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## Macromodular Computer Design, Part 2, Volume 03, Electronic Package Assembly

Computer Systems Laboratory, Washington University

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MACROMODULAR  
COMPUTER DESIGN  
PART 2  
MANUFACTURING DESCRIPTION

VOLUME III  
ELECTRONIC PACKAGE ASSEMBLY

**Technical Report No. 32**

FINAL REPORT - FEBRUARY, 1974  
CONTRACT SD-302 (ARPA)

COMPUTER SYSTEMS LABORATORY  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

MACROMODULAR COMPUTER DESIGN  
FINAL REPORT - CONTRACT SD-302  
FEBRUARY, 1974

**Technical Report No. 32**

PART 2 - MANUFACTURING DESCRIPTION  
VOL. III-ELECTRONIC PACKAGE ASSEMBLY

This work has been supported by the Advanced Research Projects Agency of the Department of Defense under Contract SD-302 and by the Division of Research Facilities and Resources of the National Institutes of Health under Grant RR-00396.

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Advanced Research Projects Agency or the U.S. Government.

Computer Systems Laboratory  
Washington University  
St. Louis, Missouri

#### ABSTRACT

Manufacturing documents, including parts lists, assembly pictorials, and adjustment procedures for the DECODE, LOAD, CALL, MERGE and DATA BRANCH macromodule electronic subassemblies are given.

## INDEX

DECODER UNIT

PAGES 206.0D thru 206.8D3

LOAD UNIT

PAGES 207.0D thru 207.8D3

CALL DECISION CALL UNIT

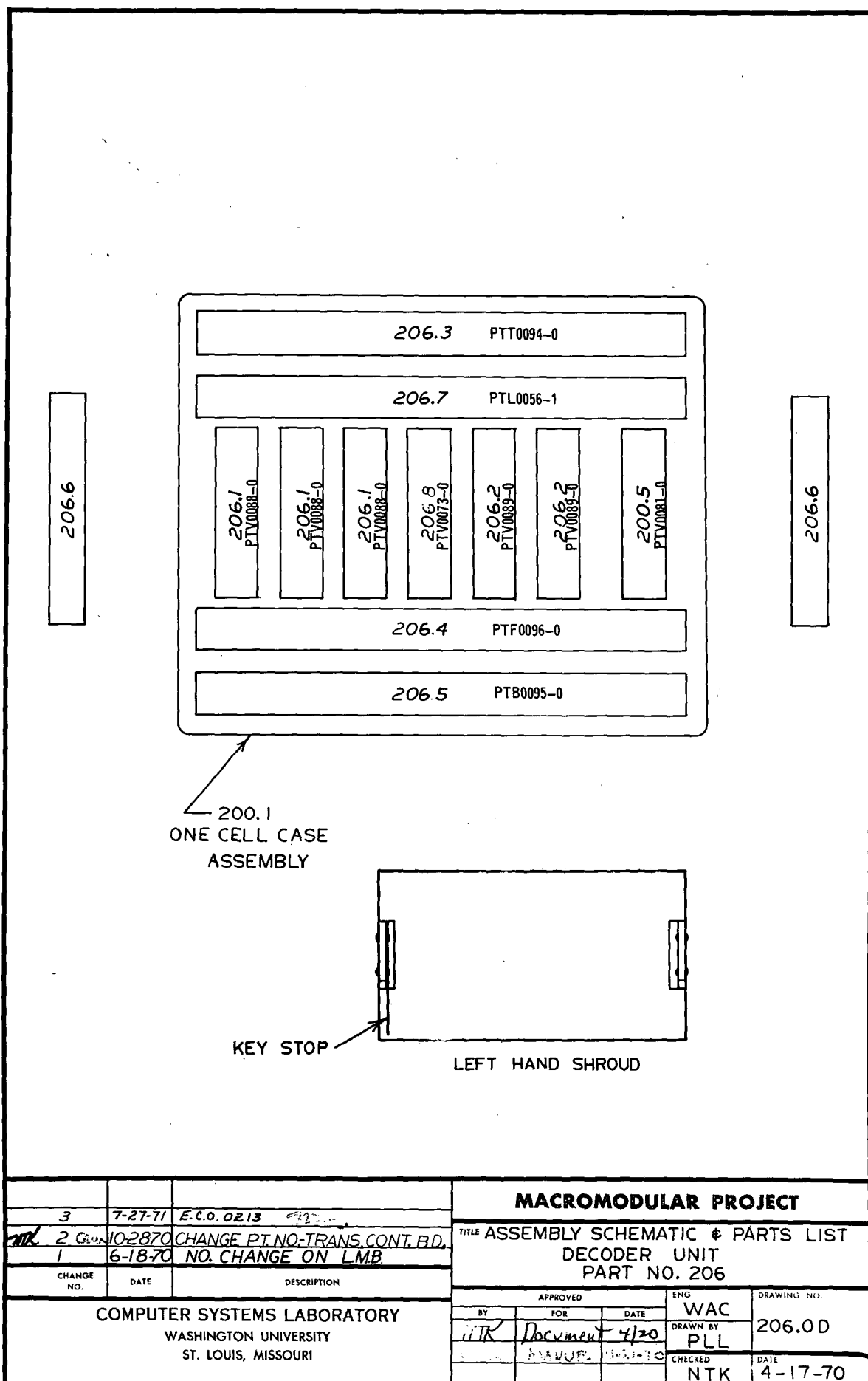
PAGES 208.0D thru 208.7D3

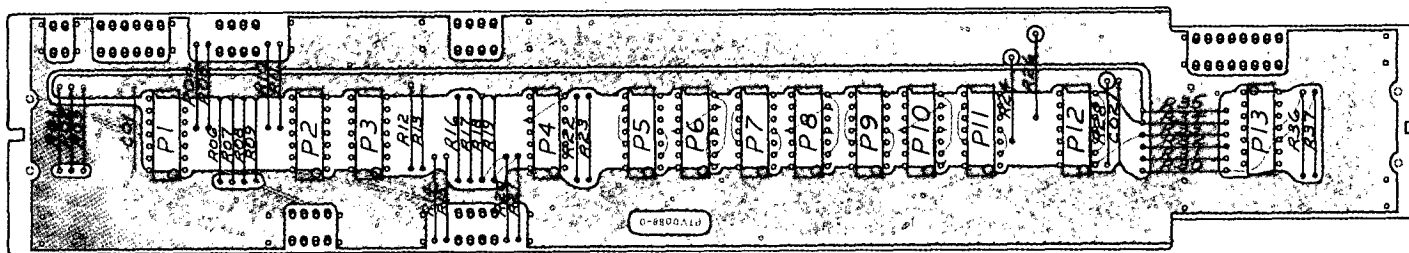
MERGE/RENDEZVOUS UNIT

PAGES 209.0D thru 209.6D2

DATA BRANCH UNIT

PAGES 210.0D thru 210.7D2





NOTE: INSTALL FEMALE AMPMODU  
CONNECTORS EXACTLY AS  
SHOWN ON DRAWING 200.50D2

			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION          DECODER DATA BOARD          PART NO. 206.1</b>			
			<b>MACROMODULAR PROJECT</b>		APPROVED BY <i>CDM</i> FOR <i>MANUP</i> DATE <i>200-70</i>		ENG. <i>REO</i>	DRAWING NO. <i>206.1D1</i>
1 1-5-71 E.C.O. 0141 <i>WTL</i>					DRAWN BY <i>PLL</i>		CHECKED <i>WTL</i>	
CHANGE NO.	DATE	DESCRIPTION						

# INTEGRATED CIRCUITS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
M04	2	P3 P4
M06	2	P1 P2
M10	8	P5 P6 P7 P8 P9 P10 P11 P12
M20	1	P13

# CAPACITORS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
CK-103 10,000 pf	2	C01 C02

# RESISTORS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
R1	8	R12 R13 R18 R19 R34 R35 R36 R37
R2	4	R06 R07 R08 R09
R3	19	R04 R05 R10 R11 R14 R15 R16 R17 R20 R21 R22 R23 R24 R26 R28 R30 R31 R32 R33
R4	3	R01 R02 R03

CONNECTORS  
AMPMODU NO. 85863-4  
47 REQUIRED

CIRCUIT BOARD  
PTV0088-0  
ONE REQUIRED

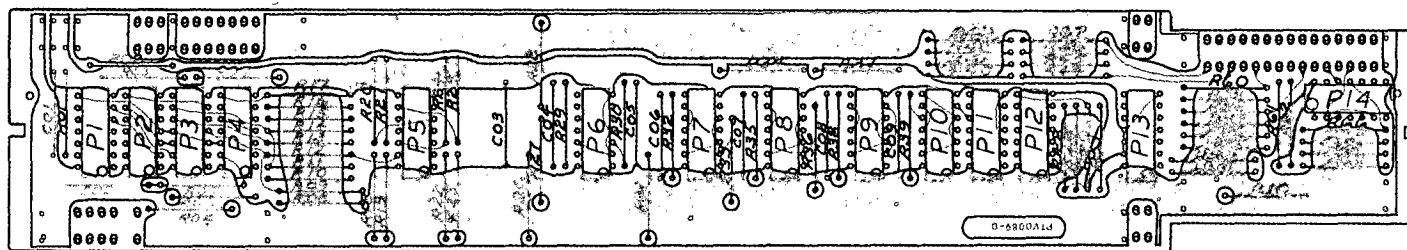
# NOTE:

R1 = 1.5 K OHM 1% FILM RESISTOR  
R2 = 750 OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R4 = 15K OHM 5% 1/4 WATT CARBON COMP.  
CK-103 = SPRAGUE CERAMIC DISC 10,000pf 50 WVDC

CHANGE NO.	DATE	DESCRIPTION	
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE PARTS LIST DECODER DATA BOARD PART NO. 206.1</p>			
APPROVED		ENG.	DRAWING NO.
BY	FOR	DATE	
CEM	MANUF.	6/9/70	206.1D2
CHECKED		DATE	
H.T.		6/22/70	

27 Oct 70





NOTE: INSTALL FEMALE AMPMODU  
CONNECTORS EXACTLY AS  
SHOWN ON DRAWING 200.50D2

			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION DECODER CONTROL BOARD PART NO. 206.2			
					APPROVED BY FOR DATE COM MAMP 230-770			
1 1-4-71 E.C.O. 0139 NTK 1 10-29-70 E.C.O. 0072 NTK COM			<b>MACROMODULAR PROJECT</b>		ENG. REO DRAWN BY PLL		DRAWING NO. 206.2D1	
CHANGE NO. DATE DESCRIPTION					CHECKED NTK		DATE 6-8-70	

# INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M04	3	P1 P2 P12
M06	2	P11 P13
M07	1	P3
M10	5	P6 P7 P8 P9 P10
M20	1	P14
M30	1	P5
M31	1	P4

# CAPACITORS

TYPE	REQUIRED	LOCATION
CK-103 10,000 pf	3	C01 C03 C10
DSM 36 pf	1	C02
DSM 180 pf	2	C04 C05
DSM 130 pf	4	C06 C07 C08 C09

# RESISTORS

TYPE	REQUIRED	LOCATION
R0	3	R04 R26 R31
R1	19	R01 R03 R06 R12 R13 R14 R15 R20 R21 R24 R25 R28 R34 R37 R48 R50 R63 R64 R65
R2	15	R05 R29 R30 R32 R35 R38 R39 R40 R41 R42 R43 R53 R54 R55 R56

# RESISTORS (cont)

TYPE	REQUIRED	LOCATION
R3	17	R02 R07 R08 R09 R10 R11 R16 R18 R19 R22 R23 R27 R33 R36 R49 R51 R66
R4	1	R17
R5	10	R44 R45 R46 R47 R57 R58 R59 R60 R61 R62

CONNECTORS  
AMPMODU NO. 85863-4  
48 REQUIRED

CIRCUIT BOARD  
PTV0089-0  
ONE REQUIRED

# NOTE:

R0 = JUMPERS  
R1 = 1.5K OHM 1% FILM RESISTOR  
R2 = 750 OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R4 = 15K OHM 5% 1/4 WATT CARBON COMP.  
R5 = 57.6 OHM 1% FILM RESISTOR

CK-103 SPRAGUE CERAMIC DISC, 50 WVDC  
DSM - DIPPED SILVER MICA 5%

1	2/3/71	E.C.O. 0153	MTK
CHANGE NO.	DATE	DESCRIPTION	
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE PARTS LIST DECODER CONTROL BOARD PART NO. 206.2</p>			
APPROVED		ENG.	DRAWING NO.
BY	FOR	DATE	206.2D2
cam	MANUF.	6/8/70	
CHECKED		DATE	
MTK		6/22/70	

2706470

## Test Procedure

### Decode Module Control Board #206.2

This board contains several critical delays whose proper value must be checked on each board prior to assembly into a Decode Module. The delays must be properly set if the module is to perform its intended operations.

#### Procedure

##### Test 1:

Apply a differential square wave with a period of 400 nanoseconds to pins F5 and F6. The signal should have a rise and fall time not greater than 10 nanoseconds. Observe the waveform at pin F6 with channel 1 of a 454 oscilloscope and observe the waveform at pin 12 of package 4 with channel 2. The waveforms will appear approximately as shown in Figure 1. The value of the smaller of  $t_1$  and  $t_2$  must be greater than 200 nanoseconds. If either  $t_1$  or  $t_2$  is less than 200 nanoseconds, the value of C05 and/or C04 should be increased.

If either  $t_3$  or  $t_4$  is smaller than 15 nanoseconds, the value of C02 must be increased. Record the capacitor and delay values for each module on the worksheet provided.

##### Test 2:

The Tektronix 2101 and Data Pulse 111 pulse generators are required for this test.

ISSUE	-	1-21-71	
1	0302	1-15-74	<i>WJS</i>

Set the Tektronix pulse generator to generate a 200 nanosecond pulse every 400 nanoseconds with MECL output levels on the + and - outputs. Set the Datapulse generator to external trigger and connect a cable from the Tektronix synch output to the external input of the Datapulse generator. Set the Data pulse generator delay to zero and set a positive going output pulse 90 nanoseconds wide with 5 nanosecond rise and fall times. Increase the Datapulse delay setting until reliable triggering is achieved with one output pulse from the Datapulse generator every 800 ns (i.e. every other pulse output from the Tektronix generator). Adjust the delay setting of the Tektronix pulse generator until the leading edge of the 90 ns pulse occurs approximately 10 ns before a transition of the square wave. The two waveforms should appear as shown in Figure 2.

Tie pin T86 low and tie pins F5 and F6 to -5.2V. Connect the output pulse from the datapulse generator to pin B86 and the + output from the Tektronix pulse generator to pin B81. Set B85 and B84 low and observe the waveform at pin 4 of package 3 with channel one of a 454 oscilloscope and observe the waveform at pin 6 of package 10 with channel 2. Use B sweep delayed by A with A set to 500 ns/div, B set to 100 ns/div and the x10 magnifier on. This gives an effective sweep speed of 10 ns/division. For each pulse on channel 1, the signal on channel 2 must change state and the change must occur at least 5 ns before the end of the pulse. Figure 3 shows the required timing relation and this relation must be checked for at least six successive pulses. Note that the pulses occur in groups

CHG.	E.C.O.	DATE	APPR
1	0302	1-15-74	475

206.2D5

of three. If the signal on channel 2 does not change at least 5 ns before the end of the pulse the value of C02 must be increased. If C02 is changed, then the entire test procedure under "Test 2" must be repeated.

Next, observe pin 5 of package 10 with channel 2 of the oscilloscope. The level, other than the times at which the signal is switching, must not be within the range of -.900 volts to -1.450 volts. This level must be checked for a range spanning at least 6 pulses on channel 1. Figure 4 shows the expected waveforms.

Next connect pin B81 to the -output of the Tektronix pulse generator instead of the +output and repeat the previous measurement on pins 6 and 5 of package 10. The above sequence of measurements must be repeated 3 more times as shown in the following table. The worksheet provided with each board should be filled in as the measurements are made to insure that no measurements are overlooked.

B84	B85	Oscilloscope Channel 1	Oscilloscope Channel 2 for Timing Measurement	Oscilloscope Channel 2 for Level Measurement
		Package 3 Pin 4	Package 10 Pin 6	Package 10 Pin 5
L	L			
L	H	" 3 " 9	" 8 " 6	" 8 " 5
H	H	" 2 " 5	" 7 " 6	" 7 " 5
H	L	" 3 " 10	" 9 " 6	" 9 " 5

When the tests are completed, the circuit board should be carefully inspected to insure that the foregoing procedure has

not resulted in damage to the circuit board, particularly in areas where fresh soldering has taken place. All flux residues should be thoroughly removed.

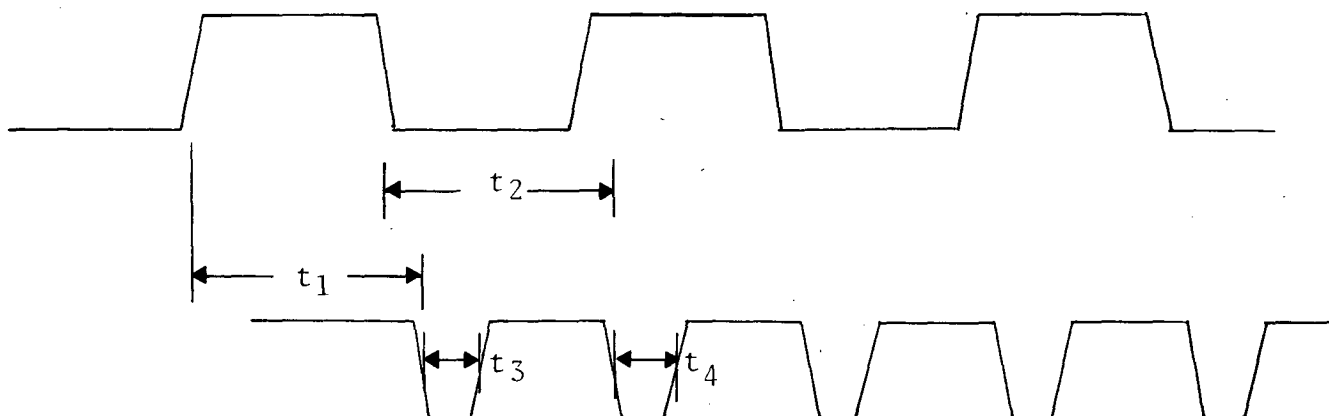


FIGURE 1

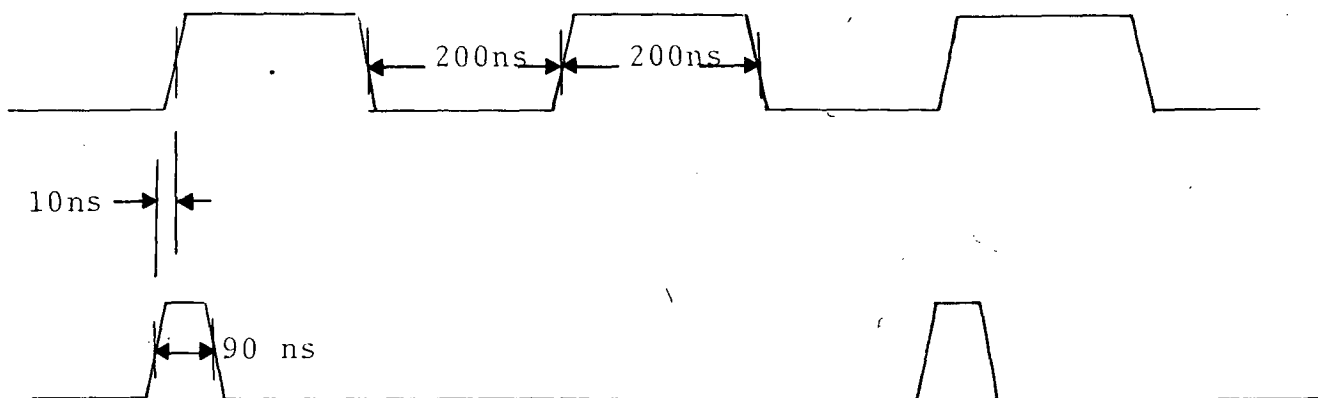


FIGURE 2

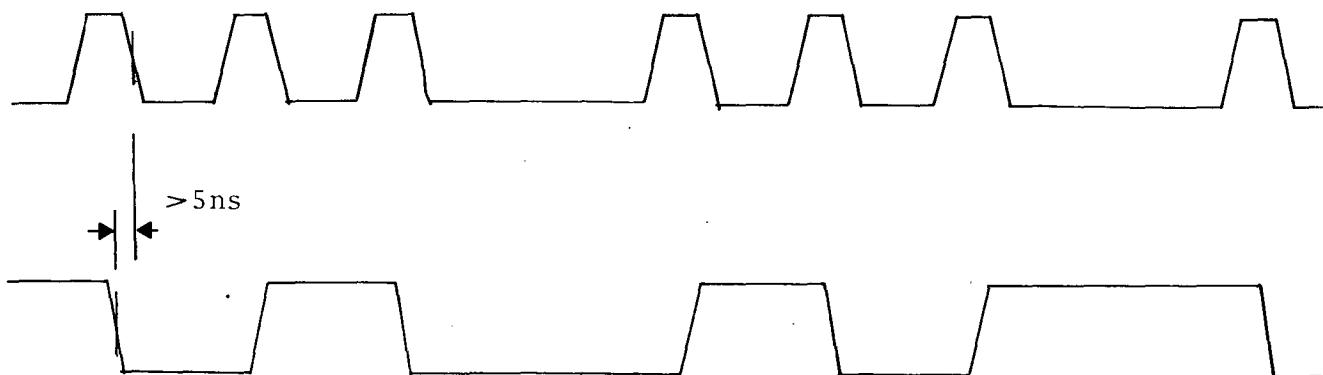


FIGURE 3

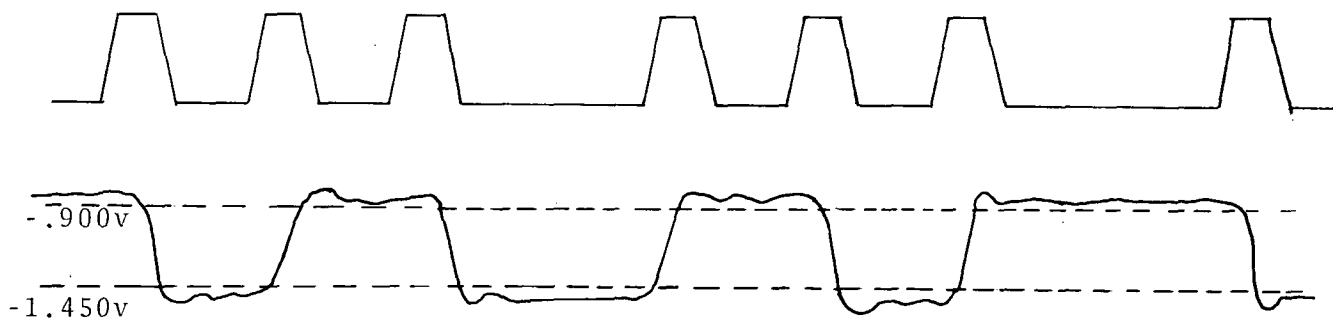
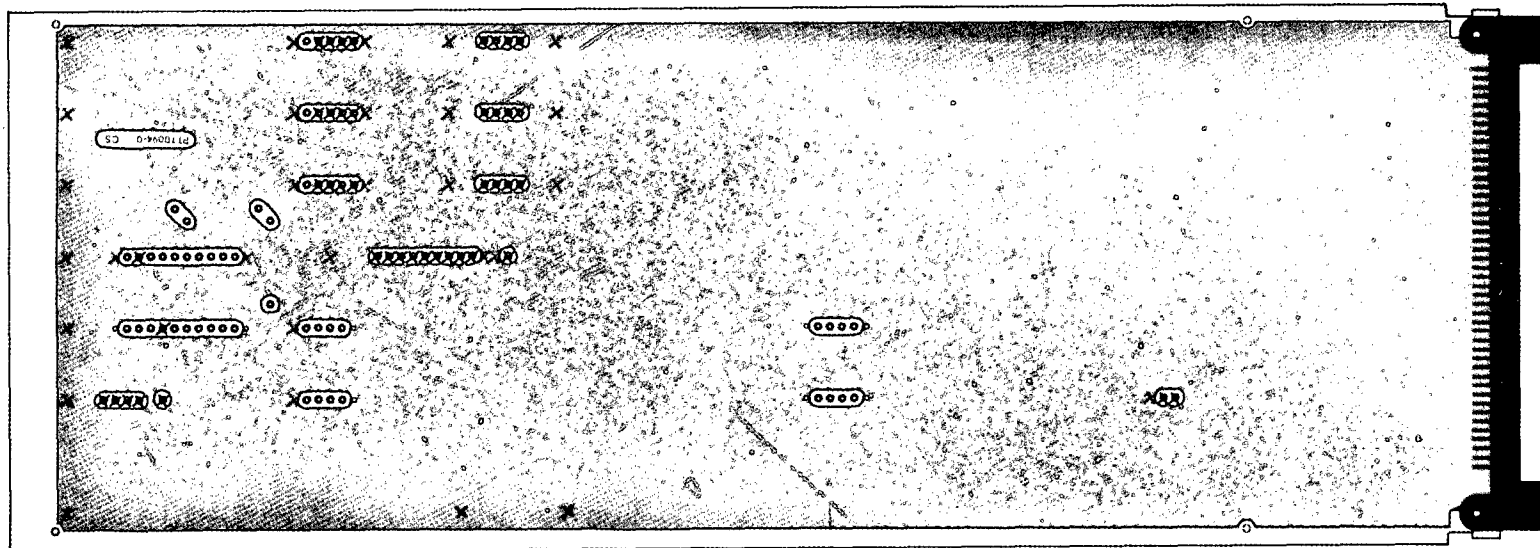


FIGURE 4





NOTE: SEE DRAWING NUMBER  
200.50D26 FOR CONNECTOR  
ORIENTATION.

NOTE: MALE AMP MODU PINS MUST BE  
INSTALLED FROM THIS SIDE IN  
LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DRAWINGS 200.50D1  
AND 200.50D2.  
(72 PINS)

				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION          DECODER TOP MOTHERBOARD CONNECTOR ASSEMBLY          PART NO. 206.3</b>	
						APPROVED BY FOR DATE <b>Cam MANUF 2001</b>	
						ENG. <b>REO</b> DRAWN BY <b>PLL</b>	
						CHECKED <b>HTK</b> DATE <b>6-8-70</b>	
CHANGE NO. <b>1</b>		DATE <b>12-1-70</b>		DESCRIPTION <b>E.C.O. 0097 Cam</b>		DRAWING NO. <b>206.3D1</b>	
				<b>MACROMODULAR PROJECT</b>			

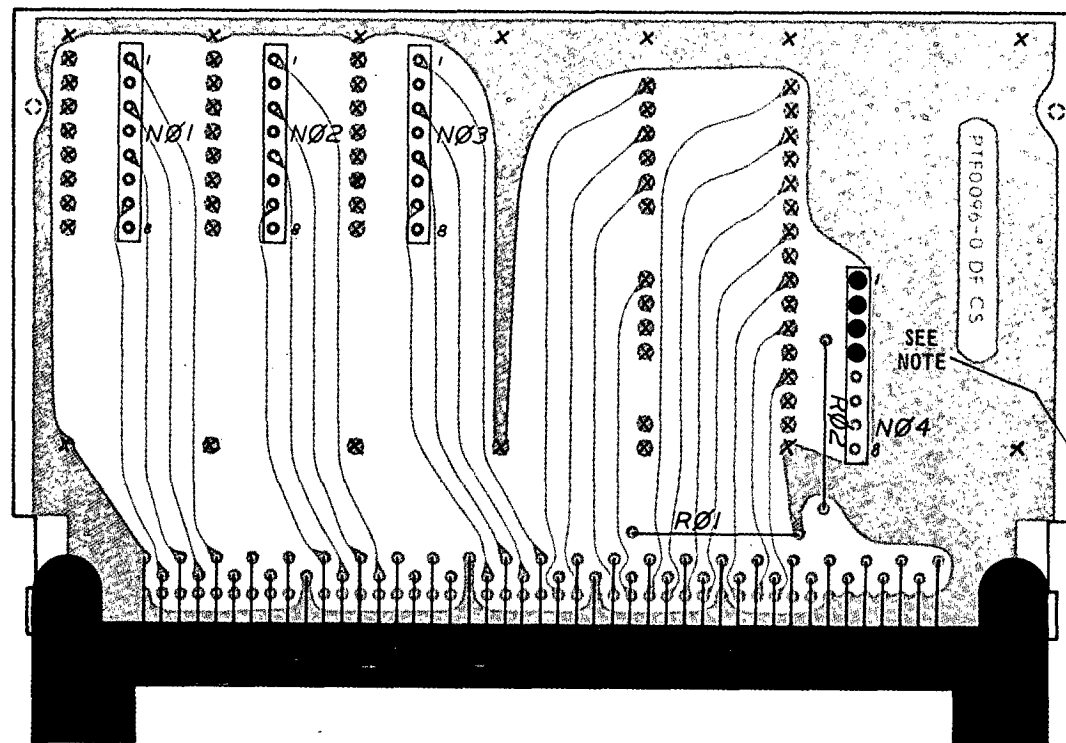
AMP CONNECTOR 1-202845-5  
ONE REQUIRED

CONNECTOR  
AMP MODU NO. 85931-5  
72 REQUIRED

CIRCUIT BOARD  
PTT0094-0  
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION			
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>					
<p align="center"><b>MACROMODULAR PROJECT</b></p>					
<p>TITLE    PARTS LIST DECODER TOP MOTHERBOARD CONNECTOR ASSEMBLY PART NO. 206.3</p>					
APPROVED				ENG.	DRAWING NO.
BY	FOR	DATE			
	MANUF.	6/16/70		DRAWN BY M3P	206.3D2
				CHECKED H. J. K.	DATE 6/22/70

2306470



NOTE: MALE AMP MODU PINS MUST BE INSTALLED FROM THIS SIDE IN LOCATIONS MARKED X PRECISELY AS SHOWN IN DRAWINGS 200.50D1 AND 200.50D2.  
(64 PINS)

NOTE: SEE DRAWING NUMBER 200.50D29 FOR CONNECTOR ORIENTATION.

NOTE: CLIP PINS 1, 2, 3 AND 4 FROM LTN-2 IN POSITION N04.

**COMPUTER SYSTEMS LABORATORY**  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

TITLE

COMPONENT IDENTIFICATION  
DECODER FACEPLATE CONNECTOR ASSEMBLY  
PART NO. 206.4

APPROVED

ENG.

DRAWING NO.

BY FOR DATE

REO

206.4D1

Cam MANUF 10/30/70

DRAWN BY  
PLL

CHECKED  
NTK

DATE  
6/8/70

CHANGE NO.	DATE	DESCRIPTION
1	11-16-70	E.C.O. 0082 NTK Cam

JUMPER  
ONE REQUIRED  
R01

RESISTOR 15K OHM 5% 1/4 WATT CARBON COMP.  
ONE REQUIRED  
R02

SPRAGUE NETWORK LTN-2  
FOUR REQUIRED  
N01  
N02  
N03  
N04 \*

\*CLIP PINS 1, 2, 3 AND 4  
FROM LTN-2 IN POSITION N04

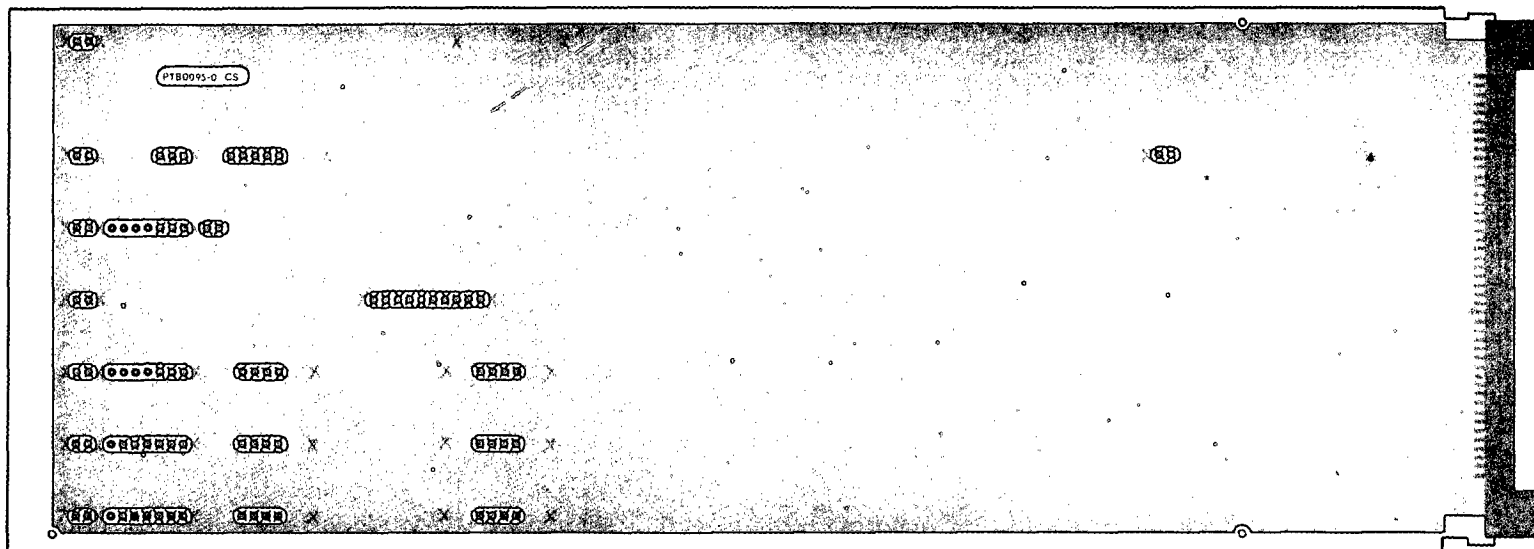
CONNECTOR AMP 583 464-1  
ONE REQUIRED

CONNECTORS  
AMPMODU NO. 85931-5  
64 REQUIRED

CIRCUIT BOARD  
PTF0096-0  
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST DECODER FACEPLATE MOTHER BOARD PART NO. 206.4			
APPROVED		ENG. <i>REO</i>	DRAWING NO.
BY <i>Cem</i>	FOR MANUF.	DATE <i>6/22/70</i>	206.4D2
CHECKED		DRAWN BY MBP	
		DATE 6/22/70	

2300470



NOTE: MALE AND AMP MODU PINS MUST BE  
INSTALLED FROM THIS SIDE IN  
LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DRAWINGS 200.50D1 AND  
200.50D2.  
(112 PINS)

NOTE: SEE DRAWING NUMBER  
200.50D27 FOR CONNECTOR  
ORIENTATION.

		<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION          DECODER BOTTOM MOTHERBOARD ASSEMBLY          PART NO. 206.5</b>	
				APPROVED BY: <i>can</i> FOR: <i>MANVP.</i> DATE: <i>2/20/70</i>	
		<b>MACROMODULAR PROJECT</b>		ENG. <b>REO</b> DRAWN BY <b>PLL</b>	
				CHECKED <i>2TR</i> DATE <b>6/12/70</b>	
CHANGE NO. *	DATE	DESCRIPTION			

AMP CONNECTOR 1-202845-5  
ONE REQUIRED

CONNECTOR  
AMP MODU NO. 85931-5  
ONE HUNDRED TWELVE REQUIRED

CIRCUIT BOARD  
PTB0095-0  
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION	
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE    PARTS LIST DECODER BOTTOM MOTHERBOARD ASSEMBLY PART NO. 206.5</p>			
APPROVED		ENG.	DRAWING NO.
BY	FOR	DATE	
Cam	MANUF.	6/12/70	206.5D2
CHECKED		DATE	
MP		6/22/70	

2800470

D  
E  
C  
O  
D  
E

METALCRAFT "AUTOGRAPH" OR EQUIVALENT:  
 BLANK SIZE: 4" X 2" SHEARED WITH  
 SQUARE CORNERS. BLACK LETTERS, VOGUE  
 BOLD 12 POINT BOLD FACE TYPE CENTERED  
 TOP, BOTTOM AND SIDES WITH 6 POINT  
 SPACING ON LIGHT OLIVE PMS 458 BACKING  
 MANUFACTURED FROM .016 THICK ALUMINUM  
 WITH SOLVENT ACTIVATED PERMANENT  
 ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

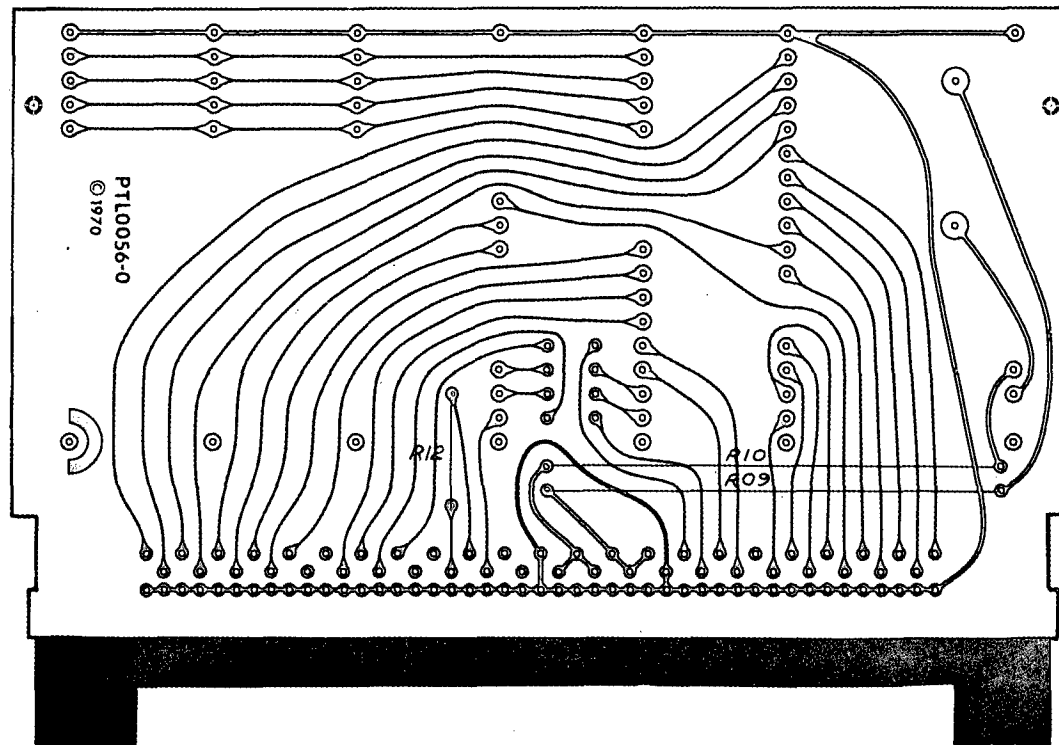
**COMPUTER SYSTEMS LABORATORY**  
 WASHINGTON UNIVERSITY  
 ST. LOUIS, MISSOURI

## MACROMODULAR PROJECT

TITLE

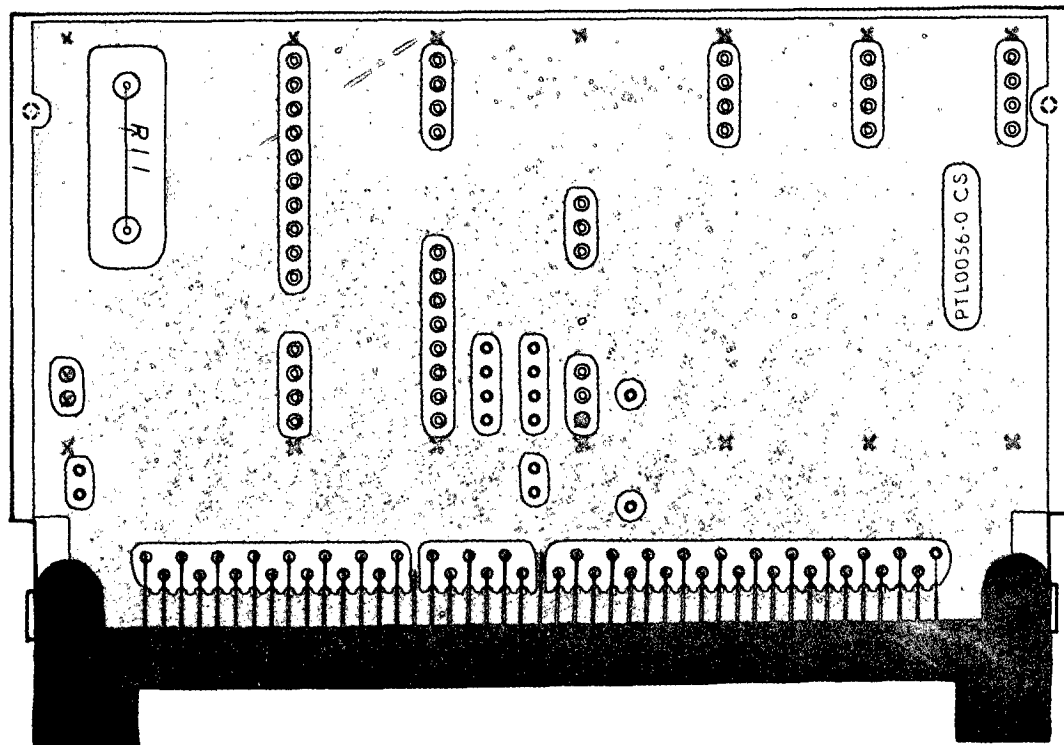
IDENTIFICATION LABEL  
 DECODE MODULE  
 PART #206.6

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	NTK	206.6D
<i>Maw</i>	<i>Prod.</i>	<i>7/28/70</i>	DRAWN BY KM	
			CHECKED	DATE
			<i>Maw</i>	6-16-70



				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION DECODER LATERAL MOTHERBOARD ASSEMBLY SIGNAL SIDE PART NO. 206.7	
				<b>MACROMODULAR PROJECT</b>		APPROVED BY <i>CDM</i> FOR <i>MANUP</i> DATE <i>200470</i>	
1 12-1-70 E.C.O. 0097 <i>cem</i>						ENG. <i>DLS</i> DRAWN BY <i>PLL</i> CHECKED <i>NTK</i>	DRAWING NO. 206.7D1
CHANGE NO.	DATE	DESCRIPTION				DATE	6-19-70





NOTE: MALE AMPMODU PINS  
MUST BE INSTALLED  
FROM THIS SIDE IN  
LOCATIONS MARKED X  
PRECISELY AS SHOWN IN  
DRAWINGS 200.50D1 AND  
200.50D2.  
(17 PINS)

NOTE: SEE DRAWING NUMBER  
200.50D28 FOR CONNECTOR  
ORIENTATION.

				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION DECODER LATERAL MOTHERBOARD ASSEMBLY COMPONENT SIDE PART NO. 206.7					
				<b>MACROMODULAR PROJECT</b>		APPROVED BY FOR DATE <i>Cem</i> <i>MANUF.</i> <i>2 Dec 70</i>			ENG. DLS DRAWN BY	DRAWING NO. 206.7D2	
CHANGE NO. 1		DATE 12-1-70				DESCRIPTION E.C.Q. 0097 <i>Cem</i>		CHECKED NTK			DATE 10-20-70

JUMPERS  
TWO REQUIRED  
R09  
R10

RESISTOR 30.9K OHM 1% FILM  
R12

CONNECTOR  
AMPMODU NO. 85931-5  
17 REQUIRED

AMP CONNECTOR  
583 464-1  
ONE REQUIRED

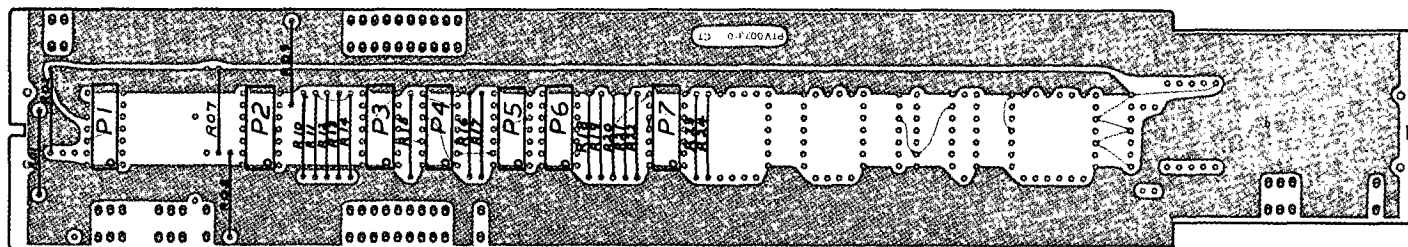
CIRCUIT BOARD  
PTL0056-1  
ONE REQUIRED

FUSE BUSSMAN GFA 3/4 AMP  
ONE REQUIRED  
R11

3	7-27-71	E.C.O. 0213
2	12-1-70	E.C.O. 0097
1	10-20-70	E.C.O. 0062 <i>cm</i>
CHANGE NO.	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST DECODER LATERAL MOTHERBOARD ASSEMBLY PART NO. 206.7		
APPROVED		ENG. <i>REO</i>
BY <i>cm</i>	FOR MANUF	DATE <i>5/2/71</i>
CHECKED		DRAWN BY MBP
		DATE 6/18/70

2306 + 70

NOTE:  
INSTALL FEMALE AMPMODU CONNECTORS  
EXACTLY AS SHOWN ON DWG. 200.50D2.



			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION          DECODER TRANSFER CONTROL BOARD          PART NO. 206.8</b>			
					APPROVED BY <i>Cem</i> FOR MANUF. DATE <i>2-28-70</i>		ENG. DLS DRAWN BY PLL	DRAWING NO. 206.8D1
2	1-15-74	E.C.O. 0302 <i>445</i>	<b>MACROMODULAR PROJECT</b>		<i>3/10/70</i>		CHECKED NTK	DATE 10/28/70
1	12-1-70	E.C.O. 0097 <i>Cem</i>						
CHANGE NO.	DATE	DESCRIPTION						

# INTEGRATED CIRCUITS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
M04	1	P3
M06	3	P2 P6 P7
M10	3	P1 P4 P5

# RESISTORS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
R1	3	R02 R11 R12
R2	5	R07 R10 R20 R21 R24
R3	10	R01 R08 R09 R13 R14 R15 R17 R19 R22 R23
R4	2	R16 R18

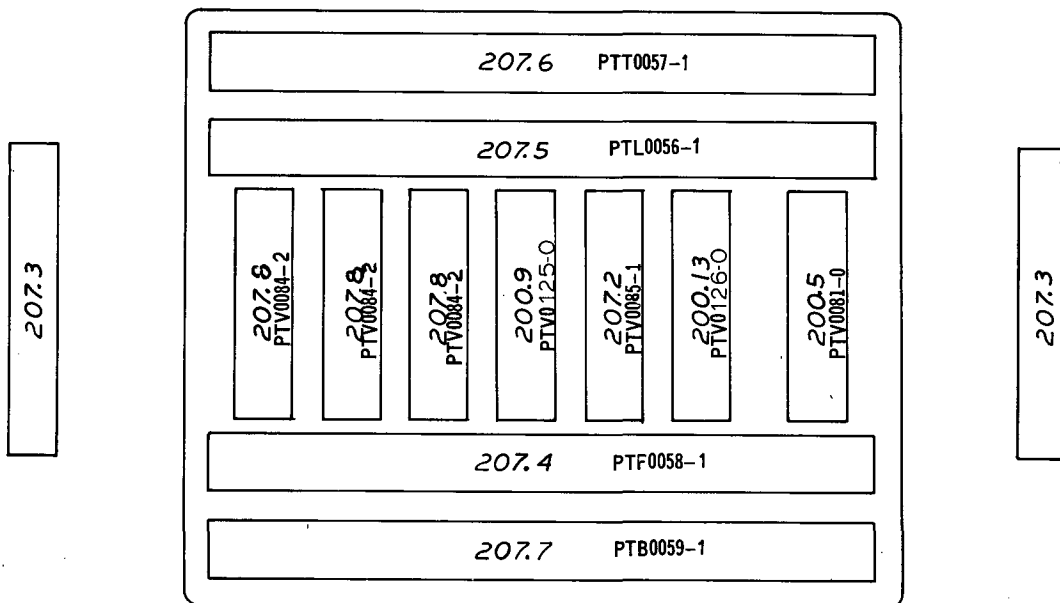
CONNECTORS  
AMP MODU NO. 85863-4  
47 REQUIRED

CIRCUIT BOARD  
PTV0073-1  
ONE REQUIRED

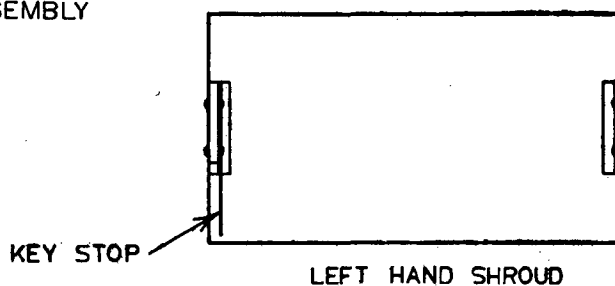
# NOTE:

R1 = 1.5K OHM 1% FILM RESISTOR  
R2 = 750 OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R4 = 15K OHM 5% CARBON COMP.

2	1-15-74	E.C.O. 0302 <i>MAJ</i>
1	7-20-72	CORR. REV. LEVEL ON P.C. BOARD
CHANGE NO.	DATE	DESCRIPTION
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>		
<p align="center"><b>MACROMODULAR PROJECT</b></p>		
<p>TITLE PARTS LIST DECODER TRANSFER CONTROL BOARD PART NO. 206.8</p>		
APPROVED		ENG. REO
BY	FOR	DATE
<i>COM</i>	<i>MANVF.</i>	<i>3 Nov 70</i>
DRAWN BY		DATE
MBP		<i>10-28-70</i>
CHECKED		DATE
<i>NTK</i>		



200.1  
ONE CELL CASE  
ASSEMBLY



6	11-30-71	E.C.O. 0234	NTK
5	7-27-71	E.C.O. 0214	NTK
4	11-11-70	E.C.O. 0080	NTK
3	6-18-70	NO. CHANGE ON LMB.	
2	6-11-70	NO. CHANGE ON F.P.M.P.	
1	4-17-70	CHANGED F.P.M.B.	
CHANGE NO.	DATE	DESCRIPTION	

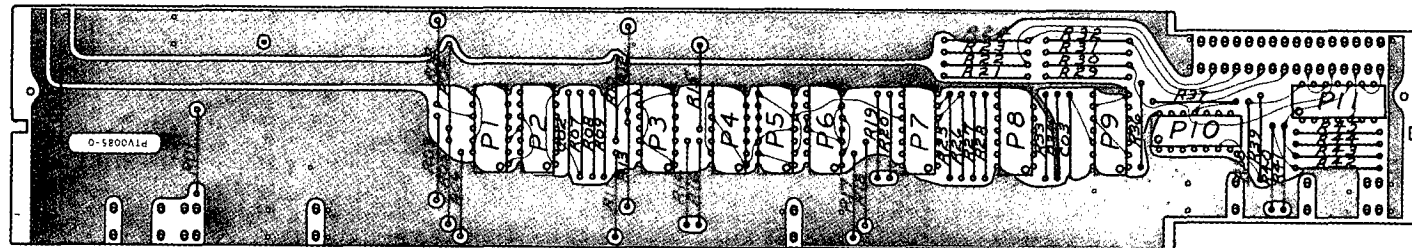
COMPUTER SYSTEMS LABORATORY  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

### MACROMODULAR PROJECT

TITLE ASSEMBLY SCHEMATIC & PARTS LIST  
LOAD UNIT  
PART NO. 207

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	WAC	207.0D
NTK	Donna	11-30-71	DRAWN BY PLL	
			CHECKED NTK	
			DATE	3-28-70

NOTE:  
INSTALL FEMALE AMPMODU CONNECTORS  
EXACTLY AS SHOWN ON DRAWING 200.50D2.



			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION LOAD CONTROL BOARD PART # 207.2			
					APPROVED BY FOR DATE <i>Cem</i> MANUF. 7/8/70 <i>Cem</i> MANUF. 11/30/71			
2 11-11-70 E.C.O. 0080 <i>NTK Cem</i>			<b>MACROMODULAR PROJECT</b>		ENG. DLS DRAWN BY PLL		DRAWING NO. 207.2D1	
1 6-3-70 CORR. RESISTOR IDENTIFICATION, R16 <i>Cem</i>					CHECKED NTK		DATE 5/11/70	
CHANGE NO.	DATE	DESCRIPTION						

INTEGRATED CIRCUITS		
TYPE	REQUIRED	LOCATION
M06	2	P7 P8
M09	1	P1
M10	3	P2 P3 P9
M11	2	P5 P6
M20	1	P11
M30	1	P4
M35	1	P10

TYPE	REQUIRED	LOCATION
10,000 pf	1	C01
100 pf	1	C02
510 pf	1	C03

CONNECTORS  
AMPMODU NO. 85863-4  
42 REQUIRED

CIRCUIT BOARD  
PTV0085-1  
ONE REQUIRED

RESISTORS		
TYPE	REQUIRED	LOCATION
R0	7	R01 R06 R14 R17 R18 R38 R39
R1	7	R09 R10 R12 R15 R42 R43 R44
R2	12	R02 R04 R07 R08 R19 R20 R25 R26 R27 R28 R33 R34
R3	8	R03 R05 R11 R13 R16 R40 R41 R45
R4	1	R36

RESISTORS (cont)		
TYPE	REQUIRED	LOCATION
R5	8	R21 R22 R23 R24 R29 R30 R31 R32
R6	1	R37

NOTE:

C01 SPRAGUE TYPE CK-103  
10,000pf 50wvdc  
C02 ELEMENCO DIPPED SILVER  
C03 MICA 5%

NOTE:

R0 = JUMPERS  
R1 = 1.5K OHM 1% FILM RESISTOR  
R2 = 750 OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R4 = 15K 5% CARBON COMP  
R5 = 57.6 OHM 1% FILM RESISTOR  
R6 = 130 OHM 1% FILM RESISTOR

3	11-30-71	E.C.O. 0234	
2	1-21-71	E.C.O. 0149	NTK
1	11-11-70	E.C.O. 0080	NTK
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b>			
WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST LOAD CONTROL BOARD PART NO. 207.2			
APPROVED		ENG. DLS	DRAWING NO.
BY	FOR	DATE	207.2D2
Cum	MANUF.	5/11/70	
CCAA	CHANGE	5/11/70	
		CHECKED	DATE
		NTK	6/19/70

## Test Procedure

### Load Module Control Board #207.2

This board contains one critical delay whose proper value must be checked on each board prior to assembly into a Load Module.

The delay value must be longer than a specified minimum value. If the delay value is excessively large, the operation of the module will be needlessly slowed down. If the delay value is excessively short, the module may perform incorrectly under certain conditions.

#### Procedure

Test 1: Tie pins L3 and T81 high and tie pins F2, F3, F4 and F5 to -5.2 volts. Apply a square wave signal with a period of 300 nanoseconds or greater to pin T31. The signal should have a rise and fall time not greater than 10 nanoseconds. Observe the waveform at pin T31 with channel one of a 454 oscilloscope. Observe the waveform at pin L2 with the second channel. The delay between the two waveforms, measured from mid-point of each transition, should be 39 nanoseconds or greater. The delay should be observed for both positive and negative going transitions, and both should be 39 nanoseconds or greater. If the smaller of the two delays is less than 39 ns, the value of C02 should be increased. If the smaller of the two delays is greater than 50 nanoseconds, the value of C02 should be reduced.

The final capacitor value and the measured delays for each board should be recorded on the test sheet provided for that board, along with the serial number of the board.

The circuit board should be carefully inspected to insure that the foregoing procedure has not resulted in damage to the circuit board, particularly in the areas where fresh soldering has taken place. All flux residues should be thoroughly removed.

12-26-70

1 0302 1-15-74 *MJS*

207.2D4



L  
O  
A  
D

METALCRAFT "AUTOGRAPH" OR EQUIVALENT:  
 BLANK SIZE:  $\frac{1}{4}$ " X 2" SHEARED WITH  
 SQUARE CORNERS, BLACK LETTERS, VOGUE  
 BOLD 12 POINT BOLD FACE TYPE CENTERED  
 TOP, BOTTOM AND SIDES WITH 6 POINT  
 SPACING ON MUSTARD PMS 130 BACKING.  
 MANUFACTURED FROM .016 THICK ALUMINUM  
 WITH SOLVENT ACTIVATED PERMANENT  
 ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

# COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

ST. LOUIS, MISSOURI

## MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL  
 LOAD MODULE  
 PART #207.3

APPROVED

ENG

DRAWING NO.

BY

FOR

DATE

NTK

207.3D

*maw*

*Prod.*

*7/28/70*

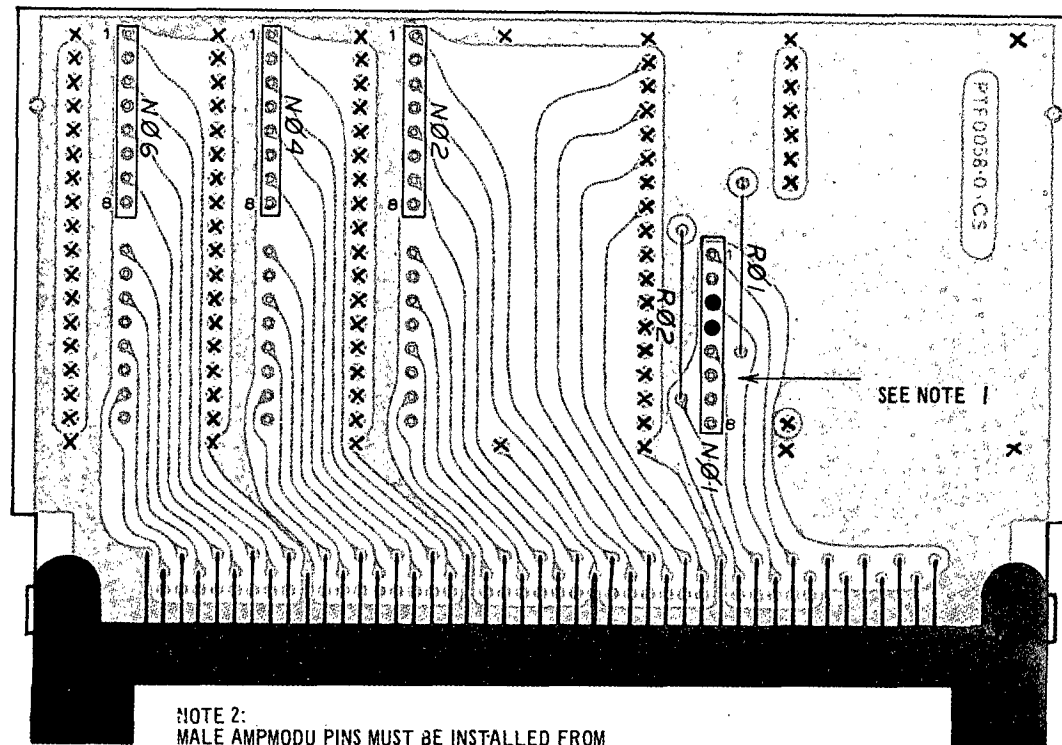
DRAWN BY  
KM

CHECKED

DATE

6-16-70

*maw*



NOTE 3:  
SEE DRAWING NUMBER 200.50D29  
FOR CONNECTOR ORIENTATION.

NOTE 2:  
MALE AMPMODU PINS MUST BE INSTALLED FROM  
THIS SIDE IN LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DRAWINGS 200.50D1 AND 200.50D2.

NOTE 1: ON SPRAGUE RESISTOR  
NETWORK LTN-2 IN POSITION  
N01 CLIP LEADS NO. 3 AND 4  
SO THAT THEY DO NOT TOUCH  
BOARD.

			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI	TITLE COMPONENT IDENTIFICATION LOAD MODULE FACEPLATE MOTHER BOARD PART NO. 207.4				
1	11-11-70	E.C.O. 0080	<b>MACROMODULAR PROJECT</b>	APPROVED		ENG.	DRAWING NO.	
				BY	FOR	DATE	DLS	207.4D1
CHANGE NO.	DATE	DESCRIPTION		Cem	MANUF.	7/8/70	DRAWN BY PLL	
				Cem	MANUF.	11/30/71	CHECKED 7/7K	DATE 6-11-70

RESISTORS 15K OHM 5% CARBON  
TWO REQUIRED  
R01  
R02

SPRAGUE RESISTOR NETWORK LTN-2  
FOUR REQUIRED  
N01\*  
N02  
N04  
N06

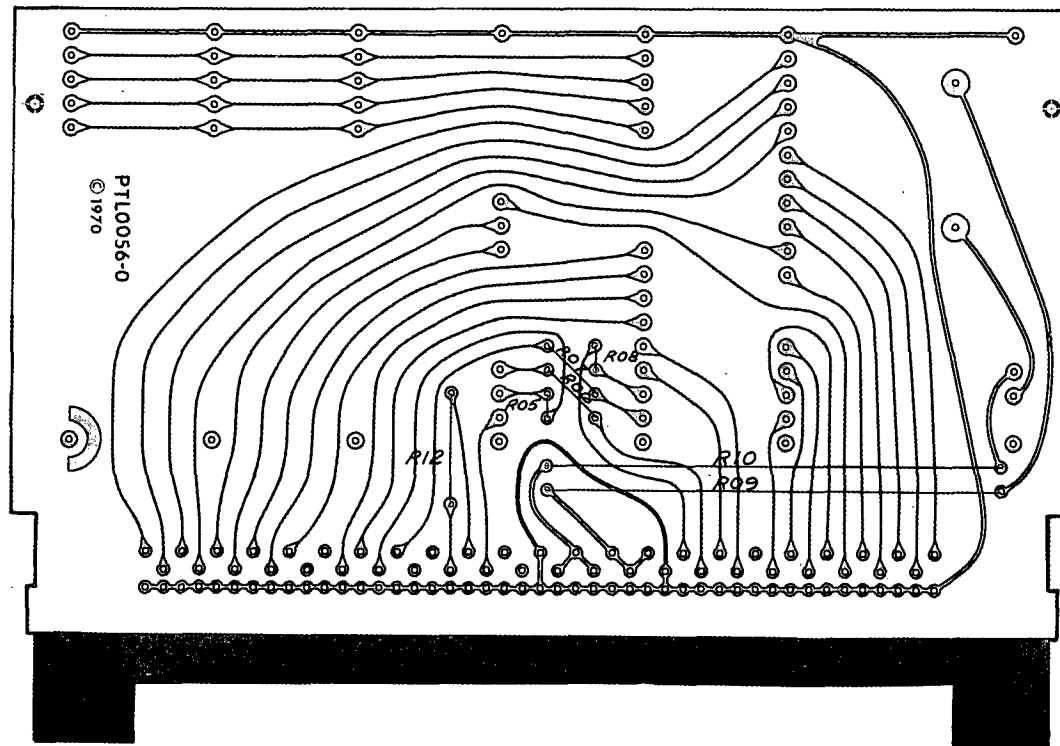
\*ON LTN-2 IN POSITION  
N01 CLIP PINS 3 AND 4.

AMP CONNECTOR  
583 464-1  
ONE REQUIRED

CONNECTOR  
AMPMODU NO. 85931-5  
EIGHTY FIVE REQUIRED

CIRCUIT BOARD  
PTF0058-1  
ONE REQUIRED

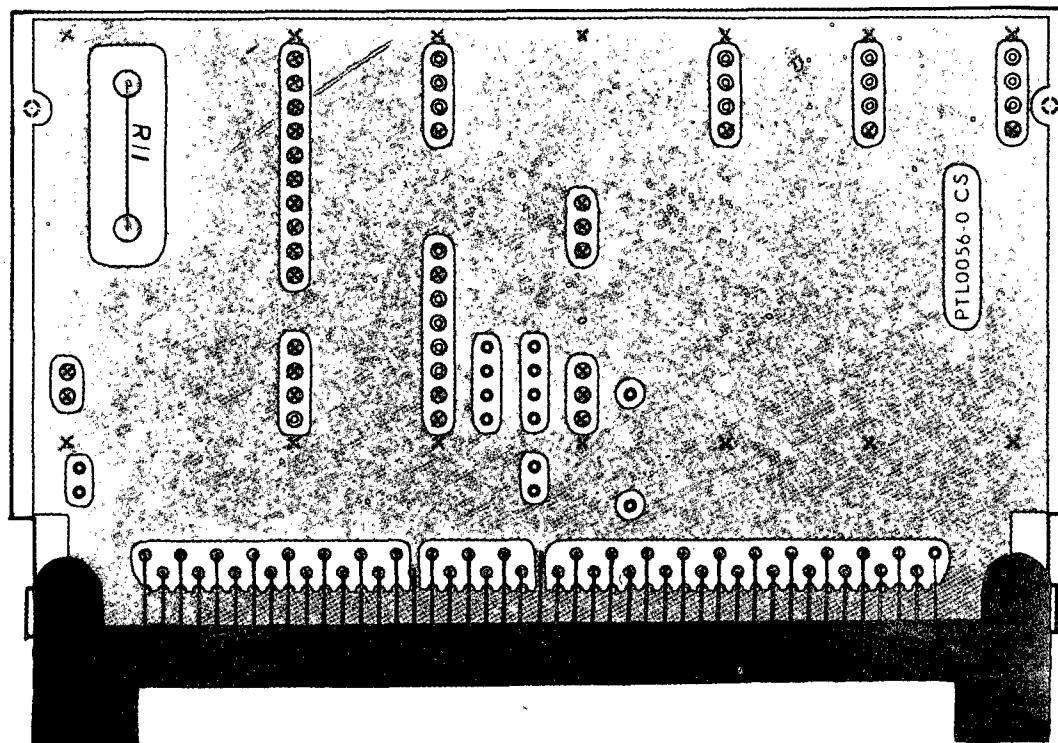
2	7-27-71	E.C.O. 0214
1	11-11-70	E.C.O. 0080 <i>ATK</i>
CHANGE NO.	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST LOAD MODULE FACEPLATE MOTHERBOARD PART NO. 207.4		
APPROVED		ENG.
BY	FOR	DATE
<i>Cem</i>	MANUF.	7/7/70
<i>Cem</i>	MANUF.	7/7/70
DRAWN BY		DRAWING NO.
MBP		207.4D2
CHECKED		DATE
<i>ATK</i>		7/7/70



				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION LOAD LATERAL MOTHERBOARD ASSEMBLY PART NO. 207.5 SIGNAL SIDE				
						APPROVED BY FOR DATE <i>Cam</i> <i>MANUF.</i> <i>7/8/70</i>			ENG. DLS DRAWN BY PLL	DRAWING NO. 207.5D1
						<i>Cam</i> <i>MANUF.</i> <i>11/20/71</i>			CHECKED NTK	DATE 6-19-70
CHANGE NO.	DATE	DESCRIPTION								
1	11-11-70	E.C.O. 0080 <i>NTK. cam</i>								
				<b>MACROMODULAR PROJECT</b>						

NOTE:  
AMPMODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED  
X PRECISELY AS SHOWN IN DRAWINGS  
200.50D1 AND 200.50D2.

NOTE:  
SEE DRAWING NUMBER 200.50D28  
FOR CONNECTOR ORIENTATION.



			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION LOAD LATERAL MOTHERBOARD ASSEMBLY COMPONENT SIDE PART NO. 207.5			
					APPROVED BY FOR DATE <i>Can</i> MANUF. 12 NOV 70 <i>Can</i> MANUF. 11/30/71			
CHANGE NO.	DATE	DESCRIPTION	<b>MACROMODULAR PROJECT</b>					
1	11 24 71	E.C.O. 0232 <i>MLP</i>						

JUMPERS  
SIX REQUIRED

R05  
R06  
R07  
R08  
R09  
R10

RESISTOR 30.9 K OHM 1% FILM  
ONE REQUIRED  
R12

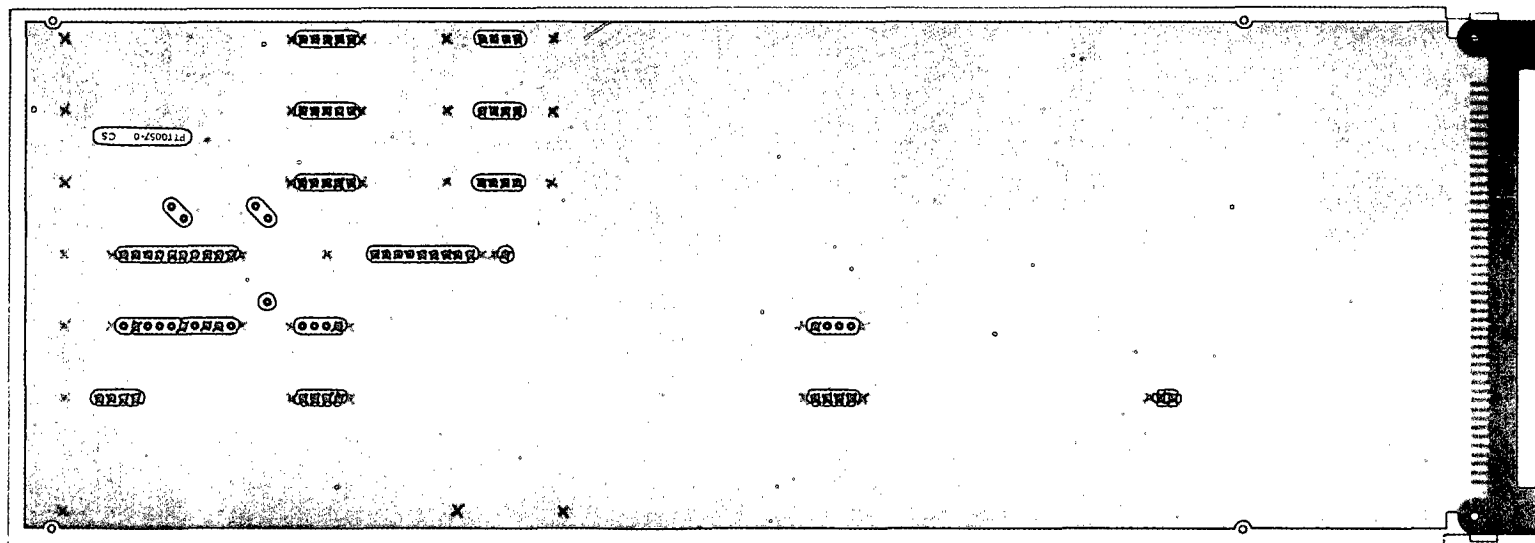
AMP CONNECTOR  
583 464-1  
ONE REQUIRED

CONNECTORS  
AMPMODU 85931-5  
FORTY TWO REQUIRED

FUSE  
BUSSMAN GFA 1/4A  
ONE REQUIRED  
R11

CIRCUIT BOARD  
PTL0056-1  
ONE REQUIRED

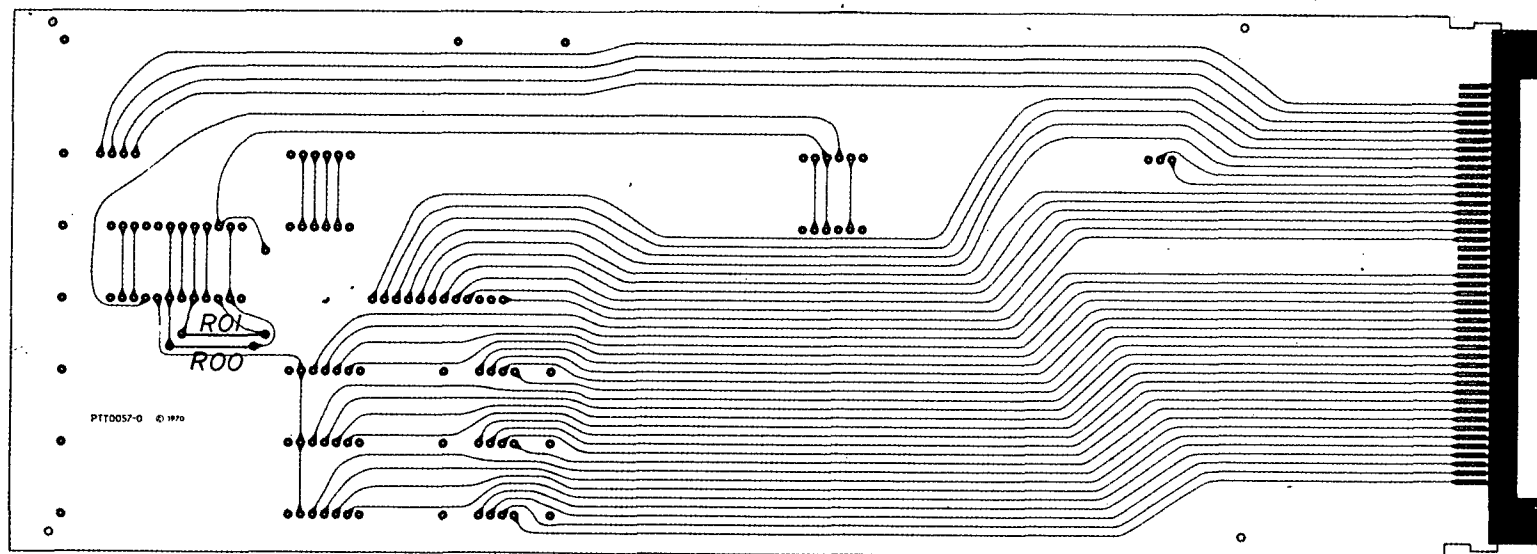
4	11-24-71	E.C.O. 0232	<i>WHP</i>
3	7-27-71	E.C.O. 0214	
2	12-11-70	E.C.O. 0126	
1	11-11-70	E.C.O. 0080	<i>WDC</i>
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST LOAD LATERAL MOTHER BOARD ASSEMBLY PART NO. 207.5			
APPROVED			ENG. <i>RSC</i>
BY <i>Chm</i>	FOR MANUF.	DATE 6/19/70	DRAWING NO. 207.5D3
CHECKED <i>NTK</i>			DATE 6/19/70



NOTE:  
SEE DRAWING NUMBER 200.50D26 FOR  
CONNECTOR ORIENTATION.

NOTE:  
MALE AMPMODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED X  
PRECISELY AS SHOWN IN DWGS. 200.50D1  
AND 200.50D2.

		<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION LOAD TOP MOTHERBOARD ASSEMBLY COMPONENT SIDE PART NO. 207.6			
				APPROVED BY <i>Cem</i> FOR <i>MAUVF</i> DATE <i>17 NOV 70</i>		ENG. DLS DRAWN BY PLL	DRAWING NO. 207.6D1
		<b>MACROMODULAR PROJECT</b>		CHECKED Cam <i>MAUVF</i> <i>11/30/71</i>		NTK	DATE 11-11-70
CHANGE NO.	DATE			DESCRIPTION			



CHANGE NO.	DATE	DESCRIPTION	<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION</b> LOAD TOP MOTHER BOARD ASSEMBLY, SIGNAL SIDE PART NO. 207.6			
			<b>MACROMODULAR PROJECT</b>		APPROVED BY <i>COM</i> FOR <i>MANUF</i> DATE <i>11/30/70</i>		ENG. <b>DLS</b> DRAWN BY <b>PLL</b>	DRAWING NO. <b>207.6D2</b>
					CHECKED <b>NTK</b>		DATE <b>11-11-70</b>	



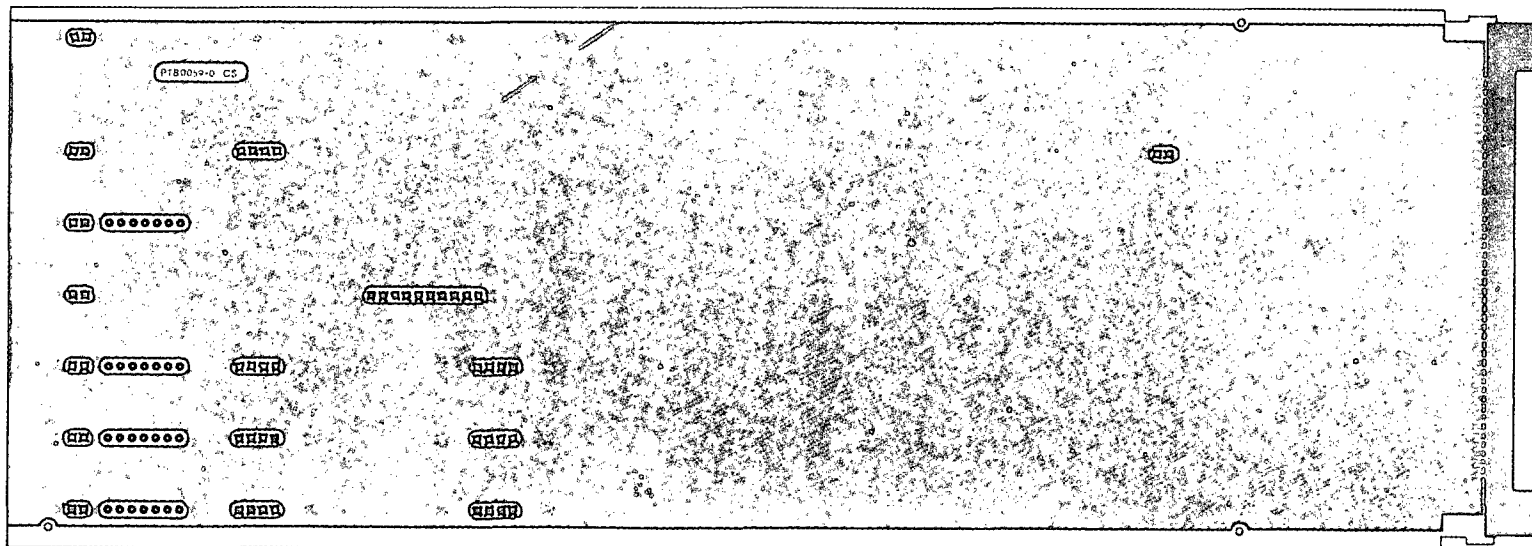
AMP CONNECTOR  
1-202845-5  
ONE REQUIRED

CONNECTORS  
AMPMODU NO. 85931-5  
ONE HUNDRED FOUR REQUIRED

JUMPERS  
TWO REQUIRED  
R00  
R01

CIRCUIT BOARD  
PTT0057-1  
ONE REQUIRED

1	7-27-71	E.C.O. 0214
CHANGE NO.	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST LOAD TOP MOTHERBOARD ASSEMBLY PART NO. 207.6		
APPROVED		ENG. <i>Red</i>
BY	FOR	DATE
DRAWN BY MBP		DRAWING NO. 207.6D3
CHECKED	DATE	
11-11-70		



NOTE:  
MALE AMPMODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED X  
PRECISELY AS SHOWN IN DWGS. 200.50D1  
AND 200.50D2.

NOTE:  
SEE DRAWING NUMBER 200.50D27  
FOR CONNECTOR ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION	<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI	TITLE COMPONENT IDENTIFICATION LOAD BOTTOM MOTHERBOARD ASSEMBLY PART NO. 207.7			
				APPROVED BY <i>CEM</i> FOR <i>MANUF.</i> DATE <i>17 Nov. 70</i>		ENG. <i>DLS</i> DRAWN BY <i>PLL</i>	DRAWING NO. 207.7D1
			<b>MACROMODULAR PROJECT</b>	CHECKED <i>CEM</i> DATE <i>11/30/71</i>	NTK	DATE 11-11-70	

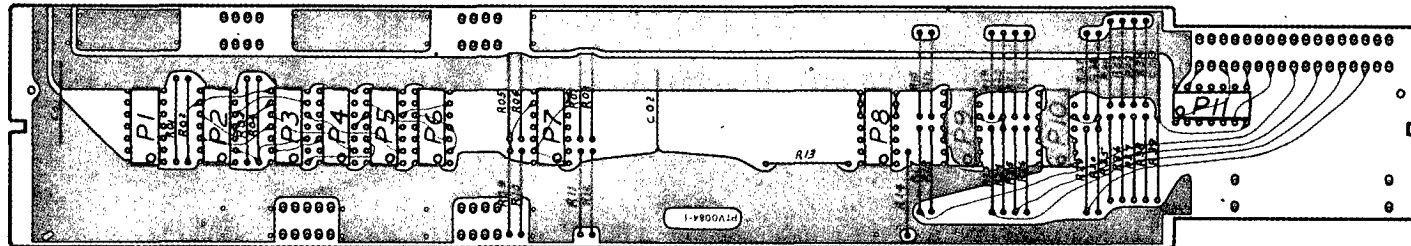
AMP CONNECTOR  
1-202845-5  
ONE REQUIRED

CONNECTORS  
AMPMODU NO. 85931-5  
88 REQUIRED

CIRCUIT BOARD  
PTB0059-1  
ONE REQUIRED

1	7-27-71	E.C.O. 0214
CHANGE NO.	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST LOAD BOTTOM MOTHERBOARD ASSEMBLY PART NO. 207.7		
APPROVED		ENG. <i>RED</i>
BY	FOR	DATE
<i>MBP</i>	<i>PAJ</i>	<i>11/20/71</i>
DRAWN BY		DRAWING NO.
MBP		207.7D2
CHECKED		DATE
<i>PAJ</i>		11-11-70

NOTE:  
INSTALL FEMALE AMPMODU CONNECTORS  
EXACTLY AS SHOWN ON DWG. 200.50D2.



				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION          LOAD MODULE DATA BOARD          PART NO. 207.8</b>			
						APPROVED BY <i>Cem</i> FOR <i>MANUF.</i> DATE <i>25 Nov. 70</i>		ENG. <i>R.E.O.</i> DRAWN BY <i>DHO</i>	
CHANGE NO. DATE		DESCRIPTION		<b>MACROMODULAR PROJECT</b>		CHECKED NTK		DATE 11-18-70	

**INTEGRATED CIRCUITS**

TYPE	REQUIRED	LOCATION
------	----------	----------

M01B	2	P1 P8
M06	2	P9 P10
M10	2	P3 P6
M20	1	P11
M30	1	P7
M16	2	P4 P5
M47	1	P2

**CAPACITORS\***

TYPE	REQUIRED	LOCATION
------	----------	----------

10,000 pf	3	C01 C02 C03
-----------	---	-------------------

\*SPRAGUE TYPE CK-103  
CERAMIC DISC 50 WVDC

**RESISTORS**

TYPE	REQUIRED	LOCATION
------	----------	----------

R0	2	R14 R39
R1	8	R05 R06 R07 R08 R35 R36 R37 R38
R2	8	R15 R16 R19 R20 R21 R22 R27 R28
R3	13	R01 R02 R03 R04 R09 R10 R11 R12 R13 R31 R32 R33 R34
R5	8	R17 R18 R23 R24 R25 R26 R29 R30

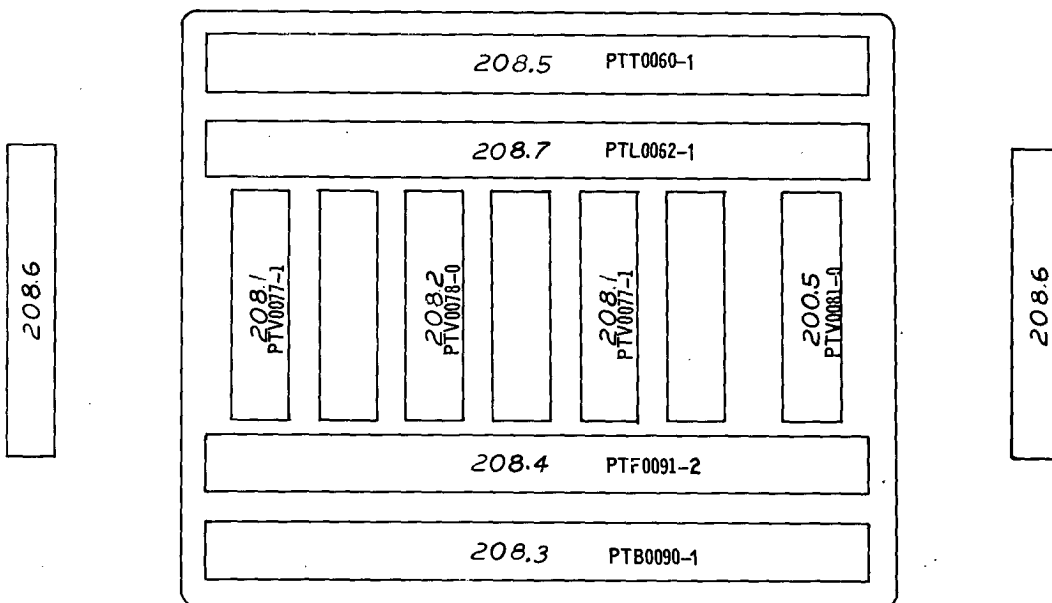
CONNECTORS  
AMPMODU NO. 85863-4  
52 REQUIRED

PRINTED CIRCUIT BOARD  
PTV0084-2  
ONE REQUIRED

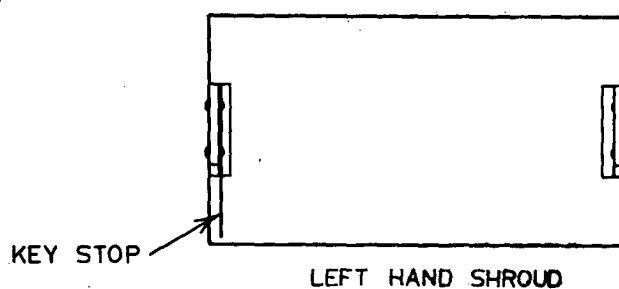
**NOTE:**

R0 = JUMPERS  
R1 = 1.5K OHM 1% FILM RESISTOR  
R2 = 750 OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R5 = 57.6 OHM 1% FILM RESISTOR

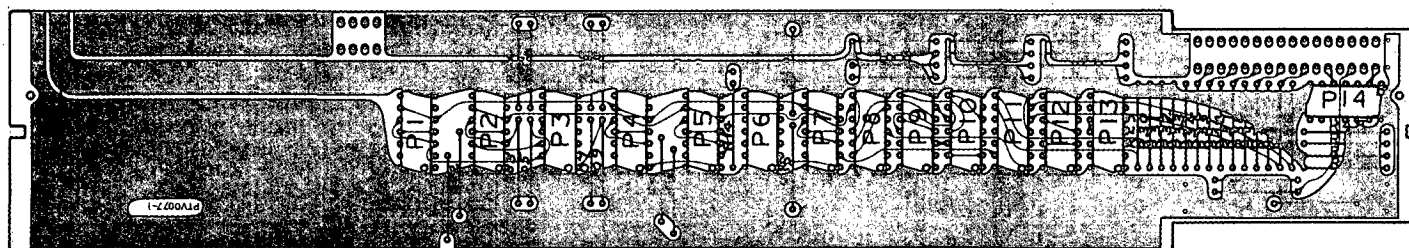
1	11-30-71	E.C.O. 0234	NTK
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b>			
WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST LOAD DATA BOARD PART NO. 207.8			
APPROVED		ENG.	DRAWING NO.
BY	FOR	DATE	207.8D2
CEM	MBP	25 Nov 70	
CEM	MBP	11/20/71	
CHECKED		DATE	
NTK		11-18-70	



200.1  
ONE CELL CASE  
ASSEMBLY



5	7-27-71	E.C.O. 0215	WAC
4	11-9-70	CHG.DOC NO-ADD BD.NOS.	WAC
3	6-19-70	NO. CHANGE ON L.M.B. CERN	WAC
2	6-9-70	NEW PART NO. ON BMB CERN	WAC
1	4-17-70	CHANGED TOP M.B. CERN	WAC
CHANGE NO.	DATE	DESCRIPTION	
COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			<b>MACROMODULAR PROJECT</b> TITLE ASSEMBLY SCHEMATIC & PARTS LIST CALL DECISION CALL UNIT PART NO. 208
APPROVED		ENG	DRAWING NO.
BY	FOR	DATE	WAC
WAC	Documentation	4/8	DRAWN BY
WAC	WAC	11/2/70	PLL
WAC	WAC	2/8/73	CHECKED
			DATE
			NTK
			3-28-70



NOTE:  
INSTALL FEMALE AMPMODU CONNECTORS  
EXACTLY AS SHOWN ON DRAWING 200.50D2.

1	11/10/70	REPLACES PTV0070-0. <i>cam</i>	<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION CALL UNIT "D"-ELEMENT BOARD PART NO. 208.1			
					APPROVED BY <i>cam</i> FOR <i>MAVUP</i> DATE <i>2/8/72</i>		ENG. <b>REO</b> DRAWN BY <b>PLL</b>	DRAWING NO. 208.1D1
CHANGE NO.	DATE	DESCRIPTION	<b>MACROMODULAR PROJECT</b>		CHECKED <i>NTK</i>		DATE 11/10/70	

# INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M10	6	P1 P2 P4 P5 P7 P8
M01B	1	P6
M06	3	P11 P12 P13
M20	1	P14
M31	2	P9 P10
M30	1	P3

# CAPACITORS \*

TYPE	REQUIRED	LOCATION
10,000 pf	2	C01 C02

\*CK-103 = SPRAGUE CERAMIC DISK  
10,000 pf 50 WVDC

# RESISTORS

TYPE	REQUIRED	LOCATION
R1	10	R04 R06 R08 R10 R13 R16 R19 R20 R45 R46
R2	12	R21 R22 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32
R3	14	R01 R02 R03 R05 R07 R09 R11 R12 R14 R15 R17 R18 R47 R48

# RESISTORS (c ont.)

TYPE	REQUIRED	LOCATION
R5	12	R33 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44

CONNECTORS  
AMPMODU NO. 85863-4  
31 REQUIRED

CIRCUIT BOARD  
PTV0077-1  
ONE REQUIRED

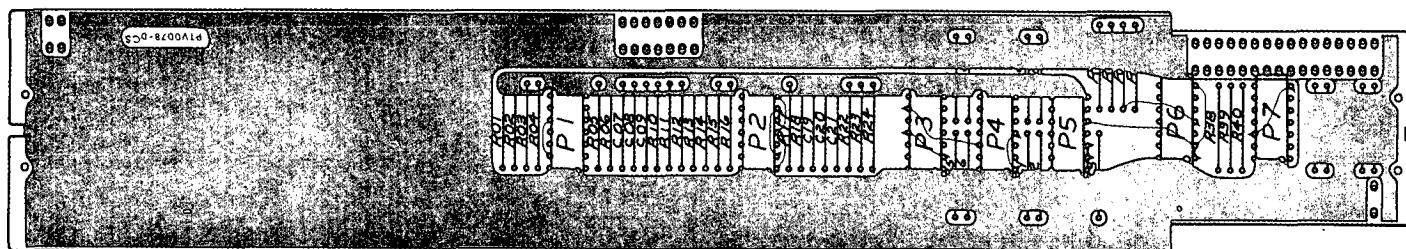
# NOTE:

R1 = 1.5K OHM 1% FILM RESISTOR  
R2 = 750 OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R5 = 57.6 OHM 1% FILM RESISTOR

CHANGE NO.		DATE	DESCRIPTION
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b></p> <p align="center">WASHINGTON UNIVERSITY</p> <p align="center">ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE    PARTS LIST           CALL UNIT "D" ELEMENT BOARD           PART NO. 208.1</p>			
APPROVED		ENG.	DRAWING NO.
BY	FOR	DATE	208.1D2
COM. MANUF.	MANUF.	DATE	
COM. MANUF.	MANUF.	DATE	CHECKED
			DATE
			11-10-70



NOTE:  
INSTALL FEMALE AMPMODU  
CONNECTORS EXACTLY AS  
SHOWN ON DWG. NUMBER  
200.50D2.



1	11-9-70	ADD NOTE <i>cem</i>	<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION          CDC CONTROL BOARD          PART NO. 208.2</b>			
			<b>MACROMODULAR PROJECT</b>		APPROVED BY <i>cem</i> FOR <i>MANUF.</i> DATE <i>25 Nov. 70</i>		ENG. DLS	DRAWING NO. 208.2D1
					CHECKED <i>cem</i> MANUF.		DRAWN BY PLL	
CHANGE NO.	DATE	DESCRIPTION					CHECKED NTK	DATE 5-12-70

# INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01B	1	P5
M06	1	P4
M10	2	P1 P2
M20	2	P6 P7
M30	1	P3

# CAPACITORS \*

TYPE	REQUIRED	LOCATION
43 pf	2	C9 C19
50 pf	2	C8 C20
56 pf	2	C7 C21

\*DIPPED SILVER MICA  
5% 50 WVDC

# RESISTORS

TYPE	REQUIRED	LOCATION
R0	5	R41 R42 R43 R44 R33
R1	6	R01 R02 R06 R13 R14 R18
R2	10	R10 R11 R12 R22 R23 R24 R27 R28 R29 R30
R3	13	R03 R04 R05 R15 R16 R17 R34 R35 R36 R37 R38 R39 R40

# RESISTORS (cont)

TYPE	REQUIRED	LOCATION
R5	4	R25 R26 R31 R32

CONNECTORS  
AMPMODU NO. 85863-4  
35 REQUIRED

CIRCUIT BOARD  
PTV0078-0  
ONE REQUIRED

# NOTE:

R0 = JUMPERS  
R1 = 1.5K OHM 1% FILM RESISTOR  
R2 = 750 OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R5 = 57.6 OHM 1% FILM RESISTOR

2	1-15-74	E.C.O. 0302	445
1	2-7-72	E.C.O. 0252	445 Conn
CHANGE NO.	DATE	DESCRIPTION	
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE PARTS LIST CDC CONTROL BOARD PART NO. 208.2</p>			
APPROVED		ENG.	DRAWING NO.
BY	FOR	DATE	
MANUF.	MANUF.	5/12/70	208.2D2
CHECKED	DATE		
	6/23/70		

Delay Test  
Call Module Board #208.2

This board contains six delays whose values must be checked prior to the inclusion of the board in a module. The minimum value observed for each delay must lie in the range 37 nsec to 45 nsec, inclusive.

The values of the delays are affected by the amplitude of the input signal. In order to assure acceptable delay values for a wide range of input voltages, each delay is tested for two sets of voltages.

Procedure For Testing A Delay

Step 1. The delay has a pair of input pins (see chart below for pins). Connect one phase of a square wave to one of the pins and connect the other phase of the square wave to the other pin.

The square wave is to have a period of 700 nsec or more, rise and fall times of 10 nsec or less, and amplitudes of -0.60V and -1.00V.

Connect channels 1 and 2 of a 454 oscilloscope to the pins indicated in the chart and observe the interval between a transition on channel 1 and the subsequent transition on channel 2. The transitions will be in the same direction for delay #1 and delay #4 and will be in opposite directions for the other delays. Measuring from midpoint to midpoint, record the following times:

- a). the interval beginning with a positive-going transition on channel 1.
- b). the interval beginning with a negative-going transition on channel 1.

Step 2. This step is exactly the same as step 1 except that the square wave amplitudes are -1.50V and -1.90V.

Step 3. From the values recorded in steps 1 and 2, determine the minimum recorded value. If this value does not lie in the range 37 nsec to 45 nsec, change the value of the capacitor indicated in the chart and then repeat steps 1, 2, and 3. A capacitor change of 5 pf will change the delay about 2 nsec.

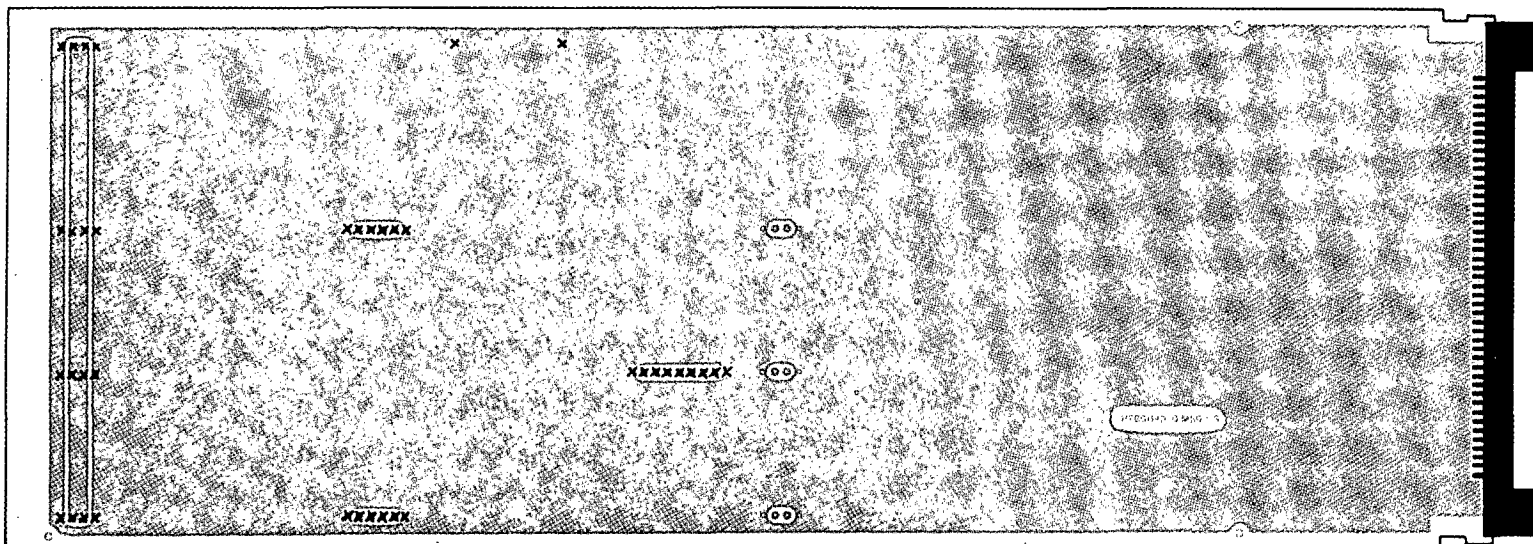
<u>Delay</u>	<u>Input Pins</u>	<u>Ch.1</u>	<u>Ch.2</u>	<u>Capacitor</u>
1	F8, F9	F9	B40	C19
2	F14, F15	F15	B41	C20
3	F16, F17	F17	B42	C21
4	F4, F5	F5	B43	C09
5	F10, F11	F11	B44	C08
6	F12, F13	F13	B45	C07

The final capacitor values and the measured delays for each board should be recorded on the test sheet provided for that board, along with the serial number of the board.

The circuit board should be carefully inspected to insure that the foregoing procedure has not resulted in damage to the circuit board, particularly in the areas where fresh soldering has taken place. All flux residues should be thoroughly removed.

ISSUE — 12-28-70

208.2D5



NOTE:  
AMPMODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED  
X PRECISELY AS SHOWN IN DWGS. 200.50D1  
AND 200.50D2.  
(39 PINS)

NOTE:  
SEE DRAWING NUMBER 200.50D27  
FOR CONNECTOR ORIENTATION.

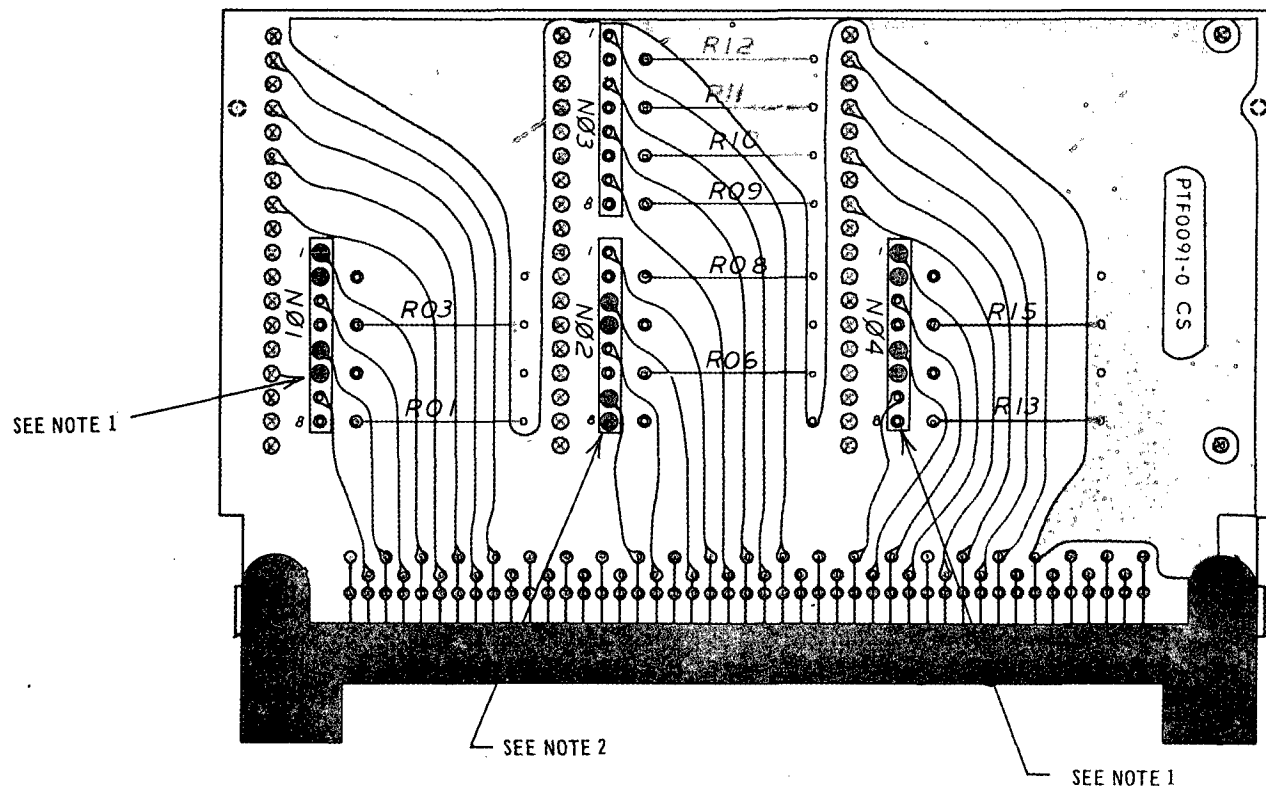
				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION CALL BOTTOM MOTHERBOARD ASSEMBLY PART NO. 208.3			
				<b>MACROMODULAR PROJECT</b>		APPROVED BY FOR DATE		ENG. <b>RED</b>	DRAWING NO. 208.3D1
						CEM MANUF 25NOV70 CEM MANUF 8Feb72	DRAWN BY PLL		
CHANGE NO.	DATE	DESCRIPTION				CHECKED <b>TR</b>		DATE 11/10/70	

CONNECTOR  
AMP 1-202 845-5  
ONE REQUIRED

CONNECTORS  
AMPMODU NO. 85931-5  
THIRTY NINE REQUIRED

CIRCUIT BOARD  
PTB0090- 1  
ONE REQUIRED

1	7-15-71	E.C.O. 0205	
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST CALL BOTTOM MOTHERBOARD ASSEMBLY PART NO. 208.3			
APPROVED			ENG.
BY	FOR	DATE	DRAWING NO. 208.3D2
CSG	MANUF.	6/22/70	
CL			DRAWN BY MBP
			CHECKED WTR
			DATE 11-10-70



**NOTE 1:** CLIP PINS 1, 2, 5 AND 6 ON LTN-2 IN POSITION N01 AND N04.

**NOTE 2:** CLIP PINS 3, 4, 7 AND 8 ON LTN-2 IN POSITION N02.

**NOTE 3:** AMPMODU PINS MUST BE INSTALLED FROM THIS SIDE IN LOCATIONS MARKED X PRECISELY AS SHOWN IN DRAWINGS 200.50D1 AND 200.50D2.

**NOTE 4:** SEE DRAWING NUMBER 200.50D29 FOR CONNECTOR ORIENTATION.

			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI	TITLE COMPONENT IDENTIFICATION CALL UNIT FACEPLATE MOTHERBOARD ASSEMBLY PART NO. 208.4			
CHANGE NO.	DATE	DESCRIPTION		APPROVED		ENG. REQ.	DRAWING NO.
2	11-10-70	ADDED LTN-2 IN N01 AND N04 <i>clm</i>	<b>MACROMODULAR PROJECT</b>	BY	FOR	DATE	208.4D1
1	6-23-70	Added Note <i>clm</i>		<i>clm</i>	MANUF.	28 Nov 70	
				<i>clm</i>	MANUF.	8 Feb 72	CHECKED <i>MTX</i>
						DATE	6/8/70

RESISTORS 15K OHM 1/4WATT 5% CARBON COMP  
TEN REQUIRED

R01  
R03  
R06  
R08  
R09  
R10  
R11  
R12  
R13  
R15

SPRAGUE NETWORK LTN-2  
FOUR REQUIRED

N01 \*  
N02 \*  
N03  
N04 \*

AMP CONNECTOR 583464-1  
ONE REQUIRED

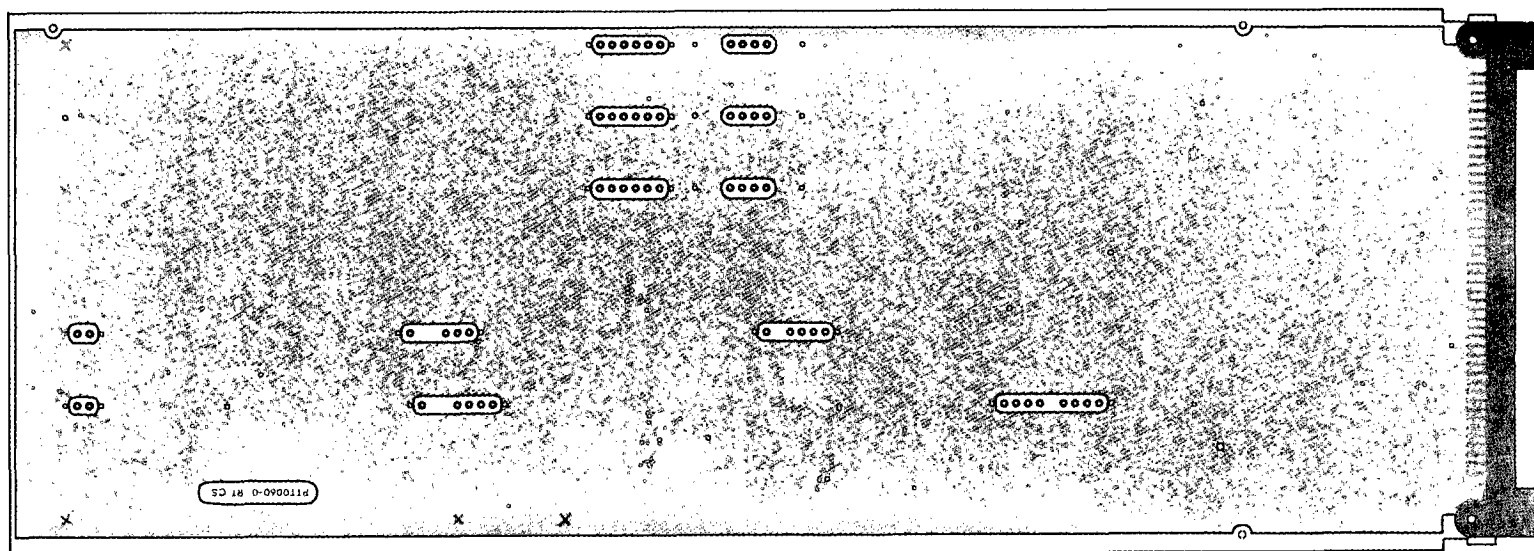
CONNECTORS  
AMPMODU NO. 85931-5  
56 REQUIRED

CIRCUIT BOARD  
PTF0091-2  
ONE REQUIRED

\*NOTE: CLIP PINS 1, 2, 5 AND 6 ON LTN-2  
IN POSITION N01 AND N04.  
CLIP PINS 3, 4, 7 AND 8 ON LTN-2  
IN POSITION N02.

3	7-20-72	CORR. REV. LEVEL ON P.C. BOARD	
2	7-15-71	E.C.O. 0205	CLIA
1	11-10-70	ADD INFO.	CLIA
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST CALL UNIT FACEPLATE MOTHERBOARD ASSEMBLY			
APPROVED		ENG. <i>REO</i>	DRAWING NO.
BY <i>CLIA</i>	FOR MANUF	DATE 6/23/70	208.4D2
<i>CLIA</i>	<i>MANUF</i>	DATE 6/11/72	
		CHECKED <i>MBP</i>	DATE
		<i>NTK</i>	11-10-70





NOTE:  
SEE DRAWING NUMBER 200.50D26  
FOR CONNECTOR ORIENTATION.

NOTE:  
MALE AMPMODU PINS MUST BE  
INSTALLED FROM THIS SIDE IN  
LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DRWGS. 200.50D1  
AND 200.50D2.  
(6 PINS)

CHANGE NO.	DATE	DESCRIPTION	<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION CALL TOP MOTHERBOARD ASSEMBLY PART NO. 208.5				
					APPROVED BY FOR DATE <i>Cem</i> MANUF. 25 Nov 70 <i>Cem</i> MANUF. 8 Feb 71			ENG. DLS DRAWN BY PLL	DRAWING NO. 208.5D1
					<b>MACROMODULAR PROJECT</b>			CHECKED NTK	DATE 11/30/70

CONNECTOR AMP 1-202845-5  
ONE REQUIRED

CONNECTOR  
AMP MODU NO. 85931-5  
SIX REQUIRED

CIRCUIT BOARD  
PTT0060-1  
ONE REQUIRED

1	7-15-71	E.C.O. 0205	
CHANGE NO.	DATE	DESCRIPTION	
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE PARTS LIST CALL TOP MOTHERBOARD ASSEMBLY PART NO. 208.5</p>			
APPROVED			ENG. <i>K. E. D.</i>
BY	FOR	DATE	DRAWING NO.
<i>C. E. D.</i>	MANUF	4/20/70	208.5D2
<i>C. E. D.</i>	MANUF	5/1/70	DRAWN BY MBP
			CHECKED <i>MR</i>
			DATE 11-10-70

C  
A  
L  
L

METALCRAFT "AUTOGRAPH" OR EQUIVALENT:  
 BLANK SIZE:  $\frac{1}{4}$ " X 2" SHEARED WITH  
 SQUARE CORNERS. BLACK LETTERS, VOGUE  
 BOLD 12 POINT BOLD FACE TYPE CENTERED  
 TOP, BOTTOM AND SIDES WITH 6 POINT  
 SPACING ON GREY BLUE PMS 550 BACKING.  
 MANUFACTURED FROM .016 THICK ALUMINUM  
 WITH SOLVENT ACTIVATED PERMANENT  
 ADHESIVE BACKING.

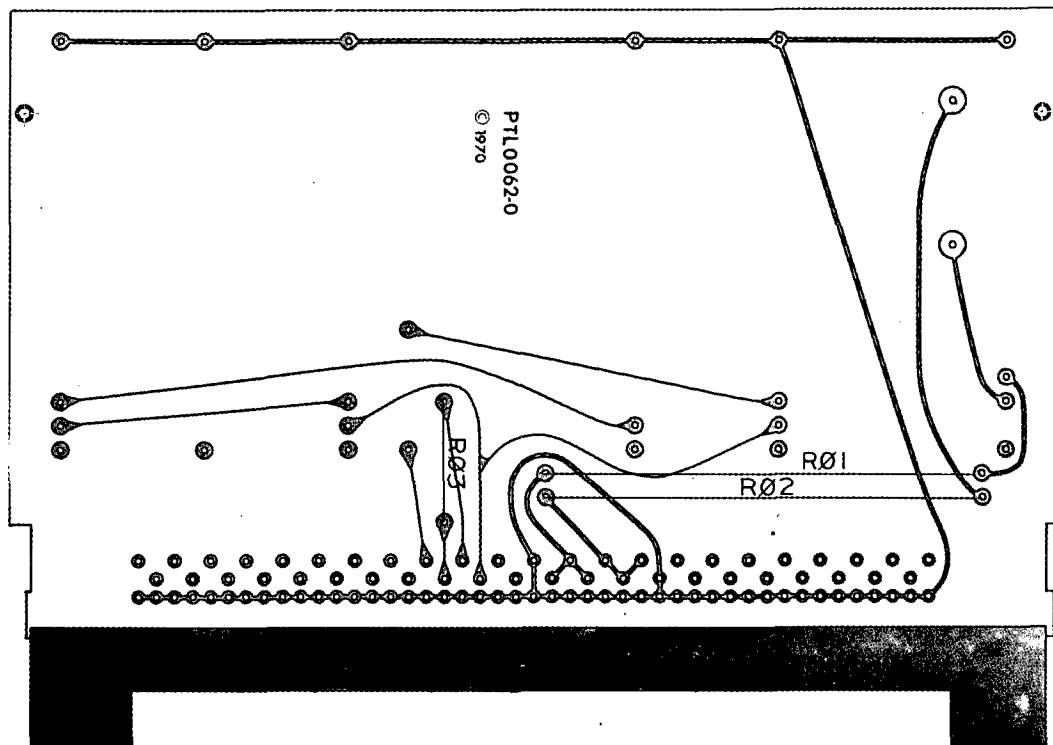
NOTE: PANTONE MATCHING SYSTEM (PMS)

**COMPUTER SYSTEMS LABORATORY**  
 WASHINGTON UNIVERSITY  
 ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

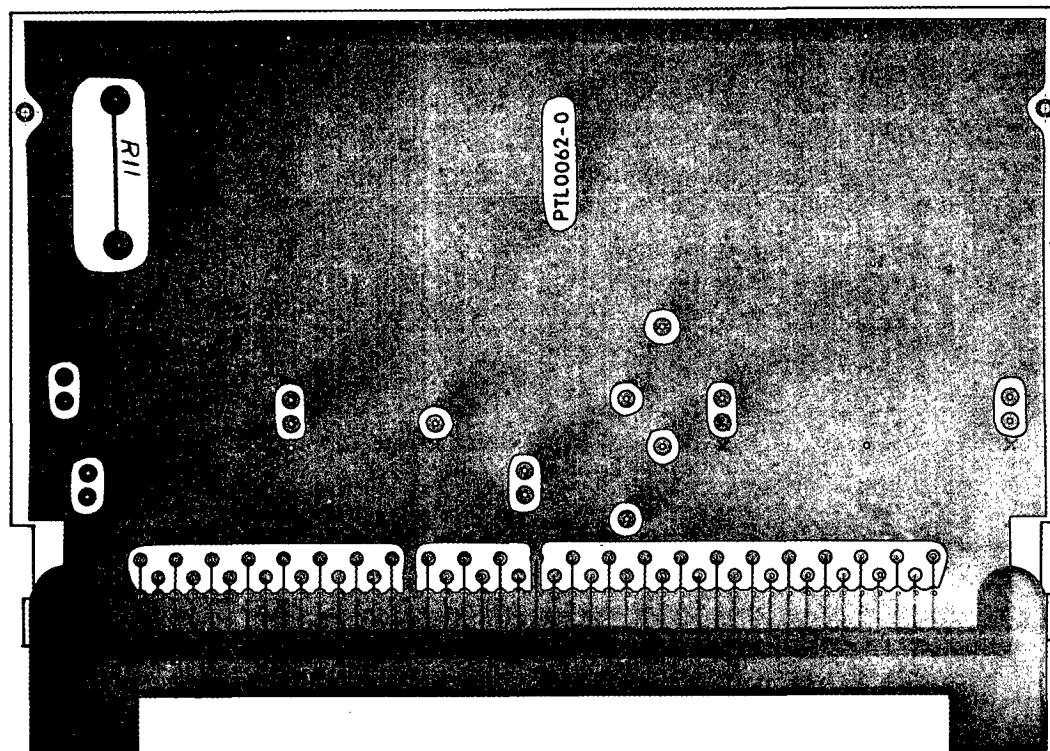
TITLE  
 IDENTIFICATION LABEL  
 CALL MODULE  
 PART #208.6

APPROVED			ENG NTK	DRAWING NO.  208.6D
BY	FOR	DATE		
<i>Maw</i>	<i>Prod.</i>	<i>7/28/70</i>	DRAWN BY KM	DATE 6-16-70
			CHECKED <i>Maw</i>	



		<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION CALL UNIT LATERAL MOTHERBOARD ASSEMBLY PART NO. 208.7 SIGNAL SIDE				
				APPROVED BY: <i>Clem</i> FOR: <i>MAVUE</i> DATE: <i>6/23/70</i> BY: <i>Clem</i> FOR: <i>MAVUE</i> DATE: <i>6/23/70</i>				
1	11-10-70	REMOVE NOTE & AMPMODUS	<i>Clem</i>	<b>MACROMODULAR PROJECT</b>		ENG.	DLS	DRAWING NO.
CHANGE NO.	DATE	DESCRIPTION				CHECKED	PLD	DATE
						<i>NTK.</i>		6/23/70

NOTE:  
AMP/ODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED  
X PRECISELY AS SHOWN IN DRAWINGS  
200.50D1 AND 200.50D2.



NOTE:  
SEE DRAWING NUMBER 200.50D28  
FOR CONNECTOR ORIENTATION.

				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION</b> CALL LATERAL MOTHERBOARD ASSEMBLY PART NO. 208.7 COMPONENT SIDE			
				<b>MACROMODULAR PROJECT</b>		APPROVED BY FOR DATE COM MANUF. 25 Nov 70 COM MANUF. 8 Feb 72		ENG. DLS DRAWN BY PLL CHECKED NTK	DRAWING NO. 208.7D2 DATE 11/10-70
CHANGE NO.	DATE	DESCRIPTION							

JUMPERS  
TWO REQUIRED  
R01  
R02

SENSE RESISTOR  
61.9K 1% FILM  
ONE REQUIRED  
R03

CONNECTOR AMP 583 464-1  
ONE REQUIRED

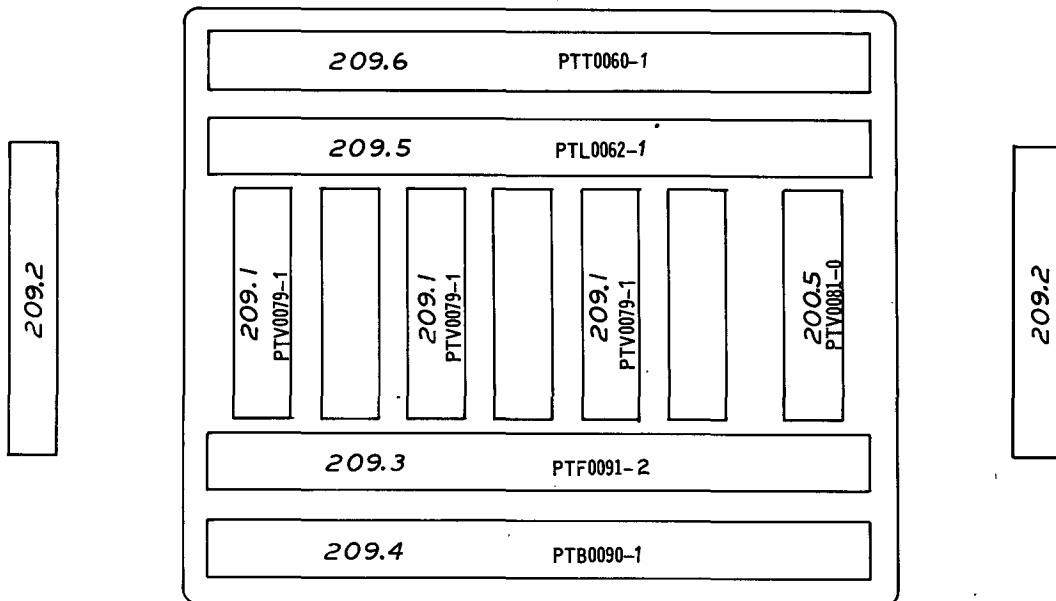
CONNECTOR  
AMPMODU NO. 85931-5  
ELEVEN REQUIRED

FUSE  
BUSSMAN GFA 3/4AMP  
ONE REQUIRED  
R11

CIRCUIT BOARD  
PTL0062-1  
ONE REQUIRED

4	7-15-71	E.C.O. 0205	
3	1-15-71	E.C.O. 0148	MTK
2	12-11-70	E.C.O. 0128	MTK
1	11-10-70	ADD INFO.	MTK
CHANGE NO.	DATE	DESCRIPTION	
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE: PARTS LIST CALL UNIT LATERAL MOTHERBOARD ASSEMBLY PART NO. 208.7</p>			
APPROVED			ENG. <b>REC</b>
BY	FOR	DATE	DRAWING NO. 208.7D3
<b>Cam</b>	MANUF	6/22/70	
<b>Cam</b>	MANUF	8/6/72	CHECKED <b>MTK</b>
			DATE 11-10-70

25 NOV 70

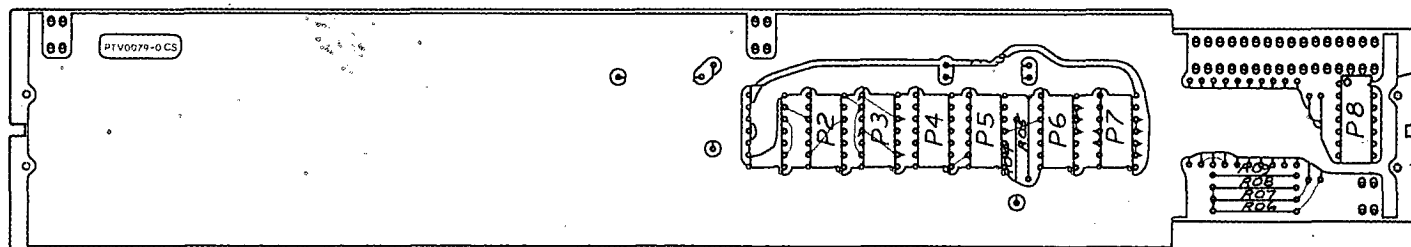


200.1  
ONE CELL CASE  
ASSEMBLY

6	7-27-71	E.C.O. 0216 <i>NTK</i>
<i>NTK</i> 5	10-6-70	ADDED PC. BOARD NOS.
<i>NTK</i> 4	6-22-70	TITLE CHANGED
<i>NTK</i> 3	6-19-70	NO. CHANGE ON L.M.B.
<i>NTK</i> 2	6-9-70	NEW PART NO. ON FP & BMB
<i>NTK</i> 1	4-17-70	CHANGED TOP M.B.

CHANGE NO.	DATE	DESCRIPTION
COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		

MACROMODULAR PROJECT			
TITLE ASSEMBLY SCHEMATIC & PARTS LIST MERGE RENDEZVOUS UNIT PART NO. 209			
APPROVED		ENG	DRAWING NO.
BY	FOR	DATE	209.0D
<i>NTK</i>	<i>Documenter</i>	<i>4/8</i>	
CHECKED		DATE	3-28-70
<i>NTK</i>		<i>11-27-70</i>	



NOTE 2

NOTE 1: INSTALL FEMALE AMPMODU  
CONNECTORS EXACTLY AS  
SHOWN ON DWG. 200.50D2  
(31 REQUIRED)  
2: NOTE ORIENTATION OF P8

**COMPUTER SYSTEMS LABORATORY**  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

TITLE  
**COMPONENT IDENTIFICATION**  
BRM BOARD  
PART NO. 209.1

APPROVED			ENG.	DRAWING NO.
BY	FOR	DATE	DLS	209.101
CEM	MANUF.	10/12/70	DRAWN BY PLL	
CEM	MANUF.	7/15/71	CHECKED TK	DATE 5-11-70

CHANGE NO.	DATE	DESCRIPTION
1	10/9/70	ADD NOTES <i>- PTK CEM</i>



# INTEGRATED CIRCUITS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
M01	2	P6 P7
M10	3	P1 P2 P3
M11	1	P4
M20	1	P8
M30	1	P5

# RESISTORS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
R0	3	R01 R02 R03
R1	5	R05 R06 R07 R08 R09
R3	5	R04 R18 R19 R20 R21
R4	1	R22
R5	8	R10 R11 R12 R13 R14 R15 R16 R17

CONNECTORS  
AMPMODU NO 85863-4  
31 REQUIRED

CIRCUIT BOARD  
PTV0079-1  
ONE REQUIRED

# NOTE

R0 = JUMPERS  
R1 = 1 5K OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R4 = 15K OHM 5% CARBON COMP  
R5 = 57 6 OHM 1% FILM RESISTOR

1	7-15-71	E.C.O. 0204
CHANGE NO	DATE	DESCRIPTION
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST LOUIS, MISSOURI</p>		
<p align="center"><b>MACROMODULAR PROJECT</b></p>		
<p>TITLE PARTS LIST BRM BOARD PART NO 209 1</p>		
APPROVED		ENG
BY	FOR	DATE
Cam	MANUF	5/11/70
DRAWN BY		DRAWING NO
MBP		209.1D2
CHECKED		DATE
MTK		6/22/70

M  
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NOTE: NOT TO SCALE

METALCRAFT "AUTOGRAPH" OR EQUIVALENT:  
BLANK SIZE:  $\frac{1}{4}$ " X 2" SHEARED WITH  
SQUARE CORNERS. WHITE LETTERS, VOGUE  
BOLD 12 POINT BOLD FACE TYPE EVENLY  
SPACED, CENTERED TOP, BOTTOM AND  
SIDES ON BLUE PMS 301 BACKING.  
MANUFACTURED FROM .016 THICK ALUMINUM  
WITH SOLVENT ACTIVATED PERMANENT  
ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

## COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

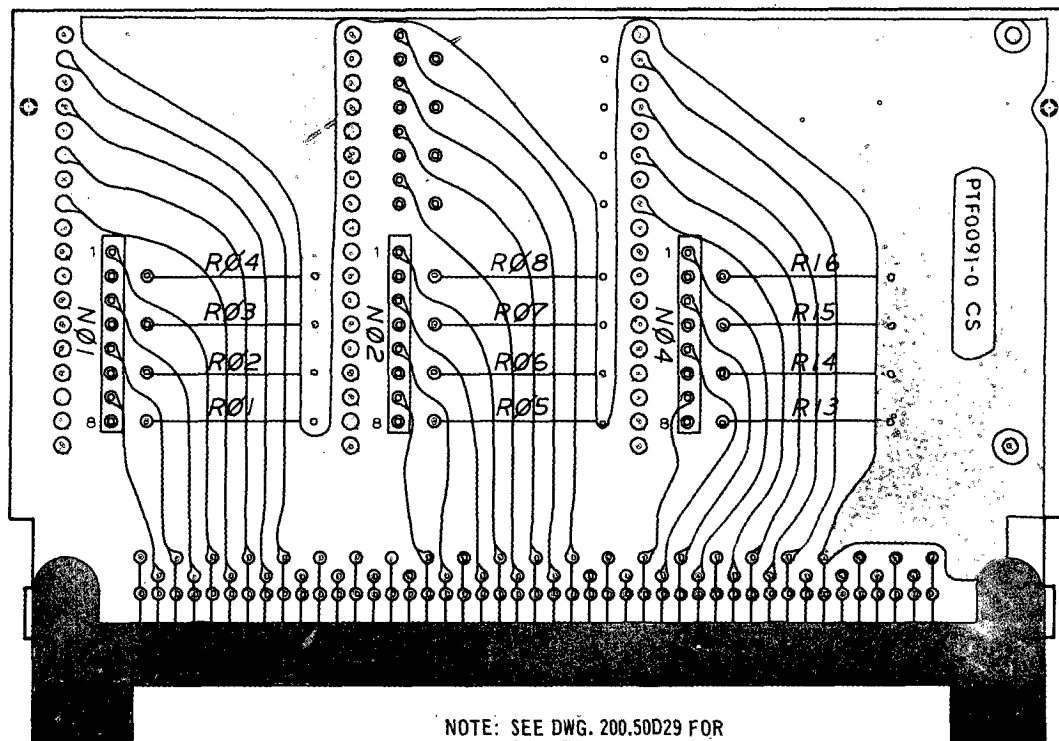
ST. LOUIS, MISSOURI

## MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL  
MERGE/RENDEZVOUS MODULE  
PART #209.2

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	HTK	
<i>maw</i>	<i>Product.</i>	<i>7/28/70</i>	DRAWN BY MEP	.209.2D
			CHECKED <i>maw</i>	DATE 7/23/70



NOTE: SEE DWG. 200.50D29 FOR  
CONNECTOR MOUNTING  
ORIENTATION.

NOTE: MALE AMPMODU PINS  
MUST BE INSTALLED FROM  
THIS SIDE IN LOCATIONS  
MARKED X PRECISELY AS  
SHOWN IN DWGS. 200.50D1  
AND 200.50D2  
(56 PINS)

		<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION</b> MERGE/RENDEZVOUS FACEPLATE MOTHERBOARD ASSEMBLY PART NO. 209.3	
		<b>MACROMODULAR PROJECT</b>		APPROVED BY FOR DATE Cam MANUF. 10/15/70 Cam MANUF. 7/15/71	
CHANGE NO. 1 DATE 11-13-70 DESCRIPTION E.C.O. 0082 NTK am				ENG. REO DRAWN BY PLL CHECKED NTK DATE 6/8/70	
				DRAWING NO. 209.3D1	

RESISTORS 15K OHM 5% 1/4WATT CARBON COMP  
TWELVE REQUIRED

R01  
R02  
R03  
R04  
R05  
R06  
R07  
R08  
R13  
R14  
R15  
R16

SPRAGUE NETWORK LTN-2  
THREE REQUIRED

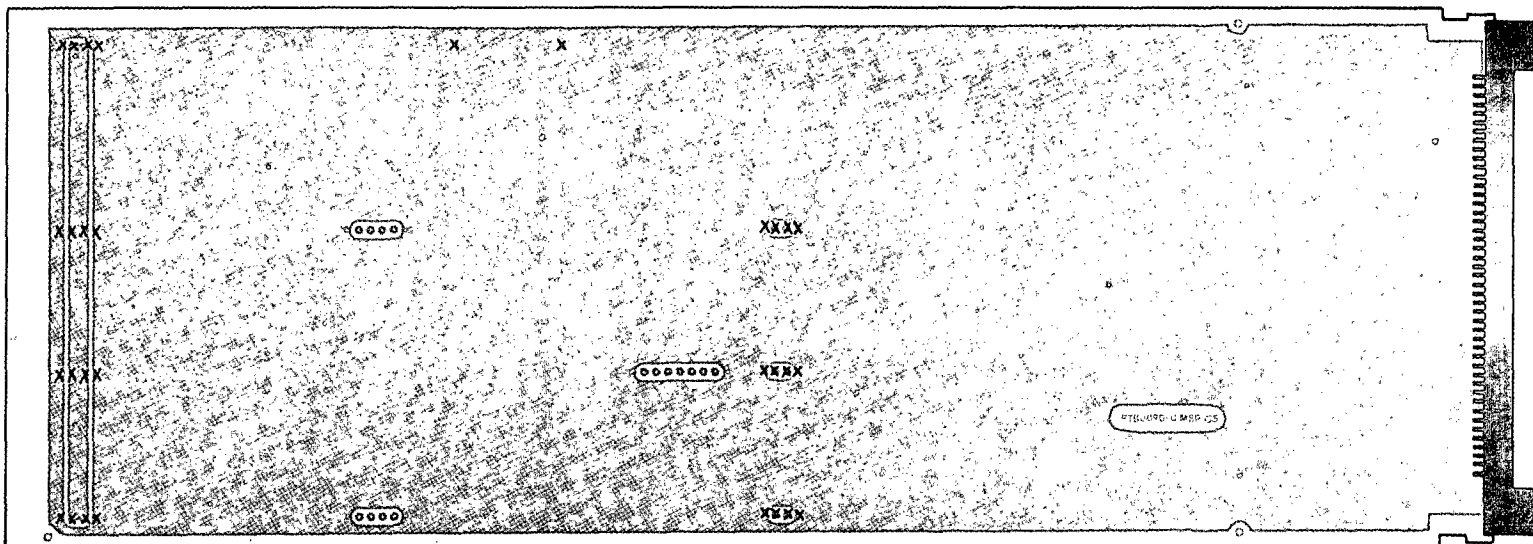
N01  
N02  
N04

AMP CONNECTOR 583464-1  
ONE REQUIRED

CONNECTORS  
AMPMODU NO-85931-5  
FIFTY-SIX REQUIRED

CIRCUIT BOARD  
PTF0091-2  
ONE REQUIRED

2	7-20-72	CORR REV LEVEL ON PC. BOARD
1	7-15-71	E C O. 0204
CHANGE NO	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST MERGE/RENDEZVOUS FACEPLATE MOTHERBOARD ASSEMBLY		
APPROVED		ENG. <i>11-20</i>
BY <i>Cem</i>	FOR MANUF	DATE 6/22/70
CHECKED <i>11-20</i>		DRAWN BY MBP
DATE 11-20		DATE 10-8-70
		DRAWING NO 209.3D2



NOTE: AMPMODU PINS MUST BE  
INSTALLED FROM THIS SIDE IN  
LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DWGS. 200.50D1  
AND 200.50D2  
(30 PINS)

NOTE: SEE DWG NUMBER  
200.50D27 FOR CONNECTOR  
MOUNTING ORIENTATION.

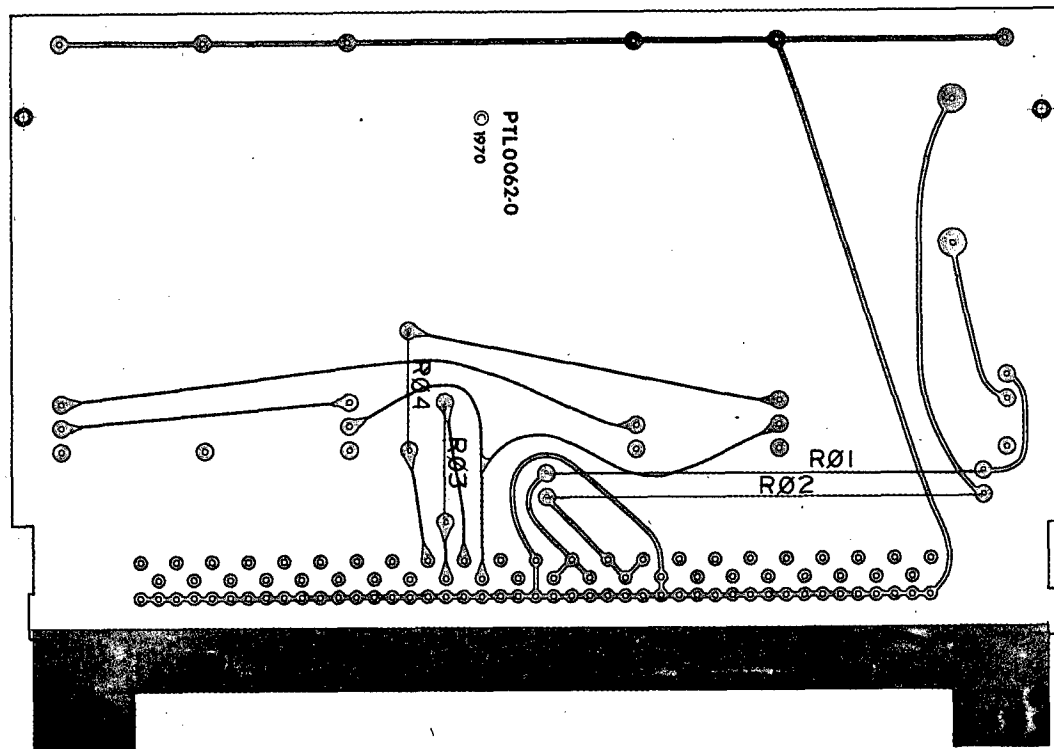
				<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE <b>COMPONENT IDENTIFICATION</b> MERGE/RENDEZVOUS BOTTOM MOTHERBOARD ASSEMBLY PART NO. 209.4					
						APPROVED BY FOR DATE CEM MANUF. 10/12/70 CEM MANUF. 7/18/71		ENG. DLS DRAWN BY PLL CHECKED NTK		DRAWING NO. 209.4D1	
1		10/5/70		REMOVED EXTRA AMPMODU PINS <i>CEM NTK</i>		<b>MACROMODULAR PROJECT</b>		DATE 6-23-70			
CHANGE NO.	DATE	DESCRIPTION									

CONNECTOR  
AMP 1-202 845-5  
ONE REQUIRED

CONNECTORS  
AMPMODU NO 85931-5  
THIRTY REQUIRED

CIRCUIT BOARD  
PTB0090-1  
ONE REQUIRED

2	7-15-71	E C O. 0204
1	10-5-70	CHANGED NO OF AMPMODU PINS
CHANGE NO	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST MERGE/RENDEZVOUS BOTTOM MOTHERBOARD ASSEMBLY PART NO 209.4		
APPROVED		ENG
BY	FOR	DATE
Cem	MANUF	6/22/70
CHECKED		DATE
HTR.		6/22/70
DRAWING NO		209.4D2



PTL00620  
© 1970

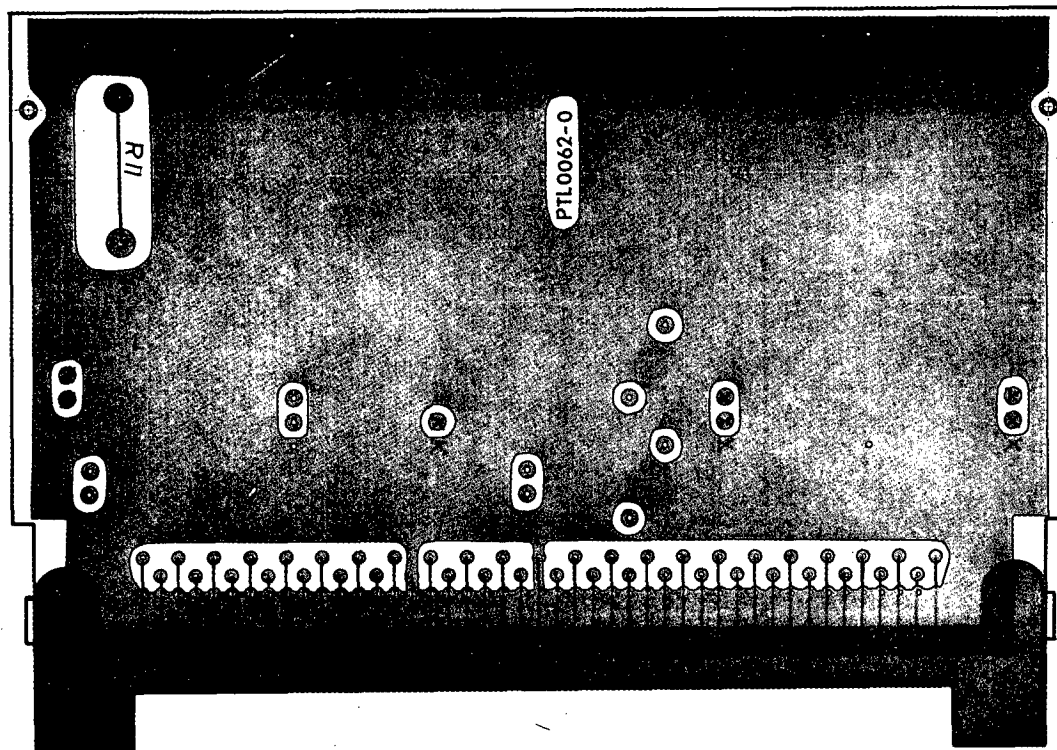
**COMPUTER SYSTEMS LABORATORY**  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

TITLE  
**COMPONENT IDENTIFICATION**  
MERGE/RENDEZVOUS LATERAL MOTHERBOARD ASSEMBLY  
PART NO. 209.5

APPROVED			ENG.	DRAWING NO.
BY	FOR	DATE	DLS	209.5D1
Cem	MANUF.	10/12/70	DRAWN BY PLL	
Cem	MANUF.	7/15/71	CHECKED TK	DATE 6/23/70

CHANGE NO.	DATE	DESCRIPTION



NOTE: MALE AMPMODU PINS MUST BE  
INSTALLED FROM THIS SIDE IN  
LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DRAWINGS 200.50D1  
AND 200.50D2.  
(15 PINS)

PLATED-THROUGH HOLES NOT  
CONTAINING COMPONENT LEADS  
SHALL BE KEPT FREE OF SOLDER.  
(8 HOLES)

SEE DRAWING NUMBER 200.50D28  
FOR CONNECTOR MOUNTING  
ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION	<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION MERGE/RENDEZVOUS LATERAL MOTHERBOARD ASSEMBLY COMPONENT SIDE			
					APPROVED		ENG. <b>REO</b>	DRAWING NO.
			BY <b>Cem</b>	FOR <b>MANUF.</b>	DATE <b>10/23/70</b>	DRAWN BY	209.5D2	
			<b>MACROMODULAR PROJECT</b>	CHECKED <b>NTK</b> DATE <b>10/10/70</b>				



CONNECTOR AMP 583 464-1  
ONE REQUIRED

CONNECTOR  
AMP MODU NO. 85931-5  
FIFTEEN REQUIRED

FUSE BUSSMAN GFA THREE-QUARTER AMP  
ONE REQUIRED  
R11

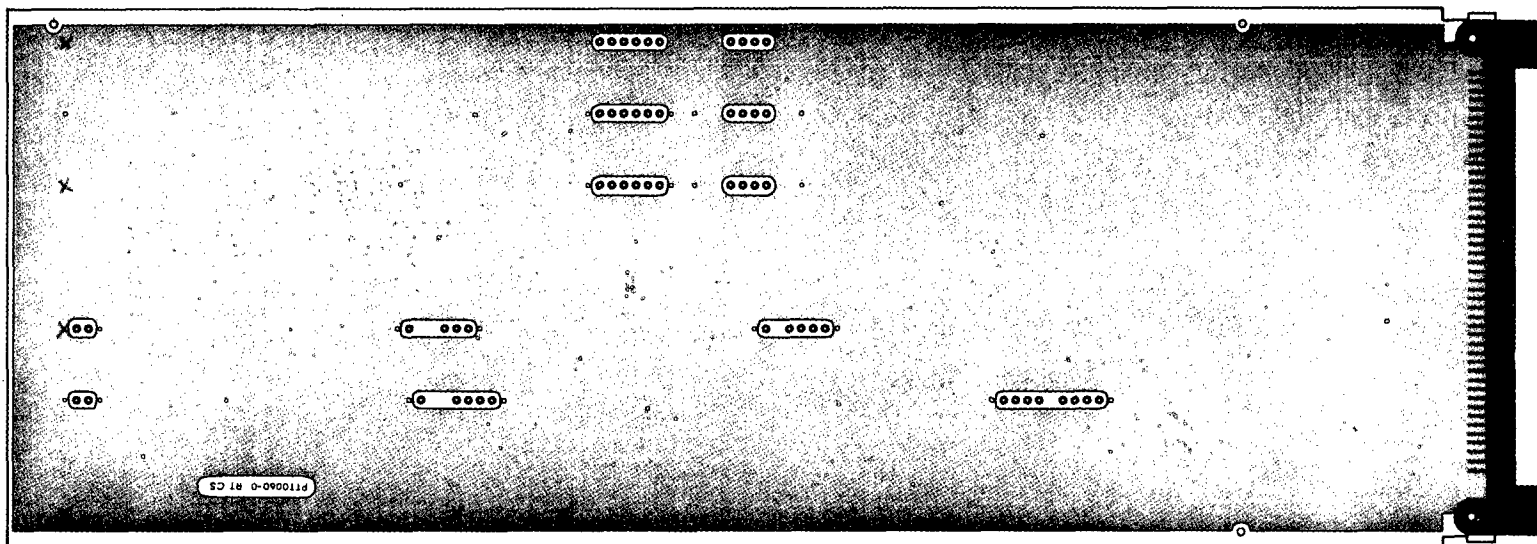
JUMPERS  
THREE REQUIRED  
R01  
R02  
R04

SENSE RESISTOR  
95.3K 1% FILM  
ONE REQUIRED  
R03

CIRCUIT BOARD  
PTL0062-1  
ONE REQUIRED

1	7-15-71	E.C.O. 0204	
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST MERGE/RENDEZVOUS LATERAL MOTHER BOARD ASSEMBLY			
APPROVED			ENGINEER
BY	FOR	DATE	DRAWING NO. 209.5D3
cam	MANUF.	5/15/70	
cam	MANUF.	7/15/71	DRAWN BY MBP
			CHECKED TRK
			DATE 10-9-70

NOTE: MALE AMPMODU PINS MUST BE  
INSTALLED FROM THIS SIDE IN  
LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DRAWINGS 200.50D1  
AND 200.50D2.  
(6 PINS)



NOTE: SEE DRAWING NUMBER  
200.50D26 FOR CONNECTOR  
MOUNTING ORIENTATION.

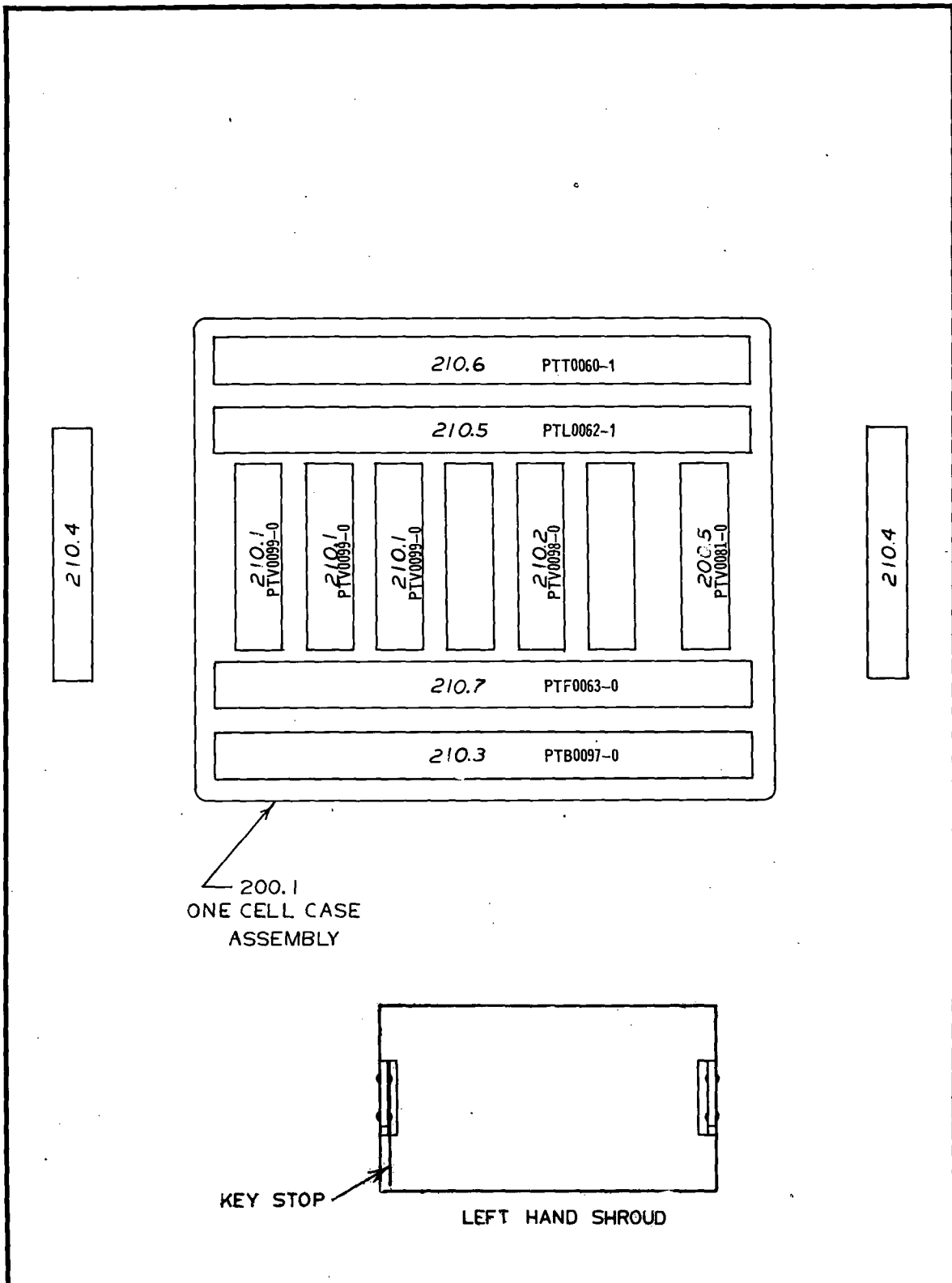
			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI	<b>COMPONENT IDENTIFICATION</b> MERGE/RENDEZVOUS TOP MOTHERBOARD ASSEMBLY				
CHANGE NO.	DATE	DESCRIPTION	<b>MACROMODULAR PROJECT</b>	APPROVED			ENG. <b>RED</b>	DRAWING NO. 209.601
				BY <b>CEM</b>	FOR <b>MANUF</b>	DATE <b>10/15/71</b>	DRAWN BY <b>CEM</b>	
						7/15/71	CHECKED <b>ARK</b>	DATE 10/5/70

CONNECTOR AMP 1-202845-5  
ONE REQUIRED

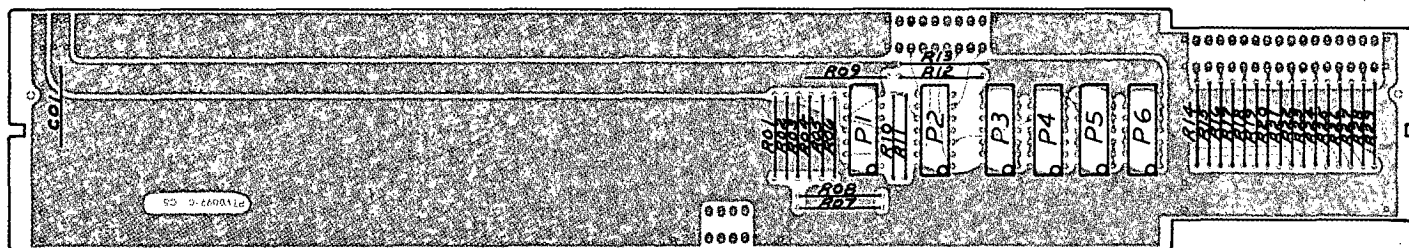
CONNECTOR  
AMPMODU NO. 85931-5  
SIX REQUIRED

CIRCUIT BOARD  
PTT0060-1  
ONE REQUIRED

1	7-15-71	E.C.O. 0204
CHANGE NO.	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST MERGE/RENDEZVOUS TOP MOTHER BOARD		
APPROVED		ENG
BY	FOR	DATE
Cem	MANUF.	10/19/70
DRAWN BY MBP		DRAWING NO. 209.6D2
CHECKED	DATE	
ATK	10-5-70	



			<b>MACROMODULAR PROJECT</b>			
3 7-27-71 E.C.O. 0217 <i>NTK</i> 2 11-24-70 ADD BOARD NOS. <i>NTK</i> 1 6-19-70 NO. CHANGE ON LMB.			TITLE ASSEMBLY SCHEMATIC & PARTS LIST DATA BRANCH PART NO. 210			
CHANGE NO.	DATE	DESCRIPTION	APPROVED		ENG	DRAWING NO.
			BY	FOR	DATE	
			<i>NTK</i>	<i>Docu</i>	<i>4-20</i>	WAC
					<i>11-27-70</i>	DRAWN BY
						PLL
						CHECKED
						NTK
COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI						DATE
						4-16-70



NOTE: INSTALL FEMALE AMPMODU  
CONNECTORS EXACTLY AS  
SHOWN ON DRAWING 200.50D2.

			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			<b>TITLE</b> COMPONENT IDENTIFICATION DATA BRANCH MODULE DATA BOARD PART NO. 210.1		
			<b>MACROMODULAR PROJECT</b>			APPROVED BY: <i>Cem</i> FOR: <i>MANUF</i> DATE: <i>23 Nov 70</i>		ENG. <i>REQ</i> DRAWN <i>PLL</i>
CHANGE NO.	DATE	DESCRIPTION				CHECKED <i>NTK</i>		DATE 6/23/70

# INTEGRATED CIRCUITS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
M01B	4	P3 P4 P5 P6
M10	1	P1
M20	1	P2

# CAPACITORS\*

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
10,000pf	1	C01

\*TYPE CK-103 SPRAGUE CERAMIC  
DISC, 50 WVDC

# RESISTORS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
R0	1	R13
R1	6	R04 R05 R06 R08 R09 R10
R3	6	R01 R02 R03 R07 R11 R12
R5	16	R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29

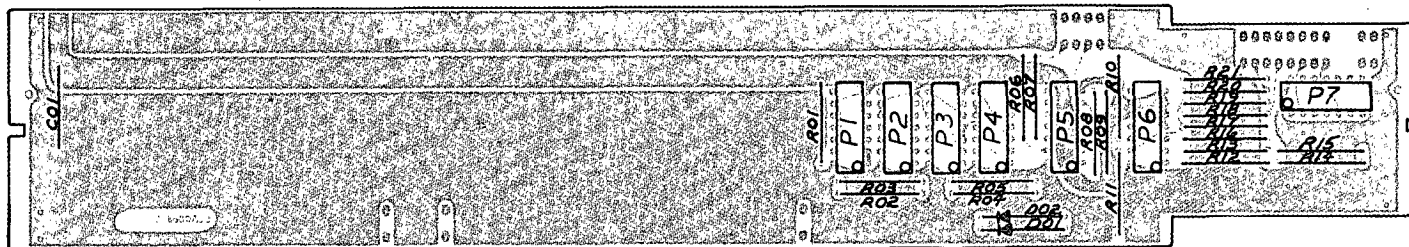
CONNECTORS  
AMPMODU NO. 85863-4  
41 REQUIRED

CIRCUIT BOARD  
PTV0099-0  
ONE REQUIRED

# NOTE:

R0 = JUMPERS  
R1 = 1.5K OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R5 = 57.6 OHM 1% FILM RESISTOR

CHANGE NO.		DATE	DESCRIPTION
<p align="center"><b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI</p>			
<p align="center"><b>MACROMODULAR PROJECT</b></p>			
<p>TITLE     PARTS LIST DATA BRANCH MODULE DATA BOARD PART NO. 210.1</p>			
APPROVED			ENG. REO
BY	FOR	DATE	DRAWING NO.
Chm	MANUF.	11/23/70	210.1D2
DRAWN BY			MBP
CHECKED			DATE
NIX			11-5-70



NOTE: INSTALL FEMALE AMPMODU  
CONNECTORS EXACTLY AS  
SHOWN ON DRAWING 200.50D2

			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		TITLE COMPONENT IDENTIFICATION DATA BRANCH MODULE CONTROL BOARD PART NO. 210.2			
					APPROVED BY: <i>CRM</i> FOR: <i>MANUF.</i> DATE: <i>23 Nov 70</i>			
1 1-7-71 E.C.O. 0142 <i>NTK</i>			<b>MACROMODULAR PROJECT</b>		ENG. <i>REO</i>		DRAWING NO. 210.2D1	
CHANGE NO. DATE DESCRIPTION					CHECKED <i>NTK</i>		DATE 6/25/70	

INTEGRATED CIRCUITS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
M01B	1	P6
M08	1	P4
M10	2	P1 P3
M12	1	P2
M20	1	P7
M35	1	P5

DIODE - 1N3604  
2 REQUIRED  
D01  
D02

CAPACITORS\*

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
10,000 pf	1	C01

\*SPRAGUE TYPE CK-103  
CERAMIC DISC

RESISTORS

<u>TYPE</u>	<u>REQUIRED</u>	<u>LOCATION</u>
R1	7	R04 R05 R10 R14 R15 R16 R17
R3	3	R11 R12 R13
R4	4	R01 R02 R03 R09
R5	6	R06 R07 R21 R20 R19 R18
R6	1	R08

CONNECTORS  
AMP MODU NO. 85863-4  
32 REQUIRED

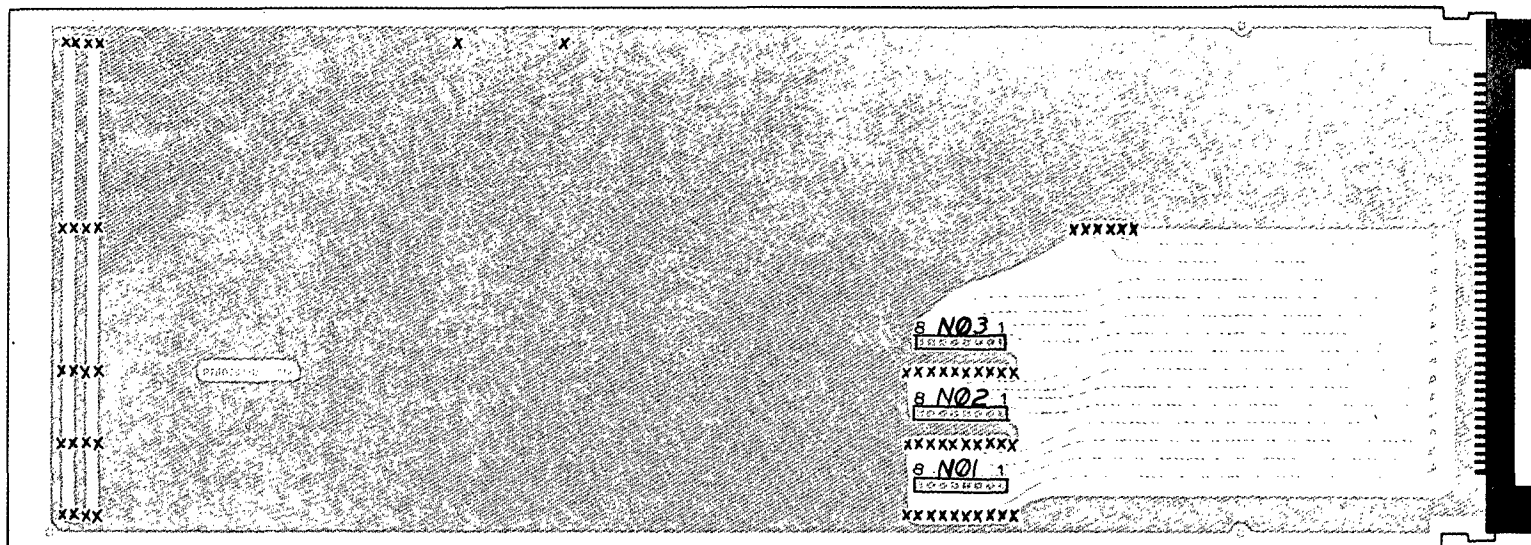
CIRCUIT BOARD  
PTV0098-0  
ONE REQUIRED

## NOTE:

R1 = 1.5K OHM 1% FILM RESISTOR  
R3 = 121 OHM 1% FILM RESISTOR  
R4 = 15K OHM 5% 1/4WATT CARBON COMP.  
R5 = 57.6 OHM 1% FILM RESISTOR  
R6 = 130 OHM 1% FILM RESISTOR

1	11-23-70	ADD INFO.	
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST DATA BRANCH MODULE-CONTROL BOARD PART NO. 210.2			
APPROVED		ENG.	DRAWING NO.
BY	FOR	DATE	
C	MANUF.	6/23/70	210.2D2
CHECKED		DATE	
		6/23/70	





NOTE: 1/SEE DRAWING NUMBER  
200.50D27 FOR CONNECTOR  
ORIENTATION.

NOTE: 2  
MALE AMP MODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED X  
PRECISELY AS SHOWN IN DRAWINGS 200.50D1  
AND 200.50D2.

			<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			TITLE COMPONENT IDENTIFICATION DATA BRANCH BOTTOM MOTHERBOARD PART NO. 210.3		
			<b>MACROMODULAR PROJECT</b>			APPROVED BY <i>COM</i> FOR <i>MANUE</i> DATE <i>23 Nov 70</i>		ENG REO DRAWN BY <i>PLI</i> CHECKED <i>MTK</i>
CHANGE NO.	DATE	DESCRIPTION						DATE 7/8/70

CONNECTOR AMP 1-202845-5  
ONE REQUIRED

CONNECTOR AMP MODU NO. 85931-5  
FIFTY-EIGHT REQUIRED

CIRCUIT BOARD  
PTB0097-0  
ONE REQUIRED

SPRAGUE NETWORK LTN-2  
THREE REQUIRED  
N01  
N02  
N03

CHANGE NO.	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST DATA BRANCH BOTTOM MOTHER BOARD PART NO. 210.3		
APPROVED		ENG. REO
BY	FOR	DATE
<i>CSM</i>	MANUF.	23 JUN 70
	CHECKED	DATE
	<i>HTK</i>	7/8/70

D  
A  
T  
A  
  
B  
R  
A  
N  
C  
H

METALCRAFT "AUTOGRAPH" OR EQUIVALENT:  
 BLANK SIZE: 1/4" X 2" SHEARED WITH  
 SQUARE CORNERS. WHITE LETTERS VOGUE  
 BOLD 12 POINT BOLD FACE TYPE CENTERED  
 TOP, BOTTOM AND SIDES WITH 6 POINT  
 SPACING BETWEEN LETTERS AND ONE  
 CHARACTER HEIGHT BETWEEN WORDS, ON  
 RED PMS 200 BACKING, MANUFACTURED FROM  
 .016 THICK ALUMINUM WITH SOLVENT  
 ACTIVATED PERMANENT ADHESIVE BACKING.

## COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

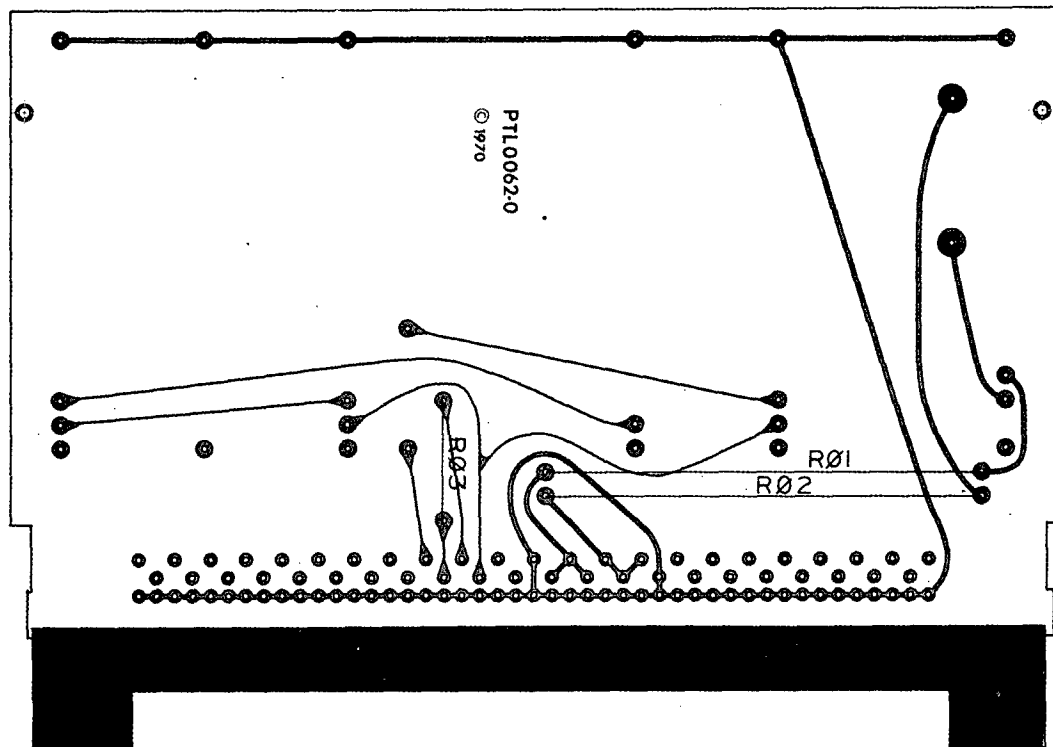
ST. LOUIS, MISSOURI

## MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL  
 DATA BRANCH MODULE  
 PART #210.4

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	NTK	
<i>Maw</i>	<i>Prod.</i>	<i>7/20/70</i>	DRAWN BY KM	210.4D
			CHECKED <i>Maw</i>	DATE 6-16-70



**COMPUTER SYSTEMS LABORATORY**  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

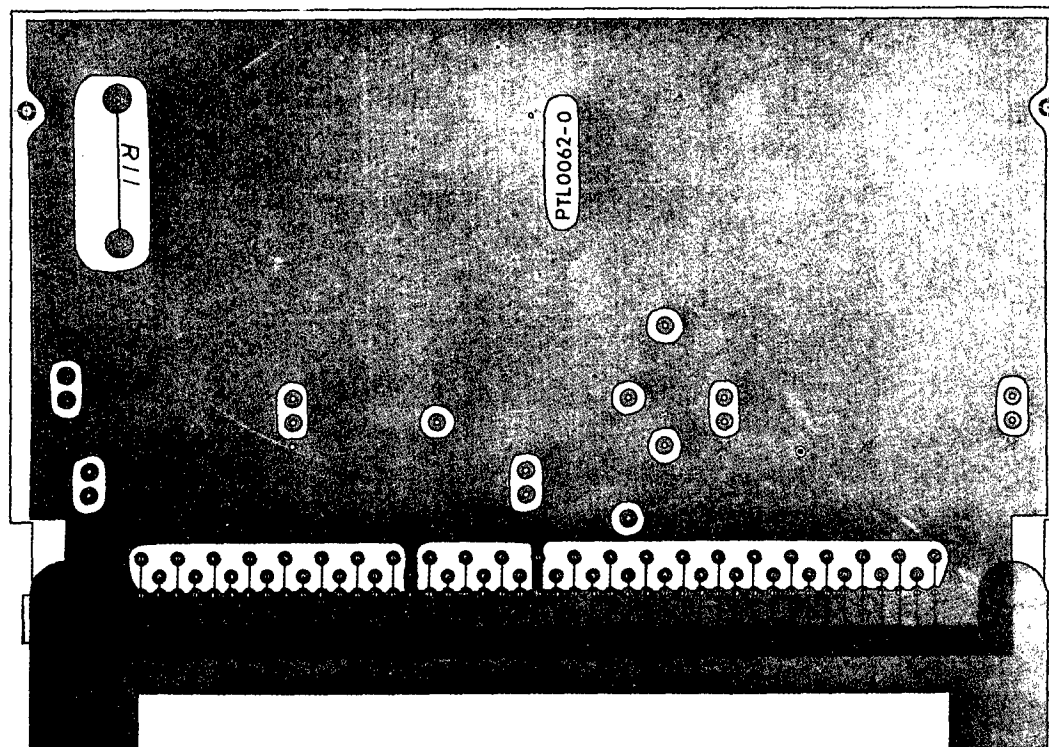
**MACROMODULAR PROJECT**

**COMPONENT IDENTIFICATION**  
**DATA BRANCH LATERAL MOTHERBOARD ASSEMBLY SIGNAL SIDE**  
**PART NO. 210.5**

APPROVED			ENG. REO	DRAWING NO. 210.5D1
BY	FOR	DATE	DRAWN BY PLL	
Cem	MANUF.	2-3 Nov 70	CHECKED HTR	DATE 6/23/70

CHANGE NO.	DATE	DESCRIPTION

NOTE:  
AMP MODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED  
X PRECISELY AS SHOWN IN DRAWINGS  
200.50D1 AND 200.50D2.



NOTE:  
SEE DRAWING NUMBER 200.50D28.  
FOR CONNECTOR ORIENTATION

1	11-6-70	E.C.O. 0076	<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		<b>TITLE</b> COMPONENT IDENTIFICATION DATA BRANCH LATERAL MOTHERBOARD ASSEMBLY COMPONENT SIDE PART NO. 210.5																	
			<b>MACROMODULAR PROJECT</b>		<table border="1"> <tr> <th colspan="3">APPROVED</th> </tr> <tr> <td>BY</td> <td>FOR</td> <td>DATE</td> </tr> <tr> <td>COM</td> <td>MANUF.</td> <td>210.5</td> </tr> </table>		APPROVED			BY	FOR	DATE	COM	MANUF.	210.5	<table border="1"> <tr> <td>ENG.</td> <td>REO</td> </tr> <tr> <td>DRAWN BY</td> <td>PLL</td> </tr> </table>		ENG.	REO	DRAWN BY	PLL	<table border="1"> <tr> <td>DRAWING NO.</td> <td>210.5D2</td> </tr> </table>
APPROVED																						
BY	FOR	DATE																				
COM	MANUF.	210.5																				
ENG.	REO																					
DRAWN BY	PLL																					
DRAWING NO.	210.5D2																					
CHANGE NO.	DATE	DESCRIPTION			<table border="1"> <tr> <td>CHECKED</td> <td>NTK</td> </tr> </table>		CHECKED	NTK	<table border="1"> <tr> <td>DATE</td> <td>4-17-70</td> </tr> </table>		DATE	4-17-70										
CHECKED	NTK																					
DATE	4-17-70																					

JUMPERS  
TWO REQUIRED  
R01  
R02

SENSE RESISTOR  
80.6K 1% FILM  
ONE REQUIRED  
R03

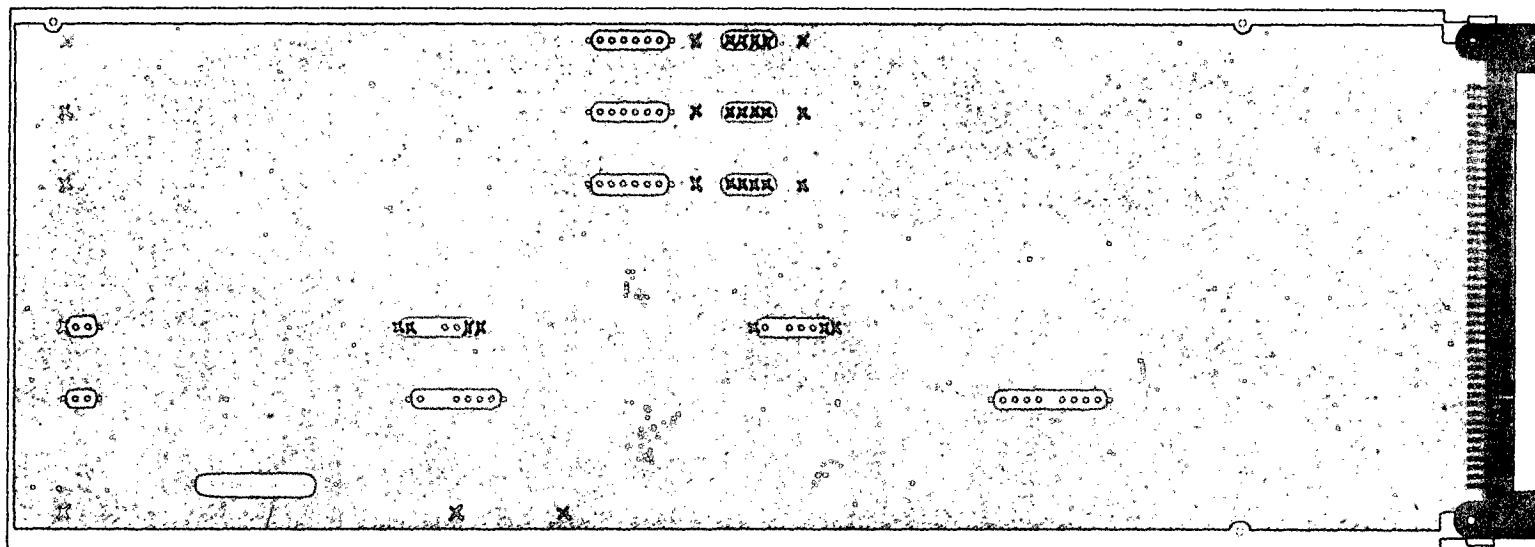
CONNECTOR AMP 583 464-1  
ONE REQUIRED

CONNECTOR  
AMPMODU NO. 85931-5  
TWELVE REQUIRED

FUSE  
BUSSMAN GFA 3/4A  
ONE REQUIRED  
R11

CIRCUIT BOARD  
PTL0062-1  
ONE REQUIRED

1	7-15-71	E.C.O. 0203	
CHANGE NO.	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST DATA BRANCH LATERAL MOTHERBOARD ASSEMBLY PART NO. 210.5			
APPROVED			ENG. REO
BY	FOR	DATE	DRAWING NO. 210.5D3
CCO	MAN	23 MAY 71	DRAWN BY MBP
CHECKED			DATE
W.H.			11-5-70



NOTE:2SEE DRAWING 200.50D26  
FOR CONNECTOR ORIENTATION

NOTE:1  
MALE AMP MODU PINS MUST BE INSTALLED  
FROM THIS SIDE IN LOCATIONS MARKED X  
PRECISELY AS SHOWN IN DRAWINGS 200.50D1  
AND 200.50D2.

**COMPUTER SYSTEMS LABORATORY**  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

TITLE  
**COMPONENT IDENTIFICATION  
DATA BRANCH TOP MOTHER BOARD ASSEMBLY  
PART NO. 210.6**

APPROVED			ENG <b>REO</b>	DRAWING NO. <b>210.6DI</b>
BY <b>Cam</b>	FOR <b>MANUF.</b>	DATE <b>23 NOV 70</b>	DRAWN BY <b>MBP</b>	
			CHECKED <b>NTK</b>	DATE <b>11-6-70</b>

CHANGE NO.	DATE	DESCRIPTION
---------------	------	-------------

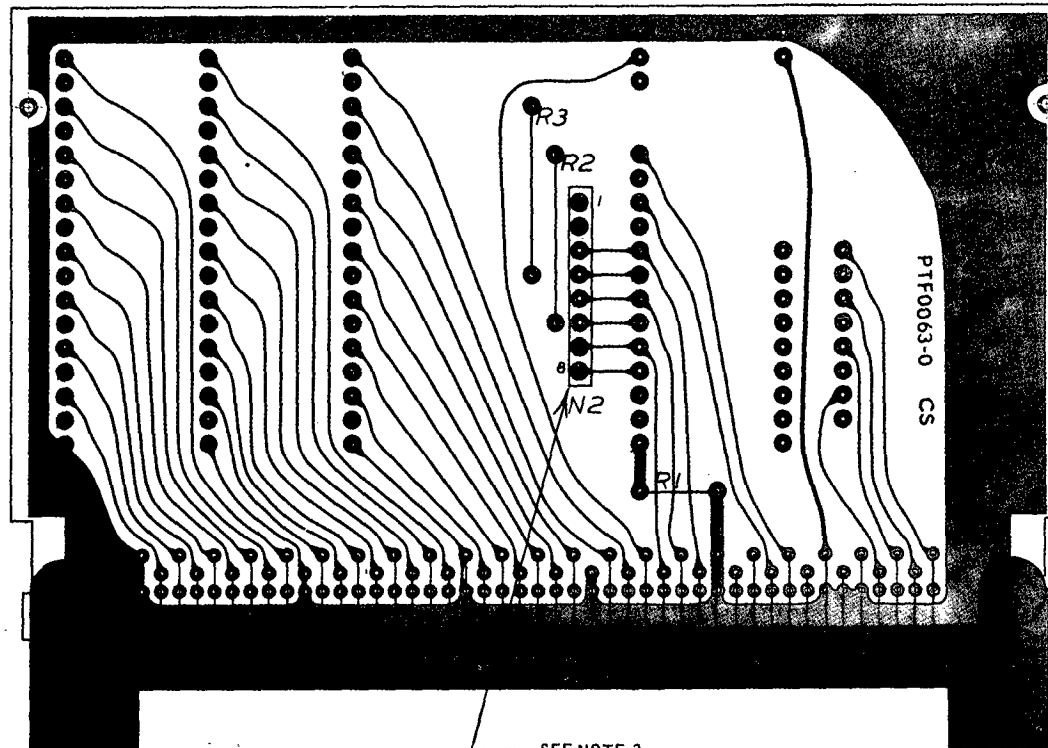
CONNECTOR AMP 1-202845-5  
ONE REQUIRED

CONNECTOR  
AMP MODU NO. 85931-5  
THIRTY TWO REQUIRED

CIRCUIT BOARD  
PTT0060- 1  
ONE REQUIRED

1	7-15-71	E.C.O. 0203
CHANGE NO.	DATE	DESCRIPTION
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		
<b>MACROMODULAR PROJECT</b>		
TITLE PARTS LIST DATA BRANCH TOP MOTHER BOARD ASSEMBLY PART NO. 210.6		
APPROVED		ENG. REO
BY	FOR	DATE
Cerna	MANUF.	25 NOV. 70
DRAWN BY MBP		DRAWING NO. 210.6D2
CHECKED	DATE	
WTR	11-5-70	





NOTE 1:  
MALE AMP MODU MUST BE  
INSTALLED FROM THIS SIDE IN  
LOCATIONS MARKED X PRECISELY  
AS SHOWN IN DRAWINGS 200.50D1  
AND 200.50D2.

NOTE 2:  
SEE DRAWING NUMBER 200.50D29  
FOR CONNECTOR ORIENTATION.

NOTE 3:  
ON SPRAGUE RESISTOR NETWORK  
IN POSITION N2, CLIP PINS 1, 2, 7  
AND 8.

SEE NOTE 3

**COMPUTER SYSTEMS LABORATORY**  
WASHINGTON UNIVERSITY  
ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

TITLE  
COMPONENT IDENTIFICATION  
DATA BRANCH FACEPLATE MOTHERBOARD ASSEMBLY  
PART NO. 210.7

APPROVED			ENG. REQ	DRAWING NO.
BY	FOR	DATE	DRAWN BY PLL	210.7DI
Cern	MANUF.	23 Jun 70		
			CHECKED NTR	DATE 4-17-70

CHANGE NO.	DATE	DESCRIPTION

JUMPER  
ONE REQUIRED  
R1

RESISTOR 15K OHM 1/4WATT 5% CARBON COMP.  
TWO REQUIRED  
R2  
R3

NETWORK LTN-2  
ONE REQUIRED (SEE NOTE)  
N2

CONNECTOR  
AMP 583 464-1  
ONE REQUIRED

CONNECTOR  
AMPMODU NO 85931-5  
SIXTY EIGHT REQUIRED

CIRCUIT BOARD  
PTF0063-1  
ONE REQUIRED

\*CLIP PINS 1, 2, 7 AND 8 BEFORE  
INSERTING IN BOARD.

1	7-20-72	CORR. REV. LEVEL ON PC BOARD	
CHANGE NO	DATE	DESCRIPTION	
<b>COMPUTER SYSTEMS LABORATORY</b> WASHINGTON UNIVERSITY ST LOUIS, MISSOURI			
<b>MACROMODULAR PROJECT</b>			
TITLE PARTS LIST DATA BRANCH FACEPLATE MOTHER BOARD ASSEMBLY PART NO 210.7			
APPROVED		ENG	DRAWING NO
BY	FOR	DATE	
CEM	MANUF	2344072	
		DRAWN BY MBP	210.7D2
		CHECKED	DATE
		11/11	11-5-70

UNCLASSIFIED

Security Classification

## DOCUMENT CONTROL DATA - R &amp; D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

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		2b. GROUP	
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13. ABSTRACT  Manufacturing documents, including parts lists, assembly pictorials, and adjustment procedures for the DECODE, LOAD, CALL, MERGE and DATA BRANCH macromodule electronic subassemblies are given.			

DD FORM 1473

REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED  
Security Classification

14.	KEY WORDS	LINK A		LINK B		LINK C	
		ROLE	WT	ROLE	WT	ROLE	WT
	DECODE Macromodule						
	LOAD Macromodule						
	CALL Macromodule						
	MERGE Macromodule						
	DATA BRANCH Macromodule						
	Macromodule						
	Emitter-Coupled Logic						
	Asynchronous Logic						

