QuickStart Guide

CAN Development Kit RCDK8C

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Figure 1: Renesas CAN Development Kit

PART 1

This QuickStart Guide is separated into two parts. Part 1 guides you through running of the pre-programmed CAN demonstration programs, including use of the CAN Sniffer.

1.0 Introduction

The boards included in your CAN Demonstration & Development Kit are already pre-programmed with software for demonstrating the use of the CAN peripheral and other functions, such as the LCD, LEDs, pushbuttons, A-D converter, etc. Follow the steps in the next paragraphs to run the demos. If you want to start connecting to the board and developing your own code immediately, jump to Part 2.

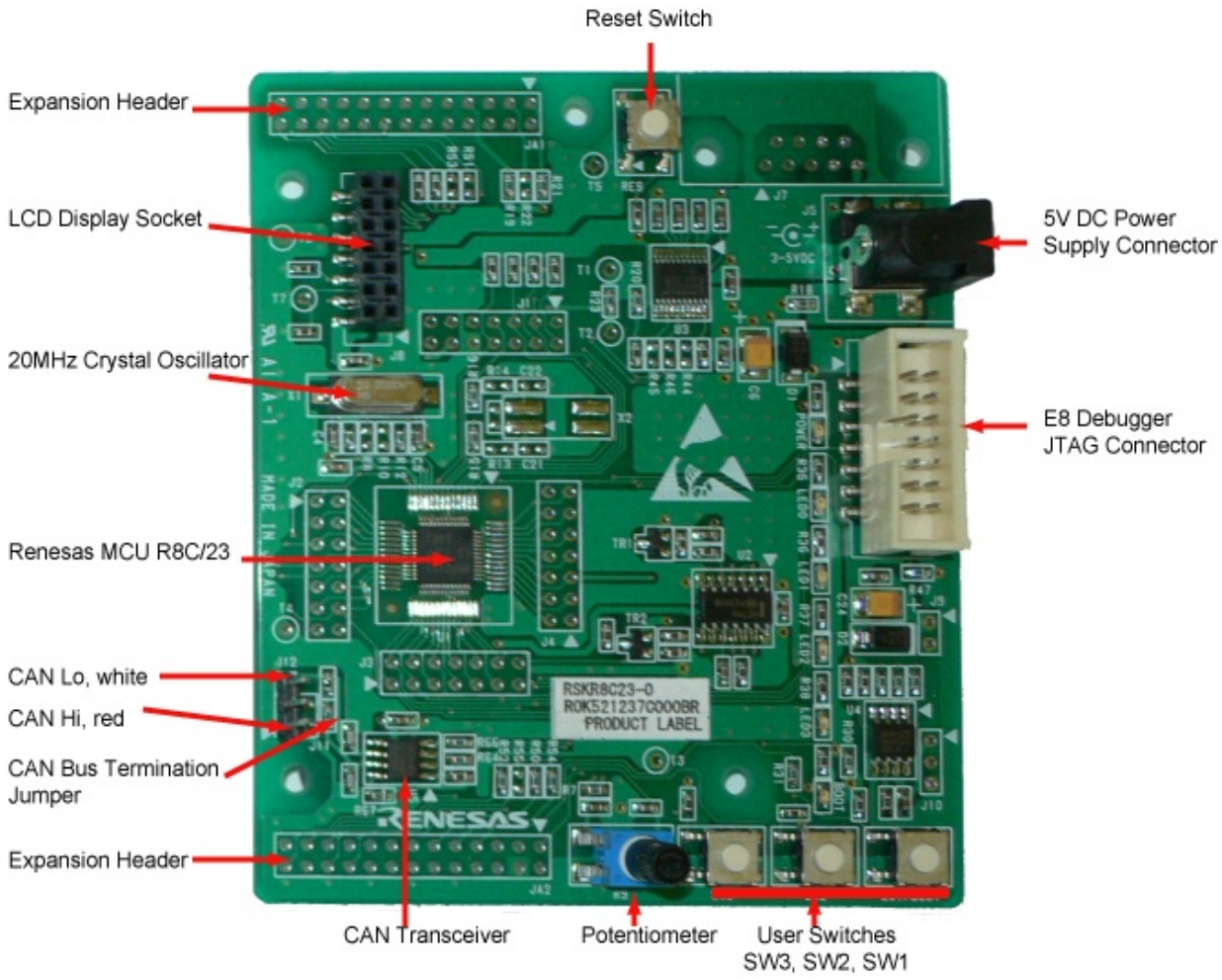

Figure 2: RSK-R8C23 Board Without LCD

This kit uses two Renesas Starter Kit (RSK) R8C23 boards. Any number of RSK boards with CAN adapted to this kit can be added to the network, such as the RSK-R8C23, the RSK-M16C29, or the RSK-M16C6NK, which has two CAN channels. Figure 2 shows the RSK-R8C23 board.

2.0 System Connection

To run the demos, only the two RSK boards need to be connected and powered with the included power supply. Figure 3 shows two RSK-R8C23 and the Systec CAN Sniffer connected to the CAN bus; the E8 debugger is connected to one of the RSK boards. Do **not** connect the Sniffer and E8 debugger to your PC at this point, as the PC drivers need to be installed first.

a.) **The CAN bus.** Connect the two RSK boards together by connecting the red-white CAN bus cables between the boards. On the RSK-R8C23 board the CAN terminal is marked J12. The pin that is marked with an arrow is CAN Hi. Connect CAN Hi to the red and CAN Lo to the white cable.

b.) **LCD.** Plug the LCD into its socket J8.

c.) **Supply voltage.** Connect the included DC power supply to the power connector of the two boards.

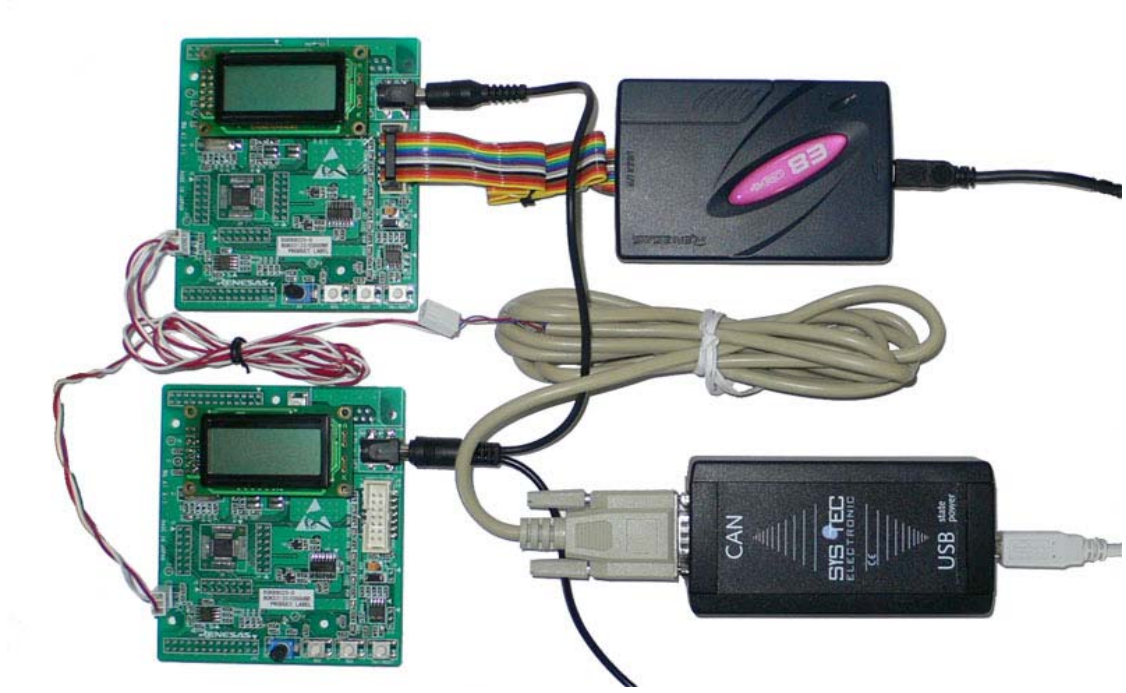

Figure 3: CAN Demo System Connectivity.

3.0 Running the ‘Streaming A-D’ Demo

Summary: The RSK board’s Renesas MCU measures a variable analog voltage applied to one of its Analog-to-Digital Converter (A-D) input pins. When the A-D value is changed by turning the potentiometer on the demo board, it is transmitted on the CAN bus. If correctly connected to the CAN bus, the transmitting board’s red LED (LED2) lights up every time an ‘A-D data frame’ is transmitted onto the bus.

The A-D conversion value will be sent onto the CAN bus and displayed by another board configured to receive frames with this message ID. The receiving board must be in Streaming A-D demo mode to show the received value. (The transmitting board does not necessarily have to be in Streaming A-D demo mode, only the receiver.) The receiving board’s green LED0 lights up every time an ‘A-D data frame’ is received. Figure 4 shows the interconnectivity of all CAN D Kit components and the TX & RX ID settings for the A-D demo

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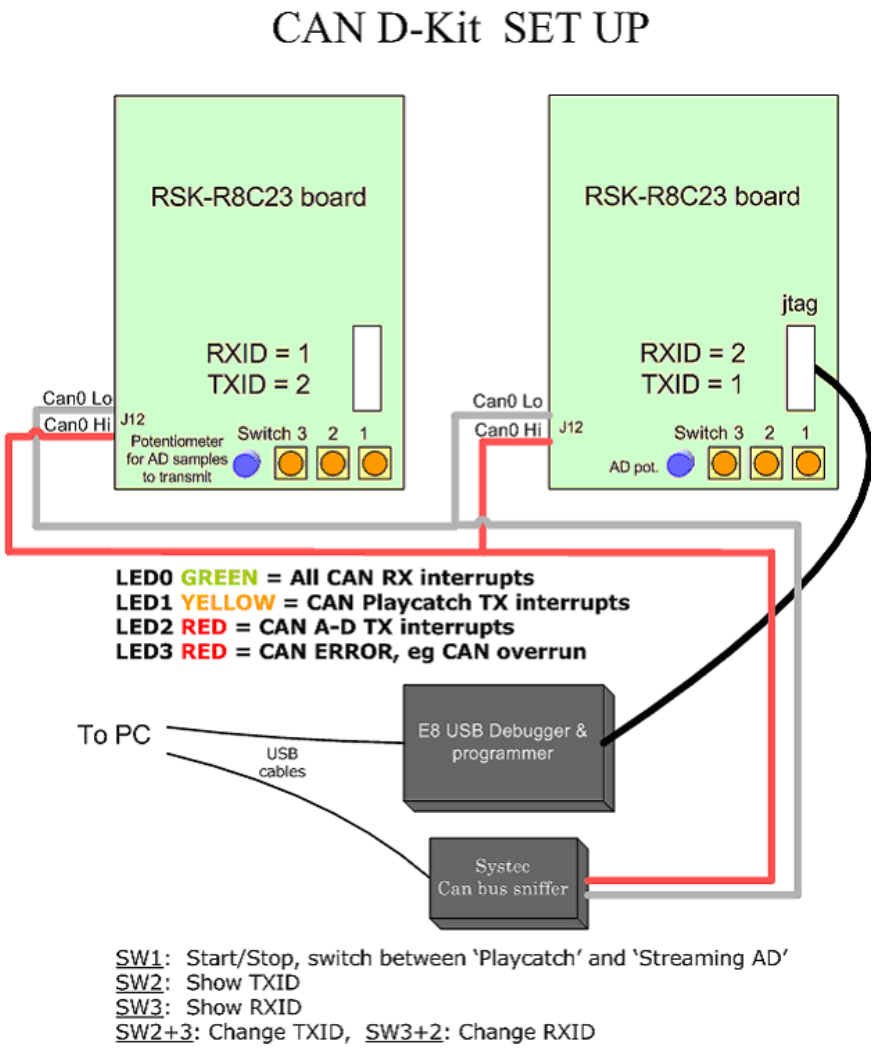

Figure 4: CAN D Kit Setup

a.) **Select Streaming A-D Demo.** After power-up the boards are in INIT state, waiting for you to select a demo. Pushing SW2 or SW3 after power-up will select the Streaming A-D demo mode. Pressing SW2 will also display the board's CAN transmit ID (TXID) and pressing SW3 the CAN receive ID (RXID). A board is in the Streaming A-D mode when the LCD shows **CAN: xx** on the first and **A-D Rx** on the second row. xx is a two digit hex number that represents the Analog-to-Digital Converter value received via the CAN bus. After a board has entered a demo mode, each subsequent press of SW1 will toggle between the Streaming A-D and PlayCatch demos.

b.) **Set CAN Transmit and Receive IDs.** On one of your boards set TXID to 01h and RXID to 02h, on the second board set TXID to 02h and RXID to 01h as shown in Figure 4. The TXID of board 1 has to equal the RXID of board 2 and vice versa for the two boards to talk to each other. Press the Reset switch (partially covered by board's LCD) if you want to reset both the transmit and receive ID to one.

c.) **Setting the CAN Transmit ID.** Press SW2 to display the CAN transmit ID (TXID). Pressing and holding SW2, while at the same time pressing SW3, allows you to change the TXID to values from 01h to 0Fh. Each push of SW3 increments the TXID by one.

d.) **Setting the CAN Receive ID.** Press SW3 to display the CAN transmit ID (RXID). Pressing and holding SW3, while at the same time pressing SW2, allows you to change the RXID to values from 01h to 0Fh. Each push of SW2 increments the RXID by one.

e.) **A-D transmission.** The voltage over the potentiometer R9 is A-D converted continuously and when the value changes, it is transmitted over the CAN bus. Turn the potentiometer on one board and see the value change on the other board. LED2 (red) blinks with every CAN interrupt as A-D data frames are transmitted over the bus. It indicates that you have a valid CAN bus connection.

f.) **A-D reception.** LED0 (green) on the other board blinks with every CAN interrupt as A-D data frames are received over the bus, it indicates that you have a valid CAN bus connection. If LED0 on the receiving board is not blinking when A-D values are send by the transmitting board, check that the receiving board's RXID equals the transmitting board's TXID. Another thing to check is that you have connected both boards correctly to the CAN bus (red wire to CAN Hi and white wire to CAN Lo).

4.0 Running the 'PlayCatch' Demo

Summary: This demo "catches" a frame off the bus, increments the data value by one and "throws" it back to the bus for the receiving PlayCatch board to receive. It is a never ending test demo to have an organized chain of communication for testing that all boards are continuously up and running.

The PlayCatch demo CAN IDs of the frames to be received and transmitted are automatically set by the demo firmware to be 10hex above the A-D demo IDs shown on the LCD display and setup in step 3.0 c.) and d.).

PlayCatch RXID = A-D demo RXID + 10h.
PlayCatch TXID = A-D demo TXID + 10h.

a.) **Select PlayCatch Mode.** After power-up, when all boards are in the INIT state, pressing SW1 will switch **all** boards which are connected to the CAN bus simultaneously to the PlayCatch mode. If a board is already running the Streaming A-D demo, pressing SW1 will switch that specific board to PlayCatch mode. Each subsequent press of SW1 will toggle between the Streaming A-D and PlayCatch demos. Upon entering PlayCatch demo mode a board transmits a data frame. All boards must be in PlayCatch mode to not break the data frame sending chain, so press SW1 if they are not.

b.) Confirm that the boards are transmitting and receiving CAN data frames by observing LED0 and LED1, which signal the CAN receive and transmit interrupts.
- The yellow LED1 flashes when successfully transmitting a PlayCatch frame.
- The green LED0 flashes when successfully receiving any frame.

Check that the LCDs are showing incremented received data field values. The LCDs will display the first two bytes of the data field of the received data frames.

5.0 Using the Systec CAN Sniffer

An advantage of CAN is the broadcasting of data. A CAN message sent to the network can be received by one or more nodes. Therefore we can use the CAN sniffer to receive from, and transmit to, all boards.

a.) Do **not** connect the USB-CANmodul to your computer.
b.) From the included USB-CANmodul Utility CD, run `\Products\USB-CANmodul_GW-00x\Software\SO-387\Setup.exe` and follow the instructions of the setup. There are detailed instructions in the 'CAN D-Kit User's Manual' on installing the USB-CANmodul software.
c.) Now connect the USB-CANmodul to the computer using the provided USB cable.
d.) Windows detects a new hardware device and the hardware assistant is started. The drivers will be detected automatically. Please confirm to install the detected drivers for the USB-CANmodul.
e.) After software installation is completed, connect the two RSK boards and the CAN Sniffer to the CAN bus as shown in Figure 3.
f.) Run the PcanView program. Set the program to use CAN Ch 0 at 500 kbaud.

The PcanView program screen shows one line for each message ID (CAN-ID) transmitted on the CAN bus. Each line shows the content for the latest frame received with that particular ID and is constantly updated as new frames are received. The first five columns in the PcanView program show:

Message: CAN ID (TXID) of unit transmitting the data
Length: Number of bytes in data field
Data: Data field content
Period: Time since last message with this ID was received in ms.
Count: Number of total frames received with this ID.

The Receive half of Figure 5 shows an example of data on the CAN bus when running both demos.

For a more detailed description of installing the sniffer software, see the CAN D Kit User Manual's Appendix.

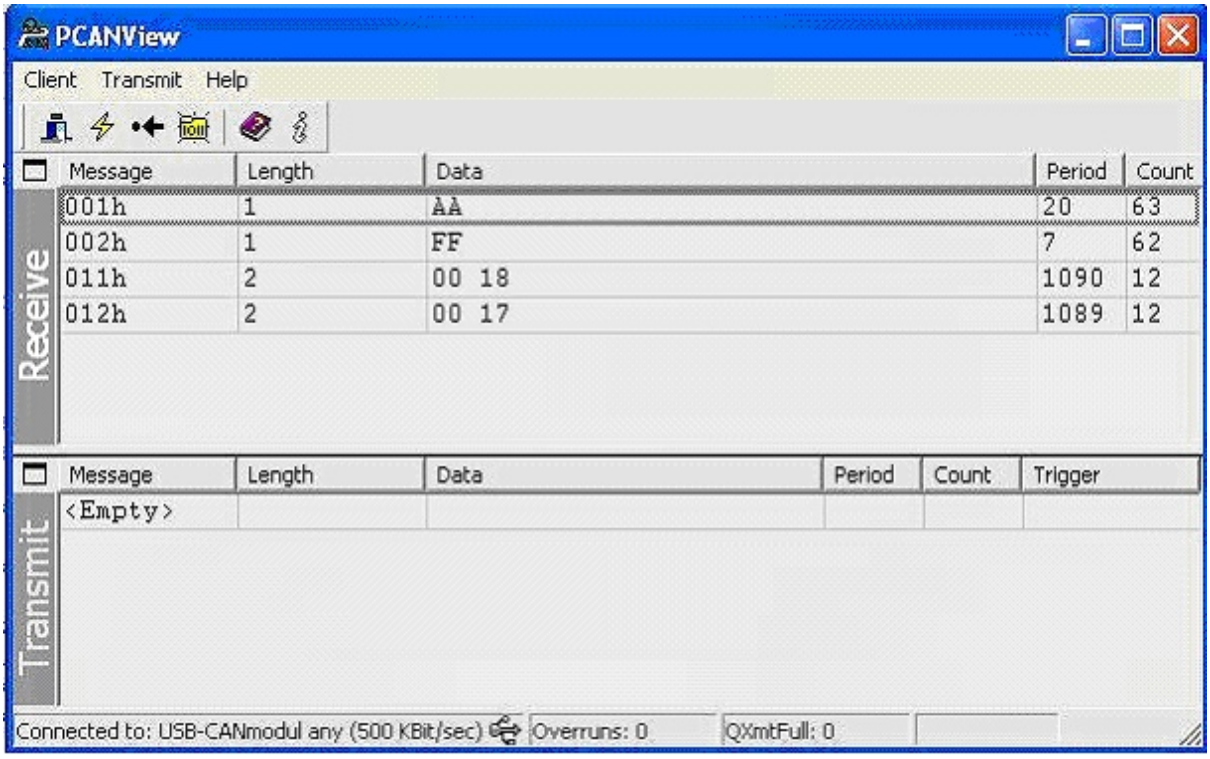

Figure 5: CAN Sniffer Window

g.) Watch the CAN bus data with the sniffer software when the A-D demo is run. Watch the CAN communication on the bus when the PlayCatch demo is run. The PlayCatch demo uses two bytes. Note that the CAN-ids used in PlayCatch are 10(h) above the A-D demo's CAN-ids.

h.) Send data frames from the sniffer. Press SW1 on one board until it is in A-D mode and set the other board to PlayCatch mode. Right click in the Transmit window, select New and set the ID to equal the RXID of the board that is in PlayCatch mode (011h or 012h if you have the IDs set as in Figure 4. Set frequency to 1000 ms, data length to 2, and the two data bytes to 12h and 34h. Press ok and check that 1234h is received and displayed on the PlayCatch board's LCD. Note that in the Sniffer's Receive window the data field of the message with the PlayCatch board's TXID is incremented to 1235h, as the board transmits the next PlayCatch value on the bus.

The A-D demo uses only one data byte. There is a version with the A-D demo using two bytes of A-D data on the Kit CD. See project `C:\Renesas\RCDK8C\Demo_code\CanDkit-RSK-R8C23-10bitAD`.

PART 2

In part 2 you will install Renesas development software and sample programs that will allow you to write and debug your own application code.

6.0 Renesas Starter Kit Software Install

Do **not** connect the E8 debugger to your computer until the software has been installed.

a.) Insert the enclosed Renesas CD into your computer's CD-ROM drive. The CD should automatically run the installation program. If the installer does not start, browse to the CD root folder and double click on `RCDKR8_Installer.exe`.
b.) The RCDK8C install splash screen appears. Click <**Next**>.
c.) The software license agreement is displayed. Please select the acceptance radio button and click <**Next**> to continue.
d.) Select the software components to install. For new users we strongly recommend to accept the default settings. Click <**Next**> to continue.
e.) The destination folder `C:\Renesas\RCDK8C` is displayed on the next screen. Click <**Install**> to start installation.
*You may be prompted to restart your computer during the installation process. Do **not** restart until the RSK installer has completed installation of all the software items.*
f.) During the installation, the Auto-Update dialog will be displayed. Do **not** configure Auto-Update 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.
g.) Click <**Finish**>.

7.0 Auto-update

After the installation has completed click the icon  in the Windows system tray to configure Auto-Update.

Configure the Auto-Update settings dialog to allow your installation to be checked for required updates.

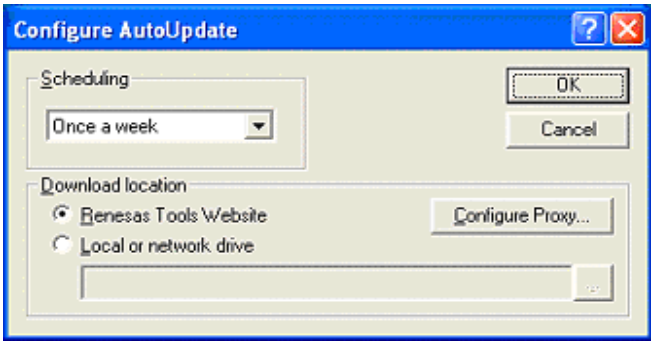

Figure 6: AutoUpdate Configuration

8.0 Connection

Note that administrator privileges are required to install the E8 debugger USB driver on a Windows™ 2000 or XP machine.

a.) Connect the E8 debugger to J6 on the RSK using the ribbon cable, also connect the LCD module to J8 on the RSK ensuring that the pin 1 designation corresponds to the marking on the RSK.
b.) Connect the E8 emulator to a spare USB port. Windows 2000 will automatically install the correct USB driver without any user interaction required. You can skip steps c-f.
c.) Under Windows XP, the "Found New Hardware" Wizard will appear.
d.) If Windows asks you to connect to "Windows Update", select "No, not this time", click <**Next**>.
e.) Select " Install the software automatically (Recommended)" and click <**Next**>.
f.) Click <**Finish**> to close the wizard.

If the Windows "New Hardware Wizard" does not automatically find the driver, browse to the `C:\Windows\system32\drivers` directory.

NOTE: If you have problems installing the drivers, or if your PC will not recognize the E8, please see the "Troubleshooting" section of the CAN D Kit User's Manual for help.

9.0 HEW Workspace

The High-performance Embedded Workshop software (HEW) integrates various tools such as the compiler, assembler, debugger, and editor into a common Graphical User Interface.

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 that "Create a new project workspace" is selected.
    ii.) Click <**OK**>.
c.) In the "New Project Workspace" dialog box:
    i.) Verify that "CPU family" is set to "M16C" and "Tool chain" is set to "Renesas M16C Standard".
    ii.) Select "RSKR8C23" (Figure 7).
    iii.) Enter "Quickstart" for the Workspace. The Project Name will auto fill with the Workspace name.
    iv.) Click <**OK**>.
d.) In the "RSKR8C23 – Step 1" window:
    i.) Select "Tutorial".
    ii.) Click <**Next**>.
e.) In the "RSKR8C23 – Step 2" window:
    i.) Click <**Finish**>.
f.) In the "Project generator information" window:
    i.) Click <**OK**>. The project that is created has two configurations: The "Release" configuration can be used for the final release code version and by default, the executable does not include debug information. The "Debug" configuration

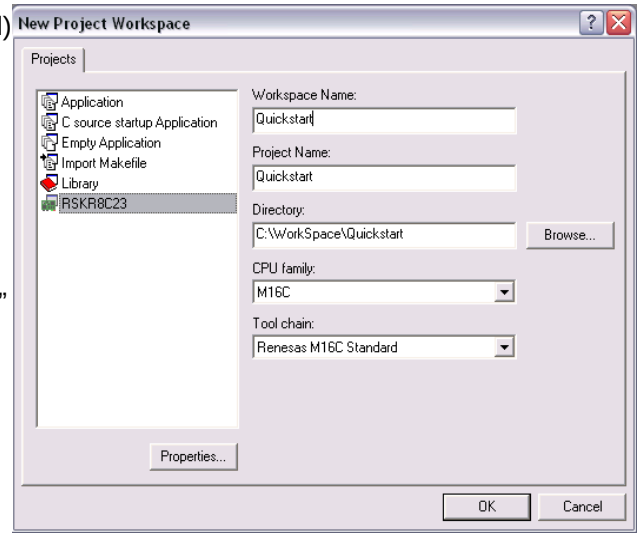

Figure 7: HEW New Project Workspace

Figure 8: Debug Configuration

allows full source level debugging within HEW.

g.) Select the “Debug” build configuration in the left hand drop down list on the tool bar. (Figure 8)

h.) Click the “Build” icon  to compile, assemble and link the project. After the build is complete, the HEW Build window will look similar to Figure 9.

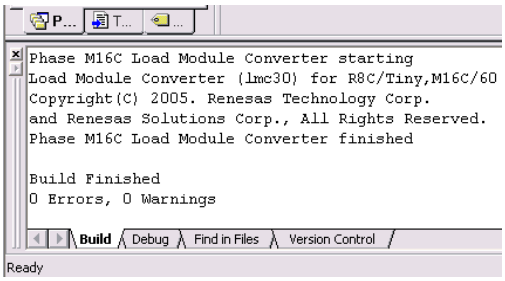

Figure 9: HEW Build Complete

NOTE: To learn more on how to use HEW, open the HEW Manual Navigator on your computer (Start > (All) Programs > Renesas > High-performance Embedded Workshop > Manual Navigator).

10.0 Programming and Debug

Figure 10: HEW Session Selection

a.) If not already done, plug one end of the USB cable into the E8 Debugger and the other into a USB port on your PC.

b.) Use the Session pull-down box and select “SessionR8C_E8_SYSTEM” as shown in Figure 10. If requested to save the session, click <**Yes**>.

c.) Click the “Connect” icon  on the debug toolbar.

d.) In the “Emulator Setting” window (Figure 11),
   i.) select Device “R5F21237”
   ii.) Select “Download emulator firmware”.
   iii.) Select “Power supply is carried out”, if you want the E8 unit to supply power to the RSK board. Otherwise connect a 5V center positive supply the RSK board.
   iv.) If you want the E8 debugger to power your target, select “5V”
   v.) Click <**OK**>.

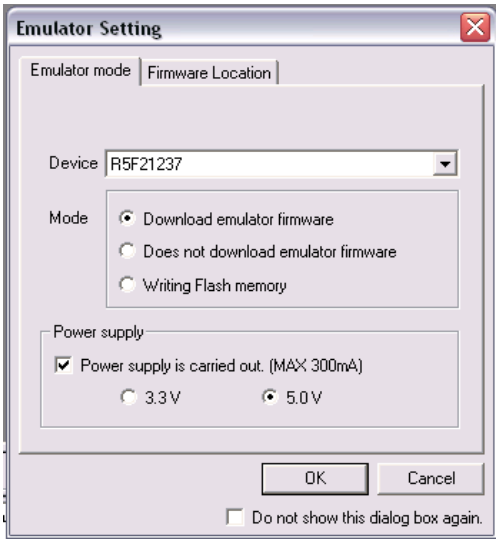

Figure 11: Emulator Mode Selection

e.) The first time the E8 is used, you are asked to choose the driver (Figure 12). Click <**OK**>.

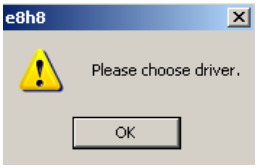

Figure 12: Choose Driver

f.) Select “Renesas E-Series USB Driver”. The “Details” items will autofill within a few seconds (Figure 13).
   i.) Click <**Close**>.

g.) If you get a message that “A newer version of E8 firmware is available”, click <**OK**> to update the firmware.

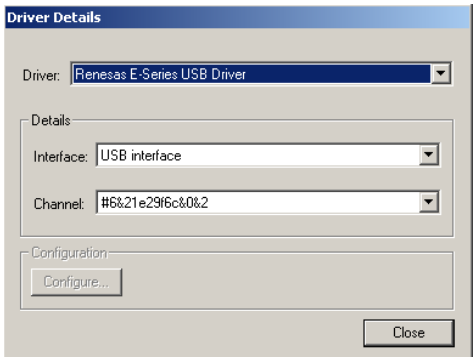

Figure 13: Driver Details

h.) Under the “Debug” menu item, select “Download Modules > All Download Modules”, or right click on the “.x30” file in the left (workspace) window and select “Download module” (Figure 14). This may take several seconds.

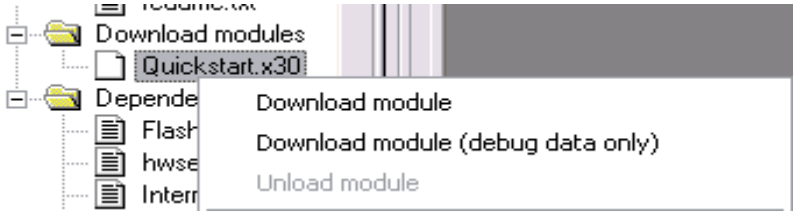

Figure 14: Download Module

i.) Click on the “Reset-Go” icon  to start the program. The code will run and you will see the LEDs flash on the board.

j.) Click on the “Stop” icon  to halt the program. Code execution will stop and the source code window display the code at the current program counter address.

k.) From the “File” pull-down menu, select “Exit”. If requested to save workspace and/or session, click <**Yes**>.

11.0 Next Steps

After you have completed this QuickStart procedure, start with the simple CAN project in folder `C:\Renesas\RCDK8C\Demo_code\CanDkit-RSK-R8C23-10bitAD` from the kit’s CD. The CAN D Kit demo folder `C:\Renesas\RCDK8C\Demo_code\TRI-CANDKIT-RSK23-29-6NK` contains three sub-projects for three different RSKs containing MCUs with CAN.

See the Demo and Expansion Manual for more info how to program and debug your RSK target boards.

Please review the other documents that come with the kit. The tutorials will help you understand and jumpstart the software development process using Renesas’ development tools. You can view the tutorials from the Start Menu via Start > (All) Programs > Renesas > RCDK8C> Documents. To read the manuals or tutorials you need to have Adobe Acrobat Reader installed on your PC.

12.0 Renesas HEW and MC16C Compiler

The High-performance Embedded Workshop (HEW) 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 access the HEW documentation, launch Start > (All) Programs > Renesas > High-performance Embedded Workshop > Manual Navigator.

Included in the RSK is the Evaluation Version of the MC16C 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.

The full licensed version is available from your Renesas supplier.

13.0 Support

To check for any updates to the CAN D-Kit, use the shortcut *Start* > *Programs* > *Renesas* > *RCDK8C* > *Check for Updates*. This will take you to a kit-specific page on the Renesas website, which provides links to any available update downloads

Online technical support and information is available at:
http://america.renesas.com/can

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