



040-0838-02

M41184

DM44 - DIGITAL MULTIMETER

For the following TEKTRONIX® Portable Storage Oscilloscopes

Type 464 Serial Numbers B050102 - UP

Type 466 Serial Numbers B050297 - 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 five steps.
- 3) A precision ohmmeter with ranges of 0-200 Ω to 0-200M Ω in six steps.
- 4) A precision temperature probe with a range of -55°C to +150°C.

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

Power to operate the DM44 is derived from a regulated power supply that utilizes the special primary winding of the instrument power transformer.

The 464 and 466 DM44 operates on 115-230 VAC ONLY and CANNOT be used with Option 7.

PARTS INCLUDED IN MODIFICATION KIT:

Ckt. No.	Quantity	Part Number	Description
	1 pr	003-0120-00*	LEAD, TEST, PAIR
	1 ea	016-0594-00	POUCH, ACCESSORY:W/HARDWARE
	1 ea	070-2036-01	MANUAL, DM44 SERVICE
	1 ea	070-2037-00	MANUAL, 464/466 DM44 OPERATORS
	0.125 ft	162-0503-00	INSUL SLVG, ELECTRICAL
	1 ea	198-3162-00	WIRE SET, (SEE NEXT PAGE)
	1 ea	200-1722-00	COVER, SCOPE, DM44
	1 ea	200-1723-00	COVER, SCOPE, FRONT W/DM44
	1 ea	210-0590-00 ¹	NUT, HEX, 0.375 X 0.438
	2 ea	210-0803-00 ²	WASHER, FLAT, 0.15 ID X 0.375 OD
	1 ea	210-0840-00 ¹	WASHER, FLAT, 0.39 ID X 0.562 OD
	2 ea	210-0938-00 ³	WASHER, FLAT, 0.109 ID X 0.25 OD
	1 ea	210-0978-00 ¹	WASHER, FLAT, 0.375 ID X 0.50 OD
	2 ea	211-0008-00 ³	SCREW, MACHINE, 4-40 X 0.25
	2 ea	212-0130-01	SCREW, MACHINE, 8-32 x 0.625
	2 ea	213-0146-00 ²	SCREW, TAPPING, 6-20 X 0.312 PAN HEAD
R1116	1 ea	311-1709-00	RESISTOR, VAR, 20K Ω 10 PCT 10-TURN
R918	1 ea	315-0203-00	RESISTOR, CMPSN, 20K Ω 5 PCT 0.25W
R1112	1 ea	321-0154-00	RESISTOR, FILM, 392 Ω 1 PCT 0.125W
R1113	1 ea	321-0252-00	RESISTOR, FILM, 4.12K Ω 1 PCT 0.125W
R1117	1 ea	321-0265-00	RESISTOR, FILM, 5.62K Ω 1 PCT 0.125W
R1142	1 ea	321-0612-07	RESISTOR, FILM, 500 Ω 0.1 PCT 0.125W
R1143,R1147	2 ea	321-0928-07	RESISTOR, FILM, 250 Ω 0.1 PCT 0.125W
	1 ea	348-0063-00	GROMMET, PLASTIC, 0.50 OD
	1 ea	366-1563-00	KNOB, GRAY
	1 ea	437-0176-00	CABINET, SCOPE
	1 ea	672-0482-00	CIRCUIT BOARD, POWER SUPPLY
	1 ea	672-0591-21	CIRCUIT BOARD, DM44 W/010-6430-00 PROBE

* A deluxe set of Test Leads is available, as an optional accessory. Order pn 012-0427-00.

¹Mounting hardware for R1116.

²DM44 Assembly mounting hardware.

³Power Supply Assembly mounting hardware.

(continued)

PARTS INCLUDED IN MODIFICATION KIT:

Quantity	Part Number	Description
1 ea	198-3162-00	WIRE SET, CONSISTING OF:
1 ea	——	8-wire ribbon cable, 6-inches long, w/two 8-contact harmonica-type plugs.
1 ea	——	7-wire ribbon cable, 6-inches long, w/two 8-contact harmonica-type plugs (pin 4 blank).
1 ea	——	3-wire ribbon cable, 24-inches long, w/one 1-contact and one 2-contact harmonica-type plugs on one end.
1 ea	——	2-wire ribbon cable, 6-inches long, w/one 2-contact harmonica-type plug.

INSTRUCTIONS:**WARNING**

Disconnect the instrument from all other electrical equipment and the power source before proceeding.

The following instructions are for use by qualified service personnel only. To avoid personal injury, do not perform any of the following procedures unless you are qualified to do so.

- () 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.
- A. TO INSTALL THE DM44 POWER SUPPLY***
- () 1. Install the 0.5-inch plastic grommet, from the kit, in the hole in the instrument chassis behind the power transformer.
 - () 2. Mount the DM44 Power Supply on the CRT side of the instrument chassis opposite the power transformer, with the open side of the 'U'-shaped channel toward the top of the instrument.
 - () 3. Thread the five-wire ribbon cable without connectors through the grommet in the instrument chassis, and dress the wires to the outside edge of the power transformer. Fasten the power supply to the instrument chassis using the hardware indicated in Note 3 in the Parts List. Install the mounting screws from the CRT side.
 - () 4. Solder the Power Supply wires to T1701 terminals as follows: (see Fig. 1)
 - () White-brown wire to terminal 10.
 - () White-red wire to terminal 11.
 - () White-orange wire to terminal 12.
 - () White-yellow wire to terminal 13.
 - () White-green wire to terminal 14.
 - () The five-wire ribbon cable with connectors and holder will be connected in a later step.

* Since the design of the 464, 466 Oscilloscope provides only one Option to operate from the special primary winding, you must choose either Option 7 (DC Power Operation) or Digital Multimeter.

INSTRUCTIONS (continued)

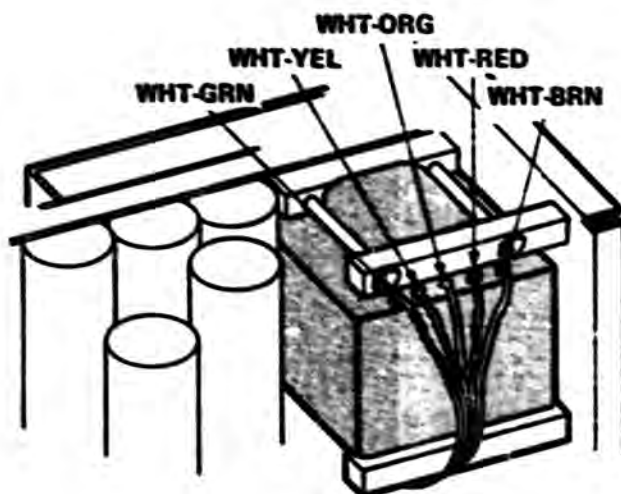


FIG. 1 POWER TRANSFORMER

8. TO MODIFY THE VERTICAL MODE SWITCHING CIRCUIT BOARD.
- () 1. Remove the Vertical Preamp circuit board as follows:
- () a. Disconnect and remove the following control extension shafts (held to switch or potentiometer shafts with 0.050" Allen setscrews):
- () Two vertical POSITION shafts.
 - () Two VAR VOLTS/DIV shafts.
 - () TRIG VIEW pushbutton shaft.
- () b. Disconnect the INVERT pushbutton extension shaft from the INVERT switch shaft. Insert a scribe or similar tool between the end of the white-plastic switch shaft and the inside of the black-plastic extension shaft and pry gently.

- () c. Remove the CH 1 and CH 2 attenuator shields (each is held with five screws and washers). Depending on the serial number of your instrument, one of the five mounting screws for each of the attenuator shields may have been replaced with a standoff, for a cabinet grounding clip.
 - () d. Unsolder the two resistors that connect the Vertical Preamp board to the Attenuator boards.
 - () e. Remove the five Vertical Preamp circuit board mounting screws. Depending on the serial number of your instrument, it may be necessary to remove one to three standoffs (for cabinet grounding clips) from the Vertical Preamp circuit board.
 - () f. Disconnect P96, P196, and P350 from the Vertical Mode Switching circuit board.
 - () g. Disconnect P1731 from the Interface circuit board.
 - () h. Lift the front of the Vertical Preamp circuit board and move it until the VERTICAL MODE Switch contacts on the Vertical Mode Switching circuit board are accessible.
- () 2. Make the following changes on the Vertical Mode Switching circuit board (See Fig. 2):
- () a. Add a 0.5 inch 26AWG bare wire between the contacts of the ALTERNATE Mode Switch as shown in Fig. 2.
 - () b. Thread the white-brown and white-red leads without connectors and the 23.5-inch three-wire ribbon cable (from the kit) through the grommets in the instrument chassis, located near the back of the front CRT shield. The ribbon wire should be positioned so the white-orange wire without a connector is located near the back of the Trigger Generator Sweep circuit board and the white-brown and white-red wires without connectors extend out the left side of the instrument chassis.
 - () c. Solder the white-brown lead of the three-conductor ribbon wire to a contact on the ALTERNATE Mode Switch as shown in Fig. 2.
- () 3. Reinstall the Vertical Preamp circuit board by performing step B-1 in reverse order.

INSTRUCTIONS (continued)

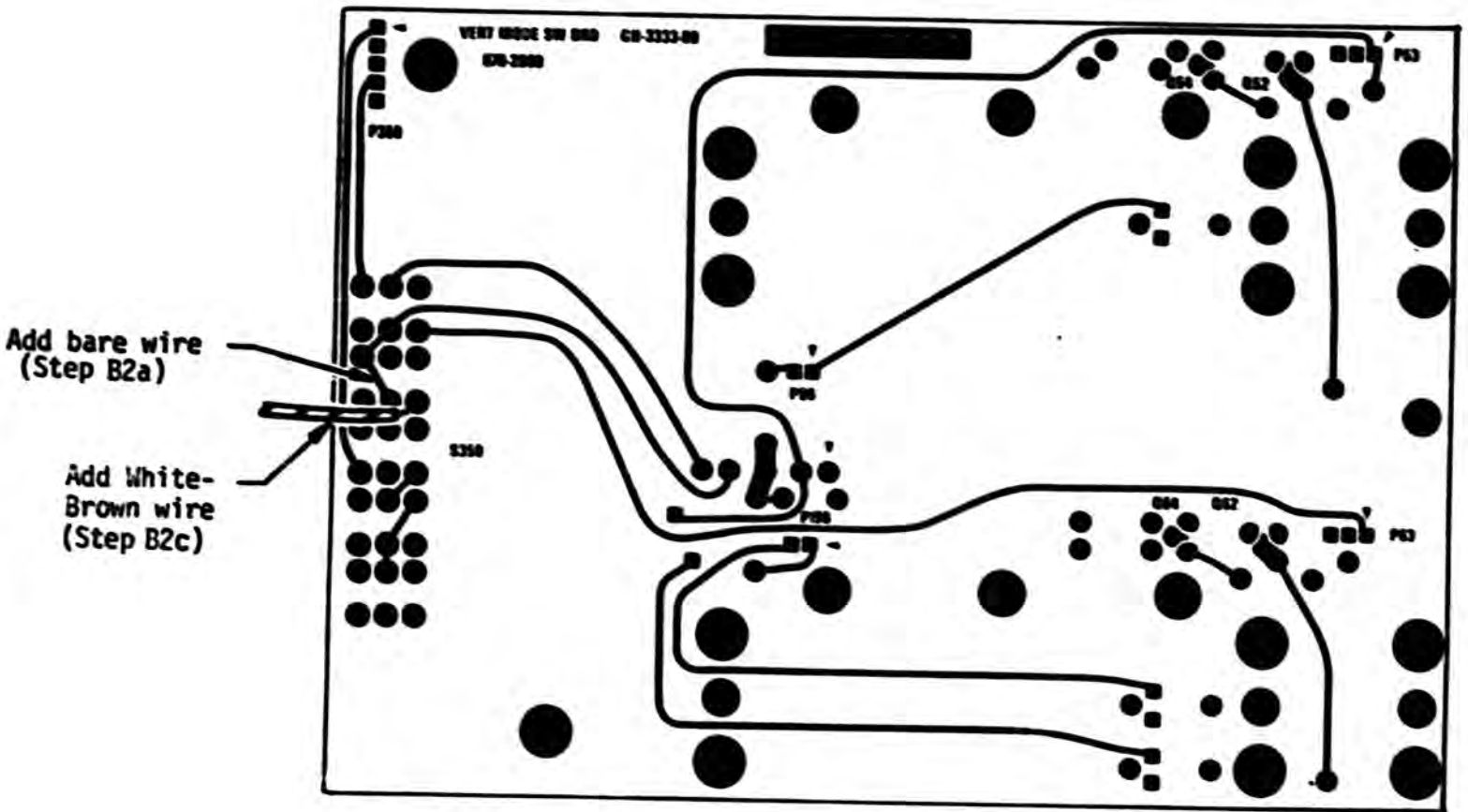


FIG. 2. VERTICAL MODE SWITCHING CIRCUIT BOARD

INSTRUCTIONS (continued)**C. TO MODIFY THE VERTICAL PREAMP CIRCUIT BOARD.**

- () 1. Solder the white-red wire from the three-wire ribbon cable added in step B-10 to the R364 (1.54k Ω) circuit board pad that connects to the collector of Q364.

D. TO MODIFY THE TRIGGER GENERATOR SWEEP CIRCUIT BOARD.

- () 1. Install R918, a 20k Ω resistor from the kit, on the back of the circuit board. Solder one end to the R916 circuit board pad that connects to the emitter of Q916. Solder the other end of R918 to the white-orange wire of the three-ribbon wire added in step 8-10.
- () 2. Remove C822, a 1 μ F electrolytic capacitor, located directly above Q866.
- () 3. Solder the white-red wire of the 6-inch two-wire ribbon cable (from the kit) to the +5V end of R866 on the component side of the circuit board.

E. TO MODIFY THE TIMING CIRCUIT BOARD.

Install the following parts (from the kit) on to the Timing circuit board (see Fig. 3):

- () 1. Replace R1117, a 562 Ω resistor, with a 5.62k Ω resistor.
- () 2. Replace and relocate R1113, a 49.9 Ω resistor, with a 4.12k Ω resistor with 0.75 inch of insulating sleeving on both leads.
- () 3. Replace R1112, a 196 Ω resistor, with a 392 Ω resistor.
- () 4. Install R1142, a 500 Ω resistor.
- () 5. Install R1143 and R1147, two 250 Ω resistors.
- () 6. Solder the white-brown wire of the 6-inch two-wire ribbon cable connected to the Trigger Generator Sweep circuit board to the unused +15V circuit board pad near R1147.

INSTRUCTIONS (continued)

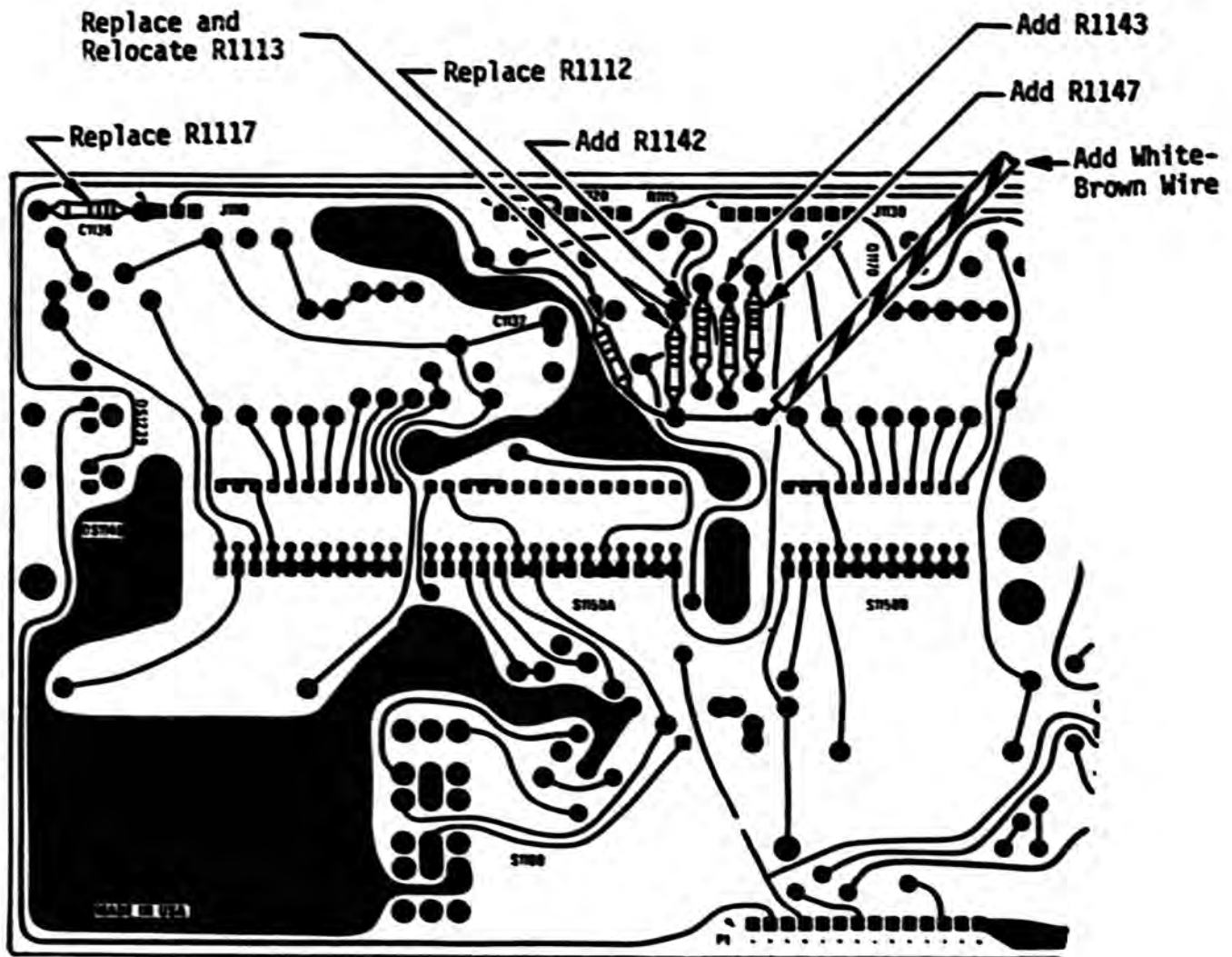


Fig. 3. Modifications to Timing Circuit Board.

INSTRUCTIONS (continued)**F. TO REPLACE THE DELAY TIME POSITION POTENTIOMETER AND DIAL.**

- () 1. Disconnect the three-wire ribbon cable w/black holder from J1110 on the Timing circuit board.
- () 2. Remove the DELAY TIME POSITION ten-turn counting dial and the potentiometer mounting hardware.
- () 3. Unsolder the three-wire ribbon cable from the DELAY TIME POSITION potentiometer making note of the wiring connections.
- () 4. Solder the three-wire ribbon cable, removed in the previous step, to the 20k Ω 10-turn potentiometer from the kit. The wiring connections on the new potentiometer should be the same as on the old potentiometer.
- () 5. Install the new potentiometer using the hardware indicated by Note 1 in the Parts List.
- () 6. Install the charcoal knob, from the kit, in place of the ten-turn counting dial removed in step 2, and connect the three-wire ribbon cable w/black holder to J1110 on the Timing circuit board. Match the arrow on the holder with the arrow on the circuit board.

G. TO INSTALL THE DM44 ASSEMBLY.

REFER TO FIG.4 ON PAGE 13 WHILE PERFORMING STEP G-2 THROUGH G-7.

- () 1. Place the DM44 assembly on top of the instrument with the DM44 front panel facing toward the front of the instrument.
- () 2. Dress the five-wire ribbon cable from the Power Supply, across the CRT neck, through the plastic grommet in the left side of the instrument chassis near the back of the front CRT shield, up through the left-hand slot in the rear mounting plate of the DM44 assembly, and connect it to P3476. Ensure the white-brown wire of the ribbon cable connects to G1 (square circuit board pad) of P3476.
- () 3. Dress the white-brown wire of the three-wire ribbon cable up through the center slot on the right hand side of the DM44 assembly and connect it to P3215 located between U3256 and U3275. (P3215 is not labeled on the circuit board.)

INSTRUCTIONS (continued)

- () 4. Dress the two-wire ribbon cable from the Timing and Trigger Generator Sweep circuit boards, up through the center slot on the right hand side of the DM44 assembly and connect it to pins 9 and 10 of P3306. The white-brown wire connects to pin 9 (+15V) and the white-red wire connects to pin 10 (+5V).
- () 5. Dress the white-red and white-orange wires of the three-wire ribbon cable up through the rear slot of the right hand side of the DM44 assembly and connect it to P3201. Ensure the white-red wire connects to pin 1 (square circuit board pad) of P3201.
- () 6. Replace the jumper connector on J1120 of the Timing circuit board with the seven-wire ribbon cable from the kit. Ensure the indicator arrow on the connector holder is adjacent to the indicator arrow on the circuit board. Dress the ribbon cable around the right edge of the DM44 assembly and connect it to P3255. Ensure the white-brown wire connects to pin 1 (square circuit board pad) of P3255.
- () 7. Connect the eight-wire ribbon cable, from the kit, to J1130 on the Timing circuit board. Ensure the indicator arrow on the connector holder is adjacent to the indicator arrow on the circuit board. Dress the ribbon cable around the right edge of the DM44 assembly and connect it to P3306. Ensure the white-brown wire connects to pin 1 (square circuit board pad) to P3306.
- () 8. Install the front end of the DM44 assembly in the slot in the edge of the front casting.
- () 9. Fasten the back end of the DM44 assembly to the edge of the instrument chassis using the hardware indicated by Note 2 in the Parts List.

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

H. TO INSTALL THE NEW OSCILLOSCOPE CABINET.

- () 1. Slide the new oscilloscope cabinet (from the kit) 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.

INSTRUCTIONS (continued)

- () 2. Reinstall the cabinet retaining ring and the hardware removed in step 1.
- () 3. Install the plastic cover (from the kit) on top of the instrument over the Digital Multimeter, using the 8-32 x 0.625-inch screws.

DCL:cp

DM44 Instruction

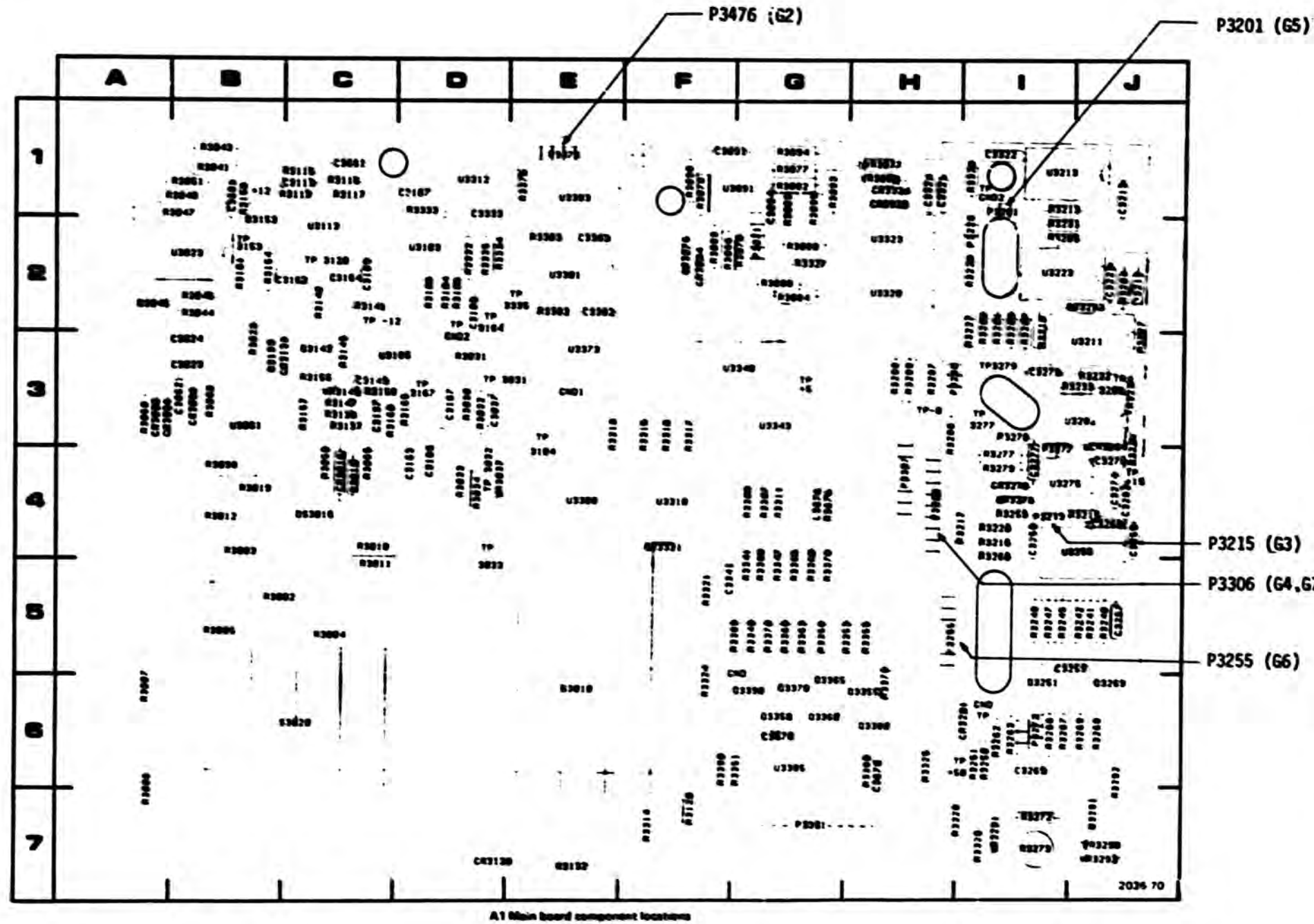


FIG. 4

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C3023	3B	D63018	4C	R3062	3B	P-233	3J	R3385	5G
C3024	3B	L3075	4G	R3065	4C	R3234	3J	R3388	5G
C3027	3D			R3068	3A	R3235	4J	R3370	5G
C3032	3B	P3071	2G	R3073	2G	R3240	5J	R3375	1E
C3031	1F	P3201	1I	R3077	1G	R3241	5J	R3378	5G
C3034	1G	P3215	4I	R3078	1F	R3242	5J	R3379	6H
C3108	2D	P3227	3J	R3080	2G	R3245	5I	R3380	6H
C3107	1D	P3228	2I	R3082	1G	R3247	5I	R3388	5G
C3109	2C	P3255	6H	R3083	1G	R3248	5I	R3389	5F
C3113	1C	P3272	4I	R3084	2G	R3250	6I	R3390	6F
C3157	3C	P3277	4I	R3086	3F	R3251	6I	R3675	4G
C3149	3C	P3280	3H	R3088	2G	R3253	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	Q3632	1C	R3098	6B	R3268	6J	TP3033	4D
C3223	2J	Q3634	2D	R3104	2D	R3269	6J	TP3104	3E
C3255	4J	Q3636	1D	R3105	2D	R3272	7I	TP3120	2C
C3256	4I	Q3638	2D	R3106	2D	R3273	7I	TP3153	3B
C3257	5J	Q3645	2A	R3113	1C	R3277	4I	TP3164	2D
C3259	5I	Q3143	3C	R3115	1C	R3278	3I	TP3167	3D
C3260	6I	Q3153	1B	R3116	1C	R3279	4I	TP3277	3I
C3269	4I	Q3251	6I	R3117	1C	R3286	3H	TP3279	3I
C3274	4J	Q3260	6J	R3120	7F	R3287	3H	TP3280	3J
C3277	4I	Q3350	6G	R3132	7E	R3288	3H	TP3282	6H
C3278	4I	Q3355	6H	R3133	3B	R3289	3H	TP3335	2E
C3279	3I	Q3360	6G	R3137	3C	R3292	6J		
C3282	4J	Q3365	6G	R3138	3C	R3293	2E	U3023	2B
C3283	2E	Q3370	6G	R3140	2C	R3293	2E	U3061	3B
C3283	2E	Q3380	6H	R3141	2C	R3297	4G	U3091	1F
C3321	1H	Q3380	6G	R3145	3C	R3299	4G	U3103	2D
C3322	1I			R3147	3C	R3311	4G	U3113	2C
C3324	1H	R3062	5B	R3153	1B	R3313	3E	U3165	3C
C3333	1D	R3063	4B	R3154	2B	R3314	7F	U3211	3J
C3341	5F	R3064	5C	R3155	3C	R3315	3F	U3213	1I
C3361	1C	R3065	5B	R3157	3C	R3316	3F	U3223	2I
C3375	6H	R3066	6A	R3158	3C	R3317	3F	U3256	4J
C3376	6G	R3067	6A	R3160	3C	R3321	5F	L3275	4I
C3381	1B	R3010	4C	R3161	2B	R3322	1I	U3282	3J
		R3011	5C	R3165	3D	R3324	6F	U3301	2E
		R3012	4B	R3201	2I	R3325	6H	U3306	4E
		R3016	4C	R3202	2I	R3326	7I	U3310	4F
		R3019	4B	R3204	2J	R3327	2G	U3312	1D
		R3023	3B	R3205	2I	R3328	7I	U3320	2H
		R3030	3D	R3208	2I	R3332	2D	U3323	2H
		R3031	3D	R3209	2I	R3333	1D	U3340	3G
		R3032	3D	R3210	2I	R3334	2D	U3343	3G
		R3033	4D	R3212	2J	R3335	2D	U3373	3E
		R3034	4D	R3213	1I	R3341	5G	U3383	1E
		R3041	1B	R3215	4J	R3347	5G	U3385	6G
		R3043	1B	R3216	4I	R3348	5G		
		R3044	2B	R3217	4H	R3351	6G	VR3037	4D
		R3045	2B	R3220	4I	R3353	5G	VR3077	1H
		R3047	1B	R3227	2I	R3355	5H	VR3082	1H
		R3048	1B	R3228	2I	R3358	5G	VR3149	3C
		R3051	1B	R3231	2I	R3360	5G	VR3291	7I
		R3058	4C	R3232	3J	R3363	5G	VR3292	7J
								VR3293	7J
								W3291	7J