CP-250-60-208/240-MC4
User Manual
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IMPORTANT SAFETY INSTRUCTIONS

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-250-60-208/240-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. This unit is not provided with a GFDI device. This inverter or charge controller must be used with an external GFDI device as required by the Article 690 of the National Electrical Code for the installation location.

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: The maximum open circuit voltage of the PV module must not exceed the specified maximum input voltage of the microinverter (for CP-250-60-208/240-MC4 this is 40 Volt).

WARNING: Verify the voltage and current specifications of your PV module match with those of the microinverter. All poly and mono-crystalline silicon 60-cell panels should be compatible. Do Not connect silicon 72-cell, silicon 96-cell, amorphous, thin-film panels, or other panel types to CP-250-60-xx microinverters. Connecting any device whose supply exceeds 40VDC 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.

SAFETY INSTRUCTIONS

- Only qualified professionals should install and/or replace Chilicon Power Microinverters.
- Perform all electrical installations in accordance with local electrical codes.
- Before installing or using the Chilicon Power Microinverter, please read all instructions and cautionary markings in the technical documents and on the Chilicon Power Microinverter system and the PV-array.
- Be aware that the body of the Chilicon Power Microinverter is the heat sink and can reach a temperature of 80°C. To reduce risk of burns, do not touch the body of the microinverter.
- 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.
CP-250 MICROINVERTER SYSTEM INTRODUCTION

The CP-250-60-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-4X. This rating allows environmental extremes beyond those found beneath solar panels where the inverters are installed. The microinverters meet stringent radiant 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.

INVERTER LABEL INFORMATION

CP-250 MICROINVERTER SYSTEM INSTALLATION

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. Unlike other microinverter systems, there is no requirement, for the sake of reliability of the inverter, to connect DC or AC first. Neither is there a requirement to disconnect AC before DC.

Normal safety procedure, however, is to make all wire connections prior to energizing the AC trunk cable.

WARNING: Perform all electrical installations in accordance with local electrical codes and with National Electrical Code, ANSI/NFPA 70.

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.
INSTALLATION KITS FOR CHILICON POWER MICROINVERTER SYSTEMS INCLUDE:

- AC interconnect trunk and branch cable
- Branch connector protective end caps
- Silicone trunk cap and self-bonding silicone tape

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
- Continuous grounding conductor and grounding washers

TRUNK CABLING

PORTRAIT MODE TRUNK CABLE – 1.025 METER SEPARATION

LANDSCAPE MODE TRUNK CABLE – 1.7 METER SEPARATION
The maximum size current protection device allowed by NEC code for use with 12AWG wire in the trunk cable is 20A. This leads to the following calculations for the maximum number of allowed inverters per trunk cable.

A. Maximum number of inverters on a 20 amp, 240V circuit:

\[
\frac{20A}{(1.04*1.25)} = 15
\]

B. Maximum number of inverters on a 20 amp, 208V circuit:

\[
\frac{20A}{(1.20*1.25)} = 13
\]

TRUNK CABLE LENGTHS

A. Portrait Mode Installations
   In portrait mode installations, the maximum supplied trunk cable length (15 taps) is 15.5m = 51’.

B. Landscape Mode Installations
   In landscape format installations, the maximum supplied trunk cable length (15 taps) is 25.5m = 84’

INSTALLATION ELECTRICAL INFORMATION

SPLIT PHASE 240 VOLT WIRING

The maximum number of inverters per 240-V split-phase string is 15. There are only two high power conductors in a split phase installation. All strings will be installed across these 2 conductors, with a third conductor is used to reference the mid-voltage of the two split phase conductors. Chilicon Power trunk cables have 3 color coded conductors, these are: RED, BLACK, BLUE. The CP-250 microinverter system uses the BLACK and BLUE conductors for communication. The grid line that connects to the trunk (BLACK) communication phase at the inverters must be matched to the grid line used to power the gateway to ensure robust communication. Specifically, the gateway should be powered by 120V using GRID HOT LINE B (defined by it connection to TRUNK BLACK) and GRID NEUTRAL.
NOTE: Miss-wiring AC grid lines to the inverter trunk (for instance swapping 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.
THREE PHASE 208 VOLT WIRING

The maximum number of inverters per 208-V split-phase string is 13. There are three high 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, BLUE. The CP-250 microinverter system uses the BLACK and BLUE 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 gateway accepts three lines, neutral, and ground. In a 3 phase installation, strings should be configured to connect {L1,L2,N} to {BLACK,RED,BLUE}; {L3,L1,N} to {BLACK,RED,BLUE}; and {L2,L3,N} to {BLACK,RED,BLUE} as shown in the figure below. For optimal communication, it is important that the black trunk conductor be connected to either L1, L3, or L2, as described above and shown in the figure below. This will serve to best balance the load on the PLC communication.

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.
Installing the microinverter system involves eight steps:

1. Attach the microinverters to the racking.
2. Connect the microinverters to the PV modules. Positive terminal of panel goes to negative terminal of inverter; negative terminal of panel goes to positive terminal of inverter. (It should be impossible to miswire these since the connectors are distinctly polarized). The reason for this is that the PV industry defines MC4 connectors in terms of the PV panel output. Therefore, to mate the positive connector leaving the PV panel, a negative connector must be used on the inverter. To mate the negative connector leaving the PV panel, a positive connector must be used on the inverter.
3. Connect the microinverter AC branch cables to each inverter and dress the trunk cable with cable ties or hangers to the racking rail.
4. Install weather-proof branch caps on any unused branch connectors to seal them.
5. Provide equipment ground to each inverter with a continuous 6 or 8 AWG copper bonding wire attached to the inverter grounding lug. 10ft-lb of torque should be used on the ground lug clamping screw.
6. Install the AC branch circuit junction box.
7. Seal the opposite end of the trunk cable with the silicone cap and self-bonding silicone tape from the cable termination kit.
8. Complete the micro inverter installation map.

**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 (17 devices). Each microinverter AC branch must be a dedicated branch circuit protected by a 20A maximum breaker.

The Installation Map is a diagram of the physical location of each microinverter in your PV installation. You can use the blank map in the appendix to record microinverter placement for your system. When your map is complete and after units are bound to the gateway device, login to the Chilicon Power website to coordinate the installation map as described below.

To complete your map:

a. Each microinverter has a serial number located on the microinverter label. These serial numbers are enumerated so that only the first few digits should change within any given installation, however, the length of the serial number is 8 digits, so this is the worst case in terms of required transcription per inverter. Transcribe the required unique digits of each label onto a grid that represents the relative location of that particular inverter.

b. After discovery is run by the gateway device, a full list of inverters will be provided on the Chilicon website. Drag items from this list to match the transcribed map made in the field. Instructions for this procedure are supplied on the website. After the map is populated, it will be pushed down to the customer premises gateway (for customer sites that include a gateway with LCD installed).

**CP-250 LIGHT EMMITTING DIODE CODES**

To operate the microinverter PV system:

1. Turn ON the AC circuit breaker on each microinverter AC branch circuit.
2. Turn ON the main utility grid AC circuit breaker. Your system will start producing power in no longer than 15 minutes.

LED Status Indicators:

<table>
<thead>
<tr>
<th>Blink Sequence</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 blink every 16 seconds</td>
<td>Normal operation, inverter bound to gateway</td>
</tr>
<tr>
<td>1 blink every 8 seconds</td>
<td>Normal operation, inverter not bound to gateway</td>
</tr>
<tr>
<td>2 blinks every 4 seconds</td>
<td>Grid phase locked, no export, no errors</td>
</tr>
<tr>
<td>3 blinks every 4 seconds</td>
<td>Grid THD out of range</td>
</tr>
<tr>
<td>4 blinks every 4 seconds</td>
<td>Grid Voltage out of range</td>
</tr>
<tr>
<td>5 blinks every 4 seconds</td>
<td>Panel Voltage out of range</td>
</tr>
<tr>
<td>1 blinks every 1 second</td>
<td>Firmware upgrade in progress</td>
</tr>
<tr>
<td>6 blinks every 2 seconds</td>
<td>Other error (appears as continuous blinking)</td>
</tr>
</tbody>
</table>

**WARNING**: Be aware that only qualified professionals should troubleshoot the microinverter.

**WARNING**: Do not attempt to repair the microinverter. If troubleshooting methods fail, please return the microinverter to your distributor for replacement.

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**CP-250-60-208/240-MC4 Microinverter Specifications**

### INPUT DATA (DC)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended input power (STC)</td>
<td>190 - 300 W</td>
</tr>
<tr>
<td>Maximum DC input voltage</td>
<td>44 V</td>
</tr>
<tr>
<td>MPPT voltage range</td>
<td>22 – 38.5 V</td>
</tr>
<tr>
<td>Operating range</td>
<td>18 – 38.5 V</td>
</tr>
<tr>
<td>Min./Max. start voltage</td>
<td>22 – 40 V</td>
</tr>
<tr>
<td>Max. DC input short circuit current</td>
<td>21 A</td>
</tr>
<tr>
<td>Max. DC input current</td>
<td>12 A</td>
</tr>
<tr>
<td>Ground fault protection</td>
<td>Transformer isolated 2000 Vrms input/output/chassis</td>
</tr>
</tbody>
</table>

### OUTPUT DATA (AC)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>@ 208 V</th>
<th>@ 240 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak sustainable output power</td>
<td>250 W</td>
<td>250 W</td>
</tr>
<tr>
<td>Rated output power</td>
<td>220 W</td>
<td>220 W</td>
</tr>
<tr>
<td>Max. continuous output current</td>
<td>1.20 A (250 W @ 208 V)</td>
<td>1.04 A (250 W @ 240 V)</td>
</tr>
<tr>
<td>Nominal output voltage / range</td>
<td>208 / 183 – 229 V</td>
<td>240 / 211 – 264 V</td>
</tr>
</tbody>
</table>
## Extended output voltage range

|                | 133 / 150 / 166 – 250 V | 153 / 173 / 192 – 288 V |

## Nominal frequency / range

|                | 60.0 / 59.3 – 60.5 Hz | 60.0 / 59.3 – 60.5 Hz |

## Extended frequency range

|                | 54.22 – 66.75 Hz     | 54.22 – 66.75 Hz     |

## Power factor

|                | > 0.95               | > 0.95               |

## Maximum units per 20 A branch circuit

|                | 13                   | 15                   |

## Maximum output fault current & duration

|                | 1.6 A peak for > 10% of any cycle | 1.6 A peak for > 10% of any cycle |

## Maximum output overcurrent protection

|                | 6.3 A                 | 6.3 A                 |

## EFFICIENCY

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CEC weighted efficiency</td>
<td>96.09 %</td>
<td></td>
</tr>
<tr>
<td>Peak inverter efficiency</td>
<td>96.6 %</td>
<td></td>
</tr>
<tr>
<td>Static MPPT efficiency (EN 50530)</td>
<td>99.5 % - 99.8 %</td>
<td></td>
</tr>
<tr>
<td>Night time power consumption</td>
<td>40 mW @ 208V, 80 mW @ 240 V</td>
<td></td>
</tr>
</tbody>
</table>

## MECHANICAL DATA

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature range</td>
<td>-40°C to +65°C</td>
<td></td>
</tr>
<tr>
<td>Dimension (W x H x D) including connectors</td>
<td>12” x 8” x 1.8”</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>1.55 kg (3.4 lbs)</td>
<td></td>
</tr>
<tr>
<td>Enclosure rating</td>
<td>NEMA 4X</td>
<td></td>
</tr>
</tbody>
</table>

## FEATURES

|                                |                        |                        |
| Communication                  | Power line (130.2 kHz carrier) |                        |
| Monitoring                     | Free monitoring via gateway or online software |                        |
| Compliance                     | UL1741, IEEE std 1547, IEEE std C62.41.2, CSA C22.2 NO. 107.1 & CISPR 22 Class B |                        |
| Compatibility                  | 60-cell PV modules compliant with input voltage operating range specification |                        |