

Manual: QA Heat Pump

Economical control of a heat pump according to spot prices — the application schedules operation during the cheapest hours while maintaining thermal comfort.

Introduction

QA Heat Pump controls the operation of the heat pump (HP) so that space heating and DHW heating take place in the cheapest hours of the spot market, while maintaining the comfort of the heated spaces.

The application can:

- schedule the daily number of operating hours according to the outdoor temperature (based on the user's operating requirements),
- ensure a minimum number of operating hours in the cheapest hours of the specified time periods,
- use extremely cheap hours for **preheating** the building (SG2 contact),
- activate the **heating block** (SG1 contact) in expensive or blocked hours,
- optionally react to the HDO signal (high / low tariff),
- take into account the variable efficiency of the HP depending on the outdoor temperature,
- publish energy needs for spot scheduling (QA Spot Pro),
- monitor the HP consumption from a separate energy meter.

The application controls two digital outputs:

- **SG1** — signal for the **heating block** / HDO signal to the HP,
- **SG2** — signal for **preheating**.

Reception of the SG1 and SG2 signals must be activated in the settings of the heat pump itself.

The application cooperates with Mervis SCADA for visualisation and with other QA applications of the Energy Management family — for spot prices, energy sharing, controlled wallboxes, DHW heating and more.

Upstream and downstream applications

Upstream applications

Mandatory:

- **QA Spot Pro** — source of the spot price plan, evaluation of the cheapest hours and communication of the energy needs from QA Heat Pump to the scheduler.
- **QA Global Climate Mode** — determines the current annual climate mode (Winter / Transient / Summer), according to which QA Heat Pump switches its operating mode from Options.

Hardware (recommended):

- **Heat pump energy meter** — a separate energy meter (smart meter) measuring the consumption of the heat pump. We recommend installing it for accurate consumption measurement and calibration of the curves. If the energy meter is not installed, the system is not able to correctly evaluate the household's baseline energy consumption and the consumption statistics are affected.

Optional:

- **QA HDO** — high / low tariff signal. The application can respect HDO when scheduling operation.

Downstream applications

Hardware (mandatory):

- **Switching module with potential-free contacts** for the SG1 and SG2 signals — we recommend the **FIBARO Double Smart Module (FGS-224)** with a 100–240 V AC 50/60 Hz or 24–30 V DC power supply. Alternatively, a Shelly module with two potential-free outputs. A potential-free contact is required for compatibility with the SG inputs on the heat pump side.

QA Heat Pump passes **energy needs** to QA Spot Pro for the overall spot scheduling of the household.

Installation and initial setup of the QA

Installation

Purchase the application in the Smart Home and Energy e-shop (<https://eshop.smarthomeenergy.cz>). After the purchase you receive an e-mail with a link to the activation form, in which you choose one of the two installation methods:

- **Installation via the SHE Installation Application (recommended)** — the activation form provides a link to download the Installation Application. Install it into the unit; it then automatically downloads and installs the purchased licences. It provides automatic updates of all applications and easy licence management (requires the "superuser" credentials for the unit). See the separate "Installation Application" manual for details.
- **Standalone installation file** — the activation form provides links to download an encrypted *.fqax file bound to the entered unit S/N. Install the file manually into the unit according to the unit manufacturer's instructions (logged in as "superuser"). This option does not allow automatic updates.

After a successful installation, a set of cards and monitoring tiles belonging to the application appears on the unit desktop in the **Heat pump** section.

Operating prerequisites

- **QA Spot Pro** and **QA Global Climate Mode** are installed in the unit.
- The heat pump has the **Smart Grid** functions corresponding to the SG1 (heating block / HDO) and SG2 (preheating) contacts activated in the manufacturer's settings.
- The SG1 and SG2 inputs of the heat pump are connected to a switching module with **potential-free contacts** (recommended FIBARO FGS-224 or a Shelly module).
- For accurate consumption measurement, a **heat pump energy meter** is connected to the unit (recommended).
- To react to the high / low tariff, **QA HDO** with the corresponding signal source is installed (optional).

Opening the application control card

To open the application card in a web browser, move the cursor over the tile (e.g. **Heat pump Control**, **Heating settings**, **Installation**) and click the **eye** icon in the top-right corner of the tile. The card detail with the current state and settings opens.

Warning: Not all cards and tiles are displayed to all users. Each user selects which cards and tiles are displayed on the Display Settings card (sheViewControl application) – levels **SHORT**, **ADVANCED** and **ADMIN**. If you cannot see a described card, check the settings on this card.

User settings

For QA Heat Pump, the following cards and tiles are displayed on the **Heat pump** desktop (in the order in which you see them on the desktop):

- **Heat pump Control** — operating card (state, mode selection, energy plan, consumption overview).
- **Heating settings** — operating requirements, preheating, efficiency and consumption curves.
- **Options** — HP operating mode according to the season.
- **Installation** — number of time slots, SG1/SG2 outputs, HDO source, energy meter.

Additional **monitoring tiles** display current values without the possibility of intervention — typically:

- **SG1 Output, SG2 Output**,
- **Basic Today** (HP consumption for the day, kWh), **Basic Total** (cumulative consumption, kWh),
- **HP SG1 / HP SG2** (state of the output contacts),
- **HP Energy Meter Total** (kWh) and **HP Power Total** (W).

Initial setup procedure

After the installation is complete, set up the cards in this order — the sets of sections on the other cards change according to the choices in Installation:

1. **Step 1 — "Installation" card** — number of heating time slots, HDO source, SG1/SG2 outputs, HP energy meter, power input and phases.
2. **Step 2 — "Options" card** — HP operating mode for Winter, the transitional period and Summer.
3. **Step 3 — "Heating settings" card** — requirements for operating hours according to the outdoor temperature, time periods of mandatory operation, preheating, efficiency and consumption curves.
4. **Step 4 — "Heat pump Control" card** — operating mode selection (Automatic / Temporary / Manual).

This manual describes all the options that can appear in the UI — a specific installation displays only the subset corresponding to the selected sources and hardware.

"Heat pump Control" card

Operating card — displays the current control state, the energy plan for the following hours and the consumption overview, and allows manual intervention.

Control state

The upper part of the card displays:

- **Control Mode** — the current operating mode (e.g. AUT-DHW, AUT-HEATING).
- **Annual climate mode** — Winter / Transient / Summer (controlled globally).
- **Operating Mode** — Heating+DHW / DHW / Off (based on Options for the current season).
- **Input Mode, EMS Input** — current input request from the downstream QAs.
- **SG1 Output, SG2 Output** — current state of the output contacts (Off / On).
- **Avg outdoor temperature today / tomorrow** and **Operating hours today / tomorrow**.

Operating mode selection

- **AUTO** — the application controls the HP according to the energy plan and the user's operating requirements.
- **TEMPORARY-HEATING / TEMPORARY-PREHEATING** — switches the heat pump on manually for the duration set in **Temporary mode time**. When this time expires, the application automatically returns to the previous mode.
- **MANUAL-HEATING / MANUAL-PREHEATING / MANUAL-DHW / MANUAL-OFF** — permanent manual control until the next change.

Temporary mode time

The time (in hours) for which the **TEMPORARY**-* mode applies before the application returns to the previous mode.

Energy plan

Hourly table with the planned command for the HP. The application generates it for the next 24 hours from the QA Spot Pro data and the user's operating requirements. Columns:

- **H** – hour,
- **Price** – purchase price (CZK/kWh),
- **Pro** – relative price advantage (%) within the day,
- **Tout** – forecast outdoor temperature (°C),
- **Ener** – expected HP consumption in the given hour (kWh),
- **Effic** – expected HP efficiency at the given temperature (%),
- **Price** – cost price including efficiency (CZK/kWh of heat),
- **Hour** – total number of hours in the given plan section,
- **Command** – Heating / Preheating / Off.

The bottom summary row **Total Prescription/Plan** displays the total number of hours specified by the user and the number of hours actually scheduled by the application.

The **Update** button is used for checking only – whenever you want to verify which plan is currently loaded from the unit, click it and the values are reloaded.

TOU

Current state of the HDO signal (low / high tariff), if configured in Installation.

Energy needs

Summary of the energy needs that QA Heat Pump passes to **QA Spot Pro** for scheduling. If no needs are active, No needs is displayed.

Energy meters

- **Energy Today** – HP consumption for the current day (kWh).
- **Energy** – cumulative HP consumption since start-up (kWh).

Average cost

- **Basic** – average cost price of the energy consumed by the HP (CZK/kWh).

Avg consum. to out.temperature

Table of the average daily HP consumption divided by days of the week and temperature bands (e.g. -15 to -11 °C, -10 to -6 °C, -5 to -1 °C, 0 to 4 °C, 5 to 9 °C, 10 to 14 °C, 15 to 19 °C). It serves as a basis for adjusting the **Average hourly consumption curve** in Heating settings.

"Heating settings" card

The card is used to enter the HP operating requirements – how many hours a day it is to heat, when and under what price conditions preheating is to take place, and what efficiency and consumption the HP has at different temperatures.

Day hours operation acc. outdoor temp

Requirement for the number of HP operating hours for the **minimum** and **maximum** design outdoor temperature. For intermediate temperatures, the application calculates the number of hours linearly.

- **Temperature Outdoor Min + Hours number** — how many hours the HP is to heat at the design minimum outdoor temperature (typically -12 °C).
- **Temperature Outdoor Max + Hours number** — how many hours the HP is to heat at the upper limit of the heating season (typically 14 to 16 °C).

Enter the values based on your experience with the building.

Min. Operation in period

Requirement for mandatory operation in daily time periods. For each period, the time **from** (symbol ►) — **to** (symbol ■) and the requirement for minimum operation are entered; the requirement can be entered in two ways (columns ⌚ and %):

- **Hours** — absolute minimum number of hours of mandatory operation in the given period.
- **Percent (%)** — minimum operation as a percentage of the period length. Example: if the period is 4 hours long and the user enters 50 %, the application ensures at least 2 hours of operation in this period.

In the given period, the application selects the **cheapest hours** so that the requirement is met and the thermal inertia of the building as well as any simultaneous DHW heating are respected.

The number of rows (periods) is determined by the **Number of heating time slots** option in Installation.

Preheating settings

Preheating uses hours with an extremely low price to accumulate heat in the building via the SG2 contact.

- **Minimal profitability buy price** — price advantage threshold (%) within the day above which an hour may be used for preheating (higher value = stricter selection).
- **Maximum daily number of hours** — cap on the number of preheating hours per day.

Efficiency curve

The HP has a variable efficiency (COP) depending on the outdoor temperature. The curve adjusts the expected efficiency and thus the cost price of heat in the energy plan.

- **Temperature Outdoor Min + Efficiency at T.Min (%)** — efficiency at the design minimum temperature.
- **Outdoor Temperature Max + Efficiency at T.Max (%)** — efficiency at the upper limit of the heating season.

Average hourly consumption curve

Expected hourly HP consumption at different outdoor temperatures. It enters the energy plan as the basis for the cost estimate.

- **Temperature Outdoor Min + Consumption of throws (kWh)** — consumption estimate at the design minimum temperature.
- **Outdoor Temperature Max + Consumption of throws (kWh)** — consumption estimate at the upper limit of the heating season.

Calibrate the values according to the actual readings from the **Avg consum. to out.temperature** table on the Heat pump Control card.

"Options" card

The card determines how the HP is to work in the individual seasons. The current season is controlled by the **Global Climate Mode** of the unit.

Climate acc. Global mode

- **CLIMATE MODE WINTER** — Off / Heating+DHW / DHW.
- **CLIMATE MODE TRANSIENT** — Off / Heating+DHW / DHW.
- **CLIMATE MODE SUMMER** — Off / Heating+DHW / DHW.

Typical setting: Winter = Heating+DHW, transitional period = DHW, Summer = DHW.

"Installation" card

The card is used to set the time slots, to configure the inputs and outputs and to select the hardware.

⚠ Warning: When saving settings, always wait until Run status changes to Running. Do not press SAVE before that. Repeated pressing before the restart is complete may cause configuration errors.

Number of heating time slots

Number of rows (time periods) available in the **Min. Operation in period** section in Heating settings.

Input/output configuration

TOU SOURCE TYPE

- **Disabled** — the application does not react to the HDO signal.
- **Global variable** — HDO is read from a shared global variable of the unit (e.g. populated by QA HDO).
- **Device** — HDO is read directly from a digital input / device in the unit.

SOURCE: TOU

The specific global variable or device carrying the HDO signal (displayed according to the **TOU SOURCE TYPE**). If the expected item is missing from the list, click **Update** to reload the available items from the unit.

VALUE OF TOU LOW TARIFF

State of the HDO source corresponding to the **low tariff** (typically Low).

OUTPUT TARGET TYPE

- **Disabled** — the application does not control any physical SG outputs.
- **Device** — the application controls physical digital outputs.

TARGET OUTPUT SG1

The specific output to which the **heating block / HDO** signal is sent. The SG1 input must be configured accordingly in the heat pump settings.

TARGET OUTPUT SG2

The specific output to which the **preheating** signal is sent. The SG2 input must be configured accordingly in the heat pump settings.

Power Nominal

Rated power input of the heat pump (W). The value is used for calculating the energy plan.

PHASES

Selection of the phases to which the HP is connected (Phase 1, Phase 2, Phase 3 — more than one can be selected).

ENERGY METER

Selection of the device that measures the consumption of the heat pump. If the expected device is missing from the list, click **Update** to reload the available devices.

Overview EMS devices

Summary information row (Device ID, Control type, Lines) — the output interface through which the application communicates with the higher-level EMS. No settings.