NATIONAL RADIO ASTRONOMY OBSERVATORY Charlottesville, Virginia

June 17, 1975

VLA COMPUTER MEMORANDUM #124

SYSTEM CONTROL BLOCKS FOR SYNCHRONOUS COMPUTERS

Revised Preliminary Specifications

B. Clark

This memo replaces VLA Computer Memo #108. The additions and changes to Memo #108 have grown to the extent that it now seems appropriate to place the revised version in general circulation. However, it is even now clear that these control blocks are not the final version. After the system is in initial operation it will be necessary to make a major revision of the control block structure in order to eliminate inconveniences, unclear conventions, and undue inefficiencies. The revisions made in this Memo are, for the most part, of technical details only, and are of concern only to the programmers of the Modcomp computers.

One change in philosophy has occurred since the writing of Memo #108. In that memo, it was contemplated that only an abbreviated version of the control blocks would be kept in Monty. We now send, every ten seconds, the entire set of control blocks, except the monitor system control blocks, from Boss to Monty, where they are located at the same addresses, so that the pointers apply without offset. If we eventually end up with a shared memory system, we may simply eliminate this data transmission step.

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1	ERROR	+	SET	DURING	NORMAL ARR	AY OPERATION	
2	SEVERE ERROR	+					
3	DANGER	+					
4	WARNING +						
5	ERROR +		SET	DURING	CALIBRATOR	OBSERVATIONS	ONLY
6	SEVERE ERROR +						
7	DANGER +						
8	WARNING	+					
9	ERKOR	+	SET	DURING	SPECIAL TE	ST OPERATIONS	
10	SEVERE ERROR	+		•••••			0.161
11	DANGER	+					

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65	REFRACTION CONSTANT FOR POINTING	8-12	TURNS
66	CURRENT SURFACE REFRACTIVITY	E	N-1
67	*		
68	ESTIMATED ATMOSPHERIC PHASE PATH	E	NANOS E CONDS
69	N		
70	POINTER TO NEXT FREE FAULTY CORRELATOR BLOCK		
71	POINTER TO MONITOR SYSTEM CONTROL BLOCK		
72	TASK SYNCHRONIZATION CONTROL FOR MONTY		
73	TASK SYNCHRONIZATION CONTROL FOR MONTY		
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1	ARM STATUS WORD	CHECK
2	POINTER TO NEXT ARM CONTROL BLOCK	CDA

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0		SUBARRAY ID		CDA	
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3		10			
4		69			
5		SOURCE NAME NUMERIC QUALIFIER	R+15		
6		OBSERVER AND PROGRAM ID	ASCII		
7		44			
8		11	8+15		
9		OBSERVATION MODE DESCRIPTORS			
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11		DATA SURPRESSION CONTROL	_	INIT	
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38		POINTER TO THIRD IF GROUP CONTROL BLOCK			
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		CORB LL			
40		POINTER TO NEXT SUBARRAY CONTROL BLOCK			
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73 44					
77 45		LU FREW #4 UURA LL			
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47		LÓ FREQ #3 CORB RR			

ARRA CONTRACTOR

LOC	CONTENTS				
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78					
79	•• •				
80	SIN RA +				
81	H +				
82	H +		-		T
83	DRA/DT +		E	EPH	TURNSTUAT
84		DEPINITIVES OF SOURCE POSITION			
86		DERIVITIES OF SOURCE FOSTITION			
87	D V/DT +		E		LIGHTS/DAY
86	H +				
89	COS DEC +		S+ 0		TURNS
90	н +				
91	GAIN C	CODE	•		
92	COS DEC +		D		
6 V	₩ ±				
74					
72 96					
97	• •				
98	COS RA +				
99	• •	TRIG FUNCTIONS OF SOURCE COORDINATES,			
100	H +	NEXT 10 SEC INTERUPT			

ARR BUILD ONT BUILD OF

LOC	CONTEN	TS			
101	SIN RA	◆			
102	H	+			
103	**	+			
104	COS HA	★			
105	15	★			
106	**	★			
107	SIN HA	★			
108	11	★			
109	**	◆	_		
110	SIN H	+	E		
111	88	+			
112	COS H	+			
113	11	+			
114	SIN H	+	8+0		
115	COS H	+			
116	COS A				
117	SIN A	+ ALTAZ COORDINATES NEXT TO SEC INTERUPT			
118	COS ETA	◆			
119	SIN EIA	•			
120	UNUSED	•			
121		•	5 • 1		THONS
122	n	•	3+1		TORNS
123		•			
124	A N	▼ ▲			
125		POINTED TO THE EIGST LE CONNECTED TO THIS SUBARRAY		CONNEC	
127			B+ 1	EPH	
124		•	• •	-	
129		•			
130		•			
131		+ PRECESSION MATRIX			
132		+			
133		★			
134		★			
135		★			
136		STOP TIME	E	SNE	RADIANS
137		M			
138		POINTER TO NEXT SOURCE CARD ON DISK			
139		START TIME			
140					
141		TIME UNTIL STOP	8+15	G10	TENS OF SECOND
142		BANDS	ASCII	SNE	
143		FIRST LO FREQUENCY			HUNDKEDS UF MH
144	•	FECOND 10 ERECUENCIES	0 . 1 F	CNE	TENE OF HUT
145	+	SELOND FO LKEQUENCIES	8+13	JNC	IENS UP MAL
140	+				
147	+	TINTNO DICITO			
148		IUNING DIGIIS			



0 1 2 3	IF GROUP ID IF GROUP STATUS FLAGS Pointer to Subarray Control Pointer to Next IF Group Con	BLOCK Trol Block		CDA Check Connec Cda	
4	SYNTHESIZER SETTING NOW +	DOPPLER DATA FOR LINE OBSERVATIONS	S+31	G10	HZ
5	• •				
6	LINE REST FREQUENCY +		0	INIT	GHZ
7	• •				
8	H +				
9	SYNTHESIZER SETTING FOR O H TODAY +		S+31		HZ
10	+				
	NOTELINE PROGRA	MS ARE NOT IMPLEMENTED IN 1975			



0 1		ANTENNA ANTENNA	ADDRESS ON COMMUNICATION SYSTEM		BLD CDA	
2		STATION	IO			
3		ANTENNA	CONTROL STATUS, INCLUDING RECEIVER SELECT		SNE	
4		ANTENNA	STATUS WORD		CHECK	
5		POINTER	TO SUBARRAY CONTROL BLOCK		CONNEC	
6		POINTER	TO ARM CONTROL BLOCK		<u>.</u>	
1	•	PUINTER	TU NEXT ANTENNA COODDINATES	5.1		TUONS
å			CORRENT ANTENNA COURDINATES	241	GEUMA	IURN3
1.5	,	•				
11	н Н	•				
12		FOCUS			SNE	
13	A	+		S+1	G10	TURNS
14	90	+ 1	ANTENNA COORDINATES LAST 10 SEC INTERUPT			
15	Z	+				
16	•	+				
17		WAVE DEL	AY, LAST 10 SEC INTERUPT	D	G10	NANOSECS
18						
19		HAVE OF	W A W LACT 10 CEC INTERNOT	6.14		1016 05 NANDESCE
20		WAVE DEL	AT, LAST TO SEC INTERUPT	2410		IU-S UP NANJSECS
22	BY	•		0		NANOSECONDS
23	ů,	+		U		NANO3CCOND3
24		÷				
25	BY	+				
26	•	+				
21	99	+	ANTENNA LOCATION, NANOSECONDS,			
28	8 Z	+				
29		+				
30		+		-		
31	BA M (V TCO)	+		E		NANUSECONDS
32	" IK IEK	19+				
34	W UELAT	*				
35		•				
30		ANTENNA	HEIGHT (RELATIVE TO ARRAY CENTER)	E	BLD	NANOSECONDS
37		**	······································			
38		DIFFEREN	TIAL PHASE PATH DUE TO REFRACTION	E	G10	NANOSEC
39		M				
40	A	+		S+1		TURNS
41		+ 1	ANTENNA COORDINATES, NEXT 10 SEC INTERUPT			
42	Z	+				
43	**	•		0.10	<u> </u>	NC
44	U V	÷	ANTENNA MOTION DEDIVATIVES, LAST 10 SEC INTERUOT	0+14	GIU	N 3
46	¥ ₩	+ /	WATERING HOLTON DEVITABLITEDA ENDI TA DEP THIEVOLI			
47		•		8+19	G1 0	NS
48	v	+ 1	ANTENNA MOTION DERIVATIVES, NEXT 10 SEC INTERUPT	<u> </u>		· • •
49	Ŵ	+				
50	U	+		D		NANOSECS
51	89	+				

LOC



52		41	◆				
53		U*	+		É		
54			◆				
55			WAVE DELAY, NEXT 10 SEC INTERUPT		D	G1 0	NANDSECS
56			8 8				
57			11				
58			WAVE CELAY, NEXT 10 SEC INTERUPT		S+16		
59			•				
60			CHANGE OF DELAY SINCE LAST 10 SEC IN	TERUPT	8+9	GEOMDL	10'S OF NANDSECOND
61	+		+	+COS(A)+TAN(H)	8-8	INIT	TURNS
62	+		★	*SIN(A)*TAN(H)			
63	+		+	*COS(A)			
64	+	AZ	+	*SIN(A)			
65	+		+	≠TAN(H)			
66	+		+	*SEC(H)			
67	+		+ ANTENNA POINTING CONSTANTS	*1	S+1		TURNS
68	+		+				
69		+	+	*SIN(A)	8-8		TURNS
70		+	◆	+COS(A)			
71		+ EL	◆	*COS(H)			
72		+	★	=SIN(H)			
73		+	★	*1.	S+1		TURNS
74		+	+				



0	FRONT END ID	COA
1	POINTER TO ANTENNA CONTROL BLOCK	CONNEC
2	FRONT END STATUS FLAGS	CHECK
3	FIRST LU FREQUENCY	
4	PUINTER TO NEXT FRONT END CONTROL BLOCK	CDA 100°S OF HHZ

0	PREAMP ID	CDA
1	POINTER TO FRONTEND CONTROL BLOCK	SNE
2	PREAMP STATUS FLAGS	CHECK
3	POINTER TO NEXT PREAMP CONTROL BLOCK	CDA CDA
4	POINTER TO ANTENNA CONTROL BLOCK	CUA

LOC C

0		IF ID			CDA	
1		IF PECU	ILIAR PHASE	B+0	INIT	TURNS
2		IF PECU	JLIAR DELAY	8+11		10'S OF NANDSECS
3	PHASE	+	CURRENT OUTPUT	BCD	GEOMLR	TURNS
4	RATE	+		\$+0		KHZ
5	f#	+				
67	DELAY	+		\$+24	GEOMDL	
8	PHASE	+		B+0	G10	TURNS
ġ	RATE	+	LAST 10 SEC INTERUPT	S+0		KHZ
10	40	+				
11	QUAD TER	M +		8-12		KHZ/SEC
12		IF STAT	US WORD		CHECK	
13		POINTER	TO FRONT END CONTROL BLOCK		SNE	
14		POINTER	TO ANTENNA CONTROL BLOCK		CDA	
15		POINTER	TO IF GROUP CONTROL BLOCK			
16		POINTER	TO THE NEXT IF CONNECTED TO THIS SUBARRAY			
17		POINTER	TU NEXT IF CONTROL BLOCK			
18	PHASE	•			G10	
19	RATE	+	NEXT 10 SEC INTERUPT			
20	66	•				
21	QUAD TER	H 4	,	B-12		KHZ/SEC
22		IF NOMI	NAL SENSITIVITY	?	?	?
23		NOISE T	UBE SYNCHRONOUS DETECTOR			
		NC)TEGAIN = SQRT(NOM.SENS.+SYNC.DET)			
		FL	UX (IN JY) = GAIN(1)+GAIN(2)+CORR.COEFF (IN THEORY. ANYWAY)			
24		IF PECU	ILIAR DELAY	F		
25		(SAME	AS 2)	-		
26		POINTER	TO PREAMP CONTROL BLOCK			
27		IF ADDR	ESS IN DELAY CONTROLLER			



0	CORRELATOR ID
1	BASELINE ID
2	CORRELATOR STATUS WORD
3	POINTER TO NEXT FAULTY CURRELATOR CONTROL BLOCK

CHECK

LOCATIONS 0-31 COMMAND GENERATOR CONTROL WORDS LOCATIONS 32-63 LEFT HALF WORD--DATASET RESPONDING TO QQ RIGHT HALFWORD--MONITOR WORD 2 IN SELECT MODE LOCATIONS 64-71 POINTERS TO ANTENNA DEMULTIPLEX TABLES--DIGITAL WORDS LOCATIONS 72-79 POINTERS TO ANTENNA DEMULTIPLEX TABLES--ANALOG WORDS Supplement to VLA Computer Memo 124

CHANGES TO GLOBAL COMMON

B. G. Clark

1. Word 17 of ARACB is a pointer to the end of the monitor data demultiplex area.

Word 18 of ARACB is a pointer to the address/ID conversion table. This table is 32 words, in which the n^{th} word is the pointer to the antenna control block of the antenna with address n. (0 for non-existent antennas, -1 for non-antenna devices.)

2. Word 7 of ARACB is control bits

bit	on significance
0	de-icers on
1	weather station off

- 3. Word 26 of ARACB is the number of antennas. Word 27 is the length of the antenna control block. Word 35 of ARACB = Length of IFCB.
- 4. Word 11 of SCB is status bits

bit	
15	subarray not in use
14	new source initialization requested
13	new source initialization in progress
11	test programs in progress
7	all antennas in motion
6	some antenna not on source

5. <u>Additional words in SCB</u> Word 149 is a pointer to source list - beginning of list relative to beginning of partition.

Words 150-152 LO composition = m = Multiplication factor of 600 MHz.

Words 154-157 = n = multiplication factor of 5 MHz, except that bit 0 indicates high/low lock on synthesizer. If the 600 MHz is in error at the antenna by \emptyset radians and the 5 MHz is conceptually in error by θ (= \emptyset /120 radians) the LO phase will be adjusted by -(m \emptyset +n θ).

Words 158, 159 Bandwidth selection. One byte per correlator quadrant. Code:

0 = 50 MHz $1 = 25 MHz$ $2 = 12 MHz$	existing filters
3 = 6 MHz	6 = 0.8 MHz
4 = 3 MHz	7 = 0.4 MHz new filters
5 = 1.5 MHz	8 = 0.2 MHz
	9 = 0.1 MHz
#00 - 4 xm-	ר

#83	=	4 Mł	1z	1		
#84	=	1.5	MHz	Y	existing	filters
#85	=	0.5	MHz			

6. Word 3 of ACB

bit	on meaning
0	reference antenna
1	transfer switch
2	Noise tube modulation on
3,4	Paramp attenuators in
5,6	Paramps off
7	Observing over the zenith
10	Subreflector information uninitialized
11	Antenna information uninitialized
12-15	Front end auxiliary switches

7. Added words in ACB

75	Subreflector rotation
76	Pointer to first IFCB
77	600 MHz round trip Ø
78	5 MHz round trip Ø

8. Added requirement:

IFCB's for a given antenna are contiguous, and immediately follow the ACB.

9. Added word in IFCB - word 28-controls.

bit	on meaning
0	Synchronous detector low gain
1	Alternate Input
2	IF information uninitialized