

RCS/5000

Hardware

Manual



Document number 80-001051-5

Revision B

RCS/5000

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Manual

Document part number 80-001051-5

Revision History

Date	Revision	Description
4/10/01	A	Initial production release
1/08/04	B	Added 10/100BaseT

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FCC Class A

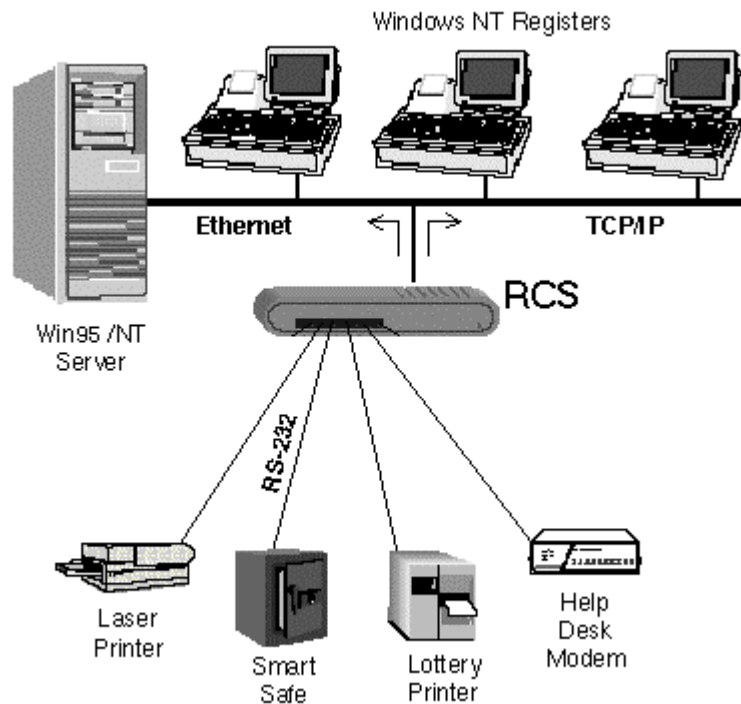
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense.

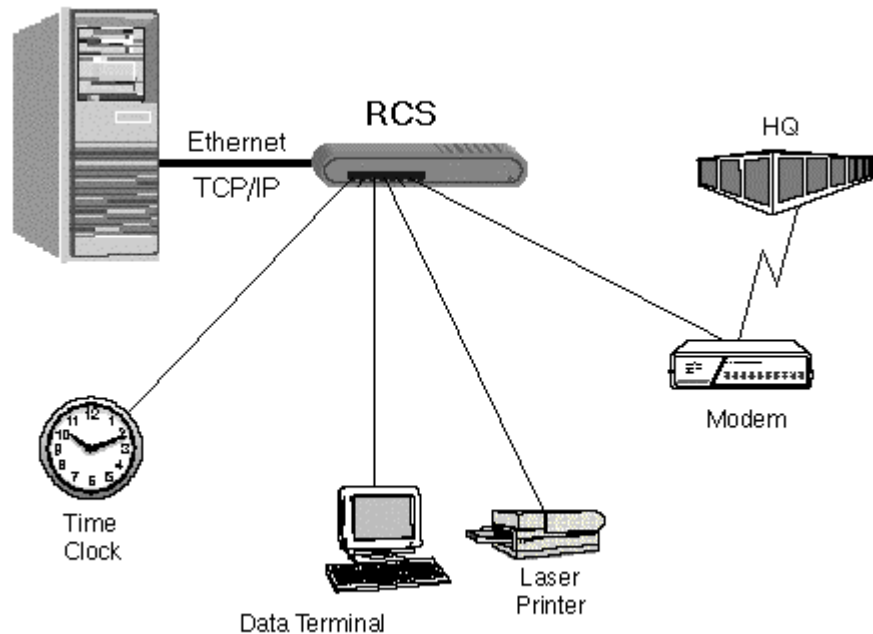
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Chapter 1: Overview

The RCS/5000 port server provides communication between peripheral devices and devices connected to your local network. When the port server is connected to your LAN and to one or more peripherals, it manages network traffic, routing it to the correct device. For instance, the RCS might be used, as shown in the network diagrams below, to allow several PC registers to share expensive peripherals or to communicate with a remote site.





Features

The RCS/5000 offer the following features and benefits:

- Easy set up and configuration
- Open systems communications for multi-site data networks
- Can be used in a variety of data communications applications
- Reduces cost and complexity
- 8 or 16 RJ-45 serial ports
- 1 Hub with 4 ethernet ports, 1 port cross-wired for easy connection to another hub
- High-speed serial connections
- Software selectable RS-232, RS-422, or RS-485 modes on each port
- Parallel printer port
- Optional WAN port for PPP over HDLC or Frame Relay
- Dial-up LAN/Internet access
- IP packet routing
- Operating system independent
- Modem and serial printer pooling
- Complete remote diagnostics
- LEDs for each port, signaling port status and error conditions
- Industry standard interoperability
- Developer's API for custom, on-board applications and protocols

- Raw reverse telnet option so you can access ports without using special protocol or processing
- Standard lpd printing option that is efficient and easy to use
- Dial on demand to automatically dial and make a connection with a remote system
- Multiple services per port allows setting up both incoming and outgoing services on the same port
- ppp header compression
- Reverse telnet support for a variety of UNIX operating systems

Using the RCS/5000

Using the RCS requires three steps:

1. Hardware installation
2. Configuration
3. Operation

Hardware installation is documented in this manual.

There are three ways to configuration and use your RCS port server: NativeCOM, a web browser, or the command line interface.

- **NativeCOM:** If you are using Windows, you can use NativeCOM, a software package provided free of charge by Systech. The NativeCOM Networked COM ports software makes remote serial communication ports (e.g. EIA-232 ports on a terminal server) available to PC programs as local COM ports. Applications from a PC running Microsoft Windows 95, Windows 98, Windows NT, or Windows 2000 can access and use the remote serial ports. For further information on configuring and using Networked COM ports, see the NativeCOM manual. The NativeCOM software and manual are available on the CD you received with your port server and from the Systech web site (www.systech.com).
- **Web Browser:** If you are not using Windows or do not wish to use NativeCOM, you can configure your port server directly using your web browser. To use the browser, point it at the IP address of your Systech port server. For further information on assigning an IP address to your port server and on the configuration and operation options for your port server, see the Systech Port Server Administrator's Guide, available on the CD you received with your port server and from the Systech web site (www.systech.com).
- **Command line interface:** You can also configure your port server directly using the command line interface, rather than a browser, by connecting a terminal to one of the serial ports or by connecting to the port server via telnet. For further information on configuration and operation using the command line interface, see the Systech Port Server Administrator's Guide, available on the CD you received with your port server and from the Systech web site (www.systech.com).

Chapter 2: Installing the Hardware

This chapter describes installing the RCS/5000 hardware, including:

- Planning the installation
- Checking cables and connectors
- Sample configurations

Overview

Installing the RCS/5000 hardware includes the following steps:

1. Plan the installation.
2. Connect the RCS port server to your network.
Most common connection method: Connect LAN (10/100BaseT RJ-45 connector located on the back panel) to your Ethernet LAN using a straight through cable.
3. Connect your peripheral devices to the RCS port server.
Most common connection method: Connect each peripheral device (e.g., cash register, card reader, modem) to a serial port (one of the RJ-45 connectors on the front panel).
4. Plug the unit into a source of AC power and turn the power switch on.

Planning the installation

Before installing the RCS remote communications server, consider the following:

- How will you configure your network—what types of devices will you connect and where will they be located? Identify the distances at which each device will be located from the RCS/5000 port server.
- Verify that the locations selected for devices do not exceed cable specifications.
- Is there an acceptable source of AC power available near each device's proposed location?

RCS/5000 Panel Connectors

Figure 2-1 shows the RCS/5000 front panel. Figure 2-2 shows the back panel.

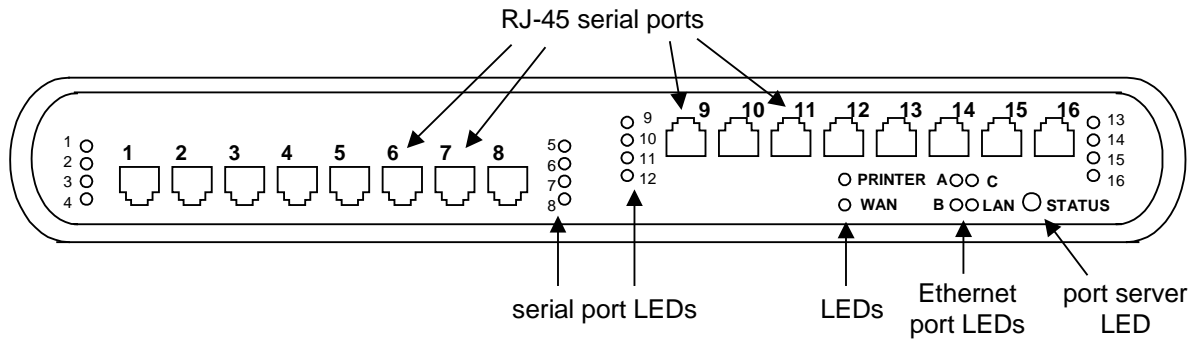


Figure 2-1. RCS/5000 Front Panel

The front panel of the RCS/5000 (Figure 2-1 above) provides 8 or 16 RJ-45 serial ports, with its number above each connector. Each serial port connector has an associated LED, also numbered, that signals normal operation or error conditions. A larger status LED on the lower right indicates the overall status of the port server. In addition, LEDs for the printer, WAN, and Ethernet ports are located on the front panel, although the connectors are located on the back panel. **(NOTE:** Not all models include a WAN port. See Model Numbers, page 31. If your model does not have a WAN port, the WAN LED will always remain dark.) For information on interpreting the LED color and pattern displays, see LED Displays, page 25.

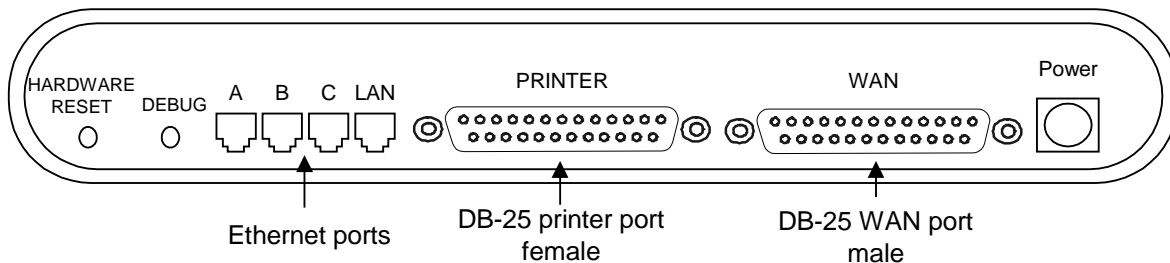


Figure 2-2. RCS/5000 Back Panel

The back panel provides four RJ-45 Ethernet hub ports. The port labeled LAN is wired for connection to a hub. The DB-25 WAN port and Printer port are also located on the back panel. **(NOTE:** Not all models include a WAN port. See Model Numbers, page 31. If your model does not have a WAN port, the WAN connector will be present but not operational.) The power connector is located on the right side.

A hardware reset button is located on the left side of the back panel. The hardware reset button reboots the port server, restarting it as if it had been powered off and back on, putting the unit into operating mode. A debug button is located next to the reset button. Pressing debug accesses the firmware monitor, but does not reboot. When the server enters the firmware monitor, operation is suspended and all active sessions are ended. The firmware monitor allows you to load new software into the port server, perform maintenance or troubleshooting functions, make a bootp request, etc. For instructions on using the Firmware Monitor, see the Systech Port Server Administrator's Guide.

Connecting EIA-232 Devices

The RCS/5000 server uses a symmetrical EIA-232 data terminal equipment (DTE) pinout on the RJ-45 serial ports. Table 2-1 lists the pinouts of the RJ-45 ports used for EIA-232 serial communications.

RJ-45 Pin Number	RS-232 Name	Direction	Signal Function
1	DCD	I	Signals module that remote device is attached and powered on
2	RTS	O	Flow control, to enable remote device to send data
3	SG		Signal return (NOT chassis ground)
4	TXD	O	Serial data out, from RCS to remote device
5	RXD	I	Serial data in, from remote device to RCS
6	SG		Signal return (NOT chassis ground)
7	CTS	I	Flow control, to enable RCS to send data on TXD
8	DTR	O	Signals remote device that RCS is attached and powered on

Table 2-1 EIA-232 RJ-45 Pinouts

To connect your EIA-232 device to the serial port of an RCS/5000, you need to determine whether the device connector wiring follows the standard for data terminal equipment (DTE) or for data communication equipment (DCE). In general, modems are wired as DCE devices and all other devices are wired as DTE; however, some equipment manufacturers may deviate from the standard. The manual for your device will contain information on the pinouts for the device. Figures 2-3 through 2-6 show cable diagrams for the most common configurations. Figure 2-7 shows a minimal cable using 3 wires.

The cable shown in Figure 2-3 or 2-4 may be used to connect most ASCII terminals or serial printers to RCS/5000 serial ports. The cable shown in Figure 2-5 or 2-6 may be used to connect modems to the RCS/5000. Modems should be configured to switch their carrier detect signal (CD) on and off in response to making and breaking telephone connections. This insures that the RCS/5000 terminates users' sessions when they disconnect. Figure 2-7 shows a 3-wire cable.



RJ-45 Plug Pin Number		DB-25 Plug Pin Number/Signal
1 DCD	←	20 DTR
2 RTS	→	5 CTS
3 SG	→	7 SG
6 SG	→	
4 TXD	→	3 RXD
5 RXD	←	2 TXD
7 CTS	←	4 RTS
8 DTR	→	8 DCD
	→	6 DSR

Figure 2-3. RJ-45 to DB-25 Terminal Cable



RJ-45 Plug Pin Number		DB-9 Plug Pin Number/Signal
1 DCD	←	4 DTR
2 RTS	→	8 CTS
3 SG	→	5 SG
6 SG	→	
4 TXD	→	2 RXD
5 RXD	←	3 TXD
7 CTS	←	7 RTS
8 DTR	→	1 DCD
	→	6 DSR

Figure 2-4 RJ-45 to DB-9 Terminal Cable



RJ-45 Plug Pin Number		DB-25 Plug Pin Number/Signal
1 DCD	←	8 DCD
2 RTS	→	4 RTS
3 SG	→	7 SG
6 SG	→	
4 TXD	→	2 TXD
5 RXD	←	3 RXD
7 CTS	←	5 RTS
8 DTR	→	20 DTR

Figure 2-5. RJ-45 to DB-25 Modem Cable



RJ-45 Plug Pin Number		DB-9 Plug Pin Number/Signal
1 DCD	←	1 DCD
2 RTS	→	7 RTS
3 SG	→	5 SG
6 SG	→	
4 TXD	→	3 TXD
5 RXD	←	2 RXD
7 CTS	←	8 RTS
8 DTR	→	4 DTR

Figure 2-6 RJ-45 to DB-9 Modem Cable

The RCS/5000 does not require the use of all 8 wires. Only pins 3, 4, and 5 are essential. RTS/CTS and DTR (pins 2, 7, and 8) are only necessary for flow control. Only one ground, (e.g., pin 3) is necessary. Although the RCS/5000 requires DCD by default, you can change the serial port setting so that the DCD signal is not required. Thus, a minimal cable as shown in Figure 2-7, using only RX (pin 5, data in), TX (pin 4, data out), and SG (pin 3, ground), can be used.

NOTE: A 3-wire cable can NOT be used to login or to start a session until after you have changed the DCD setting. Therefore, if you connect a terminal or PC with terminal emulation software to your RCS/5000 port server when you first set it up, e.g., to set the port server IP address, the factory setting that requires the DCD signal is in effect and you cannot use a 3-wire cable. The cable must have at least four wires: RXD, TXD, GND, and DCD. Be sure that the null modem cable you are using supplies DCD. Some do not.

To change the DCD setting, necessary before a 3-wire cable can be used, use the command

```
set ignoredcd portnumber yes i
```

where *portnumber* is the number of the port to be changed. (For more information, see the ignoredcd command in the Port Server Administrator's Guide).

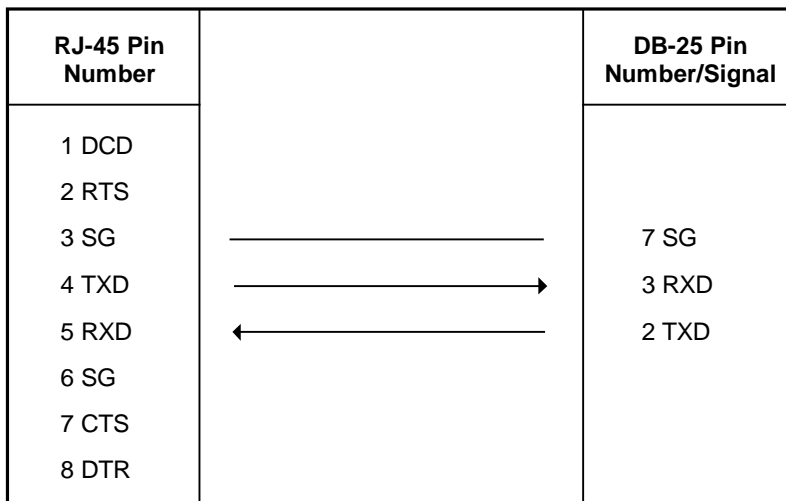


Figure 2-7 RJ-45 to DB-25 3-Wire Terminal Cable

RJ-45 to DB-25 or DB-9 adapters may be used with RJ-45 cables to create the cable configurations shown in Figures 2-4 through 2-5. In most cases, you use “straight through” RJ-45 cables. If you use “crossover” RJ-45 cables, the RJ-45 pins will be reversed. Figures 2-8 and 2-9 illustrate the difference between the two types, when constructed with flat 8-conductor wire.

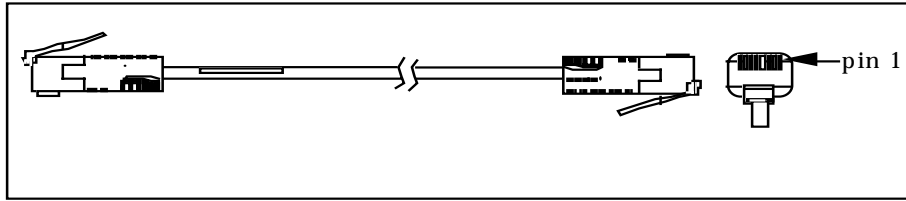


Figure 2-8 RJ-45 to RJ-45 Straight-through Cable

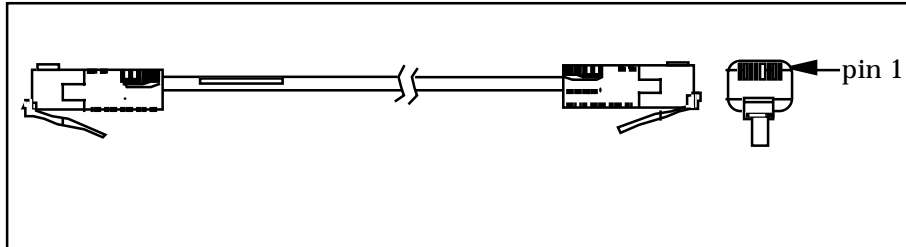


Figure 2-9 RJ-45 to RJ-45 Crossover Cable

Connecting Parallel Printers to the RCS/5000

The RCS/5000 parallel port is compatible with common PC parallel printer ports. The same printer cables used with PCs will work with the RCS. The RCS uses a male 25-pin D type connector; your printer may use a similar connector, or it may use a Centronics type connector. Make sure your cable matches the connector types at each end. Table 2-2 gives the parallel port pinouts.

Pin Number	Signal Name	I/O
1	STROBE	O
2	D(0)	O
3	D(1)	O
4	D(2)	O
5	D(3)	O
6	D(4)	O
7	D(5)	O
8	D(6)	O
9	D(7)	O
10	ACK*	I
11	BUSY*	I
12	ERROR	I
13	SELECT*	I
14	AUTOFD*	O
15	FAULT	I
16	INIT*	O
17	SELECTIN*	O
18	GND	
19	GND	
20	GND	
21	GND	
22	GND	
23	GND	
24	GND	
25	GND	

Table 2-2. Parallel Port Pinouts

Synchronous Serial Devices

(NOTE: Only some RCS models have WAN ports. See Model Numbers, page 31)

Your installation can include an RCS port server that acts as a Local Area Network-to-Wide Area Network (LAN-to-WAN) router. For example, a remote office location might use an RCS port server to access applications at regional or corporate headquarters. The RCS port server routes traffic destined for the home office off the local LAN and over its own WAN port, which would typically be connected to a wide-area network service provider via ISDN, T1/E1, 56 Kbps leased line, Switched 56 service, etc.

The WAN port on the back of the RCS/5000 can be configured to meet any of these standards:

- EIA-232
- EIA-422
- EIA-530
- V.35

The RCS comes factory-configured for EIA-232 on the WAN port. To change the WAN port interface setting, use the following command.

```
set wan interface setting
```

where *setting* is one of the following: rs232, rs422, e530, v.35. To connect synchronous modems, ISDN modems, FRADs, or CSU/DSUs to the RCS, use straight-through cables. Make sure that your cable includes conductors to carry all the signals required for the interface setting you have chosen. For V.35, you must use an RCS V.35 adapter cable available from your supplier. Table 2-3 gives the WAN port pinout for EIA-530 mode. Note that EIA-530 uses a differential pair of wires for each signal and these are denoted “A” and “B” in this table.

25-Pin		Description	I/O
A	B		
1		Shield	
7		Signal Ground	
2	14	Transmitted Data	O
3	16	Receive Data	I
4	19	Request to Send	O
5	13	Clear to Send	I
6	22	DCE Ready	I
20	23	DTE Ready	O
8	10	Received Line Signal Detector	I
24	11	Transmitter Signal Element Timing (DTE)	O
15	12	Transmitter Signal Element Timing (DCE)	I
17	9	Receiver Signal Element Timing (DCE)	I
18		Local Loopback	O
21		Remote Loopback	O
25		Test Mode	I

Table 2-3. EIA-530 Synchronous (WAN) Port Interface

Ethernet LAN

The RCS port server is connected to your LAN using an ethernet port. There are four ethernet hub ports on the front panel, labeled A, B, C, and LAN. The LAN port is hardwired as an ethernet peripheral RJ-45 port so that it can conveniently be connected to a HUB using a standard straight through patch cable. The LAN port is typically used to connect the RCS to the local ethernet network.

The A, B, and C hub ports are standard ethernet hub ports. Any 10/100BaseT ethernet device can be connected to a hub port using a standard straight through patch cable. A hub port is typically used to connect other devices to the ethernet network. The LAN port can also be used as a standard hub port, equivalent to hub ports A, B, or C, if you use a cross-over patch cable.

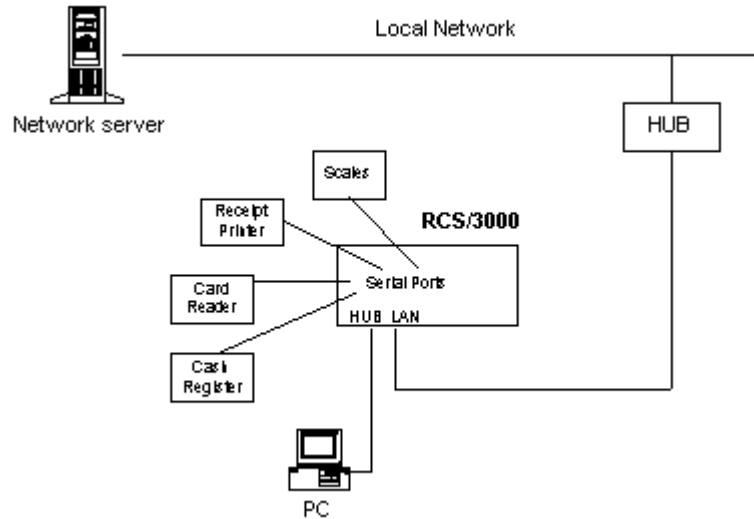


Figure 2-10: Network Configuration

To ensure correct operation, the ethernet cable must be wired to CAT5 Ethernet specifications. Even if the pinouts are correct, the cable can fail if it does not meet CAT5 specifications with respect to which pairs are twisted together. CAT5 specifies that the following pairs are to be twisted together:

- 1 twisted with 2
- 3 twisted with 6
- 4 twisted with 5
- 7 twisted with 8

Starting the RCS/5000

When the RCS port server is powered up, it will run a self-test. The LEDs will flash to indicate normal operation. The following LED colors and patterns will be displayed during normal startup, if no errors are detected.

- **Status LED**

Yellow LED blinks rapidly during self-test. When the RCS has finished the self-test and is running in normal operating mode, the LED will turn green, blinking approximately 1 times per sec.

- **Hub port LEDs (LAN, A, B, C)**

During the self-test, the LED for the hub ports will cycle through:

1. off
2. orange
3. off

When the self-test completes, the LEDs will be either off or green. Off means the port is not connected; green means the port is connected to an active ethernet network. The green LED will blink to show network activity.

- **Serial port LEDs**
- **Printer port LED**
- **WAN port LED**

During the self-test, the LED for each port will cycle through:

1. off
2. green
3. orange
4. off

When the self-test completes, the LEDs will be either off or green. Off indicates a port that is not in use. Green indicates a port that is in use. The green LED will blink when data is transmitted or received. It will blink 5 times per second when data is continuously transmitted or received.

If any of the LEDs turn orange, an error condition was detected. A serial port LED will turn orange for one blink, then return to green, if a parity, framing, or overrun error is encountered. Also, a blinking orange or blinking green indicator on the status LED signals an error. For a description of the error codes, see LED Displays, page 25.

Chapter 3: Physical Layer Interface Settings

The RCS/5000 can be used for communication with RS-232, RS-422, or RS-485 devices. By default, all the RCS ports are configured to communicate using an RS-232 electrical interface, as described in the preceding sections. This section describes connecting RS-422 and RS-485 devices and configuring the RCS to communicate in RS-422 or RS-485 mode.

Connecting RS-422/485 Devices

RS-422 and RS-485 mode are very similar, except that in RS-422 mode, the transmitter remains enabled at all times; while in RS-485 mode, the transmitter is disabled automatically when no data is being transmitted. Consequently, to transmit and receive, RS-422 devices must be connected using four-wire communication. RS-485 devices may be connected on either two-wire or four-wire systems.

You can connect two RS-422/485 devices in a point-to-point connection or more than two RS-422/485 devices in a bus configuration.

The only legal RS-422/485 cabling topology is a bus topology (including point-to-point connections)! All other topologies are expressly forbidden by the RS-422/485 specification. This includes the following illegal configurations:

- Connecting cables in any type of star topology (regardless of whether or not devices are attached to the ends of the cables). This includes using star-based patch panels or any other method that splits the physical cable off into multiple segments.
- Connecting RS-422/485 devices to the bus using cable stubs of any length.

Due to the resilience of the RS-422/485 signaling specification, some of these illegal topologies may work in certain configurations. However, changing factors such as cable length, baud rate, number of devices, bus loading, etc. may cause such configurations to stop communicating or to communicate sporadically. **The only topology guaranteed to work in all cable configurations is a properly terminated bus topology.**

RS-422/485 Point-to-point Configuration

Point-to-point connections can be established between two RS-422 devices, an RS-422 and an RS-485 device, or two RS-485 devices. Figure 3-1 shows a four-wire, point-to-point connection between two devices.

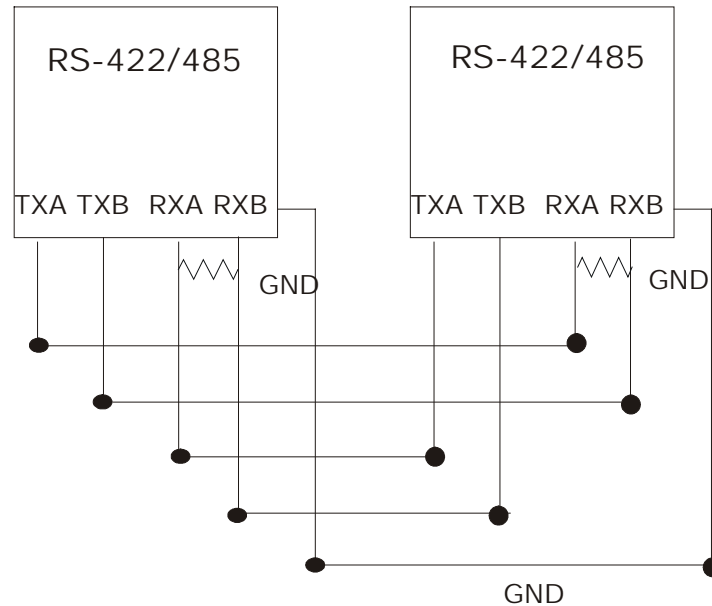


Figure 3-1. RS-422/485 point-to-point connection

Notice the termination on each end of the connection. The receiving end of the wire should be terminated with a resistance equal to the wire's characteristic impedance, generally 100 ohms.

RS-422/485 Bus Configurations

More than two RS-422 and RS-485 devices can be connected in a bus configuration. You can connect one RS-422 and several RS-485 devices on a bus or you can connect several RS-485 devices on a bus, but you cannot connect more than one RS-422 device on a single bus. If your configuration includes an RS-422 device, you must use a four-wire connection. Configurations including only RS-485 devices can use either two-wire or a four-wire communication.

When RS-422 and/or RS-485 devices are connected to a bus, they operate as one master and one or more slaves. In all configurations that include an RS-422 device, the RS-422 device is the master and the RS-485 devices are slaves.

Two-Wire System

In two-wire communication, all devices share the same pair of wires to both transmit and receive. All the devices connected to a two-wire system must be RS-485 devices. Figure 3-2 shows a typical two-wire system.

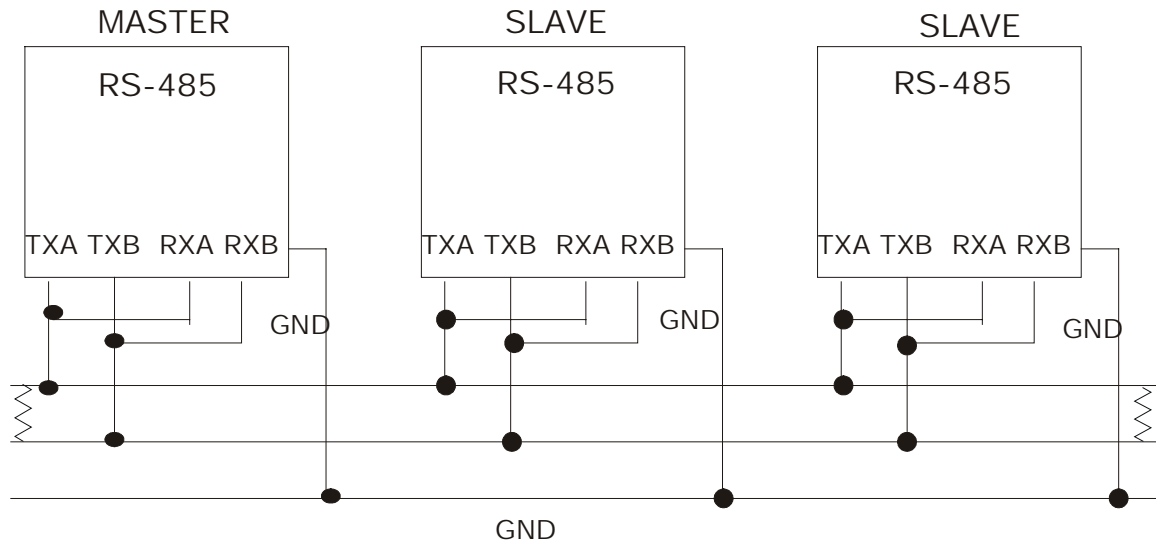


Figure 3-2. Two-wire RS-485 System

In the two-wire system diagrammed in Figure 3-2, one pair of transmit and receive lines (TXA and RXA) are connected to a single wire and the other pair of transmit and receive lines (TXB and RXB) are connected to the second wire. The device that is designated as the master manages the traffic on the lines.

As shown in the above diagram, the pair of transmit/receive lines needs to be terminated with 120 ohms at each end of the bus.

Four-Wire Systems

In four-wire communication, there are two pairs of transmit and receive lines, allowing full duplex communication. In most four-wire systems, an RS-422 device will serve as the master with several RS-485 devices as slaves. However, an RS-422 device is not required; an RS-485 device can serve as the master. Figure 3-3 shows a typical four-wire system.

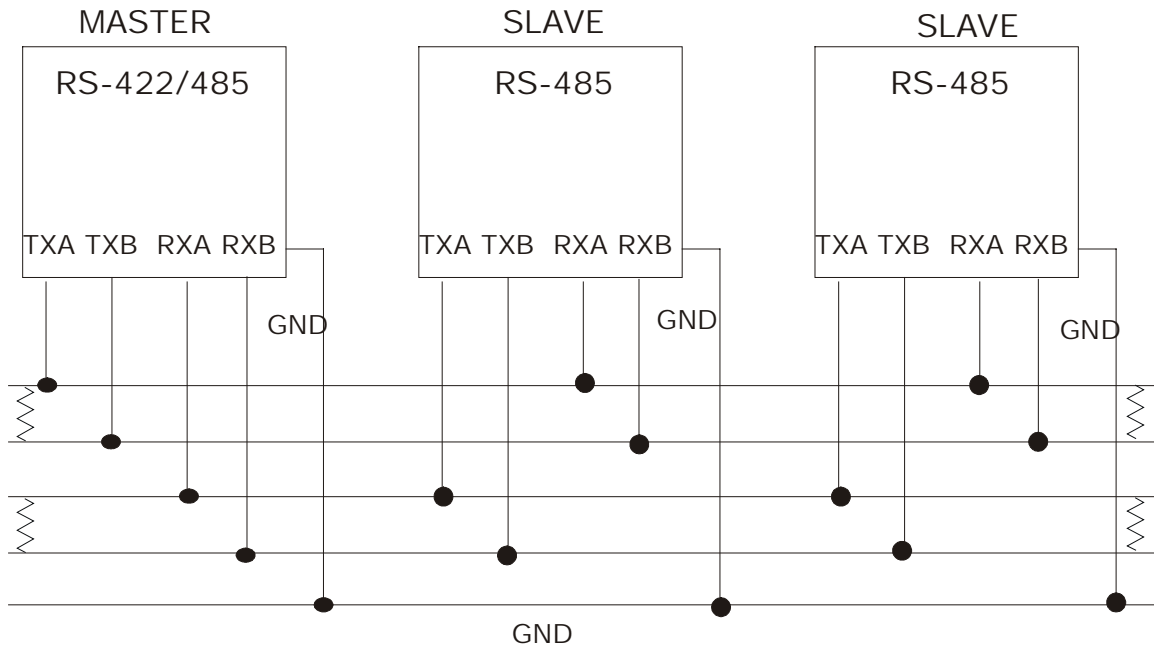


Figure 3-3. Four-wire RS-422/485 System

In most configurations, the device that is designated as the master will be an RS-422 device to constantly drive the transmit lines.

Both pairs of lines of the multi-drop wire must be terminated at each end of the bus with a resistance equal to the wire's characteristic impedance, generally 120 ohms. If the RX data pins are not terminated at all and have nothing attached, they may be susceptible to cross talk. Data on other lines on this port or other nearby ports may get coupled back onto the unterminated receive lines. If you need to leave the RX lines unattached, you may need to attach a simple 100 or 120 ohm termination resistor between the lines to avoid this.

Using the RCS Port Server in RS-422 or RS-485 Mode

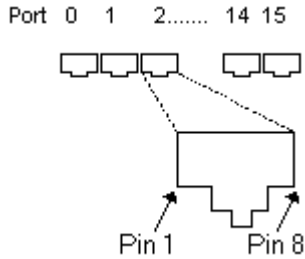
Any serial port on the RCS/5000 can be configured for either RS-422 or RS-485 communication. Thus, the RCS can function as any of the devices in any of the configurations described above. The RCS can be connected to either an RS-422 or an RS-485 device in a point-to-point connection. Or an RCS can be connected to a two-wire or four-wire bus, as either a master or a slave, and can communicate in either RS-422 or RS-485 mode. Typically, a single RCS port server is connected to the bus and functions as the master, but this is determined by the application.

Connecting the RCS RCS/5000

Connect the RCS/5000 to the network using any serial port. The RJ-45 pinouts for the RCS/5000 in RS-422 and RS-485 modes are:

The RS-485/422 RJ-45 pin assignments are:

PIN	Signal
1	Do Not Use
2	TXA
3	GND
4	TXB
5	RXB
6	GND
7	RXA
8	Do Not Use



The pins designated as **not used** should have nothing connected to them.

Be sure the wires are terminated as indicated in the wiring diagrams in the previous section. In addition, as a fail safe to prevent floating wires, the RCS/5000 provides internal 2k bias resistors that pull the lines to a known state when they are not being driven. The bias resistors cannot be removed or altered.

Configuring an RCS serial port for RS-422/485

To change the serial port electrical interface using the command line interface of the RCS port server, use the **set interface** command. The format is:

```
set interface { port number(s) } { rs232 | rs422 | rs485 } [ i ]
```

The **set interface** command sets the port to the specified physical layer interface.

For example, to set the interface for port 3 to RS-485, type:

```
set interface 3 rs485
```

This command will not change the setting immediately. If you want the RS-485 setting to go into effect immediately, use the **i** option.

```
set interface 3 rs485 i
```

For the RS-485 setting to go into effect whenever the port server is rebooted, you must save the configuration setting after you have changed it: For instance, the following two commands will cause the RS-485 setting to go into effect on port 3 when the port server is next rebooted and to continue to be in effect each time the port server is rebooted until the setting is changed.

```
set interface 3 rs485
save
```

In this second example, the following two commands will cause the RS-485 setting to go into effect immediately and to continue to be in effect each time the port server is rebooted until the setting is changed.

```
set interface 3 rs485 i
save
```

To display the current interface configuration setting for port 3, type:

```
show interface 3
```

If no port is specified in the show interface command, the interface configuration for all ports will be displayed.

You can also change the electrical interface using the port configuration section of the browser interface.

Chapter 4: Troubleshooting

The RCS/5000 has several LED status indicators:

- **RCS port server:** There is a status LED located on the lower right front panel that indicates the overall status of the unit.
- **Serial ports:** There is an LED for each serial port connector that indicates the port status. The LEDs are located to one side of the serial port connectors.
- **Ethernet ports:** There is an LED on the front panel for each of the ethernet ports (LAN, A, B, C).
- **Printer port:** There is an LED on the front panel for the parallel printer port.
- **WAN port:** There is an LED on the front panel for the WAN port.

The LEDs use orange, yellow, and green lights and blinking combinations to indicate the status of the components of the RCS/5000.

LED Displays

The LED display may differ depending on the state of the RCS/5000. When the RCS is started, it runs a self-test. If no problems are encountered, it enters the operational state. The LEDs may show different patterns in the self-test state than in the operational state. In addition, the RCS port server can be in the firmware monitor. For instance, if the RCS encounters a fatal error during the self-test, it will enter the firmware monitor. Or you can invoke the firmware monitor by pressing the debug button. The LED display may be different in the firmware monitor.

Table 4-1 shows the normal and error LED colors and patterns displayed in the self-test, operational state, and firmware monitor. Table 4-2 shows the meaning of the LED error displays.

Table 4-1: LED display

RCS Operation	Error Status	LEDs		
		Status	LAN, A, B, C	Serial Port
self-test	ok	Yellow, blinks rapidly	Cycles through: 1.off 2.orange 3.off	Cycles through: 1.off 2.green 3.orange 4.off
	<i>error</i>	<i>orange, blinking pattern</i>	<i>orange, solid</i>	<i>orange, solid</i>
normal operation	ok	solid green, while starting up; green blinking when ready for use	Either: 1.off—unconnected 2.green—connected to active ethernet network; blinks to show network activity	Either: 1.off—closed port 2.green—open port; blinks when data is transmitted or received; blinks 5 times per sec when data is continuously transmitted or received.
	<i>error</i>	<i>orange, blinks approx. 1 times per sec green/yellow blinking orange/yellow, blinking</i>	<i>orange, solid</i>	<i>orange, solid; blinks when data is transmitted or received</i> <i>orange for one blink, returns to green</i>

RCS Operation	Error Status	LEDs		
		Status	LAN, A, B, C	Serial Port
firmware monitor	ok	yellow, blinks 5 times per sec	Either: 1.off/dark—unconnected 2.green—connected to active ethernet network; blinks to show network activity.	Off/dark
	<i>error</i>	<i>orange, blinking pattern</i>	<i>orange, solid</i>	<i>orange, solid</i>

Table 4-2: LED Indicators for Error Conditions

LED	Color/pattern	During	Error
Status	orange, blinking	self-test	Fatal error detected. LED blinks a HEX code that designates the error category. See Table 11-3 below.
	green/yellow, blinking	operation	An error was detected when reading the current configuration database; the default configuration database was loaded instead.
	orange, blinking	operation	Internal AUI HUB port failure When the condition is cleared, the LED will return to green.
	orange/yellow, blinking	operation	Both the condition indicated by the blinking orange (above) and the condition indicated by the blinking green/yellow (above) exist.
HUB	orange, solid	self-test	error detected on the HUB port
	orange, solid	operation	One or more: Bit rate error detected reversed receive polarity

LED	Color/pattern	During	Error
serial port	orange, solid	self-test	error detected on the serial port
	orange, one blink, returns to green	operation	One or more overrun, parity, or framing errors.

Error Codes

The status LED blinks HEX error codes for fatal errors encountered during the self-test. Errors are considered to be fatal if they prevent the RCS operating system from starting. A RAM failure, for example, is a fatal error because it would prevent the operating system from being loaded into RAM. When a fatal error is detected, the LED blinks a sequence to indicate the category of the error. The LED continues to blink this error category until the watchdog timer causes the board to reset (at least 1 ½ minutes). Following the reset, self-test will run again and, unless the error is a transient error, will continue to fail and the LED will continue to blink the error code.

The LED does not blink codes for nonfatal errors. Errors which do not prevent the operating system from running, but may degrade the RCS capabilities, are non-fatal errors. Non-fatal errors are not blinked, but are recorded in flash memory for troubleshooting by customer service representatives.

The LED blink pattern indicates the category of fatal error that occurred. The LED blinks the HEX code for the error category. For instance, if the error is a memory test error, the LED will blink 92, the HEX code for a memory test error. The LED will blink 9 times, pause, then blink 2 times. After a longer pause, it will repeat the pattern. It will continue to repeat the pattern until the watchdog timer resets the board as described above. Table 11-3 provides the error categories associated with the blinking HEX codes.

Table 4-3: HEX codes for error messages

HEX code	Error Category
90	reason for reset
91	configuration error
92	memory test error
93	quadart test error
95	bus error detection not working
97	unexpected interrupt or exception
98	panic
99	network test error
9B	LED test error

HEX code	Error Category
9D	HUB test error

Appendix: Specifications

RCS/5000 Hardware Specifications

- Motorola MC68EN360 QUICC 33 MHz microprocessor with internal RISC processor.
- 1M byte in-circuit boot flash and program memory.
- 4 M byte nonparity DRAM.
- 10/100 Mbps Ethernet connection over 10/100BaseT physical lines.
- 1 10/100BaseT Ethernet HUB with 4 ethernet ports. 1 port is cross-wired to connect to another hub.
- Eight or sixteen asynchronous serial ports with modem control and surge suppression. Asynchronous port data rates of 50 bps to 115.2 Kbps over EIA-232 electrical interface. RCS/5000 uses RJ-45 physical interface. Supports RS-232, RS-422, and RS-485.
- External 110 or 240 VAC power supply.
- Initialization self-test.
- Hardware exerciser.
- Status LEDs for each port.

Environmental Specifications

- Operating temperature range: 0 to 50°C
- Storage temperature range: -10 to 70°C
- Humidity range: 10% to 90% noncondensing

Product Dimensions

The RCS/5000 models measure:

8 inches x 4.75 inches x 1.25 inches (203 mm x 121 mm x 32 mm)

Model Numbers

RCS/5008	-- 8 RJ ports, no WAN
RCS/5016	-- 16 RJ ports, no WAN
RCS/5108	-- 8 RJ ports, with WAN
RCS/5116	-- 16 RJ ports, with WAN

Ethernet cabling specifications

This section describes guidelines for using 10/100BaseT twisted-pair cabling:

- Recommended cable is 22 to 26 AWG category 3 or category 5 unshielded solid copper twisted pair (standard telephone wire), at least Level 2 (two twists per foot).
- Maximum distance of a segment—from concentrator to node—is 100 meters (328 feet).
- Ethernet network interface cards (NICs) are available with built-in 10/100BaseT transceivers and a 15-pin AUI port.
- Devices with standard AUI ports may be attached by using a twisted-pair transceiver (MAU).

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