Navigating around this manual

- Using this on-line manual. See page 5.
- Fast Contents. See page 7.
- Contents. See page 8.
- Quick Reference. See page 226.
- Index. See page 324.
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The products described in this manual have been 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 the instructions in this Guide, 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.

EN 55022: 1998, Class A Note

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Caution: The products described in this manual are approved for commercial use only.
About this manual

Purpose of this manual

This manual tells you how to install, configure and use the Perle RIO system hardware, associated drivers and utility software.

Who this manual is for

This manual is aimed at users who want to connect peripherals and terminals to a host either in the same site or remotely using the Perle RIO serial connectivity system. This manual requires a working knowledge of using personal computers and associated operating systems, as well as experience in installing host cards and peripherals.

Warning

Dangerous voltages exist inside computer systems. Before installing host cards in your system, turn off the power supply and disconnect the mains lead.
Using this on-line manual

The following is a brief guide to using this manual on-line.

Document navigation

This manual features document navigation hypertext buttons in the header area as shown in the next picture:

Hypertext jumps

You can also navigate around this manual by clicking on any cross reference or text in blue for example, Hypertext jumps.

Note
The Fast Contents, Contents and Index entries are all hypertext jumps into this manual.
## Revision history

<table>
<thead>
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<th>Description</th>
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<tr>
<td>January 1999</td>
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</tr>
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Chapter 1 Introduction

You need to read this chapter if you want an introduction to the Perle RIO serial connectivity system.

This chapter provides introductory information about the Perle RIO serial connectivity system, its associated components, driver software and configuration utilities.

This chapter includes the following sections:

- About the RIO system on page 21
- RIO system components on page 22
- Example RIO systems on page 25
About the RIO system

RIO is a high throughput serial connectivity system which provides up to 128 serial devices via a single server slot. You can expand a RIO system up to 512 ports per server. RIO allows you to add ports using 8 and 16 port modules which can be supplied with a wide range of serial interfaces. The RIO system has fault tolerant capabilities, and allows long distance connection without signal degradation or performance loss.

A typical RIO system is shown in the next picture. For details of the main RIO system components, see RIO system components on page 22.

You use RIO when you need a system which supports fault tolerant cabling. The RIO system allows you to add and remove port modules while the system is “live”, which means you can reconfigure without interrupting operations. The relocated units retain their original port names and settings. This capability is especially useful in the case of cable disruption, and also for situations where complete data security is required. In addition, RIO supports the connection of a stand-by host in case of server crashes.

You also use RIO because you require a system that allows long distance connection without signal degradation or performance loss. RIO allows you to install port modules up to 75 metres from the host card using twisted pair cabling. Furthermore you can extend the range by daisy chaining devices. In addition, you can connect port modules up to 1Km from the host via copper wire or fibre optic, or longer distances via leased line, using RIO connectivity modules.

You use RIO where you need a system that you can reconfigure live without interrupting system operation. This capability is typically used in environments such as manufacturing plants, test suites and hospitals.
**RIO system components**

This section provides a brief description of the main components of the RIO system and includes the following.

- Host card on page 22
- Link cables on page 22
- Remote Terminal Adaptors on page 23
- Long Distance Module (LDM) on page 23
- Fibre optic (FOLK) kit on page 24.

**Host card**

RIO host cards provide system connection to Remote Terminal Adaptors (RTAs). They have four link ports and are available in ISA and PCI formats. See also Installing a Universal 3.3/5V PCI host card on page 156, Installing an ISA host card on page 158 and Removing host cards on page 160 in Chapter 2 Installing hardware and software.

**Link cables**

Link cables allow you to link host cards to Remote Terminal Adaptors (RTAs). See also Link Cable on page 219 in Chapter 3 RIO Cabling information.
Remote Terminal Adaptors

Remote Terminal Adaptors (RTAs) are basically serial connection blocks which provide a number of ports depending on type. RTAs come in three main varieties, the RTA 8 (providing 8 ports) and RTA 16 and RRC16 (providing 16 ports). Each unit is available in a number of variations as shown in the next table.

<table>
<thead>
<tr>
<th>RTA type</th>
<th>Number of ports</th>
<th>Type</th>
<th>For details of installation see...</th>
</tr>
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<tr>
<td>Currently available products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRC16/RJX</td>
<td>16</td>
<td>High speed RS232 asynchronous RJ45 serial ports with ESD protection</td>
<td>RRC16 Remote Concentrator on page 168</td>
</tr>
<tr>
<td>RTA8/RJX</td>
<td>8</td>
<td>RS232 RJ45 with ESD protection</td>
<td>RTA8 8 port Remote Terminal Adaptors on page 162</td>
</tr>
<tr>
<td>RTA8/RJ</td>
<td>8</td>
<td>RS232 RJ45</td>
<td></td>
</tr>
<tr>
<td>RTA8/DX</td>
<td>8</td>
<td>RS232 DB25 Female/ESD Protected</td>
<td></td>
</tr>
<tr>
<td>RTA8/D</td>
<td>8</td>
<td>RS232 DB25 Female</td>
<td></td>
</tr>
<tr>
<td>RTA8/MX*</td>
<td>8</td>
<td>RS232 DB25 Male/ESD Protected</td>
<td></td>
</tr>
<tr>
<td>RTA8/M</td>
<td>8</td>
<td>RS232 DB25 Male</td>
<td></td>
</tr>
<tr>
<td>RTA8/PX*</td>
<td>8</td>
<td>Comprising 1 Centronics Parallel DB25, 7 RS232 DB25 Female/ESD Protected</td>
<td></td>
</tr>
<tr>
<td>RTA8/P</td>
<td>8</td>
<td>Comprising 1 Centronics Parallel DB25, 7 RS232 DB25 Female</td>
<td></td>
</tr>
<tr>
<td>RTA8/422</td>
<td>8</td>
<td>RS422 DB25 Female</td>
<td></td>
</tr>
<tr>
<td>Older products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA16/DX</td>
<td>16</td>
<td>RS232 DB25 with ESD protection</td>
<td>RTA16 16 port Remote Terminal Adaptors on page 165</td>
</tr>
<tr>
<td>RTA16/D</td>
<td>16</td>
<td>RS232 DB25 Female</td>
<td></td>
</tr>
</tbody>
</table>

See also Installing Remote Terminal Adaptors (RTAs) on page 161 in Chapter 2 Installing hardware and software.

Long Distance Module (LDM)

The RIO Long Distance Module (LDM) allows you to extend your RIO system via a leased line. Using a RIO Long Distance Module you can make connections over thousands of miles using synchronous (X.21/X.21bis) or asynchronous interfaces. The long distance module comprises two long distance units (LDUs). One is installed at the host site and the other at the remote site. See also Installing a Long Distance Module (LDM) on page 177 in Chapter 2 Installing hardware and software.
Fibre optic (FOLK) kit

The RIO fibre optic (FOLK) kit allows you to extend the range of a RIO link via fibre optic cable to a distance of up to one kilometre. The kit comprises two fibre optic modules. Each module consists of a 1 metre long RIO link cable connected to a fibre optic converter. The fibre optic cable plugs into one of these converters at each end. See also Installing a Fibre Optic Link Kit (FOLK) on page 175 in Chapter 2 Installing hardware and software.
Example RIO systems

This section provides typical examples of the main RIO system types.

The example systems described are as follows:
- Short distance link using RIO link cable on page 26
- Medium distance link using fibre optic (FOLK) kit on page 27
- Long distance link via leased line on page 28
- Fault tolerant link on page 29
- Dual host fail-safe link on page 30

To install any of these, first refer to Before you start on page 33 in Chapter 2 Installing hardware and software in this manual.

Note
The Remote Terminal Adaptors shown in the following examples are 8 port RTAs. For details of the different types of RTAs available see Remote Terminal Adaptors on page 23.
Short distance link using RIO link cable

For short distances up to 75 metres you can use the RIO link cable to make up a basic RIO system as shown in the next picture. Typically, you use this type of system when you want to connect peripherals to the host within the same building.

See also Before you start on page 33 and Installing a short distance link on page 174 in Chapter 2 Installing hardware and software.
Medium distance link using fibre optic (FOLK) kit

The RIO fibre optic (FOLK) kit allows you to extend the range of a RIO link via fibre optic cable to a distance of up to one kilometre. The kit comprises two fibre optic modules. (A module is shown on page 175). Each module consists of a 1 metre long RIO link cable connected to a fibre optic converter. This converts the transputer signals into light. The fibre optic cable plugs into one of these converters at each end.

See also Before you start on page 33 and Installing a Fibre Optic Link Kit (FOLK) on page 175 in Chapter 2 Installing hardware and software.
The RIO Long Distance Module (LDM) allows you to extend your RIO system via a leased line. Using a RIO Long Distance Module you can make connections can over thousands of miles using synchronous (X.21/X.21bis) or asynchronous interfaces. A typical remote system is shown in the next picture.

For further details about this type of system see Before you start on page 33 and Installing a Long Distance Module (LDM) on page 177 in Chapter 2 Installing hardware and software.
**Fault tolerant link**

In a typical non fault tolerant RIO system, a host card is connected to a peripheral (for example, a printer) via a single link and RTA. In order to make the system fault tolerant, that is to protect against RTA or link failure, multiple RTAs and links are added.

The next picture shows a typical system which features two backup RTAs and a backup link to the host. If one RTA or link cable is damaged there is still a path from the host and system operation is not disrupted.

For further information about installing a fault tolerant system, see *Before you start* on page 33 and *Installing a fault tolerant link* on page 169 in Chapter 2 Installing hardware and software.
Dual host fail-safe link

The RIO system supports the connection of a stand-by host in case of server crashes. A typical example is shown in the next picture. In this system a second stand-by host has been added which is installed in a separate server, thus if one host fails, system operation is still maintained. Note that a fault tolerant link is often added between RTAs for additional protection of the system.

For information on how to install a dual host fail-safe system, see Before you start on page 33 and Installing a fault tolerant link on page 189 in Chapter 2 Installing hardware and software.
Chapter 2 Installing hardware and software

You need to read this chapter if you want to install a RIO system and associated software. This chapter covers installing and configuring RIO hardware and software.

This chapter includes the following sections;

• Before you start on page 33
• Downloading RIO drivers from the Perle web site on page 34
• Installing RIO under Solaris on page 35
• Installing RIO under SCO OpenServer 5 and SCO OpenServer 6 on page 52
• Installing RIO under SCO UnixWare on page 76
• Installing RIO under Windows NT on page 90
• Installing RIO PCI Host Cards under Windows 2000/XP/Server 2003/Vista/Server 2008 on page 110
• Installing RIO ISA Host Cards under Windows 2000 on page 125
• Installing RIO under Linux on page 143
• Installing a Universal 3.3/5V PCI host card on page 156
• Installing an ISA host card on page 158
• Removing host cards on page 160.
• Installing Remote Terminal Adaptors (RTAs) on page 161
• Removing a Remote Terminal Adaptor (RTA) on page 173
• Installing a short distance link on page 174
• Installing a Fibre Optic Link Kit (FOLK) on page 175
• Installing a Long Distance Module (LDM) on page 177
• Installing a fault tolerant link on page 189

Note
The procedure for installing and configuring RIO serial adaptor cards varies for different operating systems. Please read Before you start on page 33 before installation.
• Installing a dual host fail-safe link (UNIX only) on page 190
Before you install your RIO host cards and software, note that the procedure for installing and configuring RIO serial adaptor cards varies for different operating systems.

To install under a particular operating system, please refer to one of the operating system specific installation procedures listed below:

- Installing RIO under Solaris on page 35.
- Installing RIO under SCO OpenServer 5 and SCO OpenServer 6 on page 52.
- Installing RIO under SCO UnixWare on page 76.
- Installing RIO under Windows NT on page 90.
- Installing RIO under Linux on page 143.
Downloading RIO drivers from the Perle web site

You can install the RIO driver and utility software from the Perle web site. To do this proceed as follows;

1. On your PC, start the Internet browser you want to use (for example, Netscape).
2. Within your Internet browser window, select the software directory using the following URL;
   http://www.perle.com/downloads
3. Select the directory you want from the list of operating system directories.
   The selected operating system directory is now displayed.
4. Download the files in this directory to a suitable location on your PC for example, /tmp.
5. Follow the instructions for installing the software.

Note
In the event of any problems contact your System Administrator or Internet Service provider for assistance.
Installing RIO under Solaris

This section tells you how to install host cards, software drivers and utilities under the Solaris operating system and includes the following:

- General setup procedure for Solaris on page 36
- Upgrading from existing device drivers on page 38
- Upgrading your current RIO driver on page 38
- Installing device drivers and utilities on page 39
- Assigning ISA host card addresses and IRQ levels on page 41
- Removing RIO drivers and utilities from your system on page 42
- Setting up terminals using Admintool on page 44
- Removing RIO serial port terminals on page 49
- Updating your RIO system configuration on page 51.

Note
This version of RIO supports versions 2.6 and 7 of the Solaris operating system.
General setup procedure for Solaris

The general procedure for installing RIO for the Solaris operating system is as follows:

1. If required, install any PCI host cards you require into your system. See Installing a Universal 3.3/5V PCI host card on page 156.

2. Install the RIO Solaris drivers and utilities onto your system using the procedures described in Installing device drivers and utilities on page 39.

3. If required, using the riosactg utility, select and assign addresses for any additional ISA host cards you want to install from the free addresses available. See Assigning ISA host card addresses and IRQ levels on page 41.

4. If required, install any ISA host cards you require into your system. See Installing an ISA host card on page 158.

5. If you want to remove any ISA host cards from your system,
   a. at the command prompt, type: `/etc/riosactg [-d <name>]` and press the Enter key. where `<name>` is the host card name (for example, ISA1) and d is the delete command.
   b. Now physically remove any host cards you want from your system using the procedures described in Removing host cards on page 160.

6. Install the links you require in your system using one of the procedures shown in the next table:

<table>
<thead>
<tr>
<th>Link type</th>
<th>For procedure see...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short distance</td>
<td>Installing a short distance link on page 174</td>
</tr>
<tr>
<td>Medium distance</td>
<td>Installing a Fibre Optic Link Kit (FOLK) on page 175</td>
</tr>
<tr>
<td>Long distance</td>
<td>Installing a Long Distance Module (LDM) on page 177</td>
</tr>
<tr>
<td>Fault tolerant</td>
<td>Installing a fault tolerant link on page 189</td>
</tr>
<tr>
<td>Dual host fail-safe</td>
<td>Installing a dual host fail-safe link (UNIX only) on page 190</td>
</tr>
</tbody>
</table>

7. Install the Remote Terminal Adaptors you require for your system. see Installing Remote Terminal Adaptors (RTAs) on page 161.

8. If required, remove any Remote Terminal Adaptors you want from your system. See Removing a Remote Terminal Adaptor (RTA) on page 173.

9. Set up any terminals attached to your system using Admintool. See Setting up terminals using Admintool on page 44.

10. If required remove any terminals from your system using Admintool. See Removing RIO serial port terminals on page 49.
11. If you have made any changes to an existing RIO system, run the **rioconfig** utility to update your system with the new configuration. See *Updating your RIO system configuration* on page 51.

Your system is now ready for use. If required, you can reconfigure the system following initial installation. See page 41 and page 44 for details.
Upgrading from existing device drivers

If your system already has an existing Perle device driver up to version 1.1.0 installed, you cannot install a new device driver unless you follow the correct upgrade procedure. The procedure required is as follows:

1. Remove the existing device driver using the procedure described in Removing RIO drivers and utilities from your system on page 42.
2. Install the new device driver using the procedures described in Installing device drivers and utilities on page 39.
3. Continue with your installation as required using the steps listed under General setup procedure for Solaris on page 36.

Upgrading your current RIO driver

To upgrade your current RIO device driver, proceed as follows:

1. Follow the procedure for installing device drivers detailed in Installing device drivers and utilities on page 39 using the upgrade options when prompted by the software.
2. Now follow the steps described in one of the procedures listed in the next table depending on your operating system to complete the installation process.

<table>
<thead>
<tr>
<th>Operating system</th>
<th>See procedure ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solaris</td>
<td>Installing device drivers and utilities on page 39.</td>
</tr>
</tbody>
</table>
Installing device drivers and utilities

To install the RIO device drivers and utilities for the Solaris operating system proceed as follows:

1. Login to your system as super user and begin a terminal session.
2. At the command prompt, type one of the commands shown in the next table depending on the source of the riosol.pkg file you want to use;

<table>
<thead>
<tr>
<th>Source of riosol.pkg file</th>
<th>Type this command</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDROM</td>
<td>pkgadd -d /cdrom/drivers/rio/solaris/riosol.pkg</td>
</tr>
</tbody>
</table>

   Note
   Before you install the RIO drivers and utilities you need to obtain the driver package file ("riosol.pkg").
   You can do this from either the CDROM (Solaris will automatically mount the CDROM when inserted, and start the file manager application), or our website (see Downloading RIO drivers from the Perle web site on page 34).

3. Press the Enter key.
   The following question is now displayed:

   # pkgadd -d /temp/riosol.pkg
   The following packages are available:
   1 rio RIO Driver (386) Development 1.1.0
   Select package(s) you wish to process (or 'all' to process all packages), (default: all) [y,N,d] y

   4. At the question prompt, type 1 and press the Enter key.
   The following confirmation is now displayed as shown in the next picture.
5. At the question prompt, type y and press the Enter key.
A series of messages are now displayed ending with a confirmation that installation was successful.

The drivers and utility software is now installed and operational. See General setup procedure for Solaris on page 36 for instructions on adding ISA host cards, Remote Terminal Adapters and Ports.
Assigning ISA host card addresses and IRQ levels

The `rioisacfg` utility allows you to define addresses and IRQ levels for RIO host cards you add to the system. You run this utility before installing the hardware using the following steps:

1. Decide on the name, memory address and IRQ level you require.

   **Note**
   You may need to reserve memory and Interrupt resources for ISA cards using the system BIOS setup or system configuration program.

2. On each host card, set the address you want using the procedures described in **Installing an ISA host card** on page 158.

3. At the command prompt, type `/etc/rioisacfg` and press the **Enter** key. Some help text is now displayed which explains the syntax used by this utility.

4. At the command prompt, enter the command to start the `rioisacfg` utility using the card parameters you decided in step 1, as shown in the next example:

   ```bash
   /etc/rioisacfg -n ISA1 -m 0xD0000 -i 9
   ```

5. Press the **Enter** key.

6. Repeat steps 1 to 5, until you have assigned addresses to all the ISA host cards you want to install.

   You can now continue with the rest of the procedure required to install the host card. See step 4, in **General setup procedure for Solaris** on page 36 for details.
Removing RIO drivers and utilities from your system

To remove the RIO device drivers and utilities for the Solaris operating system, proceed as follows:

1. Login to your system as super user and begin a terminal session.
2. At the command prompt, type `pkgrm rio` and press the Enter key.
   The following question is displayed:

   ![Terminal window showing `pkgrm rio` command]

3. At the question prompt, type `y` and press the Enter key.
   A further confirmation is displayed.

   ![Terminal window showing confirmation]

4. At the question prompt, type `y` and press the Enter key to remove the software package.
   The messages shown in the next picture are now displayed and RIO driver and utility software removed.
```
/etc/rc.d/rbIrle
/etc/rc2.d/S9rbIrle
/etc/rc5.d/S9rbIrle
/etc/rc6.d/S9rbIrle
/etc/init.d/9rbIrle
/etc (shared path name not removed)
## Updating system information.
Removal of <rio> was successful.
```
To configure RIO serial ports added to the system proceed as follows:

1. In the Solaris desktop, single click on the Application Manager toolbar icon shown in the next picture.

   ![Application Manager window]

   Double click here to start Application Manager.

   The Application Manager window is now displayed.

2. In the Application Manager window, double click on the System_Admin folder.

   ![System_Admin window]

   The System_Admin window is now displayed.

3. In the System_Admin window, double click on the Admintool icon.

   ![Admintool window]

   The main Admintool window is now displayed as shown in the next picture.
4. In the Admintool menu, click on Browse > Serial Ports.
The Serial Ports window is now displayed.

5. In the Serial Ports window, double click on the serial port you want to modify. Alternatively, click on the port to highlight it, then in the Serial Ports menu click on Edit > Modify. The Modify Serial Port window is now displayed.
6. In the Modify Serial Port window, display basic information only by clicking on the Basic button in the Detail field.

7. In the Modify Serial Port window, click on the Template selector and choose the type of device you want to connect to the currently selected serial port. For example, to attach a terminal to the serial port, select Terminal-Hardwired.

8. In the Modify Serial Port window, click in the Service Enable checkbox (displaying a tick) to enable the currently selected serial port.

9. In the Modify Serial Port window, click on the Baud Rate selector and choose the Baud rate you want. For example, 9600.

10. In the Terminal Type field, enter the terminal type you want.

11. In the Modify Serial Port window, click on the OK

The currently selected serial port now has a terminal session enabled at the specified baud rate, even parity, 7 data bits and 1 stop bit. The Serial Ports window is now updated to show this as shown in the next picture.
12. Repeat steps 5 to 11, until you have configured all the RIO serial ports you require.
Removing RIO serial port terminals

To remove any RIO serial ports configured as terminals proceed as follows:

1. In the Solaris desktop, single click on the **Application Manager** toolbar icon shown in the next picture.

2. In the Application Manager window, double click on the **System_Admin** folder.
   
   The System_Admin window is now displayed.

3. In the System_Admin window, double click on the **Admintool** icon.
   
   The main Admintool window is now displayed as shown in the next picture.
4. In the Admintool menu, click on **Browse > Serial Ports**

The Admintool window is now updated to show the serial ports available on the system as shown in the next picture.

5. In the Admintool window, single click on the terminal you want to remove to highlight it.

6. In the Admintool menu, click on **Select Edit > Delete**.

The terminal entry for the serial port is now deleted and the Admintool window updated.

7. Repeat steps 5. to 6. until you have removed all the RIO terminal entries you require.
Updating your RIO system configuration

If you make any changes to your RIO system such as adding or removing an RTA for example, you need to update your system using the `rioconfig` utility to recognise the revised configuration.

Note
The `rioconfig` utility runs automatically when system first installed (see Installing device drivers and utilities on page 39) and each time you re-boot the system.

To do this proceed as follows;
• At the command prompt, type `rioconfig` and press the Enter key.
  The following message is now displayed followed by the return of the command prompt.

Your RIO and Solaris system files are is now updated to include the revised configuration taking into account any new or removed RTAs and serial ports.
Installing RIO under SCO OpenServer 5 and SCO OpenServer 6

This section tells you how to install host cards, software drivers and utilities under the SCO OpenServer operating system and includes the following:

- General installation procedure for SCO OpenServer 5 and SCO OpenServer 6 on page 53
- Installing device drivers and utilities on page 54
- Configuring ports with config.rio on page 64
- Adding an RTA to the system on page 65
- Removing an RTA from the system on page 69
- Creating a login for an RTA on page 72
General installation procedure for SCO OpenServer 5 and SCO OpenServer 6

The general procedure for installing and configuring host cards, Remote Terminal Adaptors drivers software and associated utilities for the SCO OpenServer 5 and SCO OpenServer 6 operating system is as follows:

1. If required, install any PCI host cards you require into your system. See Installing a Universal 3.3/5V PCI host card on page 156.
2. If required, install the RIO SCO OpenServer drivers and utilities onto your system using the procedures described in Installing device drivers and utilities on page 54.

   Note
   To remove the RIO device drivers and utilities from your system, see Removing device drivers and utilities from your system on page 62.

3. If required, install any ISA host cards you require into your system. See Installing an ISA host card on page 158.
4. If required, remove any host cards you want from your system. See Removing host cards on page 160.
5. Install or remove any Remote Terminal Adaptors you require onto your system. See Installing Remote Terminal Adaptors (RTAs) on page 161 and Removing a Remote Terminal Adaptor (RTA) on page 173.
6. Add any Remote Terminal Adaptors to your system configuration and setup as required using the procedures given in Adding an RTA to the system on page 65.
7. Remove any Remote Terminal Adaptors from your system configuration as required using the procedures given in Removing an RTA from the system on page 69.

Your system is now ready for use. If you add any RTAs to your system following initial installation you need to can create logins for them using the procedures given in Creating a login for an RTA on page 72.
Installing device drivers and utilities

To install the RIO device drivers and utilities for the SCO OpenServer operating system proceed as follows:

1. Login to your system as super user.
2. Load the CDROM into your system CD drive.
3. At the command prompt, type `mount -f ISO9660 -r /dev/cd0 /mnt` and then press the Enter key to mount the CDRO file system
4. In the SCO OpenServer desktop, double click on the System Administration folder.
   The System Administration window is now displayed.
5. In the System Administration window, double click on the Software Manager icon.
   The Software Manager window is now displayed.
6. In the Software Manager menu, click on **Software > Install New**.
   The Begin Installation window is now displayed as shown in the next picture.
7. In the Begin Installation window, select the local host as the machine to install from by clicking on the **From localhostname** button and then click on **Continue**. The Select Media window is now displayed.

8. In the Select Media window, using the **Media Device** selector choose the **Media Images** option then click on **Continue**.
The Enter Image Directory window is now displayed.

9. In the Enter Image Directory window, enter the following in the Image directory field:
   
   \[\text{/mnt/drivers/rio/openserver/x.y.z}\]
   where \(\text{x.y.z}\) is the version number of the driver for SCO OpenServer 5.

   \[\text{/mnt/drivers/rio/openserver6/x.y.z}\]
   where \(\text{x.y.z}\) is the version number of the driver for SCO OpenServer 6.

10. In the Enter Image Directory window, click on **OK**.
    The Install Selection window is now displayed.

11. In the Install Selection window, click on the **Install** button.
    If you are upgrading your current Perle RIO device driver, a pop-up window is now displayed as shown in the next picture.
12. In the pop-up window, click on the Continue button to continue the installation process.

The following progress message is now displayed, followed by the RIO Install window as shown in the next pictures.
13. Now Press the Enter key to continue with your installation.
A prompt window is now displayed asking you if you wish to install ISA cards.

14. If you wish to install PCI cards now go to step 15. of this procedure, for ISA cards go to step 19.

PCI cards
15. To configure PCI cards, at the Will you be installing ISA cards? prompt, select no
A message window is now displayed
16. Press the Enter key to close the message window and continue.
   A message window is now displayed prompting you to select the operating mode for your host cards.

17. In the message window, select the **force into polled mode** option and press the **Enter** key.

   **Note**
   We recommend using **force into polled mode** to avoid using up valuable interrupt resources. Selecting this option does not produce any loss in performance.

   A prompt window is now displayed asking you whether or not you wish to re-enter hardware details.

18. At the prompt, select **no**.
    Configuration of PCI cards is now completed.
To configure ISA cards, at the **Will you be installing ISA cards?** prompt, select **yes**.

A prompt window now appears asking you for the number of ISA cards you are going to install.

In the prompt window, use the up and down arrow keys to select the number of cards you want and then press the **Enter** key to confirm your selection.

An address selection prompt is now displayed.

At the prompt, press either of the **1**, **2**, **3**, or **4** keys to select the card you want then press the **Enter** key to confirm your selection.

The address field is now highlighted as shown in the next picture.
22. Using the keys shown in the next picture, set the address you want for the currently selected host card. The press the Enter key to confirm your selection.

23. Press the Enter key to continue the installation.
A prompt is now displayed asking whether or not you want to re-enter hardware details.

24. At the prompt, select no.
Configuration of ISA cards is now completed.
Removing device drivers and utilities from your system

To remove the RIO device drivers and utilities for the SCO OpenServer operating system proceed as follows:

1. In the SCO OpenServer desktop, double click on the System Administration folder.
   The System Administration window is now displayed.

2. In the System Administration window, double click on the software manager icon.
   The Software Manager window is now displayed.

3. In the Software Manager window select the driver you want to remove.
4. In the Software Manager menu, click on Software > Remove software.
   A confirmation window is now displayed prompting you to confirm removal.
5. In the confirmation window, click on the **Remove** button.

   The software is now removed and the following Kernel re-link message is now displayed as shown in the next picture.

   ![Kernel re-link message](image)

   During this removal, the kernel was relinked. You must reboot your system to make this kernel effective.

   The Kernel re-link message window now closes and the removal continues. A message is displayed upon completion.

6. In the message window, click on **OK** to close the window.

   The software manager window is now updated to show the remaining software.
Configuring ports with config.rio

Under the SCO OpenServer operating system, RIO includes an application for configuring ports called config.rio. Config.rio provides a real time map of your system showing the Remote Terminal Adaptors, link cables and host cards and so forth that make up your system.

Any changes you make to your RIO system are automatically updated on the system map. For details of using config.rio, see the following:

- Adding an RTA to the system on page 65
- Removing an RTA from the system on page 69
- Creating a login for an RTA on page 72

Remote Terminal Adaptor (RTA).
Highlight an RTA icon and press the Enter key to display the RTA Management Menu. See page 232.

Host card. Highlight a host card icon and press the Enter key to display the Host Configuration menu. See page 232.

Link cable

Click here or type M to display Main Menu. See page 228.
Adding an RTA to the system

To add an RTA to your system configuration, proceed as follows;

1. Physically install the Remote Terminal Adaptor in your system using the procedures detailed in Installing Remote Terminal Adaptors (RTAs) on page 161.
2. Login to your system as super user.
3. At the command prompt, type `config.rio` and press the Enter key.
   The RIO configuration utility window is now displayed showing a map of your system. See Configuring ports with config.rio on page 64 for more details about how config.rio works.
4. In the RIO configuration utility window, highlight the unconfigured RTA you want to add to the system.

Note
The way in which an unconfigured RTA is displayed depends on the types of terminal being used. Normally, either the RTA icon flashes or appears in a different colour.
5. Press the **Enter** key.
The RTA Management menu is now displayed.

6. In the RTA Management menu, click on **Configure RTA**.
A prompt window is now displayed asking you for a name for the selected RTA.

7. In the prompt window, enter the RTA name you want and press the **Enter** key.
The TTY configuration menu is now displayed.

8. In the TTY configuration menu, click on **Use default TTY blocks** and press the **Enter** key.
You are now returned to the RTA Management menu.
9. If required, check your configuration settings as follows; In the RTA Management menu, click on **View RTA settings**.

The RTA Settings window is now displayed as shown in the next picture.

![RTA Settings](image)

10. If you are happy with the configuration settings press the **ESC** key to close the window. Otherwise, repeat step 4 onwards of this procedure to change the configuration as required.

   **Note**
   
   The changes you have made to the system configuration will not take effect until you exit the config.rio utility.

11. Press the **Esc** key twice

    A prompt window is now displayed asking you if you want to save changes before exiting config.rio.
12. In the prompt window, select **Yes** and press the **Enter** key.

The config.rio utility now closes down and the system is updated to use your new configuration.

**Hint**

To save and update the configuration changes without exiting proceed as follows:
- In the Main Menu, click on **Update configuration file**.
Removing an RTA from the system

To remove an RTA from your system configuration, proceed as follows:

1. Physically remove the Remote Terminal Adaptor from your system using the procedures detailed in `Removing a Remote Terminal Adaptor (RTA)` on page 173.
2. Login to your system as super user.
3. At the command prompt, type `config.rio` and press the Enter key.
   The RIO configuration utility window is now displayed.
4. Press the Enter key.
   The Main Menu is now displayed.
5. In the Main menu, click on Delete an RTA.
A popup window is now displayed showing the currently inactive RTAs.

6. In the pop-up window select the RTA you wish to remove and press the Enter key. A confirmation prompt is now displayed, asking if you want to delete the selected RTA.

7. At the confirmation prompt, select Yes and press the Enter key.

8. Press the Esc key twice. A prompt window is now displayed asking you if you want to save changes before exiting config.rio.

9. In the prompt window, select Y and press the Enter key.
The config.rio utility now closes down and the system is updated to use your new configuration.

**Hint**
To save and update the configuration changes without exiting proceed as follows:
- In the Main Menu, click on **Update configuration file**.
Creating a login for an RTA

To create a login for an RTA in your system configuration, proceed as follows:
1. Login to your system as super user.
2. At the command prompt, type `config.rio` and press the `Enter` key.
   The RIO configuration utility window is now displayed.
3. In the RIO configuration utility window, highlight the RTA you want to create a login for and then press the `Enter` key.
   The RTA Management menu is now displayed.
4. In the RTA Management menu, click on **View / edit TTY**.

   The View / edit TTY window is now displayed as shown in the next picture.
5. In the View / edit TTY window use the up and down arrow keys to select the TTY you want to add a login to and press the Enter key.

The tty menu is now displayed.

6. In the tty menu, click on Getty entry and press the Enter key.

A pop-up window is now displayed showing the available getty definitions.
7. In the pop-up window, use the up and down arrow keys to select the getty definitions entry you want to use and then press the **Enter** key.
   The TTY types menu is now displayed as shown in the next picture.

8. In the TTY types menu select the terminal type you want to attach to the tty and press the **Enter** key to return to the tty menu.

9. In the tty menu click on **Enabled?** and press the **Enter** key.
   The TTY en/disable menu is now displayed.

10. In the TTY en/disable menu, click on **TTY enabled** and press the **Enter** key to return to the tty menu.

11. Press the **Esc** key three times to exit config.rio.
Installing RIO under SCO UnixWare

This section tells you how to install host cards, software drivers and utilities under the SCO UnixWare operating system and includes the following:

- General installation procedure for SCO UnixWare on page 77
- Installing device drivers and utilities on page 78
- Assigning ISA host card address and IRQ levels on page 79
- Configuring ports with config.rio on page 82
- Adding an RTA to the system on page 83
- Removing an RTA from the system on page 86
- Removing device drivers and utilities from your system on page 89
- Creating a login for an RTA on page 89
General installation procedure for SCO UnixWare

The general procedure for installing and configuring host cards, Remote Terminal Adaptors
drivers software and associated utilities for the SCO UnixWare operating system is as
follows:

1. If required, install any PCI host cards you require into your system. See Installing a
   Universal 3.3/5V PCI host card on page 156.

2. If required, install the RIO SCO UnixWare drivers and utilities onto your system using the
   procedures described in Installing device drivers and utilities on page 78.

   Note
   To remove the RIO device drivers and utilities from your system, see Removing
device drivers and utilities from your system on page 89.

3. If required, install any ISA host cards you require into your system. See Installing an ISA
   host card on page 158.

4. If required, remove any host cards you want from your system. See Removing host
   cards on page 160.

5. Install or remove any Remote Terminal Adaptors you require onto your system. See
   Installing Remote Terminal Adaptors (RTAs) on page 161 and Removing a Remote
   Terminal Adaptor (RTA) on page 173.

6. Add any Remote Terminal Adaptors to your system configuration and setup as required
   using the procedures given in Adding an RTA to the system on page 83.

7. Remove any Remote Terminal Adaptors from your system configuration as required
   using the procedures given in Removing an RTA from the system on page 86.

Your system is now ready for use. If you add any RTAs to your system following initial
installation you need to can create logins for them using the procedures given in Creating a
login for an RTA on page 89.
Installing device drivers and utilities

To install the RIO device drivers and utilities for the SCO UnixWare operating system proceed as follows;

1. Login to your system as root.
2. Load the CDROM into your system CD drive.
3. Mount the CDROM by typing the following at the command prompt;
   `mount -r -Fcdfs -0 nmconv=uc /dev/cdrom/cdrom1 /mnt`

   **Note**
   The exact syntax of this command may differ slightly on different versions of SCO UnixWare. For details of exact syntax, please consult the documentation supplied with your operating system.

4. Press the Enter key.
5. At the command prompt, type
   `pkgadd -d /mnt/drivers/rio/unixware/riouw.pkg rio`
   and then press the Enter key.
   A series of progress messages is now displayed finishing with the command prompt.

6. Reboot your system.

   The RIO device drivers and utilities for the SCO UnixWare are now installed and activated.
Assigning ISA host card address and IRQ levels

In order to function, each ISA host card must be allocated an available I/O address and IRQ level. The Device Configuration Utility allows you to determine the available addresses and IRQ levels, then allocate them to a particular host card. To do this proceed as follows;

1. At the command prompt, type `dcu` and press the Enter key.
   The Unixware Device Configuration Utility window is now displayed.

2. In the DCU Main Menu, select the **Software Device Drivers** option and press the Enter key
   The Software Device Driver selections menu is now displayed.
3. In the Software Device Driver selections menu, click on the Communications Cards option and press the Enter key.

The Software Device Drivers window is now displayed.

4. In the Software Device Drivers window, select the RIO driver (hint use the arrow keys to move the cursor) and then press the F5 key to add the new host card.

The New Hardware Configuration window is now displayed.

5. In the New Hardware Configuration window, set the parameters listed in the next table to the values indicated.

Note

The MemStart and MemEnd values you set here must correspond to the values set on the host card as detailed in Installing an ISA host card on page 158.

The IRQ level should be an IRQ that is not already in use by the system.
6. Press the F10 key to accept the changes then press the Enter key to return to the Software Device Driver Selections menu.

7. In the Software Device Driver Selections menu, select Return to DCU.

8. In the Device Configuration Utility Main Menu, select Apply Changes and Exit DCU.

9. Re-boot your system.

ISA host configuration is now complete.
Configuring ports with config.rio

Under the SCO UnixWare operating system, RIO includes an application for configuring ports called config.rio. Config.rio provides a real time map of your system showing the Remote Terminal Adaptors, link cables and host cards and so forth that make up your system.

Host card. Highlight a host card icon and press the Enter key to display the Host Configuration menu. See page 232.

Remote Terminal Adaptor (RTA). Highlight an RTA icon and press the Enter key to display the RTA Management Menu. See page 232.

Link cable

Click here or type M to display Main Menu. See page 228.

Any changes you make to your RIO system are automatically updated on the system map. For details of using config.rio, see the following:

- Adding an RTA to the system on page 83
- Removing an RTA from the system on page 86
Adding an RTA to the system

To add an RTA to your system configuration, proceed as follows:

1. Physically install the Remote Terminal Adaptor in your system using the procedures detailed in Installing Remote Terminal Adaptors (RTAs) on page 161.
2. Login to your system as super user.
3. At the command prompt, type `config.rio` and press the Enter key.
   The RIO configuration utility window is now displayed showing a map of your system. See Configuring ports with config.rio on page 82 for more details about how config.rio works.
4. In the RIO configuration utility window, highlight the unconfigured RTA you want to add to the system.

   **Note**
   The way in which an unconfigured RTA is displayed depends on the types of terminal being used. Normally, either the RTA icon flashes or appears in a different colour.

5. Press the Enter key.
   The RTA Management menu is now displayed.
6. In the RTA Management menu, click on **Configure RTA**. A prompt window is now displayed asking you for a name for the selected RTA.

   ![RTA Management Menu]

7. In the prompt window, enter the RTA name you want (for example, Sales or Ports 1-8) and press the **Enter** key. The TTY configuration menu is now displayed.

   ![TTY Configuration Menu]

8. In the TTY configuration menu, click on **Use default TTY blocks** and press the **Enter** key. You are now returned to the RTA Management menu.

9. If required, check your configuration settings as follows; In the RTA Management menu, click on **View RTA settings**. The RTA Settings window is now displayed as shown in the next picture.
10. If you are happy with the configuration settings press the **ESC** key to close the window. Otherwise, repeat step 4 onwards of this procedure to change the configuration as required.

**Note**

The changes you have made to the system configuration will not take effect until you exit the config.rio utility.

11. Press the **Esc** key twice

A prompt window is now displayed asking you if you want to save changes before exiting config.rio.

12. In the prompt window, select **Yes** and press the **Enter** key.

The config.rio utility now closes down and the system is updated to use your new configuration.

**Hint**

To save and update the configuration changes without exiting proceed as follows;

- In the Main Menu, click on **Update configuration file**.
Removing an RTA from the system

To remove an RTA from your system configuration, proceed as follows:

1. Physically remove the Remote Terminal Adaptor from your system using the procedures detailed in Removing a Remote Terminal Adaptor (RTA) on page 173.
2. Login to your system as super user.
3. At the command prompt, type `config.rio` and press the Enter key.
   The RIO configuration utility window is now displayed.
4. Press the Enter key.
   The Main Menu is now displayed.
5. In the Main menu, click on Delete an RTA.
A popup window is now displayed showing the currently inactive RTAs.

6. In the pop-up window select the RTA you wish to remove and press the Enter key.
   A confirmation prompt is now displayed, asking if you want to delete the selected RTA.

7. At the confirmation prompt, select Yes and press the Enter key.
   8. Press the Esc key twice
      A prompt window is now displayed asking you if you want to save changes before exiting config.rio.

9. In the prompt window, select Y and press the Enter key.
The config.rio utility now closes down and the system is updated to use your new configuration.

**Hint**
To save and update the configuration changes without exiting proceed as follows;
- In the Main Menu, click on **Update configuration file**.
Removing device drivers and utilities from your system

To remove the RIO device drivers and utilities from your system under SCO UnixWare, proceed as follows:
1. Login to your system as root.
2. At the command prompt, type `pkrm rio` and then press the Enter key.
3. Re-boot your system.

Creating a login for an RTA

To create a login for an RTA under SCO UnixWare, you use the `spxadmport` utility. To do this proceed as follows (this example uses a terminal 9600, B, 1, N on RIO port r001):
1. At the command prompt, type `/etc/spxadmport add r001 9600R root` and press the Enter key.

Creation of the login is now complete. For more information about `spxadmport`, see `spxadmport utility for configuring ports` on page 240 in Chapter 4 Quick Reference.
Installing RIO under Windows NT

This section tells you how to install host cards, software drivers and utilities under the Windows NT operating system and includes the following:

- General setup procedure for Windows NT on page 91
- Installing device drivers and utilities on page 92
- Configuring ISA host cards on page 95
- Configuring PCI host cards on page 96
- Configuring Remote Terminal Adaptors on page 99
- Making and displaying changes to your system configuration on page 101
General setup procedure for Windows NT

The general procedure for installing RIO for the Windows NT operating system is as follows:

1. If required, install any PCI host cards you require into your system. See Installing a Universal 3.3/5V PCI host card on page 156.
2. Install the RIO Windows NT drivers and utilities onto your system using the procedures described in Installing device drivers and utilities on page 92.
3. Using the RIO Configuration utility, add the names of any PCI cards to your system configuration using the procedure given in Configuring PCI host cards on page 98.
4. Add your ISA host card settings to the system configuration. See Configuring ISA host cards on page 96.
5. Install any ISA host cards you require into your system. See Installing an ISA host card on page 158.
6. Install the links you require in your system using one of the procedures shown in the next table.

<table>
<thead>
<tr>
<th>Link type</th>
<th>For procedure see...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short distance</td>
<td>Installing a short distance link on page 174</td>
</tr>
<tr>
<td>Medium distance</td>
<td>Installing a Fibre Optic Link Kit (FOLK) on page 175</td>
</tr>
<tr>
<td>Long distance</td>
<td>Installing a Long Distance Module (LDM) on page 177</td>
</tr>
<tr>
<td>Fault tolerant</td>
<td>Installing a fault tolerant link on page 189</td>
</tr>
<tr>
<td>Dual host fail-safe</td>
<td>Installing a dual host fail-safe link (UNIX only) on page 190</td>
</tr>
</tbody>
</table>

7. Install and remove Remote Terminal Adaptors as required for your system. see Installing Remote Terminal Adaptors (RTAs) on page 161 and Removing a Remote Terminal Adaptor (RTA) on page 173.

8. Using the RIO Configuration utility, configure RTAs and associated serial ports you have added to the system. See Configuring Remote Terminal Adaptors on page 99.

Your system is now ready for use. If required, you can reconfigure the system following initial installation. See Making and displaying changes to your system configuration on page 101 for details.
Installing device drivers and utilities

To install the RIO device drivers on your system proceed as follows:

1. Turn on your PC and login to your system as administrator. Then load the CDROM into your systems CD drive.
2. Start the windows Explorer (or file manager) and display the `drivers\rio\winnt` directory.
3. In the `drivers\rio\winnt` directory, double click on the `setup.exe` file.

   The Install Shield window is briefly displayed.

   **Note**

   If you have previously installed RIO software, a warning message is now displayed asking you to shutdown all RIO dependent devices. This is because the device drivers updated during the installation process can only be updated properly if communication to all RIO dependent devices is stopped.

   The Welcome window is now displayed.
4. In the Welcome window, click on the Next > button.
   The Choose Destination window is now displayed as shown in the next picture.

5. In the Choose Destination window, click on the Next > button.
   The Select Program Folder window is now displayed.

6. In the Select Program Folder window, select the folder to which you want to add the program icons and click on the Next > button.
   A progress message window is now displayed.
Upon completion of the installation process a program group window is displayed showing the RIO configuration icon.
Configuring ISA host cards

To configure an ISA host card prior to actual installation proceed as follows:

1. In the Windows desktop, display the Perle program group window.
2. In the Perle program group window, double click on the RIO icon.
   The RIO Configuration window is now displayed showing a blank map on the RIO Configuration screen.
3. In the RIO Configuration menu, click on Commands > Add ISA host card.
   The ISA Card Setup tabbed window now appears.
4. In the ISA Card Setup tabbed window, click on the Rotary Switches tab to display the Rotary Switches page.

5. In the Rotary Switches page set the host card parameters detailed in the next table (if the defaults are insufficient):
6. In the ISA Card Setup tabbed window, click on the **Apply** button to save changes and close the window.

   The RIO driver will check that the memory address and interrupt that you have selected are not already being used. If either resource is being used, you will be asked to reselect.

7. In the RIO Configuration window menu, click on **File > Exit** to exit the utility.

   The Reboot Windows NT window is now displayed as shown in the next picture.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host name</td>
<td>Change the default host name to whatever you wish.</td>
</tr>
</tbody>
</table>
| Select an IRQ | Select an IRQ value, or better, choose ‘Poll’ or ‘Auto’.  

   The default is polled mode, which is an alternative to IRQ level setting and is useful when the range of available interrupts is restricted. If you choose Poll, the driver will poll the card regularly for data. When installing more than one card, set the IRQ value to Poll for all the cards.

   The Auto interrupt option is an alternative to IRQ level setting and will assign the first available interrupt. If you have reserved in the BIOS an IRQ specifically for ISA cards, you need to select the IRQ number from the list since the Auto option will not automatically use that reserved IRQ.

| SW1 and SW2   |  

   To change the address of an ISA card fitted with rotary switches, click (or use tab to highlight) the buttons marked SW1 and then SW2. Then use the space bar to increment the address, watching the message output in the bottom left of the dialogue box.

   To change the address of an ISA card fitted with a DIL switch, click the switches of the 10-way DIL switch displayed in the dialogue box.

   Make a note of the settings; you will need to set them on the card itself.
8. In the Reboot Windows NT window, click on the **Launch RioConf** check box to ensure that the RIO Configuration utility is launched automatically the next time Windows is restarted.

9. In the Reboot Windows NT window, click on the **Don't Restart Windows** button to avoid restarting Windows before you have physically installed the host card.

10. Shutdown Windows and switch off your machine.

You can now install your ISA host cards. See **Removing host cards** on page 180.
Configuring PCI host cards

The PCI host card is plug and play however, under Windows NT a small amount of configuration is required. To install and configure a PCI card under Windows NT, proceed as follows:

1. Install the PCI host card into your system using the procedures detailed in Installing a Universal 3.3/5V PCI host card on page 156.
2. Switch on your computer system.
3. In the Windows desktop, display the Perle program group window.
4. In the Perle program group window, double click on the RIO icon. The RIO Configuration window is now displayed showing the RIO PCI card on the map display.
5. In the RIO Configuration window, double-click on the card and give it a name.

You can now continue with the rest of your system installation as detailed in General setup procedure for Windows NT on page 91.

Note
Although plug and play, some machine BIOSs require that you assign IRQs to each PCI slot in order to make a PCI card use interrupts.
You cannot change the interrupt or memory address of the PCI card.

Note
During bootup, the operating system will select automatically an interrupt and memory address for the card.
Configuring Remote Terminal Adaptors

Following installation of your Remote Terminal Adaptors (RTAs) you need to configure your system using the RIO Configuration Utility. To do this proceed as follows:

1. Install your RTA units using the procedures detailed in Installing Remote Terminal Adaptors (RTAs) on page 161.
2. In the windows desktop, display the Perle program group window.
3. In the Perle program group window, double click on the RIO icon. The RIO Configuration window is now displayed.
4. In the RIO Configuration Menu, click on Commands > Configure. The Remote Terminal Adaptor Configuration window is now displayed.
5. In the Remote Terminal Adaptor Configuration window, click in the RTA Name field and edit the RTA name and ident number as required.

   Hint
   To return to the default name for the card, click on the default button.

6. In the Remote Terminal Adaptor Configuration window, single click on each port you want to configure (highlighting it) then click on the Setup button.
The Set Device Name window is now displayed.

7. In the Set Device name window, change the device name as required and click on the **Apply** button.

   **Hint**
   We recommend using COM as the default port prefix. Any change that you do make will only affect ports configured subsequently to the change.

   To quicken the naming of ports in the Remote Terminal Adaptor Configuration window select the **Enumerate** button. This action will allow you to number all the remaining ports sequentially, using the currently selected port as the starting number.

8. In the Remote Terminal Adaptor Configuration window, click on the **Apply** button to effect your settings.
Making and displaying changes to your system configuration

This section describes how to make and view changes made to your system following initial configuration under Windows NT using the RIO configuration utility.

The following sections are provided:
• Introduction on page 102
• Displaying multiple networks on page 103
• Printing a copy of the system map on page 103
• Identifying an RTA on page 104
• Displaying a port configuration summary on page 105
• Adding a Fault Tolerant Link on page 106
• Adding an RTA to your system configuration on page 106
• Adopting Port Names on page 107
• Moving an RTA on page 108
• Removing an RTA on page 108
• Disconnecting an RTA from within the software on page 108
• Re-booting an RTA on page 109
• Adding a Host Card on page 109
• Removing a Host Card on page 109
• Manually loading the module and firmware on page 150
Introduction

Once you have installed your RIO system under Windows NT, you can view changes to your RIO system using the RIO Configuration utility. The map(s) of the system displayed in the RIO Configuration utility will respond automatically to changes to your RIO system.

**Note**
When the RIO Configuration utility is not running, the RIO software will store any changes to your system and will update the display when you next run the RIO Configuration utility.

**Note**
In the event of link failure or disconnection, the broken link will disappear from the system map displayed in the RIO Configuration window and any isolated RTAs on the system map now appear greyed out. As soon as the link is restored, the map is updated automatically to display the new or resumed link. (RIO will remember the configuration of your RTA(s). There is no need to reconfigure the unit(s)).
Displaying multiple networks

If you have more than one card installed, you can display the additional network(s) of RTAs on the RIO Configuration utility in separate windows.

**Hint**
Use the Tile Option from the Windows menu to place the different windows next to one another, so you can see all the networks simultaneously.

Printing a copy of the system map

RIO allows you to print a copy of the system map displayed in the RIO Configuration utility. To do this proceed as follows:

1. In the RIO Configuration utility window, click on the File > Print menu option.
2. Use the standard windows printing options now displayed to print a copy of your system map.

**Note**
You can choose to print the whole topology or just a section of it.
Identifying an RTA

To display the identity of an RTA on the system map proceed as follows:

1. In the windows desktop, display the Perle program group window.

2. In the Perle program group window, double click on the RIO icon.
   The Rio Configuration window is now displayed showing a map of your RIO system.

3. In the Rio Configuration window, select the RTA(s) you wish to identify physically; (control - click to select more than one RTA).

4. In the Rio Configuration menu, click on Commands > Identify.
   The system map now displays a pulse moving along the link between the host card and the selected RTA(s) and the LEDs are flashed on the actual RTAs you have identified.

Hint
If you wish to identify multiple RTAs, note the pattern of flashing lights visible on the RTA symbols on the system map in the Rio Configuration window. The flashing pattern is unique to each RTA, so you can then match the pattern of flashing LEDs on the actual RTAs.

5. When you have finished identifying the RTAs you want, in the Rio configuration menu, click on Commands > Stop Identify to disable the identify feature.
   The Identify feature now cancels (over the next 5 seconds) and the flashing lights cease on both the RTA symbol and unit.
Displaying a port configuration summary

RIO allows you to display a summary of configuration settings for each port. To do this proceed as follows;
1. In the windows desktop, display the Perle program group window.
2. In the Perle program group window, double click on the RIO icon. The Rio Configuration window is now displayed.
3. In the Rio Configuration menu, click on **Windows > Summary**. The Summary window is now displayed.
4. In the Summary window, single click on a port in the **RIO defined Ports** list. A configuration summary for the selected port is now displayed in the Summary window.
5. Repeat step 4, until you have viewed all the configuration summaries you require then click on the **Close** button to close the window.
Adding a Fault Tolerant Link

When you add a fault tolerant link to your RIO system it is displayed on the system map in a
different colour to normal links (usually grey). Fault tolerant links are detected and displayed
automatically in the RIO Configuration window in the same way as standard links.

For more information about fault tolerant links, see Fault tolerant link on page 29 and
Installing a fault tolerant link on page 189.

Adding an RTA to your system configuration

When you add additional RTAs to your system, they are added to the system map displayed
in the RIO Configuration window automatically. New RTAs will display their default names
and electronic serial numbers. To change these, see Identifying an RTA on page 104 and
Adopting Port Names on page 107.

Note

You can install up to 128 ports per host card. If you install one too many, RIO will
detect it but won’t be able to assign it an ID. On the system map, the RTA will
appear but without a link (despite you having physically connected it).
Adopting Port Names

When you are installing a new RTA, the RIO Configuration utility allows you to adopt the port names of RTAs no longer connected to the system (known as orphaned). Typically, you use this facility because you want to replace a failed RTA or you are replacing an RTA with a unit which has a different physical interface.

To adopt port names in this way proceed as follows;
1. In the RIO Configuration window, locate the on the orphaned RTA you want to use.
2. Connect the new RTA to your system. See Installing Remote Terminal Adaptors (RTAs) on page 161.
   The system map is now updated to show the new RTA.
3. In the RIO Configuration window, single click on the new RTA to select it.
4. In the RIO Configuration menu, click on Commands > Configure .
   The Remote Terminal Adaptor Configuration window is now displayed.
5. In the Remote Terminal Adaptor Configuration window, click on the Adopt button.
   The Adopt window is now displayed.
6. In the Adopt window, use the Orphaned RTA selector to choose the RTA whose ports you want to adopt and then click on the Adopt button.
   A caution message window now appears.
7. In the caution message window, click on the Proceed button to complete the adoption process.
   The orphaned RTA is now deleted from the system map.
Moving an RTA

Under Windows NT RIO allows you to relocate a previously configured RTA within your RIO system without further configuration. The device driver will detect its ID and configuration automatically, and will relocate the unit on the system map in the RIO Configuration window.

For details on installing RTAs, see Installing Remote Terminal Adaptors (RTAs) on page 161.

Removing an RTA

To remove an RTA from your system under Windows NT proceed as follows;
1. Remove the RTA from your system using the procedures detailed in Removing a Remote Terminal Adaptor (RTA) on page 173.
2. In the RIO Configuration window, single click on the RTA you want to remove from the system.
3. In the RIO Configuration menu, click on Commands > Remove.

The ports that were assigned to the RTA are now added to the list of available ports.

Note
If you fail to delete RTAs from the system map configuration, the RIO system will assume the ports associated with that RTA are still installed and subsequently reject any new RTAs added to the system.

Disconnecting an RTA from within the software

The RIO configuration utility allows you to disconnect an RTA from the system without physically unplugging it. This process is known as zombiing. To disconnect an RTA in this way proceed as follows;
1. In the RIO Configuration window, single click on the RTA you want to zombie.
2. In the RIO Configuration menu, click on Commands > Zombie.

On the system map the RTA is now disconnected (orphaned) from the host and becomes dimmed.

Note
To remove an RTA from a zombied state, go to the unit and re-power it. The map should update itself to show the RTA connected once more.
Re-booting an RTA

You can re-boot an RTA through the Configuration Utility, without going to the RTA unit:
1. In the RIO Configuration window, single click on the RTA you want to re-boot.
2. In the RIO Configuration menu, click on **Commands > Reboot**.
   A pop-up window now appears asking you whether you wish to close ports before re-booting, or to re-boot and close ports simultaneously.
3. In the pop-up window, select the option you want and action your choice.
   The selected RTA is now re-booted.

Adding a Host Card

When you add host cards to your system the configuration required by the user depends on the type of host card you are installing as shown in the next table.

<table>
<thead>
<tr>
<th>Host card type</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI</td>
<td>No action required by the user.</td>
</tr>
<tr>
<td>ISA</td>
<td>Use the procedure described in Configuring ISA host cards on page 95.</td>
</tr>
</tbody>
</table>

Removing a Host Card

To remove a host card from your system under Windows NT proceed as follows;
1. Remove all the RTAs associated with the host card from your system using the procedures detailed in **Removing a Remote Terminal Adaptor (RTA)** on page 173.
2. In the RIO Configuration window, single click on the host card you want to remove from the system.
3. In the RIO Configuration menu, click on **Commands > Remove**.
   The system map now shows the card as removed.

You can now shutdown your machine and remove the card. See **Removing host cards** on page 160.


This section includes the following:

• Installing PCI card drivers and utilities on page 112
• Configuring PCI Card serial ports on page 115
• Configuring the polled mode and quick close settings for a PCI host card on page 118
• Removing PCI devices and ports from the system on page 121
• Identifying PCI RTAs on page 122.

The general procedure for installing RIO PCI host cards for the Windows 2000/XP/Server 2003/Vista/Server 2008 operating system is as follows:

1. If required, install any PCI host cards you require into your system. See Installing a Universal 3.3/5V PCI host card on page 156.

2. Install and remove Remote Terminal Adaptors as required for your system. See Installing Remote Terminal Adaptors (RTAs) on page 161 and Removing a Remote Terminal Adaptor (RTA) on page 173.

   Note
   If you connect a new device to your RIO system, for example an RTA, the new ports are added to the system automatically. No action is required by the user.

3. Install the RIO Windows 2000/XP/Server 2003/Vista/Server 2008 drivers and utilities onto your system using the procedures described in Installing PCI card drivers and utilities on page 112.

   Note
   The RTA must be installed to the PCI host card before the device drivers are installed.

4. Install the links you require in your system using one of the procedures shown in the next table;

<table>
<thead>
<tr>
<th>Link type</th>
<th>For procedure see...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short distance</td>
<td>Installing a short distance link on page 174</td>
</tr>
<tr>
<td>Medium distance</td>
<td>Installing a Fibre Optic Link Kit (FOLK) on page 175</td>
</tr>
<tr>
<td>Long distance</td>
<td>Installing a Long Distance Module (LDM) on page 177</td>
</tr>
<tr>
<td>Fault tolerant</td>
<td>Installing a fault tolerant link on page 189</td>
</tr>
<tr>
<td>Dual host fail-safe</td>
<td>Installing a dual host fail-safe link (UNIX only) on page 190</td>
</tr>
</tbody>
</table>

5. Using the Device Manager, configure the serial ports you have added to the system. See Configuring PCI Card serial ports on page 115.

   Your system is now ready for use. If required, you can reconfigure the system following initial installation. See Configuring the polled mode and quick close settings for a PCI host card on page 118, Removing PCI devices and ports from the system on page 121 for details.

   To identify an RTA from within the software. See Identifying PCI RTAs on page 122.
Installing PCI card drivers and utilities

To install the RIO device drivers on your system proceed as follows:

1. Turn on your PC and if required, log in.
   If you have installed any new host cards a Found New Hardware message is briefly
   shown followed by the Found New Hardware wizard as shown in the pictures.

2. In the Found New Hardware wizard, click the Cancel button.
3. Download the latest RIO driver zip file from the Perle website for your operating system:
   rio-x86.zip for 32-bit Windows operating systems.
   rio-amd64.zip for 64-bit Windows operating systems.
   rio-ia64.zip for 64-bit Windows Itanium operating systems.
4. Unzip the driver zip file to a local directory. We recommend that you use the `rio-setup-<arch>.exe` file when installing the drivers for a RIO PCI card, which will launch the installation wizard, to install the RIO driver.

5. Double-click the `rio-setup-<arch>.exe` installation executable and follow the installation wizard steps:

6. During the installation, you may get a Windows Logo message. Click **Continue Anyway** when these appear.

**Note**

If you are installing an unsigned driver, you may have to click through the Found New Hardware wizard for every RIO card on your system.
7. Your RIO driver installation is now finished.
Configuring PCI Card serial ports

To configure RIO serial ports, proceed as follows:

1. Click the **Start** button > **Control Panel**
   The control panel window is now displayed.

2. In the Control Panel window, click on the **System** icon.
   The System Properties tabbed window is now displayed.

3. In the System Properties window, click on the **Hardware** tab.
   The hardware page is now displayed.

4. In the Hardware page, click on the **Device Manager** Button.
   The Device Manager window is now displayed.
5. In the Device Manager window, click on the Multiport serial adapters icon to display the currently installed devices.

6. In the Device Manager window, double click on the device whose properties you want to view or change. The device Properties tabbed window is now displayed.

7. In the device Properties window, click on the Port Settings tab to display the Port Settings page.
8. In the Port Settings page, set the **Port Number**, **Baud Rate** and other configuration parameters you require and then click on the **OK** button to save changes and close the window.

The configuration process is now complete.
Configuring the polled mode and quick close settings for a PCI host card

RIO allows some basic configuration of host cards as follows.

**Polled mode**
RIO allows you to run the PCI card in polled mode i.e. without using interrupts. This facility is useful when the normal interrupt levels used by RIO are not available or you have a larger number of host cards than available interrupt levels.

**Quick close facility**
When a RIO port is closed in software, the close will not complete until all data in the buffers has been transmitted. This maintains data integrity. A quick close facility is available which allows the system to close a port immediately when requested to do. This facility is useful when you want to reduce the time taken to close a collection of ports, but final data integrity is not important.

**Note**
If you enable the quick close option, any data buffered in the driver will be lost.

To use either of these facilities proceed as follows:
1. Click the **Start** button > **Control Panel**
   The control panel window is now displayed.

2. In the Control Panel window, click on the **System** icon.
   The System Properties tabbed window is now displayed.

---

RIO Remote I/O System User Guide
Page 118
3. In the System Properties window, click on the Hardware tab.
   The hardware page is now displayed.

4. In the Hardware page, click on the Device Manager Button.
   The Device Manager window is now displayed.

5. In the Device Manager window, click on the Multi-port serial adapters icon to display the currently installed serial adaptors.

6. In the Device Manager window, double click on the device whose properties you want to view or change.
   The Adapter properties tabbed window is now displayed.
7. In the Adapter Properties window, click on the **Card Settings** tab to display the Card Settings page as shown in the next picture.

![Card Settings Page](image)

8. In the card settings page, click in the **Polled Mode** check box to enable or disable polled mode for the currently selected device. For information about polled mode, see **Polled mode** on page 118.

9. In the card settings page, click in the **Quick Close** check box to enable or disable the quick close facility for the currently selected device. For information about the quick close facility, see **Quick close facility** on page 118.
Removing PCI devices and ports from the system

Note
To remove individual ports from your system remove their associated host cards. When you do this
the connected associated ports for that device are removed automatically. No further action is
required by the user.

In order to remove a device such as an RTA from your RIO system you need to remove its
associated host card using the following procedure:

Click Start > All Programs > Perle > RIO > Uninstall.

The RIO device and all of its associated serial ports are now uninstalled from your host.
Identifying PCI RTAs

RIO allows you to identify RTAs by flashing the LEDs on selected units. You can do this for both single and multiple RTAs. To identify and RTA in this manner proceed as follows:

1. Click the **Start** button > **Control Panel**
   The control panel window is now displayed.

   ![Control Panel](image)

2. In the Control Panel window, click on the **System** icon.
   The System Properties tabbed window is now displayed.

3. In the System Properties window, click on the **Hardware** tab.
   The hardware page is now displayed.

4. In the Hardware page, click on the **Device Manager** button.
   The Device Manager window is now displayed.
5. In the Device Manager window, click on the **Multi-port serial adapters** icon to display the currently installed serial adaptors.

6. In the Device Manager window, double click on the device associated with the RTA(s) you wish to identify. The Adapter properties tabbed window is now displayed.

7. In the Adapter Properties window, click on the **Card Settings** tab to display the Card Settings page as shown in the next picture.

8. In the card settings page, click on the **Identify On / Identify Off** toggle button to the **Identify On** setting.
9. In the card settings page, click on the RTAs you want to identify in the Connected RTAs list highlighting them.

The LEDS on the selected RTA(s) now flash thus identifying the unit.

**Note**

To stop the LEDs flashing on a RTA, simply click on an RTA in the Connected RTAs list to remove the highlight.

To disable this facility, click on the **Identify On / Identify Off** toggle button to set the **Identify Off** setting. Highlighting RTAs in the list will no longer have an effect.
Installing RIO ISA Host Cards under Windows 2000

This section describes how to install RIO ISA host card under Microsoft Windows 2000.

This section includes the following:

- General setup procedure for Windows 2000 on page 126
- Adding ISA host cards to the system on page 127
- Viewing and changing the resources for an ISA device on page 130
- Configuring ISA Card serial ports on page 133
- Configuring the quick close settings for an ISA host card on page 136
- Removing ISA devices and ports from the system on page 139
- Identifying ISA RTAs on page 140
General setup procedure for Windows 2000

The general procedure for installing RIO ISA host cards for the Windows 2000 operating system is as follows:

1. If required, install any ISA host cards you require into your system. See Installing an ISA host card on page 158.

2. Install and remove Remote Terminal Adaptors as required for your system. See Installing Remote Terminal Adaptors (RTAs) on page 161 and Removing a Remote Terminal Adaptor (RTA) on page 173.

   Note
   If you connect a new device to your RIO system, for example an RTA, the new ports are added to the system automatically. No action is required by the user.

3. Configure the ISA host card. See Adding ISA host cards to the system on page 127.

   Note
   The RTA must be installed to the PCI host card before the device drivers are installed.

4. Install the links you require in your system using one of the procedures shown in the next table;

<table>
<thead>
<tr>
<th>Link type</th>
<th>For procedure see...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short distance</td>
<td>Installing a short distance link on page 174</td>
</tr>
<tr>
<td>Medium distance</td>
<td>Installing a Fibre Optic Link Kit (FOLK) on page 175</td>
</tr>
<tr>
<td>Long distance</td>
<td>Installing a Long Distance Module (LDM) on page 177</td>
</tr>
<tr>
<td>Fault tolerant</td>
<td>Installing a fault tolerant link on page 189</td>
</tr>
<tr>
<td>Dual host fail-safe</td>
<td>Installing a dual host fail-safe link (UNIX only) on page 190</td>
</tr>
</tbody>
</table>

5. Using the Device Manager, configure the serial ports you have added to the system. See Configuring ISA Card serial ports on page 133.

Your system is now ready for use. If required, you can reconfigure the system following initial installation. See Configuring the quick close settings for an ISA host card on page 136, Removing ISA devices and ports from the system on page 139 for details.

To identify an RTA from within the software. See Identifying ISA RTAs on page 140.
Adding ISA host cards to the system

When you physically install an ISA host card in your system you also need to add the card to the list of installed devices in the system.

To add ISA host cards to your system proceed as follows;

1. Download the latest RIO driver zip file, rio-x86.zip, from the Perle website.
2. Unzip the driver zip file to a local directory.
3. In the Windows desktop, click on the Start button and select Settings > Control Panel.
   The control panel window is now displayed.
4. In the control panel window, double click on the Add/Remove Hardware icon.
   The Add/Remove Hardware Wizard is now displayed.

Note
The addresses used by RIO host cards are normally set by default. This procedure is used when you wish to set non-standard addresses.
5. Using the instructions given in the next table, use the Add/Remove Hardware Wizard to assign the host card addresses and IRQ levels you require.

<table>
<thead>
<tr>
<th>In this Wizard page</th>
<th>Do the following...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add/Remove Hardware Wizard</td>
<td>6. In the Add/Remove Hardware Wizard, select Add/Troubleshoot a device and press the Next &gt; button. The Choose a Hardware Device page is now displayed.</td>
</tr>
<tr>
<td>Add/Remove Hardware Wizard</td>
<td>7. In the Choose a Hardware Device page, scroll up the list of devices and click on Add a new device, then click on the Next &gt; button. The Find New Hardware page is now displayed.</td>
</tr>
<tr>
<td>Add/Remove Hardware Wizard</td>
<td>8. In the Find New Hardware page, select No, I want to select the hardware from a list and click on the Next &gt; button. The Hardware Type page is now displayed.</td>
</tr>
<tr>
<td>Add/Remove Hardware Wizard</td>
<td>9. In the Hardware Type page, select Multi-port serial adaptors and click on the Next &gt; button.</td>
</tr>
</tbody>
</table>
10. If your host card type isn’t shown, in the Select a Device Driver page click on the Have Disk button.
   A message window is now displayed which prompts you for the driver and location you want to use.

11. In the message window, enter or select the driver you want and click on the OK button to accept settings and close the window.
   The Select a Device Driver page is now updated to show the new driver you have selected.

12. In the Select a Device Driver page, select the manufacturer and model you require, then click on the Next > button.
   The Start Hardware Installation page is now displayed.

13. In the Start Hardware Installation page, click on the Next > button to accept your choice.
   A completion message page is now displayed as shown in the next picture.

14. In the completion message page click on the Finish button to complete the new configuration.
Viewing and changing the resources for an ISA device

To view or change the resources for a device proceed as follows:

1. In the Add/Remove Hardware Wizard go to the last page and click on the Resources button.

The Add New Hardware Wizard properties window is now displayed.
2. In the Add New Hardware Wizard properties window, select the Resources page and click on the Set Configuration Manually button.

The resources page is now updated to show the settings for the current installed RIO device.
3. In the Add New Hardware Wizard properties window, select the **Resource type** you require and click on the **Change Setting** button.

   The Edit Memory Range window is now displayed.

   ![Edit Memory Range Window](image)

4. In the Edit Memory Range window, enter the memory range you want and click on the **OK** button.

   If values you have selected are not acceptable to the system, then the Device Manager will display a problem icon as shown in the next picture.

   ![Device Manager Problem Icon](image)

5. If the memory settings you have selected are not acceptable to the system, check your configuration settings and adjust memory address as required. Otherwise ring Technical support.
Configuring ISA Card serial ports

To configure RIO serial ports, proceed as follows:

1. Click the **Start** button > **Control Panel**
   The control panel window is now displayed.

2. In the Control Panel window, click on the **System** icon.
   The System Properties tabbed window is now displayed.

3. In the System Properties window, click on the **Hardware** tab.
   The hardware page is now displayed.

4. In the Hardware page, click on the **Device Manager** Button.
   The Device Manager window is now displayed.
5. In the Device Manager window, click on the **Multiport serial adapters** icon to display the currently installed devices.

6. In the Device Manager window, double click on the device whose properties you want to view or change.

   The device Properties tabbed window is now displayed.

7. In the device Properties window, click on the **Port Settings** tab to display the Port Settings page.
8. In the Port Settings page, set the **Port Number**, **Baud Rate** and other configuration parameters you require and then click on the **OK** button to save changes and close the window.

The configuration process is now complete.
Configuring the quick close settings for an ISA host card

RIO allows some basic configuration of host cards under Windows 2000 as follows:

**Polled mode**
Under Windows 2000, RIO runs the ISA card in polled mode i.e. without using interrupts. This is useful when the normal interrupt levels used by RIO are not available or you have a larger number of host cards than available interrupt levels.

**Note**
RIO ISA cards are always set to polled mode. This cannot be changed by the user.

**Quick close facility**
When a RIO port is closed in software, the close will not complete until all data in the buffers has been transmitted. This maintains data integrity. Under windows 2000, a quick close facility is available which allows the system to close a port immediately when requested to do. This facility is useful when you want to reduce the time taken to close a collection of ports, but final data integrity is not important.

**Note**
If you enable the quick close option, any data buffered in the driver will be lost.

To use either of these facilities proceed as follows:
1. In the Windows 2000 desktop, click on the **Start** button and select **Settings > Control Panel**.
   The control panel window is now displayed.

2. In the Control Panel window, click on the **System** icon.
   The System Properties tabbed window is now displayed.
3. In the System Properties window, click on the Hardware tab.
   The hardware page is now displayed.

4. In the Hardware page, click on the Device Manager button.
   The Device Manager window is now displayed.

5. In the Device Manager window, click on the Multi-port serial adapters icon to display the
currently installed serial adaptors.

6. In the Device Manager window, double click on the device whose properties you want to
   view or change.
   The Adapter properties tabbed window is now displayed.
7. In the Adapter Properties window, click on the Card Settings tab to display the Card Settings page as shown in the next picture.

8. In the card settings page, click in the Quick Close check box to enable or disable the quick close facility for the currently selected device. For information about the quick close facility, see Quick close facility on page 118.
Removing ISA devices and ports from the system

In order to remove a device such as an RTA from your RIO system you need to remove its associated host cards using the following procedure:

Click **Start > All Programs > Perle > RIO > Uninstall.**

The RIO device and all of its associated serial ports are now uninstalled from your host.

**Note**

To remove individual ports from your system remove their associated host cards. When you do this, the connected associated ports for that device are removed automatically. No further action is required by the user.
Identifying ISA RTAs

Under the Windows 2000 operating system RIO allows you to identify RTAs by flashing the LEDs on selected units. You can do this for both single and multiple RTAs. To identify and RTA in this manner proceed as follows:

1. In the Windows 2000 desktop, click on the Start button and select Settings > Control Panel.
   The control panel window is now displayed.

2. In the Control Panel window, click on the System icon.
   The System Properties tabbed window is now displayed.

3. In the System Properties window, click on the Hardware tab.
   The hardware page is now displayed.

4. In the Hardware page, click on the Device Manager Button.
   The Device Manager window is now displayed.
5. In the Device Manager window, click on the Multi-port serial adapters icon to display the currently installed serial adaptors.

6. In the Device Manager window, double click on the device associated with the RTA(s) you wish to identify.

   The Adapter properties tabbed window is now displayed.

7. In the Adapter Properties window, click on the Card Settings tab to display the Card Settings page as shown in the next picture.
8. In the card settings page, click on the **Identify On**/Identify Off toggle button to the **Identify On** setting.

9. In the card settings page, click on the RTAs you want to identify in the Connected RTAs list highlighting them.

   The LEDs on the selected RTA(s) now flash thus identifying the unit.

   **Note**
   
   To stop the LEDs flashing on an RTA, simply click on an RTA in the Connected RTAs list to remove the highlight.

   To disable this facility, click on the **Identify On**/Identify Off toggle button to set the **Identify Off** setting. Highlighting RTAs in the list will no longer have an effect.
Installing RIO under Linux

This section explains how to install the device driver software for the Linux operating system.

• General installation procedure for Linux on page 144
• Installing drivers onto your system on page 145
• Installing utilities on page 147
• Creating devices for the attached ports on page 148
• Loading the driver module into the kernel on page 150
• Adding ports to the system on page 153
• Removing ports from a system on page 155
General installation procedure for Linux

The general procedure for installing and configuring host cards, drivers software and associated utilities for the Linux operating system is as follows:

1. Install any PCI host cards you require into your system. See Installing a Universal 3.3/5V PCI host card on page 156.
2. Install the RIO Linux drivers onto your system using the procedures described in Installing drivers onto your system on page 145.
3. Install the RIO Linux utilities onto your system using the procedures described in Installing utilities on page 147.
5. Load the driver module into the Kernel and download the firmware onto the host card and device concentrators. See Loading the driver module into the kernel on page 150.
6. Add or remove any ports you want to the system. See Adding ports to the system on page 153 and Removing ports from a system on page 155.
7. Install any ISA host cards you require into your system. See Installing an ISA host card on page 158.
8. Remove any host cards you want from your system. See Removing host cards on page 160.

Your system can now use the serial adaptor cards and device concentrators you have installed.

Note
The RIO driver for Linux supports up to 4 host cards of either ISA or PCI bus types. Under most circumstances the driver will not need to be configured to recognise cards of either type. Once the host card has been installed and the machine has been powered on the driver will automatically find any PCI cards installed in the system and register the correct interrupt that has been assigned by the BIOS. This is a feature of PCI Plug & Play.
Installing drivers onto your system

To install the device driver proceed as follows:

1. Make sure you have an up to date Linux kernel source directory installed. This can be obtained from major Linux web sites, along with instructions on how to install and build.
2. Copy the driver patch file onto your system in a temporary directory. For example, /tmp.
   The patch file will be named rio.patch-<driver vers>-<kernel vers>.gz
   For example, rio.patch-13-2.2.14.gz
3. At the command prompt, uncompress the driver patch file by typing
   gunzip /tmp rio.patch-13-2.2.14.gz
   and pressing the Enter key.
4. At the command prompt, change directory to the kernel source directory by typing
   cd /usr/src/linux
   and pressing the Enter key.
5. At the command prompt, apply the kernel patch by typing
   patch -p1 <tmp/rio.patch-13-2.2.14.gz
   and pressing the Enter key.
6. If the patch is successful, you will need to enable the driver using the make config or make xconfig kernel utility. The RIO driver appears in the Character devices section and is labelled RIO system support. Set this to m for modules.

Note
You will need to enable Non-standard serial port support in order to select the RIO Driver.

Note
Linux kernel version 2.2.15 has the RIO device driver integrated into the kernel sources. You do not need to apply a patch on this or later kernels. You only need to enable the driver (using step 6. of this procedure).
7. Now rebuild and install the kernel and modules. See your Linux distribution documentation on how to rebuild and install a new kernel and modules. We recommend reading the Kernel-HOWTO available in /usr/doc/HOWTO.

Note

In order to determine if any ISA cards are present, the driver will search for RIO cards at 3 well known ISA bus addresses (0xC0000, 0xD0000, 0xE0000). It is recommended that you leave your RIO ISA card at the factory default of 0xD0000, as this is the most common free ISA address slot on the majority of machines. If, for some reason your ISA card cannot be left at one of these addresses then you will need to modify the sources of the driver and re-compile the rio module for inclusion into your system.

You will need to modify the following line in the /usr/src/linux/drivers/char/rio/rio_linux.c file:

```c
int rio_probe_addrs[] = {0xc0000, 0xd0000, 0xe0000};
```

Change one of the addresses to the value you have set your ISA card rotary switches to. For example, if you have set your rotary switches to F, F (reading from left to right as you look at the switches with the ISA bus edge connector closest to you). Then you will need to set the address line to:

```c
int rio_probe_addrs[] = {0xc0000, 0xd0000, 0xff0000};
```

Once you have made this change you will need to re-compile the kernel modules and install the new module on your system. See your Linux distribution documentation for details.

RIO ISA card types are always set to polled mode. That is, they do not use up scarce interrupt request line resources. This does not adversely affect the performance of the card or the operating system.
Installing utilities

The utilities file is named: `specialix_riotools-<maj ver>-<min ver>.i386.rpm`
For example: `specialix_riotools-4-1.i386.rpm`

To install the utilities proceed as follows:

1. Copy this file to a temporary directory and install the utilities using the following command:
   
   `rpm -i specialix_riotools-4-1.i386.rpm`

   The utilities are now installed in the `/usr/sbin` directory on your machine.

Note

The RIO configuration files are in the `/etc/rio` directory. A sample RIO configuration file (`rio.cf.sample`) is installed in this directory for you to use as a template.

For details about the `rio.cf` file, see Appendix B Rio cf administration file.

The files `rta.bin` and `host.bin` should not be touched. These files contain the device firmware for the host card and the RTA and are loaded into the driver when the `rioboot` command is run.
Creating devices for the attached ports

After you have installed the new kernel, modules & hardware, and have rebooted the machine. The following procedure can be followed to create devices for the attached ports.

1. At the command prompt, load the RIO driver module by typing `modprobe rio` and pressing the Enter key.
2. Verify the module has successfully loaded using the `lsmod` command. The output should contain references to the rio module.
3. Ensure all your RIO devices are attached and powered on.
4. At the command prompt, upload the host card firmware to the driver and boot the attached devices (ignore any warning or error messages) by typing: `rioboot -f` and pressing the Enter key.
5. At the command prompt, create a configuration file (/etc/rio/rio.cf) based on what is attached to your system by typing:
   `rioboot -w > /etc/rio/rio.cf.new` and pressing the Enter key.
   The contents of the rio.cf file is now displayed as shown in the next example;

   ```
   HOST:d100000f::boot:
   RTA:9400073d: UNKNOWN RTA 1-1:1:boot:
   RTA:94000731: UNKNOWN RTA 1-2:1:boot:
   RTA:94000732: UNKNOWN RTA 1-3:1:boot:
   RTA:94000733: UNKNOWN RTA 1-4:1:boot:
   HOST:d100000f::boot:
   RTA:9400073d: RTA16 0-15:0:boot:
   RTA:94000731: RTA16 16-31:16:boot:
   RTA:94000732: RTA16 32-47:32:boot:
   RTA:94000733: RTA16 48-63:48:boot:
   ```

6. Using a suitable text editor, modify the new configuration file (/etc/rio/rio.cf.new) to give your RTA’s names and assign ports to them as shown in the next example;

   ```
   HOST:d100000f::boot:
   RTA:9400073d: RTA16 0-15:0:boot:
   RTA:94000731: RTA16 16-31:16:boot:
   RTA:94000732: RTA16 32-47:32:boot:
   RTA:94000733: RTA16 48-63:48:boot:
   ```

7. Rename the new configuration file you have created to `/etc/rio/rio.cf`
8. At the command prompt, upload the changes to the driver by typing `rioboot -u` and pressing the Enter key.
9. At the command prompt, create device nodes for the attached RTA's by typing `riomkdev` and pressing the Enter key.
10. Your system now has a number of device nodes (/dev/ttySR*) relating to the ports on the attached RTA's.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>When you have installed Remote Terminal Adaptors under Linux, you need to do the following after powering up the system;</td>
</tr>
<tr>
<td>a. Wait for the machine to boot,</td>
</tr>
<tr>
<td>b. Login as root</td>
</tr>
<tr>
<td>c. Run <code>riomkdev -f</code> to create new port devices in the /dev directory.</td>
</tr>
</tbody>
</table>
Loading the driver module into the kernel

In order to make use of the RIO devices, you must load the driver module into the Kernel and then download the firmware onto the host card and RTA devices. You can do this manually every time the machine boots. Alternatively you can configure the start-up files to ensure the driver is always loaded and initialised when the machine boots. See the following for details:

- Manually loading the module and firmware on page 150
- Loading the RIO module and firmware automatically on page 151

Manually loading the module and firmware

To manually load the module and firmware follow the steps below:

1. At the command prompt, load the RIO module into the kernel by typing `modprobe rio` and pressing the Enter key.
2. At the command prompt, load the RIO firmware into the driver by typing `rioboot` and pressing the Enter key.

The RTA's now boot and connection messages are displayed on the console.
1. To automatically configure the start up files to load the rio module and firmware, copy the following script to the file `/etc/rc.d/init.d/rio`.

```
#!/bin/sh
#
# rio           This shell script takes care of starting and stopping
#               the RIO services.
#
# probe: true
#
# Source function library.
#. /etc/rc.d/init.d/functions
#
# Exit if the rio utilities are not present
#
[-f /usr/sbin/rioboot ] || exit 0

# See how we were called.
#case "$1" in
  start)
    # Start driver and load module.
    action "Starting RIO services: " /sbin/modprobe rio
    echo -n "Starting RIO Firmware: "
    #
    # If we have a rio.cf file then just rioboot
    #
    if [-f /etc/rio/rio.cf ]; then
      daemon /usr/sbin/rioboot
    else
      daemon /usr/sbin/rioboot -f
    fi
    echo
  ;;
  stop)
    # Stop driver and unload module.
    action "Shutting down RIO services: " /sbin/modprobe -r rio
    echo
  ;;
  status)
    status rio
  ;;
  restart|reload)
    $0 stop
    $0 start
  ;;
  *)
    echo "Usage: rio {start|stop|restart|reload|status}"
    exit 1
esac
exit
```

2. Create symbolic links to the file in the relevant system start-up directories (page 152).
Creating symbolic links

If your machine normally boots into run level 5 you will need to create the following symbolic links:

```
ln -s /etc/rc.d/init.d/rio /etc/rc.d/rc5.d/S50rio
ln -s /etc/rc.d/init.d/rio /etc/rc.d/rc5.d/K50rio
```

These links will ensure that the RIO start-up script `S50rio` is run each time the machine is booted into run level 5 and that the kill script `K50rio` is run whenever the machine is shutdown.
Adding ports to the system

You can add more ports, in the form of extra RTA devices, to a live system following the guidelines below.

1. Attach the new RTA to the RIO network via its link cable and power the unit on. See Installing Remote Terminal Adaptors (RTAs) on page 161.
2. Wait until the unit has booted (indicated by the RUN and CON LEDs being on).
3. At the command prompt, write out the current device driver configuration: by typing `rioboot -w > /etc/rio/rio.cf.new` and pressing the Enter key.
   Modify the configuration file to give the new RTA (the one named "UNKNOWN RTA...") a name and allocate a starting port number to the device as shown in the next example:
   The contents of the rio.cf file is now displayed as shown in the next example;

   Before modification
   
   HOST:d100000f: RIO PCI 1: boot:
   RTA:9400073d:RTA16 Ports 0-15:0:boot:
   RTA:94000731:RTA16 Ports 16-31:16:boot:
   RTA:94000732:UNKNOWN RTA 1-3:-1:boot:

   After modification
   
   HOST:d100000f:RIO PCI 1:boot:
   RTA:9400073d:RTA16 Ports 0-15:0:boot:
   RTA:94000731:RTA16 Ports 16-31:16:boot:
   RTA:94000732:RTA16 Ports 32-47:32:boot:
   
   Here the new "UNKNOWNRTA" has been assigned a name "RTA16 Ports 32-47" and allocated a starting port number of 32.

4. At the command prompt, syntax check the new configuration file by typing `rioboot -s -c /etc/rio/rio.cf.new` and pressing the Enter key.
5. Fix any errors indicated by the syntax check and then rename the configuration file to `/etc/rio/rio.cf`
6. At the command prompt, upload the changes to the driver by typing `rioboot -u` and pressing the Enter key.
7. At the command prompt, create device nodes for the attached RTA's by typing `riomkdev` and pressing the Enter key.
Your system now has a number of new device nodes (/dev/ttySR*) relating to the ports on the new RTA.

**Note**
To check that the port is present and available, type `stty -a </dev/ttySR32` at the command prompt and press the Enter key.

The port name can be determined by the RTA offset in the rio.cf file (page 164) added to the port offset on the RTA i.e. the 4th port on RTA "RTA16 Ports 16-31" is 16 + 4 or /dev/ttySR20.
Removing ports from a system

You can remove groups of ports from a live system using the following procedure:

1. Determine the name and/or unique number of the RTA you wish to remove from the system.

   **Hint**
   You can do this by disconnecting the RTA link and getting its name from the console messages that occur when an RTA is disconnected from the network. Alternatively, use the `rioidentify` command to determine which RTA/name needs to be removed.

2. Power off and detach an RTA from the RIO network. See Removing a Remote Terminal Adaptor (RTA) on page 173.

3. At the command prompt, delete the RTA entry from the device driver by typing `riodelete <unique number|"name">` and pressing the `Enter` key.

4. Using a suitable text editor, edit the `/etc/rio/rio.cf` file to remove the RTA you have just powered off. Remove the RTA line that contains the unique number and/or name of the RTA just deleted.

5. At the command prompt, syntax check the new configuration file and fix any errors by typing `rioboot -s -c /etc/rio/rio.cf` and pressing the `Enter` key.

6. At the command prompt, upload the changes to the driver by typing `rioboot -u` and pressing the `Enter` key.

7. At the command prompt, delete the device nodes from the `/dev` directory by typing `riomkdev -d <unique number|"name">` and pressing the `Enter` key.
Installing a Universal 3.3/5V PCI host card

The latest version of the RIO PCI card will fit 3.3V, 5V and universal 3.3/5V PCI card slots in your system.

Note
Before installing your RIO PCI card note the following:
The latest Universal 3.3V/5V RIO PCI card will fit into both 5V and 3.3V PCI slots in your system. If you are installing an older 5V RIO PCI card this will not fit into 3.3V PCI slots in your system.

Before commencing installation you can identify card and slot type using the information contained in Identifying your RIO PCI card and slot type on page 156. You can then install your PCI card using the procedures given in Installation procedure on page 157.

Identifying your RIO PCI card and slot type

You can identify the PCI card type as shown in the next picture.

The new universal 3.3V/5V PCI card has two notches on the card edge connector where as the 5V PCI card has only one.

RIO 5V PCI card
RIO 3.3V/5V universal PCI card

The slots on your system will be as shown in the next picture. Note that some systems may have a 3.3V only slot as opposed to a 5V and universal 3.3V/5V.
Installation procedure

To install a PCI host card proceed as follows;

1. Turn off the power to your system and disconnect the mains supply.
2. Remove the system cover to expose the inside of the connector panel for host cards.
3. Insert the PCI card you want to install into a vacant host card slot and secure in place as shown in the next picture.
4. Repeat step 3. until you have installed all the PCI cards you want.
5. Replace and secure the system cover.

Installation of PCI host cards is now complete. For further details about installing host cards including other types, see Before you start on page 33.
Installing an ISA host card

Before you install an ISA card in your system you need to physically set the address for the card using the two rotary switches SW1 and SW2 provided on the host card (shown in the next picture).

To set the address for an ISA host card proceed as follows:

1. Choose an address you want to use for the host card in hexadecimal.
2. On the host card, set the two rotary switches SW1 and SW2 to the first two digits of the address you want as shown by the next example.

<table>
<thead>
<tr>
<th>Host card Address</th>
<th>Set SW1 to..</th>
<th>Set SW2 to..</th>
</tr>
</thead>
<tbody>
<tr>
<td>000000 (factory setting)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0F0000</td>
<td>F</td>
<td>0</td>
</tr>
</tbody>
</table>

You can now install the ISA host card in your system. To do this proceed as follows:

Note
The exact location of host card slots varies for different systems, for exact mechanical details of your system, refer to your system documentation.
3. Turn off the power to your system and disconnect the mains supply.
4. Remove the system cover to expose the inside of the connector panel for host cards.
5. Insert the ISA card you want to install into a vacant host card slot and secure in place as shown in the next picture.

6. Repeat step 3 until you have installed all the ISA cards you want.
7. Replace and secure the system cover.
8. Plug in the mains lead and turn on the power.

Installation of ISA host cards is now complete. For further details about installing host cards including other types, see Before you start on page 33.
Removing host cards

To remove a host card from your system proceed as follows;

1. Turn off the power to your system and disconnect the mains supply.
2. Remove the system cover to expose the inside of the connector panel for host cards.
3. Remove all cables plugged into the host card.
4. Undo the securing screw for the host card you want to remove then lift the card out of its slot as shown in the next picture (ISA card shown).
5. Repeat step 4 until you have removed all the host cards you want.
6. Replace and secure the system cover.
7. Plug in the mains lead and turn on the power.

Removal of host cards is now complete. For further details about installation of host cards including other types, see Before you start on page 33.

Note
The exact location of host card slots varies for different systems, for exact mechanical details of your system, refer to your system documentation.

Warning
Dangerous voltages exist inside computer systems. Before removing host cards from your system, turn off the power supply and disconnect the mains lead.

Caution
Full anti-static precautions should be taken when handling host cards.
Installing Remote Terminal Adaptors (RTAs)

Remote Terminal Adaptors (RTAs) are serial connection blocks which provide a number of ports depending on type. RTAs come in three main varieties, the RTA 8 (providing 8 ports) and RTA 16 and RRC16 (providing 16 ports). Each type of RTA is available in a number of variations see Remote Terminal Adaptors on page 23 in Chapter 1 Introduction.

The installation procedure for each main type is given in the following sections;

• RTA8 8 port Remote Terminal Adaptors on page 162
• RTA16 16 port Remote Terminal Adaptors on page 165
• RRC16 Remote Concentrator on page 168.
To install an RTA proceed as follows:

1. If required, wall mount the unit using the procedures described in **Wall mounting an RTA8** on page 164.
2. Connect the link cables from the host card or other RTA to your RTA8 into the link socket of your choice.
3. Take an RT8 power supply unit and making sure that the mains is disconnected, connect the 9 way D type connector from the power supply to the RTA unit.
4. Plug a suitable mains lead into the power supply unit, then connect the other end of the cable to the mains and turn on the power.

**Warning**

When using multiple RTA power supplies, do not stack the units as this may cause overheating.

The RTA8 unit will now boot up, then commence normal operation. The LEDs on the unit will display different colours depending on the RTA state as shown in the next table.
## Chapter 2 Installing hardware and software

### Installing Remote Terminal Adaptors (RTAs)

<table>
<thead>
<tr>
<th>RTA state</th>
<th>Link LEDs</th>
<th>Port 1 LED</th>
<th>Port 2 LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switched off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Being booted up by host</td>
<td>Orange</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Boot up successfully completed</td>
<td>Orange</td>
<td>Green</td>
<td>Off</td>
</tr>
<tr>
<td>Assigned ID by host</td>
<td>Orange</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Traffic on Link</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Error on link</td>
<td>Flashing Red</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Isolated from host</td>
<td>Red for 20 seconds then off</td>
<td>Green</td>
<td>Off</td>
</tr>
</tbody>
</table>

**Note**

If the LEDs on the unit do not display as expected, refer to Appendix C Troubleshooting for details of corrective action to take.
Wall mounting an RTA8

The RTA8 has is fitted with wall mounting holes at either end of the unit concealed by push-fit end caps. To wall mount a RTA8 unit proceed as follows:

1. On the RTA unit gently prise off the caps at either end of the unit to reveal the wall mounting holes as shown in the next picture.

2. Screw the unit to the wall through the holes provided using appropriate screws or fasteners for your installation.
3. Replace the caps at the ends of the unit.

Wall mounting of the unit is now complete. You can now perform the normal installation steps described in RTA8 8 port Remote Terminal Adaptors on page 162.

Warning
Before you wall mount the RTA, turn off and disconnect the power supply to the unit.
RTA16 16 port Remote Terminal Adaptors

Installation procedure

To install an RTA16 proceed as follows;

1. Connect the link cables from the host card or other RTA to your RTA16 into the link socket of your choice.

   **Warning**
   When using multiple RTA16s, do not stack the units more than four high as this may cause overheating.

   **Hint**
   To prevent accidental removal of link cables, fit the link retention bracket supplied with the unit as shown in the next picture.
2. Connect the power lead into the socket at the rear of the RTA unit, turn on the supply and finally turn on the power switch at the rear of the unit.

The RTA16 unit will now boot up, then commence normal operation.

The LEDs on the unit will display different colours depending on the RTA state as shown in the next table.
### LED states

<table>
<thead>
<tr>
<th>RTA state</th>
<th>Link LEDs</th>
<th>RUN LED</th>
<th>CON LED</th>
<th>PORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switched off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Being booted up by host</td>
<td>Orange</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Boot up successfully completed</td>
<td>Orange</td>
<td>Green</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Assigned ID by host</td>
<td>Orange</td>
<td>Green</td>
<td>Green</td>
<td>Off</td>
</tr>
<tr>
<td>Traffic on Link</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Off</td>
</tr>
<tr>
<td>Error on link</td>
<td>Flashing Red</td>
<td>Green</td>
<td>Green</td>
<td>Off</td>
</tr>
<tr>
<td>Isolated from host</td>
<td>Red for 20 seconds then Off</td>
<td>Green</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Port open</td>
<td>No change</td>
<td>No change</td>
<td>No change</td>
<td>Green</td>
</tr>
</tbody>
</table>

**Note**

If the LEDs on the unit do not display as expected, refer to Appendix C Troubleshooting for details of corrective action to take.
RRC16 Remote Concentrator

**Installation procedure**

To install an RRC16 proceed as follows:

1. Mount the unit depending on the type of installation you require. For example, rack mounted, wall mounted and so on. See [Mounting the RRC16](#) on page 170 for details.

   **Warning**
   When using multiple RRC16s, first fit the rubber mounting feet supplied with each unit (see page 170), and do not stack the units more than four high as this may cause overheating.

2. Connect the link cables from the host card or other RTA to your RRC16 into the link socket of your choice.

   - **Power**
   - **RJ45 Ports 1 to 16**
   - **Link ports A to D**
   - **Run LED**
     (shows RRC16 has booted up successfully and is running)
   - **Link status LEDs**
   - **Configuration LED**
     (shows RRC16 has been configured by host)
   - **RJ45 Port Transmit**
   - **RJ45 Port Receive LED**
   - **Details of RJ45 Port LEDs**
3. Connect a power lead into the socket at the rear of the RTA unit, turn on the supply and also the power switch at the rear of the RRC unit.

![Rear view of unit]

Connect power lead here  Power switch

The RRC16 unit will now boot up, then commence normal operation. The LEDs on the unit will display different colours depending on the state of the unit as shown in the next table.

<table>
<thead>
<tr>
<th>RRC state</th>
<th>Link Status LEDs</th>
<th>RUN LED</th>
<th>CON LED</th>
<th>RJ45 port transmit</th>
<th>RJ45 port receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switched off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Being booted up by host</td>
<td>Orange</td>
<td>Off</td>
<td>Off</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Boot up successfully completed</td>
<td>Orange</td>
<td>Green</td>
<td>Off</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Assigned ID by host</td>
<td>Orange</td>
<td>Green</td>
<td>Green</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Traffic on Link</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Error on link</td>
<td>Flashing Red</td>
<td>Green</td>
<td>Green</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Isolated from host</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Port open</td>
<td>No change</td>
<td>No change</td>
<td>No change</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>RJ45 port transmitting data</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Yellow</td>
<td>Off</td>
</tr>
<tr>
<td>RJ45 port receiving data</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Off</td>
<td>Green</td>
</tr>
</tbody>
</table>

Note
If the LEDs on the unit do not display as expected, refer to Appendix C Troubleshooting for details of corrective action to take.
Mounting the RRC16

You can mount the RRC16 unit in a number of ways. See the following for details:

- Mounting on a flat surface on page 170
- Rack mounting on page 171
- Rack mounting on page 171

Mounting on a flat surface

To mount an RRC16 on a flat surface proceed as follows:

1. Take the RRC16 and fix one of the self adhesive rubber mounting feet provided with the unit on each corner of the underside as shown in the next picture.

2. Install and cable up the unit using the procedure described in RRC16 Remote Concentrator on page 168.

Warning

When using multiple RRC16s, first fit the rubber mounting feet supplied with each unit (see page 170), and do not stack the units more than four high as this may cause overheating.
To rack mount an RRC16 proceed as follows:

1. Take the RRC16 and screw one of the mounting brackets provided with the unit into each side of the unit as shown in the next picture.

2. Insert the unit into your rack frame and secure in place.

3. Install and cable up the unit using the procedure described in RRC16 Remote Concentrator on page 168.
Wall mounting

To wall mount an RRC16 proceed as follows:

1. Take the RRC16 and screw one of the mounting brackets provided with the unit into each side of the unit as shown in the next picture.

2. Secure the unit to the wall via the brackets and using suitable fasteners for the type of wall you are fixing to.

3. Install and cable up the unit using the procedure described in RRC16 Remote Concentrator on page 168.
Removing a Remote Terminal Adaptor (RTA)

To remove an RTA from your RIO system proceed as follows;
1. Turn off the power to the RTA you want to remove and disconnect the power lead from the unit
2. Disconnect the link cables from the unit
3. Disconnect any peripheral cables from the unit, for example printer, terminal and so on.
4. Update to your system for the revised configuration. The exact procedure for this will depend on the operating system, see the following for details;

<table>
<thead>
<tr>
<th>Operating system</th>
<th>For updating the system, see</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solaris</td>
<td>Updating your RIO system configuration on page 51.</td>
</tr>
<tr>
<td>SCO UnixWare</td>
<td>Removing an RTA from the system on page 86.</td>
</tr>
</tbody>
</table>
Installing a short distance link

For short distances up to 75 metres you can use the RIO link cable to make up a basic RIO system as shown in the next picture. Typically, you use this type of system when you want to connect peripherals to the host within the same building.

To install a short distance link proceed as follows:
1. Take one end of a RIO link cable and plug it into the host card mini DIN socket of your choice. See Link Cable on page 219 of Chapter 3 RIO Cabling information.
2. Install the RTA as described in Installing Remote Terminal Adaptors (RTAs) on page 161.
3. Take the other end of the RIO link cable and plug it into the RTA link port. See Installing Remote Terminal Adaptors (RTAs) on page 161.
4. Connect the peripheral to the RTA using a suitable cable. See Chapter 3 RIO Cabling information.

You can now continue with the rest of the general installation procedure for your operating system.
Installing a Fibre Optic Link Kit (FOLK)

Introduction

The RIO Fibre Optic Link Kit allows you to extend the range of a RIO link via fibre optic cable to a distance of up to one kilometre. The kit comprises two fibre optic modules. A module is shown in the next picture. Each module consists of a 1 metre long RIO link cable connected to a fibre optic converter. This converts the transputer signals into light. The fibre optic cable plugs into one of these converters at each end.

Fibre optic unit main components

Fibre optic converter

Power LED
Lights green when fibre optic connection is live at both ends

Receive LED
Flashes orange on data input

Transmit LED
Flashes yellow on transmission

Dovetail connectors allow you to join adjacent units together

RIO link cable

ST3 connectors

Fibre optic patch lead

For information on how to install this unit, see Installation procedure on page 176.
**Installation procedure**

To install the fibre optic unit proceed as follows:

1. On each fibre optic converter, remove the dust caps from the ST3 sockets.

   **Note**
   The fibre optic cable used with the FOLK unit is usually part of an existing fibre optic installation. Typically the fibre optic cable is wired into a junction box, and should then emerge in the form of a patch lead with two bayonet connectors at each end.

   **Hint**
   You should keep the dust caps safe and replace them if you remove the patch lead at any time as dirt on fibre optic connections can corrupt the signal.

2. Take one end of the fibre optic patch lead and plug the bayonet connectors into the ST3 sockets on the fibre optic converter you want to connect to.

3. Plug the RIO link cable into one of the link sockets on the fibre optic converter.

4. Repeat steps 2 to 3 using the other end of the fibre-optic cable and the other FOLK unit.

5. Check that the Connect LED on each fibre optic module is green when the host card or RTA at each end are powered up.

---

**Diagram:**

- RIO link cable to RTA on host card end
- RIO link cable to RTA on peripheral end
- Fibre optic converter
- ST3 connectors
- Fibre optic patch lead

**Note**
Make sure that each strand of the fibre optic cable is plugged into a transmit channel at one end and a receive channel at the other.
Installing a Long Distance Module (LDM)

Introduction

The RIO Long Distance Module (LDM) allows you to extend your RIO system via a leased line. Using a RIO Long Distance Module you can make connections over thousands of miles using synchronous (X.21/X.21bis) or asynchronous interfaces.

**Note**

The LDM is specifically designed for use on high-speed synchronous connections. Slower, asynchronous speeds are supported but are only recommended for applications where low throughput is acceptable.

You can increase the number of RTAs on the remote site using standard RIO cables, making the LDM more cost-effective and more practical than a multiplexer.

The LDM consists of two Long Distance Units (LDUs). Each unit comprises a converter box with flying leads as shown in Long Distance Unit main components on page 178. One LDU connects your local host card or RTA to a modem, the other connects the remote RTA to a modem. You can configure the speed and protocol using a dial on the LDU.

The LDM also supports twisted-pair RS422 cable up to a distance of 1km. This may provide a more cost-effective solution than the RIO Fibre Optic Link Kit in environments with low interference levels or a low security risk. Alternatively, it could be used to provide fault tolerant links for a fibre optic link based system.

A typical remote system is shown in the next picture.
Long Distance Unit main components

The RIO Long Distance Unit (LDU) consists of a converter box with two flying leads. One is a metre-long RIO Link cable which plugs into your host card or RTA; the other is a serial cable with a DB25 connector which connects to your modem or RS422 long-wire cable.

- Power LED: Illuminated Green when LDU is connected to a host card or RTA
- Error LED: Flashes red when an error is detected on the link
- Rotary switch: for setting protocol and speed
- Dovetail connectors allow you to join adjacent units together
- Data Flow LED: flashes green to indicate incoming data
- To Modem, long wire or X.21 interface
- To host card or RTA
Installation

Note
For modem installations, you need to use a converter cable to connect the LDU DB25 flying lead to the modem. On long-wire installations, the long-wire you can connect directly to the DB25 flying lead.
For information on how to wire up the converters needed for each type of installation see Adaptor pinouts for LDU flying lead connectors on page 186.

General procedure

To install a long distance module proceed as follows;

1. On the LDU, set the speed and protocol you want by setting the rotary switch on each LDU (shown on page 178) using a small screwdriver. The settings available are shown in the next table.

<table>
<thead>
<tr>
<th>Device</th>
<th>Line Speed</th>
<th>Transmission type</th>
<th>Use switch setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern</td>
<td>9600</td>
<td>Asynchronous</td>
<td>0</td>
</tr>
<tr>
<td>Modern</td>
<td>19200</td>
<td>Asynchronous</td>
<td>1</td>
</tr>
<tr>
<td>Modern</td>
<td>38400</td>
<td>Asynchronous</td>
<td>2</td>
</tr>
<tr>
<td>Reserved address, do not use</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserved address, do not use</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long wire</td>
<td>78000</td>
<td>Asynchronous</td>
<td>5</td>
</tr>
<tr>
<td>Long wire</td>
<td>156250</td>
<td>Asynchronous</td>
<td>6</td>
</tr>
<tr>
<td>Long wire</td>
<td>312500</td>
<td>Asynchronous</td>
<td>7</td>
</tr>
<tr>
<td>Modern</td>
<td>Synchronous</td>
<td>Synchronous</td>
<td>8</td>
</tr>
<tr>
<td>X21 bis</td>
<td>Synchronous</td>
<td>Synchronous</td>
<td>9</td>
</tr>
<tr>
<td>X21</td>
<td>Synchronous</td>
<td>Synchronous</td>
<td>A</td>
</tr>
<tr>
<td>Reserved address, do not use</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern with Autodial</td>
<td>9600</td>
<td>Asynchronous</td>
<td>C</td>
</tr>
<tr>
<td>Modern with Autodial</td>
<td>19200</td>
<td>Asynchronous</td>
<td>D</td>
</tr>
<tr>
<td>Modern with Autodial</td>
<td>38400</td>
<td>Asynchronous</td>
<td>E</td>
</tr>
<tr>
<td>Reserved address, do not use</td>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Install the type of LDU link you want. For Modem via telephone line see page 180, for long wire see page 180 and for X.21 see page 180.
Installing a long distance LDM link via Modem and leased line

To install a long distance LDM link via modem and leased line proceed as follows;

1. Follow the procedure given in Installation on page 179.
2. Connect the modem which you use for the host card site to a PC and configure as follows;
   a. Set the autodial number you want using the AT command set. See modem user documentation for details.
   b. Configure the modem as shown in the next table;

<table>
<thead>
<tr>
<th>Mode</th>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td>Minimum speed</td>
<td>14.4 Kbit/s</td>
</tr>
<tr>
<td></td>
<td>Maximum speed</td>
<td>64Kbit/s</td>
</tr>
<tr>
<td></td>
<td>Port setting</td>
<td>8 data bits</td>
</tr>
<tr>
<td></td>
<td>Flow control</td>
<td>Disabled</td>
</tr>
<tr>
<td></td>
<td>Command echo</td>
<td>Disabled</td>
</tr>
<tr>
<td></td>
<td>Display of result codes</td>
<td>Suppressed</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>Specification</td>
<td>V32bis minimum</td>
</tr>
<tr>
<td></td>
<td>Minimum speed</td>
<td>Modems must connect at a minimum of 9600 baud</td>
</tr>
<tr>
<td></td>
<td>Port settings</td>
<td>8 data bits, 1 stop bit and no parity</td>
</tr>
<tr>
<td></td>
<td>Hardware flow control</td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td>Command echo</td>
<td>Disabled</td>
</tr>
<tr>
<td></td>
<td>Display of result codes</td>
<td>Suppressed</td>
</tr>
</tbody>
</table>

c. Save the settings you have chosen.

d. Turn off the power to the modem and remove the power and PC connections.
3. Connect the modem which you use for the remote site to a PC and set the modem to auto answer mode. See modem user documentation for details.
4. Configure the general modem settings to the same values as the host cards site modem as step 2., sub step b. previously.
5. Save the settings you have chosen.
6. Turn off the power to the modem and remove the power and PC connections.
7. At the host card site, connect an LDU to a modem using the DB25 female flying lead on the LDU via a DB25 female to male adaptor as shown in the next picture.

8. At the remote site, repeat step 7. to connect the LDU and so forth.

9. At both the host card and remote sites, connect each LDU to any free Link socket on the associated RTA using the RIO Link flying lead.

10. At each site, ensure the modems are connected to the required telephone line.

11. When the Host Card and RTAs at each end of the LDM connection are powered up, check that the Power LED on each LDU is green (see page 178).
To install a long distance LDM link via long wire proceed as follows:

1. Follow the procedure given in Installation on page 179.
2. At the host card site, connect an LDU to one end of a long wire cable using the DB25 female flying lead on the LDU as shown in the next picture.
3. At the remote site, repeat step 2. to connect the LDU and so forth.
4. At both the host card and remote sites, connect each LDU to any free Link socket on the associated RTA using the RIO Link flying lead.
5. When the Host Card and RTAs at each end of the LDM connection are powered up, check that the Power LED on each LDU is green (see page 178).
To install a long distance LDM link via modem and X.21 line proceed as follows:

1. Follow the procedure given in Installation on page 179.

2. At the host card site, connect an LDU to an X.21 asynchronous modem using the DB25 female flying lead on the LDU via a DB25 female to DB15 male adaptor as shown in the next picture.

3. At the remote site, repeat step 2. to connect the LDU and so forth.

4. At both the host card and remote sites, connect each LDU to any free link socket on the associated RTA using the RIO Link flying lead.

5. At each site, ensure the modems are connected to the required leased line.

6. When the Host Card and RTAs at each end of the LDM connection are powered up, check that the Power LED on each LDU is green (see page 178).
LDM Cabling information

This section contains cabling information for installing Long Distance Modules.

Note
For modem installations, a converter cable must be used to connect the LDU DB25 flying lead to the modem. See Asynchronous/Synchronous Modem & X21bis (DB25 female to DB25 male) on page 187.

On long-wire installations, you can connect the long wire directly to the DB25 flying lead. See Asynchronous Long-wire Connection (DB25 male to DB25 male) on page 186.

For X.21 Synchronous connections, you need to use a converter cable to connect the DB25 flying lead to the X21 interface. See Synchronous X.21 connection on page 188.

LDU flying lead connector pinouts

Cable diagram

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>VCC</td>
<td>Supply Voltage</td>
</tr>
<tr>
<td>3</td>
<td>RXD-</td>
<td>Inverse RXD</td>
</tr>
<tr>
<td>4</td>
<td>TXD-</td>
<td>Inverse TXD</td>
</tr>
<tr>
<td>5</td>
<td>RXD+</td>
<td>Receive Data</td>
</tr>
<tr>
<td>6</td>
<td>TXD+</td>
<td>Transmit Data</td>
</tr>
</tbody>
</table>
### DB25 female on flying lead

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Name</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chassis</td>
<td>Chassis Ground</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>Transmit Data</td>
<td>Output RS232</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>Receive Data</td>
<td>Input RS232</td>
</tr>
<tr>
<td>4</td>
<td>RTS*</td>
<td>Request To Send</td>
<td>Output RS232</td>
</tr>
<tr>
<td>5</td>
<td>CTS*</td>
<td>Clear To send</td>
<td>Input RS232</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td>Not Connected</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>Ground</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td>DCD*</td>
<td>Data Carrier Detect</td>
<td>Input RS232</td>
</tr>
<tr>
<td>9</td>
<td>DCD+</td>
<td>Data Carrier Detect</td>
<td>Input RS422</td>
</tr>
<tr>
<td>10</td>
<td>RXD-</td>
<td>Inverse RXD</td>
<td>Input RS422</td>
</tr>
<tr>
<td>11</td>
<td>RXD+</td>
<td>Receive Data</td>
<td>Input RS422</td>
</tr>
<tr>
<td>12</td>
<td>TXD-</td>
<td>Inverse TXD</td>
<td>Output RS422</td>
</tr>
<tr>
<td>13</td>
<td>TXD+</td>
<td>Transmit Data</td>
<td>Output RS422</td>
</tr>
<tr>
<td>14</td>
<td>CTS-</td>
<td>Inverse CTS</td>
<td>Input RS422</td>
</tr>
<tr>
<td>15</td>
<td>TXC</td>
<td>Transmit Clock</td>
<td>Input RS232</td>
</tr>
<tr>
<td>16</td>
<td>CTS+</td>
<td>Clear To Send</td>
<td>Input RS422</td>
</tr>
<tr>
<td>17</td>
<td>RXC</td>
<td>Receive Clock</td>
<td>Input RS232</td>
</tr>
<tr>
<td>18</td>
<td>RTS-</td>
<td>Inverse RTS</td>
<td>Output RS422</td>
</tr>
<tr>
<td>19</td>
<td>RTS+</td>
<td>Request To Send</td>
<td>Output RS422</td>
</tr>
<tr>
<td>20</td>
<td>DTR*</td>
<td>Data Terminal ready</td>
<td>Output RS232</td>
</tr>
<tr>
<td>21</td>
<td>DCD-</td>
<td>Inverse DCD</td>
<td>Input RS422</td>
</tr>
<tr>
<td>22</td>
<td>DTR+</td>
<td>Data Terminal Ready</td>
<td>Output RS422</td>
</tr>
<tr>
<td>23</td>
<td>DTR-</td>
<td>Inverse DTR</td>
<td>Output RS422</td>
</tr>
<tr>
<td>24</td>
<td>RXC-</td>
<td>Inverse RXC</td>
<td>Input RS422</td>
</tr>
<tr>
<td>25</td>
<td>RXC+</td>
<td>Receive Clock</td>
<td>Input RS422</td>
</tr>
</tbody>
</table>
Adaptor pinouts for LDU flying lead connectors

Asynchronous Long-wire Connection (DB25 male to DB25 male)

<table>
<thead>
<tr>
<th>DB25 male (host end)</th>
<th></th>
<th>DB25 male (remote end)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin</td>
<td>Signal</td>
<td>Description</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>10</td>
<td>RXD-</td>
<td>Inverse RXD</td>
</tr>
<tr>
<td>11</td>
<td>RXD+</td>
<td>Receive Data</td>
</tr>
<tr>
<td>12</td>
<td>TXD-</td>
<td>Inverse TXD</td>
</tr>
<tr>
<td>13</td>
<td>TXD+</td>
<td>Transmit Data</td>
</tr>
</tbody>
</table>

Note
Any connector pins not listed in the next table must not be connected.

Note
If you are going to build your own Long-wire cable, make sure it conforms to the Category 5 specification.
Asynchronous/Synchronous Modem & X21bis (DB25 female to DB25 male)

<table>
<thead>
<tr>
<th>DB25 female (LDU)</th>
<th>DB25 male (Modem)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin</td>
<td>Signal</td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
</tr>
<tr>
<td>15</td>
<td>TXC</td>
</tr>
<tr>
<td>17</td>
<td>RXC</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
</tr>
</tbody>
</table>

Note
Any connector pins not listed in the next table must not be connected.
Synchronous X.21 connection

Note:
Any connector pins not listed in the next table must not be connected.

<table>
<thead>
<tr>
<th>DB25 female (LDU)</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
<th>DB15 male (Modem)</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Chassis</td>
<td>Chassis ground</td>
<td>1</td>
<td>Chassis</td>
<td>Chassis</td>
<td>Chassis ground</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>GND</td>
<td>Ground</td>
<td>8</td>
<td>GND</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>DC+</td>
<td>Data Carrier Detect</td>
<td>5</td>
<td>Indicate+</td>
<td>Indicate+</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>RXD-</td>
<td>Inverse RXD</td>
<td>11</td>
<td>RXD-</td>
<td>Inverse RXD</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>RXD+</td>
<td>Receive Data</td>
<td>4</td>
<td>RXD+</td>
<td>Receive Data</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>TXD-</td>
<td>Inverse TXD</td>
<td>9</td>
<td>TXD-</td>
<td>Inverse TXD</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>TXD+</td>
<td>Transmit Data</td>
<td>2</td>
<td>TXD+</td>
<td>Transmit Data</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>DC-</td>
<td>Data Carrier Detect</td>
<td>12</td>
<td>Indicate-</td>
<td>Indicate-</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>DTR+</td>
<td>Data Terminal Ready</td>
<td>3</td>
<td>Control+</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>DTR-</td>
<td>Inverse DTR</td>
<td>10</td>
<td>Control-</td>
<td>Inverse Control</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>RXC-</td>
<td>Inverse RXC</td>
<td>13</td>
<td>Clock-</td>
<td>Inverse Clock</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>RXC+</td>
<td>Receive Clock</td>
<td>6</td>
<td>Clock+</td>
<td>Clock</td>
<td></td>
</tr>
</tbody>
</table>

Telephone line DB25 female to DB15 male adaptor.
DB25 female flying lead from host card site LDU
DB25 female flying lead to remote site LDU
DB25 female to DB15 male adaptor.

X.21 Asynchronous modem at host card site
X.21 Asynchronous modem at remote site
**Installing a fault tolerant link**

In a typical non fault tolerant RIO system, a host card is connected to a peripheral (for example, printer) via a single link and RTA. In order to make the system fault tolerant, that is to protect against RTA or link failure, multiple RTAs and links are added.

The next picture shows a typical system which features two backup RTAs and a backup link to the host. If one RTA or link cable is damaged there is still a path from the host and system operation is not disrupted.

To install a fault tolerant system proceed as follows:

1. Install the system components as normal using procedures described earlier in this chapter up to the point at which you add the links to the system.

2. When you install the links in your system, install extra links for a given device (for example, an RTA) such that there is at least two routes to each device.

3. Continue with the installation procedure as normal through to completion.

**Note**

Please refer to Before you start on page 33 to select the correct installation procedure for your operating system.

**Note**

No extra configuration is required by the user for a fault tolerant system.
Installing a dual host fail-safe link (UNIX only)

A dual host fail-safe system allows you to connect a network of RTAs to two systems each with its own host card, one being the main system, and the other a backup in case of system failure. A typical system shown in the next picture. This features two host systems (server 1 and server 2) each with a RIO host card, sharing three RTAs. Server 1 is to be main system (master), server 2 is to be backup system (slave). Note that a fault tolerant link is often added between RTAs for additional protection of the system.

Hint
You can simulate master system failure by removing the link cable to main system's host card.

To install a dual host fail-safe system, see the following:

- Installing a dual host failsafe link under Solaris on page 191
- Installing a dual host failsafe link under SCO OpenServer on page 195
- Installing a dual host failsafe link under SCO UnixWare on page 197
Installing a dual host failsafe link under Solaris

Installing for normal operation

To install a dual host fail-safe system for normal operation proceed as follows;

1. Install the host cards and RIO drivers on both systems. See Installing a Universal 3.3/5V PCI host card on page 156, Installing an ISA host card on page 158 and Installing device drivers and utilities on page 39.
2. Install the RTAs you want onto master system only (no link connection to slave). See Installing Remote Terminal Adaptors (RTAs) on page 161.
3. On the master system, run the rioconfig utility to add RTAs and port devices. See Updating your RIO system configuration on page 51.
4. On the slave system, display the rio.cf file (located in the etc/rio/ directory) and note the host card details (for example, HOST:a5000387:HOST 1:boot:). See also Appendix B rio.cf administration file.

Note
In the event of master system failure, you will need to configure the slave system to take over using the procedure given in Transferring control to the slave system on page 194.
5. Copy the `master rio.cf` file to the slave system.
6. Edit the **slave** copy of `rio.cf` (see Appendix B rio.cf administration file for syntax) as follows:
   a. Replace master host card details with slave host card details.
   b. Alter the **slave** host card "boot" setting to "noboot". (e.g. "HOST:a5000387:HOST 1:noboot:"

   ```
   cat /etc/10/rio.cf
   # Current RIO driver configuration.
   # File Created : Mon Aug 16 14:41:42 1999
   #
   # Host entry format:is;
   # HOST:unique id:<Device Name>:<boot/no/boot>:
   # Rta entry format is:
   # RTA:unique id:<Device Name>:<First Port>:<boot/no/boot>:
   # Port entry format is:
   # PORT:offset:<tty dev>:
   # DEF/PORT:offset:<dev prefix:<tty/edev>:<socket:open>:<_superuser:in
   any,ion,lock,store,dtata>
   #
   # Default port format is:
   # DEF/PORT:offset:<dev prefix:<tty/edev>:<socket:open>:<_superuser:in
   any,ion,lock,store,dtata>
   #
   DEF/PORT1:<dev/term/r03d:tty:100:XON/XOFF:in
   #
   HOST:50000001:HOST 1:noboot:
   RIO:40000001:UNIO<<IN RIO 2-1:boot:
   RIO:40000002:UNIO<<IN RIO 2-2:boot:
   RIO:40000003:UNIO<<IN RIO 2-3:boot:
   RIO:40000004:UNIO<<IN RIO 2-4:boot:
   #
   ```

7. On the slave system, run the `rioconfig` utility to create port devices.

8. Connect the RTAs to the **slave** system. See Installing Remote Terminal Adaptors (RTAs) on page 161.

You can now use your dual host fail-safe system, however the RTAs will only be booted or accessible from the **master** system.
Transferring control to the slave system

If the master system fails you need to use the following procedure to transfer control of the RTAs to the slave system:

1. On the slave system, edit the `rio.cf` file (located in the `/etc/rio/` directory), and alter the host card setting from "noboot" to "boot". (for example, "HOST:a5000387:HOST 1:boot:").

   See also Appendix B rio.cf administration file.

2. On the slave system, run the rioconfig utility. See Updating your RIO system configuration on page 51.

3. On slave system command line type `/etc/rioreboot -n` and press the Enter key.

   All RTAs and ports will be reset (this may take some time), and when complete will be accessible from the slave system.
Installing a dual host fail-safe link under SCO OpenServer

Installing for normal operation

To install a dual host fail-safe system for normal operation under SCO OpenServer proceed as follows:

1. Install the host cards and RIO drivers on both systems. See Installing a Universal 3.3/5V PCI host card on page 156, Installing an ISA host card on page 158 and Installing device drivers and utilities on page 54.
2. Install the RTAs you want onto master system only (no link connection to slave). See Installing Remote Terminal Adaptors (RTAs) on page 161.
3. On the master system, run the config.rio utility to add RTAs and port devices. See Configuring ports with config.rio on page 64, and Adding an RTA to the system on page 65.
4. Repeat step 3. for the slave system using an identical configuration to the master system.
5. For the slave system, from within the config.rio menu, click on Boot mode: > Boot no RTAs.
6. On the slave system, run the config.rio utility to create port devices.
7. Connect the RTAs to the slave system. See Installing Remote Terminal Adaptors (RTAs) on page 161.

You can now use your dual host fail-safe system, however the RTAs will only be booted or accessible from the master system.

Note
In the event of master system failure, you will need to configure the slave system to take over using the procedure given in Transferring control to the slave system on page 196.
Transferring control to the slave system

If the master system fails you need to use the following procedure to transfer control of the RTAs to the slave system:

1. On the slave system, from within the config.rio Main menu, click on Boot mode: > Boot all RTAs.

1. On the slave system, from within the config.rio Main menu, click on Reset host interconnections.

All RTAs and ports will be reset (this may take some time), and when complete will be accessible from the slave system.
Installing a dual host fail-safe link under SCO UnixWare

Installing for normal operation

To install a dual host fail-safe system for normal operation under SCO UnixWare proceed as follows:

1. Install the host cards and RIO drivers on both systems. See Installing a Universal 3.3/5V PCI host card on page 156, Installing an ISA host card on page 158 and Installing device drivers and utilities on page 78.
2. Install the RTAs you want onto master system only (no link connection to slave). See Installing Remote Terminal Adaptors (RTAs) on page 161.
3. On the master system, run the config.rio utility to add RTAs and port devices. See Configuring ports with config.rio on page 82, and Adding an RTA to the system on page 83.
4. Repeat step 3. for the slave system using an identical configuration to the master system.
5. For the slave system, from within the config.rio menu, click on Boot mode: > Boot no RTAs.
6. On the slave system, run the config.rio utility to create port devices.
7. Connect the RTAs to the slave system. See Installing Remote Terminal Adaptors (RTAs) on page 161.

You can now use your dual host fail-safe system, however the RTAs will only be booted or accessible from the master system.
Transferring control to the slave system

If the master system fails you need to use the following procedure to transfer control of the RTAs to the slave system.

1. On the slave system, from within the config.rio Main menu, click on Boot mode: > Boot all RTAs.
2. On the slave system, from within the config.rio Main menu, click on Reset host interconnections.

All RTAs and ports will be reset (this may take some time), and when complete will be accessible from the slave system.
Chapter 3 RIO Cabling information

You need to read this chapter if you want to... You need to read this chapter if you want cabling information for the Perle RIO serial connectivity system hardware.

This chapter provides cabling and connector pinout information for the Perle RIO system. Included are details of about which cables to use, their pinouts and details of standard cables for use with RIO products available from Perle.

This chapter includes the following sections;

• Mini DIN pinouts on RIO host cards on page 200
• RTA connector pinouts on page 201
• Connecting RIO host cards to RTAs on page 207
• Connecting RTAs to terminals on page 207
• Connecting RTAs to modems on page 208
• Connecting RTAs to parallel printers on page 209
• Connecting RTAs to serial printers on page 210
• Cable connector pinouts on page 211
• RIO cables available from Perle on page 219
• Fibre optic link (FOLK) cable specifications on page 221
• Loopback connector pinouts on page 222
Mini DIN pinouts on RIO host cards

The connector pinout for each mini DIN socket fitted to either RIO ISA or PCI host cards is as follows:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>VCC</td>
<td>Supply voltage</td>
</tr>
<tr>
<td>3</td>
<td>RXD-</td>
<td>Inverse RXD</td>
</tr>
<tr>
<td>4</td>
<td>TXD-</td>
<td>Inverse TXD</td>
</tr>
<tr>
<td>5</td>
<td>RXD+</td>
<td>Receive data</td>
</tr>
<tr>
<td>6</td>
<td>TXD+</td>
<td>Transmit data</td>
</tr>
</tbody>
</table>
Remote terminal adaptors RTAS are fitted with a number of different connector types as shown in the next table:

<table>
<thead>
<tr>
<th>RTA type</th>
<th>Cable description (RTA to Terminal)</th>
<th>To find details...</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA8/RJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA16/RJX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRC16/RJX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA8/DX</td>
<td>DB25 female</td>
<td>See page 203.</td>
</tr>
<tr>
<td>RTA8/D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA8/P ports 5, 6, 7 and 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA16/DX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA16/D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA8/MX</td>
<td>DB25 male</td>
<td>See page 205.</td>
</tr>
<tr>
<td>RTA8/M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTA8/P ports 2, 3 and 4</td>
<td>DB25 female</td>
<td>See page 203</td>
</tr>
<tr>
<td>RTA8/422</td>
<td>DB25 female</td>
<td>See page 204.</td>
</tr>
<tr>
<td>RTA8/P port1</td>
<td>DB25 parallel female</td>
<td>See page 206.</td>
</tr>
</tbody>
</table>
### RJ45 female RTA connector pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>2</td>
<td>DTR</td>
<td>Out</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>3</td>
<td>DSR</td>
<td>In</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>4</td>
<td>S/GND</td>
<td></td>
<td>Signal ground</td>
</tr>
<tr>
<td>5</td>
<td>TXD</td>
<td>Out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>6</td>
<td>RXD</td>
<td>In</td>
<td>Receive Data</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Out</td>
<td>Request To Send</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>In</td>
<td>Clear To Send</td>
</tr>
<tr>
<td></td>
<td>Shield</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### DB25 female RTA connector pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chassis</td>
<td>In</td>
<td>Chassis ground</td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>In</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>Out</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>In</td>
<td>Request To Send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>Out</td>
<td>Clear To Send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>Out</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>Out</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>In</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>22</td>
<td>RI</td>
<td>In</td>
<td>Ring Indicator</td>
</tr>
</tbody>
</table>
### RS422 DB25 female RTA connector pinout

#### Note

The pinout for cables connected to the RTA8/RS422 variant depends on the device being connected to. For further details refer to the documentation supplied with the product to be connected to.

Pin 1 (looking into connector)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CHASSIS</td>
<td>In</td>
<td>Chassis</td>
</tr>
<tr>
<td>2</td>
<td>RXD+</td>
<td>In</td>
<td>Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>TXD+</td>
<td>Out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td>RTS+</td>
<td>In</td>
<td>Receive Hardware Flow Control</td>
</tr>
<tr>
<td>5</td>
<td>CTS+</td>
<td>Out</td>
<td>Transmit Hardware Flow Control</td>
</tr>
<tr>
<td>6</td>
<td>DCD+</td>
<td>In</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>7</td>
<td>GROUND</td>
<td></td>
<td>Connects to logic 0V</td>
</tr>
<tr>
<td>8</td>
<td>DTR+</td>
<td>Out</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>10</td>
<td>DTR-</td>
<td>Out</td>
<td>Inverse DTR</td>
</tr>
<tr>
<td>13</td>
<td>CTS-</td>
<td>Out</td>
<td>Inverse CTS</td>
</tr>
<tr>
<td>14</td>
<td>RXD-</td>
<td>In</td>
<td>Inverse RXD</td>
</tr>
<tr>
<td>16</td>
<td>TXD-</td>
<td>Out</td>
<td>Inverse TXD</td>
</tr>
<tr>
<td>18</td>
<td>DCD-</td>
<td>In</td>
<td>Inverse DCD</td>
</tr>
<tr>
<td>19</td>
<td>RTS-</td>
<td>In</td>
<td>Inverse RTS</td>
</tr>
<tr>
<td>20</td>
<td>DSR+</td>
<td>In</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>21</td>
<td>RI-</td>
<td>In</td>
<td>Inverse Ring Indicator</td>
</tr>
<tr>
<td>22</td>
<td>RI+</td>
<td>In</td>
<td>Ring Indicator</td>
</tr>
<tr>
<td>23</td>
<td>DSR-</td>
<td>In</td>
<td>Inverse DSR</td>
</tr>
</tbody>
</table>
**DB25 male RTA connector pinout**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TXD</td>
<td>Out</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>In</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>Out</td>
<td>Request To Send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>In</td>
<td>Clear To Send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>In</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td></td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>Out</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>22</td>
<td>RI</td>
<td>In</td>
<td>Ring Indicator</td>
</tr>
</tbody>
</table>
### DB25 parallel female RTA connector pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>STROBEN*</td>
<td>Output</td>
<td>PSTROBE</td>
</tr>
<tr>
<td>2</td>
<td>D0</td>
<td>Output</td>
<td>DATA 1</td>
</tr>
<tr>
<td>3</td>
<td>D1</td>
<td>Output</td>
<td>DATA 2</td>
</tr>
<tr>
<td>4</td>
<td>D2</td>
<td>Output</td>
<td>DATA 3</td>
</tr>
<tr>
<td>5</td>
<td>D3</td>
<td>Output</td>
<td>DATA 4</td>
</tr>
<tr>
<td>6</td>
<td>D4</td>
<td>Output</td>
<td>DATA 5</td>
</tr>
<tr>
<td>7</td>
<td>D5</td>
<td>Output</td>
<td>DATA 6</td>
</tr>
<tr>
<td>8</td>
<td>D6</td>
<td>Output</td>
<td>DATA 7</td>
</tr>
<tr>
<td>9</td>
<td>D7</td>
<td>Output</td>
<td>DATA 8</td>
</tr>
<tr>
<td>10</td>
<td>PACKN*</td>
<td>Input</td>
<td>ACK</td>
</tr>
<tr>
<td>11</td>
<td>PBUSY</td>
<td>Input</td>
<td>BUSY</td>
</tr>
<tr>
<td>12</td>
<td>PPE</td>
<td>Input</td>
<td>PE</td>
</tr>
<tr>
<td>13</td>
<td>PSLCT</td>
<td>Input</td>
<td>SLCT</td>
</tr>
<tr>
<td>14</td>
<td>AUTOFDXT*</td>
<td>Output</td>
<td>AUTOFEED</td>
</tr>
<tr>
<td>15</td>
<td>PERRORN*</td>
<td>Input</td>
<td>FAULT</td>
</tr>
<tr>
<td>16</td>
<td>PINITN*</td>
<td>Output</td>
<td>INPUT PRIME</td>
</tr>
<tr>
<td>17</td>
<td>PSLINN*</td>
<td>Output</td>
<td>SLCT IN</td>
</tr>
<tr>
<td>18</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>19</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>20</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>21</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>22</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>23</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>24</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>25</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
</tbody>
</table>
### Connecting RIO host cards to RTAs

To connect a RIO host card to an RTA you use a RIO link cable. See [Link Cable](#) on page 219 and [Link cable specification](#) on page 220 for further details.

### Connecting RTAs to terminals

To connect your RTA to a terminal you use the cable types detailed in the next table:

<table>
<thead>
<tr>
<th>RTA type</th>
<th>Cable description (RTA to Terminal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA8/FLX</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
<tr>
<td>RTA8/RJ</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
<tr>
<td>RTA8/DX</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/D</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/MX</td>
<td>DB25 female to DB25 female DCE for connection to DTE devices on page 217</td>
</tr>
<tr>
<td>RTA8/M</td>
<td>DB25 female to DB25 female DCE for connection to DTE devices on page 217</td>
</tr>
<tr>
<td>RTA8/P ports 1</td>
<td>DB25 parallel male to centronics parallel on page 218</td>
</tr>
<tr>
<td>RTA8/P ports 2,3 and 4</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/P ports 5, 6, 7 and 8</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/422</td>
<td>The pinout for cables connected to the RTA8/RS422 variant depends on the device being connected to. For further details refer to the documentation supplied with the product to be connected to. For the pinout of the connector used on the RTA8/RS422, see <a href="#">RS422 DB25 female RTA connector pinout</a> on page 204</td>
</tr>
<tr>
<td>RTA16/FLX</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
<tr>
<td>RTA16/DX</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA16/D</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RRC16/FLX</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
</tbody>
</table>
# Connecting RTAs to modems

To connect your RTA to a modem you use the cable types detailed in the next table:

<table>
<thead>
<tr>
<th>RTA type</th>
<th>Cable description (RTA to modem)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA8/RJX</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
<tr>
<td>RTA8/RJ</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
<tr>
<td>RTA8/DX</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
<tr>
<td>RTA8/D</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
<tr>
<td>RTA8/MX</td>
<td>DB25 female to DB25 male DTE for connection to DCE devices</td>
<td>214</td>
</tr>
<tr>
<td>RTA8/M</td>
<td>DB25 female to DB25 male DTE for connection to DCE devices</td>
<td>214</td>
</tr>
<tr>
<td>RTA8/P port1</td>
<td>DB25 parallel male to centronics parallel</td>
<td>218</td>
</tr>
<tr>
<td>RTA8/P ports 2,3 and 4</td>
<td>DB25 male to DB25 male DTE for connection to DCE devices</td>
<td>213</td>
</tr>
<tr>
<td>RTA8/P ports 5, 6, 7 and 8</td>
<td>DB25 male to DB25 male DTE for connection to DCE devices</td>
<td>213</td>
</tr>
<tr>
<td>RTA8/422</td>
<td>The pinout for cables connected to the RTA8/RS422 variant depends on the device being connected to. For further details refer to the documentation supplied with the product to be connected to. For the pinout of the connector used on the RTA8/RS422, see RS422 DB25 female RTA connector pinout</td>
<td>204</td>
</tr>
<tr>
<td>RTA16/RJX</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
<tr>
<td>RTA16/DX</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
<tr>
<td>RTA16/D</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
<tr>
<td>RRC16/RJX</td>
<td>RJ45 male to DB25 male DTE for connection to DCE devices</td>
<td>212</td>
</tr>
</tbody>
</table>
Connecting RTAs to parallel printers

To connect your RTA to a parallel printer you use the cable types detailed in the next table:

<table>
<thead>
<tr>
<th>RTA type</th>
<th>Cable description (RTA to parallel printers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA8/PX</td>
<td>DB25 parallel male to centronics parallel on page 218</td>
</tr>
<tr>
<td>RTA8/P</td>
<td>DB25 parallel male to centronics parallel on page 218</td>
</tr>
</tbody>
</table>
## Connecting RTAs to serial printers

To connect your RTA to a serial printer you use the cable types detailed in the next table:

<table>
<thead>
<tr>
<th>RTA type</th>
<th>Cable description (RTA to Serial printer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA8/RJX</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
<tr>
<td>RTA8/RJ</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
<tr>
<td>RTA8/DX</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/D</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/MX</td>
<td>DB25 female to DB25 female DCE for connection to DTE devices on page 217</td>
</tr>
<tr>
<td>RTA8/M</td>
<td>DB25 female to DB25 female DCE for connection to DTE devices on page 217</td>
</tr>
<tr>
<td>RTA8/P port1</td>
<td>DB25 parallel male to centronics parallel on page 218</td>
</tr>
<tr>
<td>RTA8/P ports 2, 3 and 4</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/P ports 5, 6, 7 and 8</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA8/422</td>
<td>The pinout for cables connected to the RTA8/RS422 variant depends on the device being connected to. For further details refer to the documentation supplied with the product to be connected to. For the pinout of the connector used on the RTA8/RS422, see RS422 DB25 female RTA connector pinout on page 204</td>
</tr>
<tr>
<td>RTA16/RJX</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
<tr>
<td>RTA16/DX</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RTA16/D</td>
<td>DB25 male to DB25 female DCE for connection to DTE devices on page 216</td>
</tr>
<tr>
<td>RRC16/RJX</td>
<td>RJ45 male to DB25 female DCE for connection to DTE devices on page 215</td>
</tr>
</tbody>
</table>
Cable connector pinouts

This section includes the following:
- RJ45 male to DB25 male DTE for connection to DCE devices on page 212
- DB25 male to DB25 male DTE for connection to DCE devices on page 213
- DB25 female to DB25 male DTE for connection to DCE devices on page 214
- RJ45 male to DB25 female DCE for connection to DTE devices on page 215
- DB25 male to DB25 female DCE for connection to DTE devices on page 216
- DB25 female to DB25 female DCE for connection to DTE devices on page 217
- DB25 parallel male to centronics parallel on page 218.
RJ45 male to DB25 male DTE for connection to DCE devices

Typical uses
This type of cable is used to connect to DCE devices such as Modems.

Cable diagram

Connector pinout table

<table>
<thead>
<tr>
<th>RJ45 Pin</th>
<th>RJ45 Signal</th>
<th>RJ45 Direction</th>
<th>RJ45 Description</th>
<th>DB25 Pin</th>
<th>DB25 Signal</th>
<th>DB25 Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
<td>8</td>
<td>DCD</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>2</td>
<td>DTR</td>
<td>Out</td>
<td>Data Terminal Ready</td>
<td>20</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>3</td>
<td>DSR</td>
<td>In</td>
<td>Data Set Ready</td>
<td>6</td>
<td>DSR</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td></td>
<td>Signal ground</td>
<td>7</td>
<td>GND</td>
<td>Signal ground</td>
</tr>
<tr>
<td>5</td>
<td>TXD</td>
<td>Out</td>
<td>Transmit Data</td>
<td>2</td>
<td>TXD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>6</td>
<td>RXD</td>
<td>In</td>
<td>Receive Data</td>
<td>3</td>
<td>RXD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Out</td>
<td>Request To Send</td>
<td>4</td>
<td>RTS</td>
<td>Request To Send</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>In</td>
<td>Clear To Send</td>
<td>5</td>
<td>CTS</td>
<td>Clear To Send</td>
</tr>
<tr>
<td>Shield</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Chassis ground</td>
</tr>
</tbody>
</table>
DB25 male to DB25 male DTE for connection to DCE devices

Typical uses
This type of cable is used to connect to DCE devices such as Modems.

Cable diagram

Connector pinout table

<table>
<thead>
<tr>
<th>DB25 Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
<th>DB25 Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chassis</td>
<td></td>
<td>Chassis ground</td>
<td>1</td>
<td>Chassis</td>
<td>Chassis ground</td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>In</td>
<td>Transmit Data</td>
<td>3</td>
<td>RXD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>Out</td>
<td>Receive Data</td>
<td>2</td>
<td>TXD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>In</td>
<td>Request To Send</td>
<td>5</td>
<td>CTS</td>
<td>Clear To Send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>Out</td>
<td>Clear To Send</td>
<td>4</td>
<td>RTS</td>
<td>Request To Send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>Out</td>
<td>Data Set Ready</td>
<td>20</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td></td>
<td>Ground</td>
<td>7</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
<td>8</td>
<td>DCD</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>In</td>
<td>Data Terminal Ready</td>
<td>6</td>
<td>DSR</td>
<td>Data Set Ready</td>
</tr>
</tbody>
</table>
DB25 female to DB25 male DTE for connection to DCE devices

**Typical uses**
This type of cable is used to connect to DCE devices such as Modems.

**Cable diagram**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TXD</td>
<td>Out</td>
<td>Transmit Data</td>
<td>2</td>
<td>TXD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>In</td>
<td>Receive Data</td>
<td>3</td>
<td>RXD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>Out</td>
<td>Ready to send</td>
<td>4</td>
<td>RTS</td>
<td>Ready to send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>In</td>
<td>Clear to send</td>
<td>5</td>
<td>CTS</td>
<td>Clear to send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>In</td>
<td>Data Set Ready</td>
<td>6</td>
<td>DSR</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td></td>
<td>Ground</td>
<td>7</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
<td>8</td>
<td>DCD</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>Out</td>
<td>Data Terminal Ready</td>
<td>20</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
</tbody>
</table>
RJ45 male to DB25 female DCE for connection to DTE devices

**Typical uses**

This type of cable is used to connect to DTE devices such as Terminals, PCs or printers.

**Cable diagram**

**Connector pinout table**

<table>
<thead>
<tr>
<th>RJ45 Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
<th>DB25 Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
<td>8</td>
<td>DCD</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>2</td>
<td>DTR</td>
<td>Out</td>
<td>Data Terminal Ready</td>
<td>6</td>
<td>DSR</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>3</td>
<td>DSR</td>
<td>In</td>
<td>Data Set Ready</td>
<td>20</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>4</td>
<td>S/GND</td>
<td>Signal ground</td>
<td></td>
<td>7</td>
<td>S/GND</td>
<td>Signal ground</td>
</tr>
<tr>
<td>5</td>
<td>TXD</td>
<td>Out</td>
<td>Transmit Data</td>
<td>3</td>
<td>RXD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>6</td>
<td>RXD</td>
<td>In</td>
<td>Receive Data</td>
<td>2</td>
<td>TXD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Out</td>
<td>Request To Send</td>
<td>5</td>
<td>CTS</td>
<td>Clear To Send</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>In</td>
<td>Clear To Send</td>
<td>4</td>
<td>RTS</td>
<td>Request To Send</td>
</tr>
<tr>
<td>Shield</td>
<td></td>
<td></td>
<td>Chassis ground</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**DB25 male to DB25 female DCE for connection to DTE devices**

**Typical uses**
This type of cable is used to connect to DTE devices such as Terminals, PCs or printers.

**Cable diagram**

**Connector pinout table**

<table>
<thead>
<tr>
<th>DB25 Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
<th>DB25 Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TXD</td>
<td>In</td>
<td>Transmit Data</td>
<td>2</td>
<td>TXD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>Out</td>
<td>Receive Data</td>
<td>3</td>
<td>RXD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>In</td>
<td>Request To Send</td>
<td>4</td>
<td>RTS</td>
<td>Request To Send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>Out</td>
<td>Clear To Send</td>
<td>5</td>
<td>CTS</td>
<td>Clear To Send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>Out</td>
<td>Data Set Ready</td>
<td>6</td>
<td>DSR</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td></td>
<td>Ground</td>
<td>7</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
<td>8</td>
<td>DCD</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>In</td>
<td>Data Terminal Ready</td>
<td>20</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
</tbody>
</table>
DB25 female to DB25 female DCE for connection to DTE devices

Typical uses
This type of cable is used to connect to DTE devices such as Terminals, PCs or printers.

Cable diagram

Connector pinout table

<table>
<thead>
<tr>
<th>DB25 Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
<th>DB25 Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TXD</td>
<td>Out</td>
<td>Receive Data</td>
<td>3</td>
<td>RXD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>In</td>
<td>Transmit Data</td>
<td>2</td>
<td>TXD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>Out</td>
<td>Request To Send</td>
<td>5</td>
<td>CTS</td>
<td>Clear To Send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>In</td>
<td>Clear To Send</td>
<td>4</td>
<td>RTS</td>
<td>Request To Send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>In</td>
<td>Data Set Ready</td>
<td>20</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>Ground</td>
<td></td>
<td>7</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>DCD</td>
<td>In</td>
<td>Data Carrier Detect</td>
<td>8</td>
<td>DCD</td>
<td>Data Carrier Detect</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>Out</td>
<td>Data Terminal Ready</td>
<td>6</td>
<td>DSR</td>
<td>Data Set Ready</td>
</tr>
</tbody>
</table>
**DB25 parallel male to centronics parallel**

**Note**
The following pinout is included for information only and shows the DB25 pinout only. If you require this type of cable, we recommend obtaining a suitable standard PC parallel printer cable rather than making one.

* Denotes active low.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>STROBEN*</td>
<td>Output</td>
<td>PSTROBE</td>
</tr>
<tr>
<td>2</td>
<td>D0</td>
<td>Output</td>
<td>DATA 1</td>
</tr>
<tr>
<td>3</td>
<td>D1</td>
<td>Output</td>
<td>DATA 2</td>
</tr>
<tr>
<td>4</td>
<td>D2</td>
<td>Output</td>
<td>DATA 3</td>
</tr>
<tr>
<td>5</td>
<td>D3</td>
<td>Output</td>
<td>DATA 4</td>
</tr>
<tr>
<td>6</td>
<td>D4</td>
<td>Output</td>
<td>DATA 5</td>
</tr>
<tr>
<td>7</td>
<td>D5</td>
<td>Output</td>
<td>DATA 6</td>
</tr>
<tr>
<td>8</td>
<td>D6</td>
<td>Output</td>
<td>DATA 7</td>
</tr>
<tr>
<td>9</td>
<td>D7</td>
<td>Output</td>
<td>DATA 8</td>
</tr>
<tr>
<td>10</td>
<td>PACKN*</td>
<td>Input</td>
<td>ACK</td>
</tr>
<tr>
<td>11</td>
<td>PBUSY</td>
<td>Input</td>
<td>BUSY</td>
</tr>
<tr>
<td>12</td>
<td>PRE</td>
<td>Input</td>
<td>PE</td>
</tr>
<tr>
<td>13</td>
<td>PSLCT</td>
<td>Input</td>
<td>SLCT</td>
</tr>
<tr>
<td>14</td>
<td>AUTOFDXT*</td>
<td>Output</td>
<td>AUTOFEED</td>
</tr>
<tr>
<td>15</td>
<td>PERRORN*</td>
<td>Input</td>
<td>FAULT</td>
</tr>
<tr>
<td>16</td>
<td>PININ*</td>
<td>Output</td>
<td>INPUT PRIME</td>
</tr>
<tr>
<td>17</td>
<td>PSLINN*</td>
<td>Output</td>
<td>SLCT IN</td>
</tr>
<tr>
<td>18</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>19</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>20</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>21</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>22</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>23</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>24</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
<tr>
<td>25</td>
<td>GND</td>
<td>—</td>
<td>GROUND</td>
</tr>
</tbody>
</table>
**RIO cables available from Perle**

**Link Cable**

Perle supply a range of standard link cables for RIO of varying lengths all of which use 6-way mini DIN plugs. See Cable diagram on page 219 and Connector pinout table on page 219 for general information about Perle RIO link cables.

**Cable diagram**

![Cable diagram](image)

**Connector pinout table**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Ground</td>
<td>1</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>VCC</td>
<td>Supply Voltage</td>
<td>2</td>
<td>VCC</td>
<td>Supply Voltage</td>
</tr>
<tr>
<td>3</td>
<td>RXD-</td>
<td>Inverse RXD</td>
<td>4</td>
<td>TXD-</td>
<td>Inverse TXD</td>
</tr>
<tr>
<td>4</td>
<td>TXD-</td>
<td>Inverse TXD</td>
<td>3</td>
<td>RXD-</td>
<td>Inverse RXD</td>
</tr>
<tr>
<td>5</td>
<td>RXD+</td>
<td>Receive Data</td>
<td>6</td>
<td>TXD+</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>6</td>
<td>TXD+</td>
<td>Transmit Data</td>
<td>5</td>
<td>RXD+</td>
<td>Receive Data</td>
</tr>
</tbody>
</table>

**Note**

Wires 3 and 4, and 5 and 6, must be twisted together. For high noise and/or ground potential differences we recommend the Fibre-optic module.
**Link cable specification**

RIO link cables should conform to the following specification:

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>7/0.2 minimum</td>
</tr>
<tr>
<td>Type</td>
<td>Two individually screened twisted pairs with drain and overall screen, sheathed over all in grey PVC (or PTFE). The screen is aluminised polyester tape. The drain wire is tinned. For particularly noisy environments and distances greater than 5 metres we recommend an additional overall braid screen</td>
</tr>
<tr>
<td>Length</td>
<td>5.0 metres maximum</td>
</tr>
<tr>
<td>Noise</td>
<td>The receiver does not require a differential input voltage more than 200mV to correctly assume the binary state over an entire common-mode voltage range of -7V to +7V. Thus, noise must not reach more than +/-7V.</td>
</tr>
<tr>
<td>Nominal Impedance</td>
<td>100 Ohms</td>
</tr>
<tr>
<td>Ground Potential</td>
<td>The maximum voltage between either receiver input and receive ground must not exceed 8V (80% - 3V signal + 7V common mode voltage) in magnitude. Thus excessive differences in 0V between communication devices (systems) are unacceptable. Typical causes are insufficient mains earthing, heavily laden mains, or heavily laden PC slots</td>
</tr>
</tbody>
</table>
You can use a Fibre optic link (FOLK) cable in place of a normal RIO link cable with the RIO system when you want to make long distance connections up to 1 kilometre. This approach is especially useful in a high noise environment such as a machine shop where electromagnetic interference is a problem.

Perle does not supply fibre optic cables for this product. All Fibre-optic cable must conform to the following specification;

Note
When using fibre cables all manufacturers installation advice and specifications should be followed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibre type</td>
<td>62.5 μm or 125 μm multimode silica graded index fibre (= 62.5μm core diameter, 125 μm cladding inside 250 μm buffer).</td>
</tr>
<tr>
<td>Cable type</td>
<td>Tight buffered or jacketed.</td>
</tr>
<tr>
<td>Fibres</td>
<td>Duplex, 4 core, or similar, as required by installation (2 fibres are used by each fibre-optic link). Each core sub-jacketed, individually coloured.</td>
</tr>
<tr>
<td>Connectors</td>
<td>ST-type connector.</td>
</tr>
<tr>
<td>Strength member</td>
<td>Aramid strength suitable for installation procedure.</td>
</tr>
<tr>
<td>Numerical aperture</td>
<td>0.27 - 0.3 (0.275 will be typical of most fibres)</td>
</tr>
<tr>
<td>Attenuation</td>
<td>6dB/km maximum at 820nm (4dB will be typical of most fibres)</td>
</tr>
<tr>
<td>Cable Jacketing</td>
<td>General</td>
</tr>
<tr>
<td></td>
<td>Normal indoor cable requires installation in conduit or cable trays. In other situations, crush-resistant cables may be required to withstand handling and environment.</td>
</tr>
<tr>
<td></td>
<td>Smoke vulnerable applications</td>
</tr>
<tr>
<td></td>
<td>Underground applications</td>
</tr>
<tr>
<td></td>
<td>Moisture vulnerable applications</td>
</tr>
<tr>
<td></td>
<td>Aerial (pole) applications</td>
</tr>
</tbody>
</table>
Loopback connector pinouts

The type of loopback connector you require depends upon the connector type fitted to your Remote Terminal Adaptor (described in RTA connector pinouts on page 201). See one of the following sections for pinouts:

- Loopback pinouts for RJ45 female connectors on page 223
- Loopback pinouts for DB25 female connectors on page 224
- Loopback pinouts for DB25 male connectors on page 225.

For details of loopback and other tests see Appendix C Troubleshooting.
Loopback pinouts for RJ45 female connectors

To test this type of port, your loopback connector needs to join together the connector pins shown in the next picture.

- 1 DCD
- 2 DTR
- 3 DSR
- 4 TXD
- 5 RXD
- 6 RTS
- 7 CTS

For details of RJ45 female connector pinouts see page 202.
Loopback pinouts for DB25 female connectors

To test this type of port, your loopback connector needs to join together the connector pins shown in the next picture.

- 3 TXD
- 2 RXD
- 5 RTS
- 4 CTS
- 6 DSR
- 8 DCD
- 20 DTR
- 22 RI

For details of DB25 female connector pinouts see page 203.
Loopback pinouts for DB25 male connectors

To test this type of port, your loopback connector needs to join together the connector pins shown in the next picture.

For details of DB25 male connector pinouts see page 205.
Chapter 4 Quick Reference

You need to read this chapter if you want information in quick reference form about the utilities provided with the RIO serial connectivity system.

This chapter provides a quick reference guide to the software utilities provided with the RIO serial connectivity system. The utilities are grouped under operating system and include main windows and menus. In addition, cross references are provided for further information about each area.

The following sections are included:

• SCO OpenServer 5 utilities on page 227
• SCO UnixWare utilities on page 233
• Window NT utilities on page 242.
config.rio

Under the SCO OpenServer 5 operating system, RIO includes an application for configuring ports called config.rio. Config.rio provides a real time map of your system showing the Remote Terminal Adaptors, link cables and host cards and so forth that make up your system.

Main window

- Host card. Highlight a host card icon and press the Enter key to display the Host Configuration menu. See page 232.

- Link cable. Click here or type M to display Main Menu. See page 228.

- Remote Terminal Adaptor (RTA). Highlight an RTA icon and press the Enter key to display the RTA Management Menu. See page 232.

See the following sections for details of config.rio menus:
- Main menu on page 228
- RTA Management menu on page 229
- Host Configuration menu on page 232
### Main menu

For information on displaying this menu, see Main window on page 227

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Hosts</td>
<td>Selects the host card whose configuration map you want to display. Use this when you have multiple host cards installed in your machine. See also page 64.</td>
</tr>
<tr>
<td>Delete an RTA</td>
<td>Removes the currently selected RTA from the system. See also page 69.</td>
</tr>
<tr>
<td>View / edit default values</td>
<td>Changes the default settings of a port. Default settings are used when an RTA is added to your system.</td>
</tr>
<tr>
<td>Change all TTYS to default values</td>
<td>Change all port configuration values back to their default settings.</td>
</tr>
<tr>
<td>Write RTA into file</td>
<td>Allows you to save the current RTA configuration settings as an ASCII text file. You can find the file in /etc/rio/rta_info.</td>
</tr>
<tr>
<td>Identify RTAs</td>
<td>Allows you to identify each RTA in your system by flashing the LEDs on all RTAs in a different pattern for each unit.</td>
</tr>
<tr>
<td>Reset host interconnections</td>
<td>Re-acquires RTAs in a dual host failsafe system. Use this option to reset the RTAs following the failure of one of the hosts.</td>
</tr>
<tr>
<td>Update configuration file</td>
<td>Updates your system configuration file with the latest settings without having to quit config.rio.</td>
</tr>
<tr>
<td>Boot mode:</td>
<td>&gt; Bootstrap all RTAs</td>
</tr>
<tr>
<td></td>
<td>&gt; Bootstrap owned RTAs</td>
</tr>
<tr>
<td></td>
<td>&gt; Bootstrap no RTAs</td>
</tr>
<tr>
<td></td>
<td>Allows you to select which RTAs in your system are bootstrapped on startup when using a dual host failsafe configuration.</td>
</tr>
</tbody>
</table>
## RTA Management menu

For information on displaying this menu, see [Main window](#) on page 227.

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>View RTA settings</td>
<td>Displays the configuration of the currently selected RTA. See also page 65.</td>
</tr>
<tr>
<td>Configure RTA</td>
<td>Allows you to configure TTYs and give a name to the currently selected RTA. See also page 65.</td>
</tr>
<tr>
<td>Menu option</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>View / edit TTY</td>
<td>Note this option is only displayed after the selected RTA has been configured.</td>
</tr>
<tr>
<td>Enabled? &gt;</td>
<td>TTY enabled</td>
</tr>
<tr>
<td></td>
<td>Modem enabled</td>
</tr>
<tr>
<td></td>
<td>Both disabled</td>
</tr>
<tr>
<td>Getty entry</td>
<td>Selects the default getty entry in the tty configuration. See also page 72.</td>
</tr>
<tr>
<td>TTY type</td>
<td>Selects the type of terminal connected to the current selected port.</td>
</tr>
<tr>
<td>Chars/sec</td>
<td>Sets the transparent print speed.</td>
</tr>
<tr>
<td>Force ixon</td>
<td>Forces software flow control on a port when enabled.</td>
</tr>
<tr>
<td>Force -ixany</td>
<td>Some applications enable the stty ixany feature which allows any character to be accepted as an xon to the port. By default, the RIO driver prevents the use of ixany (that is, it sets the -ixany flag), and this parameter is set to Yes. To use ixany, set this field to No.</td>
</tr>
<tr>
<td>Lock settings</td>
<td>Allows you to prevent the hardware characteristics of a port being changed. It also saves the port settings across closes (but not across reboots).</td>
</tr>
</tbody>
</table>
### Menu option

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>View / edit TTY &gt; (continued)</td>
<td>Note this option is only displayed after the selected RTA has been configured.</td>
</tr>
<tr>
<td>Store settings</td>
<td>Maintains the hardware characteristics of the line across port closes and reboots when enabled. Default value is No (don’t store settings).</td>
</tr>
<tr>
<td>Drain settings</td>
<td>Forces a port to wait until all data has been drained before closing when enabled. When using this setting beware that a process may appear to be hung while it is waiting for all the data to be output before the close.</td>
</tr>
<tr>
<td>Resume output</td>
<td>Resumes output on a device that has hung.</td>
</tr>
<tr>
<td>Show port settings</td>
<td>Displays the stty and special RIO attributes set on the currently selected port.</td>
</tr>
<tr>
<td>Show modem pin settings</td>
<td>Displays the status of the modem pins on the selected port.</td>
</tr>
<tr>
<td>Port diagnostics</td>
<td>Runs the port diagnostics facility and displays the port diagnostics window. See also page 279.</td>
</tr>
<tr>
<td>Port statistics &gt; Gather port statistics</td>
<td>Gathers statistics on the selected ports. See also page 279.</td>
</tr>
<tr>
<td>Port statistics &gt; Reset port statistics</td>
<td>Resets the ports statistics counts. See also page 279.</td>
</tr>
<tr>
<td>Port statistics &gt; Show port statistics</td>
<td>Displays statistics for the currently selected ports. See also page 279.</td>
</tr>
<tr>
<td>Edit ID Name</td>
<td>Allows you to change the host ID name.</td>
</tr>
<tr>
<td>Re-boot RTA</td>
<td>Reboots the selected RTA.</td>
</tr>
<tr>
<td>Zombie RTA</td>
<td>Isolates an RTA from the system without physically disconnecting it. Once this option has been performed on an RTA it will need to be re-booted before it can be used again.</td>
</tr>
<tr>
<td>Identify RTA</td>
<td>Flashes the LEDs on the selected RTA in a unique pattern to allow identification.</td>
</tr>
<tr>
<td>Menu option</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>RTA bound to host &gt;</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Allows the selected RTA to be booted along with the rest of the RIO system for a given host card.</td>
</tr>
<tr>
<td>No</td>
<td>Excludes the selected RTA from being booted along with the rest of the RIO system for a given host card.</td>
</tr>
</tbody>
</table>

**Host Configuration menu**

For information on displaying this menu, see **Main window** on page 227

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>View Host card settings</td>
<td>Displays the current connections to the host card.</td>
</tr>
<tr>
<td>Edit ID Name</td>
<td>Allows you to edit the host card name.</td>
</tr>
</tbody>
</table>
**SCO UnixWare utilities**

**Device configuration utility**

The main window for the Device Configuration Utility is shown in the next picture.

The menu is as follows:

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Device Configuration</td>
<td>Displays the Hardware Device Configuration window which allows you to set host card addresses and IRQ levels. See page 76.</td>
</tr>
<tr>
<td>Software Device Drivers</td>
<td>Displays the Software Device Drivers window which allows you to select a software device driver type to display. See page 76.</td>
</tr>
<tr>
<td>Apply Changes &amp; Exit DCU</td>
<td>Apply configuration changes and exit the Hardware Device Configuration Utility. See page 76.</td>
</tr>
<tr>
<td>Exit DCU and Cancel Changes</td>
<td>Exit the Hardware Device Configuration Utility and cancel any changes. See page 76.</td>
</tr>
</tbody>
</table>
Under the SCO UnixWare operating system, RIO includes an application for configuring ports called **config.rio**. Config.rio provides a real-time map of your system showing the Remote Terminal Adaptors, link cables and host cards and so forth that make up your system.

Main window

Click here or type M to display **Main Menu**. See page 235.

Host card. Highlight a host card icon and press the **Enter** key to display the **Host Configuration menu**. See page 239.

Remote Terminal Adaptor (RTA). Highlight an RTA icon and press the **Enter** key to display the **RTA Management Menu**. See page 239.

See the following sections for details of config.rio menus;
- **Main menu** on page 235
- **RTA Management menu** on page 237
- **Host Configuration menu** on page 239
Main menu

For information on displaying this menu, see **Main window** on page 234

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Hosts</td>
<td>Selects the host card whose configuration map you want to display. Use this when you have multiple host cards installed in your machine. See also page 82.</td>
</tr>
<tr>
<td>Delete an RTA</td>
<td>Removes the currently selected RTA from the system. See also page 86.</td>
</tr>
<tr>
<td>View / edit default values</td>
<td>Changes the default settings of a port. Default settings are used when an RTA is added to your system.</td>
</tr>
<tr>
<td>Change all TTYS to default values</td>
<td>Change all port configuration values back to their default settings.</td>
</tr>
<tr>
<td>Write RTA into file</td>
<td>Allows you to save the current RTA configuration settings as an ASCII text file. You can find the file in <code>/etc/rio/rta_info</code>.</td>
</tr>
<tr>
<td>Identify RTAs</td>
<td>Allows you to identify each RTA in your system by flashing the LEDs on all RTAs in a different pattern for each unit.</td>
</tr>
<tr>
<td>Reset host interconnections</td>
<td>Re-acquires RTAs in a dual host failsafe system. Use this option to reset the RTAs following the failure of one of the hosts.</td>
</tr>
<tr>
<td>Update configuration file</td>
<td>Updates your system configuration file with the latest settings without having to quit config.rio.</td>
</tr>
</tbody>
</table>
### Menu option

<table>
<thead>
<tr>
<th>Boot mode:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; Boot all RTAs</td>
<td>Allows you to select which RTAs in your system are booted on startup when using a dual host failsafe configuration.</td>
</tr>
<tr>
<td>Boot owned RTAs</td>
<td></td>
</tr>
<tr>
<td>Boot no RTAs</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Create Port Monitor Entries</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Port Monitor Entries</td>
<td>Allows you to copy riomon entries when adding ports to monitors.</td>
</tr>
</tbody>
</table>
## RTA Management menu

For information on displaying this menu, see **Main window** on page 234

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>View RTA settings</td>
<td>Displays the configuration of the currently selected RTA. See also page 83.</td>
</tr>
<tr>
<td>Configure RTA</td>
<td>Allows you to configure TTYs and give a name to the currently selected RTA. See also page 83.</td>
</tr>
<tr>
<td>View / edit TTY &gt;</td>
<td>Note this option is only displayed after the selected RTA has been configured.</td>
</tr>
<tr>
<td>TTY type</td>
<td>Selects the type of terminal connected to the current selected port.</td>
</tr>
<tr>
<td>Chars/sec</td>
<td>Sets the transparent print speed.</td>
</tr>
<tr>
<td>Force ixon</td>
<td>Forces software flow control on a port when enabled.</td>
</tr>
<tr>
<td>Force -ixany</td>
<td>Some applications enable the <em>stty</em> <code>ixany</code> feature which allows any character to be accepted as an <code>xon</code> to the port. By default, the RIO driver prevents the use of <code>ixany</code> (that is, it sets the <code>-ixany</code> flag), and this parameter is set to <code>Yes</code>. To use <code>ixany</code>, set this field to <code>No</code>.</td>
</tr>
<tr>
<td>Lock settings</td>
<td>Allows you to prevent the hardware characteristics of a port being changed. It also saves the port settings across closes (but not across reboots).</td>
</tr>
</tbody>
</table>
### Menu option

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>View / edit TTY &gt; (continued)</strong>  Note this option is only displayed after the selected RTA has been configured.</td>
</tr>
<tr>
<td><strong>Store settings</strong></td>
</tr>
<tr>
<td>Maintains the hardware characteristics of the line across port closes and reboots when enabled. Default value is No (don’t store settings).</td>
</tr>
<tr>
<td><strong>Drain settings</strong></td>
</tr>
<tr>
<td>Forces a port to wait until all data has been drained before closing when enabled. When using this setting beware that a process may appear to be hung while it is waiting for all the data to be output before the close.</td>
</tr>
<tr>
<td><strong>Resume output</strong></td>
</tr>
<tr>
<td>Resumes output on a device that has been flow controlled.</td>
</tr>
<tr>
<td><strong>Show port settings</strong></td>
</tr>
<tr>
<td>Displays the tty and special RIO attributes set on the currently selected port.</td>
</tr>
<tr>
<td><strong>Show modem pin settings</strong></td>
</tr>
<tr>
<td>Displays the status of the modem pins on the selected port.</td>
</tr>
<tr>
<td><strong>Port diagnostics</strong></td>
</tr>
<tr>
<td>Runs the port diagnostics facility and displays the port diagnostics window. See also page 290.</td>
</tr>
<tr>
<td><strong>Gather port statistics</strong></td>
</tr>
<tr>
<td>gathers statistics on the selected ports. See also page 299.</td>
</tr>
<tr>
<td><strong>Reset port statistics</strong></td>
</tr>
<tr>
<td>Resets the ports statistics counts. See also page 299.</td>
</tr>
<tr>
<td><strong>Show port statistics</strong></td>
</tr>
<tr>
<td>Displays statistics for the currently selected ports. See also page 299.</td>
</tr>
<tr>
<td><strong>Edit ID Name</strong></td>
</tr>
<tr>
<td>Allows you to change the host ID name.</td>
</tr>
<tr>
<td><strong>Re-boot RTA</strong></td>
</tr>
<tr>
<td>Reboots the selected RTA.</td>
</tr>
<tr>
<td><strong>Zombie RTA</strong></td>
</tr>
<tr>
<td>Isolates an RTA from the system without physically disconnecting it. Once this option has been performed on an RTA it will need to be re-booted before it can be used again.</td>
</tr>
<tr>
<td><strong>Identify RTA</strong></td>
</tr>
<tr>
<td>Flashes the LEDs on the selected RTA in a unique pattern to allow identification.</td>
</tr>
</tbody>
</table>
### Menu option

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
</table>
| RTA bound to host | **Yes** - Allows the selected RTA to be booted along with the rest of the RIO system for a given host card.  
**No** - Excludes the selected RTA from being booted along with the rest of the RIO system for a given host card. |

---

**Host Configuration menu**

For information on displaying this menu, see Main window on page 227

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>View Host card settings</td>
<td>Displays the current connections to the host card.</td>
</tr>
<tr>
<td>Edit ID Name</td>
<td>Allows you to edit the host card name.</td>
</tr>
</tbody>
</table>
**spxadmport utility for configuring ports**

`spxadmport` is provided to simplify the process of creating port logins on RIO ports. You can use it in place of the `sacadm` and `pmadm` commands. You do this by typing a single line command which contains the information required for a given configuration task using the following syntax:

**Syntax**

```
/etc/spxadmport command svctag [label] [owner] where:
```

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>command</td>
<td>add, enable, disable, remove or list.</td>
<td>remove</td>
</tr>
<tr>
<td>svctag</td>
<td>device number from /dev/term.</td>
<td>r01</td>
</tr>
<tr>
<td>label</td>
<td>/etc/ttydefs entry (optional)</td>
<td>9600</td>
</tr>
<tr>
<td>owner</td>
<td>user ID assigned to the port (optional)</td>
<td>root</td>
</tr>
</tbody>
</table>

**Procedure**

To use the `spxadmport` script to configure your RIO serial ports proceed as follows:

1. At the command prompt, type one of the commands detailed in the next table using the syntax `/etc/spxadmport [command] [svctag] [label] [owner]`

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Example command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td>Adds a serial port to the service monitor (riomon) and enables the port for monitoring logins.</td>
<td><code>/etc/spxadmport add r001 9600 root</code></td>
</tr>
<tr>
<td>Enable</td>
<td>Enables a previously disabled port for monitoring.</td>
<td><code>/etc/spxadmport enable</code></td>
</tr>
<tr>
<td>Disable</td>
<td>Disables a port. Has the effect of disabling all further logins on this port.</td>
<td><code>/etc/spxadmport disable r001</code></td>
</tr>
<tr>
<td>Remove</td>
<td>Removes the selected serial port from the service monitor (riomon).</td>
<td><code>/etc/spxadmport remove r001</code></td>
</tr>
<tr>
<td>List</td>
<td>Lists the currently defined services and/or port monitors.</td>
<td><code>/etc/spxadmport list</code></td>
</tr>
<tr>
<td>List p</td>
<td>Lists all logins configured.</td>
<td><code>/etc/spxadmport list p</code></td>
</tr>
<tr>
<td>List s</td>
<td>Lists all port services configured.</td>
<td><code>/etc/spxadmport list s</code></td>
</tr>
</tbody>
</table>

2. Press the Enter key.

The revised RIO port configuration is now adopted by the system.
**Window NT utilities**

**RIO Configuration utility**

The RIO Configuration utility is provided for use with the Windows NT operating system. See the following sections for information about main windows and menus:

- **Main window** on page 242
- **Menu map and toolbar buttons** on page 243.

**Main window**

The main window for the RIO Configuration tool is shown in the next picture. See page 243 for details of menus.
The RIO Configuration tool menu is as follows:

<table>
<thead>
<tr>
<th>Menu option</th>
<th>Toolbar icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>File &gt;</td>
<td>Print</td>
<td>Prints a copy of the system map. See page 103</td>
</tr>
<tr>
<td></td>
<td>Print Preview</td>
<td>Displays the print preview for printing using the Print menu option.</td>
</tr>
<tr>
<td></td>
<td>Print Setup</td>
<td>Displays the printer setup window.</td>
</tr>
<tr>
<td></td>
<td>Exit</td>
<td>Exits from the RIO Configuration utility.</td>
</tr>
<tr>
<td>View &gt;</td>
<td>Toolbar</td>
<td>Displays or hides the toolbar on the RIO Configuration window.</td>
</tr>
<tr>
<td></td>
<td>Status bar</td>
<td>Displays or hides the status bar on the RIO Configuration window.</td>
</tr>
<tr>
<td>Preferences &gt;</td>
<td>Default</td>
<td>Sets the default values for the RIO Configuration utility. See page 99.</td>
</tr>
<tr>
<td>Commands &gt;</td>
<td>Configure</td>
<td>Displays the window for configuring an RTA. See page 99.</td>
</tr>
<tr>
<td></td>
<td>Zombie</td>
<td>Disconnects an RTA from the system without physically unplugging it (known as zombieing). See page 108.</td>
</tr>
<tr>
<td></td>
<td>Reboot</td>
<td>Re-boots the selected RTA through the Configuration Utility, without going to the RTA unit. See page 109.</td>
</tr>
<tr>
<td></td>
<td>Identify</td>
<td>Displays the identity of an RTA on the system map. See page 104.</td>
</tr>
<tr>
<td></td>
<td>Stop identify</td>
<td>Disables the identify feature. See page 104.</td>
</tr>
<tr>
<td></td>
<td>Remove</td>
<td>Removes the selected RTA from the system. See page 108.</td>
</tr>
<tr>
<td></td>
<td>Add ISA host card</td>
<td>Displays the window for configuring an ISA host card prior to actual installation. See page 95.</td>
</tr>
<tr>
<td>Menu option</td>
<td>Toolbar icon</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Windows</td>
<td>Cascade</td>
<td>Tiles or cascades the display of RIO Configuration windows as required.</td>
</tr>
<tr>
<td></td>
<td>Tile Vertically</td>
<td>Displays a summary of configuration settings for each port. See page 105.</td>
</tr>
<tr>
<td></td>
<td>Tile Horizontally</td>
<td>Displays the available help information.</td>
</tr>
<tr>
<td>Help</td>
<td>&gt;</td>
<td>Displays the available help information.</td>
</tr>
</tbody>
</table>
Chapter 5  RIO command line utilities

You need to read this chapter if you want information in quick reference form about the utilities provided with the RIO serial connectivity system.

This chapter provides a quick reference guide to the command line utilities, system commands and rio.cf file provided with the RIO system.

This chapter includes the following sections:

• Command line utilities on page 246
• RIO system commands under Solaris/Linux/LynxOS on page 248
• rio.cf file on page 260
Command line utilities

This section includes the following:

- riosacfg utility on page 246
- rioconfig utility on page 247
- RIO system commands under Solaris/Linux/LynxOS on page 248

riosacfg utility

Operating systems Available under: Solaris.

The riosacfg utility allows you to define addresses and IRQ levels for RIO host cards you add to the system. The command syntax for this utility is as follows:

riosacfg [-n <name>] [-m <addr>] [-i <irq>] [-p] [-a <ioaddr>] [-d <name>]

Where:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-n &lt;name&gt;</td>
<td>Specifies the host card name</td>
</tr>
<tr>
<td>-m &lt;addr&gt;</td>
<td>Specifies host card memory address</td>
</tr>
<tr>
<td>-i &lt;irq&gt;</td>
<td>Specifies host card interrupt level</td>
</tr>
<tr>
<td>-p</td>
<td>Toggles the state of polling</td>
</tr>
<tr>
<td>-a &lt;ioaddr&gt;</td>
<td>Specifies the host card i/o address</td>
</tr>
<tr>
<td>-d &lt;name&gt;</td>
<td>Deletes the named host card entry</td>
</tr>
<tr>
<td>-l</td>
<td>Lists the current configuration</td>
</tr>
</tbody>
</table>

Some typical example commands are shown below:

<table>
<thead>
<tr>
<th>Example command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/etc/riosacfg -n ISA1 -m 0xD0000 -i 9</td>
<td>Set host card parameters.</td>
</tr>
<tr>
<td>riosacfg -p</td>
<td>Sets polling.</td>
</tr>
<tr>
<td>riosacfg -d ISA1</td>
<td>Deletes an ISA card.</td>
</tr>
</tbody>
</table>

For information on using the riosacfg utility to assign host card addresses and IRQ levels, see Assigning ISA host card addresses and IRQ levels on page 41 in Chapter 2 Installing hardware and software.
**rioconfig utility**

**Operating systems**  
Available under: Solaris.

The *rioconfig* utility allows you to update the RIO system configuration after you have made changes to the system hardware. For example, adding or removing host cards or RTAs.

To run this utility, simply type *rioconfig* at the command prompt then press the Enter key.

Under the Solaris operating system the *rioconfig clean* option is also available which causes port device nodes to be created for newly attached RTAs and also deleted for removed RTAs.

For information on using this utility to update the RIO system configuration, see Updating your RIO system configuration on page 51 in Chapter 2 Installing hardware and software.
**RIO system commands under Solaris/Linux/LynxOS**

The following RIO system commands allow you to perform management functions with the RIO network. The commands use the settings stored within the rio.cf ASCII file (which is user editable). The commands are summarised in the next table.

<table>
<thead>
<tr>
<th>Operating systems</th>
<th>Command</th>
<th>For details see...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solaris</td>
<td>rioreboot</td>
<td>rioreboot on page 249.</td>
</tr>
<tr>
<td>Linux</td>
<td>rioreboot</td>
<td>rioreboot on page 249.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>rioreboot</td>
<td>rioreboot on page 249.</td>
</tr>
<tr>
<td>Solaris</td>
<td>rioversion</td>
<td>rioversion on page 250.</td>
</tr>
<tr>
<td>Linux</td>
<td>rioboot</td>
<td>rioboot on page 251.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>rioboot</td>
<td>rioboot on page 251.</td>
</tr>
<tr>
<td>Solaris</td>
<td>roadopt</td>
<td>roadopt on page 252.</td>
</tr>
<tr>
<td>Linux</td>
<td>roadopt</td>
<td>roadopt on page 252.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>roadopt</td>
<td>roadopt on page 252.</td>
</tr>
<tr>
<td>Solaris</td>
<td>nodelete</td>
<td>nodelete on page 253.</td>
</tr>
<tr>
<td>Linux</td>
<td>nodelete</td>
<td>nodelete on page 253.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>nodelete</td>
<td>nodelete on page 253.</td>
</tr>
<tr>
<td>Solaris</td>
<td>rioidentify</td>
<td>rioidentify on page 254.</td>
</tr>
<tr>
<td>Linux</td>
<td>rioidentify</td>
<td>rioidentify on page 254.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>rioidentify</td>
<td>rioidentify on page 254.</td>
</tr>
<tr>
<td>Solaris</td>
<td>riomkdev</td>
<td>riomkdev on page 256.</td>
</tr>
<tr>
<td>Linux</td>
<td>riomkdev</td>
<td>riomkdev on page 256.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>riomkdev</td>
<td>riomkdev on page 256.</td>
</tr>
<tr>
<td>Solaris</td>
<td>rioshow</td>
<td>rioshow on page 258.</td>
</tr>
<tr>
<td>Linux</td>
<td>rioshow</td>
<td>rioshow on page 258.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>rioshow</td>
<td>rioshow on page 258.</td>
</tr>
<tr>
<td>Solaris</td>
<td>riolock</td>
<td>riolock on page 255.</td>
</tr>
<tr>
<td>Linux</td>
<td>riolock</td>
<td>riolock on page 255.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>riolock</td>
<td>riolock on page 255.</td>
</tr>
<tr>
<td>Solaris</td>
<td>rioresume</td>
<td>rioresume on page 255.</td>
</tr>
<tr>
<td>Linux</td>
<td>rioresume</td>
<td>rioresume on page 255.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>rioresume</td>
<td>rioresume on page 255.</td>
</tr>
<tr>
<td>Solaris</td>
<td>riostats</td>
<td>riostats on page 259.</td>
</tr>
<tr>
<td>Linux</td>
<td>riostats</td>
<td>riostats on page 259.</td>
</tr>
<tr>
<td>LynxOS</td>
<td>riostats</td>
<td>riostats on page 259.</td>
</tr>
</tbody>
</table>

For details of the format of the `rio.cf` file, see About the `rio.cf` file on page 260.
**rioreboot**

*Operating systems* Available under: Solaris, Linux and LynxOS.

*Function* Reboots a specified RTA. Equivalent to power-cycling the device.

*Syntax* `rioreboot [-h] [-v] <name or unique num>`

- `rioreboot -v -n`

*Argument descriptions*

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-h]</td>
<td>Prints a usage message.</td>
</tr>
<tr>
<td>[-v]</td>
<td>Displays information about the current progress of a reboot.</td>
</tr>
<tr>
<td>-n</td>
<td>Reboots any network interconnected RTA's present on the network.</td>
</tr>
</tbody>
</table>

*Examples* `rioreboot 0x94000c1e` reboots the RTA with the unique ID `0x94000c1e`.

`rioreboot -n` reboots all RTAs connected to another host card. Typically this is used with Dual Host Failsafe when transferring control to a slave host card.
rio version

**Function**
Displays the current version information of the installed driver.

**Syntax**
rio version [-h] [-v]

**Argument descriptions**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-h</td>
<td>Prints a usage message.</td>
</tr>
<tr>
<td>-v</td>
<td>Prints error messages to the standard error file description.</td>
</tr>
</tbody>
</table>

**Examples**
rio version displays driver version information in the format:
RIO Driver - Release 1.1.0 Aug 17 1999, 16:52:58
rioboot

Operating systems  Available under: Solaris, Linux, and LynxOS.

Function  Boots the host cards and RTAs, to generate and apply rio.cf settings.

Syntax

rioboot [-c file] [-h] [-v] [-s]
rioboot [-c file] [-h] [-v] -u
rioboot [-c file] [-h] [-f] [-v] -w
rioboot [-c file] [-h] [-f] [-v] -a

Argument descriptions

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-c file]</td>
<td>Specifies an alternate configuration file.</td>
</tr>
<tr>
<td>[-h]</td>
<td>Prints a usage message</td>
</tr>
<tr>
<td>[-v]</td>
<td>Reports any anomalies or errors to the standard error file descriptor.</td>
</tr>
<tr>
<td>[-s]</td>
<td>Performs a syntax check on the configuration file.</td>
</tr>
<tr>
<td>-u</td>
<td>You can use the rioboot -u command to update the driver with any changes that have been made to the configuration file after the driver has been initialised.</td>
</tr>
<tr>
<td>[-f]</td>
<td>Forces the Driver to attempt to boot even if no configuration file exists.</td>
</tr>
<tr>
<td>-w</td>
<td>You can use the rioboot -w command to output the current configuration of the driver in the format of the configuration file.</td>
</tr>
<tr>
<td>-a</td>
<td>Outputs the current configuration to stdout (same as -w), but automatically allocates unassigned RTA system port numbers.</td>
</tr>
</tbody>
</table>

Examples

rioboot -f boots the RIO driver, even if no rio.cf file exists. Typically this is used during system installation or initialisation scripts.

rioboot -w outputs the current configuration to stdout, typically redirected into a configuration file such as rio.cf.

rioboot -u updates the driver settings with any changes made to the rio.cf file.
**rrioadopt**

**Operating systems** Available under: Solaris, Linux and LynxOS.

**Function** Transfers settings from an RTA removed from the system to a newly installed RTA.

**Syntax**

```
rioadopt [-c file] [-h] [-v] -r
```

```
rioadopt [-c file] [-h] [-v] -i
```

**Argument descriptions**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-c file]</td>
<td>Specifies an alternate configuration file for read and write.</td>
</tr>
<tr>
<td>[-h]</td>
<td>Prints a usage message.</td>
</tr>
<tr>
<td>[-v]</td>
<td>Sends Error messages and warnings to the standard error file description.</td>
</tr>
<tr>
<td>-r</td>
<td>Selects “report only” mode.</td>
</tr>
<tr>
<td>-i</td>
<td>Causes rrioadopt to operate interactively</td>
</tr>
</tbody>
</table>

**Examples**

`rrioadopt` -r generates a report of missing RTAs and newly reported RTAs, similar to the following:

```
rioadopt:
Missing RTA   ID : 994001b0
Missing RTA   ID : 94000f0f
New RTA       ID : 94000f0f
```
**riodelete**

**Operating systems**  Available under: Solaris, Linux and LynxOS.

**Function**  Removes settings for specified RTA(s).

**Syntax**  riodelete [-f] [-h] [-v] <name or unique num>

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-f]</td>
<td>If an RTA is currently attached and booted then the command will not delete it unless the user has specified the -f option. This option will force the deletion of the device by removing it from the network and then requesting the RIO driver to delete its entry. The RTA is removed from the network by placing the RTA software in an infinite loop.</td>
</tr>
<tr>
<td>[-h]</td>
<td>Prints a usage message to the standard error file descriptor</td>
</tr>
<tr>
<td>[-v]</td>
<td>Sends all messages to the standard error file descriptor</td>
</tr>
</tbody>
</table>

**Example**  riodelete 0x94000C1e removes the settings for RTA with unique ID 0x94000c1e.
**rioidentify**

Operating systems
Available under: Solaris, Linux and LynxOS.

Function
Locates a particular RTA (by flashing its LEDs).

Syntax
rioidentify [-h] [-v] <name or unique num>

Argument descriptions

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-h]</td>
<td>Prints a usage message.</td>
</tr>
<tr>
<td>[-v]</td>
<td>Causes the command to print error messages to the standard error file descriptor.</td>
</tr>
</tbody>
</table>

Examples
rioidentify 0x94000C1e causes the RTA with unique ID 0x94000c1e to flash its LEDs.
riolock

Operating systems  Available under: Solaris.

Function  Locks settings for a specified device.
Syntax  riolock ttyname
Example  To lock the settings of device /dev/term/r001 preventing further changes to system settings, use:
  riolock /dev/term/r001

rioresume

Operating systems  Available under: Solaris.

Function  unlocks settings for a specified device.
Syntax  rioresume ttyname
Example  To unlock the settings of device /dev/term/r001 use:
  rioresume /dev/term/r001
riomkdev

Operating systems  Available under: Solaris, Linux and LynxOS.

Function  Generates or deletes system port devices from the rio.cf settings.
Syntax  

riomkdev [-c file] [-f] [-h] [-rname or unique num] [-v] 

riomkdev [-c file] [-f] [-h] [-rname or unique num] [-v] -x 

riomkdev [-c file] [-f] [-h] [-rname or unique num] [-v] -d 

Argument descriptions

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-c file]</td>
<td>Specifies an alternative configuration file.</td>
</tr>
<tr>
<td>[-f]</td>
<td>Unlinks any existing device nodes before the new devices are created.</td>
</tr>
<tr>
<td>[-h]</td>
<td>Prints a usage message and exits.</td>
</tr>
<tr>
<td>[-rname or unique num]</td>
<td>Specifies the RTA whose devices should be created or deleted.</td>
</tr>
<tr>
<td>[-v]</td>
<td>Sends error messages and warnings to the standard error file descriptor.</td>
</tr>
<tr>
<td>-x</td>
<td>Create or deletes transparent print devices.</td>
</tr>
<tr>
<td>-d</td>
<td>Deletes all specified devices if they exist.</td>
</tr>
</tbody>
</table>

Examples  

riomkdev -f creates port device nodes for all RTAs and ports specified in the /etc/rio/rio.cf file. Typically this is used by the /etc/rioconfig script to automatically generate device nodes for newly attached RTAs.

Solaris  

When using riomkdev under Solaris please note the following

Solaris  
The RIO Solaris driver generates terminal, modem and transparent print device nodes for each specified terminal device. That is, for a specified terminal device /dev/term/r001, the following devices nodes are generated:

/dev/term/r001 for a terminal device
/dev/cua/r001 for a modem device
/dev/xprt/r001 for a transparent print device
When using riomkdev under Linux please note the following:

The RIO Linux driver generates terminal and modem device nodes for each RTA specified in the `rio.cf` file (page 260). Thus for a specified RTA, the following device nodes are created:

- `/dev/ttySRx` for a terminal device
- `/dev/cusrx` for a modem device

The Linux driver does not support transparent printing.
rioshow

Operating systems  Available under Solaris, Linux and LynxOS

Function  Displays the current list of host cards and RTAs in the system.
Syntax  rioshow [-s] [-h] [-v]
Argument descriptions  

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-s]</td>
<td>Inhibits the display of the column headings.</td>
</tr>
<tr>
<td>[-h]</td>
<td>Prints a usage message.file descriptor.</td>
</tr>
<tr>
<td>[-v]</td>
<td>Causes the command to print error messages to the standard error file descriptor.</td>
</tr>
</tbody>
</table>

Example  rioshow generates a report of the installed host cards and RTAs similar to the following:

<table>
<thead>
<tr>
<th>Unique ID</th>
<th>ID</th>
<th>Ports</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>a5000387</td>
<td>0</td>
<td>-1</td>
<td>HOST 1</td>
</tr>
<tr>
<td>94000c1e</td>
<td>1</td>
<td>0</td>
<td>UNKNOWN RTA 2-1</td>
</tr>
<tr>
<td>94000a42</td>
<td>1</td>
<td>16</td>
<td>UNKNOWN RTA 2-3</td>
</tr>
<tr>
<td>e8ff84ad</td>
<td>1</td>
<td>32</td>
<td>UNKNOWN RTA 2-5</td>
</tr>
</tbody>
</table>
**riostats**

**Function**
Displays internal driver statistics.

**Syntax**
riostats [-h] [-v] [-e] ttyname

riostats [-h] [-v] [-d] ttyname

**Argument descriptions**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[-h]</td>
<td>Prints a usage message.</td>
</tr>
<tr>
<td>[-v]</td>
<td>Sends error messages and warnings to the standard error file descriptor.</td>
</tr>
<tr>
<td>[-e]</td>
<td>Enables driver statistics gathering.</td>
</tr>
<tr>
<td>[-d]</td>
<td>Disables driver statistics gathering.</td>
</tr>
</tbody>
</table>

**Examples**

riostats -e /dev/term/r001 enables statistics gathering on device /dev/term/r001.

riostats /dev/term/r001 displays a statistics report for devices /dev/term/r001 similar to the following:

<table>
<thead>
<tr>
<th>OPEN</th>
<th>CLOSE</th>
<th>RX</th>
<th>TX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>6</td>
<td>112</td>
</tr>
</tbody>
</table>

riostats -d /dev/term/r001 disables statistics gathering on device /dev/term/r001.
This section describes the rio.cf file and includes the following:

- **About the rio.cf file** on page 260
- **rio.cf keywords** on page 262

### About the rio.cf file

The **rio.cf** file is an administration file containing configuration information for the RIO devices and drivers and is stored under `/etc/rio/rio.cf`. The rio.cf file is used by RIO utilities to obtain or specify information about the RIO system.

The file information is structured as shown in the example, each line begins with a keyword: HOST, RTA or PORT. One further keyword: DEFFPORT is used to define default settings for all undefined ports. These keywords are then followed by various configuration fields separated by `:`. If a field is left blank, then the default value for that field is used. Lines beginning with `#` are treated as comment lines.

See **rio.cf keywords** on page 262 for more details about each keyword.

A typical example of a **rio.cf** file is shown in the next picture.
Defines an RTA entry. See page 263

Defines the settings for a particular port. See page 264

Defines the default port settings. See page 266

Defines a host card entry. See page 263
rio.cf keywords

This section provides information about the following keywords:

- HOST on page 263
- RTA on page 263
- DEFPORT on page 264
- PORT on page 266
### HOST

**Function**
Defines a host card entry

**Example**
HOST:<unique id>:<Device Name>:<boot/noboot>

**Field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;unique id&gt;</td>
<td>Unique number defining the host card in the system (read only)</td>
</tr>
<tr>
<td>&lt;Device Name&gt;</td>
<td>String defining the friendly name of the host card in the system (user read/write)</td>
</tr>
<tr>
<td>&lt;boot/noboot&gt;</td>
<td>Boot flag containing the string &quot;boot&quot; or &quot;noboot&quot;. (user read/write, default = &quot;boot&quot;)&lt;br&gt;If set to &quot;boot&quot;, the device driver will attempt to boot the card.&lt;br&gt;If set to &quot;noboot&quot;, the device driver will not boot the card.</td>
</tr>
</tbody>
</table>

### RTA

**Function**
Defines a Remote Terminal Adaptor entry

**Example**
RTA:<unique id>:<Device Name>:<First Port>:<boot/noboot>

**Field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;unique id&gt;</td>
<td>Unique number defining the RTA in the system (read only)</td>
</tr>
<tr>
<td>&lt;Device Name&gt;</td>
<td>String defining the friendly name of the RTA in the system (user read/write)</td>
</tr>
<tr>
<td>&lt;First Port&gt;</td>
<td>Defines the system port number to be assigned to the first port (user read/write) of the RTA. Value must be 8 or 16 aligned in a range from 0 to 504, for example, 0, 8, 16, 24 etc.</td>
</tr>
<tr>
<td>&lt;boot/noboot&gt;</td>
<td>Boot flag containing string &quot;boot&quot; or &quot;noboot&quot;. (user read/write, default = &quot;boot&quot;)&lt;br&gt;If set to &quot;boot&quot;, the device driver will attempt to boot the RTA.&lt;br&gt;If set to &quot;noboot&quot;, the device driver will not boot the RTA.</td>
</tr>
</tbody>
</table>
DEFFPORT

Function
Defines the default settings for ports.

Example


Field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Operating systems</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;offset&gt;</td>
<td>Available under Solaris and Linux.</td>
<td>Defines an offset added to each system port when defining the default name for a device using the riomkdev utility. Solaris: Default = 1 Linux: Default = 0</td>
</tr>
<tr>
<td>&lt;dev prfx&gt;</td>
<td>ANSI C &quot;printf&quot; style string defining the default name for a device. Used by riomkdev when creating device names for ports. Solaris: The default of &quot;/dev/term/r03%0d&quot; will give the name /dev/term/r006 to system port 5 (0 based). Linux: The default of &quot;/dev/ttySR%0d&quot; will give the name /dev/ttySR5 to system port 5.</td>
<td></td>
</tr>
<tr>
<td>&lt;exp dev prfx&gt;</td>
<td>Solaris only. Not available under Linux.</td>
<td>ANSI C &quot;printf&quot; style string defining the default name for a (user read/write, default = &quot;/dev/xprt/r03%0d&quot;) transparent print device used by riomkdev when creating device names for transparent printing ports. For example, if default prefix = &quot;/dev/xprt/r03%0d&quot;, then system port 6 will have the name &quot;/dev/xprt/r006&quot;.</td>
</tr>
<tr>
<td>&lt;ctty/modem&gt;</td>
<td>Defines device type and contains string &quot;tty&quot; or &quot;modem&quot; defining the type of default device (user read/write, default = &quot;tty&quot;) to be created.</td>
<td></td>
</tr>
<tr>
<td>&lt;xcps&gt;</td>
<td>Decimal number defining the number of characters (user read/write, default = 100) per second rate for transparent print data through a terminal. Valid values are in the range 10 to 1000.</td>
<td></td>
</tr>
<tr>
<td>&lt;xpon&gt;</td>
<td>String defining the &quot;transparent print on&quot; escape sequence sent (user read/write, default = &quot;XPON&quot;) to re-direct transparent print data through a terminal. (A &quot;^&quot; character is used to generate control characters, for example, &quot;^[&quot; = 0x1B).</td>
<td></td>
</tr>
<tr>
<td>&lt;xpoff&gt;</td>
<td>String defining the &quot;transparent print off&quot; escape sequence sent (user read/write, default = &quot;XPOFF&quot;) to stop re-direction of transparent print data through a terminal. (A &quot;^&quot; character is used to generate control characters, for example, &quot;^[&quot; = 0x1B).</td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>Operating systems</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>ixany</td>
<td>Available under Solaris and Linux.</td>
<td>Always open port with termio flag, ixany set.</td>
</tr>
<tr>
<td>ixon</td>
<td></td>
<td>Always open port with termio flag,ixon set.</td>
</tr>
<tr>
<td>lock</td>
<td></td>
<td>Locks port settings, and disallows further configuration attempts using termio.</td>
</tr>
<tr>
<td>store</td>
<td></td>
<td>Store port settings across closes.</td>
</tr>
<tr>
<td>drain</td>
<td>Solaris only, Not available under Linux.</td>
<td>When set, this flag causes the port to wait until data transmission and reception has finished before closing the port. If not set the port will wait for up to 15 seconds for the data to drain and then close.</td>
</tr>
</tbody>
</table>
PORT

Function
Defines the settings for a particular port

Example
PORT:<offset>:<tty dev>:<xp dev>:<xcps>:<xpon>:<xpoff>:ixany,ixon,lock,store,drain:

Field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Operating systems</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;offset&gt;</td>
<td>Available under Solaris and Linux.</td>
<td>Defines the system port offset with respect to the owning RTA. (user read/write, must be set).</td>
</tr>
<tr>
<td>&lt;tty dev&gt;</td>
<td></td>
<td>String defining the system name for the device (user read/write, default based on DEFPORT settings) used by riomkdev when creating device names for ports.</td>
</tr>
<tr>
<td>&lt;xp dev&gt;</td>
<td>Solaris only. Not available under Linux.</td>
<td>String defining the system name for a transparent print device (user read/write, default based on DEFPORT settings) riomkdev when creating device names for transparent printing ports.</td>
</tr>
<tr>
<td>&lt;xcps&gt;</td>
<td></td>
<td>Decimal number defining the number of characters (user read/write, default = 100) per second rate for transparent print data through a terminal. Valid values are in the range 10 to 1000.</td>
</tr>
<tr>
<td>&lt;xpon&gt;</td>
<td></td>
<td>String defining the &quot;transparent print on&quot; escape sequence sent (user read/write, default = &quot;XPON&quot;) to re-direct transparent print data through a terminal. (A &quot;^&quot; character is used to generate control characters, for example, &quot;^x&quot; = 0x1B).</td>
</tr>
<tr>
<td>&lt;xpoff&gt;</td>
<td></td>
<td>String defining the &quot;transparent print off&quot; escape sequence sent (user read/write, default = &quot;XPOFF&quot;) to stop re-direction of transparent print data through a terminal. (A &quot;^&quot; character is used to generate control characters, for example, &quot;^o&quot; = 0x1B).</td>
</tr>
<tr>
<td>ixany</td>
<td>Available under Solaris and Linux.</td>
<td>Always open port with termio flag, ixany set.</td>
</tr>
<tr>
<td>ixon</td>
<td></td>
<td>Always open port with termio flag, ixon set.</td>
</tr>
<tr>
<td>lock</td>
<td></td>
<td>Locks port settings, and disallows further configuration attempts using termio.</td>
</tr>
<tr>
<td>store</td>
<td></td>
<td>Store port settings across closes.</td>
</tr>
<tr>
<td>drain</td>
<td>Solaris only. Not available under Linux.</td>
<td>When set, this flag causes the port to wait until data transmission and reception has finished before closing the port. If not set the port will wait for up to 15 seconds for the data to drain and then close.</td>
</tr>
</tbody>
</table>
Appendix A Serial port device names

You need to read this appendix if you want information about device names for the Perle RIO serial connectivity system.

This appendix provides information about the device nodes associated with each serial port for the Perle RIO serial connectivity system. Included are naming conventions, functions and file locations.

This appendix includes the following sections;
• Solaris Device node details on page 268
• Linux Device node details on page 268
Solaris Device node details

Each serial port has three device nodes associated with it. Each node takes the form of a file which you can access from operating system utilities and user applications. Details of these nodes are shown in the next table.

<table>
<thead>
<tr>
<th>Device name</th>
<th>Function</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>r001</td>
<td>Normal communications port</td>
<td>Indicates normal communications port behaviour.</td>
<td>/dev/term</td>
</tr>
<tr>
<td>r001</td>
<td>Normal communications port wait for DCD on open</td>
<td>Indicates a port open will not complete unless the DCD signal is present.</td>
<td>/dev/cua</td>
</tr>
<tr>
<td>r001</td>
<td>Print device</td>
<td>Indicates that device should only be used for transparent print.</td>
<td>/dev/xprt</td>
</tr>
</tbody>
</table>

Linux Device node details

Each serial port has two device nodes associated with it. Each node takes the form of a file which you can access from operating system utilities and user applications. Details of these nodes are shown in the next table.

<table>
<thead>
<tr>
<th>Device name</th>
<th>Function</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ttySR0</td>
<td>Normal communications port</td>
<td>Indicates normal communications port behaviour.</td>
<td>/dev</td>
</tr>
<tr>
<td>cusr0</td>
<td>Normal communications port wait for DCD on open</td>
<td>Indicates a port open will not complete unless the DCD signal is present.</td>
<td>/dev</td>
</tr>
</tbody>
</table>
Appendix B Transparent printing (Solaris only)

You need to read this appendix if you want to...

You need to read this appendix if you want background information on transparent printing.

This appendix gives an overview of the transparent printing feature offered for the Solaris operating system and includes details of configuration files associated with transparent printing.

This appendix includes the following sections:

- What is transparent printing? on page 270
- Problems with printer output on page 271
- Sample transparent printing "rio.cf" port entry on page 272
- Common Terminal Transparent Print Sequences on page 273
What is transparent printing?

Most terminals have an auxiliary (AUX) port which can be connected to a serial printer. Data can then be output to the terminal or the printer via the same serial line. This is called transparent print (or xprint) and is designed for printing simple ASCII text.

A separate xprint device node (/dev/xprt/00n where n is device number) is created for each port. This device is enabled automatically if either the local or modem device is enabled for the port.

When a host card receives data addressed to the transparent print device it prefixes it with the transparent print mode ON string and appends it with the transparent mode OFF string. The ON and OFF strings for each terminal type available are defined by the rio.cf file. See Appendix B rio.cf administration file for more details.

Terminal I/O has absolute priority over printer output. Transparent print data will only be sent when there is a break in output to the terminal (for more than a tenth of a second).

For each port, the transparent printing parameters are controlled by an entry in the rio.cf file found in the /etc/rio directory on your system. The entry for each port includes definitions of the terminal type, transparent print throughput rate and device name. See Appendix B rio.cf administration file for further details.
Problems with printer output

When you use transparent printing you may obtain incorrect printer output due to the following reasons:

Graphics printers may misinterpret some characters output through transparent print. This problem is more likely if the terminal is in 7-bit mode, because 8-bit characters will not be printed.

Some terminals suppress the output of certain characters to their printer or AUX ports. Such terminals can prevent essential control characters from reaching the printer thus generating incorrect printer output. This occurrence is extremely unpredictable because of the large number of potential hardware configurations.
Sample transparent printing "rio.cf" port entry

A typical port entry in the rio.cf file defining transparent print settings (for a wyse 60 terminal) is as follows:

```
PORT:0:/dev/term/r006::tty:100::[^d#:^T::
```

**Note**

If the terminal device name is `/dev/term/r006`, then the transparent print device name is `/dev/xprt/r006`. This is generated automatically by the Solaris operating system.

**Note**

A `^` character is used to escape the next character, that is `^` is `escape` = 0x1B.

**Terminal name.**

100 defines the characters-per-second rate at which transparent print data is sent through the terminal.

`^[d#` defines the transparent-print-on sequence use to prefix transparent print data sent to a wyse 60 terminal.

`^T` defines the transparent-print-off sequence use to suffix transparent print data sent to a wyse 60 terminal.
## Common Terminal Transparent Print Sequences

<table>
<thead>
<tr>
<th>Terminal</th>
<th>XPON</th>
<th>XOFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>wy60</td>
<td>`c[1</td>
<td>t&lt;</td>
</tr>
<tr>
<td>wy50</td>
<td>`c[1</td>
<td>t&lt;</td>
</tr>
<tr>
<td>hv925</td>
<td>`a</td>
<td>t&lt;</td>
</tr>
<tr>
<td>wtpe85</td>
<td>`a</td>
<td>t&lt;</td>
</tr>
<tr>
<td>v220</td>
<td>`a</td>
<td>t&lt;</td>
</tr>
</tbody>
</table>
Appendix C Troubleshooting

You need to read this appendix if you want information on troubleshooting for the RIO serial connectivity system.

This appendix provides examples of normal boot up messages and a troubleshooting guide including typical problems and corrective action required for all the currently supported operating systems.

This appendix includes the following sections:

- Solaris troubleshooting on page 275.
- SCO OpenServer 5 troubleshooting on page 279
- SCO UnixWare troubleshooting on page 290
- Windows NT troubleshooting on page 300.
Solaris troubleshooting

Example of normal boot up messages for host cards

The normal messages for satisfactory host card detection and initialisation form part of the normal Solaris boot up messages and are shown in the next example. This example shows one ISA host card and one PCI host card.

- RIO Jet PCI at physical address 0xFDFE0000, using IRQ 1
- RIO ISA at physical address 0xE0000, using IRQ 15

<table>
<thead>
<tr>
<th>Host card type</th>
<th>Address range used by host card in hexadecimal</th>
<th>IRQ level</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIO Jet PCI</td>
<td>0xFDFE0000</td>
<td>IRQ 1</td>
</tr>
<tr>
<td>RIO ISA</td>
<td>0xE0000</td>
<td>IRQ 15</td>
</tr>
</tbody>
</table>

RIO Remote I/O System User Guide
Solaris troubleshooting
Troubleshooting guide

This section includes the following:

- Host cards on page 276
- Remote Terminal Adaptors (RTAs) on page 277
- Ports on page 278

### Host cards

<table>
<thead>
<tr>
<th>Problem</th>
<th>Action required</th>
</tr>
</thead>
</table>
| Device driver does not start after installation | 1. Ensure PCI host cards have been installed. See page 156.  
2. Ensure ISA card settings have been specified. See page 158. |
| Host card not recognised by system | 1. Check physical installation of PCI and ISA host cards, and ensure board correctly seated in bus slot. See page 156 and page 158.  
2. Check ISA board memory settings, and ensure they match the setting specified by the riosaccfg file during installation. See page 158.  
3. Check the interrupt setting on ISA host cards, to see if the interrupt specified by the riosaccfg file during installation is available for ISA use. See page 41.  
   **Note that on most systems it is a requirement that ISA interrupts are reserved in either the BIOS setup, or system configuration program.** |
### Remote Terminal Adaptors (RTAs)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA not recognised by system</td>
<td>1. Check physical connections and power.</td>
</tr>
<tr>
<td></td>
<td>2. Run the <code>rioconfig</code> utility to update RIO system settings.</td>
</tr>
<tr>
<td></td>
<td>See page 161.</td>
</tr>
<tr>
<td>RTA not booted by system</td>
<td>1. Check the <code>rio.cf</code> file to make sure the RTA entry exists and contains the <code>boot</code> field.</td>
</tr>
<tr>
<td></td>
<td>2. Delete the <code>rio.cf</code> file and run the <code>rioconfig</code> utility to recreate the system settings.</td>
</tr>
<tr>
<td></td>
<td>See page 164.</td>
</tr>
<tr>
<td>RTA8 LED next to port 5 does not light up</td>
<td>The host card has already assigned 128 ports, if you haven't got 128 ports installed, this means that you have previously removed one or more RTAs from the network but not deleted them from the configuration.</td>
</tr>
<tr>
<td>RTA16 con LED does not light up</td>
<td>You have already installed the maximum number of RTAs up to 128 ports. This situation may arise if you have previously removed RTAs from the system but forgotten to delete them from the configuration using the <code>rioconfig</code> utility.</td>
</tr>
</tbody>
</table>
### Ports

<table>
<thead>
<tr>
<th>Problem</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port device nodes not present in the system.</td>
<td>1. Make sure RTA has been installed correctly. See page 161.</td>
</tr>
<tr>
<td></td>
<td>2. Run the <code>rioconfig</code> utility to update RIO system settings and create device nodes. See page 51.</td>
</tr>
</tbody>
</table>
SCO OpenServer 5 troubleshooting

This section includes the following:

- Using the Port Diagnostics facility on page 279
- SCO OpenServer 5 Error Messages on page 289

Using the Port Diagnostics facility

The Config.rio utility includes an online port diagnostics facility which allows you to investigate port failures and misbehaviour while the system is running. The port diagnostics facility allows you to run the following tests:

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send data to port</td>
<td>Data is written to the port to check output.</td>
</tr>
<tr>
<td>External loopback</td>
<td>Sends and receives data on the port then compares the received data with what was sent.</td>
</tr>
</tbody>
</table>

This section includes the following:

- General procedure for using Port Diagnostics on page 280
- Selecting the RTA and port to test on page 281
- Performing the send data to port test on page 285
- Performing the loopback test on a port on page 287
General procedure for using Port Diagnostics

To perform tests using the diagnostics facility proceed as follows:
1. Select the RTA and port you want to test using the procedures given in Selecting the RTA and port to test on page 281.
2. If required, perform the send data to port test using the procedures given in Performing the send data to port test on page 285.
3. If required, perform the external loopback test using the procedures given in Performing the loopback test on a port on page 287.
Selecting the RTA and port to test

To select the RTA and port to wish to test proceed as follows:

1. Turn on your system and login as super user.
2. At the command prompt, type `config.rio` and press the **Enter** key.
   
   The RIO configuration utility window is now displayed showing a map of your system. See Configuring ports with `config.rio` on page 64 for more details about how `config.rio` works.

3. In the RIO configuration utility window, move the cursor to the RTA associated with the ports you want to test and press the **Enter** key.
   
   The RTA Management menu is now displayed.

   Note
   
   You should disable any port service active on the port before running the diagnostics.
4. In the RTA Management menu, click on View / edit TTY.

The View / edit TTY window is now displayed as shown in the next picture.

The View / edit TTY window shows a list of ports for the currently selected RTA in the form of TTY blocks.

5. In the View / edit TTY window use the up and down arrow keys to select the TTY block for the port you want to test and press the Enter key.

The tty menu is now displayed.
Before proceeding, you need to disable all logins on the port you are going to test to do this:

6. In the tty menu click on Enabled? and press the Enter key.
   The TTY en/disable menu is now displayed.

7. In the TTY en/disable menu, click on Both disabled and press the Enter key.

8. In the tty menu, click on Port diagnostics and press the Enter key.
   The Online Diagnostics menu is now displayed as shown in the next picture.
9. You can now select and run the type of test you want using the Online Diagnostics menu. See one of the options listed in the next table for further details:

<table>
<thead>
<tr>
<th>Test</th>
<th>To run this test click on</th>
<th>For details of how to run this test see...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send data to port</td>
<td>Send data to port</td>
<td>Performing the send data to port test on page 285.</td>
</tr>
<tr>
<td>External loopback</td>
<td>Perform loopback test on port</td>
<td>Performing the loopback test on a port on page 287.</td>
</tr>
</tbody>
</table>
Performing the send data to port test

To run the Send data to port test proceed as follows;

1. In the tty menu, click on Port diagnostics and press the Enter key.
   The Online Diagnostics menu is now displayed as shown in the next picture.

2. In the Online Diagnostics menu, click on Send data to port.
   A test parameters window is now displayed which allows to set the values required for the duration of the test.

3. In the test parameters window, use the cursor keys to select the value you want to set then cycle through to the value you want using the space bar key.

Note
Before you can perform this test, you need to select the RTA and port you want using the procedures given in Selecting the RTA and port to test on page 281.
4. Once you have set all the test parameters you require, press the Enter key to start the test.

The test now runs and displays the test results window shown in the next picture on completion.

**Hint**

If required, you can halt the test by pressing the Enter key.

5. Once you have finished viewing the results of your test press the Enter key to return to the Online Diagnostics menu.
Performing the loopback test on a port

To run the loopback test on a port proceed as follows;

1. On the RTA containing the port you want to test, connect a loopback connector onto the port to be tested. See Loopback connector pinouts on page 222 in Chapter 3 RIO Cabling information.

2. In the fly menu, click on Port diagnostics and press the Enter key.

The Online Diagnostics menu is now displayed as shown in the next picture.

3. In the Online Diagnostics menu, click on Perform loopback test on port.

A test parameters window is now displayed which allows to set the values required for the duration of the test.

Note
Before you can perform this test, you need to select the RTA and port you want using the procedures given in Selecting the RTA and port to test on page 281.

Note
Before you can perform this test, you need to select the RTA and port you want using the procedures given in Selecting the RTA and port to test on page 281.

Note
Before you can perform this test, you need to select the RTA and port you want using the procedures given in Selecting the RTA and port to test on page 281.

Note
Before you can perform this test, you need to select the RTA and port you want using the procedures given in Selecting the RTA and port to test on page 281.
4. In the test parameters window, use the cursor keys to select the value you want to set then cycle through to the value you want using the space bar key.

5. Once you have set all the test parameters you require, press the Enter key to start the test.

The test now runs and displays the test results window shown in the next picture on completion.

Hint
If required, you can halt the test by pressing the Enter key.

6. Once you have finished viewing the results of your test, press the Enter key to return to the Online Diagnostics menu.
### SCO OpenServer 5 Error Messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Reason</th>
<th>Action required</th>
</tr>
</thead>
</table>
| FAILED: Timeout on read              | Loopback connector, Link cable or power supply has been disconnected during the test. Loopback connector has not been fitted to the port. | 1. Check that loopback connector, link cable and power supply are fitted.  
2. If the above don’t work then contact Technical Support. See Appendix D Contacting Perle. |
| FAILED: Write fail                   | RIO is unable to write to the port.                                   | 1. Contact Technical Support. See Appendix D Contacting Perle.                  |
| FAILED: Read fail                    | RIO is unable to read from the port.                                  |                                                                                 |
| FAILED: Data read is different from data written | The data read from the port is different to that written to the port. |                                                                                 |
SCO UnixWare troubleshooting

This section includes the following:
- Using the Port Diagnostics facility on page 290
- SCO UnixWare Error Messages on page 299

Using the Port Diagnostics facility

The Config.rio utility includes an online port diagnostics facility which allows you to investigate port failures and misbehaviour while the system is running. The port diagnostics facility allows you to run the following tests:

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send data to port</td>
<td>Data is written to the port to check output.</td>
</tr>
<tr>
<td>External loopback</td>
<td>Sends and receives data on the port then compares the received data with what was sent.</td>
</tr>
</tbody>
</table>

This section includes the following:
- General procedure for using Port Diagnostics on page 291
- Selecting the RTA and port to test on page 292
- Performing the send data to port test on page 295
- Performing the loopback test on a port on page 297
General procedure for using Port Diagnostics

To perform tests using the diagnostics facility proceed as follows;
1. Select the RTA and port you want to test using the procedures given in Selecting the RTA and port to test on page 292.
2. If required, perform the send data to port test using the procedures given in Performing the send data to port test on page 295.
3. If required, perform the external loopback test using the procedures given in Performing the loopback test on a port on page 297.
Selecting the RTA and port to test

To select the RTA and port to wish to test proceed as follows:

1. Turn on your system and login as super user.
2. Disable the port you wish to test. To do this, at the command prompt type
   `/etc/spacadmport disable r00x` (when r00x is the port number for example, r001) and
   press the Enter key.
   For more information about `spacadmport`, see `spacadmport utility for configuring
   ports` on page 240 in Chapter 4 Quick Reference.
3. At the command prompt, type `config.rio` and press the Enter key.
   The RIO configuration utility window is now displayed showing a map of your system. See
   Configuring ports with `config.rio` on page 82 for more details about how `config.rio`
   works.
4. In the RIO configuration utility window, move the cursor to the RTA associated with the
   ports you want to test and press the Enter key.

---

Note
You should disable any port service active on the port before running
the diagnostics.

RTA
Host card
Link cable
The RTA Management menu is now displayed.

5. In the RTA Management menu, click on View / edit TTY.
   The View / edit TTY window is now displayed as shown in the next picture.

   ![View / edit TTY window](image)

   The View / edit TTY window shows a list of ports for the currently selected RTA in the form of TTY blocks.

   6. In the View / edit TTY window use the up and down arrow keys to select the TTY block for the port you want to test and press the Enter key.
      The tty menu is now displayed.
7. In the tty menu, click on **Port diagnostics** and press the **Enter** key.
   
   The Online Diagnostics menu is now displayed as shown in the next picture.

8. You can now select and run the type of test you want using the Online Diagnostics menu. See one of the options listed in the next table for further details:

<table>
<thead>
<tr>
<th>Test</th>
<th>To run this test click on</th>
<th>For details of how to run this test see...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send data to port</td>
<td>Send data to port</td>
<td>Performing the send data to port test on page 295.</td>
</tr>
<tr>
<td>External loopback</td>
<td>Perform loopback test on port</td>
<td>Performing the loopback test on a port on page 297.</td>
</tr>
</tbody>
</table>
Performing the send data to port test

To run the Send data to port test proceed as follows;

1. In the tty menu, click on Port diagnostics and press the Enter key.
   The Online Diagnostics menu is now displayed as shown in the next picture.

2. In the Online Diagnostics menu, click on Send data to port.
   A test parameters window is now displayed which allows to set the values required for the duration of the test.

3. In the test parameters window, use the cursor keys to select the value you want to set then cycle through to the value you want using the space bar key.

Note
Before you can perform this test, you need to select the RTA and port you want using the procedures given in Selecting the RTA and port to test on page 292.
4. Once you have set all the test parameters you require, press the Enter key to start the test.

   The test now runs and displays the test results window shown in the next picture on completion.

   **Hint**

   If required, you can halt the test by pressing the Enter key.

5. Once you have finished viewing the results of your test press the Enter key to return to the Online Diagnostics menu.

6. Press the Esc key to return to the main RIO configuration utility window (page 292) and then press the Esc key again to exit the utility.

7. If you have finished running port diagnostics you now need to re-enable the port you have tested. To do this, at the command prompt, type `/etc/spxadmport enable r00x` (when r00x is the port number for example, r001) and press the Enter key.

   For more information about spxadmport, see spxadmport utility for configuring ports on page 240 in Chapter 4 Quick Reference.
Performing the loopback test on a port

To run the loopback test on a port proceed as follows;

1. On the RTA containing the port you want to test, connect a loopback connector onto the port to be tested. See Loopback connector pinouts on page 222 in Chapter 3 RIO Cabling Information.

2. In the fly menu, click on Port diagnostics and press the Enter key.
   The Online Diagnostics menu is now displayed as shown in the next picture.

3. In the Online Diagnostics menu, click on Perform loopback test on port.
   A test parameters window is now displayed which allows to set the values required for the duration of the test.

   Note
   Before you can perform this test, you need to select the RTA and port you want using the procedures given in Selecting the RTA and port to test on page 292.
4. In the test parameters window, use the cursor keys to select the value you want to set then cycle through to the value you want using the space bar key.

5. Once you have set all the test parameters you require, press the Enter key to start the test.

The test now runs and displays the test results window shown in the next picture on completion.

6. Once you have finished viewing the results of your test, press the Enter key to return to the Online Diagnostics menu.

7. Press the Esc key to return to the main RIO configuration utility window (page 292) and then press the Esc key again to exit the utility.

8. If you have finished running port diagnostics you now need to re-enable the port you have tested. To do this, at the command prompt, type `sudo /etc/spxadmport enable r00x` (when r00x is the port number for example, r001) and press the Enter key.

For more information about spxadmpport, see spxadmpport utility for configuring ports on page 240 in Chapter 4 Quick Reference.
### SCO UnixWare Error Messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Reason</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAILED: Timeout on read</td>
<td>Loopback connector, Link cable or power supply has been disconnected during the test. Loopback connector has not been fitted to the port.</td>
<td>1. Check that loopback connector, link cable and power supply are fitted. 2. If the above don’t work then contact Technical Support. See Appendix D Contacting Perle.</td>
</tr>
<tr>
<td>FAILED: Write fail</td>
<td>RIO is unable to write to the port.</td>
<td>1. Contact Technical Support. See Appendix D Contacting Perle.</td>
</tr>
<tr>
<td>FAILED: Read fail</td>
<td>RIO is unable to read from the port.</td>
<td></td>
</tr>
<tr>
<td>FAILED: Data read is different from data written</td>
<td>The data read from the port is different to that written to the port.</td>
<td></td>
</tr>
</tbody>
</table>
Windows NT troubleshooting

This section contains information designed to help you solve any problems you may experience while installing or configuring your RIO system under Window NT. It includes the following:

- General fault finding under Windows NT on page 301
- Error Messages on page 305
- Testing RIO host cards with the Hardware Diagnostics program on page 312
General fault finding under Windows NT

This section outlines some general problems you may encounter under Windows NT and some suggested actions;

- Machine fails to boot on page 301
- NT operating system fails while loading on page 302
- RIO driver or another driver fails to boot on page 302
- COM ports are not accessible on page 303
- RIO NT driver is operating satisfactorily but then fails on page 303

Machine fails to boot

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total boot failure (blank screen), or there is ROM boot but the machine hangs</td>
<td>1. Turn off machine, remove RIO card(s) and reboot.</td>
</tr>
<tr>
<td></td>
<td>2. Ensure any RIO PCI cards are not using a resource required by another non-RIO card.</td>
</tr>
<tr>
<td></td>
<td>3. Ensure resources in the BIOS setup are not reserved for a non-RIO non-PCI card</td>
</tr>
<tr>
<td></td>
<td>4. In the BIOS setup, make sure memory addresses and interrupts are reserved for any ISA cards in use.</td>
</tr>
<tr>
<td></td>
<td>5. If required, change the configuration switches on any ISA cards to use available addresses.</td>
</tr>
<tr>
<td></td>
<td>6. Insert your host card in a different machine and use RIO Hardware Diagnostics Program to check if you have a faulty card.</td>
</tr>
</tbody>
</table>
### NT operating system fails while loading

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>System hangs or blue screen</td>
<td>1. If a blue screen is displayed, note the five hexadecimal numbers at the top line of the screen. Otherwise go to step 2. of this procedure.</td>
</tr>
<tr>
<td></td>
<td>2. Reboot your machine.</td>
</tr>
<tr>
<td></td>
<td>The system now displays this message:</td>
</tr>
<tr>
<td></td>
<td>Press spacebar NOW to invoke Hardware Profile/Last Known Good Menu</td>
</tr>
<tr>
<td></td>
<td>3. Press the spacebar.</td>
</tr>
<tr>
<td></td>
<td>The system now displays this message:</td>
</tr>
<tr>
<td></td>
<td>To switch to the Last Known Good configuration, press 'L'.</td>
</tr>
<tr>
<td></td>
<td>4. Press the L key to switch to last known good configuration.</td>
</tr>
<tr>
<td></td>
<td>5. If your machine now boots properly, change the configuration settings of the RIO card to match those in the BIOS setup. See <a href="#">Installing an ISA host card</a> on page 158 in Chapter 2 Installing hardware and software.</td>
</tr>
<tr>
<td></td>
<td>6. If your machine still fails to boot properly, check for resource conflicts or faulty hardware.</td>
</tr>
</tbody>
</table>

### RIO driver or another driver fails to boot

...
### COM ports are not accessible

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>A window entitled Service Control Manager is displayed with the message: At least one service or driver failed during startup. Use Event Viewer to examine the event log for details.</td>
<td>1. Check the Windows NT Event Viewer; you will see actions suggested to you.</td>
</tr>
<tr>
<td></td>
<td>2. Run Windows NT Diagnostics to find available IRQ and memory addresses. (You may need to reserve settings in the BIOS setup).</td>
</tr>
<tr>
<td></td>
<td>3. Alternatively, test the card with the RIO Hardware Diagnostics program. See Testing RIO host cards with the Hardware Diagnostics program on page 312.</td>
</tr>
</tbody>
</table>

### RIO NT driver is operating satisfactorily but then fails

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>1. Run the RIOCONF configuration utility.</td>
</tr>
<tr>
<td></td>
<td>2. If a picture of the RTA is shown with the host card;</td>
</tr>
<tr>
<td></td>
<td>a. Check that the RTA is connected to the host card with a solid green line.</td>
</tr>
<tr>
<td></td>
<td>b. If no line is displayed try power-cycling the RTA. Failing this, try re-booting the system.</td>
</tr>
<tr>
<td></td>
<td>c. If the line has still not changed try re-installing the driver.</td>
</tr>
<tr>
<td></td>
<td>d. Once a green line is displayed, configure the RTA to set the COM device names for the system.</td>
</tr>
<tr>
<td></td>
<td>3. If no picture of an RTA is shown with the host card;</td>
</tr>
<tr>
<td></td>
<td>a. Check connection of RTA link cable.</td>
</tr>
<tr>
<td></td>
<td>b. Reinstall the driver.</td>
</tr>
</tbody>
</table>
### Symptom | Action required
---|---
blue screen | 1. Contact Technical Support. See Appendix D Contacting Perle
black screen | 1. Contact Technical Support. See Appendix D Contacting Perle
machine reboots: | 1. Contact Technical Support. See Appendix D Contacting Perle
system hangs: | 1. Contact Technical Support. See Appendix D Contacting Perle
Error Messages

This section lists all error messages output by RIO. To see the error messages, go into the Windows NT Event Viewer, in the Windows NT Desktop. Each error message is explained and steps to overcome the problem are described. If these steps do not remedy the error, contact Technical Support, see Appendix D Contacting Perle.

If you cannot find the error message here, it may have been produced by your operating system, or another hardware device installed on your system. Most problems can be resolved by selecting a different address/interrupt for the RIO card or by reinstalling the software.

Error messages are detailed in the following sections;
• Messages which are common: on page 306
• Messages which are infrequent: on page 307
• Messages which you should rarely see: on page 308
Messages which are common:

<table>
<thead>
<tr>
<th>Message</th>
<th>Reason</th>
<th>Action required</th>
</tr>
</thead>
</table>
| No host cards found                         | Host card is not found        | 1. Install card.  
2. Alternatively, alter memory address/interrupt settings with RIOCONF. |
| Can't boot host card                        | Problem with host card        | 1. Check card installation.  
2. Alternatively, alter memory address/interrupt settings with RIOCONF. |
| Resource conflict detected                  | Possible host card clash      | 3. Alter host card memory address and interrupt with RIOCONF |
| Host card physical address collision detected at %2 serial numbers are %3* | Host card clash              | 4. Alter host card memory address and interrupt with RIOCONF |
Messages which are infrequent:

<table>
<thead>
<tr>
<th>Message</th>
<th>Reason</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Couldn’t find download code file</td>
<td>Download file missing, or registry entry wrong</td>
<td>1. Reinstall driver</td>
</tr>
<tr>
<td>Download code file too big</td>
<td>Internal Error</td>
<td></td>
</tr>
<tr>
<td>Couldn’t open driver key</td>
<td>RIO file/registry damaged</td>
<td></td>
</tr>
<tr>
<td>Couldn’t open host key</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not enough config data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercepted exception while reading host keys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bad status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rta Id not in valid range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rta Id already configured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>port not found</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No device object available for port</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercepted exception while scanning for host cards</td>
<td>Possible host card clash</td>
<td>1. Alter host card memory address and interrupt with RIOCONF</td>
</tr>
<tr>
<td>Intercepted exception while checking out host cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Couldn’t connect to interrupt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Couldn’t create symbolic Link</td>
<td>Internal Error</td>
<td>1. Reinstall driver</td>
</tr>
<tr>
<td>Couldn’t create devicemap entry</td>
<td>Possible clash with a current device name</td>
<td>1. Change to different com device name</td>
</tr>
<tr>
<td>Maximum number of host cards exceeded</td>
<td>Host card limit exceeded</td>
<td>1. Remove host card</td>
</tr>
</tbody>
</table>
Messages which you should rarely see:

<table>
<thead>
<tr>
<th>Message</th>
<th>Reason</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed to allocate buffer</td>
<td>Internal Error</td>
<td>1. Reinstall driver</td>
</tr>
<tr>
<td>Couldn’t find enough RTA download code names</td>
<td>Internal Error</td>
<td>2. Alternatively, contact technical support.</td>
</tr>
<tr>
<td>Couldn’t map download code file</td>
<td>Download file</td>
<td></td>
</tr>
<tr>
<td></td>
<td>missing, or registry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>entry wrong</td>
<td></td>
</tr>
<tr>
<td>Overflowed enumerate buffer</td>
<td>Internal Error</td>
<td></td>
</tr>
<tr>
<td>Too many addresses</td>
<td>Internal Error</td>
<td></td>
</tr>
<tr>
<td>Too many interrupts</td>
<td>Internal Error</td>
<td></td>
</tr>
<tr>
<td>Couldn’t convert to Unicode</td>
<td>Internal Error</td>
<td></td>
</tr>
<tr>
<td>Couldn’t delete value entry %2</td>
<td>Internal Error</td>
<td></td>
</tr>
<tr>
<td>Couldn’t create port device</td>
<td>Internal Error</td>
<td></td>
</tr>
<tr>
<td>Couldn’t create Rio device</td>
<td>Internal Error</td>
<td></td>
</tr>
</tbody>
</table>
Clashing memory address

Clashing memory addresses can occur on PCI and ISA bus machines.

**PCI machines**
On PCI machines, clashes are possible when the memory address for an ISA card has not been reserved in the system. Use the PCI BIOS setup program to reserve ISA memory resources and ensure that the physical address of the ISA card matches this setting.

**ISA machines**
On ISA machines, if you suspect that installation has failed due to a clashing memory address, switch off your machine, remove the card, reconfigure the settings using the RIO Configuration program, reset the rotary switches on the card, re-insert the card and reboot. You do not need to re-install the RIO software.

**RIO Memory requirements**
The RIO host card requires a full, non-cached, 64K memory segment starting on a 64K boundary. The default address is **0D0000** but address space below a megabyte is usually tight.

The segments at **0C0000** and **0E0000** may be available, but if you have less than 16Mb of extended memory installed, we recommend that you install at a high address. You can use any non-cached 64Kb memory segment above extended memory (For example, **F00000**, **F10000**, or **F20000**).

If you are unable to find a free memory segment, you will have to reconfigure another device to make room for your RIO card.
Clashing Interrupts

Interrupt clashes can occur on both PCI and ISA machines.

On PCI machines, clashes are likely when the interrupt level for an ISA board has not been reserved in the system. Use the PCI BIOS setup program to reserve the ISA interrupt level that will be used by the card, or select polled mode operation.

(RIO Host ISA can use interrupts 9, 11, 12 or 15.)

On ISA machines, you will have to reconfigure the RIO software and select a new interrupt, or polled mode. RIO HOST ISA cards can use interrupt 9, 11, 12 or 15.
System Information

To obtain information about your system, including the drivers and DLLs in use proceed as follows;

1. In the Windows desktop, display the Perle program group window.
2. In the Perle program group window, double click on the RIO icon.
   The RIO Configuration window is now displayed.
3. In the RIO Configuration menu, click on Help > System
   The System Information tabbed window is now displayed.

4. In the System Information tabbed window click one of the following tabs to display the information you require.

<table>
<thead>
<tr>
<th>System Information</th>
<th>Click on this tab</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>System</td>
</tr>
<tr>
<td>DLL information</td>
<td>Dll's</td>
</tr>
<tr>
<td>Driver information</td>
<td>Drivers</td>
</tr>
</tbody>
</table>

5. When you have completed viewing, in the System Information window, click on the OK button to close the window.
Testing RIO host cards with the Hardware Diagnostics program

RIO includes a Hardware Diagnostics program which allows you to pinpoint and diagnose faults with your RIO host card(s). The Hardware Diagnostics program is included on the CDROM included with your RIO system. It consists of a stand-alone command line utility that you run from the DOS prompt.

This section includes the following:
- How to run a test using RIO Hardware Diagnostics on page 313
- Test options guide on page 315
- Additional options on page 317
How to run a test using RIO Hardware Diagnostics

To test the host cards on your system using the RIO Hardware Diagnostics program, proceed as follows:

1. Ensure your RIO host cards are installed and configured correctly before running these tests. See Installing a Universal 3.3/5V PCI host card on page 156 and Installing an ISA host card on page 158 in Chapter 2 Installing hardware and software.

   **Note**
   You can install up to a maximum of four host cards in the test machine. The cards can be a mixture of types.

2. On each host card under test, loopback the ports on the host card by linking ports 1 and 2 using a RIO link cable and do the same for ports 3 and 4.

3. Copy the RIO diagnostics program `riodiags.exe` from the CDROM to a DOS bootable disk. You can find the diagnostics program under:
   `rio/diags/hostdiag/riodiags.exe`

   **Note**
   You must use DOS 3.1 or above to run the diagnostics program.

4. Boot your system using the disk you have made. You can use the diagnostics program to run the type of test you require.
5. At the Dos prompt, type `riodiags <options>` and press the Enter key. Where `<options>` are the commands needed to the different types of test available.

The general types of tests available are shown in the next table. For details of commands, see `Test options guide` on page 315 and `Additional options` on page 317.

<table>
<thead>
<tr>
<th>Type of test</th>
<th>To run this type of test.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual tests</td>
<td>At the dos prompt, type <code>riodiags</code> followed by the test option you require. For example, <code>riodiags -cpu</code>:</td>
</tr>
<tr>
<td>Multiple tests</td>
<td>At the dos prompt, type <code>riodiags</code> followed by the test names on the same command line separated by spaces, for example, <code>riodiags -cpu -prom -config</code></td>
</tr>
<tr>
<td>Running tests on multiple host cards</td>
<td>At the dos prompt, type <code>riodiags -board &lt;board number&gt;, &lt;board number&gt;, etc. up to the maximum of four cards. If one of the cards is an ISA card, add the string </code>-isa &lt;address&gt; after riodiags<code>For example,</code>riodiags -board 0,1,2 cpu<code>and</code>riodiags -isa 0xd0000 -board 0,1,2 -cpu`</td>
</tr>
</tbody>
</table>

The complete suite of tests will commence.

6. Should any of the other tests indicate a failure, check your host card’s physical address or interrupt are not clashing with other devices/memory. Do this by using the `-installed` information query (see `Additional options` on page 317). Try a different interrupt and/or memory address for the RIO card.

Note

In the event of a test failure the programme will not execute the remainder of the tests. If you can, clear the problem on the failed test and re-run the tests.

7. Upon completion of the tests, press the Esc key to return to the DOS prompt.

Note

If all the tests pass, the programme will complete and return you to the DOS prompt.
A summary of the tests available using the Diagnostics utility is given in the next table.

<table>
<thead>
<tr>
<th>Test</th>
<th>To run this type of test, at the dos prompt, type...</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM test</td>
<td>riodiags -ram &lt;type&gt;</td>
<td>Validates BYTE and WORD accesses and address lines when the host machine reads and writes data patterns to the RIO host card memory.</td>
</tr>
<tr>
<td>Arbitration Test</td>
<td>riodiags -ram &lt;arb&gt;</td>
<td>Checks that the host machine and the RIO host card CPU can concurrently access the RAM on the host card using the cards arbitration logic.</td>
</tr>
<tr>
<td>Frequency test</td>
<td>riodiags -freq</td>
<td>In this test host machine times the transputer on the host card to check the host card is running at an approved frequency. Note that some transputer run at both 20MHz and 25MHz, both speeds are correct.</td>
</tr>
<tr>
<td>Test</td>
<td>To run this type of test, at the dos prompt, type...</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Links test</td>
<td>riodiags -link</td>
<td>This test checks that the RIO host card can send and receive data on all its Transputer links via an external cable. To perform the test: 1. On each host card under test, loopback the ports on the host card by linking ports 1 and 2 using a RIO link cable and do the same for ports 3 and 4. 2. If have only one cable, run the test on ports 1 and 2, then swap the cable over to ports 3 and 4 and repeat the test.</td>
</tr>
<tr>
<td>CPU test</td>
<td>riodiags -cpu</td>
<td>This test checks that the RIO host card CPU is capable of running code from its external ram and that a reset to the card shall cause the CPU to be reset. It checks also that the Configuration Prom can also be accessed from the Transputer bus.</td>
</tr>
<tr>
<td>Interrupt test</td>
<td>riodiags -intr &lt;level&gt;</td>
<td>Allows you to specify particular Interrupt levels when running a test, rather than use all levels which can cause problems on some systems.</td>
</tr>
<tr>
<td>Config prom test</td>
<td>riodiags -prom</td>
<td>In this test the host machine reads and verifies the host card configuration prom.</td>
</tr>
</tbody>
</table>
Additional options

The RIO Diagnostics utility allows you to add other control and information display commands to your command line instructions. The available options are detailed in the next table.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-soak</td>
<td>This option causes all the selected tests to be repeated continuously until the program is interrupted by your pressing CTRL+BREAK, or an error is detected.</td>
</tr>
<tr>
<td>-cont</td>
<td>This option causes the application to continue if possible after an error has been detected. The default mode of operation is for the diagnostics to stop execution as soon as an error is detected.</td>
</tr>
<tr>
<td>-board &lt;number&gt;</td>
<td>If more than one host card is installed in the machine you can use this option to indicate which host card to perform the tests on. Valid &lt;numbers&gt; are 0, 1, 2 and 3.</td>
</tr>
<tr>
<td>-isa &lt;addr&gt;</td>
<td>This option allows the user to specify the address(es) of RIO ISA cards installed in the system. Addresses are given in the format '0xc0000,0xd0000,0xe0000,0xf0000': if no addresses are specified the application shall search through valid addresses looking for AT host cards.</td>
</tr>
<tr>
<td>-testarea</td>
<td>Host cards can only be tested if they are mapped in memory address space below 256 Mbytes. If cards are mapped in outside this range, the diagnostics will detect this and exit with a warning. If the <code>-testarea</code> option is specified this instructs the diagnostics to test the host cards above 256Mbytes.</td>
</tr>
<tr>
<td>-help, -h</td>
<td>This option overrides all other options and displays a help message documenting the function of the diagnostics and displaying the command line options.</td>
</tr>
<tr>
<td>-version</td>
<td>Displays RIO Diagnostics version information.</td>
</tr>
<tr>
<td>-info</td>
<td>This option generates the display of configuration prom information from the host card(s) under test.</td>
</tr>
<tr>
<td>-installed</td>
<td>This option displays a list of host cards installed in the system (Max. 4 cards), their physical addresses, slots and so on.</td>
</tr>
<tr>
<td>-config</td>
<td>Performs the PCI configuration space test.</td>
</tr>
</tbody>
</table>
Appendix D Contacting Perle

You need to read this appendix if you want to contact Perle for technical support or any other queries about this product.

This appendix includes the following sections;

- Making a technical Support Query on page 109
- Repair procedure on page 112
- Feedback about this manual on page 112
- Contacting Perle technical support on page 113

Internet access

Click here to access the our website at the following URL:
http://www.perle.com

Email

Click here to email Perle at the following address;
Email: ptac@perle.com
This section contains the following information about making a query:

• Who to contact on page 109
• Information needed when making a query on page 110
• Making a support query via the Perle web page on page 111

Who to contact

If you bought your product from a registered Perle supplier, you must contact their Technical Support department; they are qualified to deal with your problem.

If you are a registered Perle supplier, and bought your product from Perle, contact Perle Technical Support using the details given in Contacting Perle technical support on page 113.
**Information needed when making a query**

When you make a technical support enquiry please have the following information ready:

<table>
<thead>
<tr>
<th>Item</th>
<th>Write details here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product name and version</td>
<td></td>
</tr>
<tr>
<td>Problem description</td>
<td></td>
</tr>
<tr>
<td>Operating system version</td>
<td></td>
</tr>
<tr>
<td>Driver version</td>
<td></td>
</tr>
<tr>
<td>Details of any other cards installed in your system</td>
<td></td>
</tr>
<tr>
<td>Your name</td>
<td></td>
</tr>
<tr>
<td>Company Name</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
</tr>
<tr>
<td>Phone number</td>
<td></td>
</tr>
<tr>
<td>Fax number</td>
<td></td>
</tr>
<tr>
<td>Email address (if available)</td>
<td></td>
</tr>
</tbody>
</table>

**Hint**

Print out this page and fill in the table provided with the basic information you need.
Making a support query via the Perle web page

If you have an internet connection, please send details of your problem to Technical Support using the email links provided on the Perle web site in the 'Support' area.

See also Contacting Perle technical support on page 113 for email links and other contact details for the Perle technical support centres.

Click here to access our website at the following URL:
http://www.perle.com
Repair procedure

Before sending a unit for repair, you must contact your Perle supplier. If, however, you bought your product directly from Perle you can contact directly. See Contacting Perle technical support on page 113 for contact information.

Customers who are in Europe, Africa or Middle East can submit repair details via a website form shown in the next picture. This form is on the Perle website, www.perle.com, in the Support area.

Click here to access our web site at the following URL:
http://www.perle.com/support_services/rma_form.asp

In the USA and Asia contact the office shown in the Technical Support section.

Feedback about this manual

If you have any comments or suggestions for improving this manual please email Perle using the following address;

Email: ptac@perle.com

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