

VLA Technical Report No. 67
The VLA MKII Data Gathering System
A Manual for Operation
P. Hicks, C. Janes
March 1991

Table of Contents

Introduction

The Formatter

The VCRs

The Data Quality Analyzer

Checklist

Procedure for setting clocks

VLA Technical Report No. 67
The VLA MKII Data Gathering System

Introduction

The purpose of the MKII equipment is to record base band signals at the VLA site in such a way that the data can later be decoded and correlated with data taken at other radio sites. The base band signal is passed from a video converter to the MKII formatter which samples the analog signal and converts it to a serial pulse train of 1's and 0's. The formatter adds identification, synchronizing, and error checking information to the sampled data and passes the signal to a VHS VCR. The radio data are recorded on the tape recorder video track; time code is recorded on the audio track. The data tape can be played back to the DQA (Data Quality Analyzer) to check for correct formatting. The VHS tapes from the various radio sites are shipped to a correlator.

The data output of the correlator are converted from the time domain to the frequency and space domains. The result is a line spectrum of a radio source, or a 2-D radio brightness map of an area of the sky.

The purpose of this document is to provide a procedural guide for the VLA MKII formatter.

2 The VLA MKII Data Gathering System

MKII Formatter.

The MKII formatter provides data in a MKIIC format for recording on magnetic tape.

The formatter uses a phase-locked loop and a 5 MHz input from the station clock to sample the incoming base band analog signal at a 4 MHz rate. A signal level above a certain threshold (0 volts) is sampled as a 1 and below as a 0.

The VCR writes data frames in place of video frames on the magnetic tape cartridge. To synchronize the VCR with the formatter, the formatter divides the 5 MHz down to 60 Hz (Sync), and outputs that signal to the VCR. In addition to the data, each frame contains a beginning-of-frame code (BOF), a frame count and parity code, and a re-synchronizing code every 512 microseconds.

The formatter time is manually set to agree with UTC by entering a time, and arming the timing circuit when that exact time comes up on WWV. A 1PPS input triggers the counting circuit. The clock counting circuit uses the 5 MHz input to update the formatter clock. The time difference between the formatter clock and the 1PPS is displayed at the bottom of the MKIII rack. The difference between the time displayed for MKII and the time displayed for TIC should be < 1 microsecond. A procedure for setting the clocks is attached. The difference must remain stable during an observing run.

The "Sync Slope" switch on "+" selects the positive edge of the 1PPS signal to synchronize the formatter clock. The time difference may be adjusted with the "Sync Level" knob on the formatter; the favored position is marked with a white dot.

Two different data inputs or channels are available on the formatter. For the most part, only channel 1 is used. The data from channel 1 may be sent to either VCR 1 or 2. Signs posted near the VCRs tell which recorder to use. A switch on the front of the formatter allows a selection of "Channel 1 to Recorder 2" or "Channel 1 to Recorder 1." Should Channel 2 ever be used, it is routed to the opposite recorder from Channel 1. If the wrong position is selected, the formatter will send the correct format characters to the recorder, but no data. The tape will check out correctly on the DQA, but no data will be found later on the correlator. The point is that the positioning of the channel selector switch on the formatter must be checked carefully.

For the formatter to operate correctly, 5 MHz from the maser and the 2 MHz data from the video converter must be connected to the back of the formatter. 1PPS from the MKIII TIC Box must be connected to "Sync In" on the face of the formatter. The correct UTC time must be displayed, and the "DATA," "TIME," and "LOCK" red LEDs must be lit. No DATA light means the video converter is not connected or the signal level is too low. No TIME light means the 1PPS is not connected. No LOCK light means the 5 MHz is not present.

3 The VLA MKII Data Gathering System

VCRs

The MKII system uses Video Cassette Recorders (VCRs) to record the data. Two different VCR types are used in the MKII system: the Panasonic model PV1360 and the RCA VDT501. Both are dual video head VHS machines.

All the MKII VCR machines at NRAO are modified to meet the requirements of the MKII system. The servo drive circuit for the video head cylinder drive requires an external 60 Hz rather than an internally-generated Sync. The tuners are removed and the video data signal injected into the head drive circuit. Playback video is lifted immediately after the read head amplifier circuit. BNC connectors are added for audio track input and output, but the audio circuits are otherwise unmodified.

The RCA units include a circuit board which routes inputs and outputs and displays their respective amplitudes on a meter. The circuit board and meter for the Panasonic VCRs is located externally in the so-called Blue Box.

Turn the power on to operate the VCR. A red LED near the power switch on the RCA VCR must be lit for the unit to function. The Panasonic VCR has a power on indication on the front display panel. The speed for both models must be "LP." Ignore the video level adjustment, and on the RCA VCR, the "Low VID" LED, the counter memory, and the "remote/local" switch.

To record, load an unused tape in the VCR. Make sure the tape is completely rewound. On the RCA, press "RECORD" and "PLAY." It is only necessary to press "RECORD" on the Panasonic. The VID IN, AUD IN, and SYNC positions on the meter select switch should cause the meter to deflect. If not, a signal is missing. The meter on the RCA should show between 0.8 and 1.0 for VID IN; the current number in favor is marked on a label near the meter. The meter should be pegged for VID IN on the Blue Box. The VCR will stop automatically at the end of the tape.

To rewind, press "STOP" and "REW." The unit will stop automatically at the end of the tape.

The tape may be played back by pressing "PLAY." The VID OUT, AUD OUT, and SYNC positions on the meter select switch should cause the meter to deflect. The track centering knob should be in its "center" position, with the pointer on the knob straight up. The track centering knob on the Panasonic is behind the front panel.

4 The VLA MKII Data Gathering System

The Data Quality Analyzer

The Video and Audio outputs of the VCR and the formatter 60 Hz (Sync) go to the DQA. The audio is decoded to give the time display. The Video is decoded to look for missing sync characters.

A missing BOF will cause the BOF error LED to flash on, and increment the BOF error display by 1. If the frame count fails to increment correctly, the frame count error LED will flash on; and if the frame count parity is wrong, the parity LED will flash on. Either of the frame count errors will increment the frame count error display by 1. Finally, a missing 512 microsecond sync character will cause the Drop Out (DO) LED to flash on, and the error display will increment by 1.

Three different integration times may be selected: 1 second, 10 seconds, and 60 seconds. To count the number of errors in a minute, for example, set the integration time on "60" and press "Reset." The display will go blank until the end of 1 minute, and then will display the number of errors encountered during the integration period. The display will update with a new error count every minute.

The only adjustment of the DQA is a vernier dial which alters the phase of the sampling frequency. This writer's experience is that a setting of 790 on the dial is satisfactory for most cases.

The DQA may be used to measure the output of either VCR or the formatter. The DQA displays the quality of the formatter output when the selected VCR is recording. The time display should be the same as the formatter clock, and, in the case of the RCA VCR only, no video track errors should be displayed. Ignore the "total power" display.

To measure the quality of at tape on VCR #1, for example, select "Position 1" on the VCR selector. Then play the tape on VCR #1 (the bottom one). The error rate ideally will be 0 BOF, 0 HFC, and <12 DO per minute.

If the time display does not update, no audio signal is being decoded. If the error display does not update, the 60 Hz Sync input to the DQA is missing. If the error display is all 9's, no video signal is being received. If the error display is all 60's, no BOF is being decoded.

With all high numbers, the recording may be defective. In this case, move the VCR position selector switch back and forth between #1 and #2 a few times to see if the DQA will "sync up." Play the "Test Tape" to make sure the VCR and the DQA still work, and report the problem to service personnel.

If the BOF and Frame Count errors are low, but the DO errors are high, check the VCR track centering. Play the "Test Tape" and call service personnel if the problem persists. If you are preparing to record, try recording and playing back on a different tape. If the replacement tape works, mark the questionable tape for testing by service personnel.

SETUP CHECKLIST FOR MK II

EXPERIMENT: _____

- ☐ Set MKII IF unit to EXT FILTER.
- ☐ Turn off 1MHz phase cal comb.
- ☐ Set MKIII video converter frequency and bandwidth per setup sheet, and set 10dB switches up.
- ☐ Use attenuator for IF 1 on MKIII IF Distributor panel to set a mid-range reading on the MKII meter.
- ☐ Verify that the power reading on the MKII meter goes to zero when the cable is removed from the USB jack of the video converter specified on the setup sheet.
- ☐ For single dish experiments, verify that the signal source is correct by pulling the cable at the T5 module and observing that the MKII meter goes to zero.
- ☐ Verify that the MKII UTC clock agrees to the second with WWV and the MKII "TIME" indicator is on. Record on the setup sheet the MKII one (1) second tic measurement from the time interval meter.
- ☐ Verify that the LOCK, TIME, and DATA LEDs on the TIMING GENERATOR are lit.
- ☐ Verify that the recorder selector switch left of the clock setting window is set for "CH 1 to REC 2". Check that the recorder selector switch recessed in the bottom recorder rack is set for "REC 2 to DQA". See note #1.
- ☐ Verify that the selected VCR is on, and the speed selection is "LP".
- ☐ Verify that signals are present on VID IN, AUD IN, and SYNC. The VID IN must be 0.8 to 1.0 for the RCA and pegged for the Panasonic.
- ☐ Verify that the VCR is in record: PLAY and RECORD buttons down on the RCA: REC displayed on the Panasonic.
- ☐ Make sure the VCR tape is rewound.

Notes:

1. In the event of a VCR failure, use the other VCR by switching the selector switch mention in the last step above to "CH 1 to REC 1" and "REC 1 to DQA".
2. Detector outputs are available at the rear of the patch panel, along with permanently connected detector outputs for IF A and IF D. Cables labeled "DET 1" and "DET 2" run to the chart recorder.
3. A MKIII video converter, USB output, is the signal source for MKII experiments, as specified on the setup sheet for the experiment.
4. To check data quality, record data via the VCR for >1 minute, then rewind the tape. On the DQA rack, set the **integration period** to 60 seconds. On the VCR, **press play** to playback data into the DQA. When the tape has advanced past the clear tape, **press the red reset button**. Error counts in all three fields should be less than 20 in 60 seconds. In general, the LEDS above the DQA display should not blink rapidly. If the test fails, call person on VLBI call-out list.

VLBI EXPERIMENT BC5

August 13, '90

PRINCIPAL INVESTIGATOR:

PROGRAM TITLE:

Conway, J. (Caltech)

Phase Connection VLBI.

Start MST: Aug. 13 at 19:30 UT

(Aug. 13 at 13:30 MST)

Stop MST: Aug. 14 at 9:30 UT

(Aug. 14 at 3:30 MST)

MK2 LCP

BAND: 6CM

Total Hours: 14.00

Number of MK2 tapes: 4

Single Dish YLA

YCO 9 at 180.99MHz

Bandwidth: 2MHz

SCHEDULE:

West Arm =

East Arm = 23

North Arm =

Timing checks: MK2 - W.R.T. Loran

Negative means YLA is early, Positive means YLA is late

UT TIME

DAY NUMBER

MEASUREMENT

07:30

226

1.5

MK2 Data Quality Check, 60 second count.

~~Test Pattern on Tape yes/no~~

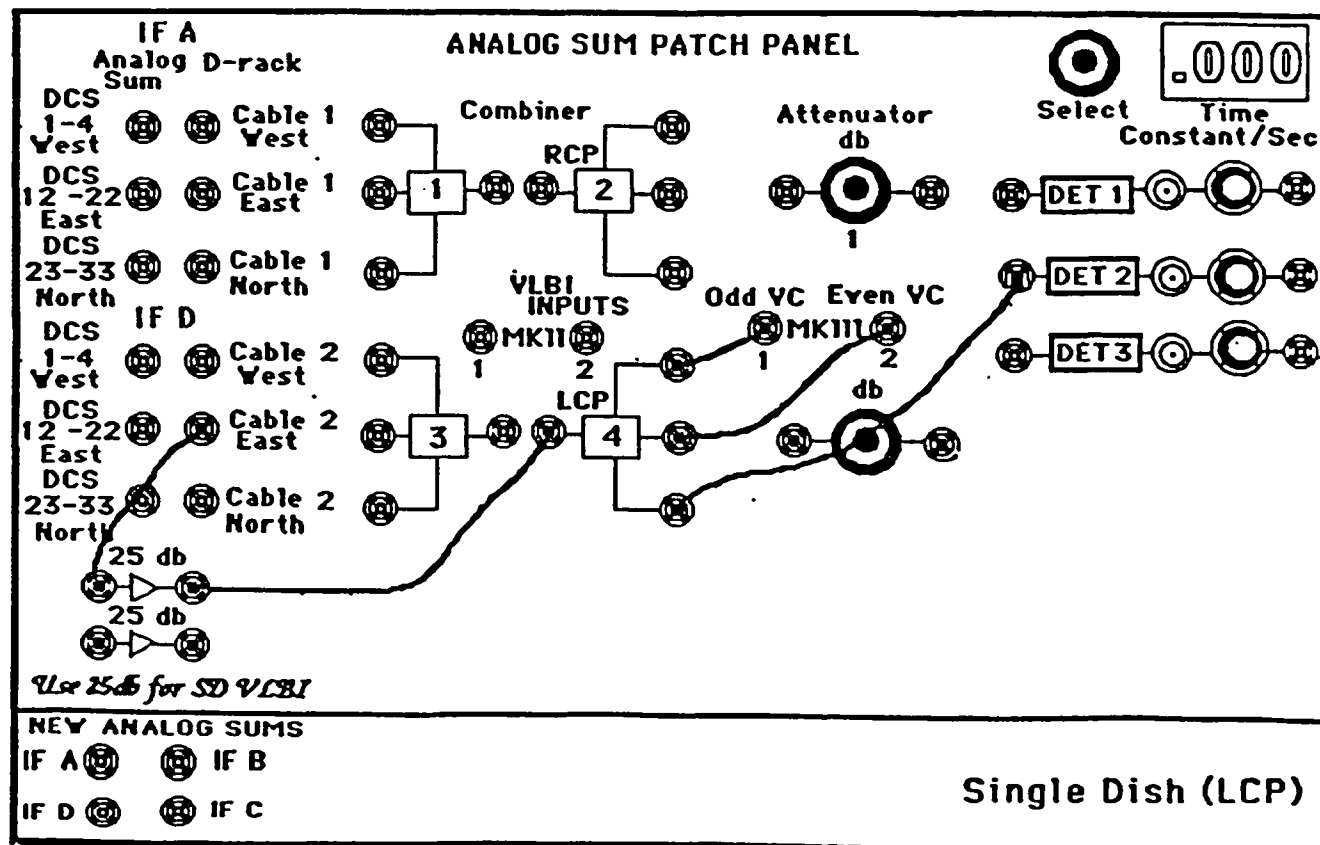
These values are found upon the Data Quality Analyzer:

B.O.F

Frame Count

Drop Outs

TAPE NUMBER



9/30/90

**Procedure For Setting The Clocks
On The Mark II/Mark III Formatters**

1. At The Tick Box, on the bottom of the Mark III rack, insure the Loran/Rb switch is set to the Loran position and the A-B/B-A switch is set to A-B position.
2. Rotate the SELECT switch to the Tick Box position.
3. Increment the left most (MS) digit of the thumb wheel switch, one number at a time until the OVER indicator in the time interval display goes out.
4. Subtract the number in the time interval display from the number on the thumb wheel switch. Enter this number into the thumb wheel switches. Adjust the (LS) digit for a value of approx. 2.0 u/s on the display.
5. Rotate the SELECT Switch to the Mark III position. Place the formatter RUN/SET switch to the SET position and press the 1 PPS SYNC button. When the formatter is "in sync" the time interval display should be approx. 2.0 u/s.
6. Reset the clock, using the buttons under the digital display. Start the clock running when the clock is coincident with the time tic from WWV or the National Bureau of Standards by putting the RUN/SET switch to RUN.
7. Rotate the SELECT Switch to the Mark II position. On the Mark II formatter, insure a coaxial cable is connected from the SYNC IN, on the formatter to the MARK III TIC BOX OUT, at the top of the rack.
8. Place the SET/INHIBIT switch to the SET position and press the sync arm button. When "in sync" the time interval display should be approx. 2.0 u/s.
9. Set the clock to the correct time, using the buttons under the display. Use WWV or NBS (6 1 900 410-8463) for the correct time.

