RX62N

Sample Code and Workspace Projects Guide

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Introduction

This document describes the projects in the demo workspace for the Renesas RX62N Demonstration Kit (YRDKRX62N).

Target Device

RX62N

Contents

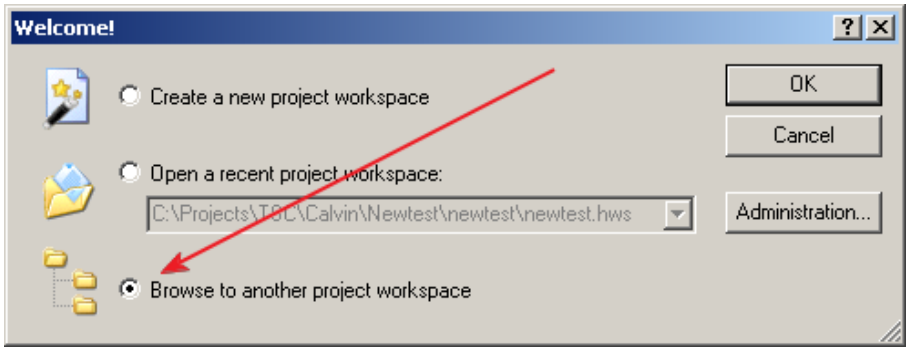
1. Introduction

The Renesas YRDKRX62N is a low-cost demonstration kit that provides users with a platform to evaluate the powerful RX62N MCU. Included on the CD that ships with the Renesas RX62N Demonstration Kit (YRDKRX62N) is a Project Generator that creates projects demonstrating various peripherals on the RX62N MCU that are on the YRDK board. The projects included in the project generator are derived from a single master demo workspace that includes all of the projects.

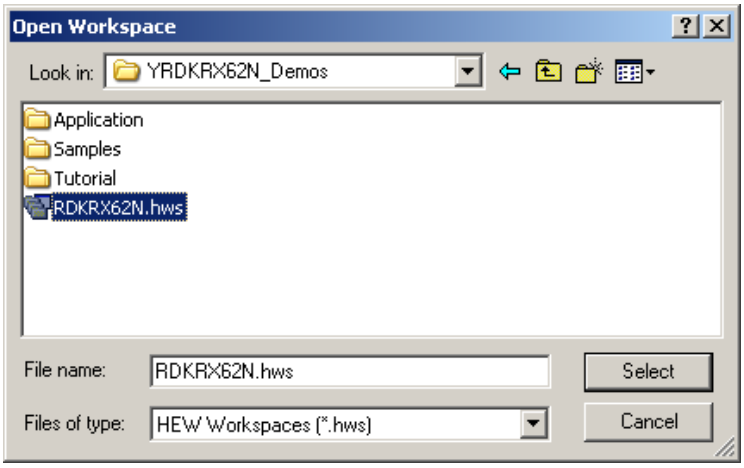
This document provides a brief overview of the projects included in the demo workspace.

1.1 Using Demo Workspace

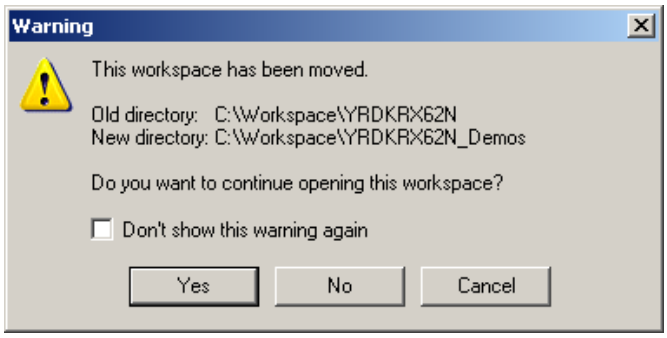
To load the Demo workspace, start HEW. The Welcome dialog is displayed. Choose the "Browse to another project workspace" option and then click "OK".



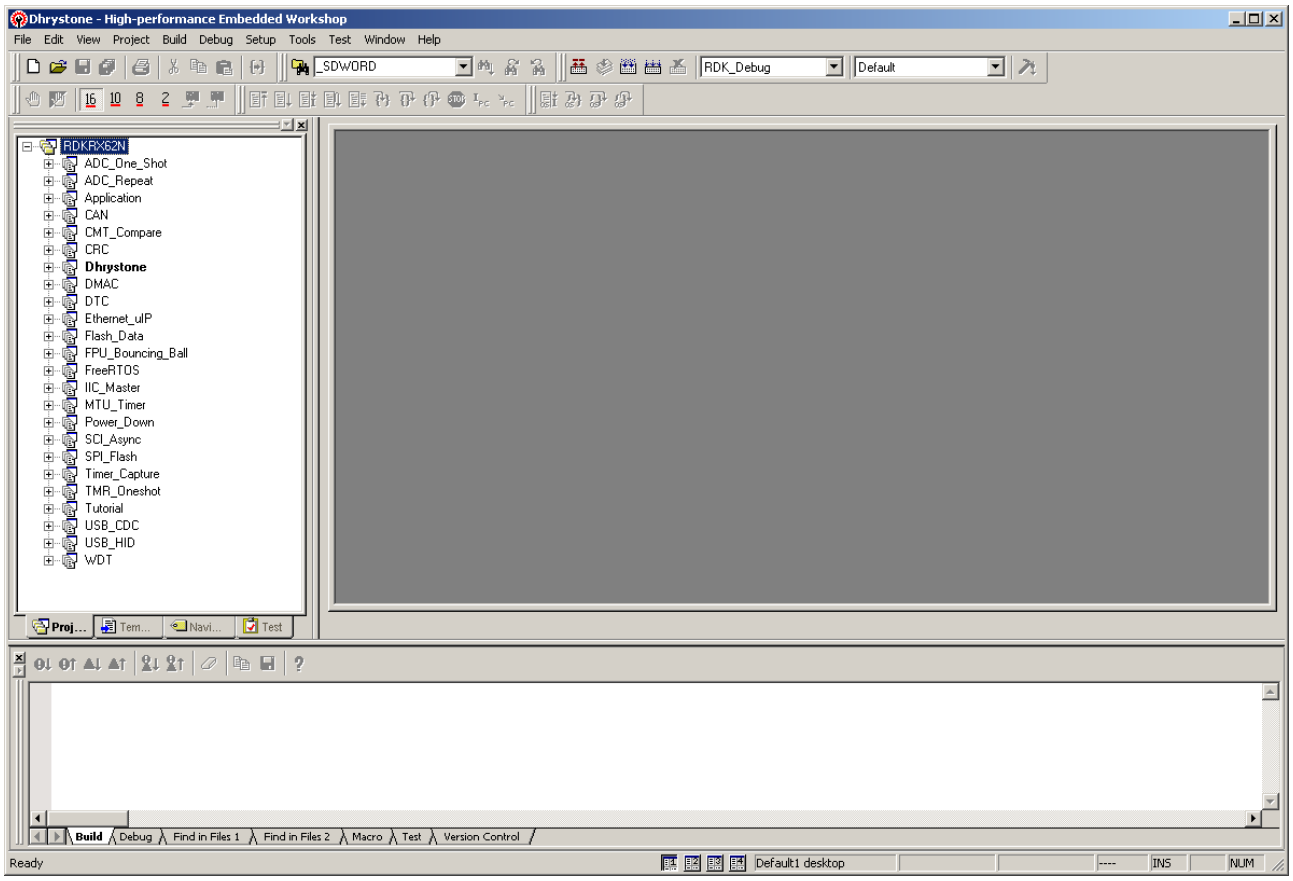
The Open Workspace dialog is shown. Browse to the location where you unzipped the Demo Workspace, and select the workspace "RDKRX62N.hws"



You may receive the following dialog as the project is loaded; if you do, click “Yes”. This dialog indicates that you have unzipped the workspace to a directory with a different name than the directory it was created in. Clicking “Yes” will update all of the path references internal to the project so that it will build properly in your new location.



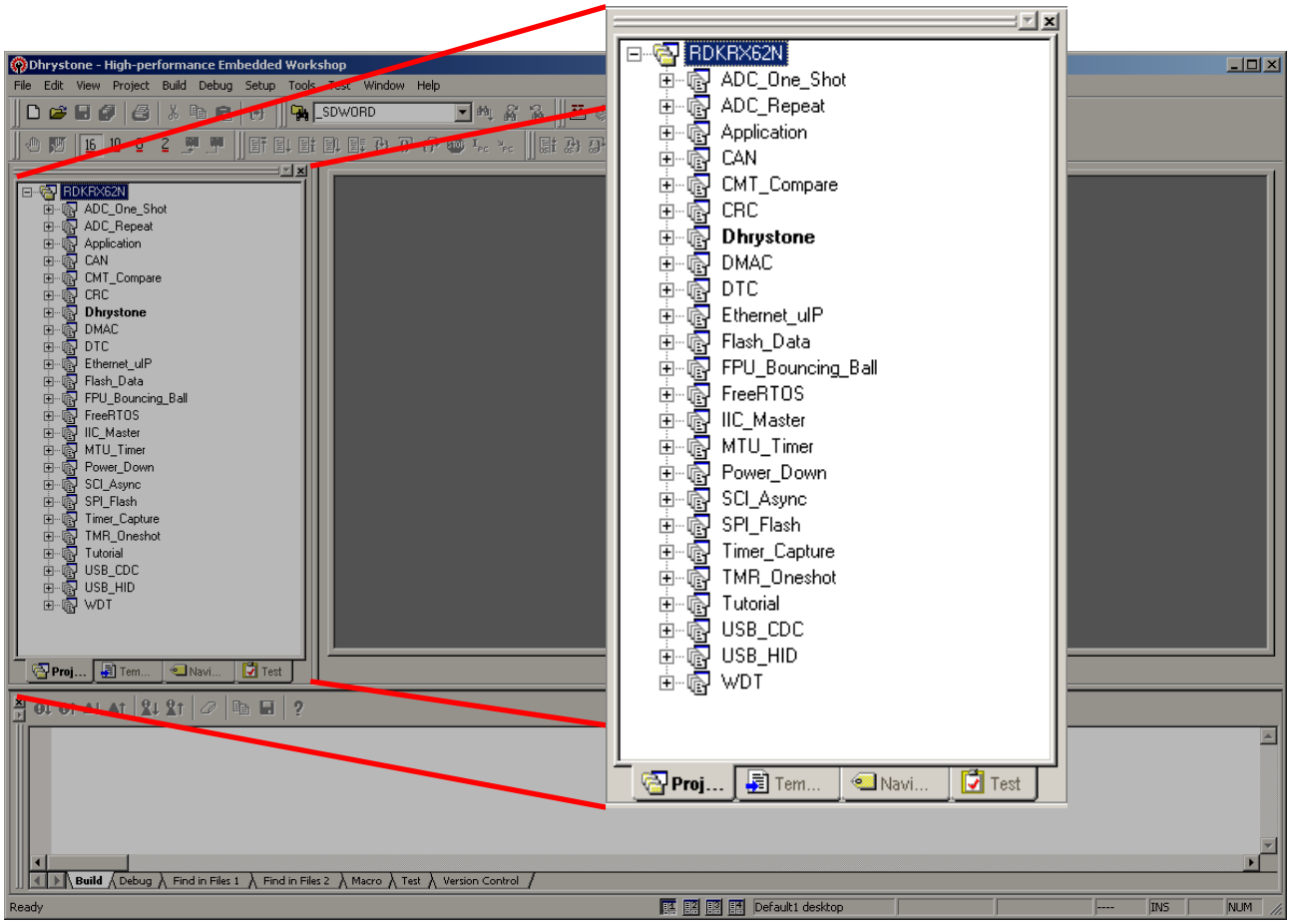
The demo workspace is loaded, and your HEW workspace should look like this:



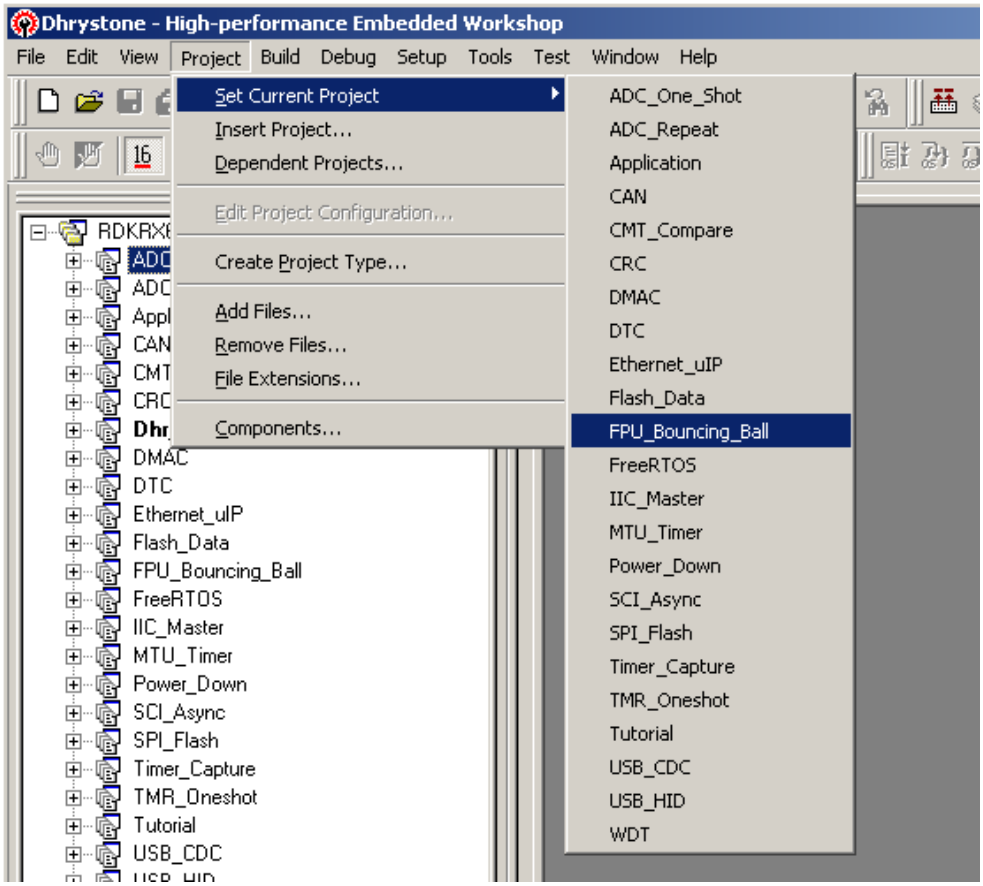
1.2 Changing the Current Project

The project pane on the left side of the screen shows the projects included in the workspace. Each project is a stand-alone program that runs on the YRDK board. The project name in bold letters is the current project, and is the project that will be downloaded to the board. Only one project can be the current project at a time.

The project pane below shows that the **Dhrystone** project is the current project.



To change the current project, click on the “Project” menu and then choose “Set current project”. A list of all the projects in the workspace is shown. Choose a new project. If you’ve made any changes to the current project, you will be asked if you’d like to save them.



1.3 Building a Project

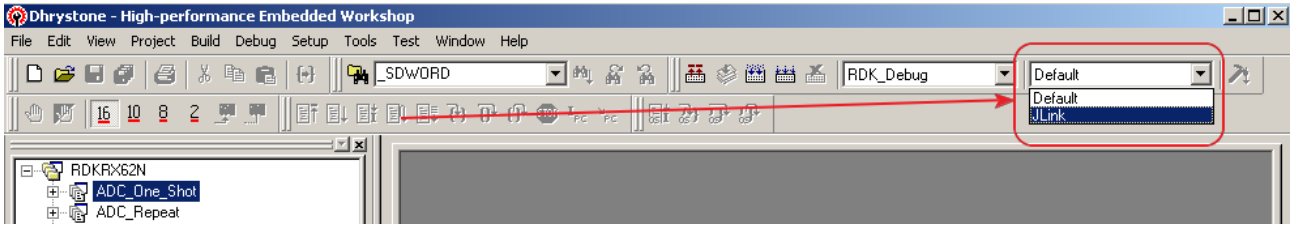
Once you have set the desired project as the Current Project, you can build the project by pressing the “F7” key or by choosing “Build” from the Build menu. The demo projects will all build with no errors. If you make changes to the demo code, just press “F7” to build the project again; all changed files are saved before building when you press “F7”.

1.4 Connecting to the YRDKRX62N Board

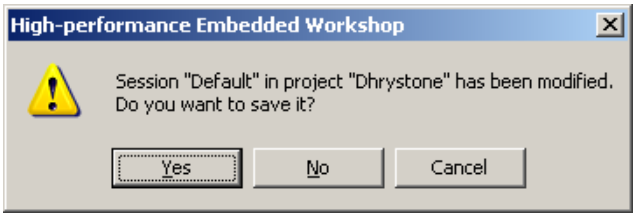
Once the project is built, you can connect to the YRDKRX62N board to download and run your code. HEW supports multiple **debug sessions** for each project. A debug session includes all the information HEW needs to connect in a specific way to a target board. A project can include a session that runs on the cycle-accurate simulator as well as one that runs on the target board. It's generally a good idea to include in your projects a debug session that does not connect to a target; this allows you to edit & compile code without having a target connected.

The projects in the Demo workspace generally have two debug sessions: a "Default" session that does not require a hardware connection, and a "JLink" debug session that connects to the Segger J-Link Lite debugger on-board the YRDKRX62N board. The projects are saved with the "Default" debugger session as the active session; you will need to change the debug session in order to connect to the YRDKRX62N.

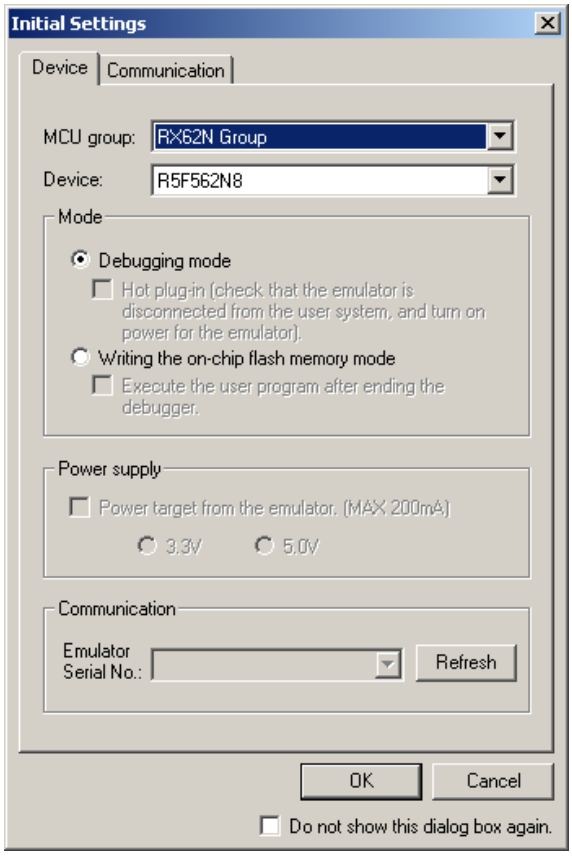
The current debug session is listed in the toolbar at the top of the HEW main window. Simply drop down the box and change the target from "Default" to "JLink":

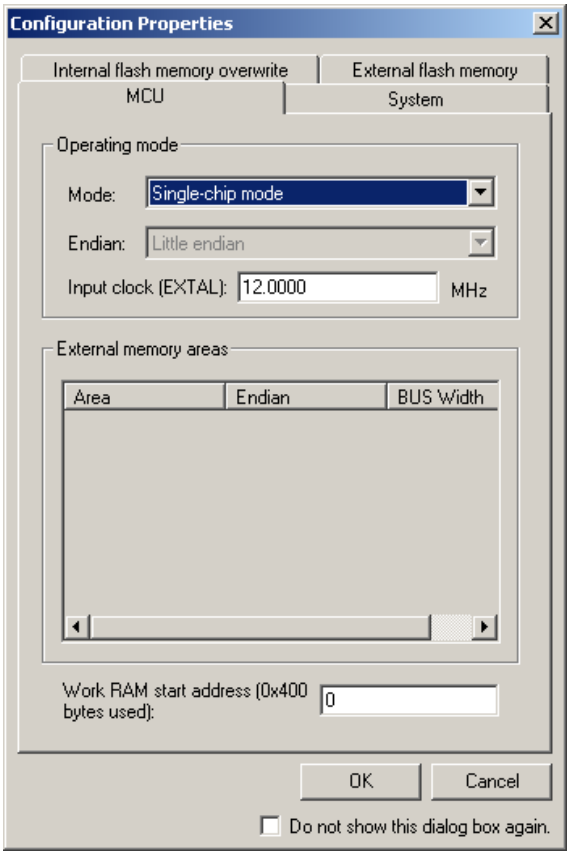


Depending on changes you've made to your project, you may be shown the following dialog. Just click "Yes".



If your YRDKRX62N is connected to your PC, the connection settings dialog is shown. The default settings should be as shown, click OK. A second configuration window is shown. The default settings should be as shown, click OK:





You should now be connected to the YRDK board, and you can download and run your code. Under the “Debug” menu, choose “Download Modules” and then “All download modules”. The code is sent to the board and burned into flash. You can press “Shift-F5” to reset the board and run your program from reset.

2. Description of Projects

2.1 Application

This is an empty project with just a “while” loop in the main function. The project demonstrates basic hardware initialization, utilizing RPDL to access the hardware. Review the file HWSetup.C to see how the RDK hardware is initialized. Only basic setup is performed such as setting the direction of the I/O pins.

2.2 ADC One Shot

This sample demonstrates use of the ADC in single conversion mode. The program takes a sample reading of the voltage created by the potentiometer VR1 and displays it on the LCD.

2.2.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software.
3. Instructions are displayed on the LCD. Adjust the potentiometer VR1, and press switch SW3 to trigger an AD conversion.
4. The ADC result will be displayed on the second line of the LCD in the format =H'0000.
5. Re-adjust VR1, and press SW3 again to perform another conversion.
6. The value of the AD conversion can be watched in the variable usADC_Result. Right click on the variable, select “Instant Watch” and click “yes” to the following dialogs.

2.3 ADC Repeat

This sample demonstrates use of the ADC in continuous scan mode. After the ADC is started, a timer is triggered to periodically fetch the result from the conversion. The potentiometer VR1 is connected to the ADC; adjust it and watch the results on the LCD.

2.3.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software.
3. The LCD will show the name of the program and the current ADC value.
4. Adjust the potentiometer, VR1, and observe the value displayed on the LCD change.
5. The user may examine the AD conversion result in the global array usADC_Result[ ].

2.4 Asynchronous Serial

This sample demonstrates the SCI in asynchronous mode by transmitting data to a connected terminal.

2.4.1 Operation

1. Build and download the sample code to the YRDK.
2. Connect the YRDK to the host PC via an RS232 serial cable.
3. Launch a suitable terminal program (e.g. HyperTerminal) and configure it to operate on the channel the YRDK is connected to with the following settings:

Baud.....19200
Data Bits.....8
Parity.....None
Stop Bits.....1
Flow Control.....None

4. Click 'Reset Go' to start the software.
5. Observe the terminal window - instructions will be displayed at the top, then the numbers 0 - 9 will be written across the screen repeatedly.
6. Type 'z' (lowercase) into the terminal to pause the SCI transmission, and any other key to resume it.

2.5 CAN

This CAN sample demonstrates receive and transmit using the CAN API.

The demo can be run in three ways:

1. Program two boards and connect them together over the CAN bus.
2. With CANPORT_TEST_1_INT_LOOPBACK used in the R_CAN_PortSet API you can communicate internally, no external bus needed!
3. Use a CAN bus monitor, e.g. SysTec's low-cost monitor 3204000, to send and receive frames to/from the demo. Remote frames can also be demonstrated if CAN interrupts are enabled.

2.5.1 Operation

The demo transmits and receives frames with CAN-ID 1 by default. The default demo CAN-ID value is set in api_demo.h by TX_ID_DEFAULT. The software starts up by immediately sending ten test frames. This has two purposes, to check the link and to demonstrate how messages are sent back-to-back as quickly as possible.

Press SW1 to send one CAN frame. The frame will be received and displayed by the other RDK as long as that board's receive ID (RxID) matches the sending boards transmit ID (TxID).

Press SW2 to display the current demo TxID on the LCD. To increment the TxID, hold SW2 down and press SW3. The actual send command is invoked by the Sw1Func function.

Press SW3 to display current demo RxID on the LCD. To change RxID hold SW3 down and press SW2.

By default, polled CAN is used. To use the CAN interrupts for faster processing, uncomment USE_CAN_POLL in file config_r_can_rapi.h.

REMOTE frames:

Besides demonstrating Tx and Rx of Standard CAN frames, the demo will also send remote frame responses for CAN-ID 50h remote frame requests. Remote frames demo is only done in interrupt mode; with USE_CAN_POLL commented in the CAN API configuration file. Remote requests are not sent by this demo as it is, and so must come from an outside source, e.g. the CAN monitor mentioned above.

2.6 CMT Compare

This sample demonstrates the use of a CMT configured to generate an interrupt every 100 milliseconds. The interrupt triggers a callback function to toggle the user LEDs.

2.6.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software.
3. Observe the user LEDs, which will flash every time a compare match occurs in the CMT channel.

2.7 CRC Calculator

This sample demonstrates the CRC unit by echoing characters typed in the terminal with their checksums.

2.7.1 Operation

1. Build and download the sample code to the YRDK.
2. Connect the YRDK to the host PC via an RS232 serial cable.
3. Launch a suitable terminal program (e.g. HyperTerminal) and configure it to operate on the channel the YRDK is connected to with the following settings:

Baud.....19200
Data Bits.....8
Parity.....None
Stop Bits.....1
Flow Control.....None

4. Click 'Reset Go' to start the software.
5. Observe the terminal window - instructions will be displayed at the top, asking the user to input a character.
6. Type any letter (printable characters only) into the terminal, and the character will be echoed back to the terminal display, along with its corresponding CRC checksum.

2.8 Dhrystone

This project runs the Dhrystone benchmark on the YRDK highlighting the 1.65 DMIPS/MHz performance of the RX.

2.8.1 Operation

1. Build and download the program to the YRDK.
2. Click “Reset Go” to start the benchmark.
3. When the LED’s change and the display indicates, the Dhrystone is complete. Break the program by clicking the “Stop” button on the toolbar and examine the value of the variables “DMIPS_per_MHz” and “Dhrystones_Per_Second” to see the results.
4. If you uncomment the calls to “S12ADC_Init” and “S12ADC_Start” at the beginning of the main function, the RX will use the DMAC to take ADC samples at 400 kHz while the Dhrystone is running. The samples are saved to two ping-pong buffers of 5K samples each. Compare the Dhrystone results with and without the ADc running. This is an interesting experiment that shows how the advanced bus architecture of the RX plus its smart peripherals work together to offload the CPU.

2.9 DMAC

This sample demonstrates the DMAC by performing a DMA transfer from one variable and duplicating it into a 1024 element array.

2.9.1 Operation

1. Build and download the sample code to the YRDK.
2. Right-click the variable 'gDMA_DataBuff' and select 'Instant Watch', clicking 'Add' on the subsequent dialog.
3. The contents of 'gDMA_DataBuff can now be observed in the variable watch window.
4. Click 'Reset Go' to start the software.
5. Observe the contents of 'gDMA_DataBuff' being filled with the contents of the variable 'gDMA_DataSource'.

Note: In order to watch the contents of the gDMA_DataBuff array during execution, the sample must be built in 'debug' mode.

2.10 DTC

This sample demonstrates the DTC; by performing a DMA transfer from one variable, and duplicating it into a 1024 element array.

2.10.1 Operation

1. Build and download the sample code to the YRDK.
2. Right-click the variable 'gDTC_Destination' and select ‘Instant Watch', clicking 'Add' on the subsequent dialog.
3. The contents of the variable 'gDTC_Destination' can be viewed in the watch window.
4. Click 'Reset Go' to start the software. Instructions will be displayed on the debug LCD.
5. Adjust the potentiometer, RV1, and press the switch SW3. The result from the ADC conversion will be transferred into the first element of the transfer destination array.
6. Repress the switch SW3, and subsequent results will be transferred into the next array element.
7. Once the last array has been filled, the next transfer will clear the array contents and start from the first element.

Note: In order to watch the contents of the gDTC_Destination array during execution, the sample must be built in 'debug' mode.

2.11 Ethernet uIP

This sample shows the open-source uIP Ethernet stack ported to the RDK.

2.11.1 Operation

1. Build and download the sample code to the YRDK.
2. Connect the YRDK to your network (be sure there is a DHCP server accessible from the network).
3. Click “Reset Go” so start the software.
4. The YRDK will look for a DHCP server to obtain an IP address. Once an address is obtained, it is displayed on the LCD.
5. Type the IP address into the address bar of your web browser to contact the web server running on the YRDK.

2.12 Flash Data

This sample demonstrates the FCU by writing ADC results to incrementing data flash memory locations.

2.12.1 Operation

1. Build and download the sample code to the YRDK.
2. Open the memory viewing, right click in the window and click 'address'. Enter the Display address 0x00100000, and then click OK.
3. Ensure the 'Auto Refresh' option in the memory viewer is disabled before proceeding. (It is not possible to use this feature when observing flash memory).
4. Click 'Reset Go' to start the sample. Instructions will be displayed on the debug LCD.
5. Push the switch SW1 to trigger an ADC conversion. The value will be written into the data flash memory (click refresh in the memory viewer).
6. The data written to flash and its memory location are displayed on the debug LCD.
7. Repress switch SW1 to trigger another ADC conversion. The result will be stored in an incremented memory location, displayed on the debug LCD.
8. Press switch SW3 to reset the contents of the entire flash memory block, and set the flash write pointer back to the start of the block (0x00100000).

Note: Memory locations which have not initialized do not have a defined state, and will continuously change with random values.

2.13 FPU Bouncing Ball

Demonstrates hardware Floating Point Unit (FPU) versus software floating point performance.

2.13.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software. Two small bouncing balls will appear on the LCD. The top ball is being moved using the FPU. The lower ball's position is updated using the floating point emulation library instead of the FPU hardware. Each ball is given an equivalent time slice to perform as many position calculations as possible in the allotted time. It takes thousands of these calculations to move the ball one pixel on the display.

2.14 FreeRTOS Demo

A basic FreeRTOS project with two tasks communicating via a queue. For more examples of using FreeRTOS resources see the FreeRTOS.org web site.

2.14.1 Operation

1. Build and download the sample code to the YRDKRX62N
2. Click "Reset Go" to start the software.
3. A brief explanation of the demonstration will be displayed on the LCD. Two tasks are started. The first task blinks the red LED at a fixed rate. Every 10 toggles of the LED it sends a message to the second task. The second task wakes up on receiving the message and toggles the green LED.

2.15 IIC Master

This sample demonstrates use of IIC in master mode by reading from 2 separate IIC devices:

- ADXL345 digital accelerometer
- ADT7420 thermal sensor

2.15.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software. The name of the sample will be displayed on the debug LCD, along with the current board temperature in Celsius.
3. Place a finger over the ADT720 device. It is located just below the APPLICATION HEADER located along the top edge of the board. Observe that the temperature is updated four times per second. When you remove your finger, the temperature returns to normal.
4. Pick up the board and tilt the board forward/backward and left/right.
5. As you slowly roll the board in a circular motion, observe the circle LEDs light to indicate the direction of the tilt.

2.16 MTU Timer

This sample uses an MTU to generate a 1KHz square waveform.

2.16.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the program.
3. The 1 KHz waveform can be observed with an oscilloscope connected to the header JN2, pin 8. (JN2 pin 2 can be used for a ground.)

2.17 Power Down

This sample demonstrates the MCU power down modes by entering standby when a switch is pressed. The MCU then wakes up by any interrupt.

2.17.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software.
3. The user LEDs will start to flash and the current MCU power mode will be displayed on the debug LCD.
4. Press switch SW1 to enter the MCU into standby mode. The debug LCD will update with the current power mode and the LEDs will stop flashing.
5. Holding down another switch whilst releasing SW1 will prevent the MCU from entering standby until all switches are released. If another switch is held down whilst SW1 is released, the red LEDs will be lit to indicate that the MCU cannot enter standby. Once all switches are released, the LEDs will turn off.
6. Press any switch to wake the MCU from standby mode. The debug LCD will display the new power mode, and the LEDs will stay constantly lit.
7. To repeat the sample, restart the software by clicking 'Reset Go'.

2.18 SPI Flash

Demonstrates use of Renesas Peripheral Development Library (RPDL) to write to/read from the RSPI flash device. This program writes 2048 bytes of data to the flash device located on RSPI-0, 64 bytes at a time. It then proceeds to read the data back 512 bytes at a time and compares it to the original data. Upon successful completion, LED 4 is turned on. However, if the programming fails, LED 14 is turned on.

2.18.1 Operation

Build and download the sample code to the YRDK.

2.19 Timer Capture

Demonstrates capture a timer value from the Compare Match Timer (CMT)

2.19.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software. Instructions will be displayed on the debug LCD.
3. Press switch SW1, and observe the result on the debug LCD. The time duration, in milliseconds (ms), will be displayed.
4. Press switch SW1 again to repeat the test.

2.20 TMR Oneshot

This sample demonstrates use of the TMR unit, by creating one timer to restore the debug LCD.

2.20.1 Operation

1. Build and download the sample code to the YRDK.
2. Click 'Reset Go' to start the software.
3. The debug LCD will show:

   "TMR 1 Shot "
   "Press SW3 "

4. Press switch 3 and the debug LCD will display a new message and the one shot timer is started.
5. When the one shot timer fires, the debut LCD is restored to the original display.

2.21 Tutorial

This tutorial sample will demonstrate basic use of the YRDK hardware and the J-Link debugger.

2.21.1 Operation

1. Build and download the tutorial project to the YRDK.
2. Click 'Reset Go' to start the software.
3. "Renesas RX62N" will be displayed on the debug LCD, and the user LEDs will flash.
4. The user LEDs will flash at a fixed rate until either a switch is pressed, or the LEDs have flashed 200 times.
5. The software will then vary the rate in which the LEDs flash by the position of the potentiometer, VR1. Turn the potentiometer in both directions, and observe the change in flash rate.
6. While the LEDs flash at a varying rate, the second line of the debug LCD will show “STATIC". The second LCD line will slowly be replaced, letter by letter, with the string "TESTTEST".
7. Once the second line of the debug LCD shows "TESTTEST" fully, it will return back to showing "RX62N". The LEDs will continue to flash at a varying rate until the tutorial is stopped.
8. In order to repeat the tutorial, click 'Reset Go'.

2.22 USB Communications Class Device (CDC)

This Application demonstrates the USB function controller. The code implements the CDC class. This means the device will appear as a virtual COM port to the host.

2.22.1 Operation

1. Build and download the project to the YRDK.
2. Connect a second USB cable to the USB jack below the Ethernet jack. Connect the other end to your PC.
3. Click “Reset Go” to start the software.

4. When Windows displays the “Found New Hardware” dialogs, point it to the INF file in the project “Host\Driver” directory. The board will then enumerate as a virtual COM port on the PC.
5. Open a terminal program and select the virtual COM port for the board. Follow the instructions that are displayed.

2.23 USB Human Interface Device (HID)

A USB HID Application. This USB HID application allows a host to perform the following operations by sending an OUTPUT report:

1. Toggle a LED.
2. Read the ADC.
3. Write to the LCD.

The Device will tell the host, via an INPUT report, when a user has pressed a switch.

2.23.1 Operation

1. Build and download the program
2. Click “Reset & Go” on the tool bar.
3. Connect a second USB cable to the jack just below the Ethernet connector; connect the other end to your PC.
4. In the “Host” folder of the project (you can see it in the Project pane), run the program “RSK_HID.EXE” by double clicking on it. Click “Connect”, accept the defaults, and then use the buttons in the program to turn an LED on and off, read the ADC, and update the LCD via the USB HID connection to the board.

2.24 Watchdog Timer

This sample demonstrates use of the watchdog timer (WDT) by configuring the timer to require periodic resets to prevent a timer underflow. The sample configures a periodic timer reset which has a period that varies with the position of the potentiometer, VR1. The LEDs flash to indicate each period.

2.24.1 Operation

1. Build and download the sample code to the YRDK.
2. Ensure the potentiometer, VR1, is turned to the fully counter-clockwise position before starting the sample. To start the sample, click 'Reset Go'.
3. The debug LCD will display the sample name, and the user LEDs will begin to flash.
4. Slowly turn the potentiometer VR1 clockwise, and observe the gradual decrease the LED flash rate. Each time the LEDs toggle output state, the watchdog timer is reset, preventing it from triggering an overflow interrupt.
5. Continue to turn the potentiometer clockwise - the LED flashing will slow down to a point where the watchdog timer is allowed to overflow.
6. When the timer has overflowed, the LEDs will stay constantly lit, and the program will wait in an infinite while loop. The debug LCD will display "Watchdog Overflow".
7. To repeat the sample, ensure VR1 is fully counter-clockwise and click 'Reset Go'.

Website and Support

Renesas Electronics Website
http://www.renesas.com/

Inquiries
http://www.renesas.com/inquiry

Revision Record

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Mar.01.2011	—	First edition issued

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Notice

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