RIO Programmable I/O Kit

The RIO Programmable I/O Kit is intended to demonstrate how to expand an embedded control system design by adding additional I/O and other features. The Kit provides a Prototyping Board with a Rabbit RIO chip already installed and configurable header locations to allow you to develop your own application using the Dynamic C function calls and sample programs included with the Kit.

Application Kit Contents

The RIO Programmable I/O Kit contains the following items:

- 2 CD-ROMs — *Dynamic C*® with complete product documentation on disk, and supplemental CD with sample programs and information related to the RIO Programmable I/O Kit.
- RCM4110 module.
- Rabbit RIO Prototyping Board.
- Universal AC adapter, 12 V DC, 1 A (includes Canada/Japan/U.S., Australia/N.Z., U.K., and European style plugs).
- 10-pin header to DB9 programming cable with integrated level-matching circuitry.
- *Getting Started* instructions.
- Plastic and metal standoffs with 4-40 screws.
- A bag of jumpers and jumper wires for use on the Prototyping Board.
- *Rabbit 4000 Processor Easy Reference* poster.
- Registration card.

Visit our online Rabbit store at www.rabbit.com/store/ for the latest information on peripherals and accessories that are available for the Rabbit RIO chip.

Installing Dynamic C®

Insert the CD from the RIO Programmable I/O Kit in your PC's CD-ROM drive. If the installation does not auto-start, run the `setup.exe` program in the root directory of the Dynamic C CD. Install any Dynamic C modules after you install Dynamic C.

Hardware Connections

1. Prepare the Prototyping Board for Development

Snap in four of the plastic standoffs supplied in the bag of accessory parts from the RIO Programmable I/O Kit in the holes at the corners as shown.
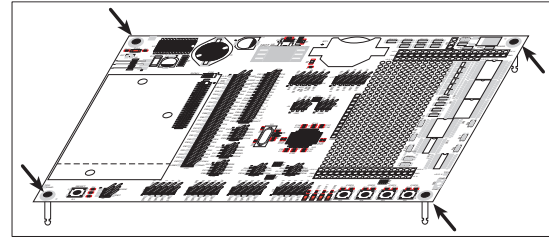
2. Attach Module to Prototyping Board

Turn the RCM4110 module so that the mounting holes of the RCM4110 line up with the corresponding holes

Figure 1. Insert Plastic Standoffs

on the Prototyping Board. Insert the metal standoffs as shown in Figure 2, secure them from the bottom of the Prototyping Board using the 4-40 × 3/16 screws, then insert the module's header J3 on the bottom side into header socket RCM1 on the Prototyping Board.
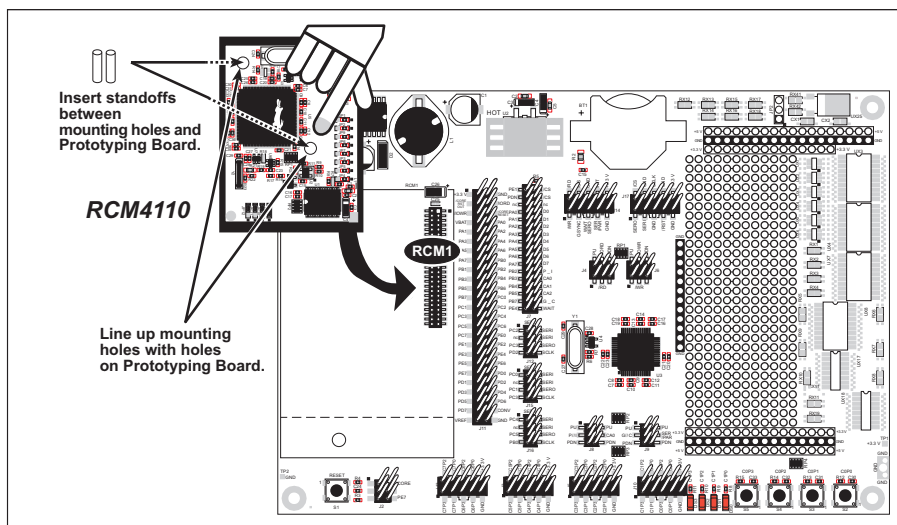

Figure 2. Install the RCM4110 Module on the Prototyping Board

> **NOTE:** It is important that you line up the pins on header J3 of the RCM4110 module exactly with socket RCM1 on the Prototyping Board. The header pins may become bent or damaged if the pin alignment is offset, and the module will not work. Permanent electrical damage to the module may also result if a misaligned module is powered up.

Press the module's pins gently into the Prototyping Board header socket—press down in the area above the header pins. For additional integrity, you may secure the RCM4110 to the standoffs from the top using the remaining two 4-40 × 3/16 screws.

3. Set Jumpers

Jumpers were placed at the factory on Prototyping Board headers J2, J7, J8, J9, and J15 as shown in Figure 3 to set up the Prototyping Board for the SPI serial mode used with the sample programs. Application Note AN415, *RIO Programmable I/O Kit*, describes other configuration options.

4. Connect Programming Cable

The programming cable connects the RCM4110 to the PC running Dynamic C to download programs and to monitor the RCM4110 module during debugging.

Connect the 10-pin connector of the programming cable labeled **PROG** to header J1 on the RCM4110 as shown in Figure 3. Be sure to orient the marked (usually red) edge of the cable towards pin 1 of the connector. (Do not use the **DIAG** connector, which is used for a normal serial connection to Serial Port A.)
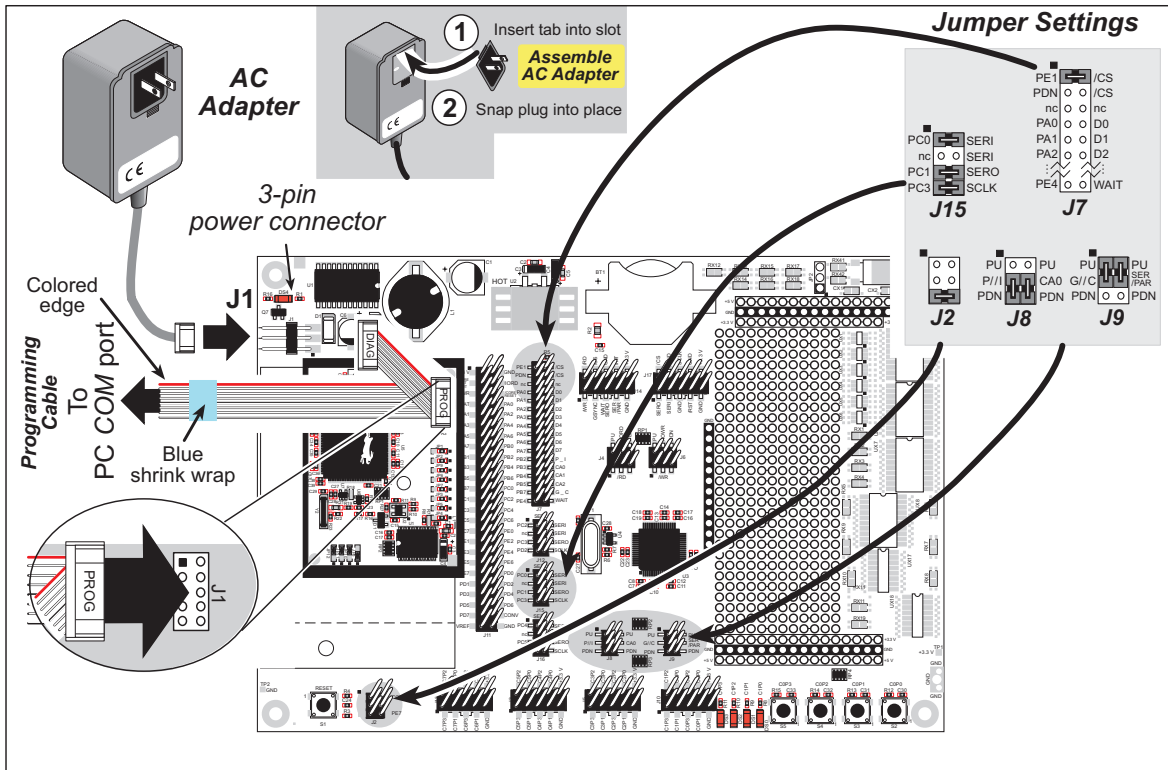
Figure 3. Prototyping Board and Programming Cable Setup

> **NOTE:** Be sure to use the programming cable (part number 101-0542) supplied with the RIO Programmable I/O Kit—the programming cable has blue shrink wrap around the RS-232 converter section located in the middle of the cable. Programming cables with red or clear shrink wrap from other Rabbit Semiconductor kits are not designed to work with RCM4110 modules.

Connect the other end of the programming cable to a COM port on your PC.

> **NOTE:** Some PCs now come equipped only with a USB port. It may be possible to use an RS-232/USB converter (Part No. 540-0070) with the programming cable supplied with the RIO Programmable I/O Kit. Note that not all RS-232/USB converters work with Dynamic C.

5. Connect Power

Once all the other connections have been made, you can connect power to the Prototyping Board.

First, prepare the AC adapter for the country where it will be used by selecting the appropriate plug. The RIO Programmable I/O Kit presently includes Canada/Japan/U.S., Australia/N.Z., U.K., and European style plugs. Snap in the top of the plug assembly into the slot at the top of the AC adapter as shown in Figure 3, then press down on the plug until it clicks into place.

Connect the AC adapter to 3-pin header J1 on the Prototyping Board as shown in Figure 3 above. The connector may be attached either way as long as it is not offset to one side—the center pin of J1 is always connected to the positive terminal, and either edge pin is ground.

Plug in the AC adapter. The power LED on the Prototyping Board above the power connector at J1 should light up. The RCM4110 and the Prototyping Board are now ready to be used.

> **NOTE:** If you need to reset the RCM4110, disconnect, then reconnect the power supply.

Starting Dynamic C

Once the RCM4110 is connected as described in the preceding pages, start Dynamic C by double-clicking on the Dynamic C icon on your desktop or in your **Start** menu. Dynamic C uses the serial port specified during installation.

If you are using a USB port to connect your computer to the RCM4110, choose **Options > Project Options** and check "Use USB to Serial Converter" in "Serial Options." Click **OK** to save the settings.

Run a Sample Program

Use the **File** menu to open the sample program **ROTATELED.C** in the Dynamic C **SAMPLES\RIO** folder. Press function key **F9** to compile and run the program. The four LEDs on the Prototyping Board will flash on and off in a rotating sequence, and the Dynamic C **STDIO** window will open on your PC to display the status of the Rabbit RIO chip's Channel 1.

This sample program uses Channel 1 with the Rabbit RIO chip operating in the *SPI clocked serial* communication mode. The *Rabbit RIO Chip User's Manual* describes the communication modes in more detail.

Where Do I Go From Here?

If the sample program ran fine, you are now ready to go on to other sample programs and to develop your own applications. Application Note AN415, *RIO Programmable I/O Kit*, discusses how to use the Prototyping Board and explains the sample programs and Rabbit RIO function calls. The source code for the sample programs is provided to allow you to modify them for your own use. The *RCM4100 User's Manual* on the Dynamic C CD also provides complete hardware reference information and describes the software function calls for the RCM4110 RabbitCore module, and the *Rabbit RIO User's Manual* provides complete reference information for the Rabbit RIO chip.

Troubleshooting

If Dynamic C cannot find the target system (error message **"No Rabbit Processor Detected."**):

- Check that the RCM4110 is powered correctly — the red power LED on the Prototyping Board should be lit when the RCM4110 is mounted on the Prototyping Board and the AC adapter is plugged in.

- Check both ends of the programming cable to ensure that they are firmly plugged into the PC and the **PROG** connector, not the **DIAG** connector, is plugged in to the programming port on the RCM4110.

- Ensure that the RCM4110 module is firmly and correctly installed in its socket on the Prototyping Board.

If there are no faults with the hardware, select a different COM port within Dynamic C. On your computer, open **Control Panel > System > Hardware > Device Manager > Ports** and look at the list of available COM ports. In Dynamic C, select **Options > Project Options**, then select one of the available COM ports on the "Communications" tab, then click **OK**. Press **<Ctrl-Y>** to force Dynamic C to recompile the BIOS. If Dynamic C still reports it is unable to locate the target system, repeat the above steps for another available COM port. You should receive a **Bios compiled successfully** message once this step is completed successfully.

If a program compiles and loads, but then loses target communication before you can begin debugging, it is possible that your PC cannot handle the default debugging baud rate. Try lowering the debugging baud rate.

- Locate the **Serial Options** dialog in the Dynamic C **Options > Project Options > Communications** menu. Choose a lower debug baud rate.

If there are any other problems:

- Use the Dynamic C **Help** menu to get further assistance with Dynamic C.

- Check the Rabbit Semiconductor Technical Bulletin Board at www.rabbit.com/support/bb/.

- Use the Technical Support e-mail form at www.rabbit.com/support/.

> **NOTE:** If you purchased your RIO Programmable I/O Kit through a distributor or through a Rabbit Semiconductor partner, contact the distributor or partner first for technical support.