

QB-MINI2-RF

MINICUBE2 Wireless Option

1 Preface

Thank you for purchasing MINICUBE2 Wireless Option (QB-MINI2-RF). This product can be used with the programmable on-chip debug emulator MINICUBE2 to make the connection between your development system and MINICUBE2 wireless.

This document describes how to prepare to use and start this product and also describes wireless communication.

<1> Checking the package contents

Check the package contents in accordance with the packing list supplied with QB-MINI2-RF.

If there are any missing or damaged items, consult an NEC Electronics sales representative or distributor.

<2> Product information and documents

For information on QB-MINI2-RF, access the following NEC Electronics website (hereinafter referred to as Wireless Option information site).

<http://www.necel.com/micro/en/development/asia/minicube2/minicube2.html>

Click "Wireless Option" on the above website.

Documents for this product are also provided on the wireless option information website.

<3> Software download

NEC Electronics software for QB-MINI2-RF is available on the following website (hereinafter referred to as ODS).

<http://www.necel.com/micro/en/development/asia/index.html>

Click "Version-up Service" on the above website, and then, on the next website, click "MINICUBE2_Software".

We recommend using the latest software. If you want to be notified about software updates, subscribe to the Version-up Service according to the Version-up Service guide.

To use software made by a partner company, see the documents issued by that company.

2 Software Installation

First, install the software necessary to use this product.

<1> Software for the standard use of MINICUBE2

Install the software tool for using MINICUBE2 in a standard configuration. For example, to debug a V850 microcontroller, the debugger ID850QB, device files, and the MINICUBE2 USB driver must be installed.

Installing the software used in the standard configuration



<2> Runtime libraries provided by Microsoft

For Windows 2000 and XP, install the runtime libraries provided by Microsoft.

- Microsoft .NET Framework 2.0 Service Pack 1
- Microsoft Visual C++ 2005 Redistributable

The above libraries can be downloaded from a website that is linked to the wireless option information website.

Caution If the name of a Windows temporary file includes multiple-byte characters (such as when a Japanese login name is used), an error might occur during installation.

<3> MINICUBE2 RF utility

The MINICUBE2 RF utility (the RF utility) is used for monitoring the used radio frequency, the unit ID specified for the connection destination, and the wireless connection status.

Download the RF utility from among the MINICUBE2 software products available with the Version-up Service, and then decompress it. "mqb2rftul.exe" is the RF utility.

3 Setting up Wireless Unit and Checking Unit ID

This product includes two wireless units (QB-MINI2-RM). One unit is connected to MINICUBE2 and the other is connected to the target system.

Switch the former unit to "H" and the latter unit to "T". The wireless units will not be damaged by connecting them with a different setting, but note that they might malfunction.

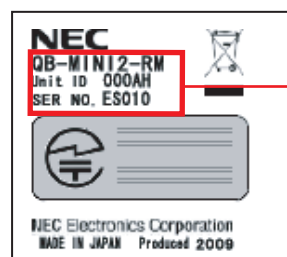
Set the unit to connect to MINICUBE2 to "H".



Set the unit to connect to the target system to "T".



The wireless units have four-digit unit IDs that are unique to each product. Memorize the unit IDs of the two wireless units because they will be used for identification when connecting them wirelessly.



QB-MINI2-RM
Unit ID 000AH
SER NO. XXXXX

Unit ID

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

4 Connecting and Starting Hardware

Connect the hardware, and then turn on the system.

Caution Before connecting the hardware, confirm the following:

- MINICUBE2 is not connected via USB.
- The target system is turned off.

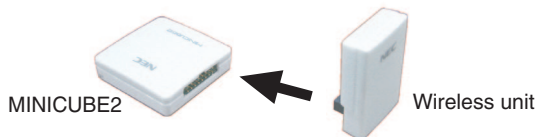
<1> Flipping the MINICUBE2 switches

Flip the MINICUBE2 switches to the following positions:



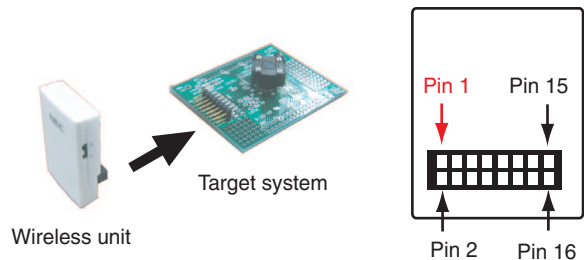
<2> Connecting a wireless unit to MINICUBE2

Connect the wireless unit that was set to "H" to MINICUBE2. Note the direction when connecting the unit.



<3> Connecting a wireless unit to the target system

Connect the wireless unit that was set to "T" to the target system. Note the position of pin 1, because the wireless unit is not protected against false connection. (The pin layout is shown in the figure to the right below.)



<4> Starting the system

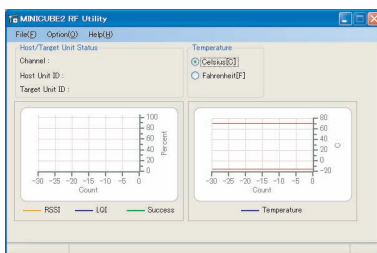
- (1) Connect MINICUBE2 to the host by using a USB cable. The LED on the wireless unit turns on and off.
- (2) Turn on the target system.
The LED on the wireless unit turns on and off as in (1) above.

5 Establishing Wireless Communication and Checking Firmware

Next, perform wireless communication, use the wireless units, and then check the firmware version and the radio wave status.

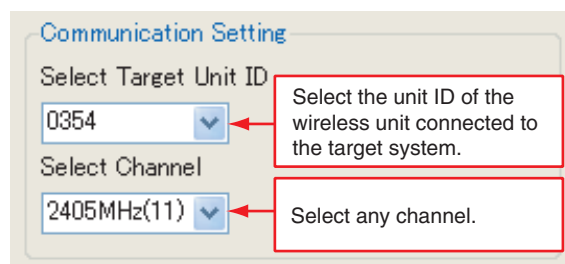
<1> Starting the RF utility

Run the mqb2rfutl.exe file that was downloaded and decompressed in step 2. The following window is displayed.



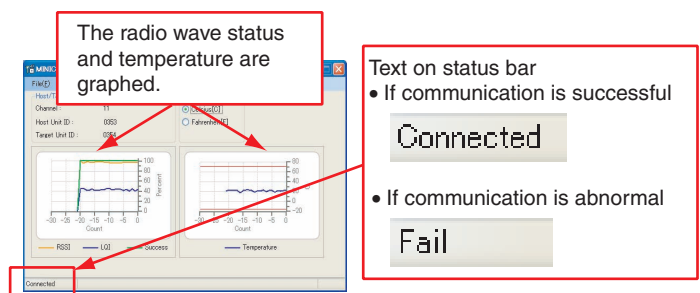
<2> Specifying the basic settings for wireless communication (the frequency channel and target unit ID)

Click [Option] on the menu bar and then [Configuration] to display the configuration dialog box. Specify the frequency channel and target unit ID, and then click the [OK] or [Apply] button.



<3> Starting and checking wireless communication

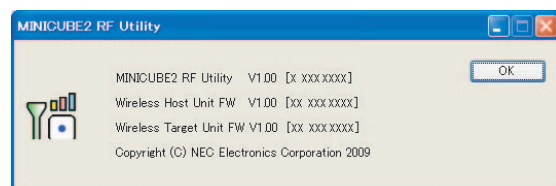
Wireless communication starts when the basic settings have been specified. After the settings are specified, they are held in the host registry and automatically specified every time the host starts. If wireless communication is successful, the radio wave status and measured temperature are graphed in the main window.



If wireless communication was not successful, "Fail" is displayed on the status bar. In this case, change the frequency channel and check the target unit ID in the configuration dialog box.

<4> Checking the firmware version

Click [Help] on the menu bar and then [Version]. The firmware versions of the RF utility and wireless units are displayed. On the Version-up Service website, check whether these are the latest versions.



This concludes setting up wireless communication.

6 Starting Debugging and Programming

After wireless communication ends, create a program in the same way as for a standard configuration in which the target cable is used. For example, when starting debugging, start the debugger, download the program, and then perform debugging.

The radio wave status during wireless communication changes depending on external factors such as other used wireless devices. Such changes can be determined using the RF utility. Be sure to use this product in an environment where radio waves are relatively stable.

We recommend reading the additional information on the following pages.

7 End Procedure

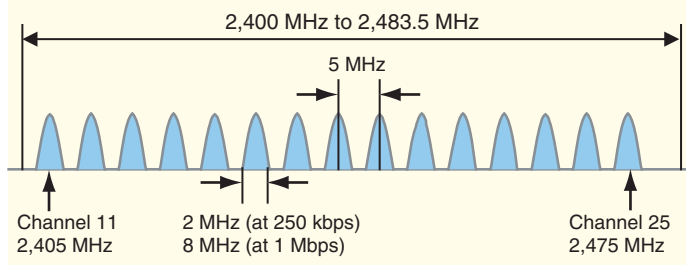
To end debugging or programming, turn off the system according to the following procedure. Next, disconnect the wireless units as required.

- (1) Close the debugger or programming GUI.
- (2) Close the RF utility.
- (3) Turn off the target system.
- (4) Disconnect MINICUBE2 from the host.

Wireless Communication

Type of wireless communication used

- An ISM frequency band from 2,400 MHz to 2,483.5 MHz is used.
- Physical layers (PHY) and media access layers (MAC) formulated according to IEEE802.15.4 are used.
- The 15 channels of communication frequencies shown below can be selected. If the interference by peripheral wireless devices is strong, communication can sometimes be improved by changing the channel.



- This product uses a spread spectrum method called direct sequence spread spectrum (DSSS) that is highly resistant to disturbing and interfering waves.

This method transmits 4-bit data by multiplying the data by pseudonoise codes and then restores the 4-bit data on the receiving side as actual data. Due to the used code string, the signal frequency is spread and less affected by interfering waves in specific frequency bands.

| Bit | Code |
|------|----------------------------------|
| 0000 | 11011001110000110101001000101110 |
| 1000 | 11101101100111000011010100100010 |
| 0100 | 00101110110110011100001101010010 |
| : | : |
| 1111 | 1100100101100000011101111011000 |

Radio wave status and temperature indicated using RF utility

- **RSSI (Receive Signal Strength Indicator)**

This indicator indicates the signal intensity. If the indicator is greater than 0, radio waves can be transmitted in the relevant environment. This indicator does not take the effects of interfering waves into consideration, but can be used as a reference to determine the intensity of the signal received by the wireless unit connected to the target system. For example, if the target system is running, this indicator decreases the longer the communication distance becomes. By using this indicator, you can estimate how far a signal can be transmitted in the current environment.

- **LQI (Link Quality Indication)**

This indicator is calculated based on the intensity of the signal and noise interference. If this indicator is greater than 0, communication can be performed in the relevant environment. Unlike RSSI, the effects of interfering waves are taken into consideration. Therefore, this indicator is affected by the used frequency band and communication speed.

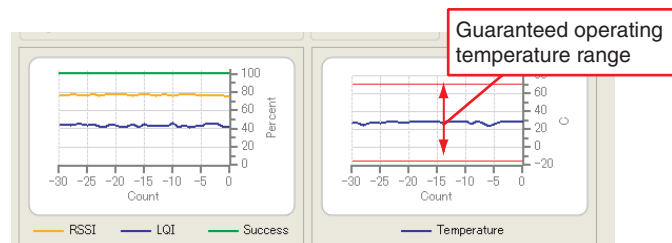
For example, if the signal is affected by other wireless devices even though RSSI is large, LQI decreases. This can sometimes be improved by changing the used channel.

- **Success**

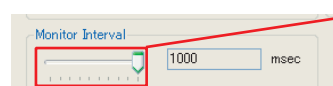
This indicator indicates whether the wireless unit connected to the target system is correctly receiving the data transmitted from the wireless unit connected to MINICUBE2. Because data that is not correctly received is ignored, no malfunction occurs, but the operating speed of the debugger and programming tool is affected.

- Temperature

The wireless units have a temperature sensor that determines the internal temperature of the wireless unit connected to the target system. This indicator indicates the internal temperature of the unit, not the ambient temperature. The guaranteed operating temperature for the wireless units is -15°C to $+70^{\circ}\text{C}$. The red line shown on the graph in the RF utility shows this temperature range. Use this product in the guaranteed operating temperature range.



To change the interval at which to update the graphs, change the right setting in the configuration dialog box.



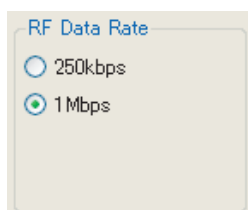
- Can be specified in the range from 100 ms to 1,000 ms.

✓ Using RF Utility More Flexibly

Performing faster wireless communication

The data transfer speed according to the default RF utility settings is 250 kbps. The data transfer speed can be changed to 1 Mbps by changing the setting below in the RF utility configuration dialog box. However, because LQI tends to decrease if the speed increases, make sure the radio wave status is relatively stable before changing the speed to 1 Mbps.

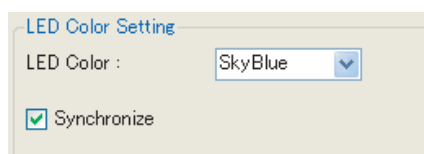
Even if 1 Mbps is specified, the operating speed of the debugger does not simply quadruple. The data transfer speed for wireless communication quadruples, but the speed of processing the firmware in the wireless units and USB communication for MINICUBE2 does not change.



Customizing LED color for wireless units

When using the wireless units for the first time, the LEDs on the wireless units turn on in blue. The color of the LEDs can be changed or the LEDs can be turned off to reduce current consumption.

The LED color for the wireless unit connected to MINICUBE2 can be changed by specifying a setting in the RF utility configuration dialog box. By selecting [Synchronize], the same color is specified for the LED on the wireless unit connected to the target system.



Information

Safety Information

Encrypting wireless communication data

Because radio waves can be transmitted up to about 100 m and the used type of communication conforms to the IEEE 802.15.4 communication standard, programs under development might be stolen.

To prevent this, the data to transmit using wireless communication can be encrypted. AES-CTR can be used as the encryption format from the advanced encryption standards specified in the United States. If this format is used, communicating units that do not have the same encryption key cannot communicate.

An encryption key consists of 128 bits (16 bytes). If encryption is used, the communication speed drops. Therefore, encryption is not used in the default RF utility settings.

Data is encrypted as shown to the right.

Caution Even if sophisticated encoding is performed using AES-CTR, the data is never completely secure. To protect programs during development, use the target cable instead of this product.

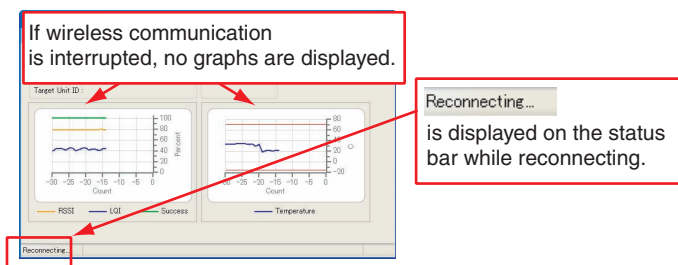
- (1) Set the two wireless units to "H".
- (2) Connect one wireless unit to MINICUBE2, and then start the RF utility.
- (3) Click [Option] on the menu bar and then [Security]. The security dialog box is displayed.
- (4) Select [Security Valid], and then enter an alphanumeric character string of 16 characters or less for [Security Key]. This string is case sensitive.



- (5) Click [OK]. The security setting is applied to the connected wireless unit.
- (6) Also, specify the security setting for the other wireless unit by repeating steps (2) to (5).

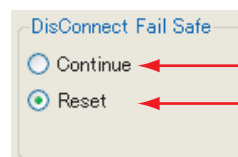
When wireless communication is interrupted

Wireless communication might be interrupted due to the effects of other wireless devices or when the distance between the wireless units changes. If this happens, the wireless units regularly issue a connection request and attempt to re-establish wireless communication. At this time, no graphs are displayed in the RF utility as shown below and [Reconnecting] is displayed on the status bar.



However, if wireless communication is interrupted during debugging or programming, the target system cannot be stopped until wireless communication is restored. Therefore, the system might be corrupted due to an infinite loop.

To prevent this, a setting that immediately resets the system when wireless communication is interrupted can be specified. Select [Reset] for the fail-safe setting in the RF utility configuration dialog box as shown below.



Select this to continue operation even if wireless communication is interrupted.

Select this to reset the system if wireless communication is interrupted.

Troubleshooting

If a problem occurs, first check for abnormalities by using the MINICUBE2 self-diagnosis tool. Also, check whether MINICUBE2 and the wireless units use the latest firmware according to the Version-up Service website. If the problem cannot be resolved, see the FAQs on the NEC Electronics website or see the following website and contact us by E-mail.

<http://www.necel.com/contact/en/index.html>

The information in this document is current as of June, 2009. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

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(Note)

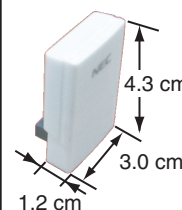
(1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.

(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

Specifications

• Hardware

| Item | Specification |
|--|--|
| Size | See the right figure. |
| Weight | About 10 g |
| Guaranteed operating temperature range | -15 °C to +70 °C |
| Storage temperature range | -15 °C to +70 °C |
| Connectors | 16 pins, general-purpose 2.54 mm pitch |
| Special features | Temperature detection, changing the LED color, monitoring the radio wave intensity |



• Wireless communication

| Item | Specification |
|---|--|
| Frequency band | 2,400 MHz to 2,483.5 MHz |
| Connectable distance | Maximum 100 m (depending on the used environment) |
| Usable number of frequency channels | 15 (in 5 MHz intervals) |
| Number of units identifiable in the same space | 100 |
| Current consumption (supplied from the target system) | About 50 mA on average |
| Communication method | Direct sequence spread spectrum (DSSS) |
| Data rate | 250 kbps, 1 Mbps |
| Applicable laws | Radio Act (Japan), CE, FCC |

CUSTOMER NOTIFICATION

| |
|--|
| ZUD-CD-09-0171 (1/2) |
| August 4, 2009 |
| Yoshinari Ando, Team Manager Development Tool Solution Group Multipurpose Microcomputer Systems Division Microcomputer Operations Unit NEC Electronics Corporation |

QB-MINI2-RF Precautions

This product complies with radio act (Japan), CE (Europe), Part 15 of FCC Rules (America). QB-MINI2-RF is usable in Japan, Europe, and America. To use in other countries, please confirm the law in the country. If you need anything, please contact an NEC Electronics sales representative or distributor.

FCC Compliance Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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



WARNING TO USER:

- Change or modifications not expressly approved the manufacturer can void the user's authority to operate this equipment.
- This equipment must not be co-located or operated in conjunction with any other antenna or transmitter.
- This equipment complies with FCC radiation exposure limits set forth for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This equipment must be installed and operated with at least 20cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and ankles).