CPS SCA Series Grid-tied PV Inverter

CPS SCA36KTL-DO/US-480
CPS SCA50KTL-DO/US-480
CPS SCA60KTL-DO/US-480

Installation and Operation Manual - Rev 4.0

CHINT POWER SYSTEMS AMERICA CO.

Revision 4.0 – June 2023

Revision History			
Rev.	**Chap/Sec**	**Description**	**Date**
1.0	N/A	• Initial Release	Aug 2016
2.0	3	• H4 Wirebox, Operating Mode	Sep 2016
2.1	3	• H4 Termination, AC Terminal	Feb 2017
2.2	3, 5, 7, 8	• AC Terminal, Parameters, • Troubleshooting, Accessories	Sept 2017
3.0	3, 5, 6, 10	• Increased kVA Ratings	Feb 2018
3.1	3 5 3.3 9.3	• Allow MPPT to be Unbalanced • Increased RS485 3pin Terminal • LCD interface • Parameters • Y-Comb Terminal	Mar 2019
3.2	2, 3	• Added Rapid Shutdown Wirebox • Removed H4 Wirebox • Added water tight design/installation requirements	Oct 2019
3.3	1 3.3.1 3.3.3.2 6.2.3	• DC Switch Fault Procedure • Wiring box bottom gland plate. • Factory installed fuse values • ISO-NE Protection Settings	Sept 2020
3.4	2.11 3.3.3.2	• Added RSD PVRSS Table • PV Fuse replacement • clarification	Jan 2021

3.5	2.2 2.4 2.11 3.3.3.5 3.5 6.2 10	• Updated Tigo and APS types; • Added CPS SCA36KTL-DO/US-480; • Updated register parameters • Updated datasheet • Added Tigo RSS Transmitter	August, 2022
3.6	3.3.3.1 3.3.3.5	• Changed DC Input Specifications • Deleted the specific DC Connection for 36kw wirebox	Feb., 2023
3.7	2.4 3.2.3 10	• Updated smart functions • Changed baffle spacing values • Updated datasheet	Apr., 2023
3.8	2.5 3.3	• Updated pictures	Apr., 2023
3.9	10	• Changed Max PV Power per MPPT	May, 2023
4.0		• Updated RSD information	June, 2023

Table of Contents

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 SCA36KTL-DO/US-480, 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 1 “Overview”, 4 “User Interface”, 6 “Main Menu and Operation”, 7 “Fault Shutdown and Troubleshooting”, and 9 "Accessories" is intended for the owner and operator of the inverter, and does not require any special training or qualifications. The information in Chapters 0 “Installation”, 5 "Commissioning", 8 “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 1000VDC).
- 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 SCA36KTL-DO/US-480, CPS SCA50KTL-DO/US-480 or CPS SCA60KTL- DO/US-480 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 SCA36KTL-DO/US-480, 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.

Failure to follow these instructions and other relevant safety procedures may result in voiding of the product warranty and/or damage to the inverter or other property.

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.

Warnings and Markings on the product

	**CAUTION:** Risk of electric shock from energy stored in capacitor. Do not remove cover until 5 minutes after disconnecting all sources of supply. **CAUTION:** Risk of electric shock, do not remove cover. No user serviceable parts inside. Refer servicing to qualified service personnel. **WARNING:** Electric shock hazard. The DC conductors of this photovoltaic system are ungrounded and may be energized. **CAUTION:** Risk of Electric Shock. a) Both ac and dc voltage sources are terminated inside this equipment. Each circuit must be individually disconnected before servicing. b) When the photovoltaic array is exposed to light, it supplies a dc voltage to this equipment. **WARNING:** Electric Shock Hazard. The DC conductors of this photovoltaic system are normally ungrounded but will become intermittently grounded without indication when the inverter measures the PV array isolation.
	**CAUTION:** Hot surfaces. To reduce the risk of burns. Do not touch.

Warnings and Markings on the product (cont'd)

	**WARNING:** For continued protection against risk of fire, replace only with same type and ratings of fuse.
	**WARNING:** HAZARDOUS VOLTAGE AREA UNDER THE PLASTIC COVER. DO NOT OPEN FUSE HOLDERS UNDER LOAD! PERSONAL PROTECTIVE EQUIPMENT MUST BE USED/WORN BEFORE ACCESSING FUSES! DO NOT OPEN FUSE HOLDERS IF BYPASS TERMINALS ARE INSTALLED!
	**WARNING:** High touch current. Earth connection essential before connecting supply.
	**INFORMATION:** For more details please see the user manual.

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:

The main enclosure of CPS SCA36/50/60KTL-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.

WARNING:

WARNING: The DC Switch is rated to break loads under normal operating conditions. However, a DC short circuit could be hazardous, and the following procedures should be followed before turning OFF the DC Switch under fault conditions.

If there is a fault and it is safe to access the inverter:

1. Read/record the fault code(s) displayed on the LCD interface.
2. Turn OFF the inverter via the LCD/Keypad or Remote access.
3. Turn OFF the AC feed breaker.
4. Turn OFF the AC Switch.
5. If possible, read the DC MPPT currents displayed on the LCD interface:
    a. If the MPPT current is <30A or the irradiation is obviously low, turn OFF the DC switch.
    b. If it is safe to open the wire-box, proceed with troubleshooting procedures listed in Table 7-1. Make sure appropriate safety precautions and PPE are used.
6. If it is not possible to read the DC MPPT currents through the LCD interface, and no fire, smoke, or voltage (AC or DC) to ground is present in the enclosure:
    a. Follow general safety practices including PPE to open the wire-box.
    b. Measure the DC current on each string. If zero, open the fuse holder for each string reading approximately zero amps.
    c. If the DC current is >0.25A, do not open the fuse holder.
    d. When all possible fuses are open, measure the total MPPT current. If it is <30A, turn OFF the DC switch.
    e. If turning OFF the DC switch causes smoke, then (if safe) turn the DC switch back ON and wait until low irradiation ~30min prior to sunset to continue troubleshooting.

If there is a fault and it is unsafe to access the inverter:

1. Notify someone else. Initiate emergency mitigation plan if necessary. a. If smoke or fire exists, procure a fire extinguisher.
2. If a fire has escaped the inverter enclosure – notify 911 immediately!
3. Turn OFF the AC feed breaker as soon as possible/safe.
4. If safe but conditions are deteriorating, consider:
    a. Using the fire extinguisher.
    b. Cutting the string conductors – one cable at a time with insulated cutters (while wearing appropriate PPE).
5. Monitor conditions until low irradiation ~30min prior to sunset. If safe, turn OFF AC and DC switches on the inverter and proceed with normal troubleshooting procedures listed in Table 7-1.

2 Overview

INSTRUCTION:

The contents of following sections are applicable to all the CPS SCA36/50/60KTL-DO/US-480 3-Phase transformerless string inverters.

2.1 Inverter for grid-tied PV systems

CPS SCA36/50/60KTL-DO/US-480 3-Phase transformerless string inverters are designed for use with an UNGROUNDED PV 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.

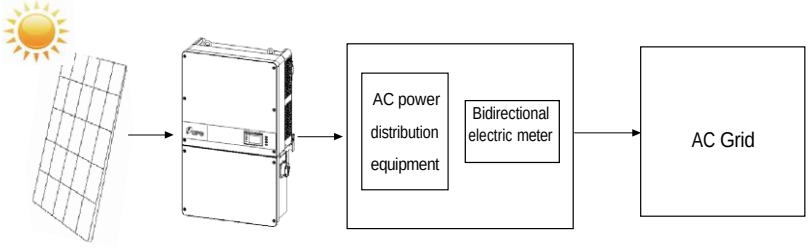


Figure 2-1: Grid-tied PV System

2.2 Product Features

- **High Conversion Efficiency:** Advanced 3-level conversion topology with Space-Vector PWM; Max. efficiency: 98.8%.
- **Grid Adaptability:** Selectable grid standards: IEEE 1547-2018, ISO-NE, CA Rule 21, and HECO; Reactive Power; >0.99 PF (±0.8 adjustable), Selectable Apparent Power rating of 50/60kW models enables 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 via FlexOM gateway card to ensure compatibility with 3rd party monitoring and control systems. The FlexOM gateway card enables further command/control as well as remote firmware upgrades. (FlexOM gateway card is optional accessory. Refer to FlexOM gateway card manual for further detailed information.)
- **Wide DC input voltage range:** Operating DC Input Voltage Range: 200-950VDC; Max DC input voltage: 1000VDC.
- **Long Service Life:** Uses thin-film and electrolytic capacitors to extend inverter's service life.
- **3 MPPTs:** Multi-channel MPPT (Maximum Power Point Tracker) enables 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 Rapid Shutdown (RSD) wireboxes with integrated PLC transmitters for use with APS RSD-S-PLC/RSD-D products.

- **High Protection Degree:** Powder coated aluminum NEMA 4X enclosure meets the demanding needs of both indoor and outdoor use.
- **Intelligent Integration:** Integrated 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. The rapid shutdown version wireboxes have integrated the rapid shutdown PLC transmitter, requiring no field wiring, and eliminated the negative DC fuses in accordance with the 2017/2020 National Electric Code.

2.3 Product Protection and Functions

- ✓ AC output voltage and frequency monitoring
- ✓ Anti-islanding detection with bi-directional frequency perturbation
- ✓ DC input and AC output over-voltage protection
- ✓ DC input and AC output over-current protection
- ✓ DC input insulation to ground monitoring
- ✓ DC injection of AC output
- ✓ DC Arc-fault detection and circuit interruption
- ✓ Leakage current to ground monitoring
- ✓ Internal enclosure temperature monitoring
- ✓ IGBT power module temperature monitoring
- ✓ KVA overhead to enable full rated Active Power from unity PF to 0.91 PF (Only for SCA50/60KTL)
- ✓ Load rejection over voltage (LROV) protection
- ✓ No neutral connection required - delta connection permitted with external AC GFCI
- ✓ PVRSS certified rapid shutdown compliant to 2017/2020 NEC (with RSD version wireboxes only).

2.4 Smart Inverter Functions:

The CPS SCA36/50/60KTL-DO/US-480 3-Phase String Inverters employ Smart Inverter (Grid Support) Functions in compliance with UL1741, SA8-SA18 and UL1741-SB standards. The default activation status is indicated below.

Smart Inverter Function	IEEE1547-2018	Rule 21	ISO-NE
Anti-islanding	Enabled	Enabled	Enabled
Low/High Voltage Ride-Through	Enabled	Enabled	Enabled
Low/High Frequency Ride-Through	Enabled	Enabled	Enabled
Dynamic Volt/VAR Operation	Enabled	Enabled	Disabled
Ramp Rate	Enabled	Enabled	Enabled
Fixed Power Factor	Enabled	Disabled	Disabled
Reconnect by “Soft-Start”	Enabled	Enabled	Enabled
Frequency-Watt	Disabled	Enabled	Disabled
Volt/Watt	Enabled	Enabled	Disabled

2.5 Appearance and Main Item Description

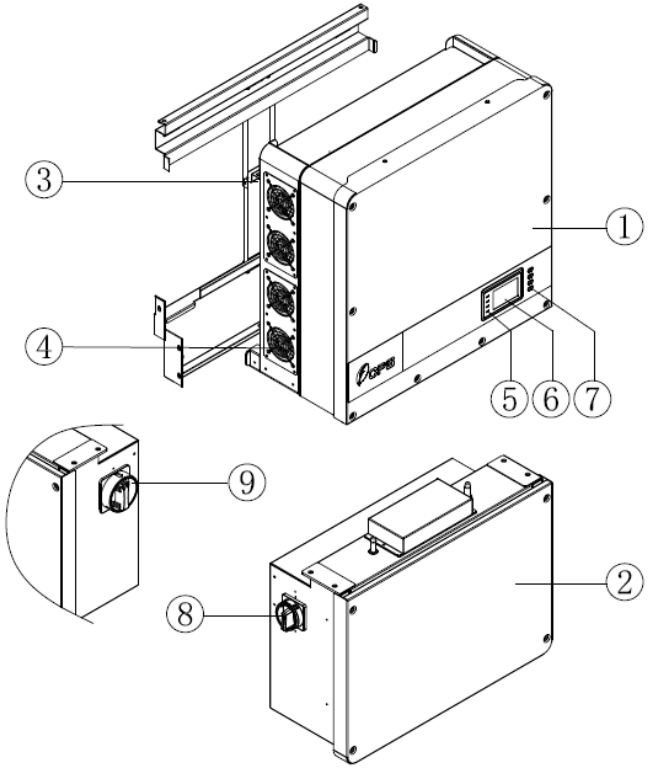


Figure 2-2 Diagram of the Inverter Assembly

Main Items of the Inverter:

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

2.6 Schematic Diagram and Circuit Design

The basic electrical schematic diagram of the CPS SCA36/50/60KTL-DO/US-480 3-Phase String Inverters are shown in Figure 2-3 and Figure 2-4. 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.

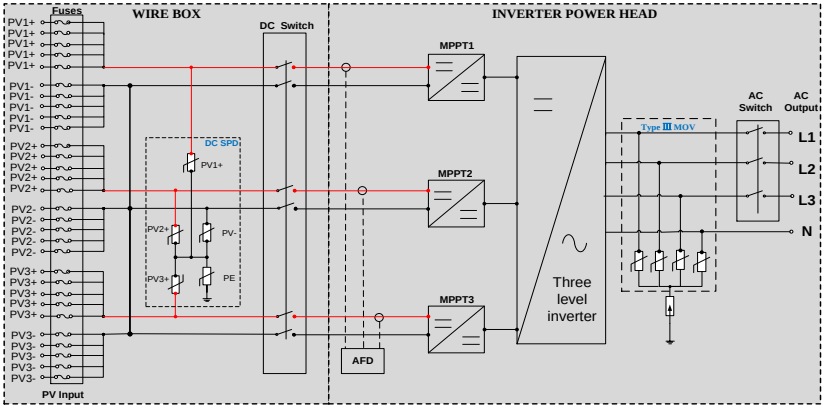


Figure 2-3 CPS SCA36/50/60KTL-DO/US-480 Inverter Schematic, Standard Wirebox

The Rapid Shutdown wireboxes have been designed specifically for 2017/2020 NEC Rapid Shutdown applications. These wireboxes include a powerline communications transmitter for use with APS RSD-S-PLC/RSD-D products. The integrated PLC transmitter is powered by AC at the inverter output.

This PLC transmitter sends a “keep alive” signal to the MLPE mounted/integrated at each PV module within the array. When the inverter senses the loss of AC voltage by way of opening the PV system disconnect switch, inverter circuit breaker or under loss of grid events, the transmitter ceases sending signal, and the MLPE devices go into rapid shutdown. This rapid shutdown system has been tested and certified with APS RSD-S-PLC/RSD-D products to meet NEC 2017/2020 rapid shutdown requirements.

The negative fuses have been removed from this model in accordance with NEC 2017/2020 690.9(C).

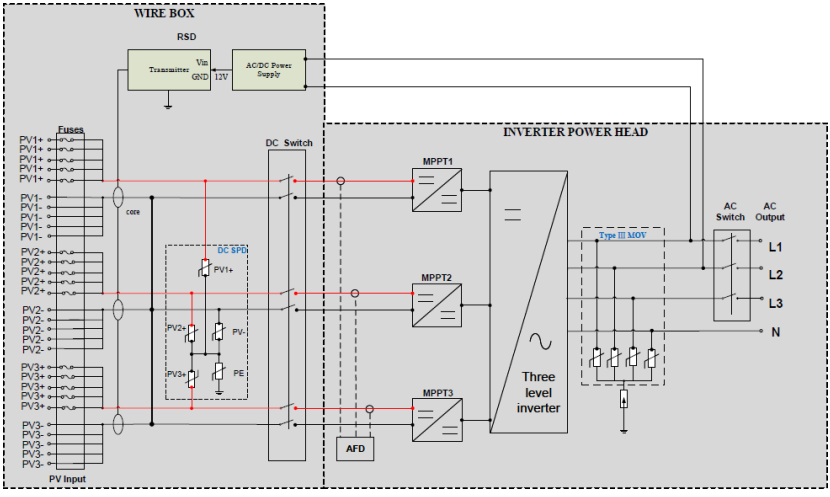


Figure 2-4 CPS SCA36/50/60KTL-DO/US-480 Inverter Schematic, RSD Wirebox

2.7 Anti-Islanding Detection

The CPS SCA36/50/60KTL-DO/US-480 3-Phase String 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.

2.8 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.

2.9 Surge Suppression

Table 2-1 Standard Waveform Peak Values

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

- "Standard 1.2/50 μs - 8/20 us Combination Wave"
- "Standard 0.5 μs - 100 kHz Ring Wave"

2.10 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.

2.11 Module-Level Rapid Shutdown

The RSD version of the inverter wirebox includes a Sunspec powerline communication transmitter for use with following rapid shutdown listed below.
The Standard version of the inverter wirebox is also compatible with a Sunspec powerline communication transmitter mounted in an external enclosure when used with the compatible rapid shutdown devices.
The SCA36/50/60KTL-DO/US-480 inverters are PVRSS (PV Rapid Shutdown System) certified to perform module-level rapid shutdown when used with APS RSD-S-PLC/RSD-D products.

When the inverter is connected to the AC voltage source (grid) the powerline communication (PLC) transmitter integrated within the RSD wirebox receives power via an internal power supply. Once the transmitter is powered it will send a “keep alive” signal on the PV string wiring to the MLPE mounted or integrated at each PV module within the array.

Opening the PV system AC disconnect or AC circuit breaker initiates Rapid Shutdown: The AC conductors become de-energized, the inverter will detect the loss of AC voltage and cease operation, and the integrated transmitter will lose its power source and cease sending the “keep alive” signal.

When the PLC transmitter is mounted in an external enclosure and used with the Standard wirebox, a dedicated power supply for the transmitter and common RSD Initiation device (e.g., AC disconnect) with the inverter must be used. **Please refer to the MLPE device user manual for installation and operation requirements.**

3 Installation

INSTRUCTION:

The contents of the following sections are applicable to all the CPS SCA36/50/60KTL-DO/US-480 3-Phase transformerless string inverters. Their mounting procedures are the very same, electrical connection methods are almost the same, the different points will be introduced separately.

This chapter describes the planning and installation procedures for the CPS SCA36/50/60KTL-DO/US-480 3-Phase String 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 (Standard or RSD version)	1	Standard Wire-box includes fuses on both PV string polarity. RSD Wire-box includes fuses on the positive PV string polarity only.	B
(3)	Mounting bracket	1	Bracket upon which the PV inverter is hung and mounted	B
(4)	Quick Guide	1	PV inverter quick install guide	B
(5)	Accessory kit	1	Kit contains all necessary hardware and accessories for installation	B

Table 3-2 Accessory Kit

No.	Item	Q'ty	Note
(1)	M6 X18mm Phillips screw	12	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, 1 spare
(2)	5-pin PCB connector plug	1	For the RS485 communication (Input)
(3)	3-pin PCB connector plug	1	For the RS485 communication (Output)
(4)	M8 Nut	4	For the AC terminal block
(5)	M8 Flat washer	4	For the AC terminal block
(6)	M8 Spring washer	4	For the AC terminal block
(7)	Phillips screw	1	Spare (for wire-box cover)

INSTRUCTION:

Additional accessories for the CPS 36/50/60kW inverters are available and can be purchased separately.

3.1 Recommendations Before Installation

See Chapter 10, Technical Data for specification ranges and limits.

NOTICE: DESIGN AND INSTALLATION RECOMMENDATIONS

Maintaining NEMA4X Rating is essential to assure safe operation of the inverter. Water ingress is likely to cause a failure that could result in an unsafe condition. The following are recommended.

- ✓ Addition of weep holes or any other hole will void the warranty.
- ✓ For earlier wire box models with gland plate – the conduit connections must be strain relieved to ensure the plate to gasket interface is water-tight. Water-tight metal flex conduit is one method.
- ✓ All conduit entries must be metallic to prevent propagation.
- ✓ All conduit entries must be sealed to prevent moisture ingress.
    - o Sealing conduits at the other end will provide additional protection – firestop putty may be used.

NOTICE: The allowable ambient temperature ranges for the CPS SCA36/50/60KTL-DO/US-480 3-Phase String Inverters are 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).

Bulk head connector cover does not provide a water-tight seal.

PRE-INSTALLATION CHECKLIST

- ✓ 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.

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.

Bulk head connector cover does not provide a water-tight seal.

CPS hotline: 855-584-7168

3.2 Mechanical Installation

3.2.1 Dimensions

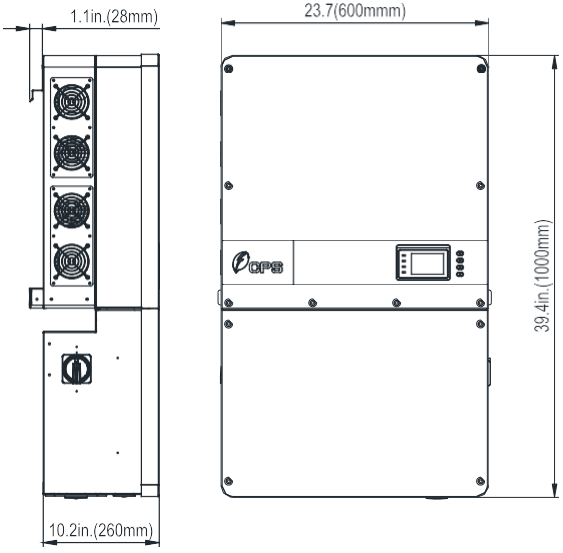


Figure 3-1 Dimensions of Inverter

3.2.2 Installation Method

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

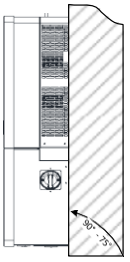
(a) If the location permits, install the inverter mounted vertically.

(b) If the inverter cannot be mounted vertically, it may be tilted backward at any angle from vertical to 15° from horizontal.

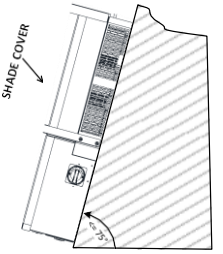
(c) When tilted backward at ≤75° from horizontal in an outdoor environment, the CPS Shade Cover (SSC-60ST) accessory is required to be installed. See Section 9.2 for more information.

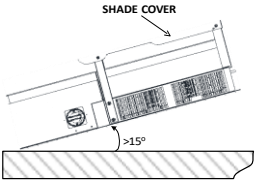
(d) Do not mount the inverter leaning forward.

(e) Do not mount the inverter upside down.

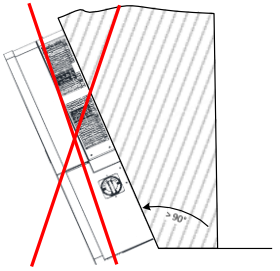


a.) **NO** SHADE COVER REQUIRED

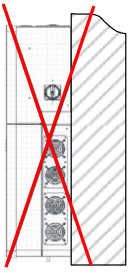




b.) SHADE COVER REQUIRED



c.) **NOT** > 90° TILTED FORWARD



d.) **NOT** UPSIDE DOWN

Figure 3-2 Inverter Mounting Options

3.2.3 Installation Space Requirement

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

NOTICE:

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

NOTICE:

The spacing between two adjacently mounted inverters must be ≥19.7in (500mm). Spacing should be increased for installation locations with ambient temperature ≥ 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.

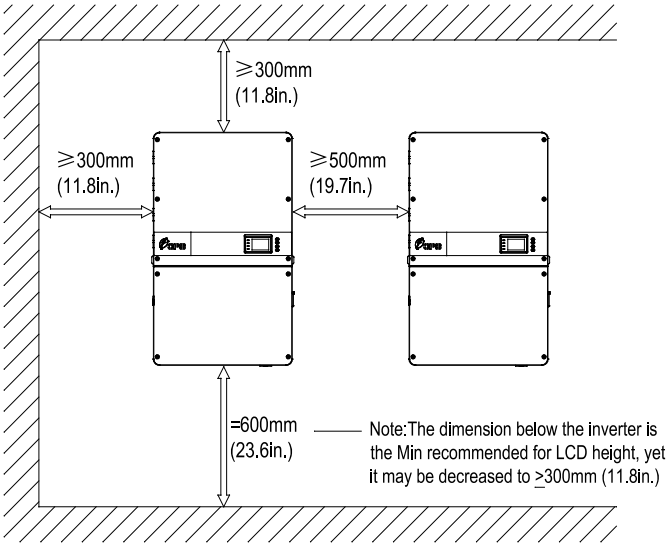


Figure 3-3 Inverter Wall Mounting Dimensions

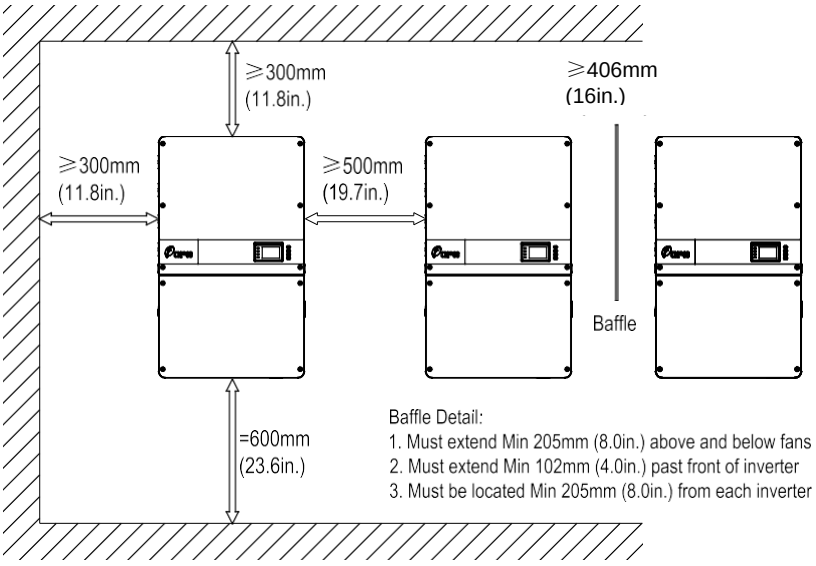


Figure 3-4 Inverter Wall Mounting Baffle Details

NOTICE:

Ensure that the air space around the inverter is well ventilated. The spacing between two adjacently wall mounted inverters may be reduced to ≥16in (406mm) provided a baffle is installed. Installing an aluminum or galvanized steel baffle (Not supplied by CPS) with the dimensions detailed above is intended to divert or deflect warm exhaust air from entering the adjacent inverter. Elevated ambient air temperature ≥ 45°C will cause the inverter to enter a thermal derating mode and reduce its Active power output.

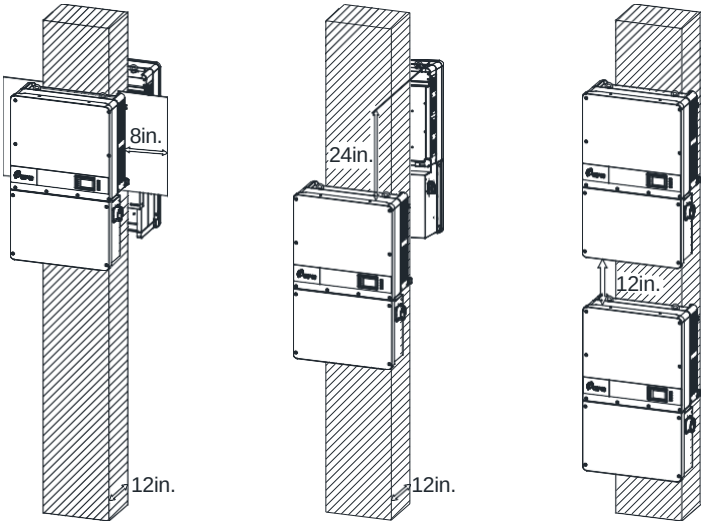
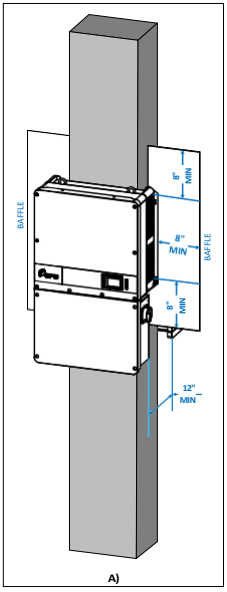
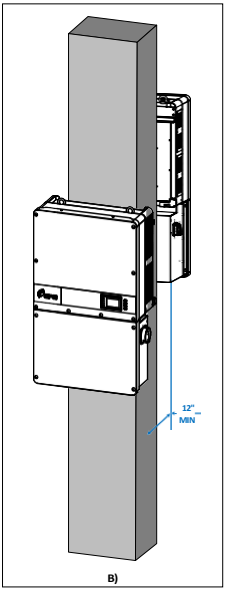


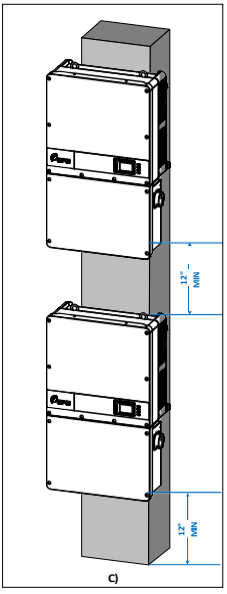
Figure 3-5 Inverter Pillar or Column Mounting Dimensions

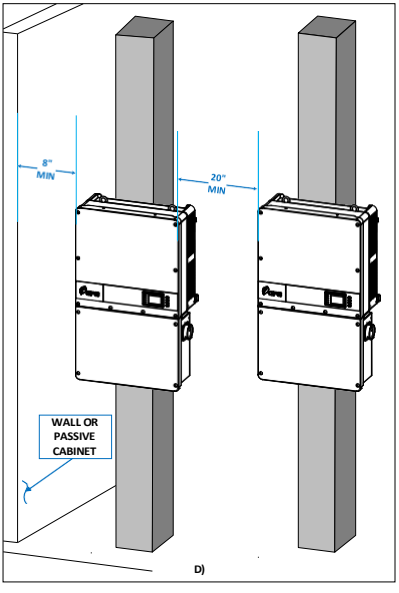
INSTRUCTION:

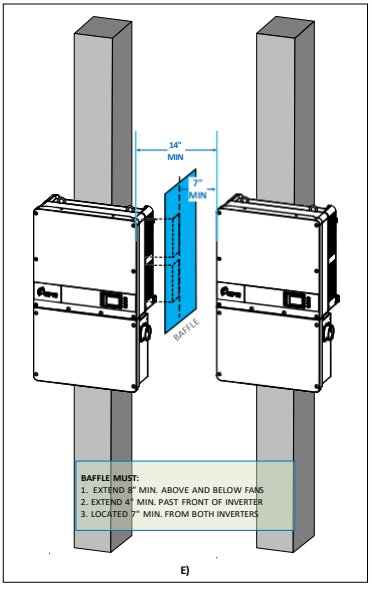
If the inverter is installed on a pillar or column (instead of solid wall), the space from the bottom of one inverter to the top of the inverter below may be as small as 11.8in (300mm).


BAFFLE
8" MIN
8" MIN
8" MIN
BAFFLE
12" MIN
A)


12" MIN
B)


12" MIN
12" MIN
C)


8" MIN
20" MIN
WALL OR PASSIVE CABINET
D)


14" MIN
7" MIN
BAFFLE
BAFFLE MUST:
1. EXTEND 8" MIN. ABOVE AND BELOW FANS
2. EXTEND 4" MIN. PAST FRONT OF INVERTER
3. LOCATED 7" MIN. FROM BOTH INVERTERS
E)

3.2.4 Mounting the Inverter onto the Bracket

Step 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 3-6.

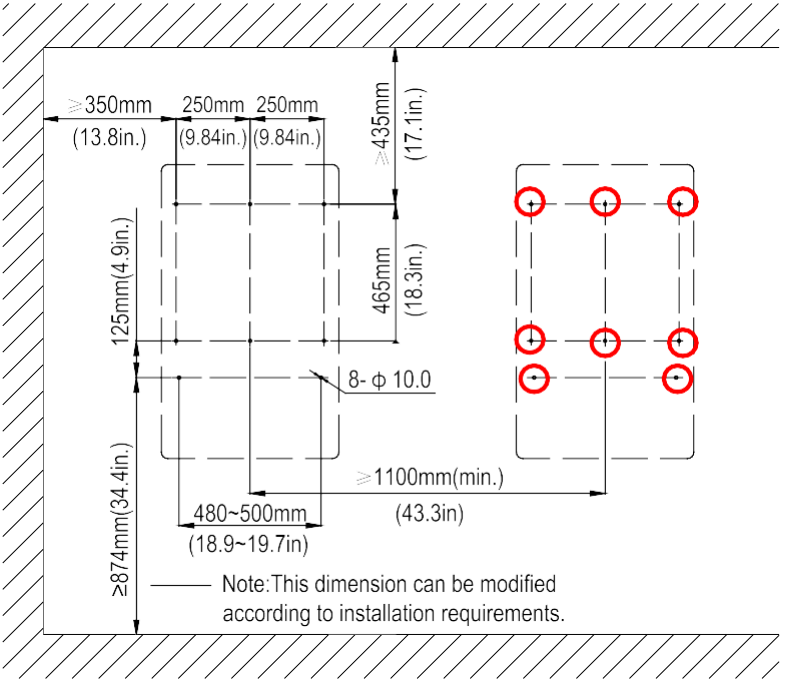


Figure 3-6 Dimensions of the Bracket Anchoring Holes for Mounting

(a) PV Racking Mount: Locate holes or anchors at the marked positions; Fasten the **Mounting Bracket** with **M8x25 Assembling Bolts** and **M8 Nuts** (not supplied). 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 **M8 Expansion Anchors** into the holes (expansion anchors not provided); Fasten the **Mounting Bracket** with the **M8x25 Assembling Bolts** (not supplied). Figure 3-7 and Figure 3-8. Tools Required: Electric drill (Φ10mm/0.4in. masonry bit), No. 13 wrench

Figure 3-7 Drill holes, set Anchors, and tighten Assembly Bolts

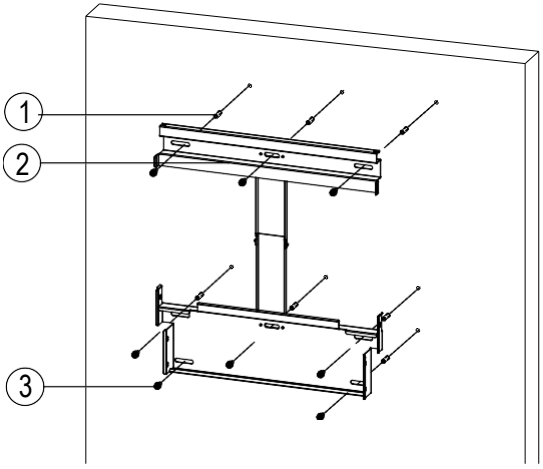


Figure 3-8 Secure the Mounting Bracket

Step 2 Hang the inverter onto the mounting bracket as shown in Figure 3-9 and Figure 3-10:

(a) Lift mounting: Two M10 lifting eye nuts may be installed 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. **NOTE: The M10 lifting eye nuts are not included with inverter.**

(b) Manual mounting: At least two people are required to safely lift the inverter by the grab handle positions marked in Figure 3-10 and mount it onto the bracket.

CAUTION:

The main enclosure of the CPS SCA36/50/60KTL-DO/US-480 3-Phase String Inverters weighs approximately **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.

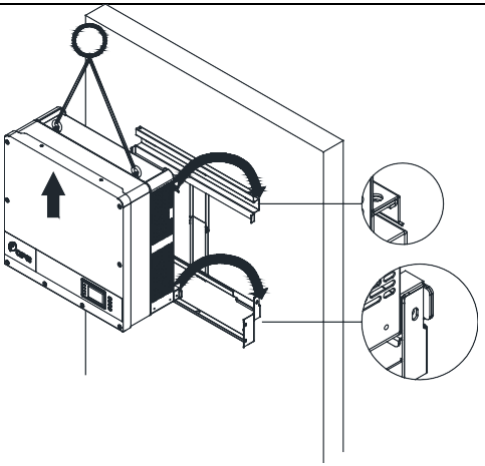


Figure 3-9 Mount the Main Enclosure on the Bracket by Lifting Sling (eye nuts required)

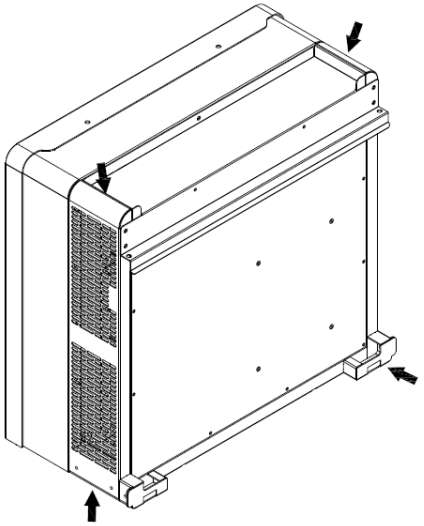


Figure 3-10 Grab Handle Position

Step 3 Install the wirebox:

(a) Remove the cover plate at the bottom of the main enclosure. Tool required: No. 2 Phillips head screwdriver

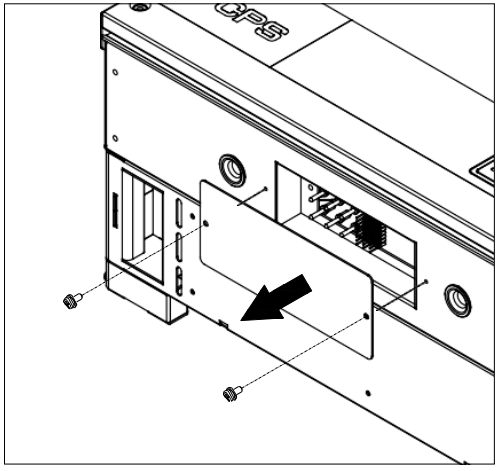


Figure 3-11 Main Enclosure Cover Plate

(b) Remove screws securing the bulkhead cover at the top of the wirebox – **COVER IS NOT WATER-TIGHT**.

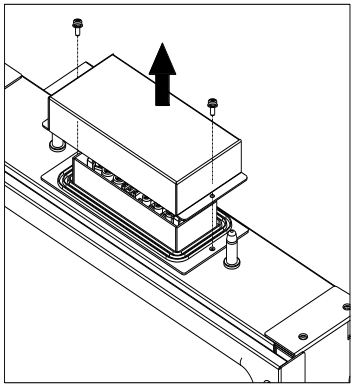


Figure 3-12 Wiring Bulkhead Cover

(c) Save the bulkhead cover and screws, and attach the cover to the left side of the wirebox after the wirebox is attached to the inverter enclosure. Covers may be required in the future if an inverter or wirebox is to be removed during servicing (see step 6, Figure **3-15**). Tool required: No.2 Phillips head screwdriver

Step 4 Secure the wirebox to the main enclosure by using the **M6x18 screws** (4pcs) to fasten the wirebox. (see Figure 3-13). Tool required: No.3 Phillips head screwdriver or 10mm Wrench, torque value of 4 Nm (35.4in-lbs)

WARNING:

Ensure the M6x18 screws (4pcs) installed in Step 4 above are properly torqued and the area under the bolt-head is clear of paint. This **connection provides an electrical ground bond of the wirebox to the upper/main enclosure.**

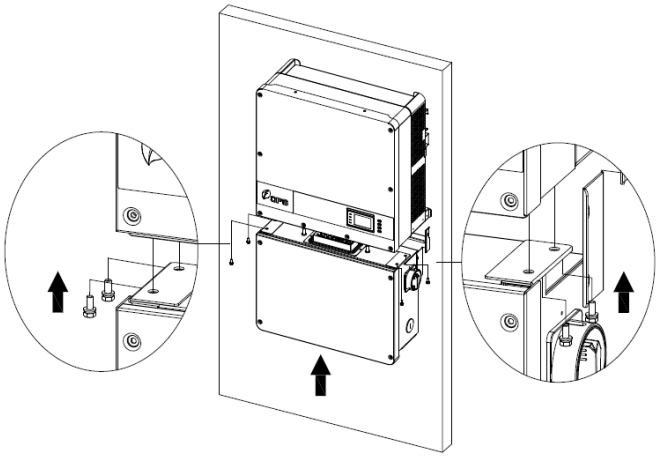


Figure 3-13 Installation of the Wiring Box

Step 5 Attach the main enclosure and the wiring box to the mounting bracket with the M6x18 screws (6 pcs). (see Figure 3-14). Tool required: No.3 Phillips head screwdriver, torque value of 4N.m (35.4in-lbs)

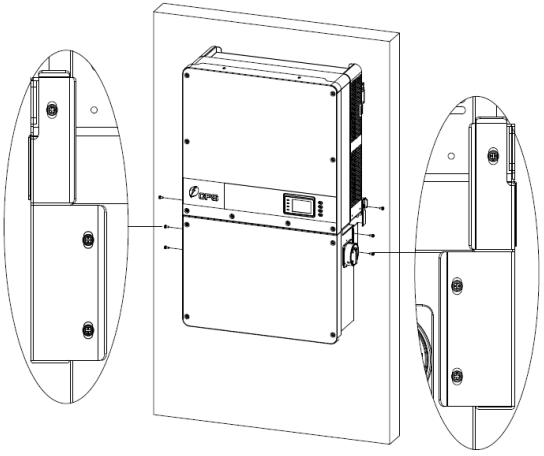


Figure 3-14 Secure the Main Enclosure and Wiring Box to the Bracket

Step 6 Attach the bulkhead cover shown in Figure **3-12** to the left side of the wiring box. (See Figure **3-15**). Tool required: No. 2 Phillips head screwdriver, torque value of 1.6N.m (14.2in-lbs)

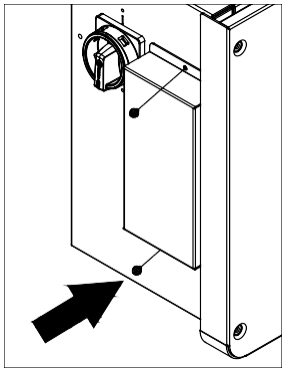


Figure 3-15 Attach the Cover to the left side of the Wiring Box

Step 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 (Figure 3-16).

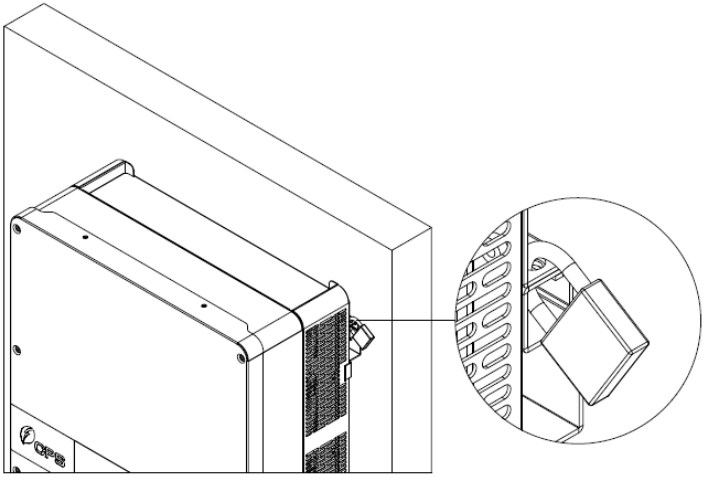
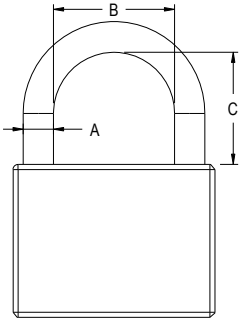


Figure 3-16 Location of the Anti-Theft Padlock

The anti-theft padlock should meet the dimensional requirements shown in Figure 3-17.



Recommended lock size:

A: Shackle diameter 3~6mm

B: Shackle width 20~50mm

C: Shackle height 20~50mm

Figure 3-17 Dimensions of Anti-Theft Padlock Shackle

3.3 Electrical Installation

NOTICE:

The CPS SCA36/50/60KTL-DO/US-480 3-Phase Inverters must be installed in accordance with the National Electric Code, NFPA 70, and any State Codes or local jurisdictions. An MS ExcelTM based Solar PV Array sizing tool is available for download at http://www.chintpowersytems.com and is obtainable by selecting the Product Downloads link to acess the CPS String Sizing tool. This is an optional design tool to help guide designers by matching the PV panel type and quantity to the inverter's power rating.

WARNING

Prior to performing any electrical installation, ensure the **M6x18 screws** (4pcs) installed in Step 4 of section 3.2.4 Mounting the Inverter onto the Bracket are properly torqued and the area under the bolt-head is clear of paint. This connection provides an electrical ground bond of the wirebox to the upper/main enclosure.

3.3.1 Removing/Replacing the Wiring Box Cover:

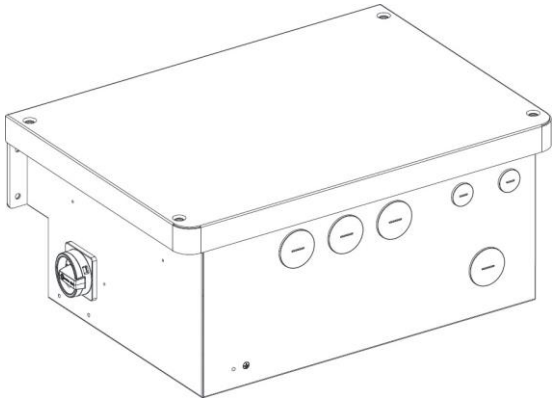


Figure 3-18 Standard and RSD Wirebox

Step 1 Use a No. 3 Philips head screwdriver to remove the 4 screws on the wiring box and remove the cover. (See Figure 3-19)

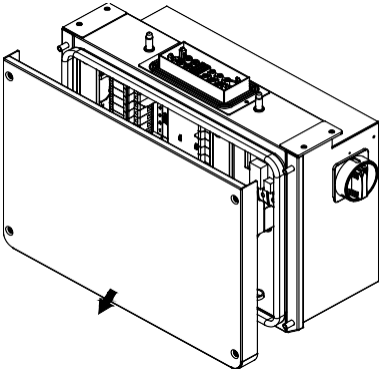


Figure 3-19 Removing the Wiring Box Cover

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

3.3.2 Wiring Boxes

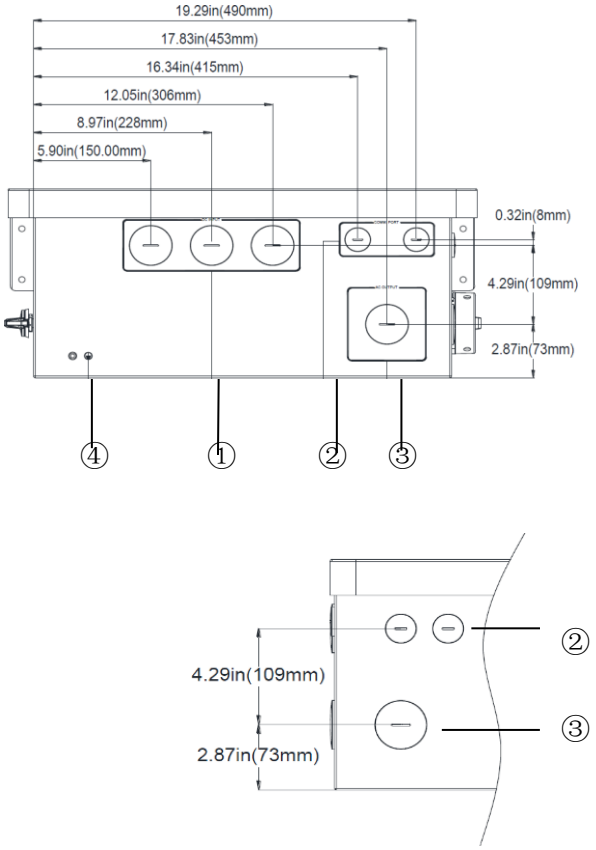


Figure 3-20 Conduit Knock-out Locations on the wirebox

① Three Knock-outs for DC inputs, 1-1/2 inch Trade Size (1.98" Dia) on a removable gland plate for custom size conduit (i.e. when use of 2 inch or 2-1/2 inch Trade Size conduit is required) – later models may not have gland plates.

② Four Knock-outs for communication, 3/4 inch Trade Size (1.11" Dia)

③ Two Knock-outs for AC output, 1-1/2 inch Trade Size (1.98" Dia) 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 Two external ground connection points (M6)

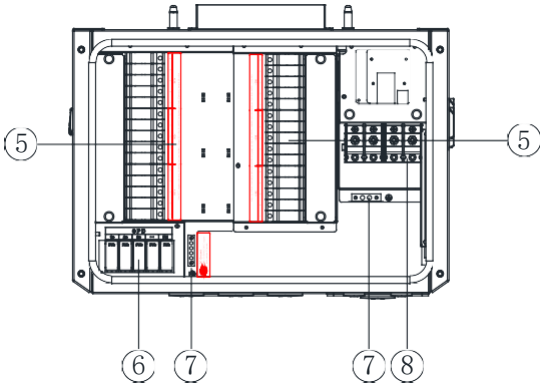


Figure 3-21 Internal Connection Points within the Standard wirebox

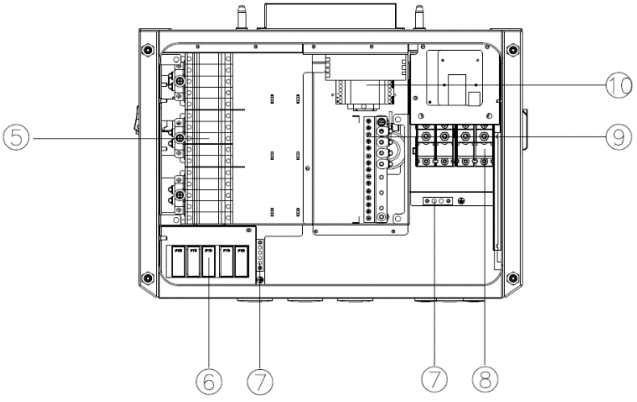


Figure 3-22 Internal Connection Points within the RSD wirebox

⑤ DC Input fuse holder/terminal

⑥ DC SPD (Surge Protective Device)

⑦ Internal ground terminal(s)

⑧ AC output terminal block

⑨ Negative DC input busbar

⑩ Rapid Shutdown transmitter

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 Maximum Power Point Tracker (MPPT).

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 P&O (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 execute 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 input power from the array may be unbalanced between the three MPPT zones, however every effort should be made to design within one string count difference. See Table 3-3.

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

Table 3-3 DC Input Specifications (Independent Mode)

Specification	(Independent Mode - per MPPT)		
Model	**SCA50KTL-DO/US-480**	**SCA60KTL-DO/US-480**	**SCA36KTL-DO/US-480**
Max PV Power	33kW (Combined ≤ 90kW)	33kW (Combined ≤ 90kW)	22.44kW (Combined ≤ 61.2kW)
Max PV Voltage	1000Vdc		
Start-up Voltage / Power	330 / 80W		
Operating Voltage	200-950Vdc		
MPPT Voltage Range	480-850Vdc	540-850Vdc	400-850Vdc
Maximum PV Current (Isc x 1.25)	68A		

Table 3-4 DC Input Specifications (Parallel Mode)

Specification	(Parallel Mode - 3 MPPTs combined)		
Model	**SCA50KTL-DO/US-480**	**SCA60KTL-DO/US-480**	**SCA36KTL-DO/US-480**
Max PV Power	90kW	90kW	61.2kW
Max PV Voltage	1000Vdc		
Start-up Voltage / Power	330 / 80W		
Operating Voltage	200-950Vdc		
MPPT Voltage Range	480-850Vdc	540-850Vdc	400-850Vdc
Maximum PV Current (Isc x 1.25)	204A		

INSTRUCTION:

The default Working Mode of the inverter is **Independent Mode** (3 MPPTs). The Working Mode may be configured to operate in **Parallel Mode** (1 MPPT) only as an exception.

Every effort should be made to design within one string count difference for each of the three MPPTs to avoid unnecessary power clipping. When the input power for one MPPT zone exceeds the individual maximum allowed (Max PV Power), however the combined input power is below the inverter maximum input specifications, the inverter may be set to operate in **Parallel Mode** (1 MPPT). In this mode, all strings should be the same module type (Mfg and ratings), same series module count, and same module orientation (tilt and azimuth).

Parallel Mode is not preferred since it affects the sensitivity of the AFCI and may increase the possibility of false DC Arc-Fault trips. Setting to Parallel Mode must be approved in advance by CPS and must be performed by a CPS Service Technician. Contact CPS Customer Service for further information.

Select the DC conductor size and material for the inverters according to the following configuration table:

Table 3-5 DC Terminal Specifications

Terminal	Acceptable wire range
DC input (+ / –) Fuseholder Screw-clamp; or Bypass Terminal M6 Screw	#14-6AWG (Copper only) when terminating to the fuse holders. Terminals are 90C rated. #6~2AWG (Copper or Aluminum) when using the Bypass Terminal kit accessory. Terminals are 90C rated.

INSTRUCTION:

The CPS SCA36/50/60KTL-DO/US-480 3-Phase Inverters are designed 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 SCA36/50/60KTL-DO/US-480 inverter Standard and RSD wire boxes include touch safe fuse holders and preinstalled 20A DC fuses as factory standard. Ensure that the appropriate fuse values are used depending on the configuration of the PV array 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 Isc of the PV string. Refer to NEC 690.8 for Circuit Sizing and Current requirements.

Table 3-6 DC Fuse Selection

	Manufacturer	15A	20A	25A	30A
36/50/60KTL	Sinofuse	RS308-PV-3E15A	RS308-PV-3E20A	RS308-PV-3E25A	RS308-PV-3E30A
		15A/1000V	20A/1000V	25A/1000V	30A/1000V
	Mersen	HP10M15	HP10M20	HP10M25	HP10M30
		15A/1000V	20A/1000V	25A/1000V	30A/1000V

UL listed, 1000$V_{DC,}$ 20A, 10.3x38mm cylindrical, PV fuses from the following manufacturers are recommended as replacement fuses when necessary: Sinofuse or Mersen.

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 20A fuses with appropriate ampere ratings, however CPS does not provide nor stock these fuses.

NOTICE:

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

When Y branch connectors or harnesses are used with DC field wiring to reduce PV source circuit home runs, the Y-Comb Terminal Block may be used as an optional accessory. Refer to section 9.3 for further detailed information.

Use of fuses from other manufacturers or incorrectly sized fuses can cause either equipment damage or create an unsafe working condition. Any damage resulting from use of incompatible fuses is not covered by the CPS warranty.

NOTICE:

Note 1: The recommended fuse values are configured based on the condition that the input strings are the same (module type and length).

Note 2: The temperature rating of the fuse holder terminals is (90°C).

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 1000VDC 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 within the wirebox. Referring to Figure 3-23, 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.

WARNING:

A reversed string is not protected by the inverter and can cause severe damage to equipment and personnel. A reversed string is extremely hazardous and will result in a blown fuse when the irradiation is high. The voltage across the blown fuse can be as much as two times Voc and could prevent proper fuse operation resulting in a fire.

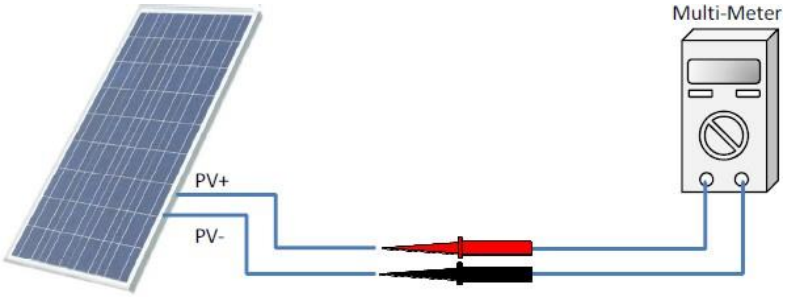


Figure 3-23 Polarity Check

3.3.3.4 DC Fuseholder Torque Specification

The inverter wiring box may be assembled using fuse holders supplied by Sinofuse. The touch safe fuse holders have unique terminal torque values specified by their manufacturers. See Table 3-7 for specified torque values.

Table 3-7 DC Fuse Holder and Busbar Torque Value by Manufacturer

Sinofuse TSA1038-S-HR		**CPS Neg Busbar**
	**Single Conductor Specified Torque:** 14-6AWG: 26 in-lbs (3.0Nm)	**Single Conductor Specified Torque:** 14-6AWG: 26 in-lbs (3.0Nm)

WARNING:

Failure to apply proper torque to the fuse holder and busbar terminals may result in an improper conductor termination and cause excessive heat or fire.

3.3.3.5 DC Connection for Standard and RSD Wirebox

1. **Using the 1-1/2 inch knockouts**. 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 the use of smaller conduit is desired, proper weather-tight reducing bushings may be installed. Confirm all fittings are NEMA 4X rated, properly tightened, and route the DC source circuit conductors through the conduit into the wiring box.

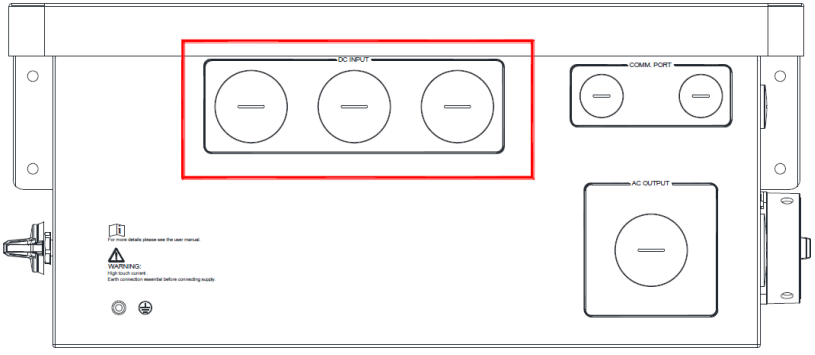


Figure 3-24 DC Input Connection

Table 3-8 Tools Required for DC Cable Termination

No.	Tools	Remark	Torque
1	#2 Phillips head screwdriver	Fuse holder Terminal	26 in-lbs (3.0Nm)
2	Diagonal pliers or cable cutters	Cut cable	-
3	Wire stripping pliers	Remove jacket	-
4	Torque driver	Torque terminals to specification	-

2. **Terminate at fuseholders**. The RSD wirebox only contains fuseholders for the positive DC conductors. Follow instructions in step 3 for the negative conductors. Strip approximately ½ 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 3-7. Continue terminating the remaining strings in this manner for each MPPT (PVIn1, PVIn2, PVIn3).

3. **Terminate at busbar (RSD wirebox)**. The RSD wirebox only contains fuseholders for the positive DC conductors. Follow instructions in step 2 for the positive conductors. The negative DC conductors are to be terminated on the busbar. Strip approximately ½ inch of the cable jacket from the end of the string conductor. Insert the conductor into the busbar ensuring the stranding of the conductor remains firmly twisted and does not separate. Tighten the screw to the torque specified in Table 3-7. Continue terminating the remaining negative DC conductors 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 3-25. See Section 9 Accessories for installation information.

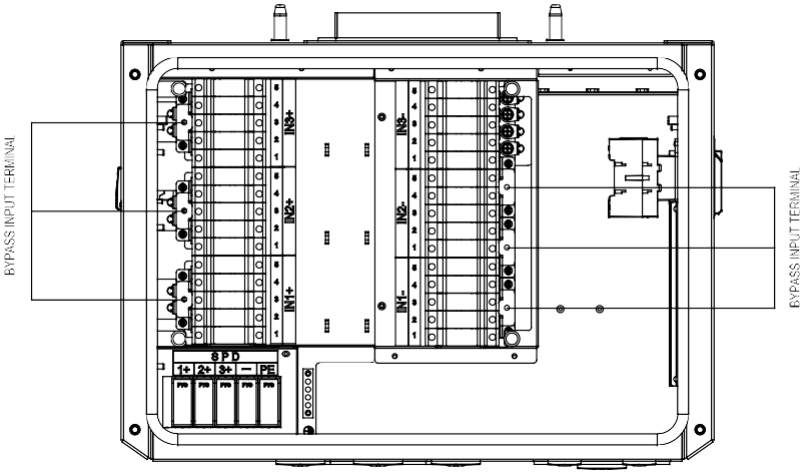


Figure 3-25 Bypass Terminal option installed within the Standard wirebox

The DC input connection diagrams for SCA36/50/60KTL-DO/US-480 inverters are as follows:

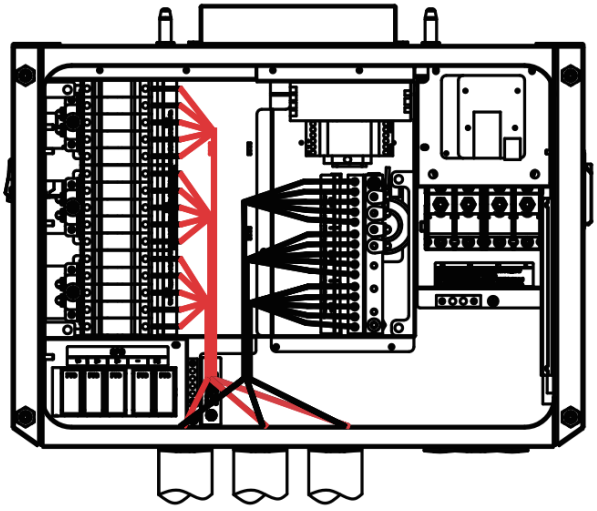


Figure 3-18-1 SCA36/50/60KTL RSD wiring box

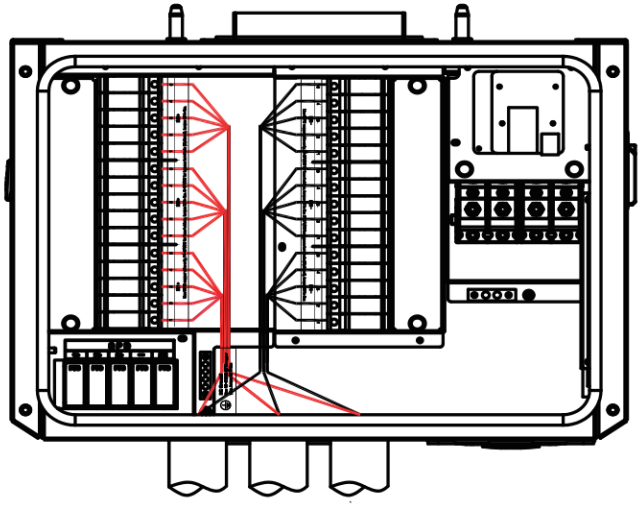


Figure 3-28-2 SCA36/50/60KTL Standard wiring box

NOTICE:

To maximize production, reduce clipping losses, and optimize thermal performance, the DC input power should be distributed across all MPPTs as evenly as possible (e.g. difference in number of strings per MPPT not larger than 1).

Before terminating the PV conductors to the Bypass Terminals, verify connector specifications (Table 3-9) and always verify polarity to avoid risk of reverse polarity.

Table 3-9 Connector Specifications

Bypass Terminal Kit	Conductor Termination	Wire Range	Wire Type	Torque
36/50/60KTL	M6 Machine Screw	#6 -2AWG	AL/CU	6.0N.m (53 lbf-in)

3.3.4 AC and Ground Connection

The following section describes the AC and ground connections.

3.3.4.1 Acceptable Transformer Configurations

The SCA36/50/60KTL inverters operate at 480V_{AC}/Wye output. If another voltage/configuration is required a transformer may be necessary.

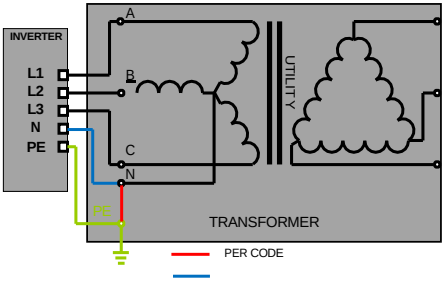
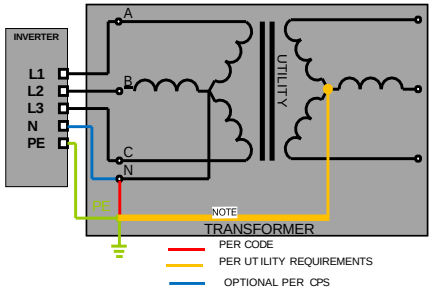
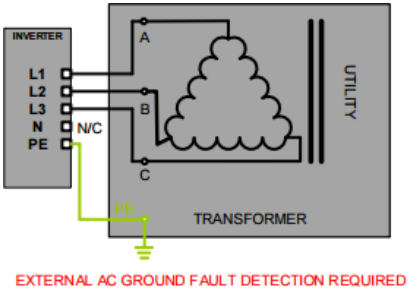
<table>
<tr><th>Wye (Inverter) / DELTA (Utility)</th><th>Wye (Inverter) / WYE (Utility)</th></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>NOTE: If the transformer neutral is not connected to ground, additional ground fault detection must be added external to the inverter per NEC 250.21</td><td>NOTE: If the transformer neutral is not connected to ground, additional ground fault detection must be added external to the inverter per NEC 250.21</td></tr>
<tr><td> 
</td><td>In a Delta connected system, the inverter does not detect AC Side Ground Faults. Only DC Side Ground Fault protection is provided by the inverter. Additional AC ground fault detection must be added external to the inverter per NEC 250.21.</td></tr>
</table>

Figure 3-26 AC Acceptable Transformer Winding Configurations

NOTES:

1. If the upstream transformer is a Wye winding on the inverter side, the Neutral must be grounded or additional ground fault detection must be installed. 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 should 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 32.
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 3-10 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

1. **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.

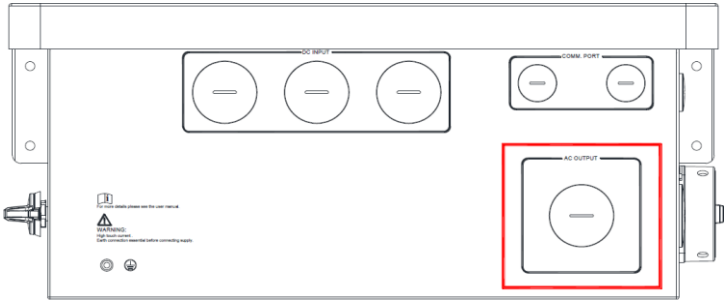


Figure 3-27 AC Input Connection

NOTICE:

Terminate the Ground cable prior to terminating the AC cables.

2. **Grounding/Bonding.** The inverter provides 1 grounding connection on the AC side and one bonding location. These configurations are illustrated below Figure 3-28).

   (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.

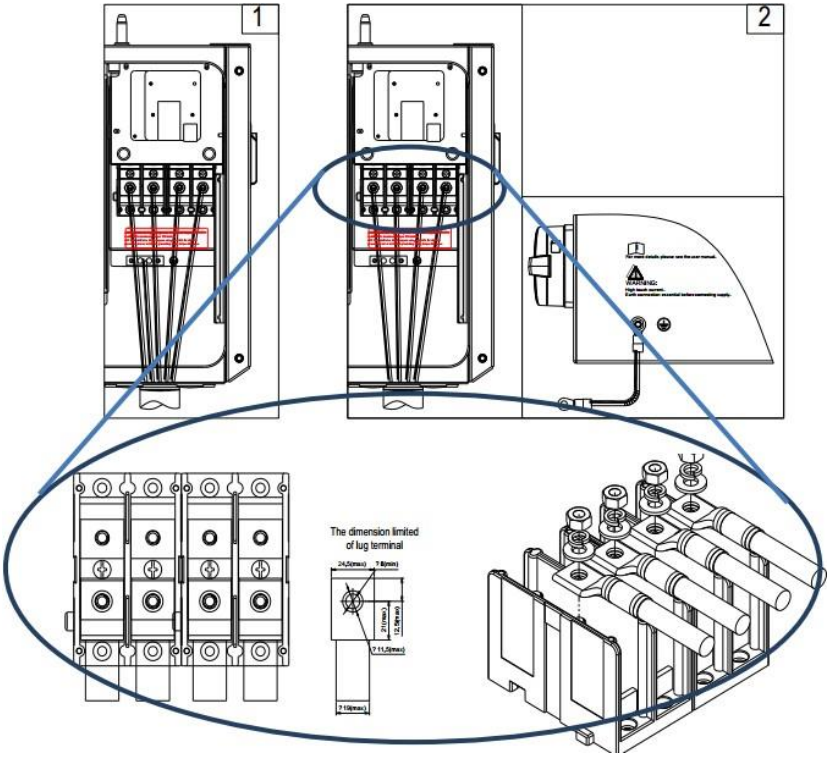
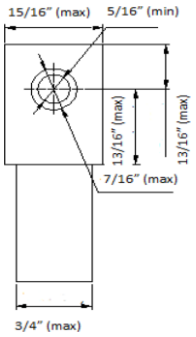


Figure 3-27 AC Output and Ground Cable Connection

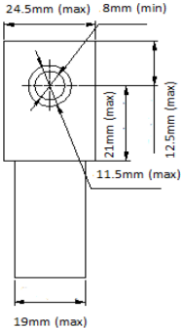
Table 3-11 Torque and Conductor Specifications

Connection Point	Conductor Range	Torque Value
AC output terminal block	L1/L2/L3/N: #6~3/0AWG (75/90℃ CU/AL)	14.2 N-m (126 in-lbs）
Internal grounding bar	6-4 AWG (CU/AL)	5.6 N-m (50 in-lbs）
External grounding point	6-4 AWG (CU/AL)	5.6 N-m （50 in-lbs）

The AC Terminals are 90C rated. 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 3-29.



Standard 1-hole Lug



Metric 1-hole Lug

Figure 3-28 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 (Compression Lugs) 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, however the PE ground is ALWAYS required. When terminating the ground conductor at the Gnd busbar a ferrule is recommended but not required. (See the 1st diagram in Figure 3-29) Set up the conductors referring to Figure 3-30.

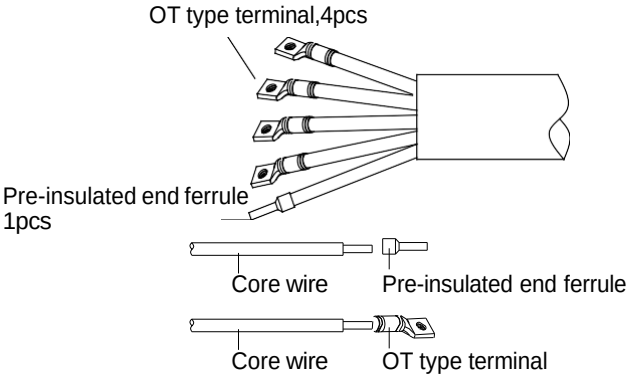


Figure 3-29 AC output and internal ground conductor set up

When bonding the inverter/mount to a metallic structure is required, use the OT type terminal (Compression Lug) 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 wirebox as shown in Figure 3-31.

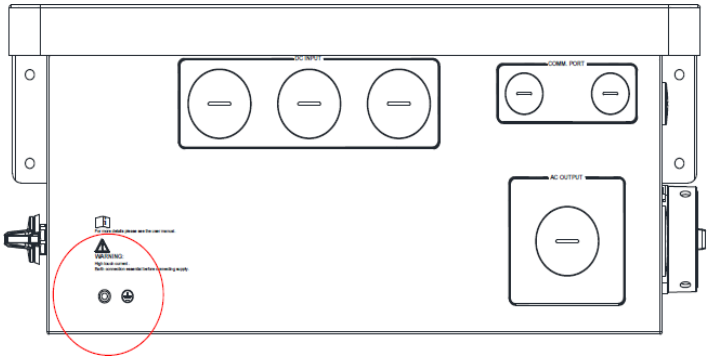


Figure 3-30 External Ground Point Location of wirebox

NOTICE:

Always connect the Ground conductor (EGC) before terminating any of the AC 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 should 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. A floating delta is allowed, but ground fault protection must be provided external to inverter.

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 (Authority Having Jurisdiction). Note that the Minimum AC OCPD is determined by the inverter Maximum Apparent power (kVA) setting (ReactivePowerOver) for the 50kW and 60kW models.

Table 3-12 Specification of AC Breaker Selection

Inverter	Min AC OCPD	Max AC OCPD
CPS SCA50KTL-DO/US-480	50kVA = 80A 55kVA = 90A	110A
CPS SCA60KTL-DO/US-480	60kVA = 100A 66kVA = 100A	125A
CPS SCA36KTL-DO/US-480	60A	125A

3.4 Communication Connection

CPS SCA36/50/60KTL-DO/US-480 inverters support industry standard Modbus RS485 communication.

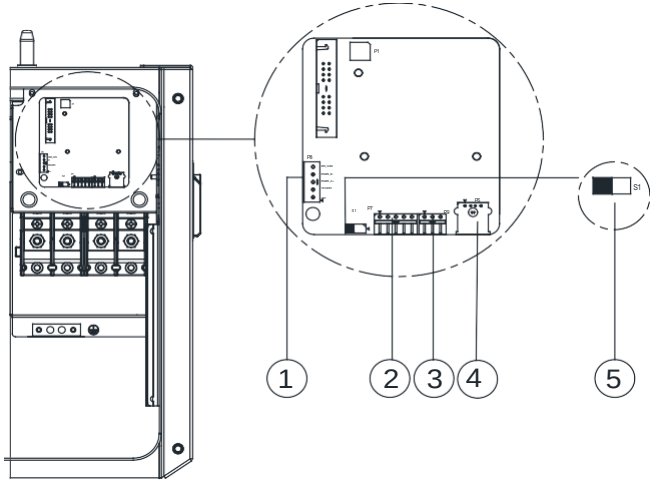
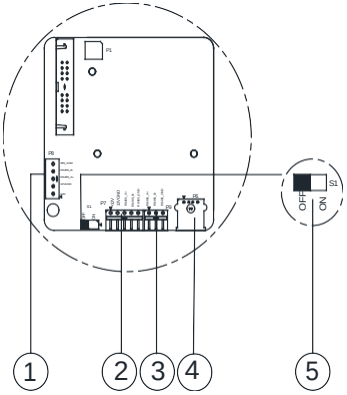


Figure 3-31 Communication Board in the Wirebox

3.4.1 Description of the Communication Board



① RS485 P8 (Debug only)
1. 12V+
2. 12VGND
3. RS485+
4. RS485-
5. COM

② RS485 P7 (Communication Input)
1. 12V+
2. 12VGND
3. RS485+
4. RS485-
5. COM

③ RS485 P9 (Communication Output)
1. RS485+
2. RS485-
3. COM

④ USB Port P6: Firmware upgrade

⑤ Selector Switch (S1): 120Ω terminal resistor switch for communications.
1. **ON:** Enable termination resistance
2. **OFF:** Disable termination resistance

Figure 3-32 Communication Connection Interfaces

3.4.2 RS485 Communication

CPS recommends the following cable for inverter RS485 communications:

CAT-5e or (3) 18-22AWG communication cables.

It is recommended that industrial grade shielded twisted pair RS485 cable be used in lieu of unshielded twisted pair. Communication cable such as (CAT5e) 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 above figure 3-32. When creating a network of multiple inverters, the cables are terminated to the same 5-pin connector and 3-pin connector. Figure 3-34 shows a single inverter communication connection in (1) and a network configuration in (2).

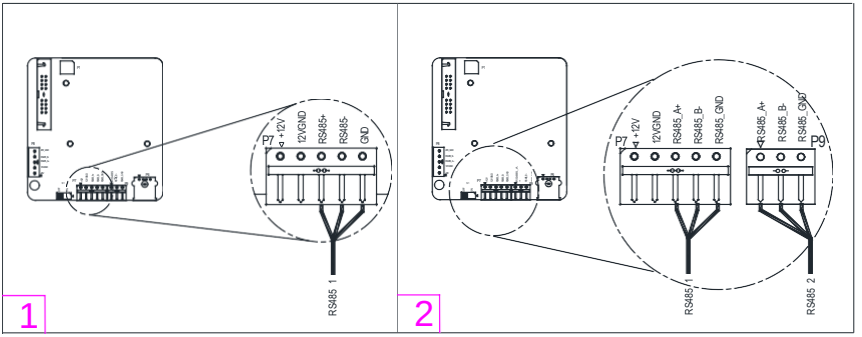


Figure 3-33 RS485 Connection of Communications Board

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 3-35. 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.

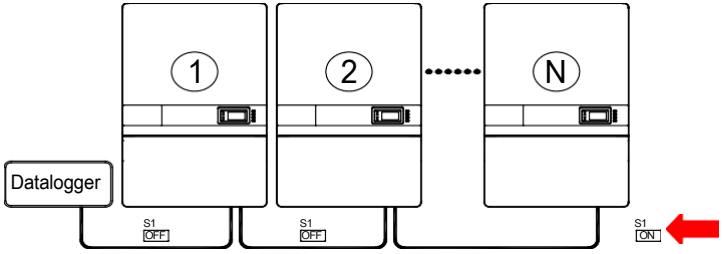


Figure 3-34 RS485 Network Connection

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 120Ω 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 (network P7 and P9) ensuring correct polarity and using a shielded twisted pair cable.

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. See application not on website: : https://www.chintpowersystems.com/

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.

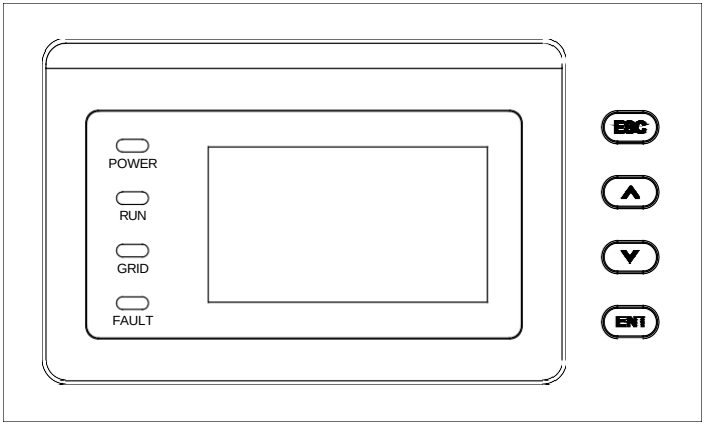


Figure 4-1 LCD Panel

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 4-1and 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
ESC	Escape key	Back/end/mute
ENT	Enter key	Confirm entering the menu/confirm set value/Switch to parameter setting mode
∧	Up	Page up in selection menu/+1 when setting parameters. Press more than 1 second to go to the last number when setting the parameters. eg: from 2008 to 2008
∨	Down	Page down in selection menu/-1 when setting parameters. Press more than 1 second to go to the next number when setting the parameters. eg: from 2008 to 2008

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. Derate may be caused by low grid voltage; MPPT voltage out of range; or excessive temperature.

"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.

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 LOGO Interface), **Normal operation** and **Standby** modes (as shown in Figure 4-3 Default Display Interface for Normal Operation), and **Fault** mode (as shown in Figure 4-4 History Record Interface).

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.”

3. 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.

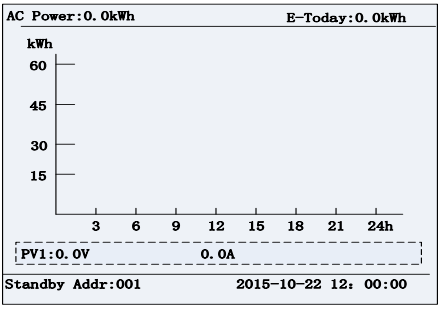


Figure 4-3 Default Display Interface for Normal Operation

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

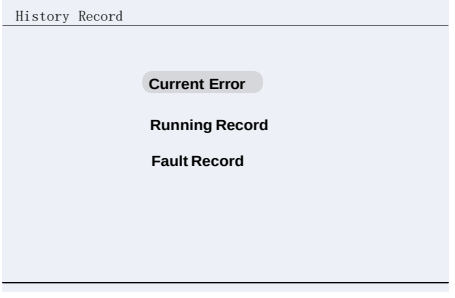


Figure 4-4 History Record Interface

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 check

- 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 check

- Make sure all conductors are connected to the right terminals and properly labeled.
- The appropriate cable management is important to avoid physical damage. No points of sharp edge againstcable 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. Note: If APS MLPE RSD products are installed and in the OFF position, each module will measure ~0.6 to 0.7 Vdc. Ensure the DC open circuit voltage of input strings will be less than 1000V when power is supplied to the Rapid Shutdown transmitter, if applicable.

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 “**Initialization**”, the LCD will show the screen as Figure 5-1 below.

Figure 5-1 System Initialization 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**.

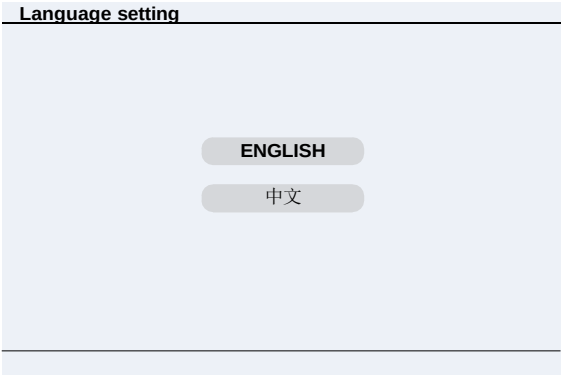


Figure 5-2 Language Setting

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.

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.

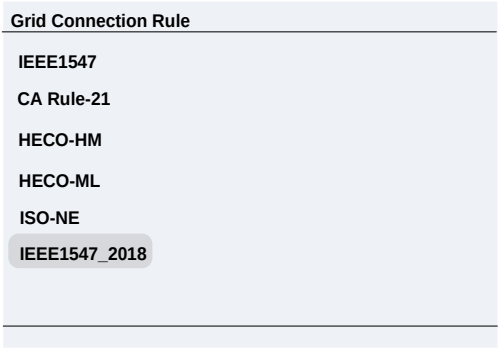


Figure 5-3 Set up Grid Standard

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, press ESC to go to last option. e.g.: Month to Year. Finally Press the ENT key to confirm the setting. (Press ⌃ more than 1 second to go to last position of the number when setting the parameters. e.g: 2008 to 2008. Press ⌄ more than 1 second to go to the next position of the number when setting the parameters. e.g: 2008 to 2008.)

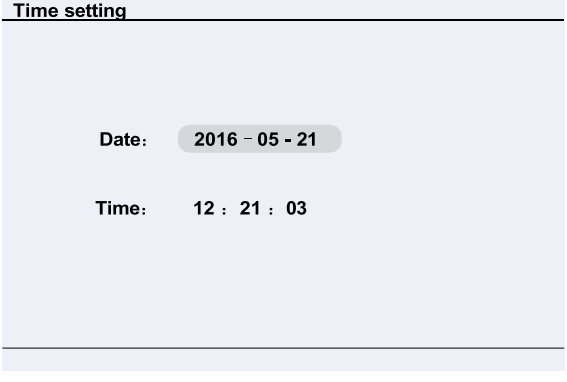


Figure 5-4 Time Setting

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.

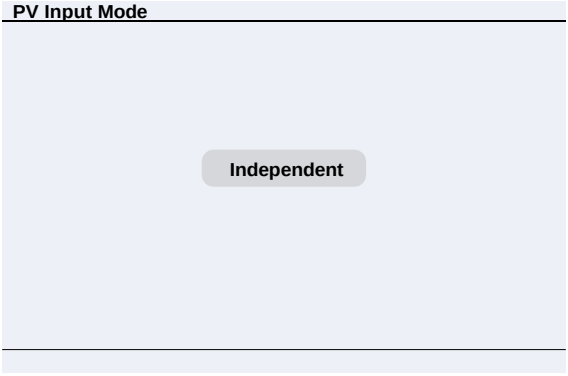


Figure 5-5 Independent Mode Setting

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.

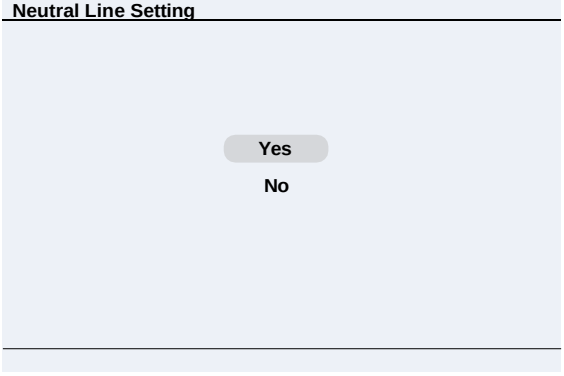


Figure 5-6 Setting the Neutral Line

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.

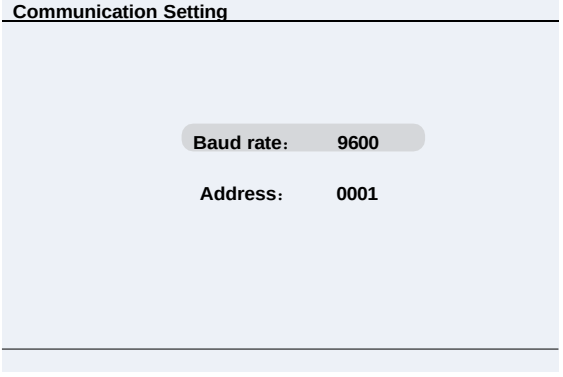


Figure 5-7 Communication Setting

10. Setting the LCD contrast grade. From the previous menu, press ESC to return to System Parameters 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.

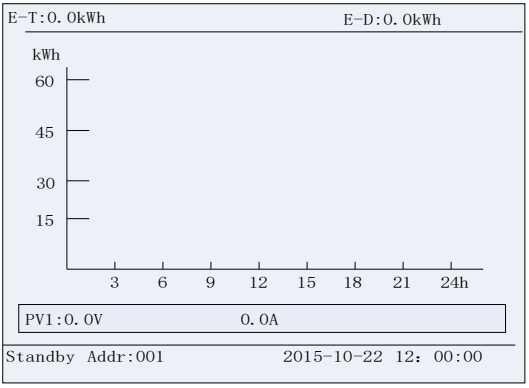


Figure 5-8 Normal Operation Status

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.

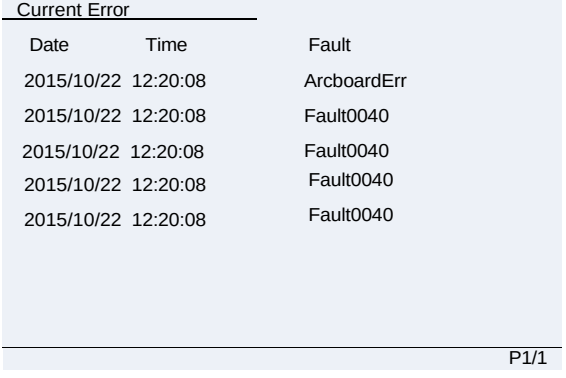


Figure 5-9 Fault Information Interface

6 Main Menu and Operation

INSTRUCTION:

The contents of following sections are applicable to all the CPS SCA36/50/60KTL-DO/US-480 3-Phase Transformerless String Inverters. Their main menus are almost the same, the following contents will take the CPS SCA60KTL-DO/US-480 inverter as instance, and different points will be introduced separately.

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 6-1.

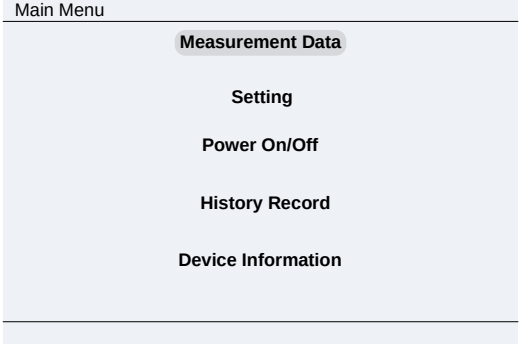


Figure 6-1 Main Menu on the LCD Screen

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 curser 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.

6.1 Measurement Data

When **Measurement Data** is selected in the main screen, pressing the **ENT** key opens the operation information as shown in Figure 6-2. Check the information by pressing ⌃ and ⌄. Return to the previous menu by pressing the **ESC** key.

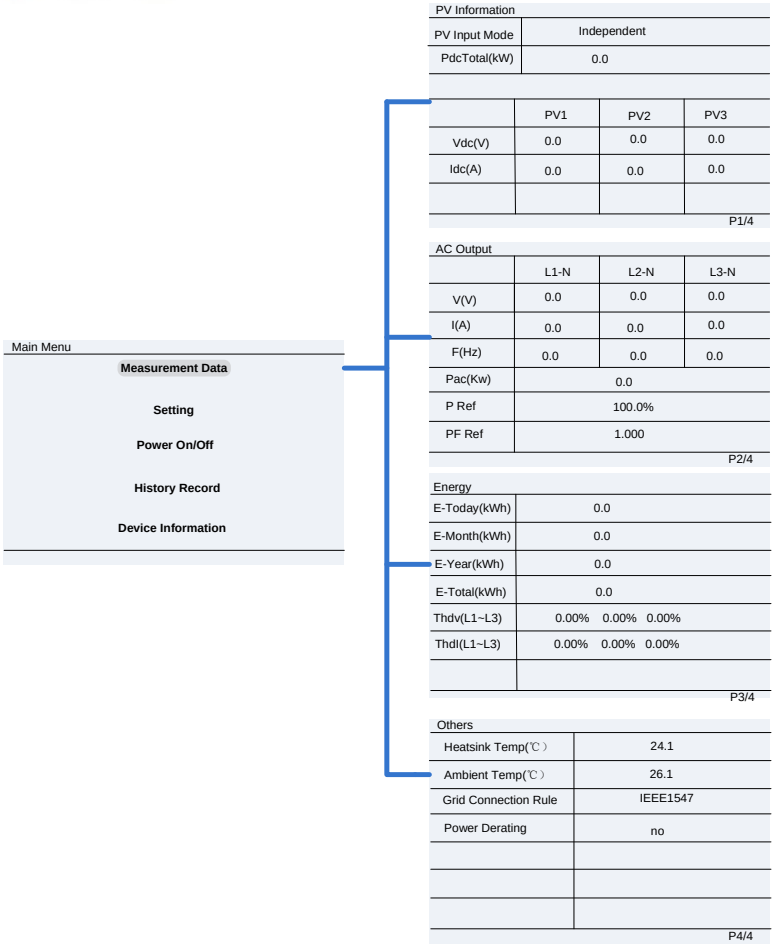


Figure 6-2 Operation Information

6.2 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 6-3. 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.

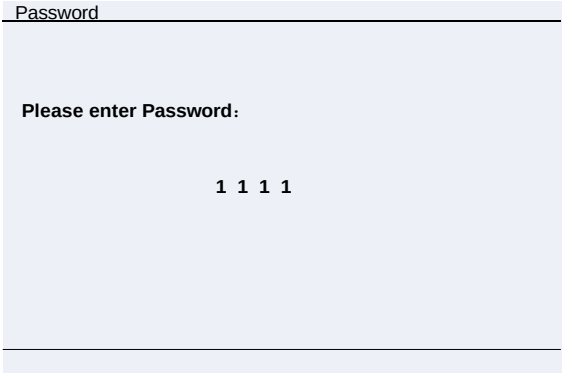


Figure 6-3 Input Password Number

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.

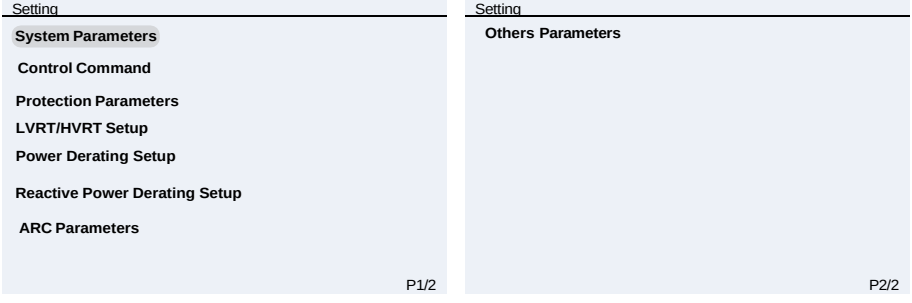


Figure 6-4 System Setup Menu and Submenus Overview

6.2.1 System Parameters

The System Parameter selection contains nine submenus.

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

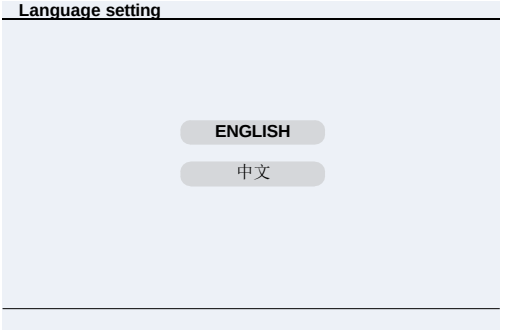


Figure 6-5 Language Setting

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.

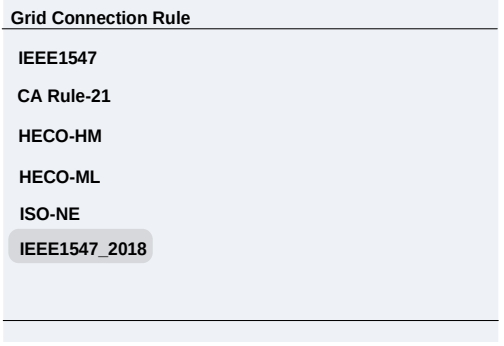


Figure 6-6 Setting Grid Rule

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. When a neutral is installed and "Yes" is selected, the inverter will display L-N measurements.
5. **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.
6. **Time.** Press ⌃ or ⌄ to select the numerical value, then press **ENT** to go to next option. e.g.: Year to Month, press **ESC** to go to last option. e.g.: Month to Year. Finally Press the **ENT** key to confirm the setting. Press ⌃ more than 1 second to go to last position of the number when setting the parameters. e.g: 2008 to 2008. Press ⌄ more than 1 second to go to the next position of the number when setting the parameters. e.g: 2008 to 2008.

7. **LCD Contrast Setting.** Press ⌃ or ⌄ to increase/decrease the LCD contrast. Press **ENT** to accept changes.

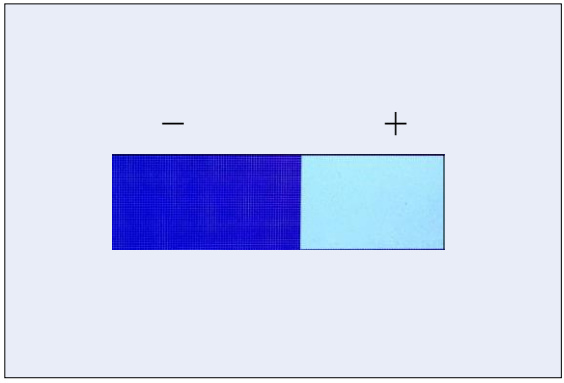


Figure 6-7 LCD Contrast Grade Setting

8. **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 128 faults.

6.2.2 Control Command

There are five submenus in the "**Control Command**" menu:

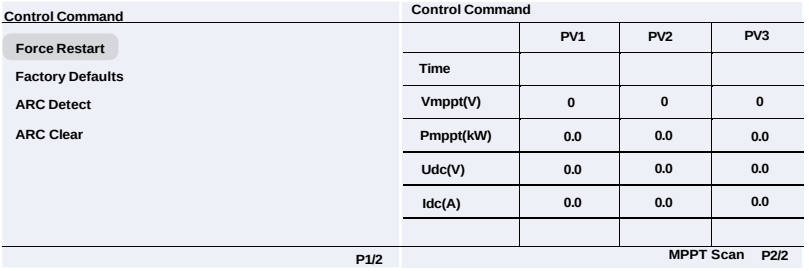


Figure 6-8 Control Command Setting

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**. Mannually 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.

6.2.3 Protect Parameters

This interface is used to display and set the Protect parameters of the AC grid voltage, frequency and recovery, etc, as shown in Figure 6-9.

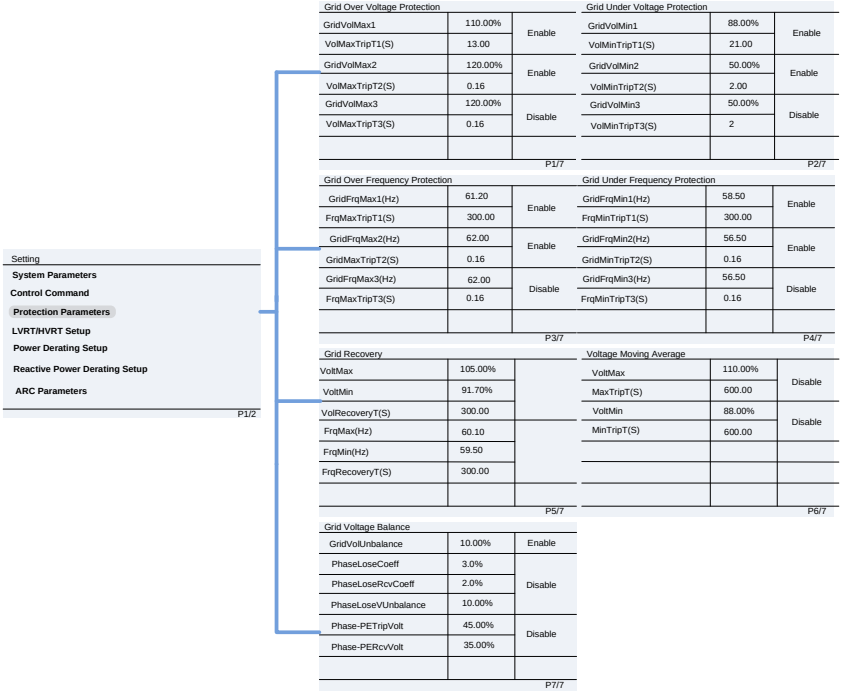


Figure 6-9 Protection Parameter Settings

There are 7 pages of parameters displayed. Navigate the parameters by pressing ⌃ and ⌄. Then press **ENT** to access the highlighted selection. Change the parameter value by pressing ⌃ and ⌄ then **ENT** to confirm the parameter setting. The LCD will display new parameters if the setting is successful, otherwise the old parameters will remain displayed on the LCD.

Table 6-1 Protection Parameters (IEEE1547-2018, Rule21 and ISO-NE)

Grid Voltage Protection		Setting Range								
Parameter name	Description (Threshold Value of)	IEEE1547−2018			Rule21			ISO−NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
GridVoltMax1(%)	Level 1 Max. grid voltage	100	**110**	135	100	**110**	135	100	**110**	135
VoltMaxTripTime1(S)	Level 1 Max. grid trip voltage	0	**13**	655	0	**12.5**	655	0	**2**	655
GridVoltMax2(%)	Level 2 Max. grid voltage	100	**120**	135	100	**120**	135	100	**120**	135
VoltMaxTripTime2(S)	Level 2 Max. grid trip voltage	0	**0.16**	655	0	**0.16**	655	0	**0.16**	655
GridVoltMax3(%)	Level 3 Max. grid voltage	100	**120**	135	100	**120**	135	100	**120**	135
VoltMaxTripTime3(S)	Level 3 Max. grid trip voltage	0	**0.16**	655	0	**0.16**	655	0	**0.16**	655
GridVoltMin1(%)	Level 1 Min. grid voltage	0	**88**	100	0	**88**	100	0	**88**	100
VoltMinTripTime1(S)	Level 1 Min. grid trip voltage	0	**21**	655	0	**20.5**	655	0	**2**	655
GridVoltMin2(%)	Level 2 Min. grid voltage	0	**50**	100	0	**70**	100	0	**50**	100
VoltMinTripTime2(S)	Level 2 Min. grid trip voltage	0	**2**	655	0	**10.5**	655	0	**1.1**	655
GridVoltMin3(%)	Level 3 Min. grid voltage	0	**50**	100	60	**50**	100	0	**50**	100
VoltMinTripTime3(S)	Level 3 Min. grid trip voltage	**0**	**2**	655	0	**1.5**	655	0	**1.1**	655

Table 6-2 Protection Parameters (IEEE1547-2018, Rule21 and ISO-NE) Cont'd

Grid Frequency Protection		Setting Range								
Parameter name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
GridFrqMax1(Hz)	Protection threshold value of Level 1 Max. grid frequency	60	**61.2**	66	60	**60.5**	66	60	**61.2**	66
FrqMaxTripT1(S)	Trip time of Level 1 Max. grid frequency	0	**300**	1000	0	**300**	1000	0	**300**	1000
GridFrqMax2(Hz)	Protection threshold value of Level 2 Max. grid frequency	60	**62**	66	60	**62**	66	60	**62**	66
FrqMaxTripT2(S)	Trip time of Level 2 Max. grid frequency	0	**0.16**	1000	0	**0.16**	1000	0	**0.16**	1000
GridFrqMax3(Hz)	Protection threshold value of Level 3 Max. grid frequency	60	**62**	66	60	**62**	66	60	**62**	66
FrqMaxTripT3(S)	Trip time of Level 3 Max. grid frequency	0	**0.16**	1000	0	**0.16**	1000	0	**0.16**	1000
GridFrqMin1(Hz)	Protection threshold value of Level 1 Min. grid frequency	48	**58.5**	60	48	**58.5**	60	48	**58.5**	60
FrqMinTripT1 (S)	Trip time of Level 1 Min. grid frequency	0	**300**	1000	0	**300**	655	0	**300**	1000
GridFrqMin2(Hz)	Protection threshold value of Level 2 Min. grid frequency	48	**56.5**	60	48	**57**	60	48	**56.5**	60
FrqMinTripT2 (S)	Trip time of Level 2 Min. grid frequency	0	**0.16**	1000	0	**0.16**	655	0	**0.16**	1000
GridFrqMin3(Hz)	Protection threshold value of Level 3 Min. grid frequency	48	**56.5**	60	48	**57**	60	48	**56.5**	60
FrqMinTripT3 (S)	Trip time of Level 3 Min. grid frequency	0	**0.16**	1000	0	**0.16**	655	0	**0.16**	1000

Table 6-3 Protection Parameters (IEEE1547-2018, Rule21 and ISO-NE) Cont'd

Grid Recovery		Setting Range								
Parameter name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
VoltMax(%)	Recovery Max threshold of grid voltage protection	80	**105**	135	80	**108**	135	80	**108**	135
VoltMin(%)	Recovery Min threshold of grid voltage protection	20	**91.7**	100	20	**90**	100	20	**90**	100
VolRecoveryT (S)	Recovery time of grid voltage protection	0	**300**	655	0	**300**	655	0	**300**	655
FrqMax (Hz)	Recovery Max threshold of grid Frequency protection	54	**60.10**	66	54	**60.4**	66	54	**61**	66
FrqMin (Hz)	Recovery Min threshold of grid Frequency protection	48	**59.5**	60	48	**58.6**	60	48	**58.8**	60
FrqRecoveryT (S)	Recovery time of grid frequency protection	0	**300**	655	0	**300**	655	0	**300**	655
Voltage Moving Average										
VoltMax(%)	The Max grid voltage of moving average filter	100	**110**	135	100	**110**	135	100	110	135
MaxTripT(s)	The trip time of the Max grid voltage of moving average filter	0	**600**	655	0	**600**	655	0	600	655
VoltMin(%)	The Min grid voltage of moving average filter	80	**88**	100	80	**87.99**	100	80	88	100
MinTripT(s)	trip time of Min grid voltage of moving average filter	0	**600**	655	0	**600**	655	0	600	655

Grid Voltage Balance										
GridVolUnbalance	Threshold value of grid voltage imbalance	0.01	**10**	10	0.01	**10**	10	0.01	**10**	10
PhaseLoseCoeff	The trigger value of Zig-Zag protection	0.5	**3**	30	0.5	**3**	30	0.5	**3**	30
PhaseLoseRcvCoeff	The recovery value of Zig-Zag protection	0.5	**2**	30	0.5	**2**	30	0.5	**2**	30
PhaseLoseVUnbalabce	Threshold value of Zig-Zag voltage imbalance	0.01	**10**	10	0.01	**10**	10	0.01	**10**	10
Phase-PETripVolt(%)	The trigger voltage value of Phase-to-ground	0.01	**45**	100	0.01	**45**	100	0.01	**45**	100
Phase-PERcvVolt(%)	The recovery voltage value of Phase-to-ground	0.01	**35**	100	0.01	**35**	100	0.01	**35**	100

6.2.4 LVRT/HVRT Parameters

"**LVRT/HVRT**" is used to set the LVRT and HVRT parameters. Move the cursor to this item and press the ENT key to set the parameters. There are 7 pages of LVRT/HVRT parameter settings. These can be changed in the menu tree or by the LVRT (Figure 6-11) and HVRT (Figure 6-12) graphs.

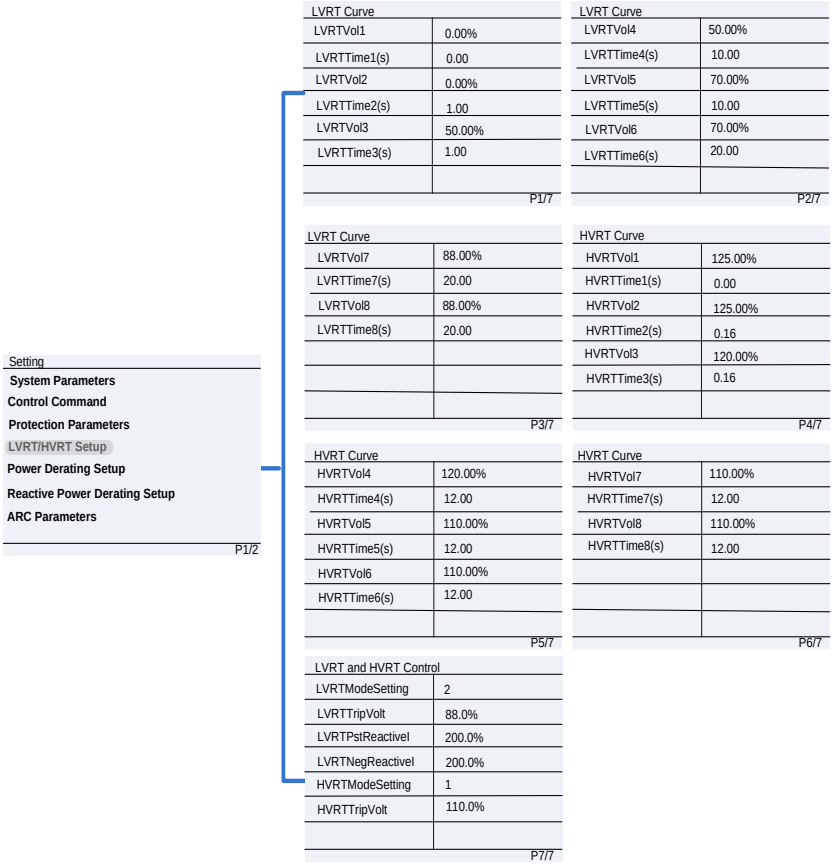


Figure 6-1 L/HRVT Parameter Settings

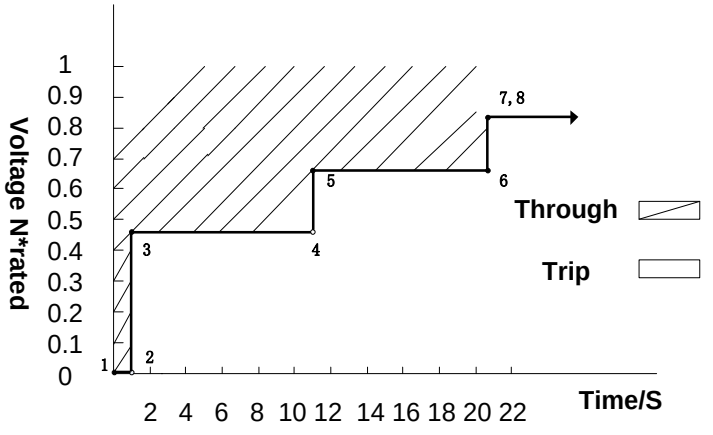


Figure 6-2 The LVRT Curve

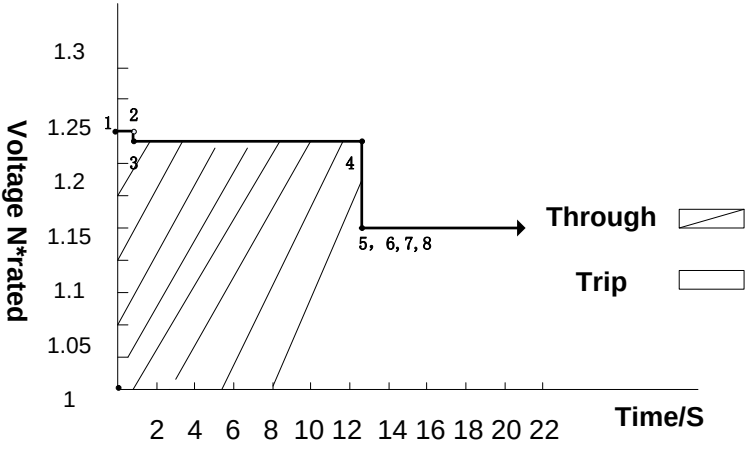


Figure 6-3 The HVRT Curve

Table 6-4 LVRT Parameters (IEEE1547-2018, Rule21 and ISO-NE)

LVRT		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
LVRTVolt (1,2) (%)	Threshold value of Low voltage ride through (1st & 2nd point)	0 0	**0** **0**	100 100	0 0	**0** **0**	100 100	0 0	**0** **0**	100 100
LVRTTime (1,2) (s)	Time of Level Low voltage ride through (1st & 2nd point)	0 0	**0** **1**	655 655	0 0	**0** **1.2**	655 655	0 0	**0** **0.16**	655 655
LVRTVolt (3,4) (%)	Threshold value of Low voltage ride through (3rd & 4th point)	0 0	**50** **50**	100 100	0 0	**50** **50**	100 100	0 0	**30** **45**	100 100
LVRTTime (3,4) (s)	Time of Level Low voltage ride through (3rd & 4th point)	0 0	**1** **10**	655 655	0 0	**1.2** **10.5**	655 655	0 0	**0.16** **0.21**	655 655
LVRTVolt (5,6) (%)	Threshold value of Low voltage ride through (5th & 6th point)	0 0	**70** **70**	100 100	0 0	**70** **70**	100 100	0 0	**45** **65**	100 100
LVRTTime (5,6) (s)	Time of Level Low voltage ride through (5th & 6th point)	0 0	**10** **20**	655 655	0 0	**10.5** **20.5**	655 655	0 0	**0.37** **0.37**	655 655
LVRTVolt (7,8) (%)	Threshold value of Low voltage ride through (7th & 8th point)	0 0	**88** **88**	100 100	0 0	**88** **88**	100 100	0 0	**65** **88**	100 100
LVRTTime (7,8) (s)	Time of Level Low voltage ride through (7th & 8th point)	0 0	**20** **20**	655 655	0 0	**20.5** **20.5**	655 655	0 0	**3.05** **3.25**	655 655

Table 6-5 HVRT Parameters (IEEE1547-2018, Rule21 and ISO-NE)

HVRT		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
HVRTVolt (1,2) (%)	Threshold value of high voltage ride through (1st & 2nd point)	100 100	**125** **125**	135 135	100 100	**125** **125**	135 135	100 100	**120** **120**	135 135
HVRTTime (1,2) (s)	Time of Level high voltage ride through (1st & 2nd point)	0 0	**0** **0.16**	655 655	0 0	**0** **0.11**	655 655	0 0	**0** **0.16**	655 655
HVRTVolt (3,4) (%)	Threshold value of high voltage ride through (3rd & 4th point)	100 100	**120** **120**	135 135	100 100	**120** **120**	135 135	100 100	**120** **117.5**	135 135
HVRTTime (3,4) (s)	Time of Level high voltage ride through (3rd & 4th point)	0 0	**0.16** **12**	655 655	0 0	**0.11** **12.50**	655 655	0 0	**0.25** **0.25**	655 655
HVRTVolt (5,6) (%)	Threshold value of high voltage ride through (5th & 6th point)	100 100	**110** **110**	135 135	0 0	**110** **110**	135 135	100 100	**117.5** **115**	135 135
HVRTTime (5,6) (s)	Time of Level high voltage ride through (5th & 6th point)	0 0	**12** **12**	655 655	0 0	**12.5** **12.5**	655 655	0 0	**0.55** **0.55**	655 655
HVRTVolt (7,8) (%)	Threshold value of high voltage ride through (7th & 8th point)	100 100	**110** **110**	135 135	100 100	**110** **110**	135 135	100 100	**115** **110**	135 135
HVRTTime (7,8) (s)	Time of Level high voltage ride through (7th & 8th point)	0 0	**12** **12**	655 655	0 0	**12.5** **12.5**	655 655	0 0	**1.05** **1.05**	655 655

Table 6-6 LVRT and HVRT Parameters (IEEE1547-2018, Rule21 and ISO-NE)

Grid Frequency Protection		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
LVRTModeSetting	0: Disable 1: Enable, no reactive power output 2: Enable, reactive power output	0	**2**	2	0	**2**	2	0	**2**	2
LVRTTripVolt(%)	Threshold value of LOW voltage trip	70	**88**	100	70	**88**	100	70	**88**	100
LVRTPstReactive1	The factor LVRT Positive Reactive Current	0	**200**	300	0	**200**	300	0	**150**	300
LVRTNegReactive1	The factor LVRT Negative Reactive Current	0	**200**	300	0	**200**	300	0	**200**	300
HVRTModeSetting	0: Disable 1: Enable, no reactive power output 2: Enable, reactive power output	0	**1**	2	0	**1**	2	0	**1**	2
HVRTTripVol(%)	Threshold value of HIGH voltage trip	100	**110**	135	100	**110**	135	100	**110**	135

6.2.5 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 6-13.

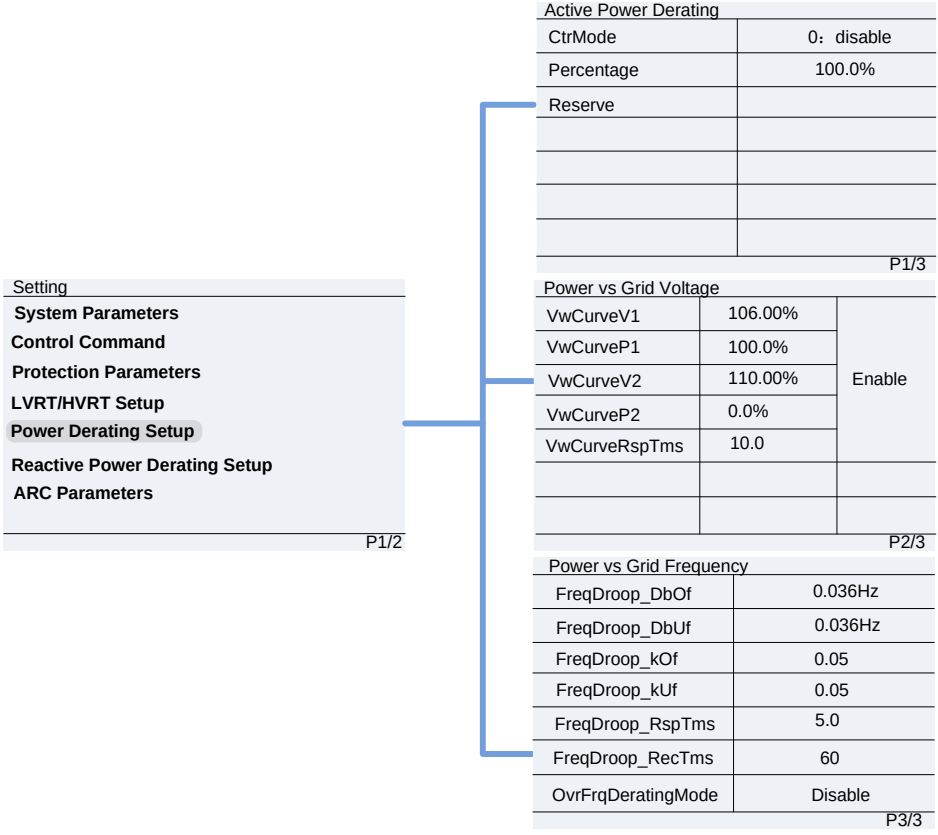


Figure 6-4 Power Derating Setup

Power vs Grid Frequency: The active power output shall be as defined by the relevant formula below, plus any inertial response to the rate of change of frequency, until frequency returns to within the dead band.(See Figure 6-14)

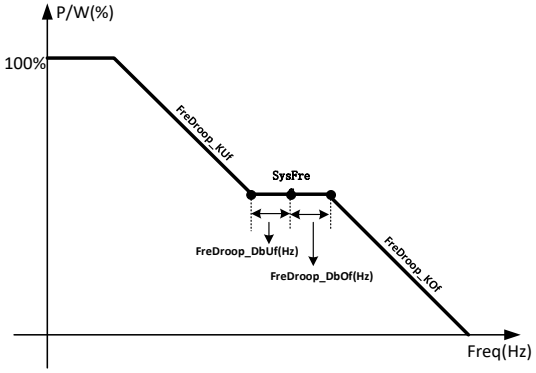


Figure 6-14 Curve of frequency derating

Formula for over frequency **:**

$P=P_{pre}+(F_n +FreqDroop\_DbOf- F_{pre}) / F_n/ FreqDroop\_KOf$

Formula for under frequency:

$P = P_{pre} + (F_n - FreqDroop\_DbUf - F_{pre})/ F_n / FreqDroop\_KUf$

where

P is the active power output, in p.u. of the DER nameplate active power rating;

P_{pre} is the pre-disturbance active power output at the point of time, in p.u. of the DER nameplate active power rating;

F_n is the grid rated frequency

F_{pre} is the disturbed system frequency in Hz

Table 6-7 Power Derating Setup

Power Derating Setup		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
CtrMode	The control mode of active power 0: Disable dispatch 1: Remote dispatch 2: Local control	0	**0**	2	0	**0**	2	0	**0**	2
Percentage(%)	Local electric dispatch Active Power setting value	0	**100**	100	0	**100**	100	0	**100**	100
Grid Over Voltage Derating										
VwCurveV1(%)	The starting voltage V1 of grid overvoltage derating	105	**106**	109	105	**106**	109	105	**106**	109
VwCurveP1(%)	The starting power P1 of grid overvoltage derating	0	**100**	100	0	**100**	100	0	**100**	100
VwCurveV2(%)	End voltage V2 of grid overvoltage derating	106	**110**	110	106	**110**	110	106	**110**	110
VwCurveP2(%)	End power P2 of grid overvoltage derating	0	**0**	100	0	**0**	100	0	**0**	100
VwCurveRspTms (s)	Open-loop response time for grid overvoltage derating	0.5	**10**	90	0.5	**5**	90	0.5	**10**	90
Grid Frequency Derating										
FreqDroop_DbOf (Hz)	The dead zone of overfrequency active power regulation	0	**0.036**	1	0	**0.036**	1	0	**0.5**	1

Power Derating Setup		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
FreqDroop_DbUf (Hz)	The dead zone of underfrequency active power regulation	0	**0.036**	1	0	**0.036**	1	0	**0.5**	1
FreqDroop_kOf	Coefficient of overfrequency active power regulation	0.02	**0.05**	0.1	0.02	**0.05**	0.1	0.02	**0.05**	0.1
FreqDroop_kUf	Coefficient of underfrequency active power regulation	0.02	**0.05**	0.1	0.02	**0.05**	0.1	0.02	**0.05**	0.1
FreqDroop_RspT ms(s)	Response time of frequency active regulation	0.2	**5**	10	0.2	**5**	10	0.2	**5**	10
FreqDroop_RecT ms(s)	Recovery time of frequency active regulation	0	**60**	1000	0	**900**	1000	0	**900**	1000
OverFrqDerating Mode	Overfrequency underload protection enable setting 0: Disable 1: Enable	0	**0**	1	0	**1**	1	0	**0**	1

6.2.6 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 6-8.

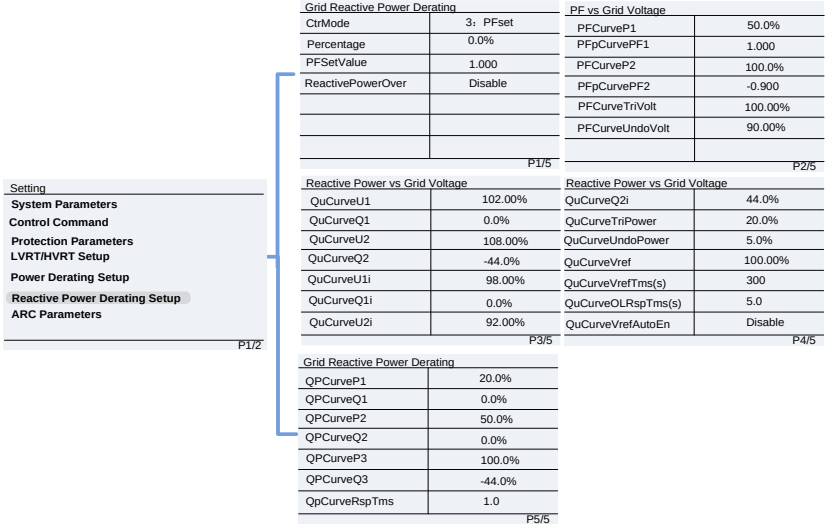


Figure 6-15 Reactive Derating Setting

Table 6-8 Reactive Power Control (IEEE-1547, Rule21, and ISO-NE)

Grid Reactive Power Derating		Setting Range								
Parameter Name	Description	IEEE1547−2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
CtrMode	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 6：Q(P)curve	0	**3**	6	0	**5**	6	0	**0**	6
Percentage (%)	Local Power Factor Setting	-60	**0**	60	-60	**0**	60	-60	**0**	60
PFSetValue	Local Power Factor Setting	-1.0, -0.8	**1.0**	0.8, 1.0	-1.0, -0.8	**-0.95**	0.8, 1.0	-1.0, -0.8	**1.0**	0.8, 1.0
ReactivePowerOver	Reactive power over-provisioning enable setting 0: Disable 1: Enable	0	**0**	1	0	**0**	1	0	**0**	1
PFCurveP1（%）	Power of PF(P) Curve point 1	0	**50**	110	0	**50**	110	0	**50**	110
PFpCurvePF1	PF of PF(P) Curve point 1	-1.0, - 0.8	**1.0**	0.8, 1.0	-1.0, - 0.8	**1.0**	0.8, 1.0	-1.0, - 0.8	**1.0**	0.8, 1.0
PFCurveP2（%）	Power of PF(P) Curve point 2	0	**100**	110	0	**100**	110	0	**100**	110
PFpCurvePF2	PF of PF(P) Curve point 2	-1.0, - 0.8	**-0.9**	0.8, 1.0	-1.0, - 0.8	**-0.9**	0.8, 1.0	-1.0, - 0.8	**-0.9**	0.8, 1.0
PFCurveTriVol (%)	The trigger voltage of PF(P)Curve	100	**100**	110	100	**100**	110	100	**100**	110
PFCurveUndoVol (%)	PF curve revocation voltage	90	**90**	100	90	**90**	100	90	**90**	100

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

1. **PFSetValue**: Set the PF value. This function changes the reactive power by adjusting the Power Factor.
2. **PFpCurve functions**: PFp curve mode. Using the curves to set the PFp setpoints (See Figure 6-16).

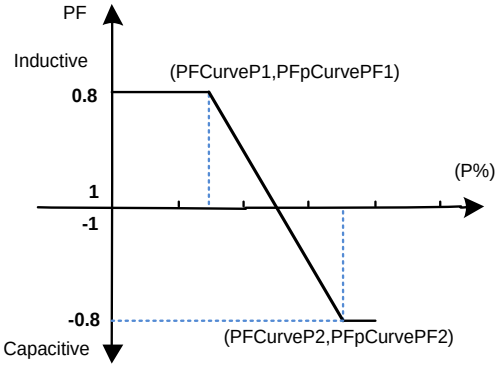


Figure 6-16 PF(P) Curve Mode

3. **Q(U) Curve**：Q(U) curve mode. Using the curves to set the reactive power setpoints (See Figure 6-17). The reactive power compensation changes according to the grid voltage.

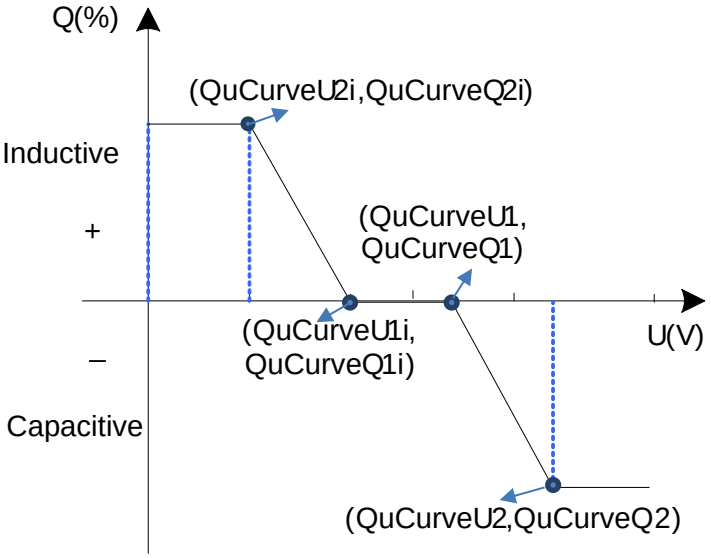


Figure 6-17 Q(U) Curve Mode

Table 6-9 lists the parameters for Q(U) Curve modes. Press ENT to start the modes after the parameters are set.

Table 6-9 Reactive Power Control (IEEE-1547, Rule21, and ISO-NE)

Grid Reactive Power Derating		Setting Range								
Parameter name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
QuCurveU1 (%)	Voltage of Q(U) Curve point 1	90	**102**	110	90	**103.3**	110	90	**107.99**	110
QuCurveQ1 (%)	Reactive power of Q(U) Curve point 1	-60	**0**	60	-60	**0**	60	-60	**0**	60
QuCurveU2 (%)	Voltage of Q(U) Curve point 2	90	**108**	120	90	**107**	120	90	**110**	120
QuCurveQ2 (%)	Reactive power of Q(U) Curve point 2	-60	**-44**	60	-60	**-30**	60	-60	**-50**	60
QuCurveU1i (%)	Voltage of Q(U) Curve point 1i	90	**98**	110	90	**96.7**	110	90	**92.01**	110

QuCurveQ1i (%)	Reactive power of Q(U) Curve point 1i	-60	**0**	60	-60	**0**	60	-60	**0**	60
QuCurveU2i (%)	Voltage of Q(U)Curve point 2i	80	**92**	110	80	**92**	110	80	**90**	110
QuCurveQ2i (%)	Reactive power of Q(U)Curve point 2i	-60	**44**	60	-60	**30**	60	-60	**50**	60
QuCurveTriPower (%)	The trigger of Q(U)Curve	5	**20**	100	5	**20**	100	5	**20**	100
QuCurveUndoPower (%)	The end of Q(U)Curve	5	**5**	100	5	**5**	100	5	**5**	100
QuCurveVref(%)	The rated reference voltage of Q(U) curve	95	**100**	105	95	**100**	105	95	**100**	105
QuCurveVrefTms (s)	The rated reference voltage regulation time of Q(U) curve	300	**300**	5000	300	**300**	5000	300	**300**	5000
QuCurveOLRspTms(s)	Open loop response time of Q(U) curve	1	**5**	90	1	**5**	90	1	**5**	90
QuCurveVrefAutoEn	The rated reference voltage enable of QU curve 0: Disable 1: Enable	0	**0**	1	0	**0**	1	0	**0**	1

4. **Q(P) Curve**: Q(P) curve mode. Using the curves to set the reactive power setpoints (See Figure 6-18). The reactive power compensation changes according to the active power.

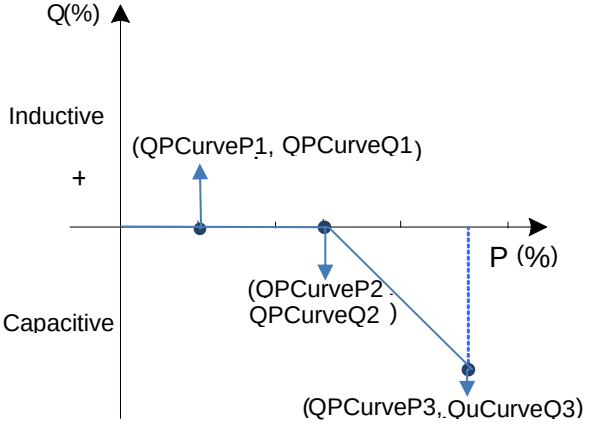


Figure 6-18 Q(P) Curve Mode

Table 6-10 lists the parameters for PF Set and Q(P) Curve modes. Press ENT to start the modes after the parameters are set.

Table 6-10 Reactive Power Control (IEEE1547-2018, Rule21 and ISO-NE)

Grid Reactive Power Derating		Setting Range								
Parameter name	Description	IEEE1547−2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
QPCurveP1 (%)	Active power of Q(P) Curve point 1	0	**20**	100	0	**20**	100	0	**20**	100
QPCurveQ1 (%)	Reactive power of Q(P) Curve point 1	-66	**0**	66	-66	**0**	66	-66	**0**	66
QPCurveP2 (%)	Active power of Q(P) Curve point 2	0	**50**	100	0	**50**	100	0	**50**	100
QPCurveQ2 (%)	Reactive power of Q(P) Curve point 2	-66	**0**	66	-66	**0**	66	-66	**0**	66
QPCurveP3 (%)	Active power of Q(P) Curve point 3	0	**100**	100	0	**100**	100	0	**100**	100
QPCurveQ3 (%)	Reactive power of Q(P) Curve point 3	-66	**-44**	66	-66	**-44**	66	-66	**-44**	66
QpCurveRspT ms(s)	Response time of of Q(P)Curve	0	**1**	10	0	**1**	10	0	**1**	10

6.2.7 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.

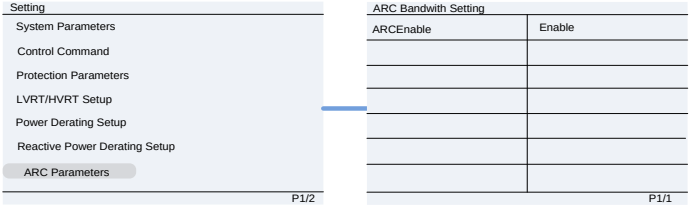


Figure 6-19 Arc Parameters Setting

6.2.8 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 6-20 and Table 6-11.

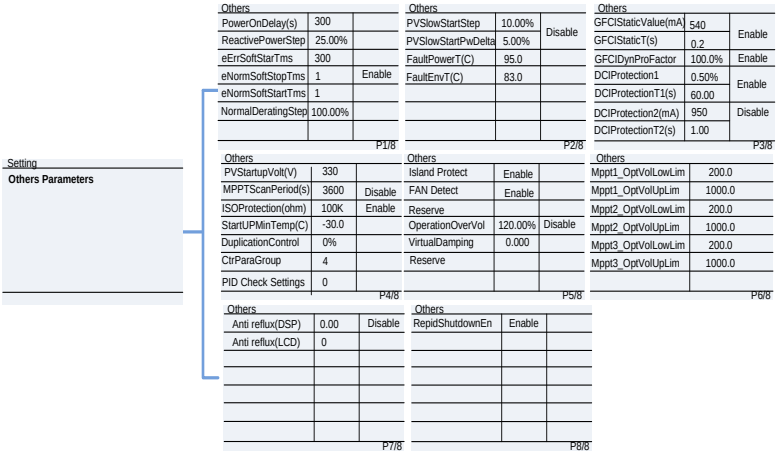


Figure 6-20 Other Parameters Setting

Table 6-11 Other Parameters

Other Parameters		Setting Range								
Parameter Name	Description	IEEE1547−2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
PowerOnDelay (s)	Startup delay time	1	**300**	1200	1	**300**	1200	1	**300**	1200
ReactivePowerStep (%/P)	Reactive power adjustment step	0.01	**25**	600	0.01	**25**	600	0.01	**25**	600
eErrSoftStarTms (s)	Power startup time after Grid Fault	1	**300**	1000	1	**50**	1000	1	**600**	1000
eNormSoftStopTms (s)	Normal power time in soft stop	1	**1**	1000	1	**10**	1000	1	**10**	1000
eNormSoftStartTms (s)	Normal power time in soft startup	1	**1**	1000	1	**1**	1000	1	**50**	1000
NormalDeratingStep	Power step in Derarting	0.01	**100**	100	0.01	**100**	100	0.01	**6**	100
PVSlowStartStep (%/P)	PV power sudden change slow start step size	0.01	**10**	100	0.01	**10**	100	0.01	**10**	100
PVSlowStartPwDelta	PV power sudden change slow start power limit increment	0.01	**5**	10	0.01	**5**	10	0.01	**5**	10
FaultPowerT(C)	The trigger temperature of module (C)	95	**95**	95	95	**95**	95	95	**95**	95
FaultEnvT(C)	The trigger temperature of enviroment (C)	83	**83**	83	83	**83**	83	83	**83**	83
GFCIStaticValue (mA)	The static threshold value of Leakage current	100	**540**	1000	100	**540**	1000	100	**540**	1000
GFCIStaticT (s)	The static threshold time of	0	**0.2**	655	0	**0.20**	655	0	**0.2**	655

Other Parameters		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
	Leakage current									
GFCIDynProFactor	The dynamic trigger coefficient of Leakage current	0	**100**	200	0	**100**	200	0	**100**	200
DCIProtection1	Maximum DCI value1	0.01	**0.50**	5	0.01	**0.50**	5	0.01	**0.50**	5
DCIProtectionT1 (s)	Trip time 1 of DCI	0	**60**	120	0	**60**	120	0	**60**	120
DCIProtection2 (mA)	Maximum DCI value2	5	**950**	5000	5	**950**	5000	5	**950**	5000
DCIProtectionT2 (s)	Trip time 2 of DCI	0	**1**	120	0	**1**	120	0	**1**	120
PVStartupVolt(V)	PV start-up voltage	300	**330**	400	300	**330**	400	300	**330**	400
MPPTScanPeriod (s)	MPPT Scan Cycle	300	**3600**	5400	300	**3600**	5400	300	**3600**	5400
ISOProtection (Ω)	Minimum insulation resistance	1k	**100k**	2000 k	1k	**100k**	2000 k	1k	**100k**	2000 k
StartUPMinTemp (C)	The minimum startup temperature	-35	**-30**	-20	-35	**-30**	-20	-35	**-30**	-20
DuplicationControl	Parameter of repetitive control	0	**0**	100	0	**0**	100	0	**0**	100
CtrParaGroup	The enabled control parameters group.	0	**4**	4	0	**4**	4	0	**4**	4
PID Check Settings	PIDcheck enable setting 0: Disable 1: Enable	0	**0**	1	0	**0**	1	0	**0**	1

Other Parameters		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
Island Protect	Island enable/disable control 0: Disable 1: Enable	0	**1**	1	0	**1**	1	0	**1**	1
FAN Detect	Fan detection enable/disable control 0: Disable 1: Enable	0	**1**	1	0	**1**	1	0	**1**	1
OperationOverVol	Operating overvoltage protection value	100	**120**	135	100	**120**	135	100	**120**	135
VirtualDamping	The parameter of Virtual Damping	0	**0**	5	0	**0**	5	0	**0**	5
Mppt1_OptVolLowLim	Mppt1 optimizer's Voltage lower limit	200	**200**	1500	200	**200**	1500	200	**200**	1500
Mppt1_OptVolUpLim	Mppt1 optimizer's Voltage upper limit	200	**1000**	1500	200	**1000**	1500	200	**1000**	1500
Mppt2_OptVolLowLim	Mppt2 optimizer's Voltage lower limit	200	**200**	1500	200	**200**	1500	200	**200**	1500
Mppt2_OptVolUpLim	Mppt2 optimizer's Voltage upper limit	200	**1000**	1500	200	**1000**	1500	200	**1000**	1500
Mppt3_OptVolLowLim	Mppt3 optimizer's Voltage lower limit	200	**200**	1500	200	**200**	1500	200	**200**	1500
Mppt3_OptVolUpLim	Mppt3 optimizer's Voltage upper limit	200	**1000**	1500	200	**1000**	1500	200	**1000**	1500
Anti reflux(DSP)	DSP anti-backflow communication	0.5	**0**	60	0.5	**0**	60	0.5	**0**	60

Other Parameters		Setting Range								
Parameter Name	Description	IEEE1547-2018			Rule21			ISO-NE		
		Min	Default	Max	Min	Default	Max	Min	Default	Max
	delay									
Anti reflux(LCD)	LCD anti-backflow communication delay	0	**0**	255	0	**0**	255	0	**0**	255
RapidShutdownEn	Fast Shutdown Enable control 0: Disable 1: Enable	0	**1**	1	0	**1**	1	0	**1**	1

Note: Compatibility among the functions:

1. Once the grid voltage is lower than LVRT trigger voltage, i.e. when it is in LVRT state, the following functions will be unavailable:

   Anti-islanding, QU, PF(P), Q(P), PF Setting, reactive power setting, over frequency derating, GFCI, Grid over frequency protection, Grid unbalance protection, DCI protection.

2. Only one of the following four functions can be set as valid at one time: QU, PF(P), PF Setting and reactive power setting.

6.3 Power ON/OFF

6.3.1 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.

6.3.2 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.

6.4 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 6-21.

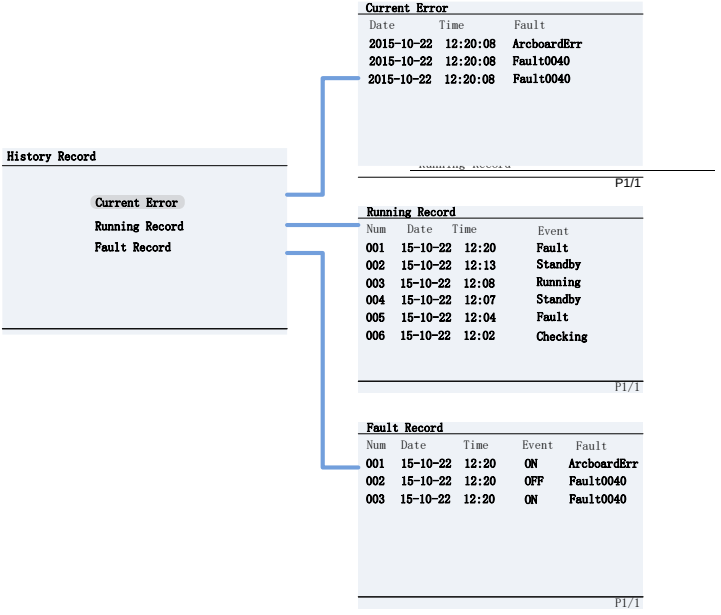


Figure 6-21 History Menu and Submenu

1. **Current Error:** This log will display any faults that are currently affecting the operation of the inverter.
2. **Running Record**: This log can store up to 128 running history messages. This includes normal operating events such as the inverter turning on, going into standby and turning off.
3. **Fault Record:** This log can store up to 128 fault codes.

6.5 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 6-22.

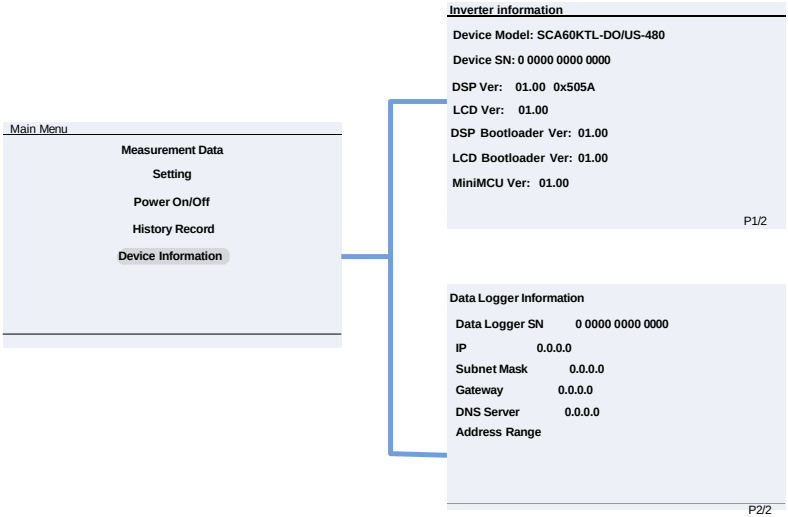


Figure 6-22 Device Information

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.

6.6 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.

6.7 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 shut down 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.

6.8 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 section 7 to determine the cause of the error.

6.9 Grid-tied Power Generation

The CPS SCA36/50/60KTL-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.

6.10 Firmware Upgrade

Contact CPS Service about upgrading the inverter firmware. The inverter firmware can be upgraded remotely if a CPS FlexOM Gateway is installed.

To 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.

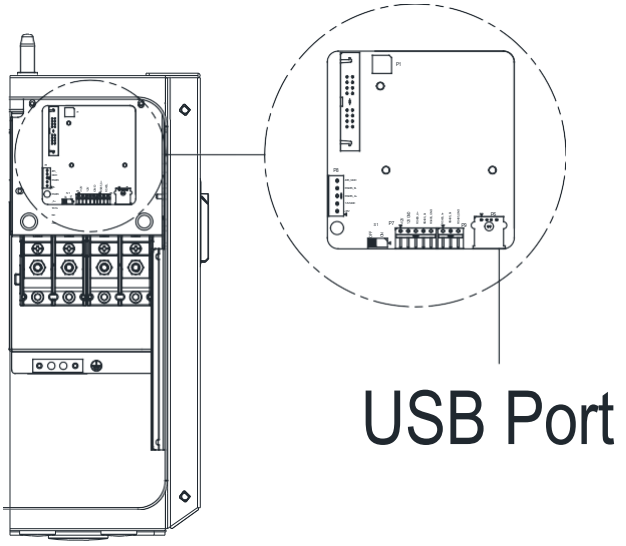


Figure 6-23 USB Port for Firmware Upgrades

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 6-24.
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.

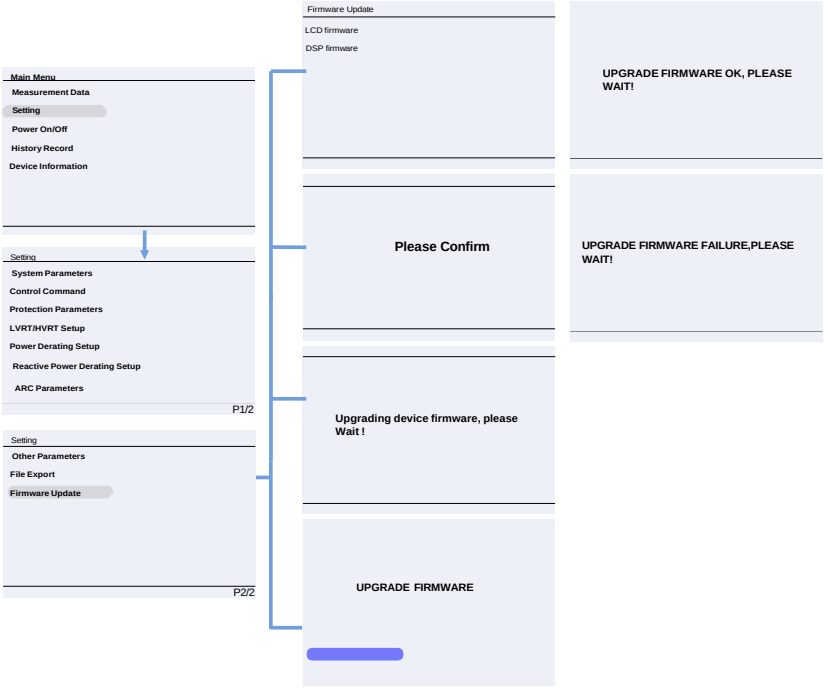


Figure 6-24 Firmware Upgrade Interface

7 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.

7.1 LED Fault and Troubleshooting

Please refer to the definition of LED lights in Table 4-1 and troubleshoot according to Table 7-1:

Table 7-1 Troubleshooting of LED Lights

LED fault status	Solutions
Neither the “Power” LED nor the LCD screen lights up.	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.	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 7-2 through Table 7-4 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.

7.2 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 6.4 History Record for detailed operation.

The causes of a fault can be identified based on the faults listed in Table 7-2 through Table 7-7. 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 7-2 LCD Troubleshooting WARNING

Type	Error/State	Fault Description / Instruction
Warning	ExtFanErr	When the inverter is displaying "ExtFanErr" and the output power of the inverter is greater than 50% of it's rated output, do the following: If the fan is spinning --> Replace the inverter because the sensing circuit has a problem. If the fan is not spinning --> Remove the 6 bolts that are holding the two external fans in place. Open the white, snap-on wire connector. Measure the voltage between the pins connected to the RED and BLACK wires. If the voltage is below 6VDC --> Replace the inverter. If the voltage is higher than 6V --> Replace the fan
	IntFanErr	Replace the inverter
	Warn0030 (EepromErr)	Recommended solutions: 1. Observe for 5 minutes to see whether the alarm will be eliminated automatically. 2. Contact post-sales service if not corrected
	Warn0040 (DC SPD)	Recommended solutions: 1. Visually check the DC Surge Protection Device (SPD) 2. If the indicator is "red" --> Replace the SPD module. 3. If the indicator is "green" --> Remove and reinstall SPD module in the socket. 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
	Warn0100 (AC SPD)	Recommended solutions: 1. Visually check the DC Surge Protection Device (SPD) 2. If the indicator is "red" --> Replace the SPD module. 3. If the indicator is "green" --> Remove and reinstall SPD module in the socket. Contact post-sales service if not corrected

Table 7-3 LCD Troubleshooting ALARM

Type	Error/State	Fault Description / Instruction
ALARM	TempSensorErr	Definition: Prompt detection of abnormal temperature
		Possible causes: 1. Temperature Sensor socket connecter 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 connecters 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 connecter 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

	EepromErr	Definition: Internal alarm 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 7-4 LCD Troubleshooting PROTECTION

Type	Error/State	Fault Description / Instruction
Protection	Protect0090 (Bus over voltage)	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)	1. 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 2. If after adjustment, alarm still occurs, replace inverter
	Protect0030 (Inverter Over Current)	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	1. Check the AC connections and AC voltage is within range 2. Restart the inverter again
	GridF.OutLim	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)	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)	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)	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)	1. Raise limit of DCImax (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 7-5 LCD Troubleshooting PROTECTION (cont.)

Type	Error/State	Fault Description / Instruction
PROTECTION	IsolationErr (Insulation resistance low)	Check wires of PV and ground: 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)	Check wires of PV and ground: 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 grid, add in the next string. Start inverter again 5. Continue until the string that triggers the alarm is identified. 6. Trace back the faulted string to find any leakage to Earth Ground
	Protect0150 (Mini MCU Fault)	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))	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)	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 filter board or inverter.
	PVxReverse (PVx input reverse connection x=1,2,3)	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)	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 3. If inverter cannot clear fault, replace inverter
	PV2VoltOver (PVx Over Volt x=1,2,3)	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 panels in the string.

Table 7-6 LCD Troubleshooting PROTECTION (cont.)

Type	Error/State	Fault Description / Instruction
Protection	Protect0230 (Inverter open-loop self-test fault)	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	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	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 7-7 LCD Troubleshooting FAULT

Type	Error/State	Fault Description / Instruction
Fault	Fault0020 (Bus over volt Hardware)	1. Restart inverter by turning both AC and DC switches OFF. Wait for 5 minutes for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	Fault0060 (CPLD Fault)	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 Control Board or inverter
	Fault0080 (Bus Hardware overcurrent fault)	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
	Fault0090 (Dynamic leakage current high)	Check wires of PV and ground: 1. Turn OFF AC switch to disconnect inverter from grid 2. Open fuse holders to isolate PV strings. Test strings with meter 3. Add one PV string and start inverter to see if alarm occurs. 4. If no alarm, turn OFF AC switches to disconnect from grid and add in the next string. Start inverter again. 5. 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)	1. Restart inverter by turning both AC and DC switches OFF. Wait for 5 minutes for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter
	Fault0110 (Bus imbalance)	1. 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 2. If after adjustment, alarm still occurs, replace inverter

	Fault0130 (Bus over total voltage)	1. Restart inverter by turning both AC and DC switches OFF. Wait for 5 minutes 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)	1. Restart inverter by turning both AC and DC switches OFF. Wait for 5 minutes for all energy to discharge and turn both switches ON 2. If inverter cannot clear fault, replace inverter

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.

8 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.

8.1 Product Maintenance

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

8.1.1 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.

8.1.2 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.

8.1.3 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.
5. Torque value: 0.8-1N.m (7.1-8.9 in-lbs)
6. Install the assembled fan tray back on the inverter and secure with the original screws.
7. Torque value: 1.2N.m (10.6in-lbs)

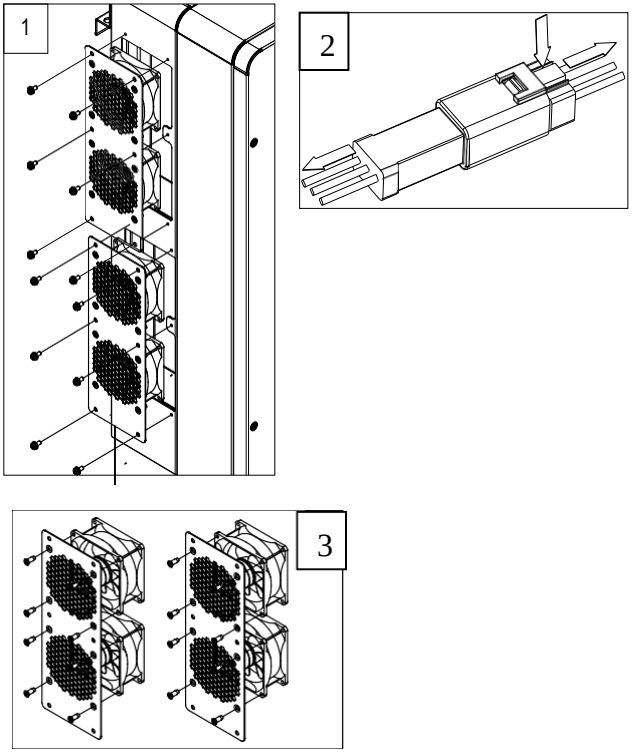


Figure 8-1 Replacing Cooling Fans

DANGER:

Disconnect the electrical power sources in strict accordance with the following steps. Otherwise, the inverter will be damaged and the service personnel's life will be endangered.

8.1.4 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.

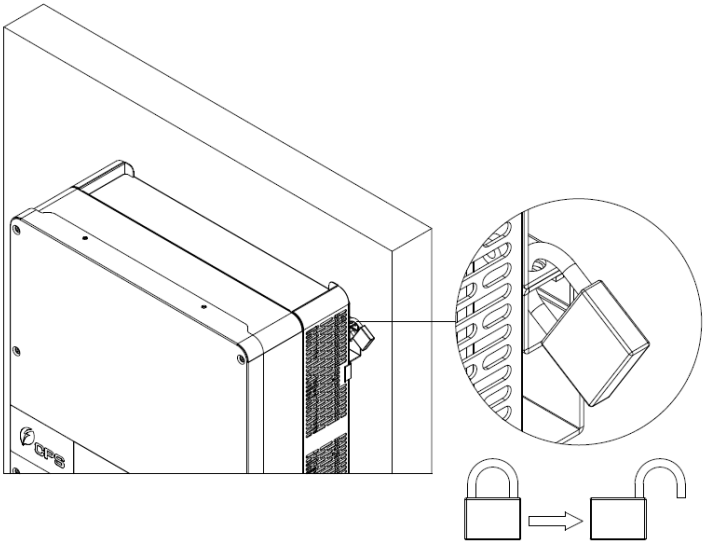


Figure 8-2 Unlock the padlock

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

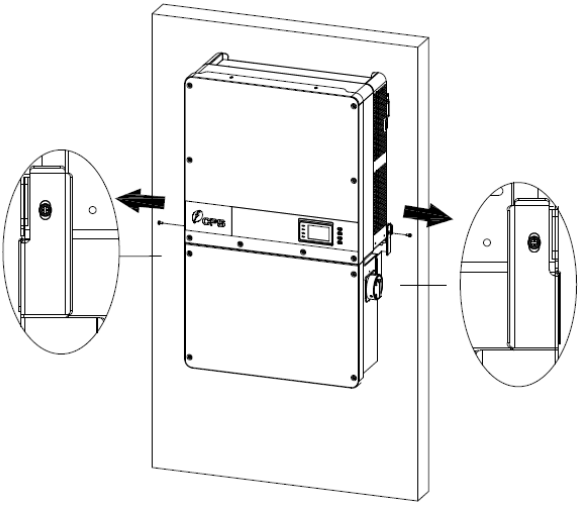


Figure 8-3 Remove the screws on both sides

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.

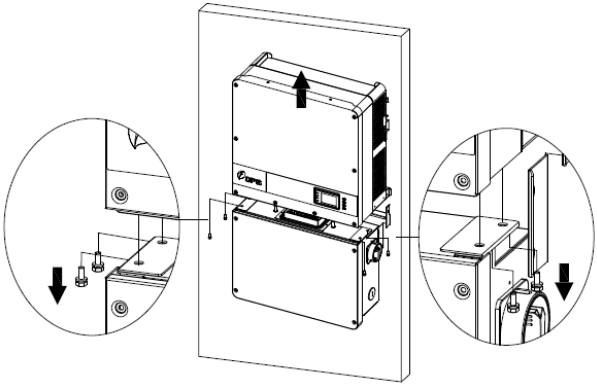


Figure 8-4 Disconnect the main housing from the wiring box

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)

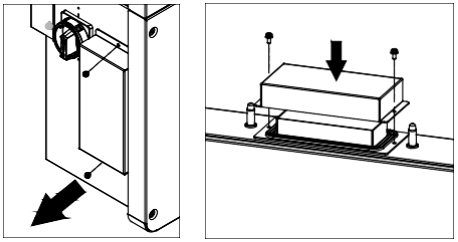


Figure 8-5 Install the cover on the connector of the wiring box

The cover connector does not provide a watertight seal – if inverter replacement is not immediately available, watertight integrity must be maintained by method in addition to connector cover.

8.2 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.

9 Accessories

The CPS SCA36/50/60KTL-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 (36/50/60 Kit, Product Code 1.0107.0131)

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. A maximum #2AWG wire should be used to minimize stress on the adapter.
2. Remove the wirebox cover (Figure 9-1).
3. Remove the plastic touch safe finger guards (Figure 9-2).
4. 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 14.2 in-lbs (1.6 Nm) (Figure 9-3 and Figure 9-4).
5. 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 53 in-lbs (6.0N.m.).
6. Reinstall the plastic touch safe finger guards. Torque value #
7. Reinstall the wirebox cover. Torque to 35.4 in-lbs (4N.m).

Figure 9-1 Remove Wirebox Cover

Figure 9-2 Remove Plastic Touch-safe Finger Guards

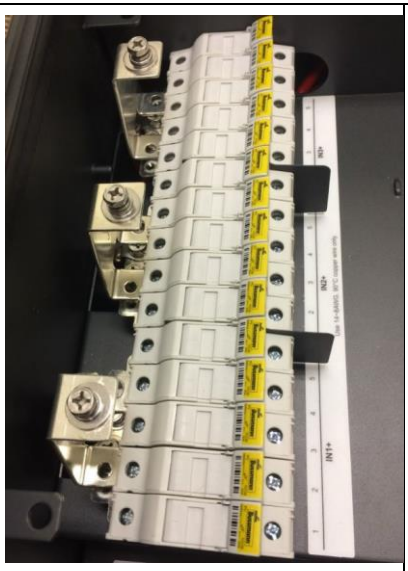


Figure 9-3 Bypass Terminals Installed on POS Input

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**.

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/PVEL-Field-Testing-Report-28kW-Inveter-Shade-Plate.pdf

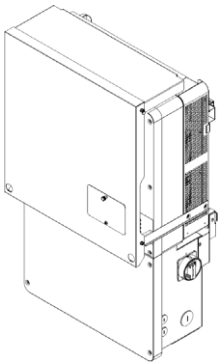


Figure 9-5 Shade Cover installed on CPS 36/50/60kW inverter

9.3 Y-Comb Terminal Block (Optional)

The Y-Comb is intended for use in the SCA36/50/60KTL-DO/US-480 inverters. This accessory is applied between two adjacent fuseholders within the inverter wire-box and distributes current between the two fuseholders. When products such as Y-branch connectors are used in the array field to combine the output of two strings the current is as much as 30 or 40A. In order to distribute current and provide optimal thermal results the Y-Comb is required.

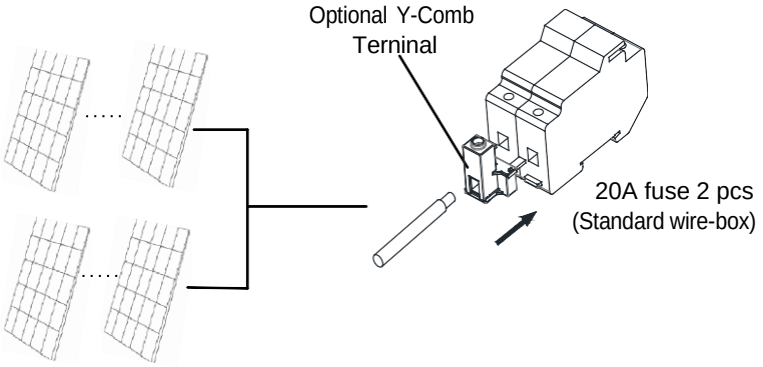


Figure 9-6 Y-Comb Terminal Block

10 Technical Data

10.1 Datasheet

Model Name	SCA50KTL-DO/US-480	SCA60KTL-DO/US-480	SCA36KTL-DO/US-480
DC Input			
Max. PV Power	90kW (33kW per MPPT)		61.2kW (22.44kW per MPPT)
Max. DC Input Voltage	1000VDC		
Operating DC Input Voltage Range	200-950VDC		
Start-up DC Input Voltage / Power	330V / 80W		
Number of MPP Trackers	3		
MPPT Voltage Range	480-850VDC	540-850VDC	400-850Vdc
Max.PV Short-Circuit Current (Isc 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, 2800VC, 20kA ITM (8/20μS)		
AC Output			
Rated AC Output Power @ PF>0.99 to ±0.91 [1]	50kW	60kW	36kW
Max. AC Apparent Power (Selectable)	50kVA/55kVA	60kVA/66kVA	36kVA
Rated Output Voltage	480VAC		
Output Voltage Range[2]	422-528VAC		
Grid Connection Type	3Φ/PE/N (Neutral optional)		
Max. AC Output Current @480V_{AC}	60.2A/66.2A	72.2A/79.4A	43.5A
Max AC OCPD Rating	110A	125A	125A
Rated Output Frequency	60Hz		
Output Frequency Range[2]	57-63 Hz		
Power Factor	>0.99 (±0.8 adjustable)		
Current THD	<3%		
Max. Fault Current Contribution (1 Cycle RMS)	64.1A (1.06/0.88 PU)		73.2 A (1.68 PU)
AC Disconnection Type	Load rated AC switch		

1) Active Power Derating begins; at PF=±0.91 to ±0.8 when Max AC Apparent Power is set to 55 or 66kVA.
2) 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%	97.4%
Stand-by / Night Consumption	<1W	<3W
Environment		
Enclosure Protection Degree	NEMA 4X	
Cooling Method	Variable speed cooling fans	
Operating Temperature Range[3]	-22°F to +140°F / - 30°C to +60°C (derating from +113°F / +45°C)	
Non-Operating Temperature Range[4]	No low temp minimum to +158°F / +70°C maximum	
Operating Humidity	0 to 100%	
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	SunSpec, Modbus RS485	
Site Level Monitoring	CPS FlexOM Gateway (1 per 32 inverters)	
Modbus Data Mapping	CPS	
Remote Diagnostics / FW Upgrade Functions	Standard / with FlexOM Gateway	
Mechanical Data		
Dimensions (WxHxD)	39.4 x 23.6 x 10.24 in. (600×1000×260mm)	
Weight	Inverter:123.5lbs/56kg; Wirebox:33lbs/15kg	
Mounting / Installation Angle[5]	15 to 90 degrees from horizontal (vertical, or angled)	
AC Termination	M8 Stud Type Terminal Block (Wire range: #6-3/0AWG CU / AL, Lugs not supplied)	
DC Termination[6]	Screw Clamp, Neg. Busbar (RSD version[6]) Wire range: #14 - #6AWG CU	
Fused String Inputs [7]	RSD[6] and Standard Wire-box: 20A fuses provided (Fuse values up to 30A acceptable)	
Safety		
Certifications and Standards	UL1741-SA Ed. 3, UL1699B, UL1998, CSA-C22.2 NO.107.1-01, IEEE1547-2018, FCC PART15	
Selectable Grid Standard	IEEE 1547a2014, IEEE1547-2018, CA Rule 21, ISO-NE, HECO	
Smart-Grid Features	Volt-RideThru, Freq-RideThru, Ramp-Rate, Specified-PF, Volt-VAr, Freq-Watt, Volt-Watt	

3) Active Power Derating begins; at 40°C when PF=±0.9 and MPPT ≥Vmin, at 45°C when PF=1 and MPPT ≥Vmin, and at 50°C when PF=1 and MPPT V ≥ 700Vdc.
4) See user manual for further requirements regarding non-operating conditions.
5) Shade Cover accessory required for installation angles of 75 degrees or less.
6) RSD wire-box only includes fuses/fuseholders on the positive polarity, compliant with NEC 2017, 690.9 (C).
7) Fuse values above 20A have additional spacing requirements or require the use of the Y-Comb Terminal Block. See user manual for details.

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 analyzers). The inverter is not a measuring instrument and has wider tolerances for the measurements it makes.

The inverter tolerances are generally:

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

CPS inverter tolerances are specified below:

- Voltage tolerances: ±1%
- Current tolerances: ±2%
- Frequency tolerances: ±0.5%
- Power tolerances: ±3%
- Time tolerances: ±1%
- Temperature tolerances: ±2degC

10.3 Production Graphs

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

10.3.1 High Temperature Derating Graph

When the ambient temperature is higher than 113°F (45℃), the inverter output power (Pn) will begin to derate, as shown in Figure 10-1:

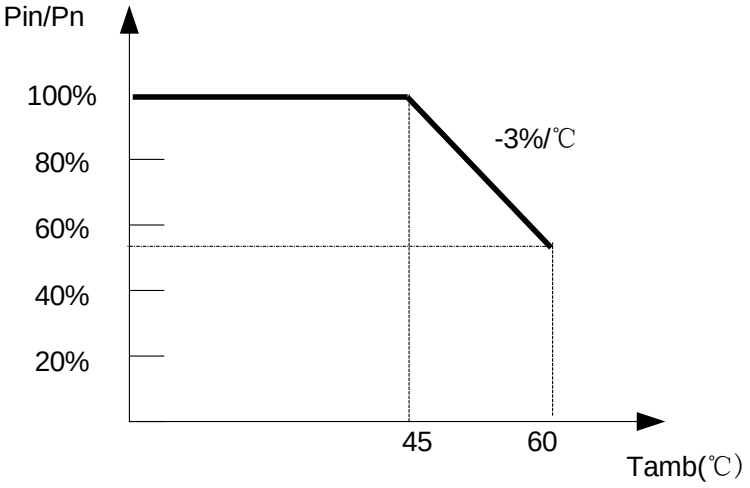


Figure 10-1 SCA36/50/60KTL Derating Curve with High Temperature

10.3.2 Altitude Derating Graph

When the altitude is higher than 9842.5ft (3000m), the rated output power (Pn) of the inverter will decrease, as shown in Figure 10-2:

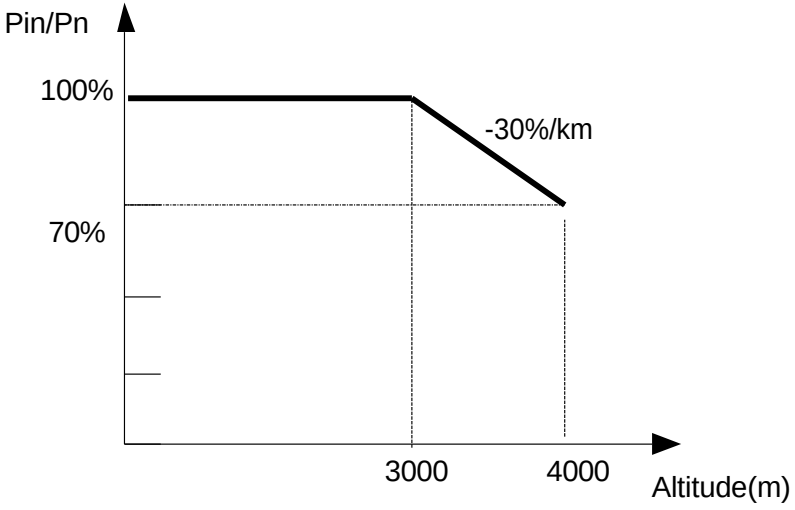


Figure 10-2 SCA36/50/60KTL Derating Curve with High Altitude

10.3.3 Grid Voltage Derating Graph

1) When the Volt-Watt function is disabled, and grid voltage is within 100%~110% (Un ~ 1.1*Un) of the Rated Output Voltage, the inverter output power (Pn) 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 (Pn) will begin to derate, as shown in Figure 10-3-1.

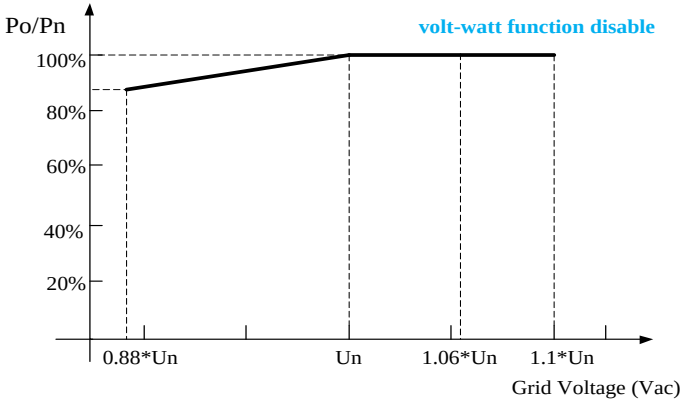


Figure 10-3-1 SCA36/50/60KTL Derating Curve of Grid Voltage

2) When volt-watt function enable, the grid voltage is within 100%~106% (Un ~ 1.06*Un) of the Rated Output Voltage, the inverter output power (Pn) may reach 100%. When the grid voltage is lower than the Rated Output Voltage or more than 106%Un, the inverter will limit the AC Output Current and the output power (Pn) will begin to derate, shown in Figure 10-3-2.

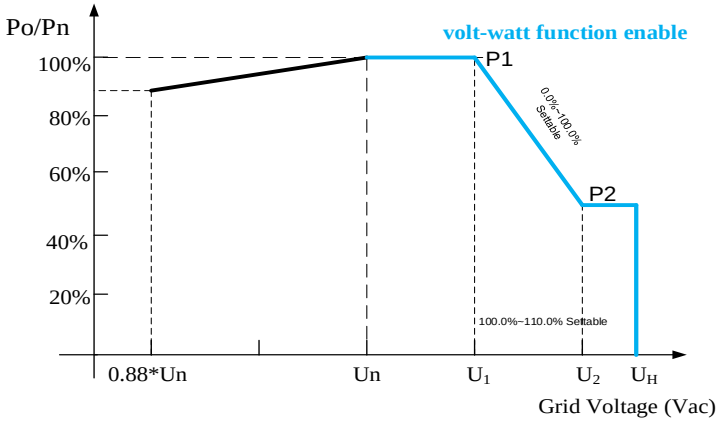


Figure 10-3-2 SCA36/50/60KTL Derating Curve of Grid Voltage

10.3.4 PV Voltage Derating Graph

For CPS SCA50/60KTL-DO/US-480, when the DC input voltage is lower than 480/540V or higher than 850V, the inverter output power (Pn) will begin to derate, as shown in Figure 10-4 and 10-5:

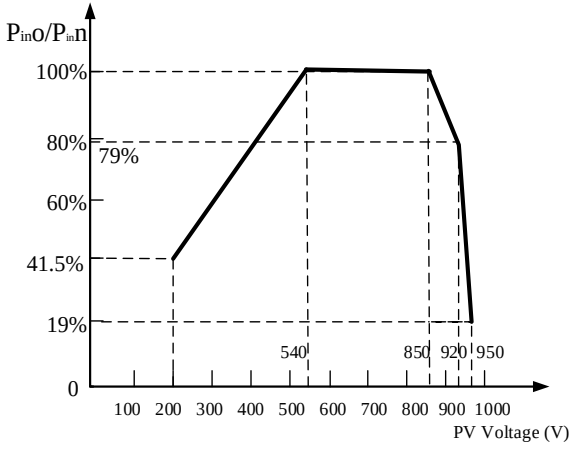


Figure 10-4 CPS SCA60KTL derating curve of PV input voltage

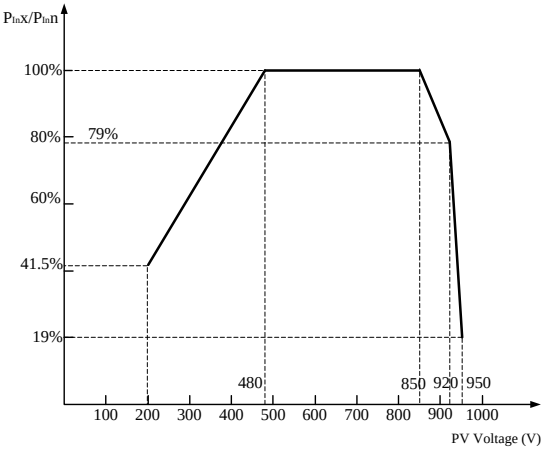


Figure 10-5 CPS SCA50KTL derating curve of PV input voltage

For CPS SCA36KTL-DO/US-480, when the DC input voltage is lower than 400V or higher than 850V, the inverter output power (Pn) will begin to derate, as shown in Figure 10-6.

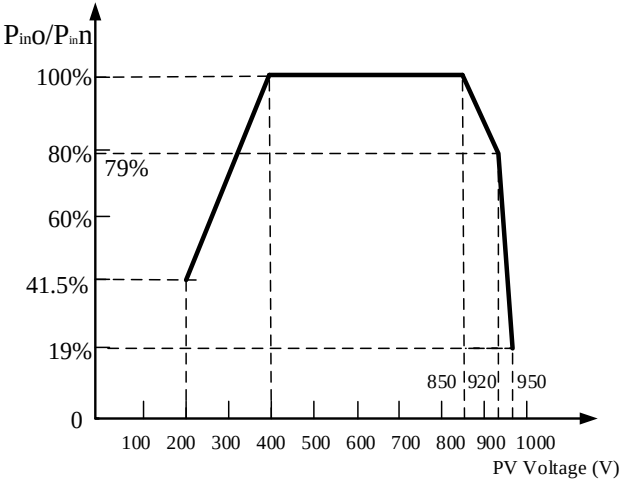


Figure 10-6 CPS SCA36KTL derating curve of PV input voltage

10.3.5 Reactive Power Capability

The Reactive Power Overload function is disabled by factory default (Max. AC Apparent Power is 50/60kVA and Max. AC Output Current is 60.2A/72.2A). **Contact CPS Customer Service** if you want to enable the function.

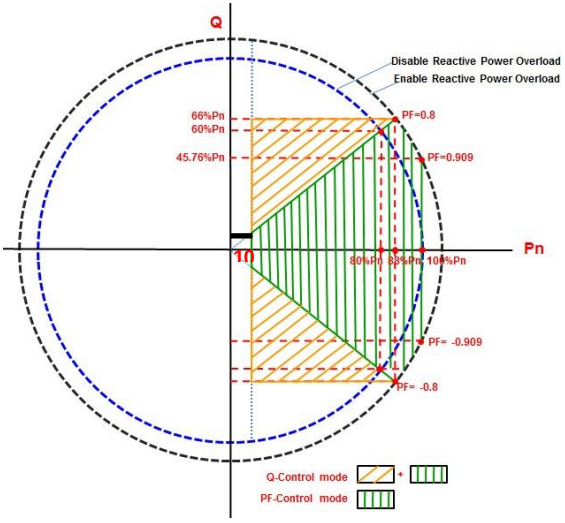


Figure 10-7 SCA50/60KTL Reactive Power Capability

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.

CHINT POWER SYSTEMS AMERICA CO., LTD.

Address: 1380 Presidential Drive, Richardson, Texas 75081

Service Hotline: 855-584-7168

Email: AmericaSales@chintpower.com

Website: www.chintpowersystem.com

SHANGHAI CHINT POWER SYSTEMS CO., LTD.

Headquarters: Building 4, No. 3255, Sixian Road,
Songjiang District, Shanghai, China

Tele: +86 -21 -3779 1222 -866300

Fax: +86 -21 -3779 1222 -866001