

NATIONAL RADIO ASTRONOMY OBSERVATORY
GREEN BANK, WEST VIRGINIA

ELECTRONICS DIVISION INTERNAL REPORT No. 150

NRAO 45-FOOT TELESCOPE
REMOTE CONTROL DATA LINK SYSTEM

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OCTOBER 1974

NUMBER OF COPIES: 150

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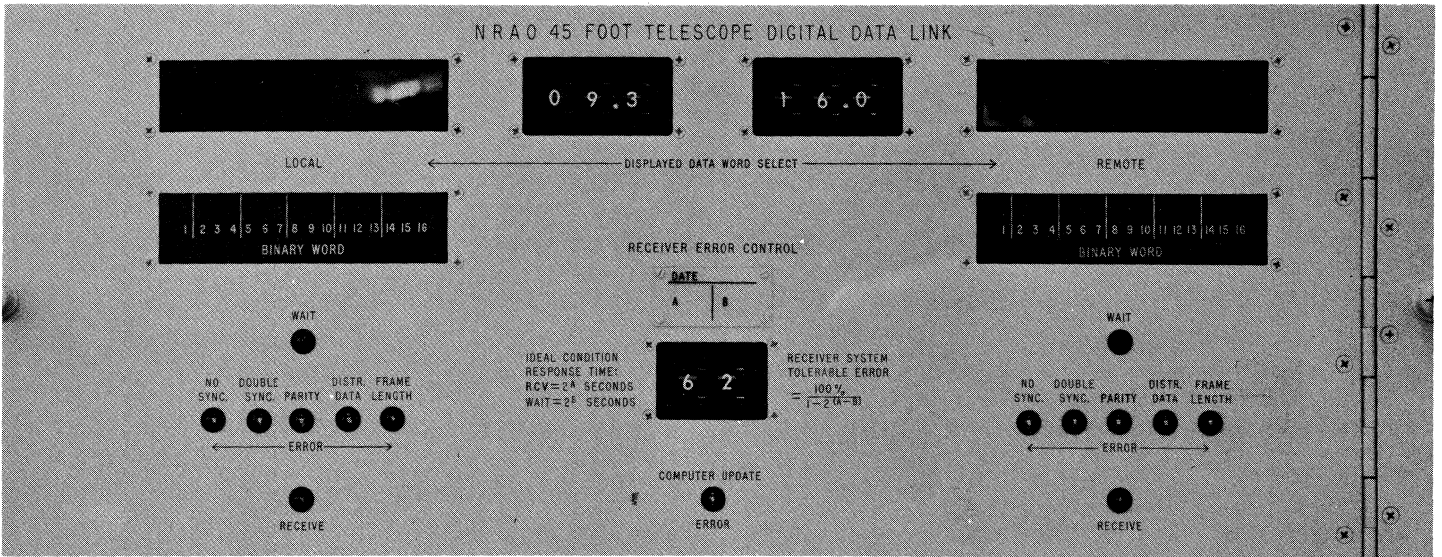
J. Ray Hallman

Introduction

General information is presented as an aid in troubleshooting the digital and analog telescope control and monitoring data signaling system linking the interferometer control building and the 45-ft remote site. The data link comprises 2 modules, one each at the control building and 45-ft remote site. Each module comprises a data concentrator and data distributor operating in full duplex via a microwave link described in EDIR #126. We like to think of all signals transmitted from the control building to the remote site as up-link signals and all others as down-link signals. In general, control signals are up-link signals while monitor or status signals are down-link signals. Specific control signals adjust the radiometers, focus and rotation of the feeds, telescope position, and power circuits. There are specific status signals generated that monitor almost any condition regarding the telescope and remote site. The telescope position control and readout system is described in EDIR #127 and EDIR #149. The remote site weather station is described in EDIR #151. The remote site primary power monitor is described in EDIR #135. The telescope position stand-alone control is described in EDIR #128.

All control and monitor data handled by the system may be inspected via numeric data displays.

The data displays comprise two groups of hardware located in the data link front panel. Each consist of one 16-bit binary display, one 7-digit octal/decimal display, and one 3-digit data access control thumbwheel.



In general, all data handled by the data link is viewable by selection of a proper access code. A data word comprises 16 bits which is displayed in the binary display in the same form as it is presented to the DDP-116 computer "A-Register". Also, for some access codes, the data is presented in "useful format" for humans on the 7-digit octal/decimal numerical display. One has to be aware of only one restriction required by the system logic which is that a currently valid access code must be dialed up on both data access control thumbwheels since the display system will "lock up" waiting for the invalid access code that never arrives in the data stream. Codes below 40.0 will capture data from the up link data stream while codes 40.0 and above capture down link data.

The following table lists the valid access codes and human formats.

<u>Thumb- Wheel Access Code</u>	<u>Function</u>	<u>Binary Display Format</u>	<u>Numeri- cal Display Format</u>	<u>Numerical Unit Range</u>	<u>Notes</u>
2	Azimuth Position Command	A	Z	0000000 1777777) ₈	
3	Azimuth Position Command	B	Ignore	N. A.	
4	Elevation Position Command	A	Z	0000000 1777777) ₈	
5	Elevation Position Command	B	Ignore	N. A.	
6	Focus/Polarization Rate Command	C	Y	000000 177777) ₈	
7	Spare 0. 1 sec Analog Data Channel	D	W	+20. 475 volts -20. 480 volts	Input in rear BNC DLCB
8	Spare 0. 1 sec Analog Data Channel	D	W	+20. 475 volts -20. 480 volts	Input in rear BNC DLCB
9	Azimuth Analog Rate Command Pot	D	W	+204. 75 °/m -204. 80 °/m	
10	Elevation Analog Rate Command Pot	D	W	+204. 75 °/m -204. 80 °/m	
11	Local Sidereal Time	E	V	0:00:00. 0 23:59:59. 9	
12	Local Sidereal Time	F	Ignore	N. A.	
13	Control Panel Single Bit Controls	H	U	000000 177777) ₈	
14	Front End Single Bit Controls	J	Ignore	N. A.	This access code renders both nu- merical displays confusing — only the binary displays

<u>Thumb- Wheel Access Code</u>	<u>Function</u>	<u>Binary Display Format</u>	<u>Numeri- cal Display Format</u>	<u>Numerical Unit Range</u>	<u>Notes</u>
42	Azimuth Position Readout	A	Z	0000000 1777777) ₈	0) ₈ is due north 1000000) ₈ is due north, 400000) ₈ is due south.
43	Azimuth Position Readout	B	Ignore	N. A.	
44	Elevation Position Readout	A	Z	0000000 1777777) ₈	0) ₈ is due north, 200000) is zenith Binary displays. Bit 1 is the key bit.
45	Elevation Position Readout	B	Ignore	N. A.	
46	Azimuth Coarse Position Readout	K	T	000. 0° 719. 9°	0° due north. 360° due north.
47	Elevation Coarse Position Readout	K	T	000. 0° 359. 9°	0° at zenith. 90° at horizon.
48	General Purpose Analog Data Channel 0. 1 sec Refresh. (May be used for total power, etc.)	D	W	+20. 475 volts	I/O at BNC on rear chassis.
49. 0	Focus	L	W	+2047. 5 mm -2048. 5 mm	Limits set at approximately 0. 0 mm and 757. 5 mm.
49. 1	Azimuth Error	M	W	+20475" -20480"	Indicator limit at approximately ± 10240".
49. 2	Azimuth Tachometer	N	W	+204. 75 °/m -204. 80 °/m	Actual telescope rate limit is approximately ± 60 °/m.
49. 3	Barometric Pressure	P	W	+2047. 5 mm -2048. 5 mm	

<u>Thumb- Wheel Access Code</u>	<u>Function</u>	<u>Binary Display Format</u>	<u>Numeri- cal Display Format</u>	<u>Numerical Unit Range</u>	<u>Notes</u>
49.4	Wind Speed	Q	W	+204.75 MPH -204.80 MPH	
50.0	Polarization	L	W	+2047.5° -2048.0°	Limits set at approximately 0° and 403°.
50.1	Elevation Error	M	W	+20475" -20480"	Indicator Limit at approximately ± 10240".
50.2	Elevation Tachometer	N	W	+204.75 °/m -204.80 °/m	Actual telescope rate limit is approximately ± 60 °/m.
50.3	Dew Point	P	W	+204.75 °C -204.80 °C	
50.4	Wind Direction	Q	Q	+2047.5 ° -2048.0 °	
51.0	Spare No. 1 Analog Data Channel 1 2 sec Refresh.	L	W	+20.475 volts -20.480 volts	I/O BNC Link Rear
51.1	45' Telescope Primary Power Amplitude Monitor	M	W	+2047.5 volts -2048.0 volts	
51.2	45' Telescope Primary Power Period Monitor	N	W	+204.75 ms -204.80 ms	
51.3	45' Site Temp.	P	W	+204.75 °C -204.80 °C	
51.4	Control Room Temp.	Q	W	+204.75 °C -204.80 °C	
52	Control Panel Single Bit Controls	R	U	000000 177777) ₈	
53	Front End Single Bit Controls	S	Ignore	N. A.	This access code renders both numerical dis- plays confusing — only the binary displays are useful.

Binary Display Data Formats

<u>Bit</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
1	Logical Zero	x	Sign (-)	x	x	8 m
2	360:00:00.0	0:00:39.55078125	R1	x	x	4 m
3	180:00:00.0	19.775390625	R2	x	x	2 m
4	90:00:00.0	9.8876953125	R3	Sign	x	1 m
5	45:00:00.0	4.94384765625	R4	10240	0	0
6	22:30:00.0	x	R5	5120	0	40 s
7	11:15:	x	R6	2560	20 h	20 s
8	5:37:30	x	R7	1280	10 h	10 s
9	2:48:45	x	R8	640	8 h	8 s
10	1:24:22.5	x	R9	320	4 h	4 s
11	0:42:11.25	x	R10	160	2 h	2 s
12	21:05.625	x	R11	80	1 h	1 s
13	10:32.8125	x	R12	40	0	0.8 s
14	5:16.40625	x	Spare	20	40 m	0.4 s
15	2:38.203125	x	Spare	10	20 m	0.2 s
16	1:19.1015625	x	** F/P	5	10 m	0.1 s

Notes: Unless otherwise noted, the binary display LED is lit to indicate the respective bit is true.

x = Don't care.

** Word No. 6 may control either focus or polarization but not both at the same time.

F/P selects which may be controlled with R1 through R12 being assigned according to the following table:

<u>F/P =</u>	<u>0</u>	<u>1</u>
R1	2.5 mm/sec	250 min/sec
R2	1.25	125
R3	.625	62.5
R4	.3125	31.25
R5	.15625	15.625
R6	.078125	7.8125
R7	.0390625	3.90625
R8	.01953125	1.953125
R9	.009765625	.9765625
R10	.0048828125	.48828125
R11	.00244140625	.244140625
R12	.001220703125	.1220703125
Function Driven	Focus	Polarization

The sign convention for focus in the minus direction is box movement down toward dish which is a logical 1 = sign. For polarization minus direction is rotation north to west beam on sky.

Binary Display Formats (continued):

Bit	H	Logical	J	Logical	K
		Sense for True (1)		Sense for True (1)	
1	Power On	L	XR-XL IF Select	L	0
2	Power Off	L	SR-SL IF Select	L	400°
3	Accept	L	XR-XL IF Select	L	200°
4	Reject	L	X Band Cal On	L	100°
5	El Stow Pin Out	L	S Band Cal On	L	80°
6	El Stow Pin In	L	21 cm Cal On	L	40°
7	Brake Release	L	Down Link Transmitters Off	L	20°
8	Brake Set	L	WD Band Trans. Pwr. 10 dB Down	L	10°
9	Computer Control	L	WD Band Trans. Pwr. 20 dB Down	L	8°
10	Spare Bit	U	S-Band Filter Control	U	4°
11	Spare Bit	U	Spare	U	2°
12	Emer. Stop	L	Spare	U	1°
13	Rate Comm. Zero Ck.	L	Spare	U	0.8°
14	Spare Bit	U	Spare	U	0.4°
15	Spare Bit	U	P	L	0.2°
16	Spare Bit	U	O	L	0.1°

Note: (1) L = Lit, E = Extinguish, U = Unassigned.

Bit	L	M	N	P	Q
1	0	0	0	0	1
2	0	0	1	1	0
3	0	1	0	1	0
4	Sign	→			
5	10240	→			
6	5120	→			
7	2560	→			
8	1280	→			
9	640	→			
10	320	→			
11	160	→			
12	80	→			
13	40	→			
14	20	→			
15	10	→			
16	5	→			

Binary Display Formats (continued):

<u>Bit</u>	<u>R</u>	<u>Logical Sense for True (1)</u>	<u>S</u>	<u>Logical Sense for True (1)</u>
1	Power On	E	Rx Out of Lock	L
2	Az CW Limit	E	FOPPL Out of Lock	L
3	Az CCW Limit	E	XR Rec Out of Range	L
4	El Up Limit	E	XL Rec Out of Range	L
5	El Down Limit	E	SR Rec Out of Range	L
6	El Stow Pin In Light	E	SL Rec Out of Range	L
7	El Stow Pin Out Light	E	21 cm Rec Out of Range	L
8	Accept Light	E	FE Box Temp. Out of Range	L
9	Reject Light	E	Spare Bit	U
10	El Spring Depress Light	E	Spare Bit	U
11	Az Pin Out	E	Spare Bit	U
12	Computer Control	E	Spare Bit	U
13	Brake Released	E	Spare Bit	U
14	Brake Set	E	Spare Bit	U
15	Spare Bit	U	P	L
16	Spare Bit	U	O	L

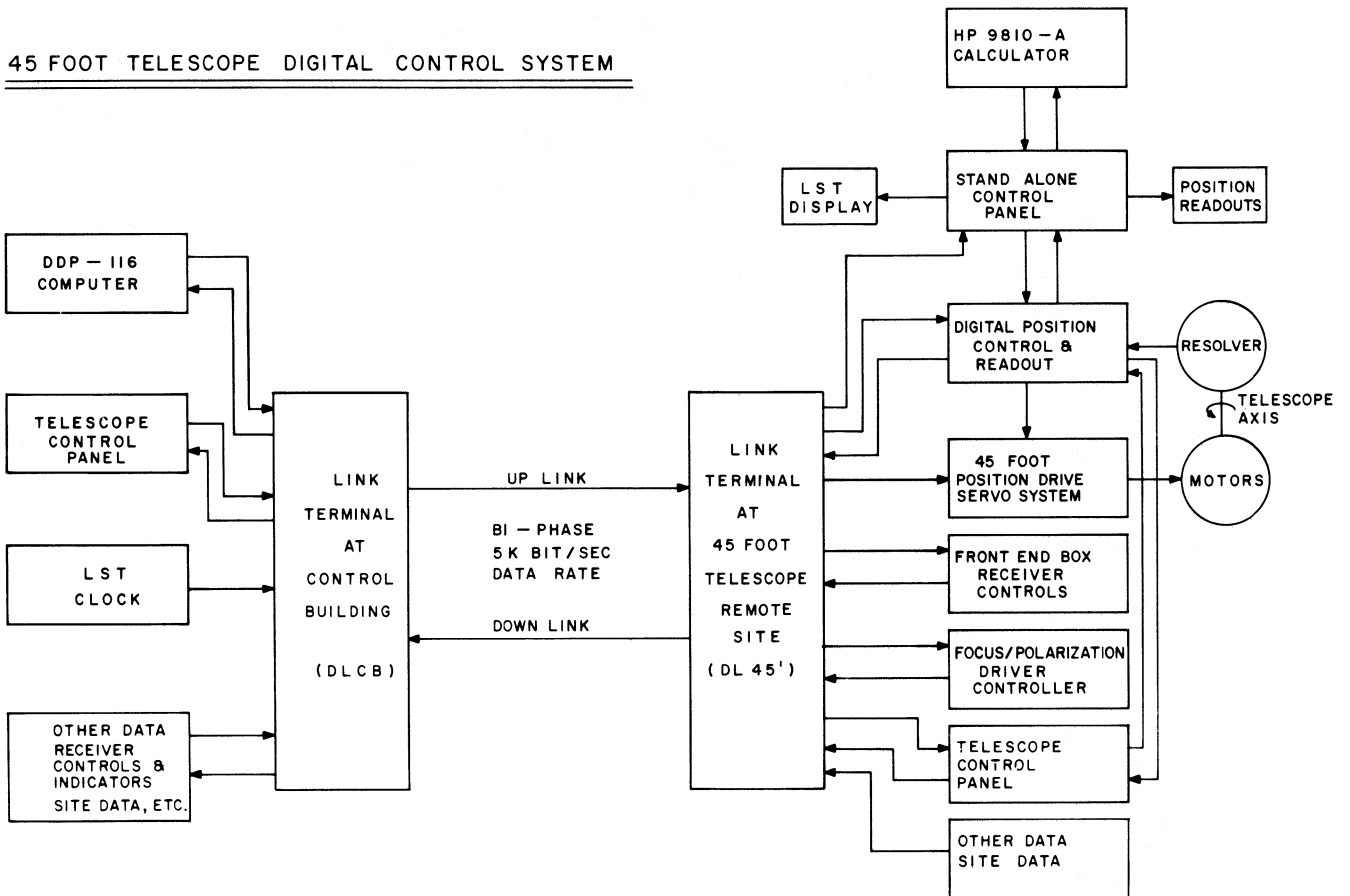
Note: (1) L = Lit, E = Extinguish, U = Unassigned.

Numerical Display Format

<u>Index</u>	<u>Format</u>	<u>Notes</u>
T	359.9 degrees	
U	177777) ₈	16 binary bits presented as a 6 digit octal number.
V	23:59:59.9	LST presented without colons.
W	-20475	5 digit BCD with sign representing the analog data.
Y	177777) ₈	The 16 bit focus/polarization numerical control word presented as a 6 digit octal number. There is a unique number for each function and rate. The least significant octal digit of this number is zero when focus is driven and 1 when rotation is being driven.
Z	1777777) ₈	The 19 bit precision telescope position is presented as a seven digit octal number. A unique value exists for any position with 1 octal count equivalent to 4.943847658 arc seconds.

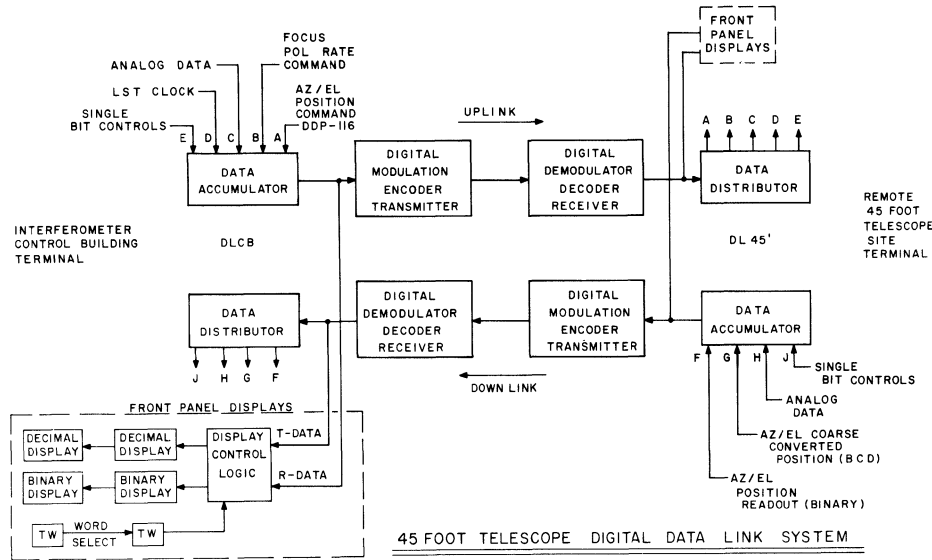
A block diagram of the data link system is presented which shows the basic functions:

45 FOOT TELESCOPE DIGITAL CONTROL SYSTEM



The 5 blocks on the left are associated with the control building terminal. The blocks on the right are associated with the remote terminal.

The block diagram below shows the basic functions of the 45-ft digital data link system.

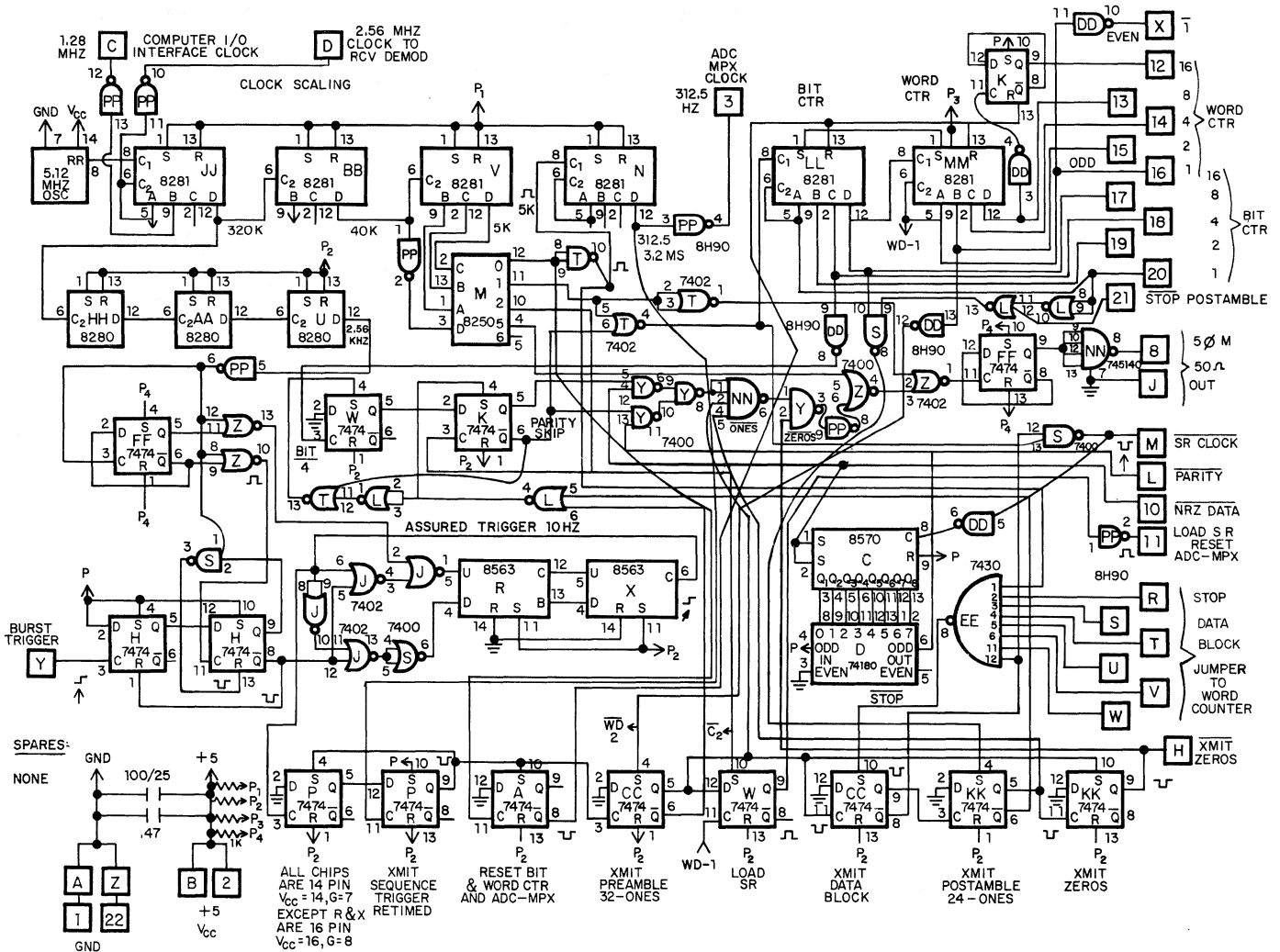


The block diagram should be self-explanatory with the interferometer terminal on the left while the 45-ft remote site terminal circuit functions are on the right. The binary and decimal diagnostic displays and control circuits are drawn in the lower left enclosed in the dotted block. There is one of these display systems at the remote site terminal which can be imagined in the upper right of the drawing.

Troubleshooting Aids

The following is presented as an aid to clearing faults. Only notes are provided on schematics and occasional comments provided herein since a thorough description of every nut and bolt is not possible due to space limitations. In general, the schematics are organized according to the electronics associated with each circuit card which is identified by numbered tags running from 1-22. Also, each tag contains legends defining the function of each card. Generally, the transmitter electronic cards are on the left behind the front door, while the receiver cards are on the right.

Card #1

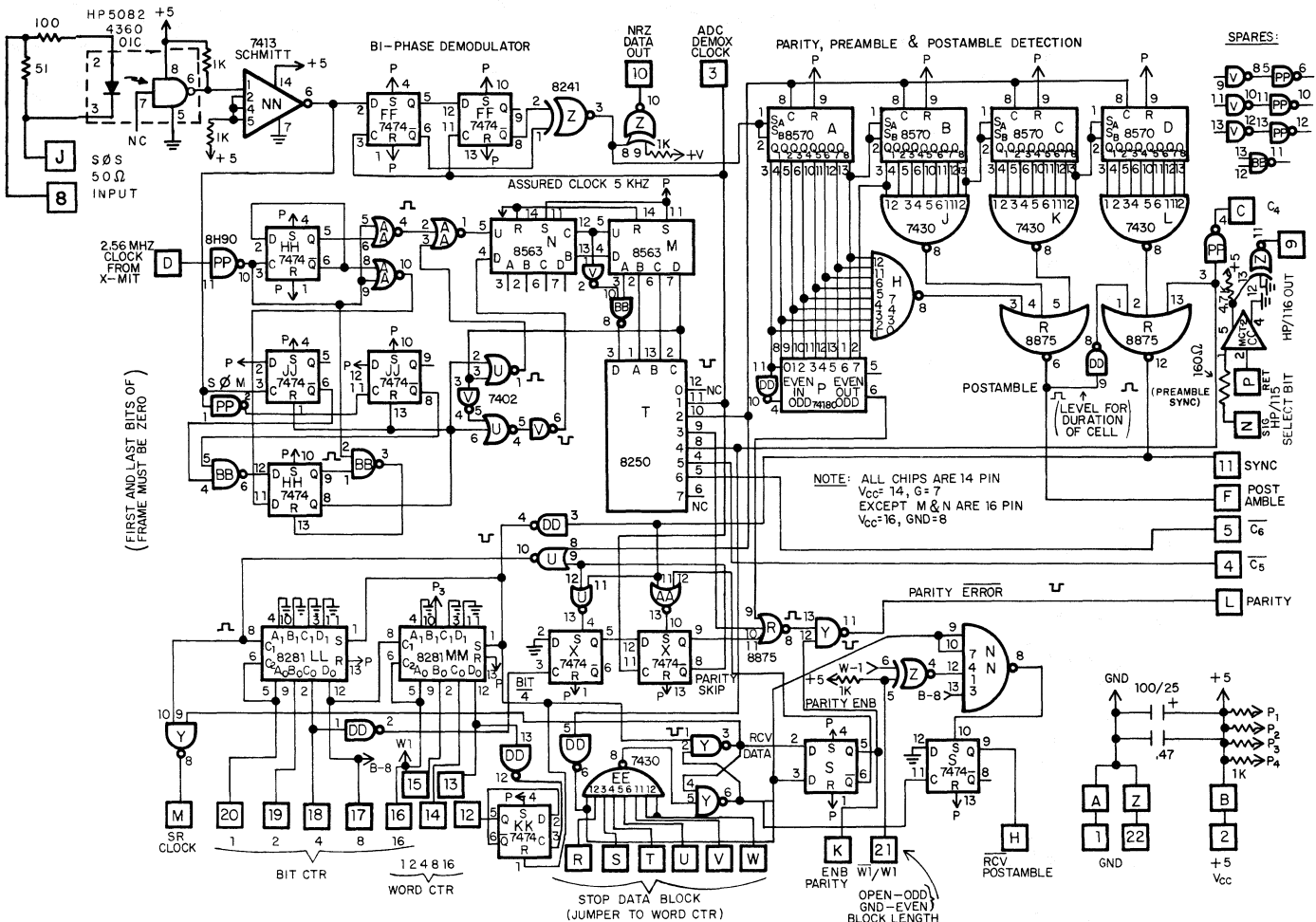
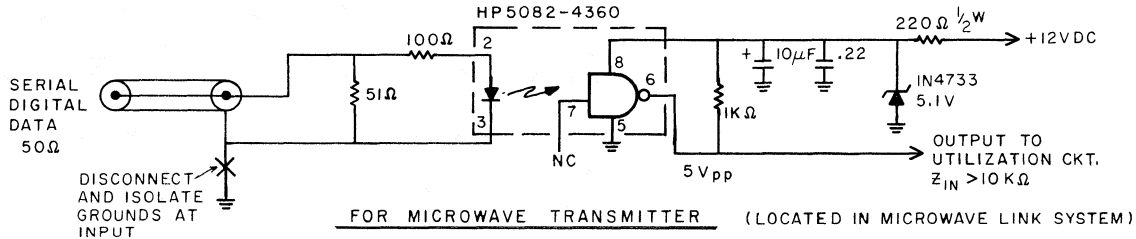


TRANSMITTER MODULATOR & SYSTEM TIMING CARD 1

"NRZ" data from the shift registers sprinkled down the other transmitter cards is introduced at Pin 10 with the clock at Pin M. A ninth bit for parity is inserted serially for each eight NRZ data bits under control of flip-flop K. Parity is generated by chip D and monitored at Pin L.

The row of flip-flops along the bottom of the schematic sequentially control the transmitter status. The sequence is triggered by the assured trigger "fly-wheel" circuit which runs synchronously with the 0.1 sec sidereal introduced at Pin Y. A scope may be used to monitor the bi-phase encoded data output at Pin 8 by synching at Pin H. Pin H is high during the data transmit sequence. The transmitter operates in an asynchronous mode in which the receiver is resynchronized every 0.1 sec at the start of the data sequence when 32 logic ones is transmitted. Data is loaded into the shift registers next, then data is transmitted with parity added, then a postamble for error checking of 24 ones and finally a zero sequence, for maintaining bit sync, lasting until the next trigger.

Card #2



RECEIVER DEMODULATOR & SYSTEM TIMING CARD 2

Optically-isolated 5 kilo-bit/sec bi-phase SφS data is introduced at Pin 8.

"NRZ" data issues at pin 10. Scope sync may be obtained at pin 11 which is connected to the trigger input pin 4 of transmitter card 1 at the 45-ft site to synchronize the down-link transmitted sequence to the up-link sequence so that the DDP-116 computer may reliably read the monitor data at the same time as the control data is updated under control of one priority interrupt that occurs every 0.1 second sidereal. Every ninth bit of data is extracted as parity and verified under control of flip-flop X. Parity is checked only during the active data sequence under control of flip-flop S. An assured clock digital "flywheel" circuit maintains bit sync during drop outs and noisy conditions.

Card #3

Five different error checks are performed on received data under control of card #3:

1. No sync — No preamble received.
2. Double sync — No postamble received between preambles.
3. Parity — Serial parity in groups of eight bits is checked during data sequence.
4. Distributed data — Four groups of 3 bits each that occur during the analog data words are compared.
5. Frame length — Check number of bits occurring between preamble and postamble.

When any errors occur the error averager circuit maintains a tally. If the tally exceeds a certain percentage according to the relation:

$$\frac{\text{Receiver System}}{\text{Tolerable Error}} = \frac{100\%}{1 + 2^{(A-B)}}$$

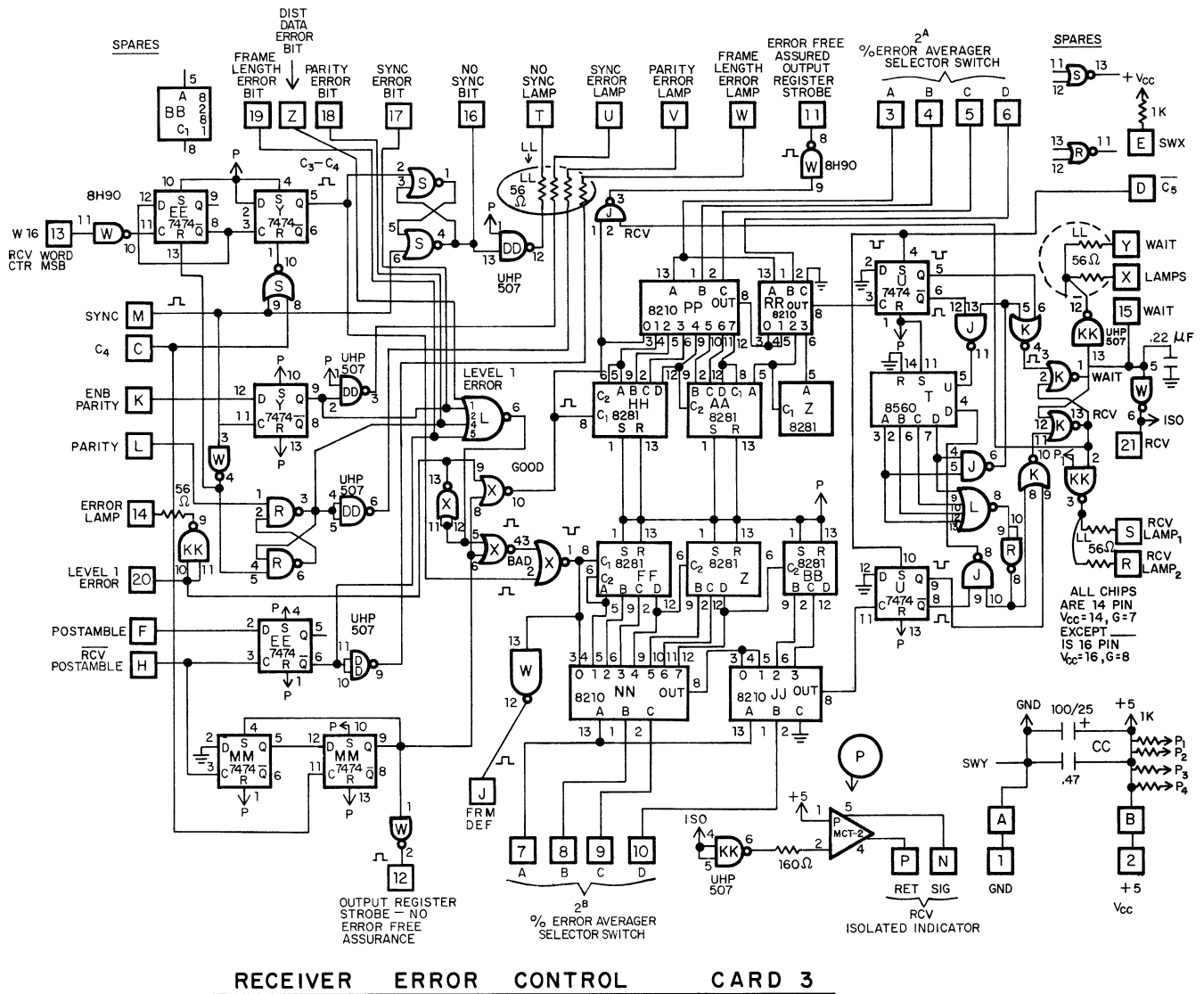
where "A" and "B" are values set in thumbwheels that control the "good" versus "bad" frame weighted values.

The receiver response time to "good" or "bad" data is:

$$\text{Receive} = 2^A \text{ seconds}$$

$$\text{Wait} = 2^B \text{ seconds}$$

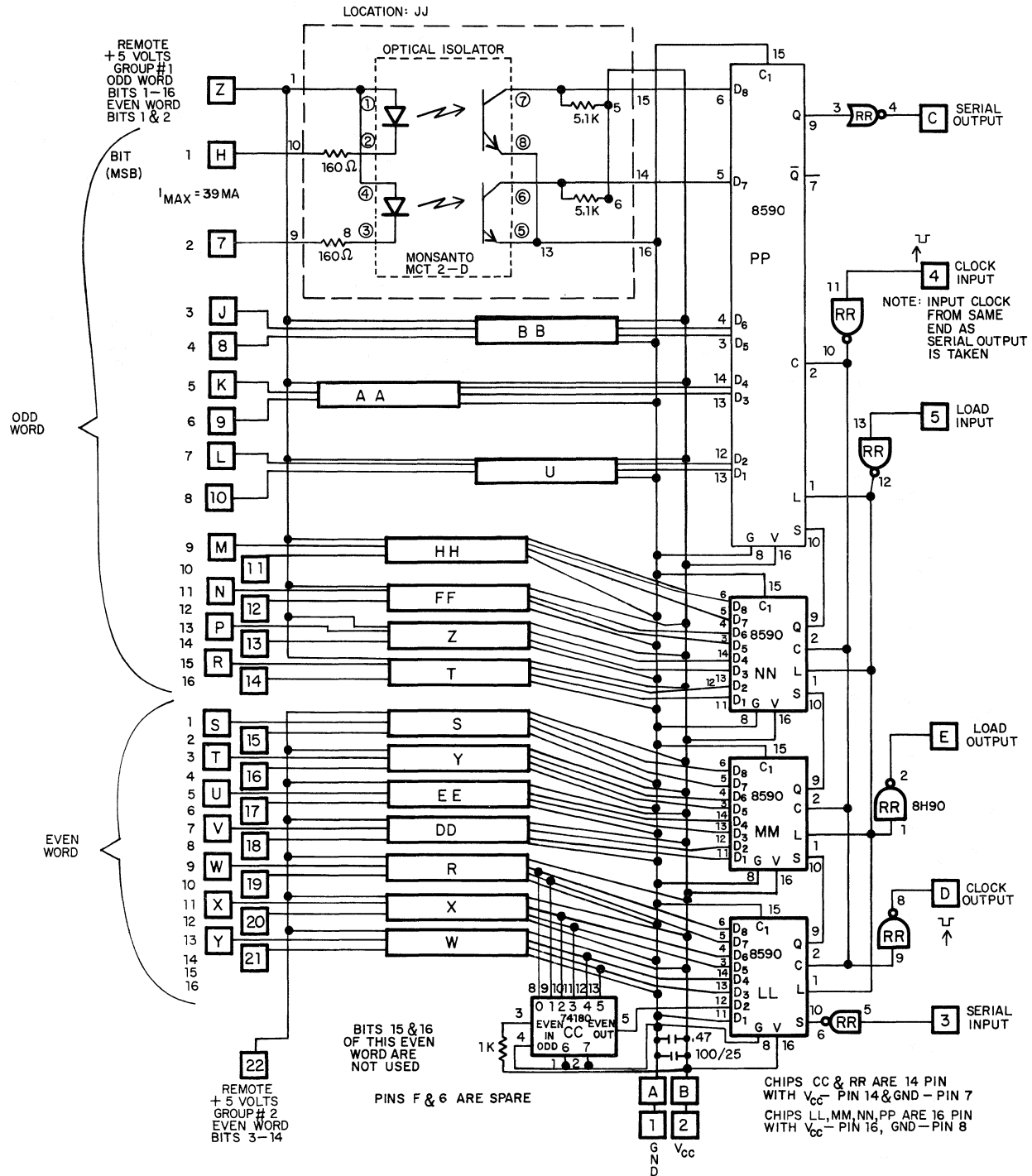
A schematic of card #3 is presented:



The strobe that latches the data from the receiver shift registers may be connected to either pin 11 or 12, depending on whether data should be latched if an error is detected.

Card #4

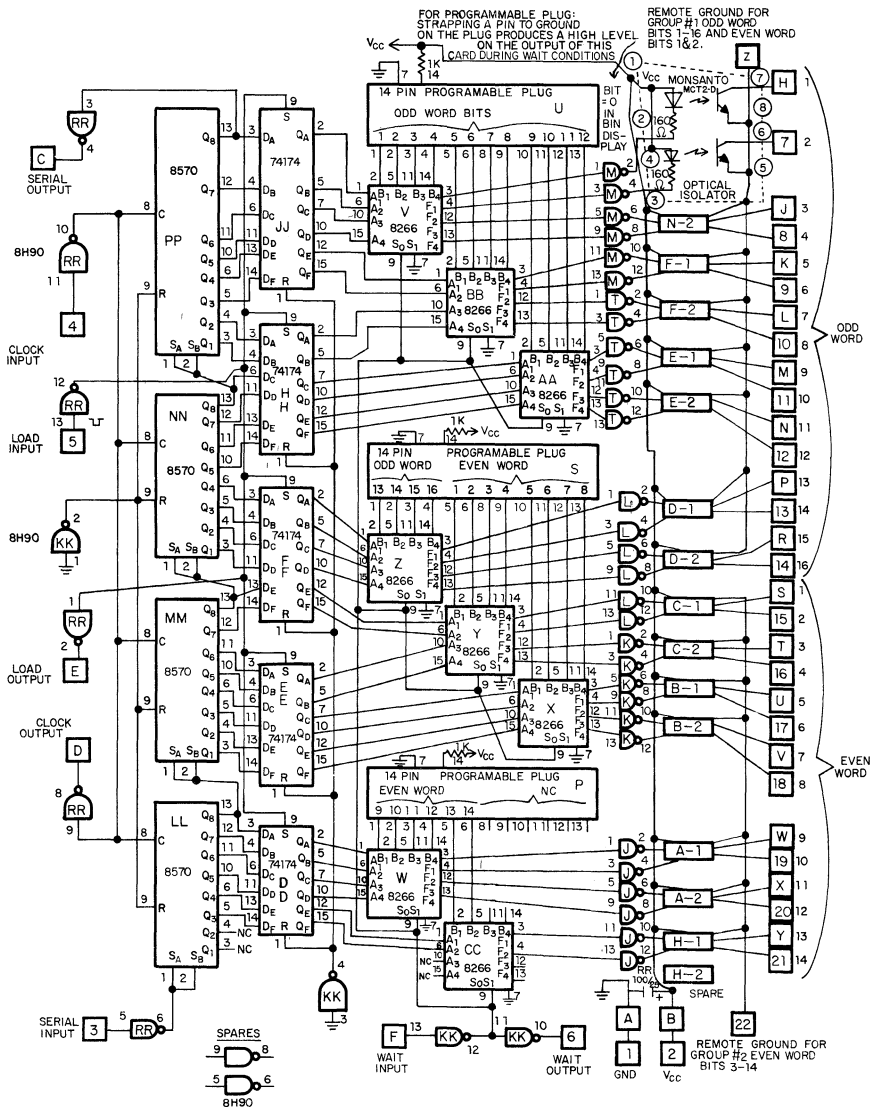
The telescope and radiometer single-bit controls card schematic is presented:



The circuit comprises shift registers which function as data concentrators with single bit inputs via optical isolators for electrical isolation of the various system.

Card #5

The schematic of the receiver single-bit controls distributes the data that was transmitted by card #4. The shift registers (8570) output data to the latches

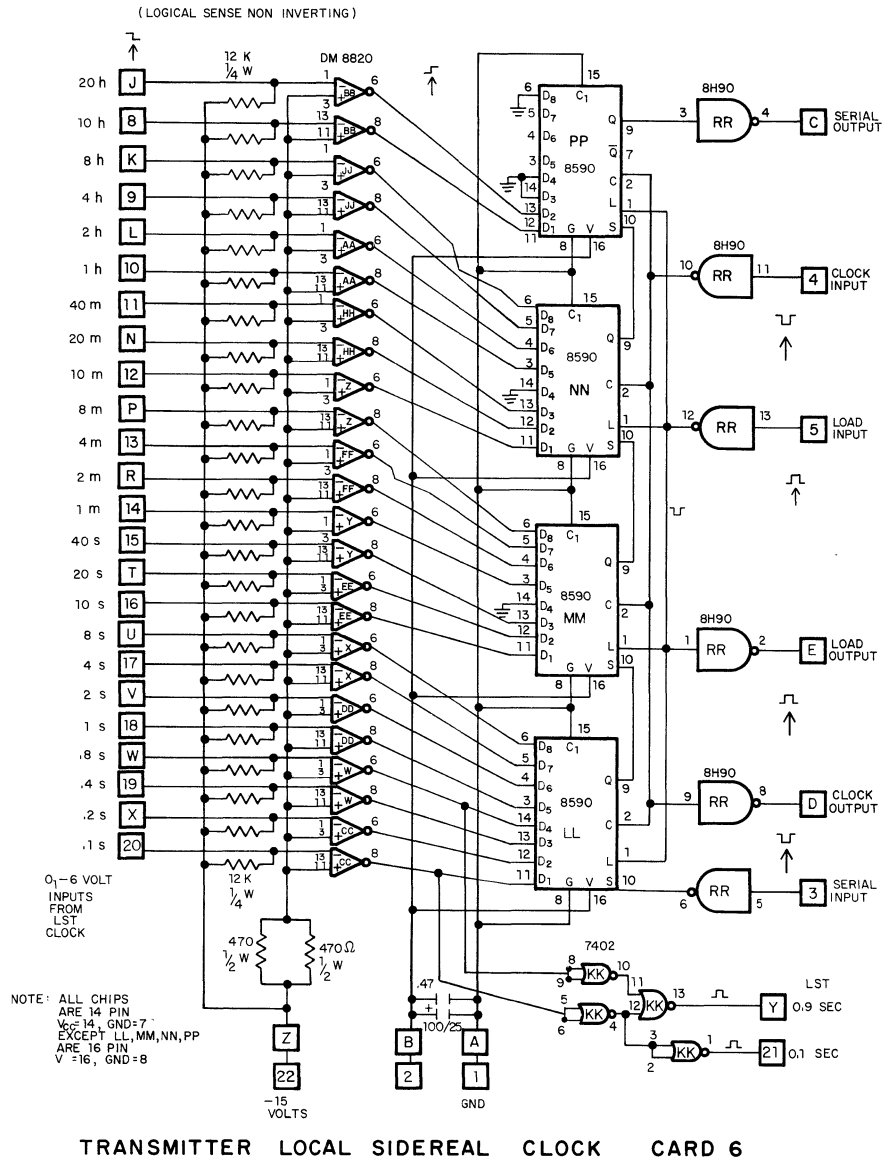


RECEIVER SINGLE BIT CONTROLS CARD 5

(74174) under control of card #3. The double-throw switches (8266) connect either the latches or the hand-wired program plugs to optical isolators which isolate the outputs from the various systems connected to the data link. The double-throw switches are toggled under control of the receiver error control logic of card #3. When the receiver detects a percentage of transmission errors that exceeds that value selected by the thumbwheels A and B, then the receiver goes into a "wait" mode wherein the output circuits are connected to the "hand-wire" program defined by the plugs. When the errors fall below the critical level the receiver will return to the receive mode, thus toggling the double-throw switches each to the latch output circuits. Also, during the receive condition but during a data frame detected as in error, the latches (74714) are not updated, but retain the old data from the previous "good" frame. This sequence is under control of card #3.

Card #6

Sidereal time is transmitted from the control building to the remote site via card #6, the schematic of which is shown below:

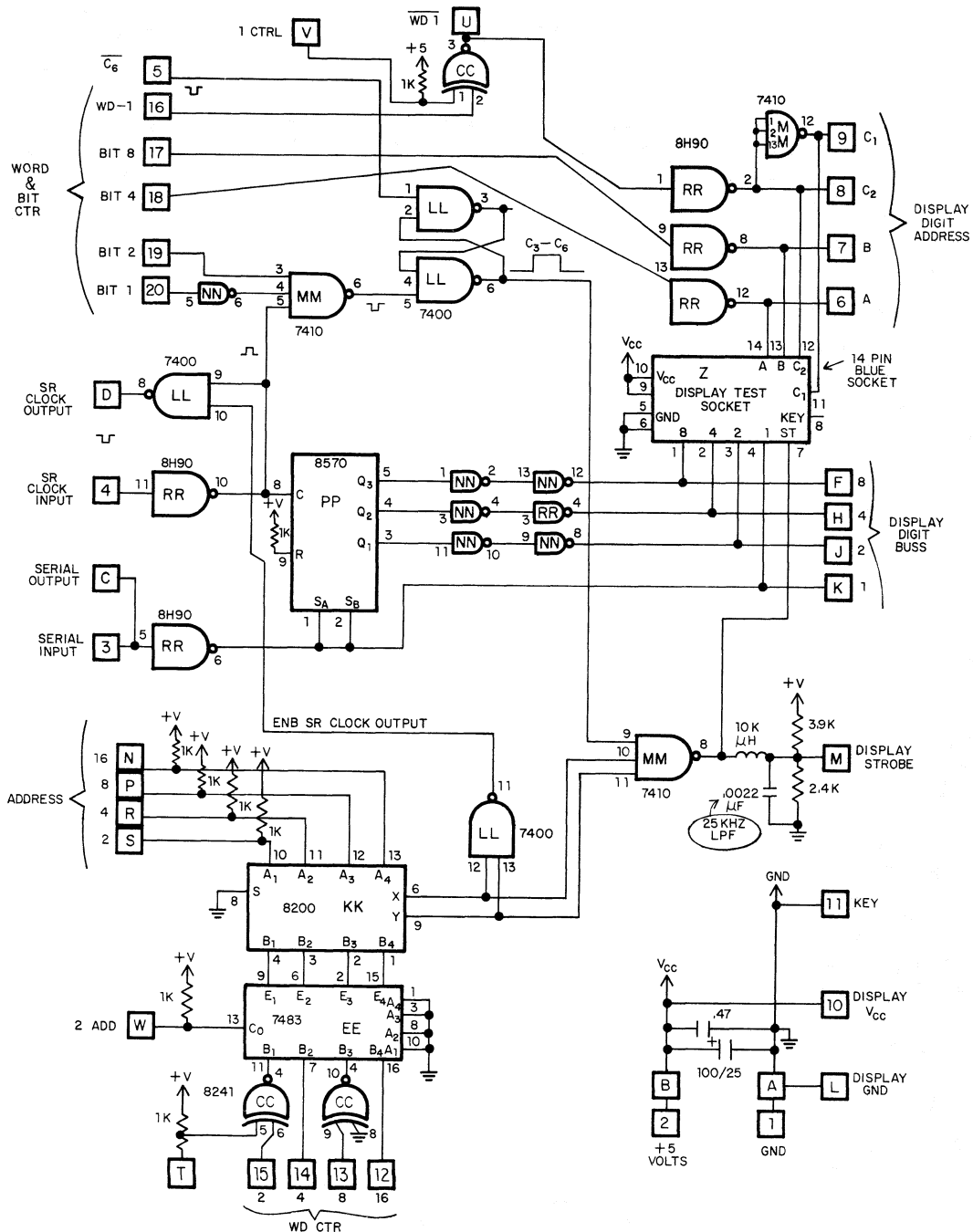


The LST input is (3C - Logic; 0, -6) is buffered and level shifted by the DM-8820 into the shift registers (8590).

Card #7

The receiver LST/Az/El display driver card #7 is a general purpose card that is designed to capture from the serial data stream any two 16-bit words as selected by pins N, P, R, S, T, and W and send the data in 4-bit BCD character serial format to either the seven digit LST displays at the 45-ft site or a pair of four digit azimuth and elevation coarse position displays at the control building control panel. The schematic is shown below.

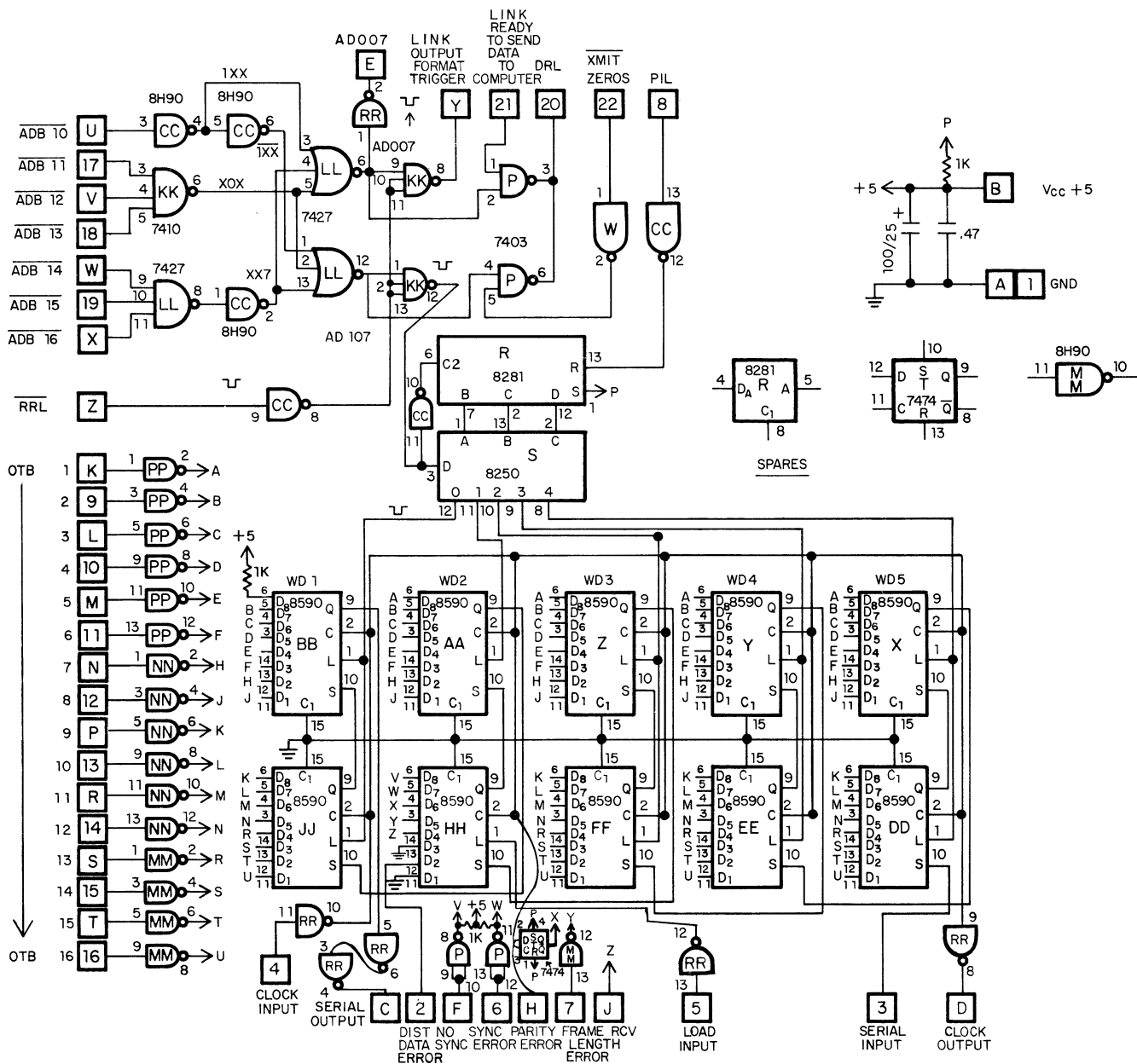
The word and bit counter signals from the receiver card #2 are connected to the word and bit counter inputs of card #7 which are used as an index for the data capture sequence.



RECEIVER LST/AZ/EL DISPLAY CARD 7

Card #8

Electronic card #8 comprises the telescope position command data input from the computer and some computer interface such as I/O address decoder, OTA sequence counter (8281), output buss buffers (8H90), and some control logic as the schematic shows:

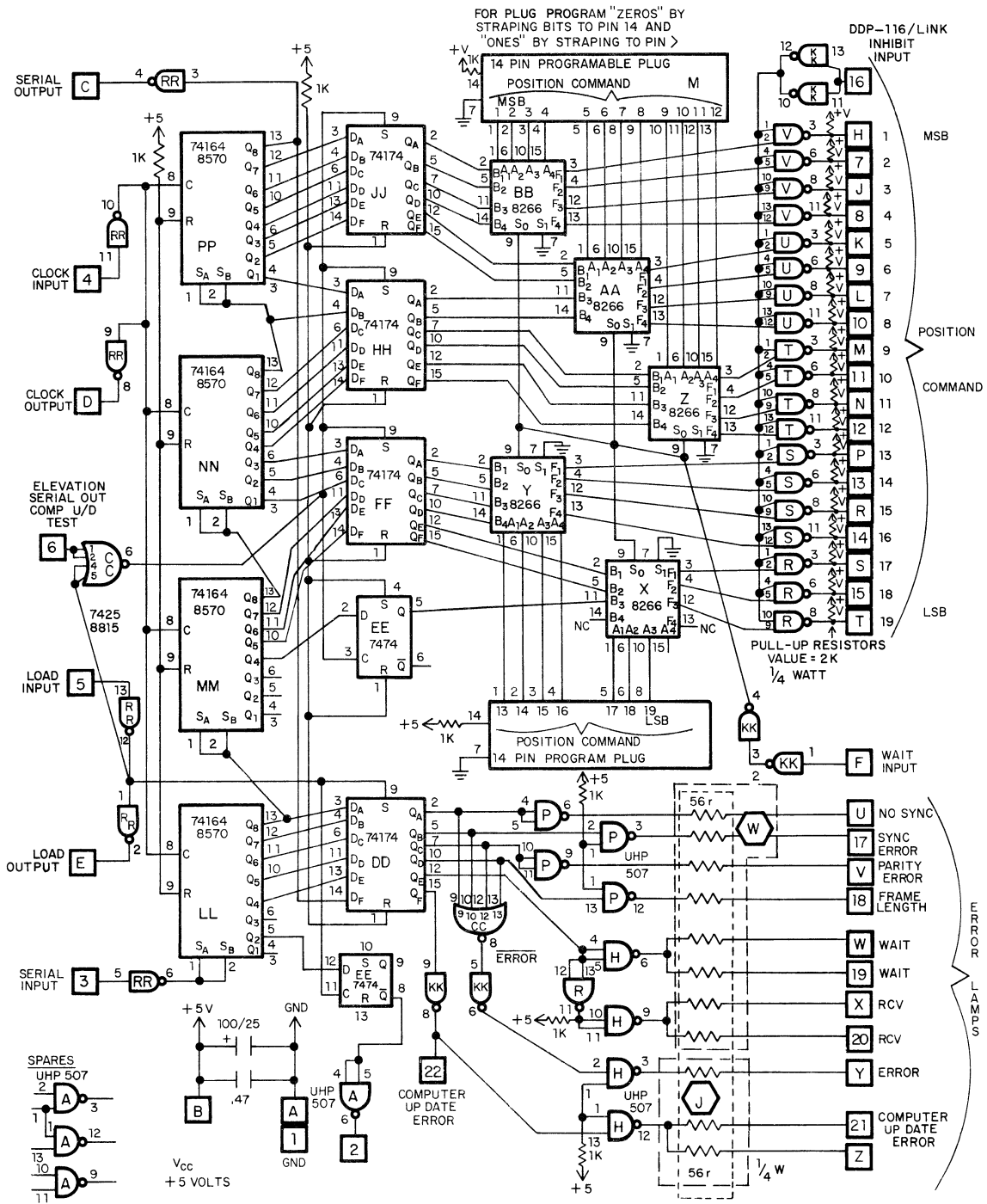


TRANSMITTER AZ/EL POSITION COMMAND CARD 8

Every 0.1 second, the computer receives an interrupt signaling the computer to output five 16-bit words to the data link. As each OTA is executed, the data on the output buss is latched into the corresponding concentrator shift register WD-1, through WD-5. After the OTA sequence, WD-1 and WD-2 contain the azimuth position command, WD-3 and WD-4 contain the elevation position command, and WD-5 contains the focus/polarization command, if any. The data in chip HH is strobed at the start of the next transmitter concentrator load sequence so that it contains the receiver error status. The OTA sequence counter (chip R) is reset with the PIL and advanced with the address gated RRL so that through the 8250 the shift registers are sequentially loaded with each successive OTA.

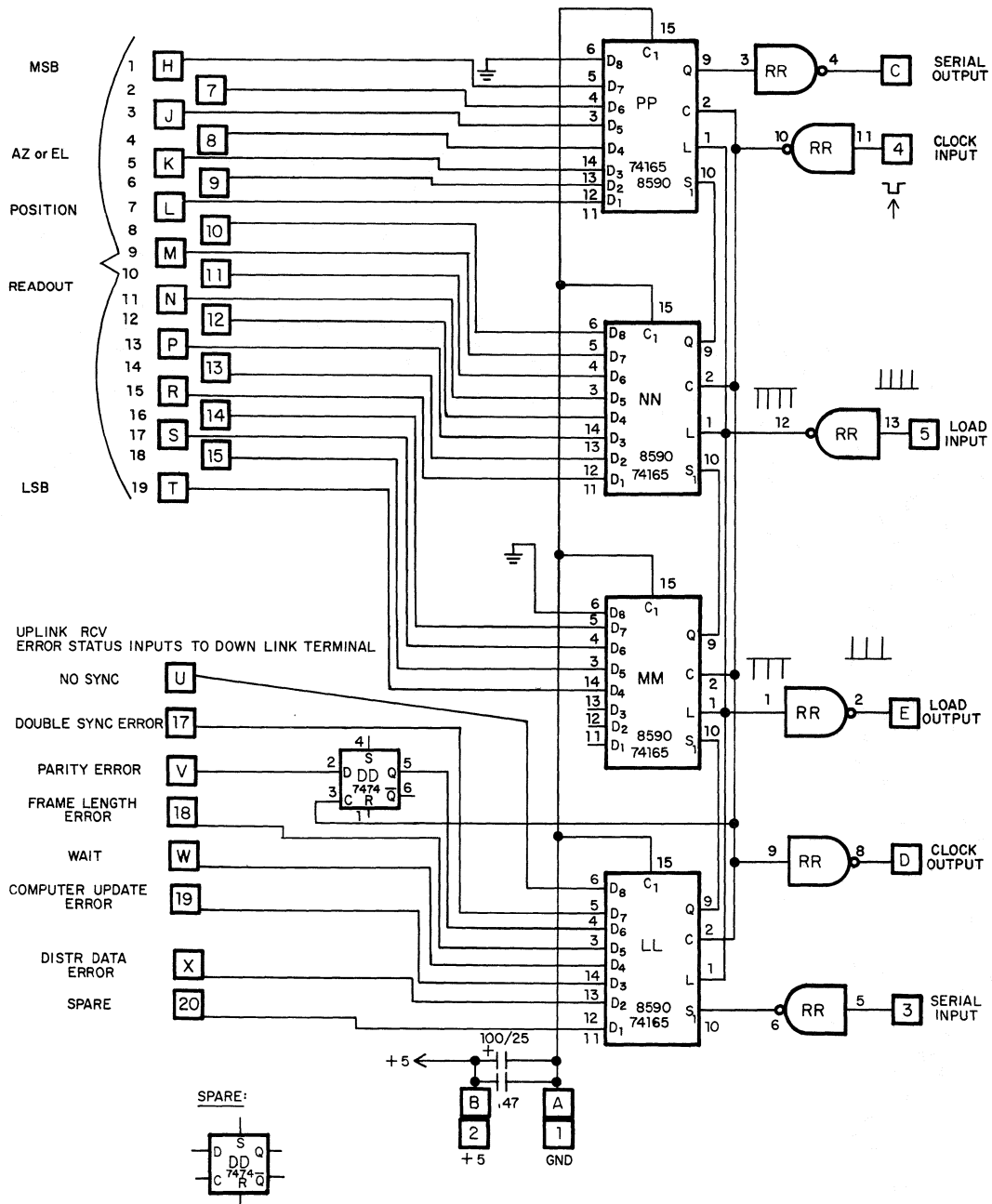
Card #9

The receiver Az/El position command card distributes (at the 45-ft site) the first four words of data sent by card 8 just discussed. The card functions similarly to card 5 previously discussed.



Card #10

As the schematic of card 10 shows:

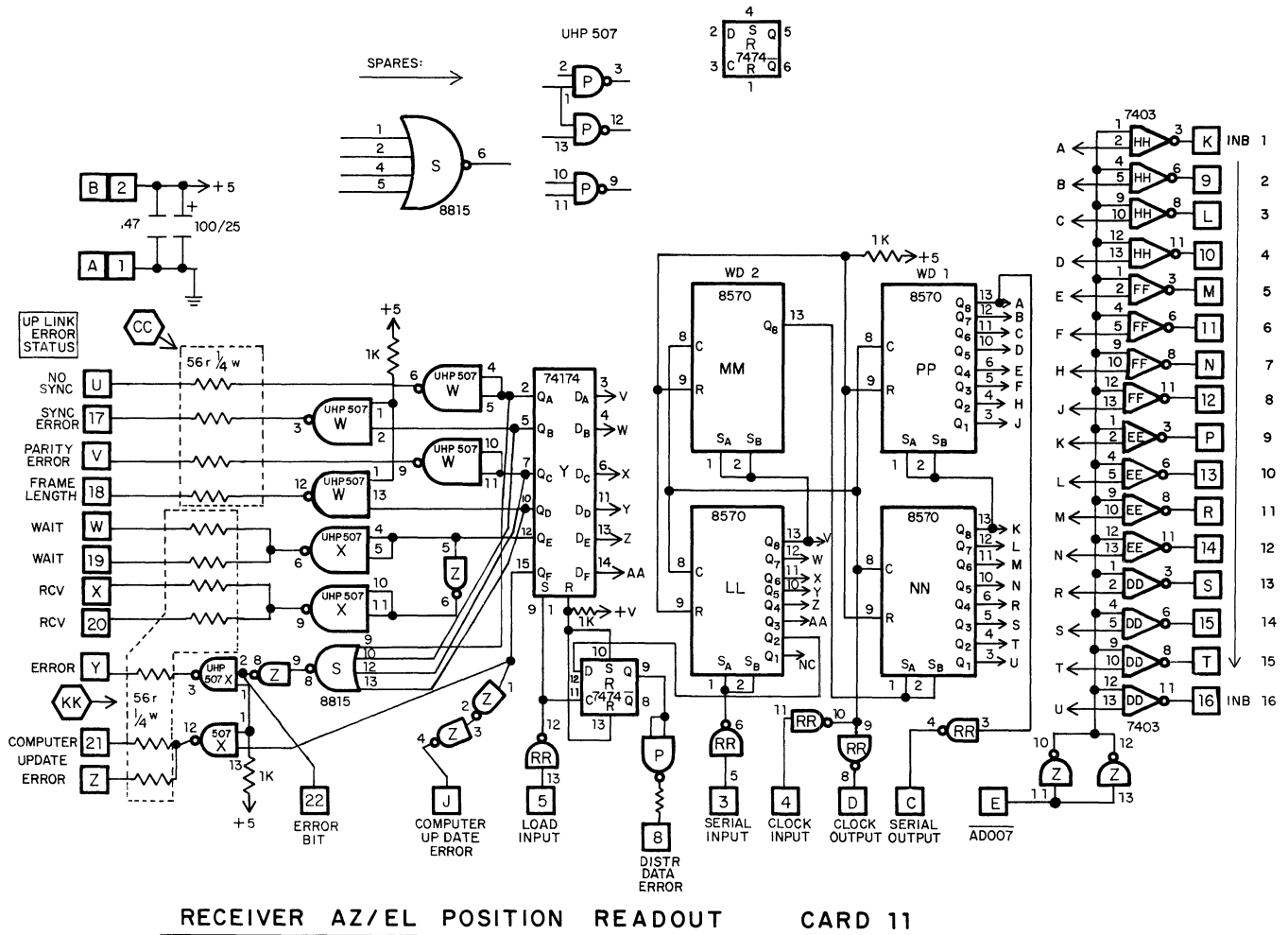


TRANSMITTER AZ/EL POSITION READOUT CARD 10

The position readout signals obtained from the digital position readout (DPSCAR) box is sent to the control building. Two cards are required at the remote site, one each for the azimuth and elevation position data.

Card #11

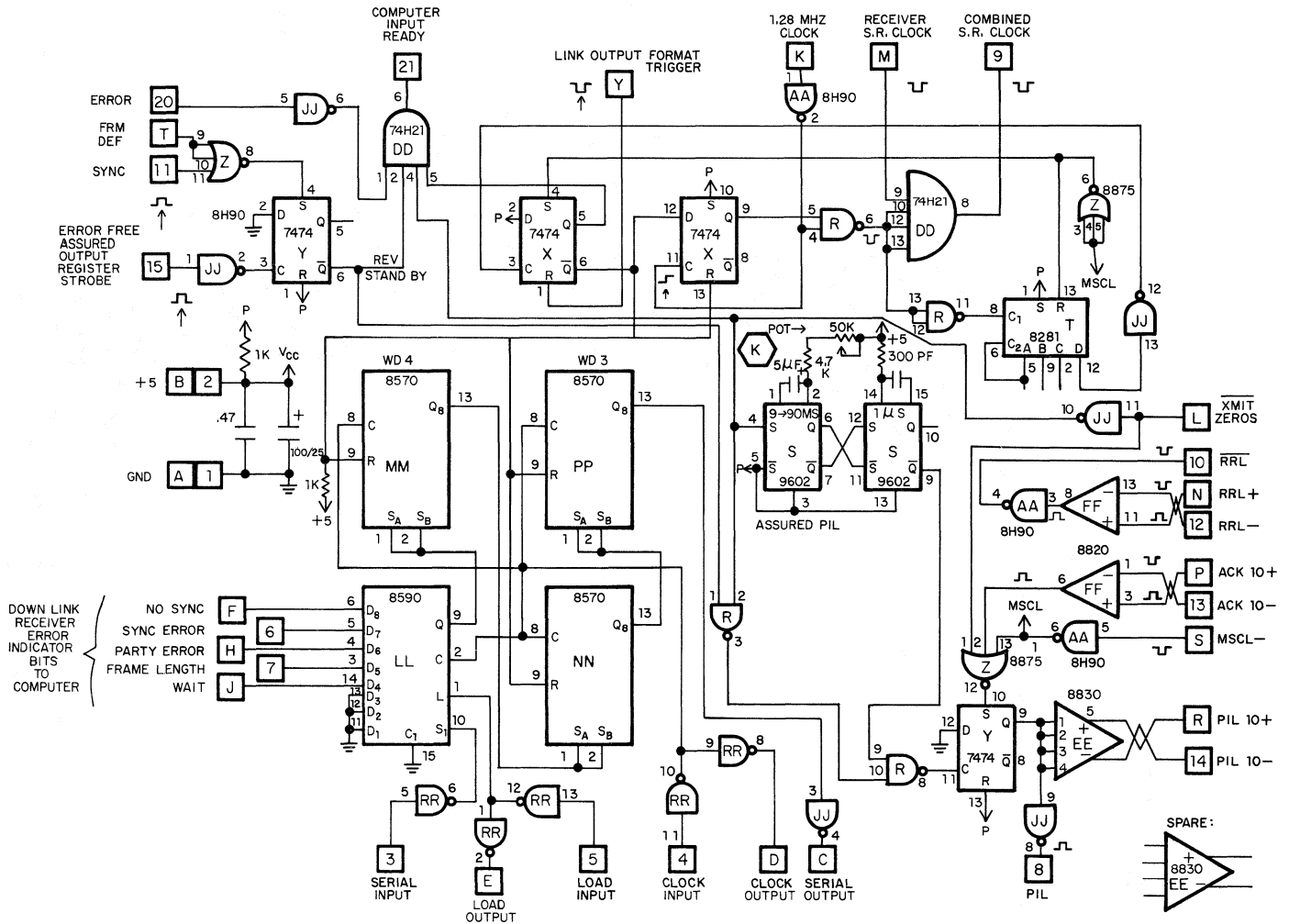
Circuit card 11 contains the computer input buss driver circuits and the azimuth position data shift register.



The WD-1 shift register (chips PP and NN) unloads the data to the computer when an INA 007 instruction is executed. After the first INA after an interrupt on line 40, the data is shifted (16 bits for each INA) from the rest of the data distributor shift registers on other receiver cards at the data link control building (DLCB) terminal. Thus, the computer may unload and read all monitor data sent from the remote site after it has been latched for utilization by the various sub-systems. Also card 11 comprises some data regarding the remote site receiver status.

Card #12

The circuits of card #12 is the computer interface control logic that works in conjunction with cards 11 and 8 to provide proper computer I/O sequence.

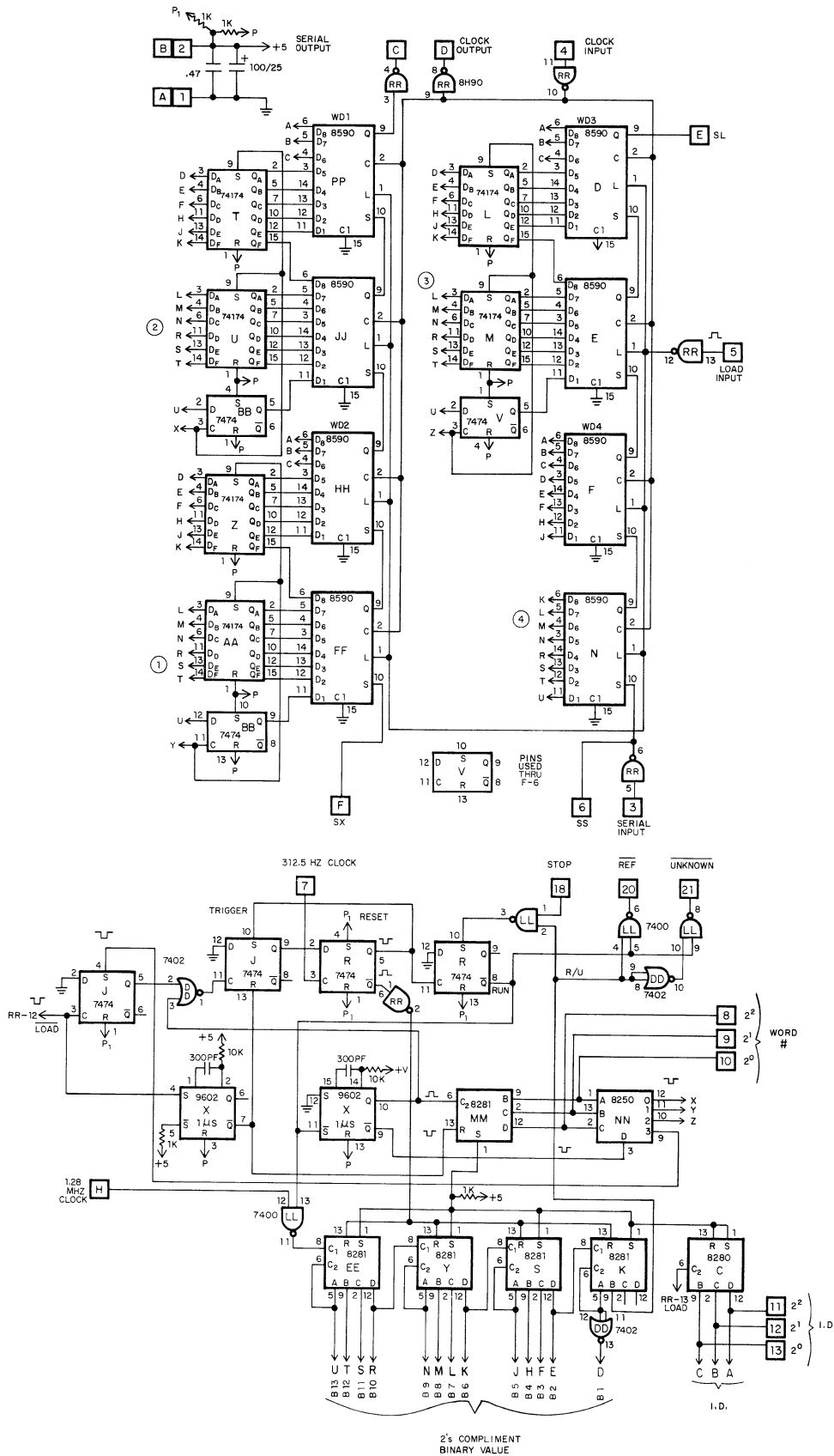


RECEIVER COMPUTER INTERFACE CONTROL CARD 12

Normally, the data is shifted into the data distributor shift registers at a 5 kilobit per second rate. After a complete frame is received, the data is latched into the output register latches if the frame checks good by the circuits of card 3. Then a PII is issued. If the data frame contains transmission errors, then no PII is issued until the assured PII one shots time out at which time a PII is forced so that the computer may "OTA" the next telescope position control words to the transmitter. No computer INA's are possible if a bad data frame occurs.

The combined S.R. clock signal at pin 9 is connected to the distributor shift register clock which is normally a 5 kHz clock during the receive sequence. After a computer INA pin 9 output is a 1.28 MHz clock signal for 16 pulses which unloads another 16-bit word from the WD-2 shift register to the WD-1 shift register on card 11.

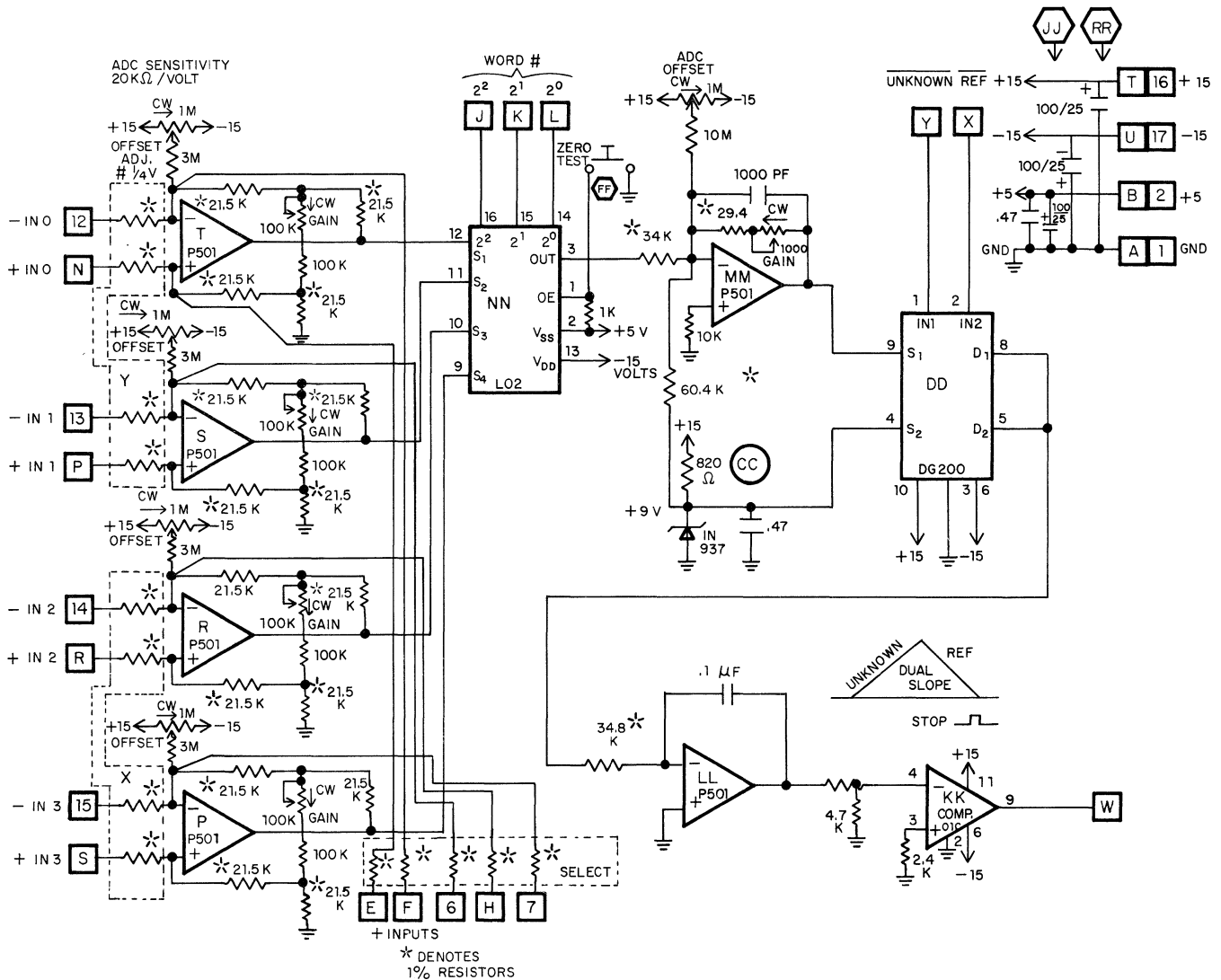
Card #13



The circuits of card 13 are the digital portion of the 13-bit dual slope A/D converter. The circuits in the upper half of the drawing are four latch and shift circuits providing four analog to digital channels of data. The circuits at the bottom of the drawing are the control logic for the dual slope ADC.

Card #14

Card 14 is the analog circuit for the ADC which is controlled by the digital circuits of card 13.

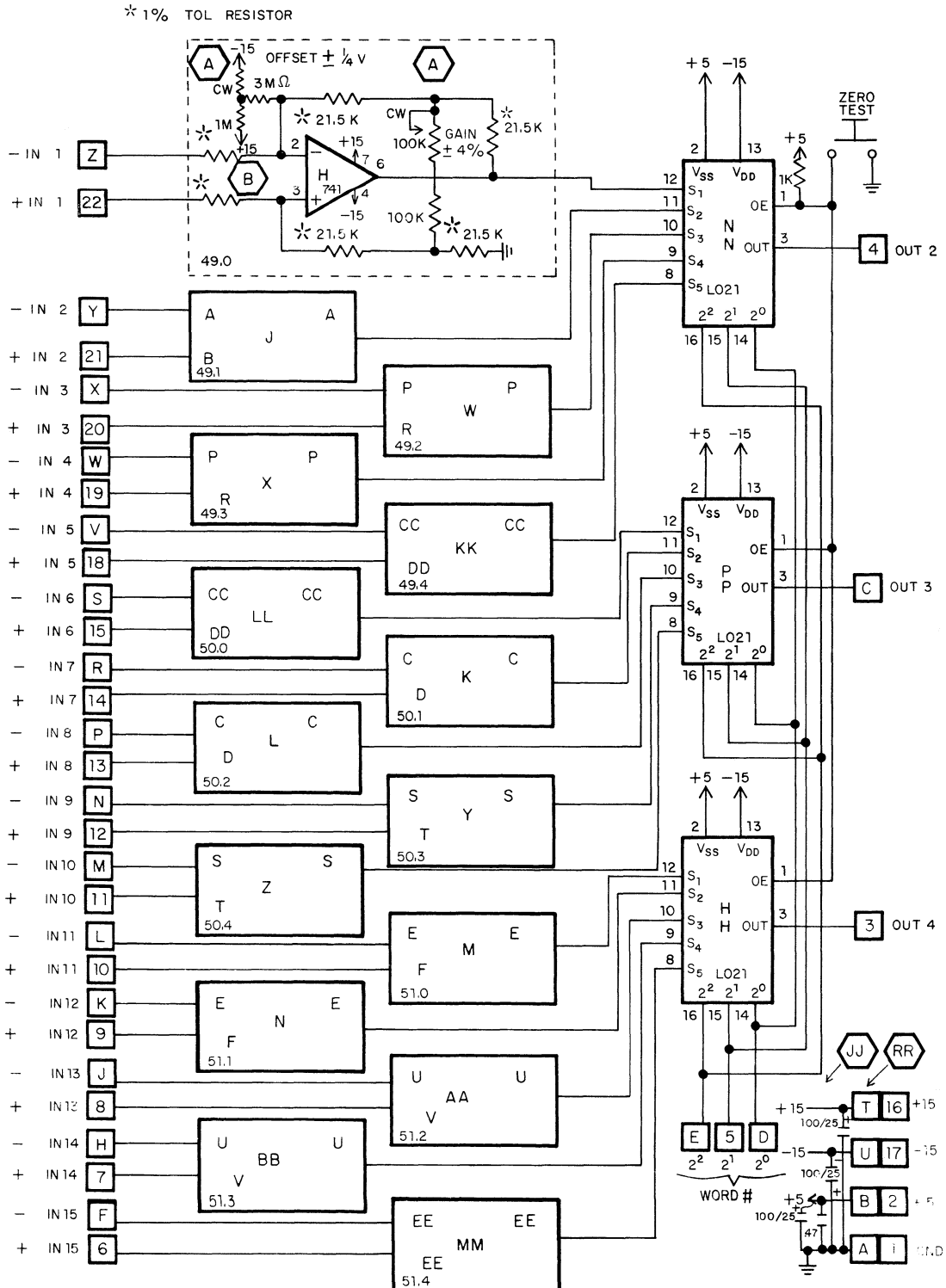


TRANSMITTER ANALOG DATA A1 CARD 14

The ADC converts 4 channels in less than 100 milliseconds.

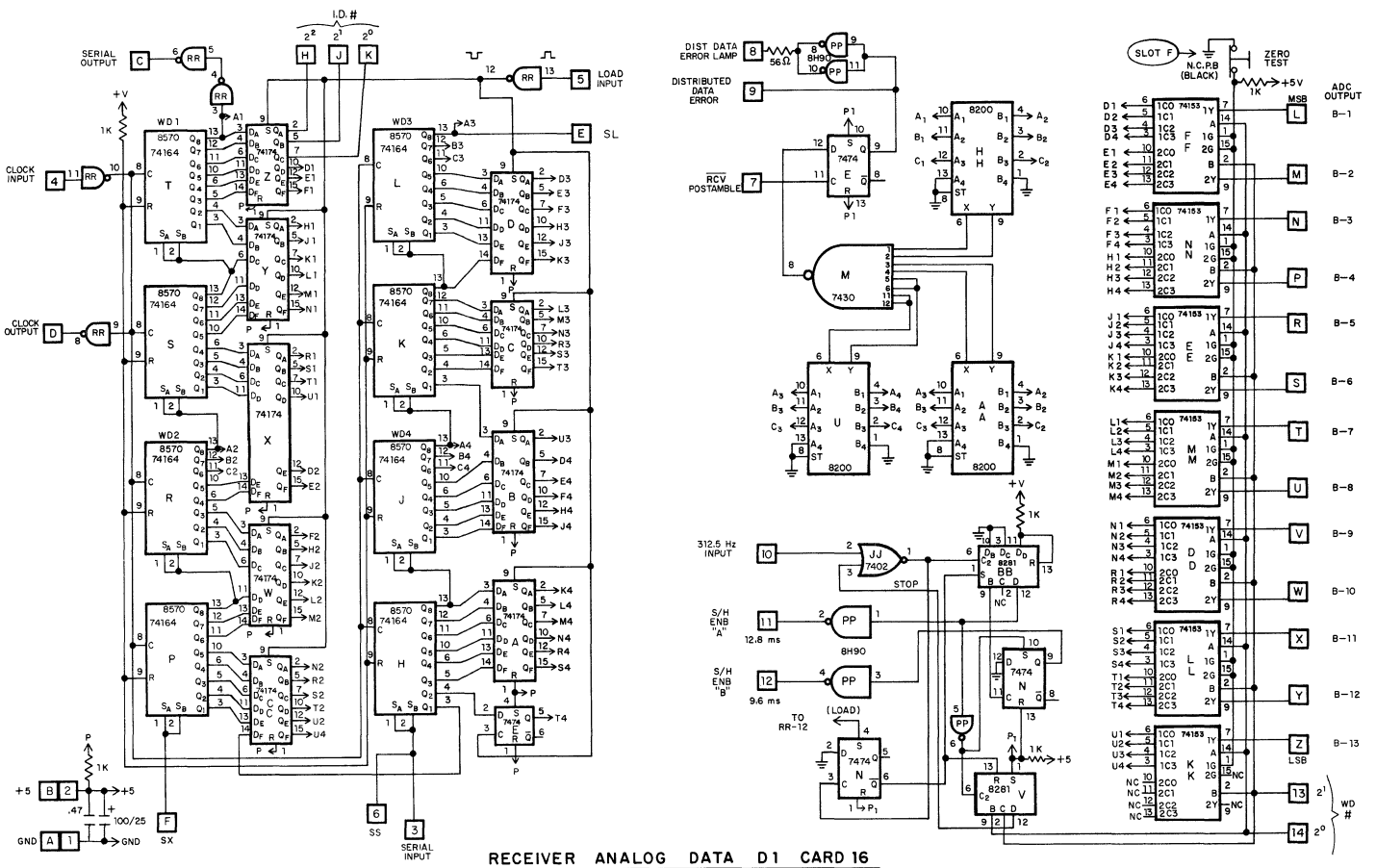
Card #15

When card 15 is used, the last 3 channels of card 14 are multiplexed, yielding 15 analog channels and 1 precision channel that is left unaffected for a total of 16 channels. During each 100 millisecond data frame 4 conversions are done, yielding one precision channel and 3 multiplexed channels. A sequence of five 100 millisecond sequences is required to provide data for all 16 channels. The precision channel is converted 5 times for each single conversion of the other 15.



Card #16

The D/A converter digital circuits are found in the schematic of card 16:

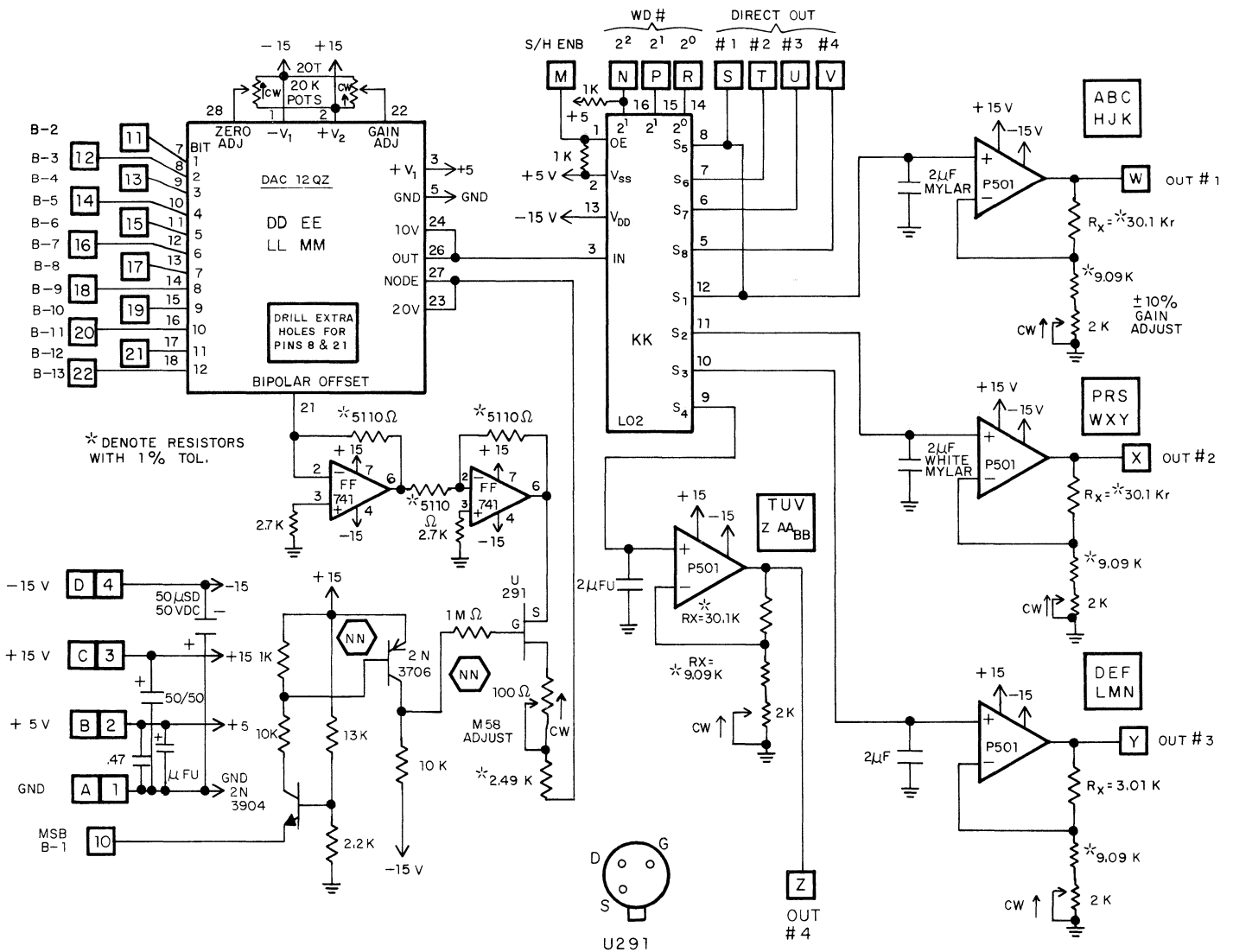


The circuits on the left are the data distributor shift register and latch circuits providing 4 digital to analog data circuits. The 13-pole 4-position switch on the right selects which word is converted during a given time.

A sequence of 4 conversions are done in 100 milliseconds. The control counter circuit for the switch is in the lower-middle of the drawing. The upper middle shows the distributed data error test circuit which compares the four 3-bit I.D. groups which should be identical within a given data frame.

Card #17

A schematic of card 17 shows the analog circuits of the D/A conversion and demultiplex system.

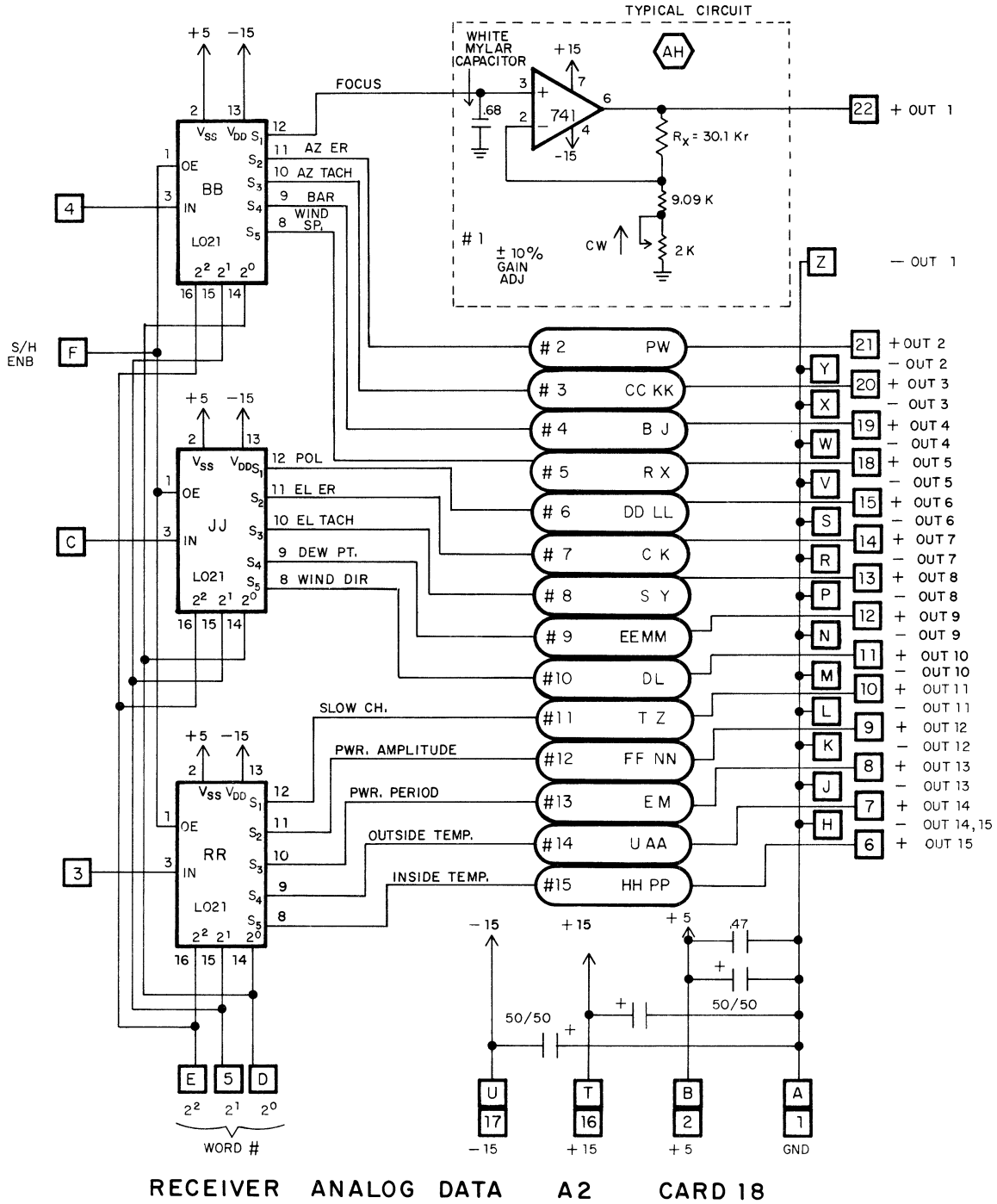


RECEIVER ANALOG DATA A1 CARD 17

Under control of card 16 the analog circuits of card 17 generate 4 precision D/A conversions during a data frame. A 12-bit D/A converter module forms the basis of the system with the addition of the 13th bit. This 13th bit is drawn in the lower left quadrant of the drawing. The circuits on the right are the analog buffer circuits and analog demultiplexer FET switch.

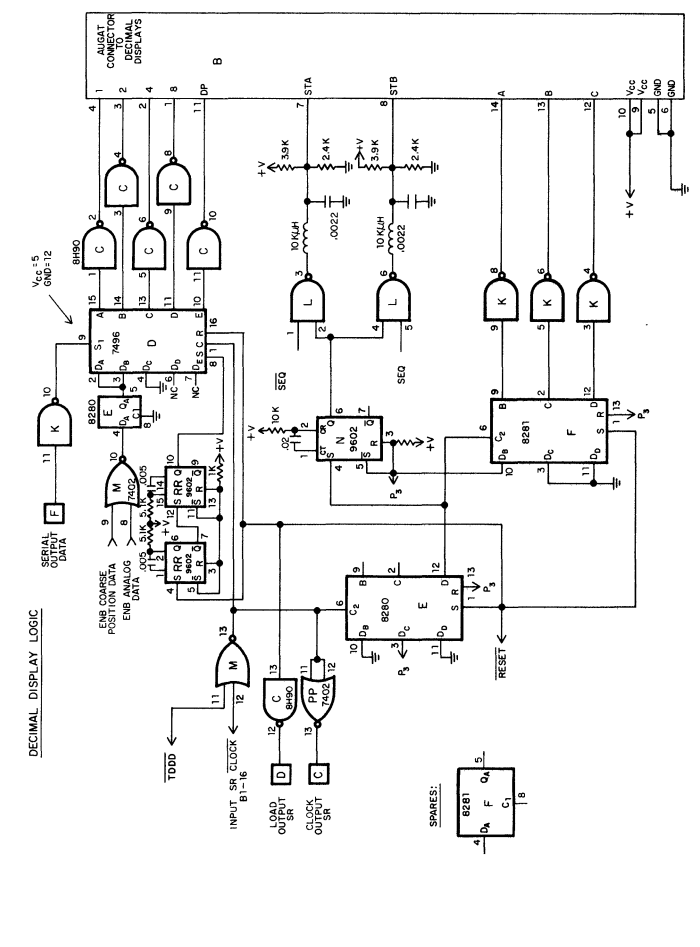
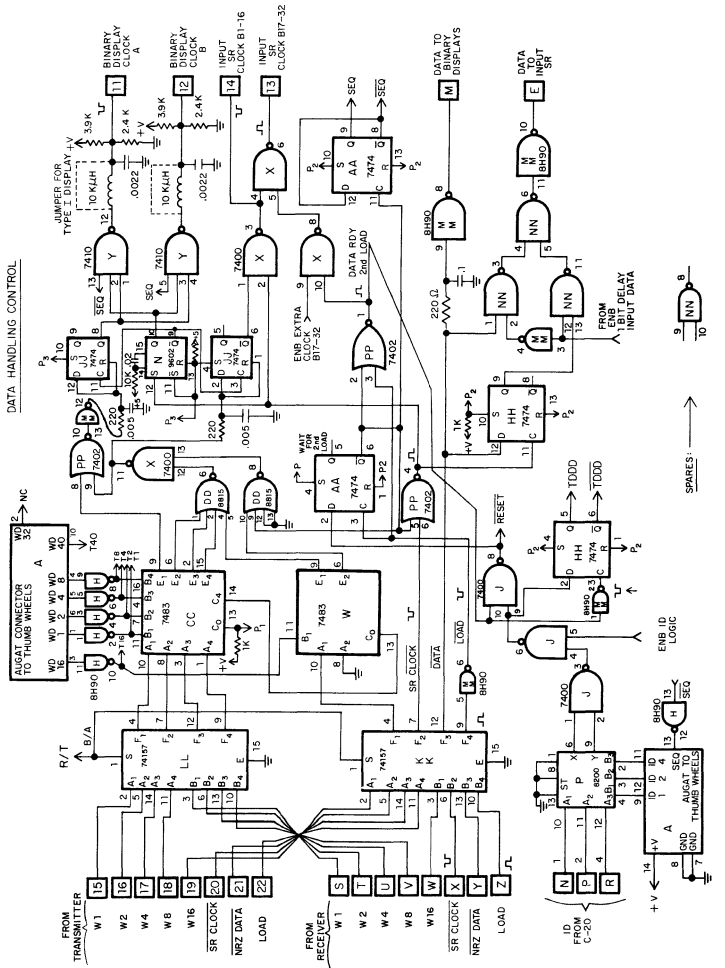
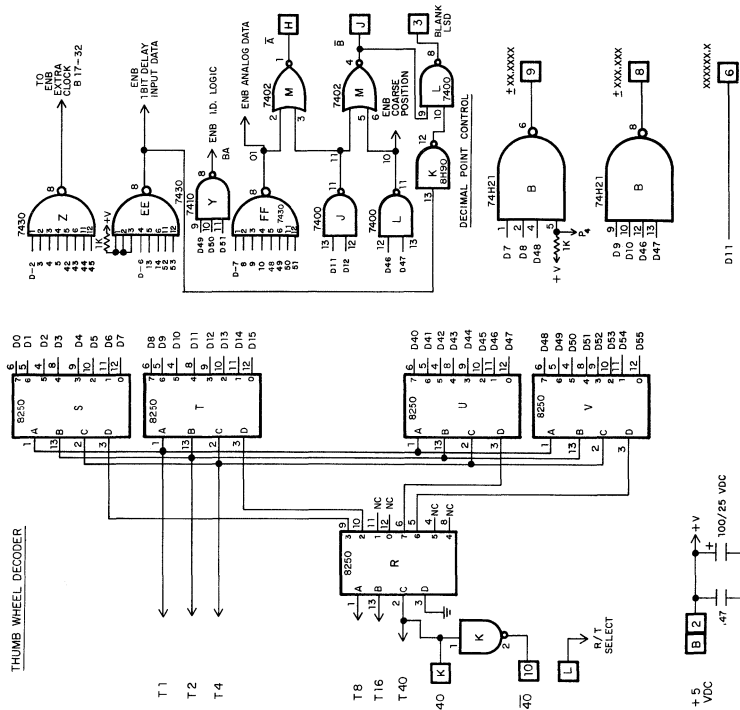
Card #18

If card 18 is coupled to card 17 then the last 3 channels are converted to 15 analog channels providing 16 total channels. Sample and hold circuits store the analog values during the dead time between samples.



Card #19

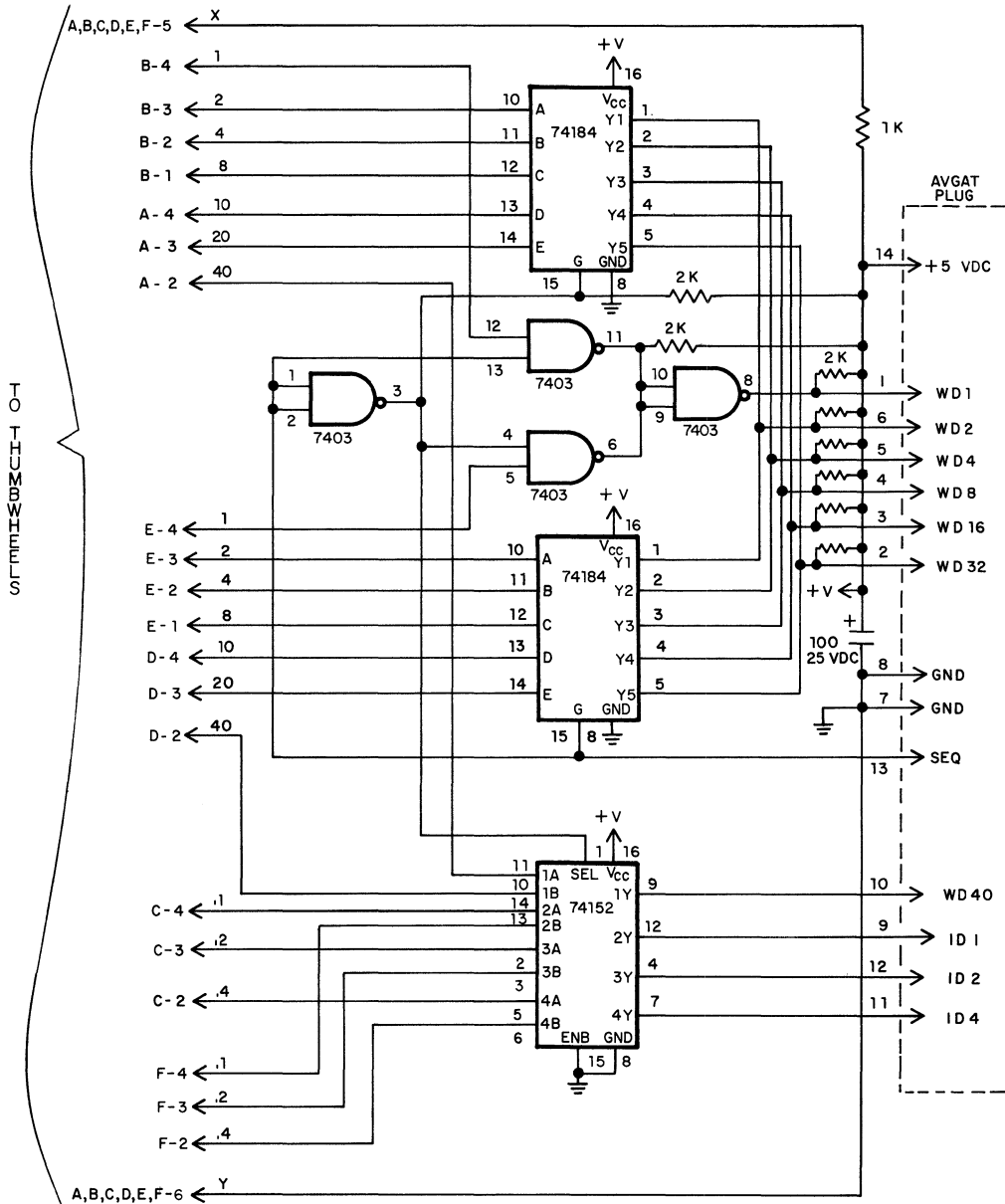
The circuits of card 19 are shown below:



TRANSMITTER FRONT PANEL DISPLAYS
CONTROL CARD 19

These circuits control the front panel digital displays. Data is captured and converted as necessary to provide serial data and clock to the binary displays and character serial data to the decimal displays under control of the access code thumbwheel switches on the front panel.

The schematic of the thumbwheel data multiplexer which is mounted on the back of the thumbwheels is shown:

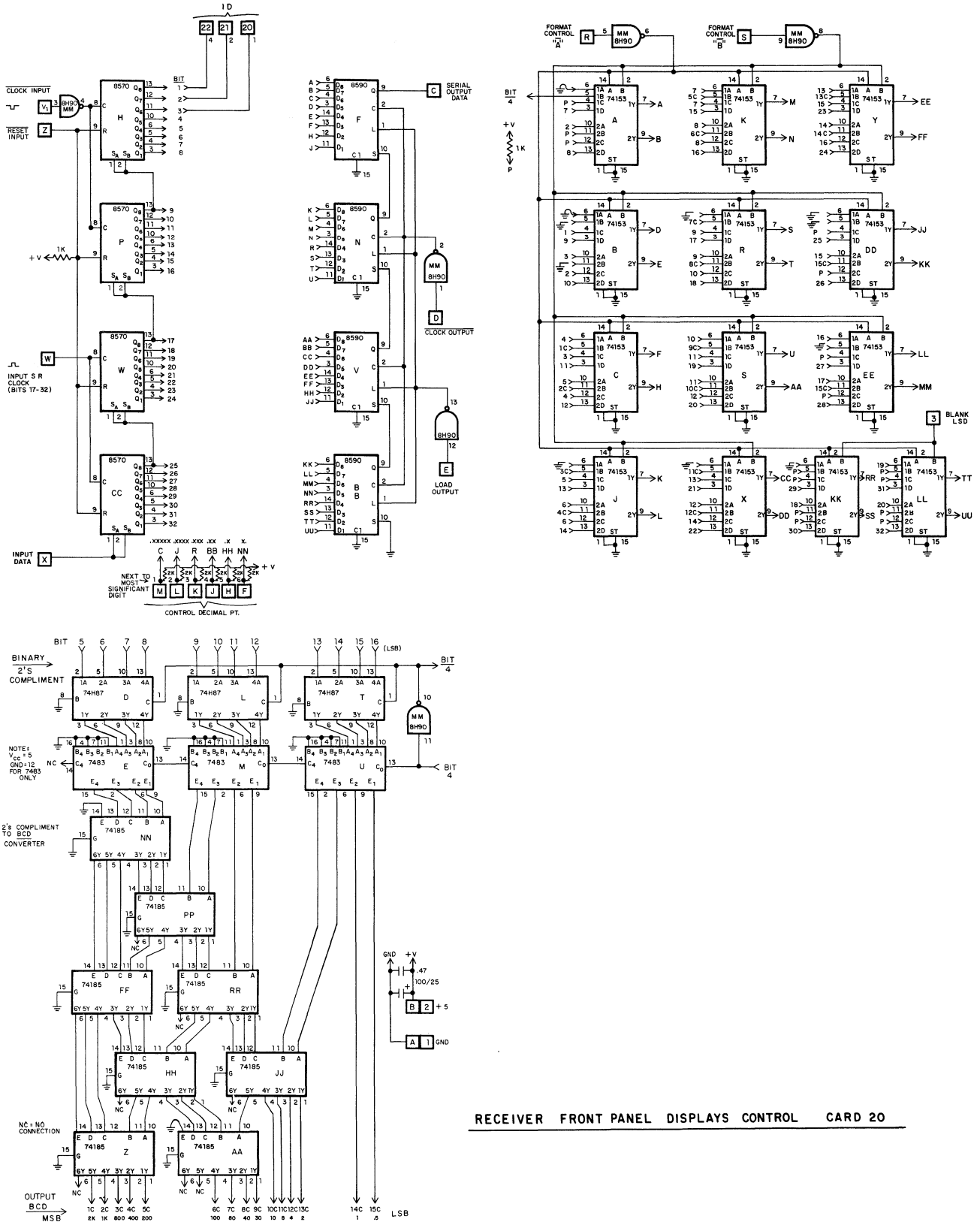


THIS IS A "PIGGY BACK" PC. MOUNTED ON FRONT PANEL
DATA WORD SELECT THUMBWHEELS

THUMBWHEEL SWITCH CONVERTER MULTIPLEX

Card #20

The circuits of card 20 form the formater for the front panel decimal displays:



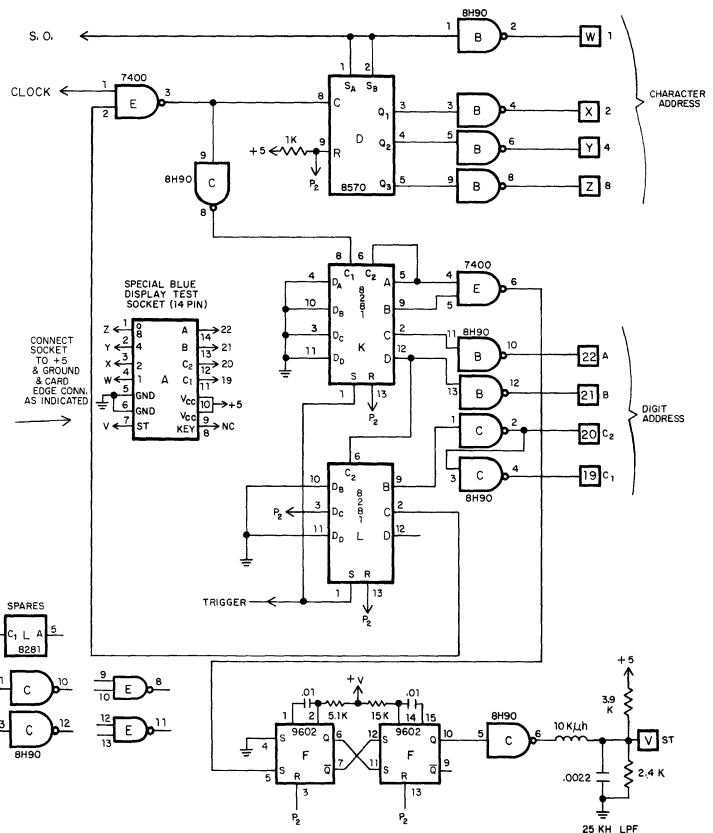
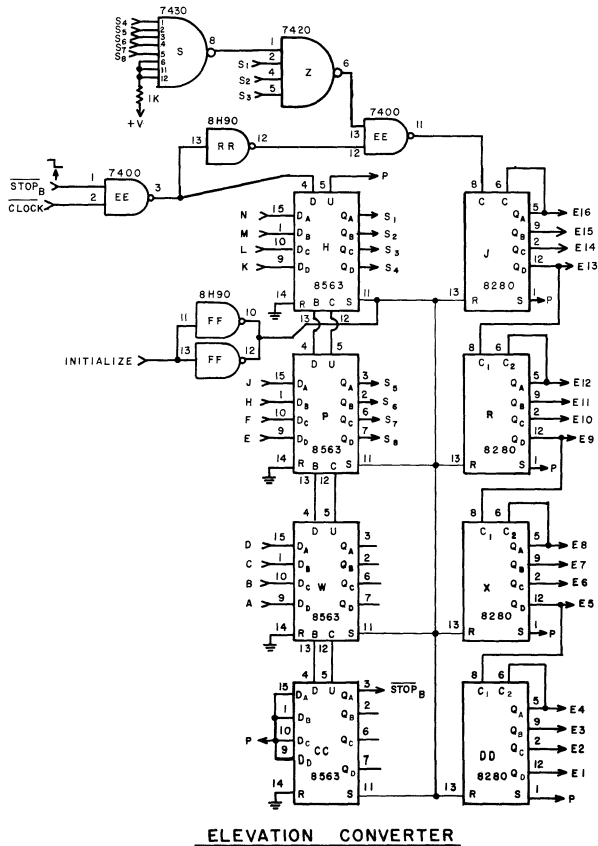
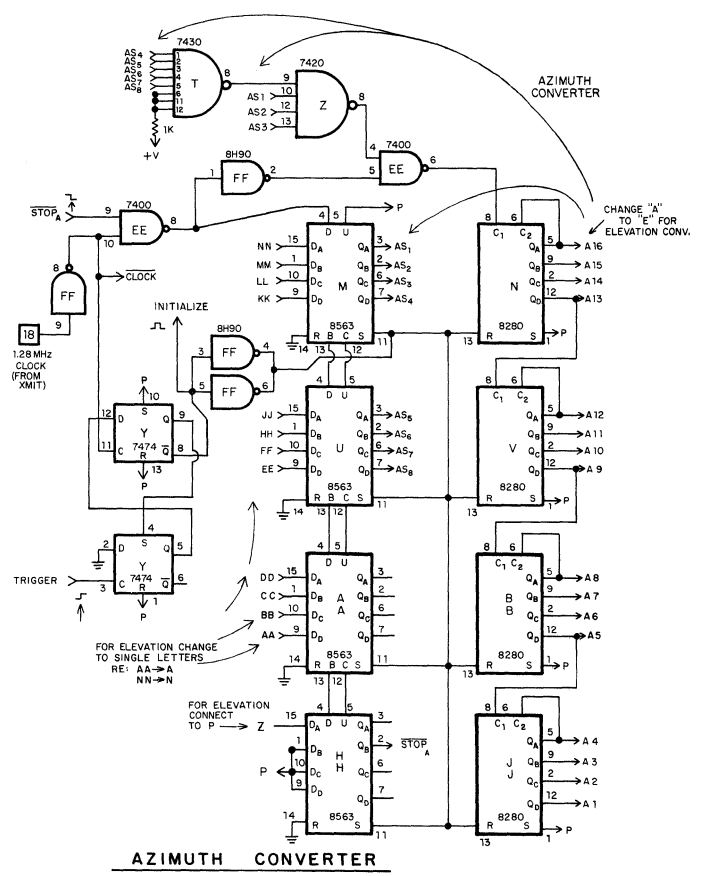
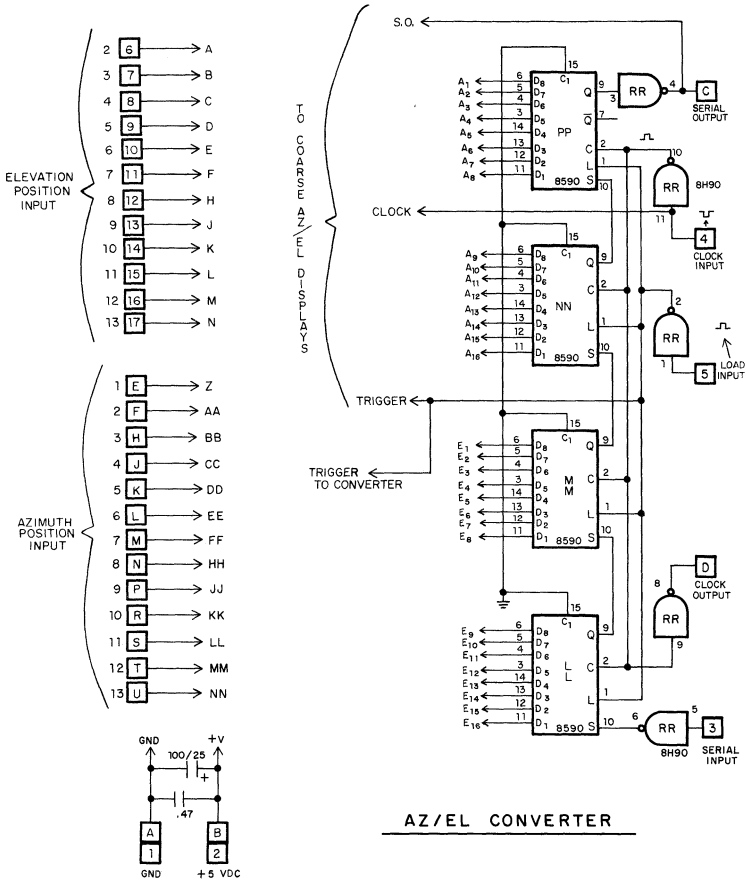
RECEIVER FRONT PANEL DISPLAYS CONTROL CARD 20

Data transmitted over the data link system is sent to the binary displays unchanged while the data is formatted to "human" terms and sent to the decimal displays. Since we have two sets of binary and decimal displays, all of the logic is "time shared" so that data is alternated and sent to the respective display by alternate control of the respective data access thumbwheel. The data is brought into the shift registers (8570) in the upper left corner of the drawing. Data is sent through the 26-pole 4-position switch in the upper-right quadrant and returned to the output shift registers (8590) on the left. When position "B" of the switch is selected, binary data is sent to the binary-to-decimal converter in the lower left corner for conversion.

Card #21

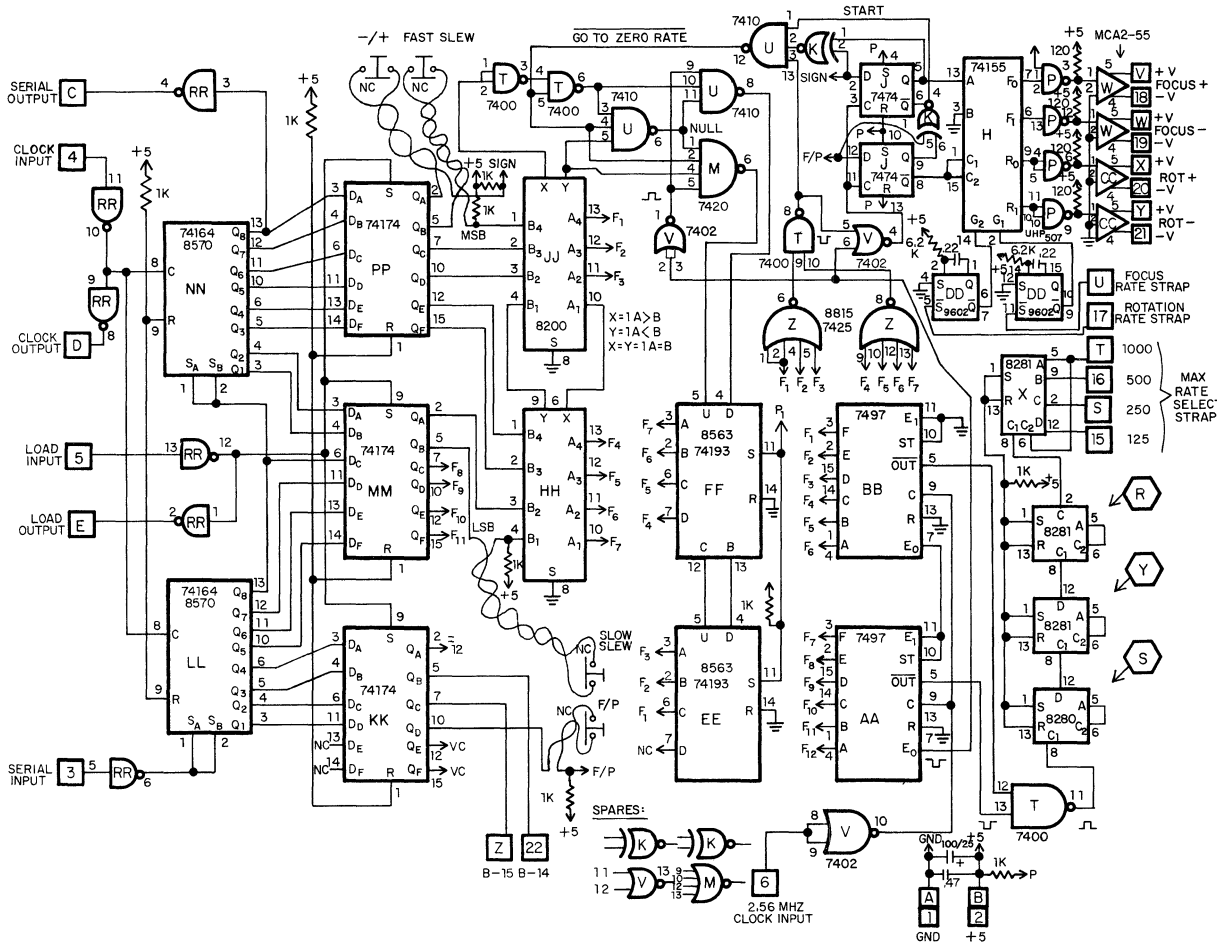
The electronics of card 21 as shown on the next page comprises a data input buss, upper left corner (which is connected to the position encoders); a data concentrator shift register, upper middle; azimuth binary-to-decimal degrees converter, upper right; elevation converter, lower left; and remote site control panel local position readout displays driver circuit. the azimuth converter is basically a digital count-down circuit that inhibits a clock pulse to the decimal counter (8280) for every eight clocks to the binary counter (8563) under control of gate "Z"; except for every 32nd group of eight binary clock pulses the decimal clock is allowed to pass under control of gate T. A conversion sequence is triggered every 0.1 second by the data concentrator shift register load pulse from the transmitter card #1 via pin #5. the elevation converter (lower left) operates in similar fashion to the azimuth converter. The converted data is transferred out of the converter at the same instant that new binary data is loaded. The circuit in the lower right drives the pair of 4-digit control panel displays. Converted data is received from the serial output to chip "PP" via "RR" and translated to 4-bit character serial format by chip "D" and sent to the display modules.

The address counters "K" and "L" select the digit receiving the present character. The data strobe provided by gate "E-6" is retimed by one shot chip "F" and sent to the display via the RLC 25 kHz low pass filter network which improves noise immunity over the display cable.



Card #22

The focus/rotation driver circuit (card 22) is presented below:



RECEIVER FOCUS/ROTATION RATE CONTROL CARD 22

The circuit accepts a binary command input via the 16-bit data distributor chips "NN" and "LL" which is latched by chips "PP", "MM", and "KK" and sent to the digital low pass filter circuit comprising the comparator circuit "JJ" and "HH" which controls the up/down counters (8563) via gates "T", "U", and "M". The output of the counter is fed back to the other input of the comparator. The feed-back loop operates in such a way that the counter output drives up or down until it equals the binary input command. This operation limits the rate of change in velocity command to the focus or rotation step motors. This rate of

change is controlled by the clock input to the up/down counter at pin "V-3". The output of the up/down counter is also connected to the rate multiplier chips "AA" and "BB" which function as a frequency synthesizer that drives the step motor translator drivers via the focus/rotation function and direction selection logic in the upper right corner of the drawing. The function and direction are selected by control bits from the distributor. In actual operation, if the system is being commanded to run in one direction and function and the direction and/or function is changed, then the system will first go to zero rate under control of logic "J", "K", and "U" and then the new command will be executed.

Wire Lists and Cable Lists

The following compressed wire and cable lists are presented as an aid to troubleshooting and understanding the system. The control building terminal is designated as "Data Link Control Building" (DLCB) whereas the 45-ft remote terminal is designated as the "Data Link 45 Foot" (DL45'). All cable connectors are "J" numbers and card slots are "S" numbers.

45-FT DIGITAL DATA LINK CONTROL BUILDING TERMINAL (DLCB)

CARD SLOT ASSIGNMENTS

<u>Slot</u>		<u>Card Name</u>	
1		Spare	
2		Spare	
3		Spare	
4	U	Spare	
5	P	Transmitter Single Bit Controls	Card #4
6		Transmitter Local Sidereal Clock	Card #6
7	L	Vacant	
8	I	Transmitter Analog Data (A-1)	Card #14
9	N	Transmitter Analog Data (D-1)	Card #13
10	K	Transmitter Az/EI Position Command	Card #8
11		Transmitter Front Panel Displays Control	Card #19
12		Transmitter Modulator and System Timing	Card #1
13		Not usable	
14		Receiver Demodulator and System Timing	Card #2
15		Receiver Error Control	Card #3
16	D	Receiver Front Panel Displays Control	Card #20
17	O	Receiver A/EI Position Readout	Card #11
18	W	Receiver Computer Interface Control	Card #12
* 19	N	Receiver LST/Az/EI Display	Card #7
20		Receiver Analog Data (D-1)	Card #16
21	L	Receiver Analog Data (A-1)	Card #17
22	I	Receiver Analog Data (A-2)	Card #18
23	N	Receiver Single Bit Controls	Card #5
24	K	Spare	
25		Spare	
26		Spare	

* Coarse Az/EI Display.

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CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 4 _____

Slot	From	To	From	To
Slot 5	A	Gnd	1	Gnd
	B	+5	2	+5
	C	S6-3	3	NC
	D	NC	4	S6-D
	E	NC	5	S6-E
	F		6	
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	
	U		17	
	V		18	
	W		19	
	X		20	
	Y		21	
	Z		22	

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 6 _____

Slot	From	To	From	To
Slot 6	A	Gnd	1	Gnd
	B	+5	2	+5
	C	S9-3	3	
	D		4	S9-D
	E		5	S12-11
	F	NC	6	NC
	H	NC	7	NC
	J		8	
	K		9	
	L		10	
	M	NC	11	
	N		12	
	P		13	
	R		14	
	S	NC	15	
	T		16	
	U		17	
	V		18	
	W		19	
	X		20	
	Y		21	S12-Y
	Z	(-) 15 volts	22	(-) 15 volts

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 14 _____

Slot	From	To	From	To
Slot 8	A	Gnd	1	Gnd
	B	+5 V DC	2	+5 V DC
	C		3	
	D		4	
	E	NC	5	
	F	NC	6	NC
	H	NC	7	NC
	J	S9-8	8	
	K	S9-9	9	
	L	S9-10	10	
	M		11	
	N	B3 - Center	12	B3 - Shell
	P	B4 - Center	13	B4 - Shell
	R		14	
	S		15	
	T	+15 V DC	16	+15 V DC
	U	-15 V DC	17	-15 V DC
	V		18	
	W	S9-18	19	
	X	S9-20	20	
	Y	S9-21	21	
	Z		22	

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 13 _____

Slot	From	To	From	To
Slot 9	A	Gnd	1	Gnd
	B	+5 V DC	2	+5 V DC
	C	S10-3	3	
	D		4	S10-D
	E	S9-F	5	S12-11
	F		6	
	H	S12-C	7	S12-3
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	
	U		17	
	V		18	
	W		19	
	X		20	
	Y		21	
	Z		22	

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	8	
		From	To	From	To
Slot 10	A	Gnd		1	Gnd
	B	+5		2	+5
	C	S12-10		3	
	D			4	S12-M
	E	S17-E		5	S6-E
	F	S15-16		6	S15-17
	H	S15-18		7	S15-19
	J	S15-21		8	S18-8
	K			9	
	L			10	
	M			11	
	N			12	
	P			13	
	R			14	
	S			15	
	T			16	
	U			17	
	V			18	
	W			19	
	X			20	
	Y	S18-Y		21	S18-21
	Z	S18-10		22	S12-H

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	19	
		From	To	From	To
Slot 11	A	Gnd		1	Gnd To pins 1-5 of Bin. Display Cable
	B	+5 V DC		2	+5 V DC - to pins 8-12 of Bin. Display Cable
	C	S16-D		3	S16-3
	D	S16-E		4	
	E	S16-X		5	
	F	S16-C		6	S16-H
	H	S16-R		7	S16-J
	J	S16-S		8	S16-K
	K	S11-L		9	S16-L
	L			10	NC
	M	Pin 6 & 7 of Bin. Display Cable (Augat)		11	Pin 14
	N	S16-20		12	Pin 13
	P	S16-21		13	S16-W
	R	S16-22		14	S16-Y
	S	S14-16		15	S12-16
	T	S14-15		16	S12-15
	U	S14-14		17	S12-14
	V	S14-13		18	S12-13
	W	S14-12		19	S12-12
	X	S14-M		20	S12-M
	Y	S14-10		21	S12-10
	Z	S15-12		22	S12-11

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	1	
		From	To	From	To
Slot 12	A	Gnd		1	Gnd
	B	+5		2	+5
	C	S18-K		3	
	D	S14-D		4	
	E			5	
	F			6	
	H			7	
	J	B1 - Shell		8	B1 - Center
	K			9	
	L			10	
	M			11	
	N			12	
	P			13	
	R	S12-13		14	
	S	S12-15		15	
	T	S12-16		16	S12-21 (odd)
	U	S12-16		17	
	V	S12-14		18	
	W	S12-14		19	
	X			20	
(even)	Y			21	
	Z			22	

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

- 44d -
CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	2	
		From	To	From	To
Slot 14	A	Gnd		1	Gnd
	B	+5		2	+5
	C	S15-C		3	
	D			4	S15-D
	E			5	
	F	S15-F		6	
	H	S15-H		7	
	J	B2 - Shell		8	B2 - Center
	K	S15-K		9	
	L	S15-L		10	S23-3
	M	S18-M		11	S15-M
	N			12	S15-13
	P			13	
	R	S14-13		14	
	S	S14-13		15	
	T	S14-15		16	
	U	S14-15		17	
	V	S14-14		18	
	W	S14-14		19	
	X			20	
	Y			21	S14-22
	Z			22	

Abbreviations:
 Ex: S 25-22
 Slot 25, Pin 22
 J9-MM
 Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	3
		From	To	
Slot 15	A	Gnd - (D2 ^B - F)	(D2 ^A - F)	1 Gnd
	B	+5		2 +5
	C			3 D2 ^A - D
	D			4 D2 ^A - C
	E	D2 ^A - E; D2 ^B - E		5 D2 ^A - B
	F			6 D2 ^A - A
	H			7 D2 ^B - D
	J			8 D2 ^B - C
	K			9 D2 ^B - B
	L			10 D2 ^B - A
	M			11 S23-5
	N			12
	P			13 S12-12
	R			14
	S			15
	T			16
	U			17
	V			18
	W			19
	X			20
	Y			21
	Z	S10-2		22

Remove +5 Pwr from Pin 2, Card 10

Digi Switch: D2^A; D2^B

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	20
		From	To	
Slot 16	A	Gnd		1 Gnd
	B	+5 V DC		2 +5 V DC
	C			3
	D			4
	E			5
	F			6
	H			7
	J			8
	K			9
	L			10
	M			11
	N			12
	P			13
	R			14
	S			15
	T			16
	U			17
	V			18
	W			19
	X			20
	Y			21
	Z	NC		22

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	11
		From	To	
Slot 17	A	Gnd		1 Gnd
	B	+5		2 +5
	C			3 S18-C
	D			4 S18-D
	E			5 S18-E
	F			6
	H			7
	J			8
	K			9
	L			10
	M			11
	N			12
	P			13
	R			14
	S			15
	T			16
	U			17
	V			18
	W			19
	X			20
	Y			21
	Z			22

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

- 45d -

CARD SLOT WIRING LIST

FOR:	BOX	DLCB	CARD	12
		From	To	
Slot 18	A	Gnd		1 Gnd
	B	+5		2 +5
	C			3 S19-C
	D			4 S19-D
	E			5 S23-E
	F	S15-16		6 S15-17
	H	S15-18		7 S15-19
	J	S15-15		8
	K			9 S23-4
	L	S12-H		10
	M			11 S15-M
	N			12
	P			13
	R			14
	S			15 S15-11
	T	S15-I		16
	U			17
	V			18
	W			19
	X			20 S15-20
	Y			21
	Z			22

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 7 _____

Slot	From	To	From	To
19	A	Gnd	1	Gnd
	B	+5	2	+5
	C		3	S20-C
	D		4	S20-D
	E		5	S14-5
	F		6	
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N	S19-A	12	S14-12
	P	NC	13	S14-13
	R	NC	14	S14-14
	S	S19-A	15	S14-15
	T	S19-A	16	S14-16
	U		17	S14-17
	V		18	S14-18
	W	S19-A	19	S14-19
	X		20	S14-20
	Y		21	
	Z		22	

Abbreviations:
Ex: S 25-22
Slot 25, Pin 22
J9-MM
Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 16 _____

Slot	From	To	From	To
20	A	Gnd	1	Gnd
	B	+5 V DC	2	+5 V DC
	C		3	S23-C
	D		4	S23-D
	E	S20-F	5	S23-E
	F		6	
	H	S22-E	7	S15-H
	J	S22-5	8	To (local) dist. data lamp on front panel
	K	S22-D	9	S10-2 - remove +5 pwr buss from pin 2
	L	S21-10	10	S22-F/S21-M
	M	S21-11	11	
	N	S21-12	12	
	P	S21-13	13	S21-P
	R	S21-14	14	S21-R
	S	S21-15	15	
	T	S21-16	16	
	U	S21-17	17	
	V	S21-18	18	
	W	S21-19	19	
	X	S21-20	20	
	Y	S21-21	21	
	Z	S21-22	22	

Abbreviations:
Ex: S 25-22
Slot 25, Pin 22
J9-MM
Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

- 46c -
CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 17 _____

Slot	From	To	From	To
21	A	Gnd/B6 - Shell	1	Gnd
	B	+5 V DC	2	+5 V DC
	C	+15 V DC	3	+15 V DC
	D	-15 V DC	4	-15 V DC
	E		5	
	F		6	
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N	NC	12	
	P		13	
	R		14	
	S	NC	15	
	T	S22-4	16	
	U	S22-C	17	
	V	S22-3	18	
	W	B6 - Center B6-Shell to Pin A	19	
	X	NC	20	
	Y	NC	21	
	Z	NC	22	

Abbreviations:
Ex: S 25-22
Slot 25, Pin 22
J9-MM
Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

- 46d -
CARD SLOT WIRING LIST

FOR: BOX _____ DLCB _____ CARD _____ 18 _____

Slot	From	To	From	To
22	A	Gnd	1	Gnd
	B	+5 V DC	2	+5 V DC
	C		3	
	D		4	
	E		5	
	F		6	
	H		7	
	J		8	
	K		9	
	L	B5 - Shell	10	B5 - Center
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T	+15 V DC	16	+15 V DC
	U	-15 V DC	17	-15 V DC
	V		18	
	W		19	
	X		20	
	Y		21	
	Z		22	

Abbreviations:
Ex: S 25-22
Slot 25, Pin 22
J9-MM
Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

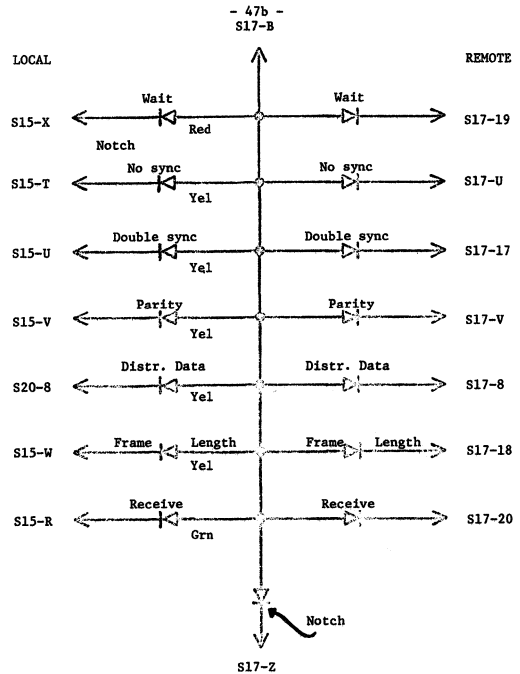
FOR: BOX _____ DLCB _____ CARD _____ 5 _____

Slot	From	To	From	To
23	A	Gnd	1	Gnd
	B	+5	2	+5
	C		3	
	D		4	
	E		5	
	F	S19-A	6	
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	
	U		17	
	V		18	
	W		19	
	X		20	
	Y		21	
	Z		22	

Abbreviations:

Ex: S 25-22
Slot 25, Pin 22
J9-MM
Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.



45-FT DATA LINK SYSTEM ERROR INDICATOR LAMPS - DLCB

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link Control Bldg. Term.

Table with columns: CONNECTOR, DESIGNATION, J-1, TYPE, Elco, 56 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Rows include Pin To Function for various connectors like S10-K, S10-9, etc.

Abbreviations: Ex: S25-22 Slot 25, Pin 22 J9-MM Elco J9, Pin MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

- 48c -

ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link Control Bldg. Term.

Table with columns: CONNECTOR, DESIGNATION, J-3, TYPE, Elco, 56 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Rows include Pin To Function for various connectors like S5-H, S5-7, etc.

Abbreviations: Ex: S25-22 Slot 25, Pin 22 J9-MM Elco J9, Pin MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link Control Bldg. Term.

Table with columns: CONNECTOR, DESIGNATION, J-2, TYPE, Elco, 56 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Rows include Pin To Function for various connectors like S17-K, INB 01, etc.

Abbreviations: Ex: S25-22 Slot 25, Pin 22 J9-MM Elco J9, Pin MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

- 48d -

ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link Control Bldg. Term.

Table with columns: CONNECTOR, DESIGNATION, J-5, TYPE, Elco, 38 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Rows include Pin To Function for various connectors like S22-22, Focus + Out, etc.

Abbreviations: Ex: S25-22 Slot 25, Pin 22 J9-MM Elco J9, Pin MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

(+) Term = Signal (-) Terminals are common.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link Control Bldg. Term.

CONNECTOR: DESIGNATION J-6 ; TYPE Elco ; 38 PINS

SMALL KEY _____ LARGE KEY _____ ; PANEL E CABLE P

Pin	To	Function	Pin	To	Function
A	S6-J	20 Hour	u		
B	8	10	v		
C	K	8	w		
D	9	4	x		
E	L	2	y		
F	10	1	z		
H	11	40 Minutes	AA		
J	N	20	BB		
K	12	10	CC		
L	P	8	DD		
M	13	4	EE		
N	R	2	FF		
P	14	1	HH		
R	15	40 Seconds	JJ		
S	T	20	KK		
T	16	10	LL		
U	U	8	MM		
V	17	4	NN		
W	v	2			
X	18	1			
Y	W	0.8 Second			
Z	19	0.4			
AA	a	X 0.2			
BB	b	S6-20 0.1			
CC	c	Spare			
DD	d	Spare			
EE	e	S6-A			
FF	f	Common			
HH	h	S6-A			
JJ	j	Spare			
KK	k	Spare			
LL	l	Spare			
MM	m	Spare			
NN	n	Spare			
PP	p	Spare			
RR	r	Spare			
SS	s	Spare			
TT	t	Spare			

Abbreviations: Ex: S25-22 J9-MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link Control Bldg. Term.

CONNECTOR: DESIGNATION J-7 ; TYPE Elco ; 38 PINS

SMALL KEY _____ LARGE KEY _____ ; PANEL E CABLE P

Pin	To	Function	Pin	To	Function
A	S5-S	XR-XL IF Select	u		
B	15	SR-SL IF Select	v		
C	T	XR-XL IF Select	w		
D	16	X Band Cal On	x		
E	U	S Band Cal On	y		
F	17	21 cm Cal On	z		
H	V	Down Link Transmitters Off	AA		
J	18	WD Band Trans. Pwr 10 dB DN	BB		
K	W	WD Band Trans. Pwr 20 dB DN	CC		
L	19	S Band Filter Control	DD		
M	X	Spare Bit	EE		
N	20	Spare Bit	FF		
P	Y	Spare Bit	HH		
R	S5-21	Spare Bit	JJ		
S	NC		KK		
T	NC		LL		
U	S5-22	(+5 V, 350 mA Input)	MM		
V	S5-22		NN		
W	NC				
X	NC				
Y	S23-S	Rx Out of Lock			
Z	15	FOFPL Out of Lock			
AA	a	T XR Rec Out of Range			
BB	b	16 XL Rec Out of Range			
CC	c	U SR Rec Out of Range			
DD	d	17 SL Rec Out of Range			
EE	e	V 21 cm Rec Out of Range			
FF	f	18 F.E. Box Temp Out of Range			
HH	h	W Spare Bit			
JJ	j	19 Spare Bit			
KK	k	X Spare Bit			
LL	l	20 Spare Bit			
MM	m	Y Spare Bit			
NN	n	21 Spare Bit			
PP	p	NC			
RR	r	NC			
SS	s	S23-22 (Remote Ground)			
TT	t	S23-22 (Remote Ground)			

Abbreviations: Ex: S25-22 J9-MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link C.B. Term.

CONNECTOR: DESIGNATION J-8 ; TYPE Elco ; 38 PINS

SMALL KEY _____ LARGE KEY _____ ; PANEL E CABLE E

Pin	To	Function	Pin	To	Function
A	S19-F	"8" 1	u		
B	H	"4" 2	v		
C	J	"2" 3	w		
D	K	"1" 4	x		
E	L	Gnd 5	y		
F	L	Gnd 6	z		
H	M	Strobe 7	AA		
J	11	Key 8	BB		
K	10	CC 9	CC		
L	10	CC 10	DD		
M	S19-9	C1 11	EE		
N	8	C2 12	FF		
P	7	B 13	HH		
R	6	A 14	JJ		
S	S17-W	Wait Lamp Up Link	KK		
T	Y	Error " " "	LL		
U	X	Receive " " "	MM		
V	S15-Y	Wait " Down	NN		
W	14	Error " " "			
X	S	Receive " " "			
Y	A	Lamp Common			
Z	S17-A	Lamp Common			
AA	a	NC			
BB	b	NC			
CC	c	S17-21 Computer Update Error Lamp			
DD	d	NC			
EE	e	S19-A Coarse Displays			
FF	f	Ground (tied also to pins E and F)			
HH	h				
JJ	j				
KK	k				
LL	l				
MM	m	S19-B Coarse Displays			
NN	n				
PP	p	CC			
RR	r	(tied also to pins K and L)			
SS	s				
TT	t				

Abbreviations: Ex: S25-22 J9-MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

Link P/E F/E Control Panel

J-8 Elco 38 Pin

COMPUTER UP DATE STATUS

DATA LINK RECEIVER STATUS

UP LINK	DOWN LINK
(Red) <input type="radio"/> Wait <input type="radio"/>	
(Yellow) <input type="radio"/> Error <input type="radio"/>	
(Green) <input type="radio"/> Receive <input type="radio"/>	

LED's

Notch Sig. Lamp Common

Back View

45-FT DIGITAL DATA LINK REMOTE SITE TERMINAL (DL45')

CARD SLOT ASSIGNMENTS

<u>Slot</u>		<u>Card Name</u>	
1		Spare	
2		Spare	
3	D	Transmitter Single Bit Controls	Card #4
4	O		
5	W	Transmitter Analog Data (A-2)	Card #15
6	N	Transmitter Analog Data (A-1)	Card #14
7		Transmitter Analog Data (D-1)	Card #13
Coarse Az/El Display	8	L Transmitter Az/El Coarse Position Converter	Card #21
El	9	I Transmitter Az/El Position Readout	Card #10
Az	10	N Transmitter Az/El Position Readout	Card #10
	11	K Transmitter Front Panel Displays Control	Card #19
	12	Transmitter Modulator and System Timing	Card #1
	13	Not Usable	
	14	Receiver Demodulator and System Timing	Card #2
	15	Receiver Error Control	Card #3
	16	U Receiver Front Panel Displays Control	Card #20
	17	P Receiver Az/El Position Command	Card #9
	18	Receiver Az/El Position Command	Card #9
	19	L Receiver Focus/Rotation Rate Control	Card #22
	20	I Receiver Analog Data (D-1)	Card #16
	21	N Receiver Analog Data (A-1)	Card #17
	22	K Vacant	
LST Display	23	Receiver LST/Az/El Display	
	24	Receiver Single Bit Controls	
	25	Spare	
	26	Spare	

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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 4

From	To	From	To
Slot 3 - A	Gnd	1	Gnd
B	+5	2	+5
C	S7-3	3	NC
D	NC	4	S7-D
E	NC	5	S8-5
F		6	
H		7	
J		8	
K		9	
L		10	
M		11	
N		12	
P		13	
R		14	
S		15	
T		16	
U		17	
V		18	
W		19	
X		20	
Y		21	
Z		22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 15

From	To	From	To
Slot 5 - A	Gnd	1	Gnd
B	+5 V DC	2	+5 V DC
C	S6-H	3	S6-7
D	S7-13	4	S6-6
E	S7-11	5	S7-12
F		6	
H		7	
J		8	
K		9	
L	B5 - Shell	10	B5 - Center
M		11	
N		12	
P		13	
R		14	
S		15	
T	+15 V DC	16	+15 V DC
U	-15 V DC	17	-15 V DC
V		18	
W		19	
X		20	
Y		21	
Z		22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 14

From	To	From	To
Slot 6 - A	Gnd	1	Gnd
B	+5 V DC	2	+5 V DC
C		3	
D		4	
E	B6 - Center	5	
F	B6 - Shell	6	
H		7	
J	S7-8	8	
K	S7-9	9	
L	S7-10	10	
M		11	
N		12	
P		13	
R		14	
S		15	
T	+15 V DC	16	+15 V DC
U	-15 V DC	17	-15 V DC
V		18	
W	S7-18	19	
X	S7-20	20	
Y	S7-21	21	
Z		22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 13

From	To	From	To
Slot 7 - A	Gnd	1	Gnd
B	+5 V DC	2	+5 V DC
C	S8-3	3	
D		4	S8-D
E	S7-F	5	S8-5
F		6	
H	S12-C	7	S12-3
J		8	
K		9	
L		10	
M		11	
N		12	
P		13	
R		14	
S		15	
T		16	
U		17	
V		18	
W		19	
X		20	
Y		21	
Z		22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	21
			From	To
Slot 8	A	Gnd	1	Gnd
	B	+V	2	+V
	C	S9-3	3	
	D		4	S9-D
	E	S10-H	5	S9-E
	F	7	6	S9-7
	H	J	7	J
	J	8	8	8
	K	K	9	K
	L	9	10	9
	M	L	11	L
	N	10	12	10
	P	M	13	M
	R	11	14	11
	S	N	15	N
	T	12	16	12
	U	S10-P	17	S9-P
	V		18	S12-C
	W		19	
	X		20	
	Y		21	
	Z		22	

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

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CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	10
			From	To
Slot 9	A	Gnd	1	Gnd
	B	+5	2	+5
	C	S10-3	3	
	D		4	S10-D
	E		5	S10-E
	F	NC	6	NC
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	
	U	NC	17	NC
	V	NC	18	NC
	W	NC	19	NC
	X	NC	20	NC
	Y	NC	21	NC
	Z	NC	22	NC

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

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CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	10
			From	To
Slot 10	A	Gnd	1	Gnd
	B	+5	2	+5
	C	S12-10	3	
	D		4	S12-M
	E		5	S12-11
	F	NC	6	NC
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	
	U	S15-16	17	S15-17
	V	S15-18	18	S15-19
	W	S15-15	19	S17-22
	X		20	NC
	Y	NC	21	NC
	Z	NC	22	NC

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

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CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	19
			From	To
Slot S11	A	Gnd	1	Gnd to Pins 1-5 of Bin. Display Cable
	B	+5 v DC	2	+5 v DC to Pins 7-12 of Bin. Display Cable
	C	S16-D	3	S16-3
	D	S16-E	4	
	E	S16-X	5	
	F	S16-C	6	S16-H
	H	S16-R	7	S16-J
	J	S16-S	8	S16-K
	K	S11-L	9	S16-L
	L		10	NC
	M	Pins 6 & 7 of Bin. Display Cable (Augat)	11	Pin 14
	N	S16-20	12	Pin 13
	P	S16-21	13	S16-W
	R	S16-22	14	S16-Y
	S	S12-16	15	S14-16
	T	S12-15	16	S14-15
	U	S12-14	17	S14-14
	V	S12-13	18	S14-13
	W	S12-12	19	S14-12
	X	S12-M	20	S14-M
	Y	S12-10	21	S14-10
	Z	S12-11	22	S15-12

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

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CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	1	
Slot		From	To	From	To
12	A	Gnd		1	Gnd
	B	+5		2	+5
	C	NC		3	
	D	S14-D		4	
	E			5	
	F			6	
	H	NC		7	
	J	B1 - Shell		8	B1 - Center
	K			9	
	L			10	
	M			11	
	N			12	
	P			13	
	R	S12-13		14	
	S	S12-13		15	
	T	S12-15		16	(odd)
	U	S12-15		17	
	V	S12-14		18	
	W	S12-14		19	
	X	S12-21		20	
(even)	Y	S14-11		21	
	Z			22	

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

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CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	2	
Slot		From	To	From	To
14	A	Gnd		1	Gnd
	B	+5		2	+5
	C	S15-C		3	
	D			4	S15-D
	E			5	
	F	S15-F		6	
	H	S15-H		7	
	J	B2 - Shell		8	B2 - Center
	K	S15-K		9	To S17-16 & S18-16
	L	S15-L		10	S24-3
	M	S24-4		11	S15-M
	N			12	S15-13
	P			13	
	R	S14-13		14	
	S	S14-15		15	
	T	S14-16		16	
	U	S14-16		17	
	V	S14-15		18	
	W	S14-14		19	
	X			20	
	Y			21	NC Open Odd 9 wds Even
	Z			22	

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

- 53c -

CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	3	
Slot		From	To	From	To
15	A	Gnd	D2 ^A -F, D2 ^B -F	1	Gnd
	B	+5		2	+5
	C			3	D2 ^A - D
	D			4	D2 ^A - C
	E	D2 ^A -E, D2 ^B -E		5	D2 ^A - B
	F			6	D2 ^A - A
	H			7	D2 ^B - D
	J			8	D2 ^B - C
	K			9	D2 ^B - B
	L			10	D2 ^B - A
	M			11	S24-5
	N			12	
	P			13	
	R			14	
	S			15	
	T			16	
	U			17	
	V			18	
	W			19	
	X			20	
	Y			21	
	Z			22	

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

- 53d -

CARD SLOT WIRING LIST

FOR:	BOX	DL45'	CARD	20	
Slot		From	To	From	To
16	A	Gnd		1	Gnd
	B	+5 V DC		2	+5 V DC
	C			3	
	D			4	
	E			5	
	F			6	
	H			7	
	J			8	
	K			9	
	L			10	
	M			11	
	N			12	
	P			13	
	R			14	
	S			15	
	T			16	
	U			17	
	V			18	
	W			19	
	X			20	
	Y			21	
	Z	NC		22	

Abbreviations: BNC Connectors: B1, B2, B3, etc.
 Ex: S 25-22 Elco Connectors: J1, J2, J3, etc.
 Slot 25, Pin 22 Slot Connectors: S1, S2, S3, etc.
 J9-MM Pin No.'s -3, -X, -B, -22, etc.
 Elco J9, Pin MM

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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 9

Slot	From	To	From	To
Slot 17	A	Gnd	1	Gnd
	B	+5	2	To remote distr. data lamp on front panel.
	C	NC	3	S18-C
	D	NC	4	S18-D
	E	NC	5	S18-E
	F	S18-F	6	S18-C
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	S14-9
	U	NC	17	NC
	V	NC	18	NC
	W	NC	19	NC
	X	NC	20	NC
	Y	NC	21	NC
	Z	NC	22	NC

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM
 BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

- 54c -

CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 22

Slot	From	To	From	To
Slot 19	A	Gnd	1	Gnd
	B	+5	2	+5
	C		3	S20-C
	D		4	S20-D
	E		5	S24-E
	F	NC	6	S14-D
	H	NC	7	NC
	J	NC	8	NC
	K	NC	9	NC
	L	NC	10	NC
	M	NC	11	NC
	N	NC	12	NC
	P	NC	13	NC
	R	NC	14	NC
	S		15	NC
	T	NC	16	
	U	S19-16	17	S19-16
	V		18	
	W		19	
	X		20	
	Y		21	
	Z	NC	22	NC

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM
 BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 9

Slot	From	To	From	To
Slot 18	A	Gnd	1	Gnd
	B	+5	2	+5
	C		3	S19-C
	D		4	S19-D
	E		5	S19-E
	F	S24-6	6	S19-C
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	S17-16
	U		17	
	V		18	
	W		19	
	X		20	
	Y		21	
	Z		22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM
 BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.

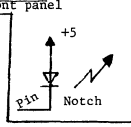
- 54d -

CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 16

Slot	From	To	From	To
Slot 20	A	Gnd	1	Gnd
	B	+5 V DC	2	+5 V DC
	C		3	S23-C
	D		4	S23-D
	E	S20-F	5	S24-E
	F		6	
	H	NC	7	S15-H
	J	NC	8	To (local) distr. data lamp on front panel
	K	NC	9	S10-X/S15-Z
	L	S21-10	10	S12-3
	M	S21-11	11	S21-M
	N	S21-A12	12	
	P	13	13	S21-P
	R	14	14	S21-R
	S	15	15	
	T	16	16	
	U	17	17	
	V	18	18	
	W	19	19	
	X	20	20	
	Y	21	21	
	Z	22	22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM
 BNC Connectors: B1, B2, B3, etc.
 Elco Connectors: J1, J2, J3, etc.
 Slot Connectors: S1, S2, S3, etc.
 Pin No.'s -3, -X, -B, -22, etc.



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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 17

Slot	From	To	From	To
Slot <u>21</u>	A	Gnd/B3 - Shell	1	Gnd/B4 - Shell
	B	+5 V DC	2	+5 v DC
	C	+15 V DC	3	+15 V DC
	D	-15 V DC	4	-15 V DC
	E		5	
	F		6	
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N	S20-A	12	
	P		13	
	R		14	
	S		15	
	T		16	
U		17		
V		18		
Sp. 3	W		19	
Sp. 4	X		20	
Az R/C	Y	B3 - Center	21	
E1 R/C	Z	B4 - Center	22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

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CARD SLOT WIRING LIST

FOR: BOX DL45' CARD 7

Slot	From	To	From	To
Slot <u>23</u>	A	Gnd	1	Gnd
	B	+5	2	+5
	C		3	S24-C
	D		4	S24-D
	E		5	S14-5
	F		6	
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N	S23-A	12	S14-12
	P		13	S14-13
	R		14	S14-14
	S		15	S14-15
	T	S23-U	16	S14-16
U		17	S14-17	
V		18	S14-18	
W		19	S14-19	
X		20	S14-20	
Y		21		
Z		22		

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

- 55c -

CARD SLOT WIRING LIST

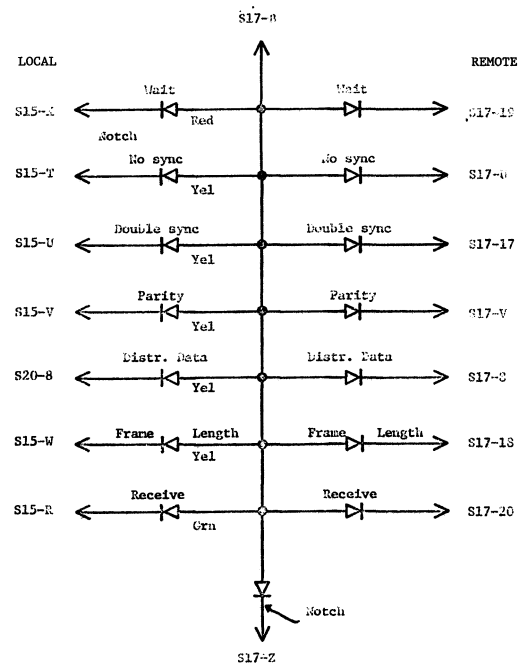
FOR: BOX DL45' CARD 5

Slot	From	To	From	To
Slot <u>24</u>	A	Gnd	1	Gnd
	B	+5	2	+5
	C		3	
	D		4	
	E		5	
	F	S15-15	6	
	H		7	
	J		8	
	K		9	
	L		10	
	M		11	
	N		12	
	P		13	
	R		14	
	S		15	
	T		16	
	U		17	
	V		18	
	W		19	
	X		20	
	Y		21	
	Z		22	

Abbreviations:
 Ex: S 25-22 Slot 25, Pin 22
 J9-MM Elco J9, Pin MM

BNC Connectors: B1, B2, B3, etc.
Elco Connectors: J1, J2, J3, etc.
Slot Connectors: S1, S2, S3, etc.
Pin No.'s -3, -X, -B, -22, etc.

- 55d -



45-FT DATA LINK SYSTEM ERROR INDICATOR LAMPS - DLCB

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Term.

CONNECTOR:		DESIGNATION	J-1	TYPE	Elco	56	PINS
SMALL KEY	LARGE KEY	:	PANEL	E	CABLE	P	
Pin	To	Function	Pin	To	Function		
A	S10-H	Az Pos Bit 1 (MSB)	u	S9-T	Elev. Pos. Bit 19 (LSB)		
B	7	2	v	S9-A	Logic Common Ground		
C	J	3	w	S14-11	Link Sync		
D	8	4	x	S14-1	Logic Common		
E	K	5	y				
F	9	6	z				
H	L	7	AA				
J	10	8	BB				
K	M	9	CC				
L	11	10	DD				
M	N	11	EE	S5-21	Az Pos. Error + In		
N	12	12	FF	S5-Y	Az Pos. Error - In		
P	P	13	HH	S5-14	El Pos. Error + In		
R	13	14	JJ	S5-R	El Pos. Error - In		
S	R	15	KK				
T	14	16	LL				
U	S	17	MM		NC		
V	15	18	NN		NC		
W	T	19 LSB					
X	S10-A	Logic Com. Gnd					
Y	S9-7	El Pos. Bit 1 (MSB)					
Z	7	2					
AA	a	3					
BB	b	4					
CC	c	5					
DD	d	6					
EE	e	7					
FF	f	8					
HH	h	9					
JJ	j	10					
KK	k	11					
LL	l	12					
MM	m	13					
NN	n	14					
PP	p	15					
RR	r	16					
SS	s	17					
TT	t	18					

Abbreviations: Ex: S25-22 J9-MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No. 's -3, -X, -B.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Term.

CONNECTOR:		DESIGNATION	J-2	TYPE	Elco	56	PINS
SMALL KEY	LARGE KEY	:	PANEL	E	CABLE	F	
Pin	To	Function	Pin	To	Function		
A	S17-H	Az Pos Com Bit 1 MSB	u	S18-T	El Pos Com Bit 19 LSB		
B	7	2	v	S18-A	Logic Common Ground		
C	J	3	w	S14-9	HP/116 Control Select		
D	8	4	x	S14-A	Logic Common Ground		
E	K	5	y	S18-22	(Initialize P.R. Comp. U/D Error)		
F	9	6	z	S18-1	(Logic Common)		
H	L	7	AA				
J	10	8	BB				
K	M	9	CC				
L	11	10	DD				
M	N	11	EE				
N	12	12	FF				
P	P	13	HH				
R	13	14	JJ				
S	R	15	KK				
T	14	16	LL				
U	S	17	MM				
V	15	18	NN				
W	S17-T	19 LSB					
X	S17-A	Logic Com Gnd					
Y	S18-7	El Pos Com Bit 1 MSB					
Z	7	2					
AA	a	3					
BB	b	4					
CC	c	5					
DD	d	6					
EE	e	7					
FF	f	8					
HH	h	9					
JJ	j	10					
KK	k	11					
LL	l	12					
MM	m	13					
NN	n	14					
PP	p	15					
RR	r	16					
SS	s	17					
TT	t	18					

Abbreviations: Ex: S25-22 J9-MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No. 's -3, -X, -B.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Terminal

CONNECTOR:		DESIGNATION	J-3	TYPE	Elco	56	PINS
SMALL KEY	LARGE KEY	:	PANEL	E	CABLE	P	
Pin	To	Function	Pin	To	Function		
A	S24-H	Power On	u		NC		
B	7	Power Off	v				
C	J	Accept	w				
D	8	Reject	x				
E	K	El Stow Pin Out	y				
F	9	El Stow Pin In	z		NC		
H	L	Brake Off	AA	S5-20	Az Tach + In		
J	10	Brake On	BB	S5-X	Az Tach - In		
K	M	Computer Control	CC	S5-13	El Tach + In		
L	11	Velocity 1 (Az)	DD	S5-P	El Tach - In		
M	N	Velocity 1 (EL)	EE		NC		
N	12	Emergency Stop	FF				
P	P	Rate Com. Zero Chk	HH				
R	13	Az Drive 1/Tach Select	JJ				
S	R	El " " " "	KK				
T	14	Spare Bit	LL		NC		
U	Z	Remote Ground	MM	S15-N	Receive (Link OK) Signal		
V	S24-Z	Remote Ground	NN	S15-P	Receive (Link OK) Gnd Ret.		
W		NC					
X		NC					
Y	S3-H	Servo System o.k.					
Z	7	Az CW Limit					
AA	a	Az CCW Limit					
BB	b	El Up Limit					
CC	c	El Down Limit					
DD	d	El Stow Pin In Light					
EE	e	El " " Out "					
FF	f	Accept Light					
HH	h	Reject Light					
JJ	j	El Spring DEPR Light					
KK	k	Az Pin Out Light					
LL	l	Computer Control					
MM	m	Brake Off					
NN	n	Brake On					
PP	p	Spare Bit					
RR	r	Spare Bit					
SS	s	Spare Bit					
TT	t	S3-Z (4.5 V, 400 mA Input)					

Abbreviations: Ex: S25-22 J9-MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No. 's -3, -X, -B.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Terminal

CONNECTOR:		DESIGNATION	J-4	TYPE	Elco	56	PINS
SMALL KEY	LARGE KEY	:	PANEL	E	CABLE	P	
Pin	To	Function	Pin	To	Function		
A	S5-9	45' Primary Power	u				
B	S5-K	Amplitude	v				
C	S5-8	45' Primary Power	w				
D	S5-J	Period	x				
E			y				
F			z				
H			AA				
J			BB				
K			CC				
L			DD				
M			EE				
N			FF				
P			HH				
R			JJ				
S			KK				
T			LL				
U			MM				
V			NN				
W							
X							
Y							
Z							
AA	a						
BB	b						
CC	c						
DD	d						
EE	e						
FF	f						
HH	h						
JJ	j						
KK	k						
LL	l						
MM	m						
NN	n						
PP	p						
RR	r						
SS	s						
TT	t						

Abbreviations: Ex: S25-22 J9-MM Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No. 's -3, -X, -B.

5.1 - Amplitude 115 V
5.1.2 - Period 16.70

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Terminal

Table with columns: CONNECTOR, DESIGNATION, TYPE, Elco, 38 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Includes pin assignments for A through TT and abbreviations at the bottom.

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ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Terminal

Table with columns: CONNECTOR, DESIGNATION, TYPE, Elco, 38 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Includes pin assignments for A through TT and abbreviations at the bottom.

- 57c -

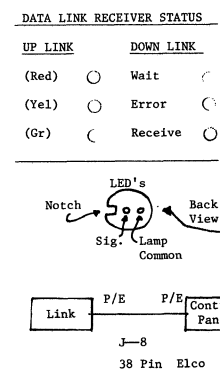
ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Terminal

Table with columns: CONNECTOR, DESIGNATION, TYPE, Elco, 38 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Includes pin assignments for A through TT and abbreviations at the bottom.

- 57d -

ELCO CONNECTOR LIST FOR BOX/RACK/DRAWER Data Link 45' Site Terminal

Table with columns: CONNECTOR, DESIGNATION, TYPE, Elco, 38 PINS, SMALL KEY, LARGE KEY, PANEL, P, CABLE, E. Includes pin assignments for A through TT and abbreviations at the bottom.



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Data Link 45' Site Terminal

CONNECTOR: DESIGNATION J-9 ; TYPE Elco ; 20 PINS

SMALL KEY _____, LARGE KEY _____ ; PANEL E, CABLE E

Pin	To	Function	Pin	To	Function
A	S19-V	Focus + V	u		
B	18	Focus - V	v		
C	W	Focus + V	w		
D	10	Focus - V	x		
E			y		
F			z		
H			AA		
J			BB		
K			CC		
L			DD		
M	X	Rotation +V	EE		
N	20	Rotation -V	FF		
P	Y	Rotation +V	HH		
R	J-21	Rotation -V	JJ		
S			KK		
T			LL		
U			MM		
V			NN		
W			End 56 Pin		
X					
Y					
Z					
AA	a				
BB	b				
CC	c				
DD	d				
EE	e				
FF	f				
HH	h				
JJ	j				
KK	k				
LL	l				
MM	m				
NN	n				
PP	p				
RR	r				
SS	s				
TT	t				

Abbreviations: Ex: S25-22 Slot 25, Pin 22 | J9-MM | Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

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Data Link 45' Site Terminal

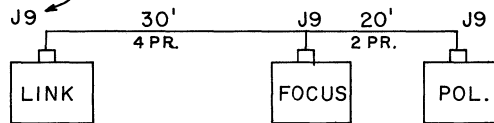
CONNECTOR: DESIGNATION J-10 ; TYPE Elco ; 20 PINS

SMALL KEY _____, LARGE KEY _____ ; PANEL E, CABLE P

Pin	To	Function	Pin	To	Function
0 - 10 V	A	S5-22	Focus + In	u	
0 - 757 mm	B	S5-Z	Focus - In	v	
0 - 29.8"	C	S5-A	Shield	w	
	D			x	
	E			y	
	F			z	
	H			AA	
	J			BB	
	K			CC	
	L			DD	
0 - 10 V	M	S5-15	Polarization + In	EE	
0 - 403°	N	S5-S	Polarization - In	FF	
	P	S5-A	Shield	HH	
	R			JJ	
	S			KK	
	T			LL	
	U			MM	
	V			NN	
	W			End 56 Pin	
	X				
	Y				
	Z				
AA	a				
BB	b				
CC	c				
DD	d				
EE	e				
FF	f				
HH	h				
JJ	j				
KK	k				
LL	l				
MM	m				
NN	n				
PP	p				
RR	r				
SS	s				
TT	t				

Abbreviations: Ex: S25-22 Slot 25, Pin 22 | J9-MM | Elco Connectors: J1, J2, J3, etc. Slot Connectors: S1, S2, S3, etc. Pin No.'s -3, -X, -B.

EXPOSED PIN ON CABLE



PAIR #	LINK	FOCUS	POL.
# 1	A	A	
	B	B	
	C	C	
	D	D	
	M		M
	N		N
	P		P
	R		R

FOCUS / POLARIZATION DRIVE CABLE J-9