costs: In this mode the SGC will create a plan with the goal to reduce costs. How this happens depends on the type of installation (completely electric, or hybrid) and other settings. In most situations we recommend this option.

The effect of this option (when it saves costs) **on hybrid heating:** In case of hybrid (electrical + gas) heating, the heat pump will be switched to the Low state if the alternative, gas heating, is cheaper. Comparisons will be made based on prices of gas and electricity, and the efficiency of both heating methods, that are configured in this Energy Planner settings. The planning takes into account the expected outside temperature and the effect thereof on the efficiency of the heat pump.

The effect of this option (when it saves costs) **on electrical heating:** Saving costs when using completely electrical heating can be done by scheduling the heating time at the relatively cheap hours, instead of scheduling it when heating is expensive. When the price differences are very small, it might not be useful to switch the heat pump off temporarily, because irregular heating may cause energy loss. Therefore the planner will compare the costs reduction to the expected energy loss (in % per half an hour or 1 hour). If the energy loss is low, the SGC can benefit from smaller price differences than when the energy loss is high.

when electricity costs more than: The heat pump can be set to a lower mode (less power consumption) when electricity costs more than a configured amount per kWh (price inclusive of taxes).

when electricity is most expensive: The heat pump can be set to a lower mode (less power consumption) during hours when electricity is most expensive (independent of outside temperatures).

when heating is most expensive: The heat pump can be set to a lower mode (less power consumption) during hours when electricity is most expensive (depending on outside temperatures).

The outside air temperature can strongly influence the efficiency of a heat pump (when air from outside is the source). Based on the expected

outside air temperature (weather prediction for selected location), the SGC will calculate the expected efficiency (COP) and, based on the COP, the expected heating costs.

Show all options: use this option if you want to combine more than one option. All options available for the Low state will appear, and the edit boxes that below to them. If you don't fill in an edit box of an certain option, but leave the edit box empty, the certain option will not be applied. If you fill in more than one option (turning them on by doing so), then all these options will be applied. Sufficient time blocks will be assigned to meet all the conditions necessary for application of all enabled options. If you enable multiple options, the assigned hours will often overlap. For example, the following has been configured:
 [Low] when electricity costs more than: £ 0.30 / kWh
 [Low] when electricity is most expensive: 2 hours
 If the electricity price is higher than £ 0.30 / kWh for 4 hours, the heat pump will be set to the [Low] mode for 4 hours.
 If the electricity price on a certain day never exceeds the configured price limit, the heat pump will be set to [Low] mode during 2 hours when electricity is most expensive.

The screenshot shows the configuration interface for the Smart Grid Controller 2. It features two main sections: **Boost** (indicated by an orange square) and **Max** (indicated by a red square). Each section has three input fields: 'when electricity costs less than:' (with a dropdown menu set to 'show all options'), 'when electricity is least expensive:', and 'when heating is least expensive:'. The 'Max' section has a value of '1.5' entered in the heating field. Below these is a **Normal** section (indicated by a grey square) with the text 'in all other cases'. A note states 'Price data available for today until 11 PM' with a refresh icon. A 'Current plan:' section lists a sequence of states and times: 'yesterday 22:58 - Low - today 00:29 - Normal - 00:58 - Low - 02:58 - Normal - 03:59 - Low - 04:28 - Normal - 05:29 - Low - 06:00 - Normal - 06:32 - Low - 06:58 - Normal - 07:32 - Low - 09:32 - Normal - 10:02 - Low - 11:32 - Boost - 12:31 - Max - 12:59 - Low - 13:31 - Max - 13:58 - Boost - 14:32 - Max - 14:59 - Normal - 16:59 - Low - 19:01 - Normal - 20:28 - Low - 22:31 - Normal - 23:00'. At the bottom is a 24-hour status bar with numbered cells (0-23) colored according to the current plan. A green 'Save' button and a grey 'Additional configuration' button are at the bottom.

Boost

The heat pump can be set to an elevated mode (more power consumption) when electricity is cheaper than a configured amount per kWh (price inclusive of taxes), or during hours that electricity is cheapest (independent of outside temperatures) or when heating with electricity is cheapest (depending on outside temperatures).

Max

The heat pump can be set to the highest mode (even more power consumption) when electricity is cheaper than a configured amount per kWh (price inclusive of taxes), or during hours that electricity is cheapest (independent of outside temperatures) or heating with electricity is cheapest (depending on outside temperatures).

It is possible that in the Max mode additional electrical heating is applied, having a lower COP than normal. The software doesn't take that into account.

The options that are available for the modes Boost and Max work like the options available for the Low mode. (See above for the explanation of the options for the Low mode.)

The SGC will preferably assign the cheapest hours to the Max mode, and the other cheap hours to the Boost mode.

Note: Because electricity prices may fluctuate considerably, it might be better not to specify *fixed* price boundaries in the Energy Planner, but rather to use options that will make the SGC to look at the *relatively* dearest and cheapest times of the day.

Normal

If none of the three other states is active, the Normal state will be active. In that case the heat pump will operate in the same way as without a connected Smart Grid Controller.

An automatic random variation will be applied to the start and stop times of the planning, to prevent that the system will switch on or off at the same time as other systems. The start and stop times of Boost mode and Max mode will be placed inside the time blocks that are assigned to them, to prevent that these modes are active outside the time assigned to them.

Current plan

The plan is shown as text: It will show the modes (Low/Normal/Boost/Max), each of them placed between two times. The time preceding an operating state is its start time. The time following an operating state is its stop time.

The planning is shown by a row of color codes. Every colored block stands for 1 half hour of the day.

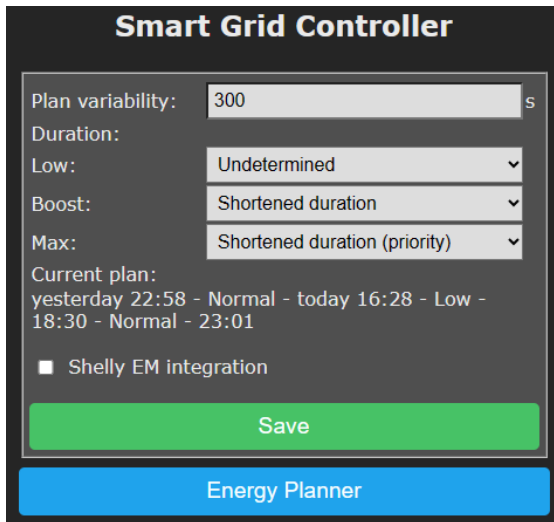
blue = Low, grey = Normal, orange = Boost, red = Max.

When the SGC is connected to a heat pump, the current planning will be automatically applied to the heat pump via the SG-ready connection.

You can set the heat pump to another mode manually in the main menu of the web interface of the SGC. After that, the heat pump will stay in this mode until the next switching moment of the Energy Planner.

5.2 Extra Configuration

Click on the button **Additional Configuration** to access the extra settings that belong to the Energy Planner.



The screenshot shows the 'Smart Grid Controller' configuration window. It features a dark grey background with white text. At the top, the title 'Smart Grid Controller' is displayed in a bold, white font. Below the title, there are several configuration options:

- Plan variability:** A text input field containing the value '300' and a small 's' unit indicator to its right.
- Duration:** A label followed by a dropdown menu.
- Low:** A dropdown menu currently showing 'Undetermined'.
- Boost:** A dropdown menu currently showing 'Shortened duration'.
- Max:** A dropdown menu currently showing 'Shortened duration (priority)'.

Below these settings, the 'Current plan' is displayed as a text string: 'yesterday 22:58 - Normal - today 16:28 - Low - 18:30 - Normal - 23:01'. Underneath the plan text is a checkbox labeled 'Shelly EM integration', which is currently unchecked. At the bottom of the configuration area, there is a prominent green button labeled 'Save'. Below the entire configuration panel is a blue button labeled 'Energy Planner'.

Plan variability: On default, the time variation of the plan is 300 seconds (5 minutes). This means that the start time variation will be 300 seconds or less, and the stop time variation will be 300 seconds or less. Random numbers between 0 and 300 seconds will be used to adjust the start

time and stop time of the plan. For example 09:00 – 10:00 can be adjusted to 08:58 – 09:57.

Duration: With these “Duration” options, you can choose how the “plan variability” behaves for each SG mode. Per SG mode, you can select the following:

Undetermined: The (random) variation in the plan is allowed to make the planned time shorter or longer. For example 08:58 – 09:57

Shortened duration: The (random) variation in the plan is only allowed to make the plan shorter. For example 09:02 – 09:58. This can be useful to force that the planned state (Low, Boost, or Max) will always be inside the expensive or cheap time span.

Shortened duration (priority): The same as previous, but with one difference: by choosing this option for a certain SG mode, you will give this SG mode priority during calculations above other SG modes.

Note on the priority function:

A reason to choose this priority function for the Max mode could be: The Max state consumes more power, so if Boost and Max are planned next to each other, Max will be shorted, resulting in Boost (only when following or preceding Max) to be somewhat longer.

Lengthened duration: The (random) variation in the plan is only allowed to make the plan longer. For example: 08:58 – 10:02. This can be useful to force that during the complete run of an expensive/cheap time span, the Planned State (Low, Boost, Max) will be applied.

Shelly EM integration

IP Address:

When power:

less than: W

switch to:

greater than: W

switch to:

Shelly EM integration: With a Shelly EM it is possible to measure the electrical power on a wire.

IP Address: Fill in the local IP address of the Shelly EM. The Shelly web interface is running at this IP as well.

A Shelly EM can measure the energy consumption from one or more channels.

Channel: Fill in to which channel the SGC should respond to.

When power less than: The SGC should switch when the power at the specified channel becomes less than a certain amount of Watts.

(Then) switch to: Choose one of the following options: Planned state, Low, Normal, Boost, Max. When you choose "Planned state" you let the Energy Planner decide between Low, Normal, Boost, Max, and the SGC will in fact fall back to the planned state.

(When power) greater than: The SGC should switch when the power at the specified channel is greater than a certain amount of Watts.

(Then) Switch to: Choose one of the following options: Planned state, Low, Normal, Boost, Max. When you choose "Planned state" you let the Energy Planner decide between Low, Normal, Boost, Max, and the SGC will in fact fall back to the planned state.

For example, if you want to switch the heat pump to "Boost" when 200 W or more is fed back to the grid, and switch the heat pump to "Planned state" when 180W or less is fed back to the grid, than choose: 180, Planned State, 200, Boost.

<input checked="" type="checkbox"/> Shelly EM integration	
IP Address:	192.168.0.16
When power:	channel 1
less than:	180 W
switch to:	Planned state
greater than:	200 W
switch to:	Boost
Save	

The reason why to switch back to the Planned State when the power is 20W lower (and not earlier) is to prevent that the SGC will often switch to-and-fro, which is unnecessary and undesired.

6 Information Pages

6.1 Events

The SGC registers switch-on and switch-off events, and when the energy plan is adjusted. To view this information, go to the main menu, press System and then choose Events.

On default, the most recent events will be at the top. Use the arrow buttons to browse to next or previous events.

The list shows by whom the SGC has been operated: by the user (via the web interface or via the button on the device itself) or by the automated Energy Planner.

7 Solving Problems

The SGC 2 is not accessible in the network

Check the network cable and the network connection. If DHCP is active, but mDNS doesn't work, you can try to find the IP address of the smart grid controller by looking it up in your router.

As an alternative, you can access the SGC 2 via WiFi (only when WiFi is turned on). Check if the SGC is available as a WiFi Access Point (search in your smart phone for a network called SGC). Check if WiFi is still working and its signal is strong enough at the site where the SGC is located. To reset the WiFi settings of the SGC, click 7x quickly on the SET button. After that, the SGC should become available as a WiFi network, and you can continue the installation from there, as described in the chapter [Installing the Smart Grid Controller 2](#).

The SGC is visible in the network, but accessing the SGC fails.

Hold the SET button of the SGC for 40 seconds to reset the WiFi settings and the SGC password.

8 Ecosoft Energy app (optional)

8.1 Download

The SGC can be operated from any smart phone with a web browser, like iPhones and Android phones.

The free Ecosoft Energy App for Android is optional. With this app you can configure and operate your SGC (and other Ecosoft products, such as the EcoSwitch devices, when they are connected to your network).



You can download the Ecosoft Energy App from <https://play.google.com/store/apps/details?id=nl.vidicode.ecosoftenergieplanner>

9 Other information

9.1 Access to open-source code

The SGC uses open source programs. If you want access to the source code, you may send a request to Ecosoft.