571B DIGITAL CLOCK

OPERATING AND SERVICE MANUAL

HEWLETT hp PACKARD

HP 571B

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OPERATING AND SERVICE MANUAL

MODEL 571B
DIGITAL CLOCK

SERIALS PREFIXED: 330 -

This manual applies directly to hp Model 571B Digital Clocks with serial number prefix 330. With Changes provided in Appendix I, this manual also applies to older instruments with serial number prefix 219 or 037.

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Table 1-1. Specifications

INDICATION:	Six in-line life digital display tubes indicate to 23 hours, 59 minutes, 59 seconds. Twelve-hour format with indication to 11:59:59 available on special order.
TIME BASE:	Front panel TIME BASE switch selects: (1) 60 cps (50 cps available on special order), (2) COUNTER (1 pps from hp counters), (3) EXTERNAL (5 volt positive pulses, 200 μsec long. Input impedance approximately 500 ohms.
ACCURACY:	Time base accuracy ±0, -1 second. (If external print command is received at the time when a one-second step would occur, switching is delayed until after print is completed.)
PRINT CONTROL:	(1) Front panel switch selects PRINT CONTROL by CLOCK or EXTERNAL device. (2) PRINT RATE switch on front panel provides sampling rates of 1 per second, 6 per minute, 1 per minute, 6 per hour, and 1 per hour.
OUTPUT:	(1) All time digits provided for digital recording. (2) Hold-off signals for hp and Dymec Electronic Counters when PRINT CONTROL switch is in CLOCK position. (3) Relay operated SPDT dry contacts. Relay is energized at times determined by setting of RATE switch. Relay is de-energized: (a) by print action if clock controls sample rate, (b) after approximately 50 milliseconds if PRINT CONTROL switch is in EXT position.
TIME PRINT FORMAT:	Six time digits may be recorded in right-hand six columns of Model 561B with clock cable connected to J101 on Model 561B. With clock cable connected to J102, time digits will be recorded in the five left-hand columns of the Model 561B, without the tens-of-hours digit.
POWER INTERRUPTION ALARM:	Front panel warning light. Extinguished by switching OFF - SET - OPERATE switch to SET.
ACCESSORY SUPPLIED:	Lubrication kit hp stock number 6040-0019.
SHIPPING WEIGHT:	40 lb
POWER:	AC and dc supplied by Digital Recorder, approximately 15 watts.
OPTIONS:	For operation from 50 cps power lines, specify H01-571B. hp Model 571B installed in Model 561B/BR Digital Recorder, specify E01-561B/BR.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides complete instructions on installation, operation and maintenance of hp Model 571B Digital Clock, including options designated H01-571B and E01-561B/BR.

1-3. DESCRIPTION.

1-4. The clock extends the usefulness of the hp Model 561B Digital Recorder by adding time of day to printed records. The clock can be used to control sampling rate of the data source during long-term monitoring. Clock specifications are given in table 1-1.

1-5. OPERATION AND OUTPUT. The clock accumulates time information on a cascaded group of stepping switches. Front-panel digital-indicator tubes give time to the nearest second on a 24-hour basis. Time information is supplied electrically to the associated recorder and printed during each recorder printing cycle. The recorder columns which are used for time recording may be quickly selected by inserting the clock output connector into a second recorder connector. Spare contacts are provided on each clock stepping switch so that external circuits can be connected for any desired time-indicating or time-controlled scanning operation.

1-6. TIME BASE. The timing signal which drives the clock may be selected with a front-panel switch from one of the following: (1) power-line frequency, (2) 1-pps tick from an hp or Dymec electronic counter used with the recorder, or (3) externally supplied one-second tick.

1-7. DATE-SOURCE TIMING. The clock provides a timed source-disabling voltage which may be used to automatically control the sampling rate of hp or Dymec electronic counters. The disable voltage is removed at intervals selected by the PRINT RATE switch, permitting a single measurement to be completed by the counter. The counter reading and time of day are recorded and the counter is again disabled as the cycle repeats.

1-8. RATE RELAY. Relay contacts (SPDT) are available to provide timed contact closure for control of external devices. The relay is energized at intervals selected by the PRINT RATE switch.

1-9. OPTIONS. The Specification H01-571B is a standard Model 571B which has been modified for 50-cycle operation by the installation of a 50-cycle timing motor (B601). The Specification E01-561B/BR is a Model 561B/BR with a factory-installed Model 571B.

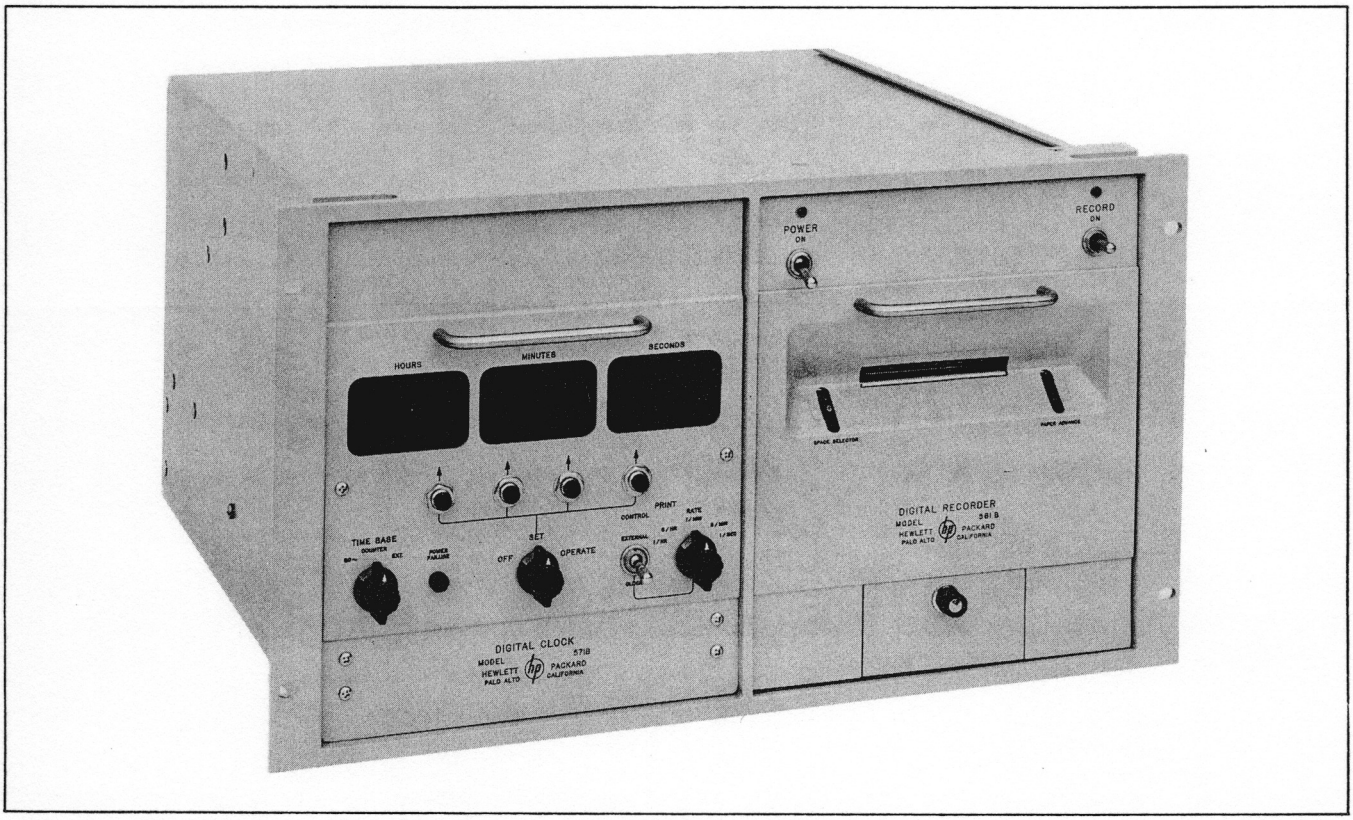

Figure 1-1. Model 571B Installed in Model 561B

SECTION II
PREPARATION FOR USE

2-1. INTRODUCTION.

2-2. This section tells how to install and connect the Model 571B Digital Clock. The clock is available either as a unit, ready for field installation in a digital recorder, or as a portion of a complete system factory-installed in the companion recorder (Specification E01-561B/BR). Field mounting instructions are given in paragraph 2-21. Electrical connections are described in paragraphs 2-23 through paragraph 2-33.

CAUTION

Ambient temperature during operation of the clock should normally not exceed limits of 32°F (0°C) to 122°F (50°C).

2-3. The following Hewlett-Packard instruments may require modification if used with the clock-recorder combination. Refer to paragraph 2-23 for modification instructions.

521D/E Electronic Counter
521DR/ER Electronic Counter
522B Electronic Counter
523C/D Electronic Counter
524C Electronic Counter
K07-561B Dual Input Coupler

2-4. INSPECTION, STORAGE, SHIPMENT.

2-5. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage. If the instrument is damaged or fails to meet specifications (Operating Check, Para 6-16), notify the carrier and the nearest Hewlett-Packard field office immediately (field offices listed at back of manual). Retain the shipping carton and padding material for the carrier's inspection. The field office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-6. Protect equipment during storage or shipment by using the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used for original factory packaging. Contract packaging companies can provide dependable custom packaging on short notice.

2-7. Environmental conditions during shipping and storage should normally be limited as follows:

a. Maximum altitude 20,000 feet.

b. Minimum temperature - 40°F (-40°C).

c. Maximum temperature 167°F (75°C).

2-8. 230-VOLT AND 50-CYCLE OPERATION.

2-9. Slide switch S604 permits operation from 115 or 230 volts ac. Set switch to expose correct marking for your line voltage.

2-10. To convert a standard 60-cycle clock for operation from a 50-cycle power line, install a 50-cycle timing motor (B601). Refer to the parts list in section VII for motor stock number.

2-11. COLUMN PROGRAMMING.

2-12. A short cable with a 100-pin plug (P605A-B) is used to connect the Model 571B to the Model 561B. The plug may be connected to either input connector (J101 or J102) of the Model 561B; the unused connector is then used for the normal Model 561B data input. With P605A-B inserted in J101, time is recorded in the six right-hand columns. With P605A-B inserted in J102, time is recorded in the five left-hand columns (tens-of-hours digit omitted).

2-13. EXTERNAL TIME BASE.

2-14. When an external 1 pps timing "tick" is used for clock timing, connection to the clock must be made to connector J604 through P604, pin 7 (see figure 6-8). The recorder must be connected to a data source such as an electronic counter or digital voltmeter, otherwise there is no dc return from the chassis to B minus in the clock and recorder. The 1-second timing pulse must be positive, at least 5 volts in amplitude, and 200 microseconds or longer in duration. The clock input impedance is approximately 500 ohms.

2-15. TIME OUTPUT.

2-16. Stepping-switch contact closure is available for external time indication. A unique closure pattern is produced for each second of the day. Extra banks of switch contacts are provided on each stepping switch (K602 through K606). The extra bank contacts (figure 6-6), represent the same numerical value as the corresponding contacts which are connected to the digital indicator tubes (DS602-DS607). Connection to these contacts must be made through added cabling between external equipment and the stepping switches.

2-17. RATE RELAY.

2-18. The SPDT contacts of the rate relay and the external one-second tick input are available at the 8-pin connector (J604) which fastens on the rear of the Model 561B. A mating plug for J604, P604 is supplied with the Model 571B; additional plugs are available (hp stock number 1251-0133). Connector wiring is shown in the schematic diagram, figure 6-8.

2-19. If PRINT CONTROL switch S621 is set to EXTERNAL, K620 is energized for about 50 milliseconds at the rate selected by PRINT RATE switch S620.

2-20. If PRINT CONTROL switch S621 is set to CLOCK, K620 is energized at the rate selected by PRINT RATE switch S620 but is kept energized until

Table 2-1. Materials for Installation

Quantity	Description	Quantity	Description
1	Right slide	9	8-32 x 3/8 inch binder head machine screw with lockwasher
1	Left slide		
2	Spacing rods	2	8-32 x 5/8 inch round head machine screw
2	Spacers, 5/32 inch	2	#8 internal lockwashers
1	Retainer bracket	4	#10 external lockwashers
1	Wall plate		
1	Lubrication kit bracket	4	10-24 x 1/2 inch flat head machine screw
1	Lubrication kit	4	#8 flat washer
2	Hole plugs, 5/8 inch	1	Cable Assembly
3	Cable clamp, 7/16 inch		
1	Cable lacing, 10 inch	1	Template

the start of the recorder printing cycle. Rate RELAY K620 may therefore remain energized for a considerable period of time if the data source produces print command pulses at a low rate. There is a small additional delay of about 20 milliseconds between the occurrence of the print command pulse from the data source and the drop-out of K620.

2-21. INSTALLATION.

2-22. All hardware and materials for mounting the clock in the recorder are supplied with the clock (see table 2-1). Proceed as follows for installation:

a. Remove cabinet or dust cover from recorder.

b. Remove printer mechanism. Disconnect cable so that printer mechanism can be completely separated from recorder.

c. Remove left panel by removing four #10 flat head screws along left side of panel frame, then four #10 round head screws in vertical center rib of frame. Do not replace the #10 screws.

d. Remove bottom plate from recorder.

e. Cut holes in left gusset of recorder as shown in figure 2-1. Remove cable clamp (if used) from inside of gusset before drilling to prevent damage. Use the template to accurately position the holes. Do not remove felt from inside of gusset.

f. Replace the four flat head screws along left side of panel frame with four 10-24 x 1/2 inch flat head machine screws. Place a single #10 external lockwasher under the head of each screw.

g. Assemble mounting hardware as shown in figure 2-2. Apply a light coat of paraffin along the upper edge of each slide for lubrication. Place the clock on the slides. Check to see that clock slides freely.

h. Insert slide assembly into the left-hand recorder compartment via the right-hand opening. Use the four 10-24 round head machine screws which originally supported the left recorder panel to fasten the wall plate in place; insert the screws from the left side of the middle rib of the frame. Attach wall plate to right slide using 8-32 x 5/8 inch round-head screws with 5/32 inch spacers. Attach left slide to gusset with 8-32 x 3/8 inch binder-head screws. Tighten the installation screws after adjusting the slides, so that the top edge of each slide is perpendicular to the vertical front face of the recorder frame and the bottom front corner of the tracks is about 1/16 inch above the recorder frame.

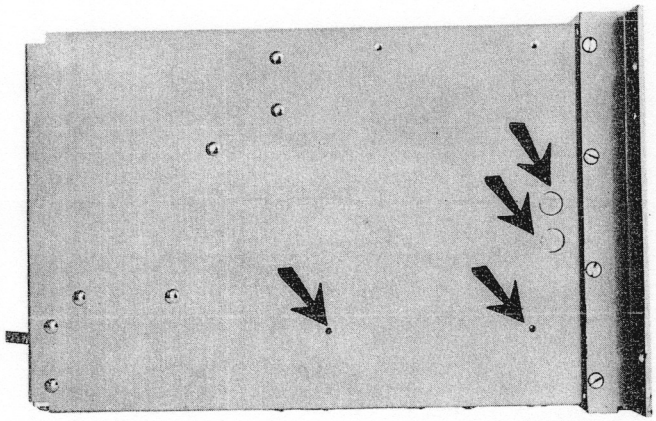

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Figure 2-1. Recorder, Left Gusset

i. Adjust the position of the retainer bracket on the wall plate so that the clock is firmly held in the clock compartment when the locking stud is pushed inward and twisted 90°.

j. Loosen the four clock door mounting bracket screws accessible through the 5/8 inch diameter holes in the left gusset and wall plate. Position the digital clock approximately 3/16 inch in from the front

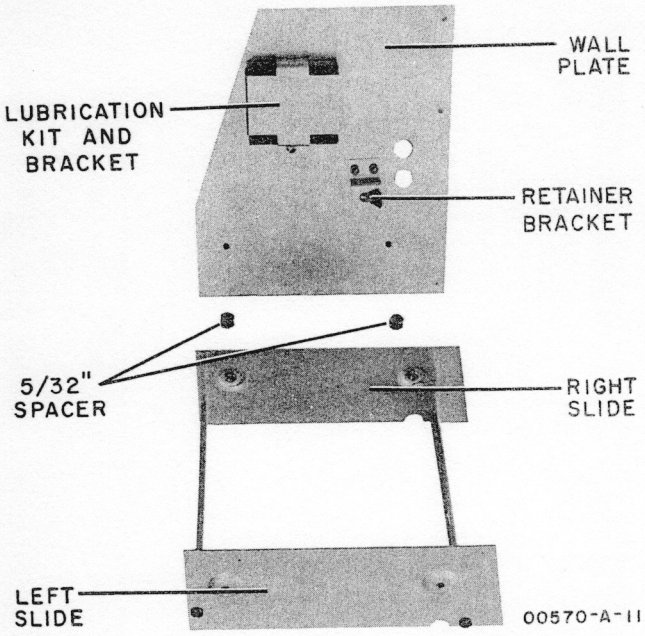


Figure 2-2. Assembled Mounting Hardware

surface of the recorder frame. Position the door vertically and hold the bottom edge of the door about 1/16 inch above the frame surface; tighten the four door-mounting bracket screws.

k. Slide the clock in and out several times. Check to make sure that binding does not occur. Adjust all mounting hardware screws for a smooth and snug fit.

m. Apply a light coat of paraffin to the lower inside corners of clock-compartment opening in the recorder frame.

n. Remove plate (next to fuse, four screws) from rear of Model 561B chassis.

p. Install Model 571B connector plate. Orient plate so that 8-pin connector is next to fuse post.

q. Solder wires from Model 571B cable assembly as shown in figure 2-3.

r. Remove the three cable clamps located along the lip of chassis behind tube sockets.

s. Route Model 571B cable along rear of chassis lip. Clamp Model 571B cable together with original cable using 7/16 inch cable clamps to replace those removed in step r.

t. Connect 8-pin female plug to connector located on the vertical part of the clock chassis behind the nixie tube housing.

u. Attach bottom plate; attach clock connectors and install clock; install printer mechanism; replace dust cover or cabinet. Attach input connectors.

2-23. MODIFICATIONS FOR DIGITAL READ-OUT INSTRUMENTS.

2-24. MODEL 521D/E (CABINET MODEL) CAPACITOR MODIFICATION.

2-25. Check to see if a 10-μfd capacitor is installed between ground and pin 11 of the front socket of either the thousands or 10-thousands counter. If capacitor is not present, the following materials are required for installation.

Capacitor, 10 μfd, 450 vdcw (hp Stock No. 0180-0005)

Vertical tie point

Solder lug

#8 external lockwashers (2 required)

Insulated tubing (3 inches)

2-26. Proceed as follows to install the capacitor:

a. Mount tie point and ground lug under existing nuts. Use lockwashers next to chassis.

b. Solder negative lead of capacitor to ground lug.

c. Route positive lead through tie point, add a short length of sleeving, and solder to pin 11 of the socket of either the thousands counter (Z605) or the ten-thousands counter (Z606).

2-27. MODEL 521DR/ER (RACK MODEL) CAPACITOR MODIFICATION.

2-28. Check to see if a 10-μfd capacitor is installed between ground and pin 11 of the front socket of the units counter. If capacitor is not present, the following materials are required for installation:

Capacitor, 10 μfd, 450 vdcw (hp Stock No. 0180-0005)

Large plastic cable clamp

6-32 x 5/16 inch machine screw

6-32 Hex Nut

Insulated tubing

2-29. Proceed as follows:

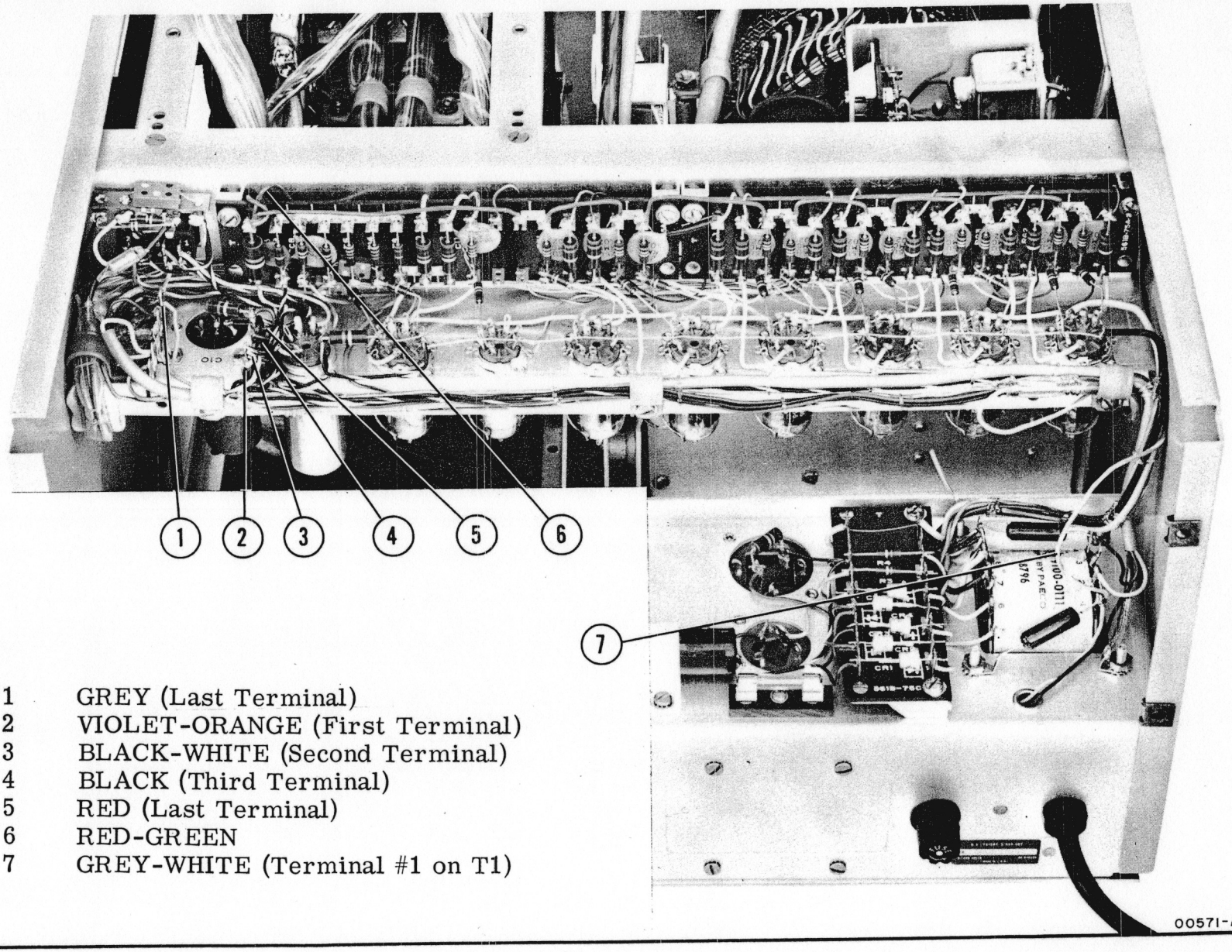
a. Use cable clamp to hold 10-μfd capacitor. Attach cable clamp at existing hole near socket of the units counter (Z602).

b. Solder negative capacitor lead to the existing ground lug on the rear socket of the units counter (Z602).

c. Solder the positive capacitor lead to pin 11 of the front socket of the units counter. Insulate the lead with a short length of insulated tubing.

2-30. MODEL 523C/D ONE-SET TICK MODIFICATION.

2-31. Check to see if a brown wire emerges from the printer-kit cable in the right-front corner of the chassis and connects to the FREQUENCY UNIT switch (this



1 GREY (Last Terminal)
2 VIOLET-ORANGE (First Terminal)
3 BLACK-WHITE (Second Terminal)
4 BLACK (Third Terminal)
5 RED (Last Terminal)
6 RED-GREEN
7 GREY-WHITE (Terminal #1 on T1)

Figure 2-3. Cable Connections

wire emerges with a violet-white wire if counter is equipped for 10-line code or with a green-orange wire if counter is equipped for single-line staircase code). If brown wire is located in the place described above the parts listed below are necessary for modification.

Single tie point

#6 external lockwasher

Resistor, 10,000 ohms, 1/2 watt

2-32. Proceed as follows for modification:

a. Cut the brown wire at the FREQUENCY UNIT switch. Pull the wire out of the cable until the wire emerges from the cable at a point located directly to the rear of V203 and V204.

b. Route the brown wire toward the front of the chassis so that it passes between the V203 and V204, and between V311 and V312. Run the wire to the left around the support feet for the resistor board at the left-front of V312.

c. Mount a single tie point under the nut located on the terminal board near V312. Use original lockwasher next to the board and #6 external lockwasher between tie-point mounting and nut.

d. Solder the brown wire to the tie point.

e. Connect 10,000 ohm resistor between tie point and the terminal of the resistor board which is connected to pin 2 of V311 with a yellow wire.

2-33. MODEL 523C CAPACITOR MODIFICATION.

2-34. Check to see if a 10-μfd capacitor is connected between pin 11 of the units counter front socket and pin 1 (ground) of the units counter rear socket. If capacitor is not present the following parts are necessary for modification.

Capacitor, 10 μfd, 450 vdcw (hp Stock No. 0180-0005)
Spacer, 1/4 in. x 3-3/16 in. (hp 721A-47A)
6-32 x 1/2 in. machine screw with lockwasher
8-32 x 1/2 in. machine screw with lockwasher
#8 flat washer
Sleeving (3 in.)

2-35. Proceed as follows for modification:

a. Drill a hole near the front socket of the units counter. Attach 3-3/16 in. spacer. Mount capacitor with cable clamp at end of spacer; use a flat washer between cable clamp and head of screw.

b. Solder positive capacitor lead to pin 11 of the front socket of the units counter. Use insulated tubing on the lead.

c. Solder negative capacitor lead to pin 1 (ground) of the rear socket of the units counter.

2-36. MODEL 524C CAPACITOR MODIFICATION.

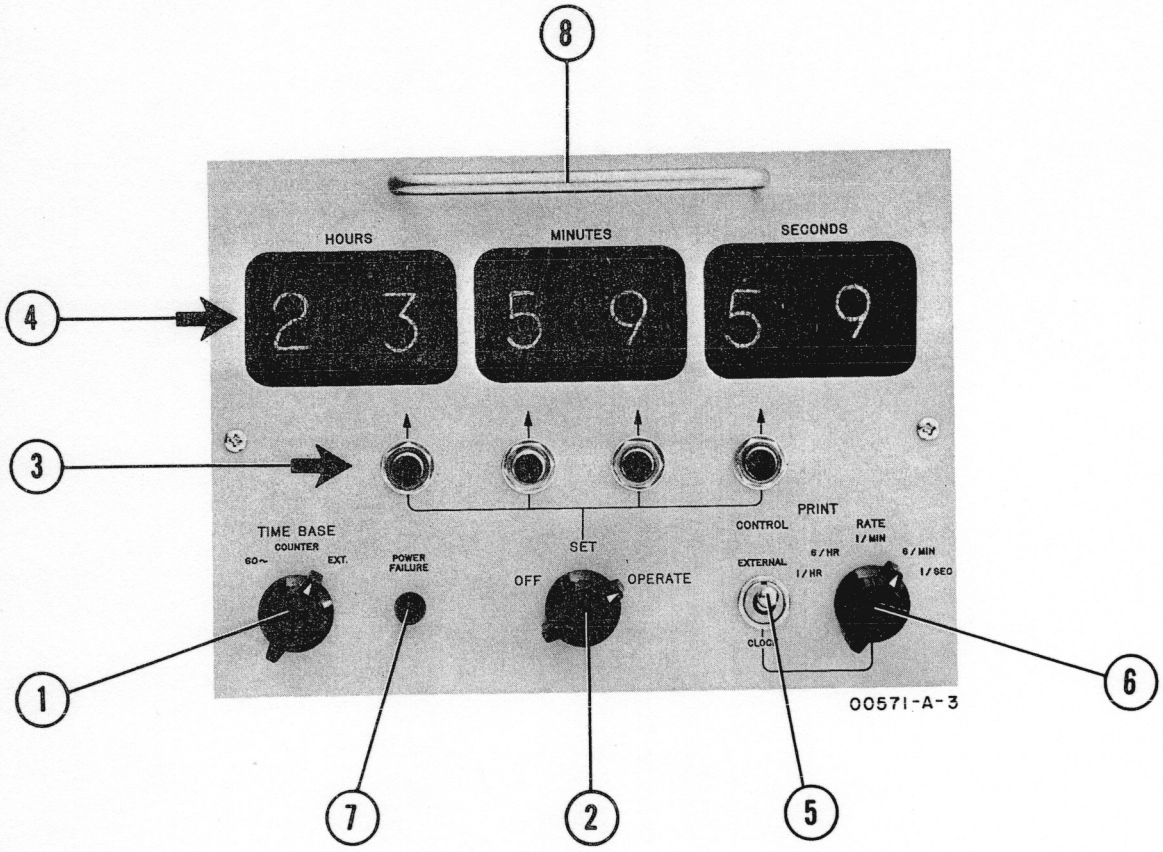
2-37. Some Model 524C counters require installation of a 10-μfd, 450-vdcw capacitor (hp Stock No. 0180-0005). This capacitor should be connected between ground and pins 12, 13, and 14 of J1402A. If capacitor is not present proceed as follows for installation:

a. Attach a single tie point and a large cable clamp to hold the capacitor with the existing cable clamp located about 2 inches from J1402. Replace the original screw with a slightly longer one to accommodate the additional material.

b. Solder the negative capacitor lead to the existing ground lug located at the end of J1402.

c. Solder the positive capacitor lead to the insulator tie point.

d. Solder one end of a short length of insulated hookup wire to the tie point. Solder the other end to pins 12, 13, and 14 of J1402A.



1. TIME BASE switch:
   60 ∿ position selects power-line frequency as timing source for clock.

   COUNTER position selects 1-cps timing ticks derived from crystal oscillator in electronic counter.

   EXT. position switches clock timing input to 1-cps pulse source connected at rear of digital recorder.

2. OFF/SET/OPERATE switch:
   OFF position turns off all clock power.

   SET position permits setting of clock time with pushbuttons located below clock numerals.

   OPERATE position turns clock on for normal operation. Time-setting buttons are disabled.

3. Pushbuttons advance time on indicator tubes located directly above each button. Switch to SET to use pushbuttons.

4. Digital indicators show time at one-second intervals to 23 hours, 59 minutes, 59 seconds.

5. PRINT CONTROL switch:

   EXTERNAL position permits counter sampling rate to be adjusted with DISPLAY TIME control on electronic counter.

   CLOCK position gives control of counter sampling rate to PRINT RATE switch.

6. PRINT RATE switch selects counter sampling rate when PRINT CONTROL switch is in CLOCK position.

7. POWER FAILURE lamp is normally extinguished. Lamp comes on, warning that clock time is incorrect, if power fails and then returns. To extinguish lamp, switch to SET.

8. Panel handle is used to open hinged front panel for servicing.

Figure 3-1. Front Panel Controls

SECTION III
OPERATING INSTRUCTIONS

3-1. GENERAL OPERATION.

3-2. Figure 3-1 shows the operation of all front-panel controls.

Note

The clock rate circuit is capable of disabling the data source (electronic counter, etc.) even if the clock is turned off. Therefore, operate the PRINT CONTROL switch to EXTERNAL when operating the data source while clock is turned off.

3-3. When the sampling rate of the electronic counter (or other data source) used with the recorder is controlled by the PRINT RATE switch (PRINT CONTROL switch in CLOCK position), counter measurements are started either slightly before or slightly after exact time. For example, the "6/HR" rate starts measurements at approximately 00:00:00, 00:10:00, 00:20:00, etc. (Counter is actually released 180 ms before exact clock time; recorded time depends on several delays and is equal to even time less 180 ms plus time for next gate opening pulse in counter plus counter gate time plus approximately 10 ms mechanical delay in the digital recorder.) The recorded time is the time at the end of the measurement.

3-4. The internal rate relay (SPDT contacts) is energized at the rate selected by the PRINT RATE switch. When the PRINT CONTROL switch is set to EXTERNAL, the rate relay is energized for approximately 50 ms at the selected rate. When the PRINT CONTROL switch is set to CLOCK, the rate relay is kept energized until the start of the succeeding recorder printing cycle. Refer to paragraph 2-17 for additional information on rate relay timing.

3-5. SETTING PROCEDURE.

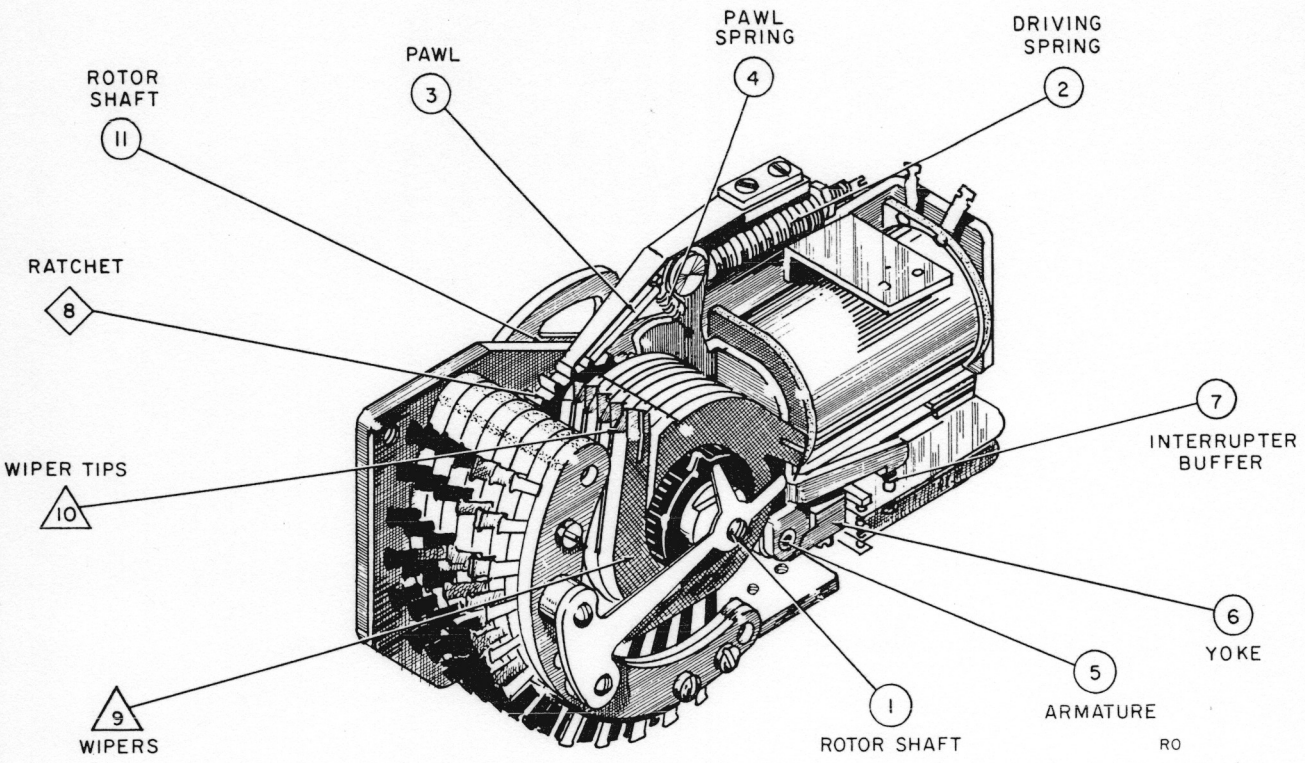
3-6. Proceed as follows when it is desired to set digital clock time to agree with a master clock:

a. Select desired TIME BASE (60 ∿, COUNTER or EXT.).

b. Switch to SET.

c. Press pushbuttons located directly below clock numerals to set digital time slightly ahead of time shown on master clock.

d. When time on master clock and time on digital clock coincide, quickly switch to OPERATE. Phasing can be adjusted in the 60 ∿ TIME BASE position by switching between SET and OPERATE.



○ USE BLENDED LUBRICATING OIL SPEC. 5684:

Apply one dip of oil on rotor shaft at point (1) and another at point (11) . (Point (11) is not visible on the figure but is between the ratchet and the frame.)

Press on pawl pin to push pawl away from armature, and wipe part of a dip between pawl (3) and armature.

Press sideways on pawl to push head of pawl pin away from armature, and wipe brush between head of pawl pin and armature. Spread rest of this dip through coils of pawl spring (4) and driving spring (2) and into holes in armature and pawl where pawl spring is engaged.

Push armature sideways away from mounting frame and wipe a dip between armature (5) and yoke (6) and around armature pin where it passes through yoke near mounting frame.

Push armature sideways toward mounting frame and wipe lubricant between armature and yoke on mounting-frame side of yoke, and around armature pin where it passes through yoke away from mounting frame.

Brush rest of this dip on interrupter-spring buffer where it strikes armature (7)

◇ USE SWITCH LUBRICANT SPEC. 5232-C:

Wipe one dip over and between ratchet teeth on one half of ratchet ◇8◇ and wipe second dip on other half of ratchet.

△ USE WATCH OIL SPEC. 5228:

Using one dip per wiper pair, apply oil near the center of each wiper △9△ at a point where it will contact tip of brush spring. The brush spring is part of first switch contact and makes permanent contact with wiper. Rotate wiper to distribute oil.

Using one dip for each group of wiper tips, apply oil between the wiper tips △10△ . Oil the switch contacts by rotating the wipers. Oil all wiper tips.

After lubrication, wipe lubricant from all parts and surfaces you did not intend to lubricate.

Figure 4-1. Stepping Switch Lubrication Diagram

SECTION IV
PERIODIC MAINTENANCE

4-1. REMOVING CLOCK FROM CABINET.

4-2. The clock can be slid out through the front panel of the recorder cabinet for servicing. Proceed as follows:

a. Open hinged front panel of clock.

b. Loosen single retaining screw in lower-right-front of clock (1/4 turn counterclockwise).

c. Remove clock through panel opening.

d. Clock may be operated normally while cables are connected. If it is desired to completely remove the clock, disconnect cable connectors on clock.

WARNING

Discharge +150 volt filter capacitor after disconnecting clock by pressing a SET button, with OFF - SET - OPERATE switch at SET.

4-3. STEPPING SWITCH LUBRICATION.

4-4. SCHEDULE. To assure long switch life and dependable clock operation, monthly lubrication is required for the four stepping switches and yearly lubrication is required for the one 26-position stepping switch.

4-5. CLEANING. To obtain the best results from lubrication, first wipe the parts as clean as possible. If the switch is excessively dirty, clean it with a high-quality cleaner which does not leave a film upon evaporation, such as xylene.

4-6. LUBRICATION KIT. A lubrication kit consisting of three types of lubricant is included with the clock. The kit is attached to the upper-right wall of the clock compartment in the recorder. Loosen the screw under the lubrication kit bracket to remove the kit. Each bottle is marked with a geometric figure and the switch manufacturer's specification number for easy identification. Each bottle cap has the correct applicator attached for that bottle of lubricant.

4-7. LUBRICANT APPLICATION. When lubricating a stepping switch, it is important to apply the right amount of lubricant. Excessive oil application can cause damage. To assure correct measurement, the term "dip" is used as a guide. To obtain one dip of lubricant, dip the applicator into the lubricant, then wipe the applicator against the side of the bottle to remove the end drop. In most cases one dip will be enough to lubricate several parts. Brush the lubricant lightly over the parts.

4-8. MONTHLY LUBRICATION PROCEDURE. Only the stepping switches (K602, K603, K604, and K605, located beneath chassis) require monthly oiling. Proceed as follows:

a. Remove clock from recorder (paragraph 4-1).

b. Remove lubrication kit from clock compartment.

c. Place clock upside down on work table.

d. Clean stepping switches (paragraph 4-5).

e. Follow lubrication instructions in figure 4-1. Be sure to apply correct amount of correct lubricant at each point.

Note

For easy switch access loosen the two 5/16-inch hexagonal-head screws on the right side of the switch mounting bracket, then swing the rear of the switch away from the chassis, pivoting the switch around the front screw. Tighten screws when lubrication is finished.

f. Install clock in its compartment.

4-9. YEARLY LUBRICATION PROCEDURE. The 26-position stepping switch (K606, located on top of chassis) should be oiled once a year. It can be lubricated while the clock is removed for regular monthly lubrication of the switches. Proceed as follows:

a. Place clock in upright position on work table.

b. Remove the rotor-shaft retaining screw (1/4-inch hexagonal head) located on the front plate of the switch just below the rotor shaft.

c. Slide the rotor shaft forward about 1/4 inch.

d. Apply one dip of watch oil (bottle marked with triangle) to each end of shaft.

e. Slide shaft into place; install and tighten screw removed in step b.

f. Apply one dip of watch oil to each sliding brush near the rotor hub. Rotate the switch to distribute oil by pressing the armature plate several times (armature is locked at left side of switch).

g. Apply one dip of watch oil across one group of wiper tips on switch rotor; apply another dip across the other group of wiper tips. Rotate the switch to distribute oil by pressing the armature plate.

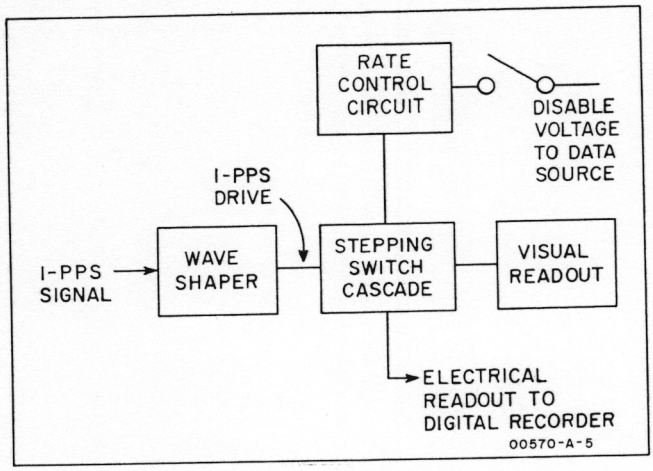


Figure 5-1. Simplified Block Diagram

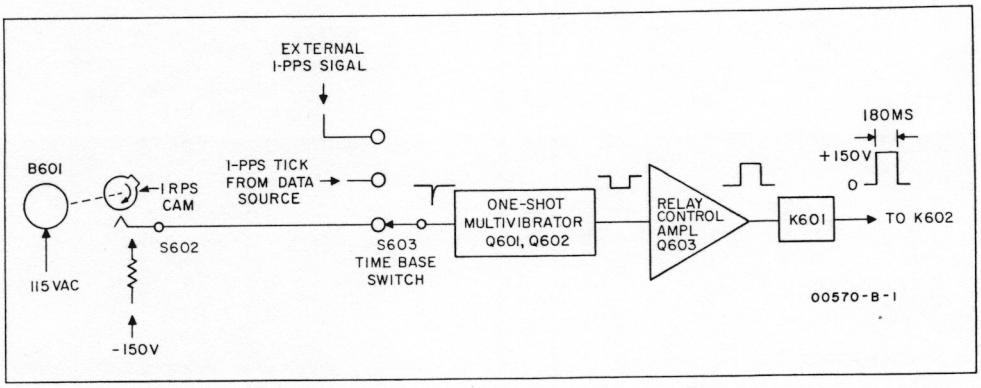


Figure 5-2. Waveshaper Block Diagram

SECTION V
PRINCIPLES OF OPERATION

5-1. BLOCK DIAGRAM.

5-2. WAVESHAPER. The clock (figure 5-1) is timed by a 1-pps signal. Input timing pulses are shaped and amplified before being used to drive the first (one-second) stepping switch.

5-3. STEPPING SWITCH CASCADE. The stepping switch cascade consists of five switches which tabulate seconds, 10-seconds, minutes, 10-minutes, and hours. The seconds stepping switch completes its operating cycle after ten 1-pps input pulses have been received, at which time it gates a drive pulse to the 10-second stepping switch. The 10-second stepping switch advances every ten seconds and completes its cycle after six input pulses, at which time it gates a drive pulse to the minutes stepping switch. Each stepping switch advances each time a driving pulse is received and gates a carry pulse to the following stepping switch after the completion of its full cycle.

5-4. READOUT. Digital display tubes are connected to contacts on each stepping switch so that time is continuously indicated in hours, minutes and seconds. A 10-line electrical output is taken from the cathodes of digital-indicator tubes and sent to the recorder.

5-5. RATE CONTROL. The clock PRINT CONTROL switch, when set to CLOCK, lets the clock control the rate at which measurements are made by the data source. Rate control circuitry supplies a positive voltage to a disable circuit at the data source while the PRINT CONTROL switch is set to CLOCK. After a selected interval, the voltage is removed, thus enabling a measurement to be made at the data source. The recorder printing cycle following the measurement operation at the data source signals the rate control circuit to again supply the disable voltage.

5-6. TIMING SOURCE AND WAVESHAPE.

5-7. The waveshaper circuit (refer to figure 5-2 and the schematic diagram, figure 6-5) in the clock produces a pulse suitable for driving the one-second stepping switch. TIME BASE switch S603 permits selection of 1-pps triggering pulses from one of three sources: cam-operated switch S602, driven by synchronous motor B601; the data source to which the recorder is connected; or an external 1-pps source.

5-8. One-shot multivibrator Q601-Q602 provides a negative 180-millisecond pulse each second for driving relay control amplifier Q603 which energizes relay K601. Contacts on K601 supply +150 volt pulses to drive seconds stepping switch K602.

5-9. STEPPING SWITCH GENERAL INFORMATION.

5-10. The stepping switch illustrated in figure 5-3 consists principally of an actuating coil, an armature, a drive pawl and a stepping rotor. When the coil is

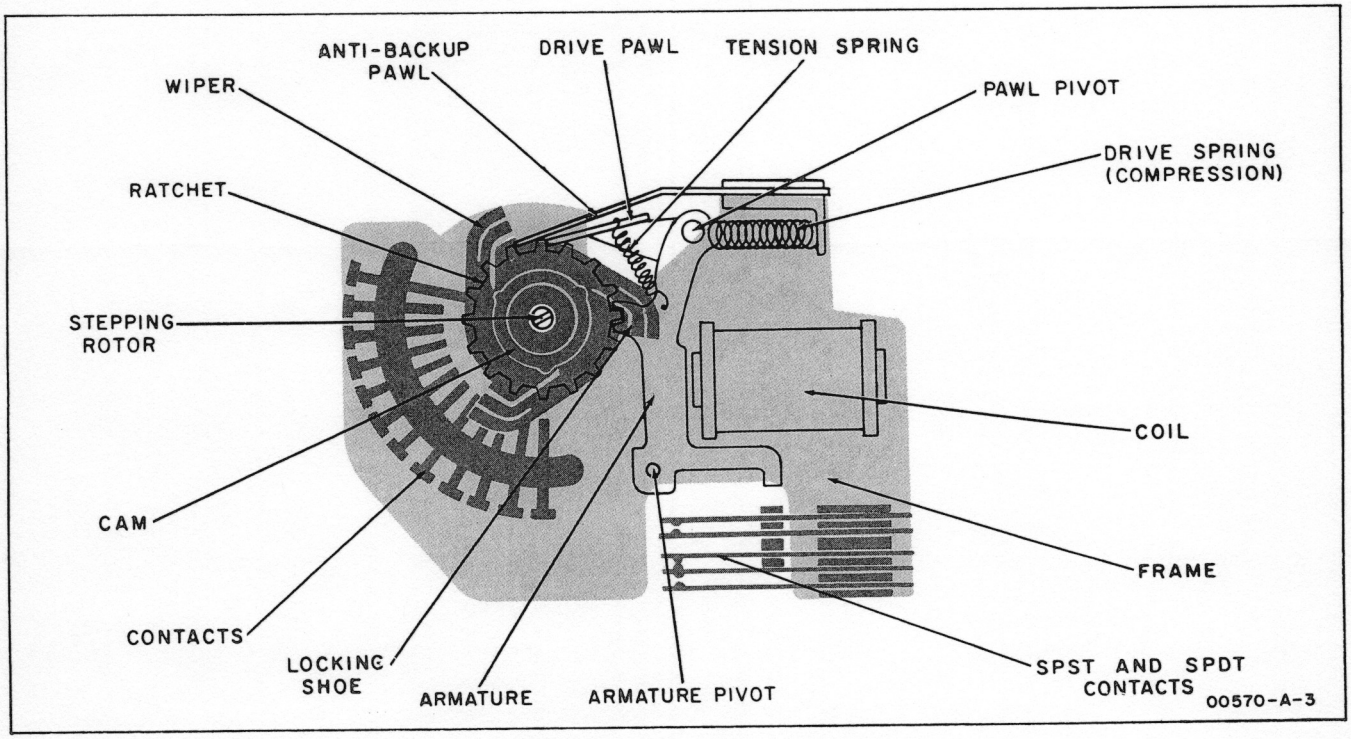


Figure 5-3. Stepping Switch Mechanics

energized, the armature is pulled back, compressing the drive spring and moving the drive pawl across one ratchet tooth. The anti-backup pawl prevents movement of the rotor. When the coil is de-energized, the drive spring pushes the drive pawl against a ratchet tooth and advances the switch one position.

5-11. Notice that while the coil of a stepping switch is energized, only its SPST and SPDT contacts are operated; the stepping contacts remain stationary. The drive mechanism for the stepping contacts is cocked when the coil is energized; the stepping contacts then advance one step when the coil is de-energized (figure 5-4).

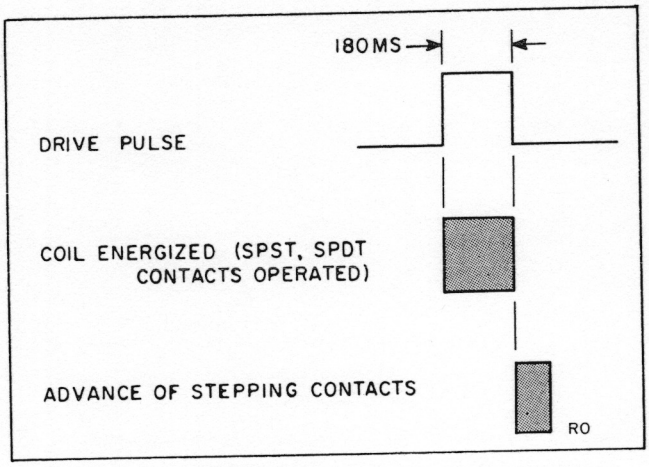


Figure 5-4. Stepping Switch Time Relationships

5-12. Pull-in current for each switch flows through the normally closed SPST relay contacts of the switch (figures 5-5, 6-6). After the coil is energized, holding current flows through a resistor which is in parallel with the SPST relay contacts. A diode is connected across the coil of each stepping switch for arc suppression.

5-13. The seconds and minutes stepping switches (K602 through K605) are connected to have only 6 or 10 functional stepping positions, as required; the 26-

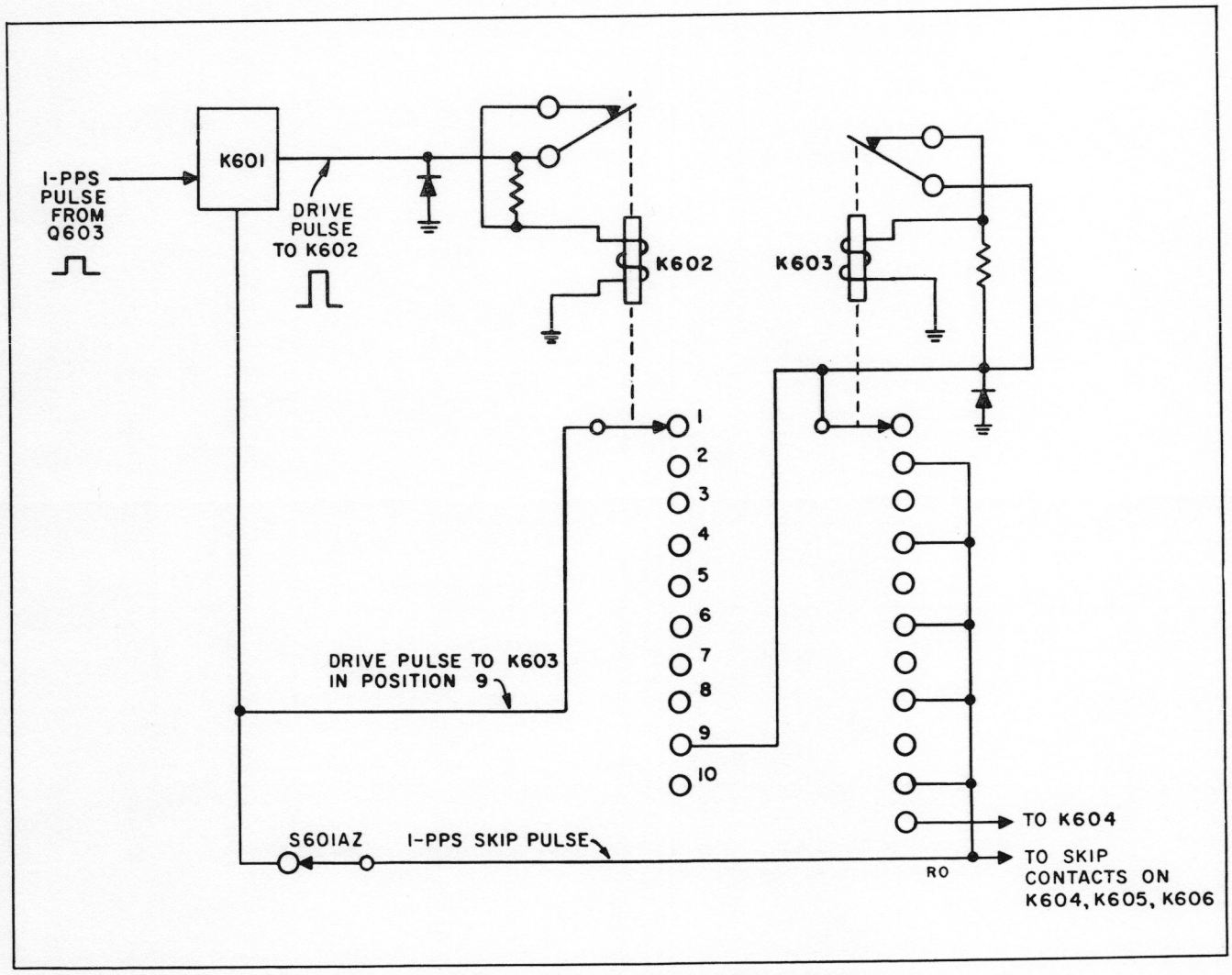


Figure 5-5. Simplified Schematic K602 and K603

Table 5-1. Relays and Stepping Switches

Desig	Name	Switch Positions	
		Actual	Functional
K601	One-Sec Drive Relay	--	--
K602	Seconds Switch	10	10
K603	10-Sec Switch	11	6
K604	Minutes Switch	11	10
K605	10-Min Switch	11	6
K606	Hours Switch	26	24
K620	Rate Control Relay	--	--

position hours stepping switch (K606) has only 24 functional stepping positions (table 5-1). The method of reducing the effective number of switch positions, using a "skip pulse", is described in the following paragraphs.

5-14. STEPPING SWITCH OPERATING SEQUENCE.

5-15. Refer to figure 5-5 for a simplified schematic of K601, K602, and K603; time relationships are shown in figure 5-6.

5-16. Relay K601 sends a positive driving pulse to K606 (seconds switch) each second. During the driving pulse, K602 is energized and its SPDT and SPST relay contacts are operated; the stepping contacts remain in their original position. At the end of the driving pulse, the relay contacts return to their original position, and the stepping contacts advance one position.

5-17. The stepping switch advances one position per second until it reaches position "9". The next time K601 is energized, a +150-volt drive pulse is gated through the "9" contact of K602 to energize K603 (10-second switch). The SPDT and SPST relay contacts on K603 operate, but the stepping contacts remain in their original position. As K601 is de-energized, the stepping contacts on K602 advance to position "10" and the contacts on K603 advance one step.

5-18. Once each second, when drive relay K601 operates, a +150-volt "skip-pulse" is applied to the "skip line" through S601AZ. Even-numbered contacts of K603 are connected to the skip line and may be considered "skip positions" since the skip pulse steps K603 to the next (odd-numbered) position one second after K603 is driven to an even-numbered position.

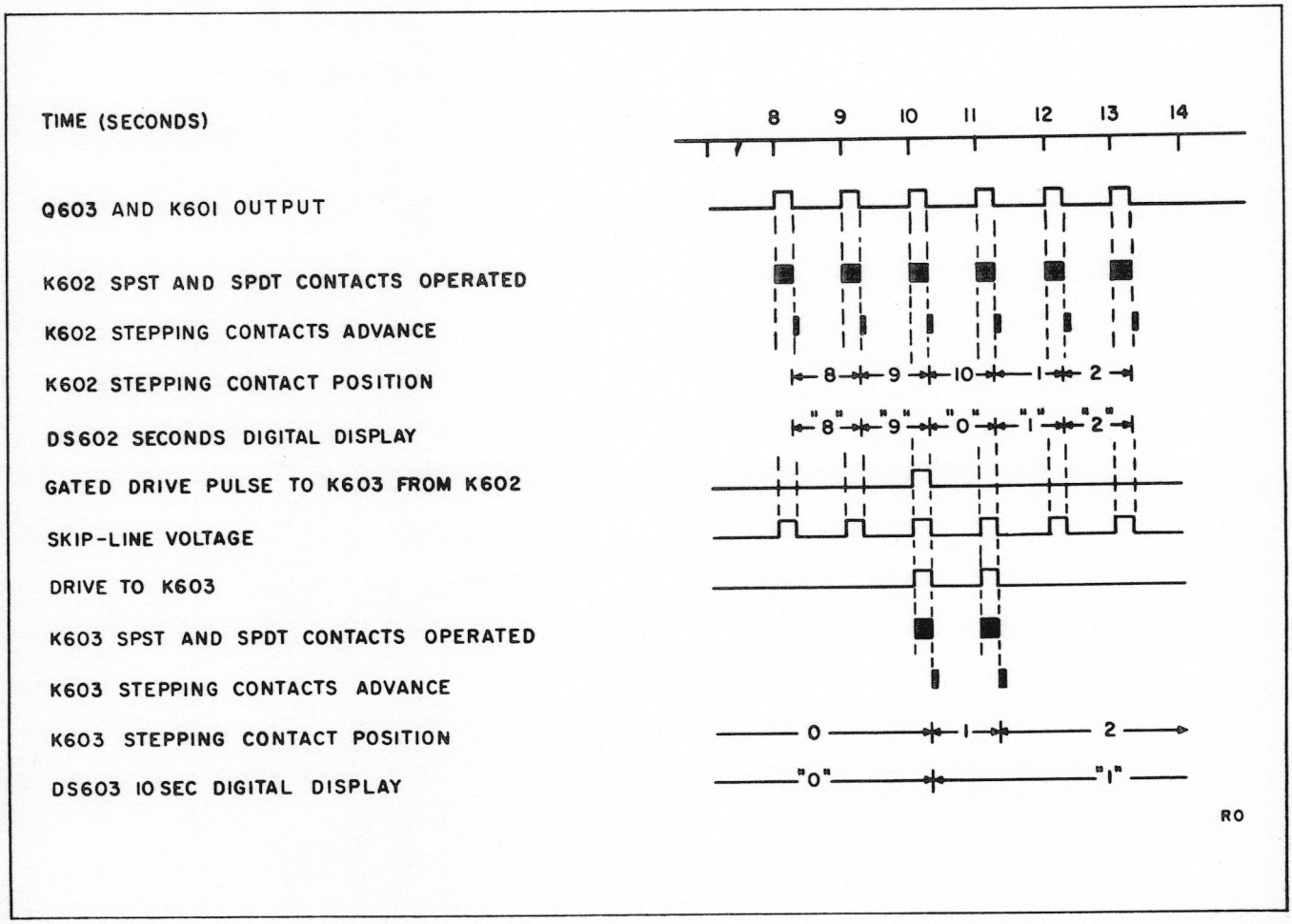


Figure 5-6. Time Relationships: K601, K602, K603

5-19. Successive input pulses continue to operate K602 and K603 as described above. To summarize:

a. K602 advances one step at the termination of each input pulse.

b. K603 advances one step when K602 steps from position "9" to position "10" (once each ten seconds).

c. The skip pulse, generated once each second by drive relay K601, is applied to the five even-numbered contacts of K603. One second after K603 enters an even-numbered position, the skip pulse energizes K603 and steps it to the next (odd-numbered) position. Since five skip positions are provided on K603, only six driving pulses (60 seconds) are required for a complete 11-step operating cycle.

5-20. Once each minute, when K603 is in position "11" (refer to schematic diagram, figure 6-6), the drive pulse from K602 is gated through K603 and the SPDT contacts of K603 to K604 (minutes switch), advancing K604 one step. Position "9" of K604 is a skip position. The skip pulse steps K604 to position "10" one second after K604 moves into position "9". A full operating cycle for K604 is thus completed after K604 receives ten drive pulses (ten minutes) through K603.

5-21. When K604 is in position "11" the gated drive pulse from K603 is passed through K604 and the normally-open SPDT contacts of K604 to K605 (10-minute switch) advancing K605 one step. Even-numbered switch positions on K605 are skip positions. Therefore the first second after K605 moves into a skip position the skip pulse steps K605 to the next position. Since five skip positions are provided, six drive pulses from K604 (one hour) are required to operate K605 through one complete cycle.

5-22. While K605 is in position "11" (once per hour), the gated drive pulse from K604 is passed through K605A and the normally open SPDT contacts of K605 to K606 (hours switch), advancing K606 one position. Two skip positions are provided so that the 26-position stepping switch can complete its cycle after 24 input pulses (24 hours). The skip pulse operates K606 one second after K606 steps into position "23" and position "25".

5-23. SET CIRCUIT.

5-24. The +150 volt supply is connected to the "set line" through S601AY when S601 is in the SET position (refer to schematic diagrams, figures 6-5, 6-6). Stepping switches K603, K604, K605 and K606 may be stepped to any desired position by operating push-button switches S605, S606, S607, and S608. Since carry pulses are not generated while in SET, the sequence of setting is unimportant. Note that it is necessary to press a SET button twice to advance a numeral through a skip position since no skip pulse is generated while in SET.

5-25. When S601 is operated from SET to OPERATE, +150 volts is applied momentarily to the skip line through a no-detent contact on S601AY. This advances any stepping switch inadvertently set to the first contact of a skip position.

5-26. A set switch is not provided for K602 (seconds switch) since K602 can be rapidly set to any desired position simply by setting S601 to the OPERATE position for a short time.

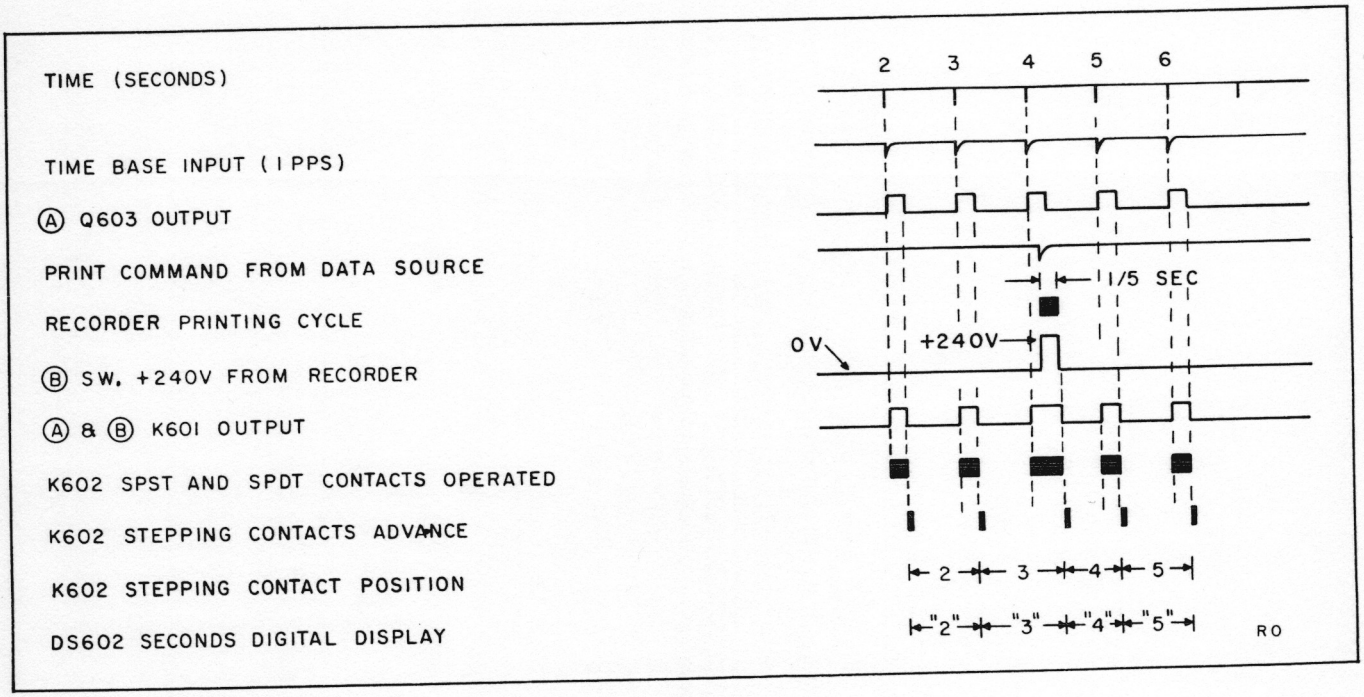


Figure 5-7. Time Relationships: Printing Cycle During Pulse

01158-2

5-27. LOCKUP DURING PRINTING CYCLE.

5-28. The digital recorder requires fixed data inputs during its printing cycle. If the one-second driving pulse occurs during a recorder printing cycle, K601 is kept energized until the end of the printing cycle by switched +240 volts from the recorder which is applied through R632 and the SPDT contacts of K602 to the coil of K601. Since the stepping switch advances at the termination of the drive pulse, it therefore cannot change position during a printing cycle. Time relationships during a printing cycle which occur during a normal numeral-change time are shown in figure 5-7.

5-29. READOUT CIRCUITRY.

5-30. Time is shown visually on digital indicator tubes (DS602 through DS607), which are gas tubes with ten numeral-shaped cathode elements (refer to schematic diagram, figure 6-6). The anode of each tube is connected to +150 volts. Each cathode is connected to a stepping-switch contact. A negative potential supplied to the wiper arm of each switch determines which cathode element (i.e. numeral) glows.

5-31. Electrical time information is taken from the cathodes of the digital indicator tubes. The time information is routed to connector P605A and P605B.

5-32. PRINT RATE CONTROL.

5-33. The DISPLAY TIME or SAMPLING control on the data source used with the recorder controls the sampling rate of the data source when the PRINT CONTROL switch is operated to EXTERNAL.

5-34. Source sampling rate is controlled by the PRINT RATE switch if the PRINT CONTROL switch is operated to the CLOCK position. Refer to this schematic diagram, figure 6-7, to follow circuit operation. Time relationships for both EXTERNAL and CLOCK control are shown in figure 5-8.

5-35. While K602 is de-energized, K620C supplies a positive source-disable voltage to prevent operation of the data source. A stepping-switch drive pulse energizes K620 every second, ten seconds, minute, ten minutes, or hours, as selected by S620 (PRINT RATE). Immediately after K620 is energized the source-disable

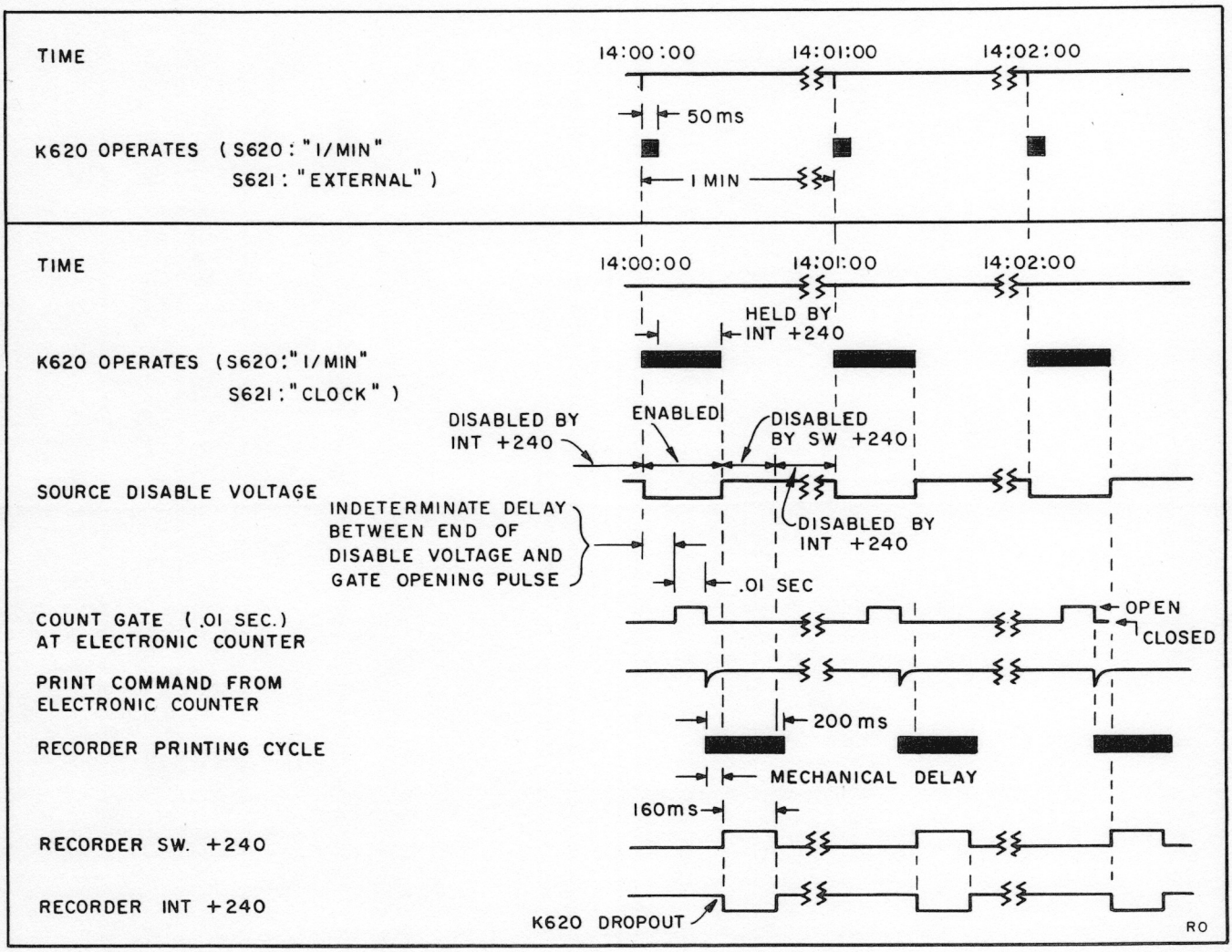


Figure 5-8. Time Relationships: Print Rate Control

voltage is removed, permitting data source operation. Relay holding current (INT +240V from the digital recorder) is supplied to K620, keeping the relay energized. The data source completes one measurement operation and sends a print command pulse to the digital recorder which then prints the data source reading and the time. Relay holding current (INT +240V) is interrupted by the digital recorder during the printing cycle to de-energize K620. The counter disable voltage is again supplied through K620C to prevent counter operation until the next time K620 is energized.

5-36. POWER FAILURE ALARM.

5-37. If line power is interrupted while the clock is operating, POWER FAILURE lamp (DS601) comes on, indicating that clock time may be in error. The lamp is extinguished when S601 is switched to SET to adjust clock time.

5-38. Refer to the schematic diagram, figure 6-5. When the clock is turned on (S601 from OFF to SET), the potential at both terminals of DS601 is sufficient to light DS601. Neither V601 nor V602 can light since the voltage drop across R628 lowers the voltage across V601 and V602 to less than their firing potential.

5-39. When S601 is switched from SET to OPERATE, a no-detent switch contact is momentarily closed and the DS601 circuit is momentarily opened; V602 is lighted and DS601 is extinguished. The potential at the junction of V601 and V602 goes negative when V602 lights. When the OPERATE contacts of S601 close, the potential across V601 is sufficient to permit it to fire. The voltage drop across R628 prevents DS601 from firing while both V601 and V602 are conducting.

5-40. If power should fail, V601 and V602 will be extinguished. When power returns, DS601 will fire and the resulting voltage drop across R628 will prevent V601 and V602 from lighting. Operating S601 to SET extinguishes DS601 and lights V601 and V602, to reset the circuit as described above.

SECTION VI
TROUBLESHOOTING AND REPAIR

6-1. GENERAL.

6-2. This section tells how to locate defective components. The general method to be followed is to (a) observe front-panel symptoms, (b) make simple tests and checks described in the troubleshooting chart (figure 6-1) to localize trouble, and (c) check individual components for failure. Refer to figures 6-2 through 6-4 for component identification. Schematic diagram figures 6-5 through 6-8 are at the end of this section.

6-3. This section includes a quick operating or performance check (paragraph 6-16). Repair hints for replacement of a defective power transformer are given in paragraph 6-10. Instructions are given for positioning S602 (paragraph 6-12). If the digital recorder does not accurately print time information.

6-4. STEPPING SWITCH DRIVE CHECK.

6-5. The driving pulses (and skip pulses) which energize stepping switch coils can be observed by making a simple dc voltage check. Proceed as follows:

a. Set stepping switches which precede point at which drive pulse is to be checked to a position several seconds before occurrence of desired drive pulse.

b. Connect dc voltmeter leads between power supply common and check point (e.g., coil of stepping switch; SPDT, SPST, and stepping contacts of switch).

c. Switch to OPERATE and let switches operate through the time of the expected drive pulse.

d. The drive pulse, if present, can be observed as a momentary positive jump in the meter reading. If no drive pulse is observed, check for drive on each side of all switch contacts involved in transmitting the drive pulse. Defective contacts may require cleaning or bending.

6-6. COMPONENT CHECK.

6-7. Many meaningful component checks can be made with an ohmmeter. After trouble has been localized, turn off power, discharge power supply filter capacitors, and measure the resistance of possible defective components.

6-8. Check continuity across switch contacts as switch is operated. Stepping switches can be operated manually by pressing switch armature toward coil.

6-9. The final test for a defective component is replacement with one known to be good. This is especially true for open capacitors and faulty transistors.

6-10. POWER TRANSFORMER.

6-11. Proceed as follows to replace power transformer T601:

a. Clip or unsolder transformer leads.

b. Remove screws which hold K606 support brackets to chassis (three screws on left bracket, two screws on right bracket).

c. Remove two screws which hold transformer.

d. Lift right side of K606 and slide transformer out.

e. Install replacement transformer and reassemble in reverse order of removal.

6-12. ADJUSTMENT OF S602.

6-13. Positioning is required if cam-operated switch S602 is replaced. Add #5 flat washers as shims between the switch and its bracket until there is 1/32-inch movement of switch contacts during operation.

6-14. 10-LINE CODE CHECK.

6-15. The 10-line code voltage obtained at the cathodes of the digital-display tubes is adjusted to operate with the Model 561B recorder. The voltage at a cathode of the digital-display tube, with that cathode lighted, is nominally between -100 and -120 volts with connector P605A/605B disconnected.

6-16. OPERATING CHECK.

6-17. It is good practice to check for correct clock operation after maintenance. The seconds stepping switch (K602) can be checked by switching to OPERATE. The one-second indicator, DS602, should switch smoothly at one-second intervals through each digit from "0" through "9".

6-18. To check operation of other stepping switches and digital indicators, switch to SET and step each digital indicator through a complete number sequence using the pushbutton located beneath the indicator. Each time the button is pressed and released the indicator above the button should advance one digit, except when a stepping switch enters a skip position. The pushbutton must be pressed twice to advance to the next digit following a numeral representing a skip position. The numerals representing stepping-switch skip positions are shown in table 6-1.

Table 6-1. Skip Positions

Indicator	Switch	Skip Position Numerals
1-Sec (DS602)	K602	- - -
10-Sec (DS603)	K603	1, 2, 3, 4, 5
1-Min (DS604)	K604	8
10-Min (DS605)	K605	1, 2, 3, 4, 5
Hours (DS606, DS607)	K606	22, 23

6-19. To check the ability of the clock to carry time accumulation between columns, set the clock to a time immediately preceding a carry operation, then switch to OPERATE and observe time indication for proper operation. Example: Set clock to 23:59:59; switch to OPERATE; clock should step to 00:00:00.

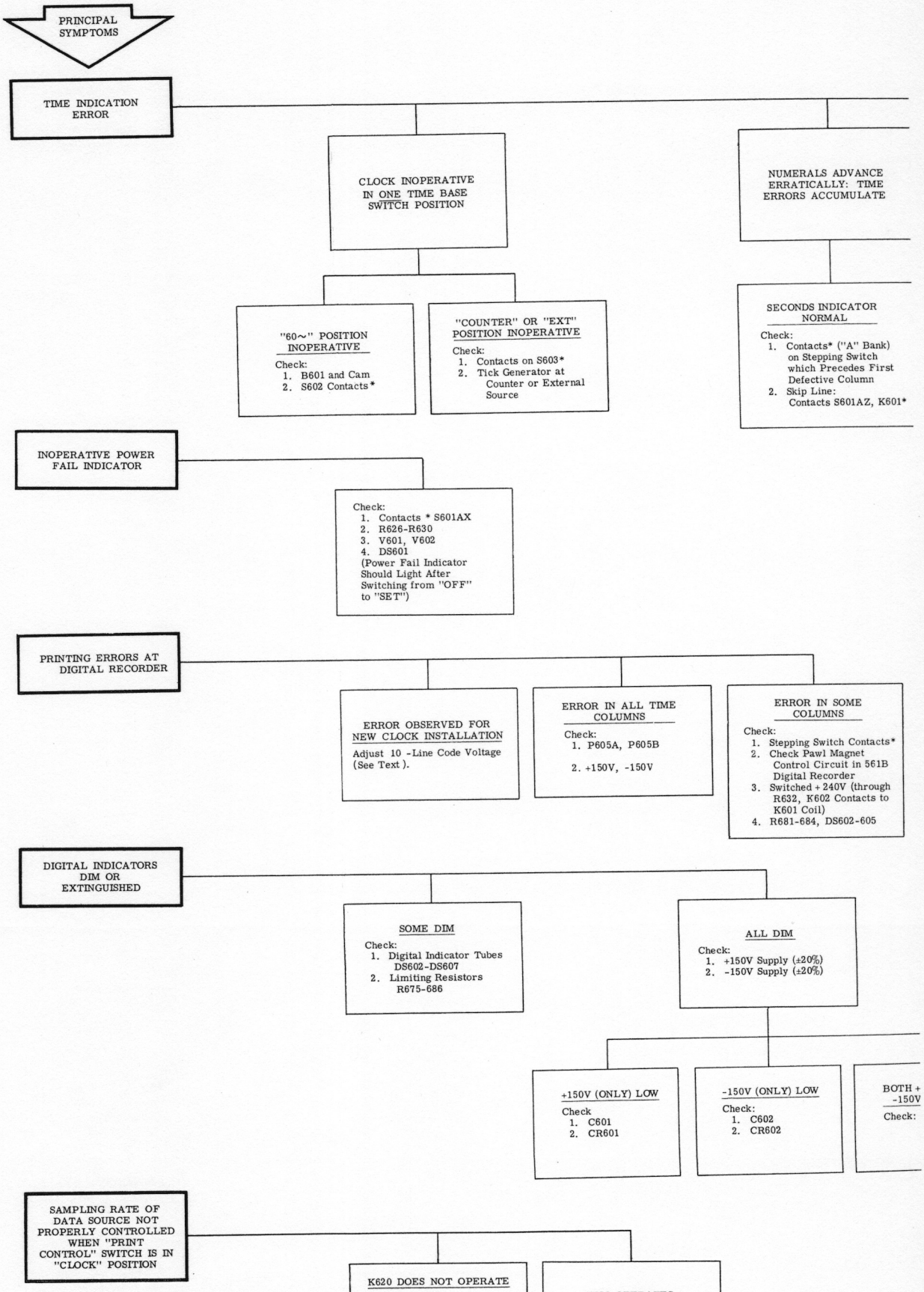
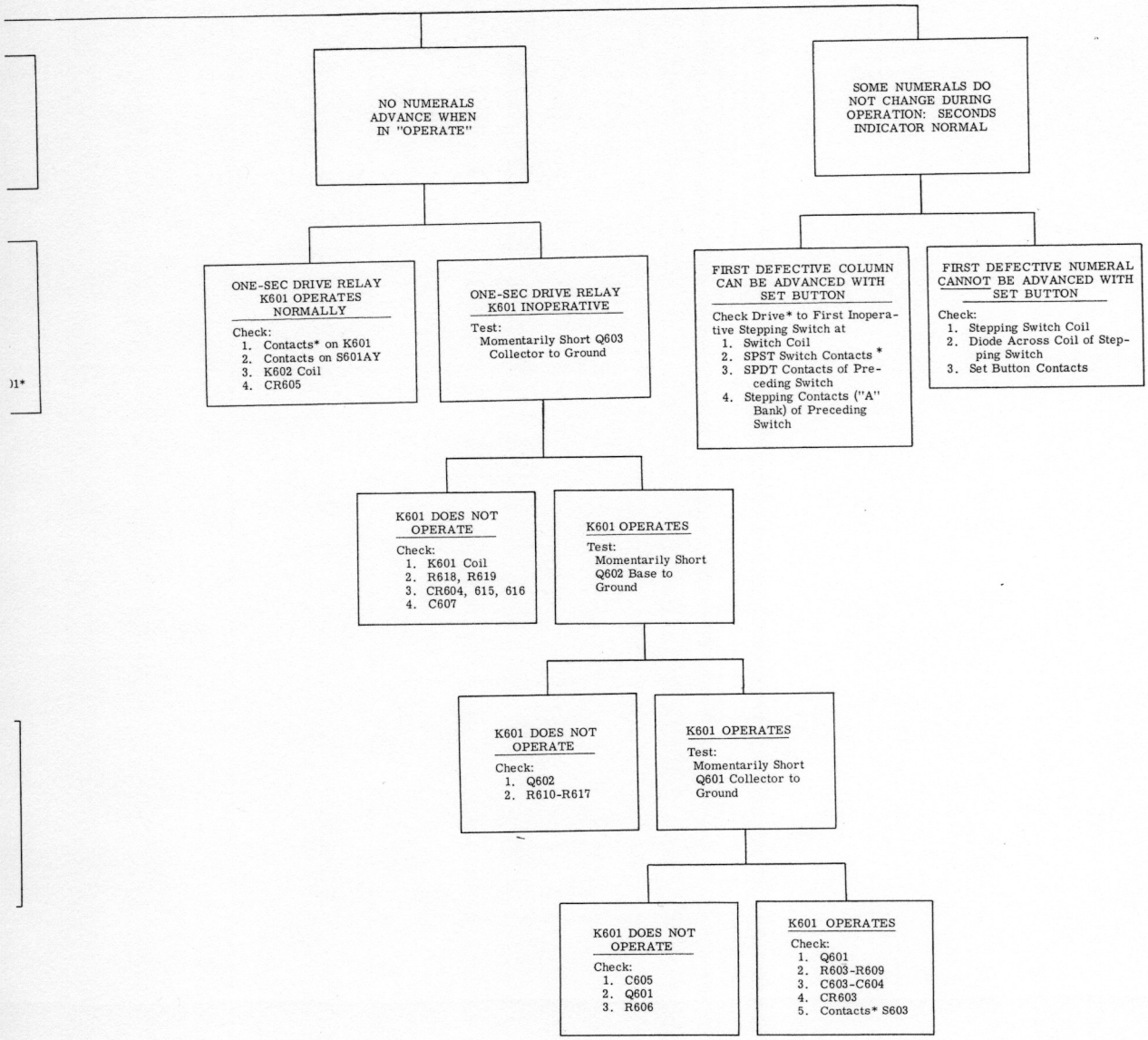


Figure 6-1. Troubleshooting Chart



*SEE TEXT FOR OUTLINE OF METHODS FOR CHECKING DRIVE AND SWITCH CONTACTS.

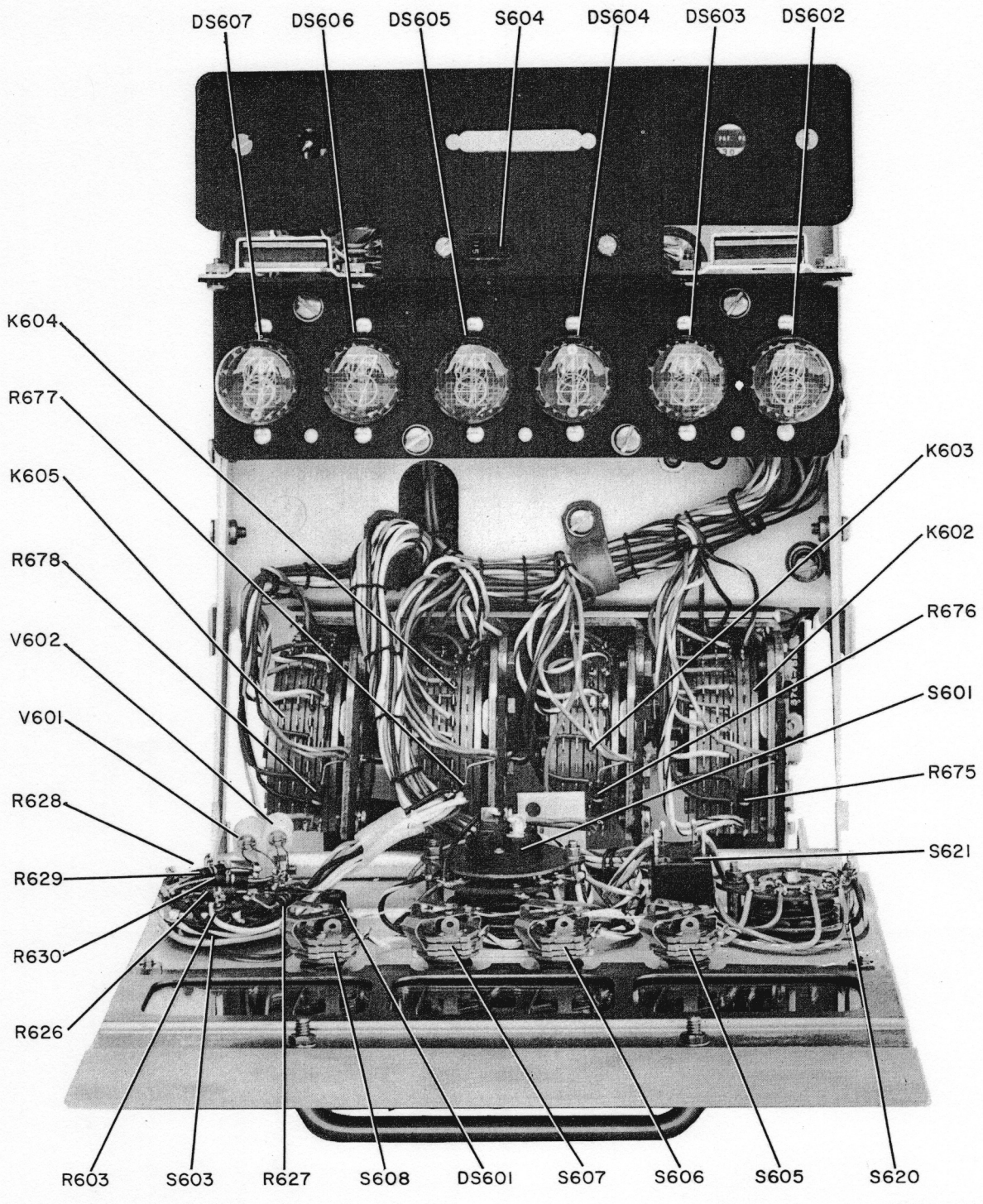


Figure 6-2. Components Location, Front

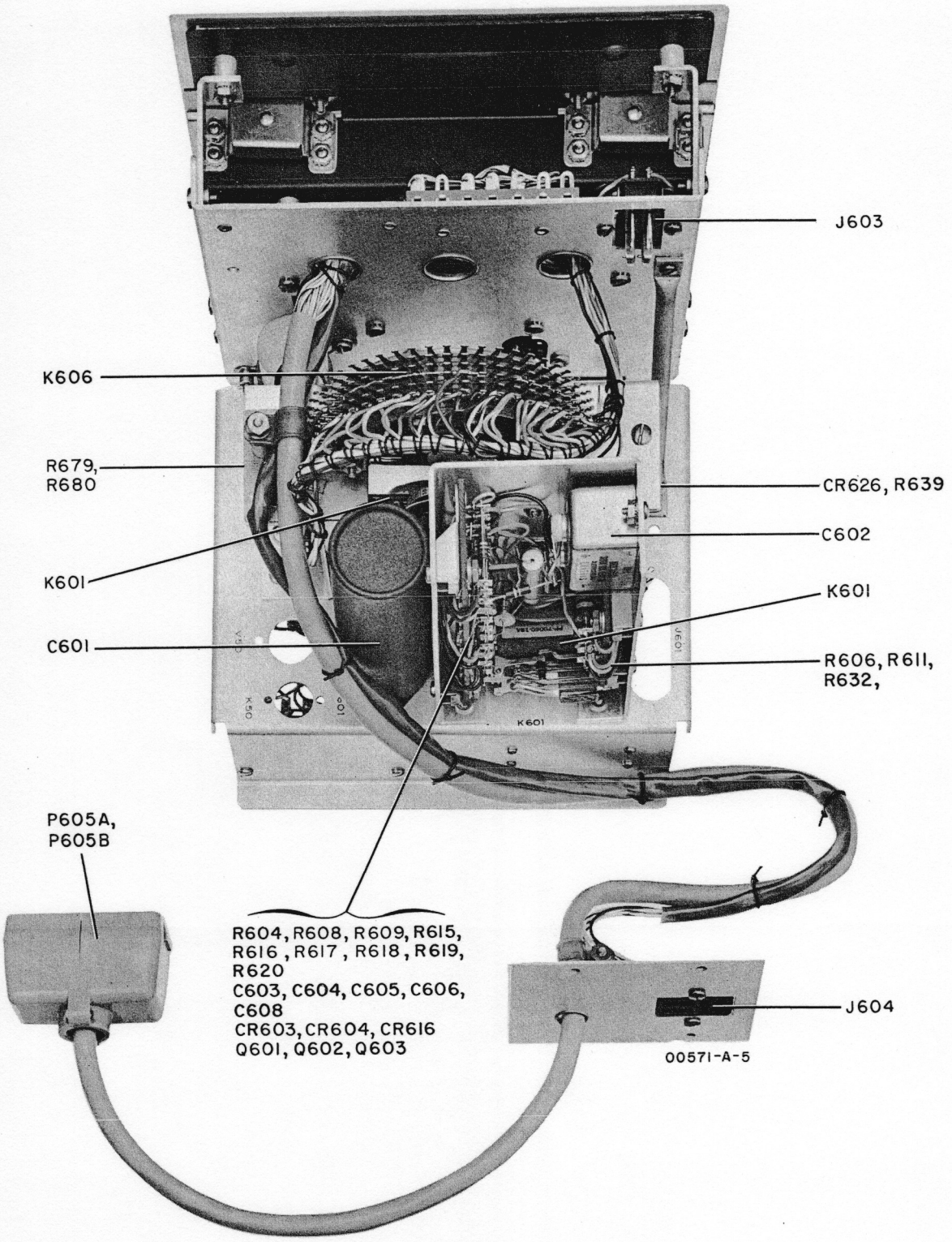


Figure 6-3. Components Location, Top

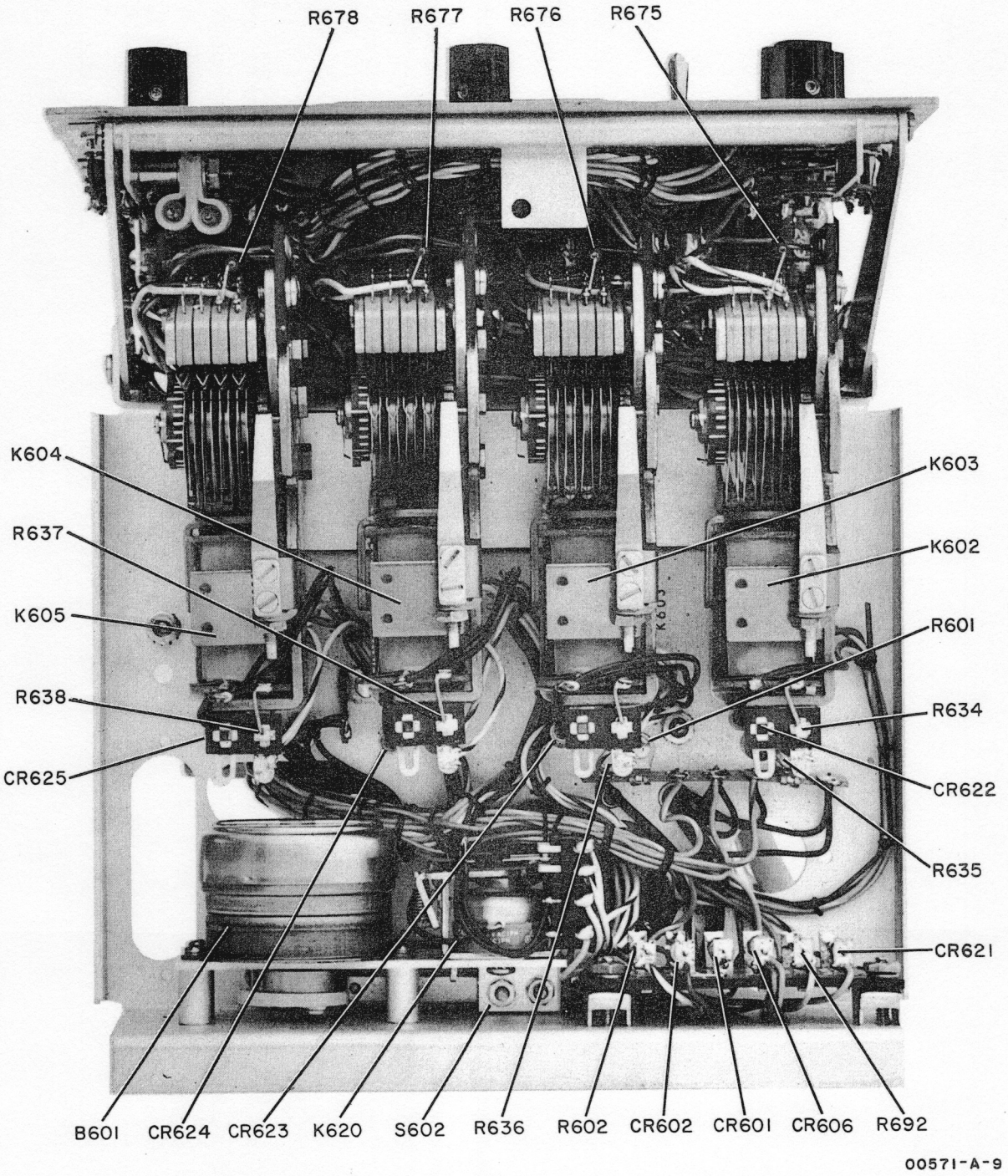


Figure 6-4. Components Location, Bottom

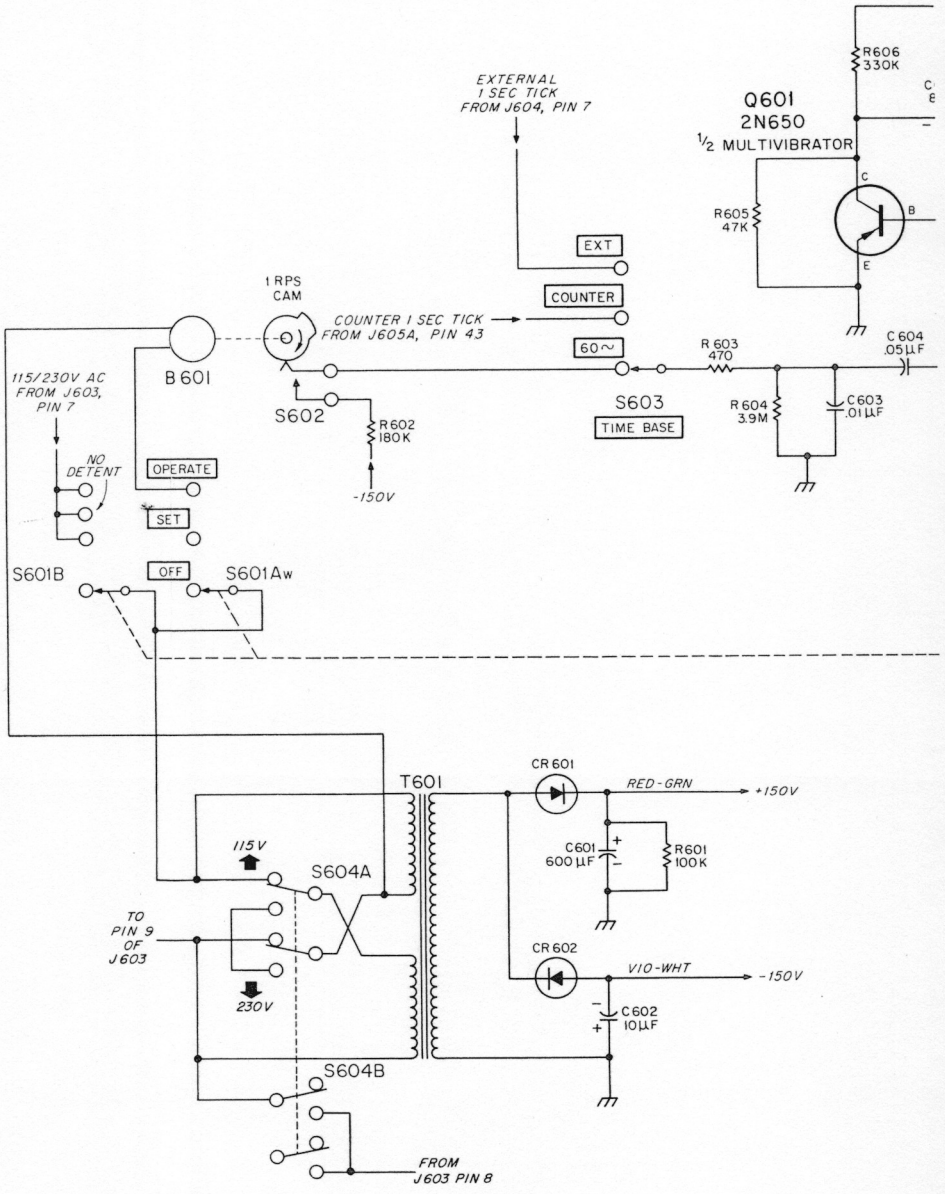
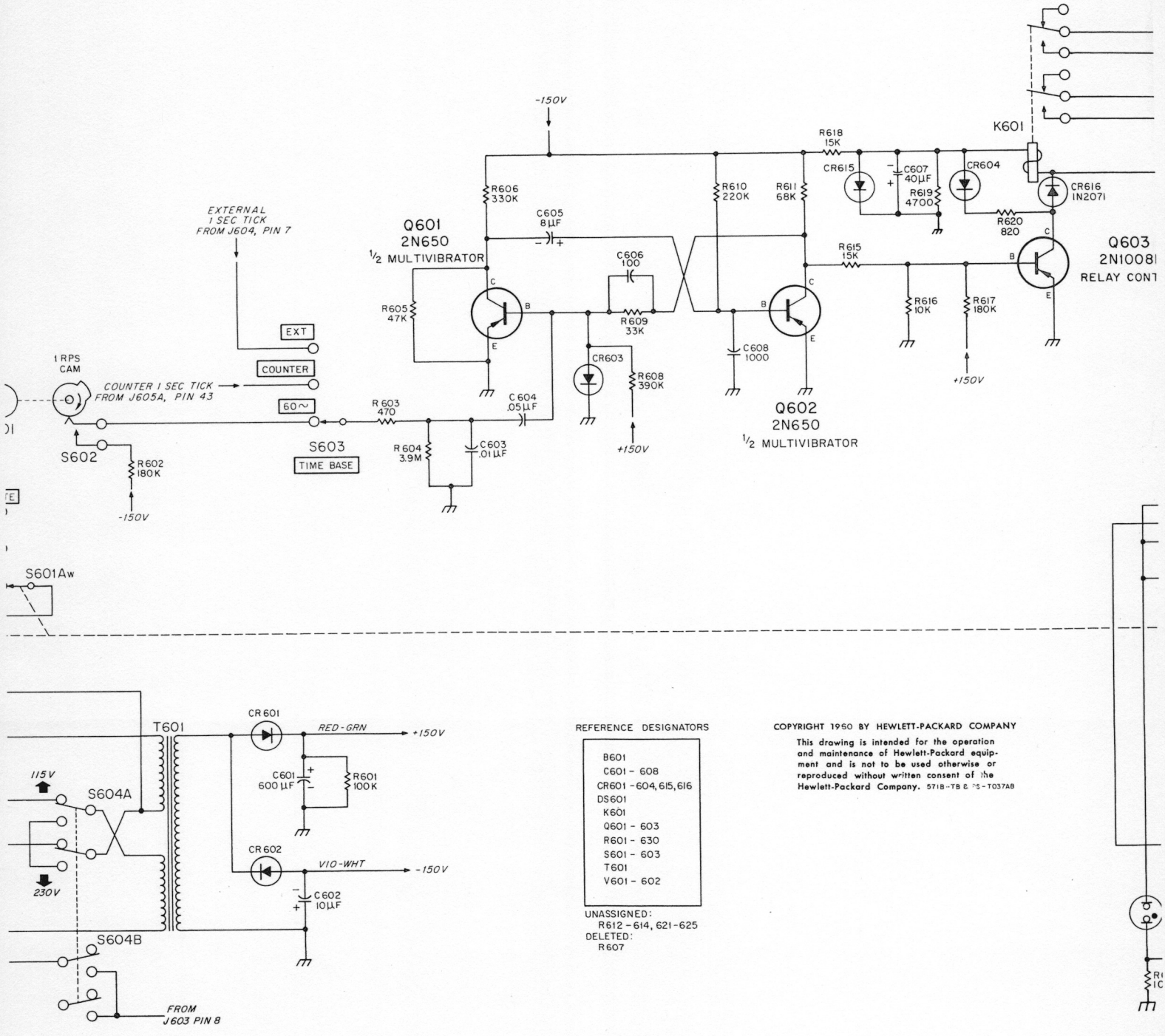


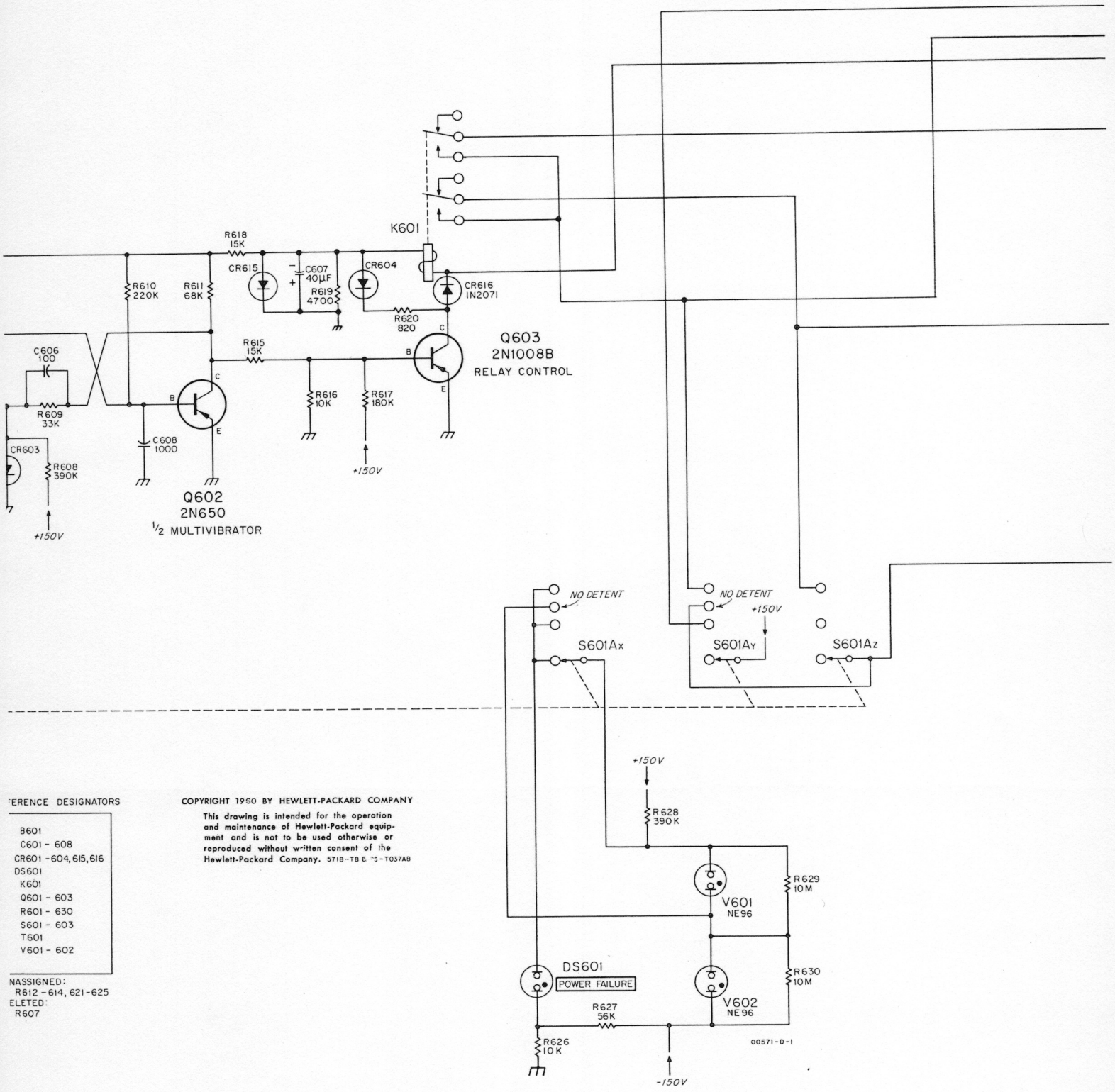
Figure 6-5. Time Base and Power Supply



REFERENCE DESIGNATORS

B601
C601 - 608
CR601 - 604, 615, 616
DS601
K601
Q601 - 603
R601 - 630
S601 - 603
T601
V601 - 602

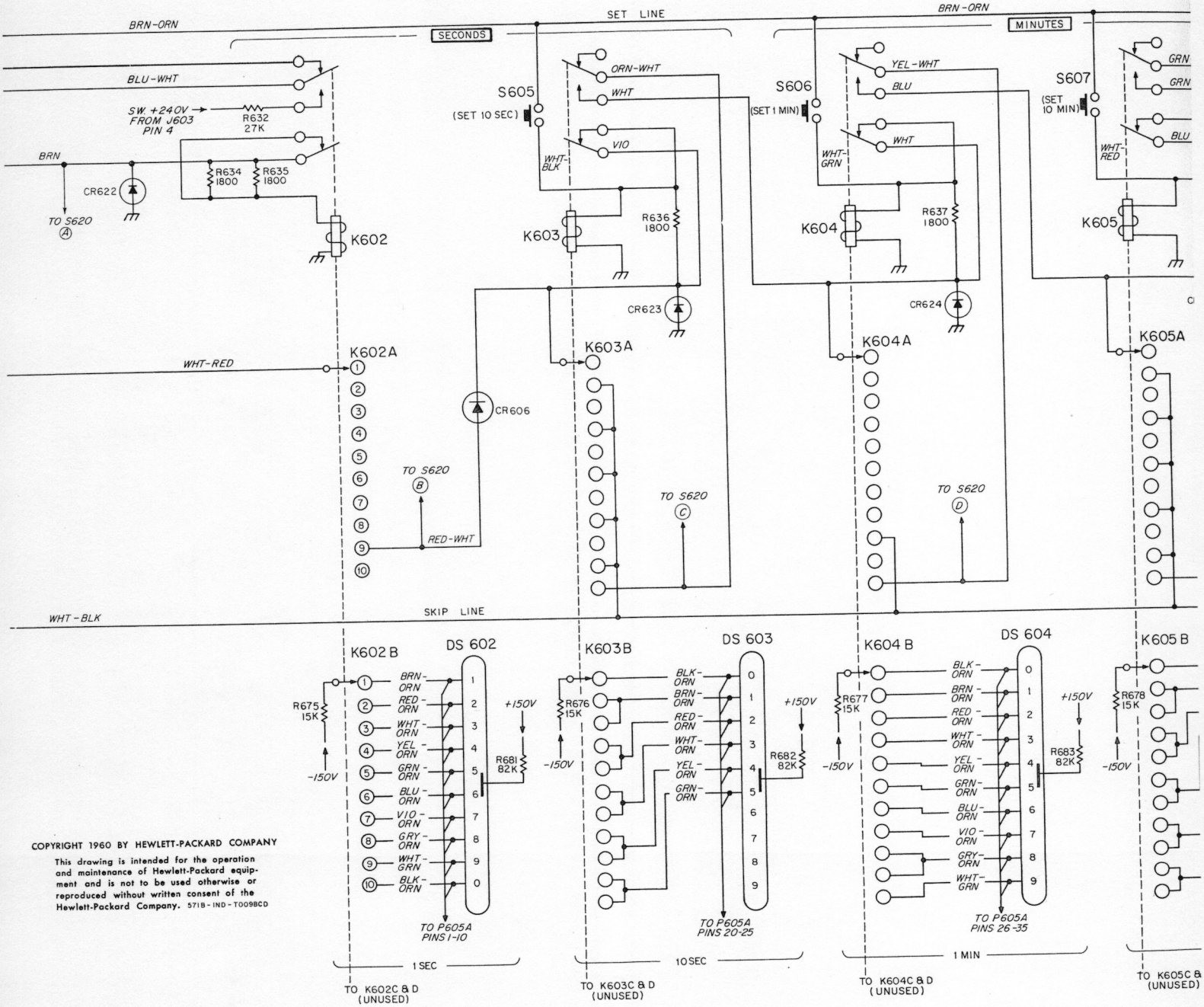
UNASSIGNED:
R612 - 614, 621 - 625
DELETED:
R607

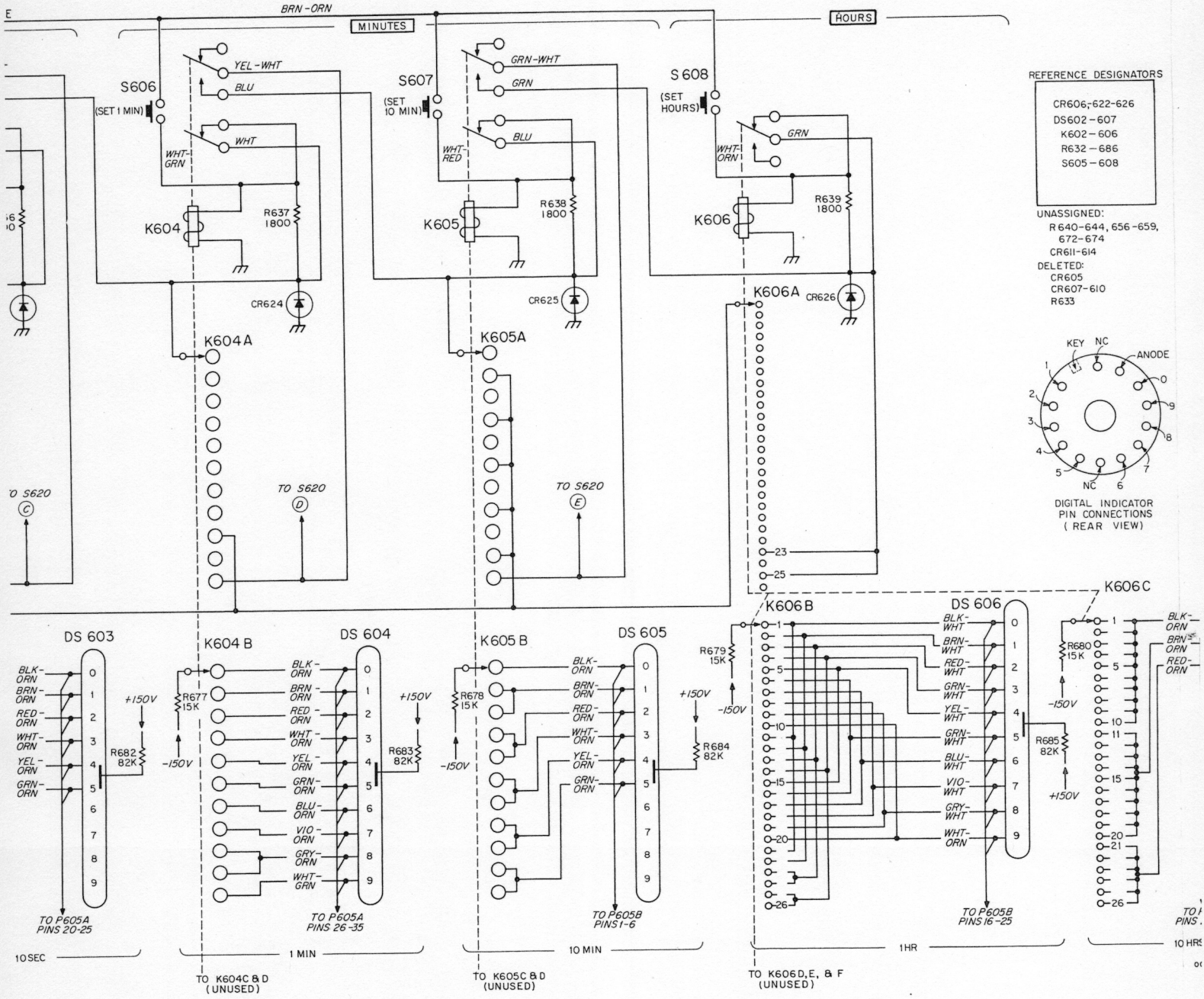


ERENCE DESIGNATORS

B601
C601 - 608
CR601 - 604, 615, 616
DS601
K601
Q601 - 603
R601 - 630
S601 - 603
T601
V601 - 602

NASSIGNED:
R612 - 614, 621-625
ELETED:
R607




BRN-ORN
MINUTES
HOURS
S606
(SET 1 MIN)
S607
(SET 10 MIN)
S 608
(SET HOURS)
YEL-WHT
BLU
WHT
WHT-GRN
GRN-WHT
GRN
WHT-RED
WHT-ORN
K604
K605
K606
R637 1800
R638 1800
R639 1800
CR624
CR625
CR626
K604A
K605A
K606A
TO S620 (C)
TO S620 (D)
TO S620 (E)
REFERENCE DESIGNATORS
CR606-622-626
DS602-607
K602-606
R632-686
S605-608
UNASSIGNED:
R640-644, 656-659, 672-674
CR611-614
DELETED:
CR605
CR607-610
R633
KEY
NC
ANODE
DIGITAL INDICATOR PIN CONNECTIONS (REAR VIEW)
DS 603
K604 B
DS 604
K605 B
DS 605
K606B
DS 606
K606C
BLK-ORN
BRN-ORN
RED-ORN
WHT-ORN
YEL-ORN
GRN-ORN
BLU-ORN
VIO-ORN
GRY-ORN
WHT-GRN
BLK-WHT
BRN-WHT
RED-WHT
GRN-WHT
YEL-WHT
BLU-WHT
VIO-WHT
GRY-WHT
WHT-ORN
+150V
-150V
R677 15K
R678 15K
R679 15K
R680 15K
R682 82K
R683 82K
R684 82K
R685 82K
TO P605A PINS 20-25
TO P605A PINS 26-35
TO P605B PINS 1-6
TO P605B PINS 16-25
10 SEC
1 MIN
10 MIN
1 HR
10 HRS
TO K604C & D (UNUSED)
TO K605C & D (UNUSED)
TO K606D, E, & F (UNUSED)

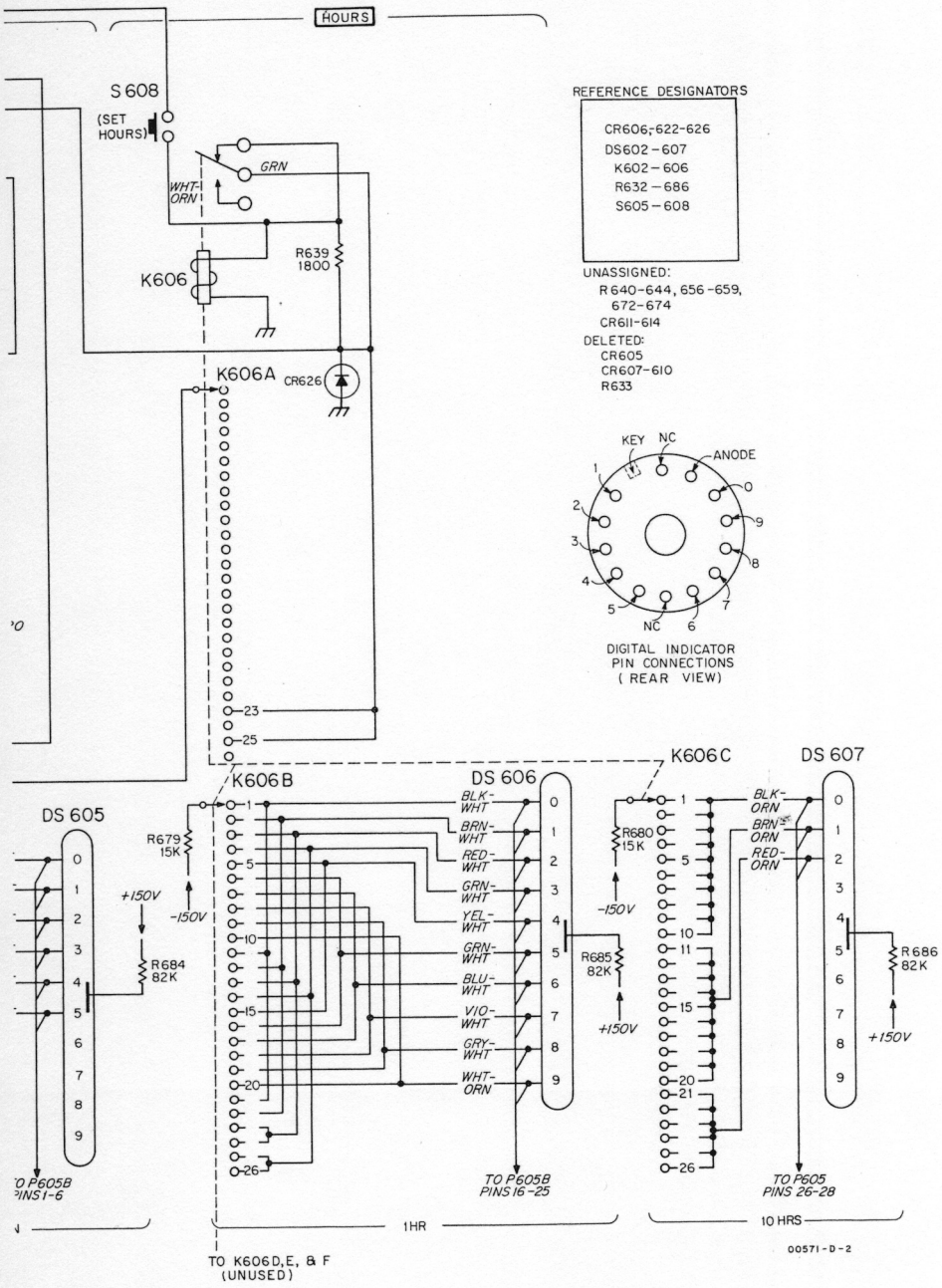
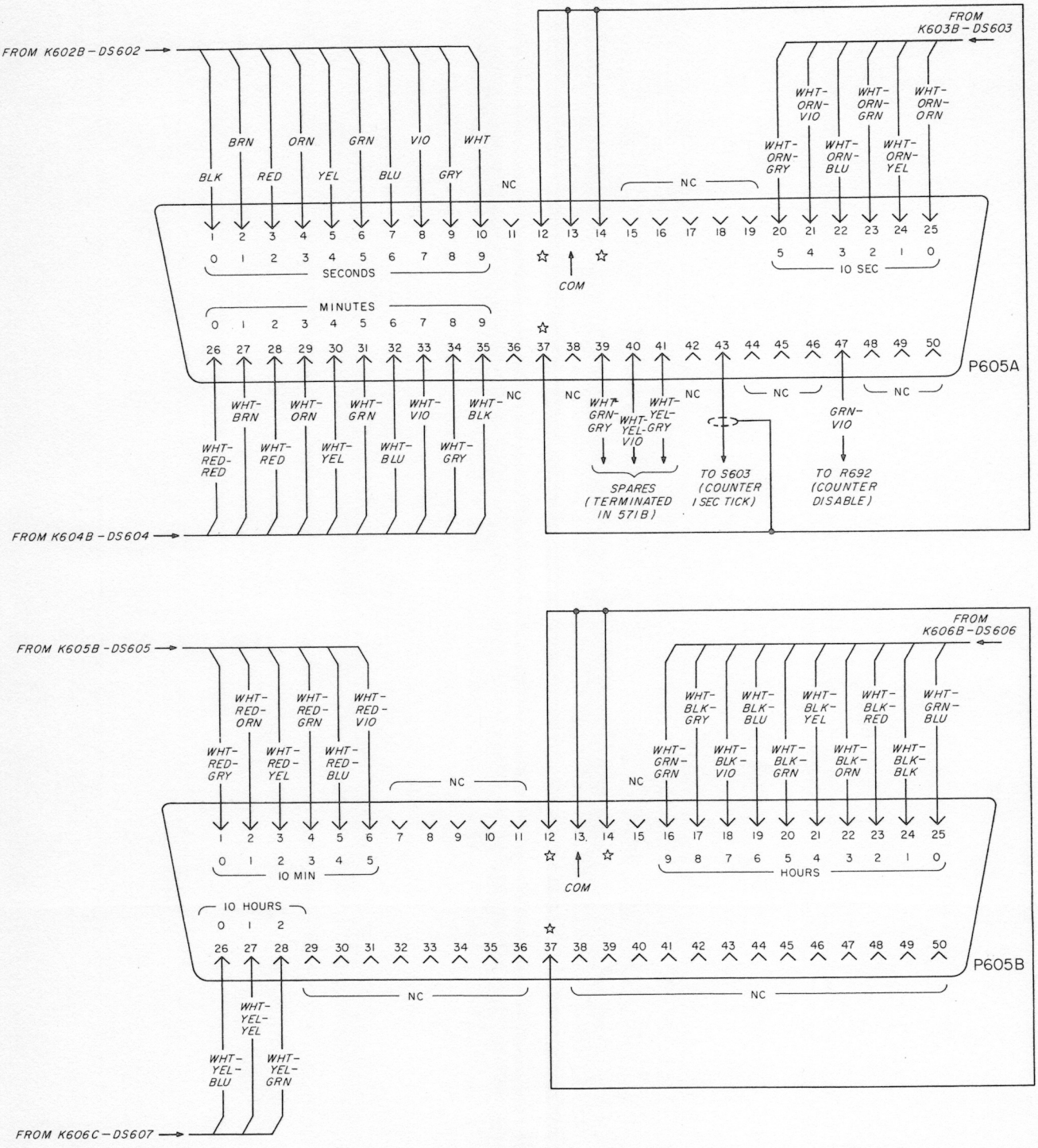
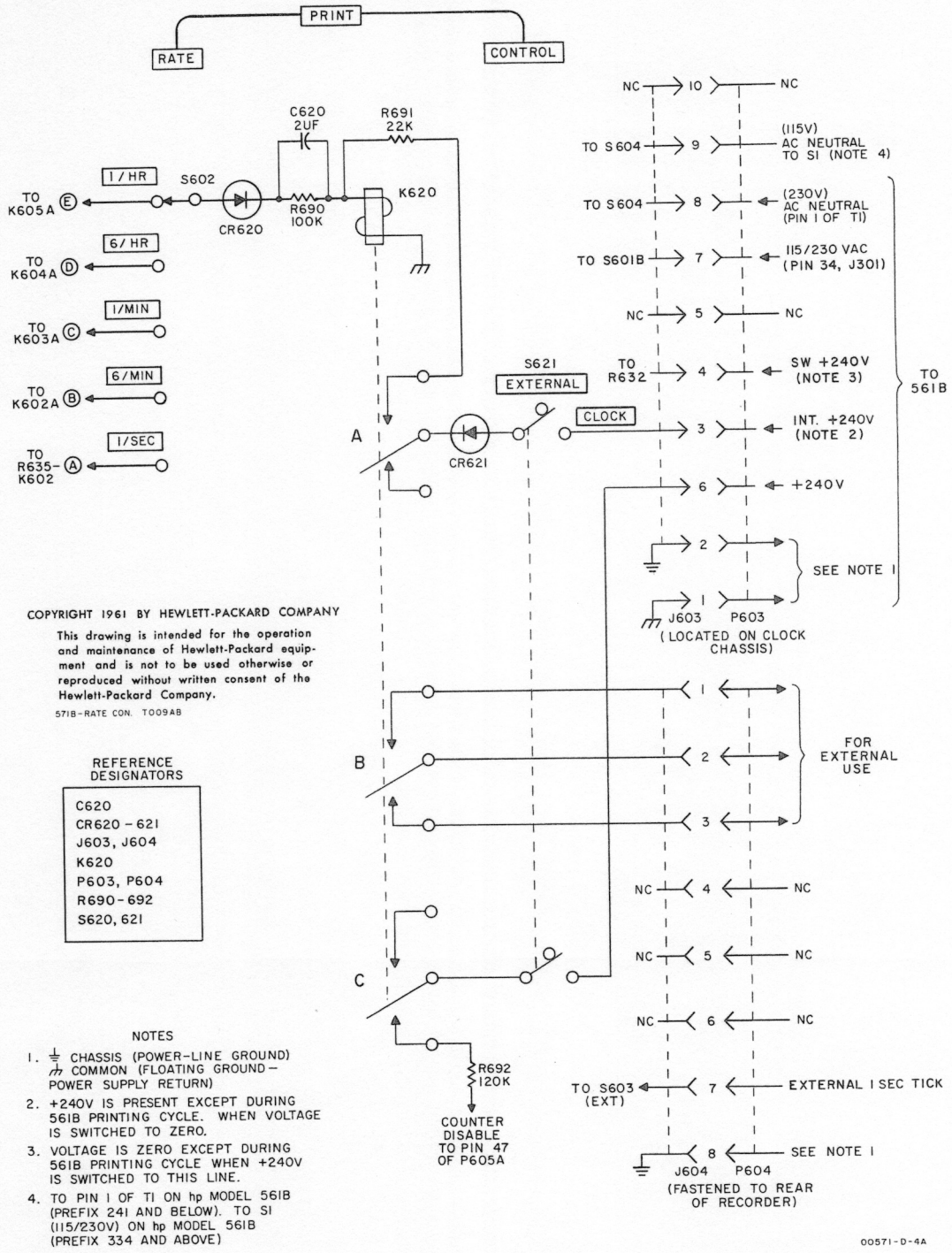


Figure 6-6. Stepping Switches and Indicators



NOTES:
1. ☆ THESE TERMINALS CONNECTED TO COMMON TO DISABLE BLANK PRINT-POSITION IN RECORDER
2. P605A AND P605B LOCATED ON CABLE AT REAR OF RECORDER

Figure 6-7. Clock Connector



571B-RATE CON. T009AB

REFERENCE DESIGNATORS

C620
CR620 - 621
J603, J604
K620
P603, P604
R690 - 692
S620, 621

NOTES

1. ⏚ CHASSIS (POWER-LINE GROUND) ⏚ COMMON (FLOATING GROUND — POWER SUPPLY RETURN)
2. +240V IS PRESENT EXCEPT DURING 561B PRINTING CYCLE. WHEN VOLTAGE IS SWITCHED TO ZERO.
3. VOLTAGE IS ZERO EXCEPT DURING 561B PRINTING CYCLE WHEN +240V IS SWITCHED TO THIS LINE.
4. TO PIN 1 OF T1 ON hp MODEL 561B (PREFIX 241 AND BELOW). TO S1 (115/230V) ON hp MODEL 561B (PREFIX 334 AND ABOVE)

Figure 6-8. Rate Relay and Connector

SECTION VII
REPLACEABLE PARTS

7-1. INTRODUCTION.

7-2. This section contains information for ordering replacement parts. Table 7-1 lists parts in alpha-numerical order of their reference designators and indicates the description and (hp) stock number of each part, together with any applicable notes. Table 7-2 lists parts in alpha-numerical order of their (hp) stock numbers and provides the following information on each part:

a. Description of the part (see list of abbreviations below).

b. Manufacturer of the part in a five-digit code; see Table 7-3.

c. Typical manufacturer's stock number.

d. Total quantity used in the instrument (TQ column).

7-3. Miscellaneous parts not indexed in Table 7-1 are listed at the end of Table 7-2.

7-4. ORDERING INFORMATION.

7-5. To order a replacement part, address order or inquiry to your local Hewlett-Packard field office (see list at rear of this manual for addresses).

7-6. Specify the following information for each part:

a. Model and complete serial number of instrument.

b. Hewlett-Packard stock number.

c. Circuit reference designator.

d. Description.

7-7. To order a part not listed in Tables 7-1 and 7-2, give a complete description of the part and include its function and location.

REFERENCE DESIGNATORS

A = assembly	E = misc electronic part	MP = mechanical part	TB = terminal board
B = motor	F = fuse	P = plug	TP = test point
C = capacitor	FL = filter	Q = transistor	V = vacuum tube, neon bulb, photocell, etc.
CP = coupling	J = jack	R = resistor	
CR = diode	K = relay	RT = thermistor	W = cable
DL = delay line	L = inductor	S = switch	X = socket
DS = device signaling (lamp)	M = meter	T = transformer	Y = crystal

ABBREVIATIONS

A = amperes	GE = germanium	N/C = normally closed	RMO = rack mount only
A.F.C = automatic frequency control	GL = glass	NE = neon	RMS = root-mean-square
AMPL = amplifier	GRD = ground(ed)	NI PL = nickel plate	
		N/O = normally open	S-B = slow-blow
B.F.O. = beat frequency oscillator	H = henries	NPO = negative positive zero (zero temperature coefficient)	SCR = screw
BE CU = beryllium copper	HEX = hexagonal		SE = selenium
BH = binder head	HG = mercury		SECT = section(s)
BP = bandpass	HR = hour(s)	NRFR = not recommended for field replacement	SEMICON = semiconductor
BRS = brass			SI = silicon
BWO = backward wave oscillator	IF = intermediate freq	NSR = not separately replaceable	SIL = silver
	IMPG = impregnated		SL = slide
CCW = counter-clockwise	INCD = incandescent		SPL = special
CER = ceramic	INCL = include(s)	OBD = order by description	SST = stainless steel
CMO = cabinet mount only	INS = insulation(ed)	OH = oval head	SR = split ring
COEF = coefficient	INT = internal	OX = oxide	STL = steel
COM = common			
COMP = composition	K = kilo = 1000	P = peak	TA = tantalum
CONN = connector		PC = printed circuit	TD = time delay
CP = cadmium plate	LIN = linear taper	PF = picofarads = 10^{-12} farads	TGL = toggle
CRT = cathode-ray tube	LK WASH = lock washer		TI = titanium
CW = clockwise	LOG = logarithmic taper	PH BRZ = phosphor bronze	TOL = tolerance
	LPF = low pass filter	PHL = Phillips	TRIM = trimmer
DEPC = deposited carbon		PIV = peak inverse voltage	TWT = traveling wave tube
DR = drive	M = milli = 10^{-3}	P/O = part of	
	MEG = meg = 10^{6}	POLY = polystyrene	U = micro = 10^{-6}
ELECT = electrolytic	METFLM = metal film	PORC = porcelain	
ENCAP = encapsulated	MFR = manufacturer	POS = position(s)	VAR = variable
EXT = external	MINAT = miniature	POT = potentiometer	VDCW = dc working volts
	MOM = momentary	PP = peak-to-peak	
F = farads	MTG = mounting	PT = point	W/ = with
FH = flat head	MY = "mylar"	RECT = rectifier	W = watts
FIL H = fillister head		RF = radio frequency	WW = wirewound
FXD = fixed	N = nano (10^{-9})	RH = round head	W/O = without

01194-10

Table 7-1. Reference Designation Index

Circuit Reference	℗ Stock No.	Description	Note
B601	3140-0023	Motor, 60RPM, 110V, 60 cps	
	3140-0025	Motor, 60RPM, 110V, 50 cps	
C1 thru C600		Not Assigned	
C601	0180-0046	fxd, elect, 600 uf, 200 VDCW	
C602	0180-0009	fxd, elect, 10 uf +100% -10%, 200 VDCW	
C603	0150-0012	fxd, cer, 10K pf ±20%, 1000 VDCW	
C604	0150-0052	fxd, cer, 0.05 uf ±20%, 400 VDCW	
C605	0180-0010	fxd, elect, 8 uf +50% -15%, 30 VDCW	
C606	0150-0051	fxd, cer, 100 pf, 600 VDCW	
C607	0180-0050	fxd, elect, 40 uf +100% -15%, 50 VDCW	
C608	0150-0050	fxd, cer, 1500 pf, 600 VDCW	
C609 thru C619		Not Assigned	
C620	0170-0002	fxd, my, 2 uf ±20%, 400 VDCW	
CR1 thru CR600		Not Assigned	
CR601, 602	1901-0028	Diode: si: type SD-500	
CR603	1910-0016	Diode: GE	
CR604	1901-0026	Diode: si: 200 PIV	
CR605		Delete	
CR606		Same as CR601	
CR607 thru CR610		Delete	
CR611 thru CR614		Not Assigned	
CR615		Same as CR604	
CR616	1901-0029	Diode: si: 600 PIV, 1N3194	
CR617 thru CR619		Not Assigned	
CR620		Same as CR601	
CR621		Same as CR604	
CR622 thru CR626		Same as CR601	
DS1 thru DS600		Not Assigned	
DS601	1450-0037	Lamp, neon: red, wire leads	
DS602 thru DS607	1970-0002	Tube, electron	
J1 thru J602		Not Assigned	
J603	1251-0386	Connector, male	
J604	1251-0043	Connector, female, 8 contact	
K1 thru K600		Not Assigned	
K601	0490-0030	Relay, DPDT, 17 VDCW coil	
K602	0492-0005	Switch, stepping, 110 VDCW, 10 point, 4 level	
K603 thru K605	0492-0003	Switch, stepping, 110 VDCW coil, 11 point, 4 level	
K606	0492-0004	Switch, stepping, 115 VDCW, 26 point, 6 level	
K607 thru K619		Not Assigned	
K620	0490-0029	Relay: 3 PDT, 110 VDCW coil	
P1 thru P602		Not Assigned	
P603	1251-0113	Connector, female	
P604	1251-0133	Connector, male, 8 contact	

See introduction to this section

Table 7-1. Reference Designation Index (Cont'd)

Circuit Reference	℗ Stock No.	Description	Note
P605A, B	1251-0102	Connector, male, 50 contact	
Q1 thru Q600		Not Assigned	
Q601, 602	1850-0048	Transistor, type 2N650	
Q603	1850-0049	Transistor, type 2N1008B	
R1 thru R600		Not Assigned	
R601	0687-1041	fxd, comp, 100K ohms ±10%, 1/2 W	
R602	0687-1841	fxd, comp, 180K ohms ±10%, 1/2 W	
R603	0687-4711	fxd, comp, 470 ohms ±10%, 1/2 W	
R604	0687-3951	fxd, comp, 3.9M ±10%, 1/2 W	
R605	0687-4731	fxd, comp, 47K ohms ±10%, 1/2 W	
R606	0687-3341	fxd, comp, 330K ohms ±10%, 1/2 W	
R607		Not Assigned	
R608	0687-3941	fxd, comp, 390K ohms ±10%, 1/2 W	
R609	0687-3331	fxd, comp, 33K ohms ±10%, 1/2 W	
R610	0687-2241	fxd, comp, 220K ohms ±10%, 1/2 W	
R611	0690-6831	fxd, comp, 68K ohms ±10%, 1 W	
R612 thru R614		Not Assigned	
R615	0687-1531	fxd, comp, 15K ohms ±10%, 1/2 W	
R616	0687-1031	fxd, comp, 10K ohms ±10%, 1/2 W	
R617		Same as R602	
R618	0767-0010	fxd, mfg, 15K ohms ±5%, 3 W	
R619	0690-4721	fxd, comp, 4.7K ohms ±10%, 1 W	
R620	0687-8211	fxd, comp, 820 ohms ±10%, 1/2 W	
R621 thru R625		Not Assigned	
R626		Same as R616	
R627	0687-5631	fxd, comp, 56K ohms ±10%, 1/2 W	
R628		Same as R608	
R629, 630	0687-1061	fxd, comp, 10M ±10%, 1/2 W	
R631		Not Assigned	
R632	0693-2731	fxd, comp, 27K ohms ±10%, 2 W	
R633		Delete	
R634, 635	0692-1825	fxd, comp, 1.8K ohms ± 5%, 2 W	
R636 thru 639	0690-1821	fxd, comp, 1.8K ohms ±10%, 1 W	
R640 thru R674		Not Assigned	
R675 thru R680		Same as R615	
R681 thru R686	0687-8231	fxd, comp, 82K ohms ±10%, 1/2 W	
R687 thru 689		Not Assigned	
R690		Same as R601	
R691	0693-2231	fxd, comp, 22K ohms ±10%, 2 W	
R692	0687-1241	fxd, comp, 120K ohms ±10%, 1/2 W	
R693 thru 699		Not Assigned	

See introduction to this section

Table 7-1. Reference Designation Index (Cont'd)

Circuit Reference	ℎp Stock No.	Description	Note
S1 thru S600		Not Assigned	
S601	3100-0237	Switch, rotary, 3 pos, 1 sect, 4 pole w/AC power switch	
S602	3101-0022	Switch, leaf, cam operated, SPST	
S603	3100-0236	Switch, rotary, 3 pos, 1 sect, 1 pole	
S604	3101-0034	Dual-DPDT 115/230	
S605 thru S608	3101-0014	Switch, push, SPDT	
S609 thru S619		Not Assigned	
S620	3100-0238	Switch, rotary, 1 sect, 5 pos	
S621	3101-0003	Switch, toggle, DPST	
T1 thru T600		Not Assigned	
T601	9100-0119	Transformer, power	
V1 thru V600		Not Assigned	
V601, 602	2140-0014	Lamp, neon, type NE-96	
		MISCELLANEOUS	
	571B-16A	Assembly, output cable	
	8120-0066	Cable, 50 conductor, 426'/100	
	1251-0003	Connector, taper pin	
	6040-0019	Kit, lubrication	
	G-74BS	Knob, black, bar w/arrow	
	1200-0055	Tube, socket	

See introduction to this section

Table 7-2. Replaceable Parts

℗ Stock No.	Description	Mfr.	Mfr. Part No.	TQ			
0150-0012	fxd, cer, 10K pf ±20%, 1000 VDCW	71590	13 C DISC order by description	1			
0150-0050	fxd, cer, 1000 pf, 600 VDCW	84411	E order by description	1			
0150-0051	fxd, cer, 100 pf, 600 VDCW	84411	EE order by description	1			
0150-0052	fxd, cer, 0.05 uf ±20%, 400 VDCW	05729	20X503MC4	1			
0170-0002	fxd, my, 2 uf ±20%, 400 VDCW	84411	663UW20504	1			
0180-0009	fxd, elect, 10 uf +100% -10%, 200 VDCW	00853	BTF 3010	1			
0180-0010	fxd, elect, 8 uf +50% -15%, 30 VDCW	10411	Order by description	1			
0180-0046	fxd, elect, 600 uf, 200 VDCW	56289	D 26725	1			
0180-0050	fxd, elect, 40 uf +100% -15%, 50 VDCW	56289	D 32538	1			
0490-0029	Relay: 3PDT, 110 VDCW coil	77342	KA14D	1			
0490-0030	Relay: DPDT, 17 VDCW coil	04773	EQA, R2-19, 2C	1			
0492-0003	Switch, stepping 110 VDCW coil, 11 point, 4 level	04773	type 44 (PW-54093-1)	1			
0492-0004	Switch, stepping, 115 VDCW 26 point, 6 level	04773	A-259836	3			
0492-0005	Switch, stepping, 110 VDCW, 10 point, 4 level	04773	type 40 (PW-4401-1)	1			
0687-1031	fxd, comp, 10K ohms ±10%, 1/2 W	01121	EB1031	2			
0687-1041	fxd, comp, 100K ohms ±10%, 1/2 W	01121	EB1041	2			
0687-1061	fxd, comp, 10M ±10%, 1/2 W	01121	EB1061	2			
0687-1241	fxd, comp, 120K ohms ±10%, 1/2 W	01121	EB1241	1			
0687-1531	fxd, comp, 15K ohms ±10%, 1/2 W	01121	EB1531	1			
0687-1841	fxd, comp, 180K ohms ±10%, 1/2 W	01121	EB1841	2			
0687-2241	fxd, comp, 220K ohms ±10%, 1/2 W	01121	EB2241	1			
0687-3331	fxd, comp, 33K ohms ±10%, 1/2 W	01121	EB3331	1			
0687-3341	fxd, comp, 330K ohms ±10%, 1/2 W	01121	EB3341	1			
0687-3941	fxd, comp, 390K ohms ±10%, 1/2 W	01121	EB3941	2			
0687-3951	fxd, comp, 3.9M ±10%, 1/2 W	01121	EB3951	1			
0687-4711	fxd, comp, 470 ohms ±10%, 1/2 W	01121	EB4711	1			
0687-4731	fxd, comp, 47K ohms ±10%, 1/2 W	01121	EB4731	1			
0687-5631	fxd, comp, 56K ohms ±10%, 1/2 W	01121	EB5631	1			
0687-8211	fxd, comp, 820 ohms ±10%, 1/2 W	01121	EB8211	1			
0687-8231	fxd, comp, 82K ohms ±10%, 1/2 W	01121	EB8231	6			
0690-1821	fxd, comp, 1.8K ohms ±10%, 1 W	01121	GB1821	4			
0690-4721	fxd, comp, 4.7K ohms ±10%, 1 W	01121	GB4721	1			
0690-6831	fxd, comp, 68K ohms ±10%, 1 W	01121	GB6831	1			
0692-1825	fxd, comp, 1.8K ohms, ±5%, 2 W	01121	HB1825	2			
0693-2231	fxd, comp, 22K ohms ±10%, 2 W	01121	HB2231	1			
0693-2731	fxd, comp, 27K ohms ±10%, 2 W	01121	HB2731	1			
0767-0010	fxd, mfg, 15K ohms ±5%, 3 W	07115	LPI-3 order by description	1			

See introduction to this section

Table 7-2. Replaceable Parts (Cont'd)

℗ Stock No.	Description	Mfr.	Mfr. Part No.	TQ			
1251-0043	Connector, female, 8 contact	71785	2611208010	1			
1251-0102	Connector, male, 50 contact	02660	57-0993-01	2			
1251-0113	Connector, female	71785	2611208030	1			
1251-0133	Connector, male, 8 contact	71785	2611108031	1			
1251-0386	Connector, male	71785	2611110010	1			
1450-0037	Lamp, neon: red, wire leads	03797	1B9-5279	1			
1850-0048	Transistor, type 2N650	04713	2N650	2			
1850-0049	Transistor, type 2N1008B	04713	2N1008B	1			
1880-0013	Diode: se: type 9GA8	75042	9GA8	6			
1901-0008	Diode: si: type SD91A	81483	SD-91A	4			
1901-0012	Diode: si: type 1N2071	81483	EIA 1N2071	2			
1901-0028	Diode: si: type SD-500	02735	34532	9			
1910-0004	Diode: ge: type 1N90	73293	EIA 1N90	1			
1970-0002	Tube, electron	83594	B5092	6			
2140-0014	Lamp, neon, type NE-96	24455	NE-96	2			
3100-0236	Switch, rotary, 3 pos, 1 sect, 1 pole	76854	204057-K1	1			
3100-0237	Switch, rotary, 3 pos, 1 sect, 4 pole w/AC power switch	76854	204058-H1AC	1			
3100-0238	Switch, rotary, 1 sect, 5 pos	76854	204059-N1	1			
3101-0003	Switch, toggle, DPST	88140	8908K434	1			
3101-0014	Switch, push, SPDT	82389	4S-1106	4			
3101-0022	Switch, leaf, cam operated, SPST	82389	2S-1743	1			
3101-0034	Switch, Dual DPDT	42190	6633	1			
3140-0023	Motor, 60 RPM, 110 V, 60 cps	73061	type 12 (obd)				
9100-0119	Transformer, power	98734	8876	1			
	MISCELLANEOUS						
G-74BS	Knob, black, bar w/arrow	28480	G-74BS	3			
571B-16A	Assembly, output cable	28480	571B-16A	1			
1200-0055	Tube, socket	83594	HSK-112	6			
1251-0003	Connector, taper pin	00779	41648	1			
6040-0019	Kit, lubrication	04773	PD-9100-1	1			
8120-0066	Cable, 50 conductor, 426'/100	Sequoia Wire	30092	2			

See introduction to this section

Table 7-3. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 handbooks.

Code No.	Manufacturer	Address
00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N. Y.
00334	Humidail Co.	Colton, Calif.
00335	Westrex Corp.	New York, N.Y.
00373	Garlock Packing Co., Electronic Products Div.	Camden, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Company, Ordill Division (Capacitors)	Marion, Ill.
00866	Goe Engineering Co.	Los Angeles, Calif.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc. Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01561	Chassi-Trak Corp.	Indianapolis, Ind.
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01930	Amerock Corp	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02286	Cole Mfg. Co.	Palo Alto, Calif.
02660	Amphenol-Borg Electronics Corp.	Chicago, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	El Monte, Calif.
03877	Transitron Electronic Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co.	Morristown, N.J.
03954	Air Marine Motors, Inc.	Los Angeles, Calif.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lambertville, N. J.
04062	Elmenco Products Co.	New York, N.Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04298	Elgin National Watch Co., Electronics Division	Burbank, Calif.
04354	Precision Paper Tube Co.	Chicago, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Prods., Inc. Electronic Tube Div.	Mountain View, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc., Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04777	Automatic Electric Sales Corp.	Northlake, Ill.
04796	Sequoia Wire & Cable Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P. M. Motor Company	Chicago 44, Ill.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05277	Westinghouse Electric Corp., Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05593	Illumitronic Engineering Co.	Sunnyvale, Calif.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metropolitan Telecommunications Corp., Metro Cap. Division	Brooklyn, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	The Bassick Co.	Bridgeport, Conn.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co. Inc.	New Rochelle, N. Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06751	U. S. Semcor Division of Nuclear Corp. of America	Phoenix, Arizona
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
07115	Corning Glass Works Electronic Components Dept.	Bradford, Pa.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N. Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07261	Avnet Corp.	Los Angeles, Calif.
07263	Fairchild Semiconductor Corp.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	The Birtcher Corp.	Los Angeles, Calif.
07700	Technical Wire Products	Springfield, N.J.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Rheem Semiconductor Corp.	Mountain View, Calif.
07966	Shockley Semi-Conductor Laboratories	Palo Alto, Calif.
07980	Boonton Radio Corp.	Boonton, N.J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08289	Blinn, Delbert, Co.	Pomona, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada.
08717	Sloan Company	Burbank, Calif.
08718	Cannon Electric Co., Phoenix Div.	Phoenix, Ariz.
08792	CBS Electronics Semiconductor Operations, Div. of C.B.S., Inc.	Lowell, Mass.
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays, Inc.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Atohm Electronics	Sun Valley, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09664	The Bristol Co.	Waterbury, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11312	Microwave Electronics Corp.	Palo Alto, Calif.
11534	Duncan Electronic, Inc.	Santa Ana, Calif.
11711	General Instrument Corporation Semiconductor Division	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12136	Philadelphia Handle Co.	Camden, N. J.
12697	Clarostat Mfg. Co.	Dover, N.H.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
13103	Thermolloy	Dallas, Texas
13396	Telefunken (G.M.B.H.)	Hannover, Germany
13835	Midland Mfg. Co.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14655	Cornell Dubilier Elec. Corp.	So. Plainfield, N.J.
14960	Williams Mfg. Co.	San Jose, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15909	The Daven Co.	Livingston, N.J.
16037	Spruce Pine Mica Co.	Spruce Pine, N. C.
16352	Computer Diode Corp.	Lodi, N. J.
16688	De Jur-Amsco Corporation	Long Island City 1, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Calif.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
19315	Eclipse Pioneer, Div. of Bendix Aviation Corp.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19701	Electra Manufacturing Co.	Kansas City, Mo.
20183	Electronic Tube Corp.	Philadelphia, Pa.
21226	Executive, Inc.	New York, N.Y.
21520	Fansteel Metallurgical Corp.	No. Chicago, Ill.
21335	The Fafnir Bearing Co.	New Britain, Conn.
21964	Fed. Telephone and Radio Corp.	Clifton, N.J.
24446	General Electric Co.	Schenectady, N.Y.
24455	G.E., Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobet File Co. of America, Inc.	Carlstadt, N.J.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Corp.	Hawkesbury, Ontario, Canada
37942	P.R. Mallory & Co., Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer and Inst. Co.	Philadelphia, Pa.
49956	Raytheon Company	Lexington, Mass.
52090	Rowan Controller Co.	Baltimore, Md.
63743	Ward Leonard Electric	Mt. Vernon, N.Y.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Sorenson & Co., Inc.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex, Inc.	St. Paul, Minn.
59730	Thomas & Betts Co.	Elizabeth 1, N.J.
60741	Tripplett Electrical Inc.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Swissvale, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Div. of Daystrom, Inc.	Newark, N.J.
66295	Wittek Manufacturing Co.	Chicago 23, Ill.
66346	Wollensak Optical Co.	Rochester, N.Y.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control Co., Inc.	New York, N.Y.
70319	Allmetal Screw Prod. Co., Inc.	Garden City, N.Y.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	New York, N.Y.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio Inc.	Cleveland, Ohio
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Allen D. Cardwell Electronic Prod. Corp.	Plainville, Conn.
71400	Bussmann Fuse Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71450	CTS Corp.	Elkhart, Ind.
71468	Cannon Electric Co.	Los Angeles, Calif.
71471	Cinema Engineering Co.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71700	The Cornish Wire Co.	New York, N.Y.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71753	A.O. Smith Corp., Crowley Div.	West Orange, N.J.
71785	Cinch Mfg. Corp.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72092	Eitel-McCullough, Inc.	San Bruno, Calif.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
71707	Coto Coil Co., Inc.	Providence, R.I.
72354	John E. Fast & Co.	Chicago, Ill.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	General Ceramics Corp.	Keasbey, N.J.
72699	General Instrument Corp., Semiconductor Div.	Newark, N.J.
72758	Girard-Hopkins	Oakland, Calif.
72765	Drake Mfg. Co.	Chicago, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Resistor Corp.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Instruments, Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Electronic Co., Div. of North American Phillips Co, Inc.	Hicksville, N.Y.
73490	Beckman Helipot Corp.	So. Pasadena, Calif.
73506	Bradley Semiconductor Corp.	Hamden, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73682	George K. Garrett Co., Inc.	Philadelphia, Pa.
73734	Federal Screw Prod. Co.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	The General Industries Co.	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N. Y.
73905	Jennings Radio Mfg. Co.	San Jose, Calif.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75173	Jones, Howard B., Division of Cinch Mfg. Corp.	Chicago, Ill.
75378	James Knights Co.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littlefuse Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	Micamold Electronic Mfg. Corp.	Brooklyn, N.Y.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Monadnock Mills	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	Bendix Pacific Division of Bendix Corp.	No. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phaostran Instrument and Electronic Co.	South Pasadena, Calif.
77250	Phoell Mfg. Co.	Chicago, Ill.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	Potter and Brumfield, Div. of American Machine and Foundry	Princeton, Ind.
77630	Radio Condenser Co.	Camden, N.J.
77638	Radio Receptor Co., Inc.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	Pasadena, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80120	Schnitzer Alloy Products	Elizabeth, N.J.
80130	Times Facsimile Corp.	New York, N.Y.
80131	Electronic Industries Association.	Any brand tube meeting EIA standards Washington, D.C.
80207	Unimax Switch, Div. of W.L. Maxson Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Laboratories, Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Fulton Controls Co.	Columbus 16, Ohio
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Adhesive Label Corp.	Monrovia, Calif.
80583	Hammerlund Co., Inc.	New York, N.Y.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
81030	International Instruments, Inc.	New Haven, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Electronics Co., Inc.	Norwalk, Conn.
81349	Military Specification	.....
81415	Wilkor Products, Inc.	Cleveland, Ohio
81453	Raytheon Mfg. Co., Industrial Components Div., Industr. Tube Operations	Newton, Mass.
81483	International Rectifier Corp.	El Segundo, Calif.
81541	The Airpax Products Co.	Cambridge, Mass.
81860	Barry Controls, Inc.	Watertown, Mass.

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Table 7-3. Code List of Manufacturers (Cont'd)

Code No.	Manufacturer	Address
82042	Carter Parts Co.	Skokie, Ill.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Allen B. DuMont Labs, Inc.	Clifton, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Div.	Emporium, Pa.
82376	Astron Co.	East Newark, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals and Controls, Inc., Div. of Texas Instruments, Inc., Spencer Prods.	Attleboro, Mass.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Manufacturing Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83053	Western Washer Mfr. Co.	Los Angeles, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	Pyramid Electric Co.	Darlington, S.C.
83148	Electro Cords Co.	Los Angeles, Calif.
83186	Victory Engineering Corp.	Union, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co., Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp., Electronic Tube Div.	Plainfield, N.J.
83740	Eveready Battery	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
84171	Arco Electronis, Inc.	New York, N.Y.
84396	A. J. Glesener Co., Inc.	San Francisco, Calif.
84411	Good All Electric Mfg. Co.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Calif.
85474	R.M. Bracamonte & Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	New Haven, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86197	Clifton Precision Products	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, RCA Electron Tube Div.	Harrison, N.J.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	Seattle, Wash.
87930	Tower Mfg. Corp	Providence, R. I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	General Electric Distributing Corp.	Schenectady, N.Y.
89636	Carter Parts Div. of Economy Baler Co.	Chicago, Ill.
89665	United Transformer Co.	Chicago, Ill.
90179	U.S. Rubber Co., Mechanical Goods Div.	Passaic, N.J.
90970	Bearing Engineering Co.	San Francisco, Calif.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Brothers', Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Philadelphia, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91929	Minneapolis-Honeywell Regulator Co., Micropswitch Div.	Freeport, Ill.
92180	Tru-Connector Corp.	Peabody, Mass.
92196	Universal Metal Prod., Inc.	Bassett Puente, Calif.
92367	Elgeet Optical Co., Inc.	Rochester, N.Y.
92607	Tinsolite Insulated Wire Co.	Tarrytown, N.Y.
93332	Sylvania Electric Prod. Inc., Semiconductor Div.	Woburn, Mass.
93369	Robbins and Myers, Inc.	New York, N.Y.
93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio
93788	Howard J. Smith Inc.	Port Monmouth, N. J.
93929	G. V. Controls	Livingston, N. J.
93983	Insuline-Van Norman Ind., Inc. Electronic Division	Manchester, N.H.
94137	General Cable Corp.	Bayonne, N.J.
94144	Raytheon Mfg. Co., Industrial Components Div., Receiving Tube Operation	Quincy, Mass.
94145	Raytheon Mfg. Co., Semiconductor Div., California Street Plant	Newton, Mass.
94148	Scientific Radio Products, Inc.	Loveland, Colo.
94154	Tung-Sol Electric, Inc.	Newark, N.J.
94197	Curtiss-Wright Corp., Electronics Div.	East Paterson, N.J.
94222	Southco Div. of S. Chester Corp.	Lester, Pa.
94310	Tru Ohm Prod. Div. of Model Engineering and Mfg. Co.	Chicago, Ill.
94330	Wire Cloth Products Inc.	Chicago, Ill.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
95023	Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.	Miami, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	New York, N.Y.
95264	Lerco Electronics, Inc.	Burbank, Calif.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordas Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Chicago, Ill.
95712	Dage Electric Co.	Beech Groove, Ind.
95987	Weckesser Co.	Chicago, Ill.
96067	Huggins Laboratories	Sunnyvale, Calif.
96095	Hi-Q Division of Aerovox	Olean, N.Y.
96256	Thordarson-Meissner Div. of Maguire Industries, Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic and Precision Mfg. Co.	Yonkers, N.Y.
97966	CBS Electronics, Div. of C.B.S., Inc.	Danvers, Mass.
97979	Reon Resistor Corp.	Yonkers, N.Y.
98141	Axel Brothers Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Calif.
98220	Francis L. Mosley	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98405	Carad Corp.	Redwood City, Calif.
98731	General Mills	Minneapolis, Minn.
98821	North Hills Electric Co.	Mineola, N.Y.
98925	Clevite Transistor Prod. Div. of Clevite Corp.	Waltham, Mass.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99515	Marshall Industries, Electron Products Division	Pasadena, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99934	Renbrandt, Inc.	Boston, Mass.
99942	Hoffman Semiconductor Div. of Hoffman Electronics Corp.	Evanston, Ill.
99957	Technology Instrument Corp of Calif.	Newbury Park, Calif.

THE FOLLOWING H-P VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

C0000	JFD Electronics Corp.	Van Nuys, Calif.
G0000	Tranex Company	Mountain View, Calif.
I0000	Western Devices, Inc.	Inglewood, Calif.
J0000	Winchester Electronics, Inc.	Santa Monica, Calif.
0000F	Malco Tool and Die	Los Angeles, Calif.
0000M	Western Coil Div. of Automatic Ind., Inc.	Redwood City, Calif.
0000N	Nahm-Bros. Spring Co.	San Leandro, Calif.
0000P	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
0000W	Webster Electronics Co. Inc.	New York, N.Y.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AA	British Radio Electronics Ltd.	Washington, D.C.
000AB	ETA	England
000AC	Indiana General Corp., Elect. Div.	Indiana
000AD	Curtis Instrument Inc.	Mt. Kisco, N.Y.
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	A "N" D Manufacturing Co.	San Jose 27, Calif.
000QQ	Cooltron	Oakland, Calif.
000RR	Radio Industries	Des Plaines, Ill.
000SS	Control of Elgin Watch Co.	Burbank, Calif.
000WW	California Eastern Lab.	Burlingame, Calif.
000XX	Methode Electronics, Inc.	Chicago 31, Ill.
000YY	S.K. Smith Co.	Los Angeles 45, Calif.

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APPENDIX I - MANUAL CHANGES

This manual applies directly to 571B Digital Clocks with serial number prefix 330. With the following changes, this manual also applies to older Digital Clocks with serial number prefix 219 or 037.

To adapt this manual to older instruments with serial number prefix 219 or 037, make the following changes:

Instrument Serial No. Prefix	Change No.
219	1
037	1, 2

CHANGE 1:

Figure 6-5, Delete S604 and change schematic to appear as shown on partial schematic.

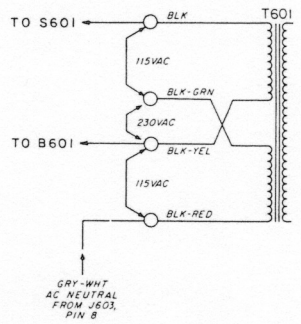


Figure 6-8, J603, P603: Delete terminals 9 and 10: Connection to pin 8 of J603 should read: to T601.

Table 7-1, Table 7-2, J603: Change ⓗp Stock No. to 1251-0043, connector, male.

P603: Change ⓗp Stock No. to 1251-0113.

CHANGE 2:

Figure 6-6, Tables 7-1, 7-2,

K602: Change to switch, stepping, 110 vdcw, 11 point, 4 level, ⓗⓟ Stock No. 0492-0002, Mfr. Part No. type 44 (PW - 54091-1).

Add: CR605, 607 thru 610, ⓗⓟ Stock No. 1880-0013, as shown on partial schematic.

Delete: CR622 thru CR626, ⓗⓟ Stock No. 1901-0028.

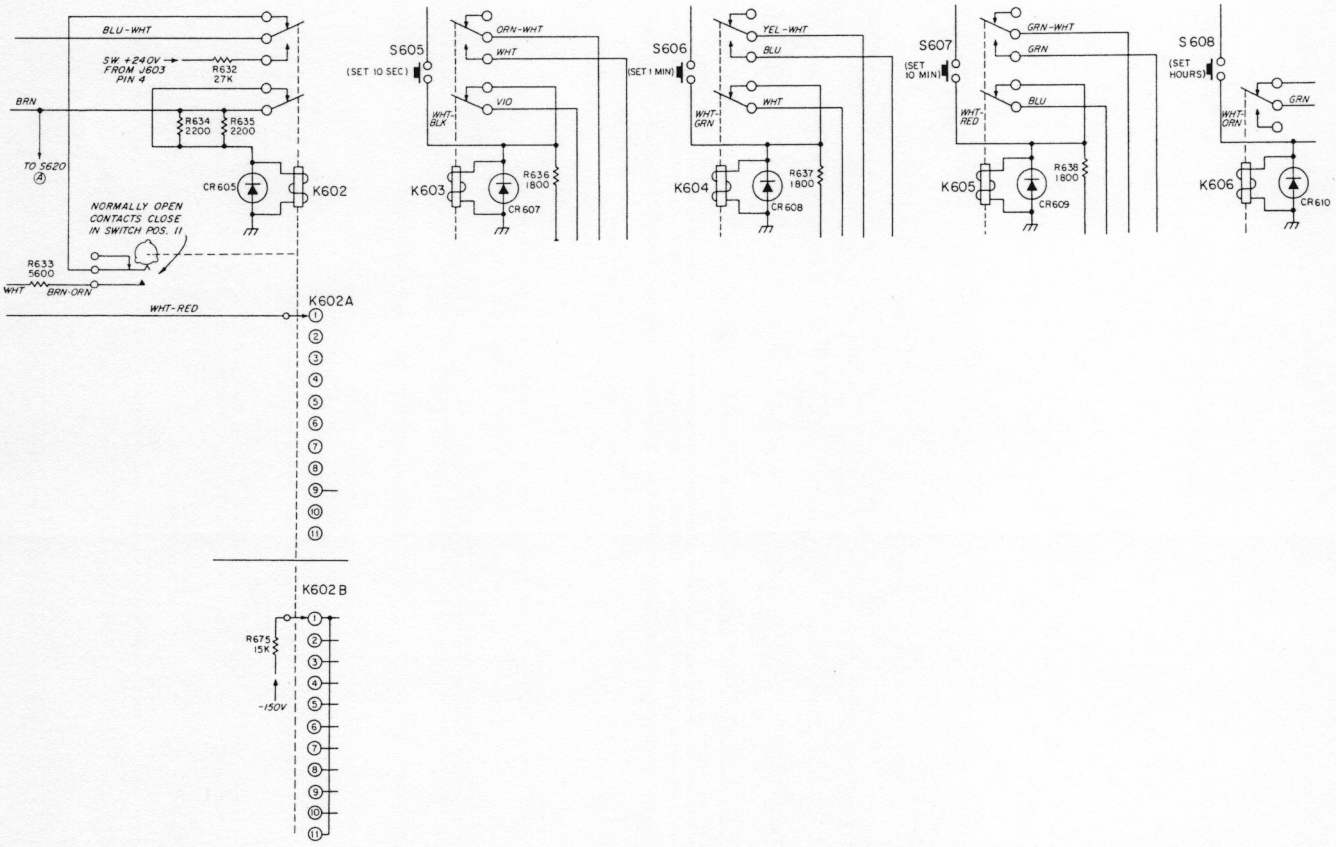
Add: R633, 5.6K ohms, ⓗⓟ Stock No. 0693-5621, as shown on partial schematic.

R634, 635: Change to 2.2K ohms ±10%, ⓗⓟ Stock No. 0693-2221.

CR601, 602, 606, 620: Change ⓗⓟ Stock No. to 1901-0007.

CR604, 615, 621: Change ⓗⓟ Stock No. to 1901-0008.

CR616: Change ⓗⓟ Stock No. to 1901-0012, type 1N2071.



SALES AND SERVICE OFFICES IN THE U.S. AND CANADA

ALABAMA

Huntsville, 35801
Hewlett-Packard
Southern Sales Division
Holiday Office Ctr., Suite 18
(205) 881-4591
TWX: 510-579-2204

ARIZONA

Scottsdale, 85251
Hewlett-Packard
Neely Sales Division
3009 No. Scottsdale Rd.
(602) 945-7601
TWX: 602-949-0111

Tucson, 85716
Hewlett-Packard
Neely Sales Division
232 So. Tucson Blvd.
(602) 623-2564
TWX: 602-792-2759

CALIFORNIA

Los Angeles Area
Hewlett-Packard
Neely Sales Division
3939 Lankershim Blvd.
North Hollywood 91604
(213) 877-1282 and 766-3811
TWX: 910-499-2170

Sacramento, 95821
Hewlett-Packard
Neely Sales Division
2591 Carlsbad Ave.
(916) 482-1463
TWX: 916-444-8683

San Diego, 92106
Hewlett-Packard
Neely Sales Division
1055 Shafter Street
(714) 223-8103
TWX-714-276-4263

San Francisco Area
Hewlett-Packard
Neely Sales Division
501 Laurel Street
San Carlos 94071
(415) 591-7661
TWX: 910-376-4390

COLORADO

Englewood, 80110
Hewlett-Packard
Lahana Sales Division
7965 East Prentice
(303) 771-3455
TWX: 303-771-3056

CONNECTICUT

Middletown, 06458
Hewlett-Packard
Yewell Sales Division
589 Saybrook Rd.
(203) 346-6611
TWX: 203-346-7433

FLORIDA

Miami, 33125
Hewlett-Packard
Florida Sales Division
2907 Northwest 7th St.
(305) 635-6461

Orlando, 32803
Hewlett-Packard
Florida Sales Division
621 Commonwealth Ave.
(305) 425-5541
TWX: 305-275-1234

St. Petersburg, 33708
Hewlett-Packard
Florida Sales Division
410-150th Ave., Madeira Beach
(813) 391-0211
TWX: 813-391-0666

GEORGIA

Atlanta, 30305
Hewlett-Packard
Southern Sales Division
3110 Maple Drive, N. E.
(404) 233-1141
TWX: 810-751-3283

ILLINOIS

Chicago, 60645
Hewlett-Packard
Crossley Sales Division
2501 West Peterson Ave.
(312) 275-1600
TWX: 910-221-0277

INDIANA

Indianapolis, 46205
Hewlett-Packard
Crossley Sales Division
3919 Meadows Dr.
(317) 546-4891
TWX: 317-635-4300

KENTUCKY

Louisville, 40218
Hewlett-Packard
Southern Sales Division
Suite 4, 3411 Bardstown Rd.
(502) 459-4140
TWX: 810-535-3128

MARYLAND

Baltimore, 21207
Hewlett-Packard
Horman Sales Division
6660 Security Blvd.
(301) 944-5400

Washington, D. C. Area
Hewlett-Packard
Horman Sales Division
941 Rollins Avenue
Rockville 20852
(301) 427-7560
TWX: 710-828-9684

MASSACHUSETTS

Boston Area
Hewlett-Packard
Yewell Sales Division
Middlesex Turnpike
Burlington 01804
(617) 272-9000
TWX: 710-332-0382

MICHIGAN

Detroit, 48235
Hewlett-Packard
Crossley Sales Division
14425 West Eight Mile Road
(313) 342-5700
TWX: 313-342-0702

MINNESOTA

St. Paul, 55114
Hewlett-Packard
Crossley Sales Division
842 Raymond Avenue
(612) 646-7881
TWX: 612-551-0055

MISSOURI

Kansas City, 64131
Harris-Hanson Company
7916 Paseo Street
(816) 444-9494
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CANADA
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Montreal, Quebec
(514) 735-2273

Hewlett-Packard (Canada) Ltd.
1762 Carling Avenue
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FINLAND
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TURKEY
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P.O. Box 376—Galata, Istanbul
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UNITED KINGDOM
Hewlett-Packard Ltd.
Dallas Road
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Tel: Bedford 68052

VENEZUELA
Citec, C. A.
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Avda. Francisco de Miranda-Chacaito
Apartado del Este 10.837, Caracas
Tel: 71.88.05

YUGOSLAVIA
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Brussels 15, Belgium
Tel: 35.29.58

For Sales and Service Assistance in Areas Not Listed Contact:

IN EUROPE
Hewlett-Packard, S. A.
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Geneva, Switzerland
Telephone: (022) 42.81.50
Telex: 2.24.86
Cable: HEWPACKSA

IN LATIN AMERICA
Hewlett-Packard Inter-Americas
1501 Page Mill Road
Palo Alto, California 94304, U.S.A.
Telephone: (415) 326-7000
TWX: 910-373-1267
Telex: 033811 Cable: HEWPACK

ELSEWHERE
Hewlett-Packard
International Marketing Department
1501 Page Mill Road
Palo Alto, California 94304, U.S.A.
Telephone: (415) 326-7000
TWX: 910-373-1267
Telex: 033811 Cable: HEWPACK

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