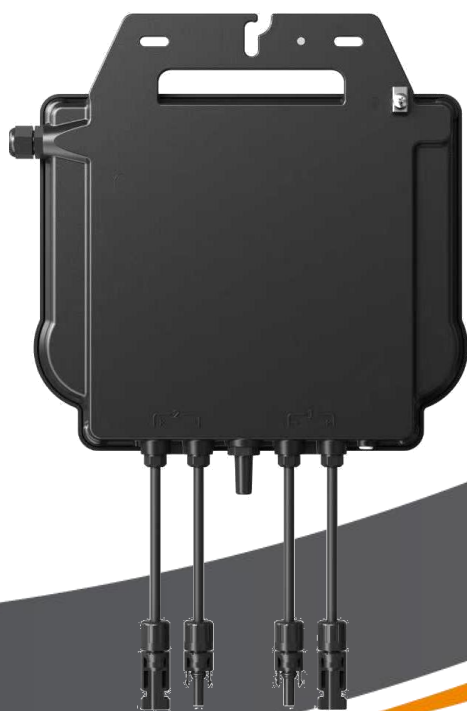




# APsystems Microinverter User Manual

## APsystems DS3-LV Microinverters

(For North America)



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# 1. Important Safety Instructions

This manual contains important instructions to follow during installation and maintenance of the APsystems Photovoltaic Grid-connected Microinverter. To reduce the risk of electrical shock and ensure a safe installation and operation of the APsystems Microinverter, the following symbols appear throughout this document to indicate dangerous conditions and important safety instructions.

Specifications are subject to change without notice. Please ensure you are using the most recent update found at <https://usa.apsystems.com/resources/library/> or <https://canada.apsystems.com/resources/library/>

## **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.

## **NOTICE:**

This indicates information that is important for optimized microinverter operation. Follow these instructions closely.

## 1.1 Safety Instructions

- ✓ **Do NOT** disconnect the PV module from the APsystems Microinverter without first disconnecting the AC power.
- ✓ Only qualified professionals should install and/or replace APsystems Microinverters.
- ✓ Perform all electrical installations in accordance with local electrical codes.
- ✓ Before installing or using the APsystems Microinverter, please read all instructions and cautionary markings in the technical documents and on the APsystems Microinverter system and the solar-array.
- ✓ Be aware that the body of the APsystems 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 APsystems Microinverter. If it fails, contact APsystems Customer Support to obtain an RMA number and start the replacement process. Damaging or opening the APsystems Microinverter will void the warranty.
- ✓ **Caution!**  
The external protective earthing conductor is connected to the inverter protective earthing terminal through AC connector. When connecting, connect the AC connector first to ensure the inverter earthing then do the DC connections. When disconnecting, disconnect the AC by opening the branch circuit breaker first but maintain the protective earthing conductor in the branch circuit breaker connect to the inverter ,then disconnect the DC inputs.
- ✓ Please install AC breakers on the AC side of the inverter.
- ✓ **CAUTION** – Hot surfaces - To reduce the risk of burns - Do not touch. Risk of electric shock-(a) both ac and dc voltage source are terminated inside this equipment. Each circuit must be individually disconnected before servicing, and (b) When the photovoltaic array is exposed to light, it supplies a dc voltage to this equipment. Warranty void if cover removed. No user serviceable parts inside.Refer servicing to qualified service personnel. This inverter has an integral ground-fault detector / interrupter (GFDI).This Utility-InteractivelInverter contains active anti-islanding protection(IEEE1547).

# 1. Important Safety Instructions

## 1.2 Symbols in Lieu of Words

 **APsystems** Trademark.



Caution, risk of electric shock.



Caution, hot surface.



NOTICE, danger! This device directly connected with electricity generators and public grid.

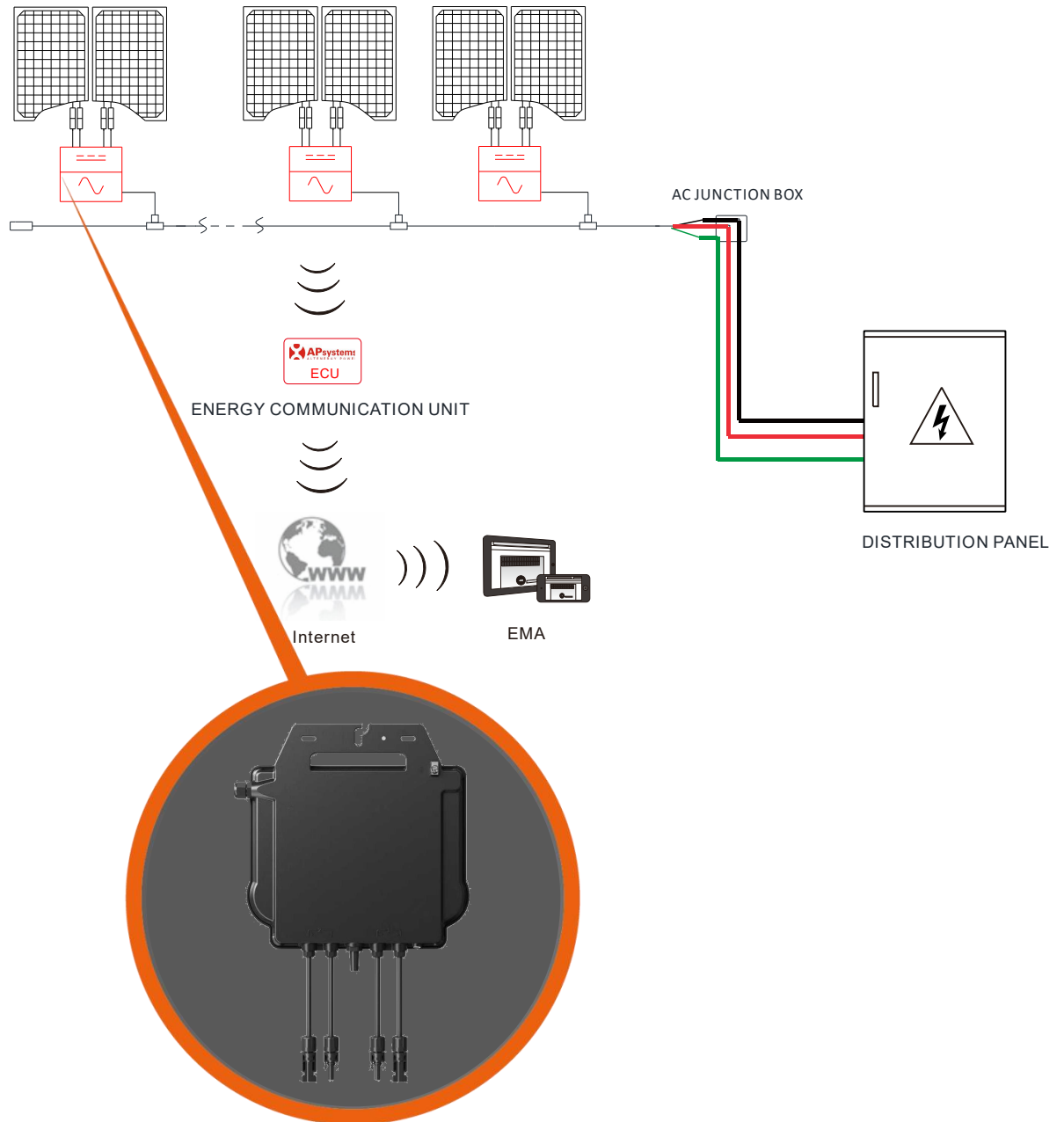
Qualified personnel

Person adequately advised or supervised by an electrically skilled person to enable him or her to perceive risks and to avoid hazards which electricity can create. For the purpose of the safety information of this manual, a "qualified person" is someone who is familiar with requirements for safety, electrical system and EMC and is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures. The inverter and photovoltaic system may only be commissioned and operated by qualified personnel.

## 2. APsystems Microinverter System Introduction

The APsystems Microinverter is used in utility-interactive grid-tied applications, comprised of three key elements:

- APsystems Microinverter
- APsystems Energy Communication Unit (ECU)
- APsystems Energy Monitor and Analysis (EMA) web-based monitoring and analysis system



## 2. APsystems Microinverter System Introduction

This integrated system improves safety; maximizes solar energy harvest; increases system reliability, and simplifies solar system design, installation, maintenance, and management.

### **Safety with APsystems Microinverters**

In a typical string inverter installation, PV modules are connected in series. The voltage adds-up to reach high voltage value (from 600Vdc up to 1000Vdc) at the end of the PV string. This extreme high DC voltage brings a risk of electrical shocks or electrical arcs which could cause fire.

When using an APsystems microinverter, PV modules are connected in parallel. Voltage at the back of each PV module never exceeds PV modules Voc, which is lower than 60Vdc for most of PV modules used with APsystems microinverters. This low voltage is considered “safe to touch” by fire departments and negates the risk of electrical shock, electrical arcs and fire hazards.

### **APsystems Microinverters maximize PV energy production**

Each PV module has individual Maximum Peak Power Tracking (MPPT) control, which ensures that the maximum power is produced to the utility grid regardless of the performance of the other PV modules in the array. When PV modules in the array are affected by shade, dust, different orientation, or any situation in which one module underperforms compared with the other units, the APsystems Microinverter ensures top performance from the array by maximizing the performance of each module individually within the array.

### **More reliable than centralized or string inverters**

The distributed APsystems Microinverter system ensures that no single point of system failure exists across the PV system. APsystems Microinverters are designed to operate at full power at ambient outdoor temperatures of up to 65 deg C (or 149 F). The inverter case is designed for outdoor installation and complies with the Type 6 environmental enclosure rating.

### **Simple to install**

APsystems Microinverters are compatible with most of 60 and 72 cell PV modules or 120 and 144 half-cut cells PV modules. (In order to confirm compatibility of PV module with APsystems microinverter, feel free to check our online “E-decider” module compatibility tool or contact your local APsystems Technical Support).

Installation requires a minimum number of accessories and microinverters offer a lot of versatility to the installer: microinverters can indeed be installed on different roofs with different orientation or with modules having different orientation.

In the same way, end-users can extend their system whenever they want with microinverters.

### **Smart system performance monitoring and analysis**

The APsystems Energy Communication Unit (ECU) is installed by simply plugging it into any wall outlet and providing an Ethernet or Wi-Fi connection to a broadband router or modem. After installing and setting the ECU (see ECU Instruction Manual), the full network of APsystems Microinverters automatically reports to the APsystems Energy Monitor and Analysis (EMA) web server.

### 3. APsystems Microinverter DS3-LV Introduction

#### Key Product Feature:

- One microinverter connects to two modules with independent MPPT
- Max output power reaching 900VA for different models
- Two independent input channels (MPPT)
- CA Rule 21 (UL 1741 SA) compliant
- NEC 2020 690.12 Rapid Shutdown Compliant
- Encrypted Wireless ZigBee Communication
- Phase Monitored and Phase Balanced

## 4. APsystems Microinverter System Installation

A PV system using APsystems Microinverters is simple to install. Each Microinverter easily mounts on the PV racking, directly beneath the PV module(s). Low voltage DC wires connect from the PV module directly to the Microinverter, eliminating the risk of high DC voltage.

Installation MUST comply with local regulations and technical rules.

**Special Statement:** we advise installation of an RCD breaker only if required by the local electrical code.

### WARNING:

- ①. Perform all electrical installations in accordance with local electrical codes.
- ②. Be aware that only qualified professionals should install and/or replace APsystems Microinverters.
- ③. Before installing or using an APsystems Microinverter, please read all instructions and warnings in the technical documents and on the APsystems Microinverter system itself as well as on the PV array.
- ④. Be aware that installation of this equipment includes the risk of electric shock.
- ⑤. Do not touch any live parts in the system, including the PV array, when the system has been connected to the electrical grid.

### NOTICE:

Even if not required by local electrical code, we strongly recommend to install surge protection devices in the dedicated AC box.

#### 4.1 Additional accessories supplied by APsystems

- AC Y3 Bus cable
- AC Y3 Bus Cable End Cap
- AC Y3 Bus Cable Y-CONN Cap
- AC Y3 Bus Cable Unlock Tool
- ECU
- AC connectors male/female

#### 4.2 Other required accessories not supplied by APsystems

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

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



## 4. APsystems Microinverter System Installation

### 4.3 PV Rapid Shut Down Equipment

This product is PV Rapid Shut Down Equipment and conforms with NEC-2014 and NEC-2017 section 690.12, for AC and DC conductors, when installed according to the following requirements:

- Microinverters and all DC connections must be installed inside the array boundary.
- The array boundary is defined as 305 mm (1 ft.) from the array in all directions, or 1 m (3 ft.) from the point of entry inside a building.

This rapid shutdown system must be provided with an initiating device and (or with) status indicator which must be installed in a location accessible to first responders, or be connected to an automatic system which initiates rapid shutdown upon the activation of a system disconnect or activation of another type of emergency system.

The initiator shall be listed and identified as a disconnecting means that plainly indicates whether it is in the “off” or “on” position. Examples are:

- Service disconnecting means
- PV system disconnecting means
- Readily accessible switch or circuit breaker

The handle position of a switch or circuit breaker is suitable for use as an indicator. Refer to NEC for more information.

Additionally, in a prominent location near the initiator device, a placard or label must be provided with a permanent marking including the following wording:

**‘PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN’** The term ‘PHOTOVOLTAIC’ may be replaced with ‘PV.’

The label requires reference NEC 690.65 to meet the audit requirements.

## 4.APsystems Microinverter System Installation

### 4.4 Installation Procedures

#### 4.4.1 Step 1 - Verify that the grid voltage matches the microinverter rating

#### 4.4.2 Step 2 - Y3 AC bus cable distribution

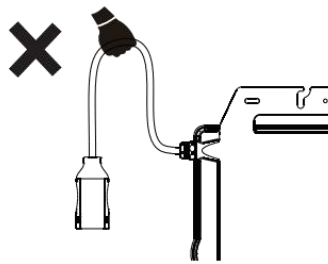
- One end of the AC bus cable is used to access the junction box connected to the power grid.
- Wire the conductors of the AC bus as follows: L1 - BLACK ; L2 - RED; PE - GREEN.

#### **WARNING:**

- Wiring color codes may vary according to local regulations. Before connecting to the AC bus, ensure that all wires of the installation match. Incorrect cabling can irreparably damage the microinverters, and such damage is not covered by the warranty.
- During the entire cable laying and installation process, it is essential to ensure that the circuit breakers for the AC bus and the grid are turned off to prevent accidental electric shock during installation.

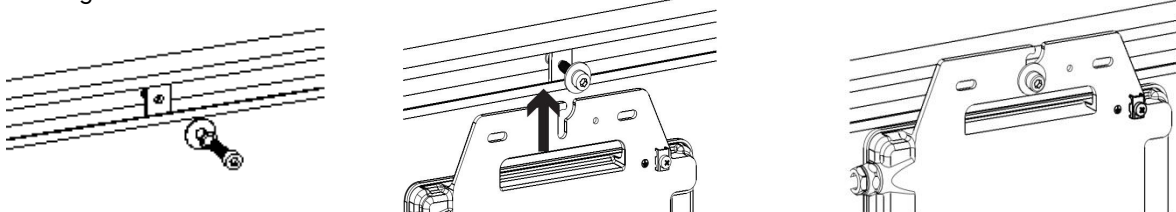
#### **WARNING:**

Do NOT carry the microinverter by the AC cable. This may cause the AC cable to partially or fully disconnect from the unit, resulting in no or poor operation.



#### 4.4.3 Step 3 - Attaching the APsystems microinverters to the racking

- Mark the location of each microinverter on the rack relative to the PV module junction box or any other obstructions.
- Install one microinverter at each of these marked locations using the hardware recommended by your module racking vendor.

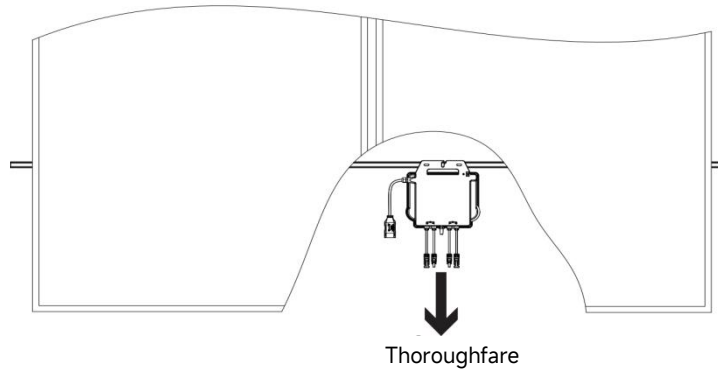


#### **WARNING:**

Install the microinverters (including DC and AC connectors) beneath the PV modules to protect them from direct exposure to rain, UV, or other adverse weather conditions.

Leave a minimum of 2 cm (3/4 inch) space below and above the microinverter casing to allow proper airflow. The racking must be grounded in accordance with local electrical codes.

## 4.APsystems Microinverter System Installation



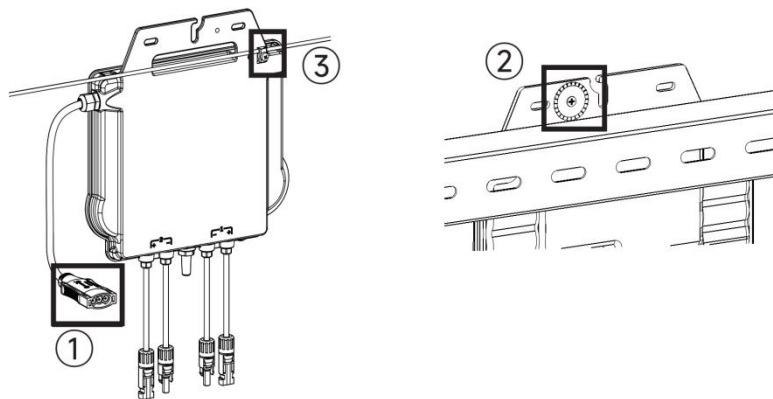
### WARNING:

When flush-mounting photovoltaic modules on the rooftop, ensure that the DC connectors, antenna, and LED indicator of the microinverter are facing outwards. This arrangement facilitates monitoring of indicator status and ensures optimal communication quality.

#### 4.4.4 Step 4 - Grounding the system

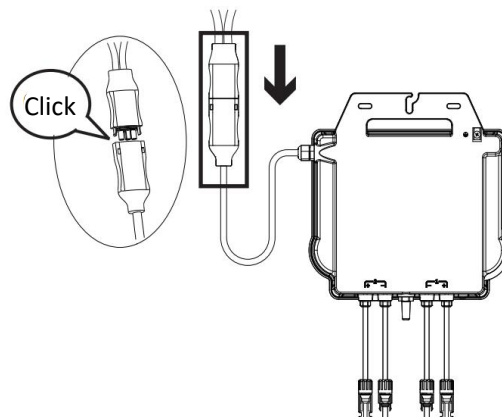
There are three ways to connect grounds on the APsystems DS3-LV:

- ① Y3 AC Bus cable has an embedded PE wire to ground the inverters in the AC circuit box.
- ② If the rack is grounded, the grounding washer on the inverter could create a tight bond onto the rack as a ground connection. This is also a solution to ground the rack through inverter when the inverters are grounded.
- ③ If an external connection is necessary, an external wire can be bonded to the grounding lug on the exterior of the inverter and connected to ground.



#### 4.4.5 Step 5 - Connecting the APsystems microinverter to the AC bus cable

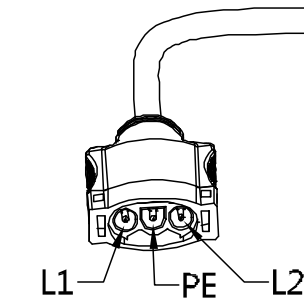
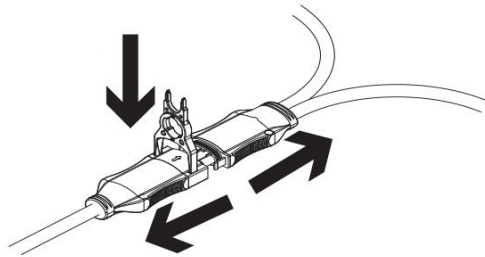
Insert the microinverter AC connector into the trunk cable connector. Ensure you hear the “click” sound as evidence of a secure connection.



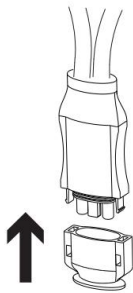
## 4.APsystems Microinverter System Installation

*Best Practice: Use the AC Bus Cable  
Unlock Tool to disconnect the connectors.*

*The AC connector interface is as follows.*

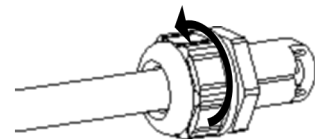
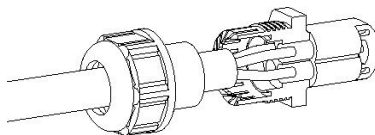
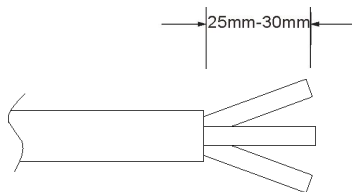


*Cover any unused connectors with the Bus Cable Y-CONN to protect them.*

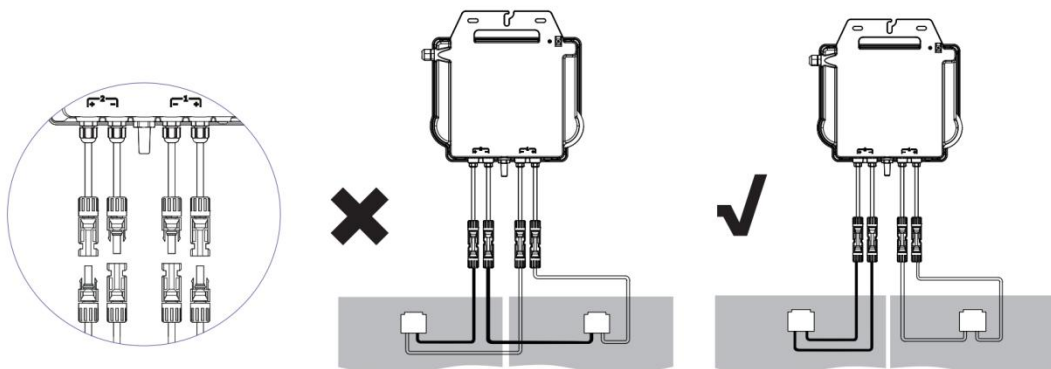


### 4.4.6 Step 6 - Installing a bus cable end cap at the end of the AC bus cable

- A. Strip cable jacket.
- B. Insert the cable end into the seal.
- C. Rotate the nut with 4-5N·m until the latching mechanism meets the base.



### 4.4.7 Step 7 - Connecting APsystems microinverters to the PV modules



## 4.APsystems Microinverter System Installation

### NOTICE:

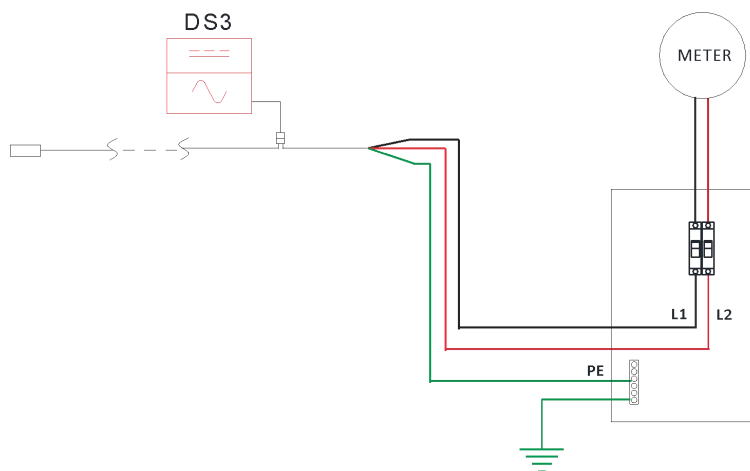
When plugging in the DC cables, the microinverter should immediately blink green ten times. This will happen as soon as the DC cables are plugged in and will indicate that the microinverter is functioning correctly. This entire check function will start and end within 10 seconds of plugging in the unit. Therefore, pay close attention to these lights while connecting the DC cables.

### WARNING:

Double-check to ensure that all AC and DC wiring has been correctly installed. Verify that none of the AC and/or DC wires are pinched or damaged. Confirm that all junction boxes are properly closed.

Each PV panel must be meticulously connected to the same channel. Do not split positive and negative DC cables into two different input channels, as this will damage the microinverter and void the warranty.

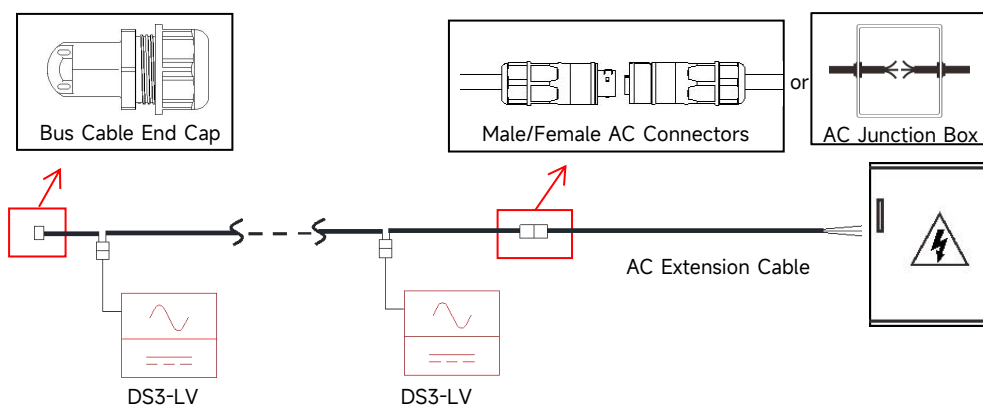
### 4.4.8 Step 8 - Connecting APsystems microinverters to the grid



### WARNING:

- ①. Please install bi-polar circuit breakers with the appropriate rated current or according to local regulations. These circuit breakers are mandatory for grid connection.
- ②. Installation of leakage current breakers or AFCI/GFCI breakers is not recommended.

### 4.4.9 Step 9 - Connecting APsystems microinverters to the grid

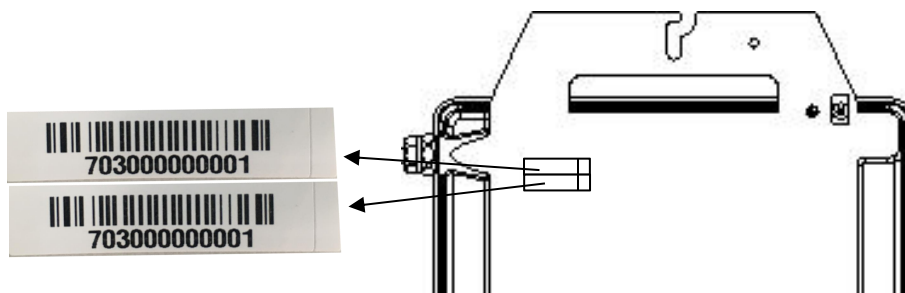


When an AC extension cable is required, users can either connect the AC bus cable and AC extension cable within a junction box or use a pair of male/female AC connectors provided by APsystems as optional accessories.

## 4. APsystems Microinverter System Installation

### 4.4.10 Step 10 - Completing the APsystems installation map

- a. Each APsystems Microinverter comes with 2 removable serial number labels.
- b. Complete the installation map by affixing the ID label of each microinverter at the appropriate location.
- c. The second serial number label can be adhered to the solar module frame. This label will assist in later confirmation of the microinverter's position without the need to dismantle the PV module.



#### NOTICE:

- ①. The arrangement of the microinverters' serial numbers in the installation map is designed for standard installations.
- ②. The Installation Map can be found in the appendix on the last page of this manual.
- ③. When configuring the ECU, use the ECU\_APP (accessible through the EMA Manager) to scan the serial numbers on the map (refer to the ECU instruction manual for further details).

## 5. APsystems microinverter system operating instructions

### To operate the APsystems 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 after approximately one minute of waiting time.
3. Microinverter data will be available in the EMA Manager APP or in the EMA web portal.

Alternatively, LED sequences could be an indicator of microinverters status (see section 6.1)

### NOTICE:

Once the ECU has been commissioned properly, the APsystems Microinverters will start to send performance data to the ECU. The time required for all of the Microinverters in the system to report to the ECU will vary depending on the number of Microinverters in the system.

## 6. Troubleshooting

Qualified personnel can use the following troubleshooting steps if the PV system does not operate correctly:

### 6.1 Status Indications and Error Reporting

Assuming they are easily accessible and visible, Operation LEDs can give a good indication of the microinverters status

#### 6.1.1 Start up LED

Ten short green blinks when DC power is first applied to the Microinverter indicates a successful Microinverter startup.

#### 6.1.2 Operation LED

**Flashing Slow Green (5 sec. gap)** - Producing power

**Flashing Slow Red (5 sec. gap)** - Not producing power

**Steady Red** – default, DC side ground fault protection, see 6.1.3

#### 6.1.3 GFDI Error

A solid red LED indicates the Microinverter has detected a Ground Fault Detector Interrupter (GFDI) error in the PV system. Unless the GFDI error has been cleared, the LED will remain red and the ECU will keep reporting the fault. Please contact your local APsystems Technical Support.

### 6.2 ECU\_APP

APsystems ECU\_APP (available in the EMA Manager APP) is the recommended tool to do on-site troubleshooting. When connecting the ECU\_APP to the ECU hotspot (please check ECU User Manual for more detailed information), installer can check every microinverter status (production, communication) but also ZigBee signal strength, grid profile and other insightful data helping the troubleshooting.

### 6.3 Installer EMA (web portal or EMA Manager APP)

Before going on site for troubleshooting, installer can also check all information remotely using his installer account, either on the web or using the EMA Manager APP (see EMA Manager APP User Manual for more detailed information). Having access to module data (DC, AC, voltages and currents) gives the first indication on potential issues.

### 6.4 Trouble Shooting Guide

Professional installers can also refer to our Troubleshooting Guide

(<https://usa.apsystems.com/resources/library/> or <https://canada.apsystems.com/resources/library/>, section libraries) for more in depth guidelines on how to troubleshoot and fix PV installations powered by APsystems microinverters.



## 6. Troubleshooting

### 6.5 APsystems Technical Support

The APsystems local Technical Support team is available to support professional installers in becoming familiar with our products and to troubleshoot installations when needed.

#### **WARNING:**

Do not attempt to repair APsystems Microinverters. Please contact your local APsystems Technical Support.

#### **WARNING:**

- ①. Never disconnect the DC wire connectors under load. Ensure that no current is flowing in the DC wires prior to disconnecting.
- ②. Always disconnect AC power before disconnecting the PV module wires from the APsystems Microinverter.
- ③. The APsystems Microinverter is powered by PV module DC power. AFTER disconnecting the DC power, when reconnecting the PV modules to the Microinverter, be sure to watch for the quick red light followed by ten short green LED flashes.

### 6.6 Maintenance

APsystems microinverters do not require any specific regular maintenance.

## 7. Replace a microinverter

### Follow the procedure to replace a failed APsystems Microinverter

- B. Disconnect the APsystems Microinverter from the PV Module, in the order shown below:
  - 1. Disconnect the AC by turning off the branch circuit breaker.
  - 2. Disconnect the inverter AC connector from the AC Bus.
  - 3. Disconnect the PV module DC wire connectors from the microinverter.
  - 4. Remove the Microinverter from the PV array racking.
- C. Install a replacement Microinverter to the rack. Remember to observe the flashing green LED light as soon as the new Microinverter is plugged into the DC cables.
- D. Connect the AC cable of the replacement Microinverter to the AC bus.
- E. Close the branch circuit breaker, and verify proper operation of the replacement Microinverter.

Update the microinverter in the EMA Manager through the "Replace" function and update the system's map with new serial number labels.

## 8. Technical Data

### WARNING:

- ①. Be sure to verify that the voltage and current specifications of your PV module are compatible with the range allowed on APsystems Microinverter. Please check the microinverter datasheet.
- ②. DC operating voltage range of the PV module must be within allowable input voltage range of the APsystems Microinverter.
- ③. The maximum open circuit voltage of the PV module must not exceed the specified maximum input voltage of the APsystems.

**While the Grid Support Utility interactive function evaluated according to IEEE 1547-2018, IEEE 1547a-2020 and IEEE 1547.1-2020, Utility Interconnection Voltage and Frequency Trip Limits and Trip Times setting as well as the enter service setting as following:**

| Shall trip function | Abnormal Voltage Shall trip—Category III |                   |                                   |                   |
|---------------------|------------------------------------------|-------------------|-----------------------------------|-------------------|
|                     | Default settings                         |                   | Ranges of allowable settings      |                   |
|                     | Voltage (p.u. of nominal voltage)        | Clearing time (s) | Voltage (p.u. of nominal voltage) | Clearing time (s) |
| OV2                 | 1.20                                     | 0.16              | fixed at 1.20                     | fixed at 0.16     |
| OV1                 | 1.10                                     | 13.0              | 1.10 – 1.20                       | 1.0 – 13.0        |
| UV1                 | 0.88                                     | 21.0              | 0.0 – 0.88                        | 2.0 – 50.0        |
| UV2                 | 0.50                                     | 2.0               | 0.0 – 0.5                         | 0.16 – 21.0       |

| Shall trip function | Abnormal Frequency Shall trip—Category III |                   |                              |                   |
|---------------------|--------------------------------------------|-------------------|------------------------------|-------------------|
|                     | Default settings                           |                   | Ranges of allowable settings |                   |
|                     | Frequency (Hz)                             | Clearing time (s) | Frequency (Hz)               | Clearing time (s) |
| OF2                 | 62                                         | 0.16              | 61.8–66.0                    | 0.16–1 000.0      |
| OF1                 | 61.2                                       | 300.0             | 61.0–66.0                    | 180.0–1 000.0     |
| UF1                 | 58.5                                       | 300.0             | 50.0–59.0                    | 180.0–1 000       |
| UF2                 | 56.5                                       | 0.16              | 50.0–57.0                    | 0.16–1 000        |

| Enter service criteria          |               | Default settings  | Ranges of allowable settings |
|---------------------------------|---------------|-------------------|------------------------------|
| Permit service                  |               | Enabled           | Enabled/Disabled             |
| Applicable voltage within range | Minimum value | $\geq 0.917$ p.u. | 0.88 p.u. to 0.95 p.u.       |
|                                 | Maximum value | $\leq 1.05$ p.u.  | 1.05 p.u. to 1.06 p.u.       |
| Frequency within range          | Minimum value | $\geq 59.5$ Hz    | 59.0 Hz to 59.9 Hz           |
|                                 | Maximum value | $\leq 60.1$ Hz    | 60.1 Hz to 61.0 Hz           |

Time accuracy: 1% but not less than 2 cycles( $\approx 34$ ms)

### Constant power factor mode

Minimum Injective Power Factor: 0.9

Minimum Absorb Power Factor: -0.9

Default : 1

### Voltage-reactive power mode

## 8. Technical Data

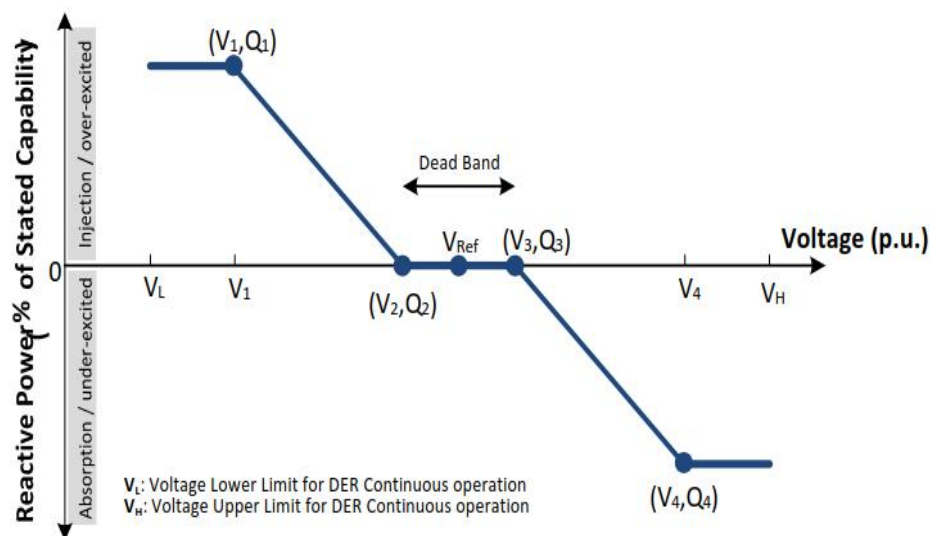
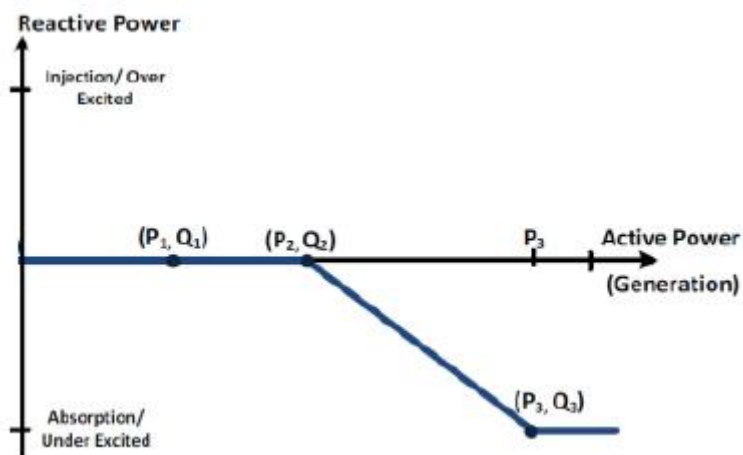


Figure 9—Example voltage-reactive power characteristic

| Voltage-reactive power parameters | Default values for DER                             |                                                    |
|-----------------------------------|----------------------------------------------------|----------------------------------------------------|
|                                   | Category A                                         | Category B                                         |
| $V_{Ref}$                         | $V_N$                                              | $V_N$                                              |
| $V_2$                             | $V_N$                                              | $0.98 V_N$                                         |
| $Q_2$                             | 0                                                  | 0                                                  |
| $V_3$                             | $V_N$                                              | $1.02 V_N$                                         |
| $Q_3$                             | 0                                                  | 0                                                  |
| $V_1$                             | $0.9 V_N$                                          | $0.92 V_N$                                         |
| $Q_1$                             | 25% of nameplate apparent power rating, injection  | 44% of nameplate apparent power rating, injection  |
| $V_4$                             | $1.1 V_N$                                          | $1.08 V_N$                                         |
| $Q_4$                             | 25% of nameplate apparent power rating, absorption | 44% of nameplate apparent power rating, absorption |
| Open loop response time, $T_r$    | 10 s                                               | 5 s                                                |

### Active power-reactive power mode

## 8. Technical Data



| Active power-reactive power parameters | Default values for DER                             |                                                    |
|----------------------------------------|----------------------------------------------------|----------------------------------------------------|
|                                        | Category A                                         | Category B                                         |
| $P_3$                                  | $P_{rated}$                                        |                                                    |
| $P_2$                                  | $0.5 P_{rated}$                                    |                                                    |
| $P_1$                                  | The greater of $0.2 P_{rated}$ and $P_{min}$       |                                                    |
| $P'_1$                                 | The lesser of $0.2 P'_{rated}$ and $P'_{min}$      |                                                    |
| $P'_2$                                 | $0.5 P'_{rated}$                                   |                                                    |
| $P'_3$                                 | $P'_{rated}$                                       |                                                    |
| $Q_3$                                  | 25% of nameplate apparent power rating, absorption | 44% of nameplate apparent power rating, absorption |
| $Q_2$                                  | 0                                                  |                                                    |
| $Q_1$                                  | 0                                                  |                                                    |
| $Q'_1$                                 | 0                                                  |                                                    |
| $Q'_2$                                 | 0                                                  |                                                    |
| $Q'_3$                                 | 44% of nameplate apparent power rating, injection  |                                                    |

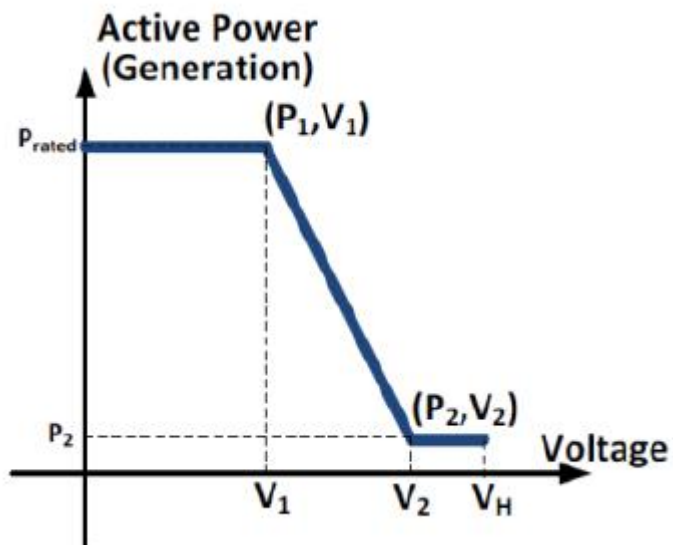
NOTE— $P_{rated}$  is the nameplate active power rating of the DER.  
 $P'_{rated}$  is the maximum active power that the DER can absorb.  
 $P_{min}$  is the minimum active power output of the DER.  
 $P'_{min}$  is the minimum, in amplitude, active power that the DER can absorb.  
 $P'$  parameters are negative in value.

### Constant reactive power mode

|                                                       |     |
|-------------------------------------------------------|-----|
| $Q_{max,abs}$ – maximum absorbed reactive power (var) | 396 |
| $Q_{max,inj}$ – maximum injected reactive power (var) | 396 |

### Voltage-active power mode

## 8. Technical Data



| Voltage-active power parameters                                         | Default values for DER                     |                                            |
|-------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------|
|                                                                         | Category A                                 | Category B                                 |
| $V_1$                                                                   | $1.06 V_N$                                 | $1.06 V_N$                                 |
| $P_1$                                                                   | $P_{rated}$                                | $P_{rated}$                                |
| $V_2$                                                                   | $1.1 V_N$                                  | $1.1 V_N$                                  |
| $P_2$<br>(applicable to DER that can only generate active power)        | The lesser of $0.2 P_{rated}$ or $P_{min}$ | The lesser of $0.2 P_{rated}$ or $P_{min}$ |
| $P'_2$<br>(applicable to DER that can generate and absorb active power) | 0                                          | 0                                          |
| Open loop response time                                                 | 10 s                                       | 10 s                                       |

### Frequency-droop (frequency-power)

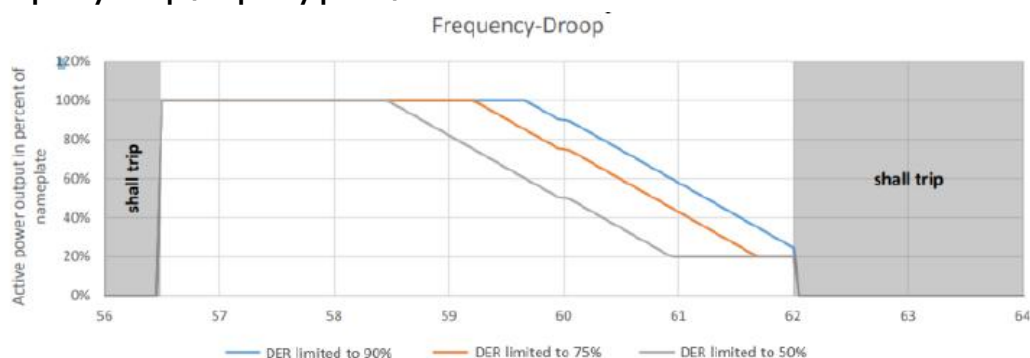


Figure 12—Example of a frequency droop function

**Table 34—Characteristic 1:**  
Default frequency-power power settings for abnormal operating performance  
Category I, II, and III DER

| Parameter                   | Category I | Category II | Category III |
|-----------------------------|------------|-------------|--------------|
| $db_{OF}$ (Hz)              | 0.036      | 0.036       | 0.036        |
| $k_{OF}$                    | 0.05       | 0.05        | 0.05         |
| $T_r$ (s)<br>(small signal) | 5          | 5           | 5            |

# 8.1 DS3-LV Microinverter Datasheet

## Model

**DS3-LV**

### Input Data (DC)

|                                         |               |
|-----------------------------------------|---------------|
| Recommended PV Module Power (STC) Range | 315Wp-660Wp+  |
| Peak Power Tracking Voltage             | 27V-45V       |
| Operating Voltage Range                 | 26V-60V       |
| Maximum Input Voltage                   | 60V           |
| Maximum Input Current                   | 18A x 2       |
| Maximum input short circuit current     | 25A per input |

### Output Data (AC)

|                                                |                                     |
|------------------------------------------------|-------------------------------------|
| Maximum Continuous Output Power                | 900VA                               |
| Nominal Output Voltage/Range <sup>(1)</sup>    | 120V/105.6-132V                     |
| Nominal Output Current                         | 7.5A                                |
| Nominal Output Frequency/ Range <sup>(1)</sup> | 60Hz/58.8Hz-61.2Hz (HECO:57Hz-63Hz) |
| Power Factor (Default/Adjustable)              | >0.99(-0.9~0.9 adjustable)          |
| Maximum Units per 12AWG Branch <sup>(2)</sup>  | 2 (20A breaker)                     |
| Maximum Units per 10AWG Branch <sup>(2)</sup>  | 3 (30A breaker)                     |

### Efficiency

|                         |       |
|-------------------------|-------|
| Peak Efficiency         | 96%   |
| Nominal MPPT Efficiency | 99.5% |
| Night Power Consumption | 20mW  |

### Mechanical Data

|                                                    |                                      |
|----------------------------------------------------|--------------------------------------|
| Operating Ambient Temperature Range <sup>(3)</sup> | -40°F to +149°F (-40°C to +65°C)     |
| Storage Temperature Range                          | -40°F to +185°F (-40°C to +85°C)     |
| Dimensions (W x H x D)                             | 11.1" x 9.2" x 1.6" (283x233x39.5mm) |
| Weight                                             | 9.5lbs(4.3kg)                        |
| DC Connector Type                                  | Stäubli MC4 PV-ADBP4-S2&ADSP4-S2     |
| Cooling                                            | Natural Convection - No Fans         |
| Enclosure Environmental Rating                     | Type 6                               |

### Features

|                                                |                                                    |
|------------------------------------------------|----------------------------------------------------|
| Communication (Inverter To ECU) <sup>(4)</sup> | Encrypted ZigBee                                   |
| Isolation Design                               | High Frequency Transformers, Galvanically Isolated |
| Energy Management                              | Energy Management Analysis (EMA) system            |

### Compliances

|                                |                                                                                                                                                                                                                                                 |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Safety, EMC & Grid Compliances | UL1741; CSA C22.2 No.107.1-16; IEC60338; IEEE1547; UL1741SB; SRD-V2.0;<br>NEC2014 & NEC2017 & NEC2020 Section 690.11 DC Arc-Fault circuit Protection<br>NEC2014 & NEC2017 & NEC2020 Section 690.12 Rapid Shutdown of PV systems<br>on Buildings |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

(1)Nominal voltage/frequency range can be extended beyond nominal if required by the utility.

(2)Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

(3)The inverter may enter to power de-grade mode under poor ventilation and heat dissipation installation environment.

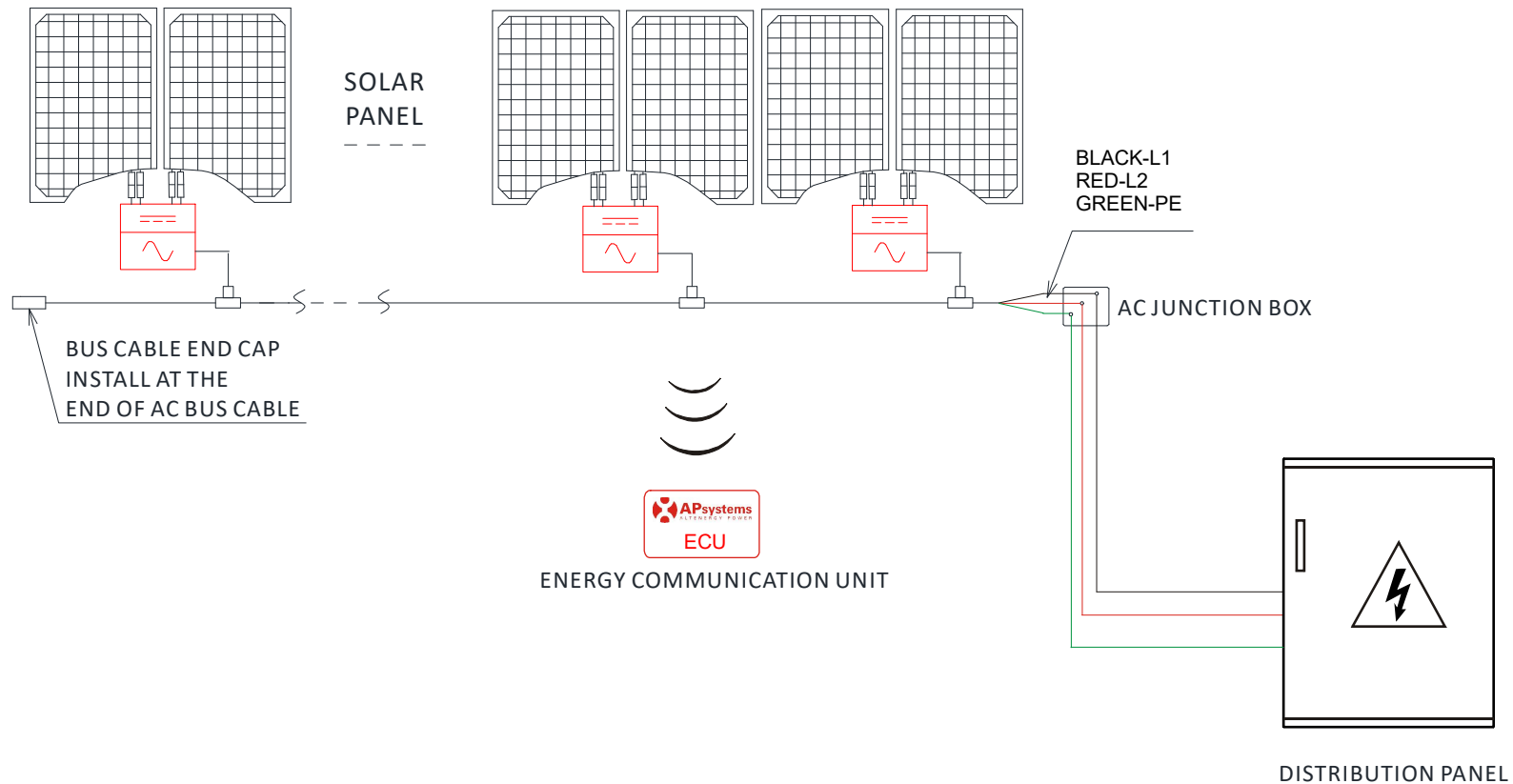
(4)Recommend no more than 80 inverters register to one ECU for stable communication.

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Specifications subject to change without notice please ensure you are using the most recent update found at web : [usa.APsystems.com](http://usa.APsystems.com)

## 9. Wiring Diagram

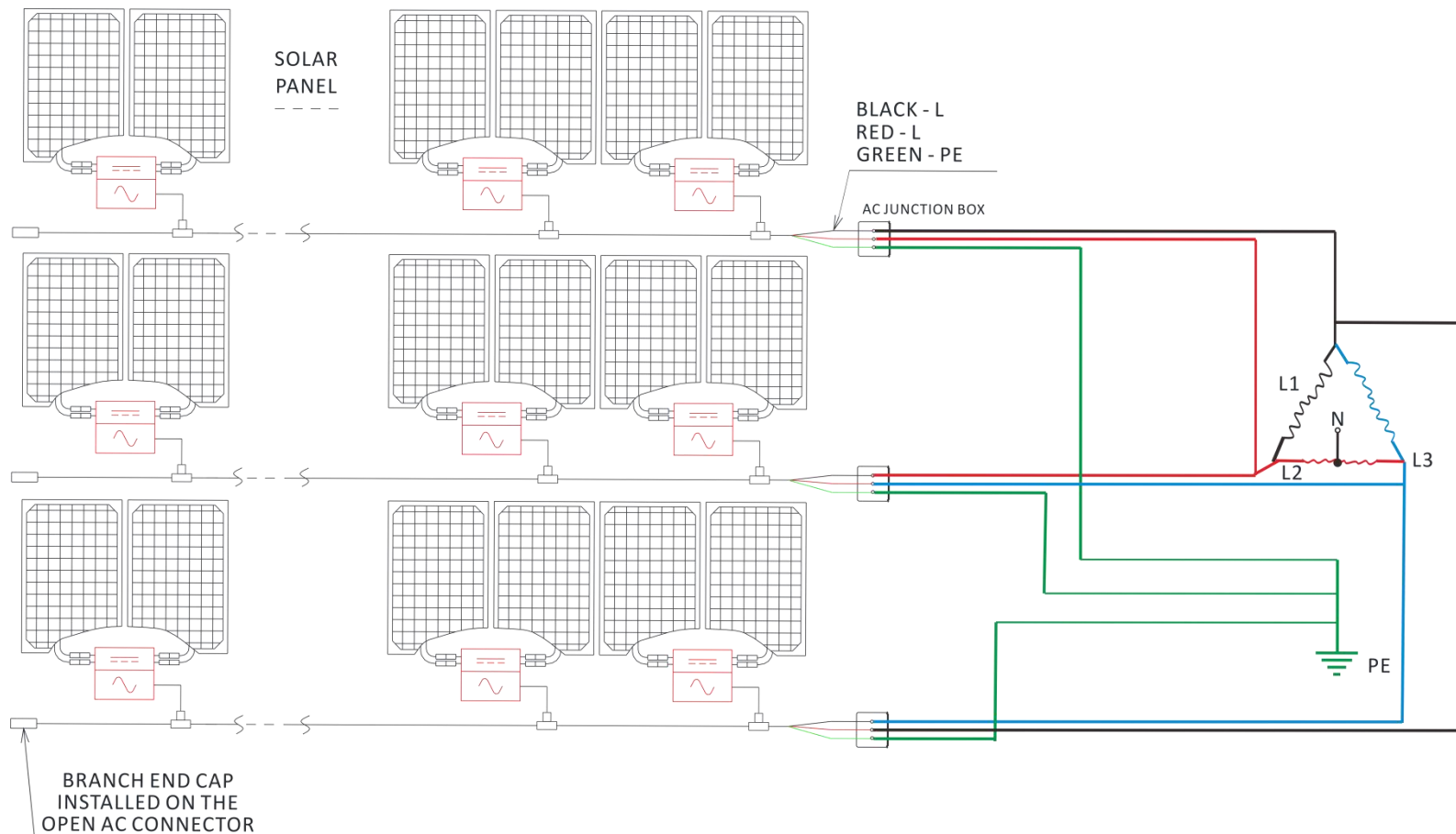
### 9.1 Sample Wiring Diagram - Split Phase





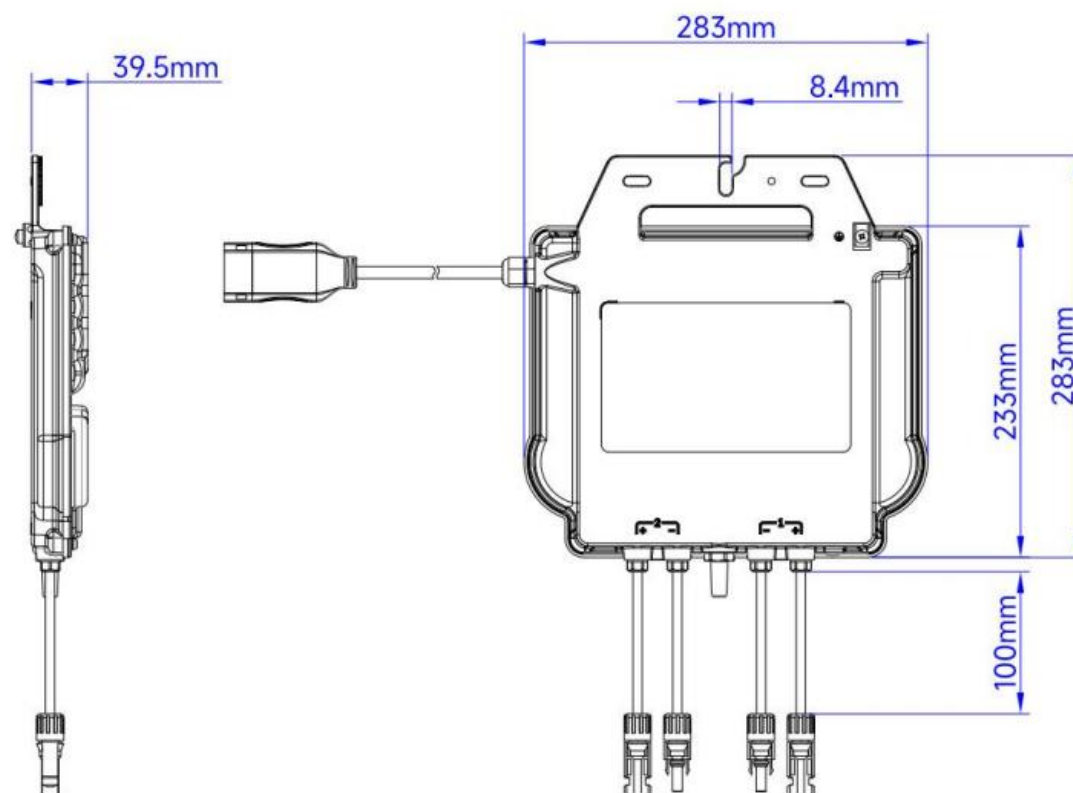
## 9. Wiring Diagram

### 9.2 DS3-LV Connected to High Leg Delta Grid



## 10.DS3 series Accessory

### 10.1 Dimensions



## 11. APsystems Microinverters Installation Map

The APsystems Installation Map is a diagram of the physical location of each microinverter in your PV installation. Each APsystems microinverter has two serial number labels. Peel the one label and affix it to the respective location on the APsystems installation map.

Installation Map Template

| Installer: |          | PV module type:     |          | Qty:     |          | Sheet__of__ |  |
|------------|----------|---------------------|----------|----------|----------|-------------|-------------------------------------------------------------------------------------|
| Owner:     |          | Microinverter type: |          | Qty:     |          |             |                                                                                     |
|            | Column 1 | Column 2            | Column 3 | Column 4 | Column 5 | Column 6    | Column 7                                                                            |
| Row 1      |          |                     |          |          |          |             |                                                                                     |
| Row 2      |          |                     |          |          |          |             |                                                                                     |
| Row 3      |          |                     |          |          |          |             |                                                                                     |
| Row 4      |          |                     |          |          |          |             |                                                                                     |
| Row 5      |          |                     |          |          |          |             |                                                                                     |
| Row 6      |          |                     |          |          |          |             |                                                                                     |
| Row 7      |          |                     |          |          |          |             |                                                                                     |
| Row 8      |          |                     |          |          |          |             |                                                                                     |
| Row 9      |          |                     |          |          |          |             |                                                                                     |
| Row 10     |          |                     |          |          |          |             |                                                                                     |