2-1974

Macromodular Computer Design, Part 2, Volume 02, Electronic Package Assembly

Computer Systems Laboratory, Washington University

MACROMODULAR COMPUTER DESIGN PART 2 MANUFACTURING DESCRIPTION

VOLUME II

ELECTRONIC PACKAGE ASSEMBLY

Technical Report No. 31

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

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR COMPUTER DESIGN

FINAL REPORT - CONTRACT SD-302

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PART 2 - MANUFACTURING DESCRIPTION

VOL. II-ELECTRONICS PACKAGE ASSEMBLY

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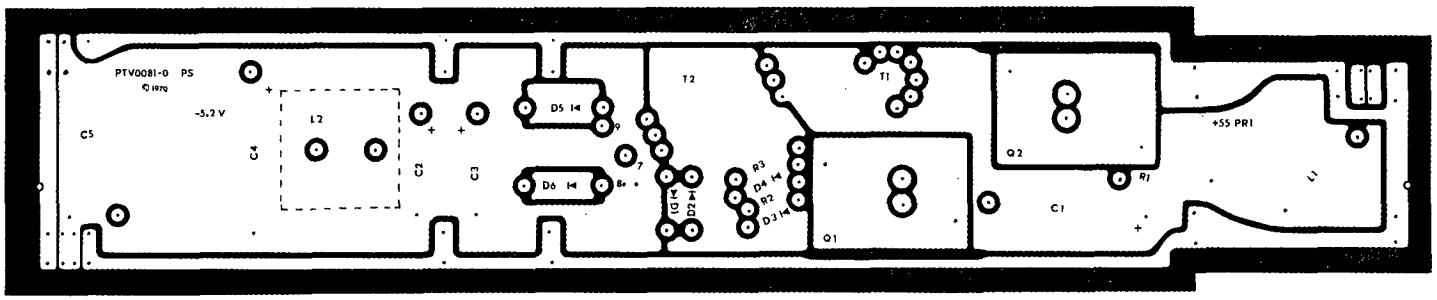
Computer Systems Laboratory
Washington University
St. Louis, Missouri

ABSTRACT

Manufacturing documents, including parts lists, assembly pictorials, and adjustment procedures for the LOGIC, ARITHMETIC, SHIFT, COMPARE and REGISTER macro-module electronic subassemblies are given.

INDEX



CHANGE NO.	DATE	DESCRIPTION
1	10-5-70	E.C.O. 0043 MTL

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
POWER SUPPLY BOARD ASSEMBLY

APPROVED BY	FOR	DATE
Cam	MANUF.	24SEP70
Cam	MANUF.	7/15/71

ENG. TJC
DRAWN BY PLC
CHECKED TJC

DRAWING NO. 200.5D1
DATE 9/23/70

TRANSFORMERS

TWO REQUIRED

TYPE	LOCATION
MPS-T1	T1
* MPS-T2	T2

INDUCTORS

TWO REQUIRED

TYPE	LOCATION
MPS-L1	L1
MPS-L2	L2

TRANSISTORS

TWO REQUIRED

TYPE	LOCATION
RCA 40374	Q1
	Q2

DIODES

SIX REQUIRED

TYPE	LOCATION
MOTOROLA MR810	D1
	D2
	D3
	D4
MOTOROLA SR1922A	D5
	D6

CAPACITORS

FIVE REQUIRED

TYPE	LOCATION
SPRAGUE ALUMINUM 600D 256 G060 DD4	C1
SPRAGUE TANTALUM 150D 475X 0050 B2	C2
	C3
SPRAGUE TANTALUM 150D 187X 0006 R2	C4
SPRAGUE DISC CERAMIC C080A 120 P474Y OR C052B100P474Z	C5

RESISTORS

5% CARBON COMP.

THREE REQUIRED

TYPE	LOCATION
13 K OHM ½ W	R1
75 OHM ¼ W	R2
	R3

CONNECTORS

17 REQUIRED

AMPMODU 85863-4

PRINTED CIRCUIT BOARD

ONE REQUIRED

PTV 0081-0

NOTE:

MPS-T2-78 USED IN FOLLOWING MODULES:

- LOGIC
- ADDITION
- SHIFT
- COMPARE
- DECODE

MPS-T2-79 USED IN FOLLOWING MODULES:

- REGISTER
- LOAD
- FUNCTION CALLER

MPS-T2-81 USED IN FOLLOWING MODULES:

- CALL
- MERGE/RENDEZVOUS
- DATA BRANCH
- INTERLOCK

CHANGE NO.	DATE	DESCRIPTION
5	2-9-73	E.C.O. 0284
4	11-15-72	E.C.O. 0275
3	7-28-71	E.C.O. 0219
2	4-20-71	E.C.O. 0172
1	10-5-70	E.C.O. 0043

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
POWER SUPPLY BOARD

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
Cem	MANUF.	24SEP70	TJC	200.5D2
			DRAWN BY CDG	
			CHECKED TJC	DATE 9/23/70

PSS-1

COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

INDUCTOR DESCRIPTION AND SPECIFICATION

Part Number MPS-L1

200.5D2A

Inductor Description:

The inductor is a single layer coil of 35 ±1 turns of number 24 magnet wire wound on a *Magnetics Incorporated permalloy power toroidal core number 55118-A2. The magnet wire is insulated with polyurethane (sodereze or equal) for 90°C operation.

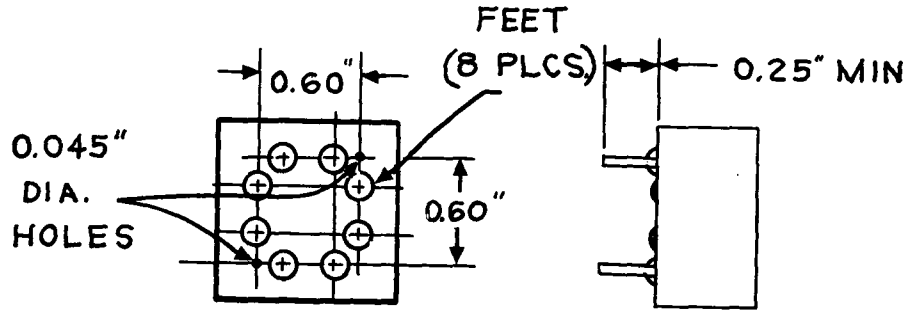
The wound inductor is potted in a **Milton Ross shell 50071 and header 60200 with Scotcheast number 222 polyurethane resin. The two leads of the wound inductor extend through the header as shown in the figure. The leads extend through the header a minimum of 0.25 inches and, beginning at a distance of 0.05 inch from the package, are tinned.

The characters "MPS-L1" in white at least 0.1 inch high appear on the top of the package.

Finished Inductor Specifications:

I. Identification: The characters "MPS-L1" in white at least 0.1 inch high will appear on the top of the inductor package and shall remain readable after hard rubbing with thumb.

II. Inductance: The inductance of the inductor shall be Lp>100μhy and Q>8 when measured on a General Radio type 1650-A impedance bridge. The bridge controls are set to: OSC LEVEL control adjusted for maximum output; the function switch to INT 1 KC; the CRL SELECTOR to Lp; and the CRL MULTIPLIER to 100μH.



BOTTOM VIEW

*Magnetics Incorporated
Butler, Pa. 16001

**Milton Ross Company
511 Second Street Pike Box 158
Southampton, Pa. 18966

PSS-2

COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

INDUCTOR DESCRIPTION AND SPECIFICATION

Part Number MPS-L2

200.5D2C

Inductor Description:

The inductor is a single layer coil of 20 ±1 turns of number 20 magnet wire wound on a *Magnetics Incorporated permalloy power toroidal core number 55118-A2. The magnet wire is insulated with polyurethane (sodereze or equal) for 90°C operation.

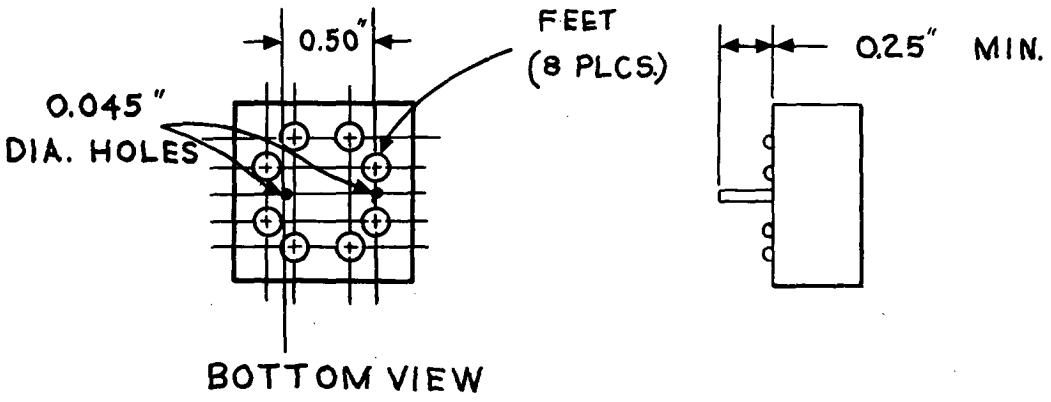
The wound inductor is potted in a **Milton Ross shell 50071 and header 60200 with Scotcheast number 222 polyurethane resin. The two leads of the wound inductor extend through the header as shown in the figure. The leads extend through the header a minimum of 0.25 inches and, beginning at a distance of 0.05 inch from the package, are tinned.

The characters "MPS-L2" in white, at least 0.1 inch high, appear on the top of the package.

Finished Inductor Specifications:

I. Identification: The characters "MPS-L2" in white at least 0.1 inch high will appear on the top of the inductor package and shall remain readable after hard rubbing with thumb.

II. Inductance: The inductance of the inductor shall be Lp>30μhy and Q>8 when measured on a General Radio type 1650-A impedance bridge. The bridge controls are set to: OSC LEVEL control adjusted for maximum output; the function switch to INT 1 KC; the CRL SELECTOR to Lp; and the CRL MULTIPLIER to 100μH.



*Magnetics Incorporated
Butler, Pa. 16001

**Milton Ross Company
511 South Street Pike Box 158
Southampton, Pa. 18966

PSS-3

COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

TIMING TRANSFORMER DESCRIPTION AND SPECIFICATION

Part Number MPS-T1

200.5D2E

Transformer Description:

The transformer core is an *Indiana General toroidal ferrite core number CF-102-C2 that has been coated with paint to reduce scratching of the wire wound on the core. Windings T1 and T2 of Figure 1 form an 16 turn bifilar winding of number 30 copper wire which is uniformly distributed around core. Windings T3 and T4 form a second bifilar winding of 3 turns of number 30 copper wire which is uniformly distributed around the core. The copper wire insulation will be polyurethane-nylon cover coat (Nyleze or better for 125°C operation).

The wound transformer is installed in a **Epoxy Products Company shell 173-02-10-43A and header 068-02-10-43A. Two of the 9 pins in the header 068-02-10-43A are cut off above and below the header per Figure 2. A piece of number 3 mylar tape or equivalent is placed over the cut pins to protect the transformer windings from scratches. The transformer leads are soldered to the header pins per Figures 1 and 3. The pin numbers used in Figure 3 are the same as the lead numbers of Figure 1. The assembled transformer is filled with Scotcheast number 212 red potting compound.

A sample of 5 Indiana General cores from each shipment received by the vendor shall be forwarded to the Computer Components Laboratory for tests before the transformers are assembled.

Finished Transformer Specifications:

I. Identification: The characters "MPS-T1" at least 0.1 inches high will appear on the transformer and shall remain readable after hard rubbing with thumb.

II. Turns: The number of turns on each winding must be exact:

a. T1 = 16 turns
b. T2 = 16 turns
c. T3 = 3 turns
d. T4 = 3 turns

*Indiana General
Electronics Div/Ferrites
Keasbey, New Jersey

**Epoxy Products Company
Div of Allied Products Corp
119 Coit Street
Irvington, New Jersey

III. High Voltage Breakdown: Less than 0.1 milliampere shall flow when 200 V_{RMS} AC is applied for one minute across:

a. pins 1, 2 and 3 shorted together and pins 4 and 5 shorted together.

b. pins 1, 2 and 3 shorted together and pins 6 and 7 shorted together.

c. pins 4 and 5 shorted together and pins 6 and 7 shorted together.

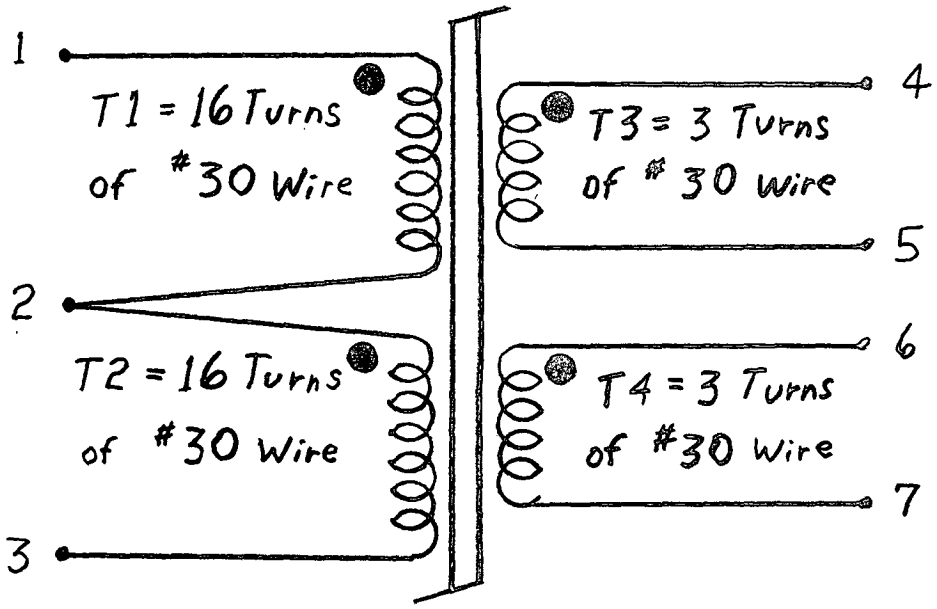


Figure 1

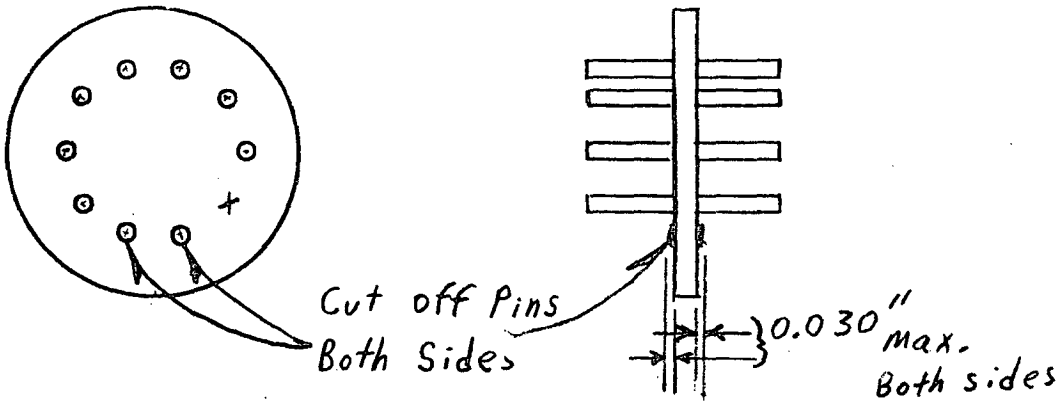


Figure 2

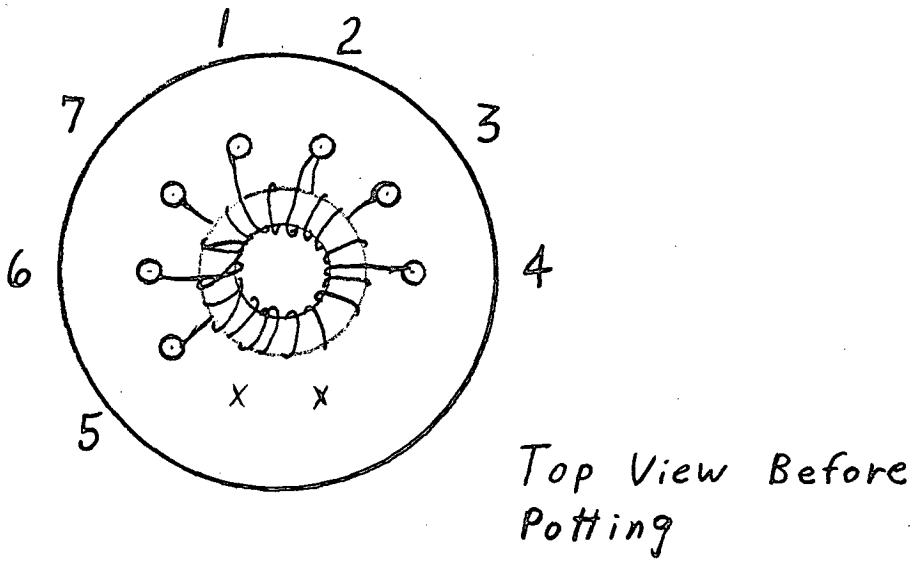


Figure 3

PSS-4

COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

POWER TRANSFORMER DESCRIPTION AND SPECIFICATION

Part Number MPS-T2-78

200.5D2I

Transformer Description:

The coil form is a *Ferroxcube type number 2616PCB1 printed circuit bobbin.

Windings T1 and T2 are first wound on the bobbin as a 78 turn bifilar winding of number 30 copper wire uniformly covering the length of the bobbin. Next, windings T3 and T4 are wound on the bobbin as a 6 turn bifilar winding of number 30 copper wire. A single layer of tape (Mylar or equivalent) less than 0.007 inch thick is then placed over the windings. Windings T5 and T6 are then wound on the bobbin as a 9 turn bifilar winding of number 20 copper wire. The wire insulation shall be polyurethane nylon overcoat (Nyleze) or better for 120°C operation.

Windings T1, T2, T3 and T4 are connected to the bobbins' pins as shown in Figures 1 and 2. The ends of windings T5 and T6 extend out the side shown in Figure 2 and are 0.7 to 1.0 inch long. Wires 8A and 8B must be identified together. Wires 7 and 9 need not be individually identified.

The wound bobbin is then placed inside two *Ferroxcube number 2616P-L00-3B7 flat ground half-pot cores. The cores are then cemented together, with the center posts of the cores aligned, using Biggs R-312 epoxy cement. The two slits in the side of the transformer are both completely filled with a rigid epoxy such as **Mista Pox 103. The completed transformer is then sprayed with a light coat of clear varnish.

Finished Transformer Specifications:

I. Identification: The characters "MPS-T2-78" at least 0.1 inches high will appear on the transformer and shall remain readable after hard rubbing with thumb.

*Ferroxcube Corporation
Saugerties, New York

**M and R Plastics and Coatings, Inc.
11460 Dorsett Road
Maryland Heights, Mo. 63042

II. Turns: The number of turns on each winding must be exact:

a. T1 = 78 turns

b. T2 = 78 turns

c. T3 = 6 turns

d. T4 = 6 turns

e. T5 = 9 turns

f. T6 = 9 turns

III. Inductance: The inductance between pins 1 and 2 shall be Lp>16mhy and Q>15 with all other windings open circuited when measured on a General Radio type 1650-A impedance bridge. The bridge controls are set to: OSC LEVEL control adjusted for maximum output; the function switch to INT 1 KC; the CRL SELECTOR to Lp; and the CRL MULTIPLIER to 10 mH.

IV. High Voltage Breakdown: Less than 0.1 milliampere shall flow when 200 V_{RMS} AC is applied for one minute across pins 1, 2 and 3 shorted together and pins 4, 5 and 6 shorted together.

Less than 0.1 milliampere shall flow when 500 V_{RMS} AC is applied for one minute across:

a. pins 1, 2, 3, 4, 5 and 6 shorted together and wires 7, 8A, 8B and 9 shorted together.

b. pins 1, 2, 3, 4, 5 and 6 with wires,7, 8A, 8B and 9 all shorted together and the core.

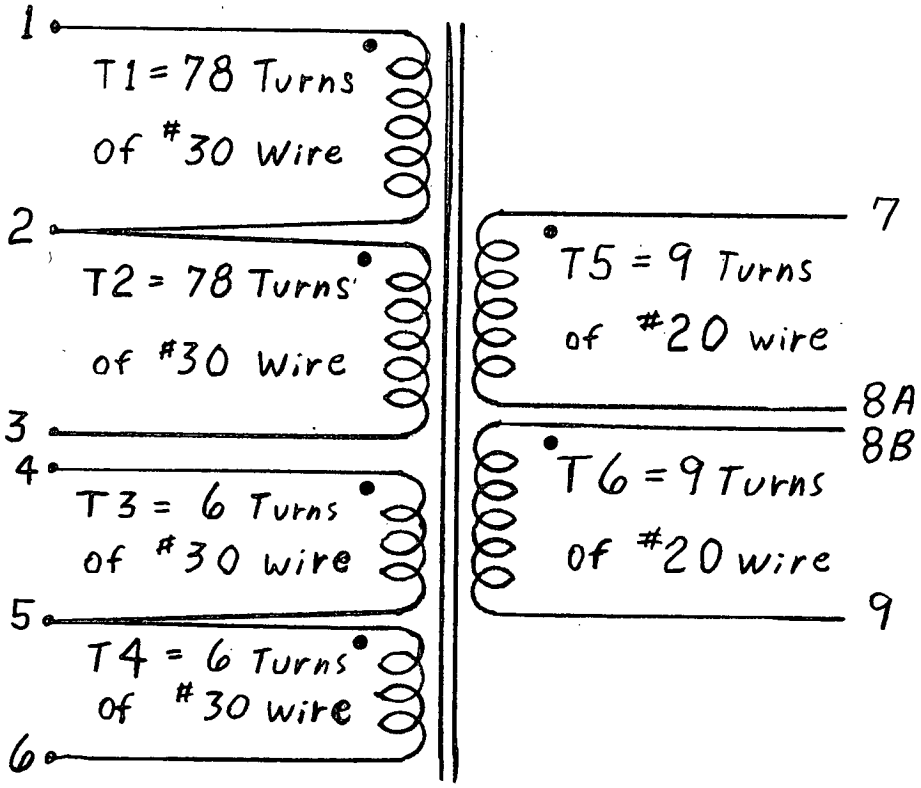


Figure 1

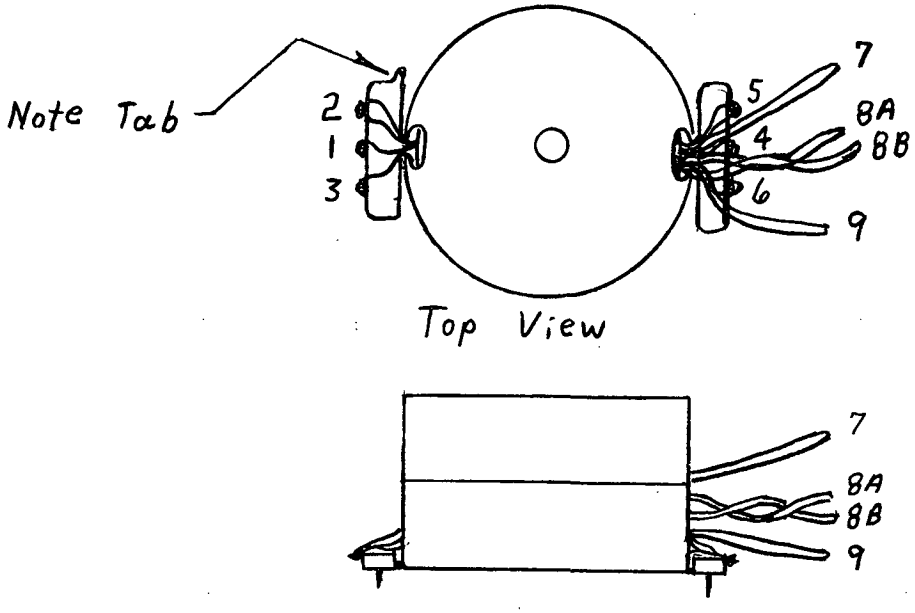


Figure 2

PSS-5

COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

POWER TRANSFORMER DESCRIPTION AND SPECIFICATION

Part Number MPS-T2-79

200.5D2M

Transformer Description:

The coil form is a *Ferroxcube type number 2616PCB1 printed circuit bobbin. Windings T1 and T2 are first wound on the bobbin as a 79 turn bifilar winding of number 30 copper wire uniformly covering the length of the bobbin. Next, windings T3 and T4 are wound on the bobbin as a 6 turn bifilar winding of number 30 copper wire. A single layer of tape (Mylar or equivalent) less than 0.007 inch thick is then placed over the windings. Windings T5 and T6 are then wound on the bobbin as a 9 turn bifilar winding of number 20 copper wire. The wire insulation shall be polyurethane nylon overcoat (Nyleze) or better for 120°C operation.

Windings T1, T2, T3 and T4 are connected to the bobbins' pins as shown in Figures 1 and 2. The ends of windings T5 and T6 extend out the side shown in Figure 2 and are 0.7 to 1.0 inch long. Wires 8A and 8B must be identified together. Wires 7 and 9 need not be individually identified.

The wound bobbin is then placed inside two *Ferroxcube number 2616P-L00-3B7 flat ground half-pot cores. The cores are then cemented together, with the center posts of the cores aligned, using Biggs R-312 epoxy cement. The two slits in the side of the transformer are both completely filled with a rigid epoxy such as **Mista Pox 103. The completed transformer is then sprayed with a light coat of clear varnish.

Finished Transformer Specifications:

I. Identification: The characters "MPS-T2-79" at least 0.1 inches high will appear on the transformer and shall remain readable after hard rubbing with thumb. The style "9" used shall be easily distinguished from an "8".

*Ferroxcube Corporation
Saugerties, New York

**M and R Plastics and Coatings, Inc.
11460 Dorsett Road
Maryland Heights, Mo. 63042

II. Turns: The number of turns on each winding must be exact:

a. T1 = 79 turns

b. T2 = 79 turns

c. T3 = 6 turns

d. T4 = 6 turns

e. T5 = 9 turns

f. T6 = 9 turns

III. Inductance: The inductance between pins 1 and 2 shall be Lp>16mhy and Q>15 with all other windings open circuited when measured on a General Radio type 1650-A impedance bridge. The bridge controls are set to: OSC LEVEL control adjusted for maximum output; the function switch to INT 1 KC; the CRL SELECTOR to Lp; and the CRL MULTIPLIER to 10 mH.

IV. High Voltage Breakdown: Less than 0.1 milliampere shall flow when 200 V_{RMS} AC is applied for one minute across pins 1, 2 and 3 shorted together and pins 4, 5 and 6 shorted together.

Less than 0.1 milliampere shall flow when 500 V_{RMS} AC is applied for one minute across:

a. pins 1, 2, 3, 4, 5 and 6 shorted together and wires 7, 8A, 8B and 9 shorted together.

b. pins 1, 2, 3, 4, 5 and 6 with wires 7, 8A, 8B and 9 all shorted together and the core.

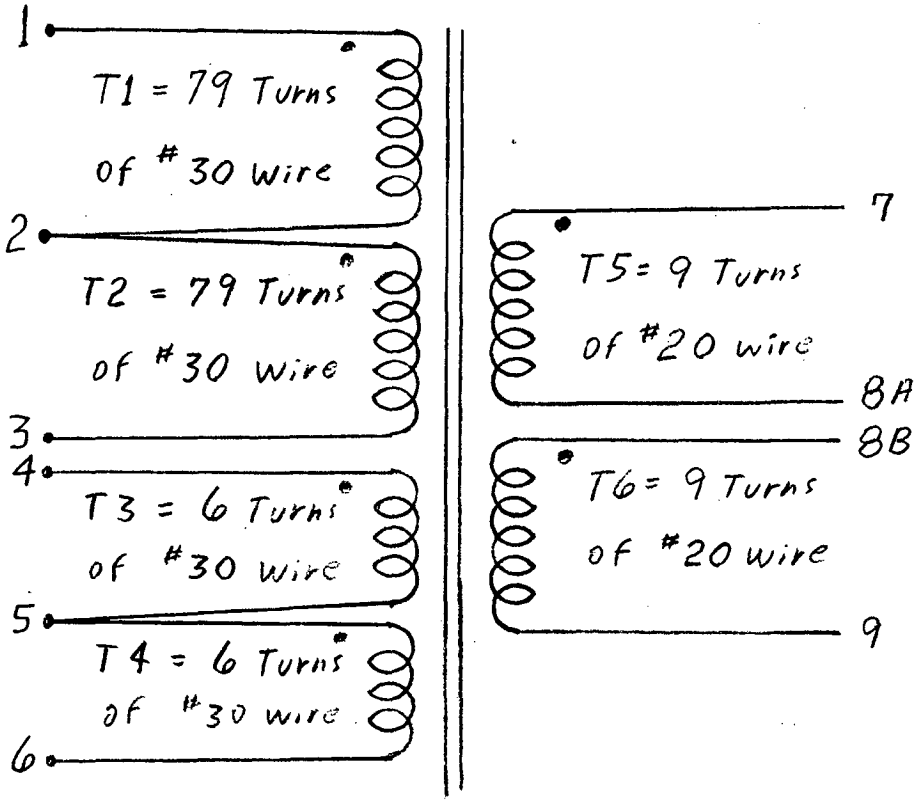


Figure 1

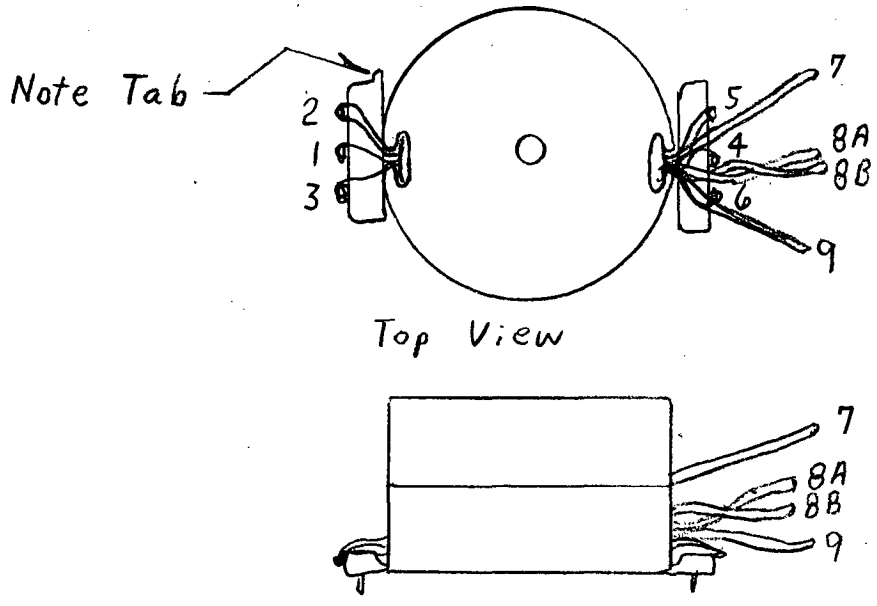


Figure 2

200.5D2P

PSS-8

COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

POWER TRANSFORMER DESCRIPTION AND SPECIFICATION

Part Number MPS-T2-81

200.5D2Q

Transformer Description:

The coil form is a *Ferroxcube type number 2616PCB1 printed circuit bobbin. Windings T1 and T2 are first wound on the bobbin as an 81 turn bifilar winding of number 30 copper wire uniformly covering the length of the bobbin. Next, windings T3 and T4 are wound on the bobbin as a 6 turn bifilar winding of number 30 copper wire. A single layer of mylar tape 0.003 to 0.007 inch thick is then placed over the windings. Windings T5 and T6 are then wound on the bobbin as a 9 turn bifilar winding of number 22 copper wire. The wire insulation shall be polyurethane nylon overcoat (Nyleze) for 120°C operation.

Windings T1, T2, T3, and T4 are connected to the bobbins' pins as shown in Figures 1 and 2. The ends of windings T5 and T6 extend out the side shown in Figure 2 and are 0.7 to 1.0 inch long. Wires 8A and 8B must be identified together. Wires 7 and 9 need not be individually identified.

The wound bobbin is then placed inside two *Ferroxcube number 2616-L00-3B7 flat ground half-pot cores. The cores are then cemented together, with the center posts of the cores aligned, using Biggs R-312 epoxy cement. The two slits in the side of the transformer are both completely filled with a rigid epoxy such as **Mista Pox 103. The completed transformer is then sprayed with a light coat of clear varnish.

Finished Transformer Specifications:

I. Identification: The characters "MPS-T2-81" at least 0.1 inches high will appear on the transformer and shall remain readable after hard rubbing with thumb. The style "8" used shall be easily distinguished from a "9".

*Ferroxcube Corporation
Saugerties, New York

**M and R Plastics and Coatings, Inc.
11460 Dorsett Road
Maryland Heights, Mo. 63042

II. Turns: The number of turns on each winding must be exact:

a. T1 = 81 turns

b. T2 = 81 turns

c. T3 = 6 turns

d. T4 = 6 turns

e. T5 = 9 turns

f. T6 = 9 turns

III. Inductance: The inductance between pins 1 and 2 shall be Lp>16mhy and Q>15 with all other windings open circuited when measured on a General Radio type 1650-A impedance bridge. The bridge controls are set to: OSC LEVEL control adjusted for maximum output; the function switch to INT 1 KC; the CRL SELECTOR to Lp; and the CRL MULTIPLIER to 10 mH.

IV. High Voltage Breakdown: Less than 0.1 milliampere shall flow when 200 V_{RMS} AC is applied for one minute across pins 1, 2 and 3 shorted together and pins 4, 5 and 6 shorted together.

Less than 0.1 milliampere shall flow when 500 V_{RMS} AC is applied for one minute across:

a. pins 1, 2, 3, 4, 5 and 6 shorted together and wires 7, 8A, 8B and 9 shorted together.

b. pins 1, 2, 3, 4, 5 and 6 with wires 7, 8A, 8B and 9 all shorted together and the core.

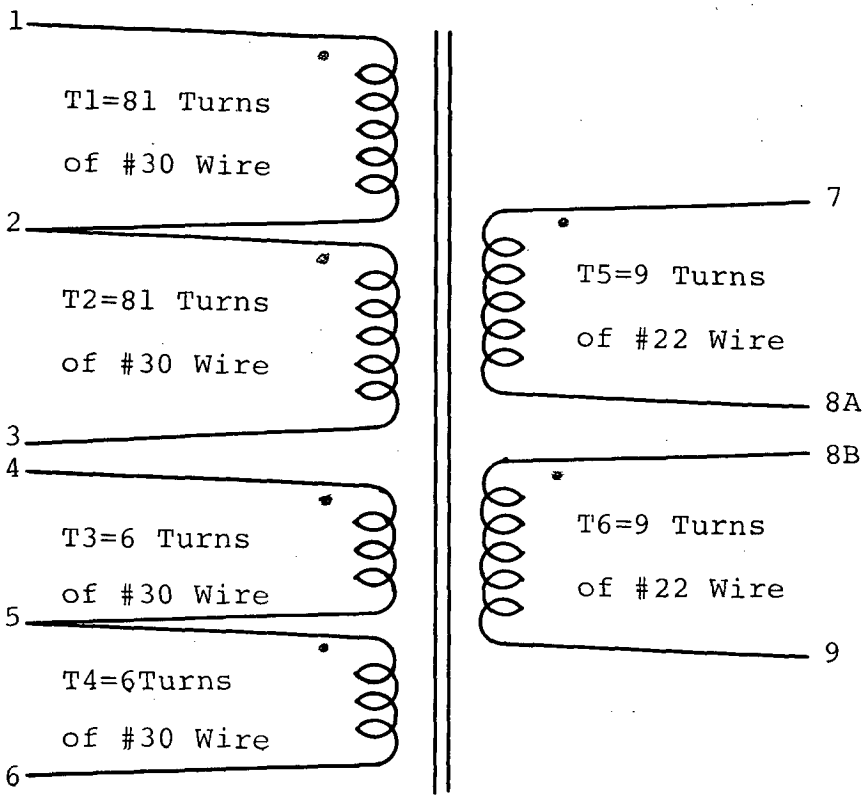


Figure 1

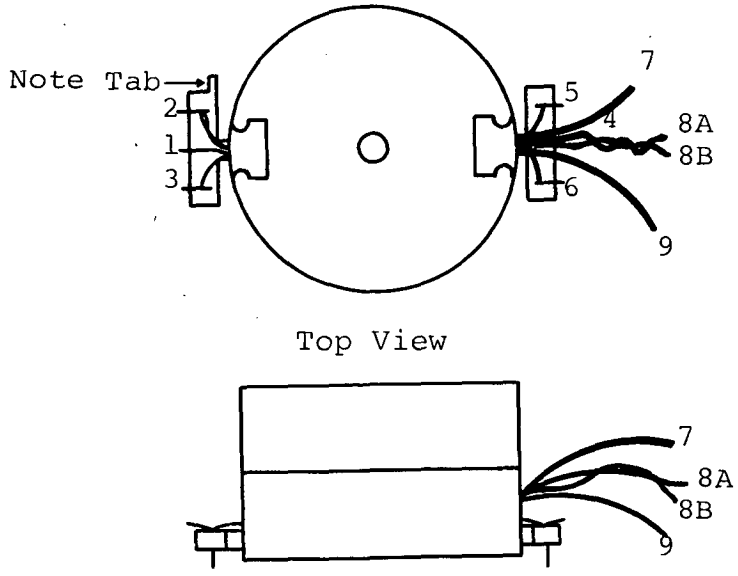
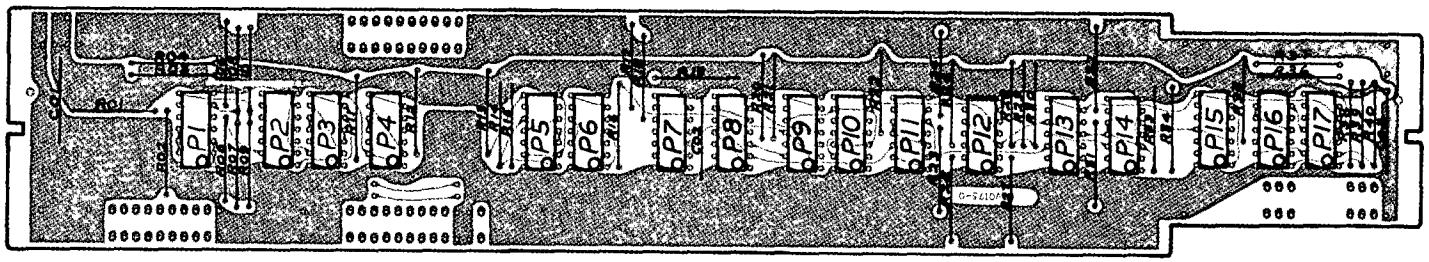


Figure 2

200.5D2T

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



CHANGE NO.	DATE	DESCRIPTION
1	3-27-72	E.C.O. 0258 MTK

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
TRANSFER CONTROL BOARD
PART NO. 200.9

APPROVED BY	FOR	DATE
Cam	MANUF.	7/26/71

ENG. REO
DRAWN BY DHO
CHECKED MTK

DRAWING NO. 200.9D1
DATE 7-24-71

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M04	2	P1
		P7
M08	1	P16
M10	8	P3
		P4
		P5
		P6
		P8
		P10
		P15
		P17
M11	2	P11
		P14
M16	1	P2
M30	1	P12
M31	2	P9
		P13

CAPACITORS

TYPE	REQUIRED	LOCATION
10,000pf	3	C01
		C02
		C03

RESISTORS

TYPE	REQUIRED	LOCATION
R0	1	R18
R1	17	R01
		R04
		R06
		R08
		R10
		R19
		R21
		R22
		R24
		R26
		R29
		R30
		R31
		R33
		R36
		R39
		R40
R3	19	R02
		R03
		R05
		R07
		R09
		R11
		R12
		R13
		R16
		R17
		R20
		R23
		R25
		R27
		R28
		R32
		R34
		R37
		R38
R4	3	R14
		R15
		R35

CIRCUIT BOARD
PTV0125-0
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85863-4
FIFTY ONE REQUIRED

NOTE

R0 = JUMPERS ZERO OHM
R1 = 1.5K OHM 1% FILM RESISTOR
R3 = 121 OHMS 1% FILM RESISTOR
R4 = 15K OHMS 5% CARBON COMP.

CHANGE NO.	DATE	DESCRIPTION

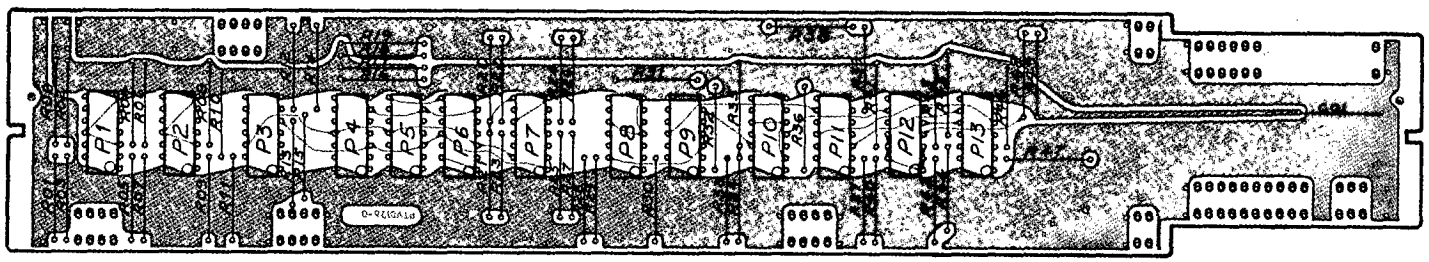
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
TRANSFER CONTROL BOARD
PART NO. 200.9

APPROVED BY	FOR	DATE	ENG. REO	DRAWING NO. 200.9D2
			DRAWN BY MBP	
			CHECKED	DATE 7-15-71

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



CHANGE NO.	DATE	DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
MODE CONTROL BOARD
PART NO. 200.13

APPROVED BY	FOR	DATE
Cerm	MANUF.	7-28-71

ENG. REO
DRAWN BY PLL
CHECKED MTK

DRAWING NO. 200.13D1
DATE 7-27-71

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01	2	P8 P11
M01B	1	P9
M04B	3	P1 P2 P12
M10	4	P4 P5 P10 P13
M12	3	P3 P6 P7

CAPACITORS

TYPE	REQUIRED	LOCATION
CK-103	1	C01

RESISTORS

TYPE	REQUIRED	LOCATION
R0	2	R39 R48
R1	9	R00 R02 R04 R06 R35 R41 R43 R45 R46
R2	8	R08 R10 R12 R14 R20 R22 R24 R26
R3	24	R01 R03 R05 R07 R09 R11 R13 R15 R21 R23 R25 R27 R28 R29 R30 R32 R33 R34 R36 R37 R40 R42 R44 R47

RESISTORS

TYPE	REQUIRED	LOCATION
R4	7	R16 R17 R18 R19 R31 R38 R49

CIRCUIT BOARD
PTV 0126-G
ONE REQUIRED

CONNECTORS
AMPMODU NO.85863-4
57 REQUIRED

R0 JUMPERS
R1 1.5K 1% FILM RESISTOR
R2 750 OHM 1% FILM RESISTOR
R3 121 OHM 1% FILM RESISTOR
R4 15K OHM 5% CARBON COMP.

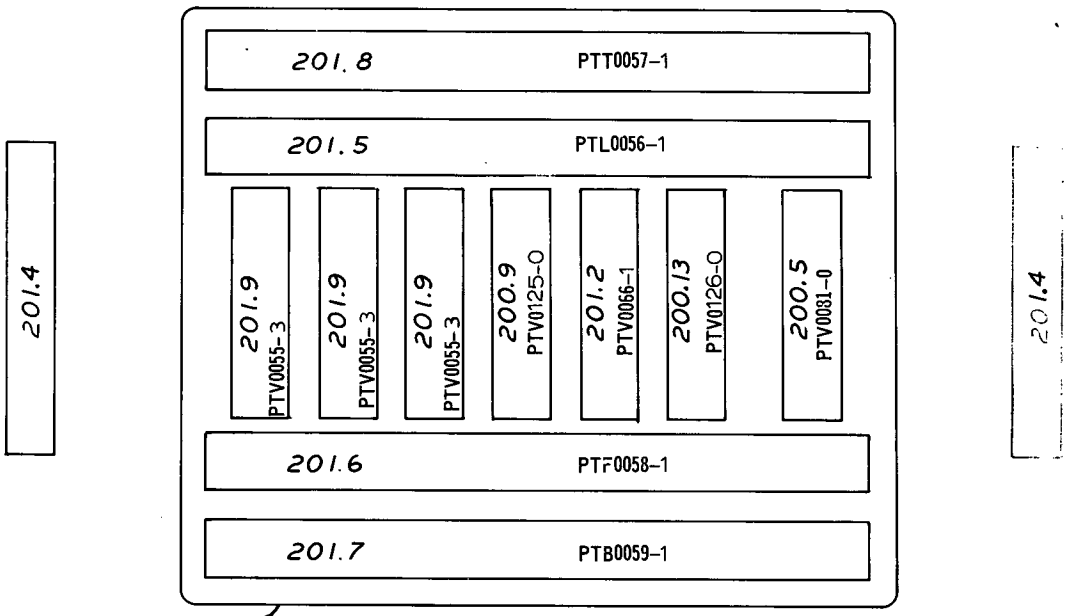
CHANGE NO.	DATE	DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

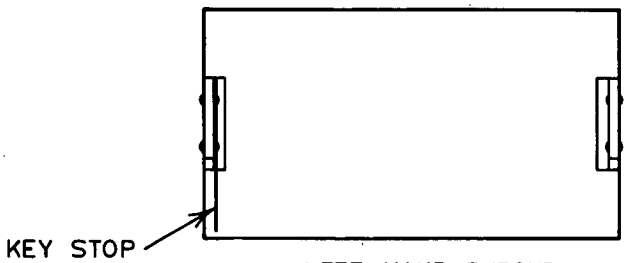
MACROMODULAR PROJECT

TITLE
PARTS LIST
MODE CONTROL BOARD
PART NO. 200.13

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
	MANUF.	7-28-71	REO	200.13D2
			DRAWN BY MAK	
			CHECKED	DATE 7-26-71



200.1
ONE CELL CASE
ASSEMBLY



LEFT HAND SHROUD

CHANGE NO.	DATE	DESCRIPTION
4	11-16-73	E.C.O. 0301
3	7-27-71	E.C.O 0207
2	10-6-70	E.C.O. 0050
1	6-18-70	NO. CHANGE ON L.M.B.

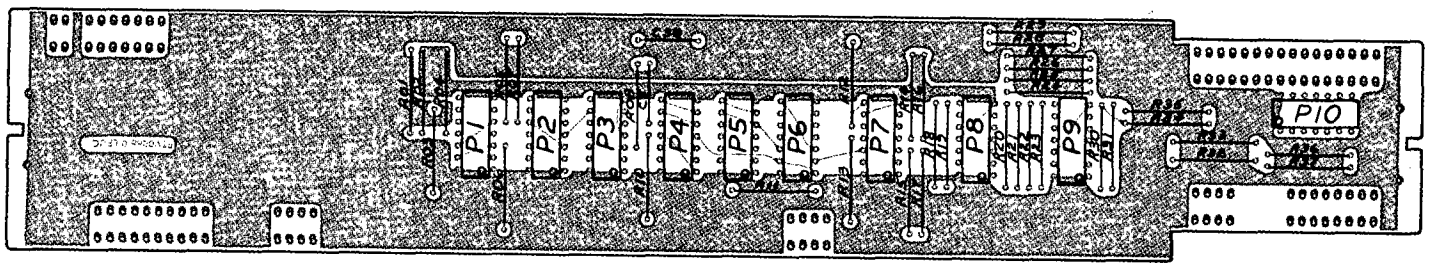
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE ASSEMBLY SCHEMATIC & PARTS LIST
LOGIC FUNCTION UNIT
PART NO. 201

APPROVED BY	FOR	DATE

ENG WAC
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 201.0D
DATE 3-28-70



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

CHANGE NO.	DATE	DESCRIPTION
1	10-6-70	E.C.O. 0050 NTK

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
LOGIC FUNCTION UNIT LOCAL CONTROL BOARD
PART NO. 201.2

APPROVED BY	FOR	DATE
Clem	MANUF.	3-20-70
Clem	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 201.2D1
DATE 3-19-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M06	2	P8 P9
M07	1	P2
M10	2	P3 P7
M11	3	P1 P4 P5
M20	1	P10
M30	1	P6

CAPACITORS

TYPE	REQUIRED	LOCATION
18 pf	2	C9 C38

RESISTORS

TYPE	REQUIRED	LOCATION
R0	2	R06 R11
R1	7	R02 R04 R12 R14 R16 R36 R37
R2	11	R05 R08 R10 R18 R19 R20 R21 R22 R23 R30 R31
R3	8	R01 R03 R07 R13 R15 R17 R32 R33
R5	8	R24 R25 R26 R27 R28 R29 R34 R35

CONNECTORS
AMPMODU NO. 85863-4
69 REQUIRED

CIRCUIT BOARD
PTV0066-1
ONE REQUIRED

NOTE:

R0 = JUMPER
R1 = 1.5 K OHM 1% FILM RESISTOR
R2 = 750 OHM 1% FILM RESISTOR
R3 = 121 OHM 1% FILM RESISTOR
R5 = 57.6 OHM 1% FILM RESISTOR
18 pf DIPPED SILVER MICA 5%

CHANGE NO.	DATE	DESCRIPTION
1	7-27-71	E.C.O. 0207

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: PARTS LIST
LOGIC MODULE CONTROL BOARD
PART NUMBER 201.2

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG. DLS	DRAWING NO.
CRW	MANUF.	6/8/70	DRAWN BY MBP	201.2D2
	MANUF	7-28-71	CHECKED	DATE 6/16/70

Test Procedure

Logic Module Control Board #201.2

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

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 56 nanoseconds or greater. The delay should be observed for both positive and negative going transitions, and both should be 56 nanoseconds or greater. If the smaller of the two delays is less than 56 ns, increase the value of C9 and C38. If the smaller of the two delays is greater than 65 nanoseconds the value of C9 and C38 should be reduced.

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.

CHG.	E.C.O.	DATE	APPR.
		12-28-70	
1	0301	11-16-73	MJS

201.2D4

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 LIGHT BROWN PMS 466
BACKING. MANUFACTURED FROM .016
THICK ALUMINUM WITH SOLVENT ACTIVATED
PERMANENT ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

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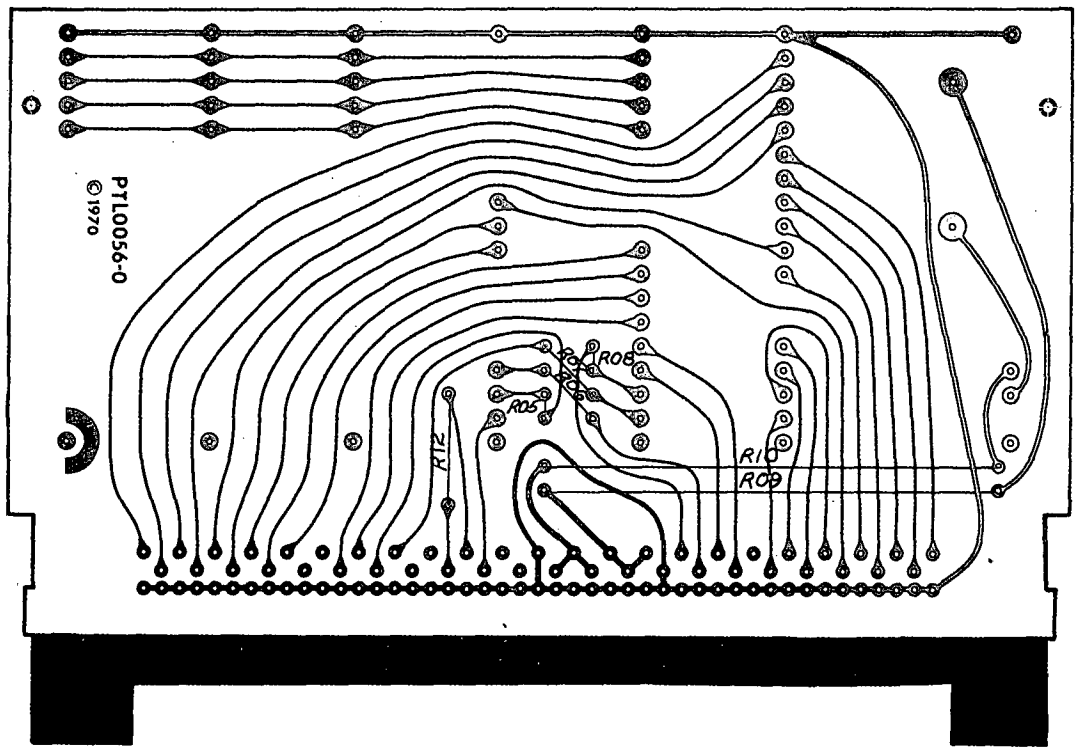
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL
LOGIC MODULE
PART #201.4

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	NTK	201.4D
Mauro	Prod.	7/28/70	DRAWN BY KM	
			CHECKED Mauro	DATE 6-16-70



CHANGE NO.	DATE	DESCRIPTION
3	10-6-70	E.C.O. 0050
2	6-18-70	CHANGE DRAWING NO. AND REMOVE NOTE
1	6-11-70	ADDED 206 AND 207 AS PART NO. USED.

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

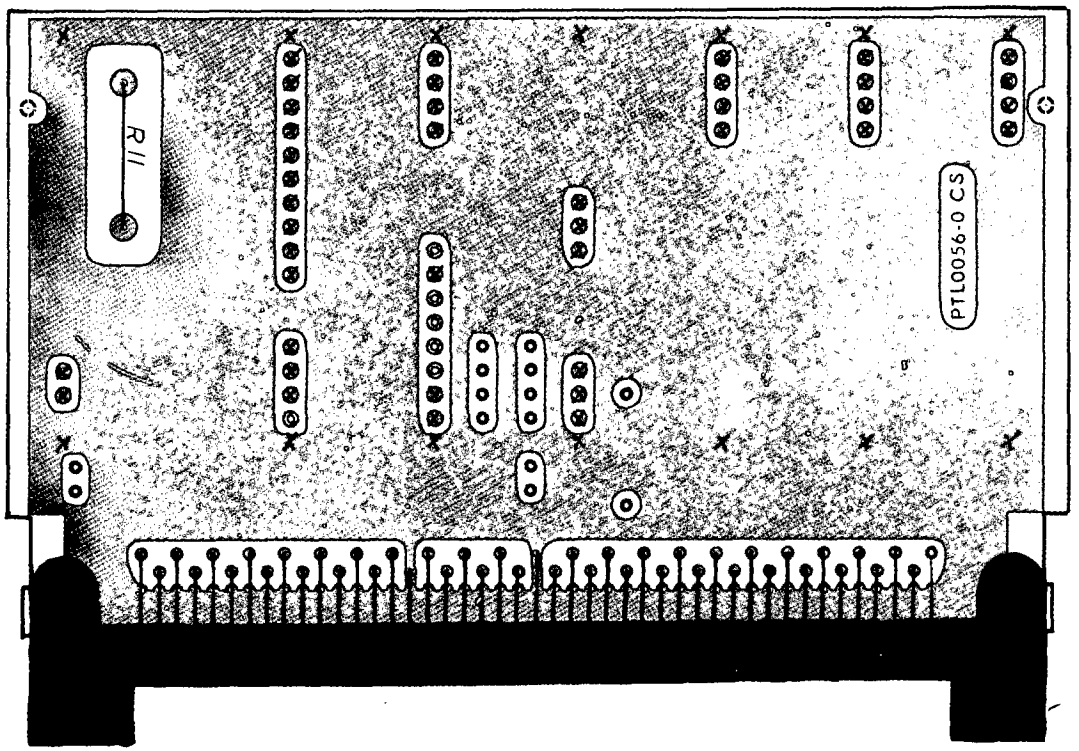
MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
LATERAL MOTHERBOARD ASSEMBLY SIGNAL SIDE
PART NO. 201.5

APPROVED BY	FOR	DATE
	MANUF.	30 Apr. 71
	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 201.5D1
DATE 3-27-70

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



NOTE: SEE DRAWING NUMBER 200.50D28 FOR CONNECTOR MOUNTING ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
2	11-24-71	E.C.O. 0232 MKP
1	11-30-70	E.C.O. 0098 Clm

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
LOGIC LATERAL MOTHERBOARD CONNECTOR ASSEMBLY
PART NO. 201.5 COMPONENT SIDE

APPROVED BY	FOR	DATE
Clm	MANUF.	160ct70
Clm	MANUF.	7-28-71

ENG. DLS
DRAWN BY
CHECKED NTK
DRAWING NO. 201.5D2
DATE 10/14/70

JUMPERS
SIX REQUIRED
R05
R06
R07
R08
R09
R10

RESISTOR 280K OHM 1% FILM
R12

FUSE BUSSMAN GFA 3/4 AMP
ONE REQUIRED
R11

AMP CONNECTOR
583 464-1
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85931-5
FIFTY-FOUR REQUIRED

CIRCUIT BOARD
PTL0056-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
5	11-24-71	E.C.O. 0232 MKP
4	7-27-71	E.C.O. 0207
3	12-11-70	E.C.O. 0127
2	10-6-70	E.C.O. 0050
1	6-18-70	CHANGED DRAWING NO.

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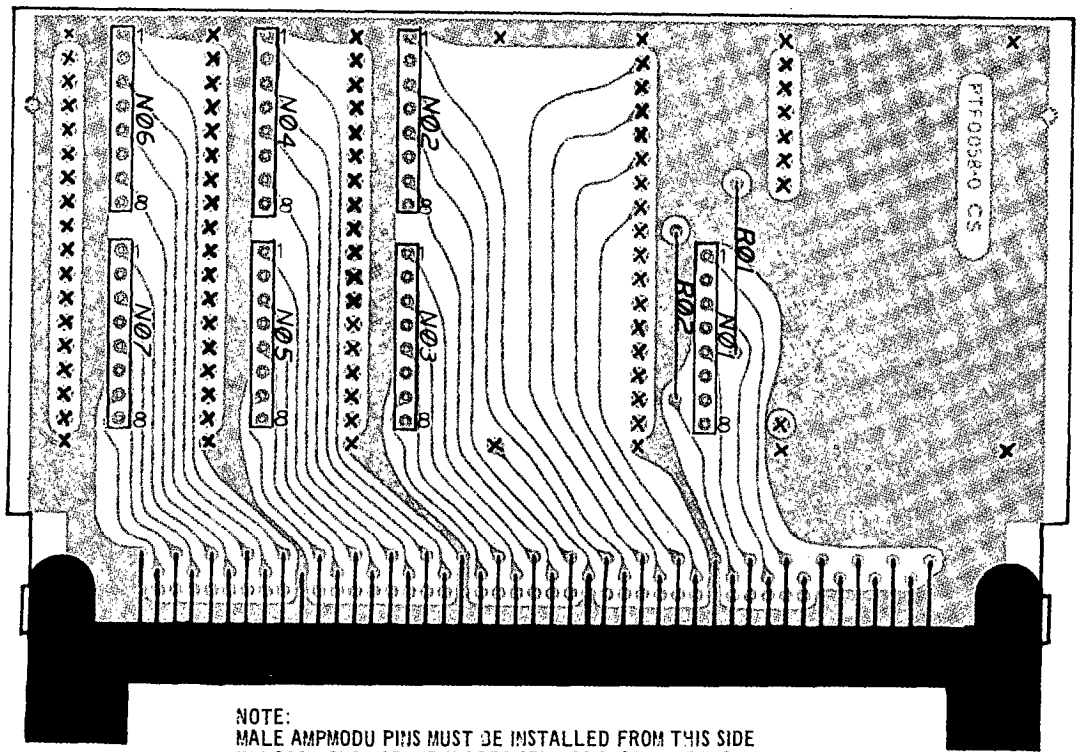
MACROMODULAR PROJECT

TITLE PARTS LIST
LOGIC LATERAL MOTHER BOARD
PART NO. 201.5

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	6/8/70	DRAWN BY MBP	201.5D3
	MANUF	7-28-71	CHECKED MTR	DATE 6/16/70



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

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

CHANGE NO.	DATE	DESCRIPTION
2	11-13-70	E.C.O. 0082 Cem

COMPUTER SYSTEMS LABORATORY
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ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
LOGIC FACEPLATE MOTHERBOARD CONNECTOR ASSEMBLY
PART NO. 201.6

APPROVED BY	FOR	DATE
Cem	MANUF	20 Nov 70
Cem	MANUF.	7-28-71

ENG.	DLS
DRAWN BY	PLL
CHECKED	NTK
DRAWING NO.	201.6D1
DATE	11-17-70

AMP CONNECTOR
583 464-1
ONE REQUIRED

RESISTORS 15K OHM 5% 1/4WATT CARBON
TWO REQUIRED
R01
R02

SPRAGUE NETWORK LTN-2
SEVEN REQUIRED
N01
N02
N03
N04
N05
N06
N07

CIRCUIT BOARD
PTF0058-1
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931-5
EIGHTY-FIVE REQUIRED

10/22/70

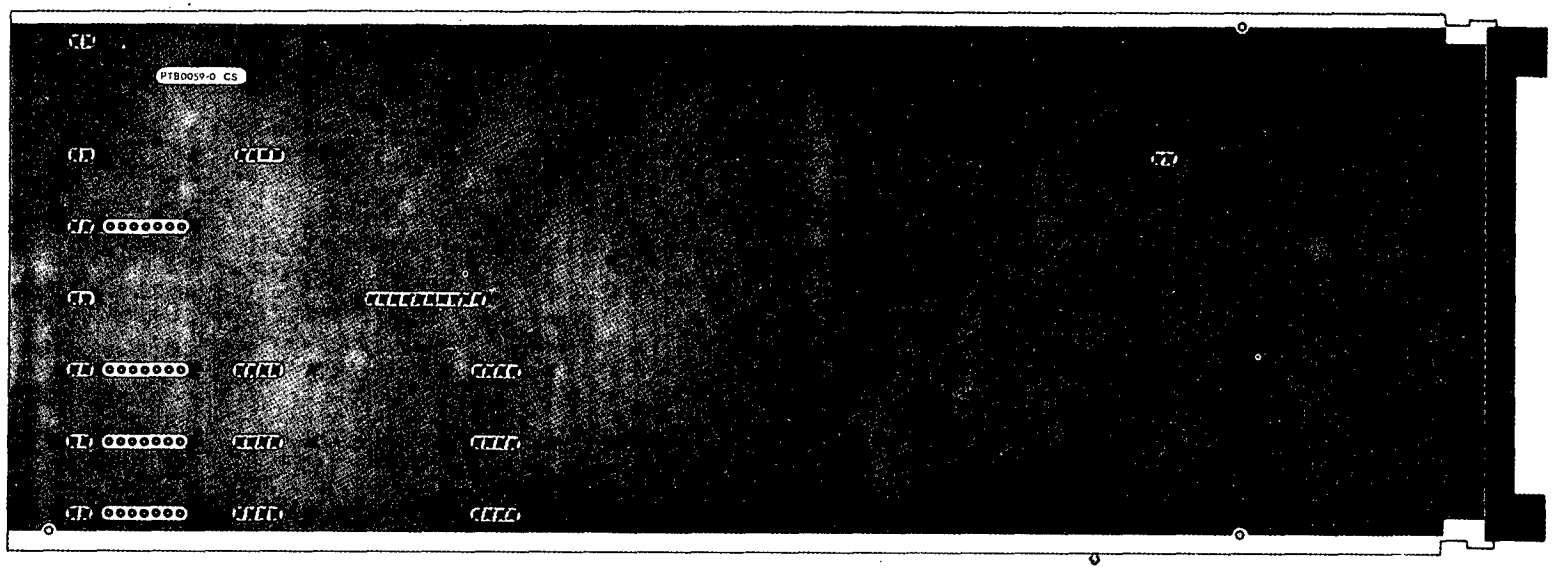
CHANGE NO.	DATE	DESCRIPTION
1	7-27-71	E.C.O. 0207

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
FACEPLATE MOTHERBOARD CONNECTOR ASSEMBLY
PART NO. 201.6

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
			DLS	
Clem	MANUF	~~10/14/70~~	DRAWN BY MRP	201.6D2
	MANUF	7-28-71	CHECKED	DATE 10/14/70



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

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

CHANGE NO.	DATE	DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
BOTTOM MOTHERBOARD ASSEMBLY
PART NO. 201.7

APPROVED BY	FOR	DATE
Chm.	MANUF.	10/23/70
Chm.	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 201.7D1
DATE 10/14/70

AMP CONNECTOR
1-202845-5
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85931-5
EIGHTY EIGHT REQUIRED

CIRCUIT BOARD
PTB0059-1
ONE REQUIRED

10/23/70

CHANGE NO.	DATE	DESCRIPTION
1	7-27-71	E.C.O. 0207

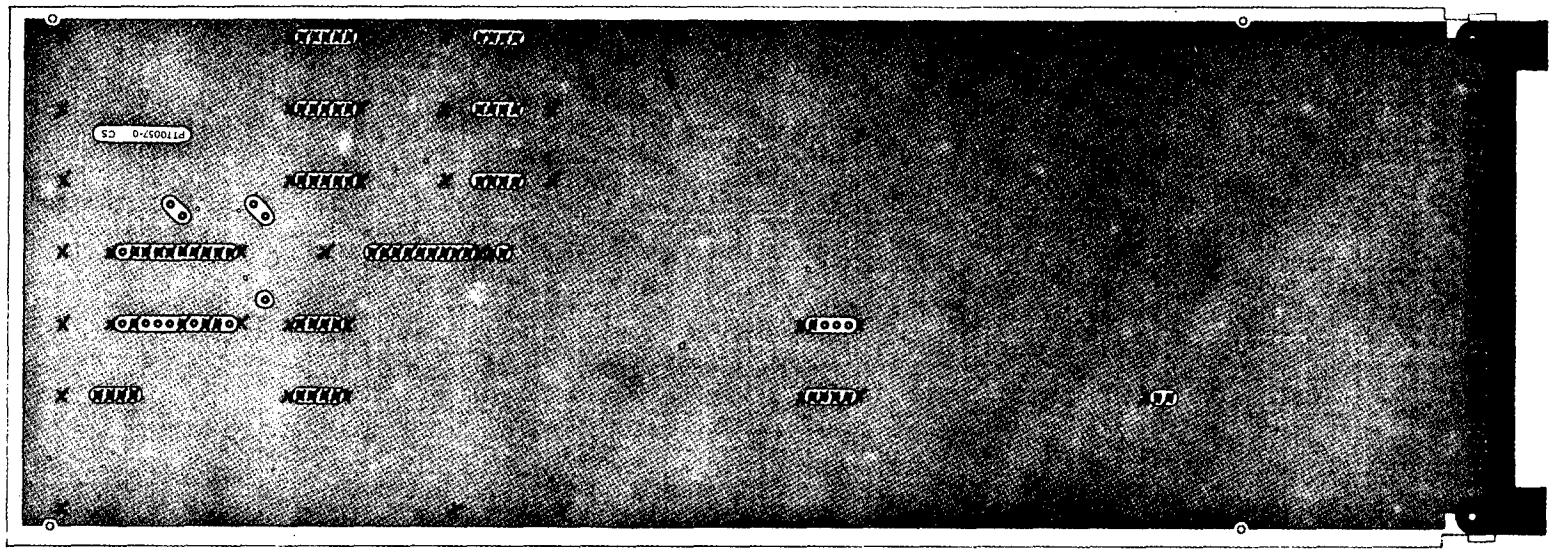
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: PARTS LIST
BOTTOM MOTHERBOARD ASSEMBLY
PART NO. 201.7

APPROVED BY	FOR	DATE
	MANUF	~~10/14/70~~
	MANUF	7-28-71

ENG. DLS
DRAWN BY MBP
CHECKED
DRAWING NO. 201.7D2
DATE 10/14/70



NOTE: SEE DRAWING NUMBER 200.50D26
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.
(106 PINS)

CHANGE NO.	DATE	DESCRIPTION
1	11-30-70	E.C.O. 0098 Cem

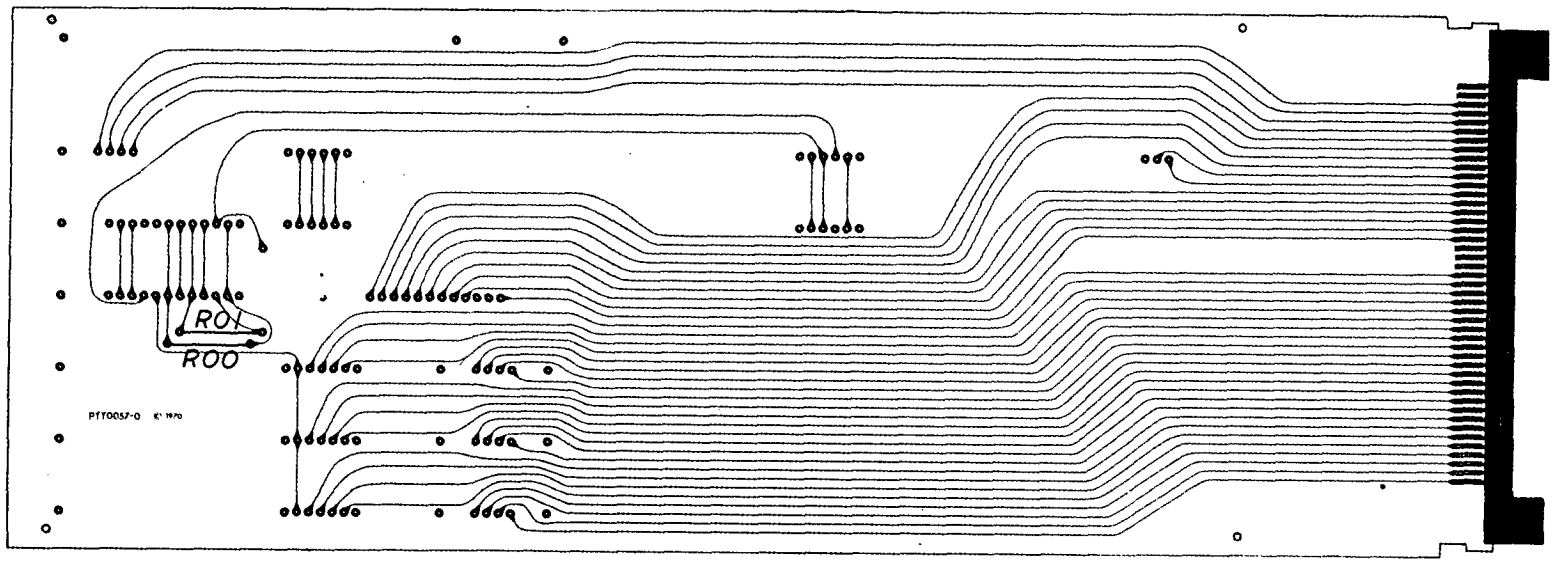
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY,
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
LOGIC TOP MOTHERBOARD ASSEMBLY COMPONENT SIDE
PART NO. 201.8

APPROVED BY	FOR	DATE
Cem	M&MP	10/22/70
Cem	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 201.8D1
DATE 10/14/70



CHANGE NO.	DATE	DESCRIPTION
1	10/14/70	CHANGED PART NO., DWG. NO., TITLE CBM NTK

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
LOGIC TOP MOTHERBOARD ASSEMBLY SIGNAL SIDE
PART NO. 201.8

APPROVED BY	FOR	DATE
CBM	MANUF	3 Apr. 70
CBM	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 201.8D2
DATE 3-28-70

AMP CONNECTOR
1-202845-5
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85931-5
ONE HUNDRED SIX REQUIRED

JUMPERS
TWO REQUIRED
R00
R01

CIRCUIT BOARD
PTT0057-1
ONE REQUIRED

10/23/70

CHANGE NO.	DATE	DESCRIPTION
2	7-27-71	E.C.O. 0207
1	11-30-70	E.C.O. 0098

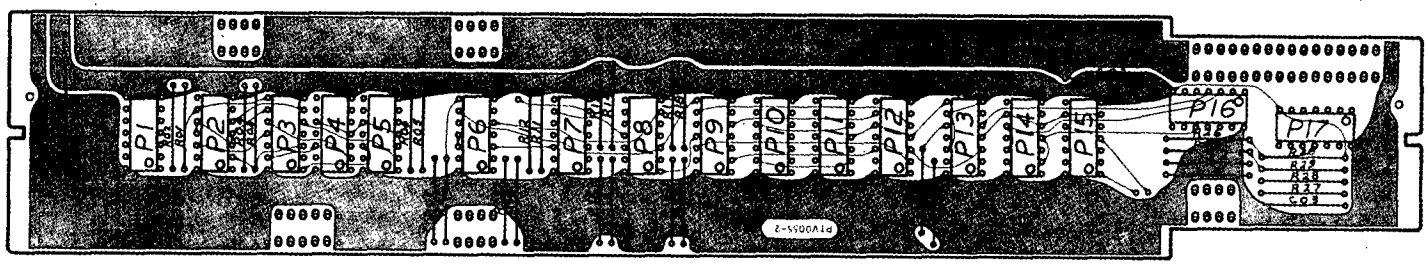
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
LOGIC TOP MOTHERBOARD ASSEMBLY
PART NO. 201.8

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF	~~10/14/70~~	DCS	201.8D3
	MANUF	7-28-71	DRAWN BY MRP	
			CHECKED MTK	DATE 10/14/70

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



CHANGE NO.	DATE	DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
LOGIC FUNCTION UNIT DATA BOARD
PART NO. 201.9

APPROVED BY	FOR	DATE
Cerm	MANUF.	25 Nov. 70
Cerm	MANUF.	7-28-71

ENG. REO
DRAWN BY DHO
CHECKED NTK
DRAWING NO. 201.9D1
DATE 11-18-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01B	1	P1
M04	2	P6
		P7
M10	6	P3
		P9
		P10
		P13
		P14
		P15
M20	2	P16
		P17
M31	3	P8
		P11
		P12
M16	2	P4
		P5
M47	1	P2

CAPACITORS*

TYPE	REQUIRED	LOCATION
10,000 pf	3	C01
		C02
		C03

*SPRAGUE TYPE CK-103
CERAMIC DISC 50WVDC

RESISTORS

TYPE	REQUIRED	LOCATION
R0	2	R21
		R22
R1	12	R05
		R06
		R11
		R12
		R13
		R14
		R17
		R18
		R27
		R28
		R29
		R30
R3	16	R01
		R02
		R03
		R04
		R07
		R08
		R09
		R10
		R15
		R16
		R19
		R20
		R23
		R24
		R25
		R26

CONNECTORS
AMPMODU NO. 85863-4
54 REQUIRED

PRINTED CIRCUIT BOARD
PTV0055-3
ONE REQUIRED

NOTE:

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

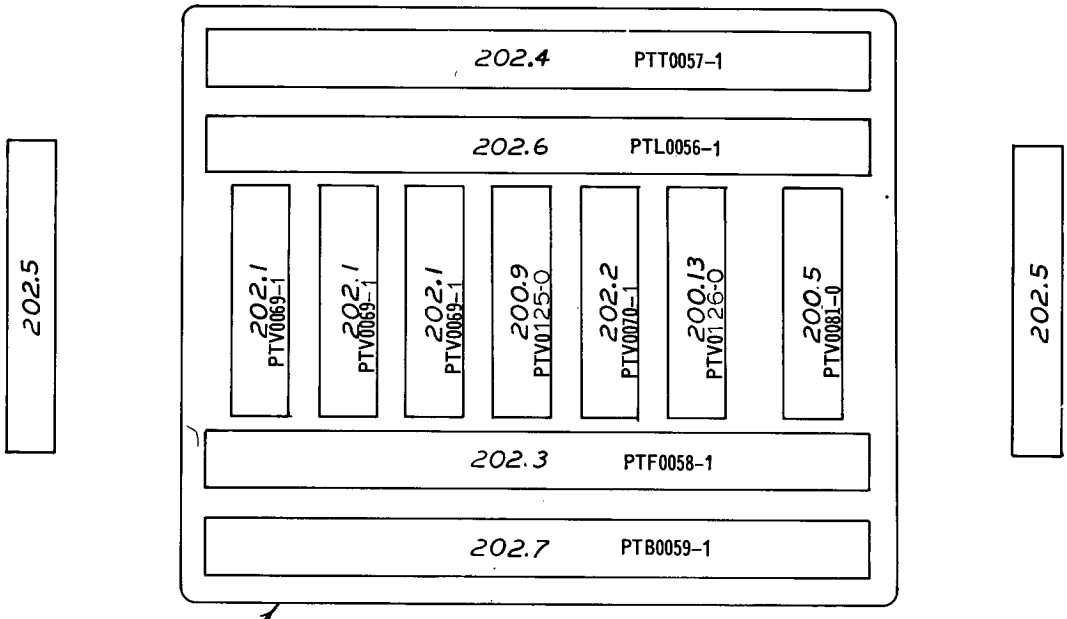
CHANGE NO.	DATE	DESCRIPTION
1	7-27-71	E.C.O. 0207

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

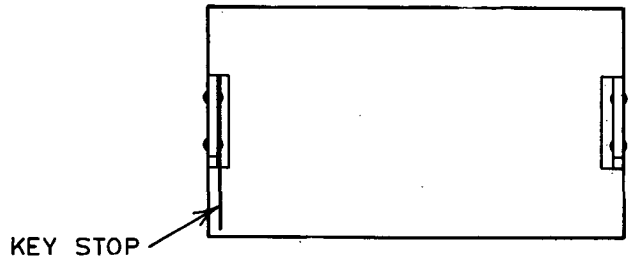
MACROMODULAR PROJECT

TITLE
PARTS LIST
LOGIC DATA BOARD
PART NO. 201.9

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
			REO	201.9D2
	MANUF.	7-28-71	DRAWN BY MBP	
	MANUF	7-28-71	CHECKED NTK	DATE 11-18-70



200.1
ONE CELL CASE
ASSEMBLY



LEFT HAND SHROUD

CHANGE NO.	DATE	DESCRIPTION
4	8-17-71	E.C.O. 0223
3	7-27-71	E.C.O. 0208
NTK 2	10-6-70	E.C.O. 0045
1	6-18-70	NO. CHANGE ON L.M.B.

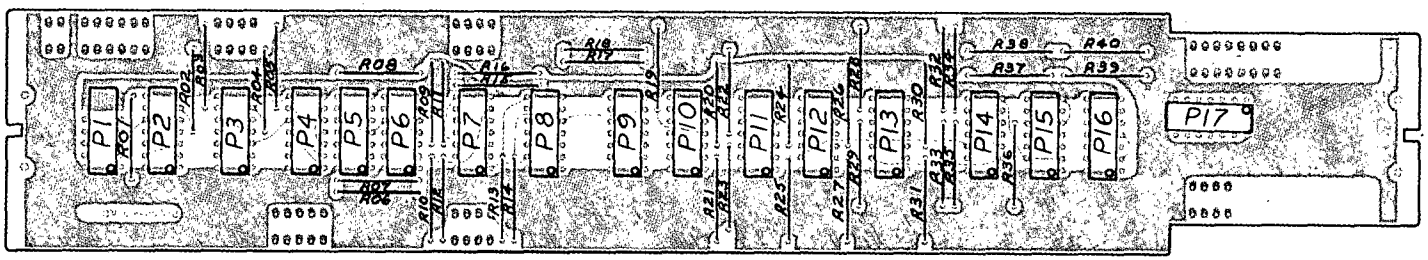
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE ASSEMBLY SCHEMATIC & PARTS LIST
ADDITION UNIT
PART NO. 202

APPROVED BY	FOR	DATE
NTK	Drawing Release	
	MANUF.	

ENG WAC	DRAWING NO. 202.0D
DRAWN BY PLL	
CHECKED NTK	DATE 3-28-70



INSTALL FEMALE AMPMODU
CONNECTORS EXACTLY AS
SHOWN ON DRAWING 200.50D2

CHANGE NO.	DATE	DESCRIPTION
1	10-6-70	E.C.O. 0045 Cam TITL

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
ADDITION DATA BOARD
PART NO. 202.1

APPROVED BY	FOR	DATE
Cam	MANUF.	3-20-70
Cam	MANUF	18 AUG 71

ENG. DLS
DRAWN BY PLL
CHECKED NTK

DRAWING NO. 202.101
DATE 3-19-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01	1	P1
M04	2	P7
		P8
M10	4	P2
		P3
		P4
		P15
M12	1	P16
M16	2	P5
		P6
M19	4	P10
		P11
		P12
		P13
M20	1	P17
M30	1	P9
M31	1	P14

RESISTORS

TYPE	REQUIRED	LOCATION
R0	7	R08
		R15
		R16
		R19
		R22
		R23
		R36
R1	14	R07
		R09
		R11
		R17
		R18
		R20
		R24
		R26
		R29
		R30
		R33
		R35
		R39
		R40
R3	19	R01
		R02
		R03
		R04
		R05
		R06
		R10
		R12
		R13
		R14
		R21
		R25
		R27

RESISTORS (cont)

TYPE	REQUIRED	LOCATION
		R28
		R31
		R32
		R34
		R37
		R38

CONNECTORS
AMPMODU NO. 85863-4
52 REQUIRED

CIRCUIT BOARD
PTV0069-1
ONE REQUIRED

NOTE:

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

CHANGE NO.	DATE	DESCRIPTION
3	8-17-71	E.C.O. 0223
2	1-14-71	E.C.O. 0147
1	10-6-70	E.C.O. 0045

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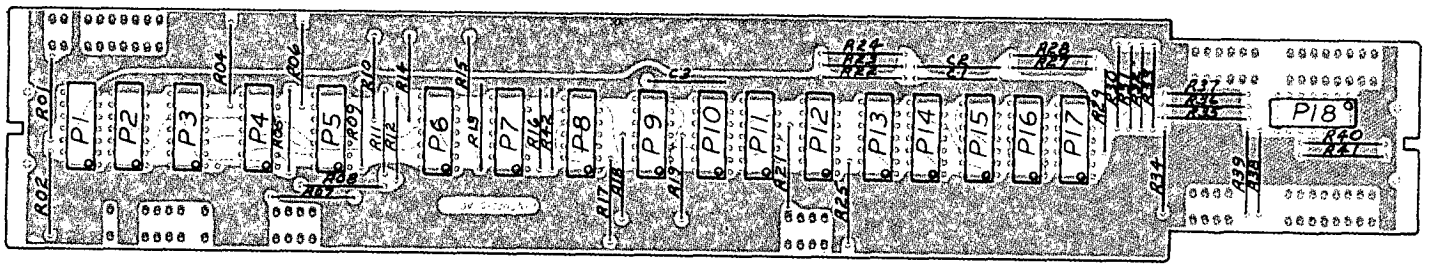
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
ADDITION DATA BOARD
PART NO. 202.1

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	7/7/70		202.1D2
		12/4/71	DRAWN BY MBP	
		12/17/71	CHECKED	DATE 6/24/70



INSTALL FEMALE AMPMODU
CONNECTORS EXACTLY AS
SHOWN ON DRAWING 200.50D2

CHANGE NO.	DATE	DESCRIPTION
1	10-6-70	E.C.O. 0045 cern NTK.

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
ADDITION LOCAL CONTROL BOARD
PART NO. 202.2

APPROVED BY	FOR	DATE
cern	MANUF.	3-20-70
cern	MANUF.	17 APR 71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 202.2D1
DATE 3-19-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01	2	P3
		P16
M04	4	P4
		P6
		P9
		P17
M07	1	P8
M08	1	P2
M10	5	P1
		P7
		P10
		P11
		P12
M11	2	P13
		P14
M20	1	P18
M30	2	P5
		P15

CAPACITORS *

TYPE	REQUIRED	LOCATION
130 pf	2	C1
		C2
820 pf	1	C3

* DIPPED SILVER MICA 5% – 50 WVDC

RESISTORS

TYPE	REQUIRED	LOCATION
R0	9	R07
		R08
		R09
		R21
		R34
		R38
		R39
		R40
		R41
R1	12	R01
		R05
		R11
		R12
		R13
		R16
		R22
		R29
		R30
		R31
		R32
		R42
R2	2	R23
		R24
R3	10	R02
		R04
		R06
		R10
		R14
		R15
		R17
		R18
		R19
		R25

RESISTORS (cont)

TYPE	REQUIRED	LOCATION
R5	6	R27
		R28
		R33
		R35
		R36
		R37

CONNECTORS
AMPMODU NO. 85863-4
63 REQUIRED

CIRCUIT BOARD
PTV0070-1
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

CHANGE NO.	DATE	DESCRIPTION
3	11-16-73	E.C.O. 0301
2	8-17-71	E.C.O. 0223
1	10-6-70	E.C.O. 0045

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MACROMODULAR PROJECT

TITLE
PARTS LIST
ADDITION CONTROL BOARD
PART NO. 202 2

APPROVED BY	FOR	DATE	ENG	DRAWING NO.
	MANUF.	4/7/70	DLS	202.2D2
	MANUF.	12/4/71	DRAWN BY MBP	
			CHECKED	DATE 6/24/70

Test Procedure

Addition Module Control Board #202.2

This board contains two critical delays whose proper value must be checked on each board prior to assembly into an Addition Module.

Both delay values 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 T88 high and tie pins L5 and T30 low. 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 T82 with the second channel. The delay between the two waveforms, measured from mid-point of each transition, should be 157 nanoseconds or greator. The delay should be observed for both positive and negative going transitions, and both should be 157 nanoseconds or greater. If the smaller of the two delays is less than 157 nanoseconds, the value of capacitors C1 and C2 should be increased. If the value of the smaller of the delays is greater than 175 nanoseconds, the value of C1 and C2 should be reduced.

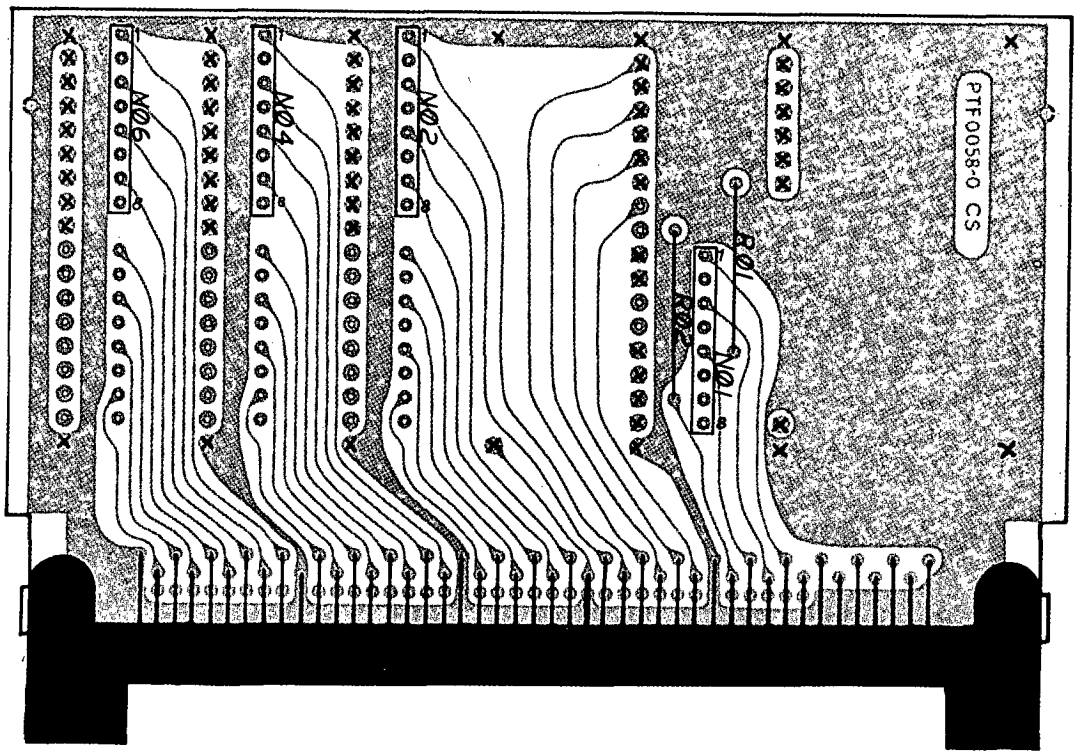
Test 2: Tie pin T31 high and pins L5, T30 and T88 low. Apply a square wave signal with a period of 300 nanoseconds or greater to pin L3. The signal should have a rise and fall time not greater than 10 nanoseconds. Observe the waveform at pin L3 with channel one of a 454 oscilloscope and observe the waveform at pin T82 with the second channel. The delay between the two waveforms, measured from mid-point of each transition, should be 133 nanoseconds or greater for the positive going output. There is no delay specification for a negative going output, but the delay will be much less than the positive transition delay. If the positive going delay is less than 133 nanoseconds, increase the value of C3 to increase the delay. If the positive going delay is greater than 150 nanoseconds, reduce the value of C3.

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.

CHG.	E.C.O.	DATE	APPR.
		12-10-70	
1	0301	11-16-73	MS

202.2D4

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.



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

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

CHANGE NO.	DATE	DESCRIPTION
2	11-13-70	E.C.O. 0082 cem

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
ADDITION FACEPLATE MOTHERBOARD ASSEMBLY
PART NO. 203.3

APPROVED BY	FOR	DATE
cem	MANUF.	20 NOV 70
cem	MANUF	18 AUG 71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 202.301
DATE 11-17-70

RESISTORS 15K OHM ¼WATT CARBON
TWO REQUIRED
R01
R02

SPRAGUE NETWORK LTN-2
FOUR REQUIRED
N01
N02
N04
N06

AMP CONNECTOR
583 464-1
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931-5
FIFTY SEVEN REQUIRED

CIRCUIT BOARD
PTF0058-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-27-71	E.C.O. 0208
1	10-6-70	E.C.O. 0045

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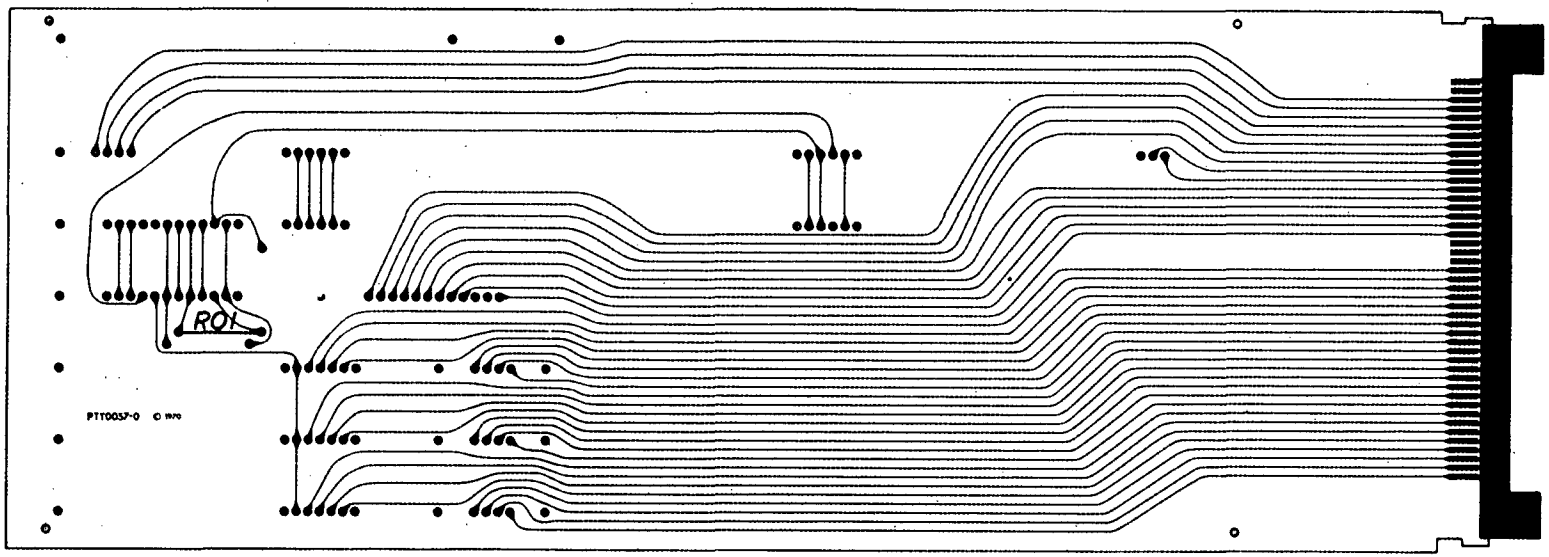
MACROMODULAR PROJECT

TITLE PARTS LIST
ADDITION FACEPLATE MOTHER BOARD
PART NO. 202.3

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	4/7/70	DRAWN BY MBP	202.3D2
			CHECKED	DATE 6/24/70



CHANGE NO.	DATE	DESCRIPTION
1	10/6/70	E.C.O. 0045

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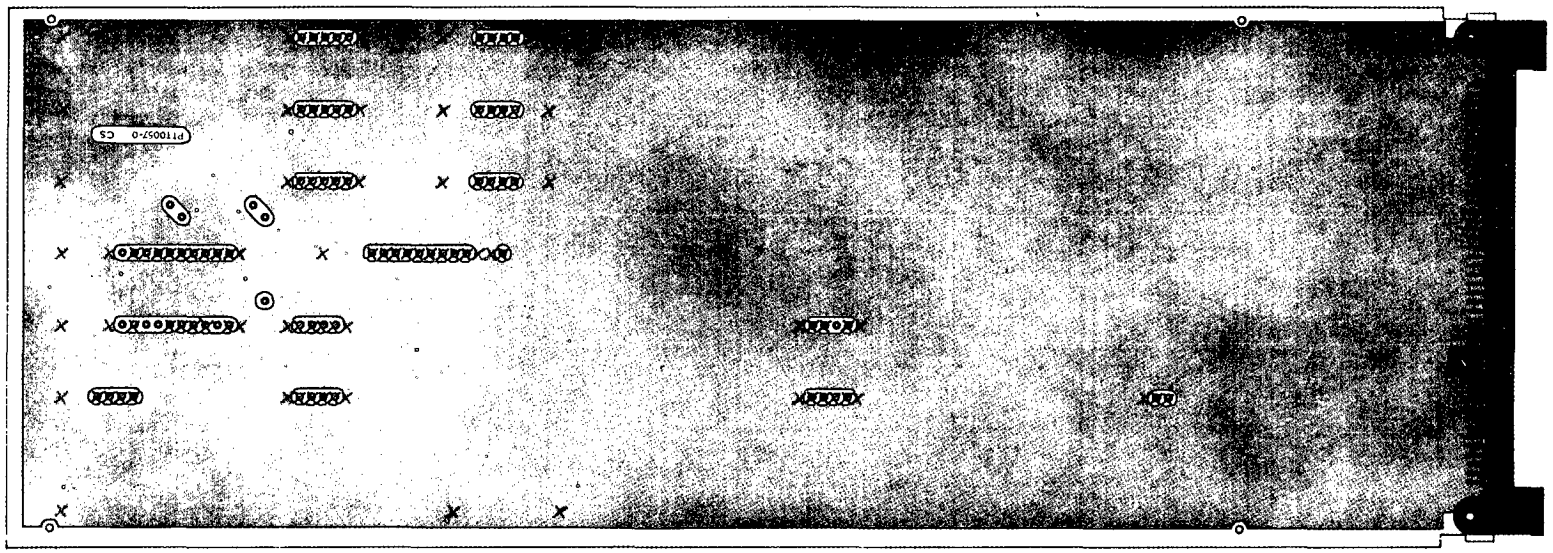
MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
ADDITION UNIT TOP MOTHER BOARD
SIGNAL SIDE
PART NO. 202.4

APPROVED BY	FOR	DATE
Cdmm	MANUF	31Aug.70
Cdmm	MANUF	18AUG71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 202.4D1
DATE 3-28-70



NOTE:
MALE AMP MODU 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 200.50D26 FOR CONNECTOR MOUNTING ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
3	11-30-70	E.C.O. 0070
2	10/10/70	E.C.O. 0044
1	6/11/70	ADDED 207 AS PART NO. USED.

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
TOP MOTHERBOARD ASSEMBLY
COMPONENT SIDE
PART NO. 202.4

APPROVED BY	FOR	DATE
CRW	MANUF	3 Apr 70
CRW	MANUF	19 AUG. 71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 202.4D2
DATE 3-28-70

JUMPERS
ONE REQUIRED
R01

AMP CONNECTOR
1-202 845-5
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85931-5
ONE HUNDRED TEN REQUIRED

CIRCUIT BOARD
PTT0057-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-27-71	E.C.O. 0208
1	10-6-70	E.C.O. 0045

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MACROMODULAR PROJECT

TITLE: PARTS LIST
ADDITION UNIT TOP MOTHER BOARD
PART NO. 202.4

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	4/10/70	DRAWN BY MBP	202.4D3
			CHECKED	DATE 6/24/70

ADDITION

METALCRAFT "AUTOGRAPH" OR EQUIVALENT: BLANK SIZE: ¼" 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 GREEM PMS 557 BACKING. MANUFACTURED FROM .016 THICK ALUMINUM WITH SOLVENT ACTIVATED PERMANENT ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

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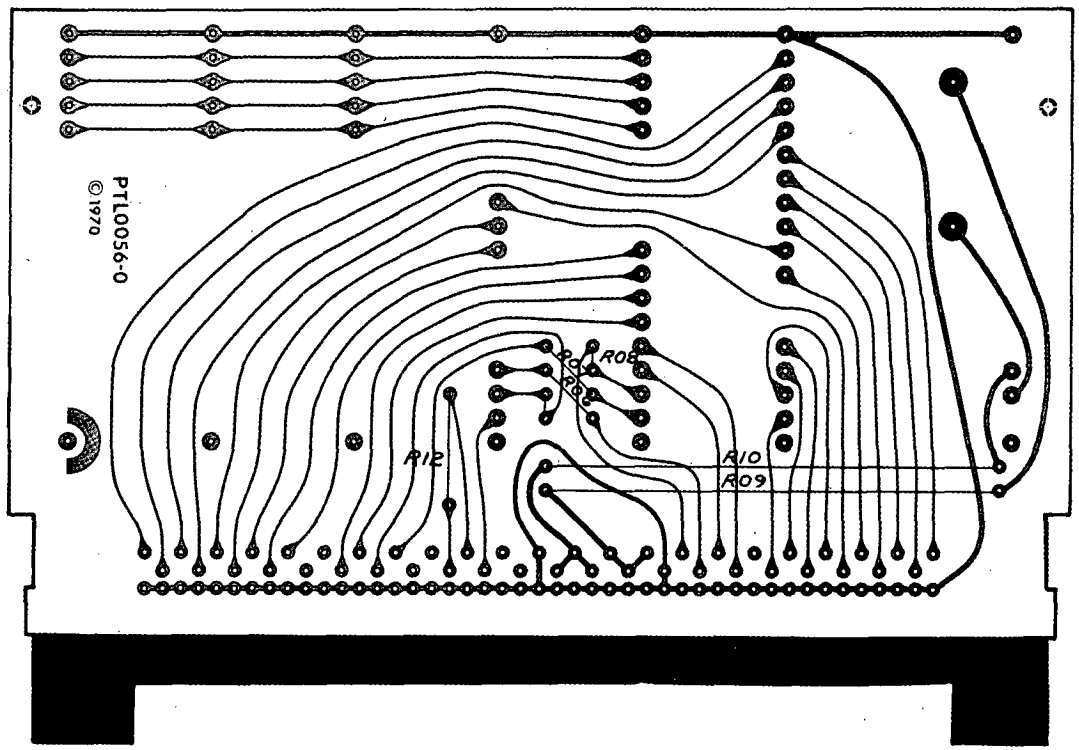
MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL
ADDITION MODULE
PART #202.5

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	NTK	
Mair	Prod.	7/28/70	DRAWN BY KM	202.5D
			CHECKED Mair	DATE 6-16-70



CHANGE NO.	DATE	DESCRIPTION
1	10/6/70	E.C.O. 0045 Cem NTK

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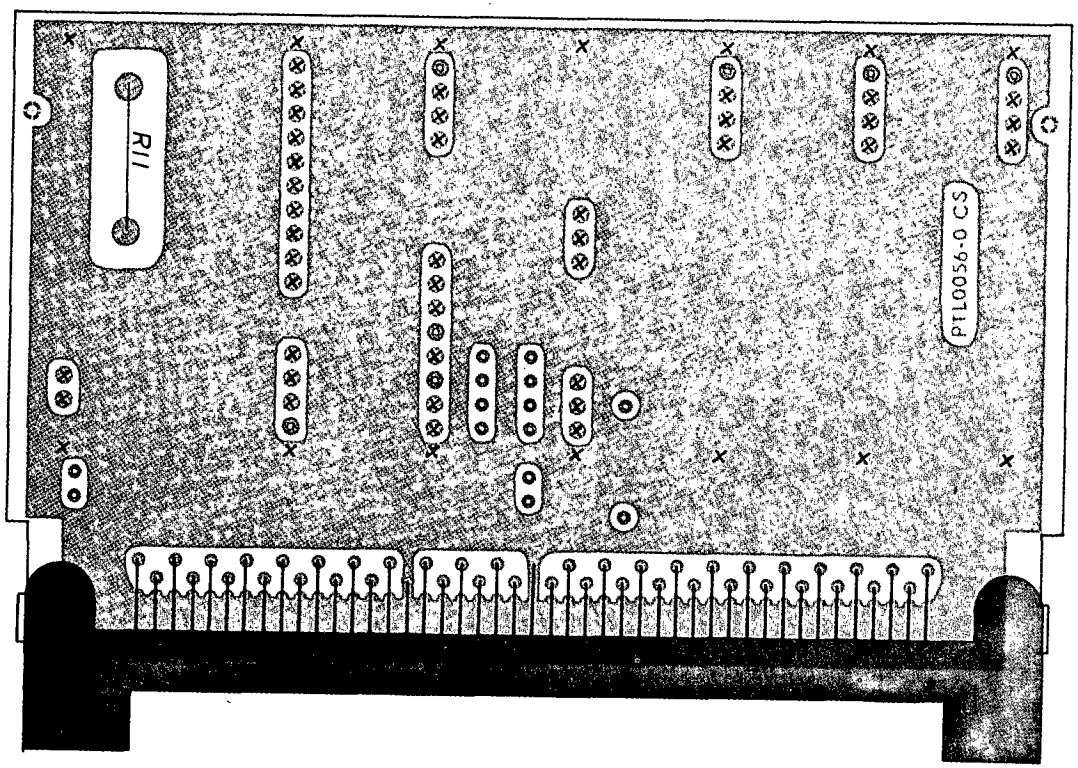
MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
LATERAL MOTHERBOARD ASSEMBLY SIGNAL SIDE
PART NO. 202.6

APPROVED BY	FOR	DATE
Cem	MANUF	10/13/70
Cem	MANUF.	18AUG.71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 202.6D1
DATE 6-19-70

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 MOUNTING ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
4	11-24-71	E.C.O. 0232 MLP
3	11-30-70	E.C.O. 0094 Cam
2	10/10/70	E.C.O. 0044 Cam NTK
1	6/19/70	ADD PART NOS. TO LIST

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
ADDITION LATERAL MOTHERBOARD ASSEMBLY
COMPONENT SIDE
PART NO. 202.6

APPROVED BY	FOR	DATE
Cam	MANUF	3Apr.70
Cam	MANUF.	18Aug.71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 202.6D2
DATE 3-26-70

JUMPERS
SIX REQUIRED
R05
R06
R07
R08
R09
R10

RESISTOR 25.5K OHM 1% FILM
R12

AMP CONNECTOR
583 464-1
ONE REQUIRED

CONNECTORS
AMPMODU 85931-5
FIFTY THREE REQUIRED

FUSE BUSSMAN GFA 3/4 AMP
ONE REQUIRED
R11

CIRCUIT BOARD
PTL0056-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
3	11-24-71	E.C.O. 0232
2	7-27-71	E.C.O. 0208
1	10-6-70	E.C.O. 0045

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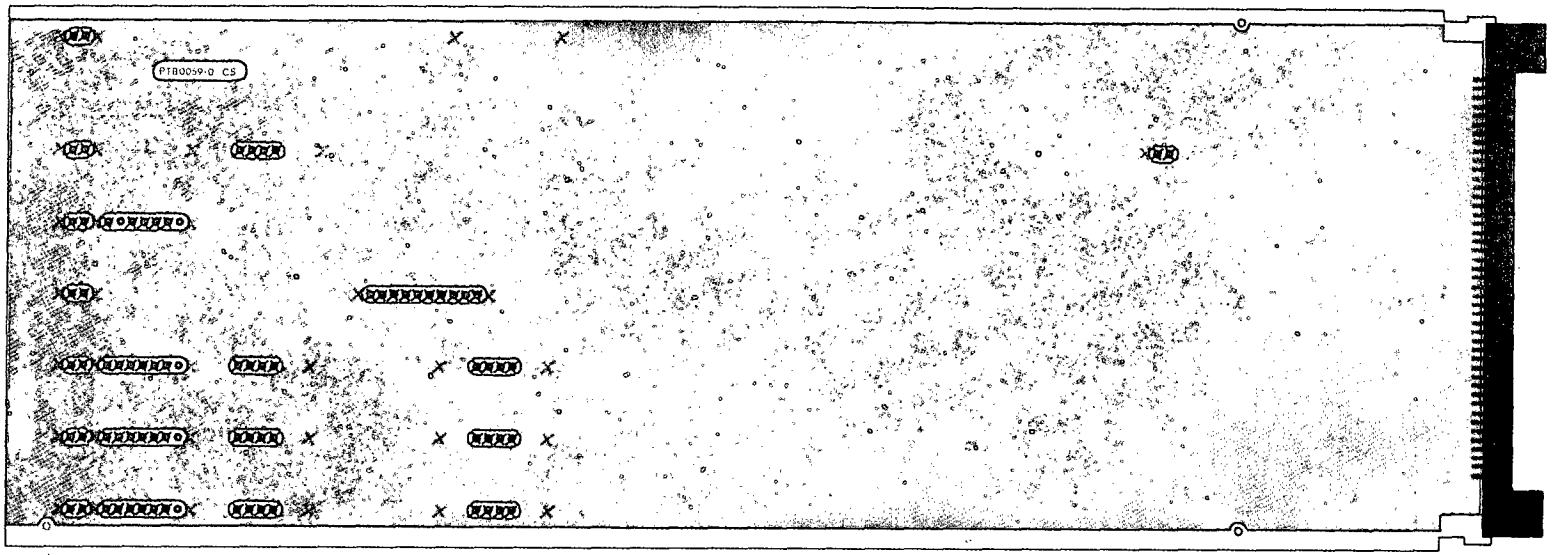
MACROMODULAR PROJECT

TITLE
PARTS LIST
LATERAL MOTHER BOARD ASSY
PART NO. 202.6

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	6/8/70	DRAWN BY MBP	202.6D3
			CHECKED	DATE 6/18/70



NOTE:
MALE AMP MODU 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 MOUNTING ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
2	10/10/70	E.C.O. 0044 NTK
1	6/11/70	ADDED 207 AS PART NO. USED.

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
BOTTOM MOTHERBOARD ASSEMBLY
PART NO. 202.7

APPROVED BY	FOR	DATE
CRW	MANUF	3 Apr. 70
CRW	MANUF	13 APR 70

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 202.7b1
DATE 3-27-70

AMP CONNECTOR
1-202845-5
ONE REQUIRED

CONNECTORS
AMPMODU NO 85931-5
ONE HUNDRED ELEVEN REQUIRED

CIRCUIT BOARD
PTB0059-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-27-71	E.C.O. 0208
1	10-6-70	E.C.O. 0044

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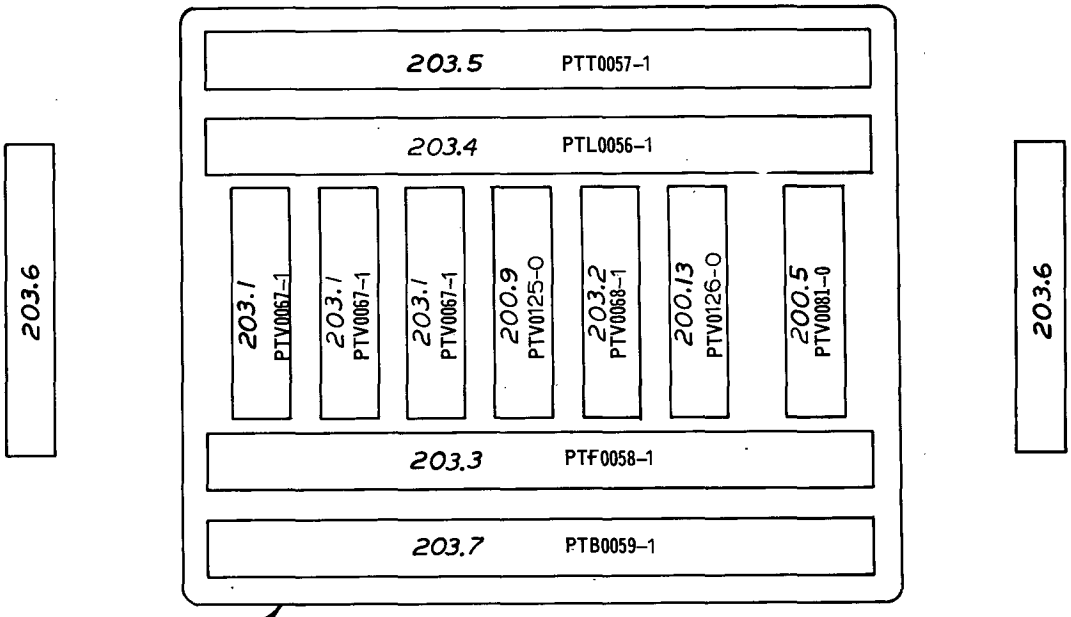
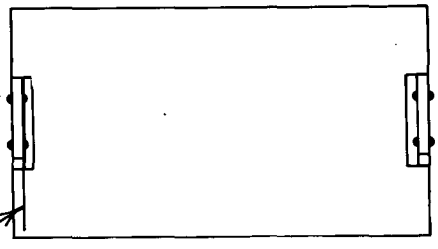
MACROMODULAR PROJECT

TITLE: PARTS LIST
BOTTOM MOTHER BOARD ASSEMBLY
PART NO. 200.11

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	6/8/70	DRAWN BY MBP	202.7D2
			CHECKED	DATE 6/16/70



200.1
ONE CELL CASE
ASSEMBLY



KEY STOP

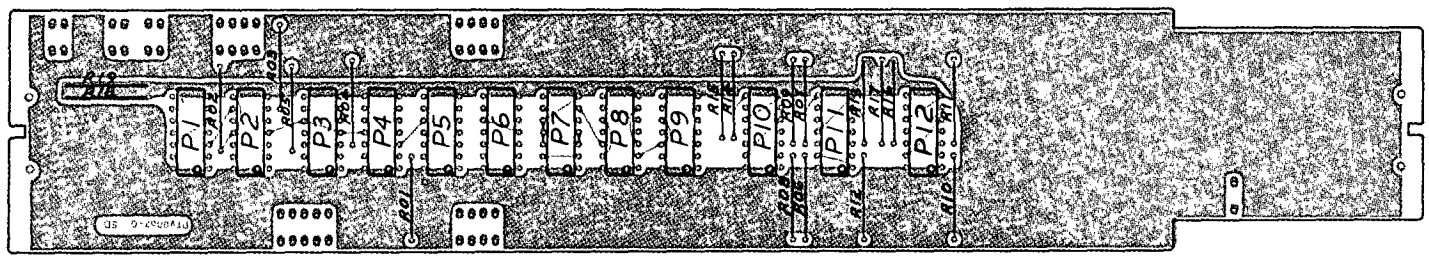
LEFT HAND SHROUD

2	7-27-71	E.C.O. 0209	NTK
1	10-10-70	E.C.O. .0051	NTK

MACROMODULAR PROJECT

ASSEMBLY SCHEMATIC & PARTS LIST
SHIFT
PART NO. 203

APPROVED BY	FOR	DATE	ENG	DRAWING NO.
NTK	Documentation	4/8	WAC	203.0 D
MANUF.		7-27-70	DRAWN BY PLL	
			CHECKED NTK	DATE 3-28-70



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

CHANGE NO.	DATE	DESCRIPTION
1	10-10-70	E.C.O. 0051 Cem NTK

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
SHIFT DATA BOARD
PART NO. 203.1

APPROVED BY	FOR	DATE
Cem	MANUF.	3-20-70
Cem	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 203.1D1
DATE 3-19-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01B	1	P4
M04 B	4	P7
		P10
		P11
		P12
M10	5	P1
		P2
		P3
		P8
		P9
M16	2	P5
		P6

RESISTORS

TYPE	REQUIRED	LOCATION
R0	3	R01
		R18
		R19
R1	6	R07
		R09
		R11
		R13
		R14
		R16
R3	10	R02
		R03
		R04
		R05
		R06
		R08
		R10
		R12
		R15
		R17

CONNECTORS
AMPMODU NO. 85863-4
39 REQUIRED

CIRCUIT BOARD
PTV0067-1
ONE REQUIRED

NOTE: NOTE:

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

CHANGE NO.	DATE	DESCRIPTION
2	7-27-71	E.C.O. 0209 MTK
1	7-9-71	E.C.O. 0201 MTK

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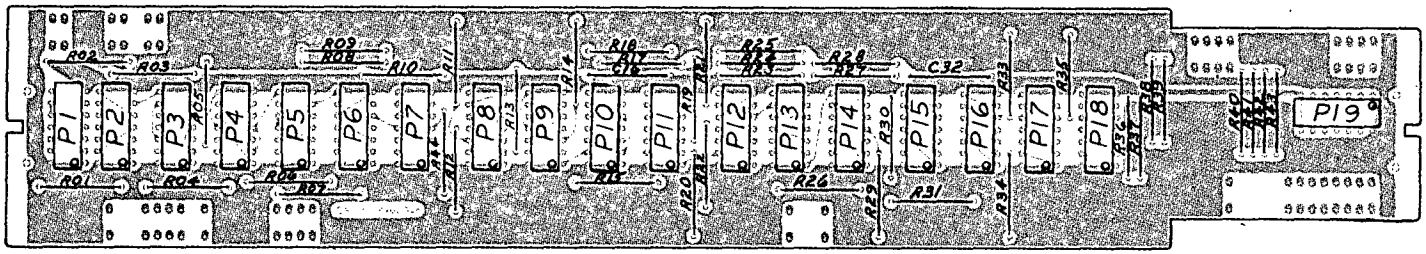
MACROMODULAR PROJECT

TITLE
PARTS LIST
SHIFT DATA BOARD
PART NO. 203.1

APPROVED BY	FOR	DATE	ENG. DLS	DRAWING NO.
cam	MANUF.	~~4/7/70~~	DRAWN BY MBP	203.1D2
CAM	MANUF.	7-28-71	CHECKED MTK	DATE 6/24/70

270670



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

CHANGE NO.	DATE	DESCRIPTION
1	10-10-70	E.C.O. 0051 NTK Cerm

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WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
SHIFT LOCAL CONTROL BOARD
PART NO. 203.2

APPROVED BY	FOR	DATE
Cerm	MANUF.	3-20-70
Cerm	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 203.2D1
DATE 3-19-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M04	2	P5
		P6
M05	1	P12
M06	1	P18
M10	8	P1
		P7
		P8
		P9
		P10
		P11
		P13
		P14
M11	4	P3
		P4
		P15
		P16
M20	1	P19
M30	1	P17
M31	1	P2

CAPACITORS*

TYPE	REQUIRED	LOCATION
33 pf	1	C32

*DIPPED SILVER MICA 5% 50WVDC

RESISTORS

TYPE	REQUIRED	LOCATION
R0	12	R04
		R06
		R07
		R11
		R13
		R22
		R26
		R29
		R33
		R34
		R35
		R44
R1	8	R02
		R10
		R18
		R19
		R23
		R24
		R28
		R30
R2	6	R17
		R27
		R36
		R37
		R42
		R43
R3	12	R01
		R03
		R05
		R08
		R09
		R12
		R14
		R15
		R20

RESISTORS (cont)

TYPE	REQUIRED	LOCATION
		R21
		R25
		R31
R5	4	R38
		R39
		R40
		R41

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

CONNECTORS
AMPMODU NO. 85863-4
49 REQUIRED

CIRCUIT BOARD
PTV0068-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
3	7-27-71	E.C.O. 0209 MTK
2	2-12-71	E.C.O. 0157 MTK
1	10/10/70	E.C.O. 0051 MTK

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
SHIFT CONTROL BOARD
PART NO. 203.2

APPROVED BY	FOR	DATE	ENG. REO	DRAWING NO.
[illegible]	MANUF.	4/7/70	DRAWN BY MBP	203.2D2
[illegible]	MANUF.	7-28-71	CHECKED MTK	DATE 6/24/70

Test Procedure

Shifter Control Board Part #203.2

This board contains two critical delays whose proper value must be checked on each board prior to assembly into a Shifter Module.

Both delay values 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

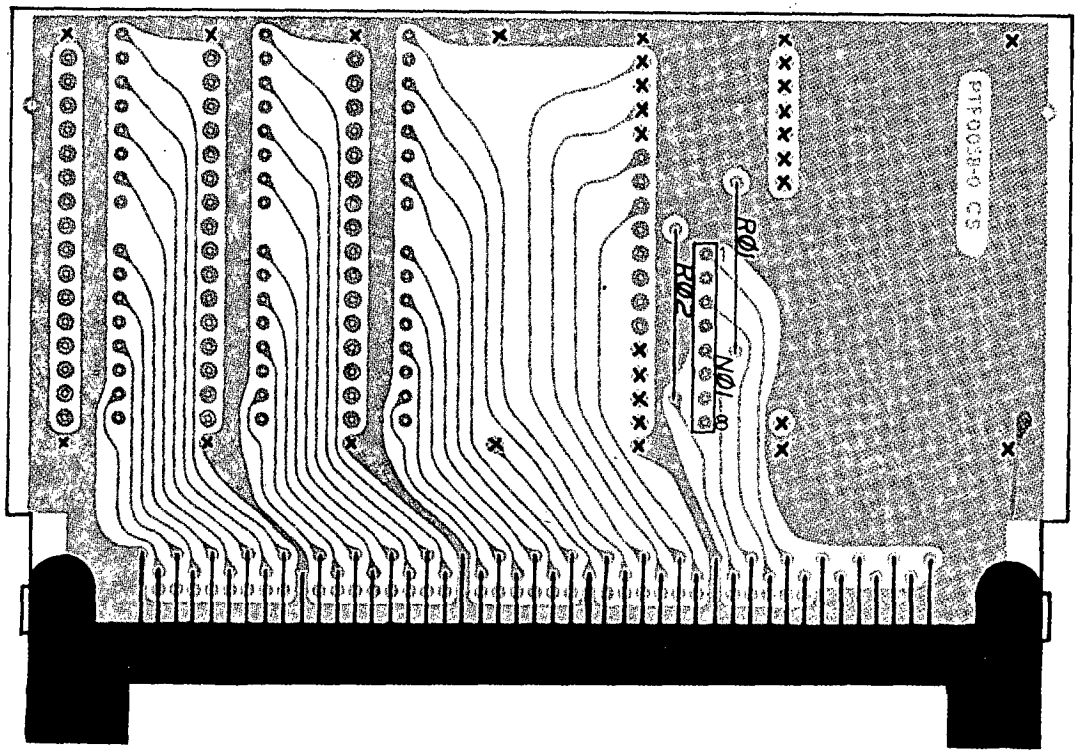
Test 1: Tie pin T83 low and apply **one** phase of a 200 nanosecond square wave to pin L3 and apply the opposite phase of the square wave to pin T31. Observe the waveform at pin L2 with the second channel of a 454 oscilloscope. Observe the waveform at pin L3 with the first channel. The delay between the two waveforms, measured from mid-point of each transition, should be 17 nanoseconds or greater. The delay should be observed for both positive and negative going transitions, and both should be 17 nanoseconds or greater. If the smaller of the two delays is less than 17 nanoseconds, add a capacitor in location C16 to increase the delay.

Test 2: Tie pins L3 and T83 high. Apply a square wave signal with a period of 240 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 one channel of 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 40 nanoseconds or greater. The delay should be observed for both positive and negative going transitions, and both should be 40 nanoseconds or greater. If the smaller of the two delays is less than 40 nanoseconds, the value of capacitor C32 should be increased. If the value of the smaller of the delays is greater than 50 nanoseconds, the value of C32 should be reduced.

CHG.	E.C.O.	DATE	APPR
		12-10-70	
1	0301	11-16-73	MJS

The final capacitor values and the measured delays for both directions of transition should be recorded, 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.



NOTE 1:
MALE AMPMODU PINS MUST BE INSTALLED FROM THIS SIDE IN LOCATIONS MARKED X PRECISELY AS SHOWN IN DWGS. 200.50D1 AND 200.50D2.
(29 PINS)

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

CHANGE NO.	DATE	DESCRIPTION
2	11-13-70	E.C.O. 0082 Cem

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
SHIFT FACEPLATE MOTHERBOARD
PART NO. 203.3

APPROVED BY	FOR	DATE
Cem	MANUF.	20 Nov 70
Cem	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED MTK.

DRAWING NO. 203.3D1
DATE 11-17-70

RESISTORS 15K OHM 5% ¼WATT CARBON
TWO REQUIRED
R01
R02

SPRAGUE NETWORK LTN-2
ONE REQUIRED
N01

AMP CONNECTOR
583 464-1
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931-5
29 REQUIRED

CIRCUIT BOARD
PTF0058-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-27-71	E.C.O. 0209 MTR
1	10/10/70	E.C.O. 0051 Conn MTR

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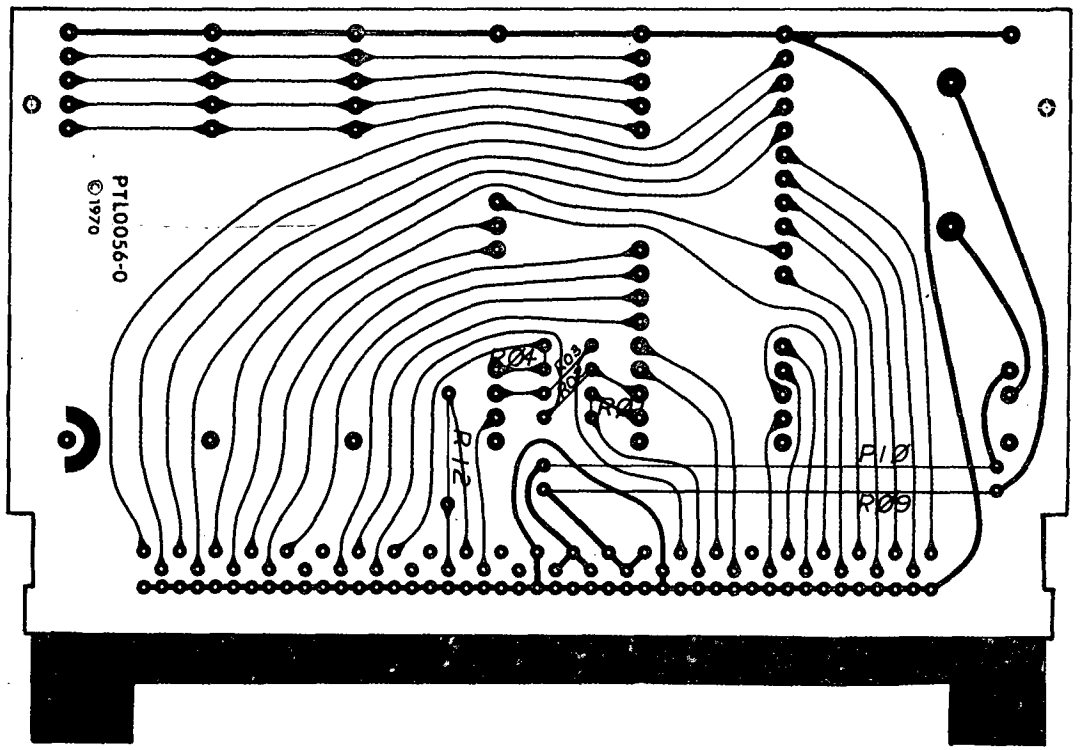
MACROMODULAR PROJECT

TITLE PARTS LIST
SHIFT FACEPLATE MOTHER BOARD
PART NO. 203.3

APPROVED BY	FOR	DATE	ENG. REO	DRAWING NO.
Conn.	MANUF.	4/7/70	DRAWN BY MBP	203.3D2
Conn.	MANUF.	7-28-71	CHECKED MTR	DATE 6/24/70



CHANGE NO.	DATE	DESCRIPTION
1	10/10/70	E.C.O. 0051 NTK Clm

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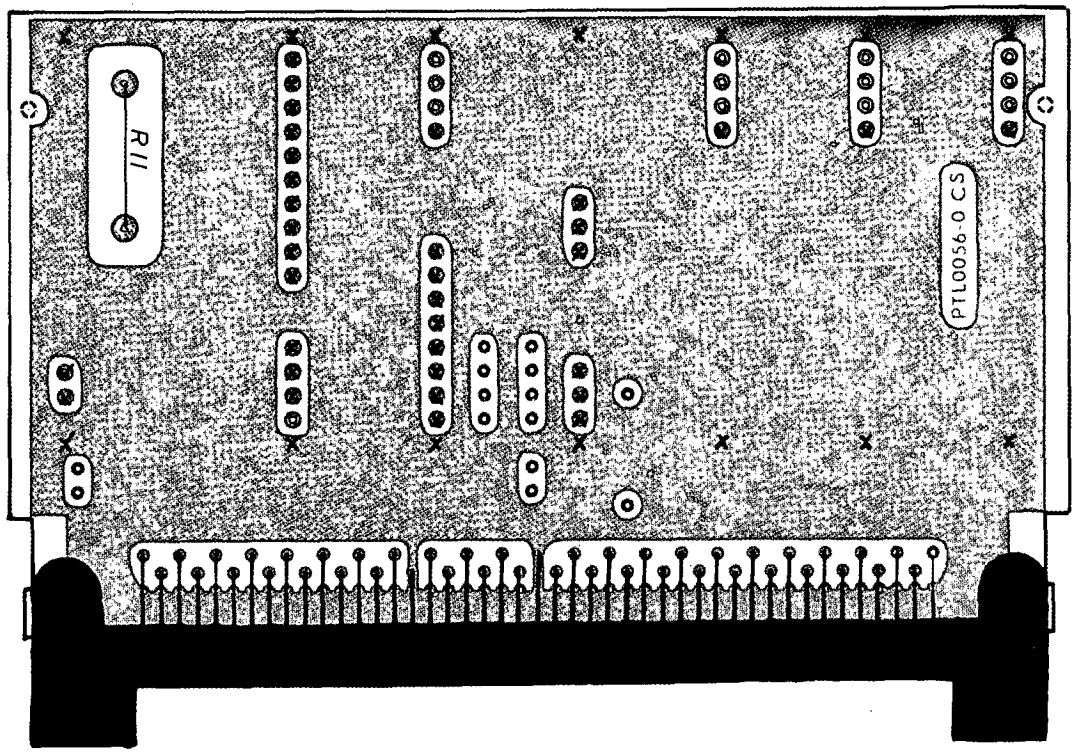
MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
SHIFT LATERAL MOTHER BOARD ASSEMBLY
SIGNAL SIDE
PART NO. 203.4

APPROVED BY	FOR	DATE
Clm	MANUF	10/10/70
Clm.	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 203.4D1
DATE 3-27-70

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 MOUNTING ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
2	11-24-71	E.C.O. 0232 MLP
1	11-27-70	E.C.O. 0095 Clm

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
SHIFT LATERAL MOTHERBOARD ASSEMBLY
PART NO. 203.4 COMPONENT SIDE

APPROVED BY	FOR	DATE
Clm	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 203.4D2
DATE 10/14/70

JUMPERS
SIX REQUIRED
R01
R02
R03
R04
R09
R10

RESISTOR 33.2K OHM 1/8 WATT 1%
ONE REQUIRED
R12

AMP CONNECTOR
583 464-1
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85931-5
FORTY SEVEN REQUIRED

FUSE, BUSSMAN GFA 3/4 AMP
ONE REQUIRED
R11

CIRCUIT BOARD
PTL0056-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
3	11-24-71	E.C.O. 0232 MKP
2	7-27-71	E.C.O. 0209
1	10/10/70	E.C.O. 0051 MK

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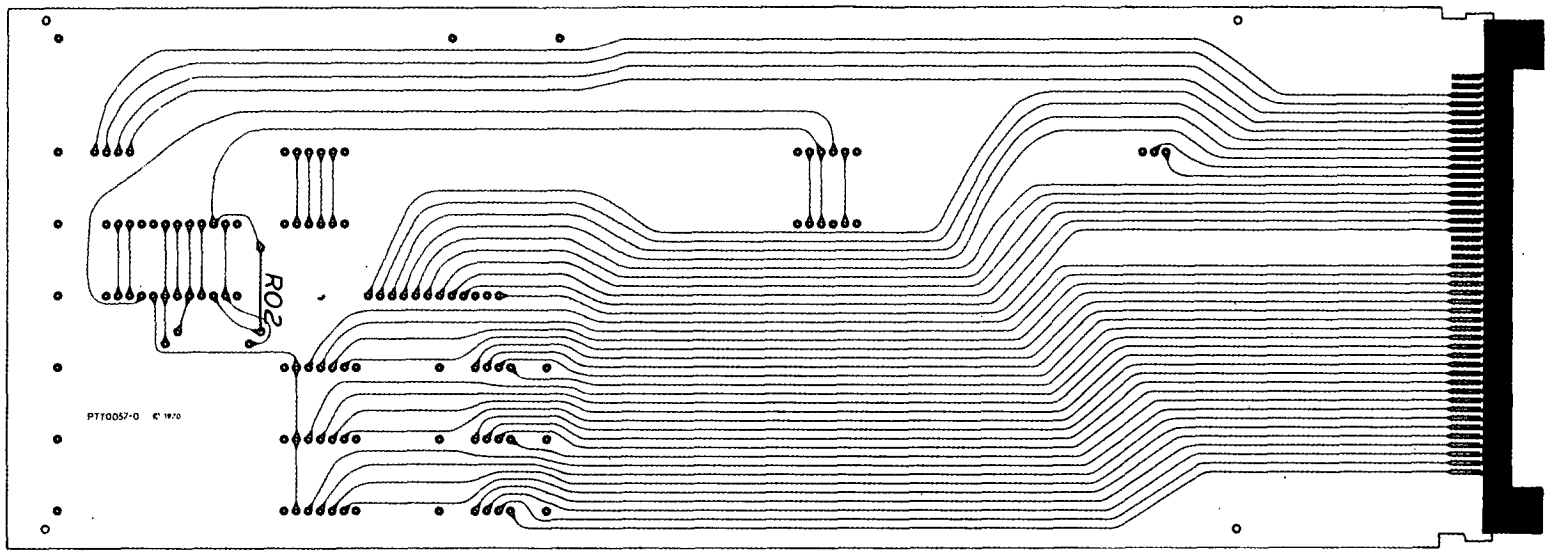
MACROMODULAR PROJECT

TITLE PARTS LIST
SHIFT LATERAL MOTHER BOARD
PART NO. 203.4

APPROVED BY	FOR	DATE
C. [illegible]	MANUF.	4/7/70
[illegible]	MANUF.	7-28-71

ENG. REO
DRAWN BY MBP
CHECKED MK
DRAWING NO. 203.4D3
DATE 6/24/70



CHANGE NO.	DATE	DESCRIPTION
1	10/10/70	E.C.O. 0051

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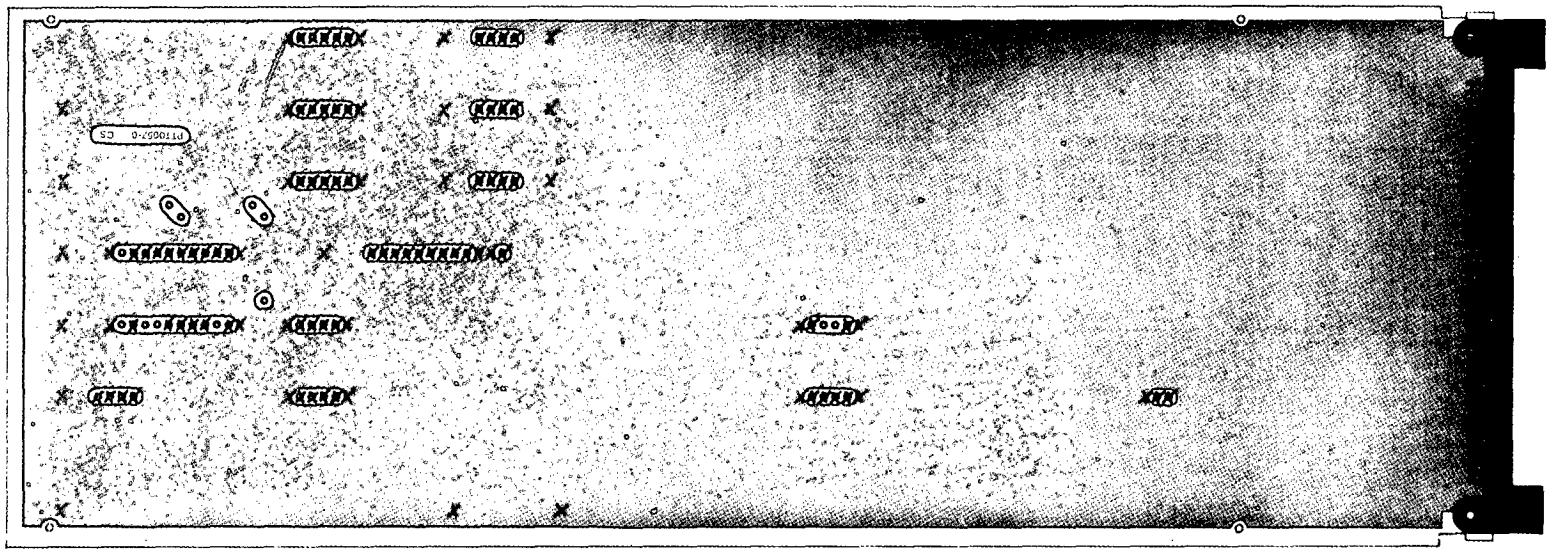
MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
SHIFT TOP MOTHERBOARD
SIGNAL SIDE
PART NO. 203.5

APPROVED BY	FOR	DATE
	MANUF	3 Nov. 70
	MANUF.	7-28-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 203.5D1
DATE 3-28-70



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 200.50D26 FOR CONNECTOR MOUNTING ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
2	11-27-70	E.C.O. 0095 Cam
1	11-11-70	E.C.O. 0081 Cam

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION, SHIFT TOP MOTHERBOARD ASSEMBLY COMPONENT SIDE PART NO. 203.5

APPROVED BY	FOR	DATE
Cam	MANUF	10/23/70
Cam	MANUF.	7-28-71

ENG. DLS	DRAWING NO. 203.5D2
DRAWN BY	
CHECKED NTK	DATE 10/14/70

JUMPERS
ONE REQUIRED
R02

AMP CONNECTOR
1-202845-5
ONE REQUIRED

CONNECTOR
AMPMODU 85931-5
109 REQUIRED

CIRCUIT BOARD
PTT0057-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-27-71	E.C.O. 0209
1	10/10/70	E.C.O. 0051

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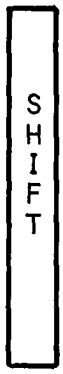
TITLE PARTS LIST
SHIFT TOP MOTHER BOARD
PART NO. 203.5

APPROVED BY	FOR	DATE
	MANUF.	4/10/70
	MANUF.	7-28-71

ENG. REO
DRAWN BY MBP
CHECKED MTR

DRAWING NO. 203.5D3
DATE 6/24/70



METALCRAFT "AUTOGRAPH" OR EQUIVALENT"
BLANK SIZE: ¼" X 2" SHEARED WITH
SQUARE CORNERS. WHITE LETTERS,
VOGUE BOLD 12 POINT BOLD FACE TYPE CENTERED
TOP, BOTTOM AND SIDES WITH 6 POINT
SPACING ON RUST PMS 152 BACKING,
MANUFACTURED FROM .016 THICK ALUMINUM
WITH SOLVENT ACTIVATED PERMANENT
ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

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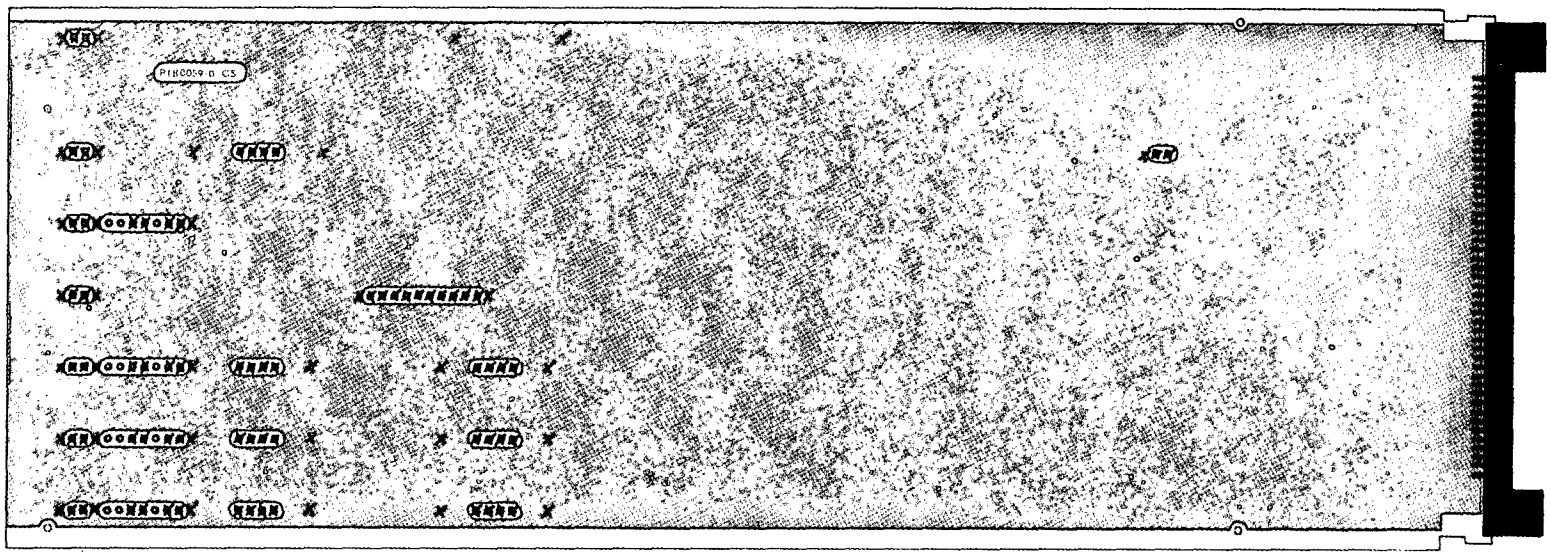
MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL
SHIFT MODULE
PART #203.6

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	NTK	203.6D
Maw	Prod.	7/28/70	DRAWN BY KM	
			CHECKED Maw	DATE 6-16-70



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

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

CHANGE NO.	DATE	DESCRIPTION

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WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
SHIFT BOTTOM MOTHERBOARD ASSEMBLY
PART NO. 203.7

APPROVED BY	APPROVED FOR	APPROVED DATE
Conn	MANUF	10/22/70
Conn	MANU F.	7-28-71

ENG.	DLS
DRAWN BY	MBP
CHECKED	MTK
DRAWING NO.	203.7D1
DATE	10/14/70

AMP CONNECTOR
1-202845-5
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85931-5
ONE HUNDRED FOUR REQUIRED

CIRCUIT BOARD
PTB0059-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
1.	7-27-71	E.C.O. 0209

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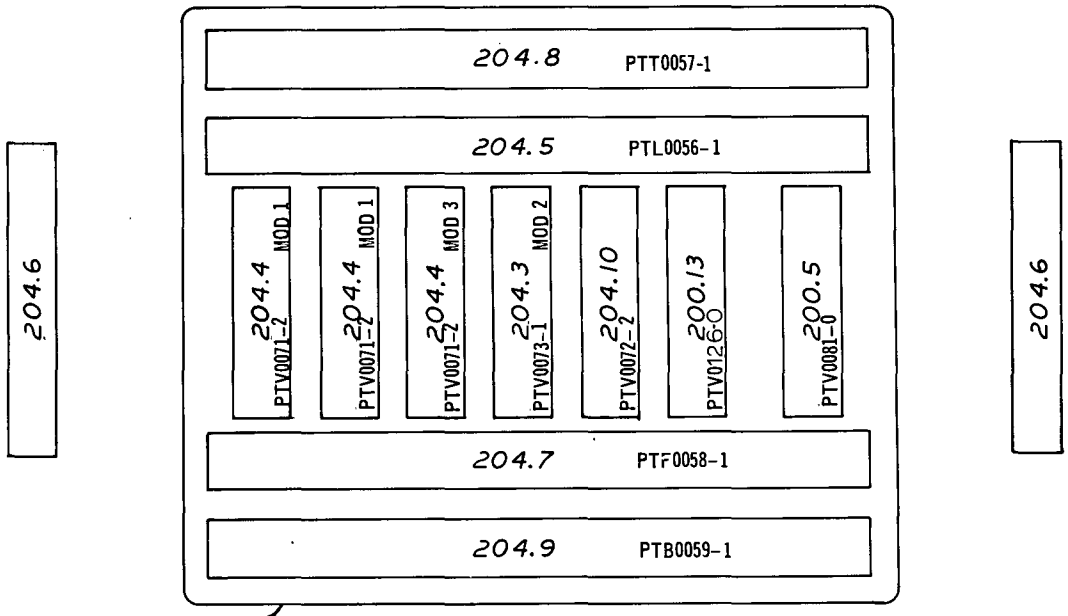
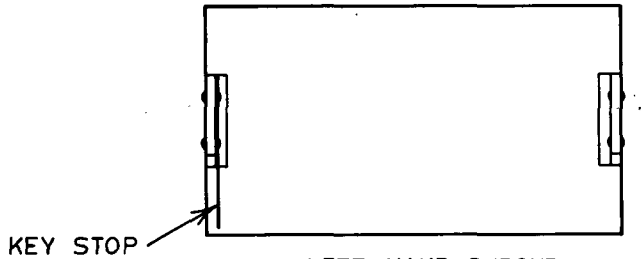
MACROMODULAR PROJECT

TITLE: PARTS LIST
BOTTOM MOTHERBOARD ASSEMBLY
PART NO. 203.7

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
			DLS	
10/23/70 cem	MANUF.	~~10/14/70~~	DRAWN BY MBP	203.7D2
	MANUF.	7-28-71	CHECKED MJK	DATE 10/14/70



200.1
ONE CELL CASE
ASSEMBLY



LEFT HAND SHROUD

CHANGE NO.	DATE	DESCRIPTION
1	7-27-71	ECO 0211

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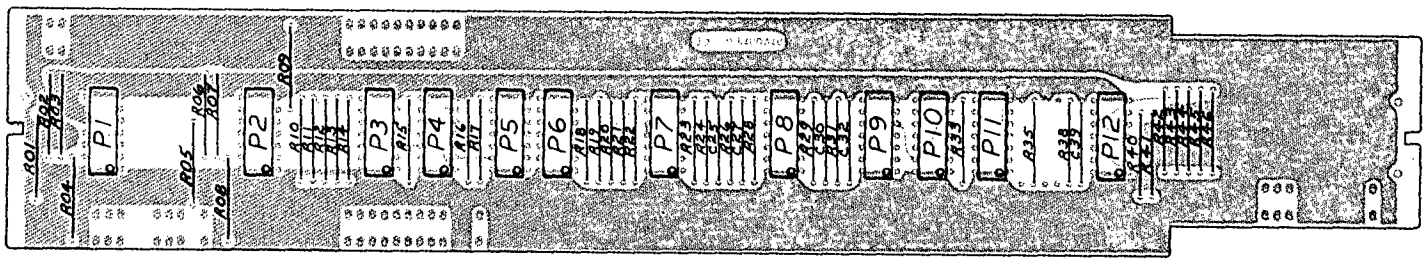
MACROMODULAR PROJECT

TITLE ASSEMBLY SCHEMATIC & PARTS LIST
COMPARATOR UNIT MOD. 2
PART NO. 204

APPROVED BY	FOR	DATE	ENG	DRAWING NO.
			WAC	204.0D MOD. 2
			DRAWN BY PLL	
			CHECKED NTK	DATE 6-3-71



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

CHANGE NO.	DATE	DESCRIPTION
3	2-19-71	E.C.O. 0159 NTK. clm
2	11-30-70	E.C.O. 0099 NTK clm
1	10/20/70	E.C.O. 0061 NTK clm

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
COMPARATOR TRANSFER CONTROL BOARD
PART NO. 204.3 MOD 2

APPROVED BY	FOR	DATE
clm	MANUF.	3-20-70
clm	MANUF.	7/1/71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 204.3D1
DATE 3-19-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M04	3	P3 P9 P11
M06	3	P2 P6 P7
M10	5	P1 P4 P5 P8 P12
M11	1	P10

CAPACITORS*

TYPE	REQUIRED	LOCATION
33 pf	4	C25 C27 C30 C32
5 pf	1	C39

*DIPPED SILVER MICA 5%

RESISTORS

TYPE	REQUIRED	LOCATION
R1	7	R02 R03 R11 R12 R42 R43 R44
R2	13	R06 R07 R10 R20 R21 R24 R26 R28 R29 R31 R33 R35 R38
R3	15	R01 R04 R05 R08 R09 R13 R14 R15 R17 R19 R22 R23 R40 R41 R45
R4	3	R16 R18 R46

CONNECTORS
AMPMODU 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.

CHANGE NO.	DATE	DESCRIPTION
1	6-2-71	E.C.O. 0194

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MACROMODULAR PROJECT

TITLE
PARTS LIST
COMPARATOR TRANSFER CONTROL BOARD
PART NO. 204.3 MOD 2

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG. DLS	DRAWING NO. 204.3D2
	PROD.	6-17-71	DRAWN BY MBP	
			CHECKED	DATE 6-4-71

Test Procedure

Compare Module Transfer Control Board #204.3 MOD 2

This board contains 3 critical delays whose proper value must be checked on each board prior to assembly into a Compare Module.

All delay values 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 pin L9 high. Apply one phase of a square wave signal with a period of 300 nanoseconds or greater to pin L10 and apply the opposite phase to pin T82. The signal should have a rise and fall time not greater than 10 nanoseconds. Observe the waveform at pin L10 with channel one of a 454 oscilloscope. Observe the waveform at pin L11 with the second channel. The delay between waveform at L10 and L11, measured from mid-point of each transition, should be 17 nanoseconds or greater. The delay should be observed for both positive and negative going transitions, and both should be 17 nanoseconds or greater. If the smaller of the two delays is less than 17 nanoseconds, increase the value of C39. If the smaller of the two delays is greater than 22 nanoseconds, the value of C39 should be reduced.

Test 2: Next observe the signal at pin T84 with channel two of the oscilloscope. The delay for both positive and negative transitions should be 22 nanoseconds or greater. If the smaller of the two delays is less than 22 nanoseconds, increase the value of C34 and C36. If the smaller of the two delays is greater than 30 nanoseconds, decrease the value of C34 and C36.

Test 3: Tie pins L9 and L10 low. Apply a square wave signal with a period of 300 nanoseconds or greater to pin T82. The signal should have a rise and fall time not greater than 10 nanoseconds. Observe the waveform at pin

CHG.	E.C.O.	DATE	APPR
	Orig.	12-29-70	Cam
1	0194	6-2-71	MTK
2	0301	11-16-73	4/5

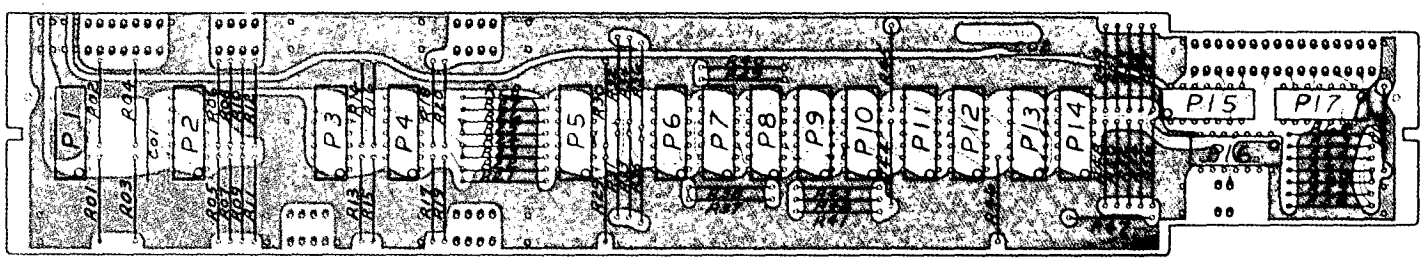
T82 with channel one of a 454 oscilloscope and observe the waveform at pin T84 with the second channel. The delay between the two waveforms, measured from midpoint of each transition, should be 133 nanoseconds or greater for both the positive and negative transtiion. If the shorter of the two delays is less than 133 nanoseconds, increase the value of C25 and C27 to increase the delay. If the shorter of the two delays is greater than 145 nanoseconds, reduce the value of C25 and C27, to decrease the delay.

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 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.

	Orig.	12-29-70	em
1	0194	6-2-71	mk
2	0301	11-16-73	HS

NOTE:
AT TIME OF INSTALLATION OF BOARD,
MODIFY AS FOLLOWS-
MOD 1: REMOVE R31
MOD 3: REMOVE R33



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

CHANGE NO	DATE	DESCRIPTION
2	11-30-70	E.C.O. 0099
1	10/30/70	NEW LAYOUT E.C.O. 0074

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
COMPARATOR DATA BOARD
PART NO. 204.4

APPROVED BY	FOR	DATE
Cam	MANUF.	25 Nov. 70
Cam	MANUF.	7/1/71

ENG. R.E.O.
DRAWN BY PLL
CHECKED MK

DRAWING NO. 204.4D1
DATE 10-30-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M06	5	P1 P3 P4 P10 P16
M10	1	P11
M11	1	P13
M12	1	P14
M20	2	P15 P17
M21	4	P6 P7 P8 P9
M30	3	P2 P5 P12

CAPACITORS*

TYPE	REQUIRED	LOCATION
10,000 pf	2	C01 C02

RESISTORS

TYPE	REQUIRED	LOCATION
R0	2	R04 R31
R1	21	R05 R07 R09 R11 R30 R34 R36 R37 R38 R39 R40 R42 R43 R49 R51 R53 R55 R58 R59 R60 R65
R2	12	R01 R14 R16 R18 R20 R21 R23 R25 R28 R44 R56 R57
R3	27	R02 R06 R08 R10 R12 R13 R15

RESISTORS (Cont)

TYPE	REQUIRED	LOCATION
R3	(Cont)	R17 R19 R22 R24 R26 R27 R29 R33 R35 R45 R46 R47 R48 R50 R52 R54 R61 R62 R63 R64
R4	3	R03 R32 R41

CONNECTORS
AMPMODU NO. 85863-4
58 REQUIRED

CIRCUIT BOARD
PTV0071-2
ONE REQUIRED

NOTE:

R0 = JUMPERS
R1 = 1.5K OHM 1% FILM RESISTOR
R2 = 750 OHM 1% FILM RESISTOR
R3 = 121 OHM 1% FILM RESISTOR
R4 = 15K OHM 5% ¼WATT CARBON COMP.

*CK-103 SPRAGUE
CERAMIC DISC. 50 WVDC

CHANGE NO.	DATE	DESCRIPTION
3	7-2-71	E.C.O. 0199
2	5-28-71	E.C.O. 0186
1	10-30-70	NEW LAYOUT E.C.O. 0074

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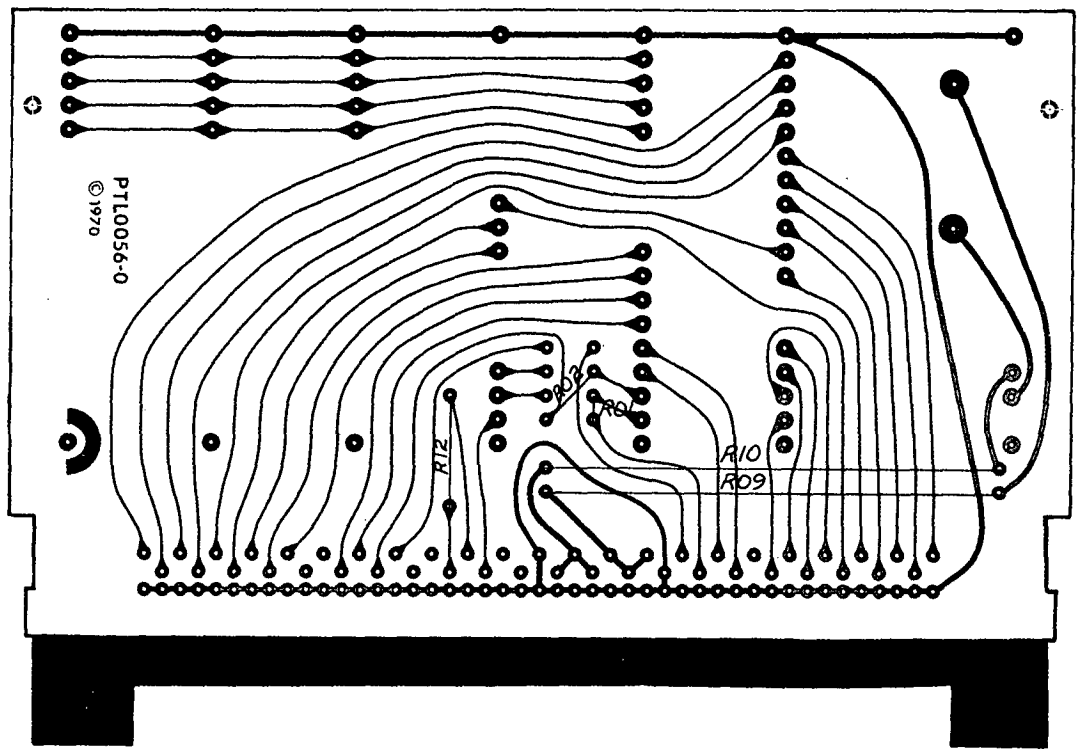
MACROMODULAR PROJECT

TITLE
PARTS LIST
COMPARATOR DATA BOARD
PART NO. 204.4

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG. REO	DRAWING NO. 204.4D2
			DRAWN BY MBP	
			CHECKED	DATE 10-30-70



CHANGE NO.	DATE	DESCRIPTION
1	11-23-70	E.C.O. 0083

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

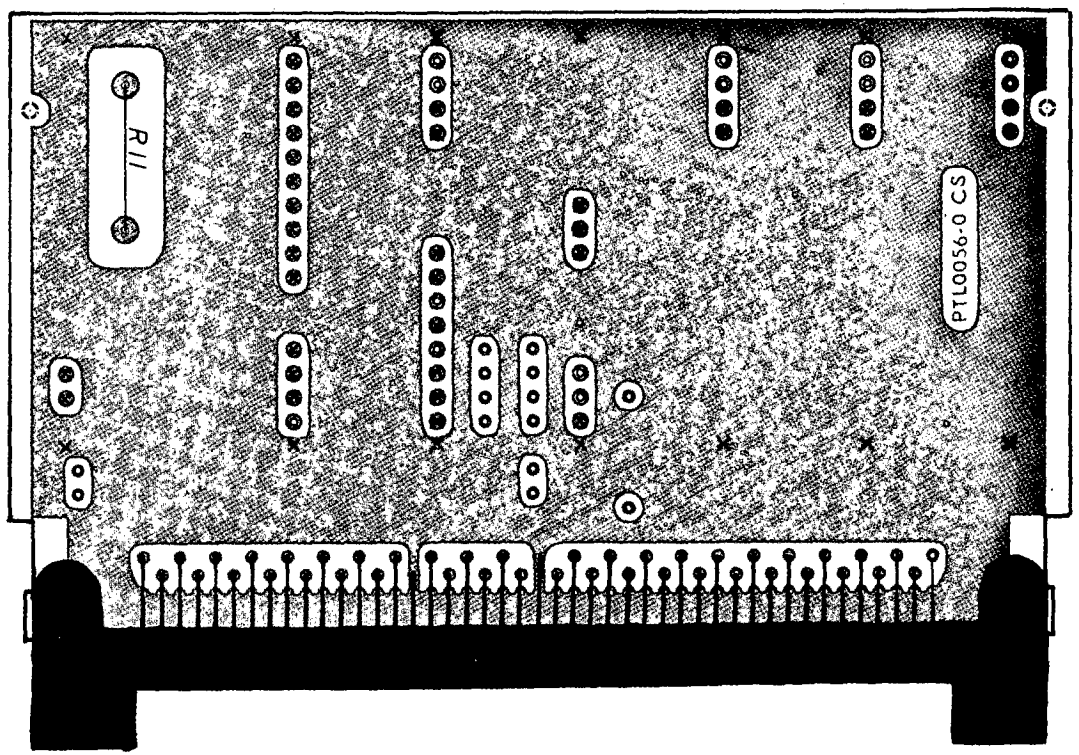
TITLE
COMPONENT IDENTIFICATION
COMPARATOR LATERAL MOTHERBOARD SIGNAL SIDE
PART NO. 204.5

APPROVED BY	FOR	DATE
Cam	MANUF	3 Apr 70
Cam	MANUF	7/1/71

ENG. DLS
DRAWN BY DHO
CHECKED NTK
DRAWING NO. 204.5D1
DATE 3-27-70

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.



CHANGE NO.	DATE	DESCRIPTION
2	11-24-71	E.C.O. 0232 MKP
1	2-24-71	E.C.O. 0161 NTK Cam

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
COMPARATOR LATERAL MOTHERBOARD ASSEMBLY COMPONENT SIDE
PART NO. 204.5

APPROVED BY	FOR	DATE
Cam	MANUF.	11-27-70
Cam	MANUF.	7/1/71

ENG. DLS
DRAWN BY DHO
CHECKED NTK
DRAWING NO. 204.5D2
DATE 11-23-70

JUMPERS
FOUR REQUIRED
R01
R02
R09
R10

RESISTOR 25.5K OHM 1/8WATT 1%
ONE REQUIRED
R12

AMP CONNECTOR
583 464-1
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931-5
FORTY-SEVEN REQUIRED

FUSE BUSSMAN GFA-¾AMP
ONE REQUIRED
R11

CIRCUIT BOARD
PTL0056-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
4	11-24-71	E.C.O. 0232 MLP
3	7-2-71	E.C.O. 0199
2	2-24-71	E.C.O. 0161
1	11-16-70	E.C.O. 0083

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MACROMODULAR PROJECT

TITLE
PARTS LIST
COMPARATOR LATERAL MOTHER BOARD
PART NO. 204.5

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	4/7/70	DLS	204.5D3
			DRAWN BY MBP	
			CHECKED MK	DATE 6/24/70

COMPARE

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 YELLOW PMS 109 BACKING.
MANUFACTURED FROM .016 THICK ALUMINUM
WITH SOLVENT ACTIVATED PERMANENT
ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

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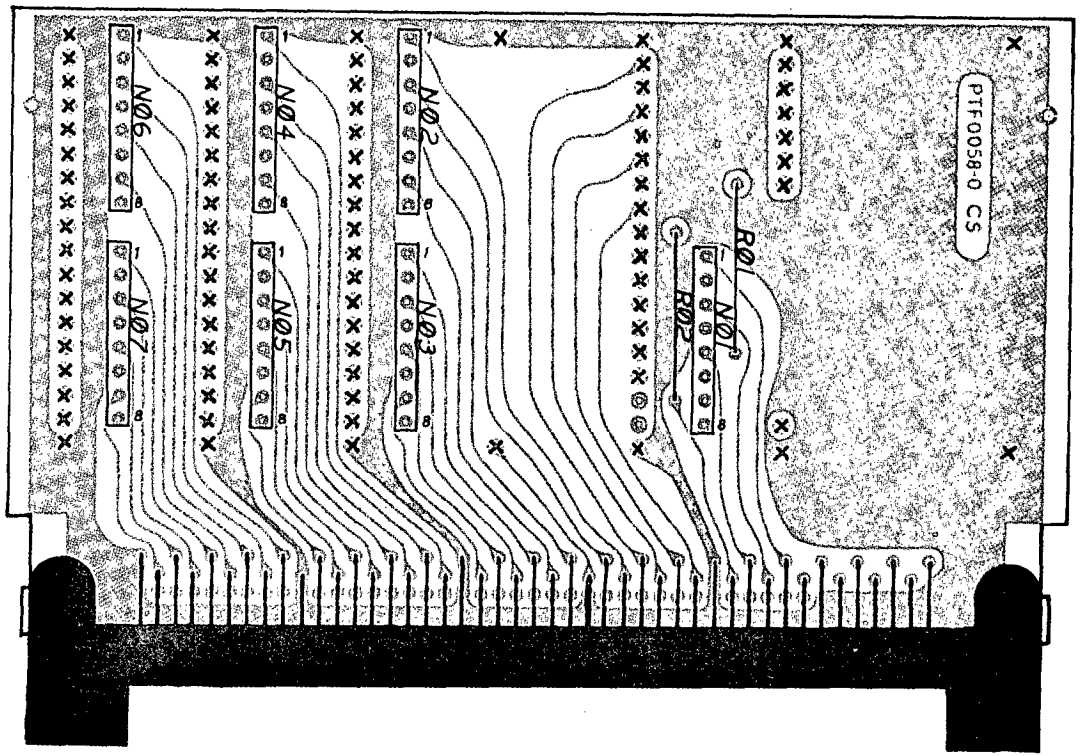
MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL
COMPARE MODULE
PART #204.6

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	NTK	
Maw	Prod.	7/28/70	DRAWN BY KM	204.6D
			CHECKED Maw	DATE 6-16-70



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

NOTE:
SEE DRAWING NUMBER 200.50D29 FOR CONNECTOR ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
COMPARATOR FACEPLATE MOTHERBOARD
PART NO. 204.7

APPROVED BY	FOR	DATE
CBM	MANUF.	11-27-70
CBM	MANUF.	7/1/71

ENG. DLS
DRAWN BY DHO
CHECKED NTK
DRAWING NO. 204.7D1
DATE 11-16-70

RESISTORS 15K OHM 5% ¼WATT CARBON
TWO REQUIRED

R01
R02

SPRAGUE NETWORK LTN–2
SEVEN REQUIRED

N01
N02
N03
N04
N05
N06
N07

AMP CONNECTOR
583 464–1
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931–5
EIGHTY–THREE REQUIRED

CIRCUIT BOARD
PTF0058–1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-2-71	E.C.O. 0199
1	5–28–71	E.C.O. 0191

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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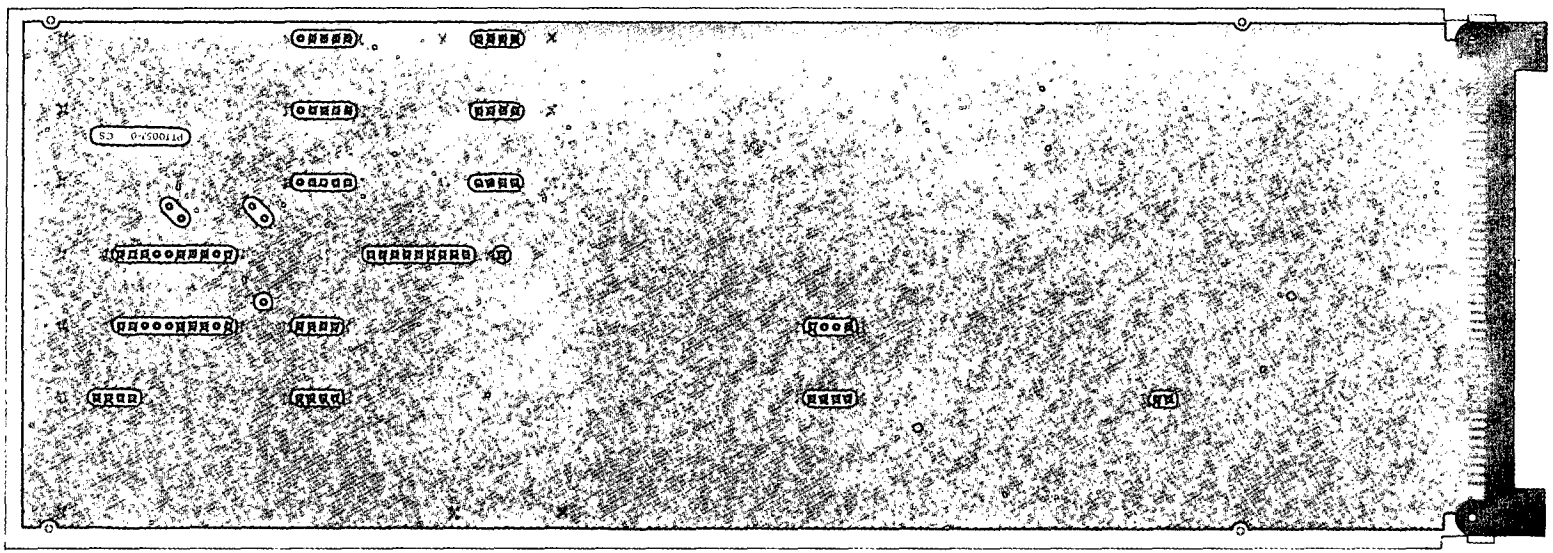
MACROMODULAR PROJECT

TITLE
PARTS LIST
COMPARATOR FACEPLATE MOTHERBOARD
PART NO. 204.7

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
				204.7D2
			DRAWN BY MBP	
			CHECKED	DATE



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

NOTE 2:
SEE DRAWING NUMBER 200.50D26 FOR CONNECTOR ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
2	5-28-71	E.C.O. 0189 NTK. cam
1	1130-70	E.C.O. 0099 cam

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WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
COMPARATOR TOP MOTHERBOARD ASSEMBLY
PART NO. 204.8

APPROVED BY	FOR	DATE
cam	MANUF.	11-27-70
cam	MANUF.	7/1/71

ENG. DLS
DRAWN BY DHO
CHECKED NTK
DRAWING NO. 204.8D1
DATE 11-16-70

AMP CONNECTOR
1-202845-5
ONE REQUIRED

CONNECTORS
AMPMODU HO. 85931-5
ONE HUNDRED FOUR REQUIRED

CIRCUIT BOARD
PTT0057-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
3	7-2-71	E.C.O. 0199
2	5-28-71	E.C.O. 0189
1	11-30-70	E.C.O. 0099

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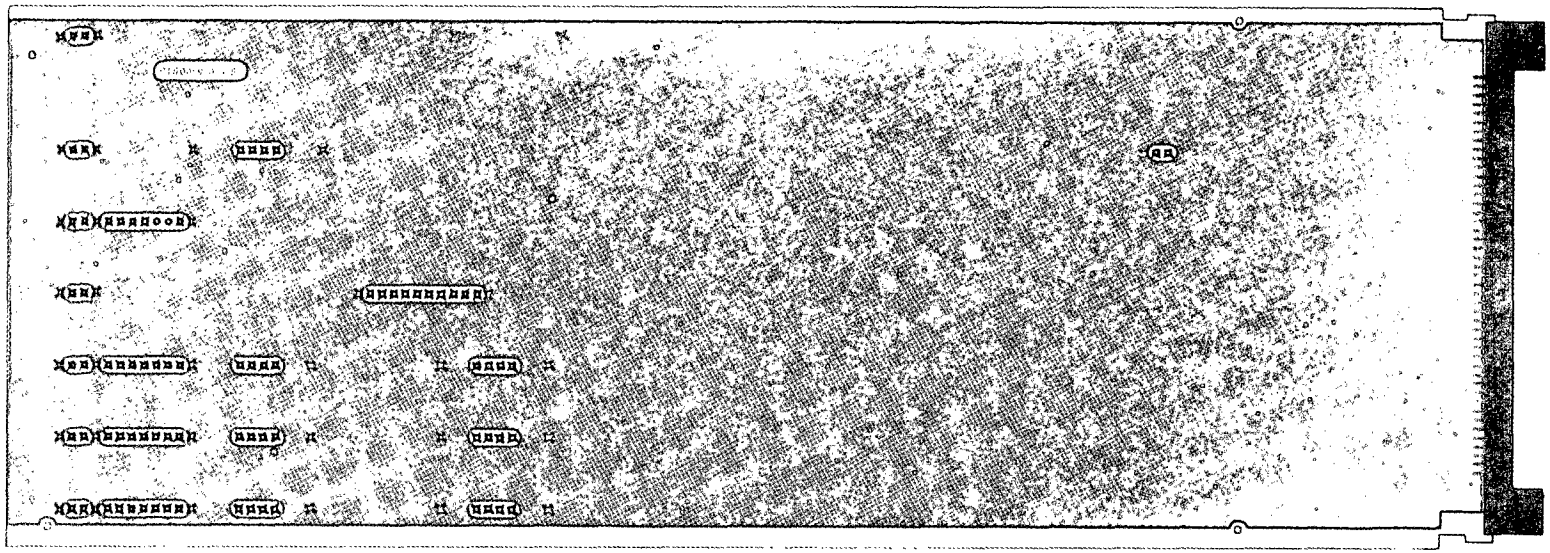
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
COMPARATOR TOP MOTHERBOARD ASSEMBLY
PART NO. 204.8

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
				204.8D2
			DRAWN BY MBP	
			CHECKED	DATE 11/24/70



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

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

CHANGE NO.	DATE	DESCRIPTION
1	1-4-71	E.C.O. 0140 DTK. clm

COMPUTER SYSTEMS LABORATORY
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MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
COMPARATOR BOTTOM MOTHERBOARD ASSEMBLY
PART NO. 204.9

APPROVED BY	FOR	DATE
clm	MANUF.	11-27-70
clm	MANUF.	7/1/71

ENG. DLS
DRAWN BY DHO
CHECKED NTK
DRAWING NO. 204.9D1
DATE 11-16-70

AMP CONNECTOR
1-202845-5
ONE REQUIRED

CONNECTORS
AMPMODU NO. 85931-5
ONE HUNDRED FOURTEEN REQUIRED

CIRCUIT BOARD
PTB0059-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-2-71	E.C.O. 0199
1	1-5-71	E.C.O. 0140

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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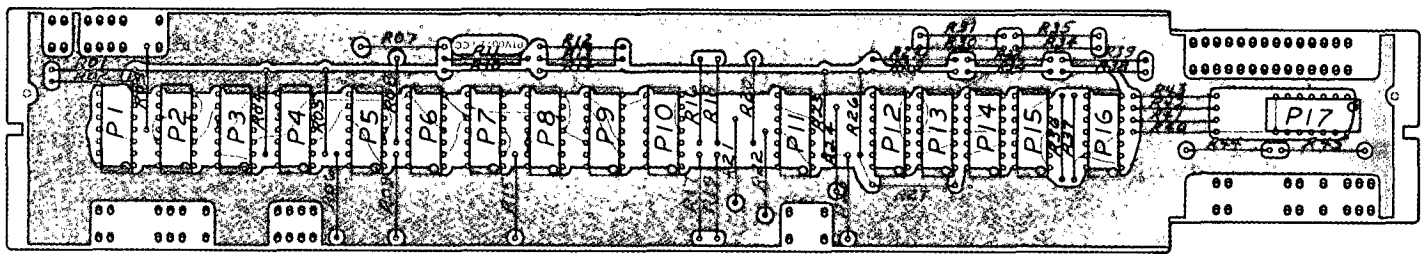
MACROMODULAR PROJECT

TITLE
PARTS LIST
BOTTOM MOTHERBOARD ASSEMBLY
PART NO. 204.9

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
			DRAWN BY MBP	204.9D2
			CHECKED	DATE 11/24/70



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

CHANGE NO.	DATE	DESCRIPTION
2	11-30-70	E.C.O. 0099 cem
1	10/30/70	NEW LAYOUT E.C.O. 0074 cem

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
COMPARATOR CONTROL BOARD
PART NO. 204.10

APPROVED BY	FOR	DATE
cem	MANUF.	25 Nov. 70
cem	MANUF.	7/1/71

ENG. REO
DRAWN BY PLL
CHECKED MTK
DRAWING NO. 204.10D1
DATE 10-30-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M02	1	P4
M04	1	P8
M05	1	P6
M06	2	P15 P16
M10	5	P2 P10 P11 P13 P14
M11	4	P1 P3 P7 P9
M20	1	P17
M31	2	P5 P12

RESISTORS

TYPE	REQUIRED	LOCATION
R0	6	R01 R02 R03 R15 R22 R24
R1	10	R08 R10 R11 R14 R16 R18 R20 R23 R26 R45
R2	10	R04 R05 R28 R29 R30 R31 R36 R37 R40 R41
R3	11	R06 R07 R09 R12 R13 R17 R19 R21 R25 R27 R44

RESISTORS (cont)

TYPE	REQUIRED	LOCATION
R5	8	R32 R33 R34 R35 R38 R39 R42 R43

CONNECTORS
AMPMODU NO. 85863-4
55 REQUIRED

CIRCUIT BOARD
PTV0072-2
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

CHANGE NO.	DATE	DESCRIPTION
4	7-2-71	E.C.O. 0199
3	5-28-71	E.C.O. 0187
2	11-30-70	ECO 0099
1	10/30/70	NEW LAYOUT E.C.O. 0074

COMPUTER SYSTEMS LABORATORY
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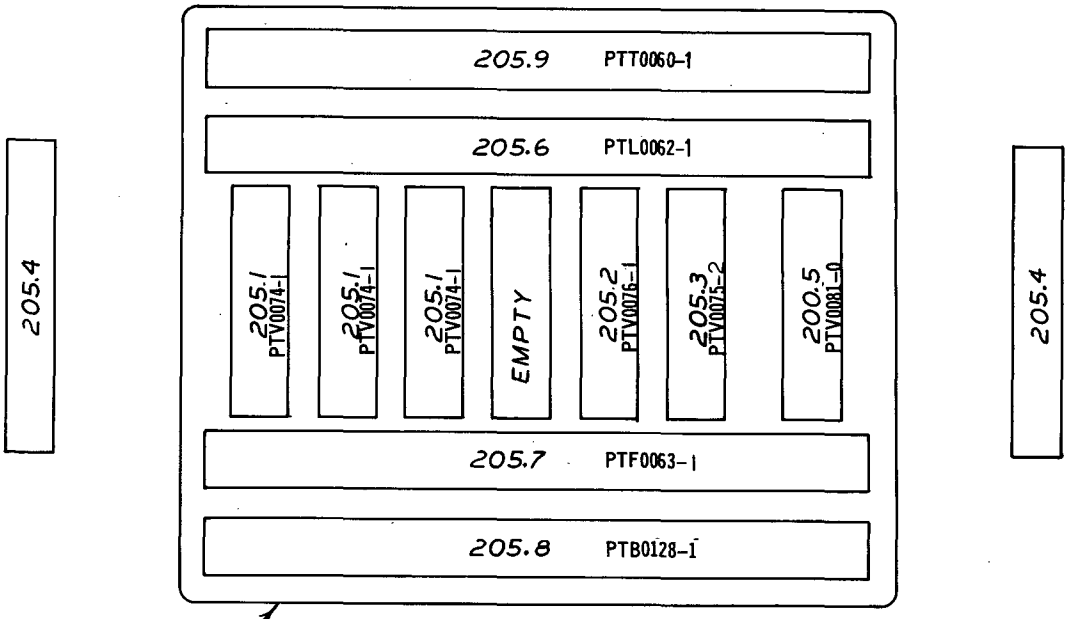
MACROMODULAR PROJECT

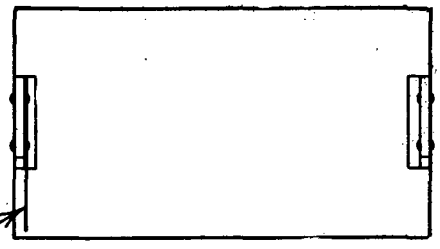
TITLE
PARTS LIST
COMPARATOR CONTROL BOARD
PART NO. 204.10

APPROVED BY	FOR	DATE	ENG	DRAWING NO.
	MANUF.	4/7/70	REO	204.10D2
	MANUF.		DRAWN BY MBP	
			CHECKED MTR	DATE 10-30-70

1Nov70



200.1
ONE CELL CASE
ASSEMBLY



LEFT HAND SHROUD

CHANGE NO.	DATE	DESCRIPTION
4	9-9-71	E.C.O. 0226
3	7-27-71	E.C.O. 0212
2	11-9-70	E.C.O. 0079
1	4-17-70	CHANGED TOP M.B.

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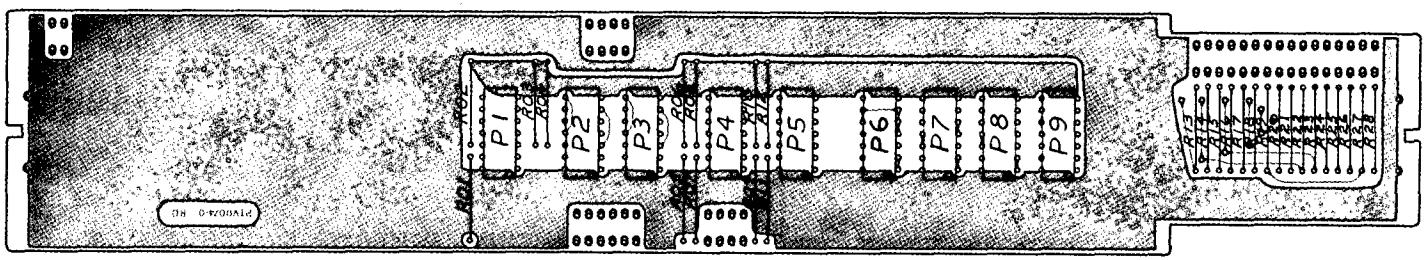
MACROMODULAR PROJECT

TITLE ASSEMBLY SCHEMATIC & PARTS LIST
REGISTER UNIT
PART NO. 205

APPROVED BY	FOR	DATE
NTK	Communication	
	MANUF	

ENG	DRAWING NO.
WAC	205.0 D
DRAWN BY: PLL	
CHECKED: NTK	DATE: 3-28-70



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

CHANGE NO.	DATE	DESCRIPTION
2	11-9-70	E.C.O. 0079
1	8-19-70	Added Polarity Indicators E.C.O. 29

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
REGISTER DATA BOARD
PART NO. 205.1

APPROVED BY	FOR	DATE
Cem	MANUF	3/27/70
Cem	MANUF.	9-15-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 205.101
DATE 3-26-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01B	4	P6
		P7
		P8
		P9
M04	1	P1
M10	2	P2
		P3
M16	2	P4
		P5

RESISTORS

TYPE	REQUIRED	LOCATION
R1	7	R04
		R06
		R08
		R10
		R12
		R02
		R03
R3	5	R01
		R05
		R07
		R09
		R11
R5	16	R13
		R14
		R15
		R16
		R17
		R18
		R19
		R20
		R21
		R22
		R23
		R24
		R25
		R26
		R27
		R28

CONNECTORS
AMPMODU NO. 85863-4
45 REQUIRED

CIRCUIT BOARD
PTV0074-1
ONE REQUIRED

NOTE:

R1 = 1.5 K OHM 1% FILM RESISTOR

R3 = 121 OHM 1% FILM RESISTOR
R5 = 57.6 OHM 1% FILM RESISTOR

CHANGE NO.	DATE	DESCRIPTION
2	9-9-71	E.C.O. 0226
1	9-9-70	CHG CIRCUIT TYPE E.C.O. 0034

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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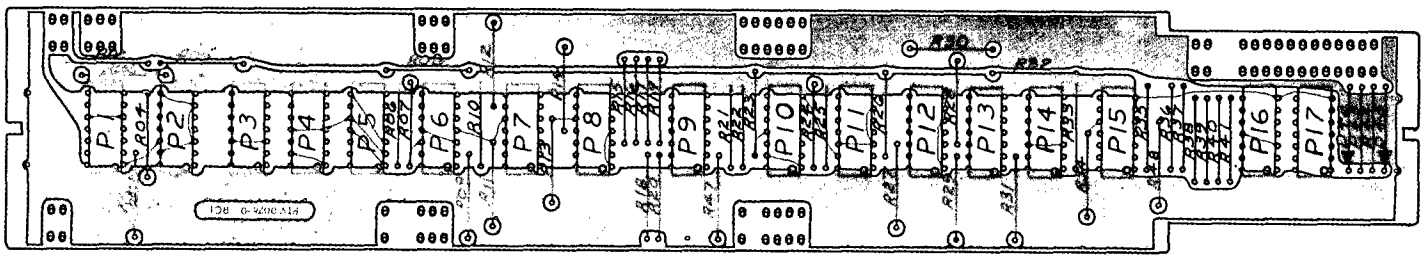
MACROMODULAR PROJECT

TITLE: PARTS LIST
REGISTER DATA BOARD
PART NO. 205.1

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
	MANUF.	5/15/70	DRAWN BY MBP	205.1D2
			CHECKED	DATE 6/17/70



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

CHANGE NO.	DATE	DESCRIPTION
2	11-9-70	E.C.O. 0079 NTK Clem
1	5-12-70	ADDED PIN NO. 1 INDICATORS

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
REGISTER CONTROL BOARD NO. 1
PART NO. 205.2

APPROVED BY	FOR	DATE
Clem	MANUF	3/27/70
Clem	MANUF.	9-15-71

ENG.	DLS
DRAWN BY	PLL
CHECKED	NTK
DRAWING NO.	205.2D1
DATE	3-26-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01	2	P7
		P15
M08	1	P5
M10	6	P1
		P8
		P10
		P12
		P13
		P16
M11	4	P2
		P3
		P11
		P14
M16	1	P9
M20	1	P17
M30	1	P6
M31	1	P4

RESISTORS

TYPE	REQUIRED	LOCATION
R0	7	R08
		R11
		R12
		R13
		R27
		R29
		R34
R1	15	R01
		R04
		R06
		R10
		R14
		R16
		R17
		R19
		R21
		R22
		R25
		R32
		R33
		R35
		R48
R3	14	R02
		R03
		R05
		R07
		R09
		R15
		R18
		R20
		R23
		R24
		R26
		R30
		R31
		R47
R4	3	R28
		R43
		R44

RESISTORS (cont)

TYPE	REQUIRED	LOCATION
R5	6	R36
		R37
		R38
		R39
		R40
		R41

DIODES 1N3604
TWO REQUIRED
D42
D45

CONNECTORS
AMPMODU NO. 85863-4
56 REQUIRED

CIRCUIT BOARD
PTV0076-1
ONE REQUIRED

NOTE:

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

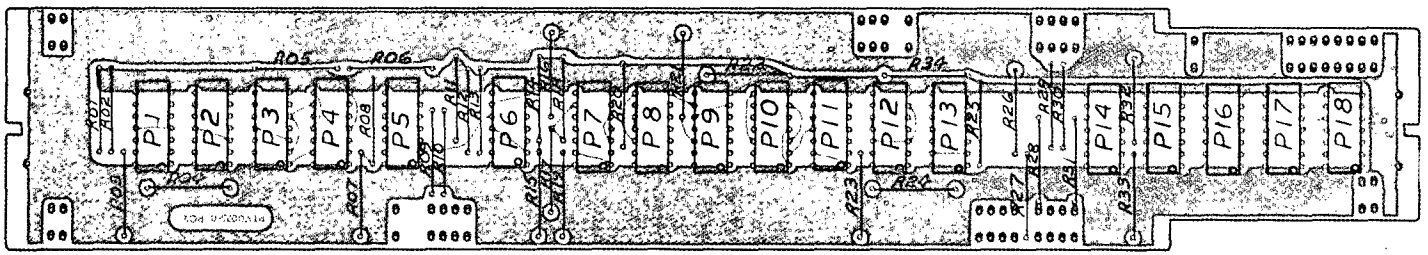
CHANGE NO.	DATE	DESCRIPTION
2	9-9-71	E.C.O. 0226
1	9-9-70	CHG CIRCUIT TYPE E.C.O. 0033

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
REGISTER CONTROL BOARD NO. 1
PART NO. 205.2

APPROVED			ENG.	DRAWING NO.
BY	FOR	DATE		
	MANUF.	5/15/70	DRAWN BY MBP	205.2D2
			CHECKED	DATE 6/17/70



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

CHANGE NO.	DATE	DESCRIPTION
2	11-9-70	E.C.O. 0079 NTK. Cam Cam
1	8-19-70	Added Polarity Indicators E.C.O. 30 NTK

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
REGISTER CONTROL BOARD NO. 2
PART NO. 205.3

APPROVED BY	FOR	DATE
Cam	MANUF	3/27/70
Cam	MANUF.	9-15-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 205.3D1
DATE 3-26-70

INTEGRATED CIRCUITS

TYPE	REQUIRED	LOCATION
M01B	4	P14
		P15
		P16
		P17
M10	4	P6
		P8
		P9
		P13
M11	4	P2
		P3
		P10
		P12
M16	1	P5
M20	1	P18
M30	1	P1
M31	3	P4
		P7
		P11

RESISTORS

TYPE	REQUIRED	LOCATION
R0	1	R09
R1	11	R01
		R02
		R05
		R08
		R11
		R12
		R14
		R18
		R20
		R22
		R24
R3	20	R03
		R04
		R06
		R07
		R10
		R13
		R15
		R16
		R17
		R19
		R21
		R23
		R26
		R27
		R28
		R29
		R30
		R31
		R32
		R33
R4	2	R25
		R34

CONNECTORS
AMPMODU NO. 85863-4
52 REQUIRED

CIRCUIT BOARD
PTV0075-1
ONE REQUIRED

NOTE:

R0 = JUMPERS
R1 = 1.5 K OHM 1% FILM RESISTOR
R3 = 121 OHM 1% FILM RESISTOR
R4 = 15K OHM 5% CARBON COMP.

CHANGE NO.	DATE	DESCRIPTION
1	9-9-71	E.C.O. 0226

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
PARTS LIST
REGISTER CONTROL BOARD NO. 2
PART NO. 205.3

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
C Olsen	MANUF.	5/15/70	DRAWN BY MBP	205.3D2
C Olsen	[illegible]	[illegible]	CHECKED [illegible]	DATE 6/17/70

METALCRAFT "AUTOGRAPH" OR EQUIVALENT:
BLANK SIZE: ¼" 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 IVORY PMS 134
BACKING. MANUFACTURED FROM .016
THICK ALUMINUM WITH SOLVENT ACTIVATED
PERMANENT ADHESIVE BACKING.

NOTE: PANTONE MATCHING SYSTEM (PMS)

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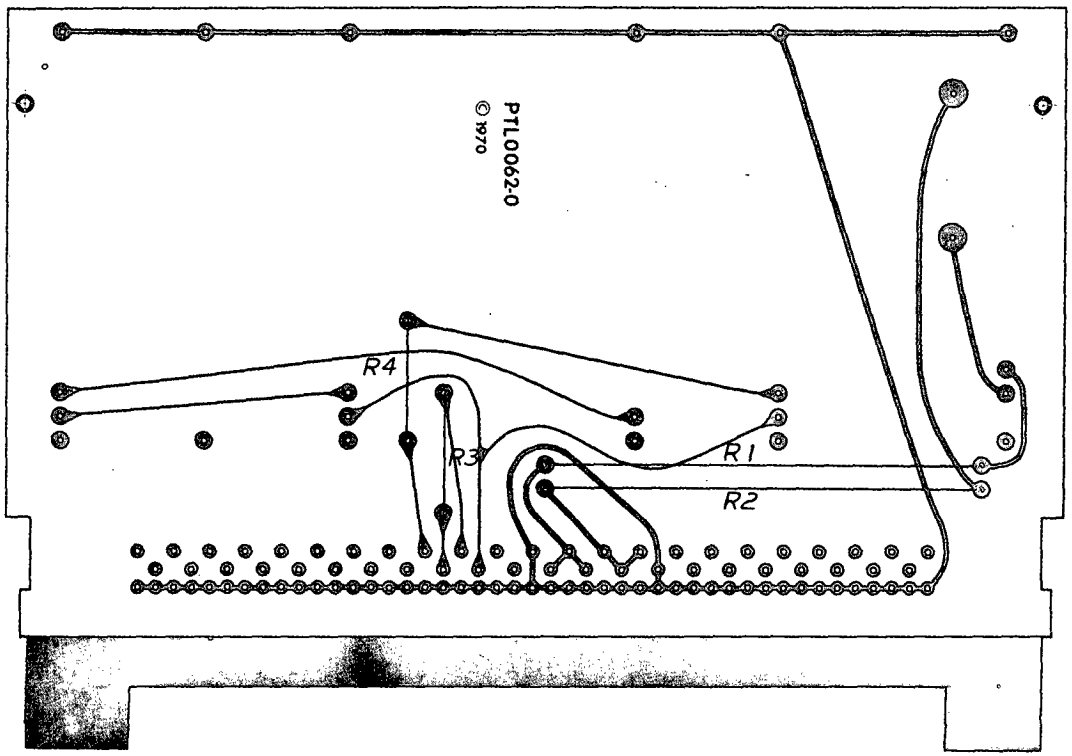
MACROMODULAR PROJECT

TITLE

IDENTIFICATION LABEL
REGISTER MODULE
PART #205.4

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	NTK	
Mau	Prod.	7/28/70	DRAWN BY KM	205.4D
Cem	MANUF.	10-11-71	CHECKED Mau	DATE 6-16-70



CHANGE NO.	DATE	DESCRIPTION
1	11-9-70	E.C.O. 0079 Cem NTK

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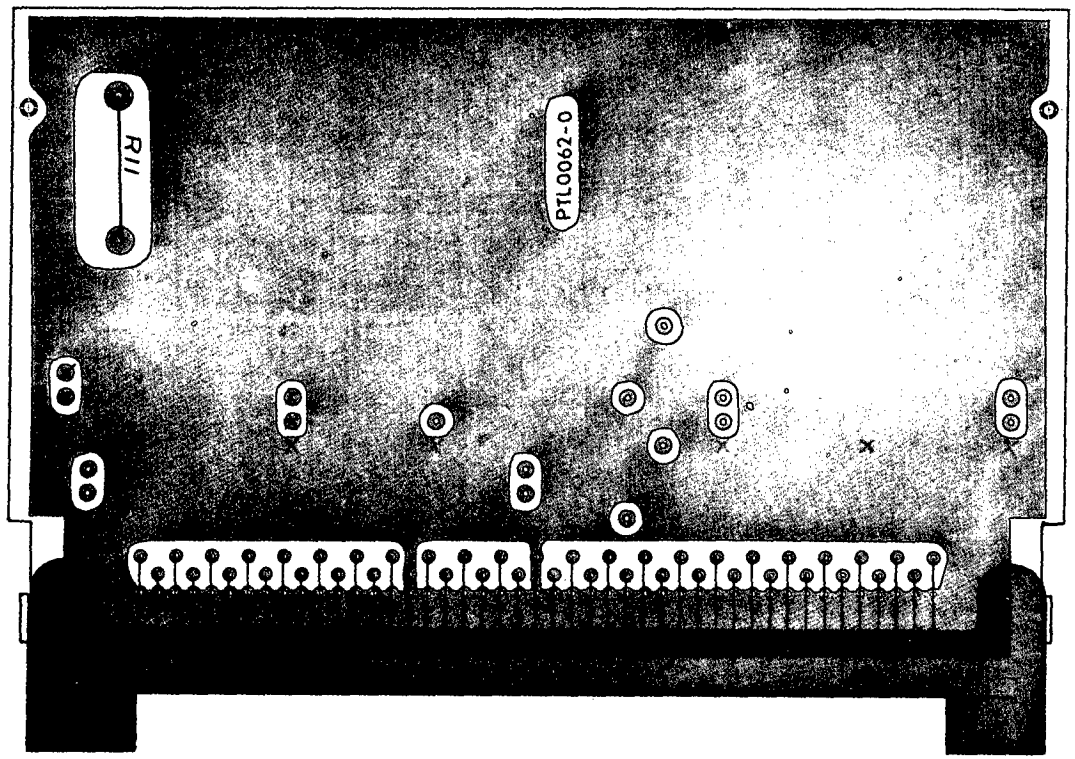
MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
REGISTER LATERAL MOTHERBOARD ASSEMBLY SIGNAL SIDE
PART NO. 205.6

APPROVED BY	FOR	DATE
Cem	MANUF.	28 Apr 70
Cem	MANUF.	9-15-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 205.6D1
DATE 4-17-70

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.

CHANGE NO.	DATE	DESCRIPTION

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
REGISTER LATERAL MOTHERBOARD ASSEMBLY COMPONENT SIDE
PART NO. 205.6

APPROVED BY	FOR	DATE
Com	MANUF.	11-22-70
Com	MANUF.	9-15-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 205.6D2
DATE 11-10-70

JUMPERS
THREE REQUIRED
R1
R2
R4

RESISTOR 34K OHM 1% FILM
ONE REQUIRED
R03

CONNECTOR AMP 583 464-1
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931-5
SIXTEEN REQUIRED

FUSE BUSSMAN GFA THREE-QUARTER AMP
ONE REQUIRED
R11

CIRCUIT BOARD
PTL0062-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-15-71	E.C.O. 0206
1	11-9-70	E.C.O. 0079 MTK

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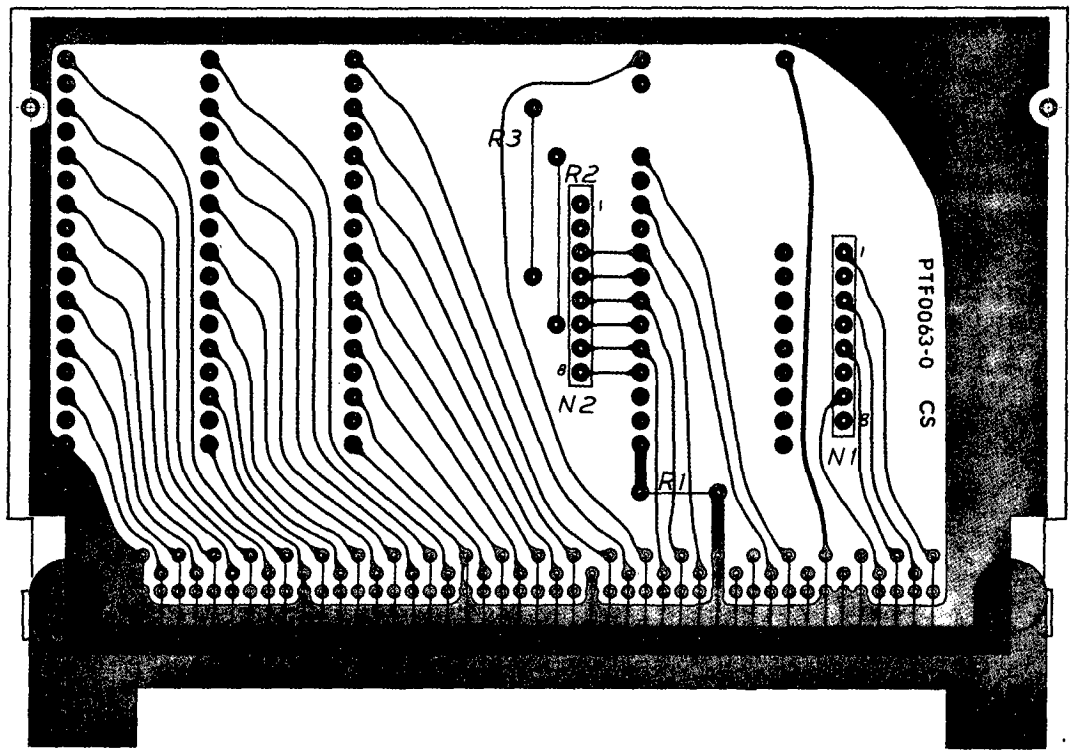
MACROMODULAR PROJECT

TITLE
PARTS LIST
REGISTER LATERAL MOTHER BOARD
PART NO. 205.6

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.		DLS	205.6D3
	MANUF.	9-15-71	DRAWN BY MBP	
			CHECKED MTK	DATE 11-9-70



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

NOTE:
SEE DRAWING 200.50D29 FOR CONNECTOR ORIENTATION.

CHANGE NO.	DATE	DESCRIPTION
1	11-9-70	E.C.O. 0079 NTK CRM

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
REGISTER FACEPLATE MOTHERBOARD ASSEMBLY
PART NO. 205.7

APPROVED BY	FOR	DATE
CRM	MANUF	21 Apr 71
CRM	MANUF.	9-15-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK
DRAWING NO. 205.701
DATE 4-17-70

JUMPER
ONE REQUIRED
R1

RESISTOR 15K OHM ¼WATT 5% CARBON COMP.
TWO REQUIRED
R2
R3

NETWORK LTN-2
TWO REQUIRED
N1
N2

CONNECTOR AMP 583 464-1
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931-5
EIGHTY-TWO REQUIRED

CIRCUIT BOARD
PTF0063-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	9-9-71	E.C.O. 0226
1	11-9-70	E.C.O. 0079

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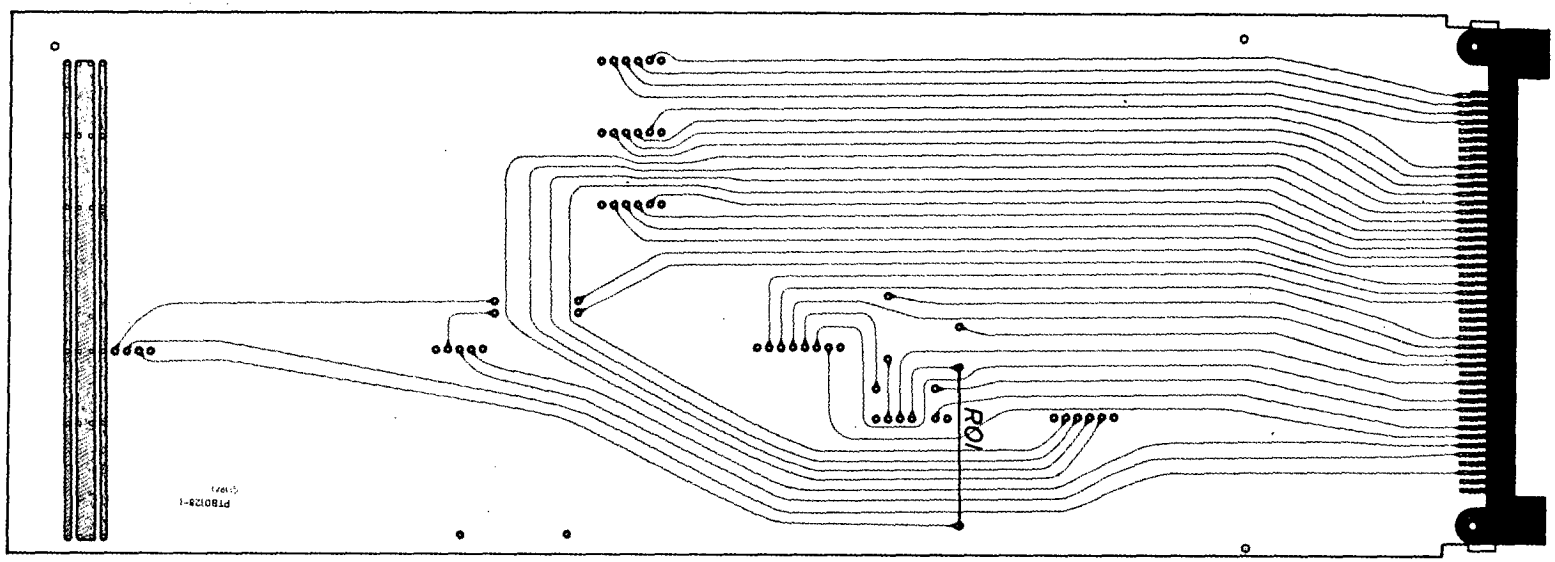
MACROMODULAR PROJECT

TITLE
PARTS LIST
REGISTER FACEPLATE MOTHER BOARD
PART NO. 205.7

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.		DLS	205.7D2
			DRAWN BY MBP	
			CHECKED	DATE 11-9-70



CHANGE NO.	DATE	DESCRIPTION

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WASHINGTON UNIVERSITY
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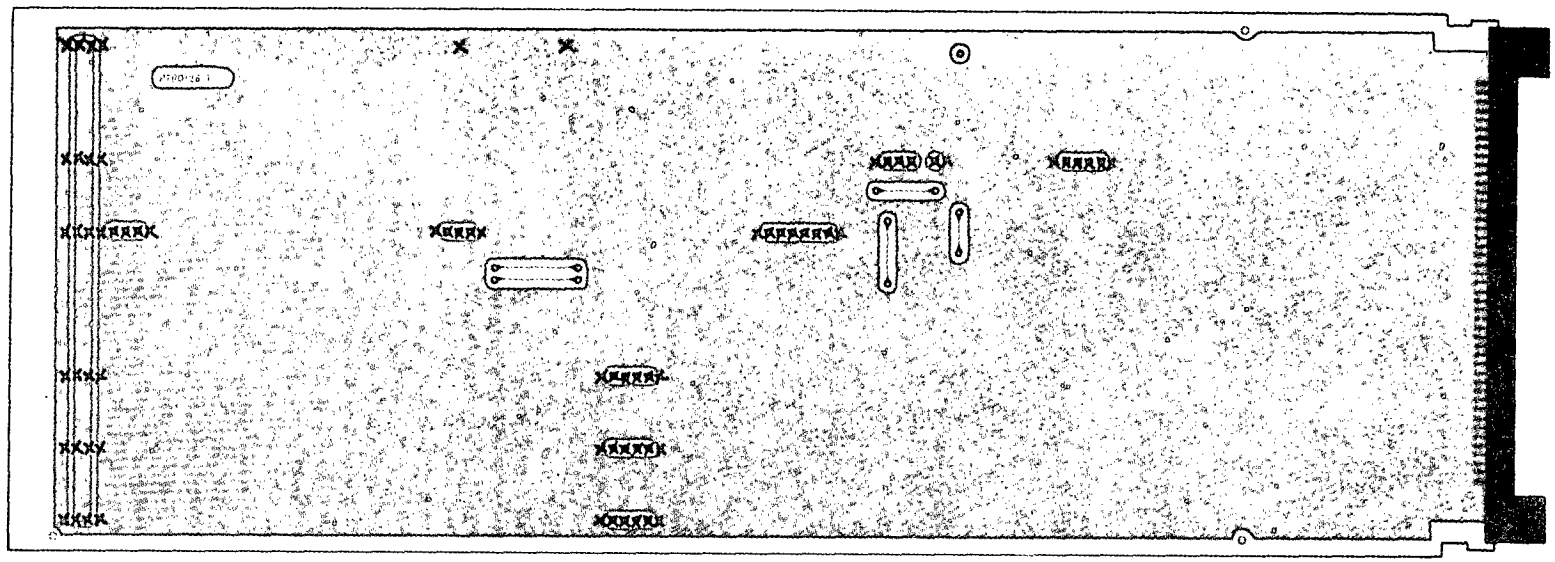
MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
REGISTER BOTTOM MOTHERBOARD ASSEMBLY SIGNAL SIDE
PART NO. 205.8

APPROVED BY	FOR	DATE
	MANU.	9/15/71

ENG. REO
DRAWN BY MBP
CHECKED MK

DRAWING NO. 205.8D1
DATE 8-13-71



NOTE 1:
SEE DRAWING 200.50D27 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.
(73 PINS)

CHANGE NO.	DATE	DESCRIPTION

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MACROMODULAR PROJECT

TITLE
COMPONENT IDENTIFICATION
REGISTER BOTTOM MOTHERBOARD ASSEMBLY COMPONENT SIDE
PART NO. 205.8

APPROVED BY	FOR	DATE	ENG. REO	DRAWING NO. 205.8D2
			DRAWN BY MBP	
			CHECKED	DATE 9-10-71

JUMPER
R01
ONE REQUIRED

CONNECTOR
AMP 1-202845-5
ONE REQUIRED

CONNECTOR
AMP NO. 85931-5
SEVENTY-THREE REQUIRED

CIRCUIT BOARD
PTB0128-1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION

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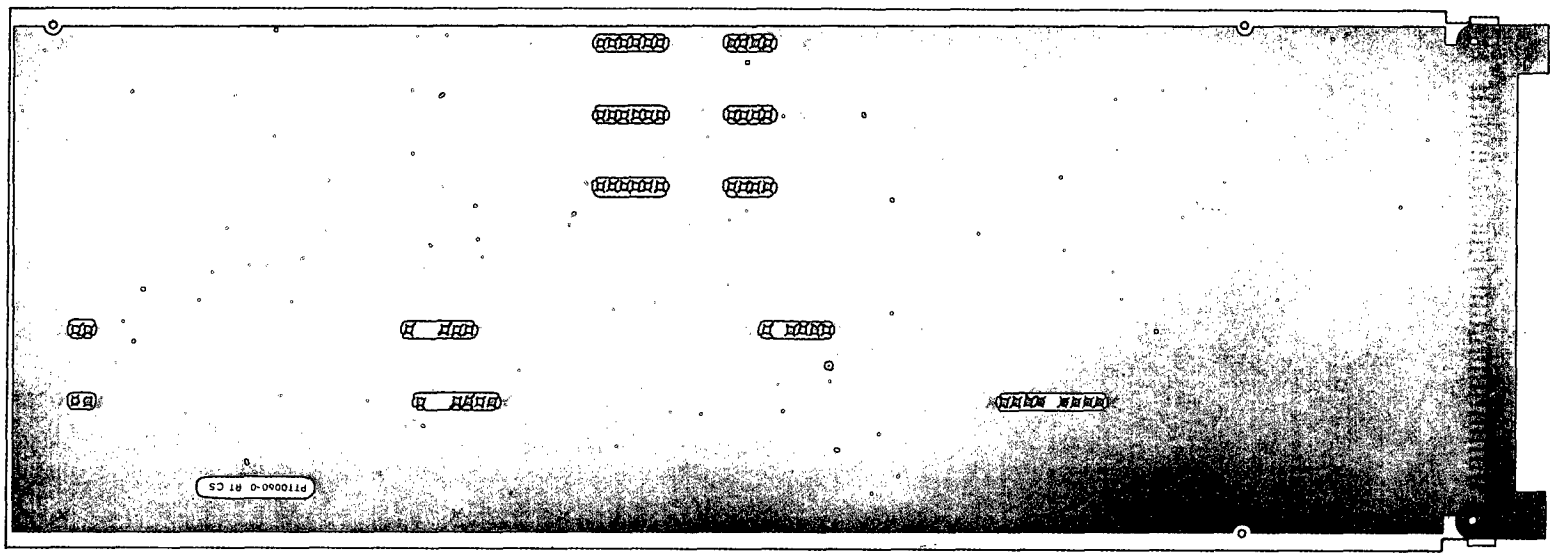
MACROMODULAR PROJECT

TITLE
PARTS LIST
REGISTER BOTTOM MOTHER BOARD
PART NO. 205.8

APPROVED BY	FOR	DATE	ENG. REO	DRAWING NO. 205.8D3
			DRAWN BY MBP	
			CHECKED	DATE 9-10-71



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.

CHANGE NO.	DATE	DESCRIPTION

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MACROMODULAR PROJECT

TITLE: COMPONENT IDENTIFICATION
REGISTER TOP MOTHER BOARD ASSEMBLY
PART NO. 205.9

APPROVED BY	FOR	DATE
Cam	MANUF.	21 APR 70
Cam	MANUF.	9-15-71

ENG. DLS
DRAWN BY PLL
CHECKED NTK

DRAWING NO. 205.9D1
DATE 4-18-70

CONNECTOR AMP 1-202845-5
ONE REQUIRED

CONNECTOR
AMPMODU NO. 85931-5
EIGHTY-SEVEN REQUIRED

CIRCUIT BOARD
PTT0060- 1
ONE REQUIRED

CHANGE NO.	DATE	DESCRIPTION
2	7-15-71	E.C.O. 0206
1	11-9-70	CHANGED NO. & TITLE

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MACROMODULAR PROJECT

TITLE
PARTS LIST
REGISTER TOP MOTHER BOARD ASSEMBLY
PART NO. 205.9

APPROVED BY	FOR	DATE	ENG.	DRAWING NO.
	MANUF.	4/20/70		205.9D2
	MANUF	9-15-71	DRAWN BY MBP	
			CHECKED	DATE 6/17/70

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13. ABSTRACT

Manufacturing documents, including parts lists, assembly pictorials, and adjustment procedures for the LOGIC, ARITHMETIC, SHIFT, COMPARE and REGISTER macromodule electronic subassemblies are given.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
LOGIC Macromodule						
ARITHMETIC Macromodule						
SHIFT Macromodule						
COMPARE Macromodule						
REGISTER Macromodule						
Macromodule						
Emitter-Coupled Logic						
Asynchronous Logic						


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