AN406

Will That Be Serial *or* Ethernet?

Introduction

Ethernet networks and the Internet are rapidly becoming the preferred means for connecting remote devices, and Web browsers provide an easy access to display data and otherwise interface with the remote devices. Regardless of whether you're collecting data automatically or are looking at a remote device of one kind or another, you're going to eventually have to connect your device to a PC or other terminal. In many cases that connection will likely be through a network of some kind. A serial RS-232 or RS-485 network may suffice for short distances, but you'll have to use an Ethernet/Internet network for long-distance or world-wide connectivity. Ethernet/Internet connections will also help you view and control multiple devices when all you have is one PC or terminal with a limited number of COM ports, or maybe just a notebook with one USB port.

Then, too, the device sending all the data might just have a single RS-232 port to save on costs, and you will have yet another reason to convert the signal protocols. Rabbit Semiconductor's Multi-Port Serial-to-Ethernet Application Kit provides you with the proven hardware and software you need to convert between serial and Ethernet protocols or vice-versa.

The software in the Multi-Port Serial-to-Ethernet Application Kit is pretty straightforward. It initializes the RCM3700, sets up the TCP/IP protocol stack and serial ports, and waits for a network connection from an external host (PC) via Telnet. Once the network connection is made, the software simply moves bytes between a serial port's Tx and Rx and the network connection's socket.

The ***Multi-Port Serial-to-Ethernet Application Kit Getting Started*** instructions included with the Application Kit show how to set up and program the RCM3700.

What Else You Will Need

Besides what is supplied with the Application Kit, you will need a PC with an available COM or USB port to program the RCM3700 in the Application Kit. If your PC only has a USB port, you will also need an RS-232/USB converter (Part No. 540-0070).

To run the **`S2E_DVM.C`** sample program, which uses a digital voltmeter to illustrate the use of the serial-to-Ethernet serial handler, you will need a digital voltmeter with a serial port such as the Radio Shack 22-812 digital voltmeter and a DB9 male to DB9 male null modem cable.

Configuration Information

Network/IP Address Configuration

Any device placed on an Ethernet-based Internet Protocol (IP) network must have its own IP address. IP addresses are 32-bit numbers that uniquely identify a device. Besides the IP address, we also need a netmask, which is a 32-bit number that tells the TCP/IP stack what part of the IP address identifies the local network the device lives on as well as which host it is connected to.

The sample programs supplied with this Multi-Port Serial-to-Ethernet Application Kit already configure the RCM3700 with a default **TCPCONFIG 6** macro, which allows specific IP address, netmask, gateway, and other network parameters to be set at runtime. This sample code shows these network configurations, which are used by the parameters in the **s2e_setnetparams()** function call

```
#define TCPCONFIG   6
#define TCPPORT 23 // 23, 1230, …, 1233 used in the sample programs,
                   // 23 is the default Telnet TCP port
#define BAUDRATE 115200L // L identifies baud rate as a long variable
#define DEFAULT_IP_ADDRESS "10.10.6.100"
#define DEFAULT_GATEWAY "10.10.6.1"
#define DEFAULT_NETMASK "255.255.255.0"
#define DEFAULT_KEEPALIVE 1   // 0 = KeepAlive Off, 1 = On.
#define DEFAULT_ALIVETIME 120 // Delay Between KeepAlive pings.
#define DEFAULT_DHCP_STATE 0  // 0 = DHCP Off, 1 = On.
#define DEFAULT_USE_NAGLE 1   // 1 = Use Nagle, 0 = Do not use Nagle
```

Change the network settings to configure the RCM3700 with your own Ethernet settings only if that is necessary to run the sample programs.

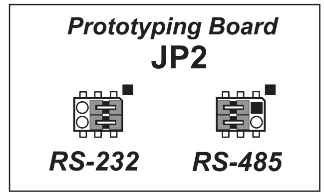
There are some other "standard" configurations for **TCPCONFIG** that let you select different features such as DHCP. Their values are documented at the top of the **TCP_CONFIG.LIB** library in the **LIB\TCPIP** directory. More information is available in the ***Dynamic C TCP/IP User's Manual***.

Serial Port Configuration

In addition to configuring the network connections, you can also configure the serial ports. Four serial ports from the RCM3700 are used by the sample programs with this Application Kit.

Serial Port	Default Use	Alternate Use	Sample Programs
Serial Port A	Programming port	3-wire RS-232	**S2E_RABBITWEB.C**
Serial Port C	3-wire RS-232	RTS/CTS	**S2E_SAMPLE.C** **S2E_BASIC_5WIRE.C**
Serial Port D	3-wire RS-232	5-wire RS-232	**S2E_BASIC.C** **S2E_SAMPLE.C** **S2E_BASIC_5WIRE.C** **S2E_TEMP_SAMPLE.C** **S2E_ZCONSOLE.C** **S2E_RABBITWEB.C**
Serial Port E	RS-485	3-wire RS-232	**S2E_SAMPLE.C** **S2E_RABBITWEB.C**

Serial Port E on the RCM3700 may be configured in hardware as either an RS-232 or an RS-485 serial port when the RCM3700 is used with the RCM3700 Prototyping Board. The hardware configuration details for doing this via header JP2 on the RCM3700 Prototyping Board are shown in the ***RCM3700 User's Manual***, which is available on the Dynamic C CD-ROM.



When Serial Port E is configured as an RS-232 serial port, its signals are available on header J2, the "RS-232 header" on the RCM3700 Prototyping Board. When Serial Port E is configured as an RS-485 serial port, its signals are available on header J1, the "RS-485 connector" on the RCM3700 Prototyping Board. Serial Ports C and D are also available on header J2, the "RS-232 header" on the RCM3700 Prototyping Board. Serial Ports C and D are RS-232 only, and must be configured in software for RS-232.

Configure Serial Ports in Software

One of the first steps is to **`#use`** the serial-to-Ethernet library.

```
#use "SER2ETH.LIB"
```

Now define the serial port use via configuration macros—**`X`** here represents Serial Port A to Serial Port F.

```
#define S2E_USEPORT_X // Enable Serial Port X, X = A to F
#define S2E_SERX_BUFSIZE N // Serial Port X buffer size, default 255
#define S2E_SERX_USE_HANDSHAKING // Serial Port X flow control if used
```

These are typical settings for an RS-232 serial port.

- 8 data bits
- 1 stop bit
- No parity
- No flow control (one serial port required) *or* Flow control on (two serial ports required)
- 115200 baud

Use the **`s2e_setup()`** function call from the Dynamic C **`SER2ETH.LIB`** library to set up each serial port.

```
s2e_setup(S2E_SERPORT_X, LOCALTCP, REMOTETCP, REMOTEIP, BAUDRATE,
   S2E_DATABITS_8 | S2E_PARITY_NONE | S2E_THREE_WIRE |
   S2E_ACTIVE_LISTEN | S2E_RS232);
```

where

`S2E_SERPORT_X` is the serial port being set up (**`X`** = A to F)

`LOCALTCP` is the TCP address of the local port—set 23 as a default Telnet address; 1230, …, 1233 are also used in the sample programs

`REMOTETCP` is the TCP address of the remote port—use **`0`** to listen to all remote ports

`REMOTEIP` is the IP address of the remote port—use **`0`** to listen to all remote ports; always add **`L`** to the number to indicate to Dynamic C that this is a long type of variable

`BAUDRATE` is the baud rate to use as declared earlier in the **`#define BAUDRATE`** line

the final parameter, the serial port parameter, is configured via a logical combination of the five macros (replace **`S2E_RS232`** with **`S2E_RS485`** if you are configuring Serial Port E for RS-485)

Call **`s2e_set485()`** if you are using Serial Port E for RS-485.

```
int s2e_set485(S2E_SERPORT_E, ser485Tx, ser485Rx);
```

When using RS-485, you will have to include code to enable and disable the RS-485 transmitter with **`ser485Tx`** and **`ser485Rx`** as shown in the **`S2E_SAMPLE.C`** sample program.

Now use the **`s2e_setnetparams()`** function call to set up the network parameters.

```
s2e_setnetparams(resolve(DEFAULT_IP_ADDRESS),
   resolve(DEFAULT_NETMASK), resolve(DEFAULT_GATEWAY),
   DEFAULT_DHCP_STATE, DEFAULT_KEEPALIVE, DEFAULT_ALIVETIME,
   DEFAULT_USE_NAGLE);
```

Remember to call **`s2e_init()`** to initialize the **`SER2ETH.LIB`** library.

```
s2e_init();
```

Although ASCII data encoding is the most common protocol, some serial devices use binary data or different character encoding. This means the data that are sent over the serial port might not be readily readable via the Telnet or Hyperterminal utilities on your PC. However, the serial data will still be handled just fine by the RCM3700 as long as a compatible device is available at the other end to receive and display the data.

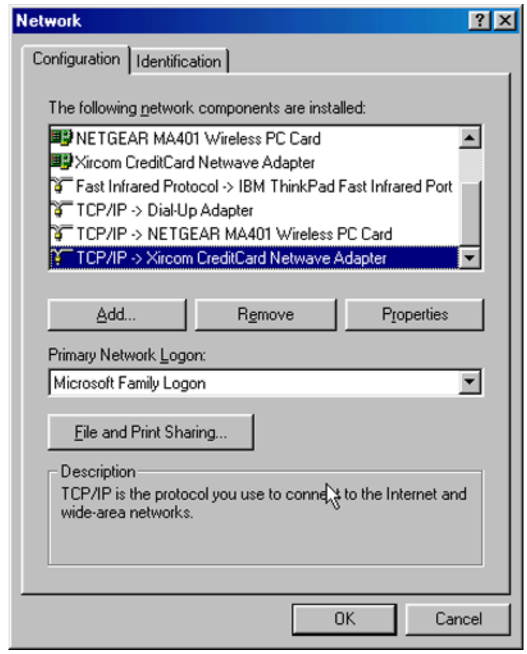
PC Configuration

This section shows how to configure your PC or notebook to run the sample programs. If the PC or notebook used with the RCM3700 is connected to a network, disconnect it from the network. Check with your administrator if you are unable to change the settings as described here since you may need administrator privileges. The screen shots shown here are from Windows 2000, and the interface is similar for other versions of Windows.

1. Go to the control panel (**Start > Settings > Control Panel**) and start **Network Connections**.

2. Select the network interface card used for the Ethernet interface you intend to use (e.g., **TCP/IP Xircom Credit Card Network Adapter**) and click on the "Properties" button. Depending on which version of Windows your PC is running, you may have to select the "Local Area Connection" first, and then click on the "Properties" button to bring up the Ethernet interface dialog. Then "Configure" your interface card for a "10Base-T Half-Duplex" or an "Auto-Negotiation" connection on the "Advanced" tab.

   NOTE: Your network interface card will likely have a different name.



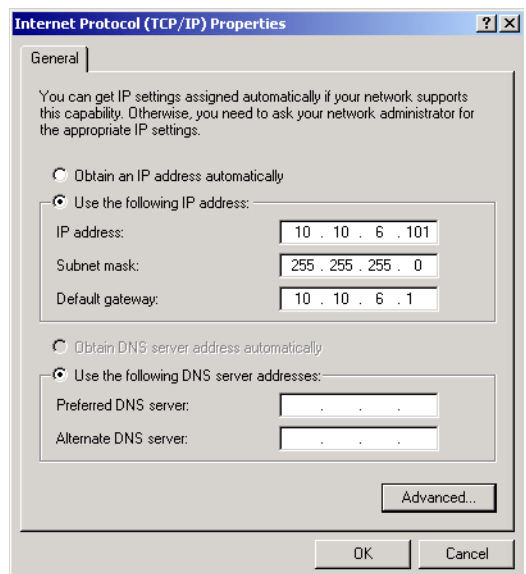
3. Now select the **IP Address** tab, and check **Specify an IP Address**, or select TCP/IP and click on "Properties" to fill in the following fields:

   IP Address : 10.10.6.101

   Netmask : 255.255.255.0

   Default gateway : 10.10.6.1

   TIP: If you are using a PC that is already on a network, you will disconnect the PC from that network to run these sample programs. Write down the existing settings before changing them to facilitate restoring them when you are finished with the sample programs and reconnect your PC to the network.



4. Click **<OK>** or **<Close>** to exit the various dialog boxes.

Once the PC is set up, we're ready to communicate. You can use Telnet, which comes with most Windows installations, to view the Ethernet port, and you can use Hyperterminal to view the serial port.

Now we're ready to run the sample programs.

Sample Programs

Standard Serial-to-Ethernet Sample Programs

The following sample programs are available for the Multi-Port Serial-to-Ethernet Application Kit, and can be found in the Dynamic C **`SAMPLES\S2EMULTI`** folder.

- **`S2E_BASIC.C`**—basic sample program involves one RS-232 serial port
- **`S2E_SAMPLE.C`**—basic sample program involves multiple RS-232 serial ports and RS-485
- **`S2E_BASIC_5WIRE.C`**—basic sample program shows flow control
- **`S2E_ZCONSOLE.C`**—demonstrates Zconsole
- **`S2E_TEMP_SAMPLE.C`**—demonstrates use of serial data from sensor
- **`S2E_HEX.C`**—demonstrates the functionality of the serial handler for converting data
- **`S2E_DVM.C`**—demonstrates the functionality of the serial handler with a digital voltmeter
- **`S2E_RABBITWEB.C`**—sample program with ZConsole and optional RabbitWeb configuration

In order to run these and other sample programs,

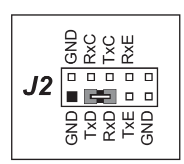
1. Your RCM3700 must be plugged in to the Prototyping Board as described in the ***Multi-Port Serial-to-Ethernet Application Kit Getting Started*** instructions.
2. Dynamic C and the supplementary Multi-Port Serial-to-Ethernet Application Kit software must be installed and running on your PC.
3. The programming cable must connect the programming header on the Prototyping Board to your PC.
4. Power must be applied to the RCM3700 through the Prototyping Board.

To run a sample program, open it with the **File** menu, compile it using the **Compile** menu (or press **F5**), and then run it by selecting **Run** in the **Run** menu (or press **F9**).

If you only have one PC or notebook available, disconnect the programming cable once the sample program is running. Then press the **RESET** button on the RCM3700 Prototyping Board to restart the RCM3700 in the **Run** mode.

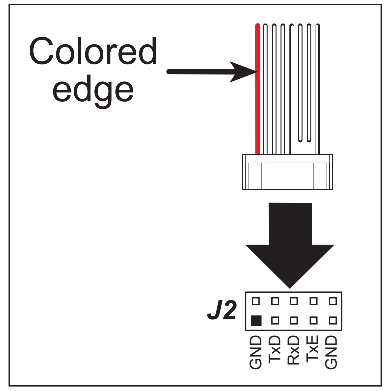
S2E_BASIC.C

This sample program gives a very basic example of three-wire RS-232 serial communication using the serial-to-Ethernet library with Serial Port D and the standard Telnet port (23).



Before you run this program, place one of the jumpers supplied with the spare parts in the Application Kit between the Serial Port D Rx and Tx lines (pins 3 and 5) on header J2 on the RCM3700 Prototyping Board. (Be careful not to confuse header J2 with nearby header JP2.) Once this sample program is running, start a Telnet session (**Start > Run > `telnet 10.10.6.100`**) with the default Telnet socket (23). Once the Telnet client is active (click on the Telnet window appearing on your PC desktop), anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Telnet window. To convince yourself that the RCM3700 is indeed doing the serial-to-Ethernet conversion, you can remove the jumper between the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board, and you will no longer see what you type on your keyboard in the Telnet window.

Instead of using a jumper across the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board, you may use the long 10-pin header to DB9 cable (Part No. 540-0085) to connect header J2 to your PC COM port (remember to disconnect the programming cable if you only have one COM port). Line up the colored edge of the cable with pin 1 on header J2 as shown in the diagram (pin 1 is indicated by a small square on the Prototyping Board silkscreen). Note that two of the lines in the cable opposite the colored side are *not* connected within the 10-pin connector.



Open a Hyperterminal session (**Start > Accessories > Communications**). Select the PC COM port the cable is connected to and set the default serial parameters:

Bits per second: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

With the Hyperterminal client active (click on the Hyperterminal window appearing on your PC desktop) and the Telnet session you started before still running, anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Telnet window. With the Telnet client active (click on the Telnet window appearing on your PC desktop), anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Hyperterminal window. Note that you will not see what you are typing in the active window unless you have enabled the local echo.

To select a different serial port, change the **`S2E_USEPORT_D`**, and **`S2E_SERD_BUFSIZE`** macros in the sample program. To select a different TCP/IP port, change the **`TCPPORT`** macro in the sample program. Note that the long 10-pin header to DB9 cable (Part No. 540-0085) only provides a serial connection to the PC for Serial Port D.

S2E_SAMPLE.C

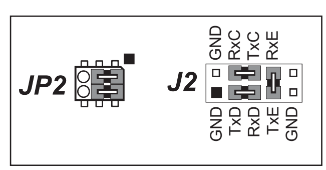
This sample program is similar to the **`S2E_BASIC.C`** sample program, except three serial ports (Serial Ports C, D, and E) are enabled for three-wire RS-232 serial communication, with a unique TCP/IP port (socket) corresponding to each of the three serial ports. TCP/IP "ports" or "sockets" are used whenever multiple devices are associated with a single IP address.

Serial Port C: port 1231

Serial Port D: port 1232

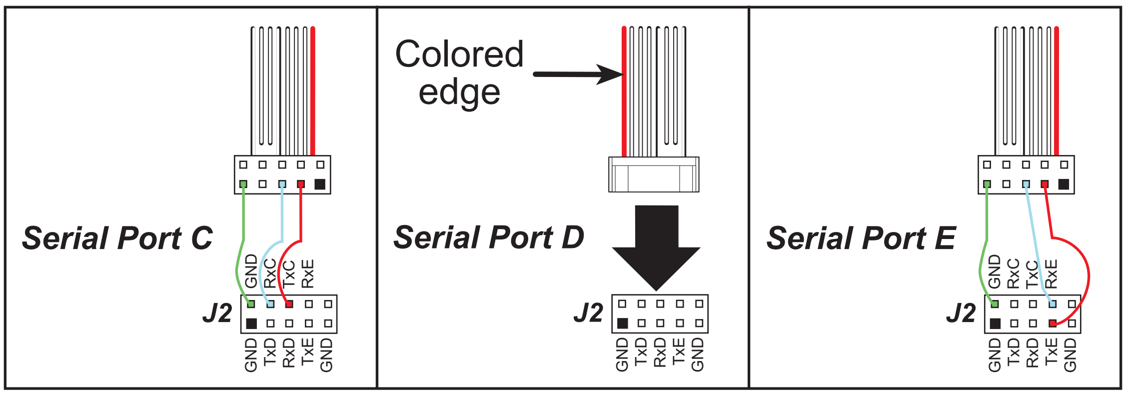
Serial Port E: port 1233

Before you run this program, place jumpers between the Serial Port C, D, and E Rx and Tx lines on header J2 on the RCM3700 Prototyping Board as shown. Also, pins 1–3 and pins 2–4 on header JP2 on the Prototyping Board must be jumpered to set up Serial Port E as an RS-232 serial port. Once this sample program is running, start three Telnet sessions (**Start > Run >** **`telnet 10.10.6.100 1231`**)…(**Start > Run >** **`telnet 10.10.6.100 1233`**) to the IP address 10.10.6.100. With a Telnet client active (click on one of the Telnet windows appearing on your PC desktop), anything you type on your keyboard will be echoed back



by the Rabbit and will appear in that Telnet window.To convince yourself that the RCM3700 is indeed doing the serial-to-Ethernet conversion, you can remove the jumper for the Rx and Tx lines on header J2 for the serial port you are using, and you will no longer see what you type on your keyboard in the Telnet window. You may also try connecting the Tx line from one serial port to the Rx line of another serial port.

Instead of using jumpers across the three serial port Rx and Tx lines on header J2 on the RCM3700 Prototyping Board, you may use the long 10-pin header to DB9 cable (Part No. 540-0085). Because the PC COM port only has one set of Tx and Rx lines, you can only view Serial Port D when you connect the cable directly from header J2 to your PC COM port. Line up the colored edge of the cable with pin 1 on header J2 as shown in the diagram (pin 1 is indicated by a small square on the Prototyping Board silkscreen). Note that two of the lines in the cable opposite the colored side are not connected within the 10-pin connector.



Open a Hyperterminal session (**Start > Accessories > Communications**). Select the COM port the cable is connected to and set the default serial parameters:

Bits per second: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

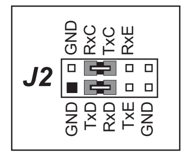
With the Hyperterminal client active (click on the Hyperterminal window appearing on your PC desktop) and the Telnet session to port 1232 still running, anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Telnet window. With the Telnet window active (click on the Telnet window appearing on your PC desktop), anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Hyperterminal window. Note that you will not see what you are typing in the active window unless you have enabled the local echo.

You can repeat this activity via the long cable by connecting Serial Port C or Serial Port E from header J2 to the cable 10-pin connector with hookup wire to the cable 10-pin connector positions shown in the above diagram.

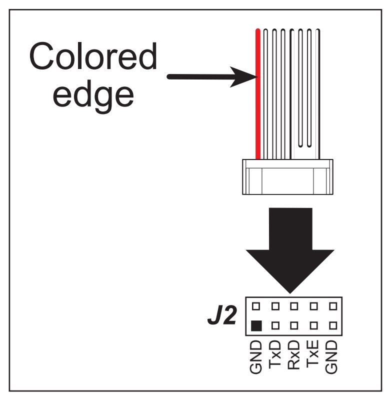
You can also try out Serial Port E as an RS-485 serial port by jumpering pins 3–5 and pins 4–6 on header JP2 on the Prototyping Board before you recompile and run the sample program with the programming cable attached. You will also need to uncomment the **`#define USE_RS485_ON_SER_E`** line in the sample program by removing the `//` characters. Once you're running the revised sample program, you can proceed as before. You will not see any characters typed in the Telnet window echoed back. The RS-485 signals will be on header J1 of the RCM3700 Prototyping Board, and can be observed with an oscilloscope. Alternatively, you may connect an RS-485 device of your own to header J1 to get a visual indication that the RS-485 to Ethernet conversion is taking place.

S2E_BASIC_5WIRE.C

This sample program provides an example of five-wire RS-232 serial communication with flow control. Serial Port D is used as a regular RS-232 serial port, and the two flow control signals (RTS and CTS) are derived from the Serial Port C signals, which are used as a digital input and output.



Before you run this program, place one of the jumpers supplied with the spare parts in the Application Kit between the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board. Then place a second jumper between the Serial Port C Rx and Tx lines on header J2. Once this sample program is running, start a Telnet session (**Start > Run >** `telnet 10.10.6.100`) to the default Telnet socket (23). With the Telnet client active (click on the Telnet window appearing on your PC desktop), anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Telnet window. To convince yourself that the RCM3700 is indeed doing the serial-to-Ethernet conversion, you can remove the jumper between the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board, and you will no longer see what you type on your keyboard in the Telnet window. To check the flow control, leave the jumper in place between the Serial Port D Rx and Tx lines on header J2, and remove the jumper between the Serial Port C Rx and Tx lines on header J2. No communication will occur when this Serial Port C jumper is removed.



Instead of using a jumper across the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board, you may use the long 10-pin header to DB9 cable to connect header J2 to your PC COM port. Line up the colored edge of the cable with pin 1 on header J2 as shown in the diagram (pin 1 is indicated by a small square on the Prototyping Board silkscreen). Note that two of the lines in the cable opposite the colored side are *not* connected to the 10-pin connector.

Open a Hyperterminal session (**Start > Accessories > Communications**). Select the COM port the cable is connected to and set the default serial parameters:

Bits per second: 115200

Data bits: 8

Parity: None

Stop bits: 1

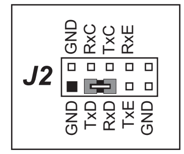
Flow control: Hardware

With the Hyperterminal client active (click on the Hyperterminal window appearing on your PC desktop) and the Telnet session you started before still running, anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Telnet window. With the Telnet window active (click on the Telnet window appearing on your PC desktop), anything you type on your keyboard will be echoed back by the Rabbit and will appear in the Hyperterminal window. Note that you will not see what you are typing in the active window unless you have enabled the local echo.

S2E_ZCONSOLE.C

This sample program demonstrates how to perform serial and network configuration using a console based on the Dynamic C **ZCONSOLE.LIB** library. The console functionality can be embedded in an application to allow network and serial configurations to be changed without having to rewrite and recompile the whole application. The console functionality is wrapped by the Dynamic C **S2E_ZCONSOLE.LIB** library, which interfaces directly with the Dynamic C **SER2ETH.LIB** library.

More information about the **ZCONSOLE.LIB** library and settings and structures can be found in Chapter 17 of the ***TCP/IP User's Manual***.



Before you run this program, place one of the jumpers supplied with the spare parts in the Application Kit between the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board. Once this sample program is running, start a Telnet session (**Start > Run > telnet 10.10.6.100**) to the default TCP socket (23). The console will be displayed in the Telnet window. Type **help<return>** to display the available commands.

```
Available Commands: (type "help <command>" for more info)

ECHO              Turn on or off echoing of characters.
HELP              This help Screen.
LOGIN NAME        Change or set login name.
LOGIN PASSWORD    Change or set password.
SETx              Set Serial port attributes. Replace x with serial port.
SETNET            Set network settings.
SHOW SERx         Show serial port settings. Replace x with serial port.
SHOW NET          Show network settings.
STORE             Store settings.
RECALL            Undo unstored changes.
RESTART           Restart device.
EXIT              Exit console.
LOGOUT            Logout.
```

The x serial ports in the SETx and SHOW SERx commands correspond to x = 0 = Serial Port D and x = 1 = Serial Port E

Type **help <command><return>** for more information about the ECHO, SETNET, and SETx commands. The type of additional information is listed here for the various commands:

- ECHO—"echo off" will stop the characters being input from being echoed back.
- SETx—is used in the context "setx <parameter>". The following parameters can be set.

    status on|off —enable or disable port

    baudrate <number>—baud rate

    sermode rs232|rs485—select RS-232 or RS-485

    databits 8|7—serial data bits

    parity even|odd|none|2—serial parity (2 = 2 stop bits)

    flow on|off—enable hardware flow control

    ipmode listen|open—listen or actively open connection

    rport <tcp port>—remote port (0–65536) to use

    lport <tcp port>—local port (0–65536) to use

    raddress <ip address>—remote IP address to connect to

    flush on|off—enables socket flushing

• `SETNET`—is used in the context “`setnet <parameter>`”. The following parameters can be set.

`ip <ip address>`—exa 10.10.6.99

`netmask <netmask>`—exa 255.255.255.0

`gateway <gateway>`—exa 10.10.6.1

`dhcp on|off`—enable or disable DHCP

`nagle on|off`—turn nagle on or off

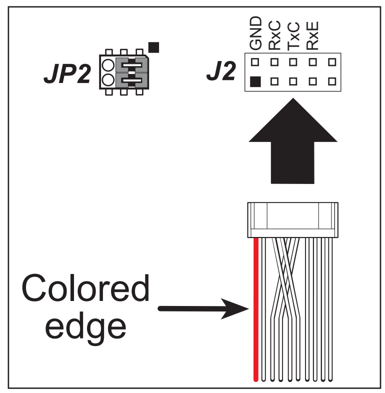
`keepalive on|off`—turn on TCP keepalives

`alivetime <seconds>`—how often to test keepalive

When you change any settings, you must store them and restart the device before the changes will take effect. If you changed the IP address, you will have to start a new Telnet session to the new IP address.

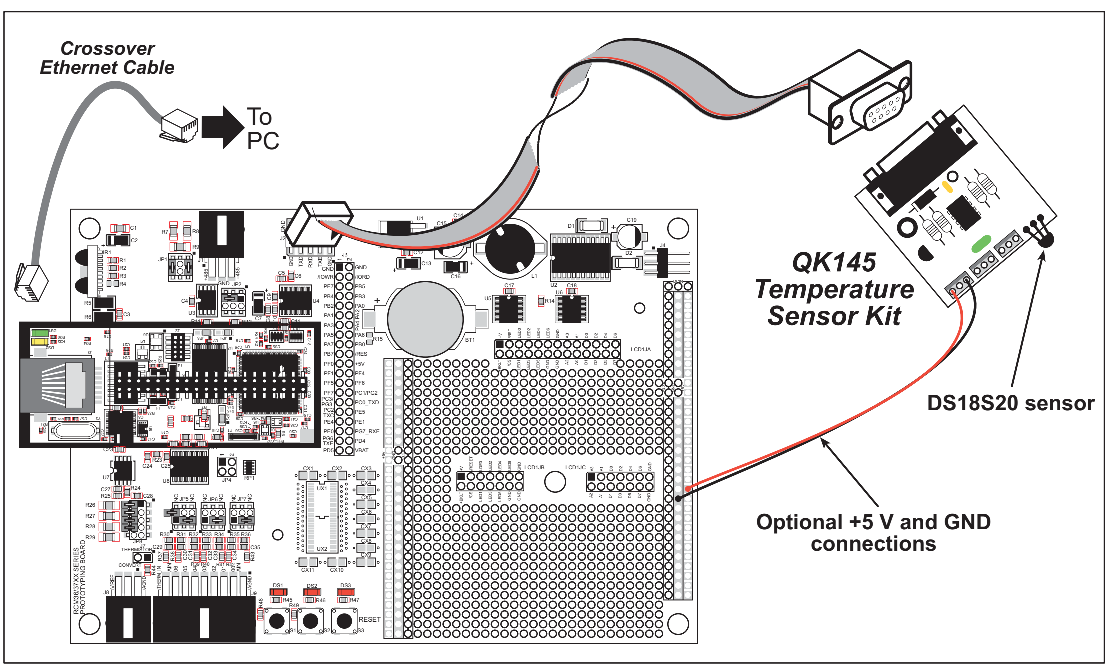
S2E_TEMP_SAMPLE.C

This sample program illustrates using a serial device, the QK145 temperature sensor, to provide the serial data.



Before you run this sample program, use the short 10-pin header to DB9 cable to connect the QK145 temperature sensor to Serial Port D via header J2 on the RCM3700 Prototyping Board. Most of the time, the RS-232 chip on the Prototyping Board can supply sufficient current to operate the QK145 temperature sensor—connect pins 1–3 and pins 2–4 on header JP2 on the Prototyping Board to configure Serial Port E for RS-232 operation.

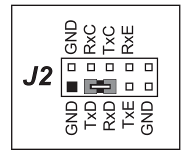
Once the sample program is running, start a Telnet session (**Start > Run >** **`telnet 10.10.6.100 1230`**) to the IP address 10.10.6.100 and Telnet port 1230. The serial data sent by the QK145 temperature sensor will be displayed in the Telnet window.



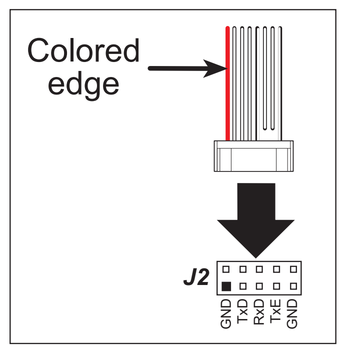
Should you encounter any problem viewing the data output in the Telnet window once the sample program is running, you will have to connect the QK145 temperature sensor to the +5 V and GND traces on the Prototyping Board.

S2E_HEX.C

This sample program demonstrates the functionality of the serial handler using the serial-to-Ethernet library with Serial Port D and the standard Telnet port (23). The serial handler takes a single ASCII byte from the serial port and translates it into two hexadecimal characters and a space, which makes it easier to observe and process certain types of data streams. The functionality of the serial handler is documented in the appendix.



Before you run this program, place one of the jumpers supplied with the spare parts in the Application Kit between the Serial Port D Rx and Tx lines (pins 3 and 5) on header J2 on the RCM3700 Prototyping Board. (Be careful not to confuse header J2 with nearby header JP2.) Once this sample program is running, start a Telnet session (**Start > Run >** **`telnet 10.10.6.100`**) with the default Telnet socket (23). Once the Telnet client is active (click on the Telnet window appearing on your PC desktop), anything you type on your keyboard will have its hex equivalent echoed back by the Rabbit and will appear in the Telnet window. To convince yourself that the RCM3700 is indeed doing the serial-to-Ethernet conversion, you can remove the jumper between the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board, and you will no longer see the hex equivalent from your keyboard in the Telnet window.



Instead of using a jumper across the Serial Port D Rx and Tx lines on header J2 on the RCM3700 Prototyping Board, you may use the long 10-pin header to DB9 cable (Part No. 540-0085) to connect header J2 to your PC COM port (remember to disconnect the programming cable if you only have one COM port). Line up the colored edge of the cable with pin 1 on header J2 as shown in the diagram (pin 1 is indicated by a small square on the Prototyping Board silkscreen). Note that two of the lines in the cable opposite the colored side are *not* connected within the 10-pin connector.

Open a Hyperterminal session (**Start > Accessories > Communications**). Select the PC COM port the cable is connected to and set the default serial parameters:

Bits per second: 57600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

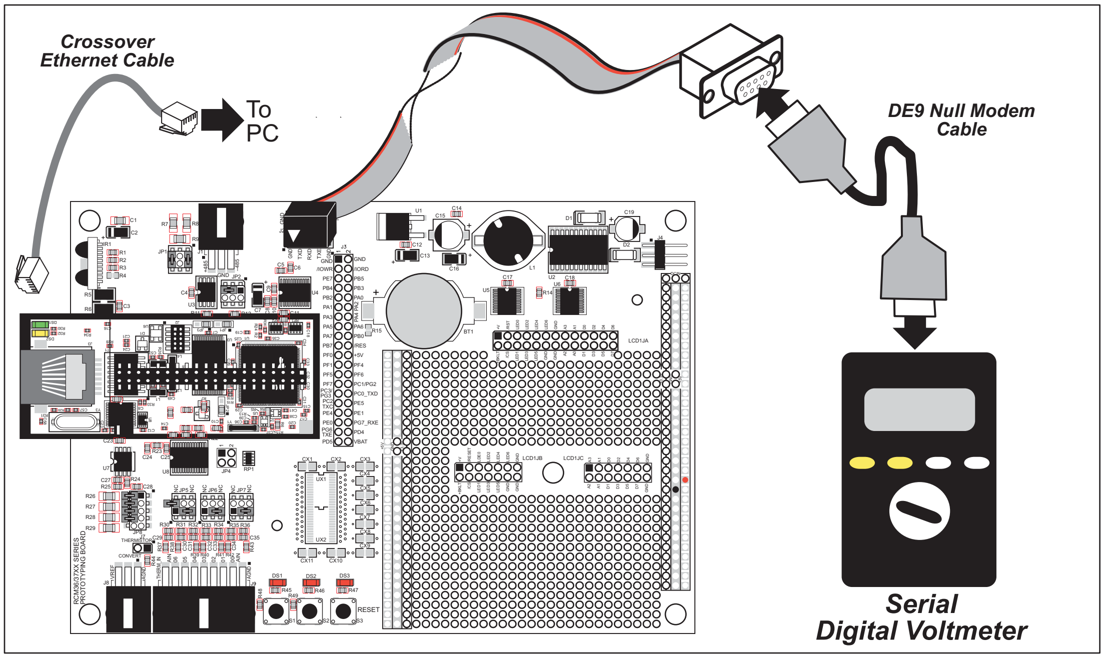
With the Hyperterminal client active (click on the Hyperterminal window appearing on your PC desktop) and the Telnet session you started before still running, anything you type on your keyboard will have its hex equivalent transferred by the Rabbit and will appear in the Telnet window. With the Telnet client active (click on the Telnet window appearing on your PC desktop), anything you type on your keyboard will be transferred by the Rabbit without a hex conversion and will appear in the Hyperterminal window. Note that you will not see what you are typing in the active window unless you have enabled the local echo.

To select a different serial port, change the **`S2E_USEPORT_D`**, and **`S2E_SERD_BUFSIZE`** macros in the sample program. To select a different TCP/IP port, change the **`TCPPORT`** macro in the sample program. Note that the long 10-pin header to DB9 cable (Part No. 540-0085) only provides a serial connection to the PC for Serial Port D.

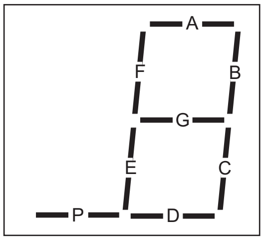
S2E_DVM.C

This sample program demonstrates the serial handler functionality with the Radio Shack 22-812 digital voltmeter. This digital voltmeter has a at 4800 baud serial port that sends information about what is on the screen out its serial port. The functionality of the serial handler is documented in the appendix.

Before you run this sample program, use the long 10-pin header to DB9 cable (Part No. 540-0085) and a DB9 male to DB9 male null modem cable (not included) to connect header J2 on the RCM3700 Prototyping Board to the serial port on the digital voltmeter. Turn the digital voltmeter on, and press the **SELECT** and **RANGE** keys at the same time to turn on the serial port interface on the meter. Use the digital voltmeter to measure a voltage (for example, between the +5 V and GND traces on the RCM3700 Prototyping Board).



Once the sample program is running, start a Telnet session (**Start > Run >** `telnet 10.10.6.100`) with the default Telnet socket (23). An ASCII text representation of the serial data sent by the digital voltmeter will be displayed in the Telnet window.



The data from the digital voltmeter LCD are sent out the serial port in packets of 9 bytes. The first byte describes the mode and the next two bytes describe the units; the next four bytes describe the number on the screen as it is drawn (the P is the decimal point)—the bytes are from right to left as they appear on the LCD. The eighth byte represents some special symbols on the LCD, and the final byte is a checksum of the packet. The sample program converts each packet received into an equivalent ASCII text string that is then displayed in the Telnet window.

The sample program and the manual for the digital voltmeter provide additional information about the nine-byte data strings and the voltmeter modes.

Web Browser Sample Program

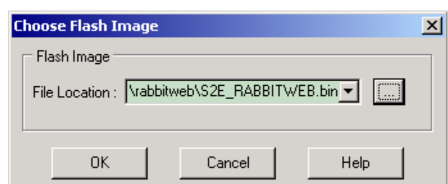
One additional sample program is available to illustrate the use of a Web browser with the Multi-Port Serial-to-Ethernet Application Kit. A binary image file is available to demonstrate the sample program for users who do not have the Dynamic C RabbitWeb module installed; the Dynamic C RabbitWeb module is available at a reduced price to customers who have purchased this Multi-Port Serial-to-Ethernet Application Kit. If you purchased the RabbitWeb module, you will have to install it before you run the RabbitWeb sample program in the **`SAMPLES\Serial2Ethernet_2`** folder.

Like the **`S2E_BASIC.C`** sample program, this sample program can be evaluated by tying the Rx and Tx lines of Serial Ports D and E together via jumpers on header J2 of the RCM3700 Prototyping Board. The jumpers are not required to simply view or use the Web console or the serial console.

The Web browser sample program uses both Serial Port A and the standard Telnet port (23) as a console. Serial Ports D and E are associated with TCP ports 1230 and 1231. The standard Telnet port 23 is used as a remote console.

No RabbitWeb Module—Install BIN File

An already compiled binary image is available in the **`SAMPLES\Serial2Ethernet_2\RabbitWeb`** folder for users who do not have the Dynamic C RabbitWeb module installed or do not want to compile the **`S2E_RABBITWEB.C`** sample program at this time. Close Dynamic C if you have it running on your desktop, but leave the programming cable in place between the programming header of the RCM3700 and your PC COM port. The crossover Ethernet should be in place between the RJ-45 jack on the RCM3700 and the Ethernet card on your PC.

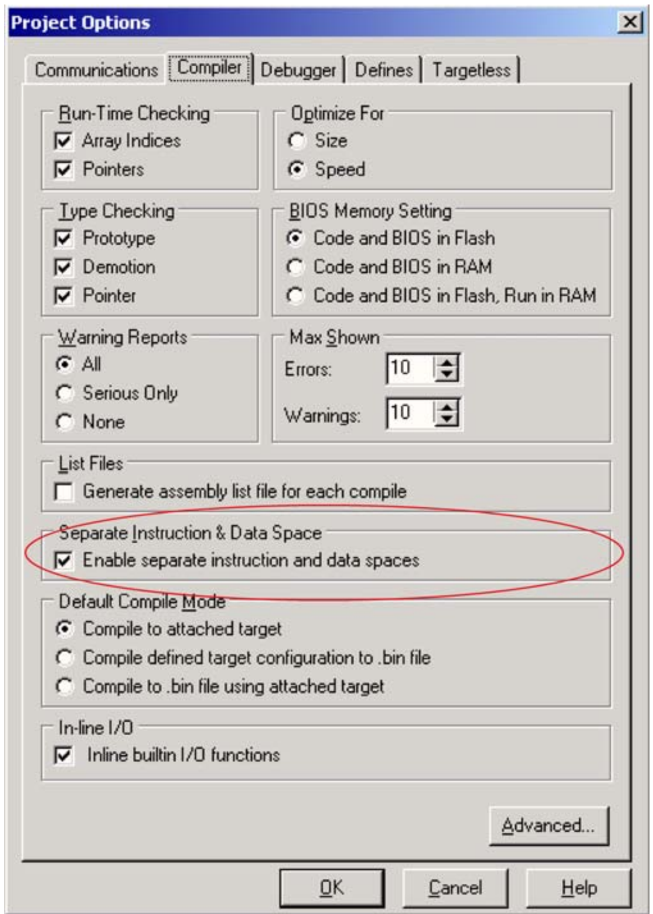


Load the **`S2E_RABBITWEB.BIN`** file with the Rabbit Field Utility, which is available as part of your Dynamic C installation in the Dynamic C **`Utilities`** folder. Locate this folder via Windows Explorer or My Computer, and double-click on **`Rfu.exe`** to launch the Rabbit Field Utility. Select **File > Load Flash Image** and click on the **...** beside the dialog box to browse for the **`S2E_RABBITWEB.BIN`** file in the Dynamic C **`SAMPLES\Serial2Ethernet_2\RabbitWeb`** folder. Select the **`S2E_RABBITWEB.BIN`** file, then click on **Open** and press **OK** to load the file.

Now remove the programming cable connector from the RCM3700 programming header and press the **RESET** button on the RCM3700 Prototyping Board. Launch a Web browser and enter the URL for this sample program **`http://10.10.6.100/`** in the **Address** line. You should be able to bring up a Web console version of the serial console we looked at in the **`S2E_ZCONSOLE.C`** sample program.

RabbitWeb Module Installed—Compile and Run Sample Program

Before you can compile and run the **S2E_RABBITWEB.C** sample program, you must enable the separate I&D space compiler option to handle this program's need for more than 24 Kbytes of root data. This option is accessible from the **Options > Project Options** or the **Compiler** tab of the **Option/Project** dialog.

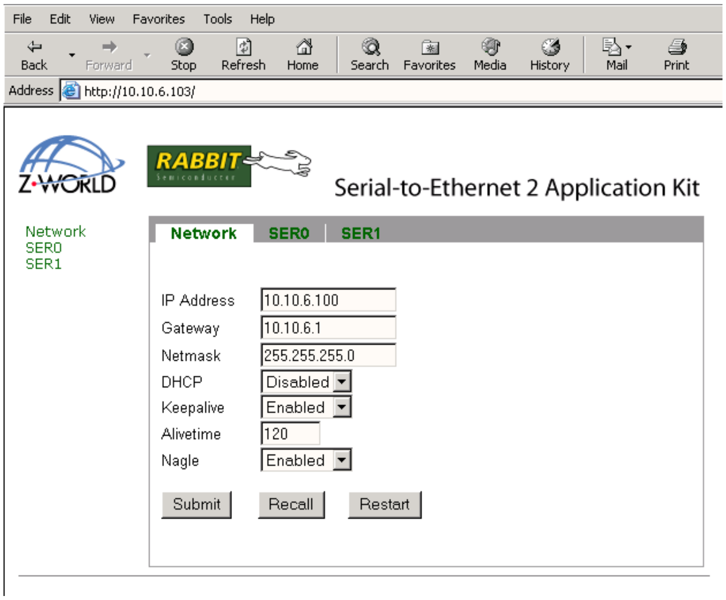


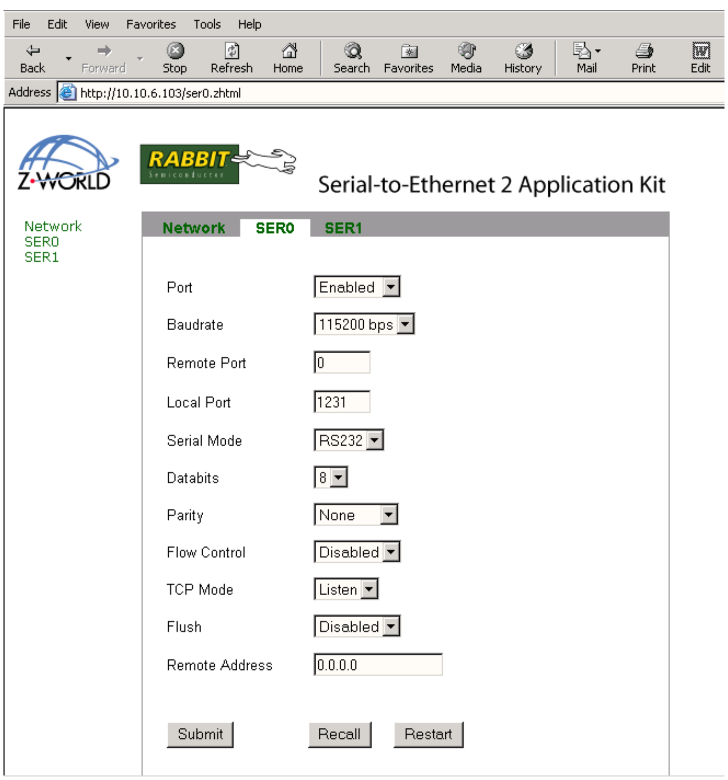
Now open the **S2E_RABBITWEB.C** sample program, and compile and run it by pressing **F9**. You could get a "target not responding message" because the console will interrupt the debugging interface, but you may ignore that message.

Remove the programming cable from the RCM3700 programming header and press the **RESET** button on the RCM3700 Prototyping Board. Launch a Web browser and enter the URL for this sample program **http://10.10.6.100/** in the **Address** line. You should be able to bring up a Web-based console that is similar to the serial console we looked at in the **S2E_ZCONSOLE.C** sample program.

Web Console

The Web console has **Network**, **SER0**, and **SER1** tabs, which correspond to the `SETNET` and `SETx` commands in the **`S2E_ZCONSOLE.C`** sample program, with **SER0** = Serial Port D and **SER1** = Serial Port E. Once you have changed to parameters on a Web console screen, press the **Submit** button to save them, or press the **Recall** button to recall the previous settings. New settings will not take effect until you press the **Store** button (which comes up after you press the **Submit** button) and then the **Restart** button.





Serial Console

You can also bring up the serial console on Serial Port A by connecting the **DIAG** connector on the programming cable to the programming header on the RCM3700; the other end of the programming cable is still connected to the COM port on your PC. Open a Hyperterminal session (**Start > Accessories > Communications**). Select the COM port the programming cable is connected to and set the default serial parameters:

Bits per second: 57600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

With the Hyperterminal client active (click on the Hyperterminal window appearing on your PC desktop), you should see the serial console that we looked at in the **`S2E_ZCONSOLE.C`** sample program. (You may have to press **<return>** or type **help<return>** to start the serial console.)

Comparing Consoles

What you save in one console is reflected in what is displayed in the other console. For example, try changing the network IP address from 10.10.6.100 to 10.10.6.103 in the **Network** screen of the Web console. After you press the **Submit** button, the **Store** button (which comes up after you press the **Submit** button), and the **Restart** button, the Web browser will display **Restarting…**. You will to enter the new URL **`http://10.10.6.103/`** in the Web browser's **Address** line to view the changed network settings, or you can type **show net<return>** to view them using the serial console.

Now let's change things back using the serial console. Type **setnet ip 10.10.6.100<return>** in the serial console (followed by **store<return>** and **restart<return>**) and refresh your Web browser with the URL **`http://10.10.6.100/`** in the Web browser's **Address** line.

In summary, we have shown three ways that network and serial parameters can be viewed and configured.

- Via a Web browser as shown in the **`S2E_RABBITWEB.C`** sample program
- Via Hyperterminal through a serial interface as shown in the **`S2E_RABBITWEB.C`** sample program
- Via Telnet through an Ethernet interface as shown in the **`S2E_ZCONSOLE.C`** sample program

Appendix — Software Reference

Sample Program

Let's examine some of the code in the **S2E_BASIC.C** sample program.

First, the program settings used at startup are defined. These settings are using by the parameters in the **s2e_setup()** and the **s2e_setnetparams()** function calls.

```
#define TCPPORT           23      // Default telnet service port
#define BAUDRATE 115200
#define DEFAULT_IP_ADDRESS "10.10.6.100" // IP Address.
#define DEFAULT_GATEWAY "10.10.6.1"      // Gateway.
#define DEFAULT_NETMASK "255.255.255.0"  // Netmask.
#define DEFAULT_KEEPALIVE 1       // 0 = KeepAlive Off, 1 = On.
#define DEFAULT_ALIVETIME 120     // Delay Between KeepAlive pings.
#define DEFAULT_DHCP_STATE 0      // 0 = Dhcp Off, 1 = On.
#define DEFAULT_USE_NAGLE 1       // 1 = Use Nagle, 0 = No use Nagle
#define SERIALPORT S2E_SERPORT_D  // Select Serial Port D
```

Next, the **SER2ETH.LIB** library settings are defined.

```
#define S2E_USEPORT_D        // Enable Serial Port D
#define S2E_SERD_BUFSIZE 511 // Serial Port D buffer size
#define S2E_ACKNOWLEDGE      // Acknowledge an established connection.
  // #define S2E_DEBUG   // For single-stepping through library
  // #define S2E_VERBOSE // For displaying handler status
```

Now select a setting for the **TCPCONFIG.LIB** library. TCPCONFIG 6 allows the network interface to be set up manually using the macros in lines 27–34 above.

```
#define TCPCONFIG 6
```

Remember to **#use** the **SER2ETH.LIB** library.

```
#use  "ser2eth.lib"
```

The **brdInit()** function call initializes the Rabbit microprocessor.

```
brdInit();        // Initialize Rabbit
```

The **sock_init()** function call initializes the Dynamic C **DCRTCP.LIB** library used for TCP/IP.

```
sock_init();     // Initialize dcrtcp library
```

Set bit 5 low on Parallel Port E of the Rabbit 3000 microprocessor to enable the RS-232 chip on the RCM700 Prototyping Board.

```
#if (_BOARD_TYPE_ >= RCM3600A && _BOARD_TYPE_ <=  0x1FFF)
  BitWrPortI(PEDR,&PEDRShadow,0,5);
#endif
```

Initialize the **SER2ETH.LIB** library.

```
s2e_init();
```

Set up each serial port.

```
s2e_setup(SERIALPORT, TCPPORT, 0, 0L, BAUDRATE,
            S2E_DATABITS_8  | S2E_PARITY_NONE  | S2E_THREE_WIRE |
            S2E_ACTIVE_LISTEN | S2E_RS232);
```

Set up the global network parameters.

```
s2e_setnetparams (resolve(DEFAULT_IP_ADDRESS),
            resolve(DEFAULT_NETMASK),
            resolve(DEFAULT_GATEWAY),
            DEFAULT_DHCP_STATE,
            DEFAULT_KEEPALIVE,
            DEFAULT_ALIVETIME,
            DEFAULT_USE_NAGLE);
```

The TCP interface is brought up using the parameters stored in flash memory.

```
s2e_connect();
```

The sample program now loops until the interface comes up and then loops continuously to perform the serial-to-Ethernet conversions.

Serial Handler

A callback is provided with the serial-to-Ethernet software to allow you to interpret data before sending it out the TCP connection. The Multi-Port Serial-to-Ethernet Application Kit has two sample programs, **`S2E_HEX.C`** and **`S2E_DVM.C`**, to illustrate this functionality. The function prototype of the serial handler in the **`S2E_HEX.C`** sample program looks like this.

```
int serhandler_hex(S2EControl* ctrl)
{
   ...
}
```

The **`serhandler_hex()`** function takes a pointer to an **`S2EControl`** structure, which provides the user context and access to the serial-to-Ethernet connection. After a TCP connection has been established, the **`userstate`** variable gets initialized to zero. This value is intended to be used by the handler to track any state information. There is also a **`void*`** member **`userdata`**, which can be used for an extended data structure if more state information is needed. The **`userdata`** member is initialized to zero at the beginning of the program by the **`s2e_init()`** function call, and unlike **`userdata`** does not get reinitialized on each new connection.

The **`S2EControl`** structure provides members to access the TCP and serial sides of the connection. The **`sock`** member can be used with the TCP functions as outlined in the ***TCP/IP User's Manual***. The structure also has function pointers to the underlying serial routines as outlined in the following table. Each of the function pointers maps directly to functions in the Dynamic C **`RS232.LIB`** library.

Member	Maps to
`open`	`serXopen`
`close`	`serXclose`
`rdFlush`	`serXrdFlush`
`wrFlush`	`serXwrFlush`
`rdUsed`	`serXrdUsed`
`read`	`serXread`
`peek`	`serXpeek`
`write`	`serXwrite`
`databits`	`serXdatabits`
`parity`	`serXparity`
`flowcontrolOn`	`serXflowcontrolOn`
`flowcontrolOff`	`serXflowcontrolOff`
`TxOn`	`serXTxOn`
`RxOn`	`serXRxOn`
`wrUsed`	`serXwrUsed`
`wrFree`	`serXwrFree`

In addition to the function pointers, there are several data members that can be used by the handler. The **serbuf** member is a buffer that can be used to store data either temporarily or across handler calls. The **bufsize** member gives the size of the **serbuf** member in bytes. The **serlen** member is the number of bytes available on the serial port.

Let's look at the **S2E_HEX.C** sample program. The **serialhandler_hex()** function takes a single byte from the serial port and translates it into two hexadecimal characters and a space. This handler both serves as an example of a serial handler and can be generally useful for looking at the characters from a serial port.

The **serialhandler_hex()** function gets called any time there is a valid TCP connection and there is serial data to process. We do not use the **userstate** in this handler because any bytes that we choose to remove from the serial ports are processed completely. If there is not room in the TCP transfer buffer, we do not remove characters from the serial port. The return value of the **serialhandler_hex()** function is the number of bytes to send out the serial port. The **sock_tbleft()** function can be used to insure the write fit in the buffer.

The **S2E_DVM.C** sample program provides an example for using the **userstate** member.

The serial-to-Ethernet control structure has certain states and data. The sample program shows how the control structure is used to set up the serial handler.

```
int serhandler_hex(S2EControl* ctrl)
```

The line below ensures that only as many bytes as can be transmitted are read. Since one byte is converted into a three-character hex representation, the number of original bytes is multiplied by three.

```
if((ctrl->serlen*3)>sock_tbleft(&ctrl->sock))
   ctrl->serlen=sock_tbleft(&ctrl->sock)/3;
```

The same action needs to happen on the buffer so that the buffer and the memory do not overflow. If there is not buffer space to write the full amount, characters may be dropped.

```
if((ctrl->serlen*3)>ctrl->bufsize)
   ctrl->serlen=ctrl->bufsize/3;

memset(ctrl->serbuf,0,ctrl->bufsize);
```

Next, the bytes are read from the serial port and are replaced.

```
ctrl->read(ctrl->serbuf,ctrl->serlen,5L);
   for(x=ctrl->serlen-1;x>=0;x--) {
```

The least significant nibble is done first because we do not want to overwrite the number before we calculate the most significant nibble. The hex conversion is done nibble by nibble. When the least significant nibble is done, the actual byte is replaced, and the space is written.

The serial handler should return the number of bytes to write to the TCP port.

```
    return ctrl->serlen*=3;
```

We're now ready to look at the **main** part of the program where **s2e_init()** initializes the **userdata** member.

```
  s2e_init();
```

The serial handler control structure can now be installed for the given serial port with the **s2e_setserhandler()** function call.

```
  s2e_setserhandler(SERIALPORT,serhandler_hex);
```

The **s2e_tick()** function calls the serial handler when serial data are available.

```
  s2e_tick();
```

Function Reference Guide

The Dynamic C **SerialtoEthernet_2.0\SER2ETH.LIB** library provides the function calls used with the Multi-Port Serial-to-Ethernet Application Kit. Console support is provided in the **SerialtoEthernet_2.0\S2E_ZCONSOLE.LIB** library.

The following macros are used throughout with the **SER2ETH.LIB** library and the serial-to-Ethernet sample programs.

- **S2E_USEPORT_X** (where **X** = **A** to **F**, corresponding to Serial Port A to Serial Port F) must be defined prior to the **#use SER2ETH.LIB** statement to use the specified serial port. For example, use the following line for Serial Port D.

```
#define S2E_USEPORT_D // Enable Serial Port D
```

- **S2E_SERX_BUFSIZE** (where **X** = **A** to **F**, corresponding to Serial Port A to Serial Port F) sets the size of the serial-to-Ethernet transmit and receive buffers. The default is 255. For example, use the following line to set a buffer size of 511 for Serial Port D.

```
#define S2E_SERD_BUFSIZE 511 // Serial Port D buffer size
```

- **S2E_SERX_USE_HANDSHAKING** (where **X** = **A** to **F**, corresponding to Serial Port A to Serial Port F) must be defined prior to the **#use SER2ETH.LIB** statement when using RTS/CTS Handshaking for the specified serial port. For example, use the following line when using Serial Port D for Rx and Tx with RTS/CTS on Serial Port C.

```
#define S2E_SERD_USE_HANDSHAKING // Enable Serial Port D flow control
```

- **S2E_ACKNOWLEDGE** will send an acknowledgement message to both the serial port and the TCP/IP connection, when a socket connection is made.
- **S2E_ACK_MESSAGE** is the message string to send when S2E_ACKNOWLEDGE is used.

```
#define S2E_ACK_MESSAGE "This is a sample message."
```

- **S2E_SERPORT_X** (where **X** = **A** to **F**, corresponding to Serial Port A to Serial Port F) is used in the **s2e_setup**, **s2e_enable()** and **s2e_disable()** function calls.
- **S2E_ACTIVE_OPEN** configures a serial port in **s2e_setup()** as a TCP client that connects to a TCP server.
- **S2E_ACTIVE_LISTEN** configures a serial port in **s2e_setup()** as a TCP server that will listen for a connection from a TCP client.
- **S2E_STARTING_STORAGE_ADDR** is the starting location in the user block for storage and retrieval of all serial port TCP/IP settings. The default starting location is 0.

Two debugging macros are handy when debugging applications written with the **SER2ETH.LIB** library.

- **S2E_DEBUG** allows you to single-stepping through the library.
- **S2E_VERBOSE** displays status information for the **s2e_tick()** function call.

The following function calls are in the **SER2ETH.LIB** library.

```
int s2e_setup(int serport, unsigned int l_port,
   unsigned int ip_port,long rem_address, long baudrate,
   unsigned int params);
```

Assigns a serial port to an IP port. This function must be the first serial-to-Ethernet function used. After the setup is completed, this function will also enable the serial port for Ethernet connectivity.

PARAMETERS

serport is the serial port to set up—use the **S2E_SERPORT_X** macro (where **X** = A to F, corresponding to Serial Port A to Serial Port F) for this parameter

l_port is the TCP address of the local port—the default is 23 for Telnet connections; 1230, …, 1233 are also used in the sample programs. In the **ACTIVE_LISTEN** mode the port listens for a connection at the TCP address, and in the **ACTIVE_OPEN** mode the port is used to send data.

ip_port is the TCP address of the remote port to listen to in the **ACTIVE_LISTEN** mode—use **0** to listen to all the remote ports; in the **ACTIVE_OPEN** mode **ip_port** is the TCP address of the remote port to connect to

rem_address is the IP address of the remote port—an address is required if the **ACTIVE_OPEN** macro was set with the **ip_port** parameter; a value of **0** can be passed if the **ACTIVE_LISTEN** macro was set with the **ip_port** parameter and the remote IP address is required

baudrate is the baud rate to use—add **L** to the baud rate to indicate to Dynamic C that this is a **long** variable

params are the serial port parameters based on a logical combination of the following macros:

S2E_DATABITS_8 or **S2E_DATABITS_7**

S2E_PARITY_NONE, **S2E_PARITY_ODD**, **S2E_PARITY_EVEN**, or **S2E_STOPBITS_2**

S2E_THREE_WIRE or **S2E_FIVE_WIRE**

S2E_ACTIVE_OPEN or **S2E_ACTIVE_LISTEN**

S2E_RS232 or **S2E_RS485**

For example, a **params** string could be **S2E_DATABITS_8 | S2EPARITY_NONE | S2E_THREE_WIRE | S2E_ACTIVE_LISTEN | S2E_RS232**

S2E_DEF_PARAM sets up **params** using **S2E_DATABITS_8 | S2EPARITY_NONE | S2E_THREE_WIRE | S2E_ACTIVE_LISTEN | S2E_RS232**

RETURN VALUE

1 if successful.

-1 if there was a COM port initialization error.

SEE ALSO

s2e_init, s2e_set485, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_setnetparams

`int s2e_init();`

Initialize the serial-to-Ethernet library.

RETURN VALUE

None.

SEE ALSO

`s2e_setnetparams, s2e_setup, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings`

`int s2e_setnetparams(long ip_addr, long netmask, long gateway, unsigned int lport, int dhcp_OnOff, int keepalive_OnOff, int keepalive_Time, int NagleOnOff);`

Sets the network parameters used in the Serial-to-Ethernet software.

PARAMETERS

`ip_addr` is the resolved IP address

`netmask` is the resolved netmask

`gateway` is the resolved gateway address

`lport` is the resolved address for the local port

`dhcp_OnOff` is the DHCP status (0 for OFF, 1 for ON)

`keepalive_OnOff` is the KeepAlive on/off (0 for OFF, 1 for ON)

`keepalive_Time` is the KeepAlive time (in seconds)

`dhcp_OnOff` is the Nagle algorithm on/off (0 for OFF, 1 for ON)

RETURN VALUE

None.

SEE ALSO

`s2e_init, s2e_setup, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings`

`int s2e_connect();`

Brings up the network interface using the data specified by the **`s2e_setparams`** function call and sets up the serial ports.

RETURN VALUE

1 when completed.

SEE ALSO

`s2e_init, s2e_setup, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_setnetparams`

`int s2e_set485(int port, void(*tx), void(*rx));`

Sets the Tx and Rx function callbacks for RS-485.

PARAMETERS

`port` is the serial port

`void(*tx)` is a pointer to the transmit callback

`void(*rx)` is a pointer to the receive callback

RETURN VALUE

1 when completed.

SEE ALSO

`s2e_setup, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_setnetparams, s2e_connect`

`int s2e_setiphandler(int port, int (*handler)());`

Sets the TCP handler for incoming data.

PARAMETERS

`port` is the serial port

`handler` is a pointer to the TCP handler callback

RETURN VALUE

Number of bytes to write.

SEE ALSO

`s2e_init, s2e_setserhandler`

`int s2e_setserhandler(int port, int (*handler)());`

Sets the IP handler for incoming data.

PARAMETERS

`port` is the serial port

`handler` is a pointer to the serial handler callback

RETURN VALUE

Number of bytes to write.

SEE ALSO

`s2e_init, s2e_setserhandler`

`int s2e_enable(int serport);`

Enables the serial port for serial-to-Ethernet connectivity. The serial port must be first set up using the **`s2e_setup`** function call.

PARAMETER

`serport` is the serial port to enable—use the **`S2E_SERPORT_X`** macro (where **`X`** = A to F, corresponding to Serial Port A to Serial Port F) for this parameter

RETURN VALUE

1 if successful.

-1 if an error occurred.

SEE ALSO

`s2e_setup, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_init, s2e_printsetup, s2e_setnetparams, s2e_connect`

`int s2e_disable(int serport);`

Disables the serial port for serial-to-Ethernet connectivity. The serial port must be first set up using the **`s2e_setup`** function call.

PARAMETER

`serport` is the serial port to enable—use the **`S2E_SERPORT_X`** macro (where **`X`** = A to F, corresponding to Serial Port A to Serial Port F) for this parameter

RETURN VALUE

1 if successful.

-1 if an error occurred.

SEE ALSO

`s2e_setup, s2e_enable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_init, s2e_printsetup, s2e_setnetparams, s2e_connect`

`int s2e_tick (void);`

This serial-to-Ethernet handler function must be called periodically from the application. This function copies the data to and from the serial and TCP connection. If there is a serial handler, the serial handler gets called from this function when serial data are available.

RETURN VALUE

1 when completed.

SEE ALSO

`s2e_setup, s2e_enable, s2e_disable, s2e_savesettings, s2e_recallsettings, s2e_init, s2e_printsetup, s2e_setnetparams, s2e_connect`

`int s2e_printsetup (void);`

Displays the serial port and TCP/IP settings in the Dynamic C **STDIO** window.

RETURN VALUE

None.

SEE ALSO

`s2e_setup, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_init, s2e_setnetparams, s2e_connect`

`int s2e_savesettings(void);`

Saves all the serial-to-Ethernet settings to the user block.

RETURN VALUE

1 if successful

-5 if there is an error writing to the user block.

SEE ALSO

`s2e_setup, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_init, s2e_printsetup s2e_setnetparams`

`int s2e_recallsettings(void);`

Retrieves all the serial-to-Ethernet settings from the user block.

RETURN VALUE

1 if successful

-5 if there is an error writing to the user block.

-6 if there were no previous data saved

SEE ALSO

`s2e_setup, s2e_enable, s2e_disable, s2e_tick, s2e_savesettings, s2e_recallsettings, s2e_init, s2e_printsetup, s2e_setnetparams`