ABB solar inverters Application note Improving CDD wireless reception



Reader note

This document is to be used in conjunction with the MICRO-0.25-0.3-0.3HV-I product manual or Quick Installation Guide (QIG).

All safety precautions in the product manual must be read, understood and followed.

Scope and target audience

This document describes how to improve wireless communication between ABB MICRO inverters and ABB's Concentrator Data Device (CDD). This application note is for installers and homeowners with ABB MICRO systems, who are familiar with basic CDD operations and have a user manual or QIG nearby for reference.

Introduction

MICRO inverters report their status to the receiver unit (the CDD) over a radio frequency wireless link. The ABB MICRO inverter and CDD automatically choose the best signal routing but, as with any wireless communication, signals may degrade due to obstacles or non-ideal antenna orientation.

This application note discusses ways to check the radio signal strength the CDD obtains, and offers suggestions to strengthen it if needed.

Note also the Frequently Asked Questions (FAQs) posted at www.abb.com/solarinverters.



How to check the radio signal strength

The ABB MICRO and CDD system must be installed, and the inverters acquired and recognized as described in the product manual or QIG, and set up for local monitoring as follows. Note that local monitoring does not involve the AURORA Vision® Plant Viewer program on the Internet.

1. Enter the CDD's IP address in the URL address bar of an Internet browser (e.g., Internet Explorer, Chrome, Firefox, Safari). The IP address can be viewed on the CDD screen by pressing the ESC button on the right side of the CDD, as shown in "Figure 1 Right side of CDD unit showing ESC key" below.



Figure 1 Right side of CDD unit showing ESC key

2. After entering the CDD's IP address, the CDD's web server home page will display all the MICRO inverters in the system and their current energy output. Click on "View" and "RF Signals" as shown below in the blue box of "Figure 2 CDD web server home page "View" > "RF Signals" options".



Figure 2 CDD web server home page "View" > "RF Signals" options

3. If prompted for a user name and password, enter this information in the dialog box which pops up on the screen (user name is admin, factory default password is admin; however, the password can be changed by the user - refer to the AURORA Vision Plant Viewer software instructions for details).

4. On the "View - RF Signals" screen, the signal strength from each inverter will be displayed ("Figure 3 Signal bar graph screen from "View" > "RF Signals" page from the CDD web server"). Although information will be displayed on the screen, this information is a consolidated 15-minute data snapshot.

Total Output Review	Microinverter RF Signals				
0.0000 kW	Plant	quality signal:			Low (0 %)
0.000 kWh	SN:	MacRF: 00:12:4B:00:02:CE:24:E2	mag: O	r88i: 0	Low (0 %)
CO2 Saved	SN: 793559	MacRF: 00:12:4B:00:02:7C:D9:3D	mag: O	rasi: O	LOw (0 %)
0.00 t	SN: 793545	MacRF: 00:12:4B:00:02:CE:20:BB	mag: O	rasi: O	Low (0 %)
Plant Status OK Genero-GMT-7 280-0-1-1220 DST rot active Micro # 3					

Figure 3 Signal bar graph screen from "View" > "RF Signals" page from the CDD web server

There will be a signal strength bar for each MICRO inverter in the system. The example above shows data for three inverters. The following items are of particular interest:

- msg column: Shows how many data packets were received in the last 15 minutes.
- rssi column: The "received signal strength indicator" is a measure of the power in the radio signals received by the CDD.
- Plant quality signal (average): The percentage is a measure of the overall RF (radio frequency) communication link quality for each inverter-CDD link.

An average plant signal in the 40-70% range indicates a functioning system.

Average plant quality signals <40% are suboptimal, indicating poor communication quality. In this case, an outside extension antenna should be considered.

Boosting signal strength – antenna orientation

If the signal strength is less than desired, the fastest and easiest item to check is the CDD RF antenna orientation.

The RF antenna readily receives signals which come in from the sides, but has a dead zone at its top and bottom ("Figure 4 CDD RF antenna (black, A) showing the best orientation for signal reception (green, B), and the worst (red, C)").

A clear line of sight from antenna to the inverters is best. Nothing should be in contact with the part of the antenna above the base, as the item in contact will reduce the signal strength.



Figure 4 CDD RF antenna (black, A) showing the best orientation for signal reception (green, B), and the worst (red, C)

1. If the RF antenna is pointed straight towards the MICROs (red X in "Figure 5 Correct orientation for CDD RF antenna, vertical to the MICRO inverters" below), turn it to the vertical position (green $\sqrt{}$ mark in Figure 5).

2. After adjusting the antenna direction as noted above, wait 15 minutes for the CDD to receive a complete set of data and refresh its average plant quality signal strength screen.

3. Check the msg and average plant quality signal numbers on the Microinverter RF signals screen (see "Figure 3 Signal bar graph screen from "View" > "RF Signals" page from the CDD web server"), looking for an improvement in the average plant quality signal.



Figure 5 Correct orientation for CDD RF antenna, vertical to the MICRO inverters

Boosting signal strength – CDD location

The best location for the CDD is as close as possible to the MICRO inverters though, of course, the location must be readily accessible to the user and close to the wireless router.

Obstacles between the CDD and its MICRO inverters could degrade reception. Such obstacles are generally solid objects and include metal roof surfaces, metal-reinforced concrete and rebar or other metal objects, building frames, granite and other hard stone, bulletproof glass, some tinted glass, some reflective surfaces, or even particle board. The table below shows typical signal degradation due to various objects and materials, compared to clear line-of-slight reception through open air, across a distance of 100 yards (e.g., the length a football field).

Obstacle material	Signal degradation relative to an open field				
Metal	Up to 100%	(complete blockage of signal)			
Metal-reinforced	10 - 90%	(depending on the amount of metal)			
concrete					
Stone, particle	10 – 40%				
board, pressed					
cardboard					
Wood, plain glass	0 - 10%	(little degradation of signals)			

If such items are in the path of the CDD and the inverter, or if the CDD is far from the inverters, try relocating the CDD, though it needs to remain close to an electrical power source, close enough to the wireless router to maintain the network connection, and where the connectors on the bottom of the unit remain accessible.

Note that fog and rain can also affect signal transmission, although PV panels are not likely to be producing energy when it's foggy or rainy. Dust storms are not likely to affect signal transmission, but may require PV panels to be cleaned.

Boosting signal strength - CDD antenna extension cable

If a poor average plant quality signal persists after all the recommendations in the "Boosting signal strength – antenna orientation" and "Boosting signal strength – CDD location" sections of this document have been followed, then an ABB "CDD Antenna Extension Cable" (part number ZLH.00563) may help boost the strength of the radio signals received by the CDD. The RF antenna is attached at the end of the extension cable, up to 45 feet from the CDD. The CDD may then be placed in a convenient location indoors, while the antenna itself is closer to the inverters, even outdoors, bypassing metal roofs, metal building structures, etc.

The coaxial antenna extension cable is approximately 45 feet (15 meters) in length, has an outer diameter of 0.195 inches and coaxial terminals. It is rated for temperatures -40°F to 167°F (-40°C to 75°C).

Boosting signal strength – CDD antenna extension cable (continued)

If the RF antenna is mounted indoors, a special housing is not required, only a mounting bracket of plastic or other nonmetallic material, as metal may interfere with antenna reception and transmission.

If the RF antenna is to be mounted outdoors (for example, to bypass a metal roof), the external antenna may be set up using the following items available from ABB:

- CDD RF antenna (unscrew the RF antenna from the CDD) see "Figure 6 CDD RF antenna"
- CDD RF antenna extension cable (order part number ZLH.00563 from ABB)

The customer will need to supply the following items to create an external enclosure for the CDD RF antenna:

- Weatherproof, non-metallic junction box (of a sufficient size to house the antenna)
 Figure 6 CDD RF antenna
- Waterproof cable gland assembly (with seal and nut) (see "Figure 7 cable gland assembly") ØA min-max = 3-7 mm/ 0.118" -0.275")



105 mm / 4.13

Figure 7 cable gland assembly

Instructions for attaching the antenna extension cable

1. Unscrew the RF antenna from the top right side of the CDD ("Figure 8 CDD RF antenna (right) and WiFi antenna (left - stationary)").





If not using the external enclosure for outdoor mounting, skip step 2 and proceed to step 3.

2. If the antenna is to be mounted outside, thread the extension cable through the grommet and into the box. An example is shown in "Figure 9 Outdoor installation; mounting the RF antenna and watertight grommet assembly in a plastic junction box", though note that the exact cable received from ABB may vary from what is shown. The box and grommets will be supplied by the customer.



Figure 9 Outdoor installation; mounting the RF antenna and watertight grommet assembly in a plastic junction box

3. Attach the RF antenna to the extension cable ("Figure 10 45' RF antenna extension cable attached to RF antenna").



Figure 10 45' RF antenna extension cable attached to RF antenna

If not using the external enclosure for outdoor mounting, skip step 4 and proceed to step 5.

Instructions for attaching the antenna extension cable (continued)

4. Fit the antenna in the enclosure and tighten the cable glands. In the external enclosure, the base of the antenna should be visible above the grommet ("Figure 11 Outdoor installation; base of RF antenna showing inside the weatherproof box"), leaving only the waterproof parts outside the box.



Figure 11 Outdoor installation; base of RF antenna showing inside the weatherproof box

A cable tie, mounted inside the enclosure, can be used to secure the antenna. An example of a completed outdoor antenna assembly is shown in "Figure 12 Outdoor installation; example of CDD RF antenna mounted inside a plastic box with watertight seal".



Figure 12 Outdoor installation; example of CDD RF antenna mounted inside a plastic box with watertight seal

5. Mount the antenna or outdoor enclosure box where desired, with the antenna oriented as referenced in "Figure 4 CDD RF antenna (black, A) showing the best orientation for signal reception (green, B), and the worst (red, C)".

6. Screw the other end of the extension cable in to the CDD RF antenna connector ("Figure 13 CDD with RF antenna extension cable attached, top view (left) and bottom view closeup (right)").



Figure 13 CDD with RF antenna extension cable attached, top view (left) and bottom view closeup (right)

7. Check the average plant quality signal again, waiting 15 minutes for the screen to refresh (refer to "Figure 3 Signal bar graph screen from "View" > "RF Signals" page from the CDD web server").

Technical support line

If concerns arise, call ABB Technical Support at 1-877-261-1374 from Canada, the USA or Mexico. ABB Technical Support is open Monday through Friday (excluding major holidays), 6 a.m. to 6 p.m., Mountain Standard Time, and does not switch to Daylight Saving Time in the summer.

An answering service responds to calls outside normal business hours, taking call-back numbers and other contact information.

Please have the following information available when calling:

1. Serial number(s) and other information from the label on the back side of the MICRO(s).

2. Serial number, MAC address and other information from the label on the back of the CDD.

- 3. Name of the installer (if an installer was used).
- 4. Name of the site.
- 5. Description of the problem:
- Is it a one-time failure?
- Does it occur daily and if so, when?
- Is it a hard failure?

6. Conditions (weather, atmospheric, electrical) under which the problem occurs or occurred.

7. List of actions which have been attempted to fix the problem and their results.

8. Sections of the product manual or other Quick Installation Guide which the caller has referred to, and instructions which have already been completed.

For more information please contact:

www.abb.com/solarinverters

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