

CP-250E-60/72-208/240-MC4

Microinverter with Modular Trunk Cable



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CP-250E MICROINVERTER SYSTEM

The CP-250E-60/72-MC4 microinverter has been designed ground up for industry leading efficiency (96.6% peak, and 96.09% CEC) and reliability. The devices contain no electrolytic capacitors and no opto-isolators. The chassis uses an aluminum extrusion process optimized for high volume manufacturing and is rated to NEMA-6. This rating allows environmental extremes beyond those found beneath solar panels where the inverters are installed. The microinverters meet stringent radiated emission standards to CISPR-22/EN55022 Class B which has 2X lower levels than FCC Part 15 B at various frequencies and complies with worldwide unintended radiation requirements to eliminate interference with other devices. The inverter has also been designed and tested to withstand 6kVolt line to line, line to ground, and neutral to ground surge. In addition overcurrent protection sampling at 30kHz ensures grid anomalies that cannot be compensated in the AC drive result in a clearing state to protect the output stage.

The Chilicon Power communication stack employs advanced forward error correction and encryption. The system also implements a multi-rate physical layer that automatically adjusts throughput to maintain link reliability. Fail-safe firmware upgradability allows future compatibility with emerging utility interactive requirements such as reactive power control.

In summary the designers at Chilicon Power have made the highest effort to put forward a world class energy conversion device for your use. Please consult this installation manual for further details and send requests or inquiries to support@chiliconpower.com.

Please find more information in the download and video sections of www.chiliconpower.com -> Resources.

Chilicon Power microinverters are designed to be installed with the Chilicon Power CP-100 gateway. This is the industry's most power and fully featured monitoring solution that provides time-savings in commissioning of the system as well as convenience of day to day use for end customers. More information can be found www.chiliconpower.com/products/gateway.

THE CP-100 CORTEX GATEWAY



IMPORTANT SAFETY INFORMATION

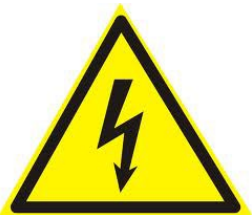
This manual contains important instructions to follow during installation and maintenance of the Chilicon Power CP-250 microinverter. To reduce the risk of electrical shock and ensure the safe installation and operation of microinverters, the following symbols appear throughout this document to indicate dangerous conditions and important safety instructions.

SAVE THESE INSTRUCTIONS – This manual contains important instructions for model CP-250E-60/72-208/240-MC4 that shall be followed during installation and maintenance of the microinverter.



WARNING: This indicates a situation where failure to follow instructions may cause a serious hardware failure or personnel danger if not applied appropriately. Use extreme caution when performing this task. The CP-250E microinverter implements an integrated GFDI device that satisfies Article 690 of the National Electrical Code for ground fault detection. The integrated ground fault detector requires that the inverter be properly earth grounded using the integrated trunk cable grounding wire. If an inverter is in ground fault, this state is indicated by the CP-100 gateway device. An inverter in ground fault cannot export power unless the ground fault detection is specifically bypassed by the installer using a message that is broadcast to the inverter from the gateway. Chilicon does not recommend bypassing ground fault power export lock out. However, if this lock out is disabled, the inverter will export power while continuing to indicate ground fault to the gateway.

Note: There is no galvanic path from the DC to AC connections in the device, or from DC connectors to the enclosure, or AC connectors to the enclosure. The rated hi-pot on any of these paths is 2500Vrms.



CAUTION: Risk of electrical shock. Do not remove endplates from device. No user serviceable parts are inside the inverter. When the photovoltaic array is exposed to light it supplies a DC voltage to this equipment

WARNING: Electric Shock Hazard. The DC Conductors of this photovoltaic system are ungrounded and may be energized.

WARNING: Perform all electrical installations in accordance with local electrical codes and with National Electrical Code, ANSI/NFPA 70, including Sec. 690.35 with an ungrounded PV array.

WARNING: The maximum open circuit voltage of the PV module must not exceed the specified maximum input voltage of the microinverter (for CP-250E-60/72-208/240-MC4 this is **60 Volts**).

WARNING: Verify the voltage and current specifications of your PV module match with those of the microinverter. All poly and mono-crystalline silicon 60 and 72-cell panels should be compatible. **Do Not** connect silicon silicon 96-cell, amorphous, thin-film panels, or other panel types to CP-250E-60/72-xx microinverters. Connecting any device whose supply exceeds 60VDC will cause a shutdown of the inverter. Though the device may continue to operate when returned to normal voltage, *the event will be recorded in flash memory and will void the warranty.*

WARNING: Be aware that the body of the Chilicon Power Microinverter is the heat sink, and although it usually rises less than 20°C above ambient, it can reach a temperature of 80°C. To reduce risk of burns, do not touch the body of the microinverter.

WARNING: Do NOT attempt to repair the Chilicon Power Microinverter. If it fails, contact customer support to obtain an RMA number and start the replacement process. Damaging or opening the Chilicon Power Microinverter will void the warranty.

WARNING: Be aware that only qualified professionals should install and/or replace Chilicon Power microinverters.

WARNING: Before installing or using a Chilicon Power Microinverter, please read all instructions and warnings in the technical documents and on the Chilicon Power Microinverter system itself as well as on the PV array.

WARNING: Be aware that installation of this equipment includes the risk of electric shock.

WARNING: Do not touch any live parts in the system, including the PV array, after the system has been connected to the electrical grid.

WARNING: Do NOT connect microinverters to the utility grid or energize the AC circuit until you have completed all of the installation procedures as described in the following sections.

WARNING: Do NOT remove AC or DC connectors to the invert under load. Doing so will not damage the inverter, but the connectors are not rated for removal under load.

WARNING: Do NOT exceed the maximum number of microinverters in an AC branch circuit, as displayed on the unit label (20 devices for 240V connections or 18 devices for 208V connections).

INVERTER LABEL INFORMATION



Chilicon Power
 CP-250E-60/72-208/240-MC4
 Designed in California
 Manufactured in California
 Enclosure NEMA-5
 Max. Ambient Op. Temp: 65C
 FCC Part 15 Class B
 Conforms to UL 1741, IEEE 1547
 & CSA TLL 1.35 UL
 1741SA / CPC: Rule-21

Grid Support Interactive Inverter
 Utility Interactive Inverter
 Input Operating Voltage (Vmp): 29V - 41V
 Max DC Input Current: 12A
 Rated Output Power: 250W
 Max. Cont. Output Current: 1.20A (240V)
 AC Output Voltage (min/nom/max): 211V 240V 264V
 Max. Cont. Output Current: 1.36A (208V)
 AC Output Voltage (min/nom/max): 193V 208V 229V
 Operating Freq. Hz (min/nom/max): 59.3 60 60.5
 Output Power Factor: -0.8 to 0.5 (1.0 Default)
 Max Units Per Branch: 18 (208V) / 20 (240V)



CAUTION: Risk of electric shock.
 The DC Conductors of this photovoltaic system are ungrounded and may be energized.
 Do not remove endplates, no user serviceable parts inside.
 When the photovoltaic array is exposed to light it supplies a DC voltage to this equipment.
 Input/Output galvanically isolated from chassis.

ATTENTION: Risque de choc électrique.
 Ne pas dévisser le boîtier.
 Aucune pièce réparable par l'utilisateur.
 Lorsque le panneau solaire est exposé à la lumière, il fournit une tension continue à cet équipement.
 Entrée/Sortie galvaniquement isolées du châssis.

U.S. Patent No. 8,780,592 and CIPs

Serial No
 115008C3



INSTALLATION OVERVIEW

A PV system using Chilicon Power microinverters is simple to install. Each microinverter mounts on the PV racking, directly beneath each PV module. Low voltage DC wires connect from the PV module directly to the microinverter, eliminating the risk of high DC voltage.

INSTALLATION KITS FOR CHILICON POWER MICROINVERTER SYSTEMS INCLUDE:

- AC interconnect modular trunk cable with self-terminating feature
- CP-100 Gateway Monitoring Device

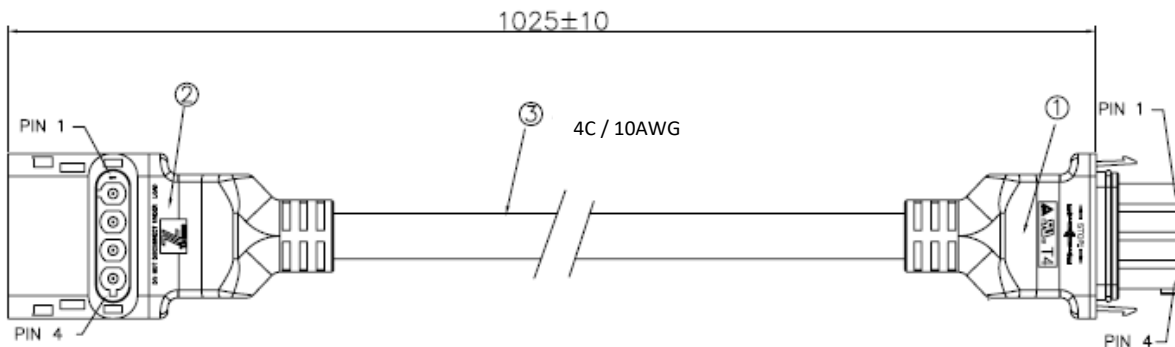
REQUIRED NON-CHILICON PARTS

In addition to your PV array and its associated hardware, you need to provide the following:

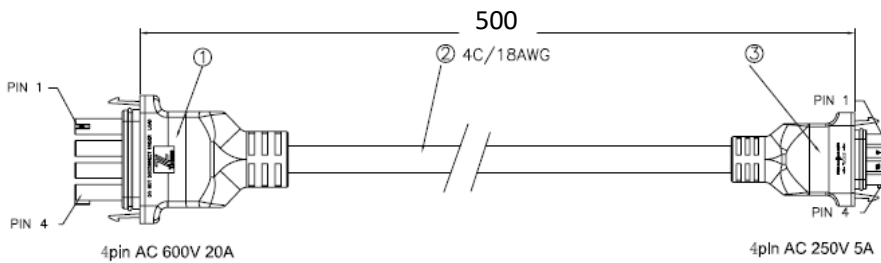
- An AC connection junction box
- Mounting hardware suitable for module racking
- Sockets and wrenches for mounting hardware

MODULAR TRUNK CABLING

Trunk Cable Segment, portrait shown, 1.7M landscape also available



Branch Cable Segment, 0.5M



Color Codes

PIN 1	G: Wire Colour Green
PIN 2	L1: Wire Colour Black
PIN 3	N: Wire Colour White
PIN 4	L2: Wire Colour Red

INSTALLATION INSTRUCTIONS

STEP1: DC CONNECTION

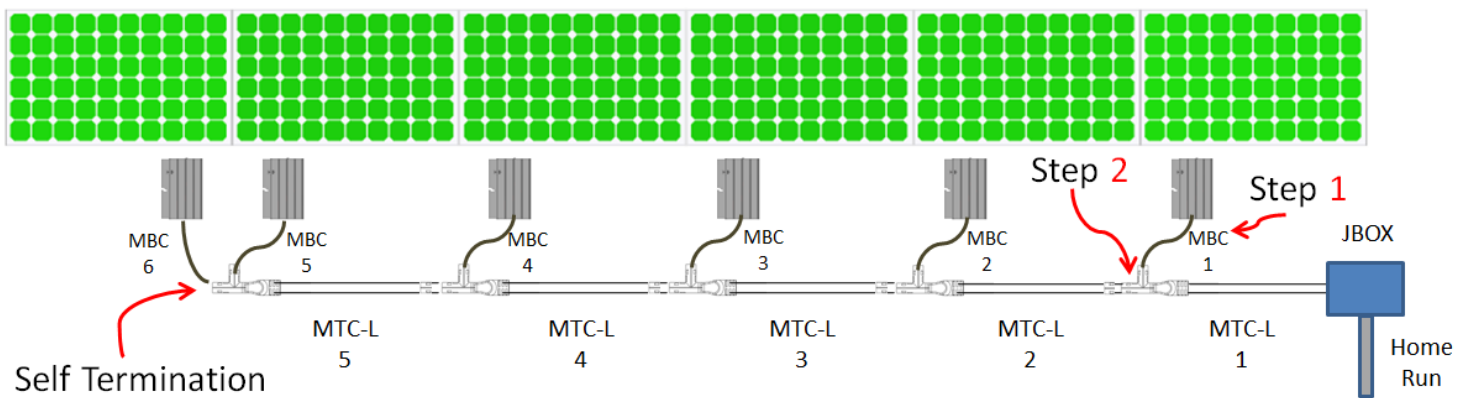


IMPORTANT: ALWAYS CONNECT DC FIRST. DO NOT ENERGIZE AC BUS TO INVERTERS UNTIL ALL INVERTERS HAVE BEEN DC POWERED WITH ENOUGH SUN LIGHT (LED code continuously blinking)

STEP2: AC CONNECTOR – INSTALLATION PROCEDURE

IMPORTANT: all MCB connections must be placed with care not to miss-align. All connectors are keyed to ensure properly polarity.

- 1) Place the modular branch connector (MBC) on the inverter FIRST. This will make it easier to align the small pins on the inverter with the connector. They self-align and are keyed.
- 2) Join the larger connector of the MBC to the T-Junction of the modular trunk cable (MTC).



LED CODES

AFTER DC is applied:

Blink Sequence	Meaning
Slow, 1 blink every 4 seconds	DC Connected, NOT Ready for AC to be applied
Continuous Blinking	DC Connected, Ready for AC to be applied (see step 1 warning)

AFTER AC is applied:

Blink Sequence	Meaning
1 blink every 16 seconds	Normal operation, inverter bound to gateway
1 blink every 8 seconds	Normal operation, inverter not bound to gateway
2 blinks every 4 seconds	Inverter phase locked to Grid, no export, no errors
4 blinks every 4 seconds	Error: Grid Voltage out of range
5 blinks every 4 seconds	Error: Panel Voltage out of range

WIRING FOR COMMUNICATION TO THE GATEWAY (240 V SPLIT-PHASE SYSTEMS)

Chilicon Power trunk cables have 4 color-coded conductors: **RED**, **BLACK**, **WHITE**, **GREEN**

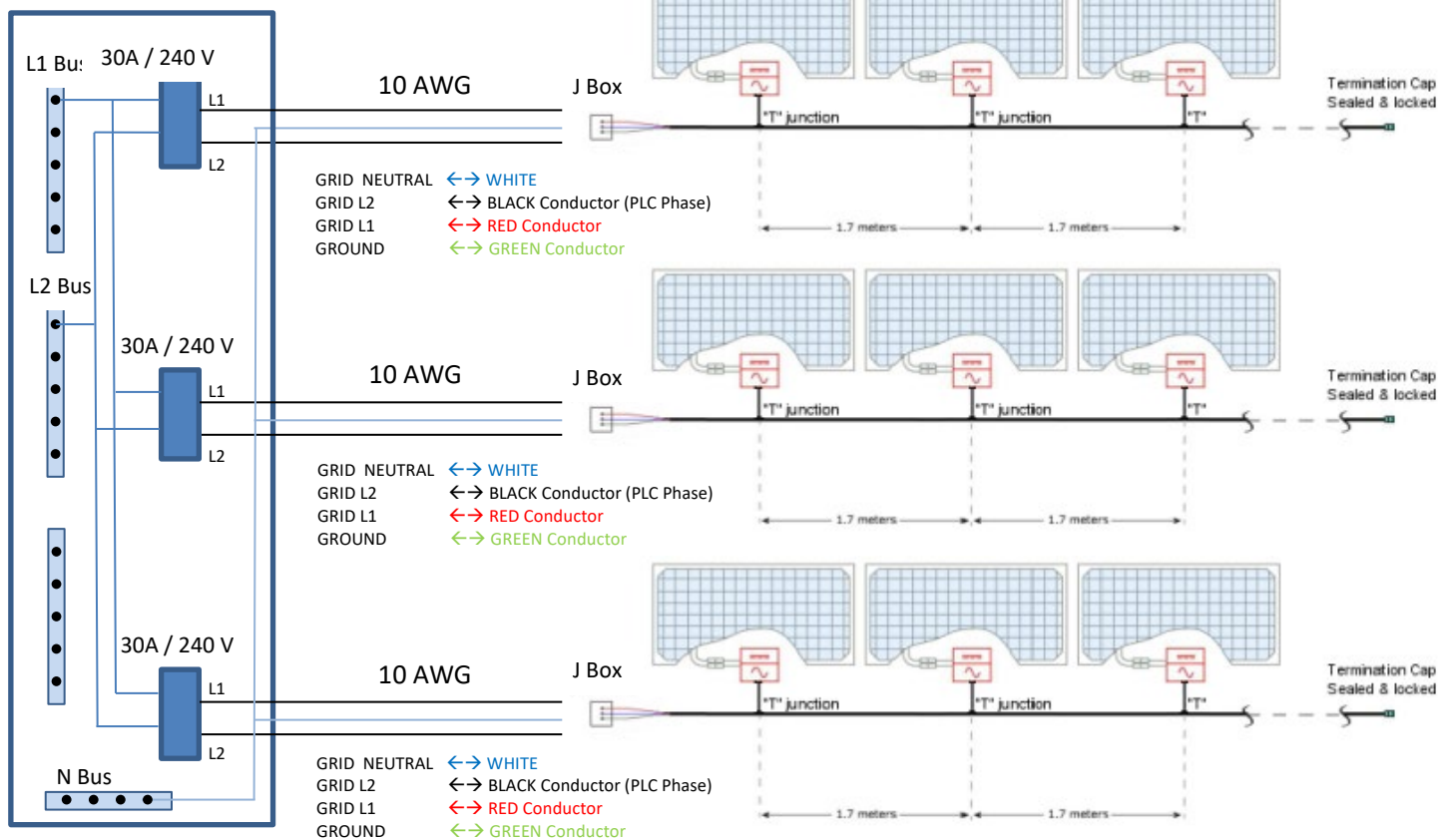
BLACK and **WHITE** conductors are for the PLC communication. The same grid line (**BLACK**) must be used to connect the inverter to the Gateway to ensure robust communication. Specifically, the Gateway inside the home (120 V) should be powered using **GRID HOT LINE B** (= **BLACK** trunk conductor) and **GRID NEUTRAL** (= **WHITE** trunk conductor).

NOTE: Communication with the Gateway is usually fine even if the Gateway is connected in the wall socket to the **RED** and **WHITE** trunk-equivalent wires. However, the signal will be weaker. The Gateway socket survey screen (Menu->Advanced Settings) indicates the strength of the signal. In the worst case, you simply have to swap the **RED** and **BLACK** trunk wires on the breaker or at the AC disconnect.

NOTE: Miss-wiring AC grid lines to the inverter trunk (for instance swapping a GRID L1 for GRID NEUTRAL) will not damage the inverters. However, they will not export power in this configuration. If inverters are miss-wired, LED single blink export confirmation from the LED will never be established.

WARNING: NEVER CONNECT **GREEN** to a Live Wire

Solar AC Subpanel



THREE PHASE 208 VOLT WIRING

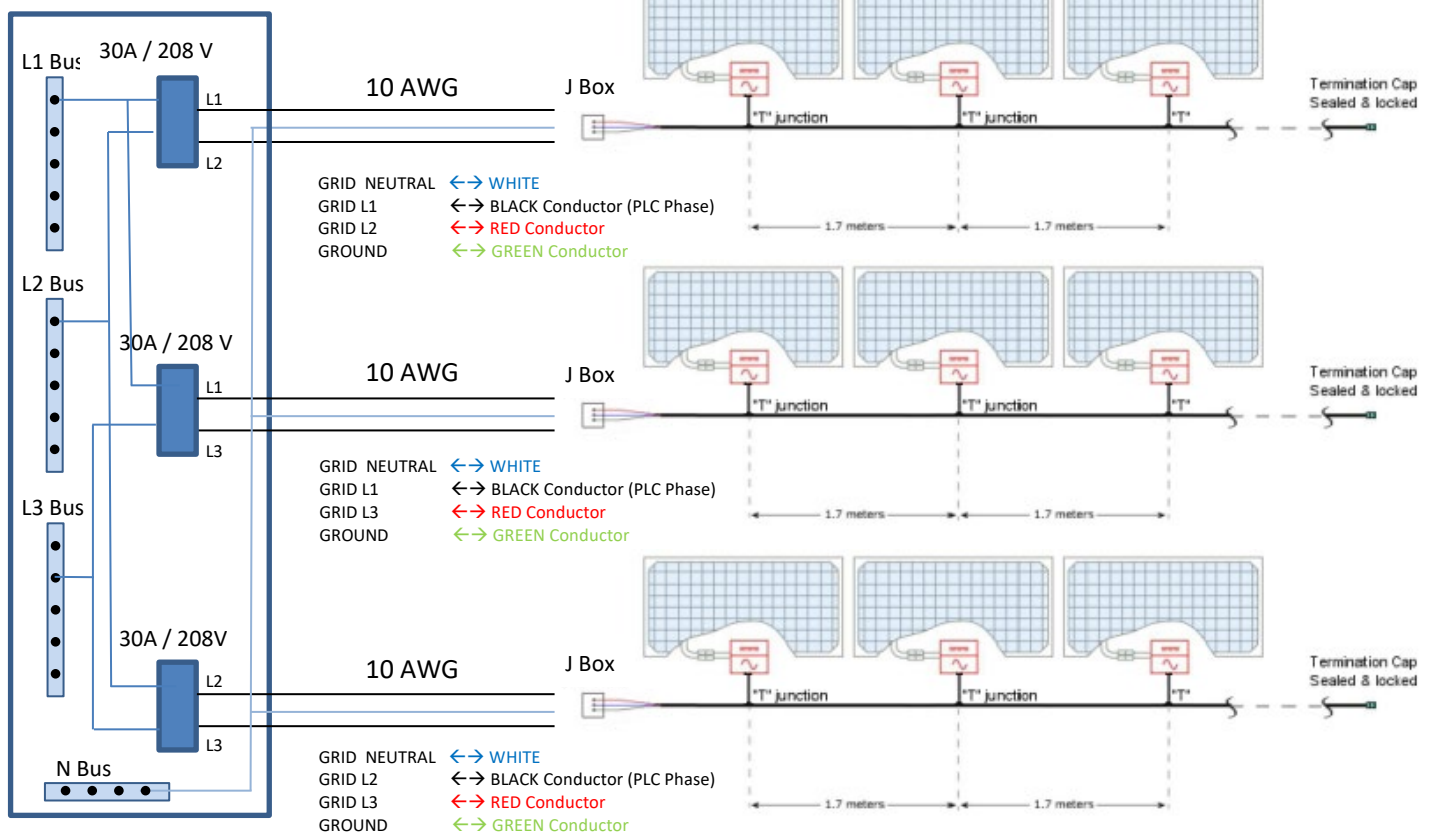
The maximum number of inverters per 208-V split-phase string is 13. There are three power conductors in a split phase installation. Strings should be staggered across these 3 conductors, with a third conductor (neutral) to reference the mid-voltage of any 2 of the 3 power conductors. Chilicon Power trunk cables have 3 color coded conductors, these are: **RED**, **BLACK**, **WHITE**. The CP-250 microinverter system uses the **BLACK** and **WHITE** conductors for communication. The inverters automatically detect when they are connected to a 3-phase grid and the user does not need to provide any additional configuration control.

The Chilicon Power 3-phase gateway option accepts three lines, neutral, and ground. In a 3 phase installation, strings should be configured to connect {L1,L2,N} to {**Black,Red, WHITE** }; {L3,L1,N} to {**Black,Red, WHITE** }; and {L2,L3,N} to {**Black,Red, WHITE** } as shown in the figure below.

NOTE: Miss-wiring AC grid lines to the inverter trunk (for instance swapping a GRID L1 for GRID NEUTRAL) will not damage the inverters. However, they cannot export power in this configuration. If inverters are miss-wired, single blink export confirmation from the LED will not be established.

WARNING: NEVER CONNECT **GREEN** to a Live Wire

Solar AC Subpanel



CABLE MAXIMUMS AND OCPD REQUIREMENTS

The maximum size current protection device allowed by NEC code for use with 10AWG wire in the trunk cable is 30A. Such an OCPD is required for every string of microinverters. This leads to the following calculations for the maximum number of allowed inverters per trunk cable.

- A. Maximum number of inverters on a 30 amp, 240V circuit:

$$289W \text{ output mode: } (30A / (1.2 * 1.25)) = 20$$

- B. Maximum number of inverters on a 30 amp, 208V circuit:

$$277W \text{ output mode: } (30A / (1.33 * 1.25)) = 18$$

POLLUTION DEGREE AND VOLTAGE CATEGORY

We note that the CP-250E microinverter is characterized by:

Pollution Degree	Pollution Degree 1 (NEMA 6 Sealed Enclosure)
Over Voltage Category	Overvoltage category III

GRID SUPPORTIVE MODES OF OPERATION

The CP-250E microinverter provides the following list of grid supportive features with the given stated accuracies

Manufacturer's Stated Accuracy

Description	Value
Manufacturer's stated AC voltage accuracy (%Vac)	2%
Manufacturer's stated DC voltage accuracy (%Vdc)	2%
Manufacturer's stated AC current accuracy (%Aac)	2%
Manufacturer's stated frequency measurement accuracy (Hz or %Hz)	0.02Hz
Manufacturer's stated output power accuracy (W or %W)	5W
Manufacturer's stated reactive power accuracy (% or Var)	50Var
Manufacturer's stated power factor accuracy	0.02
Manufacturer's stated time accuracy (sec)	0.3sec

The following UL1741SA Grid Supportive features are provided by the CP250E microinverter. For specific parameter ranges associated with the features in the table below, please refer to <https://www.chiliconpower.com/support-materials#UL-Test-Summaries> (in specific verification of conformity).

Grid Support Function Tested	Source Requirement Document(s)	Test Standard(s) and Section(s)
LOW/HIGH VOLTAGE RIDE-THROUGH	Electric Rule No. 21 Table Hh.1	UL 1741 SA 9
LOW/HIGH FREQUENCY RIDE-THROUGH	Electric Rule No. 21 Table Hh.2	UL 1741 SA10
DYNAMIC VOLT/VAR OPERATIONS	Electric Rule No. 21 Hh.2J	UL 1741 SA 13
RAMP RATES	Electric Rule No. 21 Hh.2k	UL 1741 SA 11
RECONNECT BY "SOFT START"	Electric Rule No. 21 Hh.2k	UL 1741 SA 11
ANTI-ISLANDING PROTECTION - WITH GRID SUPPORT FUNCTIONS ENABLED	Electric Rule No. 21 Hh.1a	UL 1741 SA 8
SPECIFIED POWER FACTOR	Electric Rule No. 21 Hh.2i	UL 1741 SA 12
Frequency-Watt	Electric Rule No. 21 Hh.2l	UL 1741 SA 14
Volt-Watt	Electric Rule No. 21 Hh.2m	UL 1741 SA 15
DISABLE PERMIT SERVICE (EUT Disconnect and Reconnect Command)	Electric Rule No. 21 Hh.8	UL 1741 SA 17
LIMIT ACTIVE POWER (Limit Maximum Active Power Mode)	Electric Rule No. 21 Hh.8	UL 1741 SA 18