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OmniBus MIL-STD-1553

MIL-STD-1553 for OmniBus Family Products

Features

- 1 or 2 dual-redundant 1553A/B channels per module
- BC, RT, or Monitor simulation
- Each 1553 channel may be ordered in five levels of functionality (see table at right)
- Flexible BC schedules with gaps, branches, retries, etc.
- Support for all 1553B messages, mode codes, broadcast, etc.
- Capture all or selected traffic on fully loaded buses
- Full error detection and error injection to word and bit level
- Variable transmit amplitude and zero crossing distortion
- IRIG time-tags/synchronization
- Programmable bus termination



	A	B4	B32	C	D
Number of Simultaneous Terminals	1	4	32	32	32
Monitor	✓	✓	✓	✓	✓
Filtering for terminal address	✓	✓	✓	✓	✓
Filtering for subaddress		✓	✓	✓	✓
Concurrent terminal monitoring				✓	✓
Protocol Error Injection				✓	✓
Variable Transmit Amplitude					✓
Zero Crossing Distortion					✓

Levels of functionality for OmniBus 1553 channels

Description

Ballard's OmniBus® products connect computers or networks to one or more avionics databuses. OmniBus 1553 refers to the MIL-STD-1553 capabilities available for all OmniBus platforms. Separate brochures provide information on OmniBus platforms (PCI, cPCI, VME, USB, Ethernet) and protocols (ARINC 429/708/717).

OmniBus products are built around an intelligent platform that can host one or more protocol modules. This flexible architecture accommodates mixed protocols, high channel counts, and unsurpassed processing power. An on-board PowerPC® processor can be programmed by the user to offload the host or for stand-alone operation. Each module has its own DSP dedicated to protocol processing.

OmniBus 1553 modules are available with 1 or 2 dual-redundant 1553 channels, so each OmniBus can have up to 4 or 8 1553

channels, depending on the platform. To provide flexibility and economy, each channel can be ordered in one of five levels of functionality (see table above). All levels provide Bus Controller, Remote Terminal, or Monitor operation and support all 1553 message types. The higher levels can concurrently simulate multiple terminals, inject errors, and adjust the waveform.

Applications for OmniBus products include testing, simulation, and operational uses of avionics databuses. With extensive error detection and generation capability, OmniBus 1553 is well suited to product development, production, and system testing. The high channel count, multi-terminal capability, and on-board PowerPC processor provide the power necessary for flight simulators and system integration laboratories. An OmniBus

product may also be used as a data server or as a stand-alone converter from one protocol to another.

Software

The easiest way to use OmniBus 1553 products in a Windows environment is with Ballard's graphical CoPilot® software. CoPilot can host multiple cards, channels, and databuses (MIL-STD-1553, ARINC 429, and ARINC 708), so it is the ideal tool for OmniBus products.

Alternatively, users can develop their own software using the included BTIDriver™ API. Although each OmniBus product can be easily configured and run with only a few API calls, the comprehensive library includes a broad range of functions for specialized needs.

An SDK is available for advanced users who are developing software to run on the PowerPC.



MIL-STD-1553 Functional Specifications

Bus Controller

- Specify no-response timeout value up to 102.4 μ s in units of 0.1 μ s
- Automatic schedule (based on specified message frequencies) or custom schedule, including:
 - Multiple frames and programmable frame times
 - Programmable inter-message gap times
 - Conditional retries and branches for exception processing
- Schedule operation modes:
 - Continuous (until explicitly halted)
 - Specified number of loops
 - Single-step mode (for debugging)
- Configure schedule to wait for each message to be triggered or for a single starting trigger
- Programmable sync out signal on all or selected messages (multiple sync lines available)
- Insert aperiodic messages into a running BC schedule

Remote Terminals

- Multi-terminal simulation with up to 31 RTs (Level B4 or higher channels)
- Configurable response time for MIL-STD-1553A or B (default)
- Specify a response time value up to 25.5 μ s, in units of 0.1 μ s
- Programmable status word bits
- Auto Busy option automatically sets the Busy bit of the status word after each command
- Programmable sync out signal on all or selected messages (multiple sync lines available)
- Configure/legalize all or selected SAs and mode codes
- Support for all 1553B mode codes
- Selectable mode code subaddress (00000, 11111, both, or neither)
- Enable broadcast reception on a per-RT basis
- RT 31 functions as broadcast terminal or valid RT address

Monitor

- Monitor concurrently with terminal simulation (Level C or higher channels)
- Create a sequential record in board memory or stream to file (with a simple program)
- Monitor and record all traffic on fully loaded buses
- Capture all traffic or filter by RT, SA, or tagged BC messages
- Each monitored message includes command/status/data words plus: time-tag, detected errors, transmission bus (A/B), and RT response time(s)
- RT "Shadow Monitor" mode allows message activity of external RTs to be monitored

Message Data

- Buffering schemes facilitate data handling:
 - Single buffers (default)
 - Ping-pong double buffers ensure data integrity
 - Circular lists transmit a repeated pattern, such as a sine wave
 - FIFO list buffers can handle sequences of data, such as file transfers
- Data initialization options: zeros, incremental, or command word values
- Each message record can track activity by min, max, or elapsed time

Time-Tags

- Use 32-bit binary timer or 64-bit IRIG timer (displays day/hour/min/sec/ms/ μ s)
- IRIG timer options:
 - IRIG-B or IRIG-A format
 - Generate IRIG signal or synchronize to an IRIG signal (on-board or external)
 - Initialize timer to time of day or other value

Error Injection

- Protocol error injection (Level C and above): parity, bit count, inverted sync, Manchester, gap, and word count (relative and absolute)
- Advanced error injection (Level D): variable transmit amplitude and zero crossing distortion on leading or mid-bit (± 5 to 250 ns, in 5 ns increments)
- Trigger error injection from an external signal
- Inject errors in all or tagged messages

Interrupts/Logging

- Configurable event log can be polled and can generate interrupts to the host PC
- The following events may be user-selected for logging/interrupts:
 - When tagged messages (BC or RT) are sent or received
 - When the BC schedule halts or pauses
 - When the BC schedule encounters a user-inserted Log Event command
 - When a list buffer is empty or full
 - When the monitor is full or halts
- On a user-specified frequency of monitored messages

Ballard//////
Technology

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OmniBus Products:

- OmniBus PCI
- OmniBus cPCI
- OmniBus VME
- OmniBusBox (Ethernet/USB)

OmniBus Protocols:

- MIL-STD-1553
- ARINC 429
- ARINC 708
- ARINC 717

OmniBus 1553

Ordering Information:

OmniBus Order Numbers

The order number for an OmniBus product is a combination of the board part number (see table below) and module part number(s). For example, order number 111-510 is an OmniBus PCI with a single Level A channel MIL-STD-1553 module.

	1 Core	2 Cores	4 Cores
PCI (short)	111	112	—
cPCI (3U)	121	122	—
VME (6U)	—	152	154
Ethernet/USB	—	162	—

MIL-STD-1553 Module Part Numbers

The table below illustrates the 1553 module numbering scheme. Any mix of levels may be ordered on a single module. The table on the previous page describes the 5 levels of functionality (A to D).

P/N	CH0 Level	CH1 Level
510	A	—
520	B4	—
530	B32	—
540	C	—
550	D	—
511	A	A
522	B4	B4
533	B32	B32
544	C	C
555	D	D
551	D	A

Example Configurations:

1553 Configurations for 2 Modules

- Up to 4 MIL-STD-1553 channels
 - 1 or 2 MIL-STD-1553 channels plus up to 16 ARINC 429 channels
- 1 or 2 MIL-STD-1553 channels plus 8 ARINC 429 channels and 8 ARINC 717 channels

1553 Configurations for 4 Modules

- Up to 8 MIL-STD-1553 channels
 - 1 or 2 MIL-STD-1553 channels plus up to 48 ARINC 429 channels
- 1 or 2 MIL-STD-1553 channels plus 2 ARINC 708 channels and 32 ARINC 429 channels

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