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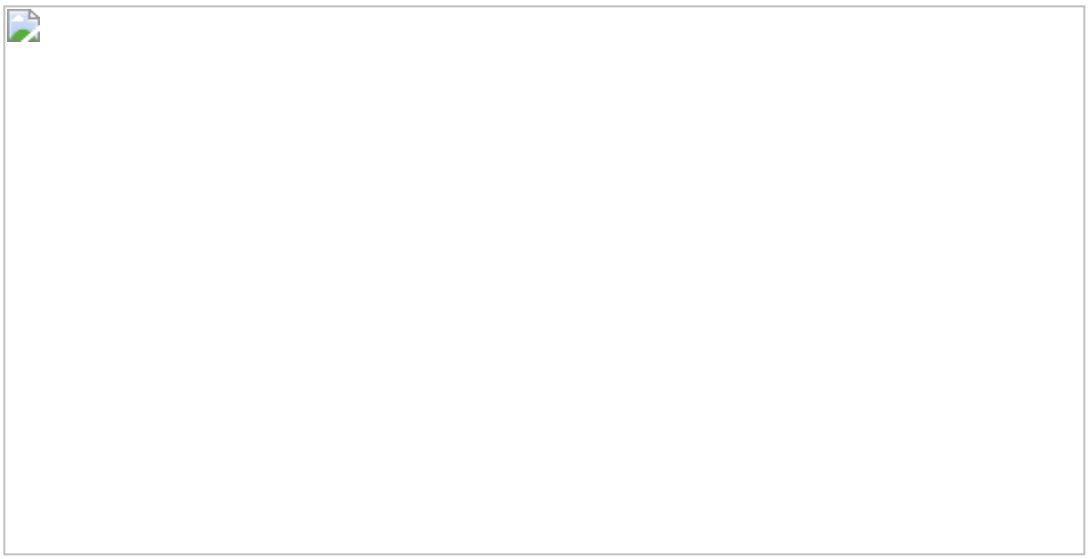
APC1553T

MIL-STD-1553B/MACAIR Simulator and Tester Board for PC/AT

General Features:

The APC1553T board is an advanced PC/AT interface for testing, simulation, and monitoring of serial bus systems in accordance with MIL-STD-1553B and MACAIR A3818. The APC1553T 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 APC1553T allow the user to simulate the Bus Controller (BC) and up to 32 remote terminals (RT) simultaneously. For both simulation modes, full protocol error injection is available, which is individually programmable for each transfer.

In parallel, the Monitor function provides full chronological 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.

Functional Characteristics

BC Simulation

In BC mode, the APC1553T 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, significantly reducing 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 APC1553T memory, even when used in multiple minor frames.

To support validation testing of RTs, the APC1553T can simulate Bus Controller intermessage gaps down to four microseconds.

A programmable double-buffered scheme is provided for BC and MRT simulation to support message data consistency.

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

In addition, BC operation can be synchronized to an external trigger input.

Multiple RT Simulation

The APC1553T can simulate up to 32 RTs. 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 down to 3 microseconds dead time on the bus. 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.

Non-simulated RTs can act as a Monitor Terminal by the RT simulation function of the APC1553T. 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 APC1553T 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 APC1553T can generate overriding command sequences for all types of commands.

Bus Media Interface

The interface of the APC1553T 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.

The standard APC1553T board is equipped with trapezoidal transceivers for MIL-STD-1553B applications. Optionally, the board is available with sinusoidal transceivers typically used for MACAIR applications. Modification to protocol for MACAIR is also available.

Bus Monitor Operation

The Bus Monitor function of the APC1553T provides comprehensive bus monitoring and analysis features with powerful hardware trigger and programmable capture facilities.

Trigger Facilities:

The APC1553T 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:

- Elapsed time;
- Error condition;

- Bus word (Command Word, Status Word, or Data Word, whereby individual bits can be masked via a 16 bit mask word)

For triggers on data words the user can specify a specific value or a range.

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

An external trigger input is also provided, which allows the user to trigger bus monitor operation from an external source.

Data Capture and Time Tagging:

The APC1553T 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 22 bits tags each message. Additionally, a separate 16 bit counter is available to count timer resets, providing gross scale measurements which can be concatenated to the 22 bit time tag for extended precision. 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 APC1553T.

The APC1553T has three 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 APC1553T.

- Start: The trigger condition starts data capturing in the stack.
- Center: Half of the stack is filled with pre-trigger bus traffic and the other half is filed with post-trigger bus traffic.
- End: Bus traffic is captured until the trigger event occurs. A full history from before the trigger event is available in monitor memory.

The stack size allows the user to store up to 28K 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.

PC/AT Bus Interface

The APC1553T can be used in any 8 or 16 bit AT bus slot. The bus width can be programmed via an I/O register. The 16 bit wide access option provides considerable improvement over 8 bit only interface boards. This allows the user to achieve a high level of real-time simulation and dynamic data handling capabilities even on a PC/AT platform.

The APC1553T uses one Interrupt Request line of the PC/AT which can be configured via jumpers.

The APC1553T comprises a total of 256 Kbytes of RAM mapped into the 1 Mbyte real address space of the PC/AT as eight 32 Kbyte pages. Address mapping and page addressing is controlled by an I/O register on the APC1553T. As a result only 32 Kbytes of the real address space is occupied by the APC1553T.

Support Software

The APC1553T is delivered with the object code of a DOS device driver and a C language interface. For Windows 3.1x/95/98/NT applications the driver software is available as a Dynamic Link Library (DLL). The functions available to 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

Interface software for LabVIEW and LabWindows is optionally available.

A comprehensive Windows 3.11/95/98/NTsoftware package called the 'PBA-2000', which implements full bus tester and analyzer features on any PC/AT equipped with an APC1553T board, is optionally available. Via an advanced menu driven interface, the user can setup and control the Bus Simulator for BC and MRT mode operation and control the Bus Monitor. The PBA-2000 software supports one or two APC1553T boards and also allows hard disk logging of captured bus traffic and electrical playback modes. A parameterized version of the software, PBA-2000-P, is available which supports the definition and display of engineering units and graphical display for visual data identification.

Technical Data

Subsystem Interface:

PC/AT slave, Byte or Word access

One interrupt line configured via jumpers

Processors:

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

Single cycle instruction execution

Reprogrammable microcode memory

Memory:

Total of 256 Kbytes of fast static RAM on the APC1553T, split as 128 Kbytes (64K x 16) for Simulator functions and 128 Kbytes (64K x 16) 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, with optional sinusoidal transceiver for MACAIR applications

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

Connectors:

PC/AT slot edge connector;
9 Pin D-Sub for 1553 bus signals;
BNC connector for trigger output;
BNC connector for trigger input

Dimensions:

Full size PC/AT board, 333mm x 105mm

Power Consumption (typical):

5 Watts @ +5V;
4.5 Watts @ ±12V

Temperature Range:

+5° to +45° C ambient

Relative Humidity:

5% to 90% non-condensing

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