



CPS SCA Series Grid-tied PV Inverter

**CPS SCA50KTL-DO/US-480
and SCA60KTL-DO/US-480**

Installation and Operation Manual - Rev 3.0



CHINT POWER SYSTEMS AMERICA CO.

Revision 3.0 - Feb 2018

Revision History

Rev Number	Chap/Sec	Rev Date	Description
1.0	N/A	Aug 2016	Initial Release
2.0	3	Sep 2016	H4 Wirebox, Operating Mode
2.1	3	Feb 2017	H4 Termination, AC Terminal
2.2	3, 5, 7, 8	Sept 2017	AC Terminal, Parameters, Trouble-Shooting, Accessories
3.0	3, 5, 6, 10	Feb 2018	Increased kVA Ratings

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Before You Start...



Scope

This Installation and Operation manual contains important information, safety guidelines, detailed planning and setup information for installation, as well as information about configuring, operating and troubleshooting the CPS SCA50KTL-DO/US-480 and CPS SCA60KTL-DO/US-480 3-Phase String Inverters. Here after in this manual this equipment may be referred to simply as the inverters. Be sure to read this manual carefully before operating or servicing the inverters.

Audience

The information in Chapters 2 "Overview", 5 "User Interface", 6 "Operation", and 8 "Accessories" is intended for the owner and operator of the inverter, and does not require any special training or qualifications. The information in Chapters 3 "Installation", 4 "Commissioning", 7 "Maintenance and De-Installation" is intended for qualified personnel only. Qualified personnel have training, knowledge, and experience in:

- Installing electrical equipment and PV power systems (up to 1000V_{DC}).
- Applying all local installation codes.
- Analyzing and eliminating the hazards involved in performing electrical work.
- Selecting and using Personal Protective Equipment (PPE).

Installation, commissioning, troubleshooting, and maintenance of the inverter must be done only by qualified personnel.

Thank you for choosing a CPS 3-Phase String Inverter. These PV Inverters are high performance and highly reliable products specifically designed for the North American Solar market.

Instructions inside this user manual will help you solve most installation and operation difficulties. Installation, commissioning, troubleshooting, and maintenance of the inverter must be performed by qualified personnel. If you encounter any problems during installation or operation of this unit, first check the user manual before contacting CPS Customer Service. This user manual is applicable for the following models:

CPS SCA50KTL-DO/US-480 and CPS SCA60KTL-DO/US-480

Please keep this user manual on hand for quick reference.






The manual will be periodically updated or revised due to the product development or improvement. The latest version of this manual can be acquired via the website at www.chintpowersystems.com.

1. IMPORTANT SAFETY INSTRUCTIONS




(SAVE THESE INSTRUCTIONS)

Please read this user manual carefully before installation of the inverter. CPS reserves the right to refuse warranty claims for equipment damage if the user fails to install the product according to the instructions in this manual.

Warnings and symbols in this document

	DANGER: DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING: WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION: CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	NOTICE: NOTICE indicates a hazardous situation which, if not avoided, could result in the inverter working abnormally or property loss.
	INSTRUCTION: INSTRUCTION indicates important supplementary information or provides skills or tips that can be used to help you solve a problem or save you time.

Markings on the product

	<p>HIGH VOLTAGE:</p> <p>This inverter operates with high voltages. All work on the inverter must only be performed as described in this document.</p>
	<p>HOT SURFACE:</p> <p>The inverter is designed to meet international safety standards, but surfaces can become hot during operation. Do not touch the heat sink or peripheral surfaces during or shortly after operation.</p>
	<p>EARTH GROUND:</p> <p>This symbol marks the location of the grounding terminal, which must be securely connected to Ground through the AC EGC (Equipment Grounding Conductor) to ensure operational safety.</p>



WARNING:

All the installation and wiring connections must be performed by qualified technical personnel. Disconnect the inverter from the PV modules and the AC grid before maintaining or servicing the equipment.

Risk of electric shock and fire. Use only with PV modules that have a maximum system voltage of rating of 1000V_{DC} or higher.

Electric shock Hazard. The DC conductors of this photovoltaic system are normally ungrounded but will become intermittently grounded without indication when the inverter performs the PV array isolation measurement.

Shock Hazard. The inverter is energized from both AC and DC sources. Disconnect all energy sources before servicing.

For continued protection against risk of fire, replace only with same type and ratings of fuse.

**DANGER:**

Disconnect the inverter from the AC grid and PV modules before removing covers or opening the equipment. Wait at least 5 minutes after disconnecting from the DC and AC sources before servicing or maintaining the inverter. Ensure hazardous high voltage and energy inside the inverter has been discharged prior to servicing.

**NOTICE:**

The inverters are designed to only interconnect with an AC power source as part of the public electric utility grid. Do not connect the AC output of the inverters directly to any private electric utility power equipment. The inverters are to be installed with floating or ungrounded PV arrays only.

**CAUTION:**

CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 inverters weigh approximately **56kg (123.5 pounds)**. The wirebox portion weighs approximately **15kg (33 pounds)**.

Ensure the mounting bracket is properly installed before hanging the inverter and wirebox on the bracket. A team of two is recommended to lift and place the inverter and wirebox into position.

**INSTRUCTION:**

Please check with your local electric utility supply company before selecting a grid standard. If the inverter is operated with an incorrect grid standard, the electric utility supply company may cancel the interconnection agreement.

Placing the inverter into operation before the overall system complies with the national codes, rules and safety regulations of the application is also not permitted.

2. Overview

2.1. Inverter for grid-tied PV systems

CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 3-Phase Transformerless String Inverters are designed for use with an ungrounded array in carport, commercial rooftop, and large utility scale PV grid-tied systems. The system is generally made up of PV modules, a 3-Phase String Inverter with a fused combiner/disconnect, and AC power distribution equipment (Figure 2-1). The inverter converts the available DC energy from the PV modules to AC power by synchronizing the output current to the same frequency and phase as the AC grid. All or part of the AC power is supplied to local loads, and the surplus power is exported to the electric utility grid.

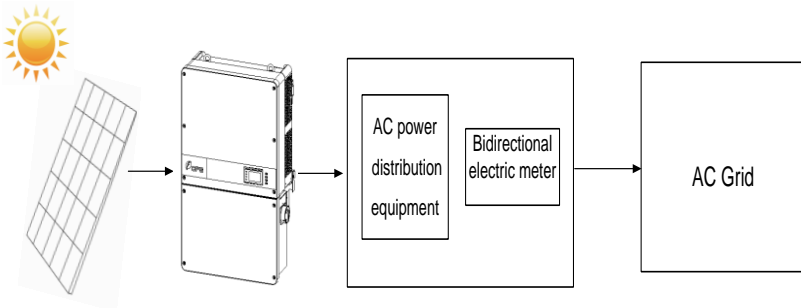


Figure 2-1 Grid-tied PV system

2.2. Product Features

- **High conversion efficiency:** Advanced 3-level conversion topology with Space-Vector PWM; Max. efficiency: 98.8%, CEC efficiency: 98.5%.
- **Grid adaptability:** IEEE 1547 Interconnect Standard and CPUC Rule 21 applicable; Reactive Power; >0.99 PF (± 0.8 adjustable), Full Active Power rating to ± 0.91 PF, and optional local or remote Active Power Curtailment.
- **Flexible communication:** Supports standard CPS Modbus RS485, SunSpec Modbus, and HTTPS/XML communications to ensure compatibility with 3rd party monitoring and control systems. Flex Gateway enables further command/control as well as remote firmware upgrades.
- **Wide DC input voltage range:** Operating DC Input Voltage Range: 200-950V_{DC}; Max DC input voltage: 1000V_{DC}.
- **Long Service Life:** Designed with thin-film capacitors to extend inverter's service life.
- **3 MPPTs:** Multi-channel MPPT (Maximum Power Point Tracker) enable maximum design flexibility and energy harvest optimization over the life of the system.
- **Separable Wirebox:** The wirebox enables fused input of either discrete wiring using the Standard wirebox, or an optional H4 wirebox with quick-fit connectors for connection of industry standard conductor assemblies.
- **High protection degree:** Powder coated aluminum NEMA 4X enclosure meets the demanding needs of both indoor and outdoor use.
- **Intelligent Integration:** Integrated load break rated DC/AC disconnect switches, and up to 15 fused string inputs eliminate the need for external DC combiner boxes, simplifying installation and the need for DC BOS equipment.

2.3. Product Protection Functions

- ✓ Reverse polarity protection of DC input
- ✓ AC and DC Short circuit protection
- ✓ Arc-fault detection and circuit interruption
- ✓ Anti-islanding detection with bi-directional frequency perturbation
- ✓ DC Input and AC output over-voltage protection
- ✓ DC Input over-current protection
- ✓ DC input insulation against ground monitoring
- ✓ DC injection of AC output
- ✓ AC output voltage and frequency monitoring
- ✓ Leakage current against ground monitoring
- ✓ Internal enclosure temperature monitoring
- ✓ IGBT power module temperature monitoring

2.4. Appearance and Main Item Description

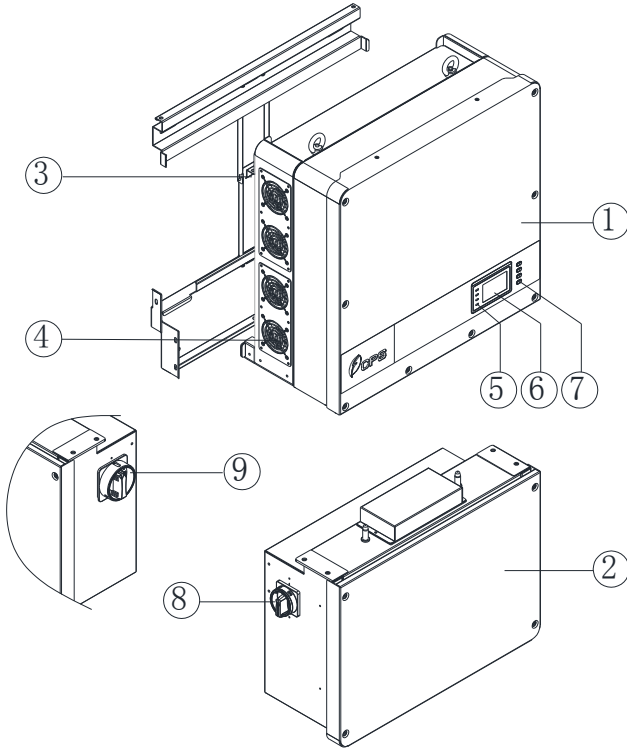


Figure 2-3 Diagram of the Inverter assembly

Main items of the Inverter:

- | | |
|-----------------------------|------------------------------|
| ① Main inverter enclosure | ⑥ User LCD display |
| ② Inverter wirebox | ⑦ User Key buttons |
| ③ Inverter mounting bracket | ⑧ DC switch: DC power on/off |
| ④ Cooling fans | ⑨ AC switch: AC power on/off |
| ⑤ LED indicator lights | |

2.5. Schematic Diagram and Circuit Design

The basic electrical schematic diagram of CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 inverters are shown in [Figure 2-2](#). The input from PV source circuits passes through surge protection circuitry, DC EMI wave filters, and independent DC-DC boost circuitry to achieve maximum power point tracking and boost the voltages to a common DC bus. The inverter uses line voltage and frequency measurements to synchronize to the grid and converts the available PV energy to AC power by injecting balanced 3-phase AC current into the electric utility grid. Any high frequency AC component is removed by passing through a two-stage relay and EMI wave filter to produce high quality AC power.

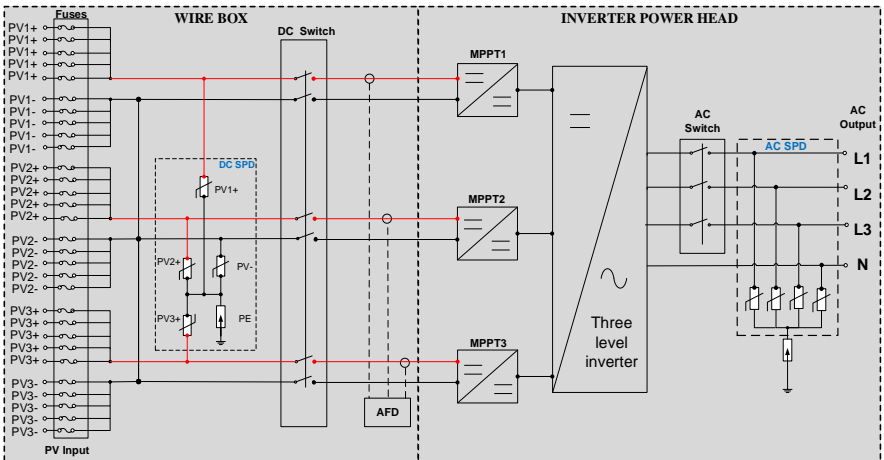


Figure 2-2 Schematic Diagram of the CPS SCA50/60KTL-DO/US-480 Inverter

2.6. Anti-islanding Detection

The SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 inverters include Unintentional Islanding detection as required by UL 1741/IEEE 1547. The inverter will continuously make bi-directional perturbations to the frequency of the output current by injecting a small amount of reactive power to detect a possible islanding condition. If the grid is stable, these small perturbations will have negligible effects on the system voltage frequency. However, in an islanded condition the changes in reactive power will force the frequency of the system voltage to deviate significantly, which will trigger the inverter to cease operation and disconnect from the grid.

2.7. DC Ground Fault Protection

The inverters include residual current detection GFCI as part of the DC ground fault detection method required by UL 1741. If there is a ground fault in the PV array, the ground fault detection circuitry will detect leakage current, trigger an alarm, and the inverter will cease operation. See Chapter 5 for further information regarding GFCI Static and Dynamic trip thresholds and operation.

2.8. Surge Suppression

Standard Waveform Peak Values		
Surge Category	Ring Wave	Combination Wave
B	6kV/0.5kA	6kV/3kA

- "Standard 1.2/50 μ s - 8/20 μ s Combination Wave"
- "Standard 0.5 μ s - 100 kHz Ring Wave"

2.9. DC Arc-fault Protection

The inverters include DC Arc-fault detection compliant with UL 1699B. The inverter will detect electrical noise that is indicative of a DC series arc. Upon detection of an arc-fault, the inverter will cease operation.

3. Installation

This chapter describes the planning and installation procedures for the SCA50KTL-DO/US-480 and SCA 60KTL-DO/US-480 inverters. Please read carefully and install the products following the step-by-step instructions.

The inverter and other main items are shipped in two separate packages, consisting of A.) the main inverter enclosure and B.) the wirebox, mounting bracket, user manual, and accessory kit. Before installation, please check that the following items are included in the packages:

Table 3-1 Main Items

No.	Item	Q'ty	Note	Box
(1)	Main enclosure of the PV inverter	1		A
(2)	Wiring box of the PV inverter	1		B
(3)	Mounting bracket	1	Bracket upon which the PV inverter is hung and mounted	B
(4)	User manual	1	PV inverter installation and operation manual	B
(5)	Accessory kit	1	Kit contains all necessary hardware and accessories for installation	B

Note that the items in the Accessory Kits vary between the **Standard wirebox** and **H4 wirebox**, the items listed below:

Table 3-2 Accessory Kit (Standard wirebox)

No.	Item	Q'ty	Note
(1)	M8 Expansion Anchors	8	For attaching the mounting bracket to a concrete wall or surface
(2)	M8x25mm machine bolts with integrated lock washer	8	Used with M8 expansion anchors
(3)	M6 X18mm Phillips screw	11	4 for securing the wiring box to the main enclosure; 6 for securing the inverter to the mounting bracket; 1 for the External Ground connection
(4)	5 pin PCB connector plug	1	For the RS485 communication
(5)	#10 AWG Wire ferrules*	33	30 for PV conductors, includes 3 spares
(6)	M8 Nut	4	For the AC terminal block
(7)	M8 Flat washer	4	For the AC terminal block
(8)	M8 Spring washer	4	For the AC terminal block

*Wire ferrules included in the accessories are not mandatory for installation.

Table 3-3 Accessory Kit (H4 wirebox)

No.	Item	Q'ty	Note
(1)	M8 Expansion Anchors	8	For attaching the mounting bracket to concrete wall or surface
(2)	M8x25mm machine bolts with integrated lock washer	8	Used with M8 expansion anchors
(3)	M6 X18mm Phillips screw	11	4 for securing the wiring box to the main enclosure; 6 for securing the inverter to the mounting bracket; 1 for the External Ground connection
(4)	5 pin PCB connector plug	1	For the RS485 communication
(5)	PV Connector (Male)	15	For the PV input. #14 AWG contact
(6)	PV Connector (Female)	15	For the PV input. #14 AWG contact
(7)	Tool for PV Connector	1	For assembling/disconnecting PV Connector
(8)	M8 Nut	4	For the AC terminal block
(9)	M8 Flat washer	4	For the AC terminal block
(10)	M8 Spring washer	4	For the AC terminal block



INSTRUCTION:

The items in the Accessory Kit Table 3-2 and Table 3-3 above are for the standard configuration. The accessories provided may vary if optional parts are purchased.

3.1. Recommendations before Installation

See [Chapter 10](#), Technical Data for specification ranges and limits.



NOTICE:

The allowable ambient temperature range for the SCA50KTL-DO/US-480 and SCA 60KTL-DO/US-480 inverters is defined based on the following conditions;

Condition 1: -40°C to 70°C, Inverter not installed, and in storage (in packaging or unpackaged).

Condition 2: -30°C to 60°C, Inverter installed, connected to electric utility grid and operating during daylight hours.

Condition 3: No low temp limit to 70°C, Inverter installed, connected to electric utility grid but non-operating (daylight or nighttime hours).

- ✓ Check that the inverter environmental specifications (protection degree, operating temperature range, humidity and altitude, etc) meet the requirements of the specific project location.
- ✓ Make sure that the electric utility grid voltage is within range for the grid standard chosen.
- ✓ Ensure that the local electric utility grid authority has granted permission to connect to the grid.
- ✓ Installation personnel must be qualified electricians or those who have received professional training.
- ✓ Wear and use proper PPE (personal protective equipment) during installation.
- ✓ Sufficient space according to [Figure 3-3](#) and [Figure 3-4](#) must be provided to allow the inverter cooling system to operate effectively.
- ✓ Install the inverter away from flammable and/or combustible substances.
- ✓ Avoid installing the inverter in locations that exceed the temperature limits specified for the inverter to prevent undesirable power loss.
- ✓ Do not install the inverter near an electromagnetic source which can compromise the normal operation of electronic equipment.

**NOTICE:****Outdoor Installations for Extended Periods without Power**

CPS advises against leaving inverters mounted outdoors for an extended period of time (more than 90 days) and/or allowing inverters exposed to cycles of freezing temperature without both DC and AC power connected to the inverters under normal operation.

The CPS inverter enclosures are designed to conform to NEMA4 (or IP65), however there exists the possibility of water condensation inside the inverter enclosure when it is left exposed to an outdoor environment without power to operate for an extended period of time. Moisture in the air could enter the power head of the inverter through the small opening between wiring box and power head during the time that the wiring box cover is opened for wiring purposes. When the inverter is exposed to temperature swings, especially in cold weather, moisture inside the inverter power head could condense over the aluminum heatsink area where inverter semiconductors are mounted. Water droplets on the heatsink may cause a short-circuit to live semiconductor devices. When the PV source is applied to the inverter, this PV power source could cause the inverter to fail and result in a short-circuit across the PV array.

If such a situation in which the inverter is mounted outdoors without operating power occurs, CPS recommends that the inverter power head be inspected for water condensation before any DC or AC power can be applied to inverter. Without inspection, customers will run the risk of having inverter electronic circuit damage when power is applied to inverter during startup. It is advised that customers contact CPS for further advice and to arrange schedule for CPS service personnel to perform inspection of inverter on site.

- CPS hotline: 855-584-7168

3.2. Mechanical Installation

3.2.1. Dimensions

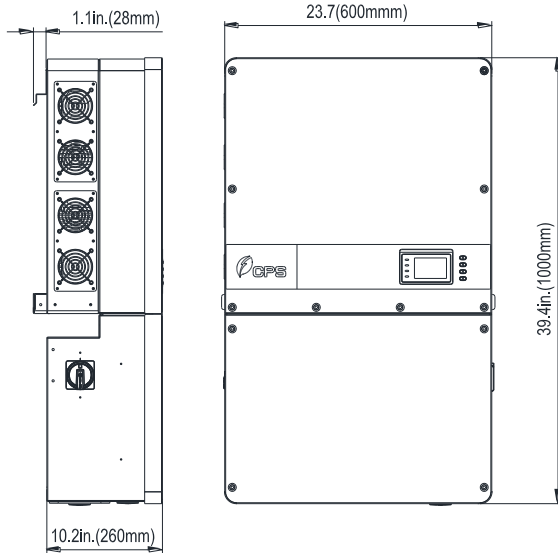


Figure 3-1 Dimensions of the Inverter

3.2.2. Installation Method (see [Figure 3-2](#)):

Ensure that the mounting structure (wall, rack, roof, etc) is suitable to support the weight of the inverter. Follow the mounting guidelines below:

- (a) If the location permits, install the inverter vertically.
- (b) If the inverter cannot be mounted vertically, it may be tilted backward at any angle from vertical to horizontal.
- (c) When tilted backward at $\leq 75^\circ$ from horizontal in an outdoor environment, the CPS Shade Cover (SSC-60ST) accessory is required to be installed. See [Section 9.2](#) for more information.
- (d) Do not mount the inverter leaning forward.
- (e) Do not mount the inverter upside down.

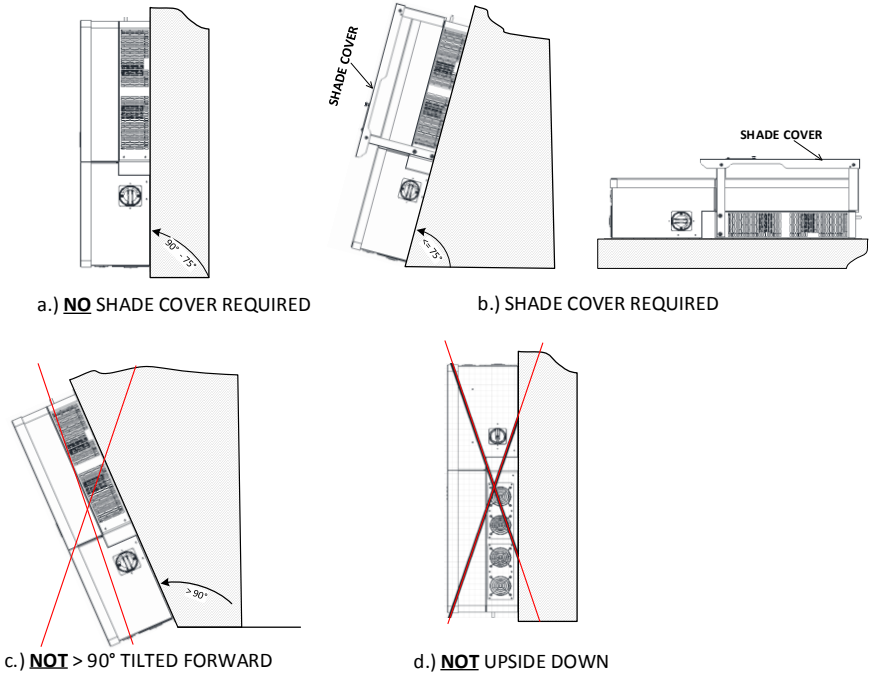


Figure 3-2 Inverter Mounting Options



NOTICE:

When the inverter is mounted tilted backward at $\leq 75^\circ$ from horizontal in an outdoor environment, the CPS Shade Cover (SSC-60ST) accessory must be installed on the inverter to avoid direct sunlight.

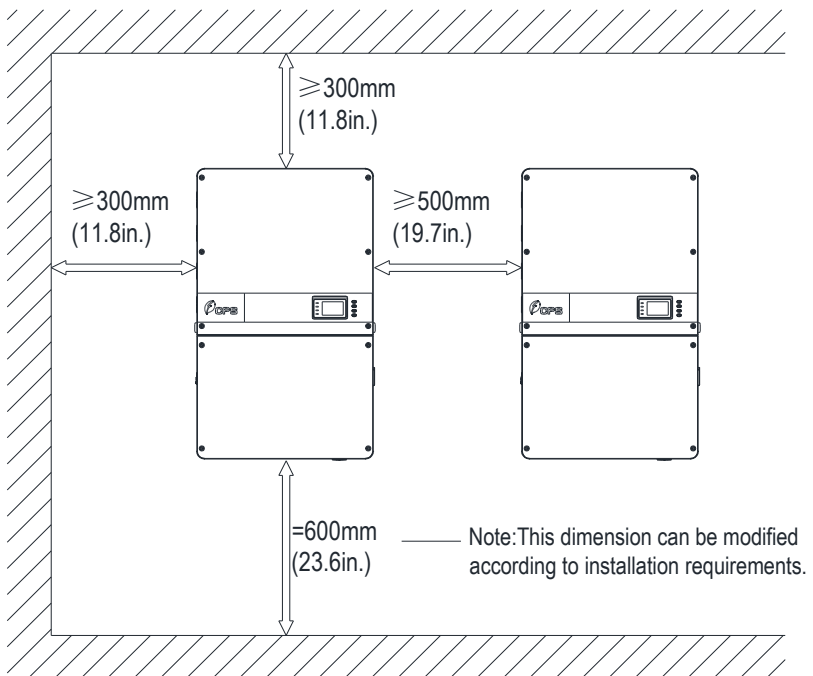
3.2.3. Installation Space Requirement

The distances between the inverters or the surrounding objects should meet the following conditions:



NOTICE:

The spacing between two adjacently mounted inverters must be $\geq 19.7\text{in}$ (500mm). Spacing should be enlarged for installation locations with ambient temperature higher than 45°C . Ensure that the air space around the inverter is well ventilated. The spacing below the inverter is intended to ensure the LCD and Keypad height are well positioned for the user, and may be decreased, however consideration must be taken for locations known to flood or have seasonal snow build up.



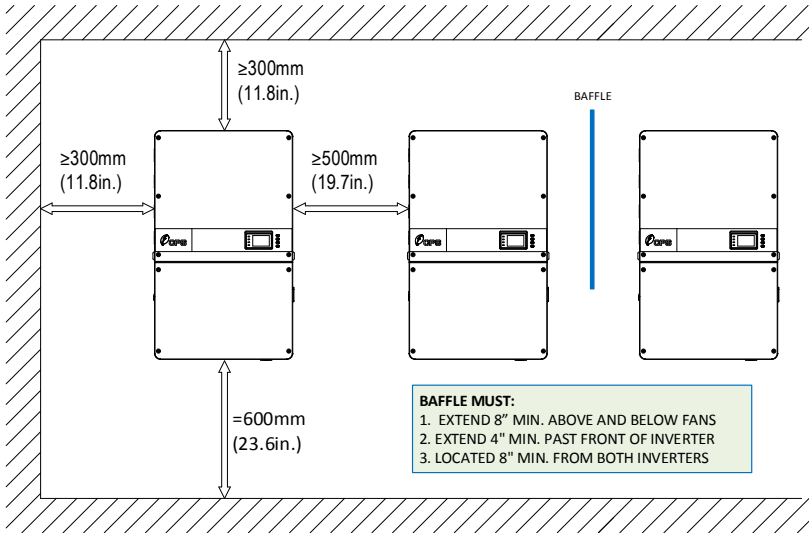


Figure 3-3 Inverter Wall Mounting Dimensions



INSTRUCTION:

If the inverter is installed on Unistrut or the array racking (instead of solid wall), the space from the bottom of one inverter to the top of the inverter below may be as small as 3.9in (100mm). The spacing below may be as small as 11.8in (300mm).

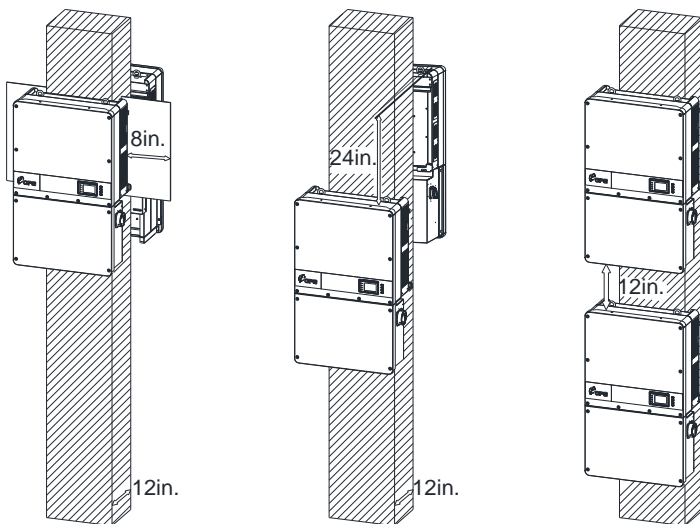
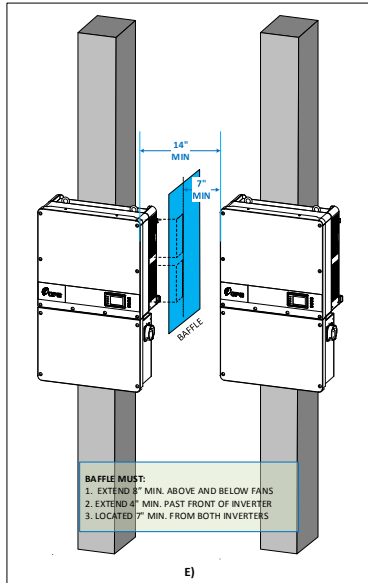
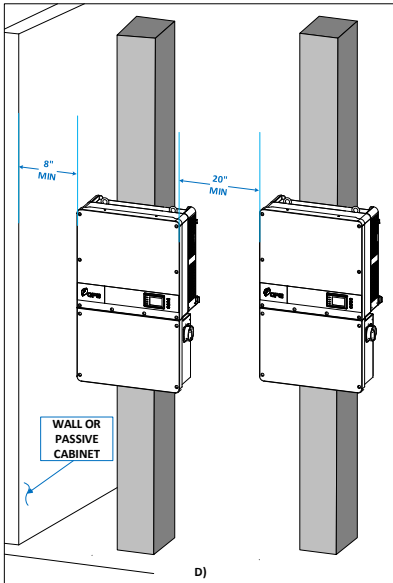
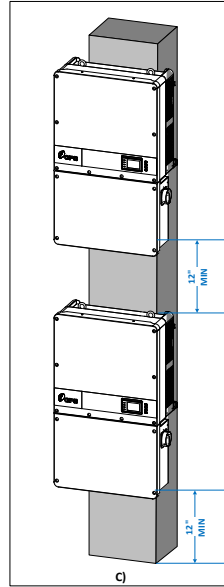
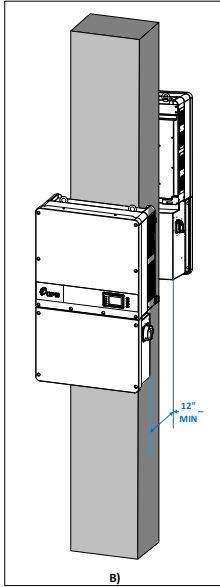
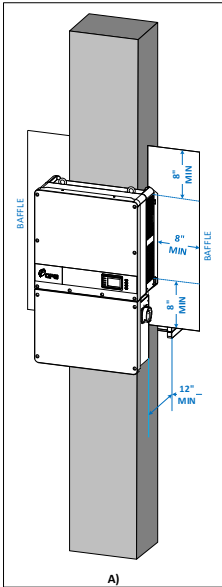


Figure 3-4 Inverter Pillar or Column Mounting Dimensions



INSTRUCTION:

If the inverter is installed on a pillar or column (instead of solid wall), the space from the bottom of one inverter to the top of the inverter below may be as small as 12in (300mm).



3.2.4. Mounting the Inverter onto the Bracket

1. Locate and mark the 8 holes on the wall, PV racking structure, or bearing surface for attaching the inverter mounting bracket as shown in Figure 3-5.

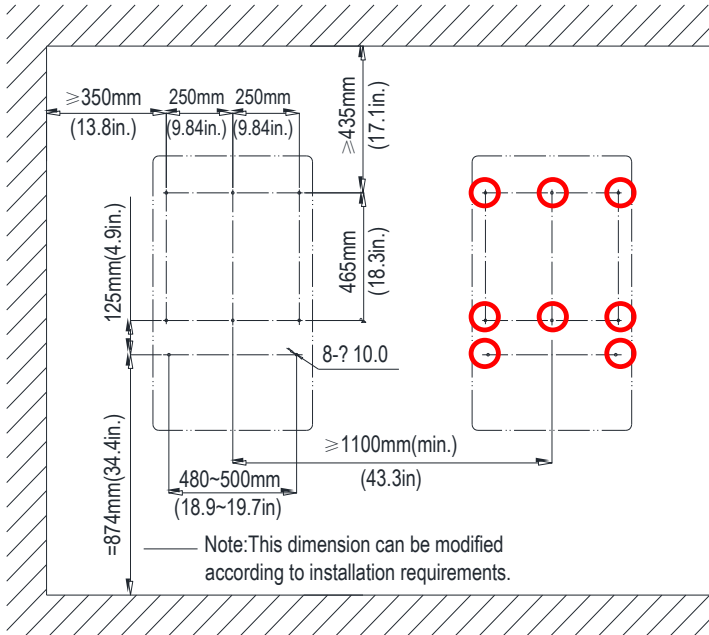


Figure 3-5 Dimensions of the bracket anchoring holes for mounting

- PV Racking Mount:** Locate holes or anchors at the marked positions; Fasten the **Mounting Bracket** ② with the **M8x25 Assembling Bolts** ③ supplied with the Accessory Kit. M8 nuts are not provided in the Accessory Kit. See [Figure 3-7](#).
Tools Required: No. 13 wrench(es)

- b. Concrete Wall Mount: Drill holes at the marked positions with a 0.4in. (10mm) masonry bit and insert the **M8 Expansion Anchors ①** into the holes; Fasten the **Mounting Bracket ②** with the **M8x25 Assembling Bolts ③** supplied with the Accessory Kit. [Figure 3-6](#) and [Figure 3-7](#).

Tools Required: Electric drill (Φ 10mm/0.4in. masonry bit), No. 13 wrench

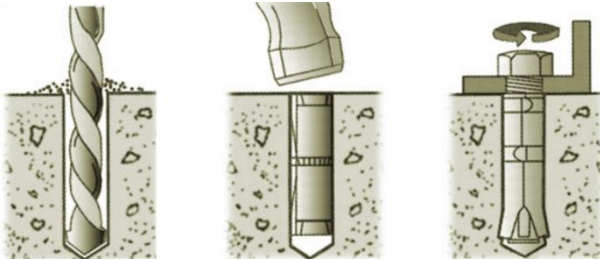


Figure 3-6 Drill holes, set Anchors, and tighten Assembling Bolts

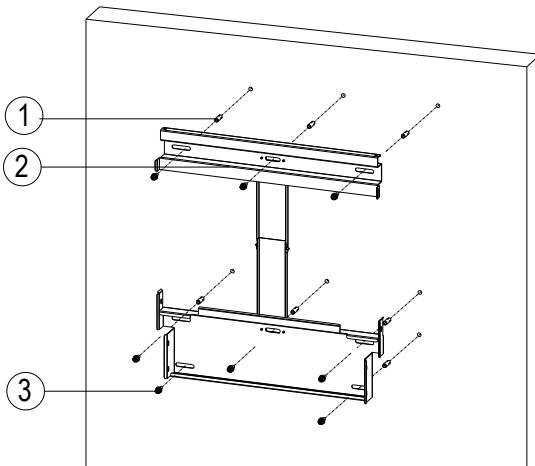


Figure 3-7 Secure the Mounting Bracket

2. Hang the inverter onto the mounting bracket as shown in [Figure 3-8](#) and [Figure 3-9](#):
 - a. Lift mounting: Locate the lifting eyes at the top of the inverter. Use sling rope or bar (inserted through both lifting eye nuts) to lift the inverter onto the bracket. The minimum angle between the two sling ropes should be less than 90 degrees.
 - b. Manual mounting: Two people are required to safely lift the inverter by the handle positions marked in [Figure 3-9](#), and mount it onto the bracket.



CAUTION:

The main enclosure of the CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 inverters is approx **56kg (123.5 pounds)**. Ensure the mounting bracket is properly installed and secured before hanging the inverter on the bracket. It is recommended to have at least 2 people to mount the inverter due to the weight of the equipment.

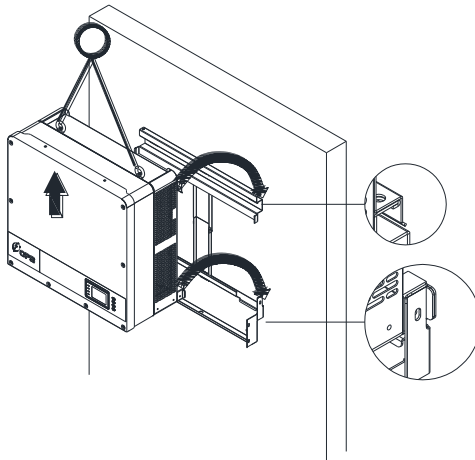


Figure 3-8 Mount the Main Enclosure on the Bracket by Lifting Sling

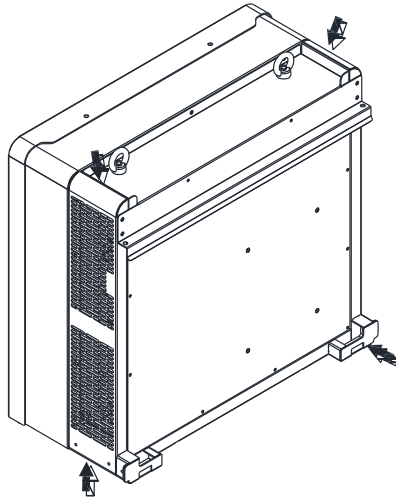


Figure 3-9 Grab Handle Position

3. Install the wiring box
 - a. Remove the cover plate at the bottom of the main enclosure.

Tool required: No.2 Phillips head screwdriver

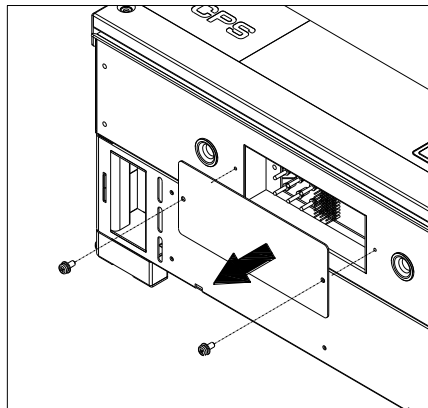


Figure 3-10 Main Enclosure Cover Plate

- b. Remove screws securing the bulkhead cover at the top of the wiring box.

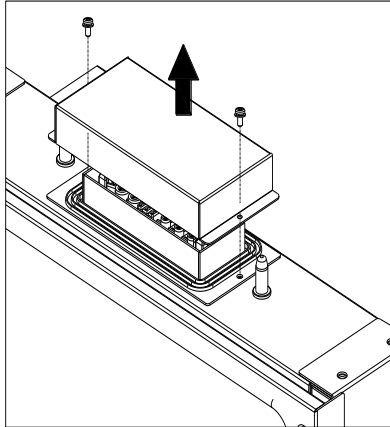


Figure 3-11 Wiring Bulkhead Cover

Save the bulkhead cover and screws, and attached the cover to the left side of the wiring box after the wiring box is attached to the inverter enclosure. Covers may be required in the future if an inverter or wiring box is to be removed during servicing (see step 6, [Figure 3-14](#))

Tool required: No.2 Phillips head screwdriver

4. Secure the wiring box to the main enclosure by using the **M6x18 screws** (4pcs) to fasten the wiring box. (see Figure 3-12)

Tool required: No. 10 Wrench, torque value of 4 Nm (35.4in-lbs)

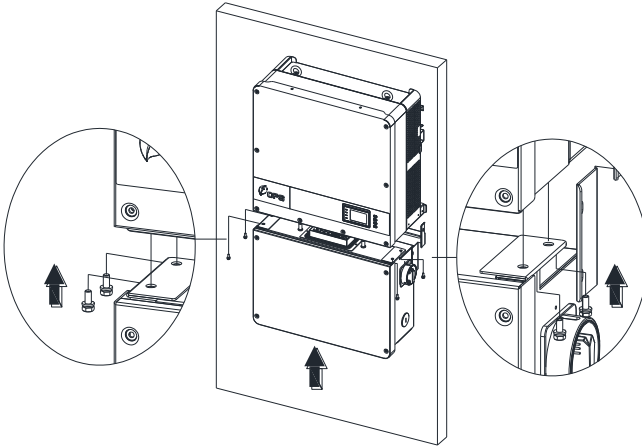


Figure 3-12 Installation of the Wiring Box

5. Attach the main enclosure and the wiring box to the mounting bracket with the **M6x18 screws** (6 pcs). (see [Figure 3-13](#))
Tool required: No.3 Phillips head screwdriver, torque value of 4N.m (35.4in-lbs)

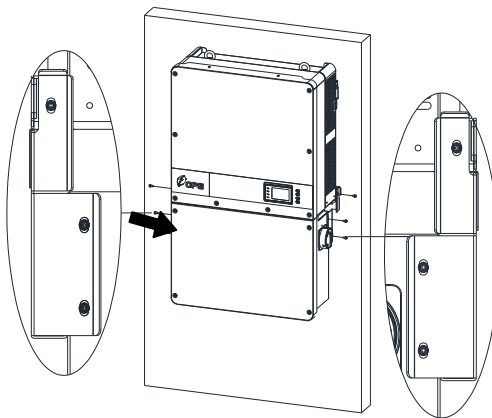
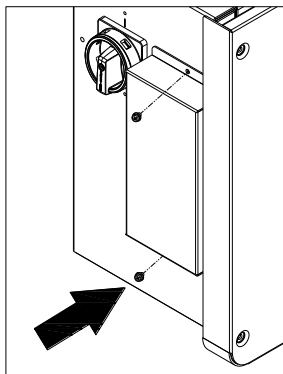


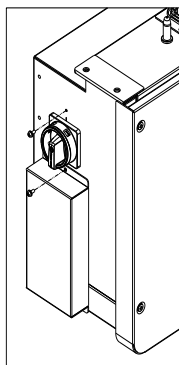
Figure 3-13 Secure the Main Enclosure and Wiring Box to the Bracket

6. Attach the bulkhead cover shown in Figure 3-11 to the left side of the wiring box. (see Figure 3-14)

Tool required: No.2 Phillips head screwdriver, torque value of 1.6N.m (14.2in-lbs)



Standard wirebox



H4 wirebox

Figure 3-14 Attach the Cover to the left side of the Wiring Box

7. Optional - Install an anti-theft padlock when the installation is complete. The anti-theft padlock is used to prevent the inverter from being stolen when the equipment is installed outdoors. The inverter may be locked to the bracket, as shown in [Figure 3-15](#):

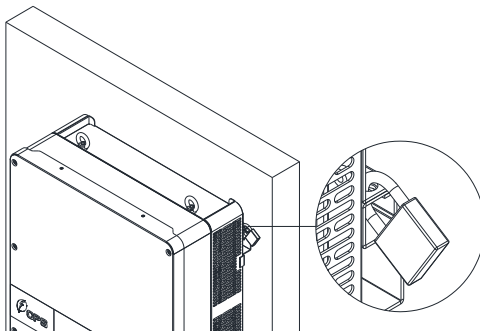
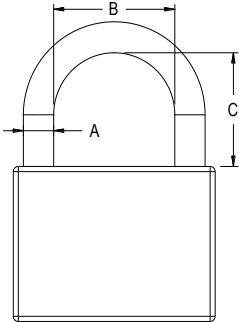


Figure 3-15 Location of the Anti-Theft Padlock

The anti-theft padlock shackle should meet the requirements of the dimensions shown in Figure 3-16:



Recommended lock size:

A: Shackle diameter 3~6mm

B: Shackle width 20~50mm

C: Shackle height 20~50mm

Figure 3-16 Dimensions of Anti-Theft Padlock Shackle

3.3. Electrical Installation



NOTICE:

The inverters must be installed in accordance with the National Electric Code, NFPA 70, and any local codes or jurisdictions. A PV array sizing tool is available for download at <http://www.chintpowersystems.com> and accessed by selecting the Product Downloads link to get to String Sizing tool. This is an optional tool to help guide designers by matching the PV panel type and quantity to the inverter's power rating.

3.3.1. Removing/Replacing the Wiring Box Cover:

Prior to installation, confirm the wiring box to be used is either the Standard wirebox as shown in Figure 3.17(a) or H4 wirebox as shown in Figure 3.17 (b).

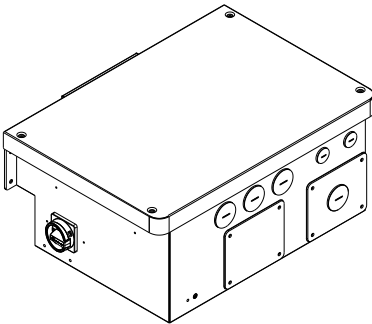


Figure 3.17(a) Standard wirebox

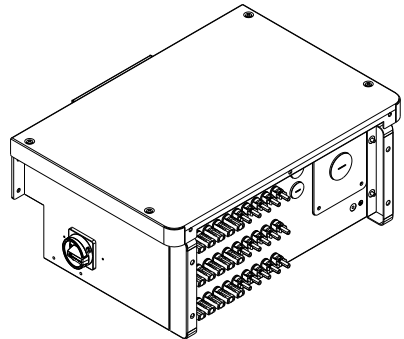


Figure 3.17(b) H4 wirebox

1. Use a No. 3 Philips head screwdriver to remove the 4 screws on the wiring box and remove the cover. (See [Figure 3-18](#))

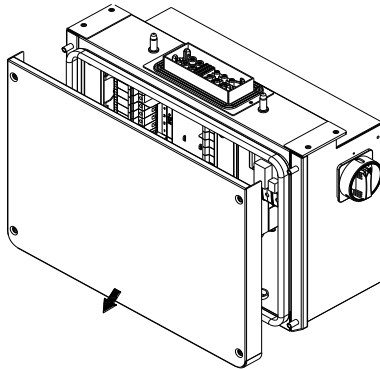


Figure 3-18 Removing the Wiring Box Cover

To reinstall the cover, replace cover and align the screws. Use a No. 3 Phillips head screwdriver to secure the 4 screws on the cover. Torque to 35.4 in-lbs (4 N.m.)



INSTRUCTION:

It is important to use hand tools (e.g. Screwdriver or T-handle, #3 Phillips) and not power drivers or other types of screw drivers. During cover installation, it is recommended to hold the cover in alignment with balanced force. Partially engage the screws into the threaded inserts before tightening. Maintain alignment to avoid thread damage, and after screws are fully engaged torque to 35.4 in-lbs (4N.m).

3.3.2. Wiring boxes

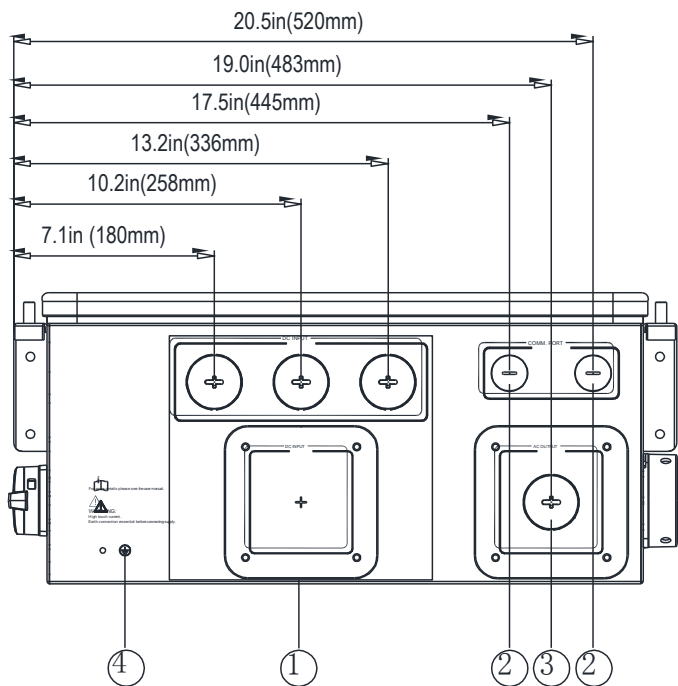


Figure 3-19(a) Conduit Knock-out Locations on the Standard wirebox

- ① Knock-outs for DC input, (3) 1-1/2 inch Trade Size and (1) removable gland plate for custom size conduit (i.e. when use of 2 inch or 2-1/2 inch Trade Size conduit is required)
- ② Knock-outs for communication, 3/4 inch Trade Size
- ③ Knock-out for AC output, (1) 1-1/2 inch Trade Size on a removable gland plate for custom size conduit (i.e. when use of 2 inch or 2-1/2 inch Trade Size is required)
- ④ External ground connection point (M6)

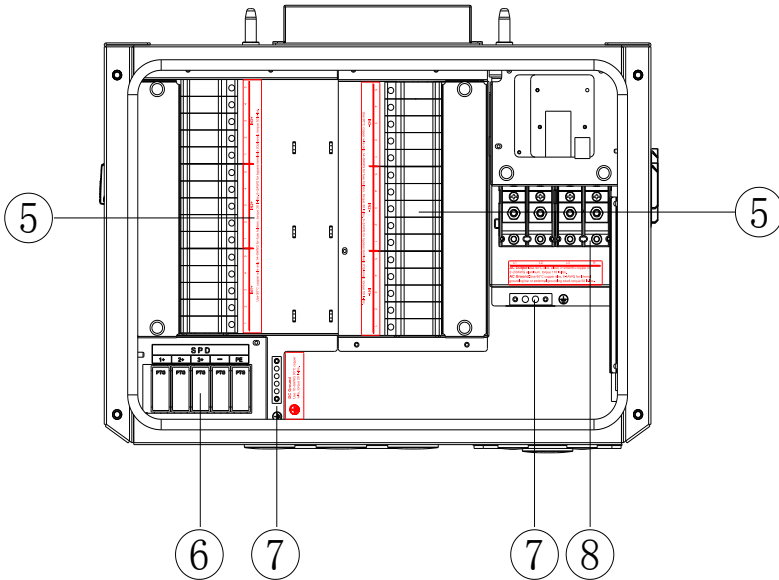


Figure 3-19(b) Internal Connection Points within the Standard wirebox

- ⑤ DC Input fuse holder/terminal
- ⑥ DC SPD (Surge Protective Device)
- ⑦ Internal ground terminal
- ⑧ AC output terminal block

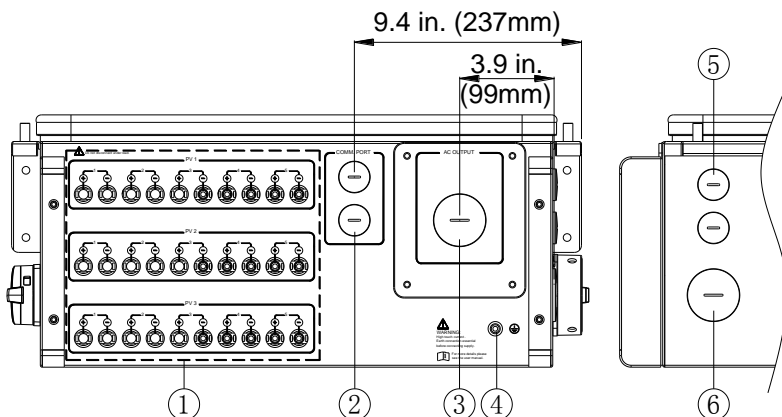


Figure 3-20(a) Conduit Knock-out Locations on the H4 wirebox

- ① H4 connectors
- ② Knock-outs for communication, 3/4 inch Trade Size
- ③ Knock-out for AC output, 1-1/2 inch Trade Size on a removable gland plate for custom size conduit (i.e. when use of 2 inch or 2-1/2 inch Trade Size is required)
- ④ External ground connection point (M6)
- ⑤ Knock-outs for communication in the right side of wirebox, 3/4 inch Trade Size
- ⑥ Knock-out for AC output in the right side of wirebox, 1-1/2 inch Trade Size

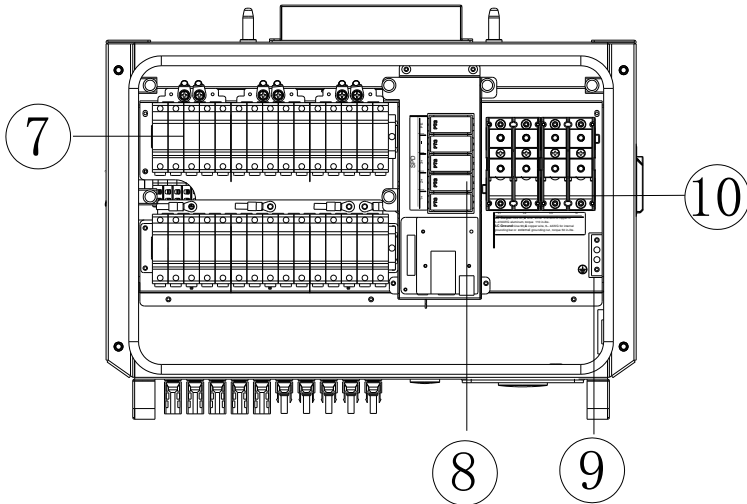


Figure 3-20(b) Internal Connection Points within the H4 wirebox

- ⑦ DC Input fuse holder
- ⑧ DC SPD (Surge Protective Device)
- ⑨ Internal ground terminal
- ⑩ AC output terminal block

3.3.3. DC Connection

3.3.3.1. Working mode

These inverters are factory configured with three MPPTs which are electrically divided into separate PV input zones: PV Input-1, PV Input-2, and PV Input-3. Each 5-string PV input zone operates as a separate and independent MPP Tracker.

Independent mode can be very useful for sites with partial shading of the array or with arrays consisting of different tilt or

azimuth. Each MPPT employs a method known as perturb and observe for seeking and tracking the maximum power point along the I/V curve of the PV array. During operation each MPPT will make small adjustments to the PV voltage and then executes a power measurement; if the PV power increases, further voltage adjustments in that same direction are performed until the PV power no longer increases.



INSTRUCTION:

PV power should be balanced as much as possible between the three MPPT zones. See Table 3-6 for string/zone combinations.

NOTE 1: Always attempt to connect an equal number of PV source circuits to PVIn1, PVIn2 and PVIn3 to optimize the individual MPPT zone, total inverter operation and energy harvest.

NOTE 2: Connecting all the inputs to only one will result in only utilizing 33% of the inverter power.

NOTE 3: When designing the PV system ensure each PV string within a single PV input zone includes the same module type (Mfg and ratings), series module count, and module orientation (tilt and azimuth) to maximize MPPT performance and energy harvest.

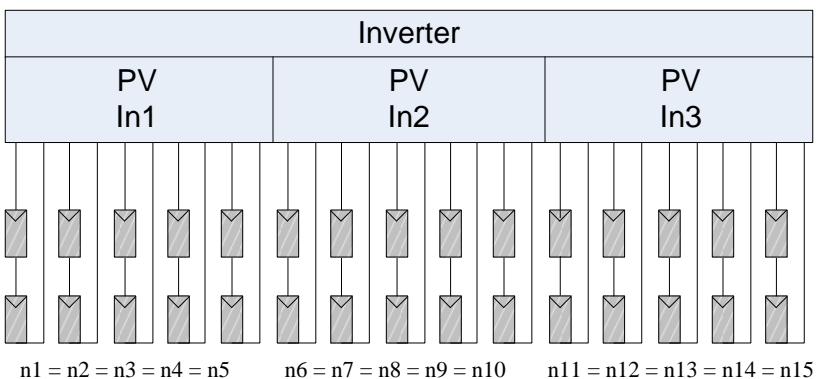


Figure 3-21 Independent Mode

Table 3-4a DC Input Specifications (Independent Mode)

Specification	(Independent Mode - per MPPT)	
	Model	Model
	SCA50KTL-DO/US-480	SCA60KTL-DO/US-480
Max PV Power	30kW (Combined \leq 75kW)	33kW (Combined \leq 90kW)
Max PV Voltage	1000Vdc	1000Vdc
Start-up Voltage / Power	330 / 80W	330 / 80W
Operating Voltage	200-950Vdc	200-950Vdc
MPPT Voltage Range	480-850Vdc	540-850Vdc
Maximum PV Current (Isc x 1.25)	68A	68A

When the input power for one MPPT zone exceeds the maximum allowable, but the combined input power is still below the inverter input specifications the inverter must be set in **Parallel Mode** (1 MPPT). In this mode, all strings should contain the same number of modules, be of the same manufacturer, orientation and tilt.

Table 3-4b DC Input Specifications (Parallel Mode)

Specification	(Parallel Mode - 3 MPPTs combined)	
	Model	Model
	SCA50KTL-DO/US-480	SCA60KTL-DO/US-480
Max PV Power	75kW	90kW
Max PV Voltage	1000Vdc	1000Vdc
Start-up Voltage / Power	330 / 80W	330 / 80W
Operating Voltage	200-950Vdc	200-950Vdc
MPPT Voltage Range	480-850Vdc	540-850Vdc
Maximum PV Current (Isc x 1.25)	204A	204A

When using the Standard wiring box, choose the DC conductor size and material for the inverters according to the following configuration table:

Table 3-3 DC Terminal Specifications

Terminal	Acceptable wire range
DC input (+ / -)	#14-6AWG (Copper only) when terminating to the fuse holders #6~2AWG (Copper or Aluminum) when using the Bypass Terminal kit

The inverters operate with ungrounded arrays, although the PV system requires a DC EGC (equipment grounding conductor) to ensure operational safety. The grounding busbars are electrically bonded by way of the inverter chassis.

3.3.3.2. DC Fuse Configuration/Selection

The CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 inverter wire boxes include touch safe fuse holders and 15A DC fuses as a factory standard. Ensure that the appropriate fuse values are used depending on the configuration of the PV string and by performing PV fuse sizing calculations for each string.

1. Each DC input conductor for the PV string requires fuse protection. (2014 NEC and earlier editions)
2. The voltage rating of the fuse must be at least 1000V_{DC}.
3. The ampere rating of the fuse is generally selected as 1.56 × module I_{sc} of the PV string. Refer to NEC 690.8 for Circuit Sizing and Current requirements.



INSTRUCTION:

The Working Mode of the inverter may be configured from 3 MPPTs (Independent Mode [Factory Default]) to 1 MPPT (Parallel Mode) operation. Parallel mode must be performed by a CPS Service Technician. Contact CPS Customer Service for further information.

Verify and select the appropriate fuses for installation depending on the configuration of the PV strings.

Table 3-5 DC Fuse selection

50-60 kW	Brand	Standard fuses	20A	25A	30A
	Mersen	HP10M15	HP10M20	HP10M25	HP10M30
		15A/1000V	20A/1000V	25A/1000V	30A/1000V

The 1000V_{DC} Mersen HP10M PV fuse series are required as replacement fuses if necessary. Detailed fuse information is available at <http://www.ep-us.mersen.com/>.

The touch safe fuse holders and wirebox internal factory wiring are designed to accept either 15A, 20A, 25A, or 30A rated fuses. The larger rated fuses may be required for combined input strings; for example, when Y branch connectors are used with DC field wiring to reduce PV source circuit home runs. CPS allows replacement of the factory installed 15A fuses with appropriate ampere ratings, however CPS does not provide nor stock these fuses.



NOTICE:

When installing 25A or 30A fuses, these fuses may not be installed in adjacent fuse holders. An empty or unused fuse holder must be situated between each 25A/30A fuse within each MPPT.

Use of different fuses or incorrectly sized fuses can cause damage to equipment or create unsafe working conditions. Any damage resulting from incompatible fuses is not covered by the CPS warranty.



NOTICE:

Note 1: The temperature rating of the PV Source circuit conductors should be no less than 90°C (194°F).

Note 2: The recommended fuse values are configured based on the condition that the input strings are the same (module type and length).

Note 3: The temperature rating of the fuse holder terminals is (90°C) for Mersen or Bussman components.

3.3.3.3. DC Conductor Connection

To ensure the optimum performance of the inverter, please read the following guidelines before performing any DC connections.

1. Confirm the maximum open circuit voltage of the PV modules is lower than $1000V_{DC}$ under any conditions.
2. Confirm that the PV modules for each MPPT within the inverter are of the same type and specification before connection.

3. Ensure correct polarity of the PV Strings before terminating the DC source circuits. Referring to Figure [3-22](#), the wiring from the PV string pairs must be checked according to the following steps:
 - A. Use a multi-meter to measure the PV strings' conductor ends and check the polarity.
 - B. The positive (+) terminal of the conductor should match the positive (+) terminal of inverter's DC input.
 - C. The negative (-) terminal of the conductor should match the negative (-) terminal of inverter's DC input.



NOTICE:

It is important to use a multi-meter to check the polarity of the DC source circuit conductors to avoid any risk of reverse polarity.

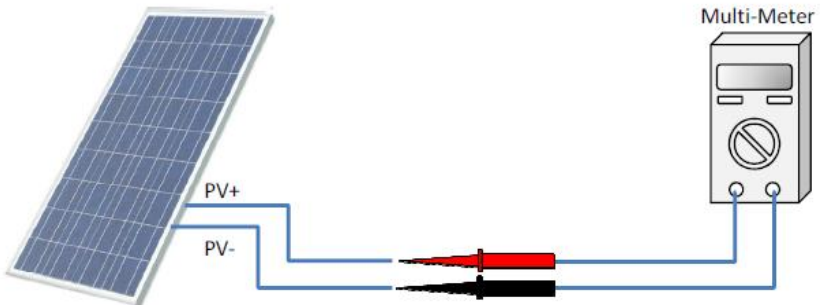




Figure 3-22 Polarity Check

3.3.3.4. DC Fuseholder Torque Specification

The inverter wiringbox may be assembled using fuse holders supplied by either Bussmann or Mersen (Ferraz Shamut). The touch safe fuse holders have unique terminal torque values specified by their manufacturers. The fuse holders can be identified by color markings; Bussmann-Yellow, and Mersen-Orange. See Table 3-6 for specified torque values.

Table 3-6 DC Fuse Holder Torque Value by Manufacturer

Bussmann CHPV1		Mersen (Ferraz Shamut) USM1	
	<p>Single Conductor Specified Torque: 18-12AWG: 20in-lbs (2.3Nm) 10AWG: 25in-lbs (2.8Nm) 8-4AWG: 30in-lbs (3.4Nm)</p>		<p>Single Conductor Specified Torque: 14-6AWG: 30in-lbs (3.4Nm)</p>

3.3.3.5. DC Connection for Standard Wiringbox

This section is intended for the Standard wirebox connections.

Refer to **Section 3.3.3.6** for connections to the H4 wirebox connections.

1. **Using the 1-1/2 inch openings.** Remove the factory installed liquid-tight hole plugs from the DC knockout holes in the wiring box and install 1-1/2 inch Trade Size conduit and conduit fittings. If smaller conduit is needed use proper weather-tight reducing bushings to ensure the wiring box maintains it's NEMA 4X rating. Confirm all fittings are properly tightened, and route the DC source circuit conductors through the conduit into the wiring box.
2. **Using the removable gland plate.** Optionally, all DC input cables from the PV source circuits may be routed through a single larger knock-out hole inside the wiring box. The wiring box includes removable gland plates that may be drilled or punched for up to 2-1/2 inch Trade Size conduit.
 - a. Remove the **M6x18 screws** (4 pcs) securing the DC gland plate to the wiring box. (see [Figure 3-23](#)) Removing the gland plate before punching the hole is required to ensure metal filings are not introduced into the wirebox.
 - b. Remove the DC gland plate and rubber gasket
 - c. Use a punching tool to create desired hole size in the gland plate.
 - d. Reattach the rubber gasket and DC gland plate to the wiring box with the **M6x18 screws** (4 pcs).
 - e. Tool required: No. 3 Phillips head screwdriver, torque value of 4Nm (35.4in-lbs)

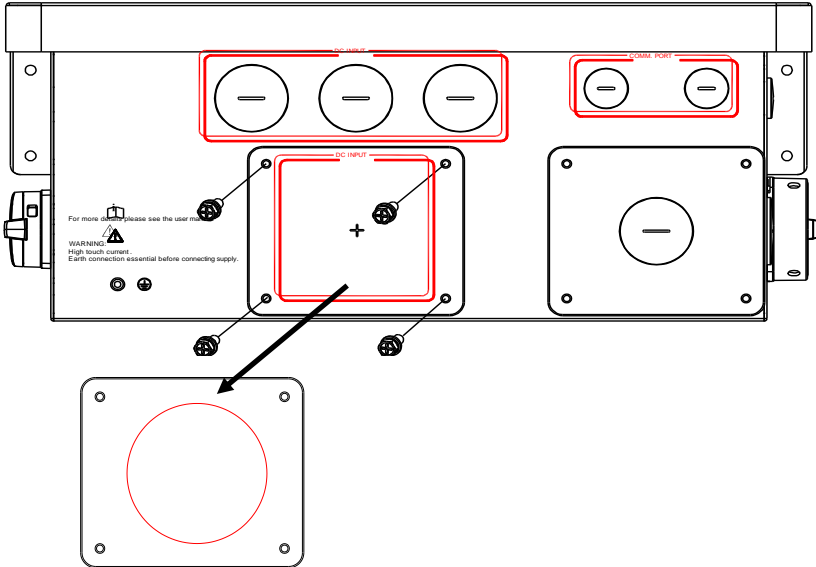


Figure 3-23 DC input through single knockout hole

Table 3-7 Tools Required for Cable Termination

No.	Tools	Remark
1	#2 Phillips head screwdriver	Fuse holder Terminal
2	Diagonal pliers or cable cutters	Cut cable
3	Wire stripping pliers	Remove jacket
4	Torque driver	Torque terminals to specification
5	Crimping pliers/tool	Ferrule crimp (optional)



INSTRUCTION:

10 AWG wire ferrules are provided in the Accessory Kit for the Standard wirebox. The ferrules are intended to preclude the onset of stray/lose wire strands or "birdcaging" of the conductor during installation, and improve the integrity of the termination. Use of the wire ferrules is not mandatory and shall not void the product warranty if not used.

- 3. Terminate at fuseholders.** Strip approximately $\frac{1}{2}$ inch of the cable jacket from the end of the string conductor. Insert the conductor into the fuseholder terminal ensuring the stranding of the conductor remains firmly twisted and does not separate. Tighten the screw clamp to the torque specified in Table 3-6. Continue terminating the remaining strings in this manner for each MPPT (PVIn1, PVIn2, PVIn3).
- 4. Bypass Terminal option for standard wirebox.** Fuse Bypass Terminals are available as an optional accessory when external PV string fused combiners are used. The Bypass Terminals allow for larger single conductors to be terminated at each MPPT within the wirebox, bypassing the input fuses as shown in [Figure 3-24](#). See [Chapter 9](#) (Accessories) for installation information.

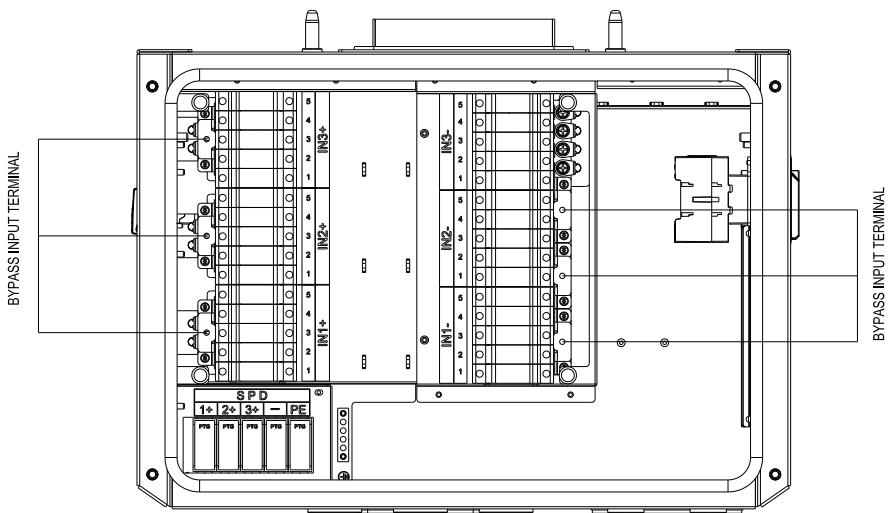


Figure 3-24 Bypass Terminal option installed within the Standard wirebox

3.3.3.6. DC Connection for H4 Wiringbox

This section addresses the DC connections to the H4 wiringbox. If the Standard wiring box is used reference **Section 3.3.3.5.**



NOTICE:

The Amphenol H4 connectors provided within the Accessory Kit must be used for the DC input with the H4 wirebox. Male and Female H4 connectors with 14awg contact pins are provided. Other wire sizes require replacing the connectors/contact pins provided. Use of incompatible connector types may create an improper contact and cause faults and/or loss of production requiring servicing of the inverter and installation.

1. Always verify polarity before terminating the PV conductors to avoid risk of reverse polarity.
2. **Cable preparation and stripping process:** Strip the cables 0.276 inches (7.0 mm) and be careful not to nick conductor strands.

Amphenol's specified strip tool (H4TS0000) can be used in this step (contact Amphenol retailer to purchase this tool). Adjust the stripper stopper and insert the cable in the corresponding notch to strip to 0.276 inches (7.0 mm) length.

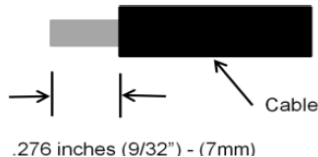



Figure 3-25 Cable strip length

Table 3-8 Contact terminals for H4 connectors

No.	Item	Function
1		Socket solid contact for Positive DC cable
2		Pin solid contact for Negative DC cable

- 3. Insertion process solid contacts:** When inserting stripped conductor into contact barrel, verify all conductor strands are captured in the contact barrel and the conductor is visible in the inspection hole.

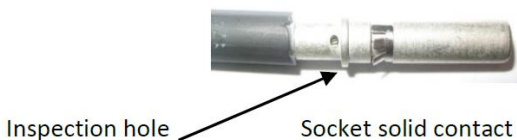


Figure 3-26 Cable insertion process

- 4. Crimp process solid contacts:** The Amphenol specified crimp tool (H4TC0001) must be used in this step. Insert the contact into the corresponding crimping notch or locator (male or female) considering the cable size used. Insert the stripped cable end until the insulation comes up against the crimp insert. Completely close the crimping pliers.

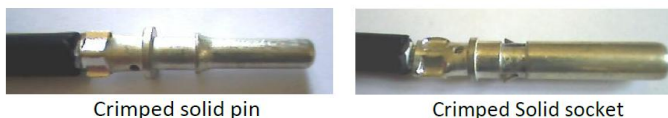


Figure 3-27 Cable/Crimp process

- 5. Assembly process H4 connector.** Insert contact cable assembly into back of male and female connector. A “click” should be heard or felt when the contact cable assembly is seated in correct position. Contacts cannot be removed once seated. See Figure 3-29 and Figure 3-30.



Figure 3-28(a) Assemble female connector with DC positive cable



Figure 3-28(b) Assemble male connector with DC negative cable

- 6. Connector body tightening.** The back cap must be closed using a torque of approx 2.7Nm (24in-lbs). Amphenol specified hand wrench tool (H4TW0001) can be used in this step with the Amphenol open-end back cap spanner (H4TE0000) or socket wrench (H4TF000) as shown in Figure 3-31.



Figure 3-29 Connector body tightening



NOTICE:

Confirm the following points before connecting the assembled H4 DC cables to the inverter:

- A. Check the GND conductor is well connected. Refer to Section 3.3.4 for detailed information regarding the ground connection.
- B. Confirm the DC Disconnect switch is in the OFF position.

7. Connect the assembled H4 DC connectors with the respective mating positive and negative connectors on the H4 wirebox. Install the DC cables from the PV string pairs to the PVIn1, PVIn2, and PVIn3 terminals.



Figure 3-30 Install assembled H4 DC cable connectors

3.3.4. AC and Ground Connection

The following section describes the AC and ground connections.

3.3.4.1. Acceptable Transformer Configurations

The SCA50/60KTL inverters operate at 480V_{AC}/Wye output. If another voltage/configuration is required a transformer may be necessary.

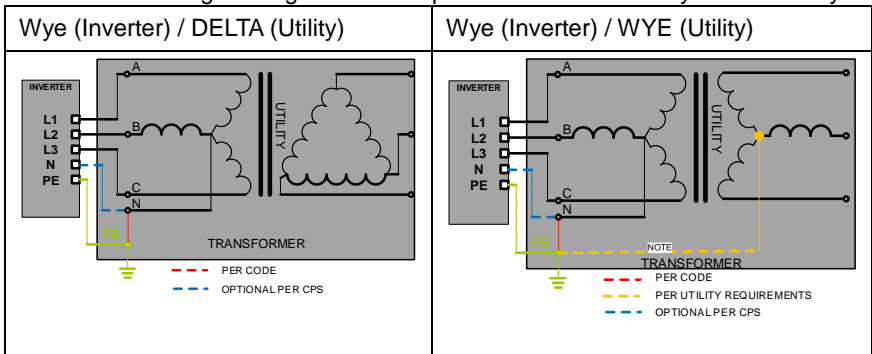


Fig 3-31 AC Acceptable Transformer Winding Configurations

NOTES:

1. The nearest upstream transformer must be a grounded WYE on the inverter side. The Neutral on the Utility Side (H0) and Inverter Side (X0) may be connected internally and brought out as one terminal in the LV compartment and labeled (H0X0).
2. Transformer short-circuit impedance (Z%) should be less than 6%.
3. The transformer VA rating must be at least 100% of the sum of the connected inverter VA ratings.
4. CPS recommends the **transformer VA rating be selected** based on IEEE C57.159-2016 *Guide on Transformers for application in Distributed Photovoltaic (DPV) Power Generation Systems*. It is the responsibility of the system designer to determine and take in account the reliability of the transformer or other system parameters.
5. The transformer does not require a static shield.
6. The maximum number of inverters connected to a single transformer is 70.
7. The recommended maximum voltage-drop on the Inverter to Point of Common Coupling (to the grid) is 2% at full load – including conductor temperature considerations. Voltage drop greater than 2% may require changing the transformer tap or as a last resort adjusting the GridMaxVolt trip point settings.

3.3.4.2. AC Connections

This section includes instructions to connect the AC conductors to the inverter and grounding options.

Table 3-9 Tools Required for Cable termination

No.	Tools	Remark
1	5mm flat screwdriver	Internal grounding bar
2	#3 Phillips head screwdriver	External grounding
3	14mm hex socket wrench	AC terminal block
4	Diagonal pliers or cable cutters	Cut cable
5	Wire stripping pliers	Remove jacket
6	Crimping pliers/tool	Crimp terminal

- Using the 1-1/2 inch knockouts.** Remove the liquid-tight hole plug from the right side or bottom of the AC input portion of the wiring box to install 1-1/2 inch Trade Size conduit and conduit fittings into the hole. Then route the cables through the conduit inside the wiring box. If 2 or 2-1/2 inch Trade Size conduit is required see Step 2.
- Using the removable gland plate.** Optionally, all AC conductors may be routed through a single large knock-out hole on a removable gland plate at the bottom of the wiring box. Refer to [Fig 3-32](#). The plate may be drilled or punched for up to 2-1/2 inch conduit.

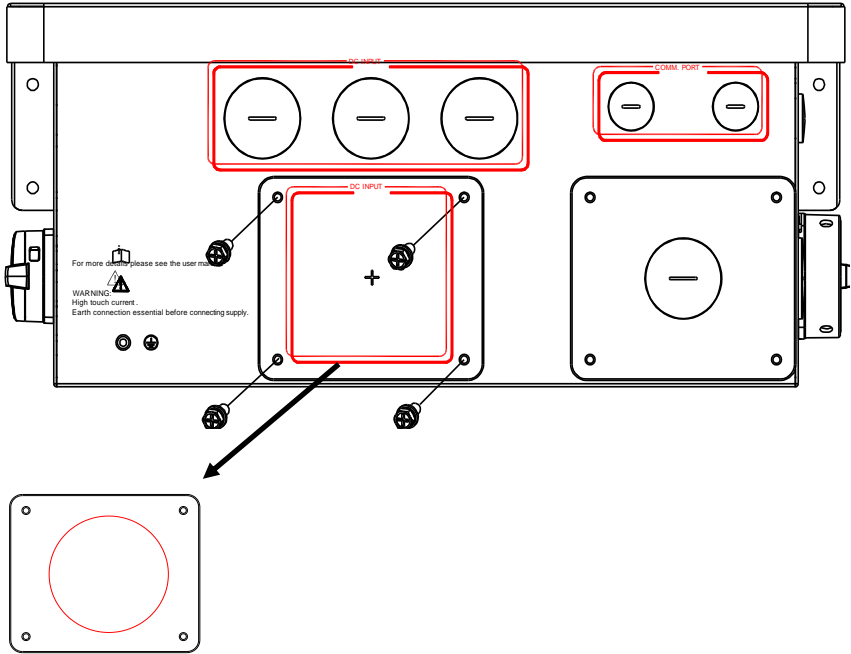


Fig 3-32 AC Input through single knock-out hole

- A. Remove the **M6x18 screws** (4 pcs) securing the AC gland plate to the wiring box.
- B. Remove the AC gland plate and rubber gasket prior to punching the conduit hole to ensure metal filings do not enter the wirebox.
- C. Use a punching tool to create desired hole size in the gland plate.
- D. Reattach the rubber gasket and AC gland plate to the wiring box with the **M6x18 screws** (4 pcs). Tool required: No.3 Phillips head screwdriver, torque value of 4N.m (35.4in-lbs).

**NOTICE:**

Terminate the Ground cable prior to terminating the AC cables.

3. **Grounding/Bonding.** The inverter provides 1 grounding connection on the AC side and one bonding location. These configurations are illustrated below (Figure 3-33).
 - A. Grounding via the ground busbar (left) [1] This is required for grounding the equipment by running the EGC with the ungrounded conductors.
 - B. Bonding via the external grounding point (right) [2]. The external bonding connection is provided in case the inverter/mount needs to be bonded to a metallic structure on which it may be mounted.

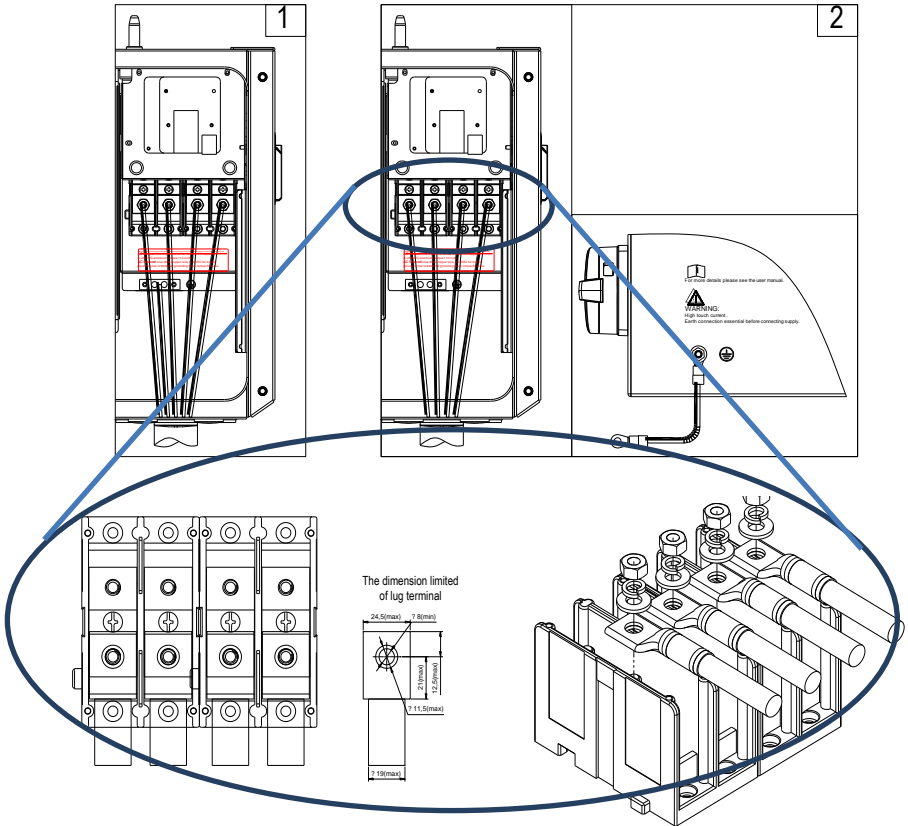
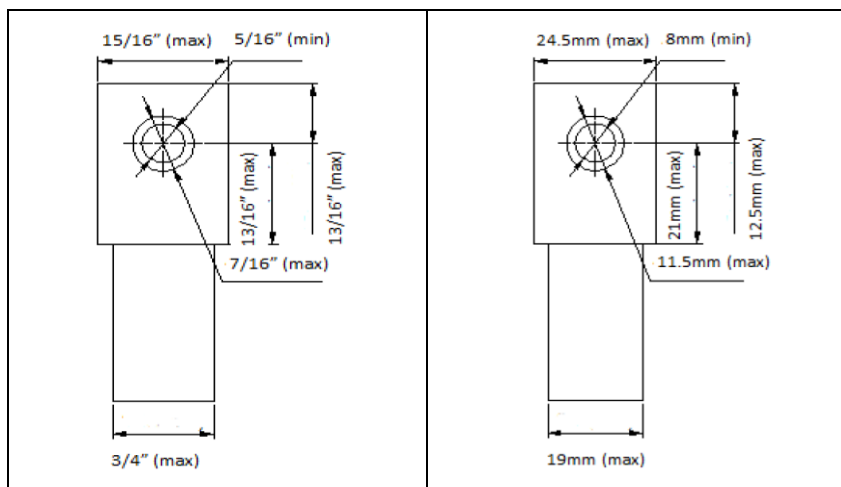


Figure 3-33 AC Output and Ground Cable Connection

Table 3-10 Torque and Conductor Specifications

Connection Point	Conductor Range	Torque Value
AC output terminal block	6-3/0 AWG (CU/AL)	14.25 N-m (126 in-lbs)
Internal grounding bar	6-4 AWG (CU)	5.65 N-m (50 in-lbs)
External grounding point	6-4 AWG (CU)	5.65 N-m (50 in-lbs)

The maximum acceptable conductor size that may be terminated to the AC output terminal is restricted based on the compression lug maximum dimensions shown in [Figure 3-34](#).



Standard 1-hole Lug

Metric 1-hole Lug

Figure 3-34 Compression Lug (OT Terminal) maximum dimensions



INSTRUCTION:

The neutral conductor from the inverter to point of interconnection (POI) is optional. The function of the neutral, when used, is to provide a point of reference for measurement purposes that is essentially at ground potential. The neutral conductor is for control or measurement purposes only, and therefore may be sized according to NEC section 705.95(B). The ground conductor (PE) is sized to section 250.122.

Use the OT type terminal to connect the AC conductors to the AC terminal block and connect the PE (GND) cable to the grounding terminal block. The neutral conductor is optional. The inverter may be wired as a 3-wire or 4-wire connection, the PE ground is ALWAYS required. When terminating the ground at the busbar a ferrule is recommended but not required. (See the 1st diagram in [Figure 3-33](#)) Set up the conductors referring to Figure 3-35.

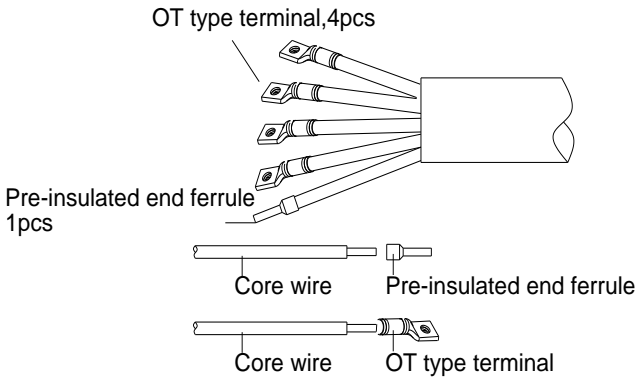


Figure 3-35 AC output and internal ground conductor set up

When bonding the inverter/mount to a metallic structure is required, use the OT type terminal to connect the ground conductor to the external bonding point at the bottom of the wiring box. The bonding point is located at the bottom of the **Standard wirebox** as shown in [Figure 3-36\(a\)](#), the **H4 wirebox** as shown in [Figure 3-38\(b\)](#).

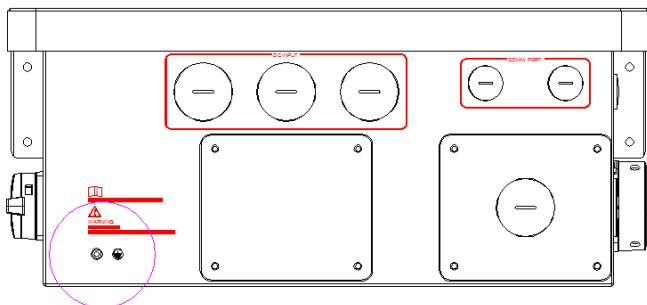


Figure 3-36(a) External Ground Point Location of Standard wirebox

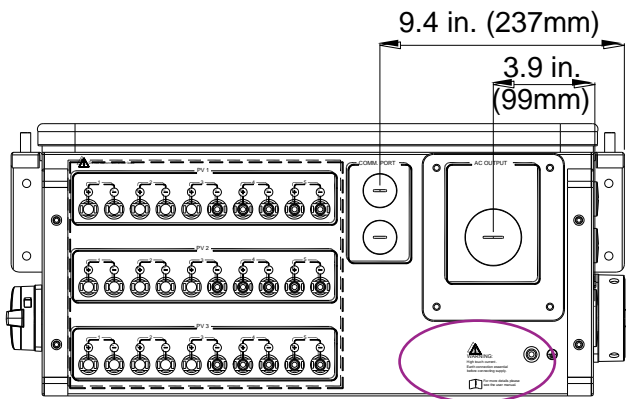


Figure 3-36(b) External Ground Point of H4 connector wirebox



NOTICE:

Always connect the Ground cable before AC cable.

It is required to use the AL9CU OT type terminal if you chose the aluminum cable for AC output.



Information: If aluminum conductors are being used, CPS recommends the following steps to prepare each conductor prior to landing and terminating to the AC terminal block:

1. Strip the outer insulating jacket from the conductor and use care so as not to nick any of the strands.
2. Using a utility knife, gently strip the top layer of the aluminum conductors



Figure 3-38 Preparing Aluminum Conductors prior to connecting

3. After removing the oxidized layer immediately apply neutral grease (Noalox or an acid-and alkali-free Vaseline) and immediately connect the cable lug to the conductor. Perform these steps on one conductor at a time. If the process is stopped or delayed before applying the grease, and continued later the conductor must be scraped again. It takes roughly 30-60 seconds for an oxidized layer to form on top of the conductors.

When the output of the inverter is connected to the grid, an external AC circuit breaker is required to be installed to safely disconnect the inverter from the grid should an over current event occur.

The Grid connection type must be a 4-wire Wye, grounded neutral, the inverter may connect to the grid via 3 or 4-wires. The neutral conductor from the inverter to point of interconnection (POI) is optional.

Either 3-pole or 4-pole AC circuit breaker (OCPD) may be selected as per the following table. Selecting a breaker of another size may either result in nuisance tripping or rejection from the AHJ.

Table 3-10 Specification of AC breaker selection

Inverter	Min AC OCPD	Max AC OCPD
CPS SCA50KTL-DO/US-480	90A	110A
CPS SCA60KTL-DO/US-480	100A	125A

3.4. Communication Connection

CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 inverters support industry standard Modbus RS485 communication. The communication board is in different places in the standard ([Figure 3-39\(a\)](#)) and H4 wiringboxes ([Figure 3-39\(b\)](#)).

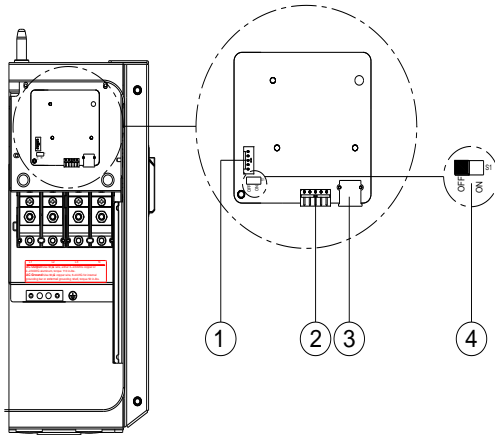


Figure 3-39(a) Communication Board of Standard wirebox

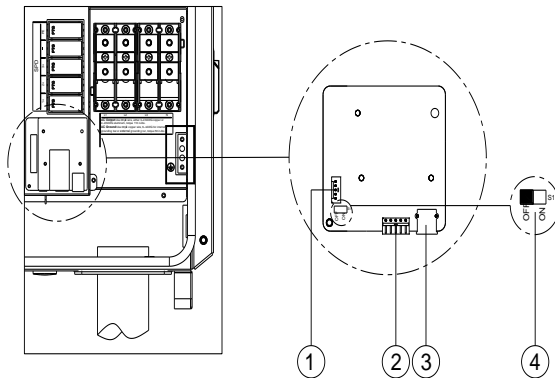


Figure 3-39(b) Communication Board of H4 Connectors wirebox

3.4.1. Description of the Communication Board

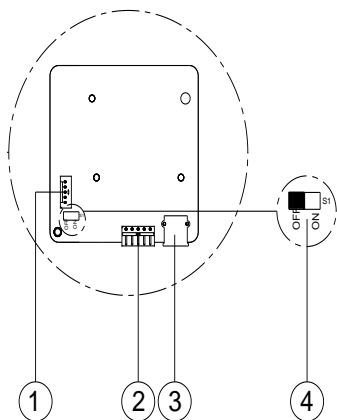


Figure 3-40 Communication Connection Interfaces

- ① RS485 P8 (Debug only)
 1. 12V+
 2. 12V_{GND}
 3. RS485+
 4. RS485-
 5. COM
- ② RS485 P7 (Communication)
 1. 12V+
 2. 12V_{GND}
 3. RS485+
 4. RS485-
 5. COM
- ③ USB Port P6: Firmware upgrade
- ④ Selector Switch (S1): 120Ω terminal resistor switch for communications.
 1. ON: Enable the termination resistance
 2. OFF: Disable termination resistance

3.4.2. RS485 Communication

CPS recommends the following cable for inverter RS485 communications: UTP CAT-5e or (3) 18-22AWG communication cables.

It is recommended that industrial grade shielded RS485 cable be used in lieu of unshielded twisted pair. Communication cable such as (CAT5) or Belden 3106A cable for RS485 5 pin connector is preferred.

RS485 communication cables are connected via the 5-pin connector to the port labeled (2) in [Figure 3-40](#). When creating a network of multiple inverters, the cables are terminated to the same 5-pin connector, double seating the conductors. [Figure 3-41](#) shows a single inverter communication connection in (1) and a network configuration in (2).

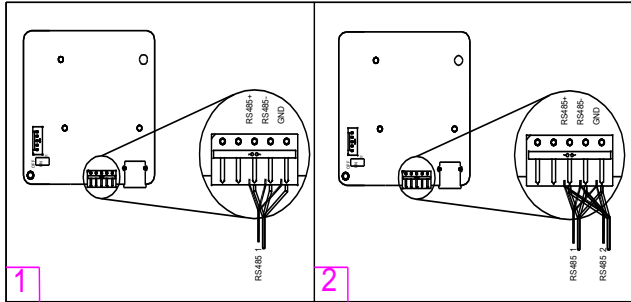


Figure 3-41 RS485 Connection of Standard wirebox

3.4.3. RS485 Network Set-up

When the inverters are monitored via the RS485 communication, a unique RS485 address for each inverter can be set up through the LCD interface. Up to 32 inverters can be connected in the RS485 communication network. The daisy-chain topology is recommended for the RS485 network connection to minimize noise and bus reflections, as shown in [Figure 3-42](#). Other communication topologies, such as the star networks, are not recommended. All RS485 connections must be terminated in a serial fashion and not to exceed 32 in total.

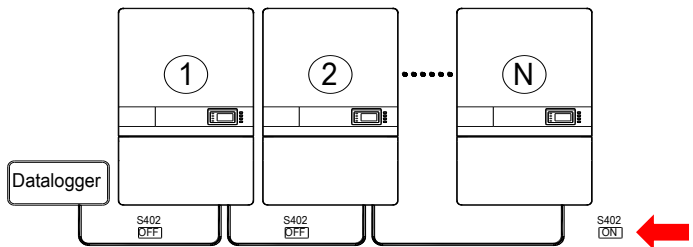


Figure 3-42 RS485 Network Connection



DANGER:

Disconnect the inverter from the AC grid and PV modules before removing covers or opening the equipment. Wait at least 5 minutes after disconnecting from the DC and AC sources before servicing or maintaining the inverter. Ensure hazardous high voltage and energy inside the inverter has been discharged prior to servicing.

If there are multiple inverters in the RS485 network, the selector switch S1 of the last inverter in the daisy-chain should be in ON position, to have the 120 Ω terminal resistor enabled. The selector switch S1 of all other inverters should be in the OFF position to disable the terminal resistor.

3.4.4. Communication Wiring

Instructions for wiring the communications of one or a network of inverters:

1. Open the inverter wiring box. Refer to Section 3.3.1 for instructions and torque requirements when replacing cover.
2. Bring the communication cables into the wiring box through the provided knockout holes at the bottom, using similar methods to the AC and DC wiring. Conduit and knockouts must be sealed and water tight to maintain the NEMA 4X rating.
3. Connect the RS485 wires to the P7 connector ensuring correct polarity and using a shielded twisted pair cable.
 - a. If connecting only one inverter, one network cable is required.
 - b. If connecting multiple inverters into a daisy chain network all inverters but the last in the chain will require two cables terminated in the same RS485 pin connector (input/output).

4. If the inverter is the **last** Modbus device in the daisy chain, make sure the Modbus termination switch S1 is in the ON position enabling Modbus termination. Do **not** turn the switch to the ON position in any other inverters of the daisy chain. If there is only one inverter, the Modbus termination switch S1 should be set to ON.
5. The shield of the individual cables must be open (not connected to ground) on one end – the other end of the shield must be grounded. Failure to follow this installation practice will increase lightning surge damage to the inverter and will void the warranty.

4. User Interface

This section is intended to orient the user with the inverter interface prior to turning the system on and commissioning.

4.1 Description of LCD Panel

The inverter's LCD panel consists of the LCD screen, four LED status indicator lights, a buzzer, and four user keys, as shown in [Figure 4-1](#).

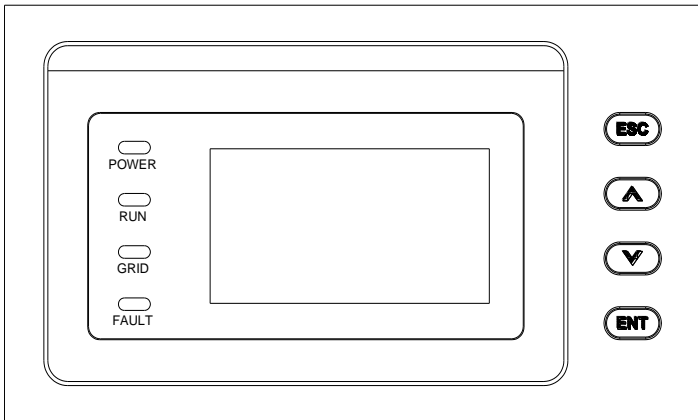


Figure 4-1 LCD Panel

The LCD panel includes a screen-saver function to increase the service life of the display. If there is no user activity or operation (key press) for greater than 1 minute, the display will enter the screen-saving mode to protect the screen and prolong the service life.





During normal inverter operation, a key press or any warnings or system faults that may occur will cause the LCD to exit screen-saver mode.

Interpretation for the indicator lights is shown in Table 4-1 and function of the keys is shown in Table 4-2.

Table 4-1 LED Indication

LED light	Name	Status	Indication
POWER	Working power light	Light on	Energized (control panel starts to work)
		Light off	Power supply not working
RUN	Grid-tied operation indication light	Light on	In grid-tied power generation state
		Flash	Derated running status (light up 0.5s, light off 1.6s)
		Light off	In other operation status or power supply not working
GRID	Grid status indication light	Light on	Grid is normal
		Flash	Grid fault (light up 0.5s, light off 1.6s)
		Light off	Power supply not working
FAULT	Fault status indication light	Light on	Indicates a Fault
		Slow flash	Indicates Alarm (light up 0.5s, light off 2s)
		Fast flash	Protective action (light up 0.5s, light off 0.5s)
		Light off	No fault or power supply not working

Table 4-2 Definition of the Keys

Key	Description	Definition of function
	Escape key	Back/end/mute
	Enter key	Confirm entering the menu/confirm set value/Switch to parameter setting mode
	Up	Page up in selection menu/+1 when setting parameters
	Down	Page down in selection menu/-1 when setting parameters

4.2 Operation State

“**POWER**” LED indicates that the system is energized and under DSP control when “POWER” lights up.

“**RUN**” LED will illuminate when the inverter detects that the grid connection conditions meet the requirements and power is being fed into the grid. The “RUN” LED will blink if the grid is in a de-rated running state while feeding power into the grid.

“**GRID**” LED will illuminate when the grid is normal during inverter operation. Otherwise, the “GRID” LED will continue to blink until the grid restores to normal.

“**FAULT**” LED will blink quickly as a fault (except grid fault) occurs. The “FAULT” LED will stay illuminated until the fault is eliminated. The LED will blink slowly when an alarm occurs. The “FAULT” LED remains illuminated when an internal fault occurs.

The buzzer will sound if a fault (involving power grid fault) occurs.

4.3 Interface Types

Users can perform the corresponding operations with the 4 function keys, described in Table 4-2, according to the indications of the LCD display.

The LCD screen will display different interfaces based on the operation modes of the inverter. There are four operation modes: **Logo** interface mode (as shown in Figure 4-2), **Normal operation** and **Standby** modes (as shown in [Figure 4-3](#)), and **Fault** mode (as shown in [Figure 4-4](#)).

1. The LCD interface starts with the company logo once the system is energized, as shown in Figure 4-2.



Figure 4-2 LOGO Interface

2. While the inverter is in **Normal Operation** mode (and not in screen saver) the interface indicates PV voltage, PV current, Grid voltage, instant power, daily generated power and time. This is the “Default Indication Interface.” The inverter will enter **Standby** mode when the output voltage and power of PV modules do not meet the startup conditions or PV voltage and input power are lower than the set value. The inverter will check automatically whether it meets the startup conditions in this mode until it turns back to

normal mode. The inverter will switch from standby mode to fault mode if a malfunction occurs.

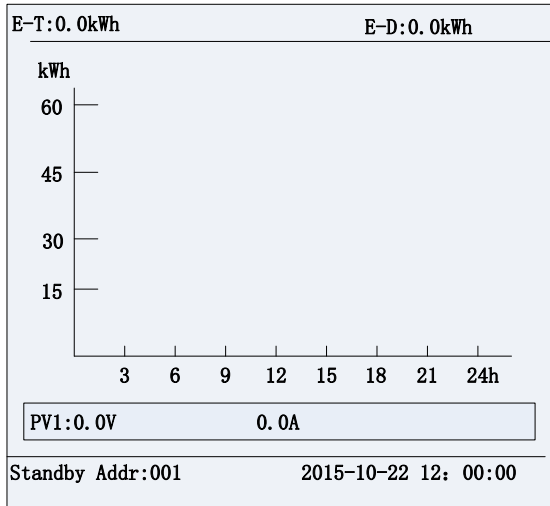


Figure 4-3 Default Display Interface for Normal Operation

3. If the inverter experiences a Fault it will enter Fault mode and display the current or most recent faults.

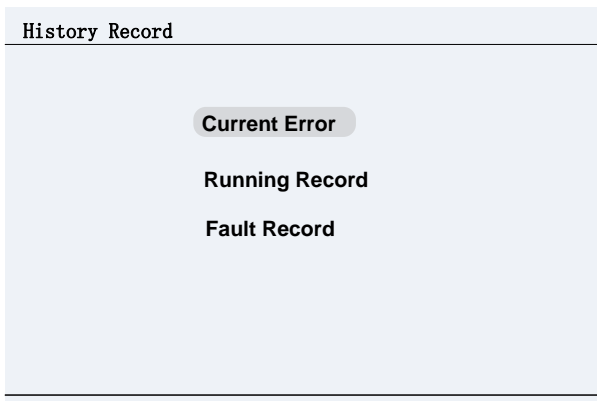


Figure 4-4 History Record Interface

4.4 Main Menu

LCD screen displays “default indication interface” when the inverter is in operation mode. Press **ESC** in this interface to escape the default interface and Press **ENT** to access the main operation interface. The main operation interface is shown in Figure 4-5.

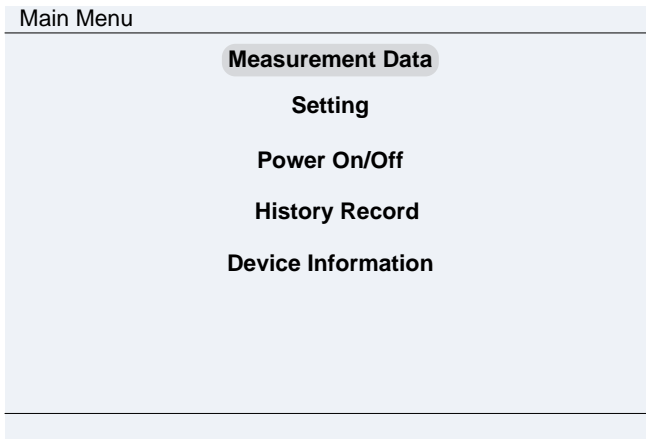






Figure 4-5 Main Menu on the LCD Screen

The main menu of the LCD screen has 5 menus, “**Measurement Data**”, “**Setting**”, “**Power ON/OFF**”, “**History Record**”, and “**Device Information**”. The users may select options by moving the cursor up/down with  and , and then press the **ENT** key to confirm the selection. The users can return to the default indication interface by pressing the **ESC** key.

4.4.2 Setting

Move the cursor to **Setting** in the main interface. Press the **ENT** key to be prompted for the password: “1111” as shown in Figure 4-7. Enter the password number by pressing  and , selecting the numeral, and pressing the **ENT** key to input and proceed to the next digit of the password number. Once all four digits are entered, press the **ENT** key to confirm the password or Press the **ESC** key to go back to **Setting**.

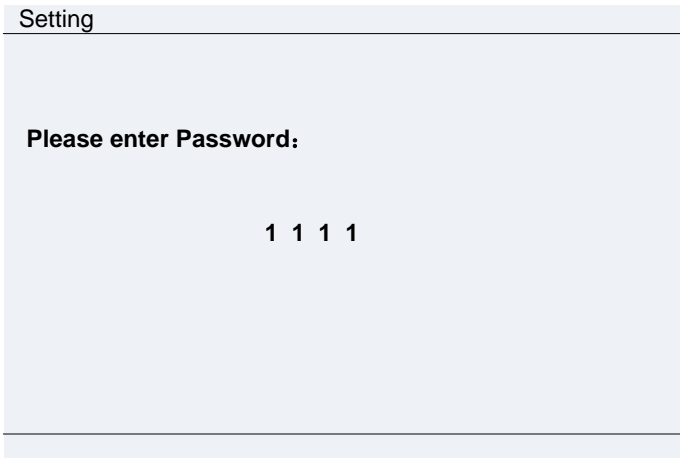


Figure 4-7 Input Password Number

The **Setting** menu contains eight submenus: **System Parameters**, **Control Command**, **Protection Parameters**, **LVRT/HVRT Setup**, **Power Derating Setting**, **Reactive Power Derating Setup**, **ARC Parameters**, and **Other Parameters**.

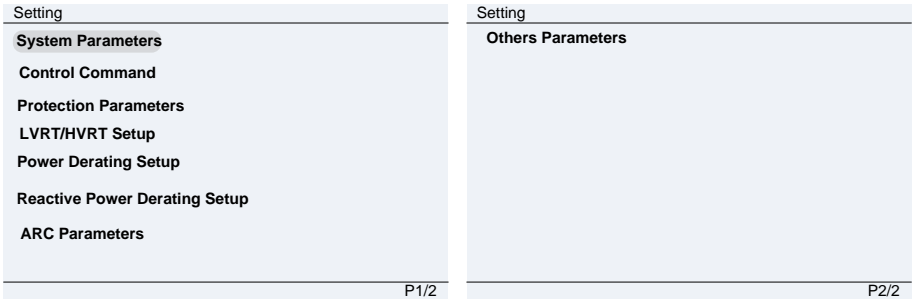


Figure 4-8 System Setup Menu and Submenus Overview

4.4.2.1 System Parameters

The System Parameter selection contains nine submenus.

1. **Language Setting.** Two languages, i.e. Chinese and English are available in **Language** menu.

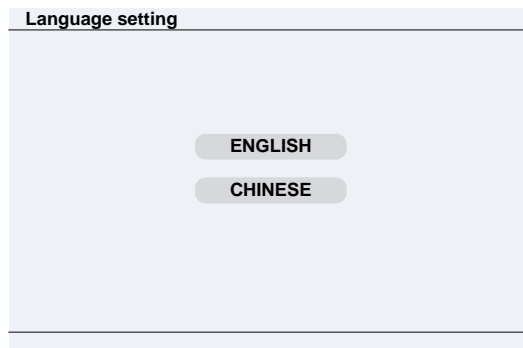


Figure 4-9 Language Setting



2. **Grid Connection Rule.** Multiple grid standards are available. Press  and  to select the corresponding grid standard required for the installation and press the **ENT** key.



Figure 4-10 Setting Grid Rule



INSTRUCTION:

Please check with your local electric utility supply company before selecting a grid standard. If the inverter is operated with an incorrect grid standard, the electric utility supply company may cancel the interconnection agreement.

Placing the inverter into operation before the overall system complies with the national codes, rules and safety regulations of the application is also not permitted.

3. **PV Input Mode.** This allows the user to read the inverter working mode as "**Independent**" or "**Parallel**" mode. The inverter is factory set in Independent mode. If this needs to be set to Parallel contact CPS to have this setting changed.
4. **Neutral Line Setting.** This option allows the user to select "Yes/No" if a neutral conductor has been connected to the inverter. This setting does not affect the operation of the inverter. This is for measurement and display purposes only. When a neutral is installed and "Yes" is selected, the inverter will display L-N measurements.
6. **Communication Setting.** This interface is used to set the Modbus ID and Baud rate for communication. More information on this is found in the "Commissioning" section.
7. **Time.** Press or to select the numerical value, then press **ENT** to go to next option. e.g.: Year to Month. Finally Press the **ENT** key to confirm the setting.
8. **LCD Contrast Setting.** Press or to increase/decrease the LCD contrast. Press **ENT** to accept changes.

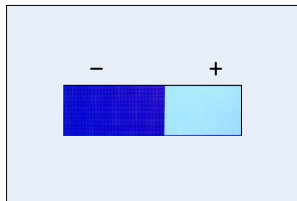


Figure 4-11 LCD contrast grade Setting

9. **Clear Running Record.** Clear the running information. This contains normal operating information such as when the inverter starts up and shuts down.
9. **Clear Fault Record.** Clear the fault record for the inverter. The Fault Record can store up to 100 faults.

4.4.2.2 Control Command

There are five submenus in the “**Control Command**” menu:

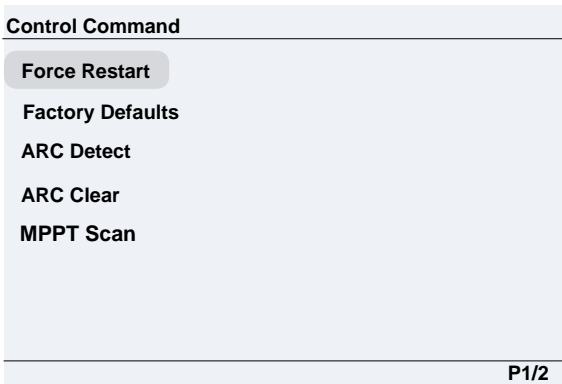


Figure 4-12 Control Command Setting

1. **Force Restart.** If a fault shutdown happens, a severe fault may have occurred inside the inverter. The user can perform a force reboot for one time in this menu if the user needs to restart the inverter.



INSTRUCTION:

Force Restart is effective only when the faults “IntFault0010~0150” in the troubleshooting table occur. The inverter may restore to normal operation automatically if alarm or protection faults occur. This function will not respond when the inverter is in operation mode and a “FaultOperated” alarm interface will be indicated.

2. **Factory Default.** The manufacturer's parameter default values can be restored when the inverter is not in operation mode. Otherwise "Fault Operated" will be reported.
3. **ARC Detect.** Manually begin an arc-fault test. The inverter will cease power production and test ARC.
Arcing check and protection is mainly divided into two parts, the Arcing check board is responsible for whether there is Arcing in line, and transfer an Arc protection signal to the DSP in the dominating control board. The control board DSP is responsible for disconnecting the inverter from the grid after receiving the Arc protection signal to ensure safety. The Arc board failure will cause 'arc board err' shown on the LCD and it will not connect to the grid until the arc board is OK. If there is an Arc fault, the LCD displays the fault which can only be cleared manually.
4. **ARC Clear.** Manually clear the ARC fault. Move the cursor to this menu, and press **ENT**. The operation result will appear on the LCD, ie. "Succeed" or "Failed". Complete this action after checking the PV system for potential arcs and taking corrective action.
5. **MPPT Scan.** Manually execute the MPPT scan. Move the cursor to this item, and press the **ENT** key to initiate the scanning. The LCD screen will skip to normal operation interface if the MPPT scanning succeeds, or remain on the **MPPT Scan** menu interface if the scanning fails.

The factory default setting for "MPPTScan" is set to <Enabled, yet can also be set to Disabled. When the MPPT scan function is enabled, the default scan period is every 60

minutes. The inverter will scan the maximum power point in the MPPT range, according to the following condition:

- While in Parallel mode, the total input power is lower than 90% of the active power.
- While in Independent mode (3 MPPTs), the input power must be lower than 75% of the rated power for each MPPT tracker.

Once this MPPT scan function is activated on LCD, it will search the maximum power point at a voltage step of 5V in the MPPT range for full load, and retrieve the maximum power point.

Table 4-3 Protection Parameters (IEEE1547 and Rule21)

Grid Voltage Protection		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
GridVoltMax1	Threshold value of Level 1 Max. grid voltage	{100.00%, 110.00% , 135.00%}	{100.00%, 110.00% , 135.00%}
VoltMaxTripTime1(S)	Threshold value of Level 1 Max. grid trip voltage	{0, 1.00 , 655}	{0, 12.50 , 655}
GridVoltMax2	Threshold value of Level 2 Max. grid voltage	{100.00%, 120.00% , 135.00%}	{100.00%, 120.00% , 135.00%}
VoltMaxTripTime2(S)	Threshold value of Level 2 Max. grid trip voltage	{0, 0.16 , 655}	{0, 0.16 , 655}
GridVoltMax3	Threshold value of Level 3 Max. grid voltage	{100.00%, 120.00% , 135.00%}	{100.00%, 120.00% , 135.00%}
VoltMaxTripTime3(S)	Threshold value of Level 3 Max. grid trip voltage	{0, 0.16 , 655}	{0, 0.16 , 655}
GridVoltMin1	Threshold value of Level 1 Min. grid voltage	{30.00%, 88.00% , 100.00%}	{30.00%, 88.00% , 100.00%}
VoltMinTripTime1(S)	Threshold value of Level 1 Min. grid trip voltage	{0, 2.0 , 655}	{0, 20.50 , 655}
GridVoltMin2	Threshold value of Level 2 Min. grid voltage	{30.00%, 60.00% , 100.00%}	{30.00%, 70.00% , 100.00%}
VoltMinTripTime2(S)	Threshold value of Level 2 Min. grid trip voltage	{0, 1.00 , 655}	{0, 10.50 , 655}
GridVoltMin3	Threshold value of Level 3 Min. grid voltage	{30.00%, 45.00% , 100.00%}	{30.00%, 50.00% , 100.00%}
VoltMinTripTime3(S)	Threshold value of Level 3 Min. grid trip voltage	{0, 0.16 , 655}	{0, 1.5 , 655}

Table 4-3 Protection Parameters (IEEE1547 and Rule21) cont'd

Grid Frequency Protection		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
GridFrqMin1	Protection threshold value of Level 1 Min. grid frequency	{54, 59.5 , 60}	{45, 58.5 , 60}
FrqMinTripT1 (S)	Trip time of Level 1 Min. grid frequency	{0, 2 , 655}	{0, 299.50 , 655.00}
GridFrqMin2	Protection threshold value of Level 2 Min. grid frequency	{54, 57 , 60}	{45, 57 , 60}
FrqMinTripT2 (S)	Trip time of Level 2 Min. grid frequency	{0, 0.16 , 655}	{0, 0.16 , 655}
GridFrqMin3	Protection threshold value of Level 3 Min. grid frequency	{54, 57 , 60}	{54, 57 , 60}
FrqMinTripT3 (S)	Trip time of Level 3 Min. grid frequency	{0, 0.16 , 655}	{0, 0.16 , 655}
GridFrqMax1	Protection threshold value of Level 1 Max. grid frequency	{60, 60.5 , 65}	{50, 60.5 , 65}
FrqMaxTripT1(S)	Trip time of Level 1 Max. grid frequency	{0, 2 , 655}	{0, 299.50 , 655}
GridFrqMax2	Protection threshold value of Level 2 Max. grid frequency	{50, 62 , 65}	{50, 62 , 65}
FrqMaxTripT2(S)	Trip time of Level 2 Max. grid frequency	{0, 0.16 , 655}	{0, 0.16 , 655}
GridFrqMax3	Protection threshold value of Level 3 Max. grid frequency	{60, 62 , 65}	{50, 62 , 65}
FrqMaxTripT3(S)	Trip time of Level 3 Max. grid frequency	{0, 0.16 , 655}	{0, 0.16 , 655}

Table 4-3 Protection Parameters (IEEE1547 and Rule21) cont'd

Grid Recovery		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
VolMax (V)	Recovery Max threshold of grid voltage protection	{80.00%, 107.92% , 135.00%}	{80.00%, 107.99% , 135.00%}
VolMin (V)	Recovery Min threshold of grid voltage protection	{20.00%, 90.08% , 100.00%}	{20.00%, 90.00% , 100.00%}
VolRecoveryT(S)	Recovery time of grid voltage protection	{0, 300 , 655}	{0, 300 , 655}
FrqMax (Hz)	Recovery Max threshold of grid Frequency protection	{54, 60.3 , 66}	{54, 60.4 , 65}
FrqMin (Hz)	Recovery Min threshold of grid Frequency protection	{54, 59.8 , 60}	{48, 58.6 , 60}
FrqRecoveryT (S)	Recovery time of grid frequency protection	{0, 300 , 655}	{0, 300 , 655}
Grid Voltage Balance		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
GridVolBalance	Threshold value of grid voltage imbalance	(0.01%, 10% ,10%)	(0.01%, 10% ,10%)

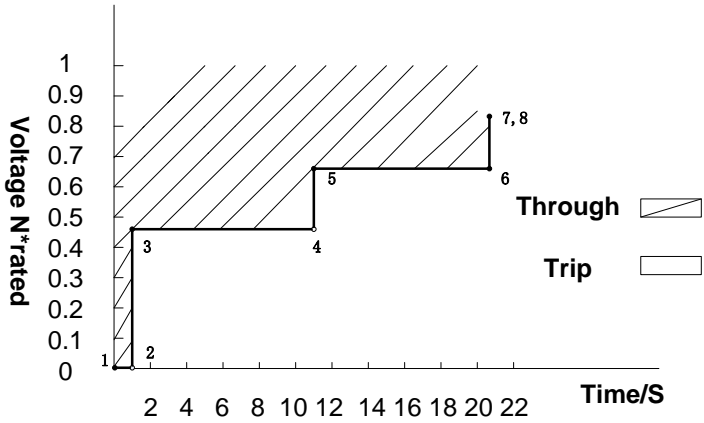


Figure 4-15 The LVRT Curve

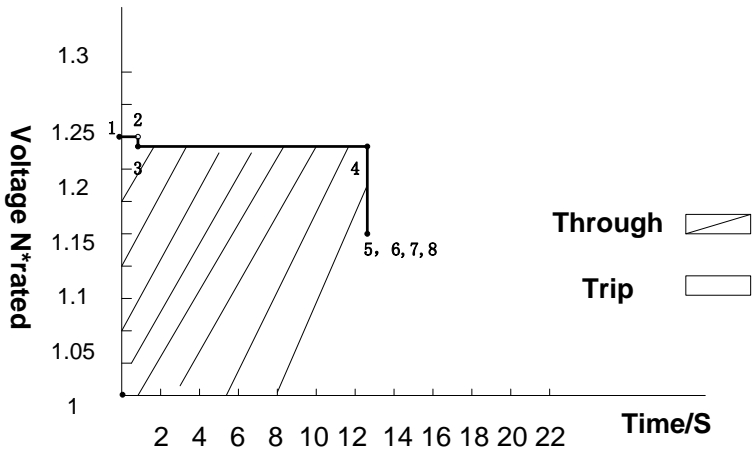


Figure 4-16 The HVRT Curve

Table 4-4 LVRT Parameters (IEEE1547 and Rule21)

LVRT		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
LVRTVolt (1,2)	Threshold value of Low voltage ride through (1 st & 2 nd point)	{0%, 0% , 100%} {0%, 0% , 100%}	{0%, 0% , 100%} {0%, 0% , 100%}
LVRTTime (1,2)	Time of Level Low voltage ride through (1 st & 2 nd point)	{0, 0 , 655} {0, 1.2 , 655}	{0, 0 , 655} {0, 1.2 , 655}
LVRTVolt (3,4)	Threshold value of Low voltage ride through (3 rd & 4 th point)	{0%, 45% , 100%} {0%, 45% , 100%}	{0%, 50% , 100%} {0%, 50% , 100%}
LVRTTime (3,4)	Time of Level Low voltage ride through (3 rd & 4 th point)	{0, 1.2 , 655} {0, 10.5 , 655}	{0, 1.2 , 655} {0, 10.5 , 655}
LVRTVolt (5,6)	Threshold value of Low voltage ride through (5 th & 6 th point)	{0%, 65% , 100%} {0%, 65% , 100%}	{0%, 70% , 100%} {0%, 70% , 100%}
LVRTTime (5,6)	Time of Level Low voltage ride through (5 th & 6 th point)	{0, 10.5 , 655} {0, 20.5 , 655}	{0, 10.5 , 655} {0, 20.5 , 655}
LVRTVolt (7,8)	Threshold value of Low voltage ride through (7 th & 8 th point)	{0%, 83% , 100%} {0%, 83% , 100%}	{0%, 88% , 100%} {0%, 88% , 100%}
LVRTTime (7,8)	Time of Level Low voltage ride through (7 th & 8 th point)	{0, 20.5 , 655} {0, 20.5 , 655}	{0, 20.5 , 655} {0, 20.5 , 655}

Table 4-5 HVRT Parameters (IEEE5147 and Rule21)

HVRT		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
HVRTVolt (1,2)	Threshold value of high voltage ride through (1 st & 2 nd point)	{100%, 125% , 135%} {100%, 125% , 135%}	{100%, 125% , 135%} {100%, 125% , 135%}
HVRTTime (1,2)	Time of Level high voltage ride through (1 st & 2 nd point)	{0, 0 , 655} {0, 0.8 , 655}	{0, 0 , 655} {0, 0.11 , 655}
HVRTVolt (3,4)	Threshold value of high voltage ride through (3 rd & 4 th point)	{100%, 124% , 135%} {100%, 124% , 135%}	{100%, 120% , 135%} {100%, 120% , 135%}
HVRTTime (3,4)	Time of Level high voltage ride through (3 rd & 4 th point)	{0, 0.8 , 655} {0, 12.5 , 655}	{0, 0.11 , 655} {0, 12.5 , 655}
HVRTVolt (5,6)	Threshold value of high voltage ride through (5 th & 6 th point)	{100%, 115% , 135%} {100%, 115% , 135%}	{100%, 110% , 135%} {100%, 110% , 135%}
HVRTTime (5,6)	Time of Level high voltage ride through (5 th & 6 th point)	{0, 12.5 , 655} {0, 12.5 , 655}	{0, 12.5 , 655} {0, 12.5 , 655}
HVRTVolt (7,8)	Threshold value of high voltage ride through (7 th & 8 th point)	{100%, 115% , 135%} {100%, 115% , 135%}	{100%, 110% , 135%} {100%, 110% , 135%}
HVRTTime (7,8)	Time of Level high voltage ride through (7 th & 8 th point)	{0, 12.5 , 655} {0, 12.5 , 655}	{0, 12.5 , 655} {0, 12.5 , 655}

Table 4-6 LVRT and HVRT Parameters (IEEE5147 and Rule21)

LVRT and HVRT Control		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
LVRTModeSetting	0: Disable 1: Enable, no reactive power output 2: Enable, reactive power output	(0, 0 , 2)	(0, 2 , 2)
LVRTTripVolt	Threshold value of LOW voltage trip	(70.0%, 80.0% , 100.0%)	(70.0%, 88.0% , 100.0%)
LVRTPstReactive1	The factor LVRT Positive Reactive Current	(0%, 150.0% , 300.0%)	(0%, 150.0% , 300.0%)
LVRTNegReactive1	The factor LVRT Negative Reactive Current	(0%, 200.0% , 100%)	(0%, 200.0% , 100%)
HVRTModeSetting	0: Disable 1: Enable, no reactive power output 2: Enable, reactive power output	(0, 0 , 2)	(0, 1 , 2)
HVRTTripVol	Threshold value of HIGH voltage trip	(100.0%, 110.0% , 135.0%)	(100.0%, 110.0% , 135.0%)

4.4.2.5 Power Derating Setup

“Power Derating Setup” menu is used to set the active power derating parameters including Active Power Derating, Over frequency derating, Low frequency derating, High temperature frequency derating, etc.

The parameters are shown in Figure 4-17.

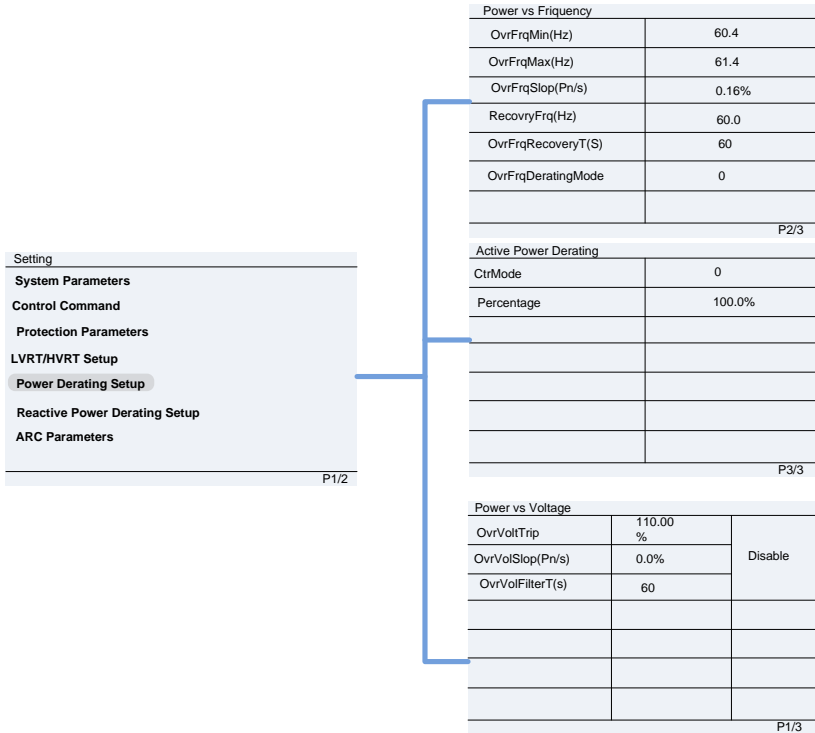


Figure 4-17 Power Derating Setup

Table 4-7 Power Derating Setup

Voltage-Watt		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
OvrVoltTrip	The trigger voltage of OverVoltage derating	{100%, 110% ,135%}	{100%, 110% ,135%}
OvrVoltSlop	The rate of OverVoltage derating	{0%, 0% ,100%}	{0%, 0% ,100%}
OvrVoltFilterT(s)	The filtering time of OverVoltage derating	{1, 60 ,90}	{1, 60 ,90}
Grid Over Frequency Derating		IEEE1547	Rule21
OvrFrqMin (Hz)	The trigger frequency of Over Frequency derating	{54, 60.5 ,66}	{54, 60.2 ,66}
OvrFrqMax (Hz)	The end frequency of Over Frequency derating	{60, 61.4 ,72}	{60, 61.5 ,72}
OvrFrqSlop (P%/s)	The rate of Overfrequency derating	{0,01, 0.16 ,10}	{0,01, 8.00 ,10}
RecoveryFrq (Hz)	The recovery frequency of OverFrequency derating	{58.8, 60 ,66}	{58.8, 60.20 ,66}
OvrFrqRecoveryT (s)	The recovery time of OverFrequency derating	{0, 60 ,1200}	{0, 20 ,1200}
OvrFrqDeratingMode	Over frequency derating enable/disable 0: Disable 1: Enable	{0, 0 ,1}	{0, 0 ,1}
CtrMode	The control mode of active power 0: Disable 1: Remote 2: Local control	{0, 0 ,2}	{0, 0 ,2}
Percentage	Local electric dispatch Active Power setting value	{0, 100.0 ,100.0}	{0, 100.0 ,100.0}

4.4.2.6 Reactive Power Derating Setup

The Reactive Power Derating menu is used to set the Grid reactive power derating parameters including PF parameters, Qu parameters, etc. The parameters as shown in Table 4-8.

Setting System Parameters Control Command Protection Parameters LVRT/HVRT Setup Power Derating Setup Reactive Power Derating Setup ARC Parameters	PF vs Voltage		Reactive Power vs Grid Voltage	
	pFSetValue	1.000	QuCurveU1	107.99%
	pFCurveP1	50.0%	QuCurveQ1	0.0%
	pFCurvePF1	1.000	QuCurveU2	110.00%
	pFCurveP2	100.0%	QuCurveQ2	-50.0%
	pFCurvePF2	-0.900	QuCurveU1i	92.01%
	pFCurveTriVolt	100.00%	QuCurveQ1i	0.0%
	pFCurveUndoVolt	90.00%	QuCurveU2i	90.00%
		P1/4		P2/4
	Reactive Power vs Grid Voltage		Grid Reactive Power Derating	
	QuCurveQ2i	50.0%	CtrlMode	0
	QuCurveTriPower	20.0%	Percentage	0.0%
	QuCurveUndoPower	5.0%		
		P3/4		P4/4

Figure 4-18 Reactive Derating Setting

Table 4-8 Reactive Power Control (IEEE-1547 and Rule21)

Grid Reactive Power Derating		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
pFSetValue	Local Power Factor Setting	{-0.8,-1},{ 1 },{0.8,1}	{-0.8,-1},{ 1 },{0.8,1}
pFCurveP1 (%)	Power of PF(P) Curve point 1	{0, 50% , 110%}	{0, 50% , 110%}
pFCurvePF1	PF of PF(P) Curve point 1	{-1,-0.8},{ 1 },{0.8,1}	{-1,-0.8},{ 1 },{0.8,1}
pFCurveP2 (%)	Power of PF(P) Curve point 2	{0, 100% , 110%}	{0, 100% , 110%}
pFCurvePF2	PF of PF(P) Curve point 2	{-1,-0.8},{ -0.9 },{0.8,1}	{-1,-0.8},{ -0.9 },{0.8,1}
pFCurveTriVol (V)	The trigger voltage of PF(P)Curve	{100%, 100% , 110%}	{100%, 100% , 110%}
pFCurveUndoVol (V)	PF curve revocation voltage	{90%, 90% , 100%}	{90%, 90% , 100%}

Note: The PF and Q value can be adjusted by remote software if the “Remote” is selected.

1. **pFSetValue** : Set the PF value. This function changes the reactive power by adjusting the Power Factor.
2. **pFCurve functions** : PF curve mode. Using the curves to set the PF(P) setpoints (See Figure 4-19). These functions are only available for IEEE-1547 grid standards.

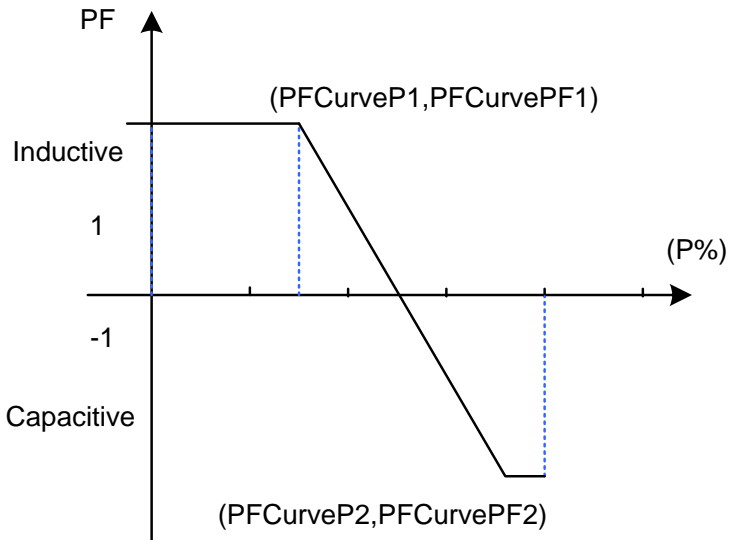


Figure 4-19 PF(P) Curve Mode



INSTRUCTION:

The PF (P) Curve function is only available for IEEE-1547 grid standards.

3. Q(U) Curve : Q(U) curve mode. Using the curves to set the reactive power setpoints (See Figure 4-20). The reactive power compensation changes according to the grid voltage. These functions are only available for IEEE-1547 grid standards.

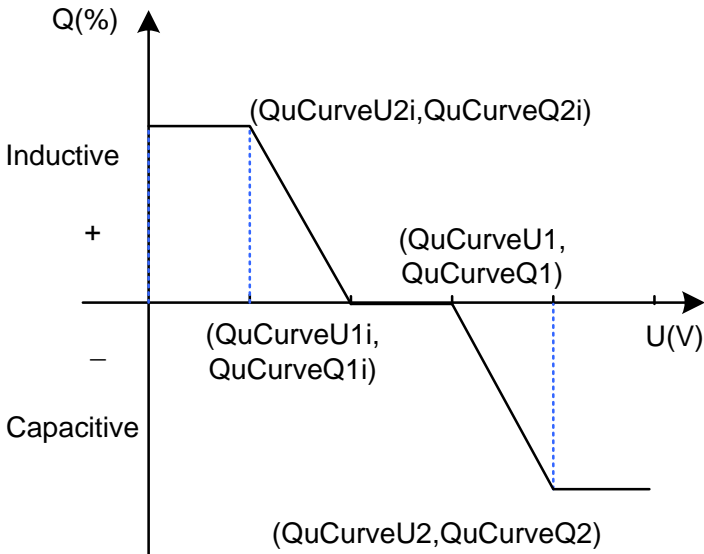


Figure 4-20 Q(U) Curve Mode



INSTRUCTION:

The Q(U) curve function is only available for IEEE-1547 grid standards.

Table 4-9 lists the parameters for PF Set, PF(P) Curve and Q(U) Curve modes. Press **ENT** to start the modes after the parameters are set.

Table 4-9 Reactive Power Control (IEEE-1547 and Rule21)

Grid Reactive Power Derating		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
QuCurveU1 (V)	Voltage of Q(U) Curve point 1	{100%, 107.99% , 110%}	{100%, 107.99% , 110%}
QuCurveQ1 (%)	Reactive power of Q(U) Curve point 1	{-66%, 0 , 66%}	{-60%, 0 , 60%}
QuCurveU2 (V)	Voltage of Q(U) Curve point 2	{108%, 110% , 110%}	{108%, 108% , 110%}
QuCurveQ2 (%)	Reactive power of Q(U) Curve point 2	{-66%, -50% , 66%}	{-60%, -60% , 60%}
QuCurveU1i (V)	Voltage of Q(U) Curve point 1i	{90%, 92.01% , 99%}	{90%, 99% , 99%}
QuCurveQ1i (%)	Reactive power of Q(U) Curve point 1i	{-66%, 0 , 66%}	{-60%, 0 , 60%}
QuCurveU2i (V)	Voltage of Q(U) Curve point 2i	{80%, 90% , 92%}	{80%, 92% , 92%}
QuCurveQ2i (%)	Reactive power of Q(U) Curve point 2i	{-66%, 50% , 66%}	{-60%, 60% , 60%}
QuCurveTriPower (V)	The trigger voltage of Q(U) Curve	{5%, 20% , 100%}	{5%, 20% , 100%}
QuCurveUndoPower (V)	The end voltage of Q(U) Curve	{5%, 5% , 100%}	{5%, 5% , 100%}
CtrlMode	The control mode of reactive power 0: Disable dispatch mode. 1: Remote dispatch mode. 2: Local control, by Q 3: Local control, by PF 4: PF(P) curve 5: Q(U) curve	{0, 0 , 5}	{0, 0 , 5}
Percentage	Local Power Factor Setting	{-66%, 0% , 66%}	{-60%, 0% , 60%}

4.4.2.7 Arc Parameters

ARC Parameters is used to enable/disable the ARC function and set the ARC parameters. These settings are only to be changed by CPS personnel with approval from the AHJ.

Setting System Parameters Control Command Protection Parameters LVRT/HVRT Setup Power Derating Setup Reactive Power Derating Setup ARC Parameters	ARC Bandwidth Setting		ARC Bandwidth Setting	
	Bandwidth1	10K	Bandwidth2	10K
	StarFrq1	20K	StarFrq2	50K
	Proportion1	25	Proportion2	25
	Filter1	20%	Filter2	20%
	Threshold1(dB)	455	Threshold2(dB)	420
	SigPerApdLmit1(dB)	65	SigPerApdLmit2(dB)	60
		P1/4		P2/4
	ARC Percentage Setting		ARC Others Parameters	
PctStarFq1	30K	TestPeriod	7	
PctStarFq2	0K	ARCParaGroup	0	
PctStartBW1	5K	ARCEnable	Enable	
PctStartBW2	0K			
Roughness1	60%			
Roughness2	0%			
EffectivePeriod	6			
	P3/4		P4/4	

Figure 4-21 Arc Parameters Setting

4.4.2.8 Other Parameters

Other Parameters is used to set additional parameters including MPPT scan period, nominal derating step and GFCI, DCI parameters. Press **ENT** and use UP/DOWN keys to set parameters and enable/disable the functions. Press **ENT** to confirm the setting. The parameters shown in Figure 4-22 and Table 4-10.

Setting Others Parameters	Others		Others		Others		
	PowerOnDelay(s)	5	FaultPower(TC)	96.0	Island Protect	Enable	
	PVSlowStartSlope	10.00%	Disable	FaultEnv(TC)	83.0	Fan Detect	Enable
	ErrSoftStartP	0.16%					
	NormSoftStartP	6.00%	Enable				
	NormSoftStartP	4.00%					
	NormalDeratingStep	6.00%					
		P1/5		P2/5		P5/5	
	Others		Others		Others		
GFCIStaticI(kaumA)	250	Enable	PVStartUp(ohV)	330			
GFCIStaticT(s)	0.2		MPPTScanPeriod(s)	3600	Enable		
GFCIDynProfFactor	100.0%	Enable	ISOProtection	140K	Enable		
DCIProtection1	0.50%	Enable	StartUPMinTemp(C)	-30.0			
DCIProtectionT1(s)	10.00		DuplicationGroup	0%			
DCIProtection2(mA)	950	Disable	ChParaGroup	4			
DCIProtectionT2(s)	1.00		PID Check Setting	0			
	P3/5		P4/5				

Figure 4-22 Other Parameters Setting

Table 4-10 Other Parameters

Other Parameters		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
PowerOnDelay (s)	Startup delay time	{0, 5 , 1200}	{0, 5 , 1200}
PVSlow StartSlope (%/P)	The output power will slowly increase due to the change of PV illumination at the Rule21 standard	{0.01%, 10.00% , 10}	{0.01%, 10.00% , 10}
ErrSoftStartP (%/P)	Power startup step after Grid Fault	{0.01%, 0.16% , 10%	{0.01%, 0.16% , 10%
NormSoftStopP (%/P)	Normal power step in soft stop	{0.01%, 6.00% , 10%	{0.01%, 2.00% , 10%
NormSoftStartP (%/P)	Normal power step in soft startup	{0.01%, 4.00% , 10%	{0.01%, 2.00% , 10%
NormalDeratingStep	Power step in Derating	{0.01%, 6.00% , 10%	{0.01%, 5.00% , 10%
FaultPowerT	The trigger temperature of module (C)	(95.0, 95.0 , 95.0)	(95.0, 95.0 , 95.0)
FaultEnvT	The trigger temperature of environment (C)	(83, 83 , 83)	(83, 83 , 83)
GFCIStaticValue (mA)	The static threshold value of Leakage current	(100, 250 , 1000)	(100, 250 , 1000)
GFCIStaticT (s)	The static threshold value of Leakage current	(0, 0.2 , 655)	(0, 0.2 , 655)
GFCIDynProFactor	The dynamic trigger coefficient of Leakage current	(0.0%, 100% , 200%)	(0.0%, 100% , 200%)
DCIProtection1	Maximum DCI value1	(0.01%, 0.50% , 5.00%)	(0.01%, 0.50% , 5.00%)
DCIProtectionT1 (s)	Trip time 1 of DCI	(0.00, 10.00 , 120.00)	(0.00, 10.00 , 120.00)
DCIProtection2 (mA)	Maximum DCI value2	(5, 950 , 5000)	(5, 950 , 5000)
DCIProtectionT2 (s)	Trip time 2 of DCI	(0.00, 1.00 , 120.00)	(0.00, 1.00 , 120.00)
PVStartVolt(V)	PV start-up voltage	(300, 330 , 400)	(300, 330 , 400)

MPPTScanPeriod (s)	MPPT Scan Cycle	(300, 3600 , 5400)	(300, 3600 , 5400)
Other Parameters (Cont'd)		IEEE1547	Rule21
Parameter name	Description	Setting Range (Min, Default , Max)	Setting Range (Min, Default , Max)
ISOProtection (Ω)	Minimum insulation resistance	(1k, 140k , 2000k)	(1k, 140k , 2000k)
StarUPMinTemp (C)	The minimum startup temperature	(-35, -30 , -20)	(-35, -30 , -20)
DuplicationGroup	Parameter of repetitive control	{0, 0 , 100}	{0, 0 , 100}
CtrParaGroup	The enabled control parameters group.	{0, 4 , 4}	{0, 4 , 4}
PID Check Setting	PID Checking enable/disable control	{0, 0 , 1}	{0, 0 , 1}
Island Protect	Island enable/disable control 0: Disable 1: Enable	{0, 1 , 1}	{0, 1 , 1}
Fan Detect	Fan detection enable/disable control 0: Disable 1: Enable	{0, 1 , 1}	{0, 1 , 1}

4.4.2.9 File Export (local)

File Export is used to export the data including **Running History** and **Fault Record** to a flashdrive. Press **ENT** and use **UP** and **DOWN** arrows to export the data, and press **ENT** to confirm the setting.

4.4.2.10 Firmware update (local)

Firmware update is to update the versions of firmware including **LCD Firmware** and **DPS Firmware**. Press **ENT** and use **UP** and **DOWN** arrows to update the data, and press **ENT** to confirm the setting. For remote Firmware updating see Section 6.5.

4.4.3 Power ON/OFF

4.4.3.1 Manual Power ON/OFF

Restarting the inverter is required after regulation setting or manual (fault) shut-down. Press **ESC** or **ENT** to access the Main Menu. Scroll the cursor down to highlight **POWER ON/OFF** and press **ENT** to select. Move the cursor to “ON” and press **ENT** to start the inverter. The inverter will start up and operate normally if the start-up conditions are met. Otherwise, the inverter will go to stand-by mode.

Normally, it is not necessary to Turn OFF the inverter, but it can be shut down manually if regulation setting or maintenance is required. Move the cursor from the main operation interface to **POWER ON/OFF** and press **ENT**. Move the cursor to “OFF” and press **ENT**, and then the inverter will be shut down.

4.4.3.2 Automatic Turn ON/OFF

The inverter will start up automatically when the output voltage and power of PV arrays meet the set value, AC power grid is normal, and the ambient temperature is within allowable operating range. The inverter will be shut down automatically when the output voltage and power of PV modules are lower than the set value, the AC power grid fails, or the ambient temperature exceeds the normal range.

4.4.4 History Record

Move the cursor to **History Record** in the main menu interface. Press **ENT** to check the history information. There are 3 submenus in the **History Record** menu: **Current Error**, **Running Record** and **Fault Record**. See [Figure 4-23](#).

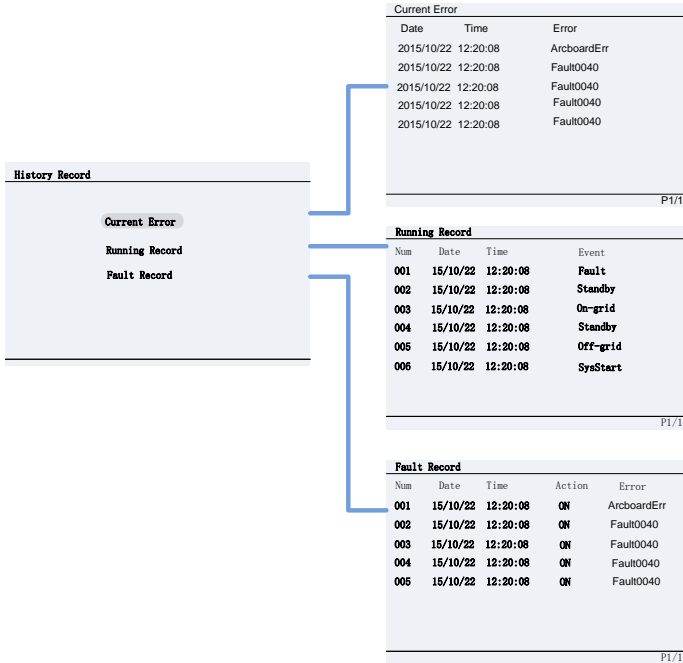


Figure 4-23 History Menu and Submenu

4.4.4.1 Current Error

This log will display any faults that are currently affecting the operation of the inverter.

4.4.4.2 Running Record

This log can store up to 100 running history messages. This includes normal operating events such as the inverter turning on, going into standby and turning off.

4.4.4.3 Fault Record

This log can store up to 100 fault codes.

4.4.5 Device Information

Press the **ESC** key to leave the main “operation interface” and press **ENT** to access the “Main Menu.” Using the arrow keys, scroll down to the submenu **Device Information** and press **ENT** to check the device information, as shown in Figure 4-24.

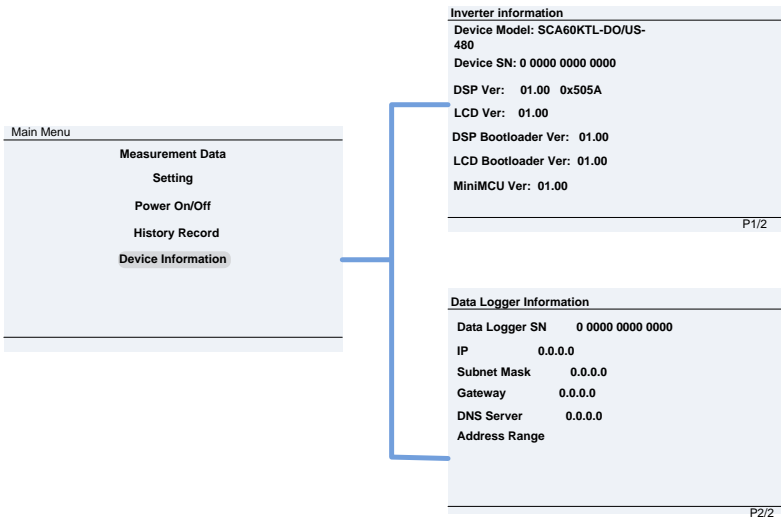


Figure 4-24 Device Information

This menu provides the information to identify the version of boards in the inverter, model number, serial number and data logger information. This information may be required when contacting CPS service.



WARNING:

Please follow the guidelines below before on-grid operation to eliminate possible dangers and to ensure safety.

5. Commissioning

Before powering up the PV system it is important to check the installation for any hazards that may be present. For convenience a commissioning checklist is included in this manual and can be found in the Appendix.

5.1 Mechanical Installation

- Make sure that the mounting bracket is secure and all screws have been tightened to the specified torque values. (Refer to 3.2 Mechanical installation)
- Confirm all knockouts are sealed and conduit is securely attached to the inverter, creating a water-tight seal.

5.2 Conductor Connections

- Make sure all conductors are connected to the right terminals and properly labeled.
- The appropriate cable management is important to avoid physical damage. No sharp edges from cable ties exist.
- Check polarity of DC input conductors. The DC Switch should be in the “OFF” position. (Refer to 3.3 Electrical installation)

5.3 Electrical Check

- Make sure that the AC circuit breaker is appropriately sized.
- Test whether the AC voltage is within the normal operating range.
- Confirm the DC open circuit voltage of input strings is less than 1000V.

5.4 Commissioning Steps

Complete the list above before commissioning the inverter as follows:

1. Turn on the AC circuit breaker.
2. Turn “ON” the external DC switch(s)/circuit breaker(s). Skip these two steps if there are no switches or circuit breakers.
3. Switch the Inverter’s DC Switch to the “ON” position. When the energy supplied by the PV array is sufficient, the LCD screen of inverter will light up. The inverter will then start up with the message “sys checking”.

When the inverter completes “**sys checking**”, the LCD will show the screen as Figure 5-1 below.



Figure 5-1 System Checking Logo

4. Setting Language. Press **ENT** to access the main menu, select **Setting** and press **ENT**. The password is “1111”, using the arrow keys enter the password and press **ENT** to access the next submenu. Select **System Parameters**, press **ENT**. Scroll to **Setting Language**, press **ENT**. Then select the desired language and press **ENT**.

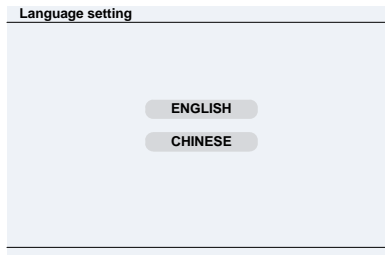


Figure 5-2 Language Setting



INSTRUCTION:

Check with your local utility company before selecting a grid standard. If the inverter is operating with a wrong grid standard, the utility company may cancel the interconnection agreement. Placing the inverter into operation before the overall system complies with the national rules and safety regulations of the application is not permitted.

5. Set the grid standard. From the previous menu press **ESC** to return to the **System Parameters** menu. If the display had been previously returned to the main menu, follow the steps in (4) to access **System Parameters** again. Select **System Parameters**, press **ENT**. Scroll to **Grid Connection Rule** and press **ENT**.

Use the arrow buttons to move up/down to the required grid standard. Press **ENT** to select the required standard.

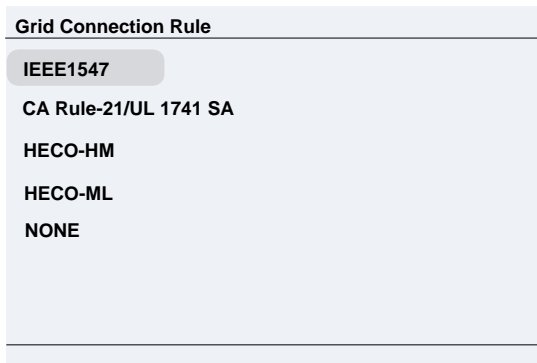


Figure 5-3 Set up Grid Standard

6. Setting the Time. From the previous menu, press **ESC** to return to the **System Parameters** menu. Select **Time** and press **ENT**. Scroll up/down to select the numerical value, then press **ENT** to go to next option. e.g.: Year to Month. Finally Press the **ENT** key to confirm the setting.

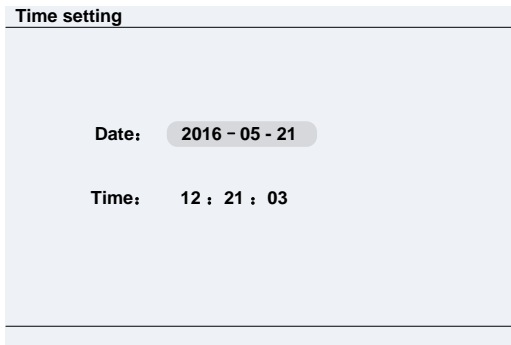


Figure 5-4 Time Setting

7. Choose PV Input working mode. The factory default working mode of the DC input connection and MPP Tracker is set for Independent. Contact CPS if parallel mode is required.

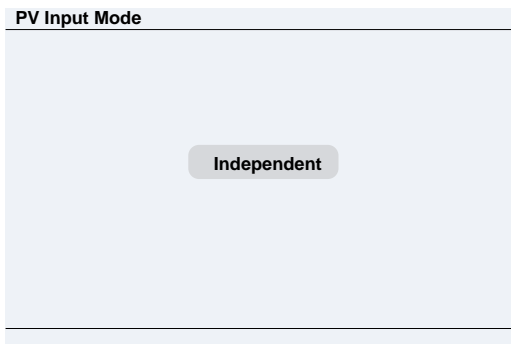


Figure 5-5 Independent mode setting

8. Neutral Line Setting. From the previous menu, press **ESC** to return to the **System Parameters** menu. Select **Neutral Line Setting** and press **ENT**. Use the arrow keys to highlight “Yes” or “No” in regard to whether a neutral conductor is present. Press **ENT**. This setting will allow the inverter to display L-N voltages on the LCD. It will not affect the operation of the inverter.

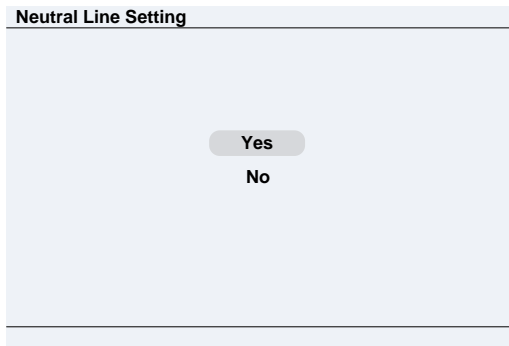


Figure 5-6 Setting the Neutral Line

9. Choosing the communication data. From the previous menu, press **ESC** to return to the **System Parameters** menu. Scroll to **Communication Setting** and press **ENT**. Select **Baud rate** and press **ENT**. The default setting is 9600. Depending on the data acquisition/SCADA system being used, the baud rate may need to be increased or decreased. Scroll up/down to select other speeds and press **ENT**.

Next, select **Address** and press **ENT**. This designates the inverter address. Each inverter within the Modbus network must have a unique address. Scroll up/down to choose an address for the inverter and press **ENT**. Addresses can be assigned from 1-128.

See [Figure 5-7](#).

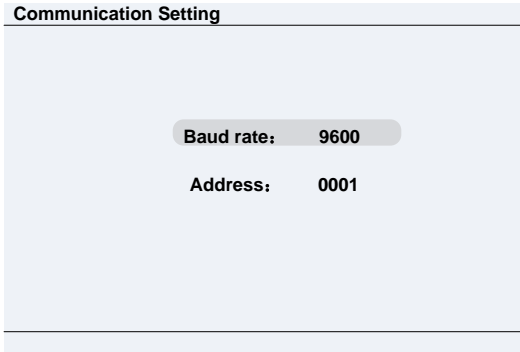


Figure 5-7 Communication Setting

10. Setting the LCD contrast grade. From the previous menu, press **ESC** to return to **System Paramters** menu. Select **LCD Contrast Setting** and press **ENT**. Using the up/down arrows increase or decrease the contrast to the desired setting. Press **ENT** to accept the changes.

11. When the LCD screen shows the normal operation status (Figure 5-8) and the "RUN" light on the LED panel is illuminated, this is an indication that the grid connection and power generation are successful.

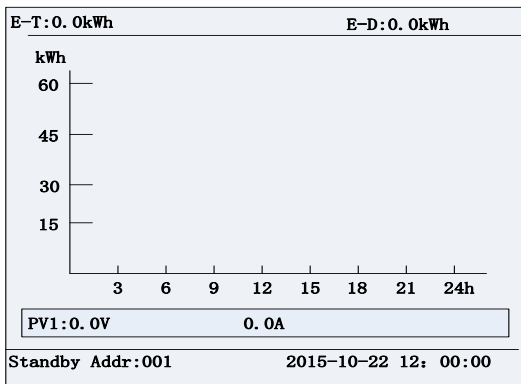


Figure 5-8 Normal Operation Status

12. If the inverter fails to operate normally, the “FAULT” light will illuminate and the fault menu will be displayed. Select **Current Error** and press **ENT** to access the current faults the inverter has recorded. This information will show on the LCD screen as shown in the Figure 5-9.

Current Error		
Date	Time	Error
2015/10/22	12:20:08	ArcboardErr
2015/10/22	12:20:08	Fault0040
2015/10/22	12:20:08	Fault0040
2015/10/22	12:20:08	Fault0040
2015/10/22	12:20:08	Fault0040

P1/1

Figure 5-9 Fault Information Interface

6 Operation

6.1 Start-Up

Automatic start-up: The inverter will start up automatically when the output voltage and power of PV arrays meet the set value, AC power grid is normal, and the ambient temperature is within allowable operating range.

Manual Power ON/OFF: Manual Power ON/OFF is required after regulation setting or manual (fault) shut-down. Press **ESC** to and **ENT** to access the Main Menu, move the cursor to “ON/OFF” and press **ENT**. Once in the “ON/OFF” submenu, move the cursor to “ON” and press **ENT** to start the inverter. Then the inverter will start up and operate normally if the start-up condition is met. Otherwise, the inverter will go to stand-by mode.

6.2 Shut-Down

Automatic shutdown: The inverter will be shut down automatically when the output voltage and power of PV modules are lower than the set value, AC power grid fails, or the ambient temperature exceeds the normal range.

Manual shutdown: Normally, it is not necessary to shutdown the inverter, but it can be shut down manually if regulation setting or maintenance is required. Press **ESC** and then **ENT** to access the Main Menu. Move the cursor to the submenu **Manual Power ON/OFF** and press **ENT**. Move the cursor to “OFF” and press **ENT**, and then the inverter will be shut down.

6.3 Operation Mode

There are 4 operation modes: **Logo/Start-up**, **Normal Operation**, **Standby** and **Fault** modes. See section 4.3 for details of these modes.

1. **Logo/Start-up** mode displays the Chint Power Systems logo when the inverter is checking if conditions are met for connection after a manual start-up of the inverter.
2. **Normal Operation** mode is the default indication interface for normal operation. In this mode, the inverter is converting the DC power from the array to AC power, feeding it continuously to the grid.
3. **Standby** mode is active when the output voltage and power of PV modules do not meet the startup conditions or PV voltage and input power are lower than the set value. The inverter will check automatically whether it meets the startup conditions in this mode until it turns back to Normal Operation mode.
4. **Fault** mode is displayed when the inverter disconnects from the grid due to a fault in the inverter or grid. Check the Fault log under **Current Errors** and reference the “Troubleshooting” table in [Chapter 8](#) to determine the cause of the error.

6.4 Grid-tied Power Generation

The CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 series inverters have an automatic grid-tied power generation process. It will check constantly whether AC power grid meets the conditions for grid-tied power generation, and test whether the PV array has adequate energy. After all conditions are met, the inverter will enter Normal Operation mode and export power to the grid. While generating power, the inverter can detect the power grid at all times, supply current, matching voltage and

frequency of the grid and keep the photovoltaic array output at the maximum power point.

In case of any abnormality, the inverter will enter the protection program immediately. In low light conditions when power generation is not enough to keep the inverter in operation, the inverter will enter standby mode. When the voltage of PV array changes, becomes stable and higher than the required start value, the inverter will attempt to start grid-tied power generation again.

6.5 Firmware Upgrade

Update the firmware by using the USB flash:

1. Prepare a USB flash drive (Capacity less than 8G) and format the drive to FAT32.
 - a. Insert the USB flash drive into a computer.
 - b. When the USB drive appears in the File Explorer Right click the drive and select “Format...”. The File system should display “FAT32” as default. If not, make this selection and click “start.”
2. Copy the LCD firmware file and the DSP firmware file into the USB flash drive. The upgrade file needs to be placed in the root directory. Contact CPS service for the latest firmware files.
3. Insert the USB flash drive into USB port on the inverter’s communications board.

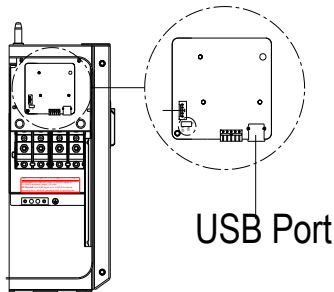


Figure 6-1 USB port for firmware upgrades

4. Using the password to enter the **Setting** menu and select **Firmware Update**. Choose the firmware to be updated (LCD or DSP) and follow the prompts on the screen. See figure 6-2.
5. When the update is successful repeat the process, if necessary, to update the next firmware (DSP or LCD). Should the update fail, return to step 4 when prompted and repeat the process.

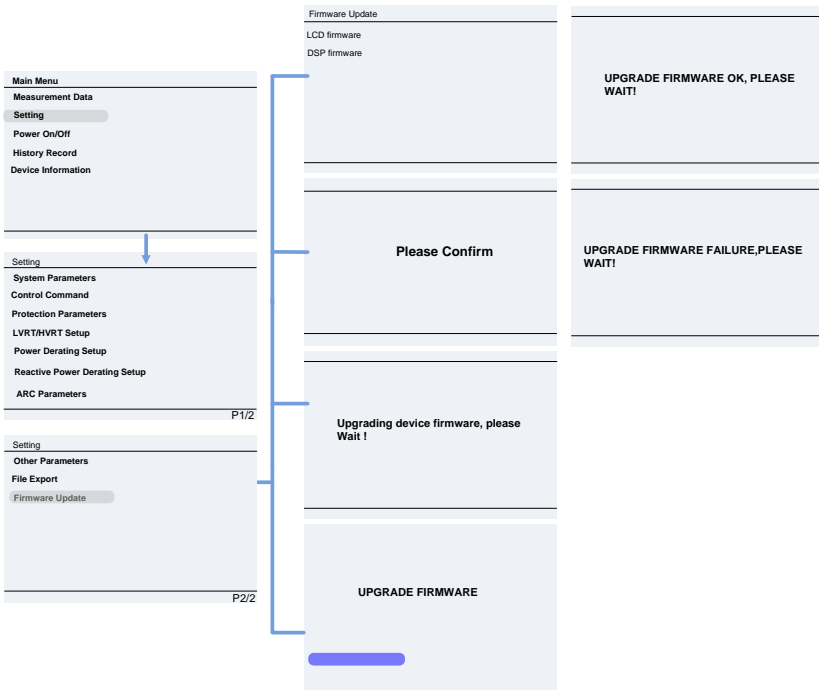


Figure 6-2 Firmware upgrade interface



WARNING:

All the installation and wiring connections should be performed by qualified technical personnel. Disconnect the inverter from PV modules and the AC supply before undertaking maintenance. Do not operate or maintain the inverter until at least 5 minutes after disconnecting all sources of DC and AC.

7 Maintenance and De-installation

This section defines the activities required to properly maintain the inverter and must be facilitated by qualified personnel, trained in the installation, de-installation and maintenance of inverters.

7.1 Product Maintenance

Maintenance is required to ensure the inverter remains in proper condition, prolonging service life and prevent potential issues.

7.1.1 Check Electrical Connections

Check all conductor connections as regular maintenance inspection every 6 months to one year, depending on the temperature changes at the installation site.

- Check the conductor/cable connections. If loose, tighten all the terminals to proper torque, referring to [3.3 Electrical Installation](#).
- Check for damage to the conductor/cable jacket. Repair or replace any damaged conductors/cables.

7.1.2 Clean the Air Vent Grate

The inverter can become hot during normal operation. It uses built in cooling fans to provide sufficient air flow and help in heat dissipation. Check the air vent grate regularly to make sure it is not blocked. Clean the grate with a soft brush or vacuum cleaner attachment if necessary. The frequency of this cleaning depends on the installation environment.

7.1.3 Replace the Cooling Fans

If the internal temperature of the inverter is too high or abnormal noise is heard, assuming the air vent is not blocked and is clean, it may be necessary to replace the external fans. Please refer to Figure 7-1 for replacing the cooling fans.

1. Use a No. 2 Phillips head screwdriver to remove the 10 screws on the fan tray (6 screws on the upper fan tray, and 4 screws on the lower fan tray).
2. Disconnect the waterproof cable connector from the cooling fan.
3. Use a No. 2 Phillips head screwdriver to remove the screws. Each fan is attached to the fan tray with 4 screws.
4. Attached the new cooling fans on the fan tray and screw into place. Fasten the cable on the fan tray with cable ties.
Torque value: 0.8-1N.m (7.1-8.91in-lbs)
5. Install the assembled fan tray back on the inverter and secure with the original screws.
Torque value: 1.2N.m (10.6in-lbs)

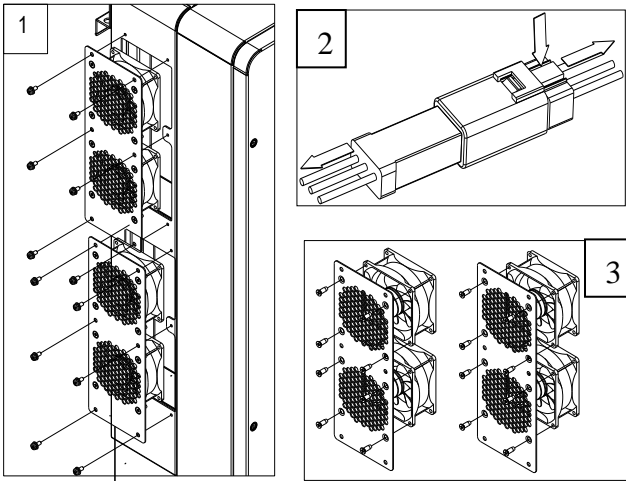


Figure 7-1 Replacing Cooling Fans

7.1.4 Replace the Inverter

Please confirm the following items before replacing the inverter:

- The AC breaker of inverter is turned off.
- The DC switch of the inverter is turned off.

Now replace the inverter according to the following steps:

1. Unlock the padlock if one is installed on the inverter.

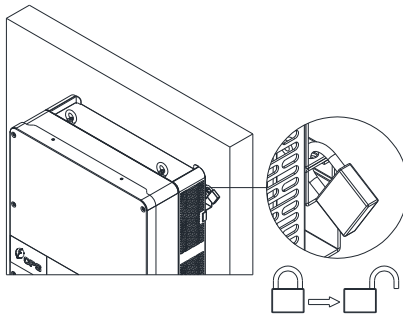


Figure 7-2 Unlock the padlock

2. Use a No. 3 Phillips head screwdriver to unscrew the 2 screws on both sides of the inverter.

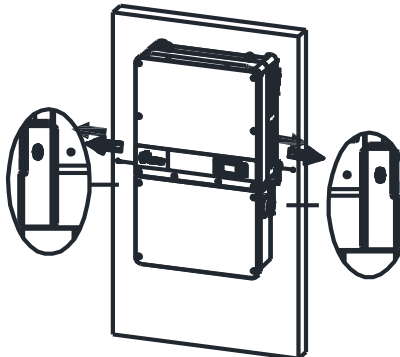


Figure 7-3 Remove the screws on both sides

3. Use a No. 10 Hex wrench to remove the 4 screws between the inverter and the wiring box. Lift the inverter enclosure and disconnect from the wiring box.

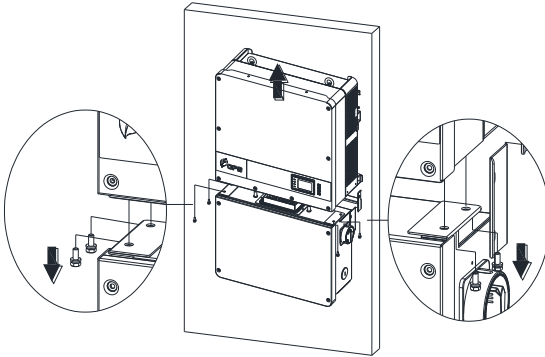


Figure 7-4 Disconnect the main housing from the wiring box

4. If the replacement inverter is on hand and to be installed immediately, skip this step and refer to section 3.2 for installation of the inverter. Otherwise, use a No. 2 Phillips head screwdriver to remove the 2 screws on the left side of the wiring box, and remove the bulkhead cover. Attach the cover on the connector of wiring box. Torque value: 1.6N.m (14.2in-lbs)

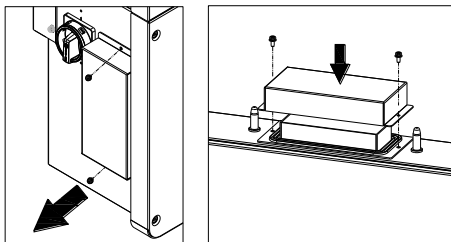


Figure 7-5 Install the cover on the connector of the wiring box



DANGER:

Please disconnect the electrical connection in strict accordance with the following steps. Otherwise, the inverter will be damaged and the service personnel's life will be endangered.

7.2 De-installing the Inverter

De-install the inverter and wire box assembly according to the following steps when the inverter needs to be removed:

1. Turn off the external AC breaker and/or system disconnect switch using lock-out/tag-out procedures.
2. Turn off the external DC breaker and/or disconnect switch, if present, and use lock-out/tag-out procedures.
3. Switch the inverter's AC disconnect switch to "OFF" position.
4. Switch the inverter's DC disconnect switch to "OFF" position.
5. **Wait for 5 minutes to ensure the internal capacitors have been completely discharged.**
6. Measure the AC output conductor terminal voltage against the ground. The meter should now read 0V.
7. Disconnect the AC and PE cables referring to "3.3.4 AC and ground connection".
8. Disconnect the DC cables referring to "3.3.3 DC connection". **Caution: if PV strings terminate directly in the wiring box and do not pass through a breaker or switch that was opened in Step 2 these strings may be energized.**
9. De-install the inverter by reversing the installation steps found in section [3.2 Mechanical installation](#).

8 Fault Shutdown and Troubleshooting

If a fault occurs within the system the inverter will recognize and report via the LED or LCD panel. If this occurs, reference the following section prior to contacting post-sales service. This will ensure the quickest time to resolution possible.

8.1 LED Fault and Troubleshooting

Please refer to the definition of LED lights in Table 4-1 and troubleshoot according to Table 8-1:

Table 8-1 Troubleshooting of LED Lights

LED fault status	Solutions
Neither the “Power” LED nor the LCD screen lights up.	<ol style="list-style-type: none"> 1. Turn off the external AC breaker 2. Switch the DC switch to “OFF” position 3. Check the PV input voltage and polarity
The “GRID” LED is blinking.	<ol style="list-style-type: none"> 1. Turn off the external AC breaker 2. Switch the DC switch to “OFF” position 3. Check whether the grid voltage is normal and whether the cable connection of AC side is correct and secure
The “RUN” LED lights off or “FAULT” LED lights up.	Refer to Table 8-2 through 8-4 for troubleshooting



DANGER:

Disconnect the inverter from AC grid and PV modules before opening the equipment. Make sure hazardous high voltage and energy inside the equipment has been discharged.

Do not operate or maintain the inverter until at least 5 minutes after disconnecting all sources of DC and AC.

8.2 LCD Fault and Troubleshooting

The inverter will shut down automatically if the PV power generation system fails, such as output short circuit, grid overvoltage/undervoltage, grid overfrequency/underfrequency, high environmental temperature or internal malfunction of the machine. The fault information will be displayed on the LCD screen. Please refer to [4.4.4 History Record](#) for detailed operation.

The causes of a fault can be identified based on the faults listed in Table 8-2 through 8-5. There are 4 types of fault: alarm, protection, warning and hardware fault. Proper analysis is recommended before contacting post-sales service to ensure your quickest time to resolution.

Table 8-2 LCD Troubleshooting WARNING

Type	Error/State	Fault Description / Instruction
Warning	Warn0030 (EepromErr)	Definition: Internal alarm Recommended solutions: 1. Observe for 5 minutes to see whether the alarm will be eliminated automatically 2. Contact post-sales service if not corrected
	Warn0050 (TempSensorErr)	Recommended solutions: 1. Observe temperature display 2. Switch off external AC disconnect, then back on to reboot the system 3. Contact post-sales service if not corrected

Table 8-3 LCD Troubleshooting ALARM

Type	Error/State	Fault Description / Instruction
Alarm	TempSensorErr	Definition: Prompt detection of abnormal temperature
		Possible causes: 1. Temperature Sensor socket connector has poor contact 2. Temperature Sensor is damaged
		Recommended solutions: 1. Observe temperature display 2. Switch off external AC disconnect, then back on to reboot the system; 3. Contact post-sales service if not corrected
	CommErr	Definition: Communication inside inverter fails
		Possible causes: Terminal block connectors of internal communication wires have poor contact
		Recommended solutions: 1. Observe for 5 minutes to see whether the alarm will be eliminated automatically 2. Switch off external AC disconnect, then back on to reboot the system 3. Contact post-sales service if not corrected
	ExtFanErr	Definition: Cooling fan failure
		Possible causes: 1. Fan is blocked 2. Fan service life has expired 3. Fan socket connector has poor contact
		Recommended solutions: 1. Observe for 5 minutes to see whether the alarm will be eliminated automatically 2. Check for foreign objects on fan blades; 3. Switch off external AC disconnect, then back on to reboot the system 4. Contact post-sales service if not corrected
		Definition: Internal alarm
	EepromErr	Possible causes: Internal memory has a problem
		Recommended solutions: 1. Observe for 5 minutes to see whether the alarm will be eliminated automatically 2. Contact post-sales service if not corrected

Table 8-4 LCD Troubleshooting PROTECTION

Type	Error/State	Fault Description / Instruction
Protection	Protect0090 (Bus over voltage)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches off. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	Protect0070 (Bus imbalance)	<ol style="list-style-type: none"> 1. Raise limit of IDC_{max} (for example, 400mA) to allow inverter more room to adjust in transient condition to cope with imbalance of impedance and voltage between Grid phases 2. If after adjustment, alarm still occurs, replace inverter
	Protect0030 (Inverter Over Current)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches off. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	GridV.OutLim	<ol style="list-style-type: none"> 1. Check the AC connections and AC voltage is within range 2. Restart the inverter again
	GridF.OutLim	<ol style="list-style-type: none"> 1. Check the AC connections and AC frequency is in range 2. Check the measured frequency value on the LCD, if within limit, restart the inverter
	Protect0020 (Grid relay error)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches off. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	TempOver (Over-temperature protection)	<ol style="list-style-type: none"> 1. Confirm the external ambient temperature is within the specified range of operating temperature 2. Check whether air inlet is blocked 3. Check whether fan is blocked 4. Check whether the location of installation is appropriate or not 5. Observe for 30 minutes and see whether the alarm will be eliminated automatically 6. Contact post-sales service if not corrected
	Protect0180 (The sampling offset of DCI)	<ol style="list-style-type: none"> 1. If the inverter can start up, then recalibrate 2. If the inverter consistently reports this alarm and can not start up, then replace inverter
	Protect0170 (DCI high)	<ol style="list-style-type: none"> 1. Raise limit of DCI_{max} (for example, 400mA) to allow inverter more room to adjust in transient condition to cope with imbalance of impedance and voltage between grid phases 2. After raising the limit, if inverter cannot clear fault, replace inverter

Table 8-4 LCD Troubleshooting PROTECTION Cont'd

Protection	TempOver (Over-temperature protection)	<ol style="list-style-type: none"> 1. Confirm the external ambient temperature is within the specified range of operating temperature 2. Check whether air inlet is blocked 3. Check whether fan is blocked 4. Check whether the location of installation is appropriate or not 5. Observe for 30 minutes and see whether the alarm will be eliminated automatically 6. Contact post-sales service if not corrected
	Protect0180 (The sampling offset of DCI)	<ol style="list-style-type: none"> 1. If the inverter can start up, then recalibrate 2. If the inverter consistently reports this alarm and can not start up, then replace inverter
	Protect0170 (DCI high)	<ol style="list-style-type: none"> 1. Raise limit of DCI_{max} (for example, 400mA) to allow inverter more room to adjust in transient condition to cope with imbalance of impedance and voltage between grid phases 2. After raising the limit, if inverter cannot clear fault, replace inverter
	IsolationErr (Insulation resistance low)	<p>Check wires of PV and ground:</p> <ol style="list-style-type: none"> 1. Turn OFF AC switch to disconnect from grid 2. Open fuse holders to isolate PV strings. Test strings with string test set. 3. Add one PV string at a time, and start up inverter to see if alarm occurs. 4. If no alarm, turn OFF AC switches to disconnect from grid and add the next string. Turn AC switch on and start up inverter again 5. Continue until you can find the string that triggers the alarm. Trace back the faulted string to find any leakage to Earth Ground 6. The parameter "ISOResist" in hidden menu can be adjusted
	GFCIErr (leakage current high)	<p>Check wires of PV and ground:</p> <ol style="list-style-type: none"> 1. Turn OFF AC switch to disconnect from grid. 2. Open fuse holders to isolate PV strings. Test strings with string test set 3. Add one PV string at a time, and start up inverter to see if alarm occurs. 3. If no alarm, turn OFF AC switches to disconnect grid, add in the next string. Start inverter again 4. Continue until the string that triggers the alarm is identified. Trace back the faulted string to find any leakage to Earth Ground

Table 8-4 LCD Troubleshooting PROTECTION Cont'd

Protection	Protect0150 (Mini MCU Fault)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	Protect0110 (BUS over voltage (firmware))	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	Protect0100 (The sensor fault of leakage current)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, contact CPS Service to replace Filt board or inverter.
	PVxReverse (PVx input reverse connection x=1,2,3)	<ol style="list-style-type: none"> 1. Turn DC Switch OFF 2. Open Fuse holders to isolate PV strings 3. Use meter to find out which PV string is connected in reverse polarity 4. Correct PV string connection
	PVx Over current (PVx Over current x=1,2,3)	<ol style="list-style-type: none"> 1. Check PV input Current 2. Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	PV2VoltOver (PVx Over Volt x=1,2,3)	<ol style="list-style-type: none"> 1. Measure voltage at DC terminals in wiring box and compare with reading in "Measurement Data" menu. PV voltage must be less than 1000V in open circuit condition 2. If display reading is not within 2% of meter reading, replace inverter 3. If display reading is within 2% of meter reading, adjust number of panel in the string.
	Protect0230 (Inverter open-loop self-test fault)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	ARC Protect	<ol style="list-style-type: none"> 1. Check logic connector to Arc board is secure. 2. Run Arc Fault Test from "Settings" Menu 3. If Alarm re-occurs, contact CPS Service to replace arc board or wiring box
	Arcboard Err	<ol style="list-style-type: none"> 1. Check logic connector to Arc board is secure 2. Run Arc Fault Test from "Settings" Menu 3. If Alarm re-occurs, contact CPS Service to replace arc board or wiring box

Table 8-5 LCD Troubleshooting FAULT

Type	Error/State	Fault Description / Instruction
Fault	Fault0020 (Bus over volt Hardware)	<ol style="list-style-type: none"> Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON If inverter cannot clear fault, replace inverter
	Fault0060 (CPLD Fault)	<ol style="list-style-type: none"> Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON If inverter cannot clear fault, replace Control Board or inverter
	Fault0080 (Bus Hardware over current fault)	<ol style="list-style-type: none"> Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON If inverter cannot clear fault, replace inverter
	Fault0090 (Dynamic leakage current high)	<p>Check wires of PV and ground:</p> <ol style="list-style-type: none"> Turn OFF AC switch to disconnect inverter from grid Open fuse holders to isolate PV strings. Test strings with meter Add one PV string and start inverter to see if alarm occurs. If no alarm, turn OFF AC switches to disconnect from grid and add in the next string. Start inverter again. Continue until the string that triggers the alarm is identified. Trace back the faulted string to find any leakage to Earth Ground.
	Fault0100 (Grid relay fault)	<ol style="list-style-type: none"> Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON If inverter cannot clear fault, replace inverter
	Fault0110 (Bus imbalance)	<ol style="list-style-type: none"> Raise limit of IDCmax (for example, 400mA) to allow inverter more room to adjust in transient condition to cope with imbalance of impedance and voltage between grid phases If after adjustment, alarm still occurs, replace inverter

Table 8-5 LCD Troubleshooting FAULT cont'd

Fault	Fault0130 (Bus over total voltage)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge between OFF and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	Fault0150 (Open-loop self-check failure)	<ol style="list-style-type: none"> 1. Restart inverter by turning both AC and DC switches OFF. Wait for 1 minute for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter

9 Accessories

The CPS SCA50KTL-DO/US-480 and SCA60KTL-DO/US-480 inverters have several optional accessories that allow the inverter to support a wide range of real world applications.

9.1 Fuse Bypass Terminals

The Fuse Bypass Terminals allow for a reduction in the number of DC homeruns by combining the PV source circuits outside of the inverter wirebox and terminating with one pair of DC inputs to each of the three MPPTs. Note that external over current protection for the PV source circuits is required outside of the inverter. The MPPT positive inputs IN1+, IN2+, and IN3+ are isolated from one another by design, although the MPPT negative inputs IN1-, IN2-, and IN3- are combined via a common bus structure.

9.1.1 Bypass Input Terminal Instructions:

1. Remove the wirebox cover ([Figure 9-1](#)).
2. Remove the plastic touch safe finger guards ([Figure 9-2](#)).
3. Use a No. 2 Phillips head screwdriver to install the Bypass Terminals on each bus by fastening each terminal with the M4 screws. Torque value of 14 in-lbs (1.6 Nm) ([Figure 9-3](#) and [Figure 9-4](#)).
4. Use a No. 10 wrench to fasten the three pairs of DC input cables to each of the Bypass Terminals at IN1+, IN2+, IN3+ ([Figure 9-3](#)) and IN1-, IN2-, IN3- ([Figure 9-4](#)) with the M6 screws. Torque value of 50 in-lbs (6.0N.m.).
5. Reinstall the plastic touch safe finger guards. Torque value #
6. Reinstall the wirebox cover. Torque to 35.4 in-lbs (4N.m).



Figure 9-1. Remove Wirebox Cover

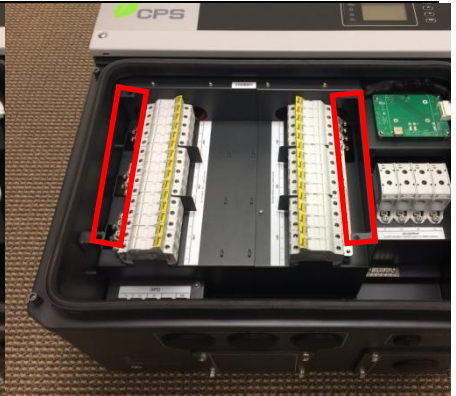


Figure 9-2. Remove Plastic Touchsafe Finger Guards

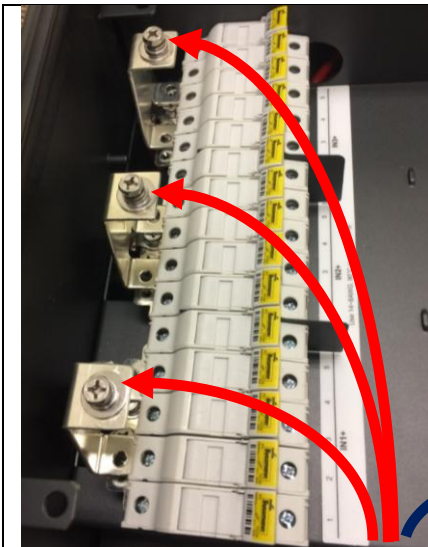


Figure 9-3. Bypass Terminals Installed on POS Input

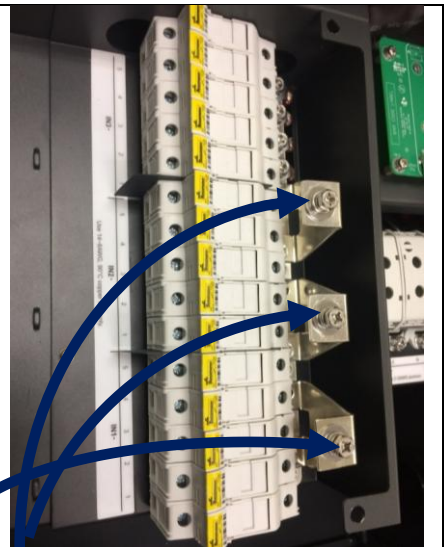


Figure 9-4. Bypass Terminals Installed on NEG Bus

9.2 Shade Cover (SSC-60ST)

9.2.1 Protection from Harsh Conditions

Shade covers provide added protection for inverters against harsh environmental conditions like direct sunlight, snow, sleet, ice, hail, and reduce soiling from dust and birds. **When installing the inverter at tilts of 75° or less from horizontal the shade cover is required.**

Protect your inverter for many years.

9.2.2 Increased Energy Production

Depending on the application and environment, shade covers will help to increase energy production by reducing potential power derating due to excessive ambient temperatures. Inverters derate in extreme temperatures to protect themselves from over temperature conditions. Field testing at PVEL showed up to 15% reduction in operating temperatures of inverters with shade covers installed in direct sunlight. This report can be found on the CPS America website under application notes.

<https://www.chintpowersystems.com/downloads/application-notes/PV-EL-Field-Testing-Report-28kW-Inveter-Shade-Plate.pdf>

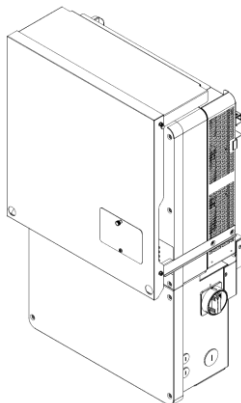


Figure 9-5 Shade Cover installed on CPS 50/60kW inverter

10 Technical Data

10.1 Datasheet

Model Name	CPS SCA50KTL-DO/US-480	CPS SCA60KTL-DO/US-480
DC Input		
Max. PV Power	75kW (30kW per MPPT)	90kW (33kW per MPPT)
Max. DC Input Voltage	1000V _{DC}	
Operating DC Input Voltage Range	200-950V _{DC}	
Start-up DC Input Voltage / Power	330V / 80W	
Number of MPP Trackers	3	
MPPT Voltage Range	480-850V _{DC}	540-850V _{DC}
Max. PV Short-Circuit Current (I _{sc} x 1.25)	204A (68A per MPPT)	
Number of DC Inputs	15 inputs, 5 per MPPT	
DC Disconnection Type	Load rated DC switch	
DC Surge Protection	Type II MOV, 2800V _C , 20kA I _{TM} (8/20μS)	
AC Output		
Rated AC Output Power	50kW	60kW
Max. AC Apparent Power	55kVA	66kVA
Rated Output Voltage	480V _{AC}	
Output Voltage Range ¹	422-528V _{AC}	
Grid Connection Type	3Φ/PE/N (Neutral optional)	
Max. AC Output Current @480V _{AC}	66.2A	79.4A
Max AC OCPD Rating	110A	125A
Rated Output Frequency	60Hz	
Output Frequency Range ¹	57-63Hz	
Power Factor	>0.99 (±0.8 adjustable)	
Current THD	<3%	
Max. Fault Current Contribution (1 Cycle RMS)	64.1A	
AC Disconnection Type	Load rated AC switch	
AC Surge Protection	Type II MOV, 1240V _C , 15kA I _{TM} (8/20μS)	

1) The "Output Voltage Range" and "Output Frequency Range" may differ according to the specific grid standard.

System	
Topology	Transformerless
Max. Efficiency	98.8%
CEC Efficiency	98.5%
Stand-by / Night Consumption	<1W
Environment	
Enclosure Protection Degree	NEMA 4X
Cooling Method	Variable speed cooling fans
Operating Temperature Range	-22°F to +140°F / - 30°C to +60°C (derating from +113°F / +45°C)
Non-Operating Temperature Range ²	No low temp minimum to +158°F / +70°C maximum
Operating Humidity	0-95%, non-condensing
Operating Altitude	13,123.4ft / 4000m (derating from 9842.5ft / 3000m)
Audible Noise Emission	<60dBA @ 1m and 25°C
Display and Communication	
User Interface and Display	LCD + LED
Inverter Monitoring	Modbus RS485
Site Level Monitoring	CPS Flex Gateway (1 per 32 inverters)
Modbus Data Mapping	CPS
Remote Diagnostics / FW Upgrade Functions	Standard / with Flex Gateway
Mechanical Data	
Dimensions (WxHxD)	39.4 x 23.6 x 10.24 in. (600x1000x260mm)
Weight	Inverter:123.5lbs/56kg; Wirebox:33lbs/15kg
Mounting / Installation Angle ³	0 to 90 degrees from horizontal (vertical, angled, or lay flat)
AC Termination	M8 Stud Type Terminal Block (Wire range: #6 - 3/0AWG CU/AL) Lugs not supplied
DC Termination	Screw Clamp Fuse Holder (Wire range: #14 - #6AWG CU), Optional H4 (Amphenol)
Fused String Inputs (5 per MPPT)	15A standard fuse value (Fuse values up to 30A acceptable)
Safety	
PV Arc-Fault Circuit Protection	Type 1
Safety and EMC Standard	UL1741-2010, UL1741SA-2016, UL1699B, CSA-C22.2 NO.107.1-01, IEEE1547; FCC PART15
Grid Standard and SRD	IEEE1547a-2014, Rule 21
Smart-Grid Features	Voltage-RideThru, Frequency-RideThru, Soft-Start, Volt-Var, Frequency-Watt, Volt-Watt

2) See Chapter 3.1 for further requirements regarding non-operating conditions.

3) See Chapter 3.2 for Shade Cover accessory requirement for installation angles of 75 degrees or less.

10.2 Measurement Tolerances

The data supplied by the inverter may differ from measurements taken by certified measuring instruments (e.g. output meters, multimeters and grid analysers). The inverter is not a measuring instrument and has wider tolerances for the measurements it makes.

The inverter tolerances are generally:

- $\pm 5\%$ for real-time measurements with output power below 20% nominal power
- $\pm 3\%$ for real-time measurements with output power above 20% nominal power
- $\pm 4\%$ for all statistical data

CPS inverter tolerances are specified below:

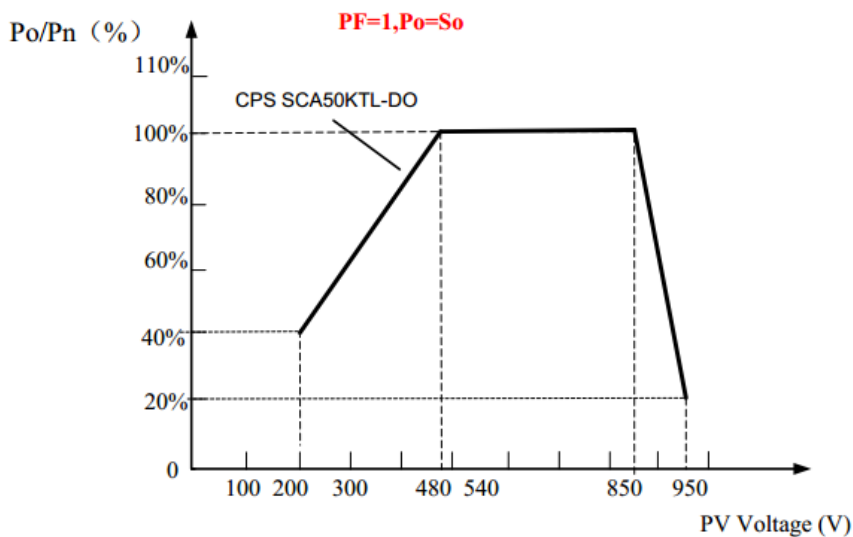
- Voltage tolerances: $\pm 1\%$
- Current tolerances: $\pm 2\%$
- Frequency tolerances: $\pm 0.5\%$
- Power tolerances: $\pm 3\%$
- Time tolerances: $\pm 1\%$
- Temperature tolerances: $\pm 1\%$

10.3 Production Graphs

The following sections illustrate the inverter production/derating in terms of DC voltage, ambient temperature, altitude and grid voltage.

10.3.1 Input Voltage Derating Graph

When the DC input voltage is lower than $480/540V_{DC}$ or higher than $850V_{DC}$, the inverter begins derating, as shown in Figure 10-1 and 10-2:



CPS SCA50KTL-DO/US

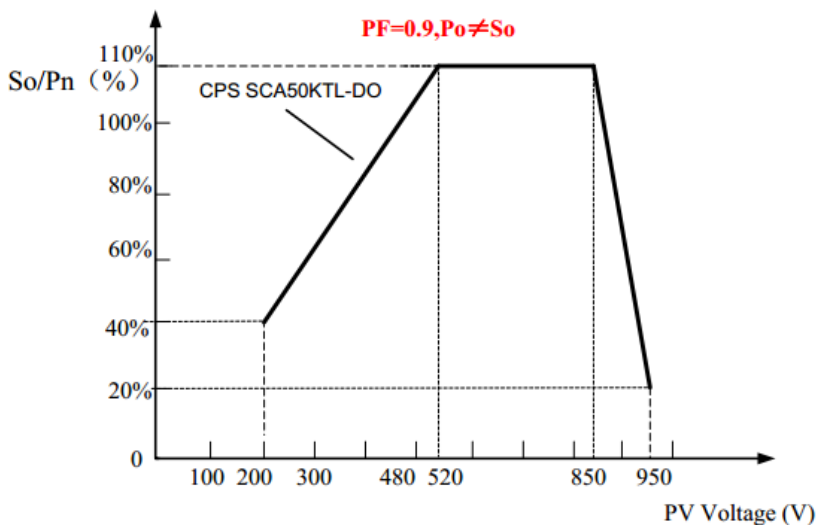
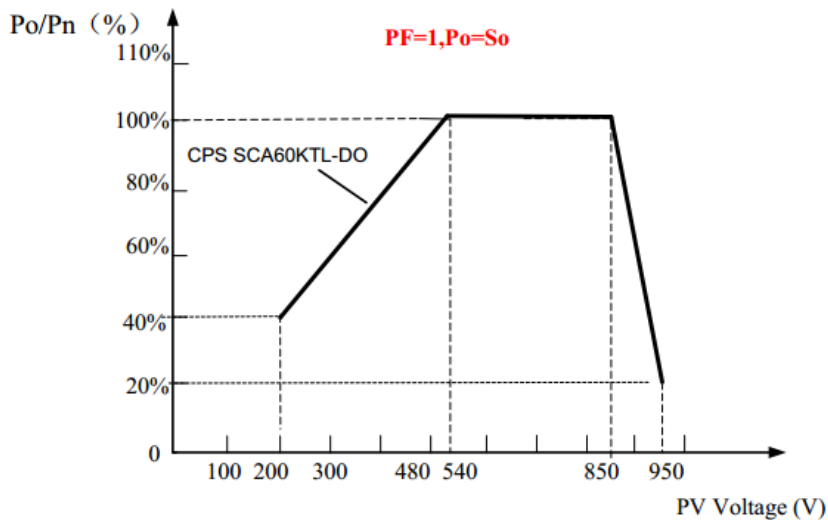


Figure 10-1 CPS SCA50KTL kW and kVA derating curves of PV input voltage



CPS SCA60KTL-DO/US

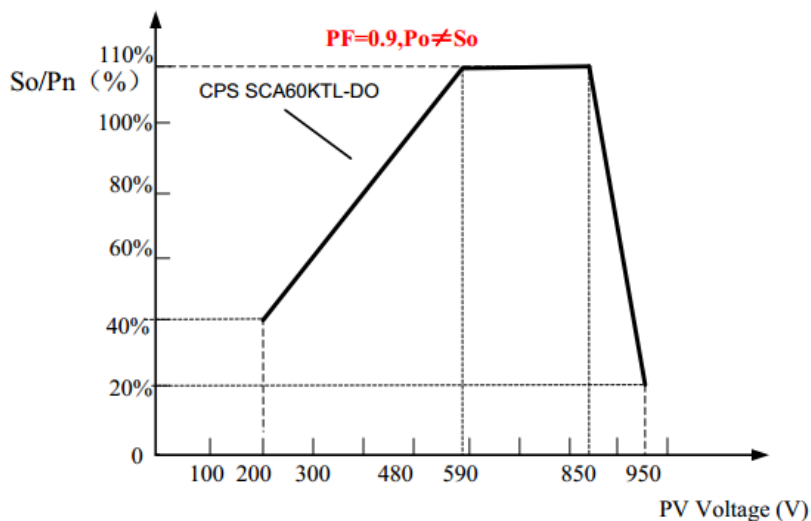


Figure 10-2 CPS SCA60KTL kW and kVA derating curves of PV input voltage

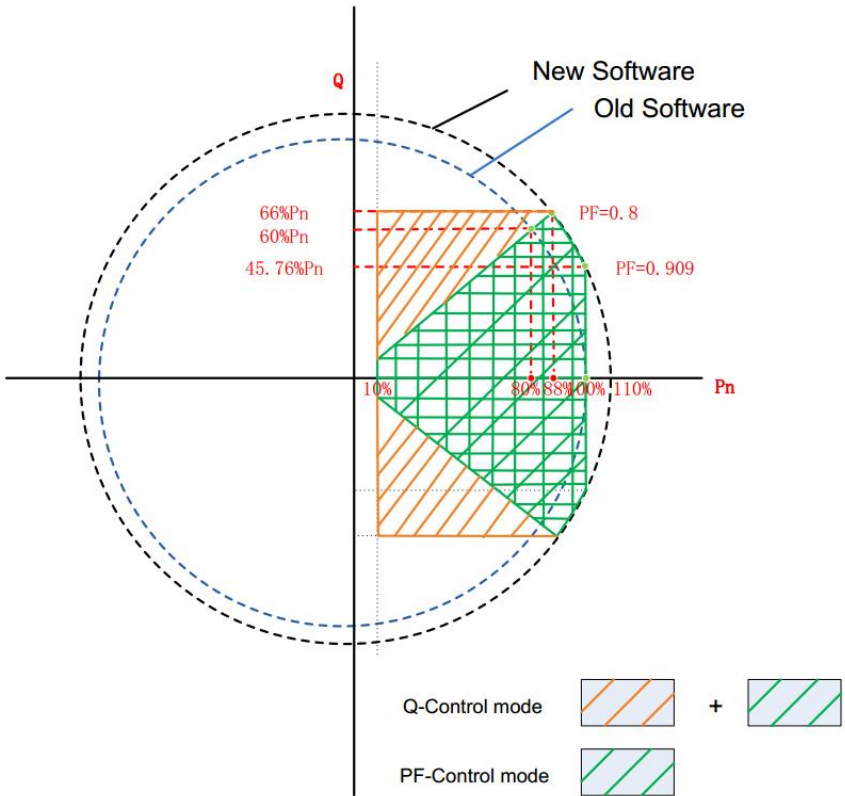


Figure 10-2 CPS SCA60KTL Reactive Power Capability

10.3.2 High Temperature Derating Graph

When the ambient temperature is higher than 113°F (45°C), the inverter output power (P_n) will begin to derate, as shown in Figure 10-2:

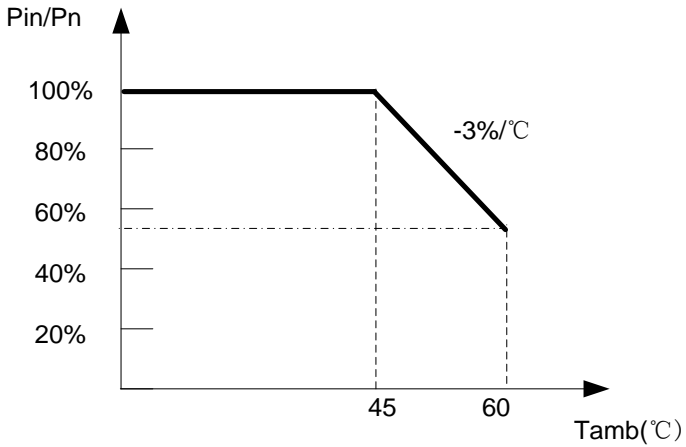


Figure 10-4 SCA50/60KTL Derating Curve with High Temperature

10.3.3 Altitude Derating Graph

When the altitude is higher than 9842.5ft (3000m), the rated output power (P_n) of the inverter will decrease, as shown in Figure 10-3:

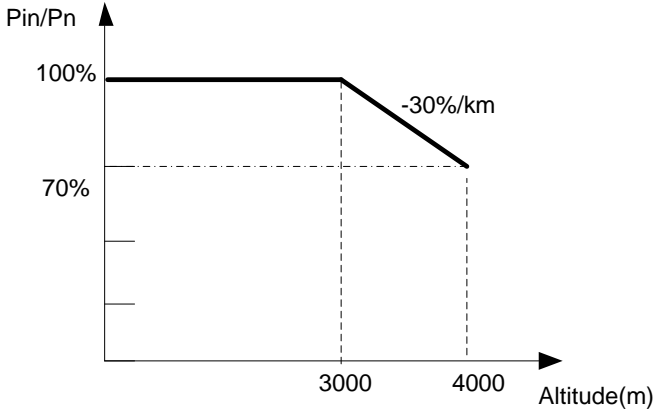


Figure 10-3 SCA50/60KTL Derating Curve with High Altitude

10.3.4 Grid Voltage Derating Graph

When the grid voltage is within 100%~110% ($U_n \sim 1.1 * U_n$) of the Rated Output Voltage, the inverter output power (P_n) may reach 100%. When the grid voltage is lower than the Rated Output Voltage, the inverter will limit the AC Output Current and the output power (P_n) will begin to derate, as shown in Figure 10-4.

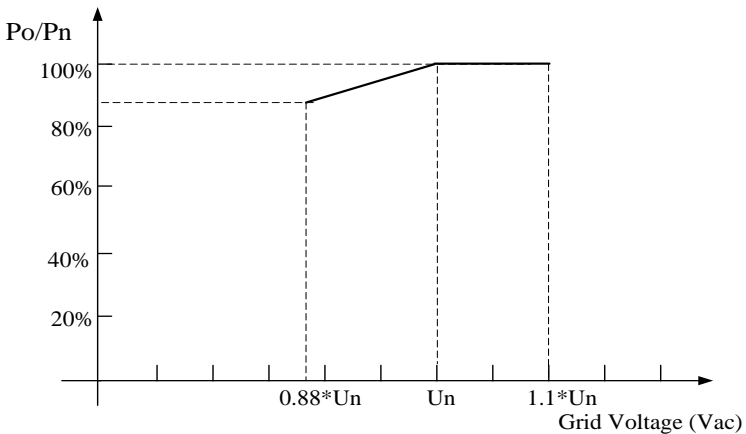


Figure 10-4 SCA50/60KTL Derating Curve of Grid Voltage

11 Limited Warranty

The warranty policy of this product is specified in the contract; otherwise, the standard warranty is 10 years.

For service, Chint Power Systems America will provide local support. For Warranty terms, please refer to the CPS America standard warranty policy in place at time of purchase.

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