**ABB solar inverters**

# Quick installation guide
# UNO-DM-6.0-TL-PLUS-US-Q
# (6.0 kW)

EN


## APPLY HERE THE WIRELESS IDENTIFICATION LABEL

BCM.V2R09.0

Before starting installation, download the product manual from www.abb.com/solarinverters. Choose the correct country, string inverters, single phase, choose the product and proceed to the “download” section.
Read and follow all safety and installation instructions to avoid disabling any safety features or making the warranty invalid.

ABB

## 1. Labels and Symbols

### IMPORTANT SAFETY INSTRUCTIONS
### SAVE THESE INSTRUCTIONS -- KEEP IN A SAFE PLACE!

**The installer must read this document in its entirety before installing or commissioning this equipment.**
For more detailed information regarding proper installation and use of this product, refer to the product manual located at www.abb.com/solarinverters. The labels on the inverter have the markings, main technical data and identification of the equipment and manufacturer. The technical data shown in this quick installation guide does not replace that shown on the labels attached to the equipment.

**Symbols used in the guide and on the products**

| | | | |
|---|---|---|---|
| | These are nationally recognized test laboratory marks showing certification to UL 1741 and CSA C22 No. 107.1 | Ø | Phase |
| | Hazardous voltage | ⎓ ~ | Direct and alternating currents, respectively |
| | General warning - Important safety information | + - | Positive pole and negative pole of the input voltage (DC) |
| | Hot surfaces | 10 minutes | Stored energy discharge time |
| | System earth conductor (main grounding protective earth, PE) | | Consult product manual |
| | Equipment Grounding Conductor (EGC) | | |

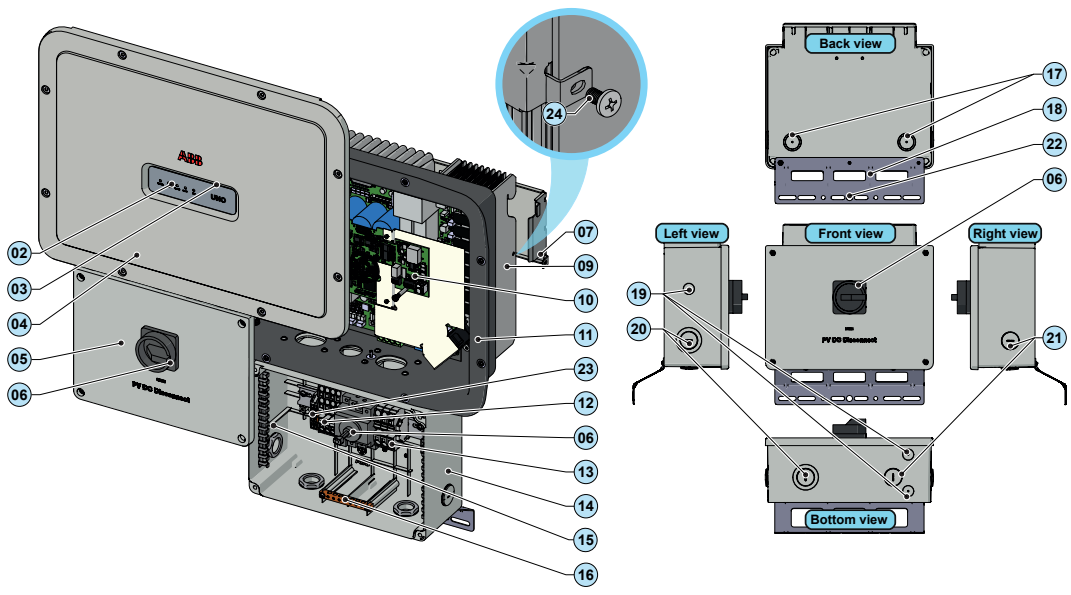
- This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 2. Inverter Models and Components

This installation guide covers the inverter model UNO-DM-6.0-TL-PLUS-US-SB-RA-QU* (6 kW).
Models equipped with Wireless communication,DC disconnection switch,Rapid Shutdown Power Supply and Arc Fault Detector
*The U suffix indicates the Unbalanced of the 2 Channels Current, always present in 6kW model (refer to datasheet or manual for further details)

**Main components**

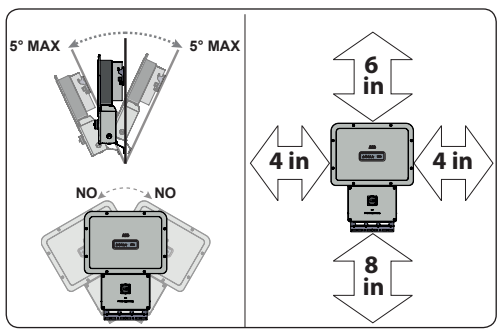
| | | | |
|---|---|---|---|
| 02 LED panel | 10 UNO-DM-PLUS Ethernet COM KIT or UNO-DM-COM KIT board (optional) | 16 Protective Earth (PE) connection point | 22 Lock screw position |
| 04 Inverter front cover | 11 Inverter | 17 Conduit drill out sizes 3/4”, 1” (drill out markings on back side) | 23 Power supply for rapid shutdown (RSD) terminal blocks |
| 05 Wiring box front cover | 12 DC input terminal blocks (two MPPT) | 18 lower flange | 24 Locking Screw |
| 06 DC disconnect switch | 13 AC output terminal blocks | 19 1/2” communication conduit drill out | |
| 07 Wall bracket | 14 Wiring box | 20 Markings for 3/4” or 1” conduit drill outs | |
| 09 Heatsink | 15 Wi-Fi antenna (-B models only) | 21 Opening for 3/4” AC conduit | |

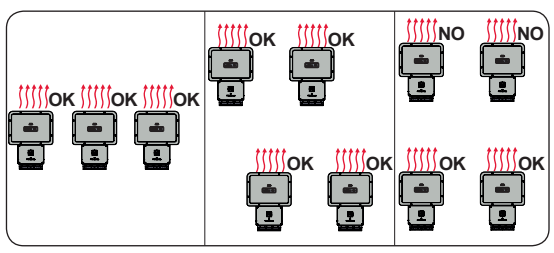



## 3. Installation location

**Installation site and position**
- Refer Datasheet/Manual to confirm that the environmental specifications have been met
- Do not install the inverter in full sun. If needed, use a sun shade to minimize solar irradiation, especially for temperatures over 104°F/40°C.
- Do not install in closed spaces where air does not circulate freely
- Always ensure that the flow of air around the inverter is not blocked, so as to prevent overheating.
- Do not install the equipment near flammable substances (minimum distance: 10 ft).
- Do not install the equipment on wooden walls or other flammable substances.
- Do not install in inhabited rooms or where the prolonged presence of people or animals is expected, because of the inverter’s noise level during operation. The sound level is heavily influenced by its location (for example, the surface around the inverter, the environment, etc.) and grid quality.
- Install on a wall or strong structure capable of bearing weight
- Install vertically with a maximum inclination as indicated in the figure
- Maintain minimum clearance from objects blocking air circulation and spacing between inverter as indicated in the figures
- Ensure sufficient working area in front of the inverter for wiring box access
- If possible, install at eye level so that the LEDs can be seen easily
- Install at a height that takes account of the weight of the equipment
- Position multiple inverters side-by-side, maintaining minimum clearances (measured from the outermost edge of the inverter)
- Multiple inverters can also be placed in a staggered arrangement. Minimum clearances for staggered arrangements include width of the inverter cover plus additional allowances for inverters arranged above or below
- All installations over 6500’ high (2,000 meters) must be assessed by ABB Technical Sales to determine the proper datasheet derating

**Do not block access to the external AC and DC disconnects.**
**Please refer to the warranty terms and conditions and avoid voiding the warranty with improper installation.**



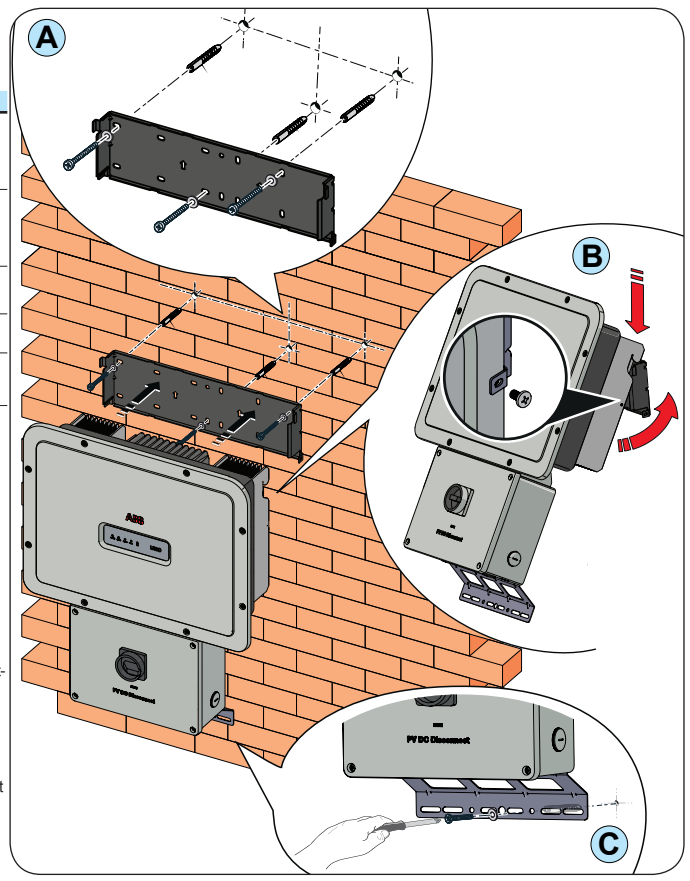

## 4. Mounting Instructions

Mount the inverter following the step-by-step procedure below.

**Do not remove the inverter chassis cover in adverse weather conditions (e.g. rain, snow) or during periods of high humidity (>95%).**

| Components included in mounting kit | Q.TY |
|---|---|
| Wall bracket | 1 |
| T20 Wall bracket locking screw (to be used when lock springs 02 on the bracket are missing) | 2 |
| (Spare part) T20 screw for front cover | 1 |
| Jumpers for configuring paralleled inputs. | 1 + 1 |
| Quick installation guide (QIG) | 1 |

- Position the bracket 07 so that it is level on the wall or pole
- It is the installer’s responsibility to choose an appropriate number and distribution of attachment points. The choice must be based on the type of wall, frame or other support, the type of anchors to be used, and their ability to support 4 times the inverter’s weight (4x33lbs=132lbs for all models).
  Depending on the type and number of attachment points, drill the required holes to mount the bracket (see figure detail A)
- Secure the bracket to the wall or frame
- If needed, make conduit cutouts in the wiring box chassis, before the wiring box is put on the wall
- Carefully lift the inverter and hook it onto the bracket by inserting the two supports in the slots on the inverter (Figure B).
- Proceed to anchor the inverter to the bracket by installing the two (one each side) locking screws (Figure B1).
  If on the bracket are present the lateral lock springs, proceed to lock the inverter by pressing the lower part toward the wall or structure until the two springs on the bracket set the inverter in position (Figure B2).
- Secure the inverter chassis bottom flange to the mounting surface using another screw (see Figure detail C). Note that the bottom flange is not a load-bearing component.

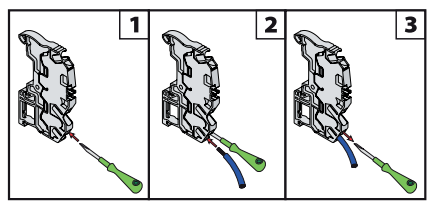



## 5. Clamps terminal use

All power conductors will be inserter in spring clamp terminals.

The figure shows an example of how to make the wire connection:

1) Insert a small flat screwdriver in the slot and lightly press the screwdriver from top to bottom; insert the screwdriver until the spring opens.
2) Insert the cable in the spring clamp.
3) Remove the screwdriver.
4) When connections are complete, give each wire a pull test

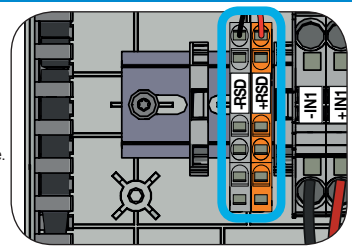



## 6. Rapid Shutdown

**If an RSD device is installed on the plant, the inverter will power-up only if both AC and DC are supplied!**

The installer must use an external rapid shutdown device compliant with the 2014 NEC.
Automatic shutdown occurs at the rooftop box when utility power (AC) is lost or when the PV system’s AC disconnect switch is opened. In jurisdictions requiring a dedicated activation switch, should be installed an emergency stop button external to the inverter.
The wiring box has 24Vdc (0.4A max) on a spring-loaded terminal block designed to power-up an external RSD device.

The wire size range of RSD terminals is 26-12 AWG.
- Connect the RSD device respecting the polarity indicated on each RSD terminal.
- Install RSD device wires in the RSD terminal block;
  +24V wire to +RSD terminal, - 24V wire to - RSD terminal




## 7. Input connection (DC)

**Confirm the correct polarity in the input strings.**
**Confirm there is no ground leakage current in the PV array.**
**When exposed to sunlight, the PV panels supply DC direct voltage to the inverter.**
**The inverter’s DC switch disconnects the DC current from the PV panels. In the “OFF” position the inverter will stop producing power, but DOES NOT disconnect the AC from the grid. To prevent electrocution hazards, all the connection operations must be carried out with the external AC disconnect switch, downstream of the inverter (grid side), open and locked out.**

**The transformerless design requires that the PV array to be floating with respect to ground per NEC 690.35.**
**DC PV string wire must be listed PV wire per NEC 690.35 rated minimum 600V.**
**PV output conductors (wiring) must consist of sheathed (jacketed) multi-conductor cables or single insulated conductors (wires) which must be installed in an approved raceway. These conductors must be isolated from the enclosure and system grounding, as required by NEC 690.35. This is the responsibility of the installer.**

**Confirm that the maximum PV array short circuit current for each DC input channel is within the inverter specification (see table in Section 14). Array equipment grounding must be installed per the requirements of the NEC and is the responsibility of the installer. A configuration program that can help to correctly size the photovoltaic system is available on at http://www.stringsizer.abb.com.**

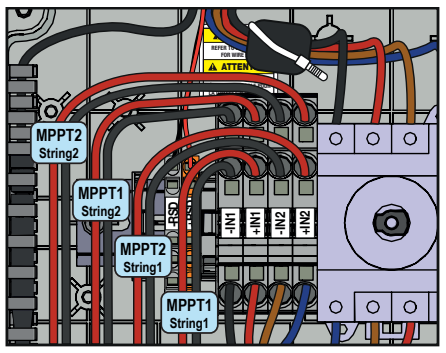
- Turn the DC switch OFF
- Loosen the four captive screws on the wiring box cover (Torx 20) and remove the cover
- Pass the DC wires through the openings dedicated to the DC conduit.

**Conduit must be sealed using water-tight fittings to maintain NEMA Type 4X enclosure integrity.**
**Installer should follow conduit manufacturers’ guidelines and best practices.**

- Connect the DC wiring to DC input terminal blocks 12. DC wiring terminals are spring pressure type and accommodate a wire size range of 20-8 AWG.
  Connect the strings in either independent or parallel mode, following the appropriate set of instructions below:

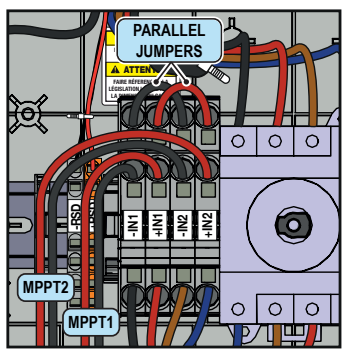
**Independent mode configuration**

In case of two PV arrays, if each of them has a current rating lower than the maximum current rating for a single inverter channel, they may be connected as “IND” array, each with its own MPPT. In this case, do nothing with the jumper wires which came with the inverters.
- Connect the positive side of the first PV array to +IN1, and its negative side to -IN1.
- Connect the positive side of the second PV array to +IN2 and its negative side to -IN2.
Up to four strings can be connected in independent mode.
- During commissioning, confirm that the input mode is set to IND.
**If connecting a single array, configure the inverter for parallel input mode.**




**Parallel mode configuration**

If a PV array’s output current is more than the rating for a single inverter channel:
- connect the red jumper wire between the +IN1 and +IN2 terminal block inputs. Then connect the jumper wire black wire between the -IN1 and -IN2 terminals. During commissioning remember to set the input mode to PAR.
- Connect the array to the IN1 (MPPT1) and IN2 (MPPT2) input positions, running separate wires for positive (+) and negative (-) for each array.



## 8. AC Output connection

**To prevent electrocution hazards, open and lock out the external AC disconnect switch before connecting the AC conductors, and any time the AC wiring box cover is to be removed. Proper PPE is required.**
**AC output overcurrent protection is not provided with the inverter; it is the responsibility of the end user to provide overcurrent protection for the AC output circuit. To reduce the risk of fire, connect only to a circuit provided with an overcurrent protection in accordance with the NEC (ANSI/NFPA 70). The inverter must be connected only to a dedicated branch circuit provided with the maximum branch overcurrent protection device (OCPD) listed in the technical data sheet at the end of this document.**
**Size conductors per the NEC, Article 310 - use 90°C copper wire only; conductors must be sized according to operating temperature range and continuous current ratings. The AC grid wiring is connected through the inverter switchbox.**
**AC output wire must be listed PV wire rated minimum 600V.**

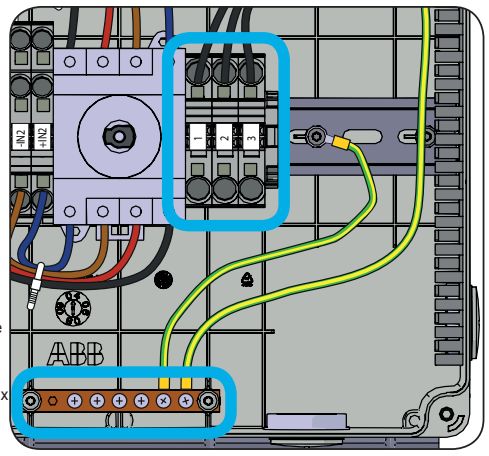
- Run an approved raceway between the inverter and external AC disconnect switch.

- Pass the AC wires throught the openings dedicated to the AC conduit.

**When complete, seal conduit with water-tight fittings to maintain the NEMA type 4X enclosure rating.**
**Installer should follow conduit manufacturers' guidelines and best practices.**

- Determine which AC output is applicable for the inverter model being installed. The AC wiring connections based on the AC grid type are shown in the table (also found on a label in the wiring box).

| GRID STANDARD TYPE DE RÉSEAU | L1 / L3 / L2 | | | L1 / N / L2 | | |
|---|---|---|---|---|---|---|
| | 208V~ 3PH - Δ | | | 240V~ SPLIT-PHASE | | |
| TERMINAL BORNE | 1 | 2 | 3 | 1 | 2 | 3 |
| WIRE CÂBLE | L1 | L2 | - | L1 | L2 | N |



- Connect wiring to the numbered terminals based on selected grid type. AC wiring terminals are spring pressure type and accommodate a wire size range of 20-6 AWG.

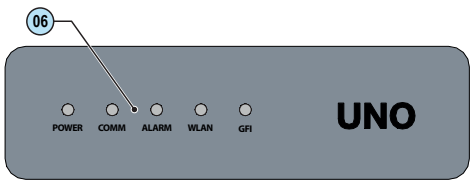
- Connect the protective earth (PE) cable to wiring box busbar ⑯. Screws the cable (max 4 wires 8AWG to 4AWG, copper) with **2.0Nm (1.5ft-lb)** torque.

**The default 240V split-phase connection requires the grid Neutral to be connected to the inverter for proper operation. Before connecting the inverter to the grid, the grid type must be selected during the commissioning phase. If several inverters are installed to a three-phase AC grid, always distribute the inverters between the phases in order to reduce power imbalance between the phases.**

- When all connections are complete, reinstall the front covers and tighten the cover screws with **1.5Nm (13.2 in-lbs)** torque.

## 9. User Interface

**LED and KEYS**, in various combinations, may show the status conditions or perform complex actions to be explored by consulting the product manual.




| LEDs ⑥ | | |
|---|---|---|
| **POWER** | **Green** | Solid when the inverter is working correctly. Flashes when checking the grid or if there is insufficient sunlight. |
| **COMM STATUS** | **Multicolor** | Operation status of wireless communication line:<br>- **Blink Red**: Communication error (no communication available)<br>- **Green**: Communication OK |
| **ALARM** | **Yellow** | The inverter has detected an anomaly. The anomaly is shown on the "EVENTS" section of the internal webserver. |
| **WLAN** | **Multicolor** | Communication type and quality of the wireless communication signal (for "Station Mode"):<br>- **Blink Blue**: Wireless board is working in Access Point mode (AP Mode)<br>- **OFF**: No signal<br>- **Blink Red**: Low signal strenght<br>- **Blink Yellow**: Medium signal strenght<br>- **Blink Green**: High signal strenght |
| **GFI** | **Red** | Ground fault on the DC side of the PV generator. The error is shown on the "EVENTS" section of the internal webserver. |

## 10. Commissioning

**Before proceeding with commissioning, make sure you have carried out all the operations and checks indicated in the previous sections of this quick installation guides, and verify that the inverter cover ⑤ was properly closed!**

**Refer to the product manual for further information about the configuration and the use of the functionality of the internal Webserver. Consult the product manual for more information.**

Commissioning and configuration of the inverter can be made using a wireless capable device such as a smartphone, tablet or laptop.
The steps for commissioning are listed below:

- Set the inverter's DC disconnect switch ⑯ and any external DC switches to "ON" position: If the input voltage applied to one of the two input channels is greater than the minimum starting voltage, the inverter will start up.

**The inverter is powered ONLY by the voltage coming from the photovoltaic generator: the presence of grid voltage alone IS NOT SUFFICIENT to allow the inverter to power up.**
**If an RSD device is installed on the plant, the inverter will power-up only if both AC and DC are supplied!**

- Set the external AC disconnect switch downstream to the inverter to "ON" position.

SN WLAN: SSSSSSSSSS
PN WLAN: PPP.PPPPP.PP
MAC: XX:XX:XX:XX:XX:XX
*Remove and apply on the Quick installation guide* [1]
SN Inverter: SSSSSSSSSS
MAC: XX:XX:XX:XX:XX:XX
PK: KKKK-KKKK-KKKK-KKKK

**• Pre-commissionig phase 1 - Connection to the local Wi-Fi network**
- DEVICE USED TABLET/SMARTPHONE.
Once powered, launch a QR reader for mobile and SCAN the QR code marked with [1] on the label on the right side of the inverter and connect to inverter network (tap connect).
The name of the Wi-Fi network created by the system, that the connection should be established with, will be:
ABB-XX-XX-XX-XX-XX-XX (where the X is the MAC address)
After this step wait 10 seconds to allow the WLAN connection

- DEVICE USED LAPTOP.
Enable the wireless on the device you are using for the commissioning and search for the network named ABB-XX-XX-XX-XX-XX-XX, where "X" is an hexadecimal number of the MAC Address (the MAC Address is indicated on the "wireless identification label" on the side of the inverter).
When prompted, type the PK (product key), including the dashes. Example: 1234-1234-1234-1234 as the network password.

**• Pre-commissionig phase 2 - Internal web UI access**
- DEVICE USED TABLET/SMARTPHONE.
SCAN this QR code (it is also reported in the inverter pre-commissioning flyer inside the box of the inverter). An internet browser page showing the step by step procedure will be open.

**The information contained in this QR code is the IP address of the web user interface of the inverter: http://192.168.117.1**
**Recommended browsers: Chrome from v.55, Firefox from v.50, Safari from V.10.2.1**

- DEVICE USED LAPTOP.
Open an internet browser page and insert http://192.168.117.1 on the address bar.

**STEP BY STEP COMMISSIONING WIZARD:**

**• STEP 1 - Administrator/User login credentials**
- Set the Administrator account user and password (minimum 8 character for password):
Administrator account can open and view the contents of photovoltaic site. Additionally, they can make changes to inverter settings. User and password are CASE SENSITIVE.
- Set the User account user and (optional) password (minimum 8 character for password):
User account can only read data. It cannot make any changes. User and password are CASE SENSITIVE.
- Click on "Next" button to proceed to the next stage of the configuration wizard.

**• STEP 2 (Optional) - Residential wireless network connection.**
The parameters relating to the home wireless network (set on the router) that must be known and set during this step are:
- IP Settings: DHCP or Static.
If you select the DHCP function (default setup) the router will automatically assign a dynamic IP address to the inverter whenever it tries to connect to the user network.
With Static, the user can assign a fixed IP address to the system. The data which has to be entered in order for IP static address assigning to take place will appear. Complete the additional fields at the bottom of the screen (all the fields are mandatory with the exception of the secondary DNS server).
- Available networks (SSID):
Identify and select your own (home) wireless network from all those shown in the SSID field (you can carry out a new search of the networks that can be detected with the Update button [↻]). Once the network has been selected, confirm.
- Password: Wireless network password.
Enter the password for the destination network (if necessary) and start the connection attempt (it will take a few seconds).
- Click on "Connect" button to connect the inverter to the home wireless network.
- A message will ask for confirmation. Click "Next" to connect the inverter to the home wireless network.
- Once the inverter is connected to the domestic wireless network, a new message will confirm that.
The message provides the IP Address assigned by the home wireless network router to the inverter that can be used each time you want to access the internal webserver, with the inverter connected to the home wireless network. Take note of it.
- Click on "Next" button to proceed to the next stage of the configuration wizard.

**The IP address assigned may vary for reasons connected to the wireless home router setup (for example, a very brief DHCP lease time). If verification of the address is required, it is usually possible to obtain the client list (and the corresponding IP addresses) from the wireless router administration panel.**
If the inverter loses the connection with the home wireless network, it is available accessing the Wi-Fi network ABB-XX-XX-XX-XX-XX-XX, where "X" is an hexadecimal number of the MAC Address.

**The most common causes of losing connectivity might be: different wireless network password, faulty or unreachable router, replacement of router (different SSID) without the necessary setting updates.**

## Commissioning

**• STEP 3 - Date, Time and Time zone**
- Set the Date, Time and Time zone (The inverter will propose these fields when available).
When it's not possible for the inverter to detect the time protocol, these fields have to be manually entered.
- Click on "Next" button to proceed to the next stage of the configuration wizard.

**• STEP 4 - Inverter country standard, Input mode, Meter and Energy policy.**

| **Country standard** | **Input mode** | **Meter** |
|---|---|---|
| Set the grid standard of the country in which the inverter is installed. | - Indipendent<br>- Parallel | None (installation without meter) |
| From the moment that the grid standard is set, you have 24 hours to make any changes to the value, after which the "Country Select > Set Std." functionality is blocked, and the remaining time will have to be reset in order to have the 24 hours of operation available again in which to select a new grid standard (follow the procedure "Resetting the remaining time for grid standard variation" described in the relevant section). | See the relevant section of this guide to know how to physically set the input mode | Not available |

- Confirm the settings by clicking "DONE"; the inverter will reboot at the finish of the meter test phase (if installed).
- After the wizard is completed, the system will power-on. The inverter checks the grid voltage, measures the insulation resistance of the photovoltaic field with respect to ground and performs other auto-diagnostic checks. During the preliminary checks on the parallel connection with the grid, the "Power" LED keeps flashing, the "Alarm" and "GFI" LEDs are off.
If the outcome of the preliminary checks on the grid parallel is positive, the inverter connects to the grid and starts to export power to the grid. The "Power" LED remains fixed on while the "Alarm" and "GFI" LEDs are off.

**To address any problems that may occur during the initial stages of operation of the system and to ensure the inverter remains fully functional, you are advised to check for any firmware updates in the download area of the website www.abb.com/solarinverters or at https://registration.abbsolarinverters.com (instructions for registering on the website and updating the firmware are given in this manual).**

**From the moment that the grid standard is set, you have 24 hours to make any changes to the value, after which the "Country Select" functionality is blocked and the remaining time will have to be reset in order to have the 24 hours of operation available again. To select a new grid standard follow the procedure "Resetting the remaining time for grid standard variation" described in the product manual.**

**Any inverters installed, or commissioned, in California after September 8, 2017 must be set to the Rule 21 country code USA - RULE21 @ 240 single [R21 240sp] or USA - RULE21 @ 208 single [R21 208si].**

**According to CEC requirements the UNO-DM-6.0-TL-PLUS-US-QU (no display model), display measured net generated energy and measured instantaneous power using a remote device like a smartphone, tablet or PC. Access it by connection to the inverter internal Webserver (please see the beginning of this paragraph on how to access to the internal webserver). In addition it is possible to use the mobile App 'ABB ability Energy Viewer for solar plants' and the ABB Web portal Aurora Vision (please refer to product manual for further details) to monitor all production data.**

## 11. Response to abnormal conditions

**Abnormal grid conditions:** The inverter is programmed to respond to abnormal grid conditions, as specified in the below table:

| Condition | Utility source | | Max. time (sec) at 60Hz before cessation of current |
|---|---|---|---|
| | Voltage (V) | Frequency (Hz) | |
| A | <0.50 Vnom[1] (Fixed) | Rated (60Hz) | Default setting[3] 0.16 (Adj. 0.16 to 50) |
| B | 0.50 Vnom[1] ≤ V < 0.88 Vnom[1] | Rated (60Hz) | Default setting[3] 2 (Adj. Set Points 0.16 to 100 sec) |
| C | 1.10 Vnom[1] < V < 1.2 Vnom[1] | Rated (60Hz) | Default setting[3] 1 (Adj. Set Points 0.16 to 100 sec) |
| D | 1.20 Vnom[1] ≤ V | Rated (60Hz) | Default setting[3] 0.16 (Adj. 0.001 to 0.16 sec) |
| E | Rated | Default setting[3] f > 60.5 Hz (Adj. 60.1 to 66.0 Hz) | Default setting[3] 0.16 (Adj. Set Points 0.16 to 1000 sec) |
| F | Rated | Default setting[3] f < 59.3 Hz (Adj. 50.0 to 59.9 Hz) | Default setting[3] 0.16 (Adj. Set Points 0.16 to 1000 sec) |
| G | Rated | Default setting[3] f << 57.0 Hz (Adj. 50.0 to 59.9 Hz) | Default setting[3] 0.16 (Adj. Set Points 0.16 to 1000 sec) |
| H | Rated | Default setting[3] f >> 63.0 Hz (Adj. 60.1 to 66.0 Hz) | Default setting[3] 0.16 (Adj. Set Points 0.16 to 1000 sec) |
| Reconnection 300s (Default setting[3]). Adjustable 20s to 1000s. | | | |

1. Vnom is the nominal output voltage rating.
2. Trip limit and trip time accuracy specification is as follows: Voltage: +/-2%, Frequency: +/- 0.10Hz, Time: 2 grid cycles (33ms @ 60Hz).
3. Default settings aligned with IEEE 1547-2003 requirements.

To adjust voltage and frequency and disconnect times to meet local utility requirements, make modifications are made using the inverter embedded web user interface. The Token is required to unlock the "Admin Plus" functionalities (contact ABB solar inverter technical support 1-877-261-1374).

**Fault currents and durations:** During a grid fault including a short circuit condition, the inverter may inject current into the grid as specified below:

| Utility voltage (V) | Fault current RMS (A) | | |
|---|---|---|---|
| | 1 cycle | 3 cycle | 5 cycle |
| 208 | 17.4 | 15.9 | 15.8 |
| 240 | 17.1 | 16.5 | 16 |

**Output power derating at high ambient temperature:** Under high ambient temperatures, the inverter is designed to automatically reduce its output power. Detailed derating curves by model are provided in the product manual found on www.abb.com/solarinverters.

## 12. AFD (arc fault detection)

The Arc Fault Circuit Protection required by NFPA 70 Article 690.11 is provided by the inverter.
The AFD performs a self-test when the system is started:
If the self-test results are OK, the inverter will continue to AC grid connection.
If a potential problem on the AFD board is detected, the self test will result in error E053.
During normal operation the input current is continually measured and analyzed.
If a DC arc fault is detected during operation, the inverter disconnects from AC grid and generates an E050 error code (readable through internal Webserver).
Based on the above conditions, the Leds behaviour is described in the table below:

| | POWER | ALARM | GFI |
|---|---|---|---|
| Arc Fault pending | OFF | ON | ON |
| Self Test Failed | OFF | ON | Blinking (200ms period) |

In order to reset the error, log into internal webserver and press on "reset AFD" button. This will clear the E050 error and restart the self test. If self-test results are OK, the inverter will reconnect to the AC grid; if the DC arc fault is still present, the inverter will result in error E050.

**Refer to the product manual (downloadable on www.abb.com/solarinverters) for troubleshooting suggestions.**

The AFD self-test can be manually started anytime using the following procedure:
1. Turn off the inverter (switching off both DC and AC switches),
2. Turn on both the DC and AC switches and wait for self-test result.

**If the AFD trips frequently, it means arcs are occurring. Turn the inverter OFF and request a complete check of the system wiring, including all connections and junction boxes, to locate the problem.**

## 13. Grid support functions

The inverter is equipped with advanced grid support functionality that is useful to support reactive loads and also assist in reliable operation of the utility grid in the presence of a large number of distributed energy generation sources. This section provides an overview of the available grid support functions.
The parameters related to the grid support functions that are in this inverter can be modified by:
- Accessing the embedded Web User Interface.
- Accessing to settings under the Service menu requires a time-limited password, which can be obtained by calling ABB solar inverter technical support at 1-877-261-1374.

**1. Voltage ride-through**
This inverter provides parameters to respond to undervoltage and overvoltage events. The inverter is designed to operate normally within the specified operating range. If voltage excursions occur, the inverter is designed to continue operating normally or cease to export power for a specified delay. Beyond this programmed delay, the inverter disconnects from the grid in the event of an abnormal voltage condition.

**2. Frequency ride-through**
This inverter provides parameters to respond to underfrequency and overfrequency events. If frequency excursions occur, the inverter is designed to continue operating normally for a specified delay. Beyond this programmed delay, the inverter disconnects from the grid in the event of an abnormal voltage condition.

**3. Reactive power control**
The inverter provides several modes of operation for reactive power control and are described below:
- Disable: This is the default setting. Under this setting, the inverter exports with a power factor of 1.0.
- Fixed power factor control (Cosϕ set): In this mode, the operator can set the output power factor to a fixed value. When enabled, a new value will be set in the inverter.
- Q Fixed (Q Set): Sets the reactive power to a fixed value. When enabled, a new value will be set in the inverter.
- Power factor as function of output power (Watt/Cosφ Settings: Cosφ(P)): In this mode, the inverter reduces the power factor (cos-phi) as a function of the output power at a given operating point. The 4 points of the default curve, where you can set the % of Pmax values and related cos-phi, can be modified using the internal Webserver. When enabled, the curve will be set in the inverter.
- Dynamic Volt/VAR control (Volt/VAr Settings: Q(V)): Under this mode, the level of reactive power exported by the inverter is a function of the operating grid voltage, also known as a Volt/VAR curve. The 4 points of the default curve, where you can set the % of Vnom values and related % of Smax, can be modified using the internal Webserver. When enabled, the curve will be set in the inverter.

**4. Active Power Control**
This inverter offers several modes for active power reduction.
- Active Power Curtailment: Sets a new value of active power as % of Pmax. When enabled, a new value will be set in the inverter.
- CEI Average VGrid Derating (only italian grid standard): Sets, after a specific threshold, an active power derating based on the average of Vac on 10 minutes as per CEI-021 italian grid standard.
- Volt/Watt settings: P(V). Under this mode, the level of active power exported by the inverter is a function of the operating grid voltage, also known as a Volt/Watt curve. The 4 points of the default curve, where you can set the % of Vnom values and related % of Pmax, can be modified using the internal Webserver. When enabled, the curve will be set in the inverter.
- Frequency/Watt function (Frequency Control: P(f)): In this mode, the inverter limits the active power as a function of the grid frequency.

**5. Ramp control**
The inverter is designed to control the rate at which output power is increased, either at startup, or after a temporary low power condition on the PV array (such as fast shading). The following ramp controls are provided on this inverter.
- Normal ramp: The normal ramp defines the maximum rate at which the inverter can increase the output power under normal operation. The normal ramp control limits the fluctuations in the output power in order to prevent instabilities on the utility grid.
- Soft start: The soft-start ramp defines the maximum rate at which the inverter can increase the output power when the inverter is first starting up. This startup may occur on a daily basis or when the inverter restarts after an abnormal grid event has ended.

**Refer to the dedicaterd application note in the ABB Solar website for more details about the grid support functions.**

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