Load and Solar Circuit Control using Enpower Auxiliary Contacts

Table of Contents

Table of Figures

Table of Tables

Overview

This document provides installers and design engineers with the information required to plan and configure Smart Control (load and solar circuit control) using Enpower Auxiliary contacts.

The Encharge Storage System (ESS) must have sufficient power capability to sink all the power from the PV system during transitions to off-grid and must source power to support all loads in intentionally islanded (standalone) operation. This may not always be feasible. In these situations, auxiliary contacts in Enpower can be used to disconnect or shed excess solar or heavy loads.

In addition, low priority loads with high power requirements may deplete energy storage. Auxiliary contacts can be used to shed these large loads to help maintain energy in the storage system.

What are auxiliary contacts and how do they work?

The Enpower has 5 relays rated for pilot duty at up to 24Vac/Vdc and 1A continuous current. One is dedicated for generator function while the others are available for general use. The contacts/terminals of the pilot relays are not energized by Enpower i.e., they have no voltage on them and are “dry”. When these contacts are connected to a voltage source, they are “wetted”. In this document, we will be referring to these as auxiliary relays or contacts. The configuration of the relays is as follows:

1. Two Normally Open (NO)
2. Two Normally Closed (NC), and
3. One NO relay used for starting a generator

While the auxiliary contacts have NO and NC electrical configurations, the ITK overrides this behavior when configuring the contacts. Once configured the contacts are closed when on-grid and open when off-grid. In special load control modes, the contacts may be closed when off-grid if battery charge exceeds a threshold or if a generator is running. **Due to this Enpower can only be used with NO-type external definite purpose contactors or power relays to implement load control or solar circuit control as described in this tech brief.**

Note: Refer to the Generator support tech brief for documentation related to generator integration. This tech brief covers load and solar circuit shedding using auxiliary contacts.

Auxiliary contact labelling in Enpower

The figure below illustrates the auxiliary contacts at the bottom of the Enpower smart switch. It also shows the AC combiner, Generator and Encharge lugs.

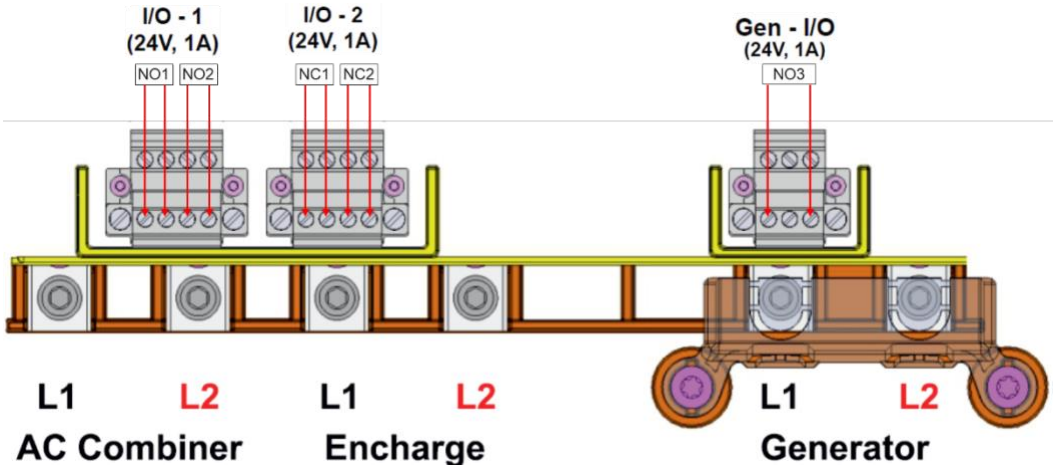


Figure *1Auxiliary contact labelling and usage*

Refer to the Enpower QIG for installation instructions.

Note: Use 3/32inch /2 mm flathead screwdriver to work on auxiliary contact terminals.

Auxiliary contact usage

Enphase recommends using Normally Open auxiliary contacts for solar and Normally Closed auxiliary contacts for loads. The load/solar circuit behavior represented in this document requires that a Normally Open (NO) definite purpose external contactor be used. Enphase's software is tailored to work with these since these are the most readily available.

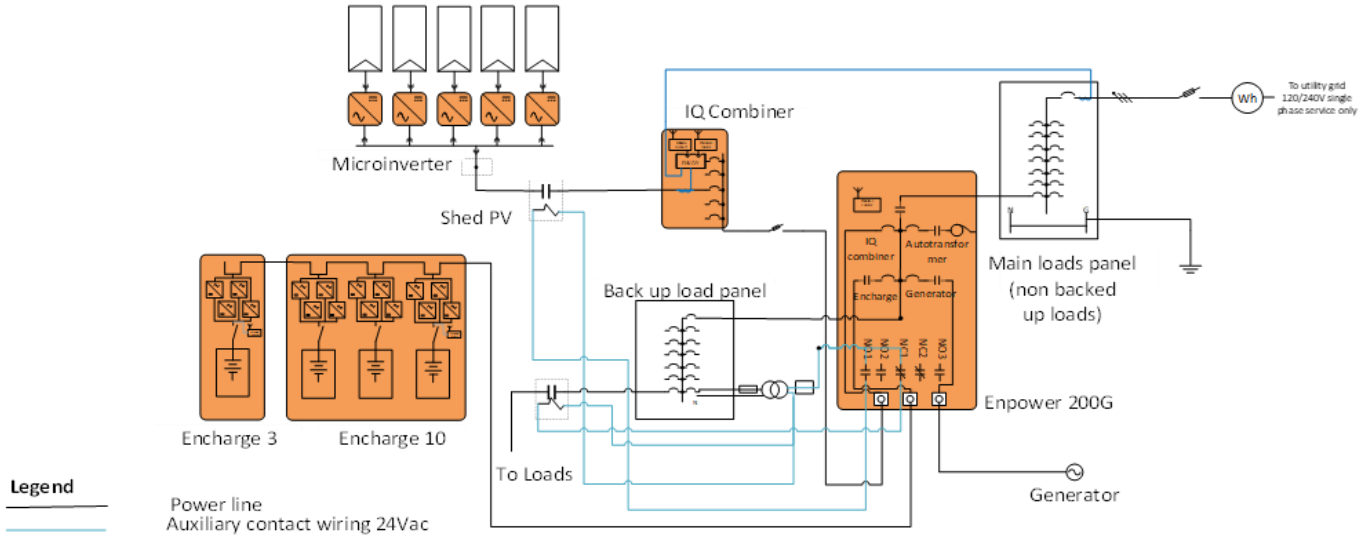
Enpower's auxiliary contacts can be used with 2 different types of external contactors:

1. Normally Open external contactor with a 24 V ac coil
2. Normally Open external contactor with a 120 V ac coil (with an interposing power relay)

Note: The definite purpose external contactor may make a humming or buzzing sound when its coil is energized. This is normal and does not indicate issues with the equipment.

Using an external contactor with a 24 Vac coil

24Vac low voltage is created with a control transformer protected with an OCPD such as an inline fuse. The 24Vac power supply should be connected to a definite purpose contactor via the auxiliary contact.



Note:

- NC1,NC2 – Normally Closed auxiliary contacts
- NO1,NO2- Normally Open auxiliary contacts
- NO3 – Normally Closed auxiliary contact dedicated to generator control
- In the diagram, NO1 is used to control a load circuit while NC1 is used to drop the PV circuit when the system is in backup mode.

Figure *2 Enpower Auxiliary contact wiring diagram*

The line diagram represents both the Normally Opens auxiliary contacts configured for PV shedding and load shedding.

Refer Appendix A for detailed Single line diagram.

Supported Contactors and transformers

Definite purpose Contactors must meet or exceed the following parameters to work with Enpower.

Parameter	Value
Continuous Current	< 1 A
Coil Voltage	24 V
Inrush VA	40 VA or rating of transformer being used
Opening time	≤ 30 ms

Table 1 Definite purpose contactor parameters

Note: Follow all guidelines by contactor manufacturer regarding installation. Ensure that the load connected does not exceed the contactor rating.

Supported contactors

Supplier	Part Number	Full Load Amperage (A)	Poles & NO/NC	Coil Voltage
Eaton	C25BNB220T	20	2 pole, NO	24 Vac
Cutler-Hammer	C25BNF240T	40	2 pole, NO	24 Vac
Protactor	PT-C240A	40	2 pole, NO	24 Vac
Packard	L45-038 C240A	40	2 pole NO	24Vac
Eaton	C25FNF260T	60	2 pole, NO	24 Vac
Square D	8910DP32V14	30	2 pole, NO	24 Vac
Square D	8910DPA63V14	60	3 pole, NO	24 Vac

Table *2 Supported contactors*

Supported transformers (for power supply)

Supplier	Part Number	Secondary Voltage	Primary Voltage	VA Rating
Fiada	B07RDBS6NK	24 Vac	120/208/240Vac	40
Endurance Pro	EP4031OF	24 Vac	120/208/240Vac	40

Table 3 Supported Transformers for power supply

Recommended fuses and fuse holders

1. 1A, Littelfuse 239 Series, 5×20 mm, Slo-Blo® Fuse in Series 150 fuse holder or equivalent
2. Eaton BP-AGC-1-RP 250 V glass fuse in BP/HMK-RP fuse holder
3. 3AG/AGC Screw Terminal Fuse holder

Reference bill of materials (BOM) for auxiliary contact wiring

Reference BOM for 2X circuits, up to 30A each

Reference BOM that can be used to design two solar or load shedding circuit of up to 30 A each.

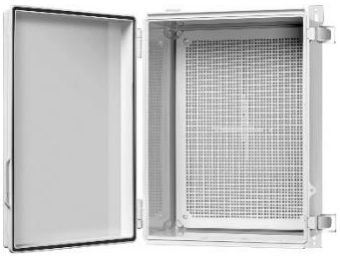
Item	Description	Images
Control transformer	Fiada B07RDBS6NK	
Fuse Retainer	2x Eaton BP/HMK-RP fuse holder	
Fuse	2x Eaton BP-AGC-1-RP 250 V glass fuse	
Contactor	2 X Square D 8910DP32V14 30A	
Box	Gratury Junction Box, Hinged Cover Stainless Steel Clip, IP67 Waterproof Plastic Enclosure for Electrical Project Includes Mounting Plate and Wall Bracket 290×190×140mm (11.4"×7.5"×5.5")	
Quick Disconnects/Fast on Terminals/Receptacle lug (required for contactors without screw-on terminals)	PIDG, Quick Disconnects, Receptacle, 22 – 18AWG Wire Size TE Internal #: 640911-1	

Table 4 *Reference BOM for 2X circuits, up to 30A each*

Example Wiring 2x Solar Circuits using 30A contactors for Excess Solar Shedding

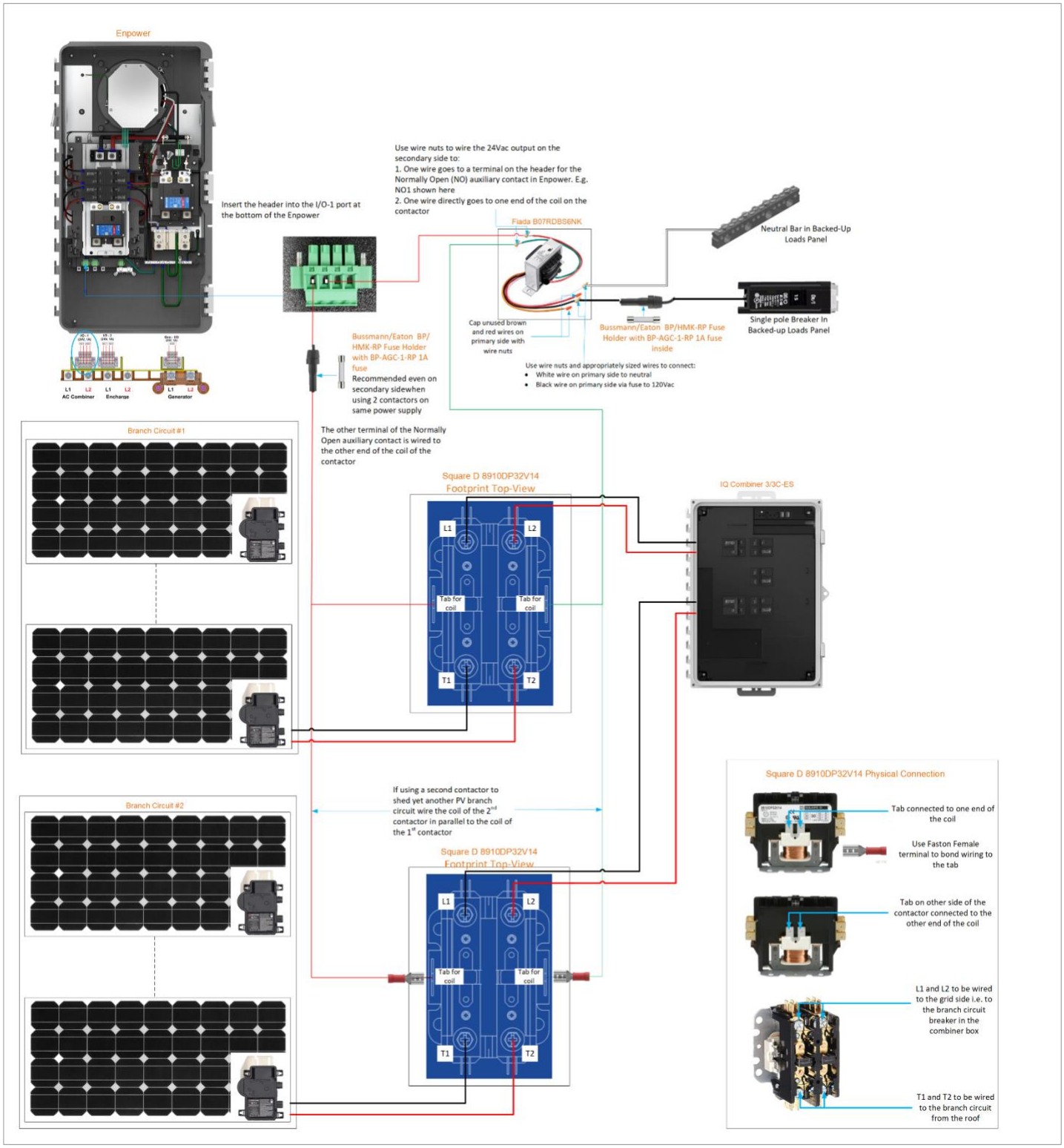


Figure 3 Example Wiring 2x Solar Circuits using 30A contactors for Excess Solar Shedding

Reference BOM for a 60 A load control

Reference BOM that can be used to design load shedding circuit of 60 A total load.

Item	Description	Images
Control transformer	Fiada B07RDBS6NK	
Fuse Retainer	Littelfuse Universal Fuse Retainer Part No: 150145	
Fuse	NTC 74-6SG1A-C 1 A 250V glass fuse	
Contactor	Square D 8910DPA63V14[1] 60 A	
Box	6X6 PVC box rated for outdoor use (NEMA 3R or better) (Carlon junction box, for example)	
Quick Disconnects/Fast on Terminals/Receptacle lug (required for contactors without screw on terminals)	PIDG, Quick Disconnects, Receptacle, 22 – 18AWG Wire Size TE Internal #: 640911-1	

Table 5 Reference BOM for a 60 A load control

[1] A 3-pole contactor is specified since the 2-pole 60A contactor from Square D i.e., 8910DPA62V14 has been discontinued.

Example Wiring: Heavy 240V Load Shedding for 1X Circuit

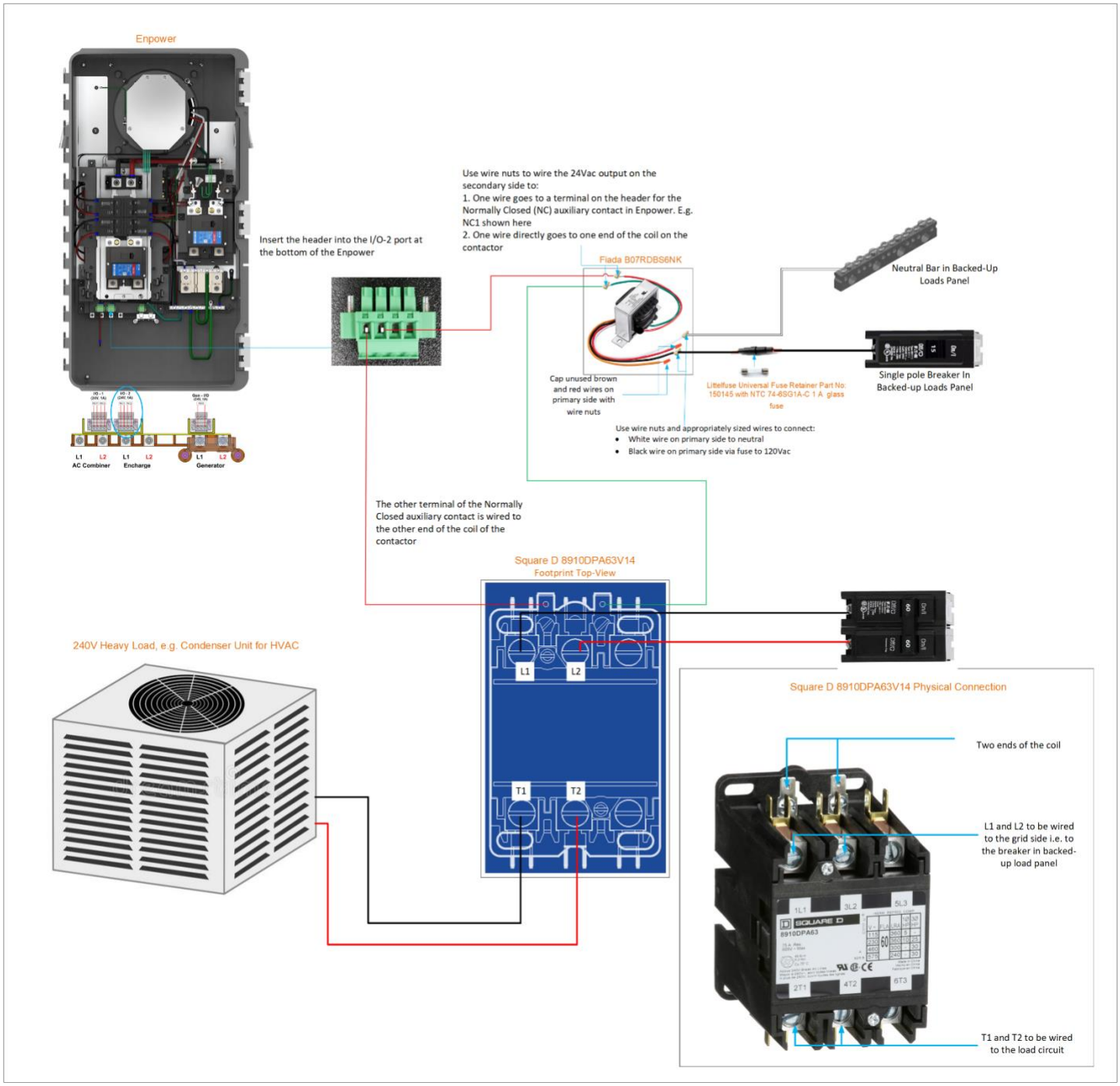


Figure 4 Example Wiring: Heavy 240V Load Shedding for 1X Circuit

Reference BOM for 20 A load or PV shedding circuit using a 20A contactor

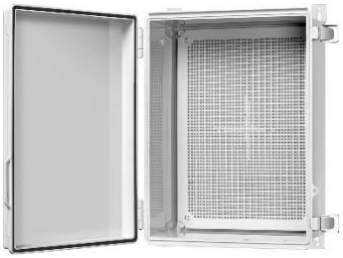
Item	Description	Images
Control transformer	EP40310F 24V 40VA	
Fuse Retainer	Bussmann BP/HMK-RP fuse holder	
Fuse	NTC 74-6SG1A-C 1 A 250V glass fuse	
Contactor	Eaton C25BNB220T 20A	
Box	Gratury Junction Box, Hinged Cover Stainless Steel Clip IP67 Waterproof Plastic Enclosure for Electrical Project Includes Mounting Plate and Wall Bracket 290×190×140mm (11.4"×7.5"×5.5")	
Quick Disconnects/Fast on Terminals/Receptacle lug (required for contactors without screw on terminals)	PIDG, Quick Disconnects, Receptacle, 22 – 18AWG Wire Size TE Internal #: 640911-1	

Table 6 Reference BOM for 20 A load or PV shedding circuit using a 20A contactor

Example Wiring: Excess Solar Shedding for 1 Branch Circuit

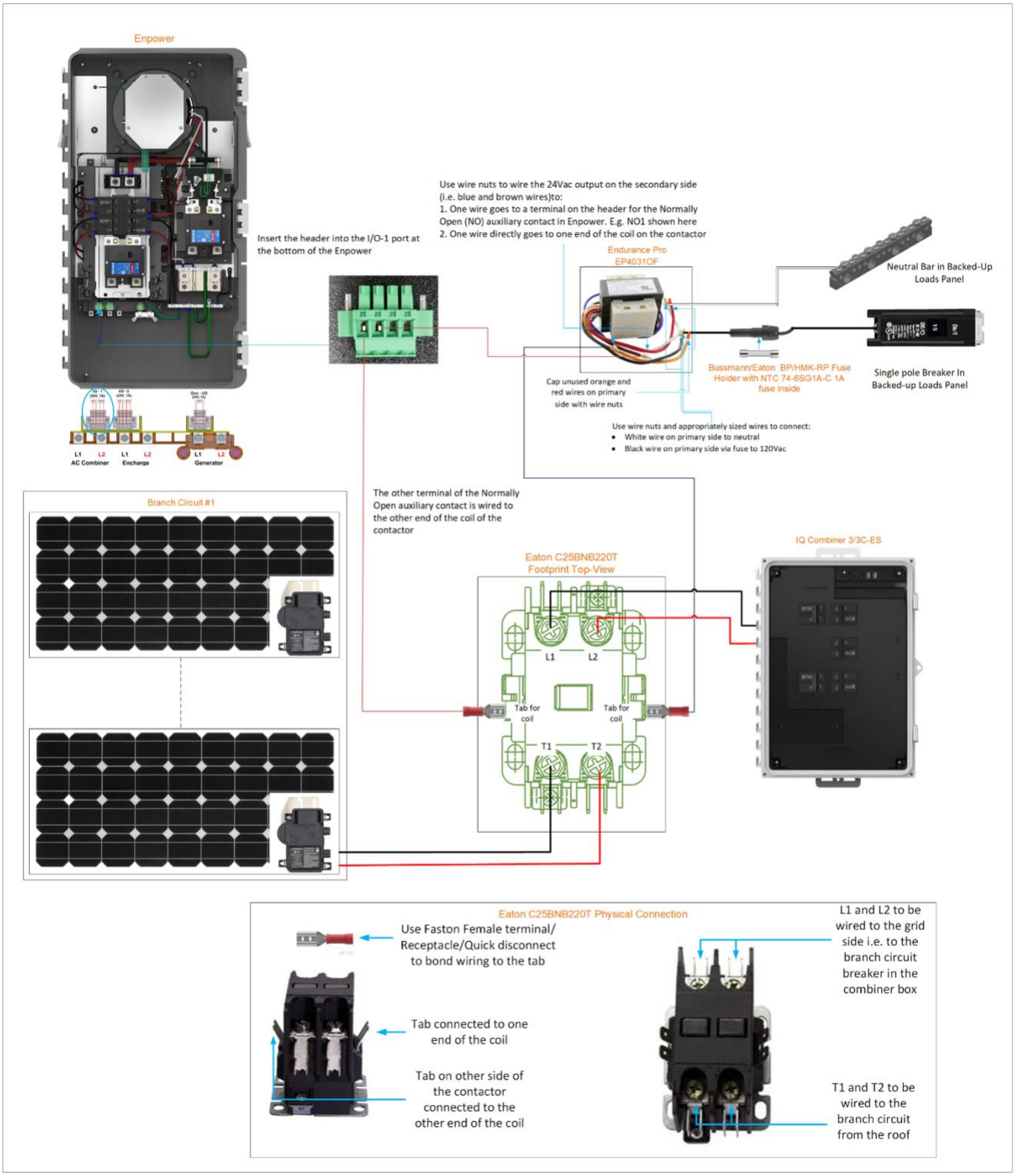
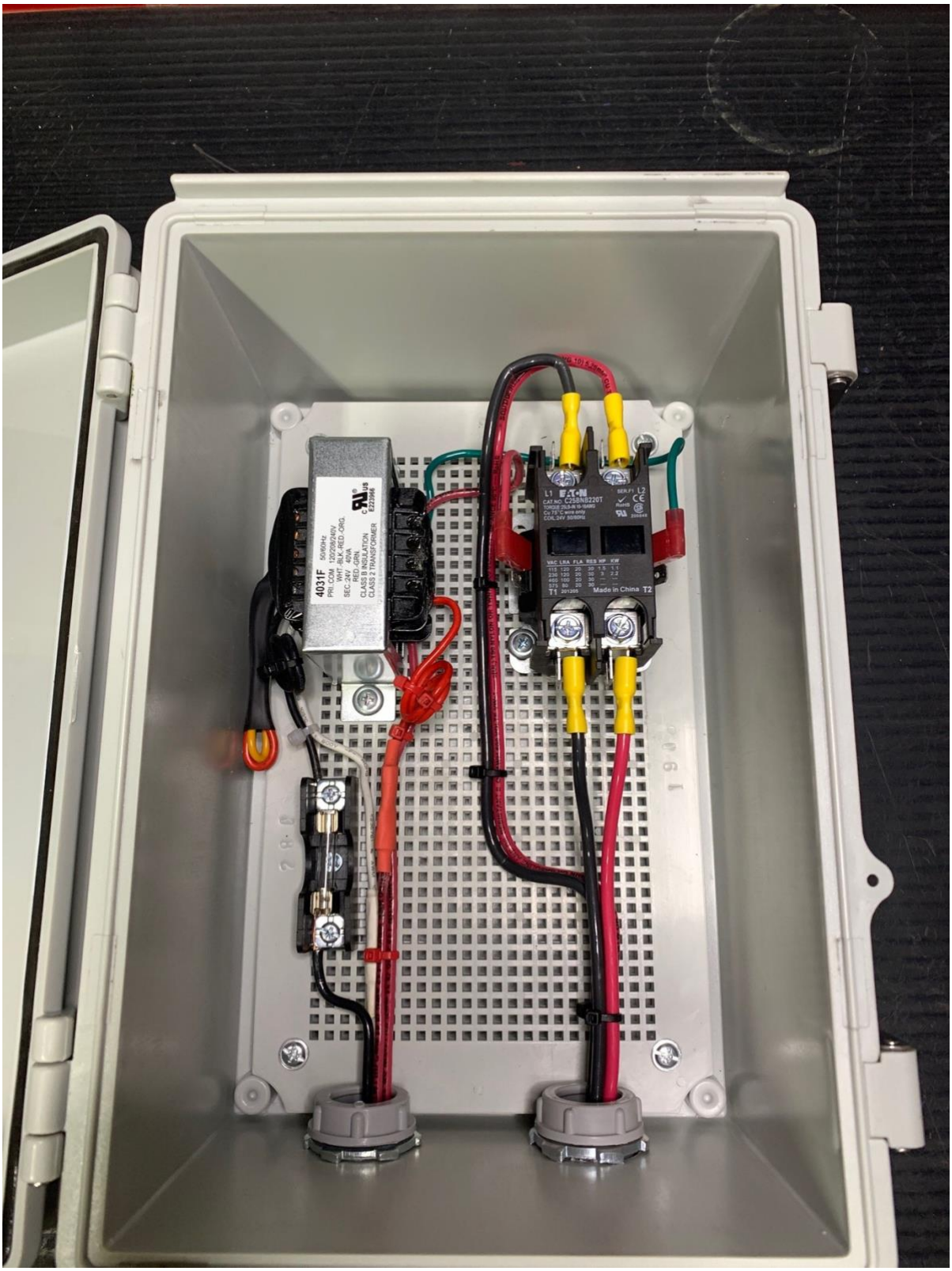


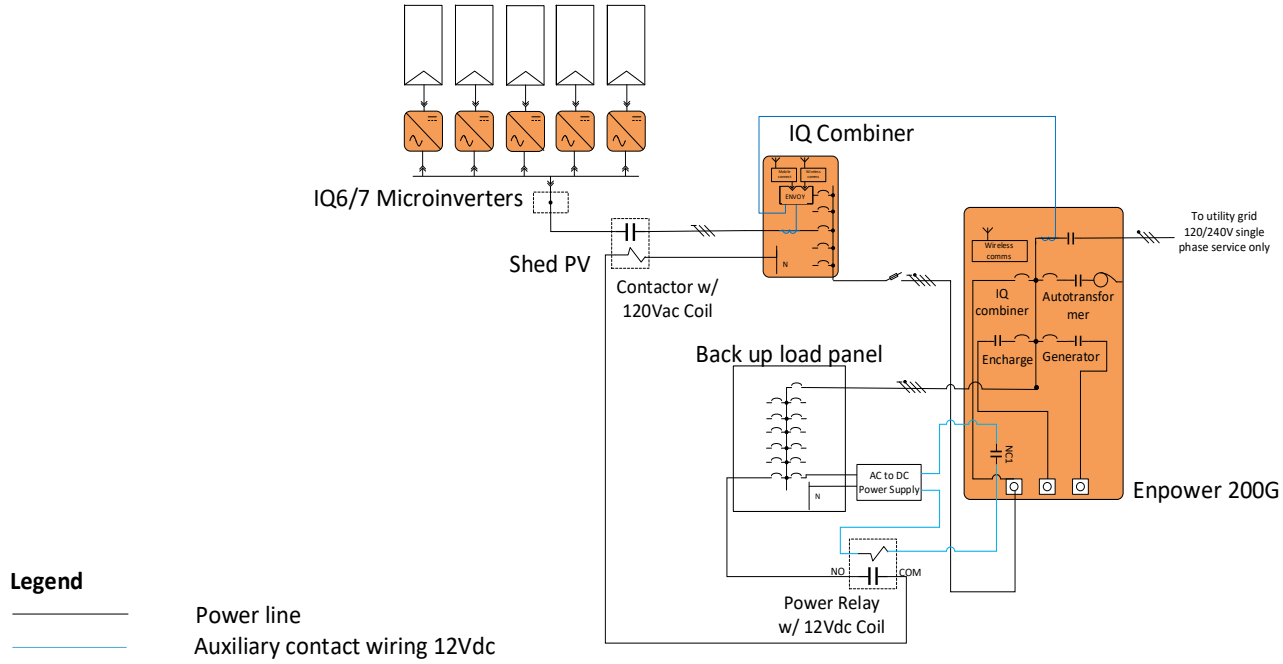
Figure 5 Example Wiring: Excess Solar Shedding for 1 Branch Circuit

Reference Wiring Image



Using an external contactor with a 120Vac coil

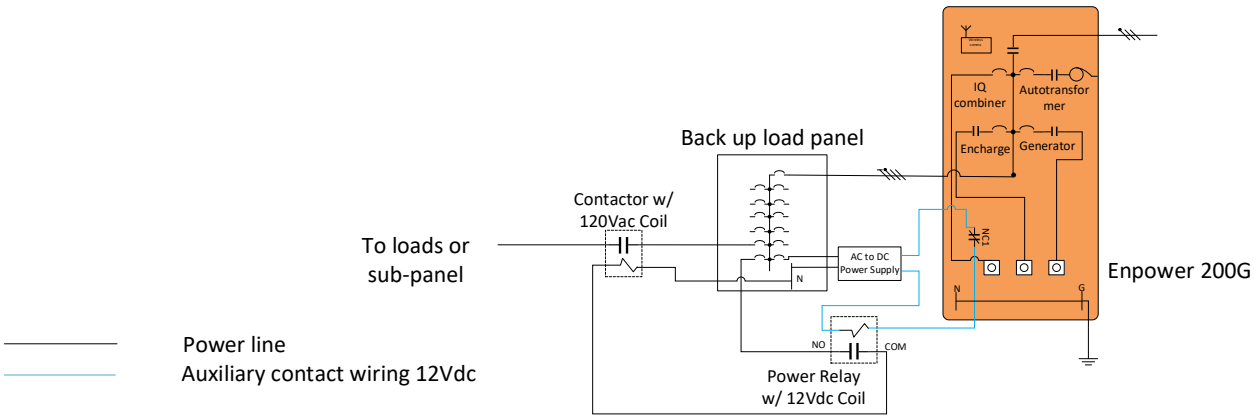
24 Vac coil based definite purpose contactors for large loads typically have holding currents that exceed Enpower auxiliary contact rating of 1 A. In such cases an external contactor with a 120 Vac coil can be used with the bill of materials and wiring specified in this section. A 12 V DC power source is used to drive an interposing power relay and the auxiliary contacts in Enpower controls the current to the coil of the power relay. The output of the power relay is used to control the 120 Vac coil of the external contactor.



Note:

- NC1 – Normally Closed auxiliary contacts used to control a load circuit when system is in backup mode
- The power relay w/ 12Vdc coil is used to control a contactor (w/ 120Vac coil) which switches the PV branch circuit (s)
- The 120Vac coil must be connected to a breaker on the backed up loads panel via the NO and COM terminals of the power relay
- Enpower switches the 12Vdc power to the coil of the power relay to shed or connect the loads/sub-panel

Figure 6 PV shedding using external contactor with 120 Vac coil



Note:

- NC1 – Normally Closed auxiliary contacts used to control a load circuit when system is in backup mode
- The power relay w/ 12Vdc coil is used to control a contactor (w/ 120Vac coil) which switches the power to the loads or sub-panel
- The 120Vac coil must be connected to a breaker on the backed up loads panel via the NO and COM terminals of the power relay
- Enpower switches the 12Vdc power to the coil of the power relay to shed or connect the loads/sub-panel

Figure 7 Load shedding using external contactor with 120 Vac coil

Reference BOM for 120 A load or PV shedding circuit

Item	Description	Images
DC power supply	12V 1A APV-12-12 Meanwell AC-DC Switching Power Supply	
Power Relay	Schneider Electric Relays W9AS5D52-12	
Contactor	120 Amp Contactor C25HNE3120A Eaton / Cutler Hammer • 3 Pole • 110 120 V Coil	
Box	QILIPSU Hinged Cover Stainless Steel Latch 370x270x150mm Junction Box with Mounting Plate, ABS Plastic DIY Electrical Project Case IP67 Waterproof Dustproof Enclosure Grey (14.6"x10.6"x5.9")	
Quick Disconnects/Fast on Terminals/Receptacle lug (required for contactors without screw on terminals)	PIDG, Quick Disconnects, Receptacle, 22 – 18AWG Wire Size TE Internal #: 640911-1	

Table 7 Reference BOM for 120 A load or PV shedding circuit

Example wiring: Load shedding using definite purpose contactor with 120 Vac coil

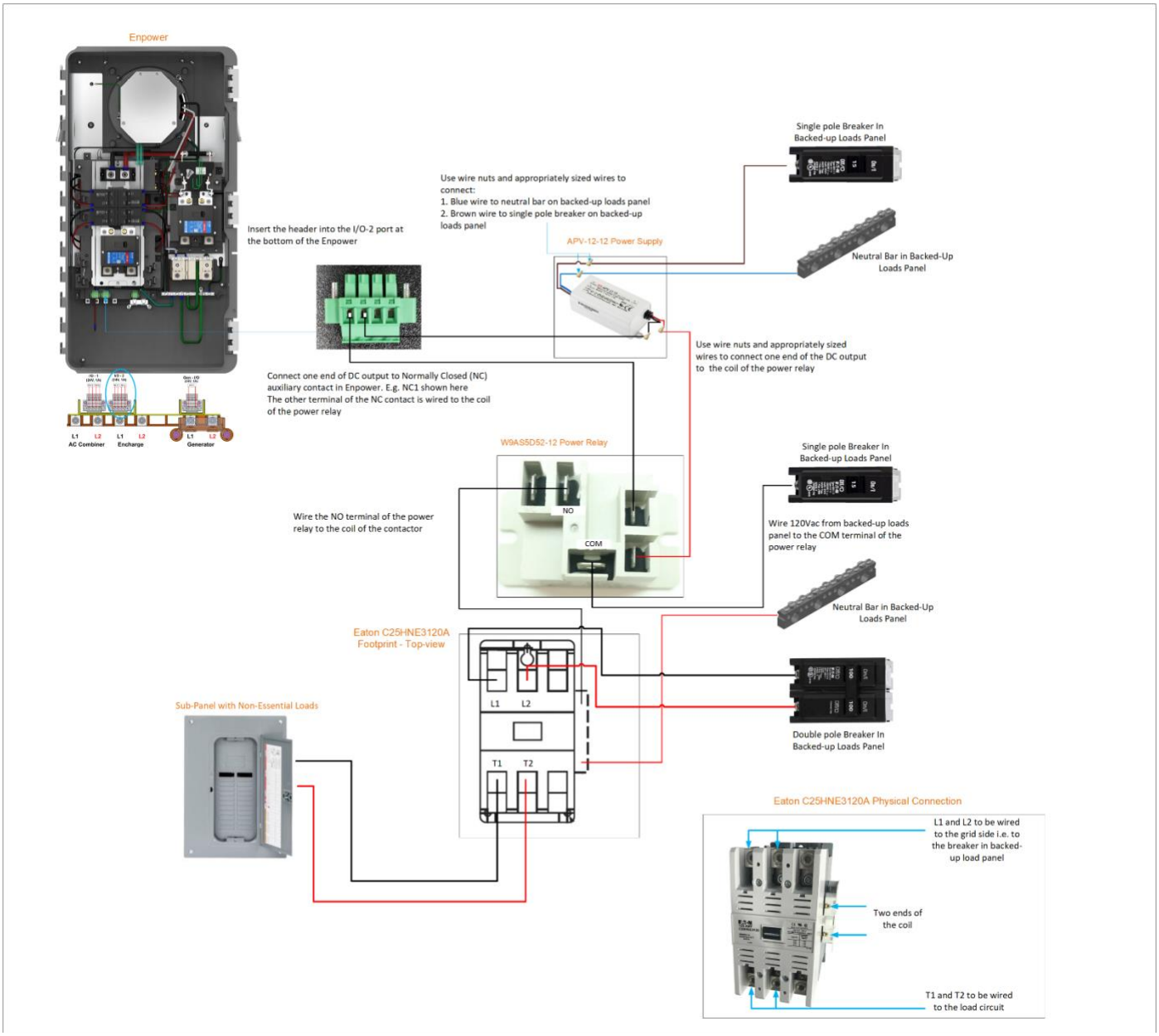


Figure 8 Example wiring: Load shedding using definite purpose contactor with 120 Vac coil

Example wiring: PV shedding using definite purpose contactor with 120 Vac coil

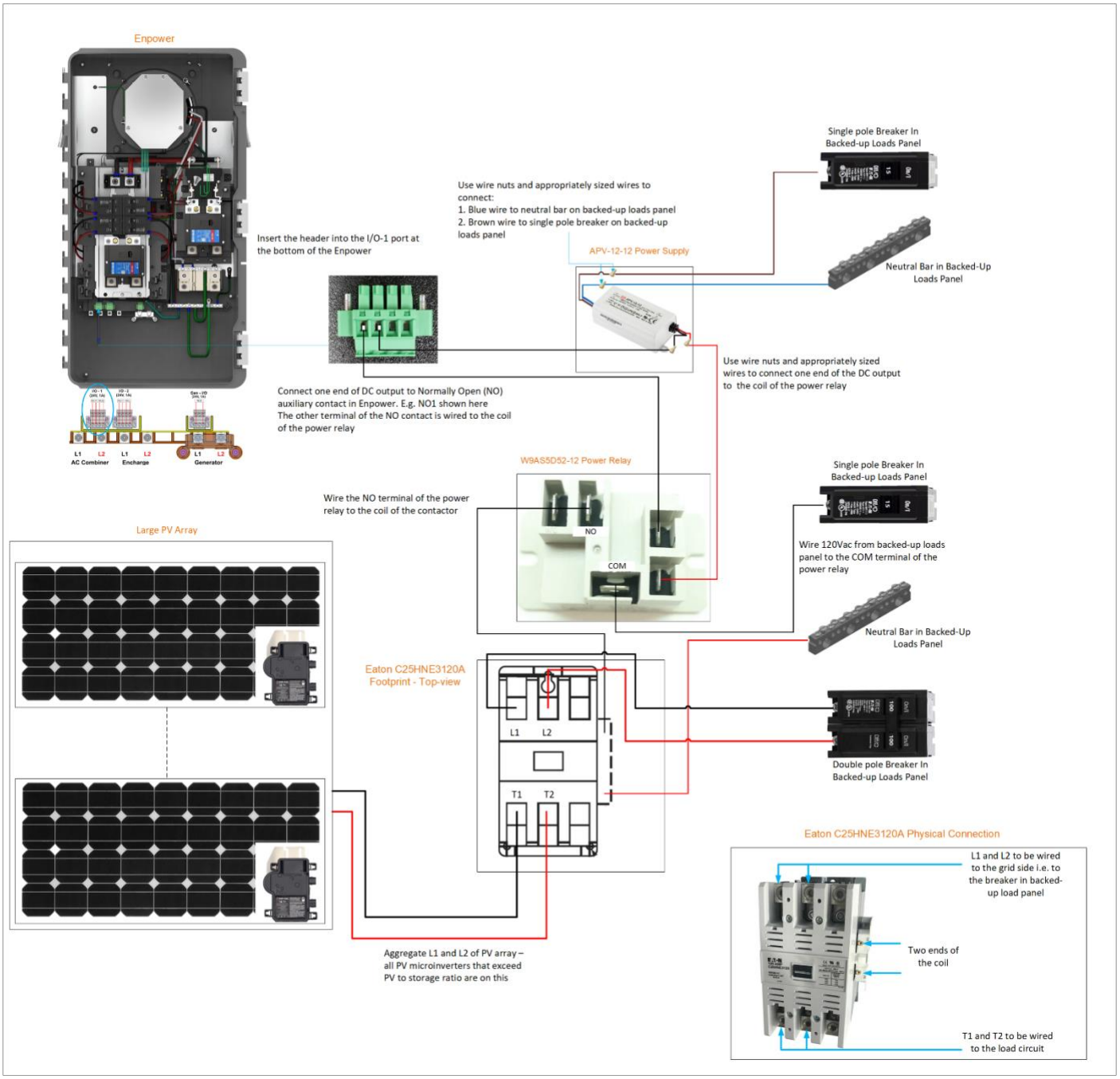


Figure 9 Example wiring: PV shedding using definite purpose contactor with 120 Vac coil

Please refer to appendix C for more wiring configurations.

Smart control modes

The Ensemble system can change the state of the auxiliary contact based on grid state, generator availability, and battery state of charge. The section describes the different control modes that are supported for solar and load circuits using auxiliary contacts.

The Smart control modes available are as follows:

- Shed solar when off-grid
- Basic Mode: Shed load when off-grid
- Battery Mode: Shed or restore load based on state of charge
- Generator Mode: Shed load when off-grid and restore when generator is connected

Load or solar circuits connected to Enpower Auxiliary contacts can be configured to any of the modes above using the Enphase Installer ToolKit (ITK).

Note: Generator Mode available for systems with a standby generator. Generator support being released soon for Enphase Storage system.

Note: If a user **disables** the smart control on an auxiliary contact, the load will remain powered irrespective of whether the system is on-grid or off-grid.

Automatically shed solar circuit when off-grid

Enpower auxiliary contacts will shed specific PV circuits from the microgrid to ensure that the solar to storage continuous power ratio is maintained at a safe level.

Mode	MID	PV circuit state
on-grid	MID Closed	Connected
off-grid	MID Open	Disconnected

Table 8 Automatically shed PV circuit when off-grid

Basic Mode: Shed load when off-grid

Enpower auxiliary contacts will shed the specific load circuits as soon as the system enters the off-grid mode. This is done to ensure that a stable microgrid is established. When the grid is back, the system will reconnect the load.

Mode	MID	Load circuit state
on-grid	Closed	Connected
off-grid	Open	Disconnected

Table 9 Automatically shed load when off-grid

Battery Mode: Load control based on ESS State of Charge (SoC)

Enpower can disconnect specific load circuits when the aggregate SoC of all the batteries on the site reaches or goes below a user set value(X%). The system will reconnect the load circuit once the aggregate SoC of all the batteries on the site reaches or goes above user set value(Y%). The load will remain online if the SoC is between X% and Y% during the grid transition and will be shed only when the SoC is less than the user set low limit (X%).

Mode	MID	SoC	Load circuit state
on-grid	MID Closed	SoC =any	Connected
off-grid	MID Open	SoC ≥ X%	Connected
off-grid	MID Open	SoC ≤ X%	Disconnected
off-grid	MID Open	X% < SoC < Y%	Connected[1] or Disconnected[2]
off-grid	MID Open	SoC ≥ Y%	Connected

1. The load will remain connected as the SoC reduces from Y% to X%. It will be disconnected once the SoC goes below X%.
2. The load will remain disconnected as the SoC recovers from X% to Y%. It will be reconnected once the SoC goes above Y%.

Table 10 Load control based on ESS State of Charge (SoC)

Generator Mode: Shed load when off-grid and restore when generator is connected

Note: Generator Mode available for systems with a standby generator. Generator support being released soon for Enphase Storage system.

Enpower auxiliary contacts will shed the specific load circuits as soon as the system enters the off-grid mode and then reconnects specific load circuits to the microgrid after the generator is connected to the microgrid.

Mode	MID	GID	Load circuit state
on-grid	Closed	Open	Connected
off-grid	Open	Open	Disconnected
off-grid	Open	Closed	Connected

Table 11 Automatically shed load when off-grid and restore when generator is connected

Configuring Smart Control via ITK

Accessing Auxiliary contact configuration

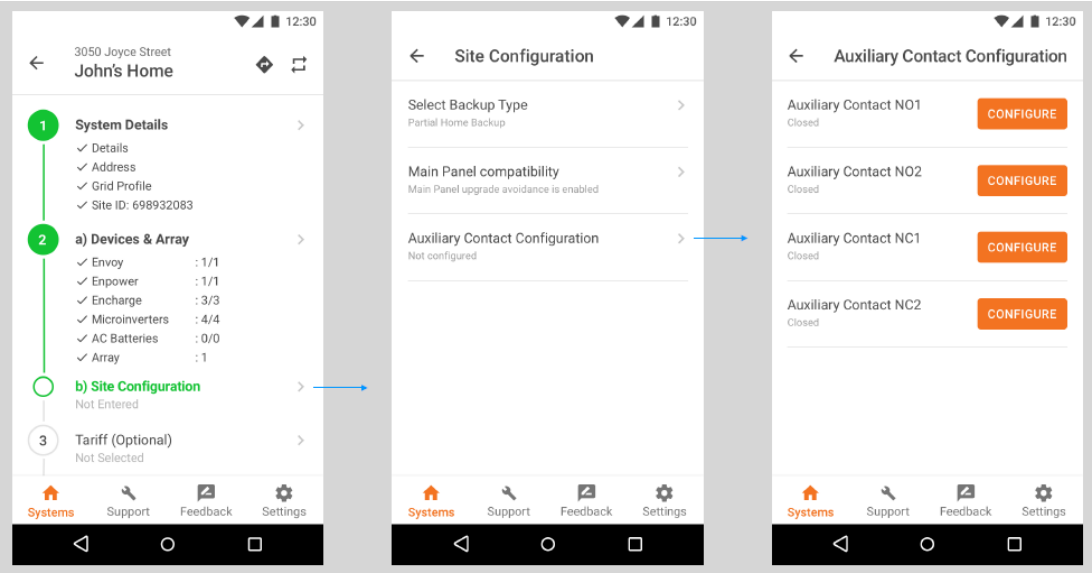


Figure *10 Accessing ITK Auxiliary contact configuration.*

Press Site Configuration → Auxiliary Contact configuration

Enable Load Control

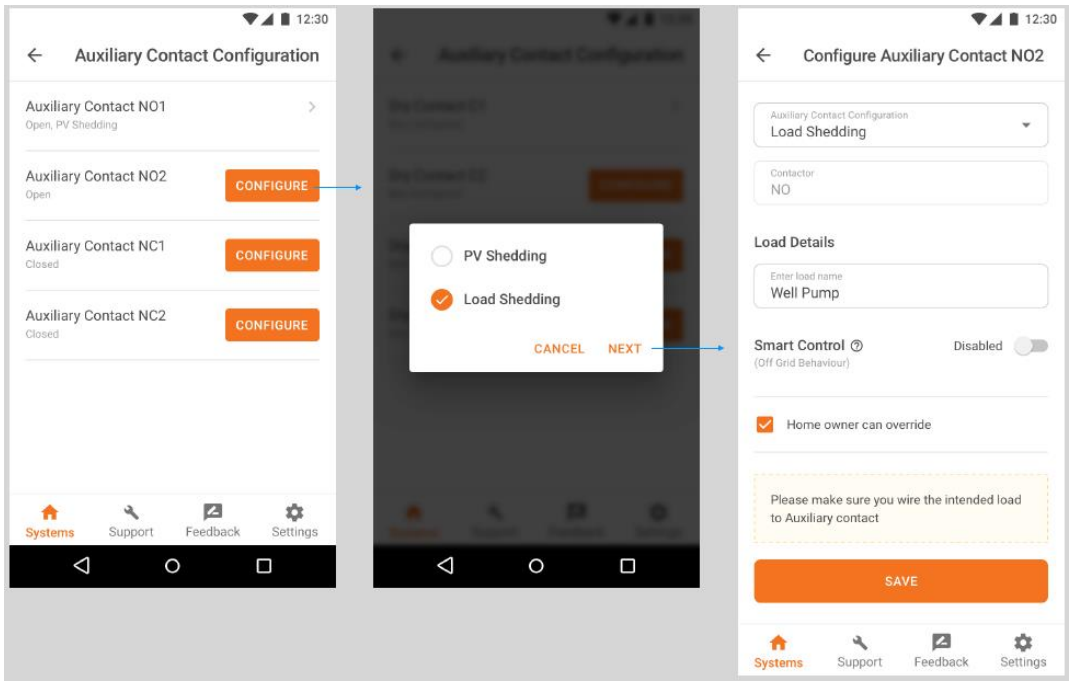


Figure 11 *Configuring Load Circuit Control - Enable Load Control using ITK*

1. Press “Configure” button
2. Select option “Load Shedding”

3. Press “Next”

Basic Mode: Shed load when off-grid

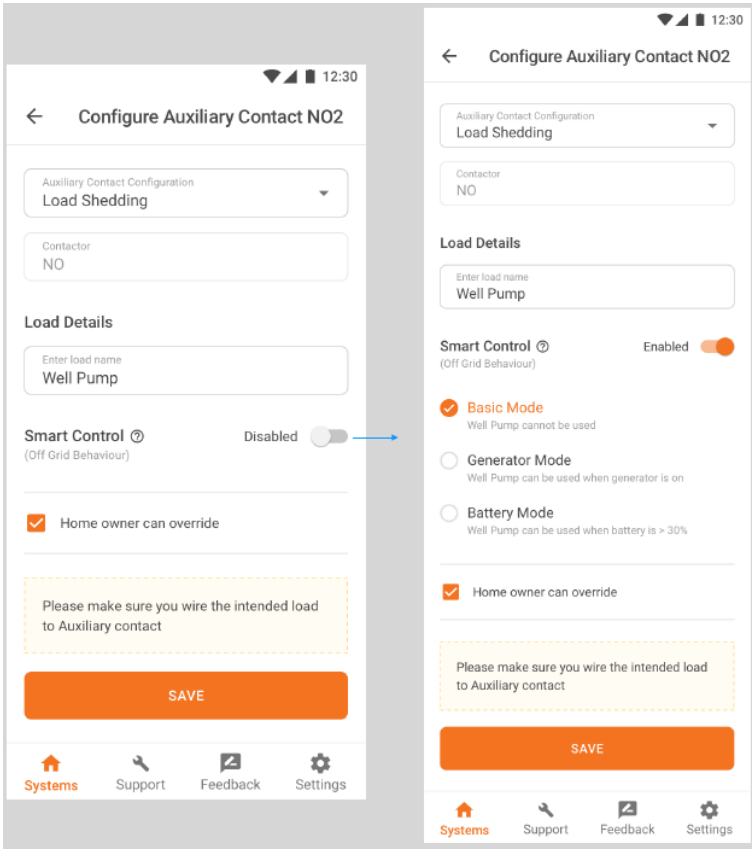


Figure 12 Automatically shed load when off-grid using ITK

1. Enable “Smart Control” by sliding the Toggle to “Enabled”
2. Select radio button “Basic Mode”
3. Check “Home owner can override” – this will let the home owner to access the settings from Enlighten Home Owner App
4. Press “Save”

Battery Mode: Load control based on ESS State of Charge (SoC)

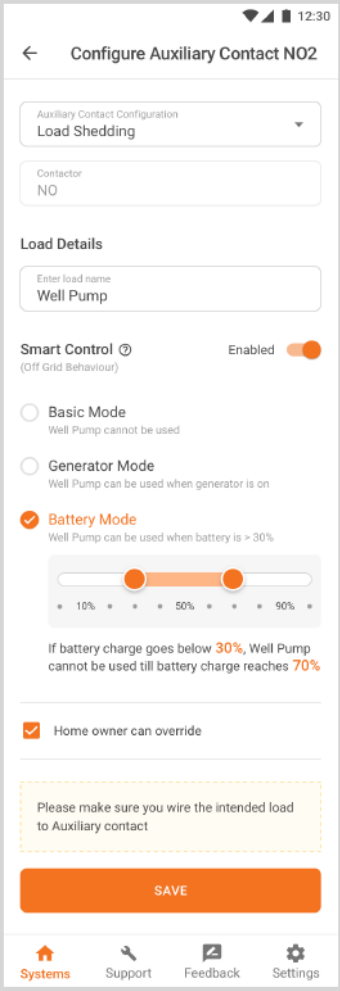


Figure 13 Battery Mode: Load control based on ESS State of Charge (SoC) using ITK

1. Check “Battery Mode”
2. Select the required SoC range using the sliding range selector
3. Check “Homeowner can override” – this will let the homeowner to access the settings from Enlighten Homeowner App
4. Press “Save”

Generator Mode: Shed load when off-grid and restore when generator is connected

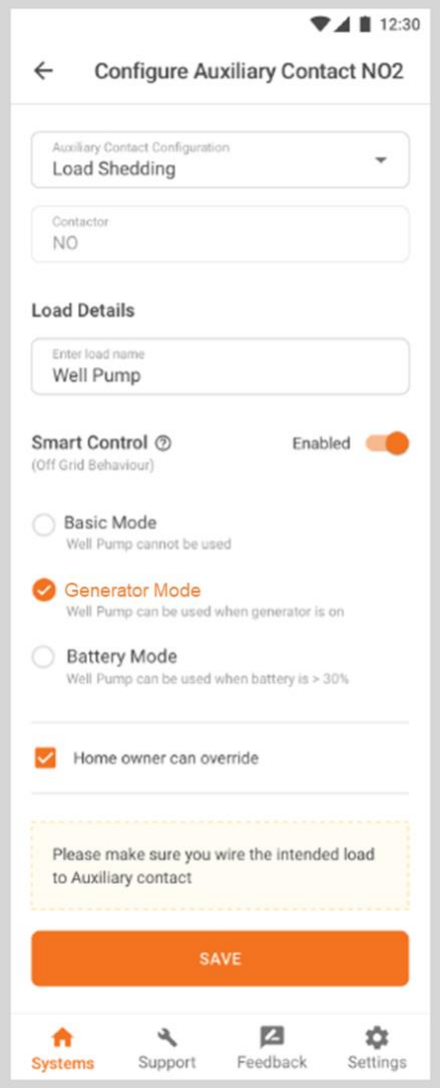


Figure 14 Generator Mode: Shed load when off-grid and restore when generator is connected using ITK

1. Check “Disconnect when off grid and generator is not on”
2. Check “Home owner can override” – this will let the home owner to access the settings from Enlighten Home Owner App
3. Press “Save”

Disable Load control

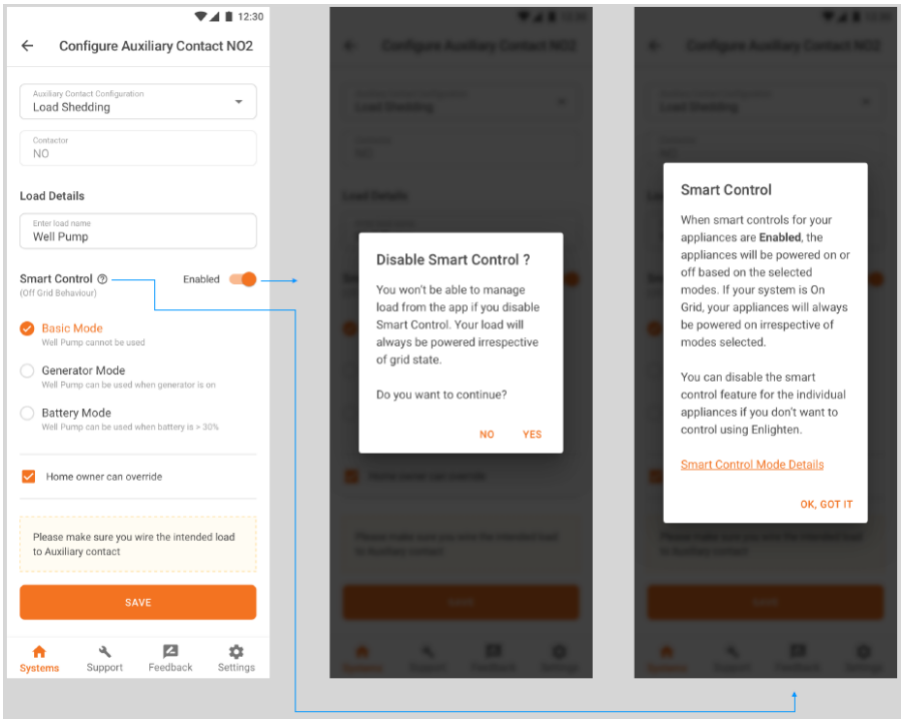


Figure 15 Configuring Load Circuit Control - Disable Load Control using ITK

1. Select the relevant Auxiliary Contact
2. Slide toggle button to “Disabled”
3. Press “Yes” on the pop-up message

Automatically shed PV circuit when off-grid

Enable PV shedding

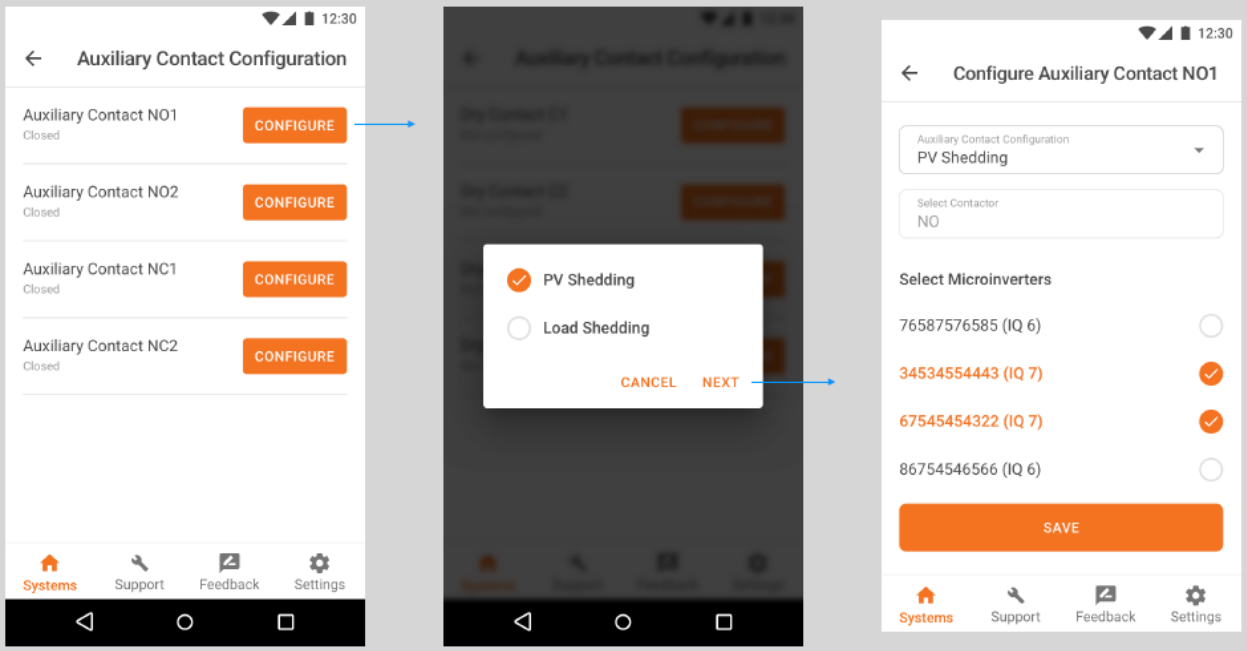


Figure 16 Automatically shed PV circuit when off-grid - Enable PV shedding using ITK

1. Click “Configure” button
2. Check “PV Shedding” to configure the Auxiliary contact for PV Shedding
3. Select the microinverter serial numbers in the PV branch circuit and click “Save”

Disable PV shedding

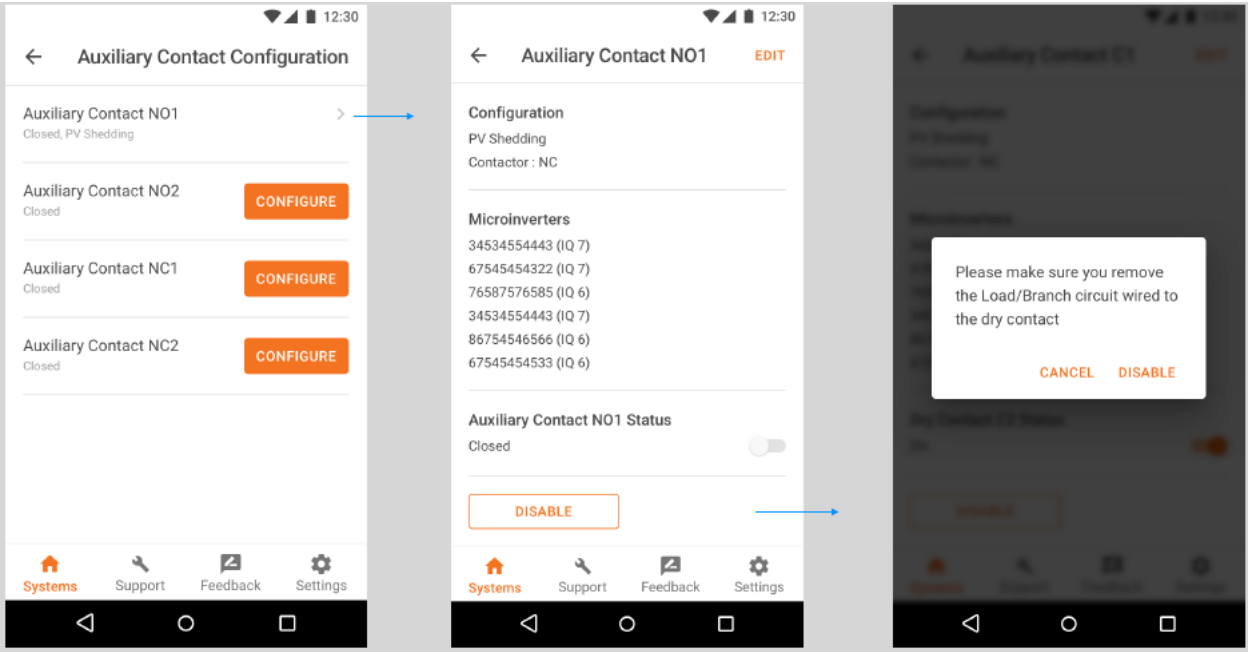


Figure 17 Automatically shed PV circuit when off-grid - Disable PV shedding using ITK

1. Select the relevant Auxiliary Contact
2. Click “Disable” button on the bottom of the screen
3. Confirm “Disable” option in the pop up

Validation of auxiliary contacts using ITK

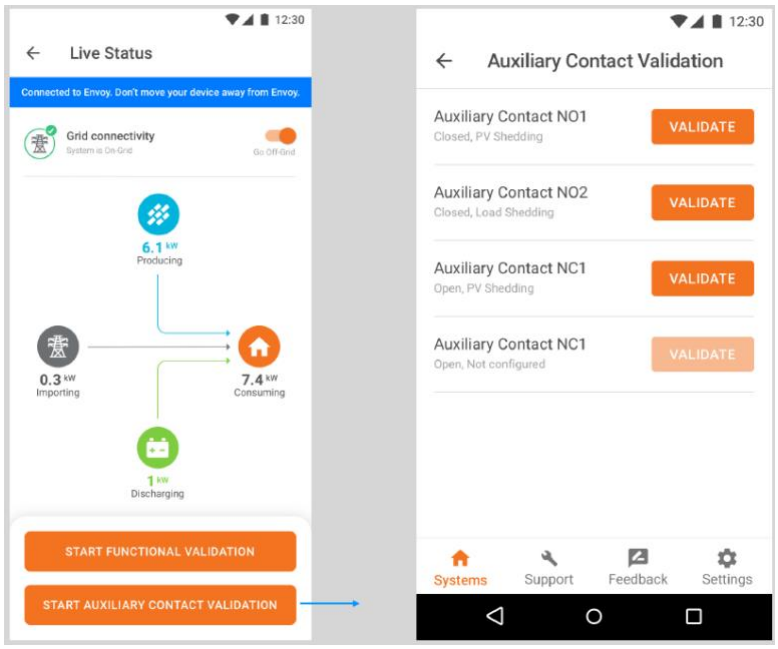


Figure 18 Validation of auxiliary contacts using ITK

1. Click “Start Auxiliary Contact Validation”

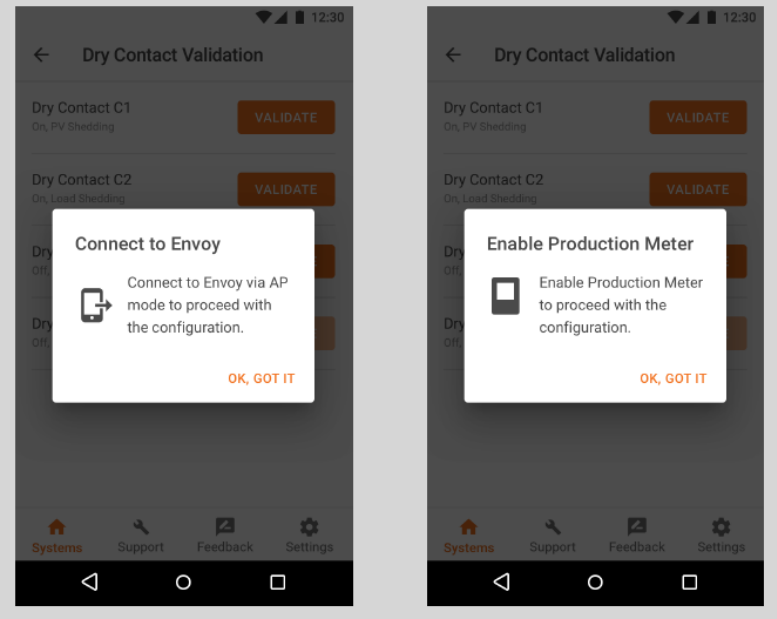


Figure 19 Validation of auxiliary contacts using ITK

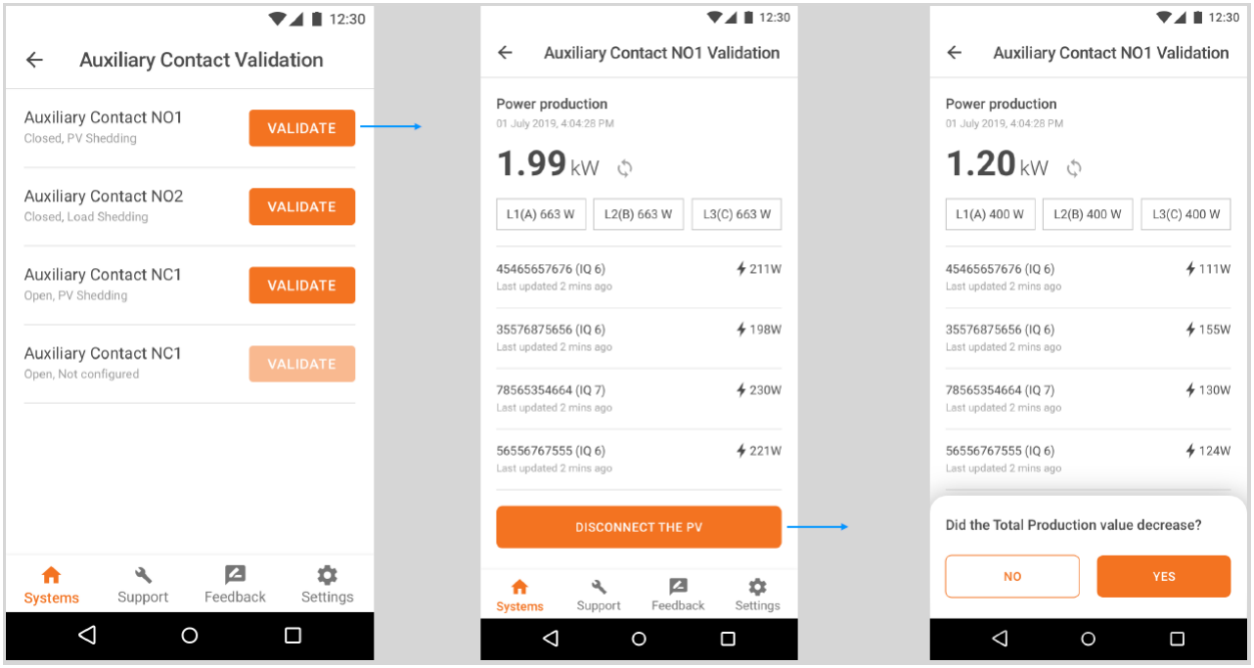


Figure 20 Validation of auxiliary contacts using ITK

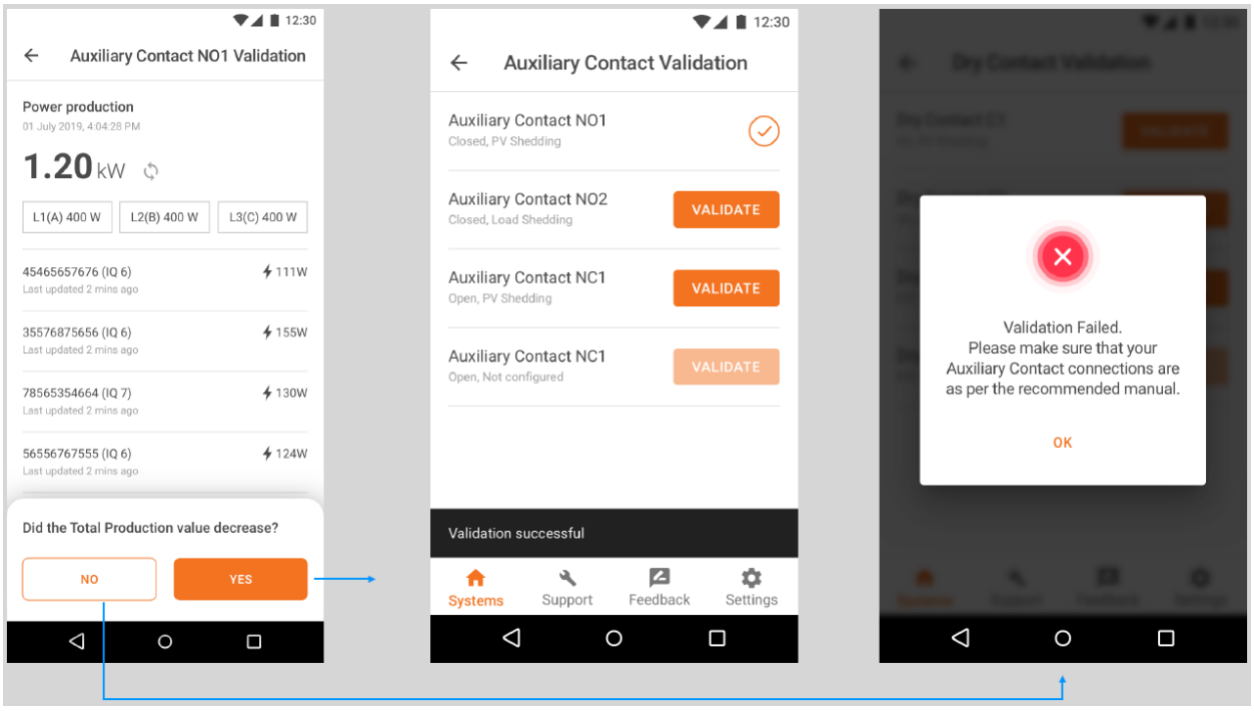


Figure 21 Validation of auxiliary contacts using ITK

1. Press “Validate”
2. Press “Disconnect the PV”

3. If the production value goes down press “Yes”
4. If production value goes down, validation is successful

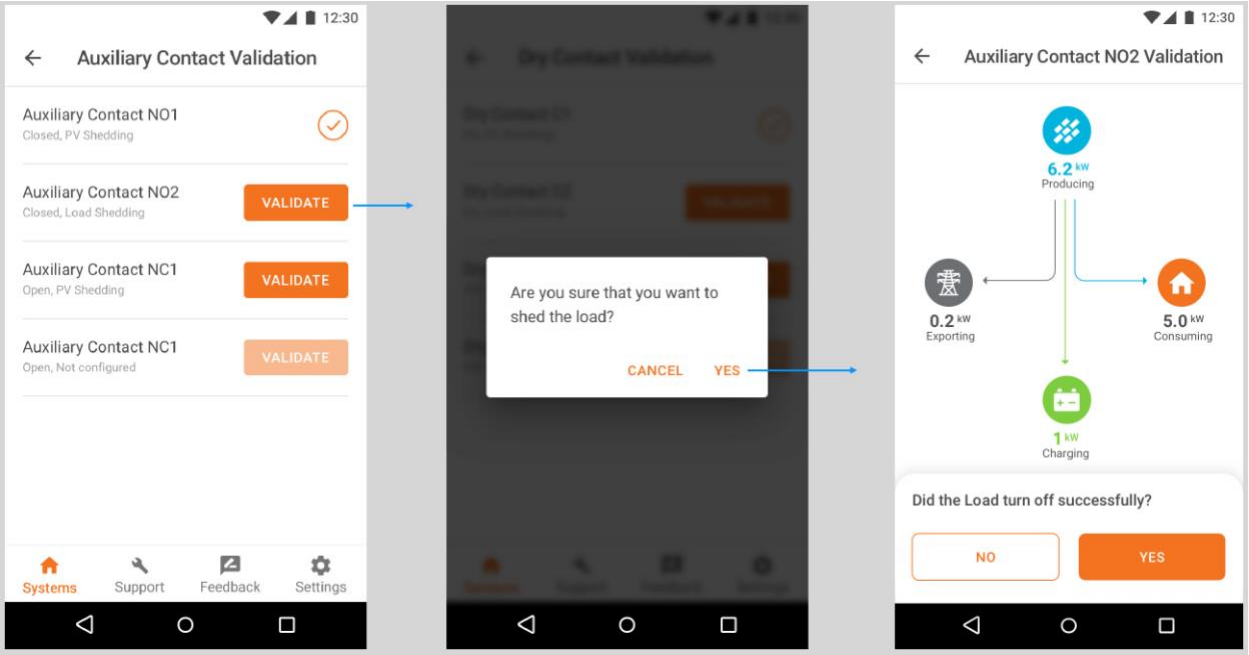


Figure 22 Validation of auxiliary contacts using ITK

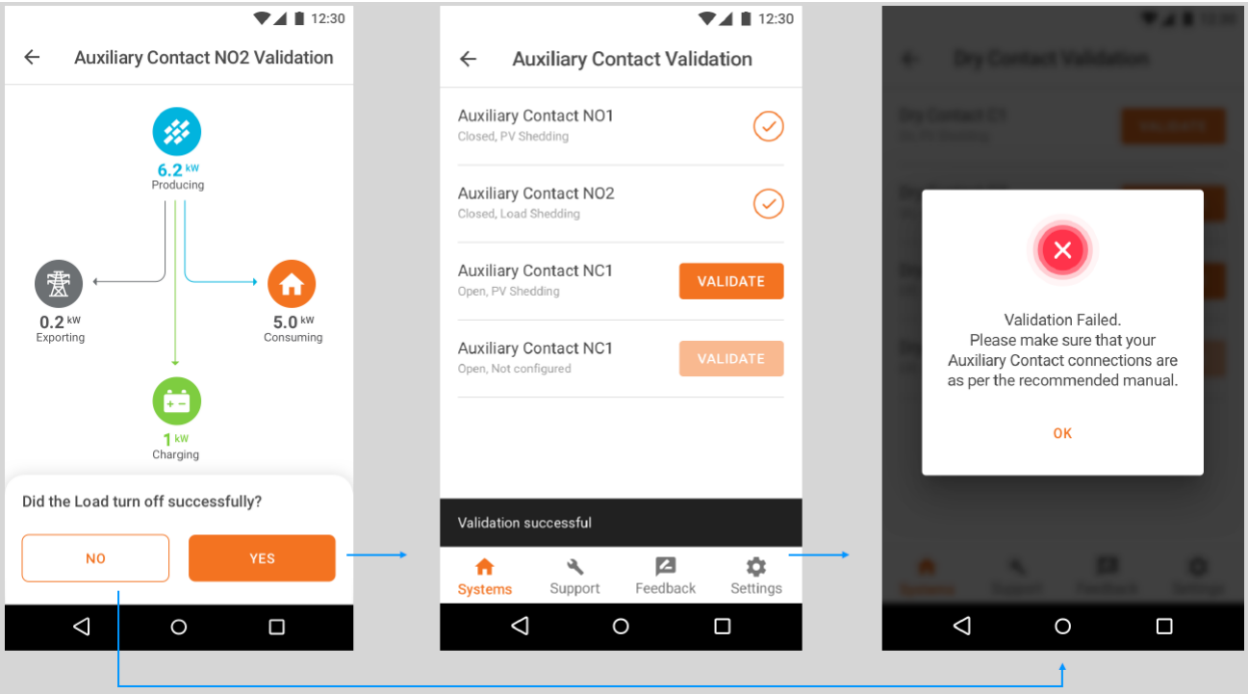


Figure 23 *Validation of auxiliary contacts using ITK*

1. Press “Validate”
2. Press “Disconnect load”
3. If the load is powered down validation is successful

4. If the load is not powered down the validation is not successful

Validation and Troubleshooting steps

Install Validation

1. Ensure control transformer is wired correctly.
    a. Confirm that there is 120 Vac to primary with appropriate fusing.
    b. Confirm that there are no shorts on the secondary
    c. Confirm that there are 24 Vac on the secondary.
    d. **Important: never wire 120 Vac to the auxiliary contactors on Enpower. The auxiliary contactor inputs on Enpower must be 24 Vac or 12V DC.**
2. *Prevent overloading of control transformer:*
    a) Secondary current must be less than 1 A and must be capable of delivering contactor inrush.
    b) Overloading the control transformer will cause the control transformer to fail or the fuse on the primary side to blow. Always match the control transformer output to the inrush and steady state power drawn by the external contactor.
    c) If you are not certain about the inrush and steady state power requirements of the external contactor, we recommend using one control transformer per external contactor.
    d) If two or more external contactor control circuits are powered using a single control transformer, use a fuse on the secondary side of the control transformer as well the primary.
3. *Ensure contactor coils are wired correctly:*
    Check the contactor specification and ensure that the wire the output of the control transformer output is wired to the appropriate contactor coil terminal.
    The external contactor must close when energized. An on-grid contactor should have 24ac across its coils.
    The Voltage across output terminals of the contactor must be the same as the input terminals.

Troubleshooting

Step	Symptom	Possible cause	Solution
1	Transformer is not powered. Diagnosed by measuring AC voltage on the secondary.	Tripped breaker or blown fuse. This can occur due to short on secondary such as the control wires landed on a single terminal of the contactor coil. This can also result in transformer is damage. When overloaded it is possible that transformer primary is damaged.	Ensure correct over current protection is installed on the primary and optionally secondary and replace transformer. Confirm there are no shorts and there is a circuit through all components.
2	Contactor is not powered. Diagnosed by measuring AC voltage on contactor coil and NO1/NO2 Auxiliary contact	NO1/ NO2 Auxiliary contact is not configured. As result there will be voltage drop across NO1/NO2	Ensure Auxiliary contacts are configured and provisioned in ITK
3	Contactor is not powered. Diagnosed by measuring AC voltage on contactor coil.	Contactor isn't energized. Faulty wiring between auxiliary contact in Enpower and definite purpose contactor.	Confirm 24V AC across aux contacts when terminal block is unplugged. Refer Figure *1Auxiliary contact labelling and usage* for identifying the auxiliary contact terminals in Enpower. If you suspect miswiring or if the auxiliary contact is not working, check the continuity across the

Step	Symptom	Possible cause	Solution
			auxiliary contact terminals. When the system is on-grid, both NC and NO auxiliary contacts will be in closed position.
4	Contactor is under powered. Diagnosed by measuring AC voltage on contactor coil.	Contactor produces loud buzzing and there is no voltage on load side (not closed.) A quiet 60 Hz hum is expected, a loud buzzing indicates that the contactor may not be closing due to insufficient transformer size or excessive voltage drop	Confirm definite purpose contactor coil voltage is 24V. Increase wire size if a single contactor. Change to a single contactor per control transformer.
5	Contactor does not open when expected.	NC 1/ NC 2 Aux contact is not configured. Unplug the terminal block to ensure that the contactor opens.	Ensure Auxiliary contacts are configured and provisioned in ITK

Table 12 Troubleshooting

Configuring Smart Control via Enlighten Homeowner App

Installer needs to provide access so that Homeowner can configure load control. Homeowner cannot access PV circuit control configuration.

Enabling Smart control configuration

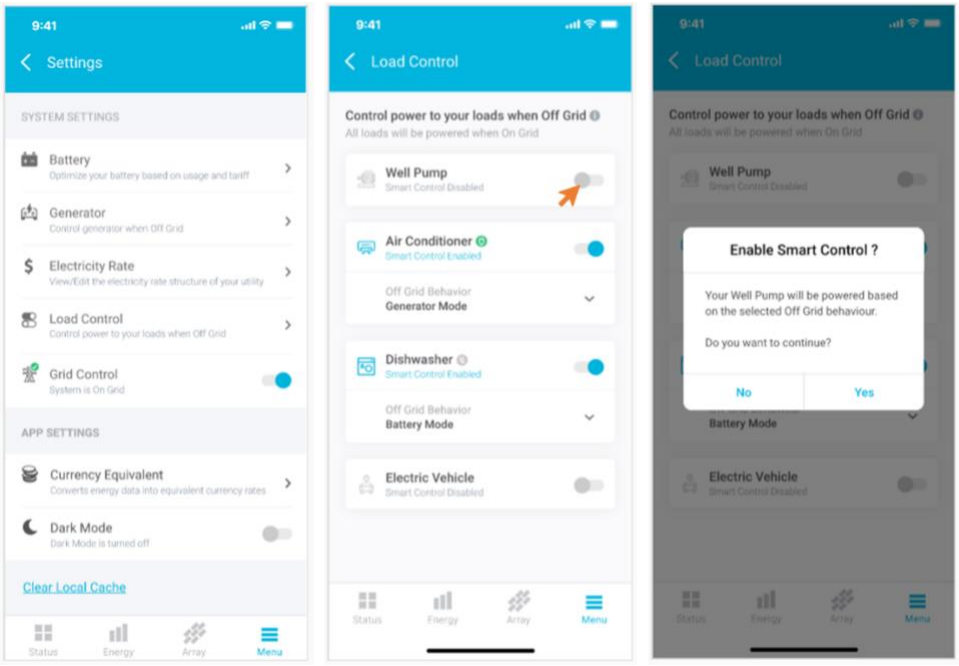


Figure 24 Enabling load control configuration using Enlighten Homeowner App

1. Select on “Load control” in Home controls
2. Slide the toggle to the right
3. Press “Yes” to confirm

Basic Mode: Shed load when off-grid

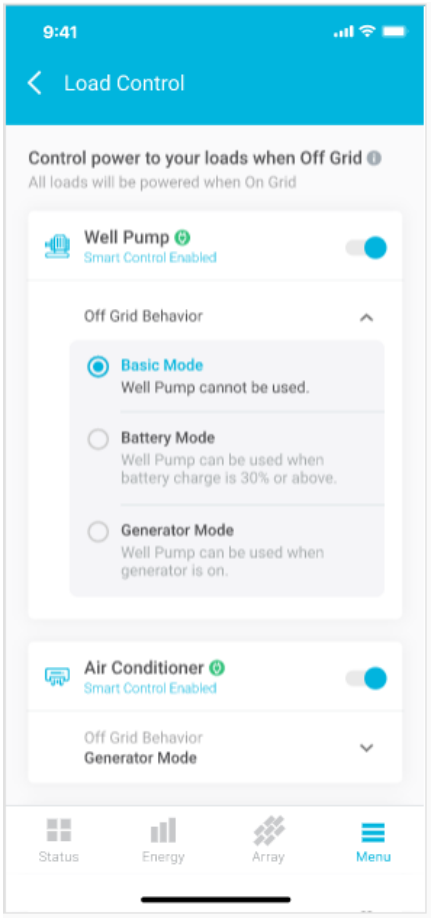


Figure 25 Basic Mode in Enlighten Homeowner App: Shed load when off-grid

1. Select radio button “Basic Mode”
2. Press “Apply”

Battery Mode: Load control based on ESS State of Charge (SoC)

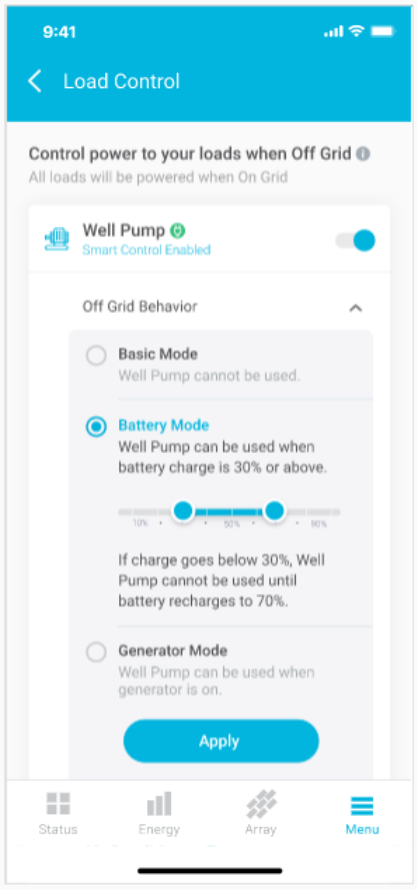


Figure 26 Battery Mode in Enlighten Homeowner App: Load control based on ESS State of Charge (SoC)

1. Select radio button “Battery Mode”
2. Select the required SoC range using the sliding range selector
3. Press “Apply”

Generator Mode: Shed load when off-grid and restore when generator is connected

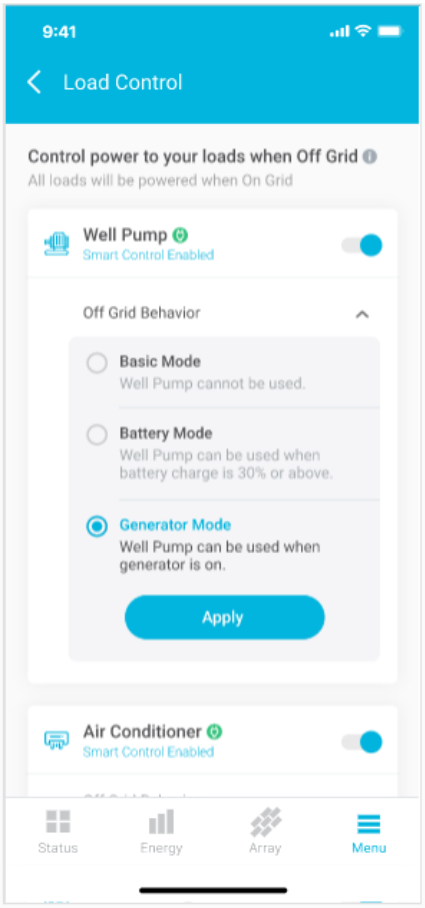


Figure 27 Generator Mode in *Enlighten Homeowner App: Shed load when off-grid and restore when generator is connected*

1. Select radio button “Generator Mode”
2. Press “Apply”

Disable Smart Control

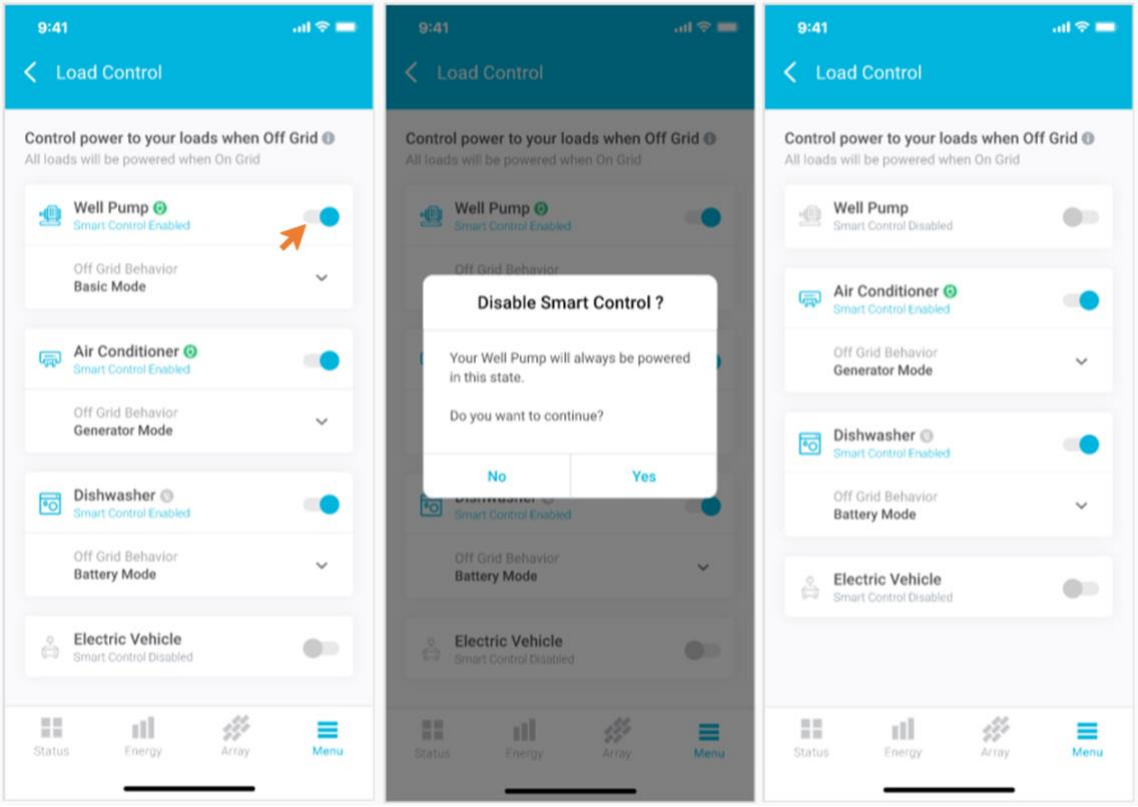


Figure 28 Disable Smart control in Enlighten Home Owner App

1. Slide the toggle to the left
2. Press “Yes” to confirm

Appendix A: Single Line Diagram

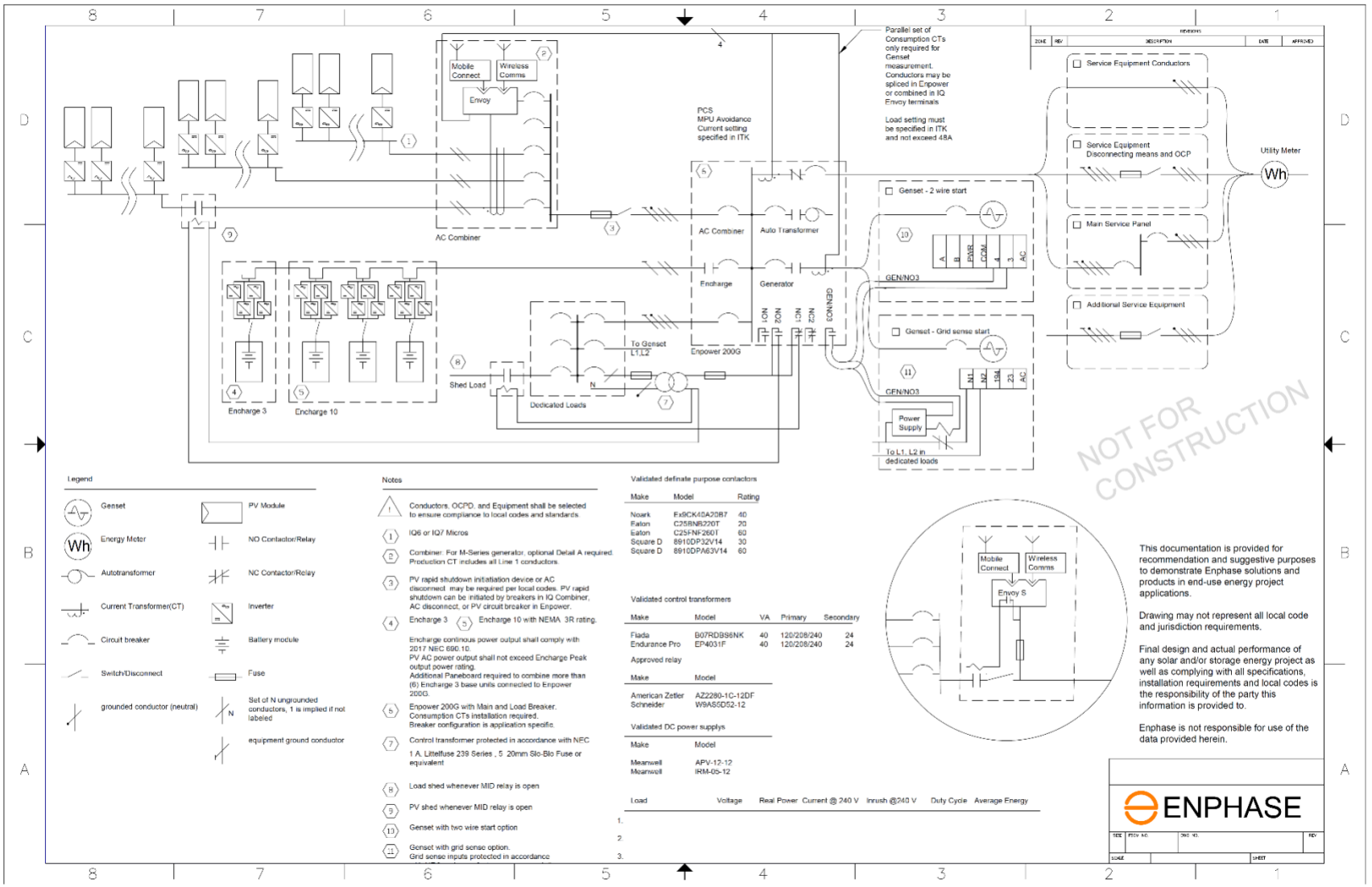


Figure 29 *Detailed Single Line Diagram*

Appendix B: Controlling air conditioning unit using a thermostat.

Auxiliary contact can be wired to intercept the control wire of a thermostat to an air conditioner

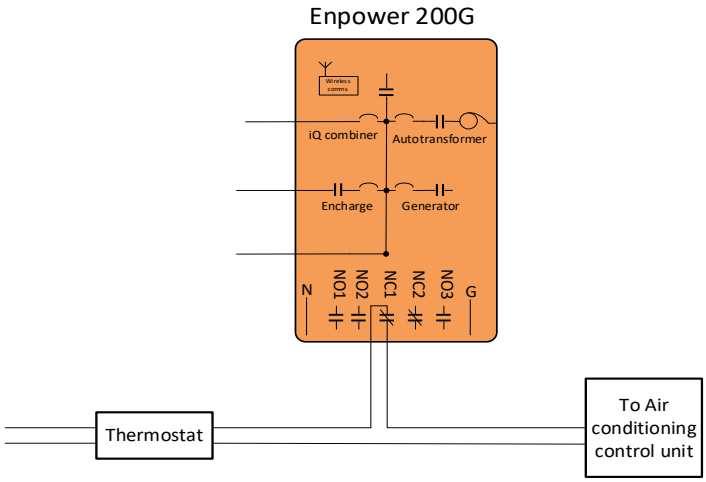


Figure 30 Using auxiliary contact for controlling air conditioning unit

Normally the air conditioning units are controlled by the thermostat. The air conditioner starts when it receives a signal from a thermostat. The signal from the thermostat usually goes into an air handler unit (typically indoors). The air handler unit in turn signals the condenser unit which is outdoors.

An auxiliary contact can be used to intercept the “cool” wire from the thermostat to the air handler. The “cool” wire may also be called a “cool call” wire. Once this is done the Enpower auxiliary contacts need to be configured to shed loads automatically in off-grid as outlined in sections above.

When this is done:

- When the system is on-grid the auxiliary contact stays closed. This ensures that the thermostat’s signal goes to the air handler thereby ensuring the air handler and condenser operate as normal.
- When the system goes off-grid, the auxiliary contact opens, interrupting the control signal from thermostat to the air handling unit. Depending on the state of the condenser during the grid transition the following can happen:
    - If the condenser was running during grid transition, it will run for a cool down period, typically a few minutes. The Encharges must be sized appropriately to support the steady state current requirement of the condenser, to ensure there is no microgrid collapse during the cooldown period.
    - If the condenser was not running during the grid transition, it will not start again during the off-grid mode.
- If the condenser is signaled to start at the same instant as the grid transition happens, the condenser may try to start. The surge current may collapse the microgrid unless the system has been designed to support the surge current. This is a very rare scenario, and the system recovers within a few seconds to form the microgrid again. Since the thermostat has been disconnected during the initial microgrid transition, the condenser will not start again in off-grid mode.

Note: Encharge must be sized appropriately to handle the power requirements of the external compressor.

Note: Use Normally Closed Auxiliary contact to wire the thermostat as the contact opens when the grid power goes off by default.

Appendix C: Additional reference BOM configurations

1. 40A Load Shedding

Item	Description	Units Required	Purchase Link
Enclosure	Gratury 15.7” *11.8” junction box	1	Link
Power Supply	Fiada (B07RDBS6NK) control transformer	1	Link
Definite Purpose Contactor	Packard(C240A) 24Vac 40A coil	1	Link
Fuse Holder	Parts Express(3AGAGC) Screw Terminal Fuse holder	1	Link
Fuse	Bussman (BP/AGC-1-RP) 1A 250V glass fuse	1	Link
Wiring	Gardner Bender(AMW-318) #18 Single Strand Wire	As required	Link