



PART 1

This QuickStart Guide is separated into two parts. Part 1 guides you through the installation of the ZigBee software and demonstration programs, including use of the RF Sniffer.

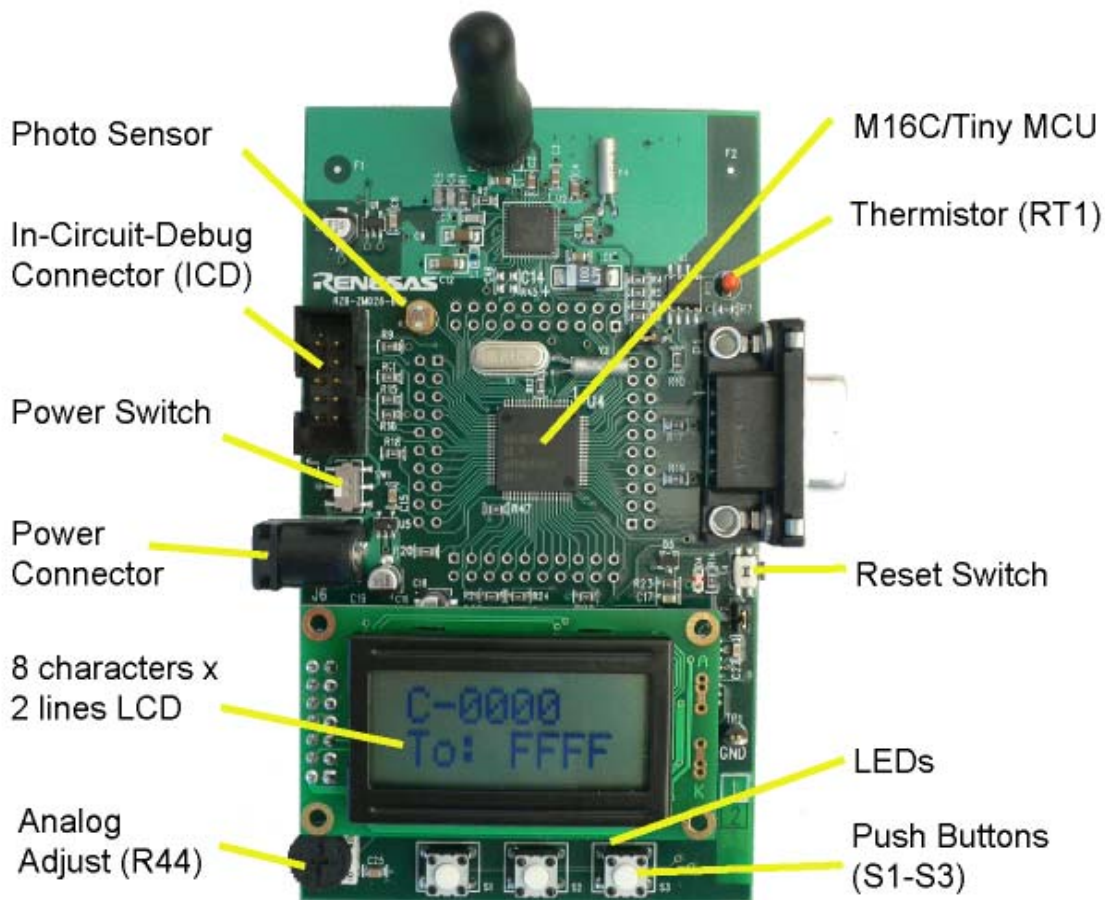


Figure 1: 900MHz ZDK Board

1. ZigBee Demonstration Kit Demo Software

Your ZigBee Demonstration Kit (ZDK) comes with four pre-programmed boards, one of which is an RF Sniffer board and three of which are ZDK Demo boards. Your kit also contains three battery packs, each with three AA cells and a power-on/off switch.

- a.) Make sure that each battery pack's power switch is in the "Off" position.
- b.) Connect the battery packs to the ZDK demo boards' power connectors (Figure 2).

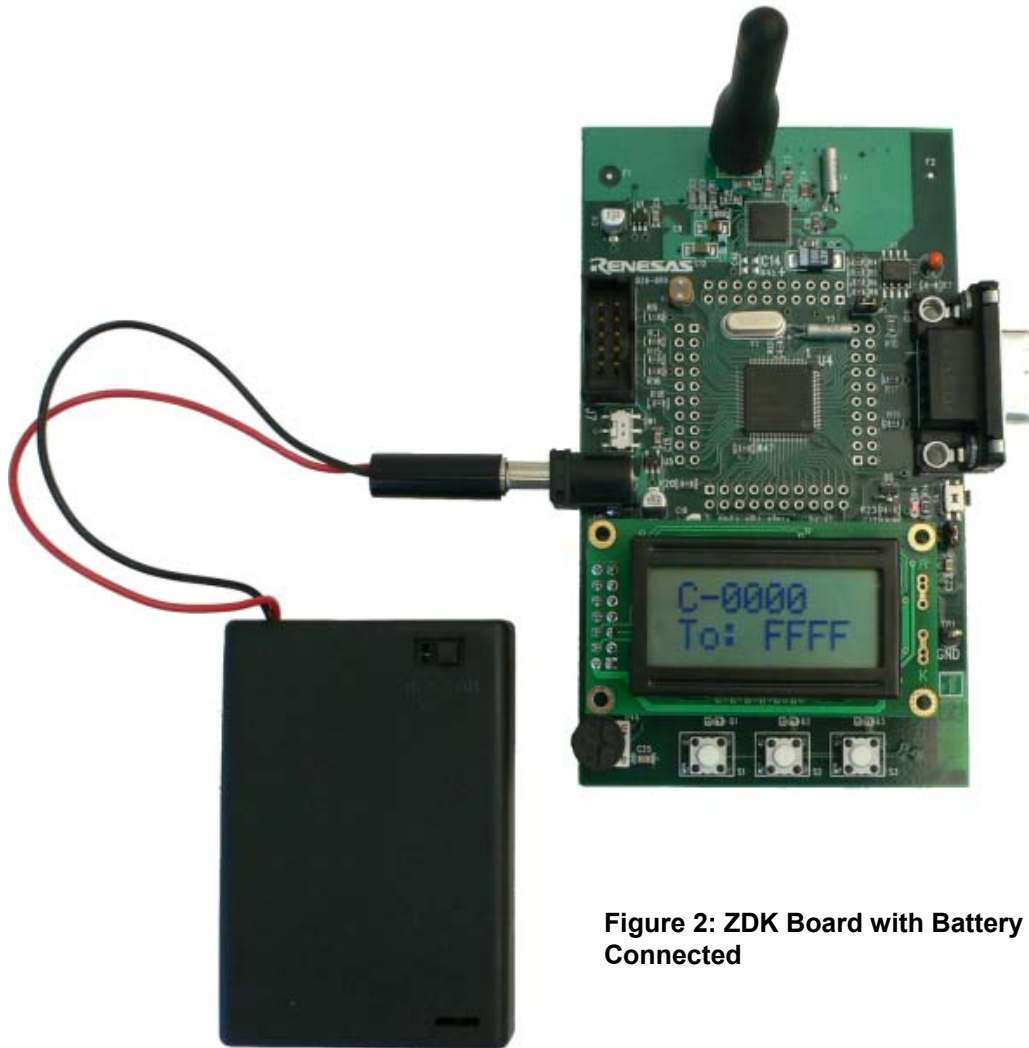
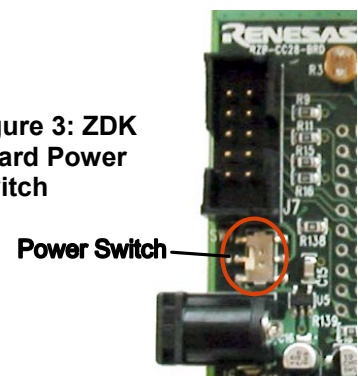


Figure 2: ZDK Board with Battery Pack Connected

- c.) The ZDK demo boards have a power switch SW1 located between the power connector and the 2×5 ICD header. Make sure the board's power switch is set toward the power connector to supply the board with power via the battery pack (Figure 3).
- d.) Now change each battery pack's power switch to the "On" position.
- e.) After a short welcome message, the display of the boards will show "Select Device Type" on line 1 and "C R" on line 2.
- f.) Press the pushbutton under the letter "C" on one of the boards (C stands for ZigBee Coordinator). You should see the message "Pan started" and then on the first line of the display "C-0000" and on the second line "To: FFFF". "C" indicates that the board has established a ZigBee network as the coordinator; "0000" is its device address. The "To:" shows the address to which all transmissions from the coordinator are sent — in this case to address FFFF, which is the ZigBee broadcast address, i.e. each message is sent to all other devices in the ZigBee network.
- g.) Press the pushbutton under the letter "R" on the second and third boards (R stands for ZigBee Router). You will briefly see the message "Router Joining" and then "R-0001" will be displayed on the first line of the LCD. "R" indicates that this board has joined the network as a router and "0001" is its device address (the third board will have a different address). The second line of the LCD indicates this board's destination address for transmitting packets. By turning the potentiometer on any of the ZDK boards

Figure 3: ZDK Board Power Switch



(type C or R), you can change the destination “To” address. As more devices enter the network, you will have more address choices.

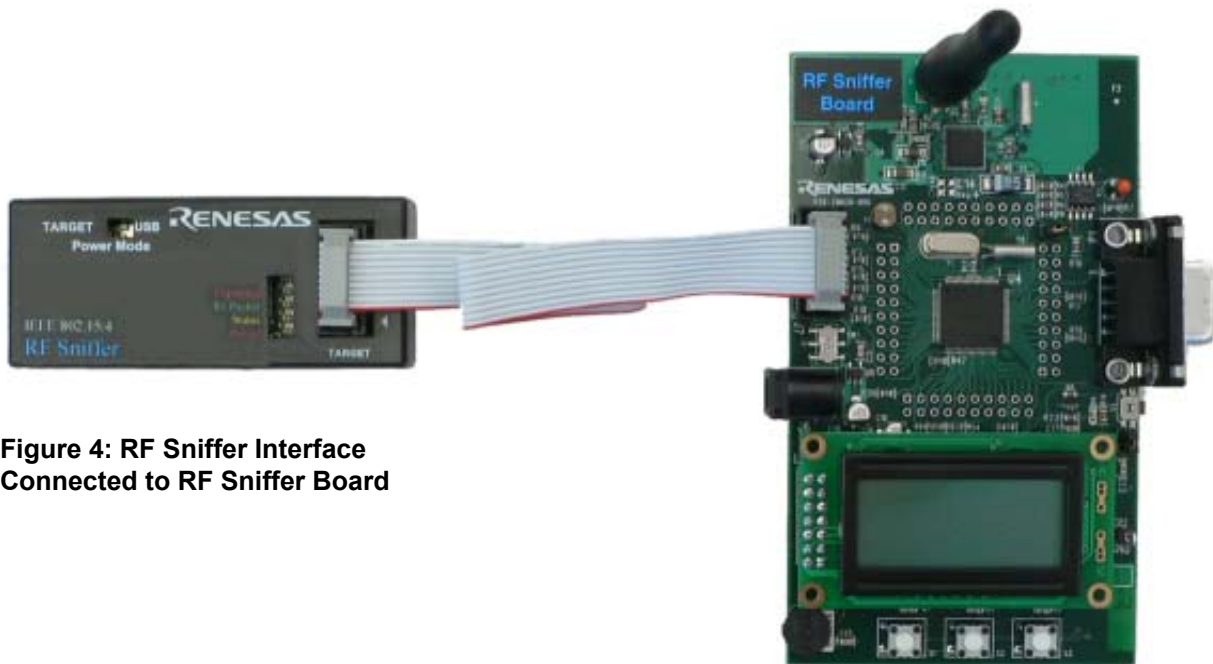
- h.) ZigBee messages between the two boards are generated and transmitted when you press any of the three pushbuttons below the LCD of a board. Pressing a pushbutton will light the LED above the button on both the transmitting and receiving boards. In addition, the receiving board's LCD will display information contained within the packet from the transmitting board as follows:
- **Pressing button S1: Signal Strength.** The receiving board's LCD displays the Link Quality Indicator value (LQI) of the received packet. The LQI is a signal strength indicator where 0 is the weakest and 255 is the strongest.
 - **Pressing button S2: Photo Sensor.** The receiving board's LCD displays the two-digit hex value of the transmitting board's photo sensor.
 - **Pressing button S3: Temperature Sensor (Thermistor).** The receiving board's LCD displays the two-digit hex value of the transmitting board's temperature sensor.
- i.) **Transmitting ASCII Text via RS-232.** There is one more function that this demo can perform. It will be covered at the end of this QuickStart Guide.

At this stage, we are done using the ZigBee demo boards and you may turn the battery pack power switches “Off”.

2. ZigBee ZDK for M16C Software Install

Please insert the enclosed CD into your computer's CD-ROM drive. The CD should auto-start, displaying the ZigBee ZDK Install Screen. Select “ZigBee Demo Kit (ZDK) Quick Start” and click <Install>. Follow the directions in the installation windows to install the ZDK demo software tools.

- If the installation screen does not appear, please browse the CD root folder and double-click on “ZDK_Installer.exe”.
- Do **not** plug the RF Sniffer Interface into your USB port until instructed to in Section 3: RF Sniffer Interface USB Driver Installation.



**Figure 4: RF Sniffer Interface
Connected to RF Sniffer Board**

3. RF Sniffer Interface USB Driver Installation

Your ZigBee Development Kit includes an RTA-FoUSB-MON unit that comes pre-programmed to function as an RF Sniffer Interface (RFSI). When you connect the RFSI to your computer for the first time, Windows will recognize the new device and request the driver. Follow the steps below to install the driver for the RFSI. Administrator privileges are required to install the driver on a Windows 2000/XP machine.

- a.) Verify that the RFSI's "Power Mode" selector is in the "USB" position.
- b.) Connect one end of the mini USB cable into the RFSI, and the other end into your PC's USB port. The red "Power" LED on the RFSI will light up, and the yellow "Status" LED will blink about 2-3 times per second.
- c.) If using Windows 98, 2000, or ME, no intervention by the user is needed. When the RFSI is plugged in, Windows automatically attaches the correct driver for your device and it is ready to use. Skip to Section 4.
- d.) If using Windows XP, the first time an RFSI device is plugged into a different USB port, the Windows XP "Found New Hardware Wizard" window will appear.
- e.) Select "No, not this time" when the Wizard prompts to search Windows Update for software.
- f.) Select the option "Install the software automatically (recommended)". Windows will then begin installing the USB driver.
 - i.) Another screen probably will appear stating that this driver has not been XP certified by Microsoft. Click the **<Continue Anyway>** button. (We did not participate in the Microsoft XP driver certification program.)
 - ii.) After the driver has installed, you will be able to click "Finish" to close the wizard.
- g.) When your Windows system correctly loads the USB driver for your RFSI, the yellow "Status" LED will begin to blink much more slowly. You can use this to verify that your RFSI is attached properly each time you connect it.

NOTE: If you have problems installing the drivers, or if your PC will not recognize the RFSI, please see the "Troubleshooting" section of the RF Sniffer user's manual for help.

4. RF Sniffer Hardware Setup

The following instructions are specific for the RF Sniffer board and RFSI. The RF Sniffer board ships with firmware that runs on the board when connected to the RF Sniffer Interface (RFSI).

- a.) If not already done in step 3b, plug one end of the USB cable into the RFSI and the other into a USB socket on your PC.
- b.) The RF Sniffer board has a power switch SW1 located between the power connector and the 2×5 ICD header. Make sure the board's power switch is set toward the ICD connector to supply the board with power via the RFSI.
- c.) Connect the RFSI to the RF Sniffer board using the supplied ribbon cable. The LCD of the board should display "Renesas Sniffer". If the LCD on the RF Sniffer board does not come on, check the "Power Mode" switch on the RFSI and verify that it is set to the "USB" position.

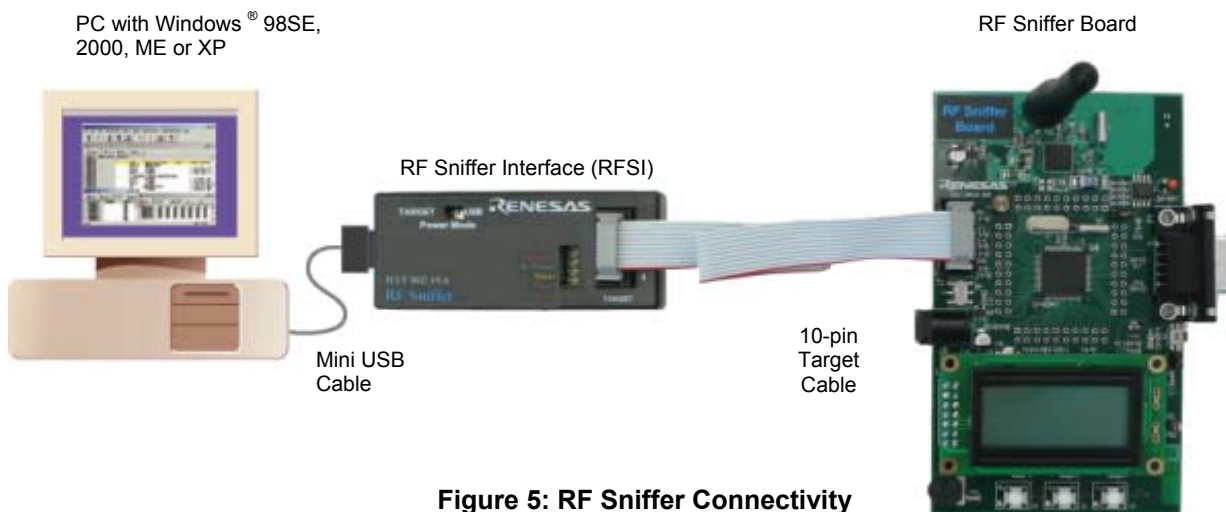


Figure 5: RF Sniffer Connectivity

5. RF Sniffer Software

- a.) If not done so already, please **disconnect** power from the two ZDK demo boards used for the ZigBee demo in Section 1 of this QuickStart Guide. This is necessary because the RF Sniffer can

only determine a ZigBee network's topology if it is already "listening" when the different nodes join the network.

- b.) Start the RF Sniffer software by using the Start Menu (Start > All Programs > Renesas > RF Sniffer Vx.xx > RF Sniffer) or desktop icon.
- c.) Click the <**Connect**> button on the RF Sniffer Software Toolbar. It should change its color to blue and display "Disconnect" now instead of "Connect". The channel selector to the right should be set to channel 1 (0x01).



Figure 6: RF Sniffer Toolbar

- d.) Click the <**Capture**> button. The RF Sniffer software is now in capture mode "listening" for any ZigBee packets within reach of the RF Sniffer target board.
- e.) Power-up one of the ZigBee Development Kit (ZDK) demo boards. Press the pushbutton located below the "C" letter to make this board the ZigBee network **C**oordinator.
- f.) Power-up your second ZDK board. Press the pushbutton located under the "R" letter to make this board a ZigBee **R**outer node.
- g.) Press any of the three pushbuttons on one of the ZDK boards to generate ZigBee traffic.
- h.) In the RF Sniffer's software capture window, you can see the ZigBee packets that have been transmitted based on that event.

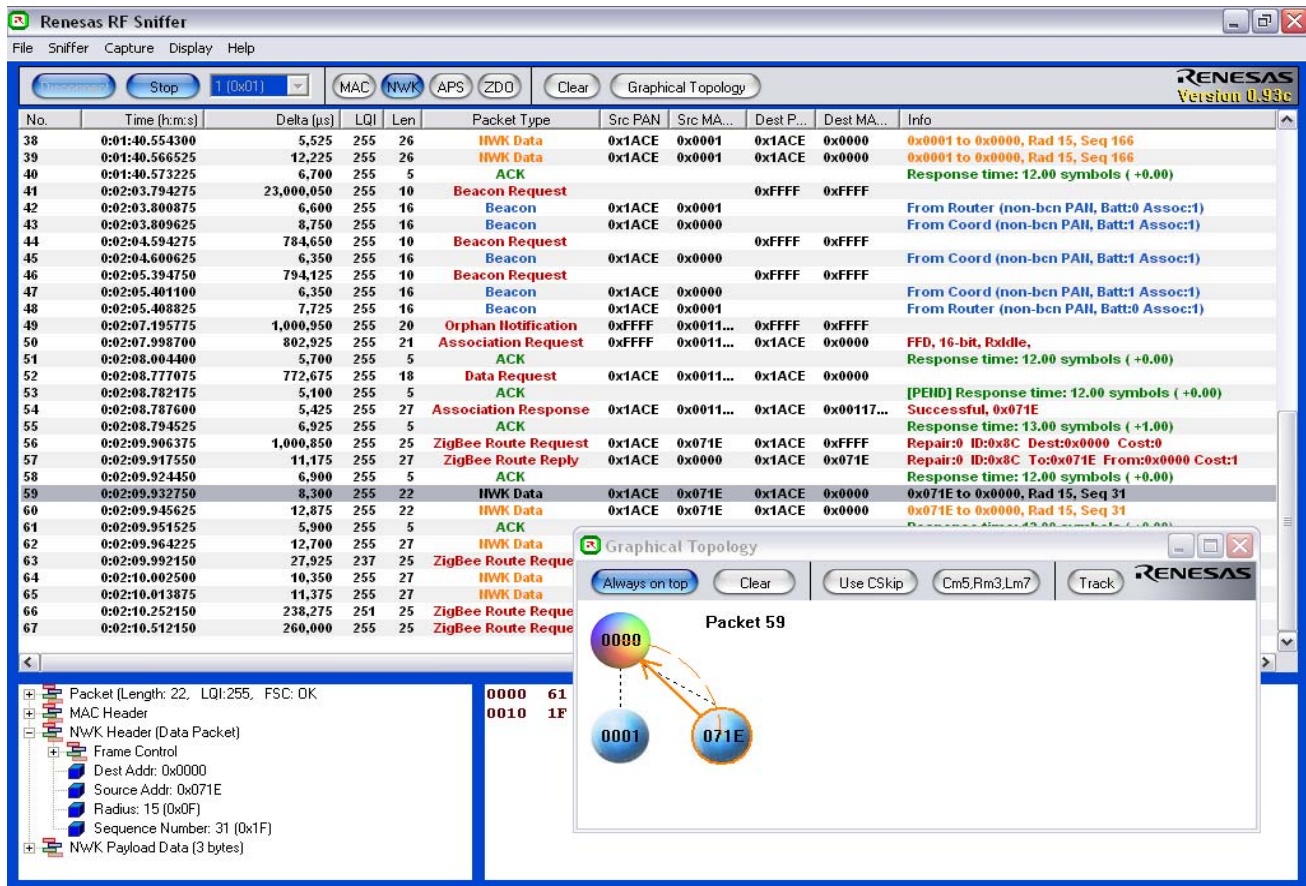


Figure 7: Capture and Graphical Topology Windows

- i.) When you click on the <Graphical Topology> button in the RF Sniffer software, a window will open showing you the ZigBee nodes that are members of the network, how they are interconnected, and the flow of information between them.

We are now done with the RF Sniffer. You may now <Stop>, <Disconnect> and close the RF Sniffer GUI, then disconnect the RFSI USB cable from your computer.

More information on the RF Sniffer software and hardware, and on updating the RF Sniffer Interface's firmware, can be found in the RF Sniffer User Manual (Start > (All) Programs > Renesas > RFSnifferV.x.xx > User Manual).

PART 2


In part 2, you will install development tool software, ZigBee stack evaluation code, and general MCU sample programs.

1. Development Tools Software Install

Please remove then re-insert the enclosed CD into your computer's CD-ROM drive. The CD should auto-start, displaying the ZigBee ZDK Install Screen. Select the second option in the list, "Development Tools & Sample Code". Follow the directions in the installation windows to install the ZDK demo software tools.

- If the installation screen does not appear, please browse the CD root folder and double-click on "ZDK_Installer.exe".
- Do **not** plug the In-Circuit Debugger into your USB port until instructed to do so in Section 2: In-Circuit Debugger USB Driver Installation.
- During the installation process, you may be prompted to restart your computer. **Do not restart** until the ZDK installer has completed installation of all the software items.
- During the installation, the AutoUpdate dialog will be displayed. Do **not** configure AutoUpdate at this time; it will be completed in the next section. Please wait for the installation wizard to complete. This will take a few minutes during which the progress bar may stop for long periods. This is normal operation.

2. AutoUpdate

After the installation has completed, click the icon  in the Windows system tray to configure AutoUpdate.

Configure the AutoUpdate settings dialog to allow your installation to be checked for required updates.

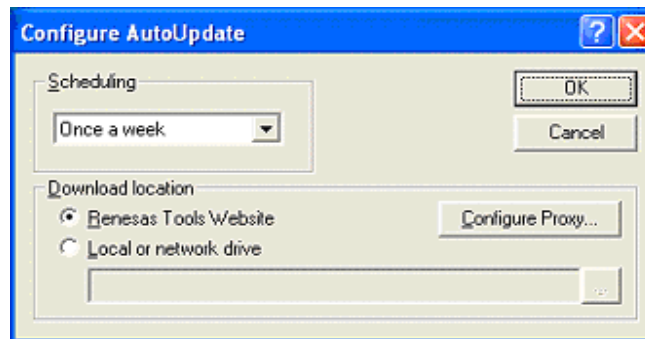


Figure 8: AutoUpdate Configuration

3. In-Circuit Debugger USB Driver Installation

Your ZigBee Development Kit also includes an RTA-FoUSB-MON unit that comes pre-programmed to function as an In-Circuit Debugger and Programmer (ICD). It requires a different USB driver than the RFSI unit. When you connect the ICD to your computer for the first time, Windows will recognize the new device and request the driver. Follow the steps below to install the driver for the ICD. Administrator privileges are required to install the driver on a Windows 2000/XP machine.

- Verify that the ICD's "Power Mode" selector is in the "USB" position.
- Connect one end of the mini USB cable into the ICD and the other end into your PC's USB port. The red "Power" LED on the ICD will light up, and the yellow "Status" LED will blink about 2-3 times per second.
- If using Windows 98, 2000, or ME, no intervention by the user is needed. When the ICD is plugged in, Windows automatically attaches the correct driver for your device and it is ready to use. Skip to Section 3.
- If using Windows XP, the first time an ICD device is plugged into a different USB port, the Windows XP "Found New Hardware Wizard" window will appear.

-
- e.) Select the option “Install the software automatically (recommended)”. Windows will then begin installing the USB driver.
 - i.) Another screen probably will appear stating that this driver has not been XP certified by Microsoft. Click the **<Continue Anyway>** button. (We did not participate in the Microsoft XP driver certification program.)
 - ii.) After the driver has installed, you will be able to click “Finish” to close the wizard.

NOTE: If you have problems installing the drivers, or if your PC will not recognize the ICD, please see the “Troubleshooting” section of the RTA-FoUSB-MON user’s manual for help.

4. Downloading the ZigBee Binary Using the Flash-over-USB™ Programmer

Before starting to work with the High-performance Embedded Workshop for experimenting with your own ZigBee application, you have to download the ZigBee stack and the RTOS to one of your ZDK boards. The ZigBee stack and RTOS are provided as a binary file called the *ZbRom*.

- a.) Make sure that the “Power Mode” switch of the RTA-FoUSB-MON In-Circuit Debugger and Programmer (ICD) is in the “USB” position and that the power switch of the ZDK board is set toward the ICD connector to power the board from the ICD. Disconnect the battery pack from the ZDK board, as power to the board now will be provided from the ICD.
- b.) Connect the ICD to the ZDK board using the 2×5 ribbon cable, and to the PC using the mini USB cable.
- c.) Start the Flash-over-USB Programmer (Start > (All) Programs > Renesas > Flash-over-USB Ver. x.xx > FoUSB Programmer) or double-click on the “FoUSB” icon on your desktop.
- d.) The first time the FoUSB Programmer is run on your computer:
 - i.) If the Chip Selection window is not displayed, click the **<Select MCU>** button.
 - ii.) Select the M16C/Tiny series.
 - iii.) Then select the MC16C/28 group and the M30280FA part.
 - iv.) Click **<OK>**.
 - v.) Click **<OK>** as requested until you are returned to the Flash-over-USB main menu.
- e.) Each subsequent time the FoUSB Programmer is run:
 - i.) If the “Unlocked” window appears, click **<OK>**.
- f.) Click **<Open>** when the Flash-over-USB main menu appears.
- g.) Browse to the C:\Renesas\RZB_ZMD16C_ZDK\ZbRom\ folder.
- h.) Select the file ZbRom_ZMD28_FFD_Vxx.mot and click **<Open>**.
- i.) When the ID Code dialog box appears, click **<OK>**.
- j.) Click **<Program>** to open the Program Flash window. Make sure “Erase Only Needed Blocks” is selected. Do **not** select “Erase all Blocks” as this would erase the unique ZigBee MAC address stored in every ZDK board.
- k.) Click **<Program>** to download the demo program.
- l.) When the FoUSB dialog box “Program completed successfully” appears, click **<OK>**.
- m.) Click **<Exit>** to close the Flash-over-USB Programmer. All three LEDs on your board will blink continuously.
- n.) For more information on how to use the Flash-over-USB Programmer, click on the **<Help>** button.
- o.) After successful programming of your ZDK board, all three LEDs above the pushbuttons should blink.

5. HEW (IDE) QuickStart

The High-performance Embedded Workshop software (HEW) integrates various tools such as the compiler, assembler, debugger, and editor into a common Graphical User Interface. To learn more about how to use HEW, open the HEW Manual Navigator on your computer (Start > (All) Programs > Renesas > High-performance Embedded Workshop > Manual Navigator).

- a.) Launch HEW from the Start menu (Start > (All) Programs > Renesas > High-performance Embedded Workshop > High-performance Embedded Workshop).
- b.) In the “Welcome!” dialog box:
 - i.) Verify “Create a new project workspace” is selected.
 - ii.) Click **<OK>**.
- c.) In the “New Project Workspace” dialog box:

- i.) Verify the “CPU family” is set to “M16C”.
- ii.) Select “ZigBee M16C/28 ZMD Kit” (Figure 9).

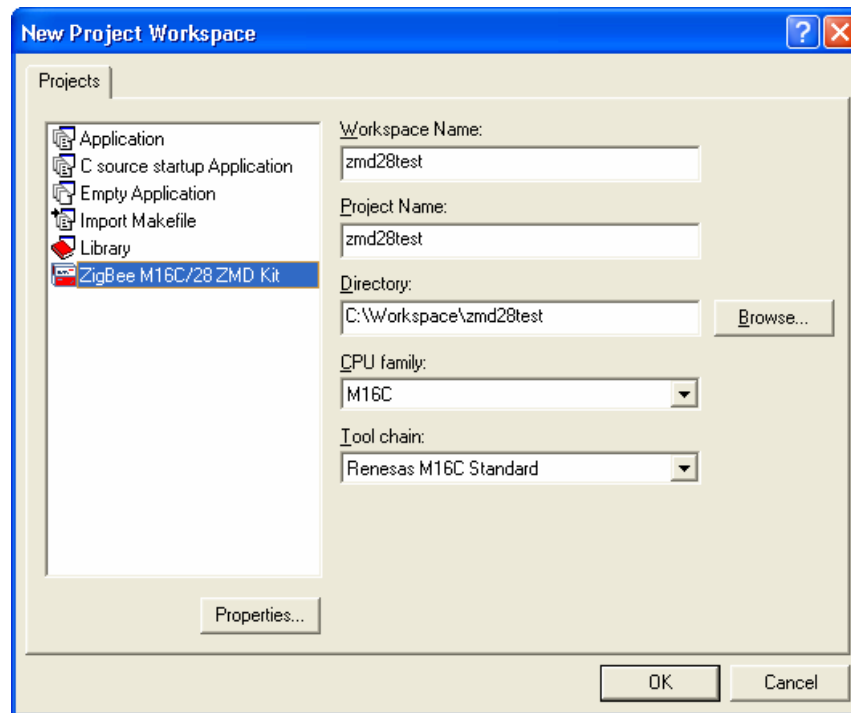



Figure 9: New Project Workspace in HEW

- iii.) Enter “zmd28test” for the Workspace Name (the Project Name will auto fill to “zmd28test”).
- iv.) Click <OK>.
- d.) In the “ZigBee M16C/28 ZMD Kit – Step 1” window:
 - i.) Select “ZDK Demo”.
 - ii.) Click <Finish>.
- e.) In the “Project generator information” window:
 - i.) Click <OK>.
- f.) Click the “Build” icon  to compile, assemble and link the project. After the build is complete, the HEW Build window will display:

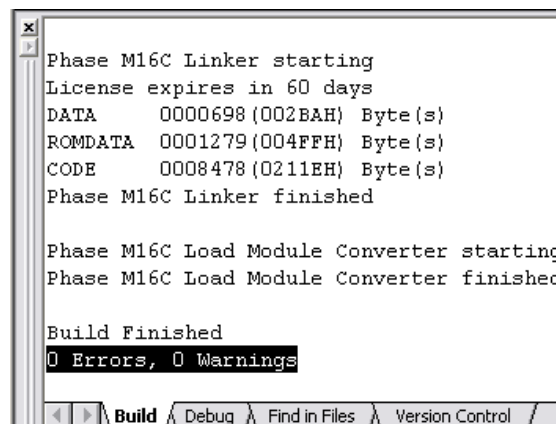


Figure 10: HEW Build Window

6. HEW (Debugger) QuickStart

- a.) Make sure that the “Power Mode” switch of the ICD is in the “USB” position and that the power switch of the ZDK board is set toward the ICD connector to power the board from the ICD.
Disconnect the battery pack from the ZDK board, as power to the board now will be provided from the ICD.
- b.) Connect the ICD to the ZDK board using the 2x5 ribbon cable, and to the PC using the mini USB cable.
- c.) Use the Configuration pull-down box to select the “Coord_Router” configuration.
- d.) Use the Session pull-down box and select “FoUSB_Debugging” as shown in Figure 11. If requested to save the session, click <Yes>.



Figure 11: Changing to a Debugging Session

- e.) The “Init” dialog box opens. The first time you open a debug session, you need to define the target:
 - i.) Click <Refer...>
 - ii.) Select the M16C-28 Group folder.
 - iii.) Select the M30280FA MCU.
 - iv.) Select USB and click <OK>.
 - If the message “We should download new firmware” appears, first make sure the “Power Mode” switch is in the “USB” position, then remove the ribbon cable connection between the ICD and the target board before clicking <OK>. The ICD can **not** update its firmware while connected to the ZDK board. After the firmware of the ICD has been updated, please re-attach the ribbon cable.
 - If you get an error, disconnect and reconnect the ICD from the USB cable and re-try.




Figure 12: FoUSB Connect Menu

- f.) From the “Debug” pull-down menu, select “Download Modules > All Download Modules”.

-
- g.) Click on the “Go” icon  to start the program.

The LCD on the board soon will display a “ZigBee” welcome message. After a few seconds:

- A text message will scroll across the first line of the display, prompting you to “Select Device Type”.
 - The second LCD line will display **C** (for Coordinator) above SW1 and **R** (for Router) above SW2. The LEDs above SW1 and SW2 will blink alternately.
 - The functionality of the code is identical to the demo code described in part 1, section 1 of this QuickStart Guide. Within HEW you can now debug the code, e.g. set breakpoints, single step through the code, and examine internal registers of the MCU.
 - Click on the “Stop” icon  to halt the program.
- h.) From the “File” pull-down menu, select “Exit”. If requested to save workspace and/or session, click **<Yes>**.
- i.) The board now can be disconnected from the ICD. If you connect the battery pack to the board and move the board’s power switch toward the power connector, the board can be used in standalone demo mode again.

7. Re-Programming the Demo Code Using the Flash-over-USB™ Programmer

This step is optional, as the demo code already has been programmed during the HEW Debugger QuickStart section. This procedure is listed here for reference in case you wish to update the demo code of a board without using HEW. Follow the steps outlined in section 4. Downloading the ZigBee Binary Using the Flash-over-USB™ Programmer, but browse to the directory `C:\Renesas\RZB_ZMD16C_ZDK\Demos` and open the file `ZDK_Demo_ZMD28_ZCR_Vxx (Ch1) .mot` instead.

8. Transmitting ASCII Text via RS-232

This section of the QuickStart guide is optional and requires items that are not included with this kit: Either RS-232 straight-through extension cables (not NULL type cables), or a USB-to-Serial converter for each of the ZDK boards. The instructions below are specific to the HyperTerminal program that comes with Windows, though any ASCII terminal may be used when set up as described in e.) below.

- a.) Connect one computer (or ASCII terminal) to each board’s RS-232 DB-9 connector (one computer/terminal per board).
- b.) In Windows on each computer, start HyperTerminal (Start > (All) Programs > Accessories > Communications > HyperTerminal).
- c.) When HyperTerminal starts, type in a name for the new connection you want to establish. Click **<OK>**. Do this on each computer.
- d.) In the “Connect To” window, select the COM port to which the ZDK board is attached. Click **<OK>**. Do this on each computer.
- e.) Set the Port Settings on each computer/terminal to 115200 bps, 8 data bits, no parity, and 1 stop bit.
- f.) Type some text in any terminal window and press the return key. The text will be RF transmitted to the remote board(s) then also displayed on the terminal window(s) of the computer(s)/terminal(s) connected to the remote board(s).

9. What are the next steps?

After you have completed this QuickStart procedure, please review the tutorials that came with the kit. The tutorials will help you understand and jumpstart the software development process using Renesas’ development tools. You can view the standard starter kit tutorials from within the Manual Navigator (Start > (All) Programs > Renesas > RZB_ZMD16C_ZDK > All Manuals and Documents).

To check for any updates to the ZigBee Demonstration Kit, use the shortcut *Start > (All) Programs > Renesas > RZB_ZMD16C_ZDK > Check for Kit Updates*. This will take you to a kit-specific page on the Renesas website which provides links to any available update downloads.

10. HEW/C-Compiler

The High-performance Embedded Workshop User Manual will show you how HEW integrates various tools such as the compiler, assembler, debugger and editor into a common Graphical User Interface. To view the

manual on your computer, go to the HEW menu (Start > (All) Programs > Renesas > High-performance Embedded Workshop > Manual Navigator).

Included in the ZDK is the Evaluation Version of the NC30WA C-compiler. The limitations are:

1. No support or warranty without the purchase of a full license.
2. After 60 days, code size is limited to 64 kBytes.

For details, see the Compiler Release Notes (Start > (All) Programs > Renesas > RZB_ZMDC16C_ZDK > All Manuals and Documents).

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