Home Energy Management (Device Control): Immersion Heater Controller Use Cases, Application Note

Revision History

Version 1.0, Nov. 2017 – Initial release

Introduction

Overview

The SolarEdge Home Energy Management (Device Control) solution allows increasing the self-consumption of a site by controlling the usage (consumption) of loads using Home Energy Management products.

These products divert power to a load according to pre-configured schedules, using the following modes:

- **Schedule** - The device turns on and off at times set by the user for the user's convenience, regardless of available PV power
- **Smart Save** - The device (typically a boiler or water pump) is controlled automatically to maximize self-consumption. Grid power is used only if PV power is insufficient to meet the user's "Ready by" time (see Definitions below). For example, to heat water for 2 hours and have hot water by 18:00, set the Duration value to 2 hours and Ready by to 18:00. The boiler may work before 16:00 if there is available PV power, but in any case, you are guaranteed to have hot water by 18:00.

This document describes several Home Energy Management use cases for systems using the Immersion Heater Controller, and details how to configure the system for each case. For general configuration guidelines, refer to the following documents:

- **Home Energy Management Connection and Configuration Guide**:
  https://www.solaredge.com/sites/default/files/device_control_connection_and_configuration_guide.pdf
- **Configuring Home Energy Management with the Monitoring App**:
  https://www.solaredge.com/sites/default/files/configuring_device_control_with_the_monitoring_app.pdf

> **NOTE**
> This document describes configuration of systems with inverter CPU version 3.21xx and above; inverters with lower version should be upgraded. If an upgrade is required, the latest version can be downloaded here; for upgrade instructions refer to the following application note:
> http://www.solaredge.com/sites/default/files/upgrading_an_inverter_using_micro_sd_card.pdf.

Definitions

This document refers to the following terms:

Term	Description	Units	Default Value	Configuration Options		
				From Inverter	From Monitoring Platform	From Monitoring App
Load Rating / Rated Power	Appliance rated power	kW	None	Yes	Yes	Yes
Minimum On Time (MinOnTime)	Minimum <u>continuous</u> time the load must remain ON, even if no excess PV power is available	Minutes	1 min	Yes	Yes	Yes
Ready by	The latest time for the requested energy to be diverted to the Load, regardless of energy source (PV/grid)	HH:MM	00:00	Yes	Yes	Yes
Duration / Minimum ON Duration (MinOnDuration)	Minimum <u>accumulated</u> time the load must remain ON (not necessarily continuous)	Minutes	1 min	Yes	Yes	Yes
Excess PV[1]	Allow excess PV to be diverted to the load; in a StorEdge system, the battery is supplied first unless a smart save schedule is configured			Yes	Yes	Yes

[1] In the monitoring platform, this may appear as "Use Excess Solar Power"

Term	Description	Units	Default Value	Configuration Options		
				From Inverter	From Monitoring Platform	From Monitoring App
Level-controlled load	Load that can be powered with varying energy (purely resistive loads). E.g. water heater, boiler			N/A		
ON/OFF-controlled load	Load that cannot be powered with varying energy. E.g. light bulb, fan, water or heat pump.			N/A		

System Components

A Home Energy Management system includes the following components:

- **Home Energy Management products**, one or several of each:
  - **Immersion Heater Controller** - Automatically diverts excess PV power to provide free hot water and highly cost-effective energy storage
  - **Plug-In Socket with Metering** - Wireless plug for controlling electrical loads, typically home appliances, pool pumps, etc.
  - **AC Switch with Metering** - Wireless relay for controlling electrical loads, typically home appliances, pool pumps, etc.
  - **Dry Contact Switch** (without metering) - Wireless switch for controlling loads using an external control interface, such as smart grid-ready supported heat pumps
- **Home Energy Management ZigBee Card** – Home Energy Management network manager, installed in the inverter; one card can manage up to 6 device control products.
- **SolarEdge Modbus Meter and Current Transformers (CTs)** – the inverter uses the meter for import/export or consumption readings, and manages Device Control network accordingly; the meter readings are displayed in the SolarEdge monitoring portal.

> **NOTE**
> It is recommended to connect the meter to the inverter which is connected to the monitoring portal.

- **Optional: RS485 Expansion Kit** – the kit is used for multi-inverter systems, and provides an additional RS485 port within the inverter
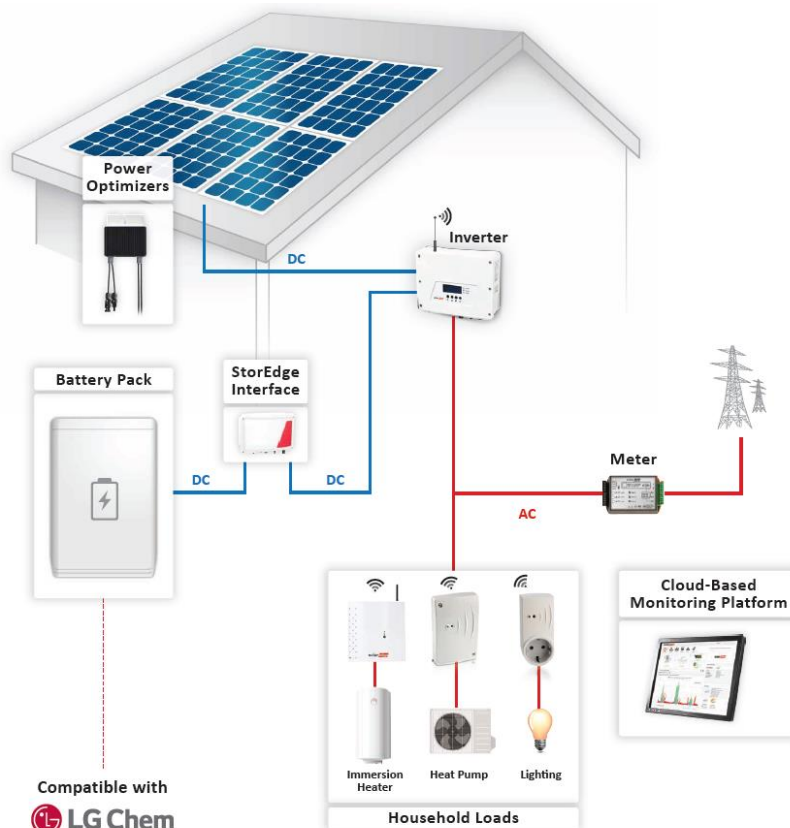

Figure 1: Device Control - system overview

Load Priority

When multiple loads are controlled and there isn't sufficient power to supply all of them, they will be prioritized as follows:

- Level-controlled loads before ON/OFF controlled loads (e.g. a water heater will be prioritized over a light bulb)
- Low power-rating devices before high power-rating devices (e.g. a 60W lightbulb will be prioritized over a 100W lightbulb)
- Identical devices will be prioritized according to the order in which they were added to the system (this is also the order in which they appear in the device list in the inverter display, monitoring platform and monitoring app).

Use Cases

Use Case 1: One Immersion Heater Controller, without StorEdge

	Use Case 1a – one schedule	Use Case 1b – no schedule
Number of Immersion Heater Controllers	1	
Load rated power	2kW	
Hot water ready by	19:00	N/A
Minimum time needed to heat the water	2 hours	N/A
StorEdge	No	
Preferred excess PV usage	N/A (no StorEdge)	
Allow load supply from grid if there is no excess PV?	Yes	No
System configuration	Power rating: 2000 Excess PV: yes Smart save: • Ready by: 19:00 • Duration: 120	Power rating: 2000 Excess PV: yes
System behavior	Excess PV power or grid power (if there is no excess) will be diverted to the load for 120 min	As long as there is excess PV power it will be diverted to the load

Use Case 2: One Immersion Heater Controller, with StorEdge

	Use Case 2a – one schedule	Use Case 2b – no schedule
Number of Immersion Heater Controllers	1	
Load rated power	2kW	
Hot water ready by	19:00	N/A
Minimum time needed to heat the water	2 hours	N/A
StorEdge	Yes	
Preferred excess PV usage	Heater	Battery
Allow load supply from grid if there is no excess PV?	Yes	No
System configuration	Power rating: 2000 Excess PV: yes Smart save: • Ready by: 19:00 • Duration: 120	Power rating: 2000 Excess PV: yes
System behavior	Excess PV power or grid power (if there is no excess) will be diverted to the load for 120 min, then it will supply the battery until it is fully charged, and then it will be diverted to the load again	As long as there is excess PV power, it will supply the battery until it is fully charged, and then it will be diverted to the load

Use Case 3: Two Immersion Heater Controllers, with StorEdge

	Use Case 3a – one schedule	Use Case 3b – no schedule
Number of Immersion Heater Controllers	2	
Load rated power	2kW, 3kW	
Hot water ready by	19:00	N/A
Minimum time needed to heat the water	2 hours, 3 hours	N/A
StorEdge	Yes	
Preferred excess PV usage	Heater	
Allow load supply from grid if there is no excess PV?	Yes	No
System configuration	Heater 1: Power rating: 2000 Excess PV: yes Smart save: • Ready by: 19:00 • Duration: 120 Heater 2: Power rating: 3000 Excess PV: yes Smart save: • Ready by: 19:00 • Duration: 180	Heater 1: Power rating: 2000 Excess PV: yes Heater 2: Power rating: 3000 Excess PV: yes
System behavior	Excess PV power or grid power (if there is no excess) will supply load 1 for 120 min, then it will supply load 2 for 180 min, then it will supply the battery until it is fully charged, and then it will be diverted to the loads again (load 1 and then load 2)	To use excess PV to be diverted to the load before the battery a smart save schedule is required, however this may lead to grid supply which is not allowed in this use case. Therefore, as long as there is excess PV power it will supply the battery until it is fully charged, then it will supply load 1 for 120 min, then it will supply load 2 for 180 min

Use Case 4: Three Immersion Heater Controllers, One Schedule, with StorEdge

Number of Immersion Heater Controllers	3
Load rated power	2kW, 2kW, 2kW
Hot water ready by	19:00
Minimum time needed to heat the water	2 hours, 2 hours, 2 hours
StorEdge	Yes
Preferred excess PV usage	Battery
Allow load supply from grid if there is no excess PV?	Yes
System configuration	Heaters 1, 2 and 3: Power rating: 2000 Excess PV: yes Smart save: • Ready by: 19:00 • Duration: 120
System behavior	Excess PV power or grid power (if there is no excess) will supply load 1 for 120 min, then it will supply load 2 for 120 min, then it will supply load 3 for 120min. If there is still excess PV power, it will supply the battery until it is fully charged, and then it will supply load 1. If there is sufficient excess PV to supply both loads 1 and 2 (and 3) it will start supplying load 2 (and 3) in addition to load 1.

Use Case 5: One Immersion Heater Controller, Two Schedules, with StorEdge

Number of Immersion Heater Controllers	1
Load rated power	2kW
Hot water ready by	07:00, 19:00
Minimum time needed to heat the water	2 hours
StorEdge	Yes
Preferred excess PV usage	Heater
Allow load supply from grid if there is no excess PV?	Yes
System configuration	Power rating: 2000 Excess PV: yes Smart save: • Ready by: 19:00 • Duration: 120 Schedule: 05:00 - 07:00 (using a second smart save setting for this time frame is ineffective as there would not be excess PV to be diverted to the load at these hours)
System behavior	Grid power will be diverted to the load from 05:00-07:00. Excess PV power or grid power (if there is no excess) will be diverted to the load again for 120 min.