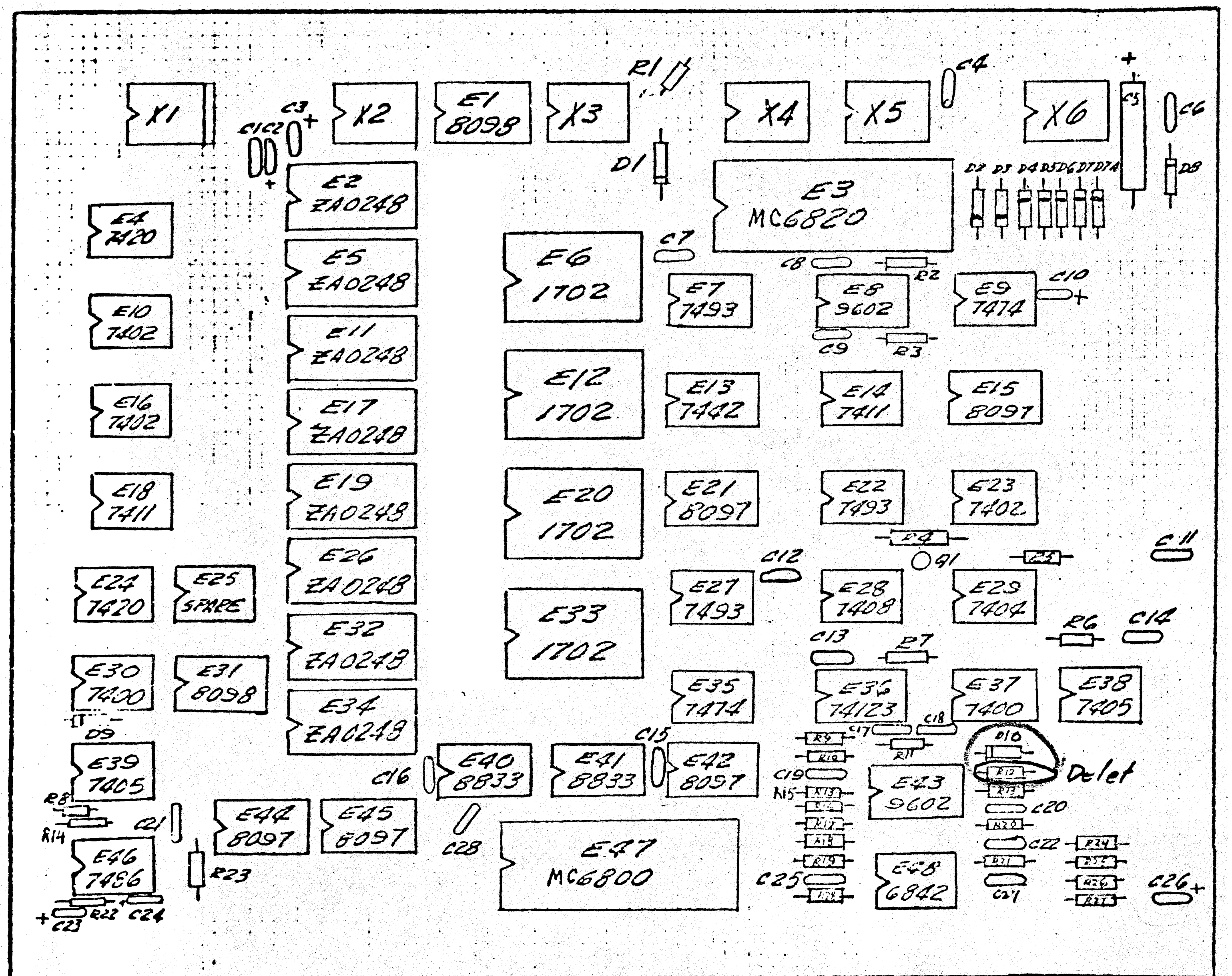
BY ___ DATE ___ SUBJECT ___ SHEET NO. ___
CHKD. BY ___ DATE ___ PARTS LAYOUT JOB NO. ___



E1,E31	8098	D1	3 V ZEN. 1N5226
E2,E5,E11,E17,E19, E26,E32,E34	2107	D2,D3,D4,D9, D10,[redacted]	1N914
E3	6820	D5,D6,D7,D8	1N4001
E4,E24	7420	Q1	2N2369A
E6,E12,E20,E33	1702		
E7,E22,E27	7493		
E8,E43	9602		
E9,E35	7474		
E10,E16,E23	7402		
E13	7442		
E14,E18	7411		
E15,E21,E42,E44, E45	8097		
E25	SPARE		
E28	7408		
E29	7404		
E30,E37	7400		
E36	74123		
E38,E39	7405		
E40,E41	8833		
E46	7486		
E47	6800		
E48	6842		
R1	130 Ω		
R2,R3	36 K		
R4 2W	100 Ω		
R5,R6,R8,R15,[illegible] R23	3.3 K		
R7	6.8 K ← Change to 15K		
R9	27.1 1% ~~[illegible]~~		
R10	11 K		
R11	33 K		
~~[illegible]~~	~~[illegible]~~		
R13,R22 2%	10 K		
R14,R25,R26	10 K		
R16,R18	22 Ω		
R17,R19	10 Ω		
R20,R21	4.7 K		
R24,R27	470 Ω		
~~R23~~	~~[illegible] K~~		
C1,C4,C6,C7,C8,C9 C11,C12,C15,C16 C21,C26,C28	.1 μF		
C2,C3,C10,C23,C24	47 μF		
C5 10v	100 μF		
C13	.01 μF		
C14 C18 C19	[illegible] μF		
C[illegible]	[illegible]		

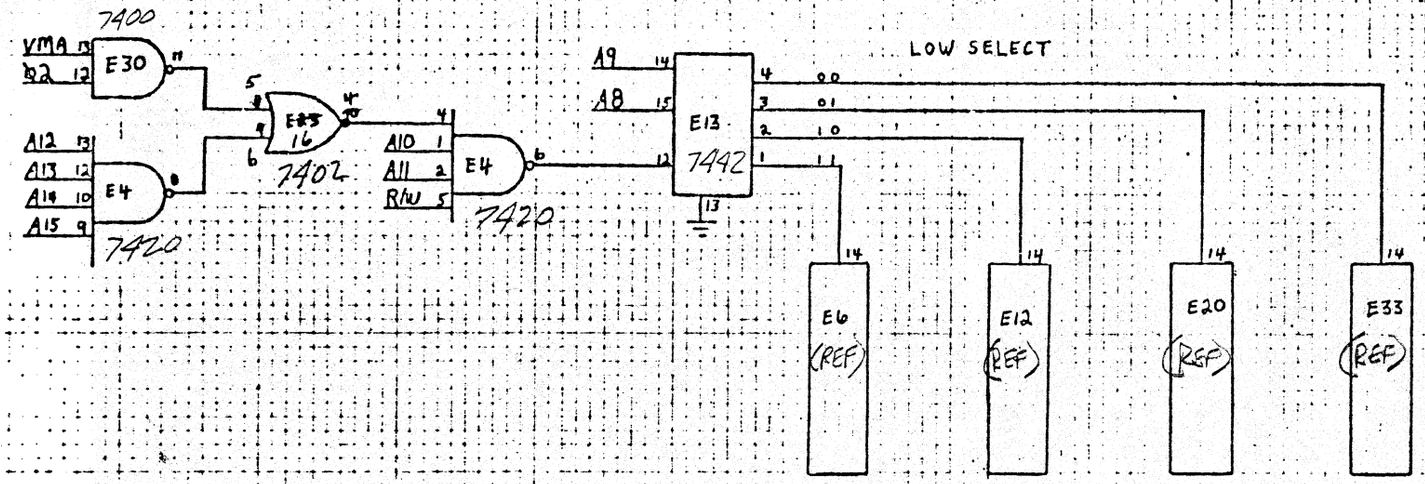
Right ↑

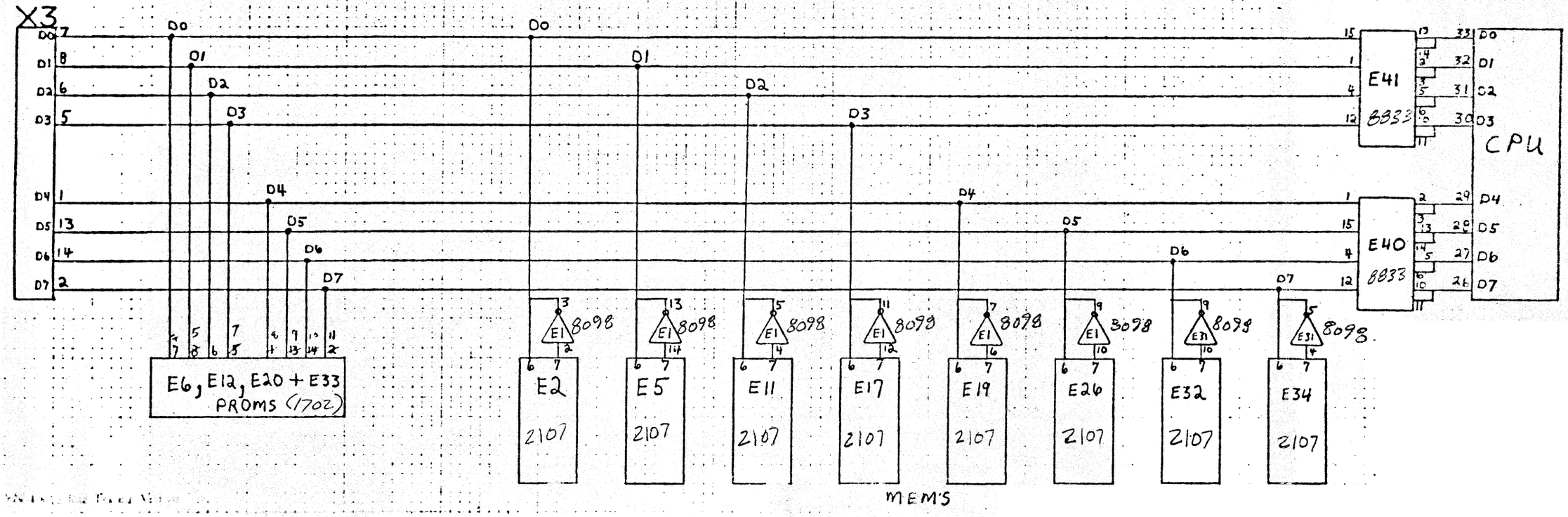
Darken left side and Xerox for Layout.

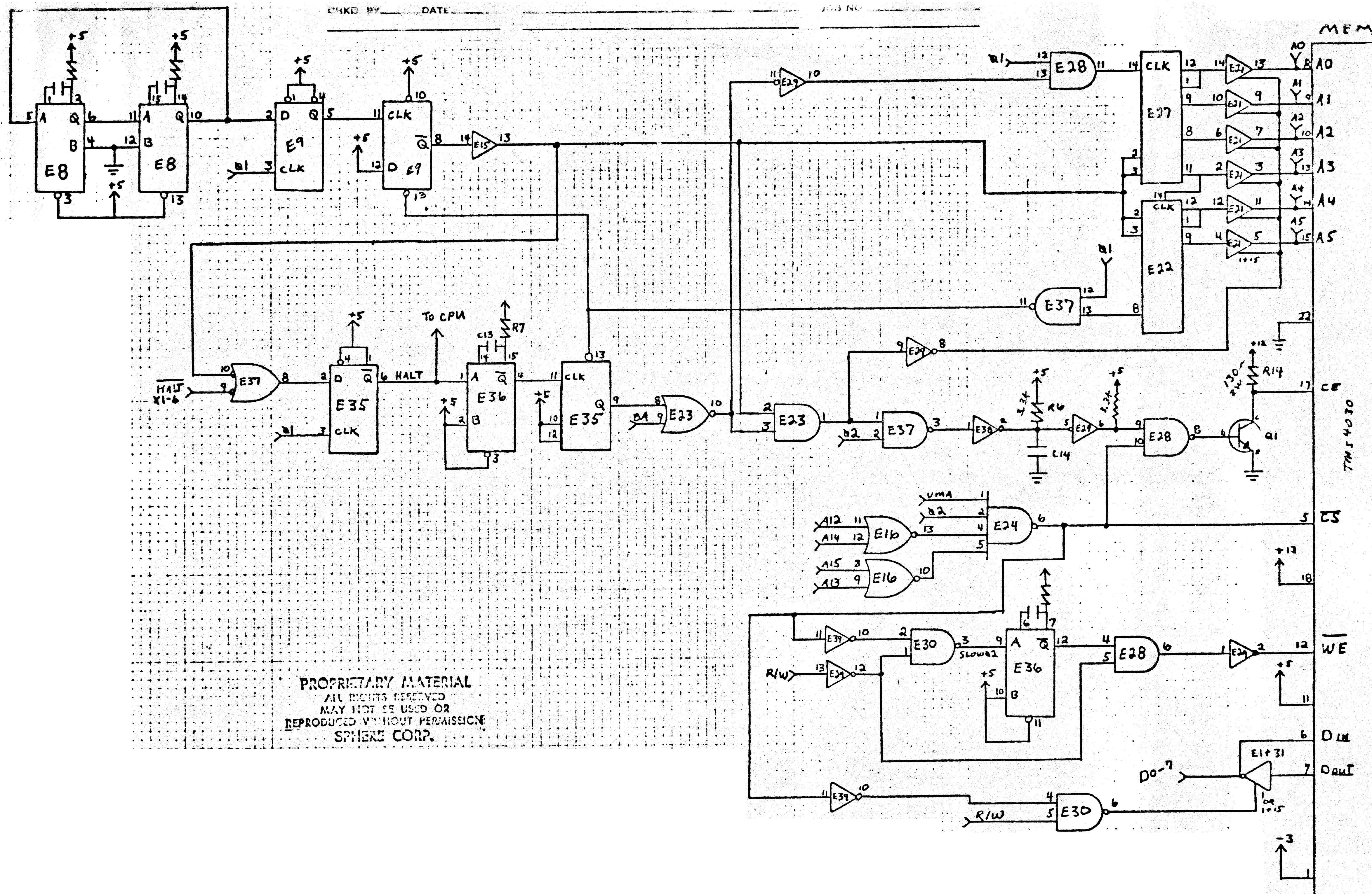
SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

DATE
CHKD. BY DATE
SUBJECT PROM SELECT
DATA DISTRIBUTION
SHEET NO OF
JOB NO.

CPU



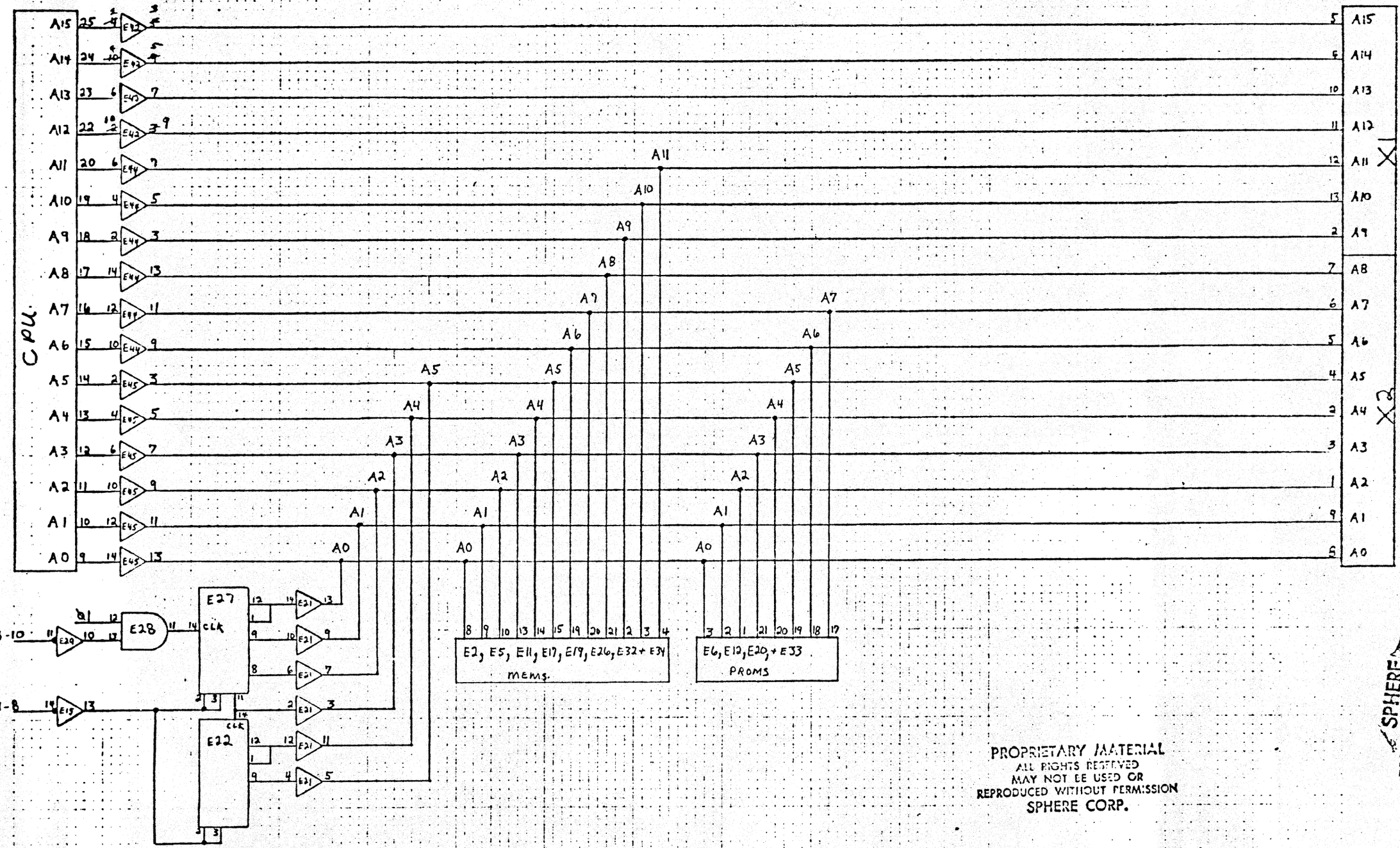




SPHERE
1791 SOUTH 500 WEST

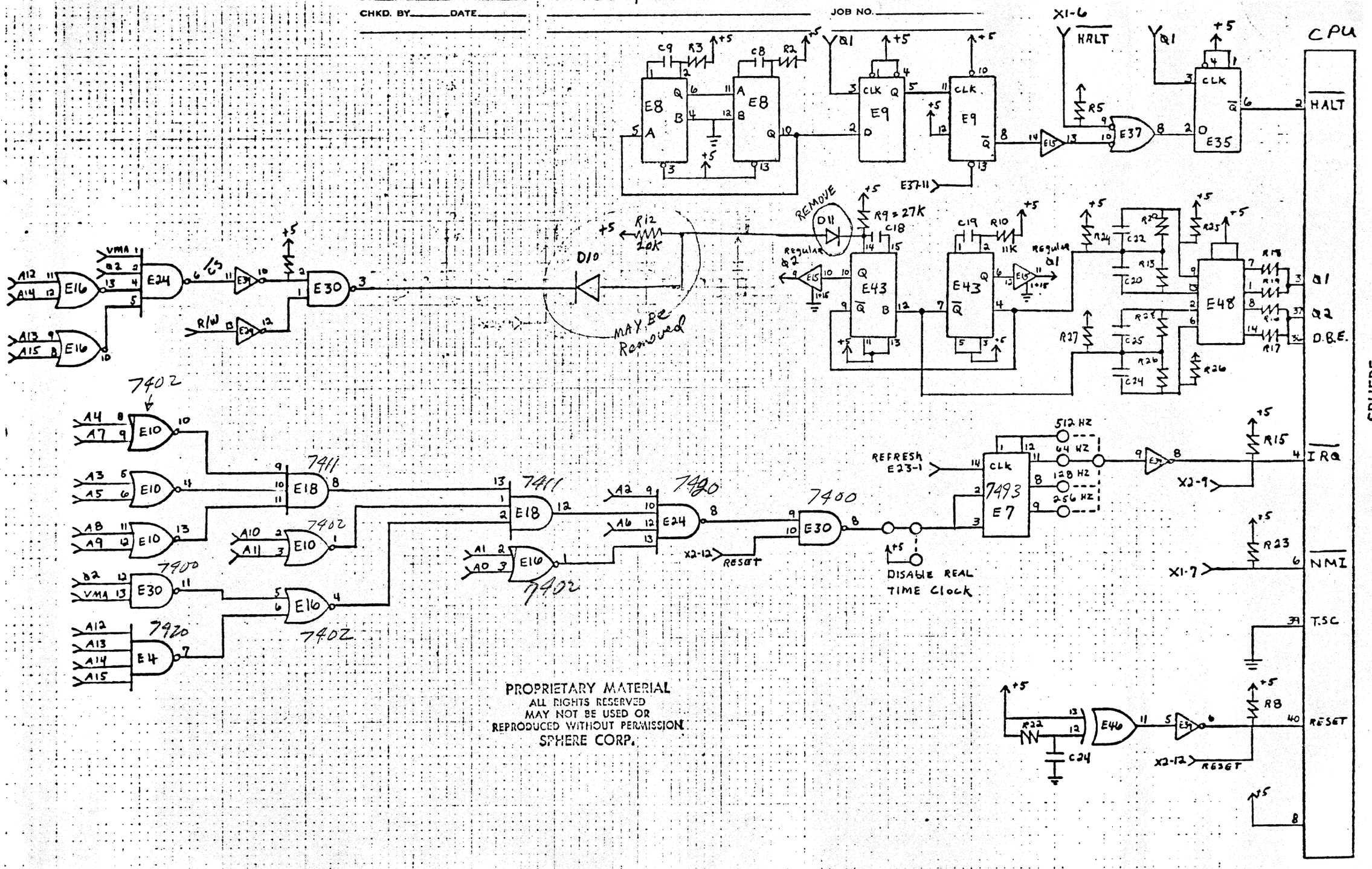
BY DLB DATE ____ SUBJECT ADDRESSES SHEET NO ____ OF ____

CHKD. BY ____ DATE ____ JOB NO. ____



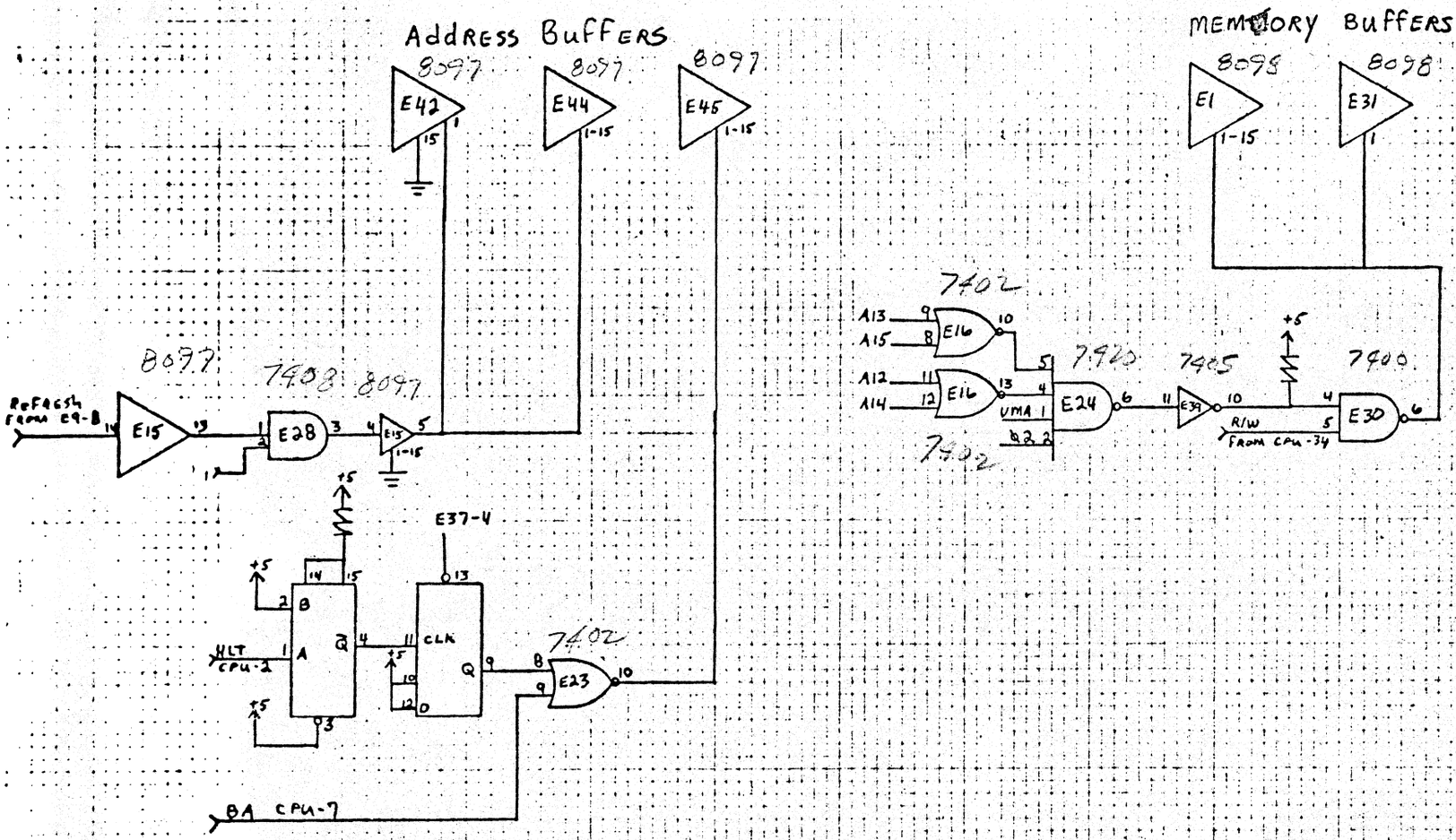
BY _____ DATE _____ SUBJECT CPU SIGNALS SHEET NO. _____ OF _____

CHKD. BY _____ DATE _____ JOB NO. _____



BY _____ DATE _____ SUBJECT _____ SHEET NO. _____ OF _____

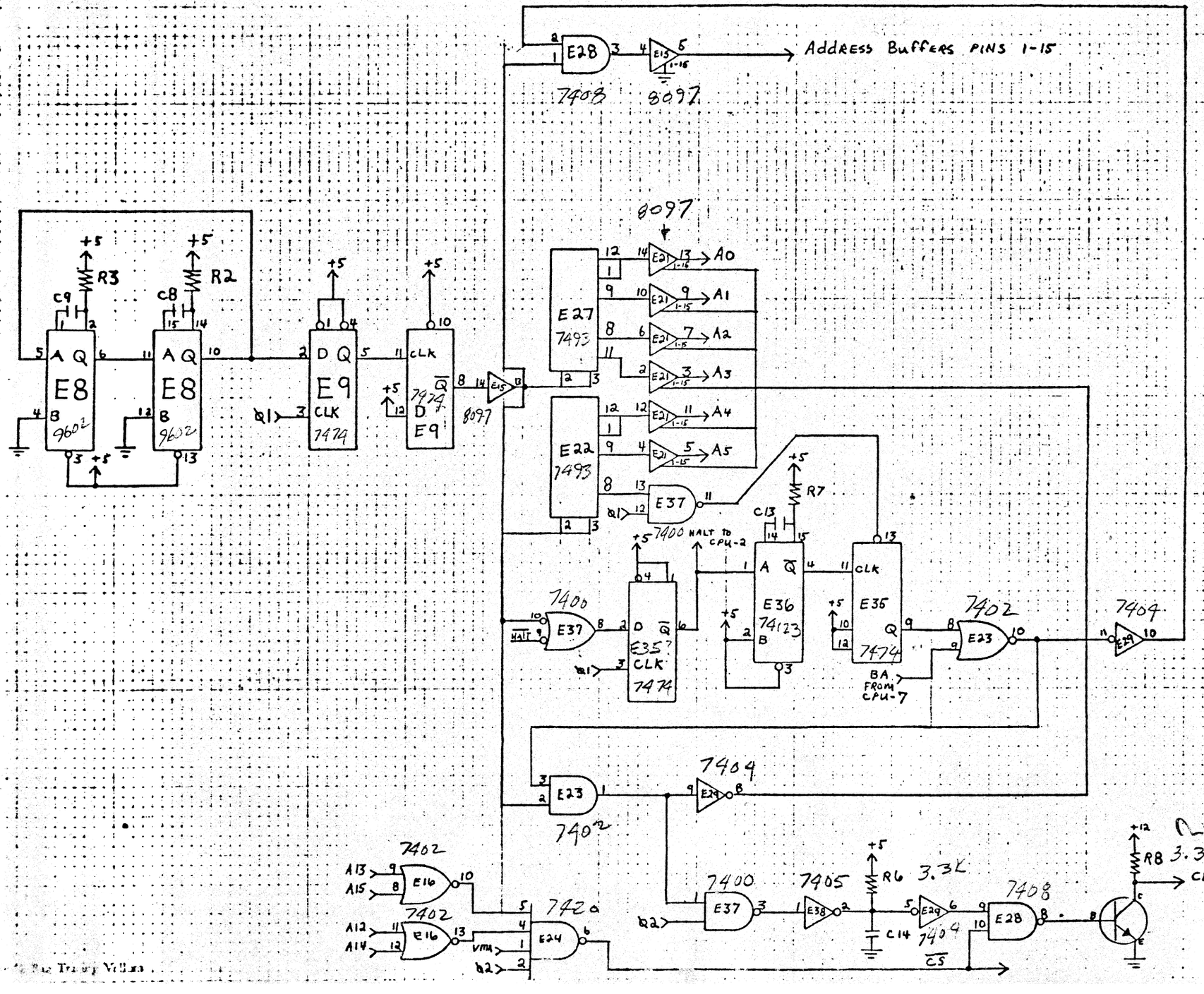
CHKD. BY _____ DATE _____ JOB NO. _____



SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

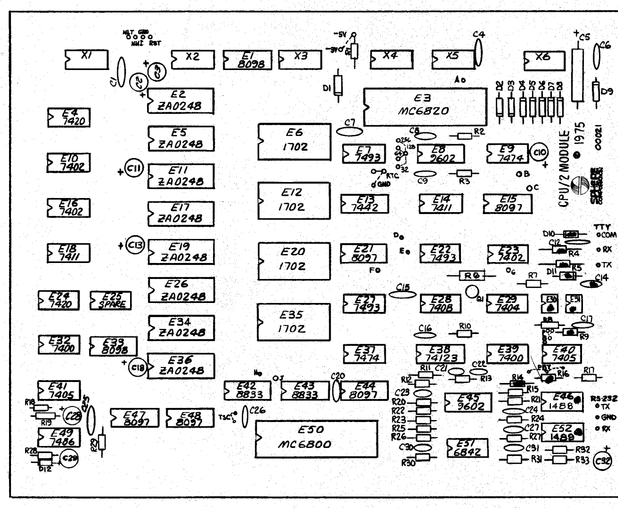
BY DRO DATE SUBJECT RELEASE SHEET NO. OF

CHKD. BY DATE JOB NO.



SPHERE
1791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

REVISIONS					
ZONE	LTR.	DESCRIPTION	DATE	BY	APPR'VD



QTY REQ'D	QTY REQ'D	ITEM NO	QTY REQ'D	NOMENCLATURE OR DESCRIPTION	IDENTIFYING OR PART NO.	SPECIFICATION	MATERIAL OR NOTE
REF	REF	G1		SCHEMATIC	D000019		
1	1	60		PRINTED CIRCUIT BOARD	E000020		
1	1	59		TRANSISTOR	2N2369A	Q1	
2	2	58		CAPACITOR CERAMIC 68pf 1KV	DD-680	C24,30	CRL
3	3	57		CAPACITOR CERAMIC 33pf 1KV	DD-101	C21,27,31	CRL
3	3	56		CAPACITOR CERAMIC 100pf 1KV	DDM-103	C17,22,23	CRL
2	2	55		CAPACITOR CERAMIC .01uf 150V	DDM-103	C16,26	CRL
1	1	54		CAPACITOR TANTULUM 100uf 10VDC		C5	SIEMENS
9	9	53		CAPACITOR 47uf 16 VDC	EK 47/16	C2,3,10,11,13,18	,28,29,32 ROE
12	11	52		CAPACITOR CERAMIC .1uf 50V ●	CK-104	C1,4,6-9,12,14,15,	19,20,25 CRL
2	2	51		RESISTOR 4.7K Ω 1/4 W.	RC07GF472	R24,27	
2	2	50		RESISTOR 10 Ω 1/4 W	RC07GF100	R23,26	
2	2	49		RESISTOR 22 Ω 1/4 W	RC07GF220	R22,25	
3	3	48		RESISTOR 10K Ω 1/4 W	RC07GF103	R21,28,30	
4	3	47		RESISTOR 1K Ω 1/4 W.	RC07GF102	R17,19,31,32	
1	–	46		RESISTOR 510 Ω 1/4 W ●	RC07GF511	R16	
2	2	45		RESISTOR 470 Ω 1/4 W.	RC07GF471	R15,33	
1	1	44		RESISTOR ●	RC07GFSEL	R14	
1	1	43		RESISTOR 33K Ω 1/4 W	RC07GF333	R13	
1	1	42		RESISTOR 11K Ω 1/4 W 1%	RNC65H1102F	R12	
1	1	41		RESISTOR 27.1K Ω 1/4 W. 1%	RNC65H2712F	R11	
1	1	40		RESISTOR 15K Ω 1/4 W.	RC07GF153	R10	
1	–	39		RESISTOR 2K Ω 1/4 W. ●	RC07GF202	R9	
5	5	38		RESISTOR 3.3K Ω 1/4 W.	RC07GF332	R7,8,18,20,29	
1	1	37		RESISTOR 130 Ω 2 W.	RC42GF131	R6	
1	–	36		RESISTOR 820 Ω 1 W. ●	RC32GF821	R5	
1	–	35		RESISTOR 1.1K Ω 1 W. ●	RC32GF112	R4	
2	2	34		RESISTOR 36K Ω 1/4 W.	RC07GF363	R2,3	
1	1	33		RESISTOR 100 Ω 1/4 W.	RC07GF101	R1	
6	4	32		DIODE ●●	1N4001	D5,6,7,8,10,11	
5	5	31		DIODE	1N914	D2,3,4,9,12	
1	1	30		ZENER DIODE 3V.	1N5225B	D1	
8	8	29		22 PIN IC SOCKETS	CA 22-CSITSD		CA
2	1	28		40 PIN IC SOCKETS	340-A639D	XE3,50	AUGAT
2	4	27		24 PIN IC SOCKETS	324-A639D	XE6,12,20,35	AUGAT
6	4	26		14 PIN IC SOCKETS	314-A639D	X1-X6	AUGAT
1	–	25		QUAD RECEIVER-RS232 ●	MC1489	E52	
1	1	24		QUAD TRANSISTOR	MPG6842N	E51	
1	1	23		MICROPROCESSOR	MC6800	E50	
1	1	22		QUAD EXCLUSIVE OR	SN7486N	E49	
1	–	21		QUAD TRANSMITTER-RS232 ●	MC1488N	E46	
2	2	20		QUAD TRI-STATE TRANSCEIVER	DM8833N	E42,43	
2	2	19		HEX INVERTER W/OC	SN7405N	E40,41	
1	1	18		DUAL ONE SHOTS	SN74123N	E38	
2	2	17		QUAD 2-INPUT NAND GATE	SN7400N	E32,E39	
2	–	16		PHOTO COUPLER ●●	4N33N	E30,31	
1	1	15		HEX INVERTER	SN7404N	E29	
1	1	14		QUAD 2 INPUT AND GATE	SN7408N	E28	
–	–	13		(SPARE)		E25	
5	5	12		TRI-STATE HEX BUFFER	DM8097N	E15,21,44,47,48	
2	2	11		TRIPLE 3-INPUT AND GATE	SN7411N	E14,18	
1	1	10		4-LINE TO 10 LINE DECODER	SN7442N	E13	
3	3	9		QUAD 2-INPUT NOR GATE	SN7402N	E10,16,23	
2	2	8		DUAL D FLIP FLOP	SN7474N	E9,37	
2	2	7		DUAL ONE SHOT	9602 (DM8602N)	E8,45	
3	3	6		4 BIT BINARY COUNTER	SN7493N	E7,22,27	
2	4	5		EPROM 256 X 8 BIT	MM1702A	E6,12,20,35	
2	2	4		8-INPUT NAND GATE	SN7420N	E4,24	
1	–	3		PERIPHERAL INTERFACE ADAPTER (PIA)	MC6820	E3	
8	8	2		4K DYNAMIC RAM MEMORY	ZA0248	E2,5,11,17,19,26,	34,36
2	2	1		TRI-STATE HEX INVERTER	DM8098N	E1,33	
-02	-01			ASSEMBLY			

LIST OF MATERIAL OR PARTS

CONTRACT No.	
DRAWN BY	G. W. / 22 DEC 75
CHECKED	
MECH.	
ELECT.	
PROJ. ENGR.	M. Tyler 15 JAN 76
APPROVED	Date
APPROVED (By Others)	Date

SPHERE

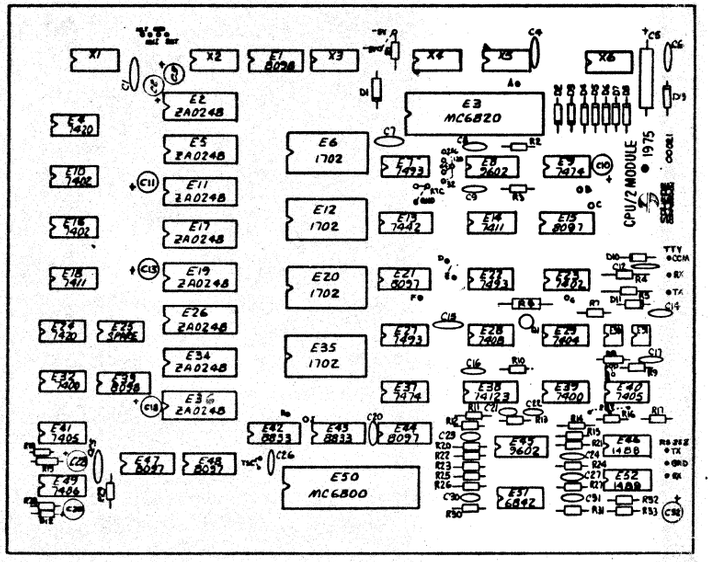
CPU/2 ASSEMBLY

SIZE: D | 000021 | REV

SCALE: NONE | Sheet 1 OF 1

CPU

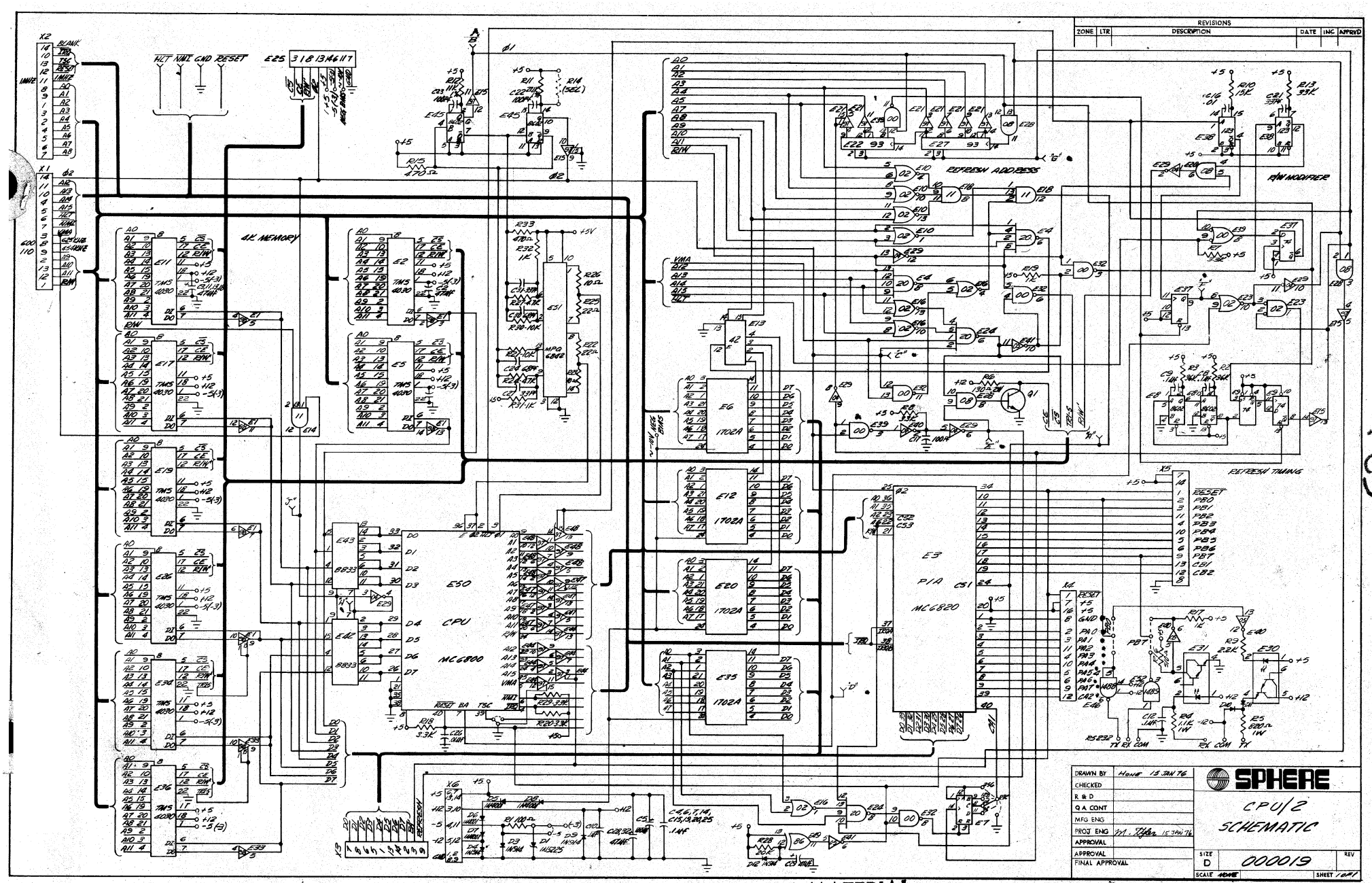
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	BY



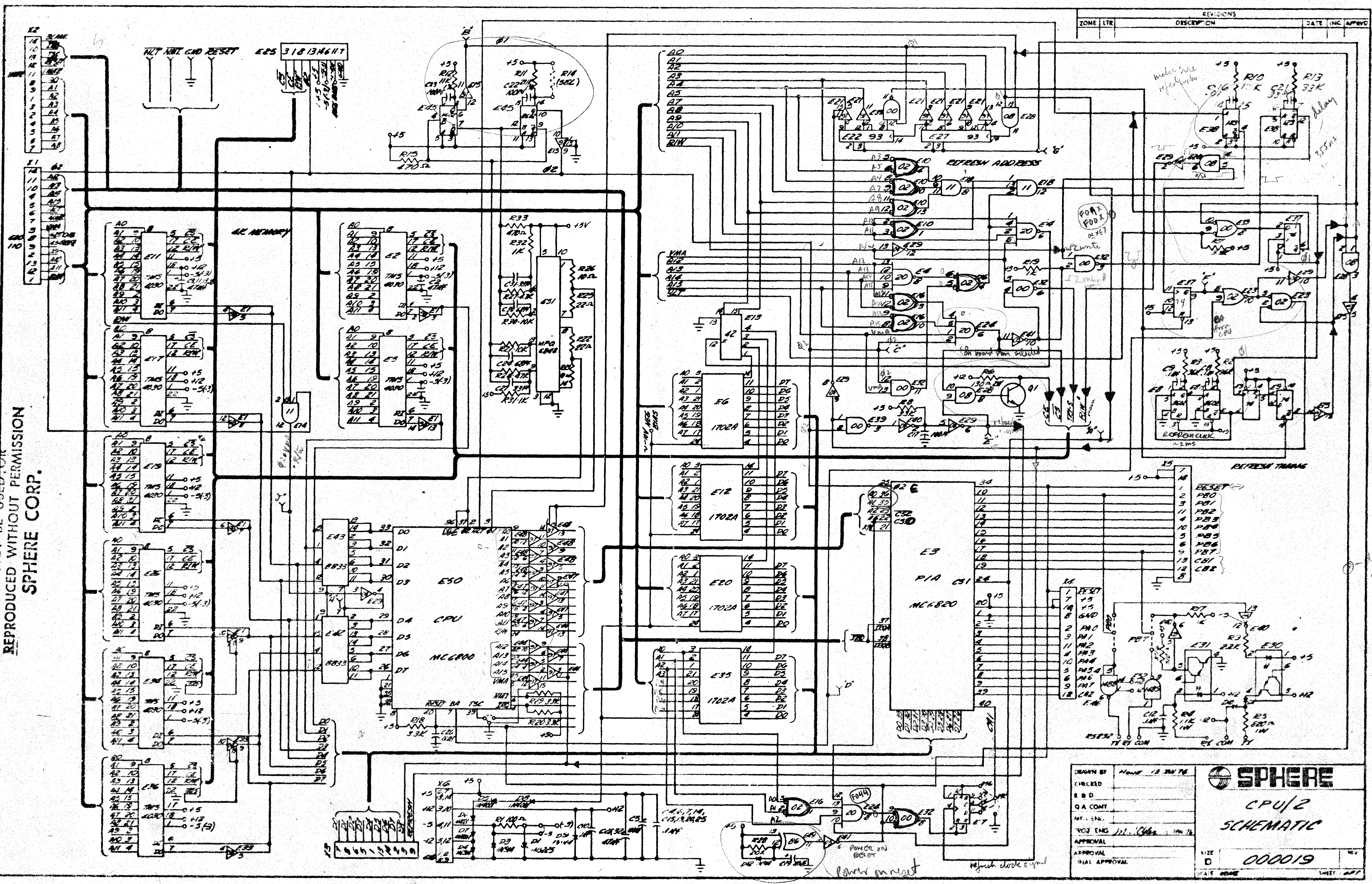
REF	REF	GI		SCHEMATIC	D000019		
1	1	60		PRINTED CIRCUIT BOARD	E000020		
1	1	59		TRANSISTOR	2N2369A	Q1	
2	2	58		CAPACITOR CERAMIC 68pf 1KV	DD-680	C29,30	CRL
3	3	57		CAPACITOR CERAMIC 330f 1KV	DD-101	C24,27,31	CRL
3	3	56		CAPACITOR CERAMIC 100PF 1KV	DDM-103	C17,22,23	CRL
2	2	55		CAPACITOR CERAMIC .01uf 150V	DDM-103	C16,26	CRL
1	1	54		CAPACITOR TANTULUM 100uf 6.2		C5	SPARE
9	9	53		CAPACITOR 47uf 16 VDC	EK47116	C2,3,10,13 [illegible]	
12	11	52		CAPACITOR CERAMIC .1uf 50V	CK-104	C1,4,6,9,11,15 [illegible]	9,20,25 CRL
2	2	51		RESISTOR 4.7K Ω 1/4 W	RC07GF472	R24,27	
2	2	50		RESISTOR 10 Ω 1/4 W	RC07GF100	R23,26	
2	2	49		RESISTOR 22 Ω 1/4 W	RC07GF220	R22,25	
3	3	48		RESISTOR 10K Ω 1/4 W	RC07GF103	R21,28,36	
4	3	47		RESISTOR 1K Ω 1/4 W	RC07GF102	R17,9,31,32	
1	-	46		RESISTOR 510 Ω 1/4 W	RC07GF511	R6	
2	2	45		RESISTOR 470 Ω 1/4 W	RC07GF471	R15,33	
1	1	44		RESISTOR	RC07GF561	R14	
1	1	43		RESISTOR [illegible] Ω 1/4 W	RC07GF	R13	
1	1	42		RESISTOR 11K Ω 1/4W 1%	RNC65H1102F	R12	
1	1	41		RESISTOR 27.1K Ω 1/4 W 1%	RNC65H2712F	R11	
1	1	40		RESISTOR 1.5K Ω 1/4 W	RC07GF152	R10	
1	-	39		RESISTOR 2K Ω 1/4 W	RC07GF202	R9	
5	5	38		RESISTOR 3.3K Ω 1/4 W	RC07GF332	R7,8,18,20,29	
1	1	37		RESISTOR 130 Ω 2W	RC42GF131	R6	
1	-	36		RESISTOR 820 Ω 1W	RC32GF821	R5	
1	-	35		RESISTOR 1.1K Ω 1W	RC32GF112	R4	
2	2	34		RESISTOR 36K Ω 1/4 W	RC07GF363	R2,3	
1	1	33		RESISTOR 100 Ω 1/4 W	RC07GF101	R1	
6	4	32		DIODE	IN4001	D5,6,7,8,10,11	
5	5	31		DIODE	IN914	D2,3,4,9,12	
1	1	30		ZENER DIODE 3V	IN5225B	D1	
8	8	29		22 PIN IC SOCKETS	CA 22-CSITSD		CA
2	1	28		40 PIN IC SOCKETS	340-4639-D	XE3,50	AUGAT
2	4	27		24 PIN IC SOCKETS	324-4639-D	XE6,7,20,35	AUGAT
6	4	26		14 PIN IC SOCKETS	314-4639-D	X1-X6	AUGAT
1	-	25		QUAD RECEIVER-RS232	MC 489	E52	
1	1	24		QUAD TRANSISTOR	MPQ6842 V	E51	
1	1	23		MICROPROCESSOR	MC6800	E50	
1	1	22		QUAD EXCLUSIVE OR	SN7486 N	E49	
1	-	21		QUAD TRANSMITTER-RS232	MC1488 N	E46	
2	2	20		QUAD TRI-STATE TRANSCEIVER	DM8833 N	E42,43	
2	2	19		HEX INVERTER W/OC	SN7405 V	E40,41	
1	1	18		DUAL ONE SHOTS	SN74123 N	E38	
2	2	17		QUAD 2-INPUT NAND GATE	SN7400 N	E32,E39	
2	-	16		PHOTO COUPLER	4N33 N	E30,31	
1	1	15		HEX INVERTER	SN7404 N	E29	
1	1	14		QUAD 2 INPUT AND GATE	SN7408 N	E28	
-	-	13		(SPARE)		E25	
5	5	12		TRI-STATE HEX BUFFER	DM8097 V	E15,21,44,47,48	
3	2	11		TRIPLE 3-INPUT AND GATE	SN7411 N	E19,18	
1	1	10		4-LINE TO 10 LINE DECODER	SN7442 N	E13	
3	3	9		QUAD 2-INPUT NOR GATE	SN7402 N	E10,6,23	
2	2	8		DUAL D FLIP FLOP	SN7474 N	E9,37	
2	2	7		DUAL ONE SHOT	9602 DM8602N	E8,45	
3	3	6		4 BIT BINARY COUNTER	SN7493 N	E7,22,27	
2	4	5		EPROM 256 X 8 BIT	MM1702A	E6,12,20,35	
2	2	4		8-INPUT NAND GATE	SN7420 N	E4,24	
1	-	3		PERIPHERAL INTERFACE ADAPTER (PIA)	MC6820	E3	
8	8	2		4K DYNAMIC RAM MEMORY	2A0248	E2,5,11,17,19,26,	34,36
2	2	1		TRI-STATE HEX INVERTER	DM8098 N	E1,33	
-02	-01			ASSEMBLY			
QTY REQ'D	QTY CHG'D	ITEM NO	REV LEVEL	NOMENCLATURE OR DESCRIPTION	IDENTIFYING PART NO.	SPECIFICATION	MATERIAL OR DATA

LIST OF MATERIAL OR PARTS

CONTRACT No.		SPHERE
DRAWN BY	G. W. / [illegible] 22 DEC 75	CPU/2 ASSEMBLY
CHECKED		
MECH.		
ELECT.		
PROJ. ENGR.	[illegible] 15 Dec 75	
APPROVED	Date	SIZE D — 000021 — REV
APPROVED (By Others)	Date	SCALE: NONE — Sheet 1 OF 1



CPU



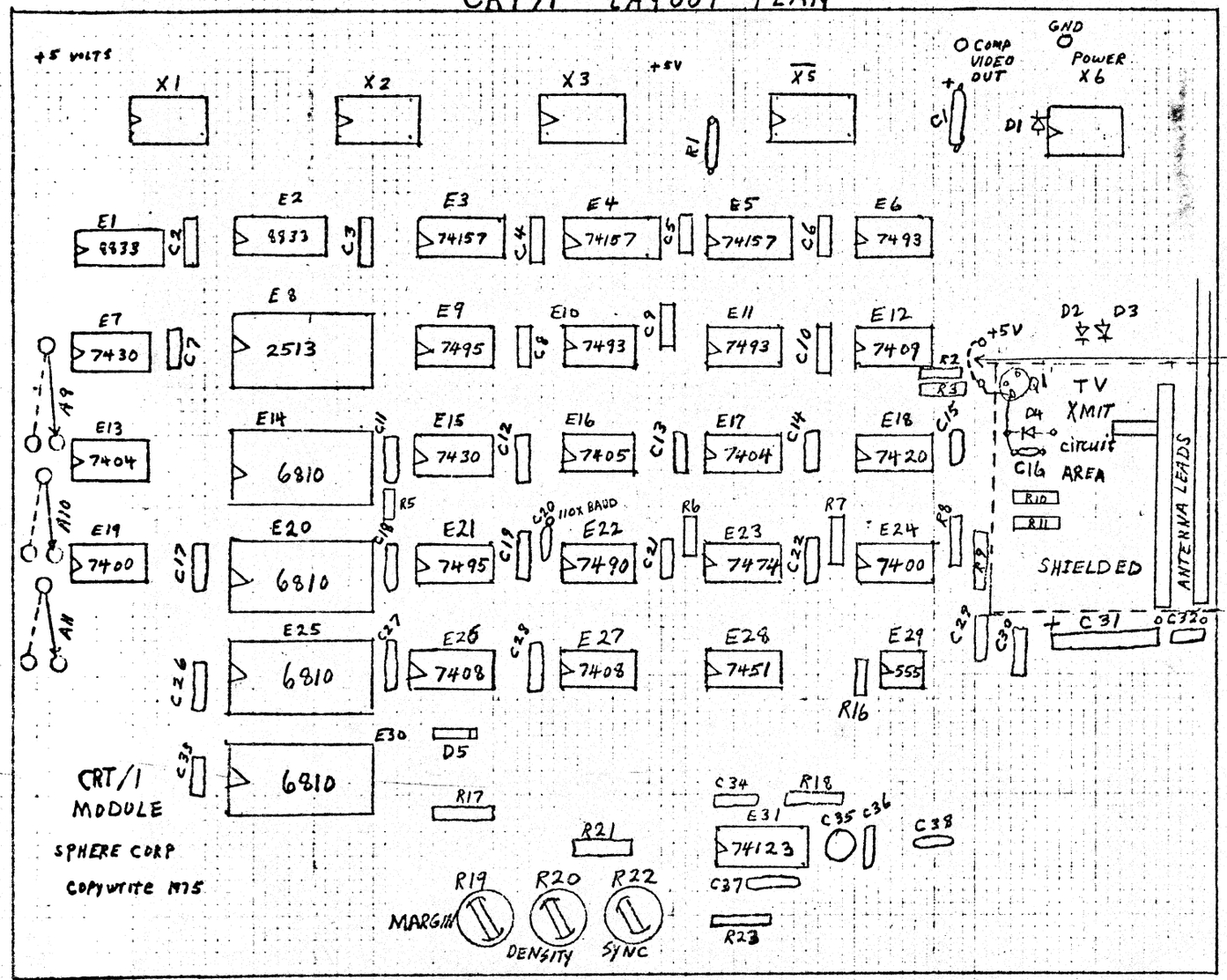
BY_____ DATE_____ SUBJECT CRT/1 SHEET NO. 3 OF 3

CHKD. BY_____ DATE_____ JOB NO._____

NOTES:

1. Address as wired is Binary "0". To change to Address "1" cut A9 etch and add jumper along dotted path. To change to address "5" for example, change connection path of A9 and A1.
2. All IC's have pin 1 in lower left corner
3. Power and ground connect to pins 14 and 7 unless shown otherwise.
4. Item's in ( ) not supplied.

CRT/1 LAYOUT PLAN



Item	Part	Discription	Designation	Qnty
0	CRT/1	P.C. Board		1
1		14pin socket	X1 - X3, X6, X5	4 (1)
2	DM8833	Quad T/R	E1, E2	2
3	SN74157	Quad MUX	E3, E4, E5	3
4	SN7493	4 bit Bin. Cntr.	E6, E10 E11	3
5	SN7430	NAND Gate	E7, E15	2
6	2513	ASC II Char. Gen	E8	1
7	SN7495	4 bit Shift Reg.	E9, E21	2
8	SN7409	Quad & Gate	E12	1
9	SN7404	HEX Inverter	E13, E17	2
10	MCM6810	128 x 8 Static RAM	E14, E20, E25, E30	4
11	SN7405	HEX Inverter	E16	1
12	SN7420	Dual Nand gate	E18	1
13	SN7400	Quad Nandgate	E24, E19	2
14	SN7490	4bit Dec. Cntr.	E22	1
15	SN7474	Dual D F/F	E23	1
16	SN7408	Quad ANDgate	E26, E27	2
17	SN74123	Dual manostable	E31	1
18	NE555	Timer	E29	1
19	SN7451	dual and/or gate	F28	1
20				
21	2N5129	Transistor	Q1 OR 2N2222A	1
22	2N918	Transistor	Q2	(1)
23	*L1	inductive coil	L1 SEE TVT ARTICLE IN RADIO ELECT	(1)
24	IN914	Diode	D1 - D5	4 (1)
25	20K	Resistor, var	R19	1
26	5K	Resistor, var	R20	1
27	50K	Resistor, var	R22	1
28	47uf	Cap. -16 vdc	C35	1
29	100uF	Cap. -10 vdc	C1, C31	1 (1)
30	.1uf	Capacitor	C2-C14, C17-C19 C21-C22, C26-28, C30, C33, C36	24
31	.01uf	Capacitor	C29	1
32	.001	Capacitor	C20, C34, C38	1
33	.27pf	Capacitor	C23	(1)
34	47pf	Capacitor	C16, C37	1 (1)
35	470pf	Capacitor	C15, C24, C32	1 (2)
36	8-25pf	Capacitor, VAR	C25	(1)
37	22	Resistor	R13	(1)
38	20K	Resistor	R17, R16	2
39	470	Resistor	R4	(1)
40	1K	Resistor	R2, R3, R6-R9, R12 R15, R18, R23	8 (2)
41	47 1/2w	Resistor	R10	1
42	100 1/2w	Resistor	R11	1
43	~~36K~~	~~Resistor~~	~~R16~~	~~1~~
44	10K	Resistor	R1, R5	2
45	2.2K	Resistor	R14	(1)
46	3.3K	RESISTOR	R21	1

SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

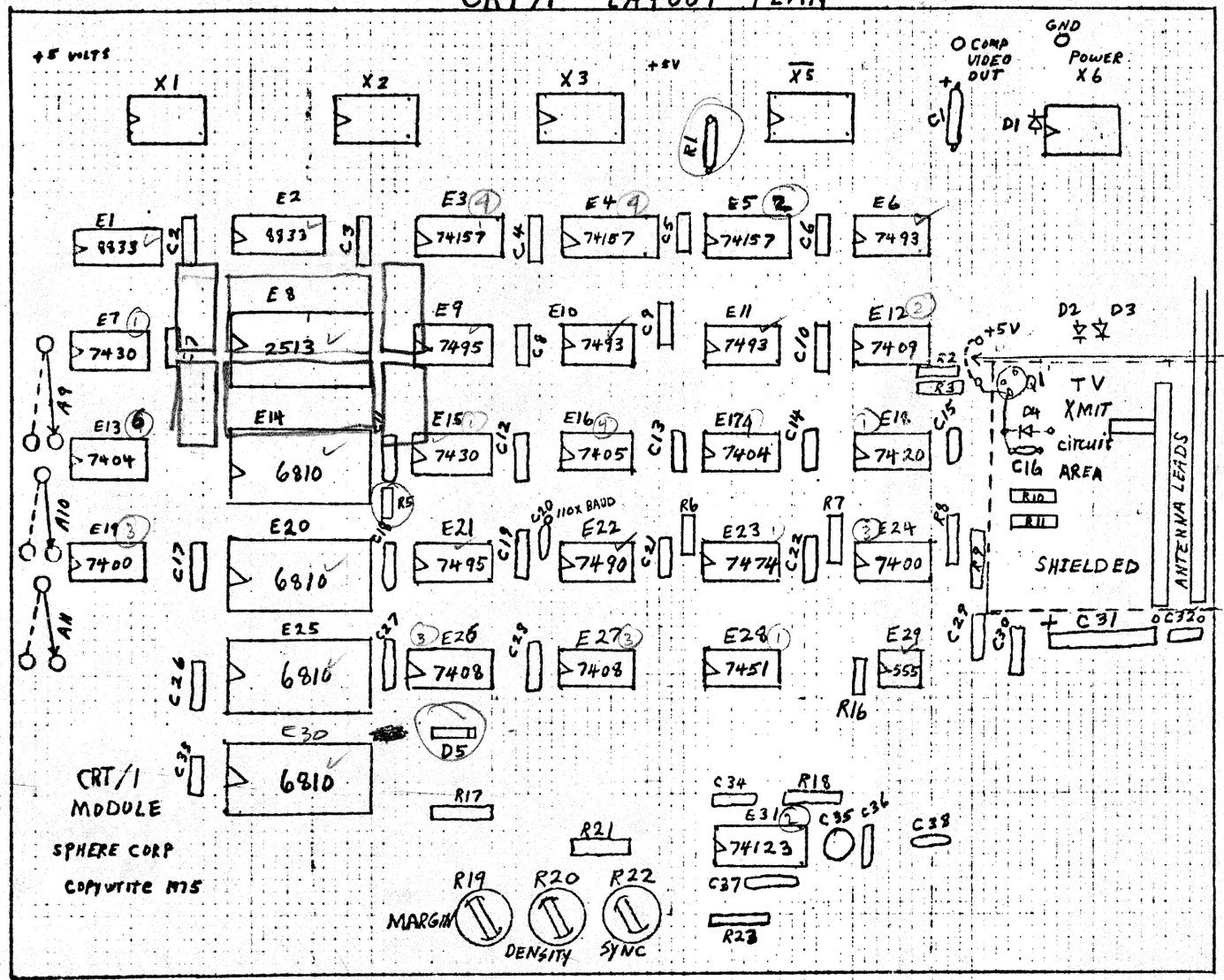
BY____ DATE____ SUBJECT CRT/I SHEET NO. 3 OF 5

CHKD. BY____ DATE____ JOB NO.____

NOTES:

1. Address as wired is Binary "0". To change to Address "1" cut A9 etch and add jumper along dotted path. To change to address "5" for example, change connection path of A9 and A1.
2. All IC's have pin 1 in lower left corner
3. Power and ground connect to pins 14 and 7 unless shown otherwise.
4. Item's in ( ) not supplied.

CRT/I LAYOUT PLAN



Item	Part	Discription	Designation	Qnty
0	CRT/I	P.C. Board		1
1		14pin socket	X1 - X3, X6, X5	4 (1)
2	DM8833	Quad T/R	E1, E2	2
3	SN74157	Quad MUX	E3, E4, E5	3
4	SN7493	4 bit Bin. Cntr.	E6, E10 E11	3
5	SN7430	NAND Gate	E7, E15	2
6	2513	ASC II Char. Gen	E8	1
7	SN7495	4 bit Shift Reg.	E9, E21	2
8	SN7409	Quad & Gate	E12	1
9	SN7404	HEX Inverter	E13, E17	2
10	MCM6810	128 x 8 Static RAM	E14, E20, E25, E30	4
11	SN7405	HEX Inverter	E16	1
12	SN7420	Dual Nand gate	E18	1
13	SN7400	Quad Nandgate	E24, E19	2
14	SN7490	4bit Dec. Cntr.	E22	1
15	SN7474	Dual D F/F	E23	1
16	SN7408	Quad ANDgate	E26, E27	2
17	SN74123	Dual manostable	E31	1
18	NE555	Timer	E29	1
19	SN7451	dual And/or gate	E28	1
20				
21	2N5129	Transistor	Q1 OR 2N2222A	1
22	2N918	Transistor	Q2	(1)
23	*L1	inductive coil	L1 SEE TVT ARTICLE IN RADIO ELECS	(1)
24	IN914	Diode	D1 - D5	4 (1)
25	20K	Resistor, var	R19	1
26	5K	Resistor, var	R20	1
27	50K	Resistor, var	R22	1
28	47uf	Cap.-16 vdc	C35	1
29	100uF	Cap.-10 vdc	C1, C31	1 (1)
30	.1uf	Capacitor	C2-C14, C17-C19 C21-C22, C26-28, C30, C33, C36	24
31	.01uf	Capacitor	C29	1
32	.001	Capacitor	C20, C34, C38	1
33	.27pf	Capacitor	C23	(1)
34	47pf	Capacitor	C16, C37	1 (1)
35	470pf	Capacitor	C15, C24, C32	1 (2)
36	8-25pf	Capacitor, VAR	C25	(1)
37	22	Resistor	R13	(1)
38	20K	Resistor	R17, R16	2
39	470	Resistor	R4	(1)
40	1K	Resistor	R2, R3, R6-R9, R12 R15, R18, R23	8 (2)
41	47 1/2w	Resistor	R10	1
42	100 1/2w	Resistor	R11	1
43	~~36K~~	~~Resistor~~	~~R16~~	+
44	10K	Resistor	R1, R5	2
45	2.2K	Resistor	R14	(1)
46	3.3k	Resistor	R21	1

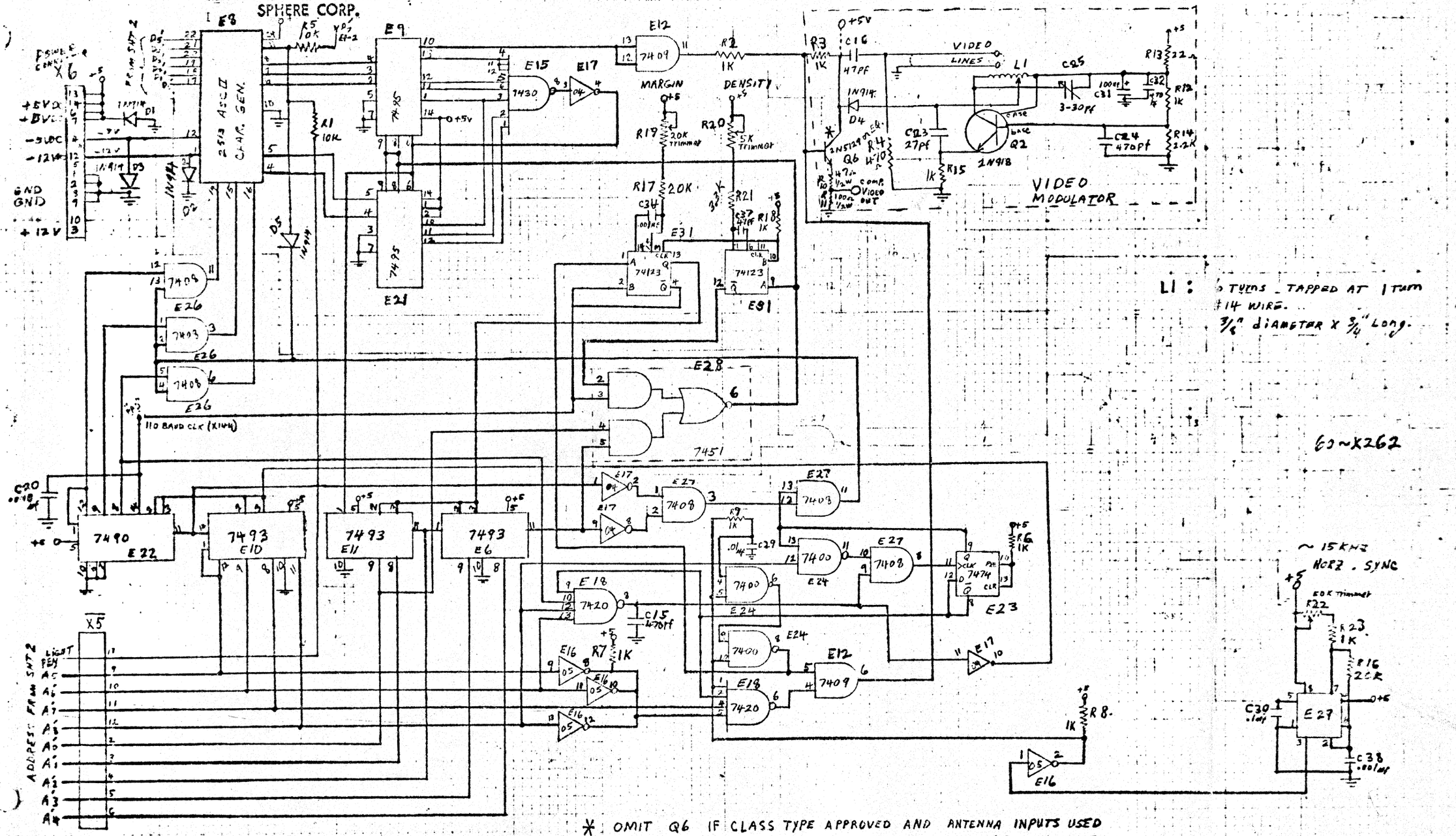
SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

BY _____ DATE 7/1/75
CHKD. BY _____ DATE _____
REVISED 09-06-75 M. KING

SUBJECT CRT/I MODULE

SHEET NO. 1 OF 3
JOB NO. 1

SPHERE CORP.



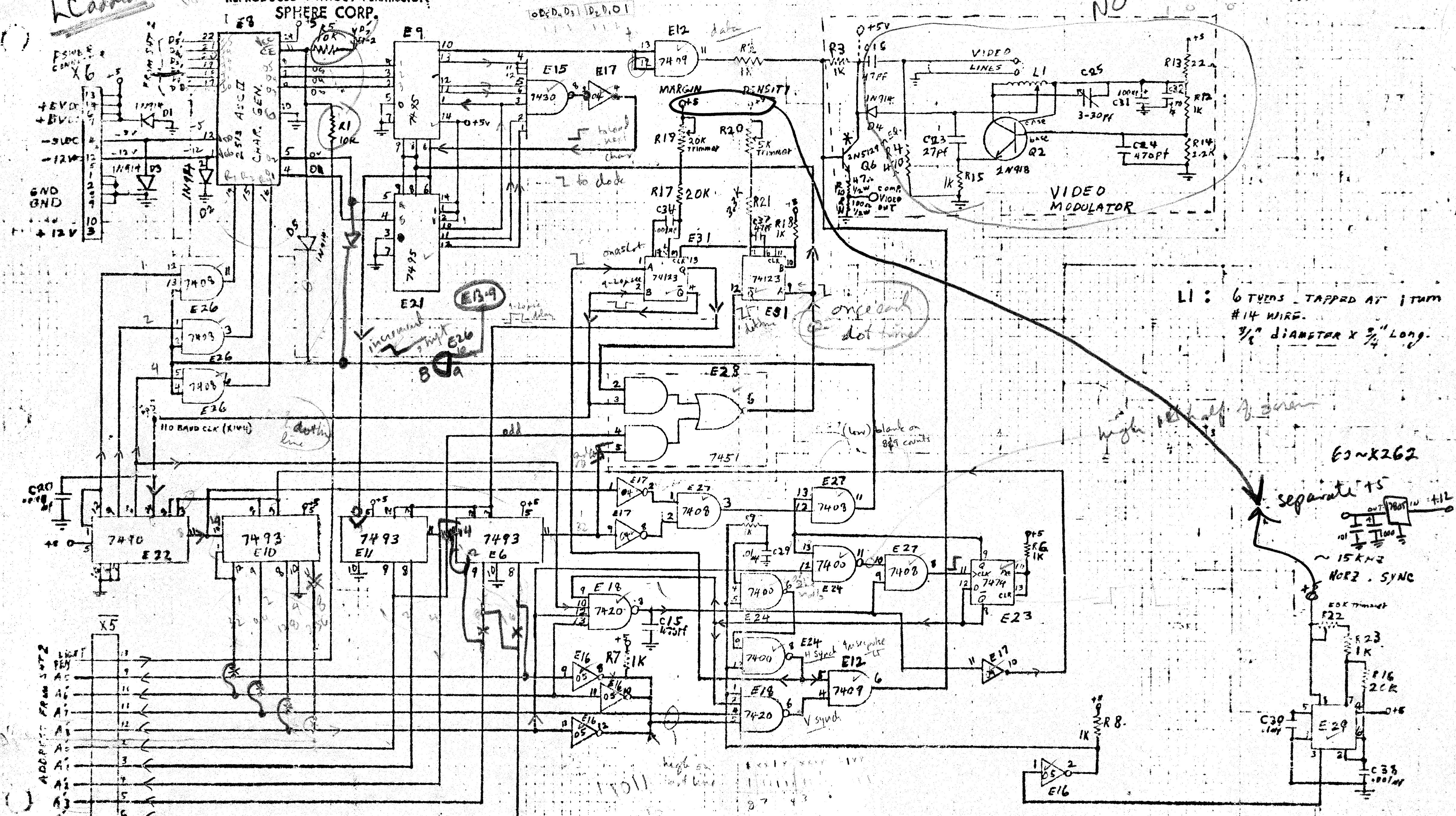
L1 : 5 TURNS TAPPED AT 1 TURN #14 WIRE. 3/8" DIAMETER X 3/4" LONG.

* OMIT Q6 IF CLASS TYPE APPROVED AND ANTENNA INPUTS USED OTHERWISE OMIT D4 AND C44 AND Q1, AND USE COMPOSITE VIDEO OUT TO DRIVE A VIDEO MONITOR. IF L1 IS OMITTED, TIE THE JUNCTION OF D4 AND R3 TO +5V.

SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

PROPRIETARY MATERIAL
ALL RIGHTS RESERVED
MAY NOT BE USED OR
REPRODUCED WITHOUT PERMISSION
SPHERE CORP.

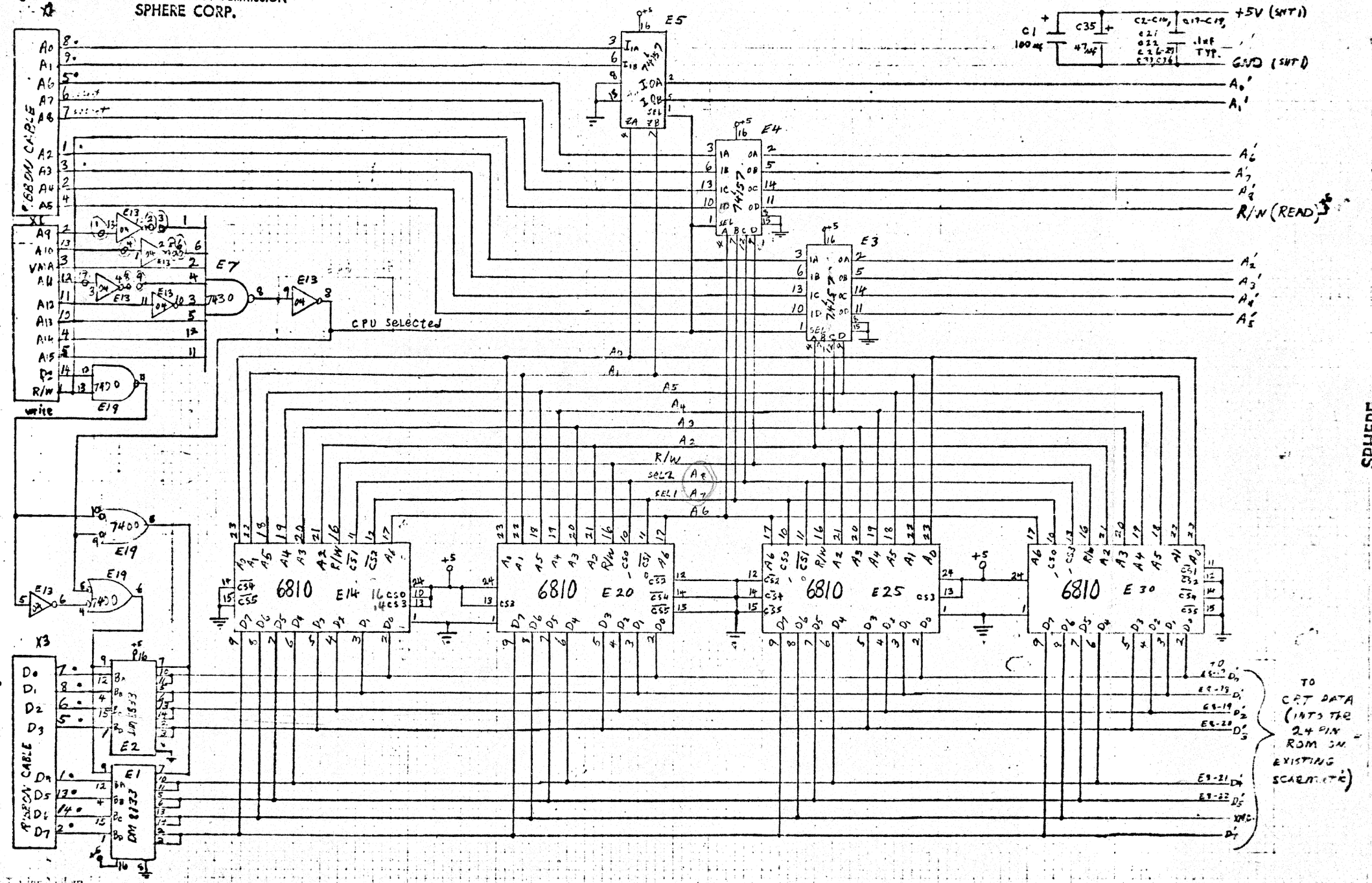
BY ________ DATE 7/22/75 SUBJECT CRT/I MODULE SHEET NO. 1 OF 3
CHKD. BY ________ DATE ________ JOB NO. 1
REVISED 09-06-75 M. KING



* OMIT Q6 IF CLASS TYPE APPROVED AND ANTENNA INPUTS USED OTHERWISE OMIT D4 AND C44 AND Q1, AND USE COMPOSITE VIDEO OUT TO DRIVE A VIDEO MONITOR. IF L1 IS OMITTED, TIE THE JUNCTION OF D4 AND R3 TO +5V.

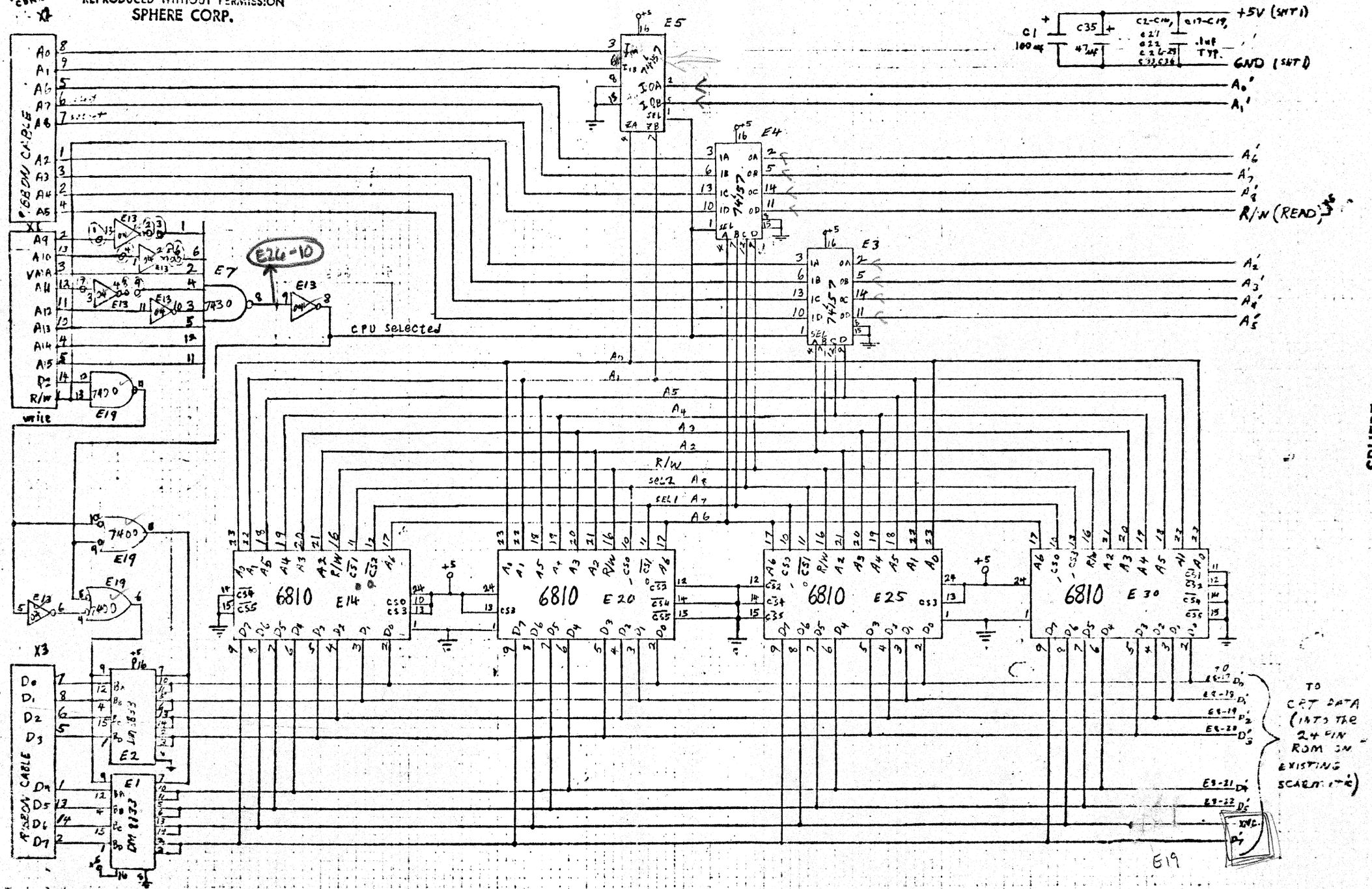
SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

BY mct/SGC DATE 15 APR 75
CHKD. BY mct DATE 7/1/75
SUBJECT CRT/I MODULE
SHEET NO. 2 OF 3
JOB NO. 1

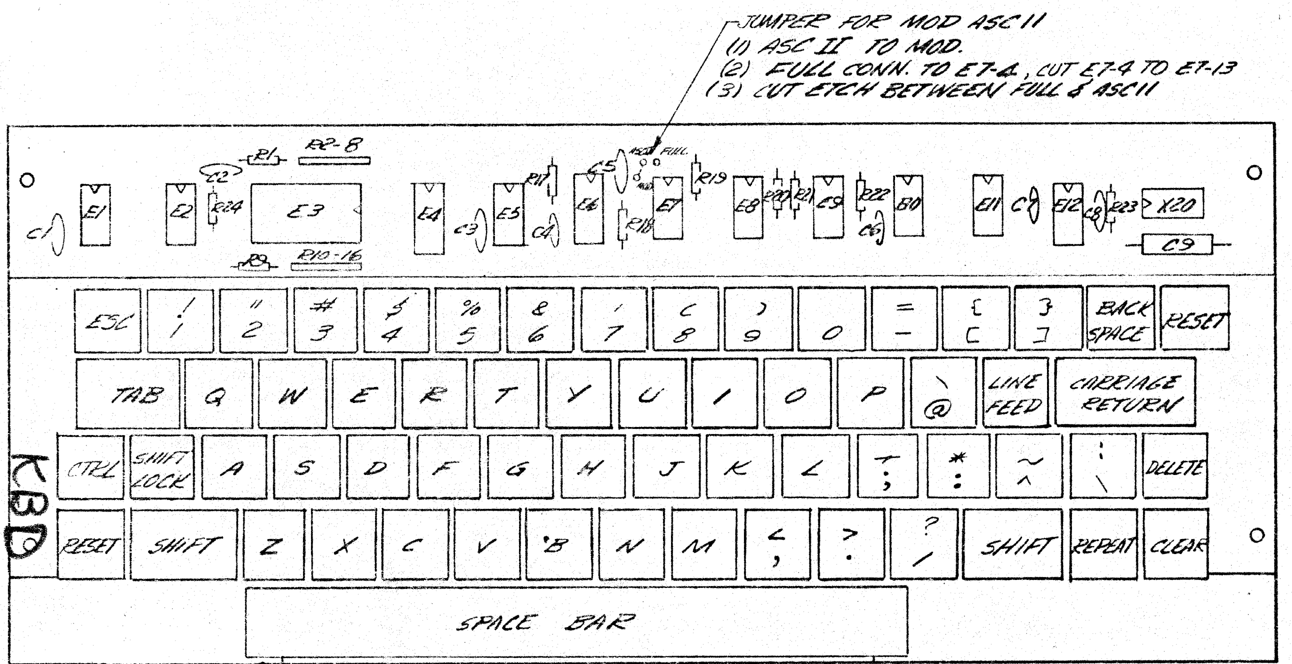


SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

BY mct/SGC DATE 15 APR 75
CHKD. BY mct DATE 7/1/75
SUBJECT CRT/I MODULE
SHEET NO. 2 OF 3
JOB NO. 1



SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

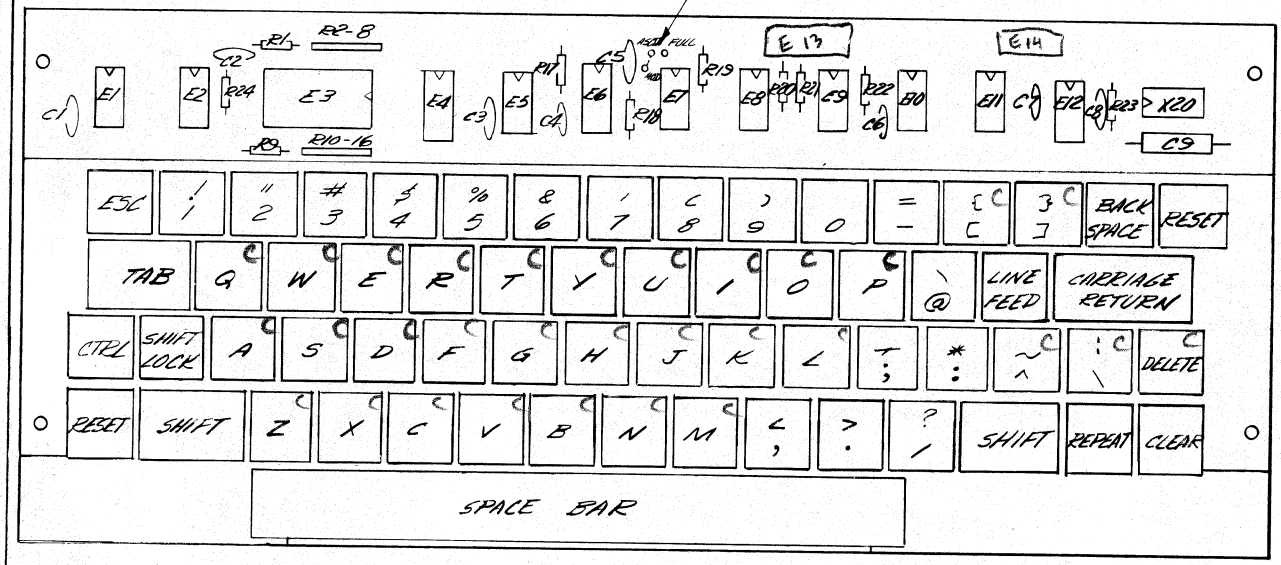


24	REF	SCHEMATIC	C000027		
23	1	PC BOARD	E000028		
22	1	ALPHANUMERIC KEYBOARD	873-10184		HI-TEK
21	1	CAPACITOR 100uF 10V	DDM-103	C9	CRL
20	1	CAPACITOR .01uF		C7	
19	1	CAPACITOR 100PF		C6	
18	1	CAPACITOR .2uF		C5	
17	1	CAPACITOR .001uF		C4	
16	4	CAPACITOR .1uF 50V	CK104	C1,C2,C3,C8	CRL
15	1	RESISTOR 47K 1/4W	RC07GF473	R18	
14	1	RESISTOR 10K 1/4W	RC07GF103	R17	
13	2	RESISTOR NETWORK	760-81-R33K	R2-8, R10-16	CTS
12	8	RESISTOR 3.3K 1/4W	RC07GF332	R1,9,19-24	
11	1	SOCKET, 14 PIN IC	314-AG39D	X20	AUGAT
10	1	DUAL D FLIP FLOP	SN7474N	E12	
9	1	QUAD 2 INPUT NAND	SN7400N	E11	
8	1	QUAD 2 INPUT AND	SN7408N	E10	
7	1	HEX INVERTER	SN7404N	E9	
6	1	QUAD EXCLUSIVE-OR	SN7486N	E7	
5	1	DUAL ONE SHOTS	SN74123N	E6	
4	1	BCD TO DECIMAL DECODER	SN7442N	E4	
3	1	16 TO 1 MULTIPLEXER	SN74150N	E3	
2	2	HEX BUFFER/DRIVER	SN7407N	E2, E8	
1	2	4 BIT BINARY COUNTER	SN7493N	E1, E5	
		ASSEMBLY			
ITEM NO.	QTY REQ'D	NOMENCLATURE OR DESCRIPTION	IDENTIFYING OR PART NO.	SPECIFICATION	MATERIAL OR NOTE

LIST OF MATERIAL

CONTRACT NO.	SPHERE
DRAWN BY: Howe 17MAR76	
CHECKED	KBD/2 ASSEMBLY
MECH	
ELECT.	
PROJ ENGR.	
APPROVED — Date	SIZE C — 000025 — REV
APPROVED (By Others) — Date	SCALE: NONE — Sheet 1 OF 1

JUMPER FOR MOD ASC II
(1) ASC II TO MOD.
(2) FULL CONN. TO E7-4, CUT E7-4 TO E7-13
(3) CUT ETCH BETWEEN FULL & ASC II



[ ] → valid CTRL key

ITEM NO.	QTY REQ'D	NOMENCLATURE OR DESCRIPTION	IDENTIFYING OR PART NO.	SPECIFICATION	MATERIAL OR NOTE
24	REF	SCHEMATIC	C000027		
23	1	PC BOARD	E000028		
22	1	ALPHANUMERIC KEYBOARD	873-10184		HI-TEK
21	1	CAPACITOR 100UF 10V	DDM-103	C9	CRL
20	1	CAPACITOR .01UF		C7	
19	1	CAPACITOR 100PF		C6	
18	1	CAPACITOR .2UF		C5	
17	1	CAPACITOR .001UF		C4	
16	4	CAPACITOR .1UF 50V	CK10A	C1, C2, C3, C8	CRL
15	1	RESISTOR 47K ¼W	RC07GF473	R18	
14	1	RESISTOR 10K ¼W	RC07GF103	R17	
13	2	RESISTOR NETWORK	760-81-R33K	R2-8, R10-16	CTS
12	8	RESISTOR 3.3K ¼W	RC07GF332	R1, 9, 19-24	
11	1	SOCKET, 14 PIN IC	314-AG39D	X20	AUGAT
10	1	DUAL D FLIP FLOP	SN7474N	E12	
9	1	QUAD 2 INPUT NAND	SN7400N	E11	
8	1	QUAD 2 INPUT AND	SN7408N	E10	
7	1	HEX INVERTER	SN7404N	E9	
6	1	QUAD EXCLUSIVE-OR	SN7486N	E7	
5	1	DUAL ONE SHOTS	SN74123N	E6	
4	1	BCD TO DECIMAL DECODER	SN7442N	E4	
3	1	16 TO 1 MULTIPLEXER	SN74150N	E3	
2	2	HEX BUFFER/DRIVER	SN7407N	E2, E8	
1	2	4 BIT BINARY COUNTER	SN7493N	E1, E5	
		ASSEMBLY			

LIST OF MATERIAL

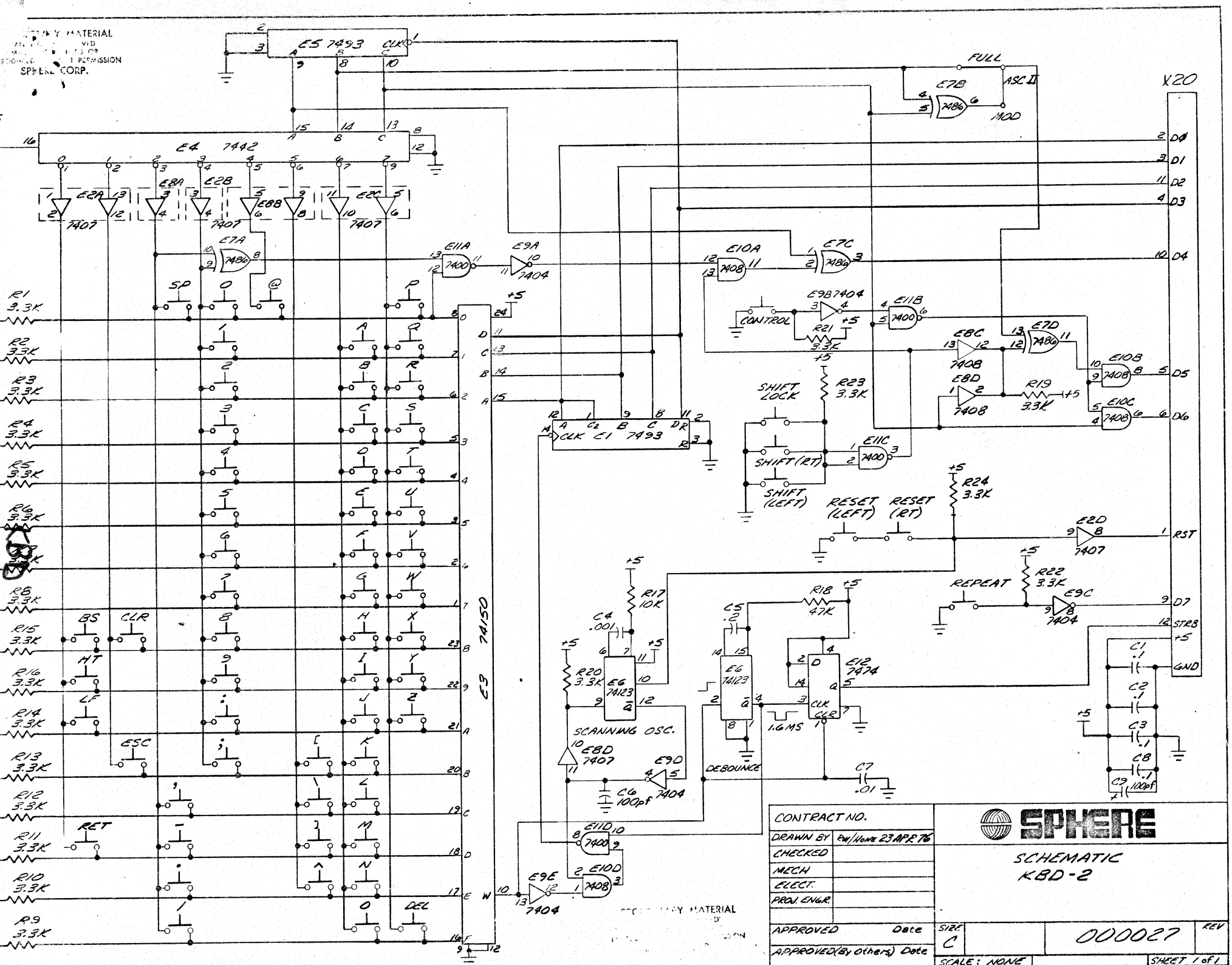
CONTRACT NO.	
DRAWN BY	HOWE 17MAR76
CHECKED	
MECH	
ELECT.	
PROJ ENGR.	
APPROVED	Date
APPROVED (By Others)	Date

SPHERE

KBD12
ASSEMBLY

SIZE C | 000025 | REV

SCALE: NONE | Sheet 1 OF 1

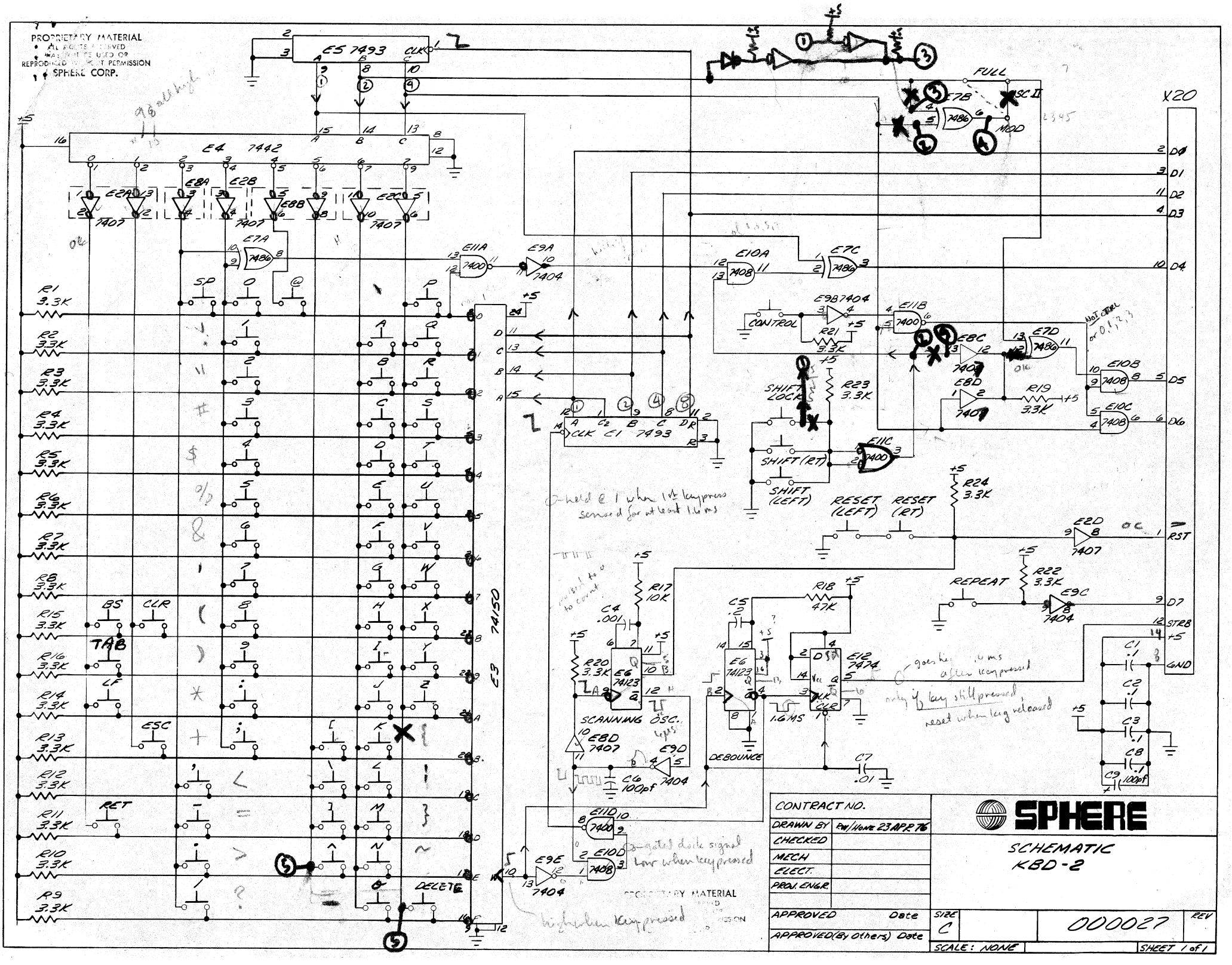


CONTRACT NO.	
DRAWN BY	Ron Howe 23 APR 76
CHECKED	
MECH	
ELECT.	
PROJ. ENG'R.	
APPROVED	Date
APPROVED (By Others)	Date

SPHERE

SCHEMATIC
KBD-2

SIZE		REV
C	000027	
SCALE: NONE		SHEET 1 of 1



held @ 1 when 1st keypress sensed for at least 1.6 ms

goes hi 1.6 ms after key pressed

only if key still pressed reset when key released

E8D gated clock signal Low when key pressed

high when key pressed

CONTRACT NO.		SPHERE	
DRAWN BY	PW/Home 23 APR 76	SCHEMATIC KBD-2	
CHECKED			
MECH			
ELECT.			
PROJ. ENGR.			
APPROVED Date		SIZE C	000027 REV
APPROVED(By Others) Date		SCALE: NONE	SHEET 1 of 1

THIS KEYBOARD WILL GENERATE A FULL ASCII CHARACTER SET HOWEVER, THIS IS NOT EASY TO USE IN HEX CODING FROM THE KEYBOARD.

BY MAKING THE JUMPERS SHOWN BELOW OR ON DRAWING A MODIFIED ASCII VERSION OF THE KEYBOARD IS ACHIEVED. THIS VERSION IS MUCH EASIER TO USE IN HEX CODING (THIS VERSION REQUIRES NO SHIFTING OF ALPHA CHARACTERS)

PRINTED CIRCUIT BOARDS THAT HAVE A PART NUMBER OF 00026 WITH NO REVISION SHOULD BE JUMPERED AS FOLLOWS:

JUMPER FOR MODIFIED ASCII

(1) 'ASCII'to E7-4 (use pin), Cut Etch E7-4 to E7-13 (under R19)

(2) 'MOD' to 'FULL'

(3) Cut Etch Between FULL & ASCII (Backside)

PROPRIETARY MATERIAL
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REPRODUCED WITHOUT PERMISSION
SPHERE CORP.

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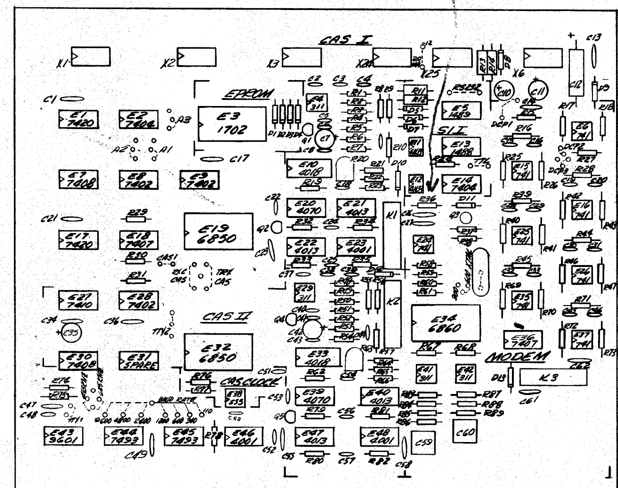
(3) Cut Etch Between FULL & ASCII (Backside)

R36



SIM

LIST OF MATERIALS OR PARTS

QTY REQD -05	QTY REQD -04	QTY REQD -03	QTY REQD -02	ITEM NO	QTY REQD -01	NOMENCLATURE OR DESCRIPTION	IDENTIFYING OR PART NO.	SPECIFICATION	MATERIAL OR NOTE
				86	A/R	SCHEMATIC	D000023		
				85	1	PRINTED CIRCUIT BOARD	E000024		
–	1	–	–	84	–	CRYSTAL	1 MHZ	XTAL	
–	1	–	–	83	–	RELAY	220-001-12	K3	TRIRIDGE
1	–	1	–	82	–	RELAY	220-100-12	K1, K2	TRIRIDGE
–	1	–	–	81	–	TRANSISTOR	2N2369	Q3	
1	–	1	–	80	–	TRANSISTOR	MPS6521	Q2, Q5	
1	–	1	–	79	–	TRANSISTOR	MPS6523	Q1, Q4	
–	2	–	–	78		CAPACITOR, 1uf		C59, 60	
–	–	–	–	77	1	CAPACITOR, 100PF 600V NPO	DTZ-100	C48	CRL
–	–	–	–	76	1	CAPACITOR, 33PF 1KV	DD-101	C47	CRL
1	–	1	–	75	–	CAPACITOR, 470PF 1KV	DD-471	C24, 56	CRL
3	12	3	–	74	2	CAPACITOR, .01uf 150V	DDM-103	C15,16,18,19,20,22,25 C28,29,30,31,32,33 C45,46,50,51,53,54,57	CRL
–	–	–	–	73	1	CAPACITOR, 100uf 10V		C12	SIEMENS
1	–	1	–	72	–	CAPACITOR .0062uf 1KV	AE0062 1KV	C9, 44	
1	–	1	–	71	1	CAPACITOR 100PF 1KV	DD-101	C8, 43, 52	
2	–	1	–	70	2	CAPACITOR 47uf 16V	EK47/16	C7,10,11,35,42	ROE
2	–	2	–	69	–	CAPACITOR, .001 1KV	DD-102	C5,6,40,41	CRL
1	–	1	–	68	–	CAPACITOR, .047uf 50V	AE.047M 50V	C4, 39	
1	–	1	–	67	–	CAPACITOR, .0015uf 1KV	DD-152	C3, 38	CRL
1	–	1	–	66	–	CAPACITOR, .47uf 16V		C2, 37	
3	5	–	–	65	7	CAPACITOR, .1uf 50V	CK-104	C1,13,14,17,21 C23,26,27,34,36,49 C55,58,61,62	CRL
–	1	–	–	64	–	RESISTOR, 680Ω 1/4W	RC07GF681	R89	
–	3	–	–	63	–	RESISTOR, 1.5K 1/4W	RC07GF152	R83-85	
–	–	–	–	62	–	RESISTOR	RC07GF(SEL)	R74	
–	1	–	–	61	–	RESISTOR 97.6K 1/4W 1%		R73	
–	1	–	–	60	–	RESISTOR 2.55K 1/4W 1%		R72	
–	1	–	–	59	1	RESISTOR, 8.87K 1/4W 1%		R71, 75	
–	1	–	–	58	–	RESISTOR, 95.3K 1/4W 1%		R70	
–	1	–	–	57	–	RESISTOR, 619Ω 1/4W 1%		R69	
–	1	–	–	56	–	RESISTOR, 330K 1/4W	RC07GF334	R59	
–	2	–	–	55	–	RESISTOR, 1MEG 1/4W	RC07GF105	R58, 60	
–	1	–	–	54	–	RESISTOR, 237K 1/4W 1%		R47	
–	1	–	–	53	–	RESISTOR, 1.24K 1/4W 1%		R46	
–	1	–	–	52	–	RESISTOR, 8.66K 1/4W 1%		R45	
–	1	–	–	51	–	RESISTOR 21.5K 1/4W 1%		R44	
–	1	–	–	50	–	RESISTOR 845Ω 1/4W 1%		R42	
–	1	–	–	49	–	RESISTOR 210K 1/4W 1%		R41	
–	1	–	–	48	–	RESISTOR, 324Ω 1/4W 1%		R40	
–	1	–	–	47	–	RESISTOR, 18.7K 1/4W 1%		R39	
–	3	–	–	46	–	RESISTOR, 510Ω 1/4W	RC07GF511	R36, 67, 68	
1	–	1	–	45	–	RESISTOR, 100K 1/4W	RC07GF104	R33, 80	
2	–	2	–	44	–	RESISTOR, 10K 1/4W	RC07GF103	R32, 35, 79, R82	
1	–	1	–	43	–	RESISTOR, 20K 1/4W	RC07GF203	R34, R81	
–	2	–	–	42	–	RESISTOR, 165K 1/4W 1%		R26, 43	
–	1	–	–	41	–	RESISTOR, 267Ω 1/4W 1%		R25	
–	–	–	1	40	–	RESISTOR, 1.2K 1/4W	RC07GF122	R24	
1	–	1	–	39	–	POTENTIOMETER 20K	3359P	R20, 63	BOURNS
1	–	1	–	38	–	RESISTOR, 100Ω 1/4W	RC07GF101	R19, 62	
1	2	1	–	37	–	RESISTOR 22K 1/4W	RC07GF223	R18, 21, 27, R64	
–	2	–	–	36	–	RESISTOR, 15K 1/4W	RC07GF153	R16, 28	
–	1	–	–	35	–	RESISTOR, 620Ω 1/4W	RC07GF621	R15	
–	–	–	–	34	2	RESISTOR, 510Ω 1W	RC32GF511	R13, R14	
–	–	–	1	33	–	RESISTOR, 820Ω 1W	RC32GF821	R12	
–	–	–	1	32	–	RESISTOR, 1.1K 1W	RC32GF112	R11	
1	6	1	0	31	2	RESISTOR, 1K 1/4W	RC07GF102	R10,17,30,37,38,57 R77,86,87,88	
1	1	1	0	30	–	RESISTOR, 4.7K 1/4W	RC07GF472	R8, 55, 61	
1	–	1	0	29	3	RESISTOR, 3.3K 1/4W	RC07GF332	R6, 29, 31, 53, 76	
3	–	3	0	28	1	RESISTOR, 47K 1/4W	RC07GF473	R3, 4, 23, 50, 51 R66, 78	
4	–	4	0	27	0	RESISTOR, 33K 1/4W	RC07GF333	R2, 7, 9, 22, 49 R49, 54, 56, 65	
2	–	2	0	26	0	RESISTOR, 2.2K 1/4W	RC07GF222	R1, 5, 48, 52	
1	2	1	3	25	7	DIODE	IN4001	D1-D13	
1	1	–	–	24	2	24 PIN IC SOCKETS	324-AG39 D	X3, 19, 32, 34	
–	–	–	–	23	6	14 PIN IC SOCKETS	314-AG39 D	X1-3, 6, 24, 25	
–	–	–	–	22	2	4 BIT BINARY COUNTER	SN7493N	E44, 45	
–	–	–	–	21	1	ONE SHOT	9601 (DM8601N)	E43	
–	–	–	–	20	1	PRECISION TIMER	SN72555P	E38	
–	1	–	–	19		MODEM	MC6860	E34	
–	–	–	–	18		SPARE		E31	
1	–	–	–	17	–	TRIPLE 3-INPUT NAND GATE	SN7410N	E27	
1	–	1	–	16	1	NOR GATE	CD4001A	E23, 46, 48	
2	–	2	–	15	–	DUAL D FLIP FLOP	CD 4013A	E21, 22, 40, 47	
1	–	1	–	14	–	EXCLUSIVE OR GATE	CD4070A	E20, 39	
1	–	–	–	13	1	ACIA	MC6850	E19, 32	
1	1	1	0	12	1	HEX BUFFER	SN7407N	E18, 36	
–	–	–	1	11	–	QUAD TRANSMITTER - RS232	MC1488N	E13	
–	–	–	2	10	–	PHOTO COUPLER	4N33N	E11, E12	
1	–	1	–	9	–	COUNTER	CD4018A	E10, 33	
1	–	–	–	8	2	QUAD 2-INPUT NOR GATE	SN7402N	E8, 9, 28	
1	–	–	–	7	1	QUAD 2 INPUT AND GATE	SN7408N	E7, 30	
–	8	–	–	6	–	OPERATIONAL AMPLIFIER	LM741	E6, 15, 16, 24, 25 E26, 35, 37	
–	–	–	1	5	–	QUAD RECEIVER - R232	MC1489	E5	
1	2	1	–	4	–	VOLTAGE COMPARATOR	LM311N	E4, 29, 41, 42	
–	–	–	–	3	*	EPROM 256X8 BIT	MM1702A	E3	
–	–	–	1	2	1	HEX INVERTER	SN7404N	E2, 14	
–	–	–	–	1	2	8-INPUT NAND GATE	SN7420N	E1, 17	
-05	-04	-03	-02		-01	ASSEMBLY			

DASH NO.	TITLE	ALPHA DESIGN
05	AUDIO CAS INTERFACE II	d
04	MODEM	c
03	AUDIO CAS INTERFACE I	b
02	SERIAL INTERFACE I	a
01	STD	–

* SPECIAL ITEM CONTROLED BY SOFT WARE DEPT.

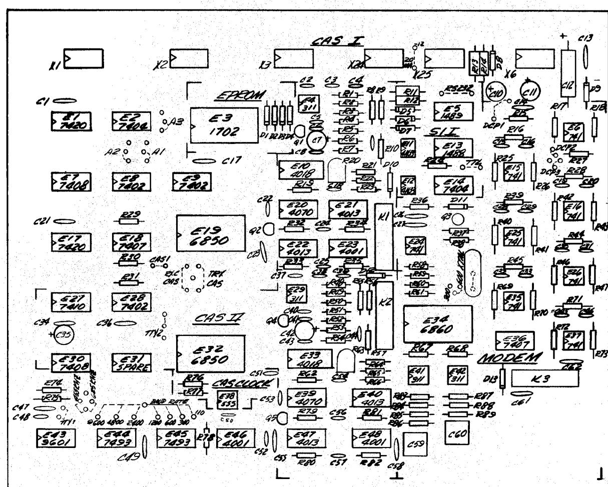
DRAWN BY	HONE 28 JAN 76
CHECKED BY	
R&D	
QA CONT	
MFG ENG	
PROD ENG	
APPROVAL	
APPROVAL	
FINAL APPROVAL	

SPHERE

SIM/1 ASSEMBLY

SIZE D | 000022 | REV A

SCALE NONE | SHEET 1 OF 1



QTY REQD -05	QTY REQD -04	QTY REQD -03	QTY REQD -02	ITEM NO	QTY REQ'D -01	NOMENCLATURE OR DESCRIPTION	IDENTIFYING OR PART NO.	SPECIFICATION	MATERIAL OR NOTE
				86	A/R	SCHEMATIC	D000023		
				85	1	PRINTED CIRCUIT BOARD	E000024		
–	1	–	–	84	–	CRYSTAL	1MHZ	XTAL	
–	1	–	–	83	–	RELAY	220-001-12	K3	TRIRIDGE
1	–	1	–	82	–	RELAY	220-100-12	K1, K2	TRIRIDGE
–	1	–	–	81	–	TRANSISTOR	2N2369	Q3	
1	–	1	–	80	–	TRANSISTOR	MPS6521	Q2, Q5	
1	–	1	–	79	–	TRANSISTOR	MPS6523	Q1, Q4	
–	2	–	–	78		CAPACITOR, 1uf		C59, 60	
–	–	–	–	77	1	CAPACITOR, 100PF 300V NPO	DTZ-100	C48	CRL
–	–	–	–	76	1	CAPACITOR, 33PF 1KV	DD-101	C47	CRL
1	–	1	–	75	–	CAPACITOR, 470PF 1KV	DD-471	C24, 56	CRL
3	12	3	–	74	2	CAPACITOR, .01uf 150V	DDM-103	C15, 16, 18, 19, 20, 22, 25, C28, 29, 30, 31, 32, 33, C45, 46, 50, 51, 53, 54, 57	CRL
–	–	–	–	73	1	CAPACITOR, 100uf 10V		C12	SIEMENS
1	–	1	–	72	–	CAPACITOR .0062uf 1KV	AE.0062 1KV	C9, 44	
1	–	1	–	71	1	CAPACITOR 100PF 1KV	DD-101	C8, 43, 52	
2	–	1	–	70	2	CAPACITOR 47uf 16V	EK47/16	C7, 10, 11, 35, 42	ROE
2	–	2	–	69	–	CAPACITOR, .001 1KV	DD-102	C5, 6, 40, 41	CRL
1	–	1	–	68	–	CAPACITOR, .047uf 50V	AE.047M 50V	C4, 39	
1	–	1	–	67	–	CAPACITOR, .0015uf 1KV	DD-152	C3, 38	CRL
1	–	1	–	66	–	CAPACITOR, .47uf 16V		C2, 37	
3	5	–	–	65	7	CAPACITOR, .1uf 50V	CK-104	C1, 13, 14, 17, 21, C23, 26, 27, 34, 36, 49, C55, 58, 61, 62	CRL
–	1	–	–	64	–	RESISTOR, 680Ω 1/4W	RC07GF681	R89	
–	3	–	–	63	–	RESISTOR, 1.5K 1/4W	RC07GF152	R83-85	
–	–	–	–	62	–	RESISTOR	RC07GF(SEL)	R74	
–	1	–	–	61	–	RESISTOR 97.6K 1/4W 1%		R73	
–	1	–	–	60	–	RESISTOR 2.55K 1/4W 1%		R72	
–	1	–	–	59	1	RESISTOR 8.87K 1/4W 1%		R71, 75	
–	1	–	–	58	–	RESISTOR, 35.3K 1/4W 1%		R70	
–	1	–	–	57	–	RESISTOR, 619Ω 1/4W 1%		R69	
–	1	–	–	56	–	RESISTOR, 330K 1/4W	RC07GF334	R59	
–	2	–	–	55	–	RESISTOR, 1MEG 1/4W	RC07GF105	R58, 60	
–	1	–	–	54	–	RESISTOR, 237K 1/4W 1%		R47	
–	1	–	–	53	–	RESISTOR, 1.24K 1/4W 1%		R46	
–	1	–	–	52	–	RESISTOR, 8.66K 1/4W 1%		R45	
–	1	–	–	51	–	RESISTOR 21.5K 1/4W 1%		R44	
–	1	–	–	50	–	RESISTOR 845Ω 1/4W 1%		R42	
–	1	–	–	49	–	RESISTOR 210K 1/4W 1%		R41	
–	1	–	–	48	–	RESISTOR, 324Ω 1/4W 1%		R40	
–	1	–	–	47	–	RESISTOR, 18.7K 1/4W 1%		R39	
–	3	–	–	46	–	RESISTOR, 510Ω 1/4W	RC07GF511	R36, 67, 68	
1	–	1	–	45	–	RESISTOR, 100K 1/4W	RC07GF104	R33, 80	
2	–	2	–	44	–	RESISTOR, 10K 1/4W	RC07GF103	R32, 35, 79, R82	
1	–	1	–	43	–	RESISTOR, 20K 1/4W	RC07GF203	R34, R81	
–	2	–	–	42	–	RESISTOR, 165K 1/4W 1%		R26, 43	
–	1	–	–	41	–	RESISTOR, 267Ω 1/4W 1%		R25	
–	–	–	1	40	–	RESISTOR, 1.2K 1/4W	RC07GF122	R24	
1	–	1	–	39	–	POTENTIOMETER 20K	3359P	R20, 63	BOURNS
1	–	1	–	38	–	RESISTOR, 100Ω 1/4W	RC07GF101	R19, 62	
1	2	1	–	37	–	RESISTOR 22K 1/4W	RC07GF223	R18, 21, 27, R64	
–	2	–	–	36	–	RESISTOR, 15K 1/4W	RC07GF153	R16, 28	
–	1	–	–	35	–	RESISTOR, 620Ω 1/4W	RC07GF621	R15	
–	–	–	–	34	2	RESISTOR, 510Ω 1W	RC32GF511	R13, R14	
–	–	–	1	33	–	RESISTOR, 820Ω 1W	RC32GF821	R12	
–	–	–	1	32	–	RESISTOR, 1.1K 1W	RC32GF112	R11	
1	6	1	0	31	2	RESISTOR, 1K 1/4W	RC07GF102	R10, 17, 30, 37, 38, 57, R77, 86, 87, 88	
1	1	1	0	30	–	RESISTOR, 4.7K 1/4W	RC07GF472	R8, 55, 61	
1	–	~~1~~	0	29	3	RESISTOR, 3.3K 1/4W	RC07GF332	R6, 29, 31, 53, 76	
3	–	3	0	28	1	RESISTOR, 47K 1/4W	RC07GF473	R3, 4, 23, 50, 51, R66, 78	
4	–	4	0	27	0	RESISTOR, 33K 1/4W	RC07GF333	R2, 7, 9, 22, 49, R49, 54, 56, 65	
2	–	2	0	26	0	RESISTOR, 2.2K 1/4W	RC07GF222	R1, 5, 48, 52	
1	2	1	3	25	7	DIODE	1N4001	D1-D13	
1	1	–	–	24	2	24 PIN IC SOCKETS	324-AG39 D	X3, 19, 32, 34	
–	–	–	–	23	6	14 PIN IC SOCKETS	314-AG39 D	X1-3, 6, 24, 25	
–	–	–	–	22	2	4 BIT BINARY COUNTER	SN7493N	E44, 45	
–	–	–	–	21	1	ONE SHOT	9601 (DM8601N)	E43	
–	–	–	–	20	1	PRECISION TIMER	SN72555P	E38	
–	1	–	–	19		MODEM	MC6860	E34	
–	–	–	–	18		SPARE		E31	
1	–	–	–	17	–	TRIPLE 3-INPUT NAND GATE	SN7410N	E27	
1	–	1	–	16	1	NOR GATE	CD4001A	E23, 46, 48	
2	–	2	–	15	–	DUAL D FLIP FLOP	CD4013A	E21, 22, 40, 47	
1	–	1	–	14	–	EXCLUSIVE OR GATE	CD4070A	E20, 39	
1	–	–	–	13	1	ACIA	MC6850	E19, 32	
1	1	1	0	12	1	HEX BUFFER	SN7407N	E18, 36	
–	–	–	1	11	–	QUAD TRANSMITTER-RS232	MC1488N	E13	
–	–	–	2	10	–	PHOTO COUPLER	4N33N	E11, E12	
1	–	1	–	9	–	COUNTER	CD4018A	E10, 33	
1	–	–	–	8	2	QUAD 2-INPUT NOR GATE	SN7402N	E8, 9, 28	
1	–	–	–	7	1	QUAD 2 INPUT AND GATE	SN7408N	E7, 30	
–	8	–	–	6	–	OPERATIONAL AMPLIFIER	LM741	E6, 15, 16, 24, 25, E26, 35, 37	
–	–	–	1	5	–	QUAD RECEIVER-R232	MC1489	E5	
1	2	1	–	4	–	VOLTAGE COMPARATOR	LM311N	E4, 29, 41, 42	
–	–	–	–	3	*	EPROM 256X8 BIT	MM1702A	E3	
–	–	–	1	2	1	HEX INVERTER	SN7404N	E2, 14	
–	–	–	–	1	2	8-INPUT NAND GATE	SN7420N	E1, 17	
-05	-04	-03	-02		-01	ASSEMBLY			

LIST OF MATERIALS OR PARTS

DASH NO.	TITLE	ALPHA DESIG.
05	AUDIO CAS INTERFACE II	d
04	MODEM	c
03	AUDIO CAS INTERFACE I	b
02	SERIAL INTERFACE I	a
01	STD	—

* SPECIAL ITEM CONTROLED BY SOFT WARE DEPT.

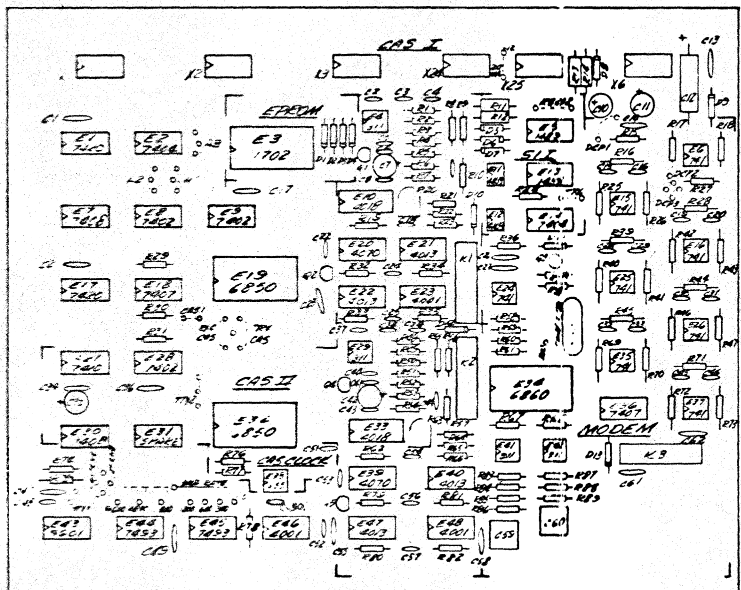
DRAWN BY	Hone 28 JAN 76
CHECKED BY	
R&D	
QA CONT	
MFG ENG	
PROD ENG	
APPROVAL	
APPROVAL	
FINAL APPROVAL	

SPHERE

SIM/1 ASSEMBLY

SIZE D | 000022 | REV A

SCALE NONE | SHEET 1 OF 1



QTY REQD	QTY REQD	QTY REQD	QTY REQD	ITEM NO	QTY REQD	NOMENCLATURE OR DESCRIPTION	IDENTIFYING OR PART NO.	SPECIFICATION	MATERIAL OR NOTE
				86	A/R	SCHEMATIC	D 000023		
				85	1	PRINTED CIRCUIT BOARD	E 000024		
–	1	–	–	84	–	CRYSTAL	1 MHZ	XTAL	
–	1	–	–	83	–	RELAY	220-001-12	K3	TRIRIDGE
1	–	1	–	82	–	RELAY	220-100-12	K1, K2	TRIRIDGE
–	1	–	–	81	–	TRANSISTOR	2N2369	Q3	
1	–	1	–	80	–	TRANSISTOR	MPS6521	Q2, Q5	
1	–	1	–	79	–	TRANSISTOR	MPS6523	Q1, Q4	
–	2	–	–	78		CAPACITOR, 1uf		C59, 60	
–	–	–	–	77	1	CAPACITOR, 100 PF 600V NPO	DTZ-100	C48	CRL
–	–	–	–	76	1	CAPACITOR, 33PF 1KV	DD-101	C47	CRL
1	–	1	–	75	–	CAPACITOR, 470PF 1KV	DD-471	C24, 56	CRL
3	12	3	–	74	2	CAPACITOR, .01uf 150V	DDM-103	C15, 16, 19, 20, 22, 25, 18 C28, 29, 30, 31, 32, 33 C45, 46, 50, 51, 53, 57, 54	CRL
–	–	–	–	73	1	CAPACITOR, 100uf 10V		C12	SIEMENS
1	–	1	–	72	–	CAPACITOR .0062uf 1KV	AE0062 1KV	C9, 44	
1	–	1	–	71	1	CAPACITOR 100PF 1KV	DD-101	C8, 43, 52	
2	–	1	–	70	2	CAPACITOR 47uf 16V	EK47/16	C7, 10, 11, 35, 42	ROE
2	–	2	–	69	–	CAPACITOR, .001 1KV	DD-102	C5, 6, 40, 41	CRL
1	–	1	–	68	–	CAPACITOR, .047uf 50V	AE.047M 50V	C4, 39	
1	–	1	–	67	–	CAPACITOR, .0015uf 1KV	DD-152	C3, 38	CRL
1	–	1	–	66	–	CAPACITOR, .47uf 16V		C2, 37	
3	5	0	–	65	7	CAPACITOR, .1uf 50V	CK-104	C1, 13, 14, 17, 20, 21 C23, 26, 27, 34, 36, 49 C54, 55, 58, 61, 62	CRL
–	1	–	–	64	–	RESISTOR, 680Ω 1/4W	RC07GF681	R89	
–	3	–	–	63	–	RESISTOR, 1.5K 1/4W	RC07GF152	R83-85	
–	–	–	–	62	–	RESISTOR	RC07GF(SEL)	R74	
–	1	–	–	61	–	RESISTOR 97.6K 1/4W 1%		R73	
–	1	–	–	60	–	RESISTOR 2.55K 1/4W 1%		R72	
–	1	–	–	59	1	RESISTOR, 8.87K 1/4W 1%		R71, 75	
–	1	–	–	58	–	RESISTOR, 35.3K 1/4W 1%		R70	
–	1	–	–	57	–	RESISTOR, 619Ω 1/4W 1%		R69	
–	1	–	–	56	–	RESISTOR, 330K 1/4W	RC07GF334	R59	
–	2	–	–	55	–	RESISTOR, 1MEG 1/4W	RC07GF105	R58, 60	
–	1	–	–	54	–	RESISTOR, 237K 1/4W 1%		R47	
–	1	–	–	53	–	RESISTOR, 1.24K 1/4W 1%		R46	
–	1	–	–	52	–	RESISTOR, 8.66K 1/4W 1%		R45	
–	1	–	–	51	–	RESISTOR 21.5K 1/4W 1%		R44	
–	1	–	–	50	–	RESISTOR 845Ω 1/4W 1%		R42	
–	1	–	–	49	–	RESISTOR 210K 1/4W 1%		R41	
–	1	–	–	48	–	RESISTOR, 324Ω 1/4W 1%		R40	
–	1	–	–	47	–	RESISTOR, 18.7K 1/4W 1%		R39	
–	3	–	–	46	–	RESISTOR, 510Ω 1/4W	RC07GF511	R36, 67, 68	
1	–	1	–	45	–	RESISTOR, 100K 1/4W	RC07GF104	R33, 90	
2	–	2	–	44	–	RESISTOR, 10K 1/4W	RC07GF103	[illegible]	
1		1		[illegible]		[illegible]		[illegible]	
–		–	–	42	–	RESISTOR, 165K 1/4W 1%		R26, 63	
–	1	–	–	41	–	RESISTOR, 267Ω 1/4W 1%		R25	
–	–	–	1	40	–	RESISTOR, 1.2K 1/4W	RC07GF122	R24	
1	–	1	–	39	–	POTENTIOMETER 20K	3359P	R20, 63	BOURNS
1	–	1	–	38	–	RESISTOR 100Ω 1/4W	RC07GF101	R19, 62	
2	2	2	–	37	–	RESISTOR 22K 1/4W	RC07GF223	[illegible]	
–	2	–	–	36	–	RESISTOR, 15K 1/4W	RC07GF153	R16, 28	
–	1	–	–	35	–	RESISTOR, 620Ω 1/4W	RC07GF621	R15	
–	–	–	–	34	2	RESISTOR, 510Ω 1W	RC32GF511	R3, R14	
–	–	–	1	33	–	RESISTOR, 820Ω 1W	RC32GF821	R12	
–	–	–	1	32	–	RESISTOR, 1.1K 1W	RC32GF112	R11	
1	6	1	0	31	2	RESISTOR, 1K 1/4W	RC07GF102	[illegible]	
1	1	1	0	30	–	RESISTOR, 4.7K 1/4W	RC07GF472	25, 55, 61	
1	–	1	0	29	1	RESISTOR, 3.3K 1/4W	RC07GF332	[illegible]	
3	–	3	0	28	1	RESISTOR 47K 1/4W	RC07GF473	[illegible]	
4	–	4	–	27	–	RESISTOR, 33K 1/4W	RC07GF333	[illegible]	
2	–	2	–	26	–	RESISTOR, 2.2K 1/4W	RC07GF222	[illegible]	
1	2	1	3	25	7	DIODE	1N4001	[illegible]	
1	1	–	–	24	2	24 PIN IC SOCKETS	324-AG39 D	13, 19, 32, 34	
–	–	–	–	23	6	14 PIN IC SOCKETS	314-AG39 D	11-3, 6, 24, 25	
–	–	–	–	22	2	4 BIT BINARY COUNTER	SN 7493N	E44, 45	
–	–	–	–	21	1	ONE SHOT	S601 (DM8601N)	E43	
–	–	–	–	20	1	PRECISION TIMER	SN 72555P	E38	
–	1	–	–	19		MODEM	MC6860	E34	
–	–	–	–	18		SPARE		E31	
1	–	–	–	17	–	TRIPLE 3 INPUT NAND GATE	SN 7410 N	E27	
1	–	1	–	16	1	NOR GATE	CD4001A	E23, 46, 48	
2	–	2	–	15	–	DUAL D FLIP FLOP	CD 4013A	E3, 22, 40, 47	
1	–	1	–	14	–	EXCLUSIVE OR GATE	CD4070A	E20, 35	
1	–	–	–	13	1	ACIA	MC 6850	E19, 32	
1	1	1	0	12	1	HEX BUFFER	SN 7407N	E18, 36	
–	–	–	1	11	–	QUAD TRANSMITTER - RS232	MC1489N	E13	
–	–	–	2	10	–	PHOTO COUPLER	4N33N	E11, E12	
1	–	1	0	9	–	COUNTER	CD4018A	E10, 33	
1	–	–	–	8	2	QUAD 2-INPUT NOR GATE	SN7402N	E8, 9, 28	
1	–	–	–	7	1	QUAD 2 INPUT AND GATE	SN 7408N	E7, 30	
–	8	–	–	6	–	OPERATIONAL AMPLIFIER	LM741	E6, 15, 16, 24, 25, 26, 33, 37	
–	–	–	1	5	–	QUAD RECEIVER - R232	MC1499	E5	
1	2	1	–	4	–	VOLTAGE COMPARATOR	LM 311N	E4, 29, 41, 42	
–	–	–	–	3	*	EPROM 256 ✕ 8 BIT	MM1702A	E3	
–	–	–	1	2	1	HEX INVERTER	SN7404N	E2, 14	
–	–	–	–	1	2	8-INPUT NAND GATE	SN7420N	E1, 17	
-05	-04	-03	-02		-01	ASSEMBLY			

LIST OF MATERIALS OR PARTS

DASH NO.	TITLE	ALPHA DESIG
05	AUDIO CAS INTERFACE II	d
04	MODEM	c
03	AUDIO CAS INTERFACE I	b
02	SERIAL INTERFACE I	a
01	STD	–

* SPECIAL ITEM CONTROLED BY SOFT WARE DEPT.

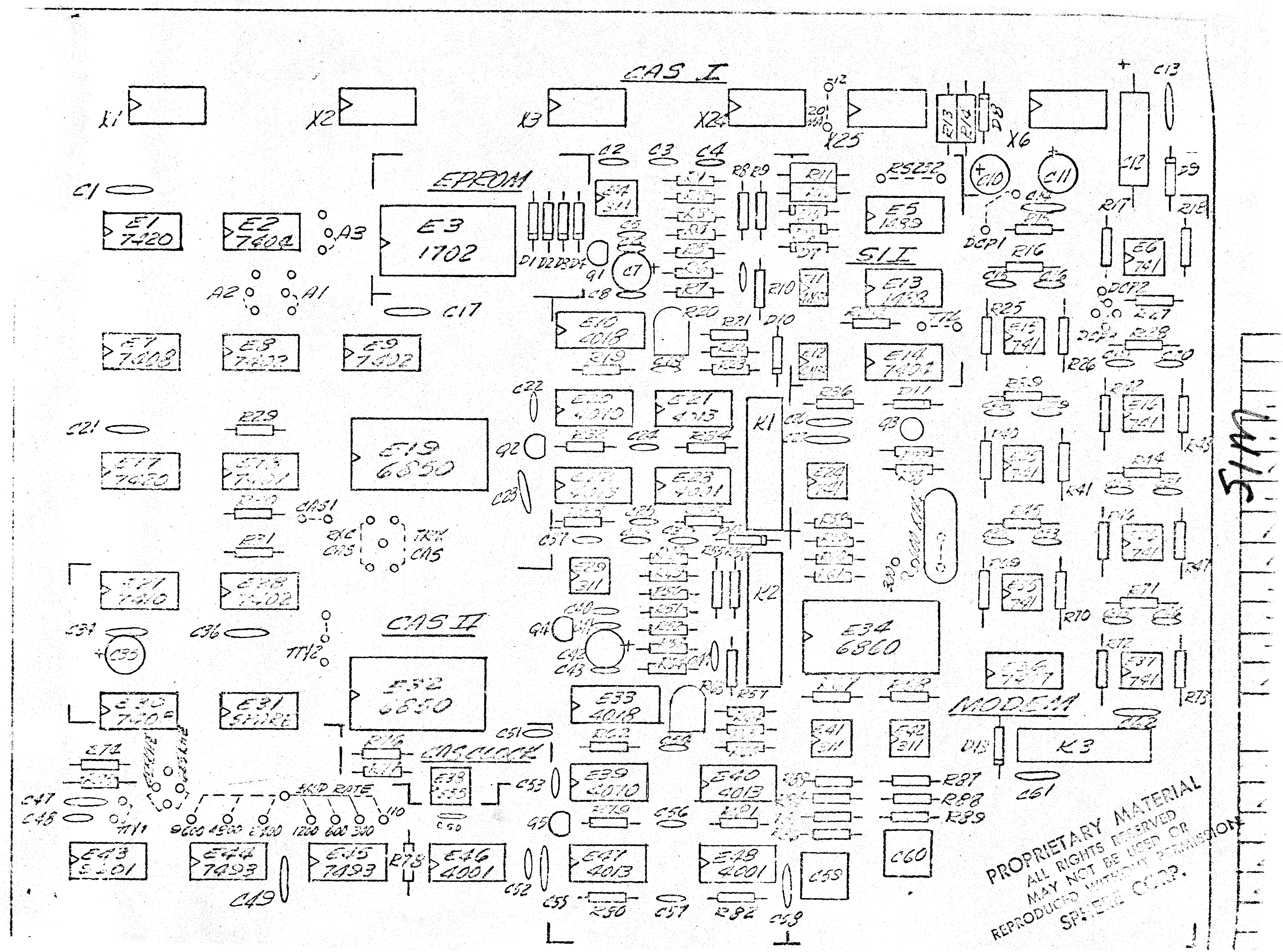
DRAWN BY	HONE 28 JAN 76
CHECKED BY	
R&D	
QA CONT	
MFG ENG	
PROD ENG	
APPROVAL	
APPROVAL	
FINAL APPROVAL	

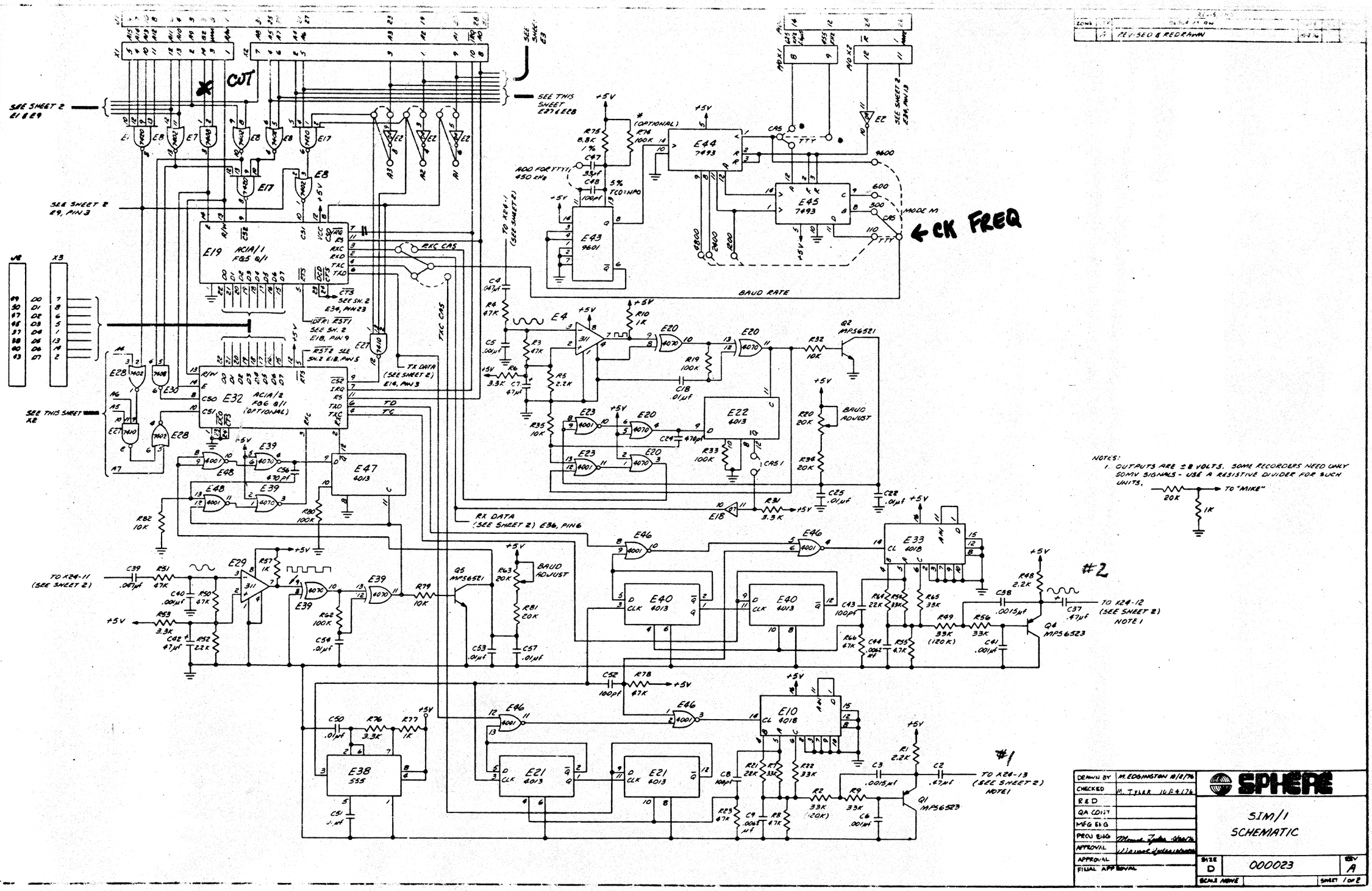
SPHERE

SIM/1 ASSEMBLY

SIZE D — 000022 — REV A

SCALE NONE — SHEET OF





ZONE	REVISIONS
	REVISED & REDRAWN

DRAWN BY	M. EDGINGTON 10/8/76
CHECKED	M. TYLER 10/14/76
R & D	
QA CONT	
MFG ENG	
PROJ ENG	
APPROVAL	
APPROVAL	
FINAL APPROVAL	

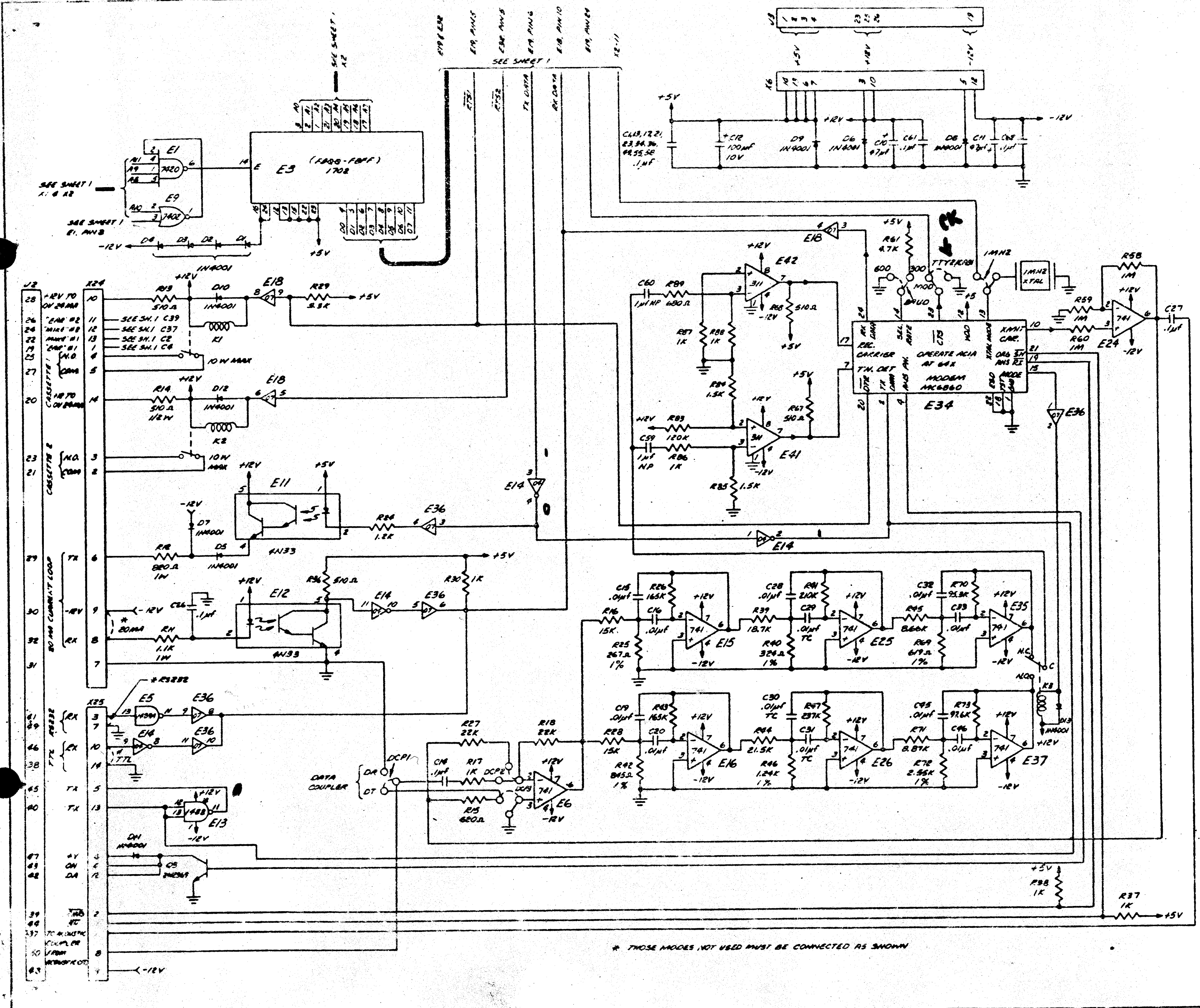
SPHERE

SIM/1
SCHEMATIC

SIZE D | 000023 | REV A

SCALE NONE | SHEET 1 OF 2

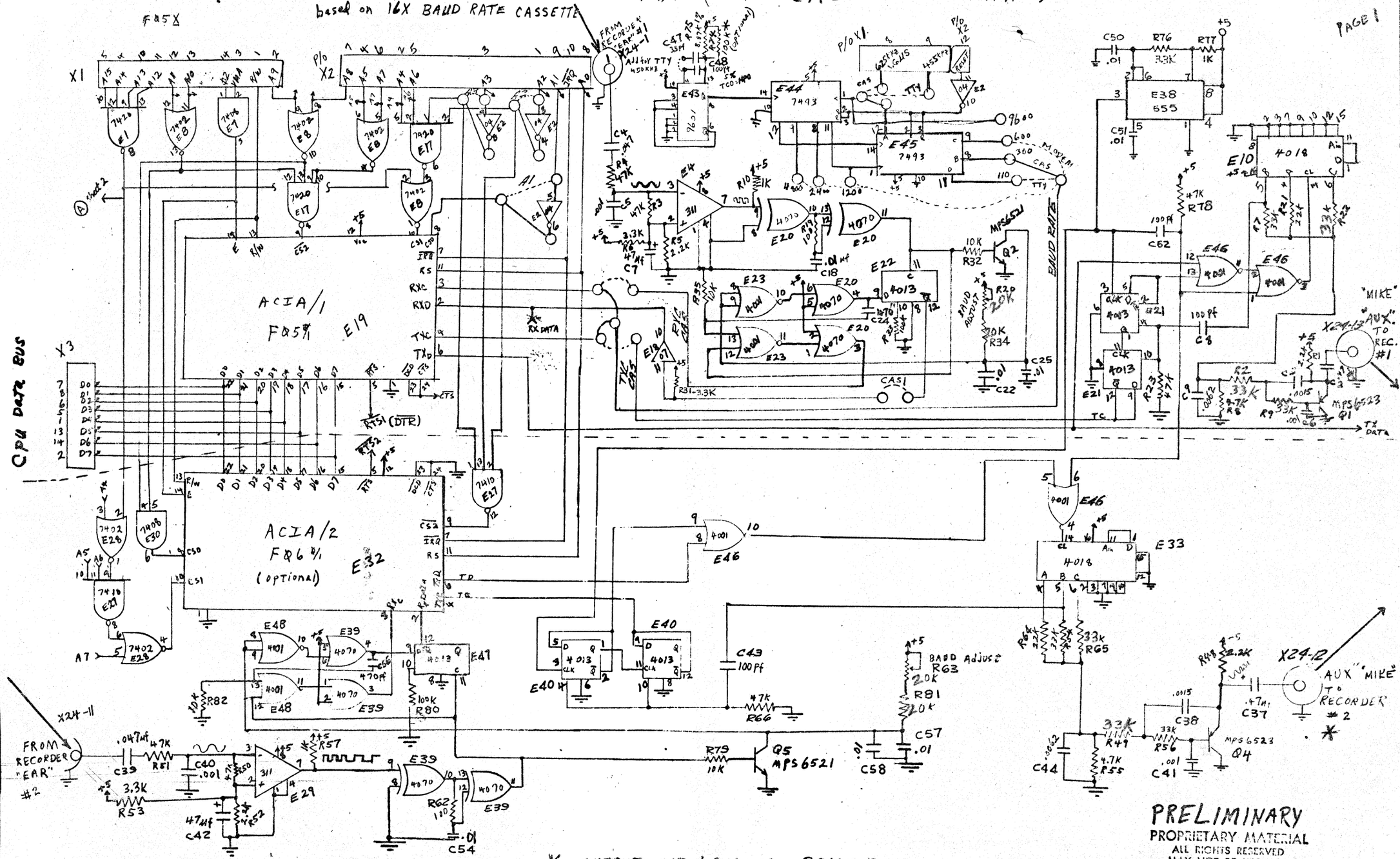
		LTR	DESCRIPTION	DATE	CHK	APPRVD
		A	REVISED & REDRAWN	10-2-76		



DRAWN BY	M. EDGINGTON 10/19/76	SPHERE	
CHECKED	M. TYLER 10/25/76	SIM/1 SCHEMATIC	
R&D			
QA CONT			
MFG ENG			
PROJ ENG	[illegible] 10/26/76		
APPROVAL	[illegible] 10/26/76		
APPROVAL		SIZE D	000023 REV A
FINAL APPROVAL		SCALE NONE	SHEET 2 of 2

SIM/1 (DUAL CASSETTE INTERFACE)

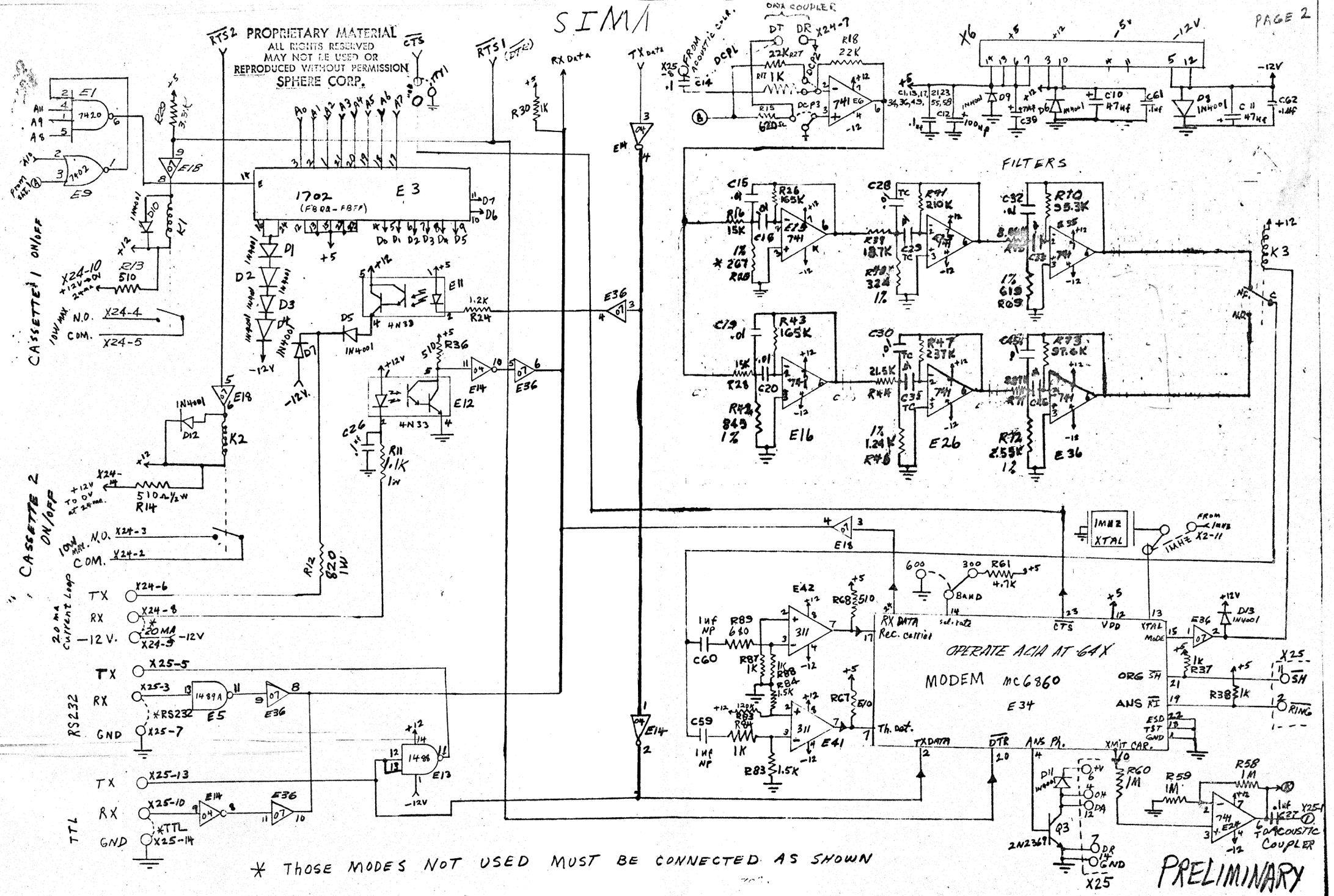
based on 16X BAUD RATE CASSETTE



* OUTPUTS ARE ±2 VOLTS. SOME RECORDERS NEED ONLY 50mV SIGNALS - USE A RESISTIVE DIVIDER FOR SUCH UNITS.

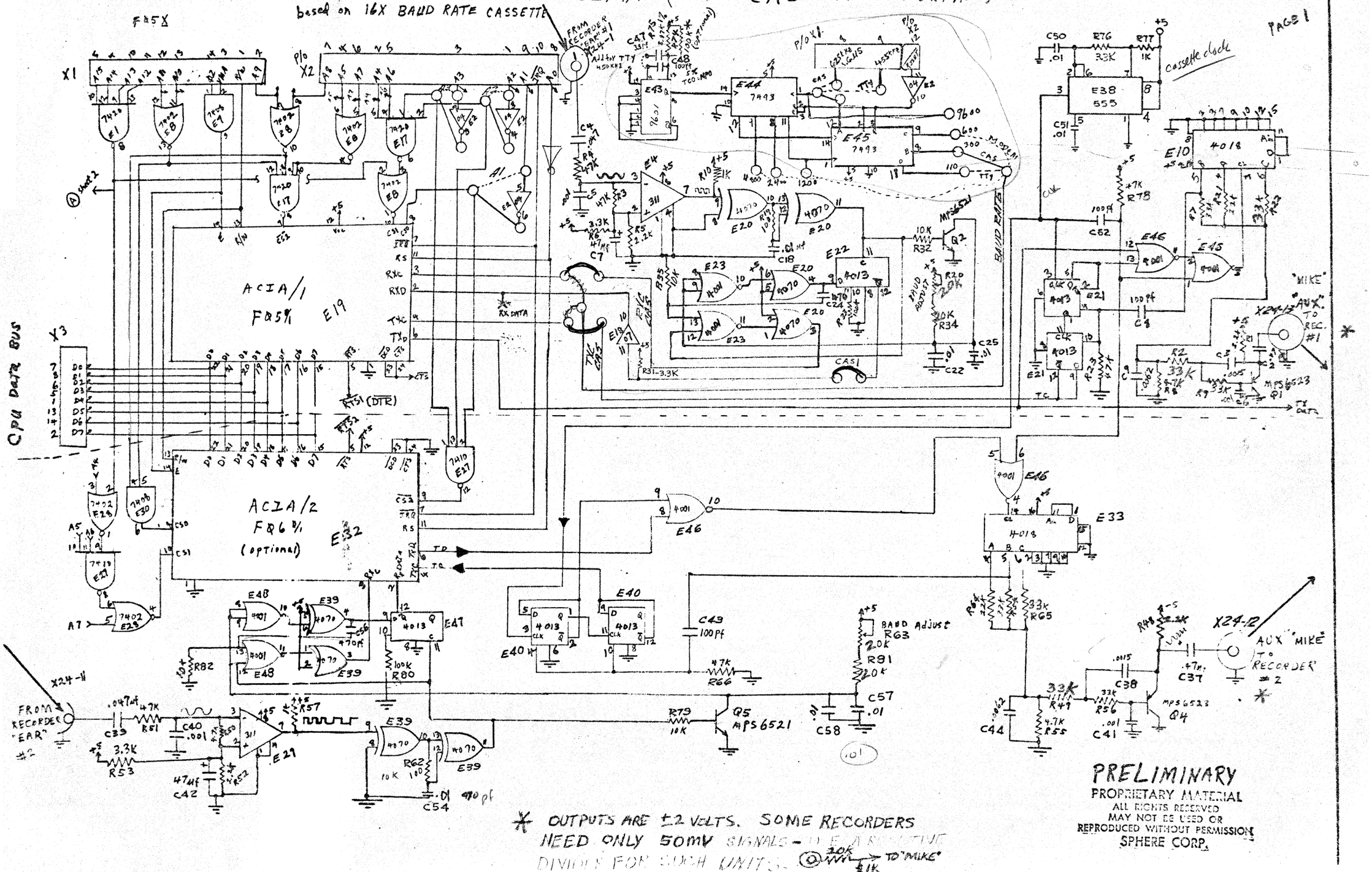
PRELIMINARY

SIM4



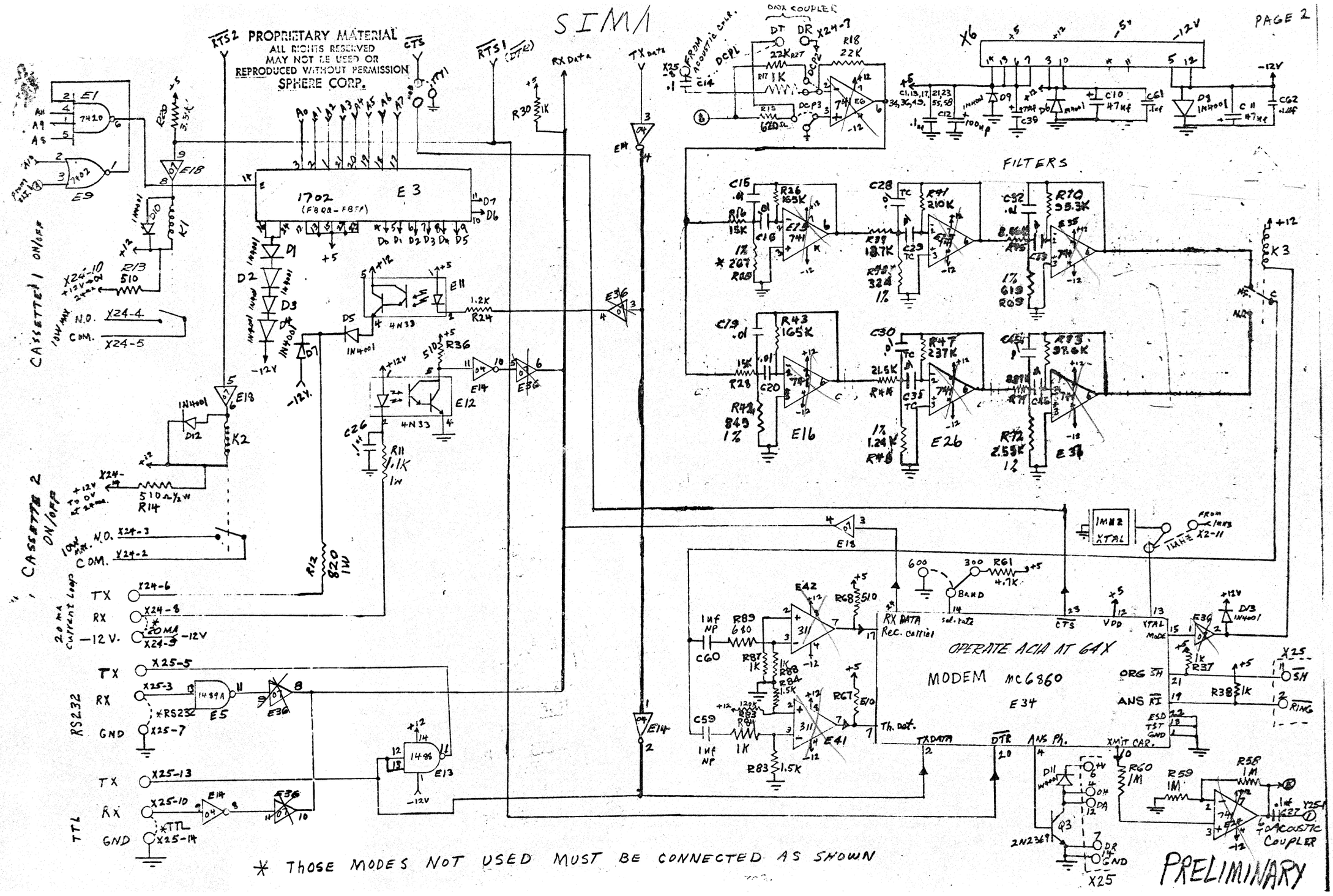
SIM/1 (DUAL CASSETTE INTERFACE)

based on 16X BAUD RATE CASSETTE



* OUTPUTS ARE ±2 VOLTS. SOME RECORDERS NEED ONLY 50mV SIGNALS - USE A RESISTIVE DIVIDER FOR SUCH UNITS.

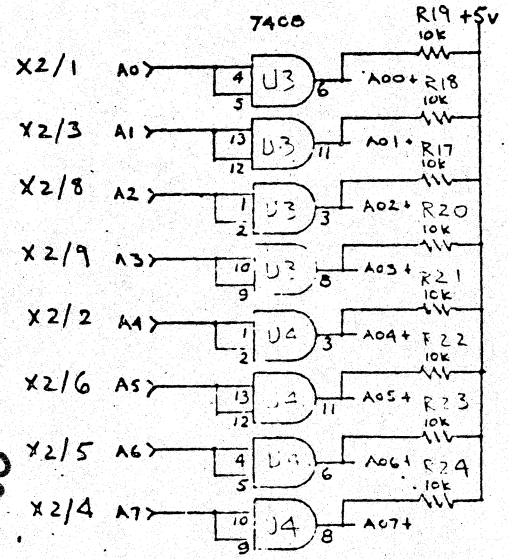
SIM1

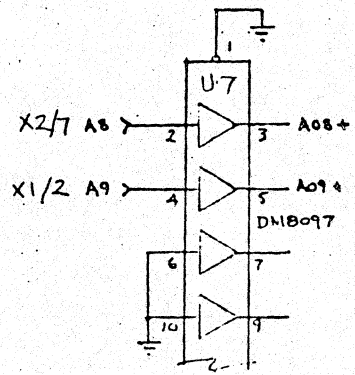


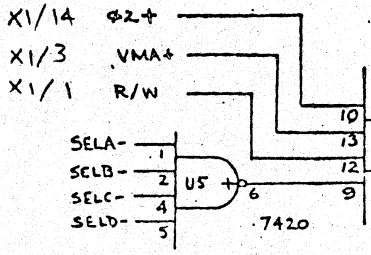
X1
X2
X3
C4
X6
U1
C1
U2
C2
U3
U4
U5
C3
U6
U7
C5
D1
D2
D3
D4
J1
U8
U9
C6
C7
U10
R1
U11
R2
U12
R3
U13
R4
J2
U14
U15
C8
U16
R5
U17
R6
U18
R7
U19
R8
J3
U20
U21
C9
U22
R9
U23
R10
U24
R11
U25
R12
J4
U26
U27
C10
C11
U28
R13
U29
R14
U30
R15
C12
U31
R16
R17
R18
R19
R20
R21
R22
R23
R24

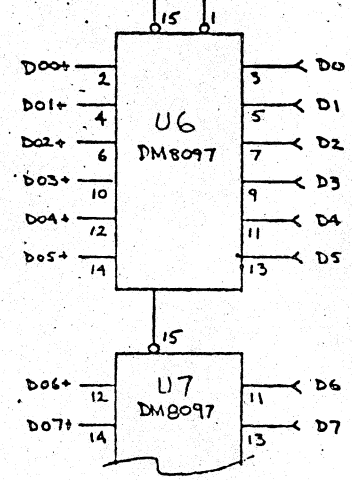
CHANGE NOTES

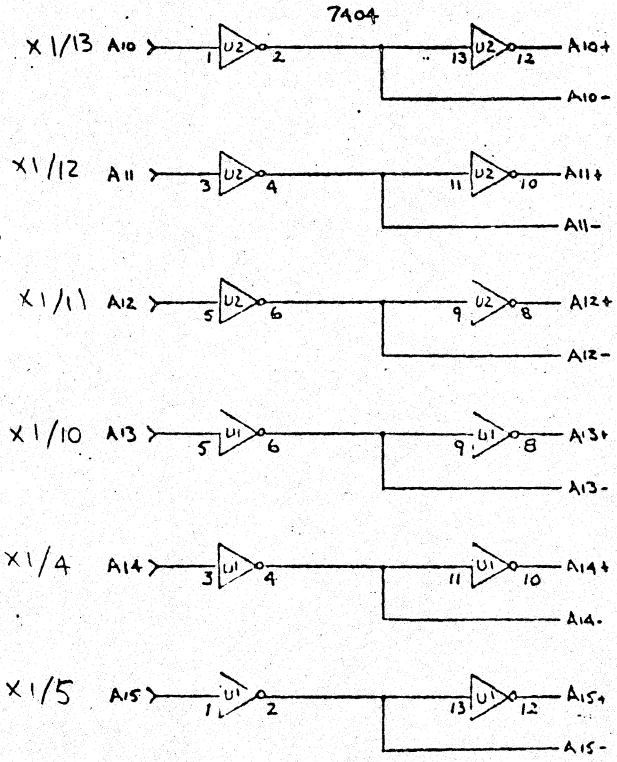
1. C1, C2, C3, C6, C8, C9, C10
   BYPASS +5V - GND
2. C7, C11, C12
   BYPASS - 9V - GND

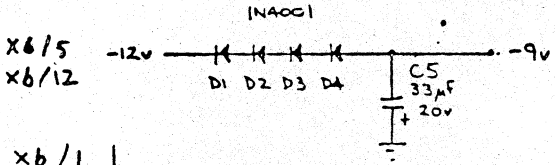


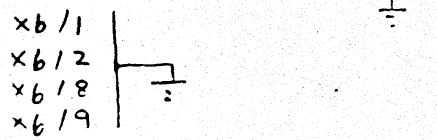


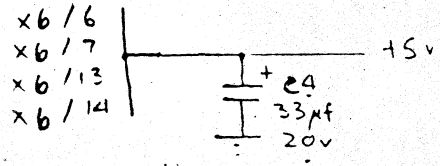












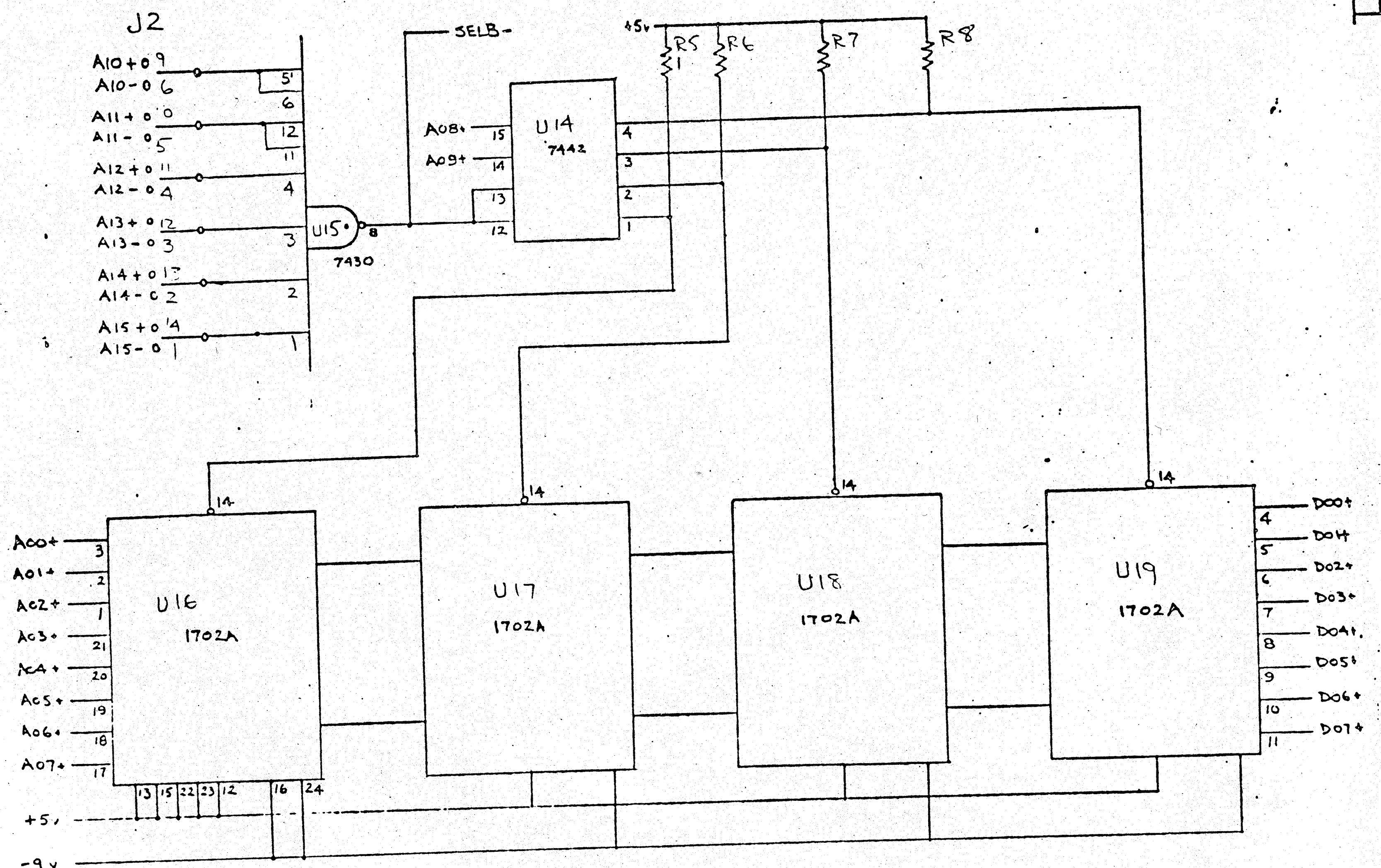
PL2M

RCM/1

SHEET 1 OF 5

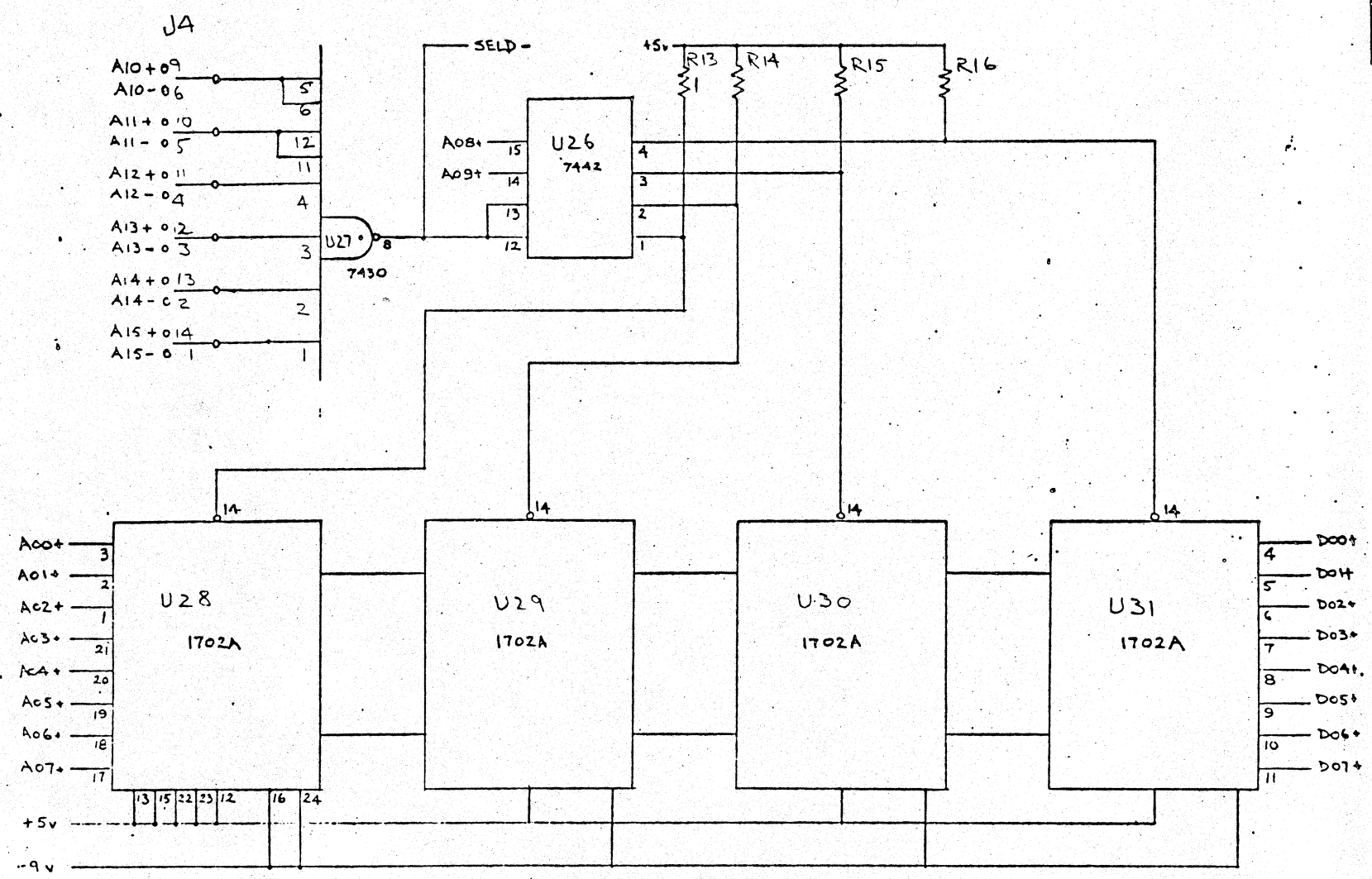
CHANGE NOTES

PROM



SHEET 2 OF 5

CHANGE NOTES

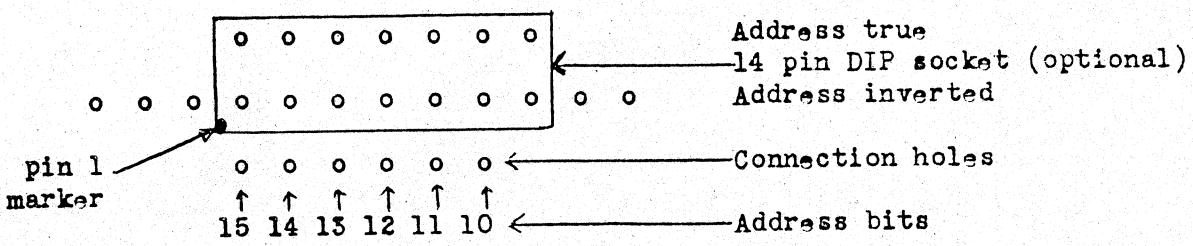


P&M

SHEET 5 OF 5

SPHERE READ ONLY MEMORY BOARD

The SPHERE ROM/1 board is designed to provide up to 4K of read only memory program space using the commonly available 1702 PROM. The addressing on the board is fully selectable on 1K boundaries by the user. All four banks must be either address strapped or grounded - no banks' address select logic may be left open. If the addressing on your board will change frequently a 14 pin DIP socket may be installed at J1-J4 and 2 inch wire-wrap type wires in the adjoining connecting holes. These wires may then be pushed into the correct hole of J1-J4



To select an address, jumper each connection hole to the appropriate address selection hole. To make a 'don't care' bit (either on or off will do) leave the jumper wire from the connection hole open (no connection). It is for this reason that unused banks must be strapped down.

To select 1000 as the starting address of bank 1 (U13 1000, U12 1100, U11 1200, U10 1300) connect
- 15 to address inverted, pin 1 of J1
- 14 to address inverted, pin 2 of J1
- 13 to address inverted, pin 3 of J1
- 12 to address true, pin 11 of J1
- 11 to address inverted, pin 5 of J1
- 10 to address inverted, pin 6 of J1

To select DC00 as the starting address of bank 3 (U25 DC00, U24 DD00, U23 DE00, U22 DF00) connect
- 15 to address true, pin 14 of J3
- 14 to address true, pin 13 of J3
- 13 to address inverted, pin 3 of J3
- 12 to address true, pin 11 of J3
- 11 to address true, pin 10 of J3
- 10 to address true, pin 9 of J3

To strap a bank of ROM off, connect any (at least one) connection hole to a ground, available feed-throughs near pin 7 of U9, U15, and U21.

In selecting addresses, remember that below 1000 is dedicated to RAM and above E000 are I/O devices and system ROM's.

Good programming to you all.

Ernest Dixon

Ernie Dixon
SPHERE Corporation

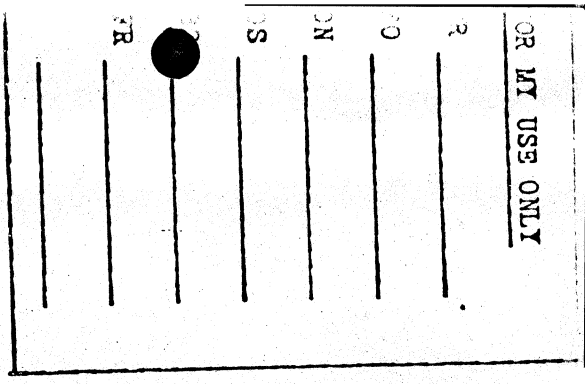
PROM

PARTS FOR RCM/1 EHD (PCB ASSY)

	QTY	TYPE	DESCRIPTION	LOC
1	2	7404	IC HEX INVERTER	U1, U2
2	2	7408	IC QUAD 2-INP AND	U3, U4
3	1	7420	IC DUAL 4-INP NAND	U5
4	4	7430	IC 8-INP NAND	U9, U15, U21, U27
5	4	7442	IC 4-10 DECODER	U8, U14, U20, U26
6	2	DM8097	IC HEX BUS DRIVER	U6, U7
7	16	1702A	IC 256X8 PROM	U(10-13), U(16-19), U(22-25), U(28-31)
8	4	IN4001	50v RECTIFIER DIODE	D1, D2, D3, D4
9	2	33µF/20v	CAPACITOR, ELECTROLYTIC	C4, C5
10	10	0.1µf/50v	CAPACITOR, CERAMIC	C1, C2, C3, C(6-12)
11	24	4.7K, ¼W, 10%	RESISTOR, CARBON COMP	R(1-24)
12	4, 4	14-pin sockets (DIP)		X1, X2, X3, X6, (J1, J2, J3, J4)
13	1	RCM/1 EHD	PCB	
14	16	24-pin DIP sockets		U(10-13), U(16-19), U(22-25), U(28-31)

UNDERLINED ITEMS NOT SUPPLIED

PROM



For my bookkeeping please:

One board per order form (copy it if necessary)

One check per order

No charges or COD orders- cash with order!

Please send me ONE (1) ROM/1 board wired to the following addresses:

BANK	STARTING ADDRESS Binary	Hex
A	_ _ _ _ _ _ 0 0 0 0 0 0 0 0 0 0	_ _ 0 0
B	_ _ _ _ _ _ 0 0 0 0 0 0 0 0 0 0	_ _ 0 0
C	_ _ _ _ _ _ 0 0 0 0 0 0 0 0 0 0	_ _ 0 0
D	_ _ _ _ _ _ 0 0 0 0 0 0 0 0 0 0	_ _ 0 0

Please remember that addresses below 1000_x and above $E000_x$ are assigned to memory and I/O devices and that SPHERE Corporation reserves the right to modify at any time or add to the addresses of the I/O devices.

Initial orders will be shipped within 10 days. Unshipped orders may be canceled after 45 days. Allow an extra 30 days for non-guaranteed checks to clear.

CORRESPONDENCE ADDRESS: _____

_____

_____

ATTN: _____ ZIP _____

SHIPPING ADDRESS: _____

_____

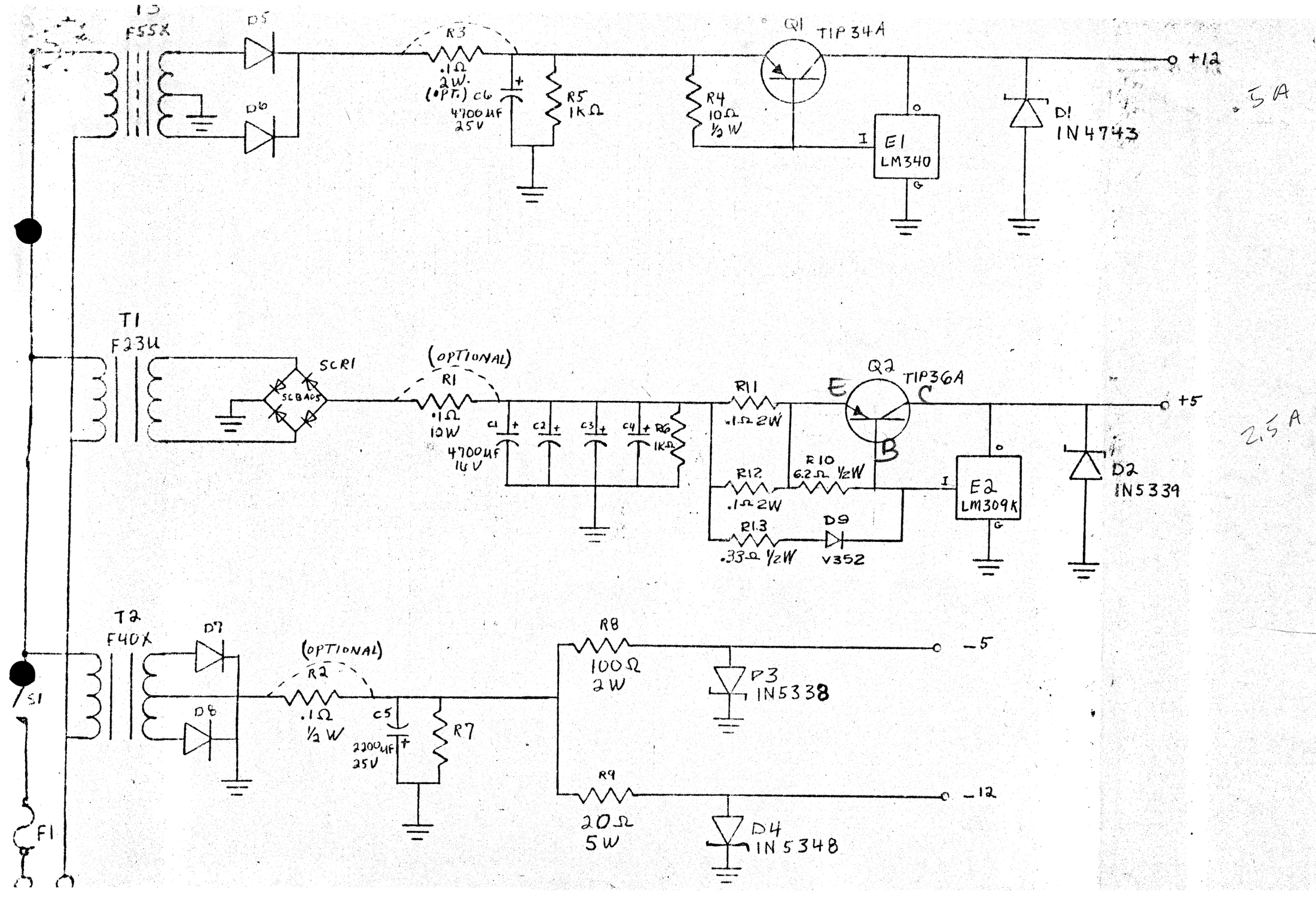
_____

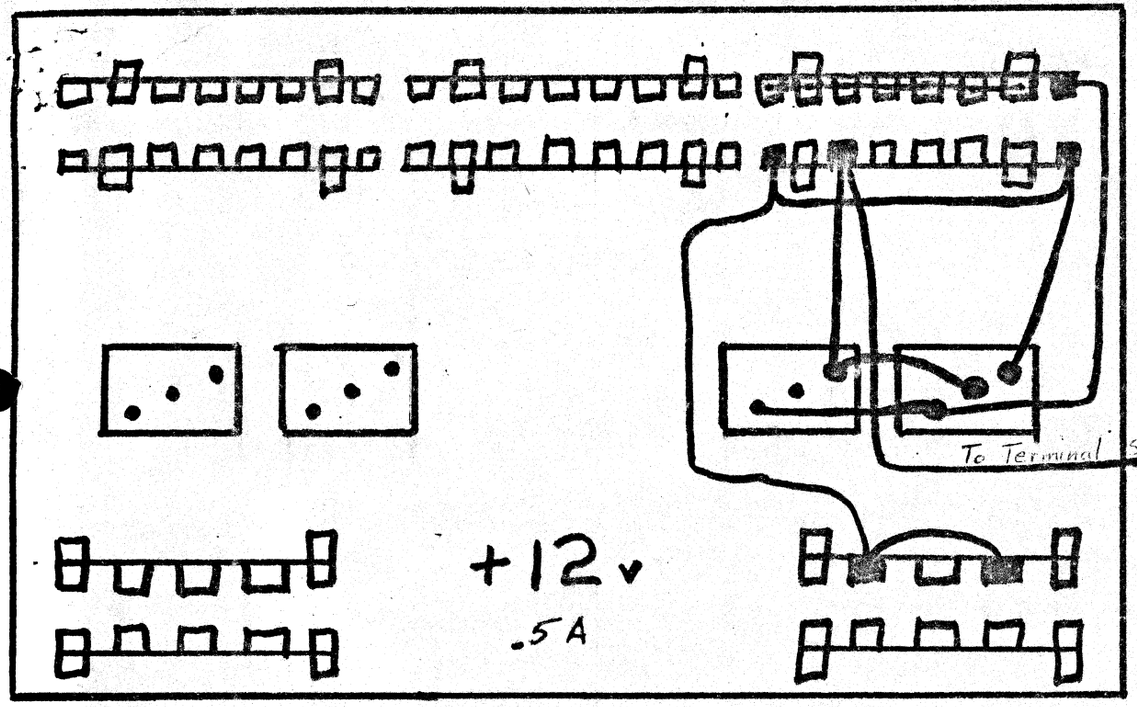
ATTN: _____ ZIP _____

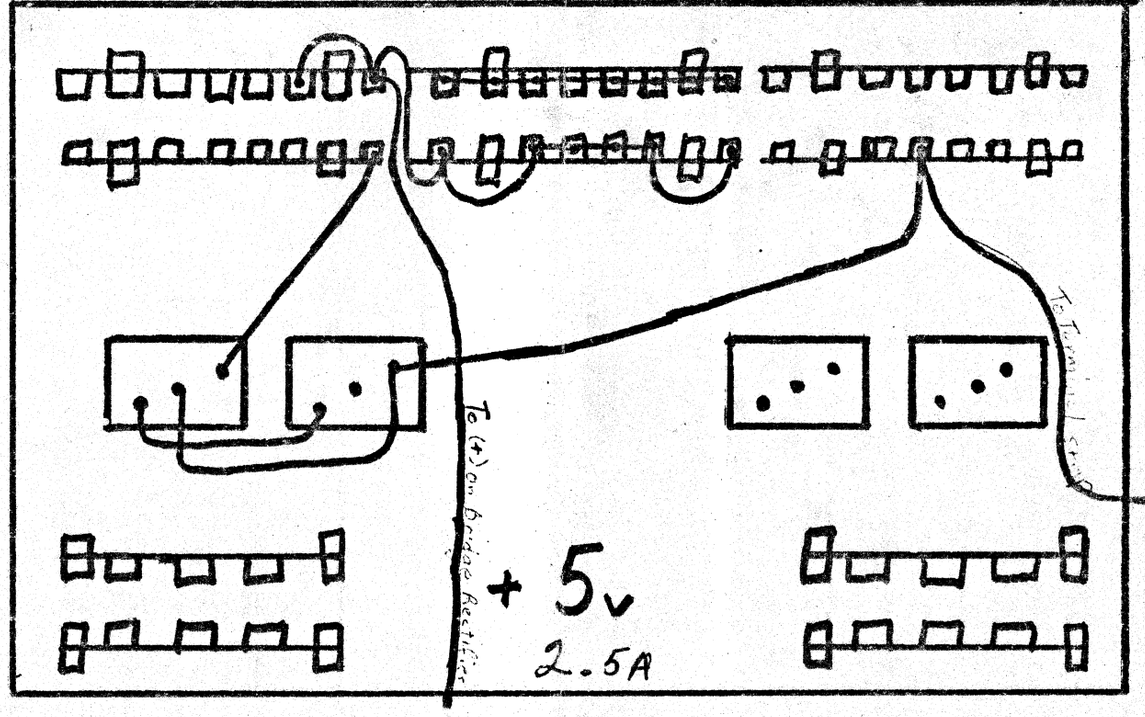
Send this form and $156.00 (plus 6% California sales tax if applicable) to:

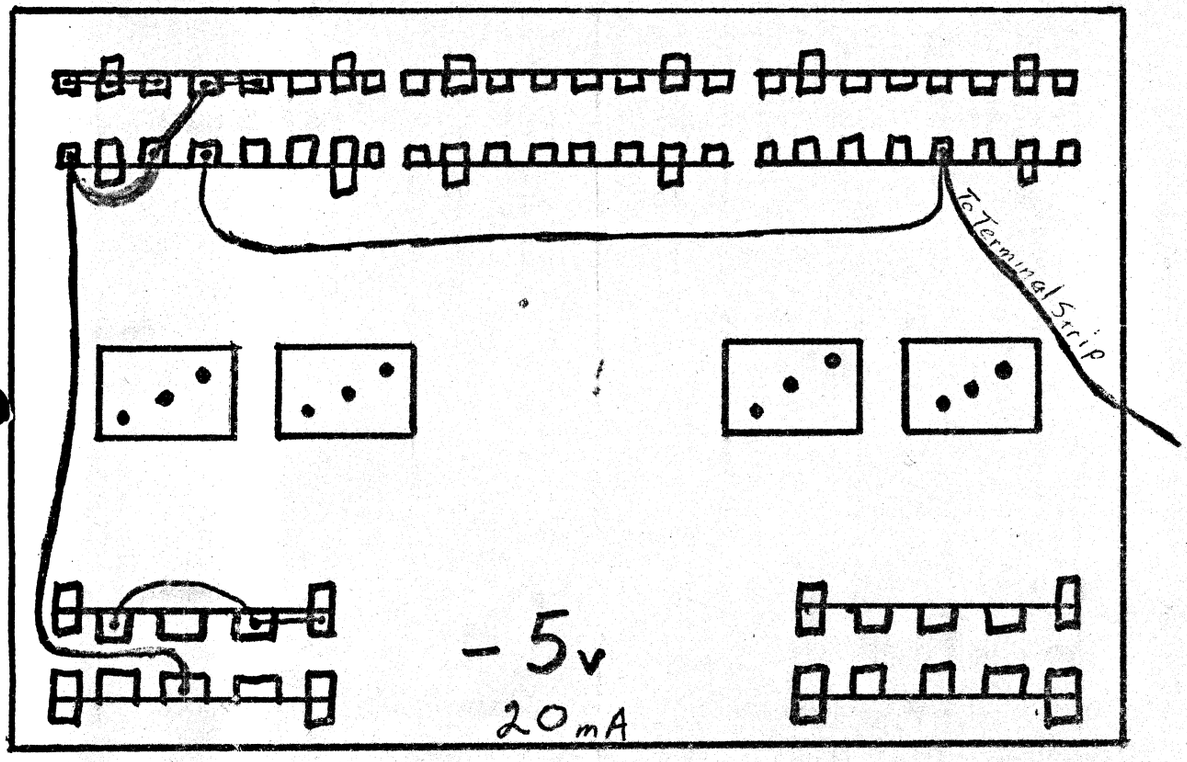
Ernest Dixon
P. O. Box 3102
Culver City, Ca. 90230

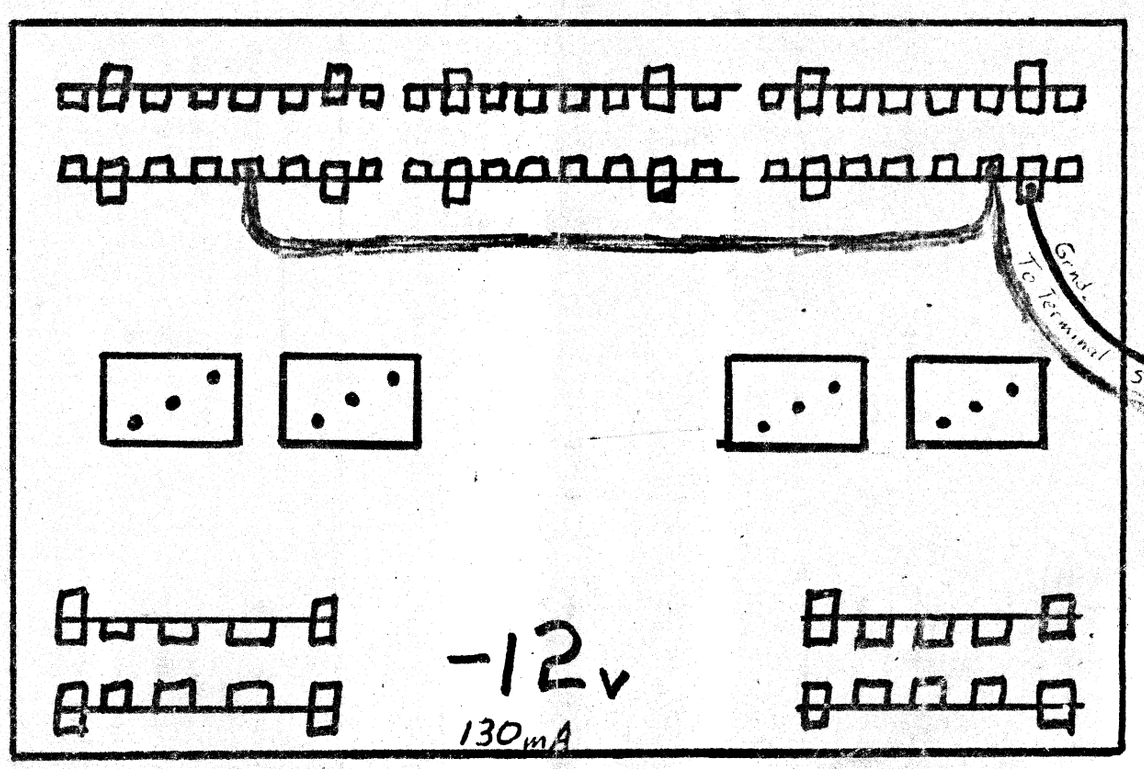
PROM

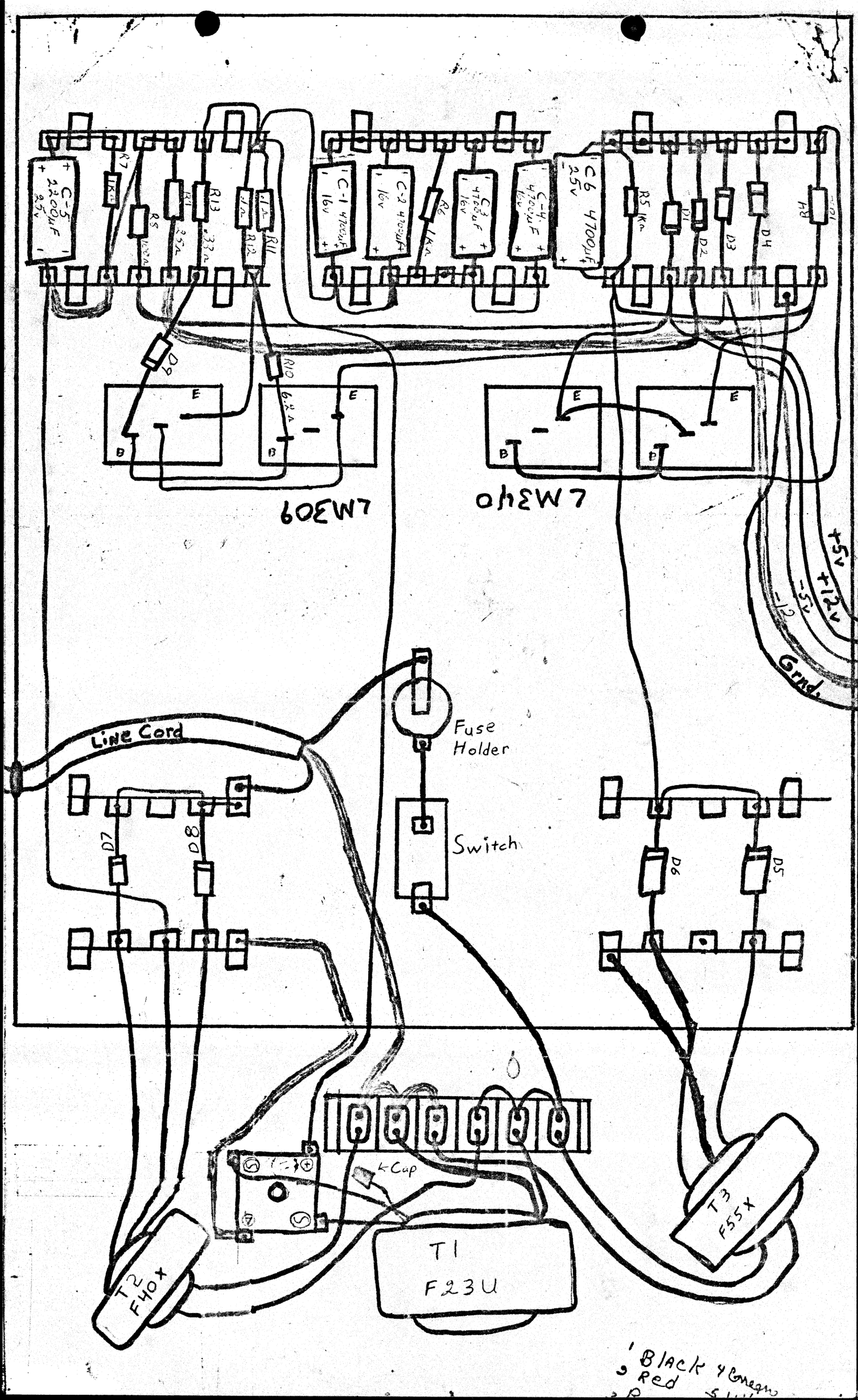

T3
F55X
D5
D6
R3
.1Ω
2W.
(PT.) C6
4700μF
25V
R5
1KΩ
R4
10Ω
½W
Q1
TIP34A
E1
LM340
+12
.5A
D1
IN4743
T1
F23U
SCR1
SCB40S
(OPTIONAL)
R1
.1Ω
10W
C1
C2
C3
C4
R6
1KΩ
4700μF
16V
R11
.1Ω 2W
Q2
TIP36A
E
C
B
+5
2.5A
R12
.1Ω 2W
R10
6.2Ω ½W
R13
.33Ω ½W
D9
V352
E2
LM309K
D2
IN5339
T2
F40X
D7
D8
(OPTIONAL)
R2
.1Ω
½W
C5
2200μF
25V
R7
R8
100Ω
2W
D3
IN5338
-5
R9
20Ω
5W
D4
IN5348
-12
S1
F1


To Terminal Strip
+12 v
.5A


To (+) on Bridge Rectifier
+ 5v
2.5A


To Terminal Strip
- 5v
20mA

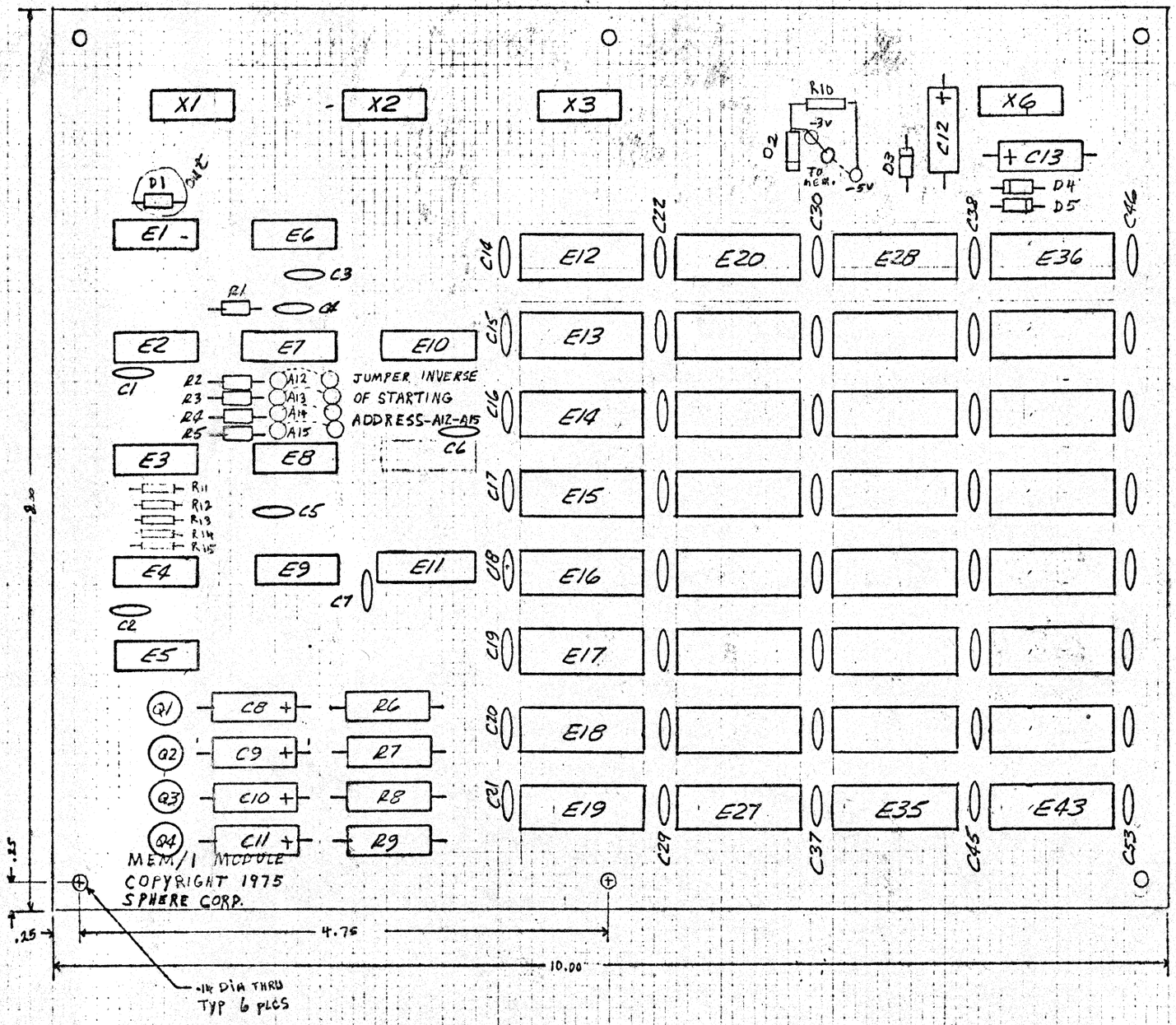

-12v
130mA


C-5 2200uF 25v
R7 16Ω
R1 3.5Ω
R13 .33Ω
R12
R11
C-1 16v 4700uF
C-2 4700uF 16v
R6 1KΩ
C-3 4700uF 16v
C-4 4700uF 16v
C6 4700uF 25v
R5 1KΩ
D1
D2
D3
D4
R8
D9
R12 6.2Ω
E
B
6EW7
6EW7
+5v
+12v
-5v
-12
Grnd.
Line Cord
Fuse Holder
Switch
D7
D8
D6
D5
Cap
T1 F23U
T2 F40X
T3 F55X
BLACK & Green
Red

BY _____ DATE _____
CHKD. BY _____ DATE _____

SUBJECT MEM/1

SHEET NO. 3 OF 3
JOB NO. MEM/1 MODULE



ITEM	QTY	PART NO.	DESCRIPTION	DESIGNATION
1	1	MEM/1	P.C. BOARD - 8X10X.062	MEM/1
2	1	SN74123	ONE SHOT	E7
3	1	SN7400	NAND GATES	E6
4	1	SN7402	NOR GATES	E3,
5	1	SN7404	INVERTER	E1
6	1	SN7408	AND GATE	E5
7			SPARE	E2, E4
8	1	SN7483	FULL ADDER	E8
9	2	DM8098	BUFFER	E10, E11
10	1	SN74156	2 LINE TO 4 LINE DECODER	E9
11	32	ZA-0243	4KX1 DYNAMIC RAM	E12-E43
12				
13	4	2N2369A	TRANSISTOR	Q1-Q4
14	3	IN4001	DIODE	D3-D5
15	1	IN914	DIODE	D1
16	1	IN5225B	3.0V ZENER	D2
17	4		RESISTOR, 100Ω 2W	R6-R9
18	9		" 3.3K ¼W	R2-R5 (A12-A15)
19	1		" 33K ¼W	R1
20	1		" 133Ω ¼W	R10
21	1		CAPACITOR CERAMIC 33Pf	C4
22	46		" CERAMIC .1uf	C1,2,3,5,6,7,14-C52
23	1		" 100Mf-10VDC	C12
24	5		" 47uf 16V	C8-C11, C13
25	4	314-AG39D	14 PIN SOCKET	X1-X3, X6

SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

Tracing Vellum

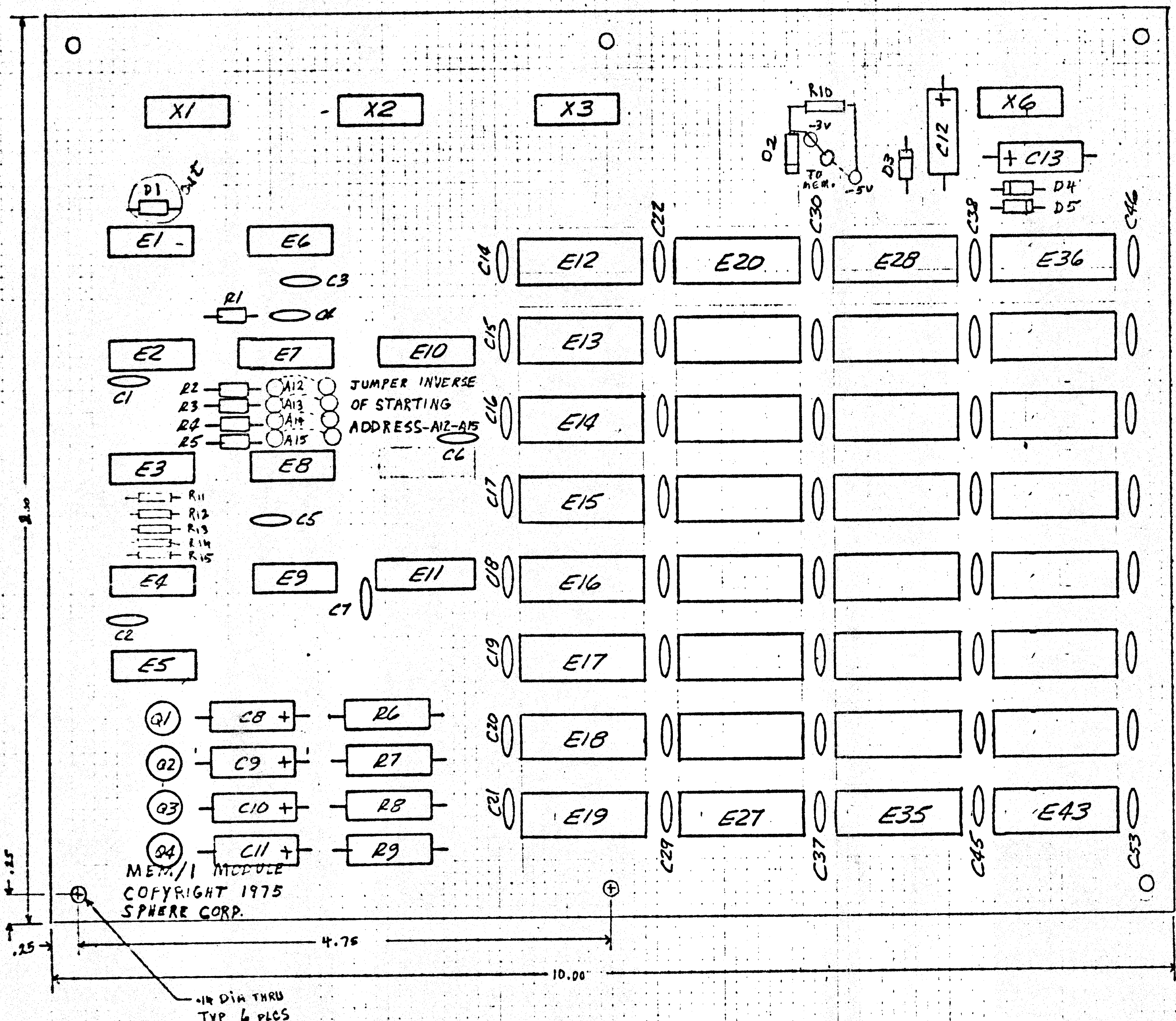
PROPRIETARY MATERIAL

BY ______ DATE ______
CHKD. BY ______ DATE ______

SUBJECT MEM/1

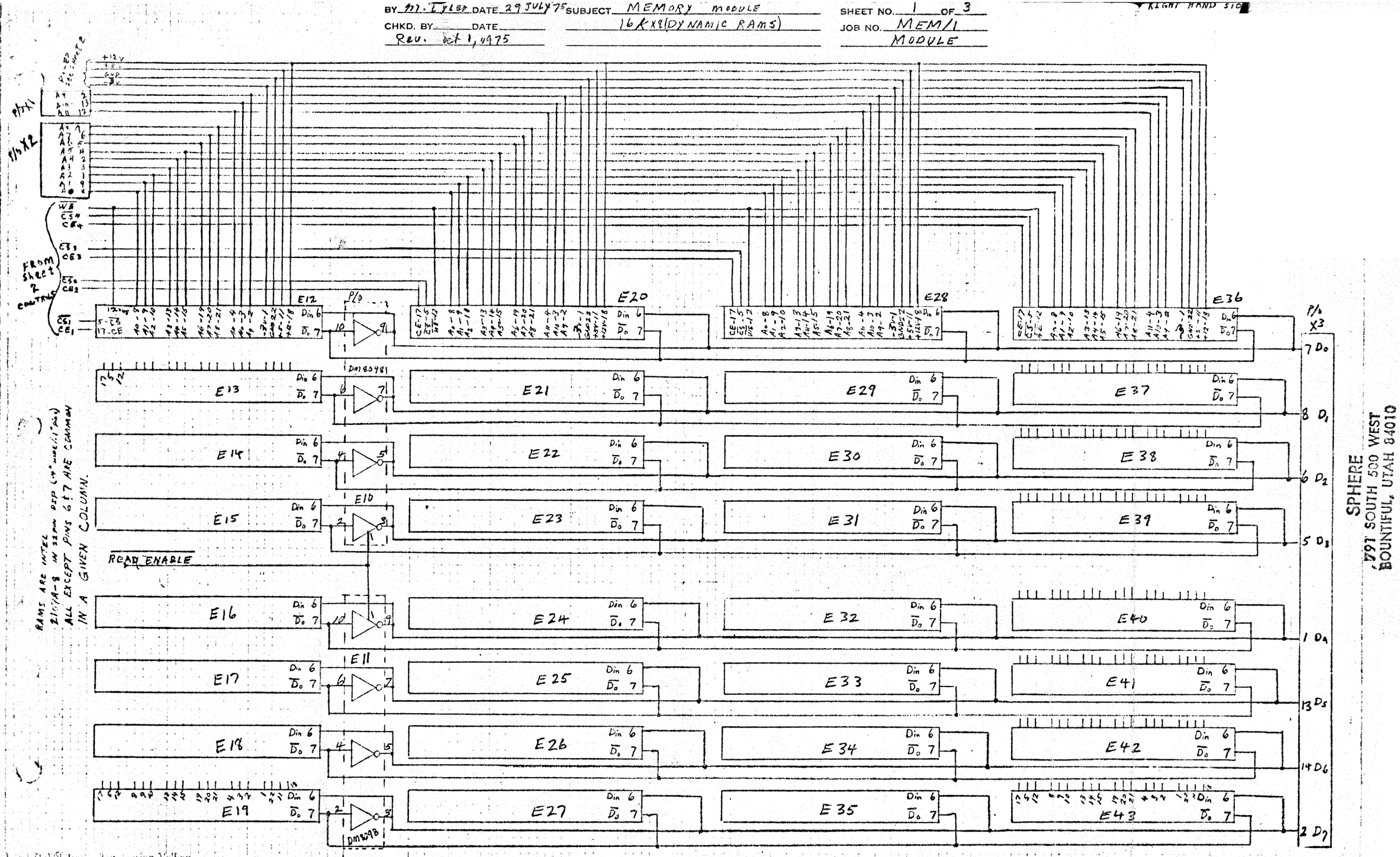
JOB NO. MEM/1 MODULE

ITEM	QTY	PART NO.	DESCRIPTION	DESIGNATION
1	1	MEM/1	P.C. BOARD - 5X10X1/16	MEM/1
2	1	SN74123	ONE SHOT	E7
3	1	SN7400	NAND GATES	E6
4	1	SN7402	NOR GATES	E3
5	1	SN7404	INVERTER	E1
6	1	SN7408	AND GATE	E5
7			SPARE	E2, E4
8	1	SN7483	FULL ADDER	E8
9	2	DM8098	BUFFER	E10, E11
10	1	SN74156	2 LINE TO 4 LINE DEMUX	E9
11	32	ZA-0248	4KX1 DYNAMIC RAM	E12-E43
12				
13	4	2N2369A	TRANSISTOR	Q1-Q4
14	3	1N4001	DIODE	D3-D5
15	1	1N914	DIODE	D1
16	1	1N5225B	3.0V ZENER	D2
17	4		RESISTOR 100Ω 2W	R6-R9
18	9		" 3.3K ¼W	R1-R5 [illegible]
19	1		" 33K ¼W	R1
20	1		" 120Ω ¼W	R10
21	1		CAPACITOR CERAMIC 33PF	C4
22	46		" CERAMIC .1uf	[illegible]
23	1		" 100uf-10VDC	C12
24	5		" 47uf 16V	C8-C11, C13
25	4	314-AG39D	14 PIN SOCKET	X1-X3, X6



SPHERE
791 SOUTH 500 WEST

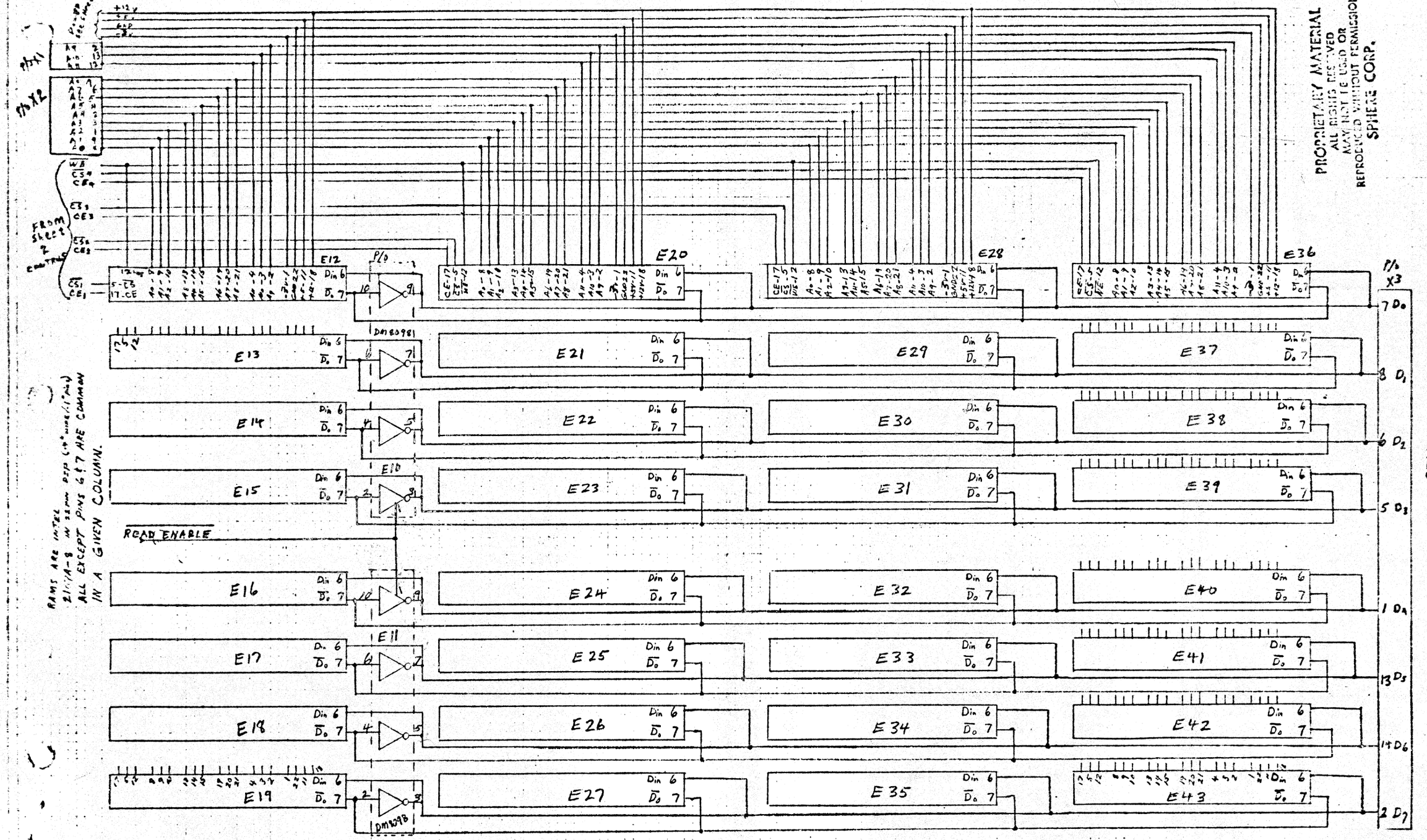
BY M.J. TYLER DATE 29 JULY 75 SUBJECT MEMORY MODULE
CHKD. BY DATE
Rev. Oct 1, 1975
16K X 8 (DYNAMIC RAMS)
SHEET NO. 1 OF 3
JOB NO. MEM/1
MODULE



SPHERE
,791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

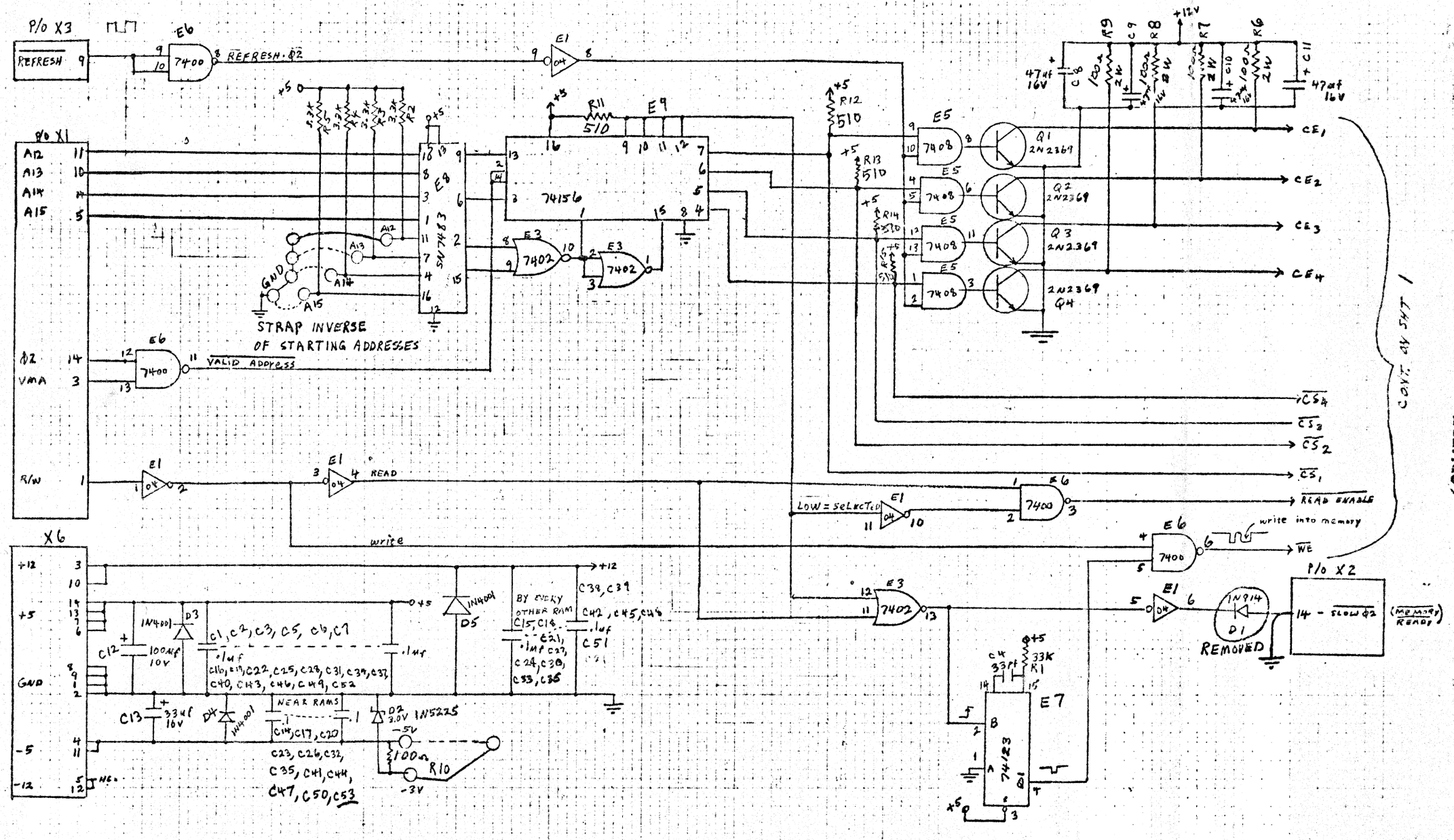
BY W. Tyler DATE 29 JULY '75 SUBJECT MEMORY MODULE
CHKD. BY DATE
Rev. oct 1, 1975
16K X 9 (DYNAMIC RAMS)
SHEET NO. 1 OF 3
JOB NO. MEM/1
MODULE

RIGHT HAND SIDE OF P.C. BOARD.



SPHERE
791 SOUTH 500 WEST

BY m.c.t. DATE 29 JULY '75 SUBJECT 16K X 8 DYNAMIC MEMORY SHEET NO. 2 OF 3
CHKD. BY DATE JOB NO. MEM/1
Rev. Oct. 1, 1975 MODULE

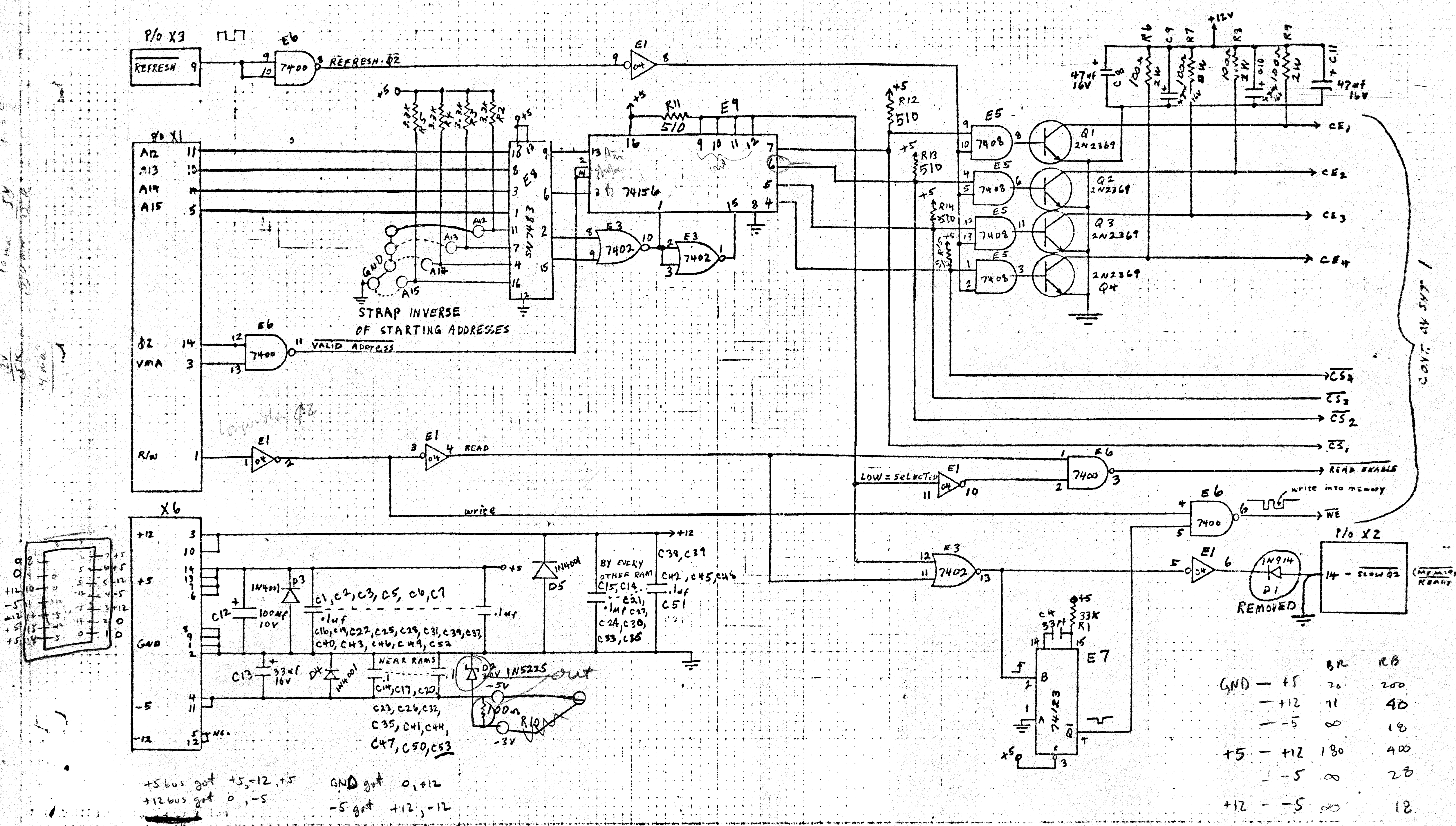


BY m.c.t. DATE 29 JULY '75 SUBJECT 16K X 8 DYNAMIC MEMORY SHEET NO. 2 OF 3

CHKD. BY ____ DATE ____ JOB NO. MEM/1

Rev. Oct. 1, 1975 MODULE

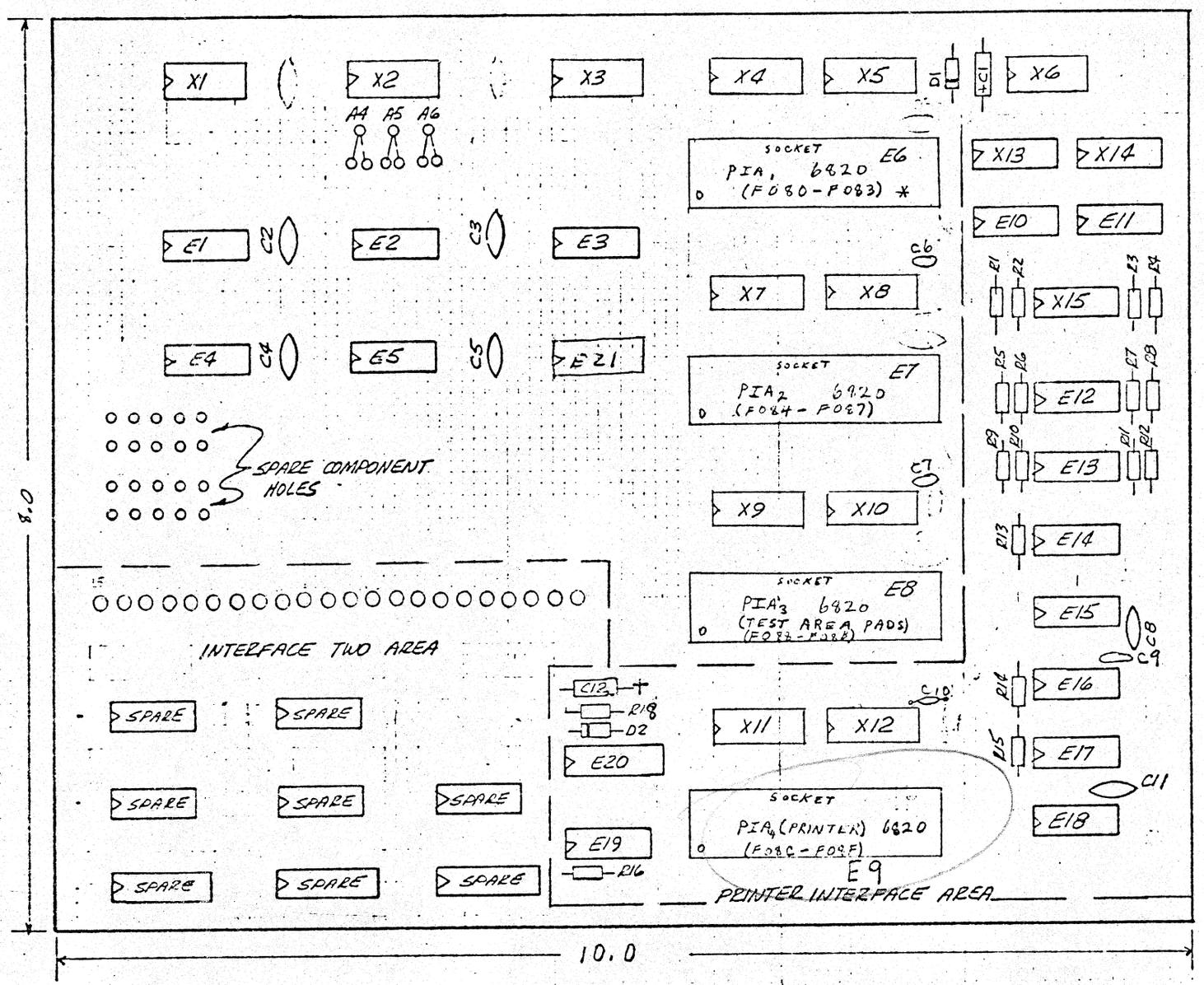
1110



SPHERE
791 SOUTH 500 WEST
BOUNTIFUL, UTAH 84010

BY _____ DATE _____ SUBJECT PIM/1 SHEET NO. 3 OF 3

CHKD. BY _____ DATE _____ Layout And Parts List JOB NO. _____



1	1	PIM/1	P. C. Board	PIM/1
2	4	MC6820	PIA	E6-E9
3	2	SN7400	NAND Gate	E5, 15
4	2	SN7402	NOR Gate	E4, 14
5	4	SN7404	Inverter	E2,12,16,1
6	1	SN7408	AND Gate	E17
7	2	SN7417	Hex Buffer	E10,11, 21
8	1	SN7420	NAND Gate	E1
9	2	SN7474	F/F	E13,18
10	1	SN74123	One Shot	E20
11	1	SN74155	2 line to 4 line Demux	E3
12				
13	15	314-AG39D	14 Pin Socket	X1-X15
14	4	340-AG39D	40 Pin Socket	E6-E9 sockets
15	2	IN914	Diode	D1, D2
16	6		Resistor, 330 ohm, 1/4 w	R1,3,5,7,9, 11
17	6		Resistor, 220 ohm, 1/4 w	R2,4,6,8, 10, 12
18	4		Resistor 33K 1/4 w	R13-16
19	1		Resistor 39K 1/4 w	R18
20	1		Capacitor 100 luf.	C1
21	10		Capacitor .1 luf.	C2-C11
22	1		Capacitor 47 luf.	C12

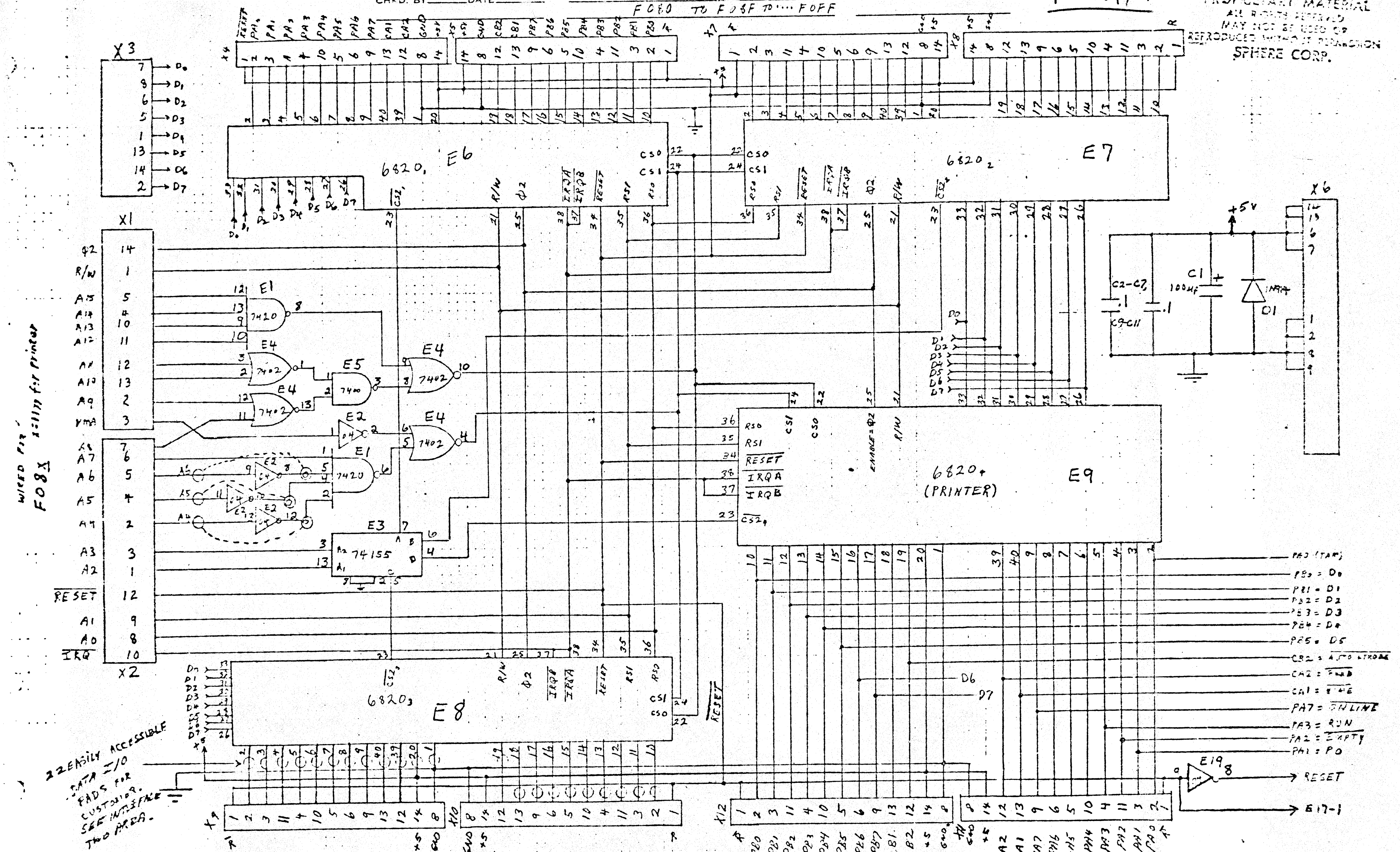
No R17

* ADDRESS GIVEN AS WIRED! JUMPERS ON A4, A5, AND A6 WILL ALLOW SELECTION OF 7 ADDITIONAL PIM/1 CARDS WITH ADDRESSES F09X, F0AX, F0BX, ... F0FX.

SPHERE

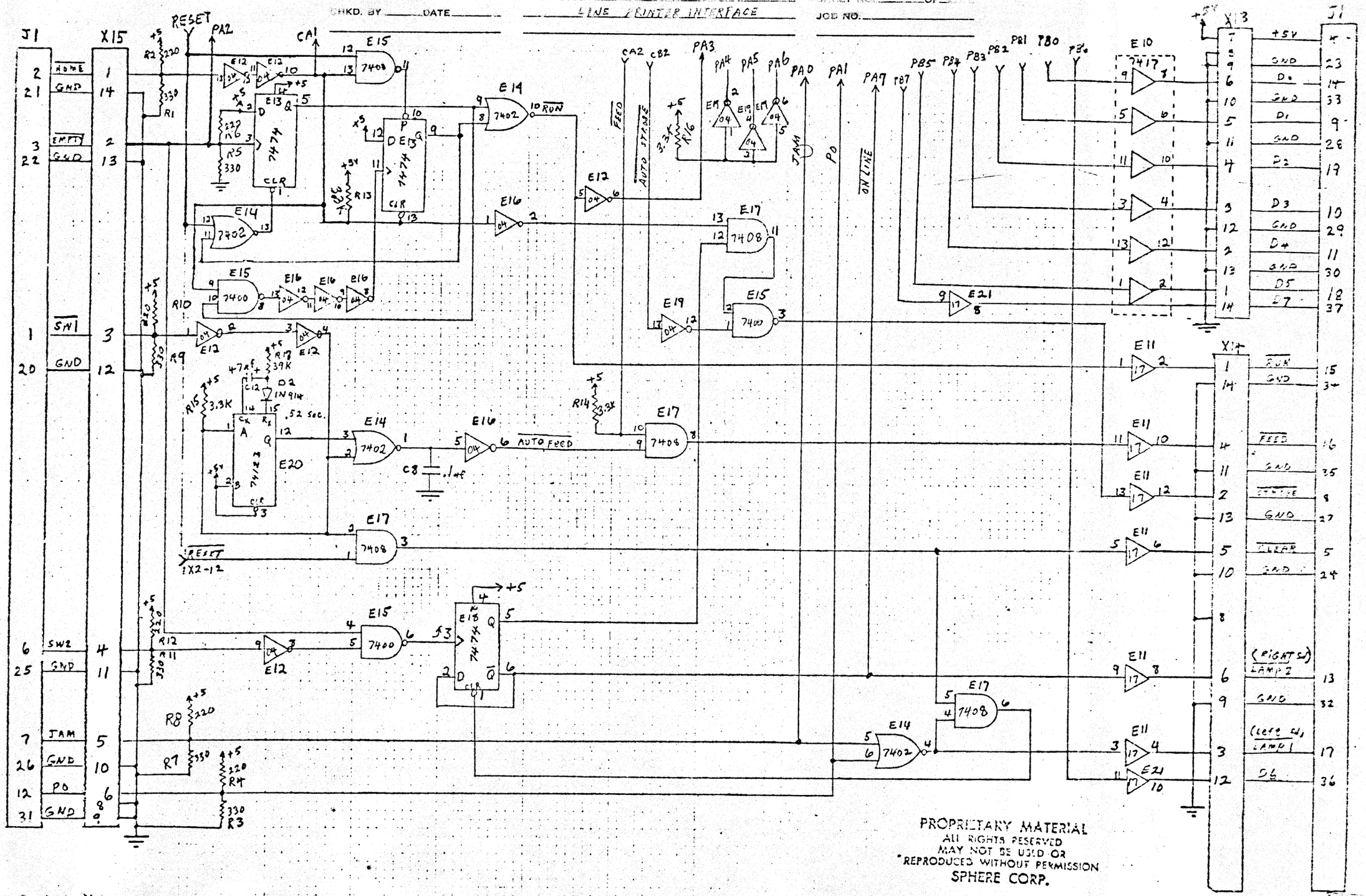
CHKD. BY ______ DATE ______ JOB NO. ______

PIM/I

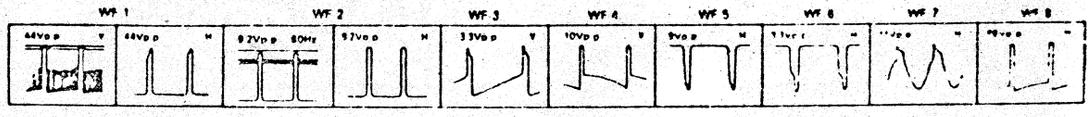


BY _____ DATE _____ SUBJECT LINE PRINTER INTERFACE SHEET NO. ___ OF ___

CHKD. BY _____ DATE _____ JOB NO. _____



SPHERE



VIDEO AMP.
Q913~Q915 2SC536×3

PICTURE TUBE
V101 240DEB4
or 240DEB4A

VIDEO OUTPUT
Q101 2SC65Y

VIDEO

CONTRAST

SYNC. SEP.
Q102 2SA201

VERT. OSC.
Q103 2SC536

VERT. DRIVE
Q104 2SC536

VERT. OUTPUT
Q105 2SC1024
or 2SD315
or 2SD321

V-HOLD

HEIGHT

V-LIN

VERT. OUTPUT
Q105 2S9474

H.V. RECT.

SEESAW SWITCH
SW1

POWER RECT.
D112 PH9d 522/1

POWER TRANS.

PHASE DET.
D104, D105 1S188×2

HORIZ. DRIVE TRANS.

DAMPER
D106 DG-13
or DG-130

H-FREQ

H-ADJ.

REGULATOR
Q111 2SA608

REGULATOR
Q113 2SB407

REGULATOR
Q112 2SD30

PHASE INVERTER
Q107 2SC536

H-HOLD

HORIZ. OSC.
Q108 2SC536

HORIZ. DRIVE
Q109 2SB187S

HORIZ. OUTPUT
Q110 2SB378A

NOTES
1. All resistance values in ohms
2. Unless otherwise noted all capacitors are ceramic or paper capacitors less than 1 and expressed in mfd and less than 1 are in pF
3. Voltage reading taken with VTVM from point indicated to chassis ground. Taken with standard channel, contrast at maximum, other controls at normal. Line voltage 120 volts
4. All waveforms measured with, picture signal input, contrast set to give normal picture and AGC line open (no reading)
5. Voltage reading may vary 20%
6. This is a fundamental circuit diagram. Some production alterations may be made without revision of this diagram.