The MIL-1553 Front-End (MFE) supports multiple functions in a 2U, 19-inch enclosure. A single platform could provide up to four, fully independent, dual redundant channels (MIL-1553 Bus A & Bus B). The MIL-1553 Front-End is part of the suite of latest generation EGSE products from Celestia Satellite Test & Simulation (C-STS).

The MIL-1553 Front-End can be configured to act as:

- Bus Controller
- Remote Terminal
- Bus Monitor

The MIL-1553 Front-End operates as the electrical interface towards flight equipment and can be used during all Assembly Integration and Test (AIT) levels (module, unit, instrument and satellite).

The MIL-1553 Front-End provides all electrical interfacing (through commercial MIL-1553 bus coupler), data extraction, protocol handling and status annotation functions.

The standard 2U/19" enclosure provides a small footprint that can be used in a table top setup or integrated into a 19" rack. The unit is powered from an external AC/DC adaptor (included in delivery).

As a Bus Controller (BC) the MIL-1553 Front-End implements a periodic, deterministic Mil-Bus scheduler supporting synchronous and asynchronous data transfers. The 1553 message scheduler is based on a standard text file that enables the user to, on-the-fly, modify the (simulated on-board) bus profile. The major and minor frame 1553 bus timing can be synchronised to an external signal (e.g. Pulse Per Second) and is highly, configurable to take into account the satellite specific message slot timing.

Standard Bus Controller functions include; Bus A/B switching, programmable timing parameters for ‘No response timeout’ and Inter-Message Gap (IMG), RT Ignore, FDIR Enable/Disable as well as error detection and injection. As an option the Bus Controller functionality can be extended with a protocol specific Dynamic Link Library (DLL) to support for example, the Data Block Transfer or Time Distribution services (ECSS-E-ST-50-13C).

The heart of the MIL-1553 Front-End is based on the Alta Data Technologies 1553 interface. These cards offer the industry’s most advanced 32-bit 1553 FPGA protocol engine and support a feature-rich application programming interface.

The MIL-1553 Front-End is part of the latest generation product suite from C-STS that provides a wide range of onboard interface front-ends, such as Discretes, Power (LCL), RS-422 (SDI), CAN, SpaceWire, Parallel LVDS, WizardLink, SpaceFibre and many more.

The Remote Terminal (RT) function of the MIL-1553 Front-End uses a dedicated, dual redundant channel to simulate one or multiple (up to 31) 1553 terminals. The operation of simulated terminal(s) is based on standard text files that describe the behaviour for each Remote Terminal independently. Standard Remote Terminal functions include; Remote Terminal Enable/Disable, Bus A/B switching, programmable timing parameters for ‘RT-response time’ and user programmable mode code response words, as well as bit-based Status and Data word corruption.

The fully independent, Bus Monitor (BM) function of the MIL-1553 Front-End can be used to monitor (and archive, including accurate time-stamps) 1553 messages on both busses (Bus A & Bus B). Sophisticated filters can be applied to trigger on (and capture) specific bus conditions. Near real-time data analysis can be performed, while continuous storing all 1553 traffic to disk in parallel. Optionally, the Bus Monitor function can be equipped with project specific decoder DLL, to support textual decodes and user specific colour schemes (simplifying 1553 data analysis).

Technical Specifications

General

- Designed for Spacecraft and Instrument Testing
- Supporting multiple MIL-1553 functions in a single platform:
  - Bus Controller
  - Remote Terminal (simulator)
  - Bus Monitor
- LAN for Control and Monitoring via TCP/IP (using RJ45)
- External Time/Reference inputs, such as 10MHz, PPS and IRIG
- PPS input for synchronisation to external equipment
- Platform Status LEDs
- External AC/DC Adaptor (+12VDC, <75W)
- FMEA Report Available
- Bus couplers, cables and terminators can be supplied

MIL-STD-1553B Channels

- Up to Four Independent, Dual Redundant MIL-STD-1553 Channels
- Fully Compliant to MIL-STD-1553B Notice II/IV
- Advanced 32-bit BC, RT and Monitor FPGA Design – Full 32 bit Memory.
- BC Framing/Subframing/Aperiodic
- IRIG-B or PPS External Clock

Project Specific Customisations (upon request)

- Custom protocols and data processing can be supported in SW
- Support for Time distribution and Data Block Transfer protocol (according to ECSS-E-ST-50-13C)

Advanced GUI and software functions

- Software design for spacecraft and instrument testing and debugging
- Flexible Polling Sequence Table structure for BC allowing simple adaptation of bus profile
- Error Injection mechanisms for BC and RT
- Error Detection mechanisms
- Bus monitoring with filtering, triggers, error detection and capture to disk upto 100E6 messages.
- Custom color coding and decoding plug-in to bus monitor

C-STS is a part of the Celestia Technologies Group (http://celestia-tech.com/)

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MIL-STD-1553 Software Support

An essential part of the MIL-STD-1553 Front-End is the application software that runs on a separate, commercial computer platform.

The 1553 hardware on the MFE platform is controlled from dedicated, low-level BC and RTsim software that communicates with the application software through IPC.

For the MIL-STD-1553 BC and RTsim, the application software is based on the Control Monitoring Data Processing & Visualisation Software (CMDVS) from C-STS.

In fact, the term CMDVS refers to a suit of software applications that are configured to support the project specific requirements.

In it’s simplest form the CMDVS is composed of a Graphical User Interface (GUI) with logging and archiving functions to control and monitor one or multiple, different hardware Front-Ends.

Within the CMDVS environment, the 1553 Bus Controller and the Remote Terminal(s) simulator functions are ‘standard’ Front-End interfaces.

 Optionally, the CMDVS environment may include for example, project specific Remote Interface (e.g. EDEN protocol) or integrate third party tools (e.g. Test Sequence Controller - TSC) to support TM/TC packet oriented data transfers (based on MIB database), automated test sequences (e.g. TclTk) and/or user defined synoptic displays.

To support the MIL-STD-1553 Bus Controller and RT simulation functions, dedicated control and status windows are provided in the CMDVS GUI.

An optional extension the standard instruction set of the Bus Controller can be used with the communication protocols, services and functions as described in ECSS standard ECSS-E-ST-50-13C (this includes the TM/TC blocks transfer and time protocols).

Bus Monitor Software

The standalone MIL-STD-1553 Bus Monitor software is based on a client-server architecture. The server runs on the MFE platform and through IPC it is controlled by the BM Client (GUI) from a commercial computer platform.

The storage capability of this computer defines the maximum size of archived 1553 messages. The BM software allows near real-time data analysis while in parallel archiving incoming data to disk.

The Bus Monitor software includes sophisticated 1553 filter functions, together with protocol specific message decoding and user defined colour-coding schemes. This is combined with elaborated export functions that allow quick and efficient 1553 data analysis.

Environmental and Physical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions H x W x D</td>
<td>133 x 448 x 443 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 6 kg</td>
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<tr>
<td>Input Power Range</td>
<td>100-240VAC 50-60Hz</td>
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<tr>
<td>Operating Temperature Range</td>
<td>+10°C to +40°C</td>
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<tr>
<td>Operating Humidity</td>
<td>30% to 85% (non-condensing)</td>
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<tr>
<td>Storage Temperature</td>
<td>-10°C to +60°C</td>
</tr>
<tr>
<td>Storage Humidity</td>
<td>Up to 85% (non-condensing)</td>
</tr>
</tbody>
</table>

Experience

Building on over 30 years of experience in spacecraft EGSE systems; C-STS provides innovative high-tech solutions for ground-based systems in the domains of spacecraft simulation and testing as well as modem (spacecraft communication) and data processing systems. Supporting all phases of the spacecraft lifetime, from integration to flight and all phases in between.

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