DM44 -- DIGITAL MULTIMETER

For the following TEKTRONIX® Oscilloscopes*

475 Serial Numbers B250000 - Up**
475A Serial Numbers B010100 - Up

This modification kit provides Parts and Instructions to install the DM44 - DIGITAL MULTIMETER.

The DM44 provides the following:

1) A Digital Readout to replace the function of the ten turn counting dial on the DELAY TIME POSITION Control.

2) A precision DC voltmeter with ranges from 0-200mV to 0-1200V in 5 Steps.

3) A precision ohmmeter with ranges from 0-200Ω to 0-20 Megohms in six decade steps.

4) A precision temperature probe with a range of -55 deg C to +150 deg C.

5) A 1/Time function for convenience in making frequency measurements with an accuracy of 2% or better.

All of the above features are included in a unit that mounts on top of the instrument inside the wraparound cover.

Power to operate the DM44 is derived from a regulated power supply that utilizes the Option 7 DC Inverter* Primary winding of the instrument power transformer.

* The DM44 operates on 115-230 VAC ONLY and CANNOT be used w/Option 7.

** 475's in the Serial Number range B071175 to B249999 use 040-0816-XX.

PARTS INCLUDED IN MODIFICATION KIT:

Ckt. No.	Quantity	Part Number	Description
	1 ea		Assembly, DELAY TIME POSITION control, consisting of:
R930	1 ea	311-1709-00	Resistor, var, 20k, 10 turn
	1 ea	198-3491-00	Cable, shielded, 0.8 ft, w/connectors
	1 ea	198-3160-00	Wire kit, consisting of:
	1 ea	-----	Cable, ribbon, 8 wires, 0.3 ft, w/connectors
	1 ea	-----	Cable, ribbon, 7 wires, 0.3 ft, w/connectors
	1 ea	-----	Cable, ribbon, 2 wires, 1.25 ft, w/connectors
	1 ea	-----	Cable, coax, white-gray, 1.7 ft and one wire, orange, 0.6 ft, w/two connectors in one holder
	1 ea	-----	Wire, 0.5 ft, white-brown, w/one connector
	1 ea	-----	Wire, 1.25 ft, white-yellow, w/one connector
	1 ea	003-0120-00*	Test Leads
	1 ea	016-0594-00	Pouch, accessory
	1 ea	070-2036-01	Manual, DM44 Service
	1 ea	070-2163-00	Manual, 475A DM44 Operators
	2 ea	131-0566-00	Connector, link, 0Ω
	1 ea	200-1722-00	Cover, Top, DM44
	1 ea	200-1723-00	Cover, front, instrument
	1 ea	210-0012-00[1]	Washer, potentiometer, 0.375 ID
	1 ea	210-0590-00[1]	Nut, 0.375-32 x 0.4375
	2 ea	210-0803-00[2]	Washer, flat, #6L
	3 ea	210-0938-00[3]	Washer, flat, 0.250 OD, 0.109 ID x 0.032
	1 ea	210-0978-00[1]	Washer, flat, 0.500 OD, 0.375 ID x 0.024
	3 ea	211-0008-00[3]	Screw, 4-40 x 0.250
	2 ea	212-0130-01	Screw, 8-32 x 0.625 Pan head
	2 ea	213-0146-00[2]	Screw, thread-forming, 6-20 x 0.312
C605	1 ea	281-0763-00	Capacitor, cer, 47pF 100V 10%
R370	1 ea	315-0102-00	Resistor, cmpsn, 1kΩ 0.250W 5%
R605	1 ea	315-0203-00	Resistor, cmpsn, 20kΩ 0.250W 5%
R923	1 ea	316-0100-00	Resistor, cmpsn, 10Ω 0.250W 5%
R1136	1 ea	321-0612-07	Resistor, prec 500Ω 0.125W 0.1%, T9
R1133	1 ea	321-0928-07	Resistor, prec 250Ω 0.125W 0.1%, T9
R1137	1 ea	321-0928-07	Resistor, prec 250Ω 0.125W 0.1%, T9
	1 ea	337-2079-00	Shield, electrical
	1 ea	348-0063-00	Grommet, plastic, 0.5 ID
	1 ea	366-1563-00	Knob, charcoal gray
	1 ea	437-0174-02	Cabinet, wraparound
	1 ea	672-0453-00	Circuit Board, Power Supply
	1 ea	672-0591-30	Circuit Board, DM44 main, w/010-6430-00 Probe

* A deluxe set of Test Leads is available as an optional accessory; order 012-0427-00.

[1]Mounting Hardware for 475/475A DELAY TIME POSITION control, R930.
[2]Mounting Hardware for DM44 Main Assembly.
[3]Mounting Hardware for DM44 Power Supply.

INSTRUCTIONS:

DISCONNECT THE INSTRUMENT FROM ITS POWER SOURCE!

( ) 1. Unwrap the power cord from the instrument feet.

( ) 2. Remove the four rear feet and two ring assembly mounting screws, and remove the ring assembly.

( ) 3. Slide the wraparound cover to the rear to remove it.

( ) 4. Remove the six CRT neck-shield mounting screws, remove and discard the shield, but save the hardware.

A. TO REPLACE DELAY TIME POSITION POTENTIOMETER, R930

( ) 1. Remove the DELAY TIME POSITION ten-turn-counting dial and the potentiometer mounting hardware.

( ) 2. Disconnect P930 from the Interface Board.

( ) 3. Replace DELAY TIME POSITION R930, a 2kΩ 10-turn variable resistor and cable,with the new R930, the 20kΩ 10-turn variable resistor w/cable from the kit, using the hardware indicated in Note 1 in the Parts List.

Connect the four-terminal connector holder to P930 on the Interface Circuit Board, and the three-terminal connector holder to J1110 on the Timing Circuit Board. Match the arrows on the holders with the arrows on the circuit boards.

( ) 5. Install the charcoal knob from the kit in place of the ten-turn-counting dial removed in Step 1.

B. TO INSTALL DM44 POWER SUPPLY*

( ) 1. Install the 1/2-inch rubber grommet from the kit in the hole in the bulkhead behind the power transformer.

The DM44 Power Supply mounts on the CRT side of the bulkhead next to the power transformer.

Position the DM44 Power Supply with the open side of the 'U' shaped channel toward the top of the instrument.

( ) 2. Thread the five-conductor ribbon cable without connectors through the grommet in the bulkhead, and dress the wires to the outside edge of the power transformer. Fasten the power supply to the bulkhead using the hardware indicated in Note 3 in the Parts List. Install the two top screws from the CRT side.

* Since the design of the 475, 475A Oscilloscopes provides for only one option to operate from the special primary winding, you must choose either Option 7 (DC Power Operation) or Digital Multimeter, DM44.

( ) Install the third power supply mounting screw, from the power transformer side, into the pem nut on the lower back edge of the power supply. Install bottom screw with a long magnetic screwdriver.

Solder the Power Supply wires to T1400 terminals as follows: SEE Fig. 1.

( ) 3. White-brown wire to terminal 10.

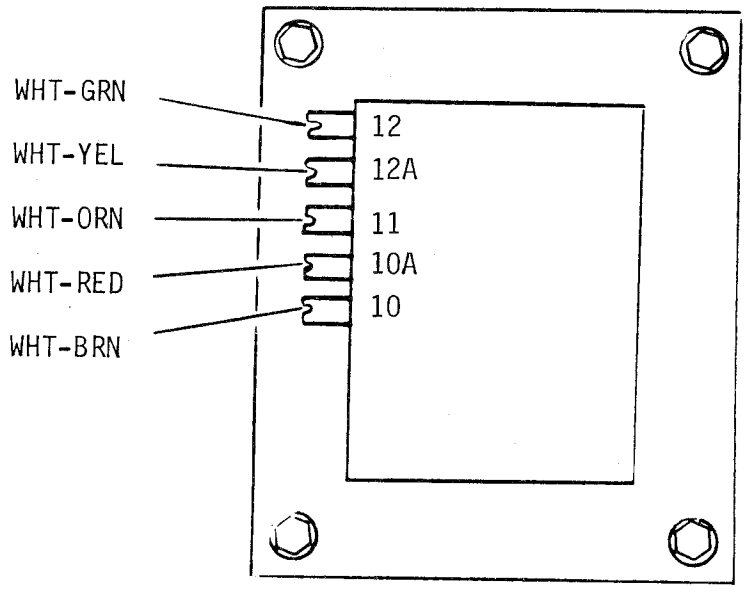
( ) 4. White-red wire to terminal 10A.

( ) 5. White-orange wire to terminal 11.

( ) 6. White-yellow wire to terminal 12A.

( ) 7. White-green wire to terminal 12.

( ) 8. The five-wire ribbon cable with connectors and holder will be connected in a later step.



POWER TRANSFORMER T1400

FIG. 1

C. TO MODIFY A-B TRIGGER GENERATOR AND Z AXIS LOGIC CIRCUIT BOARD. SEE Fig. 2.

( ) 1. Solder one lead of R605, a 20kΩ 0.25W resistor, to the collector run of Q596.

( ) 2. Solder one lead of C605, a 47pF ceramic capacitor, to the other lead of R605 (above the circuit board). Solder the other lead of C605 to ground.

( ) 3. Solder the bare end of the white-orange wire (w/white-gray coax in 2-connector holder) to the junction of C605 and R605. Coax will be connected later (in step F-2).

( ) 4. Solder the red wire of the two-wire ribbon cable to +5V at R812, a 3.3kΩ 0.25W resistor, and solder the brown wire to +15V at R788, a 4.7kΩ 0.25W resistor. (The other end of the cable will be connected to P3306 in Step H-8.)

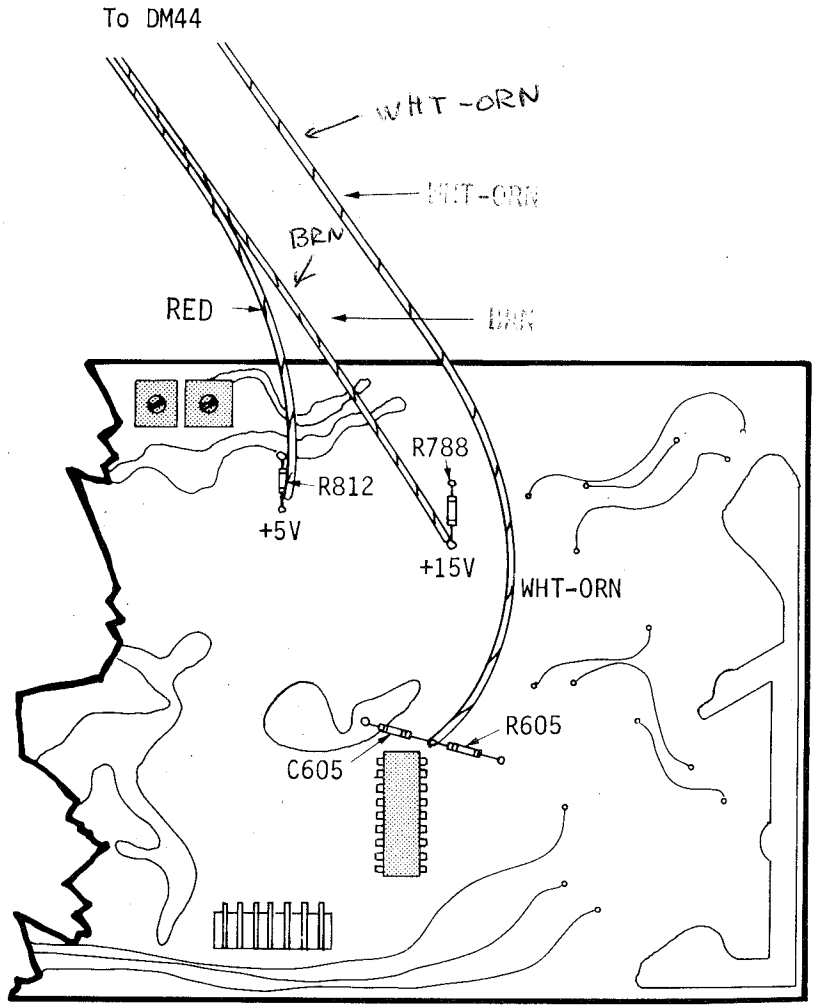


Fig. 2. PARTIAL TRIGGER GENERATOR AND Z-AXIS CIRCUIT BOARD.

D. TO MODIFY A-7 TIMING CIRCUIT BOARD: SEE Fig. 3.

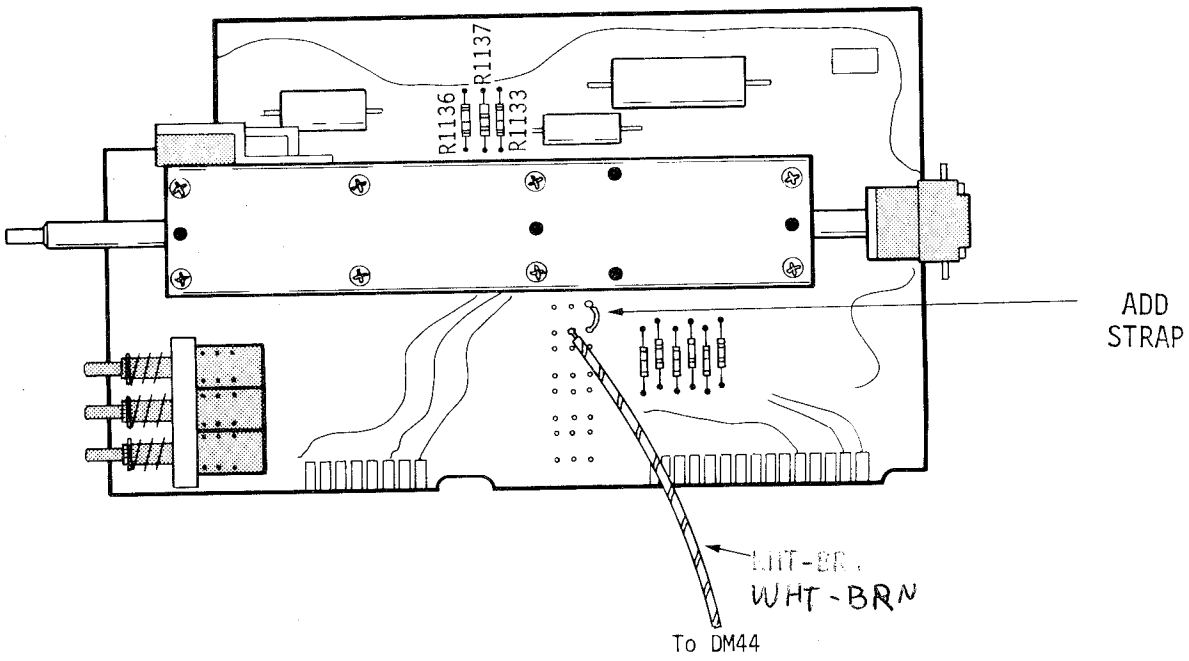
Make the following changes on the Timing Circuit Board:

1. Replace R1133 and R1137, two 1kΩ 0.125W resistors, with the two 250Ω 0.125W resistors from the kit.

2. Replace R1136, a 2kΩ 0.125W resistor, with the 500Ω 0.125W resistor from the kit.

3. Solder the six-inch white-brown wire w/single connector holder to the Timing circuit board as shown in Fig. 3. It will be connected to the DM44 in a later step. Install a piece of wire between contacts on the circuit board as shown in Fig. 3.

PARTIAL TIMING CIRCUIT BOARD
FIG. 3



E. TO MODIFY VERTICAL MODE GAIN SWITCH CIRCUIT BOARD.

( ) 1. Dress the white-yellow wire through the plastic grommet in the bulkhead (just forward of the DM44 Power Supply), across the CRT and through the grommet in the bulkhead behind the Vertical Mode-Gain Switch circuit board.

Remove Vertical Preamp circuit board to gain access to the Vertical Mode-Gain Switch circuit board as follows:

( ) 2. Remove both Vertical POSITION control shafts. This requires a 0.050-inch Allen wrench to loosen the front setscrew in each coupling.

( ) 3. Remove the TRIG VIEW, 100 OR 20 MHz BW control shafts. Loosen the coupling setscrew with a 0.050-inch Allen wrench.

( ) 4. Remove the INVERT control extension shaft. Insert a scribe or small screwdriver between the end of the white plastic switch shaft and the inside end of the black plastic extension shaft and pry gently.

( ) 5. Disconnect eight coaxial cables from the front and back sides of the board and confirm color coding of each cable with its jack number in the following list. Record any exceptions to this procedure for reference when reassembling.

a) Cable to J380 is white with black and brown stripes.

b) Cable to J385 is white with black and red stripes.

c) Cable to J399 is white with a yellow stripe.

d) Cable to J430 is white with a violet stripe.

e) Cable to J405 is white with a blue stripe.

f) Cable to J410 is white with a green stripe.

g) Cable to J400 (back of board) is white with a brown stripe.

h) Cable to J349 (bottom, back of board, rear of INVERT switch) is white with a red stripe.

( ) 6. Disconnect the delay-line connection on the Vertical Preamp board. This requires the use of a soldering iron (a 40 to 60-Watt iron works best) to unsolder the delay-line ground connection.

( ) 7. Unsolder the capacitor lead at the Vertical Preamp board (bottom, back of board, between the rear of the INVERT switch and J349) using a 15-Watt soldering iron.

( ) 8. At the Vertical Preamp board unsolder one end of a wire braid that connects between the bottom of the Vertical Preamp and the Main Interface board under the high-voltage shield.

( ) 9. Disconnect three ribbon-cables from the Vertical Mode-Gain Switch board and confirm the number of wires in each cable with its plug number in the following list. Note locations of cables to facilitate correct reinstallation.

a) Disconnect a six-wire cable from P329.

b) Disconnect a seven-wire cable from P160.

c) Disconnect a ten-wire cable from P260.

( ) 10. At a feed-through terminal near U120 and U220, unsolder two 30Ω resistors that connect each attenuator to the Vertical Preamp board. Loosen attenuator screws for clearance if necessary.

( ) 11. Remove the Vertical Preamp board mounting-hardware at eight locations described in the following list. A small Phillips screwdriver is required.

a) Remove the screw, cabinet-ground spring, and hexagonal post at center of the board.

b) Remove two screws that mount the board to two long posts on the main chassis near top and bottom center of the Vertical Preamp board.

c) Remove three screws that mount the board to the rear preamp bracket (at left edge of board).

d) Remove two screws at the right edge of the board (one screw mounts each attenuator chassis to the board).

( ) 12. Remove the Vertical Preamp circuit board, using care to prevent damage to any of the components as the board is removed.

( ) 13. Solder the white-yellow wire to the Vertical Mode-Gain Switch circuit board as shown in Fig. 4.

( ) 14. Reinstall the Vertical Preamp circuit board by performing steps 2 through 12 in reverse order.

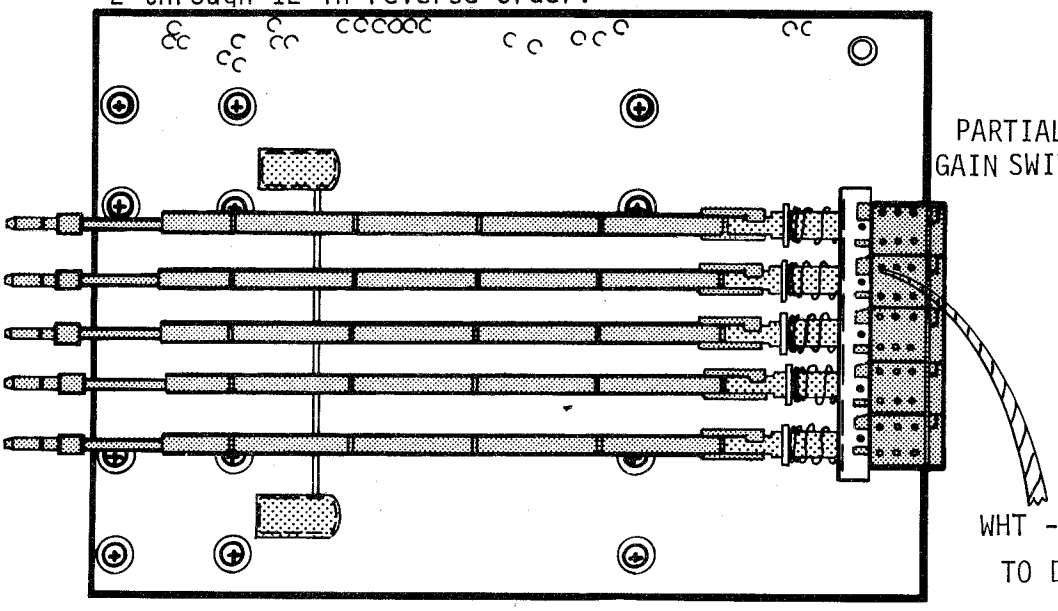


FIG. 4
PARTIAL VERTICAL MODE
GAIN SWITCH CIRCUIT BOARD

F. TO MODIFY A-3 VERTICAL PREAMP CIRCUIT BOARD. SEE Fig. 5.

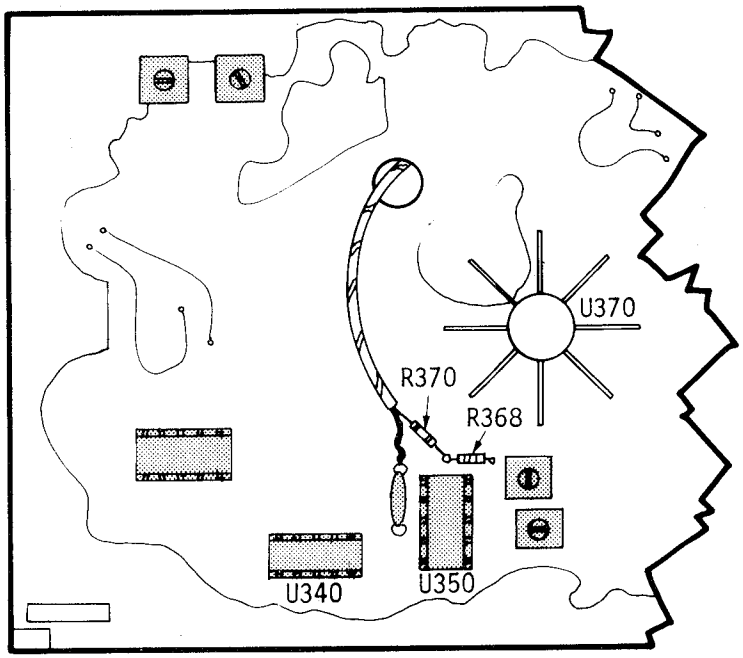
( ) 1. Solder one lead of R370, a 1kΩ 0.25W resistor, to R368, a 374Ω resistor.

( ) 2. Dress the white-gray coax (Step C-3) through the plastic grommet in the bulkhead (just forward of the DM44 Power Supply), across the CRT, through the grommet in the bulkhead behind the Vertical Mode-Gain Switch circuit board, and through the hole in the Vertical Preamp circuit board.

Solder the center conductor to the end of R370 and the shield to ground at C437.

PARTIAL VERTICAL PREAMP
CIRCUIT BOARD

FIG. 5



G. TO MODIFY MAIN INTERFACE CIRCUIT BOARD. SEE Fig. 6.

( ) 1. Replace R923, a 10Ω 0.25W resistor, with a link connector (dummy resistor) from the kit.

( ) 2. Replace C923, a 1µF capacitor, with a link connector from the kit.

( ) 3. Remove Q926 and bend the Gate lead that was connected to R923 out and reinstall Q926.

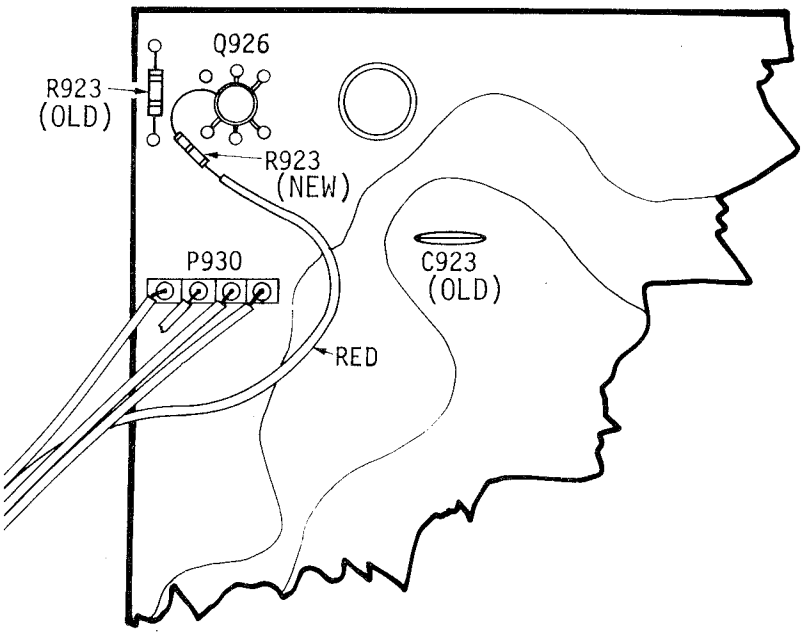
( ) 4. Cut both leads of the new R923 (the 10Ω 0.25W resistor from the kit) to about 3/8 on an inch.

( ) 5. Solder one end of R923 to the red wire in the ribbon cable going to P930.

( ) 6. Solder the other end of R923 to the gate lead of Q926.

PARTIAL MAIN INTERFACE CIRCUIT BOARD

FIG. 6



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H. TO INSTALL DM44 ASSEMBLY

REFER TO FIG. 7 WHILE PERFORMING STEPS H-3 THRU H-10.

( ) 1. Dress the five-wire ribbon cable, from the Power Supply, through the plastic grommet in the rear mounting plate of the DM44 assembly.

The front end of the DM44 assembly fits in the slot in the edge of the front casting.

( ) 2. Fasten the rear end of the DM44 assembly to the edge of the bulkheads using the hardware indicated in Note 2 in the Parts List.

( ) 3. Connect the power supply cable to P3476. Match the arrow on the holder with the arrow on the circuit board.

(✓) 4. Remove the jumper cable connected between pins 2 and 3 of J1120 on the on the Timing circuit board.

(✓) 5. Install the seven-wire ribbon cable (from the kit) between J1120 on the Timing circuit board and P3255 on the DM44 assembly.

(✓) 6. Install the eight-wire ribbon cable (from the kit) between J1130 on the Timing circuit board and pins 1 through 8 of P3306 on the DM44 assembly.

(✓) 7. Connect the two-wire ribbon cable to pins 9 & 10 of P3306 with the brown wire connected to pin 9 and the red wire connected to pin 10.

(✓) 8. Connect the white-yellow wire to P3215. —

(✓) 9. Connect the white-orange wire and the white-gray coax, in the two-connector harmonica, to P3201.

(✓) 10. Connect the white-brown wire from the Timing circuit board to P3227. —

( ) 11. Install the new CRT neck shield, from the kit, using the hardware from the old shield.

Refer to the Service Manual and check Calibration and adjust as necessary.

I. TO INSTALL NEW WRAPAROUND COVER

( ) 1. Slide the wraparound cover over the instrument, being careful not to bump any components and seat the front edge of the cabinet in the groove in the front casting.

( ) 2. Reinstall the cabinet retaining ring and the hardware removed in Step 2.

( ) 3. Install the plastic cover and accessory pouch on top of the instrument over the Digital Multimeter, using the remaining 8-32 x 0.625 inch screws from the kit.

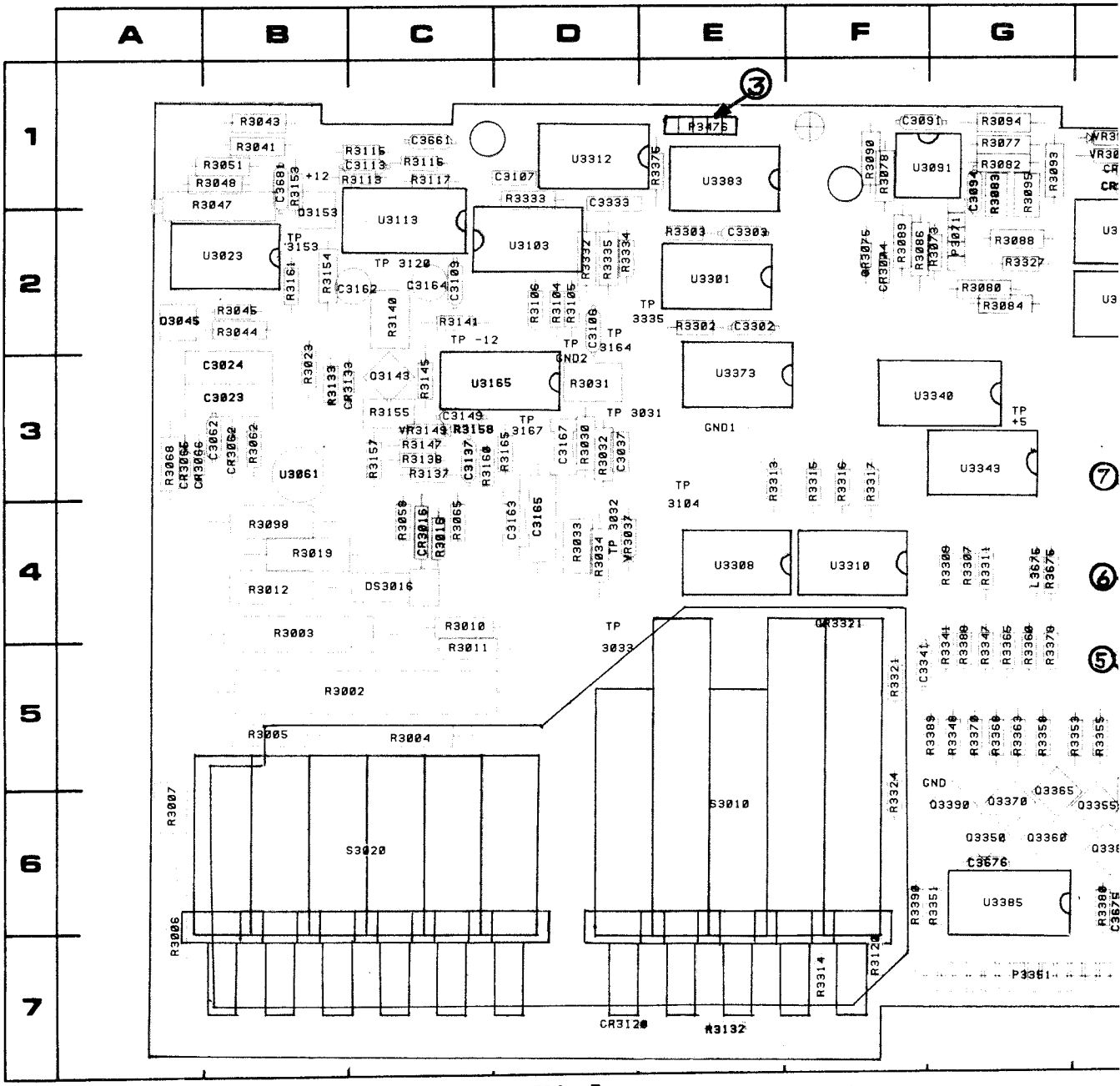

FIG. 7 Main board component locations

(Numbers in circles refer to the appropriate steps in section H.)

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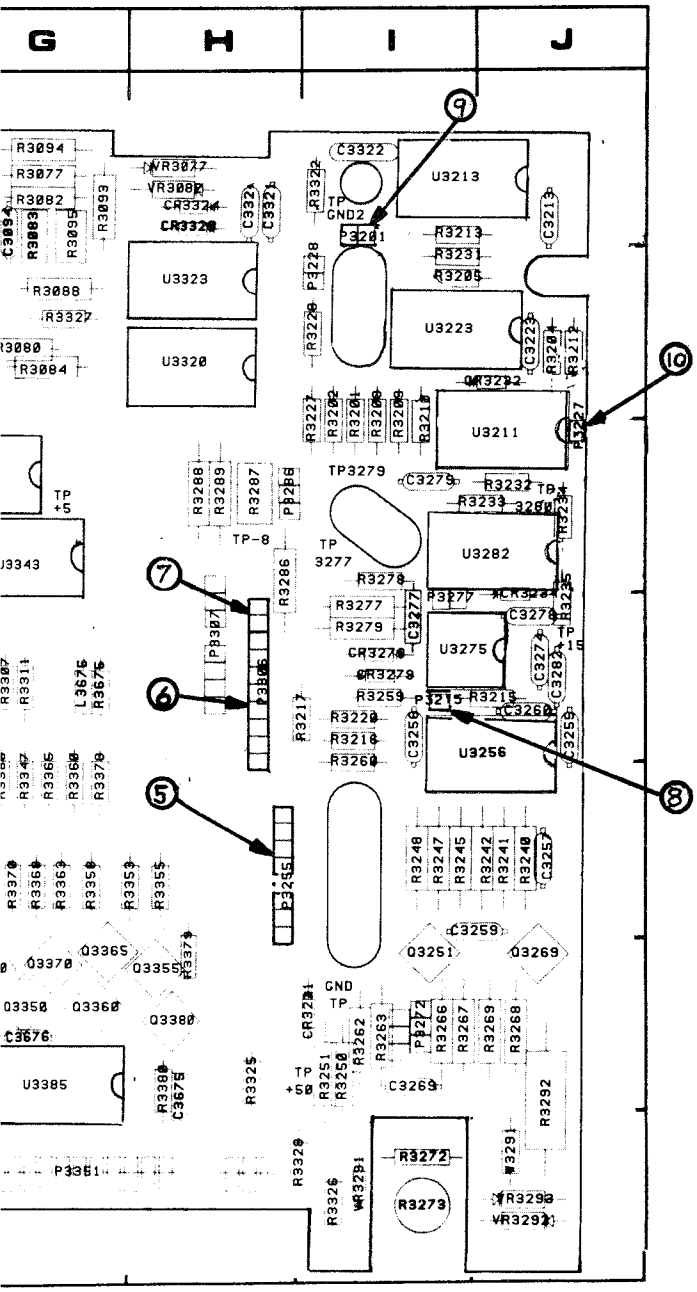

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C3023	3B	DS3016	4C	R3062	3B	R3233	3J	R3365	5G
C3024	3B	L3675	4G	R3065	4C	R3234	3J	R3368	5G
C3037	3D			R3068	3A	R3235	4J	R3370	5G
C3062	3B	P3071	2G	R3073	2G	R3240	5J	R3375	1E
C3091	1F	P3201	1I	R3077	1G	R3241	5J	R3378	5G
C3094	1G	P3215	4I	R3078	1F	R3242	5J	R3379	6H
C3106	2D	P3227	3J	R3080	2G	R3245	5I	R3380	6H
C3107	1D	P3228	2I	R3082	1G	R3247	5I	R3388	5G
C3109	2C	P3255	5H	R3083	1G	R3248	5I	R3389	5F
C3113	1C	P3272	6I	R3084	2G	R3250	6I	R3390	6F
C3137	3C	P3277	4I	R3086	2F	R3251	6I	R3675	4G
C3149	3C	P3286	3H	R3088	2G	R3259	4I		
C3162	2B	P3306	4H	R3089	2F	R3260	4I	S3010	6E
C3163	4D	P3307	4H	R3090	1F	R3262	6I	S3020	6C
C3164	2C	P3351	7G	R3093	1G	R3263	6I		
C3165	4D	P3476	1E	R3094	1G	R3266	6I	TP3031	3D
C3167	3D			R3095	1G	R3267	6I	TP3032	4D
C3213	1J	Q2632	1C	R3098	4B	R3268	6J	TP3033	4D
C3223	2J	Q2634	2D	R3104	2D	R3269	6J	TP3104	3E
C3255	4J	Q2636	1D	R3105	2D	R3272	7I	TP3120	2C
C3256	4I	Q2638	2D	R3106	2D	R3273	7I	TP3153	2B
C3257	5J	Q3045	2A	R3113	1C	R3277	4I	TP3164	2D
C3259	5I	Q3143	3C	R3115	1C	R3278	3I	TP3167	3D
C3260	4J	Q3153	1B	R3116	1C	R3279	4I	TP3277	3I
C3269	6I	Q3251	6I	R3117	1C	R3286	3H	TP3279	3I
C3274	4J	Q3269	6J	R3120	7F	R3287	3H	TP3280	3J
C3277	4I	Q3350	6G	R3132	7E	R3288	3H	TP3292	6H
C3278	4J	Q3355	6H	R3133	3B	R3289	3H	TP3335	2E
C3279	3I	Q3360	6G	R3137	3C	R3292	6J		
C3282	4J	Q3365	6G	R3138	3C	R3302	2E	U3023	2B
C3302	2E	Q3370	6G	R3140	2C	R3303	2E	U3061	3B
C3303	2E	Q3380	6H	R3141	2C	R3307	4G	U3091	1F
C3321	1H	Q3390	6G	R3145	3C	R3309	4G	U3103	2D
C3322	1I			R3147	3C	R3311	4G	U3113	2C
C3324	1H	R3002	5B	R3153	1B	R3313	3E	U3165	3C
C3333	1D	R3003	4B	R3154	2B	R3314	7F	U3211	3J
C3341	5F	R3004	5C	R3155	3C	R3315	3F	U3213	1I
C3661	1C	R3005	5B	R3157	3C	R3316	3F	U3223	2I
C3675	6H	R3006	6A	R3158	3C	R3317	3F	U3256	4J
C3676	6G	R3007	6A	R3160	3C	R3321	5F	U3275	4I
C3681	1B	R3010	4C	R3161	2B	R3322	1I	U3282	3J
		R3011	5C	R3165	3D	R3324	6F	U3301	2E
		R3012	4B	R3201	2I	R3325	6H	U3308	4E
CR3016	4C	R3016	4C	R3202	2I	R3326	7I	U3310	4F
CR3062	3B	R3019	4B	R3204	2J	R3327	2G	U3312	1D
CR3065	3A	R3023	3B	R3205	2I	R3328	7I	U3320	2H
CR3066	3A	R3030	3D	R3208	2I	R3332	2D	U3323	2H
CR3074	2F	R3031	3D	R3209	2I	R3333	1D	U3340	3G
CR3075	2F	R3032	3D	R3210	2I	R3334	2D	U3343	3G
CR3120	7D	R3033	4D	R3212	2J	R3335	2D	U3373	3E
CR3133	3B	R3034	4D	R3213	1I	R3341	5G	U3383	1E
CR3221	6I	R3041	1B	R3215	4J	R3347	5G	U3385	6G
CR3232	2J	R3043	1B	R3216	4I	R3348	5G		
CR3234	3J	R3044	2B	R3217	4H	R3351	6G	VR3037	4D
CR3278	4I	R3045	2B	R3220	4I	R3353	5G	VR3077	1H
CR3279	4I	R3047	1B	R3227	2I	R3355	5H	VR3082	1H
CR3320	1H	R3048	1B	R3228	2I	R3358	5G	VR3149	3C
CR3321	4F	R3051	1B	R3231	2I	R3360	5G	VR3291	7I
CR3324	1H	R3058	4C	R3232	3J	R3363	5G	VR3292	7J
								VR3293	7J
								W3291	7J