

# GARO Connect - Price Adaptive Charging (PAC)



## GENERAL

This manual describes the Price Adaptive Charging function (PAC).

The purpose of this function is to provide a general, relatively easy way to optimize charging using hourly variable energy prices. All setup is done through the GARO Connect app.

The GARO Connect app is available for android and Apple devices.

Source of information is fetched from Nordpool. Functions are based on the user settings and charging stations with some owner relationships.

## REQUIREMENTS

- In order to use the PAC-function, the charging station needs to have an hourly basis tariff from the energy company since the PAC-function is based on the spot price from Nordpool. This is today possible in the Nordic countries.
- The schedule that the PAC-function is creating will of course work with for instance fixed tariffs, however, the economical benefit from charging during "low price" hours will not be applicable.
- The GARO Entity charging station need to have firmware version 1.10 or higher to support PAC-function. To check your firmware version: In "overview" click "Settings" and then choose "About my device". Here you can also update the firmware.
- When activating the PAC-function, your other scheduled charging sessions will be turned off. The PAC-function can not be used at the same time as scheduled charging sessions planned in "Schedule".

## ACCESS TO THE PAC-FUNCTION

The tool is linked to a location. This means all GARO Entity charging stations in a location is possible to use with the tool.

Since location always has one or several owners, any owner of the location can use and change settings in the tool.

## ORGANIZATION ACCESS


If the location is linked to an organization, then all administrators in an organization has access to the tool.

### NOTE

*An example is a company that owns several locations. The same administrator can easily access all locations within the organization.*

## MANAGE ACCESS

All users of the tool need to be registered as owner/administrator of the charging station. To manage access:

1. Choose "Manage locations" in the "Hamburger main menu" in right upper corner. 
2. Under "Edit location", "Location settings", select "Manage ownership"
3. Here additional owners can be invited through E-mail.


## ACTIVATE THE PAC-FUNCTION

Activating the PAC-function can be done at the moment of creating a location during the installation process.

### NOTE

*The Entity Charging station need to have FW 1.10 or higher to support PAC. So, start by upgrading the charging station/s*

If not done at the moment of creating the location it can be done in the GARO Connect App by following the steps below:

1. Press the PAC-icon on the overview homescreen of the charger. 
2. Choose "Edit location".
3. Toggle the switch on "Enable price adaptive charging" On/off (Turns green when on).
4. Once you turn on the PAC, a couple of additional location settings are required in order to fetch correct price information from Nordpool.
  - Country
  - Electricity price area

### NOTE

*You should be able to find the price area on your utility bill.*

## ADD VEHICLE DATA

Vehicle data is linked to you as user.

1. On the overview home screen of your charger click the PAC-icon. Then choose "Car settings".
2. Input your car battery size (kWh) and the onboard charger power (kW). This information can be found in the car user manual. Currently, only one car is supported per user.



### NOTE 1

The settings mentioned in the previous part is a one-time setting. You only need to do this once in order to get the PAC-function to work in a proper manner. The PAC needs to know battery size and charging power of your car in order to calculate the most efficient schedule of charging.

### NOTE 2

If the charging station is installed as single phase or with current limitations that limits charging to a value lower than the on-board charger power of the car, then onboard charger power (KW) must be reduced to fit the situation.

Once the PAC-function is setup, it will appear as an alternative when starting a charging session.

## USING THE TOOL

When starting a charging session using PAC, some key information will be needed.

1. Plug in the car.
2. Make sure you are in "Overview" of your charger.
3. Select "Charging station".
4. Press "Price adaptive Charging".
5. Enter the following information:
  - **DEPARTURE TIME**  
The time when you need the car to be charged and ready to go. Enter the time within the closest 24 hours. You can not plan a PAC-charging session with longer timespan than 24 hours.

### NOTE

Default departure time is the same time that was used last PAC-charging session was started.

- **BATTERY STATE OF CHARGE AT PRESENT**  
Battery state of charge SOC (%) at present (Left sliderpoint). This is how much energy (in %) your car has when starting the charging.

This information will be available either in the car, or in the app of the car.

Select by dragging the left slider to the desired value.

### NOTE

Default departure time is the same time that was used last PAC-charging session was started.

- **BATTERY STATE OF CHARGE DESIRED**

Battery state of charge (%) desired (Right sliderpoint). This is how much energy (in %) your car is desired to have at the departure time, when the charging session is ready.

Select by dragging the right slider to the desired value.

### NOTE

Default value is same as last time PAC-charging was started.

6. Click "Start PAC" to start the PAC-function.

### NOTE

The PAC-function might take a couple of seconds to calculate so just wait for it to finish.

7. When you get the confirmation (a green box at the bottom of the screen) "Ok, PAC scheduled" the function has created the PAC. The screen will also display "PAC Active" under the charger in the homescreen.
8. The led on the charger will now indicate blue.
9. The schedule is activated and will start and stop charging according to the calculations of the PAC.

### NOTE

During an active PAC session, the charging may stop, and resume charging numerous times – this is part of the optimization. PAC will try to achieve the desired charging at lowest cost, but does not take in consideration if the charging power is lowered due to load balancing when other energy consumers affects power available.

10. To view a graphical representation of the scheduled session, press the "PAC" button in overview.

## TESTING THE PAC-FUNCTION

It is recommended to do a few test sessions to get used to the tool on your location. There are many factors that affect performance.

- First of all, power must be available for the planned charging. The PAC-function does not take the other energy consumption of the location into consideration.

## RISKS, HINTS AND RECOMMENDATIONS:

Using PAC with limited power adds complexity.

- If charging power is limited by the dynamic load balance management (DLM), then the real charging power can become (much) lower than the planned power.
- If this “gap” occurs early during the available charging time window, the PAC may be able to catch up. To avoid having a not enough charged car in the morning, it is recommended to carefully follow the available power of the location. One way to lower risk is to reduce the parameter for onboard charging power. (under user/car settings)

If you suspect that power is limited during the planned charging interval and the planned charging is critical, then consider using a normal charging session.

- If power is limited and controlled by a dynamic load balance management (DLM), the real function will likely be very different depending on time of year.

The logo for GARO, featuring the word "GARO" in a bold, white, sans-serif font with a registered trademark symbol (®) to its upper right. The logo is positioned in the top right corner of the image, which shows a wooden wall with a charging station and a car.

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Operation manual

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