



**SONY®**

HD DIGITAL FRAME RECORDER

# **HDDF-500**



SONY SCSI INTERFACE PROTOCOL  
1st Edition

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## 1. GENERAL DESCRIPTION

This manual contains the protocol for connecting the HDDF-500 HD Digital Frame Recorder to a computer equipped with a Small Computer System Interface (SCSI). It provides the necessary information to allow the user to create his own device driver or applications software for the particular host computer system in use. It is to be used in conjunction with system programming documentation for the user's particular host system.

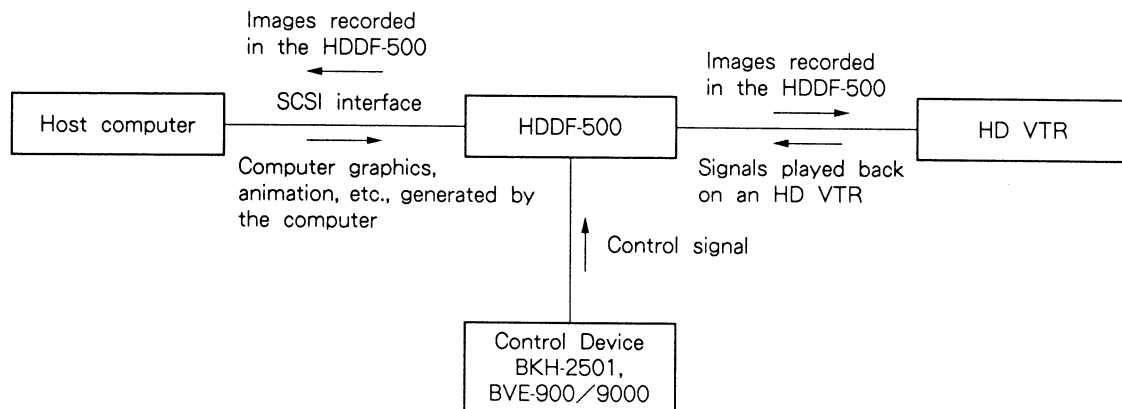
The bus provided is based on an accepted and flexible standard, ANSI (American National Standards Institute) X3.131-1986, "Small Computer System Interface (SCSI)." This interface allows created images such as animations or computer-generated graphics to be transferred to or from the HDDF-500.

The Sony HDDF-500 is a silicon-based storage device for capturing and playing back high definition video images. Based on the SMPTE 240M 1125-line, 60 Hz standard, the frame recorder accepts switchable analog or digital input video and delivers simultaneous analog and digital output video. Virtually all of the internal processing is performed in the digital domain. The system bandwidth for each of the green, blue, and red color components is 30 MHz, and the quantization is 8 bits at 74.25 MHz. This results in excellent signal characteristics.

The digitized video is stored as frames or fields in up to 192 megabytes of random access semiconductor memory. With a suitable controlling device (e.g., a BVE-900/9000, etc.), the record and playback sequences can be freely configured. Frame or field recording and playback of a selected duration can be intermixed, with a time interval between actions, and any frame or field can follow any other. As a result, continuous motion can be simulated by using all or part of the available frames in a repeating sequence.

A non-real-time parallel computer interface is provided to perform partial or full frame or field transfers between the frame recorder and a host computer. Image processing applications can utilize this feature to send high definition video from the frame recorder to an image processing system and then return the altered video to the frame recorder for evaluation or re-entry into the HDVS system. This enables computer graphics pictures to be mixed with or overlaid onto high definition video. The frame recorder can be used as a buffer to a high definition VTR for archiving graphics or for building animation or simulation sequences. Data transfers over this interface are accomplished at rates of up to 2 megabytes per second.

### SYSTEM CONFIGURATION



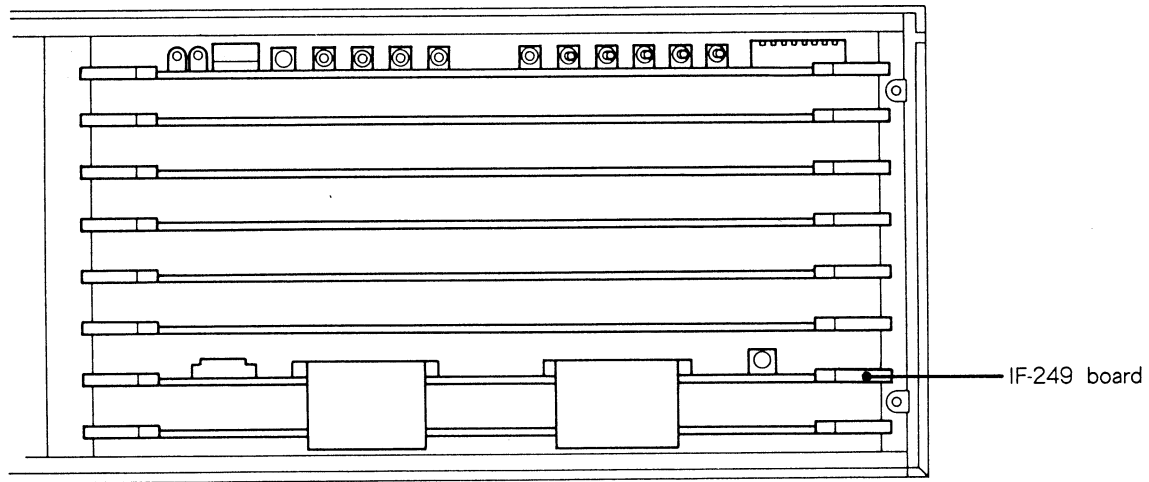
## 2. HDDF-500 INTERFACE SET UP

The following is the interface set up requirement needed to connect the the HDDF-500 to a computer with a SCSI interface.

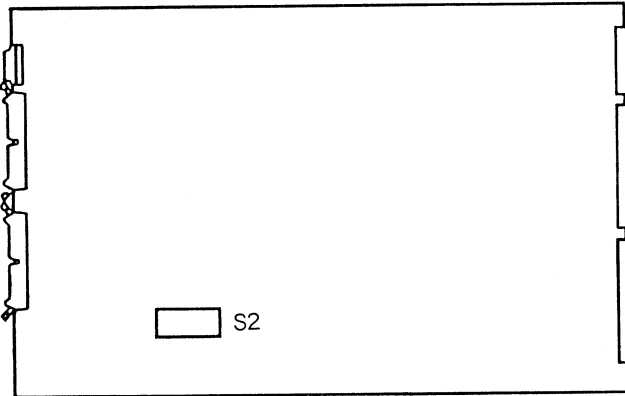
The HDDF-500 IF-249 board must be configured to establish a device Identification Number. The SCSI specification allows for up to 8 physical devices to be connected to the bus; one of these must be the host, leaving 7 physical device connections to be established. This selection is made with Switch S2 on the HDDF-500 IF-249 board.

### 2-1. IF-249 BOARD SWITCH SETTINGS

#### Location of IF-249 Board in the HDDF-500 Card Cage



#### Switch Location on IF-249 board



Switch block S2 settings used to select the device SCSI ID number.

| S2-1 | S2-2 | S2-3 | ID Number |
|------|------|------|-----------|
| OFF  | OFF  | OFF  | 0         |
| ON   | OFF  | OFF  | 1         |
| OFF  | ON   | OFF  | 2         |
| ON   | ON   | OFF  | 3         |
| OFF  | OFF  | ON   | 4         |
| ON   | OFF  | ON   | 5         |
| OFF  | ON   | ON   | 6         |
| ON   | ON   | ON   | 7         |

Factory setting : ON ON ON (7)

### 3. GENERAL SPECIFICATIONS

The host computer is connected to the HDDF-500 by way of a standard, 50-pin SCSI interconnect cable. A single-ended type of bus signalling is employed. The signals that run along the cables of the bus are represented as the absolute value of the voltage in the line compared to ground reference. The maximum length of the cable is limited to 6 meters.

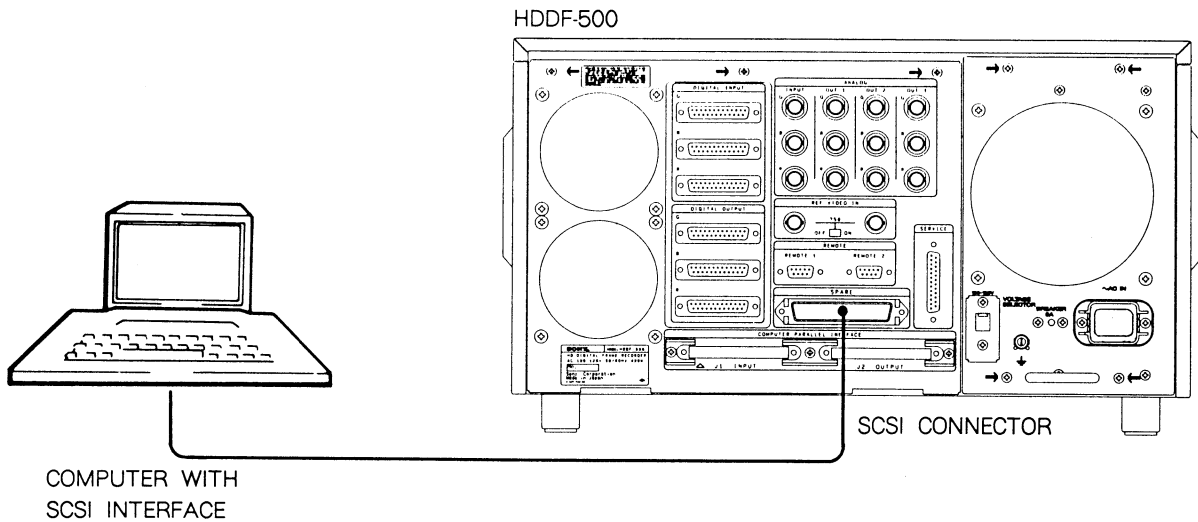
#### 3-1. CONNECTIONS

##### 3-1-1. SCSI Interface Connector Location

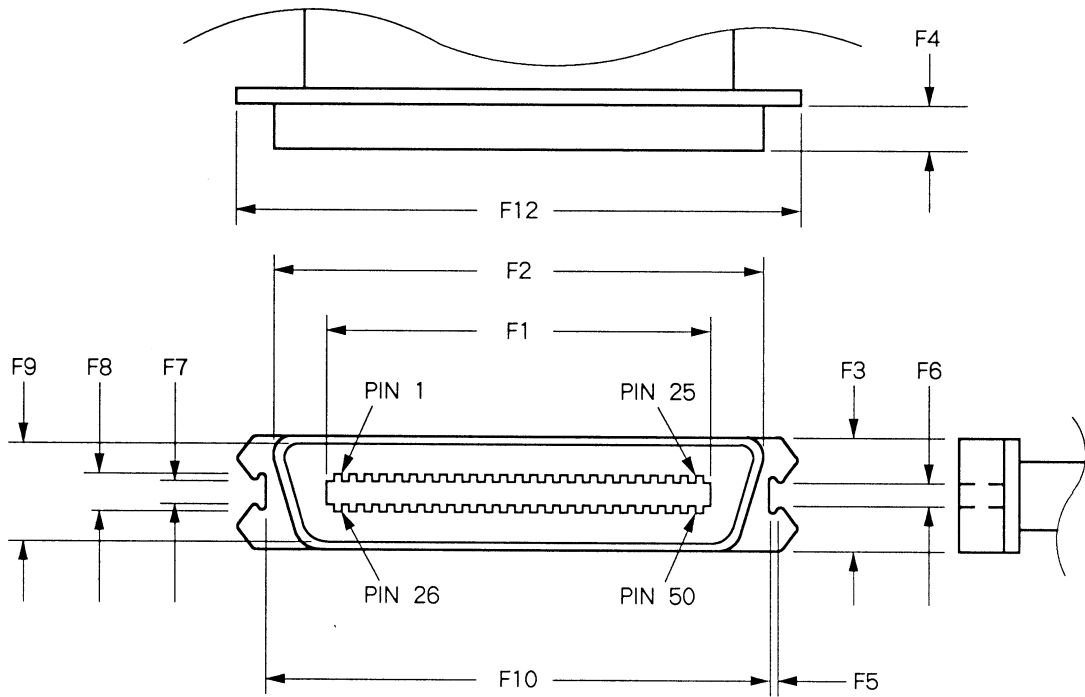
The 50-pin bidirectional interface connector shown below is used to connect the HDDF-500 to a computer having a SCSI interface.

**Note:** The HDDF-500 SCSI interface is internally terminated and must be the last device on the cable.

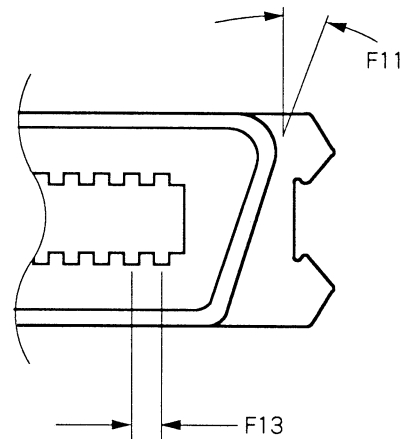
**HDDF-500 Rear Panel**



### 3-1-2. SCSI Interface Connector Specifications-Shielded Cable



| Dimensions | Millimeters | Inches     |
|------------|-------------|------------|
| F1         | 56.26 Max.  | 2.215 Max. |
| F2         | 64.29 Min.  | 2.531 Min. |
| F3 *       | 15.24       | 0.600      |
| F4         | 7.29 Min.   | 0.287 Min. |
| F5 *       | 1.02        | 0.040      |
| F6         | 4.09 Max.   | 0.161 Max. |
| F7 *       | 5.08        | 0.200      |
| F8 *       | 6.10        | 0.240      |
| F9         | 12.04 Min.  | 0.474 Min. |
| F10 *      | 68.45       | 2.695      |
| F11        | 15 ± 2°     | 15 ± 2°    |
| F12 *      | 76.71       | 3.020      |
| F13        | 2.16        | 0.085      |



- Notes:** (1) Tolerances  $\pm 0.127$  mm (0.005 inch) noncumulative, unless otherwise specified.  
 (2) Dimensions listed with " \* " are shown for reference only.

**SOURCE:** ANSI X3.131-1986  
 Small Computer Interface (SCSI) for Information Systems \*

\* Copies of this standard may be purchased from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

### 3-1-3. Pinout Connections (Single-ended) for SCSI Shielded Cable Connector

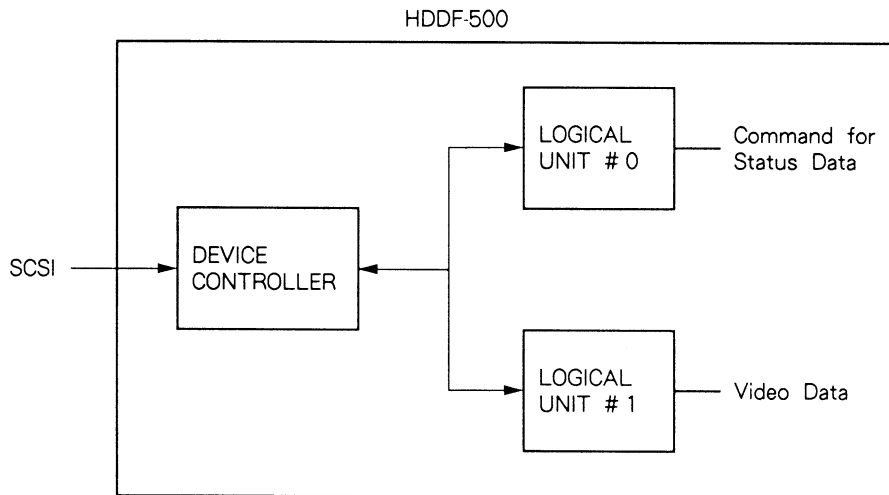
| Function or Signal | Pin No. |
|--------------------|---------|
| SHIELD GND         | 1       |
| GND                | 2 – 12  |
| NO CONNECTION      | 13      |
| GND                | 14 – 25 |
| -DB (0)            | 26      |
| -DB (1)            | 27      |
| -DB (2)            | 28      |
| -DB (3)            | 29      |
| -DB (4)            | 30      |
| -DB (5)            | 31      |
| -DB (6)            | 32      |
| -DB (7)            | 33      |
| -DB (P)            | 34      |
| GND                | 35 – 37 |
| TERMPWR            | 38      |
| GND                | 39 – 40 |
| -ATN               | 41      |
| GND                | 42      |
| -BSY               | 43      |
| -ACK               | 44      |
| -RST               | 45      |
| -MSG               | 46      |
| -SEL               | 47      |
| -C/D               | 48      |
| -REQ               | 49      |
| -I/O               | 50      |

## 4. COMMAND DESCRIPTIONS

### 4-1. COMMAND OVERVIEW

Commands written to Logical Unit Number 0 of the SCSI device specified will go to the command processor; data read from this device will be the Status Data. Data written to Logical Unit Number 1 of the selected device will be stored as video data in the location specified by the command block. Data read from this device will be video data from the specified locations. The HDDF-500 command blocks are transferred to the HDDF-500 from the host system as data with a SCSI WRITE command. The device status block is read from the HDDF-500 with the SCSI READ command.

#### LOGICAL DEVICE CONFIGURATION



### 4-2. VIDEO DATA FORMAT

The video data is transferred in block format with no additional information included (block length, checksum, CRC, etc.). The format is one byte of luminance for each pixel.

The video data limits for the HDDF-500 are decimal value 16 for black and decimal value 235 for peak white. These values are in compliance with the HDTV digital signal system of the HDDF-500. Values below 16 will be clipped.

### 4-3. HDDF-500 COMMAND BLOCK

The command block specifies the beginning and end points of a video data transfer which determines the block size. Following video data transfers must move the specified size block. This block size is restricted by the size of the largest single DMA transfer that the host system can execute (typically 64 kbytes).

- Byte 1 – Command Byte
- Byte 2 – Parameter #1
  
- Byte 3 – Unused
- Byte 4 – Parameter #2
  
- Byte 5 – MSB Parameter #3
- Byte 6 – LSB Parameter #3
  
- Byte 7 – MSB Parameter #4
- Byte 8 – LSB Parameter #4
  
- Byte 9 – MSB Parameter #5
- Byte 10 – LSB Parameter #5
  
- Byte 11 – MSB Parameter #6
- Byte 12 – LSB Parameter #6
  
- Byte 13 – MSB Checksum
- Byte 14 – LSB Checksum

#### 4-3-1. Detailed Description of the HDDF-500 Command Block

##### COMMAND BYTE

- 01H Rectangular transfer (specify diagonal corners)
- 02H Aligned transfer (specify line and column count)
- 87H Capture current frame (requires no other data)
- 88H Select display frame (requires frame number)

##### Parameter #1

|  |  |  |     |     |     |     |     |
|--|--|--|-----|-----|-----|-----|-----|
|  |  |  | INT | FLD | BLU | GRN | RED |
|--|--|--|-----|-----|-----|-----|-----|

- RED Bit 0: 1=Enable Red channel
- GRN Bit 1: 1=Enable Green channel
- BLU Bit 2: 1=Enable Blue channel
- FLD Bit 3: Starting field 0=First (odd) field  
1=Second (even) field
- INT Bit 4: 0=Single field transfer  
1=Interleaved transfer

**[Note]: WRITE MODE:** Video data will be transferred to all color channels enabled; at least one color channel must be enabled.

**EXAMPLE:** Data sent to the R, G and B color channels simultaneously will result in a monochrome image.

**READ MODE:** Only one color channel can be read at a time.

**Parameter #2**

For Rectangular/Aligned transfer  
Frame Number 0–N \* Video frame to access.  
For Frame-Select:  
In Frame mode: Frame number 0–N \*  
In Field mode: Field number 0–N \*\*

**Parameter #3**

Starting line: 0–519 Line number to begin transfer on.

**Parameter #4**

Starting column: 0–1888 Column to begin transfer on.  
MUST be multiple of 32.

**Parameter #5**

For Rectangular transfer: Line to end transfer on.  
For Aligned transfer: Number of lines to transfer.  
1–520 Non-interlaced mode  
1–1040 interlaced mode

**[Note]: The following limits exist:**

Single field transfer: The sum of parameter 3 plus parameter 5 must be less than or equal to 520.

Interleaved transfer: The sum of parameter 5 + two times parameter 3 (+ 1 if starting in the second field) must be less than or equal to 1040.

**Parameter #6**

For Rectangular transfer: Column to end transfer on.  
For Aligned transfer: Number of columns to transfer.  
32–1920 (MUST be multiple of 32)

**Checksum**

Arithmetic sum of first six words in message.

- 
- (\*) The maximum number of frames which can be made available depends on the number and types of boards inserted.
  - (\*\*) The maximum number of fields which can be made available depends on the number and types of boards inserted.

#### 4-4. STATUS BLOCK

- Byte 1: Frames of memory available
- Byte 2: Error bits
- Byte 3: IF-249 board  
ROM Revision Number "AA"  
(MSB)
- Byte 4: IF-249 board  
ROM Revision Number "BC"  
(LSB)
- Byte 5: SY-149 board  
ROM Revision Number "AA"  
(MSB)
- Byte 6: SY-149 board  
ROM Revision Number "BC"  
(LSB)
- Byte 7: Checksum (MSB)
- Byte 8: Checksum (LSB)

##### 4-4-1. Detailed Description of Status Block

###### Frames of Memory Available

Number of frames of video memory installed.

###### Error Bits

- bit 0: DMA Interrupt Error
- bit 1: Checksum Error
- bit 2: SY-149/IF-249 Communications Error
- bit 3: Unused
- bit 4: Unused
- bit 5: Command Error
- bit 6: DMA Error
- bit 7: SCSI/DR11/DRV11 Control Error

These ERROR bits are set on error condition and will remain set until the status is read.

###### ROM Revision Number

The Revision Number is returned as a hexadecimal number "AA.BC", where:

- AA: Major revision level
- B: Minor revision level
- C: Patch level

###### Checksum

Arithmetic sum of first three words of message.

##### 4-4-2. Errors Handling

Any errors which occur on the HDDF-500 system are logically ORed and displayed in the LED display on IF-249 board. This error status may also be read from the HDDF-500 with the READ STATUS request. The error status is cleared when this is read.

#### 4-5. WRITE/READ DATA

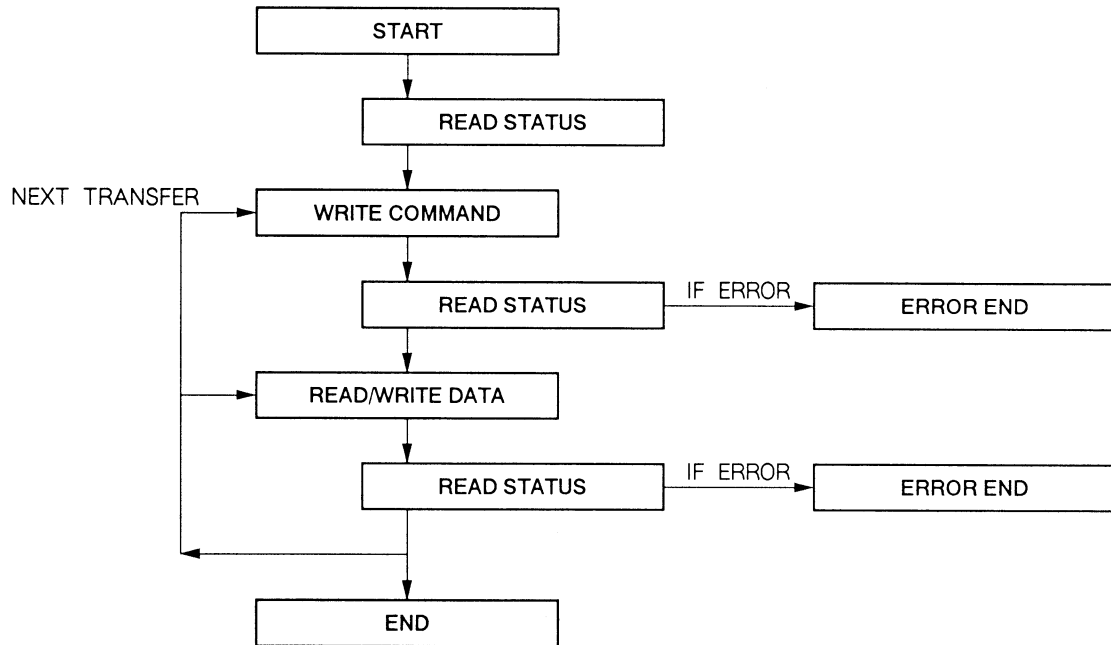
These modes are available to transfer video data to/from the specified channels in the selected area. When writing, multiple channels may be specified (to write B/W [monochrome] data, G B and R channels may be selected and loaded simultaneously).

When reading, a single channel must be specified. The selected frame may be operated on independently of the display frame.

#### 4-6. MULTIPLE WRITE/READ DATA

Multiple WRITE or READ data requests may be sent after one command transfer. When this is done, each sequential block of video data that is transferred will start on the next line following the last block. The START COLUMN, LINE COUNT and COLUMN COUNT will remain the same.

#### 4-7. FLOWCHART OF COMMUNICATIONS SEQUENCE



## 4-8. SCSI TRANSFERS

A command block transfer would proceed as follows:

|    |           |                             |                                     |       |
|----|-----------|-----------------------------|-------------------------------------|-------|
| XX | Select    | (with or without attention) |                                     |       |
| C0 | msg out   | data byte as appropriate    |                                     |       |
| 0A | command   | WRITE command               |                                     |       |
| 00 | command   | LUN #0                      |                                     |       |
| 00 | command   |                             |                                     |       |
| 00 | command   |                             |                                     |       |
| 00 | command   |                             |                                     |       |
| 00 | command   |                             |                                     |       |
| 02 | data out  | Aligned transfer            | } As in 4-3, "Command Block" above. |       |
| 11 | data out  | interlaced - red            |                                     |       |
| 00 | data out  |                             |                                     |       |
| 00 | data out  | frame 0                     |                                     |       |
| 00 | data out  | start line 0                |                                     | (MSB) |
| 00 | data out  | start line 0                |                                     | (LSB) |
| 00 | data out  | start column 0              |                                     | (MSB) |
| 00 | data out  | start column 0              |                                     | (LSB) |
| 00 | data out  | line count 32               |                                     | (MSB) |
| 20 | data out  | line count 32               |                                     | (LSB) |
| 07 | data out  | column count 1920           |                                     | (MSB) |
| 80 | data out  | column count 1920           |                                     | (LSB) |
| 09 | data out  | checksum 09B1H              |                                     | (MSB) |
| B1 | data out  | checksum 09B1H              |                                     | (LSB) |
| 00 | status    | SCSI transfer status        |                                     |       |
| 00 | msg in    | SCSI message complete       |                                     |       |
| XX | bus clear | disconnect                  |                                     |       |

A data block read would proceed as follows:

|       |           |                             |
|-------|-----------|-----------------------------|
| XX    | Select    | (with or without attention) |
| C0    | msg out   | data byte as appropriate    |
| 08    | command   | READ command                |
| 20    | command   | LUN #1                      |
| 00    | command   |                             |
| 00    | command   |                             |
| 00    | command   |                             |
| 00    | command   |                             |
| XX    | data in   | video data                  |
| XX    | data in   |                             |
| XX    | data in   |                             |
| XX    | data in   |                             |
| ..... |           |                             |
| ..... |           |                             |
| XX    | data in   |                             |
| XX    | data in   |                             |
| 00    | status    | SCSI transfer complete      |
| 00    | msg in    | SCSI message complete       |
| XX    | bus clear | disconnect                  |

The HDDF-500 also supports other generic SCSI commands as follows:

00H **TEST UNIT READY**

This call returns ready for LUN 0 and 1 while returning NOT READY ( Status 02H ) for all other devices.

03H **REQUEST SENSE**

This call will return status as 0, 0, 0, 0 if the system status is OK. It will return 8fH, 0, 0, STATUS BYTE if there is an error.

12H **INQUIRY**

This call returns a response string indicating that the device is a SONY HDDF-500 Revision Number.





### 5-3. SELECT DISPLAY FRAME COMMAND

The SELECT DISPLAY FRAME command is used to select the number of the frame to be displayed. This command is enabled only when the remote select switch is set to LOCAL.

#### COMMAND BYTE

|              |   |
|--------------|---|
| 88H          | Select display frame (requires frame number)                            |
| Parameter #1 | Unused  |
| Parameter #2 | In Frame mode: Frame number 0-N *<br>In Field mode: Field number 0-N ** |
| Parameter #3 | Unused  |
| Parameter #4 | Unused  |
| Parameter #5 | Unused  |
| Parameter #6 | Unused  |

#### Checksum

Arithmetic sum of first six words in message.

### 5-4. CAPTURE CURRENT FRAME COMMAND

The CAPTURE CURRENT FRAME command is used to execute the 1-frame/field recording command at which time 1 frame/field of the video input signal is recorded. This command is enabled only when the remote select switch is set to LOCAL. The recording frame is selected by the abovementioned SELECT DISPLAY FRAME command.

#### COMMAND BYTE

|              |  |
|--------------|--|
| 87H          | Capture current frame (requires no other data) |
| Parameter #1 | Unused   |
| Parameter #2 | Unused   |
| Parameter #3 | Unused   |
| Parameter #4 | Unused   |
| Parameter #5 | Unused   |
| Parameter #6 | Unused   |

#### Checksum

Arithmetic sum of first six words in message.

- (\*) The maximum number of frames which can be made available depends on the number and types of boards inserted.
- (\* \*) The maximum number of fields which can be made available depends on the number and types of boards inserted.

)

11

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11

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