YASKAWA
SOLECTRIA SOLAR

PVI 50TL
PVI 60TL

INSTALLATION AND OPERATION MANUAL

Revision F

ETL® LISTED

IMPORTANT REGISTRATION AND WARRANTY INFORMATION

For warranty to become active, this inverter must be registered. To activate warranty and register inverter, please visit the link below.

www.solectria.com/registration

Before You Start

This manual contains important information regarding installation and safe operation of the PVI 50/60TL. Be sure to read this manual carefully before using the inverter.

Thank you for choosing a Yaskawa Solectria Solar grid-tied PV inverter. This PV inverter is a high performance and highly reliable product specifically designed for the North American Solar market.

If you encounter any problems during installation or operation of this unit, first check the user manual before contacting your local dealer or supplier. This user manual is applicable for the following models: PVI 50TL & PVI 60TL.

Instructions inside this user manual will help you solve most installation and operation difficulties. Contact your local supplier if the problem still exists.

Please keep this user manual on hand for quick reference. Always check online for an updated version of this product manual. The contents of this document are subject to change without notice.

IMPORTANT Safety Instructions

SAVE THESE INSTRUCTIONS

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

Warnings and Symbols in this Document

	**DANGER:** DANGER indicates a hazardous situation which, if not avoided, may result in death or serious injury. *DANGER indique une situation dangereuse qui, si elle n'est pas évitée, entraînera la mort ou des blessures graves.*
	**WARNING:** WARNING indicates a hazardous situation which, if not avoided, may result in death or serious injury. *AVERTISSEMENT indique une situation dangereuse qui, si elle n'est pas évitée, pourrait entraîner la mort ou des blessures graves.*
	**CAUTION:** CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. *ATTENTION indique une situation dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures mineures ou modérées.*
	**NOTICE:** NOTICE indicates a hazardous situation which, if not avoided, may result in equipment 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.

Product Markings

	**HIGH VOLTAGE:** This inverter works with high voltages. All work on the product must only be performed as described in this document.
	**HOT SURFACE:** The equipment is designed to meet international safety standards, but surfaces can become hot during operation. Do not touch the heat sink or peripheral surfaces during or shortly after operation.
	**EARTH GROUND:** This symbol marks the location of grounding terminal, which must be securely connected to the earth through the Protective Earth (PE) cable to ensure operational safety.

WARNING:
All installation and wiring connections should be performed only by qualified technical personnel. Disconnect the inverter from PV modules and the Power Grid before maintaining and operating the equipment.

Toutes les installations et les connexions de câblage doivent être effectuées uniquement par le personnel technique qualifié. Débrancher l'onduleur de modules photovoltaiques et le grid électrique avant l'entretien et la marche de l'équipement.

Risk of electric shock and fire. Use only with PV modules with maximum system voltage of rating of 1000V or higher.

Risque de choc électrique et d'incendie. Utiliser uniquement avec les modules photovoltaiques avec la tension maximum du système de Ratinf de 1000V ou plus.

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.

Risque de choc électrique. Les conducteurs c.c. de ce système photovoltaïque sont normalement non mis à la terre mais deviendront par intermittence mis à la terre sans indication lorsque l'onduleur mesure l'isolement du champ photovoltaïque.

Shock Hazard. Energized from both AC and DC sources. Disconnect all sources before servicing.

Risque de choc électrique. Alimenté à partir de deux sources c.a. et

c.c. Débrancher toutes les sources avant de mettre en service.

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

Pour une protection continuelle contre tout risque d'incendie, remplacez les fuses uniquement avec le même type et calibre."

DANGER:
Please disconnect the inverter from AC grid and PV modules before opening the equipment. Make sure hazardous high voltage and energy inside the equipment have been discharged.
Do not operate or maintain the inverter until at least 5 minutes after disconnecting all sources from DC and AC sides.
Veuillez débrancher l'onduleur du grid C.A. et des modules photovoltaiques avant l'ouverture de l'équipement. Assurez-vous que la haute tension et l'énergie dangereuses à l'intérieur de l'équipement a été déchargée.
Ne pas utiliser ou entretenir l'onduleur jusqu'à au moins 5 minutes après avoir débranché toutes les sources du côté C.C. et C.A.

CAUTION:
PVI 50/60TL inverter is **123.5lbs** and the wiring box is **33lbs**.
Please ensure the mounting bracket is properly installed before hanging the inverter on the bracket.

Veuillez vous assurer que le montage est correctement installé avant d'accrocher le l'onduleur sur le support.

INSTRUCTION:
Please check with your local electricity supply company before selecting a grid standard. If the inverter is operated with a wrong grid standard, the electricity supply company may cancel the interconnection agreement.
Putting the inverter into operation before the overall system complies with the national rules and safety regulation of the application is not permitted.

DANGER!
Danger to life due to fire or explosion:
Despite careful construction, electrical devices can cause fires.
-Do not mount the inverter on flammable construction materials.
-Do not mount the inverter in areas where highly flammable materials are stored.
-Do not mount the inverters in areas with a risk of explosion

SAVE THESE INSTRUCTIONS

1.0 Overview1.1 Inverter for Grid-Tied PV Systems

The PVI 50/60TL inverter is suitable for use on commercial and utility-scale rooftop, carport and ground mount grid-tied PV systems. A system is generally made up of PV modules, DC power distribution equipment, PV inverter and AC power distribution equipment (Figure 1.1). The inverter converts DC from PV modules to AC with 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 supplied to the electricity grid.

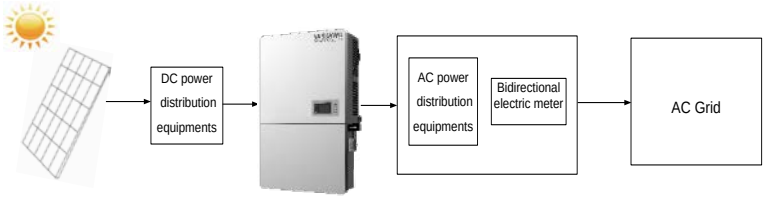


Figure 1.1 - Grid-Tied PV System

1.2 Product Features

- ✓ **High Conversion Efficiency:** Advanced 3-level conversion technology; Max. Efficiency: 99%; CEC Efficiency: 98.5%
- ✓ **Strong Grid Adaptability:** Multi grid standards applicable; Reactive power adjustable; Power Factor (PF) value: ±0.8, Remote Curtailment
- ✓ **Flexible Communication:** Supports standard Modbus communications to ensure compatibility with third-party monitoring and control systems
- ✓ **Wide DC Input Voltage Range:** Operating DC Input Voltage Range: 200-950Vdc; Max DC input voltage: 1000V
- ✓ **Long Service Life:** Uses thin-film capacitors to extend inverter's service life
- ✓ **3 MPPTs:** Multichannel independent Maximum Power Point Tracking (MPPT) enable maximum design flexibility and optimize energy harvest over the life of the system
- ✓ **High Protection Degree:** NEMA 4X protection meets the needs of both indoor and outdoor use; Embedded DC surge protection device (SPD)
- ✓ **Intelligent Integration:** Embedded DC/AC switches and up to 15 fused string inputs eliminate the need for external combiner boxes and simplify installation

1.3 Product Protection Functions

- ✓ Reverse polarity protection on the DC inputs
- ✓ Short circuit protection
- ✓ Arc-Fault Circuit Interruption

- ✓ Anti-islanding protection
- ✓ Input and output over-voltage protection
- ✓ Input over-current protection
- ✓ Monitoring of:
  - ◆ DC input insulation against ground
  - ◆ AC output voltage and frequency
  - ◆ Leakage current against ground
  - ◆ DC injection from AC output
  - ◆ Ambient temperature
  - ◆ IGBT module temperature

1.4 Circuit Structure Design

The basic schematic diagram of PVI 50/60TL inverter is shown in Figure 1.2. The input of PV modules passes through surge protection circuitry, DC EMI wave filter, and the front-end boost circuitry to achieve maximum power tracking and boost up voltages. The output of the inverter converts the DC voltage to 3-phase AC voltage. The high frequency AC components are removed with a wave filter. The 3-phase AC voltage is then passed through two-stage relays and EMI wave filter to produce high quality AC power.

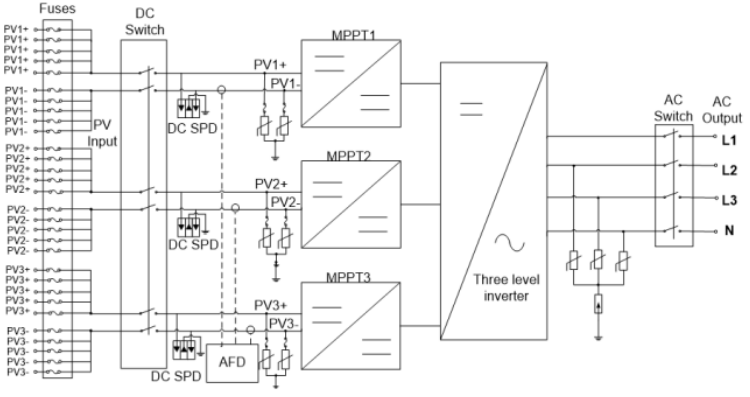


Figure 1.2 - Schematic Diagram of PVI 50/60TL Inverter

1.5 Appearance Description

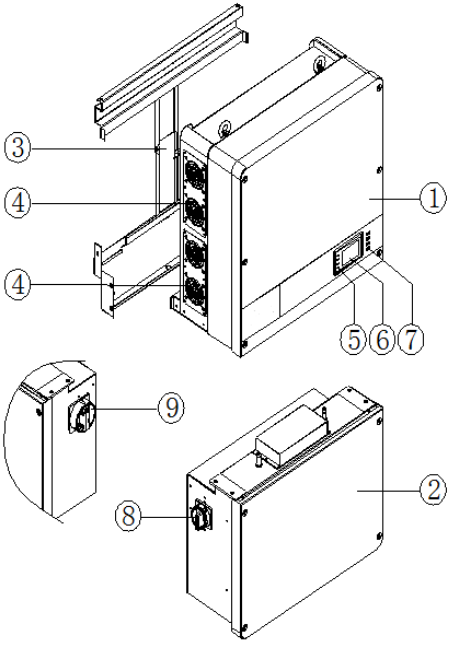


Figure 1.3 - Sketch of PVI 50/60TL Inverter

Main Items of the Inverter:

1) Main inverter section
2) Wiring box of the inverter
3) Mounting bracket
4) External cooling fans
5) LED indication lights
6) LCD
7) Key buttons
8) DC switch: DC power on/off
9) AC switch: AC power on/off (right side of the wiring box when facing the inverter)

1.6 Anti-Islanding

This inverter includes active Anti-Islanding detection as required by UL 1741/IEEE 1547. The inverter will automatically make small variations in reactive power output in order to detect a possible islanding condition. If the grid is stable, these small variations will have negligible effects on system voltage and frequency. However, in an islanded condition the small amount of reactive power changes will force the system voltage or frequency to change significantly, which will trigger the inverter to shut down. This function is always on and cannot be turned off by the user.

1.7 DC Ground Fault Protection

The PVI 50/60TL includes residual current detection as part of the DC ground fault detection method as required by UL 1741. If there is a ground fault in the array, the ground fault detection technology will detect the array leakage current. The inverter will shut down if the leakage current exceeds 500mA.

1.8 Surge Suppression

STANDARD WAVEFORM PEAK VALUES		
Surge Category	Ring Wave	Combination Wave
B	6 kV/0.50 kA	6 kV/3 kA

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

1.9 DC Arc Fault Detection

The PVI 50/60TL includes DC arc fault detection compliant with UL 1699B. The inverter detects electrical noise that typically accompanies a DC series arc. The inverter will shut down should the arc fault sensor detect a series arc.

2.0: Installation

Below is the installation procedure for the inverter. Please read carefully and install the product step-by-step.

Before installation, please check that the following items are included in the package:

Table 2.1 - Main Items

No.	Item	Qty	Note
(1)	Main inverter section	1	*It is possible to receive and install the wiring box first and the inverter later.*
(2)	Wiring box	1	

(3)	Mounting bracket	1	Upon which inverter is hung and mounted onto a wall
(4)	User manual	1	Installation and operation manual
(5)	Accessory kit	1	Contains all necessary accessories

The (5) Accessory kit contains items listed below, in Table 2.2:

Table 2.2 – Accessory Kit Components (standard wiring box)

No.	Item	Qty	Note
(1)	M8 Expansion tubes	8	For mounting bracket
(2)	M8×25 assembling bolts	8	For mounting bracket
(3)	M6x18 screw	11	4 for wiring box and main housing; 6 for inverter and mounting bracket; 1 for Ground connection
(4)	5 pin connector	1	For RS485 communication
(5)	3 pin connector	1	For RS485 communication (for optional model)
(6)	Lifting eye nut M10	2	For lifting the main section
(7)	M8 Nut	4	For AC terminal block
(8)	M8 Flat washer	4	For AC terminal block
(9)	M8 Spring washer	4	For AC terminal block
(10)	DC ferrules	33	30 for DC wires and 3 spares

INSTRUCTION:
The items in the accessory kit table above (Table 2.2) are for the standard configuration. The accessories may vary if optional parts are purchased.

Table 2.3 – Accessory Kit Components (H4 wiring box)

No.	Item	Q'ty	Note
(1)	M8 Expansion tubes	8	For mounting bracket
(2)	M8×25 assembling bolts	8	For mounting bracket
(3)	M6x18 screw	11	4 for wiring box and main housing; 6 for inverter and mounting bracket; 1 for Ground connection
(5)	H4 PV Connector (Male)	15	For PV input
(6)	H4 PV Connector (Female)	15	For PV input
(7)	Tool for PV Connector	1	For PV Connector
(8)	M8 Nut	4	For AC terminal block
(9)	M8 Flat washer	4	For AC terminal block
(10)	M8 Spring washer	4	For AC terminal block

2.1 Recommendations Before Installation

- ✓ Check that the product environmental specifications (protection degree, operating temperature range, humidity and altitude, etc.) meet the requirements of the specific project location.
- ✓ Make sure that the AC grid voltage is within the normal range.
- ✓ Ensure that the local electricity supply authority has granted permission to connect to the grid.
- ✓ Installation personnel must be qualified electricians or have received professional training.
- ✓ Sufficient space according to Figure 2.3 should be provided to allow the inverter cooling system to operate normally.
- ✓ Install the inverter away from flammable and explosive substances.
- ✓ Avoid installing the inverter in locations that exceed the temperature limits specified in the inverter data sheet to limit undesirable power loss.
- ✓ Do not install the inverter near an electromagnetic source which can compromise the normal operation of electronic equipment.

2.2 Mechanical Installation

1) Dimensions

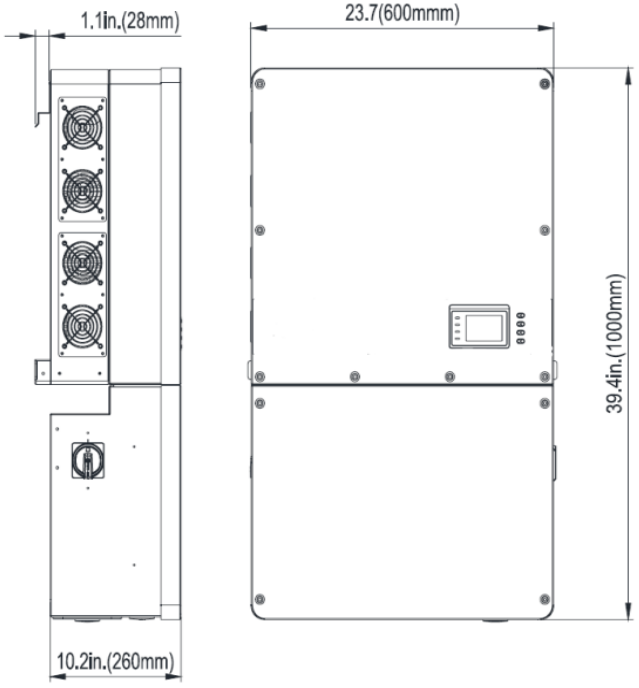


Figure 2.1 - PVI 50/60TL Inverter Dimensions

2) Installation Method (see Figure 2.2):

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

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

(b) If the inverter cannot be mounted vertically, it may be tilted backward to horizontal.

The shade cover option must be purchased and installed for any installation angles of 75° or less.

(c) **DO NOT** mount the inverter leaning forward.

(d) **DO NOT** mount the inverter upside down.

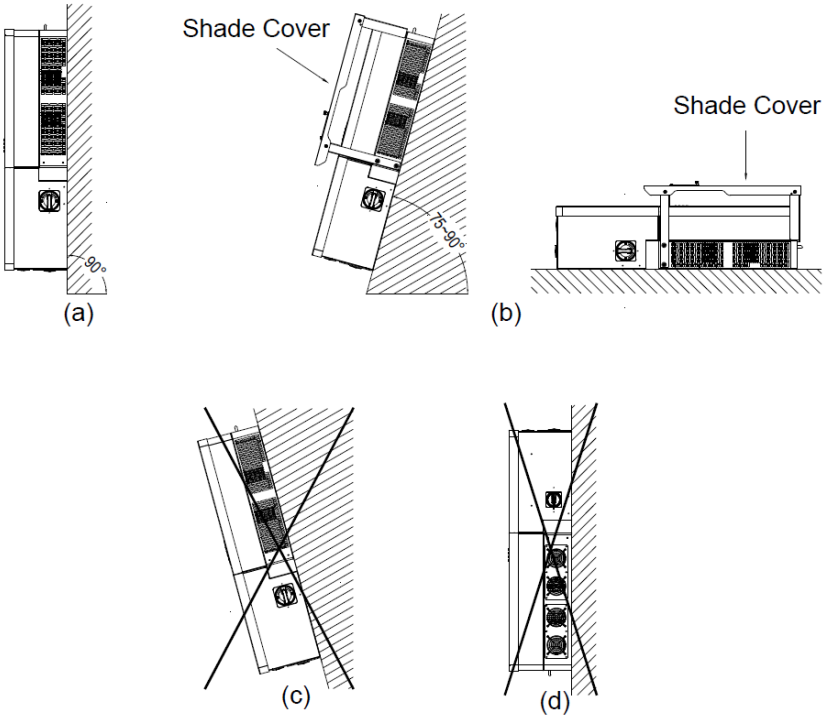


Figure 2.2 - Inverter Mounting

WARNING: Shade cover accessory required for installation angles of 75° or less.

3) Installation Space Requirement (see Figure 2.3):

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

NOTICE:

The spacing between two adjacently mounted inverters should be ≥500mm (19.7 in.). Ensure that the air space around the inverter is well ventilated.

L'espace entre deux onduleurs montés adjacentes devrait être ⩾ 500mm (19,7 pouces). Veiller à ce que l'espace d'air autour de l'onduleur est bien aéré.

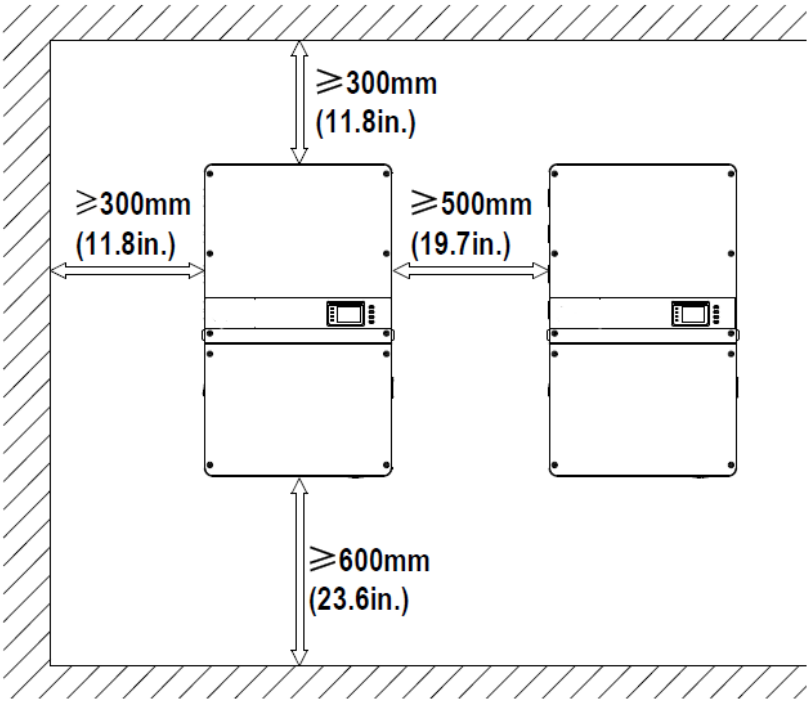


Figure 2.3 - Inverter Wall Mounting Specifications

NOTICE:

The installation clearance between two inverters must be increased to 30 in. when the ambient temperature is higher than 45°C.

La distance d'installation entre deux onduleurs doivent être élargie quand la température ambiante est supérieure à 45°C.

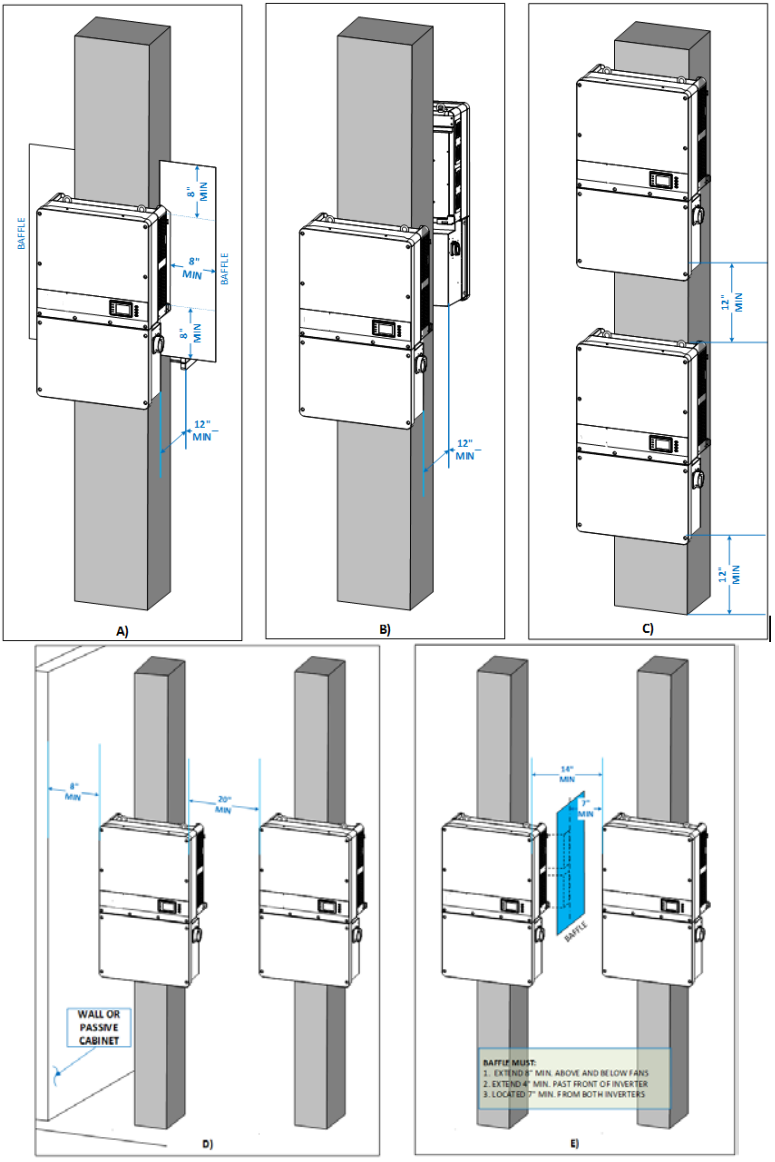


Figure 2.4 - Inverter Pillar Mounting Specifications

INSTRUCTION:
If the inverter is installed on Unistrut or the array racking (instead of solid wall), the space from the bottom of one inverter to the top of the inverter below may be as small as 4in. (100mm).

4) Mounting Inverter to Bracket

(1) Mark the 8 holes on the bearing surface for mounting the bracket as shown in Figure 2.5;

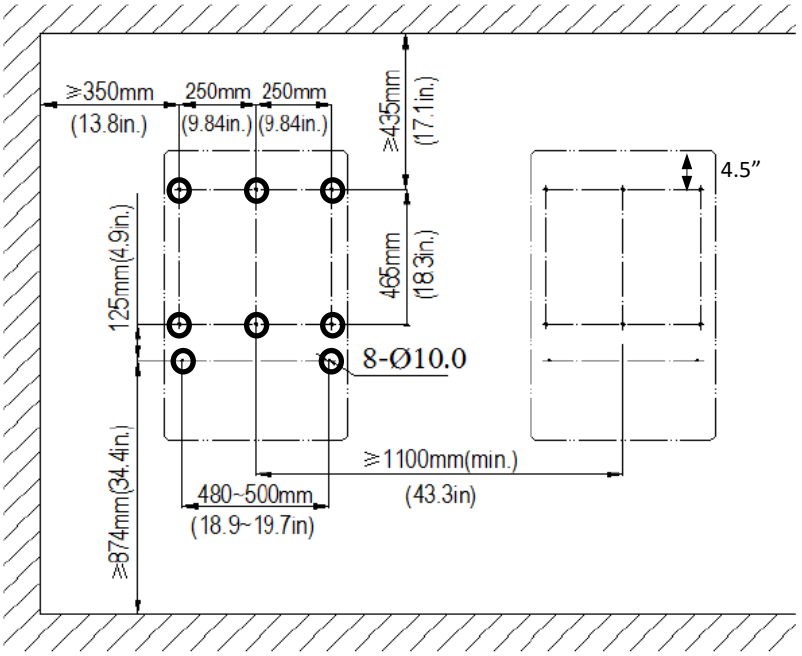


Figure 2.5 - Holes on the Bearing Surface Dimensions

(2) Drill holes at the marked positions with a 10mm (0.4in.) drill and put the **M8 expansion tubes** ① into the holes; assemble and fasten the **mounting brackets** ② with the **M8x25 assembling bolts** ③ in the accessory kit. Figure 2.6.
Tool: Electric drill (Φ10mm/0.4in. head), 13mm wrench 240 in-lbs

Figure 2.6 – Drilling holes for mounting hardware

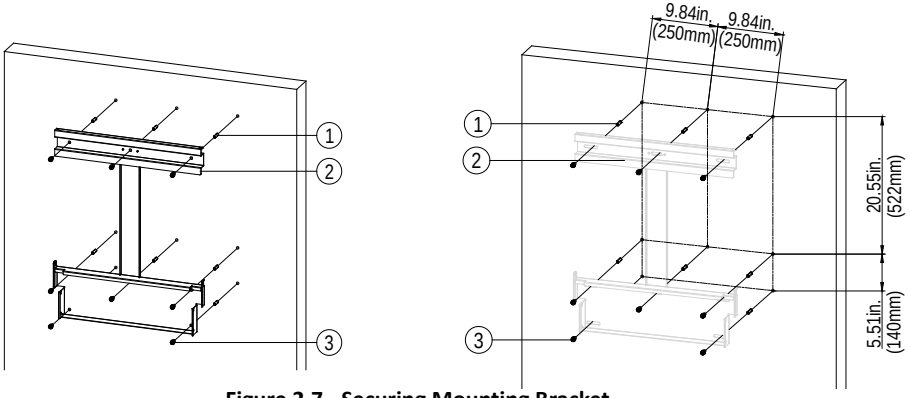


Figure 2.7 - Securing Mounting Bracket

(3) Hang the inverter onto the mounting bracket as shown in Figure 2.8 and Figure 2.9;

Lift mounting: Take out the **lifting eye nut M10 (2pcs)** from the accessory kit, and screw them onto the studs at the top of the inverter. Use a 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.

Manual mounting: Two people are needed to properly lift the inverter by the handles detailed in Figure 2.9, and mount the inverter onto the bracket.

CAUTION:
The main PVI 50/60TL inverter section is **123.5 lbs** (**56 kg)**.
Please ensure the mounting bracket is properly installed before hanging the inverter on the bracket. It is recommended to have at least 2 people mount the inverter due to the weight of the

equipment.

ATTENTION: *le poids de l'enveloppe principal de PVI 50/60TL est d'environ 56kg (≈123.5 livres).*

Veuillez vous assurer que le support est correctement installé avant de suspendre le l'inverseur sur le support. Il est recommandé d'avoir au moins 2 personnes pour monter le convertisseur en raison du poids de l'équipement.

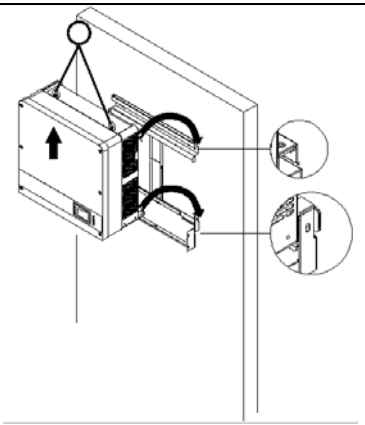


Figure 2.8 - Mounting the Main Inverter Section on the Bracket

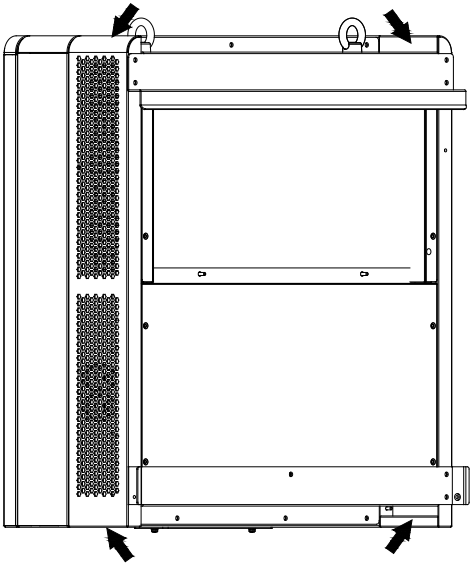


Figure 2.9 - Grab Handle Position

(4) Installing the wiring box

① Remove the cover plate at the bottom of the main section. (see Figure 2.10)

Tool: No.2 Phillips head screwdriver

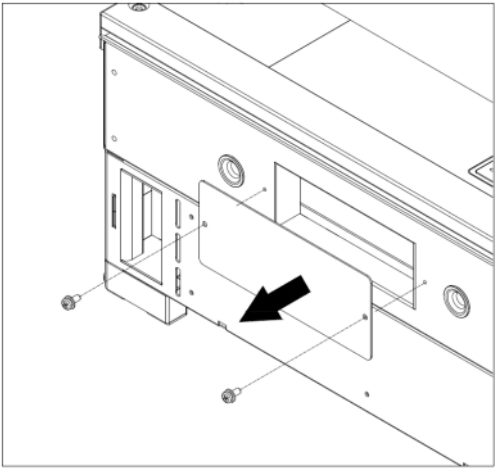


Figure 2.10 – Main Section Cover Plate

② Remove the cover at the top of the wiring box (see Figure 2.11)

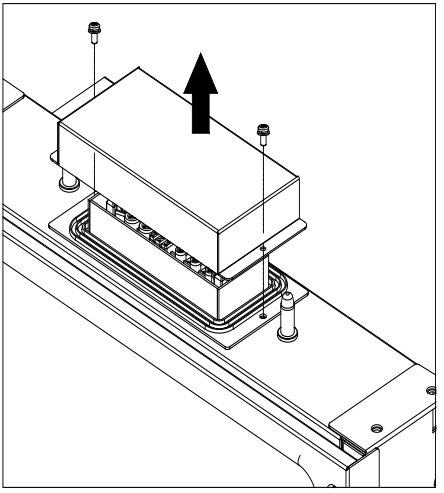


Figure 2.11 - Wiring Box Cover

③ Connect the wiring box to the main section, using M6x18 screws (4pcs) to secure the wiring box. (see Figure 2.12)

Tool: No. 10 Wrench, torque value of 25 in-lbs (2.8N.m)

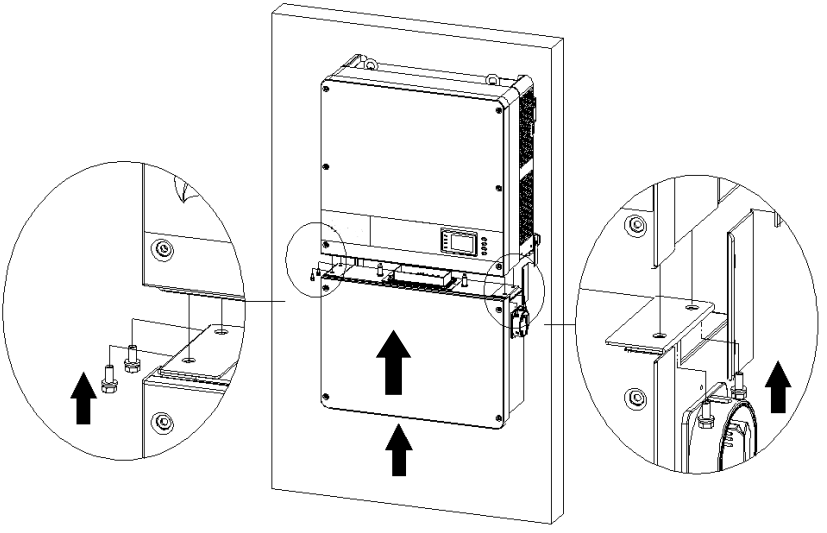


Figure 2.12 - Wiring Box Installation

CAUTION:
The total weight of the PVI 50/60TL inverter is 156 pounds (71kg).
Please ensure the mounting is properly installed before hanging the inverter on the bracket.
Le poids total de la PVI 50/60TL onduleur est d'environ 71 kg (156 livres).Veuillez vous assurer que le support est correctement installé avant de suspendre le l'inverseur sur le support.

(5) Attach the main section and the wiring box to the mounting bracket with the **M6x18 bolts** (6 pcs). (see Figure 2.13)
Tool: No.3 Phillips head screwdriver, torque value of 35 in-lbs (4 N.m.)

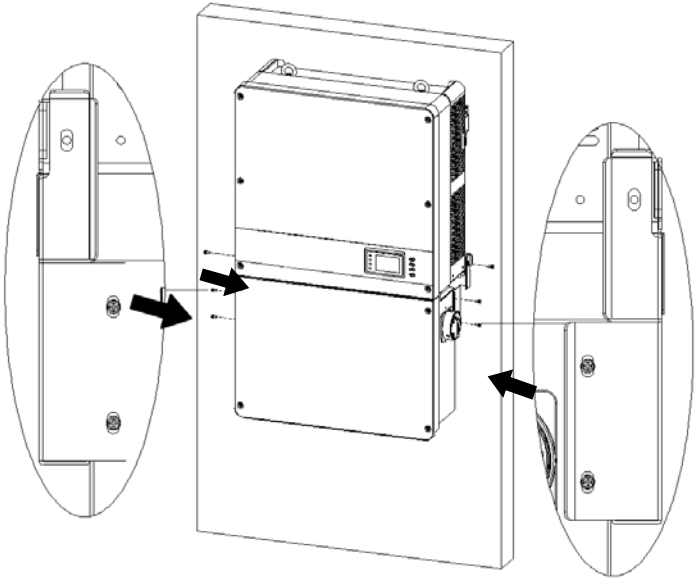


Figure 2.13 - Secure the Main Section and Wiring Box to the Bracket

(6) Optional - Install an anti-theft padlock when the installation is complete.
The anti-theft padlock is used to help prevent the inverter from being stolen when the equipment is installed outdoors. The inverter may be locked on the bracket, as shown in Figure 2.14

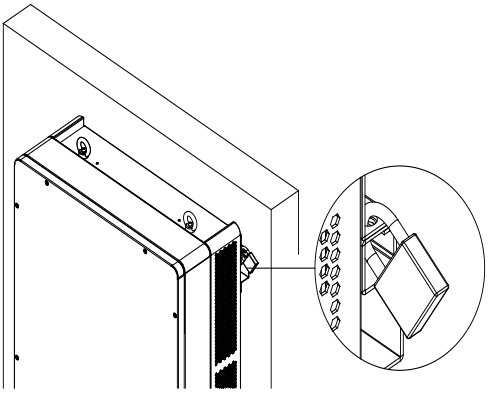
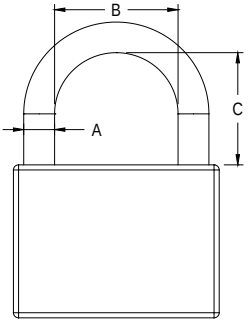


Figure 2.14 - Anti-Theft Padlock Location

The anti-theft padlock should meet the requirement of the dimensions shown in Figure 2.15



Recommended lock size:
A: Φ3~6mm
B: 20~50mm
C: 20~50mm

Figure 2.15 - Dimensions of Anti-Theft Padlock

(7) Attach the cover board as shown in Figure 2.10 to the left side of the wiring box. (see Figure 2.16)

Tool: No.2 Phillips head screwdriver, torque value of 10 in-lbs (1.2N.m)

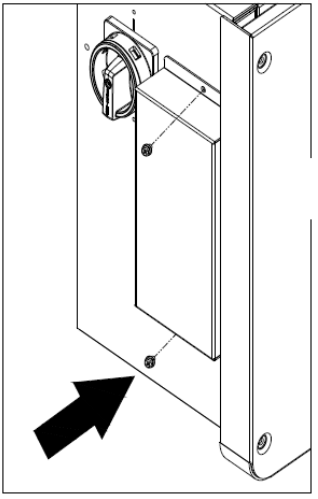


Figure 2.16 - Dimensions of Anti-Theft Padlock

5) Removing/Replacing the Wiring Box Cover:

(1) Use a #3 Phillips screwdriver to remove the 4 screws on the wiring box and pull cover straight off the box. Do not twist or slide the cover while removing. (see Figure 2.17)

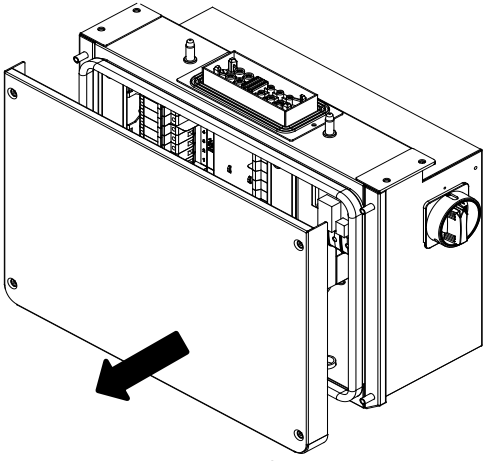


Figure 2.17 – Removing the Wiring Box Cover

(2) To replace the cover use a #3 Phillips screwdriver to replace the 4 screws on the cover.

INSTRUCTION:
It is important to use a hand tool (e.g. Screwdriver or T-handle, #3 Phillips) and not power drivers or other types of screw drivers. Also, it is important to hold the cover in alignment with balanced force across the cover, not weighted toward any edge. Partially engage all four screws to the threaded inserts a few rotations before tightening any one screw. This is important to maintain alignment and avoid thread damage. When all four screws are engaged torque to 20 in-lbs (2.2Nm).

2.3 Electrical Installation

There are two options for wiring box, please confirm which one you have:

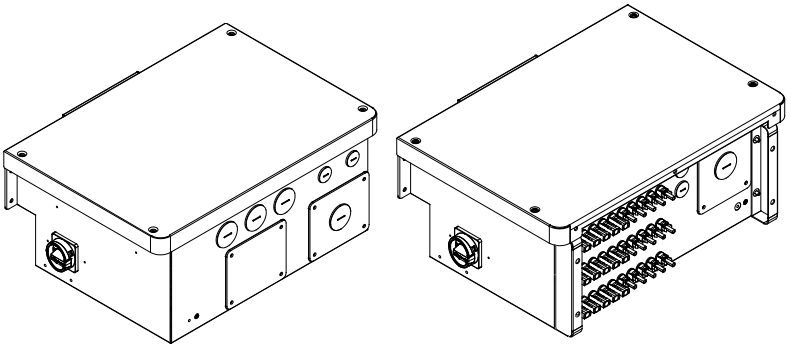


Figure 2.18 - (a) Standard Wiring Box (b) H4 Quick Connect Wiring Box

The connection interface of the PVI 50/60TL inverter with Standard wiring box:

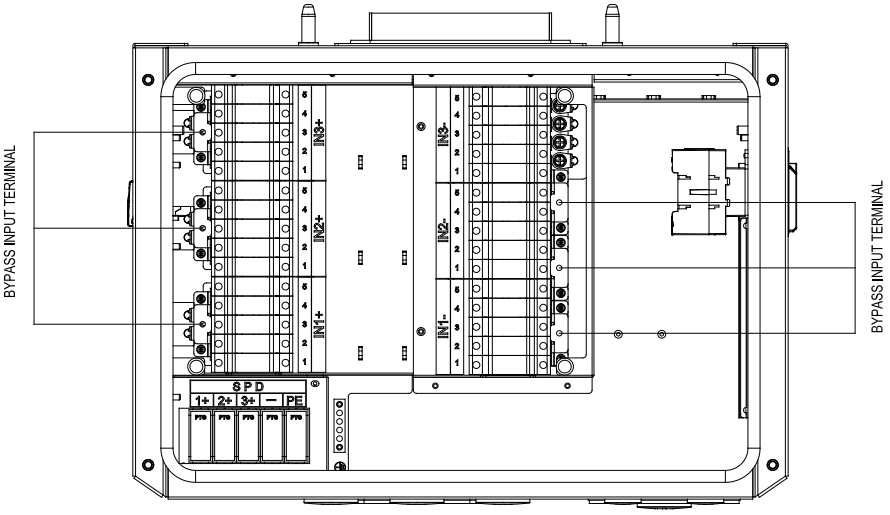


Figure 2.19 - Full View of Standard Wiring Box with Options

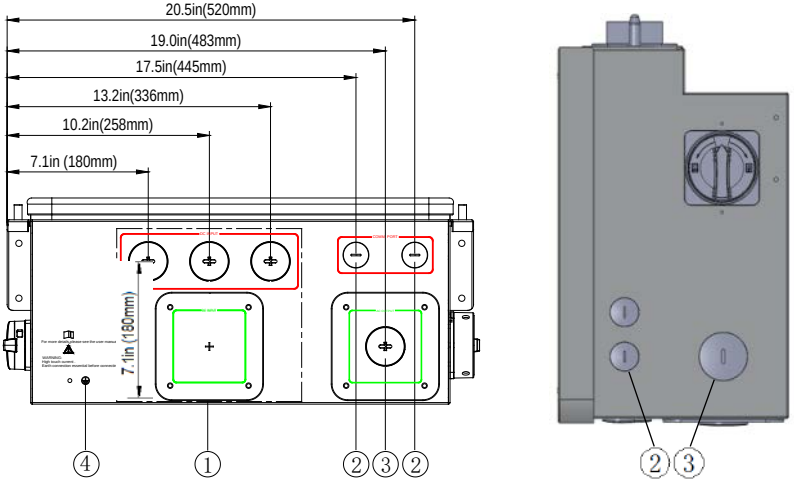


Figure 2.20 - External Connection Ports

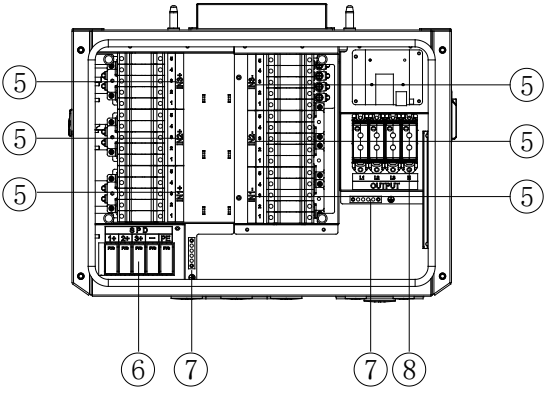


Figure 2.21 - Internal Connection Points of Standard Wiring Box

1. DC input cable area: 3 x 1.5in. conduit knockouts with an additional plate provided for custom drilled conduit entrances (i.e. use if 2in., 2.5in., 3in. conduit required).

NOTE: Do not enlarge the provided 1.5in. conduit knockouts.

2. Knockout for communication cable 3/4in.
3. Knockout for AC output cable, 1.5in.; additional plate provided for custom 2in., 2.5in., 3in.
4. External ground connection point
5. DC fuse holders
6. DC Surge Protection Device
7. Internal ground connection point and grounding studs
8. AC output terminal block

The connection interface of the PVI 50/60TL inverter with H4 wiring box:

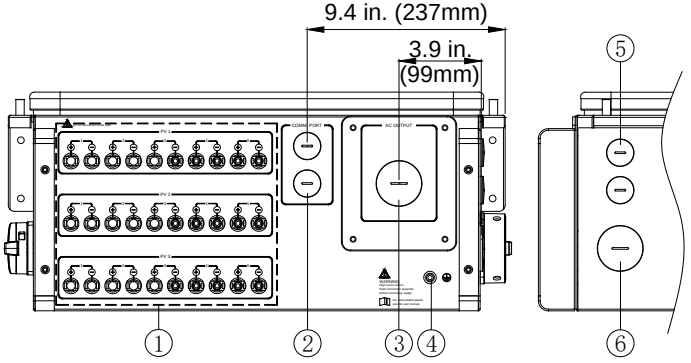


Figure 2.22 – Conduit Knock-Out Locations of H4 Quick Connect Wiring Box

1. H4 quick-fit connectors
2. Knock-outs for communication, 3/4inch Trade Size
3. Knock-out for AC output, 1-1/2in. Trade Size with removable gland plate for custom size conduit (ie use if 2in. or 2.5inch Trade Size is required)
4. External ground connection point
5. Knock-outs for communication in the right side of wire-box, 3/4inch Trade Size
6. Knock-out for AC output in the right side of wire-box, 1-1/2in. Trade Size with removable gland plate for custom size conduit (ie use if 2in. or 2.5in. Trade Size is required)

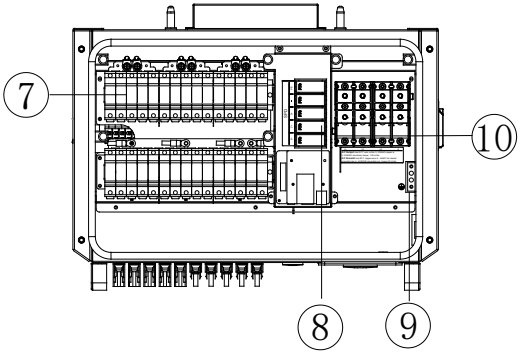


Figure 2.23 – Internal Connection Points of H4 Quick Connect Wiring Box

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

Choose the cables for inverters according to the following configuration table:

Table 2.5 - Cable Specifications

Position	Cable
DC input (+ / –)	#14-8AWG (Copper only) *using fuse holders* Up to #2AWG (Copper or Aluminum) *using bypass terminal kit*
AC output (L1/L2/L3/N*)	#3-2/0 AWG (Copper) #2-2/0 AWG Aluminum *Neutral wire is <u>not</u> current carrying; it is only for sensing purposes. It can be sized as small as the EGC (PE), but not smaller than 8AWG.
EGC (PE)	#8-2 AWG(Copper) #6-2 AWG(Aluminum)
RS-485 communication	UTP CAT-5e or 3x#22-18AWG communication cable (eg. Belden 9841)

DC and AC GROUND

Even though the inverter operates with an ungrounded PV array, the PV system still requires equipment grounding.

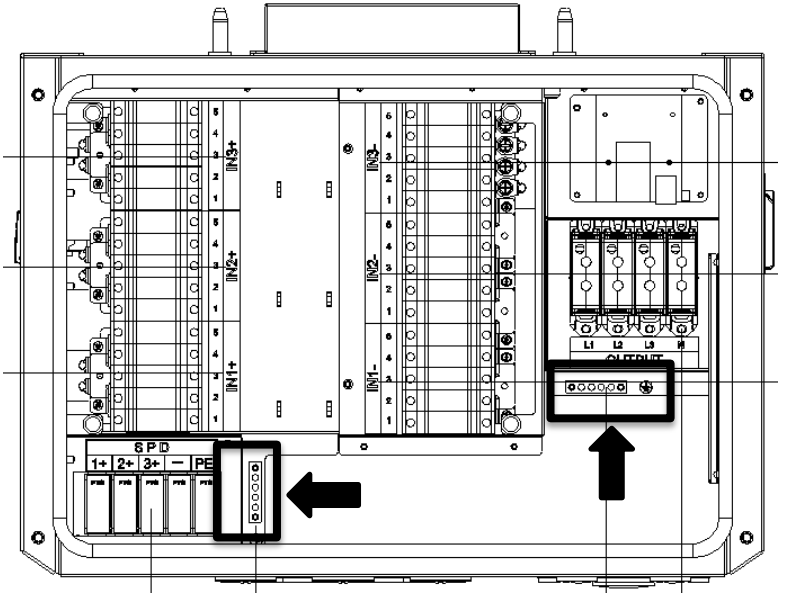


Figure 2.24 - Equipment Grounding Locations (Standard Wiring Box)

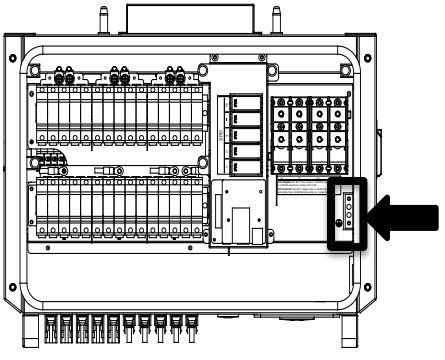


Figure 2.25 - Equipment Grounding Locations (H4 Wiring Box)

2.3.1 DC Connection

1) Working Mode

The PVI 50/60TL inverters have three PV input sections: DC Input-1, DC Input-2 and DC Input-3. These three sections can work only in "Independent mode".
In Independent mode each PV input section works with an independent MPP Tracker.

2) DC Fuse Configuration

Table 2.6 - DC Input Power Specification

PVI 50/60TL	**(Independent mode – per zone - DEFAULT)**	
	PVI 50TL	PVI 60TL
Max DC power allowed	30Kw*	33kW*
Absolute Max open circuit Voltage	1000V	1000V
Operating voltage	200-950V DC	200-950VDC
Max power input voltage range (MPPT)	480-850V DC	540-850VDC
Maximum available PV current (Isc x 1.25)	68A	68A

***Not exceeding the combined input per inverter of 75kW (PVI 50TL) and 90kW (PVI 60TL)**

The PVI 50/60TL inverters are equipped with standard 15A DC fuses. Customers must verify that the appropriate fuses are installed depending on the PV system design.

(a) Each independent PV DC input string needs fuse protection.
(b) The rated voltage of fuses should be 1000V
(c) The rated current of fuses is generally 1.56 × short circuit current from the PV strings, rounded up to the next available fuse size.

The following table lists the fuse type, specifications and number under the rated voltage and power range of 10 strings of PV panels.

Table 2.7 - DC Fuse Selection

PVI 50/60TL	Brand	Standard fuses (15A)	20A	25A	30A
	Littelfuse	SPF015	SPF020	SPF025	SPF030
		15A/1000V	20A/1000V	25A/1000V	30A/1000V

NOTE 1: The 1000VDC Littelfuse fuse series is recommended. Detailed information is available at: http://www.littelfuse.com/.
NOTE 2: The fuse holders can also accept a 20A (SPF020), 25A (SPF025) and a 30A (SPF030) fuse for combined input strings if needed.
NOTE 3: Two 30A fuses should not be used next to each other.
NOTE 4: If string fuses other than the provided 15A fuses are desired, it is the customers' responsibility to source and install these extra fuses.

WARNING:
Use of different fuses or wrongly sized fuses can cause damage to equipment or create un-safe working conditions. Any damage resulting from incompatible fuses is not covered by warranty.

3) DC Conductors Connections

To ensure the optimum performance of the inverter, please read the following guidelines before making DC connections:

(a) Confirm the DC configuration referring to Table 2.6 and ensure that the maximum open circuit voltage of the PV modules is lower than 1000 VDC under any conditions.
(b) Confirm that the PV strings for each MPPT of the inverter are of the same module type, power level and string length before connection. The number, orientation, and tilt of PV strings may differ for different applications.
(c) Configure the external wiring according to the conditions in Table 2.8.

WARNING:
Working with live voltage is dangerous. It is recommended to have all live circuits disabled prior to performing connections.

Table 2.8 - DC Input Configuration

DC Inputs	Configuration for each MPPT zone Z1/Z2/Z3	DC Wire Size	Conductors Torque	Connect to:
15	5/5/5	#14-8AWG	30 in-lbs	PV Fuseholder
14	5/5/4	#14-8AWG	30 in-lbs	PV Fuseholder
13	5/4/4	#14-8AWG	30 in-lbs	PV Fuseholder
12	4/4/4	#14-8AWG	30 in-lbs	PV Fuseholder

11	4/4/3	#14-8AWG	30 in-lbs	PV Fuseholder *
10	4/3/3	#14-8AWG	30 in-lbs	PV Fuseholder *
9	3/3/3	#14-8AWG	30 in-lbs	PV Fuseholder *
8	3/3/2	#14-8AWG	30 in-lbs	PV Fuseholder *
7	3/2/2	#14-8AWG	30 in-lbs	PV Fuseholder *
6	2/2/2	#14-8AWG	30 in-lbs	PV Fuseholder *
5	2/2/1	Mixed**	Mixed**	Mixed**
4	2/1/1	Mixed**	Mixed**	Mixed**
3	1/1/1	Up to #2 AWG	50 in-lbs	Bypass terminals
2	1/1/0	Up to #2 AWG	50 in-lbs	Bypass terminals
1	1/0/0	Up to #2 AWG	50 in-lbs	Bypass terminals

*Note that the provided fuse is 15A, your string combination may require a larger rated fuse. Always verify the I_{sc} rating of the input prior to connecting to the fuse holder.

**Mixed input signifies a combination of fuse holder connections and fuse bypass terminal utilization. Such combinations are very rare, but possible. The wire size for the fuse holder connection is #14-8 AWG (30 in-lbs) and up to #2 AWG for the bypass terminal (50 in-lbs).

NOTE: The temperature rating of the input wiring should be 90°C or greater.

(d) Check the polarity of each PV string pair (Figure 2.26) before connecting to the DC fuses or fuse bypass points by following these steps:

i. Using a multi-meter: connect the positive lead from the multi-meter to the positive lead from the string and the negative lead from the multi-meter to the negative lead from the string. If the value on the multi-meter is positive, the polarity of the strings is correct.
ii. The positive (+) end of the PV string conductor should match the positive (+) terminal of inverter's DC input.
iii. The negative (-) end of the PV string 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 input cables to avoid any risk of reverse polarity.

Il est important d'utiliser un multimètre pour vérifier la polarité des câbles d'entrée C.C. pour éviter tout risque d'inversion de polarité.

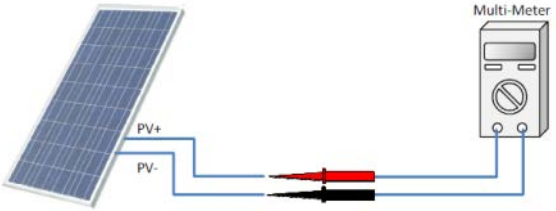


Figure 2.26 - Polarity Check

2.3.1.1 DC Connection for Standard Wiring Box

(a) Remove the plug from the DC conduit knockout holes and install the suitable 1.5 inch conduits via the knockouts. Then pull the cables through the conduits into the wiring box.

(b) Connect the DC cables to the fuse holders and fasten the screws, as shown in Figure 2.21. If you are using H4 wiring box, connect DC wires to H4 connectors as shown in Figure 2.21: *Note: If you are using the fuse bypass-skip this step and move to 8.1 Fuse bypass.*
Tools: #2 Phillips bit and a Torque driver.
Torque value: 3.4N-m (30 in-lbs)

NOTE: If the installer does not use a torque driver to secure the conductors there is risk of potential damage to the equipment, which is not covered by the warranty.

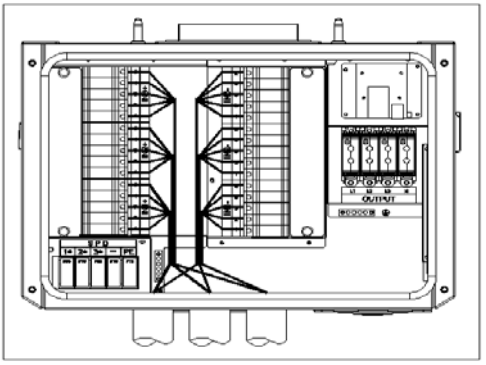


Figure 2.27- DC Input Cable Connection (Standard Wiring Box)

(c) If you prefer to route all DC cables thru a single hole inside the wiring box please refer to Figure 2.28

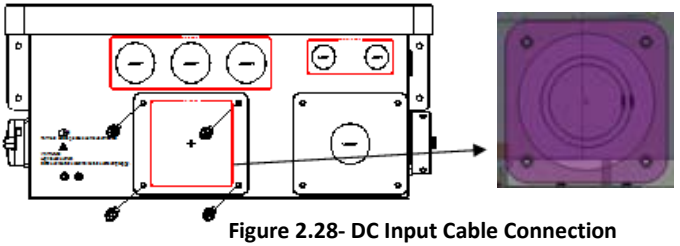


Figure 2.28- DC Input Cable Connection

① Remove the 4 screws on the wiring box and take off the adaptor plate (refer to Fig.2.22).
② Using a knockout punch tool, create the appropriate hole on the adaptor plate. Note that for your convenience there are guidelines for a 2", 2.25" and 3" hole.
③ Attach the board to the wiring box with the screws (4 pcs). Torque to 35 in-lbs.

2.3.1.2 DC Connection for H4 Wiring Box

NOTICE:
The Amphenol H4 connectors provided with the Accessory Kit must be used for the DC input with the H4 wirebox. Male and Female Amphenol H4 connectors with 14AWG contact pins are provided. Additional wire sizes will require replacing the connectors/contact pins provided. Use of incompatible connector types may create an improper contact and cause faults and/or loss of production, requiring service of the inverter and installation. Multi-Contact MC4 connectors are NOT compatible with Amphenol H4. Making such connection may result in damage to equipment or infrastructure.

(a) Check the polarity of the DC input cables to avoid any risk of reverse polarity.
(b) Cable preparation and stripping process: Strip the cables 0.276 inches (7.0 mm) and be careful not to nick conductor strands. Amphenol's specified strip tool (H4TS0000) can be used in this step (contact Amphenol retailer to purchase this tool). Adjust the stripper stopper and insert the cable in the corresponding notch to strip to 0.276 inches (7.0 mm) length.

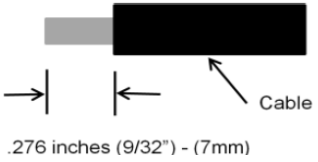


Figure 2.29 - Cable Strip Length

(c) Put the positive (negative) DC cable through the gland and cable fastener, and then crimp the cable with the cord end terminals shown in Table 2.9.

Table 2.9 - Cord End Terminals for DC Cables

No.	Item	Function
1		For Positive DC cable
2		For Negative DC cable

(c) Insert the crimped positive and negative terminals into the male and female

housing respectively, and then tighten the seal glands, as shown in Figure 2.29 and Figure 2.30:

NOTICE:
It is required to use the attached or the same type of DC input connectors. Otherwise, poor contact may happen, causing problems or damage, which is not covered under the warranty.

Figure 2.30 - Assemble the Male Connector for DC Positive Cable

Figure 2.31 - Assemble the Female Connector for DC Negative Cable

Confirm the following points before connecting the DC cables to the inverter:
Make sure the PE cable is well connected. Please refer to "DC and AC ground connection" for detailed information of ground connection.
Turn off the DC switch.
(d) Plug the assembled DC cable connectors with the positive and negative connectors on the inverter side respectively, as shown in Figure 2.32:

Figure 2.32 - Plug DC Cable Connectors

2.3.1.3 Individual Maximum Power Point Tracking

The inverter is designed with three separate MPP Trackers (MPPT), which operate independently.

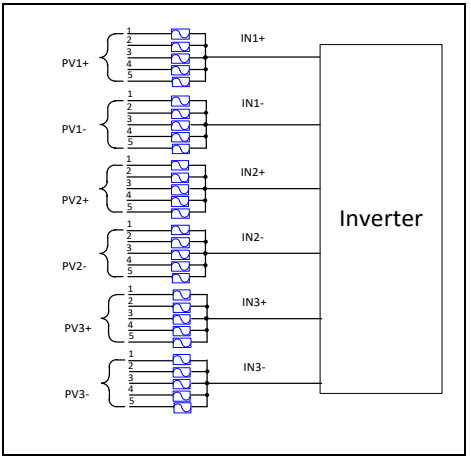


Figure 2.33 - Three MPPTs Operating Independently

Independent mode can be very useful for sites with shading on parts of the array or with arrays consisting of different orientations. **However, this also means that one must consider these three zones as three separate inverters and power must be balanced as much as possible between the three MPPT zones. See Table 2.8 for string/zones combinations.**

NOTE: Always try connecting an equal number of wires to PV1, PV2 and PV3 to each individual MPPT zone.

WARNING:
Strings should be balanced for optimal performance and AC output. The inverter is designed to allow one zone to process more than one-third of the nameplate rated power. Maximum DC/AC oversizing ratio is 1.5 STC conditions of the modules. Each zone's maximum Input Power is 30kW per zone and 75kW combined (50TL) and 33kW per zone and 90kW combined (60TL). Note for any application that may experience higher than 1000W per m^2 on a regular basis, a smaller DC/AC ratio is recommended. In addition, the combined Isc rating of all strings multiplied by 1.25 must be less than 68A for per zone. Failure to follow those guidelines will result in damage to the inverter which will **NOT** be covered under the warranty.

2.3.2 AC and Ground Connections

The following describes how to connect the AC and ground conductors between the inverter and the AC grid:

1) Use a #3 Phillips head screwdriver to loosen the 4 screws on the wiring box and remove the cover. (see Figure 2.34)
2) Remove the liquid-tight plugs from the holes of the AC side and install the suitable conduits of 1-1/2 inch through the holes. Then pull the cables through the conduit into the wiring box.
3) The inverter supports 3 kinds of conductor connection on the AC side depending on the grounding connection method. The conductor set-up procedures are illustrated below.

Use Tables 2.10 and 2.11 for required tools and torque values

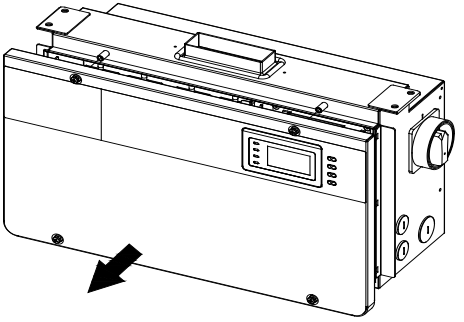


Figure 2.34 - Remove the Wiring Box Cover

Table 2.10 - Required Tools

No.	Tools	Where used
1.	#3 Phillips screwdriver	Remove cover, external grounding
2.	1/4” flat head bit	Internal grounding bar
3.	14mm hex socket wrench	AC terminal block
4.	Torque wrench	AC terminal block
5.	Diagonal pliers	Cut cables
6.	Wire stripping pliers	Remove insulation of wires
7.	Crimping pliers	Crimp terminal

Table 2.11 - Torque Values

AC output terminal block	126 in-lbs (14.25 N.m.)
Internal grounding bar	50 in-lbs (5.65 N.m.)
Internal grounding stud	50 in-lbs (5.65N.m.)
External grounding point	50 in-lbs (5.65 N.m.)

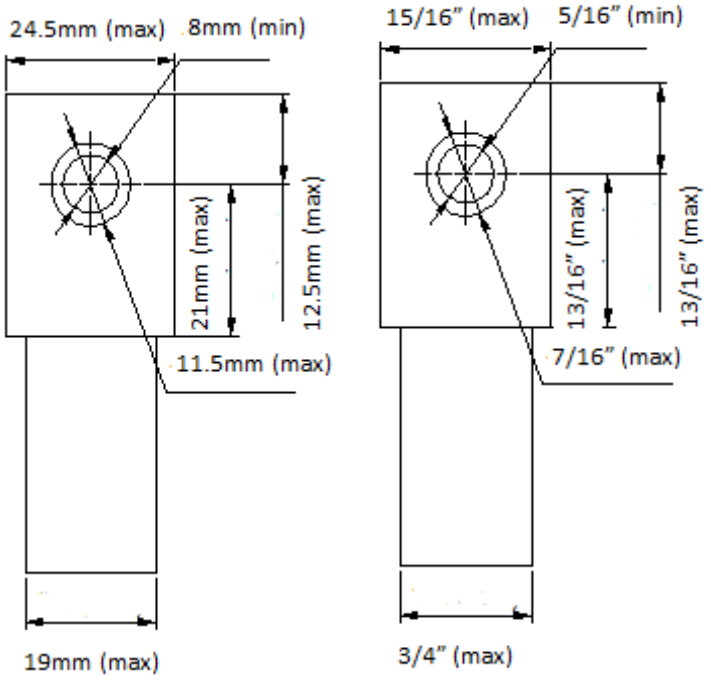


Figure 2.35 - AC Cables' Crimp Lug Specification (a) Standard (b) Metric

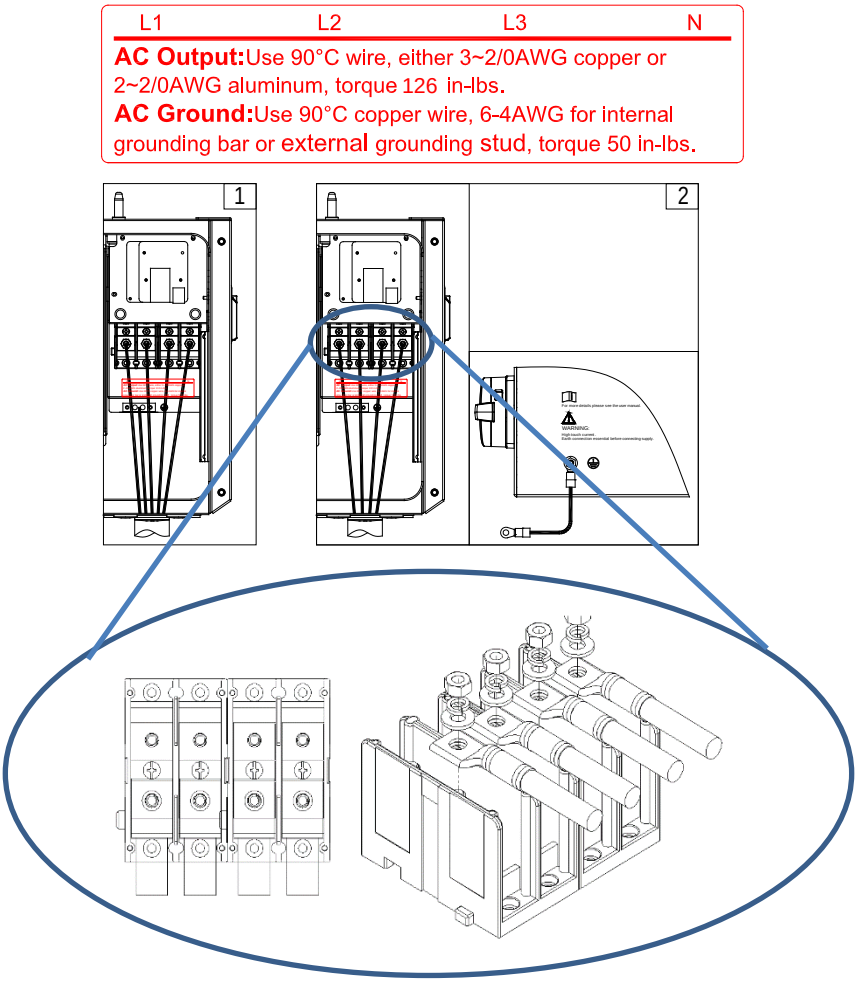


Figure 2.36 - AC Output and Ground Cable Connections

(1) Use the OT type terminal to connect the AC (L1, L2, L3, N) cables to the terminal block and connect the ground cable to the internal grounding bar inside the wiring box. (See the first diagram in Figure 2.36)

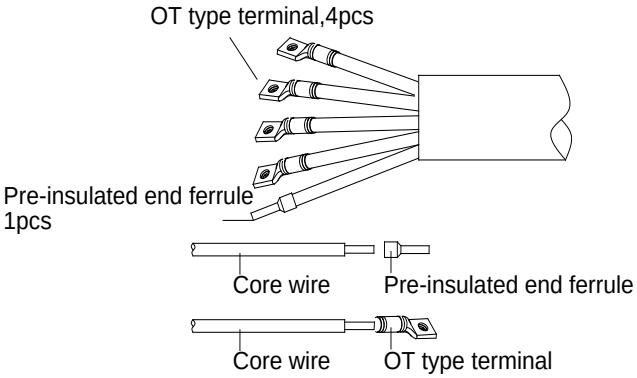


Figure 2.37 - AC Output and Ground Cable Setup

NOTICE:
Please connect the Ground cable before any AC cable.
It is required to use the AL9CU OT type terminal or equivalent if you chose the aluminum cable for AC output.

(2) Use the OT type terminal to connect the AC (L1, L2, L3, N) cables to the terminal block and use the OT type terminal to connect the ground cable to the external grounding point at the bottom of the wiring box. (See the second diagram in Figure 2.36).

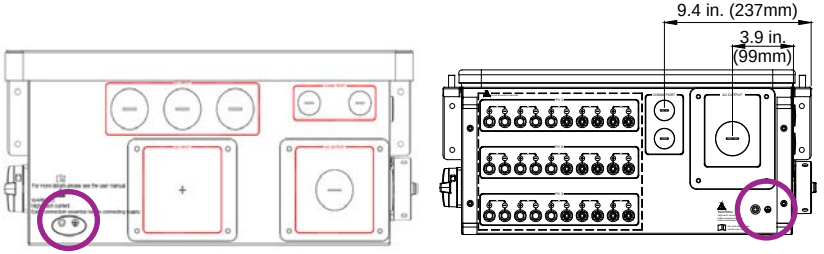


Figure 2.38 - External Chassis Ground

NOTE: If you need a larger AC conduit hole, punch one by removing the AC output adaptor plate and following the steps from Section 3: "DC Input Cable Connection".

(3) Connecting the inverter to the grid would require a breaker.

(4) The Grid connection type should be (L1, L2, L3, N, PE).

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.

Either a 3-pole or 4-pole AC circuit breaker should be selected as per the following specifications. **Choosing any other breaker size may result in nuisance tripping or rejection from the AHJ.**

Table 2.12 - Breaker Values

Inverter	AC breaker rated current (A)
PVI 50TL	90
PVI 60TL	100

When using aluminum conductors it is important to prepare the conductors properly to prevent oxidation. Always use industry approved best practices to install these conductors. Here are the basic steps of how to prepare and land aluminum conductors.
a) Remove the oxidation from the connection area of the aluminum conductors.

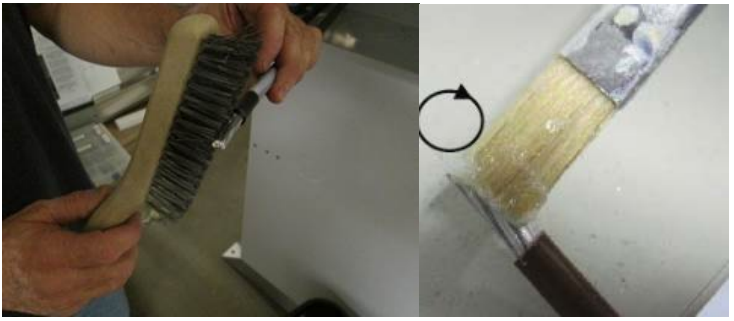


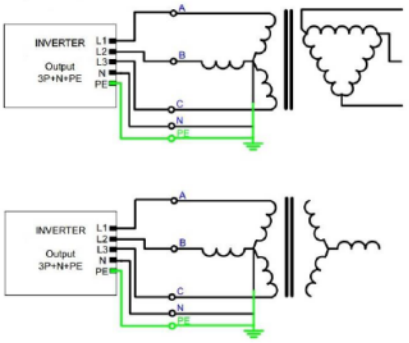
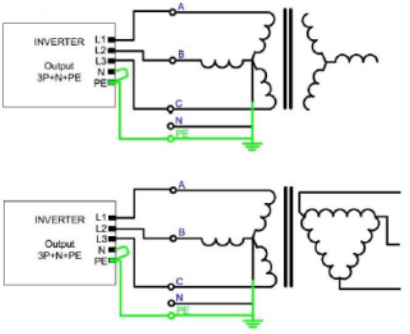
Figure 2.39 - Preparing Aluminum Wires Prior to Connecting

b) Immediately apply neutral dielectric grease, such as Noalox, and connect the cable to the terminal.
c) If the connection is not made within 30 seconds of applying the grease, repeat this process as an oxidized layer may have formed on top of the conductor. This oxidized layer is a poorer conductor than the greased aluminum.

NOTICE:
Overheating aluminum wires is a common problem in electrical installations. This is due to oxidation and increased resistance. Any such occurrence and the damaged result will **NOT** covered by the warranty.

Acceptable transformer configurations:

Table 2.13 – Transformer Configurations

Acceptable Service Configurations		
Description	**Configuration**	**Inverter Compatibility**
Wye w/ Neutral		Compatible (Preferred)
Wye w/ Neutral Jumper		Compatible (Consult Local AHJ)
Other Configurations	All other configurations not mentioned in this document	Not Compatible

When interfacing with a Wye-grounded transformer winding, a neutral is required. Since the neutral is used by the inverter for voltage sensing only, the neutral does not carry current. The size of the neutral may be reduced to a conductor no smaller than the EGC or 8 AWG, which is the smallest acceptable wire for the terminal block. Note that if AHJ approves, you can install a jumper across the EGC and the Neutral terminal, this will satisfy the inverter sensing purposes.

When installing multiple inverters for parallel operation, always refer to the latest Interconnection Guidelines available on
https://solectria.com/pv-inverters/commercial-string-inverters/pvi-50-60tl/

2.4 Inverter Communication Connections

The PVI 50/60TL inverter supports industry standard Modbus RS-485 communications for monitoring purposes. In addition to SolrenView and/or third party monitoring, these inverters are also able to send data to an online portal which is used for remote diagnostic purposes. This capability can be used by Yaskawa Solectria Solar for remote diagnostics, remote firmware upgrades and remote troubleshooting. This function is performed by the Ethernet Network Card.
Each Ethernet Network Card can handle up to 70 inverters. If a site has more than 70 inverters, additional Ethernet Network Cards will be needed.
When a third party monitoring system is used, the DAS should be connected to the Ethernet Network Card, and the Ethernet Network Card is then connected to the inverters.
Each inverter has a Communication Board installed in the wiring box which is used to daisy chain the inverters using RS-485 for communication purposes. The Ethernet Network Card should be mounted on the communications card of the first or last inverter in the daisy chain.
The following sections describe an overview of the Communication Board and Ethernet Network Card.

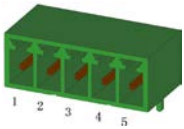
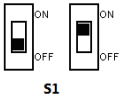
2.4.1 Communication Board

Each inverter has a Communication Board (shown below) which is installed in the top right corner of the wiring box. This board is used for daisy chaining inverters for connection to the Ethernet Network Card.

Figure 2.40 - Communication Board

Below is a brief description of the communication board**:**

Table 2.14 – Communication Board Connections and Configuration Switches

Item	Picture	Configuration Description
1. USB port S200		Firmware upgrade via USB drive
2. RS-485 ports (5pin connector)		1 -----12V+ 2 -----12VGND 3 -----RS-485- 4 -----RS-485+ 5 -----COM
3. Selector switch for setting the 120Ω termination resistor of the RS-485 communication S1		1-----Disable the termination resistor 2-----Enable the termination resistor

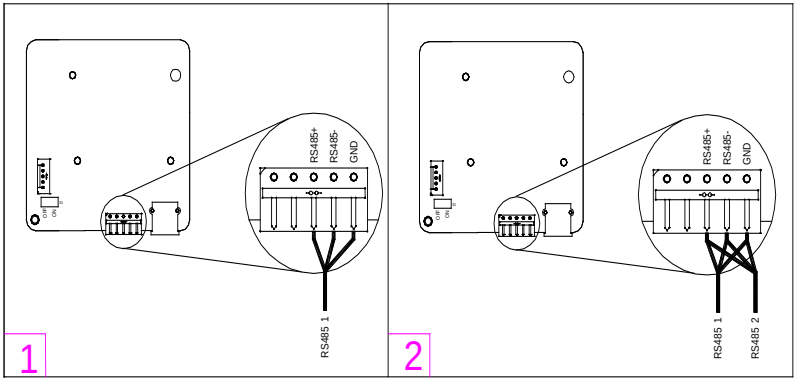


Figure 2.41 - Communication Connections

1- Cable connection of RS-485 communication: 5 pin connector
2- Cable connection of RS-485 network communication: 5 pin connector

2.4.2 Ethernet Network Card

A maximum of 70 inverters can be connected to this device. When provided with an internet connection, it can send data to an online portal which Yaskawa Solectria Solar can use for troubleshooting and remote diagnostic purposes. It is also used for allowing the connection of a third-party monitoring system.
Customers are strongly encouraged to provide internet to the Ethernet Network Card in order for it to be used for remote diagnostic purposes. Once connected, Solectria can remotely check inverter parameters (currents, voltages, parameter settings, etc.) and alarm messages. Yaskawa Solectria Solar can also use this device to remotely update firmware on all the inverters connected to it.
Below is a brief overview of the Ethernet Network Card:

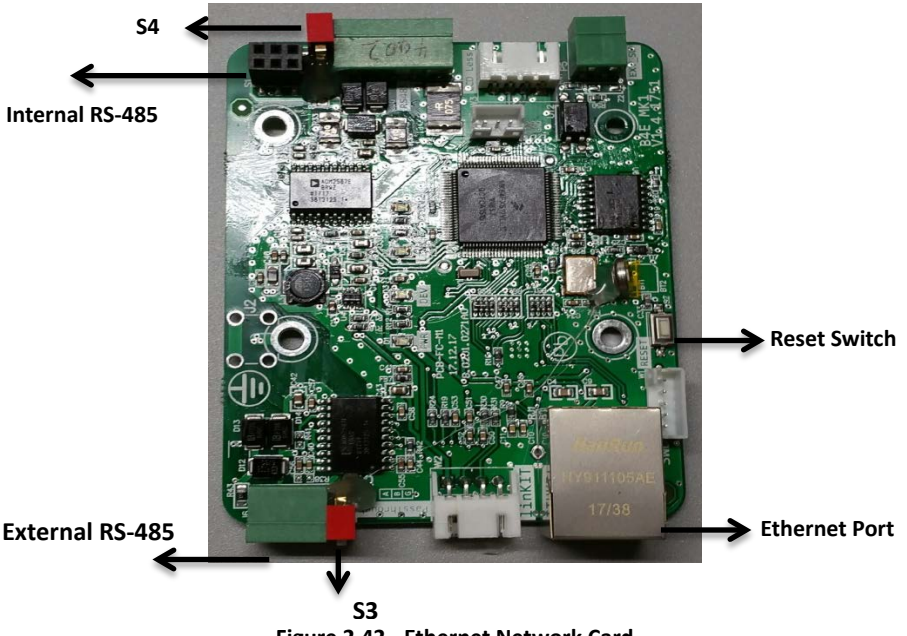


Figure 2.42 - Ethernet Network Card

Table 2.15 – Overview of Ethernet Card

Item	Configuration Description and Function
Ethernet Port	For connecting to the internet
USB Port	Firmware upgrade via USB drive
External RS485	1.RS-485+

	2. RS-485- 3 .Ground For RS-485 communication with other inverters
Internal RS485	For RS-485 communication with the inverter communication board
S3 Switch	Selector switch for setting the 120Ω terminal resistor of the third party data logger RS485 communication.
S4 Switch	Selector switch for setting the 120Ω terminal resistor of the RS485 communication between the inverters.
Reset Switch	When pressed for over 5sec, the inverter's Ethernet Network Card will be restored to the factory setting.

2.4.3 Modbus Connections for Third-Party Monitoring Systems

The PVI 50/60TL inverters can be connected to an external Data Acquisition System (DAS) via an RS-485 shielded twisted pair serial connection as shown in Figure 2.43. These inverters can communicate with an external monitoring system via the standard Modbus RTU protocol.

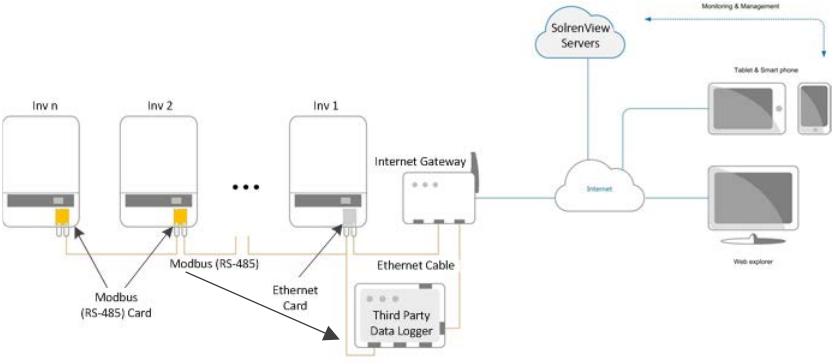


Figure 2.43 - PVI 50/60TL Inverters in a RS-485 Daisy Chain Connection to an External DAS

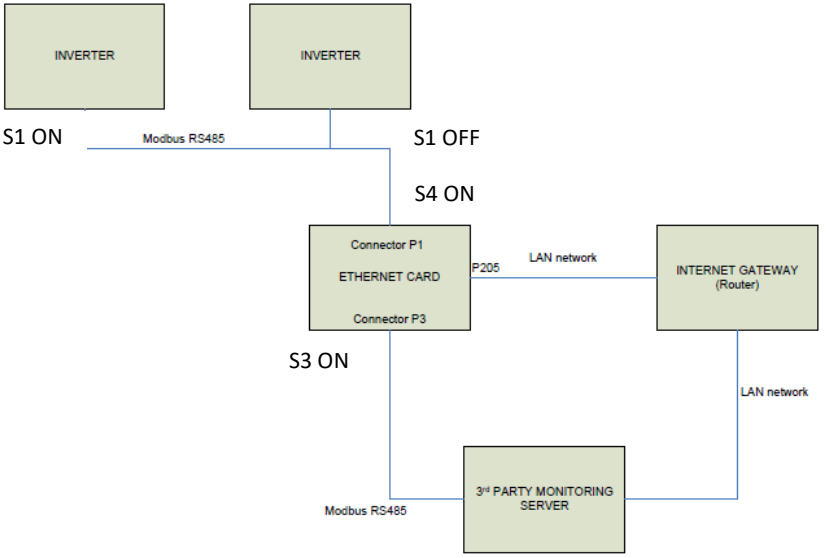


Figure 2.44 - PVI 50/60TL Inverters in a RS-485 Daisy Chain Connection to an External DAS, Connectors and Termination Resistance Details

- When connected to an external DAS, Yaskawa Solectria Solar PVI 50/60TL inverters support up to 70 inverters/devices on the RS-485 daisy chain. The Inverter Modbus IDs are configurable from 1 to 128.
- Yaskawa Solectria Solar recommends limiting the RS-485 daisy chain for PVI 50/60TL inverters to a maximum length of 3000 ft. (914m). Additionally, no individual run should be longer than 300 ft. (91.4m).
- Care must be taken when daisy chaining the inverters, utilizing a shielded twisted pair cable such as Belden 9841 or Southwire 58165802.
- The shield continuity should be maintained for the entire length of the daisy chain and should only be connected to ground (GND) at the DAS. The shield should not be connected to any of the inverters to prevent any possible grounding loops.
- It is important to terminate the Modbus (RS-485) daisy chain correctly to minimize any bus noise and reflections. The daisy chain should be terminated at the source (the DAS) and at the last Modbus device in the daisy chain. The PVI 50/60TL Modbus termination resistor is turned on by flipping switch S1 to the ON position as shown in Figure 2.46. S1 should always be left in the off position except for the last inverter in the daisy chain.
- Non-serial, such as star or ring, network topologies should always be avoided.

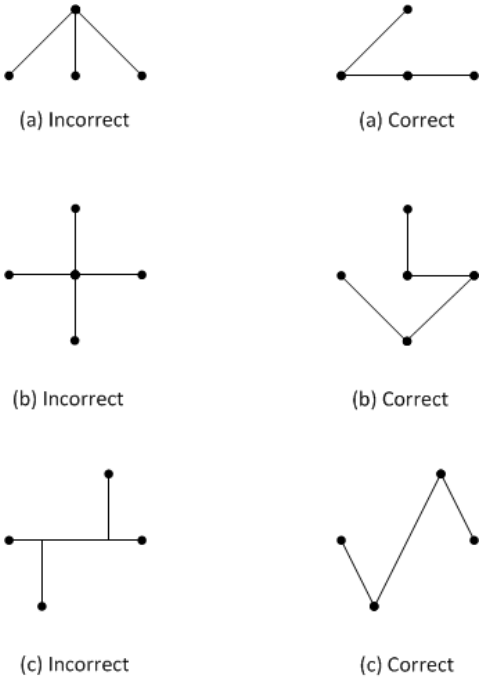


Figure 2.45 - Correct and incorrect topologies

It is important to daisy chain the inverter RS-485 connections to minimize noise and bus reflections. Any network topologies shown in the left column in Figure 2.44 should be avoided. Equivalent daisy chain topologies shown to the right should be used instead.

WARNING:
Risk of Electric Shock.
Make sure all DC and AC power to the unit has been disconnected before opening the inverter wiring box and ensure that hazardous high voltage and power inside the equipment has been discharged. Wait at least 5 minutes before opening the wiring box.

1. Open the inverter wiring box.
2. Bring the communication cables into the wiring box through the provided knockout holes at the bottom.
3. Connect the RS-485 wires to the green 5 pin connector ensuring correct polarity and using a shielded twisted pair cable.

4. If the inverter is the **last** Modbus device in the daisy chain **and** the inverter without the Ethernet Network Card, make sure the Modbus termination switch S1 is in the ON position, enabling Modbus termination. Ensure the switch is in the OFF position for all other inverters in the daisy chain, including the one where the Ethernet Network Card is installed.

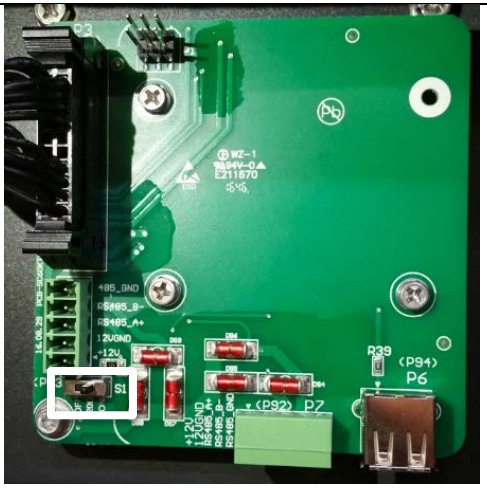
	S1 - Selector switch for the 120Ω RS-485 termination resistor **On** - Enable the Modbus (RS-485) bus termination (Applies only for the last inverter in the daisy chain) **Off** - Disable the Modbus (RS-485) bus termination. (Factory default)

Figure 2.46 - The Modbus (RS-485) Termination Switch (S1) Location and Settings on the LCD/Communication Board.

WARNING:
Risk of Electric Shock.
Make sure all shield wires are properly secured and insulated to prevent shorting to any other components inside the inverter.

5. Close the wiring box.
6. Reconnect the AC and DC power and turn the inverter on when it is safe.
7. Configure the Inverter Modbus ID and Baud rate.

2.4.4 Preparing the Inverter for Modbus Communications

To ensure correct Modbus communications, each inverter Modbus communications settings need to be configured properly. Please follow the steps below to adjust the inverter Modbus ID and Modbus Baud rate.

Please refer to "**3.2 Commissioning Steps**"

2.4.5 Installing the Ethernet Network Card

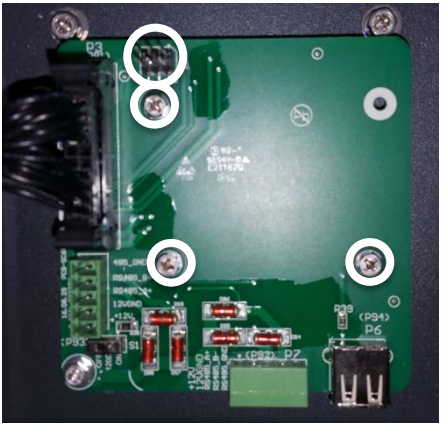


Figure 2.47 - Communication Card and Location for Ethernet Network Card

The Ethernet Network Card will be installed in the first or last inverter of the daisy chain.
1. Obtain the Ethernet Network Card that was shipped to you.
2. Remove the screws from the Communication Card and Install the included standoffs in the 3 locations shown.
3. Install the Ethernet Network Card, taking care to line up the black connector in the upper left corner on the pins of the Communication Card. Ensure the pins are seated in the connector. Install the 3 screws and torque to 7 in-lbs using #2 Phillips bit.

Figure 2.48 - Ethernet Network Card Installed

2.4.6 Connecting the Ethernet Network Card to other inverters.

1. The connector in the upper left corner of the Ethernet Network Card allows for a connection of the inverter daisy chain on the Communication Card.
2. Since the Ethernet Network Card acts as the end of the inverter daisy chain, termination must be turned on. **Set the termination resistor S4 to the ON position on the Ethernet Network Card. Set the termination resistor S1 to the ON position on the Communication Card in the inverter at the *opposite* end of the inverter daisy chain.**

2.4.7 Connecting a Third-Party Monitoring System to the Ethernet Network Card

1. From the DAS, connect the RS-485 to the 3 pin connector on the Ethernet Network Card. Do not connect to the communication card.
2. Tighten all wires securely.
3. If the Ethernet Network Card is the last device in the DAS chain, set the termination resistor S3 ON.

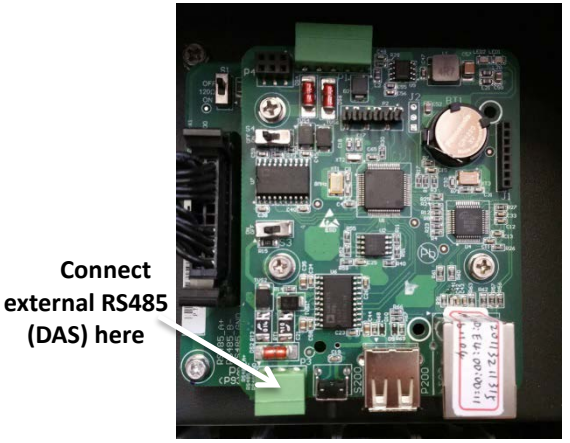


Figure 2.49 - Ethernet Network Wiring to DAS

2.4.8 Preparing the Ethernet Network Card

The Ethernet Network Card comes preset with DHCP settings. It will automatically pull a dynamic IP address and connect to the Internet. If you need to assign a static IP address please refer to the documentation provided with the board or go to http://www.solectria.com and search for “Ethernet Network Card”.

3.0: Commissioning

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

Veuillez suivre les directives ci-dessous avant l'opération on-grid pour éliminer les dangers possibles pour assurer la sécurité.

3.1 Commissioning Checklist

3.1.1 Mechanical Installation

Make sure that the mounting bracket is secure and all the screws have been tightened to the specified torque values.
(Please refer to 2.2 Mechanical Installation)

3.1.2 Cable Connections

a) Make sure that all cables are connected to the right terminals.
b) The appropriate cable management is important to avoid physical damage.
c) The polarity of DC input cables should be correct and the DC Switch should be in the "OFF" position.
(Please refer to 2.3 Electrical Installation)

3.1.3 Electrical Check

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

3.2 Commissioning Steps

Complete the checklist above before commissioning the inverter as follows:
1.) Turn on the AC circuit breaker.
2.) Turn on the DC circuit breaker.
(Skip this step if there is no circuit breaker.)
3.) Switch the DC Switch to the "ON" position. When the energy supplied by the PV array is sufficient, the LCD of inverter will light up. The inverter will then start up with the message "sys checking".
4.) You may change the grid standard. The default setting is IEEE 1547.

INSTRUCTION:
Please check with your local electricity provider before selecting the grid standard. If the inverter is operated with a wrong grid standard, the electricity provider may cancel the interconnection agreement. Putting the inverter into operation before the overall system complies with the national rules and safety regulation of the application is not permitted.

(a) When the inverter completes "sys checking", the LCD shows the screen as Figure 3.1 below. Press ENTER to the standard selection interface, as shown in Figure 3.1.

(b) The default grid standard is IEEE 1547. If a different standard is needed please go to "Menu Functions" section for further instructions on how to change it. Available grid standards are shown in

Figure 3.1 - Select Grid Standard; ML-Molokai/Lanai; OHM- O`ahu, Maui, and Hawai`i

5.) Set up the system time and language according to "**4.4.2.1 System Parameters**".

6.) To check the real time operation information, you can refer to "**4.4.1 Operation Information**".

7.) Communication Parameter Setting: The communication baud rate and Modbus address can be set in this menu (Figure 3.2):

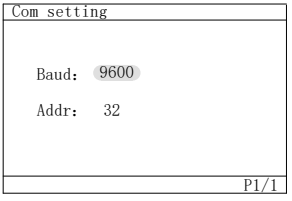


Figure 3.2 – Selecting Baud Rate and Modbus ID

8.) Time Setting: The date and time can be set as in Figure 3.3:

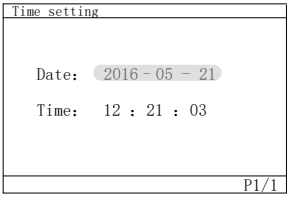


Figure 3.3 - Time Setting

9.) When the LCD screen shows the normal operation status (Figure 3.4) and the "RUN" light on the LED panel lights up, it indicates that the grid connection and power generation are successful.

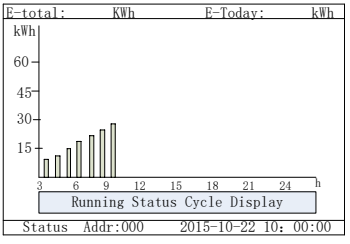


Figure 3.4 - Normal Operation Status

REMARK: The Running status cycle display include: NoErr (Error information), Pdc(kW), Udc(V), Idc(A), Pac(kW) and Q(kvar).

10.) If the inverter fails to operate normally, the "FAULT" light will illuminate and the fault information will show on the LCD screen as shown in the Figure 3.5.

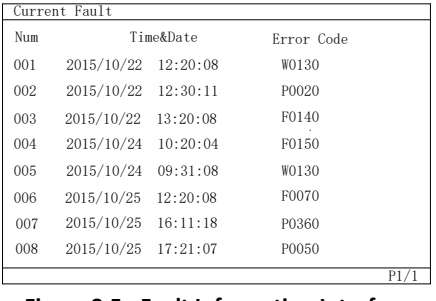


Figure 3.5 - Fault Information Interface

4.0: User Interface

4.1 Description of the Interface

The inverter's user interface screen mainly consists of LCD, LED indicator lights, buzzer and 4 keys, as shown in Figure 4.1.

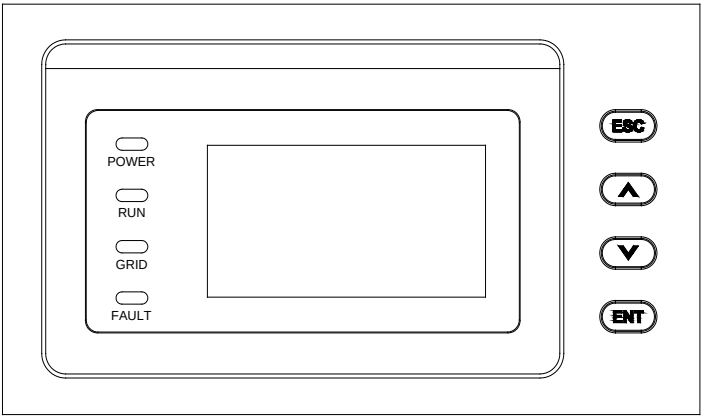


Figure 4.1 - LCD

Interpretation for the indicator lights is shown in Table 4.1 and function of the keys is shown in Table 4.2.

Table 4.1 - LED Indication

LED Indicator	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 on 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 on 0.5s, light off 1.6s)
		Light	Power supply not working

		off	
FAULT	Fault status indication light	Light on	Indicates a Fault
		Slow flash	Indicates Alarm (light on 0.5s, light off 2s)
		Fast flash	Protective action (light on 0.5s, light off 0.5s)
		Light off	No fault or power supply not working

Table 4.2 - Definition of the Keys

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

4.2 Operation State

Table 4.1 describes the meaning of LED indicators (i.e. it indicates the inverter's operational state).

- "POWER" will light up to indicate that the system is energized and under DSP control.
- "RUN" will light up when the inverter detects that the grid connection conditions meet the requirements and power is fed into the grid. "RUN" will blink if the grid is in de-rated running state during the period of feeding power into the grid.
- "GRID" will light up when the grid is normal during the operation of the inverter. Otherwise, "GRID" will blink until the grid restores to normal.
- "FAULT" will blink quickly as a fault (except grid fault) occurs. "FAULT" will not turn off until the fault is eliminated. The light will blink slowly when an alarm occurs. "FAULT" remains illuminated when an internal fault occurs. The buzzer will give an alarm if a fault (involving power grid fault) occurs.

4.3 Interface Types

Users can perform the corresponding operations with the 4 function keys according to the indications of the LCD.

(1) The LCD interface starts with the company logo once the system is energized, as shown in Figure 4.2.

Figure 4.2 - Logo Screen

(2) Indication of inverter operation mode:

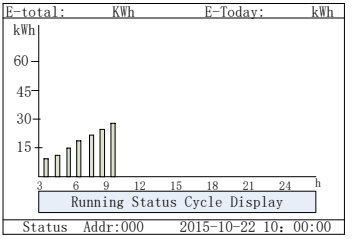


Figure 4.3 – Default Display Interface for Normal Operation

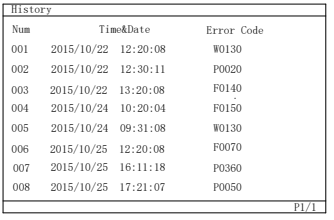


Figure 4.4 – Fault Indication Interface

LCD will display different mode interfaces based on the operation modes of the inverter. There are 3 operation modes: **startup** system check mode (as shown in Figure 4.2), **normal operation** mode (as shown in Figure 4.3), and **fault** mode (as shown in Figure 4.4).

The default interface mainly shows PV voltage, PV current, grid voltage, instant power, daily generated power and time information under normal operation.

The fault information of the most recent / currently present fault will be shown on the LCD when the inverter is in fault mode.

4.4 Menu Functions

LCD displays “Main user interface” when the inverter is in operation mode. Press **ESC** in this interface to escape the default interface and to enter the main operation interface. The main operation interface is shown in Figure 4.5.

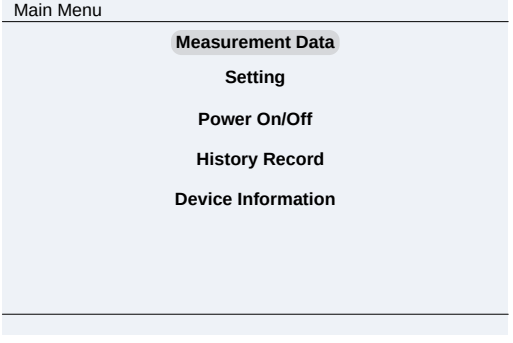


Figure 4.5 - Main Menus on the LCD

The main operation interface of LCD screen has 5 menus, i.e. “1 Measurement Data”, “2 Settings”, “3 Power ON/OFF”, “4 History Record”, and “5 Device Information”. The users may select options with ^ and v, and then press ENT to confirm selection. The users can return to the default indication interface by pressing ESC.

4.4.1 Measurement Data

When the cursor moves to “Measurement data” in the main screen, you should press **ENT** to select the operation information as shown in Figure 4.6. Check the information by pressing **UP** and **DOWN**. Return to the previous menu by pressing **ESC**.

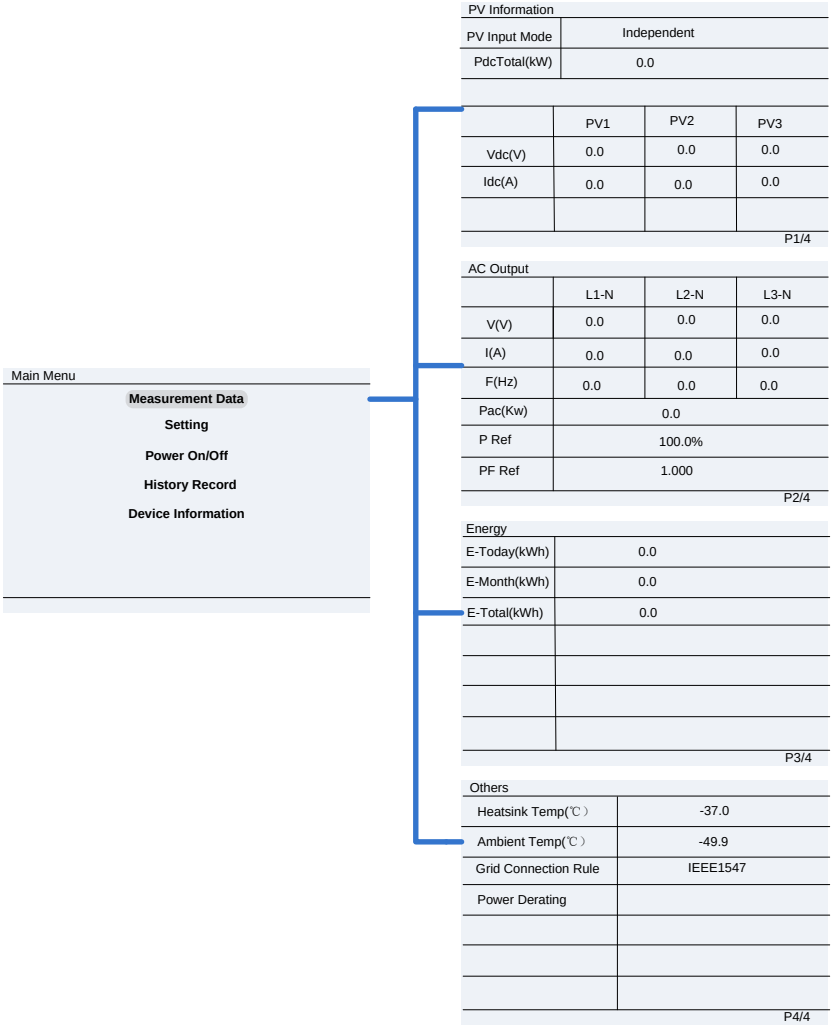


Figure 4.6 – Measurement Data

4.4.2 Setting

Move the cursor to “Settings” in the main interface. Press ENT, you will be asked for a password. Enter the password: “1111”as shown Figure 4.7. Change the password digits by pressing (∧) and (∨) . Then press ENT to input the next digit and Press ENT to confirm the password or Press ESC return back to setting.

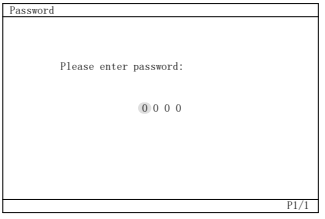


Figure 4.7 – Password Screen for Settings Menu

Press ENT to confirm, and set the current system parameters, as shown in Figure 4.8. There are 10 submenus in “Parameters Setting”: “1 System Parameters”, “2 Control Command”, “3 Protection Parameters”, “4 L/HVRT Parameters”, “5 Active Derating Setting”, “6 Reactive Derating Setting”, “7 ARC Parameters”, “8 Other Parameters”.

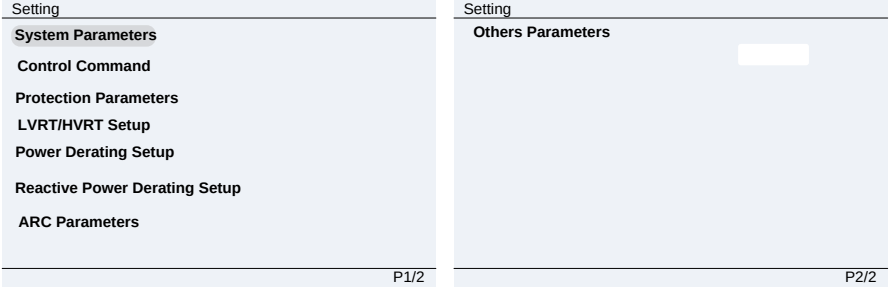


Figure 4.8 - System Settings Menu

4.4.2.1 System Parameters

(1) "**Language Setting**" One language, i.e. English is available in "Language" menu.
(2) "**Grid Rule**": There are four grid standards. Selecting the corresponding grid standard and press ENT confirm the selection as shown in Figure 4.9.

Figure 4.9 - Setting Grid Rule

INSTRUCTION:
Please check with your local electricity supply company before selecting the grid standard. If the inverter is operated with a wrong grid standard, the electricity supply company may cancel the operation license.
Putting the inverter into operation before the overall system complies with the national rules and safety regulation of the application is not permitted.

(3) "**PV Input Mode**": The inverter can work only under "Independent Mode"
(4) "**Com Setting**": In this interface you can set the address and baud rate for communication.
(5) "**Time**": Move the cursor to the "Time" set the system time. Press "∧" or "∨" set the value, then press "ENT" to move to the next option. e.g.: Year to Month. Finally Press "ENT" to confirm your selection.
(6) "LCD Contrast Setting": Setting the LCD contrast grade.

4.4.2.2 Control Command

There are 5 submenus in the "Control Command":
(1) "**Force Restart**" menu: If a fault shutdown happens, a severe fault may have occurred inside the inverter. The user can perform a manual reboot once using this menu if the user needs to restart the inverter.

INSTRUCTION:
This function is effective only when the fault "IntFault0010~0150" in the troubleshooting table occurs. The inverter may return 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 is indicated.

(2) "**Factory Default**" menu: The manufacturer's default parameters value can be restored when the inverter is not in operation mode. If you try to change the parameters while the unit is operational "Fault Operated" will be displayed.
(3) "**ARC Detect**" In the "Parameters Setting"➔"Control Command" menu, execute the "ARC Detect", the inverter will stop working and test ARC.
Arcing check and protection is mainly divided into two parts, the Arcing check board is responsible for detecting if there is arcing in the PV line, and sends the arcing protection signal to the DSP in the control board. The control board "DSP" is responsible for turning the inverter off the grid after receiving the arcing signal to ensure safety. The arcing 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 Arcing fault, the LCD displays the fault which can only be cleared manually.
(4) "**ARC Clear**" is used to 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".
(5) "**MPPT Scan**" menu: "MPPTScan" is to execute the MPPT scanning manually. Move the cursor to this item, and press ENT to initiate the scanning. The LCD screen will skip to normal operation interface if the MPPT scanning succeeds, or remain on the "MPPTScan menu" interface if the scanning fails.
MPPT scan function is used for multi-MPP point tracking, if the PV panels are partly shadowed or installed with different angle. The factory default setting of MPPT scan is Enabled, and it can also be Disabled. When the MPPT scan function is enabled, the scan period is 60 minutes; the inverter will scan the maximum power point in the MPPT range, according to below condition:

In independent mode, each input power is lower than 75% of the rated power of each MPPT tracker.

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

4.4.2.3 Protect Parameters

In this interface you can change the Protect parameters of grid voltage, frequency and recovery, etc., as shown in Figure 4-10. But you can't enable/disable the function. The protect parameters are shown in Table 4.3.

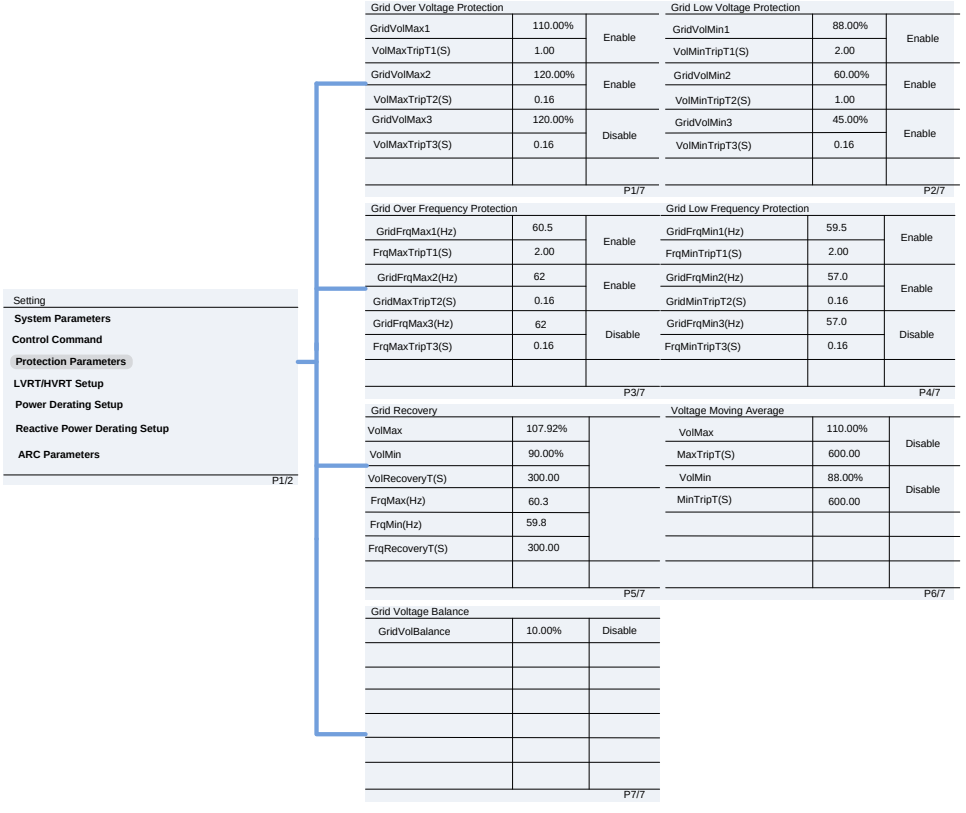


Figure 4.10 - Protection Parameters Setting

REMARK: Switching between parameters is done by pressing (∧) and (∨). Then press "ENT" to select it, change the parameter value by pressing (∧) and (∨) then press "ENT" to send the parameter to inverter. The LCD will display new parameters if the setting is successful. Otherwise the old parameters will display on the LCD.

Table 4.3 - Protection Parameters (IEEE1547 and Rule21)

Grid Voltage Protection		**IEEE1547**	**Rule21**
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
GridVoltMax1	Threshold value of Level 1 Max. grid voltage	{100.00%, 110.00%, 135.00%}	{100.00%, 110.00%, 135.00%}
VoltMaxTripTime1(s)	Threshold value of Level 1 Max. grid trip voltage	{0, 1.00, 655}	{0, 12.50, 655}
GridVoltMax2	Threshold value of Level 2 Max. grid voltage	{100.00%, 120.00%, 135.00%}	{100.00%, 120.00%, 135.00%}
VoltMaxTripTime2(s)	Threshold value of Level 2 Max. grid trip voltage	{0, 0.16, 655}	{0, 0.16, 655}
GridVoltMax3	Threshold value of Level 3 Max. grid voltage	{100.00%, 120.00%, 135.00%}	{100.00%, 120.00%, 135.00%}
VoltMaxTripTime3(s)	Threshold value of Level 3 Max. grid trip voltage	{0, 0.16, 655}	{0, 0.16, 655}
GridVoltMin1	Threshold value of Level 1 Min. grid voltage	{30.00%, 88.00%, 100.00%}	{30.00%, 88.00%, 100.00%}
VoltMinTripTime1(s)	Threshold value of Level 1 Min. grid trip voltage	{0, 2.0, 655}	{0, 20.50, 655}
GridVoltMin2	Threshold value of Level 2 Min. grid voltage	{30.00%, 60.00%, 100.00%}	{30.00%,70.00%, 100.00%}
VoltMinTripTime2(s)	Threshold value of Level 2 Min. grid trip voltage	{0, 1.00, 655}	{0, 10.50, 655}
GridVoltMin3	Threshold value of Level 3 Min. grid voltage	{30.00%, 45.00%, 100.00%}	{30.00%, 50.00%, 100.00%}
VoltMinTripTime3(s)	Threshold value of Level 3 Min. grid trip voltage	{0, 0.16, 655}	{0, 1.5, 655}
Grid Frequency Protection		**IEEE1547**	**Rule21**
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
GridFrqMin1	Protection threshold value of Level 1 Min. grid frequency	{54, 59.5, 60}	{45, 58.5, 60}
FrqMinTripT1 (s)	Trip time of Level 1 Min. grid frequency	{0, 2, 655}	{0, 299.50, 655.00}
GridFrqMin2	Protection threshold value of Level 2 Min. grid frequency	{54, 57, 60}	{45, 57, 60}
FrqMinTripT2 (s)	Trip time of Level 2 Min. grid frequency	{0, 0.16, 655}	{0, 0.16, 655}

GridFrqMin3	Protection threshold value of Level 3 Min. grid frequency	{54, 57, 60}	{54, 57, 60}
FrqMinTripT3 (s)	Trip time of Level 3 Min. grid frequency	{0, 0.16, 655}	{0, 0.16, 655}
GridFrqMax1	Protection threshold value of Level 1 Max. grid frequency	{60, 60.5, 65}	{50, 60.5, 65}
FrqMaxTripT1(s)	Trip time of Level 1 Max. grid frequency	{0, 2, 655}	{0, 299.50, 655}
GridFrqMax2	Protection threshold value of Level 2 Max. grid frequency	{50, 62, 65}	{50, 62, 65}
FrqMaxTripT2(s)	Trip time of Level 2 Max. grid frequency	{0, 0.16, 655}	{0, 0.16, 655}
GridFrqMax3	Protection threshold value of Level 3 Max. grid frequency	{60, 62, 65}	{50, 62, 65}
FrqMaxTripT3(s)	Trip time of Level 3 Max. grid frequency	{0, 0.16, 655}	{0, 0.16, 655}

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

REMARK: Please contact Yaskawa Solectria Solar's Applications Engineers if you need to change any of the voltage settings.

4.4.2.4 L/HVRT Parameters

"L/HVRT" is for setting the Low Voltage Ride-Through (LVRT) and High Voltage Ride-Through (HVRT) parameters. Move the cursor to this item, and press ENT to set

the parameters. Set the parameters as shown in Figure 4.11, the LVRT curve as shown in Figure 4.12 and the HVRT curve as shown in Figure 4.13.

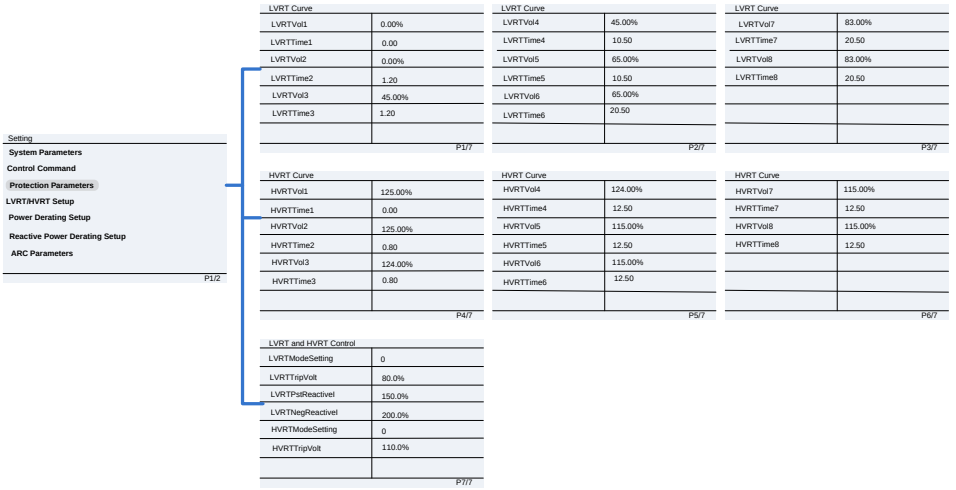


Figure 4.11 - L/HVRT Parameters Setting

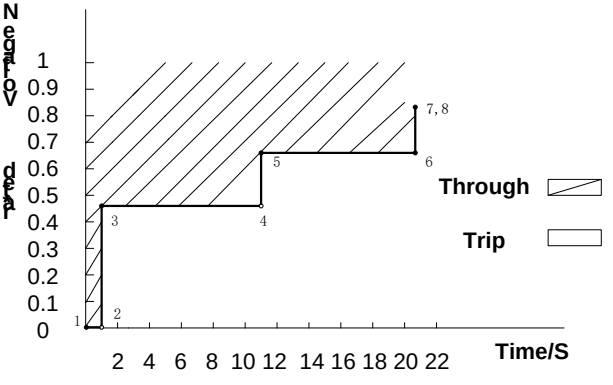


Figure 4.12 - LVRT graph

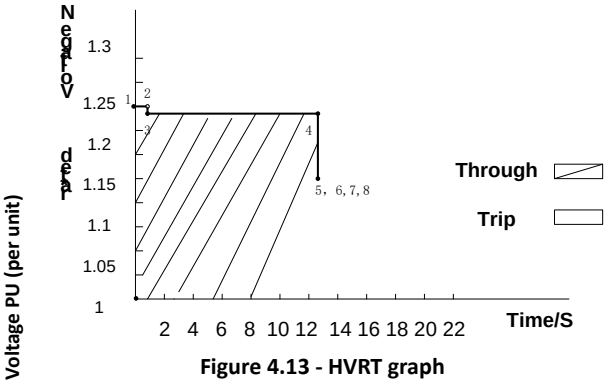


Figure 4.13 - HVRT graph

Table 4.4 - LVRT parameters (IEEE 1547 and Rule21)

LVRT		IEEE 1547	Rule 21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
LVRTVolt (1,2)	Threshold value of Low voltage ride through (1st & 2nd point)	{0%, 0%, 100%} {0%, 0%, 100%}	{0%, 0%, 100%} {0%, 0%, 100%}
LVRTTime (1,2)	Time of Level Low voltage ride through (1st & 2nd point)	{0, 0, 655} {0, 1.2, 655}	{0, 0, 655} {0, 1.2, 655}
LVRTVolt (3,4)	Threshold value of Low voltage ride through (3rd & 4th point)	{0%, 45%, 100%} {0%, 45%, 100%}	{0%, 50%, 100%} {0%, 50%, 100%}
LVRTTime (3,4)	Time of Level Low voltage ride through (3rd & 4th point)	{0, 1.2, 655} {0, 10.5, 655}	{0, 1.2, 655} {0, 10.5, 655}
LVRTVolt (5,6)	Threshold value of Low voltage ride through (5th & 6th point)	{0%, 65%, 100%} {0%, 65%, 100%}	{0%, 70%, 100%} {0%, 70%, 100%}
LVRTTime (5,6)	Time of Level Low voltage ride through (5th & 6th point)	{0, 10.5, 655} {0, 20.5, 655}	{0, 10.5, 655} {0, 20.5, 655}
LVRTVolt (7,8)	Threshold value of Low voltage ride through (7th & 8th point)	{0%, 83%, 100%} {0%, 83%, 100%}	{0%, 88%, 100%} {0%, 88%, 100%}
LVRTTime (7,8)	Time of Level Low voltage ride through (7th & 8th point)	{0, 20.5, 655} {0, 20.5, 655}	{0, 20.5, 655} {0, 20.5, 655}

Table 4.5 - HVRT parameters (IEEE 1547 and Rule 21)

HVRT		IEEE 1547	Rule 21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
HVRTVolt (1,2)	Threshold value of high voltage ride through (1st & 2nd point)	{100%, 125%, 135%} {100%, 125%, 135%}	{100%, 125%, 135%} {100%, 125%, 135%}
HVRTTime (1,2)	Time of Level high voltage ride through (1st & 2nd point)	{0, 0, 655} {0, 0.8, 655}	{0, 0, 655} {0, 0.11, 655}
HVRTVolt (3,4)	Threshold value of high voltage ride through (3rd & 4th point)	{100%, 124%, 135%} {100%, 124%, 135%}	{100%, 120%, 135%} {100%, 120%, 135%}
HVRTTime (3,4)	Time of Level high voltage ride through (3rd & 4th point)	{0, 0.8, 655} {0, 12.5, 655}	{0, 0.11, 655} {0, 12.5, 655}
HVRTVolt (5,6)	Threshold value of high voltage ride through (5th & 6th point)	{100%, 115%, 135%} {100%, 115%, 135%}	{100%, 110%, 135%} {100%, 110%, 135%}
HVRTTime (5,6)	Time of Level high voltage ride through (5th & 6th point)	{0, 12.5, 655} {0, 12.5, 655}	{0, 12.5, 655} {0, 12.5, 655}
HVRTVolt (7,8)	Threshold value of high voltage ride through (7th & 8th point)	{100%, 115%, 135%} {100%, 115%, 135%}	{100%, 110%, 135%} {100%, 110%, 135%}
HVRTTime (7,8)	Time of Level high voltage ride through (7th & 8th point)	{0, 12.5, 655} {0, 12.5, 655}	{0, 12.5, 655} {0, 12.5, 655}

Table 4.6 - LVRT and HVRT control parameters (IEEE 1547 and Rule 21)

LVRT and HVRT Control		IEEE 1547	Rule 21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
LVRTModeSetting	0: Disable 1: Enable, no reactive power output 2: Enable, reactive power output	(0, 0, 2)	(0, 2, 2)
LVRTTripVolt	Threshold value of LOW voltage trip	(70.0%, 80.0%, 100.0%)	(70.0%, 88.0%, 100.0%)
LVRTPstReactive1	The factor LVRT Positive Reactive Current	(0%, 150.0%, 300.0%)	(0%, 150.0%, 300.0%)
LVRTNegReactive1	The factor LVRT Negative Reactive Current	(0%, 200.0%, 100%)	(0%, 200.0%, 100%)
HVRTModeSetting	0: Disable 1: Enable, no reactive power output 2: Enable, reactive power output	(0, 0, 2)	(0, 1, 2)
HVRTTripVol	Threshold value of HIGH voltage trip	(100.0%, 110.0%, 135.0%)	(100.0%, 110.0%, 135.0%)

4.4.2.5 Power Derating Setting

"Power Derating Setting" menu is to set the active power derating parameters include active power derating, over frequency derating, low frequency derating and high temperature frequency derating, etc. The parameters are shown in Table 4.5.

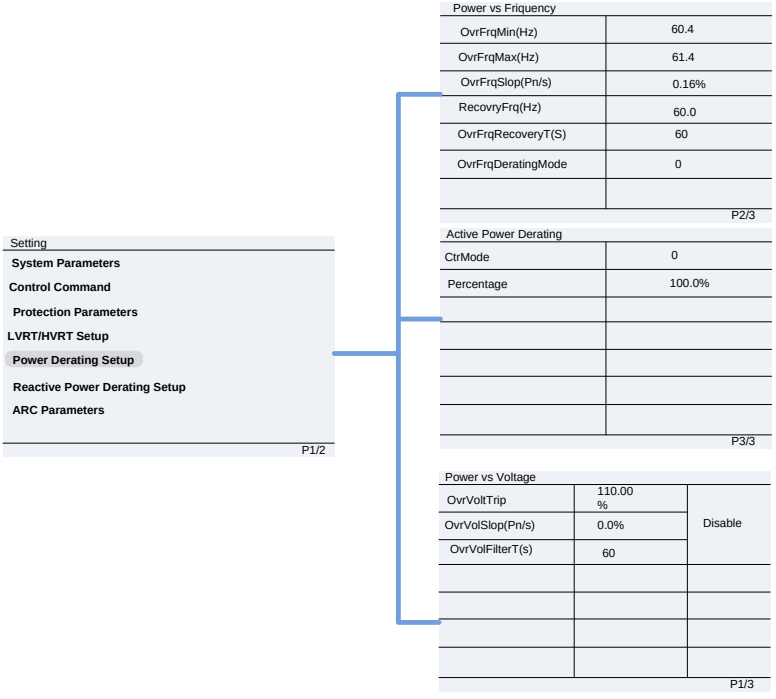


Figure 4.14 - Active Power Derating

Table 4.7 - Active Power Derating Settings

Voltage-Watt		IEEE1547	Rule21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
OvrVoltTrip	The trigger voltage of OverVoltage derating	{100%,110%,135%}	{100%,110%,135%}
OvrVoltSlop	The rate of OverVoltage derating	{0%,0%,100%}	{0%,0%,100%}

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

4.4.2.6 Reactive Derating Setting

“Reactive Power Derating Parameters” menu is to set the Grid reactive power derating parameters including PF parameters and Q parameters, etc. The parameters are shown in Table 4.6

NOTE: The PF and Q value can be adjusted by remote software if “Remote” is selected. Remote can be selected thru the Modbus map and the appropriate register.

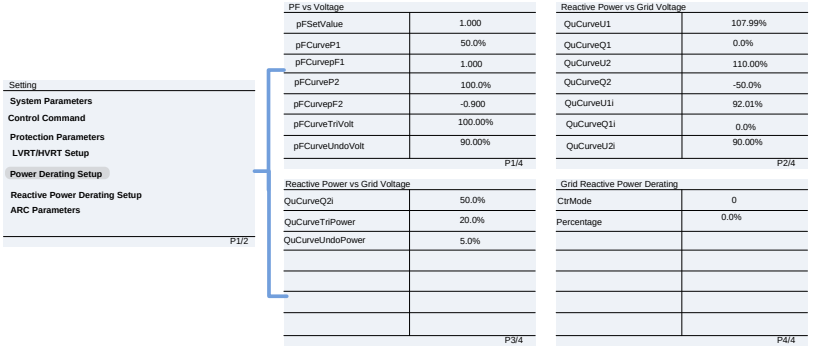


Figure 4.15 - Reactive Power Derating

Table 4.8 - Reactive Power Control (IEEE 1547 and Rule 21)

Grid Reactive Power Derating		IEEE 1547	Rule 21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
pFSetValue	Local Power Factor Setting	{-0.8,-1},{1},{0.8,1}	{-0.8,-1},{1},{0.8,1}
pFCurveP1（%）	Power of PF(P) Curve point 1	{0, 50%, 110%}	{0, 50%, 110%}
pFCurvepF1	PF of PF(P) Curve point 1	{-1,-0.8},{1},{0.8,1}	{-1,-0.8},{1},{0.8,1}
pFCurveP2（%）	Power of PF(P) Curve point 2	{0, 100%, 110%}	{0, 100%, 110%}
pFCurvepF2	PF of PF(P) Curve point 2	{-1,-0.8},{-0.9}, {0.8,1}	{-1,-0.8},{-0.9}, {0.8,1}
pFCurveTriVol (V)	The trigger voltage of PF(P)Curve	{100%, 100%, 110%}	{100%, 100%, 110%}
pFCurveUndoVol (V)	PF curve revocation voltage	{90%, 90%, 100%}	{90%, 90%, 100%}

(1) CtrMode: Set 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

(2) PF Set: Set the PF value

NOTE: You can change the reactive power by adjusting the power factor
(3) PF(P) Curve: PF curve mode
NOTE: The power factor changes according to the power change, as shown in Figure 4.16:

INSTRUCTION:
The PF (P) Curve function is only available for IEEE 1547 grid standard.

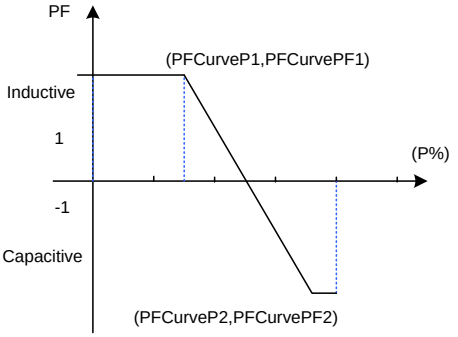


Figure 4.16 - PF(P) Curve Mode

(4) Q(U) Curve: Q(U) curve mode

Note: The reactive compensation changes according to the grid voltage change, as shown in **Figure 4.17**.

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

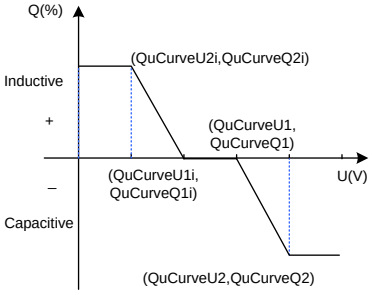


Figure 4.17 - Q(U) Curve Mode

Table 4.6 lists the parameters of PF Set, PF(P) Curve and Q(U) Curve modes. After you setup the parameters, press ENT to activate the modes.

Table 4.9 - Parameters of Reactive Power Control (IEEE 1547)

Grid Reactive Power Derating		IEEE 1547	Rule 21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
QuCurveU1 (V)	Voltage of Q(U) Curve point 1	{100%, 107.99%, 110%}	{100%, 107.99%, 110%}
QuCurveQ1 (%)	Reactive power of Q(U) Curve point 1	{-66%, 0, 66%}	{-60%, 0, 60%}
QuCurveU2 (V)	Voltage of Q(U) Curve point 2	{108%, 110%, 110%}	{108%, 108%, 110%}
QuCurveQ2 (%)	Reactive power of Q(U) Curve point 2	{-66%, -50%, 66%}	{-60%, -60%, 60%}
QuCurveU1i (V)	Voltage of Q(U) Curve point 1i	{90%, 92.01%, 99%}	{90%, 99%, 99%}
QuCurveQ1i (%)	Reactive power of Q(U) Curve point 1i	{-66%, 0, 66%}	{-60%, 0, 60%}
QuCurveU2i (V)	Voltage of Q(U)Curve point 2i	{80%, 90%, 92%}	{80%, 92%, 92%}
QuCurveQ2i (%)	Reactive power of Q(U)Curve point 2i	{-66%, 50%, 66%}	{-60%, 60%, 60%}
QuCurveTriPower (V)	The trigger voltage of Q(U)Curve	{5%, 20%, 100%}	{5%, 20%, 100%}
QuCurveUndoPower (V)	The end voltage of Q(U)Curve	{5%, 5%, 100%}	{5%, 5%, 100%}
CtrMode	The control mode of reactive power 0: Disable dispatch mode.	{0, 0, 5}	{0, 0, 5}

	1: Remote dispatch mode. 2: Local control, by Q 3: Local control, by PF 4: PF(P) curve 5: Q(U) curve		
Percentage	Local Power Factor Setting	{-66%, 0%, 66%}	{-60%, 0%, 60%}

4.4.2.7 Arc Parameters

The ARC Parameters submenu is to enable/disable the ARC detection function and set the ARC parameters. **NOTE:** always check with your AHJ before disabling this function.

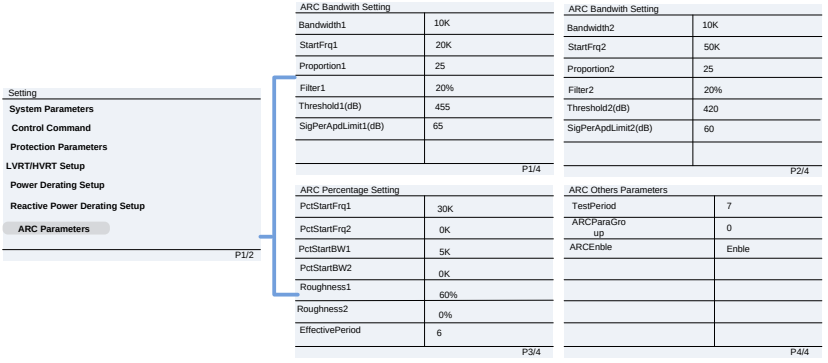


Figure 4.18 - ARC Submenu Parameters

4.4.2.8 Other Parameters

The Other Parameters submenu is to set parameters such as MPPT scan period, nominal derating step, GFCI and DCI parameters. Press ENT and use ∧ and ∨ to set the parameters and enable/disable the function. Then press ENT to confirm your selection. The parameters are shown in Figure 4.19 (Parameters in gray cannot be changed)

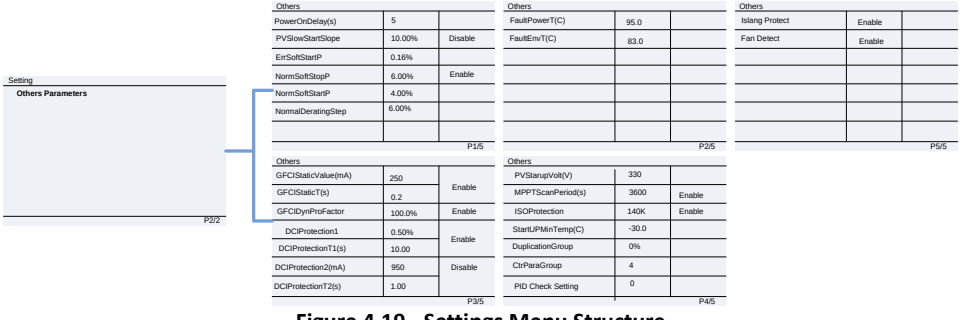


Figure 4.19 - Settings Menu Structure

Table 4.10 – Other ParameterS

Other Parameters		IEEE 1547	Rule 21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
PowerOnDelay (s)	Startup delay time	{0, 5, 1200}	{0, 5, 1200}
PVSlow StartSlope (%/P)	The output power will slowly increase due to the change of PV illumination at the Rule21 standard	{0.01%, 10.00%, 10}	{0.01%, 10.00%, 10}
ErrSoftStartP (%/P)	Power startup step after Grid Fault	{0.01%, 0.16%, 10%}	{0.01%, 0.16%, 10%}
NormSoftStopP (%/P)	Normal power step in soft stop	{0.01%, 6.00%, 10%}	{0.01%, 2.00%, 10%}
NormSoftStartP (%/P)	Normal power step in soft startup	{0.01%, 4.00%, 10%}	{0.01%, 2.00%, 10%}
NormalDeratingStep	Power step in Derarting	{0.01%, 6.00%, 10%}	{0.01%, 5.00%, 10%}
FaultPowerT	The trigger temperature of module (C)	(95.0, 95.0, 95.0)	(95.0, 95.0, 95.0)
FaultEnvT	The trigger temperature of enviroment (C)	(83, 83, 83)	(83, 83, 83)
GFCIStaticValue (mA)	The static threshold value of Leakage current	(100, 250, 1000)	(100, 250, 1000)
GFCIStaticT (s)	The static threshold value of Leakage current	(0, 0.2, 655)	(0, 0.2, 655)
GFCIDynProFactor	The dynamic trigger coefficient of Leakage current	(0.0%, 100%, 200%)	(0.0%, 100%, 200%)
DCIProtection1	Maximum DCI value1	(0.01%, 0.50%, 5.00%)	(0.01%, 0.50%, 5.00%)
DCIProtectionT1 (s)	Trip time 1 of DCI	(0.00, 10.00, 120.00)	(0.00, 10.00, 120.00)
DCIProtection2 (mA)	Maximum DCI value2	(5, 950, 5000)	(5, 950, 5000)
DCIProtectionT2 (s)	Trip time 2 of DCI	(0.00, 1.00, 120.00)	(0.00, 1.00, 120.00)
PVStartVolt(V)	PV start-up voltage	(300, 330, 400)	(300, 330, 400)
MPPTScanPeriod (s)	MPPT Scan Cycle	(300, 3600, 5400)	(300, 3600, 5400)

Other Parameters (Cont'd)		IEEE 1547	Rule 21
Parameter name	**Description**	**Setting Range (Min, Default, Max)**	**Setting Range (Min, Default, Max)**
ISOProtection (Ω)	Minimum insulation resistance	(1k, 140k, 2000k)	(1k, 140k, 2000k)
StarUPMinTemp (C)	The minimum startup temperature	(-35, -30, -20)	(-35, -30, -20)
DuplicationGroup	Parameter of repetitive control	{0, 0, 100}	{0, 0, 100}
CtrParaGroup	The enabled control parameters group.	{0, 4, 4}	{0, 4, 4}
PID Check Setting	PID Checking enable/disable control	{0, 0, 1}	{0, 0, 1}
Island Protect	Island enable/disable control 0: Disable 1: Enable	{0, 1, 1}	{0, 1, 1}
Fan Detect	Fan detection enable/disable control 0: Disable 1: Enable	{0, 1, 1}	{0, 1, 1}

4.4.2.9 File Export (local)

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

4.4.2.10 Firmware update (local)

Firmware update is to update the versions of firmware including LCD Firmware and DPS Firmware. Press ENT and use UP and DOWN arrows to update the data, and press ENT to confirm the setting. For remote Firmware updating see Section 6.4

4.4.3 Power ON/OFF

A manual power cycle ON/OFF is required after any parameter change, after getting an error message or updating the software. The unit will automatically go into the OFF state. Press ESC or ENT to enter into the Main Menu, then press ENT and go to the submenu "Power On/OFF". Then move the cursor to "ON" and press ENT to start the inverter, the inverter will start up normally and operate if the start-up conditions are met.

Normally it is not necessary to turn OFF the inverter, but if this is needed, you can do so from this menu simply by selecting “OFF” and pressing ENT to confirm.

4.4.4 History

Move the cursor to “4 History” in the main interface. Press ENT to check the history information, as shown in Figure 4.20. There are 2 submenus in “2 History”: “Running History” and “Fault Record”.
(1) The log can store up 100 running history messages in the “Running History” menu.
(2) The log can store up 100 fault records in the “Fault Record” menu.

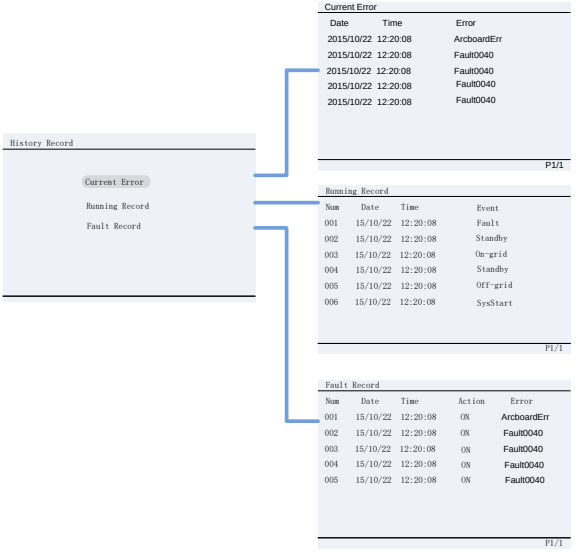


Figure 4.20 - History Menu and Submenu

4.4.5 Device Information

Move the cursor to the main operation interface “Main Menu”. Press ENT and go to sub menu “Device Information” and press ENT to check the device information as shown in Figure 4.21.

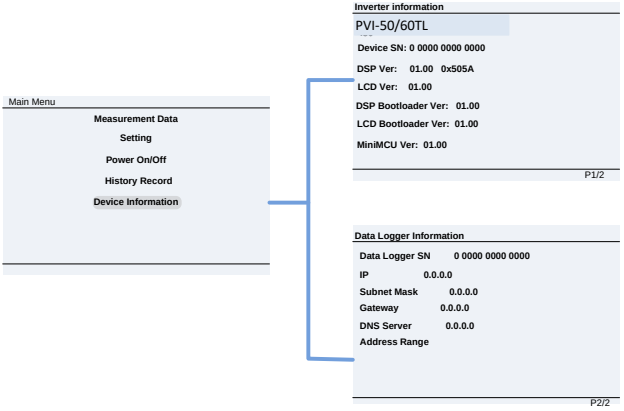


Figure 4.21 - History Menu and Submenu

5.0: Operation

5.1 Start-Up

Manual Start-up: Manual start-up is required after regulation setting change or manual (fault) shut-down. Move the cursor from the main operation interface to "Setting". Press **ENT** and go to submenu "1 ON/OFF". Then 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.

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

5.2 Shutdown

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.

Move the cursor from the main operation interface to "4 Setting". Press **ENT** and go to submenu "1 ON/OFF". Move the cursor to "OFF" and press **ENT**, and then the inverter will shut down.

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

5.3 Operation Mode

There are 4 operation modes. The following are corresponding indications for each

mode.

(1) System-check mode and logo for startup, as shown in Figure 5.1.

Figure 5.1 - System Self-Check Ongoing

This mode indicates that the inverter is checking whether it is ready for normal operation after the manual start-up of inverter.

(2) Normal operation mode: Default indication interface for normal operation is shown in Figure 5.2.

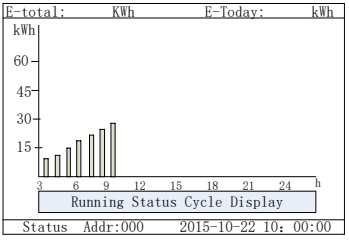


Figure 5.2 - Default Indication Interface for Normal Operation

In this mode, the inverter converts the power generated by PV modules to AC continuously and feeds into the power grid.

(3) Standby mode, as shown in Figure 5.3:

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 values. 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.

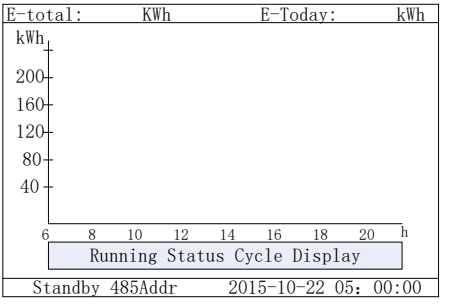


Figure 5.3 - Inverter System in Standby Mode

(4) Fault mode, as shown in Figure 5.4.

The inverter will disconnect from the power grid and turn into fault mode when the inverter or power grid fails. Check the specific cause in "**Troubleshooting Table**" (Table 6.2) according to the fault message displayed on the LCD and eliminate the fault referred to in the instructions.

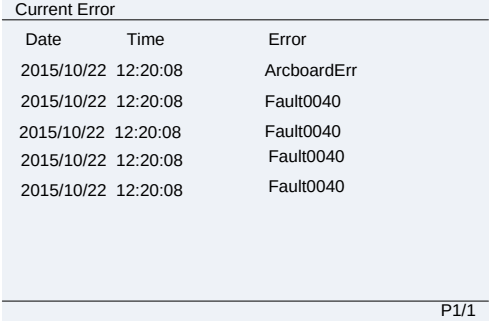


Figure 5.4 - Fault Indication Interface

WARNING:
All installation and wiring connections should be performed by qualified technical personnel. Disconnect the inverter from PV modules and the AC supply before performing maintenance.
Do not work on the inverter until at least 5 minutes after disconnecting all sources of DC and AC.
Toutes les installations et les connexions de câblage doivent être effectuées uniquement par le personnel technique qualifié. Débrancher l'onduleur de modules photovoltaiques et le grid électrique avant l'entretien et la marche de l'équipement.

Ne pas utiliser ou entretenir l'onduleur jusqu'à au moins 5 minutes après avoir débranché toutes les sources du côté C.C. et C.A.

5.4 Grid-Tied Power Generation

PVI 50/60TL series inverter has an automatic grid-tied power generation process. It will check whether AC power grid meets the conditions for grid-tied power generation constantly and test whether the PV array has enough energy. After all conditions are met, the inverter will enter grid-tied power generation mode. While in the grid-tied power generation mode, the inverter can detect the power grid at all times, and also keep the photovoltaic array output in maximum power point tracking (MPPT) mode. In case of any abnormity, the inverter will enter the protection program immediately. In low light conditions when the PV power is not enough to keep the inverter in operation, the inverter will enter standby mode. When the voltage of the PV array changes and becomes stable and higher than the required set value, the inverter will attempt to start grid-tied power generation again.

6.0: Maintenance and Removal of Inverter

6.1 Fault Shutdown and Troubleshooting

6.1.1 LED Fault and Troubleshooting

When contacting Yaskawa Solectria Solar for support please provide the serial number of the inverter and the fault message. If the fault is regarding a voltage issue, please measure the AC and DC voltage at the inverter prior to calling.

Please refer to the definition of LED lights in Table 4.1 and troubleshoot according to Table 6.1.

Table 6.1 - Troubleshooting of LED Lights

LED fault status	Solutions
Neither the "Power" LED nor the LCD 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 installed correctly and secure
The "RUN" LED turns off or "FAULT" LED lights up.	Refer to Table 7.2 for troubleshooting

6.1.2 LCD Fault and Troubleshooting

The inverter will be shut down automatically if the PV power generation system fails. This can happen due to an output short circuit, grid overvoltage / under voltage, grid over frequency / under frequency, high environmental temperature or internal malfunction of the machine. The fault information will be displayed on the LCD. Please refer to "Present Fault" for detailed operation.

The causes of a fault can be identified based on the faults listed in Table 6.2. Proper analysis is recommended before contacting after-sales service. There are 3 types of fault: alarm, protection and hardware fault.

Table 6.2 - LCD Troubleshooting

Alarm	1.CommErr	Definition: Communication inside inverter failed
		Possible causes: Terminal block connecters of internal communication wires have poor contact
		Recommended solutions: 1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Turn off both AC and DC disconnect for 2 minutes and reset the inverter; 3.Contact after-sales service personnel if the error persists
	2.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 and see whether the alarm will be eliminated automatically; 2.Check for foreign objects on fan blades; 3.Turn off both AC and DC disconnect for 2 minutes and reset the inverter; 4. Contact after-sales service personnel if the error persists
	3. IntFanErr	Recommended solutions: 1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Check for foreign objects on fan blades; 3.Turn off both AC and DC disconnect for 2 minutes and reset the inverter; 4. Contact after-sales service personnel if the error persists

Warn	Warn0030 (EepromErr)	Definition: Internal alarm
		Recommended solutions: 1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2. Contact after-sales service personnel if the error persists
	Warn0040 (DC SPD fault)	Recommended solutions: 1. Visually check the DC SPD device to see if its indicator is red. 2. If it is red, a surge has occurred and the SPD needs to be replaced. 3. Contact after-sales service personnel to purchase a replacement SPD or for additional information.
	Warn0050 (TempSensorErr)	Recommended solutions: 1.Observe temperature display; 2. Turn off both AC and DC disconnect for 2 minutes and reset the inverter; 3. Contact after-sales service personnel if the error persists
	Warn0100 (AC SPD fault)	Recommended solutions: 1. Contact after-sales service personnel.
Protection	Protect0090 (Bus over voltage)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	Protect0070 (Bus imbalance)	1. Contact after-sales service personnel if the error persists
	Protect0030 (Inverter Over Current)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	GridV.OutLim	1. Make sure the grid connection is good. 2. Restart the inverter again.
	GridF.OutLim	1. Check the AC wires connection and AC frequency is in range; 2. Check the measurement value in LCD, if the grid frequency is in limit, restart the inverter.
	Protect0020 (Grid relay error)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to

		discharge. 2. Contact after-sales service personnel if the error persists
	TempOver (Over-temperature protection)	1.Confirm that 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 after-sales service personnel
	Protect0180 (The sampling offset of DCI)	1. If the inverter can start up, then recalibrate. 2. Contact after-sales service personnel if the error persists.
	Protect0170 (DCI high)	1. Contact after-sales service personnel if the error persists
	IsolationErr (Insulation resistance low)	Check wires of PV and ground: 1.Turn OFF AC switch to disconnect inverter from Grid. 2.Open fuse holders to de-couple PV strings from each other. 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 there is no alarm, turn OFF AC switch to disconnect from Grid and add in the next string. Start the inverter again. 5. Continue until you can find the string that triggers the alarm. Trace wirings of faulted string to find any leakage to Earth Ground. 6. Contact after-sales service personnel if the error persists.
	GFCIErr (leakage current high)	Check wires of PV and ground: 1.Turn OFF AC switch to disconnect inverter from Grid. 2.Open fuse holders to de-couple PV strings from each other. 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 there is no alarm, turn OFF AC switch to disconnect from Grid and add in the next string. Startup inverter again. 5. Continue until you can find the string that triggers the alarm. Trace wiring of faulted string to find any leakage

		to Earth Ground.
	Protect0150 (Mini MCU Fault)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	Protect0110 (BUS over voltage (firmware))	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	Protect0100 (The sensor fault of leakage current)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	PVxReverse (PVx input reverse connection x=1,2,3)	1. Turn DC Switch OFF 2. Open Fuse holder 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 recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 3. Contact after-sales service personnel if the error persists
	PV2VoltOver ((PVx Over Volt x=1,2,3))	1. Measure voltage at DC terminals in wiring box and compare with reading in Measurement menu. PV voltage must be less than 1000V in open circuit condition. 2. Contact after-sales service personnel if the error persists
	Protect0230 (Inverter open-loop self-test fault)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	ARC Protect	1. Clear error from the LCD menu 2. Run Arc Fault Test from Settings Menu 3. Contact after-sales service personnel if the error persists

	Arcboard Err	1. Clear error from the LCD menu 2. Run Arc Fault Test from Settings Menu 3. Contact after-sales service personnel if the error persists

Fault	Fault0130 (Bus over total voltage)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	Fault0110 (Bus imbalance)	1. Contact after-sales service personnel if the error persists
	Fault0100 (Grid relay fault)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	Fault0090 (Dynamic leakage current high)	Check wires of PV and ground: 1.Turn OFF AC switch to disconnect inverter from Grid. 2.Open fuse drawers to de-couple PV strings from each other. Test strings with string test set 3.Add one PV string at a time, and start up inverter to see if alarm occurs. 3.If there is no alarm, turn OFF AC switches to disconnect from Grid and add in the next string. Startup inverter again. 4. Continue until you can find the string that triggers the alarm. Trace wiring of faulted string to find any leakage to Earth Ground.
	Fault0080 (Bus Hardware over current fault)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	Fault0060 (CPLD Fault)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists

	Fault0020 (Bus over volt Hardware)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists
	Fault0150 (Open-loop self-check failure)	1. Restart inverter by recycle both AC and DC switches. Wait for 1 minute between OFF and ON for all energy to discharge. 2. Contact after-sales service personnel if the error persists

INSTRUCTION:

*The actual display of “PV.VoltOver” is “PV1VoltOver” or “PV2VoltOver” or “PV3VoltOver”.

*The actual display of “PV.Reverse” is “PV1Reverse” or “PV2Reverse” or “PV3Reverse”.

DANGER:

Please 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 work in the inverter until at least 5 minutes after disconnecting all sources of DC and AC.

Veuillez débrancher l'onduleur du grid C.A. et des modules photovoltaiques avant l'ouverture de l'équipement. Assurez-vous que la haute tension et l'énergie dangereuses à l'intérieur de l'équipement a été déchargée.

Ne pas utiliser ou entretenir l'onduleur jusqu'à au moins 5 minutes après avoir débranché toutes les sources du côté C.C. et C.A

6.2 Product Maintenance

6.2.1 Check the Electrical Connection

Check all the cable connections as a regular maintenance inspection every 6 months or every year.

1.) Check the cable connections. If loose, tighten all the cables according to “2.3 Electrical Installation”.

2.) Check for cable damage, especially whether the cable surface is scratched or smooth. Repair or replace the cables if necessary.

6.2.2 Clean the Air Vent Filter

The inverter can become hot during normal operation. It uses built in cooling fans to provide sufficient air flow to help in heat dissipation.

Check the air vent regularly to make sure it is not blocked and clean the vent with a soft brush or vacuum if necessary.

6.2.3 Replace 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 6.1 for replacing the cooling fans.

(1) Use a No.2 Phillips head screwdriver to take off 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.

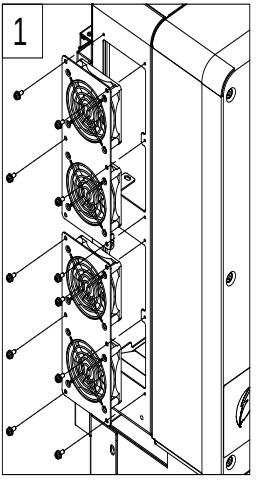
(3) Use a No.2 Phillips head screwdriver to take off the screws.

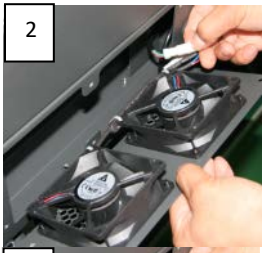
(4) Fix the new cooling fan on the fan tray, and fasten the cable on the fan tray with cable ties

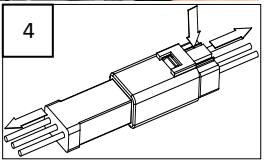
Torque value: 8 in-lbs (0.8-1N.m)

(5) Install the assembled fans back to the inverter.

Torque value: 10 in-lbs (1.2N.m)







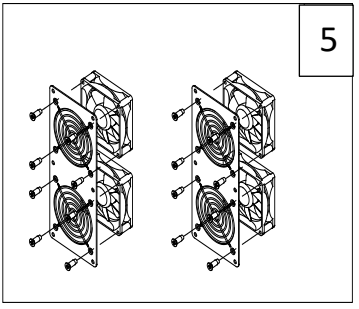


Figure 6.1 - Replace Cooling Fans

6.2.4 Replace the Inverter

Please confirm the following before replacing the inverter:
(1) The inverter is turned off.
(2) The DC switch of the inverter is turned to OFF position.
Afterwards replace the inverter according to the following steps:
a.) Unlock the padlock if it is installed on the inverter.

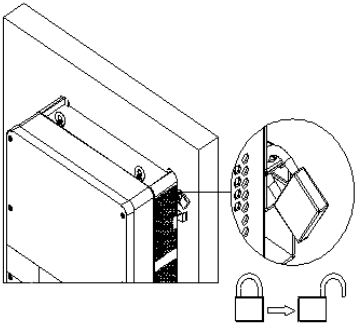


Figure 6.2 - Unlock the Padlock

b.) Use a No. 2 Phillips or No. 10 wrench head screwdriver to unscrew the 2 screws on both sides of the inverter.

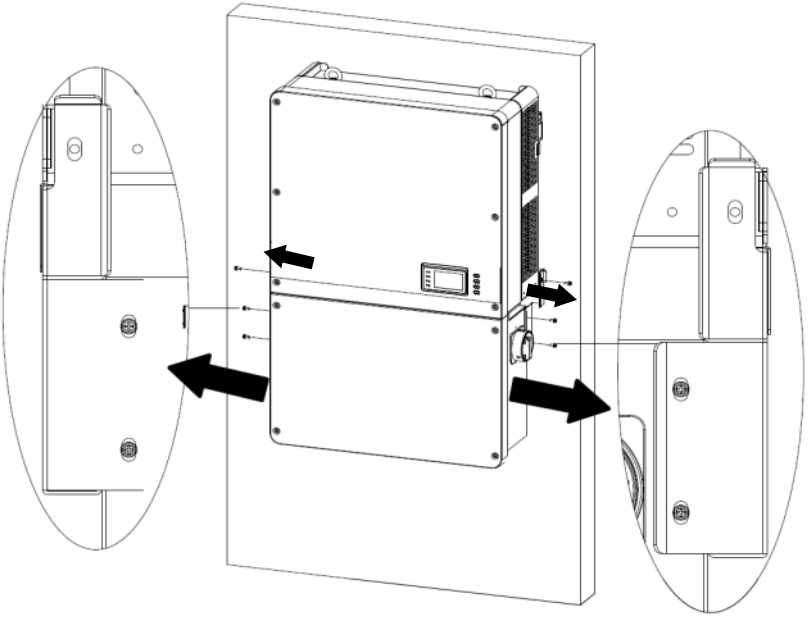


Figure 6.3 - Remove the Screws on Both Sides

c.) Use a No. 10 Hex wrench to remove the 4 screws between the main section and the wiring box. Lift up the main section and disconnect from the wiring box.

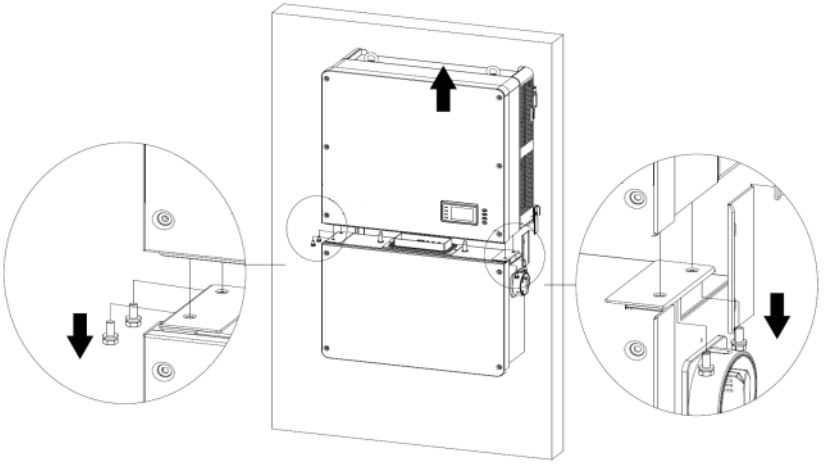


Figure 6.4 - Disconnect the Main Section from the Wiring Box

d.) Use a No.2 Phillips head screwdriver to remove the 2 screws on the left side of the wiring box, and take off the cover board. Put the board on the connector of wiring box.
Torque value: 10 in-lbs (1.2N.m)

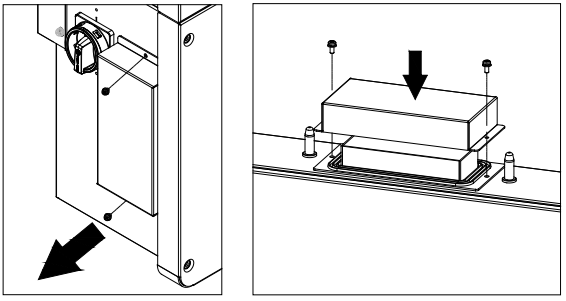


Figure 6.5 - Install the Cover Board on the Connector of the Wiring Box

6.3 Uninstalling the Inverter

Uninstall the inverter according to the following steps when the service is due or for other reasons:

DANGER:
Please disconnect the electrical connection in strict accordance with the following steps. Otherwise, the inverter will be damaged and the service personnel's life will be endangered.
Veuillez débrancher la connexion électrique en stricte conformité avec les étapes suivantes. Sinon, l'onduleur sera endommagée et la vie du personnel de service sera mise en danger.

1.) Turn off the AC breaker and use Padlocks if provided.
2.) Turn off the DC breaker and use Padlocks if provided.
(Skip this step if there is no DC circuit breaker.)
3.) Switch the AC switch to "OFF" position.
4.) Switch the DC switch to "OFF" position.
5.) Wait for 10 minutes to ensure the internal capacitors have been completely discharged.
6.) Measure the AC output cable terminal voltage against ground and make sure the voltage is 0V.
7.) Disconnect the AC and EGC cables referring to "2.3.2 AC and Ground

Connection".

8.) Disconnect the DC cables referring to "2.3.1 DC Connection".

9.) Uninstall the inverter using the reverse of its installation steps referring to "2.2 Mechanical Installation".

6.4 Local Firmware Update

Update the firmware by using a USB flash drive:

1) Prepare a USB flash drive (Capacity less than 8GB) and format the drive to FAT32

2) Insert the USB flash drive into a computer

3) When the USB drive appears in the File Explorer, right click the drive and select *"Format…".* The File system should display *"FAT32"* as the default. If not, make this selection and click *"Start."*

4) Copy the *LCD firmware* file and *DSP firmware* file onto the USB flash drive. The upgraded file needs to be placed in the *root directory*. Please contact Yaskawa Solectria Solar Technical Support & Service department for the latest firmware files.

5) Insert the USB flash drive into USB port on the inverter's communications board.

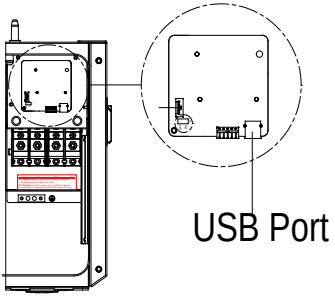


Figure 6.6 – USB Port for Firmware Upgrades

6) Using the password, enter the *Settings* menu and select *Firmware Update*. Choose the firmware to be updated (*LCD* or *DSP*) and follow the prompts on the screen. See Figure 6.2.

7) 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.

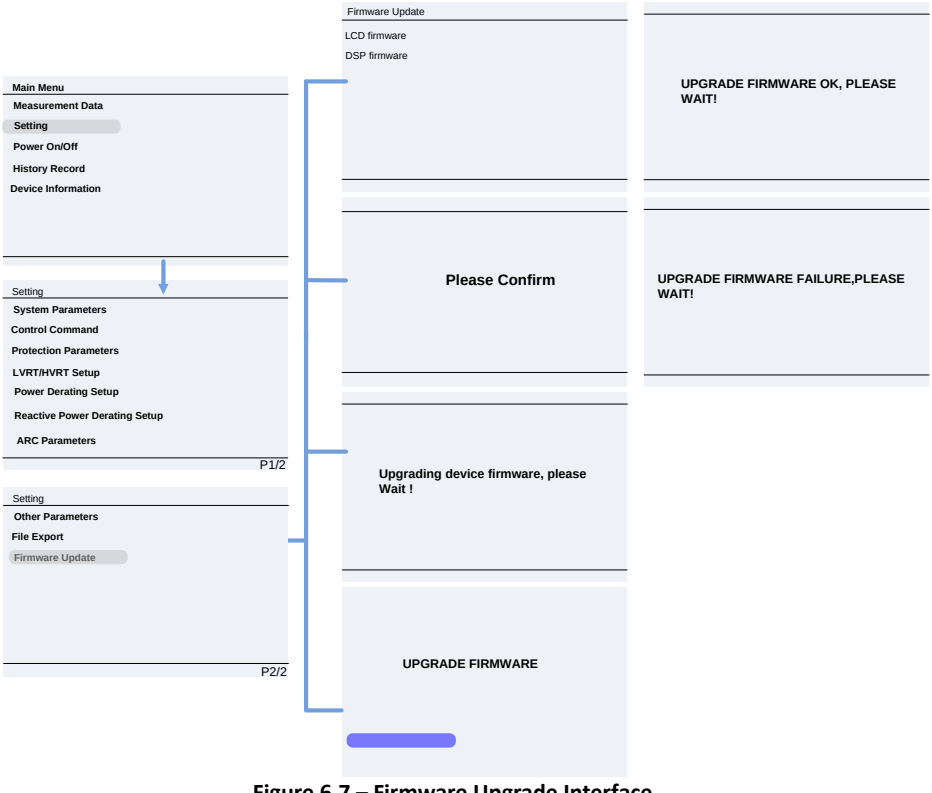


Figure 6.7 – Firmware Upgrade Interface

7.0: Product Warranty and RMA Policy

The current warranty and RMA statement for the product is available online at http://www.solectria.com/support/documentation/warranty-information/grid-tied-inverter-warranty-letter/ . If you do not have access to the internet or to request a copy to be mailed to you, please contact our **Technical Service Department 978-683-9700 x 2.**

8.0: Technical Data

Model Name	PVI 50TL	PVI 60TL
DC Input		
Max. PV Power	75kW (30kW/MPPT)	90kW (33kW/MPPT)
Nominal DC Input Power	51.5kW	61.5kW
Max. DC Input Voltage[1]	1000Vdc	
Operating DC Input Voltage Range[2]	200-950Vdc	
Start-up DC Input Voltage / Power	330V/80W	
Number of MPP Trackers	3	
MPPT Voltage Range	480-850Vdc	540-850Vdc
Operating Current(Imp)	3*36A	3*38A
Short Circuit Current (Isc)	3*68A (204A combined)	
Number of DC Inputs	15 inputs, 5 per MPPT	
DC Disconnection Type	Load rated DC switch	
AC Output		
Rated AC Output Power	50kW	60kW
Max. AC Output Power	55KVA	66KVA
Rated Output Voltage	480Vac	
Output Voltage Range[3]	422-528Vac	
Grid Connection Type	3Φ/PE/N	
Nominal AC Output Current @480Vac	66.2A	79.4A
Rated Output Frequency	60Hz	
Output Frequency Range[4]	57-63Hz	
Power Factor	>0.99 (±0.8 adjustable)	
Current THD	<3%	
AC Disconnection Type	Load rated AC switch	
System		

[1] Exceeding the Max. DC Input Voltage may cause permanent damage to the equipment.
[2] Exceeding the Max. DC Input Voltage may cause permanent damage to the equipment.
[3] The Output Voltage Range may differ according to specific grid standard.
[4] The Output Frequency Range may differ according to specific grid standard.

Topology	Transformerless
Max. Efficiency	99.0%
CEC Efficiency	98.5%
Stand-by / Night Consumption	<30W / <2W
Environment	
Protection Degree	TYPE 4X
Cooling	Variable speed cooling fans
Operating Temperature Range	-22°F to +140°F / -30°C to +60°C (derating from +122°F / +50°C)
Operating Humidity	0-95%, non-condensing
Operating Altitude	13123.4ft / 4000m (derating from 9842.5ft / 3000m)
Display and Communication	
Display	LCD + LED
Communication	Standard: RS485 (Modbus RTU) Optional: TCP/IP card
Mechanical Data	
Dimensions (HxWxD)	39.4”×23.6”×10.24”
Weight	inverter:123.5lbs/56kg; wirebox:33lbs/15kg
Orientation**	0 - 90 degrees from horizontal
Safety	
PV Arc-Fault Circuit Protection	Type 1
Safety and EMC Standard	UL1741:2010,UL1699B, CSA-C22.2 NO.107.1-01, IEEE1547, FCC PART15
Grid Standard	IEEE1547,Rule 21,HECO/Rule14H

*The "Output Voltage Range" and "Output Frequency Range" may differ according to specific grid standard.

**Shade cover accessory required for installation angles of 75 degrees or less.

NOTE 1: When the DC input voltage is lower than 540V (for PVI 60TL) and 480V (for PVI 50TL) or higher than 850V, the inverter begins derating, as shown in Figure 7.1 and Figure 7.2.

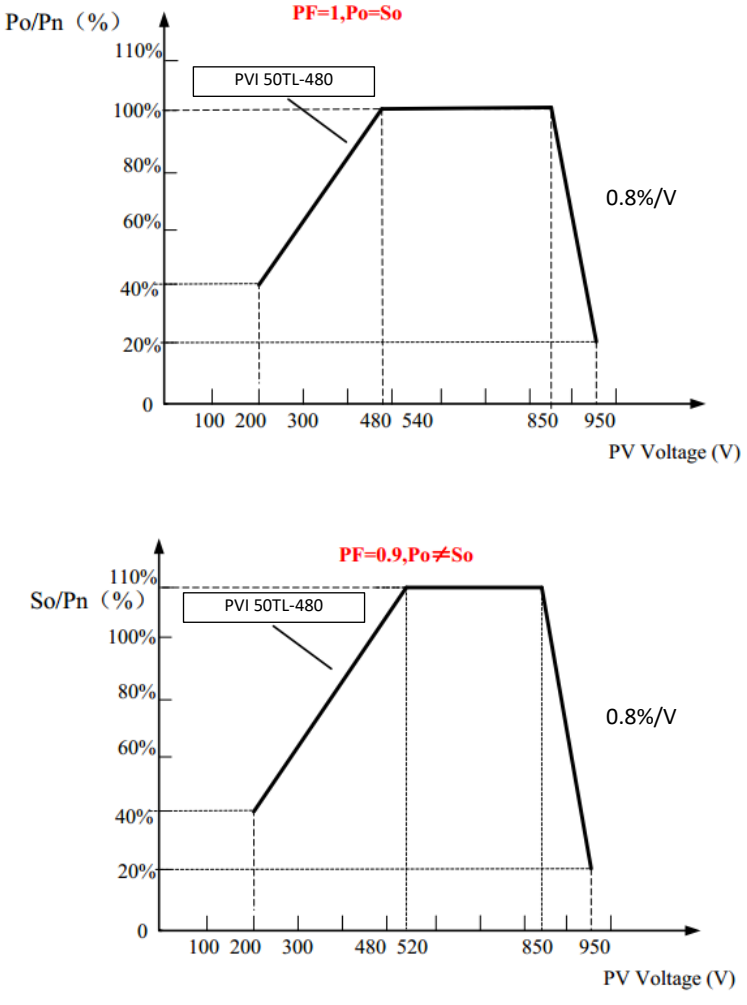


Figure 7.1 - PVI 50TL kW and kVA Derating Curves of PV Input Voltage

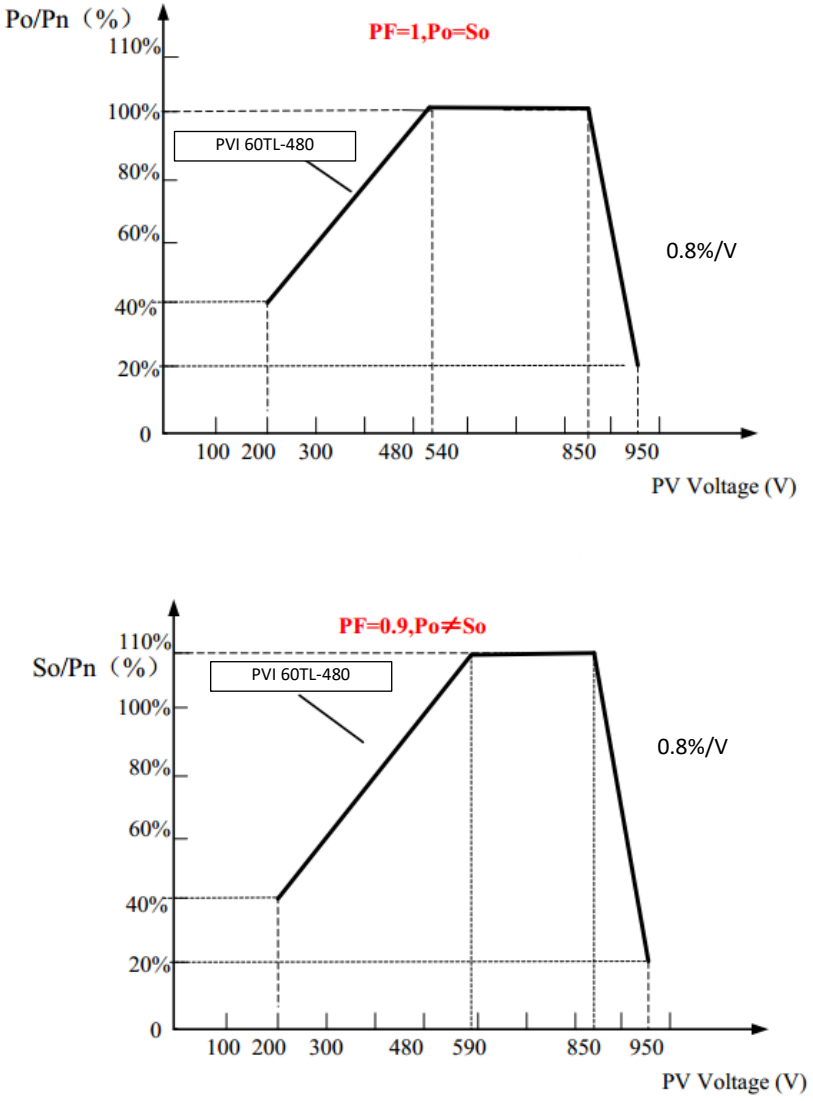


Figure 7.2 - PVI 60TL kW and kVA Derating Curves of PV Input Voltage

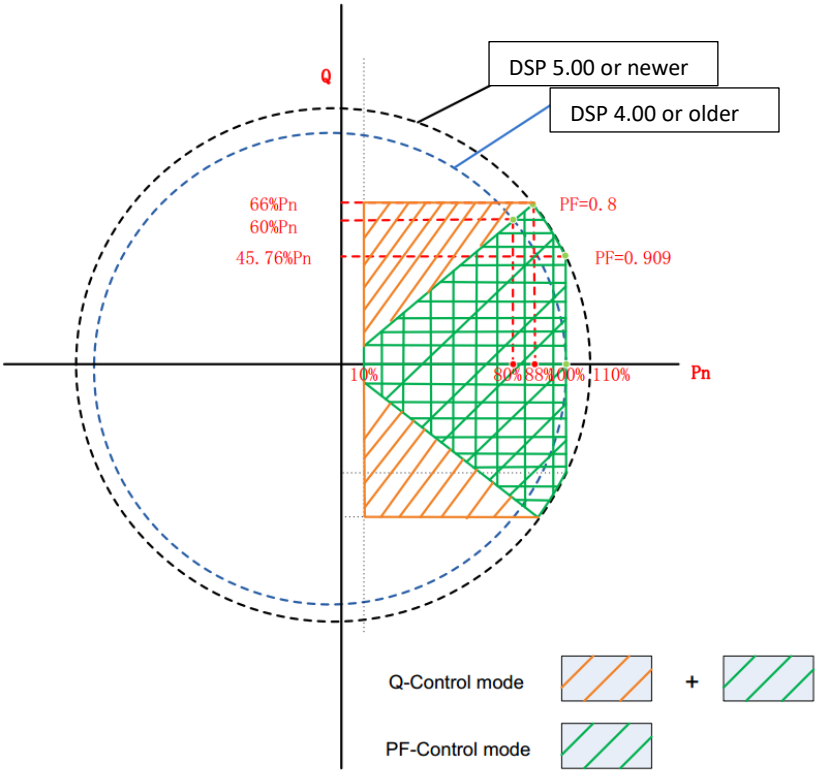


Figure 7.3 - PVI 50/60TL Reactive Power Capability

NOTE 2: When the ambient temperature is higher than 113°F (45°C), the output power may begin derating. For DC voltage as shown in Figure 7.3:

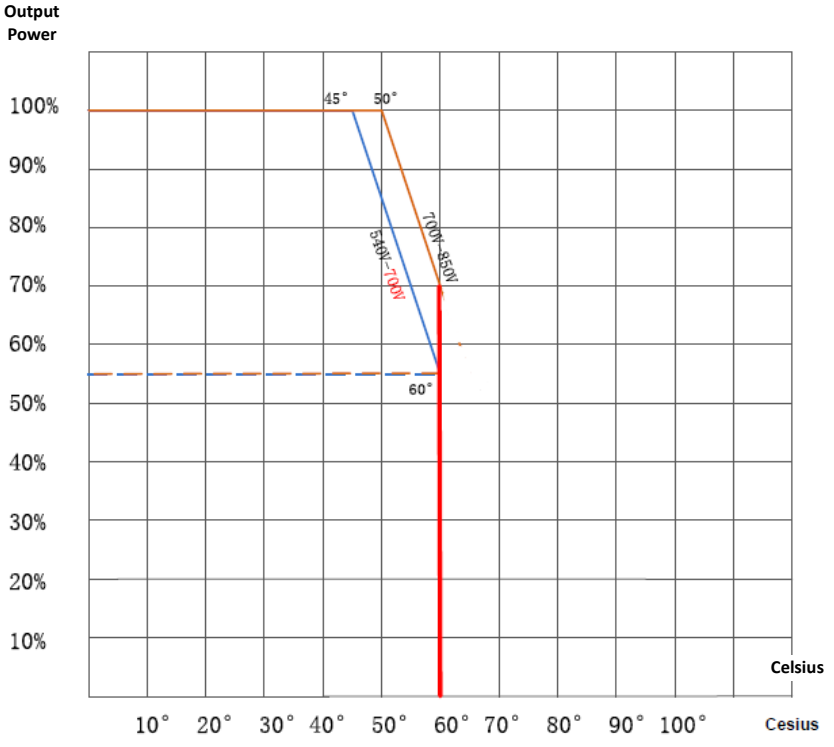


Figure 7.3 - PVI 50/60TL Derating Curve with High Temperature

Note: At 60 degrees C the inverter is likely to shutoff. Depending on various factors like angle of installation, air flow and others, the thermal shutdown may occur at higher temperature like 61-63 degrees C. For designing and modelling purposes one should consider shut down at 60 degrees C.

NOTE 3: When the altitude is higher than 9843ft (3000m), the power of the inverter will start derating, as shown in Figure 7.3:

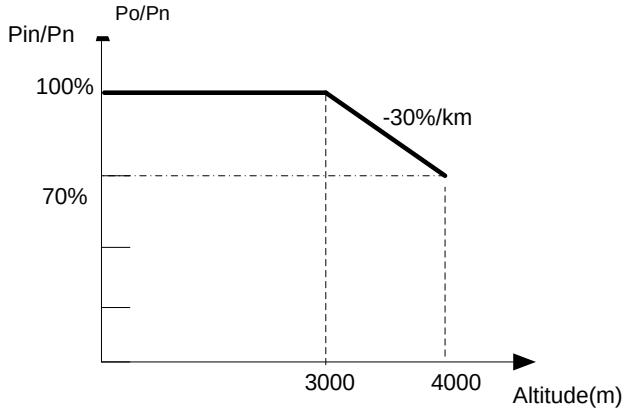


Figure 7.4 - PVI 50/60TL Derating Curve with High Altitude

NOTE 4: The inverter can output the AC power with full loads within 100%~110% of the rated grid voltage. When the grid voltage is lower than rated voltage, the output current will be limited within the allowable maximum current.

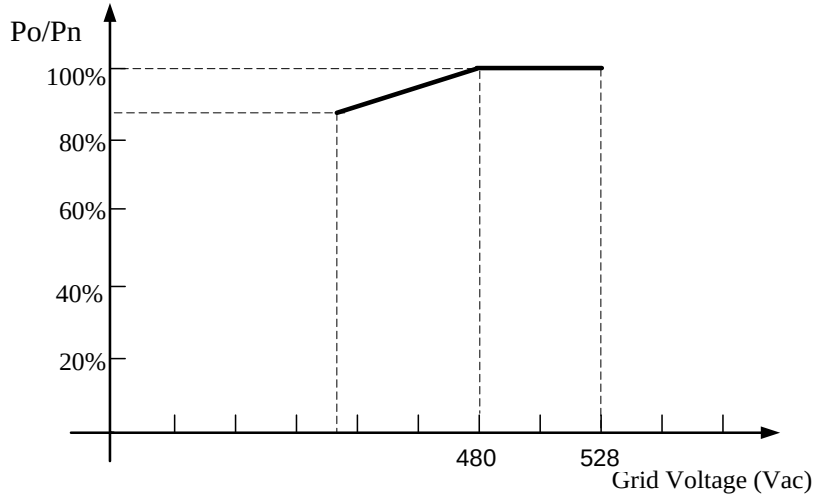


Figure 7.5 - PVI 50/60TL Derating Curve of Grid Voltage

9.0: Accessory Options

The PVI 50/60TL has several orderable options that allow the inverter to support a wide range of real life applications.

9.1 Fuse Bypass

OPT-FUSEBYPASS-PVI-50-60TL allows customers to combine the DC inputs outside of the inverter and enter with only one or two combined inputs. Torque the provided hardware to 16 in-lbs (1.8 N.m). Note that the negative inputs are combined already. The unit is separated on the positive input.

Figure 8.1 – Fuse Bypass Three Inputs (Three Independent MPPTs)

Bypass Input Terminal Instructions:

1. Remove the protection cover.
2. Use a No. 2 Phillips head screwdriver to install the bypass input terminals, 3 sets, torque value of 14 in-lbs (1.6 N.m.).
3. Use a No. 10 wrench to screw DC input cable on the bypass input terminals, torque value of 50 in-lbs (6.0 N.m.).
4. Reinstall the protection cover.

9.2 Shade Cover

OPT-SHADECOVER-PVI-50-60TL is specifically designed for inverters mounted at a 30-degree tilt angle or lower. It protects the inverter from harsh weather and direct sunlight/extremely hot temperatures while reducing thermal gain on the inverter and increasing energy production.

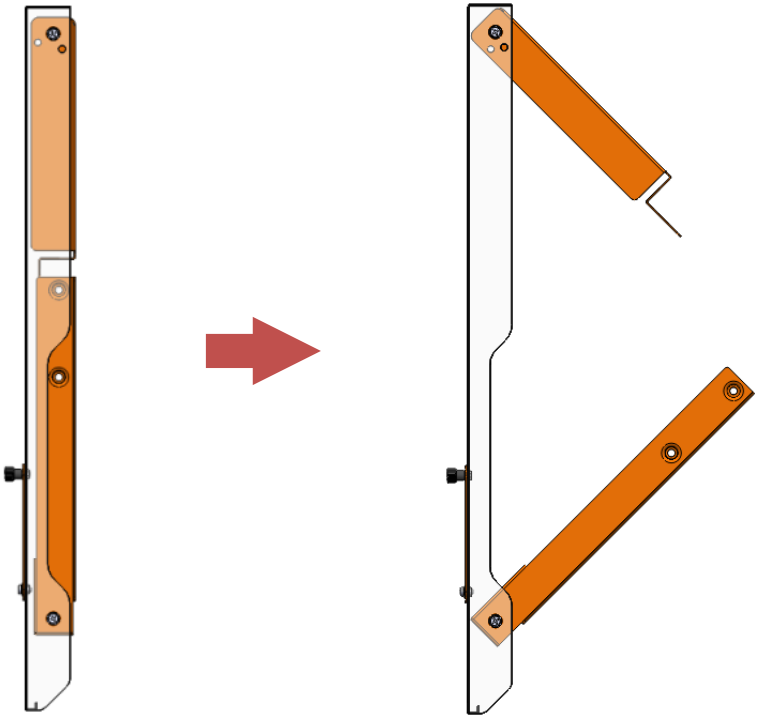


Figure 8.4 – Shade Cover Installation; Steps 1 and 2

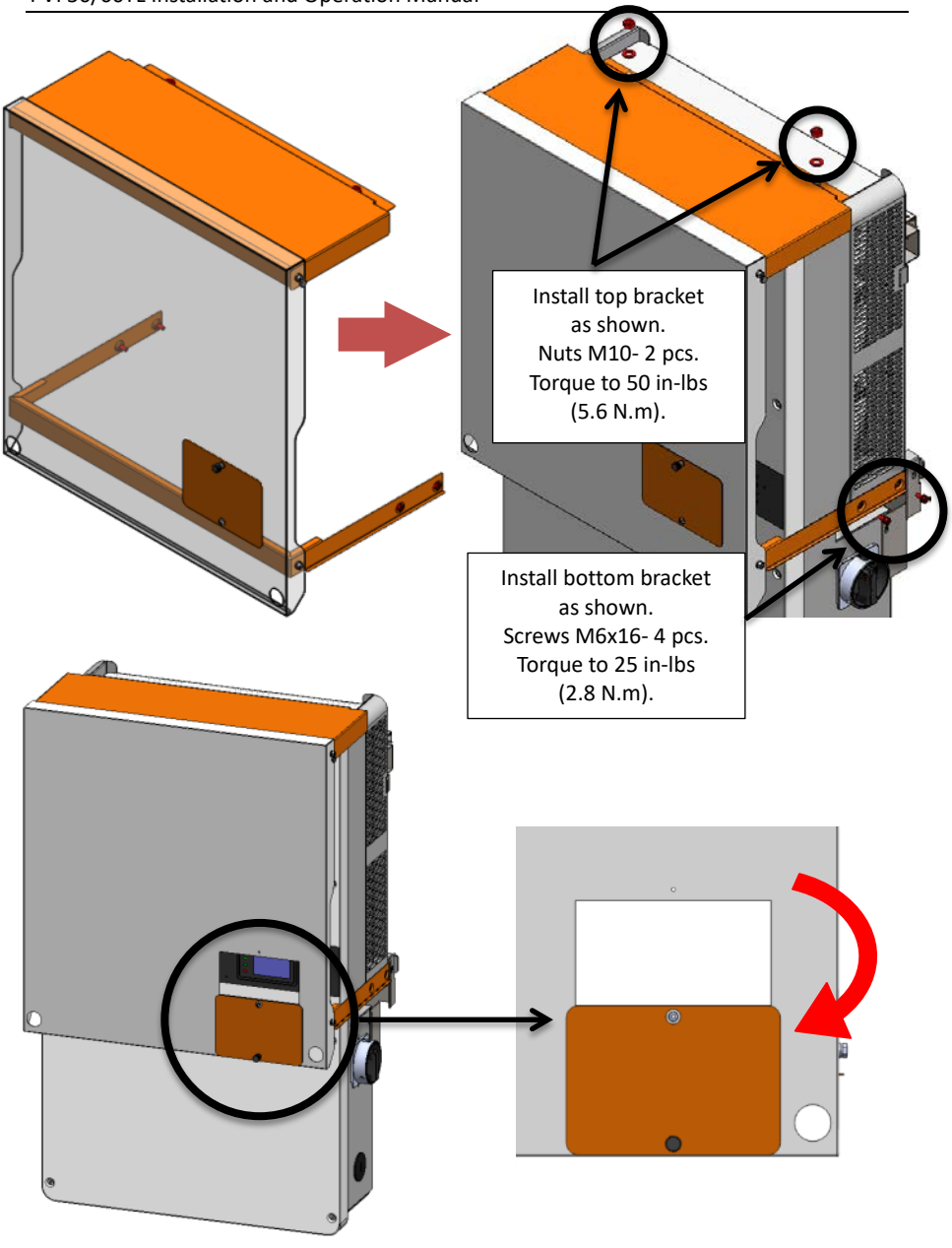


Figure 8.4 –Shade Cover Installation; Steps 3 and 4

Appendix A – PVI 50/60TL Datasheet

https://solectria.com/support/documentation/inverter-datasheets/pvi-50tl-pvi-60tl-transformerless-3-ph-string-inverters-datasheet/

Appendix B – String Sizing Tool

http://solectria.com/support/string-sizing-tool/

Appendix C – Contact Information

Yaskawa Solectria Solar
360 Merrimack Street
Lawrence, Massachusetts 01843
USA

Tel:	978.683.9700
Fax:	978.683.9702
Sales/General Info:	inverters@solectria.com
Technical Support & Service:	978.683.9700 ext.2
Website:	www.solectria.com

Appendix D – Authorized Distributors

http://www.solectria.com/products/how-to-buy/

Appendix E – UL 1741SA/ UL 1699B/ IEEE 1547 / CSA 22.2#107.1

Certificate of Compliance

Certificate:	70145966	**Master Contract:**	259363
Project:	70145966	**Date Issued:**	2017-07-06

Issued to: **Solectria Renewables,LLC**
360 Marrimack St.Bldg 9,
Lawrence,
MA,01843,
USA
Attention: Mr. James Worden

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

C US

Issued by: Kyle Song
Kyle Song

PRODUCTS
CLASS - C531109 - POWER SUPPLIES-Distributed Generation Power Systems Equipment
CLASS - C531189 - POWER SUPPLIES-Distributed Generation-Power Systems Equipment - Certified to U.S. Standards

Transformerless Grid Support Utility Interactive Inverter, PVI 50TL-480 and PVI 60TL-480 permanently connected.

Note:

For details related to rating, size, configuration, etc., reference should be made to the CSA Certification Record, Certificate of Compliance Annex A, or the Descriptive Report.

DQD 507 Rev. 2016-02-18 Page 1