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AG 4000 Series

Family of DSP and Digital PSTN Interface PCI and CompactPCI Boards

The Natural MicroSystems Alliance Generation 4000 Series (AG 4000) is a versatile family of digital signal processing (DSP) and digital PSTN interface PCI and CompactPCI boards for developers of high-performance telecommunications systems. It is a new family of boards based on Natural MicroSystems' industry-leading Alliance Generation DSP architecture which delivers an open development environment, a rich set of features, built-in scalability, and increased processing power. The AG 4000 Series provides a cost-effective platform that offers unmatched capability for mixed media types to service a wide range of voice and signaling applications.

Features

- Supports 1, 2, or 4 T1 or E1 digital interfaces in a single slot for connection to the public telephone network.
- Efficiently manages DSP resources to minimize host overhead and maximize host processing time for applications.
- Implements full CT Bus based on H.100 or H.110 specification with 4096 timeslots to build high-capacity systems.
- Efficient heat dissipation to maximize the number of boards per system.
- Advanced DSP-based voice, DTMF/MF, and call progress functions ensure application reliability.
- Hierarchical CT Bus switching model improves system and application scalability and reduces time to market.
- Natural Call Control™ protocol-independent API minimizes system development and deployment efforts.
- Feature-rich CT Access™ software development kit supports Windows NT, Solaris on SPARC and Intel systems, and UnixWare
- Alliance Generation architecture ensures scalability, compatibility, and high performance to leverage developer time and application investment.

Configuration

AG 4000 Series boards are available in PCI and CompactPCI families and are configured to address a variety of applications:

- Telecommunications interface boards with up to 120 ports of IVR and digital trunking.
- NaturalConference high-density, real-time multi-party.
- NaturalFax/AG 4000 fax boards with up to 120 ports of IVR, NaturalFax, and digital trunking.
- Fusion/AG 4000 IP telephony boards with up to 60 ports of IVR, real-time fax, and IP voice.

PCI Board Family

The PCI family offers single T1 (24 ports) or single E1 (30 ports), dual T1 (48 ports) or dual E1 (60 ports), and quad T1 (96 ports) and quad E1 (120 ports) interfaces. The standard configurations are implemented with a single board or a combination of motherboard with daughterboard. The motherboard contains the digital T1 or E1 interfaces as well as 4, 8, or 16 DSPs. The daughterboard is used to extend the processing power of the board through the addition of 16 DSPs. All versions are PCI long form-factor boards and require only a single PCI slot.

The AG 4000 Series supports the CT Bus that conforms to the ECTF standard H.100 specification. The CT Bus makes it easy for developers to switch calls between boards and telecommunications resources

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in multiple-board applications.

CompactPCI Board Family

AG 4000 CompactPCI boards may also be configured as a single board or as a motherboard-daughterboard combination, depending upon processing requirements. The motherboard contains two or four digital T1 or E1 interfaces as well as 16 DSPs. The daughterboard contains an additional 16 DSPs.

The CompactPCI boards feature CT Bus (H.110) support for connecting channels to line interfaces, to DSP resources for voice processing and signaling, or to the H.110 bus. These boards may also run signaling protocols for line interfaces on other boards by switching these resources across the H.110 bus.

CT Access Support

The AG 4000 Series is supported by Natural MicroSystems' CT Access development and runtime environment. CT Access provides a consistent set of APIs that are operating system-independent, thereby delivering true application portability. With CT Access' Natural Call Control API, programmers can easily and quickly develop applications that run on multiple types of telecommunications interfaces by using 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. This allows applications to scale from four to hundreds of ports all within the same application.

The AG 4000 CompactPCI boards fully support the PICMG hot swap specification which enables the addition, subtraction, and replacement of boards in a running system. CT Access features a number of API calls that enable applications to dynamically receive notification of board insertions and extractions.

Technical Description

On-board Resources Reduce Host Overhead

The AG 4000 Series boards include 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 4000 Series boards use from 4 to 32 high-performance (100 MIPS each), low-power, 'C549 DSPs. All AG 4000 configurations dissipate less than the PCI specification of 25 watts per slot.

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, or fax functions. The tasks are dynamically started, stopped, and interconnected as needed. Any of the tasks or services is available for use by any of the channels.

Network Interface

The AG 4000 PCI boards provide one, two, or four T1 (DSX-1) terminations and the CompactPCI boards provide two or four T1 (DSX-1) terminations, for up to 96 ports per slot. The AG 4000 T1 platforms can

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connect to other DSX-1 level equipment without the need for a CSU.

For E1 configurations, the AG 4000 PCI boards provide one, two, or four E1 terminations (either 75 or 120 ohms) and the CompactPCI boards provide two or four E1 terminations (either 75 or 120 ohms), for up to 120 ports per slot.

Technical Specifications

General - PCI Boards

- PCI Board Configurations:
  - AG 4000/400-T or AG 4000/400-E (75 or 120 ohm)
  - AG 4000/800-2T or AG 4000/800-2E (75 or 120 ohm)
  - AG 4000/1600-2T or AG 4000/1600-2E (75 or 120 ohm)
  - AG 4000/1600-4T or AG 4000/1600-4E (75 or 120 ohm)
  - Daughterboard: AG 1600 DSP
- Board Interface Capacity: One, two or four T1 (DSX-1) terminations or one, two or four CEPT E1 terminations
- TDM Bus: One complete H.100 (CT Bus) interface

General - CompactPCI Boards

- CompactPCI Board Configurations:
  - AG 4000C/1600-2T or AG 4000C/1600-2E (75 or 120 ohm)
  - AG 4000C/1600-4T or AG 4000C/1600-4E (75 or 120 ohm)
  - Daughterboard: AG 1600 DSP
- Board Interface Capacity: Two or four T1(DSX-1) terminations or two or four CEPT E1 terminations
- TDM Bus: One complete H.110 (CT Bus) interface

Software

- Software development kits: CT Access for Windows NT, Solaris for SPARC and Intel systems, and UnixWare
- Software switching support through CT Access MVIP-90 adapter interface for optional connectivity with MVIP-90 boards

Protocols

- Channel Associated Signaling: DID, Winkstart MF/DTMF, loopstart T1, ground start T1
- Channel Signaling: ISDN Primary Rate Interface (PRI)

Host Interface

- Electrical: PCI Local Bus specification Revision 2.1
- PCI Mechanical: PCI Rev. 2.2 for a long expansion card (physical dimensions 4.2 x 12.283 in.)
- CompactPCI Mechanical: PICMG 2.0, R2.1 CompactPCI
- Bus speed: DC to 33 MHz
- I/O mapped memory: Memory mapped interface for efficient block data transfers
- Address/Interrupts: Address and interrupts automatically configured by PCI BIOS (no jumpers or switches)

DSX-1 Telephony Interface

- Interface: Complete interface for up to four T1 trunks (ANSI T1.102, T1.403)
- Framing: D4, ESF
- Insertion/generation and extraction/detection: ABCD bits
- Line code: AMI, B8ZS
- Zero bit: Suppression selectable B8ZS, jammed bit (ZCS) or no zero code suppression
- Alarm signal capabilities: Yellow, Red, and Blue
- Counts: Bipolar violation, F(t) error, and CRC error
- Robbed bit: Selectable on a per-trunk basis
- Loopback: Per-channel and overall under software control. Automatic remote loopback with CSU option
- Connector: Up to four RJ-48C connectors
- Mix of ISDN and CAS trunks on single board

CEPT E1 G/703 Telephony Interface

- Interface: G.703 2048 kbps trunk interface
- Framing: CEPT G.703/G.704 Channel Associated Signaling
- Insertion/generation and extraction/detection: ABCD bits for Channel Associated Signaling and HDLD/LAPD for generating/terminating data link
- Line code: HDB3 or AMI (no zero code suppression)
- Zero bits: Selectable B8ZS, jammed bit (ZCS) or no zero code suppression
- Alarm signal capabilities: Yellow, Red, and Blue
- Counts: Bit error rate, CRC errors, slips, line code violations, far-end block errors
- Loopback: Per-channel and across channels under softtware control
- Connector: Up to four 75 ohm RJ-48C with BNC adapter cables or up to four 120 ohm RJ-48 connectors
- Mix of ISDN and CAS trunks on single board

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 Natural MicroSystems algorithm with Natural MicroSystems framing and bit packing with up to 2x speedup on play back
    - OKI-compatible ADPCM 24 kbps @ 6 kHz or 32 kbps @ 8 kHz with up to 2x speedup 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
- Easy to use API support in CT Access

On-board Processors and Memory

- DSPs: 4, 8, 16, or 32 Texas Instruments TMS320C549 DSPs at 100 MIPS each
- Microprocessor: One 100 MHz 80486 compatible embedded processor

Power Requirements

AG 4000:	3.0A max.@ 5.0V
AG 4000 w/daughterboard:	4.0A max. @ 5.0V
AG 4000C:	1.5A max. @ 5.0V 1.5A max.@ 3.3V
AG 4000C w/daughterboard:	2.2A max @ 5.0V 2.0A max. @ 3.3V

CT Bus (H.100/H.110)

- Flexible connectivity between T1/E1 trunks, DSPs, and CT Bus
- 128 full-duplex connections to bus
- 1024 local connections
- Switchable access to any of 4096 bi-directional timeslots
- CT Bus clock master or clock slave (software selectable)
- CT Bus termination capability (switch-enabled)

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- Individual data lines may be programmed in groups of 2, 4, or 8 Mbps for direct connection to boards with previous compatible technology
- Uses Lucent Microelectronics Ambassador Family chip

Regulatory Certification

- EMC:
  - US and Canada: FCC Part 15, Subpart J, Class A
  - Europe: EN55022 1994 Class B (with shielded cable); EN50082-1 1992
  - Australia: AS 3548
- Safety:
  - US and Canada: NRTL recognized to cUL 1950, 3rd edition
  - Europe: EN60950 1992 + Amendments 1, 2, 3, and 4; BABT-AN 48 Issue 6
  - Australia: TS001 1996; AS/AZ
- Telecom:
  - US and Canada: FCC Part 68 and DOC CS-03
  - Europe: CTR4 (connection to ISDN Primary Rate); CTR12 (connection to 2048 kbit/s digital structured leased lines - 120W)
  - UK: NTR4 (connection to 2048 kbps digital structured leased lines - 75 ohm)

For additional certification information, see the Global Approvals section (link in left-hand sidebar)

Standards and Compliance

- Digital multiplexer requirements and objectives: AT&T Pub. 43802, July 82
- Service description and interface specifications: AT&T TR 62411, ACCUNET T1.5
- Carrier to customer installation DS1 metallic interface: ANSI T1E1/88-001R1, Feb. 88
- ANSI T1 standard for ISDN Primary Rate Interface: T1E1.4/8868 (proposed text) April 88
- Primary Rate User-network Interface Layer 1 specification: ITU-T I.431, June 88
- ISDN Primary Rate Interface specification: AT&T Pub. TR41449 and TR41459, June 85
- PCI SIG: PCI Specification Revision 2.1
- ECTF: H.100 Revision 1.0; H.110 Revision 1.0
- CompactPCI: PICMG 2.0, Rev. 2.1
- Hot Swap: PICMG 2.1, Rev. 1.0

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