SECTION 7.
SCOPE AMPLIFIER BOARD (A2)

7.1 DESCRIPTION

The Scope Amplifier board contains the horizontal and vertical deflection amplifiers, the horizontal timebase generator, control circuitry for focus and intensity, and miscellaneous CRT bias adjustments.

The Scope Amplifier operates in an auto or normal mode. When a triggerable vertical signal is present, a sweep is developed in both auto and normal modes. When a triggerable signal is not present, the sweep is blanked in the normal mode and free-running in the auto mode. An external horizontal input is available at the front panel.

A block diagram of the Scope Amplifier board is shown in Figure 7-1, a schematic in Figure 7-2, and the printed wiring board assembly and parts list in Figure 7-3.

7.2 THEORY OF OPERATION

7.2.1 DEFLECTION AMPLIFIERS

The vertical and horizontal deflection amplifiers are identical. The input signal is initially amplified and split into two signals, 180 degrees out of phase. Each of these signals is then further amplified to become a CRT deflection-plate signal. The amplifiers provide 200V peak-to-peak signal capability with a frequency bandwidth of 1 MHz.

7.2.2 HORIZONTAL TIMEBASE GENERATOR

7.2.2.1 General

The horizontal timebase generator provides calibrated sweep rates over a six-decade range from 1 µsec to 100 msec per division. Sweep-rate selection originates from the processor via the signal lines for the SCOPE SWEEP CONTROL 0-3. Vernier control over the sweep rate is generated by the sweep-vernier voltage input from the front panel.

7.2.2.2 Ramp Generator

The ramp signal is developed using an integrator (U3) with a constant voltage. The sweep rate is determined by R5, R6, R7 and C3, C4, and C5. The combination of the RC network produces the six sweep rates.

7.2.2.3 Blanking and Trigger Hold-Off Circuitry

When the ramp voltage reaches +2.7V, the output of U11B produces a blanking pulse which is used to short-circuit the ramp integrator and trigger the hold-off integrator (U5). The hold-off rate is determined by R19, C14, and C15. The combination of the RC network produces two hold-off times, one for msec and one for µsec. When the hold-off ramp reaches +2.7V, the output of U11A short-circuits the hold-off integrator, and the sweep generator awaits a sweep trigger.

Sweep trigger is either in auto or normal mode as selected by the AUTO/NORMAL trigger-select via the front panel. In the normal mode, U11B is always disabled, thus keeping the blanking signal high and preventing the ramp from starting until a trigger pulse is present. In the auto mode, if the SYNC PRESENT input is high, indicating no sync, the scope sweep is self-triggered. If there is a sync, the sweep will wait for a pulse on the TRIG PULSE line to start the sweep.

NOTE

The entry of a scope trigger delay will prevent operation of scope triggering as long as the unit is set on "MODULATION, Tone Seq."

7.2.3 HORIZONTAL SWITCHING

The input to the horizontal deflection amplifier is selected between two sources. The first source is the INT HORIZ IN signal line, which provides the horizontal character sweep and the horizontal spectrum-analyzer sweep. The other source is the scope-mode signal path from the horizontal positioning-summing amplifier. The scope-mode signal is the output of either the horizontal timebase generator or the EXT HORIZ INPUT from the front panel. The SCOPE MODE EN line from the processor selects either internal horizontal or scope-mode horizontal inputs. The EXT HORIZ EN line selects one of the two scope-mode signals.

7.2.4 Z-AXIS MODULATOR

A crossover network provides CRT Z-AXIS modulation from dc to 1 MHz. A high-pass and low-pass network on the High-Voltage Power Supply board (A1) produces a crossover frequency of 16 Hz. The Z-AXIS modulator circuit is the high-frequency modulation path, 16 Hz to 1 MHz.

The resulting CRT Z-AXIS signal is capacitively coupled on the High-Voltage Power Supply board (A1) to the CRT grid. The low-frequency path, dc to 16 Hz, is through the intensity-control circuit.

7.2.5 INTENSITY CONTROL

The INTENSITY LEVEL signal from the front panel control is gated with the SCOPE Z-AXIS signal by the intensity-level gate (Q6). The gated signal is summed (U25) with the HIGH VOLTAGE REF and INTENSITY SAMPLE VOLTAGE signals, to provide the INTENSITY TRACKING VOLTAGE (TV) signal. The INTENSITY TV is the low-frequency control path which drives the intensity opto-isolator in the High-Voltage Supply.

7.2.6 FOCUS CONTROL

The FOCUS TRACKING VOLTAGE (TV) signal is obtained by comparing the FOCUS LEVEL control line to the FOCUS SAMPLE VOLT signal. The TV signal drives an opto-isolator circuit in the High-Voltage Supply which controls the CRT focus voltage.

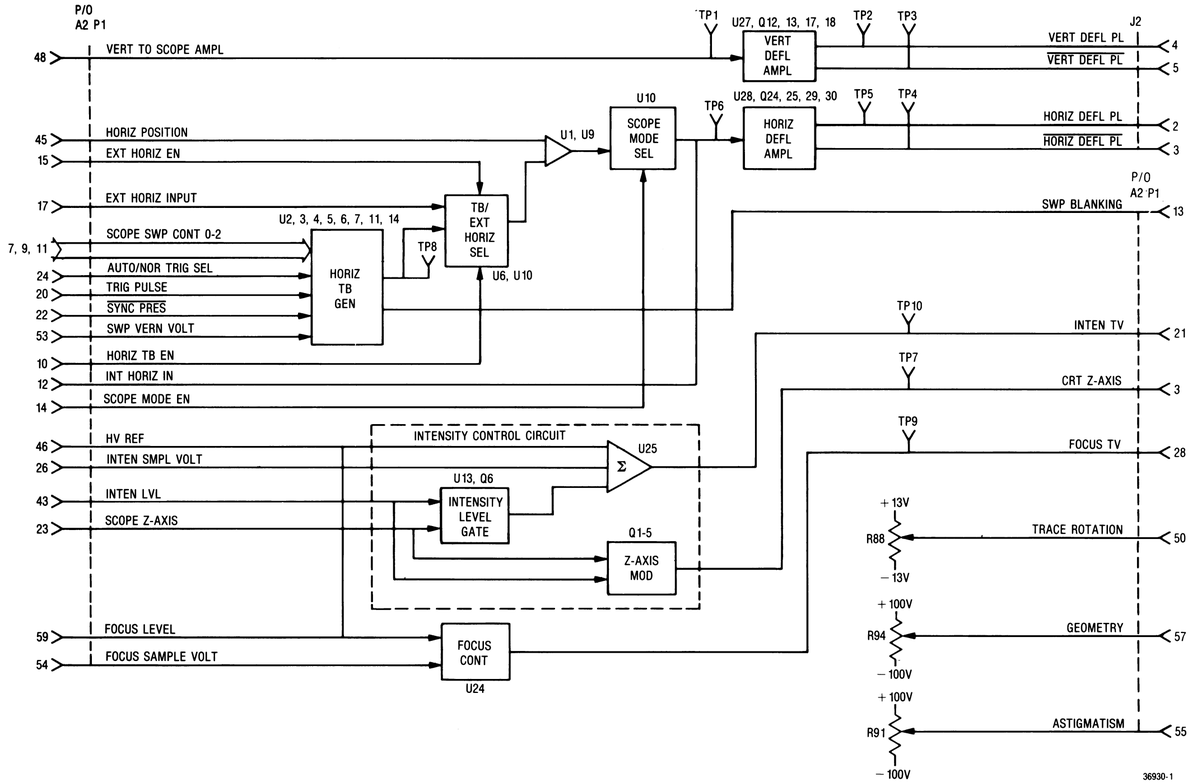
7.2.7 ASTIGMATISM, GEOMETRY, AND TRACE ROTATION

The CRT alignment controls for astigmatism, geometry and trace rotation are obtained from the respective wipers of three potentiometers. Each potentiometer is connected between supply voltages equal to the required adjustment range.

SCOPE AMPLIFIER BOARD (A2)

(RTC-1005A)

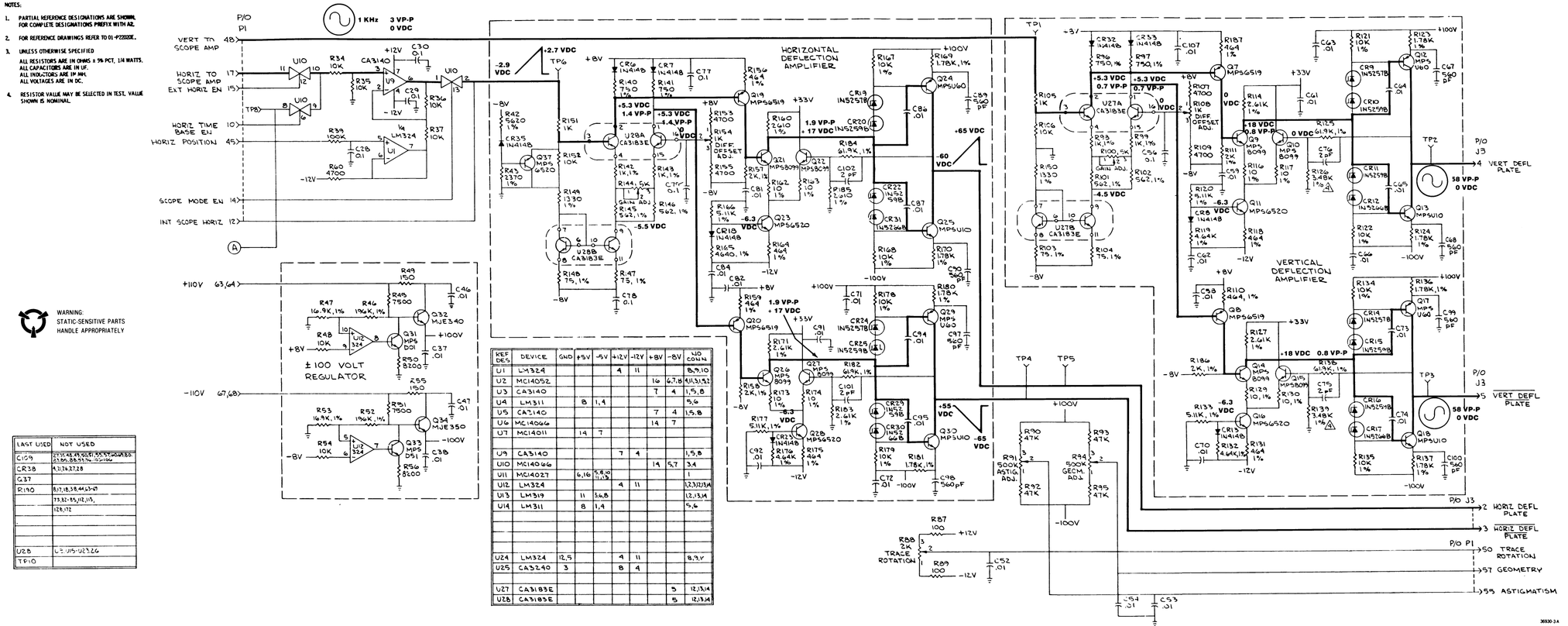
Figure 7-1. Block Diagram



SCOPE AMPLIFIER BOARD (A2)

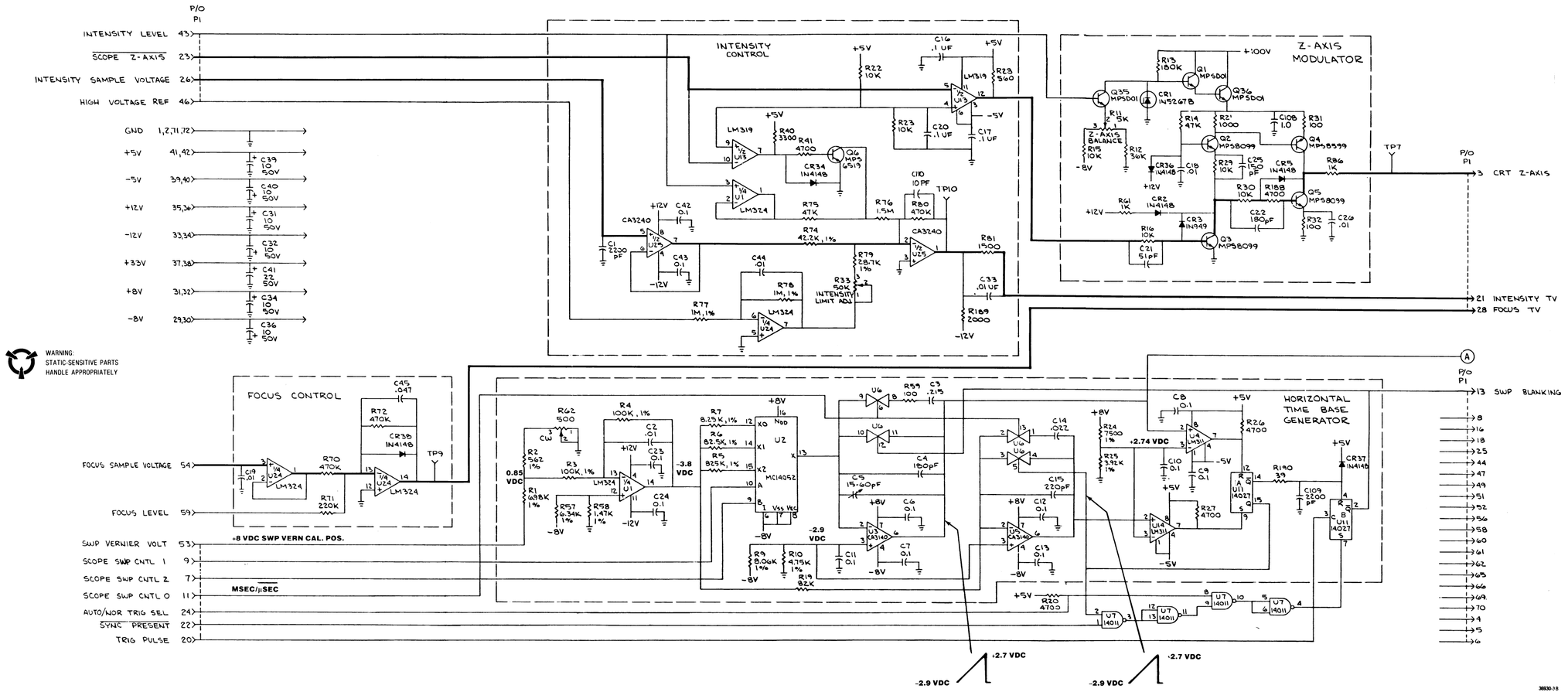
(RTC-1005A)

Figure 7-2a. Schematic (Sheet 1 of 2)



REF DES	DEVICE	GND	+5V	-5V	+12V	-12V	+8V	-8V	I/O CONN
U1	LM324				4	11			8,9,10
U2	MC14052						16	6,7,8	1,11,13,12
U3	CA3140						7	4	1,5,8
U4	LM311		8	1,4					5,6
U5	CA3140						7	4	1,5,8
U6	MC14066						14	7	
U7	MC14011		14	7					
U9	CA3140				7	4			1,5,8
U10	MC14066						14	5,7	3,4
U11	MC14027		6,16	8,8,0 11,13					1
U12	LM324				4	11			12,13,12,13,14
U13	LM319		11	3,6,8					12,13,14
U14	LM311		8	1,4					5,6
U24	LM324	12,5			4	11			8,9,10
U25	CA3240	3			8	4			
U27	CA3183E							5	12,13,14
U28	CA3183E							5	12,13,14

LAST USED	NOT USED
C109	C1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100,101,102,103,104,105,106
CR38	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28
Q37	
R190	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100,101,102,103,104,105,106
	73,82-85,112,113,
	128,172
U28	U1-U13-U23,26
TP10	


P/O P1
INTENSITY LEVEL 43
SCOPE Z-AXIS 23
INTENSITY SAMPLE VOLTAGE 26
HIGH VOLTAGE REF 46
GND 1,2,71,72
+5V 41,42
-5V 39,40
+12V 35,36
-12V 33,34
+33V 37,38
+8V 31,32
-8V 29,30
WARNING: STATIC-SENSITIVE PARTS HANDLE APPROPRIATELY
INTENSITY CONTROL
Z-AXIS MODULATOR
FOCUS CONTROL
HORIZONTAL TIME BASE GENERATOR
FOCUS SAMPLE VOLTAGE 54
FOCUS LEVEL 59
SWP VERNIER VOLT 53
SCOPE SWP CNTL 1 9
SCOPE SWP CNTL 2 7
SCOPE SWP CNTL 0 11
AUTO/NOR TRIG SEL 24
SYNC PRESENT 22
TRIG PULSE 20
+8 VDC SWP VERN CAL. POS.
MSEC/μSEC
0.85 VDC
-3.8 VDC
-2.9 VDC
+2.74 VDC
+2.7 VDC
-2.9 VDC
+2.7 VDC
-2.9 VDC
P/O P1
3 CRT Z-AXIS
21 INTENSITY TV
28 FOCUS TV
13 SWP BLANKING
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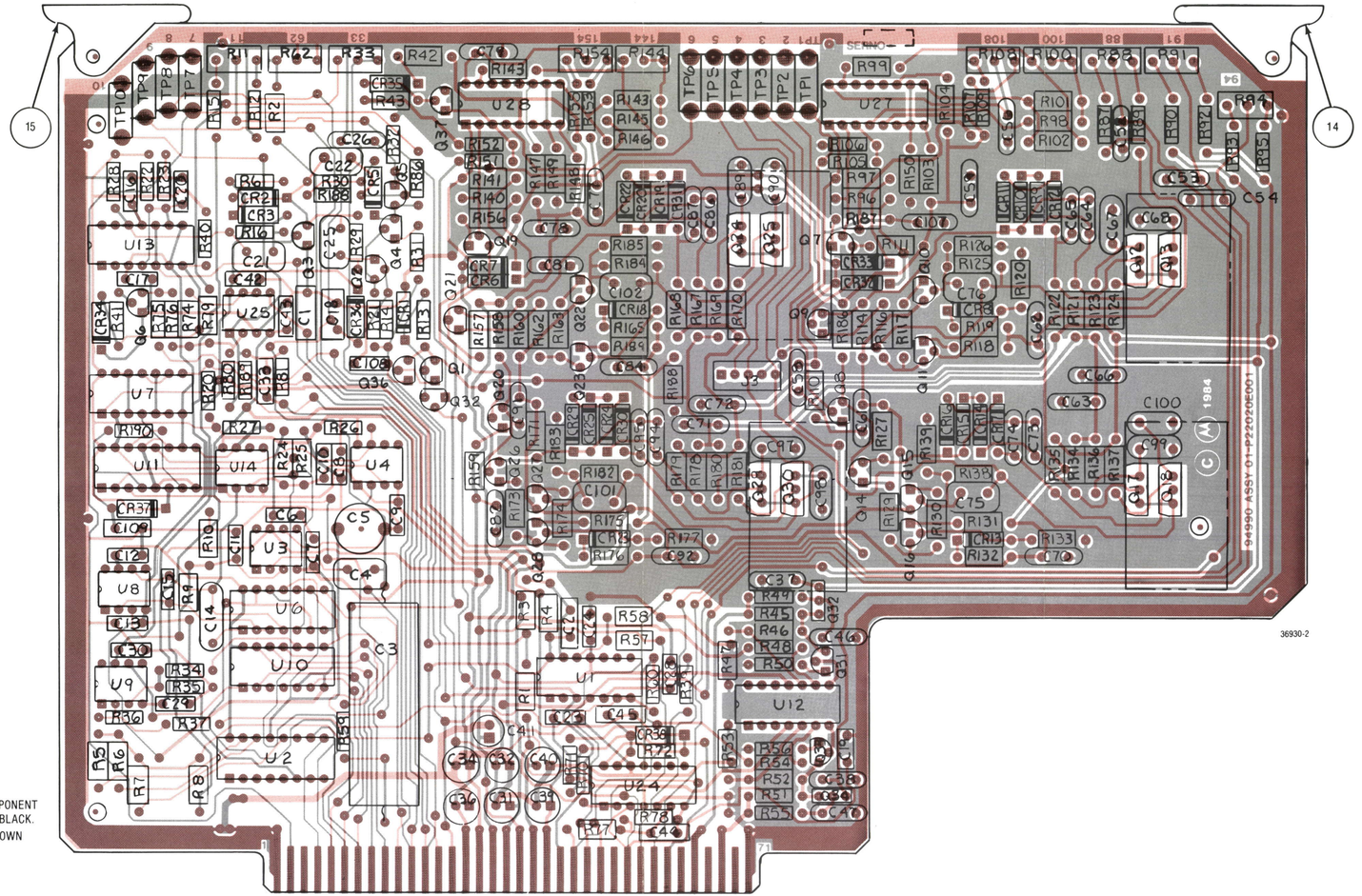
36830-38



SCOPE AMPLIFIER BOARD (A2)
RTC-1005A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
014	1	45-80339B28	CARD EJECTOR	
015	1	45-80339B35	CARD EJECTOR	MARKED
C 001	1	08-82789H01	CAPACITOR	.0022UF-5-50
C 002	1	21-80342B09	CAPACITOR	.01UF-20-50
C 003	1	08-83445B68	CAPACITOR	.215UF-1
C 004	1	21-80369A95	CAPACITOR	180PF-5-500
C 005	1	20-82399D07	CAPACITOR,VARIABLE	15-60PF
C 006	1	21-80342B10	CAPACITOR	.1UF-20-50
C 007	1	21-80342B10	CAPACITOR	.1UF-20-50
C 008	1	21-80342B10	CAPACITOR	.1UF-20-50
C 009	1	21-80342B10	CAPACITOR	.1UF-20-50
C 010	1	21-80342B10	CAPACITOR	.1UF-20-50
C 011	1	21-80342B10	CAPACITOR	.1UF-20-50
C 012	1	21-80342B10	CAPACITOR	.1UF-20-50
C 013	1	21-80342B10	CAPACITOR	.1UF-20-50
C 014	1	08-82096J08	CAPACITOR	.022UF-10-250
C 015	1	21-80339B26	CAPACITOR	220PF-5-500
C 016	1	21-80342B10	CAPACITOR	.1UF-20-50
C 017	1	21-80342B10	CAPACITOR	.1UF-20-50
C 018	1	21-80342B09	CAPACITOR	.01UF-20-50
C 019	1	21-80342B09	CAPACITOR	.01UF-20-50
C 020	1	21-80342B10	CAPACITOR	.1UF-20-50
C 021	1	21-80339B16	CAPACITOR	51PF-5-500
C 022	1	21-80369A95	CAPACITOR	180PF-5-500
C 023	1	21-80342B10	CAPACITOR	.1UF-20-50
C 024	1	21-80342B10	CAPACITOR	.1UF-20-50
C 025	1	21-80369A94	CAPACITOR	150PF-5-500
C 026	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 028	1	21-80342B10	CAPACITOR	.1UF-20-50
C 029	1	21-80342B10	CAPACITOR	.1UF-20-50
C 030	1	21-80342B10	CAPACITOR	.1UF-20-50
C 031	1	23-80341B15	CAPACITOR	10UF-20-50
C 032	1	23-80341B15	CAPACITOR	10UF-20-50
C 033	1	21-80342B09	CAPACITOR	.01UF-20-50
C 034	1	23-80341B15	CAPACITOR	10UF-20-50
C 036	1	23-80341B15	CAPACITOR	10UF-20-50
C 037	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 038	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 039	1	23-80341B15	CAPACITOR	10UF-20-50
C 040	1	23-80341B15	CAPACITOR	10UF-20-50
C 041	1	23-80341B17	CAPACITOR	22UF-20-50
C 042	1	21-80342B10	CAPACITOR	.1UF-20-50
C 043	1	21-80342B10	CAPACITOR	.1UF-20-50
C 044	1	21-80342B09	CAPACITOR	.01UF-20-50
C 045	1	21-80342B13	CAPACITOR	.047UF-20-50
C 046	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 047	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 052	1	21-80342B09	CAPACITOR	.01UF-20-50
C 053	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 054	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 056	1	21-80342B10	CAPACITOR	.1UF-20-50
C 058	1	21-80342B09	CAPACITOR	.01UF-20-50
C 059	1	21-80342B09	CAPACITOR	.01UF-20-50
C 061	1	21-80341B95	CAPACITOR	.01UF-20-100
C 062	1	21-80342B09	CAPACITOR	.01UF-20-50
C 063	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 064	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 065	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 066	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 067	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500
C 068	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500
C 070	1	21-80342B09	CAPACITOR	.01UF-20-50
C 071	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 072	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 073	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 074	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 075	1	21-80339B10	CAPACITOR	2PF-.5PF-500
C 076	1	21-80339B10	CAPACITOR	2PF-.5PF-500
C 077	1	21-80342B10	CAPACITOR	.1UF-20-50
C 078	1	21-80342B10	CAPACITOR	.1UF-20-50
C 079	1	21-80342B10	CAPACITOR	.1UF-20-50
C 081	1	21-80342B09	CAPACITOR	.01UF-20-50
C 082	1	21-80342B09	CAPACITOR	.01UF-20-50
C 084	1	21-80342B09	CAPACITOR	.01UF-20-50
C 086	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 087	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 089	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500
C 090	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500
C 091	1	21-80341B95	CAPACITOR	.01UF-20-100
C 092	1	21-80342B09	CAPACITOR	.01UF-20-50
C 094	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 095	1	21-80396A52	CAPACITOR,CERAMIC DISC	.01UF-20 + 80-200
C 097	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500
C 098	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500

SCOPE AMPLIFIER BOARD (A2)

(RTC-1005A)

Figure 7-3. Printed Wiring Board Assembly and Parts List

SCOPE AMPLIFIER BOARD (A2) (Cont)

RTC-1005A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
C 099	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500
C 100	1	21-80396A50	CAPACITOR,MODIFIED	560PF-10-500
C 101	1	21-80339B10	CAPACITOR	2PF-.5PF-500
C 102	1	21-80339B10	CAPACITOR	2PF-.5PF-500
C 107	1	21-80342B09	CAPACITOR	.01UF-20-50
C 108	1	21-80342B91	CAPACITOR	1UF-20-100
C 109	1	21-80341B99	CAPACITOR	2200PF-20-100
C 110	1	21-00859934	CAPACITOR	10PF-.5PF-500
CR001	1	48-80345A85	DIODE,ZENER	75V-5-.5
CR002	1	48-84463K02	DIODE	
CR003	1	48-80345A95	DIODE	
CR005	1	48-84463K02	DIODE	
CR006	1	48-84463K02	DIODE	
CR007	1	48-84463K02	DIODE	
CR008	1	48-84463K02	DIODE	
CR009	1	48-80345A82	DIODE,ZENER	33V-5-.5
CR010	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR011	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR012	1	48-80345A84	DIODE,ZENER	68V-5-.5
CR013	1	48-84463K02	DIODE	
CR014	1	48-80345A82	DIODE,ZENER	33V-5-.5
CR015	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR016	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR017	1	48-80345A84	DIODE,ZENER	68V-5-.5
CR018	1	48-84463K02	DIODE	
CR019	1	48-80345A82	DIODE,ZENER	33V-5-.5
CR020	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR022	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR023	1	48-84463K02	DIODE	
CR024	1	48-80345A82	DIODE,ZENER	33V-5-.5
CR025	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR029	1	48-80345A83	DIODE,ZENER	39V-5-.5
CR030	1	48-80345A84	DIODE,ZENER	68V-5-.5
CR031	1	48-80345A84	DIODE,ZENER	68V-5-.5
CR032	1	48-84463K02	DIODE	
CR033	1	48-84463K02	DIODE	
CR034	1	48-84463K02	DIODE	
CR035	1	48-84463K02	DIODE	
CR036	1	48-84463K02	DIODE	
CR037	1	48-84463K02	DIODE	
CR038	1	48-84463K02	DIODE	
Q 001	1	48-80340B87	TRANSISTOR	MPSD01
Q 002	1	48-80345A51	TRANSISTOR	
Q 003	1	48-80345A51	TRANSISTOR	
Q 004	1	48-80345A52	TRANSISTOR	
Q 005	1	48-80345A51	TRANSISTOR	
Q 006	1	48-80340B85	TRANSISTOR	MPS6519
Q 007	1	48-80340B85	TRANSISTOR	MPS6519
Q 008	1	48-80340B85	TRANSISTOR	MPS6519
Q 009	1	48-80345A51	TRANSISTOR	
Q 010	1	48-80345A51	TRANSISTOR	
Q 011	1	48-80340B86	TRANSISTOR	MPS6520
Q 012	1	48-80341A48	TRANSISTOR	MPS-U60 SCREENED
Q 013	1	48-80341A47	TRANSISTOR	MPS-U10 SCREENED
Q 014	1	48-80345A51	TRANSISTOR	
Q 015	1	48-80345A51	TRANSISTOR	
Q 016	1	48-80340B86	TRANSISTOR	MPS6520
Q 017	1	48-80341A48	TRANSISTOR	MPS-U60 SCREENED
Q 018	1	48-80341A47	TRANSISTOR	MPS-U10 SCREENED
Q 019	1	48-80340B85	TRANSISTOR	MPS6519
Q 020	1	48-80340B85	TRANSISTOR	MPS6519
Q 021	1	48-80345A51	TRANSISTOR	
Q 022	1	48-80345A51	TRANSISTOR	
Q 023	1	48-80340B86	TRANSISTOR	MPS6520
Q 024	1	48-80341A48	TRANSISTOR	MPS-U60 SCREENED
Q 025	1	48-80341A47	TRANSISTOR	MPS-U10 SCREENED
Q 026	1	48-80345A51	TRANSISTOR	
Q 027	1	48-80345A51	TRANSISTOR	
Q 028	1	48-80340B86	TRANSISTOR	MPS6520
Q 029	1	48-80341A48	TRANSISTOR	MPS-U60 SCREENED
Q 030	1	48-80341A47	TRANSISTOR	MPS-U10 SCREENED
Q 031	1	48-80340B87	TRANSISTOR	MPSD01
Q 032	1	48-80345A14	TRANSISTOR	
Q 033	1	48-80340B88	TRANSISTOR	MPSD51
Q 034	1	48-80345A15	TRANSISTOR	
Q 035	1	48-80340B87	TRANSISTOR	MPSD01
Q 036	1	48-80340B87	TRANSISTOR	MPSD01
Q 037	1	48-80340B86	TRANSISTOR	MPS6520
R 001	1	06-10621C76	RESISTOR	6.98K-1-1/4
R 002	1	06-10621B70	RESISTOR	562-1-1/4
R 003	1	06-10621D88	RESISTOR	100K-1-1/4
R 004	1	06-10621D88	RESISTOR	100K-1-1/4
R 005	1	06-10621E77	RESISTOR	825K-1-1/4
R 006	1	06-10621D80	RESISTOR	82.5K-1-1/4
R 007	1	06-10621C83	RESISTOR	8.25K-1-1/4
R 009	1	06-10621C82	RESISTOR	8.06K-1-1/4
R 010	1	06-10621C60	RESISTOR	4.75K-1-1/4
R 011	1	18-83452F11	RESISTOR,VARIABLE	5K
R 012	1	06-11009C86	RESISTOR	36K-5-1/4
R 013	1	06-11009D04	RESISTOR	180K-5-1/4
R 014	1	06-11009C89	RESISTOR	47K-5-1/4
R 015	1	06-11009C73	RESISTOR	10K-5-1/4
R 016	1	06-11009C73	RESISTOR	10K-5-1/4
R 019	1	06-11009C95	RESISTOR	82K-5-1/4
R 020	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 021	1	06-11009C49	RESISTOR	1K-5-1/4
R 022	1	06-11009C73	RESISTOR	10K-5-1/4
R 023	1	06-11009C73	RESISTOR	10K-5-1/4
R 024	1	06-10621C79	RESISTOR	7.5K-1-1/4
R 025	1	06-10621C52	RESISTOR	3.92K-1-1/4
R 026	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 027	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 028	1	06-11009C43	RESISTOR	560-5-1/4
R 029	1	06-11009C73	RESISTOR	10K-5-1/4
R 030	1	06-11009C73	RESISTOR	10K-5-1/4
R 031	1	06-11009C25	RESISTOR	100-5-1/4
R 032	1	06-11009C25	RESISTOR	100-5-1/4
R 033	1	18-83452F17	RESISTOR,VARIABLE	50K
R 034	1	06-11009C73	RESISTOR	10K-5-1/4
R 035	1	06-11009C73	RESISTOR	10K-5-1/4
R 036	1	06-11009C73	RESISTOR	10K-5-1/4
R 037	1	06-11009C73	RESISTOR	10K-5-1/4
R 039	1	06-11009C97	RESISTOR	100K-5-1/4
R 040	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 041	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 042	1	06-10621C67	RESISTOR	5.62K-1-1/4
R 043	1	06-10621C31	RESISTOR	2.37K-1-1/4
R 045	1	06-11009C70	RESISTOR	7.5K-5-1/4
R 046	1	06-10621E17	RESISTOR	196K-1-1/4
R 047	1	06-10621D14	RESISTOR	16.9K-1-1/4
R 048	1	06-11009C73	RESISTOR	10K-5-1/4
R 049	1	06-11009C29	RESISTOR	150-5-1/4
R 050	1	06-11009C71	RESISTOR	8.2K-5-1/4
R 051	1	06-11009C70	RESISTOR	7.5K-5-1/4
R 052	1	06-10621E17	RESISTOR	196K-1-1/4
R 053	1	06-10621D14	RESISTOR	16.9K-1-1/4
R 054	1	06-11009C73	RESISTOR	10K-5-1/4
R 055	1	06-11009C29	RESISTOR	150-5-1/4
R 056	1	06-11009C71	RESISTOR	8.2K-5-1/4
R 057	1	06-10621C72	RESISTOR	6.34K-1-1/4
R 058	1	06-10621C11	RESISTOR	1.47K-1-1/4
R 059	1	06-11009C25	RESISTOR	100-5-1/4
R 060	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 061	1	06-11009C49	RESISTOR	1K-5-1/4
R 062	1	18-83452F07	RESISTOR,VARIABLE	500
R 070	1	06-11009D14	RESISTOR	470K-5-1/4
R 071	1	06-11009D06	RESISTOR	220K-5-1/4
R 072	1	06-11009D14	RESISTOR	470K-5-1/4
R 074	1	06-10621D52	RESISTOR	42.2K-1-1/4
R 075	1	06-11009C89	RESISTOR	47K-5-1/4
R 076	1	06-00124B26	RESISTOR	1.5M-5-1/4
R 077	1	06-10621E85	RESISTOR	1M-1-1/4
R 078	1	06-10621E85	RESISTOR	1M-1-1/4
R 079	1	06-10621D36	RESISTOR	28.7K-1-1/4
R 080	1	06-11009D14	RESISTOR	470K-5-1/4
R 081	1	06-11009C53	RESISTOR	1.5K-5-1/4
R 086	1	06-11009C49	RESISTOR	1K-5-1/4
R 087	1	06-11009C25	RESISTOR	100-5-1/4
R 088	1	18-83452F01	RESISTOR,VARIABLE	2K
R 089	1	06-11009C25	RESISTOR	100-5-1/4
R 090	1	06-11009C89	RESISTOR	47K-5-1/4
R 091	1	18-83452F23	RESISTOR,VARIABLE	500K
R 092	1	06-11009C89	RESISTOR	47K-5-1/4
R 093	1	06-11009C89	RESISTOR	47K-5-1/4
R 094	1	18-83452F23	RESISTOR,VARIABLE	500K
R 095	1	06-11009C89	RESISTOR	47K-5-1/4
R 096	1	06-10621B82	RESISTOR	750-1-1/4
R 097	1	06-10621B82	RESISTOR	750-1-1/4
R 098	1	06-10621B94	RESISTOR	1K-1-1/4
R 099	1	06-10621B94	RESISTOR	1K-1-1/4
R 100	1	18-83452F11	RESISTOR,VARIABLE	5K
R 101	1	06-10621B70	RESISTOR	562-1-1/4
R 102	1	06-10621B70	RESISTOR	562-1-1/4
R 103	1	06-10621A85	RESISTOR	75-1-1/4
R 104	1	06-10621A85	RESISTOR	75-1-1/4
R 105	1	06-11009C49	RESISTOR	1K-5-1/4
R 106	1	06-11009C73	RESISTOR	10K-5-1/4
R 107	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 108	1	18-83452F09	RESISTOR,VARIABLE	1K
R 109	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 110	1	06-10621B62	RESISTOR	464-1-1/4
R 111	1	06-10621C24	RESISTOR	2K-1-1/4
R 114	1	06-10621C35	RESISTOR	2.61K-1-1/4
R 116	1	06-10621A01	RESISTOR	10-1-1/4
R 117	1	06-10621A01	RESISTOR	10-1-1/4
R 118	1	06-10621B62	RESISTOR	464-1-1/4
R 119	1	06-10621C59	RESISTOR	4.64K-1-1/4
R 120	1	06-10621C63	RESISTOR	5.11K-1-1/4
R 121	1	06-10621C91	RESISTOR	10K-1-1/4
R 122	1	06-10621C91	RESISTOR	10K-1-1/4
R 123	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 124	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 125	1	06-10621D68	RESISTOR	61.9K-1-1/4
R 126	S01	06-10621C55	RESISTOR	4.22K-1-1/4
R 126	S01	06-10621C31	RESISTOR	2.37K-1-1/4
R 126	S01	06-10621C35	RESISTOR	2.61K-1-1/4
R 126	S01	06-10621C39	RESISTOR	2.87K-1-1/4
R 126	S01	06-10621C42	RESISTOR	3.09K-1-1/4
R 126	S01	06-10621C43	RESISTOR	3.16K-1-1/4
R 126	1	06-10621C47	RESISTOR	3.48K-1-1/4
R 126	S01	06-10621C51	RESISTOR	3.83K-1-1/4
R 126	S01	06-10621C58	RESISTOR	4.02K-1-1/4
R 126	S01	06-10621C59	RESISTOR	4.64K-1-1/4
R 126	S01	06-10621C63	RESISTOR	5.11K-1-1/4
R 127	1	06-10621C35	RESISTOR	2.61K-1-1/4
R 129	1	06-10621A01	RESISTOR	10-1-1/4
R 130	1	06-10621A01	RESISTOR	10-1-1/4
R 131	1	06-10621B62	RESISTOR	464-1-1/4
R 132	1	06-10621C59	RESISTOR	4.64K-1-1/4
R 133	1	06-10621C63	RESISTOR	5.11K-1-1/4
R 134	1	06-10621C91	RESISTOR	10K-1-1/4
R 135	1	06-10621C91	RESISTOR	10K-1-1/4
R 136	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 137	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 138	1	06-10621D68	RESISTOR	61.9K-1-1/4
R 139	S01	06-10621C55	RESISTOR	4.22K-1-1/4
R 139	S01	06-10621C31	RESISTOR	2.37K-1-1/4
R 139	S01	06-10621C35	RESISTOR	2.61K-1-1/4
R 139	S01	06-10621C39	RESISTOR	2.87K-1-1/4
R 139	S01	06-10621C42	RESISTOR	3.09K-1-1/4
R 139	S01	06-10621C43	RESISTOR	3.16K-1-1/4
R 139	1	06-10621C47	RESISTOR	3.48K-1-1/4
R 139	S01	06-10621C51	RESISTOR	3.83K-1-1/4
R 139	S01	06-10621C58	RESISTOR	4.02K-1-1/4
R 139	S01	06-10621C59	RESISTOR	4.64K-1-1/4
R 139	S01	06-10621C63	RESISTOR	5.11K-1-1/4
R 140	1	06-10621B82	RESISTOR	750-1-1/4
R 141	1	06-10621B82	RESISTOR	750-1-1/4
R 142	1	06-10621B94	RESISTOR	1K-1-1/4
R 143	1	06-10621B94	RESISTOR	1K-1-1/4
R 144	1	18-83452F11	RESISTOR,VARIABLE	5K
R 145	1	06-10621B70	RESISTOR	562-1-1/4
R 146	1	06-10621B70	RESISTOR	562-1-1/4
R 147	1	06-10621A85	RESISTOR	75-1-1/4
R 148	1	06-10621A85	RESISTOR	75-1-1/4
R 149	1	06-10621C07	RESISTOR	1330-1-1/4
R 150	1	06-10621C07	RESISTOR	1330-1-1/4
R 151	1	06-11009C49	RESISTOR	1K-5-1/4
R 152	1	06-11009C73	RESISTOR	10K-5-1/4
R 153	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 154	1	18-83452F09	RESISTOR,VARIABLE	1K
R 155	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 156	1	06-10621B62	RESISTOR	464-1-1/4
R 157	1	06-10621C24	RESISTOR	2K-1-1/4
R 158	1	06-10621C24	RESISTOR	2K-1-1/4
R 159	1	06-10621B62	RESISTOR	464-1-1/4
R 160	1	06-10621C35	RESISTOR	2.61K-1-1/4
R 162	1	06-10621A01	RESISTOR	10-1-1/4
R 163	1	06-10621A01	RESISTOR	10-1-1/4
R 164	1	06-10621B62	RESISTOR	464-1-1/4
R 165	1	06-10621C59	RESISTOR	4.64K-1-1/4
R 166	1	06-10621C63	RESISTOR	5.11K-1-1/4
R 167	1	06-10621C91	RESISTOR	10K-1-1/4
R 168	1	06-10621C91	RESISTOR	10K-1-1/4
R 169	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 170	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 171	1	06-10621C35	RESISTOR	2.61K-1-1/4
R 173	1	06-10621A01	RESISTOR	10-1-1/4
R 174	1	06-10621A01	RESISTOR	10-1-1/4
R 175	1	06-10621B62	RESISTOR	464-1-1/4
R 176	1	06-10621C59	RESISTOR	4.64K-1-1/4
R 177	1	06-10621C63	RESISTOR	5.11K-1-1/4
R 178	1	06-10621C91	RESISTOR	10K-1-1/4
R 179	1	06-10621C91	RESISTOR	10K-1-1/4
R 180	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 181	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 182	1	06-10621D68	RESISTOR	61.9K-1-1/4
R 183	1	06-10621C35	RESISTOR	2.61K-1-1/4
R 184	1	06-10621D68	RESISTOR	61.9K-1-1/4
R 185	1	06-10621C35	RESISTOR	2.61K-1-1/4
R 186	1	06-10621C24	RESISTOR	2K-1-1/4
R 187	1	06-10621B62	RESISTOR	464-1-1/4
R 188	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 189	1	06-11009C56	RESISTOR	2K-5-1/4
R 190	1	06-11009C15	RESISTOR	39-5-1/4
TP001	1	09-80331A88	JACK	WHITE
TP002	1	09-80331A88	JACK	WHITE
TP003	1	09-80331A88	JACK	WHITE
TP004	1	09-80331A88	JACK	WHITE
TP005	1	09-80331A88	JACK	WHITE
TP006	1	09-80331A88	JACK	WHITE
TP007	1	09-80331A88	JACK	WHITE
TP008	1	09-80331A88	JACK	WHITE
TP009	1	09-80331A88	JACK	WHITE
TP010	1	09-80331A88	JACK	WHITE
U 001	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U 002	1	51-82864L59	INTEGRATED CIRCUIT	
U 003	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U 004	1	51-80347A38	INTEGRATED CIRCUIT	
U 005	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U 006	1	51-82864L71	INTEGRATED CIRCUIT	
U 007	1	51-05596E46	INTEGRATED CIRCUIT	
U 009	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U 010	1	51-82864L71	INTEGRATED CIRCUIT	
U 011	1	51-82864L10	INTEGRATED CIRCUIT	
U 012	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U 013	1	51-80345A06	INTEGRATED CIRCUIT	LM319N SCREENED
U 014	1	51-80347A38	INTEGRATED CIRCUIT	
U 024	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U 025	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U 027	1	51-80343B25	INTEGRATED CIRCUIT	CA3183E SCREENED
U 028	1	51-80343B25	INTEGRATED CIRCUIT	CA3183E SCREENED