

NATIONAL RADIO ASTRONOMY OBSERVATORY  
SOCORRO, NEW MEXICO  
VERY LARGE ARRAY PROGRAM

VLA COMPUTER MEMORANDUM NO. 155

AN IMPROVED VERSION OF THE ON-LINE  
DATA CHECKING ALGORITHM CHKDEF

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The large volume of data produced by the VLA requires an automatic means of ascertaining data quality. While at the present time manual editing does occur for continuum observations, it will become an increasingly odious and time-consuming task as more antennas come on-line. With the advent of the spectral line system, manual editing will be out of the question, and a properly functioning, automatic editing scheme will be required. The principle mechanism for providing data flagging is the on-line program CHK which runs in the Modcomp computer MONTY. The fact that manual editing of VLA data is still required points to inadequacies of this program.

For the past several months we have been working to bring on-line an improved version of the data checking algorithm CHKDEF. These modifications involve improved specifications of instrumental parameters logged in data sets 1, 2 and 5, and the implementation of checks on quantities not previously scrutinized. These modifications are possible because of information supplied by Larry D'Addario and Peter Napier on the appropriate operating characteristics of various pieces of equipment in the VLA.

The purpose of this memo is twofold; to announce the implementation of a new version of CHKDEF which will hopefully perform more effectively than its predecessor, and to document the current status of the on-line CHECKER system.

We begin by presenting a brief description of the system. The program CHK operates on "monitor points". Each monitor point records a signal from a piece of equipment in the VLA. Some examples of monitor points are power supply voltages, cal and total power readings, current drawn by paramps, device temperatures, transmitted and received IF powers, etc. The monitor points are organized into 6 "data sets", which consist of a set of monitor points specific to some VLA subsystem. Table I lists the 6 data sets. Listed are the data set number, subsystem monitored, and the number of monitor points in the data set.

TABLE I  
DCS DATA SETS

Number	Subsystem	Number of Monitor Points
0	antenna control unit	12
1	front end	80
2	antenna LO and modem controls	77
3	subreflector control	19
4	clipper/sampler + gains/phases	24
5	local LO and modem controls	45

Thus there are provisions for checking 257 monitor points per antenna. In addition to the monitor points tallied in Table I, each data set has a number of digital words which indicate status of the system, e.g., band selected. Some of the monitor points are spares and others are not checked, but Table I gives an idea of the degree of usage of the DCS system.

The program CHK accesses a subset of the monitor points, and checks whether values are within specifications. If not, a flag of one-of-four severity levels is set, and an appropriate message is fetched from a message file and printed on a line printer in the control room. The flags set by CHK range from 1 (data probably

OK) to 4 (data useless). The decisions concerning flag level specification are to some extent arbitrary.

The scheme by which Modcomp flags are converted to the data base flags accessible to the observer is given in Table II.

TABLE II  
MODCOMP TO DEC-10 FLAG CONVENTION SCHEME

CHK Flag	Modcomp Code	DEC-10 Code	Proposed
0	0	0	0
1	1	1	0
2	2	2	0
3	4	3	2
4	8	3	2

The results of our work on data sets 1, 2 and 5 are given in Tables III-V, respectively. The format for all three tables is the same, the first column gives the monitor point number and column 2 lists a brief description of the signal checked. Column 3 gives the "tolerance", the tolerance defined such that if the inequality listed in this column is satisfied, a flag is set. Column 4 gives the flag severity level as defined above. A few comments are in order with regard to the notation employed in column 3. For most cases, an obvious inequality with respect to some voltage level is specified. Slanting brackets (/) indicate absolute values, and numbers separated by a colon conform to the convention, Data Set Number:Monitor Point Number in octal. As an example, /1:107-1:160/>0.2 V means that if the absolute value of the difference of monitor points 107 and 160 in data set 1 exceeds 0.2 V, a flag is set.

Tables III-V are on the DEC-10 disk in the 13 area of Spangler. This availability will facilitate updating as the CHECKER system evolves, and provides ease in distribution of this information. The

file names for Tables III-V are, respectively, DS1.TB, DS2.TB and DS3.TB. Spangler will maintain and update these files as the system changes. Each file contains in the title line the date of last modification.

Future work in this area will consist of tests of the effectiveness of the present CHECKER system, and hopefully the determination of what monitor point tolerances need to be adjusted and what additional devices need to be monitored.

TABLE III

STATUS OF DATA SET 1 CHECKS AS OF: Feb. 25, 1980

Monitor Point	Signal Checked	Tolerance	Severity
0	A Channel Cal Strength	<0.2V, <1.0V	3,2
1	A Channel Total Power	<0.7V, >4.0V	1
2	A Channel ALC	<0.5V	1
3	A Channel Peak Detector	>1.0V	2
4	*****		
5	Not implemented: Same as 0-4 except for channel B.		
6	Will be activated when channel B becomes operational		
7	*****		
20	*****		
21	Monitor Points 20-23 are same as 0-4, except for		
22	Channel C -- is presently implemented.		
23	*****		
24	*****		
25	Monitor points 24-27 are same as 0-4 except for channel		
26	D. Will be activated when Channel D becomes operational.		
27	*****		
40	F5 -15V Power Supply	<-7.65V, >-7.35V	1
Monitor Point	Signal Checked	Tolerance	Severity
41	F5 +5V Power Supply	<4.9V, >5.1V	1
42	F5 +15V Power Supply	<7.35V, >7.65V	1
43	SPARE		
44	AB Pump Supply	<5.1V, >8.4V	1
45	AB Pump Voltage	/ 1:44-1:45/ <0.5V	2
46	CD Pump Voltage	<5.1V, >8.4V	1
47	CD Pump Supply	/ 1:46-1:47/ <0.5V	2
50	AB F6 Log Detector	< -3.5V, >-2.0V	1
51	CD F6 Log Detector	< -3.5V, >-2.0V	1
52	SPARE		
53	SPARE		
54	SPARE		
55	SPARE		
56	SPARE		
57	SPARE		
60	Dewar Temperature:0-300K Indicator	NOT CHECKED	
61	Dewar Temperature:0-30K indicator	>9.0V	2
62	Helium Return Pressure	NOT CHECKED	
63	Dewar Vacuum	NOT CHECKED	
64	Helium Supply Pressure	NOT CHECKED	
65	SPARE		
66	SPARE		
67	SPARE		
Monitor Point	Signal Checked	Tolerance	Severity
100	F2 PLL Tuning Voltage	<-5V, >+5V	1
101	F2 PLL Quad Phase	<0.5V, >1.5V	1,3
102	SPARE		
103	SPARE		
104	SPARE		
105	F5 10 Volt Source	/ 1:105-1:106-10.0/ >0.01V	1
106	Front End Ground	/ 1:106/ > 0.01V	1
107	Rack A Bin Temperature	<2.0V, >3.0V	1
		/ 1:107-1:160/ > 0.2V	2
120	F3 PLL In Phase	<-5.0V, >+5.0V	1

TABLE III (cont.)

121	F3 PLL Quad Phase	/ 1:121/ < 0.5V	2
122	SPARE		
123	SPARE		
124	AB Pump Temperature	/ 1:124-5.0/ > 0.15V	2
		/ 1:124-1:124,1/ >0.05V	2
125	AB Heater Current	<0.2V, >9.8V	1
126	CD Pump Temperature	<4.85V, >5.15V	1
127	CD Heater Current	<0.2V, >9.8V	1
144	AB K LO Mixer Current	<-10.0V, >0.25V	2
145	AB K LO Mixer Voltage	<-1.4V, >-0.25V	1
146	AB KU LO Mixer Current	<-10.0V, >-0.25V	2
147	AB KU Mixer Voltage	<-1.4V, >-0.25V	1
150	AB Paramp 1 Bias Current	>9.0V	2
151	AB Paramp 1 Bias Voltage	<-1.1V, >1.7V	2
152	AB Paramp 2 Bias Current	>9.0V	2
153	AB Paramp 2 Bias Voltage	<-1.1V, >1.7V	2
154	SPARE		
155	SPARE		
156	AB Upconverter Bias Current	>9.0V	2
157	AB Upconverter Bias Voltage	<0V, >5.0V	2
164	*****		
165	Same as 144-147, only for CD Receiver Channel		
166			
167	*****		
170	*****		
171	Same as 150-157, only for CD Receiver Channel		
172			
173			
174			
175			
176			
177	*****		

Notes on Additional Checks and Checks on Computed Quantities

- (1) For all four channels, the average values of cal deflection and total power are used to calculate the system temperature. If the system temperature is greater than 8 times nominal, a severity level 3 flag is set.
- (2) A test for cal and system temperature fluctuations is employed as follows; the instantaneous cal and total power readings are compared with the mean over a number of previous intervals. If the cal differs from the mean by > 1/ 8 of the mean, a flag is set. If the total power differs from the mean by > 1/ 16 of the mean, a flag is set.

TABLE IV

DATA SET 2 CHECKS AS OF: Feb. 25, 1980

Monitor Point	Signal Checked	Tolerance	Severity
0	L1 Ground	<-0.01V, >0.01V	1
1	5 MHz Oscillator Power	<1.5V	1
2	5 MHz Output Power	<1.5V	2
3	10 MHz Output Power	<1.5V	1
4	20 MHz Output Power	NOT CHECKED	
5	10 MHz Driver Power	<1.5V	1
6	50 MHz VCO Control Voltage	/ 2:6/ >10.0V	3
7	50 MHz Loop Phase Error	NOT CHECKED	
10	50 MHz Comb Power	<3.0V	1
11	1200 MHz PLL not locked (TTL)	>1.0 V	3
12	1200 MHz PLL Phase Error	NOT CHECKED	
13	1200 MHz VCO Control Voltage	<-5.0V, >8.0V	1
14	1800 MHz PLL Phase Error	NOT CHECKED	
15	1800 MHz VCO Control Voltage	<-5.0V, >8.0V	1
16	1200 MHz Received Level	<0.4V	1
17	1800 MHz Received Level	<0.7V	1
20	L3 1800 MHz PLL not locked	>1.0V	3
21	1200 MHz VCO Output Power	>-0.4V	1
22	1800 MHz VCO Output Power	>-0.4V	1
		>5.0V	1
23	5 MHz VCO Control Voltage	/ 2:23/ > 4.0V	3
24	5 MHz Phase Error	<-0.2V, >0.2V	1
		/ 2:24-2:24,1/ >0.3V	2
25	600 MHz Phase Error	NOT CHECKED	
26	5 MHz Lock Selected (TTL)	>2.0V	3
27	Abnormal State Selected	>2.0V	3
40	T2 Ground	<-0.01V, >0.01V	1
41	Temperature Monitor	NOT CHECKED	
42	Rack B Temperature Monitor	<2.2V, >3.0V	1
		/ 2:42-2:42,1/ >0.2V	2
Monitor Point	Signal Checked	Tolerance	Severity
43	Vertex Room Air Cooler	NOT CHECKED	
44	Vertex Room Air Heater	<0.5V, >4.5V TURNED OFF	
45	Transmit IF Power	<2.0V	2
46	Received IF Power	<2.0V	2
47	Varactor Monitor	NOT CHECKED	
50	Integrator Output	<-5.0V, >5.0V	1
51	Gunn Oscillator Voltage	NOT CHECKED	
52	Gunn Oscillator Current	NOT CHECKED	
54	SPARE		
55	Warning: Not in Auto	>2.0V	1
56	Free Run Warning	NOT CHECKED	
57	T1 Lock Warning	>2.0V	1
100	L6 Loop Amplifier Voltage-A	NOT CHECKED	
101	L6 Tuning Voltage-A	NOT CHECKED	
102	+5 Volts Power Supply (A)	<5.0V, >5.3V	1
103	-5.2 Volts Power Supply (A)	<-5.3V, >-5.0V	1
104	+15 Volts Power Supply (A)	<-7.35V, >7.65V	1
105	-15 Volts Power Supply (A)	<-7.65V, >7.35V	1
106	+20 Volts power Supply (A)	NOT CHECKED	
107	-28 Volts Power Supply (A)	<-7.15V, >-6.85V	1
120	SPARE		
121	SPARE		
122	SPARE		

TABLE IV (cont.)

123 SPARE  
 124 SPARE  
 125 SPARE  
 126 SPARE

Monitor Point	Signal Checked	Tolerance	Severity
127	SPARE		
140	Loop Amplifier Voltage-C	NOT CHECKED	
141	Tuning Voltage-C	NOT CHECKED	
142	+5 Volts power Supply-C	NOT CHECKED	
143	-5.2 Volts Power Supply-C	NOT CHECKED	
144	+15 Volts power Supply-C	NOT CHECKED	
145	-15 Volts power Supply-C	NOT CHECKED	
146	+20 Volts power Supply-C	NOT CHECKED	
147	+28 Volts Power Supply-C	<+6.85V, >+7.15V	
160	SPARE		
161	SPARE		
162	SPARE		
163	SPARE		
164	SPARE		
165	SPARE		
166	SPARE		
167	SPARE		

NOTES FOR DATA SET 2

(1) Monitor Point 24... Test for 5MHz phase jump also made



TABLE V

DATA SET 5 CHECKS AS OF: Feb. 25, 1980

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Monitor Point	Signal Checked	Tolerance	Severity
0	1200 MHz Received Level	<0.6V, >0.9V	1
1	1800 MHz Received Level	<0.6V, >0.9V	1
2	1200 MHz Phase Error	NOT CHECKED	
3	1200 MHz VCO Control	<-5V, >8V	1
4	1800 MHz Phase Error	NOT CHECKED	
5	1800 MHz VCO Control	<-5V, >8V	1
6	1200 MHz VCO Power Output	<-0.6V	1
7	1800 MHz VCO Power Output	<-0.6V	1
12	1200 MHz Lock Indication (TTL)	>1.0V (HI)	3
13	1800 MHz Lock Indication (TTL)	>1.0V (HI)	3
14	78 KHz Control Voltage	<1.0V, >6.0V	1
15	L11 -15V Power Supply	<-7.6V, >-7.4V	1
16	L11 Ground	>0.01V	1
17	L11 +15V Power Supply	<7.4V, >7.6V	1
40	Ground	>0.01V	1
41	D Rack Temperature- West Arm	NOT CHECKED	
42	D Rack Temperature - East Arm	NOT CHECKED	
45	Transmitted IF Power	<0.8V, >2.0V	2
46	Received IF Power	<2.0V	2
47	Varactor Monitor	NOT CHECKED	
50	Integrator Output	/2:50/ >5.0V	2
51	Gunn Oscillator Voltage	NOT CHECKED	
52	Gunn Oscillator Current	NOT CHECKED	
54	SPARE		
55	Warning:Not in Auto	>2.0V	1
56	T1 Free Run Warning (TTL)	NOT CHECKED	1
57	T2 Lock warning	>2.0V	
100	T5 Channel A ALC Voltage	<0V	3

Monitor Point	Signal Checked	Tolerance	Severity
101	IF Receiver B ALC	NOT CHECKED	
102	IF Receiver C ALC	<0V	3
103	IF Receiver D ALC	NOT CHECKED	
104	IF Receiver A Level Monitor	<2.0V, >10.0V	2
105	IF RCVR B Level Monitor	NOT CHECKED	
106	IF RCVR C Level Monitor	<2.0V, >10.0V	2
107	IF RCVR D Level Monitor	NOT CHECKED	
110	+5 Volts Power Supply	<4.95V, >5.25V	1
111	-5 Volts Power Supply	NOT CHECKED	
112	+15 Volts Power Supply	NOT CHECKED	
113	-15 Volts Power Supply	NOT CHECKED	
114	+28 Volts Power Supply	<6.90V, >7.10V	1
115	-28 Volts power Supply	<-7.1V, >-6.9V	1
120	T6 Total Power- Ch A	NOT CHECKED	
121	T6 Total Power -Ch B	NOT CHECKED	
122	T6 Total Power- Ch C	NOT CHECKED	
123	T6 Total Power- Ch D	NOT CHECKED	