



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





Wildcat (BL2000)

C-Programmable Single-Board Computer with Ethernet

User's Manual

019-0094 • 090529-O

Wildcat (BL2000) User's Manual

Part Number 019-0094 • 090529–O • Printed in U.S.A.

©2001–2009 Digi International Inc. • All rights reserved.

No part of the contents of this manual may be reproduced or transmitted in any form or by any means without the express written permission of Digi International.

Permission is granted to make one or more copies as long as the copyright page contained therein is included. These copies of the manuals may not be let or sold for any reason without the express written permission of Digi International.

Digi International reserves the right to make changes and improvements to its products without providing notice.

Trademarks

Rabbit and Dynamic C are registered trademarks of Digi International Inc.

Rabbit 2000 is a trademark of Digi International Inc.

The latest revision of this manual is available on the Rabbit Web site, www.rabbit.com, for free, unregistered download.

Digi International Inc.

www.rabbit.com

TABLE OF CONTENTS

Chapter 1. Introduction	1
1.1 BL2000 Description.....	1
1.2 BL2000 Features.....	1
1.2.1 Connector Options	2
1.3 Development and Evaluation Tools.....	3
1.3.1 Tool Kit.....	3
1.3.2 Software	4
1.4 CE Compliance	5
1.4.1 Design Guidelines	6
1.4.2 Interfacing the BL2000 to Other Devices	6
Chapter 2. Getting Started	7
2.1 BL2000 Connections	7
2.2 Installing Dynamic C	10
2.3 Starting Dynamic C	11
2.4 PONG.C	12
2.5 Where Do I Go From Here?	12
Chapter 3. Subsystems	13
3.1 BL2000 Pinouts	14
3.1.1 Headers and Screw Terminals.....	15
3.1.2 Power Supply Pins	16
3.2 Digital I/O	17
3.2.1 Digital Inputs.....	17
3.2.2 Digital Outputs.....	19
3.3 Relay Outputs	21
3.4 Serial Communication	22
3.4.1 RS-232	22
3.4.2 RS-485	22
3.4.3 Ethernet Port	24
3.4.4 Programming Port.....	25
3.5 A/D Converter Inputs.....	27
3.6 D/A Converter Outputs.....	28
3.7 Memory.....	30
3.7.1 SRAM	30
3.7.2 Flash Memory	30
3.8 Programming Cable	31
3.8.1 Changing Between Program Mode and Run Mode	31
3.9 Other Hardware.....	32
3.9.1 External Interrupts.....	32
3.9.2 Clock Doubler	32
3.9.3 Spectrum Spreader	33
Chapter 4. Software	35
4.1 An Overview of Dynamic C	35
4.1.1 Upgrading Dynamic C	37

4.2	Sample Programs.....	38
4.2.1	General BL2000 Sample Programs	38
4.2.2	Digital I/O.....	38
4.2.3	Serial Communication	39
4.2.4	A/D Converter Inputs	39
4.2.5	D/A Converter Outputs.....	40
4.2.6	Real-Time Clock	40
4.2.7	TCP/IP Sample Programs.....	40
4.3	BL2000 Libraries	41
4.4	BL2000 Function Calls	42
4.4.1	Board Initialization	42
4.4.2	Digital I/O.....	44
4.4.3	Serial Communication.....	45
4.4.4	Relay and LED Outputs.....	46
4.4.5	A/D Converter Inputs	47
4.4.6	D/A Converter Outputs.....	50
Chapter 5. Using the TCP/IP Features		53
5.1	TCP/IP Connections	53
5.2	TCP/IP Sample Programs.....	55
5.2.1	How to Set IP Addresses in the Sample Programs.....	55
5.2.2	How to Set Up your Computer's IP Address for a Direct Connection	56
5.3	Run the PINGME.C Sample Program.....	57
5.4	Running More Sample Programs With a Direct Connection.....	58
5.5	Where Do I Go From Here?.....	58
Appendix A. Specifications		59
A.1	Electrical and Mechanical Specifications.....	60
A.1.1	Headers	63
A.2	Conformal Coating.....	64
A.3	Jumper Configurations	65
A.4	Use of Rabbit 2000 Parallel Ports	67
Appendix B. Plastic Enclosure		69
B.1	Assembly	70
B.2	Dimensions	72
Appendix C. Power Supply		73
C.1	Power Supplies	73
C.1.1	Power for Analog Circuits	74
C.2	Batteries and External Battery Connections.....	74
C.2.1	Replacing the Backup Battery	75
C.2.2	Battery-Backup Circuit.....	75
C.2.3	Power to VRAM Switch.....	76
C.2.4	Reset Generator.....	77
C.3	Chip Select Circuit.....	78
Appendix D. Demonstration Board		81
D.1	Connecting Demonstration Board.....	81
Index		85
Schematics		89

1. INTRODUCTION

The BL2000 is a high-performance, C-programmable single-board computer that offers built-in digital and analog I/O combined with Ethernet connectivity in a compact form factor. A Rabbit[®] 2000 microprocessor operating at 22.1 MHz provides fast data processing. An optional plastic enclosure is available, and may be wall-mounted or panel-mounted.

1.1 BL2000 Description

The BL2000 is an advanced single-board computer that incorporates the powerful Rabbit 2000 microprocessor, flash memory, static RAM, digital I/O ports, A/D converter inputs, D/A converter outputs, an SPDT relay output, and a 10Base-T Ethernet port.

1.2 BL2000 Features

- Rabbit[®] 2000 microprocessor operating at 22.1 MHz.
- 128K static RAM and 256K flash memory.
- Up to 28 digital I/O:
 - 11 protected digital inputs (plus up to 7 dual-purpose unbuffered analog inputs that may be software-configured for use as digital inputs) and 10 high-current digital sinking outputs that may be factory-configured as sourcing outputs.
- 11 analog channels: nine 12-bit A/D converter inputs, two 12-bit D/A converter outputs.
- Onboard SPDT relay.
- One RJ-45 Ethernet port compliant with IEEE 802.3 standard for 10Base-T Ethernet protocol.
- Eight status LEDs.
- 4 serial ports (2 RS-232 or 1 RS-232 with RTS/CTS, 1 RS-485, and 1 CMOS-compatible programming port).
- Real-time clock.
- Watchdog supervisor.
- Voltage regulator.

- Backup battery.
- Ability to send e-mail and serve Web pages containing embedded data from single-board computer.
- Remote program downloading and debugging capability via RabbitLink.
- Boards with the CE mark are CE-compliant.
- Optional plastic enclosure (can be wall-mounted or panel-mounted) and LED light pipes (enclosure and light pipes are included with the Tool Kit, and are also sold separately).

Appendix A provides detailed specifications.

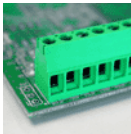

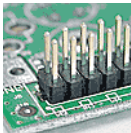
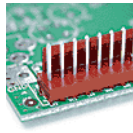
Four models of the BL2000 are available. Their standard features are summarized in Table 1.

Table 1. BL2000 Series Features

Model	Features
BL2000	Full-featured single-board computer.
BL2010	BL2000 with eleven 10-bit A/D converter inputs (no D/A converter outputs).
BL2020	BL2000 <i>without</i> Ethernet interface, only 6 LEDs.
BL2030	BL2010 <i>without</i> Ethernet interface, only 6 LEDs.

1.2.1 Connector Options

In addition to the standard screw-terminal connectors supplied on BL2000 boards, IDC headers, bottom-mount connectors, and polarized friction-lock terminals may be factory-installed instead. Visit our Web site at www.rabbit.com or contact your Rabbit sales representative or authorized distributor for further information.

Standard screw terminals, accept up to 14 AWG (1.5 mm ²) wire		“Bottom-mount connector” to mount BL2000 directly on 0.1" pitch pins located on motherboard	
2 × 17 IDC headers, 0.1" pitch		Polarized friction-lock terminals, 0.1" pitch	

1.3 Development and Evaluation Tools

1.3.1 Tool Kit

A Tool Kit contains the hardware essentials you will need to use your own BL2000 single-board computer. The items in the Tool Kit and their use are as follows:

- *Getting Started* instructions.
- *Dynamic C* CD-ROM, with complete product documentation on disk.
- Programming cable, used to connect your PC serial port to the BL2000.
- Universal AC adapter, 12 V DC, 1 A (includes Canada/Japan/U.S., Australia/N.Z., U.K., and European style plugs).
- Demonstration Board with pushbutton switches and LEDs. The Demonstration Board can be hooked up to the BL2000 to demonstrate the I/O.
- Wire assembly to connect Demonstration Board to BL2000.
- Plastic enclosure with four screws and eight customer-installable light pipes.
- Screwdriver.
- *Rabbit 2000 Processor Easy Reference* poster.
- Registration card.

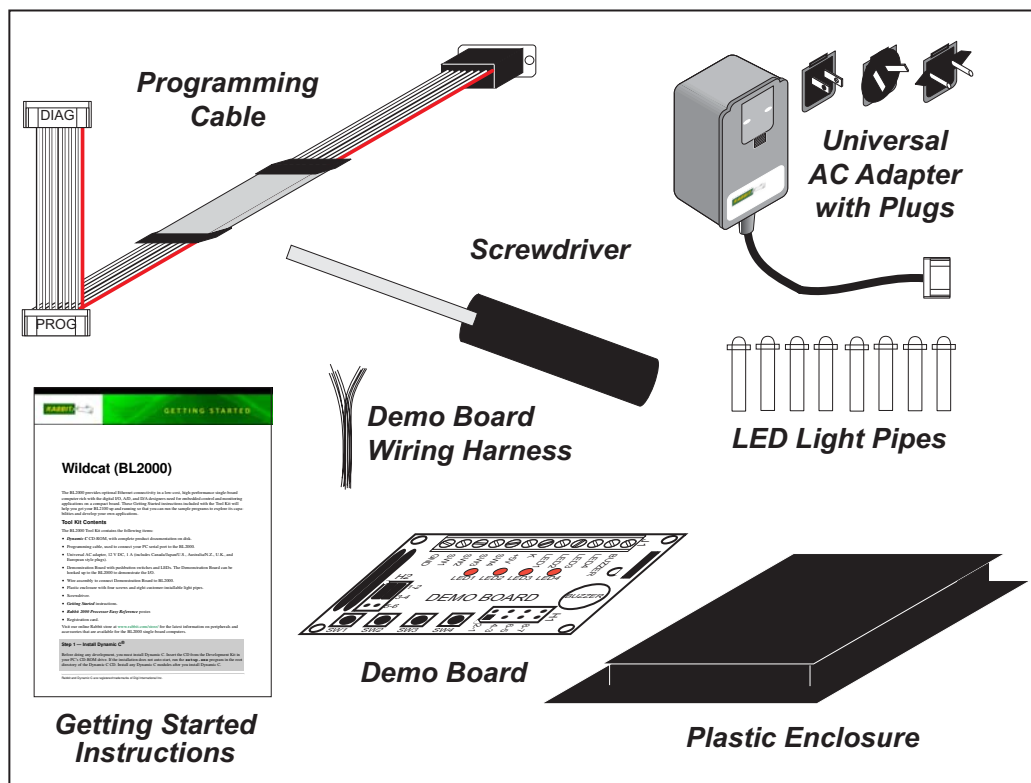


Figure 1. BL2000 Tool Kit

1.3.2 Software

The BL2000 is programmed using version 7.04 or later of Rabbit's Dynamic C. A compatible version is included on the Tool Kit CD-ROM. Dynamic C v. 9.60 includes the popular μ C/OS-II real-time operating system, point-to-point protocol (PPP), FAT file system, RabbitWeb, and other select libraries that were previously sold as individual Dynamic C modules.

Rabbit also offers for purchase the Rabbit Embedded Security Pack featuring the Secure Sockets Layer (SSL) and a specific Advanced Encryption Standard (AES) library. In addition to the Web-based technical support included at no extra charge, a one-year telephone-based technical support subscription is also available for purchase. Visit our Web site at www.rabbit.com for further information and complete documentation, or contact your Rabbit sales representative or authorized distributor.

1.4 CE Compliance

Equipment is generally divided into two classes.

CLASS A	CLASS B
Digital equipment meant for light industrial use	Digital equipment meant for home use
Less restrictive emissions requirement: less than 40 dB μ V/m at 10 m (40 dB relative to 1 μ V/m) or 300 μ V/m	More restrictive emissions requirement: 30 dB μ V/m at 10 m or 100 μ V/m

These limits apply over the range of 30–230 MHz. The limits are 7 dB higher for frequencies above 230 MHz. Although the test range goes to 1 GHz, the emissions from Rabbit-based systems at frequencies above 300 MHz are generally well below background noise levels.

The BL2000 single-board computer has been tested and was found to be in conformity with the following applicable immunity and emission standards. The BL2010, BL2020, and BL2030 single-board computers are also CE qualified as they are sub-versions of the BL2000 single-board computer. Boards that are CE-compliant have the CE mark.



NOTE: Earlier versions of the BL2000 sold before 2003 that do not have the CE mark are *not* CE-compliant.

Immunity

The BL2000 series of single-board computers meets the following EN55024/1998 immunity standards.

- EN61000-4-3 (Radiated Immunity)
- EN61000-4-4 (EFT)
- EN61000-4-6 (Conducted Immunity)

Additional shielding or filtering may be required for a heavy industrial environment.

Emissions

The BL2000 series of single-board computers meets the following emission standards using the enhanced-EMI PCB, Part# 175-0224 Rev. A, and the 668-0003 Rev. A Rabbit 2000 microprocessor.

- EN55022:1998 Class B
- FCC Part 15 Class B

Your results may vary, depending on your application, so additional shielding or filtering may be needed to maintain the Class B emission qualification.

1.4.1 Design Guidelines

Note the following requirements for incorporating the BL2000 series of single-board computers into your application to comply with CE requirements.

General

- The power supply provided with the Tool Kit is for development purposes only. It is the customer's responsibility to provide a CE-compliant power supply for the end-product application.
- When connecting the BL2000 single-board computer to outdoor cables, the customer is responsible for providing CE-approved surge/lighting protection.
- Rabbit recommends placing digital I/O or analog cables that are 3 m or longer in a metal conduit to assist in maintaining CE compliance and to conform to good cable design practices.
- When installing or servicing the BL2000, it is the responsibility of the end-user to use proper ESD precautions to prevent ESD damage to the BL2000.

Safety

- All inputs and outputs to and from the BL2000 series of single-board computers must not be connected to voltages exceeding SELV levels (42.4 V AC peak, or 60 V DC).
- The lithium backup battery circuit on the BL2000 single-board computer has been designed to protect the battery from hazardous conditions such as reverse charging and excessive current flows. Do not disable the safety features of the design.

1.4.2 Interfacing the BL2000 to Other Devices

Since the BL2000 series of single-board computers is designed to be connected to other devices, good EMC practices should be followed to ensure compliance. CE compliance is ultimately the responsibility of the integrator. Additional information, tips, and technical assistance are available from your authorized Rabbit distributor, and are also available on our Web site at www.rabbit.com.

2. GETTING STARTED

Chapter 2 explains how to connect the programming cable and power supply to the BL2000.

2.1 BL2000 Connections

1. Attach the BL2000 to the plastic enclosure base.

Position the BL2000 over the plastic enclosure base as shown below in Figure 2. Attach the BL2000 to the base at the top left and bottom right positions using the two 4-40 \times $\frac{1}{4}$ screws supplied with the enclosure.

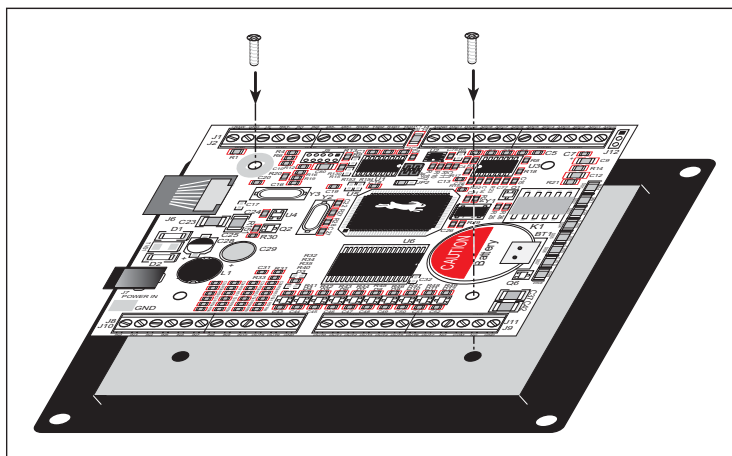


Figure 2. Attach BL2000 to Plastic Enclosure Base

The plastic enclosure base facilitates handling the BL2000 during development, and provides an attractive mounting alternative. Alternatively, you may wish to use standoffs to protect the components on the other side of the board. The plastic enclosure is offered as a separate option when individual BL2000 boards are purchased.

NOTE: Appendix B, “Plastic Enclosure,” provides additional information and specifications for the plastic enclosure.

2. Connect the programming cable to download programs from your PC and to debug the BL2000.

Connect the 10-pin **PROG** connector of the programming cable to header **J5** on the BL2000. Ensure that the colored edge lines up with pin 1 as shown. (Do not use the **DIAG** connector, which is used for a normal serial connection.) Connect the other end of the programming cable to a COM port on your PC.

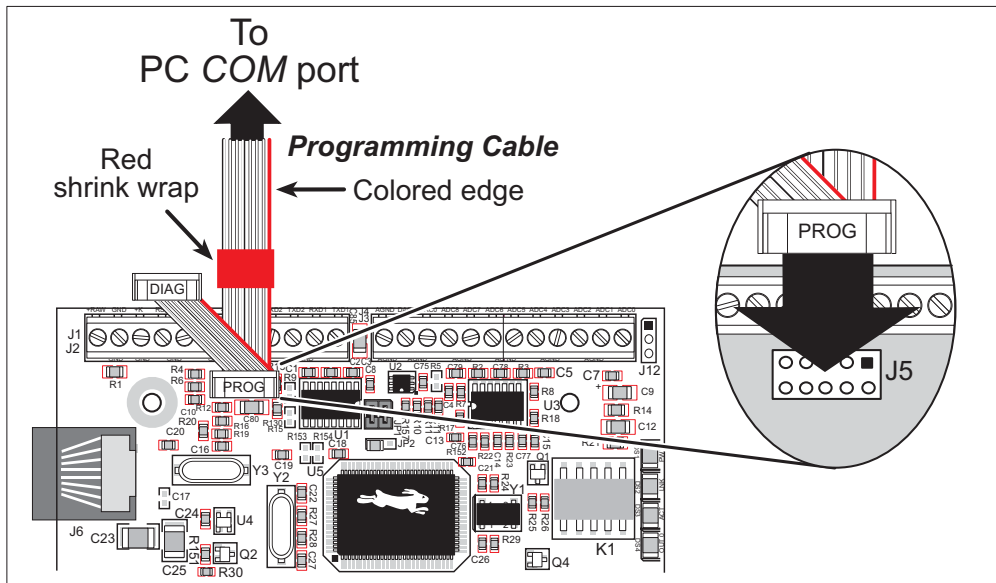


Figure 3. Programming Cable Connections

NOTE: Never disconnect the programming cable by pulling on the ribbon cable. Carefully pull on the connector to remove it from the header.

NOTE: Some PCs now come equipped only with a USB port. It may be possible to use an RS-232/USB converter (Part No. 20-151-0178) with the programming cable supplied with the Tool Kit. Note that not all RS-232/USB converters work with Dynamic C.

3. Connect the power supply.

First, prepare the AC adapter for the country where it will be used by selecting the plug. The BL2000 Tool 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 4, then press down on the spring-loaded clip below the plug assembly to allow the plug assembly to click into place.

Connect the bare ends of the power supply to the **+RAW** and **GND** positions on screw-terminal header J2 as shown in Figure 4.

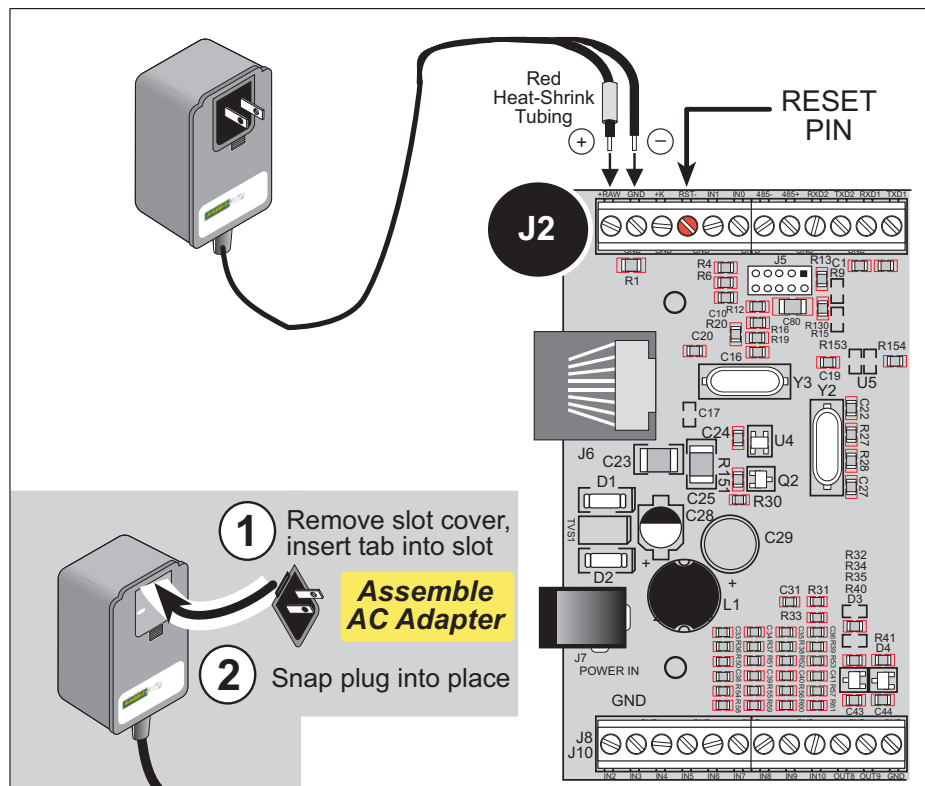


Figure 4. Power Supply Connection

4. Apply power.

Plug in the AC adapter. If you are using your own power supply, it must provide 9 V to 40 V DC—voltages outside this range could damage the BL2000.

CAUTION: Unplug the power supply while you make or otherwise work with the connections to the headers. This will protect your BL2000 from inadvertent shorts or power spikes.

NOTE: The green **PWR** LED and the red **BAD** LED on the opposite end of the board should come on, indicating that the BL2000 is now ready to be used.

NOTE: A hardware RESET is done by unplugging the AC adapter, then plugging it back in, or by momentarily grounding the board reset input at pin 9 on screw-terminal header J2.

2.2 Installing Dynamic C

If you have not yet installed Dynamic C version 7.04 (or a later version), do so now by inserting the Dynamic C CD in your PC's CD-ROM drive. The CD will auto-install unless you have disabled auto-install on your PC.

If the CD does not auto-install, click **Start > Run** from the Windows **Start** button and browse for the Dynamic C **setup.exe** file on your CD drive. Click **OK** to begin the installation once you have selected the **setup.exe** file.

The online documentation is installed along with Dynamic C, and an icon for the documentation menu is placed on the workstation's desktop. Double-click this icon to reach the menu. If the icon is missing, create a new desktop icon that points to **default.htm** in the **docs** folder, found in the Dynamic C installation folder.

The latest versions of all documents are always available for free, unregistered download from our web sites as well.

The *Dynamic C User's Manual* provides detailed instructions for the installation of Dynamic C and any future upgrades.

NOTE: If you have an earlier version of Dynamic C already installed, the default installation of the later version will be in a different folder, and a separate icon will appear on your desktop.

2.3 Starting Dynamic C

Once the BL2000 is connected to your PC and to a power source, start Dynamic C by double-clicking on the Dynamic C icon on your desktop or in your **Start** menu.

Dynamic C defaults to using the serial port on your PC that you specified during installation. If the port setting is correct, Dynamic C should detect the BL2000 and go through a sequence of steps to cold-boot the BL2000 and to compile the BIOS. (Some versions of Dynamic C will not do the initial BIOS compile and load until the first time you compile a program.)

If you are using a USB port to connect your computer to the BL2000, choose **Options > Project Options** and select “Use USB to Serial Converter.” Click **OK**.

If you receive the message **No Rabbit Processor Detected**, the programming cable may be connected to the wrong COM port, a connection may be faulty, or the target system may not be powered up. First, check both ends of the programming cable to ensure that it is firmly plugged into the PC and the programming port.

If there are no faults with the hardware, select a different COM port within Dynamic C. From the **Options** menu, select **Communications**. Select another COM port from the list, 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 until you locate the active COM port. You should receive a **Bios compiled successfully** message once this step is completed successfully.

If Dynamic C appears to compile the BIOS successfully, but you then receive a communication error message when you compile and load a sample program, it is possible that your PC cannot handle the higher program-loading baud rate. Try changing the maximum download rate to a slower baud rate as follows.

- Locate the **Serial Options** dialog in the Dynamic C **Options > Communications** menu. Select a slower Max download baud rate.

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 as follows.

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

2.4 PONG.C

You are now ready to test your set-up by running a sample program.

Find the file `PONG.C`, which is in the Dynamic C `SAMPLES` folder. To run the program, open it with the **File** menu (if it is not still open), compile it using the **Compile** menu, and then run it by selecting **Run** in the **Run** menu. The **STDIO** window will open and will display a small square bouncing around in a box.

This program does not test the serial ports, the I/O, or the TCP/IP part of the board, but does ensure that the board is basically functional. The sample program described in Section 5.3, “Run the PINGME.C Sample Program,” tests the TCP/IP portion of the board.

2.5 Where Do I Go From Here?

NOTE: If you purchased your BL2000 through a distributor or Rabbit partner, contact the distributor or partner first for technical support.

If there are any problems at this point:

- Use the Dynamic C **Help** menu to get further assistance with Dynamic C.
- Check the Rabbit Technical Bulletin Board and forums at www.rabbit.com/support/bb/ and at www.rabbit.com/forums/.
- Use the Technical Support e-mail form at www.rabbit.com/support/.

If the sample program ran fine, you are now ready to go on to explore other BL2000 features and develop your own applications.

Chapter 3, “Subsystems,” provides a description of the BL2000’s features, Chapter 4, “Software,” describes the Dynamic C software libraries and introduces some sample programs, and Chapter 5, “Using the TCP/IP Features,” explains the TCP/IP features.

3. SUBSYSTEMS

Chapter 3 describes the principal subsystems for the BL2000.

- Digital I/O
- Relay Outputs
- Serial Communication
- A/D Converter Inputs
- D/A Converter Outputs
- Memory
- External Interrupts

Figure 5 shows these Rabbit-based subsystems designed into the BL2000.

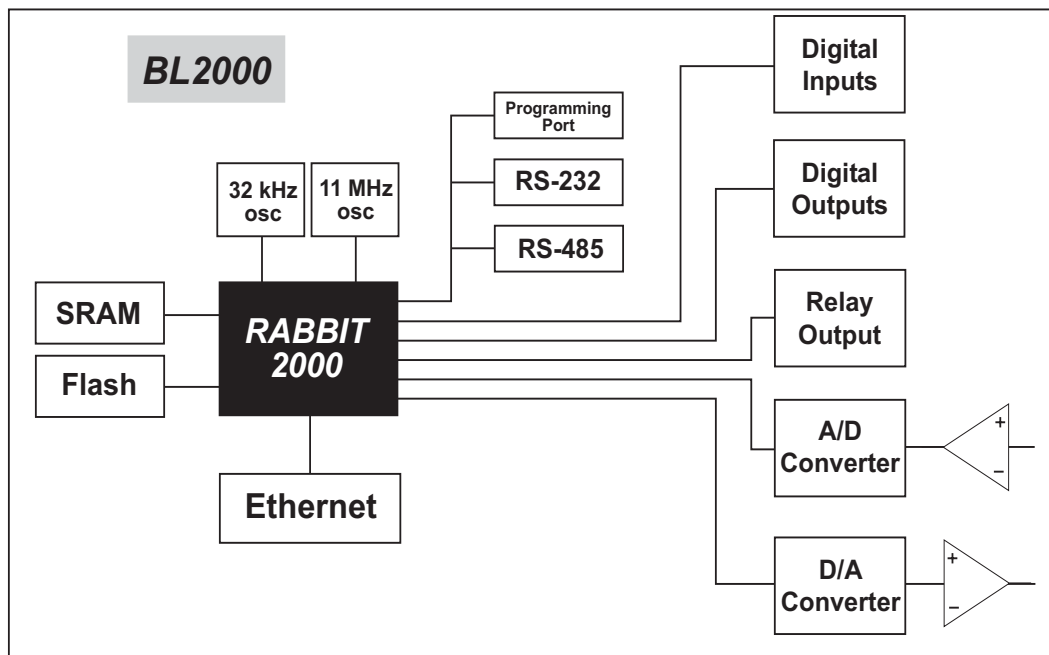


Figure 5. BL2000 Subsystems

3.1 BL2000 Pinouts

The BL2000 pinouts are shown in Figure 6(a) and Figure 6(b).

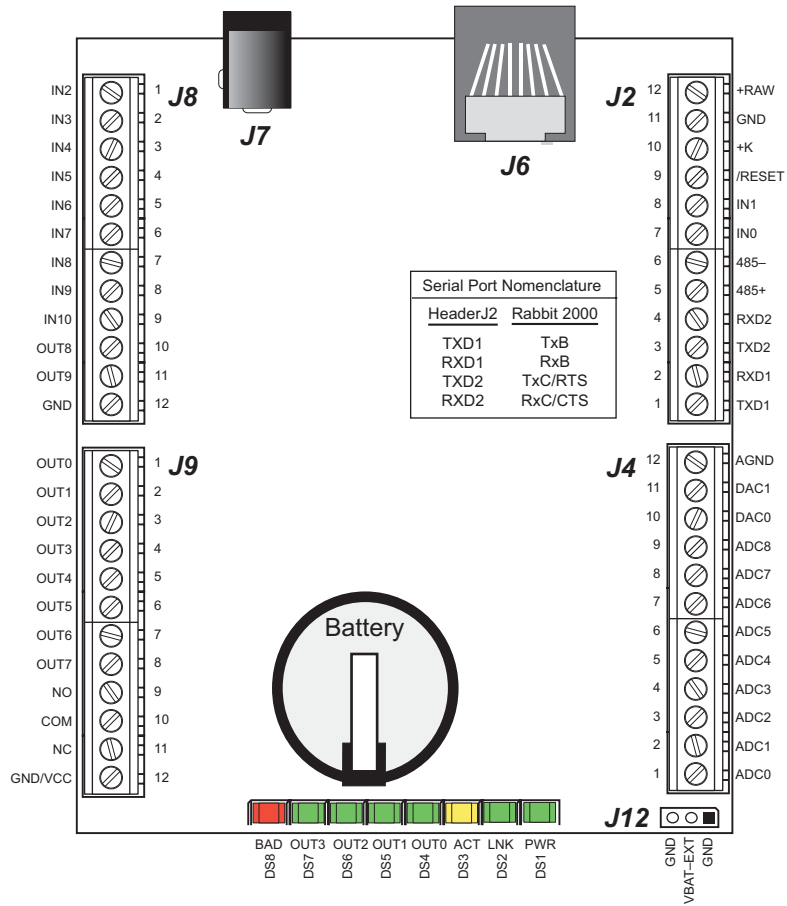


Figure 6(a). BL2000 Pinouts (screw-terminal headers)

3.1.1 Headers and Screw Terminals

All BL2000 models are equipped with 1 × 12 screw terminal strips (J2, J4, J8, and J9) and a 2-pin power jack (J7). The BL2000 and BL2010 also have the RJ-45 Ethernet jack (J6).

There is provision on the circuit board to accommodate one of the following types of connectors instead of the screw-terminal strips.

- 2 × 17 IDC headers with a pitch of 0.1".
- 1 × 17 friction-lock connectors with a pitch of 0.1".
- 1 × 17 bottom-mount sockets with a pitch of 0.1". The holes for the bottom-mount sockets are on the “outside” edges of the connector locations

The pinouts for these connectors are shown in Figure 6(b).

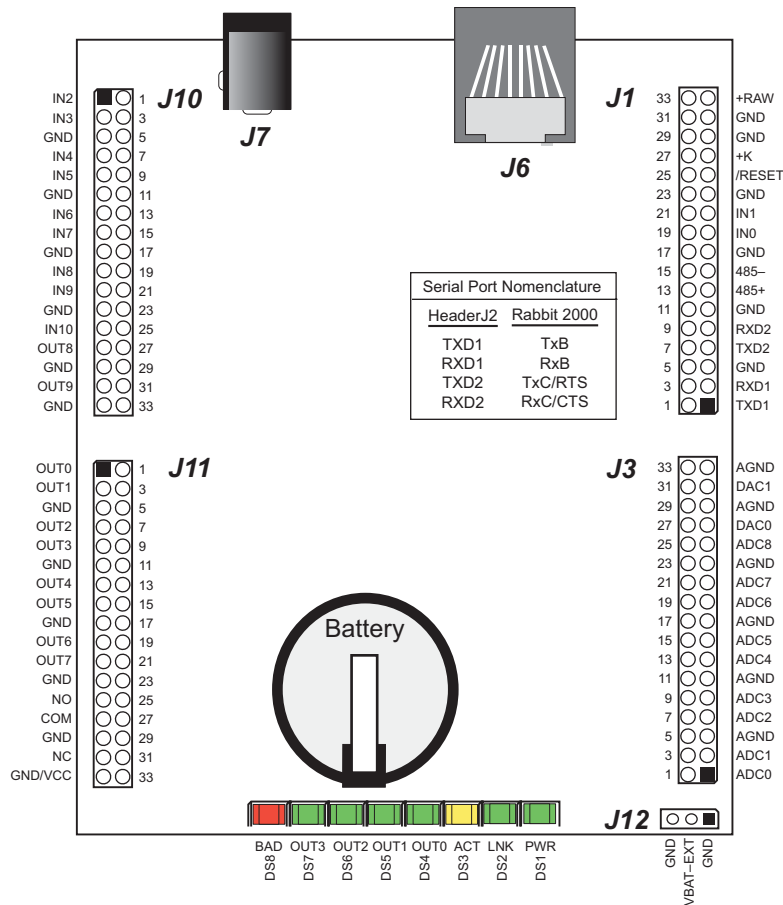


Figure 6(b). BL2000 Pinouts (other 0.1" headers)

3.1.2 Power Supply Pins

Instead of connecting an AC adapter to the power supply jack, J7, the input power supply (9 V to 40 V DC) may be connected to pins 12 and 11 on header J2 (see Figure 6(a) or Figure 6(b)).

Pin 12 on header J9 or J10 is normally GND by factory default, but may be changed to Vcc by removing resistor R161 and installing resistor R160. See Appendix C, “Power Supply,” for more information on this configuration and for information on backup-battery options.

3.2 Digital I/O

3.2.1 Digital Inputs

The BL2000 has 11 digital inputs, IN0–IN10, each of which is protected over a range of –36 V to +36 V. The inputs are factory-configured to be pulled up to +5 V, but they can also be pulled down by moving the surface-mounted jumper at JP6 as shown in Figure 7.

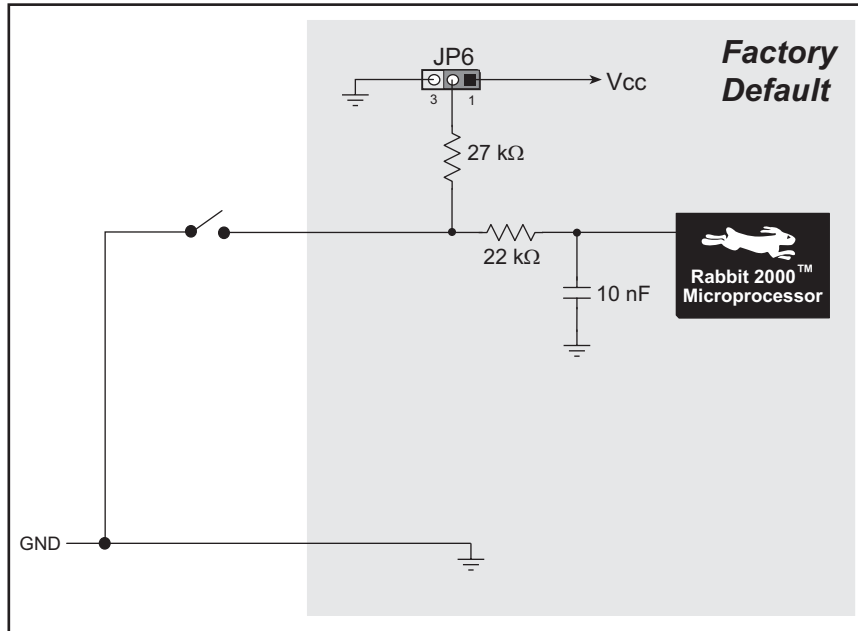


Figure 7(a). BL2000 Digital Inputs [Pulled Up—JP6(1–2) connected]

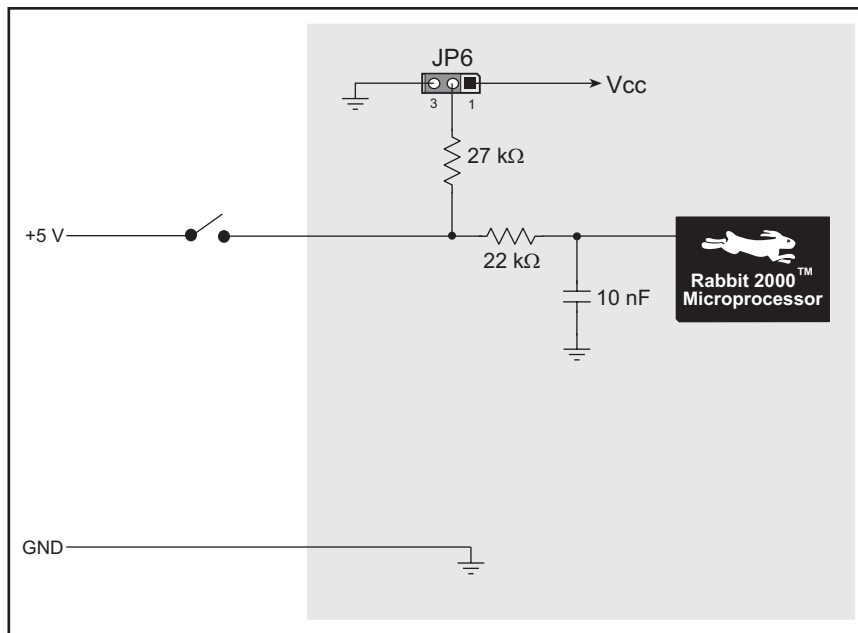


Figure 7(b). BL2000 Digital Inputs [Pulled Down—JP6(2–3) connected]

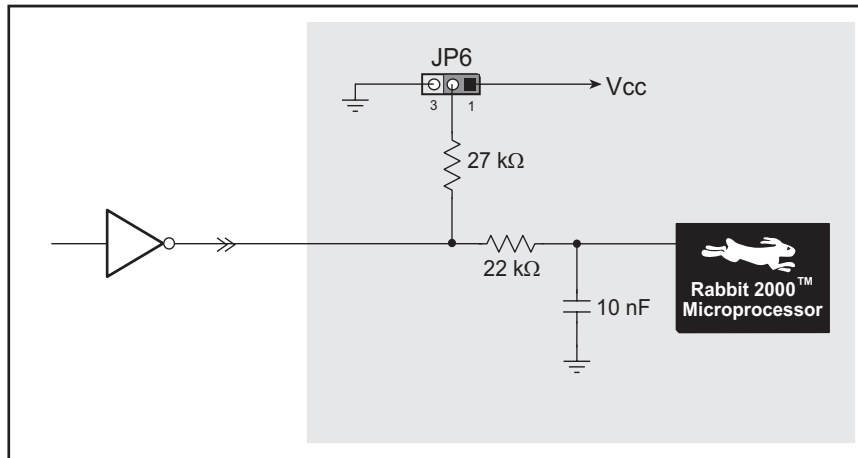


Figure 7(c). Example of Logic Gate Driving BL2000 Digital Input

The actual switching threshold is approximately 2.40 V for channels IN0–IN10. Anything below this value is a logic 0, and anything above is a logic 1.

The A/D converter inputs can be used as additional digital inputs using the parameters specified for the `digIn` software function call. The default threshold for channels IN11–IN21 is also set to 2.40 V, but may be changed by adding two lines to your program as discussed for the `digIn` software function call.

The digital inputs are each fully protected over a range of -36 V to +36 V, and can handle short spikes of ± 40 V.

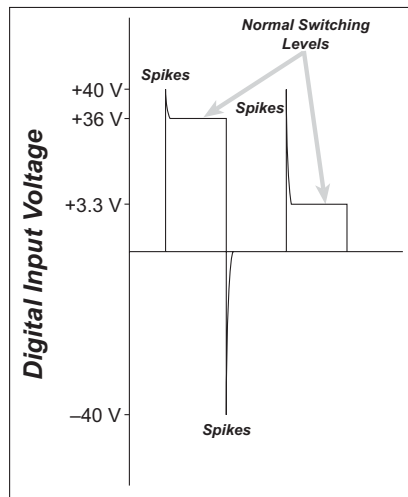


Figure 8. BL2000 Digital Input Protected Range

3.2.2 Digital Outputs

The BL2000 has 10 digital outputs, OUT0–OUT9, each of which can either sink or source up to 200 mA, depending on how the outputs are configured. On boards that carry the CE mark, OUT8 and OUT9 are each capable of sinking up to 750 mA.

Each output can be configured individually as either a sinking or a sourcing output as shown in Figure 9. The outputs can be pulled as a group to Vcc, +K, or GND through 27 kΩ resistors. Tie the outputs high to either Vcc or +K when using the outputs as sinking outputs (via 0 Ω resistors at R32 or R35 respectively), or tie the outputs to GND via R34 when using the outputs as sourcing outputs. +K is an externally supplied voltage of up to 40 V DC, and is used primarily in combination with current sourcing outputs, and *must* also be connected to an external supply when an inductive load is connected to a sinking output.

NOTE: Remove the 27 kΩ resistors (R143–R150) from the output circuits if no pull-up/down is required to avoid leakage between the outputs. These resistors are located on the bottom side of the BL2000 board above the solder points for screw terminal header J9.

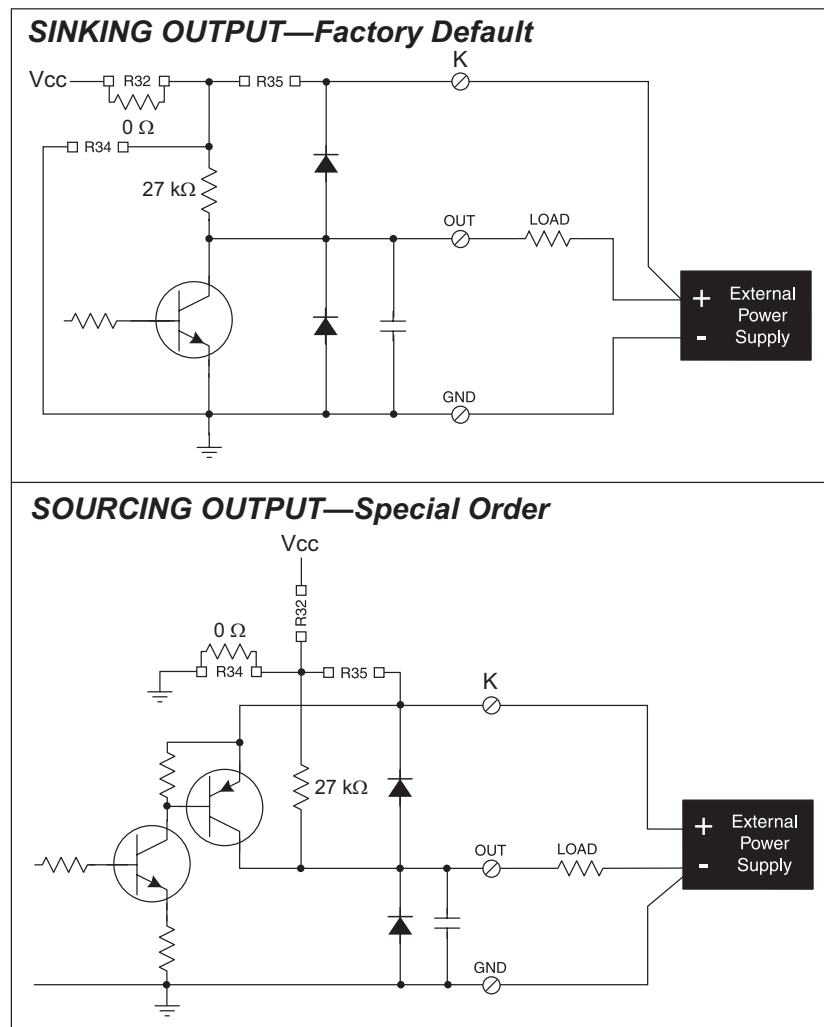


Figure 9. BL2000 Digital Outputs

The locations of the output pull-up/pull-down select resistors R32, R34, and R35 are shown in Figure 10.

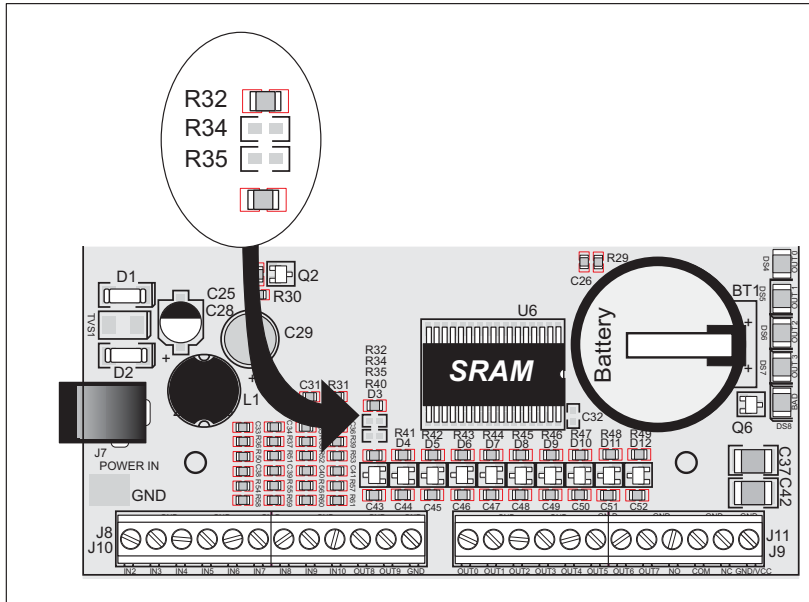


Figure 10. Locations of Resistors R32, R34, and R35

All BL2000 models are factory-configured with sinking outputs and pull-up resistors tied to Vcc via a 0 Ω resistor at R32.

3.3 Relay Outputs

Figure 11 shows the BL2000 relay contact connections. A diode across the coil provides a return path for inductive spikes, and snubbers across the relay contacts protect the relay contacts from inductive spikes.

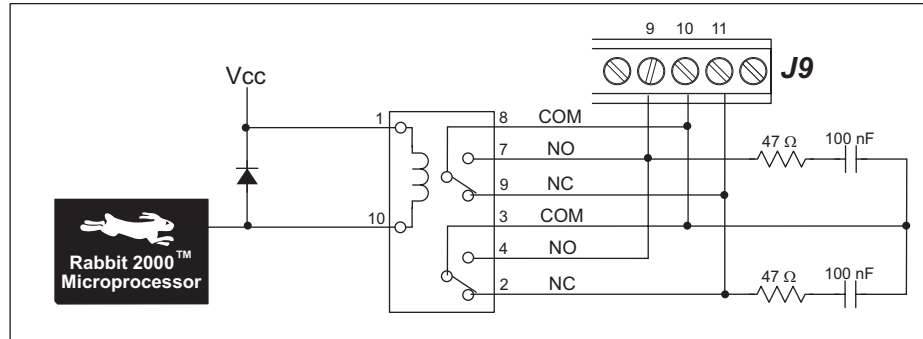


Figure 11. BL2000 Relay Output Contact Connections

The relay is driven by PA0, which is the same Rabbit 2000 parallel port that drives OUT0 and LED DS4. OUT0 therefore works in parallel with the relay output.

The relay included on the BL2000 has contacts rated for 1 A @ 30 V DC or 300 mA @ 120 V AC. When using the BL2000 in a CE-certified application, the voltages handled by the relay must not exceed SELV levels (42.4 V AC peak, or 60 V DC).