

Application Note - Heat Pump control with SolarEdge Smart Home system

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Version History

- Version 1.0 (Mar 2022) – initial release

Disclaimers

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Introduction

Being a variable load, heat pumps can store electrical energy as heat and function as a thermal storage system. This is particularly interesting for heat pumps with solar generation on site as excess PV generation can be stored under thermal energy for later usage.

Most heat pumps today have a digital control input, such as SG ready, allowing external signals to influence the working of the heat pump. Please refer to the heat pump manufacturer's manual for more information on the specific control input of the heat pump that is to be integrated with SolarEdge ecosystem.

This document covers the connection of a heat pump with a digital control input to the SolarEdge system using the first-generation Smart Energy Relay.

For more information on how to connect and configure the Smart Energy Relay see

<https://www.solaredge.com/sites/default/files/se-device-control-dry-contact-switch-installation-guide.pdf>

Principal of operation

A heat pump is typically working at a predefined temperature set point to heat/cool a space and/or heat water for domestic usage. Heat pumps with digital control input allows external signals to temporarily influence the predefined setpoints enabling the heat pump to act as a thermal storage system for the duration of the signal. Each heat pump works differently which is why it is important to first refer to the heat pump technical manual to understand its capabilities and operation modes. Most heat pump will have predefined setting allowing to increase the temperature of the space heating or the water heating by a certain percentage or by a certain temperature.

SolarEdge's Smart Energy Relay allows SolarEdge users owning a heat pump with a digital control input to signal when excess energy, generated from the PV system, is available suggesting the heat pump to operate as a thermal storage system.

It is mandatory to configure the right properties of the Smart Energy Relay to ensure a proper working of the heat pump and more specifically the following properties:

- The load rating: the rated power consumption (in kW) of the heat pump
- The minimum ON time: the minimum duration the heat pump should remain ON once switched on, even when no excess PV power is available



NOTE

Minimum ON time should be defined according to which component will be activated by the signal, namely the heat pump compressor or the electrical heating rod. We do not suggest putting an on time for less than 5 minutes to prevent rapid ON/OFF cycles. Refer to the heat pump manufacturer's manual for accurate minimal operation time.

- Use Excess PV: Allow the Smart Energy Relay to operate in excess PV mode

Guidelines:

1. Depending on the heat pump operation mode and settings, the digital control input will activate the heat pump's compressor and fan, and/or the resistive heating rod. This will influence the amount of average rated power consumption and the minimum on time required.
2. The load rating definition will determine at which available PV the heat pump will be activated. It is important to set the right load rating to optimize the usage of excess PV generation and avoid unnecessary electricity import from the grid. In case the defined load will be too low, the heat pump might cause import from the grid. We recommend using max heat pump power and add some spare (about 20%).
3. We recommend monitoring heat pump operation after connecting to SolarEdge Smart Energy Relay to verify system parameters were defined properly.

Connecting a heat pump to SolarEdge System

Connecting to a heat pump with a digital control input

1. Connect the Smart Energy Relay output to the digital control input of the heat pump.



NOTE

The Smart Energy Relay should be connected to the digital control input according to the HP manufacturer instructions.

2. Power up the relay and set the ZigBee connection from the inverter.
3. Configure the Relay according to the heat pump parameters:
 - Rated power – use the heat pump rated power + 20% spare
 - Min active time – set the minimum activation time defined for the heat pump compressor
 - Enable Excess Solar Power mode

For more information on how to connect and configure the Smart Energy Relay see

<https://www.solaredge.com/sites/default/files/se-device-control-dry-contact-switch-installation-guide.pdf>

Connecting to a heat pump with a SG-Ready control input

1. Connect the Smart Energy Relay output to the SG Ready relay port on the heat pump that trigger the control of state 3. Please see refer to the table below.
2. Power up the relay and set the ZigBee connection from the inverter.
3. Configure the Relay according to the heat pump parameters:
 - Rated power – use the heat pump rated power + 20% spare
 - Min active time – set the minimum activation time defined for the heat pump compressor
 - Enable Excess Solar Power mode

SG Ready interface consists of two contact inputs, creating four possible states according to the following table:

#	State	Relays configuration	Terminal connection	Action
1	OFF	ON/OFF	1:0	HP switched off
2	Normal	OFF/OFF	0:0	HP working in normal mode without SG effect
3	Recommended ON	OFF/ON	0:1	HP working in a recommended enhanced mode
4	Forced ON	ON/ON	1:1	HP must switch ON

Guidelines:

1. We recommend to only connect to the input that will allow a change of operation from state 2 (normal operation) to state 3 (recommended operation) on to ensure the right functioning of the heat pump without overriding its basic operation mode to avoid any discomfort from the end user.
2. The Smart Energy Relay should be connected to the SG Ready interface according to the HP manufacturer instructions. It is common that the Smart Energy Relay is connected between one of the heat pump SG Ready interface ports and heat pump VCC output, thus triggering the set point operation when the relay is closed and preventing the set point operation when it is opened.

For more information on how to connect and configure the Smart Energy Relay see

<https://www.solaredge.com/sites/default/files/se-device-control-dry-contact-switch-installation-guide.pdf>

Application Examples

Panasonic Aquarea air-to-water heat pump control for split systems and compact systems

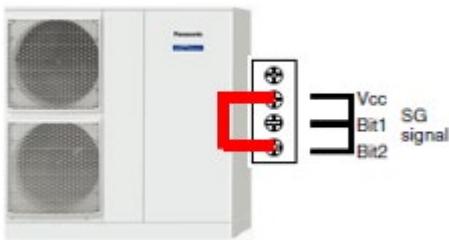
The Panasonic Aquarea heat pump may control hot water (most common use case), heating and cooling through a dry contact with two inputs (VCC- Bit1 and Vcc-Bit2). The following settings are possible:

Operating state	SG-Ready-Signal	
	Vcc-Bit1	Vcc-Bit2
Heat Pump Lock: Heat pump and E-heating element are switched off	1	0
Automatic operation Heat pump runs in a normal mode	0	0
Increased operating: Power setting 1(in %) for heating and domestic water	0	1
Maximum operation: Power setting 2 (in %) for heating and domestic water	1	1

It has 2 set points triggered by an input from an SG ready interface- S1, S2 and VCC. A signal is triggered when a relay (Bit1, Bit2) is shorted to VCC. The values for each device (X1, Y1, X2, Y2) are locally defined by the installer on the Panasonic system.

Note that the function must be enabled through the operating unit of the heat pump as well as the power setting (set % increase in heating capacity and domestic hot water capacity).

The SolarEdge Smart Energy Relay should be connected to Bit2 and VCC to switch between operation status 2 and 3.

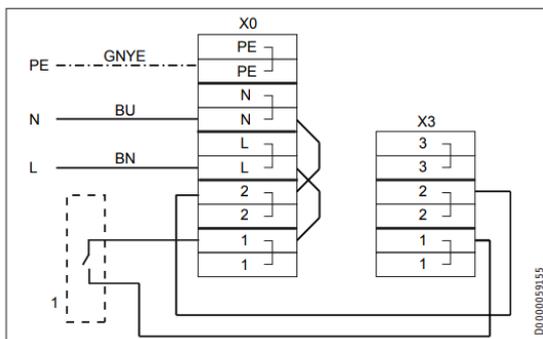


NOTE

Please check the relevant Panasonic heat pump installation guide to ensure the correct setting on the installed model.

Stiebel Eltron DHW heat pump interface

The Stiebel Eltron is able to operate with a photovoltaic signal. It has a single relay control. Once the relay is closed, shorting X0-1 and X3-1, the heat pump increases its operation set point.



NOTE

Please check the relevant Stiebel Eltron heat pump installation guide to ensure the correct setting on the installed model.