

# VLBA ACQUISITION MEMO #71\*

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*Original Memo Dated: 16 October 1986*

*Revised: 14 January 1991*

*Revised: 22 May 1992\**

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To: VLBA Data Acquisition Group

Subject: VLBA Acquisition Recorder Controller Communications Protocol

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Date: originally 86.10.16 --- most recently updated 92.5.22

## GENERAL CONSIDERATIONS:

Since the MCB standard interface will be used, the electrical specifications and initiation protocol can be found in the appropriate MCB documents. A block of 256 addresses will be employed, of which only the lower 240 are available to the user (controller). The origin of the block will be set by command along the MCB bus, and is unknown to the recorder controller. Hence, all addresses specified here will be referenced relative to 0; of course, actual commands should have added in the fixed offset appropriate to the drive. A further subdivision of the 240 byte address space has been made to separate the control (write) requests from the monitor (read) requests, as suggested by the MCB group. Address 00-7F request monitor data (read-only), and addresses 80-EF are reserved for control requests. The control request locations are actually read-write, since a read from one of these locations will echo back the last control request received at the same location. In general there will be a fair duplication of monitor data available, since commands which affect the state of the controller will be reported separately in the read (00-7F) section. This is done so that we may present what actually IS (by reading back latched ports, etc. ), as opposed to what WAS commanded (returned in 80-EF). Only quantities that can actually be sampled or measured by the hardware are duplicated.

## NOTES:

- 1) Control requests having a single bit, such as REWIND TAPE, still require that bit to be set for action to take place.
- 2) The ERROR FLAGS word is monitor word 74: If any error bit is set, so will be the ERROR EXISTS bit (0) of the General Status Word. Reading the ERROR FLAGS word will clear all error bits, although they can immediately be set again in the event of a persistent error.

MCB Monitor Data (transport outputs)

Status	# bits	Address
1) Write Module:		
a) Formatter select (=0 1 for FMTR1 FMTR2)	8 x 1	00
Bit 0: Group 0 in Head 1		
Bit 1: " 1 " " 1		
Bit 2: " 2 " " 1		
Bit 3: " 3 " " 1		
Bit 4: Group 0 in Head 2		
Bit 5: " 1 " " 2		
Bit 6: " 2 " " 2		
Bit 7: " 3 " " 2		
b) Output group enable (=0 1 for disable enable)	8 x 1	01
Bit 0: Group 0 in Head 1		
Bit 1: " 1 " " 1		
Bit 2: " 2 " " 1		
Bit 3: " 3 " " 1		
Bit 4: Group 0 in Head 2		
Bit 5: " 1 " " 2		
Bit 6: " 2 " " 2		
Bit 7: " 3 " " 2		
c) System track select (fmtr. track# = 0-35)		
SYSTRK 0 of Head 1	6	02
" 1 " " 1	6	03
" 34 " " 1	6	04
" 35 " " 1	6	05
SYSTRK 0 of Head 2	6	06
" 1 " " 2	6	07
" 34 " " 2	6	08
" 35 " " 2	6	09
2) Monitor module:		
a) Track select - both Read and Bypass (track# = 0-35)		
Head 1, Output A	6	10
" 1, " B	6	11
Head 2, " A	6	12
" 2, " B	6	13
b) Read module equalizer select (0 1 2 = std, alt1, alt2)		
Head 1, Output A	2	14
" 1, " B	2	15
Head 2, " A	2	16
" 2, " B	2	17

c) Output select (0 = Head 1, Output A, read		
1 = " 1, " A, bypass		
2 = " 1, Output B, read		
3 = " 1, " B, bypass		
4 = Head 2, Output A, read		
5 = " 2, " A, bypass		
6 = " 2, Output B, read		
7 = " 2, " B, bypass)		
Formatter 1, signal M1	3	18
" 1, " M2	3	19
Formatter 2, " M1	3	1A
" 2, " M2	3	1B
d) Data extract		
i) Bit sync select	2	1C
ii) Delay in bits	16	1D
iii) Extracted data (bits 31-0)	32	1E-1F
e) Clock recovery		
i) Range select	7	20
3) Transport module:		
a) Footage counter (feet)	16	30
b) Supply reel pack (feet)	16	31
c) Take-up reel pack (feet)	16	32
d) Low tape sense (0 1 = no yes)	1	33
e) Bar code length (chars)	16	34
f) Bar code	96	35-3A
4) Head positioner:		
a) Current headblock parameter value	16	40
b) Total position commanded (kA)	16	41
c) Actual position (kA)	16	42
d) Raw LVDT voltage last read (mV)	16	43
5) A/D board:		
a) Raw A/D channel #n (0-15) output	12	50-5F
b) Total power (0.01 V)		
Head 1	12	60
" 2	12	61
c) Head temperatures (0.1 deg C)		
Head 1	12	62
" 2	12	63
d) Vacuum (0.1 in. of water)	12	64

6) Mk3A Clock-Recovery module:		
a) Frequency band	7	68
b) Input track # (-1 - 30)	16	69
7) VME boards:		
a) Read parameter values in RAM/ROM	16	70
b) Software revision #	16	71
c) Chassis serial #	8	72
d) General status word (0 1 = false true)	16	73
bit 0: error exists		
bit 1: tape moving		
bit 2: headstack moving		
bit 3: ramping		
bit 4: head positioning		
bit 5: tape positioning		
bit 6: vacuum OK		
bit 7: 5 MHz present		
bit 8: 1 pps present		
bit 9: head peaking		
bit 10: head tracking		
bit 11: forward direction		
bit 12: bar code valid		
bit 13: slewing		
e) Error flags (0 1 = false true)	16	74
bit 0: data out of range		
bit 1: (unused)		
bit 2: unable to attain vacuum with LOAD		
bit 3: failed attempt to change active head		
bit 4: head index out of range		
bit 5: head block parameter # out of range		
bit 6: A/D conversion timeout		
bit 7: MCB write request to locs. 0 - 7F denied		
bit 8: attempted tape motion without tape loaded		
bit 9: head movement timed out		
bit 10: unsuccessful bar code read		
bit 14: spurious interrupt		
bit 15: software error		
f) Software error code (internal, see mcbus.h)	16	75
g) Spurious interrupt vector	16	76

MCB Command Data (transport inputs)

Action	# bits	Address
1) Write Module:		
a) Formatter select (=0 1 for FMTR1 FMTR2)	8 x 1	80
Bit 0: Group 0 in Head 1		
Bit 1: " 1 " " 1		
Bit 2: " 2 " " 1		
Bit 3: " 3 " " 1		
Bit 4: Group 0 in Head 2		
Bit 5: " 1 " " 2		
Bit 6: " 2 " " 2		
Bit 7: " 3 " " 2		
b) Output group enable (=0 1 for disable enable)	8 x 1	81
Bit 0: Group 0 in Head 1		
Bit 1: " 1 " " 1		
Bit 2: " 2 " " 1		
Bit 3: " 3 " " 1		
Bit 4: Group 0 in Head 2		
Bit 5: " 1 " " 2		
Bit 6: " 2 " " 2		
Bit 7: " 3 " " 2		
c) System track select (fmtr. track# = 0-35)		
SYSTRK 0 of Head 1	6	82
" 1 " " 1	6	83
" 34 " " 1	6	84
" 35 " " 1	6	85
SYSTRK 0 of Head 2	6	86
" 1 " " 2	6	87
" 34 " " 2	6	88
" 35 " " 2	6	89
2) Monitor module:		
a) Track select - both Read and Bypass (track# = 0-35)		
Head 1, Output A	6	90
" 1, " B	6	91
Head 2, " A	6	92
" 2, " B	6	93
b) Read module equalizer select (0 1 2 = std, alt1, alt2)		
Head 1, Output A	2	94
" 1, " B	2	95
Head 2, " A	2	96
" 2, " B	2	97

- c) Output select (0 = Head 1, Output A, read
  - 1 = " 1, " A, bypass
  - 2 = " 1, Output B, read
  - 3 = " 1, " B, bypass
  - 4 = Head 2, Output A, read
  - 5 = " 2, " A, bypass
  - 6 = " 2, Output B, read
  - 7 = " 2, " B, bypass)

Formatter 1, signal M1	3	98
" 1, " M2	3	99
Formatter 2, " M1	3	9A
" 2, " M2	3	9B

- d) Data extract:
  - i) Bit sync select 2 9C
  - ii) Bit delay (=0 captures sync bits 63-32) 16 9D
  - iii) Sync threshold 8 9E
  - iv) Initiate data extract 1 9F
  - v) Sync word (bits 63-0; A3 triggers download) 64 A0-A3
  - vi) Sync mask (bits 63-0; A7 triggers) 64 A4-A7
- e) Clock recovery
  - i) Range select 7 A8

3) Transport module:

- a) Stop drive 1 B0
- b) Start drive (0|1 = reverse|forward) 1 B1
- c) Fast move to low-tape point (0|1 = rev|for) 1 B2
- d) Load tape into vacuum column 1 B3
  - (0|1 = do | do not read bar code)
- e) Rewind and unload tape 1 B4
- f) Set capstan speed (in units of .01 in/s) 16 B5
- g) Enable low tape (0|1 = disable|enable) 1 B6
- h) Position tape to footage # (0-65535) 16 B7
- i) Force footage counter to value (feet) 16 B8
- j) Set capstan size constant (arbitrary units) 16 B9
- k) Release brakes and servos 1 BA
- l) Set offset speed (units of 0.01 in/s) 16 BB
- m) Slew delay (initiates; units 0.01 s) 16 BC
- n) Tape thickness (kA) 16 BD
- o) Bar code primitive 2 BE
  - Bit 0: Read (0|1 = do not | do)
  - Bit 1: Verify checksum (0|1 = disable|enable)
- p) Set low-tape point 16 BF

4) Head positioner:			
a) Set index #	16		C0
b) Download index position (kA)	16		C1
c) Set tape direction for offset (0 1 = rev for)	16		C2
d) Active head # (1-4)	16		C3
e) Set head block parameter # (0-10)	4		C4
0: Inchworm speed / fast-out	(kA/s)		
1: " " slow-out	"		
2: " " fast-in	"		
3: " " slow-in	"		
4: LVDT + linear coefficient	(kA/V)		
5: " - " "	"		
6: " + quadratic "	(kA/V <sup>2</sup> )		
7: " - " "	"		
8: Forward tape motion offset	(kA)		
9: Reverse " " "	"		
10: LVDT temperature coeff.	(kA/degC)		
f) Download head block parameter value	16		C5
g) Move head to absolute position (kA)	16		C6
h) Move head relative to current position (kA)	16		C7
i) Move active head to index position + offset(kA)	16		C8
j) Peak up on strongest track within +/- n kA	16		C9
k) Set and enable auto-tracking interval (s)	16		CA
l) Abort motion of active head	1		CB
m) Head motion primitives (CD triggers)	2		CC
Bit 0: speed (0 1 = slow fast)			
Bit 1: direction (0 1 = in out)			
Bits 15-0: delay (40 us units)	16		CD
n) Measure (active) head position	1		CE
5) A/D board:			
a) Set D/A channel #0 in mv. (0-10000)	14		D0
b) " " " 1 " " "	14		D1
c) " " " 2 " " "	14		D2
d) " " " 3 " " "	14		D3
e) Enable vacuum motor	1		D4
f) Set vacuum sensor y-intercept (0.1 in H20)	16		D5
g) " " " slope (0.1 in H20 / V)	16		D6

6) Mk3A Clock-Recovery module:		
a) Frequency band	7	D8
b) Input track # (-1 - 30) (triggers)	5	D9
c) Output track # (1-32) or common (0)	6	DA
d) Parallel mode group select	6	DB
Bits 2-0: Input group (1-4)		
Bits 10-8: Output " "		
e) Common mode track select	7	DC
Bits 4-0: Input track (1-28)		
Bits 10-8: Output group (1-4)		
7) VME boards:		
a) Set address for RAM/ROM read/write (bits 23-16)	8	E0
( " 15-0)	16	E1
b) Overwrite parameter value in RAM	16	E2
c) OR mask into RAM location	16	E3
d) AND mask into RAM location	16	E4
e) Master reset of CPU (by sending AE51)	16	EE