

Interfaces for Ethernet Based Aircraft Data Networks

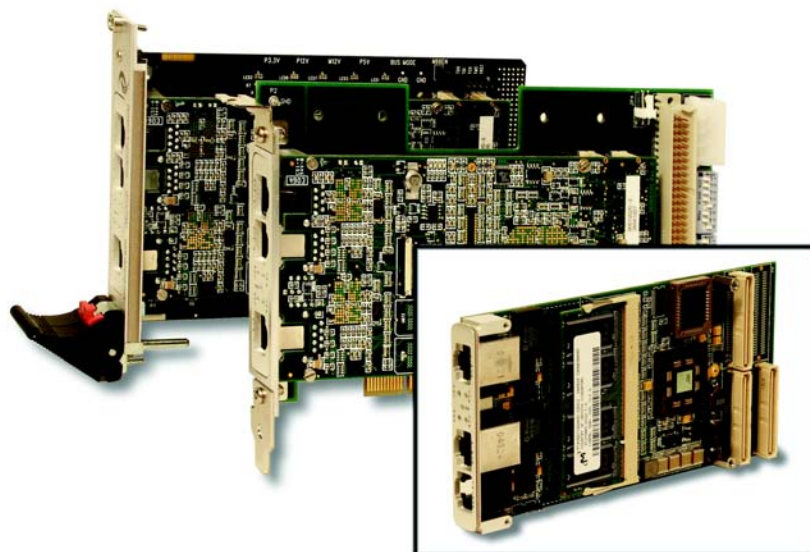
Features

- 2 Ports at 10 or 100 Mbps
- Dual-redundant or independent
- Transmit, receive, and monitor
- On-board integrity, redundancy, and transmit flow control
- Gathers wide range of statistics (MIB support)
- Packet time tagging
- Extensive filtering
- Error detection and injection
- Available in PCI, cPCI, and PMC
- Interactive and API software
- Optimized onboard recording and VL/Port processing offloads host processor

Description

The Ballard AFDX family of products interfaces various computer platforms with Ethernet based aircraft data networks. They enable computers with PCI, cPCI, or PMC expansion slots to receive, transmit, and monitor data over an Avionics Full Duplex Switched Ethernet (AFDX) network. These products meet the demanding requirements of the AFDX and ARINC 664 Aircraft Data Networks (ADN) used on the newest Airbus and Boeing aircraft.

Engineers and technicians use Ballard AFDX products for development, production, and maintenance of AFDX equipped products and systems. Ballard AFDX products are used as testers of end systems, as simulators of network switches and end systems, and as databus analyzers for measuring and recording network performance. Applications for the Ballard AFDX products are found in engineering laboratories, in avionics and airframe factories, on the flight-line, and in maintenance facilities.



The Ballard AFDX family consists of different models with varying levels of functionality. The base model permits functional operation of the transmitters and receivers or capturing bus activity through a sequential monitor. More advanced models allow operation of the transmitters and receivers while concurrently monitoring. All models capture numerous network characteristics, providing a statistical record of errors and performance. User controlled filters can limit the results to only those of interest. Additionally, advanced models can also be programmed to transmit different kinds of errors for the purpose of verifying how equipment or systems respond to error conditions.

A powerful dedicated on-board processor (PowerPC®) handles the AFDX protocol, freeing the host processor for user applications. Integrity checking, redundancy management, and flow control (scheduling) are all built-in to the firmware running on the on-board processor. Additionally, direct

memory channels provide increased data throughput to the host.

Software

The easiest way to use Ballard AFDX products in a Windows environment is with Ballard's CoPilot® AFDX software, which provides interactive access to network information and data without software programming. The intuitive Windows environment enables users to quickly and easily analyze and simulate AFDX network activity.

The Application Program Interface (API) provides high-level functions that enable custom software applications to be developed with only a few function calls. API functions configure the hardware to handle the desired Virtual Links (VLs), sub-VLs, sampling ports, and queuing ports. Extensive scheduling capability allows the user to control the sequencing of packets transmitted on the network. The API accesses data through sampling and queuing



AFDX Functional Specifications

General

- Redundant or independent operation
- VL support and Sub-VL support
- Queuing and sampling ports
- No pre-determined limit to number of VLs or ports per VL
- Non-standard addressing support (MAC, IP, etc.)
- Standard MIB (Management Information Base) plus additional statistics
- Configurable RSN (Redundancy Sequence Number) usage
- Packet time-tagging at 1 μ s resolution
- Direct memory channel data transfer (DMA)
- BAG error detection
- Skew measurement
- Jitter analysis
- Triggering

Transmitter

- Traffic shaping using BAG (Bandwidth Allocation Gap)
- Automatic scheduling based on VL's BAG and port rates
- Sub-VL scheduling with *Bandwidth Conservation* logic
- Flexible custom scheduling of VLs and ports
- Asynchronous single-shot transmission of any packet frame
- Packet to network control (A/B/A&B)
- Configurable queuing port depth
- Actively modify transmit data
- Configurable frames (headers and payload)

Receiver

- Automatic VL and Port detection
- Configurable integrity and redundancy checking
- VL and port filtering
- Default port for non-filtered AFDX packets
- Non-AFDX packet handling for host processing
- Configurable queuing port depth

Monitor

- Records packets with time-tag, header, data, and status information
- Monitor all or a selective groups of packets (filtering)
- Filtering options
 - VL, port, network
 - Packets with errors
 - Undefined packets
 - Protocol
- Summary mode records header information without payload
- Continuous or fill and halt operation

Error Injection

- Timing errors
 - BAG violation
 - Inter-frame gap (4-63 byte times)
 - Packet flooding
 - Dynamic transmit frame time scaling (parametric frame frequency)
- Logical errors
 - Frame size
 - Data alignment
 - Layers 2, 3, 4 (i.e., IP address, IP version, CRC, length, etc.)
- AFDX protocol errors
 - Multiple sources for same destination port
 - Port rate
 - Redundancy

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Technology

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Specializing in avionics databuses

MIL-STD-1553
ARINC 429/575/629/708/717
AFDX/ARINC 664
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AFDX

Ordering Information

Model	A	B
Transmit and Receive	✓	✓
Bus Monitor	✓	✓
Filtering	✓	✓
Concurrent with Tx/Rx		✓
Error injection		✓

Levels of functionality for AFDX products

PMC

- PMC form factor (149 x 74 mm)
- PCI/PCI-X interface
 - 32/64-bit
 - 33/66 MHz (PCI)
 - 66-133 MHz (PCI-X)
 - 3.3V I/O
- P/N: LM-AFDX-1x (x = model)

PCI

- PCI carrier (short) w/ PMC module
- PCI/PCI-X bridge (i31154)
 - 32/64-bit
 - 33/66 MHz (PCI)
 - 66-133 MHz (PCI-X)
 - 5V/3.3V I/O
- P/N: LP-AFDX-1x (x = model)

cPCI

- cPCI carrier (3U) w/ PMC module
- PCI bridge (i21154)
 - 32/64-bit
 - 33/66 MHz
 - 5V/3.3V I/O
- P/N: LC-AFDX-1x (x = model)

CoPilot AFDX

- Graphical User Interface for testing, simulation, and analysis
- View and edit data in Engineering Units
- Record and generate bus activity
- Inject errors
- Available in Standard and Plus versions
- Can be bundled with hardware or ordered separately

Contact Customer Support at Ballard Technology for the availability of our AFDX family of products.

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