# R2MFC Media Bay Module Installation and Configuration Guide

**BCM**

Business Communications Manager

Document Status: **Standard**

Document Number: **NN40010-300**

Document Version: **02.00**

Date: **June 2006**

NORTEL

# North American Regulatory Information

## Safety

This equipment meets all applicable requirements of both the CSA C22.2 No.60950 and UL 60950.

The shock hazard symbol within an equilateral triangle is intended to alert personnel to electrical shock hazard or equipment damage. The following precautions should also be observed when installing telephone equipment.

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when working with telephone lines.

**Danger:** Risk of shock.
Read and follow installation instructions carefully.
Ensure the system and system expansion units are unplugged from the power socket and that any telephone or network cables are unplugged before opening the system or system expansion unit.
If installation of additional hardware and /or servicing is required, disconnect all telephone cable connections prior to unplugging the system equipment.
Ensure the system and system expansion units are plugged into the wall socket using a three-prong power cable before any telephone cables are connected.

**Caution:** Only qualified persons should service the system.
The installation and service of this hardware is to be performed only by service personnel having appropriate training and experience necessary to be aware of hazards to which they are exposed in performing a task and of measures to minimize the danger to themselves or other persons.
Electrical shock hazards from the telecommunication network and AC mains are possible with this equipment. To minimize risk to service personnel and users, the system must be connected to an outlet with a third-wire ground. Service personnel must be alert to the possibility of high leakage currents becoming available on metal system surfaces during power line fault events near network lines. These leakage currents normally safely flow to Protective Earth ground via the power cord. Therefore, it is mandatory that connection to an earthed outlet is performed first and removed last when cabling to the unit. Specifically, operations requiring the unit to be powered down must have the network connections (central office lines) removed first.

## Enhanced 911 Configuration

**Caution:** Warning
Local, state and federal requirements for Emergency 911 services support by Customer Premises Equipment vary. Consult your telecommunication service provider regarding compliance with applicable laws and regulations.

## Radio-frequency Interference

**Warning:** Equipment generates RF energy.
This equipment generates, uses, and can radiate radio-frequency energy. If not installed and used in accordance with the installation manual, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Part 15 of the FCC Rules and with ICES.003, CLASS A Canadian EMI Requirements. Operation of this equipment in a residential area is not permitted and is likely to cause interference.

Repairs to certified equipment should be made by an authorized maintenance facility 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.

## Hearing Aid Compatibility

System telephones are hearing-aid compatible, as defined in Section 68.316 of Part 68 FCC Rules.

## Repairs

In the event of equipment malfunction, all repairs to certified equipment will be performed by an authorized supplier.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Important Safety Instructions

The following safety instructions cover the installation and use of the Product. Read carefully and retain for future reference.

### Installation

**Warning:** To avoid electrical shock hazard to personnel or equipment damage observe the following precautions when installing telephone equipment:

1. Never install telephone wiring during a lightning storm.
2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
4. Use caution when installing or modifying telephone lines. The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product. This symbol on the product is used to identify the following important information: Use only with a CSA or UL certified CLASS 2 power supply, as specified in the user guide.

#### *Use*

When using your telephone equipment, basic safety precautions should always be followed to reduce risk of fire, electric shock and injury to persons, including the following:

1. Read and understand all instructions.
2. Follow the instructions marked on the product.
3. Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
4. Do not use this product near water, for example, near a bath tub, wash bowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool.

5 Do not place this product on an unstable cart, stand or table. The product may fall, causing serious damage to the product.

6 This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.

7 Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.

8 Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.

9 Never spill liquid of any kind on the product.

10 To reduce the risk of electric shock do not disassemble this product, but have it sent to a qualified service person when some service or repair work is required.

11 Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

- **a** When the power supply cord or plug is damaged or frayed.
- **b** If the product has been exposed to rain, water or liquid has been spilled on the product, disconnect and allow the product to dry out to see if it still operates; but do not open up the product.
- **c** If the product housing has been damaged.
- **d** If the product exhibits a distinct change in performance.

12 Avoid using a telephone during an electrical storm. There may be a remote risk of electric shock from lightning.

13 Do not use the telephone to report a gas leak in the vicinity of the leak.

14 **Caution:** To eliminate the possibility of accidental damage to cords, plugs, jacks, and the telephone, do not use sharp instruments during the assembly procedures.

15 Save these instructions.

# International Regulatory Information

| | | |
|---|---|---|
| CE | The CE Marking on this equipment indicates compliance with the following:<br>This device conforms to Directive 1999/5/EC on Radio Equipment and Telecommunications Terminal Equipment as adopted by the European Parliament And Of The Council. |  |

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

Hereby, Nortel Networks declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Information is subject to change without notice. Nortel Networks reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant. This equipment has been tested and found to comply with the European Safety requirements EN 60950 and EMC requirements EN 55022 (Class A) and EN 55024. These EMC limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial and light industrial environment.

***WARNING***

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. The above warning is inserted for regulatory reasons. If any customer believes that they have an interference problem, either because their Nortel Networks product seems to cause interference or suffers from interference, they should contact their distributor immediately. The distributor will assist with a remedy for any problems and, if necessary, will have full support from Nortel Networks.

# Task List

# Contents

# Chapter 1
# Getting started

## About this guide

This guide explains how to install, configure, and maintain the Nortel Networks R2MFC Media Bay Module (R2MFC MBM).

The guide also provides information about the Command Line Interface (CLI) tool used to configure, operate, administer and maintain the R2MFC MBM from a computer.

**Note:** The CLI is separate from the Business Communications Manager (BCM) system configuration tool.

The document contains the following chapters:

Chapter 2, “Overview” —introduces the elements of the R2MFC MBM.

Chapter 3, “Preparing to install the R2MFC MBM” —describes the process of preparing for R2MFC MBM installation.

Chapter 4, “Installing the R2MFC MBM” —describes the process of installing the R2MFC MBM and connecting the R2MFC MBM to the host system.

Chapter 5, “Configuring the R2MFC MBM” —describes the configuration tools and the process of configuring the R2MFC MBM.

Chapter 6, “R2MFC MBM maintenance” —describes the maintenance tools and the process of maintaining the R2MFC MBM.

Chapter 7, “Command line interface” —describes the Command Line Interface and the commands used to configure, operate, administer, and maintain the R2MFC MBM.

## Audience

This guide is intended for BCM administrators who install MBMs.

# Before you begin

This guide assumes the following:

- The host system is installed and initialized and is working correctly.
- The host system is running BCM 2.5 FP 1, or greater.
- Users have a working knowledge of the host system operations.
- All configuration installers have a working knowledge of the Windows operating system and graphical user interfaces.

# Acronyms

The following is a list of acronyms used in this guide.

**Table 1** Acronyms

| Acronym | Description |
|---|---|
| AIS | Alarm Indication Signal |
| ANI | Automatic Number Identification |
| BCM | Business Communication Manager |
| BPV | Bipolar Violations |
| CLI | Command Line Interface |
| CLID | Calling Line Identification |
| CO | Central Office |
| CRC4 | Cyclic Redundancy Check 4 |
| CSU | Channel Service Unit |
| DCH | D-Channel Handler |
| DTMF | Dual Tone Multi-Frequency |
| EEPROM | Electrically Erasable Prorammable Read Only Memory |
| ETSI | European Telecommunications Standards Institute |
| FBER | Frame Bit Error |
| FEBE | Far End Block Error |
| ISDN | Integrated Services Digital Network |
| LFA | Loss of Frame Alignment |
| LMA | Loss of Multiframe Alignment |
| LOS | Loss of Signal |
| MBM | Media Bay Module |
| MFC | Multi-Frequency Compelled |
| MSC | Media Services Card |
| OOF | Out-of-Frame |

**Table 1** Acronyms (Continued)

| Acronym | Description |
|---|---|
| OOM | Out of CRC-4 Multiframe Alignment |
| OOS | Out Of Service |
| PCM | Pulse Code Modulation |
| PRI | Primary Rate Interface |
| RAI | Remote Alarm Indication |

## Symbols and text conventions

These symbols are used to Highlight critical information for the R2MFC MBM system:

**Caution:** Alerts you to conditions where you can damage the equipment.

**Danger:** Alerts you to conditions where you can get an electrical shock.

**Warning:** Alerts you to conditions where you can cause the system to fail or work improperly.

**Note:** A Note alerts you to important information.

**Tip:** Alerts you to additional information that can help you perform a task.

**Security note:** Indicates a point of system security where a default should be changed, or where the administrator needs to make a decision about the level of security required for the system.

**Warning:** Alerts you to ground yourself with an antistatic grounding strap before performing the maintenance procedure.

**Warning:** Alerts you to remove the R2MFC MBM main unit and expansion unit power cords from the ac outlet before performing any maintenance procedure.

These conventions and symbols are used to represent the Business Series Terminal display and.

| Convention | Example | Used for |
|---|---|---|
| Word in a special font (shown in the top line of the display) | Pswd: | Command line prompts on display telephones. |
| Underlined word in capital letters (shown in the bottom line of a two line display telephone) | PLAY | Display option. Available on two line display telephones. Press the button directly below the option on the display to proceed. |
| Dialpad buttons | # | Buttons you press on the dialpad to select a particular option. |

These text conventions are used in this guide to indicate the information described:

| Convention | Description |
|---|---|
| **bold Courier text** | Indicates command names and options and text that you need to enter.<br>Example: Use the **info** command.<br>Example: Enter **show ip** {**alerts**\|**routes**}. |
| *italic text* | Indicates book titles |
| plain Courier text | Indicates command syntax and system output (for example, prompts and system messages).<br>Example: Set Trap Monitor Filters |
| **FEATURE HOLD RELEASE** | Indicates that you press the button with the coordinating icon on whichever set you are using. |

# How to get Help

This section explains how to get help for Nortel products and services.

## Getting Help from the Nortel Web site

The best way to get technical support for Nortel products is from the Nortel Technical Support Web site:

http://www.nortel.com/support

This site provides quick access to software, documentation, bulletins, and tools to address issues with Nortel products. More specifically, the site enables you to:

- download software, documentation, and product bulletins
- search the Technical Support Web site and the Nortel Knowledge Base for answers to technical issues
- sign up for automatic notification of new software and documentation for Nortel equipment
- open and manage technical support cases

## Getting Help over the phone from a Nortel Solutions Center

If you don't find the information you require on the Nortel Technical Support Web site, and have a Nortel support contract, you can also get help over the phone from a Nortel Solutions Center.

In North America, call 1-800-4NORTEL (1-800-466-7835).

Outside North America, go to the following Web site to obtain the phone number for your region:

http://www.nortel.com/callus

## Getting Help from a specialist by using an Express Routing Code

To access some Nortel Technical Solutions Centers, you can use an Express Routing Code (ERC) to quickly route your call to a specialist in your Nortel product or service. To locate the ERC for your product or service, go to:

http://www.nortel.com/erc

## Getting Help through a Nortel distributor or reseller

If you purchased a service contract for your Nortel product from a distributor or authorized reseller, contact the technical support staff for that distributor or reseller.

# Chapter 2
# Overview

This chapter provides an overview of the R2MFC Media Bay Module (R2MFC MBM).

This chapter includes the following information:



The R2MFC MBM is a media bay module (MBM) that provides MFC-R2 connectivity over an E1 trunk. The module works as a converter between Euro-ISDN and MFC-R2 protocols, allowing the MFC-R2 protocol E1 to work directly with the BCM without the use of an external converter. The BCM recognizes the converter as a Euro-ISDN trunk MBM and, therefore, provides all of the functionality on the MFC-R2 E1 that is available on a Euro-ISDN E1. The MFC-R2 trunk is controlled by DIP switches and the Command Line Interface (CLI) on the R2MFC MBM. Figure 1 provides an illustration of the R2MFC MBM.

**Figure 1** R2MFC MBM


## Administration and maintenance tools

R2MFC MBM configuration involves the following:

- Internal link configuration for the PRI internal link to the BCM. The internal link uses preset characteristics and therefore does not require localization.
- External link configuration of the MFC-R2 E1 the external interface to public network. The external link allows for localization in different countries.

External link configuration is performed using the DIP switches on the front of the R2MFC MBM or by using the CLI, which is accessed through a serial port on the faceplate of the R2MFC MBM. Internal link configuration is performed using either Business Element Manager or Unified Manager. Refer to Configuring the R2MFC MBM on page 41 for information on how to use the configuration tools.

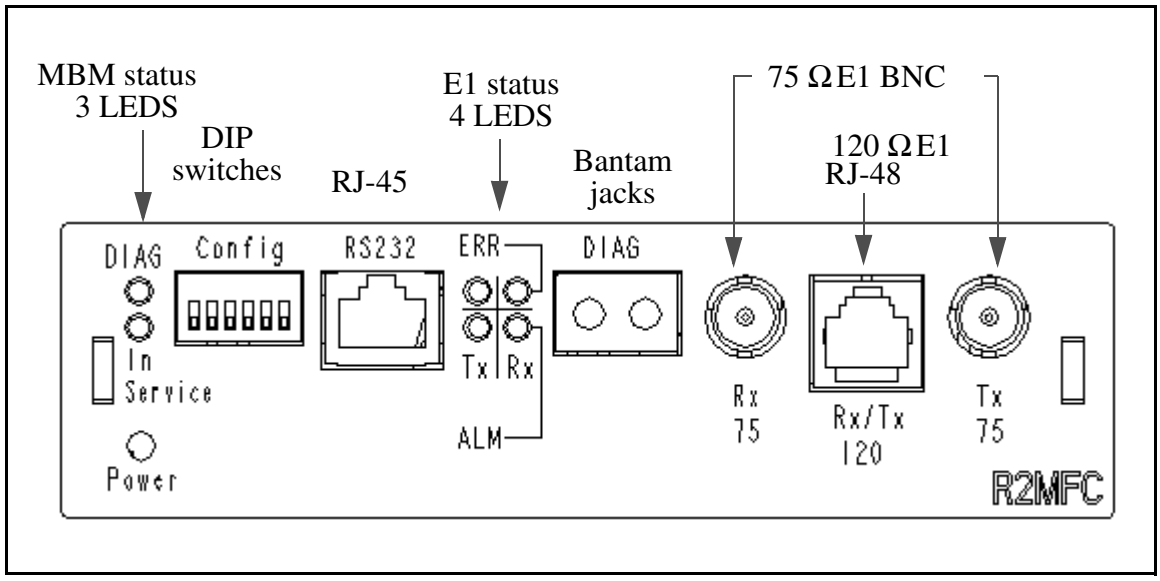
## R2MFC MBM faceplate elements

The faceplate of the R2MFC MBM consists of the following elements:

- "System status LEDs" on page 21
- "Config DIP switches" on page 21
- "RS232 port" on page 22
- "E1 Status LEDs" on page 22
- "Bantam jacks" on page 22
- "BNC and RJ-48 connectors" on page 22

Figure 2 illustrates the placement of these elements.

**Figure 2** R2MFC MBM faceplate



## System status LEDs

The R2MFC MBM has three visual status monitor indicators on the left side of the faceplate. They are

- Power LED—This green LED indicates the status of power to the R2MFC MBM.
- In Service LED—This green LED indicates the status of the E1 signal coming to the R2MFC MBM from the BCM.
- Diag LED—This red LED indicates if the R2MFC MBM is in a diagnostic or loopback mode.

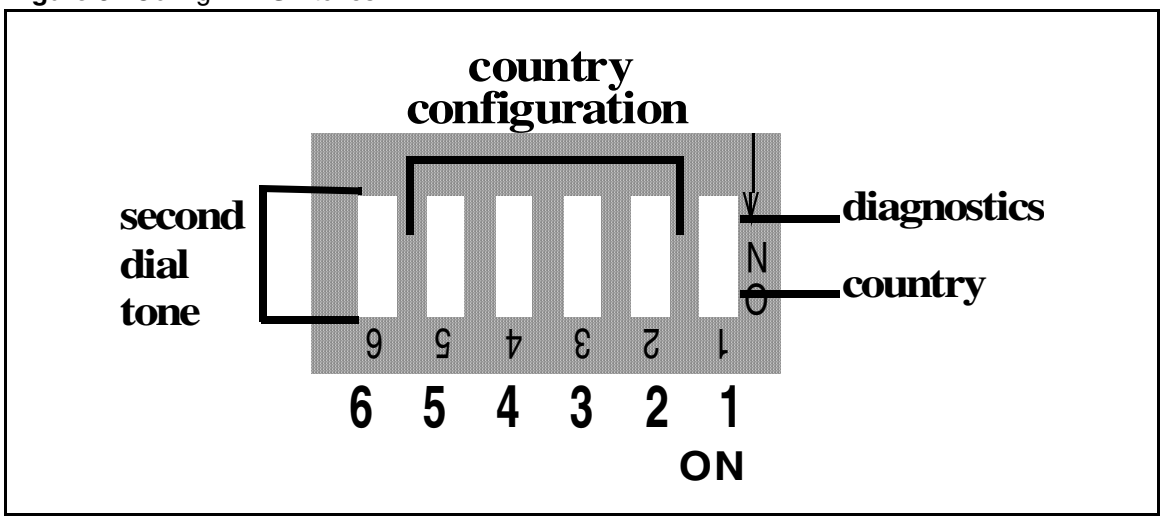
## Config DIP switches

The R2MFC MBM has six config DIP switches on its faceplate. These DIP switches are used to set the following configurations for the R2MFC MBM:

- country
- problem diagnosis
- second dial tone

DIP switches must be set before power is connected to the R2MFC MBM. Figure 3 shows the Config DIP switches.

**Figure 3** Config DIP Switches




For DIP switch values and configuration information, see Configuring the MFCR2 (external) link on page 45.

These DIP switches are also used for problem diagnostics. For specific settings and uses, see Diagnostic tools on page 59.

### RS232 port

There is an RJ-45 serial port connector named RS232 on the faceplate of the R2MFC MBM. The N0026100 cable, shipped with the R2MFC MBM, is used to connect a computer to the RS232 port for advanced configuration or for CLI-based diagnostics of the R2MFC MBM. Appendix D, "CLI cable pinout shows the pinout information to make a new N0026100 cable.

### E1 Status LEDs

The R2MFC MBM has four visual status monitor indicators in the middle section of the faceplate. They are:

- ERR Tx—indicates a Transmit error on the E1
- ERR Rx—indicates a Receive error on the E1
- ALM Tx—indicates a Transmit alarm on the E1
- ALM Rx—indicates a Receive alarm on the E1

### Bantam jacks

The R2MFC MBM contains Bantam Jacks in the middle of the faceplate, to be used for connecting diagnostic equipment. The jacks are labeled DIAG.

### BNC and RJ-48 connectors

The R2MFC MBM has both BNC and RJ-48 external E1 connectors located on the far right of the faceplate. These connectors are used to connect the R2MFC MBM to the Central Office (CO).

The default interface will be based on the country code selected. Mexico is the factory default. See Appendix A, "Config DIP switch settings and definitions for the country code default settings.

## R2MFC MBM back and underside elements

The back and underside of the R2MFC MBM contain the following elements:

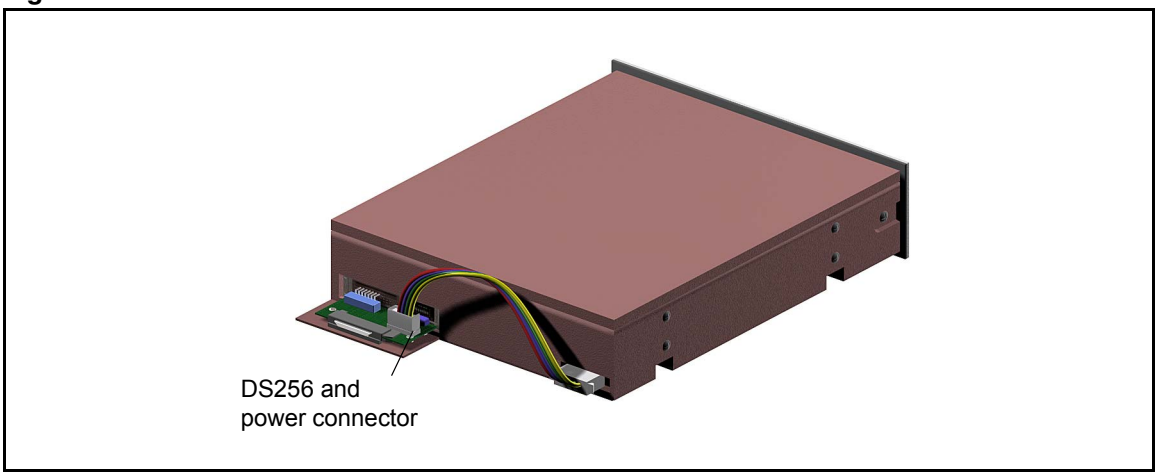

- "Power connectors" on page 23
- "MBM DIP switches" on page 23

## Power connectors

The R2MFC MBM receives its power from the BCM chassis through a power connector on the back of the module.

Figure 4 shows the placement of the power connectors.

**Figure 4** R2MFC MBM back

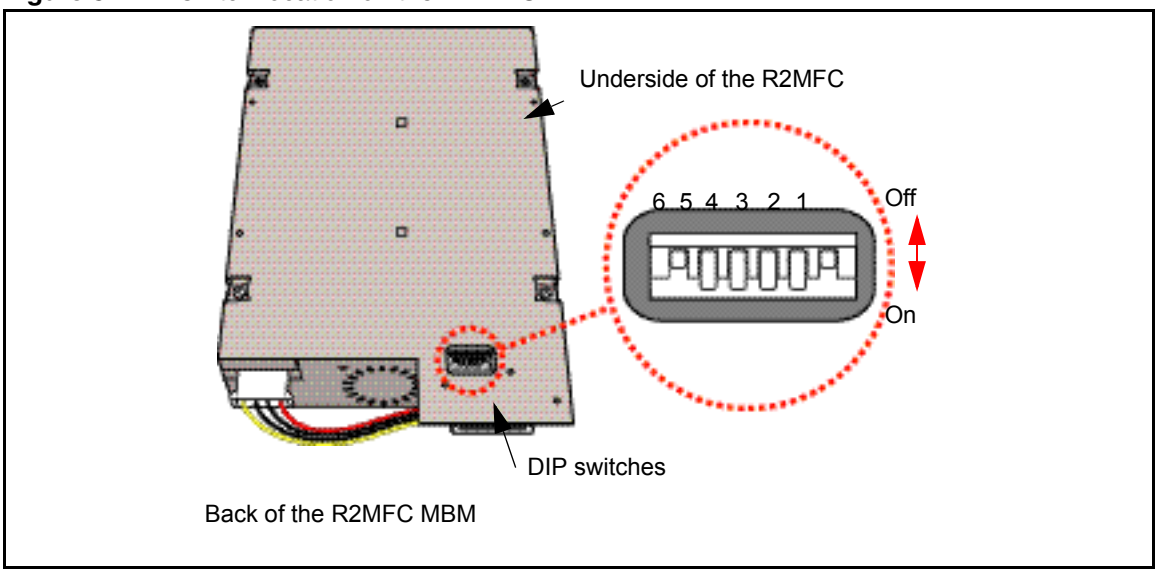



## MBM DIP switches

There are DIP switches located on the underside of the R2MFC MBM. These DIP switches are used to select the DS30 buses from the DS256 bus. These DIP switches must be set before the R2MFC MBM is installed.

Figure 5 shows the location of the DIP switches.

**Figure 5** DIP switch location on the R2MFC MBM



# Chapter 3
## Preparing to install the R2MFC MBM

This chapter provides an overview of the preparation required to install the R2MFC MBM in a host system. (The host system is the BCM system to which the R2MFC MBM connects.)

The information in this chapter is based on the following assumptions:

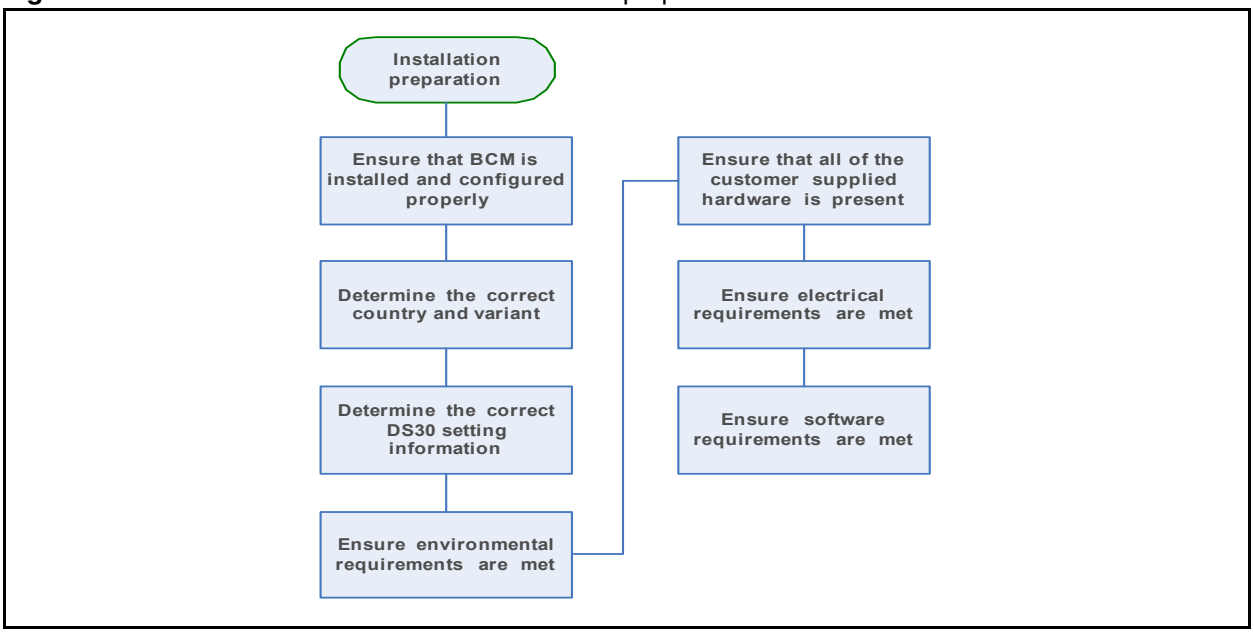
- The host system is installed, initialized, and tested.
- The installer has a working knowledge of the host system and an understanding of telecommunications.

This chapter contains the following information:

# Installation process map

Figure 6 provides an overview of the R2MFC MBM installation preparation.

**Figure 6** Overview of the R2MFC MBM installation preparation




# Host system setup requirements

Table 1 describes the tasks that must be completed on the host system before proceeding with the installation of the R2MFC MBM.

**Table 1** Host system setup requirements

| Task | Location of task information |
|---|---|
| Install host system | BCM: Installation and Maintenance Guides |
| Determine if host system has enough system capacity | BCM: Installation and Maintenance Guides |
| Configure E1 Settings | BCM: Programming Guide |

# R2MFC MBM setup requirements

This section provides the following information about the setup requirements for the R2MFC MBM:



## Config DIP switches

Determine and set the Config DIP switches to the correct country code, and second dial tone setting for the R2MFC MBM. Predefined country codes are set by the Config DIP switches. Special configurations are set through the CLI. See "Configuring the MFCR2 (external) link" on page 45 for a procedure on how to set the DIP switches for a predefined country code or how to create a special configuration to meet the installation needs.

The default country code setting is Mexico config 1. See , "Config DIP switch settings and definitions," on page 85 for a list of the available country codes, the country default settings, and the second dial tone settings.

Second dial tone, when turned on, generates and supplies a second dial tone to the end user, after the end user dials the trunk access code. The end user hears a dial tone between the last digit of the access code, indicating that a line was accessed. See "Turning on second dial tone" on page 54 for a procedure on how to set the DIP switches, and configure the BCM for second dial tone to work properly.

## MBM DIP switches

Before the R2MFC MBM is installed, DS30 buses and offsets must be set by DIP switches. Use the six DIP switches on the underside of the R2MFC MBM, behind the power connector.

The R2MFC MBM occupies two DS30 buses from the DS256 bus; however, only the first is actually used. Buses 1 and 8 are reserved for internal BCM communications. Therefore, the R2MFC MBM DIP switches can only be set to use buses 2 through 6 on a 2/6 split or buses 2 through 5 on a 3/5 split. If there are not enough DS30 resources available, an expansion module can be installed to provide the extra resources required. For information about setting DIP switches and installing an expansion module, refer to the BCM installation and maintenance guides supplied with the host system.

## Environment checklist

The R2MFC MBM environmental requirements are covered by the host system environment setup. See the BCM Installation and Maintenance guide supplied with the host system for details of environmental requirements.

### Electrical requirements

The R2MFC MBM power is supplied through the chassis on the host sytem. See the BCM Installation and Maintenance guide supplied with the host system for details of the electrical requirements.

### Software requirements

R2MFC MBM firmware upgrades will be posted at *www.nortel.com* under Support & Training > Technical Support > Software Downloads. Access this web site to see if there is a newer version of firmware available than the firmware shipped on the R2MFC MBM. See "Upgrading firmware" on page 65 for information on how to upgrade to the latest release of firmware.

## Customer supplied hardware requirements

The following equipment is required to install of the R2MFC MBM:

- Computer with monitor and serial port for access to the CLI.
- E1 connection from local telephony service provider. Full description of the signaling provided over the E1 by the CO.

# Chapter 4
## Installing the R2MFC MBM

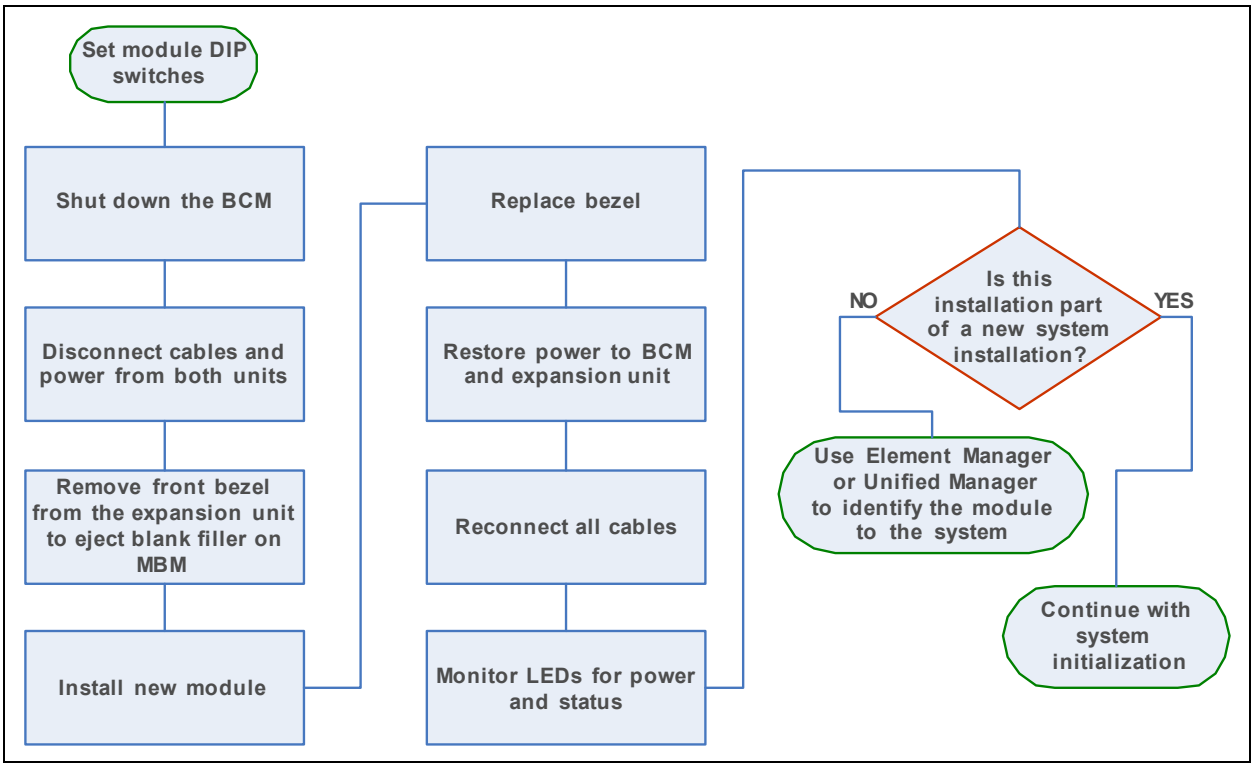
This chapter describes how to install and remove an R2MFC MBM in a host BCM system.

This chapter provides the following installation and removal procedures:



Figure 7 provides an overview of the steps for installing the R2MFC MBM.

**Figure 7** Overview of the R2MFC MBM installation



# Shutting down the system

Before you shut down the system or perform any maintenance procedures, read the following warnings to ensure you and your system are properly protected.

**Warning:** If you are installing a new BCM or an expansion unit, refer to the installation and maintenance guide for the host system for instructions about installing a new system before you connect the system to the AC power outlet.

**Warning:** Failure to follow procedures to properly disconnect the BCM and expansion unit can result in module or system damage.

**Warning:** Ensure you are properly grounded before handling modules or any components that are part of the BCM hardware.

How you shut down your system depends on the version of BCM system you are running. Use one of the following procedures to shutdown your BCM system in preparation for installing the R2MFC MBM.

- "Shutting down a BCM system using Business Element Manager"
- “Shutting down a BCM using Unified Manager” on page 31

## Shutting down a BCM system using Business Element Manager

Shutting down a BCM system using Business Element Manager is a two step process. First you must shut down the system software, then you must shut down the system hardware.

### Shutting down the BCM system software using Business Element Manager

1 If you are adding or replacing an R2MFC MBM in an active system, perform the following steps:

   **a** Access Business Element Manager.

   **b** Select **Administration > Utilities > Reset > Shutdown System**.

   This action stopa all services. All Business Element Manager sessions are disconnected from the system. You can restore the BCM system to service only by powering the BCM system off and back on again.

   **c** Click **Ok**.

   The progress update dialog box appears and the BCM system begins the shutdown process. When the shutdown process is complete, the final warning dialog box appears, and the LEDs enter the flashing state.

d Click **Ok** to disconnect Business Element Manager.

When the shutdown BCM is disconnected, the system gives an audible beep. The LEDs remain in the flashing state until the hardware is shutdown (see "Shutting down the BCM system hardware" on page 31).

If the system hardware is not shutdown within about 15 minutes, it automatically boots up again.

## Shutting down the BCM system hardware

**Warning:** Remove all of the connections to the BCM system before you power down the system. Failure to disconnect lines before you power down the system can cause damage to the system.

1 Remove the DS256 cables from the front of the BCM main unit and, if present, the expansion unit. This includes the data connections on the MSC.

Mark the cables to ensure correct reconnection.

**Warning:** You must disconnect power from the main unit after you have performed an Business Element Manager shutdown. The main unit cannot start operating again until after power has been disconnected and then reconnected.

2 Turn off the power switch located on the BCM main unit and expansion unit.

3 Disconnect the BCM main unit and expansion unit power cords from the AC outlet.

4 Ensure you have room to access the part you are working on. Remove the BCM main unit from the rack, if necessary.

## Shutting down a BCM using Unified Manager

1 If you are adding or replacing an R2MFC MBM in an active system, perform the following steps:

a Access the Unified Manager.

b Choose **System**.

c Select the **Logoff** menu and then click **Shutdown**.

d Click **Yes**.

e Wait until the Status changes to **Complete! It is safe to turn off the system**.

f Click **Done**.

g Exit the Unified Manager.

2 Attach one end of the grounding strap to your wrist and the other end to a grounded metal surface.

3 Ensure the cables connected to the front of the BCM and the expansion unit are clearly marked as to how they are connected.

4 Disconnect the BCM and expansion unit power cords from the AC outlet.

5 Remove the cables from all the R2MFC MBMs and the media services card (MSC) on the BCM base function tray and the expansion unit (if attached).

# Installing an R2MFC MBM

Follow the procedures in this section to install an R2MFC MBM in a BCM platform base chassis or expansion unit.

## Installing an R2MFC MBM in the BCM platform base chassis

Perform the following steps to install an R2MFC MBM in the BCM platform base chassis:

**Caution:** Only install the R2MFC MBM when the system is powered down. See "Shutting down the system" on page 30.

1 Ensure that both the faceplate and underside DIP switches on the R2MFC MBM are set correctly. For information on how to set the faceplate switches, refer to "Setting Config DIP switches" on page 45. For information about how to set the underside switches, refer to the installation and maintenance guide for the host BCM.

2 Select an open media bay.

3 With the face of the R2MFC MBM facing toward you, insert the R2MFC MBM into the open bay.

4 Push the R2MFC MBM completely into the unit. You will hear a click when the module is firmly seated in the media bay.

## Installing an R2MFC MBM in the expansion unit

Perform the following steps to install an R2MFC MBM in the BCM expansion unit chassis. Install the R2MFC MBM when the system is powered down:

**Caution:** Only install the R2MFC MBM when the system is powered down. See "Shutting down the system" on page 30.

**Warning:** Failure to follow procedures to properly disconnect the BCM and expansion unit can result in module or system damage.

1 Ensure that both the faceplate and underside DIP switches on the R2MFC MBM are set correctly. For information on how to set the faceplate switches, refer to "Setting Config DIP switches" on page 45. For information about how to set the underside switches, refer to the installation and maintenance guide for the host system.

2 Remove the front bezel from the expansion unit.

3 Select an open media bay.

4 With the faceplate of the R2MFC MBM facing toward you, insert the R2MFC MBM into the open bay. Ensure that any cables at the rear of the module are clear of the platform base chassis.

5 Push the R2MFC MBM into the unit. You will hear a click when the module is firmly seated in the media bay.

6 Install the front bezel on the expansion unit.

## Reconnecting the equipment

After you install the module correctly into the bay, you must return the equipment to operation.

**Caution:** Complete the following steps carefully to ensure you return your system to operation without endangering the equipment or yourself.

1 Plug the power cords for the BCM and any expansion units back into the AC outlets.

**Note:** The Business Communications Manager system starts up when you connect the AC power cord. System startup takes several minutes to complete.

2 Connect the cables to the proper outlets on the R2MFC MBM and the MSC on the BCM.

3 Check that the LEDs on the newly installed R2MFC MBM are on and indicating the correct state. Refer to "Faceplate LEDs" on page 62 for a detailed description of the LED states.

4 Confirm that the BCM is functioning properly by testing to make sure it works the same as it did before installing the R2MFC MBM.

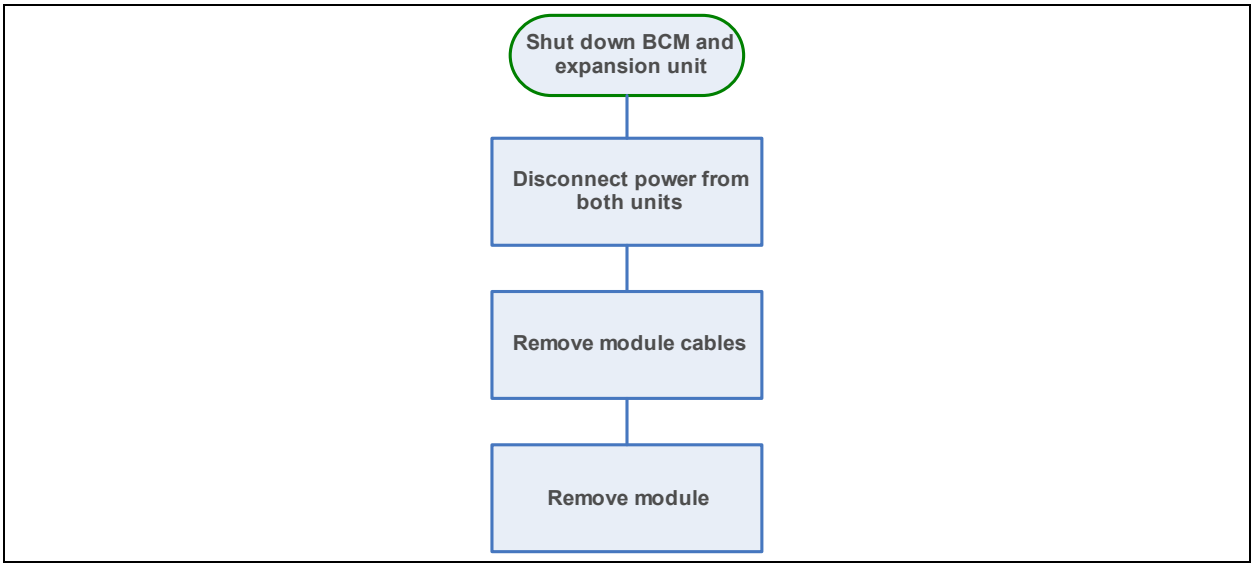
5 Configure the module. Refer to Chapter 5, "Configuring the R2MFC MBM," on page 41 for details.

# Removing an R2MFC MBM

Follow the procedures in this section to remove an R2MFC MBM from a BCM platform base chassis or expansion unit.

Figure 8 provides an overview of the process for removing an R2MFC MBM.

**Figure 8** Overview of removing an R2MFC MBM




## Removing an R2MFC MBM from the BCM platform base chassis

Perform the following steps to remove an R2MFC MBM from the BCM platform base chassis. Remove the R2MFC MBMs after the system is powered down.

1. Power-down the BCM system (see "Shutting down the system" on page 30).
2. Remove any cabling from the R2MFC MBM faceplate.
3. Grasp the right edge of the MBM ejector lever with your thumb, index, and middle fingers. Pull outward to partially eject the R2MFC MBM. Pull further on the lever to eject the R2MFC MBM from the bay. Figure 9 on page 35 shows how to remove a BCM 200 R2MFC MBM. Figure 10 on page 35 shows how to remove a BCM 400 R2MFC MBM.
4. Grasp the top and bottom edges of the R2MFC MBM. Remove the R2MFC MBM from the BCM platform base chassis MBM bay (see Figure 9 on page 35 and Figure 10 on page 35). Place the R2MFC MBM in a clean, safe, and static-free area.

**Figure 9** How to remove a BCM200 R2MFC MBM

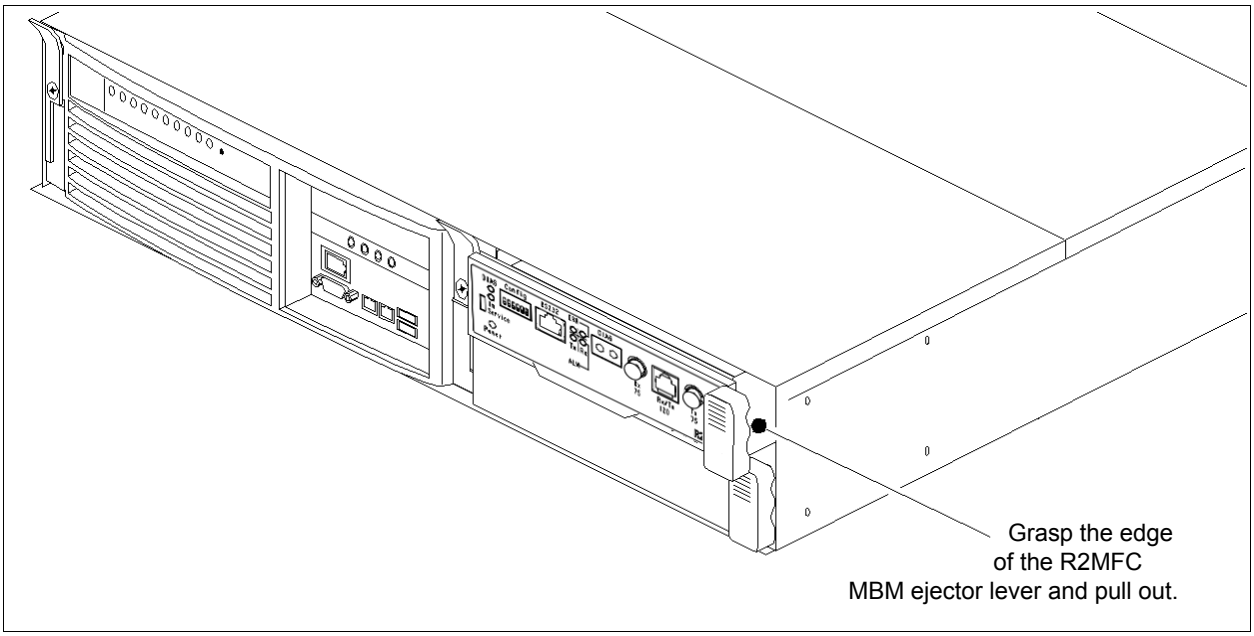
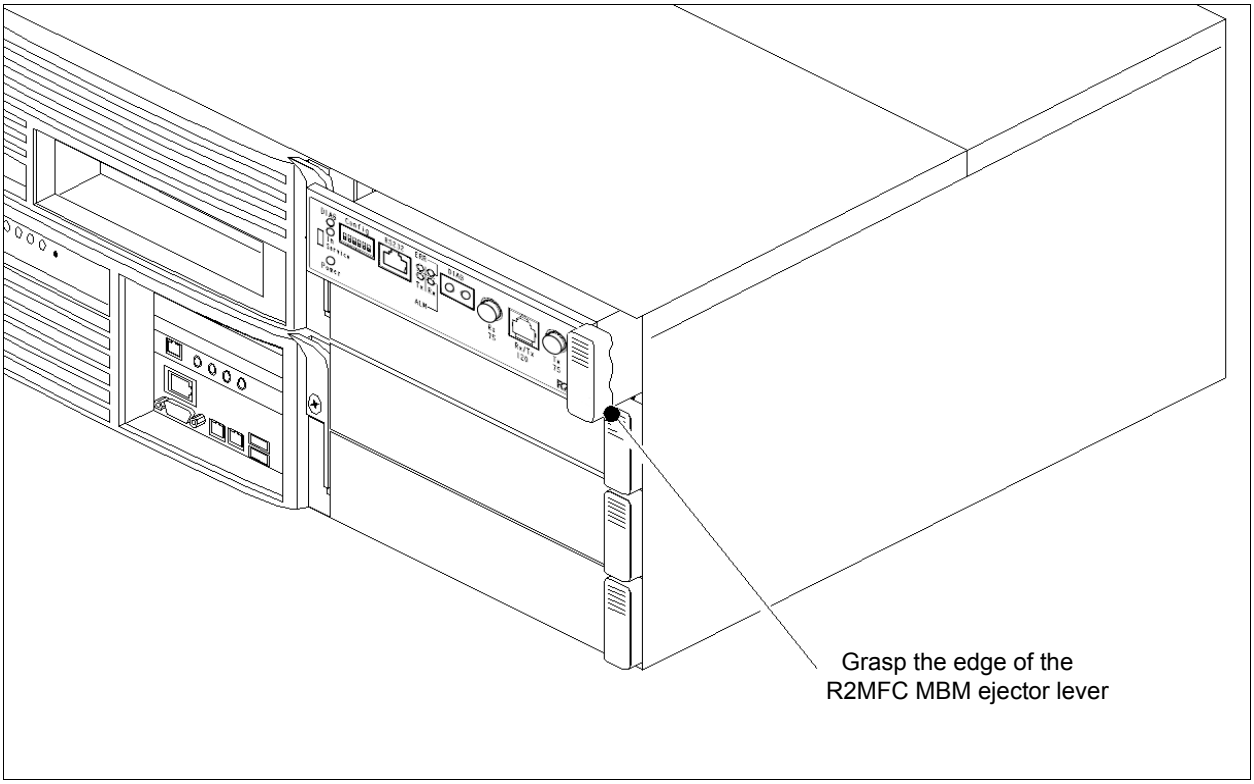



**Figure 10** How to remove a BCM400 R2MFC MBM



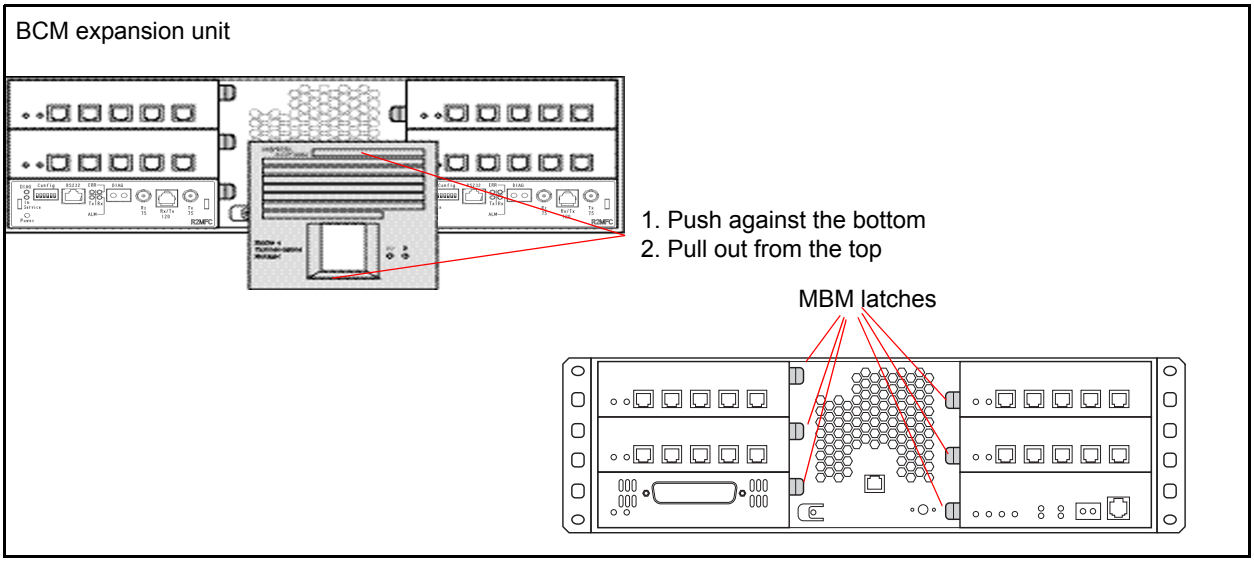
## Removing an R2MFC MBM from the expansion unit

Use this procedure to remove an R2MFC MBM from the BCM expansion unit.

**Warning:** Remove the R2MFC MBM after the system is powered down.

1. Power-down the BCM expansion unit system (see "Shutting down the system" on page 30).
2. Remove any cabling from the R2MFC MBM faceplate.
3. Remove the expansion unit front bezel.
4. Grasp the edge of the MBM ejector lever. Pull outward to eject the R2MFC MBM. Refer to Figure 11.

**Figure 11** How to remove the expansion unit front bezel




5. Grasp the top and bottom edges of the R2MFC MBM. Remove the R2MFC MBM from the BCM expansion unit. Place the R2MFC MBM in a clean, safe, and static-free area.

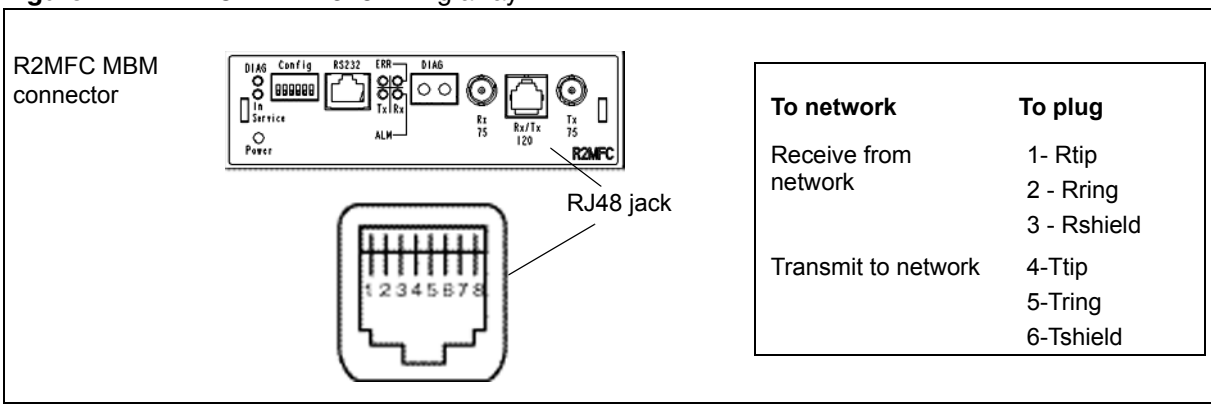
# Wiring an R2MFC MBM

This section describes how to wire the cables that connect to the R2MFC MBM. The R2MFC MBM is connected to the CO by either RJ48C or BNC connectors. The BNC connector is the default interface. The default connector can be changed either by setting the country - selection DIP switches or by creating a custom country code profile through the CLI. See "Configuring the MFCR2 (external) link" on page 45 for information on how to change the active interface.

If the 75-ohm BNC connector pair is used, two coax cables are required for transmit and receive.

If the 120-ohm RJ-48 connector is used, the cable pinout must be set up as follows:

**Figure 12** R2MFC MBM RJ48 wiring array




**Warning:** Only allow qualified persons to service the BCM system.

The installation and service of this unit must be performed by service personnel with the appropriate training and experience. Service personnel must be aware of the hazards of working with telephony equipment and wiring. They must have experience in techniques that minimize any danger of shock or equipment damage.

**Warning:** Leakage currents
Service personnel must be alert to the possibility of high-leakage currents becoming available on metal system surfaces during power line fault events on network lines. These leakage currents normally safely flow to Protective Earth ground through the power cord. However, if the ac power is unplugged prior to disconnecting the cables from the front of the base function tray, high-leakage currents available on metal system surfaces can occur.

System shutdown: You must disconnect the R2MFC MBM cables from the system before disconnecting the power cord from a grounded outlet.

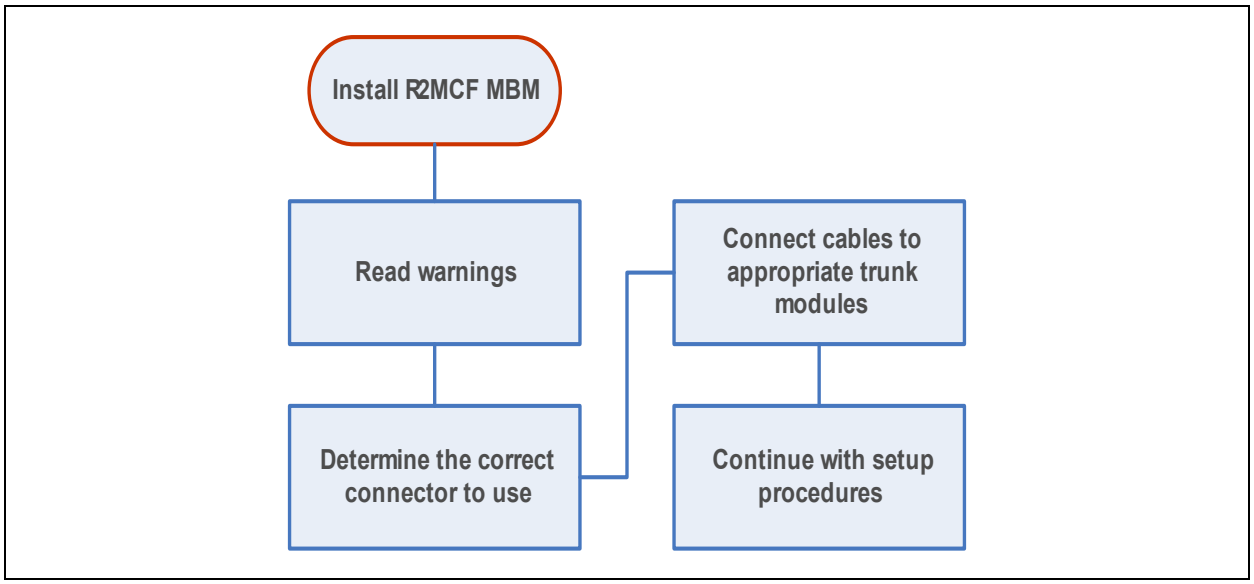
System startup: You must reconnect the power cords to a grounded outlet before reconnecting the cables to an R2MFC MBM.

**Danger: Electrical shock hazards**

Electrical shock hazards from the telecommunications network and ac mains are possible with this equipment. To minimize risk to service personnel and users, the BCM system must be connected to an outlet with a third-wire ground. In addition, all unused slots must have blank faceplates installed. The covers on all units must be in place at the completion of any servicing.

Figure 13 on page 38 provides an overview of the process for connecting trunk wiring to the BCM R2MFC MBMs.

**Figure 13** Trunk wiring overview




## Connecting an R2MFC MBM to a service provider

**Warning: Electrical shock warning**.

The Business Communications Manager R2MFC MBMs have been safety-approved for installation into BCM base units and expansion units. Both the installer and user are responsible to ensure that installation of the Business Communications Manager hardware does not compromise existing Safety approvals.

BEFORE YOU OPEN the Business Communications Manager base unit or BCM50 expansion unit, ensure that the network telecom cables are unplugged, and that the unit is then disconnected from the ac power source.

Station modules: The ports on these modules are meant to be connected only to approved digital telephones and peripherals, with the proper cables, on a protected internal wiring system.

**Do not connect any telephones to wiring that runs outside the building.**

Read and follow the installation instructions carefully.

Perform the following steps to connect an R2MFC MBM to the network:

1. Determine the connector type to be used, either RJ48C or BNC connectors.
2. Locate the appropriate connector on the front of the module.

3 Attach the transmit BNC cable to the connector labeled Tx and the receive BNC cable to the connector labeled Rx, for countries using BNC connections. Insert the connector into the RJ48 jack on the module, for countries using the RJ48 connections. Figure 12 on page 37 shows the wiring pinouts for an R2MFC MBM to connect to a service provider using RJ48 connectors.

**Warning:** If you are using a service provider channel service unit (CSU), you must disable the BCM system internal CSU by using Business Communications Manager Unified Manager. For more information, refer to the device configuration guide for the host system.

4 Use the Business Element Manager to configure the lines or sets associated with the module. Refer to the device confirguration guide for the host system for more information.

Refer to the device confirguration guide for the host system for information on changing the default settings for each line/loop.

# Chapter 5
# Configuring the R2MFC MBM

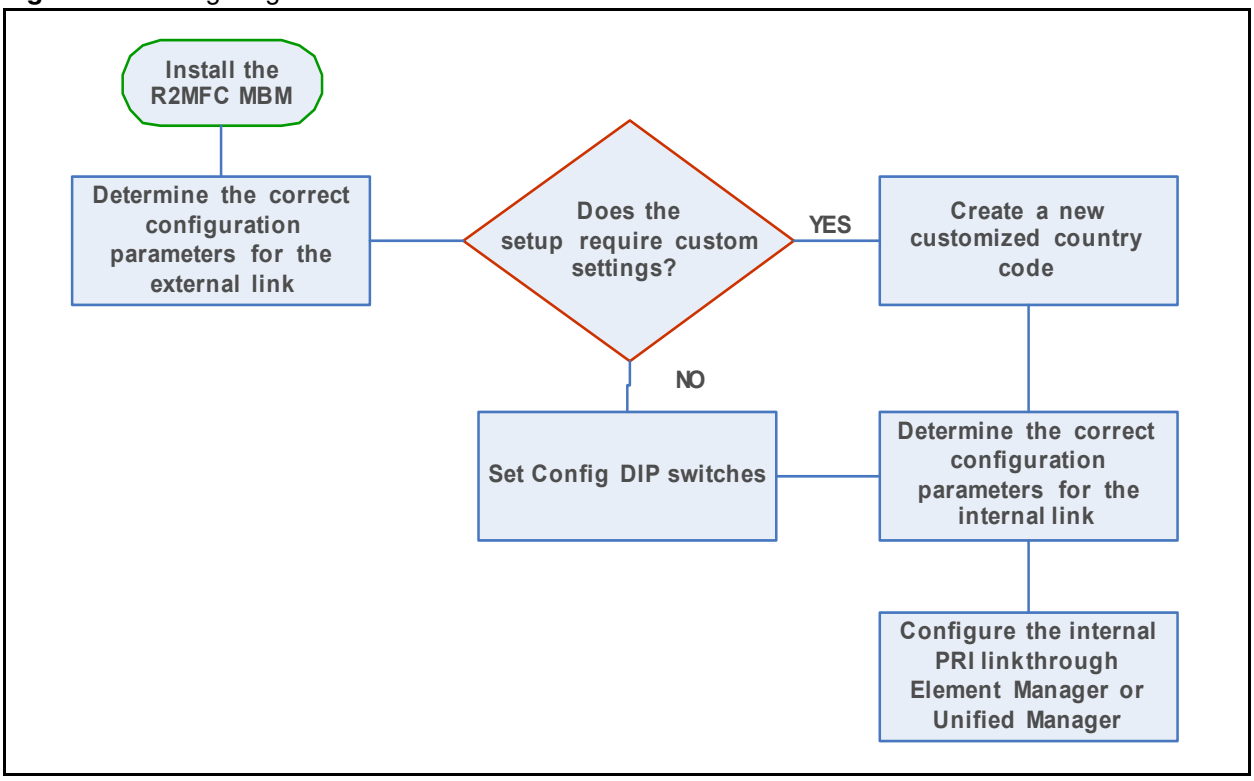
Trunk protocol conversion provides interworking between two different trunk protocols, and requires configuration for the following:

- E1- MFCR2
- E1- ETSI Euro-PRI

The MFCR2 is the external interface. The external interface connects to a public network. The R2MFC MBM contains preprogrammed country-specific MFCR2 settings that can be selected using the DIP switches on the faceplate of the R2MFC MBM. The MFCR2 settings can also be customized. The PRI is an internal link to the BCM. The PRI setting are configured to predefined settings when the region is selected during BCM initialization. The PRI does not require customization, but it must be configured as detailed in "Configuring the PRI (internal) link" on page 48.

This chapter lists the configurable parameters of both the MFCR2 side and the PRI side of the R2MFC MBM, and explains how to configure them. Figure 14 provides an overview of the configuration process.

**Figure 14** Configuring the R2MFC MBM



# MFCR2 side (External Link) configurable parameters

## Physical line characteristics

The MBM has two options for physical connections on the faceplate:

1. RJ-48 connector for twisted pair cable (line impedance of 120 Ohms)
2. a pair of BNC connectors for coax cables (line impedance of 75 Ohms)

The BNC connectors can have one of the following:

- TX shielding connected to ground (default)
- RX and TX shielding not connected to ground

Only one of the two connector types can be active. The default active interface is the BNC connector. The BCN connector is part of the country-specific defaults for Mexico. Each of the country codes activates the appropriate connector, based on the country standard for connectors.

The active interface can be customized in the firmware through the CLI by using commands in the COnfig directory.

## E1 framing

The external link uses Channel Associated Signaling on timeslot 16, therefore; TS16 multiframe format is always used. In addition, optional CRC4 multiframe can be used (for monitoring digital transmission quality), instead of basic “alternate frame” format.

The CRC4 multiframe option is activated by the firmware as part of the country-specific defaults.

PCM coding is A-law.

These settings can be customized in the firmware through the CLI by using commands in the ALarm directory.

**Note:** Changes made to the framing parameters must be configured in both the R2MFC MBM and the BCM.

## Line signaling

Line signaling (for example, seize, answer, and disconnect) are implemented by R2 Channel Associated Signaling known as ABCD bits. Only the two bits AB are used for line signaling. The state (value) of the bits indicate the signal.

The channels are always bidirectional, (that is, they accept incoming calls or originate outgoing calls). The channel behavior also supports one-way trunks. The direction of the signal does not need to be configured. Because the R2MFC MBM is passive, the R2MFC MBM does not initiate calls; it only passes call origination attempts from one side to the other. The R2MFC MBM assumes that the two sides (BCM and CO) respect the direction of the trunk as agreed between them.

The meaning of the bit states are part of the country-specific parameters; however, they can be customized through the CLI by using commands in the R2 directory.

The following are additional options included in country-specific parameters:

- use backward force-release signal to clear back (yes/no)
- release-guard state (timer) when clearing back (timer value)
- optional CD bits value (usually ignored)

## Register signaling

Register signaling (digits transmission) is implemented by in-band dual-tone signals known as MFC-R2. Physically, there are 15 forward signals and 15 backward signals. The standard defines two stages of the signaling. The meaning of the signal depends on the stage and the direction of the call. In total, there are four tables of 15 signals each. See Appendix A, “Config DIP switch settings and definitions for MFC country-specific signal tables.

The meaning of MFC signals can be different when transmitted or received. MFC signal tables are part of the country-specific parameters. The meaning of the MFC signals in the R2MFC MBM are configurable through the CLI by using commands in the MFC directory.

The following are other options included in country-specific parameters:

## End of dialing (incoming)

End of dialing for an incoming call can be configured by using the CLI. See Table 2, for the end of dialing options.

**Table 2** Minimum (or fixed) number length + timer parameters

| Option | Parameters | Meaning | Default |
|---|---|---|---|
| Explicit 'End of dial' signal (I-15) | None | The preset option for all countries. However, signal has low significance, because the end of dialing is determined by the BCM (PRI side) when it receives the last digit of the number. | Yes |
| Minimum (or fixed) number length and timer | Minimal number of digits | Receiving minimum number of digits + optional number of digits means end of dial (maximum length reached)<br>When a fixed length number is always expected, set the optional number of digits to 0. | No |
| Minimum (or fixed) number length and timer | Optional number of additional digits | | No |
| Minimum (or fixed) number length and timer | Interdigit timer in the minimal interval (long timer) | Expiry of the long timer means MFC error - number incomplete. | No |
| Minimum (or fixed) number length and timer | Interdigit timer in the optional interval (short timer) | Expiry of the short timer means end of dial. | No |

## End of dialing (outgoing)

End of dialing in outgoing calls is indicated by MFC signal "I15" (or equivalent country-specific signal). This signal is sent if the far-end requests next digit beyond the last digit of the dialed number.

When R2MFC MBM originates a call to the CO, the R2MFC MBM has already received the whole dialed number from the BCM. This is because the digits are passed from BCM to the MBM by PRI "en-bloc." This operation mode means that BCM determines user end-of-dialing either by number of digits, explicit input from user (for example, the "#" digit), or timeout.

## Disable ANI

The ANI request option can be disabled. When disabled:

- Incoming call—R2MFC MBM does not request ANI.
- Outgoing call—When far end requests ANI, R2MFC MBM answers "ANI not available."

## Default category

The MFC subscriber category, sent by R2MFC MBM in outgoing calls, is fixed. The default category for all countries is II1 (subscriber without priority). If needed, the default can be changed by CLI.

### Default subscriber status

The user can set default subscriber status (for example, free, busy, and vacant number) for incoming calls. When this feature is enabled, the R2MFC MBM in an incoming call sends the preset default subscriber status, instead of the status received from the PRI status.

The subscriber status option is not enabled in R2MFC MBM; therefore, the subscriber status is translated from ISDN message to MFC, and vice versa.

## Configuring the MFCR2 (external) link

The MFCR2 (external) link is configured directly on the R2MFC MBM by setting DIP switches, and using a CLI on the R2MFC MBM. Standard predefined configurations already exist, and must be used, whenever possible. Country code configurations set, by DIP switches, are hard-coded, and can be changed only by using the CLI. See <Cross Reference>Setting Config DIP switches for a description of how to set the predefined country code and second dial tone settings. The CLI can be used to create a customized country codes. See "Creating a customized country code" on page 46 for a procedure on how to create the customized country code.

### Setting Config DIP switches

The Config DIP switch settings include diagnostic mode, country codes, and second dial tone. Country codes include the default settings for the connection (link) for the country selected. See Appendix A, "Config DIP switch settings and definitions for the country code DIP switch settings and their specifications.

Perform the following steps to set the Config DIP switches:

1 Power down the BCM.

**Caution:** Country configuration is read by the firmware upon power up or restart. Changing the country, while the R2MFC MBM is operating, causes the firmware to restart automatically after a delay of five seconds from the last DIP switch change. All active calls during the restart are dropped.

2 Set the Config DIP switches to the appropriate country code and second dial tone setting that coincides with your location.

See Appendix A, "Config DIP switch settings and definitions for predefined country code DIP switch settings and their specifications.

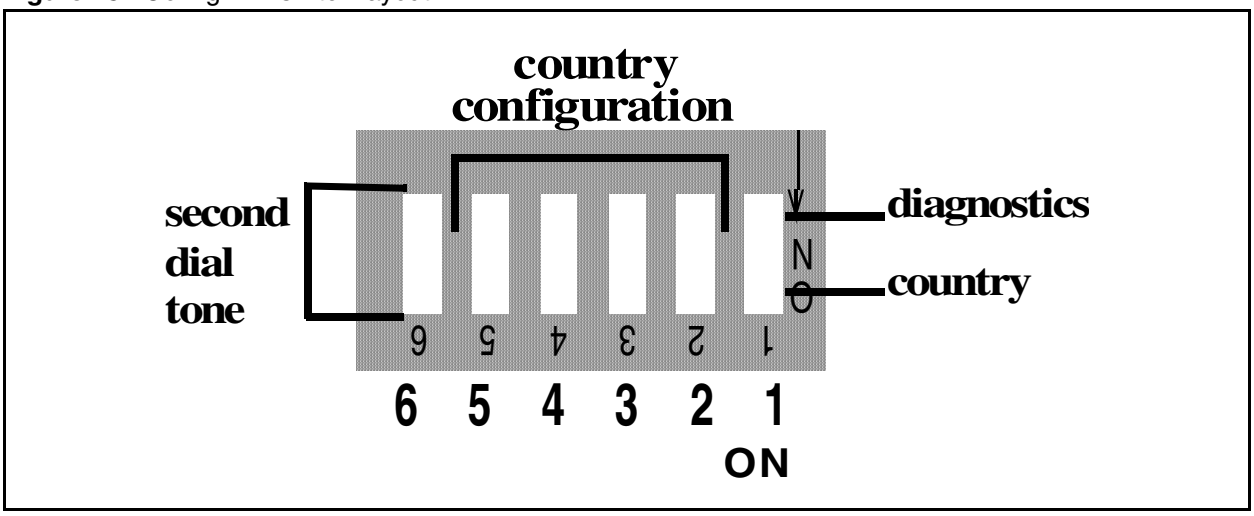
See "Turning on second dial tone" on page 54 for the procedure to turn on second dial tone.

The Config DIP switch settings are divided into the following parts:

- country or diagnostics - DIP switch 1
- country code - DIP switches 2 through 5
- second dial tone (on/off) - DIP switch 6

Figure 15 on page 46 shows the Config DIP switch layout.

**Figure 15** Config DIP switch layout




**Note:** Mexico Config 1 country code is the factory default setting. It is the setting used if an invalid country value is set, or if a custom profile is selected that does not exist.

3 Power up, or restart, the R2MFC MBM.

## Creating a customized country code

If the R2MFC MBM required settings are not identical to any country code, customization can be performed using the CLI through the serial port. Perform the following steps for configuring the customized country codes:

1 Set the Config DIP switches to match the country code closest to customer requirements. See Appendix A, “Config DIP switch settings and definitions.

2 Power up or restart the BCM.

3 Make the required modifications by CLI. See Chapter 7, “Command line interface,” on page 69 for an explanation of how to access and navigate the CLI.

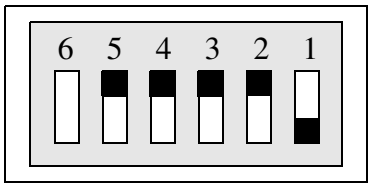
- Configuration changes made through the CLI immediately affect the operating parameters in RAM.
- Use the SaveCfg - (save configuration permanently on flash) command to save the new settings on non-volatile Flash memory.

The custom profile remains in EEPROM, even if different country codes are selected with the DIP switches, and is available again when the “custom profile” DIP switch setting is selected. The first configuration change by the CLI overwrites the existing custom profile as described above.

**Note:** Only one custom profile exists in EEPROM, so the SaveCfg command overwrites the previous custom profile saved to the EEPROM.

4 Set the Config DIP switches to custom profile. The new custom profile is used upon restart. See Figure 16 for the custom profile DIP switch setting.

**Figure 16** Custom profile DIP switch setting




# PRI side (Internal Link) configurable parameters

The R2MFC MBM is recognized by the BCM as a Euro-ISDN PRI line. The configuration for the PRI side (internal link) of the link is performed on the BCM through either Business Element Manager or Unified Manager. Refer to the installation and maintenance guide for the host system for complete information on the parameters that can be configured through the BCM. PRI side, internal link, and operational parameters for E1framing and signaling are listed below:

## E1 Framing

The list of E1 framing parameters are listed in Table 3.

**Table 3** E1 framing default parameters

| Parameter | Operational Value |
|---|---|
| Frame format | alternate frame |
| PCM coding | A-law |
| Common Channel Signaling | TS16 |

## Signaling

The list of layer 2 signaling parameters are listed in Table 4.

**Table 4** Layer 2 signaling parameters

| Parameter | Operational Value |
|---|---|
| D-channel | LAP D |
| Window size | 7 |
| Modulo | 128 |

Layer 3 signaling parameters are listed in Table 5.

**Table 5** Layer 3 signaling parameters

| Parameter | Operational Value |
|---|---|
| Protocol | ETSI Euro-ISDN (ETS 300 102). The R2MFC MBM upper board is the NETWORK side, so the BCM must be configured as USER side. |
| Incoming calls from CO to BCM - Digit dialing mode | Overlap. Every digit is passed to the BCM; the BCM determines when the number is complete. The call can be set up immediately after the last digit is dialed. |
| Outgoing calls from BCM to CO - Digit dialing mode | Overlap - for systems requiring second dial tone from the R2MFC MBM. |
| Bearer capability for calls initiated by BCM | R2MFC MBM accepts bearer capability requests of services: voice, audio, fax, modem. |
| Bearer capability for calls initiated from the R2MFC MBM to the BCM | Bearer capability indicates a normal voice service. |

# Configuring the PRI (internal) link

The BCM installs default settings for MBMs, which vary depending on the region chosen during start up. These settings for the R2MFC MBM can be verified and customized through either Business Element Manager or Unified Manager. Perform the following steps to verify and customize the PRI (internal) link:

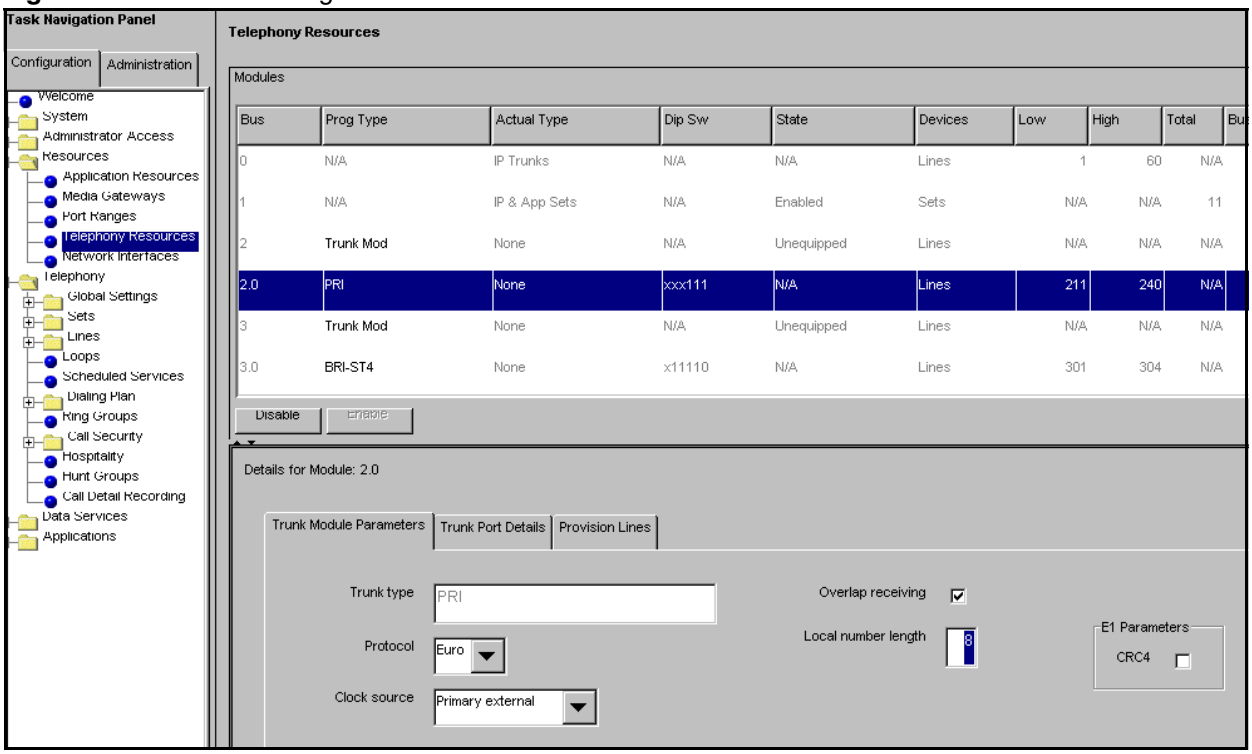
## Configuring the PRI (internal) link using Business Element Manager

1. Open the Business Element Manager. See the Administration guide for the host system for an explanation of how to use Business Element Manager.
2. Connect to the BCM you are trying to administer.

3 Select the appropriate **Bus #** under **Configuration > Resources > Telephony Resources** in the navigation tree.

The Bus # information frame displays. See Figure 17 for an example of the screen layout for an R2MFC MBM configured on Bus 2.0.

**Figure 17** BCM Bus configuration for R2MFC MBM




4 Configure the fields in the **Details for Module: 2.0** panel. See Table 6 for parameters and settings.

**Table 6** Module configuration parameters

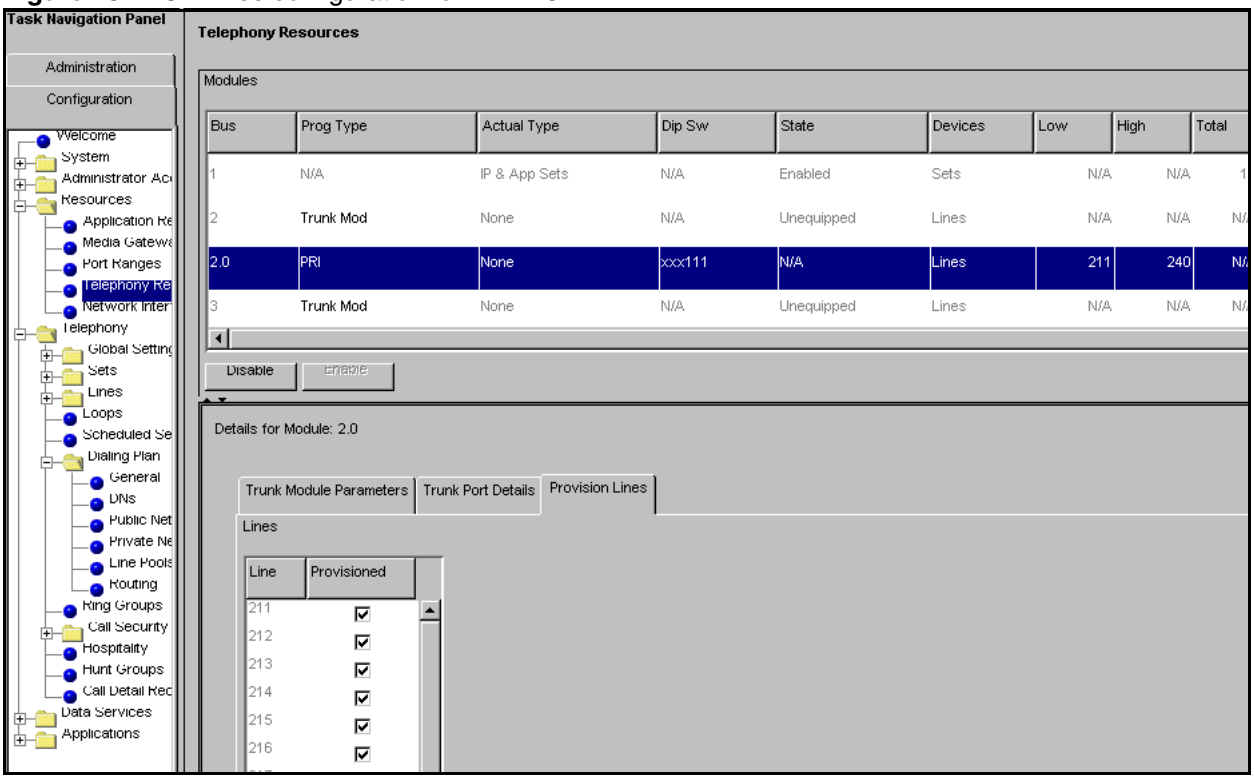
| Parameter | Setting |
|---|---|
| Trunk type | PRI |
| Protocol | Euro |
| Clock source | Primary external (if only one trunk module in system; otherwise, it depends on the synchronization scheme of the BCM) |
| Overlap receiving | Selected (On) |
| Local number length | According to BCM local dialing plan (customer - dependent)<br>**Note:** This field appears only when the Overlap receiving field is selected. |
| E1 Parameters - CRC4 | Not Selected (Off) |

5 Select all active B-channels that are provisioned for the corresponding E1 in **Configuration > Resources > Telephony Resources > Provisioned Lines**. See Figure 18.

There should be 30 channels, unless a partial E1 service is arranged with the CO.

See Figure 18, for an example of the screen layout for an R2MFC MBM configured on Bus 2.0.

**Figure 18** BCM lines configuration for R2MFC MBM




## Configuring the PRI (internal) link using Unified Manager

1 Open the Unified Manager. See the Programming guide for the host system for an explanation of how to use Unified Manager.

2 Click the **Configuration** button on the Unified Manager main page.

The Unified Manager main display opens.

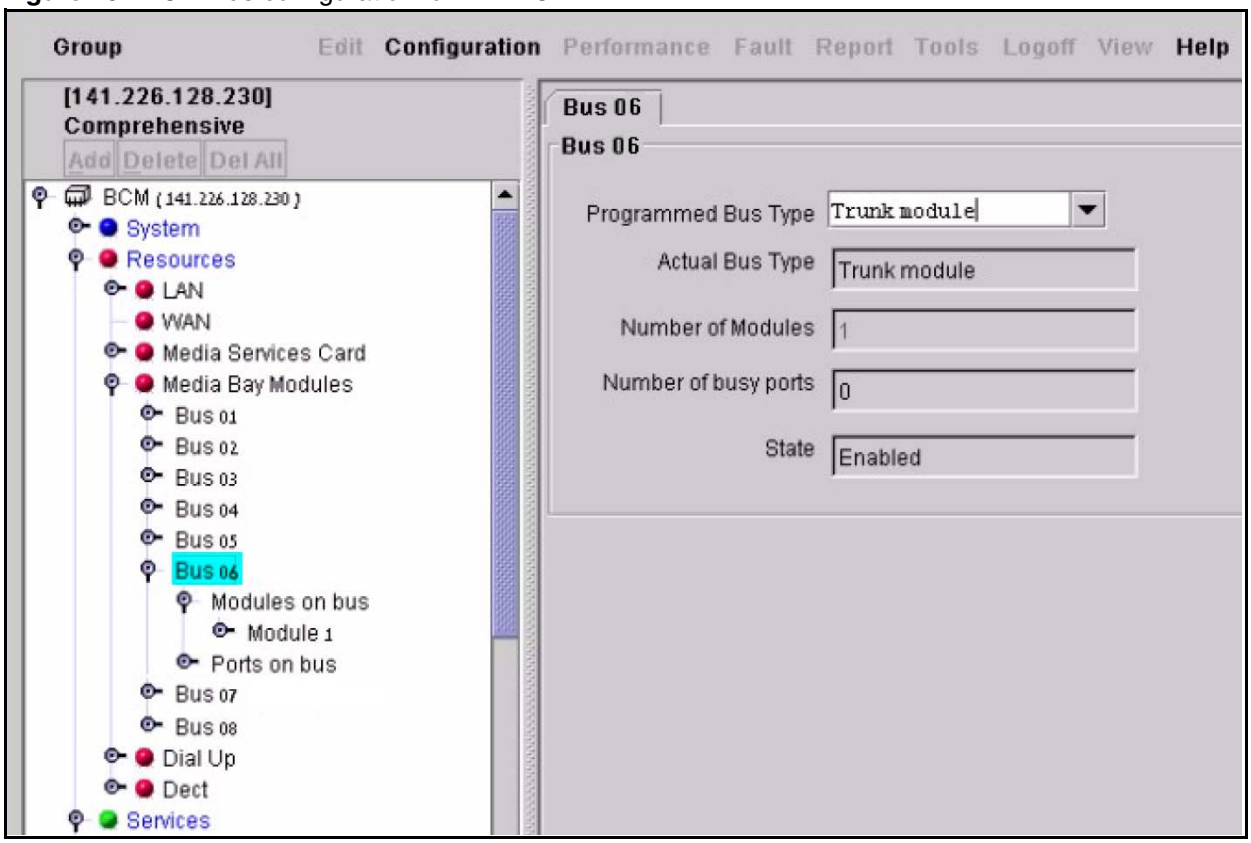
3 Enter your Unified Manager login credentials.

4 Select the appropriate **Bus #** under the **Resources > Media Bay Modules** headings in the navigation tree.

The **Bus #** information frame displays. See Figure 19 on page 51 for an example of the screen layout for an R2MFC MBM configured on Bus 06.

5 Select **Trunk module** from the **Programmed Bus Type** drop-down list.

**Figure 19** BCM Bus configuration for R2MFC MBM




6 Select **Modules on bus > Module 1** from the navigation tree.

The Bus # - Module # Information frame displays. See Figure 20 on page 52.

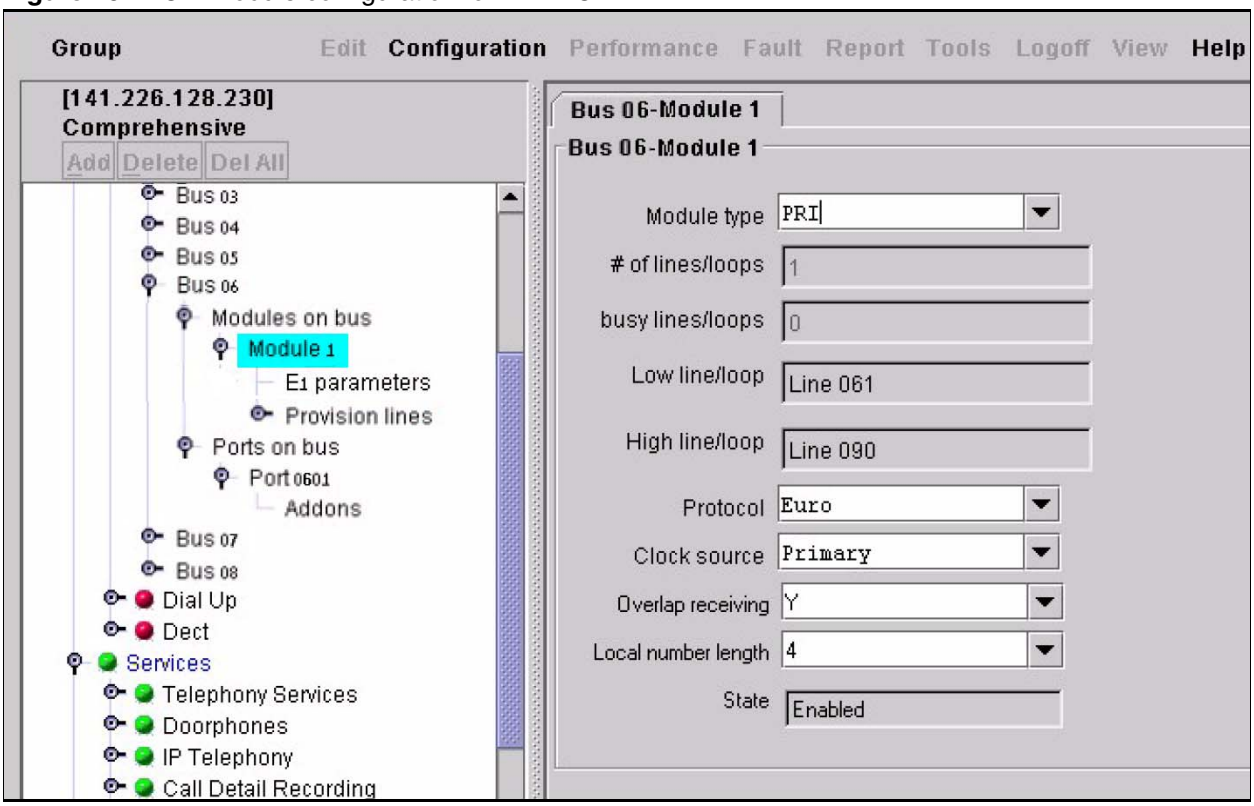
7 Configure the parameters in the **Bus# - Module #** information frame. See Table 7 for parameters and settings.

See Figure 20 on page 52 for an example of the screen layout for an R2MFC MBM configured on Bus 06.

**Table 7** Module configuration parameters

| Parameter | Setting |
|---|---|
| Module type | PRI |
| Protocol | Euro |
| Clock source | Primary (if only one trunk module in system; otherwise, it depends on the synchronization scheme of the BCM) |
| Overlap receiving | Y |
| Local number length | According to BCM local dialing plan (customer - dependent) |

**Figure 20** BCM module configuration for R2MFC MBM



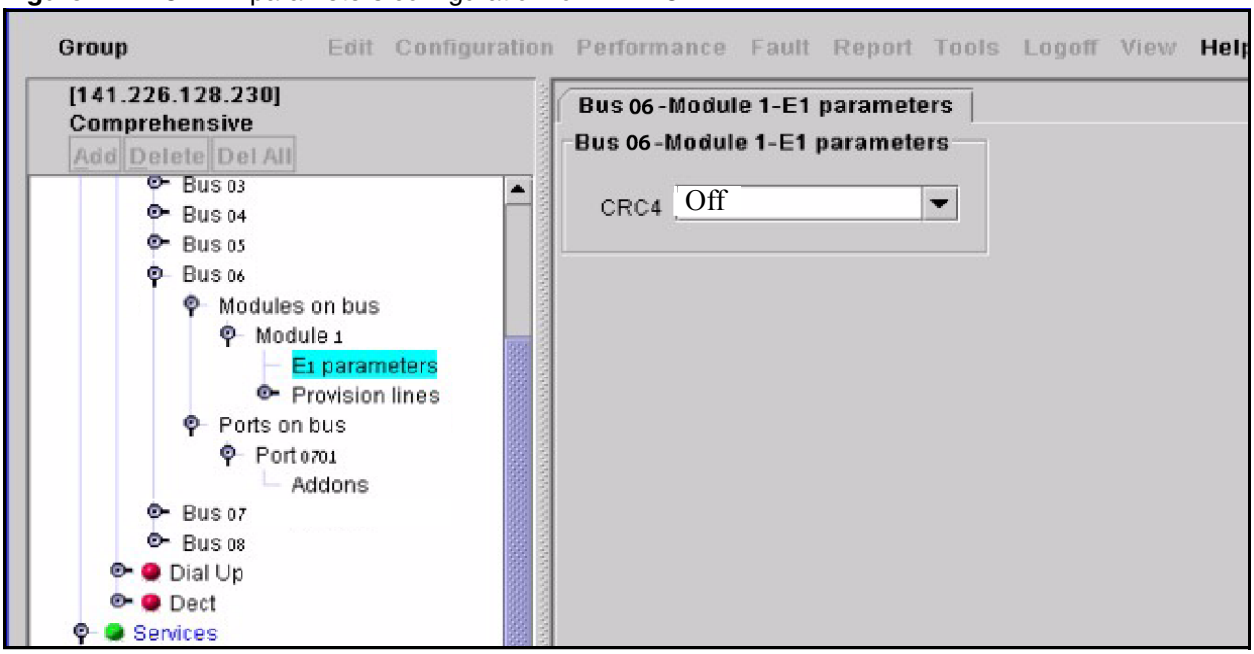

8 Select **Modules on bus > Module 1 > E1 parameters** from the navigation tree.

The **Bus # - Module # - E1 parameters** information frame displays. See Figure 21 on page 53.

9 Select **Off** from the **CRC4** drop-down list.

See Figure 21 on page 53 for an example of the screen layout for an R2MFC MBM configured on Bus 06.

**Figure 21** BCM E1 parameters configuration for R2MFC MBM




10 Select **Modules on bus > Module 1 > Provision lines** from the navigation tree. See Figure 22 on page 54.

The Bus # - Module # - E1 parameters Information frame displays.

11 Select an individual line that is displayed under the Provision lines heading. See Figure 22 on page 54.

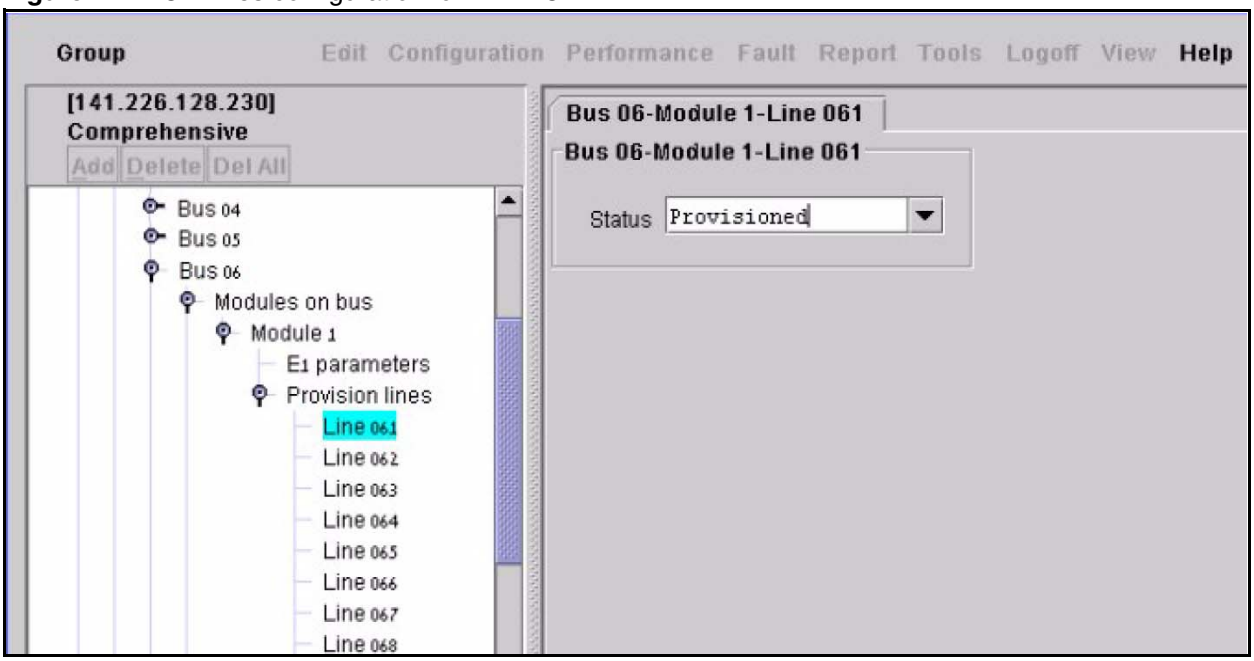
The **Bus # - Module # - Line #** information frame displays.

12 Select **Provisioned** from the **Status** drop-down list.

13 Repeat Steps 11 and 12 for every active B-channel that is provisioned for the corresponding E1. There should be 30 channels, unless a partial E1 service is arranged with the CO.

See Figure 22 on page 54 for an example of the screen layout for an R2MFC MBM configured on Bus 06.

**Figure 22** BCM lines configuration for R2MFC MBM




# Turning on second dial tone

Second dial tone, when turned on, generates and supplies, a second dial tone to the end user, after the end user dials the trunk access code. Second dial tone can be used with any country code, including customized country codes. You must turn on second dial tone at the BCM level when running a BCM device using Business Element Manager, or you must turn on second dial tone at the R2MFC MBM level when running a BCM using Unified Manager. Use one of the following ways to turn on second dial tone:

- "Turning on second dial tone on the BCM system"
- “Turning on second dial tone on the R2MFC MBM” on page 55

## Turning on second dial tone on the BCM system

Second dial tone is available for BCMs running Business Element Manager and does not need to be turned on at the R2MFC MBM level. Leave Config DIP switch 6 in the down position.

Use the following steps to turn on second dial tone at the BCM level:

1 Open the Business Element Manager.

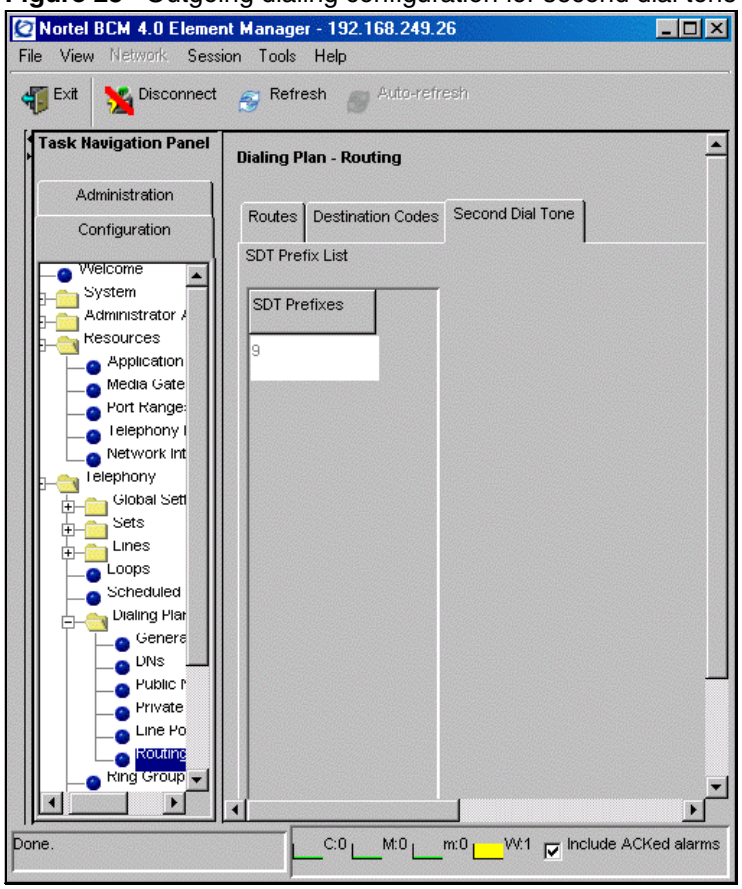
See the administration guide for the host system for an explanation of how to use Business Element Manager.

2 Connect to the BCM device you are trying to administer.

3 Enter the SDT Prefixes in **Telephony > Dialing Plan > Routing > Second Dial Tone** (see Figure 23 on page 55).

4 The digit entered is the number that indicates that a second dial tone is required.

**Figure 23** Outgoing dialing configuration for second dial tone




## Turning on second dial tone on the R2MFC MBM

Config DIP switch 6 is designated for turning on or off second dial tone. Changes to the dial tone DIP switch become effective, as soon as the DIP switch changes position, and does not require a restart to take effect. The BCM outgoing dialing must be set to Overlap in order for second dial tone to work properly.

Use the following steps to turn on second dial tone:

1. Set Config DIP switch number 6 to the up position. See Figure 16 on page 47 for the Config DIP switch layout.
2. Open the Unified Manager. See the Programming guide for the host system for an explanation of how to use Unified Manager.
3. Click the **Configuration** button on the Unified Manager main page.

   The Unified Manager main display opens.
4. Enter your Unified Manager login credentials.
5. Expand the **Services > Telephony Services > Call routing > Routes** headings from the navigation tree. See Figure 24 on page 56.

   The routes configured on the BCM are listed below the **Routes** heading.

6 Select the route that is to be configured under the **Routes** heading. See Figure 24 on page 56.

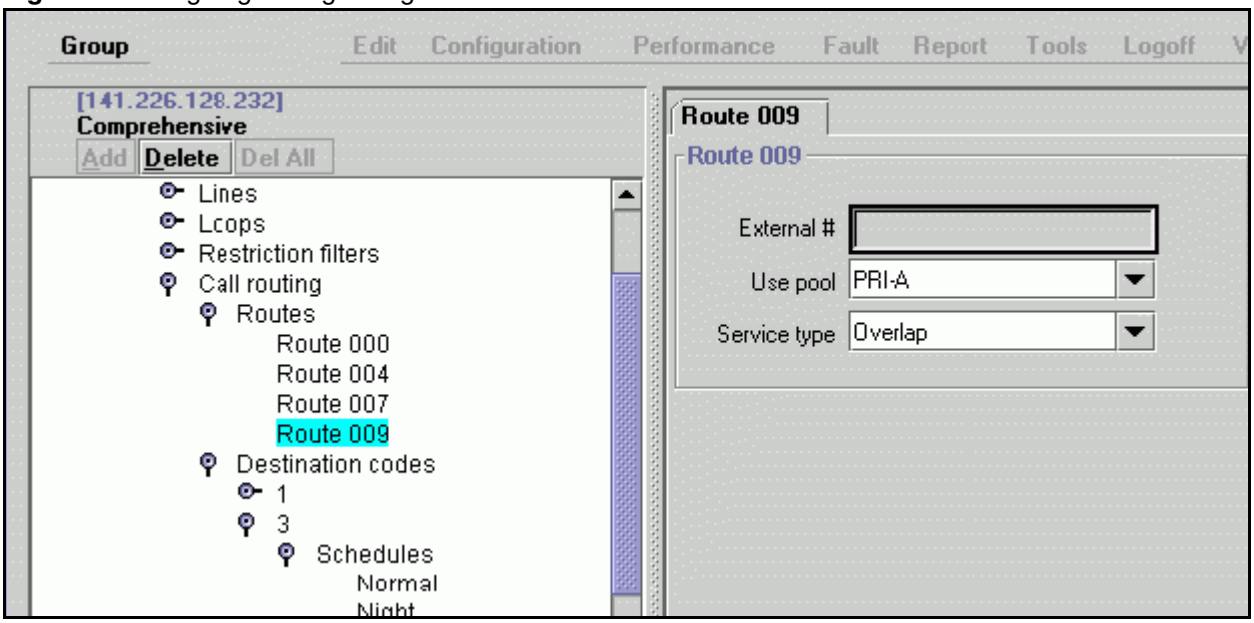
The **Route #** information frame displays.

7 Select **Overlap** from the **Service type** drop-down list.

8 Repeat Steps 6 and 7 for every active B-channel that is provisioned for the corresponding E1. There will be 30 channels, unless a partial E1 service is arranged with the CO.

See Figure 24 on page 56 for an example of the screen layout for configuring the outgoing dialing parameters for second dial tone on the R2MFC MBM.

**Figure 24** Outgoing dialing configuration for second dial tone



# Chapter 6
# R2MFC MBM maintenance

This chapter describes the general maintenance of the R2MFC MBM after it is installed and is running properly. It includes the following sections:



## Inter-working functionality

All channels on both sides of the R2MFC MBM are bidirectional: they accept both incoming and outgoing calls. If unidirectional trunks are used, the direction is handled by the far ends (BCM and CO); the direction need not be configured in the R2MFC MBM.

In order to handle bidirectional calls, and eliminate internal collisions (when both sides originate a call on the same channel simultaneously), the R2MFC MBM allows flexible channel inter working; calls originating on a channel can use any free channel on the opposite side.

On incoming calls to the BCM, the far-end (for example, CO switch) selects the MFC channel. The R2MFC MBM presents the call to the BCM by PRI and allows the BCM to determine which channel to use.

On outgoing calls, the BCM selects on which PRI channel the call starts. The R2MFC MBM selects a free MFC channel, and originates the outgoing call on it. For this purpose, the R2MFC MBM supports 3 search methods to select a free MFC channel:

- Round robin (default)
- Linear ascending
- Linear descending

The MFC channel selection method can be modified through the CLI. See Chapter 7, "Command line interface," on page 69 for commands available through the CLI.

During call setup, the following information is passed between the BCM and the CO:

1 **Dialed digits** — Dialed digits are passed without any change. Up to 24 digits can be dialed. The MFC trunk is capable of repeating dialed digits on outgoing calls to the CO, when requested according to protocol.

   Digits are passed immediately to BCM as they are received (PRI overlap mode) on incoming calls from CO to BCM. This causes the BCM to determine end of dialing, and to immediately signal call completion.

2 **Calling number** — (in PRI: CLID; in MFC: ANI) This number is passed without any change, and can be up to 16 digits long.

3 **Termination status** — Termination status is translated as presented in the Table 8. The table shows both directions. When translating a signal, only the bold value is used.

**Table 8** Translation of Subscriber Status

| Subscriber State | PRI Signal | MFC Signal[1] |
|---|---|---|
| Free (ringing) | ALERTING | **BW_FreeCharge** (B6)<br>BW_FreeNoChrg (B7) |
| Busy | Cause 17 | BW_Busy (B3) |
| Unallocated number | Cause 1 | BW_Unlocated (B5) |
| Network congestion<br>or general failure | Cause 42<br>All other values | **BW_B_Congest** (B4)<br>Unknown signal |
| Line out of order | Cause 27 | BW_OutOfOrder (B8) |
| Number changed | Cause 22 | BW_ChangOrder (B2) |

1 MFC signal is indicated by meaning. Actual signal depends on country; ITU/T standard is indicated in parentheses.

Other protocol-specific fields are not translated from side to side. They are handled as described Table 8 in the protocols implementation.

# Clock synchronization

By default, the R2MFC MBM synchronizes on the external E1 line, and transmits this clock on the internal link to the BCM. By doing so, the BCM can synchronize on the external link.

Slips may occur between the BCM and the R2MFC MBM, if the BCM needs to synchronize on another digital trunk MBM. To avoid slips, there is an option for the R2MFC MBM to synchronize on the internal link to the BCM, instead of the external E1 line. Synchronization settings can be set up by using the CLI. See Chapter 7, “Command line interface,” on page 69 for commands available through the CLI.

# Diagnostic tools

The R2MFC MBM has three diagnostic settings and two loopback settings available to help with the troubleshooting process. When the R2MFC MBM is running in diagnostic or loopback mode, the signals from the BCM to the CO, or from the CO to the BCM, can be intercepted by placing diagnostic equipment in the bantam jacks on the front of the R2MFC MBM. This allows the external MFCR2 link, or the internal E1, to be checked for communication errors. The signal can be traced from start to finish, helping to determine the source of the errors.

See Table 9 for a description of the diagnostic and loopback modes.

**Table 9** Diagnostic and loopback modes

| Mode | Description | Call Availability |
|---|---|---|
| Diagnostic Mode 1 | Routes the E1 transmit signal from the BCM through the R2MFC MBM out to the bantam jack. | Available to process calls |
| Diagnostic Mode 2 | Routes the E1 transmit signal from the CO through the R2MFC MBM out to the bantam jack. | Available to process calls |
| Diagnostic Mode 3 | Routes the E1 received signal from the BCM out to the bantam jack without any interaction with the R2MFC MBM. | Available to process calls |
| Loopback mode 1 (continuity mode) | Routes the E1 signal received from the CO back out to the CO without any interaction with the R2MFC MBM. | Not available to process calls |
| Loopback mode 2 (card edge loopback) | Routes the E1 tranmitted signal from the BCM through the R2MFC MBM and back to the BCM. | Not available to process calls |

## Setting the R2MFC MBM to diagnostic mode

The R2MFC MBM is placed in diagnostic or loopback modes by setting the Config DIP switches in either the diagnostic or loopback position. Perform the following steps to set the R2MFC MBM into either diagnostic or loopback mode:

1 Set the Config DIP switches to the desired diagnostic or loopback mode while the R2MFC MBM is still powered up. See See Appendix B, “Diagnostic and loopback DIP switch settings,” on page 101.

   The selected diagnostic or loopback mode becomes active five seconds after the last DIP switch change. The last country configuration stays in effect until a restart occurs.

2 Perform desired testing.

3 Reset the DIP switches back to the appropriate country code after testing has been completed so that the correct country code is read upon a restart.

**Warning:** Restarting the R2MFC MBM, while the Config DIP switches are in a diagnostic or loopback mode, causes the R2MFC MBM to start up in the diagnostic or loopback mode with the default country setting of Mexico config 1.

# Alarms

Performance is monitored on both the internal (PRI) and external (MFC) links, but the actions when errors occur are different. Alarms and events handling include three types of actions:

1. Propagating Alarms:
   a. Alerts the far-end by transmitting remote alarm indication (RAI).
   b. Passes alarm conditions from link to link.
2. Reflecting alarm conditions on faceplate LEDs
3. Printing to error logs

## Alarm measurements

This section describes the mechanism and terminology of alarm measurements, and the actions taken when alarms occur or stop. Several performance indicators are monitored in order to detect E1 signal degradation; these indicators are categorized into two groups:

- **Group I** errors: These are events that can be counted, and are not continuous conditions. The number of events is counted, and is compared with thresholds (number of events in a specific time interval) used to evaluate the severity of the alarm condition.
- **Group II** errors: These are continuous conditions. These indicators can turn on and off rapidly, or they can remain on or off.

Each group of performance indicators are handled differently.

### Group I errors

Each error has two thresholds of error rate, which defines two levels of error severity:

- Maintenance: error exists but acceptable (service available)
- Out Of Service (OOS): severe error (service not available)

Group I errors are the following:

1. **Bipolar Violations (BPV):** Errors in the bits coding.
2. **Frame Bit Error (FBER):** Errors in the frame alignment word.
3. **SLIPs:** The replication or deletion of the 256 payload bits of an E1 frame. This error indicates that the local E1 clock is not synchronized with the far end.
4. **CRC-4 errors:** Received CRC code is not identical to a locally calculated code. This alarm is only relevant when in CRC-4.
5. **Far-end block error (FEBE):** Far end has detected a CRC-4 error. This alarm is only relevant when in CRC-4.

### Group II errors

Group II alarms occur when an alarm persists for a predefined period. The alarm is considered cleared when it does not occurred for a predefined period.

See Table 10 for incoming-signal Group II errors listed from highest to lowest priority. Group II errors are ordered by priority; when a high priority error exists, any errors of lower priority are irrelevant.

**Table 10** Incoming signal errors

| Alarm | Cause |
|---|---|
| Loss of Signal (LOS) | No reception of incoming electrical signal on the line (cable cut or removed). |
| Alarm Indication Signal (AIS) | Reception of incoming signal is all ones. Usually indicates that the far-end is out-of-service |
| Out-of-Frame (OOF) | No detection of Frame Alignment Signal. The incoming signal is corrupted. This alarm is also known as Loss of Frame (LFA). |
| Out Of Multiframe TS16 - ($OOM_{TS16}$) | No detection of Multiframe Alignment Signal. When this alarm is active, Channel Associated Signaling (R2) is impossible. This alarm is not applicable to the PRI (internal link). This alarm is also known as Loss of Multiframe Alignment - (LMA). |
| Alarm Indication Signal in TS16 ($AIS_{TS16}$) | Reception of AIS is all ones in TS16. This is an optional alarm. It can be enabled or disabled in configuration. By default, this option is **off**. When this alarm is active, any signaling on TS16 is impossible. |
| Loss of CRC-4 Multiframe Alignment (OOM) | CRC-4 multiframe cannot be recognized. When this alarm is active, CRC-4 errors (of group I) cannot be measured. This alarm is relevant only when CRC-4 multiframe mode is used. |
| Remote Alarm Indication (RAI) | Indication that the far-end has trouble with its incoming signal. This alarm is also known as yellow alarm. |
| Remote Alarm Indication TS16 ($RAI_{TS16}$) | Indication that the far-nd has lost TS16 multiframe alignment on its incoming signal.<br>This alarm is not applicable to PRI (internal link). |

## Alarms propagation

This section describes the actions taken when alarms occur or stop. When alarms occur, the far-end is alerted by a remote alarm indication, and an alarm is transmitted on the opposite link. Table 11 table shows the reactions for Group I alarms when they enter the Out-Of-Service (OOS) state.

**Table 11** Group I Alarms propagation

| Error Condition | Alarm Transmitted to far end | Alarm sent on opposite link |
|---|---|---|
| BPV | RAI | AIS |
| FBER | RAI | AIS |
| Slips | RAI | AIS |
| CRC-4 errors | RAI | AIS |
| FEBE | none | none |

Table 12 shows the reactions for Group II alarms when they persist.

**Table 12** Group II alarms propagation

| Error Condition | Alarm Transmitted to far-end | Alarm sent on opposite link |
|---|---|---|
| LOS | RAI | AIS |
| AIS | RAI | AIS |
| OOF | RAI | AIS |
| $OOM_{TS16}$ | $RAI_{TS16}$ | AIS |
| $AIS_{TS16}$ | $RAI_{TS16}$ | AIS |
| RAI | None | RAI |
| $RAI_{TS16}$ | None | $RAI_{TS16}$ |
| DCH down | None | AIS |

# Faceplate LEDs

There are two sets of LEDs on the faceplate of the R2MFC MBM. The system status LEDs are made up of the Power LED, In Service LED, and Diag LED. Table 13 shows the LEDs and their states.

**Table 13** System status monitor LEDs

| | LED Status | | | | |
|---|---|---|---|---|---|
| **LED Name** | **Green Solid** | **Green Flashing** | **Red Solid** | **Red Flashing** | **OFF** |
| **Power** | Active Power | N/A | N/A | N/A | No Power |
| **In-Service** | Normal Operation | Start Up | N/A | N/A | Out-of-Service |
| **Diag** | N/A | N/A | Test Mode | N/A | Normal Operation |

- As the BCM starts, the In Service LED is Green Flashing.
- Once powered up, the Power LED is set to Green, the In Service LED is set to green, and the Diag LED is off.
- When the MBM is operating properly, the In Service LED is Green Solid.
- During an alarm on the internal PRI link, the In Service LED is off.
- During test mode, the Diag LED is red.

The second set of LEDs on the faceplate indicate the operation status for the E1. Table 14 describes the LEDs and what status they indicate.

**Table 14** System status monitor LEDs

| LED Name | Yellow LED | OFF | Red LED |
|---|---|---|---|
| ALM Rx | Problem with digital input on external R2 link; link unusable. | Normal Operation | N/A |
| ERR Tx | Remote Alarm Indication (RIA) transmitted on external R2 link. | Normal Operation | N/A |
| ALM Tx | N/A | Normal Operation | Inability to transmit: Alarm Indication Signal (AIS) sent on external R2 link |
| ERR Rx | Degradation of digital input on external R2 link; link is still usable. | Normal Operation | N/A |

- On power up, all four LEDs are set to off.
- The ERR Tx is only relevant when the ALM Tx and ALM Rx LEDs are off.
- ERR Rx is triggered when the Tx ALM exceeds maintenance thresholds: BPV, CRC4, and slip.
- ALM Tx is triggered by loss of communication with lower board (PRI board), or other internal error.
- ALM Rx is triggered by LOS, AIS, OOF, OOM, and when the ERR Rx alarm exceeds OOS threshold: BPV, CRC4, and slip.
- RAI transmission indicates a receive fault.

## Logs and traces

Logs are available through the Logger directory in the CLI. This directory contains commands that allow filters to be placed on the E1, for different types of errors, down to the channel level. Errors can be stored in buffer, and then viewed or printed.

## Error messages

Software error messages are available through the SWerr directory in the CLI. The errors are stored in a cyclic buffer that can be accessed to help in troubleshooting. See “SWerr directory” on page 78 for specific commands and details.

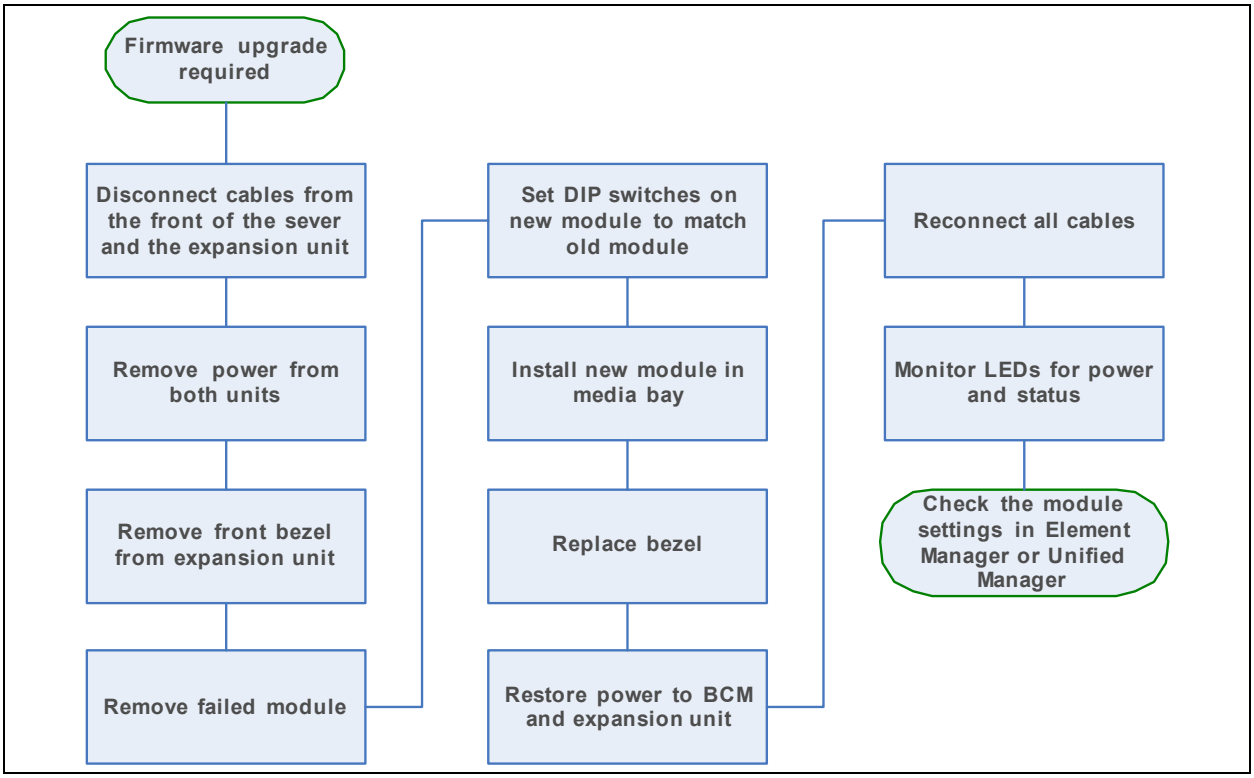
# Replacing an R2MFC MBM

When an R2MFC MBM requires replacement, follow the steps in this section.

**Warning:** This section describes replacing a module with the same type of module. If you want to replace a module with a different type of module, you must treat it as a new installation. Refer to the installation and maintenance guide to ensure the new module does not overrun any lines already assigned to other modules.

Figure 25 on page 64 provides an overview of the process for replacing R2MFC MBMs.

**Figure 25** Overview of module replacement process




## Replacing an R2MFC MBM

If replacement of the R2MFC MBM is required, perform the follow steps to properly replace the module:

1. Follow the steps in "Shutting down the system" on page 30 to ensure the system shuts down correctly.
2. Remove all cables and disconnect the BCM from the AC power outlet.
3. Remove the front bezel from the unit in which the module resides.
4. Pull the latch beside the module to be replaced to release the module. Refer to Figure 9 on page 35 or Figure 10 on page 35.

5 Slide the module out of the bay in which it is installed.

6 Record the switch settings from the old module.

7 Set the DIP switches on the new module to match the settings you recorded in the previous step.

8 Refer to "Installing an R2MFC MBM" on page 32 to install the module in the media bay.

9 Refer to "Reconnecting the equipment" on page 33 to restore the system to operation.

## Upgrading firmware

Normal installation does not require firmware download. A firmware upgrade can be required at some point to incorporate bug fixes or new features.

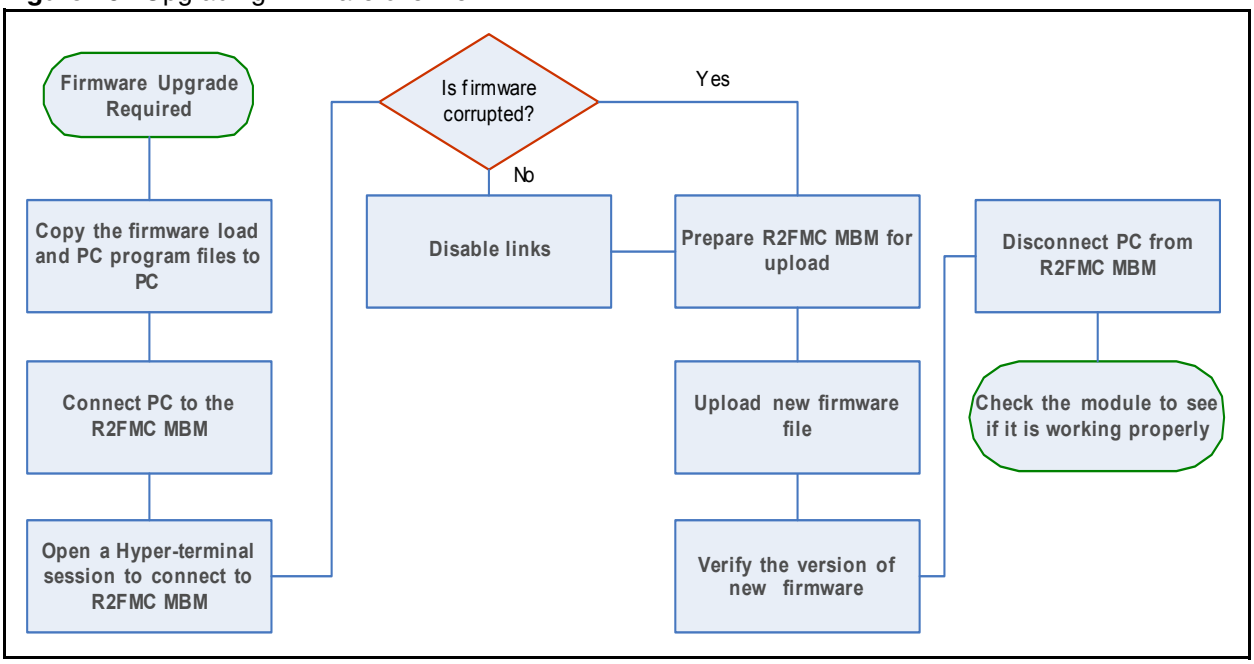
The following items are required for a firmware download:

- firmware load file
- PC connected to the RS232 serial port of the R2MFC MBM through COM1
- PC program delivered by the supplier: **Bload1.exe** for COM1

**Note:** The version of the firmware, running on an installed R2MFC MBM, is found by using the `Fwversion` command in the INfo directory of the CLI. See Chapter 7, "Command line interface' for details on the CLI.

Figure 26 on page 66 provides an overview of the process for upgrading R2MFC MBM firmware.

**Figure 26** Upgrading firmware overview




## Upgrading firmware

Perform the following steps to download the firmware the R2MFC MBM:

1. Copy the firmware load file and the PC program files, **bload1.exe**, to the same directory on the PC.
2. Use the shipped cable, part number N0026100, to connect a PC to the RS-232 port on the faceplate of the R2MFC MBM through COM1.
3. Open a new Hyper-terminal session on the PC using the parameters listed in Table 15.

**Table 15** Hyper-terminal setup parameters

| Parameter | Setting |
|---|---|
| Connect using | COM 1 |
| Bits per second | 19 200 |
| Data bits | 8 |
| Parity | None |
| Stop Bits | 1 |
| Flow Control | None |

4 Go to step 11 if the existing firmware is corrupted. Corrupted firmware is indicated if the BOOT program displays:

```
load, switch, fload, fswitch, checksum, DisMem, DisWord, *=quit

----> user monitor:
```

5 Wait for the monitor line (flashing cursor) to appear on the terminal session.

6 Go to step 8 if the BCM is not active and no calls are running. If calls are running, access the Control directory.

7 Execute the soft disable (LSD), or immediate disable (LID), to disable the links.

8 Enter the `load` subdirectory.

9 Execute `load y` command.

10 Wait for the output of the boot monitor.

11 Enter `fload` to prepare the MBM for the uploading of firmware.

The R2MFC MBM will not respond while it is waiting for a download.

12 Release the COM port by closing the Hyper-terminal session.

13 Run the download programs on the PC through the **Start > run** menu:

• //*file path*/Bload1 <load_file>

The program responds: `starting rec 0. Hit any key to continue...`

14 Press <Enter>. The program starts the download, and shows its progress by displaying the number of processed records.

When finished, the program prints: `Download ended successfully!`

15 Verify the version of firmware uploaded by using the `Fwversion` command in the INfo directory of the CLI. See Chapter 7, "Command line interface' for details on the CLI.

16 Close the program window.

17 Remove the cable (part number N0026100) connecting the RS232 port and the COM port from the R2MFC MBM.

**Tips:** Upgrading the firmware does not erase the custom profile, if the custom profile is saved in EEPROM.

# Chapter 7
# Command line interface

This chapter describes the command line interface (CLI) available through the serial port.

CLI commands are organized as a tree of directories. Each directory contains a set of commands related to a specific purpose or subject. The available directories for R2MFC MBM are

- LOad
- INfo
- VIew
- CNtrl
- COnfig
- ALarm
- SWerr
- MFC
- R2
- PRI

> **Note:** Most directories and commands have a short form indicated by uppercase letters.

To access a directory, type the directory name or the short form. A list (or menu) of available commands or subdirectories displays. The commands are not case-sensitive.The list displays again if you type an incorrect command or an empty command.

To go to the previous menu level in the tree, type an asterisk (*).

## Users and passwords

The CLI contains the following two hard-coded user names with passwords:

- **RS232**—This is the default user, which does not require a password. This user accesses configuration and maintenance commands.
- **admin**—Password: **admin**. This user has access to the same set of commands as RS232.

> **Note:** Users and passwords are case-sensitive.

## Accessing the CLI

The CLI is accessed through the RS-232 port on the faceplate of the R2MFC MBM. The cable that was shipped with the R2MFC MBM, part number N0026100, is used to connect a computer to the R2MFC MBM.

Perform the following steps to access the CLI:

1. Use the shipped cable to connect a PC to the RS-232 port on the faceplate of the R2MFC MBM through COM1.
2. Open a Hyper-terminal session on the PC using the following parameters:

**Table 16** Hyper-terminal setup parameters

| Parameter | Setting |
|---|---|
| Connect using | COM 1 or COM 2 |
| Bits per second | 19 200 |
| Data bits | 8 |
| Parity | None |
| Stop Bits | 1 |
| Flow Control | None |

3. Wait for monitor line (flashing cursor) to appear on the terminal session.
4. Switch to appropriate user by using the **`su`** command and entering the appropriate username and password.
5. Access the desired directory using the directory commands listed in this chapter.
6. Execute any desired commands.
7. Release the COM port by closing the Hyper-terminal session.
8. Remove the cable connecting the PC to the R2MFC MBM.

# Commands

The following section lists and describes the CLI commands for the available directories.

## LOad directory

Table 17 includes the CLI commands for firmware download and card restart. The commands are accessed from the LOad directory.

**Table 17** LOad directory CLI commands

| CLI command | Description |
|---|---|
| RST | Restarts card firmware regardless of current state.<br>There is no prompt to confirm the restart. |
| load y | Configures the hardware to accept downloads |
| fload | Downloads the firmware. |

## INfo directory

Table 18 includes the CLI command to display the firmware versions. The command is accessed from the INfo directory.

**Table 18** INfo directory CLI commands

| CLI command | Description |
|---|---|
| Fwversion | Displays the firmware versions and the state of the DIP switches. |
| SystTime | Prints the current time and how long the load has been in-service. |

## VIew directory

Table 19 includes the CLI commands to display the setup parameters. The commands are accessed from the VIew directory.

**Table 19** VIew directory CLI commands (Sheet 1 of 2)

| CLI command | Description |
|---|---|
| LNst | Displays the status of both links. |
| ChSt <chan1> <chan2> | Displays the status of the channels in the given range.<br><br>Where:<br>chan1 is the lower limit of the range.<br>chan2 is the upper limit of the range.<br><br>The values for chan1 and chan2 are 1...15, 17...31. |

**Table 19** VIew directory CLI commands (Sheet 2 of 2)

| CLI command | Description |
|---|---|
| ChDt <chan> | Prints the channel data.<br><br>Where:<br>chan is the channel number in the range of 1...15, 17...31. |
| ChDtGrp | Prints data for a range of channels. |
| TT <num> | Prints the timer table that contains the timer values in milliseconds.<br><br>Where:<br>num is either 1 (Outgoing timers) or 2 (Incoming timers).<br><br>If you do not enter a value for num, all timers are printed. |
| MR <mfc_link_no> <num> | Displays the MFC/R2 generic parameters for each link.<br><br>Where:<br>mfc_link_no is the value of the MFC link number, either 0 or 1.<br>num is 0 (R2 signals), 1 (MFC Tx signals), or 2 (MFC Rx signals).<br><br>If you do not enter a value for num, all MFC/R2 signals are printed. |

## CNtrl directory

Table 20 includes the CLI commands for maintenance functions. The commands are accessed from the CNtrl directory. All enable and disable commands are to be used for troubleshooting purposes only. For normal operation, both links and all channels must be enabled (default state). This includes links and channels in an environment with a partial E1 arrangement.

**Table 20** CNtrl directory CLI commands (Sheet 1 of 4)

| CLI command | Description |
|---|---|
| CSd <chan> | Performs channel soft-disabling.<br><br>Where:<br>chan is the channel number in the range of 1...15, 17...31.<br><br>If there is a call on the channel, the system disables the channel after the current call process is complete. This command sends messages to both links. |

**Table 20** CNtrl directory CLI commands (Sheet 2 of 4)

| CLI command | Description |
|---|---|
| CSdGrp <start_chan> <end_chan> | Performs soft-disabling on a group of channels.<br><br>Where:<br>start_chan is the first channel in the group.<br>end_chan is the last channel in the group.<br>The values for start_chan and end_chan are 1...15, 17...31.<br><br>If there is a call on the channel, the system disables the channel after the current call process is complete. This command sends messages to both links. |
| CId <chan> | Performs immediate disabling on a channel.<br><br>Where:<br>chan is the channel number in the range of 1...15, 17...31.<br><br>If there is a call on the channel, the system ends the call and disables the channel. This command sends messages to both links. |
| CIdGrp <start_chan> <end_chan> | Performs immediate disabling on a group of channels.<br><br>Where:<br>start_chan is the first channel in the group.<br>end_chan is the last channel in the group.<br>The values for start_chan and end_chan are 1...15, 17...31.<br><br>If there is a call on a channel, the system ends the call and disables the channel. This command sends messages to both links. |
| CEnbl <chan> | Performs channel enabling.<br><br>Where:<br>chan is the channel number in the range of 1...15, 17...31.<br><br>This command sends a message to both protocol handlers. |
| CEnblGrp <start_chan> <end_chan> | Performs channel enabling on a group of channels.<br><br>Where:<br>start_chan is the first channel in the group.<br>end_chan is the last channel in the group.<br>The values for start_chan and end_chan are 1...15, 17...31. |
| LSd | Performs link soft-disabling, which disables IDLE channels immediately.<br><br>If there is a call in progress, the system disables the channel after the current call is complete. This command sends a message to both protocol handlers. |

**Table 20** CNtrl directory CLI commands (Sheet 3 of 4)

| CLI command | Description |
|---|---|
| LId | Performs immediate link disabling.<br><br>If there is a call in progress, the system ends the call and disables the channel. This command sends a message to both protocol handlers. |
| LEnbl | Performs link enabling.<br><br>The command sends a message to both protocol handlers. |
| CoFlm <chan> | Transfers a disabled channel to an offline state.<br><br>Where:<br>chan is the channel number in the range of 1...15, 17...31.<br><br>The command sends a message to both protocol handlers. |
| CoFlmGrp <start_chan> <end_chan> | Transfers disabled channels to an offline state.<br><br>Where:<br>start_chan is the first channel in the group.<br>end_chan is the last channel in the group.<br>The values for start_chan and end_chan are 1...15, 17...31.<br><br>The command sends messages to both protocol handlers. |
| CoNlm <chan> | Transfers the channel to an online state.<br><br>Where:<br>chan is the channel number in the range of 1...15, 17...31.<br><br>If the system accepts the message, the channel becomes disabled. This command sends a message to both protocol handlers. |
| CoNlmGrp <start_chan> <end_chan> | Transfers a group of channels to an online state.<br><br>Where:<br>start_chan is the first channel in the group.<br>end_chan is the last channel in the group.<br>The values for start_chan and end_chan are 1...15, 17...31.<br><br>If the system accepts the messages, the channels become disabled. |

**Table 20** CNtrl directory CLI commands (Sheet 4 of 4)

| CLI command | Description |
|---|---|
| MC <link_num> | Sets the side that is used as clock source.<br><br>Where:<br>link_num is either 0 (link 0) or 1 (link 1).<br><br>If this command is entered without a parameter, the current clock master is printed. |

## COnfig directory

Table 21 includes the CLI commands for general card configuration. The commands are accessed from the COnfig directory.

**Table 21** COnfig directory CLI commands (Sheet 1 of 2)

| CLI command | Description |
|---|---|
| LinePhy <phy_mode> | Sets the physical interface type of the external E1 line.<br><br>Where phy_mode can be:<br>0 indicating 120 Ohm (RJ48 connector).<br>1 indicating 75 Ohm (RX and TX, BNC connector), grounded shield.<br>2 indicating 75 Ohm (TX BNC connectors), not-grounded shield. |
| SaveCfg | Stores the current configuration on non-volatile Flash memory.<br><br>All parameters are stored-country-specific and non-country-specific. The stored configuration is used when the config DIP switches on the faceplate are set to custom profile. Only one configuration (custom profile) is stored. This command deletes the previous configuration contents. |
| EraseCfg | Erases the configuration from non-volatile Flash memory.<br><br>As a result, the custom profile does not exist, and other parameters not included in custom profile use factory default settings. A live system is not affected, since current configuration is stored in RAM. The MBM tries to read configuration from Flash memory on restart. |
| DEbnc <link> <msec> | Updates the line signal debounce time.<br><br>Where:<br>link is the link number, either 0 or 1.<br>msec is the time, in milliseconds, ranging from 10 to 200.<br><br>The value for msec should be in multiples of 5. If not, then the system rounds it off to the nearest multiple of 5. |

**Table 21** COnfig directory CLI commands (Sheet 2 of 2)

| CLI command | Description |
|---|---|
| ST <year> <month> <day> <hour> <min> <sec> | Sets the current system time.<br><br>Where:<br>year = yyyy<br>month = 1...12<br>day = 1...31<br>hour = 0...23<br>min = 0...59<br>sec = 0...59<br><br>If you enter the ST command without parameters, the system displays the current system time. |

## ALarm directory

Table 22 includes the CLI commands for alarm configuration and status. The commands are accessed from the ALarm directory.

**Table 22** ALarm directory CLI commands (Sheet 1 of 2)

| CLI command | Description |
|---|---|
| G1Res <link_no> <group I alarms> | Resets Group 1 alarm counters.<br><br>Where:<br>link_no is the link number, either 0 or 1.<br>Group I alarms defines the group and can have values of:<br>• 0 – BPV<br>• 1 – FBER<br>• 2 – SLIP<br>• 3 – CRC4<br>• 4 – ALL |
| Bit3 <link_no> <bit3> | Used for bit 3 option handling.<br><br>Where:<br>link_no is the link number, 0 or 1.<br>bit3 is the option flag, 0 (off) or 1 (on). |
| OP16 <link_no> <$AIS_{TS16}$> | Used for $AIS_{TS16}$ option handling.<br><br>Where:<br>link_no is the link number, 0 or 1.<br>$AIS_{TS16}$ is the option flag, 0 (off) or 1 (on). |

**Table 22** ALarm directory CLI commands (Sheet 2 of 2)

| CLI command | Description |
|---|---|
| FR <link_no> <fr_mode> | Changes the frame mode.<br><br>Where:<br>link_no is the PCM link number, 0 or 1.<br>fr_mode is 0 (ALTRNT2_FRM) or 1 (MULTIFRM_CRC4)<br><br>Default for link 0 (external) depends on country selection. Default for link 1 (internal) is set to alternate and should not be changed to multframe. |
| G1th <link_no> <pra> <limcount> | Sets the group I alarm thresholds.<br><br>Where:<br>link_no is the PCM link number, 0 or 1.<br>pra is the problem group I errors and can have values of:<br>• 0 – BPV<br>• 1 – FBER<br>• 2 – SLIP<br>• 3 – CRC4<br>limcount is the threshold error count in the range of 1...1000. |
| GRDtime <link_no> <grs_state> <grd_time> | Changes group 1 alarm guard time for the required grade of service state.<br><br>Where:<br>link_no is the PCM link number, 0 or 1.<br>grs_state is the grade of service state, 1 (mnt state) or 2 (oos state).<br>grd_time is the guard time in the range of 20...50000. |
| G2Gtime <link_no> <grd_time> | Changes the group 2 alarm guard time for the required grade of service state.<br><br>Where:<br>link_no is the PCM link number, 0 or 1.<br>grd_time is the group guard time in the range of 0...50000. |
| G2Ptime <link_no> <perstime> | Changes persistence time for group 2 alarm handling.<br><br>Where:<br>link_no is the PCM link number, 0 or 1.<br>perstime is the persistence time for group 2 alarm handling in the range of 0...50000. |
| DB <link_no> | Displays the R2MFC MBM alarm task database content.<br><br>Where:<br>link_no is the PCM link number, 0 or 1. |

## SWerr directory

Table 23 includes the CLI commands for the Software Error (SWerr) utility. The firmware stores the Swerr messages into a cyclic buffer. The contents of the buffer are printed upon request.The commands are accessed from the SWerr directory.

**Table 23** SWerr directory CLI commands

| CLI command | Description |
|---|---|
| PS <num> | Prints the Swerr buffer constants. All the accumulated swerr messages are printed.<br><br>Where:<br>num is the number of error messages to print (optional).<br><br>The buffer stores the 20 most recent messages. |
| GF | Displays the swerr error levels and control flags.<br><br>There are three error levels: inform, serious, and fatal. Each level has two flags: Insert_flag, which stores error information in the buffer, and Print_flag, which prints to the serial port when an error occurs. |
| CF <level> <insert_flag> <Fast_print_flag> <user_func_addr> | Changes swerr control flags.<br><br>Where:<br>level is in the range of 0...2.<br>insert_flag is true or false<br>Fast_print_flag is in the range of 0...2 (0 = print, 1 = print, 2 = fast print).<br>user_func_addr is the user function address (for firmware engineers only). |
| DEL < number> | Deletes swerr messages from the buffer.<br><br>Where:<br>number is the number of swerr messages to delete (oldest messages are deleted). Enter 0 to delete all swerr messages. |
| DWN | Prints detailed debug information for one swerr message, stepping down (back in time). |
| UP | Prints detailed debug information for one swerr message, stepping up (forward in time). |
| PP | Prints detailed debug information for the current swerr message. |
| HeLP | Prints the descriptions of all the commands in the swerr directory. |

## MFC directory

Table 24 includes the CLI commands for the configuration and control of MFC-R2 protocols. The commands are accessed from the MFC directory.

**Table 24** MFC directory CLI commands (Sheet 1 of 3)

| CLI command | Description |
|---|---|
| ICm <mfc_link> <incoming_timer_type> <msec> | Sets and displays incoming call timers.<br><br>Where:<br>mfc_link is the number of required mfc/r2 links.<br>incoming_timer_type is one of the timers defined for incoming mfc call processing.<br>msec is the time interval in msec. |
| OGm <mfc_link> <outgoing_timer_type> <msec> | Sets and displays outgoing call timers.<br><br>Where:<br>mfc_link is the number of required mfc/r2 links.<br>outgoing_timer_type is one of the timers defined for outgoing mfc call processing.<br>msec is the time interval in msec. |
| REgSign <mfc_link><rs_name> | Sets the register signaling<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>rs_name is the signaling type, 0 (MFC) or 1 (SMFC). |
| AniOption <mfc_link><flag> | Enables or disables the ANI option.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>flag defines the ANI option as enabled (0) or disabled (1).<br><br>When disabled, ANI is not requested in incoming calls and not transmitted in outgoing calls. |
| CatgOpt <mfc_link> <flag> | Defines which MFC category to transmit in outgoing calls.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>flag defines the MFC category (default is 0). |
| DefltCatgVal <mfc_link><category> | Defines the MFC category value when CatgOpt is set to the default value.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>category is the MFC category in the range of 1...15. |

**Table 24** MFC directory CLI commands (Sheet 2 of 3)

| CLI command | Description |
|---|---|
| SubsIndOpt <mfc_link> <flag> | Defines which subscriber status to send when an incoming MFC call terminates successfully.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>flag is the subscriber status, 0 (subscriber option is default value) or 1 (subscriber option is received value). |
| DefltSubsVal <mfc_link><subscriber> | Defines the subscriber status value when the SubsIndOpt commands is set to the default value.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>subscriber can have the values of:<br>• 0 = speech_charge (A group)<br>• 1 = free_charge<br>• 2 = free_no_charge<br>• 3 = control_charge |
| EndDialType <mfc_link><direction><type> | Defines how to handle MFC end of dial.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>direction is 0 (IC), 1 (OG), or 2 (both).<br>type is either 0 (Ix signal) or 1 (fix number of digits). |
| SetDigitCount <mfc_link> <count_type> <value> | Sets the number of expected digits when the EndDialType is set to a fixed number of digits.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>count_type is either 0 (minimal range) or 1 (optional range).<br>value has values of 3...12 for minimal range or 0...15 for optional range. |
| EndAniType <mfc_link><direction><type> | Defines how to determine end of ANI digits.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>direction is 0 (IC), 1 (OG), or 2 (both).<br>type is either 0 (Ix signal) or 1 (fixed number of digits). |
| SetAniCount <mfc_link> <value> | Defines the number of expected ANI digits when EndAniType is set to a fixed number of digits.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>value is the expected number of ANI digits in the range of 1...16. |

**Table 24** MFC directory CLI commands (Sheet 3 of 3)

| CLI command | Description |
|---|---|
| ARP <mfc_link> <Dig_num> | Sets the number of received DID digits, after which the MBM sends ANI requests to the CO.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>Dig_num is the number of digit after which ANI is requested in the range of 1...20, or 0 (after the last digit).<br><br>This command is for incoming calls only. |
| BCatOpt <mfc_link><pls/cmpl> | Defines BW_BCateg signal as pulse or compelled signal.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>pls/cmpl is either 0 (BCategory is compelled signal) or 1 (BCategory is pulsed signal). |
| MTS <mfc_link> <MFC_signal_meaning> <MFC_signal> | Sets the MFC transmit signals value. For each logical meaning, sets which MFC physical signal is actually sent.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>MFC_signal_meaning is one of the MFC signals meaning in the range of 0...49. See Appendix C, “MFC signal definitions” MFC definition tables.<br>MFC_signal is either Forward (I,II) or Backward (A,B) signals. |
| MRS <mfc_link> <MFC_signal> <MFC_signal_meaning> | Defines how to interpret received MFC signals. For each MFC physical signal sets its logical meaning.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1.<br>MFC_signal is either Forward (I,II) or Backward (A,B) signals.<br>MFC_signal_meaning is one of the MFC signals meaning in the range of 0...49. See Appendix C, “MFC signal definitions” for MFC definition tables. |

## R2 directory

Table 25 includes the CLI commands for R2 line signaling. The commands are accessed from the R2 directory.

**Table 25** R2 directory CLI commands (Sheet 1 of 2)

| CLI command | Description |
|---|---|
| RS <link> <line_signal_meaning> <R2_signal> | Sets the R2 signaling values.<br><br>Where:<br>link is the number of the link, 0 or 1.<br>line_signal_meaning is one of the line signal meaning codes.<br>R2_signal is the ABCD bits value of 0, 1, 2, or 3.<br><br>Use this command after clearing the R2 signaling value.<br><br>The R2 signaling values must follow these rules:<br>FW_IDLE = BW_IDLE = FW_CLEAR_FORWARD<br>FW_SEIZE != FW_IDLE<br>FW_SEIZE != BW_BLOCK<br>BW_SEIZE_ACK = BW_CLEAR_BACK = BW_BLOCK<br>BW_SEIZE_ACK != BW_IDLE<br>BW_SEIZE_ACK != FW_SEIZE<br>BW_ANSWER: this signal must be different than all other BW signals.<br>BW_FORCE_RELEASE: (if used) this signal must be different than all other BW signals. |
| CD <link> <CD_bits_value> | Sets a fixed value to be transmitted on CD bits.<br><br>Where:<br>link is the number of the link, 0 or 1.<br>CD_bit_values is 0, 1, 2, or 3. |
| ER <mfc_link> | Erases the R2 signaling table values.<br><br>Where:<br>mfc_link is the number of the link, 0 or 1. |
| RingOpt <link><flag> | Sets the ringing signal.<br><br>Where:<br>link is the number of the link, 0 or 1.<br>flag is either 0 (ringing signal is not used) or 1 (ringing signal is used). |

**Table 25** R2 directory CLI commands (Sheet 2 of 2)

| CLI command | Description |
|---|---|
| SeizeOption <link><flag> | Sets seize interworking with opposite link upon detecting seize from far end.<br><br>Where:<br>link is the number of the link, 0 or 1.<br>flag is either 0 (seize process is autonomic) or 1 (seize process is dependant).<br><br>Autonomic - link responds to seize without waiting for opposite link ack.<br>Dependant - link waits for opposite link ack before sending its ack. |
| SzAckOpt <link><flag> | Work with seize ack or not.<br><br>Where:<br>link is the number of the link, 0 or 1.<br>flag is either 0 (seize ack is not used) or 1 (seize ack is used). |
| SearchMode <link><mode> | Sets MFC channel allocation mode.<br><br>Where:<br>link is the number of the link, 0 or 1 (applicable to link 0 only).<br>mode is either 0(round robin), 1 (linear ascending), or 2 (linear descending)<br><br>Round robin (default) - start search for next available channel after last channel used.<br>linear ascending - search for next available channel from channel 1 up.<br>linear descending - search for next available channel from 30 down.<br><br>New defined mode is effective immediately after it is defined. It must be saved, by using the SaveCfg command, to remain in effect after a restart. The new mode is saved on the EEPROM, and is always in effect, regardless of the Config DIP switch settings (mode is not part of the country code configuration). |

## PRI directory

Table 26 includes the CLI commands for the PRI directory. The commands are accessed from the PRI directory.

**Table 26** PRI directory CLI commands (Sheet 1 of 2)

| CLI command | Description |
|---|---|
| UNS | Displays the user and network side information.<br><br>For R2MFC MBM the value is hard-coded as network side. |

**Table 26** PRI directory CLI commands (Sheet 2 of 2)

| CLI command | Description |
|---|---|
| SDT <dial_type> | Sets the dial type to overlap or non-overlap.<br><br>Where:<br>dial_type is either 0 (enblock/non-overlap) or 1 (overlap).<br><br>The default is non-overlap. |

# Appendix A
## Config DIP switch settings and definitions

This appendix shows the faceplate DIP switch settings for the country codes and for second dial tone. It also contains the definitions of the settings for the different countries codes.

See Figure 28 on page 86 for country code DIP switch settings and Figure 29 on page 86 for second dial tone DIP switch settings.

Figure 27 shows the Config DIP switch layout.

**Figure 27** Config DIP Switches

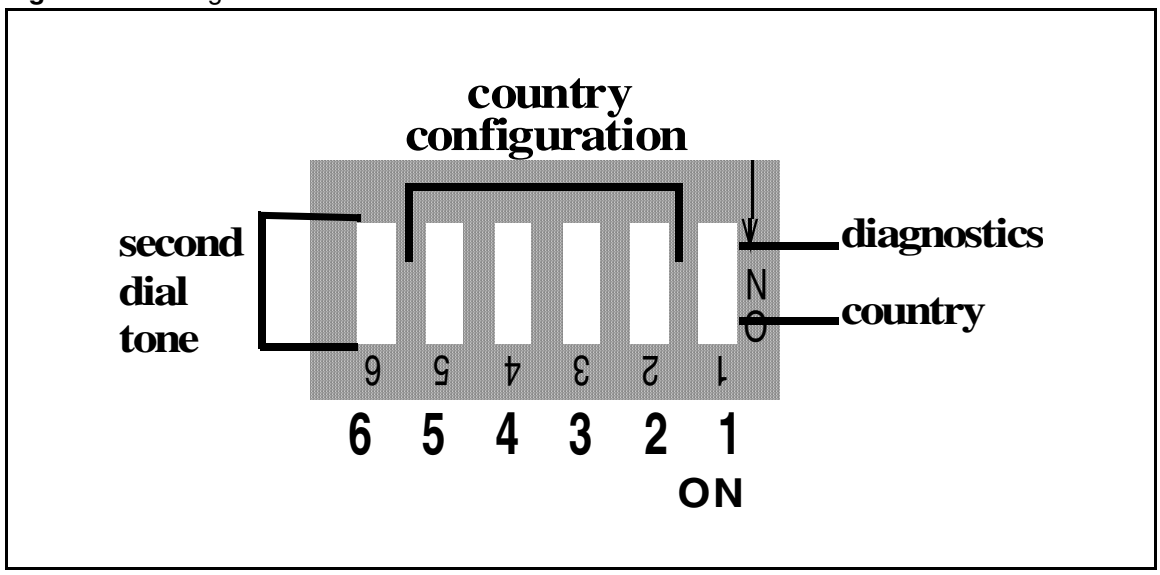


**Figure 28** Country selection DIP switch settings

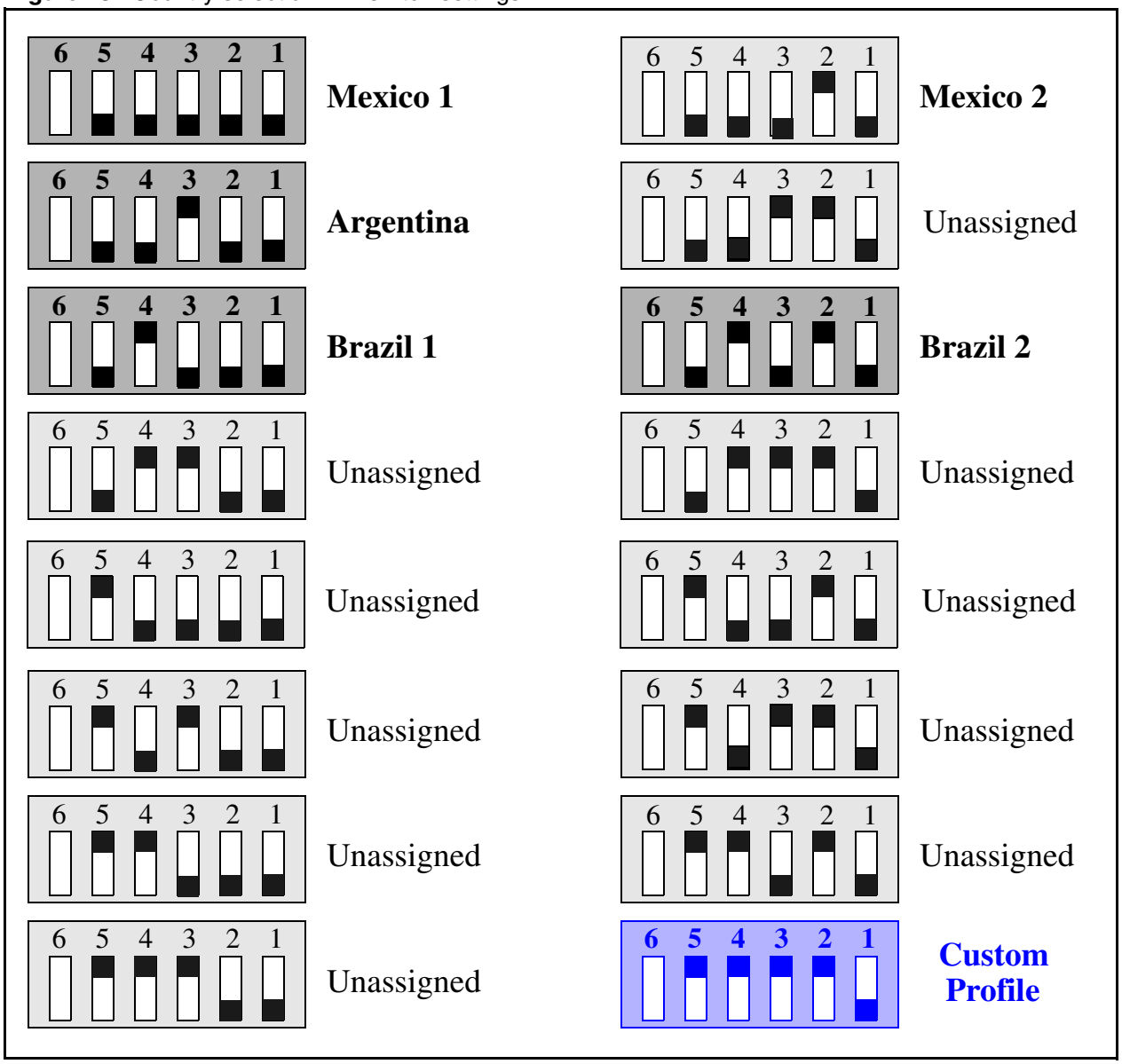
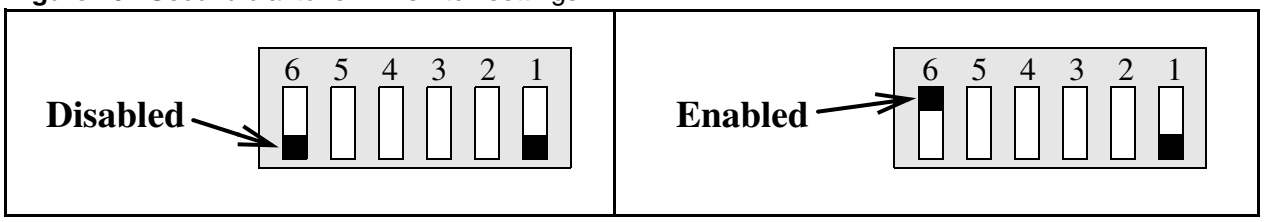



**Figure 29** Second dial tone DIP switch settings.




**Note:** Second dial tone is controlled using switch 6. Changes to this switch are effective immediately, and do not cause the MBM to restart. Also, the BCM must be set to outgoing dialling mode overlap for the dial tone to be heard.

# Country code defaults

This section contains the default configuration associated to the country code set by the DIP switches on the faceplate of the R2MFC MBM.

## Mexico Config 1

### E1 physical characteristics

- Connector type: BNC
- Line coding: HDB3

### E1 framing

Frame mode: Alternate

### Register signaling

- Regret option: OFF
- End of dialing (Incoming): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**
- End of dialing (Outgoing): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**

### R2 line signaling

Mexico Config 1 R2 signals are according to CCITT standard. See Table 27 for the Mexico Config 1 R2 signal definitions.

**Table 27** Mexico Config 1 R2 A/B signals

| Forward | | | Backward | | |
|---|---|---|---|---|---|
| Signal | A | B | Signal | A | B |
| Idle | 1 | 0 | Idle | 1 | 0 |
| Seize | 0 | 0 | Seize acknowledge | 1 | 1 |
| Clear forward | 1 | 0 | Answer | 0 | 1 |
| | | | Clear back | 1 | 1 |
| | | | Block | 1 | 1 |

**Note:** CD bits are not used. They are set to **01** in transmit direction, and are ignored in receive direction.

## MFC register signaling

MFC signal definitions depends on the stage and the direction of the call; there are four tables of 15 signals each: the first stage uses **I** signals forward and **A** signals backward, and the second stage uses **II** signals forward and **B** signals backward. The meaning of the signals can also be different when being transmitted or received. Meanings of the MFC signals are configurable. MFC signal tables are part of the country-specific parameters.

Table 28 shows the MFC signal configuration in the R2MFC MBM accessed through the CLI for Mexico Config 1. Table 29 shows the MFC transmitted signal configuration in the R2MFC MBM accessed through the CLI for Mexico Config 1. These values are preconfigured by the faceplate DIP switches as shown in Figure 28 on page 86. See Chapter 7, "Command line interface," on page 69 for information on the CLI.

**Table 28** Interpretation of received MFC signals

| Meaning | Signal | Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|---|---|
| FW_Digit_1 | I_1 | FW_Categ_1 | II_1 | BW_DigitOrAni | A_1 | BW_FreeCharge | B_1 |
| FW_Digit_2 | I_2 | FW_Categ_2 | II_2 | BW_ReSend | A_2 | BW_Busy | B_2 |
| FW_Digit_3 | I_3 | FW_Categ_3 | II_3 | BW_BCateg | A_3 | BW_B_Congest | B_3 |
| FW_Digit_4 | I_4 | FW_Categ_4 | II_4 | BW_A_Congest | A_4 | BW_B_Congest | B_4 |
| FW_Digit_5 | I_5 | FW_Categ_5 | II_5 | BW_RtrnToA | A_5 | BW_FreeNoChrg | B_5 |
| FW_Digit_6 | I_6 | FW_Categ_6 | II_6 | BW_CatgSamDig | A_6 | BW_B_Congest | B_6 |
| FW_Digit_7 | I_7 | FW_Categ_7 | II_7 | BW_Illegal | A_7 | BW_B_Congest | B_7 |
| FW_Digit_8 | I_8 | FW_Categ_8 | II_8 | BW_Illegal | A_8 | BW_B_Congest | B_8 |
| FW_Digit_9 | I_9 | FW_Categ_9 | II_9 | BW_Illegal | A_9 | BW_B_Congest | B_9 |
| FW_Digit_0 | I_10 | FW_Categ_10 | II_10 | BW_Illegal | A_10 | BW_B_Congest | B_10 |
| FW_Digit_11 | I_11 | FW_Categ_11 | II_11 | BW_Illegal | A_11 | BW_B_Congest | B_11 |
| FW_ReqFault | I_12 | FW_Categ_12 | II_12 | BW_Illegal | A_12 | BW_B_Congest | B_12 |
| FW_Digit_13 | I_13 | FW_Categ_13 | II_13 | BW_Illegal | A_13 | BW_B_Congest | B_13 |
| FW_Digit_14 | I_14 | FW_Categ_14 | II_14 | BW_Illegal | A_14 | BW_B_Congest | B_14 |
| FW_EndANIdgts | I_15 | FW_Categ_15 | II_15 | BW_Illegal | A_15 | BW_B_Congest | B_15 |

**Table 29** Interpretation of transmitted MFC signals (Sheet 1 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_NextDig | A_1 | FW_EndANIdgts | I_15 | FW_Categ_2 | II_2 |
| BW_BCateg | A_3 | FW_Digit_1 | I_1 | FW_Categ_3 | II_3 |
| BW_RtrnToA | A_5 | FW_Digit_2 | I_2 | FW_Categ_4 | II_4 |
| BW_A_Congest | A_4 | FW_Digit_3 | I_3 | FW_Categ_5 | II_5 |
| BW_B_Congest | B_4 | FW_Digit_4 | I_4 | FW_Categ_6 | II_6 |
| BW_Category | A_6 | FW_Digit_5 | I_5 | FW_Categ_7 | II_7 |
| BW_SpeechChrg | NO_SG | FW_Digit_6 | I_6 | FW_Categ_8 | II_8 |
| BW_OrigDn | A_1 | FW_Digit_7 | I_7 | FW_Categ_9 | II_9 |

**Table 29** Interpretation of transmitted MFC signals (Sheet 2 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_FreeCharge | B_1 | FW_Digit_8 | I_8 | FW_Categ_10 | II_10 |
| BW_FreeNoChrg | B_5 | FW_Digit_9 | I_9 | FW_Categ_11 | II_11 |
| BW_CntrCharge | B_1 | FW_Digit_0 | I_10 | FW_Categ_12 | II_12 |
| BW_Busy | B_2 | FW_Digit_11 | I_11 | FW_Categ_13 | II_13 |
| BW_Unlocated | B_4 | FW_Digit_12 | I_12 | FW_Categ_14 | II_14 |
| BW_OutOfOrder | B_4 | FW_Digit_13 | I_13 | FW_Categ_15 | II_15 |
| BW_ChangOrder | B_4 | FW_Digit_14 | I_14 | FW_KD_Local | II_3 |
| FW_ReqFault | I_15 | FW_Digit_15 | I_15 | FW_KD_LnDst | II_2 |
| FW_EndDigits | I_15 | FW_Categ_1 | II_1 | | |

# Mexico Config 2

## E1 physical characteristics

- Connector type: BNC
- Line coding: HDB3

## E1 framing

Frame mode: Alternate

## Register signaling

- Regret option: OFF
- End of dialing (Incoming): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**
- End of dialing (Outgoing): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**

## R2 line signaling

Mexico Config 2 R2 signals are according to CCITT standard. See Table 30 for the Mexico Config 2 R2 signal definitions.

**Table 30** Mexico Config 2 R2 A/B signals

| Forward | | | Backward | | |
|---|---|---|---|---|---|
| Signal | A | B | Signal | A | B |
| Idle | 1 | 0 | Idle | 1 | 0 |

**Table 30** Mexico Config 2 R2 A/B signals

| Forward | | | Backward | | |
|---|---|---|---|---|---|
| Signal | A | B | Signal | A | B |
| Seize | 0 | 0 | Seize acknowledge | 1 | 1 |
| Clear forward | 1 | 0 | Answer | 0 | 1 |
| | | | Clear back | 1 | 1 |
| | | | Block | 1 | 1 |

**Note:** CD bits are not used. They are set to **01** in transmit direction, and are ignored in receive direction.

## MFC register signaling

MFC signal definitions depends on the stage and the direction of the call; there are four tables of 15 signals each: the first stage uses **I** signals forward and **A** signals backward, and the second stage uses **II** signals forward and **B** signals backward. The meaning of the signals can also be different when being transmitted or received. Meanings of the MFC signals are configurable. MFC signal tables are part of the country-specific parameters.

Table 31 shows the MFC signal configuration in the R2MFC MBM accessed through the CLI for Mexico Config 2. Table 32 on page 91 shows the MFC transmitted signal configuration in the R2MFC MBM accessed through the CLI for Mexico Config 2. These values are preconfigured by the faceplate DIP switches as shown in Figure 28 on page 86. See Chapter 7, "Command line interface," on page 69 for information on the CLI.

**Table 31** Interpretation of received MFC signals (Sheet 1 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|---|---|
| FW_Digit_1 | I_1 | FW_Categ_1 | II_1 | BW_NextDig | A_1 | BW_FreeCharge | B_1 |
| FW_Digit_2 | I_2 | FW_Categ_2 | II_2 | BW_PrevDigit | A_2 | BW_Busy | B_2 |
| FW_Digit_3 | I_3 | FW_Categ_3 | II_3 | BW_BCateg | A_3 | BW_B_Congest | B_3 |
| FW_Digit_4 | I_4 | FW_Categ_4 | II_4 | BW_A_Congest | A_4 | BW_B_Congest | B_4 |
| FW_Digit_5 | I_5 | FW_Categ_5 | II_5 | BW_Category | A_5 | BW_Unlocated | B_5 |
| FW_Digit_6 | I_6 | FW_Categ_6 | II_6 | BW_SpeechChrg | A_6 | BW_B_Congest | B_6 |
| FW_Digit_7 | I_7 | FW_Categ_7 | II_7 | BW_Prev2Digit | A_7 | BW_B_Congest | B_7 |
| FW_Digit_8 | I_8 | FW_Categ_8 | II_8 | BW_Prev3Digit | A_8 | BW_OutOfOrder | B_8 |
| FW_Digit_9 | I_9 | FW_Categ_9 | II_9 | BW_OrigDn | A_9 | BW_B_Congest | B_9 |
| FW_Digit_0 | I_10 | FW_Categ_10 | II_10 | BW_ReSend | A_10 | BW_B_Congest | B_10 |
| FW_Digit_11 | I_11 | FW_Categ_11 | II_11 | BW_NextDig | A_11 | BW_B_Congest | B_11 |
| FW_ReqFault | I_12 | FW_Categ_12 | II_12 | BW_Illegal | A_12 | BW_B_Congest | B_12 |
| FW_Digit_13 | I_13 | FW_Categ_13 | II_13 | BW_Illegal | A_13 | BW_B_Congest | B_13 |

**Table 31** Interpretation of received MFC signals (Sheet 2 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|---|---|
| FW_Digit_14 | I_14 | FW_Categ_14 | II_14 | BW_Illegal | A_14 | BW_B_Congest | B_14 |
| FW_Enddigits | I_15 | FW_Categ_15 | II_15 | BW_Illegal | A_15 | BW_B_Congest | B_15 |

**Table 32** Interpretation of transmitted MFC signals

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_NextDig | A_1 | FW_EndANIdgts | I_15 | FW_Categ_2 | II_2 |
| BW_BCateg | A_3 | FW_Digit_1 | I_1 | FW_Categ_3 | II_3 |
| BW_RtrnToA | A_1 | FW_Digit_2 | I_2 | FW_Categ_4 | II_4 |
| BW_A_Congest | A_4 | FW_Digit_3 | I_3 | FW_Categ_5 | II_5 |
| BW_B_Congest | B_4 | FW_Digit_4 | I_4 | FW_Categ_6 | II_6 |
| BW_Category | A_6 | FW_Digit_5 | I_5 | FW_Categ_7 | II_7 |
| BW_SpeechChrg | NO_SG | FW_Digit_6 | I_6 | FW_Categ_8 | II_8 |
| BW_OrigDn | A_1 | FW_Digit_7 | I_7 | FW_Categ_9 | II_9 |
| BW_FreeCharge | B_1 | FW_Digit_8 | I_8 | FW_Categ_10 | II_10 |
| BW_FreeNoChrg | B_1 | FW_Digit_9 | I_9 | FW_Categ_11 | II_11 |
| BW_CntrCharge | B_1 | FW_Digit_0 | I_10 | FW_Categ_12 | II_12 |
| BW_Busy | B_2 | FW_Digit_11 | I_11 | FW_Categ_13 | II_13 |
| BW_Unlocated | B_5 | FW_Digit_12 | I_12 | FW_Categ_14 | II_14 |
| BW_OutOfOrder | B_8 | FW_Digit_13 | I_13 | FW_Categ_15 | II_15 |
| BW_ChangOrder | B_4 | FW_Digit_14 | I_14 | FW_KD_Local | II_3 |
| FW_ReqFault | I_12 | FW_Digit_15 | I_15 | FW_KD_LnDst | II_2 |
| FW_EndDigits | I_15 | FW_Categ_1 | II_1 | | |

# Brazil Config 1

## E1 physical characteristics

- Connector type: BNC
- Line coding: HDB3

## E1 framing

Frame mode: Alternate

## Register signaling

- Regret option: ON
- End of dialing (Incoming): 4
- End of dialing (Outgoing): 4

## R2 line signaling

Brazil Config 1 R2 signals are according to CCITT standard. See Table 33 for the Brazil Config 1 R2 signal definitions.

**Table 33** Brazil Config 1 R2 A/B signals

| Forward | | | Backward | | |
|---|---|---|---|---|---|
| Signal | A | B | Signal | A | B |
| Idle | 1 | 0 | Idle | 1 | 0 |
| Seize | 0 | 0 | Seize acknowledge | 1 | 1 |
| Clear forward | 1 | 0 | Answer | 0 | 1 |
| | | | Clear back | 1 | 1 |
| | | | Block | 1 | 1 |

**Note:** CD bits are not used. They are set to **01** in transmit direction, and are ignored in receive direction.

## MFC Register Signaling

MFC signal definitions depends on the stage and the direction of the call; there are four tables of 15 signals each: the first stage uses **I** signals forward and **A** signals backward, and the second stage uses **II** signals forward and **B** signals backward. The meaning of the signals can also be different when being transmitted or received. Meanings of the MFC signals are configurable. MFC signal tables are part of the country-specific parameters.

Table 34 shows the MFC signal configuration in the R2MFC MBM accessed through the CLI for Brazil Config 1. Table 35 shows the MFC transmitted signal configuration in the R2MFC MBM accessed through the CLI for Brazil Config 1. These values are pre-configured by the faceplate DIP switches as shown in Figure 28 on page 86. See Chapter 7, "Command line interface," on page 69 for information on the CLI.

**Table 34** Interpretation of received MFC signals

| Meaning | Signal | Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|---|---|
| FW_Digit_1 | I_1 | FW_Categ_1 | II_1 | BW_NextDig | A_1 | BW_FreeCharge | B_1 |
| FW_Digit_2 | I_2 | FW_Categ_2 | II_2 | BW_ReSend | A_2 | BW_Busy | B_2 |
| FW_Digit_3 | I_3 | FW_Categ_3 | II_3 | BW_BCateg | A_3 | BW_BW_OutOfOrder | B_3 |
| FW_Digit_4 | I_4 | FW_Categ_4 | II_4 | BW_A_Congest | A_4 | BW_B_Congest | B_4 |
| FW_Digit_5 | I_5 | FW_Categ_5 | II_5 | BW_CategOrAni | A_5 | BW_FreeNoChrg | B_5 |
| FW_Digit_6 | I_6 | FW_Categ_6 | II_6 | BW_Illegal | A_6 | BW_FreeCharge | B_6 |
| FW_Digit_7 | I_7 | FW_Categ_7 | II_7 | BW_Prev2Digit | A_7 | BW_Unlocated | B_7 |
| FW_Digit_8 | I_8 | FW_Categ_8 | II_8 | BW_Prev3Digit | A_8 | BW_B_Congest | B_8 |
| FW_Digit_9 | I_9 | FW_Categ_9 | II_9 | BW_PrevDigit | A_9 | BW_B_Congest | B_9 |
| FW_Digit_0 | I_10 | FW_Categ_10 | II_10 | BW_Illegal | A_10 | BW_B_Congest | B_10 |
| FW_Digit_11 | I_11 | FW_Categ_11 | II_11 | BW_Illegal | A_11 | BW_B_Congest | B_11 |
| FW_ReqFault | I_12 | FW_Categ_12 | II_12 | BW_Illegal | A_12 | BW_B_Congest | B_12 |
| FW_Digit_13 | I_13 | FW_Categ_13 | II_13 | BW_Illegal | A_13 | BW_B_Congest | B_13 |
| FW_Digit_14 | I_14 | FW_Categ_14 | II_14 | BW_Illegal | A_14 | BW_B_Congest | B_14 |
| FW_EndDigits | I_15 | FW_Categ_15 | II_15 | BW_Illegal | A_15 | BW_B_Congest | B_15 |

**Table 35** Interpretation of transmitted MFC signals (Sheet 1 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_NextDig | A_1 | FW_EndANIdgts | I_15 | FW_Categ_2 | II_2 |
| BW_BCateg | A_3 | FW_Digit_1 | I_1 | FW_Categ_3 | II_3 |
| BW_RtrnToA | A_1 | FW_Digit_2 | I_2 | FW_Categ_4 | II_4 |
| BW_A_Congest | A_4 | FW_Digit_3 | I_3 | FW_Categ_5 | II_5 |
| BW_B_Congest | B_4 | FW_Digit_4 | I_4 | FW_Categ_6 | II_6 |
| BW_Category | A_5 | FW_Digit_5 | I_5 | FW_Categ_7 | II_7 |
| BW_SpeechChrg | NO_SG | FW_Digit_6 | I_6 | FW_Categ_8 | II_8 |
| BW_OrigDn | A_5 | FW_Digit_7 | I_7 | FW_Categ_9 | II_9 |
| BW_FreeCharge | B_1 | FW_Digit_8 | I_8 | FW_Categ_10 | II_10 |
| BW_FreeNoChrg | B_5 | FW_Digit_9 | I_9 | FW_Categ_11 | II_11 |
| BW_CntrCharge | B_1 | FW_Digit_0 | I_10 | FW_Categ_12 | II_12 |
| BW_Busy | B_2 | FW_Digit_11 | I_11 | FW_Categ_13 | II_13 |
| BW_Unlocated | B_7 | FW_Digit_12 | I_12 | FW_Categ_14 | II_14 |

**Table 35** Interpretation of transmitted MFC signals (Sheet 2 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_OutOfOrder | B_4 | FW_Digit_13 | I_13 | FW_Categ_15 | II_15 |
| BW_ChangOrder | B_4 | FW_Digit_14 | I_14 | FW_KD_Local | II_3 |
| FW_ReqFault | I_12 | FW_Digit_15 | I_15 | FW_KD_LnDst | II_2 |
| FW_EndDigits | I_15 | FW_Categ_1 | II_1 | | |

# Brazil Config 2

## E1 physical characteristics

- Connector type: BNC
- Line coding: HDB3

## E1 framing

Frame mode: Alternate

## Register signaling

- Regret option: OFF
- End of dialing (Incoming): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**
- End of dialing (Outgoing): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**

## R2 line signaling

Brazil Config 2 R2 signals are according to CCITT standard. See Table 36 for the Brazil Config 2 R2 signal definitions.

**Table 36** Brazil Config 2 R2 A/B signals

| Forward | | | Backward | | |
|---|---|---|---|---|---|
| Signal | A | B | Signal | A | B |
| Idle | 1 | 0 | Idle | 1 | 0 |
| Seize | 0 | 0 | Seize acknowledge | 1 | 1 |
| Clear forward | 1 | 0 | Answer | 0 | 1 |
| | | | Clear back | 1 | 1 |
| | | | Block | 1 | 1 |

**Note:** CD bits are not used. They are set to **01** in transmit direction, and are ignored in receive direction.

## MFC Register Signaling

MFC signal definitions depends on the stage and the direction of the call, there are four tables of 15 signals each: the first stage uses **I** signals forward and **A** signals backward, and the second stage uses **II** signals forward and **B** signals backward. The meaning of the signals can also be different when being transmitted or received. Meanings of the MFC signals are configurable. MFC signal tables are part of the country-specific parameters.

Table 37 shows the MFC signal configuration in the R2MFC MBM accessed through the CLI for Brazil Config 2. Table 38 on page 96 shows the MFC transmitted signal configuration in the R2MFC MBM accessed through the CLI for Brazil Config 2. These values are preconfigured by the faceplate DIP switches as shown in Figure 28 on page 86. See Chapter 7, "Command line interface," on page 69 for information on the CLI.

**Table 37** Interpretation of received MFC signals (Sheet 1 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|---|---|
| FW_Digit_1 | I_1 | FW_Categ_1 | II_1 | BW_NextDig | A_1 | BW_FreeCharge | B_1 |
| FW_Digit_2 | I_2 | FW_Categ_2 | II_2 | BW_ReSend | A_2 | BW_Busy | B_2 |
| FW_Digit_3 | I_3 | FW_Categ_3 | II_3 | BW_BCateg | A_3 | BW_B_Congest | B_3 |
| FW_Digit_4 | I_4 | FW_Categ_4 | II_4 | BW_A_Congest | A_4 | BW_B_Congest | B_4 |
| FW_Digit_5 | I_5 | FW_Categ_5 | II_5 | BW_CategOrAni | A_5 | BW_FreeNoChrg | B_5 |
| FW_Digit_6 | I_6 | FW_Categ_6 | II_6 | BW_Illegal | A_6 | BW_B_Congest | B_6 |
| FW_Digit_7 | I_7 | FW_Categ_7 | II_7 | BW_Prev2Digit | A_7 | BW_Unlocated | B_7 |
| FW_Digit_8 | I_8 | FW_Categ_8 | II_8 | BW_Prev3Digit | A_8 | BW_B_Congest | B_8 |
| FW_Digit_9 | I_9 | FW_Categ_9 | II_9 | BW_PrevDigit | A_9 | BW_B_Congest | B_9 |

**Table 37** Interpretation of received MFC signals (Sheet 2 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|---|---|
| FW_Digit_0 | I_10 | FW_Categ_10 | II_10 | BW_Illegal | A_10 | BW_B_Congest | B_10 |
| FW_Digit_11 | I_11 | FW_Categ_11 | II_11 | BW_Illegal | A_11 | BW_B_Congest | B_11 |
| FW_ReqFault | I_12 | FW_Categ_12 | II_12 | BW_Illegal | A_12 | BW_B_Congest | B_12 |
| FW_Digit_13 | I_13 | FW_Categ_13 | II_13 | BW_Illegal | A_13 | BW_B_Congest | B_13 |
| FW_Digit_14 | I_14 | FW_Categ_14 | II_14 | BW_Illegal | A_14 | BW_B_Congest | B_14 |
| FW_EndDigits | I_15 | FW_Categ_15 | II_15 | BW_Illegal | A_15 | BW_B_Congest | B_15 |

**Table 38** Interpretation of transmitted MFC signals

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_NextDig | A_1 | FW_EndANIdgts | I_15 | FW_Categ_2 | II_2 |
| BW_BCateg | A_3 | FW_Digit_1 | I_1 | FW_Categ_3 | II_3 |
| BW_RtrnToA | A_1 | FW_Digit_2 | I_2 | FW_Categ_4 | II_4 |
| BW_A_Congest | A_4 | FW_Digit_3 | I_3 | FW_Categ_5 | II_5 |
| BW_B_Congest | B_4 | FW_Digit_4 | I_4 | FW_Categ_6 | II_6 |
| BW_Category | A_5 | FW_Digit_5 | I_5 | FW_Categ_7 | II_7 |
| BW_SpeechChrg | NO_SG | FW_Digit_6 | I_6 | FW_Categ_8 | II_8 |
| BW_OrigDn | A_5 | FW_Digit_7 | I_7 | FW_Categ_9 | II_9 |
| BW_FreeCharge | B_1 | FW_Digit_8 | I_8 | FW_Categ_10 | II_10 |
| BW_FreeNoChrg | B_5 | FW_Digit_9 | I_9 | FW_Categ_11 | II_11 |
| BW_CntrCharge | B_1 | FW_Digit_0 | I_10 | FW_Categ_12 | II_12 |
| BW_Busy | B_2 | FW_Digit_11 | I_11 | FW_Categ_13 | II_13 |
| BW_Unlocated | B_7 | FW_Digit_12 | I_12 | FW_Categ_14 | II_14 |
| BW_OutOfOrder | B_4 | FW_Digit_13 | I_13 | FW_Categ_15 | II_15 |
| BW_ChangOrder | B_4 | FW_Digit_14 | I_14 | FW_KD_Local | II_3 |
| FW_ReqFault | I_12 | FW_Digit_15 | I_15 | FW_KD_LnDst | II_2 |
| FW_EndDigits | I_15 | FW_Categ_1 | II_1 | | |

# Argentina Config 1

## E1 Physical Characteristics

- Connector type: BNC
- Line coding: HDB3

## E1 Framing

Frame mode: Alternate

## Register signaling

- Regret option: OFF
- End of dialing (Incoming): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**
- End of dialing (Outgoing): terminated by indication from destination switch, or by MFC forward signal **FW_EndDigits**

## R2 Line Signaling

Argentina Config 1 R2 signals are according to CCITT standard.See Table 39 for the Argentina Config 1 R2 signal definitions.

**Table 39** Argentina Config 1 R2 A/B Signals

| **Forward** | | | **Backward** | | |
|---|---|---|---|---|---|
| Signal | A | B | Signal | A | B |
| Idle | 1 | 0 | Idle | 1 | 0 |
| Seize | 0 | 0 | Seize acknowledge | 1 | 1 |
| Clear forward | 1 | 0 | Answer | 0 | 1 |
| | | | Clear back | 1 | 1 |
| | | | Block | 1 | 1 |

CD bits are not used. They are set to **01** in transmit direction, and are ignored in receive direction.

## MFC Register Signaling

MFC signal definitions depends on the stage and the direction of the call, there are four tables of 15 signals each: the first stage uses **I** signals forward and **A** signals backward, and the second stage uses **II** signals forward and **B** signals backward. The meaning of the signals can also be different when being transmitted or received. Meanings of the MFC signals are configurable. MFC signal tables are part of the country-specific parameters.

Table 40 shows the MFC received signal configuration in the R2MFC MBM accessed through the CLI for Argentina Config 1. Table 41 shows the MFC transmitted signal configuration in the R2MFC MBM accessed through the CLI for Argentina Config 1. These values are pre-configured by the faceplate DIP switches as shown in Figure 28 on page 86. See Chapter 7, "Command line interface," on page 69 for information on the CLI.

**Table 40** Interpretation of received MFC signals

| Meaning | Signal | Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|---|---|
| FW_Digit_1 | I_1 | FW_Categ_1 | II_1 | BW_NextDig | A_1 | BW_B_Congest | B_1 |
| FW_Digit_2 | I_2 | FW_Categ_2 | II_2 | BW_PrevDigit | A_2 | BW_FreeCharge | B_2 |
| FW_Digit_3 | I_3 | FW_Categ_3 | II_3 | BW_BCateg | A_3 | BW_Busy | B_3 |
| FW_Digit_4 | I_4 | FW_Categ_4 | II_4 | BW_A_Congest | A_4 | BW_B_Congest | B_4 |
| FW_Digit_5 | I_5 | FW_Categ_5 | II_5 | BW_CategOrAni | A_5 | BW_Unlocated | B_5 |
| FW_Digit_6 | I_6 | FW_Categ_6 | II_6 | BW_SpeechChrg | A_6 | BW_FreeCharge | B_6 |
| FW_Digit_7 | I_7 | FW_Categ_7 | II_7 | BW_Prev2Digit | A_7 | BW_FreeNoChrg | B_7 |
| FW_Digit_8 | I_8 | FW_Categ_8 | II_8 | BW_Prev3Digit | A_8 | BW_OutOfOrder | B_8 |
| FW_Digit_9 | I_9 | FW_Categ_9 | II_9 | BW_PrevDigit | A_9 | BW_B_Congest | B_9 |
| FW_Digit_0 | I_10 | FW_Categ_10 | II_10 | BW_ReSend | A_10 | BW_B_Congest | B_10 |
| FW_Digit_11 | I_11 | FW_Categ_11 | II_11 | BW_Illegal | A_11 | BW_B_Congest | B_11 |
| FW_ReqFault | I_12 | FW_Categ_12 | II_12 | BW_Illegal | A_12 | BW_B_Congest | B_12 |
| FW_Digit_13 | I_13 | FW_Categ_13 | II_13 | BW_Illegal | A_13 | BW_B_Congest | B_13 |
| FW_Digit_14 | I_14 | FW_Categ_14 | II_14 | BW_Illegal | A_14 | BW_B_Congest | B_14 |
| FW_EndDigits | I_15 | FW_Categ_15 | II_15 | BW_Illegal | A_15 | BW_B_Congest | B_15 |

**Table 41** Interpretation of transmitted MFC signals (Sheet 1 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_NextDig | A_1 | FW_EndANIdgts | I_15 | FW_Categ_2 | II_2 |
| BW_BCateg | A_3 | FW_Digit_1 | I_1 | FW_Categ_3 | II_3 |
| BW_RtrnToA | A_1 | FW_Digit_2 | I_2 | FW_Categ_4 | II_4 |
| BW_A_Congest | A_4 | FW_Digit_3 | I_3 | FW_Categ_5 | II_5 |
| BW_B_Congest | B_4 | FW_Digit_4 | I_4 | FW_Categ_6 | II_6 |
| BW_Category | A_5 | FW_Digit_5 | I_5 | FW_Categ_7 | II_7 |
| BW_SpeechChrg | A_6 | FW_Digit_6 | I_6 | FW_Categ_8 | II_8 |
| BW_OrigDn | A_5 | FW_Digit_7 | I_7 | FW_Categ_9 | II_9 |
| BW_FreeCharge | B_6 | FW_Digit_8 | I_8 | FW_Categ_10 | II_10 |
| BW_FreeNoChrg | B_7 | FW_Digit_9 | I_9 | FW_Categ_11 | II_11 |
| BW_CntrCharge | NO_SG | FW_Digit_0 | I_10 | FW_Categ_12 | II_12 |
| BW_Busy | B_3 | FW_Digit_11 | I_11 | FW_Categ_13 | II_13 |
| BW_Unlocated | B_5 | FW_Digit_12 | I_12 | FW_Categ_14 | II_14 |

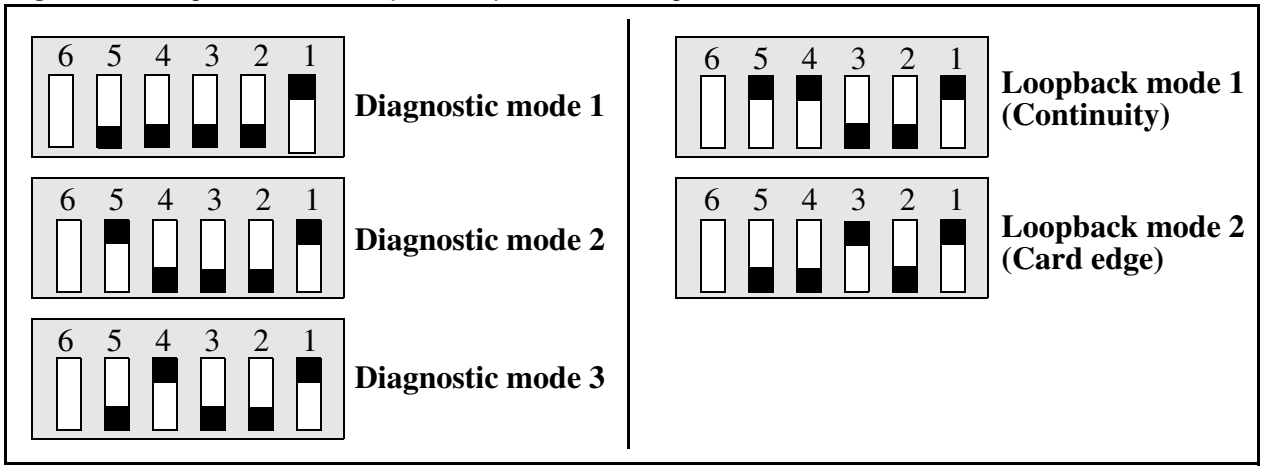
**Table 41** Interpretation of transmitted MFC signals (Sheet 2 of 2)

| Meaning | Signal | Meaning | Signal | Meaning | Signal |
|---|---|---|---|---|---|
| BW_OutOfOrder | B_8 | FW_Digit_13 | I_13 | FW_Categ_15 | II_15 |
| BW_ChangOrder | B_4 | FW_Digit_14 | I_14 | FW_KD_Local | II_3 |
| FW_ReqFault | I_12 | FW_Digit_15 | I_15 | FW_KD_LnDst | II_2 |
| FW_EndDigits | I_15 | FW_Categ_1 | II_1 | | |

# Appendix B
## Diagnostic and loopback DIP switch settings

See Figure 30 for diagnostic and loopback DIP switch settings.

**Figure 30** Diagnostics and Loopback Dip Switch Settings



# Appendix C
## MFC signal definitions

See Table 42 for meaning of MFC signals.

**Table 42** MFC signal definitions

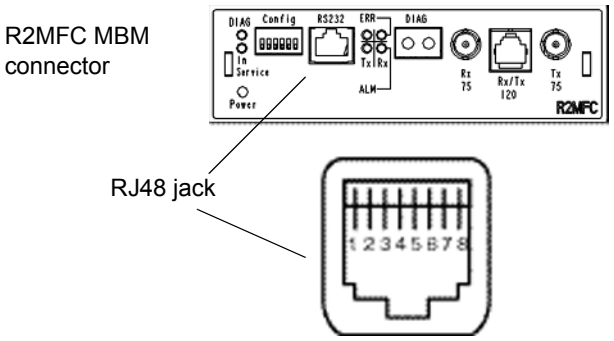
**Table 1**

| No | MFC signal meaning | N0 | MFC signal meaning | No | MFC signal meaning |
|---|---|---|---|---|---|
| 0 | BW_NextDig | 16 | FW_EndDigits | 33 | FW_Categ_1 |
| 1 | BW_BCateg | 17 | FW_EndANIdgts | 34 | FW_Categ_2 |
| 2 | BW_RtrnToA | 18 | FW_Digit_1 | 35 | FW_Categ_3 |
| 3 | BW_A_Congest | 19 | FW_Digit_2 | 36 | FW_Categ_4 |
| 4 | BW_B_Congest | 20 | FW_Digit_3 | 37 | FW_Categ_5 |
| 5 | BW_Category | 21 | FW_Digit_4 | 38 | FW_Categ_6 |
| 6 | BW_SpeechChrg | 22 | FW_Digit_5 | 39 | FW_Categ_7 |
| 7 | BW_OrigDn | 23 | FW_Digit_6 | 40 | FW_Categ_8 |
| 8 | BW_FreeCharge | 24 | FW_Digit_7 | 41 | FW_Categ_9 |
| 9 | BW_FreeNoChrg | 25 | FW_Digit_8 | 42 | FW_Categ_10 |
| 10 | BW_CntrCharge | 26 | FW_Digit_9 | 43 | FW_Categ_11 |
| 11 | BW_Busy | 27 | FW_Digit_10 | 44 | FW_Categ_12 |
| 12 | BW_Unlocated | 28 | FW_Digit_11 | 45 | FW_Categ_13 |
| 13 | BW_OutOfOrder | 29 | FW_ Digit_12 | 46 | FW_Categ_14 |
| 14 | BW_ChangOrder | 30 | FW_ Digit_13 | 47 | FW_Categ_15 |
| 15 | FW_ReqFault | 31 | FW_Digit_14 | 48 | FW_KD_Local |
| | | 32 | FW_Digit_15 | 49 | FW_KD_LnDst |

# Appendix D
## CLI cable pinout

A special cable is required to connect to the RS232 port for use of the CLI. The cable, part number N0026100, is shipped with the R2MFC MBM. Figure 31 shows the cable pins for this cable if you are required to make a new cable.

**Figure 31** Cable pinouts




| Pin | Signaling |
|---|---|
| Pin 1 | ignored |
| Pin 2 | ignored |
| Pin 3 | RXD (receive data) |
| Pin 4 | ignored |
| Pin 5 | GND (ground) |
| Pin 6 | TXD (transmit data) |
| Pin 7 | ignored |
| Pin 8 | ignored |