IA3 - MIL-STD 1553B

This course covers the 1553 military bus

Objectives

- The bus topology is explained.
- The various bus standards are described, mainly focusing on 1553B and 1553C.
- Bus frames are studied field per field.
- The architecture of a 1553 coupler is described.
- The course describes testing, covering the MIL-HDBK-1553A.
- The course details the software interface necessary to control the coupler.
- This course has been delivered several times to companies developing defense/avionics equipments.

A more detailed course description is available on request at training@ac6-training.com

Prerequisites

- Basic knowledge of a processor or DSP.

Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version for face-to-face courses.
  - Online courses are dispensed using the Teams video-conferencing system.
  - The trainer answers trainees' questions during the training and provide technical and pedagogical assistance.
- At the start of each session the trainer will interact with the trainees to ensure the course fits their expectations and correct if needed

Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

Course Outline

INTRODUCTION

- History
- Utilization domain
- Objectives of this bus
- Protocol overview
- The 3 node types: BC, RT and BM
- Differences between 1553, 1553A, 1553B, and 1553C
- Multiplex selection criteria

PHYSICAL LAYER

- Introduction to differential transmission
- 1553B transmission medium
- Stubbing
- Connecting a terminal to a backbone, long stub
- Connection a terminal to a backbone, short stub

- Multi-stub couplers
- Terminal electrical characteristics

LINK LAYER

- Terminal operation
- Manchester bi-phase coding scheme
- Word formats, SYNC pattern
- Word validation
- Command word detail
- Data word detail
- Status word detail, studying various sequences in order to explain Status flags
- Terminal architecture, word controller, message controller, frame controller

MESSAGE FORMATS

- Remote Terminal operation, assigning an address
- The 10 message types
- Point-to-point messages
- Broadcast messages
- Studying various sequences explaining the way of transferring data from terminal to terminal
- Message timings, taking into account the round-trip delay
- Illegal commands vs invalid commands

MODE CODES

- Management messages
- Command format, subaddress specific usage
- Mode codes supporting data
- Dynamic bus control
- Synchronize commands, usage to implement a heardbeat
- Transmit Status word and Transmit Last command use cases
- Interface with self tests in both RT and subsystems
- Transmitter shutdown commands used in redundant systems

SYSTEM ISSUES

- Using subaddress
- Double buffering
- Framing in the BC to support both periodic transfers and asynchronous transfers

REDUNDANT DATA BUS REQUIREMENTS

- Electrical isolation
- Dual standby redundant data bus operation
- Superseding commands
- High reliability requirements

TESTING

- Test plans described in 1553A handbook
- Using an analyzer to capture traffic
- Generating traffic to check how the system react in case of errors
- Data wrap around mechanism, remote loopback test