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# AXM1553T

## C-Size VXI Module for MIL-STD-1553B Simulation and Test



### General Features:

The AXM1553T board is an advanced VXI C-Size register based module for testing, simulation, and monitoring of serial bus systems in accordance with MIL-STD-1553B. The AXM1553T implements two comprehensive functions:

- **Bus Simulator**
- **Bus Monitor/Analyzer**

Both basic functions are available concurrently at full performance level.

The bus simulator functions of the AXM1553T allows the user to simulate the Bus Controller (BC) and up to 31 remote terminals (RT) in addition to the Broadcast RT simultaneously. Non-simulator RTs can be configured in a Mailbox Monitoring mode as a Monitor Terminal. For both simulation modes, full protocol error injection is available, which is individually programmable for each transfer.

In parallel, the Chronological Monitor function provides full bus monitoring, error analysis, and activity recording. A comprehensive two-level time-tagging scheme for capturing bus traffic allows detailed performance analysis of the monitored bus.

The AXM1553T module offers unique trigger input and output capabilities via the VXI bus TTL trigger facilities and the front panel connectors.

4 Mbytes of RAM is provided on the module to support on-board storage of large dynamic simulation data sets and of captured bus traffic.

## Functional Characteristics

### BC Simulation

In BC mode, the AXM1553T executes autonomous instructions set up in the interface memory. The comprehensive instruction set allows the user to implement minor and major frame timing completely at the board level, minimizing the required host interaction. The BC response timeout is programmable, as well as intermessage gaps. Message buffer allocation, error injection, and host interrupt generation

are programmable individually for each transfer instruction. Each transfer instruction is stored only once in the AXM1553T memory, even when used in multiple minor frames.

To support validation testing of RTs, the AXM1553T can simulate Bus Controller intermessage gaps down to four microseconds.

All types of transfers, including broadcast and mode code transfers, as defined in MIL-STD-1553B are supported.

## Multiple RT Simulation

The AXM1553T can simulate up to 31 RTs along with the Broadcast RT. For each simulated RT all subaddresses can be programmed individually including message buffer allocation, error injection, and interrupt generation. Interrupts can be programmed for specific subaddress access or mode code reception, and on error conditions. The Response Time of each RT is individually programmable with a resolution of 0.25 microseconds. All message buffers and status word locations are updated in real-time. Message buffers and subaddress descriptors can be updated during simulation at any time without corrupting RT simulation.

To support consistency of message data, programmable double buffering is provided on the AXM1553T for all RT message buffers.

Non-simulated RTs can act as a Monitor Terminal by the RT simulation function of the AXM1553T. This Mailbox Monitoring is a message oriented monitoring of bus traffic whereby the captured messages are stored in RT/Subaddress specific buffers.

## Error Injection Capabilities

For BC and MRT simulation,the AXM1553T provides full protocol error injection capabilities:

- SYNC pattern programmable on a half-bit basis;
- Manchester Error (low or high) in any word or bit position;
- Bit Count High and Low errors;
- Word Count High and Low Errors;
- Data Contiguity errors;
- Parity errors;
- Wrong Bus errors.

The position (word and bit) for the error injection can be specified precisely for each message.

In BC mode, the AXM1553T can generate overriding command sequences for all types of commands.

## Bus Monitor Operation

The Bus Monitor function of the AXM1553T provides comprehensive bus monitoring and analysis features with powerful hardware trigger and programmable capture facilities.

**Trigger Facilities:**

The AXM1553T implements a two-level complex triggering facility, where two trigger conditions can be combined in an 'AND', 'OR', or 'ARM' combination. Each individual trigger condition can be on:

- Data condition (including range checking on all or part of a specific data word);
- Error condition;
- Bus word (Command Word, Status Word, or Data Word, whereby individual bits can be masked via a 16 bit mask word)

On a single trigger condition and/or the complex trigger event, an external trigger strobe can be generated.

**Data Capture and Time Tagging:**

The AXM1553T captures bus traffic in a chronological manner. Data is tagged using a two-level time tagging scheme. A global time tag with a resolution of one microsecond and a width of 26 bits tags each message. Response times and intermessage gaps are measured with a 0.25 microsecond resolution. In cases of errors, detailed information is stored in the monitor stack of the AXM1553T.

The AXM1553T has two capture modes. Bus traffic capturing for each mode can be selective based on specific messages or groups of messages using the message filter capability of the AXM1553T. Filtering can be specified to the RT/subaddress level, implementing up to 2048 message filters.

- Standard Capture Mode:

The position of the trigger event within the monitor buffer is determined by means of a 'Trace after Trigger Count', which specifies the number of entries to be stored within the monitor buffer after the trigger event has been detected.

- Capture Only Mode:

  This mode can be used to capture a pre-defined number of messages each time the complex trigger event has been detected.

The stack size allows the user to store up to5128K entries, where an entry is defined as a 32 bit value containing general tag information and a Time Tag value, or a bus word and error analysis information.

**Activity Recording:**

Independent from trigger and capture setup, the APC153T Bus Monitor function provides a bus activity recording facility which counts the number of transfers and the number of errors that occur for each RT/Subaddress. Each of the 2048 counters (Transfer and Error counters for each RT/Subaddress combination) is 31 bits wide, allowing long-term statistics of the bus traffic.

## Bus Media Interface

The interface of the AXM1553T to the physical bus medium is programmable, offering the following options:

- Bus Coupling — Isolated; Direct Coupled; Transformer Coupled
- Bus Signal Amplitude — Direct Coupled: 0..6.5V; Transformer Coupled: 0..19.5V

Relays are used to select proper termination when isolated and to select limiting resistors for direct coupling.

## External Trigger Input/Output Facilities

The AXM1553T module implements powerful trigger input and output facilities, which are programmable by the user and can be routed to or from the VXI TTL trigger lines or via the BNC connectors at the front plate.

Trigger outputs can be generated on Monitor events (single or complex trigger) or on Simulator events such as specific transfer executed, error detected, minor frame start, and programmable timer expired.

In a similar way, trigger inputs can be configured to control Simulator operation (start of minor frame, start of operation) and Monitor operation (trigger monitor, start monitor).

## Sybsystem Interface

The AXM1553T is a register based VXI device implementing the following features:

- Slave only;
- Options D8, D16, A16, A32;
- One VXI interrupt line used
- Register based VXI device with four VXI configuration and control registers;
- MODID line termination and handling

The AXM1553T occupies either 1 Mbyte or 4 Mbytes of address space depending on the model selected.

## Support Software

The AXM1553T is supported with a plug&play VXI driver and LabVIEW and LabWindows interfaces. Drivers are included in the module price.

Optionally, a comprehensive driver software package implemented in C language is available with the AXM1553T. Functions selectable by the Application Software are grouped as follows:

- **System Functions:** For general interface control and administrative functions
- **Buffer Functions:** For definition and reading of message data in BC and RT modes
- **BC Functions:** Bus Controller mode control
- **RT Functions:** Remote Terminal mode control

- **BM Functions:** Bus Monitor mode control
- **CAL Functions:** Bus coupling/connection/amplitude control

Contact Technical Support for the latest on supported operating systems.

# Technical Data

**Subsystem Interface:**

VXI slave, options D8, D16, A16, A32

One interrupt line

VXI register based device

Up to 8 VXI TTL trigger lines configurable as inputs or outputs

**Processors:**

Two 16MHz microcoded Controllers (one for Simulator and one for Monitor functions)

Single cycle instruction execution

Reprogrammable microcode memory

**Memory:**

4 Mbytes of fast static RAM on the AXM1553T, split as half for Simulator functions and half for the Monitor

**Decoder:**

Manchester decoder with parity checker and error detection

Timer for Response Time measurement

**Encoder:**

One full function Manchester encoder with parity generation and full error injection

One standard Manchester encoder and parity generation used for superseding command generation

**Bus Network Frontend:**

Dual-redundant trapezoidal MIL-STD-1553B transceiver with programmable amplitude

Isolation/connection and direct/transformer coupling options are relay controlled and software selectable

**Connectors:**

VXI 96 Pin backplane connectors;
Two Trompeter BJ77 frontplate connectors for bus signals;
Two BNC frontplate connectors for trigger input/output;

**Dimensions:**

Standard C-Size VXI module
340mm by 233mm by 30mm

**Power Consumption (typical):**

4.5 Watts @ +5V;
5 Watts @ ±12V

**Temperature Range:**

+5º to +45º C ambient (standard)

**Relative Humidity:**

5% to 95% non-condensing

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