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Dialogic® AG 2000 PCI Media Board Installation and Developer's Manual

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Revision history

Revision	Release date	Notes
9000-60002-10	July 2000	SRG
9000-60002-11	September 2000	SRG
9000-60002-12	March 2001	MVH
9000-60002-13	April 2001	CYF
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Last modified: December 4, 2009		

Refer to www.dialogic.com for product updates and for information about support policies, warranty information, and service offerings.

Table Of Contents

1 Introduction

The *Dialogic® AG 2000 PCI Media Board Installation and Developer's Manual* explains how to configure and install an AG 2000 board, and how to verify that it has been installed correctly and is operating correctly. It also provides general information about developing an application that uses this board.

This manual targets developers of telephony and voice applications who are using the AG 2000 board with NaturalAccess. This manual defines terms where applicable, but assumes that readers are familiar with telephony concepts, switching, and the C programming language.

2 Terminology

Note: The product to which this document pertains is part of the NMS Communications Platforms business that was sold by NMS Communications Corporation ("NMS") to Dialogic Corporation ("Dialogic") on December 8, 2008. Accordingly, certain terminology relating to the product has been changed. Below is a table indicating both terminology that was formerly associated with the product, as well as the new terminology by which the product is now known. This document is being published during a transition period; therefore, it may be that some of the former terminology will appear within the document, in which case the former terminology should be equated to the new terminology, and vice versa.

Former terminology	Dialogic terminology
CG 6060 Board	Dialogic® CG 6060 PCI Media Board
CG 6060C Board	Dialogic® CG 6060C CompactPCI Media Board
CG 6565 Board	Dialogic® CG 6565 PCI Media Board
CG 6565C Board	Dialogic® CG 6565C CompactPCI Media Board
CG 6565e Board	Dialogic® CG 6565E PCI Express Media Board
CX 2000 Board	Dialogic® CX 2000 PCI Station Interface Board
CX 2000C Board	Dialogic® CX 2000C CompactPCI Station Interface Board
AG 2000 Board	Dialogic® AG 2000 PCI Media Board
AG 2000C Board	Dialogic® AG 2000C CompactPCI Media Board
AG 2000-BRI Board	Dialogic® AG 2000-BRI Media Board
NMS OAM Service	Dialogic® NaturalAccess™ OAM API
NMS OAM System	Dialogic® NaturalAccess™ OAM System
NMS SNMP	Dialogic® NaturalAccess™ SNMP API
Natural Access	Dialogic® NaturalAccess™ Software
Natural Access Service	Dialogic® NaturalAccess™ Service
Fusion	Dialogic® NaturalAccess™ Fusion™ VoIP API
ADI Service	Dialogic® NaturalAccess™ Alliance Device Interface API
CDI Service	Dialogic® NaturalAccess™ CX Device Interface API
Digital Trunk Monitor Service	Dialogic® NaturalAccess™ Digital Trunk Monitoring API
MSPP Service	Dialogic® NaturalAccess™ Media Stream Protocol Processing API
Natural Call Control Service	Dialogic® NaturalAccess™ NaturalCallControl™ API
NMS GR303 and V5 Libraries	Dialogic® NaturalAccess™ GR303 and V5 Libraries

Former terminology	Dialogic terminology
Point-to-Point Switching Service	Dialogic® NaturalAccess™ Point-to-Point Switching API
Switching Service	Dialogic® NaturalAccess™ Switching Interface API
Voice Message Service	Dialogic® NaturalAccess™ Voice Control Element API
NMS CAS for Natural Call Control	Dialogic® NaturalAccess™ CAS API
NMS ISDN	Dialogic® NaturalAccess™ ISDN API
NMS ISDN for Natural Call Control	Dialogic® NaturalAccess™ ISDN API
NMS ISDN Messaging API	Dialogic® NaturalAccess™ ISDN Messaging API
NMS ISDN Supplementary Services	Dialogic® NaturalAccess™ ISDN API Supplementary Services
NMS ISDN Management API	Dialogic® NaturalAccess™ ISDN Management API
NaturalConference Service	Dialogic® NaturalAccess™ NaturalConference™ API
NaturalFax	Dialogic® NaturalAccess™ NaturalFax™ API
SAI Service	Dialogic® NaturalAccess™ Universal Speech Access API
NMS SIP for Natural Call Control	Dialogic® NaturalAccess™ SIP API
NMS RJ-45 interface	Dialogic® MD1 RJ-45 interface
NMS RJ-21 interface	Dialogic® MD1 RJ-21 interface
NMS Mini RJ-21 interface	Dialogic® MD1 Mini RJ-21 interface
NMS Mini RJ-21 to NMS RJ-21 cable	Dialogic® MD1 Mini RJ-21 to MD1 RJ-21 cable
NMS RJ-45 to two 75 ohm BNC splitter cable	Dialogic® MD1 RJ-45 to two 75 ohm BNC splitter cable
NMS signal entry panel	Dialogic® Signal Entry Panel

3 Overview of the AG 2000 board

AG 2000 board features

The AG 2000 board is part of the Alliance Generation family of telephony boards. It provides up to eight analog line interfaces with up to eight ports of call processing and programmable voice processing.

The following illustration shows the available AG 2000 board types:

LLLL = Included software licenses
(basic IVR license always included)
NaturalFax or NMS Fusion

XXX = MIPS of DSP processing power
(not always used in the product name)
100 = Used for voice and call control
200 = Used for voice, fax, and call control
400 = Used for voice, fax, call control, NMS Fusion, etc.

LLLL/AG 2000**/XXX-NY[/NY]**

N = Number of line interfaces (4, 8, or NULL)

Notes
Optional /NY used with mixed interface configurations that are:
4LS/4SL
4LSE/4SL
4DID/4LS

Y = Line interface type
LS = Loop Start for most of the world
LSE = Loop Start for EU
SL = Subscriber Loop
DID = Direct Inward Dial (DID)

Refer to www.dialogic.com/declarations/default.htm for a list of available AG 2000 board configurations, for a list of countries where Dialogic has obtained approval for the AG 2000 board, and for product updates.

An AG 2000 board contains the following main features:

- DSP resources

  Each board has one, two, or four high-performance digital signal processors (DSPs) that provide resources for four or eight ports of call processing and programmable voice processing. Each DSP supports one or more tasks. These tasks include voice recording and playback, DTMF detection and generation, and call progress analysis. Fax is supported on an AG 2000 board with two or four DSPs.

- PCI bus connectivity

  Each AG 2000 board is designed to reside in a single PCI bus slot. Each board contains a universal PCI bus interface compliant with the PCI specification, version 2.2 (32/64 bit; 33/66MHz; 5V and 3.3 V signaling; +12 V, -12 V, 5 V and 3.3 V power).

- Line interface signaling modules

  The AG 2000 board holds two line interface signaling modules. Each module provides signaling for four ports.

- H.100 bus connectivity

The AG 2000 board fully supports the H.100 bus specification. The H.100 bus enables boards to share data and signaling information with other boards on the H.100 bus. For example, you can connect two or more AG 2000 boards for applications that perform trunk-to-trunk switching. You can add additional DSP resources, analog station interfaces, or loop start line interfaces using other AG boards. You can also use MVIP compatible products from other manufacturers with the AG 2000 board.

The H.100 interface supports the following stream configurations on the H.100 bus:

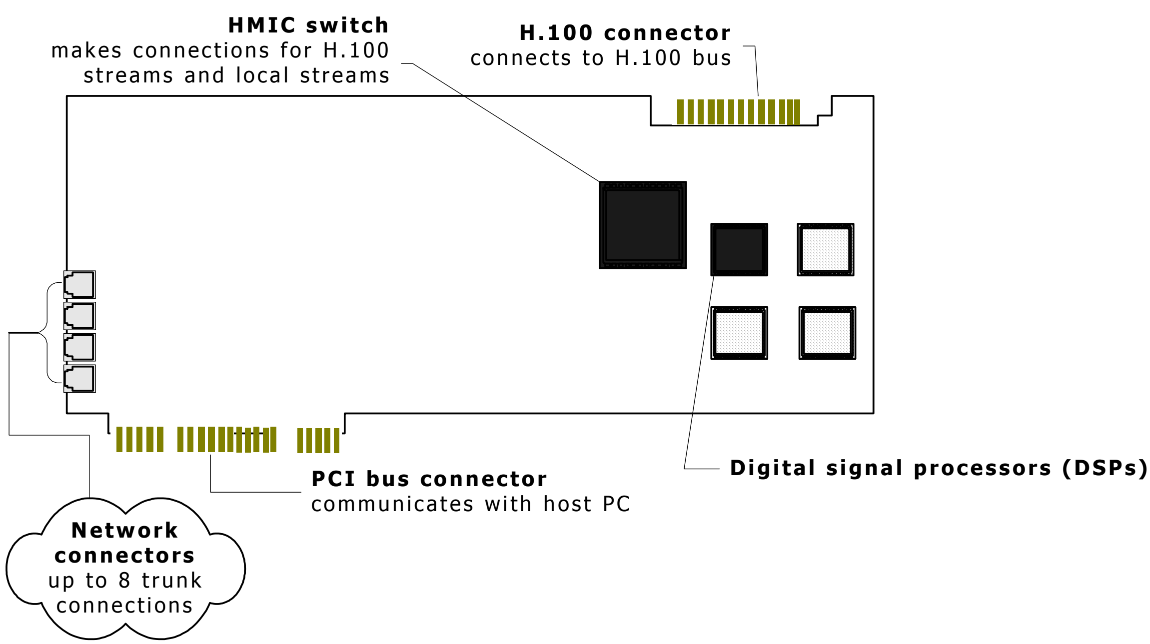
- Full mode: 32 streams at 8 MHz each that provide 128 timeslots each for a total of 4096 timeslots.
- Backward compatibility mode: 16 8MHz streams, 16 2MHz streams (total of 2560 timeslots). The H.100 interface operates with MVIP-90 boards on the same bus. In these configurations, use an H.100 board as the system bus master.

- Telephony bus switching

  Switching for the AG 2000 board is implemented with the HMIC (H.100/MVIP Integrated Circuit). The HMIC is a single chip that offers full support for the H.100 bus within the MVIP architecture providing access to all 4096 slots.

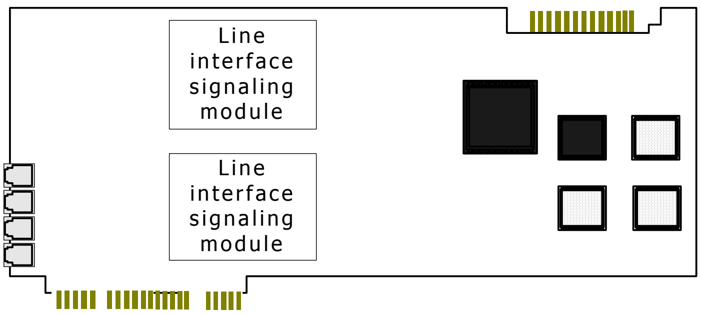
  On the AG 2000 board, switch connections are allowed for up to 128 full duplex connections between local devices and the H.100 bus. Non-blocking switch connections are allowed between local devices. On the AG 2000 board, switching is controlled by the MVIP-95 model. The MVIP-90 model is not supported.

The following illustration shows where various components are located on an AG 2000 board:



Line interface signaling modules

Line interface signaling modules are available for the AG 2000 board. A line interface signaling module is a circuit that connects a bidirectional transmission channel to separate receive and transmit channels. Each line interface signaling module has four ports. Two line interface signaling modules can fit on an AG 2000 board. This allows you to monitor and control at least eight channels of signaling information. The following illustration shows where the line interface signaling modules attach to an AG 2000 board:



Do not change the settings on the line interface signaling modules or attempt to remove the modules. They are factory installed and tested.

The following AG 2000 line interfaces are available:

- Loop start
- Subscriber loop
- Direct Inward Dialing (DID)

Loop start interface

The loop start interface replaces a telephone, modem, or fax machine at the end of a standard telephone line or PBX extension.

The loop start interface can also be a trunk interface to the telephone network. With loop start trunks, you can segregate incoming calls from outgoing calls to avoid collisions between the two.

There are two loop start interface models:

Loop start interface model	Conforms to...
AG 2000 L	North American, most Asian, and most Latin American regulations.
AG 2000 LE	The European CTR-21 regulation.

Changing the interface model has no impact on applications you have already written.

The loop start interface:

- Is certified in North America and in EU countries.
- Has very high tolerance to common mode power line interfaces.
- Detects loop current reversals and interruptions in the off-hook mode.
- Receives Called Parity Identification in some countries.
- Records calls in on-hook mode where permitted by regulations.

Subscriber loop interface

The subscriber loop interface connects to telephones, modems, or fax machines.

Unlike other station interfaces that can be limited to 2,000 or 3,000 feet (600 or 900 m) of cable, the subscriber loop interface can support a single telephone up to 18,000 cable feet (15 km) away as long as the loop resistance is less than 1500 Ohms.

The subscriber loop interface provides the loop current and ring voltage for signaling and powering the telephone. Therefore, it requires a ringing power supply. Refer to *Subscriber loop power supply* on page 26 for more information.

Direct Inward Dialing (DID)

The DID interface attaches to the telephone network for incoming calls and supports receiving dialed digits with each call. These digits can be used by a PBX to route calls to the desired extension and to route received faxes. The DID interface requires special service from the telephone network and a block of received telephone numbers. The DID interface requires a power supply. Refer to *DID power supply* on page 25 for more information.

The other end of the DID trunk can be an AG 2000 loop start interface. However, a TCP for that is not offered.

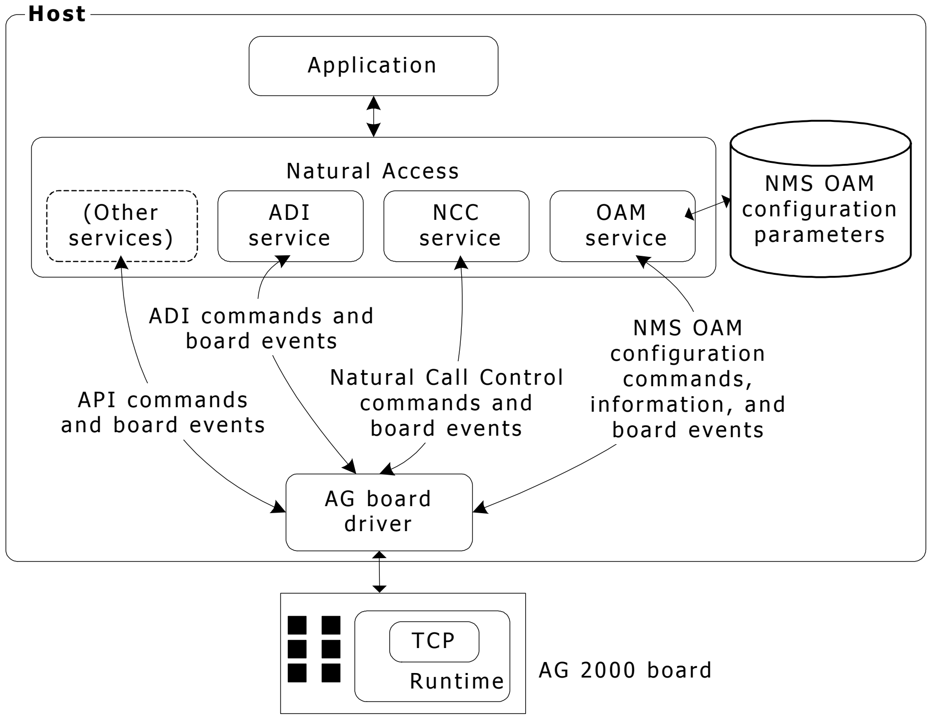
DID is not available in EU countries.

Software components

AG 2000 boards require the following software components:

- Natural Access development environment that provides services for call control, voice store and forward, and other functions.
- NMS OAM (Operations, Administration, and Maintenance) software and related utilities.
- Configuration files that describe how the board is set up and initialized.
- Runtime software that controls the AG 2000 board.
- One or more trunk control programs (TCPs) that enable applications to communicate with the telephone network using the signaling schemes (protocols) used on the trunk.

The following illustration shows how these software components relate to one another:



Natural Access

Natural Access is a complete software development environment for voice applications. It provides a standard set of functions grouped into logical services. Each service has a standard programming interface. For more information about standard and optional Natural Access services, refer to the *Natural Access Developer's Reference Manual*.

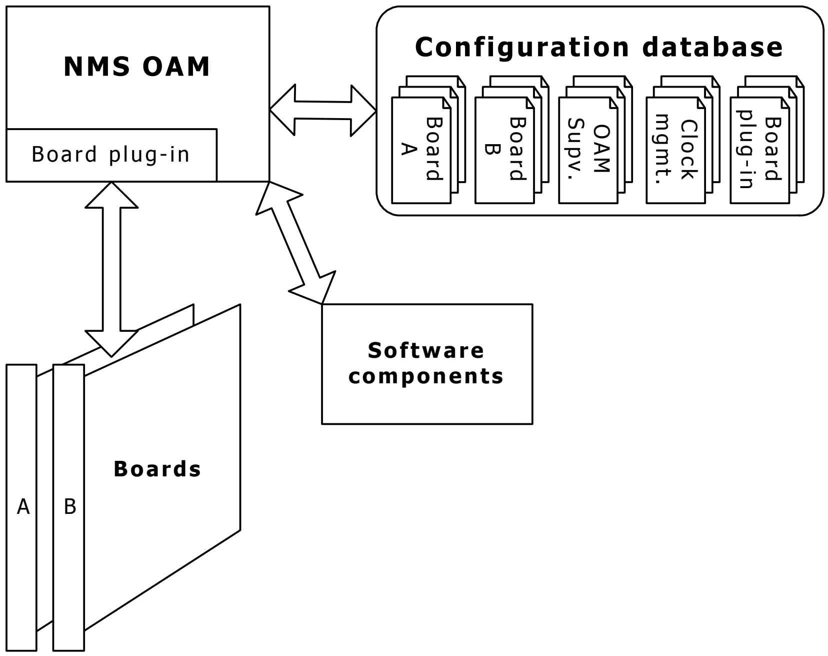
NMS OAM

NMS OAM manages and maintains telephony resources in a system. These resources include hardware components (including AG boards) and low-level board management software modules (such as clock management).

Using NMS OAM, you can:

- Create, delete, and query the configuration of a component
- Start, stop, and test a component
- Receive notifications from components

NMS OAM maintains a database containing records of configuration information for each component as shown in the following illustration. This information consists of parameters and values.



Each parameter and value is expressed as a keyword name and value pair (for example, AutoStart = NO). You can query the NMS OAM database for keyword values for any component. Keywords and values can be added, modified, or deleted.

To use NMS OAM or any related utility, ensure that the Natural Access Server (*ctdaemon*) is running. For more information about *ctdaemon*, refer to the *Natural Access Developer's Reference Manual*. For more information about NMS OAM, refer to the *NMS OAM System User's Manual*.

AG board plug-in

NMS OAM uses the AG board plug-in software module to communicate with AG boards. The name of the AG plug-in is *agplugin.bpi*. This file must reside in the *\nms\bin* directory (or */opt/nms/lib* for UNIX) for NMS OAM to load it when it starts up.

Configuration files

NMS OAM uses two types of configuration files:

File type	Description
System configuration	Contains a list of boards in the system and the name of one or more board keyword files for each board.
Board keyword	Contains parameters to configure the board. These settings are expressed as keyword name and value pairs.

Several sample board keyword files are installed with Natural Access. Each of these files configures the board to use a different protocol (for example, Wink Start or Off-Premises Station). You can reference these files in your system configuration file or modify them.

When you run the NMS OAM *oamsys* utility, it creates NMS OAM database records based on the contents of the specified system configuration file and board keyword files. *oamsys* directs NMS OAM to start the boards and configure them according to the specified parameters. For more information, refer to *Configuring and starting the system with oamsys* on page 30.

Runtime software

The runtime software consists of runfiles and DSP files. The runfile is the basic low-level software that an AG board requires to operate. DSP files enable the AG on-board digital signal processors to perform certain tasks, such as DTMF signaling, voice recording, and playback.

Several runfiles and DSP program files are installed with Natural Access. Specify the files to use for your configuration in the board keyword file. Refer to *Using board keyword files* on page 31 for more information. When NMS OAM boots a board, the runfiles and DSP program files are transferred from the host into on-board memory. For more information about the DSP files shipped with Natural Access, refer to the *ADI Service Developer's Reference Manual*.

Trunk control programs (TCPs)

AG 2000 boards are compatible with a variety of signaling schemes called protocols. To program an AG board for a specific protocol, a trunk control program (TCP) is loaded on the board. The TCP performs all of the signaling tasks to interface with the protocol used on the line.

Several different protocol standards are used throughout the world. These standards differ considerably from country to country. For these reasons, different TCPs are supplied with Natural Access for various protocols and country-specific variations.

You can load more than one TCP at a time for applications that support multiple protocols simultaneously. TCPs are specified in the configuration file and are downloaded to the board by *oamsys*. TCPs run on the board, relieving the host computer from the task of processing the protocol directly. For more information about TCPs, refer to the *NMS CAS for Natural Call Control Developer's Manual*.

4 Installing the hardware

Installation summary

The following table summarizes the procedure for installing the hardware and software components:

Step	Description
1	Ensure that your PC system meets the *system requirements* on page 22.
2	Install the AG 2000 board into one of the computer's PCI bus slots.
3	If you have any MVIP-90 boards, connect the MVIP bus adapter to one AG 2000 board and the MVIP-90 bus connector to the MVIP bus adapter. For more information, refer to *Interoperability with MVIP-90* on page 128 and *Connecting to the MVIP-90 bus* on page 129.
4	If there are multiple H.100 boards, connect the H.100 bus to your H.100 boards. Refer to *Installing the board* on page 24.
5	Install Natural Access, which also installs the AG 2000 board driver and runtime software, and NMS CAS protocols. Select the country where NMS CAS protocols is installed. This configures loop start products for local compliance. For more information, refer to the *NMS CAS for Natural Call Control Developer's Manual*.
6	Add configuration information for each board to the NMS OAM database. For more information, refer to the *NMS OAM System User's Manual*.
7	Direct the OAM service to start the boards. For more information, refer to *Configuring and starting the system with oamsys* on page 30 and to the *NMS OAM System User's Manual*.
8	Verify that the installation is operational.

Note: If your system is powered down, you can install the board before you install the software. It does not matter if you install the board or the software first.

The BootDiagnosticLevel keyword in the board's keyword file determines the type of board diagnostic tests that take place when you boot the board. If a test fails, the test number is reported back as an error code. You must be running *oammon* to view diagnostic results. For more information about board level error messages, refer to the *NMS Board and Driver Errors Manual*.

AG driver software

The following drivers for operating AG boards are installed with Natural Access software:

Operating system	Driver names
Windows	*aghwwin2k* *agwin2k*
Red Hat Linux	*aghw.o*
UNIX	*aghw* *agsw* *ag95sw* *agmx*

System requirements

To install and use AG 2000 boards, your system must have:

- Natural Access installed.
- An available PCI bus slot.
- An H.100 bus connector cable if you are connecting to any other H.100 boards.
- An MVIP-90 connector cable if you are connecting to MVIP-90 boards.
- An MVIP bus adapter if you are connecting to the MVIP-90 bus.
- A grounded chassis (with three-prong power cord).
- For DID: a -48 VDC external power supply.
- For subscriber loop: a ringing power supply.

Note: Use the power supplies that are resold and supported by NMS.

NMS recommends an uninterruptable power supply (UPS) for increased system reliability. The UPS does not need to power the PC video monitor except in areas prone to severe lightning storms.

Configuring the hardware

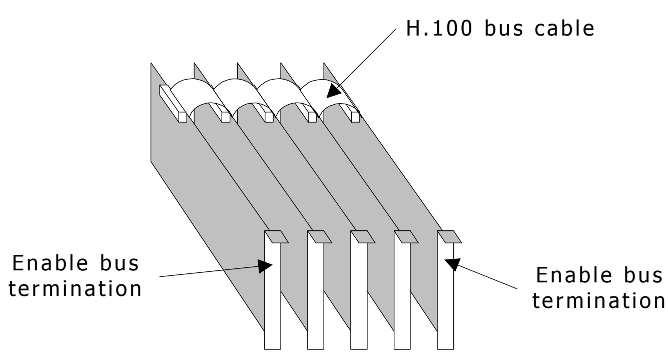
Caution:	The AG 2000 board is shipped in a protective anti-static container. Leave the board in its container until you are ready to install it. Handle the board carefully and hold it only by its edges. NMS recommends that you wear an anti-static wrist strap connected to a good earth ground whenever you handle the board. Take care not to touch the gold fingers that plug into the PCI bus connectors.

This topic describes:

- Configuring bus termination
- Configuring the DIP switch

Configuring bus termination

H.100 boards are connected to one another with an H.100 bus cable. The two boards located at the end of the H.100 bus must have bus termination enabled, as shown in the following illustration. Bus termination is controlled by a DIP switch.



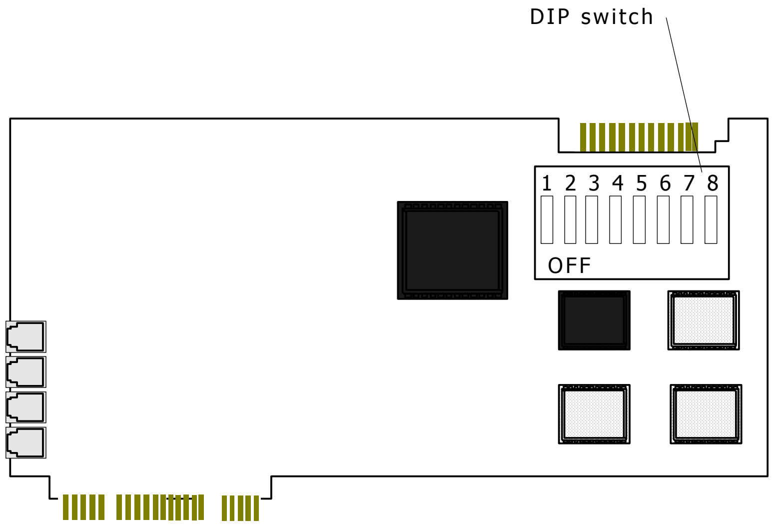
If your system contains MVIP-90 boards, connect one of the AG 2000 boards to the H.100 bus and to the MVIP-90 bus using the MVIP bus adapter. Terminate the two ends of the H.100 bus. The two ends of the MVIP-90 bus must not be terminated. The AG 2000 board does not terminate the MVIP-90 bus.

Configuring the DIP switch

The AG 2000 DIP switch is located on the component side of the board.

DIP switch S1 controls the H.100 bus termination. By default, all S1 switches are set to OFF (H.100 bus termination disabled). Setting switch S1 to ON enables H.100 bus termination. Set switch S1 to ON only for the boards that are on the ends of the H.100 bus.

DIP switch S1 should be set to either all ON or all OFF.



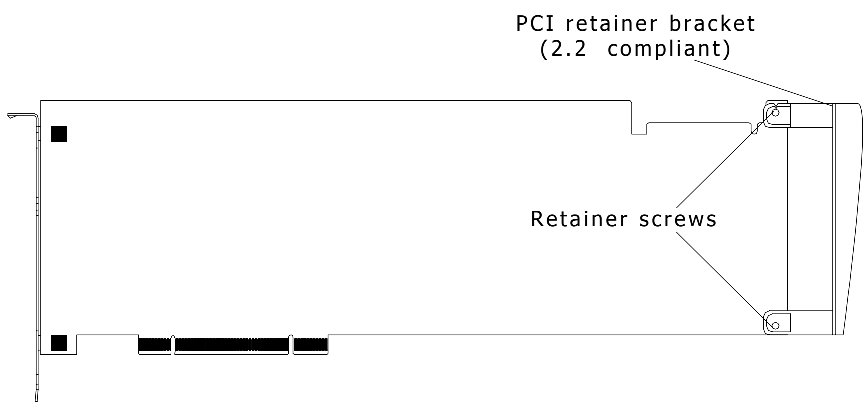
Installing the board

After you configure the DIP switch on the board, install the board and connect it to the trunk.

Complete the following steps to initially install an AG 2000 board:

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>If necessary, configure the board as described in Configuring the hardware on page 22.</td></tr>
<tr><td>2</td><td>Turn off the computer and disconnect it from the power source. Remove the cover and set it aside.</td></tr>
<tr><td>3</td><td>If you are placing the board into:

A PCI chassis, remove the PCI retainer bracket by unscrewing it from the board. The bracket is not needed for the board to properly fit into the chassis. The PCI retainer bracket is shown in the following illustration.
An ISA chassis, leave the PCI retainer bracket attached to the board. The bracket is needed for the board to properly fit into the chassis.


</td></tr>
<tr><td>4</td><td>Arrange the AG 2000 board and other H.100 boards in adjacent PCI bus slots.
Make sure each board's PCI bus connector is seated securely in a slot.</td></tr>
<tr><td>5</td><td>If your system contains MVIP-90 boards:

Arrange the MVIP-90 boards in adjacent ISA bus slots. Make sure each board's ISA bus connector is seated securely in a slot.
Connect the MVIP-90 boards to the MVIP-90 bus cable.
Connect the MVIP bus adapter to the AG 2000 board and to the MVIP-90 bus cable.
Connect the AG 2000 board to the H.100 bus cable.
</td></tr>
<tr><td>6</td><td>If you have multiple H.100 boards, connect the H.100 bus cable to each of the H.100 boards.</td></tr>
<tr><td>7</td><td>Replace the cover, and connect the computer to its power source.</td></tr>
</table>

Connecting power supplies

This topic describes how to connect power supplies on the AG 2000 board.

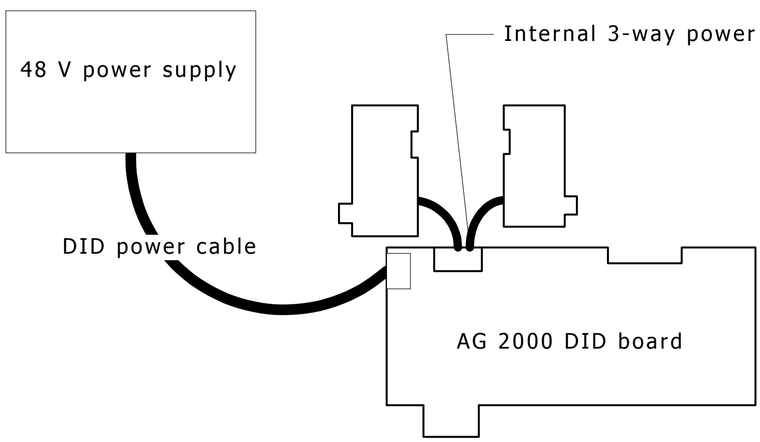
Note: A power supply is not required on the AG 2000 loop start board.

DID power supply

1. Set the power supply to -48 VDC.
2. Connect the DID power cable to the power supply.

This wire...	Which is labeled...	Goes to...
Red	BATT	Minus terminal
Dark black	RETURN	Positive terminal
Light black	GND	Com

3. Plug the other end of the power cable to the power connector on the board.
4. If additional boards need power, use the internal 3-way power connector to connect up to three boards together.



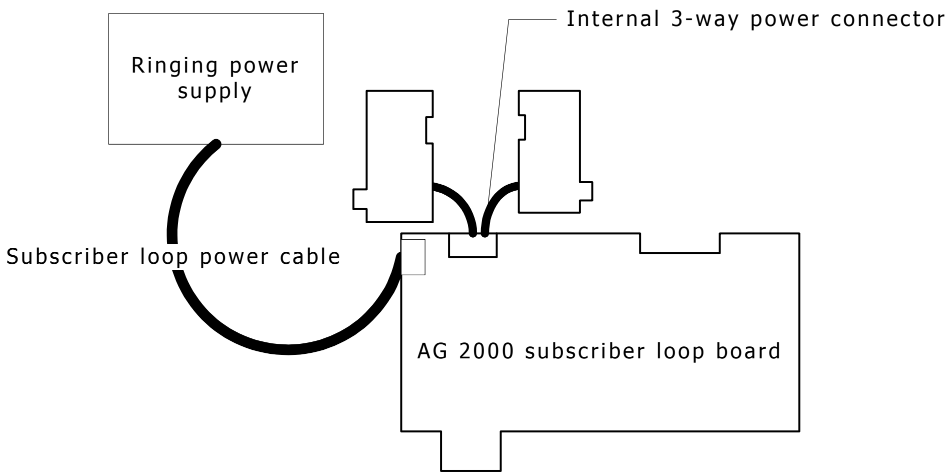
Note: Test level 5708 provides the DID power supply and the DID power cable.

Subscriber loop power supply

1. Set the power supply to 30 VDC.
2. Connect the subscriber loop power cable to the power supply.

This wire...	Which is labeled...	Goes to the...
White	RING	Ring terminal
Red	-48 V	48 terminal
Green	-24 V	24/30 terminal
Black	RING RETURN	First return terminal
Black	BATT RETURN	Second return terminal
Light black	SHIELD DRAIN	Frame ground terminal

3. Plug the other end of the power cable to the power connector on the AG 2000 board.
4. If additional boards need power, use the internal 3-way power connector to connect up to three boards together.



5. Plug the power cord into an AC outlet. It is a universal AC input for 50/60 Hz, 100 to 240 VAC.
6. Adjust ringing frequency for normal sound from the telephone while ringing. The normal frequency for the United States and Canada is 20 Hz. The normal frequency for Europe is either 25 Hz or 50 Hz, depending on the country.

Note: Test level 5707 provides the subscriber loop power supply and the subscriber loop power cable. The ringing power supplies provided for S Connect boards cannot be used with the AG 2000 board.

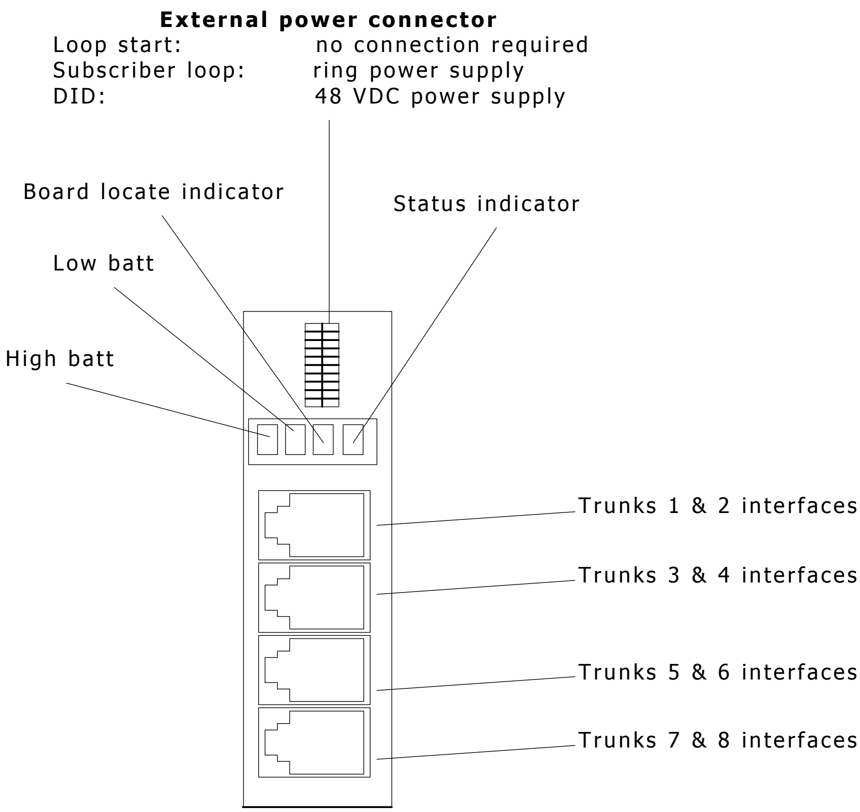
Connecting to the telephone network

This topic provides instructions for connecting to the telephone network.

Warning:	**Important safety notes for telephony connections**
	• Allow only qualified technical personnel to install this board and associated telephone wiring. • Make sure the PC chassis is grounded through the power cord or by other means before connecting the telephone line. • If your system requires an external power supply (AG 2000 subscriber loop boards and AG 2000 DID boards), make sure the power supply is grounded through the power cord or by other means. • Never install telephone wiring during a lightning storm. • Never install telephone jacks in wet locations. • Telephone companies provide primary lightning protection for their telephone lines. However, if a site connects to private lines that leave the building, make sure that external protection is provided.

Using two wire interfaces

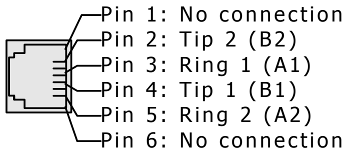
As shown in the following illustration, AG 2000 boards have four RJ-14 connectors at the end bracket:



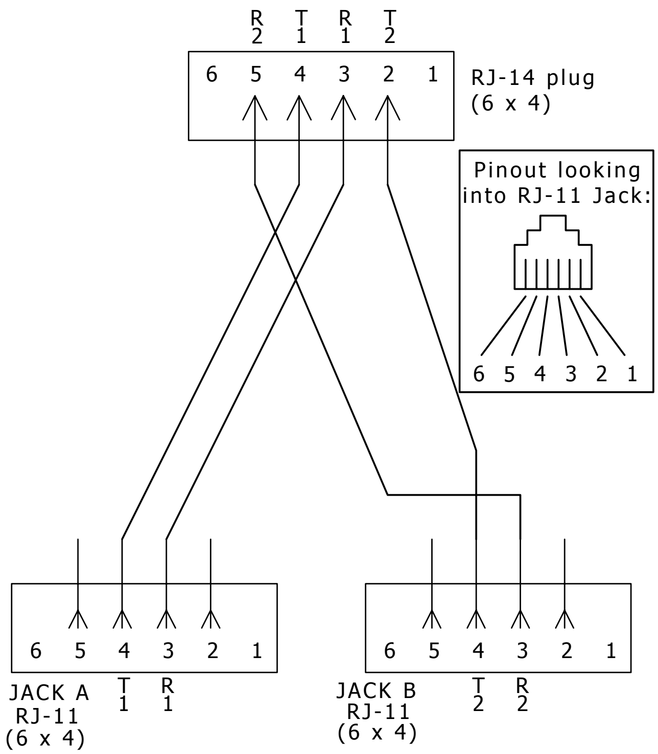
For the AG 2000 mixed signaling modules, the trunk connectors are used as shown in the following table:

Trunks...	**Are used for...**
1 & 2 and 3 & 4	Loop start on any of the AG 2000 mixed signaling modules.
5 & 6 and 7 & 8	Either subscriber loop or DID depending upon the AG 2000 mixed signaling module.

Each RJ-14 connector has the pinouts shown in the following illustration:



In countries where the AG 2000 board has obtained pan-European approval, a line splitter cable is available that separates the lines that go into each network connection. Refer to the following illustration if your country requires a splitter cable to connect to the network. Failure to use this cable will negate compliance with the country's regulatory authorities.



5 Configuring the board

Adding board configurations to the NMS OAM database

Each board that NMS OAM configures and starts must have a separate set of configuration parameters. Each parameter value is expressed as a keyword name and value pair (for example, AutoStart = NO). You can use NMS OAM to retrieve parameters for any component. These parameters (set through board keywords) can be added, modified, or deleted.

Before using NMS OAM, make sure that the Natural Access Server (*ctdaemon*) is running. For more information about the Natural Access Server (*ctdaemon*), refer to the *Natural Access Developer's Reference Manual*.

The following utilities are shipped with NMS OAM:

Utility	Description
oamsys	Configures and starts up boards on a system-wide basis. Attempts to start all specified boards based on system configuration files you supply.
oamcfg	Provides greater access to individual NMS OAM configuration functions.
oaminfo	Displays keywords and settings for one or more components. Can also set individual keywords.

Refer to the *NMS OAM System User's Manual* for more information about *oamsys* and *oamcfg*.

An application can control NMS OAM using OAM service functions. For more information about the OAM service functions and about *oaminfo*, refer to the *NMS OAM Service Developer's Reference Manual*.

Configuring and starting the system with oamsys

To configure a system and start a system using the *oamsys* utility:

Step	Description
1	Install the boards and software as described in the *installation summary* on page 21.
2	Determine which board keyword file you will use, or edit of the sample AG 2000 board keyword files, to specify appropriate configuration information for each board. For more information, refer to *Using board keyword files* on page 31.
3	Determine the PCI bus and slot locations of the boards using the *pciscan* utility. *pciscan* identifies the NMS PCI boards installed in the system and returns each board's bus, slot, interrupt, and board type.
4	Create a system configuration file, or edit a sample system configuration file to point to all the board keyword files for your system. Specify a unique name and board number for each board.
5	Start *oammon* to monitor the NMS OAM system and all NMS boards. For more information about *oammon*, refer to the *NMS OAM System User's Manual*. Start *oammon* before running *oamsys*. Keep *oammon* running to see the status of all boards in your system and to view error and tracing messages.
6	Use *oamsys* to start all of the installed boards (*ctdaemon* must be running when you use *oamsys*) according to the configuration information specified in the system configuration file and any associated board keyword files. For more information, refer to *Running oamsys* on page 34.

To determine the physical slot location of a specific board:

Operating system	Procedure
Windows	Use *pciscan* to associate the PCI bus assignment to a physical board by flashing an LED on the board. To flash the LED on a board, call *pciscan* with the PCI bus and PCI slot locations.
UNIX	Use *blocate* to associate the PCI bus assignment to a physical board by flashing an LED on the board. To flash the LED on a board, call *blocate* with the PCI bus and PCI slot locations.

For information about *pciscan* and *blocate*, refer to the *NMS OAM System User's Manual*.

Using board keyword files

Determine which board keyword file you will use, or edit one of the sample AG 2000 board keyword files, to specify appropriate configuration information for each board. These board keyword files are for the USA digital protocols:

File	Description
agpi2000.cfg	AG 2000
ag2lpspi.cfg	AG 2000 loop start

Board keyword files have many keywords in common. The differences in these files are related to the protocols, whose names appear as part of the name of the file. For more information about board keyword files, refer to the *NMS OAM System User's Manual*.

This topic presents sample board keyword files. They are located in the *ag\cfg* subdirectory under the Natural Access installation directory. They show the set of board keywords necessary to configure and start an AG 2000 board.

AG 2000 loop start board keyword file

The following sample board keyword file (*a2lpspi.cfg*) shows configuration parameters for a single AG 2000 loop start board using the loop start protocol:

```
#---------------------------------------------------------------
#    Product = AG_2000               (loop start)
#---------------------------------------------------------------

#---------- COMMON section --------

TCPFiles[0] = nocc.tcp    # "no trunk control" protocol
TCPFiles[1] = lps0.tcp    # Loopstart protocol

XLaw = mu-LAW

#--------- BOARDS section ----------

DLMFiles[0] = gtp.leo
DLMFiles[1] = voice.leo
DLMFiles[2] = svc.leo

NetworkInterface.Analog[0..7].ConfigFile = a2usals6.slc

Clocking.HBus.ClockSource = OSC
Clocking.HBus.ClockMode = STANDALONE

DSP.C5x.[0..3].Files = signal.m54 tone.m54 dtmf.m54 mf.m54 callp.m54 ptf.m54 echo.m54
                oki.m54 rvoice.m54 voice.m54 wave.m54
```

AG 2000 DID board keyword file

The following sample board keyword file shows configuration parameters for a single AG 2000 DID board using the DID protocol:

```
#---------------------------------------------------------------
# Detailed board settings for:
#    Product = AG_2000               (DID)
#---------------------------------------------------------------


#---------- COMMON section --------


TCPFiles[0] = nocc.tcp    # "no trunk control" protocol
TCPFiles[1] = wnk0.tcp


XLaw = mu-LAW

#--------- BOARDS section ----------

DLMFiles[0] = gtp.leo
DLMFiles[1] = voice.leo
DLMFiles[2] = svc.leo

NetworkInterface.Analog[0..7].ConfigFile = a2usadd6.slc

Clocking.HBus.ClockSource = OSC
Clocking.HBus.ClockMode = STANDALONE

DSP.C5x.[0..3].Files = signal.m54 tone.m54 dtmf.m54 mf.m54 callp.m54 ptf.m54 echo.m54
                oki.m54 rvoice.m54 voice.m54 wave.m54
```

AG 2000 subscriber loop board keyword file

The following sample board keyword file shows configuration parameters for a single AG 2000 subscriber loop board using the subscriber loop protocol:

```
#---------------------------------------------------------------
# Detailed board settings for:
#    Product = AG_2000               (subscriber loop)
#---------------------------------------------------------------


#---------- COMMON section --------


TCPFiles[0] = nocc.tcp    # "no trunk control" protocol
TCPFiles[1] = sta0.tcp    # for subscriber loop


XLaw = mu-LAW

#--------- BOARDS section ----------

DLMFiles[0] = gtp.leo
DLMFiles[1] = voice.leo
DLMFiles[2] = svc.leo

NetworkInterface.Analog[0..7].ConfigFile = a2usasl6.slc

Clocking.HBus.ClockSource = OSC
Clocking.HBus.ClockMode = STANDALONE

DSP.C5x.[0..3].Files = signal.m54 tone.m54 dtmf.m54 mf.m54 callp.m54 ptf.m54 echo.m54
                oki.m54 rvoice.m54 voice.m54 wave.m54
```

Creating a system configuration file for oamsys

Create a system configuration file describing all of the boards in your system. *oamsys* creates the records, and then directs NMS OAM to start the boards, configured as specified. The system configuration file is typically named *oamsys.cfg*. By default, *oamsys* looks for a file with this name when it starts up. Refer to the *NMS OAM System User's Manual* for specific information on the syntax and structure of this file.

Note: You can use the *oamgen* utility (included with the NMS OAM software) to create a sample system configuration file for your system. The system configuration file created by *oamgen* may not be appropriate for your configuration. You may need to make further modifications to the file before running *oamsys* to configure your boards based on the file. For more information about *oamgen*, refer to the *NMS OAM System User's Manual*.

The following table describes the AG board-specific settings to include in the system configuration file for each AG board:

Keyword	Description	Allowed values for AG boards
[name]	Name of the board to be used to refer to the board in the software. The board name must be unique.	Any string, in square brackets [].
Product	Name of the board product.	AG_2000
Number	Board number you use in the Natural Access application to refer to the board.	Each board's number must be unique.
Bus	PCI bus number. The bus:slot location for each board must be unique.	Values returned by *pciscan*.
Slot	PCI slot number. The bus:slot location for each board must be unique.	Values returned by *pciscan*.

File	Name of the board keyword file containing settings for the board.
	
	Several board keyword files are installed with the AG software, one for each country or region.
		For information about creating your own custom board keyword file, refer to *Changing configuration parameter settings* on page 35.
		
		You can specify more than one file after the File keyword:
		`File=mya.cfg myb.cfg myc.cfg`
		
		Alternatively, you can specify the File keyword more than once:
		`File = mya.cfg`
		`File = myb.cfg`
		`File = myc.cfg`
		
		Board keyword files are applied in the order in which they are listed. The value for a given keyword in each file overrides any value specified for the keyword in earlier files.

Sample system configuration file

The following system configuration file describes two AG 2000 boards, both to be configured for the United States:

```
[First AG 2000]
Product = AG_2000
Number  = 0
Bus     = 0
Slot    = 15
File    = agpi2000.cfg

[Second AG 2000]
Product = AG_2000
Number  = 1
Bus     = 0
Slot    = 16
File    = agpi2000.cfg
```

Running oamsys

To run *oamsys*, enter the following command:

```
oamsys -f filename
```

where ***filename*** is the name of an NMS OAM system configuration file.

Note: If you invoke *oamsys* without command line options, NMS OAM searches for a file named *oamsys.cfg* in the paths specified in the AGLOAD environment variable.

When you invoke *oamsys* with a valid file name, *oamsys* performs the following tasks:

- Checks the syntax of the system configuration file to make sure that all required keywords are present. *oamsys* discards any unrecognized keywords and reports any syntax errors it finds. *oamsys* verifies the file syntax of system configuration files but not of board keyword files.
- Checks for uniqueness of board names, board numbers, and board bus and slot numbers.
- Shuts down all boards recognized by NMS OAM (if any).
- Deletes all board configuration information currently maintained for the recognized boards (if any).
- Sets up the NMS OAM database and creates all records as described in the system configuration file.
- Attempts to start all boards as specified in the system configuration file and the board keyword files if references.

The Natural Access Server (*ctdaemon*) must be running for *oamsys* to operate. For more information about the Natural Access Server, refer to the *Natural Access Developer's Reference Manual*.

Changing configuration parameter settings

When you run *oamsys*, the utility starts all boards according to the configuration parameters specified in their associated board keyword files.

To change a parameter:

- Use or modify one of the sample board keyword files corresponding to your country and board type. Specify the name of this new file in the File statement in *oamsys.cfg* and run *oamsys* again. Refer to the *NMS OAM System User's Manual* for information about the syntax of NMS OAM board keyword files.
- Specify parameter settings with *oamcfg*. Refer to the *NMS OAM System User's Manual* for information about *oamcfg*.
- Create a new board keyword file, either with additional keywords or with keywords whose values override earlier settings.
- Specify the settings using the OAM service functions. Refer to the *NMS OAM Service Developer's Reference Manual* for more information.

You can use *oamsys* to:

- Change which software module files are downloaded to the board at startup. Refer to *Specifying configuration file locations* on page 35 for more information.
- Specify board switching.
- Configure CT bus clocking.

.leo files

A *.leo* (loadable extensible object) file is a run module, a modular extension to the core file. The core file and the run modules make up the software that runs on the board's coprocessor.

The following *.leo* files are included with AG 2000:

File	Description
svc.leo	DSP function manager
gtp.leo	Trunk protocol engine
voice.leo	Play and record manager

Specifying configuration file locations

Files to be downloaded to the AG boards are specified with keywords in the AG board's keyword file. For example:

```
DLMFiles[0] = filename
```

If ***filename*** contains a path specification, NMS OAM searches for the file in the specified directory. Otherwise, NMS OAM searches for the file in the current working directory of *ctdaemon*. If the file does not exist in the current working directory, NMS OAM searches for the file in the search path defined by the AGLOAD environment variable.

QSLAC files and trunk control programs

The QSLACs (quad subscriber line audio - processing circuit) on an AG 2000 board control:

- The 2 wire impedance matching (factory set)
- Frequency response and equalization (factory set)
- Trans-hybrid balancing (variations are available)
- Gain adjustments (-6 dB to +6 dB in 1 dB increments)

There are two QSLACs on an AG 2000 board. The first QSLAC services ports 0 - 3. The second QSLAC services ports 4 - 7. Each port can be configured separately. The configuration is contained in a QSLAC file. Each QSLAC file is customized for a specific line interface signaling module and for a certain country's two wire return loss requirements.

Through the Switching service, you can control the following on a per-port basis:

- Transmit gain (-6 to +6 dB in 1 dB increments)
- Receive gain (-6 to +6 dB in 1 dB increments)

Caution:	Increasing gain may also increase noise, echo, and possibly cause oscillations on the telephone network. There also may be regulatory authority implications. Use gain with caution.

Refer to *Line gain configuration* on page 60 for more information on controlling the gain.

Naming conventions for QSLAC files

All QSLAC files have an extension of *.slc* and adhere to the following naming convention:

pp cty ss i*.slc*

Where...	Represents the...	For example...
pp	Two-character NMS product field.	*a2* = AG 2000 board
cty	Three-character ISO country code or region code.	
ss	Two-character signaling type.	*ls* = loop start *dd* = DID *sl* = subscriber loop
i	One character line impedance field.	*6* = short 600 Ohm lines *9* = short 900 Ohm lines *n* = lines longer than 2000 feet *c* = complex (used in some international markets)

For example, *a2usals6.slc* represents the AG 2000 board/USA/loop start/ 600 Ohm line QSLAC file.

Natural Access configures the system for the QSLAC file that is intended for your country. Do not change the configuration unless you are confident that a change is required and is allowed by the regulatory agencies.

For more information about QSLAC files, refer to the *NMS CAS for Natural Call Control Developer's Manual*.

If the default file is not used, an entry is made in the error log file at boot time. If echo cancellation is enabled, there is no benefit in changing from the default QSLAC file.

For example, add the following statement to the board keyword file to load a QSLAC file:

```
NetworkInterface.Analog[0..7].ConfigFile = a2usals9.slc
```

Trunk control programs

Trunk control programs (TCPs) perform all the signaling tasks necessary to interface with the telephony protocol used on the line or trunk. TCPs are loaded onto an AG 2000 board at board initialization. After a TCP has been loaded to the AG 2000 board, the application must start up its protocol before it can use the TCP to perform call control on a specific port.

QSLAC files and TCPs for loop start

The following table lists the QSLAC files for loop start that can be selected for the United States and Canada:

File	Description
a2usals6.slc	This is the default file that is used when you have a 600 Ohm PBX.
a2usals9.slc	Optimizes performance interfacing to a 900 Ohm PBX.
a2usalsn.slc	Optimizes performance interfacing to long lines (> 2000 feet).

Other QSLAC files are used in other parts of the world. Natural Access configures the correct files for the countries that are supported.

For European countries that are not supported in the installation, use the *a2eurlsc.slc* file when connecting to the PSTN. Refer to the NetworkInterface.Analog[x].ConfigFile keyword for more information about QSLAC files. Refer to the *NMS CAS for Natural Call Control Developer's Manual* for information on changing network tone descriptions.

The following table lists the TCPs that are applicable to AG 2000 loop start boards:

Trunk control program	Description
nocc.tcp	No call control.
lps0.tcp	Loop start on AG 2000.

QSLAC files and TCPs for subscriber loop

The following table lists the QSLAC files for subscriber loop that can be selected for the United States:

File	Description
a2usasl6.slc	Default file used when you have a 600 Ohm telephone.
a2usasl9.slc	Optimizes performance interfacing to a 900 Ohm device.

The following table lists the TCPs that are applicable to AG 2000 subscriber loop boards:

Trunk control program	Description
sta0.tcp	Subscriber loop on AG 2000.
nocc.tcp	No call control.

QSLAC files and TCPs for DID

The following table lists the QSLAC files for DID that can be selected for the United States:

File	Description
a2usadd6.slc	This is the default file that is used when you have a 600 Ohm trunk.
a2usadd9.slc	Optimizes performance interfacing to a 900 Ohm trunk.

The following table lists the TCPs that are applicable to AG 2000 DID boards:

Trunk control program	Description
wnk0.tcp	Inbound wink start protocol.
nocc.tcp	No call control.

Configuring board clocking

When multiple boards are connected to the CT bus, you must set up a bus clock to synchronize timing between them. In addition, you can configure alternative (or fallback) clock sources to provide the clock signal if the primary source fails.

This topic describes:

- AG 2000 clocking capabilities
- Clock configuration methods
- Configuring board clocking using keywords
- A multiple board system example

To create a robust clocking configuration, you must understand basic clocking concepts such as clock mastering and clock fallback. This topic assumes that you have a basic understanding of CT bus clocking. For a complete overview of CT bus clocking, refer to the *NMS OAM System User's Manual*.

AG 2000 clocking capabilities

This topic describes the rules and limitations that apply to setting up CT bus clocking for AG 2000 boards.

When an AG 2000 board is configured as the system primary clock master, the boards's first timing reference must be set to OSC. Clock fallback should be disabled.

Note: An AG 2000 board should only be configured as the system primary clock master if there are no digital T1 or E1 boards in the system (that is, if the system contains only analog boards). Refer to the *NMS OAM System User's Manual* for information about assessing clocking priorities in a mixed-board system.

When an AG 2000 board is configured as the system secondary clock master:

- The board's first timing reference must be the system's primary clock.
- The board's fallback timing reference must be set to OSC.

When an AG 2000 board is configured as a clock slave:

- The board's first timing reference must be the system's primary clock.
- The board's fallback timing reference must be the system's secondary clock.
- If there is no secondary clock master for the system, the board's fallback timing reference must be set to OSC. In this case, if clock fallback occurs, the board is not synchronized with the system until you reconfigure the board's clocking.

Caution:	Versions C.5 or earlier of the AG 2000 board do not support clock fallback, cannot act as system secondary clock masters, and cannot master or slave to the B clock.

The following tables summarize the CT bus clocking capabilities of AG 2000 boards:

Note: NETREF refers to NETREF1 on the H.110 bus.

Clocking capabilities as primary master

Capability	Yes/No	Comments
Serve as primary master	Yes	Use this board as a master only if no boards with digital trunks are present on the CT bus.
Drive A_CLOCK	Yes	
Drive B_CLOCK	Yes	
Available primary timing references:		
Local trunk	No	Only digital trunks carry timing reference signals.
NETREF1	No	This board cannot use NETREF1 as a timing reference.
NETREF2	No	NETREF2 is available for H.110 boards only.
OSC	Yes	
Fallback to secondary timing reference	No	There is no timing reference to fallback to.
Available secondary timing references:		
Local trunk	No	Only digital trunks carry timing reference signals.
NETREF1	No	
NETREF2	No	NETREF2 is available for H.110 boards only.
OSC	No	
Slave to secondary master if both references fail	No	

Clocking capabilities as secondary master

Capability	Yes/No	Comments
Serve as secondary master	Yes	Use this board as a master only if no boards with digital trunks are present on the CT bus.
Drive A_CLOCK	Yes	If the primary master drives B_CLOCK, the secondary master drives A_CLOCK.
Drive B_CLOCK	Yes	If the primary master drives A_CLOCK, the secondary master drives B_CLOCK.
Available secondary timing references:		
Local trunk	No	Only digital trunks carry timing reference signals.
NETREF1	No	This board cannot use NETREF1 as a timing reference.
NETREF2	No	NETREF2 is available for H.110 boards only.
OSC	Yes	

Clocking capabilities as slave

Capability	Yes/No	Comments
Serve as slave	Yes	
Slave to A_CLOCK	Yes	
Slave to B_CLOCK	Yes	
Available fallback timing references:		
A_CLOCK	Yes	
B_CLOCK	Yes	
OSC	Yes	The board is not synchronized until the application reconfigures the clock.

Other clocking capabilities

Capability	Yes/No	Comments
Drive NETREF1	Yes	
Drive NETREF2	No	NETREF2 is available for H.110 boards only.
Operate in standalone mode	Yes	

Clock configuration methods

You can configure clocking in your system in one of two ways:

Method	Description
Using *clockdemo* application model	Create an application that assigns each board a clocking mode, monitors clocking changes, and reconfigures clocking when clock fallback occurs. A sample clocking application, *clockdemo*, is provided with Natural Access. *clockdemo* provides a robust fallback scheme that suits most system configurations. *clockdemo* source code is included, allowing you to modify the program if your clocking configuration is complex. For more information about *clockdemo*, refer to the *NMS OAM System User's Manual.* **Note:** Most clocking applications (including *clockdemo*) require that all boards on the CT bus be started in standalone mode.
Using board keywords (with or without application intervention)	For each board on the CT bus, set the board keywords to determine the board's clocking mode and to determine how each board behaves if clock fallback occurs. This method is described in this topic. Unlike the *clockdemo* application, which allows you to specify several boards to take over mastery of the clock when another board fails, the board keyword method allows you to specify only a single secondary clock master. For this reason, the board keyword method is best used to implement clock fallback in your system, or in test configurations where clock reliability is not a factor. The board keyword method does not create an autonomous clock timing environment. If you implement clock fallback using this method, an application must still intervene when clock fallback occurs to reset system clocking before other clocking changes occur. If both the primary and secondary clock masters stop driving the clocks, and an application does not intervene, the boards default to standalone mode.

Choose only one of these configuration methods across all boards on the CT bus. Otherwise, the two methods can interfere with one another and board clocking may not operate properly.

Configuring AG 2000 boards using board keywords

AG 2000 board keywords allow you to configure the board in the following ways:

- System primary clock master
- System secondary clock master
- Clock slave
- Standalone mode

You can also use board keywords to establish clock fallback sources.

The following sections describe how to use board keywords to specify the clocking role of each AG 2000 board in a system.

Primary clock master

Use the following board keywords to configure an AG 2000 board as a primary clock master:

Keyword	Description
Clocking.HBus.ClockSource	Specifies the source from which this board derives its timing. Set this keyword to OSC.
Clocking.HBus.ClockMode	Specifies the CT bus clock that the board drives. Set this keyword to reference either A clock (MASTER_A) or B clock (MASTER_B).
Clocking.HBus.AutoFallBack	Set this keyword to NO.

Note: If the primary master's first source fails and then returns, the board's timing reference (and consequently, the references for any slaves) switches back to the first timing source. This is not true for the secondary timing master.

Secondary clock master

Use the following board keywords to configure an AG 2000 board as a secondary clock master:

Keyword	Description
Clocking.HBus.ClockSource	Specifies the source from which this board derives its timing. Set this keyword to the clock driven by the primary clock master. For example, if the primary master drives A clock, set this keyword to A_CLOCK.
Clocking.HBus.ClockMode	Specifies the CT bus clock that the secondary master drives. Set this keyword to the clock (MASTER_A or MASTER_B) not driven by the primary clock master.
Clocking.HBus.AutoFallBack	Enables or disables clocking fallback on the board. Set this keyword to YES.
Clocking.HBus.FallBackClockSource	Specifies the alternate timing reference to use when the master clock does not function properly. Set this keyword to OSC.

Note: If the primary master's timing reference recovers, the secondary master continues to drive the clock referenced by all clock slaves in the system until the application intervenes.

Clock slave

Use the following board keywords to configure an AG 2000 board as a clock slave:

Keyword	Description
Clocking.HBus.ClockMode	Specifies the CT bus clock from which the board derives its timing. Set this keyword to SLAVE to indicate that the board does not drive any CT bus clock.
Clocking.HBus.ClockSource	Specifies the source from which this clock derives its timing. Set this keyword to reference the clock driven by the primary clock master.
Clocking.HBus.AutoFallBack	Enables or disables clock fallback on the board.
Clocking.HBus.FallBackClockSource	Specifies the alternate clock reference to use when the master clock does not function properly. For clock slaves, set this keyword to reference the clock (A_CLOCK or B_CLOCK) driven by the secondary clock master.

Standalone mode

To configure AG 2000 boards in standalone mode so the board references its own clocking information, set Clocking.HBus.ClockMode to STANDALONE. The board then uses its own oscillator as a timing signal reference. However, the board cannot make switch connections to the CT bus.

Multiple board system example

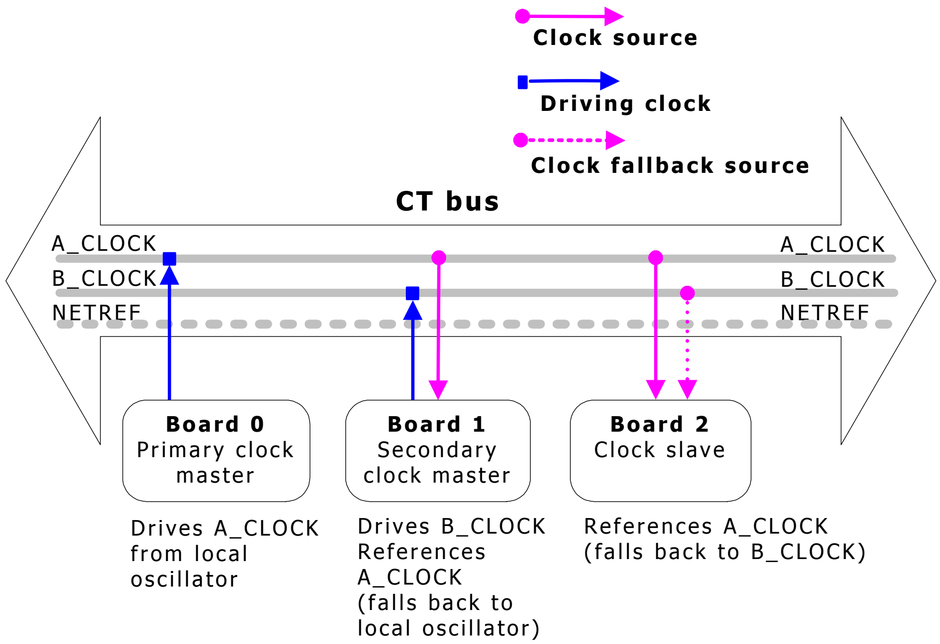
The following example assumes a system configuration in which three AG 2000 boards reside in a single chassis. The boards are configured in the following way using board keywords:

Board	Configuration
Board 0	System primary bus master (driving the A clock)
Board 1	System secondary bus master (driving the B clock)
Board 2	Clock slave (clock fallback enabled)

This configuration assigns the following clocking priorities:

Priority	Timing reference
First	Board 0, local oscillator
Second	Board 1, local oscillator

The following illustration shows a multiple-board system with a primary and secondary clock master:



The following table shows board keywords used to configure the boards according to the configuration shown in the preceding illustration:

Board	Role	Clocking keyword settings
0	Primary clock master	Clocking.HBus.ClockMode = MASTER_A Clocking.HBus.ClockSource = OSC Clocking.HBus.AutoFallBack = NO
1	Secondary clock master	Clocking.HBus.ClockMode = MASTER_B Clocking.HBus.ClockSource = A_CLOCK Clocking.HBus.AutoFallBack = YES Clocking.HBus.FallBackClockSource = OSC
2	Clock slave	Clocking.HBus.ClockMode = SLAVE Clocking.HBus.ClockSource = A_CLOCK Clocking.HBus.AutoFallBack = YES Clocking.HBus.FallBackClockSource = B_CLOCK

In this configuration, Board 0 is the primary clock master and drives A_CLOCK. All slave boards on the system use A_CLOCK as their first timing reference. Board 0 references its timing from its local oscillator.

If the clocking signal used by Board 0 fails, then Board 0 stops driving A_CLOCK. The secondary clock master (Board 1) then falls back to a timing reference based on its local oscillator and uses this signal to drive B_CLOCK. B_CLOCK and becomes the timing source for all boards that use B_CLOCK as their backup timing reference.

Note: For this clock fallback scheme to work, all clock slaves must specify A_CLOCK as the clock source and B_CLOCK as the clock fallback source.

Enabling echo cancellation

Echo cancellation improves the input signal-to-noise ratio during play which improves the performance of operations such as tone detection and speech recognition.

To enable echo cancellation:

Step	Action
1	Include the following statement in the board keyword file: `DSP.C5x[x].Files = echo.m54` where ***x*** = the next available index.
2	Set the appropriate ADI service parameters in your application and in your system.

Refer to the *ADI Service Developer's Reference Manual* for information about configuring echo cancellation on the AG 2000 board.

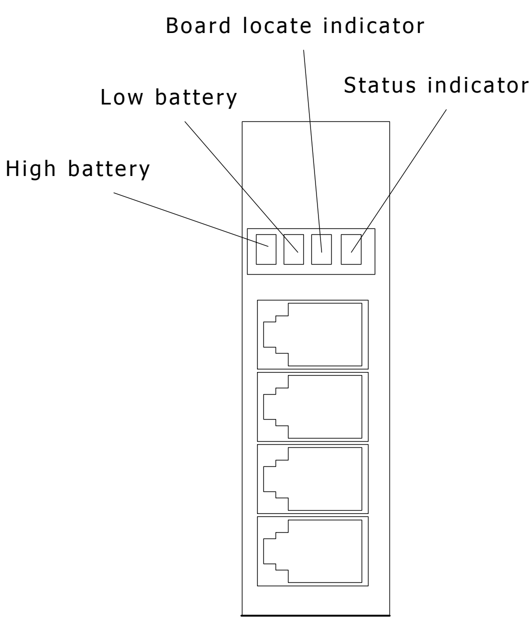
6 Verifying the installation

Status indicator LEDs

The AG 2000 board has four LED indicators on the end bracket of the board and 14 LED indicators on the component side of the board.

LEDs on the end bracket

The following illustration shows the four LED indicators on the end bracket of the AG 2000 board:



The board locate indicator identifies the board using the software. The status indicator remains on after the board is booted.

The following table present the settings for high battery and low battery:

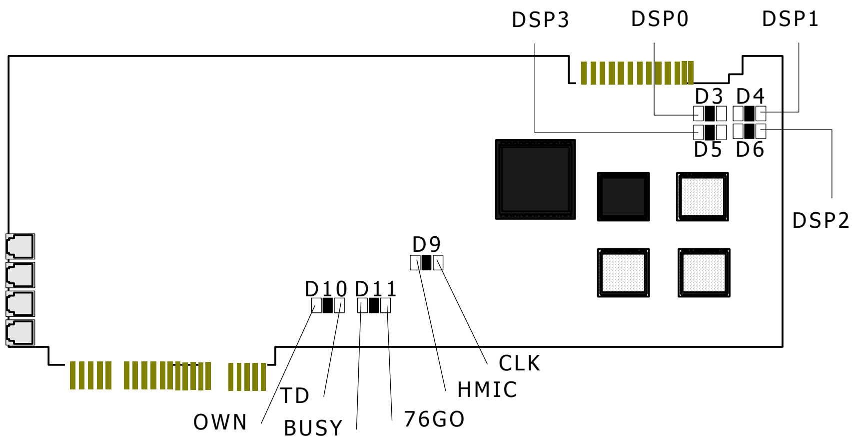
	High battery	Low battery
Loop start	N/A	N/A
Subscriber loop	On	On
DID	On	N/A

On indicates that the LED must be lit for proper operation. N/A indicates that it is not required for the LED to be lit.

Note: It is not required to have a low battery on the subscriber loop. If a single voltage is used, it must connect to high battery. If the loop cable is less than 2000 feet, -24 VDC should be used. If the loop cable is greater than 2000 feet, -48 VDC should be used.

LEDs on the component side of the board

The location of the 14 LEDs (7 pairs) on the component side of the AG 2000 board is shown in the following illustration:



LED	Purpose	Description
D3 - D6	DSPx_RST (4 red LEDs) DSPx_XF (4 green LEDs)	The corresponding DSP is communicating with the NS486. Red = Problem Green = No problem
D9	HMIC (green)	Lit = No problem with the HMIC. Not lit = Problem with the HMIC.
D9	CLK (red)	Lit = No problem with the clock section of the HMIC. Not lit = Problem with the clock section of the HMIC.
D10	OWN (green)	Owner of SRAM. Lit = Idle of host. Not lit = Coprocessor.
D10	TD (red)	Transfer direction bit. Lit = Host access to SRAM. Not lit = 486 access to SRAM.
D11	BUSY (green)	Lit = SRAM is idle. Not lit = SRAM is in use.
D11	76GO (red)	NS486 out of reset.

Verifying board installation

Complete the following steps to verify that the board is installed correctly:

Step	Action
1	Create a board keyword file to boot an AG 2000 board by copying or editing one of the sample board keyword files to match your specific configuration. Refer to *Configuring and starting the system with oamsys* on page 30 for more information. For example, use the *agpi2000.cfg* file to configure the board for the loop start protocol.
2	Run *oammon* to monitor the status of all boards.
3	Use the *pciscan* utility to determine the bus and slot number. For more information about *pciscan*, refer to the *NMS OAM System User's Manual*.
4	Edit the *oamsys.cfg* file to reflect the board locations in your system.
5	Boot the board using the command: `oamsys`

Retrieving AG board configuration information: boardinf

boardinf is a program that reports the board number, address, type, number of ports, memory, and DSP timeslot assignments for each AG board in a system.

boardinf opens the AG driver and retrieves the configuration information for up to 16 AG 2000 boards. If an AG 2000 board exists and is properly initialized, its configuration is displayed and its DSP port addresses are displayed as one or more timeslot ranges.

To run *boardinf*:

Step	Action
1	Ensure that the AG 2000 boards were initialized.
2	Open a command window.
3	Enter the following command: `boardinf` *boardinf* displays the configuration information for each AG 2000 board in the system that has been loaded and initialized.
4	If no boards are detected, verify that the AG 2000 board(s) is loaded and initialized and repeat the command. If the AG 2000 configuration information is not as expected, review the board keyword file.

Interactive test program: ctatest

ctatest is a menu-driven interactive program. Enter one- and two-letter commands to execute Natural Access and ADI service functions. Some commands prompt the user for additional input. For example, running a tone generator requires the user to specify frequencies and amplitudes. For more information about *ctatest*, refer to the *Natural Access Developer's Reference Manual*.

ctatest can execute more than one asynchronous function concurrently. For example, you can run a tone detector (`ET`) and record voice (`RF`) simultaneously. You can abort any function by entering the respective stop command (`DT` and `RS` for tone and record).

If Clocking.HBus.ClockMode = STANDALONE, then default local connections between the DSP resources and the line interfaces are nailed up as described in *Default connections* on page 57.

Keep in mind that there are two naming conventions for the streams on the MVIP bus: the MVIP-90 switch model, and the MVIP-95 switch model. You can only use the MVIP-95 switch model for AG 2000 boards.

To experiment with output and input functions simultaneously, execute two instances of *ctatest*. Use the *swish* **MakeConnection** command to make quad connections between two ports, one bound to each *ctatest* instance. Refer to the *Switching Service Developer's Reference Manual* for information about *swish*.

For example, to interactively experiment with tone generation and detection, start a tone detector in the first *ctatest* instance and a tone generator in the second *ctatest* instance.

This topic describes using *ctatest* with AG 2000 DID boards, AG 2000 subscriber loop boards, and AG 2000 loop start boards.

Using swish for a standalone board

No default connections are made for a standalone board if CT bus connectivity is enabled in the board keyword file. Use *swish* to connect the local network interface to the local DSP resource. You can use *swish* interactively, or create a script in a flat text file.

The following example of *swish* commands nails up the voice and signaling streams for all 8 line interfaces of an AG 2000 board that has been configured as board 0. The *swish* commands are expressed in MVIP-95 terms.

```
openswitch ag2000 = agsw 0

resetswitch ag2000


# make voice and signaling connections
makeconnection ag2000 local:0:0..7 to local:5:0..7 QUAD

closeswitch ag2000

exit
```

Using ctatest with an AG 2000 DID board

For testing purposes, you can connect a 2500-type telephone to a DID line interface signaling module on an AG 2000 board. This provides a direct audio connection to the AG 2000 board. Use the telephone hook switch to simulate signaling from the network. Ensure that the external power connector is connected to a -48 VDC power supply. For more information, refer to *Using two wire interfaces* on page 27.

To use *ctatest*:

Step	Description
1	Make sure that the board keyword file includes the following statement for the board that you will be using: `TCPFiles[x] = wnk0.tcp` where ***x*** = the next available index. If necessary, edit the board keyword file.
2	Start *ctatest*. The initial *ctatest* menu appears.
3	Enter `OP` to create a context and open the ADI service. CTAEVN_OPEN_SERVICES_DONE is displayed on your screen.
4	Start a protocol by entering `SP`. The following message appears: `Enter protocol name ['nocc']:`
5	Enter the wink start protocol: `wnko` The following message appears: `Event: ADIEVN_STARTPROTOCOL_DONE, Finished`
6	Lift the receiver and dial 123. The following message appears: `Event: ADIEVN_INCOMING_CALL` Called number = '123'
7	Initiate answering the call by entering `AC`. The following message appears: `Number of rings [1]:`

8	Press **Enter**.
	You should hear a single ring tone.
	The following messages appear:
	`Event: ADIEVN_ANSWERING_CALL`
	`Event: ADIEVN_CALL_CONNECTED, Answered`

9	Begin recording to memory by entering `RM`. You should hear a beep on the handset.
10	Say "Hello World," and wait. The following message appears on the screen (you may see a different number of bytes): `Event: ADIEVN_RECORD_DONE, Voice End, nbytes=15624.`
11	Play back your voice by entering `PM`. You should hear "Hello World," and *ctatest* displays: `Event: ADIEVN_PLAY_DONE, Finished, nbytes=15624.`

Step	Description
12	Quit the test program by entering `Q`.

Using ctatest with an AG 2000 subscriber loop board

If the AG 2000 board has a subscriber loop line interface signaling module, connect a 2500 set so you can make a call.

To use *ctatest*:

Step	Action
1	Make sure that the board keyword file includes the following statement for the board that you will be using: `TCPFiles[x] = sta0.tcp` where ***x*** = the next available index. If necessary, edit the board keyword file.
2	Start *ctatest*. The initial *ctatest* menu appears.
3	Enter `OP` to create a context and open the ADI service. CTAEVN_OPEN_SERVICES_DONE is displayed on your screen.
4	Start a protocol by entering `SP`. The following message appears: `Enter protocol name ['nocc']:`
5	Enter the subscriber loop protocol: `sta0`. The following message appears: `Event: ADIEVN_STARTPROTOCOL_DONE, Finished`

6	Lift the receiver (you should get a dial tone) and dial 123.
	The following message appears:
	`Event: ADIEVN_INCOMING_CALL`
	`Called number = '123'`

7	Initiate answering the call by entering `AC`. The following message appears: `Number of rings [1]:`

8	Press **Enter**.
	You should hear a single ring tone.
	The following messages appear:
	`Event: ADIEVN_ANSWERING_CALL`
	`Event: ADIEVN_CALL_CONNECTED, Answered`

9	Begin recording to memory by entering `RM`. You should hear a beep on the handset.
10	Say "Hello World," and wait. The following message appears on the screen (you may see a different number of bytes): `Event: ADIEVN_RECORD_DONE, Voice End, nbytes=15624.`

Step	Action
11	Play back your voice by entering `PM`. You should hear "Hello World," and *ctatest* displays: `Event: ADIEVN_PLAY_DONE, Finished, nbytes=15624.`
12	Quit the test program by entering `Q`.

Using ctatest with an AG 2000 loop start board

If the AG 2000 board has a loop start line interface signaling module, connect a loop start line from a PBX or the public network as a test line to your system so you can call the test line from a telephone connected to another line.

To use *ctatest*:

Step	Action
1	Make sure that the board keyword file includes the following statement for the board that you will be using: `TCPFiles[x] = lps0.tcp` where ***x*** = the next available index. If necessary, edit the board keyword file.
2	Start *ctatest*. The initial *ctatest* menu appears.
3	Enter `OP` to create a context and open the ADI service. CTAEVN_OPEN_SERVICES_DONE is displayed on your screen.
4	Start a protocol by entering `SP`. The following message appears: `Enter protocol name ['nocc']:`
5	Enter the loop start protocol: `lps0`. The following message appears: `Event: NCCEVN_START_PROTOCOL_DONE, CTA_REASON_FINISHED`
6	Place a call to the line connected to the AG 2000 board. The following message appears: `Event: NCCEVN_INCOMING_CALL`
7	Initiate answering the call by entering `AC`. The following message appears: `Number of rings [1]:`

8	Press **Enter**.
	You should hear a single ring tone.
	The following messages appear:
	`Event: NCCEVN_ANSWERING_CALL`
	`Event: NCCEVN_CALL_CONNECTED, NCC_CON_ANSWERED`

9	Begin recording to memory by entering `RM`. You should hear a beep on the handset.

Step	Action
10	Say "Hello World," and wait. The following message appears on the screen (you may see a different number of bytes): `Event: VCEEVN_RECORD_DONE, Voice End, msec=3820.`
11	Play back your voice by entering `PM`. You should hear "Hello World," and *ctatest* displays: `Event: VCEEVN_PLAY_DONE, Finished, msec=3820.`
12	Quit the test program by entering `Q`.

Demonstration programs

The following demonstration programs are provided with Natural Access and can be used to verify that the AG 2000 board is operating correctly:

Program	Demonstrates...
ctatest	Natural Access functions.
incta	Handling inbound calls.
outcta	Establishing outbound calls.
prt2prt	Transferring calls from an incoming line to an outgoing line and using the Switching service to make connections and to send patterns.
vceplay	Using the Voice Message service to play messages in voice files.
vcerec	Recording one or more messages to a voice file.

Note: Executables for *incta*, *outcta*, and *prt2prt* are in the respective sub-directories under *nms\ctaccess\demos*.

To run these demonstration programs on the AG 2000 board, specify the MVIP-95 stream and slot number of the local DSP resource on which to run the program. If Clocking.HBus.ClockMode = STANDALONE, then default switching connections between the on-board DSP resources and signaling modules are initialized as described in *Default connections* on page 57.

To run *ctatest* on DSP port 0, enter:

```
ctatest -s0
```

To run *ctatest* on DSP port 2, enter:

```
ctatest -s2
```

Switching connections must be made between DSP resources and signaling modules using the Natural Access Switching service or the *swish* utility. Refer to the AG 2000 switching section for more information.

Refer to the *Natural Access Developer's Reference Manual* for details on Natural Access demonstration programs.

7 AG 2000 switching

AG 2000 switch model

This topic describes:

- The specific use of each stream, as shown for H.100 streams and local streams
- An illustration of the AG 2000 switch model
- HMIC switch blocking

H.100 streams

H.100 streams	
H.100 bus	Streams 0..31, timeslots vary based on clock rate: Streams clocked at 8 MHz: timeslots 0..127 Streams clocked at 4 MHz: timeslots 0..63 Streams clocked at 2 MHz: timeslots 0..31

Local streams

Local stream	
Line interface voice in and out	Streams 0 and 1, timeslot 0..7
Line interface signaling in and out	Streams 2 and 3, timeslot 0..7
DSP voice in and out	Streams 4 and 5, timeslot 0..7
DSP signaling in and out	Streams 6 and 7, timeslot 0..7

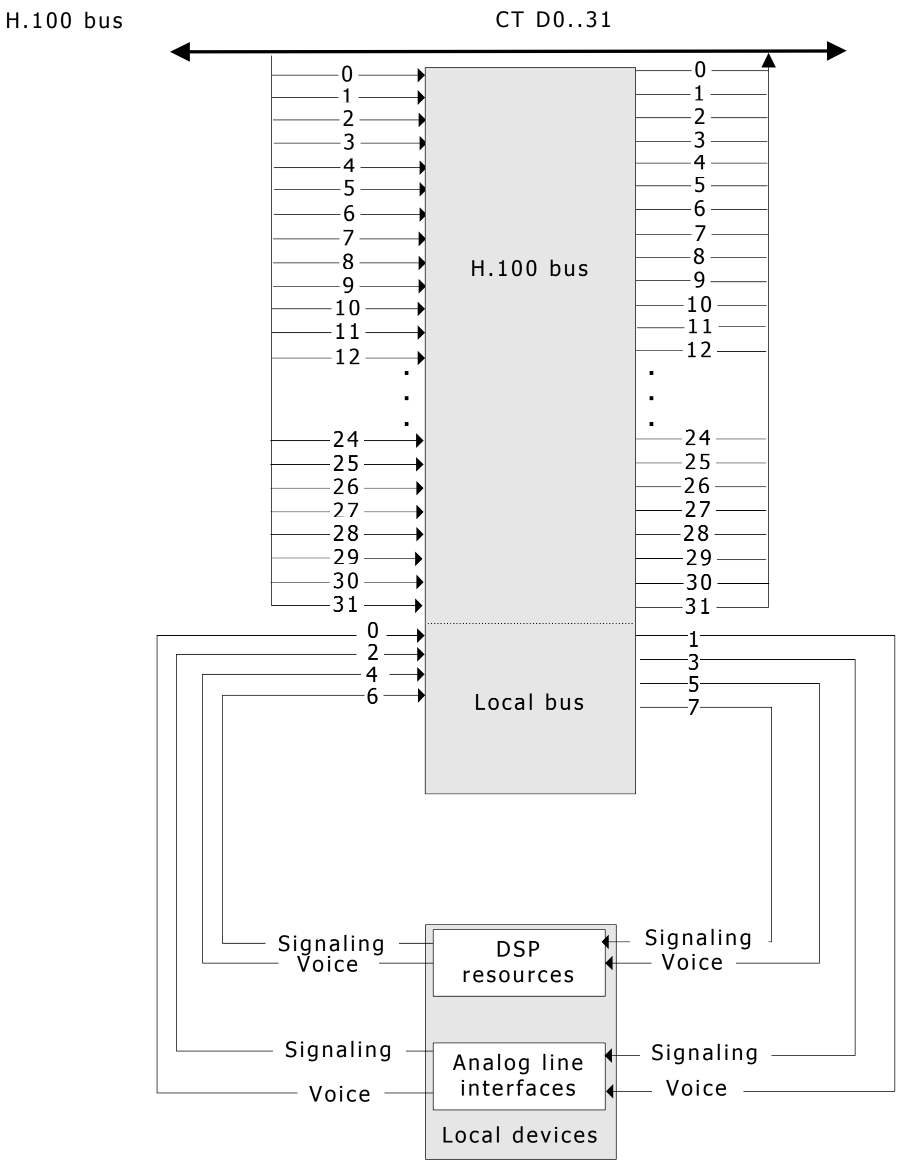
If you have an AG 2000 board in the same chassis as a CG board and you want to pass data through all streams on the board, you must set the H.100 stream speed to 8 Mbit/s for all 32 streams on the AG 2000 board.

The default stream speed for all streams on CG boards is 8 Mbit/s. On AG 2000 boards, the default speed for streams 0 through 15 is set at 2 Mbit/s, while the default stream speed for streams 16 through 31 is set to 8 Mbit/s. Therefore, before using streams 0 through 15 to pass data, you must reset the speed for these streams to 8 Mbit/s.

To reset the stream speed, use the **swiConfigStreamSpeed** function in the Switching service or the **swi.ConfigStreamSpeed** command in the *swish* utility. For more information, refer to the *Switching Service Developer's Reference Manual*.

Switch model

The following illustration shows the AG 2000 switch model:



HMIC switch blocking

Switching on the AG 2000 board is implemented by the HMIC chip. The HMIC chip can perform local bus to local bus switching in full non-blocking fashion.

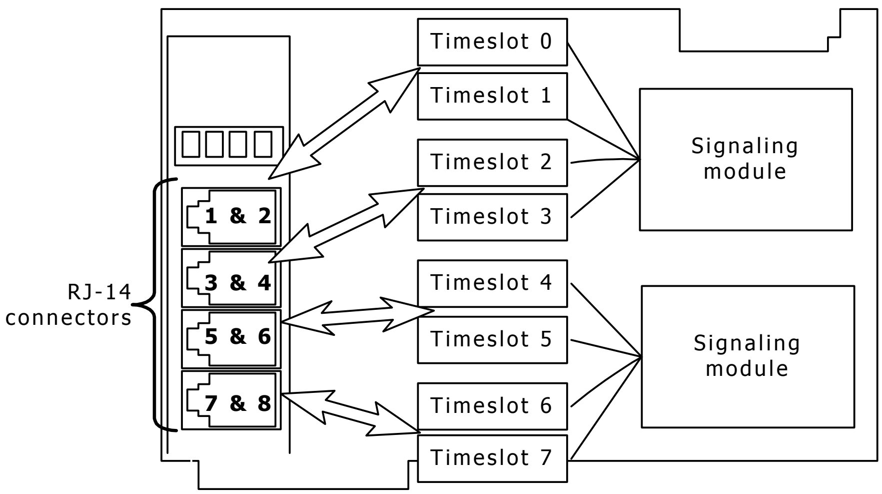
The number of H.100 connections is limited to a maximum of 128 full duplex or 256 simplex (or half-duplex) connections, in any combination, from either:

- H.100 bus to the local bus, or
- H.100 bus to H.100 bus

There are no restrictions on local switching. Any local device can be connected to any other local device.

Signaling modules and logical timeslots

On AG 2000 boards, each signaling module is hardwired to a specific logical timeslot on the local bus. Each signaling module supports four ports of telephone network connectivity and is permanently connected to two RJ-14 connectors (also called a jack). Each jack is therefore bound to the two corresponding timeslots on the local bus. The following illustration shows the relationship between signaling modules, timeslots, and jacks for AG 2000 boards:



Logical timeslots, signaling modules, and RJ-14 connectors

Default connections

If a board is configured for standalone operation (if Clocking.HBus.ClockMode is set to STANDALONE) or if SwitchConnections is set to YES, the following default local connections are nailed up at board initialization:

Switch connection	MVIP-95
Full duplex connection between line interface voice information and DSP resources.	local:0:0..7 => local:5:0..7 local:4:0..7 => local:1:0..7
Full duplex connection between line interface signaling information and DSP resources.	local:2:0..7 => local:7:0..7 local:6:0..7 => local:3:0..7

When MVIP connectivity is enabled, there are no default switch connections when SwitchConnections = YES. Control switching using the Switching service. Refer to the *Switching Service Developer's Reference Manual* for more information.

8 Configuration parameters

Using the Switching service

Local device configuration on the AG 2000 board is controlled by the Switching service. The Switching service provides functions for accessing device configuration parameters defined by the underlying hardware and device driver.

swiConfigLocalTimeslot and **swiGetLocalTimeslotInfo** allow applications to configure a device on a given local stream and timeslot by specifying a particular parameter and providing a data structure specific to that parameter. The prototypes for these functions are repeated here for convenience.

For more information about the Switching service, refer to the *Switching Service Developer's Reference Manual*.

Function information

The syntax of **swiConfigLocalTimeslot** and **swiConfigLocalTimeslotInfo** is:

Prototype

DWORD **swiConfigLocalTimeslot** (SWIHD ***swihd***, SWI_LOCALTIMESLOT_ARGS ***args***, void ***buffer***, unsigned ***size***)

DWORD **swiGetLocalTimeslotInfo** (SWIHD ***swihd***, SWI_LOCALTIMESLOT_ARGS ***args***, void ***buffer***, unsigned ***size***)

Argument	Description
swihd	Switch handle returned by **swiOpenSwitch**.
args	Pointer to a SWI_LOCALTIMESLOT_ARGS structure. This structure indicates the specific parameter to be configured on the device indicated by localstream and localtimeslot. `typedef struct { DWORD localstream; DWORD localtimeslot; DWORD deviceid; DWORD parameterid; } SWI_LOCALTIMESLOT_ARGS;`
buffer	Pointer to a structure that is specific to the parameterid.
size	Size of ***buffer***, in bytes.

Return values

SUCCESS, or an error code from *ctaerr.h* or *swidef.h*.

Details

Applications using **swiConfigLocalTimeslot** and **swiGetLocalTimeslotInfo** must open the Switching service. Refer to the *Natural Access Developer's Reference Manual* for more information about opening services.

Line gain configuration

The AG 2000 supports input and output gain configuration on network voice ports (timeslots) from -6 dB to +6 dB in one dB increments.

Input gain is applied to the signal received from the network. Output gain is applied to the signal transmitted to the network. The default value for both input line gain and output line gain on the AG 2000 loop start board is nominal 0 dB.

This topic describes:

- Getting the line gain
- Setting the line gain

Caution:	Increasing gain can also increase noise, echo, and possibly cause oscillations on the telephone network. There also may be regulatory authority implications. Use gain with caution.

Decreasing gain may reduce echo and other noise.

Getting the line gain

Use **swiGetLocalTimeslotInfo** to query the input or output line gain. Set the arguments for this function as follows:

Argument	Field	Value
swihd		Handle returned by **swiOpenSwitch**.
args	localstream	0 or 1. Refer to the *AG 2000 switch model* on page 55.
	localtimeslot	0..7. Refer to the *AG 2000 switch model* on page 55.
	deviceid	MVIP95_ANALOG_LINE_DEVICE
	parameterid	MVIP95_INPUT_GAIN or MVIP95_OUTPUT_GAIN
buffer		Points to the NMS_LINE_GAIN_PARMS structure.
size		Size of buffer, in bytes.

The NMS_LINE_GAIN_PARMS structure is:

```
typedef struct
{
     INT32 gain;

} NMS_LINE_GAIN_PARMS;
```

The value returned in the gain component of NMS_LINE_GAIN_PARMS represents the gain in dB multiplied by 1000. For example, if the input gain on a particular network timeslot is currently set to -3 dB, after calling **swiGetLocalTimeslotInfo** for parameter MVIP95_INPUT_GAIN, the gain field is -3000.

The following sample code shows how to retrieve line gain applied to a signal received from the network:

```
#include "swidef.h"     /*  Switching service                         */
#include "mvip95.h"     /*  MVIP-95 definitions                       */

DWORD myGetReceiveGain ( SWIHD swihd, SWI_TERMINUS terminus, INT32* gain_dB )
{
     SWI_LOCALTIMESLOT_ARGS  args;
     NMS_LINE_GAIN_PARMS     device ;
     DWORD                   rc ;

     args.localstream      = terminus.stream ;
     args.localtimeslot    = terminus.timeslot ;
     args.deviceid         = MVIP95_ANALOG_LINE_DEVICE ;
     args.parameterid      = MVIP95_INPUT_GAIN ;

    rc = swiGetLocalTimeslotInfo(
    swihd,             /* switch handle                            */
    & args,            /* target device and config item            */
    (void*) & device,  /* buffer (defined by parameterid)          */
    sizeof(device));   /* buffer size in bytes                     */
    )

    *gain_dB  =  device.gain / 1000  ;

     return rc ;
}
```

The following sample code shows how to retrieve line gain applied to a signal transmitted to the network:

```
#include "swidef.h"        /*  Switching service                         */
#include "mvip95.h"        /*  MVIP-95 definitions                       */
#include "nmshw.h"         /*  NMS hardware-specific definitions         */

DWORD myGetTransmitGain ( SWIHD swihd, SWI_TERMINUS terminus, INT32* gain_dB )
{
     SWI_LOCALTIMESLOT_ARGS  args;
     NMS_LINE_GAIN_PARMS     device ;
     DWORD                   rc ;

     args.localstream      = terminus.stream ;
     args.localtimeslot    = terminus.timeslot ;
     args.deviceid         = MVIP95_ANALOG_LINE_DEVICE ;
     args.parameterid      = MVIP95_OUTPUT_GAIN ;


     rc = swiGetLocalTimeslotInfo(
     swihd,              /* switch handle                            */
     & args,             /* target device and config item            */
     (void*) & device,   /* buffer (defined by parameterid)          */
     sizeof(device));    /* buffer size in bytes                     */
     )

    *gain_dB  =  device.gain / 1000  ;

     return rc ;

}
```

Setting the line gain

Use **swiConfigLocalTimeslot** to set the input or output line gain. Set the arguments for this function as follows:

Argument	Field	Value
swihd		Handle returned by **swiOpenSwitch**.
args	localstream	0 or 1. Refer to the *AG 2000 switch model* on page 55.
	localtimeslot	0..7. Refer to the *AG 2000 switch model* on page 55.
	deviceid	MVIP95_ANALOG_LINE_DEVICE
	parameterid	MVIP95_INPUT_GAIN or MVIP95_OUTPUT_GAIN
buffer		Points to the NMS_LINE_GAIN_PARMS structure.
size		Size of buffer, in bytes.

The NMS_LINE_GAIN_PARMS structure is:

```
typedef struct
{
     INT32 gain;

} NMS_LINE_GAIN_PARMS;
```

Multiply the desired gain setting in dB by 1000. For example, to set the input line gain on a network voice port to -4 dB, set the gain field of NMS_LINE_GAIN_PARMS to -4000.

The following sample code shows how to configure gain applied to a signal received from the network:

```
#include "swidef.h"       /*  Switching service                             */
#include "mvip95.h"       /*  MVIP-95 definitions                           */
#include "nmshw.h"        /*  NMS hardware-specific definitions             */

DWORD mySetReceiveGain ( SWIHD swihd, SWI_TERMINUS terminus, INT32 gain_dB)
{
     SWI_LOCALTIMESLOT_ARGS  args;
     NMS_LINE_GAIN_PARMS     device ;

     args.localstream      = terminus.stream ;
     args.localtimeslot    = terminus.timeslot ;
     args.deviceid         = MVIP95_ANALOG_LINE_DEVICE ;
     args.parameterid      = MVIP95_INPUT_GAIN ;

     device.gain  =  gain_dB * 1000  ;

     return swiConfigLocalTimeslot (
     swihd,              /* switch handle                                */
     & args,             /* target device and config item                */
     (void*) & device,   /* buffer (defined by parameterid)              */
     sizeof(device));    /* buffer size in bytes                         */
     )
}
```

The following sample code shows how to configure line gain applied to a signal transmitted to the network:

```
#include "swidef.h"      /*  Switching service                             */
#include "mvip95.h"      /*  MVIP-95 definitions                           */
#include "nmshw.h"       /*  NMS hardware-specific definitions             */
*/
DWORD mySetTransmitGain ( SWIHD swihd, SWI_TERMINUS terminus, INT32 gain_dB )
{
     SWI_LOCALTIMESLOT_ARGS  args;
     NMS_LINE_GAIN_PARMS     device ;

     args.localstream      = terminus.stream ;
     args.localtimeslot    = terminus.timeslot ;
     args.deviceid         = MVIP95_ANALOG_LINE_DEVICE ;
     args.parameterid      = MVIP95_OUTPUT_GAIN ;

     device.gain  =  gain_dB * 1000  ;

     return swiConfigLocalTimeslot (
     swihd,               /* switch handle                                 */
     & args,              /* target device and config item                 */
     (void*) & device,    /* buffer (defined by parameterid)               */
     sizeof(device));     /* buffer size in bytes                          */
     )
}
```

9 Keyword summary

Using keywords

The keywords for an AG 2000 board describe that board's configuration. Some keywords are read/write; others are read-only:

Keyword type	Description
Read/write (editable)	Determines how the board is configured when it starts up. Changes to these keywords become effective after the board is rebooted.
Read-only (informational)	Indicates the board's current configuration. Read-only keywords cannot be modified.

This topic describes:

- Setting keyword values
- Retrieving keyword values

Note: To learn how to use NMS OAM utilities such as *oamsys* and *oamcfg*, refer to the *NMS OAM System User's Manual*. To learn about setting and retrieving keywords using OAM service functions, refer to the *NMS OAM Service Developer's Reference Manual.*

AG plug-in keywords exist in a separate record in the NMS OAM database. They indicate certain board family-level information.

A keyword has the general syntax:

keyword = ***value***

Keywords are not case sensitive except where operating system conventions prevail. All values are strings, or strings that represent integers. An integer keyword can have a fixed numeric range of legal values. A string keyword can support a fixed set of legal values, or can accept any string.

Setting keyword values

There are several ways to set the values of read/write keywords:

- Use or modify one of the sample board keyword files corresponding to your country and board type. Specify the name of this new file in the File statement in *oamsys.cfg*, and run *oamsys* again. Refer to the *NMS OAM System User's Manual* for information about the syntax of board keyword files.

  Note: Using *oamsys* reboots all boards in the system.

- Create a new board keyword file, either with additional keywords or keywords whose values override earlier settings.
- Specify parameter settings using the *oamcfg* utility. Refer to the *NMS OAM System User's Manual* for information about *oamcfg*.
- Specify the settings using OAM service functions. Refer to the *NMS OAM Service Developer's Reference Manual* for more information.

To set board keywords, specify the board name in the system configuration file or on the *oamcfg* command line. To set AG plug-in level keywords, specify the AG plug-in name (*agplugin.bpi*).

Note: Keyword values take effect after the board is rebooted.

Retrieving keyword values

To retrieve the values of read/write and read-only keywords:

- Run the *oaminfo* sample program. On the command line, specify the board using either its name (with the `-n` option) or number (with the `-b` option):

  ```
  oaminfo -n boardname
  oaminfo -b boardnum
  ```

  To access AG plug-in level keywords, specify the AG plug-in name on the command line:

  ```
  oaminfo -n agplugin.bpi
  ```

  oaminfo returns a complete list of keywords and values. For more information about *oaminfo*, refer to the *NMS OAM Service Developer's Reference Manual*.

- Use the OAM service. Refer to the *NMS OAM Service Developer's Reference Manual* for more information.

Editable keywords

The following table summarizes the keywords that you can change:

If you want to...	Use these keywords...
Specify whether the board is started or stopped automatically	AutoStart AutoStop
Specify the board location	Location.PCI.Bus* Location.PCI.Slot*
Specify information about the board	LoadFile LoadSize Name* Number* DLMFiles[x] RunFile TCPFiles[x]
Change the QSLAC file	NetworkInterface.Analog[x].ConfigFile
Set up debug level information	BootDiagnosticLevel
Modify memory allocation	Buffers[x].Num Buffers[x].Size DynamicRecordBuffers MaxChannels
Set up clocking information	Clocking.HBus.ClockMode Clocking.HBus.ClockSource Clocking.HBus.NetRefSpeed Clocking.HBus.Segment
Configure clock automatic fallback	Clocking.HBus.AutoFallBack Clocking.HBus.FallBackClockSource
Set up information specific to NETREF1	Clocking.HBus.NetRefSource
Set up switching information	SwitchConnections SwitchConnectMode
Control switching on the echo canceller reference stream	Echo.AutoSwitchingRefSource Echo.EnableExternalPins
Configure DSPs	DSP.C5x[x].Image DSP.C5x.Lib DSP.C5x.Loader DSP.C5x[x].Os DSP.C5x[x].Files[y] SignalIdleCode VoiceIdleCode Xlaw

* These keywords are set in the *oamsys.cfg* file.

Informational keywords

You cannot edit the keywords listed in this topic. Use these keywords for retrieving information about the:

- Board
- EEPROM
- Board driver

Retrieving board information

Keyword	Type	Description
Location.Type	String	Host system's bus type.
Product	String	At the board level, the product type of the board.
State	String	State of the physical board. Expected values are IDLE, BOOTED, or TESTING.

Retrieving EEPROM information

Keyword	Type	Description
Eeprom.AssemblyRevision	Integer	Hardware assembly level.
Eeprom.BoardSpecific	Integer	Board-specific data.
Eeprom.BusClkDiv	Integer	Bus speed is equal to 2 x CPU speed busclkdiv.
Eeprom.CheckSum	Integer	EEPROM checksum.
Eeprom.CPUSpeed	Integer	Coprocessor speed in MHz.
Eeprom.DRAMSize	Integer	DRAM size in kilobytes.
EEprom.DSPSpeed	Integer	DSP processor speed in MHz.
EEprom.Family	Integer	Board family.
Eeprom.MFGWeek	Integer	Week of the last full test.
Eeprom.MFGYear	Integer	Year of the last full test.
Eeprom.MSBusType	Integer	Media stream bus type. H.100 = 0
Eeprom.NumDSPCores	Integer	Total number of DSP cores on the motherboard.
Eeprom.SerialNum	Integer	Serial number unique to each board. This number is factory configured.
Eeprom.SoftwareCompatibility	Integer	Minimum software revision level.
Eeprom.SRAMSize	Integer	SRAM size in kilobytes.
Eeprom.SubType	Integer	AG family variant information.

Retrieving board driver information

Keyword	Type	Description
Driver.BoardID	String	Board driver ID for the current board. Each board accessed by a driver has a unique ID. However, two boards accessed by different drivers can have the same driver ID number.
Driver.Name	String	Operating system independent root name of the driver, for example, ag.
SwitchDriver.Name	String	Operating system independent root name of the switching driver. Expected value is AGSW.

Plug-in keywords

The AG plug-in keywords include:

- Boards[x]
- LoadSize
- Products[x]
- Version.Major
- Version.Minor

10 Keyword reference

Using the keyword reference

The keywords are presented in detail in the following topics. Each keyword description includes:

Syntax	The syntax of the keyword
Access	Read/write or read-only
Type	The data type of the value: string, integer, or file name
Default	Default value
Allowed values	A list of all possible values
Example	An example of usage
Details	A detailed description of the keyword's function
See also	A list of related keywords

AutoStart

Specifies whether the board automatically starts when *ctdaemon* is started.

Syntax

AutoStart = ***setting***

Access

Read/Write

Type

String

Default

NO

Allowed values

YES | NO

Example

```
AutoStart = NO
```

Details

The Supervisor-level keyword AutoStartEnabled enables or disables the autostart feature. If AutoStartEnabled is set to YES, the Supervisor starts each board whose AutoStart keyword is set to YES when *ctdaemon* is started. If AutoStartEnabled is set to NO, no boards are started automatically, regardless of the setting of the AutoStart keyword.

For more information, refer to the *NMS OAM System User's Manual*.

See also

AutoStop

AutoStop

Specifies whether the board automatically stops when *ctdaemon* is stopped.

Syntax

AutoStop = ***setting***

Access

Read/Write

Type

String

Default

NO

Allowed values

YES | NO

Example

```
AutoStop = NO
```

Details

The Supervisor-level keyword AutoStopEnabled enables or disables the autostop feature. If AutoStopEnabled is set to YES, the Supervisor stops each board whose AutoStop keyword is set to YES when *ctdaemon* is stopped. If AutoStopEnabled is set to NO, no boards are stopped automatically, regardless of the setting of the AutoStop keyword.

For more information, refer to the *NMS OAM System User's Manual*.

See also

AutoStart

Boards[x]

Specifies the name of the board object that is managed by the AG plug-in.

Syntax

Boards[***x***] = ***boardname***

x = the index of the Board array keyword.

Access

Read-only (AG plug-in level)

Type

String

Allowed values

Not applicable.

See also

Name, Number

BootDiagnosticLevel

Specifies the level of diagnostics during initialization of the board.

Syntax

BootDiagnosticLevel = ***level***

Access

Read/Write

Type

Integer

Default

2

Allowed values

0 | 1 | 2 | 3

Example

```
BootDiagnosticLevel = 2
```

Details

This value takes precedence over the corresponding value of the BootDiagnosticLevel keyword set in the system configuration file.

The valid values for ***level*** are 0, 1, 2, and 3. Zero (0) indicates that no diagnostics are performed, and 3 is the maximum level. The trade-off for higher levels of diagnostics is the increased time needed to initialize each AG board at load time.

If a test fails, the test number is reported back as the error code. Some tests can pass back more than one error code depending on the options selected, the mode of failure, or both. Some tests report additional information.

The following tests are performed during the boot diagnostics:

Test number	Description	Error code	# WDS	Error number
1	Coprocessor booted by writing 11h to SRAM base address.			
	• Coprocessor never booted at all.	1		
	• Coprocessor booted but crashed after writing to SRAM base address.	11h		
	• aaaah option switch selected and coprocessor crashed after updating SRAM base address.	aaaah		
2	Verifies the board type.	2	1	
3	Checks the DRAM size and BUSCLK programmed in the EEPROM, and sets up the part accordingly if valid EEPROM choice.	3	1	
4	Tests DSP control and status registers	4	2	
6	Tests DRAM	6	4	
7	Tests DSPs	7	5	
8	Serial port test			
	• Failed internal loopback test. Wrote a 49h and received something else back.	8	2	
9	HMIC tests			Refer to the following tables for an explanation of the error number.
	• Failed I/O test	9	5	1
	• Failed register test	9	5	1
	• Failed CAM test	9	5	2
	• Failed local connections test	9	5	3
12	DSP HPI tests	12	4	

The following information is reported back to the host when there is a diagnostic failure:

Error code		WORD1	WORD2	WORD3	WORD4	WORD5
	# WDS	Additional data				
1	None					
2	1	EEPROM board type				
3	1	EEPROM DRAM size word				
4	2	written	read (masked by 0xfh)			
6	4	address lo	address hi	written	read	
7	5	# DSPs booted	Number expected	test ID	memory failed address	contents of failed address
8	2	written	read			
9	5	See the following table for more information.				
12	4	00 = HPIA test 01 = HPI memory test	DSP number	written	read	

The following information is reported back to the host for error code 9 when there is a diagnostic failure:

# WDS	HMIC ID	Error number	Address	Write	Read
5	0	1	5aa5	Write	Read
5	0	1	Register number	Write	Read
5	0	2	CAM address	Write	Read
5	0	3	Local connections address	Write	Read

Buffers[x].Num

Specifies the number of buffers in buffer pool ***x***.

Syntax

Buffers[***x***].Num = ***buffercount***

x = 0 - 2

Access

Read/Write

Type

Integer

Default

Index 0 large	Index 1 medium	Index 2 small
16	0	32

Allowed values

Based on the available board memory.

Example

```
Buffers[0].Num = 16
```

Details

Specifies the number of buffers available for play and record. By default, two buffers are allocated per channel. For simultaneous play and record, you must configure four buffers per channel.

Buffers[2].Num is required for NMS Fusion systems.

See also

Buffers[x].Size, DynamicRecordBuffers, MaxChannels

Buffers[x].Size

Specifies the size, in bytes, of buffers in buffer pool ***x***.

Syntax

Buffers[***x***].Size = ***size***

Access

Read/Write

Type

Integer

Default

Index	Default value
0	16400
1	1024
2	92

Allowed values

0 - 65535

Example

```
Buffers[0].Size = 16400
```

Details

Specifies the size, in bytes, of buffers used for play and record. The default buffer size is 16400.

Buffers[1].Size affects ISDN and some NMS Fusion systems. The default is 1024.

Small buffers (index[2]) cannot be configured.

See also

Buffers[x].Num, DynamicRecordBuffers

Clocking.HBus.AutoFallBack

Enables or disables clock fallback on the board.

For information about setting up CT bus clocking, and rules and restrictions for configuring CT bus clocking, refer to *Configuring board clocking* on page 38.

Syntax

Clocking.HBus.AutoFallBack = ***mode***

Access

Read/Write

Type

String

Default

NO

Allowed values

YES | NO

Example

```
Clocking.HBus.AutoFallBack = YES
```

Details

When set to YES, this keyword specifies whether or not the board automatically switches between the two clock timing references specified by the Clocking.HBus.ClockSource and Clocking.HBus.FallBackClockSource keywords. The Clocking.HBus.AutoFallBack keyword applies for all modes specified by the Clocking.HBus.ClockMode keyword.

The fallback timing reference clock is selected by the Clocking.HBus.FallBackClockSource keyword. Both of the physical timing references specified by the Clocking.HBus.ClockSource and Clocking.HBus.FallBackClockSource keywords must be present and not in alarm when the board's clocking is set up.

NO indicates that the system does not fallback to the backup timing reference.

Specify the primary clock and fallback clock with the Clocking.HBus.ClockSource and Clocking.HBus.FallBackClockSource keywords.

If the board is configured as the primary master or in standalone mode, this keyword enables the board to switch to the secondary timing reference when the first source goes into an alarm state. If the primary source returns, the board's timing reference switches back to the primary source. The *showclks* utility program can be used to determine what timing reference the board is actively using.

For an AG board configured as a secondary clock master or as a clock slave, this keyword enables the board to switch to an alternative timing reference when the first source goes into an alarm state. The board does not return to the first timing reference if the timing reference recovers. The host application must perform any further clock configuration operations.

For more information about clock fallback, refer to the *Switching Service Developer's Reference Manual*.

To support clock fallback on an AG board, refer to the NMS web site (www.nmscommunications.com) for application notes and other updates.

Clocking.HBus.ClockMode

Specifies the board's control of the H.100 clock.

For information about setting up CT bus clocking, and rules and restrictions for configuring CT bus clocking, refer to *Configuring Board Clocking* on page 38.

Syntax

Clocking.HBus.ClockMode = ***clockmode***

Access

Read/Write

Type

String

Default

STANDALONE

Allowed values

MASTER_A | MASTER_B | SLAVE | STANDALONE

Example

```
Clocking.HBus.ClockMode = MASTER_A
```

Details

Valid entries for the keyword include:

Value	Description
MASTER_A	The board is used to drive the CT bus A clock based on the timing information derived from a clocking source.
MASTER_B	The board is used to drive the CT bus B clock based on the timing information derived from a clocking source.
SLAVE	The board acts as a clock slave, deriving its timing from the primary bus master. **Note:** Connections are allowed to the board's CT bus timeslots.
STANDALONE	The board references its timing signal from its own oscillator and does not drive any CT bus timing signal clocks. **Note**: Connections are not allowed to the board's CT bus timeslots in standalone mode.

For more information, refer to *Default connections* on page 57.

See also

Clocking.HBus.AutoFallBack, Clocking.HBus.ClockSource

Clocking.HBus.ClockSource

Specifies the clock reference origin.

For information about setting up CT bus clocking, and rules and restrictions for configuring CT bus clocking, refer to *Configuring board clocking* on page 38.

Syntax

Clocking.HBus.ClockSource = ***clock_source***

Access

Read/Write

Type

String

Default

OSC

Allowed values

OSC | A_CLOCK | B_CLOCK

Example

```
Clocking.HBus.ClockSource = OSC
```

Details

Valid entries for the keyword include:

Value	Description
OSC	Uses the on-board oscillator as a reference.
A_CLOCK	Causes the board to act as a clock slave to the H.100 bus A clock by deriving the local clock from the bus. Another H.100 board (or H.110 board) must drive the clock on the bus.
B_CLOCK	Causes the board to act as a clock slave to the H.100 bus B clock by deriving the local clock from the bus. Another H.100 board (or H.110 board) must drive the clock on the bus.

Clocking.HBus.FallBackClockSource

Specifies the alternate clock reference to use when the master clock does not function properly.

For information about setting up CT bus clocking, and rules and restrictions for configuring CT bus clocking, refer to Configuring board clocking.

Syntax

Clocking.HBus.FallBackClockSource = ***clock_source***

Access

Read/Write

Type

String

Default

OSC

Allowed values

OSC | A_CLOCK | B_CLOCK

Example

```
Clocking.HBus.FallBackClockSource = OSC
```

Details

If the Clocking.HBus.AutoFallBack keyword is set to NO, this keyword is ignored.

For more information about clock fallback, refer to the *Switching Service Developer's Reference Manual*.

To support clock fallback on an AG board, refer to the NMS web site (www.nmscommunications.com) for application notes and other updates.

Clocking.HBus.NetRefSource

Specifies a source to drive the NETREF timing signal on the CT bus.

For information about setting up CT bus clocking, and rules and restrictions for configuring CT bus clocking, refer to *Configuring board clocking* on page 38.

Syntax

Clocking.HBus.NetRefSource = ***source***

Access

Read/Write

Type

String

Default

STANDALONE

Allowed values

OSC | STANDALONE

Example

```
Clocking.HBus.NetRefSource = OSC
```

Details

Value	Description
OSC	The oscillator uses the board's local clock (for diagnostics only).
STANDALONE	The NETREF clock is not driven.

See also

Clocking.HBus.NetRefSpeed

Clocking.HBus.NetRefSpeed

Indicates the speed of the NETREF timing signal on the CT bus.

For information about setting up CT bus clocking, and rules and restrictions for configuring CT bus clocking, refer to *Configuring board clocking* on page 38.

Syntax

Clocking.HBus.NetRefSpeed = ***speed***

Access

Read/Write

Type

String

Default

8K

Allowed values

8K | 1544M | 2048M

Example

```
Clocking.HBus.NetRefSpeed = 8K
```

Details

This keyword should always be set to 8K.

See also

Clocking.HBus.NetRefSource

Clocking.HBus.Segment

Specifies the CT bus segment into which the board is connected. In most cases, the chassis contains only one segment.

Syntax

Clocking.HBus.Segment = ***number***

Access

Read/Write

Type

Integer

Default

1

Allowed values

0 -255

Example

```
Clocking.HBus.Segment = 1
```

DLMFiles[x]

Specifies a runtime component (modular extension to the core file) to be transferred to the board by the configuration file.

Syntax

DLMFiles[***x***] = ***filename***

x = 0..63

Access

Read/Write

Type

File Name

Default

None.

Allowed values

Valid DLM file name.

Example

```
DLMFiles[0] = ag2fax.leo
```

Details

A *.leo* (loadable extensible object) file is a type of run module. For AG boards, the software that runs on the board coprocessor consists of the core file and any run modules.

The following *.leo* files are included with and need to be configured with AG 2000 boards:

File name	Description
svc.leo	DSP function manager.
gtp.leo	Trunk protocol engine.
voice.leo	Play and record manager.

To use NaturalFax, you must specify the NaturalFax run module to be downloaded to the board.

DLMFiles[***x***] is required for AG 2000 boards.

See also

RunFile

DSP.C5x.Lib

Specifies the DSP library file.

Syntax

DSP.C5x.Lib = ***filename***

Access

Read/Write

Type

File name

Default

ag2liba.r54 if Xlaw = A-LAW

ag2libu.r54 if Xlaw = MU-LAW

Allowed values

A valid file name.

Example

```
DSP.C5x.Lib = ag2liba.r54
```

See also

DSP.C5x[x].Os

DSP.C5x.Loader

Specifies the module to load DSP functions for boards.

Syntax

DSP.C5x.Loader = ***filename***

Access

Read/Write

Type

File name

Default

ag2boot.b54

Allowed values

A valid file name.

Example

```
DSP.C5x.Loader = special.b54
```

Details

The naming convention for DSP loader files is ***filename***.*b54*.

See also

DSP.C5x.Lib

DSP.C5x[x].Files[y]

Specifies the name or the ID of a DSP file that targets a specific DSP.

Syntax

DSP.C5x[***x***].Files[***y***] = ***filename***

x = 0..31

y = file number

Access

Read/Write

Type

File name

Default

None.

Allowed values

A valid file name.

Example

```
DSP.C5x[0..7].Files[0] = callp.m54
```

Details

These files are automatically distributed among the various DSPs by the AG plug-in according to internal rules. The naming convention for files is ***filename****.m54*.

The following DSP files are available:

DSP file	Description
adsir(_j).m54	Contains the caller ID function that decodes the modem burst that occurs between the first and second rings on a loop start line. In addition, it contains the FSK data receiver. (*_j*) is the V.23 variant.
adsix(_j).m54	Contains the FSK data transmitter. (*_j*) is the V.23 variant.
callp.m54	Contains voice and tone detectors used for call progress detection. Use for any outgoing or two-way trunk protocol and for call progress analysis.
dtmf.m54	Contains the DTMF receiver, energy and silence detector, and precise tone filter typically used for cleardown.
dtmfe.m54	A variant of *dtmf.m54*, optimized for use with the echo canceller (*echo.m54*). It yields better talk-off resistance but requires the echo canceller to achieve the best cut-through performance. **Note**: You must use the echo canceller with this function.

DSP file	Description
echo.m54	Contains the echo cancellation function. The echo canceller removes reflected transmit channel energy from the incoming signal, which improves DTMF detection and voice recognition while playing. NMS echo functions are characterized by two parameters: tail length and adaptation rate. Tail length represents the maximum duration of the echo that can be cancelled, in ms. The adaptation rate specifies the percentage of the echo canceller filter coefficients that are adapted every period. The echo function has an adapt period of 2 ms. Therefore, an echo function with a 20 ms tail length and 100% rate adapts all the coefficients in 2 ms while the same function with a 25% rate adapts in 8 ms.
echo_v3.m54	Contains an improved echo cancellation function. This echo canceller presents a higher performance than the one in *echo.m54*. It also has a maximum tail length of 64 ms. **Note:** Substitute *dtmfe.m54* for *dtmf.m54* when using this echo canceller.
echo_v4.m54	Contains the improved echo cancellation functions available in *echo_v3.m54*, and also provides comfort noise generation and tone disabling features.
g726.m54	Contains ITU G.726 ADPCM play and record functions. G.726 is a standard for 32 kbps speech coding. These functions require considerably more DSP processing time than the functions in *voice.m54*. *g6726.m54* is required if you start play and record with an encoding type of ADI_ENCODE_G726.
gsm_ms.m54	Contains MS-GSM play and record functions. The 13 kbps Full Rate GSM speech codec is in Microsoft formatted frames.
gsm_mspl.m54	Contains identical play and record functions as *gsm_ms.m54* except that the maximum output power of the play function is limited.
ima.m54	Contains IMA ADPCM play and record functions. IMA is a standard for 32 kbps speech encoding.
mf.m54	Contains the multi-frequency receiver which is required for any trunk protocol (TCP) that uses MF signaling, and required by the MF detector.
oki.m54	Contains play and record functions for OKI ADPCM speech encoding at 24 kbps or 32 kbps (used to play and record compatible voice files).
ptf.m54	Contains precise tone filters. Typically used for CNG, CED, or custom tone detection.
rvoice.m54	Contains PCM play and record functions. *rvoice.m54* is required to play or record with an encoding of ADI_ENCODE_MULAW, ADI_ENCODE_ALAW, or ADI_ENCODE_PCM8M16.
rvoice_vad.m54	Contains PCM play and record functions. Record functions can enable the voice activity detection (VAD) capability. *rvoice_vad.m54* is required to play or record with an encoding of ADI_ENCODE_MULAW, ADI_ENCODE_ALAW, or ADI_ENCODE_PCM8M16.
signal.m54	Contains signaling, ring detector, and pulse functions. These are out of band functions which typically operate on the MVIP signaling stream. This file is required for: • Any trunk protocol except NOCC • The signal detector • Sending a pulse

DSP file	Description
tone.m54	Contains the tone generation function. This file is required for any trunk protocol except NOCC. It is also required for generating tones, generating DTMF tones, MF tones, initiating dialing, and for generating a beep tone with any second record function.
voice.m54	Contains NMS ADPCM play and record functions. The compressed speech is in a framed format with 20 milliseconds of data per frame. Speech is compressed to 16, 24, or 32 kbps or stored as uncompressed mu-law or A-law (64 kbps). This file is required to play or record with encoding values of ADI_ENCODE_NMS_16, ADI_ENCODE_NMS_24, ADI_ENCODE_NMS_32, or ADI_ENCODE_NMS_64.
wave.m54	Contains play and record functions for PCM speech in formats commonly used in WAVE files, including 8-bit and 16-bit 11 kHz sampling.

Refer to *Functions for managing resources* on page 135 for more information about the DSP resources available on each board and the DSP requirements for each ADI service function.

Refer to *DSP/task processor files and processing power* on page 136 to estimate the DSP requirements for your application and for instructions for re-configuring DSP resources if necessary.

DSP.C5x[x].Image

Specifies the DSP image file for the processor.

Syntax

DSP.C5x[***x***].Image = ***filename***

x = 0..31

Access

Read/Write

Type

File name

Default

None.

Allowed values

A valid file name.

Example

```
DSP.C5x[1].Image = ag2fax.c54
```

Details

Specifies a pre-linked DSP image file for AG boards used by developers to develop their own DSP images.

The naming convention for DSP image files is ***filename***.*c54*.

Setting DSP.C5x[x].Image = NULL leaves the specified DSP(s) in an unbooted state.

DSP.C5x[x].Os

Defines the different operating systems per DSP.

Syntax

DSP.C5x[***x***].Os = ***filename***

x = 0..31

Access

Read/Write

Type

File name

Default

dspos2f.k54 on all DSPs

Allowed values

A valid file name.

Example

```
DSP.C5x[1].Os = dspos2f.k54
```

DynamicRecordBuffers

Specifies the maximum number of overflow buffers that the board automatically allocates for recording, when recording is initiated in asynchronous board-to-host data transfer mode (using **adiRecordAsync**).

Syntax

DynamicRecordBuffers = ***buffercount***

Access

Read/Write

Type

Integer

Default

0

Allowed values

0 - (Buffers[x].Num)

Example

```
DynamicRecordBuffers = 6
```

Details

Asynchronous board-to-host data transfer mode is often used to transfer data from the board to the host for near-real-time processing (for example, during voice recognition).

By default, when the application invokes **adiRecordAsync**, the board allocates a single buffer and begins filling it with recorded data. The application immediately invokes **adiSubmitRecordBuffer** to cause the board to allocate another buffer to fill when the first buffer is full. Whenever the ADI service indicates that a record buffer is full (by returning ADIEVN_RECORD_BUFFER_FULL), the application immediately invokes **adiSubmitRecordBuffer** again to cause a second buffer to be allocated. Thus at any given time there are two buffers allocated on the board: one being filled or full waiting to be sent, and a second one waiting to be filled or filling.

However, at certain times both buffers can fill before the application has a chance to invoke **adiSubmitRecordBuffer** again. In this case, data can be lost.

To mitigate this problem, set DynamicRecordBuffers to a number of additional buffers that are automatically allocated by the board when **adiRecordAsync** is invoked. If the two initial buffers fill up, the additional buffers are filled one at a time. If the host falls behind, data is preserved in the additional buffers until the application can catch up.

Regardless of how a buffer is allocated, it is not sent to the host until solicited by the host (by invoking **adiSubmitRecordBuffer**). Each buffer requires a separate request.

The size of the additional buffers is the size of the initial record buffer, requested by invoking **adiRecordAsync**. Additional buffers are allocated from the medium buffer pool (Buffers[1]). Consequently, DynamicRecordBuffers does nothing unless:

- Buffers[1].Num is set to a nonzero value, and
- Recording is started with a buffer no larger than Buffers[1].Size.

Note: All record buffers must be the same size. The final buffer can be smaller.

For example, suppose you set the buffer size to 200 ms (Buffers[x].Size =1600 for mu-law encoding), and DynamicRecordBuffers = 6. These settings mean that once the first buffer is filled and sent to the host, the host can delay up to 1.4 seconds before requesting more data:

200 ms x (1 initial buffer + 6 additional buffers)

For more information about asynchronous board-to-host recorded data transfer, refer to the *ADI Service Developer's Reference Manual*.

See also

Buffers[x].Num

Echo.AutoSwitchingRefSource

Determines if the on-board switching manager performs automatic switching of the echo canceller reference stream.

Syntax

Echo.AutoSwitchingRefSource = ***setting***

Access

Read/Write

Type

String

Default

NO

Allowed values

NO | YES

Example

```
Echo.AutoSwitchingRefSource = NO
```

Details

Echo.EnableExternalPins must be set to YES to use the Echo.AutoSwitchingRefSource keyword.

Automatic switching occurs when a connection is made to a line from another line (or any other source) and when the destination line is also connected to a DSP that has echo cancellation enabled.

For example, using *swish*:

```
swish> openswitch b = agsw 0
swish> makeconnection b local:0:0 to local:17:0          # line 0 to DSP
swish> makeconnection b local:0:0 to local:1:1 duplex    # line 0 to/from line 1
```

The first connection connects DSP 0 to listen to line 0.

The second connection connects lines 0 and 1 together. The remote parties on line 0 and line 1 are able to talk to each other. DSP 0 is still monitoring line 0. This configuration is referred to as tromboning.

The switching manager automatically makes the following connection:

```
local:0:1 --> local:35:0
```

This connects line 1 to the echo canceller reference. It enables cancellation of echoes that occur on line 0 from energy originating on line 1.

See also

Echo.EnableExternalPins

Echo.EnableExternalPins

Determines if the echo canceller reference and output can be switched.

Syntax

Echo.EnableExternalPins = ***setting***

Access

Read/Write

Type

String

Default

NO

Allowed values

NO | YES

Example

```
Echo.EnableExternalPins = NO
```

Details

Setting this keyword to YES enables the echo canceller reference input and the echo canceller output to be switched. They appear on output stream 34 and reference stream 35.

See also

Echo.AutoSwitchingRefSource

LoadFile

Specifies the boot loader for the board.

Syntax

LoadFile = ***filename***

Access

Read/Write

Type

File name

Default

ag2000.lod

Allowed values

A valid file name.

Example

Windows:

```
LoadFile = \nms\ag\load\ag2000.lod
```

UNIX:

```
LoadFile = /opt/nms/ag/load/ag2000.lod
```

See also

LoadSize

LoadSize

Indicates the coprocessor software download size specified in the system configuration file.

Syntax

LoadSize = ***size***

Access

Read/Write (AG plug-in level)

Type

Integer

Default

0x7500

Allowed values

0 - 0xFFFF

Example

```
LoadSize = 0x7500
```

See also

LoadFile

Location.PCI.Bus

Specifies the PCI logical bus location of the board.

Syntax

Location.PCI.Bus = ***busnum***

Access

Read/Write

Type

Integer

Default

0

Allowed values

0 - 255

Example

```
Location.PCI.Bus = 0
```

Details

Every PCI slot in the system is identified by a unique PCI logical bus and slot number. A PCI board is identified in the system configuration file by specifying its logical bus and slot number.

This statement along with the Location.PCI.Slot keyword assigns the board number to the physical board.

Use *pciscan* to determine the PCI logical bus and slot assigned for all NMS PCI boards in the system. For more information, refer to the *NMS OAM System User's Manual*.

Location.PCI.Slot

Defines the logical slot location of the board on the PCI bus.

Syntax

Location.PCI.Slot = ***slotnum***

Access

Read/Write

Type

Integer

Default

0

Allowed values

0 - 255

Example

```
Location.PCI.Slot = 1
```

Details

Every PCI slot in the system is identified by a unique PCI bus and slot number. A PCI board is identified in the system configuration file by specifying its bus and slot number.

This statement along with Location.PCI.Bus assigns the board number to the physical board.

Use *pciscan* to determine the PCI bus and slot assigned for all NMS PCI boards in the system. For more information, refer to the *NMS OAM System User's Manual*.

MaxChannels

Specifies the maximum number of channels to allocate on the board.

Syntax

MaxChannels = ***numChannels***

Access

Read/Write

Type

Integer

Default

8

Allowed values

1 - 255

Example

```
MaxChannels = 128
```

Details

The number of channels affects memory requirements. If Buffers[0].Num is not configured, two buffers are allocated per channel.

See also

Buffers[x].Num

Name

Specifies the name of the board.

Syntax

Name = ***boardname***

Access

Read/Write

Type

String

Default

None.

Allowed values

The name can be up to 64 characters long.

Example

```
Name = AG_2000
```

See also

Number

NetworkInterface.Analog[x].ConfigFile

Specifies the country-specific file for line interfaces for AG 2000 boards. Refer to *QSLAC files and trunk control programs* on page 36 for more information.

Syntax

NetworkInterface.Analog[***x***].ConfigFile = ***filename***

Access

Read/Write

Type

File name

Default

Line interface type	File name	Where used
Loop start	*a2usals6.slc*	Default. Loop start for 600 Ohm PBXs in North America and South America.
	a2canls6.slc	Loop start for 600 Ohm PBXs in Canada.
	a2jpnls6.slc	Loop start for 600 Ohm PBXs in Japan.
	a2usals9.slc	Loop start for 900 Ohm PBXs in North America and South America.
	a2canls9.slc	Loop start for 900 Ohm PBXs in Canada.
	a2jpnls9.slc	Loop start for 900 Ohm PBXs in Japan.
	a2usalsn.slc	PSTN connections in North America and South America.
	a2canlsn.slc	PSTN connections in Canada.
	a2jpnlsn.slc	PSTN connections in Japan.
	a2eurlsc.slc	PSTN connections in the EU countries.
	a2auslsc.slc	PSTN connections for Australia.
Subscriber loop	*a2usasl6.slc*	Default subscriber loop interface.
	a2usasl9.slc	900 Ohm subscriber loop interface.
DID	*a2usadd6.slc*	Default DID interface.
	a2usadd9.slc	900 Ohm DID interface.

Allowed values

Valid QSLAC file name.

Example

```
NetworkInterface.Analog[x].ConfigFile = a2usals9.slc
```

Number

Specifies the logical board number for this board.

Syntax

Number = ***boardnumber***

Access

Read/Write

Type

Integer

Default

0

Allowed values

0 - 31

Example

```
Number = 0
```

Details

NMS OAM creates a unique board number within a chassis. You can override this value.

See also

Name

Products[x]

At the AG plug-in level, indicates the product types supported by the plug-in (AG_2000).

Syntax

Products[***x***] = ***product_type***

Access

Read-only (AG plug-in level)

Type

String

Allowed values

Not applicable.

Details

The contents of the Products[***x***] keyword in the AG plug-in (and all other installed plug-ins) are added to the Supervisor array keyword Products[***x***] at startup. You can retrieve the values in the Supervisor keyword Products[***x***] to determine all products supported by all installed plug-ins.

See also

Name

RunFile

Specifies the runtime software to be transferred to the board.

Syntax

RunFile = ***filename***

Access

Read/Write

Type

File name

Default

ag2000.cor

Allowed values

Valid core file.

Example

```
RunFile = ag2000.cor
```

Details

The RunFile is the core file that is used with module extension files (specified by DLMFiles[x]).

RunFile is not mandatory.

SignalIdleCode

Specifies the signal bit patterns transmitted by an idle DSP or to an unconnected line interface. In general, a DSP is considered to be idle when no application is using it.

Syntax

SignalIdleCode = ***signal_idlecode***

Access

Read/Write

Type

Integer

Default

0

Allowed values

0x00 - 0xFF

Example

```
SignalIdleCode = 0xd
```

See also

VoiceIdleCode, Xlaw

SwitchConnections

Specifies whether or not to nail up default connections.

Syntax

SwitchConnections = ***setting***

Access

Read/Write

Type

String

Default

Auto

Allowed values

Yes | No | Auto

Example

```
SwitchConnections = Yes
```

Details

Valid entries include the following values:

Setting	Description
Yes	Nails up connections independent of the Clocking.HBus.ClockMode setting.
No	Does not nail up connections.
Auto	Nails up connections automatically if Clocking.HBus.ClockMode = STANDALONE.

When running the Point-to-Point Switching service, set SwitchConnections = No. Use the *ppx.cfg* file to define default connections. For more information, refer to the *Point-to-Point Switching Service Developer's Reference Manual*.

See also

SwitchConnectMode

SwitchConnectMode

Specifies the HMIC switch connect mode.

Syntax

SwitchConnectMode = ***setting***

Access

Read/Write

Type

String

Default

ByChannel

Allowed values

ByChannel | AllDirect | AllConstantDelay

Example

```
SwitchConnectMode = AllConstantDelay
```

Details

Valid entries include the following values:

Option	Description
ByChannel	The mode for each board connection depends on whether the connection is made using **swiMakeConnection** or **swiMakeFramedConnection**.
AllDirect	For all board connections, data is transferred directly from the source timeslot to the destination timeslot. For forward connections, (from lower-numbered timeslots to higher-numbered timeslots), data is transferred in the same time frame. For backward connections (from higher-numbered timeslots to lower-numbered timeslots), data is transferred in the next frame.
AllConstantDelay	Data is delayed so that the destination timeslot is always in the next frame regardless of whether it is a forward connection.

This keyword is used for configurations that transfer non-voice data in multiple timeslots (for example, HDLC in TDM).

For more information, refer to **swiMakeConnection** and **swiMakeFramedConnection** in the *Switching Service Developer's Reference Manual*.

See also

SwitchConnections

TCPFiles[x]

Specifies a trunk control program for the current boards.

Syntax

TCPFiles[***x***] = ***filename***

x = the number of the TCP file.

Access

Read/Write

Type

String

Default

None.

Allowed values

A valid file name.

Example

```
TCPFiles[0] = lsp0.tcp
```

Details

Trunk control programs perform all signaling tasks necessary to interface with the telephony protocol used on the line or trunk. TCPs are loaded onto an NMS board during initialization. After a TCP is loaded, applications must start the protocol before they can use the TCP to perform call control on specific ports.

For more information about starting protocols on NMS boards, refer to the *ADI Service Developer's Reference Manual*. For more information about loading and running TCP files, refer to the *NMS CAS for Natural Call Control Developer's Manual* or to the *NMS ISDN for Natural Call Control Developer's Manual*.

Note: The TCPFiles[***x***] keyword is required for configurations that run CAS signaling protocols.

Version.Major

Specifies the major version number of the AG plug-in. The Version.Major number is incremented if a change is made to the plug-in.

Syntax

Version.Major = ***number***

Access

Read-only (AG plug-in level)

Type

Integer

Allowed values

Not applicable.

See also

Version.Minor

Version.Minor

Specifies the minor version number of the AG plug-in. The Version.Minor value is changed when a change is made to the AG plug-in.

Syntax

Version.Minor = ***number***

Access

Read-only (AG plug-in level)

Type

Integer

Allowed values

Not applicable.

See also

Version.Major

VoiceIdleCode

Sets the voice bit pattern transmitted by an idle DSP or to an unconnected line interface.

Syntax

VoiceIdleCode = ***voice_idlecode***

Access

Read/Write

Type

Integer

Default

If Xlaw = MU-LAW, default = 0x7f.

If Xlaw = A-LAW, default = 0xd5.

Allowed values

0x00 - 0xFF

Example

```
VoiceIdleCode = 0xd5
```

Details

In general, a DSP is considered to be idle when no application is using it.

On digital trunks, the idle code is determined by local regulations and should not be altered.

See also

SignalIdleCode

Xlaw

Defines the switch idle codes.

Syntax

Xlaw = ***compandmode***

Access

Read/Write

Type

String

Default

MU-LAW

Allowed values

A-LAW | MU-LAW

Example

```
XLaw = MU-LAW
```

See also

DSP.C5x[x].Files[y], SignalIdleCode, VoiceIdleCode

11 Hardware specifications

General hardware specifications

This topic describes:

- Mechanical specifications
- H.100 compliant interface
- Host interface
- Environment
- Power requirements

Mechanical specifications

The AG 2000 board has:

- 64K x 16 of SRAM
- An HMIC, which provides enhanced-compliant MVIP switching
- 2MB of DRAM
- 100 MIPS C549 parts
- NS486SXL-25

TDM bus	Features one complete H.100 bus interface with MVIP-95 enhanced-compliant switching
DSP processing power	Up to four Texas Instruments TMS320VC549GGU-100 DSPs at 100 MIPS each
Microprocessor	One 25 MHz 80486 compatible embedded processor
Board weight	Main board: .40 lb (.18 kg) Daughterboard: .05 lb (.02 kg)
Software	Natural Access

H.100 compliant interface

- Flexible connectivity between line interfaces, DSPs, and H.100 bus.
- Switchable access to any of 4096 H.100 timeslots.
- H.100 clock master or clock slave (software-selectable).
- Compatible with any H.100 or H-MVIP compliant telephony interface.
- H.100 bus termination capability (switch-enabled)

Host interface

Feature	Specification
Electrical	PCI bus designed to PCI local bus specification revision 2.1
Mechanical	Designed to the PCI local bus specification revision 2.2 for a long expansion card (physical dimensions 4.2 x 12.283 in)
Bus speed	33 MHz
Memory	32 K on-board interface memory

Environment

Feature	Description
Operating temperature	0 to 50 degrees C
Storage temperature	-20 to 70 degrees C
Humidity	5% to 80%, non-condensing

Power requirements

+12V = 40 mA

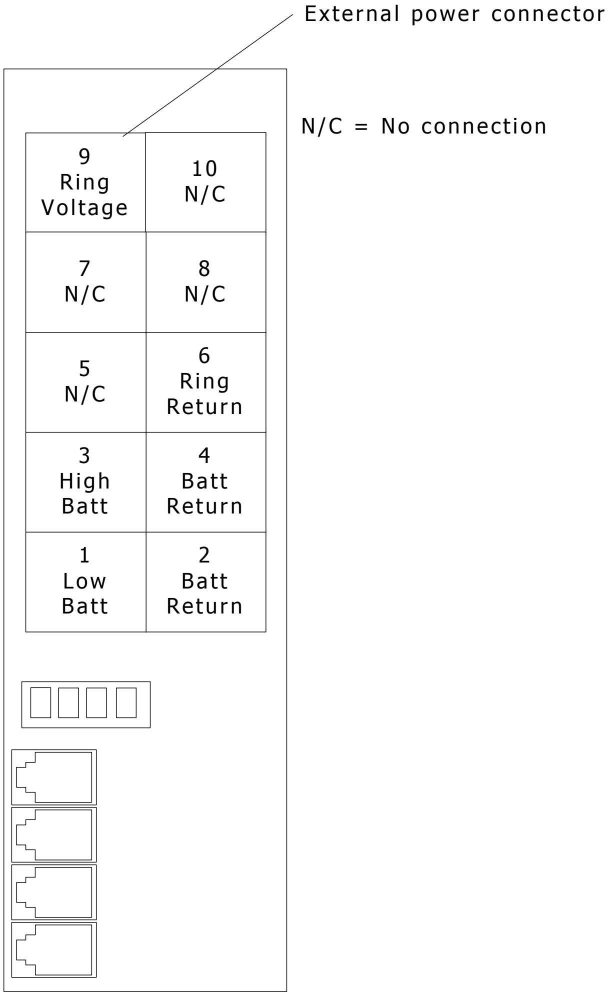
-12V = 40 mA

Power connectors

The AG 2000 board has an external and an internal power connector. Neither the external power connector or the internal power connector are used on the loop start variant of the AG 2000 board.

External power connector

As shown in the following illustration, the external power connector is located on the end bracket of the AG 2000 board. For more information about this external power connector, refer to *Connecting power supplies* on page 25.



Note: The mating power connector is Molex 43025-1000 or an equivalent.

The following table shows the voltage requirements of the different signaling modules:

AG 2000 board type	High battery	Low battery	Ring voltage
Loop start	NA	NA	NA
Subscriber loop	-48 VDC	-30 VDC	-48 VDC plus 86 VAC
DID	-48 VDC	None or -24 to -48 VDC	NA

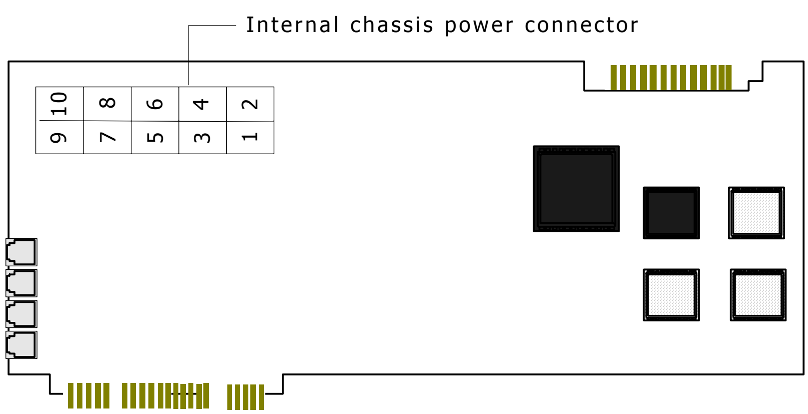
Note: If only one voltage (-24 or -48) is used with subscriber loop, connect it to the High Batt terminal.

The AG 2000 board is rated to operate within the limits presented in the following table. This information is useful if you are not using an NMS power supply.

Input	Minimum	Maximum	Unit
High Batt	-21	-52	VDC
Low Batt	-21	High Batt	VDC
Ring Voltage		175 (-48 VDC plus 90 V_{RMS} AC)	V peak (AC and DC)

Internal chassis power connector

The internal chassis power connector enables you to attach telephone battery and ringing supply voltages within the chassis. For more information about this internal power connector, refer to *Connecting power supplies* on page 25. The pin assignments are shown in the following illustration:



Signaling module electrical specifications

Common specifications (United States version)

The following specifications apply to Part Numbers 5399, 5593, 5551, and 5549 rev D.1 and higher:

Specification	Line interface type		
	Loop start	**Subscriber loop**	**DID**
Connectors	1 four-ganged, four-position modular connector (4 RJ-14x jacks).	1 four-ganged, four-position modular connector (4 RJ-14x jacks).	1 four-ganged, four-position modular connector (4 RJ-14x jacks).
Return loss (ref. 600 Ohms +2.2 uF standard)	20 dB min. (ERL)	20 dB min. (ERL)	20 dB min. (ERL)
Four to two wire gain Tolerance	+/- 1 dB	+/- 1 dB	+/- 1 dB
Four to two wire gain range	+6 to -6 dB	+6 to -6 dB	+6 to -6 dB
Two to four wire gain tolerance	+/- 1 dB	+/- 1 dB	+/- 1 dB
Two to four wire gain range	+6 to -6 dB	+6 to -6 dB	+6 to -6 dB
Frequency response 300 Hz - 3200 Hz. Reference to 1 kHz	+/- .8 dB	+/- 1 dB	+/- 1 dB
Trans-hybrid loss	17 dB min. @ 300 Hz-3.0 kHz into 600 Ohms + 2.2 uF	17 dB min. @ 300 Hz-2.5 kHz into 600 Ohms + 2.2 uF	17 dB min. @ 300 Hz-2.5 kHz into 600 Ohms + 2.2 uF
Signal overload level	+3 dBm at 0 dB gain	+3 dBm at 0 dB gain	+3 dBm at 0 dB gain
CMRR	> 80 dB	> 50 dB	> 50 dB
T-R input impedance (300 - 3200 Hz)	Voice band 600 Ohms +2.2 uF standard	600 Ohms +2.2 uF standard	600 Ohms +2.2 uF standard
Idle channel noise through connection	< 20 dB rnC	< 20 dB rnC	< 20 dB rnC
Crosstalk transmit to receive channels	< -70 dB @ 1 kHz	< -70 dB @ 1 kHz	< -70 dB @ 1 kHz
T-R isolation to SELV	>1500V_{RMS}	Not applicable.	Not applicable.
Off-hook detect	Guaranteed Detect: Current > 10 mA Guaranteed No Detect: Current < 3.3 mA	Guaranteed Detect: Current > 13 mA Guaranteed No Detect: Current < 7 mA	Guaranteed Detect: Current > 13 mA Guaranteed No Detect: Current < 7 mA
Operating loop current	18 mA to 70 mA	13 mA to 31 mA	13 mA to 31 mA

Specification	**Line interface type**		
	Loop start	**Subscriber loop**	**DID**
Loop current and polarity detect	Single bit indicates if the current is flowing from Tip to Ring or Ring to Tip.	Not applicable.	Not applicable.
Ring detection	Guaranteed Detect: 30 V_{RMS} 17 - 33 Hz (US version) Guaranteed No Detect: No detect <15 V_{RMS} (0 - 5 kHz)	Not applicable.	Not applicable.
Maximum cable distance:	Not applicable.		
At 48 V, 24 AWG		18,000 feet (5 km) (1800 Ohms)	18,000 feet (5 km) (1800 Ohms)
At 30 V, 24 AWG		2,000 feet (600 m) (600 Ohms)	Not applicable.
Maximum ringer equivalence load	Not applicable.	1.5	Not applicable.

European models change only where required to conform to regulation TBR21 (loop start only). For example, T-R input impedance is 270 Ohms in series with a parallel combination of 750 Ohms and 150 uF.

Special on-hook receive specifications for loop start

The loop start interface can be used in applications to record live telephone calls such as emergency calls or financial transactions. Special regulations require that parties be notified that they are being recorded. Check with authorities in the locality where the application is to be installed to determine what is permitted in that area.

The system cannot generate tones in this mode. The notification must be verbal.

DC tip to ring resistance	> 1 M Ohms
Audio tip to ring impedance	> 10 k Ohms
Typical receive audio loss @ 0 db line gain and 600 termination	11 dB

The impedance of the agent's telephone and length of loop cable will affect the audio loss.

QSLAC files and impedances

The QSLAC files that start with the characters *a2usa* provide an input impedance of 600 Ohms + 2.2 uF. However, a selection of files is provided (refer to *QSLAC files and trunk control programs* on page 36) to permit applications that do not use echo cancellation to reduce echo. The default file is sufficient for most applications.

Subscriber loop ringing power supply (32029)

Feature	Description
Input power	100 - 132/200 - 264 VAC 47 - 63 Hz automatic range selection
DC output	1. -24 VDC/-30 VDC 2. -48 VDC @ 1.2 A The combined total of 1 and 2 above is less than 1.2 A. The -24 output is switch selectable to -24 VDC or -30 VDC.
DC output regulation	Less than 1%
DC output ripple	Less than 1% peak to peak
Output isolation	-24 VDC/-30 VDC and -48 VDC isolated from chassis ground. AC output is referenced to -48 VDC output.
AC output	86 VAC @ 0.13 A for 17, 20, and 50 Hz 72 VAC @ 0.13 A for 25 Hz
AC output frequency	17, 20, 25, and 50 Hz +/- 10%. Switch selectable.
AC output regulation	Less than 10% for the full input voltage range and no load to full load.
AC output wave form	Simulated sine wave with less than 20% distortion.
Current limiting	All outputs have current limiting with full protection and auto recovery.
Output indicator	Green LED indicates that all outputs are operating.
Temperature range	Ambient temperature range is 0 to 50 degrees C for full load operation.
Construction	Fully enclosed aluminum chassis.

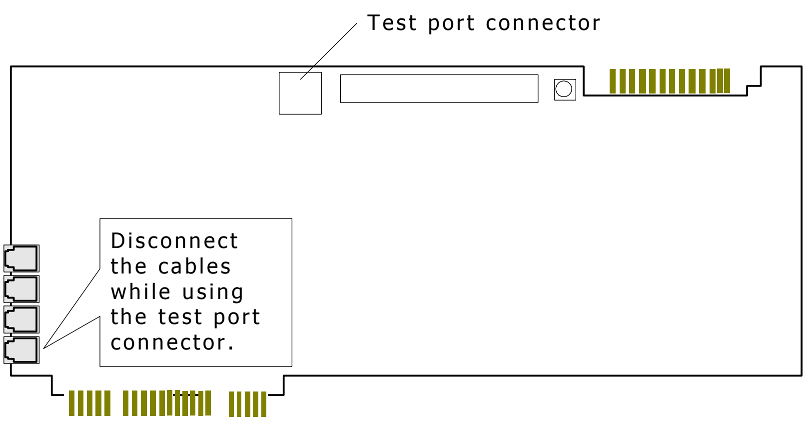
Development test port connector

The development test port connector on the AG 2000 board (shown in the following illustration) gives developers easy access to the transmit for ports 7 and 8 and the receive for port 8 for fast debugging of applications.

Warning:	This connector is not intended or certified for use at end-user sites.

The connector is a hardware interface composed of a 4-pin connector and amplifier circuitry provided on the AG 2000 board that allows audio ports from port 7 and port 8 to be summed together and played out. Audio can be recorded into port 8.

Warning:	Disconnect the cable from the port 7 and port 8 trunk interfaces while using the test port connector to avoid causing unwanted distortion, noise, and attenuation.



Connect the Line out to an amplified speaker and listen to audio. Connect a device, such as a tape player, to TST_IN to record messages or prompts on the system.

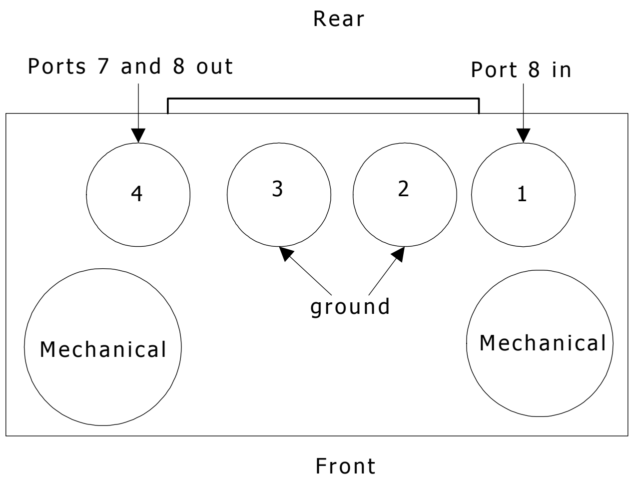
The following signals are available on the connector: summation of Trunk 7 and Trunk 8 out, Trunk 8 in, and Gnd.

The output audio amplifier has a 100 Ohm output impedance. It is designed to interface to an amplified speaker. If it is connected to an un-amplified speaker, the audio has a very low output level.

You can listen to two different digital audio streams simultaneously. The development test port connector has an on-board hardware summing amplifier. If you play audio from one stream to port 8 (stream 1:7) and the audio from another stream to port 7 (stream 1:6), the resulting audio is summed by the hardware. While this is occurring, audio cannot be recorded in. Therefore, simultaneous play and record is not possible.

A 0.774 V_{RMS} signal coming in on TST_IN records at a 0 dBm signal into the CODEC. Speech levels should not have peaks exceeding this level. The average speech level should be approximately 0.1 V_{RMS} at TST_IN. The input impedance is 20K Ohms.

The following illustration shows the pinout and mating connector for the test port connector:



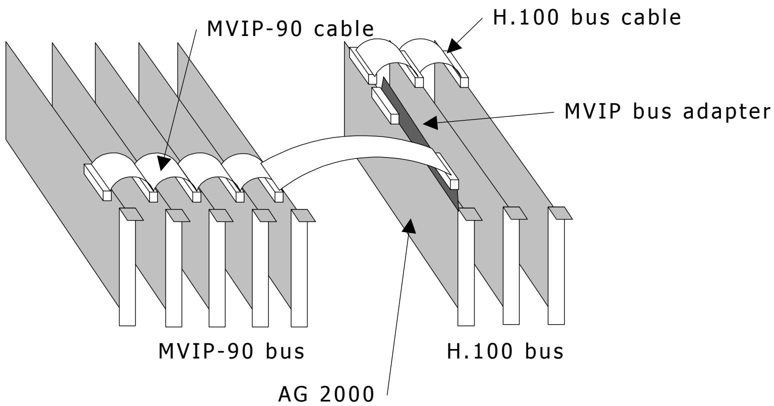
The mating connector is a Molex 50-57-9404. The pin that must also be inserted into the connector is the female pin (Molex 70058).

Pin	Description
1	Audio to the Codec Port 8
2	Ground
3	Ground
4	Audio from the Codec Port 7 and 8

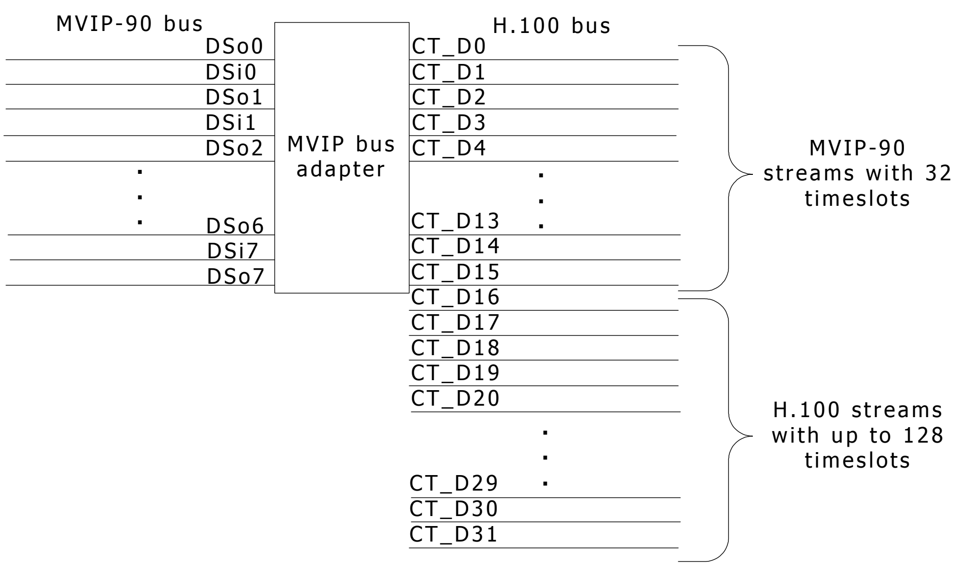
Interoperability with MVIP-90

The AG 2000 board is located in a PCI bus slot and connects to the H.100 telephony bus. MVIP-90 and H-MVIP boards connect to the MVIP-90 bus and are typically located in ISA bus slots.

The MVIP bus adapter connects the H.100 bus to the MVIP-90 bus located in the same computer chassis, as shown in the following illustration:



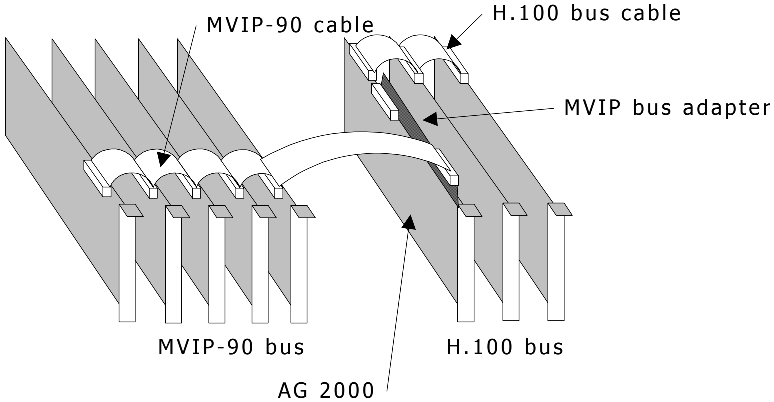
The MVIP bus adapter enables boards connected to the H.100 bus to access the MVIP-90 bus, and enables MVIP-90 boards to access the first 16 streams of the H.100 bus. When connecting H.100 boards to the adapter, the first 16 H.100 streams must be clocked at 2 MHz, where each stream has 32 timeslots. By default, the AG 2000 board is configured for MVIP-90 compatibility mode with the first 16 streams configured for 2 MHz.



Connecting to the MVIP-90 bus

The MVIP bus adapter connects the H.100 bus to the MVIP-90 bus. This connection enables boards connected to the H.100 bus to access the MVIP-90 bus, and enables MVIP-90 boards to access the first 16 streams of the H.100 bus. When connecting to the MVIP bus adapter, the first 16 streams of the H.100 bus must be configured to run in MVIP-90 mode (clocked at 2 MHz).

If your system contains an AG 2000 and MVIP-90 boards, you must use the MVIP bus adapter. The MVIP bus adapter connects the MVIP-90 bus to the H.100 bus as shown in the following illustration. Only one MVIP bus adapter is required in a system.

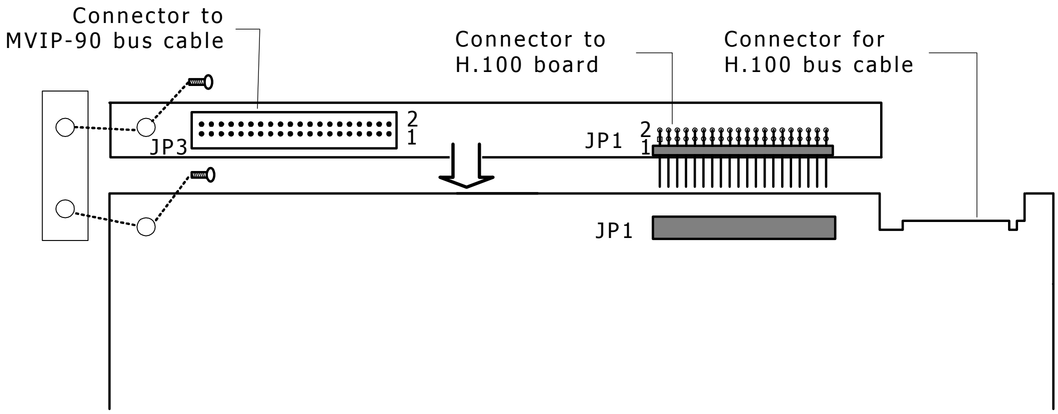


Warning:	The MVIP bus adapter is incompatible with the DID internal power cable or the subscriber loop internal power cable.

Complete the following steps to connect the MVIP bus adapter to an AG 2000 board:

Step	Action
1	Connect the right angle connector (JP1) on the MVIP bus adapter to the connector (JP1) on the AG 2000 board.
2	Support the MVIP bus adapter by connecting the threaded mounting piece to the MVIP bus adapter and the AG 2000 board using two #4 screws.
3	If you have multiple H.100 boards, connect the H.100 bus cable to the AG 2000 board and to each of the other H.100 boards.
4	Connect the MVIP-90 bus cable to the connector on the MVIP bus adapter.

The MVIP bus adapter extends the length of the bus and can reduce the total number of boards supported on the MVIP-90/H.100 bus. The following illustration shows the MVIP bus adapter assembly:



Compliance and regulatory certification

In addition to the approval obtained by NMS for the board and its associated software, some countries require a system level approval before connecting the system to the public network. To learn what approvals you require, contact the appropriate regulatory authority in the target country.

This topic describes the following compliance and regulatory information:

- EMC
- Safety
- Telecom
- Board type
- EU R&TTE statement
- Country-specific parameters
- Automatically repeated call attempts

EMC

US	FCC Part 15, Subpart J • AG2000-LS: Class B (with unshielded cable and a ferrite block). • All other AG 2000 boards: Class A (with unshielded cable).
Canada	IECS- 003 • AG2000-LS: Class B (with unshielded cable and a ferrite block). • All other AG 2000 boards: Class A (with unshielded cable).
EU countries	EN55022 1994 + Amendment 1 • AG 2000- 8LSE and 4LSE: Class B (with unshielded cable and ferrite block). • All other AG 2000 boards: Class A (with unshielded cable).
Australia	AS/NZS 3548
Other countries	Refer to www.dialogic.com

Safety

US	NRTL recognized to UL 1950, 3rd edition
Canada	NRTL recognized to CSA C22. 2 No. 950
EU countries	EN60950 (1992) + Amendments 1 to 4
Australia	ACA TS001 (1997)
Other countries	Refer to www.dialogic.com

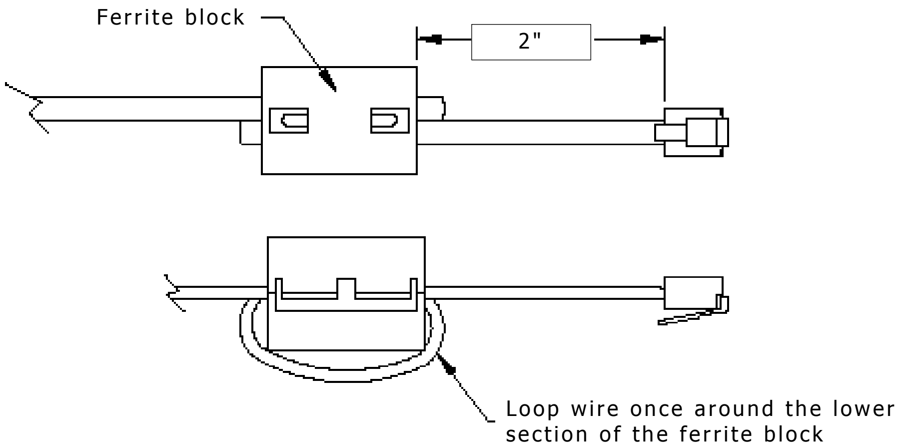
Telecom

US	FCC Part 68	
Canada	ISC CS-03	
EU countries	4 and 8 loop start interfaces	Approved under R&TTE.
	4 loop start interfaces/4 NMS Fusion ports	Approved under R&TTE.
	4 loop start/4 subscriber loop interfaces	TBR 21 approved.
Australia	TS002 (1997), TS004 (1997)	
Japan	JATE blue book	
Other countries	Refer to www.dialogic.com	

Board type

For more detail about the information contained in the previous table, refer to the following board-specific information:

Board type	Description
Loop start	To satisfy the R&TTE regulatory requirements, you must ship, with each of your products, section 2 of the *AG 2000 Loop Start and QX 2000 Loop Start Board Compliance Statements* sheet that was delivered with your AG 2000 board. In Germany, Greece, and Portugal, your application must be designed so that the AG 2000 board seizes the phone line only with the intention to make a call. Except for EU countries where a line splitter cable is used, the loop start interface can be upgraded from Class A to Class B by installing the loop start class B upgrade (shown in the following illustration) on a standard telephone cable.
Subscriber loop	This is a Class A product. In a domestic environment, this product may cause radio interference. You may be required to take adequate measures. This board type is not intended to be connected to networks within the European Union.
DID	DID is not compatible with EU service. This board type is not intended to be connected to the public telecommunication networks within the European Union.
Loop start and subscriber loop	This is a Class A product. In a domestic environment, this product may cause radio interference. You may be required to take adequate measures. Each of the 4 loop start interfaces comply with TBR-21. Check with your regulatory approval authorities for obtaining approval requirements and Type approval of the system that you are building around this NMS board. This board type is not intended to be connected to public telecommunication networks within the European Union.



EU R&TTE statement

This equipment has been approved in accordance with Council Decision 1999/ 5/ EC (R&TTE) for pan- European single terminal connection to the public switched telephone network (PSTN). However, due to differences between the individual PSTNs provided in different countries, the approval does not, of itself, give an unconditional assurance of successful operation on every PSTN network termination point. In the event of problems, contact your equipment supplier in the first instance.

Connect the AG 2000 board to the following public telecommunication networks:

d *- Austria*	***p*** *- Germany*	***d*** *- Netherlands*	***d*** *- Switzerland*
d *- Belgium*	***d*** *- Greece*	***d*** *- Norway*	***d*** *- Rep of Ireland*
p *- Denmark*	***p*** *- Iceland*	***d*** *- Portugal*	***p*** *- UK*
p *- France*	***p*** *- Italy*	***p*** *- Spain*	
p *- Finland*	***d*** *- Luxemburg*	***p*** *- Sweden*	

d - Networks which are supported by DTMF signaling only for direct attachment.

p - Networks which are supported by DTMF signaling and pulse dialing for direct attachment.

To comply with the above networks, a software setting is necessary. Load the associated software and follow the instructions for your country.

Before connecting this board to a telecommunication loop start network, refer to the *AG 2000 Loop Start Board Compliance Statements* document for information on the current approvals obtained.

Country-specific parameters

For certain countries, your application must include the control of the calls internally generated by the equipment. Failure to implement this regulatory requirement will void the regulatory approval granted to NMS for this NMS equipment.

Automatically repeated call attempts

Country	Notes	Maximum number of call attempts	Minimum interval (seconds) between numbers	Minimum interval (mn) to wait for a new series
European countries		15	5	-
Australia	For equipment with a service tone detector, a maximum number of 10 is allowed	3	-	30
Bulgaria		12	2	60
Czech Republic		12	5, then 60	-
Israel		15	30	-
Japan	There is a choice between the two requirements.	3 in 3 mn 15	- 5	3 -
Korea		3	30	-
Malaysia		2	120	-
New Zealand	Not more than five call attempts to the same number within a 60 mn period with a minimum of 60 seconds between attempts, and a total of 10 call attempts to the same number.	5	60	-
Singapore		10	60	-
Slovakia		12	60	-
South Africa		0	60	-
Taiwan		2	60	-

Note: The call attempt series parameters apply to the equipment without distinction between a wrong number and an ineffective call. Maximum intervals between numbers is 12 mn.

12 Managing resources

Functions for managing resources

Most Natural Access functions implicitly use processes that run on the DSP resources. For example, **adiStartToneDetector** starts the tone detector function running on a DSP. **adiStartRecording** starts one of many voice compression functions running on a DSP. AG boards are shipped with default configurations that make the most commonly used functions available.

Note: It is not feasible or practical to make every possible function simultaneously available to an application.

This topic lists default functions and custom functions available for AG 2000 boards.

Default functions

The following functions are available in the default configuration files shipped with AG 2000 boards:

- DTMF detection
- MF tone detection
- Tone detection
- Cleardown detection
- Signal detection
- NMS speech
- Call progress detection
- Tone generation

Custom functions

The following functions can be loaded on AG 2000 boards with NMS OAM:

- Caller ID
- ADSI
- NMS speech normal
- OKI speech normal
- IMA/DVI speech
- WAVE speech

The following functions can reduce the board's standard port count of 8:

- Echo cancellation
- NMS speech 1.5X
- NMS speech 2.0X
- OKI speech 1.5X
- OKI speech 2.0X
- G.726 speech
- MS-GSM speech

DSP/task processor files and processing power

The binary code for running functions is contained in DSP files. One or more functions are contained in each file. NMS boards differ in the total number of DSPs they contain and the speed of the DSPs on the board.

DSP speed is measured in millions of instructions per second (MIPS). Each function that runs on a DSP consumes MIPS. If the total MIPS consumption for all the requested functions on all the ports of a given board exceeds the total MIPS available for that board, an error event occurs. If MIPS-intensive functions are required, you can reduce the total number of ports on a board, which makes more MIPS per port available.

The following table shows the MIPS usage for all the available functions shipped with Natural Access:

DSP file	Function	MIPS	Related API function	Related arguments
adsir.m54	ADSI receiver	3.13	**adiStartReceivingFSK**	
adsix.m54	ADSI transmitter	1.13	**adiStartSendingFSK**	
callp.m54	Call progress	1.09	**adiStartCallProgress**	
dtmf.m54	DTMF only	1.94	**adiStartDTMFDetector**	
dtmf.m54	Post- and pre-tone silence	0.69	**adiStartEnergyDetector**	
dtmf.m54	DTMF, post- and pre-tone silence	1.94	**adiStartProtocol**	
g726.m54	G.726 Play	7.44	**adiStartPlaying**	***encoding*** = ADI_ENCODE_G726
g726.m54	G.726 Record	7.00	**adiStartRecording**	***encoding*** = ADI_ENCODE_G726
gsm_ms.m54	MS-GSM Play 8 kHz	2.13	**adiStartPlaying**	***encoding*** = ADI_ENCODE_GSM
gsm_ms.m54	MS-GSM Record 8 kHz	4.44	**adiStartRecording**	***encoding*** = ADI_ENCODE_GSM
gsm_mspl.m54	MS-GSM Play limit 8 kHz	2.82	**adiStartPlaying**	***encoding*** = ADI_ENCODE_GSM
gsm_mspl.m54	MS-GSM Record 8 kHz	4.44	**adiStartRecording**	***encoding*** = ADI_ENCODE_GSM

DSP file	Function	MIPS	Related API function	Related arguments
ima.m54	IMA/DVI ADPCM Play 6 kHz	2.06	**adiStartPlaying**	***encoding*** = ADI_ENCODE_IMA_24
ima.m54	IMA/DVI ADPCM Play 8 kHz	1.81	**adiStartPlaying**	***encoding*** = ADI_ENCODE_IMA_32
ima.m54	IMA/DVI ADPCM Record 6 kHz	2.19	**adiStartRecording**	***encoding*** = ADI_ENCODE_IMA_24
ima.m54	IMA/DVI ADPCM Record 8 kHz	2.00	**adiStartRecording**	***encoding*** = ADI_ENCODE_IMA_32
mf.m54	Forward detect, backward compelling	2.56	**adiStartMFDetector**	
mf.m54	Backward detect, forward compelling	2.56	**adiStartMFDetector**	
mf.m54	MF detection	1.81	**adiStartMFDetector**	
mf.m54	MF forward detection	1.81	**adiStartMFDetector**	
mf.m54	MF backward detection	1.81	**adiStartMFDetector**	
oki.m54	OKI Play 6 kHz	2.19	**adiStartPlaying**	***encoding*** = ADI_ENCODE_OKI_24, ***maxspeed*** = 100
oki.m54	OKI Play 8 kHz	2.13	**adiStartPlaying**	***encoding*** = ADI_ENCODE_OKI_32, ***maxspeed*** = 100
oki.m54	OKI Play 6 kHz 1.5X	4.19	**adiStartPlaying**	***encoding*** = ADI_ENCODE_OKI_24, ***maxspeed*** = 150
oki.m54	OKI Play 8 kHz 1.5X	3.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_OKI_32, ***maxspeed*** = 150
oki.m54	OKI Play 6 kHz 2.0X	5.50	**adiStartPlaying**	***encoding*** = ADI_ENCODE_OKI_24, ***maxspeed*** = 200
oki.m54	OKI Play 8 kHz 2.0X	4.81	**adiStartPlaying**	***encoding*** = ADI_ENCODE_OKI_32, ***maxspeed*** = 200
oki.m54	OKI Record 6 kHz	2.25	**adiStartRecording**	***encoding*** = ADI_ENCODE_OKI_24
oki.m54	OKI Record 8 kHz	2.00	**adiStartRecording**	***encoding*** = ADI_ENCODE_OKI_32
ptf.m54	2 single freq or 1 tone pair	1.25	**adiStartToneDetector**	

DSP file	Function	MIPS	Related API function	Related arguments
ptf.m54	4 single freq or 2 tone pair	1.81	**adiStartCallProgress**	***precmask***!=0
rvoice.m54	mu-law Play	0.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_MULAW
rvoice.m54	A-law Play	0.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_ALAW
rvoice.m54	WAVE Play, 8 kHz, 16-bit	0.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_PCM8M16
rvoice.m54	mu-law Record	0.63	**adiStartRecording**	***encoding*** = ADI_ENCODE_MULAW
rvoice.m54	A-law Record	0.63	**adiStartRecording**	***encoding*** = ADI_ENCODE_ALAW
rvoice.m54	WAVE Record, 8 kHz, 16-bit	0.63	**adiStartRecording**	***encoding*** = ADI_ENCODE_PCM8M16
rvoice_vad.m54	mu-law Play	0.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_MULAW
rvoice_vad.m54	A-law Play	0.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_ALAW
rvoice_vad.m54	WAVE Play, 8 kHz, 16-bit	0.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_PCM8M16
rvoice_vad.m54	mu-law Record	0.88	**adiCommandRecord** **adiStartRecording**	***encoding*** = ADI_ENCODE_MULAW
rvoice_vad.m54	A-law Record	0.88	**adiCommandRecord** **adiStartRecording**	***encoding*** = ADI_ENCODE_ALAW
rvoice_vad.m54	WAVE Record, 8 kHz, 16-bit	0.88	**adiCommandRecord** **adiStartRecording**	***encoding*** = ADI_ENCODE_PCM8M16
signal.m54	Pulse	0.38	**adiStartDial** **adiStartSignalDetector** **nccPlaceCall**	
signal.m54	Bit detector	0.44	**adiStartProtocol** **adiStartSignalDetector**	
tone.m54	Tone generator	0.75	**adiStartDial** **adiStartDTMF** **adiStartTones**	
voice.m54	NMS Play 16 Kbit/s	3.13	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_16, ***maxspeed*** = 100
voice.m54	NMS Play 24 Kbit/s	3.13	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_24, ***maxspeed*** = 100
voice.m54	NMS Play 32 Kbit/s	3.13	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_32, ***maxspeed*** = 100

DSP file	Function	MIPS	Related API function	Related arguments
voice.m54	NMS Play 64 Kbit/s	0.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_64, ***maxspeed*** = 100
voice.m54	NMS Play 16 6 kHz 1.5X	5.63	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_16, ***maxspeed*** = 150
voice.m54	NMS Play 24 6 kHz 1.5X	5.81	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_24, ***maxspeed*** = 150
voice.m54	NMS Play 32 6 kHz 1.5X	5.81	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_32, ***maxspeed*** = 150
voice.m54	NMS Play 64 6 kHz 1.5X	2.31	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_64, ***maxspeed*** = 150
voice.m54	NMS Play 16 6 kHz 2.0X	7.19	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_16, ***maxspeed*** = 200
voice.m54	NMS Play 24 6 kHz 2.0X	7.50	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_24, ***maxspeed*** = 200
voice.m54	NMS Play 32 6 kHz 2.0X	7.44	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_32, ***maxspeed*** = 200
voice.m54	NMS Play 64 6 kHz 2.0X	2.81	**adiStartPlaying**	***encoding*** = ADI_ENCODE_NMS_64, ***maxspeed*** = 200
voice.m54	NMS Record 16 Kbit/s	3.38	**adiStartRecording**	***encoding*** = ADI_ENCODE_NMS_16
voice.m54	NMS Record 24 Kbit/s	3.38	**adiStartRecording**	***encoding*** = ADI_ENCODE_NMS_24
voice.m54	NMS Record 32 Kbit/s	3.38	**adiStartRecording**	***encoding*** = ADI_ENCODE_NMS_32
voice.m54	NMS Record 64 Kbit/s	0.63	**adiStartRecording**	***encoding*** = ADI_ENCODE_NMS_64
wave.m54	WAVE Play 11 kHz 8-bit	1.56	**adiStartPlaying**	***encoding*** = ADI_ENCODE_PCM11M8
wave.m54	WAVE Play 11 kHz 16-bit	1.44	**adiStartPlaying**	***encoding*** = ADI_ENCODE_PCM11M16
wave.m54	WAVE Record 11 kHz 8-bit	1.5	**adiStartRecording**	***encoding*** = ADI_ENCODE_PCM11M8
wave.m54	WAVE Record 11 kHz 16-bit	1.13	**adiStartRecording**	***encoding*** = ADI_ENCODE_PCM11M16

The following table shows the correspondence between the filter and adapt values used for the echo canceller and MIPS consumption:

DSP file	Filter length (ms)	Adapt time (ms)	MIPS
echo.m54	2	100	2.75
echo.m54	2	200	2.38
echo.m54	2	400	2.25
echo.m54	2	800	2.13
echo.m54	4	100	3.13
echo.m54	4	200	2.63
echo.m54	4	400	2.38
echo.m54	4	800	2.25
echo.m54	6	100	3.50
echo.m54	6	200	2.88
echo.m54	6	400	2.63
echo.m54	6	800	2.50
echo.m54	8	100	3.88
echo.m54	8	200	3.13
echo.m54	8	400	2.88
echo.m54	8	800	2.75
echo.m54	10	100	4.25
echo.m54	10	200	3.50
echo.m54	10	400	3.00
echo.m54	10	800	2.88
echo.m54	16	100	5.25
echo.m54	16	200	4.25
echo.m54	16	400	3.63
echo.m54	16	800	3.38
echo.m54	20	100	5.63
echo.m54	20	200	4.50
echo.m54	20	400	3.88
echo.m54	20	800	3.38
echo_v3.m54	24	100	8.56
echo_v3.m54	24	200	6.13
echo_v3.m54	24	400	4.88

DSP file	**Filter length (ms)**	**Adapt time (ms)**	**MIPS**
echo_v3.m54	24	800	4.25
echo_v3.m54	32	100	10.75
echo_v3.m54	32	200	7.56
echo_v3.m54	32	400	5.94
echo_v3.m54	32	800	5.13
echo_v3.m54	40	100	13.00
echo_v3.m54	40	200	9.00
echo_v3.m54	40	400	7.00
echo_v3.m54	40	800	6.00
echo_v3.m54	48	100	15.25
echo_v3.m54	48	200	10.44
echo_v3.m54	48	400	8.06
echo_v3.m54	48	800	6.88
echo_v3.m54	64	100	19.69
echo_v3.m54	64	200	13.31
echo_v3.m54	64	400	10.19
echo_v3.m54	64	800	8.56
echo_v4.m54	2	100	4.125
echo_v4.m54	2	200	3.938
echo_v4.m54	2	400	3.875
echo_v4.m54	2	800	3.813
echo_v4.m54	4	100	4.438
echo_v4.m54	4	200	4.188
echo_v4.m54	4	400	4.063
echo_v4.m54	4	800	4.000
echo_v4.m54	6	100	4.750
echo_v4.m54	6	200	4.438
echo_v4.m54	6	400	4.313
echo_v4.m54	6	800	4.188
echo_v4.m54	8	100	5.063
echo_v4.m54	8	200	4.688
echo_v4.m54	8	400	4.500
echo_v4.m54	8	800	4.438

DSP file	**Filter length (ms)**	**Adapt time (ms)**	**MIPS**
echo_v4.m54	10	100	5.375
echo_v4.m54	10	200	4.938
echo_v4.m54	10	400	4.750
echo_v4.m54	10	800	4.625
echo_v4.m54	16	100	6.313
echo_v4.m54	16	200	5.688
echo_v4.m54	16	400	5.375
echo_v4.m54	16	800	5.188
echo_v4.m54	20	100	6.938
echo_v4.m54	20	200	6.188
echo_v4.m54	20	400	5.813
echo_v4.m54	20	800	5.625
echo_v4.m54	24	100	10.375
echo_v4.m54	24	200	7.938
echo_v4.m54	24	400	6.750
echo_v4.m54	24	800	6.125
echo_v4.m54	32	100	12.625
echo_v4.m54	32	200	9.375
echo_v4.m54	32	400	7.813
echo_v4.m54	32	800	7.000
echo_v4.m54	40	100	14.813
echo_v4.m54	40	200	10.875
echo_v4.m54	40	400	8.875
echo_v4.m54	40	800	7.875
echo_v4.m54	48	100	17.063
echo_v4.m54	48	200	12.313
echo_v4.m54	48	400	9.938
echo_v4.m54	48	800	8.750
echo_v4.m54	64	100	21.500
echo_v4.m54	64	200	15.188
echo_v4.m54	64	400	12.000
echo_v4.m54	64	800	10.438

AG 2000 board processing

In most applications, all DSP functions can run on all DSPs on the board. Complex functions such as WAVE speech, echo cancellation, and variable speech rates can result in reduced number of ports.

Use the following table as a guideline for determining board functionality. There are additional constraints such as memory and queue sizes in determining required MIPS:

AG board	Total DSPs	MIPS per DSP	Operating system overhead per DSP (MIPS)	Available MIPS
AG 2000/100	1	100	10	90
AG 2000/200	2	100	10	180
AG 2000/400	4	100	10	360

AG 2000 boards can run six ports of 16-bit, 11 kHz PCM (ADI_ENCODE_PCM11M16) per available DSP.

Customizing AG 2000 board functions

Complete the following steps to configure the AG 2000 boards in a system to use functions that are not in the default configuration:

Step	Action
1	List all of the functions that you want to make available to your application in the connected call state for the ports on a given AG board.
2	Determine which DSP files are required for the functions specified.

3	Add an entry to the DSP.C5x[x].Files[y] keyword for each new DSP file that is required. The syntax for the statement is:
	`DSP.C5x[x].Files = filename.m54`
	For example, to configure echo cancellation, specify the following DSP file:
	`DSP.C5x[x].Files = echo.m54`
	where ***x*** = DSP file number.

4	Check MIPS usage. Take the worst-case MIPS usage for each port on a board. Add up the total MIPS usage for all ports. This value must not exceed the available MIPS for any board in the system. If it does, reduce the number of ports used on that board by the application accordingly.
5	Check the list of configuration restrictions.
6	Initialize the boards by running *oamsys*.

This topic also includes:

- An example of configuring an AG 2000 board
- Data input and output queue constraints

Example of configuring an AG 2000 board

This example describes how to configure a standard AG 2000 board to play and record OKI 6 kHz speech instead of NMS speech without using echo cancellation:

Step	Action
1	List all functions used in the connected state: • DTMF detector • Cleardown detector • Tone generator (for playing beeps) • OKI play 6 kHz • OKI record 6 kHz
2	The required DSP files are: • *tone.m54* • *dtmf.m54* • *ptf.m54* • *oki.m54* • *signal.m54*
3	Calculate maximum MIPS usage per port and for the board. The MIPS requirements for the selected functions are: • Bit detector = 0.44 MIPS • DTMF detector = 1.94 MIPS • Tone detector = 1.25 MIPS • Tone generator = 0.75 MIPS • OKI play 6kHz = 2.19 MIPS • OKI record 6kHz = 2.25 MIPS Assume that the last three functions are mutually exclusive on each port. Only one of the three are active at any given time on a given port. Consequently, the per-port maximum MIPS usage is: 0.44 + 1.94 + 1.25 + 2.25 MIPS per port = 5.88 MIPS. The maximum board MIPS usage is: 8 ports * 5.88 MIPS per port = 47.04 MIPS. Since 90 MIPS are available, no restrictions apply.
4	Edit the board keyword file to contain the following: `DSP.C5x[x].Files = tone dtmf ptf oki signal` This loads the files on all DSPs.
5	Run *oamsys* with the edited board keyword file to load the DSP files.

Data input and output queue constraints

Aside from MIPS requirements, the amount of DSP memory available per data input queue (DIQ) and data output queue (DOQ) per DSP can impose additional constraints on AG board resources. For example, each WAVE 11k 16-bit DPF (*wave.m54*) requires 112 words of input queue memory and 4 words of output queue memory to perform play functions. Since AG board DSPs provide a total of 703 words of data output queue memory per DSP, the boards can run a maximum of six instances (703/112) of the WAVE 11k 16-bit play function per DSP.

The following table shows DIQ and DOQ memory requirements for DSP functions to which data input and output queue constraints apply:

DSP program	Function	DIQ words	DOQ words	Functions allowed per DSP
Total Available		703	703	63
WAVE 11k 16-bit	Play	112	4	6
	Record	0	112	6
WAVE 11k 8-bit	Play	57	4	12
	Record	0	57	12
WAVE 8k 16-bit	Play	82	4	8
	Record	0	82	8
A-law/mu-law	Play	42	4	16
	Record	0	42	16
OKI 6 KHz	Play	17	4	41
	Record	0	17	41
OKI 8 KHz	Play	22	4	31
	Record	0	22	31
IMA 6 KHz	Play	20	4	35
	Record	0	20	35
IMA 8 KHz	Play	25	4	28
	Record	0	25	28
GSM_ms	Play	67	4	10
	Record	0	67	10
NMS 24 kbit/s	Play	33	4	21
	Record	0	33	21
NMS 32 kbit/s	Play	43	4	16
	Record	0	43	16
NMS 64 kbit/s	Play	83	4	8
	Record	0	83	8

13 Line interface signaling

Interpreting line interface signaling

This section describes how to interpret signaling to and from the following AG 2000 line interfaces:

- Loop start
- Subscriber loop
- DID

The telephony protocol, embodied by a TCP running on the AG 2000 board, automatically controls and monitors the line signaling bits. This information is provided for reference only. Controlling the signaling bits manually may violate local telecommunications regulations.

The following table describes the two signaling directions:

Signaling type	Description
Transmit	The signaling that the board sends out onto the phone line through the line interface. The transmit signal is used to control the line or phone.
Receive	This signaling comes from the phone line through the line interface to the board. An application can monitor this signal to detect loop current or ringing.

The line interfaces on the board convert the signaling into the line condition appropriate for the line type (for example, loop start). They also convert incoming information into digital signals recognizable by AG 2000-based applications.

Loop start line interfaces

This topic describes signaling under loop start interfaces.

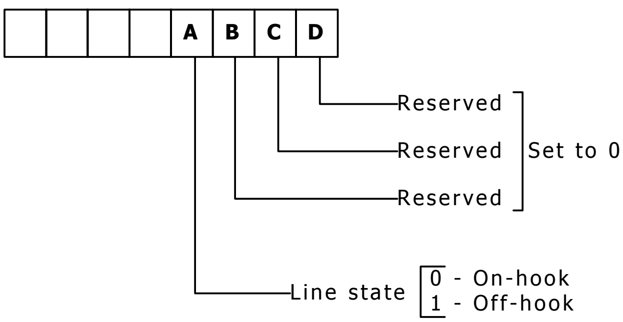
Loop start transmit signaling

With loop start interfaces, the transmitted signaling A bit in the signaling timeslot causes the interface to seize the line (go off-hook) or release the line (go on-hook).

If the A bit is set to 1, the line goes off-hook. If the A bit is set to 0, the line goes on-hook.

Bits B, C, and D are reserved, and should be set to 0.

The following illustration shows transmit signaling for loop start line interfaces:



This table summarizes the transmit signaling for loop start line interfaces:

Bit	Hex bitmask	To take line off-hook	To put line on-hook
A bit	0x08	0x08	0

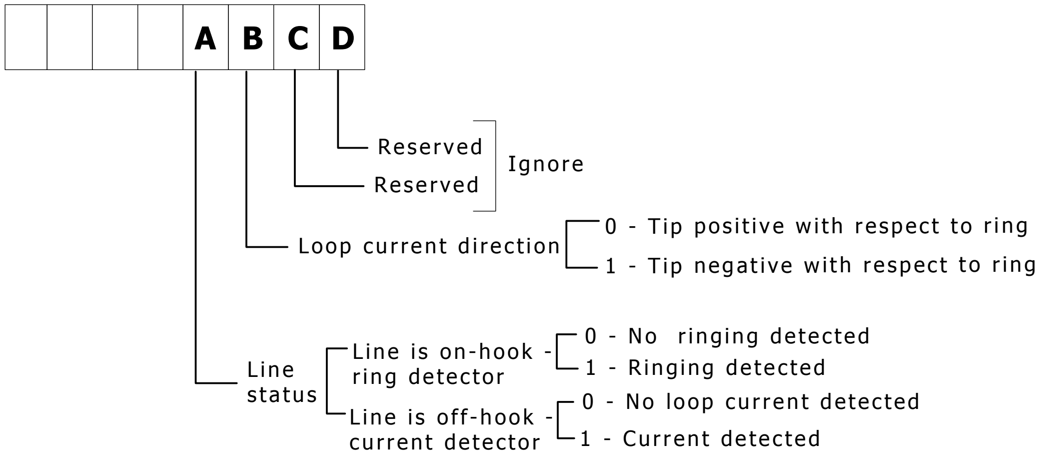
If you reset the switch, all bits are set to 0.

Loop start receive signaling

Depending on how the transmitted signaling A bit is set, the line has been placed on-hook or off-hook. Depending on the hook state, the received signaling A bit acts either as a ring signal detector or a loop current indicator. When the line is on-hook, monitoring the A bit tells you if the line is ringing. When the line is off-hook, monitoring the A bit indicates whether there is loop current flowing. The B bit indicates the polarity of tip and ring. If the B bit is set to 1, the loop current direction is reverse. Bits C and D are reserved, and should be ignored.

Regulations require that loop start equipment must function regardless of idle state polarity. The B bit normal state is undefined. The information in the B bit is in the change of state.

The following illustration shows receive signaling for loop start line interfaces:



The following table summarizes the receive signaling for loop start line interfaces:

Bit	Hex bitmask	If line is off-hook	If line is on-hook
A bit	0x08	Detects loop current: 0 = No loop current. 0x08 = Current is flowing.	A bit toggles with ring frequency. Idle state = 0.
B bit	0x04	Loop current direction: 0 = Tip positive with respect to ring. 0x04 = Tip negative with respect to ring.	0
C bit	N/A	Reserved (should be ignored).	Reserved (should be ignored).
D bit	N/A	Reserved (should be ignored).	Reserved (should be ignored).

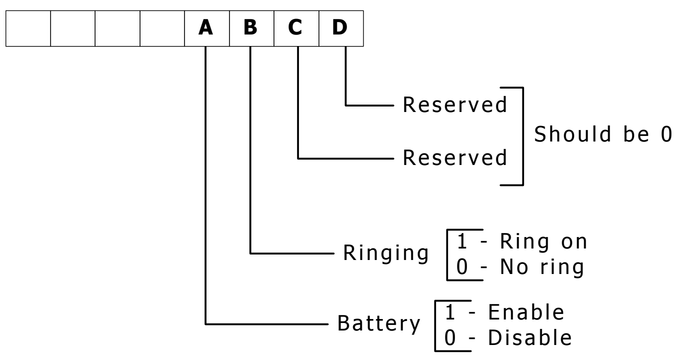
Subscriber loop line interfaces

There are three states to which the subscriber loop module may be set:

State	Description
Off	The A and B bits of the transmitted stream are set to 0 (off). No battery is applied to the line and no ringing is applied. Audio can not be passed through the system.
Idle or Active	The A bit is set to 1. This is required for the audio path to function. The B bit is set to 0. The board is active and applying battery to the line. The loop current detector is active and audio passes through the system. This is the normal operation state for the subscriber loop module.
Ringing	The A bit and the B bit are set to 1. This state is used to close the ringing relay when it is desired to ring the attached line/phone. The B bit must set the ring signal cadence. Ring-trip is done automatically by the hardware.

Subscriber loop transmit signaling

The following illustration shows transmit signaling for subscriber loop line interfaces:



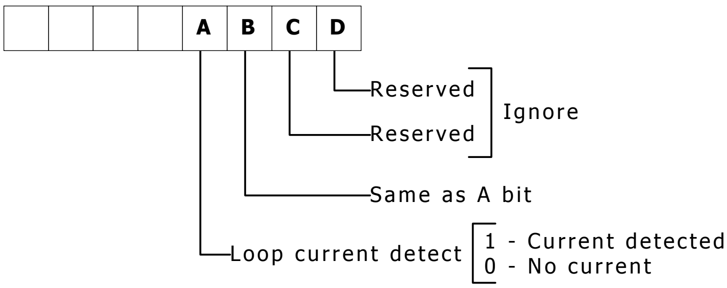
This table summarizes the transmit signaling for subscriber loop line interfaces:

Bit	Hex bitmask	Description
A bit	0x08	Puts battery voltage on tip/ring pair. 0x08 = Apply battery. 0 = No battery.
B bit	0x04 0x00	Applies ringing voltage/signal to tip/ring. No ring.
C bit	N/A	Reserved (should be 0).
D bit	N/A	Reserved (should be 0).

Subscriber loop receive signaling

On the receive signaling path, the A bit indicates whether or not the loop current is flowing. When the current flows on the line and the port is in the active state or the idle state, the A bit will be high. When the port is in the ringing state and ring-trip occurs, the A bit will go high.

The following illustration shows receive signaling for subscriber loop line interfaces:



This table summarizes the receive signaling for subscriber loop line interfaces:

Bit	Hex bitmask	Description
A bit	0x08	Denotes loop current is flowing. This bit is used to determine when the far-end is off-hook. 0x08 = Current is flowing (off-hook). 0 = No current is flowing (on-hook).
B bit	0x04	Same as A bit.
C bit	N/A	Reserved (should be ignored).
D bit	N/A	Reserved (should be ignored).

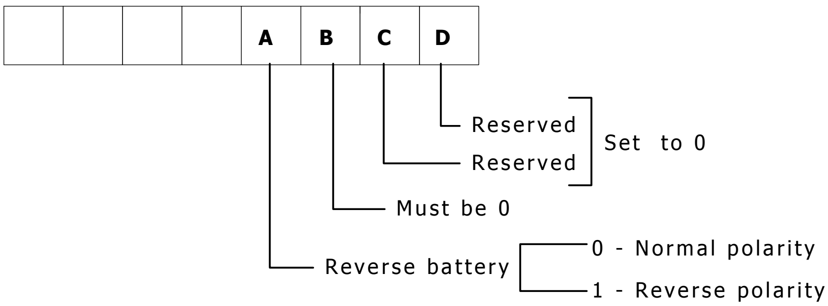
Off-hook conditions during ringing is detected in 50 to 150 ms.

DID line interface signaling

There are no dependencies between DID transmit signaling and DID receive signaling.

DID transmit signaling

The following illustration shows transmit signaling for DID line interfaces:

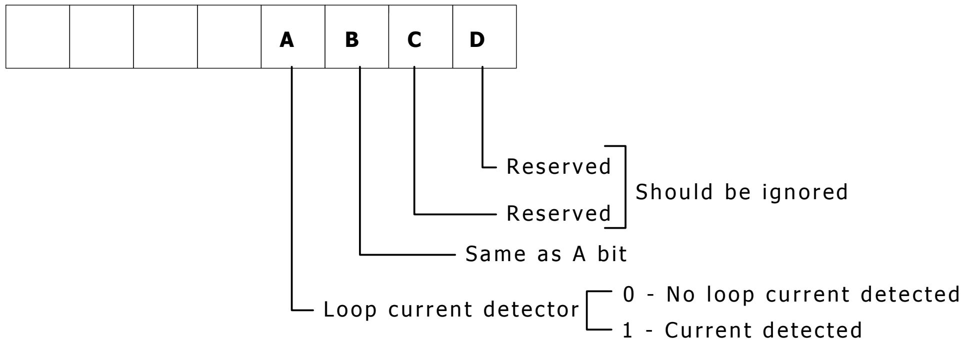


This table summarizes the transmit signaling for DID line interfaces:

Bit	Hex bitmask	Description
A bit	0x08	Reverse battery polarity. 0 = Normal polarity, tip positive. 0x08 = Reverse polarity, tip negative.
B bit	0x04	Must be 0.
C bit	N/A	Reserved.
D bit	N/A	Reserved.

DID receive signaling

The following illustration shows receive signaling for DID line interfaces:



This table summarizes the receive signaling for DID line interfaces:

Bit	Hex bitmask	Description
A bit	0x08	Loop current detector. 0 = No current detected. 0x08 = Current detected.
B bit	0x04	Same as A bit.
C bit	N/A	Reserved.
D bit	N/A	Reserved.

14 Natural Access migration

Natural Access migration overview

This section describes migration from earlier versions of AG software.

With the 2000-1 release of Natural Access, changes were made in the configuration and monitoring aspects of AG software including:

- The introduction of NMS OAM
- Configuration file changes
- Keyword changes

NMS OAM

NMS OAM performs configuration, monitoring, and testing functions across the telephony resources, including the AG boards.

NMS OAM manages a central database of configuration information. Every board in the system has a record in the database describing its configuration. NMS OAM can start boards based on the information in the database.

You can control NMS OAM using functions from the OAM service. You can also control it using various utilities. One of these utilities, *oamsys*, effectively takes the place of the *agmon* configuration and booting function. It loads a configuration file into the NMS OAM database and then starts the boards.

Another utility, *oammon*, takes the place of the *agmon* monitoring function. After running *oamsys*, you can run *oammon* to monitor board errors and other board-level events. For details on using these utilities to configure the AG system, refer to *Configuring and starting the system with oamsys* on page 30.

For more information about loading, configuring, and monitoring boards in an NMS OAM system, refer to the *NMS OAM System User's Manual*.

For more information about the OAM service, refer to the *NMS OAM Service Developer's Reference Manual.*

Configuration file changes

agmon used a single configuration file, *ag.cfg*, that contained configuration information for each board. Each board was referenced using a board number. *oamsys* uses a system configuration file that assigns each board:

- A board name, used to refer to the board in software.
- A board number, used to refer to the board in legacy software.
- A board keyword file, containing the configuration information for the board.

The internal structure of the system configuration file and the board keyword file is very different from *agmon* configuration files. For details on creating a file for your system, refer to *Configuring and starting the system with oamsys* on page 30. For more general information about NMS OAM board keyword files, refer to the *NMS OAM System User's Manual*.

Keyword changes

The statements used in configuration files have also changed. Most configuration statements are specified in the board keyword file. They are expressed in keyword name and value pairs. Keywords have type definitions; for example, some keywords can take integer values, whereas others take string values. Some keywords represent arrays of values, or structures of other keywords or arrays.

The following table lists *agmon* keywords and NMS OAM board keyword equivalents. For details on AG-specific keywords and values, refer to *Using keywords* on page 65. For more general information on NMS OAM board keywords, refer to the *NMS OAM System User's Manual*.

Old keyword	New keyword	Notes
AG2DSP_Lib	DSP.C5x.Lib	
AG2DSP_Loader	DSP.C5x.Loader	
AG2DSP_OS	DSP.C5x[x].Os	***x*** = the number specified in the AG2DSP_OS keyword.
AG2DSPFile	DSP.C5x[x].Files[y]	***x*** = running count of files from the Common section and from the board-specific section. Ensure that this list contains: *callp, dtmf, signal, ptf, mf*, and *tone*.
AG2DSPImage	DSP.C5x[x].Image	***x*** = the number specified in the AG2DSPImage keyword.
AG2TaskProcessor	DSP.C5x[x].Files[y]	If a DSP processor range is specified, then it converts to ***x***. Otherwise, it applies to all processors from 0 to number of DSPs.
Buffers	Buffers[x].Num	***x*** = 0
BufferSize	Buffers[x].Size	***x*** = 0
ClockRef	Clocking.HBus.ClockSource	**AG** **NMS OAM** OSC OSC H100 A_CLOCK SEC8K NETREF MVIP C4
ConnectMode	SwitchConnectMode	**AG** **NMS OAM** FRAMED AllConstantDelay UNFRAMED AllDirect
Diagnostics	BootDiagnosticLevel	all boards
DriveSec8K	Clocking.HBus.NetRefSource	If DriveSec8K = OSC, set Clocking.HBus.NetRefSource = OSC. If DriveSec8K is set to NONE, omit Clocking.HBus.NetRefSource.
DSP_OS	DSP.C5x[x].Os	

Old keyword	New keyword	Notes
EnableMVIP	Clocking.HBus.ClockMode	If there is no EnableMVIP setting in *agmon*, refer to the ClockRef value. If ClockRef is equal to either H100 or MVIP, set Clocking.HBus.ClockMode = SLAVE. If ClockRef is equal to a value other than H100 or MVIP, set Clocking.HBus.ClockMode = STANDALONE. If EnableMVIP was set to NO in *agmon*, set Clocking.HBus.ClockMode = STANDALONE. If EnableMVIP = YES, determine the ClockRef setting in the *ag.cfg* file. If the ClockRef setting was H100 or MVIP, set to SLAVE. If the ClockRef setting was not H100 or MVIP, set to MASTER_A. There is no migration for the MASTER_B option.
IdleCode	SignalIdleCode VoiceIdleCode	If IdleCode = ***number***, use this number for both SignalIdleCode and for VoiceIdleCode. If IdleCode is equal to two numbers, use the first number for VoiceIdleCode and use the second number for SignalIdleCode.
	Xlaw	If IdleCode = string, set Xlaw as follows: **AG** **NMS OAM** Mu-LAW MU-LAW A-LAW A-LAW
LoadFile	LoadFile	
MaxChannels	MaxChannels	
MedBuffers	Buffers[x].Num	***x*** = 1
MedBufferSize	Buffers[x].Size	***x*** = 1
PCIbus	Location.PCI.Bus	
PCIslot	Location.PCI.Slot	
Qslac	NetworkInterface.Analog[x].ConfigFile	x = the analog port number supplied with the Qslac keyword or 0..7 if no port number was specified.
RunFile	RunFile	
RunModule	DLMFiles[x]	***x*** = DLM file number.
SmallBuffers	Buffers[x].Num	***x*** = 2
TCP	TCPFiles[x]	***x*** = TCP number.

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