This Software Users Manual (SUM) is written for the Generic Avionics Data Bus Tool Kit (GADBTK) version 1.1. The GADBTK is an Ada Technology Insertion Program (ATIP) sponsored effort to produce an Ada binding with the MIL-STD-1553B time multiplex serial data bus.
SOFTWARE USERS MANUAL

For The

GENERIC AVIONICS DATA BUS TOOL KIT

Of The

ADA TECHNOLOGY INSERTION PROGRAM

Prepared For

ADA JOINT PROGRAM OFFICE

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1.0 SCOPE

1.1 Identification

This Software Users Manual (SUM) is written for the Generic Avionics Data Bus Tool Kit (GADBTK) version 1.1. The GADBTK is an Ada Technology Insertion Program (ATIP) sponsored effort to produce an Ada binding with the MIL-STD-1553B time multiplex serial data bus.

1.2 System Overview

The GADBTK is to produce an Ada binding to the 1553B standard by defining the hardware elements and data structures used in a 1553 data bus system in terms of the Ada language. These definitions will then be used to provide various building block components from which 1553 data bus applications may be constructed. Finally a bus monitor application will be constructed from the components as a proof of concept. Initial target system for this project will be a Digital Equipment Corporation VAXStation 3200 series computer with a Computer Technology & Simulation Dept developed Microprogrammable Multiplex Bus Interface (CTSD-MMBI).

1.3 Document Overview

This manual will detail the application interface to the 1553 - Ada binding, and the user interface to the bus monitor application. The document will be divided into two parts the first will show how an application programmer would use the interface. The second will detail the operation of the bus monitor application including how to start it, the commands available while using it, and how to shut it down. In the appendix a list of possible error messages, their most likely cause, and the suggested remedy are provided.
2.0 REFERENCED DOCUMENTS

2.1 Government Documents
The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

STANDARDS:
Military
MIL-STD-1553B, 8 September 1986 Digital Time Division Command/Response Multiplex Data Bus

OTHER:
SDD for the Generic Avionics Data Bus Tool Kit, 4 October 1991
SRS for the Generic Avionics Data Bus Tool Kit, 7 August 1991

2.2 Non-Government Documents
The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

STANDARDS:
3.0 EXECUTION PROCEDURES

3.1 Bus Interface

a. Initialization.

There are two steps to initializing the 1553 interface package. The first is to call the Select_Unit procedure to select a UNIBUS adaptor MMBI interface and data bus. Then call one of the three start procedures.

An interface can only be used in one of the three modes (Remote Terminal, Bus Controller, Monitor) at a time. An interface being used as a remote terminal or a monitor can support several remote terminal addresses at a time. An interface can also only be connected to a single bus at a time. If more than one mode are needed from within a single application at the same time this can be achieved by using the Select_Unit procedure to toggle the context between different interfaces. A single application can also use the Select_Unit entry to maintain interfaces on multiple buses simultaneously.

The Start procedures do not modify the firmware load in the interface at the time they are invoked. Therefore it is the application’s responsibility to make any firmware modifications necessary before calling Start_. When using the Computer Technology & Simulation Department’s MMBI interface the package MICROCODE_1553 included in this tool kit can be used to interface with the firmware.

To use the Transmit, Monitor, Receive procedures they must be instantiated with a buffer type of the users preference, and either a command word or a status word. The buffer is a contiguous data structure the size of the number of words to transmit or receive. The buffer type can be whatever is best suited to the application as long as the memory is contiguous and the size is correct. The following table illustrates the type of bus word to use.

<table>
<thead>
<tr>
<th>Interface Mode</th>
<th>MESSAGE_TYPE</th>
<th>Procedure</th>
<th>Bus Word Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Controller</td>
<td>COMMAND</td>
<td>Transmit</td>
<td>Command_Word</td>
</tr>
<tr>
<td></td>
<td>RESPONSE</td>
<td>Receive</td>
<td>Status</td>
</tr>
<tr>
<td>Remote Terminal</td>
<td>COMMAND</td>
<td>Receive</td>
<td>Command_Word</td>
</tr>
<tr>
<td></td>
<td>RESPONSE</td>
<td>Transmit</td>
<td>Status</td>
</tr>
</tbody>
</table>

b. User Inputs.

Interface_Number : AN_INTERFACE
Bus_Number : A_MFS_BUS
Unibus_Number : A_UNIBUS
Remote_Terminal : A_REMOTE_TERMINAL_ADDRESS
Data : A_TRANSMIT_MESSAGE_BUFFER
Bus_Word : A_BUS_OVERHEADWORD
Form : MESSAGE_TYPE
Subaddress : A_SUBADDRESS
type A_TRANSMITMESSAGEBUFFER
type A_BUSOVERHEADWORD
type A_RECEIVEMESSAGEBUFFER
type A_MONITORMESSAGEBUFFER

c. System Inputs.
Bus Data : A_DATA_WORD;
d. Termination.
To terminate the bus interface call the Stop_ procedure(s) that corresponds to the Start_
procedure(s) that was/were called during initialization.
e. Restart.
Repeat the initialization procedure.
f. Outputs.
BUS_DATA_FORMAT_ERROR : exception;
HARDWARE_FAILURE : exception;
KERNEL_SYSTEM_ERROR : exception;
RANGE_ERROR : exception;
Status : out A_BUS_STATUS);
Bus_Word : out A_BUS_OVERHEADWORD;
Time : out A_TIME_TAG;
Command_Word : out A_DATA_COMMAND_WORD;
Data : out A_MONITORMESSAGEBUFFER;
Status_Word : out A_STATUS_WORD;
Time : out A_TIME_TAG;

3.2 Monitor Application

a. Initialization.
The only initialization necessary to run the software is making sure the default path
contains the data file PORTS_1553. This file is necessary for the application to start processing but no hard coded path exists in the application so that different files could be used to change the configuration from machine to machine.

b. User Inputs.

HEX
DECIMAL
BINARY
OCTAL
PREFERRED_DATA
RAW_DATA
RESET_DISP
CANCEL_SELECTION
RT
QUIT

Set Data Format Hex
Set Data Format Decimal
Set Data Format Binary
Set Data Format Octal
Set Mode Prefered Data
Set Mode Raw Data
Refresh Display
Stop Montoring Selected RT
Choose an RT
Exit Program

c. System Inputs.

n.a.

d. Termination.

Type Quit at the input prompt to terminate.

e. Restart.

See initialization.

f. Outputs.

Bus_Data in either priority mode display or raw data display.
Status and error messages relating to the application.
Prompts for more data to be supplied by user.

3.2.1 Error Messages

In general error messages preceded by a % follow the same general conventions as VMS. That means the first part of the error ID is the subsystem that generated the error, the second part is the severity, the third part is the abbreviated message text, the final field is an english language description of the error.

The format of this section of this document is to list the error, then on the indented lines
that follow the possible cause and if applicable the remedy are listed.

%GETMSG-E-NOMESSAGE, unable to retrieve message text
A system error has occurred and the system supplied message text can't be loaded.

%DPMAN-I-PARTINT, Dual_Port_Ram in use - partial initialization performed
The dual port ram allocation program is not the first to map dual port.
This is not an error and should not be a cause for concern. It simply means someone else
is also using the interfaces on this machine.

%MON1553-W-UNIMPL, that command is not currently supported
The command parser accepts all valid commands, however not all the valid commands are
currently implemented in the executive.

%GETSEL-E-CONSTERR, a selection parameter is out of range
One of the values in an RT selector is out of the acceptable limits.
Reselect the RT with new parameters.

%SELECT-E-NOTINIT, an error occurred initializing RT# check process privileges
The most likely cause of this error is the lack of sufficient process privileges to execute the
application. When the application starts an RT it creates and maps a global section, to
do this you need the VMS privileges PRMGBL, PHYMAP, CMEXC. If this error occurs
exit the application, set the appropriate privileges, and restart the application.

%SELECT-E-INSUFMEM, insufficient memory for allocation of RT
There is not enough dual port ram remaining to allocate another RT. This may be due to a
lack of actual memory or the allocation table may simply be full. In either case you will
have to reconsider the amount of RTs being run on the Interface.

%SELECT-E-PRMERR, parameter error, check bus and interface numbers
The bus or interface number passed to the select_unit procedure are out of range.

%INPAR-F-RNDZFAIL, Task input parser appears to have terminated abnormally
_INPAR-J ERRORAT, This error occurred at rendezvous KILL_PARSER in task PARSER
An error occurred shutting down the application's input task. Quit the application with a
CTRL-Y if necessary and restart.

%PARSER-F-UNHDLEXPT, parser task is terminating due to an unhandled exception
Some unanticipated user input has caused the parser task to die prematurely. Use
CTRL-Y to exit.

%INPAR-F-UNHDLEXPT, error initializing IP_USER_COMMAND_INTERFACE package
Some problem kept the input parser task from starting.

%OUTFM-F-RNDZFAIL, tasking error occurred shutting down display tasks
During an application exit the display task exited abnormally.
%CLOCK-F-RNDZFAIL, task id TIMMER exiting due to error in rendezvous
Probably caused by the display task dying due to an error.
OUTFM-F-CONSTERR, task id FORMATTER died due to constraint error
Some data that was to be displayed was out of bounds.
OUTFM-F-TASKNERR, task id FORMATTER died due to tasking error
Some type of erroneous program state developed. Restart the application.
Bad data entered, please try again
The type of data entered by the user was inconsistent with the type expected.
Sub Address out of range (0..31)
enter a value from 0 to 31.
Remote Terminal out of range (0..31)
enter a value from 0 to 31.
Queue limit reached, Please wait
The command input que is full, processing input will continue as soon as the que has
space available.
ERROR IN COMMAND, Please try again
Command syntax was incorrect.
CHARACTER ERROR, Please reenter command
An invalid Ada character was entered from the command line.
NUMBER ERROR ON DATA FOR SA,BN, OR RT
One of the selection parameters contained a non numeric character.
Prompt number not reconized
An invalid prompt string was requested. This is an internal error and should be ignored
by non developers.
Invalid Entry
The data entered does not match the expected input.
Input string to long
The length of the text typed exceeds the length of the input buffer.
4.0 NOTES
4.1 Definition Of Terms and Abbreviations

AN/AYK - (Navy standard embedded mission processor)
ATIP - Ada Technology Insertion Program
BC - Bus Controller
CSCI - Computer Software Configuration Item.
CSU - Computer Software Unit.
CTSD - Computer Technology and Simulation Department.
DCL - Digital Command Language
DEC - Digital Equipment Corporation
GADBTK - Generic Avionics Data Bus Tool Kit
RT - Remote Terminal
UART - Universal Asynchronous Receiver / Transmitter
VAX - Virtual Address Extension (DEC mini computer architecture)
VMS - Virtual Memory System (VAX operating system)