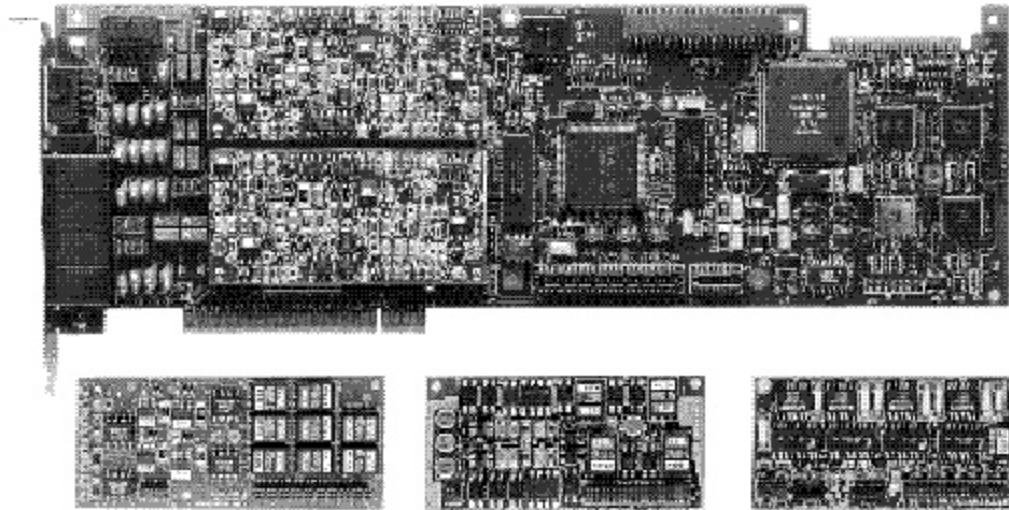


Natural MicroSystems

AG 2000 SERIES

Versatile, High-value Family of Eight-port Analog Interface and DSP Boards



The Alliance Generation® 2000 Series (AG 2000) is a powerful and versatile family of PCI analog telephony interface boards with DSP resources that provide interactive voice response (IVR), fax, and IP telephony capabilities for developers of high-performance telecommunications systems. The unique eight-port design of the AG 2000 saves valuable PCI slots over traditional four-port voice boards. The AG 2000 can be configured with loopstart (LS), subscriber loop (SL), direct inward dialing (DID), or E&M interface modules, giving users the ability to support virtually all analog telephony interface requirements. The AG 2000 is supported by the CT Access™ program development environment and shares a common API set with popular ISA bus-based AG Series digital and analog boards, as well as the AG 4000 PCI and CompactPCI® digital telephony and DSP boards. Natural MicroSystems provides developers with the widest range of PCI and CompactPCI options—all under a single programming environment.

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Versatile, High-value Family of Eight-port Analog Interface and DSP Boards

FEATURES

- Configurable to support eight analog interfaces in a single slot, saving slots over four-port boards
- Loopstart, subscriber loop, DID, and E&M configurations provide a versatile solution for diverse applications
- Advanced DSP-based play/record voice, DTMF/MF, call progress functions, and echo cancellation ensure application reliability
- Implements full CT Bus specification with 4096 timeslots to build high-capacity systems
- Uses MVIP-95 switching model
- Easy integration with MVIP bus products via an MVIP bus adapter
- Natural Call Control™ protocol-independent API minimizes system development and deployment efforts
- Feature-rich CT Access software development kit support for Windows NT and UNIX
- Universal port capability supports NaturalFax™ and Fusion™ IP telephony software
- Efficiently manages DSP resources to minimize host overhead and maximize host processing time for applications
- Built on the Alliance Generation architecture to ensure scalability, compatibility, and high performance to leverage developer time and application investment

CONFIGURATION

The eight-port AG 2000 is available in many configurations based on DSP resources and analog interface type. The DSP resources include the following:

- IVR voice including play/record, DTMF/MF, call progress and call switching
- NaturalConference high-density, real-time multi-party
- NaturalFax which includes all IVR voice capability
- Fusion IP telephony which includes IVR voice and real-time fax

Analog interfaces consist of:

- Four or eight loopstart (LS)—basic trunking

to the PSTN or PBX

- Eight DID—used in North America for direct inbound dialing service; provides inbound routing of calls or faxes; can receive ANI digits
- Four LS/four DID—popular combination for applications using DID for inbound calls and LS for outbound calls
- Eight subscriber loop (SL)—interface to telephones, head sets, modems, or fax machines
- Four LS/four SL—popular combination for PBX or call center applications
- Eight E&M, two-wire or four-wire—used to route trunks between PBXs or to private networks; supports IA, IB, VA, and VB signaling

The DID and E&M interfaces require an external power supply that provides -48 VDC to the AG 2000. The subscriber loop interface also requires an external power supply for -24 and -48 VDC and 86 VAC ringing voltage. The ringing frequency is selectable on the power supply. The subscriber loop external power supplies are connected to the front panel of an AG 2000 and then distributed to up to two adjacent AG 2000 boards by an internal board-to-board cable.

There are also DSP-only versions of the AG 2000 that connect with other CT Bus or MVIP bus boards.

All AG 2000 boards have a CT Bus interface (H.100) that provides an interface to other CT Bus boards. It also has a connector for a CT Bus-to-MVIP adapter. This interface allows the AG 2000 to connect with MVIP boards.

TECHNICAL DESCRIPTION

On-board Resources Reduce Host Overhead

The AG 2000 Series includes a powerful embedded control processor, which manages the host interface, DSP resources, and an on-board memory cache. The control processor dynamically assigns algorithms to DSPs as needed and executes signaling protocols. As a result, host processing overhead is reduced dramatically, which reserves more host processing power for the application.

Dynamic, Efficient Task Processing

The Alliance Generation was the first to implement true media streaming on DSP resource boards, through an efficient task processing design, which ensures flexibility and scalability. The AG 2000 Series boards use two or four high-performance, low-power 'C549 DSPs. Each DSP can be assigned a mix of specific tasks or services such as voice recording and playback, DTMF reception and generation, call progress analysis, speech compression, echo cancellation, fax functions, or vocoding. The tasks are dynamically started, stopped, and interconnected as needed. Any of the tasks or services are available for use by any of the board's eight ports.

Analog Interfaces

The AG 2000 eight-port board provides eight ports of call processing with loopstart, subscriber loop, DID, or E&M interfaces. The AG 2000 board uses Quad Subscriber Line Audio Circuits (QSLACs) which are software-programmable, permitting specific line parameter alterations for either performance reasons or for complying with country-specific regulations. The QSLAC files for the selected country are specified within the installation program.

The analog interfaces are also supported by software modules called trunk control protocols (TCPs) which provide the signaling schemes required by each analog interface, and by country- and PBX-specific requirements. The combination of standard analog modules, specific QSLAC files, and TCPs give the AG 2000 the flexibility to serve virtually any analog telephony requirement worldwide. The AG 2000 has telecom approvals in North America, Europe, Japan, and other countries.

CT Access Program Development

The AG 2000 Series is supported using Natural MicroSystems' CT Access software development and runtime environment. CT Access provides a consistent set of APIs that are operating system-independent, delivering application portability. With CT Access' Natural Call Control API, developers can easily and quickly integrate applications into multiple networks via a single protocol-independent API. Natural Call Control minimizes the processing overhead on the host CPU by executing protocols on the board's control processor.

CT Access unifies application development across Natural MicroSystems Alliance Generation products, both the existing ISA and the newest PCI and CompactPCI-based boards, as well as the four-port QX 2000 board. This allows applications to scale from four to hundreds of ports all within the same application.

CT Bus Assures Open Architecture, Vendor Independence

The AG 2000 Series provides full support of the ECTF CT Bus (H.100) specification. The CT Bus is an interoperable superset of H-MVIP and MVIP, allowing developers to integrate newer CT Bus-based products with existing products.

The CT Bus provides 4096 bi-directional timeslots operating at 8 MHz. The CT Bus also allows programmable operating speeds at 2, 4, or 8 MHz for direct connection to existing boards at their native operating speeds.

The AG 2000 Series uses the Lucent Ambassador™ chip family that offers full support for the CT Bus within the MVIP hierarchical

architecture. It also provides an additional 1024 timeslots of local on-board switching, improving overall application efficiency and system scalability.

AG 2000 BOARD SPECIFICATIONS

General

- **Board capacity:** Eight analog interfaces per board
- **Board configurations:**
 - Four or eight loopstart (LS) interfaces
 - Eight DID interfaces
 - Four LS/four DID interfaces
 - Eight subscriber loop (SL) interfaces
 - Four LS/four SL interfaces
 - Eight E&M interfaces
- **Connectors:**
 - LS, SL, DID: Four-ganged, four-position modular connector (4 RJ-14x jacks)
 - E&M: One 62-pin D-type subminiature-connector with cable to RJ-21 connector
- **TDM bus:** One complete CT Bus (H.100) interface
- **DSP processing power:** 200 or 400 MIPS per board
- **Software development kits:** CT Access for Windows NT, Solaris for Intel systems, Solaris for SPARC, UnixWare
- Software switching support through CT Access

Host Interface

- **Electrical:** PCI Rev. 2.1
- **Mechanical:** PCI Rev. 2.2; physical dimensions: 4.2 in (10.76 cm) x 12.283 in (31.19 cm)
- **Bus speed:** 33 MHz
- **I/O mapped memory:** 23 kB on-board interface memory at DMA rates via 16-bit I/O string move. Memory-mapped interface for efficient block data transfers. Address and interrupts automatically configured by PCI BIOS (no jumpers or switches).

Audio Signal Processing

- **Sampling rates:** 8 ksamples/sec (telephone industry standard)
- **Speech compression:**
 - 11 kHz, 8- or 16-bit linear (.WAV); 16-bit may reduce the number of ports per board
 - 8 kHz 16-bit linear (.WAV)
 - 64 kbps μ -law or A-law per ITU-T G.711
 - 16, 24, and 32 kbps ADPCM using NMS algorithm with NMS framing and bit packing; up to 2x speed-up on playback
 - OKI-compatible ADPCM 24 kbps @ 6 kHz or 32 kbps @ 8 kHz; up to 2x speed-up on playback
 - IMA-compatible ADPCM; 32 kbps
 - G.726-compatible ADPCM; 32 kbps

Tone Dialing

- **DTMF digits:** 0 to 9, *, #, and ABCD per ITU Q.23 and Q.24
- **Rate:** Programmable (10 digits/sec nominal)
- Wait-for-dial tone capability
- **Dialing parameters:** Software configurable (see Note*)
- **Dialing amplitude:** Software configurable; range -33 dBm to +1 dBm (see Note*)

Pulse Dialing

- **10 digits:** 0 to 9
- **Pulsing rate:** 10 pulse/sec (nominal)
- **Make/break ratio:** Software configurable; 40/60 nominal (see Note*)

*Note: Natural MicroSystems supplies configuration files that conform to national regulations for countries where certification has been received.

DTMF Tone Detection

- **DTMF digits:** 0 to 9, *, #, ABCD
- **Dynamic range:** -47 dBm to 0 dBm per tone, programmable
- **Tone duration:** 40 ms (minimum)
- **Acceptable twist:** 10 dB
- **Talk-off:** Exceeds Bellcore TR-TSY-000763 tests

Analog Display Services Interface (ADSI)

- Capable of sending and receiving Frequency Shift Key (FSK) data for ADSI
- Transmit FSK function implements modem portion of Bellcore advisory TA-NWT-000030
- 1200 baud FSK support
- Caller ID support (in select countries)
- Easy-to-use API support in CT Access

On-board Processors

- **Microprocessor:** One 25 MHz 80486-compatible embedded processor
- **DSP:** Two or four Texas Instruments TMS320C549 DSPs at 100 MIPS each

CT Bus (H.100)

- Flexible connectivity between analog trunks, DSPs, and H.100
- 128 full-duplex connections to bus
- 1024 local connections
- Switchable access to any of 4096 bi-directional timeslots
- Individual data lines may be programmed in groups of 2, 4, or 8 Mbps for direct connection to boards with previous compatible technology
- H.100 clock master or clock slave (software selectable)
- H.100 bus terminations (switch enabled)
- Lucent Microelectronics Ambassador chip family

Environment

- **Operating temperature:** 0 °C to 50 °C
- **Storage temperature:** -20 °C to 70 °C
- **Humidity:** 5 to 80%, non-condensing

PCI Bus Power Requirements

- +12 V @ 40 mA
- -12 V @ 40 mA
- +5 V @ 1.4 A (200 MIPS); 1.5 A (400 MIPS)

INTERFACE MODULE SPECIFICATIONS

North American Loopstart Line Interface

- **T-R input impedance (300 to 3200 Hz):** 600 Ohms + 2.2 uF
- **Return loss (ref. T-R input impedance):** 20 dB min. (ERL)
- **Gain tolerance (4-to-2 and 2-to-4 wire):** +/- 1 dB
- **Gain range (4-to-2 and 2-to-4 wire):** +6 to -6 dB
- **Frequency response (300 to 3200 Hz, reference to 1 KHz):** +/- 0.8 dB
- **Trans-hybrid loss (into matching impedance):** 17 dB min. @ 300 to 3000 Hz
- **Signal overload level:** +3 dBm at 0 dB gain
- **CMRR:** > 80 dB
- **Idle channel noise through connection:** < 20 dB mC
- **Crosstalk transmit to receive channels:** < -70 dB @ 1 kHz
- **T-R isolation to SELV:** > 1500 VRMS
- **Off-hook detect:**
 - Guaranteed detect: Current > 10 mA
 - Guaranteed no detect: Current < 3.3 mA
- **Operating loop current:** 18 mA to 70 mA
- **Loop current and polarity detect:** Single bit indicates if the current is flowing from Tip to Ring or Ring to Tip
- **Ring detection:**
 - Guaranteed detect: > 30 VRMS, 17 to 33 Hz
 - Guaranteed no detect: < 15 VRMS (0 to 5 kHz)

EU Loopstart Line Interface

EU specifications differ from North American version only where required to conform to regulation CTR-21. **Differences are:**

- **T-R input impedance (300 to 3200 Hz):** 270 Ohms in series with a parallel combination of 750 Ohms and 150 uF
- **Operating loop current:** 18 mA to 55 mA

Subscriber Loop Line Interface

- **T-R input impedance (300 to 3200 Hz):** 600 Ohms + 2.2 uF
- **Return loss (ref. T-R input impedance):** 20 dB min. (ERL)
- **Gain tolerance (4-to-2 and 2-to-4 wire):** +/- 1 dB
- **Gain range (4-to-2 and 2-to-4 wire):** +6 to -6 dB
- **Frequency response (300 to 3200 Hz, reference to 1 KHz):** +/- 0.8 dB
- **Trans-hybrid loss (into matching impedance):** 17 dB min. @ 300 to 3000 Hz
- **Signal overload level:** +3 dBm at 0 dB gain
- **Idle channel noise through connection:** < 20 dB mC
- **Crosstalk transmit to receive channels:** < -70 dB @ 1 kHz
- **Off-hook detect:**
 - Guaranteed detect: Current > 13 mA
 - Guaranteed no detect: Current < 7 mA
- **Operating loop current:** 13 mA to 25 mA
- **Maximum 24 AWG (0.5 mm) cable distance:**
 - At -48 V: 18,000 ft (5000m) (1500 Ohms)
 - At -30 V: 2,000 ft (600m) (200 Ohms)
- **Maximum ringer:** 1.5 REN

DID Line Interface

- **T-R input impedance (300 to 3200 Hz):** 600 Ohms + 2.2 uF
- **Return loss (ref. T-R input impedance):** 20 dB min. (ERL)
- **Gain tolerance (4-to-2 and 2-to-4 wire):** +/- 1 dB
- **Gain range (4-to-2 and 2-to-4 wire):** +6 to -6 dB
- **Frequency response (300 to 3200 Hz, reference to 1 KHz):** +/- 0.8 dB
- **Trans-hybrid loss (into matching impedance):** 17 dB min. @ 300 to 3000 Hz
- **Signal overload level:** +3 dBm at 0 dB gain
- **Idle channel noise through connection:** < 20 dB mC
- **Crosstalk transmit to receive channels:** < -70 dB @ 1 kHz

- **Off-hook detect:**
 - Guaranteed detect: Current > 13 mA
 - Guaranteed no detect: Current < 7 mA
- **Operating loop current:** 13 mA to 25 mA
- **Maximum 24 AWG (0.5 mm) cable distance:**
 - At -48V: 18,000 ft (5000m) (1500 Ohms)

E&M Line Interface

- **Configurations:** 2-wire/4-wire, switch programmable per port (4-wire default)
- **Signaling:** Switch programmable; choice of:
 - Type IA
 - Type IB
 - Type VA
 - Type VB
- **T-R input impedance (300 to 3200 Hz):** 600 Ohms + 2.2 μ F
- **Return loss (ref. T-R input impedance):** 20 dB min. (ERL) for 2 wire
- **Gain tolerance (4-to-2 and 2-to-4 wire):** +/- 1 dB
- **Gain range (4-to-2 and 2-to-4 wire):** +6 to -6 dB
- **Frequency response (300 to 3200 Hz, reference to 1 KHz):** +/- 1.2 dB
- **Trans-hybrid loss (into matching impedance):** 17 dB min. for 2-wire; 40 dB min. for 4 wire @ 300 to 3000 Hz
- **Signal overload level:** +3 dBm at 0 dB gain
- **CMRR:** > 80 dB
- **Idle channel noise through connection:** < 20 dB mC
- **Crosstalk transmit to receive channels:** < -62 dB @ 1 kHz
- **T-R isolation to SELV:** > 1000 VRMS
- **Off-hook detect:**
 - Guaranteed detect: Current > 10 mA
 - Guaranteed no detect: Current < 2.2 mA
- **Maximum cable distance:**
 - 2 wire: 1,000 ft (300 m)
 - 4 wire: 3,000 ft (900 m)

POWER SUPPLIES SPECIFICATIONS

Subscriber Loop Ringing Power Supply

- **Input power:** 100 to 132/200 to 264 VAC; 47 to 63 Hz, automatic range selection
- **DC output:** Two outputs: -24 VDC/-30 VDC and -48 VDC; combined total < 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
- **Ring output:** -48 VDC plus 86 VAC @ 0.13 A for 17, 20, and 50 Hz; 72 VAC @ 0.13 A for 25 Hz
- **Ring 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 all outputs are operating
- **Temperature range:** 0 to 50 °C for full load operation
- **Construction:** Fully enclosed aluminum chassis
- **Dimensions:**
 - Height: 1.92 in (4.92 cm)
 - Width: 8.75 in (22.4 cm)
 - Length: 7.25 in (18.5 cm)
- **Weight:** 2.75 lbs
- **Cable to AG 2000:** 10 ft (3 m) (powers up to three AG2000 boards.)
- **Inter-AG 2000 power cable:** Connects power to 3 AG 2000 boards

DID and E&M Power Supply

- **Input Voltage:** 105 to 130 VAC rms; 57 to 63 Hz
- **DC Output:** -24 or -48 VDC @ 1 A
- **Regulation:** +/- 1.0 VDC
- **Ripple:** 2 mV rms typical; 5 mV rms max.
- **Current limiting:** 1.2 A (approx.)
- **Fuse:** 1.5 A
- **Temperature:** -7 °C to 49 °C (20 °F to 120 °F)
- **Dimensions:**
 - Height: 6.9 in (17.53 cm)
 - Width: 2.88 in (7.3 cm)
 - Length: 7.0 in (17.78 cm)
- **Weight:** 7 lbs
- **Cable to AG 2000:** 10 ft (3 m)

COMPLIANCE AND REGULATORY CERTIFICATION

EMC

- **US and Canada:** FCC Part 15, Subpart J, Class A
- **EU countries:** EN 55022 (1994) Class B (4 or 8 LS model), Class A (all other models); EN 50082-1 (1992)
- **Other countries:** Refer to our web site at <http://www.nmss.com>

Safety

- **US and Canada:** UL 1950 3rd Edition
- **EU countries:** EN 60950 (1992) + Amendments 1 to 4
- **Other countries:** Refer to our web site

Telecom

- **US:** FCC Part 68
- **Canada:** DOC CS-03
- **EU countries:**
 - 8 LS interfaces: CTR21 approval
 - 4 LS interfaces: CTR21 approval
 - 4LS/4SL interfaces: CTR21 compliant
 - 8 E&M interfaces: not approved for public network connection
- **Other countries:** Refer to our web site

For more information visit our
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