RS 3000/3100/3200 Switch Router
Getting Started Guide

Release 9.4.0.1

36-004-16 Rev. 0A

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Riverstone Networks, Inc.
5200 Great America Parkway
Santa Clara, CA 95054

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REGULATORY COMPLIANCE INFORMATION

This product complies with the following:

SAFETY

UL 1950; CSA C22.2, No. 950; 73/23/EEC; EN 60950; IEC 950

ELECTROMAGNETIC

FCC Part 15, Canada ICES-003, EN 55022, VCCI and EN 55024

COMPATIBILITY (EMC)

EN 61000-3-3; EN 50082-1, AS/NZS 3548; VCCI V-3

REGULATORY COMPLIANCE STATEMENTS

Note Complies with Part 68, FCC rules.
FCC Registration Number 6TGUSA-46505-DE-N
Riverstone Networks, Inc.
Model WICT1-12
Made in U.S.A.

FCC COMPLIANCE STATEMENT

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

Warning Changes or modifications made to this device that are not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

INDUSTRY CANADA COMPLIANCE STATEMENT

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

NOTICE: The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational, and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

NOTICE: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

VCCI COMPLIANCE STATEMENT

This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may arise. When such trouble occurs, the user may be required to take corrective actions.

この装置は，情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

BSMI (TAIWAN BUREAU OF STANDARDS, METROLOGY AND INSPECTION, MINISTRY OF ECONOMIC AFFAIR)WARNING:

Warning: This is a Class A product. In a domestic environment this product may cause radio interference..

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，可能會造成
干擾，在這種情況下，使用者會被要求採取某些適當的對

SAFETY INFORMATION: CLASS 1 LASER TRANSCEIVERS

This product may use Class 1 laser transceivers. Read the following safety information before installing or operating this product.

The Class 1 laser transceivers use an optical feedback loop to maintain Class 1 operation limits. This control loop eliminates the need for maintenance checks or adjustments. The output is factory set and does not allow any user adjustment. Class 1 laser transceivers comply with the following safety standards:

- 21 CFR 1040.10 and 1040.11, U.S. Department of Health and Human Services (FDA)
- IEC Publication 825 (International Electrotechnical Commission)
- CENELEC EN 60825 (European Committee for Electrotechnical Standardization)

When operating within their performance limitations, laser transceiver output meets the Class 1 accessible emission limit of all three standards. Class 1 levels of laser radiation are not considered hazardous.

INFORMACIÓN SOBRE LA SEGURIDAD: TRANSMISOR/RECEPTOR LASER DE CLASE 1

Este producto puede utilizar transmisores/receptores láser de Clase 1. Lea la siguiente información de seguridad antes de instalar u operar este producto.

Los transmisores / receptores láser de Clase 1 utilizan un circuito óptico de control de retroalimentación para mantenerse dentro de los límites operativos de la Clase 1. Debido al uso del circuito de control, no es necesario llevar a cabo ajustes o revisiones de mantenimiento. La potencia ha sido configurada en la

fábrica y no puede ser ajustada por el usuario. Los transmisores / receptores láser de Clase 1 cumplen con las siguientes normas de seguridad:

- 21 CFR 1040.10 y 1040.11, Departamento de Salud y Servicios Humanos de los Estados Unidos (Administración de Alimentos y Fármacos)
- Publicación 825 de la IEC (Comisión Internacional Electrotécnica)
- CENELEC EN 60825 (Comité Europeo para la Estandarización Electrotécnica)

Al operar el equipo dentro de sus limitaciones de rendimiento, la potencia del transmisor / receptor láser cumple con los límites de emisión de las tres normas anteriores para los equipos de Clase 1. Los niveles de radiación permitidos por la Clase 1 no se consideran peligrosos.

LASER RADIATION AND CONNECTORS

When the connector is in place, all laser radiation remains within the fiber. The maximum amount of radiant power exiting the fiber (under normal conditions) is –12.6 dBm or 55 x 10^{-6} watts.

Removing the optical connector from the transceiver allows laser radiation to emit directly from the optical port. The maximum radiance from the optical port (under worst case conditions) is 0.8 W cm^{-2} or 8 x 10^{3} W m^{2} sr–1.

Do not use optical instruments to view the laser output. The use of optical instruments to view laser output increases eye hazard. When viewing the output optical port, power must be removed from the network adapter.

RADIACIÓN LÁSER Y CONECTORES

Una vez que el conector se encuentra en su sitio, toda la radiación láser permanece dentro de la fibra. La cantidad máxima de poder radiante que emana de la fibra (bajo condiciones normales) es de –12.6 dBm ó 55 x 10^{-6} vatios.

La remoción del conector óptico del transmisor / receptor permite que la radiación láser sea emitida directamente desde el puerto óptico. La radiación máxima emitida por el puerto óptico (en el peor de los casos) es de 0.8 W cm^{-2} ó 8 x 10^{3} W m^{2} sr–1.

No utilice instrumentos ópticos para visualizar la potencia del láser. El uso de instrumentos ópticos para visualizar la potencia del láser aumenta el riesgo de presentar lesiones en los ojos. Al visualizar la potencia del puerto óptico, es necesario cortar la corriente del adaptador de la red.

SAFETY INFORMATION: WICT1-12 T1 CARD

Warning To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

Warning Para reducir el riesgo de un incendio, únicamente utilice un conductor del número 26 AWG o mayor para la línea de telecomunicaciones.

CONSUMER INFORMATION AND FCC REQUIREMENTS

1. This equipment complies with Part 68 of the FCC rules, FCC Registration Number 6TGUSA-46505-DE-N Riverstone Networks Inc. Model WICT1-12 Made in the USA. On the DS1/E1 WAN Module of this equipment is a label that contains, among other information, the FCC registration number and Ringer Equivalence Number (REN) for this equipment. If requested, provide this information to your telephone company.
2. The REN is useful to determine the quantity of devices you may connect to your telephone and still have all those devices ring when your number is called. In most, but not all areas, the sum of the REN's of all devices should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should call your local telephone company to determine the maximum REN for your calling area.
3. If your DS1/E1 WAN Module causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.
4. Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.
5. If you experience trouble with this equipment DS1/E1 WAN Module, please contact Riverstone Networks Inc., 5200 Great America Parkway, Santa Clara, CA 95054, 408 878-6500, for repair/warranty information. The Telephone Company may ask you to disconnect this equipment from the network until the problem has been corrected or you are sure that the equipment is not malfunctioning.
6. There are no repairs that can be made by the customer to the DS1/E1 WAN Module.
7. This equipment may not be used on coin service provided by the Telephone Company. Connection to party lines is subject to state tariffs. (Contact your state public utility commission or corporation commission for information).

EQUIPMENT ATTACHMENT LIMITATIONS NOTICE

The Industry Canada label identifies certified equipment. This certification means that the equipment meets the telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that the compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

NOTICE: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

RIVERSTONE NETWORKS, INC.
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IMPORTANT: BEFORE UTILIZING THE PRODUCT, CAREFULLY READ THIS LICENSE AGREEMENT.

This document is a legal agreement ("Agreement") between You, the end user, and Riverstone Networks, Inc. ("Riverstone"). BY USING THE ENCLOSED SOFTWARE PRODUCT, YOU ARE AGREEING TO BE BOUND BY THE TERMS AND CONDITIONS OF THIS AGREEMENT AND THE RIVERSTONE STANDARD LIMITED WARRANTY, WHICH IS INCORPORATED HEREIN BY REFERENCE. IF YOU DO NOT AGREE TO THE TERMS OF THIS AGREEMENT, RETURN THE UNOPENED LICENSED MATERIALS, ALONG WITH THE HARDWARE PURCHASED IF PROVIDED ON SUCH HARDWARE, AND PROOF OF PAYMENT TO RIVERSTONE OR YOUR DEALER, IF ANY, WITHIN THIRTY (30) DAYS FROM THE DATE OF PURCHASE FOR A FULL REFUND.

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8. **LIMITED WARRANTY.** The sole warranty provided under this Agreement and with respect to the Licensed Materials is set forth in Riverstone's Standard Limited Warranty, which is incorporated herein by reference. THE RIVERSTONE STANDARD LIMITED WARRANTY CONTAINS IMPORTANT LIMITS ON YOUR WARRANTY RIGHTS. THE WARRANTIES AND LIABILITIES SET FORTH IN THE STANDARD LIMITED WARRANTY ARE EXCLUSIVE AND ESTABLISH RIVERSTONE'S ONLY OBLIGATIONS AND YOUR SOLE RIGHTS WITH RESPECT TO THE LICENSED MATERIALS AND THIS AGREEMENT. ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS AND WARRANTIES INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, SATISFACTORY QUALITY, NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE EXTENT ALLOWED BY APPLICABLE LAW.

9. **LIMITATION OF LIABILITY.** Your exclusive remedy for any claim in connection with the Licensed Materials and the entire liability of Riverstone are set forth in the Riverstone Standard Limited Warranty. Except to the extent provided there, if any, IN NO EVENT WILL RIVERSTONE OR ITS AFFILIATES OR SUPPLIERS BE LIABLE FOR ANY LOSS OF USE, INTERRUPTION OF BUSINESS, LOST PROFITS OR LOST DATA, OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND, REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE, EVEN IF RIVERSTONE OR ITS AFFILIATE OR SUPPLIER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE, AND WHETHER OR NOT ANY REMEDY PROVIDED SHOULD FAIL OF ITS ESSENTIAL PURPOSE. THE TOTAL CUMULATIVE LIABILITY TO YOU, FROM ALL CAUSES OF ACTION AND ALL THEORIES OF LIABILITY, WILL BE LIMITED TO AND WILL NOT EXCEED THE PURCHASE PRICE OF THE LICENSED MATERIALS PAID BY YOU. YOU ACKNOWLEDGE THAT THE AMOUNT PAID FOR THE LICENSED MATERIALS REFLECTS THIS ALLOCATION OF RISK.

10. **GENERAL**. The provisions of the Agreement are severable and if any one or more of the provisions hereof are illegal or otherwise unenforceable, in whole or in part, the remaining provisions of this Agreement shall nevertheless be binding on and enforceable by and between the parties hereto. Riverstone's waiver of any right shall not constitute waiver of that right in future. This Agreement (including the documents it incorporates) constitutes the entire understanding between the parties with respect to the subject matter hereof, and all prior agreements, representations, statements and undertakings, oral or written, are hereby expressly superseded and canceled. No purchase order shall supersede this Agreement. The rights and obligations of the parties to this Agreement shall be governed and construed in accordance with the laws of the State of California, excluding the UN Convention on Contracts for the International Sale of Goods and that body of law known as conflicts of laws. Any dispute in connection with the Licensed Materials will be resolved in state or federal courts located in Santa Clara County, California, U.S.A.. You consent to the personal jurisdiction of and waive any objections to venue in such courts.

RIVERSTONE STANDARD WARRANTY

A. Product Warranty

i. RIVERSTONE warrants that each unit of Hardware Products will be free from defects in material and workmanship for a period of one (1) year from the date of shipment.

ii. Breach of warranty will be enforceable against RIVERSTONE only if written notice of such breach is received by RIVERSTONE within the applicable warranty period.

iii. If a warranty claim is invalid for any reason, PURCHASER will be charged for services performed and expenses incurred by RIVERSTONE in repairing, handling and shipping the returned item.

iv. Expendable parts, such as fuses, lamps, filters, and other parts that are regularly replaced due to normal use are excluded from this warranty.

v. As to replacement parts supplied for a Product or repairs performed to a Product during the original warranty period for such Product, the warranty period on the replacement part or the repaired part shall terminate thirty (30) days after shipment or upon the termination of the warranty period applicable to the original item, whichever is longer.

vi. As to any out-of-warranty parts repaired, modified or replaced by RIVERSTONE at RIVERSTONE's regular charges, the warranty period with respect to the material and workmanship hereunder shall expire thirty (30) days after the date of shipment of said part.

B. Software Warranty. The only warranty RIVERSTONE makes to PURCHASER in connection with the Licensed Materials is that the media upon which the Licensed Materials are recorded will be replaced without charge, if RIVERSTONE in good faith determines that the media was defective and not subject to misuse.

C. Return to Factory.

i. If Parts, Products or Licensed Materials under warranty are claimed to be defective, RIVERSTONE must be notified by PURCHASER prior to the return of said Part, Product, or Licensed Materials. Within ten (10) days of the date of said notification RIVERSTONE will provide PURCHASER with a valid Return Material Authorization number, the location to which PURCHASER must return the shipment claimed to be defective, and the method of transportation. In no event will RIVERSTONE accept any returned part or Product which does not have a valid Return Material Authorization number.

ii. Within ten (10) days of receipt of notice from RIVERSTONE requiring return, PURCHASER shall deliver said shipment to a carrier at PURCHASER's facilities as aforesaid.

iii. Within thirty (30) days of receipt of same, RIVERSTONE shall use reasonable efforts to fix or replace, at its option, any defective Product or Licensed Material which RIVERSTONE has determined to be under warranty.

iv. Transportation costs relating to warranty claims will be borne by RIVERSTONE only in cases where repair or replacement is made and authorized pursuant hereto, but any applicable duties will be paid by PURCHASER. If no warranty repair or replacement was required, all transportation costs will be borne by PURCHASER. "Emergency" transportation costs shall be borne by PURCHASER or its Customer.

D. Installation Warranty: RIVERSTONE warrants that all Installation Services rendered pursuant hereto shall be accomplished in a good and workmanlike manner and shall be free of defects in workmanship for a period of ninety (90) days from the date that such services were rendered.

E. General

i. The above warranties are for the benefit of and shall apply only to PURCHASER.

ii. RIVERSTONE's warranties shall not apply to any Product or Licensed Material which has been subjected to accident, neglect, misuse, abuse, vandalism, negligence in transportation or handling, failure of electric power, air conditioning, humidity control, causes other than ordinary use, or causes beyond RIVERSTONE's control, or if the Product or Licensed Material was not properly maintained by PURCHASER during the warranty period.

iii. There shall be no warranty or liability for any Product or Licensed Materials which have been modified by PURCHASER without RIVERSTONE's prior written approval.

iv. Parts or Replacement Products or Licensed Materials outside the scope of these warranties or with respect to Product(s) or Licensed Material out-of-warranty will be furnished at the established charges of RIVERSTONE then

in effect.

v. RIVERSTONE shall have full and free access to the Products and Licensed Materials at PURCHASER's Customer's site, if required.

vi. RIVERSTONE shall not be responsible for failure to furnish Parts due to causes beyond its control. RIVERSTONE shall not be required to replace any Part if it would be impractical for RIVERSTONE personnel to do so because of unauthorized alterations to the Products or its unauthorized connection by mechanical or electrical means to another system or device.

F. Limitation of Liability

i. THESE WARRANTIES AND RIVERSTONE'S AND ITS AFFILIATES LIABILITY AND PURCHASER'S REMEDIES WITH RESPECT THERETO, AS SET FORTH HEREIN, ARE EXCLUSIVE AND EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, LIABILITIES, REMEDIES, EXPRESS OR IMPLIED, INCLUDING ANY OBLIGATION, LIABILITY, RIGHT, CLAIM, OR REMEDY IN TORT, WHETHER OR NOT ARISING FROM NEGLIGENCE OF RIVERSTONE OR ITS AFFILIATES, ACTUAL OR IMPUTED, AND NO WARRANTIES, EXPRESS OR IMPLIED REPRESENTATIONS, PROMISES OR STATEMENTS HAVE BEEN MADE BY RIVERSTONE OR ITS AFFILIATES UNLESS CONTAINED IN THIS AGREEMENT. NO WARRANTY, EXPRESS OR IMPLIED, IS MADE HEREIN THAT THE LICENSED MATERIALS, PRODUCTS OR ANY PARTS ARE MERCHANTABLE, OR FIT OR SUITABLE FOR THE PARTICULAR PURPOSES FOR WHICH THE LICENSED MATERIALS, PRODUCTS OR PARTS MAY BE ACQUIRED BY PURCHASER. IN NO EVENT SHALL RIVERSTONE OR ITS AFFILIATES BE LIABLE TO PURCHASER FOR ANY INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING WITHOUT LIMITATION, LOSS OF DATA, OR PROFITS, WHETHER CLAIMED BY REASON OF BREACH OF WARRANTY OR OTHERWISE, AND WITHOUT REGARD TO THE FORM OF ACTION IN WHICH SUCH CLAIM IS MADE.

ii. The Products and Licensed Materials are not specifically developed, or licensed for use in any nuclear, aviation, mass transit, or medical applications or in any other inherently dangerous applications. PURCHASER hereby agrees that RIVERSTONE shall not be liable for any claims or damages arising from such use if PURCHASER uses the Products and/or Licensed Materials for such applications. PURCHASER agrees to indemnify and hold RIVERSTONE harmless from any claims for losses, costs, damages, or liability arising out of or in connection with the use of the Products and/or Licensed Materials in such applications.

iii. Notwithstanding anything contained herein to the contrary, the total maximum liability of RIVERSTONE and it's Affiliates under this warranty is limited, at the option of RIVERSTONE, to either

(a) RIVERSTONE's use of reasonable efforts to repair any item, or part thereof; or

(b) RIVERSTONE's use of reasonable efforts to replace any item, or part thereof, or any shipment as to which any defect is claimed by PURCHASER and duly verified by RIVERSTONE; or

(c) The refund of the purchase price.

DECLARATION OF CONFORMITY ADDENDUM

Application of Council Directive(s)	89/336/EEC 73/23/EEC
Manufacturer's Name	Riverstone Networks, Inc.
Manufacturer's Address	5200 Great America Parkway Santa Clara, CA 95054
Conformance to Directive(s)/Product Standards	EC Directive 89/336/EEC EC Directive 73/23/EEC EN 55022 EN 50082-1 EN 60950
Equipment Type/Environment	Networking equipment for use in a commercial or light-industrial environment

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Get an overview of the RS 3000, RS 3100 and RS 3200 software and hardware features and specifications	Chapter 2, *"Introduction"*
Install the RS 3000, RS 3100 or RS 3200 hardware	Chapter 3, *"Hardware Installation"*
Install the RS 3000, RS 3100 or RS 3200 software, boot the software, and set up the unit	Chapter 4, *"Initial Configuration"*
Upgrade system software	Chapter 5, *"Managing Software"*
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1.2 RELATED DOCUMENTATION

The Riverstone documentation set includes the following items. Refer to these other documents to learn more about this product.

For Information About...	See the...
How to configure and manage the RS 3000, RS 3100 or RS 3200	*Riverstone RS Switch Router User Guide*
The complete syntax for all Command Line Interface (CLI) commands	*Riverstone RS Switch Router Command Line Interface Reference Manual*
Console and SYSLOG messages	*Riverstone RS Switch Router Message Reference Manual*

2 INTRODUCTION

The Riverstone RS 3000, RS 3100 and RS 3200 provide non-blocking, wire-speed Layer-2 (switching), Layer-3 (routing), and Layer-4 (application) switching. This chapter provides a basic overview of the RS 3000, RS 3100 and RS 3200 software and hardware feature set.

Note For the latest operating software and user documentation, check the Riverstone Networks web site at www.riverstonenet.com.

2.1 FUNCTIONAL LAYER TERMINOLOGY

This guide, and other RS 3000/RS 3100/RS 3200 documentation, refers to layer-2 (L2), layer-3 (L3), and layer-4 (L4) switching and routing. These layers are based on the International Standards Organization (ISO) 7-layer reference model. Here is an example of that model. The RS 3000/RS 3100/RS 3200 operates within the layers that are not shaded. Notice that layer 2 is divided into a MAC layer, an LLC layer, and an LLC2 layer. The RS 3000/RS 3100/RS 3200 operates at the MAC and LLC layers.

Table 2-1 ISO 7-layer model and RS 3000/3100/3200 capabilities

Layer 7	Application	
Layer 6	Presentation	
Layer 5	Session	
Layer 4	Transport	TCP/UDP - application
Layer 3	Network	IP/IPX - routing
	LLC2	
Layer 2	LLC	
	MAC	Bridging
Layer 1	Physical	Physical Interfaces

2.2 SPECIFICATIONS

The RS 3000/RS 3100/RS 3200 hardware provides the wire-speed switching. The software provides the performance monitoring, filtering, and Quality of Service (QoS). The router's performance is not compromised through the implementation of these software features.

Basic hardware and software specifications for the router are listed in Table 2-2.

Table 2-2 Technical specifications

Feature	Specification
Throughput	• 8 Gbps non-blocking switching fabric • Up to 8 million packets-per-second routing throughput
Capacity	• Up to 250,000 routes • Up to 512,000 Layer-4 application flows • 256,000 Layer-2 MAC addresses • 4,096 Virtual LANs (VLANs) • 20,000 Layer-2 security and access-control filters • 3 MB input/output buffering per Gigabit port • 1 MB input/output buffering per 10/100 port • 16 MB shared input/output buffering across WAN ports on a WAN module
Routing protocols	• IP: RIP v1/v2, OSPF, BGP v2/v3/v4, IS-IS • IPX: RIP, SAP • Multicast: IGMP, DVMRP, GARP/GVRP
Bridging and VLAN protocols	• 802.1d Spanning Tree • 802.1Q (VLAN trunking) • Rapid Spanning Tree Protocol (RSTP) • Per-VLAN Spanning Tree (PVST)
MPLS	• LER and LSR complete functionality • RSVP-TE and LDP for label distribution and dynamic LSP creation • OSPF-TE and ISIS-TE traffic engineering extensions with support for online CSPF

Table 2-2 Technical specifications (Continued)

Feature	Specification
Media Interface protocols	• 802.3 (10Base-T) • 802.3u (100Base-TX, 100Base-FX) • 802.3x (1000Base-SX, 1000Base-LX) • 802.3z (1000Base-SX, 1000Base-LX) • T1/E1 (WAN Multi-rate) • T3 Clear Channel • E3 Clear Channel • ATM Multi-rate (OC-3c, T1/E1, DS-3)
Quality of Service (QoS)	• Layer-2 prioritization (802.1p) • Layer-3 source-destination flows • Layer-4 source-destination flows • Layer-4 application flows
Load Balancing policies	• Round-robin • Weighted round-robin • Least loaded
RMON	• RMON v1/v2 for each port
Management	• SNMP • Emacs-like Command Line Interface (CLI)
Port mirroring	• Traffic from specific ports • Traffic to specific expansion slots line cards

2.3 SOFTWARE OVERVIEW

This section describes the features and capabilities of the RS 3000, RS 3100 and RS 3200 in greater detail. For full information regarding the use of these features and capabilities, see the *Riverstone RS Switch Router User Guide*.

2.3.1 Bridging

The RS 3000, RS 3100 and RS 3200 provide the following types of wire-speed bridging:

Address-based bridging – The RS 3000, RS 3100 and RS 3200 perform this type of bridging by looking up a packet's destination address in an L2 lookup table on the line card that received the packet from the network. The L2 lookup table indicates the exit port(s) for the bridged packet. If the packet is addressed to the RS Switch Router's own MAC address, the packet is routed rather than bridged.

Flow-based bridging – The RS 3000, RS 3100 and RS 3200 perform this type of bridging by looking up a packet's source and destination address in an L2 lookup table on the line card that received the packet from the network.

Your choice of bridging method does not affect RS Switch Router's performance. However, address-based bridging requires fewer table entries. Alternately, while flow-based bridging uses more table entries, it provides tighter management and control over bridged traffic, and greater resolution to RMON I statistics.

The RS 3000, RS 3100 and RS 3200 ports perform address-based bridging by default, but can be configured to perform flow-based bridging on a per-port basis. A port cannot be configured to perform both types of bridging at the same time.

2.3.2 Port and Protocol VLANs

The RS 3000, RS 3100 and RS 3200 support the following types of Virtual LANs (VLANs):

Port-based VLANs – A port-based VLAN is a set of ports that comprises a layer-2 broadcast domain. The RS 3000, RS 3100 and RS 3200 confine MAC-layer broadcasts to the ports in the VLAN on which the broadcast originates. RS 3000 ports outside the VLAN do not receive the broadcast.

Protocol-based VLANs – A protocol-based VLAN is a named set of ports that comprises an IP, IPX, AppleTalk, DECNet, SNA, IPv6, or L2 broadcast domain. The RS 3000 confines protocol-specific broadcasts to the ports within the protocol-based VLAN. Protocol-based VLANs sometimes are called subnet VLANs or layer-3 VLANs.

You can include the same port in more than one VLAN, even in both port-based and protocol-based VLANs. Moreover, you can define VLANs that span across multiple RS Switch Routers. To simplify VLAN administration, the RS 3000, RS 3100 and RS 3200 support 802.1Q trunk ports, which allow you to use a single port to "trunk" traffic from multiple VLANs to another RS 3000, RS 3100 or RS 3200 or to a switch that supports 802.1Q.

2.3.3 Routing

The RS 3000, RS 3100 and RS 3200 provide wire-speed routing for the following protocols:

IP – protocol that switching and routing devices use for moving traffic within the Internet and within many corporate intranets

Note All other protocols that require routing must be tunneled using IP.

By default, the RS 3000, RS 3100 and RS 3200 use one MAC address for all interfaces. The RS 3000, RS 3100 and RS 3200 can be configured to have a separate MAC address for each IP interface and a separate MAC address for each IPX interface. When the RS Switch Router receives a packet whose destination MAC address is one of the RS Switch Router's IP or IPX interface MAC addresses, the line card that received the packet from the network uses information in the line card's L3 lookup tables (or information supplied by the CPU) to route the packet to its IP destination(s).

You can add secondary IP addresses to the same IP interface, however, you can create only one IP and IPX interface on a single port or VLAN. When you add an interface to a set of ports, you are adding a VLAN to those ports. Ports that contain IP and IPX interfaces can still perform layer-2 bridging.

IP Routing

The RS 3000, RS 3100 and RS 3200 support the following IP unicast routing protocols:

- RIP v1 and RIP v2
- OSPF v2
- BGP 2,3,4
- IS-IS

IP interfaces do not use a specific routing protocol by default. When you configure an interface for routing, you also specify the routing protocol that the interface will use.

IP Multicast Routing

The RS 3000, RS 3100 and RS 3200 support the following IP multicast routing protocols:

- IGMP
- DVMRP
- GARP/GVRP

The RS 3000, RS 3100 and RS 3200 do not use a specific IP multicast routing protocol by default. When you configure an interface for IP multicast, you also specify the routing protocol you want the interface to use.

IPX Routing

The RS 3000, RS 3100 and RS 3200 support the following IPX routing protocols:

IPX RIP – a version of the Routing Information Protocol (RIP) tailored for IPX

IPX SAP – the Service Advertisement Protocol, which allows hosts attached to an IPX network to reach printers, file servers, and other services

By default, IPX routing is enabled on the RS 3000, RS 3100 and RS 3200 when an IPX interface is created.

2.3.4 Layer-4 Switching

In addition to layer-2 bridging and layer-3 routing, the RS 3000, RS 3100 and RS 3200 perform layer-4 switching. Layer-4 switching is based on applications and flows.

Layer-4 Applications – The RS 3000, RS 3100 and RS 3200 understand the application for which an IP or IPX packet contains data and therefore enables you to manage and control traffic on an application basis. For IP traffic, the RS 3000, RS 3100 and RS 3200 look at the packet's TCP or UDP port number to determine the application. For IPX packets, the RS 3000, RS 3100 and RS 3200 look at the destination socket to determine the application.

Layer-4 Flows – The RS 3000, RS 3100 and RS 3200 can store layer-4 flows on each line card. A layer-4 flow consists of the source and destination addresses in the IP or IPX packet combined with the TCP or UDP source and destination port number (for IP) or the source and destination socket (for IPX). You can therefore manage and control individual flows between hosts on an individual application basis.

A single host can have many individual layer-4 entries in the RS 3000, RS 3100 or RS 3200. For example, an IP host might have separate layer-4 application entries for email, FTP, HTTP, and so on, or separate layer-4 flow entries for specific email destinations and for specific FTP and Web connections.

2.3.5 MPLS Support

Multi Protocol Label Switching (MPLS) is supported on the RS 3000/RS 3100/RS 3200 through software and through hardware on the MPLS Gigabit Ethernet line card, the Advanced Services Module line card and the MPLS POS OC-3c line card. The following MPLS capabilities are supported on the RS 3000/RS 3100/RS 3200:

- Complete Label Edge Router (LER) and Label Switching Router (LSR) functionality with no impact on performance
- Label generation and swapping, along with push and pop operations for supporting multiple levels of label stacking
- Tunneling of layer-2 Ethernet over MPLS
- Support for thousands of label switched paths
- Support for static and dynamic creation of LSPs
- Label Distribution Protocol (LDP) and Resource Reservation Protocol with Traffic Engineering (RSVP-TE) for label distribution and dynamic Label Switched Path (LSP) creation with support for LDP over LDP and LDP over RSVP, allowing different tunneling schemes
- Standby LSPs and fail over
- Traffic engineering extensions to OSPF and IS-IS, along with Constrained Shortest Path First (CSPF)

2.3.6 Security

The bridging, routing, and application (layer-2, layer-3, and layer-4) support described in previous sections enables you to implement security strategies that meet specific needs. For layer-2, a wide range of bridging filters are available. Additionally, all layers can be protected using Access Control Lists (ACLs) filters. You can implement the following types of filters and ACLs to secure traffic on the RS 3000, RS 3100 and RS 3200:

- Layer-2 source filters (block bridge traffic based on source MAC address)
- Layer-2 destination filters (block bridge traffic based on destination MAC address)
- Layer-2 flow filters (block bridge traffic based on specific source-destination pairs)

- Layer-3 source ACLs (block IP or IPX traffic based on source IP or IPX address)
- Layer-3 destination ACLs (block IP or IPX traffic based on destination IP or IPX address)
- Layer-3 flow ACLs (block IP or IPX traffic based on specific source-destination address pairs)
- Layer-4 flow ACLs (block traffic based on application flows)
- Layer-4 application ACLs (block traffic based on UDP or TCP source and destination ports for IP or source and destination sockets for IPX)

In addition to filtering and ACL, the RS also provides login security in the form of TACACS, TACACS+, RADIUS, and Secure Session Shells (SSH) version 1.5.

2.3.7 Quality of Service

Although the RS 3000, RS 3100 and RS 3200 supply non-blocking, wire-speed throughput, you can configure the RS 3000, RS 3100 and RS 3200 to apply Quality of Service (QoS) policies during peak periods to guarantee service to specific hosts, applications, and flows (source-destination pairs). This is especially useful in networks where the traffic level can exceed the network capacity.

QoS policies can be configured for the following types of traffic:

- Layer-2 prioritization (802.1p)
- Layer-3 source-destination flows
- Layer-4 source-destination flows
- Layer-4 application flows

QoS mechanisms supported on the RS 3000 include the following:

- Traffic control queuing
- Weighted random early detection
- Weighted fair queuing
- Strict priority queuing
- QoS traffic control queues
- ToS octet rewrites
- Multi-Protocol Label Switching (MPLS) and the creation of LSPs for traffic engineering

Note Traffic control queuing is based on assigning traffic to one of four queues: control, high, medium, and low. Control traffic (routing protocols, and so on) has the highest priority, high the second highest, and so on. The default priority for all traffic is low.

2.3.8 Statistics

The RS 3000 can provide extensive statistical data on demand. You can access the following types of statistics:

Layer-2 RMON and MIB II Statistics – Port statistics for normal packets and for errors (packets in, packets out, CRC errors, and so on)

Layer-3 RMON v2 Statistics – Statistics for ICMP, IP, IP-interface, IP routing, IP multicast, VLAN

Layer-4 RMON v2 Statistics – Statistics for TCP and UDP

LFAP – Light-weight File Accounting Protocol

Open APIs – Slate and FAS Lite.

2.3.9 Web Hosting Features

The RS 3000, RS 3100 and RS 3200 provide features that support and improve performance for high-capacity web access:

Load balancing – allows incoming HTTP requests to a company's web site to be distributed across several physical servers. If one server should fail, other servers can pick up the workload.

Web caching – allows HTTP requests from internal users to Internet sites to be redirected to cached web objects on local servers. Not only is response time faster, since requests can be handled locally, but overall WAN bandwidth usage is reduced.

Session persistence – In certain situations where load balancing is being used, it may be critical that all traffic for the client be directed to the same physical server for the duration of the session; this is the concept of *session persistence*.

TCP persistence – a binding is determined by the matching the source IP/port address as well as the virtual destination IP/port address.

SSL persistence – a binding is determined by matching the source IP address and the virtual destination IP/port address. Note that requests from *any* source socket with the client IP address are considered part of the same session.

Sticky persistence – a binding is determined by matching the source and destination IP addresses only. This allows all requests from a client to the same virtual address to be directed to the same load balancing server.

Virtual private network (VPN) persistence – for VPN traffic using Encapsulated Security Payload (ESP) mode of IPSec, a binding is determined by matching the source and destination IP addresses in the secure key transfer request to subsequent client requests.

IP persistence – Used for L3 persistence of load balancing sessions.

2.3.10 Management Platforms

You can manage the RS 3000, RS 3100 and RS 3200 using the following management platforms:

Command Line Interface (CLI) – An Emacs editor-like interface that accepts typed commands and responds when applicable with messages or tables. Use the CLI to perform the basic setup procedures described in Chapter 4, *"Initial Configuration."*

SNMP MIBs and traps – The RS 3000, RS 3100 and RS 3200 support SNMP v1/v2 and many standard networking MIBs. The RS Switch Router's SNMP agent is accessed using integration software such as HP OpenView 5.x on Windows NT or Solaris 2.x, or Aprisma SPECTRUM on Windows NT or Solaris 2.x. Setting up SNMP on the RS 3000, RS 3100 or RS 3200 is described in Chapter 4, *"Initial Configuration."*

2.4 HARDWARE FEATURES

This section describes the RS 3000/RS 3100/RS 3200's hardware specifications. For information about installing the chassis and line cards, see Chapter 3, *"Hardware Installation."* This section describes the following hardware:

- Chassis and external controls
- Motherboard features
- Power supplies
- Line Cards

2.4.1 Chassis

Figure 2-1 shows the front view of an RS 3000. The RS 3000 chassis contains 32 independent, RJ-45-based, Ethernet connectors and two expansion slots for line cards. It also contains external controls and connectors as described in Section 2.4.2, *"External Controls and Connections"*.

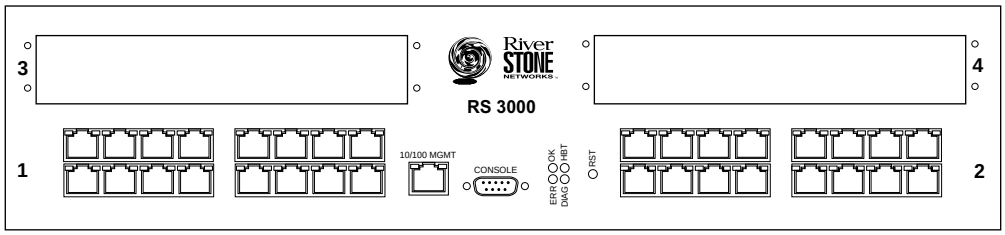


Figure 2-1 Front view of a RS 3000 chassis

Figure 2-2 shows the front view of an RS 3100. The RS 3100 chassis contains 32 independent, RJ-45-based, Ethernet connectors and two expansion slots for line cards.It also contains external controls and connectors as described in Section 2.4.2, *"External Controls and Connections"*.

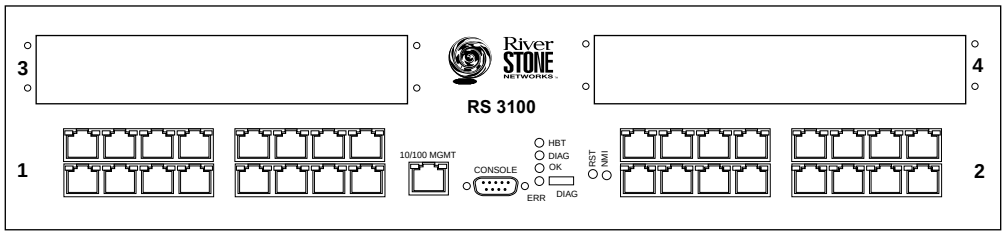


Figure 2-2 Front view of a RS 3100 chassis

Figure 2-3 shows the front view of an RS 3200. The RS 3200 chassis contains 32 independent Ethernet ports that can be individually configured with SFP transceivers (as specified in Table 2-3) and two expansion slots for line cards. It also contains external controls and connectors as described in Section 2.4.2, *"External Controls and Connections"*.

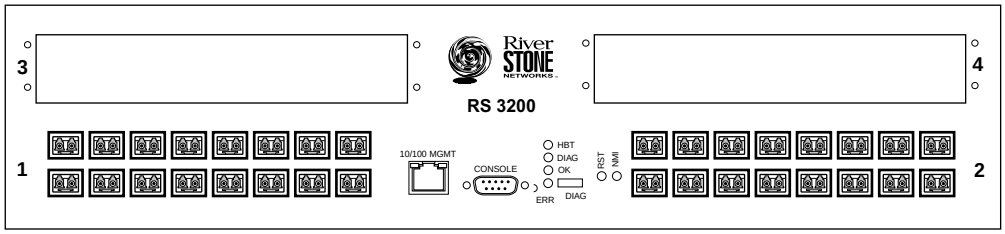


Figure 2-3 Front view of a RS 3200 chassis

You can install line cards in any order in the expansion slots. For example, you could install a module in the first slot and leave the other slot empty. The RS 3000, RS 3100 and RS 3200 provide non-blocking throughput regardless of the software features you are using. Therefore, you do not need to load balance line cards by placing them in certain relationships.

Table 2-3 SFP transceiver media specifications

Port type	Specification
SFPFX-01	• Multi-mode fiber interface • 62.5 µm multi-mode fiber cable terminated with LC connectors • 1310 nm wavelength • Maximum of 2 km of cable
SFPFX-09	• Single-mode fiber (intermediate reach) interface • 10 µm single-mode fiber cable terminated with LC connectors • 1310 nm wavelength • Maximum cable length: 15,000 m

2.4.2 External Controls and Connections

The RS 3000, RS 3100 and RS 3200 have the following external controls and ports used for management:

- Male DB-9 Data Communications Equipment (DCE) port for serial connection to a terminal or PC running terminal emulation software. Use this port to establish a direct CLI connection to the RS 3000/RS 3100/RS 3200 . The default baud rate is 9600.
- 10BASE-T/100BASE-TX Data Terminal Equipment (DTE) port for network connection to a management station. The port is configured as Media Data Interface (MDI). Use this port to establish a management connection to the RS 3000/RS 3100/RS 3200 over a local or bridged Ethernet segment.
- Reset switch (RST). Use this switch to reboot the Switch Router’s motherboard. The Reset switch is recessed in the chassis, so that a tool such as a small allen wrench is necessary to activate the switch.

- Status LEDs. Table 2-4 describes the LEDs.

Caution The Diag Port and the NMI switch on the front panel of the RS 3100 and RS 3200 are for use by Riverstone Networks, Inc. support personnel only.

Table 2-4 RS 3000/RS 3100/RS 3200 Status LEDs

LED Label	Description
OK	When this LED is on, the RS 3000, RS 3100 or RS 3200 and all line cards are functioning correctly.
ERR	When this LED is on, a fatal system error has occurred. Activate the BootPROM to reboot the RS 3000, RS 3100 or RS 3200.
HBT	This LED flashes when the RS Switch Router's BootPROM is active.
DIAG	When this LED is on, the RS 3000, RS 3100 or RS 3200 are in diagnostic mode. (While in the diagnostic mode, you will notice several other LEDs on the RS 3000, RS 3100 or RS 3200 are active, as well.)

2.4.3 Motherboard

The motherboard contains system-wide bridging and routing tables. Traffic that does not yet have an entry in the lookup tables on individual line cards is handled by the motherboard. After processing traffic, the motherboard updates the lookup tables in the line card that initially received the traffic. Consequently, the line cards learn how to forward traffic.

Boot and Image Flash

The motherboard has a boot flash containing the RS Switch Router's boot software and configuration files. The system software image file resides on an internal flash chip and can be upgraded from a TFTP or BootP/TFTP server.

RAM Memory

The motherboard of the RS 3000 uses 128MB of RAM to hold routing and other tables. This RAM is fixed and is not removable and cannot be upgraded.

The motheboard of the RS 3100 and RS 3200 use 128MB of RAM to hold routing and other tables. This RAM can be field upgraded to 256MB of RAM.

2.4.4 Fans

The router contains two fans to provide a cooling air flow across the motherboard and modules. They are located towards the rear of the chassis.

Warning To ensure that the fans can provide adequate cooling, always provide a minimum of 3 inches of clearance on each side of the chassis.

Advertencia Cerciórese de dejar un claro mínimo de 3 pulgadas (7.62 centímetros) en ambos lados de la unidad para permitir el flujo de aire hacia los ventiladores de enfriamiento.

2.4.5 Power Supplies

The RS 3000, RS 3100 and RS 3200 support either AC or DC power supplies. Each supply delivers the requisite amount of voltage to the motherboard, internal fans, and other components.

AC Power Supply

The AC power supply provides enough current to operate a fully configured chassis. On the back end of the supply is the AC power cord socket. See Figure 2-4.

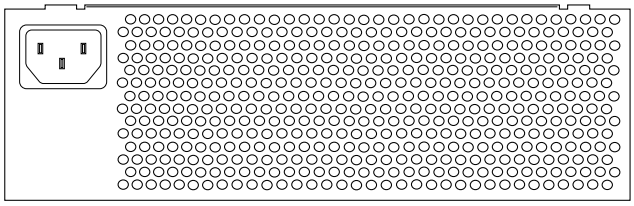


Figure 2-4 AC power supply with power cord socket

Table 2-5 AC power supply specifications

Input	Output
100-240 VAC at 5A, 50-60 Hz	3.45 VDC at 58A maximum, 5.15 VDC at 6.5A maximum, and 12 VDC at 0.6A maximum

Note The RS 3000, RS 3100 and RS 3200 do not have an on-off switch. When you plug the AC power supply into a power source, the router is on.

Nota El RS Switch Router no cuenta con un interruptor de encendido-apagado. Al conectar el suministro de energía AC a una toma de corriente, el RS Switch Router estará encendido.

Warning When using an AC power supply, be sure to plug the router into a single-phase grounded power source located within 6 feet of the installation site.

Advertencia Al utilizar un suministro de energía AC, cerciórese de conectar el RS Switch Router a una fuente de poder monofásica y puesta a tierra, misma que deberá localizarse a un máximo de 6 pies de distancia del sitio de instalación.

Warning High Leakage Current Due To Multiple Power Supplies. Connection Of Each Power Cord To Separate Branch Circuits With Proper Earth Connections Essential.

Advertencia El uso de suministros de energía múltiples puede ocasionar altas corrientes de fuga. Resulta esencial conectar cada cable de energía a distintos ramales del circuito, mismos que deberán estar puestos a tierra.

DC Power Supply

The DC power supply provides enough current to operate a fully configured chassis. On the back end of the supply is the three-terminal wiring block. See Figure 2-5.

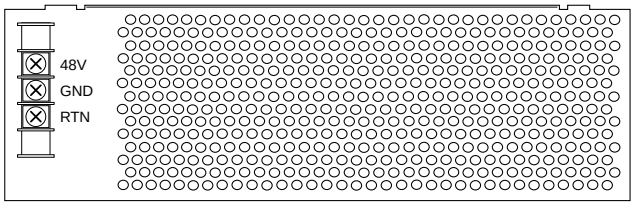


Figure 2-5 DC power supply back side with wiring block

The DC power supply has a three-terminal wiring block consisting of a positive (+) terminal, marked 48V; a negative (–) terminal, marked RTN; and a safety ground, marked GND. The DC supply is designed to be powered by a 48 Volt DC source. Use 12-gauge to 14-gauge wire to connect the 48-Volt source to the router's DC power supply. Use 12-gauge to 14-gauge wire for the safety ground.

Table 2-6 DC power supply specifications

Input	Output
40 to 70 VDC at 14A, 213W	3.45 VDC at 58A maximum, 5.15 VDC at 6.5A maximum, and 12 VDC at 0.6A maximum

Note The RS 3000, RS 3100 and RS 3200 do not have an on-off switch. When you connect the power supply to a DC power source, the router is on.

Nota El RS Switch Router no cuenta con un interruptor de encendido-apagado. Al conectar el suministro de energía DC a una toma de corriente, el RS Switch Router estará encendido.

2.4.6 Line cards

The following section lists the various line cards supported on the RS 3000, RS 3100 and RS 3200, their capabilities, and specifications.

10/100Base-TX line card

The 10/100Base-TX line card contains 16 independent Ethernet ports. Each port senses whether it is connected as 10-Mbps or 100-Mbps and configures itself automatically as a 10Base-T or 100Base-TX port. Figure 2-6 shows the front panel of the 10/100Base-TX line card.

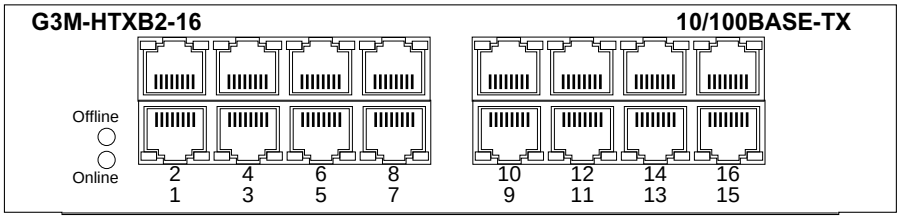


Figure 2-6 Front panel of the 10/100Base-TX line card

The following table lists the media specifications for the 10/100Base-TX line card.

Table 2-7 10/100Base-TX line card specifications

Port type	Specification
10Base-T	• 802.3 standard • RJ-45 connector wired as Media Data Interface Crossed (MDIX); • EIA Category 3, 4, or 5 unshielded twisted pair cabling • Maximum 100 meters (328 feet) segment length
100Base-TX	• 802.3u standard • RJ-45 connector wired as Media Data Interface Crossed (MDIX); • EIA Category 5 unshielded twisted pair cabling • Maximum 100 meters (328 feet) segment length

The 10/100Base-TX line card uses the following LEDs.

Table 2-8 10/100Base-TX line card LEDs

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that it is offline (powered off). The Offline LED also is lit briefly during a reboot or reset of the RS 3000/RS 3100/RS 3200 and goes out as soon as the control module discovers and properly initializes the line card.
Online	When lit, this green LED indicates that the line card is online and is ready to receive, process, and send packets if configured to do so.
Link	Each port has two LEDs on its connector. The green LED on the left side of the connector indicates the link status. When this LED is lit, the port hardware is detecting that a cable is plugged into the port and the port has established communication with the device at the other end.
Activity	The amber LED on the right side of each port connector flashes each time the port's transceiver sends or receives packets.

100Base-FX SFP Line Card

The 16-port 100Base-FX SFP line card contains 16 independent Ethernet ports that can be individually configured with SFP transceivers. Figure 2-7 shows the front panel of the 16-port 100Base-FX SFP line card.

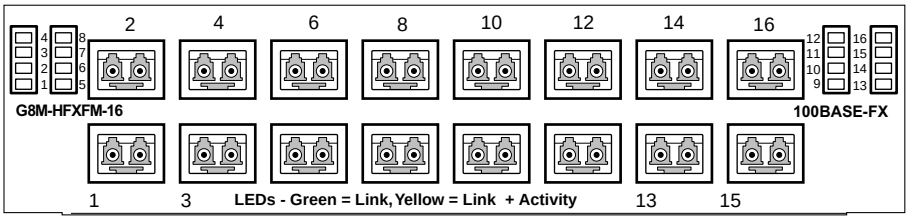


Figure 2-7 Front panel of 100Base-FX SFP line card

SFP transcievers provide the media-specific portion of a 100Base-FX SFP line card and support Gigabit Ethernet connectivity across multiple media types and distances. The host Gigabit Ethernet line card provides power, initialization, and control for each transceiver. Any combination of SFP tranceivers can be used on a single 100Base-FX SFP line card. The SFP tranceivers are not factory installed; you must order, insert, and connect them per your requirements.

The 100Base-FX SFP line cards accept the SFP transceivers shown in Table 2-9.

External Controls, Indicators, and Connections

The Gigabit Ethernet line card has the following external controls, indicators, and connections:

- The **Gigabit Ethernet SFP transceiver ports** are described earlier in this section.
- Each SFP transceiver has associated with it a **Port Status LED**.
  - If the Port is lit **Green**, a link is established with the port.
  - If the Port is lit **Yellow**, there is activity on on the port.
- The **Card Status LEDs** are comprised of the following:
  - The **OnLine** LED, when lit, indicates that the line card is online and is ready to receive, process, and send packets if configured to do so.
  - The **OffLine** LED, when lit, indicates that the line card is offline (powered off) and is ready for hot swap.The **OFF** LED also is lit briefly during a reboot or reset of the RS and goes out as soon as the line card is properly initialized.

Table 2-9 SFP transceiver media specifications

Port type	Specification
SFP SX (MMF)	• Multi-mode fiber interface • 50 or 62.5 125-mm multi-mode fiber cable terminated with LC connectors • 850 nm wavelength • Maximum of 300 m of cable
SFP LX (SMF-IR)	• Single-mode fiber (intermediate range) interface • 8 or 9 125-mm single-mode fiber cable terminated with LC connectors • 1310 nm wavelength • Maximum of 10 km of cable
SFP LH (SMF-LR)	• Single-mode fiber (long range) interface • 8 or 9 125-mm single-mode fiber cable terminated with LC connectors • 1550 nm wavelength • Maximum of 70 km of cable

1000BASE-SX Line Card

The 1000BASE-SX line card supplies two independent Gigabit (1000-Mbps) Ethernet ports. The ports connect to MMF optical cable. Figure 2-8 shows the front panel of the 1000Base-SX line card.

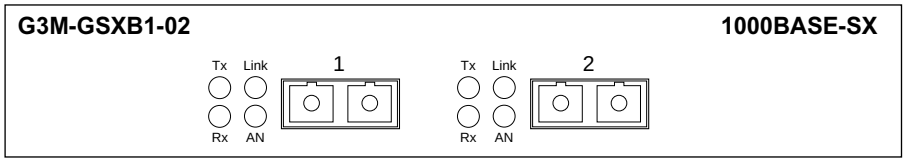


Figure 2-8 Front panel of the 1000BASE-SX line card

The following table lists the media specifications for the 1000BASE-SX line card.

Table 2-10 1000BASE-SX line card specifications

Port type	Specification
1000Base-SX	• 802.3z standard (also uses 802.3x for flow control) • SC-style Media Interface Connector (MIC) • 62.5 micron or 50 micron multi-mode fiber-optic cable • For 62.5 micron fiber-optic cable at a modal bandwidth of 160 Mhz/km, the maximum segment length is 220 meters (722 feet) • For 62.5 micron fiber-optic cable at a modal bandwidth of 200 Mhz/km, the maximum segment length is 275 meters (902 feet) • For 50 micron fiber-optic cable at a modal bandwidth of 400 Mhz/km, the maximum segment length is 500 meters (1640 feet) • For 50 micron fiber-optic cable at a modal bandwidth of 500 Mhz/km, the maximum segment length is 550 meters (1804 feet)

The 1000BASE-SX line card uses the following LEDs.

Table 2-11 1000BASE-SX line card LEDs

LED	Description
Per-port Link	**Green** – Indicates that the port hardware detects a cable and a good link is established. **Red (intermittent)** – Indicates that the port received an error during operation. **Red (solid)** – Indicates that the port hardware detects a cable, however, a bad link is established. **Off** – Indicates that no link from exists with the port.
Per-port Rx	**Green** – Indicates when the port's transceiver receives packets. **Orange** – Indicates when the port's transceiver receives flow-control packets.
Per-port Tx	**Green** – Indicates when the port's transceiver transmits packets. **Orange** – Indicates when the port's transceiver transmits flow-control packets.
Per-port AN	**Green** – Indicates that the line card is auto-negotiating the operating mode of the link between full-duplex and half-duplex. **Orange (intermittent)** – Indicates that auto-negotiation is in process. **Orange (solid)** – Indicates a problem with auto-negotiation configuration. **Red** – Indicates an auto-negotiation failure. This fault may occur if the link partner does not support full duplex. **Off** – Indicates that auto-negotiation has been disabled or the link is down.

1000BASE-LX line card

The 1000BASE-LX line card provides the same features as the 1000BASE-SX line card, but supports both single-mode fiber (SMF) and MMF. Figure 2-9 shows the front panel of the 1000BASE-LX line card.

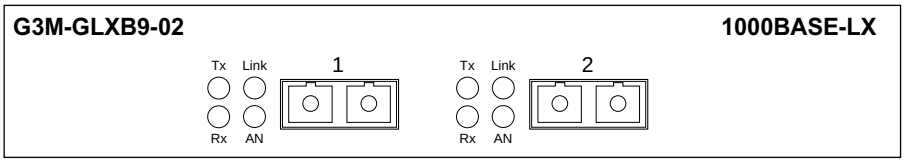


Figure 2-9 Front panel of 1000BASE-LX line card

The following table lists the media specifications for the 1000BASE-LX line card.

Table 2-12 1000BASE-LX line card specifications

Port type	Specification
1000Base-LX	• 802.3z standard (also uses 802.3x for flow control) • SC-style Media Interface Connector (MIC) • 62.5 micron or 50 micron multi-mode fiber-optic cable • 10 micron single-mode fiber-optic cable • For 62.5 micron fiber-optic cable at a modal bandwidth of 500 Mhz/km, the maximum segment length is 550 meters (1804 feet)[a] • For 50 micron fiber-optic cable at a modal bandwidth of 500 Mhz/km, the maximum segment length is 550 meters (1804 feet)[a] • For 50 micron fiber-optic cable at a modal bandwidth of 400 Mhz/km, the maximum segment length is 550 meters (1804) feet • Maximum 5 kilometer (229,659 feet) segment length for the 10 micron SMF fiber-optic cable

a. A mode-conditioning patch cord is required, one at each end of the connection.

The 1000BASE-LX line card uses the following LEDs.

Table 2-13 1000BASE-LX line card LEDs

LED	Description
Per-port Link	**Green** – Indicates that the port hardware detects a cable and a good link is established. **Red (intermittent)** – Indicates that the port received an error during operation. **Red (solid)** – Indicates that the port hardware detects a cable, however, a bad link is established. **Off** – Indicates that no link from exists with the port.
Per-port Rx	**Green** – Indicates when the port's transceiver receives packets. **Orange** – Indicates when the port's transceiver receives flow-control packets.

Table 2-13 1000BASE-LX line card LEDs (Continued)

LED	Description
Per-port Tx	**Green** – Indicates when the port's transceiver transmits packets. **Orange** – Indicates when the port's transceiver transmits flow-control packets.
Per-port AN	**Green** – Indicates that the line card is auto-negotiating the operating mode of the link between full-duplex and half-duplex. **Orange (intermittent)** – Indicates that auto-negotiation is in process. **Orange (solid)** – Indicates a problem with auto-negotiation configuration. **Red** – Indicates an auto-negotiation failure. This fault may occur if the link partner does not support full duplex. **Off** – Indicates that auto-negotiation has been disabled or the link is down.

1000Base-LH line card

The 1000Base-LH line card supports SMF. Figure 2-10 shows the front panel of the 1000BASE-LH line card.

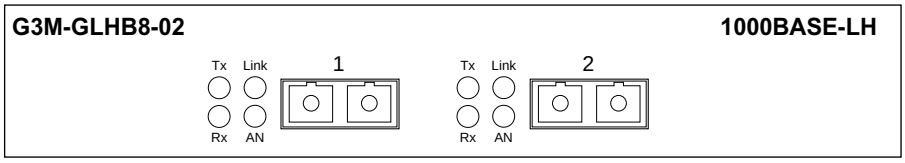


Figure 2-10 Front panel of the 1000BASE-LH line card

The following table lists the media specifications for the 1000BASE-LH line card.

Table 2-14 1000BASE-LH line card specifications

Port type	Specification
1000Base-LH	• 802.3z standard (also uses 802.3x for flow control) • SC-style Media Interface Connector (MIC); either connection pin in the MIC can be used for transmit or receive • 10 micron single-mode fiber-optic cable • Maximum 70 kilometers (229,659 feet) segment length for 10 micron SMF fiber-optic cable

The 1000BASE-LH line card uses the following LEDs.

Table 2-15 1000BASE-LH line card LEDs

LED	Description
Per-port Link	**Green** – Indicates that the port hardware detects a cable and a good link is established. **Red (intermittent)** – Indicates that the port received an error during operation. **Red (solid)** – Indicates that the port hardware detects a cable, however, a bad link is established. **Off** – Indicates that no link from exists with the port.
Per-port Rx	**Green** – Indicates when the port's transceiver receives packets. **Orange** – Indicates when the port's transceiver receives flow-control packets.
Per-port Tx	**Green** – Indicates when the port's transceiver transmits packets. **Orange** – Indicates when the port's transceiver transmits flow-control packets.
Per-port AN	**Green** – Indicates that the line card is auto-negotiating the operating mode of the link between full-duplex and half-duplex. **Orange (intermittent)** – Indicates that auto-negotiation is in process. **Orange (solid)** – Indicates a problem with auto-negotiation configuration. **Red** – Indicates an auto-negotiation failure. This fault may occur if the link partner does not support full duplex. **Off** – Indicates that auto-negotiation has been disabled or the link is down.

MPLS Gigabit Ethernet GBIC Line Card

Figure 2-11 shows the front panel of the 2-port MPLS activated Gigabit Interface Converter (GBIC) line card.

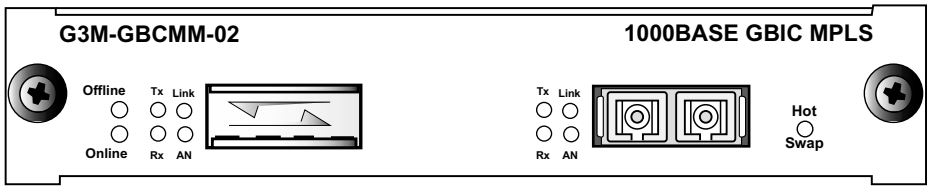


Figure 2-11 Front panel of MPLS GBIC line card with one GBIC installed

GBIC modules provide the media-specific portion of the MPLS GBIC line-card (see Figure 2-12), which support Gigabit Ethernet connectivity across multiple media types and distances. The GBIC line card provides the power, initialization, and control for each GBIC module. Any combination of GBICs can be used on a single MPLS GBIC line card.

Note 802.2 IPX encapsulation is not supported on any MPLS-capable line card.

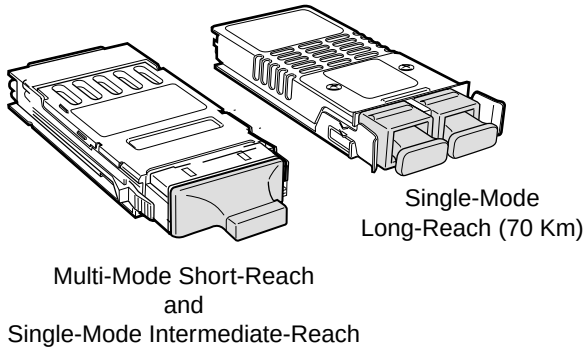


Figure 2-12 GBIC modules

The MPLS Gigabit Ethernet GBIC line cards accept the GBIC modules described in Table 2-16.

Table 2-16 GBIC modules media specification

Port type	Specification
GBIC SX (MMF)	• Multi-mode fiber interface • 50 or 62.5 125-mm multi-mode fiber cable terminated with SC connectors • Maximum of 300 m of cable
GBIC LX (SMF-IR)	• Single-mode fiber (intermediate range) interface • 8 or 9 125-mm single-mode fiber cable terminated with SC connectors • Maximum of 10 km of cable
GBIC LH (SMF-LR)	• Single-mode fiber (long range) interface • 8 or 9 125-mm single-mode fiber cable terminated with SC connectors • Maximum of 70 km of cable
GIC-12	• Twisted pair copper with RJ-45 interface • Conforms to all 1000 BaseT specifications
GIC-CWDM	• See Section 2.4.7, *"CWDM GBICs"* for details about using CWDM GBICs with this line card.

Note When the GIC-12 GBIC is plugged into a port, the link LED for the line card is lit even when there isn't a cable plugged into the GBIC.

When the GIC-12 GBIC is plugged into a port, autonegotiation should be set for that port.

The MPLS line card uses the LEDs as described in Table 2-17.

Table 2-17 MPLS GBIC line card LEDs

LED	Description
Online	When lit, this green LED indicates that the line card is online and is ready to receive, process, and send packets if configured to do so.

Table 2-17 MPLS GBIC line card LEDs (Continued)

LED	Description
Offline	When lit, this amber LED indicates that the line card is offline (powered off) and is ready for hot swap. The Offline LED also is lit briefly during a reboot or reset of the RS and goes out as soon as the Control Module discovers and properly initializes the line card.
Per-GBIC RX	**Green** – indicates when the GBIC's transceiver receives packets **Amber** – indicates when the GBIC's transceiver receives flow-control packets
Per-GBIC TX	**Green** – indicates when the GBIC's transceiver transmits packets **Amber** – indicates when the GBIC's transceiver transmits flow-control packets
Per-GBIC AN	**Green** – indicates that the port hardware has auto negotiated the operating mode of the link between full-duplex and half-duplex. **Orange (intermittent)** – indicates that auto negotiation is in process. **Orange (solid)** – indicates a problem with auto negotiation configuration. **Red** – indicates an auto negotiation failure. This fault may occur if the link partner does not support full duplex. **Off** – indicates that auto negotiation has been disabled or the link is down.
Per-GBIC LINK	**Green** – indicates that the port hardware detects a cable plugged into the port and a good link is established. **Red (intermittent)** – indicates that port hardware received an error during operation. **Red (solid)** – indicates that the port hardware detects a cable plugged into the port, however, a bad link is established. **Off** – indicates that no link from the port exists.

Non-MPLS Gigabit Ethernet GBIC Line Card

Figure 2-13 shows the front panels of the 2-port non-MPLS activated Gigabit Interface Converter (GBIC) line cards. The G3M-GBCFM-02 is used with the RS 3000, RS 3100, RS 3200, RS 1000 and RS 1100switch routers.

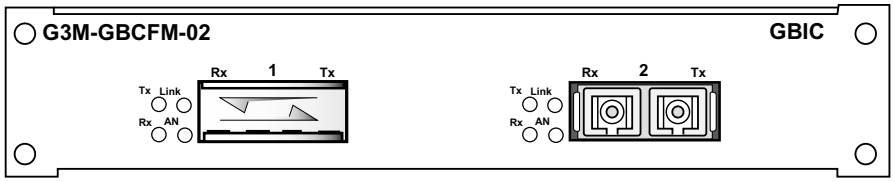


Figure 2-13 Gigabit GBIC line cards with one GBIC installed

GBIC modules provide the media-specific portion of the Gigabit GBIC line-card, which support Gigabit Ethernet connectivity across multiple media types and distances. The Gigabit GBIC line cards provide the power, initialization, and control for each GBIC module. Any combination of GBICs can be used on a single Gigabit GBIC line card.

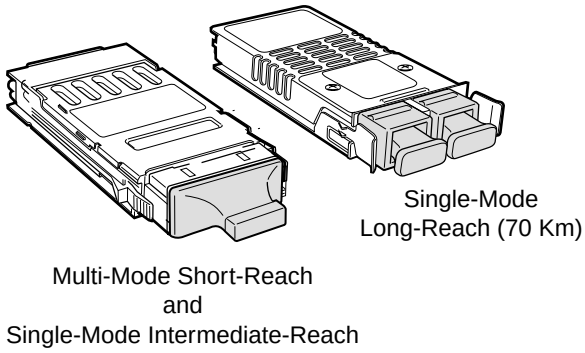


Figure 2-14 GBIC modules

The Gigabit GBIC line cards accept the GBIC modules described in Table 2-18.

Table 2-18 GBIC modules media specification

Port type	Specification
GBIC SX (MMF)	• Multi-mode fiber interface • 50 or 62.5 125-mm multi-mode fiber cable terminated with SC connectors • Maximum of 300 m of cable
GBIC LX (SMF-IR)	• Single-mode fiber (intermediate range) interface • 8 or 9 125-mm single-mode fiber cable terminated with SC connectors • Maximum of 10 km of cable
GBIC LH (SMF-LR)	• Single-mode fiber (long range) interface • 8 or 9 125-mm single-mode fiber cable terminated with SC connectors • Maximum of 70 km of cable
GIC-12	• Twisted pair copper with RJ-45 interface • Conforms to all 1000 BaseT specifications
GIC-CWDM	• See Section 2.4.7, *"CWDM GBICs"* for details about using CWDM GBICs with this line card.

Note When the GIC-12 GBIC is plugged into a port, the link LED for the line card is lit even when there isn't a cable plugged into the GBIC.

When the GIC-12 GBIC is plugged into a port, autonegotiation should be set for that port.

The Gigabit GBIC line cards use the LEDs as described in Table 2-19.

Table 2-19 Gigabit GBIC line card LEDs

LED	Description
Online	When lit, this green LED indicates that the line card is online and is ready to receive, process, and send packets if configured to do so.
Offline	When lit, this amber LED indicates that the line card is offline (powered off) and is ready for hot swap. The Offline LED also is lit briefly during a reboot or reset of the RS and goes out as soon as the Control Module discovers and properly initializes the line card.
Per-GBIC RX	**Green** – indicates when the GBIC's transceiver receives packets **Amber** – indicates when the GBIC's transceiver receives flow-control packets
Per-GBIC TX	**Green** – indicates when the GBIC's transceiver transmits packets **Amber** – indicates when the GBIC's transceiver transmits flow-control packets
Per-GBIC AN	**Green** – indicates that the port hardware has auto negotiated the operating mode of the link between full-duplex and half-duplex. **Orange (intermittent)** – indicates that auto negotiation is in process. **Orange (solid)** – indicates a problem with auto negotiation configuration. **Red** – indicates an auto negotiation failure. This fault may occur if the link partner does not support full duplex. **Off** – indicates that auto negotiation has been disabled or the link is down.
Per-GBIC LINK	**Green** – indicates that the port hardware detects a cable plugged into the port and a good link is established. **Red (intermittent)** – indicates that port hardware received an error during operation. **Red (solid)** – indicates that the port hardware detects a cable plugged into the port, however, a bad link is established. **Off** – indicates that no link from the port exists.

Dual Serial and Quad Serial – C/CE line cards

The Dual Serial line card contains a single dual serial WAN port (two serial ports located on one high density connector). The Quad Serial – C and Quad Serial – CE line cards each contain two dual serial WAN ports. In addition, the Quad Serial – C line card includes compression, and the Quad Serial – CE line card includes compression and encryption. Figure 2-15 shows the front panel of the Dual Serial WAN line card.

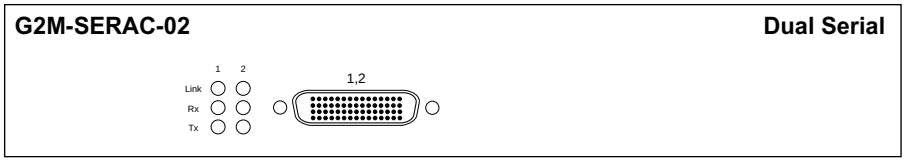


Figure 2-15 Front panel of the Dual Serial WAN line card

Figure 2-16 shows the front panel of the Quad Serial WAN line card with compression.

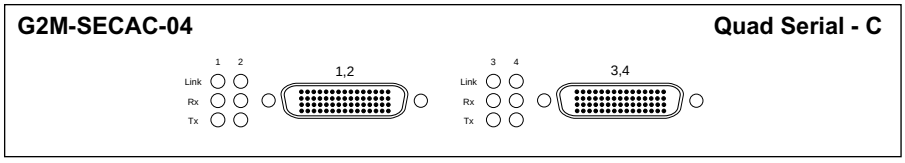


Figure 2-16 Front panel of the Quad Serial – C WAN line card

Figure 2-17 shows the front panel of the Quad Serial WAN line card with compression and encryption.

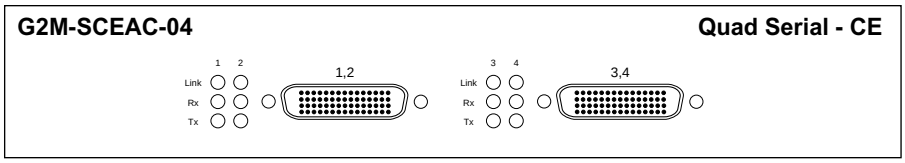


Figure 2-17 Front panel of the Quad – CE WAN line card

The following table lists the connection specifications for the Dual Serial and Quad Serial – C/CE line cards.

Table 2-20 Dual Serial and Quad Serial connection specifications

Port Type	Specification
Dual serial	• V.35, X.21, EIA530, EIA530A, or RS449 • LFH-60 high density connector • Recommended 3 meters (10 feet) segment length for standard WAN line card-to-CSU/DSU data port.[a]

a. Connector cables for WAN line cards may be ordered from Riverstone Networks, Inc. See Table 2-22.

Riverstone Dual Serial and Quad Serial–C/CE line cards use standard copper twisted-pair cable with one of four custom remote-end connectors to attach to their respective CSU/DSU connectors. Figure 2-18 shows the pin orientation of the connector.

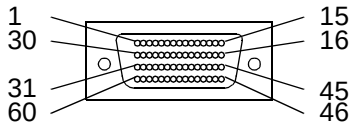


Figure 2-18 LFH-60 high density connector

Table 2-21 LFH-60 connector pinouts

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	P1_GND	16	P2_TXC_A	31	P1_GND	46	P2_TXD_A
2	P1_MODE[2]	17	P2_TXC_B	32	P1_MODE[0]	47	P2_TXD_B
3	P1_CTS_B	18	P2_DCD_A	33	P1_DCD_B	48	P2_RTS_A
4	P1_CTS_A	19	P2_DCD_B	34	P1_DCD_A	49	P2_RTS_B
5	P1_RTS_B	20	P2_MODE[1]	35	P0_RXD_B	50	P2_DSR_A
6	P1_RTS_A	21	P2_GND	36	P0_RXD_A	51	P2_DSR_B
7	P1_SCTE_B	22	P2_GND	37	Reserved	52	P2_LL_A
8	P1_SCTE_A	23	P1_TXD_A	38	P2_GND	53	P2_SHIELD
9	P1_GND	24	P1_TXD_B	39	P2_MODE[0]	54	Reserved
10	P2_GND	25	P1_TXC_A	40	P2_CTS_B	55	P1_RXC_A
11	P2_MODE[2]	26	P1_TXC_B	41	P2_CTS_A	56	P1_RXC_B
12	P2_RXD_B	27	P1_DSR_A	42	P2_DTR_B	57	P1_DTR_A

Table 2-21 LFH-60 connector pinouts (Continued)

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
13	P2_RXD_A	28	P1_DSR_B	43	P2_DTR_A	58	P1_DTR_B
14	P2_RXC_B	29	P1_MODE[1]	44	P2_SCTE_B	59	P1_LL_A
15	P2_RXC_A	30	P1_GND	45	P2_SCTE_A	60	P1_SHIELD

Riverstone offers four cables, listed in Table 2-22, used to connect the RS 3000, RS 3100 and RS 3200 to standard CSU/DSU connectors.

Table 2-22 Riverstone dual serial port to CSU/DSU connector cables

Riverstone Part Number	CSU/DSU Connector Type	Standard
RS-V35DTE-02	Two (2) V.35 34-pin connectors[a]	V.35
RS-530DTE-02	Two (2) DB-25 25-pin connectors	EIA-530
RS-449DTE-02	Two (2) DB-37 37-pin connectors	RS-449
RS-X21DTE-02	Two (2) DB-15 15-pin connectors	X.21

a. The two remote ends of each type of connector cable is labeled “Port A” and “Port B”. “Port A” corresponds to Port 1 on a Dual Serial WAN line card and Port 1 or 3 on a Quad Serial – C/CE, depending upon which WAN line card port you are using. Similarly, Port B corresponds to Port 2 on a Dual Serial WAN line card and Port 2 or 4 on a Quad Serial – C/CE.

The Dual Serial and Quad Serial – C/CE line cards use the following LEDs.

Table 2-23 Dual Serial and Quad Serial – C/CE WAN line card LEDs

LED	Description
Per-port Link	Indicates that the line card detects a cable and a good link is established.
Per-port Rx	Indicates when the port’s transceiver receives data.
Per-port Tx	Indicates when the port’s transceiver transmits data.

Dual HSSI line card

The Dual HSSI line card contains two 50-pin High Speed Serial Interface (HSSI) ports. Figure 2-19 shows the front panel of the Dual HSSI WAN line card.

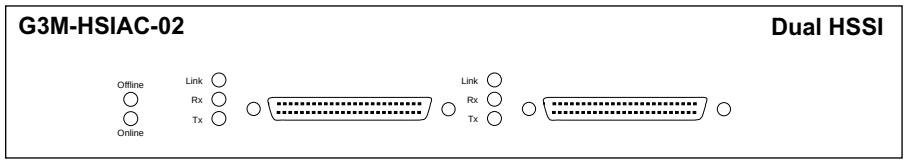


Figure 2-19 Front panel of the dual HSSI WAN line card

The following table lists the media specifications for the Dual HSSI line card.

Table 2-24 Dual HSSI line card specifications

Port Type	Specification
HSSI	• HSSI rev 2.11 • 50-pin High Speed Serial Interface (HSSI) connector • Recommended 3 meters (10 feet) segment length for standard WAN line card to CSU/DSU data port.[a]

a. Connector cables for WAN line cards may be ordered from Riverstone Networks, Inc.

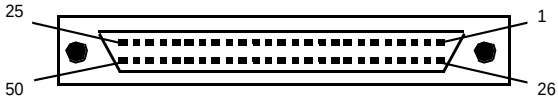


Figure 2-20 50 pin HSSI connector

Table 2-25 50 pin HSSI connector pinouts

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	GND	14	(reserved)	26	GND	39	(reserved)
2	RT+	15	(reserved)	27	RT-	40	(reserved)
3	CA+	16	(reserved)	28	CA-	41	(reserved)
4	RD+	17	(reserved)	29	RD-	42	(reserved)
5	LC+	18	(reserved)	30	LC-	43	(reserved)
6	ST+	19	GND	31	ST-	44	GND

Table 2-25 50 pin HSSI connector pinouts

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
7	GND	20	(reserved)	32	GND	45	(reserved)
8	TA+	24	(reserved)	33	TA-	46	(reserved)
9	TT+	22	(reserved)	34	TT-	47	(reserved)
10	LA+	23	(reserved)	35	LA-	48	(reserved)
11	SD+	24	(reserved)	36	SD-	49	(reserved)
12	LB+	25	GND	37	LB-	50	GND
13	GND			38	GND		

The Dual HSSI line card uses the following LEDs.

Table 2-26 Dual HSSI line card LEDs

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that it is offline (powered off). The Offline LED also is lit briefly during a reboot or reset of the router but goes out as soon as the control module discovers the line card.
Online	When lit, this green LED indicates that the line card is online and is ready to receive, process, and send packets if configured to do so.
Link	Indicates that the line card detects a cable plugged into the port and a good link is established.
Rx	Indicates when the port's transceiver receives data.
Tx	Indicates when the port's transceiver transmits data.

ATM Multi-rate Line Card

The ATM Multi-rate line card houses various Physical Layer (PHY) interface cards in its two available slots. ATM PHY cards provide the media-specific portion of an ATM interface to support ATM connectivity across multiple platforms using different media types. The line card provides the power, initialization, and control for the PHY card.

Figure 2-21 shows the front panel of the ATM Multi-rate line card.

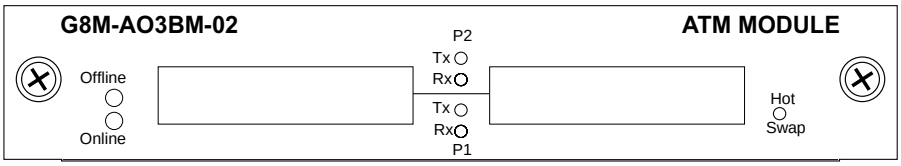
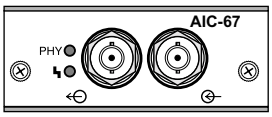
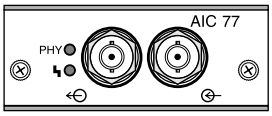
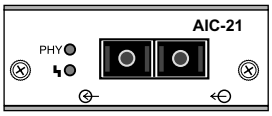
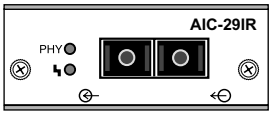


Figure 2-21 Front panel of ATM Multi-rate line card

See Section 3.3.4, *"Installing the ATM PHY Cards"* for instructions on installing PHYs into the ATM Multi-rate line card.

The ATM Multi-rate line card has two available slots. Each slot accepts the following PHY interface modules:

Table 2-27 PHY modules for ATM Multi-rate line card

Port type	Specification
AIC-67 	• DS-3/T-3 interface (BNC Coax) • 75 coaxial (RG-59B or equivalent) terminated with 75-ohm BNC connectors • Maximum of 450 ft (137 m) of cable
AIC-77 	• E-3 interface (BNC) • 75 coaxial (RG-59B or equivalent) terminated with 75-ohm BNC connectors • Maximum of 450 ft (137 m) of cable
AIC-21 	• OC-3c MMF interface (SC-style) • EIA/TIA 492-AAAA • 62.5/125 µm • Maximum of 2 kilometers of cable • 0 to 9 dB loss at 1300 nm
AIC-29IR 	• OC-3c SMF-IR interface (SC-style) • EIA/TIA 492-CAAA • 9/125 µm • Maximum of 15 kilometers of cable • 0 to 15 dB loss at 1300 nm

The ATM Multi-rate line card uses the following LEDs.

Table 2-28 LED description for ATM Multi-rate line card

LED	Description
PHY	**Green** – indicates that the PHY is operating properly and a link is established **Amber** – indicates that the PHY is inactive due to media errors Blinking Green – indicates that the PHY has been disabled by management **Off** – indicates no connection
↳	**Amber** – indicates that the diagnostics have detected a fault **Blinking Green** – indicates that the PHY port has been redirected elsewhere
Per-PHY Rx	**Green** – indicates when the PHY's transceiver receives packets **Amber** – indicates when the PHY's transceiver receives flow-control packets
Per-PHY Tx	**Green** – indicates when the PHY's transceiver transmits packets **Amber** – indicates when the PHY's transceiver transmits flow-control packets

Multi-rate WAN Line Card

The Multi-rate WAN line card can contain two WAN Interface Cards (WICs). Figure 2-22 shows the front panel of the Multi-rate WAN line card with one WIC installed. The Multi-rate WAN line card supports channelized T1 and E1 and Clear Channel T3 and E3 WICs. The WAN line card can support any combination of the various WICs.

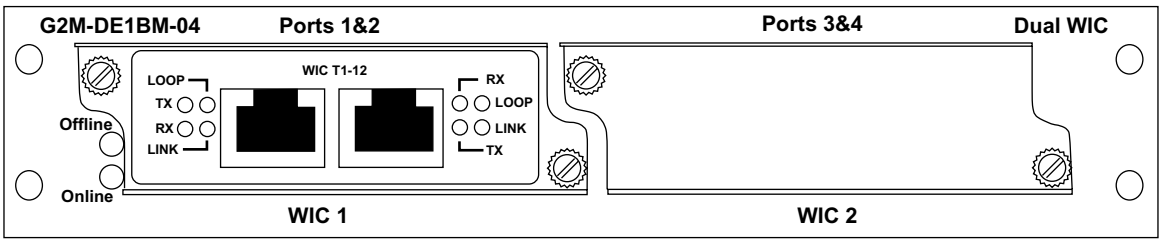


Figure 2-22 Multi-rate WAN line card with one T1 WIC

Each T1/E1 WIC has two ports, each port provides a WAN interface.

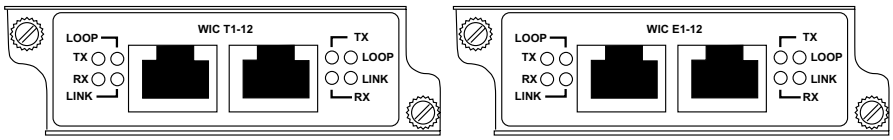


Figure 2-23 T1 and E1 WICs

Each Clear Channel T3/E3 WIC contains a transmit and a receive port that provide a single WAN interface.

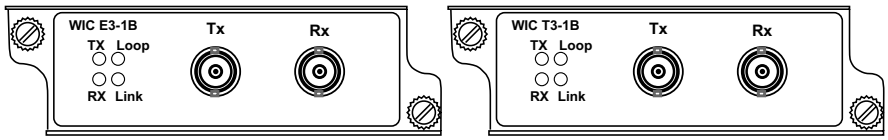


Figure 2-24 Clear channel T3 and E3 WICs

Table 2-29 through Table 2-32 list the specifications for the various WICs supported by the Multi-rate WAN module.

Table 2-29 Specifications for T1 WIC card

Port type	Specification
Channelized T1	• Two RJ-48c connectors • ANSI T1.102, T1.107, T1.403 compliant • Supports SF/ESF • Supports AMI/B8ZS

Table 2-30 Specifications for E1 WIC card

Port type	Specification
Channelized E1	• Two RJ-45 connectors • G.703, G.704, and 732 compliant • G.704 framing • HDB3, AMI

Table 2-31 Specifications for Clear Channel T3 WIC card

Port-type	Specification
Clear Channel T3	• 75-ohm coaxial BNC connectors • ANSI T1.102, T1.107, and T1.404a compliant • Supports M23 and C-bit framing • B8ZS

Table 2-32 Specifications for Clear Channel E3 WIC card

Port-type	Specification
Clear Channel E3	• 75-ohm coaxial BNC connectors • G.703, G.704, and 732 compliant • G.704 framing • HDB3, AMI

Table 2-33 lists the pin assignments for both the RJ-48c connector on the T1 WIC and the RJ-45 connector on the E1 WIC.

Table 2-33 Pin assignments for T1 and E1 WICs

WIC Line Card Connector	Pin Number	RJ-48c/RJ-45 Connector at Other End of Segment
RXD	1	TXD
RXD	2	TXD
reserved	3	reserved
TXD	4	RXD
TXD	5	RXD
reserved	6	reserved
reserved	7	reserved
reserved	8	reserved

The Multi-rate WAN line card and all WICs use the following LEDs:

Table 2-34 LEDs for Multi-rate WAN line card and WICs

LED	Description
Offline	When lit, this amber LED on the left side of the module indicates that the module is offline (powered off) but is ready for hot swap. The Offline LED also is lit briefly during a reboot or reset of the RS but goes out as soon as the Control Module discovers the module.
Online	When lit, this green LED indicates that the module is online and is ready to receive, process, and send packets if configured to do so.
Per-port Loop	**Off** – indicates normal operations. **Blinking Green** – remote loopback; Tx is looped back into Rx outside this device. **Green** – local loopback; Tx is looped back into Rx before leaving this device. **Yellow** – the network has placed this port in loopback; Rx is looped back out to Tx within this device **Blinking Yellow** – the Alarm Indication Signal (AIS)/ Blue Alarm. It indicates that the line card has a connection to the upstream device; but the upstream device has lost its receive connection to the network and is sending an AIS to indicate this.
Per-port Link	**Green** – indicates that the line card detects a cable plugged into the port and a good link is established. **Blinking Green** – Port is in transition to active state **Yellow** – indicates that the port was disabled by management. **Off** – indicates that the port is not configured (i.e., there are no time slot assignments).
Per-port Tx	**Flashing Green** – indicates that the port's transceiver is transmitting data. **Blinking Yellow** – the Remote Alarm Indication (RAI)/Yellow Alarm signal. The remote device is in a Red alarm condition (it is not receiving a signal from the line card). This is a framed indication.
Per-port Rx	**Flashing Green** – indicates that the port's transceiver is receiving data. **Blinking Yellow** – the Red alarm. Indicates a loss of signal (LOS) or loss of framing (LOF) on the Rx side.

MPLS POS OC-3c Line Card

The MPLS OC-3c line card supports Multi-Protocol Label Switching (MPLS) at the OC-3c line rate. It is designed to use Small Form-Factor Pluggable (SFP) connectors. Figure 2-25 shows the front panel of the POS OC-3c MPLS line card.

Note 802.2 IPX encapsulation is not supported on any MPLS-capable line card.

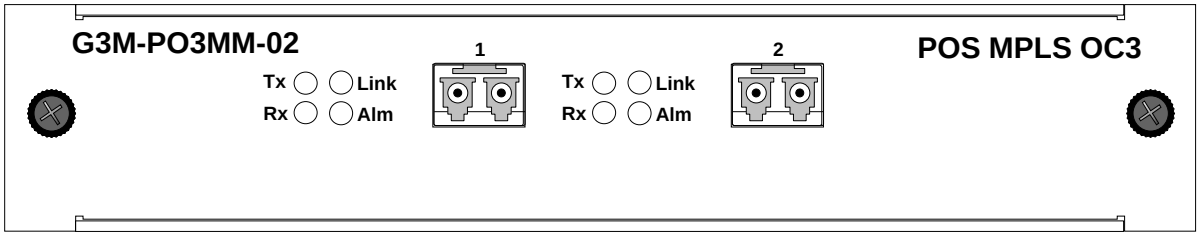


Figure 2-25 Front panel of the MPLS POS-OC3c line card

Table 2-35 lists the media specifications for the MPLS POS OC-3c line card.

Table 2-35 Cabling and connectors for MPLS POS OC-3c line card

Port type	Specification
POS OC-3c	• Bellcore GR253, ITU -T G.957, ITU-T G.958 • PPP over SONET/SDH (RFC 1619), PPP in HDLC framing (RFC 1662) • Supports standard SFP pluggable optics (Small Form-factor Pluggable Transceiver Multi Source Agreement)

Table 2-36 lists the LEDs used by the MPLS POS line cards.

Table 2-36 LED description for MPLS POS OC-3c line card

LED	Description
Per-port Link	**Solid Green** – when PPP has negotiated any NCP protocol (BNCP/IPCP/MPLSCP/IPXCP/OSICP) **Off** – indicates that PPP has NOT negotiated any NCP protocol
Per-port Rx	**Blinking Green** – indicates when the port's transceiver receives good packets **Blinking Red** – indicates when the port's transceiver receives corrupt packets **OFF** – no receive activity
Per-port Tx	**Blinking Green** – indicates when the port's transceiver transmits good packets **OFF** - no transmit activity
Per-port Alm	**Solid Red** – when signal alarms are present **Off** – when no alarms are present

Advanced Services Module

Riverstone's Advanced Services Module (ASM) is a 1-slot, 2-port Gigabit Ethernet linecard that provides Quality of Service (QoS) capabilities for Ethernet networks. It provides the following features and benefits::

- 256 shapers for ingress & egress
- Up to 512 Mbytes per-port
- CAM with 16k entries for rate-shaper classifiers
- WRED on each shaper
- Separate drop weights configurable for each port – based on 802.1P or ToS-precedence
- Groups for shapers or individual shapers
- Express-lane per-port in each direction
- Default queue per-port in each direction
- Configurable buffer size for each shaper
- CAR rate and burst rate
- Exceed-actions – based on ToS byte, ToS-precedence, DSCP, or EXP bit rewrite
- Statistics for each queue and WRED instance
- Configurable priorities (4) per queue
- Jumbo frame support - Jumo frames sizes up to 9000 bytes are supported
- Additional filtering based on ACL, VLAN, 802.1P, MPLS label, and port-of-entry (POE)

Each shaper can be individually configured into one of three modes:

- Single-rate Shaping – Rate-shapers configured with only a Committed Access Rate (CAR)
- Dual-rate Shaping – Rate-shapers configured with a CAR and a burst size
- Shaper Groups – rate-shapers, each with a CAR, are aggregated into a group. The rate assigned to the group acts as the collective burst-size for the rate-shapers within the group.

Figure 2-26 shows the front panel of the 2-port Advanced Services Module (GBIC) line card.

Note 802.2 IPX encapsulation is not supported on any MPLS-capable line card.

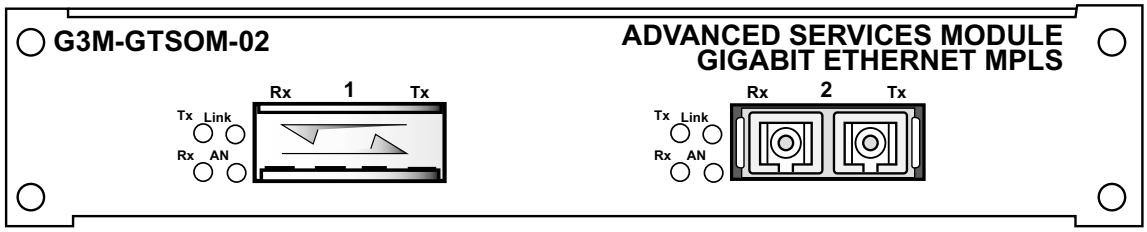


Figure 2-26 Front panel of Advanced Services card with one GBIC installed

GBIC modules provide the media-specific portion of the Advanced Services line-card (see Figure 2-27), which support Gigabit Ethernet connectivity across multiple media types and distances. The GBIC line card provides the power, initialization, and control for each GBIC module. Any combination of GBICs can be used on a single Advanced Services line card.

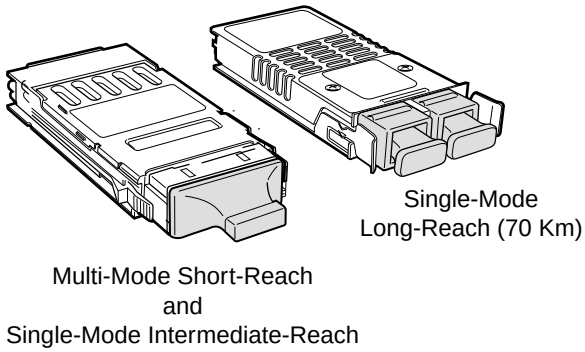


Figure 2-27 GBIC modules

The Advanced Services line card accepts the GBIC modules described in Table 2-37.

Table 2-37 GBIC modules media specification

Port type	Specification
GBIC SX (MMF)	• Multi-mode fiber interface • 50 or 62.5 125-mm multi-mode fiber cable terminated with SC connectors • Maximum of 300 m of cable
GBIC LX (SMF-IR)	• Single-mode fiber (intermediate range) interface • 8 or 9 125-mm single-mode fiber cable terminated with SC connectors • Maximum of 10 km of cable
GBIC LH (SMF-LR)	• Single-mode fiber (long range) interface • 8 or 9 125-mm single-mode fiber cable terminated with SC connectors • Maximum of 70 km of cable
GIC-12	• Twisted pair copper with RJ-45 interface • Conforms to all 1000 BaseT specifications
GIC-CWDM	• See Section 2.4.7, *"CWDM GBICs"* for details about using CWDM GBICs with this line card.

Note When the GIC-12 GBIC is plugged into a port, the link LED for the line card is lit even when there isn't a cable plugged into the GBIC.

When the GIC-12 GBIC is plugged into a port, autonegotiation should be set for that port.

The Advanced Services line card uses the LEDs as described in Table 2-38.

Table 2-38 Advanced Services line card LEDs

LED	Description
Online	When lit, this green LED indicates that the line card is online and is ready to receive, process, and send packets if configured to do so.

Table 2-38 Advanced Services line card LEDs (Continued)

LED	Description
Offline	When lit, this amber LED indicates that the line card is offline (powered off) and is ready for hot swap. The Offline LED also is lit briefly during a reboot or reset of the RS and goes out as soon as the Control Module discovers and properly initializes the line card.
Per-GBIC RX	**Green** – indicates when the GBIC's transceiver receives packets **Amber** – indicates when the GBIC's transceiver receives flow-control packets
Per-GBIC TX	**Green** – indicates when the GBIC's transceiver transmits packets **Amber** – indicates when the GBIC's transceiver transmits flow-control packets
Per-GBIC AN	**Green** – indicates that the port hardware has auto negotiated the operating mode of the link between full-duplex and half-duplex. **Orange (intermittent)** – indicates that auto negotiation is in process. **Orange (solid)** – indicates a problem with auto negotiation configuration. **Red** – indicates an auto negotiation failure. This fault may occur if the link partner does not support full duplex. **Off** – indicates that auto negotiation has been disabled or the link is down.
Per-GBIC LINK	**Green** – indicates that the port hardware detects a cable plugged into the port and a good link is established. **Red (intermittent)** – indicates that port hardware received an error during operation. **Red (solid)** – indicates that the port hardware detects a cable plugged into the port, however, a bad link is established. **Off** – indicates that no link from the port exists.

2.4.7 CWDM GBICs

All Gigabit Ethernet ports on the RS can be configured for Coarse Wavelength Division Multiplexing (CWDM) through use of CWDM GBICs. CWDM allows a single fiber to carry up to eight separate wavelengths, enabling 8 full duplex GigE links over a pair of fibers. Each wavelength is supported by a seperate GBIC that is tuned to that wavelength. Mux/DeMux modules are used to aggregate up to eight different wavelengths for transmission onto a single fiber. Add/ Drop modules are used to extract a single wavelength from a fiber. Figure 2-28 and Figure 2-29 describe two common applications for use of CWDM with the RS.

Figure 2-28 describes a CWDM point-to-point configuration. In this example, eight ports on each of two RS Switch/Routers are configured with CWDM GBICs tuned to different wavelengths. Each of the eight GBICs are then connected with two fibers, for full duplex connectivity, to a port configured for the same wavelength on a MUX/DEMUX module. All of the eight wavelengths are multiplexed on a single fiber in each direction (two fibers for full duplex connectivity). This fiber is then connected to a remote MUX/DEMUX module where it is demultiplexed and routed to the GBIC with the corresponding wavelength.

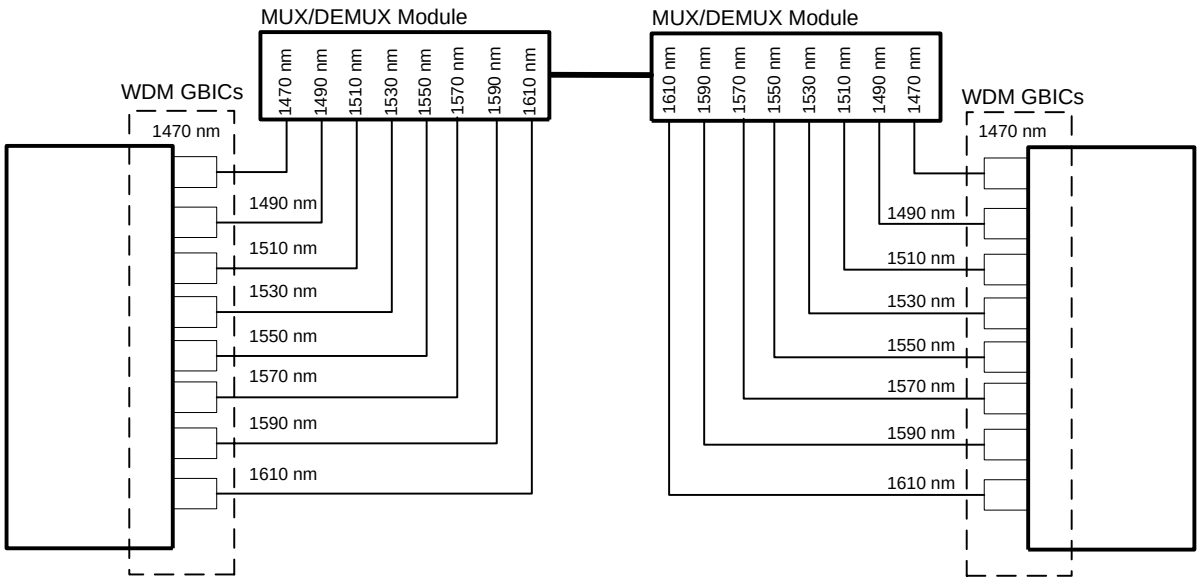


Figure 2-28 CWDM Point to Point Configuration

Figure 2-29 describes a CWDM ring configuration. In this example, four ports on an RS Switch/Router are configured with CWDM GBICs tuned to different wavelengths. Each of the four GBICs are then connected with two fibers, for full duplex connectivity, to a port configured for the same wavelength on a MUX/DEMUX module. All of the four wavelengths are multiplexed on a single fiber in each direction (two fibers for full duplex connectivity). At four different locations, a CWDM Add/Drop Module is used to demultiplex one of the wavelengths that is on the fiber and routed to the GBIC with the corresponding wavelength.

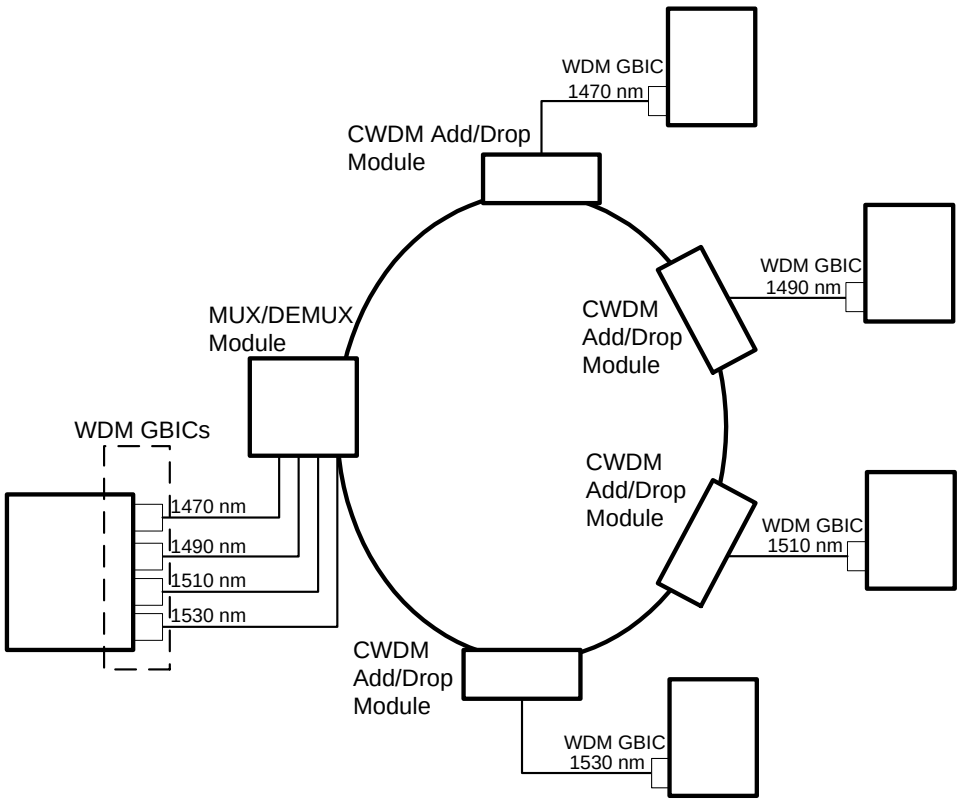


Figure 2-29 CWDM Ring Configuration

Table 2-39 shows each of the GBICs used for configuring an RS-based CWDM network. For information on obtaining the additional equipment used for an installation, contact your sales representative.

Table 2-39 CWDM GBICs

Model Number	Specification
GIC-CWDM-1470	• Single-mode fiber interface • Terminated with SC connectors • 1470 nm wavelength
GIC-CWDM-1490	• Single-mode fiber interface • Terminated with SC connectors • 1490 nm wavelength

GIC-CWDM-1510	• Single-mode fiber interface • Terminated with SC connectors • 1510 nm wavelength
GIC-CWDM-1530	• Single-mode fiber interface • Terminated with SC connectors • 1530 nm wavelength
GIC-CWDM-1550	• Single-mode fiber interface • Terminated with SC connectors • 1550 nm wavelength
GIC-CWDM-1570	• Single-mode fiber interface • Terminated with SC connectors • 1570 nm wavelength
GIC-CWDM-1590	• Single-mode fiber interface • Terminated with SC connectors • 1590 nm wavelength
GIC-CWDM-1610	• Single-mode fiber interface • Terminated with SC connectors • 1610 nm wavelength

3 HARDWARE INSTALLATION

This chapter provides hardware installation instructions and information on safety considerations, environmental considerations, and regulatory standards.

3.1 SAFETY CONSIDERATIONS *EN ESPANOL -- APPENDIX B*

Read the following safety warnings and product cautions to avoid personal injury or product damage.

3.1.1 Preventing Injury

Observe the following safety warnings to prevent accidental injury when working with the RS 3000, RS 3x00 and RS 3200 hardware:

- Be careful when lifting the RS 3000, RS 3x00 or RS 3200 out of the shipping box.
- Never attempt to rack mount the RS 3000, RS 3x00 or RS 3200 unaided. Ask an assistant to help you with the RS 3000, RS 3x00 or RS 3200.
- Before performing any mechanical upgrade or installation procedures, make sure that the RS 3000, RS 3x00 or RS 3200 is powered off.
- Never operate the RS 3000, RS 3x00 or RS 3200 with exposed expansion slots.
- Never operate the RS 3000, RS 3x00 or RS 3200 if it becomes wet or the area where it has been installed is wet.

3.1.2 Preventing Equipment Damage

To prevent damage to the RS 3000, RS 3x00 or RS 3200 components, observe the following warnings.

Warning Always use proper electrostatic discharge (ESD) gear when handling line cards or other internal parts of the RS 3000, RS 3x00 or RS 3200.

Warning Make sure you allow at least three inches of room for air flow around the RS 3000, RS 3x00 or RS 3200 chassis.

3.2 SPECIFICATIONS

Table 3-1 lists physical, electrical, and environmental specifications for the RS 3000, RS 3x00 and RS 3200.

Table 3-1 Physical, electrical, and environmental specifications

Specification	Measurement
Height	3.25 in (8.25 cm)
Width	17 in (43.2 cm)
Depth	18.5 in (47 cm)
Weight	20 lbs (9 Kg)
Power	100-240 VAC, 3-1.5 A, 50-60 Hz
Operating temperature	+0° to 40°C (32° to 104°F)
Non-Operating Temperature	-40° to 70°C (-40° to 158°F)
Operating Humidity	10% to 95% (non-condensing)
Non-operating Humidity	5% to 95% (non-condensing)

3.3 INSTALLING THE HARDWARE

Hardware installation of the RS 3000, RS 3x00 or RS 3200 is accomplished by the following basic steps:

- Unpacking your shipment and verifying its contents
- Installing expansion line cards (if any)
- Mounting the unit into an equipment rack
- Connecting the serial and 10/100 Base-T management cables

This section provides detailed information regarding these procedures.

3.3.1 Verifying Your Shipment

Before you begin installing your RS 3000, RS 3x00 or RS 3200, check your shipment to ensure that everything you ordered arrived securely. Open the shipping box(es) and verify that you received the following equipment:

- RS 3000, RS 3x00 or RS 3200 power cord(s)
- Console (serial) cable
- *Riverstone RS Switch Router Getting Started Guide*
- *Riverstone Networks Documentation CD*
- Release Notes
- Rack mount kit
- Depending on your order, your shipment may also contain line cards

3.3.2 Installing Line Cards

Before installing the RS 3000, RS 3x00 or RS 3200 into an equipment rack, it is recommended that you first install any expansion line cards that you may have ordered with the unit. Installing expansion line cards before rack mounting will prevent the need to remove the RS 3000, RS 3x00 or RS 3200 from its rack and remove the mounting hardware from the RS 3000, RS 3x00 or RS 3200 chassis.

Line Card Differences

While the process for installation is essentially the same for all line cards, there are a few differences between a few line cards that affect installation process. The following lists these differences:

- All line cards use one of two types of face plates: a “standard” face plate or an “extended,” EMI-protective face plate (see Figure 3-4). Each of these face plates must be installed in a slightly different manner.
- The Multi-rate WAN line card is designed differently from other line cards, and requires the removal of certain hardware components from inside the RS 3000, RS 3x00 or RS 3200 chassis (see Figure 3-11).

Installing Standard and Extended Face Plate Line Cards

There are two types of face plates for line cards: a standard face plate (shipped with most line cards) and an extended, EMI-protective face plate (shipped with certain line cards). The standard face plate is shaped somewhat like the expansion slot cover. The extended, EMI-protective face plate has an extended bottom surface (see Figure 3-4). The following procedure explains how to install line cards that use either the standard or extended face plate.

Warning Always use proper electrostatic discharge (ESD) gear when handling line cards or other internal parts of the RS 3000, RS 3x00 or RS 3200.

1. Make sure that the RS 3000, RS 3x00 or RS 3200 is powered off.
2. If rack mounted, remove the RS 3000 from the equipment rack.
3. If the RS 3000 is equipped for rack mounting, use the #2 Phillips-head screwdriver to remove the mounting brackets from each side of the chassis.
4. Use the #2 Phillips-head screwdriver to remove the four screws that hold the top cover on the RS 3000, RS 3x00 or RS 3200 (see Figure 3-1).

Caution Do not remove the faceplate from the chassis when you are installing line cards. You will not be able to reinstall the faceplate once the line cards are installed.

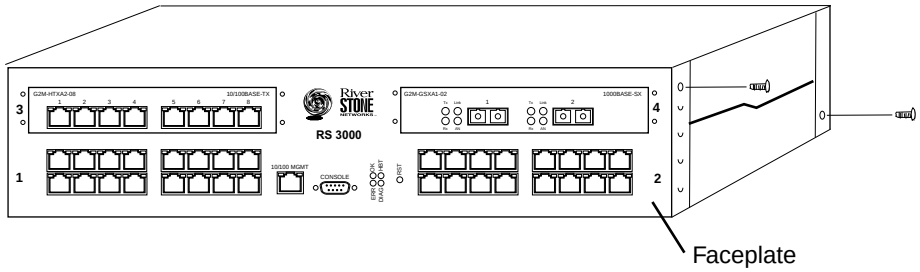


Figure 3-1 Removing the RS 3000, RS 3x00 or RS 3200's cover

5. Slide the cover away from the front of the RS 3000, RS 3x00 or RS 3200 about one-half inch (1/2"), then lift the cover away. Be careful not to damage or remove any EMI gaskets around the edges of the cover.
6. Use the #2 Phillips-head screwdriver to remove the four mounting screws that secure the cover plate to the expansion slot (see Figure 3-2). Be careful not to damage or remove any EMI gaskets around the edges of the expansion slot opening.

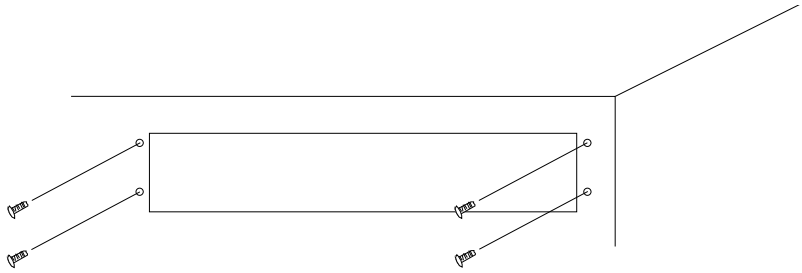


Figure 3-2 Removing the cover plate (view from outside chassis)

7. Install the line card's face plate:

   Standard Face Plate – From the inside of the chassis, line up the four holes in the line card's face plate with the corresponding holes around the expansion slot. Use the screws provided and the #2 Phillips-head screwdriver to affix the line card's face plate to the chassis.

   Extended Face Plate – From the inside of the chassis, place the face plate on top of the motherboard. Align the extended face plate so that the four holes around the front of the face plate align with the four holes around the expansion slot, and the four notches of the extended part are directly over the four stand-offs on the motherboard (see Figure 3-5). You may need to gently push the extended face plate down while lining up the first of the face plate screws. Use the screws provided and the #2 Phillips-head screwdriver to affix the line card's face plate to the chassis.

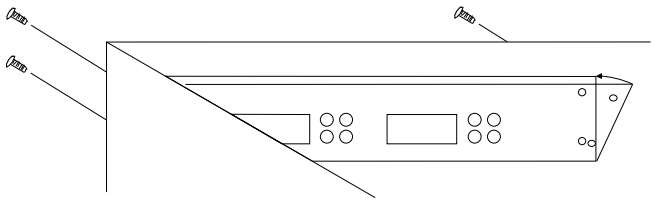


Figure 3-3 Installing “standard” line card face plate (view from inside chassis)

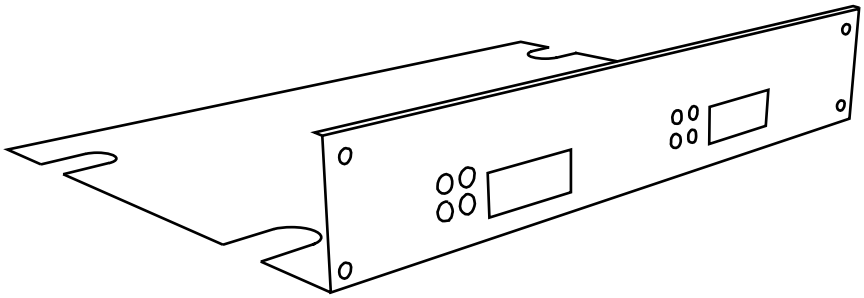


Figure 3-4 “Extended” EMI face plate

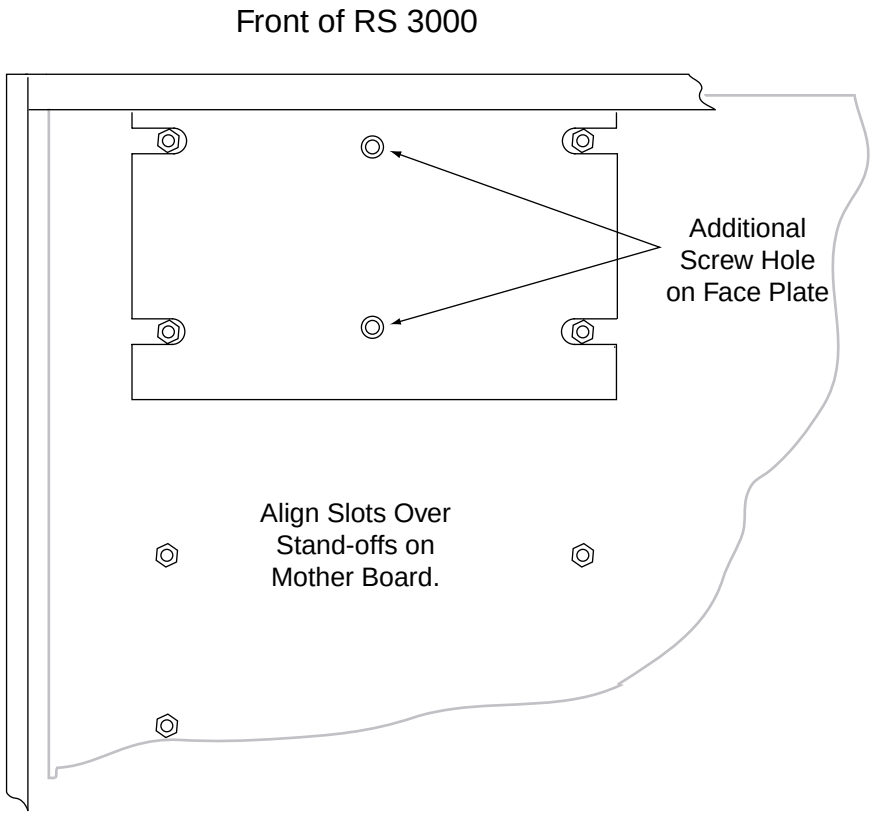


Figure 3-5 Installing the extended EMI face plate

8. Insert the line card from the top and ensure that it makes maximum surface contact with its face plate.

9. Line up the two screw holes at the back of the line card and insert the vertical female connector at the back of the line card into the male connector on the RS 3000, RS 3x00 or RS 3200's motherboard.

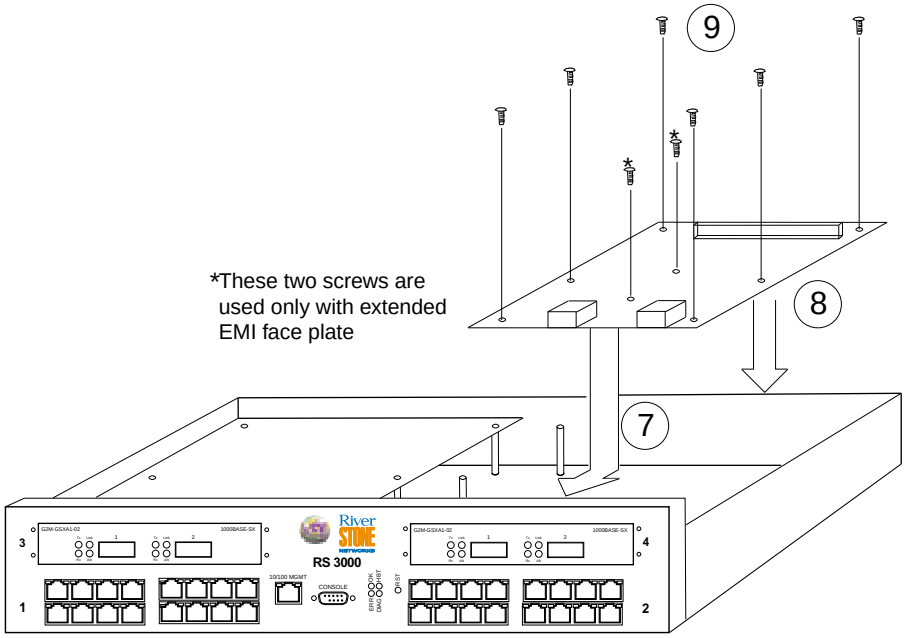


Figure 3-6 Installing the line card into the chassis

Warning The female and male connectors are not keyed, so it is possible to misalign the connection. Ensure that all pins fit properly before applying power to the RS 3000, RS 3x00 or RS 3200.

Caution When installing the Advanced Services Module (ASM) check carefully that the line card is pushed in properly. If it is not, the ASM will not power-up.

10. Insert the six screws that hold the line card in place over the motherboard. Use the #2 Phillips-head screwdriver to tighten the screws. If installing a line card that uses the extended EMI face plate, insert and tighten the two additional screws that go through the center of the line card (see Figure 3-6)

11. Replace the cover of the RS 3000, RS 3x00 or RS 3200, and secure it using the #2 Phillips-head screwdriver and the four screws previously removed.

3.3.3 Installing GBIC Modules into GBIC MPLS Line Cards

GBIC line cards support two sockets for installing GBIC modules. One GBIC module can be installed into each available socket.

Figure 3-7 shows an example of a GBIC module. The procedure following the figure describes how to install the module into the GBIC line card.

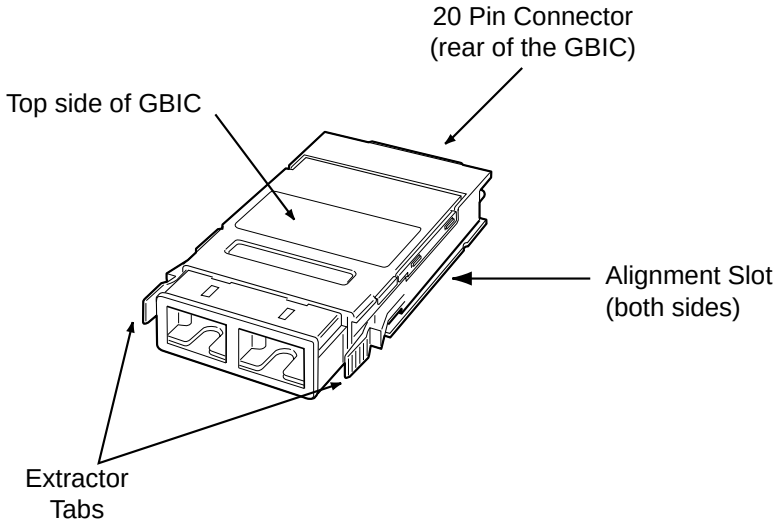


Figure 3-7 GBIC module

To install a GBIC module into a GBIC line card perform the following steps:

1. Hold the GBIC module by the edges with the network port facing away from the line card, and position the GBIC module so that it is parallel with the slot door. The 20-pin connector should be facing toward the empty GBIC slot of the line card, see Figure 3-8.

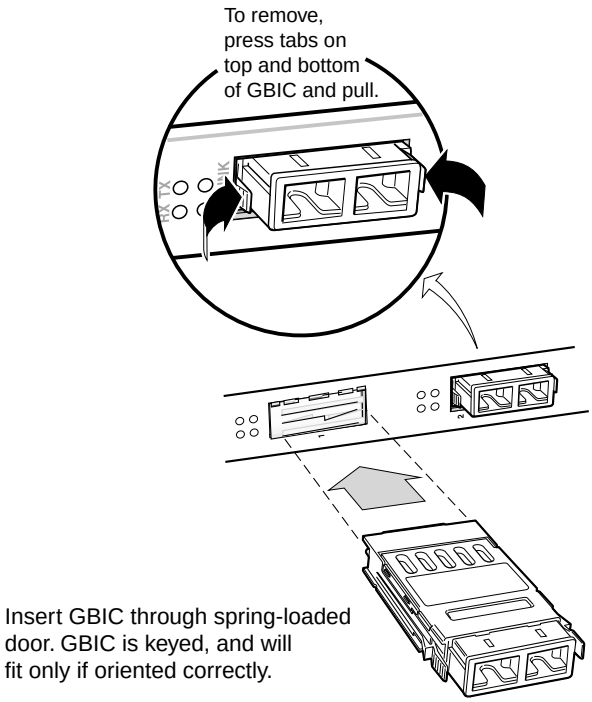


Figure 3-8 Inserting a GBIC module

2. Gently insert the GBIC module into the GBIC slot opening. The GBIC door on the line card folds in, and the internal guides engage the alignment slots on the sides of the GBIC module.

Warning If the GBIC module does not go in easily, do not force it. If the GBIC is not oriented properly, it will stop about one quarter of the way into the slot and should not be forced any further. Remove and reorient the GBIC module so that it slides easily into the slot.

3. Push the GBIC module in until the connector engages the 20-pin port. The GBIC is now installed.

3.3.4 Installing the ATM PHY Cards

Each ATM line card has two slots available for PHY cards. One ATM PHY card can be installed into each available slot. You will need a #2 Phillips screwdriver to perform this procedure.

Figure 3-9 shows an example of how to install a PHY card. The procedure following the figure describes how to do this.

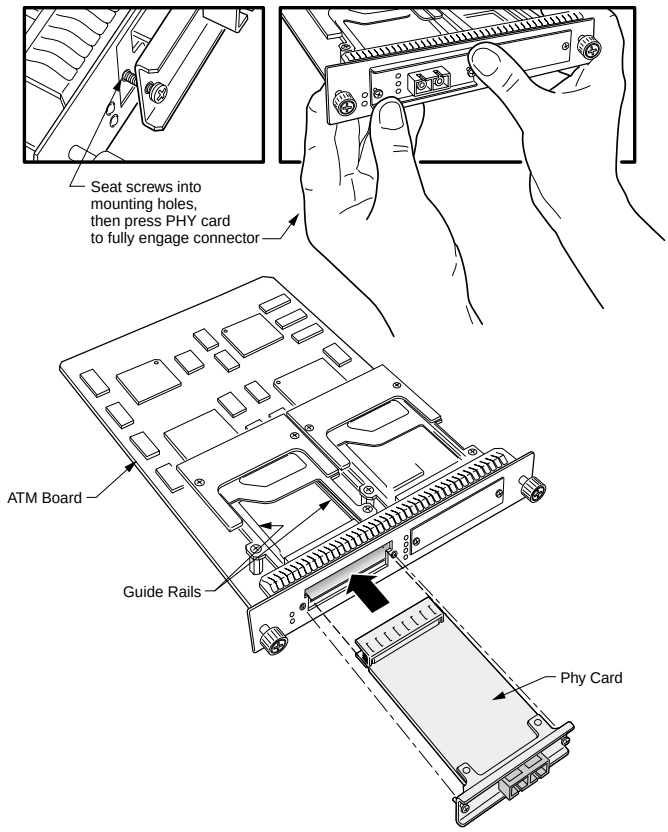


Figure 3-9 Installing an ATM PHY card

To install a PHY card into an ATM line card:

1. Use a Phillips screwdriver to loosen the two captive screws that hold the option slot cover in place.
2. Save the option slot cover.
3. Hold the PHY card by the edges and position it so that it is parallel with the slot opening.
4. Insert the PHY card through the opening in the system unit by aligning the sides of the PHY card with the card guide.
5. Push the PHY card into the slot until the 96-pin connector is firmly seated on the motherboard.
6. Fasten the PHY card to the system unit with the two captive screws and torque to 5 in-lb (0.56 N-m).

3.3.5 Multi-rate WAN Line Card and WICs

This section describes the procedure for installing the Multi-rate WAN line-card. Additionally, if your configuration uses either a Clear Channel T3 or E3 WIC, you must consider the setting of the WIC module's grounding-jumpers.

Setting Jumpers on the Clear Channel T3/E3 WICs

Both the Clear Channel T3 and E3 WICs contain a set of jumpers (JP2, JP3,and JP4). These jumpers allow you to set whether the shielding of the transmit (Tx) and Receive (Rx) cables are grounded. In their default positions, the jumpers are set such that the shielding on the Tx cable is grounded at the RS and the shielding on the Rx cable is not grounded at the RS (see Table 3-2 and Figure 3-10).

Table 3-2 Jumper default settings

Jumper	Default Position	Setting
JP2	Jumper block in place	Shielding on Tx cable is grounded at the RS
JP3	No jumper block in place (open)	Shielding on Rx cable is not grounded at the RS
JP4	Jumper block in place	Storage jumper for jumper block to be used on JP3

To Ground the Shielding on the Rx Cable – Remove the jumper block on JP4 and place it on the pins of JP3.

Note The industry standard for E3 is both Tx and Rx cable shielding grounded. To be E3 industry-compliant, the jumper block must be moved from JP4 to Jp3.

To Remove Grounding of the Shielding on the Tx Cable – Remove the jumper block on JP2.

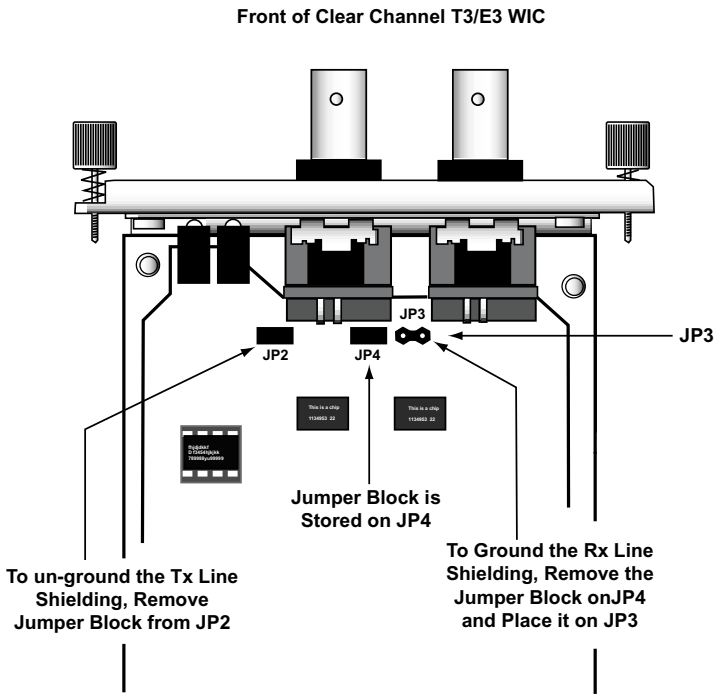


Figure 3-10 Jumper position on Clear Channel T3 and E3 WICs

Installing the Multi-rate Line card

Because of its design, the Multi-rate WAN line card requires a somewhat different installation procedure. The following describes how to install a Multi-rate WAN line card and its WAN Interface Cards (WIC).

Note The Multi-rate WAN line card does not come with a separate face plate. The face plate is integral to the Multi-rate WAN line card.

1. Make sure that the RS 3000, RS 3x00 or RS 3200 is powered off.
2. If rack mounted, remove the RS 3000, RS 3x00 or RS 3200 from the equipment rack.
3. If the RS 3000, RS 3x00 or RS 3200 is equipped for rack mounting, use the #2 Phillips-head screwdriver to remove the mounting brackets from each side of the chassis.
4. Use the #2 Phillips-head screwdriver to remove the four mounting screws that hold the top cover on the RS 3000, RS 3x00 or RS 3200 (see Figure 3-1).
5. Slide the cover away from the front of the RS 3000, RS 3x00 or RS 3200 about one-half inch (1/2”), then lift the cover away. Be careful not to damage or remove any EMI gaskets around the edges of the cover.
6. Use the #2 Phillips-head screwdriver to remove the four mounting screws that secure the cover plate to the expansion slot (see Figure 3-2). Be careful not to damage or remove any EMI gaskets around the edges of the expansion slot opening.
7. Use the #2 Phillips-head screwdriver to remove the expansion slot cover.

8. Remove the two front-most stand-offs from the motherboard as shown in Figure 3-11.

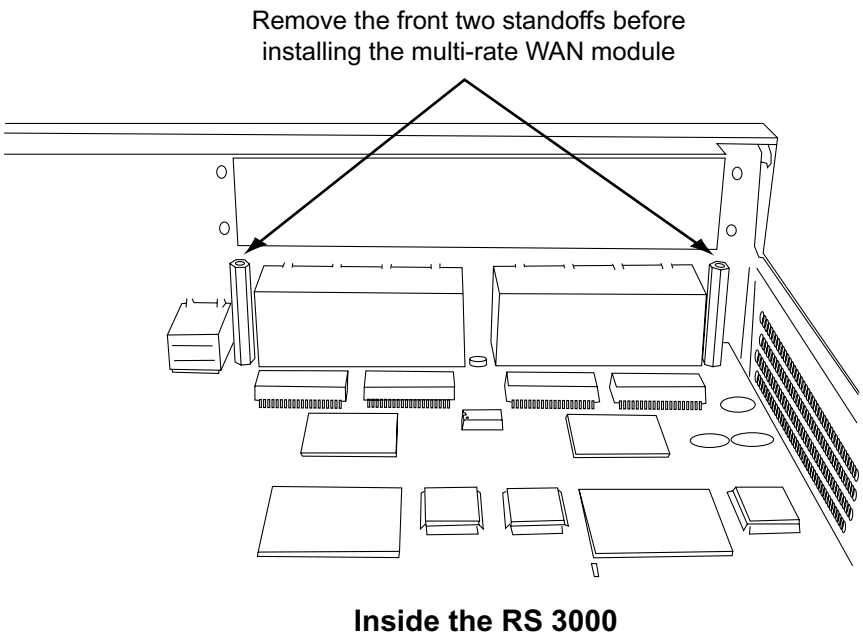


Figure 3-11 Removing the standoffs on the motherboard

9. Use the #2 Phillips-head screwdriver to replace the standoffs with the two screws provided.

10. Insert the line card from the top and ensure that it makes maximum surface contact with its face plate.

11. Line up the two screw holes at the back of the line card and insert the vertical female connector at the back of the line card into the male connector on the RS 3000, RS 3x00 or RS 3200's motherboard.

Warning The female and male connectors are not keyed, so it is possible to misalign the connection. Ensure that all pins fit properly before applying power to the RS 3000, RS 3x00 or RS 3200.

12. Insert the screws that hold the line card in place over the motherboard. Use the #2 Phillips-head screwdriver to tighten the screws.

13. Insert the WIC card into one of the WIC receptacles in the front of Multi-rate WAN line card. As you insert the WIC, make sure that the sides of the WIC card are aligned with the card guides in the WIC receptacle. See Figure 3-12.

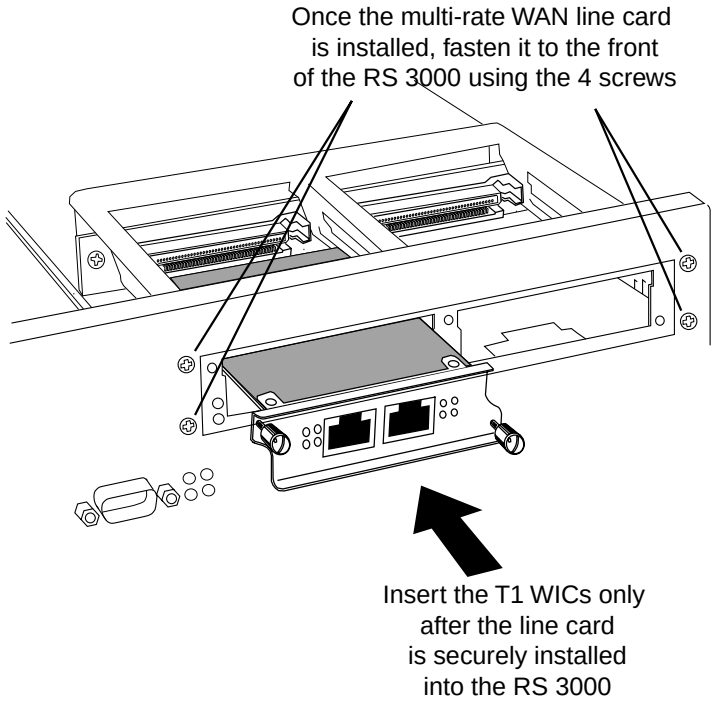


Figure 3-12 Installing a WIC

14. Push the WIC card into the WIC receptacle until the 96-pin connector is firmly seated into the connector at the back of the receptacle.

15. Use the two captive screws on the WIC card to secure it to the Multi-rate line card.

16. Replace the cover of the RS 3000, and secure it using the #2 Phillips-head screwdriver and the four screws previously removed.

3.3.6 Installing the RS 3000, RS 3x00 or RS 3200 into an Equipment Rack

The RS 3000, RS 3x00 or RS 3200 is designed to be installed in a standard 19” equipment rack. To install the RS 3000 in an equipment rack, use the following procedure; you will need a #2 Phillips-head screwdriver to perform this procedure.

Note Riverstone recommends that only qualified personnel conduct installation of any chassis.

Nota Riverstone recomienda que la instalación del chasis se lleve a cabo por personal capacitado únicamente.

Warning Before performing any mechanical upgrade or installation procedures, make sure that the RS is powered off.

Advertencia Antes de llevar a cabo cualquier actualización mecánica o procedimiento de instalación, cerciórese de que el RS esté apagado.

1. Align one of the mounting brackets over the corresponding holes in the side of the RS 3000, RS 3x00 or RS 3200. The mounting bracket is correctly positioned when the side with two open mounting holes is flush with the front of the RS 3000, RS 3x00 or RS 3200.
2. Use the #2 Phillips-head screwdriver and the eight supplied screws to attach the rack mounting flanges to each side of the chassis.

Warning Be sure to use the Phillips-head screws supplied by Riverstone Networks. If you use screws that are longer than the ones included with your shipment, there is a danger of damaging the RS's internal components.

Advertencia Asegúrese de utilizar los tornillos con cabeza de tipo Phillips que le sean provistos por Riverstone Networks. Si usted utiliza tornillos con una extensión mayor a los provistos, corre el riesgo de dañar los componentes internos del equipo RS 3000,RS 3x00,RS 3200.

3. Along with an assistant, lift the RS 3000, RS 3x00 or RS 3200 into place in the mounting rack.
4. While your assistant holds the chassis in place, attach the mounting flanges of the RS 3000, RS 3x00 or RS 3200 to the equipment rack using appropriate mounting hardware.

Warning Make sure the screws are tight before your assistant releases the chassis. If you accidentally leave the screws loose, the chassis can slip and fall, possibly becoming damaged.

Advertencia Cerciórese de que los tornillos estén debidamente ajustados antes de que su asistente suelte el chasis. Si los tornillos no están debidamente ajustados, es posible que el chasis se salga de su sitio y se dañe.

3.3.7 Management Ports

The RS 3000 has two ports for attaching management devices:

Male DB-9 DCE port – This serial port is used for direct connection to a terminal or PC running terminal emulation software. Use this port to perform basic setup using the Command Line Interface (CLI).

RJ-45 10/100Base-T DTE port – This Media Data Interface (MDI) port is used for in-band management of the RS 3000 through a Telnet session to the CLI or through SNMP.

Connecting the Serial Management Cable

Use the serial cable to connect the RS 3000, RS 3x00 or RS 3200 to a terminal (or to a PC running terminal emulation software) to perform initial setup and configuration. The RS 3000, RS 3x00 or RS 3200's serial cable is a female to female DB-9 crossover cable. Figure 3-13 shows the serial port on the front of the RS 3000, RS 3x00 or RS 3200, and Figure 3-14 shows the serial port's pin-out. Table 3-3 maps the wiring of the serial cable

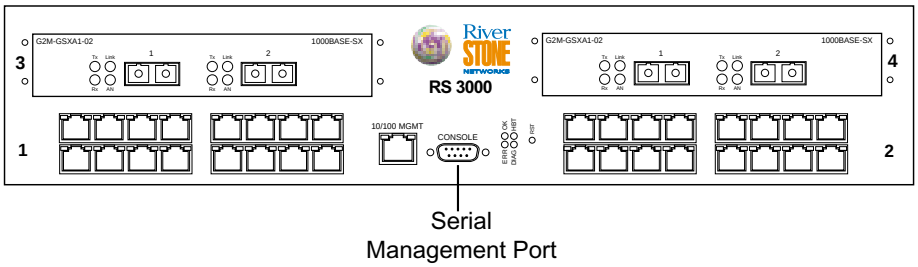


Figure 3-13 RS 3000/RS 3x00/RS 3200's serial (DB-9 DCE) management port

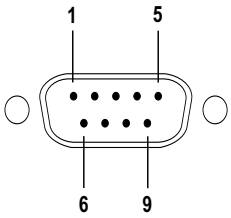


Figure 3-14 Serial port (DB-9 DCE) pin-out

Table 3-3 Wiring map for serial cable

Signal (RS 3x00 serial port)	Pin	Signal (management console port)
Unused	1	Unused
TXD (transmit data)	2	RXD (receive data)[a]
RXD (receive data)	3	TXD (transmit data)

Table 3-3 Wiring map for serial cable (Continued)

Signal (RS 3x00 serial port)	Pin	Signal (management console port)
Unused	4	Unused
GND (ground)	5	GND (ground)
Unused	6	Unused
CTS (clear to send)	7	CTS (clear to send)
RTS (request to send)	8	RTS (request to send)
Unused	9	Unused

a. The left hand column pin assignments are for the male DB-9 connector on the RS 3000. Pin 2 (TXD or "transmit data") must emerge on the management console's end of the connection as RXD ("receive data").

Connecting a 10/100BASE-TX Management Cable

Use the RJ-45 10/100BASE-TX DTE port for connecting the RS 3000 to your network for in-band management through either Telnet or SNMP. Figure 3-15 shows the location of the MDI cable management port on the front of the RS 3x00. Figure 3-16 shows the pin positions of the 10/100BASE-TX port, and Table 3-4 shows the wiring map for the MDI management cable:

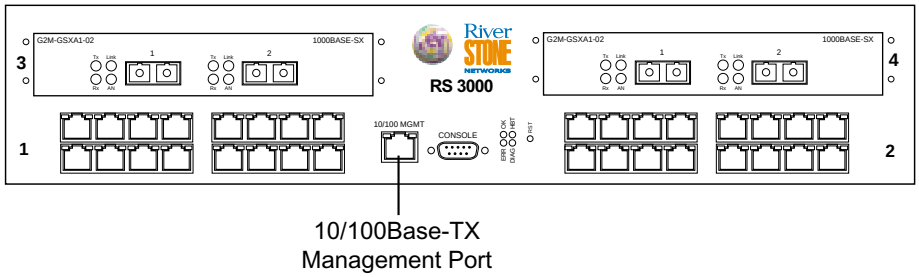


Figure 3-15 RS 3x00's 10/100BASE-TX management port

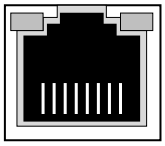


Figure 3-16 10/100BASE-TX RJ-45 port

Table 3-4 Wiring map for MDI management cable

Signal (RS 3000 port)	Pin	Signal (management console port)
TXD (transmit data)	1	RXD (receive data)[a]
TXD (transmit data)	2	RXD (receive data)
RXD (receive data)	3	TXD (transmit data)
Unused	4	Unused
Unused	5	Unused
RXD (receive data)	6	TXD (transmit data)
Unused	7	Unused
Unused	8	Unused

a. The right hand column pin assignments are for the RJ-45 connector on the RS 3x00. Pin 1 (TXD or “transmit data”) must emerge on the management console’s end of the connection as RXD (“receive data”).

4 INITIAL CONFIGURATION

This chapter provides the following information on powering up the RS 3000 for the first time, and performing basic setup procedures. Basic setup includes:

- Powering on the RS 3000/RS 3100/RS 3200 and booting the software
- Starting the Command Line Interface (CLI)
- Activating and saving configuration changes
- Assigning passwords
- Using the CLI to add an IP interface, subnet mask, and default gateway
- Setting up SNMP
- Assigning a DNS server(s) to the RS 3000/RS 3100/RS 3200
- Configuring the SYSLOG server and server message levels

4.1 POWERING ON THE RS 3000/RS 3100/RS 3200

To power on the RS 3000/RS 3100/RS 3200 perform the following steps:

1. Make sure all exposed line card slots are free of foreign objects such as tools and are covered with blanks.
2. Make sure that the RS 3000/RS 3100/RS 3200's DB-9 console port is connected to an active terminal or a PC running terminal emulation software.

Note The RS 3000/RS 3100/RS 3200 does not have a power ON/OFF switch. The RS 3000/RS 3100/RS 3200 is turned on by plugging in its AC power cords and connecting them to the AC source

Nota El RS Switch Router no cuenta con un interruptor de encendido-apagado. Al conectar el suministro de energía AC a una toma de corriente, el RS Switch Router estará encendido.

3. Plug the AC power cords into the RS 3000/RS 3100/RS 3200 chassis, then connect the RS 3000/RS 3100/RS 3200 to the AC power source.

If this is the first time you have powered on the RS 3000/RS 3100/RS 3200, it boots automatically using the software image on the internal flash memory. While the software is booting, the amber Offline LED on the front of the RS 3000/RS 3100/RS 3200 is lit. When the software finishes booting, the Offline LED goes dark and the green Online LED lights up, indicating that the Rapid Operating System (ROS) software is online.

In addition, as the software boots, the management terminal or PC attached to the RS 3000/RS 3100/RS 3200's DB-9 DCE port displays messages related to the phases of the boot sequence.

Here is a partial example:

```
Boot Software Version prom-2.0.1.1, Built Jan 5 2001 20:18:57
Processor: R7000 rev 2.1 [0x2321], 160 MHz, (bus: 80 MHz), 128 MB DRAM
I-Cache 32 KB, linesize 32. D-Cache 32 KB, linesize 32.
Mounting 16MB flash card . . . Done
Autoboot in 2 seconds - press ESC to abort and enter prom
using link: bootsource
link pointed at file:/pc-flash/boot/ros80/
source: file:/pc-flash/boot/ros80/
  Loaded version file
 Loading kernel (base 0x80001000, size 50592)
(base 0x8000d5a0, size 2658597)
  100% -  Image checksum validated
------------------------------------------------------------------------
RS 3000 System Software, Version 8.0.0.0
Copyright (c) 2000-2001, Riverstone Networks, Inc.
Built by mhaydt@diego on Mon Jan 5 17:10:42 2001
Processor: R7000, Rev 2.1, 159.99 MHz
System started on 2001-10-01 15:27:01
------------------------------------------------------------------------
2001-10-01 15:27:02 %SYS-I-FLASHCRD, Mounting 16MB Flash card
2001-10-01 15:27:06 %SYS-I-FLASHMNTD, 16MB Flash card mounted
2001-10-01 15:27:06 %SYS-I-INITSYS, initializing system RS 3000
2001-10-01 15:27:06 %SYS-I-DSCVMOD, discovered 'Control Module' module in slot CM
2001-10-01 15:27:11 %SYS-I-INITSLOTS, Initializing system slots - please wait
2001-10-01 15:27:18 %SYS-I-MODPROBE, Detecting installed media modules - please wait
2001-10-01 15:27:20 %SYS-I-DSCVMOD, discovered '10/100-TX' module in slot 1
2001-10-01 15:27:20 %SYS-I-DSCVMOD, discovered 'Quad Serial-CE' module in slot 2
```

4. When the software is fully booted, the following messages appears on the management console:

```
Press RETURN to activate console...
```

5. As prompted, press Return (or Enter) to activate the Command Line Interface (CLI) on the console.

Note If prompted for a password, simply press the Return key. The default passwords are blank.

Note If the message "**SYS-E-NOFLASHCARD**" appears while booting the RS 3000, RS 3100 or RS 3200, the system has not detected its internal flash memory. If this occurs, reboot the system. If the system still does not recognize its memory, contact Riverstone Networks Technical Support.

4.2 STARTING THE COMMAND LINE INTERFACE

To start the Command Line Interface (CLI), power on the system, as described in Section 4.1, *"Powering on the RS 3000/RS 3100/RS 3200."* After the software is fully booted, press Return (or Enter) to activate the CLI. If prompted for a password, simply press Return; the factory default passwords for all access levels is blank.

4.2.1 CLI Access Modes

The CLI has four levels of access, each of which provides the ability to perform specific operations on the RS 3000, RS 3100 or RS 3200, (see Table 4-1).

Table 4-1 CLI access modes

Access Mode	Description
User	Allows you to display basic information and use basic utilities such as ping but does not allow you to display SNMP, filter, and access control list information or make other configuration changes. You are in User mode when the command prompt ends with the "**>**"character.
Enable	Allows you to display SNMP, filter, and access control information, as well as all the information you can display in User mode. To enter Enable mode, enter the **enable** command, then supply the password when prompted. When you are in Enable mode, the command prompt ends with the "**#**" character.
Configure	Allows you to make configuration changes. To enter Configure mode, first enter Enable mode (**enable** command), then enter the **configure** command. When you are in Configure mode, the command prompt ends with "**(config)**."
Boot	This mode appears when the system image is not found during bootup. Enter the **reboot** command to reset the RS 3000. If the RS still fails to boot, contact Riverstone Networks Technical Support. Certain tasks can be performed only from Boot mode. To enter the Boot mode intentionally, boot the RS 3000, RS 3100 or RS 3200,, and then interrupted the normal bootup sequence by pressing the "Esc" key. When you are in Boot mode, the command prompt is "**rs-boot>**."

Note The command prompt will show the name of the RS 3000, RS 3100 or RS 3200, in front of the mode character(s). The default name is "rs." The procedure in Section 4.4, *"Setting the Basic System Information"* describes how to change the system name.

When you are in Configure or Enable mode, use the **exit** command or press Ctrl+z to exit to the previous access mode.

4.2.2 Basic Line Editing Commands

The CLI supports Emacs-like line editing commands. The following table lists some commonly used commands. For a complete set of commands, see the *Riverstone RS Switch Router Command Line Interface Reference Manual*.

Table 4-2 Common CLI line editing commands

Key sequence	Command
Ctrl+a	Move cursor to beginning of line
Ctrl+b	Move cursor back one character
Ctrl+d	Delete character
Ctrl+e	Move cursor to end of line
Ctrl+f	Move cursor forward one character
Ctrl+n	Scroll to next command in command history (use the **`cli show history`** command to display the history)
Ctrl+p	Scroll to previous command in command history
Ctrl+u	Erase entire line
Ctrl+x	Erase from cursor to end of line
Ctrl+z	Exit current access mode to previous access mode

4.3 CONFIGURATION CHANGES AND SAVING THE CONFIGURATION FILE

The RS 3000 uses three special configuration files:

Table 4-3 Configuration file contents

File	Descriptions
Scratchpad	The configuration commands you have entered during a management session. These commands do not become active until you explicitly activate them. Because some commands depend on other commands for successful execution, the RS 3000/RS 3100/RS 3200 scratchpad simplifies system configuration by allowing you to enter configuration commands in any order, even when dependencies exist. When you activate the commands in the scratchpad, the RS 3000/RS 3100/RS 3200 sorts out the dependencies and executes the commands in their proper sequence.
Active	The commands from the Startup configuration file and any configuration commands that you have made active from the scratchpad.
Startup	The configuration file that the RS 3000/RS 3100/RS 3200 uses to configure itself when the system is powered on.

Caution The active configuration remains in effect only during the current power cycle. If you power off or reboot the RS 3000/RS 3100/RS 3200 without saving the active configuration changes to the Startup configuration file, the changes are lost.

4.3.1 Activating the Configuration Commands in the Scratchpad

Use the following procedure to activate the configuration commands in the scratchpad.

1. Ensure that you are in Enable mode by entering the **`enable`** command in the CLI.
2. Ensure that you are in Configure mode by entering the **`configure`** command in the CLI.
3. Enter the following command:

```
save active
```

The CLI displays the following message:

```
Do you want to make the changes Active? [y]
```

4. Enter **y** to activate the changes.

Note If you exit the Configure mode (by entering the **exit** command or pressing Ctrl+z), the CLI will ask you whether you want to make active the changes in the scratchpad. If you do not make the changes in the scratchpad active, the changes will be lost when you log out.

4.3.2 Saving the Active Configuration to the Startup Configuration File

Use the following procedure to save Active configuration changes into the Startup configuration file so that the RS 3000 remembers and uses the changes when you reboot the software.

1. Enter the following command from Configure mode:

```
rs(config)# save startup
```

2. When the CLI displays the following message, enter **y** to save the changes:

```
Are you sure you want to overwrite the Startup configuration [no]? y
%CONFIG-I-SAVED, configuration saved to Startup configuration.
rs(config)#
```

Alternately, to save the Active configuration to the Startup configuration from Enable mode, perform the following steps.

1. Ensure that you are in Enable mode by entering the **enable** command in the CLI.
2. Enter the following command to copy the Active configuration to the Startup configuration:

```
copy active to startup
```

3. When the CLI displays the following message, enter **yes** to save the changes.

```
Are you sure you want to overwrite the Startup configuration? [n]
```

The new configuration changes are added to the Startup configuration file located in the RS 3000, RS 3100 or RS 3200's boot flash.

4.3.3 Viewing the Current Configuration

To view the current configuration:

1. Ensure that you are in Enable mode by entering the **enable** command.
2. Enter the following command to display the status of each command line:

```
system show active-config
```

Note Remember that the Active configuration contains both the Startup configuration and any configuration changes that you've made active in the current configuration session.

The CLI displays the Active configuration file with the following possible annotations:

- Commands without errors are displayed without any annotation.
- Commands with errors are annotated with an "**E:**."
- If a particular command has been applied such that it can be expanded on additional interfaces/line cards, it is annotated with a "**P:**." For example, if you enable STP on all ports on the RS 3000, but the RS 3000 contains only one line card, the configuration lines that enable STP will be applied to all ports on all other line cards as they are added to the system.

A command like **stp enable et.*.*** would be displayed as follows:

```
P: stp enable et.*.*
```

If you update the configuration file to state specifically which Ethernet ports STP is enabled on, the "**P:**" annotation in the above command line would disappear.

4.4 SETTING THE BASIC SYSTEM INFORMATION

Follow the procedures in this section to set the following system information:

- System time and date
- System name
- System location
- Contact name (the person to contact regarding this RS 3000)
- IP address for the management port on the RS 3000

Note Some of the commands in this procedure accept a string value. String values can be up to a maximum of 255 characters in length including blank spaces. Surround strings that contain blanks with quotation marks (for example: **"string with internal blanks"**).

1. Enter the **enable** command to get to Enable mode in the CLI.
2. Enter the following commands to set the system time and date and to verify your settings.

```
system set date year <number> month <month-name> day <day> hour <hour> minute <minute> second
<second>

system show date
```

Here is an example:

```
rs# system set date year 2003 month march day 27 hour 11 minute 54
second 0
Time changed to: Mon Mar 27 11:54:00 2003
rs# system show date
Current time: Mon Mar 27 11:54:04 2003
```

3. Enter the **configure** command to get to Configure mode in the CLI. The following commands can be entered only from Configure mode.
4. Enter the following commands to set the system name, location, and contact information:

```
system set name <string>
system set location <string>
system set contact <string>
```

Here is an example:

```
rs(config)# system set name rs
rs(config)# system set location "Houston, TX"
rs(config)# system set contact "John Smith"
```

5. Use the **interface add ip** command to set the IP address and netmask for the en0 Ethernet interface. The en0 Ethernet interface is used by the RS 3000's management port.

   Here is an example:

```
rs(config)# interface add ip en0 address-netmask 16.50.11.22/16
```

Note The en0 interface is automatically created by the system and is reserved for the RS 3x00's management port.

6. To activate the system commands entered in the previous steps, use the following command:

```
save active
```

   The CLI displays the following message:

```
Do you want to make the changes Active? [y]
```

7. Enter "**y**" to activate the changes.
8. To display the Active configuration, exit the Configuration mode, then enter the following command:

```
system show active-config
```

   Here is an example:

```
rs# system show active-config
Running system configuration:
     !
     ! Last modified from Console on Mon Jan 25 11:55:35 2001
     !
 1 : system set name "rs"
 2 : system set location "Houston, TX"
 3 : system set contact "John Smith"
```

9. Save the Active configuration to the Startup configuration file using the following command:

```
copy active to startup
```

10. When the CLI displays the following message, enter **y** to save the changes to the Startup configuration file:

```
Are you sure you want to overwrite the Startup configuration [no]? y
%CONFIG-I-WRITTEN, file copied successfully
rs#
```

4.5 SETTING UP PASSWORDS

You can password-protect CLI access to the RS 3000, RS 3100 or RS 3200, by setting up passwords for User mode access, Enable mode access, and Diag mode access. Users who have a User password but not an Enable password can use only the commands available in User mode. Users with an Enable password can use commands available in the Enable and Configure modes, as well as the commands in User mode.

In addition, you can set up the RS 3000, RS 3100 or RS 3200, for TACACS, TACACS+, and/or RADIUS authentication by a TACACS or RADIUS server. Procedures for configuring the RS 3000, RS 3100 or RS 3200, for TACACS and RADIUS can be found in the *Riverstone RS Switch Router User Guide*.

To add password protection to the CLI, use the following procedure.

1. Ensure that you are in Enable mode by entering the **`enable`** command in the CLI.
2. Ensure that you are in Configure mode by entering the **`configure`** command in the CLI.
3. Type the following command for each password you want to set:

```
system set password login|enable|diag <string>|none
```

4. Use the **`show`** command to examine the commands you just entered.
5. Use the **`save active`** command to activate the commands.
6. Exit the Configuration mode, then use the **`system show active-config`** command to verify the active changes.

Here is an example of the commands in the previous steps:

```
rs(config)# system set password login demo
rs(config)# system set password enable killer
rs(config)# system set password diag trouble
rs(config)# save active
rs# exit
rs# system show active-config

Running system configuration:
!
! Last modified from Console on Mon Mar 27 12:12:19 2003
!
 1 : system set name "rs"
 2 : system set location "Houston, TX"
 3 : system set contact "John Smith"
 4 : system set hashed-password login jNIssH c976b667e681d03ccd5fc527f219351a
 5 : system set hashed-password enable zcGzbO 5d1f73d2d478ceaa062a0b5e0168f46a
 6 : system set hashed-password diag jdfbyp 67e681d3d2d478cf21935a0b5e016f2193
```

Notice that the passwords are shown in the Active configuration in an encrypted format. Passwords also appear this way in the Startup configuration. To keep your passwords secure, the RS 3000, RS 3100 or RS 3200 does not have a command for displaying passwords in an unencrypted format.

Caution Test all new passwords before saving the active configuration to the Startup configuration file.

4.5.1 If You Forget Your Passwords

If you forget your passwords follow this procedure to regain access to your RS 3000, RS 3100 or RS 3200.

Note To perform this procedure, you must use a terminal or PC running terminal emulation software that is connected directly to the RS 3x00 through its DB-9 console port.

1. Power cycle the RS 3000, RS 3100 or RS 3200.
2. Interrupt the normal boot-cycle and enter Boot mode by pressing the “Esc” key.
3. From the boot prompt enter the **`set`** command and note the image name displayed for **`bootsource`**. For example:

```
...
mfg_loop_by = time        [time count]
mfg_loop_max = 62000
 bootdelay = 2
  autoboot = boot
promsetaddrs = 1
   netaddr = 134.152.179.132
  bootaddr = 0.0.0.0
   netmask = 255.255.255.224
   gateway = 134.152.179.129
bootsource = link:/pc-flash/boot/ros80 <This is the image name for this example>
   ethaddr = 00:00:1d:12:34:56
     sysid = -1
rs-boot>
```

4. Enter the following line to reboot the RS 3000, RS 3100 or RS 3200:

```
boot <image name> skipconfig=yes
```

Here is an example:

```
rs-boot> boot /pc-flash/boot/ros80 skipconfig=yes
```

5. When the RS 3000, RS 3100 or RS 3200 finishes booting, enter the following commands (when prompted, answer **yes**):

```
rs> enable
rs# copy startup to scratchpad
rs# config
rs(config)# system set password login none
rs(config)# system set password enable none
rs(config)# system set password diag none
rs(config)# save startup
Are you sure you want to overwrite the Startup configuration [no]? yes

There are non-committed configuration changes. Do you want to make
these changes active and then save everything to Startup [yes]? yes

%CONFIG-I-SAVED, 2001-10-02 21:53:54 %GATED-I-RECONFIGDONE, Routing
configuration changes completed (pid 0x809eab20).
configuration saved to Startup configuration.
rs(config)#
```

6. The User, Enable, and Diag access mode passwords are now reset to the default “blank” values.
7. Enter new passwords for the User, Enable, and Diag access modes.

4.6 SETTING UP SNMP

To use SNMP to manage the RS 3000, RS 3100 or RS 3200, you need to set up an SNMP community and specifying the IP address of the target host for SNMP traps. Otherwise, the RS 3000's SNMP agent runs in local trap process mode, unless disabled using the **snmp stop** command.

For additional information about configuring and using SNMP, see the *Riverstone RS Switch Router User Guide*.

4.6.1 Setting the Community string

Use the following procedure to add the SNMP community string, specify the target host for traps, and the trap interface.

1. Ensure that you are in Enable mode by entering the **enable** command in the CLI.
2. Ensure that you are in Configure mode by entering the **configure** command in the CLI.
3. Use the following commands to add an SNMP community string and set a target host IP address for the traps:

```
rs(config)#snmp set community <community-name> privilege read|read-write
rs(config)#snmp set target <IP-addr> community <community-name> status enable|disable
```

Note If the IP address of the trap target is more than one hop away from the RS 3000, RS 3100 or RS 3200, configure the RS with a static route to the target. If the RS 3000, RS 3100 or RS 3200 is rebooted, the static route allows a cold start trap to be sent to the trap target. Without a static route, the cold-start trap is lost while the routing protocols are converging.

4. Use the **save startup** command to activate the commands entered in the previous steps.

   Here is an example of the commands and output for configuring SNMP and saving the changes.

```
rs# config

rs(config)# snmp set community public privilege read-write

rs(config)# snmp set target 16.50.11.12 community public status enable

rs(config)# save startup
Are you sure you want to overwrite the Startup configuration [no]? yes

There are non-committed configuration changes. Do you want to make
these changes active and then save everything to Startup [yes]? yes

%CONFIG-I-SAVED, 2001-09-02 21:53:54 %GATED-I-RECONFIGDONE, Routing
configuration changes completed (pid 0x809eab20).
configuration saved to Startup configuration.
rs(config)#
```

By default, SNMP information is sent and received on the RS 3x00's en0 Ethernet port. If you want SNMP to use a different port on the RS 3x00, use the following command.

```
snmp set trap-source <interface>|<IPaddr>
```

Here is an example:

```
rs(config)# snmp set trap-source 134.152.78.192
```

SNMP will now use the port with IP address 134.152.78.192. Remember, to make this change permanent, enter the **save startup** command.

4.6.2 Improving SNMP Security

SNMPv1 is not a secure protocol. Messages containing community strings are sent in plain text from manager application to agent. Anyone with a protocol decoder and access to the wire can capture, modify, and replay messages.

Applying ACLs to SNMP

When using SNMP v1 or v2, it is important to protect your RS 3000, RS 3100 or RS 3200 by applying an Access Control List (ACL) to the SNMP agent to prevent unauthorized access and route your SNMP traffic through trusted networks only.

Here are the basic configuration commands to apply an ACL to the RS 3000's SNMP agent, allowing access to the RS 3000, RS 3100 or RS 3200 by only one management station.

```
rs(config)# acl mgmt_only permit udp <IPaddr> any any any
rs(config)# acl mgmt_only apply service snmp
```

The above ACL applied to the SNMP service allows messages from source IP address *<IPaddr>* to be processed by the SNMP agent, packets form any other source IP address are dropped.

Disabling Authentication Traps

To provide additional security to the RS 3000, RS 3100 or RS 3200, disable the sending of authentication traps. Authentication traps are sent when SNMP v1 packets are received with invalid community strings. A common security attack on an SNMP v1 agent is to send a message containing an invalid message, and then capture the authentication trap to learn the community string.

Here is an example of how to turn off the sending of authentication traps:

```
rs(config)#snmp disable trap authentication
```

For additional information about RS 3000, RS 3100 or RS 3200 security and ACLs, see the *Riverstone RS Switch Router User Guide.*

4.6.3 Supported MIBs

The following lists the MIBs that are supported by the RS 3000, RS 3100 or RS 3200 SNMP agent.

Table 4-4 Supported MIBs

MIB II	Layer 1	Layer 2	Layer 3	System Related	Enterprise
IP-MIB RFC 2011	ETHERLIKE-MIB | RFC 2665	FRAME-RELAY-DTE-MIB | RFC 2115	BGP4-MIB RFC 1657	RADIUS-AUTH-CLIENT-MIB | RFC 2618	NOVELL-IPX-RIPSAP 2/94
TCP-MIB RFC 2012	SONET-MIB RFC 1595	BRIDGE-MIB RFC 1493	RIPv2-MIB RFC 1724	RADIUS-ACC-CLIENTMIB RFC 2620	NOVELL-IPX 10/94
UDP-MIB RFC 2013	DS0 MIB RFC 2494	Q-BRIDGE-MIB RFC 2674	OSPF-MIB RFC 1850	DISMAN-SCHEDULE-MIB RFC 2591	RIVERSTONE-STP-MIB 7/16/00
IP-FORWARD-MIB RFC 2096	DS1-MIB RFC 2495	P-BRIDGE-MIB RFC 2674	OSPF-TRAP-MIB | RFC 1850	ENTITY-MIB | RFC2737	RIVERSTONE-RS-AGENT-CAP-MIB
IF-MIB RFC 2233	DS3-MIB RFC 2496	PPP-LCP-MIB RFC 1471	RMON2-MIB RFC 2021	SNMPv3-MIB Modules| RFC 2570-2576	RIVERSTONE-ATM-MIB | 1/31/01
SNMPv2-MIB RFC 1907	DS0BUNDLE-MIB RFC 2494	PPP-SEC-MIB RFC 1472	VRRP-MIB RFC 2787	DIFF-SERV-MIB | Draft #5	RIVERSTONE-IMAGE-MIB | 3/16/01
	MAU MIB RFC 2668	PPP-IP-NCP-MIB RFC 1473	DVMRP-MIB Draft #4	PING-MIB RFC 2925	CISCO-BGP-POL-ACCOUNTING-MIB | 12/17/99
		PPP-BRIDGE-NCP-MIB RFC 1474	IGMP-MIB RFC 2933	TRACEROUTE-MIB RFC 2925	RIVERSTONE-LFAP-MIB | 6/15/01
		RMON-MIB RFC 1757	ISIS-MIB Draft #4	NOTIFICATION LOG-MIB RFC 3014	RIVERSTONE-RL-MIB | 10/10/02
		ATM-MIB RFC 2515	MPLS-LSR-MIB Draft #7	DHCP-SERVER-MIB Draft #7	RIVERSTONE-SNMP-MIB 12/4/00
		LAG MIB | 802.3ad			RIVERSTONE-NOTIFICATIONS-MIB 3/12/02
		ATM2-MIB Draft #17			CTRON-LFAP (deprecated) 8/28/99
					CTRON-SSR-POLICY (deprecated) 8/11/99
					CTRON-SSR-CONFIG 6/27/00
					CTRON-SSR-HARDWARE (deprecated) 6/27/00

	CTRON-SSR-SERVICE-STATUS (deprecated) 6/27/00
	CTRON-SSR-CAPACITY-MIB 6/27/00
	RIVERSTONE-INVENTORY-MIB 8/22/01
	RIVERSTONE-MPLS-MIB 5/24/02
	RIVERSTONE-QUEUE-MIB 6/12/02
	RIVERSTONE-VLAN-EXTENSION-MIB 8/5/02
	RIVERSTONE-PING-EXTENSIONS-MIB 10/9//02
	RIVERSTONE-TRACEROUTE-EXTENSIONS-MIB 10/11/02
	RIVERSTONE-IF-MIB 10/17/02
	RIVERSTONE-VLAN-EXTENSIONS-MIB 8/5/02
	CISCO-SRP-MIB 3/28/01
	RIVERSTONE-DHCP-MIB 9/10/02
	RIVERSTONE-CONFIG-MIB 11/30/02

4.7 SETTING THE DNS DOMAIN NAME AND ADDRESS

Associating a DNS name server with your RS 3000, RS 3100 or RS 3200 allows you to use device names (rather than IP addresses) when entering certain commands. For example, you can use a device's name (which the DNS server knows) when using the **ping** command.

If you want the RS 3000, RS 3100 or RS 3200 to access a DNS server, use the following procedure to specify the domain name and IP address for the DNS server.

1. Ensure that you are in Enable mode by entering the **enable** command in the CLI.
2. Use the **ping** command to verify that the RS 3000, RS 3100 or RS 3200 can reach the DNS server:

   Here is an example:

```
rs# ping 16.50.11.12              <IP address of the DNS server>
PING 16.50.11.12 (16.50.11.12): 56 data bytes
64 bytes from 16.50.11.12: icmp_seq=0 ttl=255 time=0 ms

--- 16.50.11.12 ping statistics ---


1 packets transmitted, 1 packets received, 0% packet loss
round-trip min/avg/max = 0/0/0 ms
```

3. Enter Configure mode by entering the **configure** command in the CLI.
4. Enter the following command to specify the domain name for which the DNS server(s) have authority:

```
system set dns domain <domain-name>
```

   For example: <*domain-name*> = **riverstone.com**
5. Enter the following command to add the DNS server to the RS 3000, RS 3100 or RS 3200:

```
system set dns server <IP-addr>[,<IP-addr>[,<IP-addr>]]
```

   where <*IP-addr*> is the IP address of the DNS server(s). You can specify up to three DNS servers. Separate the server IP addresses with commas.
6. Enter the **save active** command to activate the commands and enter **yes** to activate the changes.

   Here is an example:

```
rs# config
rs(config)# system set dns domain "mktg.mrb.com"
rs(config)# system set dns server 16.50.11.12
rs(config)# save active
```

7. Exit Configure mode, then enter the **`system show dns`** command to verify the new DNS settings.

Here is an example:

```
rs# system show dns
DNS domain: mrb.com, DNS server(s): 16.50.11.12
```

8. Use the **`ping`** command to verify that the RS can resolve the DNS server name into its IP address.

Here is an example:

```
rs# ping rs
PING rs.mktg.mrb.com (16.50.11.22): 56 data bytes
64 bytes from 16.50.11.22: icmp_seq=0 ttl=255 time=0 ms

--- rs.mktg.mrb.com ping statistics ---
1 packets transmitted, 1 packets received, 0% packet loss
round-trip min/avg/max = 0/0/0 ms
```

4.8 SETTING THE SYSLOG PARAMETERS

The RS 3000, RS 3100 or RS 3200 can use SYSLOG messages to communicate the following types of messages to a SYSLOG server:

Table 4-5 Types of SYSLOG messages

Message Type	Description
Fatal	Information about events that caused the RS 3000, RS 3100 or RS 3200 to crash and reset.
Error	Information about errors.
Warning	Warnings against invalid configuration information and other conditions that are not necessarily errors.
Informational	Informational messages such as status messages. The SYSLOG messages that the CPU displays while booting the software and reading the startup configuration file are examples of Informational messages.

Table 4-6 shows examples of the types of SYSLOG messages. Notice that after the facility type (in this case, "`CONFIG`") the message contains a letter that refers to the message type: "`F`" for fatal, "`E`" for error, and so on.

Table 4-6 Examples of message types

Message Type	Example
Fatal	`%CONFIG-F-CREATE_SEMA4 Unable to create %s semaphore: %d`
Error	`%CONFIG-E-NEED_COMMAND Need at least one command word to match`
Warning	`%CONFIG-W-BACKUP_CFG Cannot find Startup config - using backup on PCMCIA flash`
Informational	`%CONFIG-I-SAVED configuration saved to Startup configuration`

The RS 3x00 writes the SYSLOG messages to a SYSLOG daemon on UDP port 514. You can set the CLI to send all or only some of the message types. By default, the CLI sends warning, error, and fatal messages but not informational messages to the specified SYSLOG server.

Use the following procedure to specify the SYSLOG server and the types of messages you want the CLI to send to the server.

1. Ensure that you are in Enable mode by entering the **`enable`** command in the CLI.
2. Use the **`ping`** command to verify that the RS 3x00 can reach the SYSLOG server.
3. Ensure that you are in Configure mode by entering the **`configure`** command in the CLI.
4. Enter the following commands to add the SYSLOG server to the RS 3000, RS 3100 or RS 3200, set the message level, and set the SYSLOG facility:

```
system set syslog server <hostname-or-IP-addr>
system set syslog level fatal|error|warning|info
system set syslog facility <facility-type>
```

Note The <*facility-type*> is a string of the form: *user*, *kern*, or *local0* through *local7*. These strings are reserved by the SYSLOG server daemon. for information on how <*facility-type*> is used by the SYSLOG server, see the documentation for your server's *syslog.conf* file.

Here is an example:

```
rs# config
rs(config)# system set syslog server 16.50.11.12
rs(config)# system set syslog level info
rs(config)# system set syslog facility local0
```

5. To activate the SYSLOG commands, use the **save active** command. Enter **yes** to activate the changes.

Note Up to four SYSLOG servers can be configured for each RS.

5 MANAGING SOFTWARE

This chapter describes how to perform operations regarding RS 3000, RS 3100 or RS 3200 operating software and bootPROM images software. The following topics are covered:

- Upgrading the system image software
- Upgrading the Boot PROM image software
- Loading RS 3x00 software from a TFTP server
- Loading RS 3x00 software from a BootP/TFTP server
- Upgrading FPGA code on line cards

5.1 UPGRADING SYSTEM IMAGE SOFTWARE

To upgrade the system software and boot using the upgraded image, perform the following procedure.

1. Display the current boot settings by using the **`system show version`** command. Note the current **`Image Boot Location`**.

   Here is an example:

```
rs# system show version
Software Information
  Software Version   : 8.0
  Copyright          : Copyright (c) 2000-2001 Riverstone Networks, Inc.
  Image Information  : ros8000, built on Mon Jan 25 14:10:21 2000
  Image Boot Location: file:/pc-flash/boot/img/ros80000
  Boot Prom Version  : prom-2.0.0.5
```

   In the example above, the location "**`pc-flash`**" indicates that the RS 3000, RS 3100 or RS 3200 is set to use the factory-installed software on its internal flash memory.

2. Copy the upgrade system software onto a TFTP server that the RS 3000 can access. (Use the **`ping`** command to verify that the RS 3000, RS 3100 or RS 3200 can reach the TFTP server.)

Note If the TFTP server is one or more hops away from the RS 3000, RS 3100 or RS 3200, add a route to the TFTP server's network using the **`ip add route`** command.

3. Enter the following command to copy the software upgrade onto the RS 3x00's internal flash memory:

```
system image add <IPaddr-of-TFTP-host> <image-file-name>
```

Note The <*image-file-name*> is the full directory path and filename to the image software file on the TFTP server.

Here is an example:

```
rs# system image add 134.152.178.5 tftpboot/ros8100
Downloading image 'tftpboot/ros8100' from host '134.152.178.5'
 to local image ros8100 (takes a while) . . .
 download: done
 save:
kernel: 100%
done
Image checksum validated.
%SYS-I-BOOTADDED, Image 'ros8100' added.
```

4. Enter the **system image list** command to list the images on the internal flash memory and verify that the new image is present.

   Here is an example:

```
rs# system image list
Images currently available on Master CM
slot0:
ros8100 (version 8.1.0.0)
ros8000 (version 8.0.0.0)  [selected for next boot]
```

5. Use the **system image choose** command to select the image file that the RS 3x00 will use when rebooted.

   Here is an example:

```
rs# system image choose ros8100
Found image in slot0
Making image ros8100 (version 8.1.0.0) the active image
for next reboot on Master CM . . .
%SYS-I-CHS_PRIMARY_OK, image successfully chosen on Primary CM
rs#
```

6. Use the **system image list** command to verify the change.

Note You do not need to activate this change.

7. Reboot the RS 3000, RS 3100 or RS 3200 to load and run the new system software image.

5.2 UPGRADING BOOT PROM SOFTWARE

The RS 3000, RS 3100 or RS 3200 boots using the boot PROM image software installed on the motherboard's internal memory. To upgrade the boot PROM image, use the following procedure.

1. Display the current boot settings by entering the **`system show version`** command. Note the current **`Boot Prom Image`** version.

Here is an example:

```
rs# system show version
Software Information
  Software Version   : 8.0
  Copyright          : Copyright (c) 1996-2000 Riverstone Networks, Inc.
  Image Information  : ros8000, built on Mon Jan 25 14:10:21 2000
  Image Boot Location: file:/pc-flash/boot/img/ros8000
  Boot Prom Version  : prom-2.0.0.5
```

2. Copy the upgrade boot PROM image software onto a TFTP server that the RS 3000 can access. (Use the **`ping`** command to verify that the RS 3x00 can reach the TFTP server.)

Note If the TFTP server is one or more hops away from the RS 3000, add a route to the TFTP server's network using the **`ip add route`** command.

3. Enter the following command to copy the bootPROM upgrade onto the RS 3x00's internal memory:

```
system promimage upgrade <IPaddr-of-TFTP-host> <image-file-name>
```

Note The <*image-file-name*> is the full directory path and filename to the bootPROM image file on the TFTP server.

Here is an example:

```
rs# system promimage upgrade 134.152.178.5 tftpboot/prom-211
Downloading image 'tftpboot/prom-211' from host '134.152.178.5'
image is a prom upgrade to version 'prom-2.0.1.1'
tftp complete
checksum valid. Ready to program.
Active-CM: flash found
Active-CM: erasing...
Active-CM: programming...
Active-CM: verifying...
Active-CM: programming successful.
Active-CM: Programming complete.
rs#
```

4. Reboot the RS 3000, RS 3100 or RS 3200.
5. Enter the **`system show version`** command to verify that the new boot PROM software is in the internal memory of the RS 3x00's motherboard.

5.3 LOADING SOFTWARE FROM THE NETWORK

Typically, the RS 3000 loads its operating software from the flash memory contained on the motherboard. Alternately, the RS 3000 can be configured to ignore its internal flash image and obtain its software from a network server. The RS 3000 can obtain its image software from either a TFTP or BootP/TFTP server.

5.3.1 Loading Image Software from a TFTP Server

Perform the following procedure to configure the RS 3x00 to load its image software from a TFTP server:

1. Copy the image software onto a TFTP server that the RS 3x00 can access.
2. Reboot the RS 3000, RS 3100 or RS 3200 and enter Boot mode by pressing the "Esc" key to interrupt the normal boot process.
3. At the Boot prompt, enter the **`set`** command to view the current bootPROM variable values.

   Here is an example:

```
 re-boot> set

...tty1 = 9600
bootdiagmode = off         [off on quick mfg-test]
  diag_log =
mfg_loop_by = time        [time count]
mfg_loop_max = 86400
 bootdelay = 2
promsetaddrs = 1
flow_control = on          [off on]
bootptimeout = 5
   netaddr = 0.0.0.0
  autoboot = boot
   netmask = 0,0,0,0
   gateway = 0.0.0.0
bootsource = /pc-flash/boot/ros80
  bootaddr = 0.0.0.0
   ethaddr = 00:00:1d:12:34:56
sysid = -1
rs-boot>
```

4. Notice in the example above that `netaddr`, `netmask`, and `gateway` have the value **`0.0.0.0`**, and that **`bootsource = /pc-flash/boot/ros80`**.
5. From the Boot prompt, use the **`set`** command to set the following:

- IP address of the RS 3x00 – (**`netaddr`**)
- Subnet mask for the RS 3x00 – (**`netmask`**)
- The IP address of the RS 3x00's default gateway – (**`gateway`**)
- Full path and filename to the software image on the TFTP server – (**`bootsource`**)
- IP address of the TFTP server – (**`bootaddr`**)

```
rs-boot> set netaddr <IPaddr>
rs-boot> set netmask <subnet-mask>
rs-boot> set gateway <IPaddr>
rs-boot> set bootsource <dir-filename>
rs-root> set bootaddr <IPaddr>
```

Here is an example:

```
rs-boot> set netaddr 134.152.179.132
rs-boot> set netmask 255.255.255.224
rs-boot> set gateway 134.152.179.129
rs-boot> set bootsource /tftpboot/ros80
rs-boot> set bootaddr 134.152.176.5
```

6. Enter the **set** command to view the changes:

Here is an example:

```
 rs-boot> set
...
   netaddr = 134.152.179.132
  autoboot = boot
   netmask = 255.255.255.224
   gateway = 134.152.179.129
bootsource = /tftpboot/ros80
  bootaddr = 134.152.176.5
   ethaddr = 00:00:1d:12:34:56
sysid = -1
rs-boot>
```

7. From the Boot prompt, use the **ping** command to verify that the RS 3000 can reach the TFTP server.

8. Reboot the RS 3000, RS 3100 or RS 3200. As the RS 3x00 initializes, it ignores the software image on the internal flash and retrieves its operating software from the TFTP server at **134.152.176.5**:

Here is an example:

```
rs-boot> boot

Rebooting. . .

. . .source: tftp://134.152.176.5/tftpboot/ros80

  Build location: host 'matrix' by 'adm'...

  Version: 8.0.0.0 . . .
```

5.3.2 Loading Image Software from a BootP/TFTP Server

The RS 3x00 contains a BootP client and can be configured to obtain its image software from a BootP/TFTP server. Using the BootP client allows the RS 3000, RS 3100 or RS 3200 to obtain its software network address from the server using only its MAC address. This eliminates the need to initially configure the RS's IP address, subnet mask, and boot source.

To configure the RS 3000, RS 3100 or RS 3200 to use its BootP client to obtain its image software, perform the following procedure:

1. Load the RS 3x00's image software on a BootP/TFTP server that can be reached by the RS 3000, RS 3100 or RS 3200.
2. Boot the RS 3x00 and enter Boot mode by interrupting the normal startup sequence by pressing the "Esc" key.
3. Use the **`set`** command to obtain the RS 3000, RS 3100 or RS 3200's MAC address.

   Here is an example:

```
 re-boot> set

...tty1 = 9600
bootdiagmode = off         [off on quick mfg-test]
  diag_log =
mfg_loop_by = time        [time count]
mfg_loop_max = 86400
 bootdelay = 2
promsetaddrs = 1
flow_control = on          [off on]
bootptimeout = 5
   netaddr = 0.0.0.0
  autoboot = boot
   netmask = 0,0,0,0
   gateway = 0.0.0.0
bootsource = /pc-flash/boot/ros80
  bootaddr = 0.0.0.0
   ethaddr = 00:00:1d:12:34:56   < MAC address >
sysid = -1
rs-boot>
```

4. Use the **`set`** command to change the value of **`autoboot`** to **`bootp`**.

   Here is an example:

```
rs-boot> set autoboot bootp
```

5. Configure the BootP/TFTP server with the RS 3000, RS 3100 or RS 3200's MAC address, an appropriate IP address, and the location of the RS 3x00 software image file. Additionally, make sure that the ARP cache of the BootP/TFTP server is set correctly for the RS 3000, RS 3100 or RS 3200.

6. Reboot the RS 3000, RS 3100 or RS 3200 by entering the **reboot** command at the Boot prompt.

   Here is an example:

```
rs-boot> reboot

Ethernet Base address = 00:00:1d:12:34:56
Ethernet CPU address  = 00:00:1d:12:34:57

Performing Bootp with timeout in 5 seconds.
** plen = 300  plen - sizeof(struct bootp) = 0
BOOTPD='134.141.179.134'
netaddr='134.141.179.132'
* bootp source is C:\TFTPBOOT\ROS80
Booting boot file C:\TFTPBOOT\ROS80.
source: tftp://134.141.179.134/C:\TFTPBOOT\ROS80
 File: version (703 bytes)
  Build location: host 'matrix' by 'adm'
  Version: 8.0.0.0
  Build date: Mon Dec 25 23:56:47 2000
 File: kernel (3568593 bytes)
  Loading kernel (base 0x80001000, size 50528)
(base 0x8000d560, size 3507312)
  100% - kernel loaded...
...
...
Press RETURN to activate console . . .
```

5.4 UPGRADING FPGA CODE

On occasion, Riverstone Networks may make upgraded Field Programmable Gate Array (FPGA) code available for certain line cards. To download an FPGA upgrade, use the **system linecard** command from Enable mode.

The **system linecard** command can download FPGA code from either the Control Module's flash RAM (**slot0**) or from a TFTP server on the network. In either case, the name of the file that contains the FPGA code is specified, and during the FPGA upgrade process, the line card is hot swapped out and then back in.

Note No traffic is passed on the line card while the FPGA upgrade process is being performed.

5.4.1 Upgrading FPGA Code from a TFTP Server

Follow these steps to upgrade a line card's FPGA code using a TFTP server.

In this example, the TFTP server address is **10.50.89.88**, the path and filename of the FPGA code is **posrel/oc12_mpls_38k/oc12mr38.000**, and the line card to be upgraded is in slot **2**.

1. Load the FPGA code onto the TFTP server. Make sure that the RS can reach the server across the network.
2. Enter the **`system linecard upgrade`** command, specifying the IP address of the TFTP server, the full path and filename of the FPGA code, and the slot number within which the line card resides.

```
rs# system linecard upgrade 10.50.89.88 posrel/oc12_mpls_38k/oc12mr38.000 module 2
Downloading package 'posrel/oc12_mpls_38k/oc12mr38.000' from host '10.50.89.88'
 download: done
pos02_oc12_mpls.bin: 100%
pos13_oc12_mpls.bin: 100%
pos_tmac_dp.bin: 100%

About to program the module in slot 2.
This will stop any traffic on that module until the
programming is complete and the module is restarted.

Are you sure you want to do this [no]? yes
upgrading POSITRON_FLSH_0_2 in slot 6 with pos02_oc12_mpls.bin
 flash found
 erasing...
 erasing...
 programming...
 verifying...
 programming successful.
 Programming complete.
upgrading POSITRON_FLSH_1_3 in slot 2 with pos13_oc12_mpls.bin
 flash found
 erasing...
 erasing...
 programming...
 verifying...
 programming successful.
 Programming complete.
upgrading TMAC_FLSH_0 in slot 2 with pos_tmac_dp.bin
 flash found
 erasing...

 erasing...
 programming...
 programming...
 verifying...
 programming successful.
 Programming complete.
Do you want to restarted module 2 at this time [no]? yes
%SYS-I-HOTSWAP_OUTRXD, received hotswapped-out request for slot 2
%SYS-I-HOTSWAP_INQUEUED, hotswap busy, request for hotswap-in slot 2
queued
2002-05-30 14:08:37 %SYS-I-HOTSWAPOUT, module in slot 2 is hotswapped out
```

```
2002-05-30 14:08:37 %SYS-I-HOTSWAP_INRXD, received hotswapped-in
request for slot 6, detecting, please wait
2002-05-30 14:08:44 %SYS-I-DSCVMOD, discovered '2-POS OC12 "M"' module in slot 2
2002-05-30 14:08:47 %SYS-I-INITPORT, initialized slot 2, port 1
2002-05-30 14:08:47 %SYS-I-INITPORT, initialized slot 2, port 2
2002-05-30 14:08:52 %SYS-I-HOTSWAPIN, module in slot 2 is hotswapped in
rs#
```

3. After the FPGA upgrade process completes, the line card starts passing traffic.

Notice in the example above that the hot swapping out and in occurs as part of the upgrade process – and does not have to be performed after the upgrade.

5.4.2 Upgrading FPGA Code from Flash RAM

FPGA code can be downloaded directly from the flash RAM residing within the Control Module. In this example, the FPGA code is downloaded from a network TFTP server and copied directly to the flash RAM in **`slot0`** of the Control Module. Once copied to the flash RAM, the upgrade is performed using the image on the flash RAM in **`slot0`**.

1. Load the FPGA code files onto the TFTP server. Make sure that the RS can reach the server across the network.

Enter the **`system linecard upgrade`** command, specifying the IP address of the TFTP server, the full path and filename of the FPGA code, and the slot number: **`slot0`**.

```
rs# system linecard upgrade 10.50.89.88 posrel/oc12_mpls_38k/oc12mr38.000 slot0
Downloading package 'posrel/oc12_mpls_8k/oc12mr8x.000' from host '10.50.89.88'
 download: done
Writing package 'oc12mr8x.000' to '/pc-flash0/linecard'
 save:  done
rs#
```

2. Use the **`system linecard list-images`** command to see the FPGA code that has been copied to the flash RAM.

```
rs# system linecard list-images
slot0:  oc12mr8x.000
rs#
```

3. Use the **`system linecard upgrade`** command to upgrade the line card with the FPGA code in flash RAM in **`slot0`**. Notice that only the filename is specified – the RS knows the correct path to the FPGA files on the flash RAM card.

```
rs# system linecard upgrade slot0 oc12mr8x.000 module 2
Downloading package '/pc-flash0/linecard/oc12mr38.000' from slot0
 download: done
pos02_oc12_mpls.bin: 100%
pos13_oc12_mpls.bin: 100%
pos_tmac_dp.bin: 100%

About to program the module in slot 2.
This will stop any traffic on that module until the
programming is complete and the module is hotswapped.

Are you sure you want to do this [no]? yes
upgrading POSITRON_FLSH_0_2 in slot 2 with pos02_oc12_mpls.bin
 flash found
 erasing...
```

As with the previous example, the line card is hot swapped out and then back in as part of the upgrade process.

APPENDIX A TROUBLESHOOTING

If you experience difficulty with the basic hardware or software setup procedures in this guide, check the following table to see whether the difficulty you are experiencing is described. If you find a description of the difficulty you are experiencing, try the remedy recommended for the difficulty. If the remedy does not remove the difficulty or the difficulty is not listed in this appendix, contact:

Riverstone Technical Assistance Center - RTAC

- Telephone: (408) 844-0010
- FAX: 408.878.6920
- Internet address: www.riverstonenet.com/support
- Email: support@riverstonenet.com

Table A-1 Troubleshooting

If you experience this difficulty...	Try this remedy...
The router exhibits no activity. No LEDs are on and the fan module is not operating.	Ensure that the power supply is installed and plugged into a power source and the power source is active. Ensure that the switch on the power supply is in the on position.
The power supply is installed but is not operating.	Check the power cable and the circuit to which the power supply is connected.
The fan is not operating.	Check the power cable and the circuit to which the power supply is connected.
No expansion modules are active.	Check the power cable and the circuit to which the power supply is connected.
A specific expansion module is inactive.	Ensure that the expansion module has been properly installed in its expansion slot. For more detailed information, see Section 3.3.2, *"Installing Line Cards."*
An older software version continues to boot instead of the newer version on a TFTP server.	Reconfigure the router to boot using newer software using the procedure in Section 5.1, *"Upgrading System Image Software."*
You are unable to access the configuration commands in the CLI.	From the CLI, type **`enable`** to access the Enable mode, then type **`configure`** to access the Configure mode.

Table A-1 Troubleshooting (Continued)

If you experience this difficulty...	Try this remedy...
Configuration changes do not seem to be taking effect.	Reactivate the changes using the procedure in Section 4.3.1, *"Activating the Configuration Commands in the Scratchpad."*
Configuration changes are not reinstated after a reboot.	Save the configuration changes to the startup configuration file using the procedure in Section 4.3.2, *"Saving the Active Configuration to the Startup Configuration File."*
The router is not resolving DNS names.	Set up DNS using the procedure in Section 4.7, *"Setting the DNS Domain Name and Address."* Ensure that you can use NS lookup on the DNS server to get the default domain.
An SNMP manager cannot access the router.	Set up an SNMP community string and specify a target for SNMP traps using the procedure in Section 4.6, *"Setting Up SNMP."* Type the **`snmp show all`** in the CLI to check the SNMP settings. Use the **`traceroute`** and **`ping`** commands to verify that the router can reach the SNMP management station.
You are unable to ping a certain host.	Create and add an IP or IPX interface for the host. See the *Riverstone RS Switch Router User Guide* for information.

APPENDIX B INTERNATIONAL SAFETY INFORMATION

B.1 CONSIDERACIONES DE SEGURIDAD

Lea las siguientes advertencias relacionadas con la seguridad y el uso del equipo para evitar posibles lesiones personales o daños al producto.

B.1.1 Prevención de Lesiones

Advertencia Tome en cuenta las siguientes advertencias de seguridad para prevenir una posible lesión accidental al manipular el hardware del Riverstone RS Switch Router (RS).

- Para evitar una posible lesión, tenga cuidado al sacar el chasis fuera de la caja de embalaje.
- Nunca intente montar el chasis del RS en un rack sin la ayuda de otra persona. Solicite ayuda para sostener el chasis.
- Nunca opere el RS si las ranuras de los módulos o los compartimientos del suministro de energía están expuestos.
- Nunca opere el RS si el chasis se moja o se instala en un lugar mojado.

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