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Avionics Databus Solutions

ANET-MxAy

Single or Dual Stream MIL-STD-1553 A/B & 4, 8 or 12 Channel ARINC429 Mixed Protocol Test & Simulation Module for Standard Ethernet

Data Sheet

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ANET-MxAy

General Features

The ANET-MxAy is a new member of AIM's line of Ethernet based modules for analysing, simulating, monitoring and testing of MIL-STD-1553 plus ARINC429 channels with a single interface device. Variants supporting up to 2 MIL-STD-1553 streams and up to 12 ARINC429 channels are available.

The MIL-STD-1553 bus section concurrently acts as Bus Controller, Multiple Remote Terminals (31) and Chronological/Mailbox Bus Monitor. A full range of MIL-STD-1553 protocol errors can be injected/detected.

Versions with reduced functionality (Single Function or Simulator Only) are available as well as dockable versions for use in ADock Docking Stations.
The physical bus interface provides transformer coupling and fixed output amplitude to the MIL-STD-1553A/B bus.

The ARINC429 section offers up to 12 channels, which are software programmable for Receive (Rx) or Transmit (Tx) mode. All transmitters have fixed output amplitude.

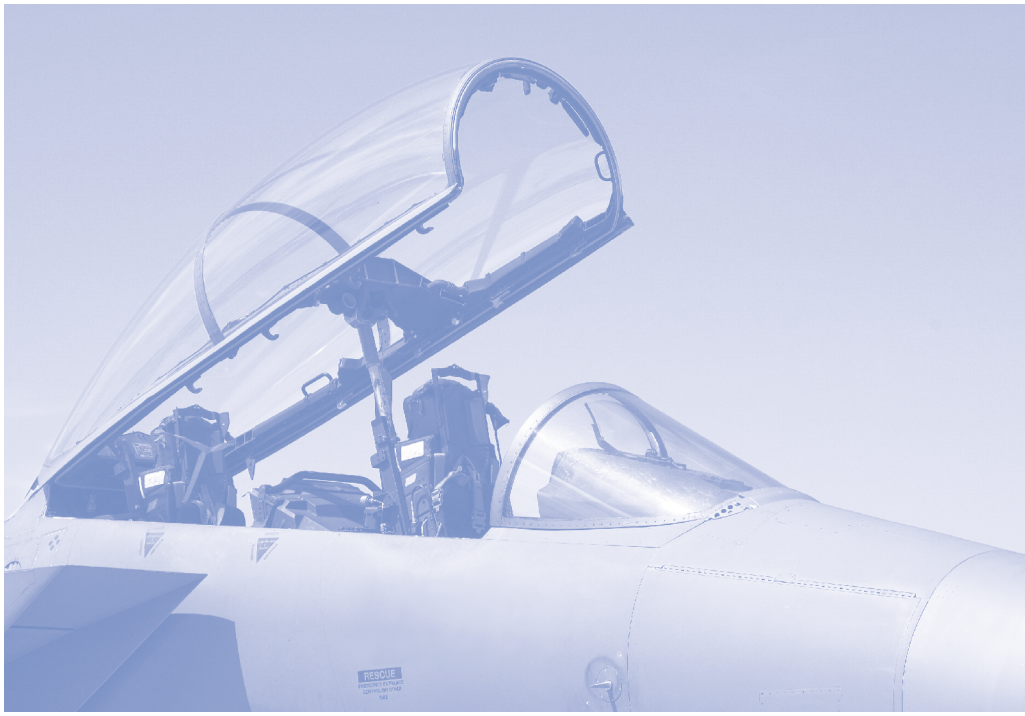
All ANET-MxAy modules have the capability to handle 8 General Purpose Discrete I/O (GPIO) signals which can be monitored or generated. Discrete I/O's can be controlled via the MIL-STD-1553 or the ARINC429 API. 1 Trigger Input and 1 Trigger Output is available per bus section (MIL-STD-1553 and ARINC429).

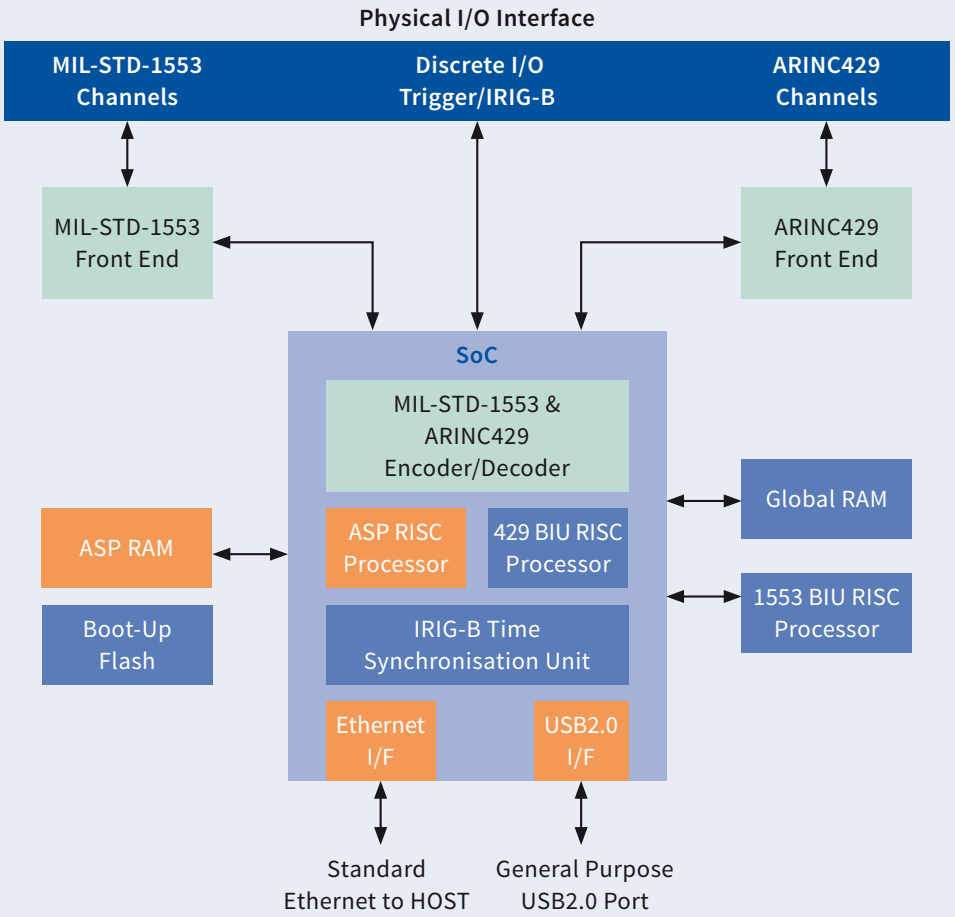
The ANET-MxAy modules use AIM's 'Common Core' hardware design utilising 2 RISC processors with 24MB of Global RAM in total for the MIL-STD-1553 and ARINC429 Bus Interface Units (BIUs). The onboard ASP (Application Support Processor) with 1GB RAM memory, which is based on a SOC (System-On-Chip) hardware device, is running under LINUX OS. This offers a scalable and flexible platform for hosting various onboard applications.

A general purpose USB 2.0 port is available e.g. for USB memory devices, USB WLAN, used by the onboard OS and onboard applications such as customer specific programs or the PBA.pro™ engine.
An onboard IRIG-B formatted time encoder/decoder is included with sinusoidal output and 'free wheeling' mode for time tag synchronisation on system level using 1 or more ANET-MxAy modules. Time stamping from a common external IRIG-B source or derived from the onboard battery buffered Real Time Clock (RTC) is available to both bus sections (MIL-STD-1553 and ARINC429). Time source control is configurable via the ANET Web frontend.

Full function software support for application development on Windows and LINUX hosts is delivered with the ANET-MxAy modules in a comprehensive Board Software Package (BSP). Per default, the ASP executes the AIM Network Sever (ANS) for use by customer applications via the standard AIM Application Programming Interfaces. The execution of customer written Python scripts on the Application Support Processor of the ANET-MxAy is also supported per default. For the development and execution of onboard customer applications written in C/C++, an optional software tool set (ANET-ADK) is available. The optional PBA.pro Engine for execution onboard offering a higher level control of the ANET is also available. The use of onboard processing capabilities enables autonomous operation with minimal interaction with the host PC.

The standard PBA.pro™ Databus Test & Analysis Tool for Windows or Linux based hosts can also be purchased for use with ANET-MxAy modules as well as support for ARINC615-3 Data Loading via PBA.pro or the standalone ARINC615-3 Data Loader.





ANET-MxAy
Block Diagram

MIL-STD-1553 Bus Section

Bus Controller

The ANET-MxAy modules provide real time Bus Controller functions on each independent, dual redundant MIL-STD-1553A/B databus channel, concurrently with Multiple RT and Chronological Bus Monitor operation.

A dedicated onboard RISC processor for up to 2 dual redundant Bus Interface Units provides true simulation of BC operations without host computer interaction.

Key features of the Bus Controller Mode include:

- Autonomous Operation including Sequencing of Minor/Major Frames
- Acyclic Message Handling
- Programmable BC Retry without Host Interaction
- Full Error Injection down to Word and Bit Level
- Multi-Buffering with Real Time Data Buffer Updates
- Synchronisation of BC Operation to external Trigger Inputs
- 4µs Intermessage Gaps
- Interrupt Generation on BC Transfer Events
- Start on external Trigger Input/Strobe external Trigger Output

Multiple Remote Terminal

The ANET-MxAy modules simulate up to 31 Remote Terminals, including all sub addresses on each MIL-STD-1553 channel, concurrently with BC and Chronological Monitor operation. Alternatively each of the 31 RT's can operate in message oriented Mailbox Monitor Mode to monitor non-simulated RT's.
Key features of the Remote Terminal Simulation Mode include:

- Programmable RT Response Time down to 4µs for each simulated RT
- Programmable & Intelligent Response to Mode Codes
- Full Error Injection down to Word and Bit Level
- Multi-Buffering with Real Time Data Buffer Updates
- Mailbox Monitor Mode
- Interrupt Generation on RT Events

Physical Bus Replay

The ANET-MxAy modules can electrically reconstruct and replay previously recorded MIL-STD-1553A/B record files physically to the MIL-STD-1553A/B bus with excellent timing accuracy.
Record files can be selected for Bus Replay. The additional capability to disable any or all RT responses from the MIL-STD-1553A/B replay enables smart systems integration and test to be performed.

Physical Bus Interface

The physical bus interface provides transformer or direct coupling (via assembly option, transformer coupling is the factory default) with fixed output amplitude.

Chronological Bus Monitor

The ANET-MxAy modules provide full bus monitoring and analysis with time tagging of all bus traffic with 1µs resolution including response time and gap time measurement down to 250ns concurrently with BC and Multi RT operation.

Key features of the Chronological Monitor include:

- 100% Data Capture on each Channel at full Bus Rates
- Single Shot, Continuous or Selective Capture Modes
- Autonomous Message Synchronisation and Full Error Detection
- 2 Dynamic Complex Triggers with Sequencing
- Message Filter and Selection Capture
- Bus Activity Recording independent from Trigger and Capture Mode
- Time Tagging:
  - All Bus Traffic to 1µs
  - Intermessage Gaps & Response Time to 250ns
- External Trigger Input & Output
- Programmable Response Time-Out

ARINC429 Bus Section

Receive Channel Operation

ANET-MxAy modules provide real time monitoring of up to 12 ARINC429 Receiver Channels concurrently controlled by a dedicated onboard RISC Processor for ARINC429 section.

The Receiver Channels can individually be operated at 12.5kbit/s or 100kbit/s, programmed via software.

- Label Oriented Receive Mode (individual Buffers for each Label with Multi-Buffering and Real Time Updates)
- Chronological Receive Mode per Channel with 1µs Resolution Time Stamping
- Chronological Mode concurrent to Label Oriented Receive Mode
- Local (1 Buffer per Channel) or Global Monitoring (1 Buffer all Channels)
- Continuous or Single Shot Capturing Modes
- Support of SDI Handling
- Interrupt Generation on Label Reception Events (configurable per Label/SDI)
- Complex Triggering and Filtering Functions
- Loop of received Data to configurable Transmit Channel with Label Data Modification Capability
- High Accuracy FPGA based Label Time Stamping with 1µs Resolution

Transmit Channel Operation

ANET-MxAy modules provide real time simulation of up to 12 ARINC429 Transmitter Channels concurrently controlled by the dedicated onboard RISC Processor for the ARINC429 section via instruction lists.

Transmission rates are software selectable for each channel at 12.5kbit/s or 100kbit/s with the associated rise/fall time in accordance with the ARINC429 electrical specification.

- Cyclic/Acyclic Label Transmission and Channel Loop Mode (re-transmission of Labels from a Receiver)
- FIFO Mode for Label Transmission driven by Application
- Error Injection for each Label Transfer: Short Gap, Parity, Bit Count, Coding
- Programmable Gap between Labels: 0 to 255-bit
- Simulate Zero-Jitter Scenarios using Virtual Label Transfers
- Multi-Buffering with Real Time Update supported per individual Label Transfer
- Reconstruction of previously recorded ARINC429 Traffic physically to the Bus with excellent Timing Accuracy (Physical Replay)
- Interrupt Generation on Label Transmit Events (configurable per Label Transfer)

Physical Bus Replay

The ANET429-x can electrically reconstruct and replay previously recorded ARINC429 channels physically to the ARINC429 bus with excellent timing accuracy. Record files can be selected for Bus Replay.
The additional capability to disable any or all ARINC429 labels from the replay enables smart systems integration and test to be performed.

Loop-back and Pollution Mode

Receive and Transmit Channels can be paired to form a ‘Loop-back’ couple. Data received from the Receiver Channel are automatically transmitted on the selected Transmitter Channel with minimum delay (onboard processing, no host software involved). A special receiver Function Block mode can be used to modify (pollute) the received label prior to its re-transmission.

Physical Bus Interface

ANET-MxAy modules have integrated ARINC429 Line Transmitter/Receiver Channels and selectable transmission rate for each single channel independently.
The channel type Transceiver/Receiver can be programmed individually via software.

Common for both Bus Sections (MIL-STD-1553 and ARINC429)

Trigger-/General Purpose Discrete I/O Signals

The Auxiliary I/O connector provides 1 Trigger Input and 1 Trigger Output dedicated to the MIL-STD-1553 section and 1 Trigger Input and 1 Trigger Output dedicated to the ARINC429 section. Additionally up to 8 user programmable General Purpose Discrete I/O signals, S/W controllable from MIL-STD-1553 and ARINC429 section (dependent on user defined configuration/assignment via Web front end), can be accessed via the Auxiliary I/O connector.
Voltage levels of all trigger signals and General Purpose Discrete I/O’s are TTL compatible whereas the General Purpose Discrete I/O's are designed to handle avionics level as well.

IRIG-B Time Encoder/Decoder

ANET-MxAy modules include an onboard IRIG-B time encoder/decoder with sinusoidal output and ‘free-wheeling’ mode for time tag synchronisation. This allows synchronisation of multiple ANET-MxAy modules and other AIM modules to a common IRIG-B time input source or to the onboard Real Time Clock (RTC) of an ANET-MxAy x module as the reference for the correlation of data across multiple MIL-STD-1553 and ARINC429 streams.

Software Support

The Driver Software is supplied with the ANET-MxAy module. Full functional Application Programming Interfaces (APIs) are provided compatible with Windows and Linux. Host applications can be written in C and C++. LabView VI application interfaces are also provided (Windows only).
The 2 bus sections (MIL-STD-1553 and ARINC429) are basically handled as 2 separate devices via their dedicated APIs. Common resources for both bus sections of the ANET-MxAy, like the Real Time Clock and Discrete I/O’s are configured via the Web based configuration application. Furthermore the ANET-MxAy LINUX OS on the ASP is preconfigured for the support of Mass Data storage devices and an optional WiFi Stick at the USB port, and with a Python installation for the execution of Python scripts.
The entire configuration of the ANET-MxAy is supported via a built-in Web based configuration application, accessible via any standard Web browser.

Technical Data

System Interface
10/100/1000Mbit/s IEEE802.3 Standard Ethernet Interface

Processors
2 dedicated RISC Processors, 1 for the MIL-STD-1553 Bus Interface Units (BIU) and 1 for the ARINC429 BIU plus 1 dedicated Application Support Processor (ASP)

Memory
1GB DDR3-SDRAM (ASP-RAM & Global RAM for ARINC429 section), 16MB SRAM (Global RAM for MIL-STD-1553 section) and 512MB Flash Memory for ASP

Encoder/Decoder
Up to 2 MIL-STD-1553A/B Encoder/Decoder with full error injection and detection;
Up to 12 ARINC429 Encoder/Decoder with full error injection and detection

Time Tagging
Sinusoidal 46-bit absolute IRIG-B formatted Time Stamping with 1µs resolution (based on external IRIG-B or internal Real Time Clock)

Trigger I/O
1 Trigger Input and 1 Trigger Output Line per bus section, TTL compatible on Auxiliary connector

General Purpose Discretes
8 bi-directional Discrete I/O Signals on Auxiliary connector

Physical Bus Interface
1 or 2 MIL-STD-1553A/B Transceivers with fixed Output Amplitude, Transformer or Direct Coupling mode (via assembly option, transformer coupling is the factory default); Up to 12 ARINC429 Line Transmitters and 12 ARINC429 Line Receivers for a total of 12 channels concurrently; channels are fully software programmable for Rx or Tx; all Transmitter Channels with fixed output amplitude

MIL-STD-1553 Connectors
9-pin D-Sub connector socket (female) (compatible to AIM standard adapter cables ACB-PCI-1 and ACB-PCI-2, not included)

ARINC429-Connectors
26-pin High Density D-Sub connector socket (female)

Ethernet
RJ-45 Standard Ethernet connector socket (female)

Auxiliary I/O
15-pin High Density D-Sub connector socket (female) for Discrete I/O, IRIG-B and Trigger Signals

DC Power
Standard DC low voltage power jack connector (2,5mm)

USB Port
1 general purpose USB 2.0 port via Type A connector

Power Supply
Wide range 9 to 36VDC Power Input (suitable external power adaptor included 110-240VAC, 50-60Hz, for mains connector types A/C/G)

Dimensions
160mm x 120mm x 26mm (without connectors)

Weight
~460g (ANET-M2A12)

Power Consumption
M1A4: 7.4W
M2A8: 8.6W
M2A12: 9.1W

Operating Temp. Range
Standard Temperature Range: 0° to 50°C
Extended Temperature Range: -15° to 60°C

Storage Temperature
-40° to 85°C

Humidity
0 to 95% non-condensing

Ordering Information

ANET-MxAy
Mx: MIL-STD-1553 Stream Option
M1 = 1 Stream
M2 = 2 Streams
Ay: ARINC429 Channel Options
A4 = 4 Channels
A8 = 8 Channels
A12 = 12 Channels

ANET-USB-WIFI USB
WiFi Dongle, compatible to ANET Devices

ANET-ADK
ANET onboard Software Development Kit including documentation, samples and tool chain; requires LINUX based development platform

Single Function
(MIL-STD-1553 Section only) versions available
Chronological & Mailbox Monitor OR BC and Chronological & Mailbox Monitor OR Multi-RT and Chronological & Mail-box Monitor

Dockable Version
(for use in AIM ADock Docking Stations) available upon request,
please add -D to the part number.

ANET-MxAy-ENG
ANET-MxAy module with embedded PBA.pro Engine Software:
Including Test and Script Manager and Database Manager Functionality

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