System Release 7.17.2
ASTRO® 25
INTEGRATED VOICE AND DATA

Cooperative WAN Routing Feature Guide

NOVEMBER 2017

MN004306A01-A

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Document History

Version	Description	Date
MN004306A01-A	Original release of the *Cooperative WAN Routing Feature Guide*.	November 2017

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About Cooperative WAN Routing Feature Guide

The Motorola Solutions Cooperative WAN Routing (CWR) solution allows core and exit routers to interface directly with site and InterZone links through a relay panel.

What is Covered In This Manual

This manual contains the following chapters:

- Cooperative WAN Routing Description on page 23, provides an overview of CWR. The environmental specifications of CWR are also included.
- Cooperative WAN Routing Theory of Operation on page 29, provides an insight into the functions of CWR and the connections used.
- Cooperative WAN Routing Installation on page 45, describes the cabling for CWR.
- Cooperative WAN Routing Configuration on page 55, provides the procedures for configuring CWR.
- Cooperative WAN Routing Maintenance on page 59, describes the maintenance required for CWR.
- Cooperative WAN Routing Troubleshooting on page 61, provides general guidelines on troubleshooting CWR.
- Cooperative WAN Routing FRU/FRE Procedures on page 65, describes the field replaceable units of CWR, and the procedures for replacing them.
- Cooperative WAN Routing Reference on page 71, describes the LEDs of the Cooperative WAN Routing (CWR) solution components.

Helpful Background Information

Motorola Solutions offers various courses designed to assist in learning about the system. For information, go to http://www.motorolasolutions.com/training to view the current course offerings and technology paths.

Related Information

See the following documents for associated information about the radio system.

Related Information	Purpose
Standards and Guidelines for Communication Sites	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. Also known as the R56 manual. This document may be purchased by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System Overview and Documentation Reference Guide	Provides an overview of the ASTRO® 25 new system features, documentation set, technical illustrations, and system-level disaster recovery that support the ASTRO® 25 radio communication system.

Table continued…

Related Information	Purpose
Dynamic System Resilience Feature Guide	Provides information necessary to understand, operate, maintain, and troubleshoot the Dynamic System Resilience (DSR) feature that adds a geographically separate backup zone core to an existing zone core to protect against catastrophic zone core failures.
MAC Port Lockdown Feature Guide	Provides information on the implementation and management of MAC Port Lockdown for standard Ethernet ports on Hewlett-Packard (HP) switches and for the internal switch of GCP 8000 Site Controllers and GPB 8000 Reference Distribution Modules (RDMs) in ASTRO® 25 systems. Additionally, the document contains instructions for configuring supplemental Ethernet port security, including the implementation of fiber optic ports on HP switches.
Link Encryption and Authentication Feature Guide	Provides information on the implementation and management of router encryption and authentication for ASTRO® 25 systems, including details about encryption modules and configuration sequences for minimizing downtime, to support encrypted links between routers that traverse an untrusted network. Router authentication enables peer routers to use pre-shared keys to authenticate messages received from various routing protocols.
SNMPv3 Feature Guide	Provides information relating to the implementation and management of the SNMPv3 protocol in ASTRO® 25 systems.
S6000 and S2500 Routers Feature Guide	Provides information relating to the installation, configuration, and management of the S6000 and S2500 routers used in various network locations.
RF Site Technician Reference Guide	Describes the ASTRO site components and tools used in their installation, configuration, and maintenance in ASTRO® 25 systems, and contains referential sections that provide additional information relevant when performing operations described in the Site Technician Guide, including feature descriptions, diagrams, and lists of parameters.
Unified Network Configurator User Guide	Covers the use of Unified Network Configurator (UNC), a sophisticated network configuration tool that provides controlled and validated configuration management for system devices including routers, LAN switches, site controllers, and base radios, and is used to set up sites for ASTRO® 25 systems. UNC has two components: VoyenceControl and Unified Network Configurator Wizards (UNCWs).

Chapter 1

Cooperative WAN Routing Description

This chapter provides a high-level description of Cooperative WAN Routing and the function it serves on your system.

NOTICE: Cooperative WAN Routing supports the Dynamic System Resilience feature for system dependency and reliability. For more information, see the *Dynamic System Resilience Feature Guide*.

1.1 Overview

The Motorola Cooperative WAN Routing (CWR) solution allows core and exit routers to interface directly with site and InterZone links through a simple, reliable, and passive relay panel. The core and exit routers are configured in pairs to provide path redundancy for audio and control packets. With CWR, the routers work to control an external relay panel to switch a group of 12 non-redundant T1/E1 links between the two routers. One router is always considered as the active router and the other router is considered as the inactive router. Each router is provisioned with two 12-port T1/E1 modules, providing up to 24 T1/E1 link terminations per router pair.

The CWR solution has the following advantages:

- Provides redundant router failover capabilities
- Allows for easier configuration, testing, and maintenance
- Requires less downtime during upgrades

The CWR interfaces the master site in one zone to Radio Frequency (RF) sites, dispatch sites, system Operations Support System (OSS), and other zones. Frame Relay Permanent (or Provisioned) Virtual Circuits (PVCs) are set up on all intrazone links. When Multilink Frame Relay (MFR) is used for higher bandwidth requirements, Constituent Virtual Circuits (CVCs) and Aggregate Virtual Circuits (AVCs) are also configured.

The InterZone links use MFR to bundle multiple T1/E1 links together, providing one logical link. T1/E1s are configured as CVCs, then as one logical AVC. Multiple T1s and E1s are required between the zones that have physical connectivity.

NOTICE: CWR is supported in a single-zone (M1/M2) or multi-zone capable (M3) zone core. The single-zone, small scale (L) zone core supports Ethernet site links only and does not support CWR.

1.2 Components

The CWR solution comprises the following components:

- Two S6000 core/exit routers.
  Each router is configured with two 12-port T1/E1 modules and runs the version of Enterprise Operating System (EOS) software.
- Relay panels
- Four 12-port relay cables

NOTICE: When ordering CWR, as part of a Switching-Routing Center (SRC) configuration, the hardware components are mounted in a rack or cabinet (based on customer option) in the factory before shipping. The rack/cabinet may not reserve space for all FRU-based items that were not included in the SRC order or may not have enough space available for mounting of all CWR router pairs for high capacity DSR systems. Items not fitting in the standard rack/cabinet is shipped loose and require a second rack or cabinet at the site (not provided by SRC model).

1.2.1
S6000 12-Port T1/E1 Module

The MNR S6000 router supports up to two 12-port T1/E1 modules per chassis. Each module features one WAN interface that supports up to 12 T1/E1 ports, for a total of up to 24 channelized T1/E1 ports for each S6000. The 12-port T1/E1 module supports both CWR and non-CWR applications.

Figure 1: MNR S6000 router with Two 12-Port T1/E1 Modules

S6000_w_2relay_pnls

Core Router Port Capacity

A relay panel supports 24 T1/E1s with a single pair of core routers.

Exit Router Port Capacity

The ASTRO® 25 system allows a zone to be directly connected to five remote zones. The relay panel permits 24 T1/E1s with a single pair of exit routers. It allows for six (24/4) InterZone MFR bundles of four T1/E1s each.

1.2.2
Relay Panel

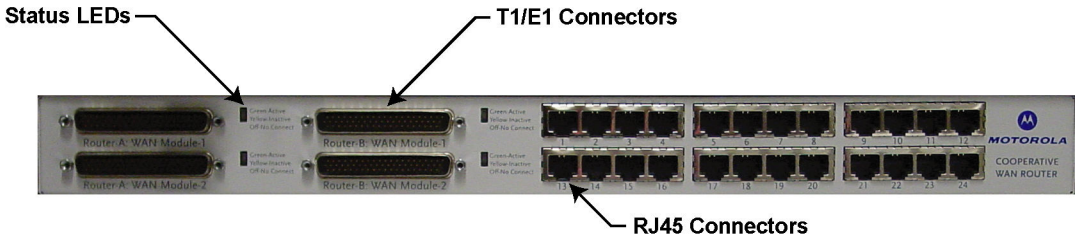
In the CWR mode, the relay panel is an electromechanical relay-based switch-device that interconnects the T1/E1 ports on the active router with the physical T1/E1 lines to the remote sites. In case of a problem with the active router in a single site link, the inactive router is made the active router and one of the routers instructs the relay panel to connect the new active router to the physical T1/E1 lines to the remote sites. An individual 12-port T1/E1 module is connected to the relay panel through a single 12-port T1/E1 interconnect cable. Attached 12-port T1/E1 module powers and controls the relay panel. The relay panel uses latching relays to retain its current state, even during the power loss.

The relay panel provides the following connectors:

- Two sets of two 62-pin high-density T1/E1 connectors, each of which supports up to 12 T1/E1 relays, for a total of up to 24 relays for each relay panel.
- 24 RJ-45 connectors, each of which supports channelized connectivity at T1/E1 line rates. In a CWR configuration, these connectors provide direct connections to the site and InterZone links.

A relay panel is composed of two separate modules within one device. A relay panel always contains both modules, even if only one module is used. A relay panel module includes two T1/E1 connectors and 12 RJ-45 connectors. It allows one relay panel to be used for both single site link (CWR enabled) and dual site link (non-CWR enabled) configurations.

Figure 2: Relay Panel

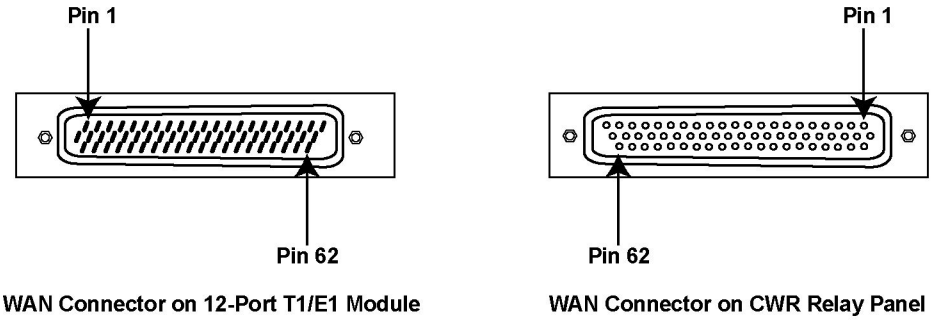


CWR_front1

1.2.3
12-Port T1/E1 Module and Relay Panel Connectors

The 12-port T1/E1 module features a 62-pin high-density T1/E1 female connector. It connects to one of the four 62-pin high density T1/E1 male connectors on the relay panel through a 12-port relay cable.

Figure 3: 62-Pin High Density T1/E1 Connector Pin Locations



CRW_WAN_connector

1.2.3.1
CWR 62-Pin High Density T1/E1 Connector Pinouts

Table 1: CWR 62-Pin High Density T1/E1 Connector Pinouts

Pin	Signal	Pin	Signal
1	RPCMND	32	Tx9_tip
2	GND	33	Rx7_ring
3	RPCBON	34	Rx7_tip
4	GND	35	Tx6_ring
5	Rx11_ring	36	Tx6_tip
6	Rx11_tip	37	Rx4_ring
7	Tx10_ring	38	Rx4_tip
8	Tx10_tip	39	Tx3_ring
9	Rx8_ring	40	Tx3_tip
10	Rx8_tip	41	Rx1_ring

Table continued…

Pin	Signal	Pin	Signal
11	Tx7_ring	42	Rx1_tip
12	Tx7_tip	43	RPCONN
13	Rx5_ring	44	GND
14	Rx5_tip	45	RPONLN
15	Tx4_ring	46	GND
16	Tx4_tip	47	Rx12_ring
17	Rx2_ring	48	Rx12_tip
18	Rx2_tip	49	Tx11_ring
19	Tx1_ring	50	Tx11_tip
20	Tx1_tip	51	Rx9_ring
21	--	52	Rx9_tip
22	--	53	Tx8_ring
23	+5 V	54	Tx8_tip
24	GND	55	Rx6_ring
25	+5 V	56	Rx6_tip
26	GND	57	Tx5_ring
27	Tx12_ring	58	Tx5_tip
28	Tx12_tip	59	Rx3_ring
29	Rx10_ring	60	Rx3_tip
30	Rx10_tip	61	Tx2_ring
31	Tx9_ring	62	Tx2_tip

1.3 CWR System Specifications

Table 2: System Specifications for CWR

CWR System	Specifications
Maximum sites per zone	297
Site limit for a single CWR pair	99
Supported core router pairs per zone	4
Supported exit router pairs per zone	2
Maximum number of relay panels per maximum number of core router pairs per zone	8
Maximum number of relay panels per maximum number of exit router pairs per zone	1

1.4 Relay Panel Environmental Specifications

Table 3: Relay Panel Environmental Specifications

Environmental Characteristic	Minimum Requirement	Maximum Requirement
Operating temperature range at 10,000 ft	0 °C (32 °F)	50 °C (122 °F)
Non-operating temperature	-30 °C (-22 °F)	60 °C (140 °F)
Operating altitude	N/A	3048 m (10,000 ft)
Non-operating altitude	N/A	12,192 m (40,000 ft)
Relative humidity – operating	5% non-condensing	95% non-condensing
Relative humidity – non-operating	5% non-condensing	95% non-condensing
Shake and vibration	5 Hz	500 Hz, 0.25 G sine maximum

1.5 S6000 Router Environmental Specifications

IMPORTANT: The S6000 router requires proper ventilation and space to accommodate cabling requirements. Be sure to adhere to the environmental specifications listed here when installing the router.

Table 4: S6000 Routers Environmental Specifications

Environmental Characteristic	Minimum Requirement	Maximum Requirement
Operating Temperature	0 °C (32 °F)	50 °C (122 °F)
Non-operating Temperature	-30 °C (-22 °F)	60 °C (140 °F)
Operating Altitude	N/A	3,048 m (10,000 ft)
Non-operating Altitude	N/A	12,192 m (40,000 ft)
Relative Humidity - Operating	5% non-condensing	95% non-condensing
Relative Humidity - Non-operating	5% non-condensing	95% non-condensing

1.6 Switching-Routing Center

The ASTRO® 25 system Switching-Routing Center (SRC) consists of a single rack that contains all components necessary for CWR. For details regarding the configuration, see *Master Site Infrastructure Reference Guide*.

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Chapter 2

Cooperative WAN Routing Theory of Operation

This chapter explains how Cooperative WAN Routing works in the context of your system.

NOTICE: Cooperative WAN Routing supports the Dynamic System Resilience feature for system dependency and reliability. For more information, see the *Dynamic System Resilience Feature Guide*.

2.1 Introduction

The Cooperative WAN Routing (CWR) solution consists of S6000 core or exit routers with 12-port T1/E1 modules connected to a passive relay panel. The S6000 routers are deployed in pairs (known as CWR peers) for redundancy and switchover protection. The active CWR peer router controls the relays on the relay panel. If the active router detects a cable failure, it switches the relays for the site or InterZone links to the inactive router. If the active router itself fails, the relay panel automatically switches the inactive router to active status.

A maximum of six router pairs are used for intrazone and InterZone connectivity. Four core router pairs are used for intrazone connections, and two exit router pairs are used for InterZone connections.

Figure 4: CWR Implementation

CWR_routers_relay_panel_A

2.2 Intrazone Connectivity

Intrazone connectivity is used within the zone only. An intrazone configuration uses only core routers, as exit routers are used to connect one zone to another zone.

Within a zone, ASTRO® 25 system repeater sites, IP-based Conventional subsystems, simulcast subsystems, network management/dispatch sites, and control room sites connect to the relay panel through the RJ-45 connectors. The relay panels use the high-density interface to connect to the 12-port T1/E1 modules of core routers.

Up to four core router pairs and eight relay panels can be used in an intrazone configuration. For more information, seeCore Router Configuration Theory on page 37.

2.3 InterZone Connectivity

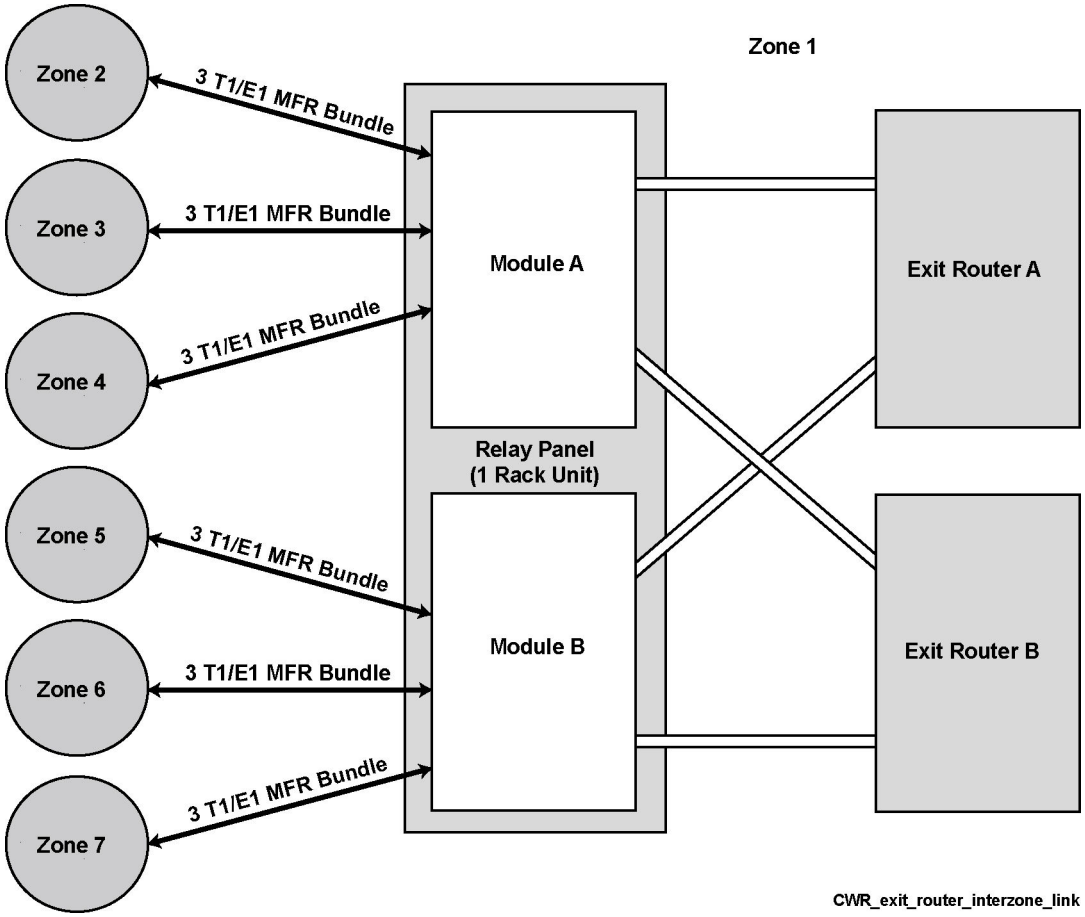
InterZone connectivity is used for multizone configurations. An InterZone configuration uses both core and exit routers. The InterZone links provide connectivity for control, voice, data, and Network Management traffic between the remote zones. These links are typically of a higher bandwidth than the site links and require higher levels of redundancy. The exit routers provide the links through the relay panels.

The InterZone links require Multilink Frame Relay (MFR) to obtain the necessary InterZone bandwidth. The InterZone links are MFR bundles running over channelized T1/E1 modules. The bundling operates as a single logical link to the networking layer. In most configurations, InterZone MFR bundles contain a minimum of three T1s or three E1s. MFR bundles are configured on the same CWR module, and cannot span two different modules.

Up to four core router pairs, two exit router pairs, and eight relay panels are allowed at each master site in each zone. For more information, seeExit Router Configuration Theory on page 42.

2.3.1
Exit Router InterZone Link Configuration

Figure 5: Exit Router InterZone Link Configuration



2.4
Site Links

The site link refers to the physical and logical connections between the master site in one zone and the following:

- RF Site
- Dispatch/Network Management Site

It entails the physical link (FT1/T1 and FE1/E1) and the logical connection between the core router and site gateway.

NOTICE: The dispatch/Network management site may connect to the master site in one zone through the LAN switch, as opposed to a WAN connection (in a colocated configuration).

The physical connection for a site link is either FT1/FE1 or T1/E1 with bandwidth ranging from 64 K to multiple T1s/E1s worth of bandwidth using MFR. Since IP-based conventional sites and HPD sites are overlaid at the simulcast prime site and sub sites, multiple T1/E1s are required.

2.4.1
Single Site Link Configuration Introduction

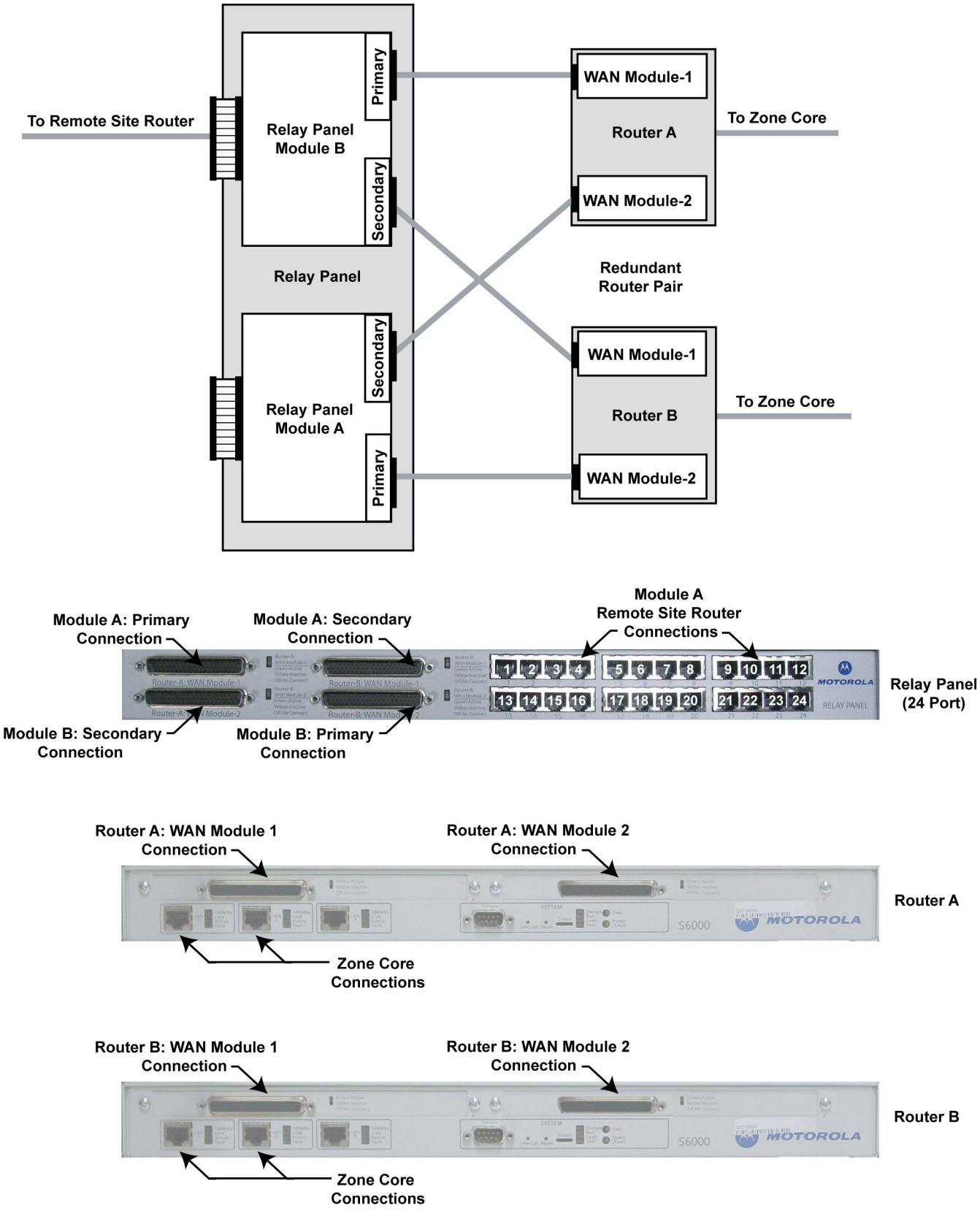
A single site link connects a master site to a remote site by using a core router pair. It also uses a relay panel at the master site that connects to the site gateway at a remote site. A single Frame Relay Permanent Virtual Circuit (PVC) is defined on both the active and the inactive router. Both core routers have a 12-port T1/E1 module which connects to one relay panel. The relay panel connects to the site links with RJ-45 connectors, with a maximum of 96 available connections.

IMPORTANT: CWR mode is only available for sites with single T1 links.

2.4.1.1

Single Site Link Configuration

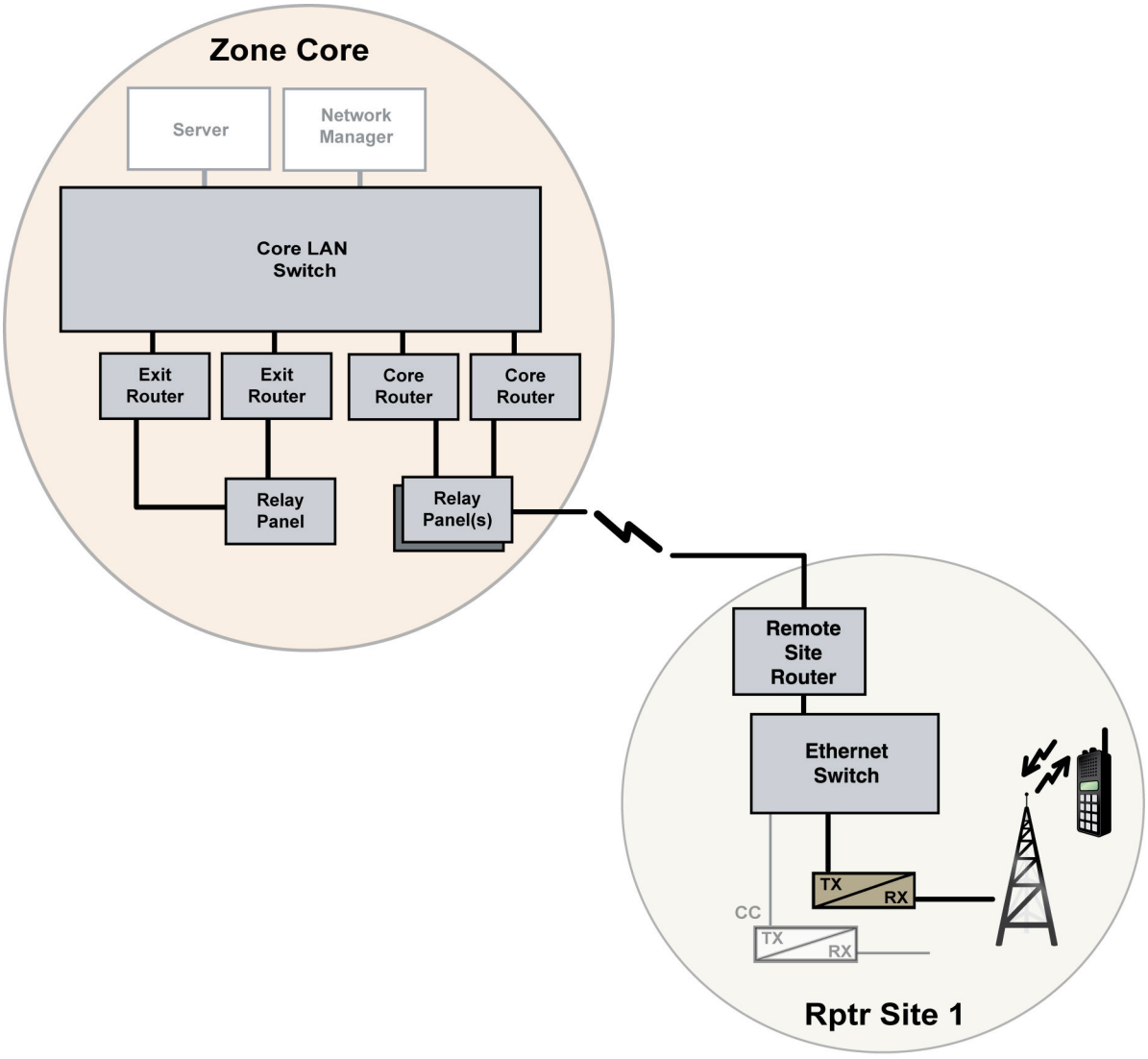
Figure 6: Single Site Link Configuration



NOTICE: The RJ-45 connections are specific to your network and are configured at the site.

2.4.1.2 Single Site Link Implementation in an ASTRO 25 System

Figure 7: Single Site Link Implementation in an ASTRO 25 System



2.4.2 Dual Site Link Configuration Introduction

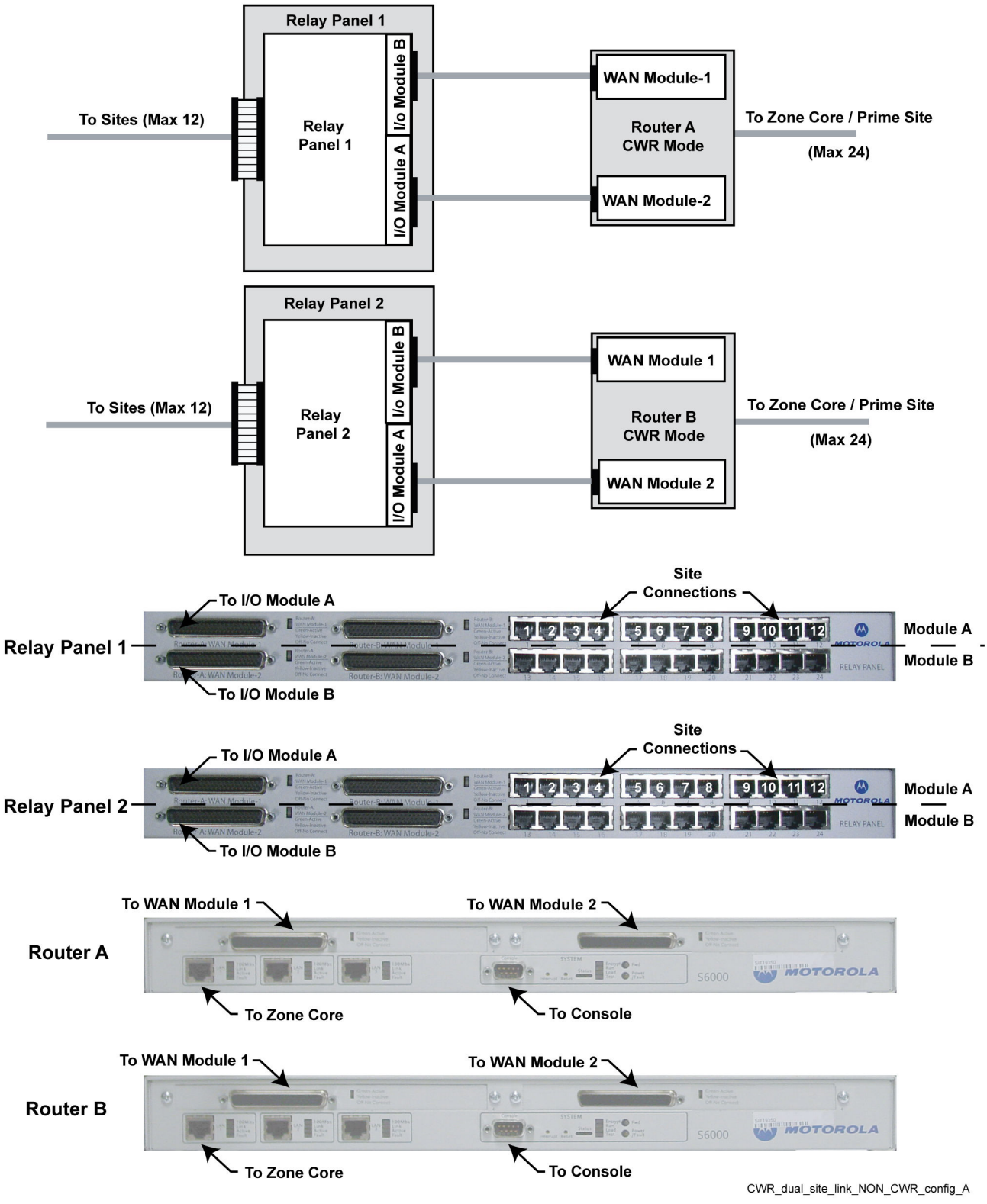
A dual site link configuration uses a core router pair and two relay panels at the master site, which connect to the remote site in an intrazone configuration. For dual site links, each 12-port T1/E1 module in the core routers connects to a separate relay panel, and is not configured in the CWR mode. Although not in CWR mode, the dual site links achieve redundancy by duplicating the hardware path and T1/E1 facilities. Failure of the CWR module does not cause any disruption to the dual site links. In a dual site link configuration, there is a maximum of 48 available connections.

IMPORTANT: CWR functionality is not enabled with a dual link configuration, because there is switchover capability, using the router pair and dual relay panels.

2.4.2.1

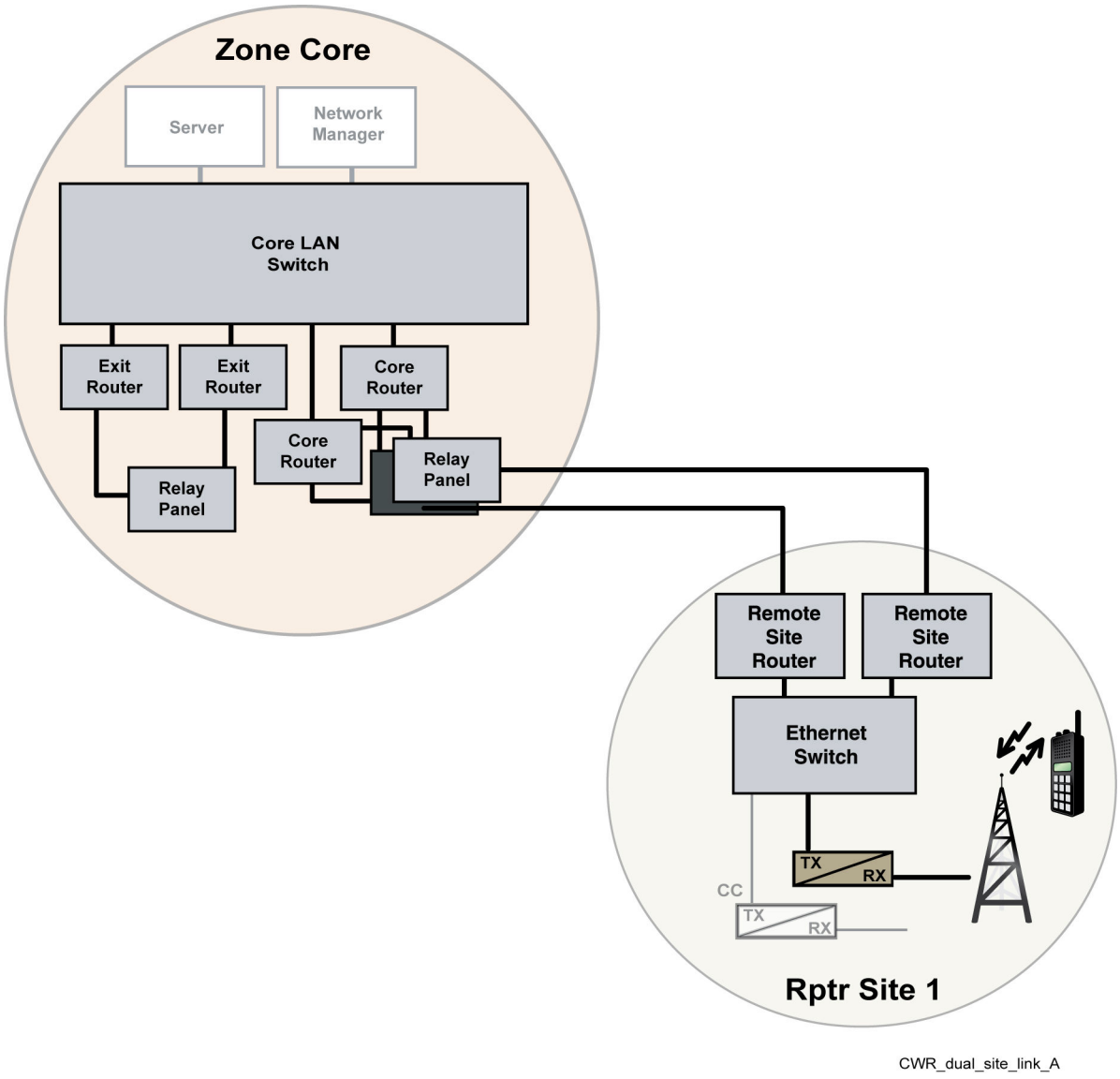
Dual Site Link Configuration

Figure 8: Dual Site Link configuration



2.4.2.2
Dual Site Link Implementation in an ASTRO 25 System

Figure 9: Dual Site Link Implementation in an ASTRO 25 System



2.5
Core Router Configuration Theory

The core routers route traffic between the master site and the remote sites. The core router connects to the site links through the RJ-45 connectors on the relay panel. The relay panel uses RJ-45 connectors on the T1/E1 links to direct traffic from the sites.

The core router configuration options available for the master site are:

- Single Site Link Configuration (Option 1) on page 38
- Dual Site Link Configuration (Option 2) on page 39
- Single and Dual Site Link Configuration (Option 3) on page 40

Core routers are used for intrazone configuration only. For InterZone configuration, see Exit Router Configuration Theory on page 42.

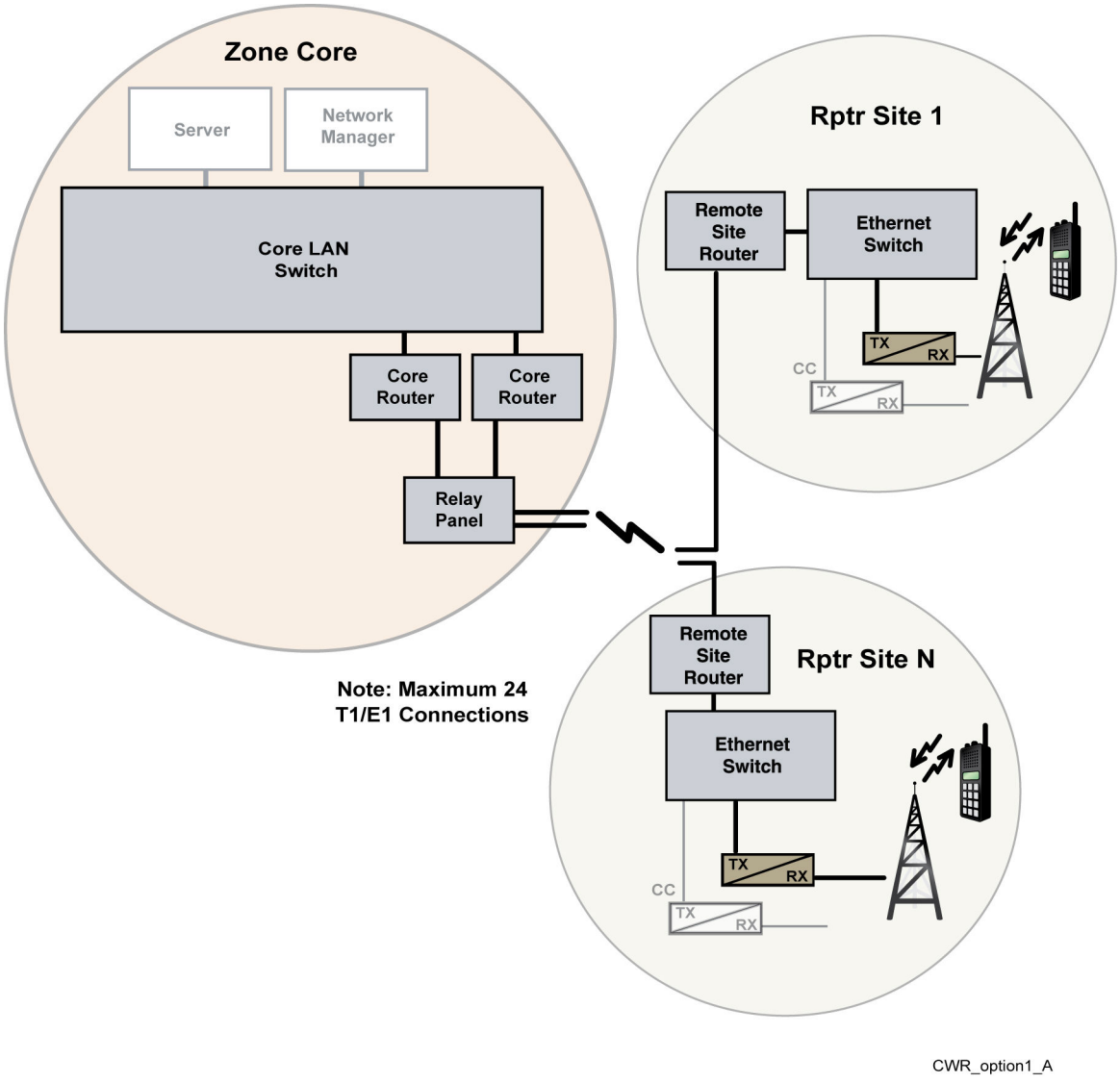
2.5.1
Single Site Link Configuration (Option 1)

The simplest configuration option for core routers at a master site is a single site link configuration. A redundant pair of core routers (Active and Inactive) is cabled to a relay panel. Each T1/E1 link from the relay panel goes to one router at a remote site. Up to 24 remote sites are supported in a single site link configuration. Single site link configuration is cost-effective, but if a link to a remote site fails, communication to that remote site is lost.

NOTICE: Single site link configuration can be used with the dual site link configuration.

2.5.1.1
Core Router – Single Site Link Configuration

Figure 10: Core Router – Single Site Link Configuration



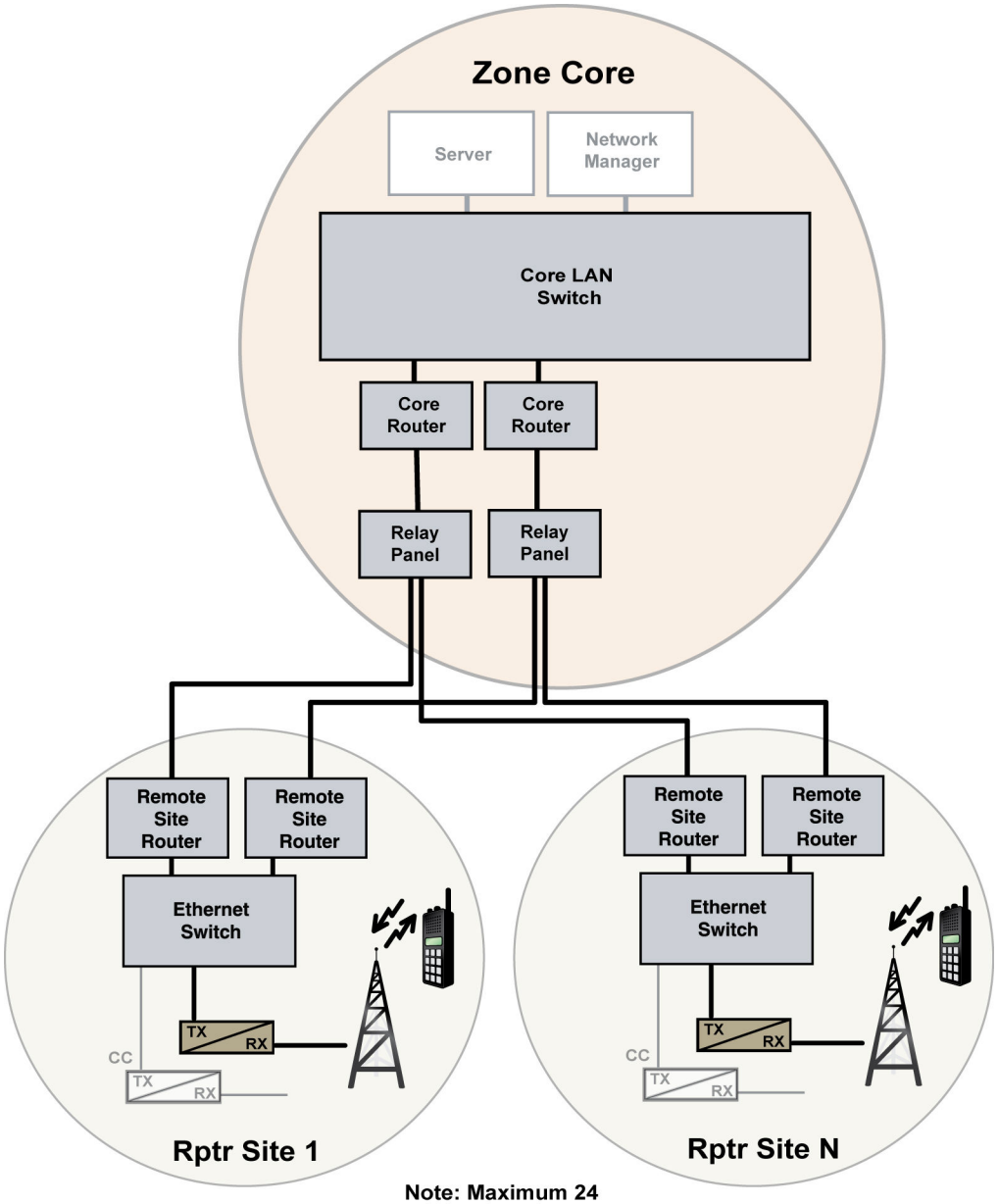
2.5.2
Dual Site Link Configuration (Option 2)

In a dual site link configuration, two core routers and two relay panels are used, providing a total of up to 24 dual site links. There are also redundant router pairs at the remote sites. This configuration offers the security of always having a redundant router pair at the remote sites, so communication is not lost if a router fails.

NOTICE: Dual site link configuration can be used with single site link configuration.

2.5.2.1
Core Router Dual Site Link Configuration

Figure 11: Core Router – Dual Site Link Configuration



2.5.3
Single and Dual Site Link Configuration (Option 3)

With single and dual site configuration at a master site, you realize the cost-effectiveness of a single site link configuration as well as the redundancy of a dual site link configuration, using one core router pair with three relay panels.

In mixed single and dual site link mode, relay panel 1 has a connection to WAN Module 1 of Router A and WAN Module 1 of Router B for the switched single link. You only need one relay panel for the

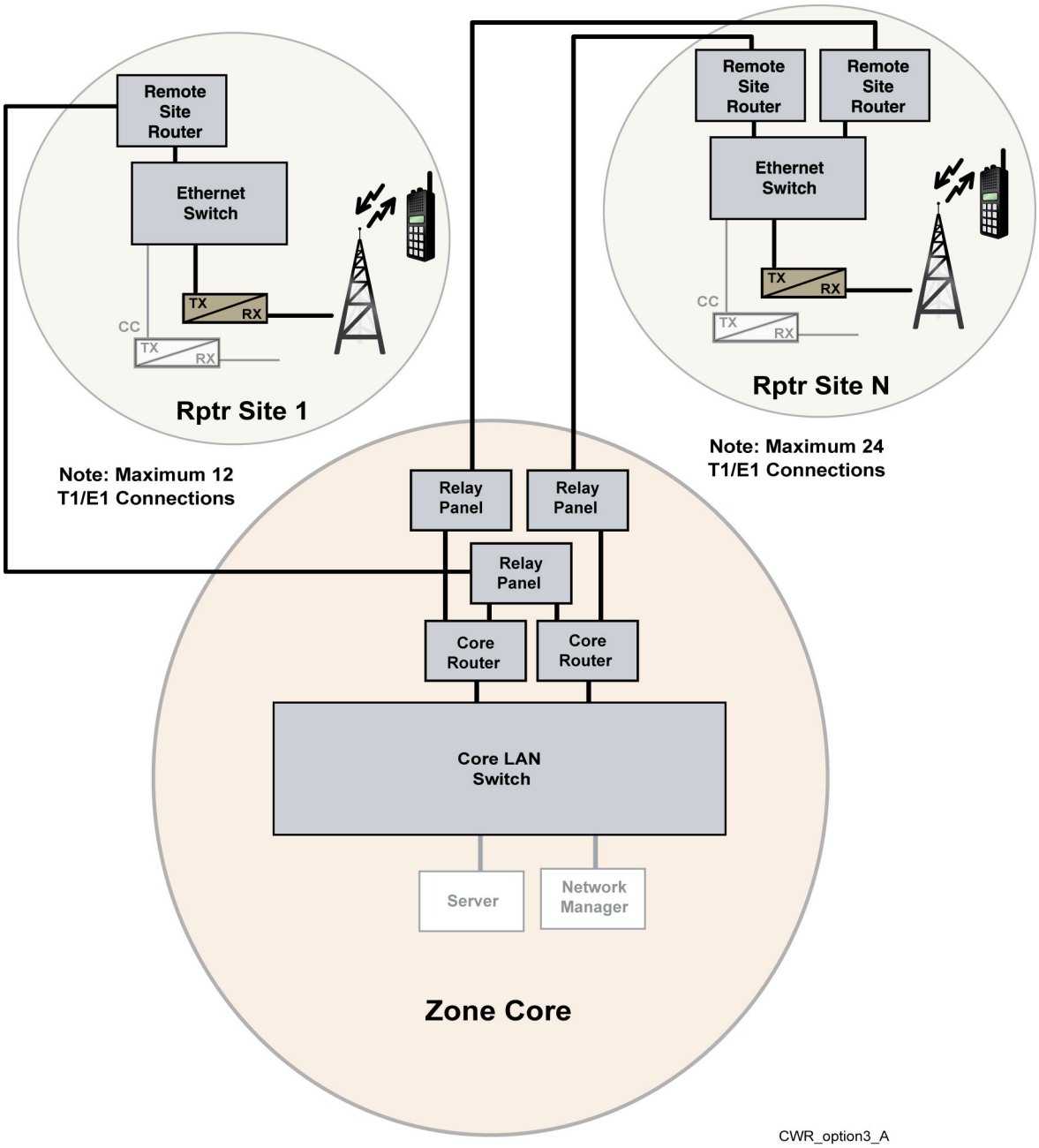
single site link. The WAN Module 2 of Router A is connected to Relay Panel 2 for dual site links, and the WAN Module 2 of Router B is connected to Relay Panel 3 for dual site links.

2.5.3.1

Core Router Single and Dual Site Link Configuration

NOTICE: This configuration option can only support up to 12 single site links and up to 12 dual site links. If more than 12 dual or single site links are needed, you can use a combination of Option 1 and Option 2 to configure your system.

Figure 12: Core Router – Single and Dual Site Link Configuration



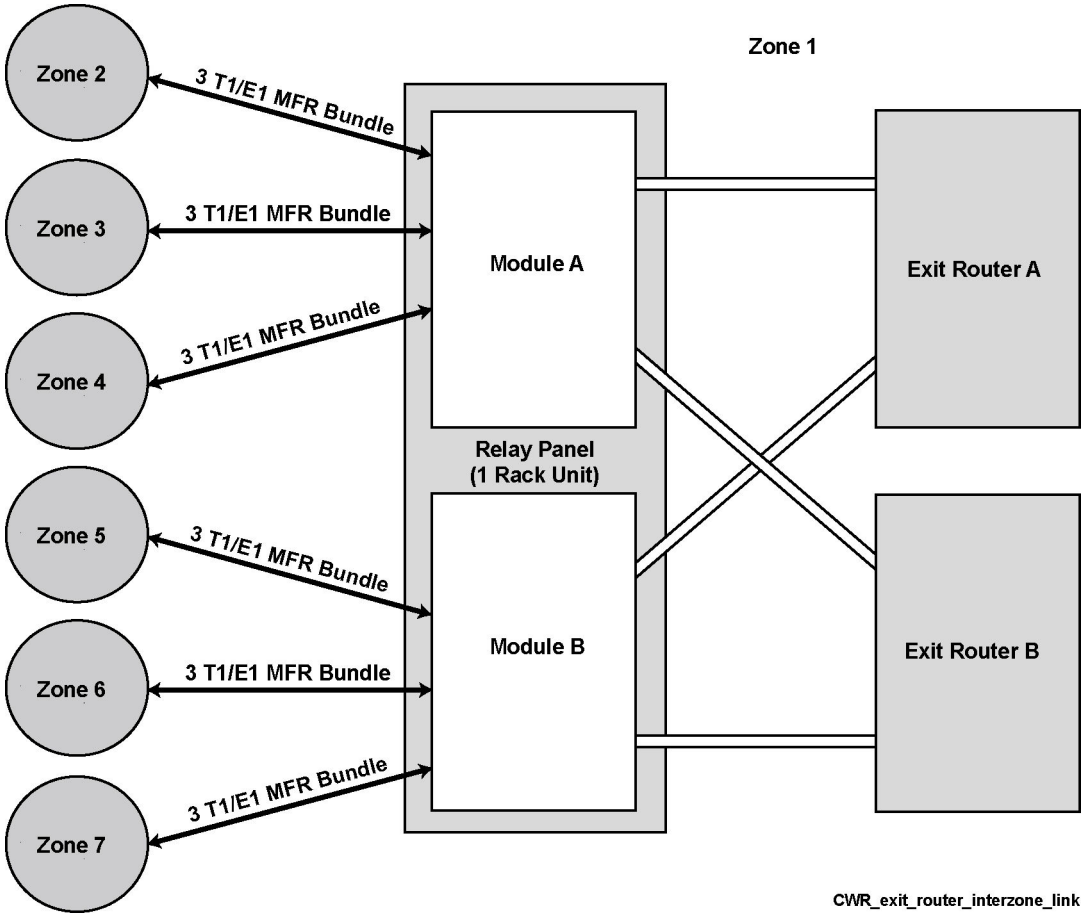
2.6
Exit Router Configuration Theory

The S6000 exit routers manage traffic for the InterZone links. There are up to two exit router pairs in each zone of a multizone system. Each exit router has two TLAN connections to the LAN switch, providing high availability to the master site in one zone. The exit router also has a T1/E1 connection to the relay panel.

One redundant exit router pair and one relay panel is available for each master site.

2.6.1
Exit Router Configuration at a CWR Enabled Master Site

Figure 13: Exit Router Configuration at a CWR Enabled Master Site



2.7
IP Simulcast Subsystem CWR Solution

The CWR differs for IP Simulcast subsystems configured with more than 15 subsites.

A standard configuration prime site with a 32 subsite capacity is the same as a standard configuration prime with a 15 subsite capacity, except there are three Ethernet LAN switches at the prime site. Switches #1 and #2 are paired between two subsite access routers or gateway pairs and switch #3 is connected to both subsite access router or gateway pairs.

Additional CWR patch panels for T1/E1 links from each subsite access router pair are required, depending on the following configurations:

- Single site links – two CWR patch panel
- Dual/single link combinations – three or four CWR patch panels
- Dual site links – four CWR patch panels

When using Ethernet links, each subsite access router or gateway is connected to a backhaul switch.

For more information regarding the IP Simulcast Prime Site, see *RF Site Technician Reference Guide*.

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Chapter 3

Cooperative WAN Routing Installation

This chapter details installation procedures relating to the Cooperative WAN Routing (CWR) solution.

3.1 12-Port T1/E1 Module Installation

To install the 12-port T1/E1 module in the S6000 Chassis, see Installing 12-Port T1/E1 Modules.

For more information, see the following procedures:

- Connecting the Core Routers to the Relay Panel for a Single Site Link Configuration
- Connecting the Core Routers to the Relay Panel for a Dual Site Link Configuration (24 Dual Links)
- Connecting the Core Routers to the Relay Panel for a Mix Site Link Configuration (12 single links and 12 dual links)

3.1.1 ESD Precautions

CAUTION: When removing or installing modules, take the following precautions to prevent Electrostatic Discharge (ESD) from damaging the internal components of the router:

- Always wear a properly grounded anti-static wrist strap.
- Transport static-sensitive components in anti-static packaging.
- Keep static-sensitive components in their anti-static packaging until you are ready to install them.
- Just before removing components from their anti-static packaging, discharge static electricity from your body by touching an unpainted metal surface.
- When you handle modules, place them with the printed circuit side down on a nonconducting, static-free, and flat surface.

IMPORTANT: Do not store unused or unconfigured I/O modules in unused router slots.

3.1.2 Installing 12-Port T1/E1 Modules

Procedure:

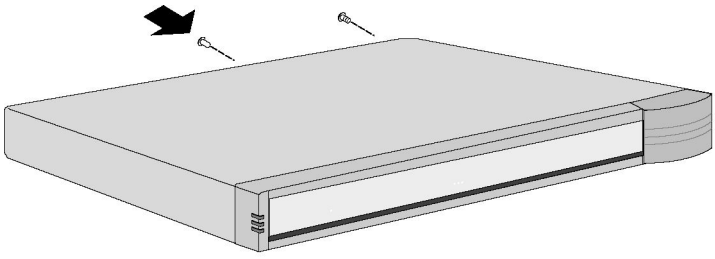
1 Remove the cover from the S6000 Chassis:

a Disconnect the power cords from the S6000 System and remove any cables that may be installed on the chassis.

WARNING: If the S6000 is configured with redundant power supplies (model numbers lower than CLN1780A), disconnect both power cords to completely remove power from the S6000.

b Remove the two screws that secure the cover to the chassis

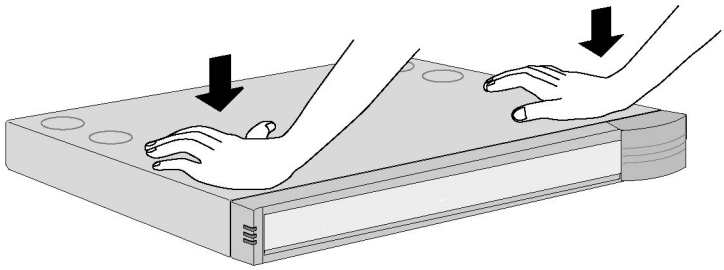
Figure 14: Removing the Screws that Secure the Chassis



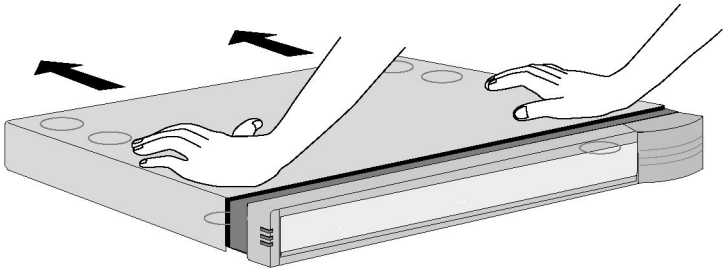
S2500_cover_replacement

c Remove the cover from the chassis.

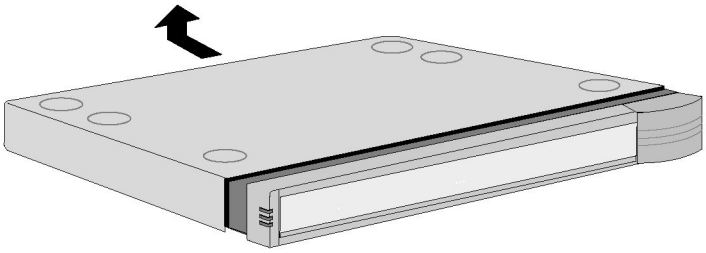
Figure 15: Removing the Cover from the Chassis



With the front panel facing you, push down on cover with both hands



Slide cover back slightly

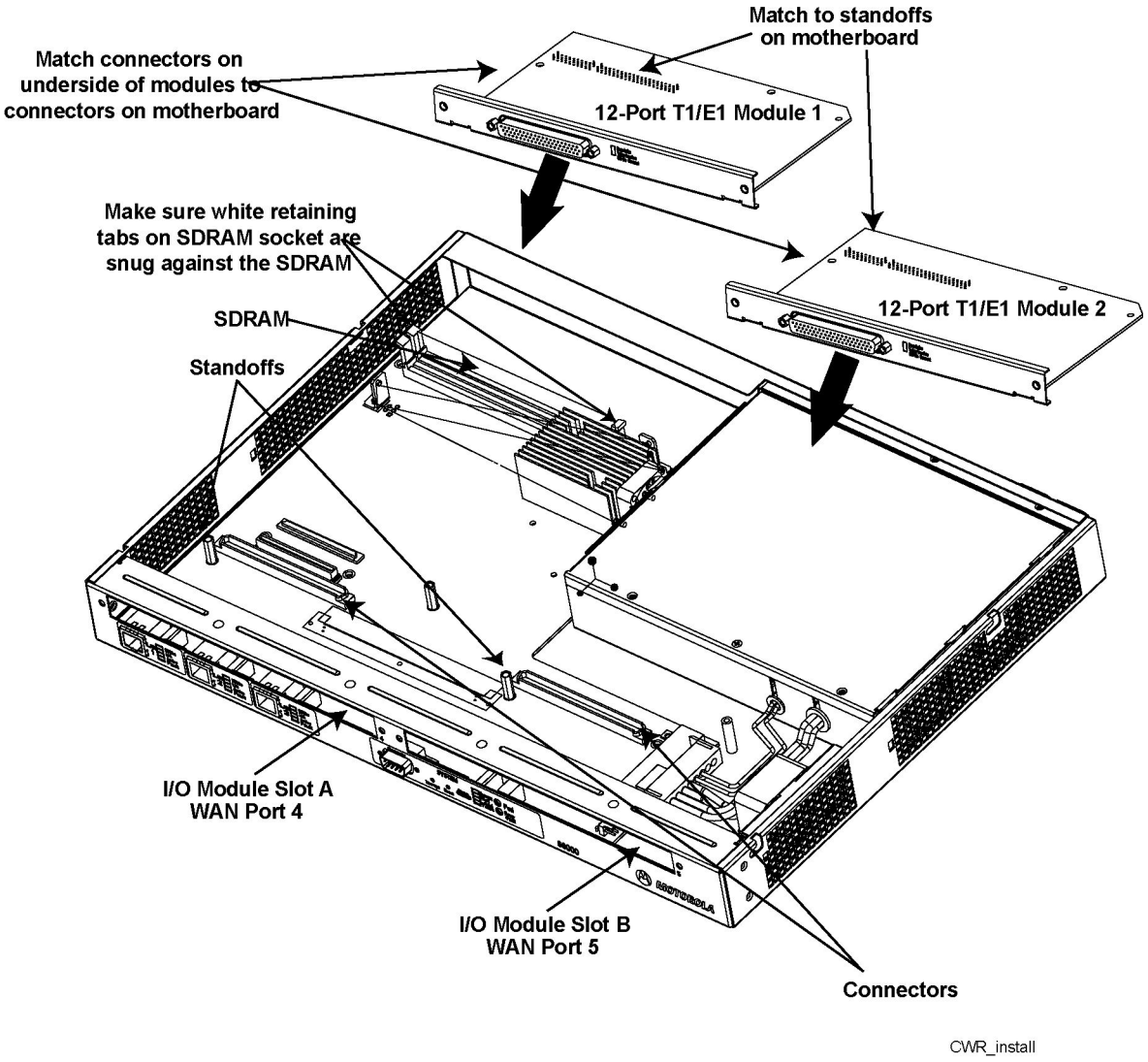


Lift cover away from chassis

S2500_optional_module_install

2 Locate the slots on the S6000 Motherboard into which you want to install the 12-port T1/E1 modules, corresponding standoffs, and connectors.

Figure 16: I/O Module Slot, Connector, and Standoff Locations on the S6000 Motherboard



3 Insert the 12-port T1/E1 modules. For each module, perform the following actions:

   a Insert the front of the module through the front panel of the chassis.

   b Line up the connector pins carefully.

   c Press down gently on the module.

   NOTICE: If you are installing a module in I/O module slot B, make sure that the power supply wires for the fan are under the card when you insert it.

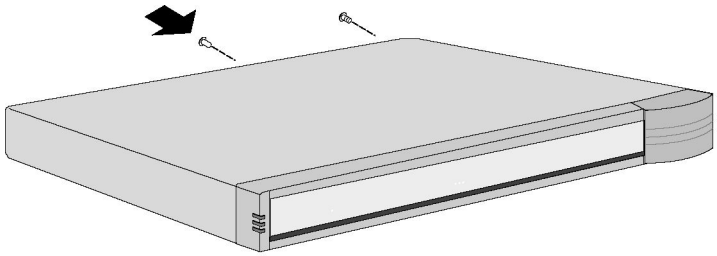
4 Using a torque screwdriver, secure the modules with the two screws and washers provided with the module.

   NOTICE: To ensure that the module is seated properly, tighten the screws to a torque of 6.5 - 8.5 inch-pounds.

5 Check the seating of the SDRAM to make sure that it was not nudged or unseated during the module installation. The white retaining tabs on the SDRAM socket are snugged against the SDRAM. Figure 16: I/O Module Slot, Connector, and Standoff Locations on the S6000 Motherboard on page 47 illustrates the location of the SDRAM on the S6000 Motherboard.

6 Replace the cover and secure it to the chassis with the two screws you removed in step 1.

Figure 17: Replacing the Cover on the S6000 Chassis



S2500_cover_replacement

3.2

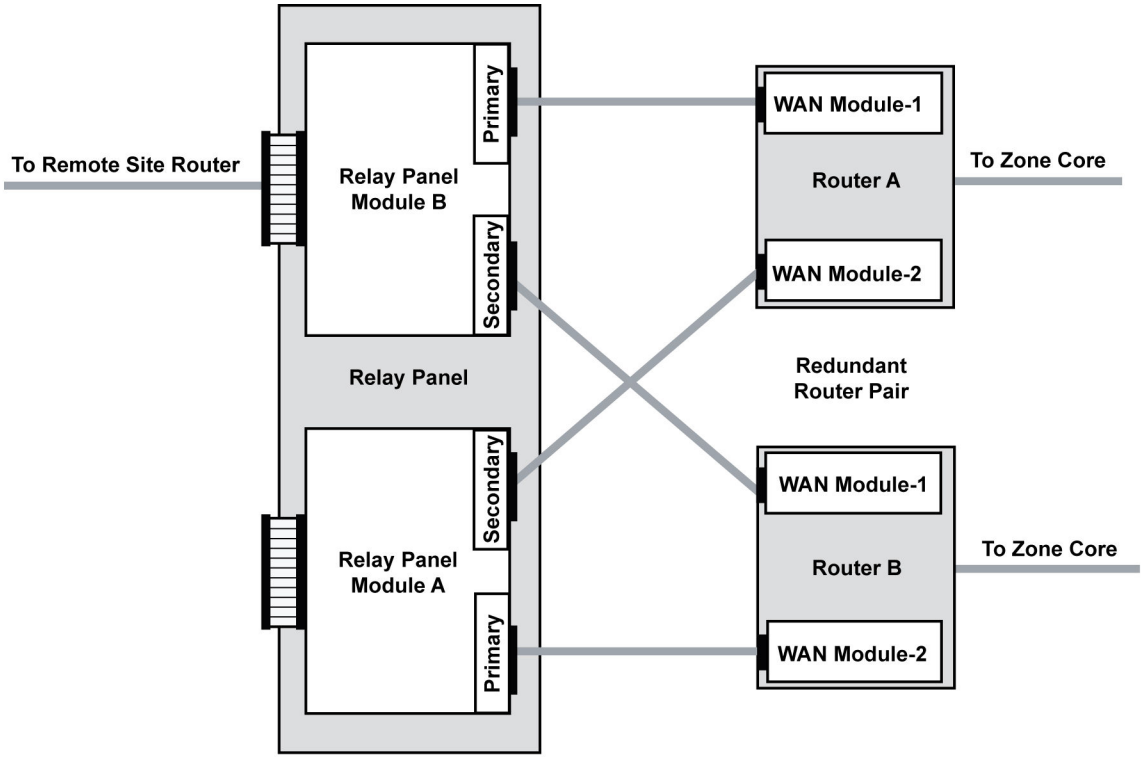
Core/Exit Routers to the Relay Panel Connection for a Single Site Link Configuration

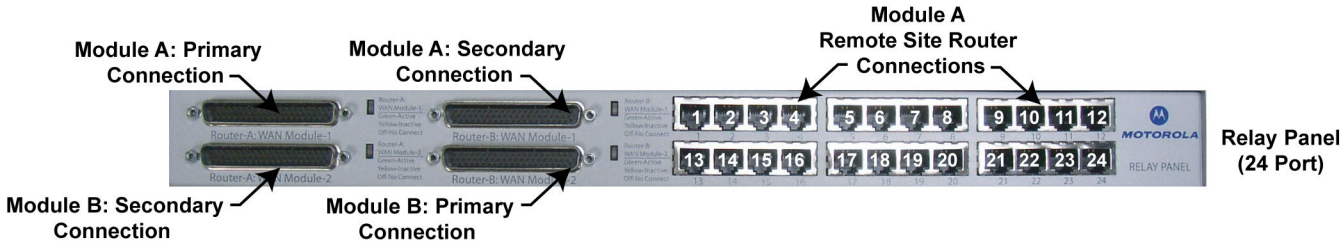
The 12-port T1/E1 modules connect to the relay panel through 12-port relay cables. Perform Connecting the Core Routers to the Relay Panel for a Single Site Link Configuration describes how to connect CWR peers to the relay panel for a single site link. For more information about connector pinouts, see 12-Port T1/E1 Module and Relay Panel Connectors on page 25.

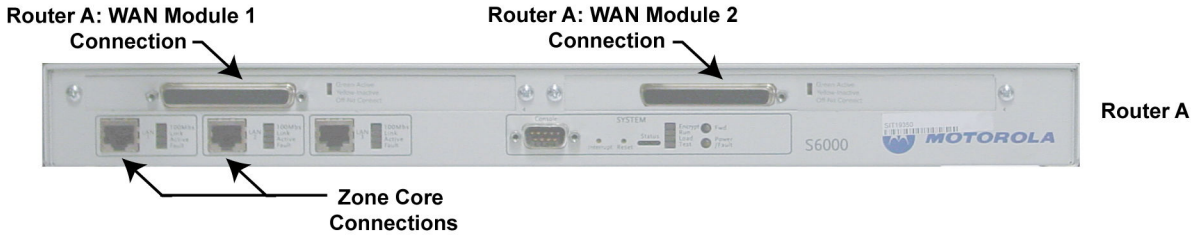
3.2.1

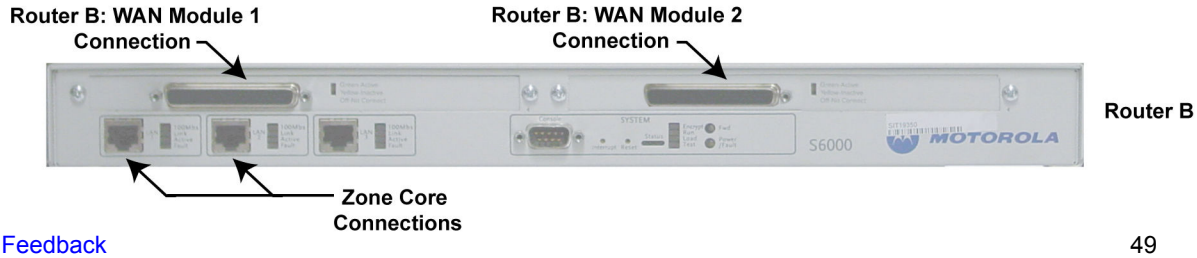
CWR Core Router Pair Connections for a Single Site Link Configuration

Figure 18: CWR Core Router Pair Connections for a Single Site Link Configuration



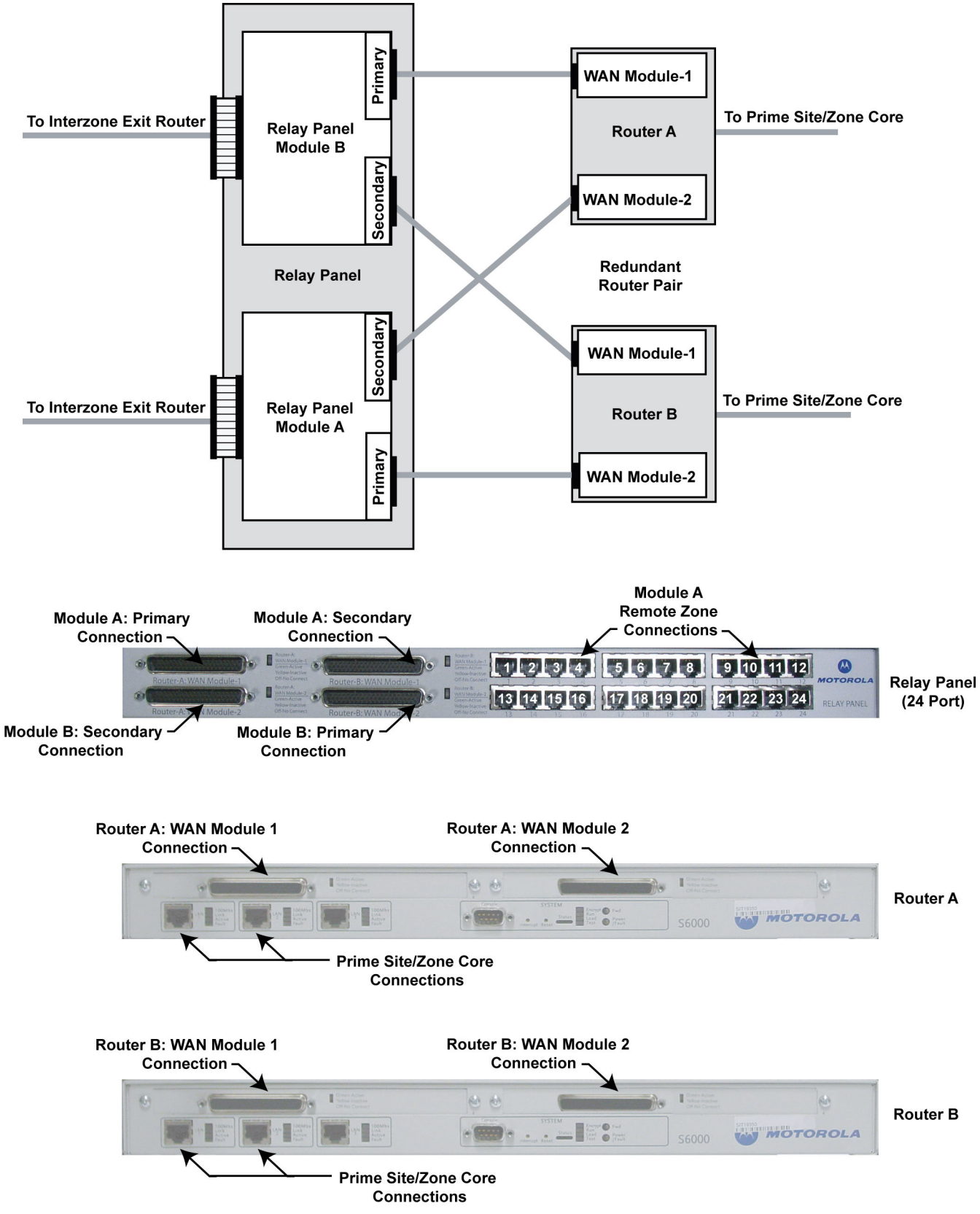






3.2.2
CWR Exit Router Pair Connections

Figure 19: CWR Exit Router Pair Connections



3.2.3
Connecting the Core Routers to the Relay Panel for a Single Site Link Configuration

Procedure:

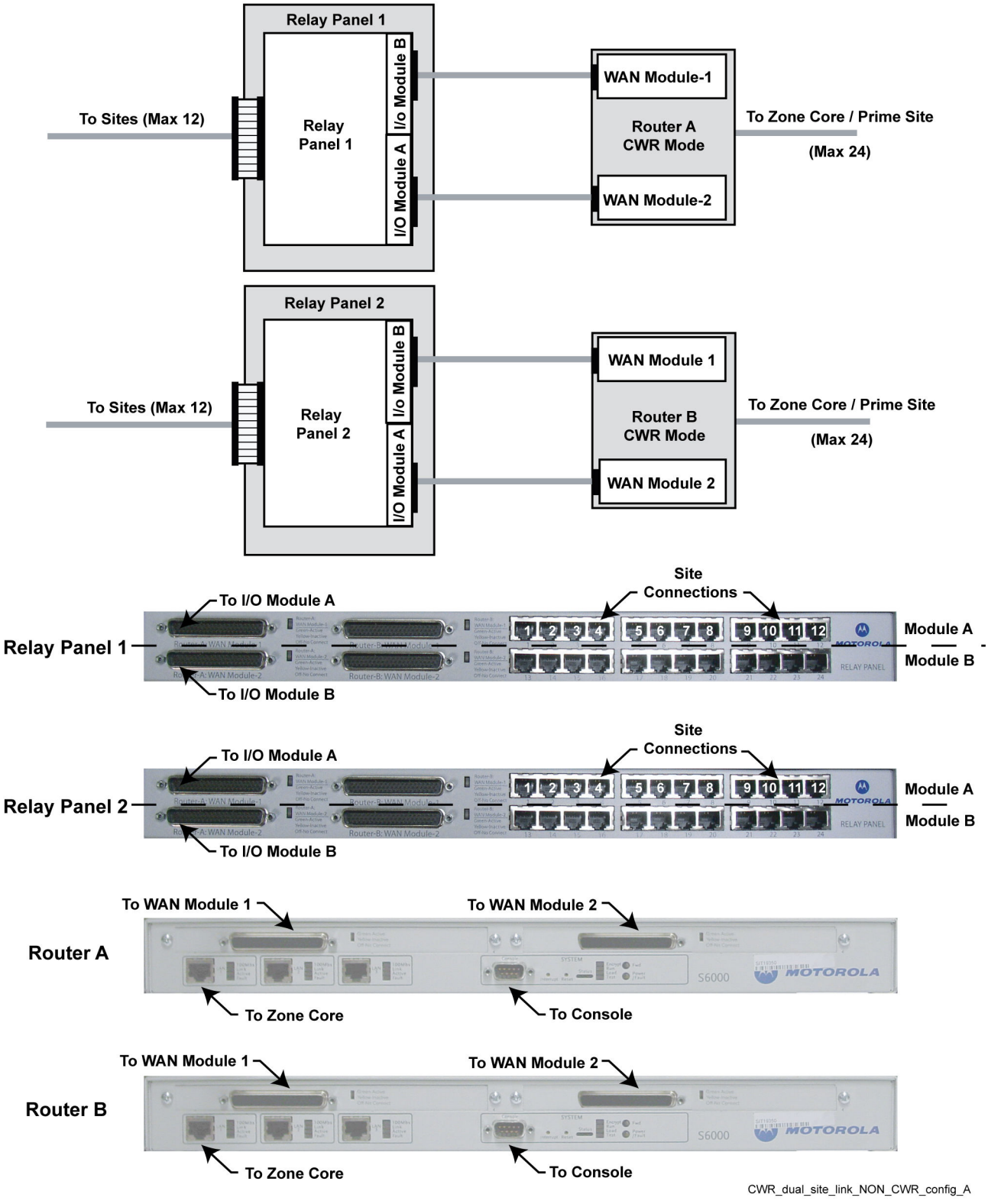
1. Connect the male end of the 12-port relay cable #1 to the 12-port T1/E1 module installed in slot A (WAN port 4) on Router A.
2. Connect the female end of the 12-port relay cable #1 to the upper left WAN connector (labeled Router A WAN Module 1) on the relay panel.
3. Connect the male end of the 12-port relay cable #2 to the 12-port T1/E1 module installed in slot A (WAN port 4) on Router B.
4. Connect the female end of the 12-port relay cable #2 to the upper right WAN connector (labeled Router B WAN Module 1) on the relay panel.
5. Perform one of the following actions:
   - If your application requires 12 or fewer T1/E1 ports, proceed to step 10.
   - If your application requires 13-24 T1/E1 ports, proceed to step 6.
6. Connect the male end of the 12-port relay cable #3 to the 12-port T1/E1 module installed in slot B (WAN port 5) on Router A.
7. Connect the female end of the 12-port relay cable #3 to the lower left WAN connector (labeled Router A WAN Module 2) on the relay panel.
8. Connect the male end of the 12-port relay cable #4 to the 12-port T1/E1 module installed in slot B (WAN port 5) on Router B.
9. Connect the female end of the 12-port relay cable #4 to the lower right WAN connector (labeled Router B WAN Module 2) on the relay panel.
10. Connect the T1/E1 ports on the right of the relay panel to the appropriate T1/E1 ports on the device on the other side of the site or InterZone link.

3.3
Core Routers to the Relay Panel Connection for a Dual Site Link Configuration

The 12-port T1/E1 modules connect to the relay panel through 12-port relay cables. For more information, see 12-Port T1/E1 Module and Relay Panel Connectors on page 25 for connector pinouts.

3.3.1
CWR Core Router Pair Connections for a Dual Site Link

Figure 20: CWR Core Router Pair Connections for a Dual Site Link



3.3.2
Connecting the Core Routers to the Relay Panel for a Dual Site Link Configuration (24 Dual Links)

Procedure:

1. Connect the male end of the 12-port relay cable #1 to the 12-port T1/E1 module installed in slot A (WAN port 4) on Router A.
2. Connect the female end of the 12-port relay cable #1 to the upper left WAN connector (labeled Router A WAN Module 1) on relay panel #1.
3. Connect the male end of the 12-port relay cable #2 to the 12-port T1/E1 module installed in slot B (WAN port 5) on Router A.
4. Connect the female end of the 12-port relay cable #2 to the lower left WAN connector (labeled Router A WAN Module 2) on relay panel #1.
5. Connect the male end of the 12-port relay cable #3 to the 12-port T1/E1 module installed in slot A (WAN port 4) on Router B.
6. Connect the female end of the 12-port relay cable #3 to the upper right WAN connector (labeled Router B WAN Module 1) on relay panel #2.
7. Connect the male end of the 12-port relay cable #4 to the 12-port T1/E1 module installed in slot B (WAN port 5) on Router B.
8. Connect the female end of the 12-port relay cable #4 to the lower right WAN connector (labeled Router B WAN Module 2) on relay panel #2.

3.3.3
Connecting the Core Routers to the Relay Panel for a Mix Site Link Configuration (12 single links and 12 dual links)

Procedure:

1. Connect the male end of the 12-port relay cable #1 to the 12-port T1/E1 module installed in slot A (WAN port 4) on Router A.
2. Connect the female end of the 12-port relay cable #1 to the upper left WAN connector (labeled Router A WAN Module 1) on relay panel #1.
3. Connect the male end of the 12-port relay cable #2 to the 12-port T1/E1 module installed in slot B (WAN port 5) on Router A.
4. Connect the female end of the 12-port relay cable #2 to the lower left WAN connector (labeled Router A WAN Module 2) on relay panel #1.
5. Connect the male end of the 12-port relay cable #3 to the 12-port T1/E1 module installed in slot A (WAN port 4) on Router B.
6. Connect the female end of the 12-port relay cable #3 to the lower right WAN connector (labeled Router A WAN Module 2) on relay panel #1.
7. Connect the male end of the 12-port relay cable #4 to the 12-port T1/E1 module installed in slot B (WAN port 5) on Router B.
8. Connect the female end of the 12-port relay cable #4 to the lower right WAN connector (labeled Router B WAN Module 2) on relay panel #2.

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Chapter 4

Cooperative WAN Routing Configuration

This chapter contains the configuration procedures, which are common to all S6000 router applications.

4.1 S6000 Routers Configuration

Motorola Solutions routers are shipped from the factory with the appropriate Enterprise OS (EOS) installed. If you are replacing a router in the field and must load a router configuration file on a new router during installation, see Configuring a Factory-Fresh S6000 Router.

WARNING: Do not tamper with the factory configuration settings for these devices. This includes software configuration, firmware release, password, and physical connections. Motorola Solutions has configured and connected these devices to meet specific performance requirements. Tampering with these devices may result in unpredictable system performance or a catastrophic failure.

4.1.1 Router Configuration Prerequisites

Table 5: Router Configuration Prerequisites

Prerequisite	Details
PC with a terminal emulation program	Service technician's laptop
Ethernet crossover cable	To establish a LAN connection between the PC and the router
DB9 null modem cable	To establish console access between the PC and the router
Appropriate router configuration file (`boot.cfg`, `StaticRP.cfg`, and `acl.cfg`) for the router you are installing or replacing	Can be obtained from a CD that shipped with your system, from your service PC if previously downloaded from Unified Network Configurator (UNC), or obtained in another way from the factory. **NOTICE:** For information on downloading router configuration files from the UNC, see the *Unified Network Configurator Online Help*.
Account logins and passwords	Contact your system administrator.

4.1.2 Configuring a Factory-Fresh S6000 Router

Prerequisites: Obtain the following items and information:

- A PC (service technician's laptop) with a terminal emulation program
- An Ethernet crossover cable to establish a LAN connection between the PC and the router
- A DB9 null modem cable to establish console access between the PC and the router

- An appropriate router configuration file (boot.cfg, StaticRP.cfg, and acl.cfg) for the router you are installing or replacing

  NOTICE: This can be obtained from a CD that shipped with your system, from your service PC if previously downloaded from Unified Network Configurator (UNC), or obtained in another way from the factory. For information on downloading router configuration files from the UNC, see the *Unified Network Configurator Online Help*.

- Account logins and passwords from your system administrator

Procedure:

1. Assign the following IP address and subnet mask to the LAN card on the PC used for configuration:
   - **IP Address**: 20.0.0.1
   - **Subnet Mask**: 255.255.255.0
2. Perform the following actions:
   a. Connect Ethernet crossover cable between the LAN card on the PC and the LAN 1 port on the replacement router. The crossover cable crosses over pins 1 and 2 to pins 3 and 6.
   b. Connect null modem cable between the serial port on the laptop and the console port on the replacement router.
3. Power up the replacement router and connect to it using a terminal emulation program (such as ProComm or HyperTerminal).
4. In the terminal emulation program, perform the following actions:
   a. Enter the `9600 baud rate` value.
   b. Enter the `8 bit` value.
   c. Enter the `No parity` value.
   d. Enter the `One stop bit` value.
5. Press ENTER.

   The `NetLogin:` prompt appears.
6. At the `NetLogin:` prompt, enter: `root`

   The `password:` prompt appears.
7. Press ENTER.

   The `EnterpriseOS#` prompt appears.
8. Verify that the replacement router is unconfigured (no IP addresses are assigned to any of the ports):
9. Enter: `sh -ip net`
10. If any IP addresses are listed, enter: `del –ip net`
11. Enter the following command to configure an IP address for the replacement router: `setd !1 –ip net = 20.0.0.2 255.255.255.0`

    NOTICE: The character after `!` is a number one, not a lowercase L.

    The IP address is assigned to the PC's LAN card and to the replacement router so that the router's IP address is on the same subnet as the PC used to configure this router.

12 Select and run the **3Com TFTP Server** application from the Windows Program menu.

The **3Com 3C** Server window appears

13 From the TFTP tool bar, click **Setup**.

The 3C Server Configuration dialog box appears.

14 Select the **TFTP Configuration** tab.

The TFTP Configuration tab appears.

15 Ensure that the router configuration is on the laptop computer, and that you know its location.

16 In the TFTP Configuration tab:

a Click **Browse Directories**.

b Select the directory containing the router configuration files.

c Click **OK**.

17 Return to the terminal emulator program and locate the `EnterpriseOS#` prompt.

18 Transfer the required router configuration files to the replacement router by performing the following actions:

a Enter: `copy 20.0.0.1:<.cfg file name> a:/primary/boot.cfg`

b Enter: `copy 20.0.0.1:<.cfg file name> a:/primary/StaticRP.cfg`

c Enter: `copy 20.0.0.1:<.cfg file name> a:/primary/acl.cfg`

Where ***<.cfg file name>*** is the name of the router configuration file specific to the router that you are replacing. For example, the configuration file for core router 1 in zone 1 is **z00core01.cfg**.

The router configuration files are transferred to the router and named boot.cfg, StaticRP.cfg, and acl.cfg.

19 Ensure that the account password is set to the same value as the replaced device.

20 Reboot the replacement router and verify that the correct configuration files are loaded:

21 Power down the router, disconnect the TFTP computer, connect all system communication cables to the router, and power on the router.

The router reboots using the new configuration files. The IP address previously assigned to the router is replaced with the IP address specific to that router in the system.

22 On systems with the MAC port locking, disable the locking and then re-enable the locking with the MAC address of the new router. For instructions on how to disable and enable the MAC port locking, see Setting Up Information Assurance.

23 On systems with link encryption or protocol authentication, enter the correct keys for the new router to be authenticated by its encryption or authentication peer. For instructions, see the *Link Encryption and Authentication Feature Guide*.

24 On systems with SNMPv3 enabled, enable passphrase information. For procedures to enable passphrases, see the *SNMPv3 Feature Guide*.

25 Upload the device configuration and hardware information from the router to the UNC. See “Scheduling the Pull of Device Configurations” in the *Unified Network Configurator User Guide*.

26 Verify that the router is operating properly.

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Chapter 5

Cooperative WAN Routing Maintenance

The relay panel and routers maintenance involves only external cleaning and no other procedures.

5.1 Maintenance Procedures

There are no maintenance procedures required for the Cooperative WAN Routing equipment.

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Chapter 6

Cooperative WAN Routing Troubleshooting

This chapter describes the hardware failures in Cooperative WAN Routing (CWR). The CWR solution provides a mechanism for redundant pairs of core and exit routers to directly failover non-redundant T1/E1 links between the router pair.

6.1 Relay Panel Failure

The relays are latching and retain their last state during power failures or loss of communications with the core/exit routers. There is no loss of connectivity.

6.2 Core Router Failure

Each S6000 core router contains up to 24 T1/E1 ports. The routers are deployed in pairs as Active and Inactive. The core router failures are as follows:

- The connection between the Active router and the relay panel fails. The router hardware detects it. Once the failure is detected, a signal is sent to the relay to switch all associated ports to the Inactive router.
- Individual site or InterZone links fail. These failures do not cause switching between the routers.
- The Active router fails completely. The Inactive router detects it through the communication between the two routers. Once the failure is detected, the Inactive router switches all the relays to itself, and becomes the Active router.
- If the relay panel sustains total damage, it is possible to lose all the sites connected to the panel. However, power failures and communication failures to the panel leave all site links connected to one of the core routers.

For more information on removing and replacing the failed routers, see the *S6000 and S2500 Routers Feature Guide*.

6.2.1 Core Router Recovery

Core routers are implemented as Active and Inactive, to reduce packet loss during core router recoveries. Switchovers occur during failures, but they can also be initiated externally. So, if one router is operational (Active) and another becomes available (Inactive), it does not force a relay switchover, but is instead designated as Inactive. Since there is only one path to the sites at a time, there is no need to manually switch back to the router that was previously Active.

Even though a router is designated as “Inactive”, its TLAN ports and Protocol Independent Multicast (PIM)-SM RP are active and in use by the system. This helps distribute the multicast RP functionality and reduce switchover time because Open Shortest Path First (OSPF) and Border Gateway Protocol (BGP) peering can be established. It also allows for active WAN ports on both routers for redundant links.

6.2.2
Core Router WAN Cable or Port Failure

During an Active core router WAN cable or port failure, the Active core router detects the failure through the loopback in the relay panel.

6.2.3
Core Router WAN Cable or Port Recovery

After detecting the Active core router WAN cable or port failure, the active core router automatically switches the relay over to the secondary core router. The IP address and DLCI are the same as the first core router.

6.2.4
Software Control

When the Active core router fails, the Inactive router detects the failure through a proprietary protocol between the routers, and switches all ports to itself. Since the relay control connection is included with the WAN port cable between the router and the relay panel, the software deals with a failure of all these connections. If this connection fails on the Active router, the relays then switch to the inactive router.

6.3
Exit Router Failure

Each S6000 exit router contains up to 24 T1/E1 ports. The routers are deployed in pairs as Active and Inactive. The two basic exit router failures are as follows:

- The connection between the Active router and the relay panel fails. The router hardware detects it. Once it is detected, a signal is sent to the relay to switch all associated ports to the Inactive router.
- The Active router fails completely. The Inactive router detects it through the proprietary communication between the two routers. Once the failure is detected, the Inactive router switches all the relays to itself and becomes the Active router. The WAN link on the newly active exit router becomes active.

NOTICE: For more information on removing and replacing failed routers, see the *S6000 and S2500 Routers Feature Guide*.

6.3.1
Exit Router Recovery

Exit routers are implemented as Active and Inactive, to reduce packet loss during exit router recoveries. Switchovers occur during failures, but they can also be initiated externally. So, if one router is operational (Active) and another becomes available (Inactive), it does not force a relay switchover, but is instead designated as Inactive. Since there is only one path to the sites at a time, there is no need to switch back to the recovered exit router.

6.3.2
Exit Router WAN Port or Cable Recovery

A switchover occurs when it is initiated externally.

6.4

CWR – Troubleshooting Tools

The tools used for troubleshooting CWR are as follows:

- Unified Network Configurator
- InfoVista
- Local Router Administration

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Chapter 7

Cooperative WAN Routing FRU/FRE Procedures

This chapter describes the FRU/FRE procedures for Cooperative WAN Routing (CWR).

7.1 CWR Field Replaceable Units

Table 6: CWR Field Replaceable Units

Component Type	Part Number	Replacement Procedure
S6000 multi-port core/exit router	ST6000B	See S6000 Routers Replacement
12-port T1/E1 WAN module, or	ST6615	See Installing 12-Port T1/E1 Modules on page 45
12-port T1/E1 II WAN module	ST6618	
CWR Relay panel	ST6700	See Replacing the Relay Panel
Cable	DKN6129	See Replacing the Cable

NOTICE: Each CWR FRU item is orderable as a part only.

7.2 Removing or Replacing the CWR–Enabled Router

Process:

1. Power down the old router, disconnect it from the relay panel, and remove it from the rack.
2. If necessary, install the 12-port T1/E1 module in the router. See Installing 12-Port T1/E1 Modules.
3. Install the router. See Replacing S6000 Routers.
4. Connect the router to the relay panel. Follow the procedure that pertains to your site configuration:
   - Connecting the Core Routers to the Relay Panel for a Single Site Link Configuration
   - Connecting the Core Routers to the Relay Panel for a Dual Site Link Configuration (24 Dual Links)
   - Connecting the Core Routers to the Relay Panel for a Mix Site Link Configuration (12 single links and 12 dual links)
5. Power on the routers. Ensure that the appropriate version of EOS software and the correct configuration files are loaded on the new router.

7.2.1

S6000 Routers Replacement

WARNING: The S6000 routers contain dangerous voltages which can cause electrical shock or damage to equipment. Turn off the router and remove the power cabling when servicing this equipment.

IMPORTANT: The router must be powered down before servicing, and before replacing any interface modules from the router. Powering down a router causes network services to and from the supported site to be suspended until the router is replaced and brought back into service. Wide area voice traffic and networking services should not be affected, but the traffic capacity that can be handled may be reduced until the router is brought back into service.

NOTICE: Locate the account login and passwords for **root** before performing this procedure. Contact your system administrator for this information.

7.2.1.1

Replacing S6000 Routers

Prerequisites: Locate the account login and passwords for root before performing this procedure. Contact your system administrator for this information.

Procedure:

1. Wear an Electrostatic Discharge (ESD) strap and connect its cable to a verified good ground. This strap must be worn throughout this procedure to prevent ESD damage to any components.
2. Power down the existing router by disconnecting the power cable from the router.

   WARNING: Shock hazard: The router contains dangerous voltages which can cause electrical shock or damage to equipment. Turn off the router and remove the power cabling when servicing this equipment.
3. Remove the existing router:
   a. Label and disconnect all communication cabling from the router.
   b. Disconnect the ground cable from the rear of the chassis.
   c. Remove the screws securing the router to the rack.
   d. Pull out the router through the front of the rack.
4. Remove the mounting brackets from the existing router and install the brackets on the replacement router.
5. Install the replacement router:
   a. Install the replacement router into the rack and secure it with the screws that were previously removed.
   b. Secure the ground cable to the ground location on the rear of the chassis.
6. Power up the replacement router by reconnecting the power cable to the router.
7. Assign the following IP address and subnet mask to the LAN card on the PC used for configuration:
   - **IP Address**: 20.0.0.1
   - **Subnet Mask**: 255.255.255.0
8. Connect the following cables between the PC and the replacement router:
   - Ethernet crossover cable between the LAN card on the PC and the LAN 1 port on the router. The crossover cable crosses over pins 1 and 2 to pins 3 and 6.
   - Null modem cable between the serial port on the laptop and the console port on the router.

9 Power up the replacement router and connect to it using a terminal emulation program (such as ProComm or HyperTerminal).

10 Configure the terminal emulation program to use the following settings:

   a Enter the `9600 baud rate` value.

   b Enter the `8 bit` value.

   c Enter the `No parity` value.

   d Enter the `One stop bit` value.

11 Press ENTER.

   The `NetLogin:` prompt appears.

12 At the `NetLogin:` prompt, enter: `root`

   The password prompt appears.

13 The `password:` prompt appears. Press ENTER.

   The `EnterpriseOS#` prompt appears.

14 Verify that the replacement router is unconfigured (no IP addresses are assigned to any ports):

15 Enter: `sh –ip net`

16 If any IP addresses are listed, enter: `del –ip net`

17 Configure an IP address for the replacement router by entering: `setd !1 –ip net = 20.0.0.2 255.255.255.0`

   NOTICE: The character after `!` is a number one, not a lowercase L.

   The IP address is assigned to the PC's LAN card and to the replacement router so that the router's IP address is on the same subnet as the PC used to configure this router.

18 Select and run the **3Com TFTP Server** application from the Windows Program menu.

   The **3Com 3C Server** window appears.

19 From the TFTP tool bar, click **Setup**.

   The **3C Server Configuration** dialog box appears.

20 Select the **TFTP Configuration** tab.

   The **TFTP Configuration** tab appears.

21 Ensure that the router configuration is on the laptop computer, and that you know its location.

22 In the TFTP Configuration tab:

   a Click **Browse Directories**.

   b Select the directory containing the router configuration files.

   c Click **OK**.

23 Return to the terminal emulator program and locate the `EnterpriseOS#` prompt. Transfer the required router configuration files to the replacement router:

   a Enter: `copy 20.0.0.1:<.cfg file name>a:/primary/boot.cfg`

   b Enter: `copy 20.0.0.1:<.cfg file name> a:/primary/StaticRP.cfg`

   c Enter:

```
copy 20.0.0.1:<.cfg file name> a:/primary/acl.cfg
```

Where ***<.cfg file name>*** is the name of the router configuration file specific to the router that you are replacing. For example, the configuration file for core router 1 in zone 1 is `z00core01.cfg`.

The router configuration files are transferred to the router and named `boot.cfg`, `StaticRP.cfg`, and `acl.cfg`.

24 Ensure that the account password is set to the same value as the replaced device.

25 Reboot the replacement router and verify that the correct configuration files are loaded:

26 Make sure that the router boots up and that it is running the new configuration.

27 Power down the router, disconnect the TFTP computer, and connect all system communication cables to the router, and power on the router.

The router reboots, using the new configuration files. The IP address previously assigned to the router is replaced with the IP address specific to that router in the system.

28 On systems with the MAC port locking, disable the locking and then re-enable the locking with the MAC address of the new router. For instructions on how to disable and enable the MAC port locking, see *MAC Port Lockdown Feature Guide*.

29 On systems with link encryption or protocol authentication, enter the correct keys for the new router to be authenticated by its encryption or authentication peer. For instructions, see *Link Encryption and Authentication Feature Guide*.

30 On systems with SNMPv3 enabled, enable passphrase information. For procedures to enable passphrases, see the *SNMPv3 Feature Guide*.

31 Upload the device configuration and hardware information from the router to the UNC. Performing the “Scheduling the Pull of Device Configurations” procedure from *Unified Network Configurator User Guide*.

32 Compare the version of the Enterprise Operating System (EOS) that is running on the replacement router with the version that was running on the replaced device by running the Compare function in the hardware history on the UNC. For instructions, see “Comparing Device Configuration Versions” procedure from *Unified Network Configurator User Guide*.

NOTICE: If the replacement router needs a software upgrade, then perform the “Updating MCC 7500 Voice Processor Module OS and Software” procedure from *Unified Network Configurator User Guide*.

33 Perform the “Rolling Back the Device Configuration to an Archived Version” procedure from *Unified Network Configurator User Guide*.

34 Verify that the replacement router is operating properly.

7.3 Replacing the Relay Panel

Procedure:

1 Power down the routers. Disconnect the power cords from the S6000 router.

WARNING: If the S6000 is configured with redundant power supplies (model numbers lower than CLN1780A), disconnect both power cords to completely remove power from the S6000.

2 Disconnect the RJ-45 connectors.

NOTICE: Before disconnecting, make a note of the locations to which each connector was connected.

3 Disconnect the 12-port T1/E1 module connections.

NOTICE: Before disconnecting, make a note of the locations to which each connector was connected.

4 Remove the faulty relay panel from the rack.

5 Place the new relay panel in the rack.

6 Reconnect all cables.

7 Power up the routers. Reconnect the power cable to each router.

7.4 Replacing the Cable

Prerequisites: Ensure that the relay panel is connected to both CWR peers (core or exit routers) through relay cables. Also, ensure that the 12-port T1/E1 module LED is green on one router (the Active router) and amber on the other router (the Inactive router).

Procedure:

1 Disconnect the faulty cable.

NOTICE: If you disconnect the cable from the connector with the green LED (the Active connection), the relays switch to the other router, and the LED on that router turns green. If you disconnect the cable from the connector with the amber LED (the Inactive connection), the relays do not switch. In either case, the LED corresponding to the connector from which you disconnect the cable, turns off.

2 Replace the cable. The 12-port T1/E1 module LED corresponding to the cable you replaced turns amber.

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Chapter 8

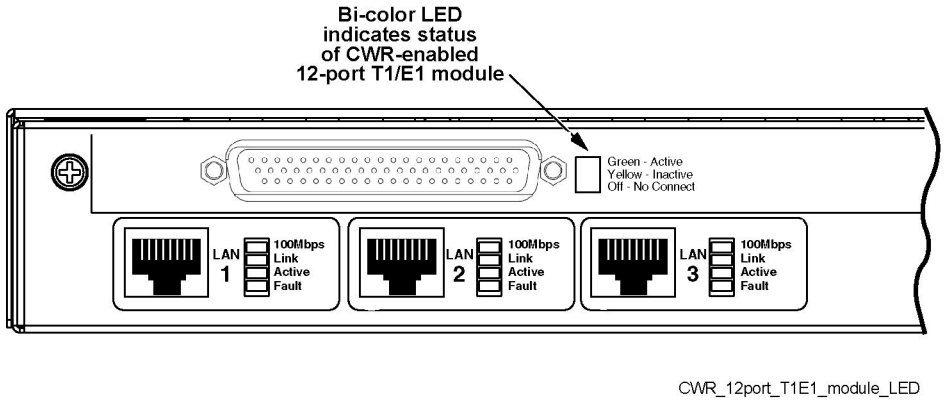
Cooperative WAN Routing Reference

This chapter describes the LEDs of the Cooperative WAN Routing (CWR) solution components.

8.1 12-Port T1/E1 Module LED

The 12-port T1/E1 module features a single bi-color LED.

Figure 21: 12-Port T1/E1 Module LED



CWR_12port_T1E1_module_LED

The LED indicates the CWR status of the module.

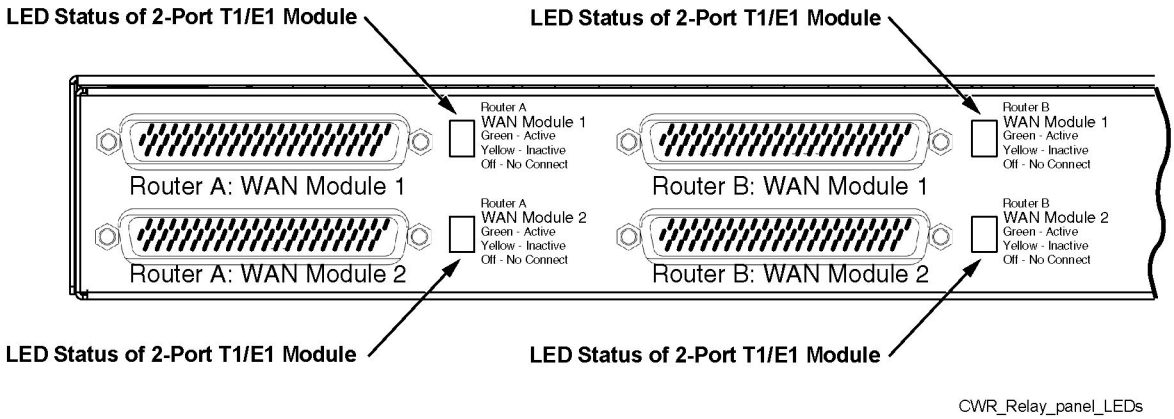
Table 7: 12-Port T1/E1 Module LED

LED	Indication	Status and Troubleshooting Action
Bi-color LED	Green	The module is connected to the relay panel and is functioning as the active router in the router pair.
	Amber	The module is connected to the relay panel and is functioning as the inactive router in the router pair.
	Off	The module is not connected to the relay panel.

8.2 Relay Panel LEDs

The relay panel features four bi-color LEDs, one for each 12-port T1/E1 module to relay panel connection.

Figure 22: Relay Panel LEDs



CWR_Relay_panel_LEDs

Each LED on the relay panel corresponds to a WAN connector, and indicates CWR status of the 12-port T1/E1 module connected to that connector.

Table 8: Relay Panel LEDs

LED	Indication	Status and Troubleshooting Action
Router A WAN module 1 LED Router A WAN module 2 LED Router B WAN module 1 LED Router B WAN module 2 LED	Green	The module is connected to the relay panel and is functioning as the active CWR peer.
	Amber	The module is connected to the relay panel and is functioning as the inactive CWR peer.
	Off	The module is not connected to the relay panel.