

National Radio Astronomy Observatory
Charlottesville, Virginia

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To: *Mr. M. L. ...*

From: Arthur M. Shalloway

Subject: Revised Functional Description of NRAO Correlation Receiver Model II
(See Original Description September 11, 1967)

The following information is being made available for those planning to use the receiver or program computers to process its output data.

SPECIFICATIONS OF NRAO CORRELATION RECEIVER MODEL II:

Number of Channels:

Total - 416

Correlation Channels - 413

Receiver Power Channels - 3

Configurations:

1. Receiver A - 192 Channels Autocorrelation - 1 Channel Power
Receiver B - 192 Channels Autocorrelation - 1 Channel Power
Receiver C - 29 Channels Autocorrelation - 1 Channel Power
2. Receiver A - 384 Channels Autocorrelation - 1 Channel Power
Receiver C - 29 Channels Autocorrelation - 1 Channel Power

Bandwidths:

- | | | | |
|-------------|---------------------------------------|----------------|------------------------------------|
| 1. 10 MHz | } Available on
Receivers A, B & C. | 6. 312.5 KHz | } Available on
Receivers A & B. |
| 2. 5 MHz | | 7. 156.25 KHz | |
| 3. 2.5 MHz | | 8. 78.125 KHz | |
| 4. 1.25 MHz | | 9. 39.0625 KHz | |
| 5. 625 KHz | | | |

Dump Times (Integration Time Available in Correlation Receiver Prior to Dumping Data into Computer):

1 sec. and 10 sec.

Switching Rates:

- 1 Hz - 50%/50% (Signal/Reference) Duty Cycle
- 5 Hz - 50%/50% (Signal/Reference) Duty Cycle
- 10 Hz - 50%/50% (Signal/Reference) Duty Cycle
- 1 Hz - 90%/10% (Signal/Reference) Duty Cycle
- 5 Hz - 75%/25% (Signal/Reference) Duty Cycle

Blanking Times:

4 to 26 ms. in steps of 2 ms.

Switching Modes:

- | | | |
|------------------------|---|--|
| 1. Load Switching | } | With continuous or separate calibration, gain modulator switching, and synchronous detector switching for analog continuum recording |
| 2. Frequency Switching | | |

Autocorrelation Data:

Signal and reference output data are provided as two independent groups of numbers. Thus, a continuous bandpass correction can be provided in the computer.

Display:

Any channel - signal or reference - plus the six power counters can be displayed in decimal.

Test Signals:

Square waves from 39.0625KHz to 10MHz can be fed into clipper inputs. Special internal tests available in digital system. Internally generated noise source can be fed into IF input.

Reference should be made to Memo: Input Interface - 300' and 140' On Line Computers by A. M. Shalloway dated October 18, 1966 for detailed information on transfer of data from the receiver to the computer. The following tabulation lists all of the output data available from the receiver and its format.

COMPUTER WORDS	DESCRIPTION	FORMAT - DDP-116 Word Bits
		Note: All even numbered words have a "1" in word bit 1. All odd words have a "0" in word bit 1.
		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 } 413 Channels Through } of Signal 825 } Correlation	Each channel is represented by a 20 bit word which is taken into the computer as two words	1st word 1 2 ¹⁴ 2 ¹³ 2 ¹² 2 ¹¹ 2 ¹⁰ 2 ⁹ 2 ⁸ 2 ⁷ 2 ⁶ 2 ⁵ 2 ⁴ 2 ³ 2 ² 2 ¹ 2 ⁰ 2nd word 0 0 0 0 0 0 0 0 0 0 0 2 ¹⁹ 2 ¹⁸ 2 ¹⁷ 2 ¹⁶ 2 ¹⁵
826 } Receiver A Signal 827 } Power Counter 828 } Receiver B Signal 829 } Power Counter 830 } Receiver C Signal 831 } Power Counter	Each counter is represented by a 20 bit word which is taken into the computer as two words.	Same as words 0 - 825.
832 } 413 Channels Through } of Reference 1657 } Correlation	Each channel is represented by a 20 bit word which is taken into the computer as two words.	Same as words 0 - 825.
1658 } Receiver A Reference 1659 } Power Counter 1660 } Receiver B Reference 1661 } Power Counter 1662 } Receiver C Reference 1663 } Power Counter	Each counter is represented by a 20 bit word which is taken into the computer as two words.	Same as words 826 - 831.
1664 Spare Word	For future requirements	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1665 Receiver A Bandwidth	4 bit word: 0 = 10 MHz 1 = 5 MHz 2 = 2.5 MHz 3 = 1.25 MHz 4 = 625 KHz 5 = 312.5 KHz 6 = 156.25 KHz 7 = 78.125 KHz 8 = 39.0625 KHz	0 0 0 0 0 0 0 0 0 0 0 2 ³ 2 ² 2 ¹ 2 ⁰
1666 Receiver B Bandwidth	Same as word 1665	Same as word 1665

ORDER OF WORDS - A/C Receiver-to-Computer (continued)

COMPUTER WORDS	DESCRIPTION	FORMAT DDP-116 Word Bits
1667 Receiver C Bandwidth	3 bit word: 1 = 10MHz 4 = 1.25MHz 2 = 5MHz 5 = 625KHz 3 = 2.5MHz	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 0 0 0 0 0 0 0 0 0 0 0 0 0 2 ² 2 ¹ 2 ⁰
1668 Receiver A Attenuator	2 ea. 4 bit words, 1 ea. 3 bit word: 1 ea. 4 bit BCD word } 0 = 0 db. } 1 = 0.1 db. } 2 = 0.2 db. } 3 = 0.3 db. } Word A 4 = 0.4 db. } 5 = 0.5 db. } 6 = 0.6 db. } 7 = 0.7 db. } 8 = 0.8 db. } 9 = 0.9 db. } 1 ea. 4 bit BCD word } 0 = 0 db. } 1 = 1 db. } 2 = 2 db. } 3 = 3 db. } Word B 4 = 4 db. } 5 = 5 db. } 6 = 6 db. } 7 = 7 db. } 8 = 8 db. } 9 = 9 db. } 1 ea. 3 bit BCD word } 0 = 0 db. } 1 = 10 db. } 2 = 20 db. } 3 = 30 db. } Word C 4 = 40 db. } 5 = 50 db. }	1 0 0 0 0 0 2 ³ 2 ² 2 ¹ 2 ⁰ 2 ³ 2 ² 2 ¹ 2 ⁰ 2 ² 2 ¹ 2 ⁰ A B C
1669 Receiver A Gain Modulator	1 bit word: 0 = on 1 = off	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 ⁰

ORDER OF WORDS -A/C Receiver-to-Computer (continued)

COMPUTER WORDS	DESCRIPTION	FORMAT DDP-116 Word Bits
		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1670 Receiver B Attenuator	Same as word 1668	Same as word 1668
1671 Receiver B Gain Modulator	Same as word 1669	Same as word 1669
1672 Receiver C Attenuator	4 bit word - same as section B of word 1668	1 0 0 0 0 0 0 0 0 0 0 0 2 ³ 2 ² 2 ¹ 2 ⁰
1673 Gain Modulator & Synchronous Detector Phase	1 bit word: 0 = normal 1 = inverted	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 ⁰
1674 Series-Parallel Operation	1 bit word: 0 = series 1 = parallel	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 ⁰
1675 Switch Rate & Duty Cycle	3 bit word: 0 = 1Hz } 50%-50% Duty 1 = 5Hz } Cycle 2 = 10Hz } 3 = 1Hz - 90%-10% (Sig.- Ref.) Duty Cycle 4 = 5Hz - 75%-25% (Sig.- Ref.) Duty Cycle	0 0 0 0 0 0 0 0 0 0 0 0 2 ² 2 ¹ 2 ⁰
1676 Dump Time	1 bit word: 0 = 1 sec. 1 = 10 sec.	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 ⁰
1677 Blanking Time	4 bit word: 0 = 4 ms 1 = 6 ms 2 = 8 ms 3 = 10 ms 4 = 12 ms 5 = 14 ms	0 0 0 0 0 0 0 0 0 0 0 0 2 ³ 2 ² 2 ¹ 2 ⁰

COMPUTER WORDS	DESCRIPTION	FORMAT DDP-116 Word Bits
1678 Digital Test Signals	These words apply only when word 1679 is not all zeros. 1 ea. 4 bit word, 1 ea. 1 bit word: Word A - 4 bits: 0 = 10 MHz 1 = 5 MHz 2 = 2.5 MHz 3 = 1.25 MHz 4 = 625 KHz 5 = 312.5 KHz 6 = 156.25 KHz 7 = 78.125 KHz 8 = 39.0625 KHz 9 = Logic - 0 - to Sampler Output Flip Flop 10 = Logic - 1 - to Sampler Output Flip Flop 11 = Shift Register Memory Test Signal Word B - 1 bit: Applies only when Word A is 11. 0 = Special Test Signal into Shift Register Memory for servicing purposes only. 1 = Standard Test Signal into Shift Register Memory.	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2⁰ 2¹ 2² 2³ 2⁴ 2⁵ 2⁶ 2⁷ 2⁸ 2⁹ 2¹⁰ 2¹¹ 2¹² 2¹³ 2¹⁴ 2¹⁵ B A

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COMPUTER WORDS	DESCRIPTION	FORMAT															
		DDP-116 Word Bits															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1679 Clipper Test Signal	3 ea. 1 bit words:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word A:																
	0 = normal } Receiver A 1 = test } Clipper																
	Word B:																
	0 = normal } Receiver B 1 = test } Clipper																
	Word C:																
	0 = normal } Receiver C 1 = test } Clipper																
1680 Front End Switch	2 bit word: 0 = Modulated-Inverted 1 = Signal 2 = Reference 3 = Modulated-Normal	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2 ¹	2 ⁰
1681 Noise Tube Mode	3 bit word: 1 = Continuous Modulation-Normal 2 = Continuous Modulation-Inverted 3 = Interrupted Modulation-Normal 4 = Interrupted Modulation-Inverted 5 = On 6 = Off	0	0	0	0	0	0	0	0	0	0	0	0	0	2 ²	2 ¹	2 ⁰
1682 External Sense Switches	6 ea. - 1 bit words: Each bit can be a one or zero to indicate the condition of a switch external to the correlator. For example, a noise tube level switch indicating 10 ⁰ or 100 ⁰ .	1	0	0	0	0	0	0	0	0	0	2	2 ⁰	2 ⁰	2 ⁰	2 ⁰	2 ⁰

ORDER OF WORDS - A/C Receiver-to-Computer (continued)

COMPUTER WORDS	DESCRIPTION	FORMAT															
		DDP-116 Word Bits															
1683 Noise Tube Duty Cycle and On-Off Indicator	2 ea. - 1 bit words: 0 = 50%-50% 1 = 90%-10%(Sig.-Ref.)) A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	0 = Noise Tube Off 1 = Noise Tube On	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2 ⁰ B	2 ⁰ A

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