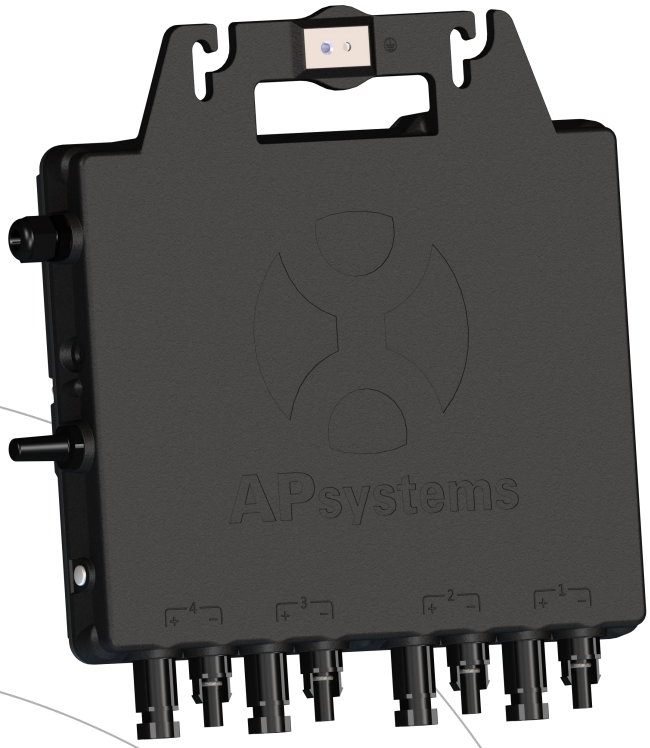
Installation / User Manual

APsystems QS1A Microinverter

Rev 1.0



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Please scan the QR code to get mobile app and more support to help the installation.

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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 Inverter (Microinverter). To reduce the risk of electrical shock and ensure the 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 www.APsystems.com.

WARNING

This symbol indicates a situation where not following instructions may cause a serious hardware or safety issue and/or put people in danger. Be extremely cautious when performing this task.

NOTICE

This symbol provides important indication to follow in order to optimize microninverters operations. 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 warning notices in the technical documents and on the APsystems Microinverter system and the solar-array.
- ✓ Be aware that the case 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 case 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-InteractiveInverter contains active anti-islanding protection(IEEE1547) and is tested per FCC/IC.

1. Important Safety Instructions

1.2 Radio Interference Statement

FCC/IC Compliance: The equipment can comply with the limits for a class B digital device,pursuant to part 15 of the FCC Rules(ICES-003), which are designed to protect against harmful interference in a residential installation. The equipment could radiate radio frequency energy and this might cause harmful interference to radio communications if instructions are not followed when installing and using the equipment. But there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, the following measures might resolve the issues:

A) Relocate the receiving antenna and keep it well away from the equipment.

B) Consult the dealer or an experienced radio / TV technical for help.

Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate the equipment.

1.3 Symbols replace words on the equipment, on a display, or in manuals

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 complete 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

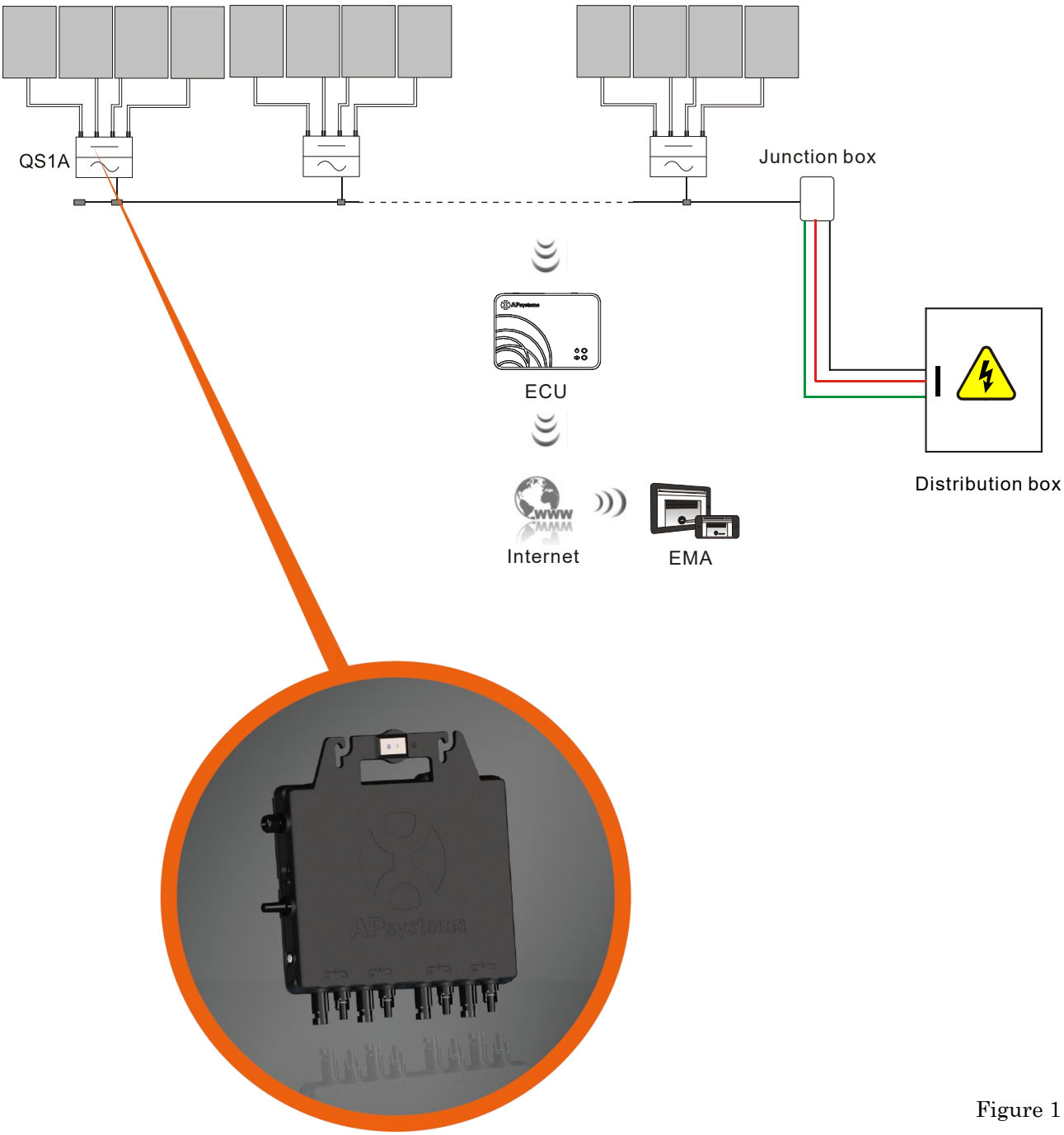


Figure 1

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.

APsystems Microinverters maximize PV energy production

Each PV module has individual Maximum Peak Power Tracking (MPPT) controls, 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, 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 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 149°F (65°C). The inverter case is designed for outdoor installation and complies with the IP67 environmental enclosure rating.

Simple to install

You can install individual PV modules in any combination of module quantity,orientation, type, and power rate.

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 configurating the ECU, the full network of APsystems Microinverters automatically reports to the APsystems Energy Monitor and Analysis (EMA) web server. The EMA software displays performance trends,informs you of abnormal events, and controls system shutdown when it is needed. (See ECU manual for instructions.)

3. APsystems Microinverter QS1A Introduction

The APsystems QS1A Microinverter connect to single phase grid and can also be configured for 3-phase grid, and operates with most 60 and 72 cell PV modules. Contact APsystems Customer Support for checking compatibility. For more information, please see the Technical Data page (p.17) of this manual.

Model Number	AC grid	PV Module	Module Connector
QS1A	60Hz/240V	60,72Cell	MC-4 Type

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.

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

Strongly recommend to install Surge protection Devices in the dedicated meter box.

4.1 Additional Installation components from APsystems

- Bus Cable End Cap (sold separately)
- Bus Cable Y-CONN Cap (sold separately)
- Bus Cable Unlock Tool (sold separately)

4.2 Required Parts and Tools from you

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

- An AC connection junction box
- Mounting hardware suitable for module racking
- Accessories and tools to fix the mounting system

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 1m (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 the grid voltage to match with microinverter rating

4.4.2 Step 2 - Install the AC bus cable

a. The AC bus is installed at a position matching the microinverter location.
b. One end of the AC bus is connected to the mains via the junction box.
c. Wire the conductors of the AC bus:
L1 - BLACK ; L2 - RED ; PE-GREEN

WARNING

Wiring colour code can be different according to local regulations, check all the wires of the installation before connecting to the AC bus to be sure they match.Wrong cabling can damage irreparably the microinverters, such an issue is not covered by the warranty.

WARNING

Forbidden to hand carry the inverter through AC cable.

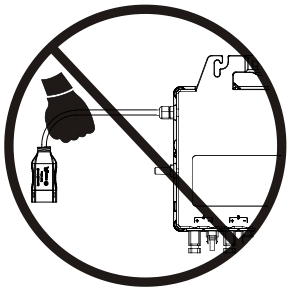


Figure 2

4.4.3 Step 3 - Attach the APsystems Microinverters to the racking

a. Mark the location of the microinverter on the rack, taking into acount the position of the PV module junction box or any other obstructions.
b. Mount one microinverter at each of these locations using hardware recommended by your module racking vendor. When installing the microinverter, make sure the grounding washer is facing the racking.

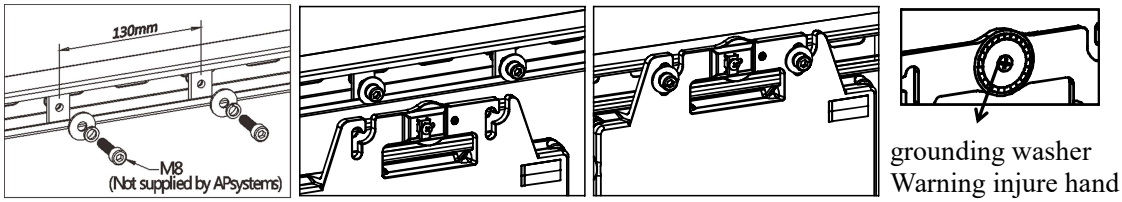


Figure 3

WARNING

Prior to installing any of the microinverters, verify that the utility Voltage at the point of common connection matches the voltage rating on microinverter label.

WARNING

Do not place the inverters (including DC and AC connectors) with direct exposure to the sun, rain, or snow. Allow a minimum of 2 cm of space around the microinverter case for heat dissipation and proper air flow. The racking used to fix the microinverter should be reliably grounded.

4. APsystems Microinverter System Installation

4.4.4 Step 4 - Ground the system

a. There already has earth wire inside the AC cable, thus the grounding work could be done directly by it.
b. For those areas that have special requirements, the external grounding work could be done by grounding brackets.

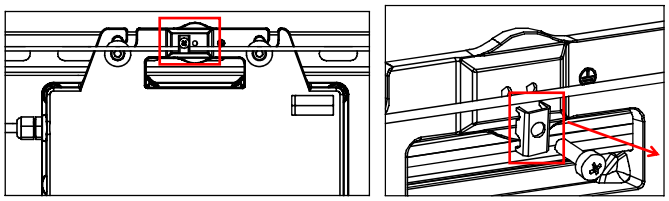


Figure 4

4.4.5 Step 5 - Connect the APsystems microinverter to AC bus cable

Push the microinverter AC connector into the trunk cable connector until you hear a "click". Try to remove it to check that it is properly locked.

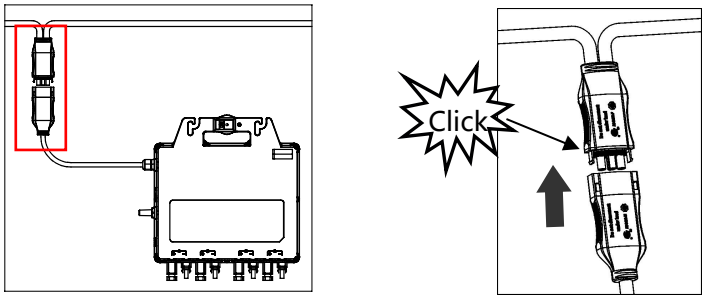


Figure 5

Best Practice: Use the Bus Cable Unlock Tool of AC Bus to split the connectors.

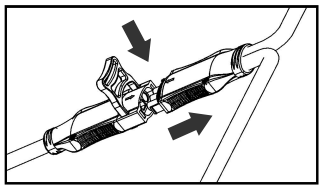
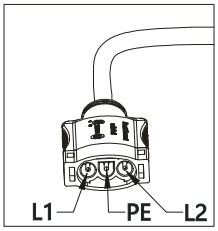


Figure 6

AC connector interface as follows.



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

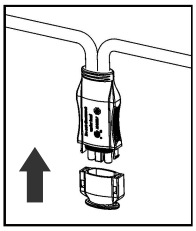
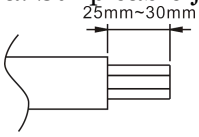


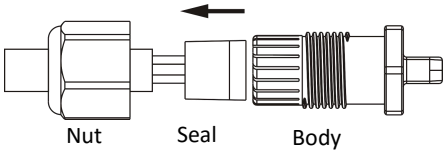
Figure 7

4.4.6 Step 6 - Install a AC bus protective end cap at the end of AC bus cable

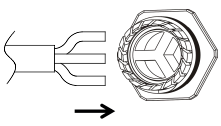
a. Strip cable jacket.



b. Insert the cable end into the seal.



c. Insert the wires into the cable clamps.



d. Rotate the nut with 3.3N·m until the latching mechanism meets the base.

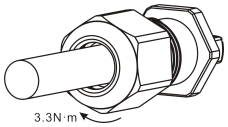


Figure 8

4.4.7 Step 7 - Connect APsystems Microinverters to the PV Modules

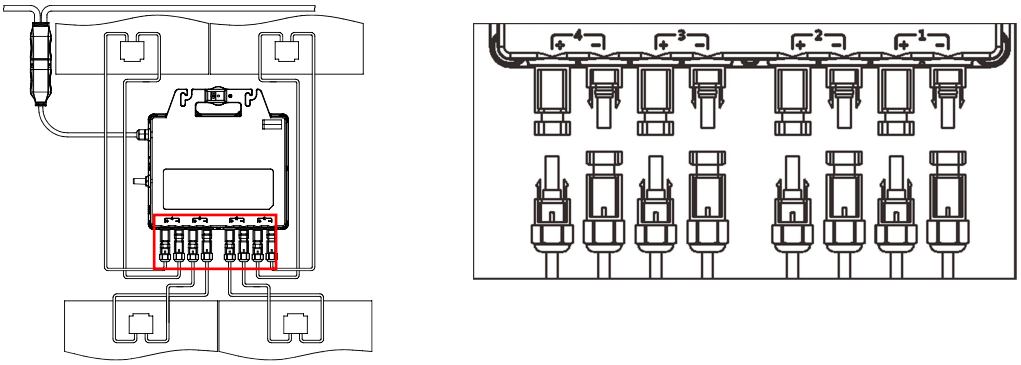


Figure 9

NOTICE

When connecting the 1st module, the LED of the microinverter must flash three times in green. This happens as soon as the cables are plugged in, to show that the microinverter is working properly. This control function starts and ends within 5 seconds after the device is connected, so pay particular attention to these LEDs when connecting the DC cables.

WARNING

Double check to make sure all of the AC and DC wiring has been correctly installed. Ensure that none of the AC and/or DC wires are pinched or damaged. Make sure that all of the junction boxes are properly closed.

4.4.8 Step 8 - Complete the APsystems installation map

Fill in the APsystems Registration Cards, which provide system information and the installation map. Feel free to provide your own layout if a larger or more intricate installation map is required. The layout map provided is designed to accomodate labels in vertical or horizontal orientation to meet all the field PV connections.

a. Each APsystems Microinverter has removable serial number labels.
b. Peel labels off, affix one to the respective location on the APsystems installation map,and fill in 1,2 in the label below,according to the layout on the roof.
c. After the completion of installation drawings sent to APsystems website

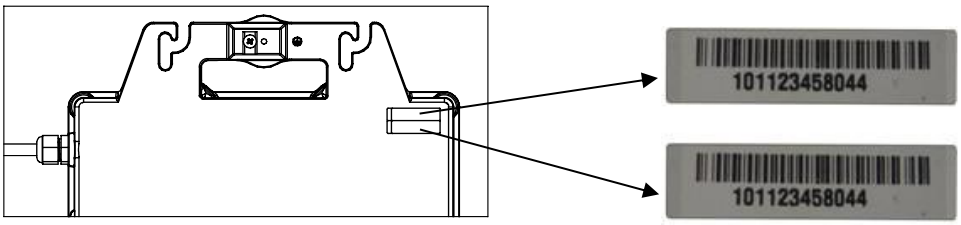


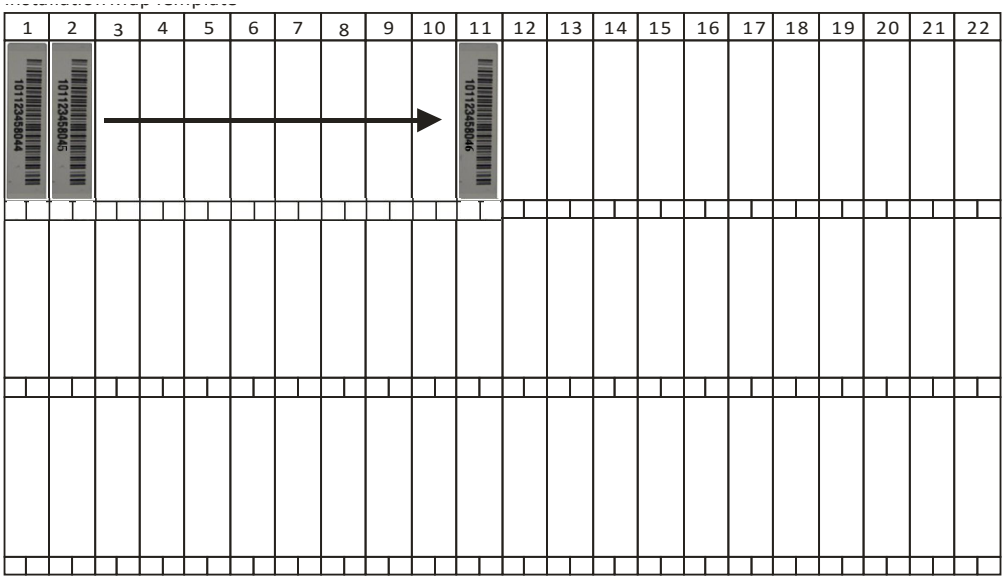
Figure 10

4. APsystems Microinverter System Installation

APsystems Microinverter & Energy Communication Unit Warranty Card

The APsystems Installation Map is a diagram of the physicallocation of each microinverter in your PV installation.Each APsystems microinverter has a removable serialnumber labellocated on the mountingplate. Peel the label and affix it to the respective location on the APsystems installation map.

Installation Map Template



NOTICE

①. The layout of the mocroinverters' serial numbers on the warranty card is only suitable for general arrangement.
②. Warranty card is located in Appendix last page of this manual.
③. You can use Scanning Gun or mobile phone to scan the serial numbers on the map when set ECU (see ECU manual).

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 a two-minute waiting time.

3. The units should start blinking green every 2 seconds five minutes after turning on the AC circuit breaker. This means they are producing power normally, but have not yet connected to the ECU. After the ECU has been plugged in, setup acknowledges the Microinverters, they will start to blink green every 10 seconds.

4. Plug in the ECU and follow the instructions according to the manual for the ECU.

5. The APsystems Microinverters will start to send performance data over ZigBee to the ECU. The time required for all the Microinverters in the system to report to the ECU will vary with the number of Microinverters in the system. You can verify proper operation of the APsystems Microinverters via the ECU. See the ECU Installation and Operation Manual for more information.

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

6.1.1 Start up LED

One quick red light followed by three 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 (10 sec. gap) - Producing power and communicating with ECU
Flashing Fast Green (2 sec. gap) - Producing power and not communicating with ECU over 60mins
Flashing Red - Not producing power
Steady Red - Electrode assembly ground fault protection

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.After the ground fault error is fixed, follow the instructions in the ECU Installation and Operation Manual to clear this GFDI error reporting.

6.1.4 Other Faults

All other faults are reported to the ECU. Refer to the ECU Installation and Operation Manual for a list of additional faults and troubleshooting procedures.

⚠ WARNING

Only qualified personnel should directly handle the APsystems microinverter.

⚠ 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 three short LED flashes.

6. Troubleshooting

6.2 Troubleshooting a non-operating APsystems Microinverter

There are two possible overall areas of trouble:
A. The Microinverter itself may be having problems.
B. The Microinverter itself is working fine but it is having trouble communicating with the ECU. The items below refer to Microinverter issues, not communication issues (addressed in the ECU manual).

A quick way to tell whether the issue is the Microinverter or communication problem with the ECU:

1. **Diagnosing from the Microinverter:** A red light – either blinking or solid on the Microinverter, or no light at all. No light, or a red light, means it is definitely a Microinverter problem.
2. **Diagnosing from the ECU:**
   a. No-Data-Display: This is probably a communication issue- not a Microinverter problem.
   b. Problems with erratic display: Data is displayed for some period and then no data is displayed: most likely a communication issue.
   c. 0 watts, or 2 watts: Possibly a Microinverter problem
   d. Erratic data display that is not coordinating with data displays from other units: most likely a Microinverter problem.

To troubleshoot a non-operating APsystems Microinverter, Follow the steps below in order:

1. Verify the utility voltage and frequency are within ranges shown in the Technical Data section of this manual.
2. Check the connection to the utility grid. Verify utility power is present at the inverter in question by removing AC, then DC power. **Never disconnect the DC wires while the microinverter is producing power.** Re-connect the DC module connectors and watch for three short LED flashes.
3. Check the AC branch circuit interconnection between all the microinverters. Verify each inverter is energized by the utility grid as described in the previous step.
4. Make sure that any AC breaker are functioning properly and are closed.
5. Check the DC connections between the microinverter and the PV module.
6. Verify the PV module DC voltage is within the allowable range shown in the Technical Data of this manual.
7. If the problem persists, please call APsystems Customer Support.

⚠ WARNING

Do not attempt to repair the APsystems Microinverter. If troubleshooting methods fail, please return the microinverter to your distributor for replacement.

.

6.3 Maintenance

No need to Maintenance.

7. Replace a microinverter

Follow the procedure to replace a failed APsystems Microinverter

A. Disconnect the APsystems Microinverter from the PV Module, in the order shown below:
1. Disconnect the inverter AC connector from the AC Bus.
2. Disconnect the first AC connector in the branch circuit.
3. Disconnect the PV module DC wire connectors from the microinverter.
4. Remove the Microinverter from the PV array racking.

B. Install a replacement Microinverter to the rack. Remember to observe the flashing LED light as soon as the new Microinverter is plugged into the DC cables.

C. Connect the AC cable of the replacement Microinverter o the AC bus.

D. Close the branch circuit breaker, and verify operation of the replacement Microinverter.

8. Technical Data

WARNING

①. Be sure to verify the voltage and current specifications of your PV module match with those of the Microinverter. Please refer to the datasheet or usermanual which can be download from APsystems website www.APsystems.com.

②. You must match the DC operating voltage range of the PV module with the 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

8.1 QS1A Microinverter Datasheet

Region		Canada
Model		QS1A-NA
Input Data (DC)		
Recommended PV Module Power (STC) Range		250Wp-440Wp+
MPPT Voltage Range		30V-52V
Operation Voltage Range		16V-55V
Maximum Input Voltage		60V
Startup Voltage		20V
Maximum Input Current		13.3A×4
Maximum DC short circuit current		15A×4
Output Data (AC)		
Maximum Continuous Output Power		1500W
Nominal Output Voltage/Range		240V/211V-264V
Adjustable Output Voltage Range		150V-280V
Nominal Output Current		6.25A
Maximum Units Per Branch		2units per 20A AC breaker
Nominal Output Frequency/Range		60Hz/59.3Hz-60.5Hz
Adjustable Output Frequency Range		55Hz-65Hz
Output Power Factor Rating		>0.99
Total Harmonic Distortion		<3%
Maximum Output Fault Current (AC) And Duration		47.3Apk，1.4ms of duration
Efficiency		
Peak Efficiency		96.5%
Nominal MPPT Efficiency		99.5%
Night Power Consumption		30mW
Mechanical Data		
Operating Ambient Temperature Range		-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 9.1” x 1.6”(281mm × 231mm × 41.3mm)
Weight		9.9lbs(4.5kg)
AC BUS Maximum Current		25A(12AWG)
Enclosure Rating		Type6
Cooling		Natural Convection - No Fans
Utility Interconnection Voltage And Frequency Trip Limits And Trip Times		See NOTE 1 Below
Trip Limit And Trip Time Accuracy	Voltage	+/-2V
	Frequency	+/-0.1H
	Alternate Trip times	See NOTE 1 Below
Features		
Communication		Wireless
Transformer Design		High Frequency Transformers, Galvanically Isolated
Monitoring		Via EMA* Online Portal
Warranty		10 Years Standard ; 25 Years Optional
Certificate&Compliance		
Safety And EMC Compliance		UL1741; CSA C22.2 No. 107.1-16; NOM-001-SCFI-1993
Grid Connection Compliance		IEEE1547

8. Technical Data

Note 1: Utility Interconnection Voltage and Frequency Trip Limits and Trip Times

Voltage and frequency limits for utility Interaction				
Condition	Simulated utility source		Maximum time (sec) (cycles) at 60 Hza before cessation of current to the simulated utility	trip time accuracy
	Voltage (V)	Frequency (Hz)		
A	< 0.50 Vnor	Rated	0.16	+/-80ms
B	0.50 Vnor ≤ V < 0.88 Vnor	Rated	1	+/-200ms
C	1.10 Vnor < V < 1.20 Vnor	Rated	1	+/-200ms
D	1.20 Vnor ≤ V	Rated	0.16	+/-80ms
E	Rated	f > 60.5	0.16	+/-200ms
F	Rated	f < 59.3	0.16	+/-200ms

*APsystems online Energy Management Analysis (EMA) platform

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Specifications subject to change without notice - please ensure you are using the most recent update found at www.APsystems.com

2020/07/22 Rev1.0

9.Wiring Diagram

9.1 Single-phase wiring diagram

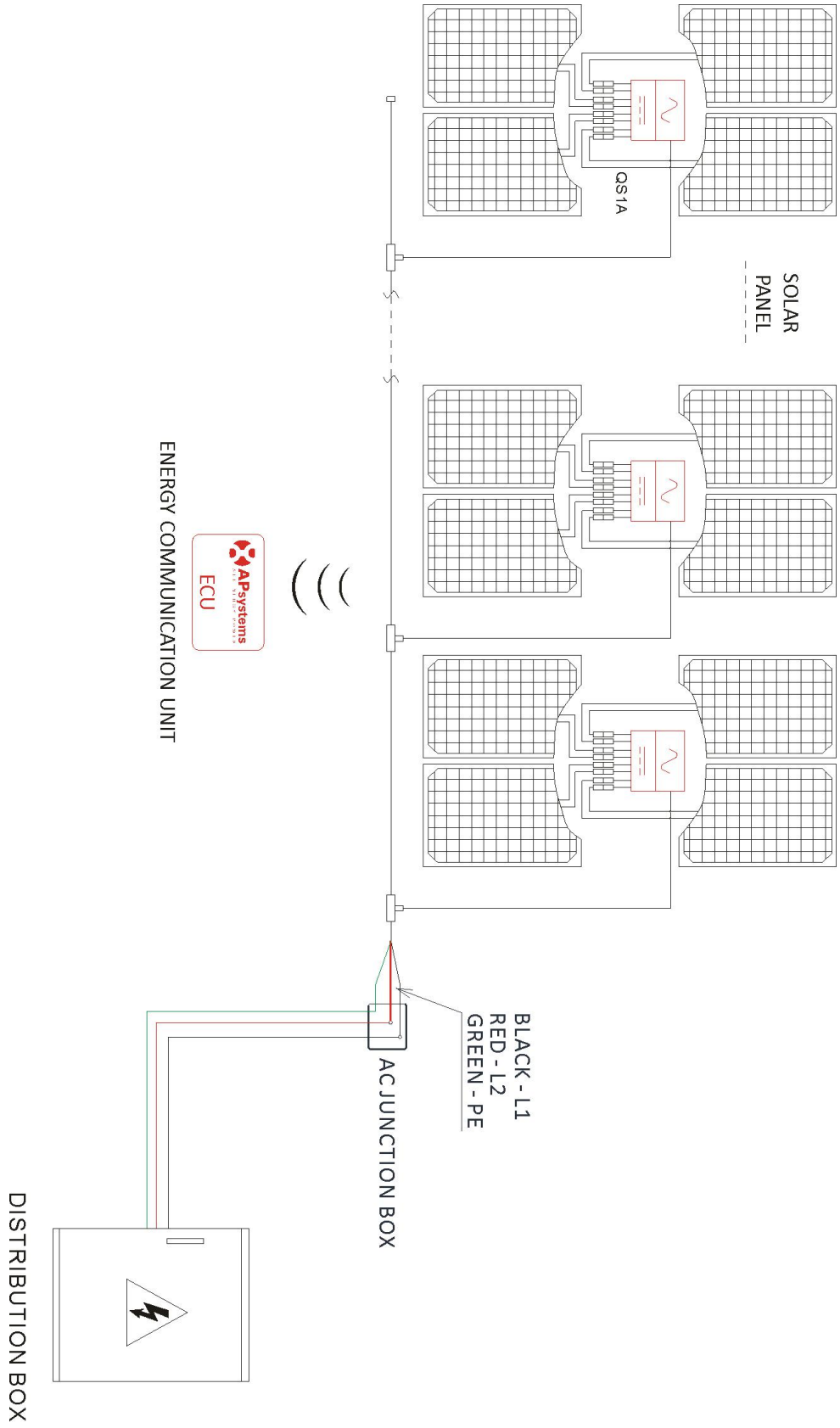
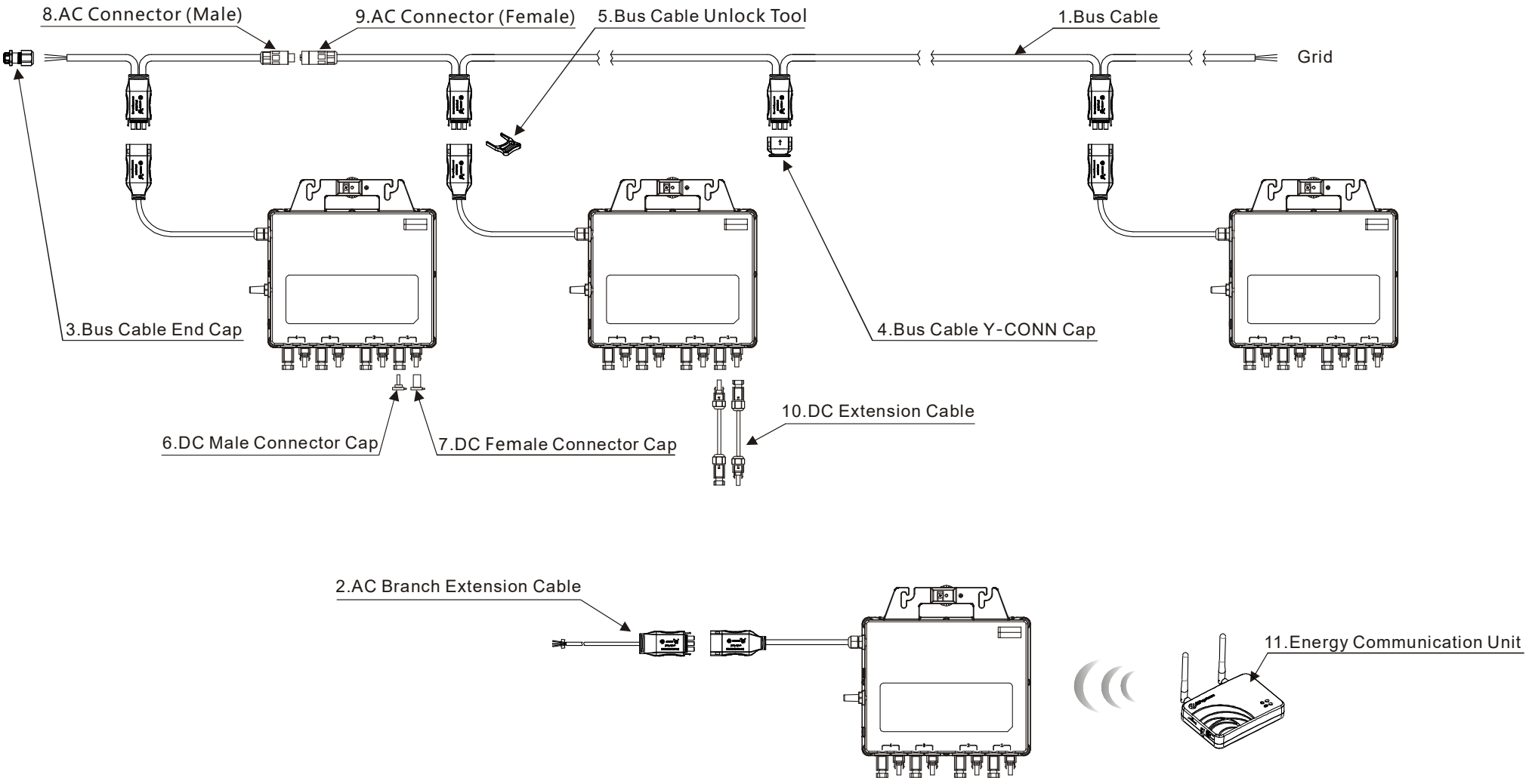


Figure11

10.QS1A Accessory

10.1 Wiring Diagram



10.2 Accessories Summary

Category		Part NO.	Name	Pic
1	Bus Cable (Mandatory)	2322301303	Y3 Bus Cable(12AWG,TC-ER cUL,2m,BK-RD-GN)	
		2322401303	Y3 Bus Cable(12AWG,TC-ER cUL,4m,BK-RD-GN)	
2	AC Branch Extension Cable (Optional)	2334075242	Y3 Br. Ext-Cable(18AWG,TCER cUL,2m,BK-RD-GN)	
3	Bus Cable End Cap (Mandatory)	2060700007	3/4-wire Bus Cable End Cap	
4	Bus Cable Y-CONN Cap (Optional)	2061702007	Bus Cable Y-CONN Cap	
5	Bus Cable Unlock Tool (Mandatory)	2352000001	Y Bus Cable Unlock Tool	
6	DC Male Connector Cap (Optional)	2060401006	DC Male Connector Cap (MC4)	
7	DC Female Connector Cap (Optional)	2060402006	DC Female Connector Cap (MC4)	
8	AC Connector (Male) (Optional)	2300531032	25A AC Male Connector (EN,3-wire)	
9	AC Connector (Female) (Optional)	2300532032	25A AC Female Connector (EN,3-wire)	
10	DC Extension Cable (Optional)	2310310274	1m DC Extension Cable (MC4)	
		2310360214	2m DC Extension Cable (MC4)	
11	Energy Communication Unit (Optional)	——	ECU-R (ECU-C)	

APsystems Microinverter &Energy Communication Unit

Warranty Card

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

Installation Map Template

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22