

Automation/Drive Interface Issues

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Draft 1

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This document is an outline of the administrative and technical issues which the Media Changer / Data Transport Element Interface working group must deal with. Interested parties should be prepared to address at least the procedural issues (and ideally also the technical issues) at the first meeting, Tuesday, 6 November 2001, 9:00 AM to 4:00 PM, in Seaside, California.

If you wish to make a presentation, please send a PDF version of the presentation to paul_a_suhler@seagate.com for distribution in advance to all participants. If the presentation contains patented technology, then so indicate. Please DO NOT include proprietary information. (An e-mail reflector is being set up to automate the information distribution process.)

1 Procedural issues

Membership: I propose that membership be open to any interested parties, without payment of dues.

However, if this working group is moved under the aegis of an existing standards body, then we would abide by their rules.

Announcements: I propose that meetings be announced publicly. such as via the T10 and T11 e-mail reflectors.

No proprietary information: I propose that no one should reveal proprietary information in any presentations, e-mail, or other communications.

Inclusion of patented technology in the standard: I propose that if a company believes that a draft standard includes the use of any technology which it has patented, then it must inform the working group, which will then decide whether to include that technology.

Umbrella organization: It may be expeditious for us to move this effort under an existing group, such as the SFF Committee, where procedures and infrastructure are already in place. (Note that SFF Committee rules allows participation by all parties in working group discussions, but only SFF members may vote on the standard. See <http://sffcommittee.org/> for further information. Most companies who have expressed interest appear NOT to be SFF members.)

Personnel: I propose to act as the facilitator of the group, but would like volunteers for editor and secretary. All of these positions will be decided at the first meeting

2 General technical requirements

This is a first draft of technical issues which must be discussed and is not intended to exclude other concepts.

Not all of the following features will be required by all implementations.

- Library determines protocol type
- Library determines device type and ID
- Library sets operational modes
- Library monitors device status
- Library commands loading and unloading of medium
- Library sends SCSI commands to drive
- Drive bridges between primary interface and library
- Firmware download from library to drive
- Firmware upload from drive to library (e.g., firmware tapes)
- Library can obtain sufficient drive info to support SCSI MIB (in development)

3 Application layer (commands)

Following is a possible set of commands issued by the library to the drive:

3.1 *Report Type*

Product type {AIT, DLT, SDLT, LTO1, LTO2,...}

Vendor ID

Serial number

Firmware revision

Node name

Port A name

Port B name

3.2 *Report Status*

Port A transport type \in {Disabled, Parallel SCSI, 1GFC, 2GFC, ...}

Port B transport type \in {Disabled, Parallel SCSI, 1GFC, 2GFC, ...}

[distinguish among Parallel SCSI types?]

Port A address (3 bytes)

Port B address (3 bytes)

Drive status \in {Ready, Not Ready, Loading, Unloading, Cleaning, Writing, Reading, Loading Failed, Unloading Failed, Cleaning Failed, Cleaning Cartridge Expired}

Vendor-unique status (2 bytes)

Medium type \in {Empty, Unknown, Cleaning, Firmware, Data Type Unknown, Data Type A, Data Type B, Data Type C, ...}

Medium format

Medium capacity

Write protect

LUN 1 command/data-out pending (synchronous bridging only)

Cartridge identifier

Operating hours since manufacture

Cartridge position \in {Threaded, Seated, Ejected, Empty}

Identifier of initiator(s) holding reservations?

3.3 *Load to Hold*

Equivalent to LOAD UNLOAD command with Load = 1 and Hold =1.

3.4 *Load to Ready*

Equivalent to LOAD UNLOAD command with Load = 1 and Hold =0.

3.5 *Unload to Hold*

Equivalent to LOAD UNLOAD command with Load = 0 and Hold =1.

3.6 *Unload to Loadable*

Equivalent to LOAD UNLOAD command with Load = 0 and Hold =0.

3.7 *Set Operational Modes*

This command is used to set drive behaviors that will persist across power cycles and resets. See also the Physical Layer section at the end of this document.

3.7.1 Primary interface selection ID

SCSI ID or FC-AL assigned loop identifier

Need to decide when this identifier takes effect. When the ID changes, any open commands will probably be lost. See the next section.

3.7.2 Primary interface enable/disable

Specify behavior for Parallel SCSI and for Fibre Channel (E.g., will enabling FC port cause a LIP? Will the drive try for the new Hard Address rather than Previously Assigned AL-PA?)

3.7.3 Baud rate

- 9600
- 19200
- 38400
- 57600
- 115200
- Higher?

3.7.4 Stop bits transmitted

- One
- Two

3.7.5 Logical unit bridging

Proposed fields:

- Synchronous vs. asynchronous vs. disabled
- Data buffer size – fixed or variable?
- Maximum number of commands per initiator?

3.7.6 Alerts

- Enabled
- Disabled

3.7.7 Host eject override

If an UNLOAD command is received from a host on the primary interface, unthread but do not eject, i.e., perform LOAD UNLOAD with Load = 0 and Hold = 1. Values of this field are:

- Override
- Do not override

3.7.8 Autoload mode

As per SPC-2 Control mode page (0Ah), AUTOLOAD MODE field, which controls handling of inserted medium, values are:

- Load to Ready
- Load to Hold (not threaded, but MAM accessible)
- Do not load

3.7.9 Autounload mode

Defines behavior when:

- Unrecognized cartridge is inserted
- Drive powers up with cartridge inside
- Cleaning is completed (or fails)
- Firmware tape flashing completes (or fails)

Values are:

- Medium threaded at BOT

- Unthread and hold
- Eject
- Data cartridges at BOT, others ejected

3.8 *Response frame*

Sent in response to the above commands.

Fields:

- Command result \in {No Error, Error}
- Erroneous field pointer
- Data fields as required for Report Type and Report Status commands.

4 SCSI command transport

Library issues SCSI commands to drive.

- Is tagged queuing required?
- Will a command from the library cause contingent allegiance?
- Will a command from library be rejected for Reservation Conflict with an initiator's reservation?
- Would this SCSI command transport be sufficient for all operations? I.e., would it be unnecessary to have separate commands for the functions in section 3 above?

4.1 *Frame types*

- Command
- Data-in
- Data-out
- Response
- Data-in and good status (avoids sending both data-in and response frames)

4.2 *Data-in and responses transmitted asynchronously or synchronously*

If Command – Data-in, Command – Response, and Data-out – Response times can all be bounded, then synchronous operation may not be necessary.

Firmware download should be supported.

5 Logical unit bridging

This mechanism allows the drive to accept a command for LUN 1 and to pass it to the library for execution.

- What if Parallel SCSI host specifies No Disconnect? Then the bus would be tied up for a long time, but there is probably no choice.

5.1 *Asynchronous, synchronous, or both?*

Asynchronous: Drive sends command or data-out as soon as received

Synchronous: Drive sets flag upon receipt of command or data-out. Library must poll for status and then request command or data-out.

Note that WRITE BUFFER with in excess of 1MB of data-out must be supported.

5.2 *Task identifier*

This will associate a frame with a task. It is necessary for handling multiple initiators. It will also serve to distinguish frames of bridged commands from frames of commands issued by the library.

5.3 *Command frame fields*

5.3.1 SCSI CDB

5.3.2 Task management function

5.3.3 Command queuing task attribute

5.3.4 Command reference numbers

5.3.5 Initiator identifier

- Parallel SCSI: SCSI ID
- Fibre Channel: Port Name, Node Name, or Port ID?

5.4 *Data buffer size (variable or fixed)*

Recommend that this be fixed.

5.5 *LUN 1 only or configurable LUN*

Recommend LUN 1 only.

5.6 *Reset behavior*

Drive must send reset to library.

All frames in flight must be cleaned up.

Drive must proceed with reset even if library does not respond. This may be problematic if using synchronous mode.

6 Topologies

6.1 *Point to point*

Only the library and one drive are on a connection.

Pros:

- Simpler protocol (implicit addressing, no contention)

Cons:

- Requires more ports in library (UARTs or one UART with mux/demux)

6.2 *Multidrop*

E.g., RS-422 multidrop or I2C.

Pros:

- Fewer serial ports in library
- Reduced EMI?

Cons:

- Increase in configuration complexity to assign unique serial port IDs
- Increase in operational complexity, especially if drives can transmit asynchronously, then collision detection and recovery is necessary
- Every drive must look at all frames.
- More complex cabling? Two connectors per drive?
- Debug nightmare?

7 Link layer

7.1 *Protocol type detection*

This protocol must coexist with legacy protocols

0x00 byte transmitted by library when link is idle obtains a standard response?

7.2 *Frame start character*

This can be a way to allow multiple protocols to exist in the same drive/library: each protocol uses a unique start character.

7.3 *End of frame recognition*

Length field vs. length implied by the frame type or the command field

7.4 *Frame ACK/NAK characters?*

Report various errors or only bad frame?

Do not use and instead send a command response

7.5 *Error detection and recovery*

Use command, etc. characters with Hamming distance > 1?

A simple checksum on the frame (e.g., one-byte XOR) ?

7.6 *Timeouts*

Events detected:

- Incomplete frame transmission. After timeout, send a NAK or send an error status for the command.
- Failure to ACK a frame. Retry at frame or command level?
- Failure to respond to command frame that was ACKed

Issues:

- Proportional to baud rate?
- Fixed number of byte times?
- Must define error recovery procedures

8 Physical layer

8.1 *Connector type*

Should this be specified?

8.2 *Cable length*

Should this be specified?

8.3 *Levels*

RS-422 / RS-232 / do not specify?

(Only RS-422 supports multidrop)

8.4 *Baud rates*

- 9600
- 19200
- 38400
- 57600
- 115200

- Higher?

8.5 Baud rate detection

This would simplify installation. After initial recognition, library could change rate.

8.6 Stop bits (one or two or selectable)

One bit time per byte reduction is significant for firmware upload/download