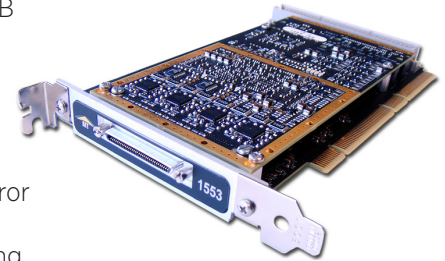## PCI-C1553

Dual-Redundant Single, Dual, or Quad Stream Full-Function MIL-STD-1553A/B Test & Simulation PCIbus Module

The PCI-C1553-1/2/4 is part of a new family of PCIbus cards offering full function test, simulation, monitoring and databus analyzer functions for MIL-STD-1553A/B applications. One single dual-redundant MIL-STD-1553A/B stream on the PCI-C1553- 1 module (short length). Two independent dual-redundant MIL-STD-1553A/B streams are provided on the PCI-C1553-2 module (full length) and four independent dual-redundant MIL-STD-1553A/B streams are provided on the PCI-C1553-4 module.

The PCI-C1553 can be used for protocol testing and simulation of MIL-STD-1553A/B Bus Controller (BC), multiple Remote Terminals (RTs) and Chronological Bus Monitoring (BM) at full bus load. All operations are performed concurrently with no degradation of performance in any operating mode. The PCI-C1553 module incorporates full protocol error injection and detection features with software programmable output amplitude and bus coupling mode of the electrical bus signals. The module fully supports the protocol testing requirements defined by the BC and RT production test plans according to SAE AS4112/4114.

An onboard IRIG-B time encoder/decoder allows users to accurately synchronize single or multiple PCI-C1553 modules to a common time source. The use of an application support processor (embedded PowerPC in the Xilinx FPGA) executing the driver software allows application specific functions to be processed onboard, significantly off-loading the host PC Processor and the PCIbus. This new concept allows users to implement system level functionality on a single interface card. A carrier card has an optional set of tranceivers allowing software-controlled variable voltage and softwarecontrolled relays for data coupling. Without this option, the carrier simply provides transformer and direct coupling on separate pinouts and fixed output voltage.

DRIVER SOFTWARE SUPPORT

Since the driver software resides on the PCI-C1553 module, a high level application interface is provided that is compatible with Windows XP/7/8/10. Host applications can be written in MSVC, Visual Basic, Delphi, Borland C++ etc. LabVIEW/VI and LabWindows/CVI function panels are also provided.

EXTENDED FUNCTIONALITY CARRIER CARD

The Extended Functionality Carrier Card (-EF) provides programmable MIL-STD- 1553A/B transformer or direct bus coupling and variable output transceivers and a resistive bus termination to enable the direct connection of external BC or RT devices. The coupling mode to the external bus system is software programmable.

Key Features

- Dual redundant, single, dual, or quad stream configurations
- Concurrent BC, Multi-RTs, and BM operation
- Full error injection/detection capabilities
- FPGA-based Hardware Architecture
- Multi-level Trigger for Capture/Filtering
- IIRIG-B Time Encoder/Decoder with Free-wheeling mode
- Real-Time Recording and Physical Bus Replay
- Application Interface supporting C, C++, C#, and .net Development
- Device Driver Support: Windows, Linux, VxWorks, LabView, and other operating systems
- Conduction-cooling and/or conformal coating available
- Flight Simulyzer™ 1553 GUI Bus Analyzer Software

BUS CONTROLLER

AIT's PCI-C1553 provides real-time bus controller functions on one, two, or four dual-redundant MIL-STD-1553A/B buses concurrently with multiple RT and chronological monitor operation.

• Autonomous operation including sequencing of minor/
major frames

• Support for acyclic message insertion/deletion

• Programmable BC Retry without host interaction

• Full error injection down to word and bit level (AS4112
compliant)

• Multi-buffering with real-time data buffer updates

• Synchronization of BC operation to trigger inputs

MULTIPLE REMOTE TERMINAL

The PCI-C1553 simulates up to 31 RTs including all subaddresses on one, two, or four MIL-STD-1553A/B bus systems concurrently with BC and BM operation. Alternately, each of the 31 RTs can operate in a message oriented 'Mailbox Monitor Mode' to monitor non-simulated RTs.

• Programmable response time for each RT with fast RT
response at 4 -secs

• Programmable and intelligent response to mode codes

• Full error injection down to word and bit level (AS4112
compliant)

• Multi-buffering with real-time data buffer updates

CHRONOLOGICAL BUS MONITOR

The PCI-C1553 offers single, dual, or quad stream bus monitoring and analysis with programmable trigger and capture features. The Chronological Bus Monitor (BM) provides accurate time tagging of all bus traffic to 1 -sec resolution including response time and gap time measurements down to 250 nsec resolution concurrently with BC and multiple RT operation.

• 100% data capture on up to four streams at full bus rates

• Autonomous message synchronization and full error
detection

• Two static/dynamic complex triggers with sequencing

• Message filter and selective capture

• Bus activity recording independent from trigger and
capture mode

• External trigger inputs and outputs

• Programmable response time-out

PHYSICAL BUS REPLAY

The PCI-C1553 module is able to electrically reconstruct previously recorded MIL-STD-1553A/B databus traffic physically to the bus with excellent timing accuracy. Recorded data files can be selected for physical bus replay with the ability to disable any or all RT responses from the record file to perform systems integration and test.

Technical Data

| System Interface	64-bit 33/66MHz PCIbus (Rev 2.2) compliant
Processors	Embedded PowerPC (250MHz)
Memory	Two banks of 128 MByte DDR2 SDRAM (one for Tx/Rx buffers, one for PowerPC)
Encoder/Decoder	One, two, or four MIL-STD-1553A/B encoder/decoder with full error injection and detection capability
Time Tagging	14 Digit (400 days) absolute IRIG-B time, 1 msec resolution
Physical Bus Interface	One, two, or four MIL-STD-1553A/B trapezoidal transceivers, direct coupled stubs and transformer coupled stubs available at front panel or back panel connector
Connectors	68-pin VHDCI at front panel connector; all signals also available at rear I/O connector; 4x standard PMC connectors
I/O	Ten software programmable TTL I/O lines supporting up to 30V signaling with external reference supply
Dimensions	Standard single wide PMC; 143.7 x 74 mm; Hole and connector dimensions and locations per: ANSI/VITA 20-2001 (R2005)
Power Consumption	TBD
Operating Temp. Range	-40º C...+85º C ambient
Storage Temperature	-40º C...+85º C ambient
Humidity:	0 to 95% non-condensing

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PCIe-C1553

Single, Dual, or Quad Stream MIL-STD-1553A/B Test & Simulation PCI Express Module

AIT's PCIe-C1553-1/2/4 is part of a new family of PCIbus cards offering full function test, simulation, monitoring and databus analyzer functions for MIL-STD-1553A/B applications. One single dual-redundant MIL-STD-1553A/B stream on the PCIe- C1553-1 module (short length). Two independent dual-redundant MIL-STD-1553A/B streams are provided on the PCI-C1553-2 module (full length) and four independent dual-redundant MIL-STD-1553A/B streams are provided on the PCIe-C1553-4 module.

The PCIe-C1553 can be used for protocol testing and simulation of MIL-STD-1553A/B bus controller, multiple remote terminals and chronological monitoring at full bus load. All operations are performed concurrently with no degradation of performance in any operating mode. The PCIe-C1553 module incorporates full protocol error injection and detection features with software programmable output amplitude and bus coupling mode of the electrical bus signals. The module fully supports the protocol testing requirements defined by the Remote Terminal (RT) and Bus Controller (BC) production test plans according to SAE-AS 4112/4114.

The use of an application support processor (embedded PowerPC in the Xilinx FPGA) executing the driver software allows application specific functions to be processed onboard, significantly off-loading the host PC Processor and the PCIbus. This new concept allows users to implement system level functionality on a single interface card. A carrier card has an optional set of tranceivers allowing softwarecontrolled variable voltage and software-controlled relays for data coupling. Without this option, the carrier simply provides transformer and direct coupling on separate pinouts and fixed output voltage.
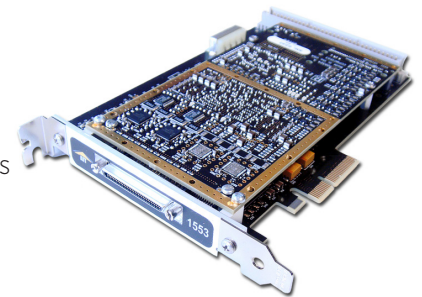
DRIVER SOFTWARE SUPPORT

Since the driver software resides on the PCIe-C1553 module, a high level application interface is provided that is compatible with Windows XP/Vista/7/8/10. Host applications can be written in MSVC, Visual Basic, Delphi, Borland C++ etc. LabVIEW/VI and LabWindows/CVI function panels are also provided.

EXTENDED FUNCTIONALITY CARRIER CARD

The Extended Functionality Carrier Card (-EF) provides programmable MIL-STD- 1553A/B transformer or direct bus coupling and variable output transceivers and a resistive bus termination to enable the direct connection of external BC or RT devices. The coupling mode to the external bus system is software programmable. Conduction-cooling is also available, according to primary and secondary ANSI/VITA-20-2001 (R2005) interfaces.

Key Features

- Dual redundant, single, dual, or quad stream configurations
- Concurrent BC, Multi-RTs, and BM operation
- Full error injection/detection capabilities
- FPGA-based Hardware Architecture
- Multi-level Trigger for Capture/Filtering
- Onboard IIRIG-B Time Encoder/Decoder with Free-wheeling mode
- Real-Time Recording and Physical Bus Replay
- ANSI Application Interface supporting C, C++, C#, and .net Development
- Device Driver Support: Windows, Linux, VxWorks, and LabView
- Flight Simulyzer™ 1553 GUI Bus Analyzer Software

ONBOARD PowerPC

An embedded PowerPC provides unique onboard processing functions typically provided by the host processing systems.

- Onboard driver software execution
- Control of RS232 debug port for firmware updates
- Dynamic data generation
- Automatic test sequence generation
- Onboard user application processing

IRIG-B TIME CODE ENCODER/DECODER

An onboard IRIG-B time code encoder and decoder allows synchronization of MILSTD- 1553A/B bus traffic using single or multiple PCIe-C1553 modules. Multiple modules can be synchronized using one common IRIG-B time source or the onboard time code generator of one module as the reference for accurate correlation of data across multiple MIL-STD-1553A/B data streams.

BUS CONTROLLER

AIT's PCIe-C1553 provides real-time bus controller functions on one, two, or four dual-redundant MIL-STD-1553A/B buses concurrently with multiple RT and chronological monitor operation.

• Autonomous operation including sequencing of minor/ major frames

• Support for acyclic message insertion/deletion

• Programmable BC Retry without host interaction

• Full error injection down to word and bit level (AS4112 compliant)

• Multi-buffering with real-time data buffer updates

• Synchronization of BC operation to trigger inputs

MULTIPLE REMOTE TERMINAL

The PCIe-C1553 simulates up to 31 RTs including all subaddresses on one, two, or four MIL-STD-1553A/B bus systems concurrently with BC and BM operation. Alternately, each of the 31 RTs can operate in a message oriented 'Mailbox Monitor Mode' to monitor non-simulated RTs.

• Programmable response time for each RT with fast RT response at 4 usecs

• Programmable and intelligent response to mode codes

• Full error injection down to word and bit level (AS4112 compliant)

• Multi-buffering with real-time data buffer updates

CHRONOLOGICAL BUS MONITOR

AIT's PCIe-C1553 offers single, dual, or quad stream bus monitoring and analysis with programmable trigger and capture features. The Chronological Bus Monitor (BM) provides accurate time tagging of all bus traffic to 1 -sec resolution including response time and gap time measurements down to 250 nsec

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resolution concurrently with BC and multiple RT operation.

• 100% data capture on up to four streams at full bus rates

• Autonomous message synchronization and full error detection

• Two static/dynamic complex triggers with sequencing

• Message filter and selective capture

• Bus activity recording independent from trigger and capture mode

• External trigger inputs and outputs

• Programmable response time-out

PHYSICAL BUS REPLAY

The PCIe-C1553 module is able to electrically reconstruct previously recorded MIL-STD-1553A/B databus traffic physically to the bus with excellent timing accuracy. Recorded data files can be selected for physical bus replay with the ability to disable any or all RT responses from the record file to perform systems integration and test.

Technical Data

|	
System Interface	64-bit 33/66MHz PCIbus (Rev 2.2) compliant
Processors	Embedded PowerPC (250MHz)
Memory	Two banks of 128 MByte DDR2 SDRAM (one for Tx/Rx buffers, one for PowerPC)
Encoder/Decoder	One, two, or four MIL-STD-1553A/B encoder/decoder with full error injection and detection capability
Time Tagging	14 Digit (400 days) absolute IRIG-B time, 1 msec resolution
Physical Bus Interface	One, two, or four MIL-STD-1553A/B trapezoidal transceivers, direct coupled stubs and transformer coupled stubs available at front panel or back panel connector
Connectors	68-pin VHDCI at front panel connector; all signals also available at rear I/O connector; 4x standard PMC connectors
I/O	Ten software programmable TTL I/O lines supporting up to 30V signaling with external reference supply
Dimensions	Standard single wide PMC; 143.7 x 74 mm; Hole and connector dimensions and locations per: ANSI/VITA 20-2001 (R2005)
Power Consumption	TBD
Operating Temp. Range	-40º C…+85º C ambient
Storage Temperature	-40º C…+85º C ambient
Humidity:	0 to 95% non-condensing

PXI-C1553

Extended Function MIL-STD-1553A/B Test & Simulation PXI Module

The PXI-C1553 module is a member of AIT's family of MIL-STD-1553A/B test and simulation modules. This module is a 3U PXI Hybrid Slot compatible instrument designed to support testing, simulations, monitoring, and analysis of MIL-STD-1553 A/B databuses. The PXI-C1553 module is capable of simultaneously simulating a MIL-STD- 1553 Bus Controller (BC), up to 31 Remote Terminals (RT), and a Chronological Bus Monitor (BM) on each channel. Single, dual, and quad channel options are available. The PXI-C1553 provides full error injection and detection capabilities in support of AS4112/AS4111 testing.
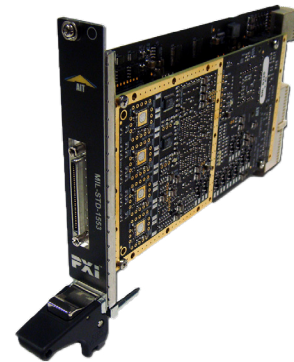
SOFTWARE SUPPORT

The PXI-C1553 is delivered with AIT's MIL-STD-1553 Software Development Kit (SDK) which includes software driver support for Windows XP/Vista/7/8/10, Linux, and LabVIEW RT. The SDK provides multiple application interfaces including support for C/C++, C#, and VB.NET. High-level LabVIEW Virtual Instruments (VI) are provided with each module in support of intuitive application development. A simple soft front panel Graphical User Interface (GUI) application is also delivered with each module.

PXI FEATURES

The PXI-C1553 is 3U PXI Hybrid Slot compatible module which supports synchronization of its onboard time tagging clock to either the PXI 10MHz system clock or an IRIG-B input signal. When using the PXI system clock, the time-tag can be reset via the PXI star trigger.

Addtionally, the module supports input and output of triggers to and from the PXI trigger bus. PXI triggers can be generated by the module based on detected MILSTD- 1553 bus events and PXI triggers can be used as input to intiate the start of BC operations, BM data captures, and many other operations.

COMPATIBLE WITH

NATIONAL INSTRUMENTS
LabVIEW™

Key Features

- One, two, or four dual redundant MIL-STD-1553 bus interfaces
- Concurrent BC, multiple RT (31), and BM operations
- Full error injection and detection
- Data capture filtering, 100% bus recording, and physical bus replay
- PXI trigger generation on 1553 bus events
- Initiate data simulation (BC) and data capture (BM) on PXI triggers
- Onboard time-tag clock synchronization to external IRIG or PXI system clock
- Variable output voltage signal and software selectable bus coupling modes
- 10 high voltage (up to 30V) programmable DIO lines
- Flight Simulyzer™ GUI Analyzer software

BUS CONTROLLER

The PXI-C1553 Bus Controller provides real-time BC simulation functions supported by the PXI-C1553's onboard advanced FPGA. The precise timing and sequencing of bus commands, within minor/major frames is handled onboard supporting autonomous operations. Error injection is supported on transfer, word, and bit levels.

REMOTE TERMINALS

The PXI-C1553 is capable of simultaneously simulating up to 31 RTs. Each RT provides fully programmable and intelligent responses to BC commands, including intelligent mode code responses and application selectable response times. Full error injection is supported down to word and bit level. Each RT may also be configured to operate in a monitor only mode in which it only stores data sent to it, while NOT responding to BC commands.

CHRONOLOGICAL BUS MONITOR

The PXI-C1553 BM supports 100% time tagged data capture and archiving to disk. Full error detection capabilities are provided as well as support for advanced filtering and triggering.

EMBEDDED PROCESSOR

The use of an embedded processor allows user specific functions to be processed onboard, significantly off-loading the host processor. This new concept allows users to implement application specific system level functionality on a single interface card. In addition, the card has the potential to host simple user applications.

BUS COUPLING

The PXI-C1553 provides multiple physical bus coupling modes including direct coupling, transformer coupling, and full bus network emulation allowing direct connections to transformer coupled devices. Selection of the coupling modes is done via software function calls from the application. Additionally, software control of the amplitude of the bus signal is provided.

REMOTE OBJECT SERVICES

Remote Object Services (ROS) service make PXI-C1553 hardware available to network clients running in other processes or on other hosts in the network. It runs on its host as either a Windows service or as a Linux daemon.

Technical Data

Form Factor	3U Hybrid Slot Compatible PXI module
System Interface	32-bit / 33 MHz PCI plus PXI Trigger Bus, PXI System Clock, and PXI Star Trigger
Connectors	J1 and XJ4 PXI backplane connectors; 68-pin VHDCI front panel connector holding bus signals, IRIG-B input/output, and 10 DIO lines
Memory	128 MBytes (channel data) 128 MBytes (embedded processor)
Power Consumption	Operating: 3 Watts Idle: 2.5 Watts
Operating Temp. Range	0º C to +45º C
Storage Temperature	-40º C to +85º C
Humidity:	0 to 95% non-condensing

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PXIe-1553

MIL-STD-1553 Test & Simulation Instrument for PXI Express

The PXIe-1553 module is the PXI Express member of AIT's family of MIL-STD-1553 test and simulation instruments. This module is a 3U PXI Hybrid Slot and PXI Express slot compatible instrument designed to support testing, simulations, monitoring, and analysis of MIL-STD-1553 A/B databuses. The PXIe-1553 module is capable of simultaneously simulating a MIL-STD- 1553 Bus Controller (BC), up to 31 Remote Terminals (RT), and a Chronological Bus Monitor (BM) on each channel. Single, dual, and quad channel options are available. The PXIe-1553 provides full error injection and detection capabilities in support of AS4112/AS4111 testing.
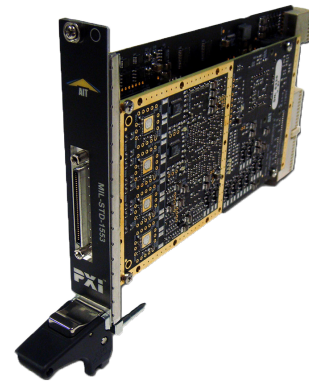
SOFTWARE SUPPORT

The PXIe-1553 is delivered with AIT's MIL-STD-1553 Software Development Kit (SDK), which includes software driver support for Windows, Linux, and LabVIEW Real Time. The SDK provides multiple application interfaces, including support for C/C++, C#, and VB.NET. High-level LabVIEW Virtual Instruments (VI) are provided with each module in support of intuitive application development. A simple soft front panel Graphical User Interface (GUI) application is also delivered with each module.

MIL-STD-1553 BUS CONTROLLER

The PXIe-1553 Bus Controller function provides real-time BC simulation functions supported by the PXIe-1553's onboard advanced FPGA. The precise timing and sequencing of bus commands, within minor/major frames is handled onboard supporting autonomous operations. Error injection is supported on transfer, word, and bit levels.

REMOTE TERMINALS

The PXIe-1553 is capable of simultaneously simulating up to 31 RTs. Each RT provides fully programmable and intelligent responses to BC commands, including intelligent mode code responses and application-selectable response times. Full error injection is supported down to word and bit level. Each RT may also be configured to operate in a monitor-only mode in which it only stores data sent to it, while NOT responding to BC commands.

Key Features

- One, two, or four dual redundant MIL-STD-1553 bus interfaces
- Concurrent BC, multiple RT (31), and BM operations
- Full error injection and detection
- Data capture filtering, 100% bus recording, and physical bus replay
- PXI trigger generation on 1553 bus events
- Initiate data simulation (BC) and data capture (BM) on PXI triggers
- Onboard time-tag clock synchronization to external IRIG or PXI system clock
- Variable output voltage signal and software selectable bus coupling modes
- 10 high voltage (up to 30V) programmable DIO lines
- Flight Simulyzer™ GUI Analyzer software

CHRONOLOGICAL BUS MONITOR

The PXIe-1553 BM supports 100% time-tagged data capture and archiving to disk. Full error detection capabilities are provided, as well as support for advanced filtering and triggering.

PHYSICAL BUS REPLAY

The PXIe-1553 module is able to electrically replay previously recorded MIL-STD-1553 traffic to the bus with exact timing accuracy. Physical Replay mode enables users to disable any or all RT responses from the recorded files to allow the actual RT's to be connected to the network to respond to the replayed commands.

IRIG-B TIME CODE DECODER/ENCODER

An onboard IRIG-B time code decoder and generator allows synchronized time tagging of multiple MIL-STD-1553 streams using single or multiple PXIe-1553 modules. The PXIe-1553 modules can be synchronized to one common external IRIG-B time source or to the free-wheeling onboard time code generator.

EMBEDDED PROCESSOR

The use of an embedded processor allows user-specific functions to be processed onboard, significantly off-loading the host processor. This new concept allows users to implement application-specific system level functionality on a single interface card. In addition, the card has the potential to host simple user applications.

BUS COUPLING & DISCRETE I/O

The PXIe-1553 provides support for both Direct and Transformer coupling. The module also provides 10 fully programmable (as input or output) discrete lines. Each discrete line is capable of TTL signaling. The output lines can drive up to 30V signals, with external supply and input lines accepting up to 30V signals in support of MIL-STD-1760 applications.

ORDERING INFORMATION

PXIe-1553-1

Single MIL-STD-1553 Channel PXI Express module, IRIG-Bencoder/decoder, 10 Input/Output DIO, Simulates BC, upto 31 RTs, AND Bus Monitor.

PXIe-1553M-1

PXIe-1553M-1 Single Function, single MIL-STD-1553 Channel PXI Express module, IRIG-B encoder/decoder, 10 Input/Output DIO, Simulates BC, OR upto 31 RTs, OR Bus Monitor.

PXIe-1553-2

Two MIL-STD-1553 Channel PXI Express module, IRIG-B encoder/decoder, 10 Input/Output DIO, Simulates BC, up to 31 RTs, AND Bus Monitor on each channel.

PXIe-1553M-2

Single Function, two MIL-STD-1553 Channel PXI Express module, IRIG-B encoder/decoder, 10 Input/Output DIO, Simulates BC, OR up to 31 RTs, OR Bus Monitor on each channel.

PXIe-1553-4

Four MIL-STD-1553 Channel PXI Express module, IRIG-B encoder/decoder, 10 Input/Output DIO, Simulates BC, up to 31 RTs, AND Bus Monitor on each channel.

PXIe-1553M-4

Single Function, four MIL-STD-1553 Channel PXI Express module, IRIG-B encoder/decoder, 10 Input/Output DIO, Simulates BC, OR up to 31 RTs, OR Bus Monitor on each channel.