Heat Pump Control with SolarEdge Home Load Controller — Application Note

This Application Note describes how the Home Load Controller transforms a heat pump into thermal storage for excess solar energy and preserves battery life during a power outage.

Revision history

Version 1.1, April 2024: Included the Home Load Controller.

Version 1.0, March 2022: Initial Release

Overview

Heat pumps can be adjusted to store electrical energy as heat and function as a thermal storage system. For heat pumps with onsite solar systems, excess PV generation can be stored as thermal energy for later usage. In addition, during a power outage, the heat pump can turn OFF automatically to preserve the battery's life.

Heat pumps can have solar control or Smart Grid ready (SG-ready) input. These inputs allow external signals to influence how the heat pump functions. For details, see the pump manufacturer's manual for the types of control input that you can integrate with the SolarEdge ecosystem.

Operation of the heat pump

A heat pump operates at a predefined temperature setpoint to heat/cool a space and/or heat water for household use. Heat pumps with a solar control input or a SG-Ready interface enable external signals to temporarily influence the predefined setpoints. This enables the heat pump to act as a thermal storage system for the duration of the signal. Each heat pump works differently — underlining the importance to refer to the heat pump technical manual for its capabilities and operation modes. Heat pumps can have predefined settings that increase the temperature of the room or the water heating by a preset percentage or temperature.

Configure the Home Load Controller with the heat pump

The Home Load Controller signals the heat pump to operate as a thermal storage system when excess solar power is available or to turn OFF during power outages. For installation details on the SolarEdge Home Load controller see the [Home Load Controller Quick Installation Guide](#).

Best practices:

- Depending on the operation mode and settings of the heat pump, the Home Load Controller activates the pump's compressor, fan, and/or the resistive heating rod. This influences the average rated power consumption and the minimum required ON time.
- During the commissioning process, you define the heat pump power rating to activate the heat pump when there is excess PV power.
- To avoid importing from the grid, define the power rating with 20% more than heat pump's maximum consumption.
- We recommend monitoring the heat pump's operation after connecting to the Home Load Controller to verify correct system parameters.

Increase heat pump consumption with solar power using a SG-Ready or digital control input

You can convert excess PV energy into thermal storage when you have a solar ready heat pump using a SG-Ready or digital control input. The Solar input is a single input contact while the heat pump's SG-Ready interface consists of two contact inputs, creating four possible operating modes.

SG- Ready heat pump operating modes.

Operating mode	Relays configuration	Terminal connection	Description
OFF	ON/OFF	1:0	Heat pump is switched off.
Normal	OFF/OFF	0:0	Heat pump is working in normal mode without an external effect.
Recommended ON	OFF/ON	0:1	Heat pump is working in a recommended enhanced mode.
Forced ON	ON/ON	1:1	Heat pump must be switched ON.

To connect a control input:

Connect the Home Load Controller output to the heat pump's interface according to the manufacturer's instructions.

1. Connect the Home Load Controller's power to a power source.
2. Configure the Home Load Controller according to the following heat pump parameters:

Heat pump parameters

Parameter	Description
Load rating	The rated power consumption (in kW) of the heat pump + 20% spare
Minimum ON time	The minimum duration the heat pump should remain operating, even when no excess PV power is available. We recommend you define a set time of five minutes to prevent rapid ON/OFF cycles. For details, see the heat pump manufacturer's manual
Excess PV power	Enable Excess PV power. Allows the Home Load Controller to operate in excess PV mode

> 💬 **NOTE**
>
> To ensure the optimal operating mode for the heat pump on SG-Ready Interface the Home Load Controller should switch between **Normal** and **Recommended ON.**

Example of a SG-Ready input

The Panasonic Aquarea heat pump controls hot water, heating, and cooling through the Home Load Controller.

Panasonic Aquera heat pump modes

SG-Ready Signal		Operating mode	Description
VCC-Bit1	VCC-Bit2		
1	0	Heat pump OFF	Heat pump and E-heating element are switched OFF.
0	0	Automatic operation	Heat pump operates in Normal mode.
0	1	Increased operation	Power setting 1 (in %) for heating and domestic water.
1	1	Maximum operation	Power setting 2 (in %) for heating and domestic water.

You must connect the Home Load Controller to Bit2 and V_{CC} on the Panasonic Aquarea heat pump controller. A signal is triggered when Bit2 is connected to V_{cc}. This enables the heat pump to switch between Automatic Operation (0:0) and Increased Operation (0:1) modes. This allows the heat pump to operate in the most energy efficient way.
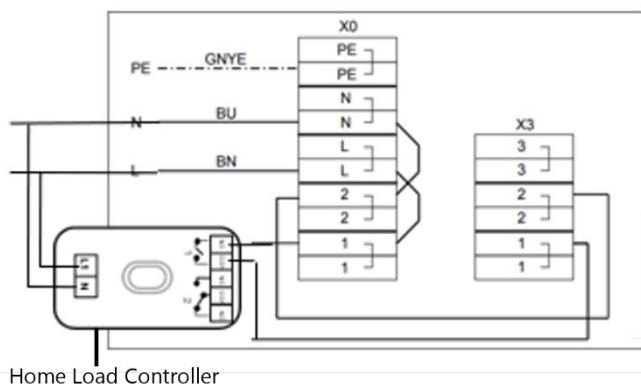
> **NOTE**
> Make sure to set a percentage increase for heating and hot water capacity.
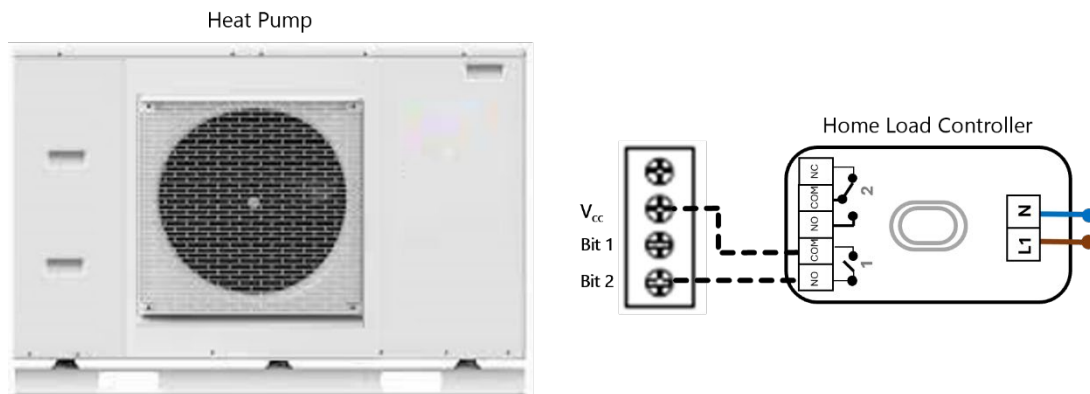
Example of a digital control input

The Stiebel Eltron can operate with a photovoltaic signal using a single relay control. After the relay is closed, shorting X0-1 and X3-1, the heat pump increases its operation set point.

> **NOTE**
> Check the relevant Stiebel Eltron heat pump installation guide to ensure the correct setting on the installed model.

Turn OFF heat pump with a SG-Ready control input

During power outages, you can set your heat pump to turn automatically off with the SG-Ready control input. You must connect the Home Load Controller output to the SG-Ready interface. For details, see the manufacturer's heat pump instructions.

Heat pump operating modes.

Operating mode	Configuration for relays	Terminal connection	Description
OFF	ON/OFF	1:0	Heat pump is switched off.
Normal	OFF/OFF	0:0	Heat pump is working in normal mode without external effect.
Recommended ON	OFF/ON	0:1	Heat pump is working in a recommended enhanced mode.
Forced ON	ON/ON	1:1	Heat pump must be switched ON.

To set the pump to turn OFF:

1. Connect the Home Load Controller output to the heat pump's SG-Ready interface according to the manufacturer's instructions.
2. Wire the Home Load Controller to switch between 0:0 and 1:0.
3. Connect the Home Load Controller to the heat pump power source.
4. Configure the Home Load Controller according to the following parameters:

Heat pump parameters

Parameter	Description
Load rating	The rated power consumption (in kW) of the heat pump + 20% spare
Minimum ON time	The minimum duration the heat pump should remain operating, even when no excess PV power is available. We recommend setting the time for five minutes, to prevent rapid ON/OFF cycles. For details, see the heat pump manufacturer's manual
Essential Device	Configure as Nonessential device.