RS 8000/8600
Switch Router
Getting Started Guide

Release 8.0

36-005-07 Rev. 0A

River STONE NETWORKS™

COPYRIGHT NOTICES

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

Printed in the United States of America

This product includes software developed by the University of California, Berkeley, and its contributors.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions, and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions, and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. All advertising materials mentioning features or use of this software must display the following acknowledgement:

   This product includes software developed by the University of California, Berkeley, and its contributors.
4. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Changes

Riverstone Networks, Inc., and its licensors reserve the right to make changes in specifications and other information contained in this document without prior notice. The reader should in all cases consult Riverstone Networks, Inc., to determine whether any such changes have been made.

The hardware, firmware, or software described in this manual is subject to change without notice.

Disclaimer

IN NO EVENT SHALL RIVERSTONE NETWORKS BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING BUT NOT LIMITED TO LOST PROFITS) ARISING OUT OF OR RELATED TO THIS MANUAL OR THE INFORMATION CONTAINED IN IT, EVEN IF RIVERSTONE NETWORKS HAS BEEN ADVISED, KNOWN, OR SHOULD HAVE KNOWN, OF THE POSSIBILITY OF SUCH DAMAGES.

Trademarks

Riverstone Networks, Riverstone, RS, and IA are trademarks of Riverstone Networks, Inc.

All other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies.

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; CSA C108.8; 89/336/EEC; EN 55022; EN 61000-3-2

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。

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.

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.

SAFETY INFORMATION: WICT1-12 T1 CARD

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

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.
STANDARD SOFTWARE LICENSE AGREEMENT

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.

The parties further agree that this Agreement is between You and Riverstone, and creates no obligations to You on the part of Riverstone's affiliates, subcontractors, or suppliers. You expressly relinquish any rights as a third party beneficiary to any agreements between Riverstone and such parties, and waive any and all rights or claims against any such third party.

1. **GRANT OF SOFTWARE LICENSE.** Subject to the terms and conditions of this Agreement, Riverstone grants You the right on a non-exclusive, basis for internal purposes only and only as expressly permitted by this Agreement
   a. to use the enclosed software program (the "Licensed Software") in object code form on a single processing unit owned or leased by You or otherwise use the software as embedded in equipment provided by Riverstone;
   b. to use the Licensed Software on any replacement for that processing unit or equipment;
   c. to use any related documentation (collectively with the Licensed Software the "Licensed Materials"), provided that You may not copy the documentation;
   d. to make copies of the Licensed Software in only the amount necessary for backup or archival purposes, or to replace a defective copy; provided that You (i) have not more than two (2) total copies of the Licensed Software including the original media without Riverstone's prior written consent, (ii) You operate no more than one copy of the Licensed Software, (iii) and You retain all copyright, trademark and other proprietary notices on the copy.
2. **RESTRICTION AGAINST COPYING OR MODIFYING LICENSED MATERIALS.** All rights not expressly granted herein are reserved by Riverstone or its suppliers or licensors. Without limiting the foregoing, You agree
   a. to maintain appropriate records of the location of the original media and all copies of the Licensed Software, in whole or in part, made by You;
   b. not to use, copy or modify the Licensed Materials, in whole or in part, except as expressly provided in this Agreement;
   c. not to decompile, disassemble, electronically transfer, or reverse engineer the Licensed Software, or to translate the Licensed Software into another computer language; provided that, if You are located within a Member State of the European community, then such activities shall be permitted solely to the extent, if any, permitted under Article 6 of the Council Directive of 14 May 1991 on the legal protection of computer programs, and implementing legislations thereunder.
3. **TERM AND TRANSFER.** You may transfer the License Materials with a copy of this Agreement to another party only on a permanent basis in connection with the transfer to the same party of the equipment on which it is used, and only if the other party accepts the terms and conditions of this Agreement. Upon such transfer, You must transfer all accompanying written materials, and either transfer or destroy all copies of the Software. Any attempted transfer not permitted by this Agreement is void. You may not lease or rent the License Materials. This Agreement is effective until terminated. You may terminate the Agreement at any time by destroying or purging all copies of the Licensed Materials. This Agreement will terminate automatically without notice from Riverstone if You fail to comply with any provision of this Agreement. Upon such termination, You must destroy the Licensed Materials as set forth above. Sections 4, 5, 6, 7, 8, 9, and 10 shall survive termination of this Agreement for any reason.
4. **TITLE AND PROPRIETARY RIGHTS.**

   (a) The Licensed Materials are copyrighted works and/or trade secrets of Riverstone and are the sole and exclusive property of Riverstone, any company or a division thereof which Riverstone controls or is controlled by, or which may result from the merger or consolidation with Riverstone (its "Affiliates"), and/or their suppliers. This Agreement conveys a limited right to operate the Licensed Materials and shall not be construed to convey title to the Licensed Materials to You.
   (b) You acknowledge that in the event of a breach of this Agreement, Riverstone shall suffer severe and irreparable damages for which monetary compensation alone will be inadequate. You agree that in the event of a breach of this Agreement, Riverstone shall be entitled to monetary damages and its reasonable attorney's fees and costs in enforcing this Agreement, as well as injunctive relief to restrain such breach, in addition to any other remedies available to Riverstone.

5. **MAINTENANCE AND UPDATES.** Updates, upgrades, bug fixes, and maintenance and support services, if any, are provided to You pursuant to the terms of a Riverstone Service and Maintenance Agreement, and only if Riverstone and You enter into such an agreement. Except as specifically set forth in such agreement, Riverstone is under no obligation to provide any updates, upgrades, patches, bug fixes, modifications, enhancements, or maintenance or support services to You. Notwithstanding the foregoing, if you are provided or obtain any software or documentation of Riverstone, which is not otherwise provided under a license from Riverstone, then Your use of such materials shall be subject to the terms of this Riverstone Networks, Inc. Software License Agreement.

6. **EXPORT REQUIREMENTS.** Licensed Software, including technical data, is subject to U.S. export control laws, including the U.S. Export Administration Act and its associated regulations, and may be subject to export or import regulations in other countries. You agree to comply strictly with all such regulations and acknowledge that you have the responsibility to obtain licenses to export, re-export or import Licensed Materials.

7. **UNITED STATES GOVERNMENT RESTRICTED RIGHTS.** The Licensed Materials are provided with RESTRICTED RIGHTS. Use, duplication or disclosure of the Licensed Materials and accompanying documentation by the U.S. Government is subject to restrictions as set forth in this Agreement and as provided in DFARS 227.7202-1(a) and 227.7202-3(a) (1995), DRAS 252.227-7013(c)(ii) (OCT 1988), FAR 12.212(a)(1995), FAR 52.227-19, or FAR 52.227-14 (ALT III), as applicable. Riverstone Networks, Inc.

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.

STANDARD LIMITED WARRANTY

Limited Warranty

Riverstone Networks, Inc. ("Riverstone") warrants that for a period of one (1) year from the date of shipment from Riverstone that the Riverstone hardware purchased by Customer ("Hardware") will be free from defects in materials and workmanship under normal use. This limited warranty extends only to Customer as original purchaser. Customer's sole and exclusive remedy and the entire liability of Riverstone, its suppliers and affiliates under this warranty is, at Riverstone's option, either (i) repair of the Hardware, (ii) replacement of the Hardware, or (iii) refund of the purchase price of the Hardware (as evidenced by a copy of Customer's purchase receipt), less any rebates or credits.

Riverstone warrants that for a period of one (1) year from the date of shipment from Riverstone that the media on which the Riverstone software purchased by Customer ("Software") is furnished will be free from defects in materials and workmanship under normal use. This limited warranty extends only to Customer as original licensee. Customer's sole and exclusive remedy and the entire liability of Riverstone, its suppliers and affiliates under this warranty is replacement of the media on which the Software is furnished. Riverstone makes no warranty with respect to the Software, and specifically disclaims any warranty that the Software is error free or that Customer will be able to operate the Software without problems or interruptions.

Restrictions. No warranty will apply if the Hardware and/or Software (collectively, "Product") (i) has been altered, except by Riverstone; (ii) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by Riverstone; or (iii) has been subjected to abnormal physical, thermal or electrical stress, misuse, negligence, or accident. In addition, Products are not designed or intended for use in (i) the design, construction, operation or maintenance of any nuclear facility, (ii) navigating or operating aircraft; or (iii) operating life-support or life-critical medical equipment, and Riverstone disclaims any express or implied warranty of fitness for such uses.

Warranty Service Procedures

Customer must notify Riverstone of any defect in the Product within the applicable warranty period and provide dated proof of original purchase prior to the return of any defective Product. Within ten (10) business days of the date of notification, Riverstone will provide Customer with a Return Material Authorization ("RMA") number and the location to which Customer must return the defective Product. Customer is responsible for proper packaging of Product returned to Riverstone, including description of the failure, shipment to Riverstone's designated location, and return of Product within ten (10) days after issuance of the RMA number. In no event will Riverstone accept any returned Product which does not have a valid RMA number. Customer's failure to return Product within thirty (30) days of its receipt of an RMA may result in cancellation of the RMA and/or the charge of the list price of any advanced replacement product. Riverstone does not accept responsibility for any Product lost in transit and recommends that the return be insured for the full value. Riverstone will use all reasonable efforts within thirty (30) days of receipt of defective Product to repair or replace such Product or refund Customer's purchase price.

Transportation costs relating to warranty service and any applicable duties will be borne by Customer. If a warranty claim is invalid for any reason, Customer will be charged at Riverstone's then-current standard rates for services performed and will be charged for all expenses incurred by Riverstone.

Replacement Products or replacement parts used in the repair of Products may be new or reconditioned.

Riverstone shall not be responsible for Customer's or any third party's software, firmware, information, or memory

data contained in, sorted on, or integrated with any Product returned to Riverstone, whether under warranty or not. Customer is responsible for backing up its programs and data to protect against loss or corruption.

Disclaimer. EXCEPT AS SPECIFIED ABOVE, 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.

Limitation of Liability. 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 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 CUSTOMER, FROM ALL CAUSES OF ACTION AND ALL THEORIES OF LIABILITY, WILL BE LIMITED TO AND WILL NOT EXCEED THE PURCHASE PRICE OF THE PRODUCT PAID BY CUSTOMER.

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

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 ABOUT THIS GUIDE

This guide provides a general overview of the 8-slot and 16-slot Riverstone Networks, Inc. RS 8000 and RS 8600 hardware and software features. Also, it provides procedures for installing the RS 8000 and RS 8600. For product information not available in this guide, see the manuals listed in Section 1.2, *"Related Documentation."*

1.1 HOW TO USE THIS GUIDE

If You Want To...	See...
Get an overview of the RS 8000 and RS 8600 software and hardware features	Chapter 2, *"Introduction"*
Install the RS 8000 or RS 8600 hardware	Chapter 3, *"Hardware Installation"*
Install the RS 8000 or RS 8600 software, boot the software, and set up the unit	Chapter 4, *"Initial Configuration"*
Troubleshoot installation problems	Appendix A, *"Troubleshooting"*

1.2 RELATED DOCUMENTATION

The Riverstone RS Switch Router documentation set includes the following items. Refer to these other documents to learn more about your product.

For Information About...	See the...
How to use Command Line Interface (CLI) commands to configure and manage the RS 8000 or RS 8600	*Riverstone RS Switch Router User Guide*
The complete syntax for all CLI commands	*Riverstone RS Switch Router Command Line Interface Reference Manual*
System messages	*Riverstone RS Switch Router Message Reference Manual*

2 INTRODUCTION

The 8-slot and 16-slot Riverstone Networks, Inc. RS 8000 and RS 8600 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 8000 and RS 8600 software and hardware feature set.

- If you want to skip this information and install the RS now, see Chapter 3, *"Hardware Installation."*
- If you want to boot the RS software and perform basic configuration tasks now, see Chapter 4, *"Initial Configuration."*

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 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 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 operates at the MAC and LLC layers.

Table 2-1 ISO 7-layer model and RS 8000/8600 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 following table lists the basic hardware and software specifications for the RS 8000 and RS 8600.

Table 2-2 RS 8000/8600 specifications

Feature	Specification
Throughput	• 16-Gbps non-blocking switching fabric (RS 8000) • 32-Gbps non-blocking switching fabric (RS 8600) • Up to 30 million packets-per-second routing throughput (RS 8600) • Up to 15 million packets-per-second routing throughput (RS 8000)
Capacity	• Up to 250,000 routes • Up to 2,000,000 Layer-4 application flows (RS 8000) • Up to 4,000,000 Layer-4 application flows (RS 8600) • 400,000 Layer-2 MAC addresses (RS 8000) • 800,000 Layer-2 MAC addresses (RS 8600) • 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 • 20 MB shared input/output buffering across WAN ports on a WAN module • 32 MB input/output buffering per Packet Over SONET/SDH OC-3c port • 64 MB input/output buffering per Packet Over SONET/SDH OC-12c port
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) • DS-3/E-3 (ATM Multi-rate and Channelized) • OC-3c (ATM Multi-rate and POS) • OC-12c (POS) • T1/E1 (WAN Multi-rate) • T3 (Channelized) • T3 Clear Channel • E3 Clear Channel • CMTS (DOCSIS 1.0, EuroDOCSIS 1.0)

Table 2-2 RS 8000/8600 specifications (Continued)

Feature	Specification
Routing protocols	• IP: RIP v1/v2, OSPF, BGP 2, 3, 4, IS-IS • IPX: RIP, SAP • Multicast: IGMP, DVMRP, GARP/GVRP
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
Bridging and VLAN protocols	• 802.1d Spanning Tree • 802.1Q (VLAN trunking) • Rapid Spanning Tree Protocol (RSTP) • Per-VLAN Spanning Tree (PVST)
RMON	• RMON v1/v2 for each port
Management	• SNMP v1, v2 • Emacs-like Command Line Interface (CLI)
Port mirroring	• Traffic from specific ports • Traffic to specific expansion slots (line cards)
Hot swapping	• Line cards • Control module (when redundant Control Module is installed and online) • Switching Fabric Modules (RS 8600 only) • Power Supply (when redundant supply is installed and online)
Redundancy	• Redundant power supplies • Redundant Control Modules • Redundant Switching Fabric Modules (RS 8600 only) • Virtual Router Redundancy Protocol (VRRP)

2.3 SOFTWARE OVERVIEW

This section describes the features and capabilities of the RS 8000/8600 in greater detail.

2.3.1 Bridging

The RS provides the following types of wire-speed bridging:

Address-based bridging – The RS performs 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 router's own MAC address, the packet is routed rather than bridged.

Flow-based bridging – The RS performs 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 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 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 supports 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 confines MAC-layer broadcasts to the ports in the VLAN on which the broadcast originates. RS 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 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 supports 802.1Q trunk ports, which allow you to use a single port to "trunk" traffic from multiple VLANs to another RS or to a switch that supports 802.1Q.

2.3.3 Routing

The RS provides 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

IPX – protocol by Novell used in NetWare products

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

By default, the RS uses one MAC address for all interfaces. The RS 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 receives a packet whose destination MAC address is one of the 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 Control Module) to route the packet to its IP destination(s). (See Section 2.4.4, *"Control Module"* for information about the Control Module.)

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 supports 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 supports the following IP multicast routing protocols:

- IGMP
- DVMRP
- GARP/GVRP

The RS does 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 supports 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 when an IPX interface is created.

2.3.4 Layer-4 Switching

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

Layer-4 Applications – The RS understands 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 looks at the packet's TCP or UDP port number to determine the application. For IPX packets, the RS looks at the destination socket to determine the application.

Layer-4 Flows – The RS 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. 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 8000/8600 through software and through hardware on the G8M-GBCMM-02 Gigabit Ethernet line cards. The following MPLS capabilities are supported on the RS 8000/8600:

- 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:

- 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 supplies non-blocking, wire-speed throughput, you can configure the RS 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 8000/8600 include the following:

- Traffic control queuing
- Weighted random early detection
- Weighted fair queuing
- Strict priority queuing
- QoS traffic control queues
- ToS octet rewrites

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 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 provides 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 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 supports SNMP v1/v2 and many standard networking MIBs. The RS'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 is described in Chapter 4, *"Initial Configuration."*

2.4 HARDWARE OVERVIEW

This section describes the RS 8000/8600 hardware modules with which you will be working. Chapter 3, *"Hardware Installation"* in this guide describes how to install the hardware. This section describes the following hardware:

- Chassis, Backplane, and Fan module
- Control Module
- Power Supply
- Switching Fabric Module (RS 8600 only)
- Line cards

2.4.1 Chassis

Figure 2-1 shows the front view of a fully loaded RS 8000 chassis. The RS 8000 chassis contains eight slots, numbered from 0 to 7. Slot 0 is in the lower left corner of the chassis and slot 7 is in the upper right corner.

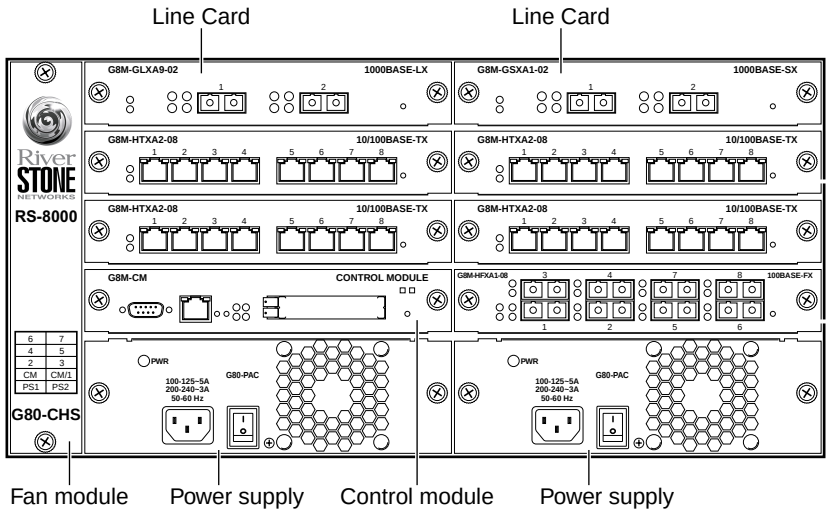


Figure 2-1 Front view of a fully loaded RS 8000 chassis

Figure 2-2 shows the front view of a fully loaded RS 8600 chassis. The RS 8600 chassis is similar to the RS 8000 chassis, except for the following:

- The chassis can contain up to 16 line cards.
- The switching fabric is stored on a separate module.
- There is a slot for a redundant switching fabric module.
- The power supply is larger.

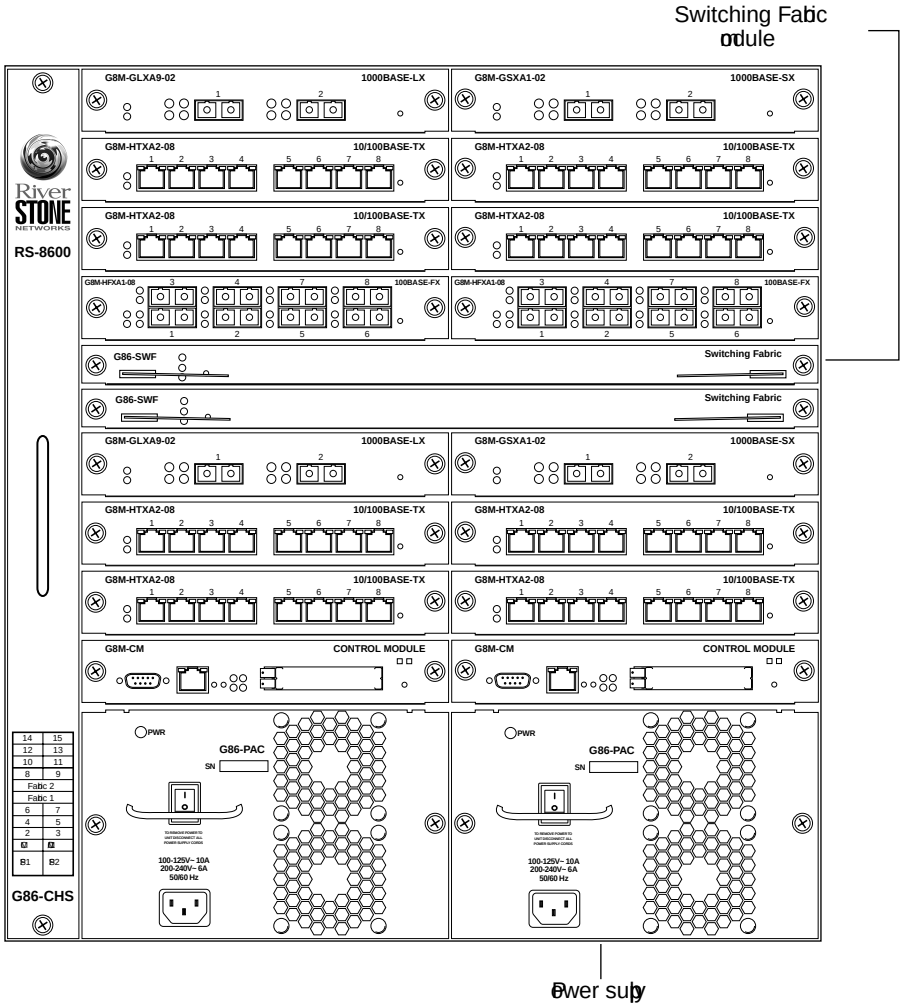


Figure 2-2 Front view of a fully loaded RS 8600 chassis

The RS 8600 chassis contains sixteen slots, numbered from 0 to 15. Slot 0 is in the lower left corner of the chassis and slot 15 is in the upper right corner. The RS 8600 also has slots for primary and redundant switching fabric modules.

On both the RS 8000 and RS 8600, slot 0 is labeled “CM” and contains the primary Control Module. The CM slot cannot be used for line cards. The primary Control Module must be installed in this slot. The CM/1 slot can contain a redundant Control Module (if you install one) or can contain a line card. Slots 2 to 7 on the RS 8000 or slots 2 to 15 on the RS 8600 can contain any line cards. (See Section 2.4.4, *"Control Module"* and Section 2.4.8, *"RS 8000/8600 Line Cards"* for information about these items.)

You can install line cards in any order in the slots. For example, you could install line cards in slots 2 and 5 and leave the other line card slots empty. The RS provides 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 to balance the load on the backplane. Regardless of where you install the line cards, the backplane can provide full, non-blocking throughput.

2.4.2 Backplane

The backplane occupies the rear of the chassis and connects the power supplies, Control Modules, and line cards together. The power supplies use the backplane to provide power to the rest of the system. The line cards and Control Modules use the backplane to exchange control information and packets. The backplane is installed at the factory. Contact Riverstone Networks, Inc. if you wish to replace the backplane.

2.4.3 Fan Module

The RS contains a fan module to provide a cooling air flow across the Control Module(s) and line cards. The fan module is located on the left side of the Control Modules and line cards. The RS 8000 fan module contains two fans; the RS 8600 fan module contains six fans. The fan module is installed at the factory, but you can replace the module yourself, if necessary.

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

2.4.4 Control Module

The Control Module is the RS's central processing unit. It contains system-wide bridging and routing tables. Traffic that does not yet have an entry in the L2 and L3/L4 lookup tables on individual line cards is sent to the Control Module. After processing traffic, the Control Module updates the L2 and L3/L4 tables on the line cards that received the traffic. The line cards thus "learn" about how to forward traffic.

Note If you plan to install a redundant Control Module, see Section 4.9, *"Using Redundant Control Modules"*

Figure 2-3 shows the front panel of the Control Module.

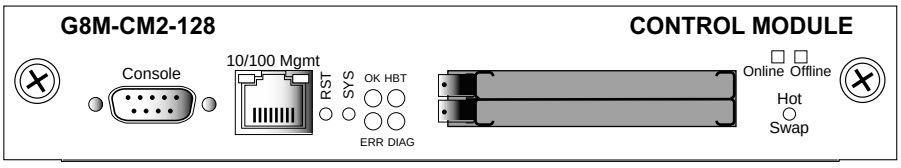


Figure 2-3 Front panel of the Control Module

Boot Flash

The Control Module has a boot flash containing the RS's boot software and configuration files. The system software image file typically resides on a 16 megabyte PC card, but can also be located on a TFTP server or BootP/TFTP server.

Memory Module

The Control Module uses memory to hold the routing tables and other tables. The Control Module 2 contains 128MB of memory (in a 128MB DIMM). The Control Module 3 contains 256MB of memory (in two 128MB DIMMs). You can obtain an RS memory upgrade kit from Riverstone Networks, Inc. to increase memory in the Control Module to 256MB.

External Controls and Connections

The Control Module has the following external controls.

- Reset switch (RST). Use this switch to reboot the RS's CPU.
- LEDs that indicate the current status of the RS 8000/8600. Table 2-3 describes the meaning of the Control Module LEDs

Table 2-3 RS 8000/8600 Control Module LEDs

LED	Description
OK	When this LED is on, the RS 8000/8600 and all ports are functioning correctly.
ERR	When this LED is on, a fatal system error has occurred. Activate the RS 8000/8600's boot PROM to reboot the system.
HBT	This LED flashes when the RS 8000/8600's boot PROM is active.
DIAG	When this LED is on, the RS 8000/8600 is in diagnostic mode. While in diagnostic mode, several other LEDs on the RS 8000/8600 are active, as well.
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.
Offline	When lit, this amber LED indicates that the Control Module 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 8000/8600.

- PC flash card slots. These slots are used to connect the PC card to the Control Module. The RS 8000/8600's operating software image resides on the PC cards, and is loaded by the system at power-up. More than one software image can reside on the PC cards, this allows for upgrades and the changing of software versions run by the RS 8000/8600.

Note The RS 8000/8600 supports the use of dual PC cards, one in slot0, the other in slot1. Each PC card is treated as an independent file system by the RS. For detailed information regarding the PC flash file system and the management of configuration files, see the "*Riverstone Networks RS Switch Router User Guide*."

- Male DB-9 Data Communications Equipment (DCE) port for serial connection to a management terminal. Use this port to establish a direct CLI connection to the RS. The default baud rate is 9600.

  The following table lists the pin assignments for the male DB-9 connector on the Control Module and for the male DB-9 connector on the management console.

Table 2-4 Pin assignments DB-9 connector on Control Module

Control Module DB-9 Connector (DCE)	Pin Number	Management Console DB-9 Connector (DTE)
Unused	1	Unused
TXD (transmit data)	2	RXD (receive data)
RXD (receive data)	3	TXD (transmit data)
Unused	4	Unused
GND (ground)	5	GND (ground)
DTR (data terminal ready)	6	DSR (data set ready)
CTS (clear to send)	7	RTS (request to send)
RTS (request to send)	8	CTS (clear to send)
Unused	9	Unused

- 10/100Base-TX Data Terminal Equipment (DTE) port for network ("in-band") connection to a management terminal. The port is configured as a Media Data Interface (MDI). Use this port to establish a management connection to the RS over a local or bridged Ethernet segment.

  The following table lists the pin assignments for the RJ-45 connector on the Control Module and for the RJ-45 connector on the network side of the cable.

Table 2-5 Pin assignments for RJ-45 connector on Control Module

Control Module RJ-45 Connector	Pin Number	Management Console RJ-45 Connector
TXD (transmit data)	1	RXD (receive data)
TXD (transmit data)	2	RXD (receive data)

Table 2-5 Pin assignments for RJ-45 connector on Control Module

Control Module RJ-45 Connector	Pin Number	Management Console RJ-45 Connector
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

2.4.5 AC Power Supply

The power supply delivers 3.3, 5, and 12 DC volts to the RS's Control Module(s), fan modules, and other components. A single power supply provides enough current to operate a fully configured chassis. The power supply has its own internal cooling fan. The vent on the front of the power supply is the inlet vent for the cooling fan.

Figure 2-4 shows the front view of an RS 8000 AC power supply.

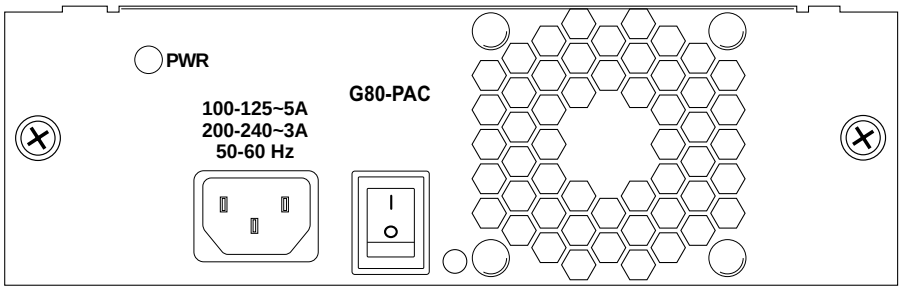


Figure 2-4 Front view of an RS 8000 AC power supply

The RS 8600 power supply is somewhat larger than the RS 8000 power supply. Figure 2-5 shows the front view of an RS 8600 AC power supply.

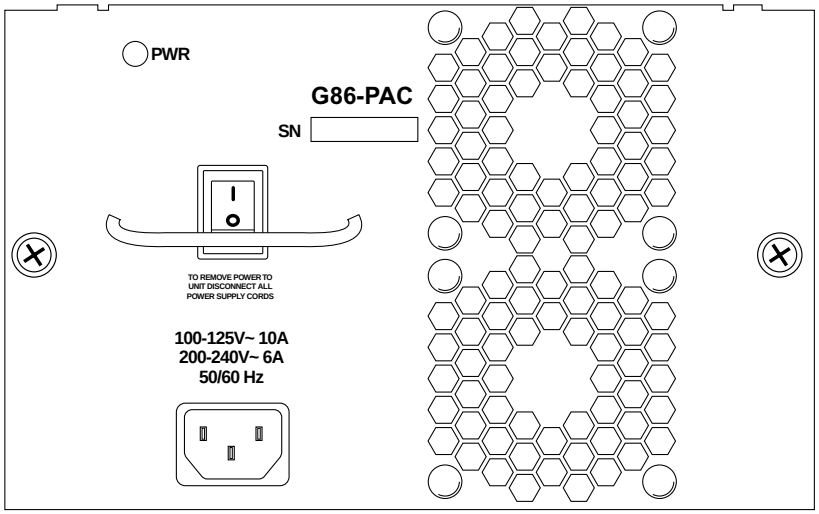


Figure 2-5 Front view of an RS 8600 AC power supply

The following table lists the specifications for the RS's AC power supply.

Table 2-6 Specifications for AC power supply

RS Switch Router	Input Voltage	Input Current
RS 8000	100 to 125, 200 to 240 V AC	5, 3 A
RS 8600	100 to 125, 200 to 240 V AC	10, 6 A

To ensure against equipment failure, you can install a redundant power supply. When two power supplies are active in the RS, they load share, each supply delivering approximately 50 percent of the current needed. Moreover, if one of the power supplies fails, the other power supply immediately assumes the entire load, thus preventing any system outage.

The AC power supply has a green status LED. When the LED is lit, the power supply is connected to an appropriate power source and is active. The status LED is lit when you switch the power supply on, not when you plug the power supply into a power source.

2.4.6 DC Power Supply

The RS DC power supply delivers 3.3, 5, and 12 volts DC to the RS's Control Module(s), fan modules, and other components. A single DC power supply provides enough current to operate a fully configured chassis.

Figure 2-6 shows the front view of an RS 8000 DC power supply.

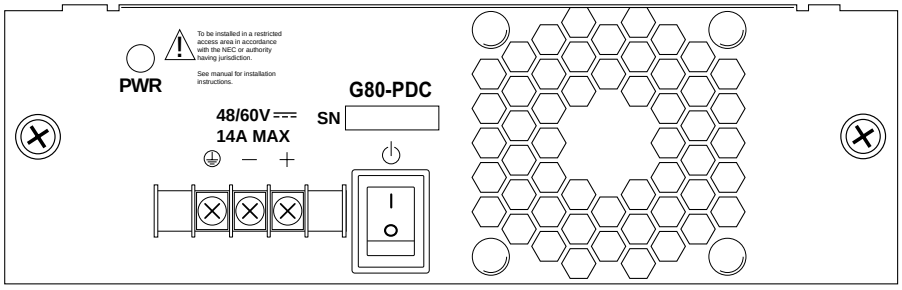


Figure 2-6 Front view of an RS 8000 DC power supply

The RS 8000 DC power supply has a three-terminal wiring block on the front panel, consisting of a positive (+) terminal, negative (-) terminal and a safety ground. 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 RS 8600 DC power supply. Use 12-gauge to 14-gauge wire for the safety ground.

Figure 2-7 shows the front view of an RS 8600 DC Power Supply.

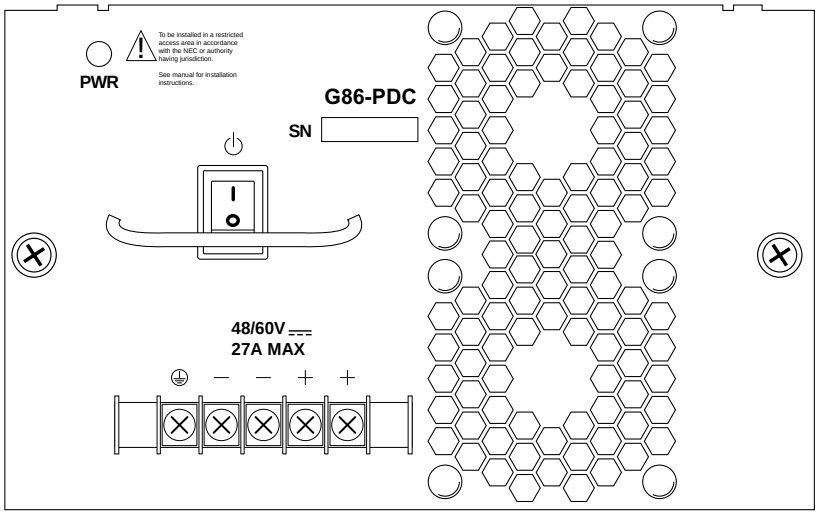


Figure 2-7 Front view of an RS 8600 DC power supply

The RS 8600 DC power supply has a five-terminal wiring block on the front panel, consisting of two positive (+) terminal, two negative (-) terminal and a safety ground. The DC supply is designed to be powered by a 48-Volt DC source.

DC Power Supply Specifications

Table 2-7 lists the physical specifications for the RS's DC Power Supplies.

Table 2-7 Specifications for DC power supply

RS Switch Router	Dimensions	Weight	Power Output	Voltage Range
RS 8000	1.00" (L) x 7.70" (W) x 2.55" (H)	6.5 lbs. (2.95 kg)	300 W	36 to 72 V, 14 A @ 48 V nominal
RS 8600	12.15" (L) x 7.70" (W) x 5.05" (H)	12.0 lbs. (5.45 kg)	600 W	36 to 72 V, 27 A @ 48 V nominal

Table 2-8 lists the environmental specifications for the RS's DC Power Supplies.

Table 2-8 Environmental specifications for DC power supply

Specification	Measurement
Operating Temperature	+5 to +40 °C (41 to 104 °F)
Non-operating temperature	-30 to +73 °C (-22 to 164 °F)
Operating Humidity	15 to 90% (non-condensing)

2.4.7 Switching Fabric Module (RS 8600 only)

On the RS 8600, the switching fabric is contained on a separate plug-in module. The RS 8600 has slots for two of these modules. When two switching fabric modules are installed, the module in the slot labelled "Fabric 1" serves as the primary switching fabric module, and the module in the slot labelled "Fabric 2" serves as a redundant switching fabric module.

Figure 2-8 shows the front panel of the RS 8600 Switching Fabric module.

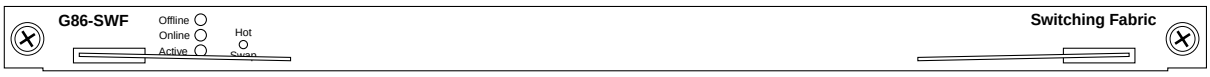


Figure 2-8 Front panel of RS 8600 Switching Fabric module

Switch Fabric LEDs

The RS 8600 Switching Fabric module uses the following LEDs.

Table 2-9 LED description for Switching Fabric

LED	Description
Offline	When lit, this amber LED indicates that the module 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 switching fabric 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.
Active	When lit, this LED indicates that the switching fabric module is actively receiving, processing, and sending packets.

2.4.8 RS 8000/8600 Line Cards

The following section lists the line cards available for the RS 8000/8600. The line cards are equipped with 4 MB, 16 MB, or 32MB of RAM, and support a wide range of protocols and interfaces.

10/100Base-TX 8-Port Line Card

The 10/100Base-TX line card contains eight independent Ethernet ports. Each port senses whether it is connected to a 10-Mbps segment or a 100-Mbps segment and automatically configures itself as a 10Base-T or 100Base-TX port. Figure 2-9 shows the front panel of the 10/100Base-TX line card.

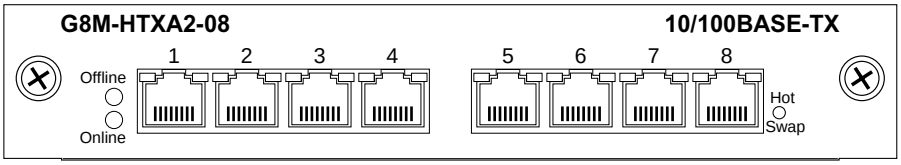


Figure 2-9 Front panel of 10/100Base-TX line card

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

Table 2-10 Connector specifications for 10/100Base-TX line card

Port type	Specification
10Base-T	• 802.3 standard • RJ-45 connector wired as Media Data Interface Crossed (MDIX); see Table 2-11 for pin assignments • 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); see Table 2-11 for pin assignments • EIA Category 5 unshielded twisted pair cabling • Maximum 100 meters (328 feet) segment length

The following table lists the pin assignments for the RJ-45 connector on the 10/100Base-TX and for the RJ-45 connector on the network side of the segment cable.

Table 2-11 Pin assignments for 10/100Base-TX line card

Line Card RJ-45 Connector	Pin Number	RJ-45 Connector at Other End of Segment
RXD (receive data)	1	TXD (transmit data)
RXD (receive data)	2	TXD (transmit data)
TXD (transmit data)	3	RXD (receive data)
Unused	4	Unused
Unused	5	Unused
TXD (transmit data)	6	RXD (receive data)
Unused	7	Unused
Unused	8	Unused

Figure 2-10 shows the pin positions in the 10/100Base-TX connectors.

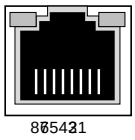


Figure 2-10 10/100Base-TX RJ-45 connector

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

Table 2-12 LED description for 10/100Base-TX line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card 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.
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.

10/100Base-TX 16-Port Line Card

The 10/100Base-TX 16-port line card contains 16 independent Ethernet ports. Each port senses whether it is connected to a 10-Mbps segment or a 100-Mbps segment and automatically configures itself as a 10Base-T or 100Base-TX port. Figure 2-11 shows the front panel of the 10/100Base-TX line card.

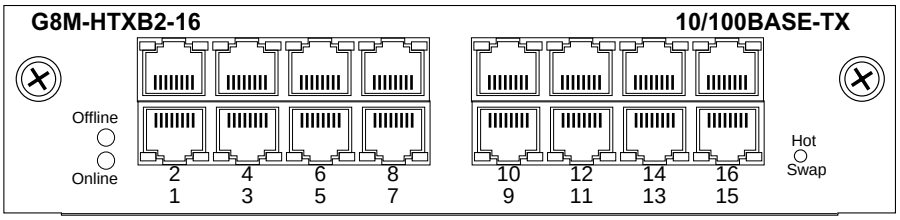


Figure 2-11 Front panel of 10/100Base-TX line card

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

Table 2-13 Connector specifications for 10/100Base-TX line card

Port type	Specification
10Base-T	• 802.3 standard • RJ-45 connector wired as Media Data Interface Crossed (MDIX); see Table 2-14 for pin assignments • 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); see Table 2-14 for pin assignments • EIA Category 5 unshielded twisted pair cabling • Maximum 100 meters (328 feet) segment length

The following table lists the pin assignments for the RJ-45 connector on the 10/100Base-TX and for the RJ-45 connector on the network side of the segment cable.

Table 2-14 Pin assignments for 10/100Base-TX line card

Line Card RJ-45 Connector	Pin Number	RJ-45 Connector at Other End of Segment
RXD (receive data)	1	TXD (transmit data)
RXD (receive data)	2	TXD (transmit data)

Table 2-14 Pin assignments for 10/100Base-TX line card (Continued)

Line Card RJ-45 Connector	Pin Number	RJ-45 Connector at Other End of Segment
TXD (transmit data)	3	RXD (receive data)
Unused	4	Unused
Unused	5	Unused
TXD (transmit data)	6	RXD (receive data)
Unused	7	Unused
Unused	8	Unused

Figure 2-12 shows the pin positions in the 10/100Base-TX connectors.

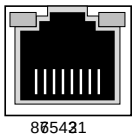


Figure 2-12 10/100Base-TX RJ-45 connector

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

Table 2-15 LED description for 10/100Base-TX line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card 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.
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 Line Cards

The 100Base-FX line cards provide the same features as the 10/100Base-TX line card but use multi-mode fiber-optic cable (MMF) to connect to the network. The MMF line cards are available in 4 MB and 16 MB versions. Figure 2-13 shows the front panel of the 4 MB 100Base-FX line card.

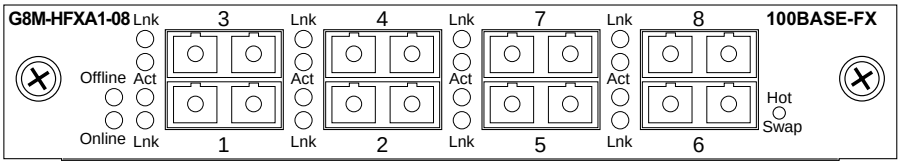


Figure 2-13 Front panel of 4 MB 100Base-FX line card (MMF)

The following table lists the media specifications for the 100Base-FX line card.

Table 2-16 Connector specifications for 100Base-FX line card

Port type	Specification
100Base-FX	• 802.3u standard • SC-style Media Interface Connector (MIC); either connection pin in the MIC can be used for transmit or receive. • 62.5 micron multi-mode fiber-optic cable • Maximum 412 meters (1352 feet) segment length for half-duplex links • Maximum 2 kilometers (6562 feet) segment length for full-duplex links

The 100Base-FX line card uses the following LEDs.

Table 2-17 LED description for 100Base-FX line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.

Table 2-17 LED description for 100Base-FX line card (Continued)

LED	Description
Lnk	Each port has two LEDs located to the left of the connector. The green Lnk LED 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.
Act	The amber Act LED flashes each time the port's transceiver sends or receives packets.

1000Base-SX Line Card

The 1000Base-SX line card contains two independent Gigabit (1000 Mbps) Ethernet ports. The ports connect to multi-mode fiber (MMF) cables. Figure 2-14 shows the front panel of the 1000Base-SX line card.

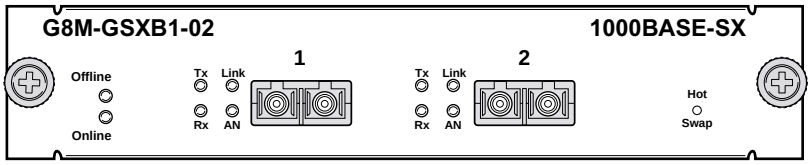


Figure 2-14 Front panel of 1000Base-SX line card

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

Table 2-18 Connector specifications for 1000Base-SX line card

Port type	Specification
1000Base-SX	• 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. • 62.5 micron or 50 micron multi-mode fiber-optic cable • Maximum 220 or 275 meters (722 or 902 feet) segment length for 62.5 micron fiber-optic cable, based on installed fiber bandwidth • Maximum 500 or 550 meters (1640 or 1804 feet) segment length for 50 micron fiber-optic cable, based on installed fiber bandwidth

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

Table 2-19 LED description for 1000Base-SX line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.
Per-port Link	**Green** – indicates that the port hardware detects a cable plugged into the port 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 plugged into the port, however, a bad link is established. **Off** – indicates that no link from the port exists.
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 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.

1000Base-LX Line Card

The 1000Base-LX line card provides the same features as the 1000Base-SX line card, but supports single-mode fiber (SMF) as well as MMF to provide for various transmission distances. Figure 2-15 shows the front panel of the 1000Base-LX line card.

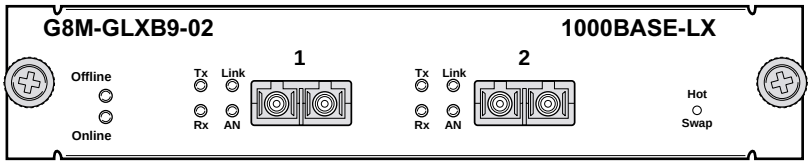


Figure 2-15 Front panel of 1000Base-LX line card

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

Table 2-20 Connector specifications for 1000Base-LX line card

Port type	Specification
1000Base-LX	• 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. • 62.5 micron or 50 micron multi-mode fiber-optic cable • 9.5 micron single-mode fiber-optic cable • Maximum 550 meters (1804 feet) segment length for 62.5 micron multi-mode fiber-optic cable (Mode conditioning patch cord required.) • Maximum 550 meters (1804 feet) segment length for 50 micron multi-mode fiber-optic cable • Maximum 5 kilometers (229,659 feet) segment length for 10 micron single-mode fiber-optic cable

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

Table 2-21 LED description for 1000Base-LX line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.
Per-port Link	**Green** – indicates that the port hardware detects a cable plugged into the port 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 plugged into the port, however, a bad link is established **Off** – indicates that no link from the port exists
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 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

1000Base-LLX Line Card

The 1000Base-LLX line card is similar to the 1000Base-LX line card, but extends the transmission distance over single-mode fiber (SMF) to 70 kilometers for Gigabit Ethernet. Figure 2-16 shows the front panel of the 1000Base-LLX line card.

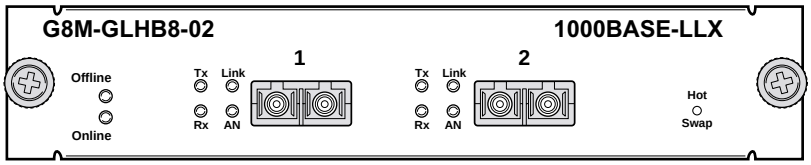


Figure 2-16 Front panel of 1000Base-LLX line card

The following table lists the media specifications for the 1000Base-LLX line card.

Table 2-22 Connector specifications for 1000Base-LLX line cards

Port type	Specification
1000Base-LLX	• 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; see. • 9.5 micron single-mode fiber-optic cable • Maximum 70 kilometers (229,659 feet) segment length for 10 micron SMF fiber-optic cable

The 1000Base-LLX line card use the following LEDs.

Table 2-23 LEDs for 1000Base-LLX line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card that indicates that the line card 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 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.

Table 2-23 LEDs for 1000Base-LLX line card (Continued)

LED	Description
Per-port Link	**Green** – indicates that the port hardware detects a cable plugged into the port 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 plugged into the port, however, a bad link is established **Off** – indicates that no link from the port exists
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 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

1000Base-T Line Card

The 1000Base-T line card contains two independent RJ-45 Ethernet ports. Each port supports a 1000Base-T connection over category 5 UTP. Figure 2-17 shows the front panel of the 1000Base-T line card.

Figure 2-17 Front panel of 1000Base-T line card

The following table lists the media specifications for the 1000Base-T line card.

Table 2-24 Connector specifications for 1000Base-T line card

Port type	Specification
1000Base-T	• 802.3ab standard • RJ-45 connector wired as Media Data Interface Crossed (MDIX); see Table 2-25 for pin assignments • EIA Category 5 unshielded twisted pair cabling • Maximum 100 meters (328 feet) segment length

The following table lists the pin assignments for the RJ-45 connector on the 1000Base-T and for the RJ-45 connector on the network side of the segment cable.

Table 2-25 Pin assignments for 1000Base-T line card

Line Card RJ-45 Connector	Pin Number	RJ-45 Connector at Other End of Segment
TXD and RXD (transmit and receive data)	1	TXD and RXD
TXD and RXD	2	TXD and RXD
TXD and RXD	3	TXD and RXD
TXD and RXD	4	TXD and RXD
TXD and RXD	5	TXD and RXD
TXD and RXD	6	TXD and RXD
TXD and RXD	7	TXD and RXD
TXD and RXD	8	TXD and RXD

Figure 2-18 shows the pin positions in the 1000Base-T connectors.

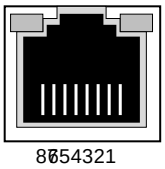


Figure 2-18 1000Base-T RJ-45 connector

The 1000Base-T line card uses the LEDs described in Table 2-26.

Table 2-26 LED description for 1000Base-T line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card 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.
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.
Per-port Link	**Green** – indicates that the port hardware detects a cable plugged into the port 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 plugged into the port, however, a bad link is established **Off** – indicates that no link from the port exists
Per-port Rx	**Green** – indicates when the port's transceiver receives packets **Amber** – indicates when the port's transceiver receives flow-control packets
Per-port Tx	**Green** – indicates when the port's transceiver transmits packets **Amber** – indicates when the port's transceiver transmits flow-control packets
Master	**Amber** – indicates that the port is configured as the timing master during auto-negotiation **Off** – indicates when the port is configured as the timing slave during auto-negotiation
Quality	**Off** – indicates that either auto-negotiation is in progress or the local receiver status is not OK **Green** – indicates that either auto-negotiation is complete and is trying to establish a link or a link is established **Fast Blink** – indicates a low SNR and close to data error **Slow Blink** – indicates detection of receive bit error

2.4.9 MPLS Gigabit Ethernet GBIC Line Card

Figure 2-19 shows the front panel of the 2-port MPLS activated Gigabit Interface Converter (GBIC) line card.

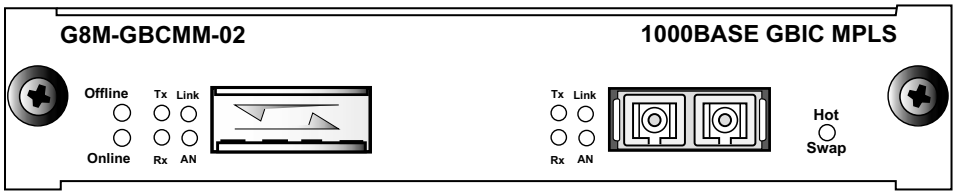


Figure 2-19 Front panel of MPLS GBIC line card with one GBIC installed

GBIC modules provide the media-specific portion of the MPLS GBIC line-card (see Figure 2-20), 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.

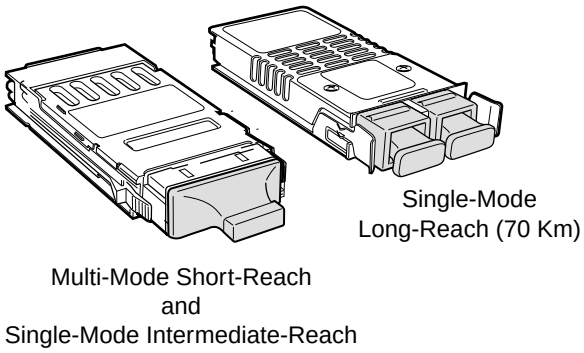


Figure 2-20 GBIC modules

The MPLS Gigabit Ethernet GBIC line cards accept the GBIC modules described in Table 2-27.

Table 2-27 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

Table 2-27 GBIC modules media specification (Continued)

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

The MPLS line card uses the LEDs as described in Table 2-28.

Table 2-28 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.
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.

Table 2-28 MPLS GBIC line card LEDs (Continued)

LED	Description
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.

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.

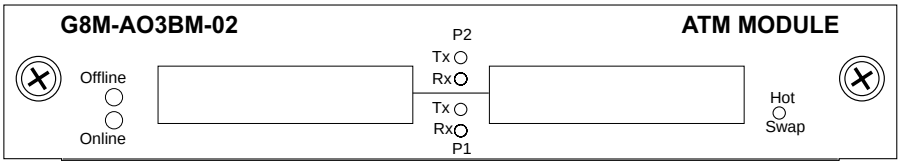
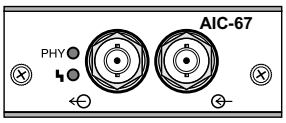
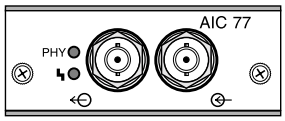
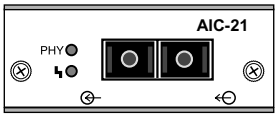
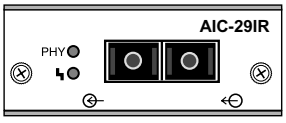


Figure 2-21 Front panel of ATM OC-3c line card

See Section 3.3.9, *"Installing ATM Physical Media Cards (PHYs)"* 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 2-29 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 2-30 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

ATM OC-12c Line Card

The ATM OC-12c line card supplies one logical connection, through two physical ports (Link 1 and Link 2). Link 1 is the working (primary) port and Link 2 is the protecting (backup) port.

Note Do not try to use Link 2 port for another connection different from Link 1. Link 2 and Link 1 act as redundant ports for APS and are essentially one logical port.

Figure 2-22 shows the front panel of the ATM OC-12c MMF line card.

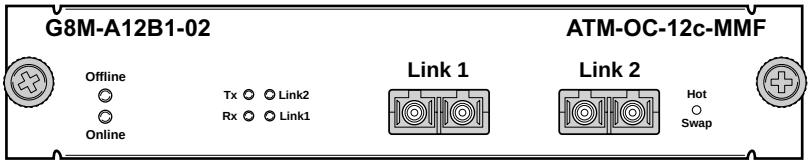


Figure 2-22 Front panel of ATM OC-12c MMF line card

Figure 2-23 shows the front panel of the ATM OC-12c SMF line card.

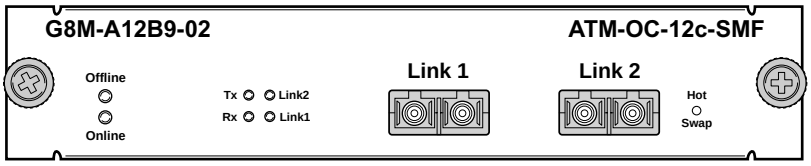


Figure 2-23 Front panel of ATM OC-12c SMF line card

The following table lists the media specifications for the ATM OC-12c MMF and ATM OC-12c SMF line card.

Table 2-31 Cabling and connectors for ATM OC-12c line card

Port type	Specification
ATM OC-12c	• SC-style Media Interface Connector (MIC); either connection pin in the MIC can be used for transmit or receive. • Link 1 - Working APS port, Link 2 - Protecting APS port • 62.5 micron or 50 micron multi-mode fiber-optic cable • 9.5 micron single-mode fiber-optic cable • Maximum 1 kilometers for multi-mode fiber-optic cable • Maximum 13 kilometers for single-mode fiber-optic cable

The ATM OC-12c SMF and ATM OC-12c MMF line cards use the following LEDs.

Table 2-32 LED description for ATM OC-12c line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.

Table 2-32 LED description for ATM OC-12c line card (Continued)

LED	Description
Per-port Link	**Green** – indicates that the port hardware detects a cable plugged into the port 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 plugged into the port, however, a bad link is established **Off** – indicates that no link from the port exists
Per-port Rx	**Green** – indicates when the port's transceiver receives packets **Red** – indicates when the port's transceiver receives flow-control packets
Per-port Tx	**Green** – indicates when the port's transceiver transmits packets **Red** – indicates when the port's transceiver transmits flow-control packets

POS OC-3c MMF Line Card and POS OC-3c SMF Line Card

The Packet-over-SONET line card supports four OC-3c connections. One of the POS line cards is designed to work with single-mode fiber (SMF), the other POS line card uses multi-mode fiber (MMF). Each line card uses MT-RJ connectors. Figure 2-24 shows the front panel of the POS OC-3c MMF line card.

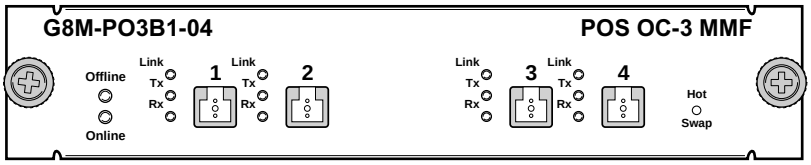


Figure 2-24 Front panel of POS OC-3c MMF line card

Figure 2-25 shows the front panel of the POS OC-3c SMF line card.

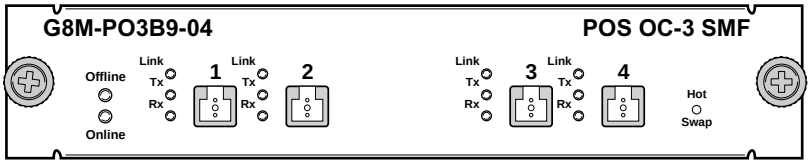


Figure 2-25 Front panel of POS OC-3c SMF line card

The following table lists the media specifications for the POS OC-3c MMF and POS OC-3c SMF line cards.

Table 2-33 Cabling and connectors for 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) • MT-RJ-style connector. • 62.5 micron or 50 micron multi-mode MT-RJ fiber-optic cable • 9.5 micron single-mode MT-RJ fiber-optic cable • Maximum 2 kilometers for multi-mode fiber-optic cable • Maximum 15 kilometers for single-mode fiber-optic cable

The POS OC-3c MMF and POS OC-3c SMF line cards use the following LEDs.

Table 2-34 LED description for POS OC-3c line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.
Per-port Link	**Green** – indicates that the port hardware detects a cable plugged into the port 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 plugged into the port, however, a bad link is established **Off** – indicates that no link from the port exists
Per-port Rx	**Green** – indicates when the port's transceiver receives packets **Red** – indicates when the port's transceiver receives flow-control packets
Per-port Tx	**Green** – indicates when the port's transceiver transmits packets **Red** – indicates when the port's transceiver transmits flow-control packets

POS OC-12c MMF Line Card and POS OC-12c SMF Line Card

The Packet-over-SONET line card supports two OC-12c connections. One model of the POS line card is designed to work with single-mode fiber (SMF), the other POS line card uses multi-mode fiber (MMF). Each line card uses SC-type connectors. Figure 2-26 shows the front panel of the POS OC-12c MMF line card.

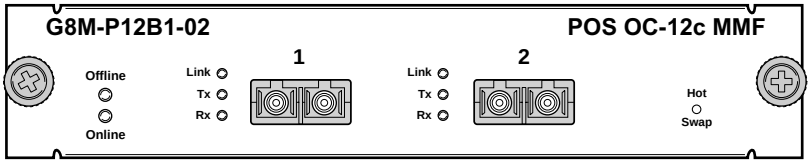


Figure 2-26 Front panel of POS OC-12c MMF line card

Figure 2-27 shows the front panel of the POS OC-12c SMF line card.

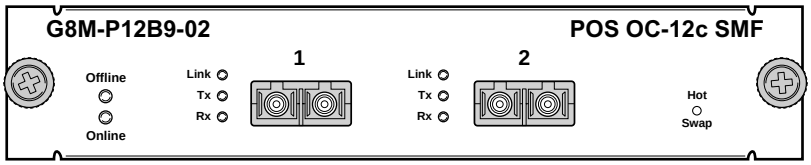


Figure 2-27 Front panel of POS OC-12c SMF line card

The following table lists the media specifications for the POS OC-12c MMF and POS OC-12c SMF line cards.

Table 2-35 Connector specifications for POS OC-12c line card

Port type	Specification
POS OC-12c	• Bellcore GR253, ITU -T G.957, ITU-T G.958 • PPP over SONET/SDH (RFC 1619), PPP in HDLC framing (RFC 1662) • SC-style Media Interface Connector (MIC); either connection pin in the MIC can be used for transmit or receive. • 62.5 micron or 50 micron multi-mode fiber-optic cable • 9.5 micron single-mode fiber-optic cable • Maximum 1 kilometers for multi-mode fiber-optic cable • Maximum 13 kilometers for single-mode fiber-optic cable

The POS OC-12c MMF and POS OC-12c SMF line cards use the following LEDs.

Table 2-36 LED description for POS OC-12c line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.
Per-port Link	**Green** – indicates that the port hardware detects a cable plugged into the port 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 plugged into the port, however, a bad link is established **Off** – indicates that no link from the port exists
Per-port Rx	**Green** – indicates when the port's transceiver receives packets **Red** – indicates when the port's transceiver receives flow-control packets
Per-port Tx	**Green** – indicates when the port's transceiver transmits packets **Red** – indicates when the port's transceiver transmits flow-control packets

Quad Serial – C and Quad Serial – CE Line Cards

The Quad Serial – C and Quad Serial – CE line cards each contain two dual-serial WAN ports (two serial ports located on one high density connector). In addition, the Quad Serial – C line card includes compression, and the Quad Serial – CE line card includes compression *and* encryption, for each WAN port. Figure 2-28 shows the front panel of the Quad Serial – CE WAN line card.

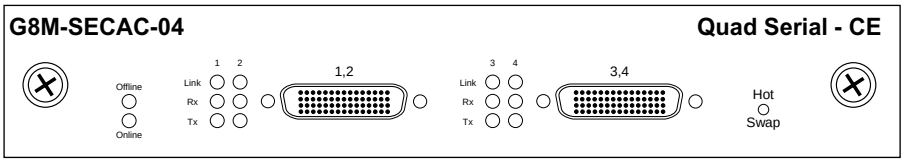


Figure 2-28 Front panel of Quad Serial – CE WAN line card

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

Table 2-37 Connector specifications for quad serial line card

Port Type	Specification
Dual serial	• V.35, X.21, EIA530, EIA530A, or RS449 • LFH-60 high density connector; see Table 2-39 for pin assignments • Recommended 3 meters (10 feet) segment length for standard WAN line card-to-CSU/DSU data port.

Table 2-38 Quad serial cables and connector types

Riverstone Part Number	CSU/DSU Connector Type	Standard
SYS-SV35-DTE	Two (2) V.35 34-pin connectors	V.35
SYS-S530-DTE	Two (2) DB-25 25-pin connectors	EIA-530
SYS-S449-DTE	Two (2) DB-37 37-pin connectors	RS-449
SYS-SX21-DTE	Two (2) DB-15 15-pin connectors	X.21

The following table maps the pin assignments for Riverstone's LFH-60 high density connectors for the Quad Serial – C/CE line cards.

Table 2-39 Pin assignments for quad serial line cards

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

Table 2-39 Pin assignments for quad serial line cards (Continued)

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
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
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

Figure 2-29 shows the pin positions in the LFH-60 high density connector.

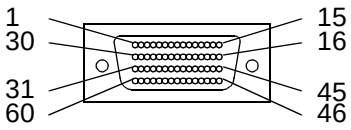


Figure 2-29 LFH-60 high density connector

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

Table 2-40 LED description for quad serial line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.
Per-port Link	Indicates that the line card detects a cable plugged into the port 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 2-30 shows the front panel of the Dual HSSI WAN line card.

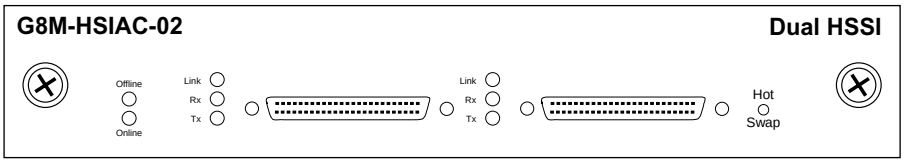


Figure 2-30 Front panel of Dual HSSI WAN line card

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

Table 2-41 Connector specifications for dual HSSI line card

Port Type	Specification
HSSI	• HSSI rev 2.11 • 50-pin High Speed Serial Interface (HSSI) connector; see Table 2-42 for pin assignments • Recommended 3 meters (10 feet) segment length for standard WAN line card-to-CSU/DSU data port.

The following table maps the pin assignments for Riverstone's 50-pin HSSI connector for the Dual HSSI line card.

Table 2-42 Pin assignments for dual HSSI line card

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
7	GND	20	(reserved)	32	GND	45	(reserved)
8	TA+	24	(reserved)	33	TA-	46	(reserved)
9	TT+	22	(reserved)	34	TT-	47	(reserved)

Table 2-42 Pin assignments for dual HSSI line card (Continued)

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
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		

Note Because neither connector at the ends of the **SYS-HSSI-CAB** cable is keyed, you can simply plug either end of the cable into either your Dual HSSI line card or the remote HSSI CSU/DSU data port.

Table 2-31 shows the pin positions in the 50-pin HSSI connector.

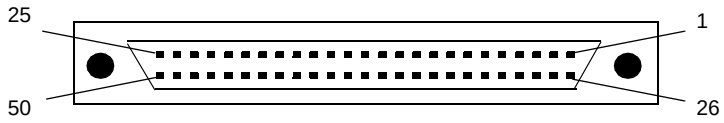


Figure 2-31 50-pin HSSI connector

The Dual HSSI line card uses the following LEDs.

Table 2-43 LED description for Dual HSSI line card

LED	Description
Offline	When lit, this amber LED on the left side of the line card indicates that the line card 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 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.

CMTS Line Card

The CMTS 4x1 line card shown in Figure 2-32 supports one transmit (downstream) and four receive (upstream) ports. The RS 8000/8600 chassis with the CMTS module provides wire-speed Cable Modem Termination Service (DOCSIS 1.0, EuroDOCSIS 1.0) integration.

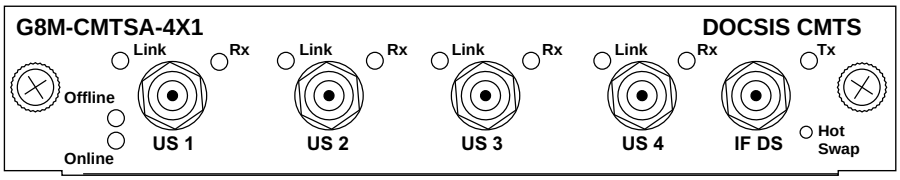


Figure 2-32 Cable Modem Termination Service (CMTS) line card

The following table lists the media specifications for the CMTS line card:

Table 2-44 Connector specifications for CMTS line card

Port Type	Specification
US1 through US4 Upstream inputs	• RG-6/u or RG-59/u with male F-type connector per (IPS-SP-406) common with the input • To connect the upstream to the laser receiver, use a 2-way splitter as a combiner to leave the RS 8000/8600 CMTS module cable access router connected at the headend, and connect the upstream headend cable to the laser receiver. • Adjust the upstream input level to the RS 8000/8600 CMTS module using the Riverstone software running on your router so the output of the laser receiver is the same as the input to your upstream port on your RS 8000/8600 CMTS module.
IF DS Downstream output	• RG-6/u or RG-59/u with male F-type connector per (IPS-SP-406) common with the input • The downstream output of the CMTS module is 44 MHz IF (intermediate frequency) with an output rating of +30 dBmV (+/-2 dBmV). • To be compatible with cable television system frequency division multiplexing, use an external IF-to-RF upconverter that translates the IF signal from the RS 8000/8600 CMTS module to the desired RF carrier frequency.

The CMTS line card uses the following LEDs:

Table 2-45 LED description for CMTS line card

LED	Description
Link	Each upstream port has a Link LED. When this LED is green, it indicates that a link is established with at least one cable model on a particular upstream port.
Online, Offline	When the module is online the Online LED is lit. When the module is Offline the Offline LED is lit. If neither of these LED is lit, the module is not receiving power.
RX, TX	Each upstream port has a Receive (RX) LED. The downstream port has a Transmit (TX) LED. When the TX or RX LED is yellow it indicates that a packet is being transmitted or received.

Multi-Rate WAN Line Card

The Multi-rate WAN line card can contain two WAN Interface Cards (WICs). Figure 2-33 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.

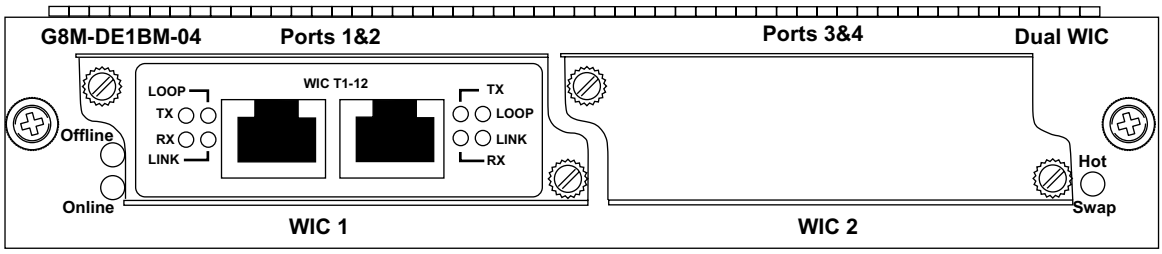


Figure 2-33 Multi-Rate WAN line card with one T1 WIC

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

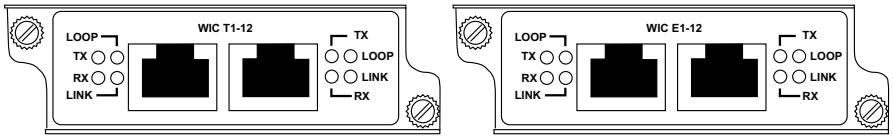


Figure 2-34 T1 and E1 WICs

Each Clear Channel T3/E3 WIC has a transmit and a receive port that provide one WAN interfaces per WIC module.

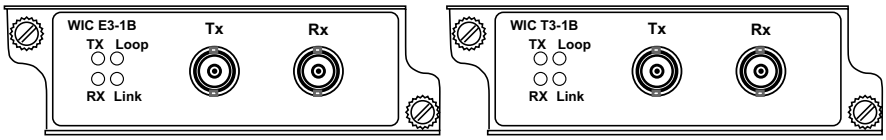


Figure 2-35 Clear channel T3 and E3 WICs

Table 2-46 through Table 2-49 list the specifications for the various WICs supported by the Multi-rate WAN line card.

Table 2-46 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 2-47 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 2-48 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 2-49 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

The following table lists the pin assignments for both the RJ-48c connector on the T1 WIC and the RJ-45 connector on the E1 WIC.

Table 2-50 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 2-51 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.

Channelized T3 Line Card

The Channelized T3 line card contains two channelized T3 ports. Each logical port consists of two BNC connectors, one for transmit and the other for receive. The following figure shows the front panel of the Channelized T3 line card.

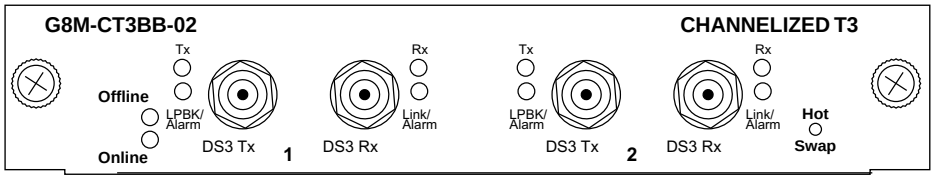


Figure 2-36 Channelized T3 Line Card

The following table lists the specifications for the Channelized T3 line card.

Table 2-52 Connector specifications for channelized T3 line card

Port type	Specification
channelized T3	• 75-ohm coaxial BNC connectors • ANSI T1.102, T1.107, and T1.404a compliant

The channelized T3 line card uses the following LEDs:

Table 2-53 LED description for channelized T3 line card

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-port Loopback/Alarm	**Yellow (solid)** – the Remote Alarm Indicator (RAI), commonly called the Yellow Alarm signal. It indicates that the failure is at the remote end. **Yellow (intermittent)** – AIS received. Red - indicates that there is a loopback.
Per-port TX	**Green** – indicates that the port's transceiver is transmitting data. **Off** – indicates a loss of signal or service disruption.

Table 2-53 LED description for channelized T3 line card (Continued)

LED	Description
Per-port Link /Alarm	**Green** – indicates that the line card detects a cable plugged into the port and a good link is established. **Yellow** – T1 any alarm. **Red** – the Alarm Indication Signal (AIS); indicates that there is a transmission fault located either at or upstream from the transmitting terminal.
Per-port RX	**Yellow** – indicates that the port's transceiver is receiving data. **Off** – indicates a loss of signal or service disruption.

3 HARDWARE INSTALLATION

3.1 SAFETY CONSIDERATIONS

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

3.1.1 Preventing Injury

Warning Observe the following safety warnings to prevent accidental injury when working with the Riverstone RS Switch Router (RS) hardware.

- To avoid injury, be careful when lifting the chassis out of the shipping box.
- Never attempt to rack mount the RS chassis unaided. Ask an assistant to help you hold the chassis.
- Never operate the RS with exposed power-supply bays or module slots.
- Never operate the RS if the chassis becomes wet or the area where the chassis is installed is wet.

3.1.2 Preventing Equipment Damage

Warning To prevent accidental product damage, observe the following precautions.

- Always use proper electrostatic discharge (ESD) gear when handling the Control Module, backplane, line cards or other internal parts of the chassis.
- Make sure you allow adequate room for air flow around the chassis.

3.2 HARDWARE SPECIFICATIONS

The following table lists the physical and environmental specifications for the RS 8000 and RS 8600.

Table 3-1 Physical and Environmental Specifications

Specification	RS 8000	RS 8600
Dimensions	Inches: 8.27” x 17.25” x 12.25” Centimeters: 22.23cm x 43.82cm x 31.12cm	Inches: 8.27” x 17.25” x 19.25” Centimeters: 22.23cm x 43.82cm x 48.9 cm
Weight	Pounds: 24 Kilograms: 10.8	Pounds: 47 Kilograms: 21.2
Power	100-125 VAC, 5A maximum; 200-240 VAC, 3A maximum	100-125 VAC, 10A maximum; 200-240 VAC, 6A maximum
Operating temperature	Fahrenheit: 41^{o}F to 104^{o}F Centigrade: 5^{o}C to 40^{o}C	Fahrenheit: 41^{o}F to 104^{o}F Centigrade: 5^{o}C to 40^{o}C

3.3 INSTALLING THE HARDWARE

Follow the procedures and steps in this section to install the RS 8000/8600 hardware. Note that some steps may apply only to either the RS 8000 or RS 8600. By the end of this section, your RS 8000/8600 should be ready for initial power-on.

3.3.1 Verifying Your Shipment

Before you begin installing your RS, 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 8000 or RS 8600 chassis, containing:
  - backplane
  - fan module
  - console cable
- RS 8000 or RS 8600 power supply
- One country-specific power cable per power supply (AC only)
- One Control Module
- One Switching Fabric Module (RS 8600 only)
- RS Media Kit, containing:
  - One PC flash card containing the RS system software
  - *Riverstone Networks RS 8000/8600 Switch Router Getting Started Guide*

- *Riverstone Networks Documentation CD*
- Release Notes

Depending on your order, your shipment may also contain some or all of the following:

- Redundant power supply
- Redundant Control Module
- Redundant Switching Fabric Module (RS 8600 only)
- Specific line cards ordered

3.3.2 Installing the Chassis

Install the RS 8000/8600 in a standard 19-inch equipment rack. The RS chassis is equipped with front-mounting brackets. Figure 3-1 shows an example of how to install an RS 8600 chassis in an equipment rack.

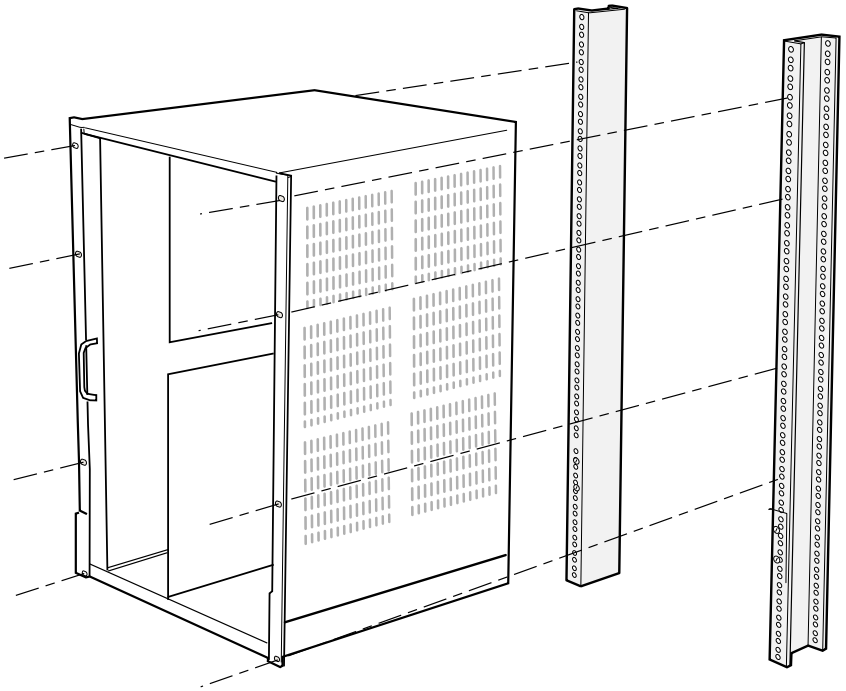


Figure 3-1 Installing the RS 8600 chassis in an equipment rack

Warning Never attempt to rack mount the RS chassis unaided. Ask an assistant to help you hold the chassis.

To install the RS chassis in an equipment rack, use the following procedure.

If the front-mounting brackets are already installed on the RS chassis, go to step 4.

1. Align one of the mounting brackets over the corresponding holes in the side of the chassis. The mounting bracket is correctly positioned when the side with the mounting holes is flush with the front of the chassis.
2. Use a #2 Phillips-head screwdriver and two of the supplied Phillips-head screws to attach the mounting bracket to the side of the chassis.
3. Attach the other mounting bracket.
4. Along with an assistant, lift the chassis into place in the 19” mounting rack.
5. While your assistant holds the chassis in place, use an appropriate screwdriver and four rack screws to attach the RS 8000/8600’s mounting brackets to the rack.

Warning Make sure there are at least 3 inches (7.62 centimeters) of room on either side of the unit for air flow to the cooling fans.

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.

3.3.3 Installing an AC Power Supply

The primary AC power supply is shipped separately from the RS chassis. To install or replace the primary AC power supply, or if you want to install a redundant power supply, use the following procedure. You will need a #2 Phillips-head screwdriver to perform this procedure. Figure 3-2 shows an example of how to install an AC power supply.

Warning Use a single-phase grounded power source located within 6 feet (1.89 meters) of the installation site.

1. Ensure that the AC power supply is not powered on.
2. If a cover plate is installed over the power supply slot, use the #2 Phillips-head screwdriver to remove it. If you are replacing an AC power supply, unplug the power cable from the supply you are replacing, loosen the captive screws on the power supply’s front panel, then pull the supply out of the chassis.
3. Slide the AC power supply all the way into the slot, firmly but gently pressing to ensure that the pins on the back of the power supply are completely seated in the backplane.
4. Use the #2 Phillips-head screwdriver to tighten the captive screws on each side of the power supply to secure it to the chassis.
5. Attach the power cable to the AC power supply.

AC Power Supply Specifications

The following table lists the physical specifications for the RS 8000/8600 AC power supplies.

Table 3-2 Physical Specifications for AC Power Supply

Specification	RS 8000	RS 8600
Dimensions	11.00" (L) x 7.70" (W) x 2.55" (H)	12.15" (L) x 7.70" (W) x 5.05" (H)
Weight	6.5 lb (2.95 kg)	12.0 lb (5.45 kg)
Power Output	300 W	600 W
Voltage Range	100 to 125 V, 5 A 200 to 240V, 3 A	100 to 125 V, 10 A 200 to 240 V, 6 A
Frequency	50 to 60 Hz	50 to 60 Hz

The following table lists the environmental specifications for the RS 8000/8600 AC power supplies.

Table 3-3 Environmental Specifications for AC Power Supply

Specification	Measurement
Operating Temperature	+5 to +40 °C (41 to 104 °F)
Non-operating temperature	-30 to +73 °C (-22 to 164 °F)
Operating Humidity	15 to 90% (non-condensing)

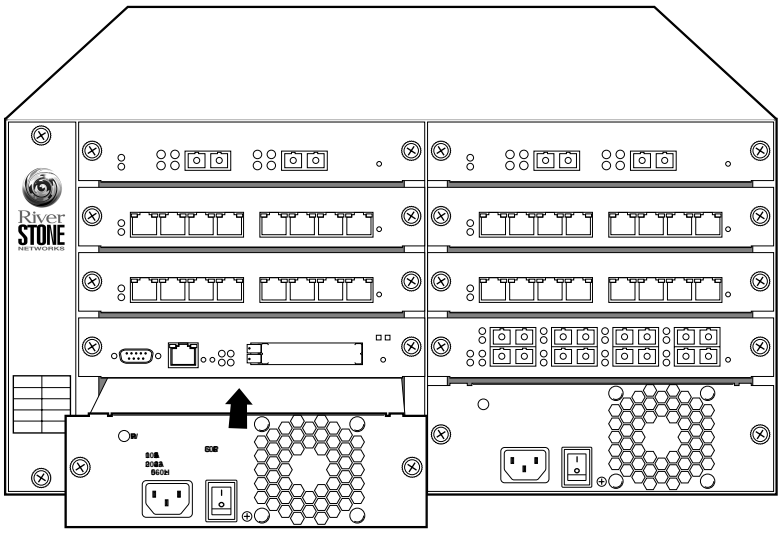


Figure 3-2 Installing an AC power supply

3.3.4 Installing a DC Power Supply

The following section explains how to install DC power supplies, and explains the differences between DC supplies for the RS 8000 and RS 8600.

Warning The RS 8000/8600 with DC power supplies should be installed only in Restricted Access Areas (Dedicated Equipment Rooms, Electrical Closets, or the like) in accordance with Articles 110-26 and 110-27 of the 1999 National Electrical Code ANSI/NFPA 70.

DC Power Supply Installation Procedure

To install a DC power supply on the RS 8000 or RS 8600:

1. Ensure that the DC power supply is not powered on.
2. If a cover plate is installed over the DC power supply slot, use a #2 Phillips-head screwdriver to remove it. If you are replacing a power supply, remove the power cables from the supply you are replacing, loosen the captive screws on the power supply's front panel, then pull the supply out of the chassis.
3. Slide the DC power supply all the way into the slot, firmly but gently pressing to ensure that the pins on the back of the power supply are completely seated in the backplane.
4. Use a #2 Phillips-head screwdriver to tighten the captive screws on each side of the DC power supply to secure it to the chassis.
5. Attach the power leads (12-gauge to 14-gauge) to the terminal blocks on the front of the unit. To attach a power lead, loosen the terminal screw, insert the exposed end of the power lead, and tighten the terminal screw.
6. Connect the safety ground wire (12-gauge to 14-gauge) to a reliable earth ground.
7. Connect the DC input wiring to a DC power source.

DC Power Supply Specifications

The following table lists the physical specifications for the RS 8000/8600 DC power supplies.

Table 3-4 Physical Specifications for DC Power Supply

Specification	RS 8000	RS 8600
Dimensions	11.00" (L) x 7.70" (W) x 2.55" (H)	12.15" (L) x 7.70" (W) x 5.05" (H)
Weight	6.5 lb (2.95 kg)	12.0 lb (5.45 kg)
Power Output	300 W	600 W
Voltage Range	36 to 72 V, 14 A @ 48 V nominal	36 to 72 V, 27 A @ 48 V nominal

The following table lists the environmental specifications for the RS 8000/8600 DC power supplies.

Table 3-5 Environmental Specifications for DC Power Supply

Specification	Measurement
Operating Temperature	+5 to +40 °C (41 to 104 °F)
Non-operating temperature	-30 to +73 °C (-22 to 164 °F)
Operating Humidity	15 to 90% (non-condensing)

RS 8600 DC Power Supply Wiring Options

Each RS 8600 DC power supply contains two internal supplies. Each of these internal power supplies must be energized to produce sufficient power for the RS 8600 to operate. Figure 3-4 shows the internal relationship between the screws on the wiring block and the internal supplies. Because of this internal arrangement, it is necessary to connect both positive (+) screws and both negative (–) screws to the 48-Volt source. This section describes a few options for connecting power to the RS 8600 power supply.

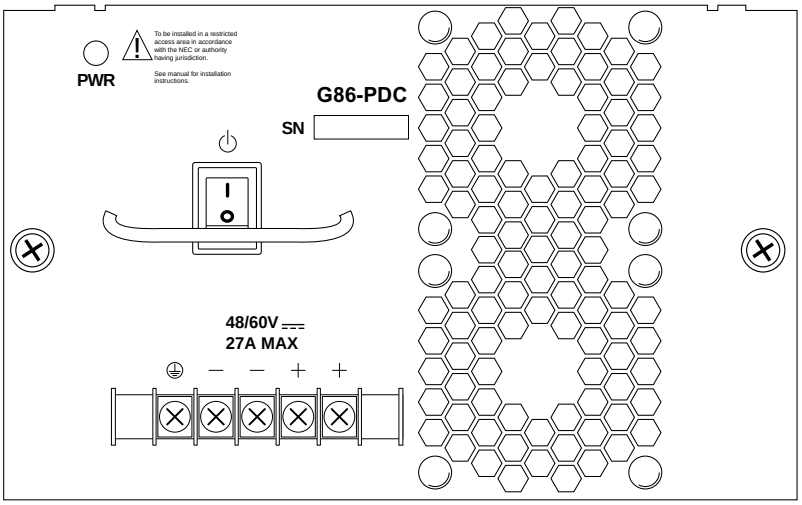


Figure 3-3 Front view of an RS 8600 DC power supply

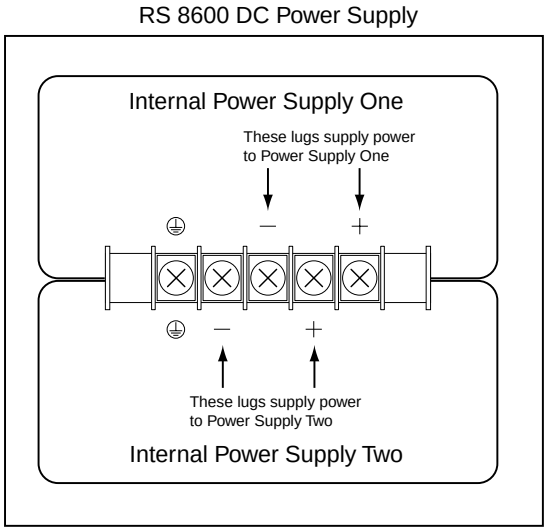


Figure 3-4 Relationship of wiring lugs on RS 8600 DC power supply

Because of the RS 8600 DC supply current requirements, each pole of the 48 Volt DC source should use 6-gauge wire. Each 6-gauge wire can be divided into two 12-gauge wires by using a conductive splitter-block. This creates two 12-gauge wires carrying positive (+) current and two 12-gauge wires carrying negative (–) current. In turn, both 12-gauge positive (+) wires and both 12-gauge negative (–) wires are connected to the RS 8600 DC power supply wiring block. See Figure 3-5.

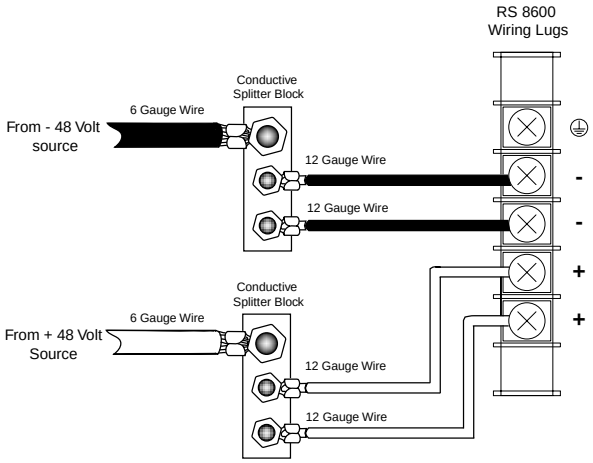


Figure 3-5 Splitting each source wire to two 12-gauge wires

An alternate method of wiring the RS 8600 power supply is to use a single set of wires (+ and –) from the DC source, and tie the RS 8600's wiring screws together (+ to + and – to –) by using suitably rated jumpers. See Figure 3-6.

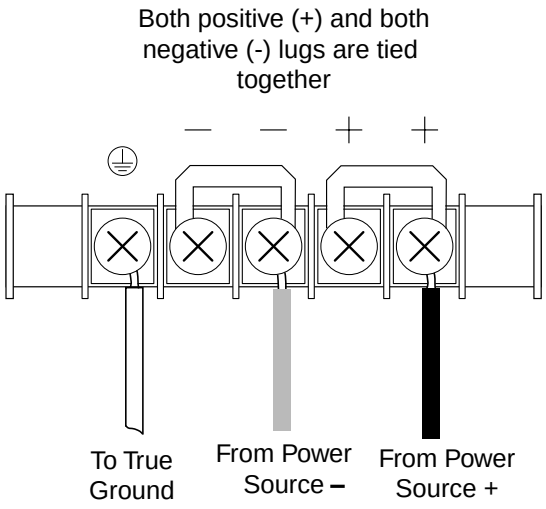


Figure 3-6 Tying RS 8600 DC supply lugs together

3.3.5 Installing the Control Module

The primary Control Module always resides in the CM slot. If you need to replace the primary Control Module in the CM slot, or if you want to install a redundant Control Module in slot CM/1, use the following procedure. You will need a #2 Phillips-head screwdriver to perform this procedure.

Note If you plan to install a redundant Control Module, see Section 4.9, *"Using Redundant Control Modules."*

1. If a cover plate is installed over the Control Module slot, use the #2 Phillips-head screwdriver to remove it.
2. Slide the Control Module all the way into the slot, firmly but gently pressing to ensure that the pins on the back of the Control Module are completely seated in the backplane.

Note Make sure the circuit board (and not the metal plate) is between the card guides, as shown in Figure 3-7. Check both the upper and lower tracks.

3. Use the #2 Phillips-head screwdriver to tighten the captive screws on each side of the Control Module to secure it to the chassis.
4. You are now ready to install the Control Module's PC flash card, and to connect the management cables to the Control Module.

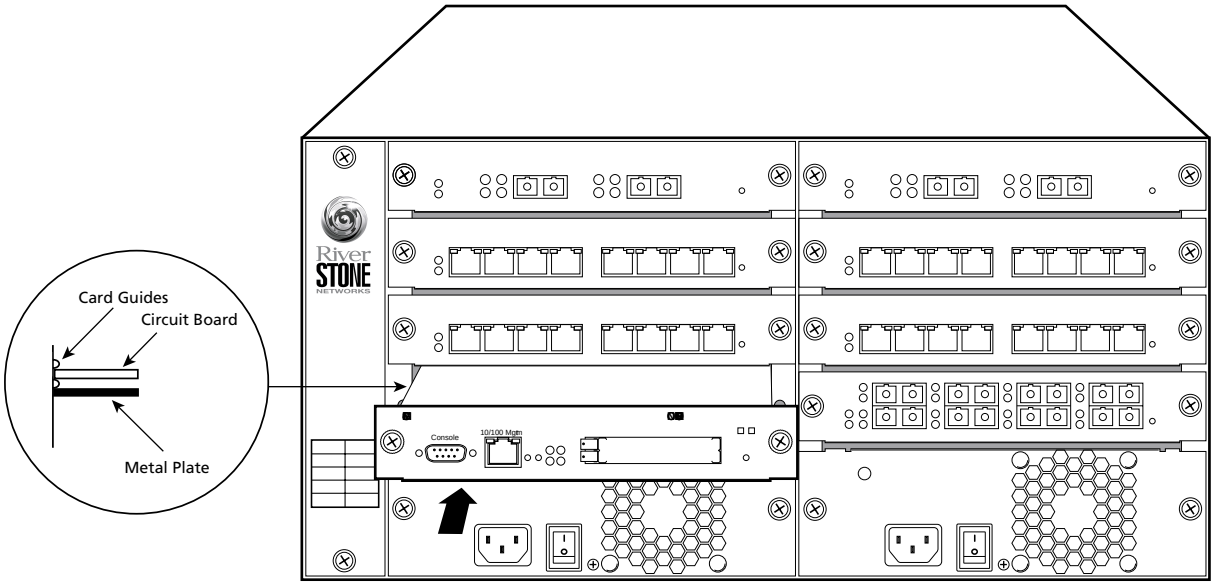


Figure 3-7 Installing a Control Module

Installing the PC Flash Card into the Control Module

The Control Module 16 megabyte PC flash card contains the system image software.

To install the PC flash card into the Control Module, perform the following steps:

1. Make sure the power is off on the RS 8000/8600. You cannot install or remove a PC card while the RS 8000/8600 is running.
2. Insert the PC card into either of the slots on the Control Module. You can choose either slot.

Note The RS 8000/8600 supports the use of dual PC cards, one in slot0, the other in slot1. Each PC card is treated as an independent file system by the RS 8000/8600. For detailed information regarding the PC flash file system and the management of configuration files, see the "*Riverstone RS Switch Router User Guide*."

Note If the message "**`SYS-E-NOFLASHCARD`**" appears while booting the RS 8000/8600, the system has not detected a PC card. If this occurs, ensure that the PC card is properly inserted, then reboot. If the system still does not recognize the card, contact Riverstone Networks, Inc. technical support.

Connecting to the Control Module's Serial Port

To attach the supplied console cable to the Control Module DB-9 port:

1. Locate the console cable included with the RS 8000/8600 chassis. The console cable is a female-to-female DB-9 crossover cable. Thus, pin 2 (TXD or "transmit data") emerges on the terminal's end of the connection as RXD ("receive data"), and so on.
2. Plug one end of the console cable into the Control Module's DCE DB-9 port.
3. Plug the other end of the console cable into the terminal's DTE port.
4. When you are ready to begin configuring the RS, use procedures in Chapter 4, *"Initial Configuration"* to power on the switch and boot the software. You will perform initial setup by entering CLI commands on a terminal or PC running terminal emulation software.

Connecting to the Control Module's 10/100Base-TX Port

Use the RJ-45 10/100Base-TX DTE port for management connections from a host on the network.

To attach a cable to the 10/100Base-TX port:

1. Obtain a cable with an RJ-45 connector. Pin 1 (TXD or "transmit data") must emerge on the network's end of the connection as RXD ("receive data") and so on.
2. After ensuring that the pin assignments on both ends of the connection are correct, plug the appropriate end of the connection into the Control Module's RJ-45 10/100Base-TX port.
3. Connect the other end of the cable to your network.

3.3.6 Installing the Switching Fabric Module (RS 8600 only)

On the RS 8600, the switching fabric module is shipped separately from the RS chassis. The primary switching fabric module must be installed in slot Fabric 1. The redundant switching fabric module must be installed in slot Fabric 2.

To install or replace the primary switching fabric module, or if you want to install a redundant switching fabric module, use the following procedure. You will need a #2 Phillips-head screwdriver to perform this procedure.

1. If a cover plate is installed over the switching fabric module slot (slot Fabric 1 or Fabric 2), use the #2 Phillips-head screwdriver to remove the cover plate.
2. Slide the switching fabric module all the way into the slot, firmly but gently pressing to ensure that the pins on the back of the module are completely seated in the backplane.

Note Make sure the circuit board (and not the metal plate) is between the card guides, as shown in Figure 3-8. Check both the upper and lower tracks.

3. Lock down the left and right metal tabs to secure the switching fabric module to the chassis.
4. Use the #2 Phillips-head screwdriver to tighten the captive screws on each side of the switching fabric to secure the switching fabric to the chassis.

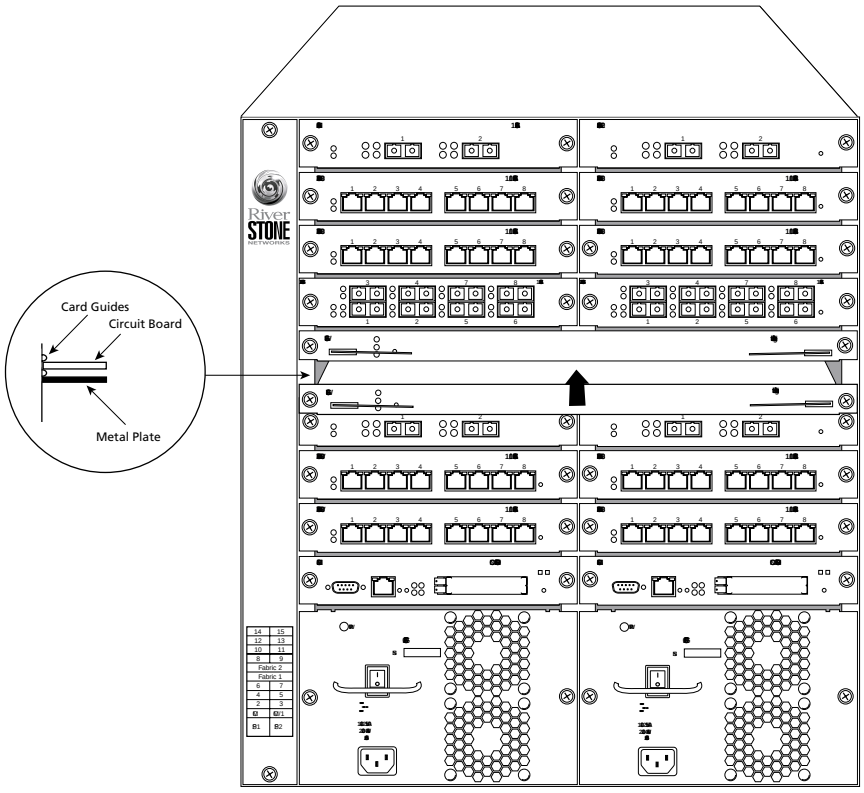


Figure 3-8 Installing a switching fabric module on the RS 8600

3.3.7 Installing Line Cards

Line cards can be installed in slots 1 to 7 (or 1 to 15 on the RS 8600). If you also plan to install a redundant Control Module, you can install line cards in slots 2 to 7 (2 to 15 on the RS 8600). You will need a #2 Phillips-head screwdriver to perform this procedure.

1. If a cover plate is installed over the line card slot, use the #2 Phillips-head screwdriver to remove it.
2. Slide the line card all the way into the slot, firmly but gently pressing the line card fully in place to ensure that the pins on the back of the line card are completely seated in the backplane.

Note Make sure the circuit board (and not the metal plate) is between the card guides, as shown in Figure 3-9. Check both the upper and lower tracks.

3. Use the #2 Phillips-head screwdriver to tighten the captive screws on each side of the line card to secure the line card to the chassis.
4. Repeat the above steps for the remaining cards.

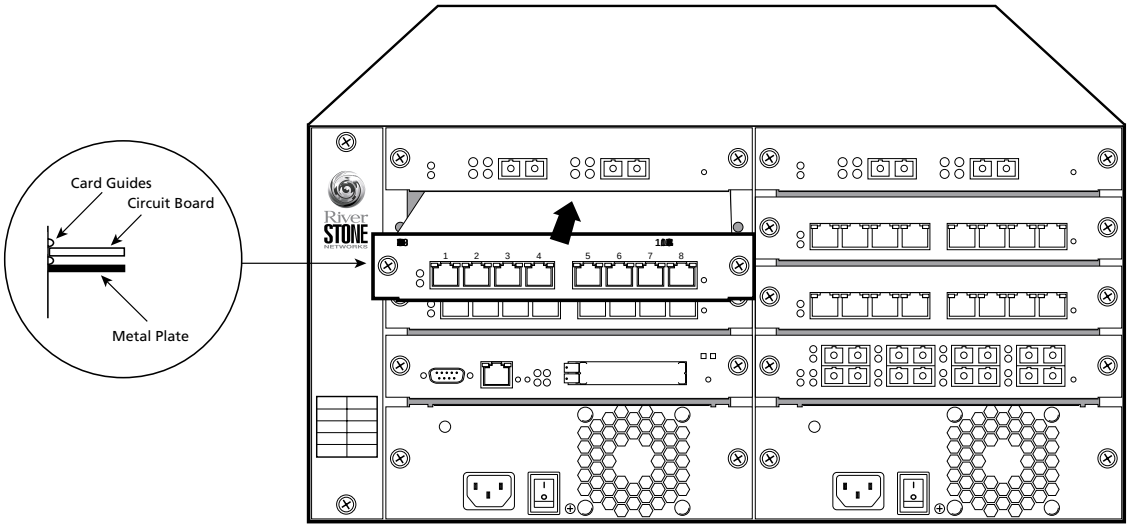


Figure 3-9 Installing a line card

3.3.8 Installing GBIC Modules into MPLS Line Cards

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

Figure 3-12 shows an example of a GBIC module. The procedure following the figure describes how to install the module into the GBIC line card.

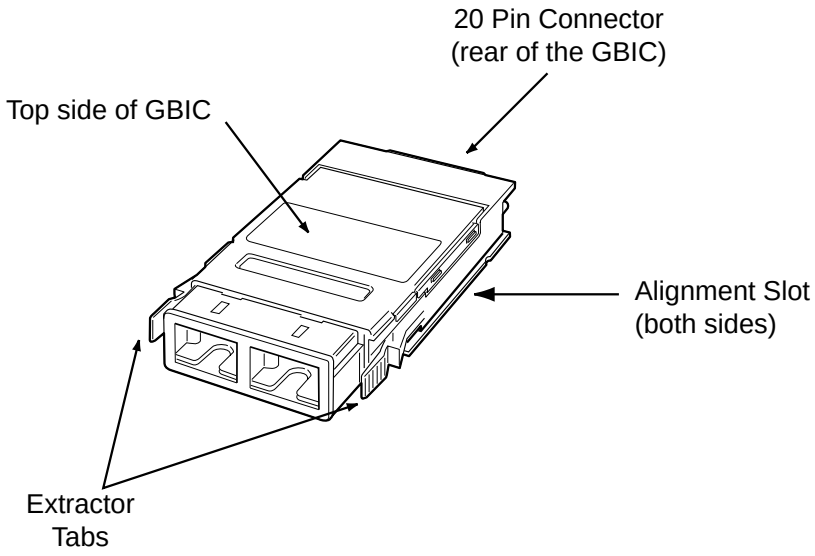


Figure 3-10 GBIC module

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 3-11.

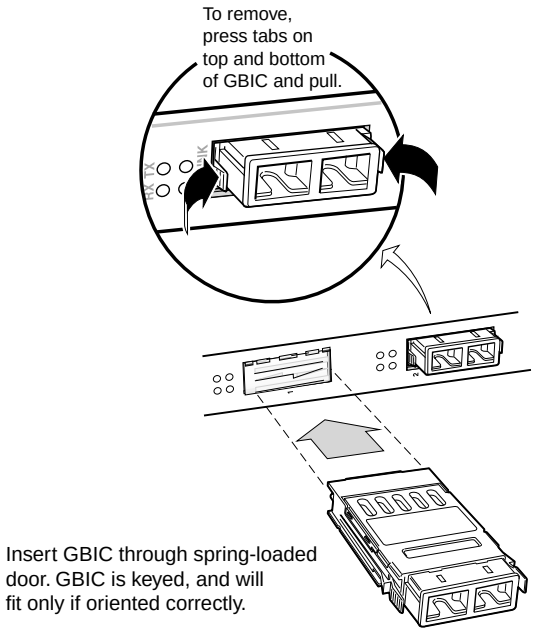


Figure 3-11 Inserting a GBIC module

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.

3.3.9 Installing ATM Physical Media Cards (PHYs)

The ATM multi-rate line card has two option slots available for Physical Layer (PHY) interface cards. One PHY card can be installed into each available slot. You will need a #2 Phillips-head screwdriver to perform this procedure.

1. Use the #2 Phillips-head screwdriver to loosen the two captive screws that hold the option slot cover plate in place.
2. Save the option slot cover plate.
3. Insert the PHY card through the opening of the slot, and align the sides of the PHY card with the guides in the option slot.
4. Push the PHY card through the front of the line card until the 96-pin connector is firmly seated in the connector at the back of the option slot.
5. Fasten the PHY card to the front of the ATM line card with the two captive screws. Torque to 5 in-lb (0.56 N-m).

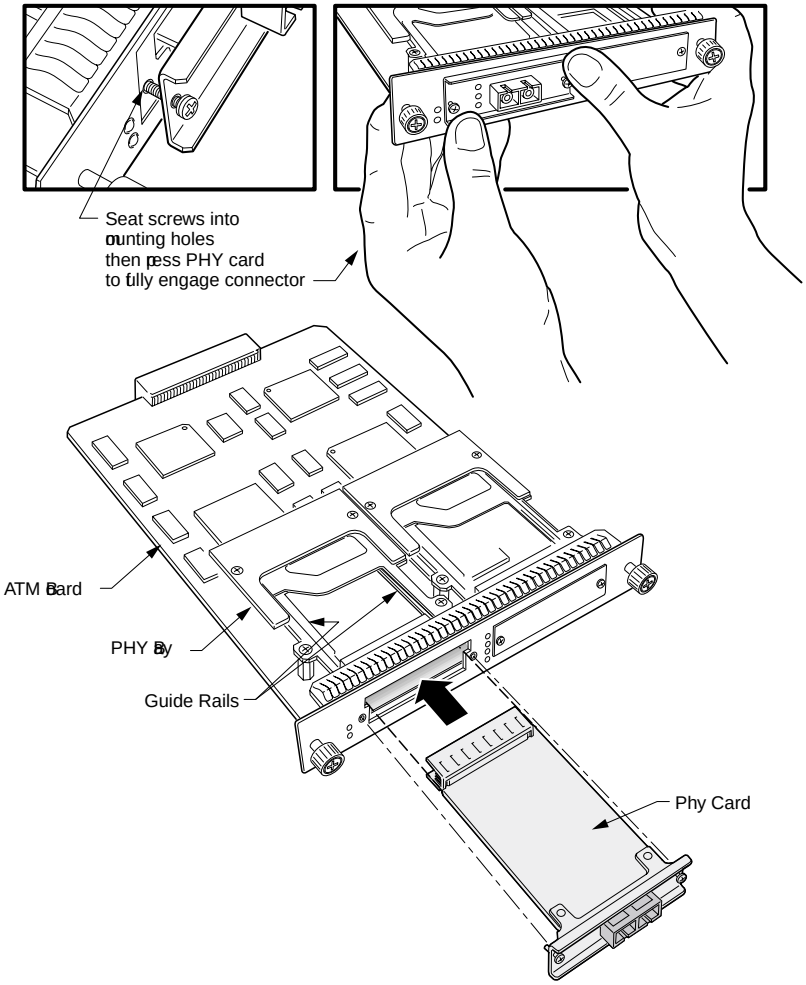


Figure 3-12 Installing an ATM PHY card

3.3.10 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 3-6 and Figure 3-13).

Table 3-6 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.

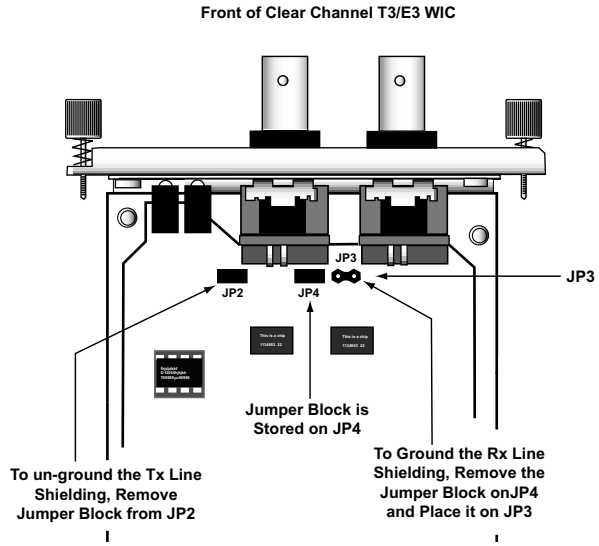


Figure 3-13 Jumper position on Clear Channel T3 and E3 WICs

Installing the Multi-rate Line card

The multi-rate WAN line card has two option slots available for WAN Interface Cards (WICs). One WIC card can be installed into each available slot. You will need a #2 Phillips-head screwdriver and a small straight-blade screwdriver to perform this procedure.

1. Use the #2 Phillips-head screwdriver to loosen the two captive screws that hold the option slot cover plate in place.
2. Save the option slot cover plate.
3. Hold the WIC card by the edges and position it so that it is parallel with the slot opening.
4. Insert the WIC card through the opening in the system unit by aligning the sides of the WIC card with the card guide.
5. Push the WIC card into the slot until the 80-pin connector is firmly seated in the connector at the back of the option slot.
6. Use the small straight-blade screwdriver to fasten the WIC card to the system unit with the two captive screws.

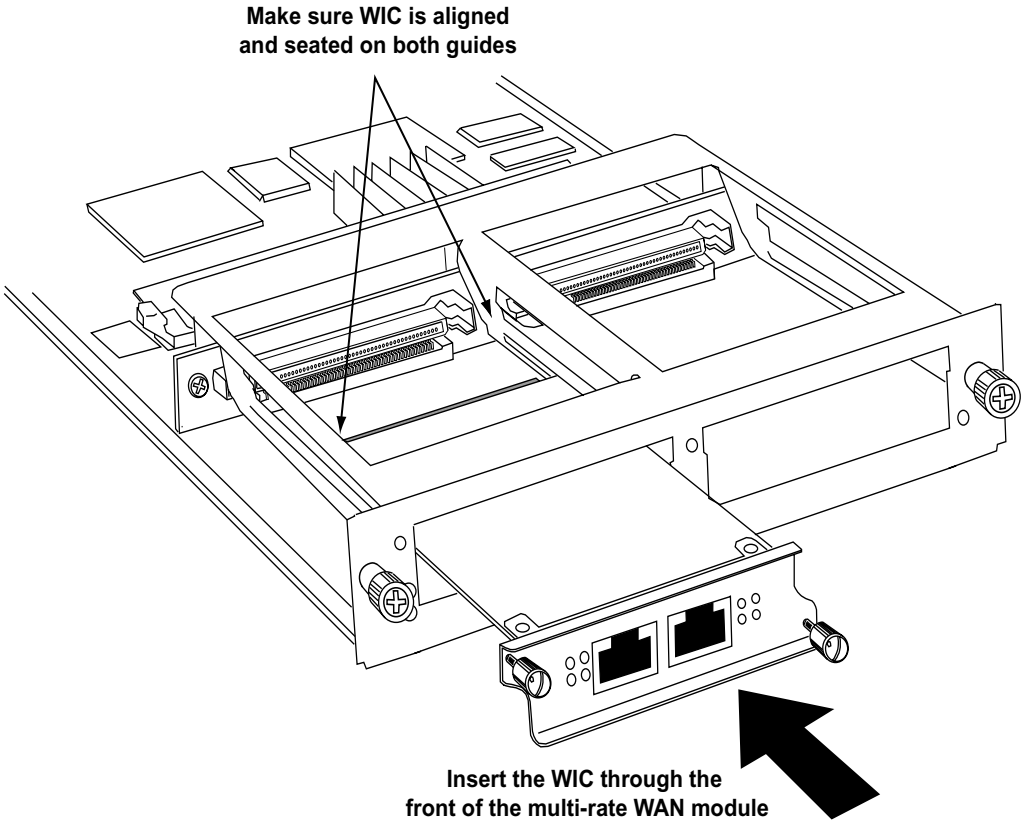


Figure 3-14 Inserting the WIC line card

3.3.11 Attaching the Network Cables to Line Cards

With your RS 8000/8600 installed and connected to a management console, you are now ready to attach the RS 8000/8600's line cards to your network. The RS 8000/8600 uses industry standard copper and fiber cables and connectors. For information regarding required connector types, cable types, and pin-out assignments, see the tables associated with each line card in Chapter 2, *"Introduction."*

Proceed to Chapter 4, *"Initial Configuration"* for instructions about powering on the RS 8000/8600 and performing initial configuration.

4 INITIAL CONFIGURATION

This chapter provides the following information on powering up the RS 8000/8600 and performing basic setup procedures. Basic setup includes:

- Powering on the RS 8000/8600 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
- Configuring the SYSLOG server and server message levels
- Managing redundant Control Modules

4.1 POWERING ON THE RS 8000/8600

To power on the RS 8000/8600, perform the following steps:

1. Make sure all exposed line card slots and power supply bays are free of foreign objects such as tools and are covered with blanks.
2. Check the power supplies to make sure they are attached to your power source.
3. Make sure that the RS's DB-9 console port is connected to an active terminal or a PC running terminal emulation software.
4. Turn the switch on each power supply to the ON position.

   If this is the first time you have powered on the RS, it will automatically boot using the software image on the PC flash card. While the software is booting, the amber Offline LED on the Control Module 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.

   As the software boots, the management terminal or PC attached to the Control Module's DB-9 DCE port displays messages related to the phases of the boot sequence.

   Here is a partial example:

```
Boot Software Version 2.0.1.1, Built Jan 25 2001 20:55:16

Processor: R7000 rev 2.1 [0x2721], 280 MHz, (bus: 93 MHz), 256 MB DRAM

I-Cache 16 KB, linesize 32. D-Cache 16 KB, linesize 32.
```

```
L2-Cache 256 KB, linesize 32, cache enabled.

Mounting 16MB external 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 2803976)
  100% -  Image checksum validated
------------------------------------------------------------------------
RS 8000 System Software, Version 8.0.0.0
Copyright (c) 2000, Riverstone Networks
Processor: R7000, Rev 2.1, 280 MHz
System started on 2001-09-01 18:57:40
------------------------------------------------------------------------
2001-09-01 18:57:45 %SYS-I-FLASHCRD, Mounting 16MB Flash card
2001-09-01 18:57:53 %SYS-I-FLASHMNTD, 16MB Flash card mounted
2001-09-01 18:57:53 %SYS-I-INITSYS, initializing system RS 8000
2001-09-01 18:57:53 %SYS-I-DSCVMOD, discovered 'Control Module' module in slot CM
2001-09-01 18:57:58 %SYS-I-INITSLOTS, Initializing system slots - please wait
2001-09-01 18:58:07 %SYS-I-MODPROBE, Detecting installed media modules - please wait
...
```

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

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

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

Note If the message "**SYS-E-NOFLASHCARD**" appears while booting the RS, the system has not detected a PC card. If this occurs, ensure that the PC card is properly inserted, then reboot. If the system still does not recognize the card, contact Riverstone Networks, Inc. technical support.

4.2 STARTING THE COMMAND LINE INTERFACE

To start the Command Line Interface (CLI), power on the system, as described in 4.1, *"Powering on the RS 8000/8600."* 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 (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 external PC card or the system image is not found during bootup. Enter the **reboot** command to reset the RS. If the RS still fails to boot, contact Riverstone Networks, Inc. technical support. Certain tasks can be performed only from Boot mode. To enter the Boot mode intentionally, boot the RSv, 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 router 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 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 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 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 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 router 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 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 Control Module'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, but the RS 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 router)
- IP address for the management port on the Control Module

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 management port on the Control Module.

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 management port on the Control Module.

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 8000/8600 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 8000/8600 for TACACS, TACACS+, and/or RADIUS authentication by a TACACS or RADIUS server. Procedures for configuring the router for TACACS and RADIUS can be found in the *Riverstone Networks 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:

```
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 router 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 the procedure below to regain access to your RS 8000/8600.

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

1. Power cycle the RS 8000/8600.
2. Enter Boot mode by interrupting the normal boot-cycle 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 = 86400
 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 = /pc-flash/boot/ros80       < This is the image name for this example >
   ethaddr = 00:00:1d:12:34:56
(ethaddr is base MAC addr, add one for actual CPU MAC address)
     sysid = -1
rs-boot>
```

4. Enter the following line to reboot the RS:

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

Here is an example:

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

5. When the RS 8000/8600 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, 2001-09-02 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 8000/8600, you need to set up an SNMP community and specify the IP address of the target host for SNMP traps. Otherwise, the RS's SNMP agent runs in local trap process mode, unless disabled using the **snmp stop** command.

For additional information about configuring SNMP, see the *Riverstone Networks 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 8000/8600, configure the RS with a static route to the target. If the RS 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 Control Module's en0 Ethernet port. If you want SNMP to use a different port on the RS, 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

SNMP v1 and v2 are not secure protocols. 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, it is important to protect your RS 8000/8600 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's SNMP agent, allowing access to the RS 8000/8600 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, disable the sending of authentication traps. Authentication traps are sent when SNMP packets are received with invalid community strings. A common security attack on an SNMP 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 8000/8600 security and ACLs, see the *Riverstone Networks RS Switch Router User Guide.*

4.6.3 Supported MIBs

The following lists the MIBs that are supported by the RS 8000/8600 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		NOVELL-IPX 4/21/94
UDP-MIB RFC 2013	DS1-MIB RFC 2495	Q-BRIDGE-MIB RFC 2674	OSPF-MIB RFC 1850		CTRON-LFAP 8/28/99
IP-FORWARD-MIB RFC 2096	DS3-MIB RFC 2496	P-BRIDGE-MIB RFC 2674	OSPF-TRAP-MIB RFC 1850		CTRON-SSR-POLICY 8/11/99
IF-MIB RFC 2233	DS0bundle-MIB RFC 2494	PPP-LCP-MIB RFC 1471	RMON2-MIB RFC 2021		CTRON-SSR-CONFIG 8/17/99
SNMPv2-MIB RFC 1907	MAU MIB RFC 2668	PPP-SEC-MIB RFC 1472	VRRP-MIB Draft #9		CTRON-SSR-HARDWARE 8/14/99
	DOCS-IF-MIB RFC 2670	PPP-IP-NCP-MIB RFC 1473	DVMRP-MIB Draft #4		CTRON-SSR-SERVICE-STATUS 8/4/98
	DOCS-BPI-MIB Draft #1	PPP-BRIDGE-NCP-MIB RFC 1474	IGMP-MIB Draft #5		CTRON-SSR-CAPACITY 5/13/99
		RMON-MIB RFC 1757			RIVERSTONE-STP-MIB 7/11/00
		ATM-MIB RFC 1695			RIVERSTONE-RS-AGENT-CAP-MIB
		IEEE LAG MIB 8/17/00			RIVERSTONE-ATM-MIB

4.7 SETTING THE DNS DOMAIN NAME AND ADDRESS

Associating a DNS name server with your RS 8000/8600 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 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 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:

```
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 8000/8600 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 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 Control Module 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 8000/8600 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 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 8000/8600, 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.

4.9 USING REDUNDANT CONTROL MODULES

The RS 8000/8600 supports the use of redundant Control Modules (CMs), one Control Module acts as the primary CM, while the other Control Module acts as the backup CM. By default, the CM installed in slot CM is the primary CM, while the CM installed in slot CM/1 is the backup CM. The purpose of the backup CM is to take over as the primary CM in the event that the primary CM fails.

In normal operation, whenever changes are made to the primary CM's Configuration file, the changes are copied to the backup CM's configuration file. In this way, if the primary CM fails, the backup CM has all the configuration information necessary to take over as the primary CM. For instance, a static route is added to the RS 8000/8600. Notice the messages displayed in the example when the change is saved to both the Active and Startup Configuration:

```
rs1(config)# ip add route 134.141.169.0/24 gateway 134.141.179.129
rs1(config)# save active

%SYS-I-ACTIVECFGTOBACKUP, active configuration updated on Backup CM

rs1(config)# save startup

Are you sure you want to overwrite the Startup configuration [no]? yes

%CONFIG-I-SAVED, configuration saved to Startup configuration.

%SYS-I-STARTUPCFGTOBACKUP, startup configuration file updated on Backup CM
rs1(config)#
```

Each message confirms that the Active and Startup Configurations were saved to the backup CM.

4.9.1 Fail Over

There are two ways that the primary CM can fail – either by a software failure (which causes a *soft fail over*) or by a hardware failure (which causes a *hard fail over*). Each of these failures cause the backup CM to assume the role of primary CM in a different way.

Soft Fail Over

If the primary CM experiences a crash because of a software failure, it sends a command to the backup CM to take over the role of primary CM. Because the backup CM's configuration has been kept in sync with the primary CM's configuration, the switch over to becoming the primary CM occurs immediately. The new primary CM (formerly the backup CM) begins learning layer-2 flows within 5 to 20 seconds, while layer-3 flow learning begins as soon as the layer-3 protocols converge. When the original primary CM reboots or is reset, it assumes the role of the backup CM.

Notice that the default positions for the CMs within the RS 8000/8600 chassis have now changed – the primary CM now resides in slot CM/1 and the backup CM resides in slot CM. As configuration changes are saved on the new primary CM (in slot CM/1) they are copied over to the new backup CM (in slot CM). Again, the two Control Modules always keep their configurations in sync.

Hard Fail Over

During normal operation, the status of the primary CM is communicated to the backup CM through a heartbeat signal. As long as the backup CM receives heartbeats from the primary CM, the backup CM retains its standby status. If, however, the primary CM experiences a hardware failure, the heartbeat signals cease. The backup CM waits 20 seconds for the heartbeats to resume, if they do not, the backup CM assumes the role of primary CM. As with the soft fail over, the new primary CM begins learning layer-2 flows within 5 to 20 seconds, and learns layer-3 flows as soon as the layer-3 protocols converge.

Note The amount of time that the backup CM waits before taking over as the primary CM because of a hard fail over is configured using the **`system set backup-cm-timeout`** command from within Configure mode. The timeout can be set between 20 and 1000 seconds.

If the failed primary CM (in slot CM) is replaced by a new Control Module, the new CM assumes the role of backup CM.

4.9.2 Communicating with the Backup Control Module

There are two ways to establish communication with the backup CM: through the backup CM's console port or through a telnet session from the primary CM to the backup CM using the keyword **backup-cm**. For Instance, the following example shows a telnet session from the primary CM to the backup CM.

```
telnet RS1
------------------------------------------------------------------------
RS 8000 System Software, Version 8.0
Copyright (c) 2000-2001 Riverstone Networks
System started on 2001-04-24 09:37:35
------------------------------------------------------------------------


Press RETURN to activate console . . .


rs1> enable
rs1#
rs1# telnet backup-cm
Trying 127.0.0.1, port 10130 ...
Connected to 127.0.0.1.
Escape character is '^]'.


------------------------------------------------------------------------
RS 8000 System Software, Version 8.0
Copyright (c) 2000-2001 Riverstone Networks, Inc.
System started on 2001-04-19 14:40:57
------------------------------------------------------------------------



Press RETURN to activate console . . .

rs1>$
```

Notice in the example above that the prompt displays a dollar sign ($). This indicates that the display belongs to the backup CM. The dollar sign also appears if you connect to the backup CM through its console port.

When connected to the backup CM (either through telnet or the console) you are provided with only a sub-set of the commands available on the primary CM.

For example, enter Enable mode on the backup CM, and then enter the help command (**?**). This produces the following output:

```
rs1>$enable

rs1#$?
 cli                    - Modify the command line interface behavior
 enable                 - Enable privileged user mode
 exit                   - Exit current mode
 file                   - File manipulation commands
 logout                 - Log off the system
 reboot                 - Reboot the system
 system                 - Show system global parameters
rs1#$
```

Notice that most of the Enable mode functionality is missing and there is no access to Configure mode. However, the backup CM does provide access to both the **file** and **system** facilities. These facilities allow you to do the following on the backup-CM:

- Copy files
- Delete files
- Rename files
- Reformat the file system
- List system images
- load system images
- Choose system images

Note Also, you can enter the **reboot** command from the backup CM, however, the command reboots only the backup CM – the primary CM is not affected.

4.9.3 Things to Remember when Using Redundant Control Modules

This section points out several issues that must be taken into account when using redundant Control Modules.

Booting the RS 8000/8600 From the Network

If you have set the RS 8000/8600 to obtain its image software from a TFTP server (see Section 5.3, *"Loading Software from the Network"*), the IP addresses that appear for **netaddr** from within BootPROM mode should be different for both the primary and backup CM. Furthermore, the IP address of the Ethernet management interface (en0) should differ from both **netaddr** addresses. These IP addresses are listed below:

- One unique primary CM boot IP address
- One unique backup CM boot IP address
- One unique en0 interface IP address

If any of these IP addresses are the same, non-unique IP address errors will occur during fail over.

Software/Hardware Versions

Make sure that the software image are the same on the primary CM and backup CM – it is possible to have two different software images on each Control Module. If the images are not the same and fail over occurs, the image on the backup CM may or may not be able to process the configuration of the failed primary CM.

Caution Any changes made to the RS from the primary CM using the **`system image`** commands (**`add`**, **`choose`**, **`delete`**, and so on) are propagated to the backup CM. However, when the **`system image`** commands are entered from the backup CM, the changes are not propagated to the primary CM.

Caution Both the primary and backup Control Modules should be of the same hardware version, and should contain the same amount of memory.

Changing Mastership

Whenever the power is cycled on the RS 8000/8600, the default relationship between the primary and backup CM is reestablished. In other words, the Control Module in slot CM (whatever its role) becomes the primary CM and the Control Module in slot CM/1 becomes the backup CM. There is one instance in which this change in “mastership” can cause a problem.

Consider the following scenario: The primary CM in slot CM experiences a hard fail over. As a result, the backup CM in slot CM/1 assumes the role of primary CM. Another Control Module is obtained and is to be installed into slot CM. The operator powers down the RS 8000/8600, installs the new Control Module in slot CM, and then powers up the RS 8000/8600. At power up, the Control Module in slot CM assumes the role of the primary CM, and copies its startup configuration (which is blank) to the Control Module in CM/1. This overwrites the configuration file on the Control Module in slot CM/1, and results in the loss of all configuration information.

To avoid the loss of the configuration file, hot-swap the new Control Module into slot CM. As it boots, it will assume the role of the backup CM, and will obtain its configuration from the current primary CM. Enter the **`save startup`** command on the primary CM, then once the file transfer is complete, you can restore the default roles of the Control Modules by cycling the power on the RS 8000/8600.

5 MANAGING SOFTWARE

This chapter describes how to perform operations regarding RS 8000/8600 operating software and bootPROM images software. The following topics are covered:

- Upgrading the system image software
- Upgrading the Boot PROM image software
- Loading RS software from a TFTP server
- Loading RS software from a BootP/TFTP server

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) 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/ros80
  Boot Prom Version  : prom-2.0.0.5
```

   In the example above, the location "**`pc-flash`**" indicates that the RS is set to use the factory-installed software on the PC card.

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

Note If the TFTP server is one or more hops away from the RS, 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's PC card:

```
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/ros81
Downloading image 'tftpboot/ros81' from host '134.152.178.5'
 to local image ros81 (takes a while) . . .
 download: done
 save:
kernel: 100%
done
Image checksum validated.
%SYS-I-BOOTADDED, Image 'ros81' added.
```

4. Enter the **system image list** command to list the images on the PC card and verify that the new image is present.

   Here is an example:

```
rs# system image list
Images currently available on Master CM
slot0:
ros81 (version 8.1.0.0)
ros80 (version 8.0.0.0)  [selected for next boot]
```

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

   Here is an example:

```
rs# system image choose ros81
Found image in slot0
Making image ros81 (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#
```

Note If the RS has a redundant Control Module, the upgrade performed on the primary CM will occur automatically on the backup CM.

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

Note You do not need to activate this change.

7. Reboot the RS to load and run the new system software image.

5.2 UPGRADING BOOT PROM SOFTWARE

The RS boots using the boot PROM image software installed on the Control Module'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 can access. (Use the **`ping`** command to verify that the RS can reach the TFTP server.)

Note If the TFTP server is one or more hops away from the RS, 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'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.
5. Enter the **`system show version`** command to verify that the new boot PROM software is in the internal memory of the RS's Control Module.

5.3 LOADING SOFTWARE FROM THE NETWORK

Typically, the RS loads its operating software from the PC flash card inserted in the Control Module. Alternately, the RS can be configured to ignore its PC flash image and obtain its software from a network server. The RS 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 to load its image software from a TFTP server:

1. Copy the image software onto a TFTP server that the RS can access.
2. Reboot the RS 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
(ethaddr is base MAC addr, add one for actual CPU MAC address)
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 – (**`netaddr`**)
- Subnet mask for the RS – (**`netmask`**)
- The IP address of the RS'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
(ethaddr is base MAC addr, add one for actual CPU MAC address)
sysid = -1
rs-boot>
```

7. From the Boot prompt, use the **ping** command to verify that the RS can reach the TFTP server.
8. Reboot the RS. As the RS initializes, it ignores the software image on the PC card 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 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 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 to use its BootP client to obtain its image software, perform the following procedure:

1. Load the RS's image software on a BootP/TFTP server that can be reached by the RS.
2. Boot the RS and enter Boot mode by interrupting the normal startup sequence by pressing the "Esc" key.
3. Use the **set** command to obtain the RS's MAC address – Make sure to add one to the address to get the MAC address of the CPU.

   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 >
(ethaddr is base MAC addr, add one for actual CPU 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's MAC address, an appropriate IP address, and the location of the RS software image file. Additionally, make sure that the ARP cache of the BootP/TFTP server is set correctly for the RS.

6. Reboot the RS 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 . . .
```

APPENDIX A TROUBLESHOOTING

If you experience difficulty with the basic hardware or software setup procedures in this guide, check the following table. If you find a description of the difficulty you are experiencing, try the recommended resolution.

If the resolution does not remove the difficulty or it 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 Riverstone RS Switch Router (RS) exhibits no activity (no LEDs are on, the fan module is not operating, and so on).	Make sure the power supply is installed and plugged into a power source and the power source is active. Also check to see whether 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 module is not active.	Check the power cable and the circuit to which the power supply is connected. If the green status LED on the power supply indicates that it is active, immediately power down the chassis, unplug the power supply, and contact. The fan module may be improperly connected or damaged.
The Control Module is not active.	Check the power cable and the circuit to which the power supply is connected. If the power supply is working, make sure the Control Module is inserted all the way into its slot in the chassis and the captive screws are screwed in. The Control Module must be in the CM or CM/1 slot and not in a line card slot.
No line cards are active.	Check the power cable and the circuit to which the power supply is connected.

Table A-1 Troubleshooting (Continued)

If You Experience This Difficulty...	Try this Remedy...
A specific line card is inactive.	Make sure the line card is inserted all the way into the chassis and the captive screws are screwed in.
The chassis LEDs indicate activity but you cannot tell what the RS is doing.	Make sure you have properly connected the primary Control Module to a management console and the console is powered on.
An older software version continues to boot instead of the newer version on a PC card or TFTP server.	Use the procedure in Section 5.1, *"Upgrading System Image Software"* to configure the RS to boot using newer software.
You are unable to access the configuration commands in the CLI.	Enter the **enable** command to access the Enable mode, then enter the **configure** command to access the Configuration mode.
Configuration changes do not seem to be taking effect.	Use the procedure in Section 4.3.1, *"Activating the Configuration Commands in the Scratchpad"* to activate the changes.
Configuration changes are not reinstated after a reboot.	Use the procedure in Section 4.3.2, *"Saving the Active Configuration to the Startup Configuration File"* to save the configuration changes to the Startup configuration file.
The RS is not resolving DNS names.	Use the procedure in Section 4.7, *"Setting the DNS Domain Name and Address"* to set up DNS. If you have already performed this procedure, make sure you can use NS lookup on the DNS server to get the default domain.
An SNMP manager cannot access the RS.	Use the procedure in Section 4.6, *"Setting Up SNMP"* to set up an SNMP community string and specify a target for SNMP traps. If you have already performed this procedure, enter the **snmp show all** command to check the SNMP settings. Use the **traceroute** and **ping** commands to verify that the RS 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.

INDEX

Numerics

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W