

Knowledge Base

KB86 Smart Load Control Installation Guide

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1. Introduction

Redback's Smart Load Control (SLC) feature enables homeowners to make the most of their generated energy by only operating their large loads (such as a pool pump or hot water system) when there is excess solar energy available.

Smart Load Control is a sophisticated system that aims to:

- Run the load using only excess PV energy.
- Avoid switching the load excessively (e.g., when a small cloud passes in front of the sun).
- Optionally, the system will ensure that the load runs for a nominated number of hours each day. This is useful for equipment like pool pumps or hot water systems which require a minimum daily run-time.

The Smart Load Control feature is available to all Redback SI-series, SB-series, SH5000 or ST10000 Smart inverters, with suitable meter, relay and software installed. Relay configuration and operation is similar for all inverters and is described in this document.

**Avoid damage to controlled equipment!**

The installer must ensure all equipment is installed as per the electrical standards.

All relay timing settings must consider the minimum ON and minimum OFF times of the controlled equipment, and follow any requirements specified by the manufacturer of the controlled equipment.

2. Audience

This document is for use by Redback installers or Redback technical staff. It is not for use by homeowners or non-qualified personnel.

3. Quick Start guide

3.1 SI-series Smart Inverters

1. SI-series inverters require connection of a suitable relay to the standard PA110 Energy Meter, as described in section 4.
2. The inverter Energy Management System module (EMS) must have software 3.2 or newer. Contact the Redback Customer Support team if the inverter needs updating.
3. When the hardware and software are prepared, soft-configure the system as described in section 5 onward.
4. Use the Redback Portal and physical monitoring to confirm the load is switching as expected.

3.2 SH5000 Smart Hybrid inverters

1. SH5000 inverters support up to two internal and two optional, external relays: Smart Load Control may be assigned to one relay only. Optional relays must be installed per the [SH5000 Installation Manual](#).
2. SH5000 inverters must have ROSS 2.18 or newer software installed. Contact the Redback Customer Support team if the inverter needs updating.
3. When the hardware and software are prepared, soft-configure, and test the system as shown from section 5 onward.

3.3 SB-series Smart Batteries or ST10000 Smart Hybrid 3-phase inverters

1. SB and ST products support up to three optional, external relays: Smart Load Control may be assigned to one relay only. Relays must be installed per the relevant installation manual: [SB-series Installation Manual](#) or [ST10000 Installation Manual](#).
2. SB-series products should be installed AC-coupled as per the installation manual, otherwise, they must be configured to use export-power based control.
3. SB and ST products must have ROSS 2.18 or newer software installed. Contact the Redback Customer Support team if the inverter needs updating.
4. When the hardware and software are prepared, soft-configure, and test the system as shown from section 5 onward.

4. SI-series Hardware Installation

4.1 Requirements

- A Redback SI-series Smart Inverter
- A Redback PA110 Energy Meter installed in the main switch board (supplied with the inverter)
- A relay or contactor rated to switch the desired load (supplied by installer)
- The inverter EMS module with software 3.2 or newer. Contact the Redback Customer Support team to perform this upgrade.

4.2 Wiring Diagram for SI-series installations

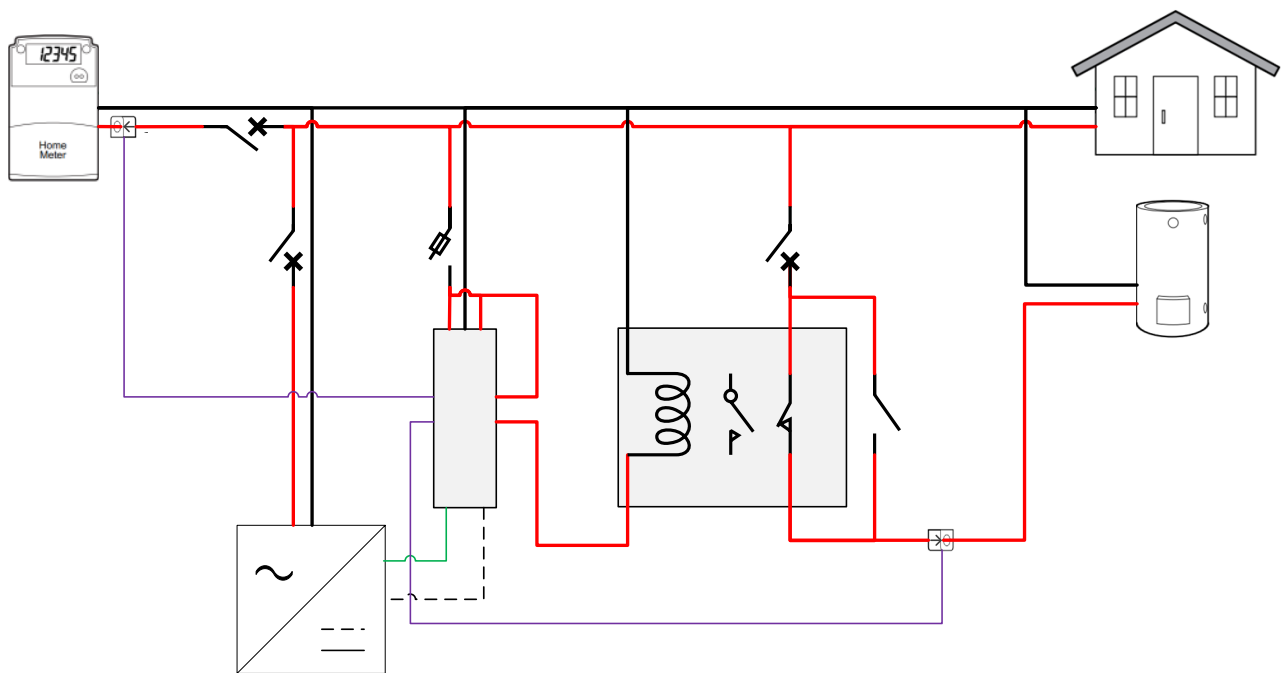


Figure 1: SI-series inverter Smart Load Control Wiring Diagram

4.3 Hardware installation

Install the relay as shown above, noting:

- The AC relay / contactor is to be supplied by the installer. The relay must be sized correctly to meet the power requirements of the load. The coil must be 240V.
- For critical loads, it is recommended to wire the load to the normally closed contact of the relay (as shown): in the event of any system failure, the relay will fail to the closed position, the load will be energized, and can be manually switched ON and OFF until a repair can be affected.
- Optional: Add a manual relay-bypass switch if required. Then, at any time, the homeowner can override the Smart Load Control and switch the load ON.
- Clamp the current transformer CT2 around the load's active wire, with the arrow pointing towards the load. CT2 is supplied with the PA110 Energy Meter.

5. Smart Load Control operation

Smart Load Control can be configured from the Redback Portal or the RedbackINSTALL app*. The minimum required settings are:

- Load Type: Hot water system, heat pump, air conditioner, EV charger or pool pump. The selection of the load type is used to preset system timers that prevent the load from frequently switching (refer to section 5.7 below).
- ON Trigger Level: Power level required to switch the load ON.
- OFF Trigger Level: Power level required to switch the load OFF.
- Power signal type (solar generation / export power): Switch the load ON, based on solar generation or export power. This affects the way in which Smart Load Control responds to PV, Grid, and household loads, as detailed below.

*SB-series, SH5000 and ST10000 Smart Load Control configuration using the RedbackINSTALL app is scheduled for release on 31 August 2023.

5.1 Controlling Load Based on Solar Generation

In Figure 2 below, the system has been configured to control the load based on solar generation.

Note the period when the grid power is negative, and the home is therefore importing power: the Smart Load Control does not respond to this since the solar power is still sufficiently high.

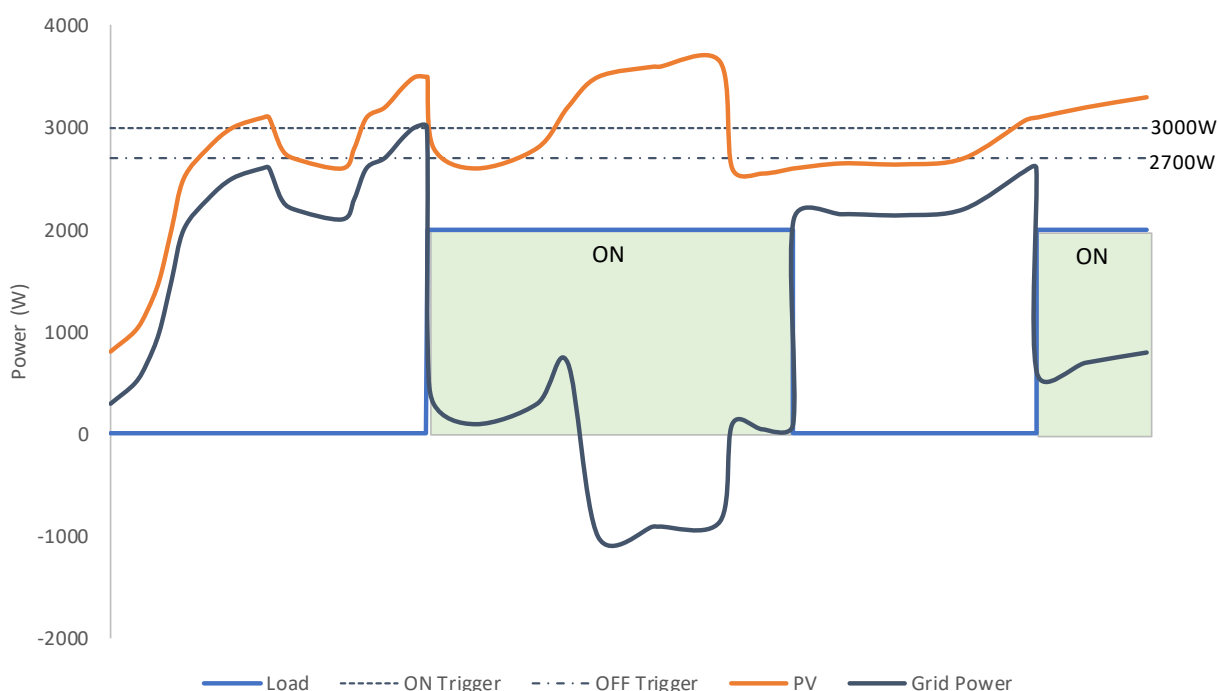


Figure 2: Smart Load Controlled by Solar Generation Power

5.2 Controlling Load Based on Export Power

If the export power is selected, then the load will switch ON only when the home is exporting power. Therefore, the Smart Load Control may react to other large loads in the house. This is demonstrated below.

In Figure 3 shows the same home, except the system is configured to control the load using Export Power instead of Solar Generation. Note:

- The load switches OFF sooner, therefore less power is bought from the grid.
- There is a delay built into the system before switching OFF. This is to reduce equipment switching and premature wear.
- When the 2kW load is switched ON it causes the grid power to drop by 2kW. Therefore, the OFF-Trigger must be reduced to compensate. In this case, we are using an OFF-Trigger value of 200W instead of 2700W used in the Solar Generation controlled scenario.

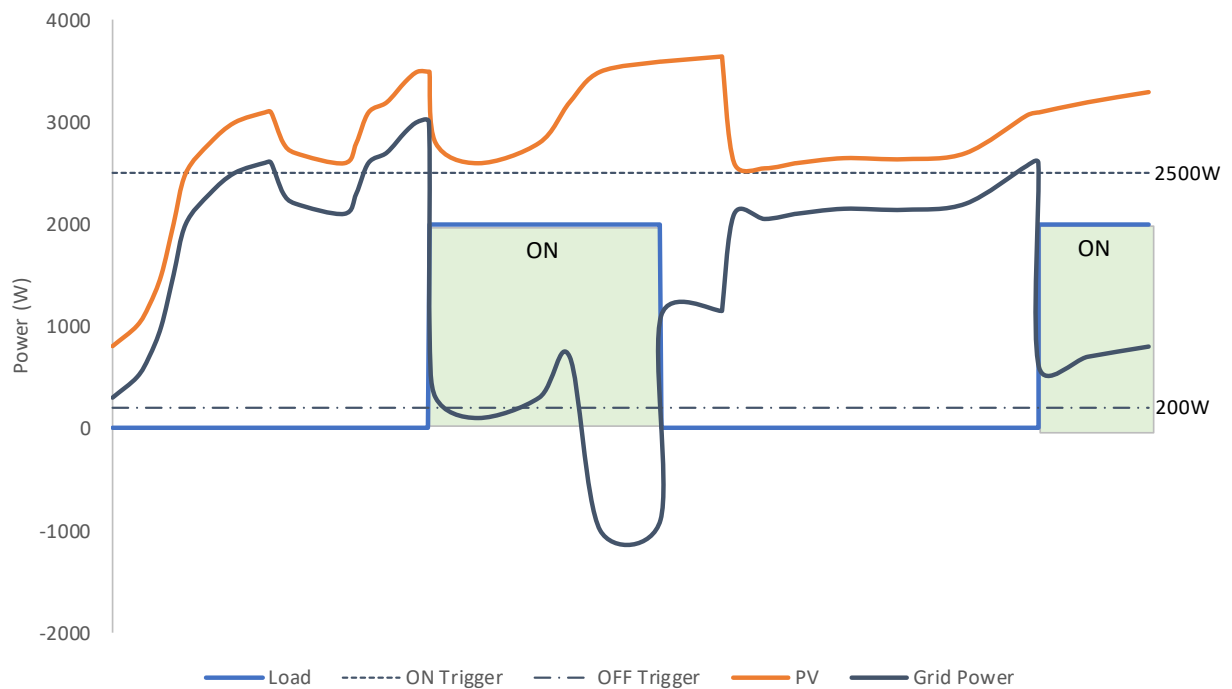


Figure 3: Smart Load Controlled by Export Power

5.3 Required Daily Run Time

As described above, Smart Load Control will always aim to run the load from excess PV power only. However, on cloudy days, the run-time may be too short. Loads such as hot water systems or pool pumps require configuration to ensure a minimum daily run-time. If needed, the system will buy power from the grid to achieve the specified daily run-time.

Consider the following example for a pool pump:

- The homeowner would like the pump to run for a minimum of 8 hours per day.
- The homeowner would like the pump to finish running by 4:00pm.
- The time is now 11:00am.
- It has been a cloudy day and the pool pump has only run for 3 hours.
- Therefore, Smart Load Control will switch the pool pump ON and run it continuously for the next 5 hours, so that the pool pump reaches its target of running 8 hours before 4:00pm.
- This may cause power to be bought from the grid.

Configuration Example

Consider the following scenario:

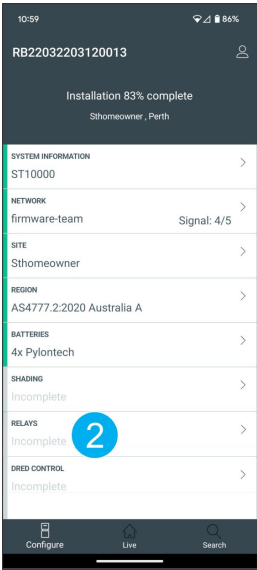
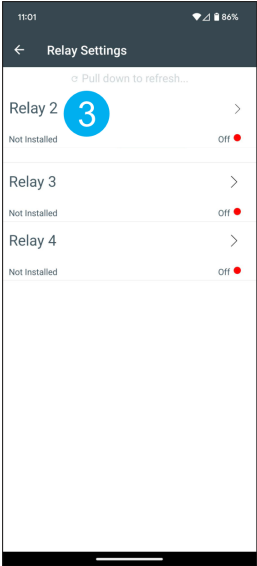
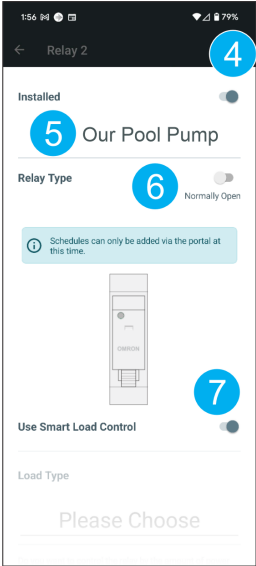
- The homeowner has a 2kW pool pump that they want to run on excess power only.
- The homeowner would like the pump to run for a minimum of 8 hours per day and be finished before 4:00pm each day.
- The installer has wired the relay as “normally closed” so the pump will switch ON if there is a system fault.

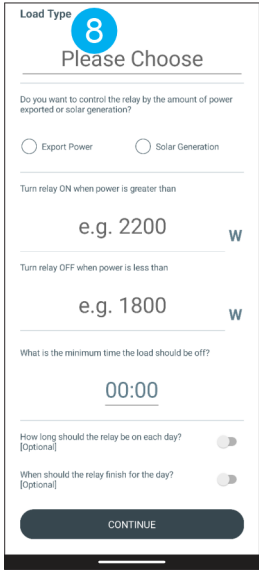
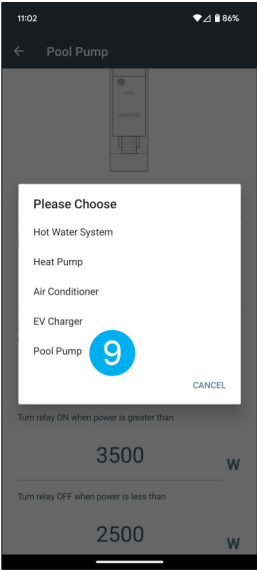
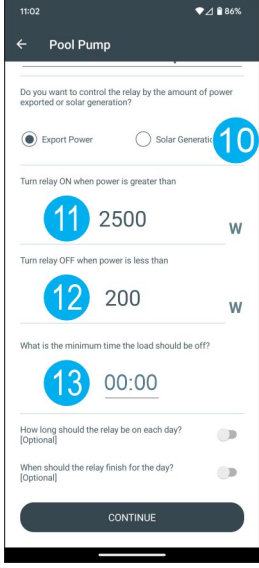
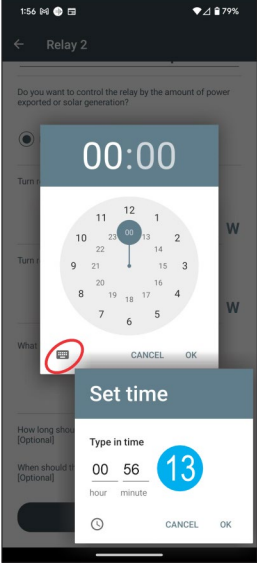
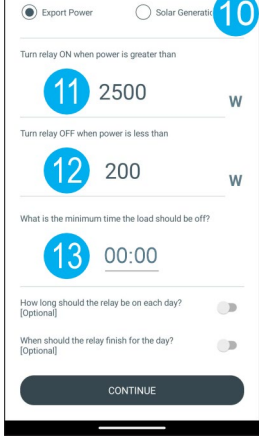
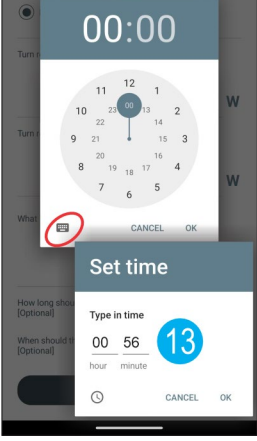
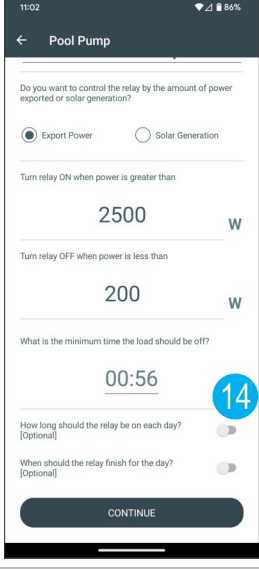
The installer should make the following selections:

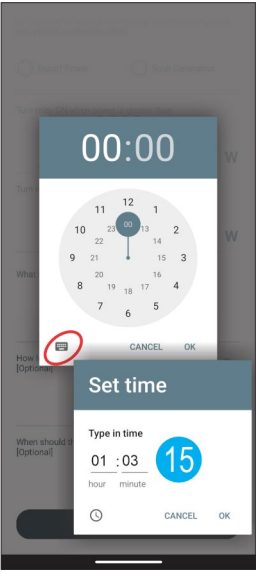
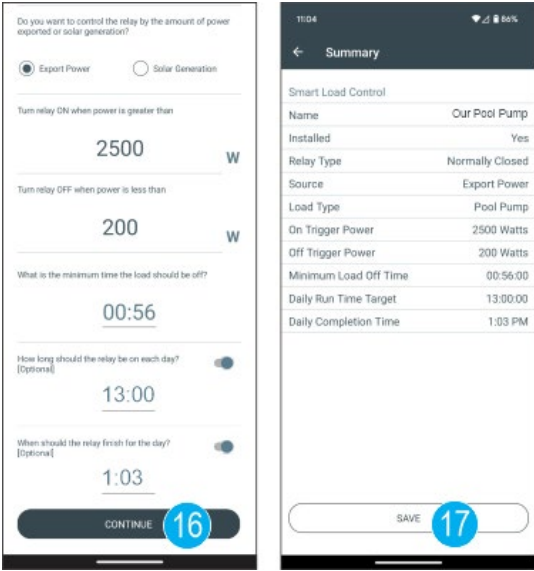
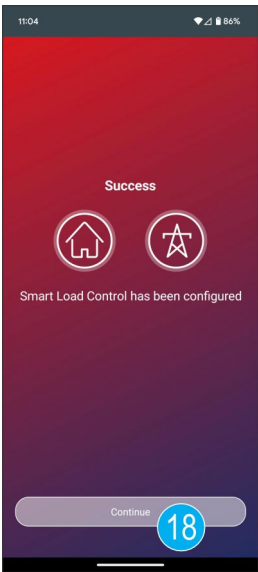
SETTING	VALUE
Relay Type:	Normally Closed
Do you want to control the relay by the amount of export power or solar generation?	Export Power
Switch the relay ON when power is greater than:	2500W
Switch the relay OFF when power is less than:	200W
How long should the relay be ON each day?	8 hours
When should the relay finish for the day?	16:00

5.4 Configure Smart Load Control using the RedbackINSTALL

After the relay has been installed, follow the below steps to configure Smart Load Control.

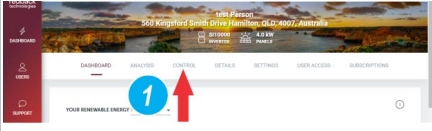
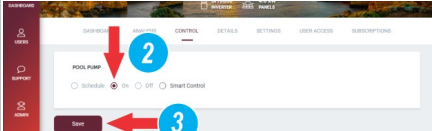
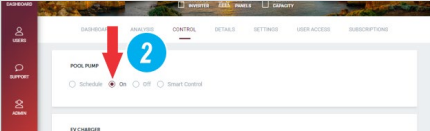
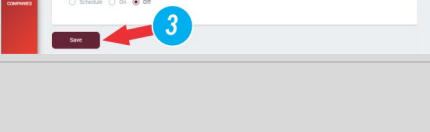
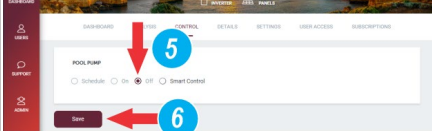
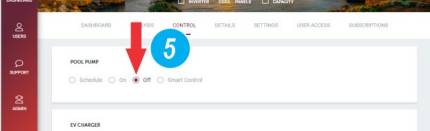
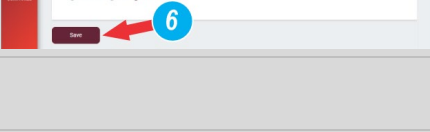
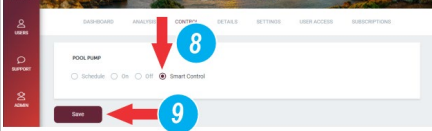
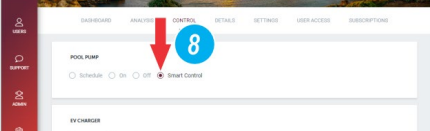
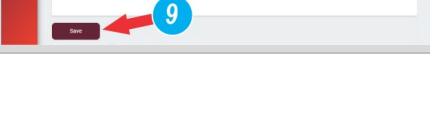
STEP	PROCEDURE	IMAGE/COMMENT
1	Connect to the inverter using the RedbackINSTALL app.	
2	Select RELAYS from the main page.	
3	Select the relay to be assigned to Smart Load Control e.g., Relay 2 .	 
4	Change status to Installed (toggle right).	
5	Enter the name of the load (e.g., “ Pool Pump ”)	
6	Set the Relay Type. Toggle between <i>Normally Open</i> or <i>Normally Closed</i> .	
7	Toggle Use Smart Load Control if you want to use Smart Load Control. Additional setting fields will appear. Note: If Use Smart Load Control is OFF, the relay will operate on manual control or by time schedules (see below).	

STEP	PROCEDURE	IMAGE/COMMENT	
8	Touch Please Choose . A list of load types will appear.		
9	Touch to select a load type from the list. Additional setting fields may appear.		
10	Touch Export Power to control the load based on power to the grid, or Touch Solar Generation to control the load based on solar power level.		
11	Set the power level at which the relay will switch ON, e.g., 2500W		
12	Set the power level at which the relay will switch OFF, e.g., 200W. Note: If Export Power has been selected, then OFF-Power should be less than (ON-power minus Load).		
13	Set the delay before the load can restart (to protect against excessive switching). Touch 00:00 . A time picker will appear. Select the required delay or touch the keyboard icon to display a type-in pop-up.		
14	Optional: Is a minimum daily run-time required? - If YES, touch How long should the relay be on each day? A time picker will appear. Select the daily run-time required. Select OK to finish. - If NO, touch Continue and go to Step 16 below.		

STEP	PROCEDURE	IMAGE/COMMENT
15	Optional: Set the daily finish-by time. Touch When should the relay finish for the day? and then use the Time Picker. Select OK to finish.	
16	Touch Continue once all settings have been configured.	
17	Review the settings. Touch Save to finish.	
17	A success screen will appear. Touch Continue to return to the main settings page.	

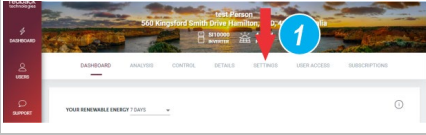
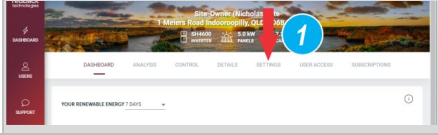
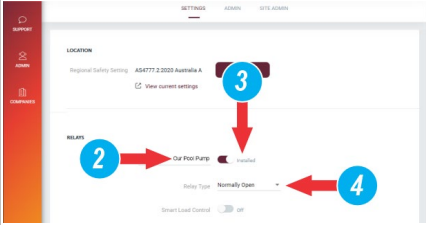
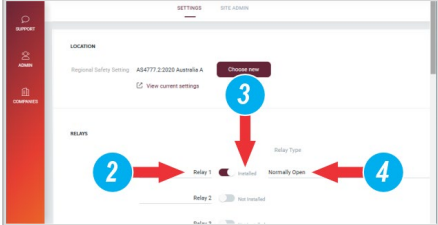
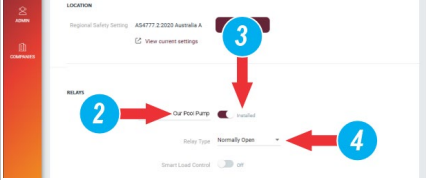
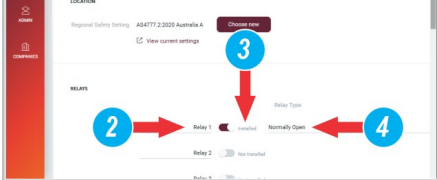
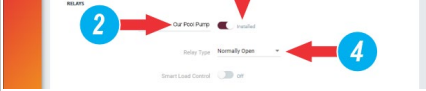
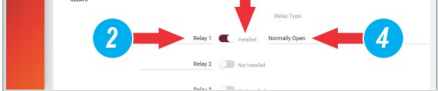
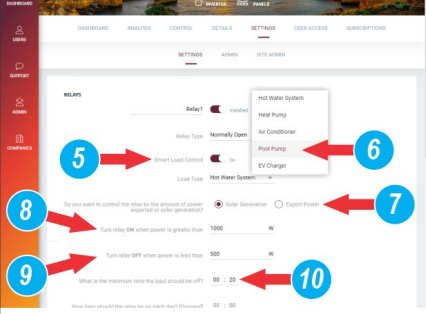
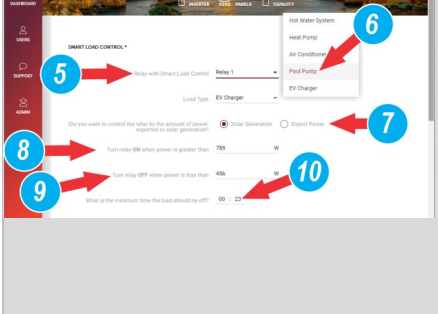
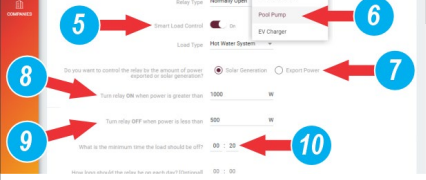
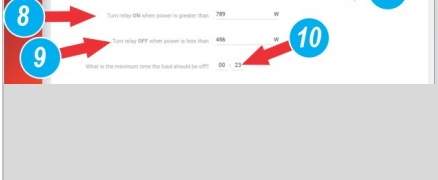
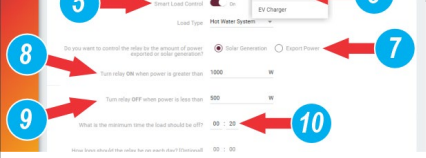
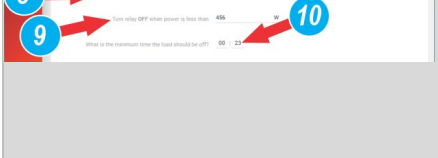
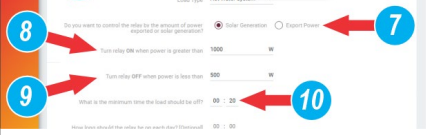
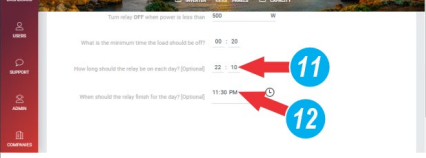
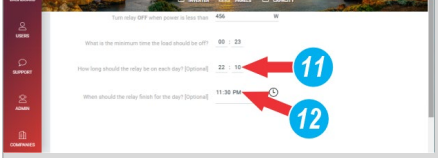
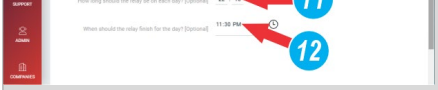
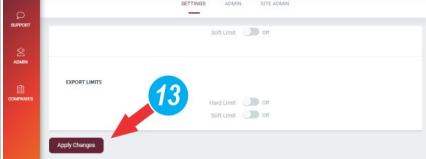
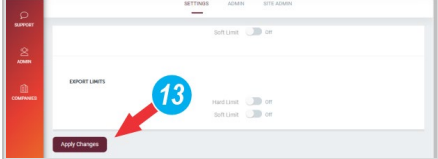
5.5 Confirm the Relay Wiring using the Redback Portal

Once the relay has been configured, it must be checked. This can be carried out using the inverter's portal page.

STEP	PROCEDURE	SI-SERIES INVERTER PORTAL RESPONSE	SB-SERIES SH5000 OR ST10000 PORTAL RESPONSE
1	Select the Control tab from the portal page		
2	Identify the Relay with Smart Control assigned. Select ON		
3	Select Save		
4	Confirm the load physically switches ON (Look and listen).		
5	Select OFF		
6	Select Save		
7	Confirm the load switches OFF . (Look and listen).		
8	Select Smart Control		
9	Select Save . The relay has now been wired correctly.		

5.6 Configure Smart Load Control using the Redback Portal

Smart Load Control can also be configured using the Settings page on the Redback Portal, as shown below.

STEP	PROCEDURE	SI-SERIES INVERTER PORTAL RESPONSE	SB-SERIES, SH5000 OR ST10000 PORTAL RESPONSE
1	Select the Settings tab on the Inverter Dashboard on the Redback Portal.		
2	Enter a name for the load		
3	Select the Not Installed slider		
4	Set the Relay Type : Normally Closed or Normally Open.		
5	Select Use Smart Load Control if you want to use Smart Load Control. Note: If Use Smart Load Control is OFF, the relay will operate on manual control or by time schedules (see below).		
6	SH or ST inverters only: Select the relay to be configured as the Smart Relay.		
7	Select the Load Type		
8	Select Export Power to control the load based on power to the grid. Select Solar Generation to control the load based on solar power level.		
9	Set the power level that will switch the relay ON		
10	Set the power level that will switch the relay OFF. Note: If Export Power has been selected, then this value should be less than the "ON power" minus load size.		
11	OPTIONAL: Select the required daily run time from How long should the relay be ON each day?		
12	OPTIONAL: Set the end time from When should the relay finish for the day?		
13	Select Apply Changes to save all changes and activate Smart Load Control.		

5.7 Advanced: Preventing Frequent Load Switching

The selection of the Load Type sets several timers that prevent the load from switching frequently and unnecessarily wearing equipment. This section describes in detail how frequent load switching is avoided.

When a Load Type is selected, the system will pre-select four timer values:

- ON Delay: How long the power must be above the “ON Trigger” level before starting the load.
- OFF Delay: How long the power must be below the “OFF Trigger” level before stopping the load.
- Minimum Run Time: When the load switches ON, it must remain ON for a minimum time.
- Minimum Stop Time: When the load switches OFF, it must remain OFF for a minimum time.

Example Configuration

Consider the following scenario:

- The homeowner has a 2kW pool pump that they want to run on excess power only.
- The homeowner would like the pump to run for a minimum of 8 hours a day and be finished before 4:00pm each day.
- The installer has wired the relay as “normally closed” so that the pump will switch ON if there is a system fault.

The installer has made the following selections:

SETTING	VALUE
Do you want to control the relay by the amount of power or solar generation?	Export Power
Switch relay ON when power is greater than:	2500W
Switch relay OFF when power is less than:	200W
How long should the relay be ON each day:	8 hours
When should the relay finish for the day:	16:00
Relay Type:	Normally Closed

Figure 4 below shows an example of Smart Load Control in this scenario.

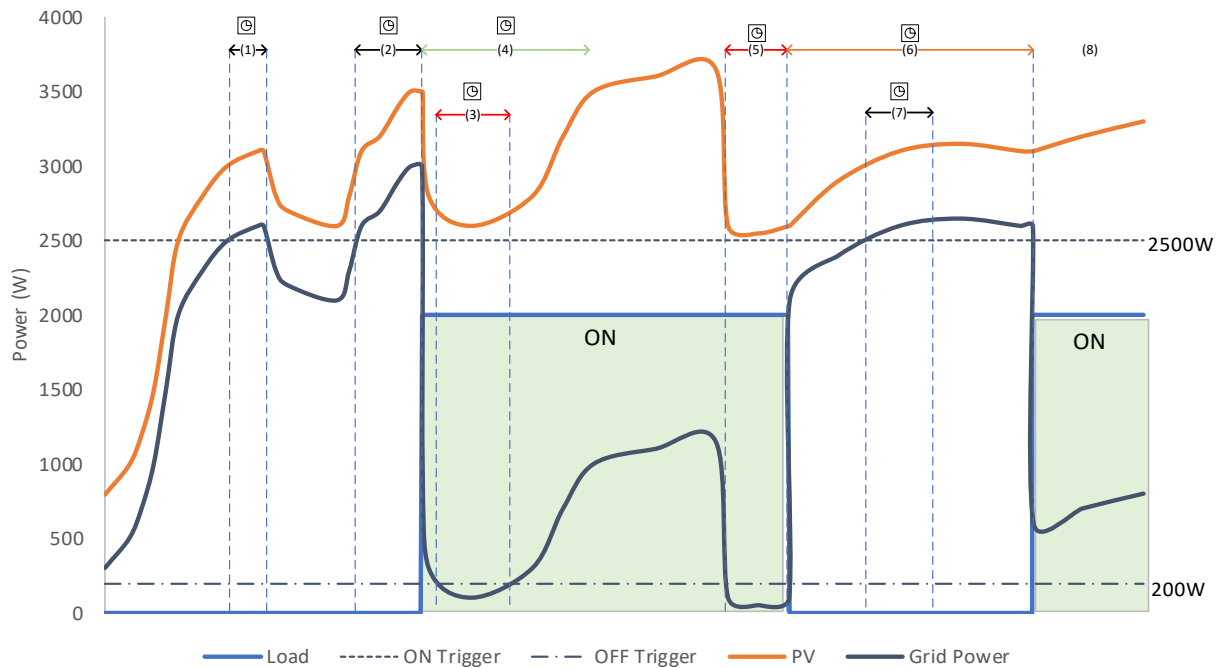


Figure 4: Smart Load Control with Delay Timers

Note the following points depicted above:

1. The power level exceeds the 2500W *ON Trigger*, but SLC does not start the pump as the excessive power is not sustained for the *ON Delay* time.
2. The power exceeds 2500W for the *ON Delay* time: SLC switches the 2kW pump ON. This causes the grid power to drop by 2kW. The pump will run for at least the *Minimum Run Time*.
3. The power falls below 200W soon after the pump starts, but SLC keeps the pump running to reduce equipment wear (*Minimum Run Time*).
4. The pump has run for the *Minimum Run Time* and SLC is permitted to shut the pump down if the power drops.
5. The power is below 200W and the *OFF Delay* time has passed: SLC stops the pump.
6. SLC rests the pump for at least the *Minimum Stop Time*.
7. The power exceeds 2500W for the *ON Delay* time but the pump stays resting (*Minimum Stop Time*).
8. The power stays above 2500W and the *Minimum Stop Time* has passed: SLC starts the pump.

5.8 Delay Time Settings

The table below shows the preset times configured for each load type. These settings are fixed and cannot be changed from the app or portal.



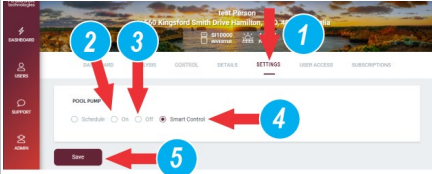
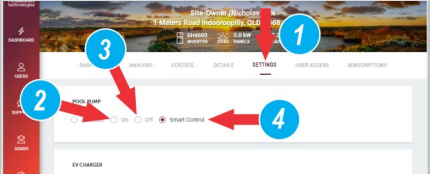
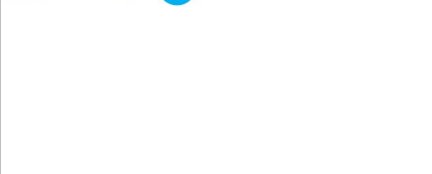
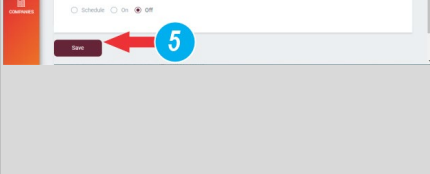
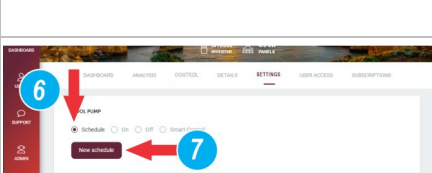
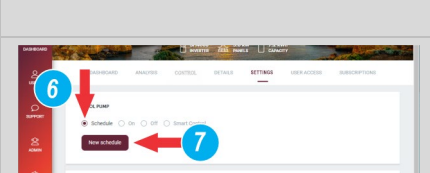
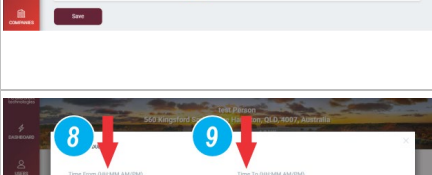
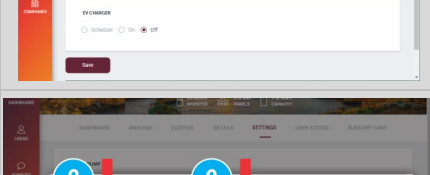
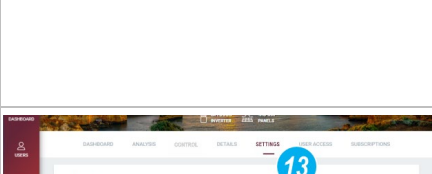
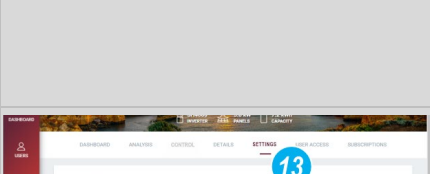
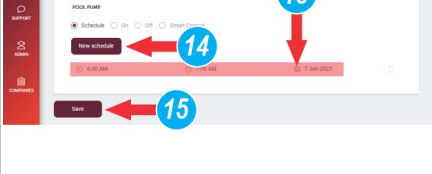
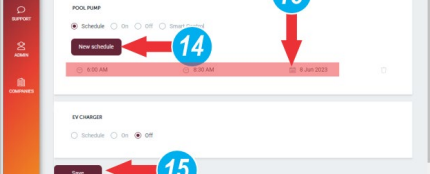
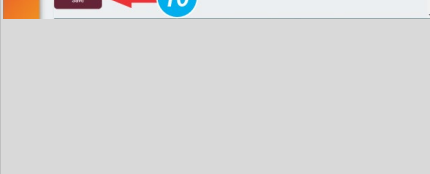
Avoid damage to controlled equipment!

The times below are defaults set by Redback and intended as a guide only. All relay timing settings must consider the minimum RUN and minimum STOP times of the controlled equipment, and follow any requirements specified by the manufacturer of the controlled equipment.

LOAD TYPE	ON DELAY	OFF DELAY	MINIMUM RUN TIME	MINIMUM STOP TIME
Hot Water System	10s	3 minutes	5 minutes	10 minutes
Heat Pump	10s	6 minutes	10 minutes	10 minutes
Air Conditioner	10s	6 minutes	10 minutes	10 minutes
EV Charger	10s	6 minutes	10 minutes	15 minutes
Pool Pump	10s	3 minutes	5 minutes	10 minutes

5.9 Control the Load from the Portal

The homeowner can control the load from the portal. This will allow them to manually switch the load ON or OFF or create a schedule that will override the Smart Load Control. The following describes how to access the control feature from a homeowner's user account.

STEP	PROCEDURE	SI-SERIES INVERTER PORTAL RESPONSE	SB-SERIES, SH5000 OR ST10000 PORTAL RESPONSE
1	Select the Settings tab from the portal Inverter page		
2	Select ON to manually switch the load on.		
3	Select OFF to manually switch the load OFF.		
4	Select Smart Control to assign control to Smart Load Control.		
5	Select Save after changing an option.		
6	Select Schedule to control the load using created schedules.		
7	Select New Schedule		
8	Select a start time in Time From		
9	Select an end time in Time To		
10	Select whether the schedule should run once or daily from Run the Schedule		
11	For schedules running Once, select the date in Schedule Date		
12	Select Add Schedule		
13	Review the schedule and confirm it is correct.		
14	Select New Schedule to add additional schedules		
15	Press Save once all schedules have been added.		

Note: if Smart Load Control was selected before adding the schedule, the system will resume Smart Load Control when the schedule completes.

Recurring schedules will override Smart Load Control until cancelled.

6. Further assistance

If you think you will require assistance, book Redback Technical Support 2 days before going to site. This ensures that technical support is reserved for you if you are on-site and need assistance. Redback support is in Brisbane, Australia and is available 8am-4pm (Brisbane time) Monday to Friday. There are three ways to book a support call:

Web: redback.link/support

SMS: 0417 632 065

Tel: 1300 240 182

7. Revisions

VERSION	DETAIL	AUTHOR	DATE
1.0	First published version	Simon Willis	11Apr2023
1.1	Adding SH and ST inverters	Adam Shipway	15Jun2023
1.2	P2 Added Table of Contents Added more regarding SB, SH and ST configuration using RedbackINSTALL. Minor corrections to section 5.9 illustrations. Clarification of installer responsibilities with respect to matching SLC settings to the equipment being controlled. P15 Rewritten for improved clarity and conciseness P18 HWS & Pool Pump Minimum Stop Times now 10 minutes was 5.	Adam Shipway	30Jun2023
1.3	Major rewrite for clarity; Updated Portal and app diagrams.		
Document Owner	Simon Willis		
Version	1.3		
Contributors	Paul Hillman, Adam Shipway		
Approved by	Adrian Knack		
Filename:	KB86 Smart Load Control Installation Guide v1.3.docx		
Issue date:	27Mar2024		