

SECTION 9. SCOPE/DVM CONTROL BOARD (A7)

9.1 DESCRIPTION

The primary function of the Scope/DVM Control board is to route the required measurement and viewing signals to the digital voltmeter (DVM) and scope circuitry. A large portion of the displayed data is determined by DVM measurements on internal signal points. Thus, for a rapid update of several data displays, several internal signal points must be time-division multiplexed to the DVM. The DVM Control circuitry and the system processor provide this function.

With the Scope Control circuitry, the user can choose to display either data information, or signals for internal modulation or demodulation, or external scope inputs. The horizontal sweep provided for the spectrum-analyzer display is coherent with the synthesizer sweep generator. The coherent horizontal sweep and synthesizer sweep can be used for an external filter-alignment display. An external horizontal input is also possible.

The Scope/DVM Control board also contains the 1-kHz notch filter and the rectifier circuit used for distortion measurements.

A block diagram of the Scope/DVM Control board is shown at the end of this section in Figure 9-1, a schematic in Figure 9-2, and the printed wiring board assembly and parts list in Figure 9-3.

9.2 THEORY OF OPERATION

9.2.1 SCOPE VERTICAL CONTROL

The input to the scope vertical amplifier is switched by the scope vertical-select switch (U6) to one of four sources: the range switch (VERT FROM RNG SW), the vertical character-sweep generator, the spectrum analyzer (SPECT ANA VERT), or the 700-kHz IF. Inputs to the range switch, which are routed through the range switch on the Front-Panel Interface board (A15), come from either 1) the scope's vertical-input port on the front panel or 2) the internal modulation signals, as selected by this board's control circuitry for modulation display. The vertical character sweep is a sawtooth waveform generated by the vertical character-sweep generator and synced by the VERT CHAR SYNC signal from the character generator on the Processor board (A14). The detected and amplified output of the Receiver logarithmic IF is the vertical input for the spectrum analyzer. The remaining signal source is the second IF signal from the Receiver for IF envelope observation.

9.2.2 DUAL-DISPLAY CONTROL

The dual-display control circuitry produces a screen with a single row of characters at the top of the CRT and a display for either the spectrum analyzer or the scope. This function is implemented with the vertical sweep control by alternating the signal for the spectrum analyzer or the range switch with the signal for the vertical character sweep.

The dual-display sequence starts with the synthesizer sweep generator (U12, U51A, U59A), which is common to the displays for both the spectrum analyzer and the scope. This sweep generator is started with a pulse of the SYNTH 100 Hz input signal, which fires the one-shot U12B. This also enables the scope Z-axis. Now the display for either the spectrum analyzer or the scope is being traced on the CRT.

When the synthesizer sweep reaches 2.5 Vdc (that is, the scope's horizontal sweep is at the edge of the screen), the dual-display control circuitry (U10B, U11, U12A, Q6) activates the CHAR GEN RST line. This switches the scope's vertical and horizontal inputs to the character-sweep generators. The vertical sweep generator (U3, U4) determines the CRT frame rate of 61 Hz. The horizontal character-sweep generator (U60) determines the row rate of 7812.5 Hz; eight rows make a character height. The vertical and horizontal character generators are synchronized by the character generator on the Processor board (A14).

When the first line of characters has been traced, a transition on the LINE 1 input from the A14 board resets both character-sweep generators, and increments the character counter (U13). This causes LINE 1 to be traced again. This process is repeated four times, at which point the counter output resets the scope inputs to "spectrum analyzer" or "range switch." During the retrace time, the scope Z-axis is blanked by U30D and is held off until the synthesizer sweep starts. The timing of the process allows the four character traces to be completed before the next synthesizer sweep-sync.

9.2.3 SCOPE HORIZONTAL CONTROL

Switching for the scope horizontal input is divided between two boards. The timebase generator and the external horizontal input are selected on the Scope Amplifier board (A2). The horizontal character-sweep generator and the signals for the synthesizer sweep generator are selected on the A7 board by the scope horizontal switches (U52A and U52D) and sent to the INT SCOPE HORIZ signal line.

For the dual-display modes, the horizontal switch switches the horizontal input between the synthesizer sweep and the character sweep. This switching is simultaneous with that in the scope vertical control, as described in paragraph 9.2.2. The horizontal switch control also provides the SCOPE MODE EN line to the scope amplifier to enable the horizontal inputs for the scope mode.

9.2.4 SYNTHESIZER SWEEP CONTROL

The control circuitry for the synthesizer sweep (U52B and U52C) controls the amplitude and range of the synthesizer's sweep-generator signal. Two sweep ranges, 1 to 10 MHz and 0.01 to 1 MHz, are provided by the control circuitry. The control circuitry has two fixed attenuations of 1.0 and 0.1. The variable sweep range is provided by the dispersion sweep control on the front panel. To control the bottom range of the sweep, a 10-to-1 resistor change in the sweep return line is simultaneous with the attenuator change.

9.2.5 SCOPE Z-AXIS CONTROL

The SCOPE Z-AXIS signal has three possible sources, as selected by the Z-axis control circuitry (U55, U61A and U61B). For character displays, the Z-axis signal is the CHAR GEN Z-AXIS from the character generator on A14. For the scope mode, the SWP BLANKING signal from the horizontal timebase generator on A2 is switched to the scope Z-axis. For the remaining modes (spectrum analyzer and scope sweep), a logic zero level is gated to the Z-axis input.

9.2.6 MODULATION-DISPLAY CONTROL

The select circuitry for the internal scope and peak detector (U20A, U20B, and U20C) switches the DEMOD CAL AUDIO, AM CARRIER + MOD LEVEL, or MOD CAL AUDIO signals to the internal scope and peak detectors. The signals are gain adjusted by processor select before exiting the module from the INT SCOPE TO RNG SW output.

For FM, the MOD CAL AUDIO input from the Audio Synthesizer board (A10) is calibrated to 5 kHz/V for narrowband and to 20 kHz/V for wideband. These signals are gain adjusted by gain amplifier U23B to a level of 25 kHz/V and become the INT SCOPE TO RNG SW output.

The DEMOD CAL AUDIO signal from the Receiver is either AM, FM, or SSB, as determined by the operating mode. The peak signal on this line is calibrated

to 10 kHz/V for FM and 10 percent/V for AM. These signals are gain adjusted by gain amplifier U23B to a level of 25 kHz/V and 25 percent/V. This gain-adjusted signal becomes the INT SCOPE TO RNG SW output. SSB signals are not calibrated.

For AM, the CARRIER + MOD LEVEL input from the output detector on the Wideband Amplifier board (A17A2) provides a direct display of the modulation. This input is a dc-level representative of the average output level, plus an ac signal representative of the amplitude modulation on the output. For the scope's modulation display, the dc level is blocked by C49 so that only the ac component is observed. This input is uncalibrated for absolute ac levels. The percent of AM is determined from the peak ac and average dc level of the CARRIER + MOD LEVEL signal. The average dc signal is obtained by a low-pass filter (U19).

9.2.7 PEAK DETECTOR

Each of the modulation and demodulation inputs can be switched to the peak-detecting circuitry (U21-U23, U26, U54) to determine the percent AM or kHz deviation. The peak-detector circuitry provides dc outputs equal to the negative and positive peak values of the input signal. These peak values are relative to the average dc level of the input signal. The dc levels are then digitized by the DVM and input to the Processor.

9.2.8 DVM CONTROL

Any one of nine internal measurement points may be switched to INT DVM TO A/D. This signal is routed to the Processor Interface board (A11) where it is multiplexed with external DVM data to the input of the analog-to-digital (A/D) converter. In general, several internal measurement points must be input to the A/D converter to obtain all the display data. Therefore, the processor continuously cycles the Internal DVM Select switch (U20D and U28) through the required measurement points, stopping at each one long enough to digitize and input the data to the processor.

The Internal DVM Select switch is followed by a range attenuator (U29 and Q5). As the processor cycles through each input, it sets the range attenuator according to the last cycle reading made at that input. Thus, each internal input is auto-ranged over two decades to give 3-digit accuracy up to a maximum input of 10V. The internal DVM inputs and their functions are listed in Table 9-1.

Table 9-1. Internal DVM Inputs

DVM Inputs	Function
+ Peak Voltage	Positive modulation measurements
- Peak voltage	Negative modulation measurements
Carrier Level	RF output level
RF INPUT PWR	Power level applied to the RF Input/Output port
EXT FWD PWR	Forward power level on external inline-wattmeter element
EXT RFL PWR	Reflected power level on external inline-wattmeter element
BATT VOLT	Voltage level at dc input port on the rear panel divided by 10
SIG STRENGTH VOLTAGE	DC level proportional to the level in dBm of the received signal
Distortion Meter Input	DC level proportional to the signal power at the input of the SINAD/DISTORTION notch filter

9.2.9 EXTERNAL DVM/DISTORTION CONTROL

External DVM and distortion inputs to the front panel port are ranged by processor control over four decades on the Front-Panel Interface board (A15). The resulting output is routed to the DVM FROM RNG SWITCH input of the A7 board. This signal is input to the DVM/Distortion Select circuitry (U30B and U30C) and the gain stage of 6.5 (U62) preceding the 1-kHz notch filter.

9.2.10 DISTORTION MEASUREMENT

In the distortion mode, the DVM/Distortion Select circuitry routes the output of the 1-kHz notch filter (U62 and U63) to the EXTERNAL DVM TO A/D output pin. This output pin is connected to the rms-to-dc converter on the A11 board. The output of the rms-to-dc converter is multiplexed to the A/D converter and read by the processor. The input to the notch filter is rectified and filtered by U3, and applied to the Internal DVM Select for reading by the processor (as discussed in paragraph 9.2.8). To obtain the percent distortion for a 1-kHz input, the processor divides the rms output voltage of the notch filter by the average rectified input voltage to the notch filter. The notch filter has a processor-controlled gain that is switched to either $\times 10$ or $\times 1.0$, depending on input distortion and signal levels.

9.2.11 EXTERNAL DVM MEASUREMENT

In the external DVM mode, the DVM FROM RNG SWITCH input is routed by the DVM/Distortion Select circuitry directly to the EXT DVM TO A/D output. At this point, it is connected to the rms-to-dc converter on the A11 board. The output of the rms-to-dc converter is multiplexed to the A/D converter, where it is read by the processor.

9.2.12 AUDIO AMPLIFIER AND ALARM GENERATOR

An astable multi-vibrator (U61 and U50) operating at 1.2 kHz is the alarm generator. The alarm signal, controlled by the processor, is summed with the VOL CNTL AUD RTN signal at the input of the audio amplifier (U7). The SPEAKER AUDIO output of the amplifier has a 0.5W capability and is connected directly to the system speaker.

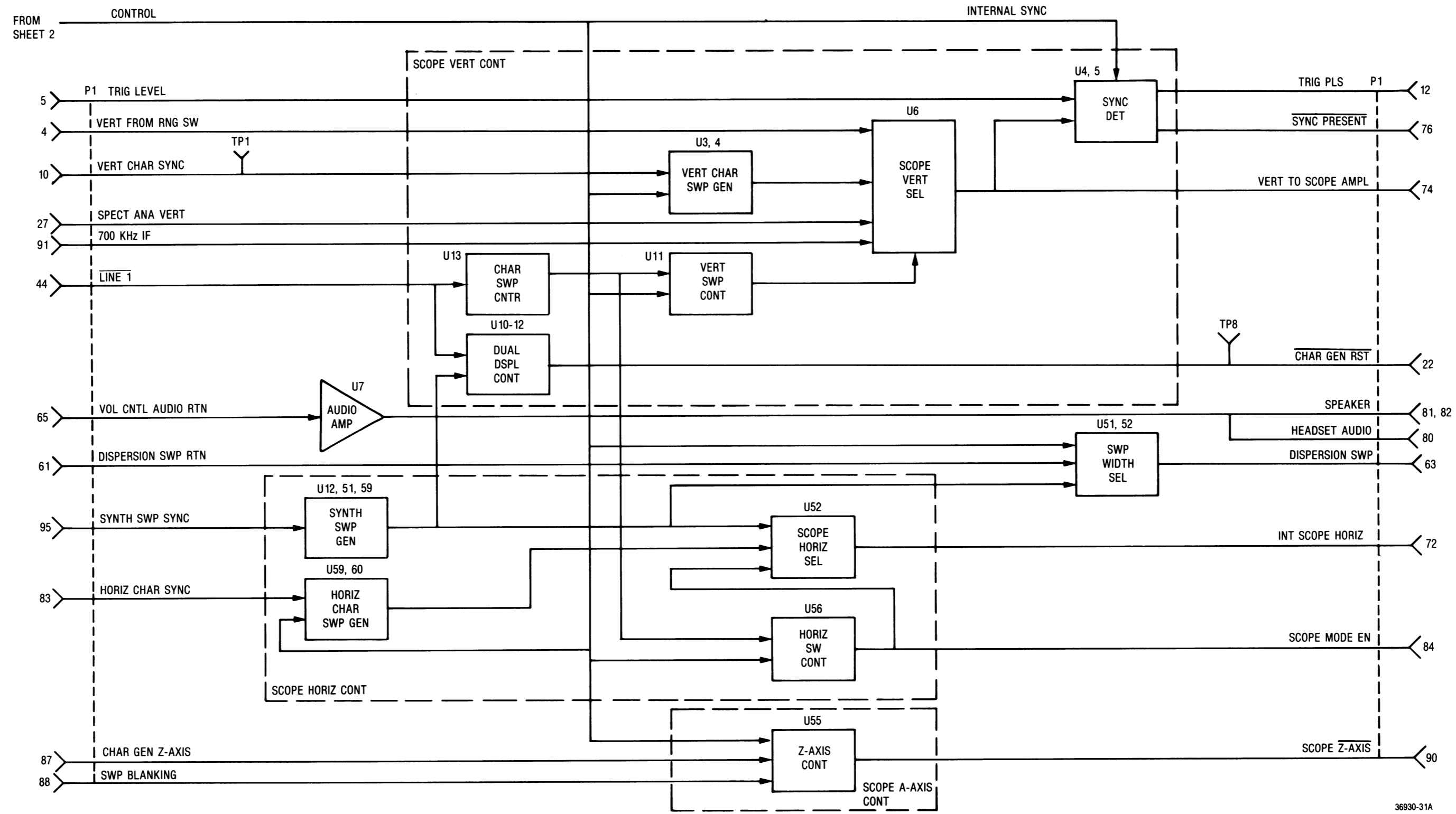
9.2.13 BOARD CONTROL

Processor control of the Scope/DVM Control board is via three signal lines: the AF ADD BUS 0-3, the AF DATA BUS 0-3, and the AF BUS EN 1. The four address bits are decoded by the address decoder (U46) to determine which control latch the four bits of data will be latched into. The latching process is synchronized by the AF BUS EN 1 line. Control latches in addition to those necessary for controlling this board (A7) provide control for the Scope Amplifier board (SCOPE SWP 0-2) and part of the RF Input module (ANTENNA ENABLE).

SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

Figure 9-1a. Block Diagram (Sheet 1 of 2)

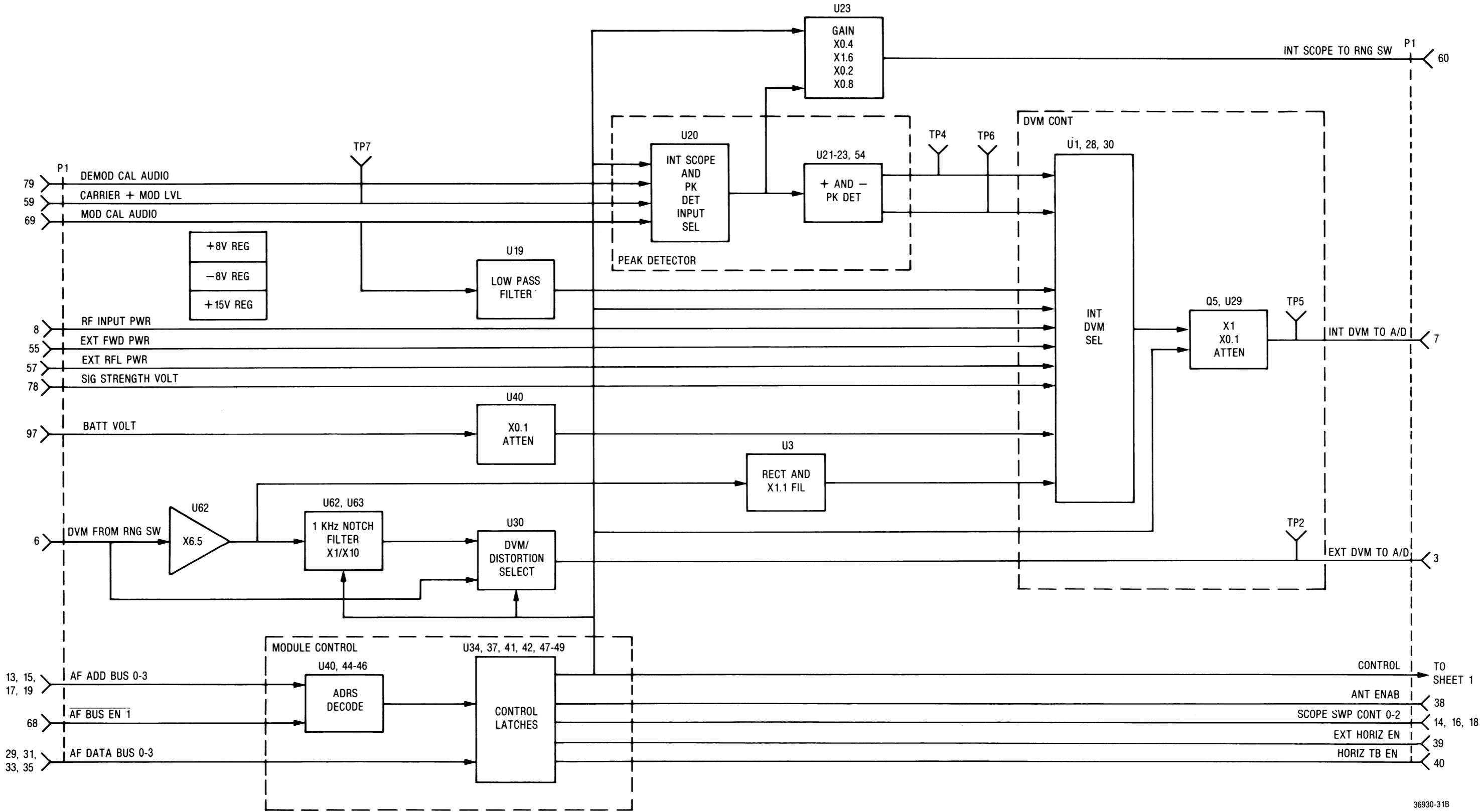


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SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

Figure 9-1b. Block Diagram (Sheet 2 of 2)



36930-31B

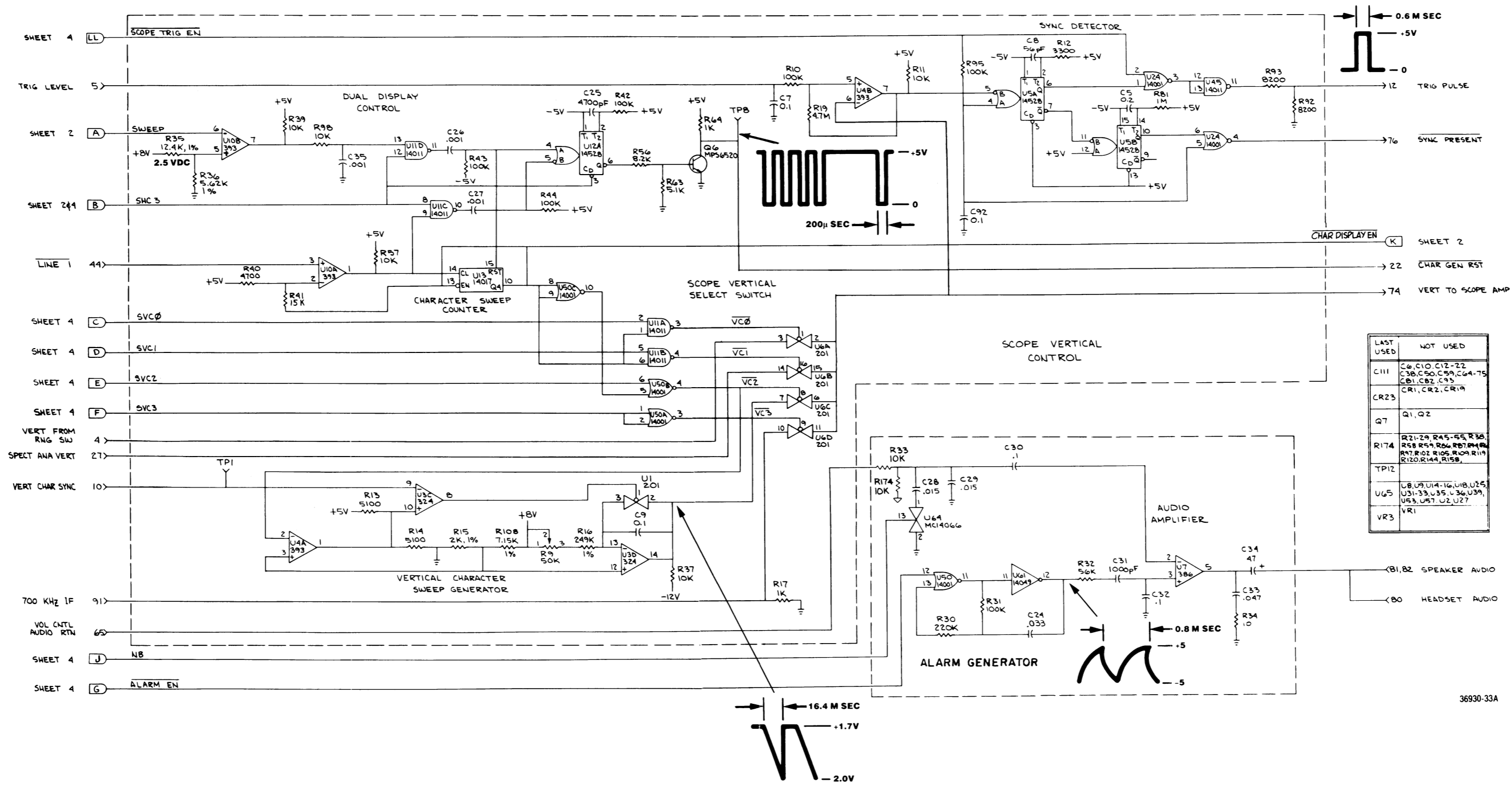
SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

Figure 9-2a. Schematic (Sheet 1 of 4)

- NOTES:
- PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATIONS PREFIX WITH LAF.
 - FOR REFERENCE DRAWINGS REFER TO ASSY NO. 01-42200E.
 - UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS ± 5% PCT, 1/4 WATT(S). ALL CAPACITORS ARE IN UF. ALL INDUCTORS ARE IN UH. ALL VOLTAGES ARE IN DC.

REF DES	DEVICE	GND	V PIN	V PIN	NO CONNECT
U1	HI-201-S	5,14	-2	-2	12
U2					
U3	LM324		+12	-12	
U4	LM393		+5	-	
U5	MC1452B		+5	-	
U6	HI-201-S	5	-2	-2	12
U7	LM324		+12	-12	1,7,8
U8					
U9					
U10	LM393		+5	-	
U11	MC1401		+5	-	
U12	MC1452B		+5	-	7,10
U13	MC1401		+5	-	1-7,9,11,12
U17	MC14066	2,3,6	+12	-12	8,9
U19	CA3140	4	+5	-	15,16
U20	HI-201-S	5	+12	-12	12
U21	CA3140	5	+5	-	8
U22	CA3240	3	+12	-12	
U23	CA3240	3	+12	-12	
U24	MC14001	14	7		
U25					
U26	CA3140		+12	-12	8
U27					
U28	DG508	14	+12	-12	
U29	LM308		+5	-	5
U30	HI-201-S	5,7	+12	-12	12
U34	MC14042	8	+5	-	3,15,12,10
U37	MC14042		+5	-	12,9,11
U38	MC14555		+5	-	
U39					
U40	LM324		+12	-12	12,3,8,9,10
U41	MC14042		+5	-	1,10
U42	MC14042		+5	-	3,9,12,15
U43	LM324		+12	-12	
U44	LM324		+12	-12	
U45	MC1401		+5	-	
U46	MC1402B		+5	-	4,5,9
U47	MC14042		+5	-	9,12,15
U48	MC14042		+5	-	3,9,12,15
U49	MC14042		+5	-	3,9,12,15
U50	MC14001		+5	-	
U51	LM324	9	+12	-12	
U52	MC14066	9,4	+5	-	
U53					
U54	LM393		+5	-	
U55	74LS02	7	+12	-12	
U56	MC14001		+5	-	
U57					
U58	MC1403	3	+12	-12	4,5,6,7,8
U59	LM393		+5	-	
U60	CA3140		+12	-12	1,5,8
U61	MC14049		+12	-12	6,13,16
U62	CA3240		+12	-12	
U63	CA3240		+12	-12	
U64	MC14066	12	+12	-12	10,11
U65	MC7815	5	+12	-12	



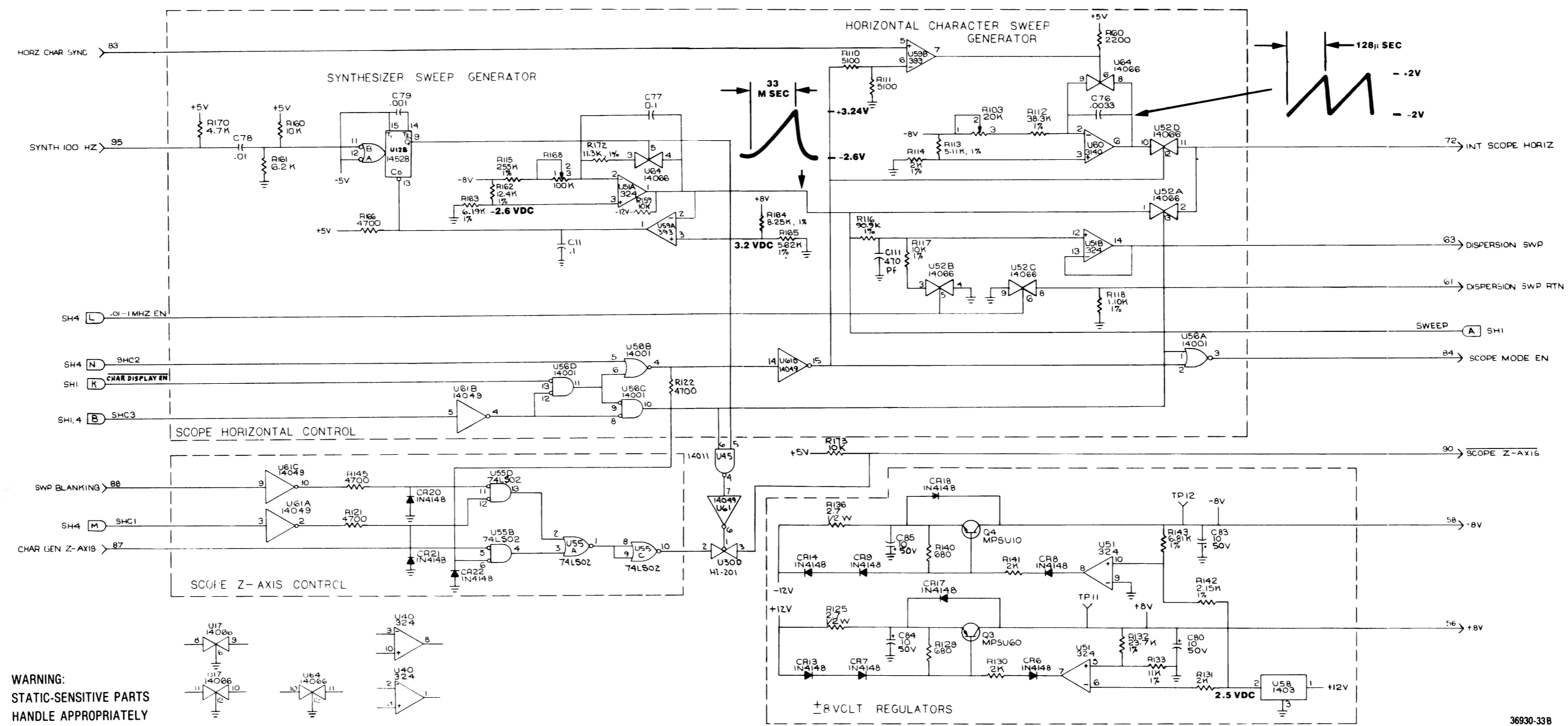
LAST USED	NOT USED
C111	C6, C10, C12-22, C38, C50, C59, C64-75, C81, C82, C93
CR23	CR1, CR2, CR19
Q7	Q1, Q2
R174	R21-29, R45-55, R38, R58, R59, R66, R67, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100
TP12	
U65	U8, U9, U14-16, U18, U25, U31-33, U35, U36, U39, U53, U57, U2, U27
VR3	VR1

WARNING: STATIC-SENSITIVE PARTS HANDLE APPROPRIATELY

SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

Figure 9-2b. Schematic (Sheet 2 of 4)



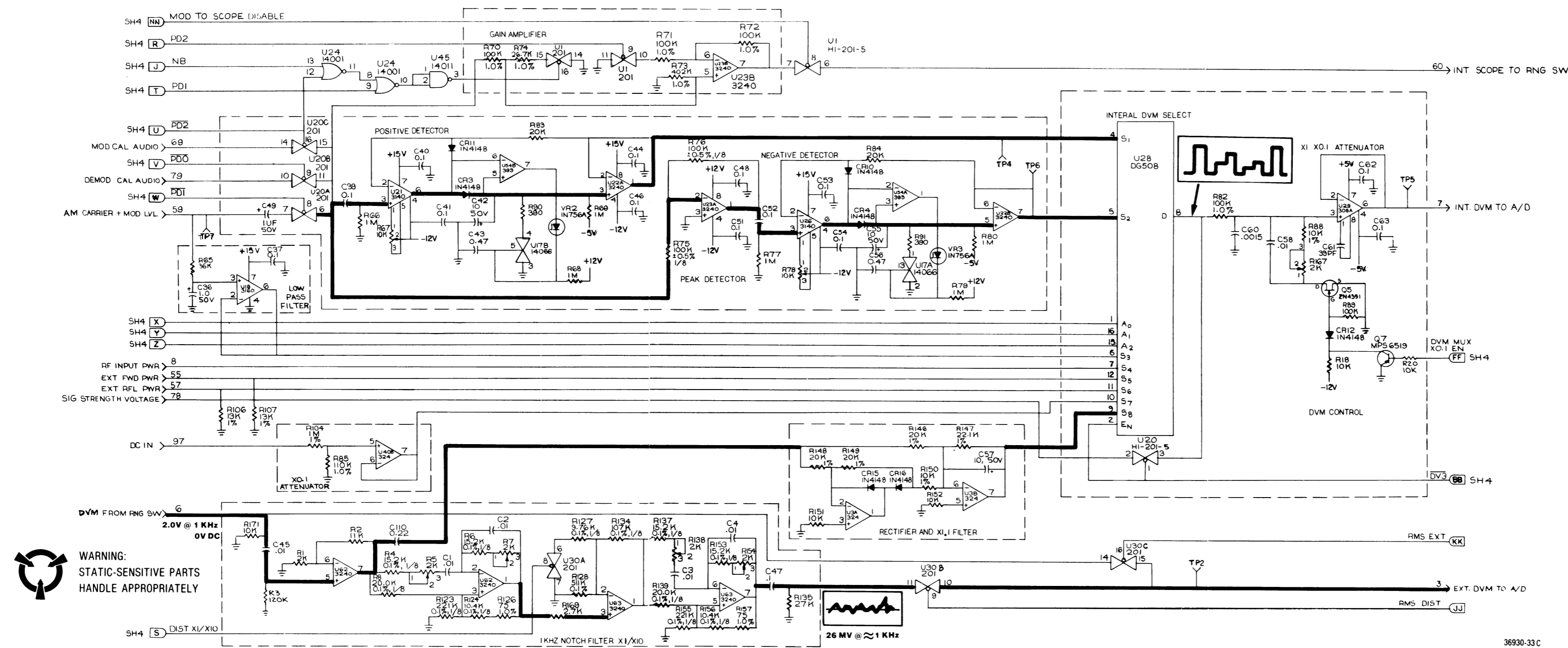
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

36930-338

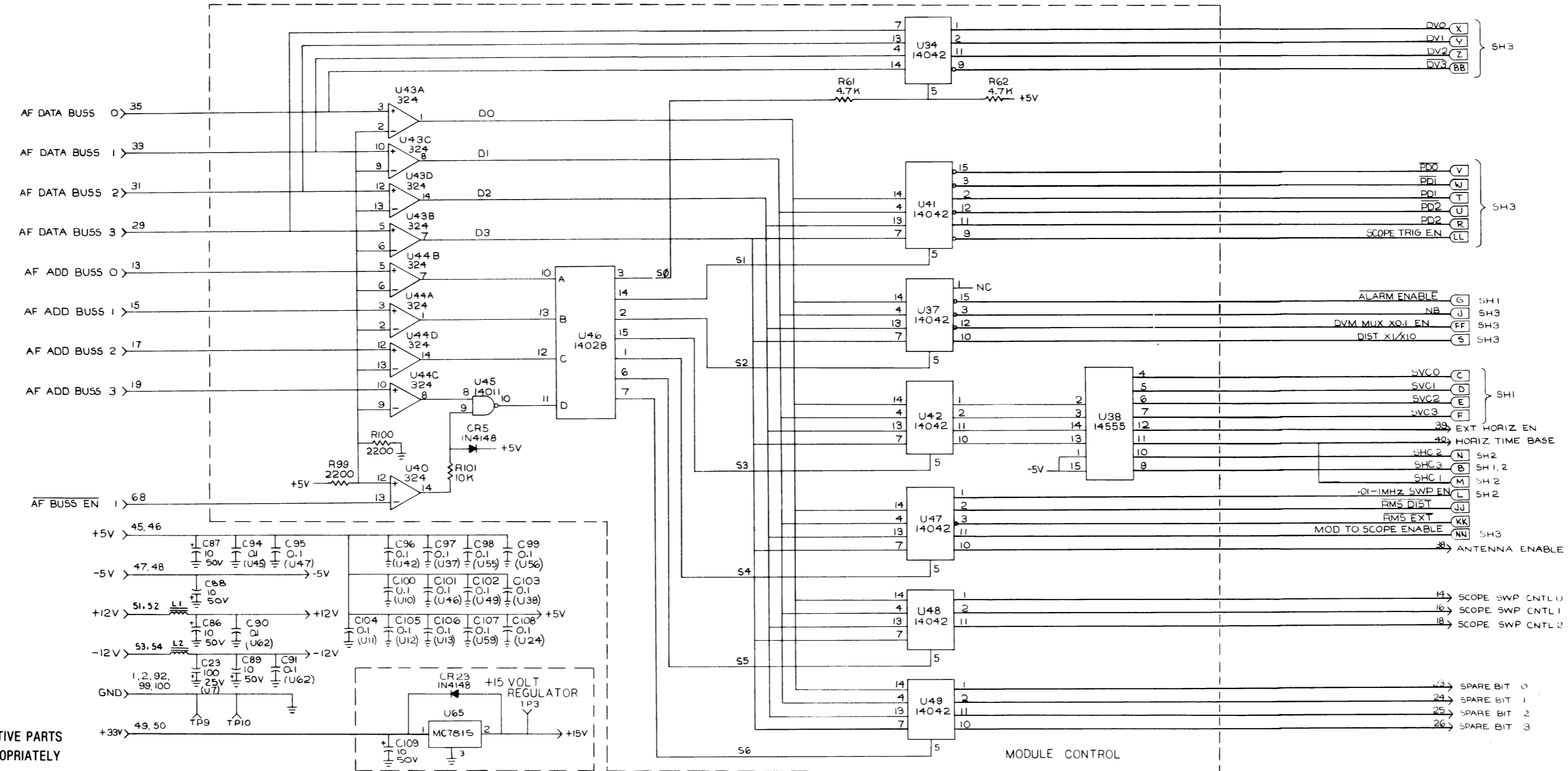
SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

Figure 9-2c. Schematic (Sheet 3 of 4)

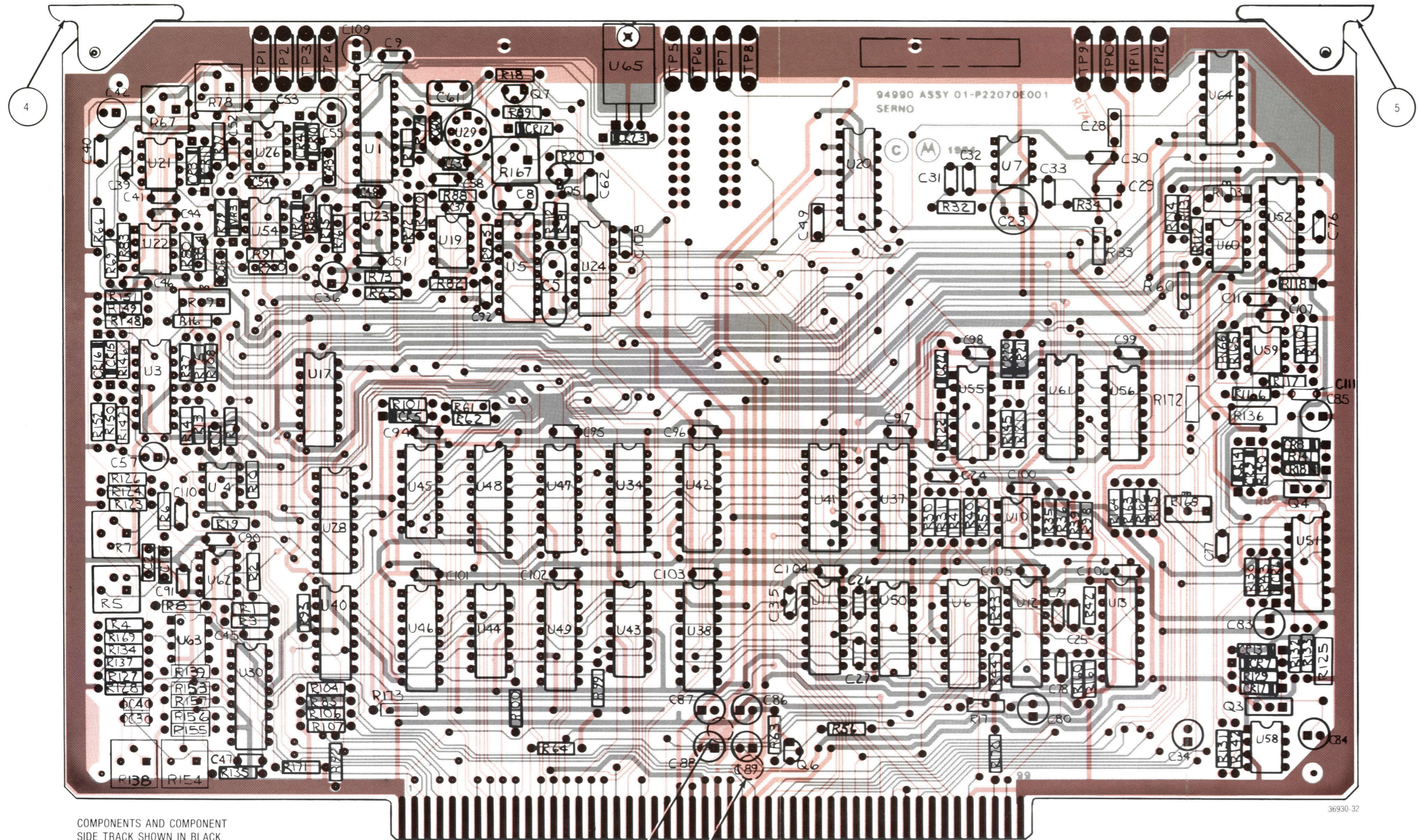


SCOPE/DVM CONTROL BOARD (A7)
 (RTC-1006A)
 Figure 9-2d. Schematic (Sheet 4 of 4)



WARNING:
 STATIC-SENSITIVE PARTS
 HANDLE APPROPRIATELY

36930-330



SCOPE/DVM CONTROL BOARD (A7)
RTC-1006A

SCOPE/DVM CONTROL BOARD (A7)
(RTC-1006A)

Figure 9-3. Printed Wiring Board Assembly and Parts List

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
004	1	45-80339B28	CARD EJECTOR	
005	1	45-80339B40	CARD EJECTOR	MARKED
C 001	1	21-80342B32	CAPACITOR	.01UF-5-50
C 002	1	21-80342B32	CAPACITOR	.01UF-5-50
C 003	1	21-80342B32	CAPACITOR	.01UF-5-50
C 004	1	21-80342B32	CAPACITOR	.01UF-5-50
C 005	1	21-82372C05	CAPACITOR	.2UF-80-20-25
C 007	1	21-80342B10	CAPACITOR	.1UF-20-50
C 008	1	21-80339B17	CAPACITOR	56PF-5-500
C 009	1	21-80341B96	CAPACITOR	.1UF-10-100
C 011	1	21-80341B96	CAPACITOR	.1UF-10-100
C 023	1	23-84665F03	CAPACITOR	100UF-20-25
C 024	1	21-80342B02	CAPACITOR	.033UF-10-100
C 025	1	21-80342B05	CAPACITOR	4700PF-10-100
C 026	1	21-80341B92	CAPACITOR	1000PF-10-100
C 027	1	21-80341B92	CAPACITOR	1000PF-10-100
C 028	1	21-80342B04	CAPACITOR	.015UF-10-100
C 029	1	21-80342B04	CAPACITOR	.015UF-10-100
C 030	1	21-80342B10	CAPACITOR	.1UF-20-50
C 031	1	21-80341B92	CAPACITOR	1000PF-10-100
C 032	1	21-80341B96	CAPACITOR	.1UF-10-100
C 033	1	21-80342B13	CAPACITOR	.047UF-20-50
C 034	1	23-84665F25	CAPACITOR	47UF-20-10
C 035	1	21-80341B92	CAPACITOR	1000PF-10-100
C 036	1	23-83441B15	CAPACITOR	.1UF-20-35
C 037	1	21-80342B10	CAPACITOR	.1UF-20-50
C 039	1	21-80342B10	CAPACITOR	.1UF-20-50
C 040	1	21-80342B10	CAPACITOR	.1UF-20-50
C 041	1	21-80342B10	CAPACITOR	.1UF-20-50
C 042	1	23-80341B15	CAPACITOR	10UF-20-50
C 043	1	21-80342B45	CAPACITOR	47UF-10-50
C 044	1	21-80342B10	CAPACITOR	.1UF-20-50
C 045	1	21-80342B09	CAPACITOR	.01UF-20-50
C 046	1	21-80342B10	CAPACITOR	.1UF-20-50
C 047	1	21-80342B10	CAPACITOR	.1UF-20-50
C 048	1	21-80342B10	CAPACITOR	.1UF-20-50
C 049	1	21-80342B46	CAPACITOR	.1UF-20-50
C 051	1	21-80342B10	CAPACITOR	.1UF-20-50
C 052	1	21-80342B10	CAPACITOR	.1UF-20-50
C 053	1	21-80342B10	CAPACITOR	.1UF-20-50
C 054	1	21-80342B10	CAPACITOR	.1UF-20-50
C 055	1	23-80341B15	CAPACITOR	10UF-20-50
C 056	1	21-80342B45	CAPACITOR	47UF-10-50
C 057	1	23-80341B15	CAPACITOR	10UF-20-50
C 058	1	21-80341B94	CAPACITOR	.01UF-10-100
C 060	1	21-80341B56	CAPACITOR	1500PF-10-50
C 061	1	21-80339B15	CAPACITOR	39PF-5-500
C 062	1	21-80342B10	CAPACITOR	.1UF-20-50
C 063	1	21-80342B10	CAPACITOR	.1UF-20-50
C 076	1	21-80341B71	CAPACITOR	3300PF-5-50
C 077	1	08-80343B12	CAPACITOR	.1UF-10-100
C 078	1	21-80342B09	CAPACITOR	.01UF-20-50
C 079	1	21-80341B46	CAPACITOR	1000PF-5-50
C 080	1	23-80341B15	CAPACITOR	10UF-20-50
C 083	1	23-80341B15	CAPACITOR	10UF-20-50
C 084	1	23-80341B15	CAPACITOR	10UF-20-50
C 085	1	23-80341B15	CAPACITOR	10UF-20-50
C 086	1	23-80341B15	CAPACITOR	10UF-20-50
C 087	1	23-80341B15	CAPACITOR	10UF-20-50
C 088	1	23-80341B15	CAPACITOR	10UF-20-50
C 089	1	23-80341B15	CAPACITOR	10UF-20-50
C 090	1	21-80342B10	CAPACITOR	.1UF-20-50
C 091	1	21-80342B10	CAPACITOR	.1UF-20-50
C 092	1	21-80342B10	CAPACITOR	.1UF-20-50
C 094	1	21-80342B10	CAPACITOR	.1UF-20-50
C 095	1	21-80342B10	CAPACITOR	.1UF-20-50
C 096	1	21-80342B10	CAPACITOR	.1UF-20-50
C 097	1	21-80342B10	CAPACITOR	.1UF-20-50
C 098	1	21-80342B10	CAPACITOR	.1UF-20-50
C 099	1	21-80342B10	CAPACITOR	.1UF-20-50
C 100	1	21-80342B10	CAPACITOR	.1UF-20-50
C 101	1	21-80342B10	CAPACITOR	.1UF-20-50
C 102	1	21-80342B10	CAPACITOR	.1UF-20-50
C 103	1	21-80342B10	CAPACITOR	.1UF-20-50
C 104	1	21-80342B10	CAPACITOR	.1UF-20-50
C 105	1	21-80342B10	CAPACITOR	.1UF-20-50
C 106	1	21-80342B10	CAPACITOR	.1UF-20-50
C 107	1	21-80342B10	CAPACITOR	.1UF-20-50
C 108	1	21-80342B10	CAPACITOR	.1UF-20-50
C 109	1	23-80341B15	CAPACITOR	10UF-20-50
C 110	1	21-80342B11	CAPACITOR	22UF-20-50
C 111	1	21-80341B82	CAPACITOR	470PF-5-50
CR003	1	48-84463K02	DIODE	
CR004	1	48-84463K02	DIODE	

COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE

L1 L2 SEE BACK OF BOARD

SCOPE/DVM CONTROL BOARD (A7) (Cont)
RTC-1006A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value	Find No.	Qty. Req.	Part No.	Nomenclature	Part Value	Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
CR005	1	48-84463K02	DIODE		R 084	1	06-11009C80	RESISTOR	20K-5-1/4	TP007	1	09-80331A88	JACK	WHITE
CR006	1	48-84463K02	DIODE		R 085	1	06-10621D92	RESISTOR	110K-1-1/4	TP008	1	09-80331A88	JACK	WHITE
CR007	1	48-84463K02	DIODE		R 088	1	06-10621C91	RESISTOR	10K-1-1/4	TP009	1	09-80331A88	JACK	WHITE
CR008	1	48-84463K02	DIODE		R 089	1	06-11009C97	RESISTOR	100K-5-1/4	TP010	1	09-80331A88	JACK	WHITE
CR009	1	48-84463K02	DIODE		R 090	1	06-11009C99	RESISTORS	390-5-1/4	TP011	1	09-80331A88	JACK	WHITE
CR010	1	48-84463K02	DIODE		R 091	1	06-11009C39	RESISTORS	390-5-1/4	TP012	1	09-80331A88	JACK	WHITE
CR011	1	48-84463K02	DIODE		R 092	1	06-11009C71	RESISTOR	8.2K-5-1/4	U 001	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
CR012	1	48-84463K02	DIODE		R 093	1	06-11009C71	RESISTOR	8.2K-5-1/4	U 003	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
CR013	1	48-84463K02	DIODE		R 095	1	06-11009C97	RESISTOR	100K-5-1/4	U 004	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED
CR014	1	48-84463K02	DIODE		R 098	1	06-11009C73	RESISTOR	10K-5-1/4	U 005	1	51-82884L28	INTEGRATED CIRCUIT	
CR015	1	48-84463K02	DIODE		R 099	1	06-11009C57	RESISTOR	2.2K-5-1/4	U 006	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
CR016	1	48-84463K02	DIODE		R 100	1	06-11009C57	RESISTOR	2.2K-5-1/4	U 007	1	51-80345A09	AUDIO AMP	LM386N-1 SCREENED
CR017	1	48-84463K02	DIODE		R 101	1	06-11009C73	RESISTOR	10K-5-1/4	U 010	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED
CR018	1	48-84463K02	DIODE		R 103	1	18-83452F15	RESISTOR,VARIABLE	20K	U 011	1	51-05596E46	INTEGRATED CIRCUIT	
CR020	1	48-84463K02	DIODE		R 104	1	06-10621E85	RESISTOR	1M-1-1/4	U 012	1	51-82884L28	INTEGRATED CIRCUIT	
CR021	1	48-84463K02	DIODE		R 106	1	06-10621D03	RESISTOR	13K-1-1/4	U 013	1	51-82884L35	INTEGRATED CIRCUIT	
CR022	1	48-84463K02	DIODE		R 107	1	06-10621D03	RESISTOR	13K-1-1/4	U 017	1	51-82884L71	INTEGRATED CIRCUIT	
CR023	1	48-84463K02	DIODE		R 108	1	06-10621C77	RESISTOR	7.15K-1-1/4	U 019	1	51-80345A02	INTEGRATED CIRCUIT	CA3160E SCREENED
L 001	1	25-80342B79	COIL,TOROID		R 110	1	06-11009C86	RESISTOR	5.1K-5-1/4	U 020	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
L 002	1	25-80342B79	COIL,TOROID		R 111	1	06-11009C86	RESISTOR	5.1K-5-1/4	U 021	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
Q 003	1	48-80341A48	TRANSISTOR	MPS-U60 SCREENED	R 112	1	06-10621D48	RESISTOR	38.3K-1-1/4	U 022	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
Q 004	1	48-80341A47	TRANSISTOR	MPS-U10 SCREENED	R 113	1	06-10621C63	RESISTOR	5.11K-1-1/4	U 023	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
Q 005	1	48-80343B21	TRANSISTOR	2N4391 SCREENED	R 114	1	06-10621C24	RESISTOR	2K-1-1/4	U 024	1	51-05126M33	INTEGRATED CIRCUIT	
Q 006	1	48-80340B86	TRANSISTOR	MPS6520	R 115	1	06-10621E28	RESISTOR	255K-1-1/4	U 026	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
Q 007	1	48-80340B85	TRANSISTOR	MPS6519	R 116	1	06-10621D84	RESISTOR	90.9K-1-1/4	U 028	1	51-80396A13	INTEGRATED CIRCUIT	DG508CJ SCREENED
R 001	1	06-11009C56	RESISTOR	2K-5-1/4	R 117	1	06-10621C91	RESISTOR	10K-1-1/4	U 029	1	51-80340B02	INTEGRATED CIRCUIT	
R 002	1	06-11009C74	RESISTOR	11K-5-1/4	R 118	1	06-10621B98	RESISTOR	1.1K-1-1/4	U 030	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
R 003	1	06-11009C99	RESISTOR	120K-5-1/4	R 121	1	06-11009C65	RESISTOR	4.7K-5-1/4	U 034	1	51-82884L15	INTEGRATED CIRCUIT	
R 004	1	06-80396A63	RESISTOR	15.2K-1-1/8	R 122	1	06-11009C65	RESISTOR	4.7K-5-1/4	U 037	1	51-82884L15	INTEGRATED CIRCUIT	
R 005	1	18-83452F02	RESISTOR,VARIABLE	2K	R 123	1	06-80396A65	RESISTOR	221K-1-1/8	U 038	1	51-80252D01	INTEGRATED CIRCUIT	
R 006	1	06-80396A63	RESISTOR	15.2K-1-1/8	R 124	1	06-80396A61	RESISTOR	10.4K-1-1/8	U 040	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
R 007	1	18-83452F02	RESISTOR,VARIABLE	2K	R 125	1	06-80037G11	RESISTOR	2.7-5-1/2	U 041	1	51-82884L15	INTEGRATED CIRCUIT	
R 008	1	06-80396A64	RESISTOR	20K-1-1/8	R 126	1	06-10621A85	RESISTOR	75-1-1/4	U 042	1	51-82884L15	INTEGRATED CIRCUIT	
R 009	1	18-83452F17	RESISTOR,VARIABLE	50K	R 127	1	06-80396A72	RESISTOR	9.78K-1-1/8	U 043	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
R 010	1	06-11009C97	RESISTOR	100K-5-1/4	R 128	1	06-80396A68	RESISTOR	511K-1-1/8	U 044	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
R 011	1	06-11009C73	RESISTOR	10K-5-1/4	R 129	1	06-11009C45	RESISTOR	680-5-1/4	U 045	1	51-05596E46	INTEGRATED CIRCUIT	
R 012	1	06-11009C61	RESISTOR	3.3K-5-1/4	R 130	1	06-11009C56	RESISTOR	2K-5-1/4	U 046	1	51-82884L09	INTEGRATED CIRCUIT	
R 013	1	06-11009C66	RESISTOR	5.1K-5-1/4	R 131	1	06-11009C56	RESISTOR	2K-5-1/4	U 047	1	51-82884L15	INTEGRATED CIRCUIT	
R 014	1	06-11009C66	RESISTOR	5.1K-5-1/4	R 132	1	06-10621D28	RESISTOR	23.7K-1-1/4	U 048	1	51-82884L15	INTEGRATED CIRCUIT	
R 015	1	06-10621C24	RESISTOR	2K-1-1/4	R 133	1	06-10621C95	RESISTOR	11K-1-1/4	U 049	1	51-82884L15	INTEGRATED CIRCUIT	
R 016	1	06-10621E27	RESISTOR	249K-1-1/4	R 134	1	06-80396A62	RESISTOR	107K-1-1/8	U 050	1	51-05126M33	INTEGRATED CIRCUIT	
R 017	1	06-11009C49	RESISTOR	1K-5-1/4	R 135	1	06-11009C83	RESISTOR	27K-5-1/4	U 051	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
R 018	1	06-11009C73	RESISTOR	10K-5-1/4	R 136	1	06-80037G11	RESISTOR	2.7-5-1/2	U 052	1	51-82884L71	INTEGRATED CIRCUIT	
R 019	1	06-00124B38	RESISTOR	4.7M-5-1/4	R 137	1	06-80396A63	RESISTOR	15.2K-1-1/8	U 054	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED
R 020	1	06-11009C73	RESISTOR	10K-5-1/4	R 138	1	18-83452F02	RESISTOR,VARIABLE	2K	U 055	1	51-84561L06	INTEGRATED CIRCUIT	
R 030	1	06-11009D06	RESISTOR	220K-5-1/4	R 139	1	06-80396A64	RESISTOR	20K-1-1/8	U 056	1	51-05126M33	INTEGRATED CIRCUIT	
R 031	1	06-11009C97	RESISTOR	100K-5-1/4	R 140	1	06-11009C45	RESISTOR	680-5-1/4	U 058	1	51-05499E13	INTEGRATED CIRCUIT	
R 032	1	06-11009C91	RESISTOR	56K-5-1/4	R 141	1	06-11009C56	RESISTOR	2K-5-1/4	U 059	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED
R 033	1	06-11009C73	RESISTOR	10K-5-1/4	R 142	1	06-10621C27	RESISTOR	2.15K-1-1/4	U 060	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
R 034	1	06-11009C01	RESISTOR	10.5-1/4	R 143	1	06-10621C75	RESISTOR	6.81K-1-1/4	U 061	1	51-82884L02	INTEGRATED CIRCUIT	
R 035	1	06-10621D01	RESISTOR	12.4K-1-1/4	R 145	1	06-11009C65	RESISTOR	4.7K-5-1/4	U 062	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
R 036	1	06-10621C67	RESISTOR	5.62K-1-1/4	R 146	1	06-10621D21	RESISTOR	20K-1-1/4	U 063	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
R 037	1	06-11009C73	RESISTOR	10K-5-1/4	R 147	1	06-10621D25	RESISTOR	22.1K-1-1/4	U 064	1	51-82884L71	INTEGRATED CIRCUIT	
R 039	1	06-11009C73	RESISTOR	10K-5-1/4	R 148	1	06-10621D21	RESISTOR	20K-1-1/4	U 065	1	51-83629M28	INTEGRATED CIRCUIT	
R 040	1	06-11009C65	RESISTOR	4.7K-5-1/4	R 149	1	06-10621D21	RESISTOR	20K-1-1/4	VR002	1	48-83461E32	DIODE,ZENER	8.2V-5-5
R 041	1	06-11009C77	RESISTOR	15K-5-1/4	R 150	1	06-10621C91	RESISTOR	10K-1-1/4	VR003	1	48-83461E32	DIODE,ZENER	8.2V-5-5
R 042	1	06-11009C97	RESISTOR	100K-5-1/4	R 151	1	06-11009C73	RESISTOR	10K-5-1/4					
R 043	1	06-11009C97	RESISTOR	100K-5-1/4	R 152	1	06-11009C73	RESISTOR	10K-5-1/4					
R 044	1	06-11009C97	RESISTOR	100K-5-1/4	R 153	1	06-80396A63	RESISTOR	15.2K-1-1/8					
R 056	1	06-11009C71	RESISTOR	8.2K-5-1/4	R 154	1	18-83452F02	RESISTOR,VARIABLE	2K					
R 057	1	06-11009C73	RESISTOR	10K-5-1/4	R 155	1	06-80396A65	RESISTOR	221K-1-1/8					
R 060	1	06-11009C57	RESISTOR	2.2K-5-1/4	R 156	1	06-80396A61	RESISTOR	10.4K-1-1/8					
R 061	1	06-11009C65	RESISTOR	4.7K-5-1/4	R 157	1	06-10621A85	RESISTOR	75-1-1/4					
R 062	1	06-11009C65	RESISTOR	4.7K-5-1/4	R 159	1	06-185A73	RESISTOR	10K-5-1/8					
R 063	1	06-11009C66	RESISTOR	5.1K-5-1/4	R 160	1	06-11009C73	RESISTOR	10K-5-1/4					
R 064	1	06-11009C49	RESISTOR	1K-5-1/4	R 161	1	06-11009C68	RESISTOR	6.2K-5-1/4					
R 065	1	06-11009C86	RESISTOR	36K-5-1/4	R 162	1	06-10621D01	RESISTOR	12.4K-1-1/4					
R 066	1	06-11009D22	RESISTOR	1M-5-1/4	R 163	1	06-10621C71	RESISTOR	6.19K-1-1/4					
R 067	1	18-83452F14	RESISTOR,VARIABLE	10K	R 164	1	06-10621C83	RESISTOR	8.25K-1-1/4					
R 068	1	06-11009D22	RESISTOR	1M-5-1/4	R 165	1	06-10621C67	RESISTOR	5.62K-1-1/4					
R 069	1	06-11009D22	RESISTOR	1M-5-1/4	R 166	1	06-11009C65	RESISTOR	4.7K-5-1/4					
R 070	1	06-10621D88	RESISTOR	100K-1-1/4	R 167	1	18-83452F02	RESISTOR,VARIABLE	2K					
R 071	1	06-10621D88	RESISTOR	100K-1-1/4	R 168	1	18-83452F19	RESISTOR,VARIABLE	100K					
R 072	1	06-10621D88	RESISTOR	100K-1-1/4	R 169	1	06-11009C59	RESISTOR	2.7K-5-1/4					
R 073	1	06-10621E47	RESISTOR	402K-1-1/4	R 170	1	06-11009C65	RESISTOR	4.7K-5-1/4					
R 074	1	06-10621D33	RESISTOR	26.7K-1-1/4	R 171	1	06-11009C73	RESISTOR	10K-5-1/4					
R 075	1	06-80396A58	RESISTOR	100K-0.5-1/8	R 172	1	06-10621C96	RESISTOR	11.3K-1-1/4					
R 076	1	06-80396A58	RESISTOR	100K-0.5-1/8	R 173	1	06-11009C73	RESISTOR	10K-5-1/4					
R 077	1	06-11009D22	RESISTOR	1M-5-1/4	R 174	1	06-11009C73	RESISTOR	10K-5-1/4					
R 078	1	18-83452F14	RESISTOR,VARIABLE	10K	TP001	1	09-80331A88	JACK	WHITE					
R 079	1	06-11009D22	RESISTOR	1M-5-1/4	TP002	1	09-80331A88	JACK	WHITE					
R 080	1	06-11009D22	RESISTOR	1M-5-1/4</										