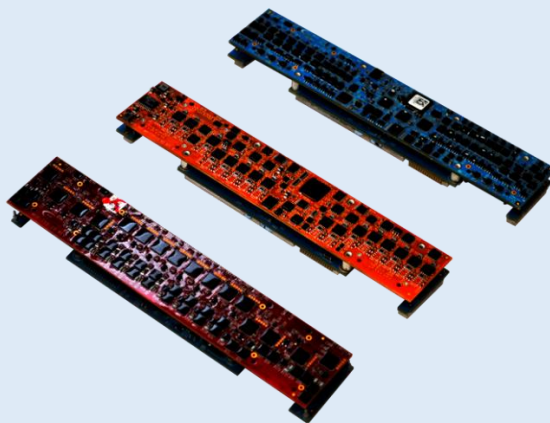


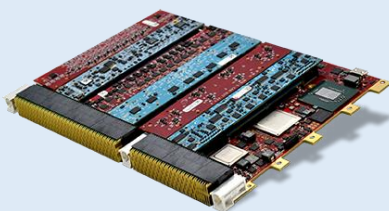
What are the Advantages of the NAI Function Modules?

When Size, Weight and Power are critical NAI provides

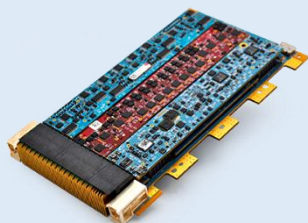
- High functional density
- Wide range of I/O, Communication, Measurement and Simulation
- Programmable Channels
- Background Built in Test
- ARM processor and FPGA to offload system processor
- TurnKey Solution from one supplier



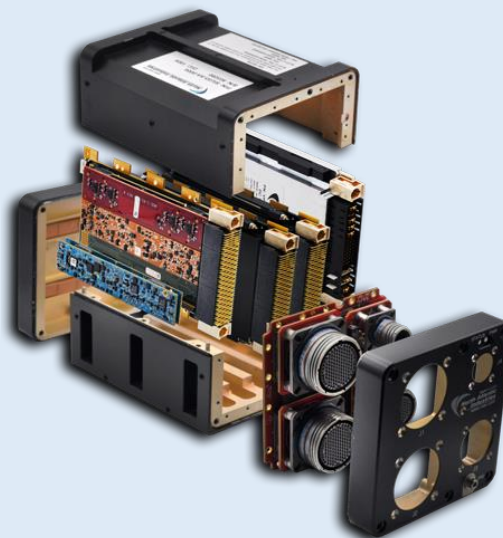
Over 90 Function Modules Available
Board level Products Supported – VPX, VME, cPCI and PCIe and Systems



6U VPX/VME – 6 Modules



3U VPX – 3 Modules

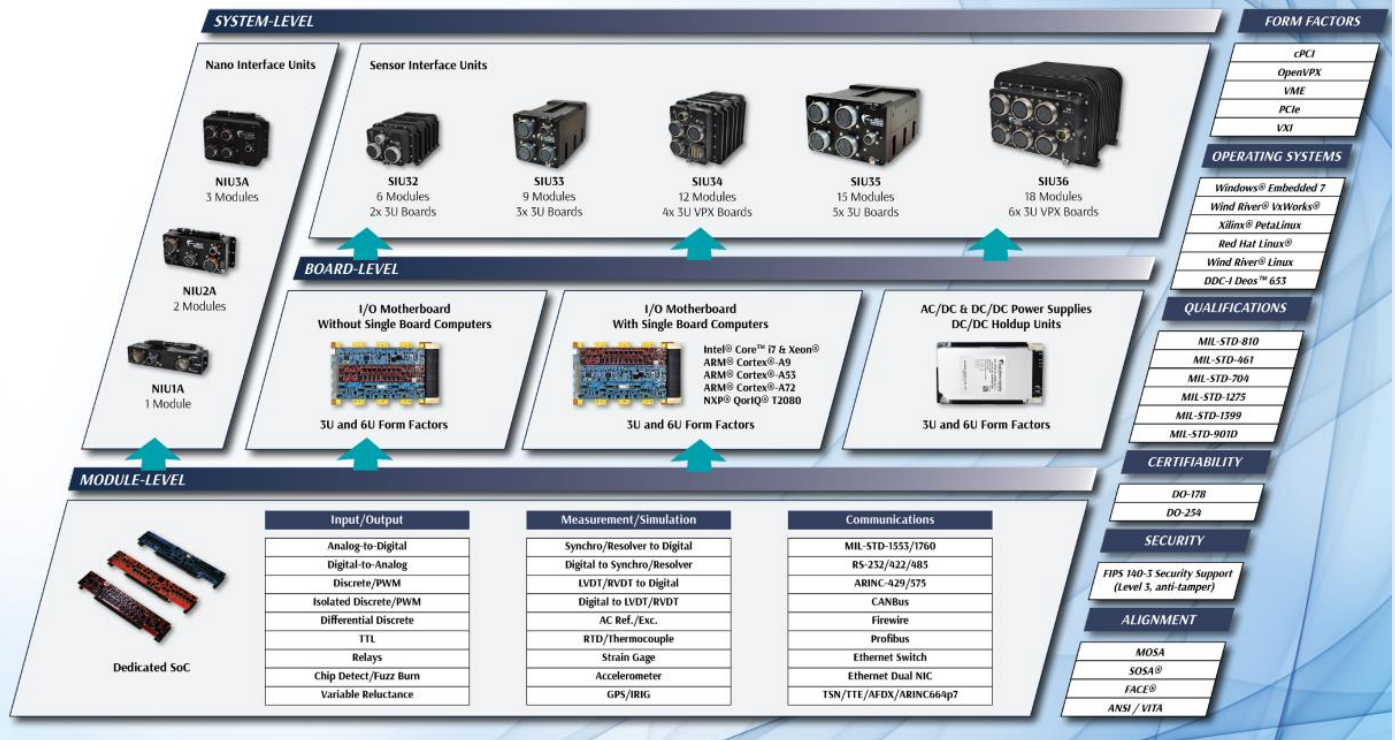


System (3) 3U VPX cards and Power Supply



NAI Configurable Open Systems Architecture™ (COSA®) for I/O Boards, SBCs, and Systems

A massively configurable, modular, intelligent approach offering unmatched breadth and scalability. COSA supports a wide range of complex and time-critical requirements in a distributed, intelligent, software-driven architecture that allows you to rethink the way you engineer power-critical and I/O-intensive mission systems.



90 Modules Available

I/O

- A/D 9 Modules
- D/A 5 Modules
- Discrete I/O 5 Modules
- Digital I/O 2 Modules
- Differential Transceivers 2 Modules

Measurement and Simulation

- LVDT/RVDT 15 Modules
- Synchro/Resolver 26 Modules
- AC Reference 2 Modules
- RDT 3 Modules
- Variable Reluctance 1 Module
- Strain Gauge 1 Module

Communication

- [MIL-STD-1553](#) 6 Modules
- [ARINC](#) 2 Modules
- [Time Triggered Ethernet](#) 1 Module
- [IEEE 1394 \(FireWire\)](#) 2 Modules
- [CANBus](#) 3 Modules
- [Serial](#) 4 Modules
- [Ethernet](#) 1 Module

Communication Modules

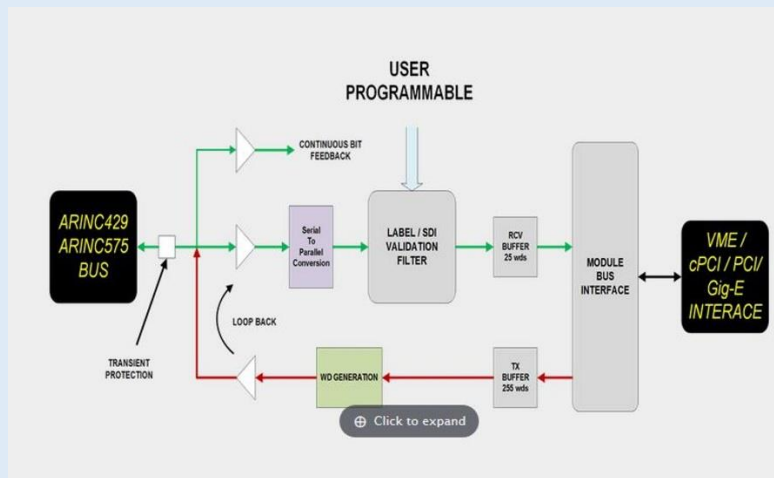
MIL-STD-1553B - MIL-STD-1553 is a military standard published by the United States Department of Defense that defines the mechanical, electrical, and functional characteristics of a serial data bus. It features a dual, redundant, balanced-line, physical layer; a (differential) network interface; time division multiplexing; half-duplex command/response protocol; and up to 31 remote terminals (devices). NAI's MIL-STD-1553 communication smart function modules provide programmable 1, 2 or 4-channel and dual-redundant in transformer-coupled or direct-coupled interfaces and possess an improved assisted mode.

Module	Description
FTA	1 Channel, MIL-STD-1553, Dual Redundant, Transformer Coupled, Assisted Mode Capable (AMC)
FTB	2 Channels, MIL-STD-1553, Dual Redundant, Transformer Coupled, Assisted Mode Capable (AMC)
FTC	4 Channels, MIL-STD-1553, Dual Redundant, Transformer Coupled, Assisted Mode Capable (AMC)
FTD	1 Channel, MIL-STD-1553, Dual Redundant, Direct Coupled, Assisted Mode Capable (AMC)
FTE	2 Channel, MIL-STD-1553, Dual Redundant, Direct Coupled, Assisted Mode Capable (AMC)
FTF	4 Channel, MIL-STD-1553, Dual Redundant, Direct Coupled, Assisted Mode Capable (AMC)

Key Features

- Independent (dual-redundant) MIL-STD-1553 interface channels: Bus Controller (BC), Remote Terminal (RT), and Bus Monitor (BM) or RT/BM combined mode operation
- Assisted Mode (AM)
- 16K words on-board memory/channel
- IP-core register-compatible with DDC™ family of devices
- Ability to set message retry policy
- Message scheduling capability
- Asynchronous message capability Message FIFO capability

ARINC - NAI's ARINC 429/575 smart function modules provide up to twelve programmable channels. ARINC 429 is a data transfer standard for aircraft avionics. ARINC 575 is an equipment characteristic for a Digital Air Data System (DADS) that provides essential air-data information for displays, autopilots, and other flight controls and instrumentation on commercial and transport-type aircraft. ARINC 568/579 smart function modules provides a communications interface with 2 channels. ARINC 568 is an equipment characteristic for Distance Measurement Equipment (DME). ARINC 579 is an equipment characteristic for a VHF Omnidirectional Radio range (VOR) short range navigation system.



Module	Description
AR1	12 Channels, ARINC 429/575 Communications
AR2	2 Channels, ARINC 568/579 Communications

Key Features

AR1

- Receive/Transmit mode programmable per channel
- 100 kHz or 12.5 kHz operation per channel
- Transmit: 255 message FIFO or scheduled transmits per channel
- Async transmits during scheduled transmits
- Receive: 255 message FIFO or mailbox buffering per channel
- Message Validation (SDI/Label Filtering) on received messages per channel
- Selectable hardware parity generation/checking
- Receive time stamping
- Continuous BIT
- Loop-back test
- Tri-state outputs
- High and Low speed Slew Rate outputs

AR2

- Receive/Transmit mode programmable channel (ARINC-579)
- Separate Receive and Transmit channel (ARINC-568)
- 11 kHz transmission rate
- Programmable gap times
- Transmit: 1024-word FIFO per channel
- Receive: 1024-word FIFO per channel
- Selectable hardware parity generation/checking
- Receive time stamping
- Continuous BIT
- Loop-back test
- Tri-state outputs
- High and Low Speed Slew Rate outputs

Time-Triggered Ethernet - NAI's Time Triggered Ethernet (TTE) smart function modules are certifiable, single-port, tri-redundant, deterministic Ethernet communications interface module that supports TTTech's certifiable TTEthernet® End System product consisting of three traffic classes: SAE AS6802 (Time-Triggered Ethernet), ARINC 664 Part 7 (Avionics Full-Duplex Switched Ethernet (AFDX®)), and/or IEEE 802.3 best-effort protocol. By supporting all three traffic classes, NAI's smart function modules are the ideal solution for current users of IEEE 802.3 Ethernet, who plan to upgrade to Deterministic Ethernet (ARINC 664 Part 7 (AFDX®) or Time-Triggered Ethernet SAE AS6802) protocols in the future at any time without changing hardware.

Module	Description
TE2	Time-Triggered Ethernet / ARINC 664 Part 7 (AFDX®) / IEEE 802.3 Ethernet Deterministic Communications

Key Features

- TTEthernet's 3 modes of operation: SAE AS6802 (Time-Triggered Ethernet), ARINC 664 Part 7 (AFDX®), IEEE 802.3
- Single-port, tri-redundant Ethernet module that supports each protocol
- Supports 10/100/1000Base-T Mbps Ethernet

- Currently supported on 75PPC1 (PPC P2041) and on 68PPC2 & 67PPC2 (PPC T2080) with Wind River® VxWorks® (v6.9, v3.x) or DDC-I Deos™ RTOS as well as optional ARINC 653 driver & middleware support.

IEEE 1394 (FireWire) - NAI's FireWire smart function modules provide IEEE 1394 (Firewire) high-speed serial communications. Two models are available from NAI and provide a direct PCIe interface to the local (on-board) processor, or, an external host processor for board platforms that support external PCIe connectivity. These module(s) are not supported with the classic memory register-based NAIbrd Software Support Kit (SSK) API libraries and support device control and management via standard native OS (Linux) FireWire device driver.

Module	Description
FW1	Dual-Channel, Tri-port per channel, for extended cabling up to 20 meters
FW2	Dual-Channel, Tri-port per channel, for extended cabling up to 4.5 meters

Key Features

- Channel Capacity (maximum) - 2 Channel, Tri-port per channel
- Dual Channel IEEE1394b - Open host controller/link-layer controller with a 3-port 1394b PHY per Channel
- IEEE 1394b Compatibility - IEEE 1394b / AS5643 Hardware Compatible
- OHCI / Physical Interface (PHY) - IEEE 1394b OHCI with 3-Port Phy
- Throughput / Data Rate Supported - Full x1 PCI Express (PCIe) throughput (aggregate)
 - IEEE 1394a data speeds of S100, S200 and S400
 - IEEE 1394b data speeds of S400B and S800B

CANBus Communications - NAI's CANBus smart function modules provide independent, isolated channels of CAN serial data bus links, conforming to the ISO 11898 International Standard. All CAN nodes can transmit data and several CAN nodes can request the bus simultaneously. NAI offers three CANBus smart function module models with different levels of support for CANBus 2.0 A and B protocols and CANBus SAE J1939 protocols – offering features including: Fully compliant ANSI C network: Transport and DataLink layers, Adjustable baud rate with speeds up to 1 Mbit/sec and MilCAN compliance.

Module	Description
CB1	8 CANBus Channels, CAN 2.0 A/B Protocol
CB2	8 CANBus Channels, J1939 Protocol
CB3	8 CANBus Channels, CAN 2.0 A/B Protocol or J1939 Protocol

Key Features

- Eight independent galvanically-isolated, channels
- ANSI-C fully Compliant Network, Transport and DataLink layers
- Addressing can be set to be Self-configurable, Non-Configurable or Command-Configurable
- CB1 module stack supports CAN 2.0 A & B protocol. Each channel is independently configurable.
- CB2 module supports the J1939 protocol.
 - Transport and DataLink layers IAW SAE section J1939/21
 - Network layer IAW SAE section J1939/81 for self-configurable or non-configurable device
- CB3 module supports both protocols and allows channels to be set for either protocol
- Adjustable baud rate with speeds up to 1 Mbit/sec supported

Built-In Test (BIT)/Diagnostic Capability

Built-In Test (BIT) is invoked at power on and then can be manually invoked on demand by setting a bit in the Control register for each channel, which forces BIT to be run for the given channel. When running BIT, the CANBus module will be taken out of "Normal" mode and temporarily placed in "Loopback" mode. When BIT finishes, CANBus will be placed back into Normal mode. While in Loopback mode, CANBus will not respond to receive or transmit requests. A specific

CAN test message is sent, received and verified for each of the CAN channels while in loopback mode. Upon failure, an interrupt is generate.

Serial Communications - NAI's serial communication smart function modules provide up to 8 high-speed, programmable RS-232, RS-422, RS-485, non-isolated communication channels. Each channel is programmable for either Serial Communications (SC) protocol or General Purpose I/O (GPIO) modes as either RS-422/485 (differential) or RS-232 (single ended) hardware level interfaces. Each channel has one Transmit and one Receive signal pair (\pm) available as applicable. Synchronous (SYNC) communications mode (added feature) automatically configures the clock (clk) signal(s) on the companion pair channel: CH1-CH4 clk companion channels are CH5-CH8, respectively.

Module	Description
SC1	4 Serial Communication Channels, multi-mode programmable, non-isolated
SC2	4 Serial Communication Channels, multi-mode programmable, isolated
SC3	8 Serial Communication Channels, programmable RS-232/422/485 non-isolate
SC7	4 Serial Communication Channels, multi-mode programmable, non-isolated

Key Features

SC1, SC2, SC7

- Each channel can be programmed into a Loop-Back mode that internally wraps the transmitter around the receiver without the need of external wiring.
- An additional asynchronous mode to support "Immediate Transmit" operation results in Serial Data Transmit Enhancement. Each channel has its own Transmit and Receive buffer where total aggregate buffer allocation is user configurable/programmable up to 64 MB.
- A Receiver Enable/Disable function allows the user to turn selected receivers ON/OFF.
- This serial card can operate in an Interrupt-Driven Environment to provide notification of all events to the system. When a flow control mode is selected, the serial card does the operation automatically with minimal system intervention.
- Multi-Drop Link Mode: The transmitter and receivers of up to 32 cards can be tied together in either Half or Full-Duplex mode.
- Built-in Test

SC3

- Eight (8) high-speed, programmable RS-232, RS-422, RS-485, non-isolated communication channels that can be programmed as 8 async or 4 sync channels. Sync (added feature) sets up the clock (clk) signal(s) on the companion pair channel: CH1-4 clk companion channels are CH5-8, respectively.
- General Purpose Input/Output (GPIO) mode available
- Data transfers within two baud clocks for Async communications, 15 for Sync communications.
- Digital Noise filtering on Receivers
- A Receiver Enable/Disable function allows the user to turn selected receivers ON/OFF.
- This serial module can operate in an Interrupt-Driven Environment to provide notification of all events to the system. When a flow control mode is selected, the serial card does the operation automatically with minimal system intervention.
- 1MBx16 Receive and Transmit buffers.
- Built-in Test

Ethernet Switch - NAI's ethernet switch smart function modules provide 10/100/1000Base-T Ethernet ports. These modules feature one 10/100/1000 BaseT Ethernet maintenance port interface, one RS-232 maintenance/console port interface, and one Fiber-Optic interface with four 10 Gb ports. It also provides numerous L2 and L3 networking, quality of service (QoS) and security features.

Module	Description
ES2	Managed Ethernet Switch with L2/L3 Layer Support and Fiber Optic option

Key Features

- 16x 10/100/1000Base-T Ethernet (GbE) ports
- 4x Fiber Optic (10 Gb @ 850 nm)
- 1x GbE and 1x RS-232 for maintenance
- Quality of Service (QoS) and Security Features
- L2+ / L3 Management
 - Transparent bridging
 - VLAN aware bridging
 - Rapid Spanning Tree Protocol
 - Multiple Spanning Tree Protocol
- Full auto-negotiation and auto-MDIX
- IEEE 802.3ab (1000Base-T Gig-E)
- IEEE 802.3u (100Base-TX Fast Ethernet)
- IEEE 802.3i (10Base-T Ethernet)
- IEEE 802.3x (Flow control/full and half-duplex)
- IEEE 802.3ae (10GBase-SR, 10 Gbit/s Ethernet over Fiber for LAN)

For more information contact ティー・ピー・ティー株式会社 (TPT K.K.)

www.tpotech.co.jp

Telephone: 81-3-5832-7350

TPT KK: [Contact](#)

Rev. A