APsystems
ALTENERGY POWER

Professional Installers Troubleshooting Guide

MICROINVERTERS COMMUNICATION AND PRODUCTION ISSUES

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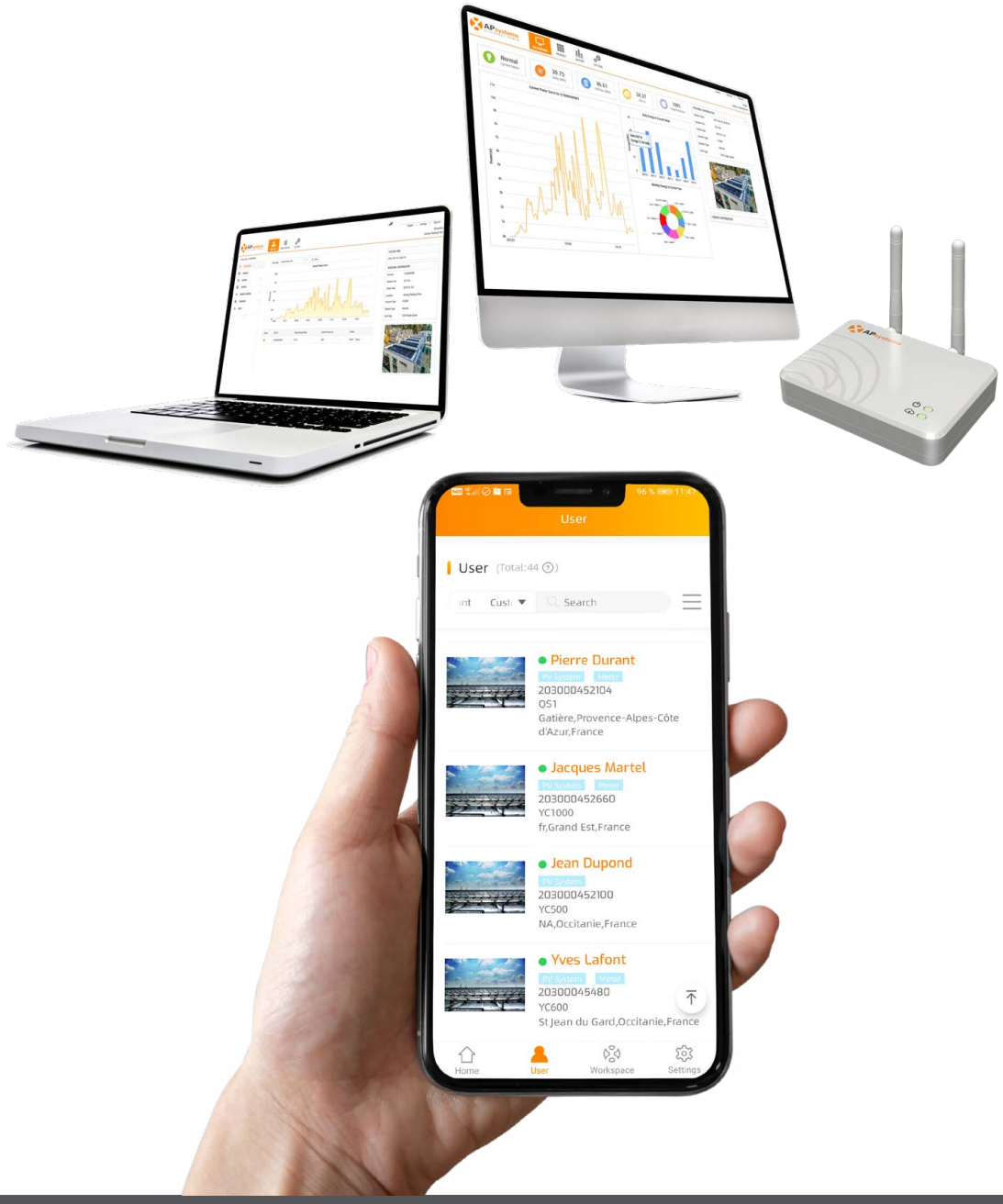
1. Introduction

Warning: This Troubleshooting Guide assumes that the person in charge of the troubleshooting has an Installer EMA account and is familiar with the basic menus and functions of the EMA portal.

This Troubleshooting Guide outlines some guideline in case APsystems microinverters exhibit some production or communication issues. It only addresses Microinverters with Zigbee communication, monitored with Zigbee ECU-R, ECU-C or ECU-B.
During lifespan of a PV system powered by APsystems microinverters, 2 main types of technical issue may occur:

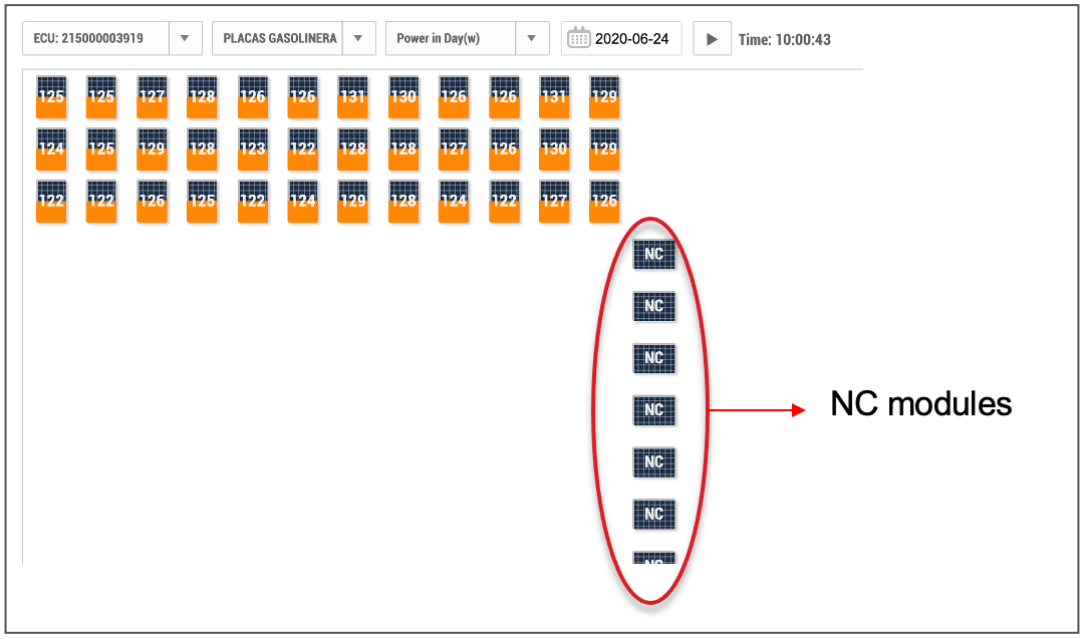
- Communication Issue
- Production Issue



2. Communication Issue - Definition

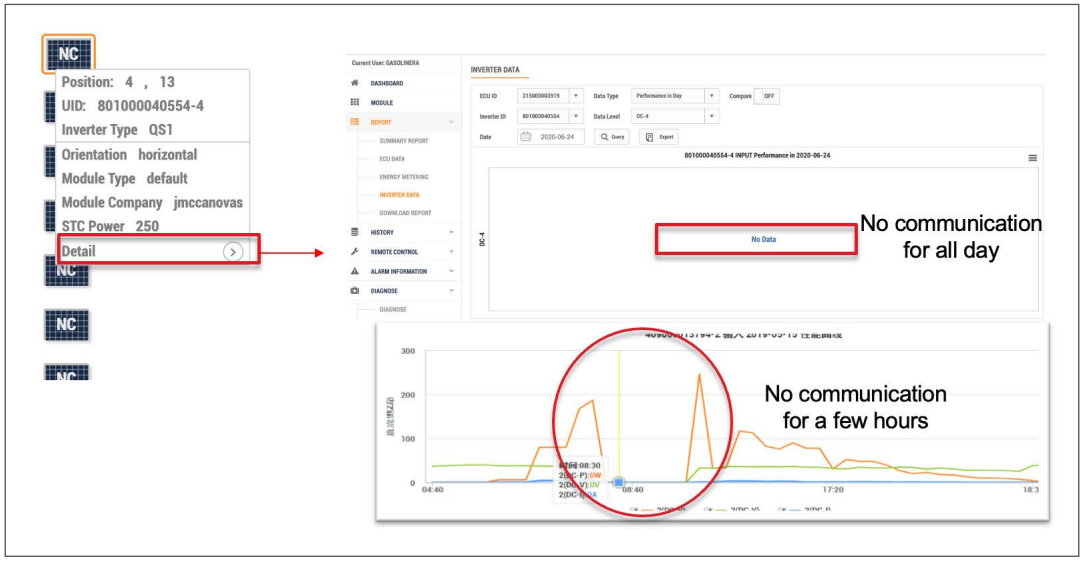
During a “Communication Issue” occurence, the microinverters continue to produce power, but data are not transferred to the EMA portal. Communication Issues can be identified in a different way, but the most direct way is to check the “module” view in the EMA portal.

Typical example for “Communication Issue” is shown below:
Microinverters affected by the Communication Issue are shown as “NC” (No Communication) on the Module View of the PV system.



When checking the “details” of the “NC” modules, 2 types of patterns may occur:

- No Communication during All day: “No data” display
- Loss of Communication during part of the day



3. Production Issue - Definition

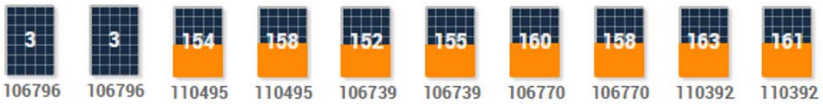
Production Issue covers low power or no power generation.

On the Module View in the EMA, typical behavior of a low power or no power generation displays 0W or 2W, or much lower power than other modules while there is no known shading patterns.

Typical “Module View” of microinverter(s) being impacted by low or no power:

1 channel only:

1 microinverter:



4. ECU Heartbeat - Definition

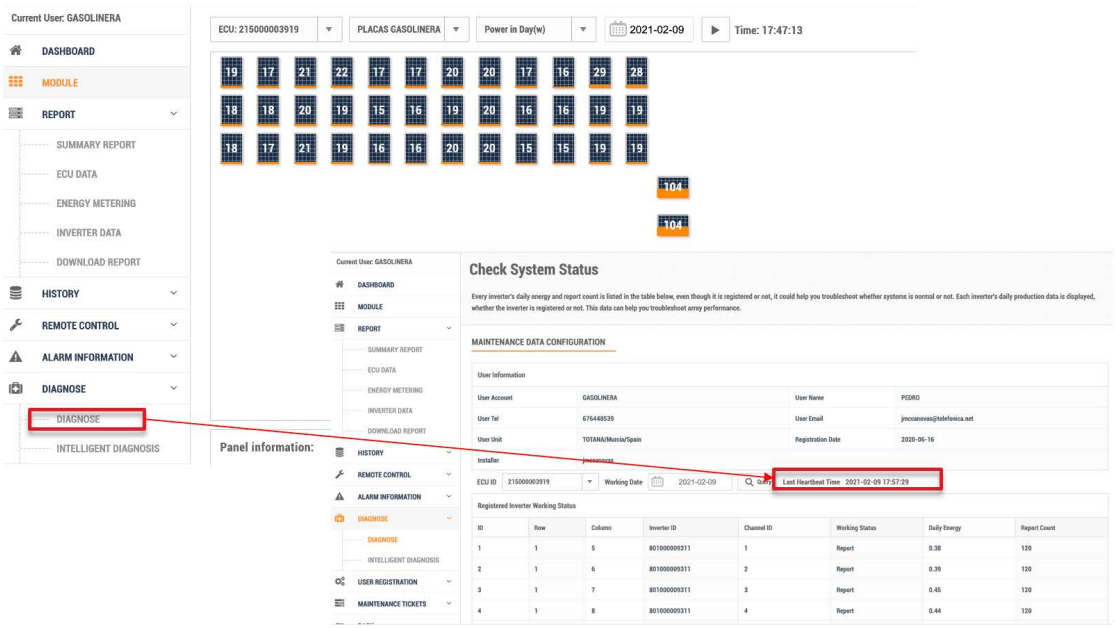
Before going through the trouble-shooting tree in the next chapter, we need to define the “ECU Heartbeat” The ECU Heartbeat feature registers the time of the latest communication and data exchange between the ECU and the EMA server.

Doing troubleshooting:

- If the ECU Heartbeat is registered within the last 30 minutes or hour, we can conclude that the ECU is properly connected to the internet and exchange data with the EMA server. If there is a current heartbeat and there is a communication issue, we can then focus our attention to the communication between the micros and the ECU.
- If there is no heartbeat during the current hour or more, it can mean that
  - ECU is not properly connected to the internet
  - ECU does not exchange data with the EMA server

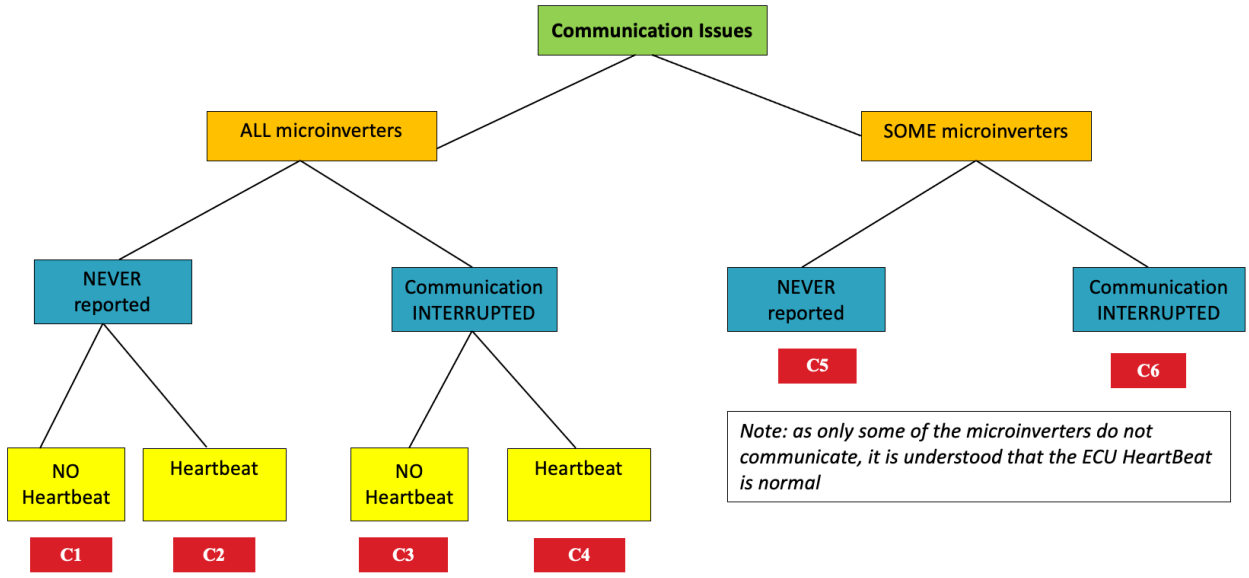
***Note**: the ECU can be properly connected to the internet, but still not able to exchange data with the server due to firewall restrictions per example.*

In the menu “Diagnose” > “Diagnose”, please check “Last Heartbeat Time” information



***Note**: another way to check ECU’s state of connection to EMA server is to check its cloud LED: LED ON means that the ECU is connected to the EMA server, LED OFF means that ECU is disconnected from EMA server.*

5. Communication Issues – Troubleshooting Tree

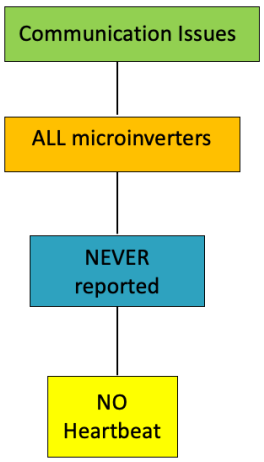


The diagram above summarizes the typical situations (C1 to C6) installer can face when troubleshooting microinverters communication issues.

Each branch of the tree is detailed in the next pages, with some recommendations and troubleshooting tips for each of the situation.

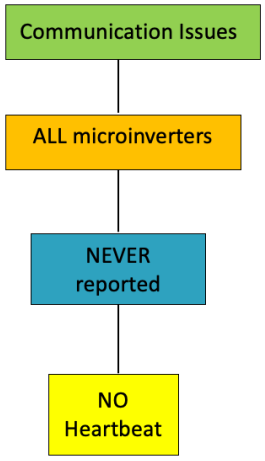
***Note**: sometimes in case of loss of communication (especially when it affects only some of the microinverters), it is recommended to check again the system after a couple of hours. Communication may have been momentarily interrupted (internet signal unstable or heavy network traffic preventing timely access to our EMA server).*
On rare occasion, communication might be interrupted a bit longer.
Despite loss of communication, microinverters continue to produce power.

Communication Issues – C1

All Microinverters **Never reported** **No Heartbeat** (page 1/2)	

#	Recommendations / Check-Points
1	• Check if the ECU is properly powered ON • Power OFF the ECU, wait for 1 mn, then power ON the ECU
2	• Make sure that ECU's WIFI antenna is properly screwed and installed outside of any AC box or cabinet (any metal material could block the signal) • Make sure that the ECU is properly connected to the router: • In case of WIFI connection - please check using the ECU_APP features (See ECU Installation Manual on our libraries on www.APsystems.com) • In case of Ethernet connection - Check and/or change the Ethernet cable - On the router side, check if the internet port is activated or not dedicated to TV for instance - Verify that port used in ECU is the correct one  • If unsuccessful connection with WIFI, please try connection with Ethernet cable • If unsuccessful connection with Ethernet cable, please try WIFI connection

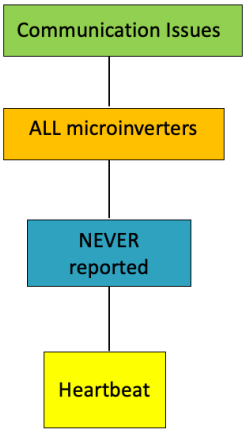
Communication Issues – C1 (continued)

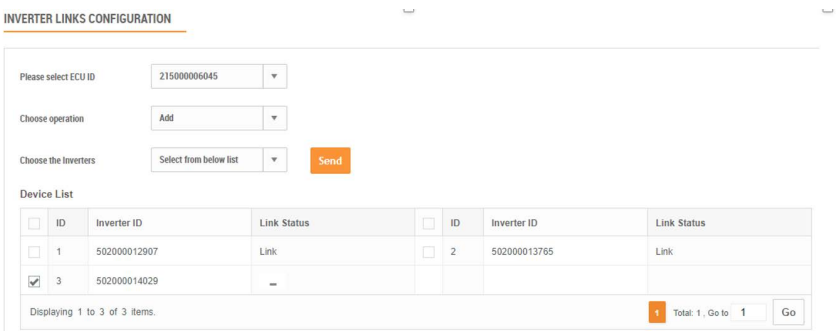
All Microinverters **Never reported** **No Heartbeat** (continued, page 2/2)	

#	Recommendations / Check-Points
3	• Check if there could be network restrictions (firewall or MAC/IP restriction for instance) • Contact your IT team to make sure ports below are open
4	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

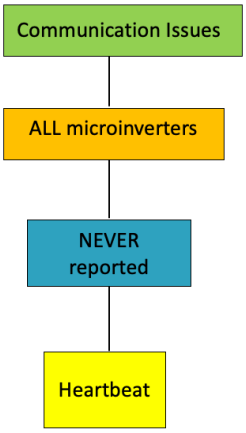
Domain	Port	Protocol
ecu.apsystemsema.com	8995, 8996,8997, 8998, 9227, 9228, 9001, 9002, 9003, 9004	TCP
ecu2.apsema.com	9220, 9222	TCP
	9219, 21	FTP
ecuna.apsema.com	9220, 9222	TCP
	9219, 21	FTP
ecueu.apsema.com	9220, 9222	TCP
	9219, 21	FTP

Communication Issues – C2

All Microinverters **Never reported** **Heartbeat** (page 1/2)	

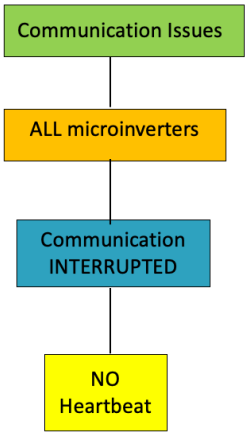
#	Recommendations / Check-Points
1	• **ECU firmware may not be compatible with the microinverters** - Power ON the ECU, connect it to the router (WIFI or Ethernet): the latest firmware shall be uploaded and updated automatically in 5 mins. - If the firmware update does not seem to take place, please leave the ECU powered ON and connected to the router and contact your APsystems local Technical Support Team ***Note**: this situation may occur when installing new micros (for instance DS3) with an ECU shipped prior the availability of the new micros*
2	• **Microinverters have not been registered into the ECU** - Check that the microinverters UIDs (serial numbers) have been properly entered into the ECU and synchronized using the ECU APP features (See ECU Installation Manual on our libraries on www.APsystems.com) - Alternatively, in the EMA portal, check menu Remote Control > ECU Settings and make sure that each microinverter has a "link" active. If a microinverter has no "link", select it, choose "Add" and press "Send" to synchronise the microinverter with the ECU (Link shall be visible after 20 mns) 

Communication Issues – C2 (continued)

All Microinverters **Never reported** **Heartbeat** (continued, page 1/2)	

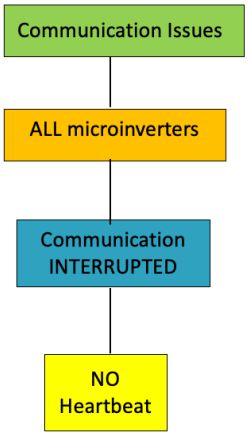
#	Recommendations / Check-Points
3	• **Communication between microinverters and ECU is weak or unstable** too long distance between the ECU and the microinverters or obstacles – large concrete walls, metallic roofs – can block or decrease the intensity of the Zigbee signal • **Try to move the ECU closer to the microinverters** If the ECU needs to be installed too far away from the microinverters, you can replace the default antenna with an extension up to 10 meters: please make sure to select a WIFI antenna 2.4GHz with SMA connectors male/female - Check if the ECU antennas are properly screwed - Make sure the ECU antennas are installed outside of the AC box or any other cabinet - YC1000 (501 or 503- serial number): make sure the microinverter antenna is properly installed
4	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Communication Issues – C3

All Microinverters **Communication Interrupted** **No Heartbeat** (Page 1/2)	

#	Recommendations / Check-Points
1	• Check if the ECU is properly powered ON • Power OFF the ECU, wait for 1 mn, then power ON the ECU
2	• Make sure that ECU's WIFI antenna is properly screwed and installed outside of any AC box or cabinet • Make sure that the ECU is properly connected to the router: • In case of WIFI connection - please check using the ECU_APP features (See ECU Installation Manual on our libraries on www.APsystems.com) • In case of Ethernet connection - Check and/or change the Ethernet cable - On the router side, check if the internet port is activated or not dedicated to TV for instance - Verify that port used in ECU is the correct one  • If unsuccessful connection with WIFI, please try connection with Ethernet cable • If unsuccessful connection with Ethernet cable, please try WIFI connection

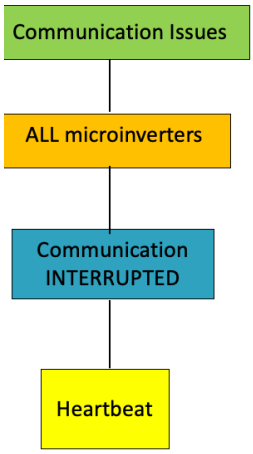
Communication Issues – C3 (continued)

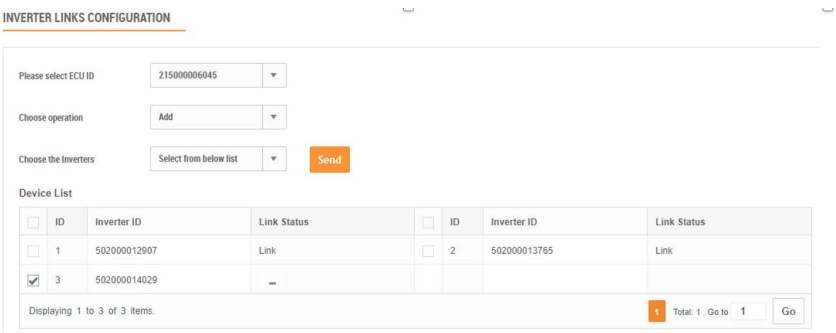
All Microinverters **Communication Interrupted** **No Heartbeat** (continued, page 2/2)	

#	Recommendations / Check-Points
3	• Check if there could be network restrictions (firewall or MAC/IP restriction for instance) • Contact your IT team to make sure ports below are open
4	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

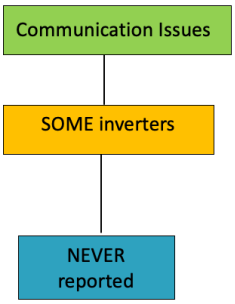
Domain	Port	Protocol
ecu.apsystemsema.com	8995、8996、8997、8998、9227、9228	TCP
	9219、21	FTP
ecu2.apsema.com	9220、9222	TCP
	9219	FTP
ecuna.apsema.com	9220、9222	TCP
	9219	FTP
ecueu.apsema.com	9220、9222	TCP
	9219	FTP

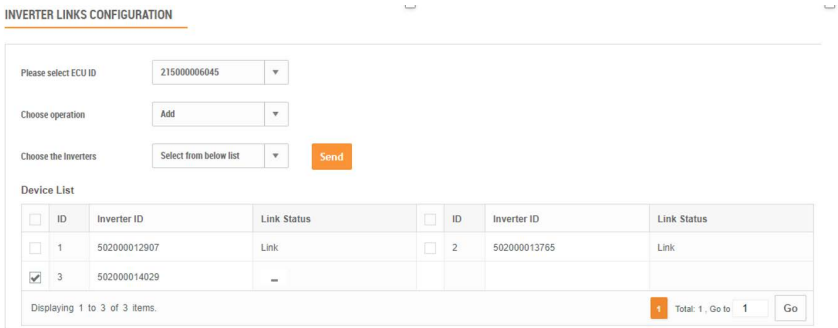
Communication Issues – C4

All Microinverters **Communication Interrupted** **Heartbeat**	

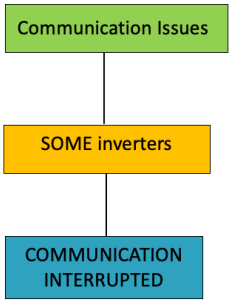
#	Recommendations / Check-Points
1	• **Communication between microinverters and ECU is weak or unstable** *too long distance between the ECU and the microinverters or obstacles – large concrete walls, metallic roofs – can block or decrease the intensity of the Zigbee signal* • **Try to move the ECU closer to the microinverters** If the ECU needs to be installed too far away from the microinverters, you can replace the default antenna with an extension up to 10 meters: please make sure to select a WIFI antenna 2.4GHz with SMA connectors male/female - Check if the ECU antennas are properly screwed - Make sure the ECU antennas are installed outside of the AC box or any other cabinet - YC1000 (501 or 503- serial number): make sure the microinverter antenna is properly installed
2	• **Microinverters have not been registered into the ECU** - Check that the microinverters UIDs (serial numbers) have been properly entered into the ECU and synchronized using the ECU APP features (See ECU Installation Manual on our libraries on www.APsystems.com) - Alternatively, in the EMA portal, check menu Remote Control > ECU Settings and make sure that each microinverter has a "link" active. If a microinverter has no "link", select it, choose "Add" and press "Send" to synchronise the microinverter with the ECU (Link shall be visible after 20 mns) 
3	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Communication Issues – C5

SOME Microinverters **Never reported**	

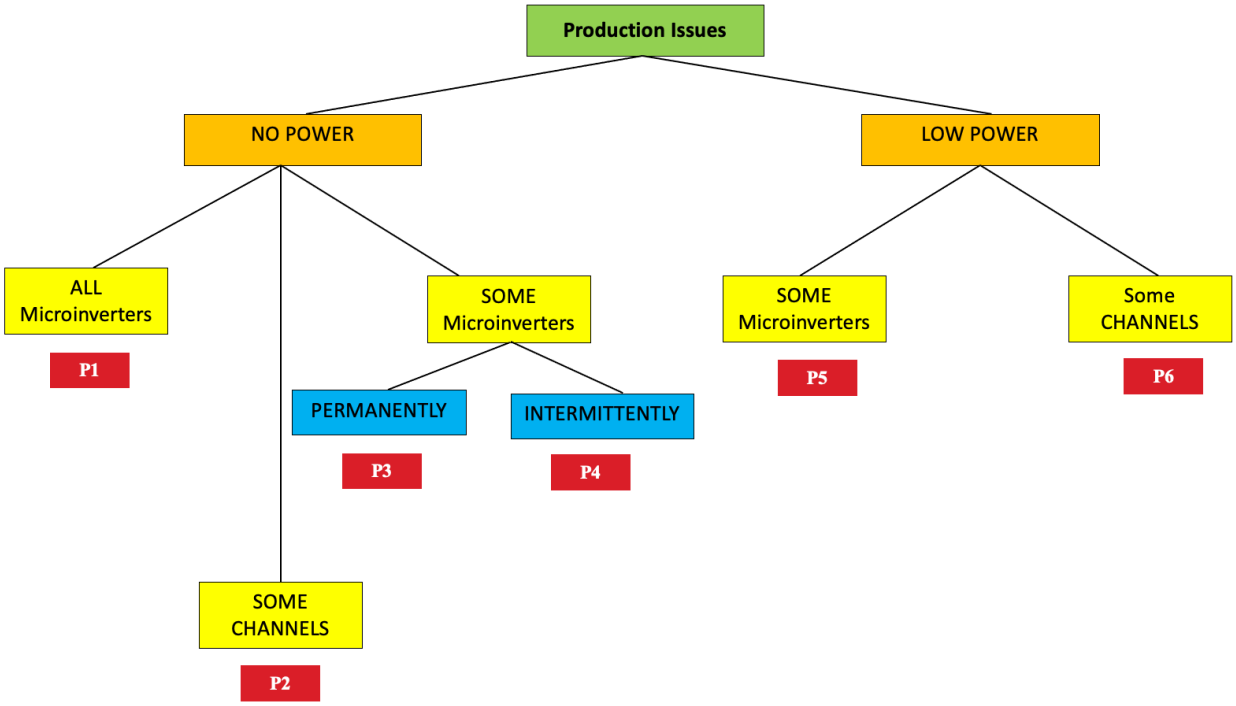
#	Recommendations / Check-Points
1	• **Some inverters may not be connected to PV modules** *- Please check thoroughly DC connections*
2	• **ECU firmware may not be compatible with the microinverters** - Power ON the ECU, connect it to the router (WIFI or Ethernet): the latest firmware shall be uploaded and updated automatically - If the firmware update does not seem to take place, please leave the ECU powered ON and connected to the router and contact your APsystems local Technical Support Team - ***Note**: this situation may occur when installing new micros (for instance DS3) with an ECU shipped prior the availability of the new micros*
3	• **Microinverters have not been registered into the ECU** - Check that the microinverters UIDs (serial numbers) have been properly entered into the ECU and synchronized using the ECU APP features (See ECU Installation Manual on our libraries on www.APsystems.com) - Alternatively, in the EMA portal, check menu Remote Control > ECU Settings and make sure that each microinverter has a "link" active. If a microinverter has no "link", select it, choose "Add" and press "Send" to synchronise the microinverter with the ECU (Link shall be visible after 20 mns) 
4	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Communication Issues – C6

SOME Microinverters **Communication Interrupted**	

#	Recommendations / Check-Points
1	• Make sure that the antennas of the ECU are still properly connected
2	• YC1000 (501or 503- serial number): make sure the microinverter antenna is properly installed/connected or not corroded
3	• It is recommended to check again the system after a couple of hours. Communication may have been momentarily interrupted (internet signal unstable or heavy network traffic preventing timely access to our EMA server) • On rare occasions, communication can be interrupted a bit longer • Despite loss of communication, microinverters continue to produce power
4	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

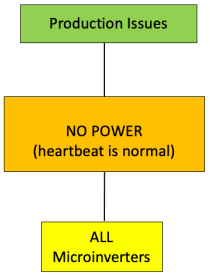
6. Production Issue – Troubleshooting Tree



The diagram above summarizes the typical situations (P1 to P6) installer can face when troubleshooting microinverters production issues.

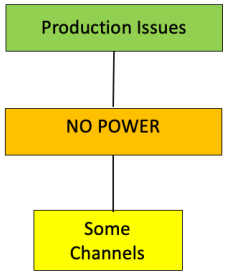
Each branch of the tree is detailed in the next pages, with some recommendations and troubleshooting tips for each of the situation.

Production Issues – P1

NO POWER (heartbeat is normal) **ALL microinverters**	

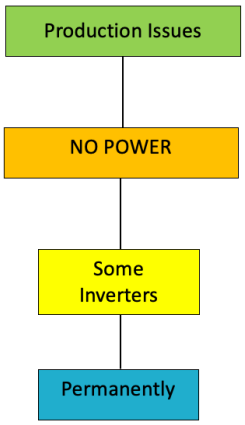
#	Recommendations / Check-Points
1	• **AC voltage at 0V or nearly 0V on every microinverter** - Check the circuit breaker - Check connections on AC side
2	• **AC voltage at 0V or nearly 0V on every microinverter** - Check that the proper Grid profile has been selected (See ECU Installation Manual on our libraries on www.APsystems.com)
3	• If an ECU-C is connected, please check status of the “zero export” function. If activated, all microinverters can stop producing if there is no load consumption in the house. • To deactivate “zero export” function of the ECU-C, please go to your Installer EMA account, menu Remote Control > Meter Zero Export, close the “Zero Export”, then press “Submit”
4	• Microinverters may be in “AC protection mode” against large swings of the utility grid or high temperature (over 100 deg C): in that case, microinverters will resume producing power, as soon as the instabilities on the grid have subsided or the temperature has dropped
5	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Production Issues – P2

NO POWER **Some Channels only**	

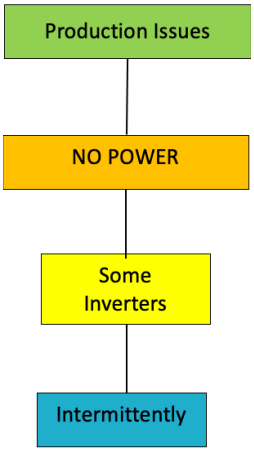
#	Recommendations / Check-Points
1	• **YC-1000** - Connection to different PV modules brand or type, different power or with different orientation may be the cause of some channel not producing - With YC-1000, it is highly recommended to always use the same PV module brand and type, power and orientation with the YC-1000 microinverter
2	• **Non Connected Channel** - Please reconnect DC channel / make sure the DC connection is not loosen - If the non producing channel is not connected on purpose, please unregister the channel in the EMA to avoid unnecessary alarms. Make sure that the unused channel is properly covered by a DC cap.
3	• **+/- polarities may be reversed in DC extensions, or twisted pairs, or crossed connections** - Please check connections thoroughly - Positive and negative DC cables from the same PV module may not be connected to the right microinverter
4	• **PV modules might be faulty** - In the Module View, please check “details” on the not producing microinverter and check the DC Voltage: if too low, microinverter will not start - If DC Voltage is 1/3rd lower than other PV modules DC voltage, it indicates that the junction box of the PV module is faulty and that the PV module needs to be replaced - Alternatively you can swap suspected faulty PV module with one PV module which is working well to confirm the root-cause
5	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Production Issues – P3

NO POWER **Some Inverters** **Permanently**	

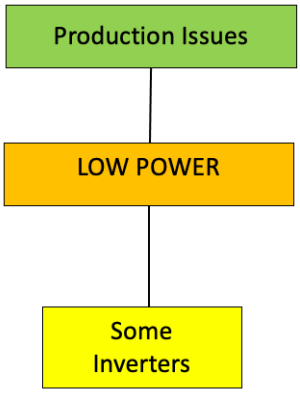
#	Recommendations / Check-Points
1	• **Some branch breaker may be OFF** - Please check branch breaker
2	• **Some DC or AC connections may be loosen** - Please check DC and AC connections thoroughly
3	• If an ECU-C is connected, please check status of the “zero export” function. If activated, all microinverters can stop producing if there is no load consumption in the house. • To deactivate “zero export” function of the ECU-C, please go to your Installer EMA account, menu Remote Control > Meter Zero Export, close the “Zero Export”, then press “Submit”
4	• **PV modules might be faulty** - In the Module View, please check “details” on the not producing microinverter and check the DC Voltage: if too low, microinverter will not start - If DC Voltage is 1/3rd lower than other PV modules DC voltage, it indicates that the junction box of the PV module is faulty and that the PV module needs to be replaced - Alternatively you can swap suspected faulty PV module with one PV module which is working well to confirm the root-cause
5	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Production Issues – P4

NO POWER **Some Inverters** **Intermittently**	

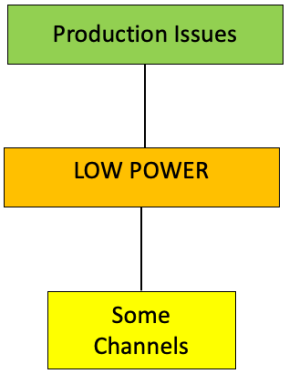
#	Recommendations / Check-Points
1	• Microinverters may be in “AC protection mode” against large swings of the utility grid or high temperature (over 100 deg C): in that case, microinverters will resume producing power, as soon as the instabilities on the grid have subsided or the temperature has dropped
2	• If an ECU-C is connected, please check status of the “zero export” function. If activated, all microinverters can stop producing if there is no load consumption in the house. • To deactivate “zero export” function of the ECU-C, please go to your Installer EMA account, menu Remote Control > Meter Zero Export, close the “Zero Export”, then press “Submit”
3	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Production Issues – P5

LOW POWER **Some Inverters**	

#	Recommendations / Check-Points
1	• **Shading pattern (repetitive pattern, same hour of the day)** - If low power is created by obstacles (tree, dormer, electrical pole), the low power is a normal behavior and will stay unless the obstacle is removed. Impact of shading will be more or less pronounced depending on time of year.
2	• Microinverters may be in “AC protection mode” against large swings of the utility grid or high temperature (over 100 deg C): in that case, microinverters will resume producing power, as soon as the instabilities on the grid have subsided or the temperature has dropped
3	• If an ECU-C is connected, please check status of the “zero export” function. If activated, all microinverters can stop producing if there is no load consumption in the house. • To deactivate “zero export” function of the ECU-C, please go to your Installer EMA account, menu Remote Control > Meter Zero Export, close the “Zero Export”, then press “Submit”
4	• **Some DC or AC connections may be loosen** - Please check DC and AC connections thoroughly
5	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

Production Issues – P6

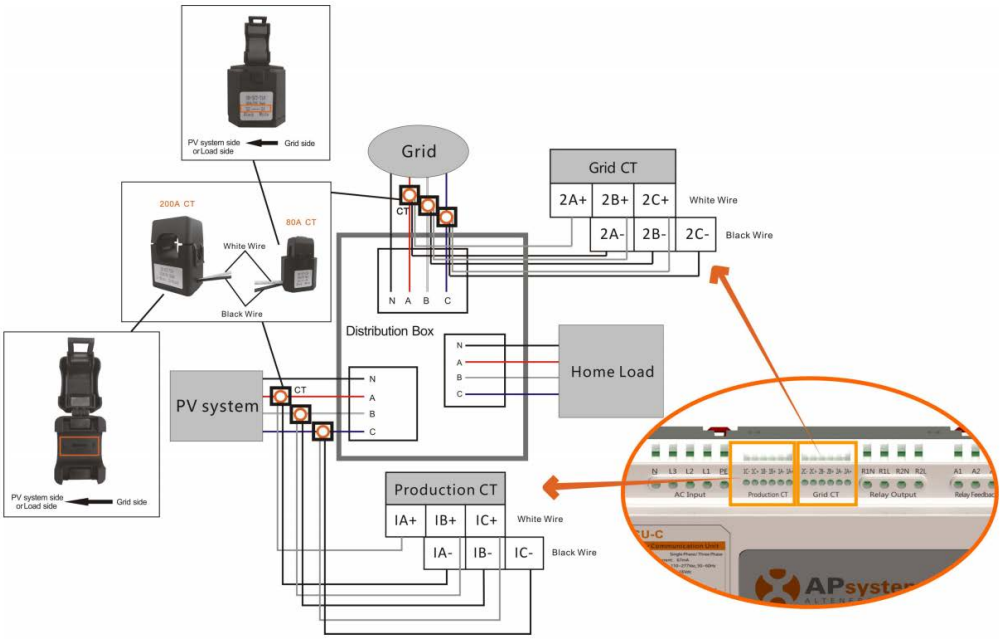
LOW POWER **Some Channels**	

#	Recommendations / Check-Points
1	• **Shading pattern (repetitive pattern, same hour of the day)** - If low power is created by obstacles (tree, dormer, electrical pole), the low power is a normal behavior and will stay unless the obstacle is removed. Impact of shading will be more or less pronounced depending on time of year.
2	• **Shading pattern (repetitive pattern, same hour of the day)** - In the Module View, please check "details" on the not producing microinverter and check the DC Voltage: if too low, microinverter will not start - If DC Voltage is 1/3rd lower than other PV modules DC voltage, it indicates that the junction box of the PV module is faulty and that the PV module needs to be replaced - Alternatively you can swap suspected faulty PV module with one PV module which is working well to confirm the root-cause
3	• **Some DC or AC connections may be loosen** - Please check DC and AC connections thoroughly
4	• If none of the actions listed above fixes the issue, please contact your local APsystems Technical Support Team

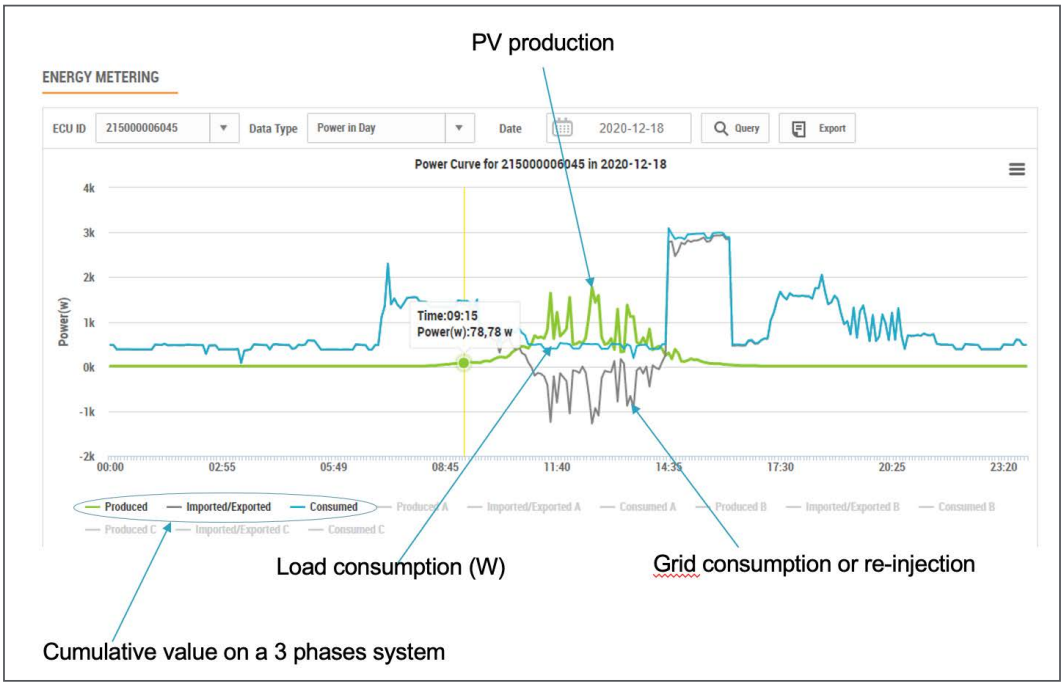
7. ECU-C : Additional Guideline to troubleshoot installation of the CTs

By installing CTs (Current Transformers) at PV side and Utility Grid side, we can access to 3 sets of data in the ECU-C and EMA portal:
- PV production
- Utility Grid consumption or re-injection
- Load consumption

Please see details on how to connect ECU-C CTs in our Technical Brief at www.apsystems.com, “Resources”, then “Library”, then “Installation Guides, White Papers, Brochures”(ECU-C Advanced Functions Technical Brief”)

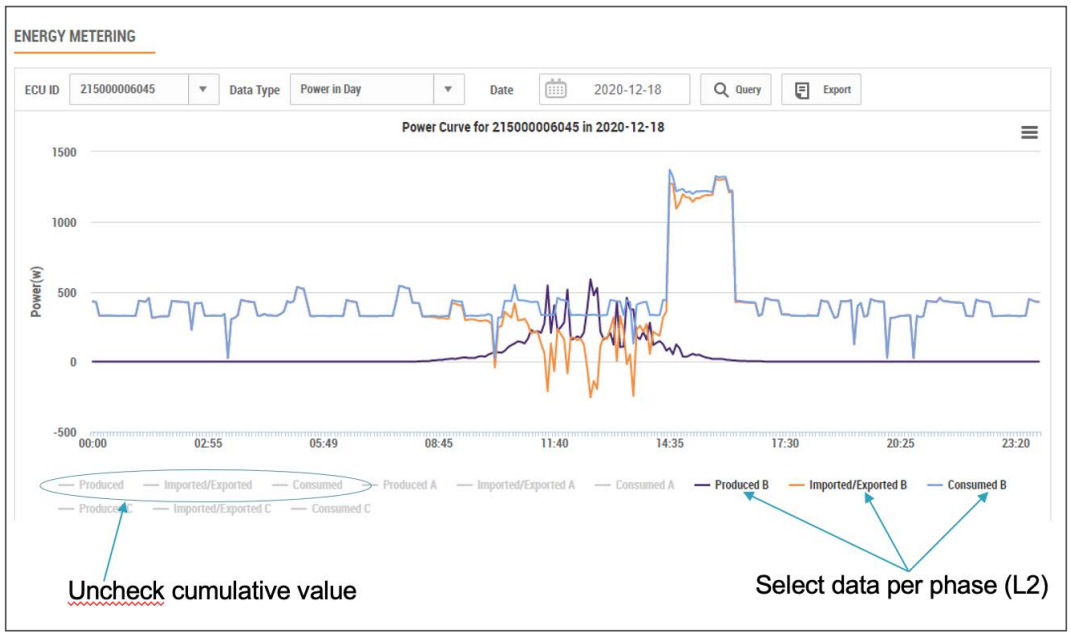


Typical metering reporting appears as below in the EMA:



Warning: 3-Phases systems

When doing the sanity checks described further below on a 3-phases systems, the analysis must be done phase by phase.



Sanity check on Energy Metering curves:

- PV production is measured (green curve) and is always showing positive data
- Grid consumption or re-injection is measured (grey curve) and can be either positive (when we pull power from the grid) or negative (when we re-inject power into the grid)
- The Load consumption is calculated (blue curve): it is always positive

PV production CTs

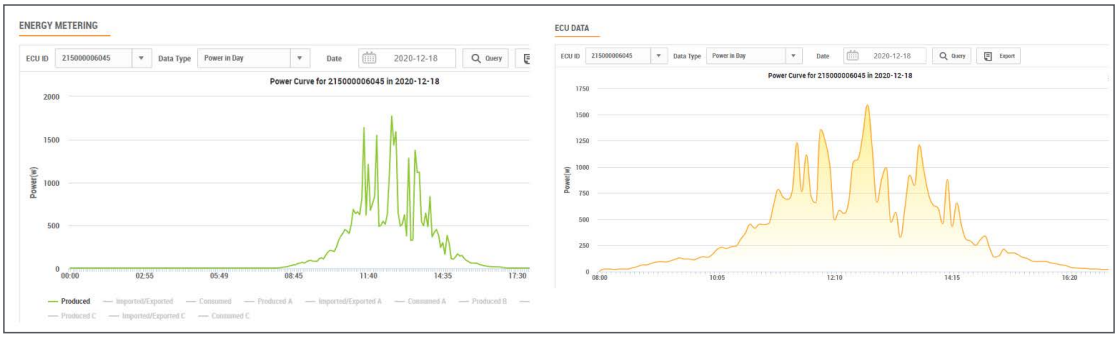
- If the PV production curve shows negative or low power data (on one or several phase), it is highly plausible that the related phase(s) Production CT(s) direction needs to be reversed or CT's wires connected to ECU-C's port need to be reversed, or that the CT(s) is not placed properly or is not connected properly into the ECU-C

  - Check that Production CT is connected to the right cable (phase wire only)

  - If 3 Phases PV system, check that Production CT is connected to the right phase (A=L1, B=L2, C=L3)

  - If Single phase PV system connected to a 3 phase AC box, check that Production CT is connected to the right phase (A=L1)

- PV production measured with the CTs shall follow trend visible on the Module View of the EMA portal.



A gap of 5-10% between the PV production curve measured via the CTs and the PV production curve measured via the ECU is normal: it reflects the difference between AC power (measured by the CTs) and DC power (measured by the ECU)

If the PV production curve measured by the CT does not follow the EMA curve, the CTs installation must be revisited: not properly installed or not properly connected into the ECU-C.

- **For a 3-phase systems installed with YC-1000** (native 3-phase microinverter), the 3 phases for PV production shall match. If this is not the case, please swap the 2 CTs showing lower power
- **For a perfectly balanced 3-phase PV system installed with Single phase microinverters** (same number of microinverters per phase), the 3 phases for PV production shall match. If this is not the case, please swap the 2 CTs showing lower power

Sanity check on Energy Metering curves:

- If Grid consumption (and thus Load Consumption) shows negative value during the night, it is highly plausible that the related phase(s) Grid Consumption CT(s) direction needs to be reversed or CT's wires connected to ECU-C's port need to be reversed, or that the CT(s) is not placed properly or is not connected properly into the ECU-C
- If Load Consumption curve follows the PV production curve:
  - Check that Grid Consumption CT is connected to the right cable (phase wire only)
  - If 3 Phases PV System, Check that Grid Consumption CT is connected to the right phase (A=L1, B=L2, C=L3)

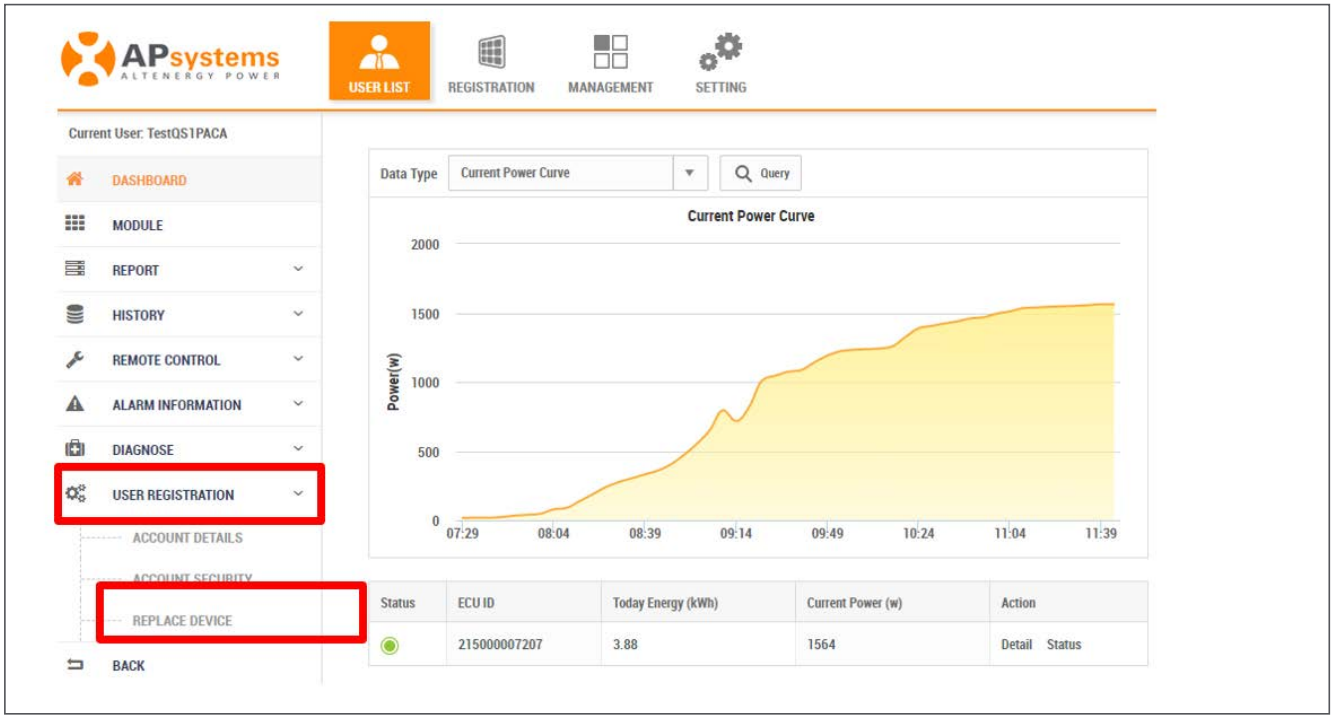
8. Replacement of Microinverter or ECU: best practice

In case of replacement of a microinverter or ECU is needed, please follow these easy steps to streamline the replacement and registration of the new microinverter or ECU.

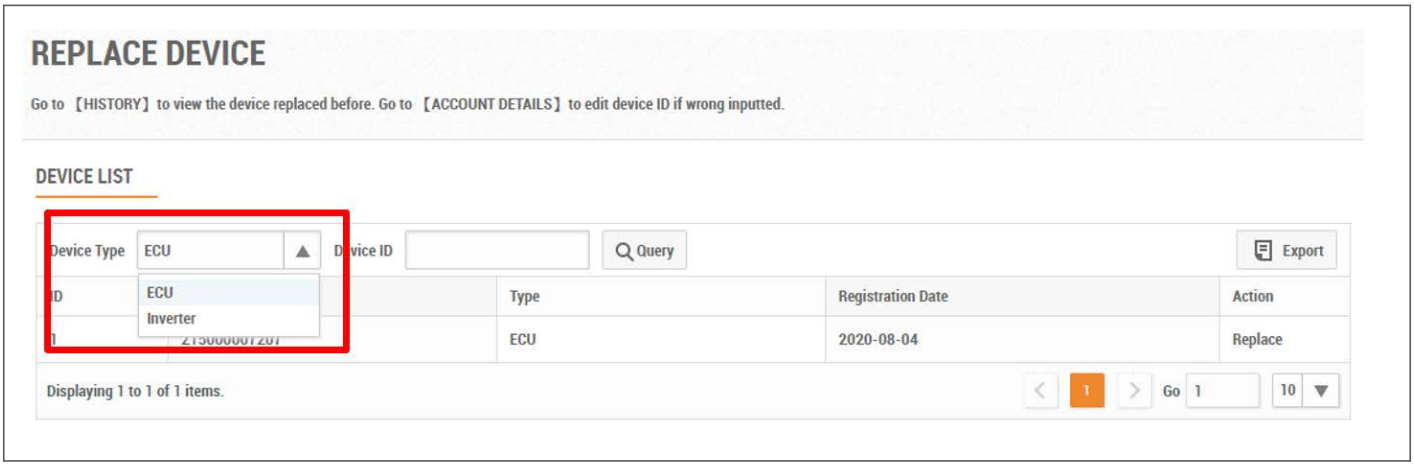
Microinverter:

Replace the microinverter on-site. Check that the new microinverter is producing and communicating properly while on-site.
The replacement must be effective in the EMA portal and ECU as well.

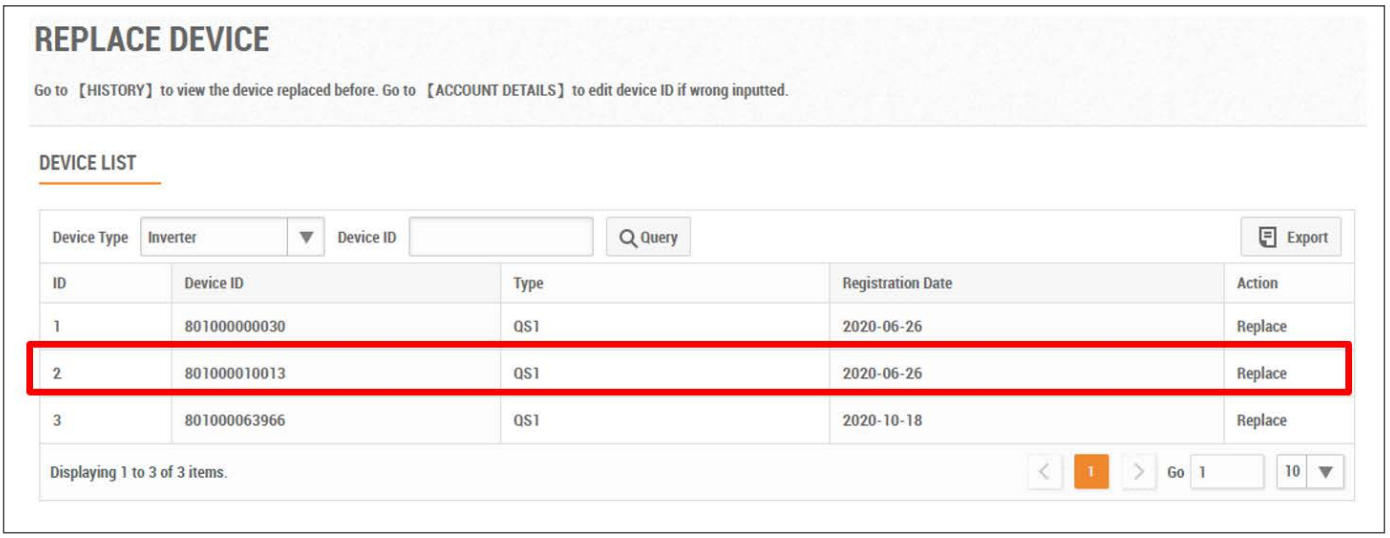
From your EMA Installer Account, enter the "User Account" where the microinverter has been replaced. Click "**User Registration**", then "**Replace Device**"



Select "Inverter" in the drop-down menu:



Current microinverter list is displayed. Select the microinverter to replace, then click **“Replace”**



Enter UID (serial number) of replacement microinverter, Click “OK”

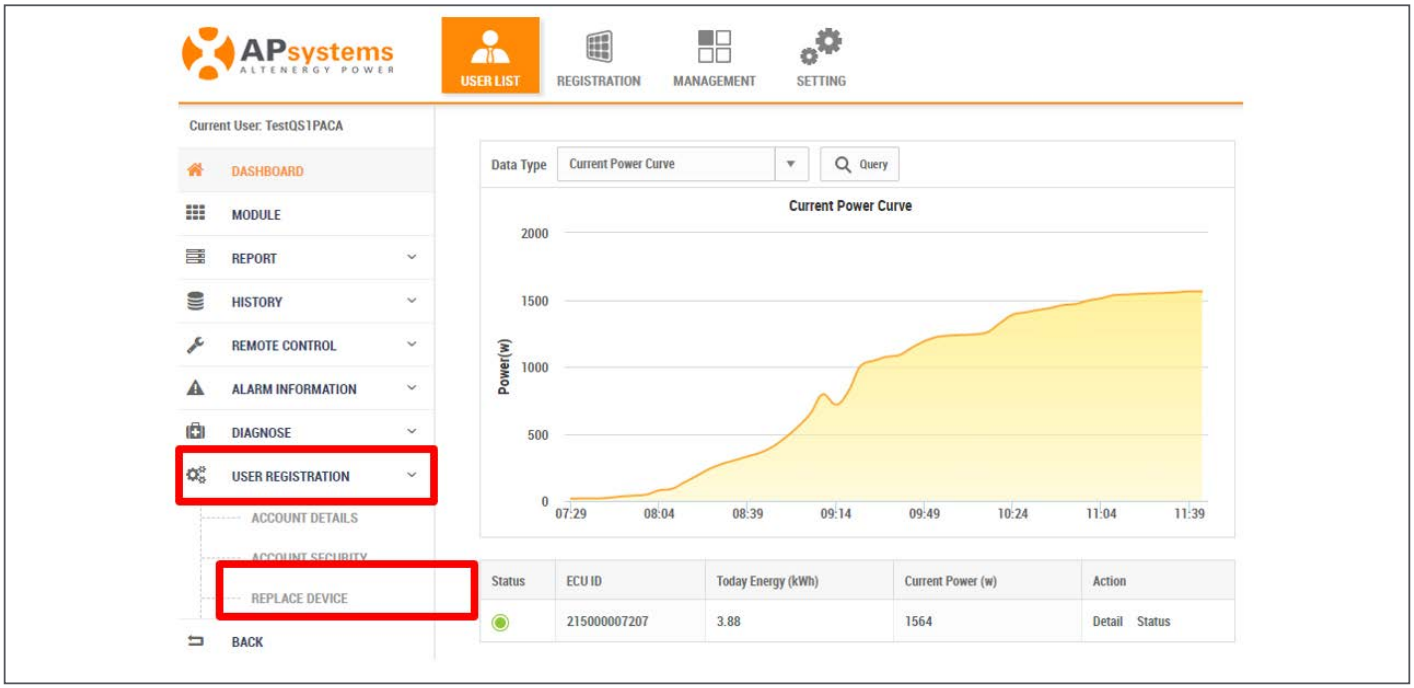
In Report > Inverter Data, you can then check that the new microinverter is sending data.

Both your EMA portal and ECU have been updated properly.

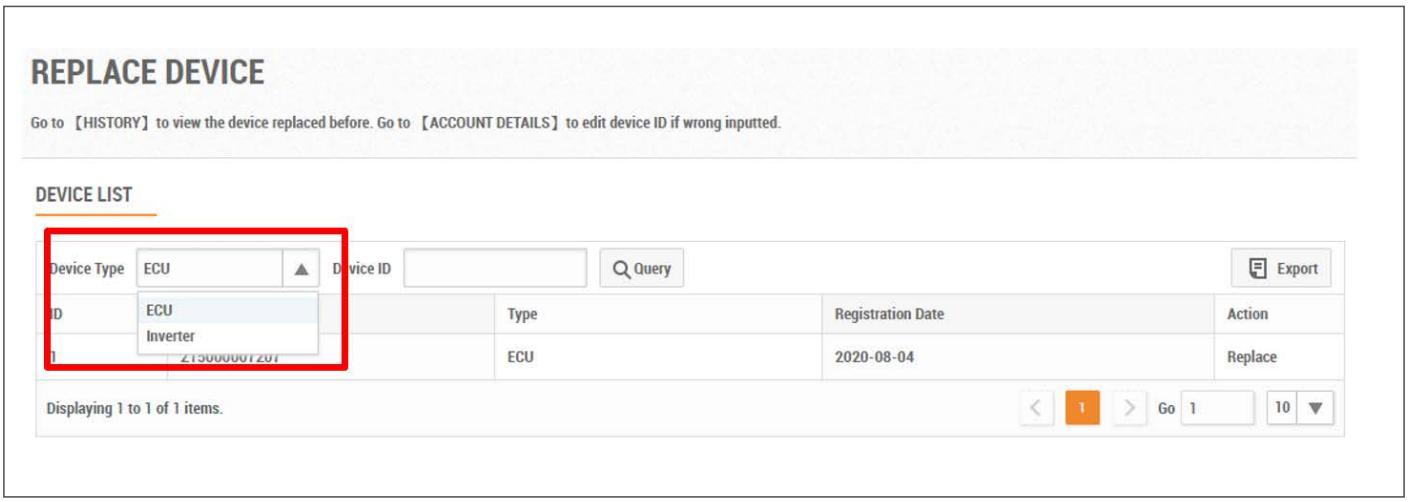
Warning: DO NOT use «delete/add» commands to replace an inverter. Historical data would be lost as well as automatic transfer of the remainder of the warranty to the replacement microinverter.

ECU:

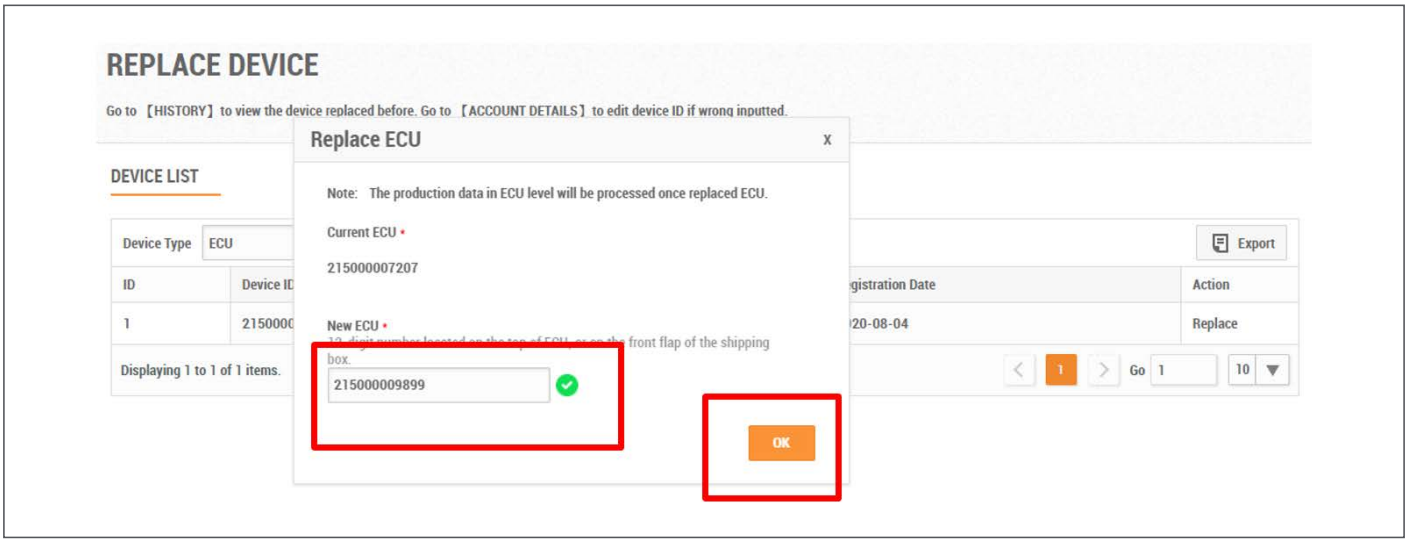
- Replace the ECU on-site. Check that everything is working properly while on-site, especially that the new ECU is properly connected to the internet router.
- When replacing an ECU by using the «**Replace Device**» function, it is not necessary to input all the inverters UIDs again in the new ECU.All data from the prior ECU will be saved and transferred in the new ECU.
- From your EMA Installer Account, enter the "User Account" where the microinverter has been replaced. Click "**User Registration**", then "**Replace Device**"



Select "ECU" in the drop-down menu:



Current ECU list is displayed. Select the ECU to replace, then click **“Replace”**
Enter UID (serial number) of replacement ECU, Click “OK”



In the Menu “Dashboard”, check that the new ECU is sending data properly.

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