



Installation/User Manual

APsystems YC500-A Photovoltaic Grid-connected Inverter

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TABLE OF CONTENTS

IMPORTANT SAFETY INSTRUCTIONS	1
Radio interference statement	2
APsystems YC500-A System Introduction	3
APsystems microinverter system installation	6
Additional installation components from APsystems	6
Required parts and tools from installer	6
Installation procedures	7
Step 1 – Installing the AC Branch Circuit Junction Box	
Step 2 – Attaching the APsystems microinverters to the racking or the PV module frame	8
Step 3 – Connecting the APsystems microinverter to the PV module	9
Step 4 – Ground the system	10
Step 5 – Connecting APsystems microinverters to the AC cables	11
Step 6 – Completing the APsystems installation map	12
APsystems microinverter system operating instructions	13
Troubleshooting	14
• Status indications and error reporting	14
• Operation LED	14
• GFDI error	14
• Other faults	14
Troubleshooting a non-operating APsystems microinverter	15-16
Replace a microinverter	17
Technical data	18-19
Efficency curves	20
Wiring diagrams	21
• Sample wiring diagram – 120V/240V split phase	21
• Sample wiring diagram – 120V/ 208V three phase	22

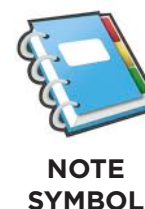
IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE 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.*

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.



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



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 PV – array.
- ✓ Be aware that the body of the APsystems microinverter is the heat sink and can reach high temperatures. 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 (844-666-7034) to obtain an RMA number and start the replacement process. Damaging or opening the APsystems microinverter will void the warranty.

Radio Interference Statement

RADIO INTERFERENCE STATEMENT

FCC compliance: The equipment complies with the limits for a class B digital device, pursuant to part 15 of the FCC Rules, 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 were 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 technician for assistance.

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

APsystems YC500-A System Introduction

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

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

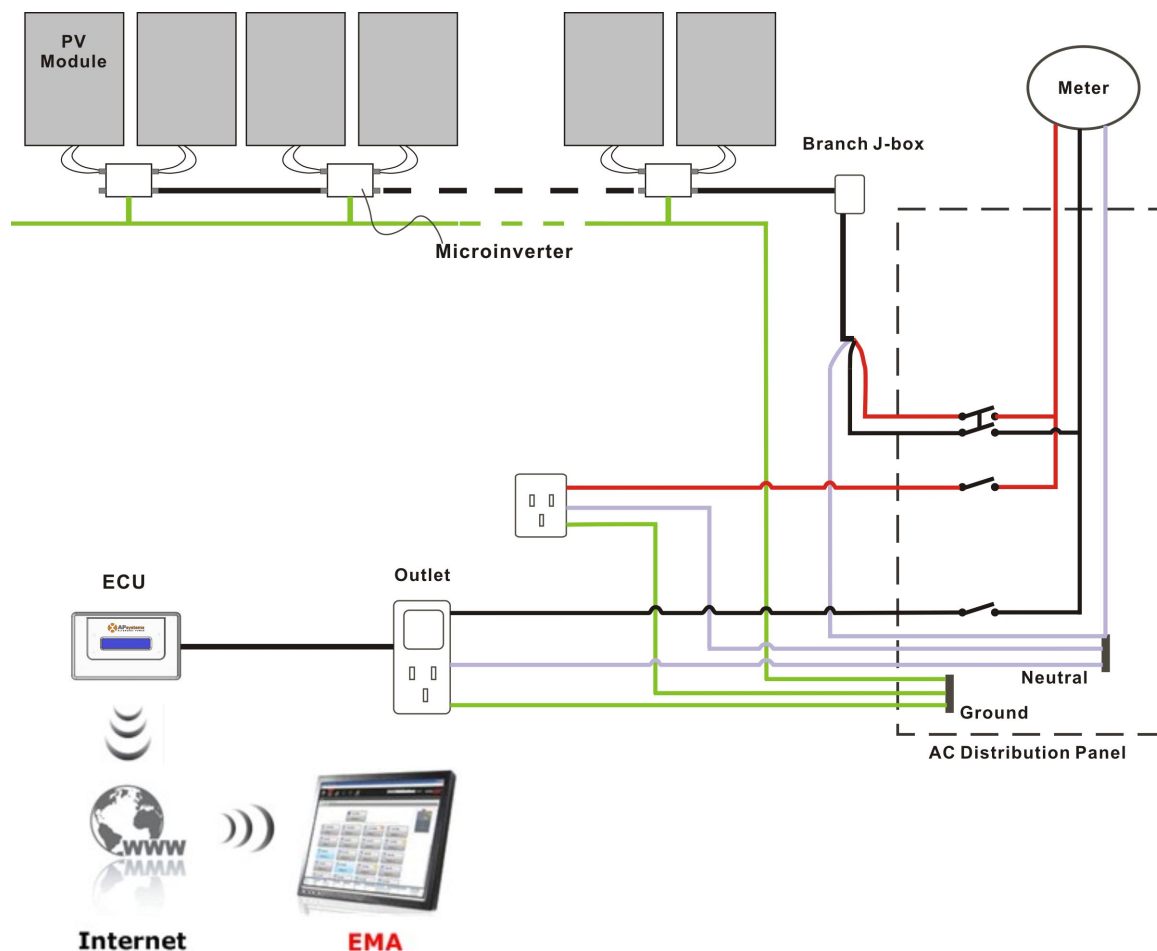


Figure 1

APsystems microinverters maximize PV energy production

Each PV module has individual Maximum Power Point Tracking (MPPT) controls, which ensures that the maximum power is exported 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-array. APsystems microinverters are designed to operate at full power at ambient outdoor temperatures of up to 149°F (65°C). The inverter housing is designed for outdoor installation and complies with the NEMA 6 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 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.)

The APsystems 500 series microinverters connect with the split-phase grid, and operate with most 60 and 72 cell PV modules. For more information, please see the Technical Data page (p.19) of this manual.

MODEL NUMBER	AC GRID	PV MODULE	MODULE CONNECTOR
YC500	60Hz/240V	60,72 Cell	MC-4 Type or Customize

Maximum units per branch of YC500

Max. parallel combination of APsystems modules = 7/branch for 20A breaker (14 PV modules)

The APsystems YC500 has two independent DC inputs, each with independent MPPT control and data monitoring.

The following figure shows the APsystems YC500 microinverter schematic:

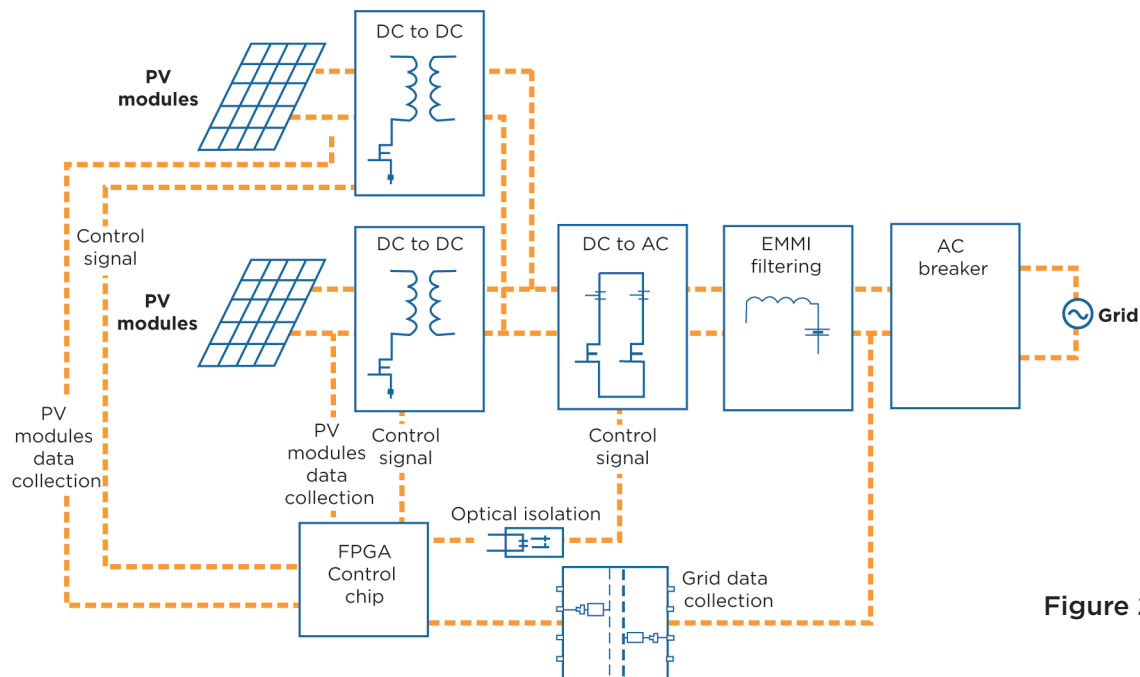


Figure 2

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: Perform all electrical installations in accordance with local electrical codes.

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

WARNING: 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.

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, when the system has been connected to the electrical grid.



Additional installation components from Apsystems

- * AC branch end cable (1 per branch, sold separately - P/N: AC Cable - F)
- * Protective end cap (1 per branch, sold separately - P/N: End Cap - F)
- * AC Extension Connector Cable (if required - P/N: AC - EXT)
 - Available in 1m, 2m, and 4m lengths.

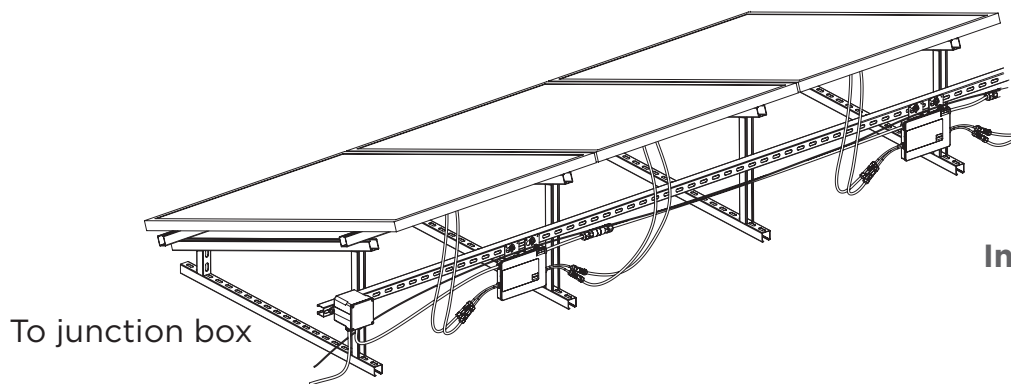
Required parts and tools from installer

In addition to your PV array and its associated hardware, the following tools are required for assembly:

- * One AC connection junction box per branch circuit
- * Mounting hardware suitable for module racking
- * Sockets and wrenches for mounting hardware
- * Continuous grounding conductor and grounding washers
- * Phillips screwdriver
- * Torque wrench

APsystems microinverters are designed to only operate when they can sense power coming from the grid. Even if they are plugged into the PV array, they will not turn themselves on until they can read power from the grid.

WARNING: Do NOT connect APsystems 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.



**YC500A
Installation**

Figure 3

Step 1 - Installing the AC branch circuit junction box

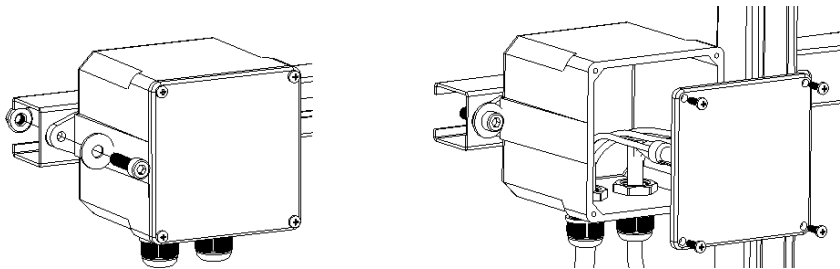


Figure 4

- A.** Install an appropriate junction box at a suitable location on the PV racking system (typically at the end of a branch of modules).
- B.** Connect the open wire end of the AC branch end cable into the junction box using an appropriate gland or strain relief fitting.
- C.** Wire the conductors: L1- RED; L2 - BLACK; NEUTRAL -WHITE.

NOTE: Be sure to size the AC wire to account for voltage drop between the AC branch circuit junction box and the point of utility interconnection. (See wire size diagram on following page.)



YC500 number per branch

EXTERNAL WIRE SIZE (AWG)	2	3	4	5	6	7*	8	9
12	370.7	237.1	167.9	124.3	93.6	70.2	51.4	35.7
10	593.1	379.4	268.6	198.9	149.7	112.3	82.3	57.1
8	926.8	592.9	419.6	310.7	233.9	175.5	128.6	89.3
6	1482.8	948.6	671.4	497.1	374.3	280.8	205.7	142.9

*7 is the maximum number/branch with a 20 amp breaker

Step 2 – Attaching the APsystems microinverters to the racking or the PV module frame

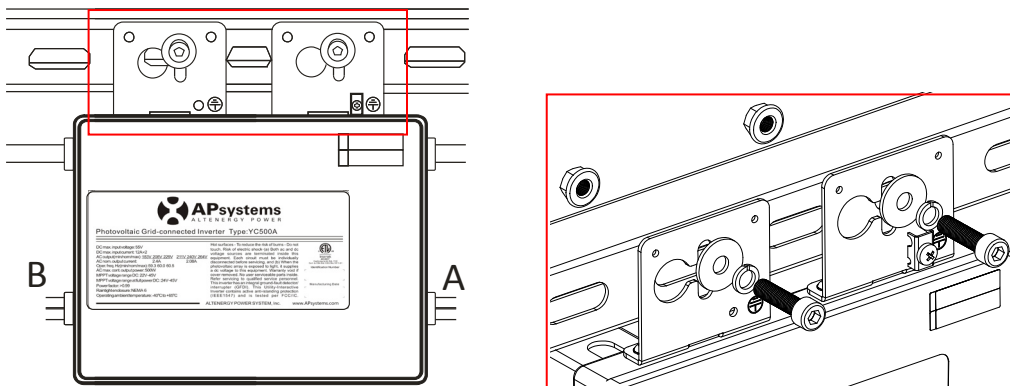


Figure 5

- A. Mark the location of the microinverter on the rack, keeping in mind 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.
- C. **GROUNDING WASHER:** If using the appropriate grounding washer (check with a licensed electrician), attach the grounding washer between the PV racking frame and the microinverter.

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



WARNING: Do not mount the microinverter in a location that allows exposure to direct sunlight. Allow a minimum of 3/4" (1.5 cm.) between the roof and the bottom of the microinverter to allow proper air flow.



NOTE: Connecting cables (steps 3-5) can be done in any order but DO NOT energize the utility power grid until all the steps are completed.



Step 3 – Connecting APsystems microinverters to the PV module

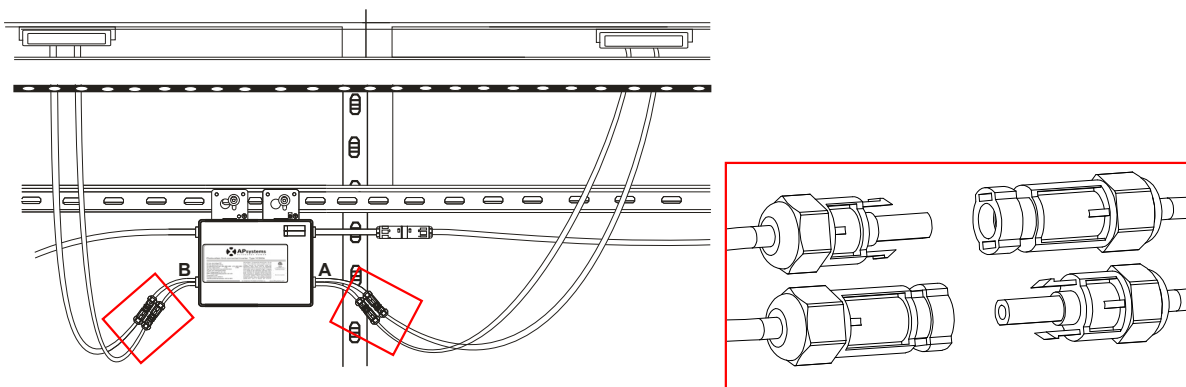
Connect the DC cables from the PV modules to the microinverter per the diagram below:

Note: When plugging in the DC cables, the microinverter should immediately blink red then green three times. This will happen as soon as the cables are plugged in and will show that the microinverter is functioning correctly. This entire check function will start and end within 5 seconds of plugging in the unit, so pay careful attention to these lights when connecting the DC cables. This only occurs when DC voltage is first applied. The LED will not flash when the second panel is connected.



Photovoltaic panels and microinverter DC input cable connection

Figure 6



MC4 Connectors

WARNING: Ensure that all AC and DC wiring is correct. Check that none of the AC and DC wires are pinched or damaged. Be sure that all junction boxes are properly closed.



Step 4 - Ground the system

NOTE: If you already used grounding washers (WEEB) to ground the microinverter chassis to the PV module racking as described in Step 2C, skip this step.

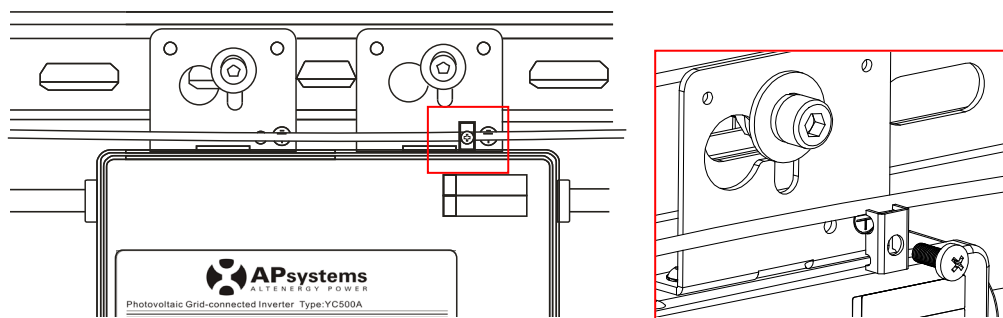


Figure 7

Each APsystems microinverter comes with a ground clamp that can accommodate a single #6 awg strand and #4 awg solid conductor. Check your local electrical code for grounding conductor sizing requirements. Connect the grounding electrode conductor to the microinverter ground clamp.

NOTE: The AC output neutral is not bonded to ground inside the microinverter.



Step 5 - Connecting the APsystems microinverter to the PV module

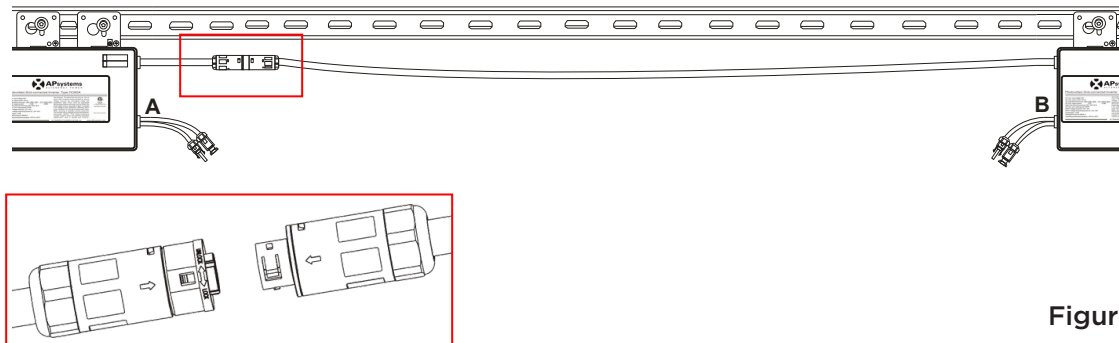


Figure 8

- A. Check the microinverter datasheet for the maximum allowable number of microinverters on one AC branch circuit.
- B. Plug the AC female connector of the first microinverter into the male connector of the next microinverter, and so on, to form a continuous AC branch circuit.
- C. Install a protective end cap on the open AC connector of the last microinverter in the AC branch circuit.

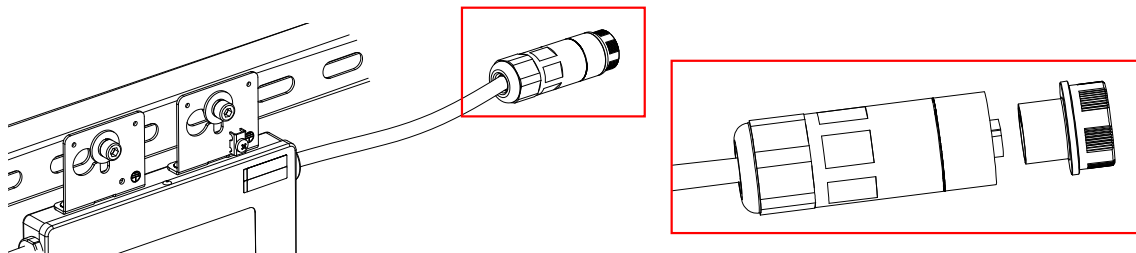


Figure 9

WARNING: Do NOT exceed the maximum number of microinverters in an AC branch circuit, as displayed on the unit label.



Step 6 - Completing 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 accommodate labels in vertical or horizontal orientation to meet all field PV configurations.

1. Each APsystems microinverter has a removable serial number label. Peel each label off, and affix it to the respective location on the APsystems installation map.
2. Fill out the warranty cards. The warranty card and installation map are needed to register the site in the EMA.
3. Complete the EMA Installer Account Registration form found on the APsystems website. APsystems will create the EMA account and email you the account information. Then you can use the EMA website to view detailed performance data for the PV system.

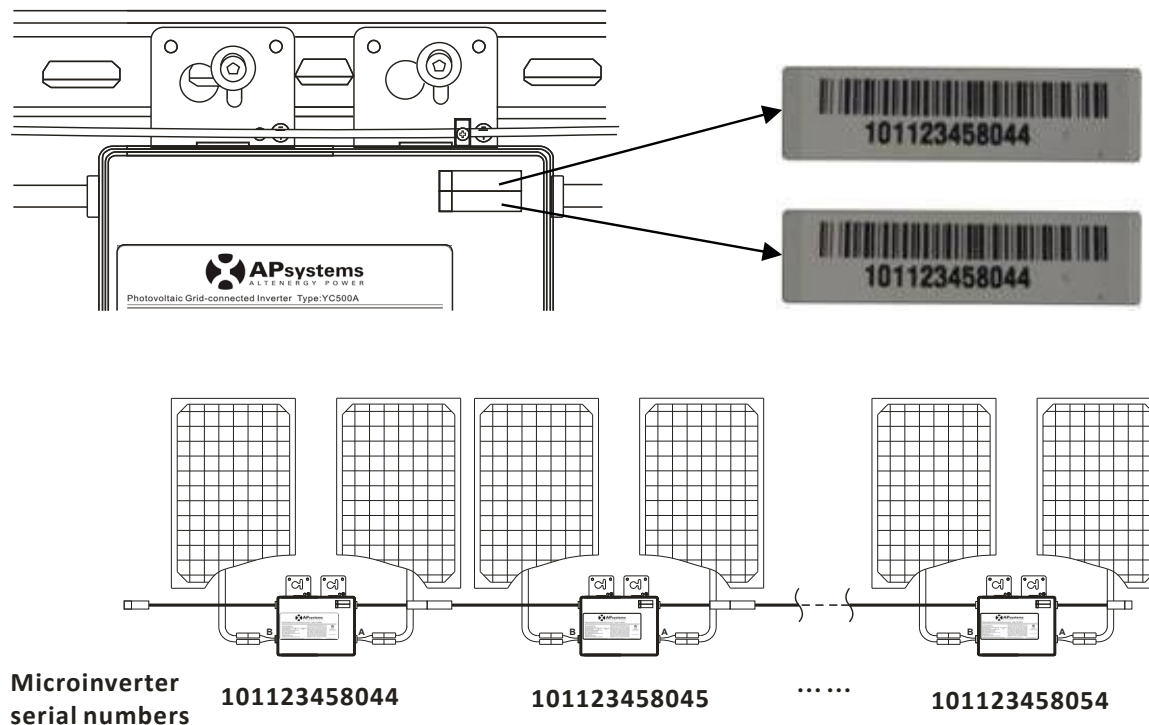


Figure 10

APsystems Microinverter System Operating Instructions

To operate the ASystems microinverter PV system:

1. Turn ON the AC circuit breaker on each microinverter branch circuit.
2. Turn ON the main utility grid AC circuit breaker. Your system will start producing power after a five-minute wait 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.
4. Plug in the ECU and follow the instructions according to the manual for the ECU.
5. After the ECU has been plugged in and acknowledges the microinverters, they will start to blink green every 10 seconds.
6. 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. Once communications have been established between the ECU and the inverters, the microinverters will start to send performance data over power line to the ECU. You can verify proper operation of the ASystems microinverters via the ECU. See the ECU Installation and Operation Manual for more information.

Troubleshooting

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

Status indications and error reporting

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

Operation LED

Flashing Slow Green (10 sec. gap) – Producing power and communicating with ECU

Flashing Fast Green (2 sec. gap) – Producing power but not communicating with ECU

Flashing Red – Not producing power

GFDI Error

A solid red LED indicates the microinverter has detected a DC Voltage 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.

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: Never disconnect the DC wire connectors under load. Ensure that no current is flowing in the DC wires prior to disconnecting.

WARNING: Always disconnect AC power before disconnecting the PV module wires from the APsystems microinverter. Either disconnecting by the appropriate AC circuit breaker or unplugging the first AC connector of the first microinverter in a branch circuit is suitable as a means of disconnection.



WARNING: 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 four short LED flashes - one red, and three green.



A non-operating APsystems microinverter

There are two possible overall areas of trouble:

- A. The microinverter may be having problems, or
- B. The microinverter 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 a 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 more than likely 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 one red followed by three short green LED flashes.

Troubleshoot a Non-operating APsystems microinverter. . .

continued on next page

...TROUBLESHOOT A NON-OPERATING APSYSTEMS MICROINVERTER

3. Check the AC branch circuit interconnection between all the microinverters. In rare cases, the wire in the AC plug may have worked loose. This will need to be reviewed by a qualified electrician. Verify that each inverter is energized by the utility grid as described in the previous step.
4. Make sure that all AC breakers are functioning properly and are closed.
5. Check the DC connections between the microinverter and the PV module.
6. Verify that the PV module DC voltage is within the allowable range shown in the Section 8 Technical Data of this manual.
7. If the problem persists, please call APsystems Customer Support at 844-666-7035.

WARNING: Do not attempt to repair the APsystems microinverter. If troubleshooting methods fail, please contact APsystems Technical Services at 844-666-7034 for a Return Merchandise Authorization (RMA).



Replace a Microinverter

Follow this procedure to replace a failed APsystems microinverter

A. 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 AC connector from the adjacent inverters 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 and the neighboring microinverter to complete the branch circuit connections.

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

WARNING: Be sure to verify the voltage and current specifications of your PV module match that those of the microinverter. Refer to the APsystems website for a list of approved PV modules.

WARNING: You must match the DC operating voltage range of the PV module with the allowable input voltage range of the APsystems microinverter.

WARNING: The maximum open circuit voltage of the PV module must not exceed the specified maximum input voltage of the APsystems microinverter.



APsystems YC500A Microinverter Datasheet

Input Data (DC)

Recommended PV Module Power (STC)Range	180W-310W
MPPT Voltage Range	22V-45V
Operation Voltage Range	16V-52V
Maximum Input Voltage	55V
Startup Voltage	22V
Maximum Input Current	12A x 2

Output Data (AC)

Nominal Output Voltage	208V ¹	240V ¹
Maximum Continuous Output Power	500W	500W
Nominal Output Current	2.4A	2.08A
Default Output Voltage Range	183V-229V ²	211V-264V ²
Maximum Output Fault Current (peak)	33.4A	54.8A
Maximum Output Fault Current (RMS)	2.79A	4.85A
Maximum Output Fault Current Duration	1.875ms	1.639ms
Reactive Current	0.1A	
Extended Output Voltage Range	181V-298V	
Nominal Output Frequency	60Hz	
Default Output Frequency Range	59.3Hz-60.5Hz ²	
Extended Output Frequency Range	55.1Hz -64.9Hz	
Power Factor	>0.99	
Total Harmonic Distortion	<3%	
Maximum Units per Branch	6 for 20 Breaker ³	7 for 20A Breaker ³

Efficiency

Peak Efficiency	95.5%
CEC Weighted Efficiency	95%
Nominal MPPT Efficiency	99.5%
Night Power Consumption	120mW

Mechanical Data

Operating Ambient Temperature Range	-40° F to +149° F (-40°C to +65° C)
Operating Internal Temperature Range	-40° F to +185° F (-40°C to +85° C)
Storage Temperature Range	-40° F to +185° F (-40°C to +85° C)
Dimensions (W x H x D)	221mm X 167mm X 29mm (8.7" X 6.6" X 1.1")
Weight	5.5lbs/2.5kg
AC BUS	12AWG
Enclosure Rating	NEMA 6
Cooling	Natural Convection

Features & Compliance

Communication	Power line
Design Lifetime	25yrs
Emissions & Immunity (EMC) Compliance	FCC Part15; ANSI C63.4;ICES-003
Monitoring	Life monitoring via EMA software
Safety Class Compliance	UL1741, CSA C22.2 No.107.1-01
Grid Connection Compliance	IEEE1547

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

¹ The default AC output is 240V mode. For 208V mode, please set the AC output range through ECU.

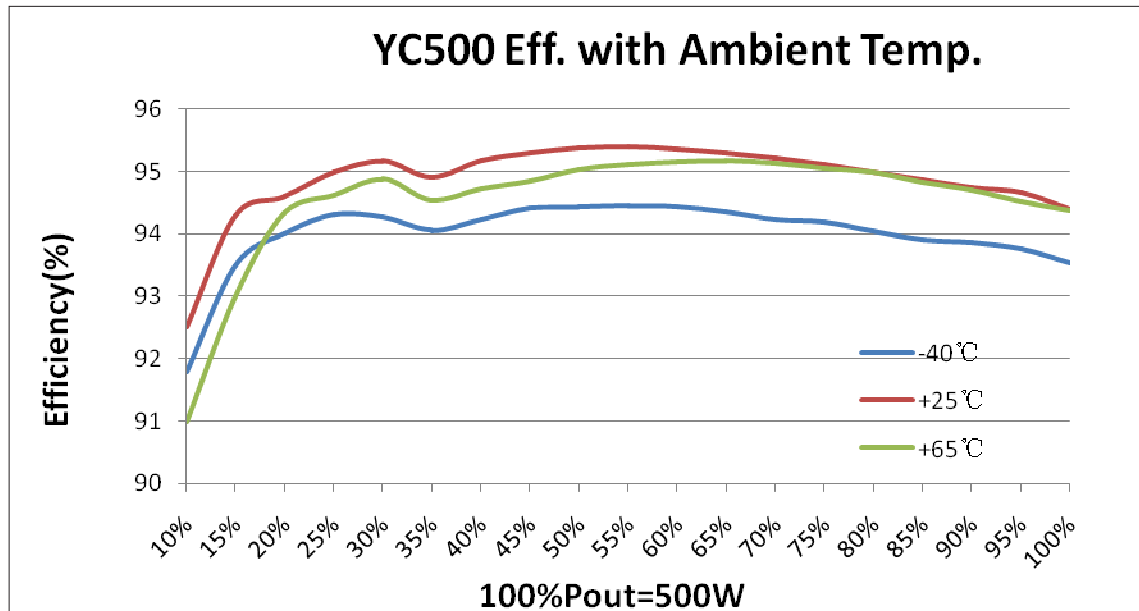
² Programmable through ECU to meet customer need.

³ Depending on the local regulations.

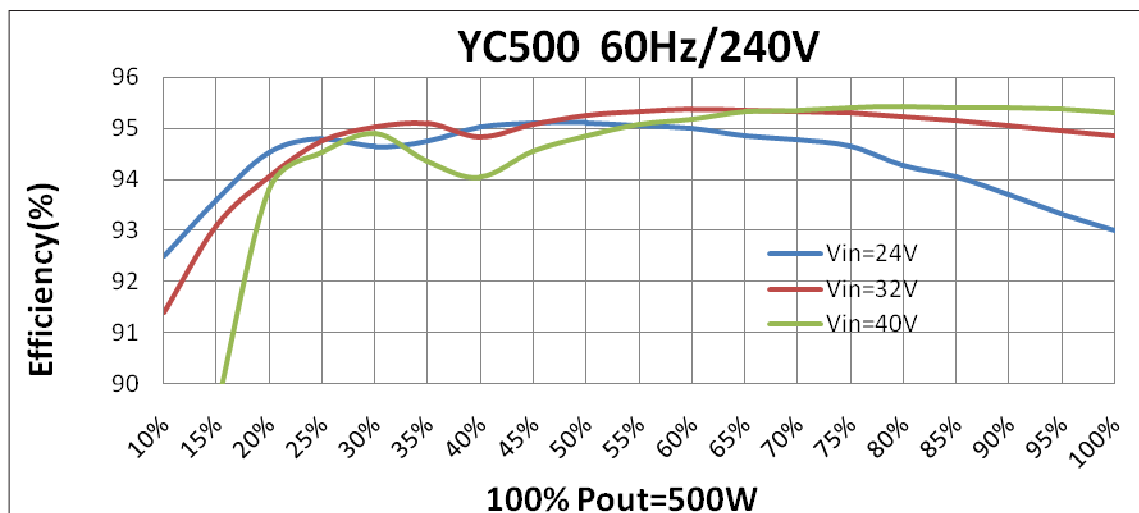
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Efficiency Curves

YC500-A Efficiency-temperature curves



YC500-A Efficiency curves



Sample Wiring Diagrams

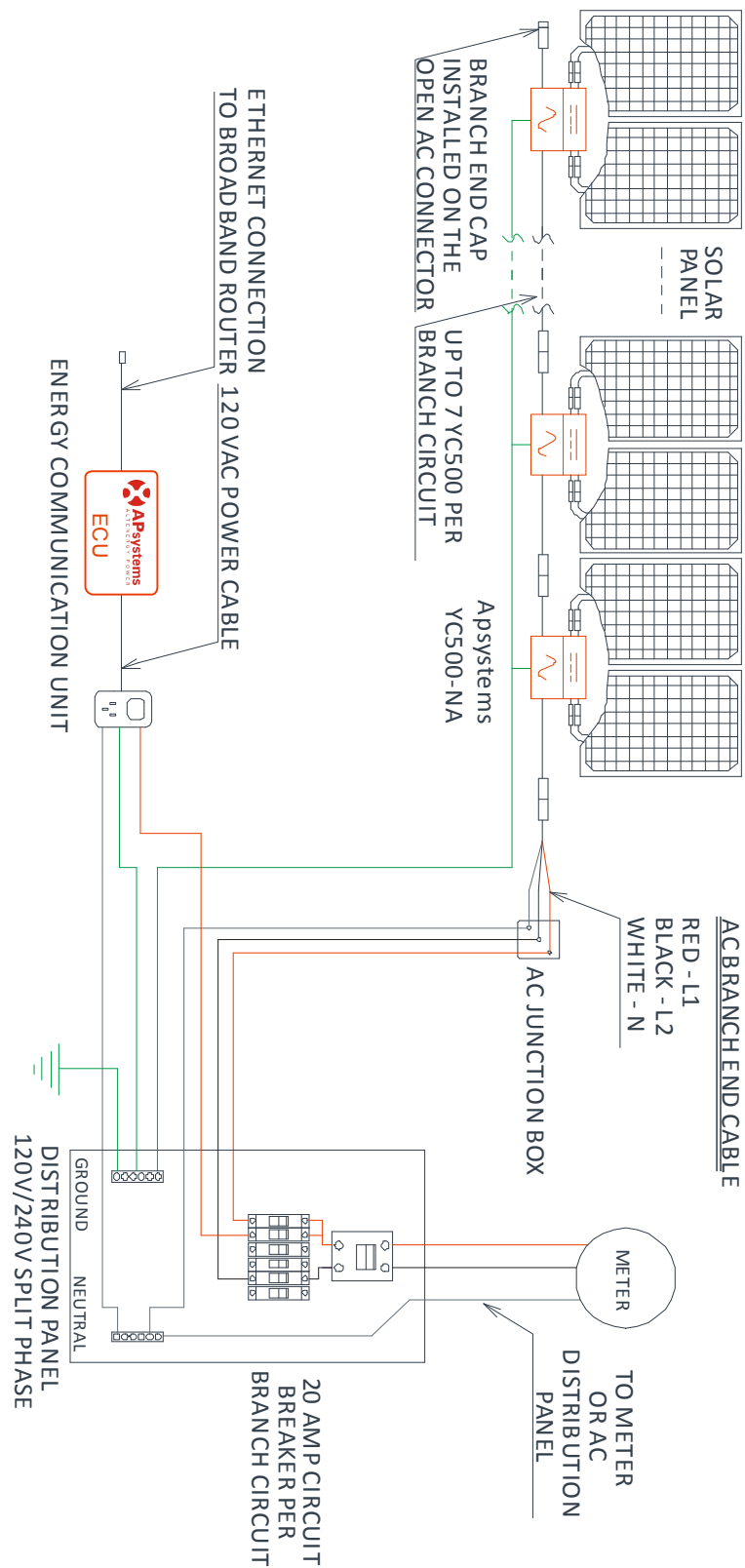


Figure 11

Sample wiring diagram - 120V/208V Three Phase

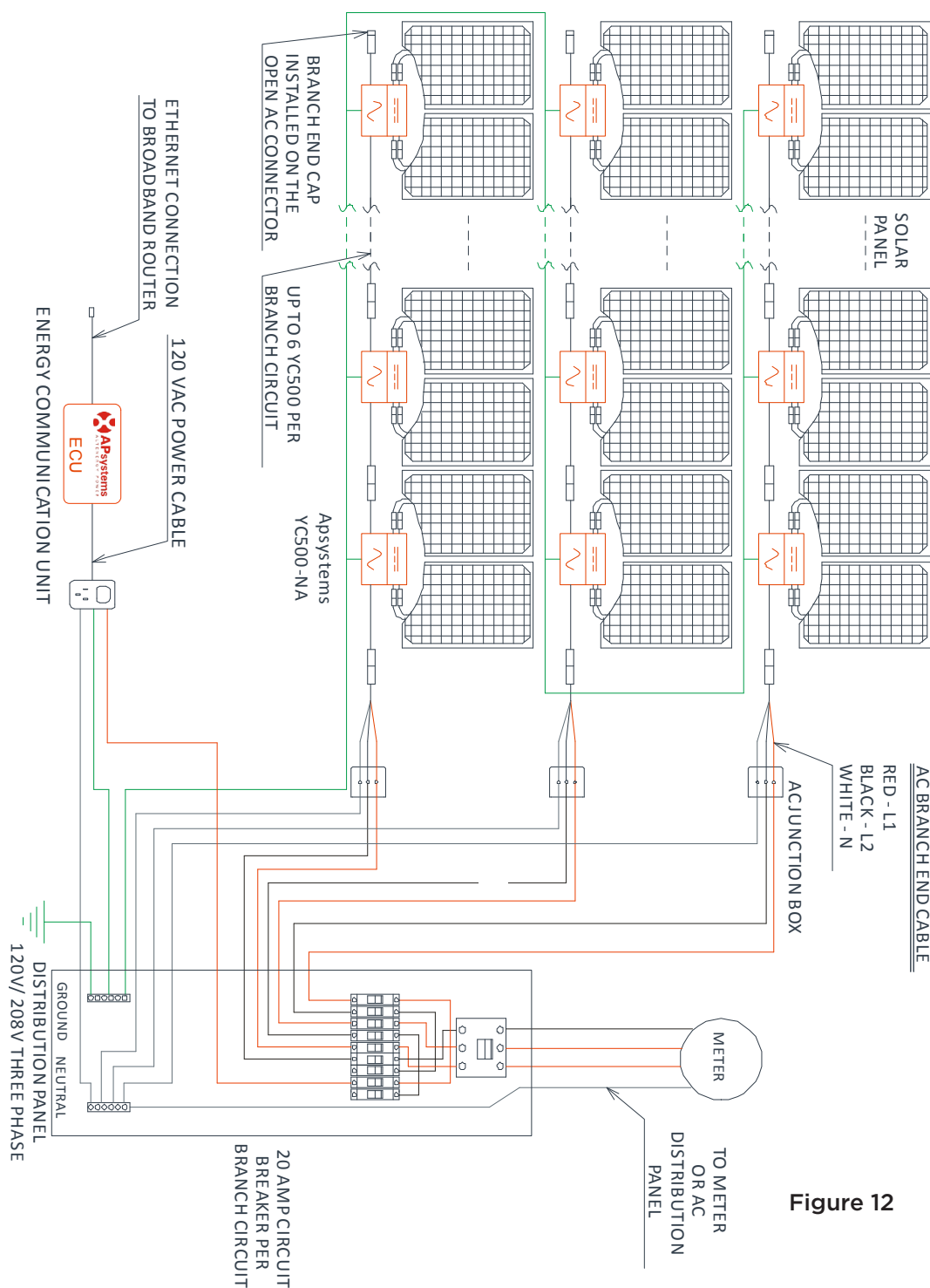


Figure 12

NOTE: The ECU should function properly when connected to L1, L2 or L3.

