TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS FOR OSCILLOGRAPH RECORDER RO-460(V)1/U (HEWLETT-PACKARD MODEL 7702B) (NSN 6625-00-464-2957)

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y

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This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications, the format has not been structured to consider levels of maintenance.

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Figure 1-1. Model 7702A Recording System and Option 01

SECTION O.
INTRODUCTION

0-1. SCOPE.

This manual describes Oscillograph Recorder RO-460(V)1/U and provides instructions for operation and maintenance. Throughout this manual, the RO-460(V) 1/U is referred to as Hewlett-Packard Model 7702B. Refer to Section VI for differences between the 7702A and 7702B.

0-2. INDEXES OF PUBLICATIONS.

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

0-3. FORMS AND RECORDS.

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A and DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/-NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

EIR's will be prepared using Standard Form SF 368, Quality Deficiency Report. Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished directly to you.

0-5. ADMINISTRATIVE STORAGE.

Administrative storage of equipment issued to and used by Army activities shall be in accordance with paragraph 2-11.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

SECTION I.
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Sanborn Model 7702A is a two-channel thermal writing recording system, mounted in a mobile cart, that has excellent versatility through the use of all solid-state 8800 Series interchangeable pre- amplifiers. Any two of the 8800 Preamplifiers (see Table 1-3) may be used with the Model 7702A, permitting a broad range of measurements. 'Possible applications include high sensitivity AC and DC measurements, carrier excited transducer monitoring, recording of phase and amplitude in servo systems, and obtaining permanent records of AC levels having a wide dynamic range directly in dB on a linear scale. Complete operating and service instructions for each of the 8800 Series Preamplifiers are contained in separate manuals.

1-3. The 7702A is also available in a portable carrying case with a protective cover over the front panel, or the recorder may be rack mounted.

1-4. Input signals to the 7702A System are connected to the signal input panel located on the rear of the recorder. The input connector contains a guard shield for high common-mode rejection. Output signals are available at the signal panel for connection to an oscilloscope or magnetic recorder.

1-5. Four chart speeds for industrial or medical applications are selected by front panel pushbuttons. Eight chart speeds, pushbutton selected, are optional. The recorder start-stop function is controlled either from the front panel or from a remote location.

1-6. Component Identification.

1-7. This Sanborn System consists of the following major components:

a. Model 7702-OlA Recorder Assembly, including power supply for preamplifiers and driver amplifiers.
b. Model 7700-02A Driver Amplifiers (2).
c. Model 1069A-02A Mobile Cart.
d. 8800 Series Preamplifiers, as ordered.

1-8. Standard System Options.

1-9. The basic System, Model 7702A, is available with the following standard system options:

a. Option 01: 7702A System less mobile cart. Slide kit 01060-60310 is included for rack mounting.
b. Option 02: The 7702A System less mobile cart, mounted in portable case.
c. Option 08: For 50 Hz power line.
d. Option 10: Recorder with medical speeds (2. 5, 5, 25, and 50 mm/sec).
e. Option 11: Eight-speed recorder for 60 Hz power line. (Adds four mm/min recorder speeds by means of a 60:1 speed reduction.)
f. Option 12: Eight-speed recorder for 50 Hz power line. (Adds four mm/min recorder speeds by means of a 60:1 speed reduction.)
g. Option 13: One minute timer for 60 Hz power line. Provides one per minute timing marks on chart. For use with Option 11.
h. Option 14: One minute timer for 50 Hz power line. Provides one per minute timing marks on chart. Used with Option 12.
i. Option 15: Auxiliary marker. Records between channels 1 and 2 on chart paper; actuated by external contact closure.

1-10. Special Options.

1-11. When contractual requirements require special modifications to the standard Sanborn 7702A System, complete data on the difference between the modified and standard system is covered in Section VII of this manual.
The contents of this manual apply directly to instruments with Production Change Order (PCO) numbers up to 17-15637. Refer to Section VII for other PCO numbers

1-12. COMPONENT DESCRIPTION.

1-13. Model 7702-01A Recorder.

1-14. The 7702-0lA (Figure 1-2 shown with preamp lifiers installed) is a two-channel, four or eight-speed thermal writing recorder, with provisions for mounting two 8800 Series Preamplifiers. The recorder is mounted horizontally in the 7702A Mobile Cart, or vertically in the portable case or rack mount. The paper take-up assembly located on the left end of the recorder stores the chart paper on a take-up spool that is easily removed. Recorder characteristics are given in Table 1-1.

1-15. The power supply (Figure 1-6) provides operating power for the 7702-OlA Recorder, 8800 Series Preamplifiers, and two 7700-02A Driver Amplifiers. The mm/sec timer assembly 14002S and the optional mm/min timer assembly 14002R plug into the power supply. Also mounted on the rear of the power supply are three plug-in circuit boards; (1) Regulator Card 868-500A-C6 which furnishes regulated +12 and -12 volts to the preamplifiers, (2) Oscillator Plug-in 868-500A-C13 which provides a 2400 Hz transducer excitation voltage for use with the 8805A Carrier Pre- amplifier, and (3) Oscillator Plug-in 868-500A-C14 which provides a 440 Hz chopper excitation voltage for Model 8803A High Gain Preamplifier.

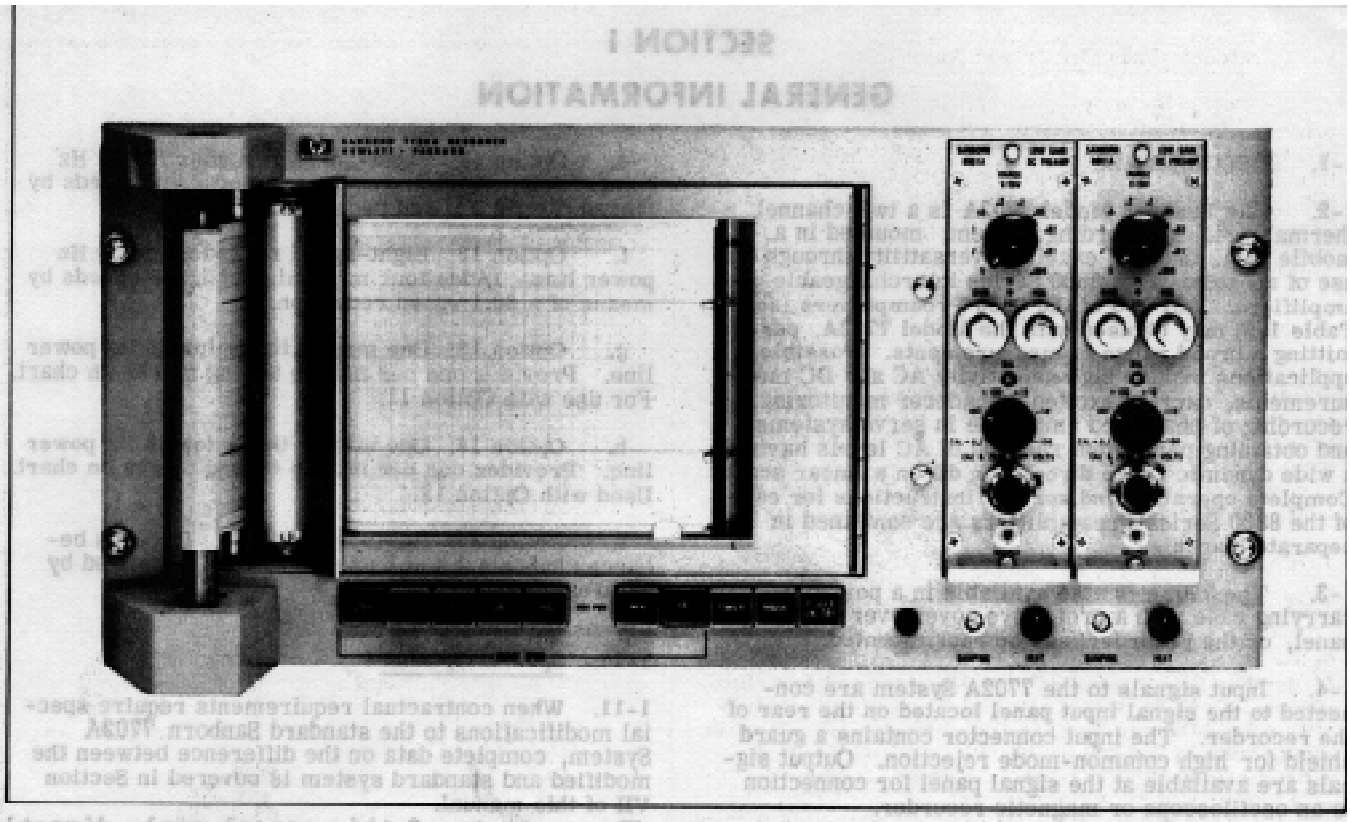


Figure 1-2. Model 77-01A Recorder

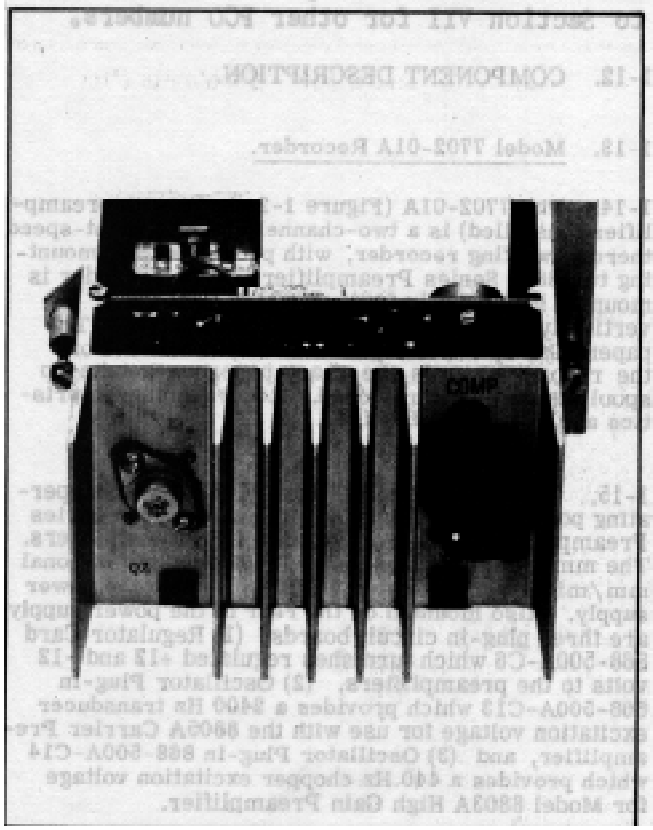


Figure 1-3. Model 7700-02A Driver Amplifier

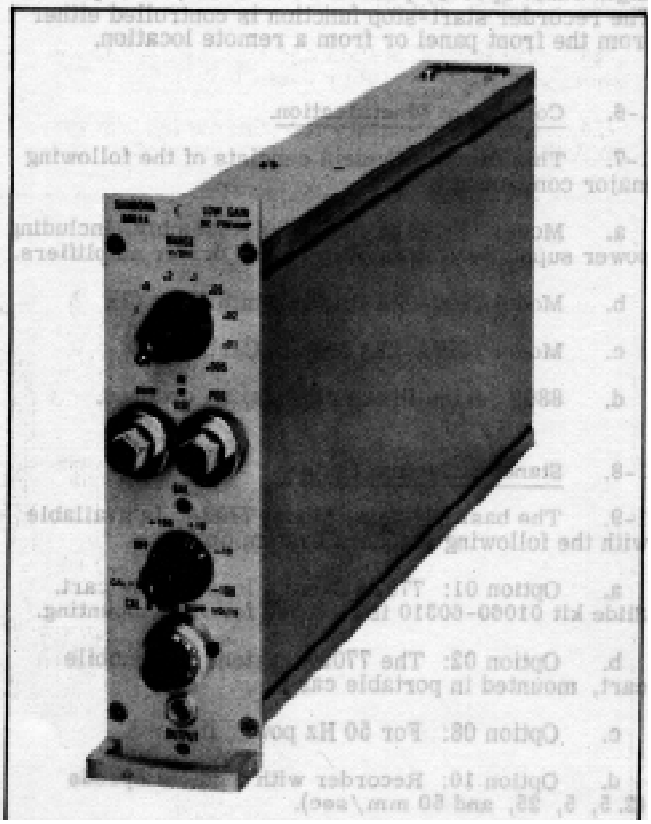


Figure 1-4. 8800 Series Preamplifier (8801A Shown)

1-16. Model 7700-02A Driver Amplifier.

1-17. One plug-in driver amplifier (Figure 1-3) is provided for each recording galvanometer. The combination of driver amplifier and galvanometer simulate the characteristics of a galvanometer at 71% of critical damping, by negative velocity-voltage feed- back from the galvanometer in conjunction with a compensation circuit in the driver amplifier. Driver Amplifier specifications are listed in Table 1-2. 1-18.

Preamplifiers, 8800 Series.

1-19. Any of the solid-state high performance preamplifiers (Figure 1-4) for medical or industrial applications may be installed in the recorder. Preamplifiers may be interchanged easily from the front panel of the recorder by removing two panel mounting screws. Preamplifiers contain built-in voltage cali- bration sources.

1-20. Model 1069-02A Mobile Cart.

1-21. The ruggedly constructed all-metal mobile cart (Figure 1-5) is an ideal unit for many recording applications. Metal bar handles mounted on both ends of the cart and large diameter rubber wheels permit the system to be moved from one location to another with minimum effort. The line power cord, which is permanently attached to the cart, is conveniently stored behind the rear panel. Two AC accessory out- lets are provided on the rear panel. A 5" high panel located on the top of the cart and two 7" panels locate on the front of the cart may be used to mount signal panels or other instrumentation. 1-22. System Specifications.

Figure 1-5. Model 1069-02A Mobile Cart

1-23. The power, weight and dimensions for the Model 7702A are listed in Table 1-4.

1-24. Accessories provided with the System (or available on order) are listed in Table 1-5.

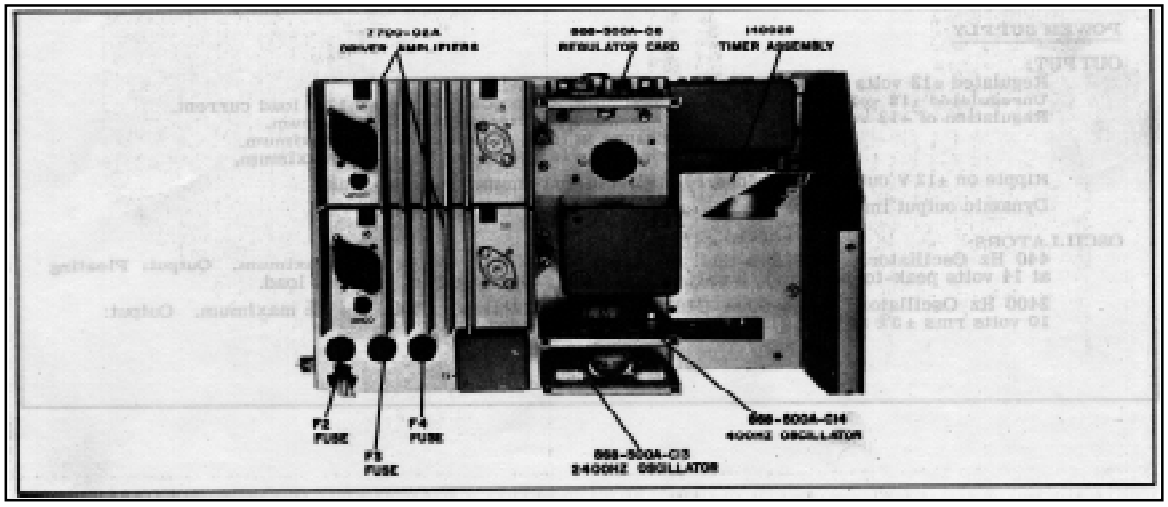


Figure 1-6. 7702A System Power Supply

Table 1-1. Model 7702-01A Specifications

RECORDER

CHART SPEEDS: 1, 5, 20, and 100 mm/sec are standard; four additional speeds: 1, 5, 20, 100, mm/min, available as Option 11 (eight speeds total). Medical speeds of 2. 5, 5, 25, and 50 mm/ sec available instead of standard speeds as Option 10. Options 10 and 11 may be combined for a total of eight medical speeds. Non-standard speeds available on special order. Speed regulation 1% at specified power line frequency.

CHART PAPER: 2-channel Permapaper(Sanborn No. 651-52. Paper width 5" (127 mm). Each recording channel 50 mm wide, with amplitude lines spaced 1 mm apart. Timing lines also have 1 mm spacing.

STYLUS: Stylus heat electrically controlled by speed selector and also adjustable by front panel control. Analog Stylus, Sanborn No. 398; Marker/Timer Stylus, Sanborn No. 411-10.

STYLUS HYSTERISIS: Recording affected by previous signals by less than 0O. 1 divisions. DAMPING: Galvanometer with velocity-voltage feedback in combination with drive circuit simulates a 71% critically damped galvanometer.

MARKER: Marker on right side (lower edge) of chart is standard; center margin marker optional; amplitude of marker approximately 1. 5 mm. Marker is operated by front panel switch or by external contact closure.

TIMER: With TIMER pushbutton depressed, marker pulse occurs on right side of chart every second (standard) or every minute (see standard option, Paragraph 1-8). Marker operation over-rides timer signal.

COOLING: Mounting case vented top and bottom for convection cooling. For rack mounting, temperature inside rack should not exceed 40'C.

TERMINALS: Signal input, signal monitor, remote chart drive start-stop, and servo reference input located on rear.

FRONT PANEL CONTROLS: Individual STYLUS heat adjustments; individual galvanometer DAMPING screwdriver adjust; pushbutton TIMER, MARK and POWER switches; pushbutton SPEED selector switches.

POWER SUPPLY

OUTPUT:

Regulated +12 volts at 500 milliamperes maximum, each polarity.
Unregulated ±18 volts at 1/2 ampere maximum, each polarity, less ±12V load current.
Regulation of ±12 volt output
a) with 20% change in line voltage 1/o maximum.
b) with change in load, 0 to full load 2% maximum.
c) with change in temperature 3 mV/C' maximum.
Ripple on ±12 V output at full load 10 millivolts maximum, peak-to-peak.
Dynamic output impedance of +12V output: 1/2 ohm, DC to 10 kHz.

OSCILLATORS:

440 Hz Oscillator, 868-500-C14: Frequency Stability: 440 Hz ± 5% maximum. Output: Floating at 14 volts peak-to-peak at 1/2 watt. Amplitude stability +2% of constant load.
2400 Hz Oscillator, 868-500A-C13: Frequency Stability: 2400 Hz + 2% maximum. Output: 10 volts rms ±5% at 50 milliwatts maximum. Grounded center tap.

Table 1-2. Model 7700-02A Specifications

DRIVER AMPLIFIER

FREQUENCY RESPONSE: DC to less than 3 dB down at 125 Hz for chart deflection of 10 divisions pp. Damping set for 4% overshoot with a 10 division pp square wave.

SENSITIVITY: ±2. 5 volts nominal for full recording chart width deflection.

NOISE: Less than 0. 1 division pp with zero signal input.

RESPONSE TIME: Less than 5 msec, 10% to 90% for a 10 division square wave with damping set for 4% overshoot.

DRIVER INPUT IMPEDANCE: (preamplifier output loading) 5K ohms, ±5%, single-ended, with signal ground isolated from chassis ground.

LINEARITY:

Method 1: After setting mechanical zero of stylus within 0o. 1 division of chart center and calibrating for zero error at center scale and +20 divisions, error is less then ±0. 25 divisions at any point on printed coordinates.

Method 2: After setting mechanical zero of stylus within +1 division of chart center and calibrating for zero error at lower and upper ends of printed coordinates, error is less than t0. 5 division at any point on the scale.

GAIN STABILITY (after one hour warmup): Temperature: Less than 0. 25%/10'C, 20° to 40°C. Line Voltage: 0. 5%, 103 to 127 volts.

ZERO DRIFT (driver amplifier input shorted and after one hour warmup): Temperature: Less then 0.25 div/10°C, 20° to 40°C. Line Voltage: 0.1 div, 103 to 127 volts. Paper Drift: Less than 0.25 div.

LIMITING: Electrical limiting in drive circuit at approximately 125% of full scale. Stylus is mechanically limited by spring stops.

Table 1-3. 8800 Series Preamplifiers

Preamplifier	Description	Sensitivity
8801A	Low Gain DC Preamplifier	5 mV/div
8802A	Medium Gain DC Preamplifier	1 mV/div
8803A	High Gain DC Preamplifier	1 μV/div
8805A	Carrier Preamplifier (with calibrated CAL factor)	10 μV/div
8806B	Phase Sensitive Demodulator	0. 5 mV rms/div
8807A	AC-DC Converter	1 mV rms/div (at x20 scale expansion)
8808A	Log-Level Preamplifier	100 μV rms
8809A	Special Purpose DC	20 mV/div

NOTE: All preamplifiers except 8806B and 8808A feature calibrated zero suppression.

Table 1-4. System Specifications

POWER: 115/230 volts ± 10%, 60Hz, approximately 200 watts. 115/230 volts ±10%, a50 Hz, specify Option 08.
WEIGHT: 130 lb. (59kg), includes 1069-02A Mobile Cart and two preamplifiers.
DIMENSIONS: (see illustrations below)

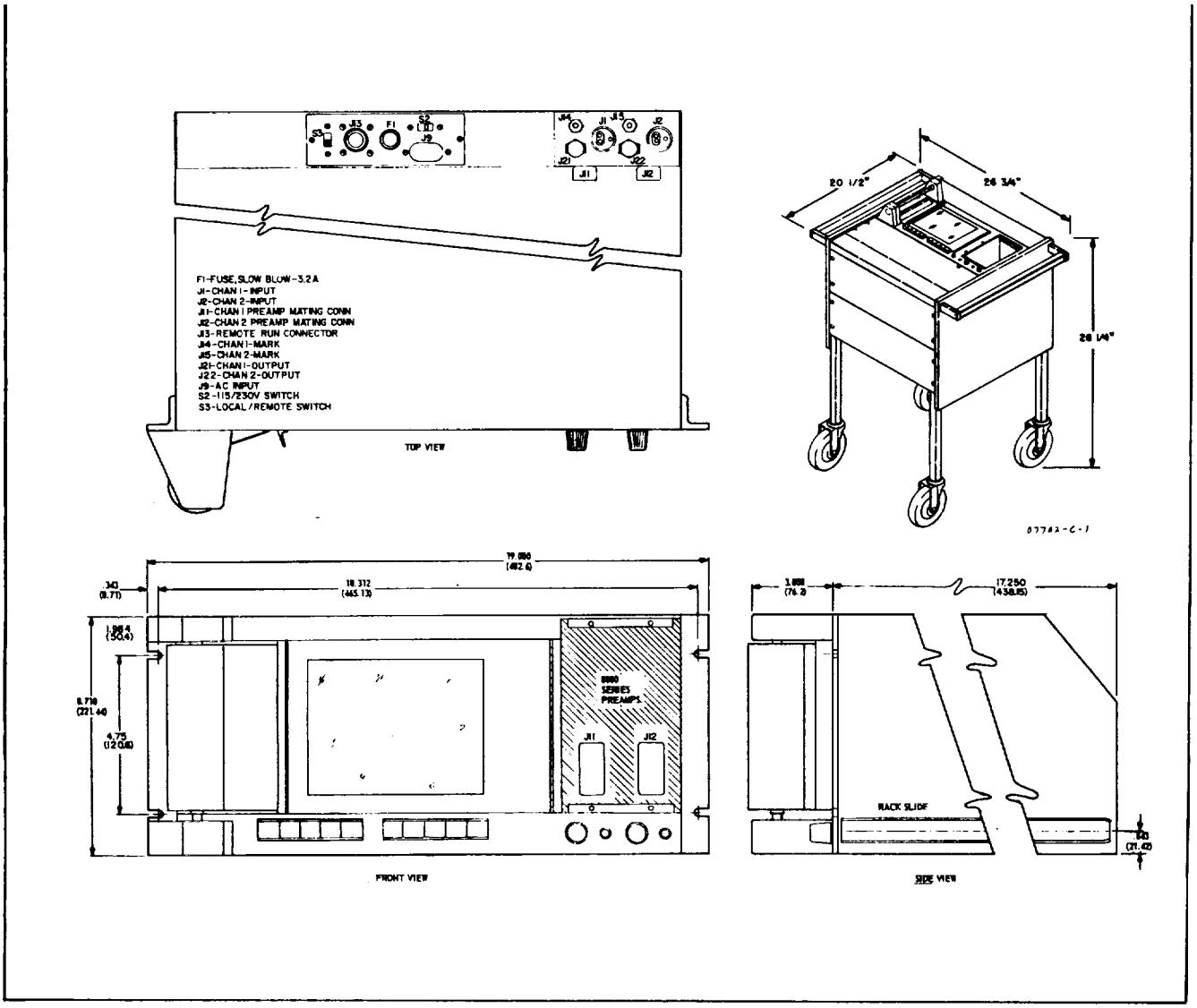


Table 1-5. System Accessories

Qty.	Description	Number
2	Signal Input Connector	10G3-34FW
2	Signal Output Connector	10B9-5MW
1	Remote Run Connector	10A5-3MW
1	Remote Run Connector Cable Clamp	10OA5-lFWA
1	Remote Marker Plug	10G2-22MW
1	Power Cord 3-wire	10G3-42MFW
1	Adapter, 3-wire to 2-wire	10G3-11MFW
2	Fuse 0.5 Amp Slo Blo (F2, F3)	26B-4
1	Fuse 0.8 Amp Slo Blo (Fl 220V)	26B-6
1	Screwdriver	37A-10A
2	Record Spool	94-104P1
1	Spline Wrench	100-600-C5
2	Galvanometer Stylus	398
1	Roll, Permapaper	651-52
1	Stylus Pressure Tester	14015A

SECTION II.
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, repacking, and installation.

2-3. INITIAL INSPECTION.

2-4. Mechanical Inspection.

2-5. If external damage to the shipping carton is evident, ask the carrier's agent to be present when the System is unpacked. Check the System for external damage such as broken controls or connectors, and dents or scratches on the panel surface. If damage is found, refer to Paragraph 2-8 for recommended claim procedure and repacking information. If the shipping carton is not damaged, check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. Retain the packaging material for possible future use.

2-6. Electrical Check.

2-7. Check the electrical performance of the Sys- tem as soon as possible after receipt; see Section V for the recommended performance checks. The checks will verify that the System is operating within the specifications listed in Table 1-1. This check is a good test procedure for incoming quality control inspection and for an operational check after repairs or adjustments have been made.

2-8. CLAIMS AND REPACKAGING.

2-9. Claims for Damage.

2-10. If physical damage is evident or if the System components do not meet specifications when received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office (see list in back of manual). The Sales/Service Office will arrange for repair or replacement of the unit(s) without waiting for settlement of the claim against the carrier.

2-11. Repacking for Shipment or Storage.

2-12. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag showing owner and address, instrument model and serial number, and the repair required. The original ship- ping carton and packaging material, with the exception of accordion-pleated pads, may be reusable. The Hewlett-Packard Sales/Service Office will also pro- vide information and recommendations on materials to be used if the original packaging material is not available or not reusable. Materials should include, (1) a double-walled carton (check with a freight carrier for test strength required), (2) heavy paper or sheets of cardboard to protect all instrument surfaces; use extra material around projecting parts of the instrument, (3) at least four inches of tightly-packed shock-absorbing material surrounding the instrument. Close the package securely with heavy paper tape.

2-13. INSTALLATION.

2-14. The 7702A System is ready for use after removal from the packing case. No packing materials are contained in the recorder section. The system is shipped without Permapaper mounted in the recorder; see paper loading instructions in Section III.

2-15. Environment.

2-16. System location should be reasonably free from vibration, dust, corrosive or explosive vapors or gases, extremes of temperature, humidity, etc. The floor should be level and must supply support for all four wheels of the System. For a cabinet mounted installation, allow sufficient room at the front for operation with any part of the System extended forward, and at the rear for servicing with access door open.

2-17. The 7702A System requires no additional cooling. For rack mounting (7702A, Option 01), the temperature inside the rack cabinet should not exceed 40°C.

2-18. Check that the power line voltage, voltage regulation, power capacity, frequency, and frequency stability are suitable for the requirements of the Sys- tem. The time-axis accuracy of the recording will be directly dependent upon the frequency stability of the power line.

2-19. Rack Mounting Instructions.

2-20. Model 7702A, Option 01, consists of the Model 7702-0lA Recorder, with Slide Kit 01060-60310, for mounting in a cabinet. To install the recorder, attach the slides to the side rails of the cabinet. Figure 2-1 shows the location of the mounting holes for the slide kit. Slide the recorder into the side rails and fasten the recorder in place with panel screws.

2-21. System in Portable Case.

2-22. Model 7702A, Option 02, consists of the 7700-OlA Recorder mounted in a portable transit case 7702-14A, shown in Figure 2-2. Two side handles are used for carrying the case. A removable metal cover protects the recorder front panel when being transported. Signal input and power cables are connected to the system through an open- ing in the rear of the case.

2-23. AC Power Requirements.

2-24. The Model 7702A may be operated from an ac source of 155 or 230 volts (+10%), 60 Hz. Model 7702A, Option 08, operates on 115 or 230 volts (+10%), 50 Hz. With the instrument power cord disconnected, move the slide switch located on the rear panel (see Figure 3-3) until the desired voltage numbers (115 or 230) are visible. A narrow blade screwdriver may be used to operate the switch. Fuse F1 should be 1.5 amp slow-blow for 115 volt operation, or 0.8 amp slow-blow for 230 volt operation.

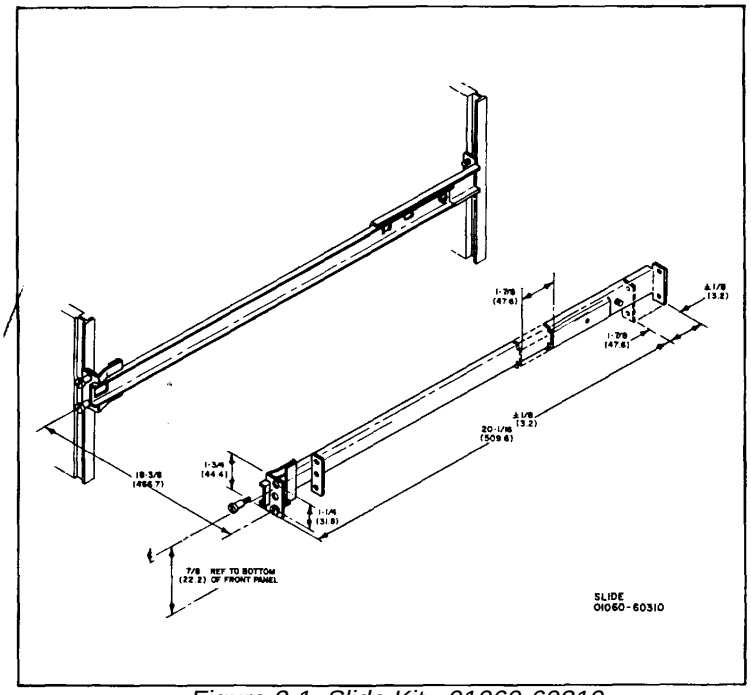


Figure 2-1. Slide Kit - 01060-60310

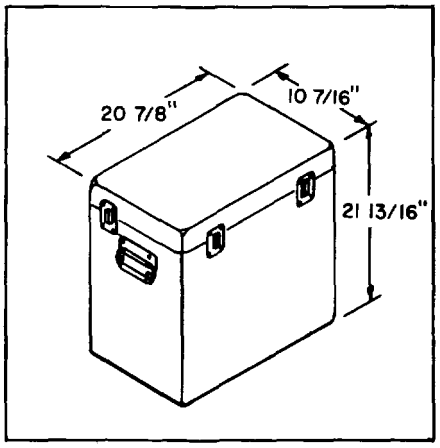


Figure 2-2. Portable Case

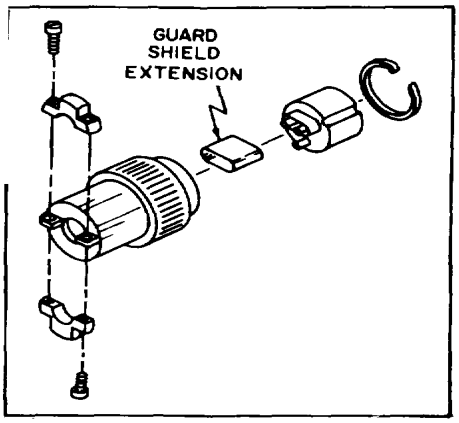


Figure 2-3. 10G3-34FW Connector

2-25. Three-Conductor Power Cable. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the instrument and cabinet be grounded. The Model 7702A is supplied with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument to the power line ground. The round pin on the power cable is the ground connection. To retain this protection feature when operating the instrument from a two-contact outlet, use the 10G3-11lMFW three-conductor to two- conductor adapter (supplied as an accessory with the instrument) and connect the green wire to the outlet box.

2-26. Input Signal Connections.

2-27. The 8800 Preamplifier signal input circuits may be divided into two types, guarded and non- guarded. Preamplifiers having a guard shield terminal (8803A, 8806B, 8807A) feature a high common- mode rejection ratio. To obtain the high rejection ratio, the signal input cable must contain a guard shield. Non-guarded preamplifiers (8801A, 8802A, 8805A, 8808A, 8809AY do not require a guard shield in the signal input cable. Additional information on input signal connections is contained in the preamplifier instruction manuals.

2-28. Signal Input Connectors.

2-29. Two signal input connectors, 10G3-34FW(see Figure 2-3), are supplied as accessories with the system. The connectors plug into the signal input jacks J1 and J2 on the rear of the recorder. J1 signals (channel 1) are internally cabled to the left pre- amplifier (viewed from the front of the recorder) and recorded on the upper channel of the chart paper. J2 input signals are cabled to the right preamplifier, and are recorded on the lower channel of the chart
paper.

2-30. Signal Input Cable.

2-31. Two conductor shielded cable 3/16" O.D., with single or doubled braided shield is required for connecting the signal source to the input connectors. See Figure 2-4 for cable preparation information.

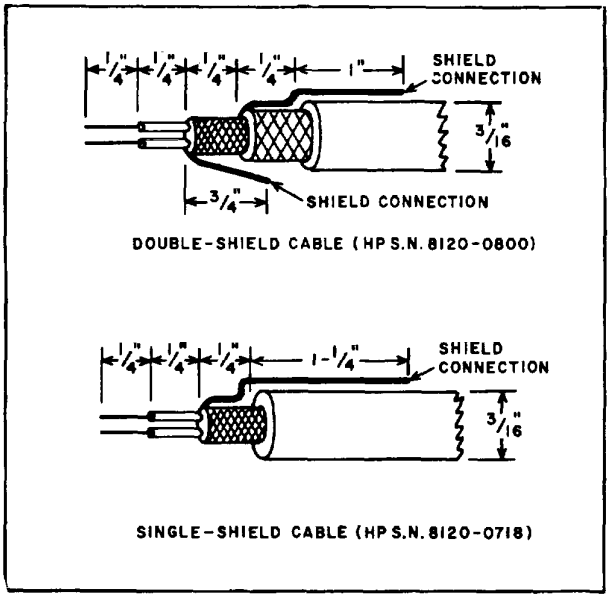


Figure 2-6. Input Connector Wiring, Guarded

2-32. Preamplifiers which have a guard shield input terminal use double shielded cable for a fully guarded input circuit. The inner shield connects to the common mode potential of the signal source to reduce capacitive and resistive currents between the signal conductors and ground. The outer shield is grounded, to prevent capacitive coupling of the common mode potential on the inner shield into other circuitry. In many cases, the second (outer) shield may be omitted with no deterioration in performance.

2-33. Input Connector Wiring for Non-Guarded Preamplifiers.

2-34. The following instructions are for wiring the input connector using either single or double shielded cable.

a. Loosen the 10G3-34FW connector cable clamp screws.

b. Slide the dressed end of the cable into the cable clamp and through the connector shell.

c. Remove and store the guard shield extension.

d. Solder the cable center conductors to connector pins A and B. See Figure 2-5.

e. Solder the cable shield(s) to pin C.

f. Press the connector block carefully into the connector shell, allowing the cable to pass through the connector clamp.

g. Insert the retaining ring.

h. Tighten the cable clamp screws.

NOTE

Single conductor cable can be used with the 8808A and 8809A Preamplifiers, which have single-ended input circuits. Connect the cable center conductor to pin A, and the shield to pin B.

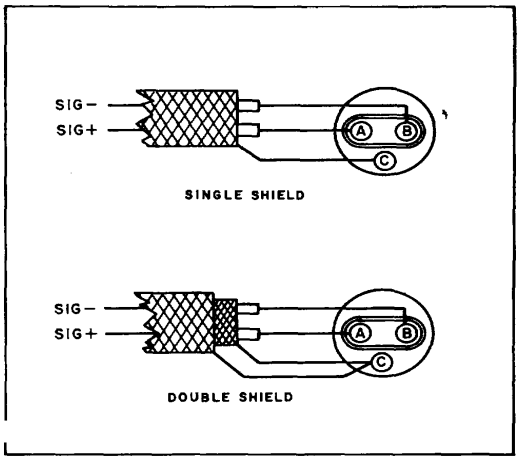


Figure 2-5. Input Connector Wiring, Non-Guarded

2-35. Input Connector Wiring for Guarded Preamplifiers.

2-36. The following instructions are for wiring the input connectors using either single or double shielded cable.

a. Loosen the 10G3-34FW connector cable clamp screws.

b. Slide the dressed end of the cable into the cable clamp and through the connector shell.

c. Slide the guard shield extension down over the cable shield(s) and onto the guard socket.

d. Solder the cable center conductors to pins A and B. See Figure 2-6.

e. For single shield cable, solder the cable shield to the guard shield extension.

f. For double shield cable solder the inner (guard) shield to the guard shield extension, and solder the outer shield to pin C. Check that shields are not shorted to each other or to the connector shell.

g. Press the connector block carefully into the connector shell, allowing the cable to pass through the cable clamp.

h. Insert the retaining ring.

i. Tighten the cable clamp screws.

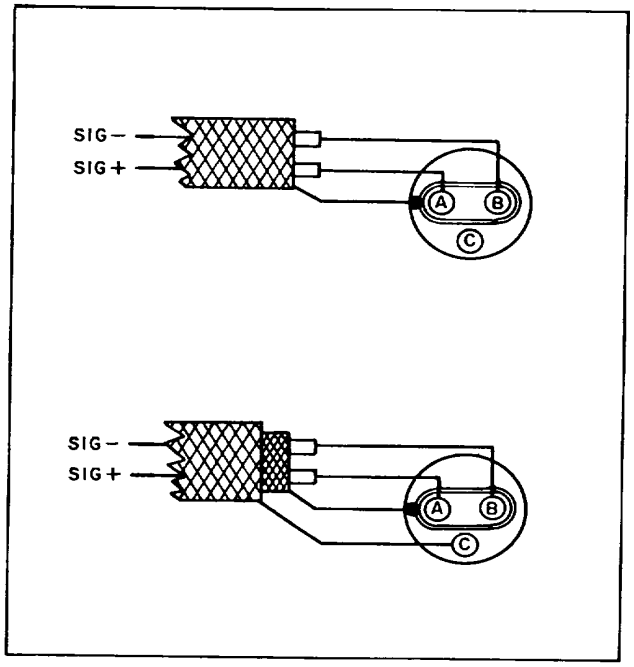


Figure 2-6. Input Connector Wiring, Guarded

2-37. 8805A CARRIER PREAMPLIFIER INPUT CABLES.

2-38. Carrier preamplifier operation requires both a non-guarded signal input cable and a carrier refer- ence cable, connected between the strain gage or transducer and the 7702A System. A cable assembly for use with Sanborn transducers is shown in Figure 2-7. Cables for other applications are assembled following the instructions in Paragraph 2-41.

2-39. Cable Assembly for use with Sanborn Transducers.

2-40. Use the cable assembly no. 5060-4602 (Figure 2-7) to connect Sanborn Series 267, 268 and 270 Series Transducers to the 7702A System. This Y-cable contains both a signal input cable and a carrier reference cable.

2-41. Instructions for Assembling Signal Input and Reference Cables.

2-42. Signal input and carrier reference cables for carrier preamplifier applications described in the instruction manual IM-8805A-1 are assembled as follows:

a. Signal Input Cable.

(1) Connect a two-conductor shielded cable to the 10G3-34FW connector, supplied as an accessory with the system. Solder the two cable conductors to pins A and B, cable shield to pin C (see Paragraph 2-33).

(2) Connect the cable to jack J1 (for channel 1) or jack J2 (for channel 2), located on the rear panel of the recorder.

b. Carrier Reference Cable. (1) Connect a two-conductor shielded cable to the 10B9-5MW connector, supplied as an accessory with the system. Solder the two cable conductors to pins A and B, cable shield to pin E.

(2) Connect the cable to jack J21 (for channel 1) or jack J22 (for channel 2) located on the rear panel of the recorder.

2-43. 8806B PHASE SENSITIVE DEMODULATOR SIGNAL CABLES.

2-44. Demodulator preamplifier operation requires both a signal input cable and a servo reference cable. Construction of the cables is described below.

2-45. Construct the two-conductor signal input cable with a guard shield (see Paragraph 2-[35)] if a high common-mode rejection is desired. If high common-mode rejection is not required, the input cable is wired with an unguarded, single-shield cable (see Paragraph 2-33). Connect the signal input cable to J1 (channel 1) or J2 (channel 2).

2-46. Construct the servo reference cable using two-conductor shielded cable and the 10B9-5MW con- nector supplied as an accessory with the system. Normal connection uses a single-shielded cable, in a non-guarded circuit. Solder the "+" servo reference signal to pin K, and the "-" servo reference to pin F. Connect the servo reference cable to J21 (channel 1) or J22 (channel 2), located on the rear panel of the 7702A Recorder.

2-47. SIGNAL MONITOR CONNECTIONS.
2-48. The preamplifier single-ended output signals are available at J21 (channel 1) and J22 (channel 2), located on the rear panel of the recorder. Signal output is pin D, signal common is pin H. For 8803A High Gain Preamplifier, signal out is pin A, signal common is pin B. The 10B9-5MW mating connectors are supplied as accessories with the system.
2-49. REMOTE RECORDER OPERATION.
2-50. The 7702A Recorder chart drive START- STOP function and the MARKER function can be con- trolled from a remote location. The circuits required are shown in Figures 2-8 and 2-9.
2-51. Remote Chart Drive START-STOP Control.
2-52. Construct the circuit shown in Figure 2-8. The 10A5-3MW remote run connector and the 10A5-lFWA cable clamp are supplied as accessories with the system. Any length of four conductor cable may be used. The remote run circuit plugs into the J13 jack on the rear panel of the recorder.

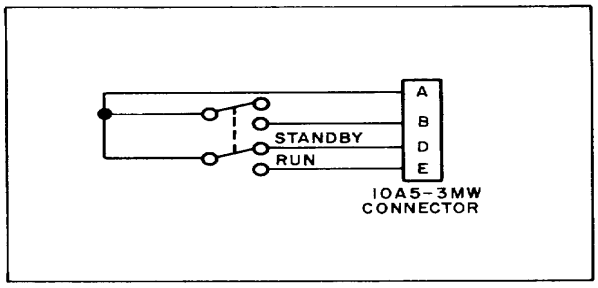


Figure 2-8. Remote Run Circuit Diagram

2-53. To operate the recorder using the REMOTE RUN circuit, switch the LOCAL-REMOTE switch S3 located on the rear panel of the recorder to the REMOTE position and press the desired speed push-button on the recorder front panel. Operate the remote STANDBY-RUN switch to control chart drive.
2-54. Remote Marker Control.
2-55. The marker may be operated from a remote location or from the recorder front panel. To oper-ate the marker from a remote location, construct the circuit shown in Figure 2-9. The connector 10G2-22MW is supplied as an accessory with the system. Any length of cable may be used.
2-56. The Remote marker circuit plugs into the J15 jack on the rear panel of the recorder.
2-57. Auxiliary Marker Operation.
2-58. To operate the auxiliary marker, available as 7702A Option 15, construct a switch circuit as shown in Figure 2-9. Plug the switch into the auxil-iary marker Jack J14, located on the rear panel of the recorder.

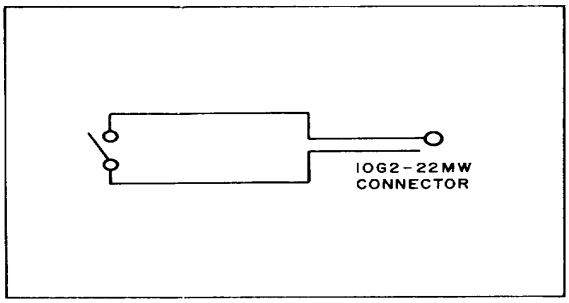


Figure 2-9. Remote Marker Circuit Diagram

2-59. INITIAL SYSTEM CHECK.
2-60. The following procedures are designed to check the recorder drive, marker, timer, and re- mote control functions. To check the operation of the preamplifiers, refer to the instruction manual for the 8800 Series preamplifiers installed in the system.
2-61. Review the installation process, checking the cables and connectors. Tighten all connections. Check that the S3 power line switch (see Figure 3-3) indicates the correct voltage. The recording system may be damaged if the switch is set to the incorrect voltage range.
2-62. Install a roll of Permapaper in the recorder, following the instructions in Figure 3-4.
2-63. To Check Recorder Drive Functions.
a. Press the POWER pushbutton. The panel indicator lamp will light.
b. Press the MM/SEC pushbutton.
c. Press each of the four speed-pushbuttons. Check for proper paper travel at each speed selected. If recorder is equipped with mm/min speeds, Option 11 or Option 12, press MM/MIN pushbutton. Press each of the four speed-pushbuttons, checking for proper paper travel at each speed selected.
d. Adjust the stylus HEAT controls for a dense, well-defined baseline.
2-64. To Check Recorder Marker and Timer Functions.
a. Press the MARKER pushbutton. A mark will be recorded on the lower edge of the chart. To check remote marker operation, connect the circuit shown in Figure 2-9 to J15.
b. Press MM/SEC and TIMER pushbuttons. A one per second timing mark will be recorded on the lower edge of the chart. Press TIMER again to re- lease pushbutton. If system is equipped with mm/min timer, Option 13 or 14, press MM/MIN and TIMER pushbuttons. A one per minute timing mark will be recorded on the chart.

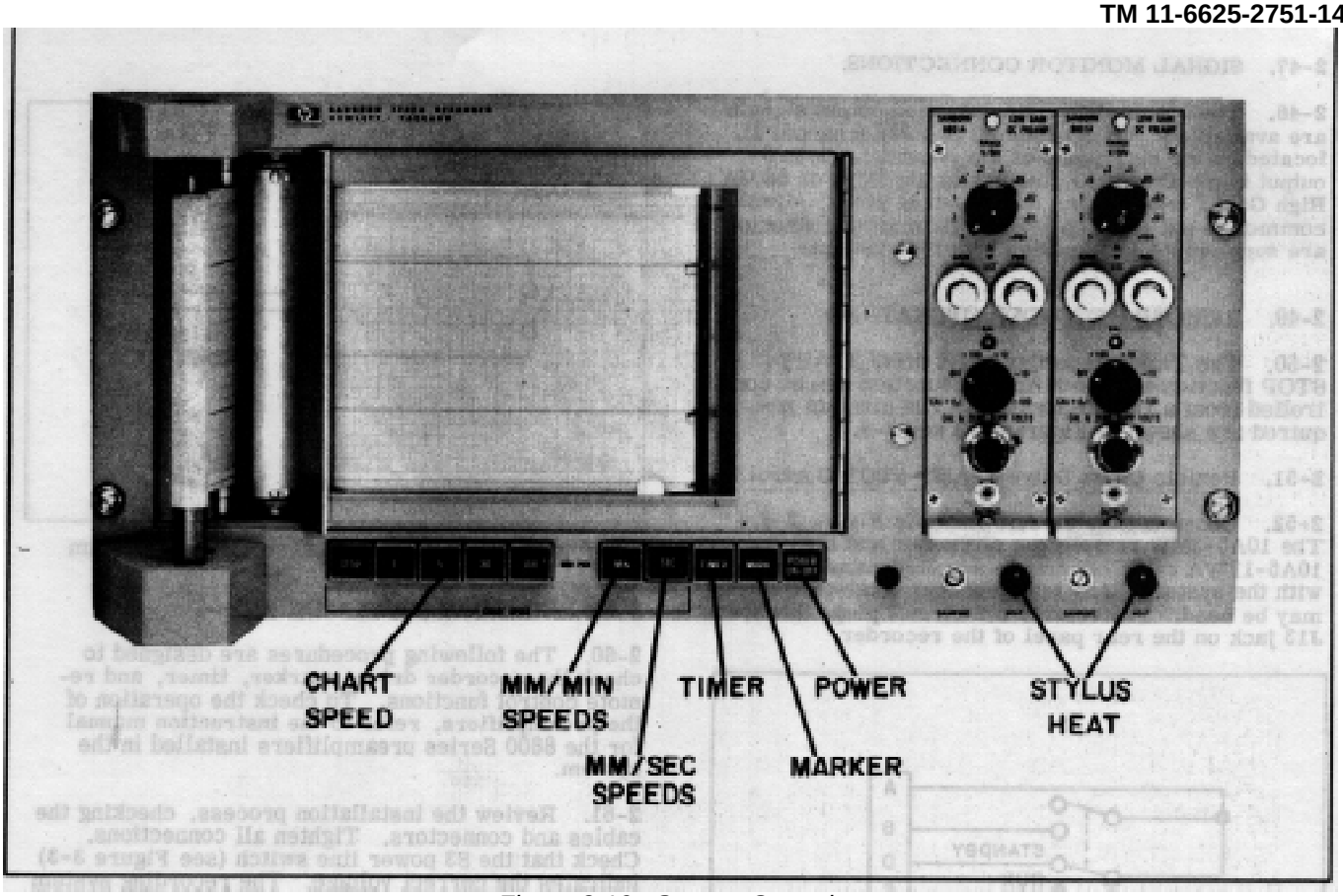


Figure 2-10. System Controls

SECTION III.
OPERATION

3-1. INTRODUCTION.

3-2. The basic function of the 7702A System is to produce graphic tracings on two-channel thermal sensitive Permapaper, using the heated stylus recording technique. Input signals are amplified by the 8800 Series signal conditioning preamplifiers, and displayed on 50 mm-wide channels on the chart paper. Preamplifiers contain amplitude calibration standards which can be recorded on the chart paper when desired. The chart paper time scale unit is adjustable in fixed steps by the setting of the pushbutton chart speed controls. Standard recorder speeds provide time scale calibration ranging from 1 mm/sec to 100 mm/sec. With Option 11 (60 Hz) or Option 12 (50 Hz), four chart speeds are added which provide time scale calibration from 1 mm/min to 100 mm/min.

3-3. CONTROLS AND CONNECTORS.

3-4. Front and rear panel controls and connectors are shown in Figures 3-2 and 3-3.

3-5. OPERATING PROCEDURES.

3-6. The 7702A System is ready for use following installation, discussed in Section II. Figure 3-4 describes the Permapaper loading procedure, and Figure 3-5 provides step-by-step operating instructions, for normal operation of the instrument. Figure 3-6 provides instructions for remote operation of the chart drive start - stop and marker functions.

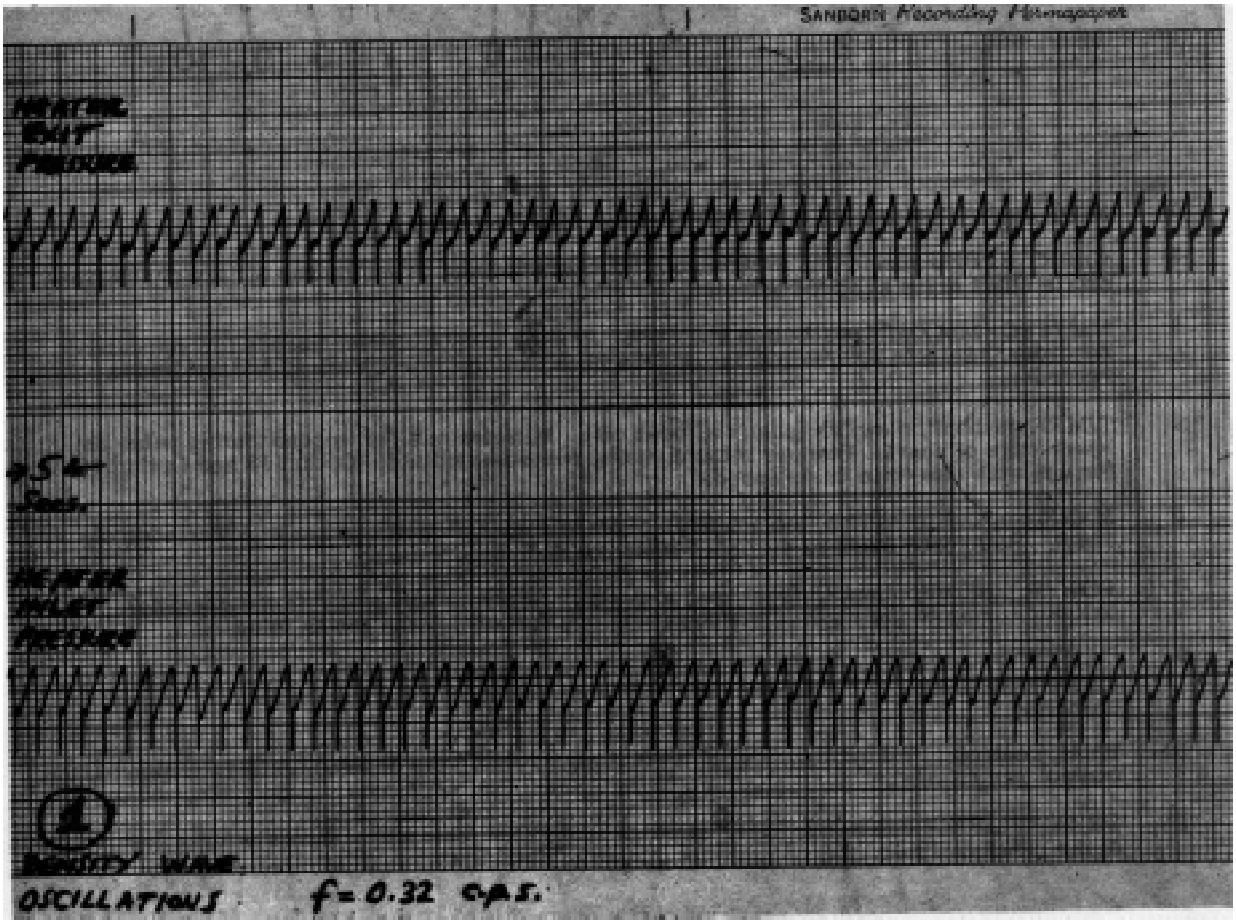


Figure 3-1. Typical 2-Channel Recording

1 STOP pushbutton switch (momentary). Controls chart drive.

2 CHART SPEED pushbutton switches select chart speed. Pressing any of four pushbuttons starts chart drive at speed selected.

3 MM/SEC-MM/MIN pushbutton switches. Selects mm/sec drive speeds for standard recorder. Selects mm/min drive speeds when Option 11 or Option 12 is installed in recorder.

4 TIMER pushbutton switch (push on, push off). Initiates one per second timing pulse on lower edge of chart. One per minute timing pulse is available (Option 13 and Option 14) for use with mm/min drive speeds.

5 MARK pushbutton switch (momentary). Controls operation of marker at lower edge of chart. Reference mark is recorded when pushbutton is pressed.

6 POWER pushbutton switch (push on, push off). Controls line power to the recorder. Indicator lamp to the right of the power switch lights when the power is on.

7 9 DAMPING controls. Adjusts the amount of feedback from the galvanometer windings to the driver amplifiers, to obtain optimum galvanometer pulse response. One control per channel

8 10 HEAT controls. Adjusts amount of stylus heat to obtain the desired trace intensity. One control per channel

11 PREAMPLIFIER controls. Refer to the preamplifier instruction manuals for a description of the panel controls.

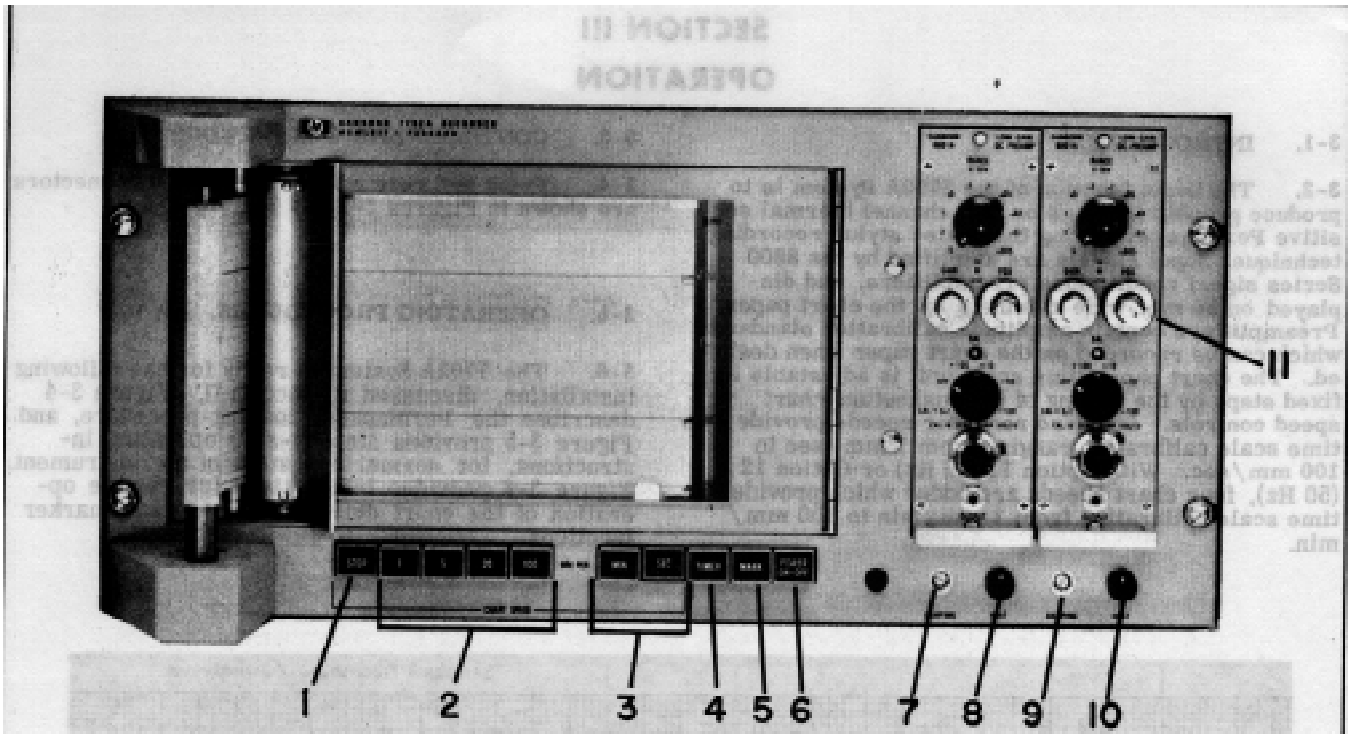
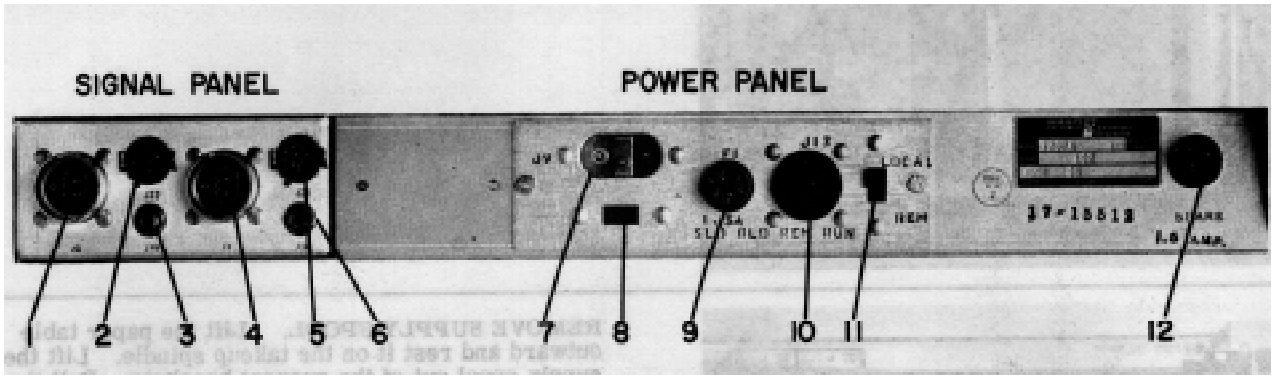


Figure 3-2. Front Panel Controls



1 SIGNAL INPUT connector. Input for Channel 2.

2 SIGNAL MONITOR connector. Output of Channel 2 preamplifier, for connection to monitoring instruments. Includes connections for carrier excitation and servo reference voltages.

3 REMOTE MARK jack. Mates with external marker switch circuit, for control of marker on chart paper.

4 SIGNAL INPUT connector. Input for Channel 1.

5 SIGNAL MONITOR connector. Output of Channel 1 preamplifier, for connection to monitoring instruments. Includes connections for carrier excitation and servo reference voltages.

6 AUXILIARY MARK jack. Mates with external switch circuit for control of auxiliary marker on chart paper.

7 POWER INPUT connector. Mates with power cable supplied with the instrument.

8 LINE VOLTAGE slide switch. Controls power supply input connections. CHECK THAT SWITCH IS SET FOR NOMINAL VOLTAGE OF EXTERNAL POWER SOURCE.

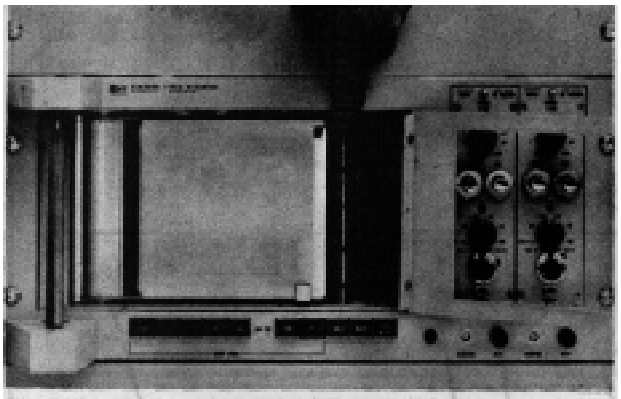
9 FUSE holder. Contains the input power fuse (1.5 amp slow-blow for 115 volts, 0.8 amp slow-blow for 230 volts).

10 REMOTE RUN connector. Mates with external switch circuit for control of recorder chart drive start-stop function.

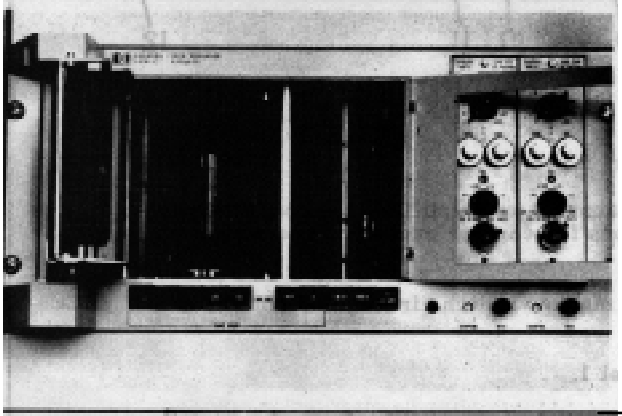
11 LOCAL-REMOTE switch. Selects either front panel switch or remote run circuit for control of recorder start-stop function.

12 Spare FUSE holder. Contains spare line fuse.

Figure 3-3. Rear Panel Controls

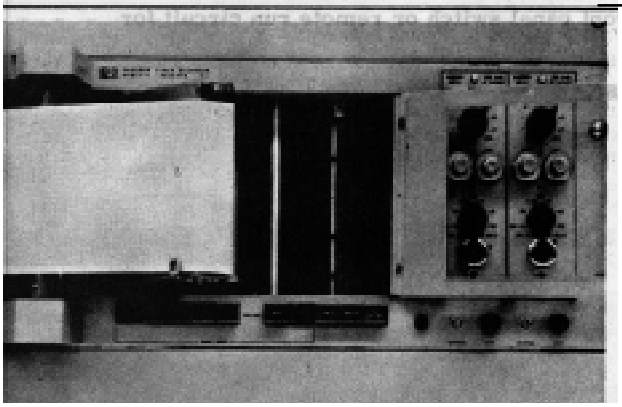


RELEASE PAPER TABLE. Turn instrument OFF, and open the recorder cover. Push the writing table lock lever toward the galvanometers.



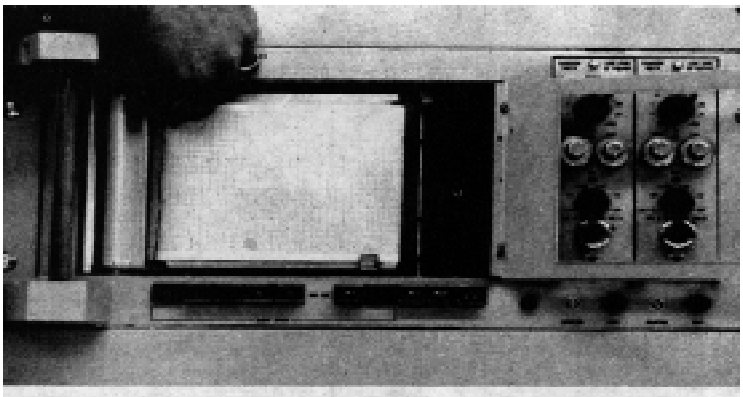
REMOVE SUPPLY SPOOL. Lift the paper table outward and rest it on the takeup spindle. Lift the supply spool out of the support brackets. Pull the end discs apart to remove the paper core.

RELEASE PAPER TABLE. Turn instrument OFF, and open the recorder cover. Push the writing table lock lever toward the galvanometers.

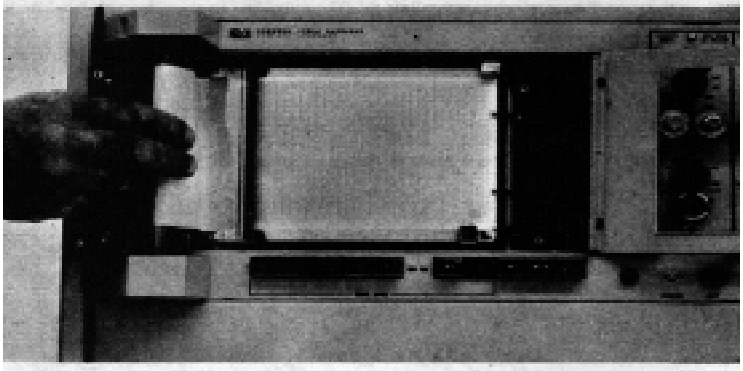


REMOVE SUPPLY SPOOL. Lift the paper table outward and rest it on the takeup spindle. Lift the supply spool out of the support brackets. Pull the end discs apart to remove the paper core.

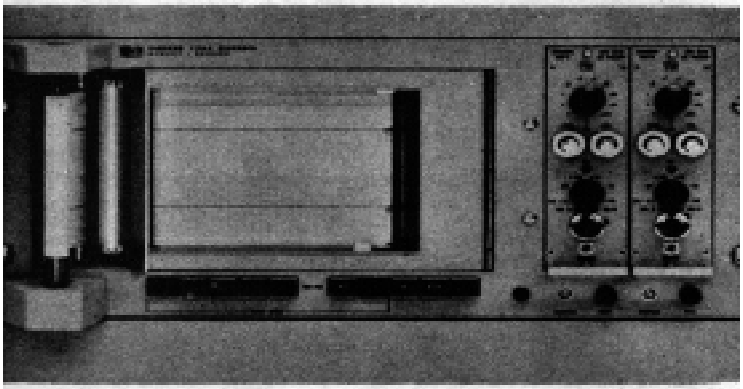
Figure 3-4. Permapaper Loading Procedures



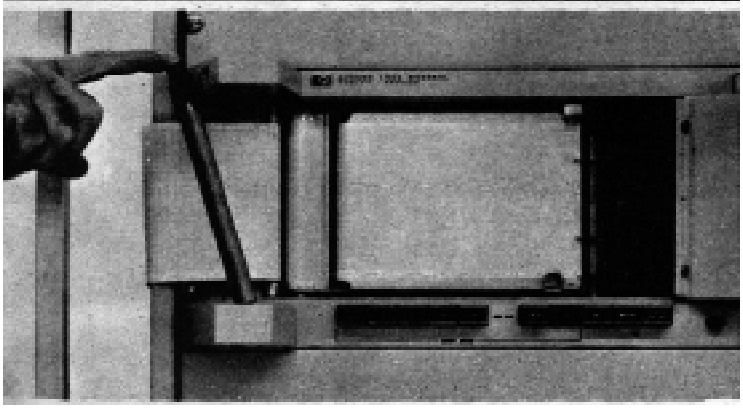
FEED PAPER RNTO DRIVE ROLL. Fold back and crease the paper about 1 inch from the end of the roll. Start chart drive at 5 mm/sec. Insert the paper into the drive roll squarely, so that the entire leading edge of the paper contacts the drive roll. Stop the recorder when the paper is drawn tightly over the paper table. Lock the paper table.



THREAD PAPER ONTO THE TAKEUP SPINDLE. Turn on chart drive at 5 mm/sec, and loop paper around the spindle tightly. The paper will be drawn onto the rotating spindle. Stop the recorder. (The paper takeup feature must be used for satisfactory recorder operation.)

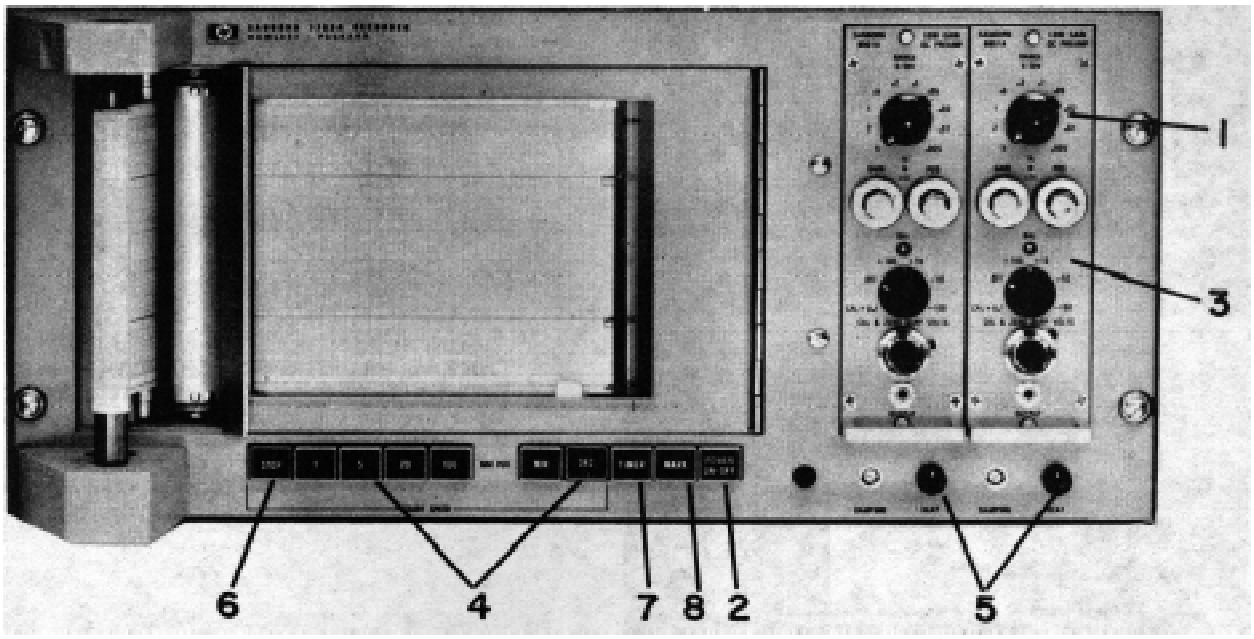


RECORDER IS READY FOR USE. Close the recorder cover. A printed star appears on lower edge of chart, 30 feet from end of roll, to indicate remaining footage.



TO REMOVE PAPER AFTER RECORDING. Remove the paper takeup spindle. Press the black plastic button on the end of the spindle. Pull out the upper and lower ends of the spindle. After sliding the recording paper off, re-install the spindle, lower end first.

Figure 3-4. Permapaper Loading Procedures (Cont.)



1 Connect 7702A System to power line, and connect input signals to J1 and J2 on the rear recorder panel. Rotate preamplifier attenuator or function switch to the OFF position. For 8801A, 8802A preamplifiers, place signal use-off switch in OFF position.

2 Press POWER pushbutton. Indicator lamp on recorder will light. Allow three minutes warmup time.

3 Balance and calibrate preamplifiers following the procedures outlined in the preamplifier instruction manual. When making calibration adjustments, set chart drive ON (see Step 4).

4 Press MM/SEC pushbutton, then press "5" pushbutton. Recorder will run at 5 mm/sec chart speed. (When recording data, press numbered speed pushbutton to suit recording application. Select mm/min speeds with recorder Options 11 or 12 by pressing MIN pushbutton.)

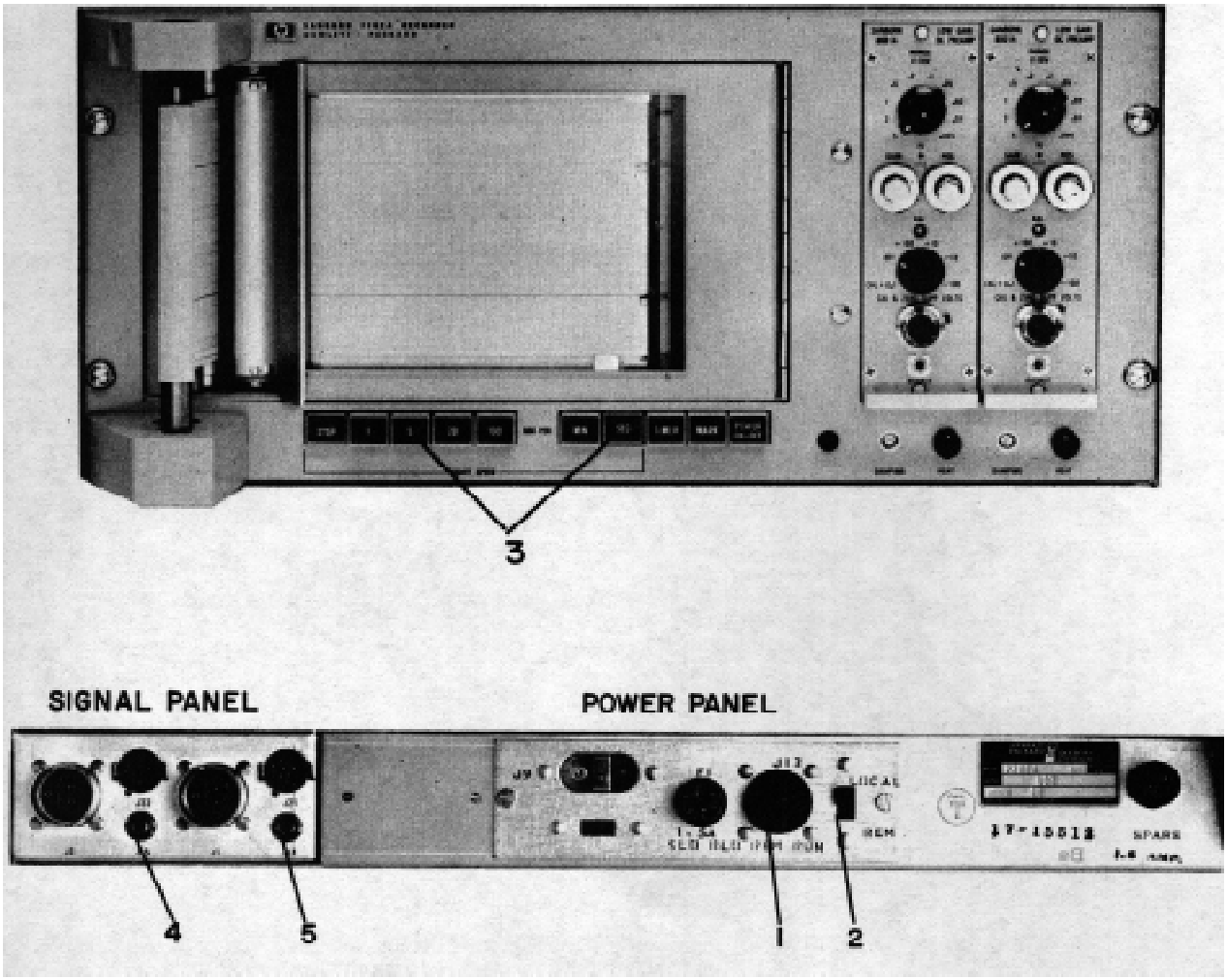
5 Adjust stylus heat for each channel to obtain a satisfactory trace intensity (when recording data which is in the upper range of the recorder bandwidth, a higher stylus heat is required for good trace definition).

6 Press STOP pushbutton to stop chart drive.

7 Press TIMER pushbutton to obtain one per second time markings on recording. For mm/min speeds, optional timer records one mark per minute.

8 Press MARK pushbutton to record reference marks on lower edge of Permapaper.

Figure 3-5. System Operating Procedures



REMOTE CHART DRIVE CONTROL

1 Connect the switch circuit shown in Figure 2-8 to J13 on the rear panel of the recorder.

2 Place the LOCAL-REMOTE switch in the REMOTE position.

3 Press speed pushbuttons on the recorder front panel for the desired recording speed. With remote switch in RUN position, chart drive is ON. In STANDBY position, chart drive is OFF.

REMOTE MARKER CONTROL

4 Connect the switch circuit shown in Figure 2-9 to J15 on the recorder rear panel. Press the remote mark switch to record a reference mark on the lower edge of the Permapaper.

5 For systems with an auxiliary marker (Option 15), connect the switch circuit of Figure 2-9 to J14. Press the auxiliary marker switch to record a reference mark between channels on the Permapaper.

Figure 3-6. Remote System Operation

SECTION IV.
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section of the manual contains the principles of operation of the electrical and mechanical components in the 7702A System. A block diagram of the system is shown in Figure 4-1. Introductory paragraphs 4-3 to 4-13 contain basic information on semiconductor diode and transistor circuits used in the recording system.

4-3. BASIC CIRCUITS.

4-4. Diodes.

4-5. Semiconductor diodes are used in the signal handling circuits and in the power supply rectifier and regulator circuits.

4-6. Diodes are used as limiters or clippers in circuits to remove positive or negative peaks of waveforms. The diode can be used either as a waveform shaping circuit or as a protective device to prevent excessive voltages being applied to a sensitive circuit. Figure 4-2 (a) shows a limiter which prevents the negative peak of a pulse from going more negative than approximately 0.6 volts. Note that for a conducting silicon diode, the cathode voltage is about 0.6 to 0.8 volts more negative than the anode.

4-7. A diode clamper or dc restorer is a circuit which establishes either the positive or negative peak of a waveform at a particular dc reference voltage to provide a definite baseline voltage for the waveform. Figure 4-2 (b) shows a clamper which provides a baseline of about +20 volts for a negative pulse.

4-8. A diode regulator circuit uses either the constant reverse-bias breakdown voltage characteristics of a zener diode, or the constant forward bias voltage drop characteristic of a silicon diode. Power supply reference voltages are generally provided by break-down diodes which maintains a constant voltage when supplied with a reverse-bias voltage greater than their specified breakdown voltage. Regulated voltages can also be provided by a forward-biased silicon diode which maintains a constant 0.6 to 0.8 volt drop. Figure 4-2 (c) shows connections for both types of diodes.

4-9. Transistors.

4-10. Transistors are used throughout the 7702A in amplifier and oscillator circuit configurations. Vacuum tubes and transistors are functionally similar. In the tube, a small grid-to-cathode potential controls a large plate to cathode current flow. In a transistor, a small base-to-emitter current controls a large collector-to-emitter current. A comparison of basic

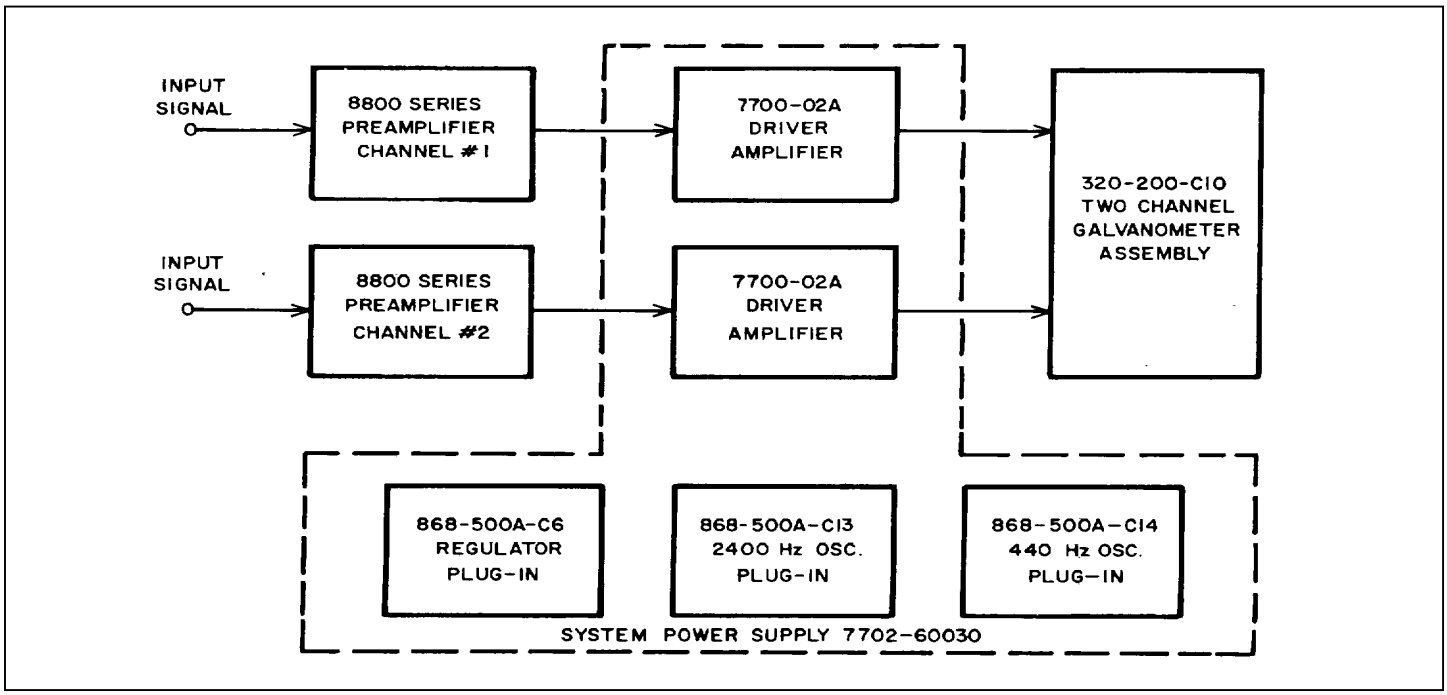


Figure 4-1. Model 7702A System Block Diagram

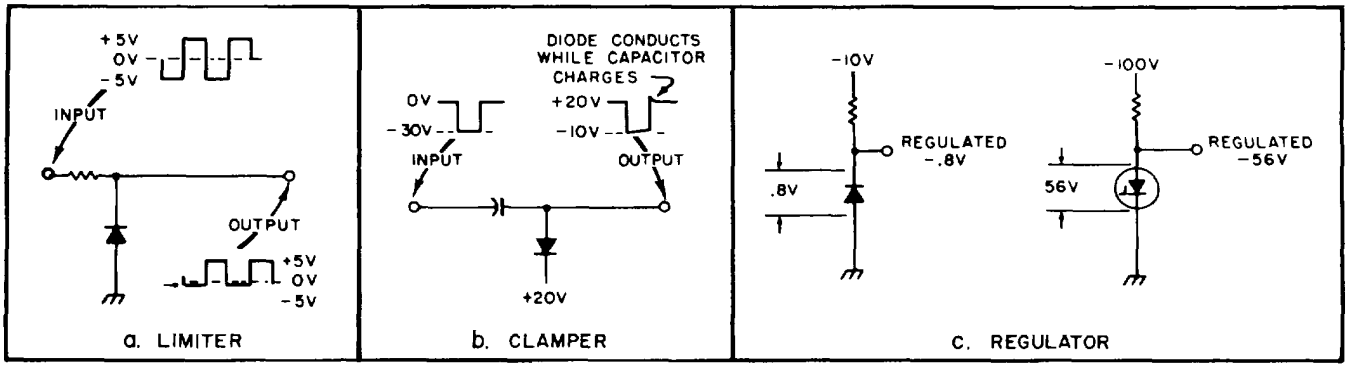


Figure 4-2. Basic Diode Circuits

a. TRANSISTOR BIASING

DEVICE	SYMBOL	CUTOFF	CONDUCTING
VACUUM TUBE	PLATE, GRID, CATHODE	+200V, -15V	+200V, -3V
N P N TRANSISTOR	COLLECTOR, BASE, EMITTER	+20V, 0V (OR-)	+20V, +.6V, MAIN CURRENT, CONTROL CURRENT
P N P TRANSISTOR	COLLECTOR, BASE, EMITTER	-20V, 0V (OR+)	-20V, -.6V, MAIN CURRENT, CONTROL CURRENT

b. AMPLIFIER CHARACTERISTICS

CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT Z	30-50 Ω	500-1500 Ω	20-500K Ω
OUTPUT Z	300-500K Ω	30-50K Ω	50-1000 Ω
VOLTAGE GAIN	500-1500	300-1000	<1
CURRENT GAIN	<1	25-50	25-50
POWER GAIN	20-30 db	25-40 db	10-20 db
	-15V, INPUT, OUTPUT	-15V, OUTPUT, INPUT	-15V, INPUT, OUTPUT

Figure 4-3. Transistor Operation

vacuum tube, NPN transistor, and PNP transistor operation is shown in Figure 4-3 (a); indicated current represents conventional flow of positive charges external to the transistor and is not intended to indicate flow of carriers inside the transistor structure. Notice that the effect of emitter-base-collector voltages is totally reversed between NPN and PNP transistors; circuits which are arranged for an NPN transistor usually function normally for a PNP transistor if supply voltages are reversed.

4-11. There are three basic amplifier types, Figure 4-3 (b). These amplifiers are used alone or in combinations to form complex circuits.

4-12. COMPONENT CIRCUIT DESCRIPTION.

4-13. Preamplifiers.

4-14. The principles of operation for the 8800 Series Preamplifiers are contained in the particular preamplifier Operating and Service Manual. A list of the preamplifiers is shown in Section I, Table 1-3. The preamplifier signal input connectors (J1, J2) mounted on the rear of the recorder include provision for use of a guard shield in the signal input cable. Use of a guard shield contributes to a high common-mode rejection ratio when floating input preamplifiers such as the 8803A are installed in the system. Additional information on the preamplifier guard shield circuit is contained in the preamplifier manual.

4-15. The output signal of each preamplifier is connected to the input of a 7700-02A galvanometer driver amplifier. The preamplifier output signals are also available at connectors J21 and J22 at the rear of the recorder, for connection to oscilloscopes or other monitoring instruments. Signal distribution in the 7702A System is shown in Figure 4-4.

4-16. Driver Amplifiers.

4-17. Two 7700-02A Galvanometer Driver Amplifiers are mounted on the rear panel of the power supply 7702-60030. The driver amplifier block diagram is shown in Figure 4-5.

4-18. The input signal and the galvanometer feed-back signal shown in the block diagram are amplified by the balanced amplifier Q1, Q2, and directly coupled to the differential amplifier Q3, Q4. The signal driving Q1 is limited in amplitude by the transistors Q8 and Q9 to a value which will not overload the driver amplifier or drive the galvanometer writing arm excessively. The single-ended output from the Q3, Q4 stage is obtained from the collector of Q4 and is fed to the base of Q5. Transistor Q5 operates as a Class A driver for the complementary-symmetry Class B emitter-follower power amplifier Q6, Q7. The amplifier output is connected to the galvanometer drive coil. A galvanometer feedback signal is obtained from the galvanometer drive coil and velocity coil, and returned as an input to the balanced amplifier.

4-19. FEEDBACK CIRCUIT. The feedback circuit provides an adjustable amount of galvanometer damping and galvanometer frequency compensation to obtain optimum galvanometer transient response and frequency response characteristics. Galvanometer damping is obtained by generating a feedback voltage proportional to the galvanometer coil velocity, and inserting this voltage into the driver amplifier circuit with a polarity as to reduce the coil velocity. Frequency compensation is achieved by an RC network in the feedback circuit, which determines the amplitude of high frequency feedback voltages returned to the balanced amplifier.

4-20. The feedback voltage is derived from two sources; the galvanometer velocity coil output, and the voltage drop across R24 (see Figure 4-6). The velocity voltage component is proportional to galvanometer coil velocity, to damp the galvanometer motion. The DAMPING control selects the amount of this velocity voltage component which gives the best damping characteristics. The drive coil current through R24 produces a voltage at the base of Q2 with an amplitude approximately equal to the Q1 input signal due to the high ratio of open loop to closed loop gain. This feedback action forces a current through the galvanometer drive coil almost exactly proportional to the input voltage.

4-21. The DAMPING control is adjusted for the best transient response, and the COMPENSATION control is adjusted to match the high-frequency roll-off of the galvanometer. Figure 4-7 shows the galvanometer response both in the frequency and time domains to illustrate different degrees of damping.

4-22. The underdamped condition in Figure 4-7 (a) depicts a partially damped system, with the damping supplied only by the shorted coil frame of the galvan-meter. This shorted frame is equivalent to a low resistence, one-turn short-circuited coil winding. The currents induced in this coil frame develop a damping force which is proportional to the coil velocity, and is in a direction as to reduce the velocity. In this case, the galvanometer oscillates around its final value before coming to rest. The overdamped condition is the result of excessive feedback damping voltage. In this case, the galvanometer approaches its final value slowly, giving too slow a rise time for recording short-period transient voltages.

4-23. The ideal waveshape is the result of properly adjusting the feedback voltage. In this case, the galvanometer approaches the final value quickly, and settles to the final value with a slight overshoot (about 4%). This corresponds to 71% of critical damping, which provides the desired transient and frequency response.

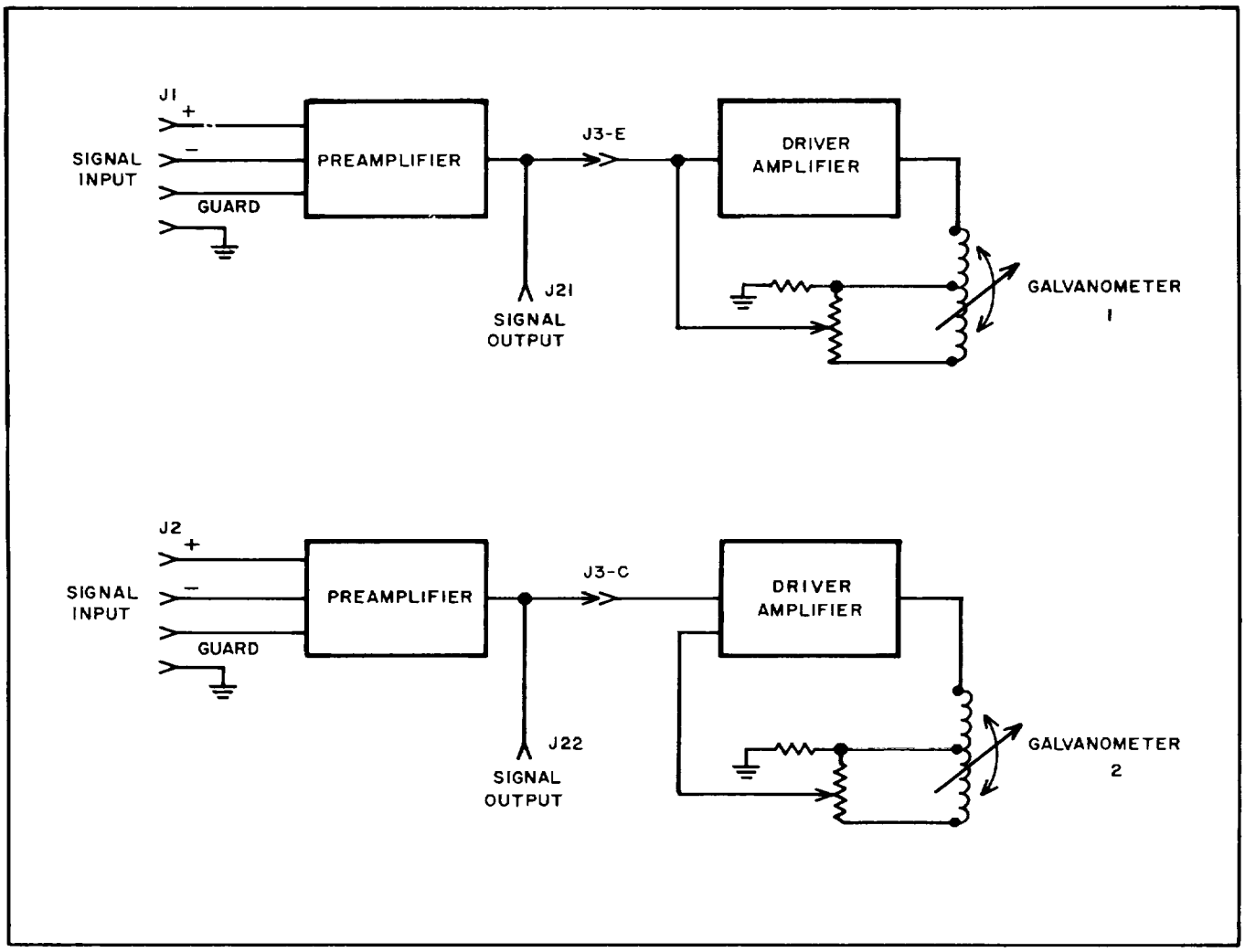


Figure 4-4. Signal Distribution Diagram

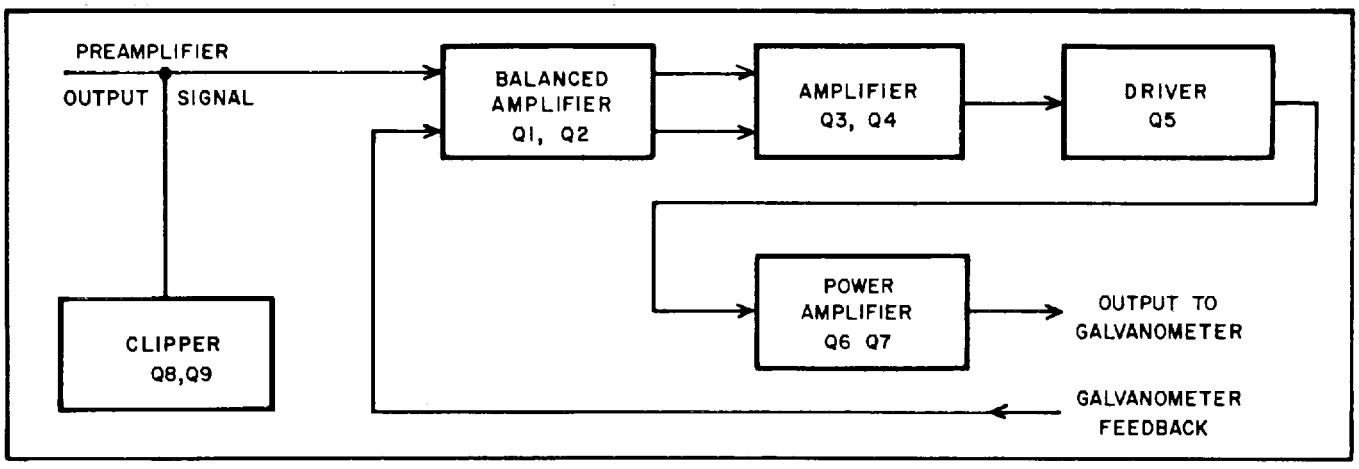


Figure 4-5. Model 7700-02A Driver Amplifier Block Diagram

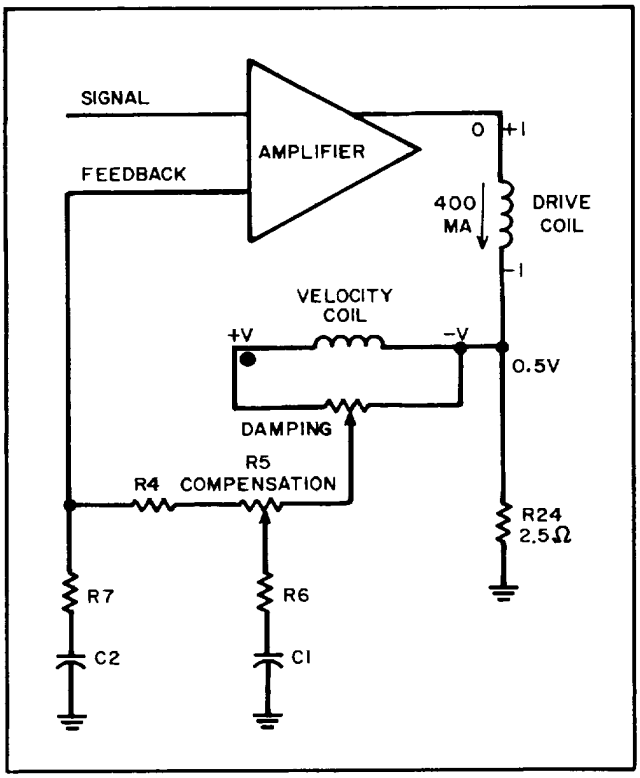
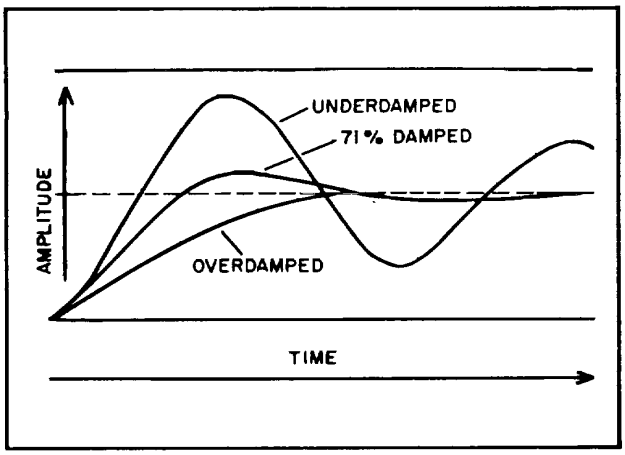
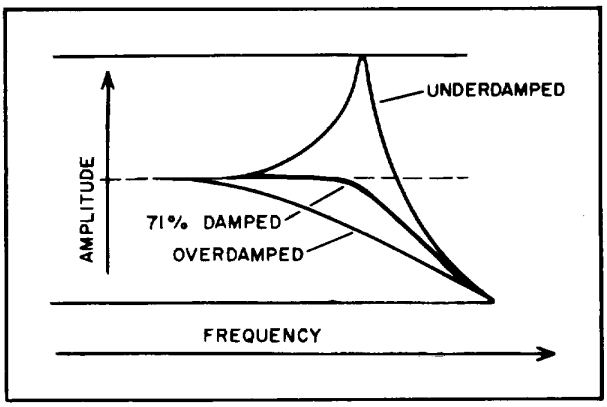


Figure 4-6. Feedback Circuit-Simplified Schematic



(a) Transient response, step function input



(b) Frequency response, sine-wave input

Figure 4-7. Galvanometer Frequency Response and Transient Response

4-24. The frequency response obtained with an underdamped, overdamped and 71% damped galvanometer is shown in Figure 4-7 (b).

4-25. The frequency response for the 7702A Recording System with an 8802A Preamplifier installed is shown in Figure 4-8. The DAMPING control is adjusted for 0.71 critical damping at 10mm deflection.

4-26. System Power Supply.

4-27. The 7702A System Power Supply (07706-60030) furnishes operating power for the preamplifiers, driver amplifiers, and the recorder chart drive circuits. The power supply consists of the following sections:

a. ± 18 Vdc unregulated supply.

b. ± 12 Vdc regulated supply.

c. 440 Hz oscillator (provides chopper excitation for 8803A Preamplifier).

d. 2400 Hz oscillator (provides transducer excitation voltage for 8805A Carrier Preamplifier).

e. Control circuits for the chart drive motor, the marker and timer assemblies, and the stylus heat circuit.

4-28. UNREGULATED DC SUPPLY. The unregulated ± 18 Vdc supply (see Figure 4-9) consists of transformer T1, diodes CR1 to CR8, and the filter capacitors C13 to C16. Each pair of diodes (CR1, CR2, CR3, CR4) connected across the T1 secondary winding forms a full wave rectifier circuit. The output of the rectifiers is filtered by capacitors C13 to C16. The distribution of the ± 18 volt power in the 7702A System is shown in Figure 4-10.

4-29. REGULATED DC SUPPLY. The regulated ± 12 Vdc supply block diagram is shown in Figure 4-11, and in the schematic diagram at the rear of the manual. The +18 volt and -18 volt unregulated supply outputs are connected to the series regulator transistors Q1 and Q2, which are controlled by the output of amplifiers Q3 and Q6 in the 868-500A-C6 regulator card. Both regulated voltages are controlled by one

voltage adjust control, R4. One input of differential amplifier Q4, Q5 is maintained at 6.2 volts by zener diode CR14; the other input is maintained at a fraction of the -12 volt regulated output by the setting of R4. If the -12 volt regulated output voltage should vary slightly, this will appear as a change in input signal levels between the inputs to Q4 and Q5. This change is further amplified by Q3, and applied to the series control transistor Q1, with such polarity as to return the -12 volt regulated output towards its original value. The +12 volt regulated line is controlled in the same manner. In this case, one input of the differential amplifier Q7, Q8 is at ground potential, and the other input is held at a value determined by the voltage divider R12, R13. Assuming regulation of the -12 volt line, if the +12 volt output should vary slightly, this will appear as a change in input signal levels at the input to Q7, Q8. This change is further amplified by Q6, and applied to the series control transistor Q2 with such polarity as to return the -12 volt regulated power in the 7702A System is shown in Figure 4-12.

4-30. 440 HZ OSCILLATOR CARD. The 440Hz Oscillator (868-500A-C14) is shown in the block diagram, Figure 4-13. The frequency of the Q12, Q13 Oscillator is determined by the transformer T4 and capacitor C15. Output from T4 drives the power amplifier Q4, Q5. Diodes CR21, CR22 control the amplitude of oscillation at a level determined by zener diode CR23. The power for the oscillator and power amplifier is provided by the -18 volt unregulated supply through regulator Q3. The base of Q3 is held at -12 volts by the -12 V regulated supply.

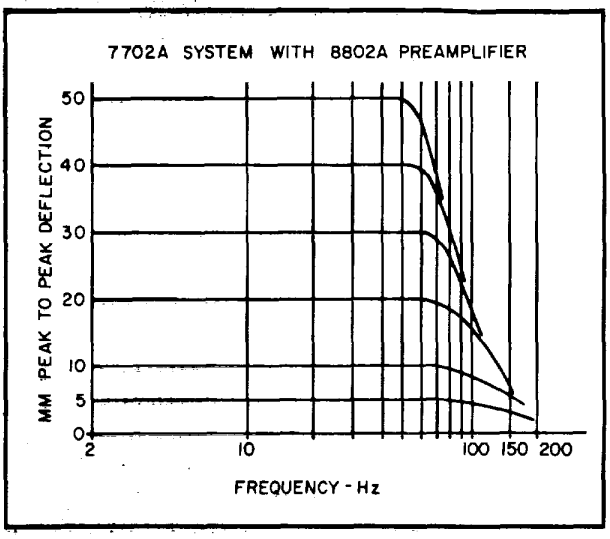


Figure 4-8. 7702A System Frequency Response

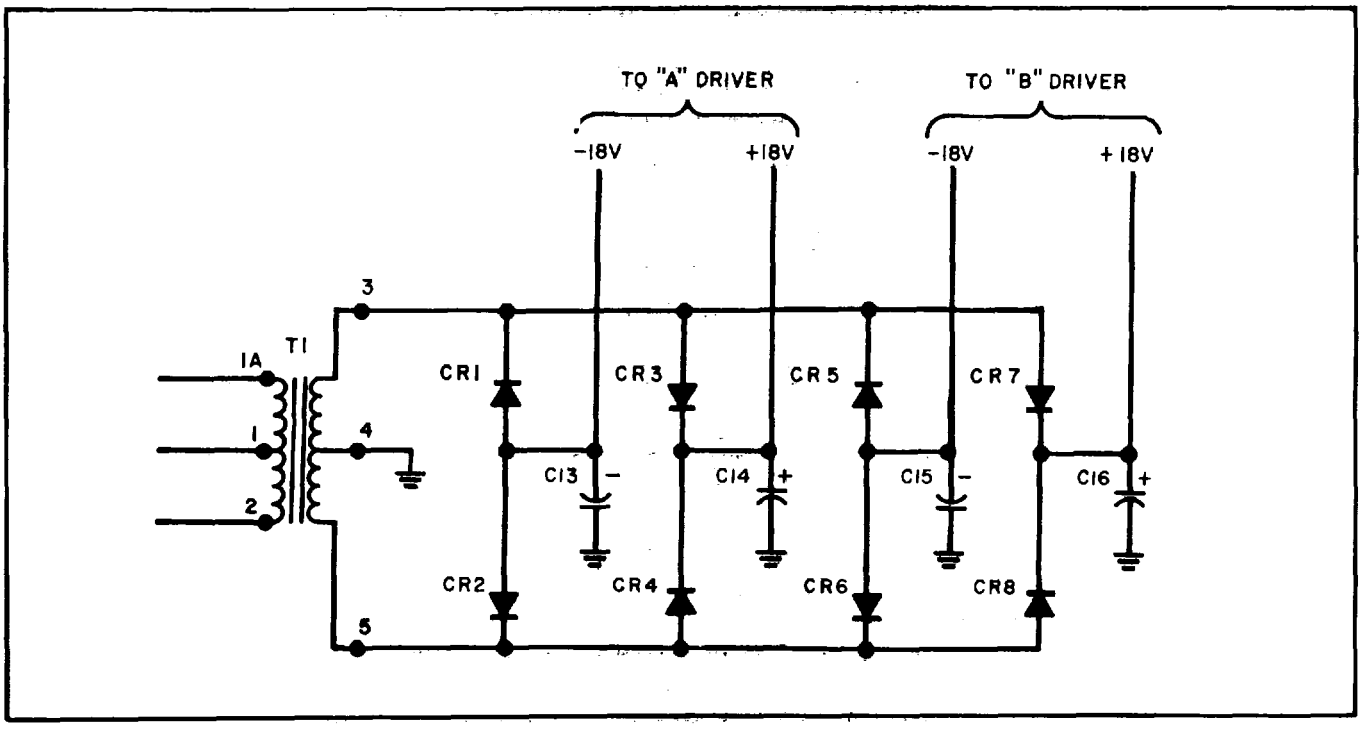


Figure 4-9. Unregulated ± 18V Supply

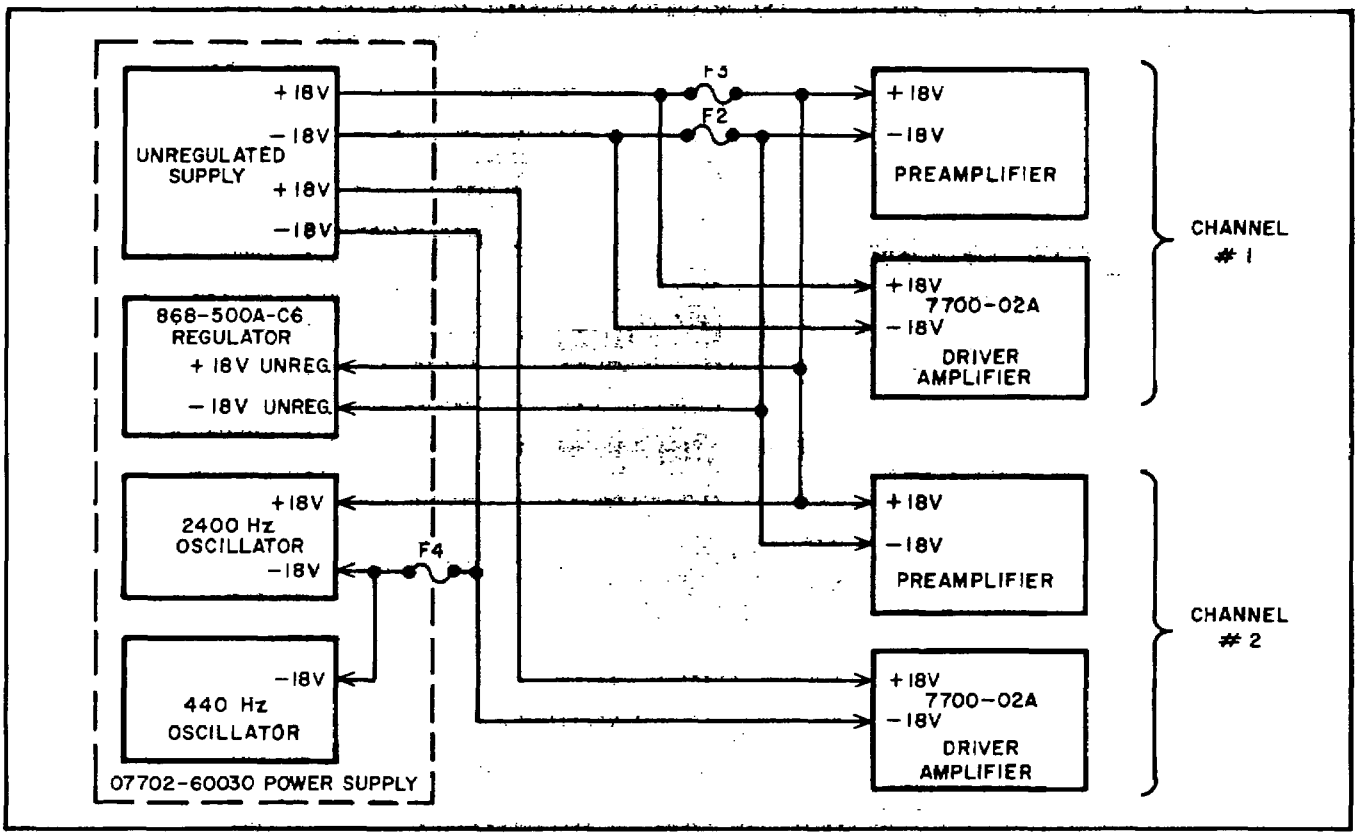


Figure 4-10. Unregulated ± 18 V Power Distribution

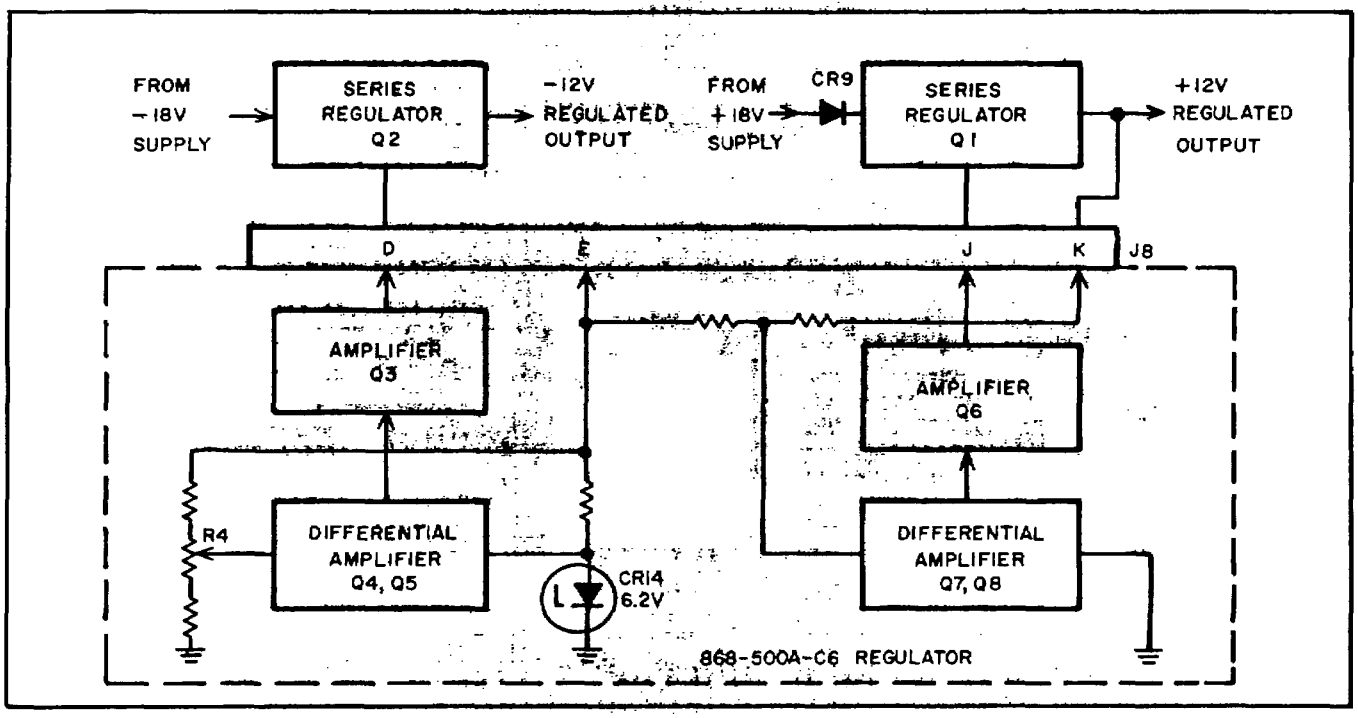


Figure 4-11. Regulated ± 12 V Supply

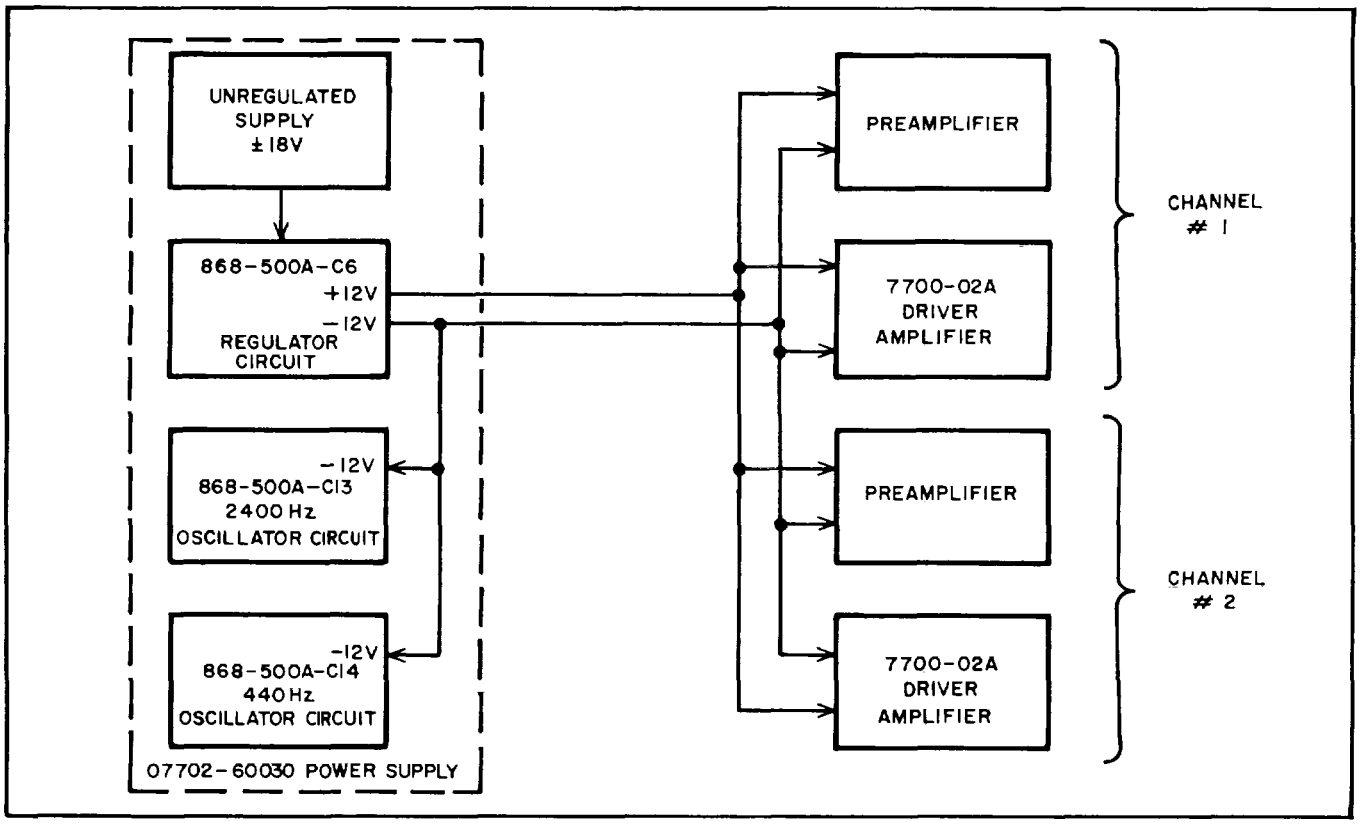


Figure 4-12. Regulated ± 12 V Power Distribution

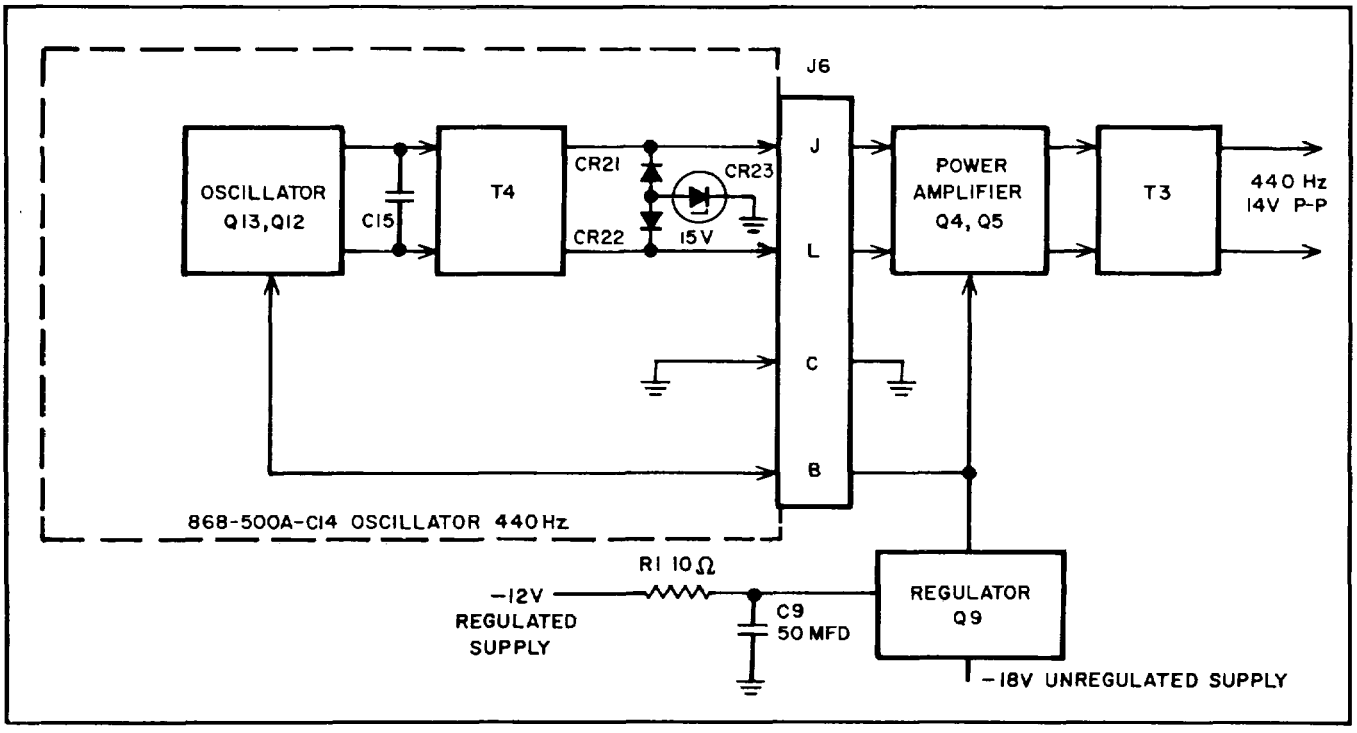


Figure 4-13. 440 Hz Plug-In Oscillator Block Diagram With Associated Circuits

4-31. 2400 HZ OSCILLATOR CARD. The 2400 Hz Oscillator Plug-In Card (868-500A-C13) is shown in the block diagram, Figure 4-14. Q20 and Q21 oscillate at a frequency determined by transformer T7 and capacitors C18 and C19 in parallel. Thermistors TM7 and TM8 provide oscillator stability. Diodes CR25, CR26 control the amplitude of oscillation at a level determined by zener diode CR24. Output from T7 is a 2400 Hz sine wave balanced with respect to ground, which is used as a transducer excitation voltage, and also provides a reference voltage for the 8805A Carrier Preamplifier.

4-32. Oscillator power is provided by the -18 volt unregulated supply through regulator Q19, located on the plug-in card. The base of Q19 is held at a fixed voltage by the regulated -12 volt supply. The Q19 emitter output voltage (approximately 12 volts), supplies the Q20 and Q21 oscillator circuit.

4-33. RECORDER DESCRIPTION.

4-34. Recorder consists of chart drive components to transport the recording paper past the recording styluses onto a paper takeup assembly, and a dual galvanometer assembly. Also included are control circuits for the following functions: chart drive, stylus heat, timer and marker stylus.

4-35. Chart Drive Components.

4-36. The chart drive mechanism consists of: (1) a 450 rpm (60 Hz) synchronous drive motor, coupled to speed reduction gears to obtain chart speeds from 1 mm/sec to 100 mm/sec; (2) pushbutton actuated clutch assemblies, located on the reduction gear shafts, to determine which of the speed reduction gears are in the drive train for the chart speed selected; (3) a paper drive assembly, which includes a paper supply spool, a brake roll to hold the paper under tension as it passes over the paper table and a paper drive roll driven by the output of the speed reduction gears, and; (4) a paper takeup assembly, which stores the chart paper following the recording process.

4-37. Drive Motor and Speed Reduction Gears.

4-38. The drive motor (B1) is coupled to the input shaft, see Figure 4-15(a), by means of a drive chain and sprockets. The input shaft rotates at 300 rpm for the 1 to 100 mm/sec chart speeds (50 or 60 Hz power line). Four additional chart speeds are available (Option 11 or Option 12) with the addition of a second synchronous drive motor. The optional mm/min drive motor (B103) rotates the input shaft at 5 rpm (50 or 60 Hz power line), through a similar sprocket and chain coupling. An overrunning clutch is installed on each drive motor sprocket so that only one motor shaft rotates at a time.

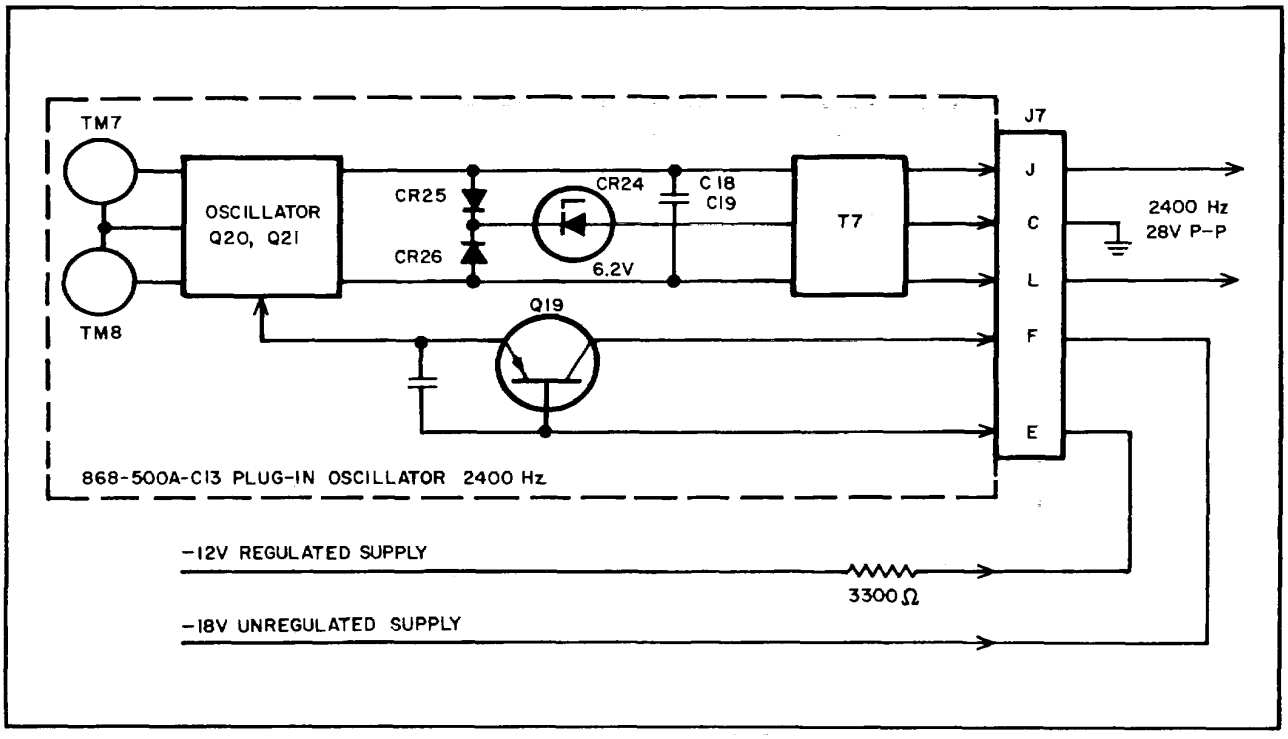


Figure 4-14. 2400 Hz Plug-In Oscillator Block Diagram

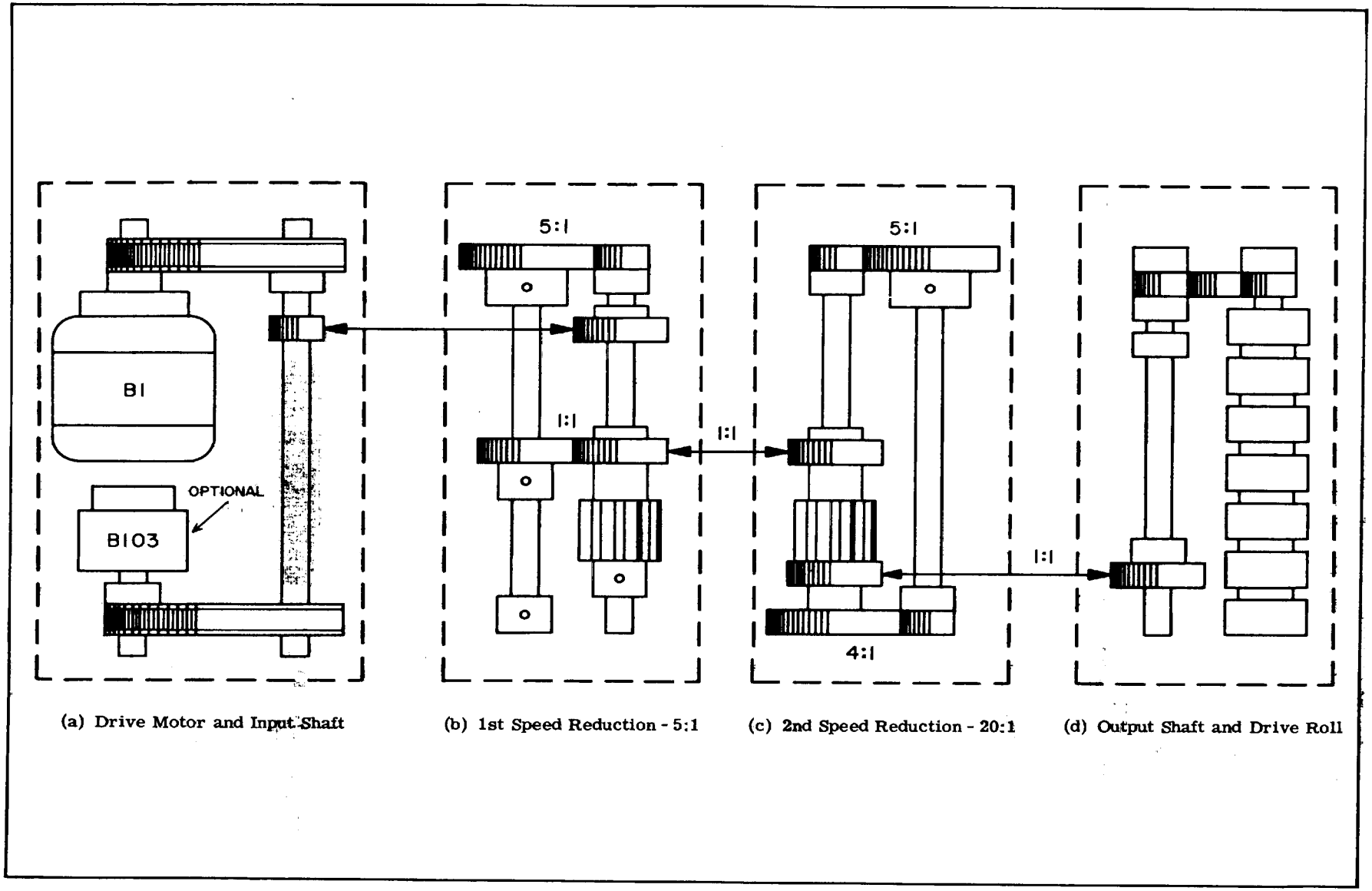


Figure 4-15. Chart Drive Motor and Speed Reduction Gears

4-39. Two speed-reduction gear assemblies are included in the recorder. The first speed reduction assembly, Figure 4-15(b), contains a 5:1 speed reduction gears. The second speed reduction, Figure 4-15 (c), contains both 5:1 and 4:1 reduction gears, to obtain a 20:1 overall speed reduction for the second assembly.

4-40. Pushbutton Actuated Clutch Assemblies.

4-41. A spring clutch installed in each of the speed reduction assemblies permits the reduction gears to be by-passed, resulting in a 1:1 speed ratio. The spring clutches are mechanically linked to the four-speed pushbuttons on the front panel of the recorder by the clutch actuator assembly shown in Figure 4-12 of Section VI. Pressing one of the pushbuttons causes the appropriate clutch to be engaged for the speed selected. Table 4-1 lists the speed reductions in effect for 1 mm/sec to 100 mm/sec recorder operation.

Table 4-1. Speed Reduction Ratios

CHART DRIVE MOTOR → CHART DRIVE ROLL

DRIVE SPEED MM/SEC	SPEED REDUCTION 1 ST	2 ND
1	5:1	20:1
5	1:1	20:1
20	5:1	1:1
100	1:1	1:1

4-42. The power flow through the first speed reduction assembly is shown in Figure 4-16. For 1:1 speed ratio, the pushbutton linkage pulls the clutch actuator arm (1) away from the clutch housing. This action locks the gear (2) to shaft (3). The resulting power flow by-passes the 5:1 speed reduction gears (4) (5), on the upper end of the two shafts. An overriding clutch, mounted in the gear hub (5) disengages gear (5) from shaft (6). For 5:1 speed transfer, the push-button linkage causes the clutch actuator arm to engage with the clutch housing, preventing the housing from rotating. This action releases gear (2), permitting it to rotate freely on shaft (3). The power flow is from shaft (3) through the reduction gears (4), (5), to shaft (6). Gear (7) then drives the output gear (2).

4-43. The second speed reduction assembly, which is driven by gear (2), operates in a similar manner. For medical operating speeds, 2.5 to 50 mm/sec, the reduction ratios in the first and second speed reduction assemblies are 2:1 and 10:1.

4-44. Chart Drive Circuits.

4-45. The chart drive circuits are shown in the functional diagram, Figure 4-17. The diagram shows the recorder with the mm/sec drive motor (B1) and the optional mm/min drive motor (B103).

4-46. The recorder may be connected to either a 115 or 230 volt power line. The switch S2 on the rear of the recorder is set to agree with the line voltage. For 115 volt input, the power line is connected directly to the chart drive circuits from transformer

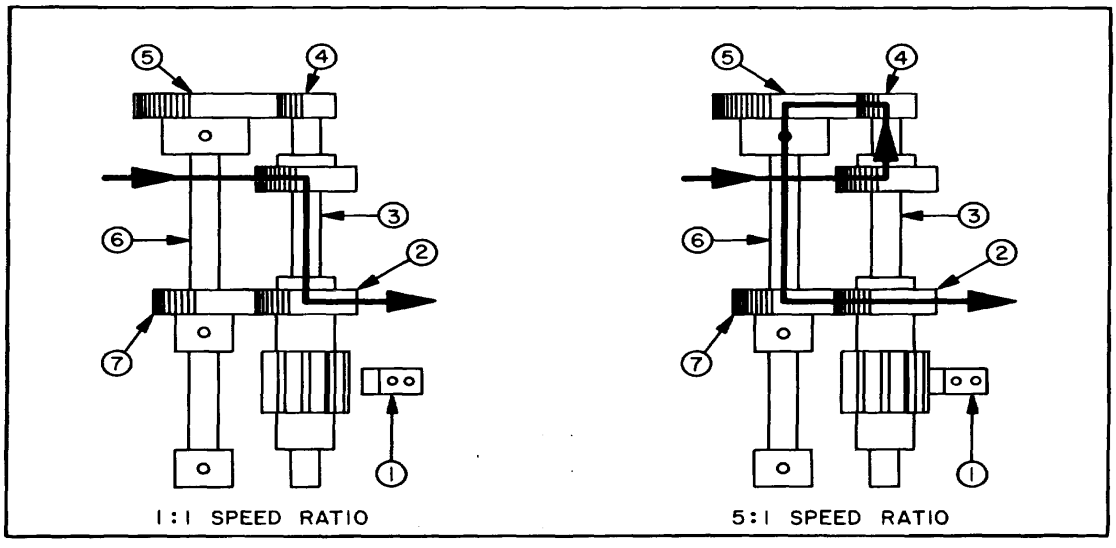


Figure 4-16. First Speed Reduction Assembly Operation

T1 terminals 1 and 2. For 230 volt line power, the line voltage is applied to terminals 1A and 2 of transformer T1. Through transformer action, the voltage is reduced to 115 volts at terminals 1 and 2 of T1. Terminal 2 of T1 is connected to the upper lead of the mm/sec drive motor. With the mm/min drive motor installed in the recorder, terminal 2 is also connected to the mm/min drive motor. The lower terminal of the drive motor(s) is connected to switch S1C. For recorders with mm/sec speeds only, the S1C switch is always in the mm/sec position. For recorders with the mm/min drive motor installed, the switch may be operated to select either the mm/sec or the mm/min drive motor. The chart drive circuit continues to the left of S1C and upward to the STOP switch S1D. When any of the numbered speed pushbuttons is pressed, the STOP switch is closed and drive motor power is applied. Pressing the STOP pushbutton opens the chart drive circuit. With the LOCAL/REMOTE switch in the REMOTE position, the switch circuit shown is connected to the connector J13 for remote control of the chart drive start-stop function.

4-47. Stylus Heat Circuits.

4-48. The stylus heat circuits are shown in the functional diagram, Figure 4-18. Each recording stylus has a hot wire element which is heated by the ac line voltage (50 or 60 Hz). The line voltage is reduced by the transformers T1, T2, to the level required for the operation of the stylus heat elements.

The temperature of the heated element in each recording stylus is adjustable for setting desired trace intensity. This adjustment is made by means of variable resistors R2, R3, which are front panel controls marked HEAT. The recorder also contains a circuit to switch the level of stylus heat for each of the selected mm/sec operating speeds. Thus the same trace intensity is obtained for each of the mm/ sec speeds without the need for manual readjustment when a different speed is selected. The mm/min speeds do not require a different level of heat for each of the four speeds, so a constant voltage is applied to the stylus circuit for all speeds selected.

4-49. STYLUS HEAT CIRCUITS-CHART DRIVE OFF. When the line POWER switch S1A is closed, the 115 volts ac line power is present at T1 terminals 1 and 2. Through transformer action, 115 volts is also present at terminals 1 and 1A. For 230 volt power line operation, the S2 switch is in the 230 volt position. The line voltage applied to terminals 1A and 2 is stepped down by transformer action so that 115 volts is present at T1 terminals 1 and 1A. With the REMOTE/LOCAL switch in the LOCAL position, and the STOP pushbutton pressed, 115 volts is applied to terminals A and E of the T2 primary windings. The T2 secondary voltage (0.75 V) is connected to each stylus, providing a standby heat level.

4-50. STYLUS HEAT CIRCUIT: CHART DRIVE ON. With the power line switch ON and the 1 mm/sec speed pushbutton pressed, the RUN-STOP switch is

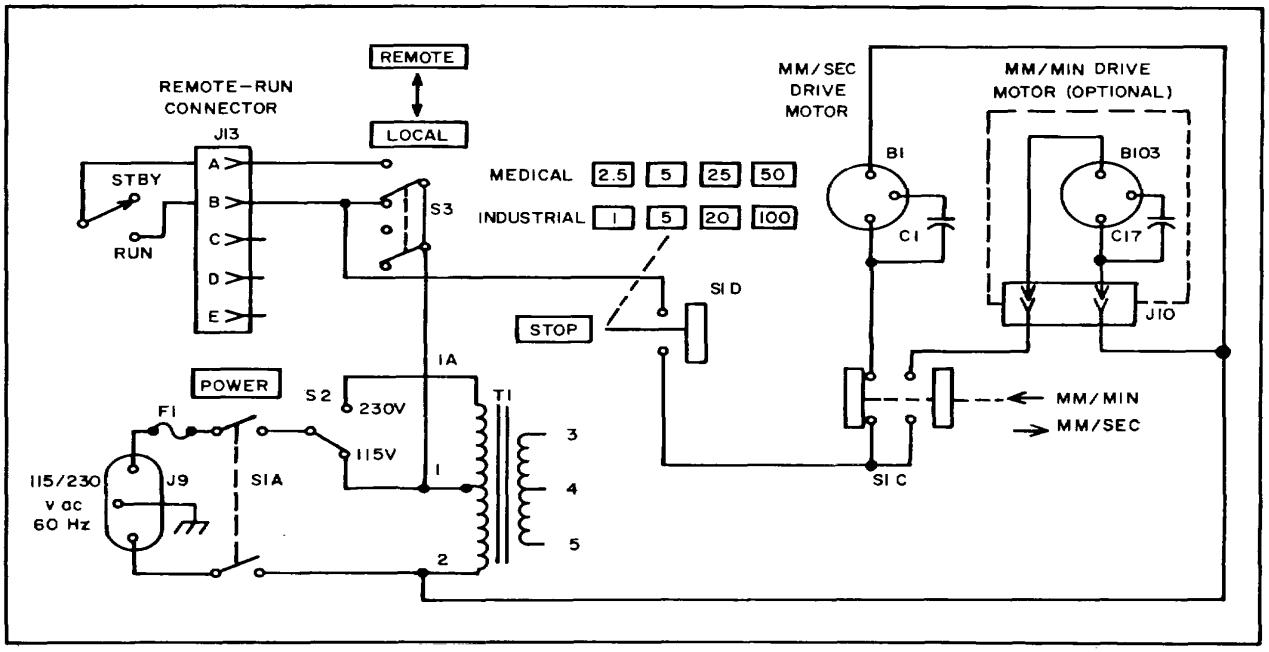


Figure 4-17. Chart Drive Circuit

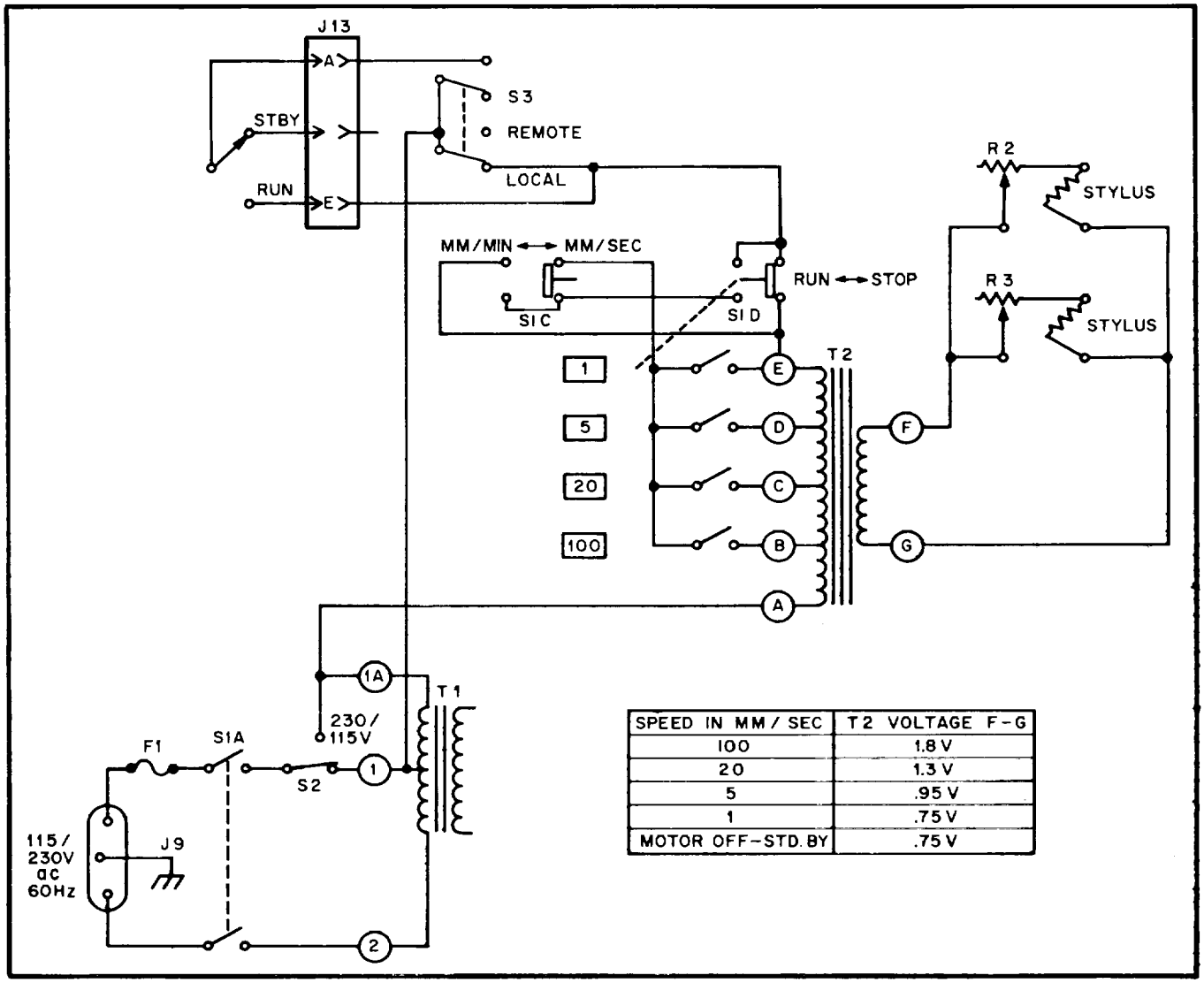
in the RUN position, and the switch contact adjacent to T2 terminal E is closed. The circuit is completed from terminal E of T2 to the power line input through the 1 mm/sec speed switch; through S1C, S1D, S3, and terminal 1 of T1. For higher speeds, transformer T2 turns ratio tap is changed, resulting in progressively higher stylus heat voltages. A table of T2 output voltages for the various chart speeds is shown in Figure 4-18.

4-51. Marker and Timer Circuit.

4-52. The recorder marker and timer circuitry is shown in the functional diagram, Figure 4-19. The following description includes the circuitry for the standard 7702A, and for the optional marker and timer features.

4-53. MARKER CIRCUIT. The 7702A Recorder includes a marker assembly for recording a reference mark on the lower edge of the chart. The marker assembly consists of an ac operated marker coil which vibrates a heated stylus attached to the coil armature. The lower end of the marker coil is connected to transformer T1, terminal 3 (15 Vac). The upper end of the coil is connected to the MARK switch S1E. Pressing the MARK button grounds the upper end of the marker coil, completing the circuit to the grounded T1 center tap (terminal 4). The marker is also actuated from a remote location by connecting a switch circuit to J15.

4-54. AUXILIARY MARKER CIRCUIT. An additional marker, which records on the chart between channels 1 and 2, is available as Option 15. The auxiliary marker is actuated by a switch circuit connected to J14.



SPEED IN MM/SEC	T2 VOLTAGE F-G
100	1.8 V
20	1.3 V
5	.95 V
1	.75 V
MOTOR OFF-STD. BY	.75 V

Figure 4-18. Stylus Heat Control Circuit

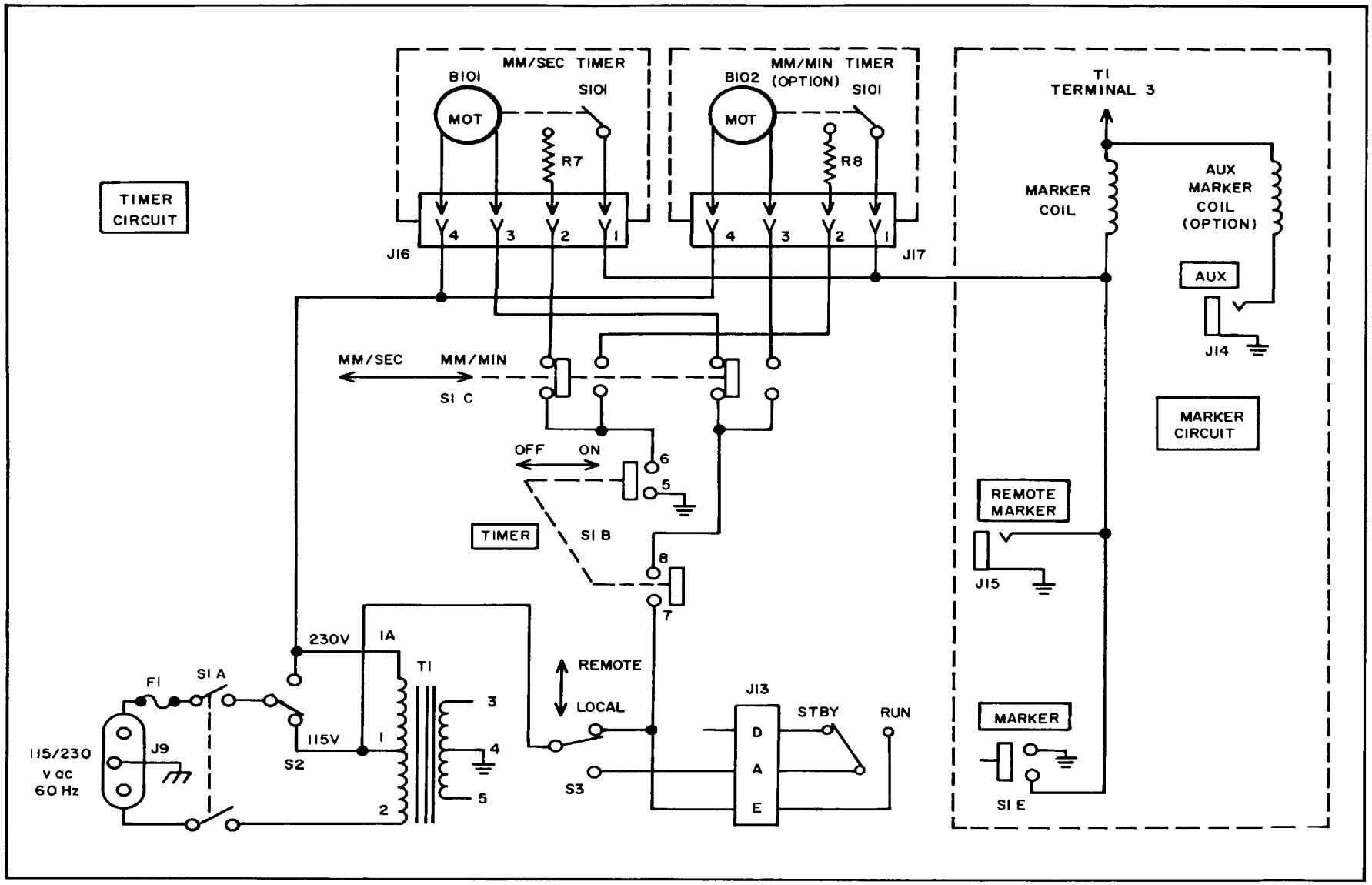


Figure 4-19. Marker and Timer Control Circuitry

4-55. TIMER CIRCUIT. The standard 4-speed recorder, for 60 Hz power line, includes a 14002S Timer Assembly. This timer is actuated by the front panel TIMER pushbutton switch, to record one timing mark per second on the chart. The timer assembly consists of a 1 RPS synchronous timing motor and a magnetic reed switch. The reed switch is wired so that the marker coil is energized each time the switch closes, recording a timing mark on the lower edge of the chart once per second. Plug-in Timer Assembly 14002T is supplied with recorders operation on 50 Hz line power. A second, optional timer can be plugged into J17 on the rear of the recorder to provide minute timing marks for recorders equipped with eight recording speeds. Table 4-2 lists the timing assemblies for use with the 7702A System.

Table 4-2. Timer Assembly Part Numbers

	I/SEC. TIMER	I/MIN. TIMER
7702A (60 Hz PWR)	14002S	14002V (OPT 14)
7702A OPT 08 (50 Hz PWR)	14002T	14002R (OPT 13)

4-56. Pressing the power pushbutton closes the line power switch S1A (see Figure 4-19). For 115 volt operation, the S2 switch is in the lower position, and the line power is applied to T1 terminals 1 and 2. Through transformer action, 115 volts is also present on T1 terminals 1 and 1A, to operate the timer circuit. For 230 volt line operation, T1 steps the line voltage down to 115 volts. Terminal 4 of the mm/sec timer motor B101 is connected to T1 terminal 1A. With the TIMER and mm/sec pushbuttons pressed, T1 terminal 1 is connected to terminal 3 of the mm/sec timer motor through S3, the TIMER switch S1B terminals 7 and 8, and the S1C switch.

4-57. For each one per second closure of the timer switch, current flows from T1 terminal 3 through the marker coil, terminals 1 and 2 of the timer, S1C contacts, the S1B terminals 5 and 6, to ground. Each time the marker coil is energized, the marker stylus records a time mark on the chart.

SECTION V.
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides the maintenance and service information for the 2-Channel 7702A Recording System. Maintenance information includes performance checks (Paragraph 5-5) which can be used as incoming quality control checks or as a performance check after repair; preventive maintenance (Paragraph 5-10); corrective maintenance (Paragraph 5-48); troubleshooting and repair (Paragraph 5-85).

5-3. TEST EQUIPMENT.

5-4. Recommended test equipment for performance checking, troubleshooting, repair, and for making adjustments is listed in Table 5-1 together with the performance characteristics required. Other test equipment can be used if their specifications equal or exceed those listed. Refer to the Maintenance Allocation Chart in the appendix for the required test equipment.

5-5. PERFORMANCE CHECKS.

5-6. General.

5-7. The Performance Checks (Table 5-2) and Performance Test Card (to be filled out during incoming inspection) are designed to verify specifications and to provide a permanent record of the performance of the system. These checks verify proper operation of all circuits in the system and can be used:

a. As part of an incoming inspection check of the component specifications.

b. Periodically, where maximum reliability is paramount.

c. As part of a troubleshooting process to locate malfunctioning circuits.

d. After any repairs or adjustments, before returning the system (or components) to regular service.

5-8. VARIABLE LINE VOLTAGE.

5-9. During the following procedures, the system (or component) should be connected to the power source through a variable voltage device so that line voltage can be varied ±10% from nominal (115 or 230 Vac) to assure proper operation of the system under various supply conditions.

CAUTION

AVOID DAMAGE BY REMOVING POWER FROM THE SYSTEM PRIOR TO REMOVAL OR REPLACEMENT OF ASSEMBLIES OR COMPONENTS.

Table 5-1. Recommended Test Equipment.

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	USE	INSTRUMENT RECOMMENDED
Variable Voltage Controller	115 or 230 volt; 0-130 Vac 2 amp 0-260 Vac 1 amp	General Test	General Radio Variac
DC VTVM	1 mV to 1000V full-scale 1 mA to 1 amp	Performance Test and Troubleshooting	HP 412A
Oscilloscope	dc to 450 kHz 10 mV/cm to 10V/cm	Performance Test and Troubleshooting	HP 120B
Power Supply	Stable to within 1/10% output greater than 1.5 volts	Signal Source	Harrison Lab 808A
Voltage Divider	Accurate to 0.05% less than 1.5 K ohms	Performance Checks	General Radio
Differential VTVM	±10V with 5-digit resolution	Monitor	HP 740A, 741A

Table 5-1. Recommended Test Equipment (Cont.)

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	USE	INSTRUMENT RECOMMENDED
Function Generator	Sine Square Oscillator to 150 Hz	Signal Source	HP 202A
AC/DC VTVM	300 volts full-scale	Performance Testing	HP 410B
Wattmeter	200 watts 50/60 Hz	Adjustment	Any
Stylus Pressure Tester	0-5 grams	Adjustment	Sanborn 14015A
Frequency Counter	To 40 kHz	Performance Checks	HP 5223L

Table 5-2. Performance Checks

POWER SUPPLY (07702-60030)

1. ± 12 VOLT REGULATED SUPPLY

Regulation: With ± 10% change in line voltage, change in output voltage is 1% maximum (0.12 volt dc).

a. Install two 8800 Series Preamplifiers in the 7702A System using a Variac or a similar variable voltage source to supply line power to the system. For 115 V ± 10% power line, adjust the Variac output to 115 volts. For 230V ±10% power line, adjust the Variac to 230 volts output. See Reference 8, Figure 3-3, Section III.

b. Connect a dc VTVM to the -12V dc test point, which is pin 1 on the upper drive amplifier circuit board 07700-62010. Voltage should be -12 Vdc ± 20 mV. Adjust R4 on the Regulator 868-500A-C6 if necessary.

c. Increase the Variac output voltage 10% from the 115 V or 230V level. VTVM reading should change no more than 0.12 volts from reading in step b.

d. Decrease the Variac output voltage 10% from the 115 V or 230 V level. The VTVM reading should change no more than 0.12 volts from the reading in step b.

e. Connect the VTVM to the +12 volt test point which is pin 3 on the upper driver amplifier circuit board 07700-62010. For a line voltage of 115V or 230 V, the test point should read approximately +12 volts.

f. Adjust the Variac output ± 10% as described in steps c and d. The VTVM reading should not vary more than ± 0.12 volts from the reading in step e.

Ripple: With 115 or 230 volt line power, ripple on +12V or -12V supply should not exceed 10 mV pp.

Connect a test oscilloscope to the +12 and -12 test points described above. The measured ripple should not exceed 10 mV pp, for a 115V or 230V line voltage.

2. ± 18 VOLT UNREGULATED SUPPLY

Connect the dc VTVM to the following test points, to determine whether the +18V and -18V ±2V supply voltages are present.

+18 V - Pin 7 on the upper driver amplifier circuit board 07700-62010.
-18V - Pin 8 on the upper driver amplifier circuit board 07700-62010.

Table 5-2. Performance Checks (Cont.)

3. 2400 Hz OSCILLATOR 868-500A-C13

Output voltage and frequency: 14 volts pp each side to ground; frequency between 2.352 kHz and 2.448 kHz.

a. Connect a test oscilloscope to J11l pin 4 and pin 1 (common). The amplitude of the output should be at least 28 V pp.

b. Disconnect the oscilloscope and connect a frequency counter to the same test points. The frequency should read between 2.352 kHz and 2.448 kHz.

4. 440 Hz OSCILLATOR 868-500A-C14

a. Connect test oscilloscope to J11 pin 11 and pin 9 (common). The amplitude of the output should be at least 14 V pp.

b. Disconnect the test oscilloscope and connect the frequency counter to the same test points. The frequency should read between 430 and 450 Hz.

RECORDER

1. STYLUS: MECHANICAL CENTER

a. Check the stylus pressure. Correct stylus pressure is 2 to 2-3/4 grams.

b. Set the recorder POWER switch to OFF. The stylus on each galvanometer should come to rest at chart center, ± 1 division.

2. LINEARITY

With 8801A, 8802A: 0.25 div. 8803A: 0.25 div (1 mV range 0.35 div). 8805A, 8806B, 8809A: 0.4 div (after setting mechanical zero of stylus within ± 1 div of chart center and calibrating for zero error at center scale and +20 divisions). 8807A: 0.55 div +0.05 div x scale expansion, 330 Hz to 5 kHz (after setting mechanical zero of stylus within ± 1 division of chart center and calibrating for zero error at lower and upper ends of printed coordinates). 8808A: 50 dB span 1.25 div, 100 dB span 1 div (after setting mechanical zero of stylus within ± 1 division of chart center and calibrating for zero error at lower and upper ends of printed coordinates).

a. Connect a precision voltage divider to the signal input connector J1 (Channel 1) or J2 (Channel 2).

b. Connect a signal source to the voltage divider input. (A dc source is used for the 8801A, 8802A, 8803A, 8809A Preamplifiers.)

c. Balance and calibrate the preamplifier using the procedure outlined in the preamplifier instruction manual.

d. Set the preamplifier range switch to OFF. Adjust the preamplifier POSITION control to center the stylus on the recording chart.

e. Set the preamplifier RANGE and GAIN controls to obtain a 20 division stylus deflection; this is the 100% value.

f. Set the voltage divider output in steps of 25% voltage, starting with 125%, and observe the recording:

125% = 25 div deflection
100% = 20 div deflection
75% = 15 div deflection
50% = 10 div deflection
25% = 5 div deflection

g. The stylus deflection for each signal level should be within the limit specified above for each preamp.

Table 5-2. Performance Checks (Cont.)

3. FREQUENCY RESPONSE

Preamps	Dc to less than 3 dB down at
8801A	125 Hz
8802A	125 Hz
8803A	86 Hz
8805A	104 Hz
8806B	With 60 Hz fixed frequency plug-in 12 Hz; 400 Hz fixed frequency plug-in 65 Hz; 5000 Hz fixed frequency plug-in 125 Hz
8807A	54 Hz Option 01, 9 Hz
8808A	Not Applicable
8809A	125 Hz

The system frequency response and transient response using the dc preamplifiers 8801A, 8802A, 8803A, and 8809A are checked using the following procedure. For other preamplifiers, see the preamplifier manual:

Frequency Response

a. Connect the oscillator to the preamplifier input connectors J1 and J2.

b. Center each stylus using the preamplifier position controls.

c. Set the DAMPING controls for each channel full clockwise.

d. Record a 2-Hz sine wave at 10 divisions pp amplitude.

e. With the oscillator output voltage maintained at the same amplitude, set the oscillator to the frequency listed above.

f. Adjust the compensation (COMP) control located at the rear of each driver amplifier (upper driver for upper channel) for a 7-div pp recorded signal (3 dB down).

Transient Response

g. Set the oscillator to 2 Hz, square wave output. Adjust oscillator amplitude to obtain a 25 division pp recorder amplitude. (The calibration source within the preamp may be used in place of a square wave oscillator to record a step function.)

h. Run recorder at 20 mm/sec or 25 mm/sec (medical speed) and adjust the DAMPING controls for each channel to obtain a 1 division overshoot on the leading edge of the square wave.

Rise Time

i. Run recorder at 100 mm/sec or 50 mm/sec while recording above signal. Observe the recorded rise time which is the time required for the signal to rise from the zero amplitude level (-12.5 divisions) to the 90% level (+10 divisions).

Preamplifier	Rise Time (10 div, 10-90% with 4% overshoot)
8801A	5 msec
8802A	5 msec
8803A	7 msec
8805A	5.6 msec
8809A	5 msec

10 msec = 1 div at 100 mm/sec
10 msec = 1/2 div at 50 mm/sec

Table 5-2. Performance Checks (Cont.)

4. DRIFT

Line voltage from 103 to 127 volts. Maximum allowable drift for each preamplifier is:

Preamplifier	Drift
8801A, 8802A	0.2 div
8803A	0.27 div
8805A, 8806B	0.35 div
8807A	0.005 div x scale expansion + 0.30 div
8808A	Not applicable
8809A	0.50 div

a. Apply 103 volts ac power line voltage to 7702A System.

b. Run the recorder at 5 MM/SEC and center the styli with the position controls.

c. Increase the power line voltage to 127 volts ac and observe each stylus trace deviation from the zero reference point.

5. NOISE (with zero signal input)

Preamplifier	Noise
8801A	0.2 div pp
8802A	0.2 div pp
8803A	1 div pp max. gain 1 div pp min. gain
8805A	0.2 div pp and 1% of chart deflection
8806B	7 μ V x square root of frequency response, referred to input
8807A	Baseline offset and/or noise 2 mV rms referred To input plus 0.025 div x scale expansion
8808A	50 dB range: 0.8 div, pp 100 dB range: 0.4 div, pp (With bottom scale input signal)
8809A	0.1 div, pp

Table 5-3. Recorder Minor Repairs and Adjustments

PARTS CHECKED	DEFECTS NOTED	REQUIRED REPAIRS
1. Stylus	1. Bent or twisted writing element. If the writing element is not at a 90% angle to the paper table platen with the stylus at center chart position, non- linearity will result (unequal upscale and downscale deflections). 2. Broken stylus side wire support. 3. Broken writing element welds. 4. Broken connection between side wires and mounting base. 5. Side wires twisted out of parallel with each other. 6. Writing element nicked. 7. Carboned (blackened) writing element. 8. Mounting base contact surface corroded. 9. Stylus mounting adapter corroded.	1. through 6. Defects - Replace stylus. 7. Clean with cleaning fluid. 8. Clean gently with fine sandpaper taking care not to remove contact plating. 9. Clean with fine sandpaper being careful not to remove plating on stylus adapter contacts.

Table 5-3. Recorder Minor Repairs and Adjustments (Cont.)

PARTS CHECKED	DEFECTS NOTED	REQUIRED REPAIRS
2. Platen	1. Carbon buildup (caused by stylus heat too high). 2. Slight nicks or burrs on knife edge. 3. Deep dents, nicks, or burrs on knife edge.	1. Clean with cleaning fluid such as Chlorothene. 2. Use fine emery stone to remove all sharp edges. 3. Replace platen (pull platen from table).
3. Table Plate	1. Carbon, dirt, or other contamination. 2. Dents, nicks, or burrs. 3. Burrs or nicks on radius at bottom of table plate.	1. Clean with Chlorothene. 2. Remove sharp edges with fine emery stone. Do not cut Permapaper on table plate. 3. Remove sharp edges with emery stone.
4. Pressure Roll	1. Seized oilite bearings. 2. Slight burrs or nicks on working surface.	1. Clean out with Chlorothene and oil bearings sparingly. 2. Remove sharp edges with emery stone.
5. Drive Roll Guide	1. Squeaking or chattering from roll guide and table plate.	1. Check for clearance of roll guide edge near Drive Roll. Adjustment can be made by loosening mounting screws and moving Drive Roll Guide away from Drive Roll. See Ref. 20, Figure 11, IPB Section. **CAUTION** Do not run recorder with loose drive roll guide.
6. Drive Roll	1. Surface cracks or cuts. 2. Drive Roll surface slick or dirty.	1. Replace Drive Roll. If Permapaper winds around Drive Roll, use a blunt-edged instrument to cut the paper. 2. a) Remove Permapaper from Recorder. b) Swing the hinged paper guide upward on the Drive Roll. See Figure 5-1. c) Clean surface of DriveRollwith a cloth dampened with Chlorothene with recorder running at highest speed. Do not saturate Drive Roll with Chlorothene and be careful that the cleaning cloth does not get caught in the Drive Roll. Do not install Permapaper until Drive Roll is completely dry.
7. Brake Roll	1. Surface cracks. 2. Surface dirty or slick.	1. Replace Brake Roll. 2. Clean surface with Chlorothene. Turn Brake Roll by hand while cleaning.

Table 5-3. Recorder Minor Repairs and Adjustments (Cont.)

PARTS CHECKED	DEFECTS NOTED	REQUIRED REPAIRS
7. Brake Roll (Continued)	3. Brake Roll sticking or jamming.	3. With proper brake adjustment, the Brake Roll should turn smoothly even though a small pressure is required to turn the Brake Roll by hand. Three defects which can cause Brake Roll jamming are: a) Side plate bearing dirty or too tight. b) Brake disc washer not lubricated. c) Brake Roll adjustment too tight. For lubrication or replacement of Brake Roll, do the following: <u>Brake Roll Removal</u>: Turn the brake roll screw at the right end of the Brake Roll counterclockwise until the Allen-head setscrew is almost flush with the collar. See Figure 5-3. Push the spring-loaded screw until the right end of the Brake Roll can be pivoted upward. Pull the Brake Roll out of the left table flange. <u>Brake Roll Lubrication:</u> a. Following the removal of the Brake Roll from the recorder, clean the brake disc washer and left bearing with Chlorothene. Replace bearing if defective. b. Re-oil the bearing and lubricate the brake disc (cork washer) with a thin layer of No. 39LU-7 grease. c. Clean and re-oil the right brake roll support bearing. Replace the bearing if defective. <u>Re-installation and Adjustment of Brake Roll:</u> Fit the Brake Roll into the left table flange, and push the spring-loaded screw on the right end until the Brake Roll can slide into the right table flange. Adjust for proper paper tension on platen by turning the Brake Roll screw clockwise until the paper is snug, but not tight, on the platen.
8. Paper Take-Up	1. Paper too loose or tight on spindle; take-up operates erratically, particularly at low speeds; take-up chatters.	1. Adjust the Paper Take-Up assembly as outlined below. If problem is not corrected, lubricate the Paper Take-Up assembly. See Paragraph 5-38.

Table 5-3. Recorder Minor Repairs and Adjustments (Cont.)

PARTS CHECKED	DEFECTS NOTED REQUIRED REPAIRS
8. Paper Take-Up (Continued)	Paper Take-Up Adjustment: a) Run recorder at 20 mm/sec or 25 mm/sec for preliminary check of paper tension between drive roll and take-up spindle. Paper tension should be snug, not tight or loose. Adjust take-up clutch screw clockwise, then counterclockwise until slight finger pressure depresses paper (see Figure 5-7). b) Run recorder at highest speed and make clockwise and counterclockwise adjustments until proper paper tension is achieved. c) Repeat adjustments at slow speeds, then check operation at high, medium and slow speeds for a check on overall operation of the Paper Take-Up.

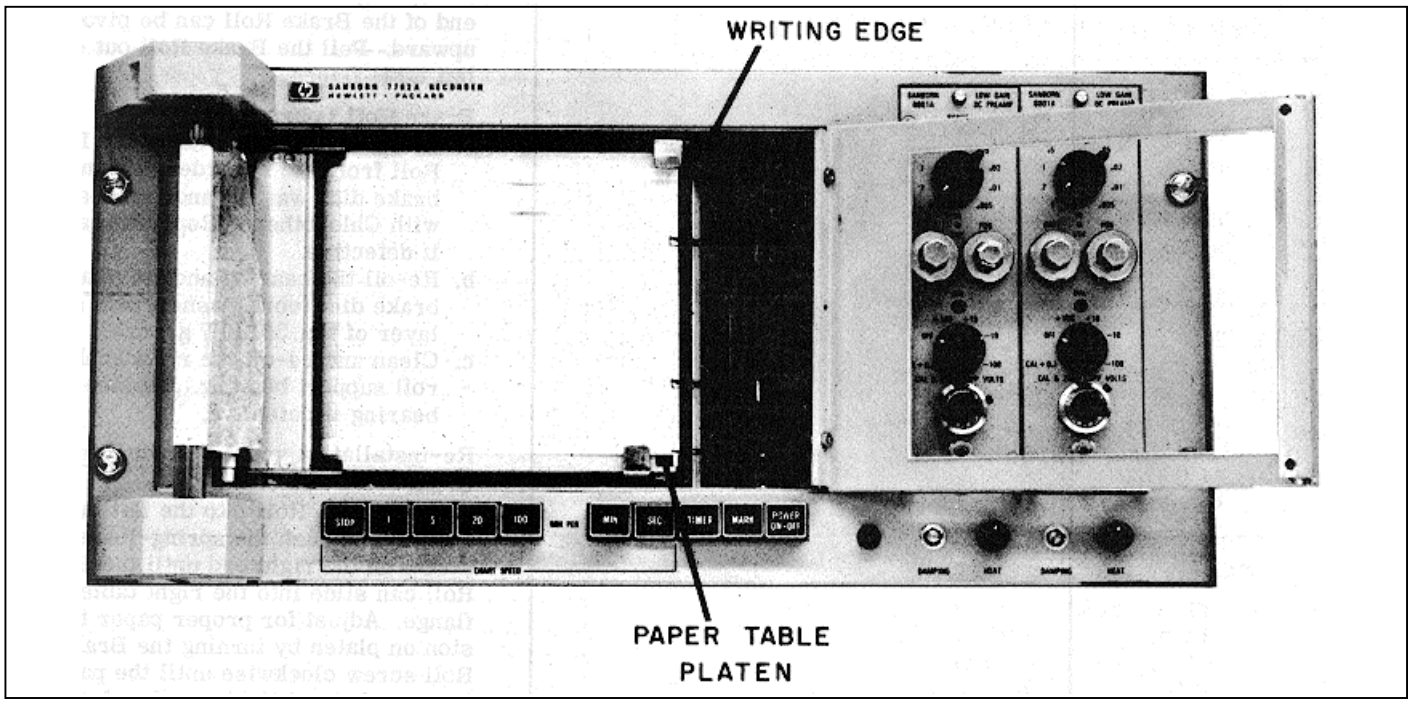


Figure 5-1. Recorder Platen and Writing Edge

PERFORMANCE CHECK TEST CARD

Model 7702A Oscillographic Recording System Serial No._____	Tests performed by _____ Date _____
Description	Check
1. STYLUS MECHANICAL CENTER: Each channel ± 1 division from chart center with system power OFF.	☐ CH 1 ☐ CH 2
2. POWER SUPPLY ± 12 VOLTS NEGATIVE ADJUSTABLE	☐ -12 V, adjustable ☐ +12V, ±0.5V ☐ +12V ripple, O1mV pp ☐ -12V ripple, 10mV pp
3. POWER SUPPLY ± 18 VOLTS UNREGULATED. AMPLITUDE DEPENDS ON LINE VOLTAGE.	☐ +18 V ± 2V ☐ -18V ±2V
4. LINEARITY: 8801A, 8802A: 0.25 div 8803A: 0.25 div (1 mV range 0.35 div) 8805A, 8806B, 8809A: 4 div 8807A: 0.55 div + 0.05 div x scale expansion 8808A: 50 dB span: 1.25 div 100 dB span: 1 div	☐ CH 1 ☐ CH 2
5. FREQUENCY RESPONSE WITH DC PREAMPS: dc to 3 dB down at 8801A 125 Hz 8802A 125 Hz 8803A 86 Hz 8809A 125 Hz	☐ CH 1 ☐ CH 2
6. DRIFT: Line voltage from 103 to 127 V 8801A, 8802A: 0.2 div 8803A: 0.27 div 8805A, 8806B: 0.35 div 8807A: 0.005 div, x scale expansion +0.30 div 8808A: does not apply 8809A: 0.50 div	☐ CH 1 ☐ CH 2

PERFORMANCE CHECK TEST CARD (Cont.)

7. NOISE: With zero signal input 8801A: 0.2 div pp 8802A: 0.2 div pp 8803A: 1 div pp max gain 1 div pp min gain 8805A: 0.2 div pp +1% of chart deflection 8806B: 7 μ V x square root of frequency response, referred to input. 8807A: Baseline offset and/or noise 2 mV rms referred to input plus 0.025 div x scale expansion 8808A: 50 dB range: 0, 8 div pp 8809A: 0.1 div pp	☐ CH 1 ☐ CH 2

5-10. PREVENTIVE MAINTENANCE.

5-11. Preventive maintenance is recommended every 1000 hours of operation or every six months, depending upon the operating conditions. Table 5-3 is recommended as a check chart for preventive maintenance as well as an aid for minor repairs and adjustments.

5-12. Mechanical

5-13. Refer to Initial System Check in Section II and perform these checks before continuing.

5-14. Switch power to the system OFF. Inspect the system for symptoms of mechanical or electrical overload. Check for dents, rust, corrosion, or other evidence of mechanical or electrical abuse. Check that all system components are securely mounted, including the cable connectors. Check the cables for strain, breaks, frayed insulation.

5-15. The following steps will check the recorder mechanical operation:

a. Paper Loading. Load Permapaper in the recorder. Apply power and run two feet of paper at the highest paper drive speed to correct any mistracking resulting from paper loading. Approximately 3/32 in. of the platen table surface should be visible to the right of the chart. Check that paper take-up is working properly.

b. Paper Take-Up. Inspect paper on take-up spindle. If it is too loose or excessively tight, see Table 5-3.

c. Paper Tension. Inspect paper travel over the writing edge at the highest MM/SEC speed. The paper should remain tight against the edge during travel, not curve over it. To adjust the brake screw, see Table 5-3.

d. Paper Tracking. Run approximately 5 feet of chart at the 50 mm or 100 mm speed with one channel stylus centered. Remove the recording and measure the peak-to-peak varaition of the trace due to paper drift. The tracing should not vary more than 0.5 mm from center. If paper weave exceeds the limit, check paper loading techniques and paper tension. Check Table 5-3.

e. Paper Parallax. Check parallax with paper drive motor OFF and Permapaper tight against the writing edge. With the side of a pencil, mark the outer edges of the two channels on the recording paper precisely where the paper is angled over the knife edge of the platen. The two points marked on the recorder must lie within 0.25 division of each other on the timing lines. If not, check paper loading technique and brake roll tension.

f. Writing Stylus. Remove each stylus by loosening clamping screw and disconnecting the stylus heat wires (see Figure 5-2); lift stylus from

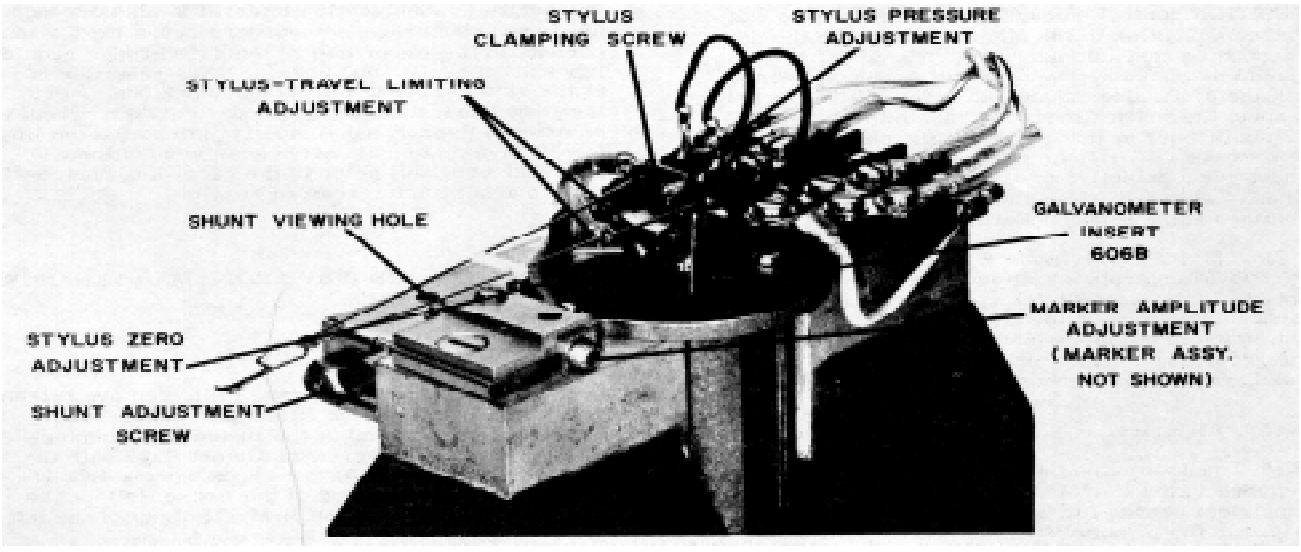


Figure 5-2. Stylus Adjustment Screws and Limits

holder. Inspect the writing surface. It should be clean and straight. If the stylus is bent, it sometimes can be straightened with tweezers; if not, replace it. If the stylus is burred or twisted, replace it. Insert a good stylus in galvanometer clamp and secure in place. The flexible stylus heater leads should not touch the adjacent side panel. Tighten the stylus heat lead screws. The ribbon must be at 90° to the writing edge to obtain the correct stylus overhang. See Figure 5-10. With correct overhang, the middle 1/3 of the ribbon contacts the writing edge when the stylus is positioned from one edge of the chart to the other.

NOTE

Improper overhang can result in poor trace definition across the channel, an erroneous indication of system nonlinearity.

g. Stylus Pressure. When pressure is too light, the trace will be faint and not clearly defined. When pressure is too high, friction will cause noticeable hysteresis and non-linearity. Refer to Paragraph 5-42 for adjustment procedure.

h. Marker Stylus. Inspect the marker for cleanness and good mechanical condition. Run a few feet of recording at highest chart speed with the marker button held for continuous operation. Inspect the recording. If unsatisfactory, replace the stylus.

i. Stylus Heat. Apply power to system, set paper drive to 20 mm/sec or 25 mm/sec, -and adjust each Stylus Heat control for best trace. Rotate POSITION control on each preamplifier from one extreme position to the other and observe the corresponding channel recording. Trace definition should be the same over the entire channel width. In case of a sudden change in definition at one point, inspect the writing surface beneath the paper for a nick or burr at that point. If the change in definition extends over some portion of a channel's width, check for a defective or improperly inserted stylus. Check Table 5-3. Maximum trace definition is obtained using Sanborn Permapaper.

j. Stylus Deflection. With the preamplifier POSITION controls set alternately to the extreme rotation points, check the stylus deflection. The mechanical stops on the galvanometers should limit deflection to not more than 2 mm beyond the edge of the recording channel or 1 mm when motion is toward an adjacent marker. See Paragraph 5-46.

5-16. Electrical.

5-17. The only electrical checks to be made are included in the Performance Checks for the system. Electrical checks for the preamplifiers are contained in the preamplifier instruction manuals.

5-18. Cleaning.

5-19. The cleaning procedure outlined below should be performed at intervals determined by environmental conditions.

a. Remove power from the system. Remove any dust or dirt accumulation on the recorder with a vacuum hose.

b. Clean all front panels, controls, etc., with a clean, lint-free cloth, or with a wax impregnated polishing cloth. Wipe the viewing window with a cloth moistened with water.

c. Remove Permapaper and clean deposits from the writing edge of the recorder platen with a cleaning fluid, such as Chlorothene. Clean the Drive Roll and the paper Brake Roll with Chlorothene. See Table 5-3. Use it sparingly and let rolls dry thoroughly after cleaning.

d. Clean each stylus with Chlorothene. Do not use steel wool or any cleaner containing abrasive metal particles.

5-20. Lubrication.

5-21. Lubrication of the paper Brake Roll and the Paper Take-Up assembly should be performed each 1000 hours of recorder operation.

5-22. Lubrication of the chart drive mechanism gears and clutches is performed during each recorder overhaul. Lubrication interval is also dependent upon recorder usage. Recorders operating for long periods in the upper half of the speed range require lubrication every 1000 hours. If the recorder is run at the slower speeds for extended periods, more frequent lubrication is required. Further, whenever an extended recording period is anticipated (on line for 30 days or more), drive gear lubrication and recorder overhaul prior to the recording period will help to assure uninterrupted service.

5-23. BRAKE AND DRIVE ROLL MAINTENANCE PROCEDURES.

5-24. Brake Roll Lubrication.

a. To lubricate the Brake Roll, remove it from the recorder. Turn the Brake Roll Allen-head screw at the right end of the Brake Roll counter-clockwise until the screw is almost flush with the collar (see Figure 5-3). Push the spring-loaded screw until the right end of the Brake Roll can be pivoted upward. Pull the Brake Roll out of the left table flange as shown in Figure 5-4.

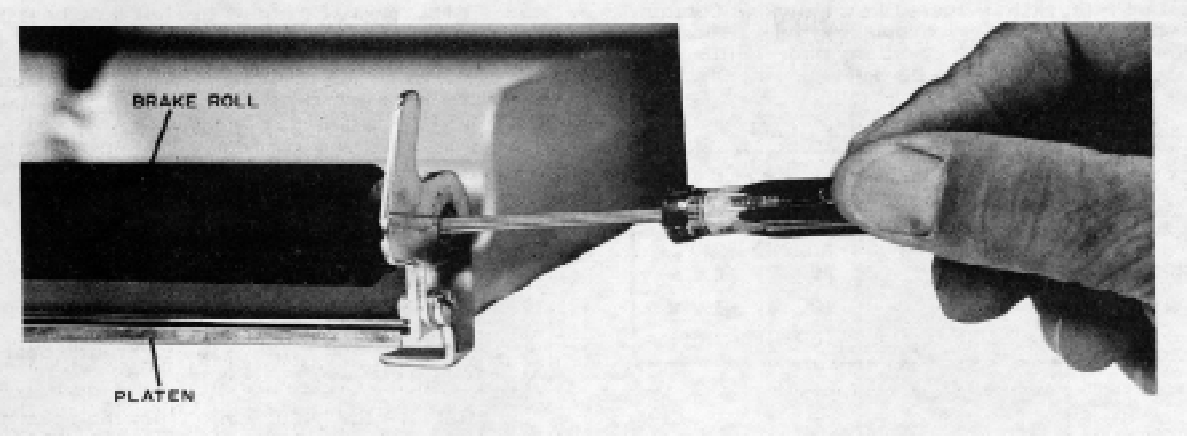


Figure 5-3. Brake Roll Adjusting Screw Location

b. Following the removal of the Brake Roll from the recorder, clean the brake disc washer and left bearing with Chlorothene. Replace bearing if defective.

c. Lubricate the bearing with 39LU-8 oil, and lubricate the brake disc (cork washer) with a thin layer of No. 39LU-7 grease.

d. Clean and re-oil the right brake roll support bearing. Replace the bearing if defective.

5-25. Brake Roll Adjustment.

5-26 Permapaper in recorder. Unlock and open the paper table. Insert Allen wrench into the end of the Brake Roll, as shown in Figure 5-3. Turn the screwdriver five turns counterclockwise, thus releasing the brake mechanism in the Brake Roll.

Re-lock the paper table and run the recorder. The paper should travel loosely over the platen. Unlock and raise the paper table and turn brake adjusting screw clockwise about 1/2 turn increasing the brake tension. Lock paper table and run recorder. Repeat the clockwise adjustment until the paper is pulled snugly over the platen edge by the braking action.

5-27. After completing the above adjustment, check the paper speed accuracy (± 1%) using the following procedure. If the paper runs too slowly, adjust the brake screw slightly in a counterclockwise direction. If the paper is too loose, adjust the screw clockwise.

5-28. To check the paper speed, press the TIMER and SEC pushbuttons on the recorder. Run the recorder at the speeds listed in Table 5-4 (Page 5-12),

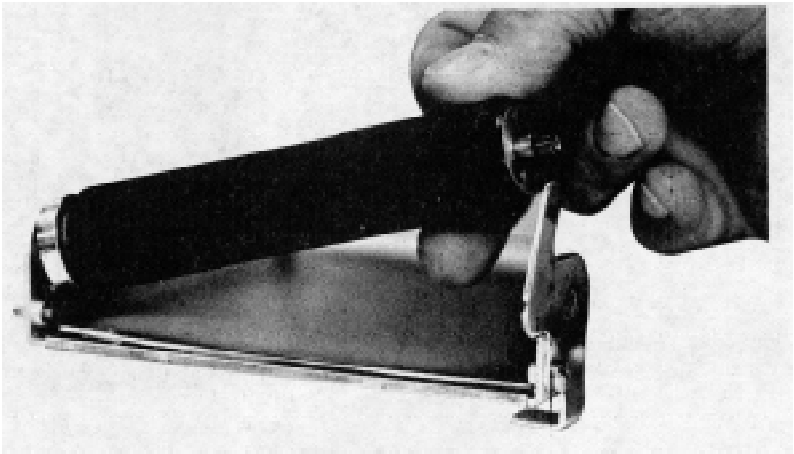


Figure 5-4. Brake Roll Removal

for the time intervals indicated in the second column. For the 100 mm/sec paper speed, the paper length should be 200 divisions ± 2 divisions between three successive timing marks on the record.

Table 5-4. Timing Calibration

SPEED IN MM/SEC	TIMING INTERVAL in SEC	PAPER LENGTH
100	2	200 div±2 div
20	10	200 div±2 div
5	20	100 div±1 div
1	100	100 div±1 div

5-29. Drive Roll Replacement.

a. Remove the recorder from the mobile cart or cabinet, and place on a clean work area.

b. Remove the recorder top and bottom covers (Items 4 and 28 in Figure 2, IPB Section).

c. On the top side of the recorder, remove the three gears adjacent to the left side bearing retainer. Note the location of the shims on the gear assemblies, so that the shims can be reassembled correctly. See Figure 5-5.

d. Unscrew and remove the left side bearing and bearing retainer (see Figure 5-6).

e. Unfasten the two #4 screws which fasten the ten-button push switch to the recorder side plate and swing the switch outward.

CAUTION

THE SPEED PUSHBUTTONS HAVE CONNECTORS WHICH MUST BE FREED FROM THE CLUTCH CAMS AS THE SWITCH ASSEMBLY IS PIVOTED OUTWARD. (SEE FIGURE 8, REF. 14, IX SECTION).

f. Unscrew and remove the right side bearing and bearing retainer (see Figure 5-6).

g. Remove the paper table from the recorder by lifting the right side of the table upward and outward. (See Figure 5-6.)

h. To separate the Drive Roll from the table assembly, spread the side plates slightly.

i. Install a new Drive Roll, following the above procedure in the reverse order.

j. Use care in attaching the pushbutton switch connectors over the cams, so that the cams or the pushbutton switch linkages are not bent out of adjustment. Be sure that buttons are centered in panel holes, and do not bind when activated.

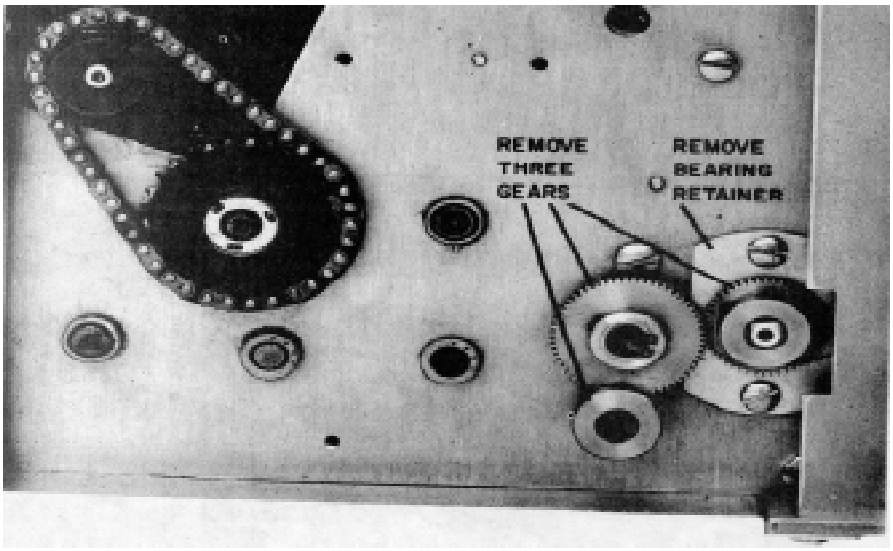


Figure 5-5. Bearing Retainer and Gears

5-30. BRAKE ROLL OR DRIVE ROLL SERVICE PROBLEMS. If any of the following symptoms are evident in the recorder, it is probable that it could be caused by Brake Roll or Drive Roll malfunction:

a. Paper not tracking properly, i. e., paper moves to one side or the other.

b. Paper weaving, i.e., moves side-to-side in regular pattern.

c. Chattering noise, i. e., uneven tension cause by dry cork disc or bad bearing.

d. Irregular paper speed, i. e., speed range drops or paper stalls.

e. Uneven paper tension over platen, i. e, paper on one end of platen is tight, loose on other end.

5-31. PAPER NOT TRACKING PROPERLY. The surface of the Drive or Brake Roll becomes slick from paper residue after long usage, preventing proper traction. A worn roll can be determined by inspection and touch after it is cleaned with Chlorothene.

NOTE

New rolls have a rippled surface that disappears shortly after use. Loss of ripple does not indicate a bad roll. Other indications that the roll is deteriorating are minute surface cracks or inability to maintain proper speed. Correct fault by replacing defective roll.

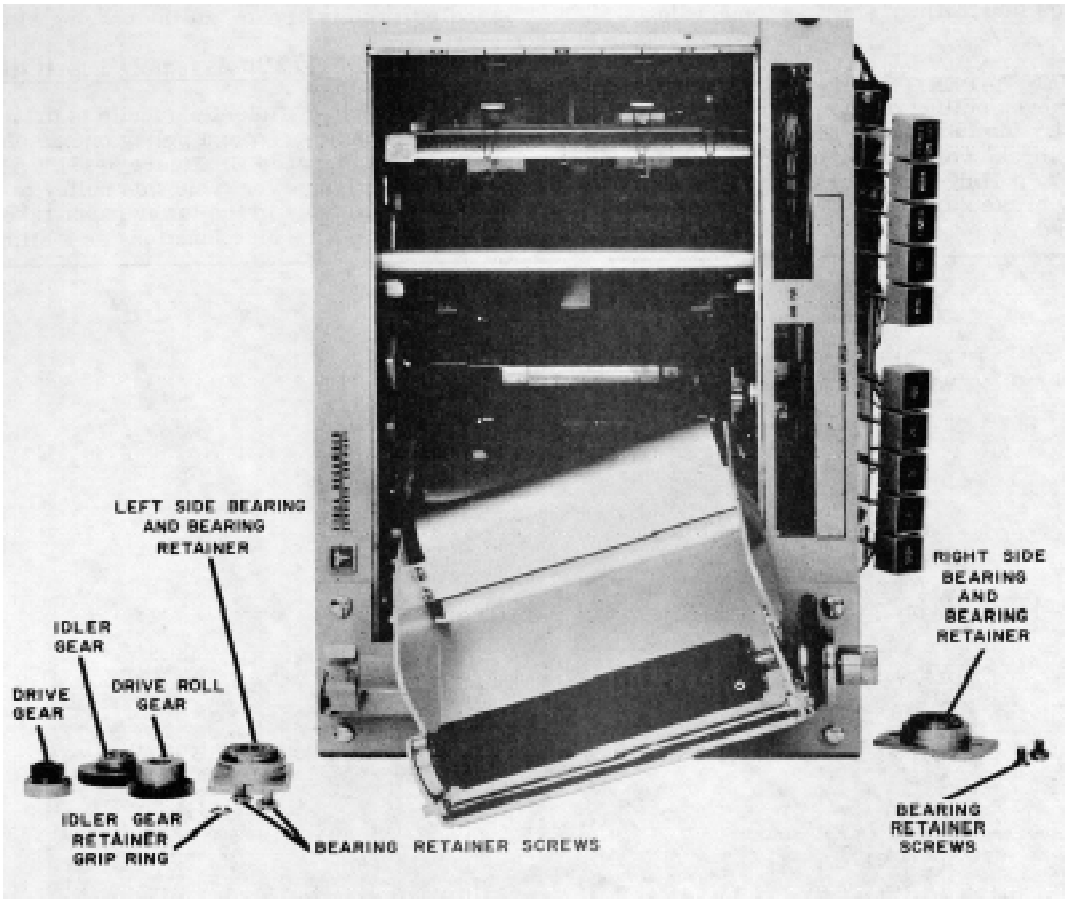


Figure 5-6. Paper Table Removal

5-32. PAPER WEAVING. If the rolls are not worn (see Paragraph 5-31), weaving is caused by dirt or other foreign matter on the rolls. Clean with Chlorothene. Also, play in the spindle support from the left spindle support spring can cause paper weave. To increase the spring pressure, simply remove the spindle and gently push the spring slightly inward. Too much spring action can cause spindle hub wear.

5-33. CHATTERING. This is usually caused by lack of lubrication on the brake roll cork disc, which causes positive traction instead of the slipping action desired, or a defective brake. Check the bearings for out-of-roundness, too tight fit of roll stud and bearing, presences of burrs or foreign matter. Brush wash with Chlorothene (do not submerge bearing in fluid); remove burrs; check for out-of-roundness. Lubricate with 39LU-8 oil. Chattering is also due to lack of shaft A or B clutch lubrication.

5-34. IRREGULAR PAPER SPEEDS. Most problems that cause irregular speeds can be attributed to Drive and/or Brake Roll trouble: roll needs cleaning, disc needs lubricating, etc., see preceding paragraphs.

5-35. UNEVEN PAPER TENSION. The brake roll causes this uneven pulling on the paper. When the cork disc is dry (no lubricant), there is no slipping action and the brake roll tension becomes constant at the disc end, pulling the paper taut over the platen edge. Follow brake roll removal and disc lubricating procedures.

5-36. PAPER TAKE-UP MAINTENANCE PROCEDURES.

5-37. Paper Take-Up Adjustment.

a. Run recorder at 20 mm/sec or 25 mm/ sec for preliminary check of paper tension between drive roll and take-up spindle. Paper tension should be snug, not tight or loose. Adjust take-up screw clockwise, then counterclockwise until slight finger pressure depresses paper.

b. Run recorder at highest speed and make clockwise and counterclockwise adjustments until proper paper tension is achieved. (See Figure 5-7).

c. Repeat adjustments at slow speeds, then check operation at high, medium and slow speeds for a check on overall operation of the Paper Take-Up.

d. Check that the spindle is free to turn in the bearing located in the upper paper take-up housing. If there is insufficient bearing clearance for the spindle to rotate, ream out the bearing slightly.

5-38. Paper Take-Up Assembly Lubrication.

5-39. The Paper Take-Up spindle is driven by the chart drive motor, from a pulley on one of the drive shafts (see Reference E, Figure 5-11). A composition belt couples power from this pulley to the pressure disc assembly in the lower paper take-up housing. The pressure disc functions as a slipping clutch,

Figure 5-7. Paper Take-Up Adjustment

maintaining constant tension on the take-up spindle. Smooth operation of the Paper Take-Up depends on lubrication of the cork disc. If the lubrication is insufficient, the paper take-up assembly will operate erratically and the drive belt will wear excessively.

5-40. Perform the following lubrication procedure if the Paper Take-Up Assembly malfunctions, or during a scheduled lubrication of the recorder.

a. Remove the spindle from the Paper Take-Up assembly. Remove the recorder bottom cover.

b. Remove the two screws which fasten the lower paper take-up housing to the front panel (Reference 30, Figure 7, IPB Section). Remove the paper take-up drive belt from the pulley on the drive shaft.

c. Separate the two halves of the housing. The sections are joined by two roll pins and a nut and screw mounted under the chrome plug buttons.

d. Remove the adjusting setscrew from the pulley assembly. Disassemble the remaining items in the pressure disc assembly, noting the parts locations.

e. Clean all parts with Chlorothene. Lubricate the cork disc with 39LU-7 grease. Reassemble and re-install the paper take-up housing. Note that the pressure disc spring is installed with the turned-in end facing the adjusting setscrew (Reference 26, Figure 7, IPB Section).

f. Adjust the paper take-up adjustment screw as directed in Paragraph 5-36.

g. Check the take-up belt at 1000 hour intervals and replace when badly frayed.

5-41. STYLUS ADJUSTMENTS AND REPAIRS.

5-42. Stylus Pressure.

5-43. Check stylus pressure with the calibrated pressure gage SN 14015A (see Figure 5-8). Lift the stylus at the center of the heating element support wire, with the gage perpendicular to the writing arm. Run the recorder at 5 mm/sec speed. Lift the stylus with the gage until the stylus stops writing on the paper. The gage should read between 2 and 2-3/4 grams. If the pressure is not correct, adjust the stylus pressure. The stylus pressure adjusting screw is located on the top of the galvanometer assembly (see Figure 5-2). Remove the preamplifiers, and insert screwdriver through the access holes shown in Figure 5-9. Turn clockwise for less pressure and counterclockwise for more pressure. The adjustment should be made 1/4 turn at a time. Check that the stylus remains level with the paper for correct definition.

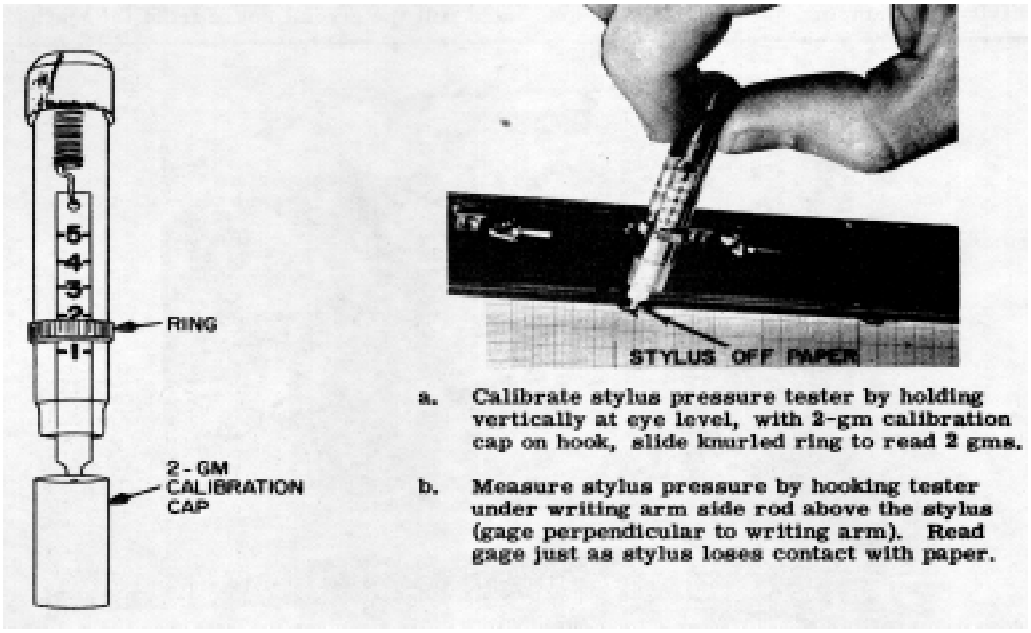


Figure 5-8. Calibrating and Measuring Stylus Pressure

5-44. Stylus Mechanical Stop.

5-45. The mechanical stops prevent the stylus excursions from exceeding 2 mm beyond the channel edge or 1 mm toward an adjacent marker arm. Set these limits by loosening the stylus Travel Adjustment screw with a screwdriver, setting the stops and tightening the screw. Refer to Figure 5-2 for screw location.

5-46. Stylus Mechanical Center (Zero).

5-47. Before making the following adjustment, be sure that the Permapaper feeds through the recorder correctly with no weaving or sliding to one side.

a. Set the recorder power switch to OFF.

b. Loosen the setscrew at the bottom of the stylus adapter slightly (Figure 5-10) with a spline wrench.

c. Mechanically swing the stylus adapter with the spline wrench to the desired position and tighten the setscrew. This adjustment may have to be done repeatedly as tightening the setscrew may move the setting. The final check of the stylus center position is made with the recorder running. ± 1/2 div from centerline is allowable.

d. Adjust the stylus pressure as described in Paragraph 5-42. Stylus pressure must be correct for proper sensitivity and damping.

5-48. CORRECTIVE MAINTENANCE.

5-49. Disassembly of System Components.

5-50. Model 7702-OlA Recorder Assembly Removal:

a. To remove the Recorder Assembly from the 1069-02A Mobile Cart, remove the four front panel screws, disconnect all cables attached to the rear of the recorder, and lift the RecorderAssembly upward.

b. Model 7702A Option 01 Recording System; the recorder is removed from the rack by unscrewing the four front panel screws, disconnecting all cables attached to the rear of the recorder, and sliding the recorder outward.

c. Model 7702A Option 02 Recording System; the recorder is removed from the portable transit case by removing the four front panel screws after disconnecting all cables at the rear of the recorder, and sliding the recorder out of the case.

5-51. Model 7700-02A Driver Amplifier Removal; both driver assemblies are mounted on the rear of the power supply. Unscrew the rear panel (Item 36, Figure 2, IPB Section) to gain access to the driver assemblies. Each driver assembly is fastened to the power supply with two captive mounting screws.

5-52. Model 868-500A-C13, 868-500A-C14, 868-500A-C6 Plug-in Circuit Board Removal; each of the circuit boards is fastened to the power supply with two mounting screws. Remove the screws and pull the circuit board from the mating connector.

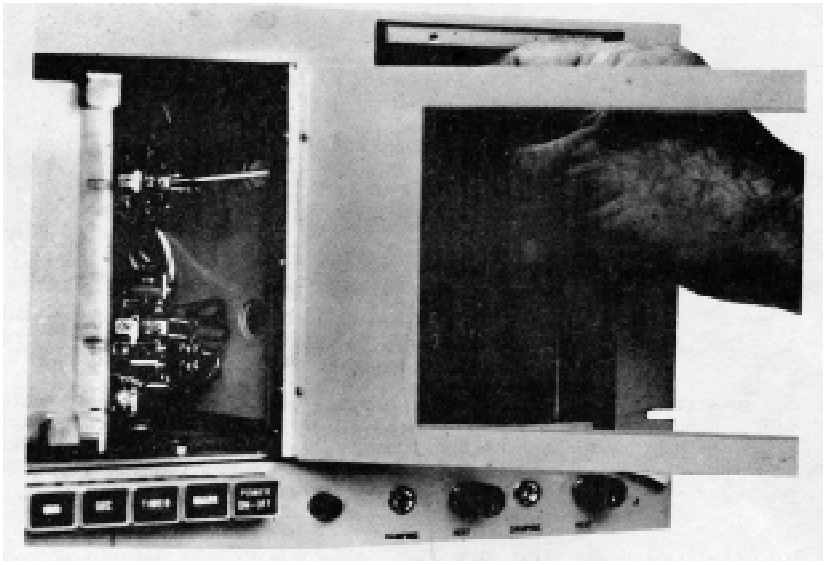


Figure 5-9. Stylus Pressure Adjustment

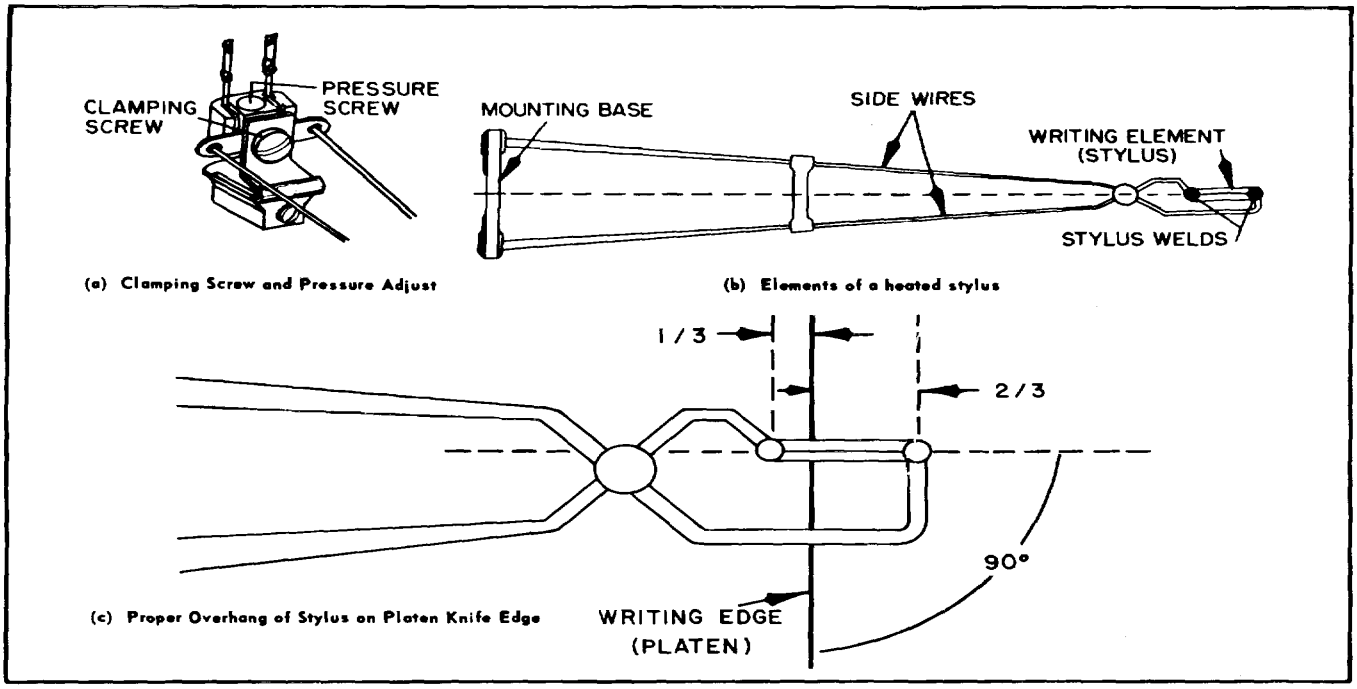


Figure 5-10. Heated Stylus Part No. 398

5-53. Model 14002S (60 Hz), 14002T (50 Hz) MM/SEC Timer Assembly Removal; the mm/sec timer assembly (Reference 35, Figure 2, IPB Section) is located on the left end of the power supply. Remove the recorder top cover, and the three screws on the top bar that secure the power supply. Unfasten and remove the rear plate of the recorder. Unplug the cable which connects to the preamplifier input connectors, and swing the power supply outward. Remove the two screws which fasten the timer assembly to the power supply.

5-54. Timer Assembly Removal; the optional mm/min timer assembly (Reference 37, Figure 2, IPB Section) is located on the rear of the power supply. Remove the two mounting screws on the base of the timer.

5-55. Power Supply Assembly 07702-60030 Removal; to gain access to the components inside the power supply, remove the recorder top cover (Reference 4, Figure 2, IPB Section). Remove the three screws in the top bar (Reference 25) which fasten the power supply to the bar. Remove rear plate from recorder. Unplug the cable which connects to the preamplifier input connectors. Swing the top end of the power supply outward.

5-56. DISASSEMBLY AND LUBRICATION OF CHART DRIVE COMPONENTS.

5-57. The recorder chart drive gears, clutch assemblies and drive chains should be inspected and lubricated each 1000 hours of recorder operation.

5-58. The disassembly and lubrication of the drive shafts and the components mounted on them is accomplished one shaft at a time. After one shaft is serviced, it is replaced in the recorder and another shaft removed. Shaft disassembly and lubrication procedures are given in Paragraph 5-61. Lubrication of the drive motor sprockets and chains, mounted on the outside of the recorder side plates, is given in Paragraph 5-72.

5-59. Chart Drive Lubricants.

5-60. The required lubricants for use in the chart drive mechanisms are listed in Table 5-5.

Table 5-5. Lubricants

Lubricant Part No.	Application
39LU-7	Gears
39LU-8	Oilite bearings, miniclutches
39LU-10	Sprockets, chains

5-61. Shaft Disassembly and Lubrication

5-62. The six shafts in the chart drive mechanism are shown in Figure 5-11. To gain access to the shafts, remove the left side plate, Reference 45, Figure 2, IPB Section. Also remove the top and bottom cover plates on the recorder.

5-63. Shaft A Servicing.

a. Loosen the setscrews on the gears and collars on the shaft. Do not loosen or tighten the set-screws on the nylon gear hub. Press a speed push-button which lifts the clutch bracket clear of the clutch sleeve. With a long bladed screwdriver, push shaft A out of the recorder side plates, as shown in Figure 5-12 (a). Do not allow the gears or clutch to drop, otherwise they may be damaged.

CAUTION

IF A NYLON GEAR IS STRIPPED OR CHIPPED, THE NYLON FIBERS MAY BECOME IMBEDDED IN ADJACENT GEARS, DAMAGING THEM. TO PREVENT THIS DAMAGE, WASH ALL GEAR TEETH WITH A SOLVENT, THEN INSPECT THE GEARS WITH A MAGNIFYING GLASS TO DETECT SMALL NYLON PARTICLES.

b. Lay the parts on a clean work area in the order that they are removed from the shaft. See Figure 5-12 (b). Wash the parts in a solvent such as Chlorothene, making sure all gear teeth are thoroughly cleaned. Do not submerge Item 4, hub assembly, in solvent, or the solvent will wash out the oil in the oilite bearing. When clean, check all parts for excessive wear.

c. Grease the outer surface of the clutch shaft adapter with 39LU-7 lubricant. See Figure 5-12 (c).

d. Coat the inner surface of the clutch spring with a thick layer of grease, as shown in Figure 5-12 (d).

e. Install the clutch spring on the clutch shaft adapter. The end of the coil with the upturned tab must be placed on the adapter first. Fill the adapter and spring completely with grease so that there is no air pocket. Heavily coat the outer surface of the spring with grease. See Figure 5-12 (e).

f. Heavily coat the inner surface of the clutch sleeve with grease.

g. Slide the clutch assembly, Figure 5-12 (f), onto the shaft. Coat the clutch hub and gear assembly with grease. See Figure 5-12 (g).

h. Slide the clutch hub onto the shaft. Plug the hole in the flange of the shaft adapter with a tool, to prevent the escape of grease. Force the clutch hub into the clutch spring with a twisting motion. If the clutch hub is prevented from bottoming by the grease packed in the spring, unplug the hole to allow some of the grease to flow out. Remove the whole clutch assembly from the shaft. See Figure 5-12(h).

i. Install shaft A in the recorder with the parts in the sequence shown in Figure 5-12 (b). Position all parts in the correct locations, and tighten the setscrews on the shaft flats. Position gear 1 on the shaft to obtain about 0.004" end play.

j. After installing the shaft, check the clearance between the clutch sleeve and the clutch bracket (Reference 5, Figure 12, IPB Section). When the bracket is disengaged from the clutch sleeve by the action of the pushbutton speed switches, the clearance between the sleeve and the bracket should be about 0.015" (see Figure 5-13). The bracket mounting screw can be loosened and the bracket position shifted slightly to obtain the correct clearance.

5-64. Shaft B Servicing.

5-65. The lubrication procedure for shaft B is similar to the procedure for shaft A. The shaft B gear located on the outside of the side plate must be loosened to permit the shaft to be pulled out of the recorder. Establish 0.004" shaft end play by setting the position of the gear on the left end of the shaft.

5-66. Shaft C Servicing.

a. Loosen the shaft collar and gear on the right end of shaft C. Slowly pull the shaft to the right about 2" while holding the miniclutch gear (see Figure 5-14). A shim washer may be found between the miniclutch gear and the left side plate. Wash the clutch gear with solvent and inspect the inner surface of the hub for wear. Wash the miniclutch rollers with solvent, and inspect the rollers for excessive wear.

b. Making sure all clutch springs are in their proper location, install the miniclutch in the gear hub with a twisting motion. When the clutch is half way in the hub, liberally oil the miniclutch using 39LU-8 lubricant. Complete the re-assembly, taking care that none of the clutch springs slip out of position.

c. Return the shaft assembly to its proper position. Lock the collar on the shaft to obtain 0.004"shaft end play while pushing the shaft as far left as possible.

5-67. Shaft D Servicing.

5-68. The inspection and lubrication procedure for shaft D is the same as that outlined for shaft C.

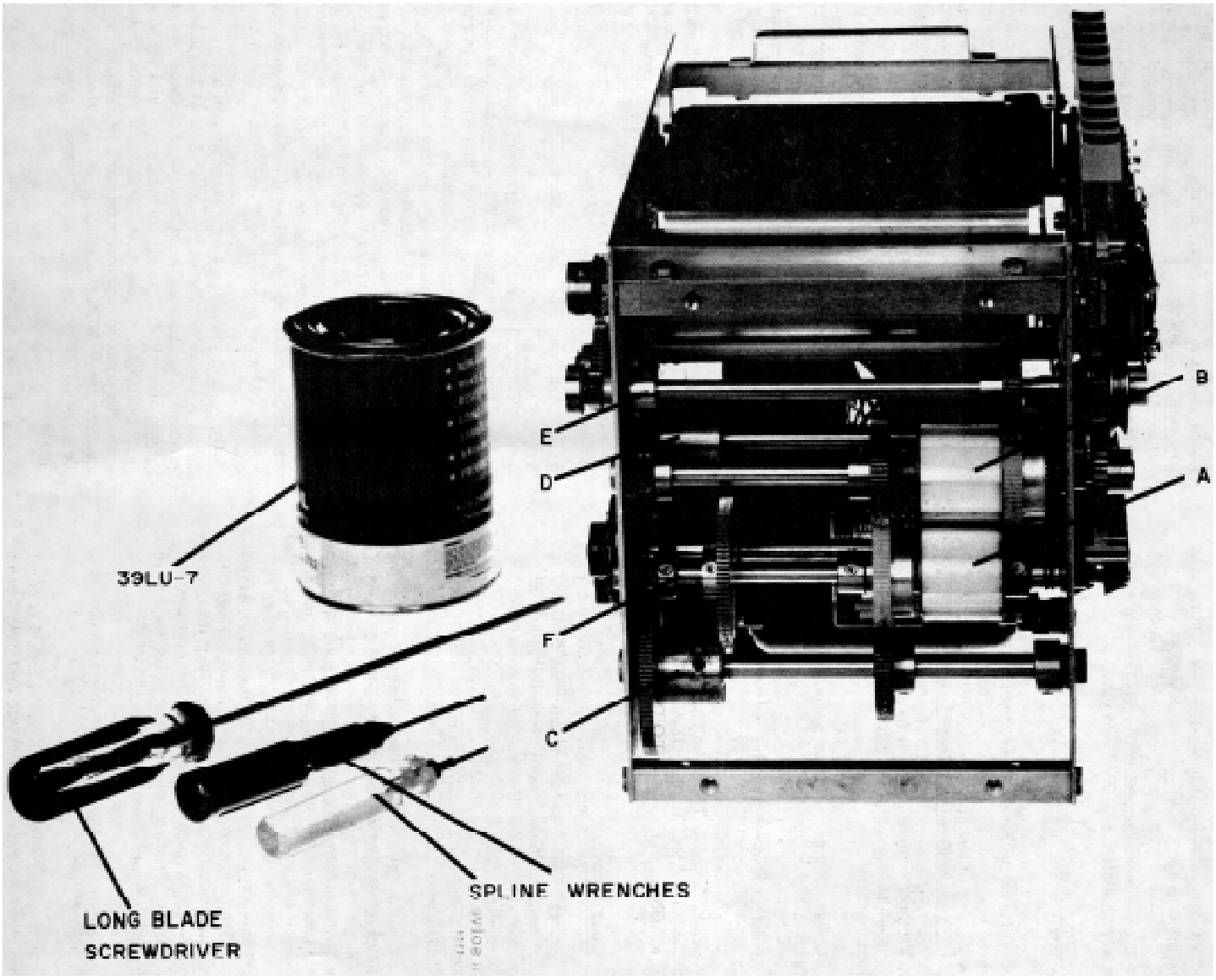


Figure 5-11. Chart Drive Shafts

5-69. Shaft E Servicing.

a. Wash the gears with solvent and inspect for worn or broken gear teeth.

b. If gear replacement is necessary, set the collar on the shaft for 0.004" end play.

5-70. Shaft F Servicing.

5-71. Use the same procedure as for shaft E.

5-72. Drive Motor Sprocket and Chain Lubrication.

a. To gain access to the mm/sec drive motor sprockets and chain, remove the top cover of the instrument.

b. Grease the drive motor sprockets and chain with 39LU-10 lubricant.

c. Oil the miniclutch in the sprocket hub with 39LU-8 oil.

d. For recorders equipped with a mm/ min drive motor, remove the recorder bottom cover and lubricate the sprockets and chains as outlined above.

5-73. Gear Lubrication.

5-74. Apply 39LU-7 grease to all gear teeth in the chart drive mechanism. Run the drive motor to run off any excess grease. Switch the recorder power OFF, and wipe away any excess grease.

5-75. Results of Incorrect Lubrication Procedure.

5-76. Figure 5-15 illustrates excessive wear on the clutch and hub assemblies. These parts will wear when the gears have been run for long periods of time without a maintenance check or wrong methods of packing the clutches or the wrong grease used. Trouble will also be evident if the recording paper is allowed to double around the drive roll of the recorder and jam the drive roll gears to a sudden stop. If paper jamming happens and is corrected, but the gears tend to run roughly or chatter, turn the power off and locate the damaged part immediately. Damaged clutch sleeves result when there is not enough clearance between the clutch sleeve and the bracket.

5-77. GALVANOMETER ASSEMBLY.

5-78. The individual galvanometers for both channels are alike except that a marker assembly is added to the channel 2 galvanometer. These conventional D'Arsonval moving coil galvanometers have the coil mounted in the air gap between the poles of the large U-shaped Alnico magnets.

5-79. The platen table locking mechanism and galvanometer assemblies are linked together so the writing styli move up, out of the way of the table. This helps prevent styli damage during paper loading. However, a large paper loop over the platen will damage the styli if the stvli are dropped heavily on the paper.

5-80. Galvanometer Magnet Replacement.

5-81. The galvanometer magnet is replaced only if there is physical damage to the magnet or if the galvanometer shunt cannot be adjusted to the required sensitivity (see Paragraph 5-84 for sensitivity check). Normal magnet strength is 8000 gauss. To replace a magnet, do the following:

a Remove the stylus from the galvanometer.

b. Unscrew the magnet from its mounting plate. See Reference 36, Figure 6, IPB Section. The front screw is made accessible by opening the paper table. The rear screw is made accessible by unfastening the power supply. See Paragraph 5-55.

c. In remounting the replacement magnet, adjust the position of the magnet using the screw at the rear of the mounting plate (Reference 33, Figure 6, IPB Section) to obtain the correct stylus overhang. See Figure 5-10(c).

5-82. Galvanometer Insert Replacement.

5-83. The coil is rigidly suspended on torsion wires inside the coil housing which is mounted in the air gap of the magnet. The bottom torsion wire is rigidly clamped to hold the coil so oriented with respect to the housing that, when assembled in a complete recorder, the stylus will maintain a zero-signal position at the center of the recording chart. The torsion wires thus function not only to suspend the coil, but also like the spring in a meter movement, to provide restoring torque to return the stylus to zero when no signal information current passes through the coil, and to determine the position of the stylus when signal currents pass through the coil.

5-84. Each galvanometer has an adjustable magnet shunt permanently mounted to the side at the pole pieces. The magnet shunt has two functions: (1) to adjust sensitivity of the galvanometer, and (2) when fully pulled in, to maintain the magnet gauss at full strength if the galvanometer insert is removed from the magnet. When the shunt is fully pulled in, it can be seen in the hole of the shunt housing (see Figure 5-2).

a. Rotate the shunt adjusting screw clockwise until the shunt is visible in the hole of the shunt housing.

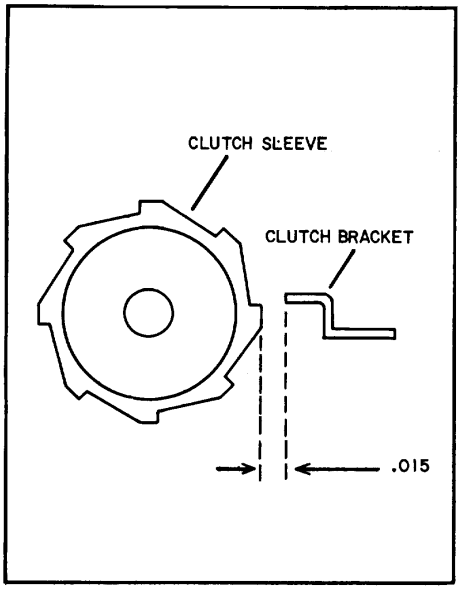


Figure 5-13. Clutch Sleeve Clearance

CAUTION

ONLY WHEN THE SHUNT IS VISIBLE IS IT SAFE TO REMOVE THE COIL FROM THE MAGNET WITHOUT LOSING THE MAGNET GAUSS.

b. Remove the stylus from the galvanometer by loosening the clamping screw (see Figure 5-2).

c. Remove the screws attaching galvanometer
insert to the block (see Figure 5-2).

d. Attach identifying labels to the wires connected to the galvanometer insert, then disconnect the wires from the insert. Gently pull the insert from the magnet.

e. Use masking tape to remove all foreign matter from the magnet gap. The magnet must be clean of filings or chips.

f. Gently lower the new coil into the magnet and attach the mounting screws. Firmly push the galvanometer coil to the front of the magnet and tighten the mounting screws. If there is no mechanical rubbing when the stylus holder is moved from side to side, the galvanometer is mounted correctly. If the galvanometer does touch the sides, the mounting screws must be loosened and the galvanometer recentered in the magnet gap. Adjust the stylus overhang if necessary. See Paragraph 5-81 c.

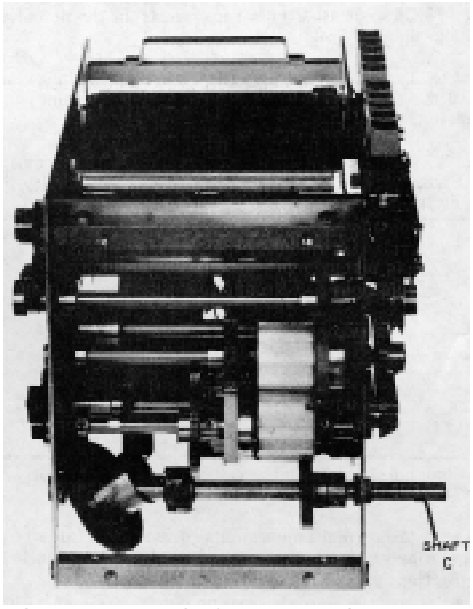


Figure 5-14. Shaft C Inspection

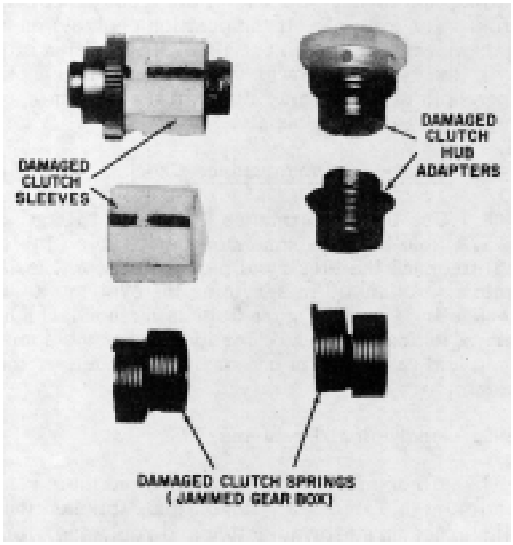
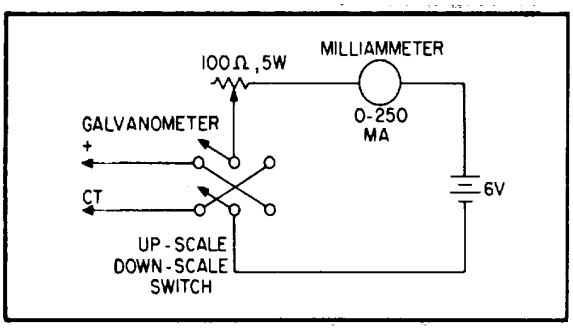


Figure 5-15. Excessive Wear in Clutch Assembly

g. Connect all wiring removed from the defective coil to the new coil.

h. Turn the shunt adjusting nut counterclockwise until the shunt is flush with the rear of the shunt housing.

i. Check the galvanometer coil with the circuit in Figure 5-16. Correct galvanometer sensitivity is 10 divisions for 160 mA current.



j. Make final adjustments of the shunt (either clockwise or counterclockwise) until the 10 divisions deflection for 160 mA current is obtained.

k. All newly installed galvanometer inserts must have the stylus mechanically centered and the stylus stops adjusted (see Paragraphs 5-44 and 5-46).

5-85. TROUBLESHOOTING.

5-86. In troubleshooting the 7702A System, it is frequently possible to determine the source of the malfunction through the use of the front panel controls. For example, if the position controls on both of the preamplifiers do not affect the position of the styli, the recorder power supply should be checked, since both of the preamplifiers in the system operate from a single power supply.

6-87. Electrical Performance Check.

5-88. Use the Performance Check Card (Page 5-7a/b) and the Performance Check Table (Table 5-2) to check the electrical performance of the 7702A System. As an aid in servicing the system, a Troubleshooting Chart, Figure 5-17 is included which contains a logical procedure for identifying the source of electrical problems in one or both channels of the System.

5-89. Mechanical Problems.

5-90. Minor mechanical problems and their remedies are listed in Table 5-3. In addition, this section contains procedures for adjusting and replacing, if necessary, components in the chart drive mechanism and galvanometer assembly.

5-91. As in most equipment consisting of sub-systems, troubleshooting the 7702A System can be divided into two categories:

a. System troubleshooting, in which the malfunction is identified with a specific subassembly or system function. A defective preamplifier or driver amplifier can be isolated by interchanging the preamplifiers or driver amplifiers in the system. Also, with this substitution method, the galvanometer assemblies can be interchanged by exchanging the wires connected to the galvanometer inserts.

b. Component troubleshooting, in which the defective circuit component such as a resistor, capacitor, or transistor is identified and replaced. The information is contained in Section IV of this manual, and the schematic diagrams for the circuits will be helpful in locating the defective components.

5-92. Etched Circuit Board Repair.

5-93. The etched circuit boards used in the Model 7702A are of the plated-through type consisting of metallic conductors bonded to a baseboard of insulating material. The metallic conductors are extended through the component mounting holes by the plating process.

5-94. The following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high-power soldering iron on the etched circuit boards. Excessive heat may lift a conductor or warp the board.

c. Use a wooden toothpick to remove solder from component mounting holes.

CAUTION

DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

d. After soldering, remove excess flux from the soldered areas and apply electrical varnish or lacquer to protect against contamination and corrosion.

5-95. Component Replacement.

5-96. Apply heat carefully to avoid damage to the plated-through conductor holes and to the replacement component. The following is recommended:

a. Remove defective component.

b. Melt solder in component lead holes. Use clean, dry soldering iron to remove excess solder.

c. Bend lead of replacement component to correct shape and insert component into the lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of the board. A heat sink (longnose pliers, heat-sink tweezers, etc.) should be used when replacing transistors and diodes to prevent excessive heat from being conducted to the component.

d. Through-hole plating breaks are indicated by the separation from the board of the round conductor pad on either side of the board. To repair breaks, press conductor pads against the board and solder replacement component lead to conductor pad on both sides of the board.

MAINTENANCE NOTES

SECTION VI.

UPDATING SUPPLEMENTS

UPDATING SUPPLEMENT NO. 1

INTRODUCTION

This change sheet updates the instruction manual by detailing the changes that transform the Model 7702A Oscillographic Recording System into a Model 7702B. The changes are divided into three catagories, as follows:

Designation

Options

Equipment

The following paragraphs describe these changes in detail.

DESIGNATION

The designation for the recorder assembly, the basic unit, has been changed from Model 7702-01A to 7702B.

OPTIONS

All present options for the 7702A apply to the 7702B except that Option 01 has been dropped and Option 05 has been added to denote that the 7702B can be obtained in a Model 1069A-02A Mobile Cart.

EQUIPMENT

Equipment changes are primarily changes in connectors and the wiring pin assignments of these connectors, as detailed below. Circuit and wiring changes are shown on the schematic diagram, Drawing 07702-91000.

Connector	Change
J1, J2	Changed from 3-pin guarded twinax input connectors to 5-pin guarded connectors to permit transducer excitation and returning signals to appear on the same connector.
J3	Changed from a 14-pin connector to a 20-pin connector. This change increases the number of possible connections and allows the carrying of a separate ground lead between each preamplifier and power supply common.

Connector	Change
J11, J12	Change in pin assignments. The 440 Hz excitation has been made single-ended; pin 9 of the connectors is now wired directly to pin C of connectors J1 and J2.
J13	Changed from a 5-pin connector to a 6-pin connector to prevent customers from accidentally plugging transducers and ECG patient cables (with 5-pin connectors) into it.
J21, J22	Changed from 9-pin connectors to 10-pin connectors. Pin assignments have also been changed, and a 115V/230V AC line has been wired to pins H and K. This connection permits the feeding of AC power to the preamplifier by a simple jumper plug.

The above changes require the addition of a jumper from pin 9 to the chassis in the 8800 Series Preamplifiers or the 860-4300 Data Amplifier with a Production Change Order Number lower than 17-15945.

Table 1 provides parts information for the connectors used in the 7702B Recorder. Connectors not listed are the same as those used in the 7702-01A Recorder.

Table 1. Connector Data

REF. DESIG.	FUNCTION	DESCRIPTION	PART NO.	MATING CONNECTOR PART NO.
J1, J2	Signal Input	Male, 5 pins	1251-1894	1251-1895*
J3	Internal Conn.	Female, 20 pins	**	***
J11, J12	Preamp Conn.	Female, 16 pins	1251-1842	1251-1843
J13	Remote Conn.	Female, 6 pins	1251-1599	1251-1957
J21, J22	Auxiliary Conn.	Female, 10 pins	1251-1945	1251-1944

* Requires:

(1) Rubber Bushing 0340-0404

** Kit not available, consists of:

(1) Female Block 1251-1001
(1) Guide Socket 1251-1005
(1) Guide Pin 1251-1006
(1 pair) Catch Lock Spring 1251-1694
(A/R) Contact Socket 1251-1606

*** Kit not available, consists of:

(1)	Male Block	1251-1381
(1)	Guide Socket	1251-1005
(1)	Guide Pin	1251-1006
(1 pair)	Lock Spring	1251-1292
(1)	Strain Relief and Hood Clamp	1251-1344
(A/R)	Contact Pin	1251-1679

Requires:

(1)	Cable Clamp	1251-1595

UPDATING SUPPLEMENT No. 2

GENERAL INFORMATION

Data included in this technical manual for the Model 7702A/B Oscillographic

Recording System is also applicable to the 7782A Oscillographic Recording System except for the following:

1. The Model 1069-02A Mobile Cart has been replaced with the Model 1063A

Mobile Cart (except Options 002 and 005). Replaceable parts of the Model 1063A

Mobile Cart are as follows:

QTY	PART NUMBER	DESCRIPTION
2	01062 20014	HANDLE, OLIVE BEIGE
	ATTACHING HARDWARE	
4	2940 0061	SCREW, 1/4-20 x 1/2 inch
	****	
1	01062 60013	CASE, OLIVE BEIGE
2	01063 40011	TRAY, OLIVE BEIGE
	ATTACHING HARDWARE	
8	2190 0702	WASHER, SHOULDER
8	2190 0760	WASHER, FLAT
8	2680 0103	SCREW, 10-32 x 1/2 inch
2	2740 0003	NUT, 10-32
	****	
1	01063 60030	POWER BRACKET ASSEMBLY
	ATTACHING HARDWARE	
3	2510 0107	SCREW, 8-32 x 1/2 inch
	****	

QTY	PART NUMBER	DESCRIPTION
2	01511 00070	CLAMP, FRONT LEG
	ATTACHING HARDWARE	
2	0590 0304	NUT, 1/4-20
2	3020 0006	HEX SCREW, 1/4-20 x 1-1/2 inch
2	01511 00090	CLAMP, REAR LEG
	ATTACHING HARDWARE	
2	0590 0304	NUT, 1/4-20
2	3020 0006	HEX SCREW, 1/4-20 x 1-1/4 inch
	****	
4	01511 60042	LEG ASSEMBLY

2. Option 045 is available for the Model 1063A Mobile Cart. This is a swivel scope mount for the Model 7803B Monitor Scope (see Option 040 for the Model 7782A System).

3. Rack mounting option (Option 001 for 7702A System) is not required for the Model 7782A. Option 005 provides rack mount when Mobile Cart is deleted.

4. Model 1069-02A Mobile Cart option (Option 005 for 7702B System) is not available for the Model 7782A.

OPTIONS

One or more of the following options may be supplied with the Model 7782A Oscillographic Recording System.

NOTE: The 7782A System includes Model 7702B Recorder and Model 1063A Cart (except Option 002).

Option 002	Portable Case and Cover (7702-14A), Recorder (7702B) (less preamplifiers) 115/230 volts, 60 Hz.

Option 003	One channel decrease.
Option 005	Delete Mobile Cart (Model 1063A).
Option 009	Medical Speeds 2.5, 5, 25, 50 mm/sec 50 Hz.
Option 010	Medical Speeds 2.5, 5, 25, 50 mm/sec 60 Hz.
Option 011	Eight speed recorder with one minute timer for 60 Hz power line (Adds four mm/min recorder speeds by means of a 60 to 1 speed reduction and provides one minute timing marks on chart).
Option 012	Eight speed recorder with one minute timer for 50 Hz power line (Adds four mm/min recorder speeds by means of a 60 to 1 speed reduction and provides one minute timing marks on chart).
Option 015 or	Auxiliary marker. Records between channels 1 and 2 on 031 chart paper. Activated by external control closure.
Option 040	Model 7803B Monitor Scope, Swivel Scope Mount and two interconnecting cables (14213-61000) for 7782A System.

The following options relate directly to the Model 7702B Recorder as part of the Model 7782A Recording System. Options 020 and 025 are incorporated on each system 7702B Recorder while the remainder (Options 008, 013, 014, 018, 019) are supplied in accordance with the selected options (listed previously) for the Recording System.

Option 008	50 Hz Operation.
Option 013	One minute timer for 60 Hz power line. Provides one per minute timing marks on chart. For use with Option 011.
Option 014	One minute timer for 50 Hz power line. Provides one per minute timing marks on chart. For use with Option 012.

Option 020 Phone jack outputs [preamplifier output jacks J23 (Channel 1) and J24 (Channel 2) at Recorder rear panel]

Option 018 2 to 1 speed reductions, 60 Hz.

Option 019 2 to 1 speed reductions, 50 Hz.

Option 025 White Paint.

REMOVAL/INSTALLATION PROCEDURES -- MODEL 7702B RECORDER IN MODEL 1062A/1063A MOBILE CART

Remove the recorder from the cart as follows:

a. Disconnect all signal cables to the recorder and the power cable from the cart to the recorder.

b. Remove six (6) screws from each side of the top of the cart. See Figure 1. These screws secure the recorder front panel and the two (2) side top panels (or trays) to the top of the cart.

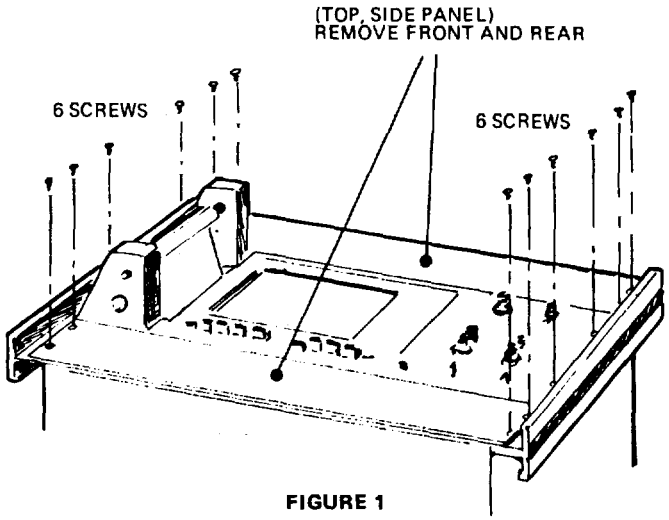


FIGURE 1

NOTE: Instead of screws, one (1) corner of either or both of the side top panels (or trays) may be secured with a transducer holder, or an oscilloscope mounting bracket, etc. This device must be removed along with the remaining screws as described in step b.

c. Remove the two (2) side top panels (or trays).

CAUTION

DO NOT REMOVE THE TWO LARGE SCREWS WHICH SECURE EACH HANDLE TO THE CART.

d. Remove the four (4) screws from the bottom of the recorder which secure the recorder to the bottom of the cart. See Figure 2.

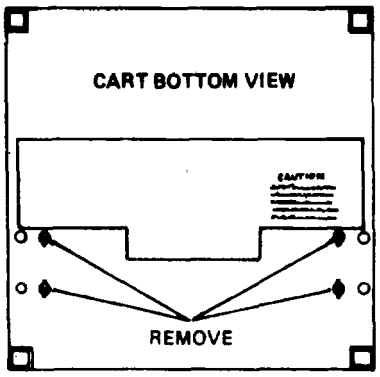


FIGURE 2

NOTE: Access the screws through the bottom of the cart with the cart standing upright. DO NOT TIP THE CART OVER.

WARNING

LIFTING THE RECORDER FROM THE CART IS A TWO (2) MAN OPERATION. DO NOT ATTEMPT TO REMOVE THE RECORDER WITHOUT ASSISTANCE.

e. With one (1) person at each end of the recorder as shown in Figure 3, grasp the recorder securely and lift it straight up and out of the cart.

f. To install the recorder, reverse the removal procedures.

g. To disassemble the recorder, refer to the Maintenance Section of this manual.

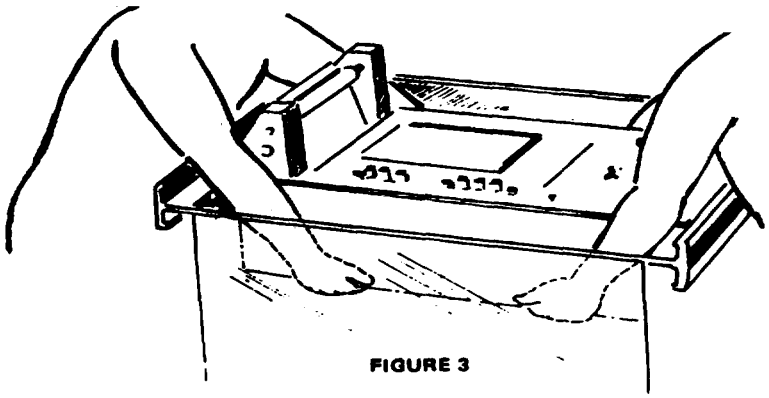


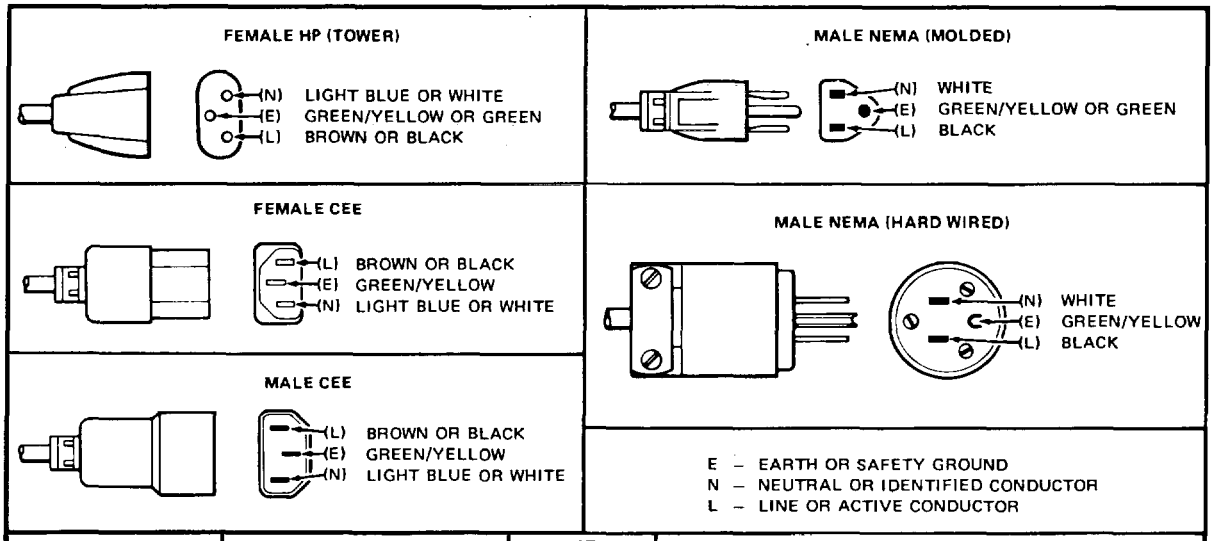
FIGURE 3

UPDATING SUPPLEMENT NO. 3

INTRODUCTION

This change sheet contains descriptions, Hewlett-Packard stock numbers and wire color codes for AC power cord sets that connect to instruments manufactured by HP Medical Electronics Division.

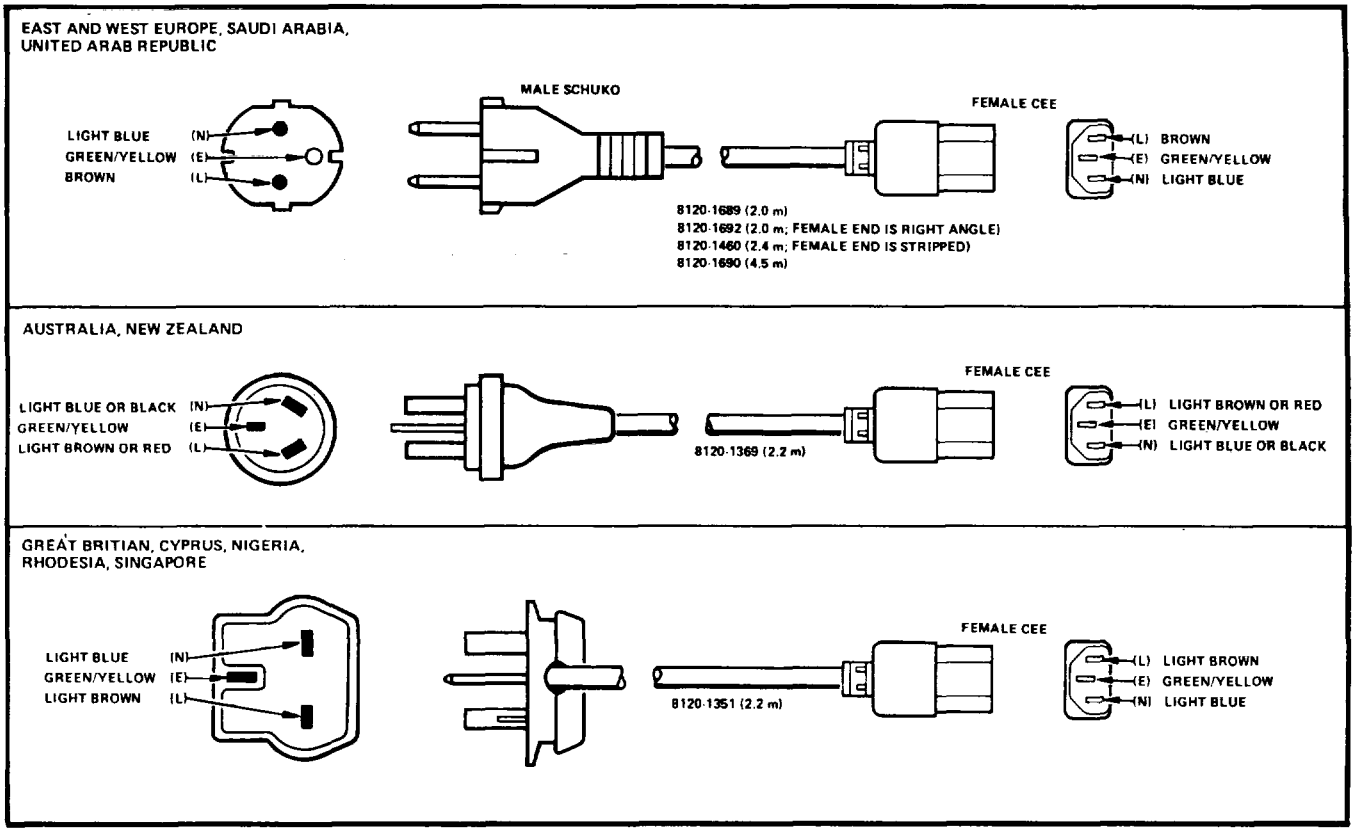
AC POWER CORD SETS (USA)



HP NUMBER	POWER CORD LENGTH		WIRE SIZE	CONNECTORS
8120-1406	2 1/2 ft.	(76 cm)	18/3	FEMALE HP (TOWER) to MALE CEE
8120-1396*	2 1/2 ft.	(76 cm)	18/3	FEMALE CEE to MALE CEE
8120-1900*	2 1/2 ft.	(76 cm)	16/3	FEMALE CEE to MALE CEE
8120-1625*	8.0 ft.	(2.4 m)	18/3	FEMALE CEE to MALE CEE
*USA OR NON-USA				
8120-1405	2 1/2 ft.	(76 cm)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1348	7 1/2 ft.	(2.2 m)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1395	8.0 ft.	(2.4 m)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1407	15.0 ft.	(4.5 m)	18/3	FEMALE CEE to MALE NEMA (MOLDED)
8120-1933	2 1/2 ft.	(76 cm)	16/3	STRIPPED ENDS to MALE CEE
8120-1755	4.0 ft.	(1.22 m)	18/3	STRIPPED ENDS to MALE CEE
8120-1934	4.0 ft.	(1.22 m)	16/3	STRIPPED ENDS to MALE CEE
8120-1706	15.0 ft.	(4.5 m)	14/3	STRIPPED ENDS to MALE NEMA (HARD WIRED)
8120-1935	12.0 ft.	(3.6 m)	16/3	STRIPPED ENDS to MALE NEMA (HARD WIRED)
8120-1796	8.0 ft.	(2.4 m)	18/3	FEMALE CEE to MALE NEMA (HARD WIRED)
8120-1931	8.0 ft.	(2.4 m)	16/3	FEMALE CEE to MALE NEMA (HARD WIRED)
8120-1932	12.0 ft.	(3.6 m)	16/3	FEMALE CEE to MALE NEMA (HARD WIRED)

NOTE: OTHER COUNTRIES SUCH AS CANADA, JAPAN (100 or 200 VOLTS), MEXICO, PHILLIPPINES, AND TAIWAN MAY USE SOME OF THE ABOVE SETS. CONSULT YOUR NEAREST HP SALES OFFICE.

AC POWER CORD SETS (NON USA)



NOTE:

OTHER COUNTRIES USE MORE THAN ONE OF THE ABOVE POWER CORD CONFIGURATIONS. FOR CORRECT POWER CORD SET IN YOUR AREA, CONSULT YOUR NEAREST HP SALES OFFICE.

SECTION VII.

MANUAL CHANGES

(for model 7702A)

MAKE ALL CHANGES IN THIS MANUAL ACCORDING TO THE ERRATA BELOW. ALSO CHECK THE FOLLOWING TABLE FOR YOUR INSTRUMENT CR/PCO NUMBER AND MAKE ANY LISTED CHANGE(S) IN THE MANUAL.

CR/PCO NUMBER	MAKE MANUAL CHANGES
ALL	ERRATA
PCO-17-15921	CHANGE 1
PCO 17-15940	CHANGE 2
PCO 17-15981	CHANGE 3

CR/PCO NUMBER	MAKE MANUAL CHANGES

∆ NEWOR REVISED ITEM

ERRATA: Page 1-3, Figure 1-6;

Change 868-500A-C13 to read 868-500A-C14, 440 Hz Osc.
Change 868-500A-C14 to read 868-500A-C13, 2400 Hz Osc.

Page 1-4, Table 1-1;

Change the paragraph marked "TERMINALS" to read: "Signal input, signal monitor, servo reference, carrier excitation and power line terminals located on rear panel. Remote chart drive and remote marker terminals also located on rear panel."

Page 1-6, Table 1.4;

Change F1 to read Fuse, 1.5 AMP Slo Blo, 115 volt power line; .8 AMP Slo Blo, 230 volt power line.
Change J14 to read auxiliary marker.
Change J15 to read Remote Marker.

Page 1-7, table 1--5;

Delete Galvanometer stylus part No. 398.

Page 3-2, Item 1;

Change to read: "STOP pushbutton switch.

MANUAL CHANGES MODEL 7702A (Cont'd)

Note: The following are IPB changes.

ERRATA: (Cont'd)

Page 4;

Change Ref. No. 7 to read: "Case, Portable (see Figure 22) (Option 02 only).

Page 16, Ref No. 27;

Change to read: Stock No. 3030-0304, Screw, Allen 10-32 1/4.

Page 22, Ref. No. 48;

Change description to read "Motor, 60 Hz (B1)"

Page 24, Ref. No. 10;

Change to read Stock No. 3030-0303, Screw, Allen, 10-32 5/8.

Page 26, Ref. No. 16;

Change to read Stock No. 0361-0416 Trimount.
Change Ref No. 37 to 38.
Change Ref No. 38 to 37.

Page 38, Ref No. 1; Listing for Figure 19

Add to No. 38B-21 description the designation B101
Add to the Stock No. 38B-21A description the designation B101
Add to the Stock No. 38B-39 description the designation B102
Ref No. 6; Add to description - (S101).

Page 38, Listing for Figure 20;

Ref. No. 1 stock No. 38B-78 description - change to read "Motor, 60 Hz (Used on 7702-60110) (B103). Stock No. 38B-78A description - change to read "Motor, 50 Hz (used on 07702-60220) (B103).

Page 44;

Add the following: Ref. Desig.: B1; Description: Motor, 60 Hz; Sanborn Part No. 38B-37; Vendor Part No. NCH-13 RM; Vendor Code: 07829; See Fig. & Index No.: 10-48.

MANUAL CHANGES MODEL 7702A (Cont'd)

ERRATA: (Cont'd)

Page 44;

Delete the following items: C17, LC-1, LC-2.
R1: change Figure No. to read "16".
R2 and R3: change Fig. and Index No. to 7-8.
R4 and R5: change Fig. and Index No. to 7-4.

Page 45;

S1: change to read Part No. 3101-3001, Fig. No. 8-15.

Page 45, Driver Amplifier Assembly;

J1: Change Fig. No. to read 3-9.
Q6: Change Fig. No. to read 3-3.
Q7: Change Fig. No. to read 3-14.
R22: Change Fig. No. to read 3-5.
R23: Change Fig. No. to read 3-5.

Page 46; Add the following:

(Timer Assemblies)

Desig.	Description	Sanborn Part No.	Vendor Part No.	Vendor Code	See Fig. & Index No.
B101	Motor Assy (14002S only)	38B-21	117P	14907	19-1
B101	Motor Assy (14002T only)	38B-21A	117P	14907	19-1
B102	Motor Assy (14002R only)	38B-39	117P	14907	19-1
B102	Motor Assy (14002V only)	38B-39A	117P	14907	19-1
R7	Resistor, 10 Ohms	50AB-100J	EB1005	01121	19-4
R8	Resistor, 10 Ohms	50AB-100J	EB1005	01121	19-4
S101	Switch, Magnetic reed	62V-1	MRR-1	12617	19-6
S102	Same as S101				

(MM/Min Drive Motor Kits)

B103	Motor (60 Hz)	38B-78	B8122EX-300C	07829	20-1
B103	Motor (50 Hz)	38B-78A	B8150EX-250C	07829	20-1
C17	Capacitor, .84 μ F (60 Hz)	8B-231	YAT-102	14655	20-5
C17	Capacitor, 1.0 μF (50 Hz)	0160-2555	YAT-103	14655	20-5

CHANGE 1: Page 46, Oscillator Card Assemblies;

Change Q19 to Part No. 1853-0045, Vendor Part No. 2N4036, Vendor Code 02735.
Add C21, Part No. 8B-212, .0056 MF, Vendor Part No. 192P56292-PTS, Vendor Code 56289.

CHANGE 1: (Contd)

Page 49, Schematic Diagram 868-500A-C13, 2400 Hz Osc.

Change Q19 to 2N4036. Add .0056 mF capacitor from the emitter to base of Q19.

Page 34;

Change Q19 to Part No. 1853-0045, 2N4036.
Add C21 Stock No. 8B-212 capacitor, .0056 μ F, Quantity 1.

CHANGE 2:

Page 46, oscillator card assemblies;

Change CR24 to part No. 1902-0551, Vendor Part No. 1902-0551, Vendor Code 28480.

Page 49;

Change the CR24 voltage to read 6.2 volts.

Page 34;

Change CR24 to Part No. 1,902-0551, Diode, Quantity 1.

CHANGE 3:

Page 45, Recorder Assembly;

Change R9 to 3300 ohms, Part No. 50AB-323J.

Page 20;

Add Item 53, Stock No. 07702-20020 Spacer, Sideplate, Quantity 1.
Add Item 53 Spacer to Page 21, Figure 9. Spacer is located midway between two Ref. 39 spacers on bottom edge of recorder.

MANUAL CHANGES

(for MODEL 7702-01A, 7702A. 7702B)

MAKE ALL CHANGES IN THIS MANUAL ACCORDING TO THE ERRATA BELOW. ALSO CHECK THE FOLLOWING TABLE FOR YOUR INSTRUMENT CR/PCO NUMBER AND MAKE ANY LISTED CHANGE(S) IN THE MANUAL.

CR/PCO NUMBER	MAKE MANUAL CHANGES
ALL	ERRATA
17-15981	CHANGE 4
17-16057	CHANGE 5
17-16280	CHANGE 6
17-16285	CHANGE 7
17-16414	CHANGE 8
17-16860	CHANGE 9
17-16903	CHANGE 10

CR/PCO NUMBER	MAKE MANUAL CHANGES
17-16915	CHANGE 11
17-17019	CHANGE 12
17-17232	CHANGE 13
17-17508	CHANGE 14
Serial Prefix 1012A	CHANGE 15
1016A	CHANGE 16
1021A	CHANGE 17

9 - 16860 - 1
10 - 17019 - 2
ERRATA - 3
13 - 17232 - 4
14 - 17508 - 5
16 - 17615 - 6
17 - 17954 - 7
ERRATA - 18029 - 8

MANUAL CHANGES MODEL 7702A, 7702B

ERRATA: Page 5-3, Table 5-2, Paragraph 4b:
Change frequencies from 430 and 450 Hz to 418 and 462 Hz, respectively.

Page 5-4, Table 5-2, Paragraph 3g:
Change paragraph on Transient Response Test to read as follows:

TRANSIENT RESPONSE

g. Set the oscillator to 2 Hz, square wave output. Adjust the oscillator amplitude to obtain a 10 division peak to peak chart deflection. (The preamplifier calibration voltage may be used in place of a square wave generator to record a step function.)
h. Run the recorder at 20 mm/sec or 25 mm/sec (medical speed), and adjust the DAMPING controls for each channel to obtain a .4 division overshoot on the leading edge of the square wave.

IPB Page 6, Item 8:
Change Stock No. of Rack, Slide and Lock Assembly to 07702-60020.

IPB Page 13, Figure 5:
Ch Change lowermost reference 22 (guide pin) to 28.

IPB Page 14, Item 10:
Change location of entry so it appears under Item 17; Board assembly is part of coil and coil/stylus holder.

IPB Page 14, Item 17:
Change Stock No. to 608,D- 100-C4.

IPB Page 22, Item 48:
Change Stock No. for Motor 60 Hz to 3140-0397.

CHANGE 4: IPB Page 18:
Add designation (Except Option 10) after items 2, 4 and 5.
Add second Item 2, 5000-0308, LABEL, Stick-on (2.5) (Option 10)
Add second Item 4, 5000-0312, LABEL, Stick-on (25) (Option 10)
Add second Item 5, 5000-031 2, LABEL, Stick-on (50) (Option 10)

IPB Page 7:
Add Item 55, Z Offset Bracket 07702-00067, to parts list.

CHANGE 5: IPB, Page 45, Recorder Assembly:
Change R9 from RESISTOR 4.7K ohms to RESISTOR, 0686-3325, 3.3K ohms, 5%, I/2W, comp, 01121, EB-3325.

Schematic Diagram:
Connect Q3 collector to F2 (0.5A instead of 0.25A fuse shown).

IPB Page 15:
Change Item 39 from 151-2-1001 MAGNET to 00350-63120 MAGNET.
Add to Item 4, the 613-100-CI I STYLUS MOUNTING ADAPTER ASSY, (1) Spring, HP Part No. 1460-0945

MANUAL CHANGES MODEL 7702A. 7702B

IPB Page 30:
Change R6 from 0683-3325 to 0684-2721, 2700 ohms, 10%, 1/4W.

CHANGE 6: IPB Page 46:
Change R6 to RESISTOR, 2700 ohms, 10%, 1/4W, HP Part No. 0684-2721, Vendor Part No. CB-2721, Vendor 01121

CHANGE 7: Throughout manual, change Model Number of System from 7702A to 7702B, and change Model Number of Recorder Assembly from 7702-01A to 77028.

IPB, Table of Contents:
Item 1, change Model Number to 7702B
Item 2, change Model Number to 7702B
Item 3, change Model Number to 7700-02B and add (See Supplement)
Item 13, change Part Number to 07702-61030
Item 14, change Part Number to 07702-61030
Item 7, change Part Number to 07702-60210
Item 23A, change Model Number to 7702B and add (See Manual Changes)
Item 23B, change Model Number to 7702B

IPB Page 4,
Item 1, Change Stock No. to 7702B.

Page 6:
Item 1, Change Stock No. to 7700-02B
Item 30, Change Stock No. to 07702-61030
Item 51, Change Stock No. to 07702-61040

Page 9:
Delete Information and Insert (See Supplement at Rear of Manual).

Page 12:
Item 11, Change Stock No. to 07702-61200
Item 12, Change entry to read: 1251-1894, CONNECTOR, 5-pin Male Twinax type, (J 1, J2), 2
Item 16, Change Stock No. to 1251-1945
Item 23, Change Stock No. to 1251-1344
Item 25, Change Stock No. to 1251-1381
Add 0683-1005, Resistor, 10 ohms, 5%, 1/4W (R 12)
Add 0150-0096, Capacitor, 0.05 mfd, Ceramic (C20)

Page 26:
Item 1, Change Stock No. to 7700-02B
Item 2, Change Stock No. to 07702-61040
Item 25, Change Stock No. to 07702-61170

Page 28:
Item 15, Change Stock No. to 07702-61150
Item 16, Change Stock No. to 07702-61160

Pages 2-2, 2-3, 2-4 Replace Figures 2-3 to 2-6 and Paragraphs 2:26 to 2-42 with illustration sheet INPUT CABLE PREPARATION and SIGNAL INPUT AND AUXILIARY CONNECTORS, Wiring Diagram.

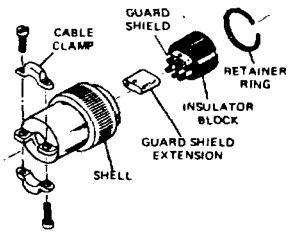
MANUAL CHANGES MODEL 7702A, 7702B

INPUT CABLE PREPARATION

SIGNAL CONNECTOR PREPARATION

a. Slide the prepared end of the cable into the cable clamp and through the connector shell. Also slide the end of the cable through the guard shield extension, for guarded input circuits. For non-guarded input circuits, remove and store the guard shield extension.
b. Wire the connector according to the diagram below, according to preamplifier to be used. For guarded input circuits, slide the guard shield extension into place after soldering the signal leads to terminals A and B.
c. Press the connector block carefully into the connector shell.
d. Insert the retaining ring.
e. Tighten the cable screws.
f. Check with an ohmmeter to determine that the cable shields are not shorted to the connector shell or to each other.

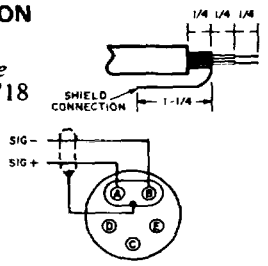
Connector HP 1251-1895



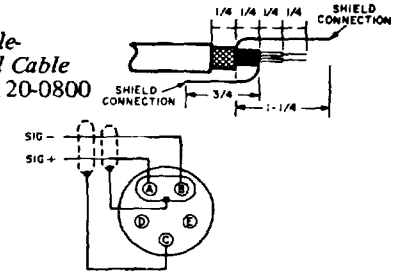
GUARDED CABLE PREPARATION

PREAMPLIFIER MODEL
8803A
8806B *
8807A **

Single-Shield Cable HP 8120-0718



Double-Shield Cable HP 8120-0800



NOTES:

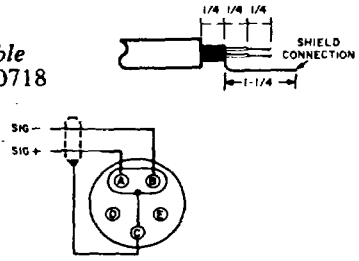
* 1. Connect Ref voltage to pins A and B on auxiliary connector of the power supply.

** 1. AC output available on pin C of auxiliary connector of the power supply.
2. DC input (8807A, Opt 02) available on pins A and B of auxiliary connector of the power supply.

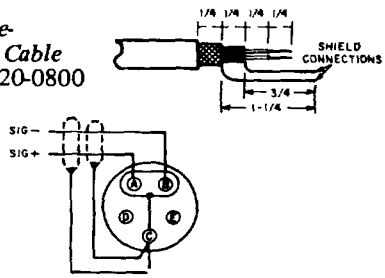
NON-GUARDED CABLE PREPARATION

PREAMPLIFIER MODEL
8801A
8802A
8808A *
8809A *

Single-Shield Cable HP 8120-0718



Double-Shield Cable HP 8120-0800



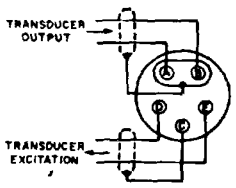
***NOTE:**

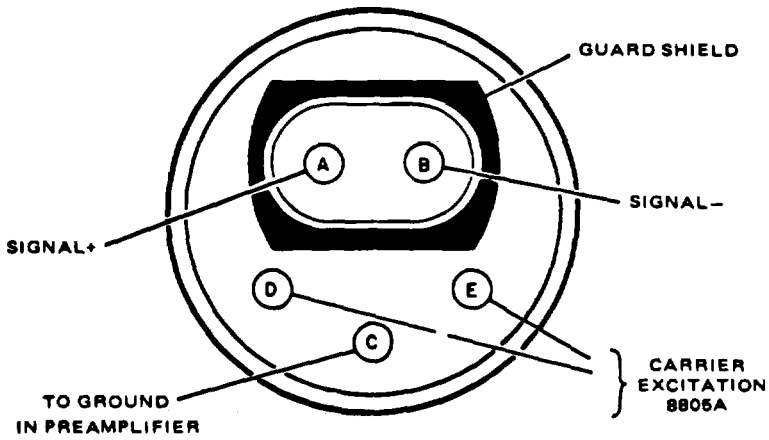
Single conductor shielded cable can be used by connecting center conductor to pin A and shield to pin B.

CARRIER PREAMPLIFIER CABLE PREPARATION

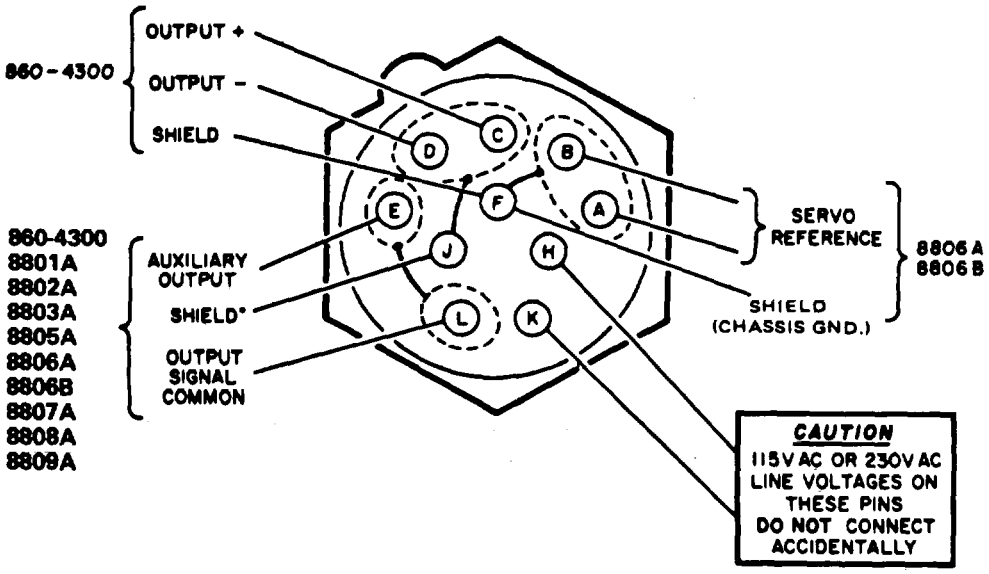
PREAMPLIFIER MODEL
8805A

HP Transducers having 5-pin AN connectors (pin pattern ⊙) use Input Adapter 14060B for signal input connections. For other signal sources, connect the input signals as shown. The transducer output leads and transducer excitation leads must be twisted and enclosed in braided shielding.





SIGNAL INPUT CONNECTOR 1251-1895, WIRING END, MATES WITH CHASSIS MOUNTED CONNECTOR 1251-1894



AUXILIARY CONNECTOR 1251-1944, WIRING END, MATES WITH CHASSIS MOUNTED CONNECTOR 1251-1945

*COMMON WITH PIN C OF INPUT SIGNAL CONNECTOR

Signal Input and Auxiliary Connectors, Wiring Diagram

MANUAL CHANGES MODEL 7702A, 7702B

IPB Page 47, Figure 23A:
Replace schematic diagram with attached schematic. On the figure supplied, change shields for J 11, Pins 9, 2, 5, 3 and 10 so they are like those on the corresponding pins of J 512. On J 12, Pin 7, add shield like that on J I 1, Pin 7. Change S2 description to 115/230 V.

CHANGE 8: IPB, Page 12, Item 10:
Add to Auxiliary Marker Jack (J 14): 0150-0012, CAPACITOR, C19, 0.01 Mfd, 20%, Ceramic

Page 22, Item 48:
Add to 60 Hz Motor BI (Except Option 08)
Add the following components to cover Option 08:
3140-0398, MOTOR, 50 Hz (Option 08 only)
0160-2556, CAPACITOR, 0.84 Mfd, C18 (Option 08 only)
07702-00330, BRACKET (Option 08 only)

IPB, Page 2, Also Page 1-7 (Table 1-5):
Change accessory lists to the following list:

1	651 52	PERMAPAPER
1	1251 0405	CONN 2 PIN M
1	1251 0405	CONN 2 PIN M (Option 15 only)
2	1251 0405	CONN 2 PIN M (Option 50 only)
2	1251 1757	CONN 9 PIN M
2	1251 1860	CONN CONT F
2	1490 0797	CORE 1 CH
1	2110 0005	FUSE 1.6A
2	2110 0012	FUSE .5A
1	2110 0020	FUSE .80A
1	2110 0059	FUSE 1.5A 125V
1	8120 1395	PWR. CORD 8-FOOT
1	14015A	STYLUS PRESSURE TESTER

Page 1-1:
Add Option 16, 2: 1 Speed Increase, 60 Hz (Deleted by Change 12)
Add Option 17, 2:1 Speed Increase, 50 Hz (Deleted by Change 12)
Add Option 18, 2: 1 Speed Reduction, 60 Hz
Add Option 19, 2:1 Speed Reduction, 50 Hz

CHANGE 9: IPB, Page 12, Item 10:
Change Jacks J 14, J 15 to 1251-2230

Page 2, Also page 1-7 (Table 1-5) Change plug 1251-0405 to 1251-1140.

CHANGE 10: IPB, Page 47, Figure 23A:
Make the following wiring changes to schematic diagram illustrated.
1. Change signal input wires from double shield to single shield.
2. Delete shielded wire between Preamp connector Pin 9 and Input connector Pin C.

IPB Page 16, Ref 16:
Add the following: 07702-23013, HOUSING, Paper takeup, left, (Option 25 only).

IPB Page 16, Ref 32:
Add the following: 07702-23033, HOUSING, Paper takeup, right (Option 25 only)

IPB Page 16, Ref 33:
Add the following: 07702-00301, FRAME, Door P/O item 18 (Option 25 only)

IPB Page 20, Ref 50:
Add the following: 07702-00021, PAPER GUIDE (Option 25 only)

IPB Page 16, Ref 10:
Add the following: 07702-61061, FRONT PANEL (Option 25 only)

IPB Page 18, Ref 16:
Add the following: 0370-0909, BUTTON (Option 25 only)

IPB Page 45:
Add R10; RESISTOR, variable, 0.5 ohm, 12.5W, W/W (Option 12); 2100-2325;
Vendor Part No. E-48253; Vendor 44655.

IPB Page 26, Item 10:
Change Stock No. to 3101-1234.

CHANGE 14: Schematic diagram for Change 7;
Change C2 from .01 MFD to 0.1 MFD.

Add R11, 10 ohms, in series with terminal 3 of switch S1-B.

IPB Page 18, Reference 13:
Change C2 to listing to read CAPACITOR, 0. I MFD, QTY 1.

IPB Page 18:
Add Reference 17;
RESISTOR, 10 ohms (RI 1) QTY 1.

IPB Page 44, Recorder Assembly Parts List:
Change C2 listing to read, CAPACITOR, 0.1 MFD, 0 50-0084, 8131-100-651-1042,
15450.

IPB Page 45, Recorder Assembly Parts List:
Add R10, RESISTOR, 10 ohms, +5%, ¼/4W, 0683-1005, CB 1005, 01121.

IPB Page 16, Ref 15:
Change to read 1450-0419, PILOT LIGHT, white (I1).

IPB Page 44, Ref I1:
Change to read i1, PILOT LIGHI, white; 1450-0419; 599-237-WHT-TL, NEON;
Drake Mfg. Co.; 7-15.

MANUAL CHANGES MODEL 7702A, 7702B

CHANGE 15: IPB Page 16, Ref 10:
Change Part No. to 07702-61070 (07702-61071 for Option 25).

IPB Page 18, Ref 16:
Change PWR pushbutton Part No. to 07800-00523 (07800-00524 for Option 25).

CHANGE 16: IPB Page 16, Ref 26:
Change Part No. to 1460-1203

IPB Page 12, Ref I:
Delete 07702-00130 and add 07702-00131 (Option 25 only)

Page 1-7, Table 1-5:
Change 3-wire power cord to 8120-1395.

IPB Page 2, ACCESSORIES:
Change power cord to 8120-1395.

IPB Page 26, Parts List for Figure 13:
Change Ref 12 to read 07702-00350

IPB Page 26, Parts List for Figure 15:
Change Ref 11 to read 1251-2357.

IPB Page 44, RECORDER ASSEMBLY Parts List:
Change J9 listing to read, CONNECTOR, Power, 1251-2357, EAC-301, 82389.

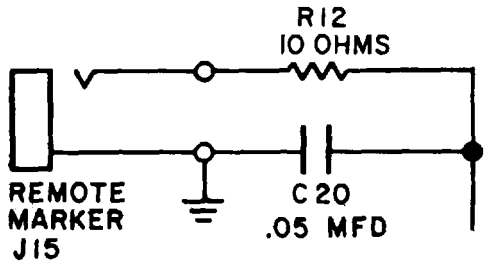
Page 1-5, Table 1-2:
Add to noise specification: With 8803A Preamplifier set to max gain and with marker on, 3 μ V (referred to input) noise spikes may be present.

CHANGE 17: Page 1-7, Table 1-5:
Change remote marker plug to 1251-0405.

IPB Page 2, ACCESSORIES:
Change 10OG2-22MW to 1251-0405

IPB Page 44, Recorder Assembly Parts List:
Change C2 to read, CAPACITOR, 0.05 MFD I00 WVDC, Ceramic, 0150-0096, 845-Y5V-5032, 15450, 8-13.

Schematic diagram for Change 7;
Change C2 to .05 MFD.
Add R 12, C20 as shown below:



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AND REFERENCE TO COMPONENT PARTS, WIRING, OR INSTRUCTIONS APPEARING IN THE PUBLICATION FOR THE

INSTRUMENT SHOULD BE CHANGED AS FOLLOWS:

ON 07702-60000 RECORDER ASSEMBLY

ADD C108 0160-3731 CAP .01M 20% CER ACROSS TERMINALS 27 AND 28 OF S1.

ADD C109 0160-0904 CAP .05M 20% 1000V C109 ACROSS THE DRIVER MOTOR AT THE MOTOR LEAD TERMINAL BLOCK.

ADD 2 07702-00200 BRACKETS (TOTAL QUANTITY 4).

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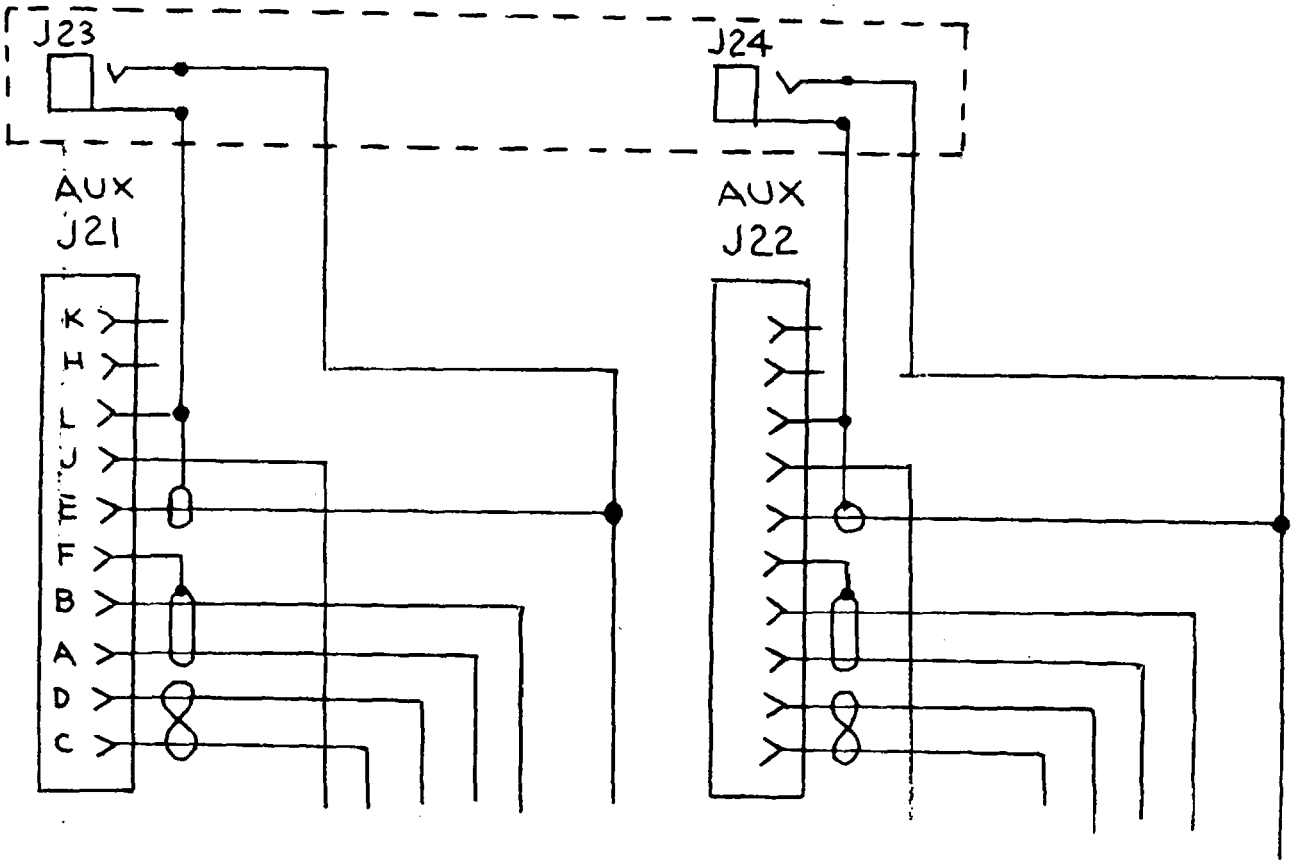
7702B OPTION 20: INSTRUMENTS SUPPLIED WITH THIS OPTION INCLUDE PREAMPLIFIER OUTPUT JACKS J23 (CHANNEL 1) AND J24 (CHANNEL 2), MOUNTED ON THE REAR PANEL OF THE RECORDER. TWO UNWIRED PHONE PLUGS PART NO. 6960-0006 ARE INCLUDED WITH THE INSTRUMENT ACCESSORIES. A SCHEMATIC OF THE OPTION 20 OUTPUT JACKS IS GIVEN BELOW.



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77023 RECORDER

KNOB	FROM	0370-0151 KNOB ALL
	TO	0370-1005 KNOB
GUIDE	FROM	07702-00020 GUIDE
	TO	07702-00022 GUIDE
SHIELD	FROM	07702-00130 SHIELD
	TO	07702-00132 SHIELD
ASSY RACK SLIDE	FROM	07702-60020 ASSY RACK SLIDE
	TO	07702-60022 ASSY RACK SLIDE

07702-60000 ASSY RECORDER

KNOB	FROM	0370-0497 KNOB
	TO	0370-1874 KNOB
	FROM	07800-00533 KNOB
	TO	07800-00527 KNOB

00702-60230 ASSY FRONT DOOR

DOOR FRAME	FROM	07702-00300 DOOR FRAME
	TO	07702-00302 DOOR FRAME

07702-61210 ASSY PANEL

PTU HOUSING	FROM	07702-23010 HOUSING
	TO	07702-23014 HOUSING
	FROM	07702-23030 HOUSING
	TO	07702-23034 HOUSING
FRONT PANEL	FROM	07702-61070 FRONT PANEL
	TO	07702-61072 FRONT MBMH,

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☐ FOR INSTRUMENTS HAVING SERIAL PREFIX _____ AND HIGHER MAKE THE FOLLOWING PUBLICATION CHANGE(S):

07702-63498 ACCESSORY MATERIAL LIST

FUSE	FROM	2110-0201	1.5A
	TO	21160004	1.5A
	FROM	2110-0202	.50A
	TO	2110-0012	.50A
	ADD	1251-0405 CONN ON OPT. 20 (2)	
		1251-0405 CONN ON OPT. 15 (1)	

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☐ FOR SUBASSEMBLIES HAVING SERIAL PREFIX_____AND HIGHER MAKE THE FOLLOWING PUBLICATION CHANGE(S):

Section, 7702A 2-CHANNEL THERMAL RECORDING SUB-SYSTEM; Page 26:

Change Part No. of REF# 31 from 66B-199 to 9100-1974.

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07702-61030 MATERIAL LIST

T2	TRANSFORMER	FROM	9100-1933
		TO	07702-63600

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FOR SUBASSEMBLIES HAVING SERIAL PREFIX _____ AND HIGHER MAKE THE FOLLOWING PUBLICATION CHANGEIS):

7702B MATERIAL LIST

PAPER	DRIVE STOP	FROM	1530-1287
		TO	154-108

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☐ FOR SUBASSEMBLIES HAVING SERIAL PREFIX _____ AND HIGHER MAKE THE FOLLOWING PUBLICATION CHANGECS):

07702-61030 MATERIAL LIST

T1	TRANSFORMER	FROM	9100-1974
		TO	07702-63500

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INSTRUCTIONS APPEARING IN THE PUBLICATION FOR THE
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07700-62030 PRINTED CIRCUIT BOARD ASSEMBLY
R10 0698-5966 5K 1% ½W CHANGE TO 0757-0367 100K 1% ½W

07700-92010 SCHEMATIC
CHANGE R10 5K 1% TO 100K 1%

APPENDIX A

ILLUSTRATED PARTS BREAKDOWN

FOR

Section I. 7702A 2-CHANNEL THERMAL RECORDING SUBSYSTEM

Section II. 7700-02B SYSTEM DRIVER AMPLIFIER

Section I. 7702A 2-CHANNEL THERMAL RECORDING SUBSYSTEM

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INTRODUCTION

This publication lists and illustrates replaceable parts of the Model 7702A Two-Channel Thermal Recording Sub-system and its available options. Figures 1 thru 22 provide a breakdown of the complete Recording Sub-system, while Figure 23 provides a sub-system schematic. The schematic reference designators are cross-referenced to the exploded-view illustrations.

The publication covers a standard 60 Hz industrial system which has a MM/sec paper drive and marking system, and is mounted in a mobile cart. Options for a portable carrying case, 50 Hz operation, and the addition of MM/min. paper drive speeds and marking capabilities, are also included. All optional parts (non-standard) are identified by their option number following the part description.

Prior to using this parts list, it is recommended that the user establish the proper system configuration as to applicable options. The options covered in this manual are as follows:

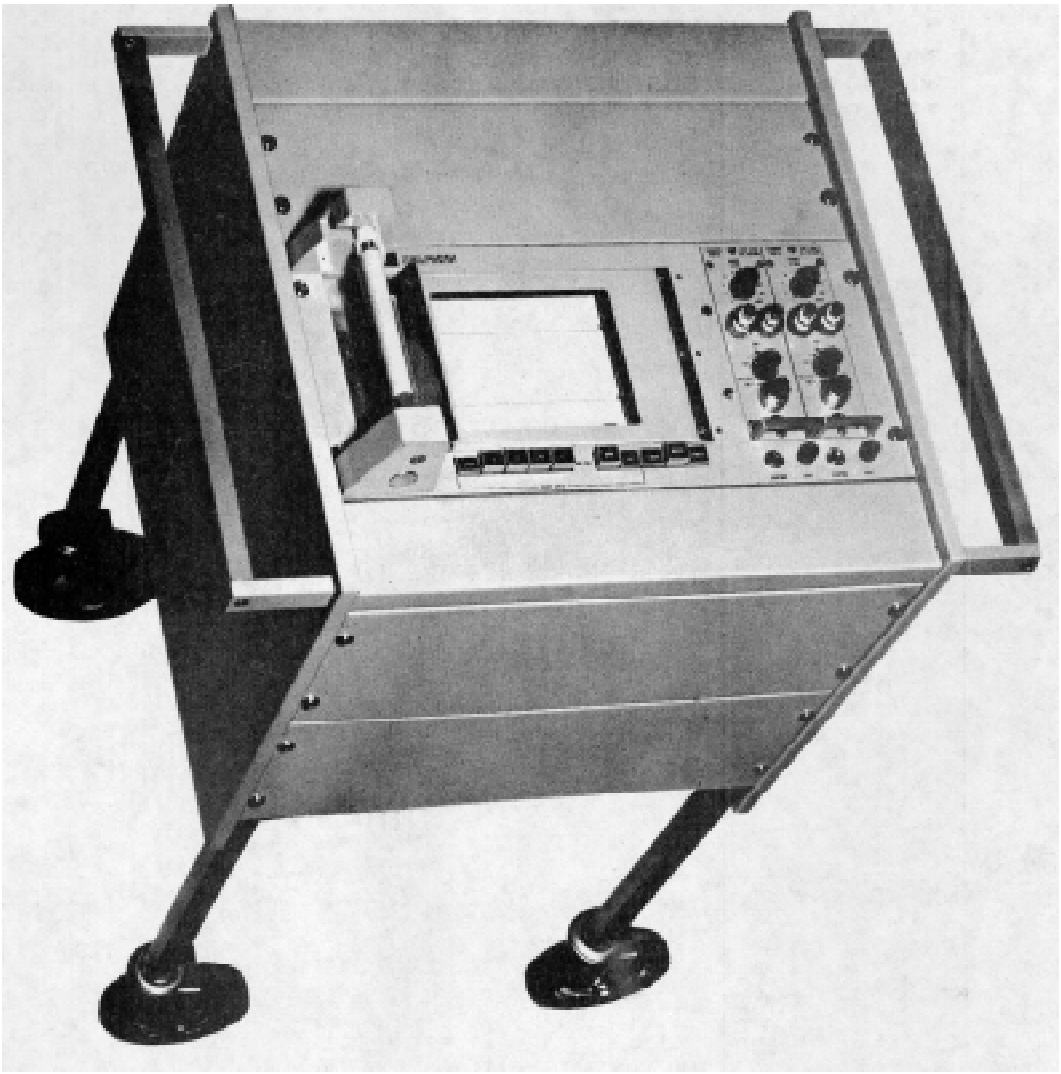
OPTION	DESCRIPTION
01	7702-01A Recorder less mobile cart.
02	7702-0 A Recorder with 7702-14A portable case.
08	Recorder converted to 50 Hz operation.
10	Paper drive converted to medical speeds of 2. 5, 5, 25 and 50 MM/sec.
11	Addition of (60 Hz) MM/min. paper drive speeds. Uses 60:1 speed reduction kit 07702-60110.
12	Addition of (50 Hz) MM/min. paper drive speeds. Uses 60:1 speed reduction kit 07702-60220 (Used only when option 08 is in force.)
13	Addition of (60 Hz) one-minute Timer (14002R). (Used only when option 11 is in force.)
14	Addition of (50 Hz) one-minute Timer (14002V). (Used only when options 08 and 12 are in force.)

ACCESSORIES

A listing of accessories for the Model 7702A Two-Channel Thermal Recording Sub-system is given below:

STOCK NUMBER	DESCRIPTION	QUANTITY
10A5-3MW	CONNECTOR	1
10A5-1FWA	CONNECTOR	1
10B9-5MW	CONNECTOR	2
10G2-22MW	PHONE PLUG*	1
10G3-11MFW	2-WIRE ADAPTER	1
10G3-34FW	CONNECTOR	2
10G3-42MFW	POWER CORD	1
26B-4	FUSE, Fast blo, 0. 5A (FZ, 3)	2
26B-27	FUSE, Slo blo, 1. 5A (F1) (115V)	1
26B-6	FUSE, Slo blo, 0. 8A (F1) (230V)	1
26B-32	FUSE, Fast blo, .25A (F4)	1
37A-10A	SCREW DRIVER	1
94-104 P1	RECORD SPOOL	2
100-600-C5	SPLINE WRENCH	1
398	STYLUS	2
651-52	PERMAPAPER	1
14015A	STYLUS PRESSURE TESTER	1
77D-5	GROMMET	2
5060-4602	CABLE**	1

NOTES:
* Two supplied when extra event marker 462-189 is ordered.
** For use with Recorder when 8805A Carrier Amplifier is used with Sanborn 267, 268, 270 Transducers.



Model 7702A Two-Channel Thermal Recording Sub-system

Listing for Figure 1

REF.	STOCK NO.	DESCRIPTION	QTY.
1	7702-01A	RECORDER ASSEMBLY	1
2	1069-02A	CART, Mobile	1
3	511-19-3-P5	PANEL	1
4	710N-10C	WASHER, Nylon	8
5	74G-1	WASHER, Cup	8
6	80A-1032-01E	SCREW, Oval hd, no. 10-32 x 5/8 in. lg	8
7	7702-14A	CASE, Portable (See fig. 2 1) (option 02 only)	1

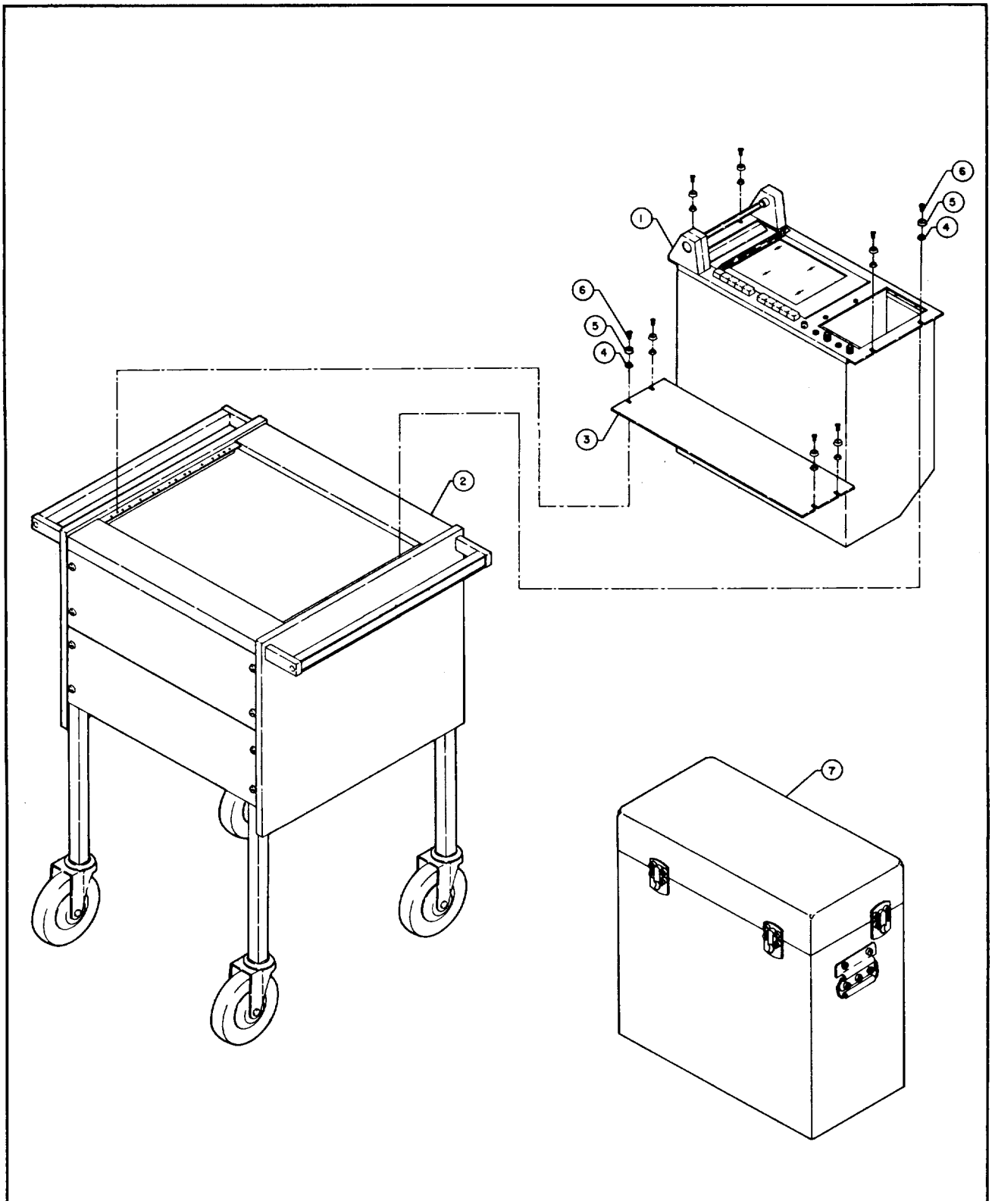


Figure 1 . Two-Channel Thermal Recording Subsystem (Model 7702A)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 2	
1	7700-02A	DRIVER AMPLIFIER (See fig. 3)	2
2	83A-6-5B	SCREW, Sems, no. 6-32 x 5/16 in. Lg	4
3	83A-6-14B	SCREW, Sems, no. 6-32 x 7/8 in. Lg	2
4	07702-00260	PLATE, Cover top	1
5	700-8049-23	SPACER	1
6	No Number	AMPLIFIER HOUSING ASSEMBLY (See fig. 5)	1
7	83D-632-6V	SCREW, Hex hd, no. 6-32 x 3/8 in. lg	4
8	07702-60220	RACK SLIDE AND LOCK ASSEMBLY	2
9	07702-00122	PLATE, Right side	1
10	320-200-C10	GALVANOMETER ASSEMBLY, Complete (See fig. 6)	1
11	80A-832-6B	SCREW, Bind hd, chrome, no. 8-32 x 3/8 in. lg	1
12	710N-8	WASHER, Nylon, no. 8	2
13	07702-60210	FRONT PANEL, DOOR AND PAPER TAKE-UP ASSEMBLY (See fig. 7)	1
14	74G-1	WASHER, Chrome	4
15	80B-1032-12G	SCREW, Phillips, no. 10-32 x 3/4 in. lg	4
16	710N-10C	WASHER, Nylon	4
17	83D-1/4 20-8B	SCREW, Round hd, 1/4-20 x 1/2 in. Lg	1
18	3101-1001	10 BUTTON PUSH SWITCH (See fig. 8)	1
19	2510-0045	SCREW, Phillips hd, chrome, no. 8-32 x 3/8 in. lg	3
20	No Number	PAPER DRIVE ASSEMBLY (See figs. 9 and 10)	1
21	83A-1032-8B	SCREW, Bd. hd, no. 10-32 x 1/2 in. lg	2
22	80A-1032-8J	SCREW, Pan hd, no. 10-32 x 1/2 in. lg	2
23	07702-00152	BAR, Bottom	1
24	07702-00180	PLATE STIFFENER	1
25	07702-00151	BAR, Top	1
26	83A-8-O1B	SCREW, Sems, no. 8-32 x 5/8 in. lg	3
27	80D-832-6V	SCREW, Hex hd, no. 8-32 x 3/8 in. lg	5
28	07702-00230	PLATE COVER, Bottom	1
29	72A-10A	LOCKWASHER	2
30	07702-60030	POWER SUPPLY ASSEMBLY (See figs. 13 and 14)	1
31	40T-6	NUT, Keps, no. 6-32	1
32	12ZC-5	CLAMP, Cable	1
33	74B-6L	WASHER, Flat, no. 6	1
34	83A-6-6B	SCREW, Sems, no. 6-32 x 3/8 in. Lg	1
35	14002S	TIMER ASSEMBLY, I/sec. 60 Hz (See fig. 19)	1
	14002T	TIMER ASSEMBLY, I/sec. 50 Hz (See fig. 19) (Option 08 only)	1
36	07702-00160	PLATE, Back support	1
37	14002R	TIMER ASSEMBLY, I/min, 60 Hz (See fig. 19) (Option 13 only)	1
	14002V	TIMER ASSEMBLY, I/min, 50 Hz (See fig. 19) (Option 14 only)	1
38	3110-0022	HINGE, Chassis	1
39	No Number	NUT, P/O item 37	2
40	07702-60110	KIT, MM/min, drive motor, 60:1, 60 Hz (See fig. 20) (Option 11 only)	1
	07702-60220	KIT, MM/min, drive motor, 60:1, 50 Hz (See fig. 20) (Option 12 only)	1
41	83D-10-4V	SCREWS, Sems, no. 10-32 x 1/4 in. Lg	6
42	85B-632-4H	SCREW, Phillips, flat hd, no. 6-32	2
43	80D-1/4 20-8B	SCREW, Rd. hd, 1/4 - 20 x 1/2 in. Lg	4
44	83D-10-6B	SCREW, Sems, no. 10-32 x 3/8 in. Lg	4

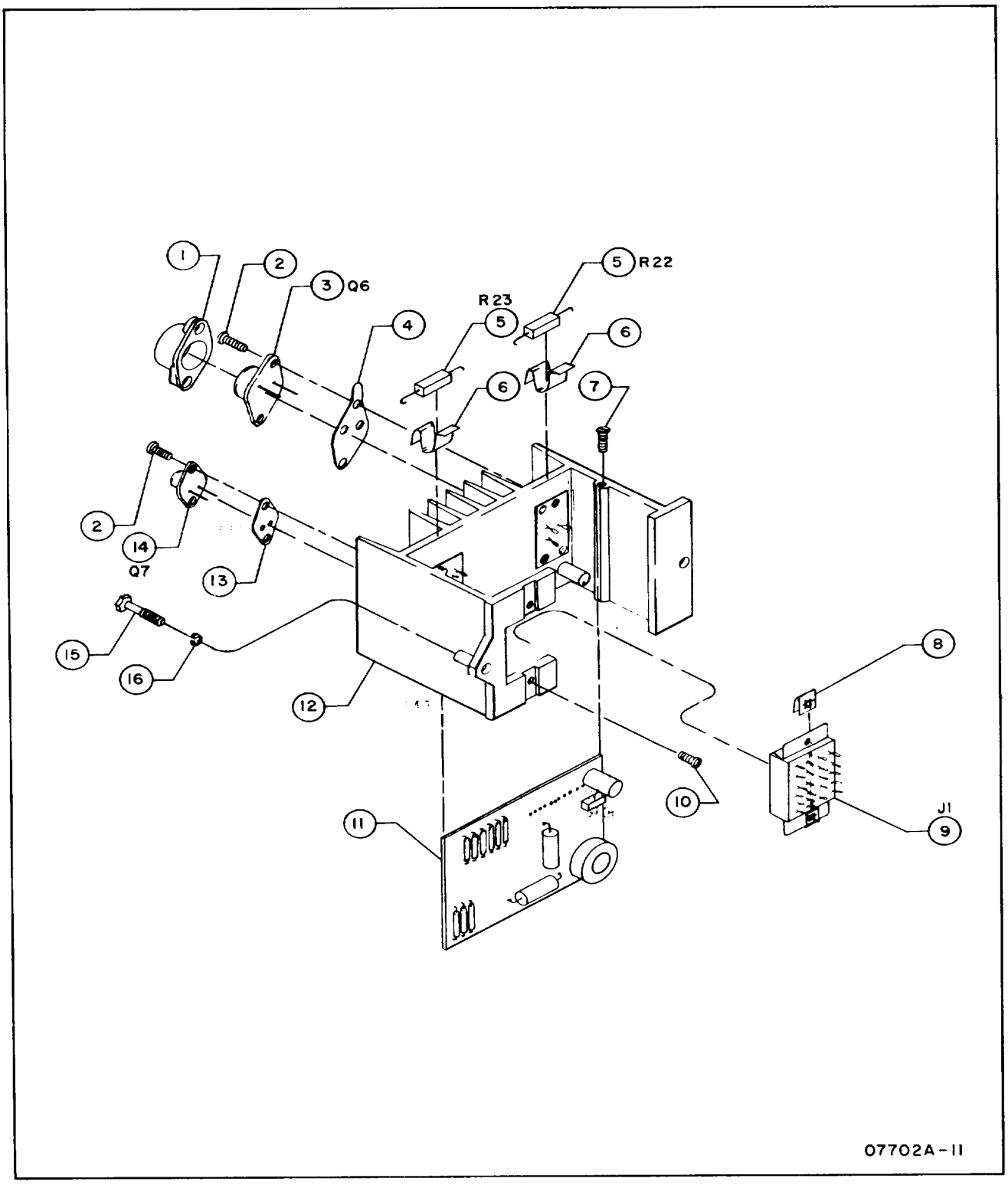


Figure 3 . Driver Amplifier Assembly (Model 7700-02A)

Listing for Figure 4

REF.	STOCK NO.	DESCRIPTION	QTY.
C1	8T-10	CAPACITOR, 2.2 mfd, 35V	1
C2	8B-136	CAPACITOR, 0.39 mfd, 100V	1
C3	8C-91	CAPACITOR, 50 mfd, 25V	1
C4	8E-18	CAPACITOR, 200 pf, 500V	1
C5	8T-29	CAPACITOR, 0. 12 mfd	1
Q1	16T-78MP	TRANSISTOR, 2N3393MP	1
Q2	16T-78MP	TRANSISTOR, 2N3393MP	1
Q3	16T-78	TRANSISTOR, 2N3393	1
Q4	16T-78	TRANSISTOR, 2N3393	1
Q5	1853-0045	TRANSISTOR, Type 2N4036	1
Q8	16T-81	TRANSISTOR, SM9143	1
Q9	16T-78	TRANSISTOR, 2N3393	1
R1	54A-365F	RESISTOR, 2750 ohms ± 1%	1
R2	50E-375-1F	RESISTOR, 3750 ohms * 1%	1
R3	54A-364F	RESISTOR, 2250 ohms 1%	1
R4	50E-302F	RESISTOR, 3K ohms 1.%	1
R5	56PA-34	POTENTIOMETER, 2K ± 20%	1
R6	50AB-221J	RESISTOR, 220 ohms 5%.	1
R7	50AB-102J	RESISTOR, 1K ohms + 5,%	1
R8	50E-125-2F	RESISTOR, 12. 5K ohms + 1%%	1
R9	50E-125-2F	RESISTOR, 12. 5K ohms + 1%	1
R10	50E-113F	RESISTOR, 11K ohms 1%	1
R11	50E-751F	RESISTOR, 750 ohms + 1%	1
R12	50E-751F	RESISTOR, 750 ohms 1%	1
R13	50E-113F	RESISTOR, 11K ohms + 1%	1
R14	50E-125-2F	RESISTOR, 12. 5K ohms 4 1%	1
R15	50AB-101I	RESISTOR, 100 ohms 5%	1
R16	50AB-1011J	RESISTOR, 100 ohms 5%	1
R17	50AB-332J	RESISTOR, 3300 ohms 5%%	1
R18	50AB-102J	RESISTOR, 1K ohms 5%	1
R19	52B-681J	RESISTOR, 680 ohms 5%	1
R20	50E-500F	RESISTOR, 50 ohms 1%	1
R21	52B-222J	RESISTOR, 2200 ohms ± 5%%	1
R24	54PA-71F	RESISTOR, 2.5 ohms 1%	1

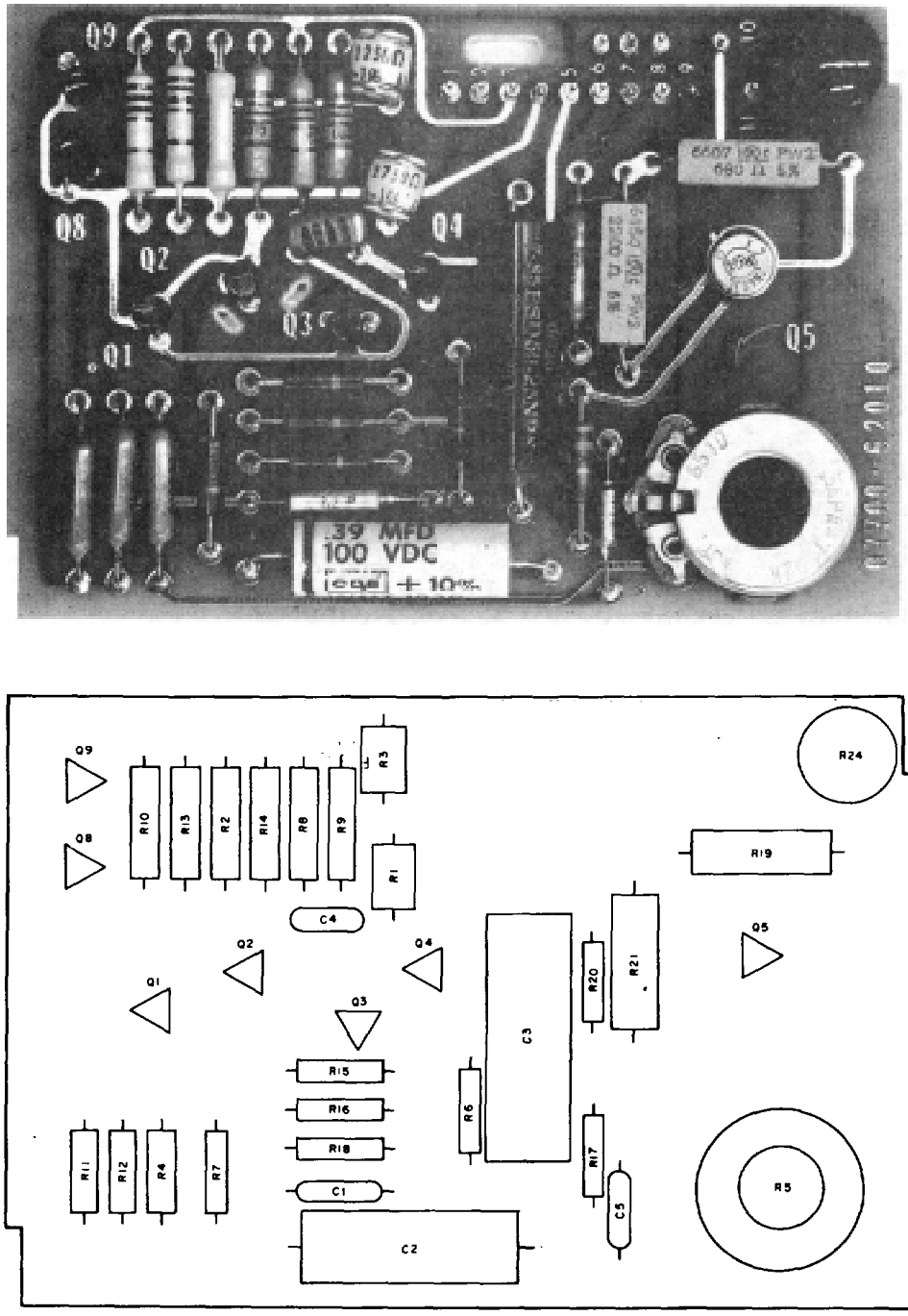


Figure 4 . Printed Circuit Board Assembly (07700 - 62010)

Listing for Figure 5

REF.	STOCK NO.	DESCRIPTION	QTY.
1	07702-00130	SHIELD, Compartment	1
2	12C-7	CLAMP, Cable	1
3	74B-6L	WASHER, Flat, no. 6	1
4	40T-8	NUT, Kep, no. 8-32	1
5	NY-06	GROMMET, Nylon	1
6	47A-12	RIVET, 3/16 in,	8
7	No Number	NUT, Hex, P/O item 10	2
8	No Number	WASHER, P/O item 10	4
9	07702-60090	CONNECTOR BRACKET ASSEMBLY	1
10	10G2-22FX	JACK, Miniature (514, J15)	2
11	07702-60200	CABLE, Input connector	1
12	10G3-34MX	CONNECTOR, 3-pin, Male (J1, J2)	2
13	No Number	NUT, Hex, P/O item 16	2
14	No Number	WASHER, P/O item 15	4
15	10G16-1FX	CONNECTOR, Preamplifier (J11, J12)	2
16	10B9-5FX	CONNECTOR, Hex, female, 9 pin (J21, J22)	2
17	10R14-1C	CLAMP	1
18	No Number	BOLT, U, P/O item 17	1
19	No Number	SPACER, P/O item 17	2
20	No Number	CLAMP BAR, P/O item 17	1
21	No Number	NUT, Hex, P/O item 17	2
22	No Number	NUT, Cap, P/O item 17	2
23	10R14-1E	HOOD	1
24	10R14-1B	SPRING, Lock	2
25	10R14-1D	BLOCK	1
26	10R1-2B	GUIDE SOCKET, Female	1
27	10R1-4MW	PIN, Contact, 1/16 in	13
28	10R1-2A	GUIDE PIN, Male	1
29	No Number	LOCKWASHER, P/O items 26 and 28	2
30	No Number	NUT, Hex, P/O items 26 and 28	2
31	83D-8-6V	SCREW, Hex, hd, no. 8-32 x 3/8 in. Lg	6
32	83D-6-6V	SCREW, Hex, hd, no. 6-32 x 3/8 in. Lg	11
33	07702-60220	RACK SLIDE AND LOCK ASSEMBLY	Ref
34	07702-00122	PLATE, Right side	Ref

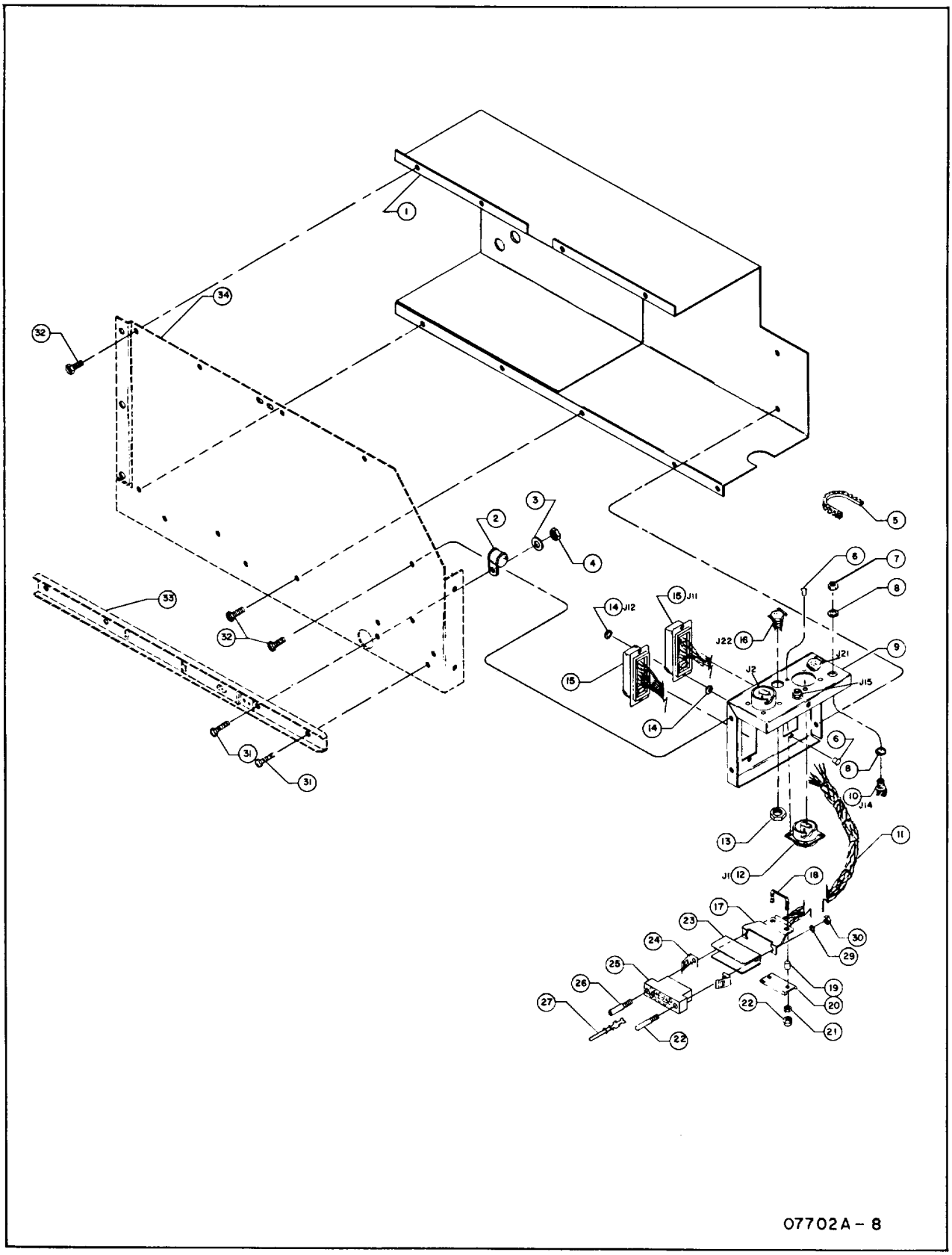


Figure 5. Amplifier Housing Assembly

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 6	
1	80A-440-4B	SCREW, Machine, bind hd, no.4-40 x 1/4 in. lg.	5
2	613-100-C8	PIG TAIL, Stylus mtg. Adaptor	2
3	85B-172-4C	SCREW, Adj. stylus pressure	1
4	613-100-Cll	STYLUS, MOUNTING ADAPTOR ASSY	1
5	398	WRITING ARM	2
6	85B-4-3C	SCREW, Stylus hold down	1
7	81D-832-22	SCREW, Set, no. 8-32 x 1/8 in. lg	1
8	613-100-C2	BASE ASSEMBLY, Stylus mtg. Adaptor	1
9	626-119	SLEEVE, Split	1
10	158-1000-C10	BOARD ASSEMBLY, Lead marker	1
11	83A-4-7B	SCREW, Sems, no. 4-40 x 7/16 in. lg	1
12	83A-4-5B	SCREW, Sems, no. 4-40 x 5/16 in. lg	7
13	411-10	MARKER ARM	1
14	83A-2-3B	SCREW, Sems, no. 2-56 x 3/16 in. lg	2
15	158-1023	CLAMP, Marker	1
16	613-106-P1	STOP, Stylus, R.H	2
17	608-101-P1	COIL AND STYLUS HOLDER	1
18	158-1022	SHOE, Clamp	1
19	608-107	BRACKET	1
20	608- 103	BRIDGE	1
21	608- 102	SUPPORT LEAD MARKER	2
22	80A-632-8D	SCREW, Flat hd, no. 6-32 x 1/2 in. lg	1
23	608-108	BODY LEAD MARKER	1
24	81D-10-8	SCREW, Set, nylon, no. 10-32 x 1/2 in. lg	1
25	158-1033	BLOCK	1
26	462-189	MARKER ASSEMBLY, Complete "Kit"	1
27	825-2-P4	ROD STYLUS	1
28	320-177	HINGE, Male	1
29	824-2	SPRING, Table latch	1
30	320-119	HINGE, Female	1
31	608E	GALVANOMETER ASSEMBLY, With marker minus stylus	1
32	320-110	PLATE, Mounting, galvanometer	1
33	81A-1032F	SCREW, Set, slotted, no. 10-32 x 5/8 in. lg	2
34	40M- 10	NUT, Hex	2
35	73A-1/4	LOCKWASHER, Interlocking, 1/4 in	4
36	80D-1/420-10V	SCREWN Hex hd, 1/4-20 x 5/8 in. lg	4
37	158-1007	COVER, Shunt	2
38	158-1000-C1	SHUNT ADJUSTMENT ASSEMBLY	2
39	151-2-1001	MAGNET	1
40	83A-4-14B	SCREW, Sems, no. 4-40 x 7/8 in. lg	4
41	158-1005	BLOCK, Shunt	2
42	158-1004	BLOCK, Step, shunt	4
43	DELETED		
44	606B	GALVANOMETER COIL HOUSING AND CAP ASSEMBLY	2
45	83A-2-2B	SCREW, Sems, no. 2-56 x 1/8 in. lg	6
46	607B	GALVANOMETER ASSEMBLY, Minus stylus	1
47	613-106-P2	STOP, Stylus, L.H	2

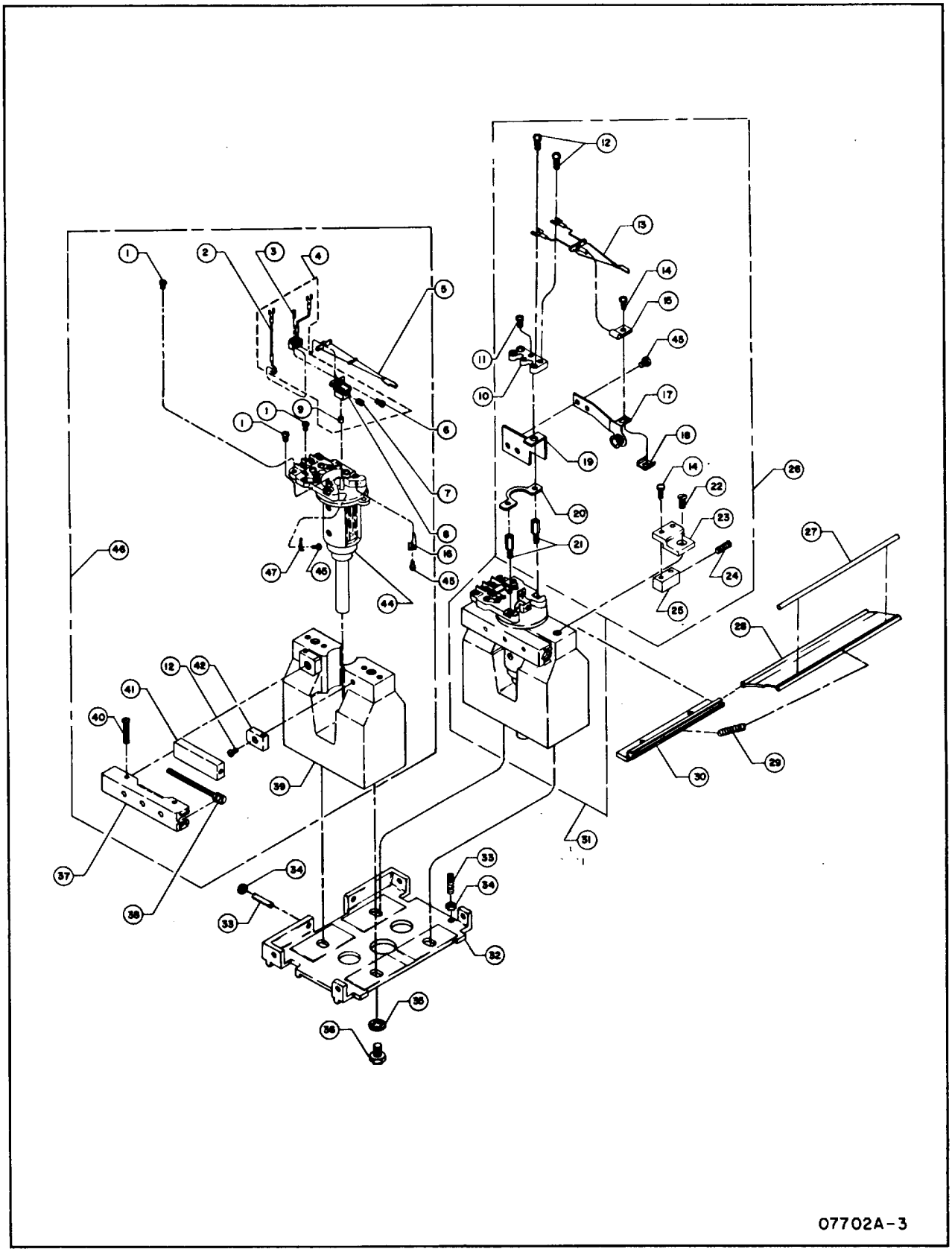


Figure 6. Galvanometer Assembly Complete (320 - 200 - C10)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 7	
1	07702-63010	SPINDLE ASSEMBLY - Consisting of:	1
	824-77	•SPRING	1
	07702-03050	•BEARING	1
	07702-03060	•BUTTON, Release	1
	44J-4-28	•ROLL PIN	1
	07702-03041	•SPINDLE	1
2	83D-10-8B	SCREW, Sems, no. 10-32 x 1/2 in. lg	4
3	0510-0173	SPEED NUT	1
4	56A-145	POTENTIOMETER, 200 ohm (R4, R5)	2
5	56M-5	NUT, Potentiometer	2
6	73A-3/8"	LOCKWASHER	2
7	169-135 P1	BUSHING, Standoff	2
8	56R-4	POTENTIOMETER, 0.5 ohm (R, R3)	2
9	73A- 1/4"'	LOCKWASHER	2
10	07702-60060	FRONT PANEL ASSEMBLY	1
11	No Number	WASHER, P/O item 8	2
12	No Number	NUT, Hex, P/O item 8	2
13	0370-0151	KNOB	2
14	169-134	BUSHING	2
15	1450-0048	PILOT LIGHT, Red (II)	1
16	07702-23010	HOUSING, Paper take-up, left, (half of matched pair)	1
17	83A-4-6B	SCREW, Sems, no. 4-40 x 3/8 in. lg	5
18	07702-60230	FRONT DOOR ASSEMBLY	1
19	40T-4	NUT, Keps, no. 4-40	2
20	40T-10	NUT, Keps, no. 10-32	1
21	59A-11	RING, Retaining	2
22	07702-03070	SHAFT	1
23	358-122	DISC	2
24	158-613	PULLEY	1
25	158-614	DISC, Friction, cork	2
26	824-8	SPRING	1
27	81D-10-8	SET SCREW, Nylock	1
28	83A-10-12B	SCREW, Sems, no. 10-32 x 3/4 in. lg	1
29	22B-4	BUTTON, Plug	2
30	No Number	HOUSING, Paper take-up left (half of matched pair - see item 16 for part no.)	Ref
31	3110-0021	HINGE	1
32	07702-23030	HOUSING, Paper take-up, right	1
33	07702-00300	FRAME, Door P/O item 18	1
34	07702-00030	GLASS, Window P/O item 18	1
35	07702-00500	HANDLE, P/O item 18	1
36	75A-74	CATCH, Bullet, P/O item 18	2
37	80A-4-5C	SCREW, Fillister hd, no. 4-40 x 5/16 in. lg P/O item 18	2
38	5A-8	BEARING	1
39	5A-43	BEARING	2

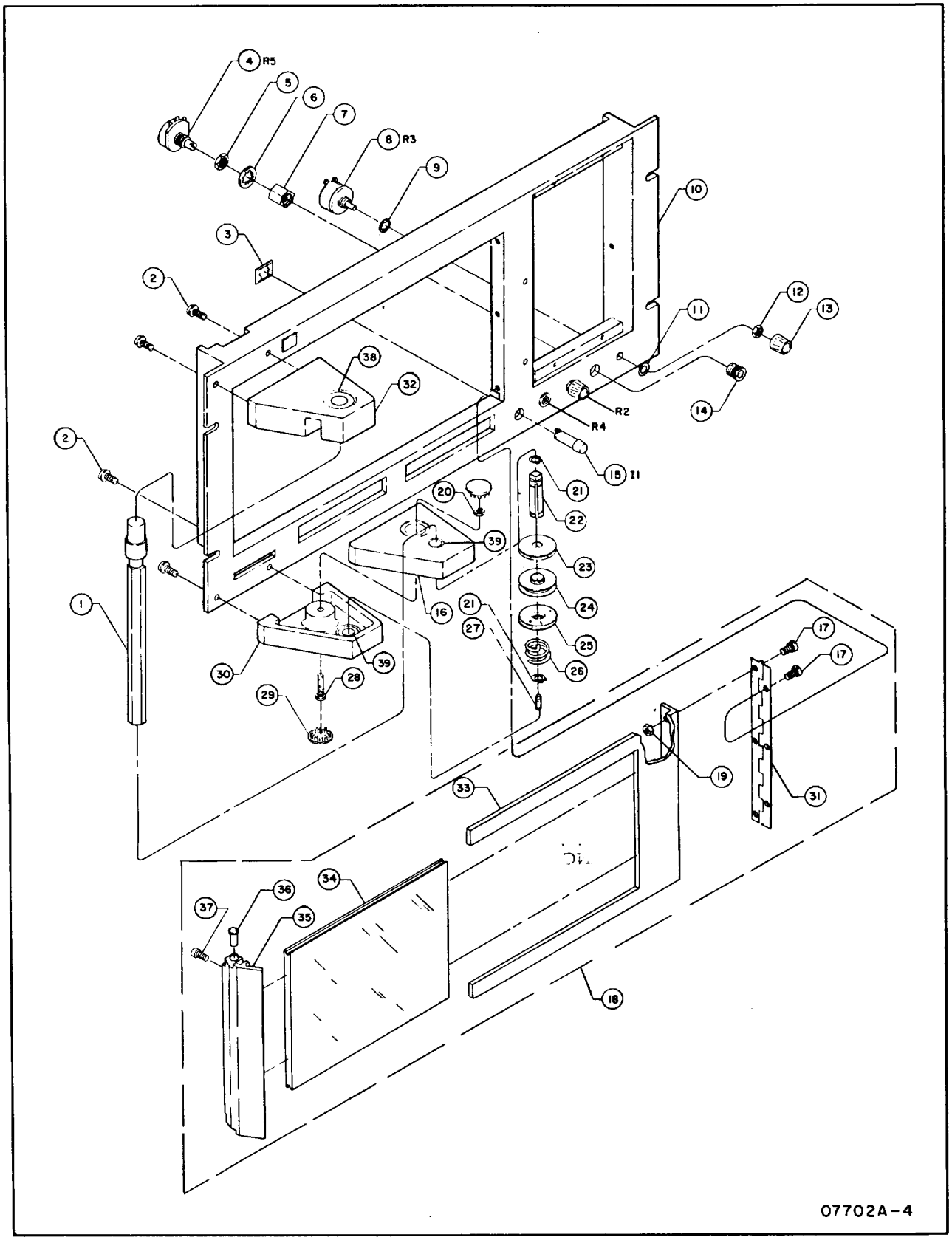


Figure 7. Front Panel, Door and Paper Take-up Assembly (07702-60220)

Listing for Figure 8

REF.	STOCK NO.	DESCRIPTION	QTY.
1	5000-0289	LABEL, Stick-on (stop)	1
2	5000-0307	LABEL, Stick-on (1)	1
3	5000-0309	LABEL, Stick-on (5)	1
4	5000-0385	LABEL, Stick-on (20)	1
5	5000-0313	LABEL, Stick-on (100	1
6	5000-3245	LABEL, Stick-on (min)	1
7	5000-3246	LABEL, Stick-on (sec)	1
8	5000-3247	LABEL, Stick-on (timer)	1
9	5000-0317	LABEL, Stick-on (mark)	1
10	5000-3299	LABEL, Stick-on (PWR on/off)	1
11	83A-6-5B	SCREW, Sems, no. 6-32 x 5/16 in. lg	2
12	07702-00200	BRACKET, Angle	2
13	8E-6	CAPACITOR, 0.01 mfd (C2 through C8)	7
14	320-142	CLAMP, Cam and switch	3
15	3101-1001	PUSH SWITCH, 10 button (SI)	1
16	01253-00101	BUTTON, Gray, no tabs	10

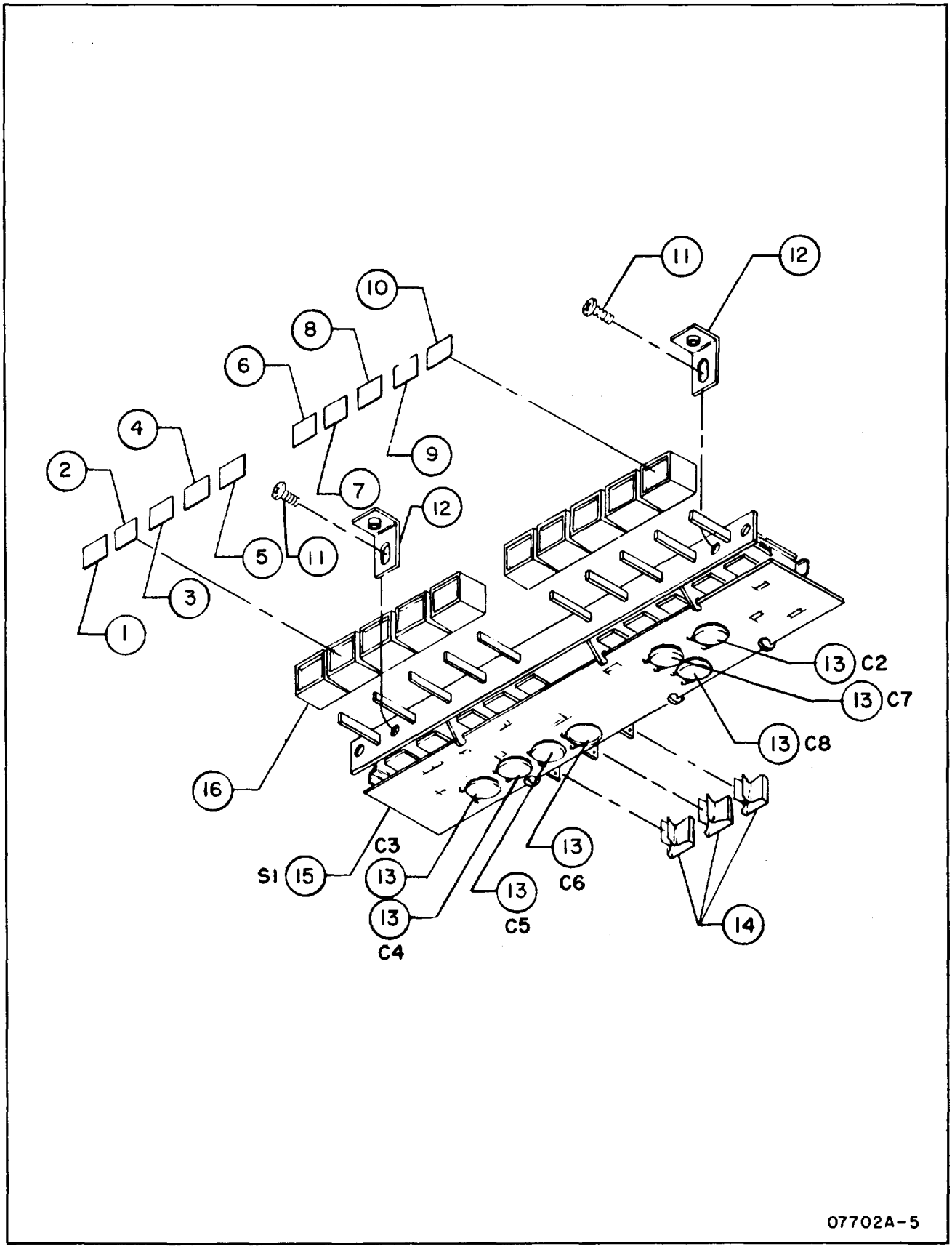


Figure 8. Ten-Button Push Switch (3101 - 1001)

REF.	STOCK NO.	DESCRIPTION	QTY.
1	83A-6-20B	SCREW, Sems, no. 6-32 x 1 1/4 in. lg	4
2	64S-6	BARRIER STRIP, 17 terminal	2
3	700-8058-6	SPACER	2
4	40T-10	NUT, Kep, no. 10-32	3
5	80A-1032-8D	SCREW, Flat hd, no. 10-32 x 1/2 in. lg	1
6	838-7	SHOULDER SCREW	10
7	83A-10-6B	SCREW, Sems, no. 10-32 x 3/8 in. lg	3
8	80A-832-5B	SCREW, Flat hd, no. 8-32 x 5/16 in. lg	1
9	83A-8-5B	SCREW, Sems, no. 8-32 x 5/16 in. lg	3
10	320-125	RETAINER, Bearing	2
11	59A-12	RING, Retaining	2
12	824-32	SPRING, Pressure roll	2
13	320R-1411	SPACER, Sideplate	1
14	320-168	SPACER, Sideplate	2
15	320-147	SUPPORT, Spindle right	1
16	320-122	ROLL, Pressure	1
17	5A-28	FLANGE, Bearing	2
18	No Number	TABLE DRIVE ROLL AND BRAKE ASSEMBLY (See fig. 11)	1
19	320-100-C22	PAPER SPINDLE ASSEMBLY	1
20	154-100-C3	PAPER SPOOL HUB AND DISC ASSEMBLY	1
21	320-148	SUPPORT, Spindle, left	1
22	358-140	SPRING, Paper spindle	1
23	83A-10-8B	SCREW, Sems, no. 10-32 x 1/2 in. lg	2
24	74A-8L	WASHER, Flat	2
25	320-200C5	LEFT SIDE PLATE ASSEMBLY	1
26	83A-6-8B	SCREW, Sems, no. 6-32 x 1/2 in. lg	1
27	40T-4	NUT, Kep, no. 4-40	2
28	64B-5	TERMINAL BLOCK, Three terminal	1
29	83A-4-8B	SCREW, Sems, no. 4-40 x 1/2 in. lg	2
30	154-108	STOP, Table	2
31	74A-14S	WASHER, Flat	1
32	710A-9	WASHER, Shim	3
33	80N-632-2B	SCREW, Nylon, bd hd, no. 6-32 x 1/8 in. lg	1
34	320-100-C23	LOCK TABLE AND STRIKER ASSEMBLY	1
35	838-8	SHOULDER SCREW	1
36	158-118	SPRING, Table lock	1
37	74A-6L	WASHER, Flat	1
38	40M-6	NUT, Hex, no. 6-32	1
39	320R-1412	SPACER, Sideplate	3
40	83A-8-10OB	SCREW, Sems, no. 8-32 x 5/8 in. lg	2
41	07702-60100	CLUTCH ACTUATOR ASSEMBLY (See fig. 12)	1
42	83A-8-12B	SCREW, Sems, no. 8-32 x 3/4 in. lg	2
43	801-118	BRACKET, Panel mounting	1
44	8B-117	CAPACITOR, 2. 5 mfd (C1)	1
45	No Number	CLAMP, Capacitor, P/O item 44	1
46	83A-10-6B	SCREW, Sems, no. 10-32 x 3/8 in. lg	2
47	320-200C6	RIGHT SIDE PLATE ASSEMBLY	1
48	5G-30	GEAR, 48 tooth	1
49	81D-8-32	SETSCREW, Spline, no. 8-32 x 3/16 in. lg	2
50	07702-00020	PAPER GUIDE	1
51	83A-8-12B	SCREW, Sems, no. 8-32 x 3/4 in. lg	2
52	320-100-C28	GUIDE ASSEMBLY	1

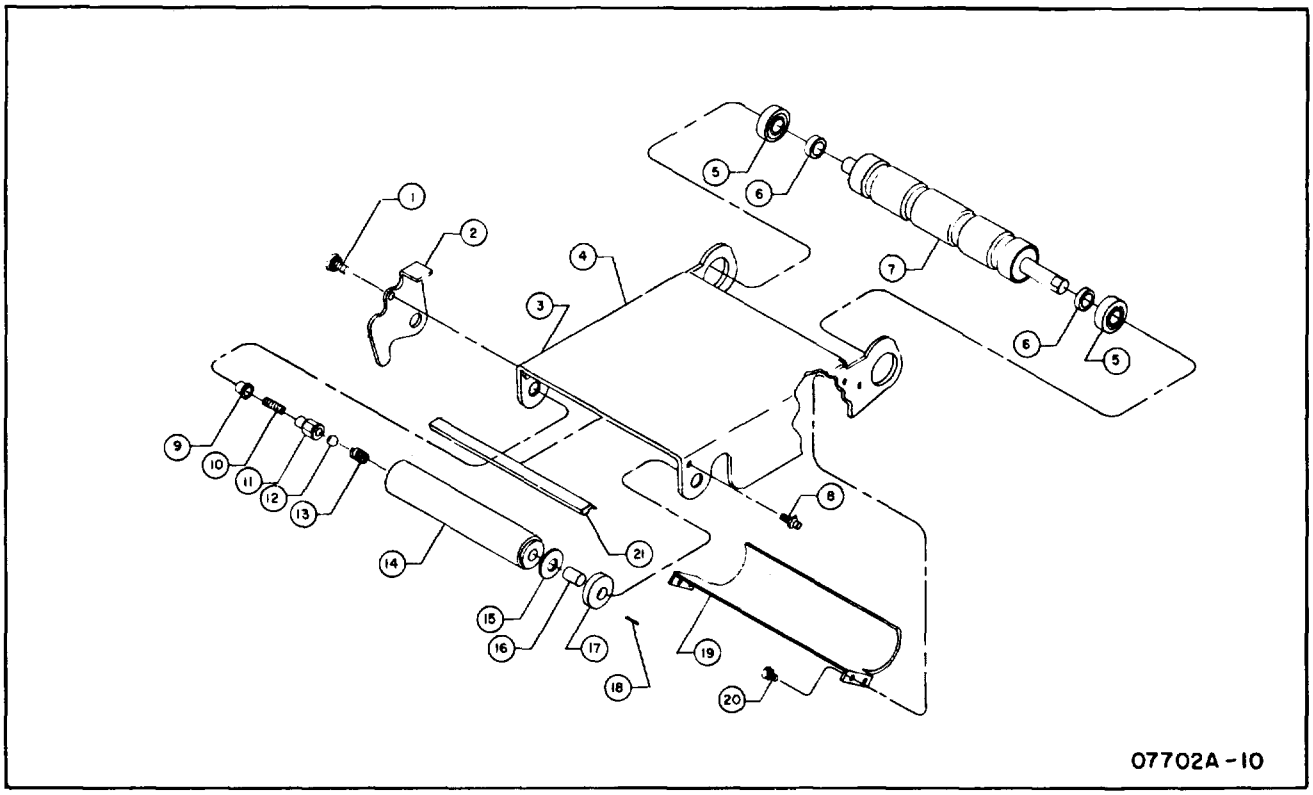


Figure 11. Table, Drive Roll and Broke Assembly

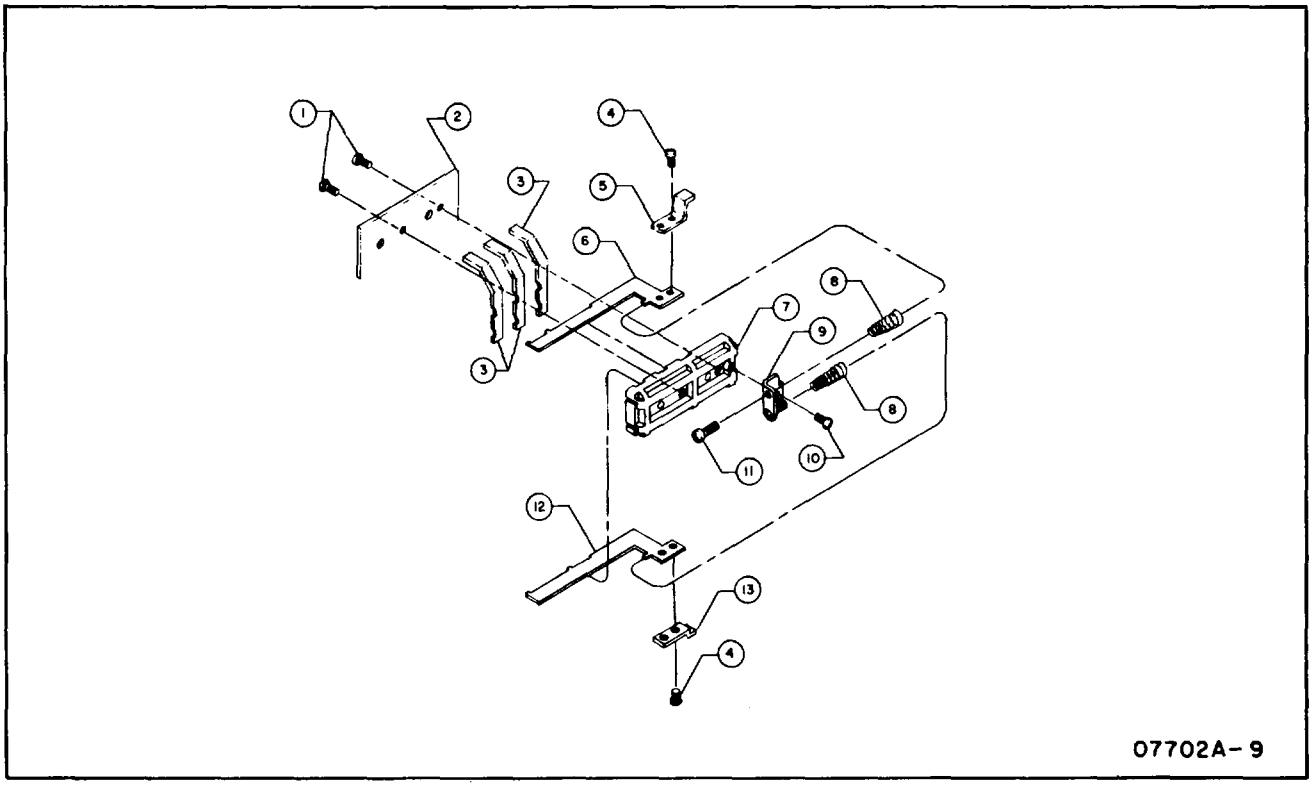


Figure 12. Clutch Actuator Assembly (07702 - 60100)

Listing for Figure 13

REF.	STOCK NO.	DESCRIPTION	QTY.
1	7700-02A	DRIVER AMPLIFIER	Ref
2	07702-60040	POWER INPUT PLATE ASSEMBLY	Ref
3	26B-27	FUSE, Slo blo, 1. 5A, 115V (F1)	1
		FUSE, Slo blo, 0.8A, 230V (F1)	1
4	No Number	TOP, Fuse holder, P/O item 7	4
5	No Number	WASHER, P/O item 7	4
6	No Number	NUT, P/O item 7	4
7	26H-2	HOLDER, Fuse	4
8	62D-47	SWITCH, Slide (S3)	1
9	10A5-IFX	CONNECTOR, Female, 5-pin (J13)	1
10	62D-54	SWITCH, Slide (S2)	1
11	10G3-38MX	CONNECTOR, Power (J9)	1
12	07702-00220	PLATE, Connector mounting	1
13	47E16	RIVET	8
14	47E10	RIVET	4
15	07702-40010	COVER, Protective	1
16	83A-4-4B	SCREW, Sems, no. 4-40 x 1/4 in. lg	2
17	26B-4	FUSE, Slo blo, 0. S5A (F2 and F3)	2
18	86D-6-8B	SCREW, Steel, self-tapping, no. 6	10
19	16T-68	TRANSISTOR, Type 2N301 (QI thru Q5)	5
20	74T-5	WASHER, Anodized	5
21	83A-6-5B	SCREW, Sems, no. 6-32 x 5/16 in. lg	6
22	868-500A-C6	REGULATOR CARD AND BRACKET ASSEMBLY (See fig. 15)	1
23	66B-102MS	TRANSFORMER, Output (T3)	1
24	26B-32	FUSE, Slo blo, 0. 25A (F4)	1
25	07702-60170	CHASSIS ASSEMBLY, Inseparable	1
26	66B-115MS	TRANSFORMER, Stylus heat (T2)	1
27	14002S	TIMER ASSEMBLY, 1/sec, 60 Hz (See fig. 19)	Ref
	14002T	TIMER ASSEMBLY, I/sec, 50 Hz (Option 08 only) (See fig. 19)	Ref
28	83A-6-6B	SCREW, Sems, no. 6-32 x 3/8 in. lg	2
29	74A-5S	WASHER	2
30	10G2-25FX	CONNECTOR, Female, 2-pin (J10)	1
31	66B-199	TRANSFORMER, Power (T)	1
32	10B10-lFX	CONNECTOR, Female, 10-contact (J6, 7, 8)	3
33	74F-4C	WASHER, Fibre	6
34	83A-4-8B	SCREW, Sems, no. 4-40 x 1/2 in. lg	6
35	14002R	TIMER ASSEMBLY 1/min., 60 Hz (See fig. 19) (Option 13 only)	Ref
	14002V	TIMER ASSEMBLY I/min., 60 Hz (See fig. 19) (Option 14 only)	Ref
36	8E6	CAPACITOR (C12), 0.01 mfd	1
37	868-500A-C13	OSCILLATOR ASSEMBLY, 2400 Hz (See fig. 17)	1
38	868-500A-C14	OSCILLATOR ASSEMBLY, 440 Hz (See fig. 18)	1
39	83A-6-6B	SCREW, Sems, no. 6-32 x 3/8 in. lg (Options 13 and 14 only)	2

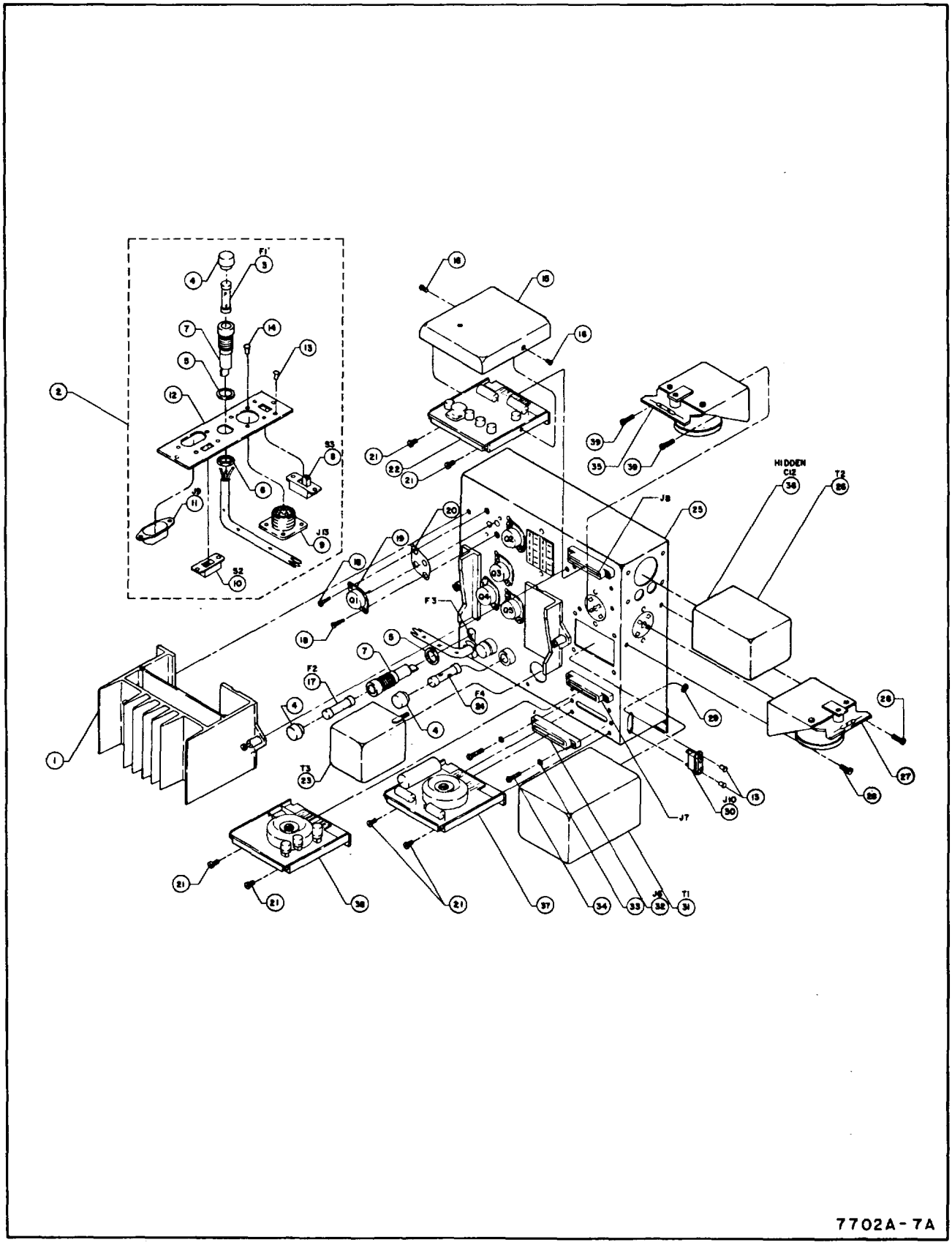


Figure 13. Power Supply Assembly, Top View (07702-60030)

Listing for Figure 14

REF.	STOCK NO.	DESCRIPTION	QTY.
1	47A-9	RIVET, 1/8 in.	14
2	40T-6	NUT, Kep, no. 6-32	10
3	10B4-6FX	SOCKET, Female, 4-pin (J16 and J17)	2
4	83A-4-6B	SCREW, Sems, no. 4-40 x 3/8 in. lg	2
5	10E20-1FX	SOCKET, Elco, 20-pin (J4 and J5)	2
6	8C-90	CAPACITOR, 2000 mfd (C13 thru C16)	4
7	10T3- 1FX	SOCKET	5
8	47A-12	RIVET, 3/16 in.	10
9	83A-6-8B	SCREW, Sems, no. 6-32 x 1/z in. lg	4
10	12A-28	CLAMP	4
11	10R1-2B	GUIDE, Female socket	1
12	10RI-2A	GUIDE, Male pin	1
13	10R14-IF	BLOCK, Connector (J3)	1
14	10R14-IA	SPRING CATCH, Connector block	2
15	07702-6050	CABLE ASSEMBLY, Barrier	1
16	07702-60160	CABLE ASSEMBLY, Internal	1
17	07702-60070	DIODE BOARD ASSEMBLY (See fig. 16)	1
18	No Number	NUT, Hex, P/O item 7	1
19	No Number	NUT, Hex, P/O items 11 and 12	2
20	40T-4	NUT, Kep, no. 4-40	4
21	16A-39	RECTIFIER (CR9)	1

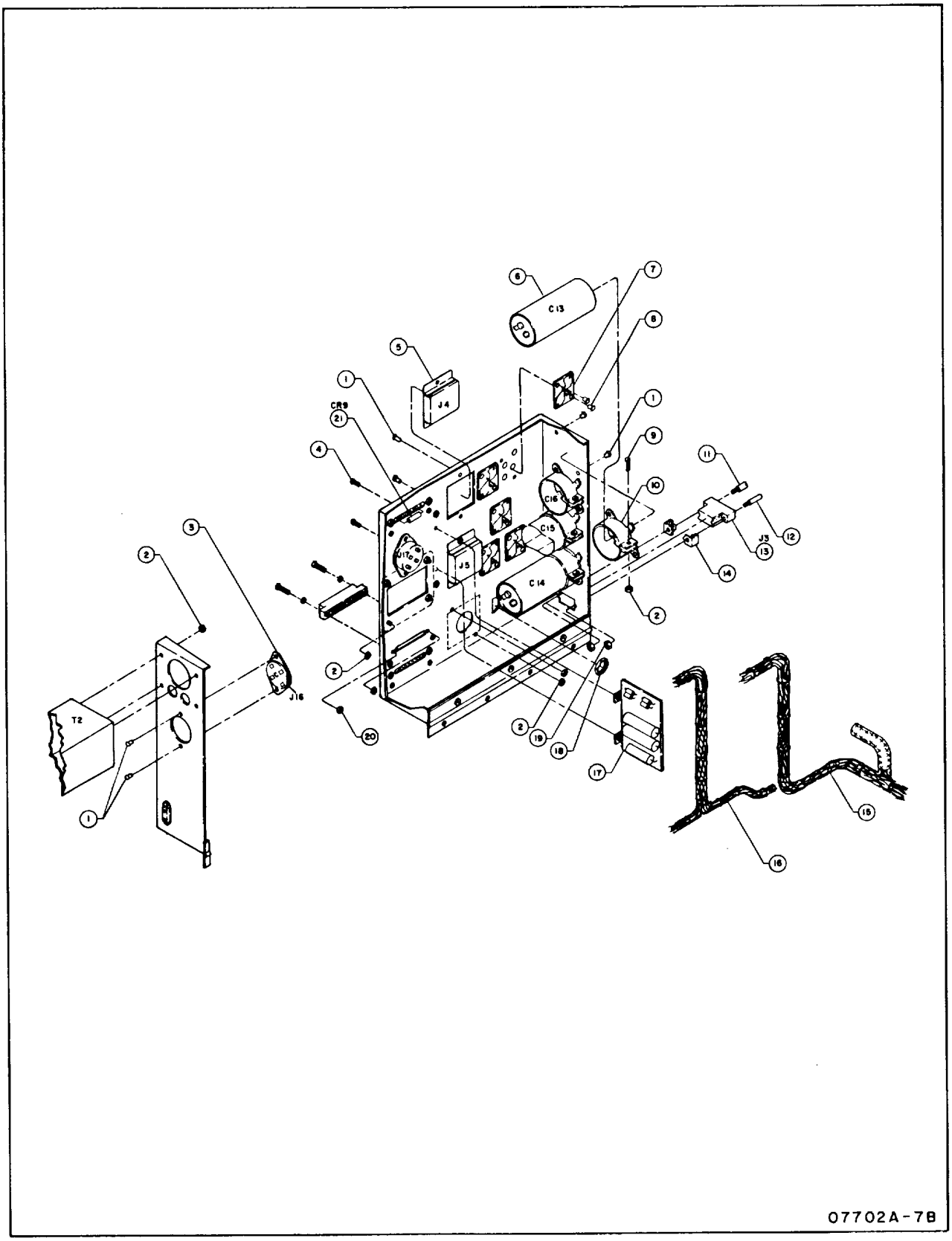
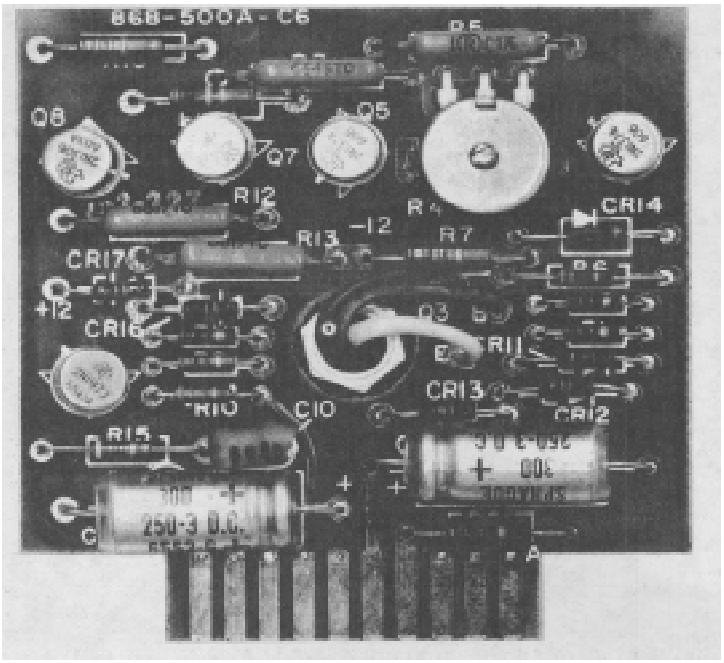


Figure 14. Power Supply Assembly, Bottom View (07702-60030)

Listing for Figure 15

REF.	STOCK NO.	DESCRIPTION	QTY.
C6	8C-60	CAPACITOR, 250 mfd	1
C9	8C-60	CAPACITOR, 250 mfd	1
C10	8E-8	CAPACITOR, 100 pf	1
CR11	16A-45A	DIODE	1
CR12	16A-45A	DIODE	1
CR13	16A-45A	DIODE	1
CR14	16A-62	DIODE	1
CR16	16A-45A	DIODE	1
CR17	16A-45A	DIODE	1
Q3	16T-38	TRANSISTOR, ZN2552	1
Q4	16T-31	TRANSISTOR, 2N1374	1
Q5	16T-31	TRANSISTOR, 2N1374	1
Q6	16T-47	TRANSISTOR, 2N1973	1
Q7	16T-33	TRANSISTOR, 2N1306	1
Q8	16T-33	TRANSISTOR, 2N1306	1
R1	50B-10ZJ	RESISTOR, 1K ± 5%	1
R2	50B-102J	RESISTOR, 1K ± 5%	1
R3	50E-102F	RESISTOR, 1K ± 1%	1
R4	56PA-20	POTENTIOMETER, 500 ohms	1
R5	50E-102F	RESISTOR, 1K ± 1%	1
R6	50B-332J	RESISTOR, 3300 ohms ± 5%	1
R7	50AB- 102J	RESISTOR, 1K ± 5%	1
R8	50AB-102J	RESISTOR, 1K ± 5%	1
R9	50B-102J	RESISTOR, 1K ± 5%o	1
R10	50B-681J	RESISTOR, 680 ohms ± 5%	1
R11	50B-102J	RESISTOR, IK ± 5%	1
R12	50E-501F	RESISTOR, 500 ohms ± 1%	1
R13	50E-501F	RESISTOR, 500 ohms ± 1%	1
R14	50AB-103J	RESISTOR, 10K ± 5%	1
R15	50B-472J	RESISTOR, 4700 ohms ± 5%	1
R16	50AB-271J	RESISTOR, 270 ohms ± 5%	1



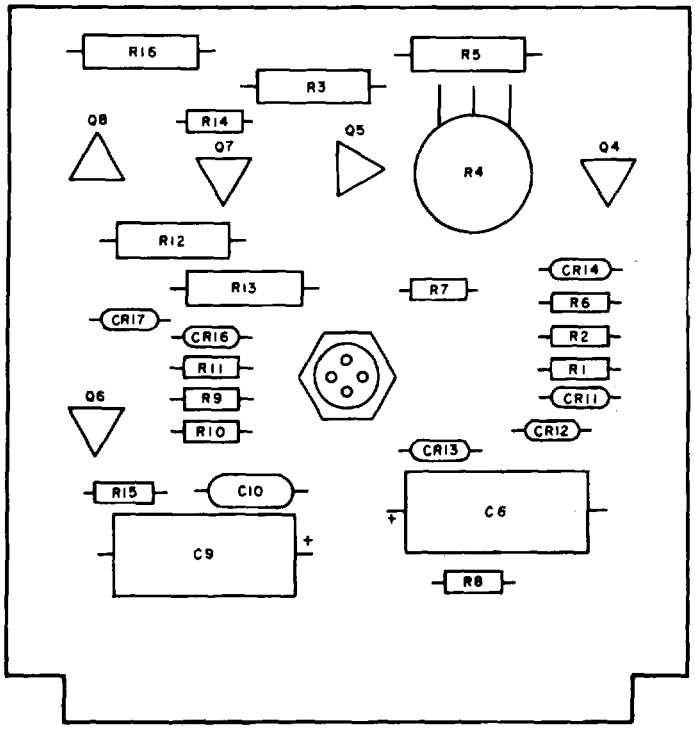
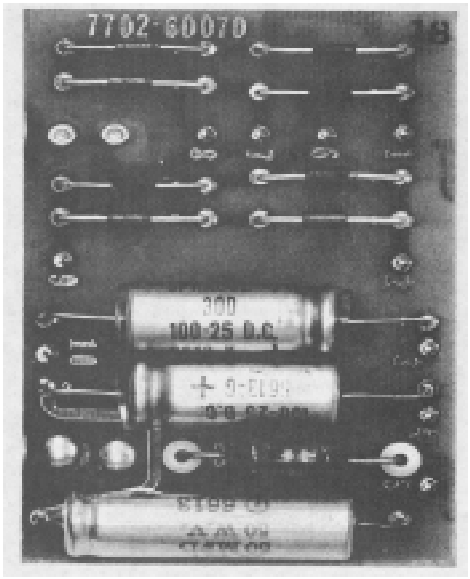


Figure 15. Regulator Card and Bracket Assembly (868. 500A-C6)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 16	
C9	8C-54	CAPACITOR, 50 mfd	1
C10	8C-40	CAPACITOR, 10Q mfd	1
C11	8C-40	CAPACITOR, 100 mfd	1
CR1	16A-39	RECTIFIER	1
CRZ	16A-39	RECTIFIER	1
CR3	16A-39	RECTIFIER	1
CR4	16A-39	RECTIFIER	1
CR5	16A-39	RECTIFIER	1
CR6	16A-39	RECTIFIER	1
CR7	16A-39	RECTIFIER	1
CR8	16A-39	RECTIFIER	1
R1	53B-100J	RESISTOR, 10 ohm, 3W	1



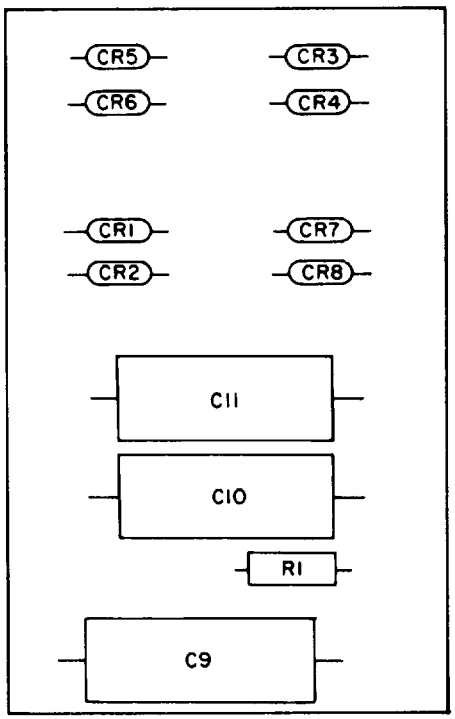
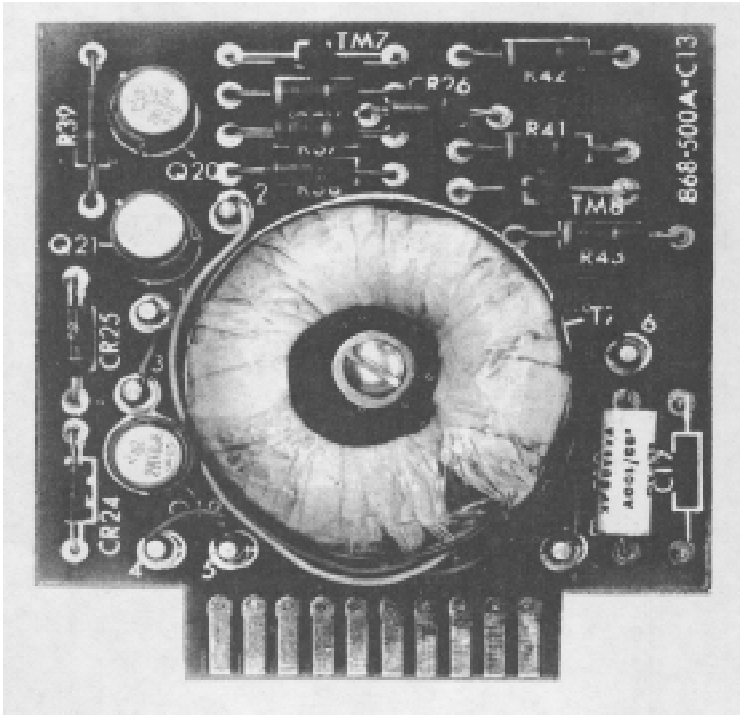


Figure 16. Diode Board Assembly (07702 - 60070)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 17	
C18	8B-130	CAPACITOR, 0.33 mfd	1
C19	8B-120	CAPACITOR, 0.022 mfd	1
CR24	16A-17	DIODE	1
CR25	16A-39	DIODE	1
CR26	16A-39	DIODE	1
Q19	16T-25	TRANSISTOR, 2N1038	1
Q20	16T-31	TRANSISTOR, 2N1374	1
Q021	16T-31	TRANSISTOR, 2N1374	1
R37	50AB-682J	RESISTOR, 6800 ohms ± 5%	1
R38	50AB-100J	RESISTOR, 10 ohms ± 5%	1
R39	50AB-682J	RESISTOR, 6800 ohms ± 5%	1
R40	50AB-471J	RESISTOR, 470 ohms ± 5%	1
R43	50AB-471J	RESISTOR, 470 ohms ± 5%	1
T7	66B-218	TRANSFORMER, Toroidal oscillator, 2400 Hz	1
TM7	56T-3	THERMISTOR	1
TM8	56T-3	THERMISTOR	1



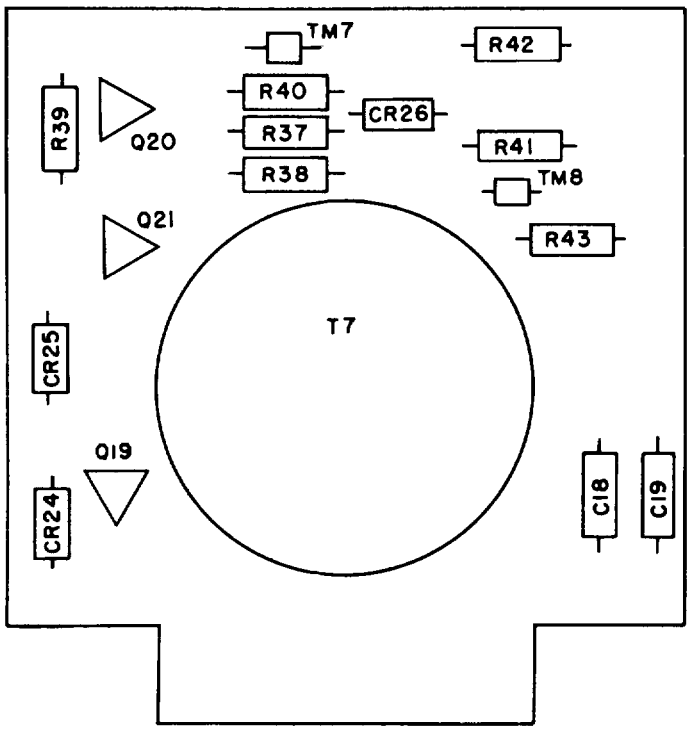
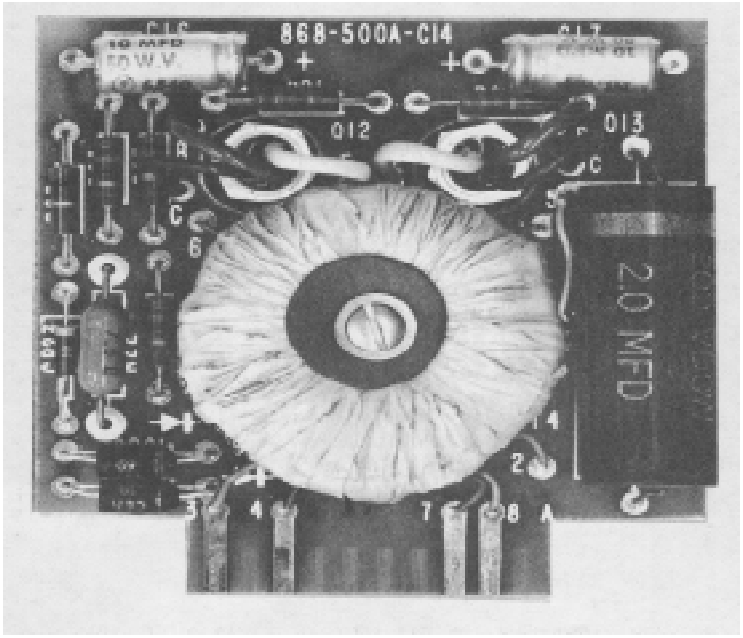


Figure 17. Oscillator Cord Assembly, 2400 Hz (868-500AC13)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 18	
C15	8B-42A	CAPACITOR, 2.0 mfd	1
C16	8C-68	CAPACITOR, 10 mfd	1
C17	8C-68	CAPACITOR, 10 mfd	1
CR21	16A-39	DIODE	1
CR22	16A-39	DIODE	1
CR23	16A-44	DIODE	1
Q12	16T-38	TRANSISTOR, 2N2552	1
Q13	16T-38	TRANSISTOR, 2N2552	1
R21	50AB-181J	RESISTOR, 180 ohms + 5%	1
RZ2	53B-7R5J	RESISTOR, 7.5 ohms + 5%	1
R23	50AB-182J	RESISTOR, 1. 8 K ohms - 5%	1
R24	50AB-182J	RESISTOR, 1.8 K ohms + 5%	1
R25	50B-181J	RESISTOR, 180 ohms + 5%.o	1
R26	50AB-182J	RESISTOR, 1. 8 K ohms + 5%	1
R27	50AB-102J	RESISTOR, I K ohms ± 5%	1
T4	66B-172	TRANSFORMER, Toroidal oscillator, 440 Hz	1



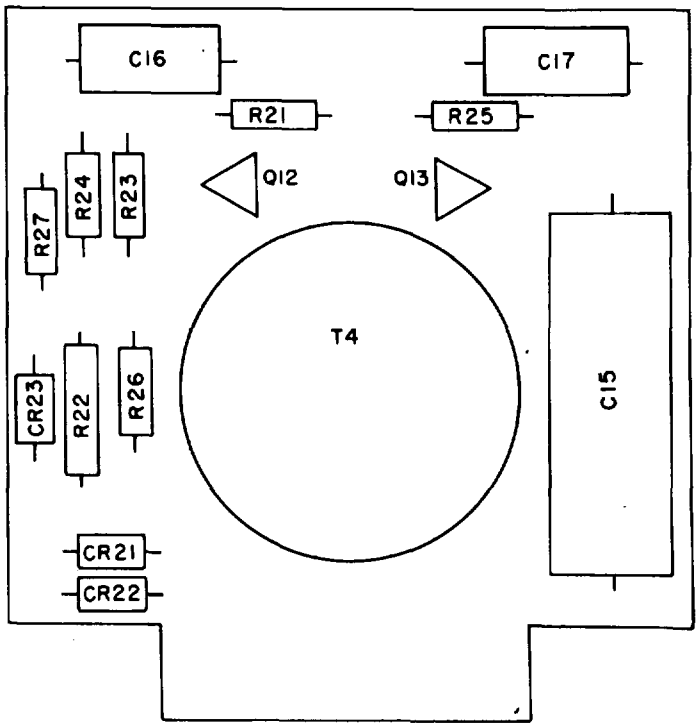


Figure 18. Oscillator Card Assembly, 440 Hz (868.500A.C14)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 19	
1	38B-21	MOTOR ASSEMBLY, 60 rpm, 60 Hz (Used on 14002S TIMER)	1
	38B-21A	MOTOR ASSEMBLY, 60 rpm, 50 Hz (Used on 14002T TIMER)	1
	38B-39	MOTOR ASSEMBLY, 1 rpm, 60 Hz (Used on 14002R TIMER)	1
	38B-39A	MOTOR ASSEMBLY, 1 rpm, 50 Hz (Used on 14002V TIMER)	1
2	07702-00190	BRACKET, Timer	1
3	1OB4-IMWA	PLUG, Male, 4-pin	1
4	S0AB-100J	RESISTOR, 10 ohms 1/2 watt (Used on 14002S and 14002T TIMER) (R7)	1
	50AB-I00J	RESISTOR, 10 ohms 1/2 watt (Used on 14002R and 14002V TIMER) (R8)	1
5	752-417	BOARD ASSEMBLY, Printed circuit	1
6	62V-1	SWITCH, Magnetic reed	1
7	14002-60010	SWITCH ACTUATOR ASSEMBLY	1
8	81D-6-2Z	SET SCREW, Bristol, no. 6 x 1/8 in. lg	1
9	83A-440-6B	SCREW, Sems, no. 4-40 x 3/8 in. lg	1
10	34E- I1	BUSHING, Standoff	1I
11	83A-6-5B	SCREW, no. 6-32 x 5/16 in. lg	1
12	40T-6	NUT, Kep, no. 6-32	1
		Listing for Figure 20	
1	38B-78	MOTOR, 60 Cycle (Used on 07702-60110)	1
	38B-78A	MOTOR, 50 Cycle (Used on 07702-60220)	1
2	40T-8	NUT, Kep, no. 8-32	3
3	72A-8A	WASHER, Flat	3
4	07702-00250	BRACKET	1
5	8B-231	CAPACITOR, 0.84 mfd (C-17) (Used on 07702-60110)	1
	0160-2555	CAPACITOR, 1.0 mfd (C-17) (Used on 07702-60220)	1
6	33A-6-6B	SCREW, Machine, oval hd, no. 6-32	2
7	40T-6	NUT, Kep, no. 6-32	2
8	5C-10	OVER-RUNNING CLUTCH	1
9	No Number	SET SCREW, P/O item 8	2
10	5S-28	SPROCKET	1
11	5B-68	DRIVE CHAIN	1
12	81D-832-1Z	SET SCREW	1
13	5S-8	SPROCKET	1
14	10G2-25MW	CONNECTOR AND CORD, A. C.	1
15	07702-20013	SHAFT, no. 2 (See fig. 10, item 23)	Ref

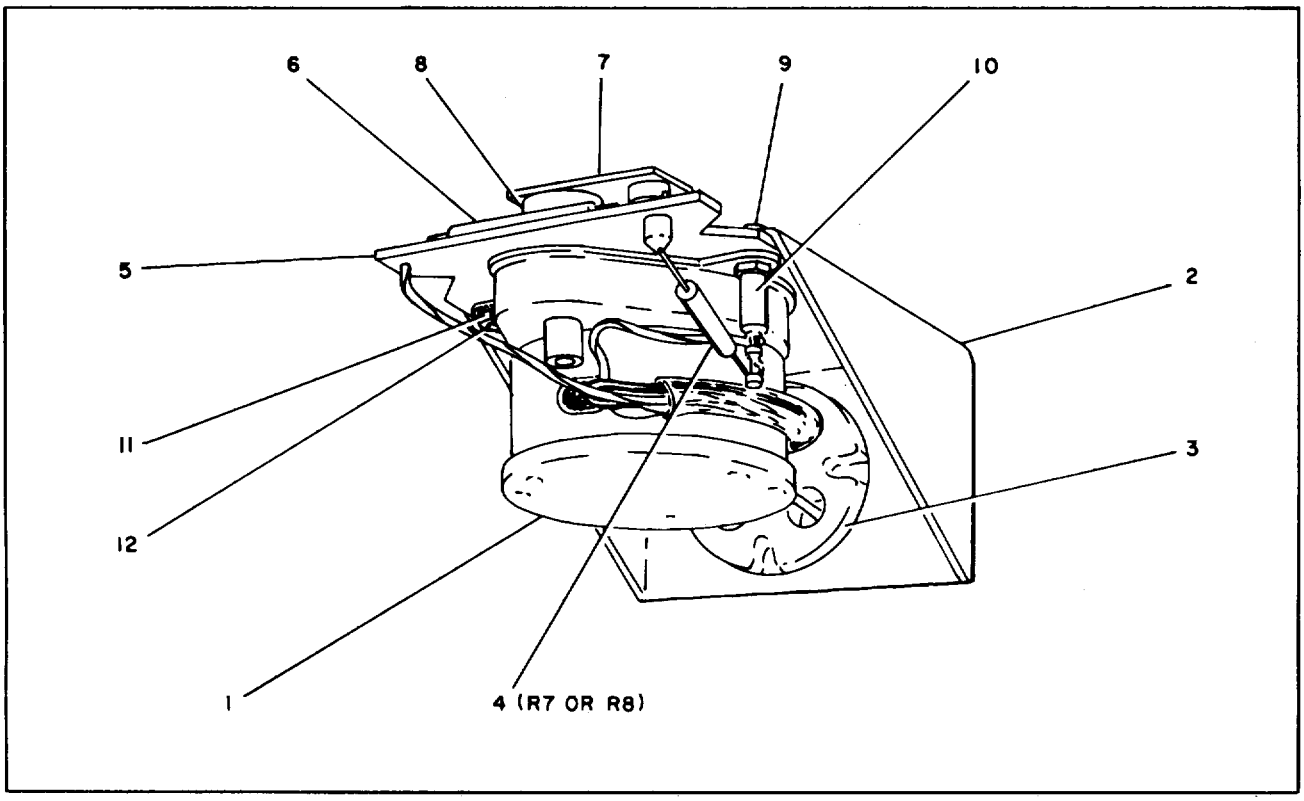


Figure 19. Timer Assembly (14002S - 14002T- 14002R - 14002V)

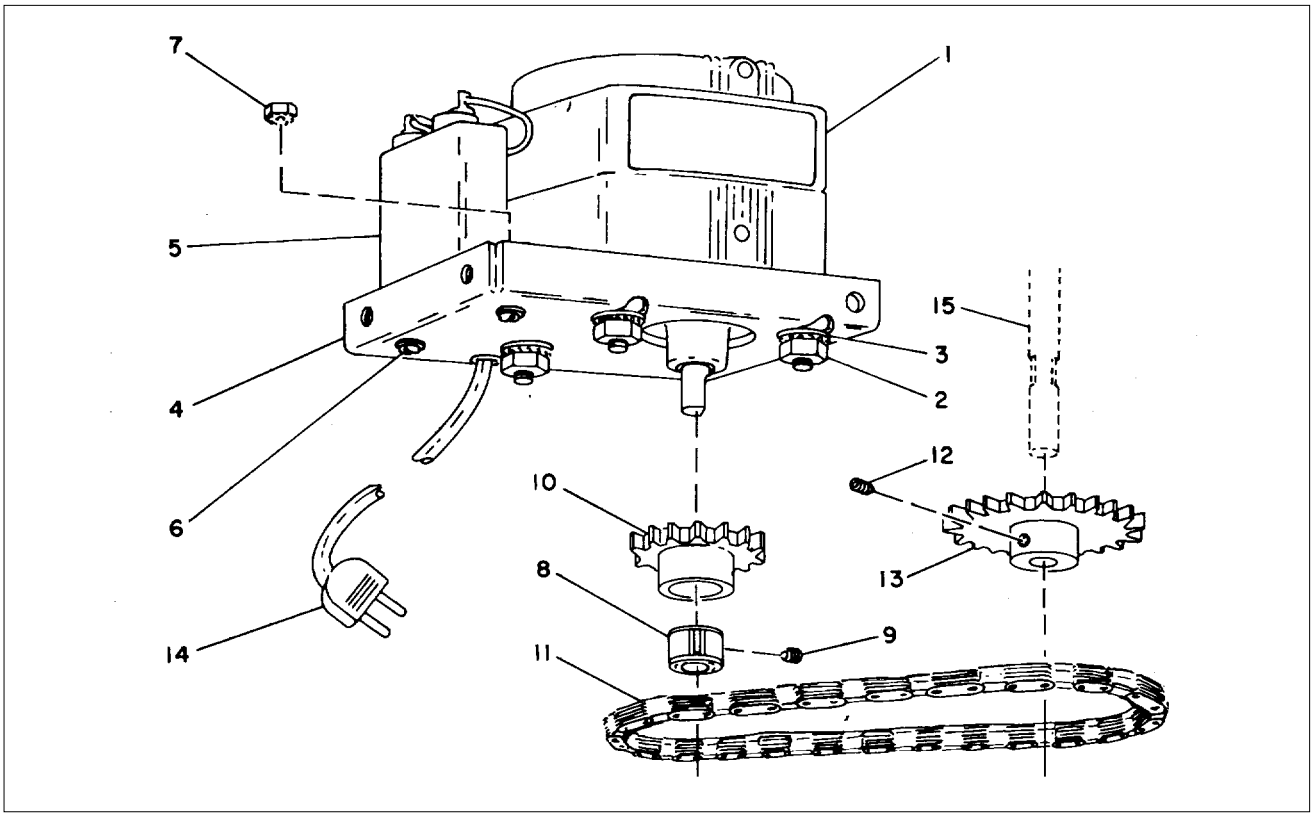


Figure 20. MM/Min. Drive Motor Kit - 60:1 (07702 - 60110) (07702 - 60220)

Listing for Figure 21

REF.	STOCK NO.	DESCRIPTION	QTY.
1	780-10-C2P1	HANDLE ASSEMBLY	2
2	780-10-5P1	PANEL, Outer	2
3	780-10-4P1	PANEL, Inner	2
4	780-10-8	BRACKET, Top panel	2
5	780-10-16P1	PANEL, Top	2
6	780-10-18	STIFFENER	1
7	780-10-3P1	PANEL, Front	2
8	01069-02010	SHIELD	1
9	780-10-1	LEG, Right hand	2
10	780-10-2	LEG, Left hand	2
11	780-10-13P1	PANEL ASSEMBLY, Rear	1
12	1063-46FW	CONNECTOR, A. C	3
13	32B-3	BUSHING, Strain relief	1
14	01069-62010	CORD ASSEMBLY, Connector	1
15	80A-832-6D	SCREW, Flat hd, no. 8-32 x 3/8 in. lg	8
16	40T-10	NUT, Keps, no. 10	16
17	80A-1032-1OE	SCREW, Oval hd, no. 10-32 x 5/8 in. lg	14
18	74G-1	WASHER, Cup	14
19	710N-10C	WASHER, Nylon	14
20	7A-26	CASTER	4
21	44D-3	SCREW, Drive	4
22	83D-10-4V	SCREW, Sems, no. 10-32 x 1/4 in. lg	16
23	83D-10-6V	SCREW, Sems, no. 10-32 x 3/8 in. lg	16
24	74A-8L	WASHER, Flat	8
25	83D-8-4V	SCREW, Sems, no. 8-32 x 1/4 in. lg	8
26	40D-2	NUT, Speed	8

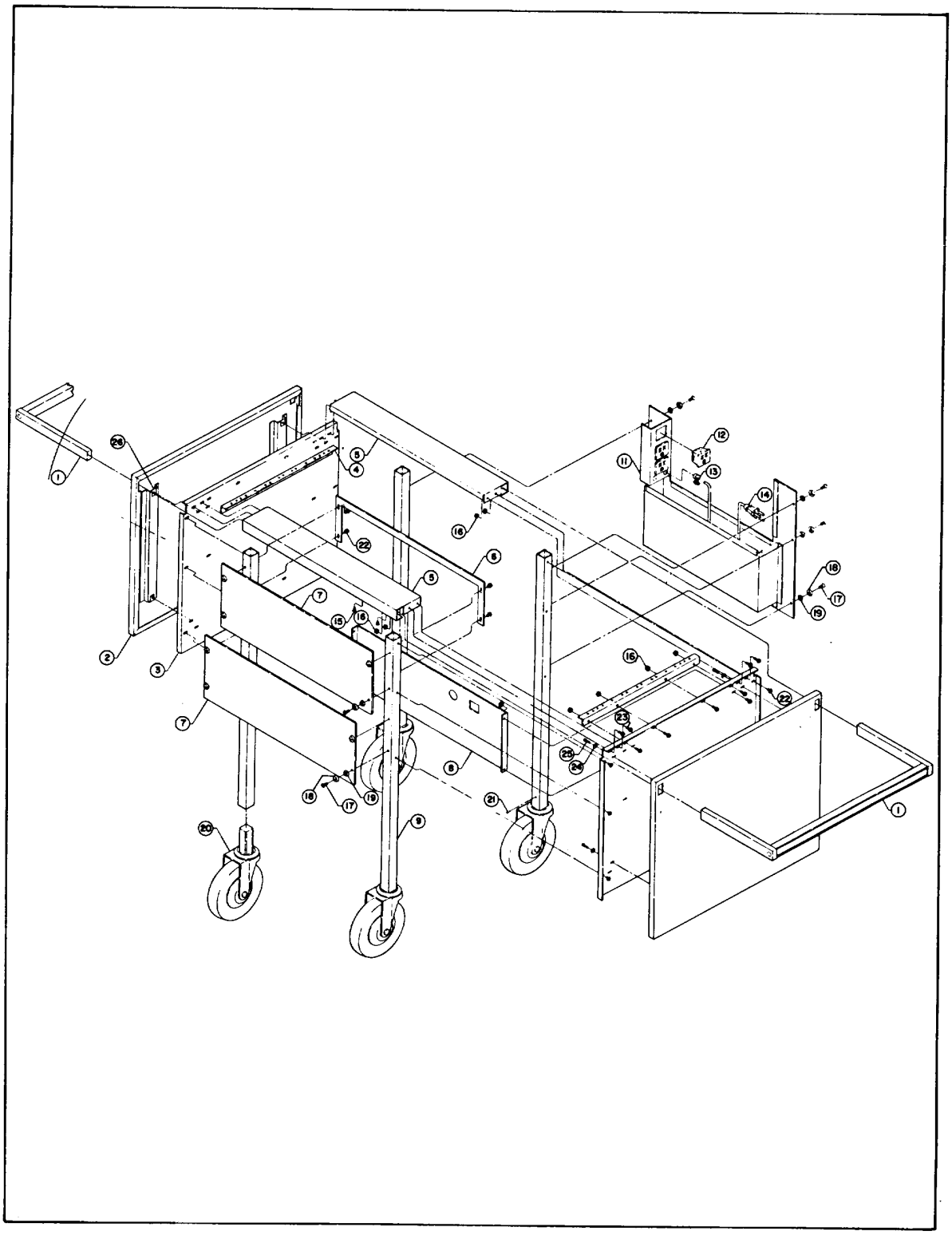


Figure 21. Mobile Cart (1069 02A)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 22	
1	07702-00290	COVER	1
2	No Number	LATCH ASSEMBLY, P/O item 1 and 9	4
3	80A-4-5E	SCREW, Machine, oval hd, no. 4-40 x 5/16 in. lg.	18
4	07702-00320	HANDLE	2
5	83A-10-8B	SCREW, Machine, no. 10-32 x 1/2 in. lg	10
6	241-48	FOOT, Rubber	8
7	241-50	INSERT, Foot	8
8	83A-10-O1B	SCREW, Machine, no. 10-32 x 5/8 in. lg	8
9	07702-00280	CASE	1
10	80A-4-8E	SCREW, Machine, oval hd, no. 4-40 x 1/2 in. lg	2
11	40T-4	NUT, Keps, no. 4	20

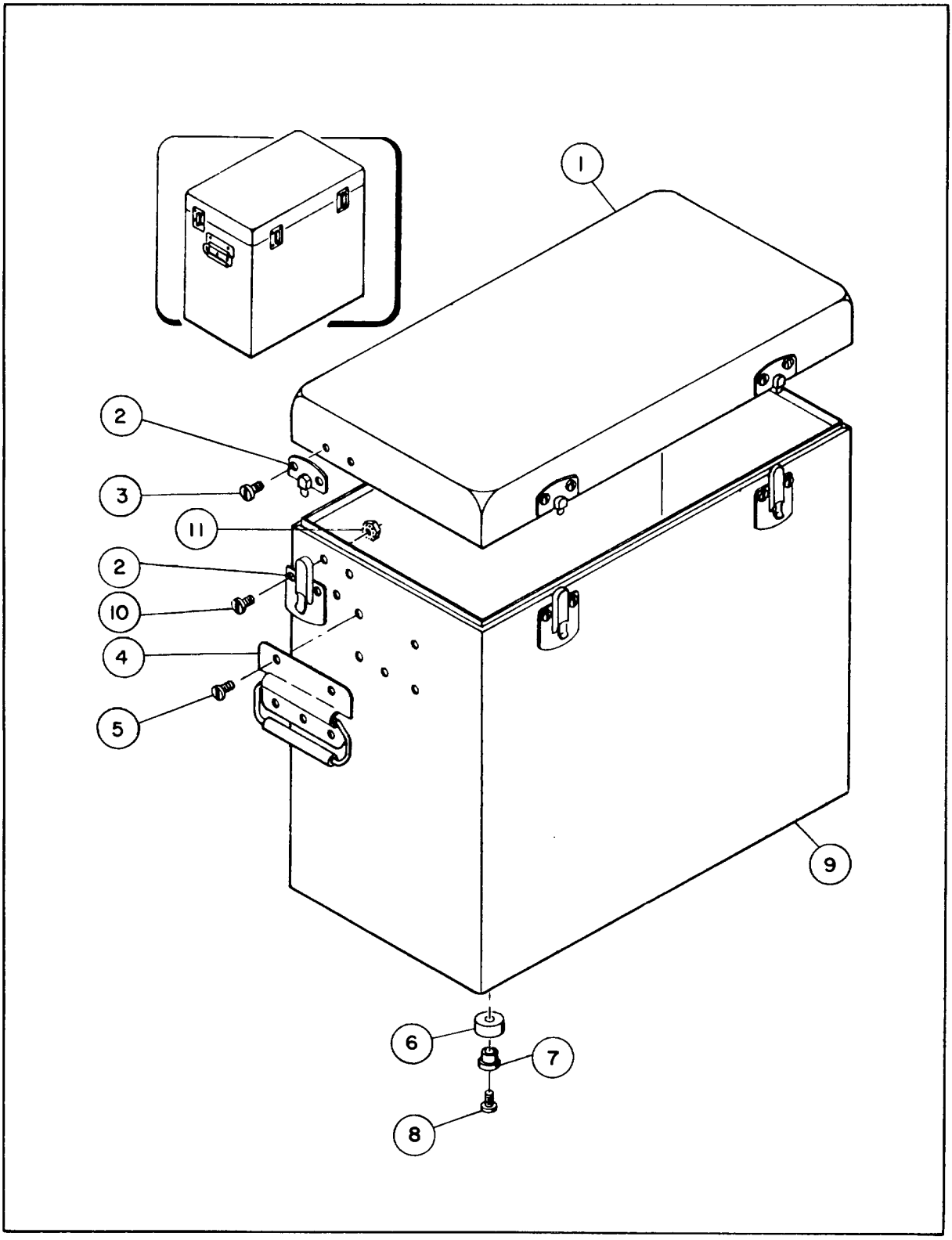


Figure 22. Portable Case (7702 - 14A)

REFERENCE DESIGNATION INDEX (See Figure 23)
(Recorder Assembly)

REF. DESIG.	DESCRIPTION	SANBORN PART NO.	VENDOR PART NO.	VENDOR CODE	SEE FIG. & INDEX NO.
C1	CAPACITOR, 2.5 mfd	8B-117	KGNU 3025	14655	9-44
C2	CAPACITOR, 0.01 mfd	8E-6	29CZ14A1	56289	8-13
C3	CAPACITOR, 0.01 nfd	8E-6	29C214A1	56289	8-13
C4	CAPACITOR, 0.01 mfd	8E-6	29CZ14A1	56289	8-13
C5	CAPACITOR, 0.01 mfd	8E-6	29C214A1	56289	8-13
C6	CAPACITOR, 0.01 mfd	8E-6	29C214A1	56289	8-13
C7	CAPACITOR, 0.01 mfd	8E-6	29C214A1	56289	8-13
C8	CAPACITOR, 0.01 mfd	8E-6	29C214A1	56289	8-13
C9	CAPACITOR, 50 mfd	8C-54	ACRE-767	00656	16-
C10	CAPACITOR, 100 mfd	8C-40	ACRE-767	00656	16-
C11	CAPACITOR, 100 mfd	8C-40	ACRE-767	00656	16-
C12	CAPACITOR, 0.01 mfd	8E-6	29C214A1	56289	13-36
C13	CAPACITOR, 2000 mfd	8C-90	Type QE-71 #E6A383	00656	14-6
C14	CAPACITOR, 2000 mfd	8C-90	Type QE-71 #E6A383	00656	14-6
C15	CAPACITOR, 2000 mfd	8C-90	Type QE-71 #E6A383	00656	14-6
C16	CAPACITOR, 2000 mfd	8C-90	Type QE-71 #E6A383	00656	14-6
C17	CAPACITOR, 0. 84 mfd	8B-231	YAT 102	14655	20-6
CR1	RECTIFIER	16A-39	SR1358-8	04713	16-
CR2	RECTIFIER	16A-39	SR1358-8	04713	16-
CR3	RECTIFIER	16A-39	SR1358-8	04713	16-
CR4	RECTIFIER	16A-39	SR1358-8	04713	16-
CR5	RECTIFIER	16A-39	SR1358-8	04713	16-
CR6	RECTIFIER	16A-39	SR1358-8	04713	16-
CR7	RECTIFIER	16A-39	SR]358-8	04713	16-
CR8	RECTIFIER	16A-39	SR1358-8	04713	16-
CR9	RECTIFIER	16A-39	SR1358-8	04713	14-21
F1	FUSE, Slo Blo, 1. 5A	26B-27	MDL-1-1/2	71400	13-3
F1	FUSE, Slo Blo, O. 8A	26B-6	MDL-8/10	71400	13-3
F2	FUSE, Slo Blo, 0. 5A	26B-4	AGC-1/2	71400	13-17
F3	FUSE, Slo Blo, 0. 5A	26B-4	AGC-1/2	71400	13-17
F4	FUSE, Slo Blo, 0.25A	26B-32	312.250	75915	13-24
I1	PILOT LIGHT, Clear	1450-0049	858-C/NEZE	08717	7-15
J1	CONNECTOR, Male, 3-pin	10G3-34MX	5935-972-8829	04919	5-12
J2	CONNECTOR, Male, 3-pin	10G3-34MX	5935-972-8829	04919	5-12
J3	CONNECTOR, Block	10R14-1F	201298-1	00779	14-13
J4	SOCKET, Elco, 20-pin	IOE20-IFX	01-4220-115-001-000	91662	14-5
J5	SOCKET, Elco, 20-pin	O1E20-1FX	01-4220-115-001-000	91662	14-5
J6	CONNECTOR, Female, 10-contact	1OB1O-1FX	SD-610S	95354	13-32
J7	CONNECTOR, Female, 10-contact	IOB10-IFX	SD-610S	95354	13-32
J8	CONNECTOR, Female, 10-contact	IOBIO-IFX	SD-610S	95354	13-32
J9	CONNECTOR, Power	10G3-38MX AC3G	82389	13-11	
J10	CONNECTOR, Female, 2-pin	10G2-25FX	3301-CF2KA	04919	13-30
J11	CONNECTOR, Preamplifier	IOG16-IFX	CMS-7175	04919	5-15
J12	CONNECTOR, Preamplifier	O1G16-1FX	CMS-7175	04919	5-15
J13	CONNECTOR, Female, 5-pin	IOA5-IFX	97-3102A-14S-5S	02660	13-9
J14	JACK, Miniature	10G2-22FX	#41	82389	5-10
J15	JACK, Miniature	10G2-22FX	#41	82389	5-10
J16	SOCKET, Female, 4-pin	10B4-6FX	77-MIP-4	02660	14-3
J17	SOCKET, Female, 4-pin	10B4-6FX	77-MIP-4	02660	14-3
J21	CONNECTOR, Female, 9-pin	10B9-5FX	126-221	02660	5-16
J22	CONNECTOR, Female, 9-pin	10B9-5FX	126-221	02660	5-16
LC-1	FILTER, Line, Type 2J X 38	9100-2206	2JX38	56289	2-37
LC-2	FILTER, Line, Type 2J X 38	9100-2206	2JX38	56289	2-37
QI	TRANSISTOR, Type 2N301	16T-68	2NZ869/2N301	02735	13-19
QZ	TRANSISTOR, Type 2N301	16T-68	2NZ869/2N301	02735	13-19
Q3	TRANSISTOR, Type 2N301	16T-68	2N2869/2N301	02735	13-19
Q4	TRANSISTOR, Type 2N301	16T-68	ZN2869/2N301	02735	13-19
Q5	TRANSISTOR, Type 2N301	16T-68	2N2869/2N301	02735	13-19
R1	RESISTOR, 10 ohms, 3W	53B-100J	995-3A	44655	16-4
R2	POTENTIOMETER, 0. 5 ohm	56R-4	Model E-48253	44655	7-5
R3	POTENTIOMETER, 0. 5 ohm	56R-4	Model E-48253	44655	7-5
R4	POTENTIOMETER, 200 ohms	56A-145	Type 45	71450	7-1
R5	POTENTIOMETER, 200 ohms	56A-145	Type 45	71450	7-1
R6	RESISTOR, 33K ohms	50AB-333J	EB	01121	2-53

REF. DESIG.	DESCRIPTION	SANBORN PART NO.	VENDOR PART NO.	VENDOR CODE	SEE FIG. & INDEX NO.
R7	RESISTOR, 10 ohms	50AB-10J	EB]005	01121	20-4
R8	RESISTOR, 10 ohms	50AB-1OOJ	EB1005	01121	20-4
R9	RESISTOR, 4. 7K ohms	50AB-472J	EB	01121	
S1	SWITCH, Push, ten-button	3101-1001-1	Type 130	76854	8-13
SZ	SWITCH, Slide	62D-54	6510C	79727	13-10
S3	SWITCH, Slide	62D-47	Type SS-50	78488	13-8
TI	TRANSFORMER, Power	66B-199	MMC1129	52983	13-31
T2	TRANSFORMER, Stylus Head	66B-115MS	NE7275	94315	13-26
T3	TRANSFORMER, Output	66B-102MS	NE5192	94315	13-23
	(Driver Amplifier Assembly)				
C1	CAPACITOR, 2. 2 mfd, 35V	8T-10	150D225X9035B2	56289	4-
C2	CAPACITOR, 0. 39 mfd, 100V	8B-136	Type WMTIP39	14655	4-
C3	CAPACITOR, 50 mfd, 25V	8C-91	7-85PSD50-25NPS-20+ 50	05844	4-
C4	CAPACITOR, 200 pfd, 500V	8E-18	D6-201 or BB20-201K	71590	4-
C5	CAPACITOR, 0. 12 mfd	8T-29	150D125X9035AZ	56289	4-
J1	CONNECTOR, ZO-contact	10E20-3MX	012220-115-004-000	91662	4-
Q1	TRANSISTOR, Type 2N3393MP	16T-78MP	16T-78MP	52983	4-
QZ	TRANSISTOR, Type 2N3393MP	16T-78MP	16T-78MP	52983	4-
Q3	TRANSISTOR, Type 2N3393	16T-78	2N3393	89473	4-
Q4	TRANSISTOR, Type 2N3393	16T-78	2N3393	89473	4-
Q5	TRANSISTOR, Type 2N4036	1853-0045	2N4036	02735	4-
Q6	TRANSISTOR, Type 2N2869/301	16T-68	2N2869/301	02735	4-
Q7	TRANSISTOR, Type 2N3054	16T-74	2N3054	02735	4-
Q8	TRANSISTOR, Type SM9143	16T-81	SM-9143	01295	4-
Q9	TRANSISTOR, Type 2N3393	16T-78	2N3393	89473	4-
R1	RESISTOR, 2750 ohms ± 1%	54A-365F	C10	01686	4-
R2	RESISTOR, 3750 ohms ± 1%	50E-375-1F	CEC-M-Coat Code T-O	75042	4-
R3	RESISTOR, 2250 ohms ± 1%	54A-364F	C10	01686	4-
R4	RESISTOR, 3K ohms ± 1%	50E-302F	CEC-M-Coat Code T-O	75042	4-
R5	RESISTOR, 2K ohms ± 20%	56PA-34	Type UPM-45	71450	4-
R6	RESISTOR, 220 ohms ± 5%	50AB-22IJ	EB2215	01121	4-
R7	RESISTOR, 1K ohm ± 5%	50AB-102J	EB	01121	4-
R8	RESISTOR, 12. 5K ohms ± 1%	50E-125-2F	CEC-M-Coat Code T-O	75042	4-
R9	RESISTOR, 12. 5K ohms ± 1%	50E-125-2F	CEC-M-Coat Code T-O	75042	4-
R10	RESISTOR, 11K ohms ± 1%	50E-113F	CEC-M-Coat Code T-O	75042	4-
R11	RESISTOR, 750 ohms ± 1%o	50E-751F	CEC-M-Coat Code T-O	7542	4-
R12	RESISTOR, 750 ohms ± 1%	50E-751F	CEC-M-Coat Code T-O	7b42	4-
R13	RESISTOR, 11K ohms ± 1%	50E-113F	CEC-M-Coat Code T-O	75042	4-
R14	RESISTOR, 12. 5K ohms ± 1%	50E-125-2F	CEC-M-Coat Code T-O	75042	4-
R15	RESISTOR, 100 ohms ± 5%	50AB-101J	EB1015	01121	4-
R16	RESISTOR, 100 ohms ± 5%	50AB-101J	EB1015	01121	4-
R17	RESISTOR, 313K ohms ± 5%	50AB-332J	EB	01121	4-
R18	RESISTOR, 1K ohm ± 5%	50AB-102J	EB	01121	4-
R19	RESISTOR, 680 ohms ± 5%	52B-681J	PW2	75042	4-
R20	RESISTOR, 50 ohms ± 1%	50E-500F	CEC-M-Coat Code T-O	75042	4-
R21	RESISTOR, 2. 2K ohms ± 5%	52B-222J	PW2	75042	4-
R22	RESISTOR, 7. 5 ohms ± 5%	53B-7R5JA	PW3	75042	4-
R23	RESISTOR, 7. 5 ohms ± 5%	53B-7R5JA	PW3	75042	4-
R24	RESISTOR, 2. 5 ohms ± 1%	54PA-71F	PW50	94322	4-
	(Regulator Card and Bracket Assembly)				
C6	CAPACITOR, 250 mfd	8C-60	ACRE 233	00656	15-
C9	CAPACITOR, 250 mfd	8C-60	ACRE 233	00656	15-
CIO	CAPACITOR, 100 pfd	8E-8	331-Z5U-101K	15450	15-
CRI1	DIODE	16A-45A	IN485B	79727	15-
CR12	DIODE	16A-45A	1N485B	79727	15-
CR13	DIODE	16A-45A	1N485B	79727	15-
CR14	DIODE	16A-62	PS10087	01281	15-
CR16	DIODE	16A-45A	1N485B	79727	15-
CR17	DIODE	16A-45A	1N485B	79727	15-
Q3	TRANSISTOR, 2N2552	16T-38	2N2552	01295	15-
Q4	TRANSISTOR, 2N1374	16T-31	2N1374	01295	15-
Q5	TRANSISTOR, 2N1374	16T-31	2N1374	01295	15-
Q6	TRANSISTOR, 2N1973	16T-47	2N1973	01295	15-

REF. DESIG.	DESCRIPTION	SANBORN PART NO.	VENDOR PART NO.	VENDOR CODE	SEE FIG. & INDEX NO.
Q7	TRANSISTOR, 2N1306	16T-33	2N1306	01295	15-
Q8	TRANSISTOR, 2N1306	16T-33	2N1306	01295	15-
R1	RESISTOR, 1K ohm ± 5"%	50B-102J	CB1025	01121	15-
R2	RESISTOR, 1K ohm ± 5%	50B-102J	CB1025	01121	15-
R3	RESISTOR, 1K ohm ± 1%	50E-102F	CEC-M-Coat Code T-O	75042	15-
R4	POTENTIOMETER, 500 ohms	56PA-20	U. P. E. -Z00RE #MR7984	71450	15-
R5	RESISTOR, 1K ohm ± 1%	50E-102F	CEC-M-Coat Code T-O	75042	15-
R6	RESISTOR, 3.3K ohms ± 5%	50B-332J	CB3325	01121	15-
R7	RESISTOR, 1K ohm ± 5%	50AB-102J	EB	01121	15-
R8	RESISTOR, IK ohm ± 5%	50AB-102J	EB	01121	15-
R9	RESISTOR, 1K ohm ± 5 %	50B-102J	CB1025	01121	15-
R10	RESISTOR, 680 ohms ± 5%	50B-681J	CB6815	01121	15-
R11	RESISTOR, 1K ohm ± 5%	50B-102J	CB1025	01121	15-
R12	RESISTOR, 500 ohms ± 1	50E-501F	CEC-M-Coat Code T-O	75042	15-
R13	RESISTOR, 500 ohms ±* 1%	50E-501F	CEC-M-Coat Code T-O	75042	15-
R14	RESISTOR, 10K ohms ± 5%	50AB-103J	EB	01121	15-
R15	RESISTOR, 4.7K ohms ± 5%	50B-472J	CB4725	01121	15-
R16	RESISTOR, 270 ohms ± 5%	50AB-271J	EB2715	01121	15-
	(Oscillator Card Assemblies)				
C15	CAPACITOR, 2.0 mfd	8B-42A	P8292ZN	00656	18-
C16	CAPACITOR, 10 mid	8C-68	ACRE 757	00656	18-
C17	CAPACITOR, 10 mfd	8C-68	ACRE 757	00656	18-
C18	CAPACITOR, 0.33 mfd	8B-130	VEIA334K	12406	17-
C19	CAPACITOR, 0.022 mfd	8B-120	WMF2S22Z	14655	17-
CR21	DIODE	16A-39	SR1358-8	04713	18-
CR22	DIODE	16A-39	SR1358-8	04713	18-
CR23	DIODE	16A-44	16A-44	52983	18-
CR24	DIODE	16A- 17	16A-44	52983	17-
CR25	DIODE	16A-39	SR1358-8	04713	17-
CR26	DIODE	16A-39	SR1358-8	04713	17-
Q12	TRANSISTOR, 2N2552	16T-38	2N2552	01295	18-
Q13	TRANSISTOR, 2NZ552	16T-38	2N2552	01295	18-
Q019	TRANSISTOR, 2N1038	16T-25	2N1038	01295	17-
Q20	TRANSISTOR, 2N1374	16T-31	2N1374	01295	17-
Q21	TRANSISTOR, 2N1374	16T-31	2N1374	01295	17-
R21	RESISTOR, 180 ohms ± 5%	50AB-181J	EB1815	01121	18-
R22	RESISTOR, 7.5 ohms ± 5%	53B-7R5J	242E	56289	18-
R23	RESISTOR, I.8 K ohms ± 5%	50AB-182J	EB	01121	18-
R24	RESISTOR, 1.8 K ohms ± 5%	50AB-182J	EB	011*21*	18-
R25	RESISTOR, 180 ohms ±: 5%	50AB-181J	EB1815	01121	18-
R26	RESISTOR, 1.8 K ohms ± 5%	50AB-182J	EB	01121	18-
R27	RESISTOR, I K ohm ± 5%	50AB-10ZJ	EB	01121	18-
R37	RESISTOR, 6800 ohms ± 5%	50AB-682J	EB	01121	17-
R38	RESISTOR, 10 ohms ± 5%	50AB- 100J	EB	01121	17-
R39	RESISTOR, 6800 ohms ± 5%	50AB-682J	EB	01121	17-
R40	RESISTOR, 470 ohms ± 5%	5OAB-471J	EB4715	01121	17-
R43	RESISTOR, 470 ohms ± 5%	50AB-471J	EB4715	01121	17-
T4	TRANSFORMER, Toroidal 440 Hz	66B-172	T8497	14701	18-
T7	TRANSFORMER, Toroidal 2400Hz	66B-218	NE-7530	94315	17-
TM7	THERMISTOR	56T-3	23E3	83186	17-
TM8	THERMISTOR	56T-3	23E3	83186	17-

VENDOR'S CODE

Code No.	Name and Address
00656	Aerovox Corporation New Bedford, Mass.
00779	AMP, Inc Harrisburg, Penna.
01121	Allen-Bradley Co. Milwaukee, Wisconsin
01281	TRW Semiconductors Inc. Lawndale, Calif.
01295	Texas Instruments, Inc. Transistor Products Division Dallas, Texas
01686	RCL Mfg. Co. Riverside, N. J.
02660	Amphenol-Borg Electronics Corp. Broadview, Chicago, Ill.
02735	RCA Semiconductor & Materials Div. of Radio Corp. of America Somerville, N.J.
04713	Motorola, Inc. Semiconductor Products Div. Phoenix, Arizona
04919	Component Mfg. Service Co. W. Bridgewater, Mass.
05844	Callins Industries, Inc. Greenfield, Tenn.
08717	Sloan Co Burbank, Calif.
12406	ELPAC Inc. Fullerton, Calif.
14655	Cornell-Dubilier Electric Corp. Newark, N.J.
14701	TENCO Electronics Inc. Boston, Mass.
15450	Erie Electronics Div. of Erie Resistor Corp. Erie, Pa.
44655	Ohmite Mfg. Co. Skokie, Ill.
52983	Sanborn Company Waltham, Mass.
56289	Sprague Electric Co. North Adams, Mass.
71400	Bussmann Fuse Division of McGraw-Edison Co. St. Louis, Mo.
71450	CTS Corp. Elkhart, Ind.
71450	CTS Corp. Elkhart, Ind.
71590	Centralab Division of Globe-Union, Inc. Milwaukee, Wis.
75042	International Resistance Co. Philadelphia, Pa.
75915	Littlefuse, Inc. Des Plaines, nl.
76854	Oak Mfg. Co. Crystal Lake, Ill.
78488	Stackpole Carbon Co. St. Mary' s, Pa.
79727	Continental-Wirt Electronics Corp. Philadelphia, Pa.
82389	Switchcraft, Inc. Chicago, Ill.
83186	Victory Engineering Corp. Springfield, N.J.
89473	General Electric Distr. Corp. Schenectady, N. Y.
91662	Elco Corp. Philadelphia, Pa.
94315	New England Transformer Co. Somerville, Mass.
94322	Television Labs, Inc. Manchester N.H.
95354	Methode Mfg. Co. Chicago, Ill.

Section II. 7700-02B SYSTEM DRIVER AMPLIFIER

CONTENTS

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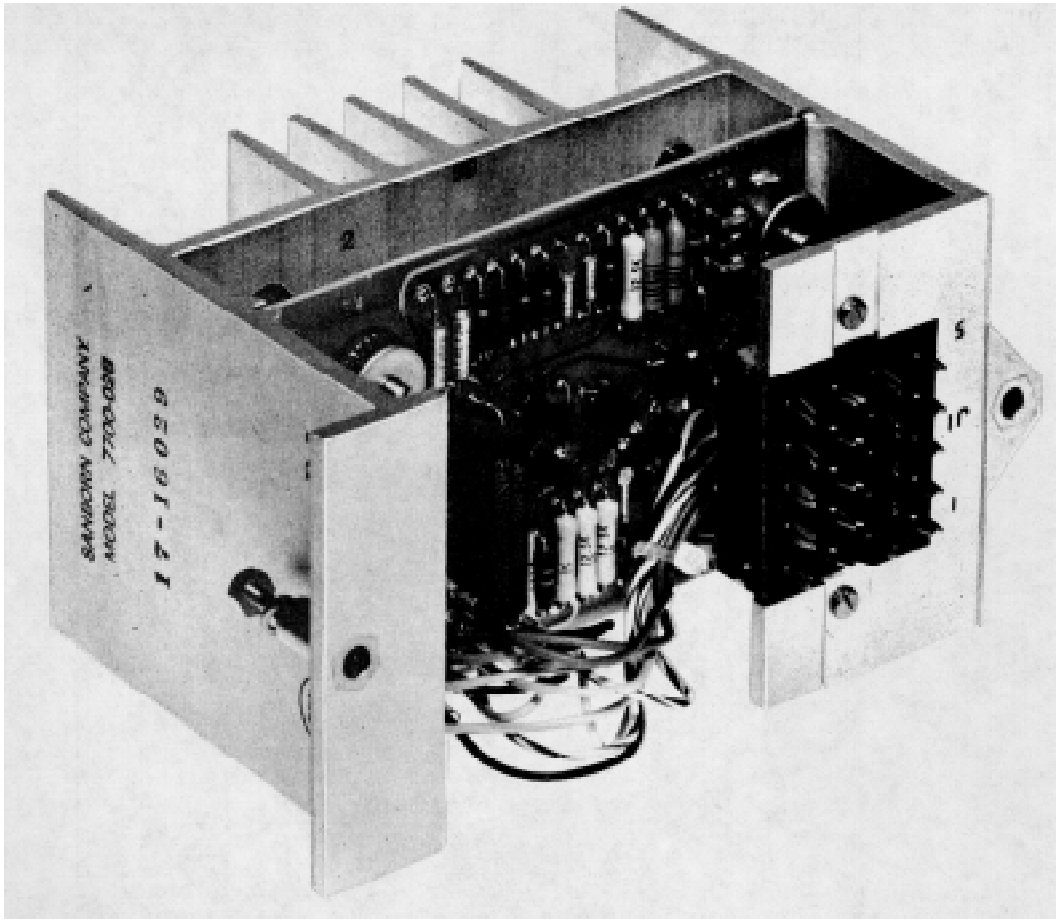
INTRODUCTION

This publication lists and illustrates the replaceable parts of the Model 7700-02B Driver Amplifier. Figures 1 and 2 provide a breakdown of the complete equipment. Figure 3 is an equipment schematic supplemented by a Reference Designation index which cross-references the schematic diagram reference designators to the appropriate equipment illustrations.



Model 7700-02B Driver Amplifier

REF.	STOCK NO.	DESCRIPTION	QTY.
		LISTING FOR FIGURE 1	
1	0340-196	COVER, Transistor	1
2	86D-6-8B	SCREW, Sheet metal, no. 6	2
3	1850-0126	TRANSISTOR, Type 2N2869/301 (Q6)	1
4	74T-5	WASHER, Anodized	1
5	0811-2335	RESISTOR, Fixed, ww, 7.5 ohms ± 5%, 3W (R22, R23)	2
6	126-17	CLAMP	2
7	86B-4-4P	SCREW, Sheet metal, no. 4	1
8	40D-10	NUT, Speed	2
9	1251-1730	CONNECTOR, 20-contact (J1)	1
10	86D-4-6B	SCREW, Sheet metal, no. 4	2
11	07700-62030	PRINTED CIRCUIT BOARD ASSEMBLY (See fig. 2)	1
12	07700-62020	CHASSIS ASSEMBLY (Inseparable)	1
13	74T-8	WASHER, Anodized	1
14	1854-0072	TRANSISTOR, Type 2N3054 (Q7)	1
15	0700-02020	SCREW, Retaining	2
16	71A-8/32	WASHER, Split	2
17	1390-0127	RETAINER, Tubular	3
18	0340-189	COVER, Transistor	1

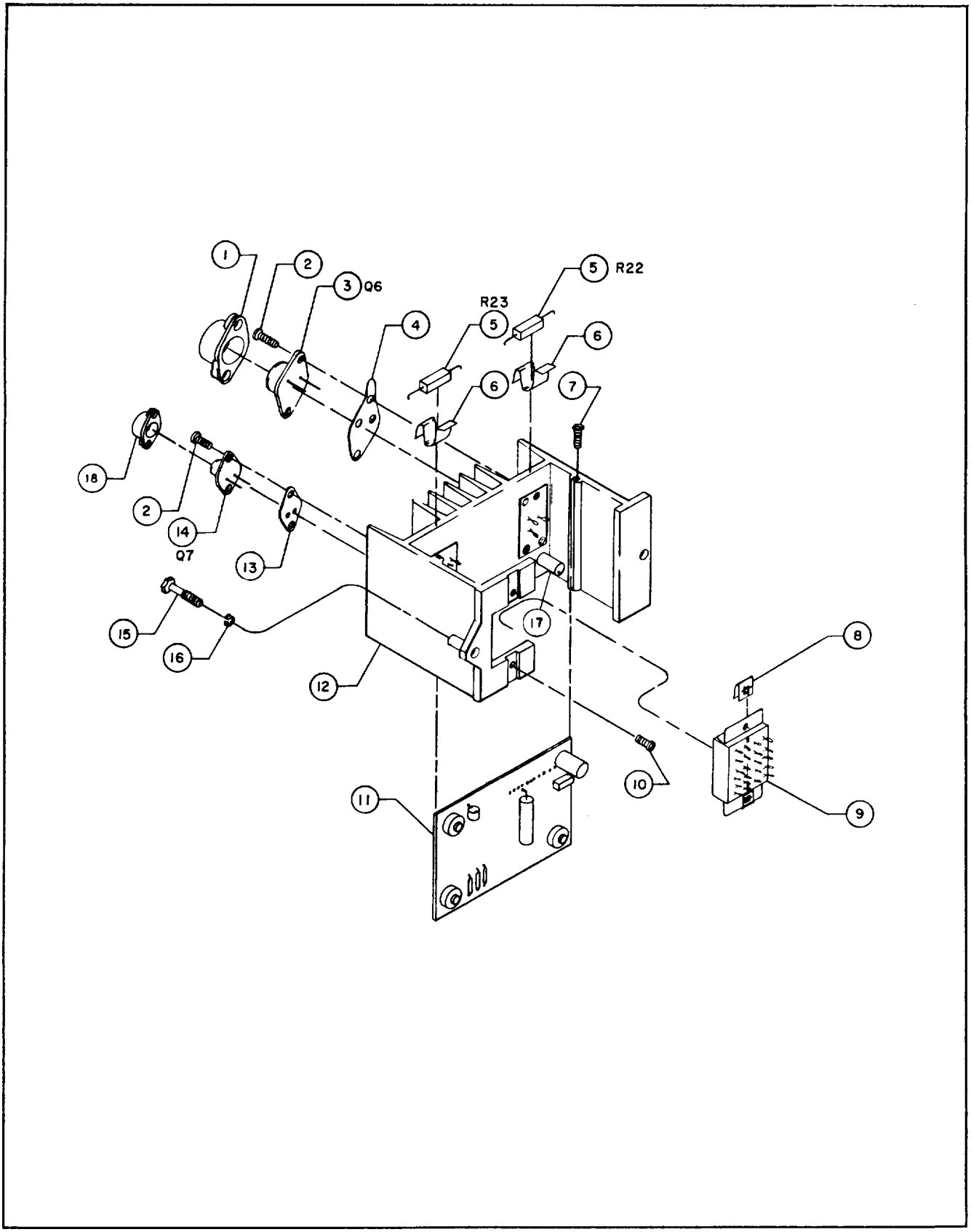
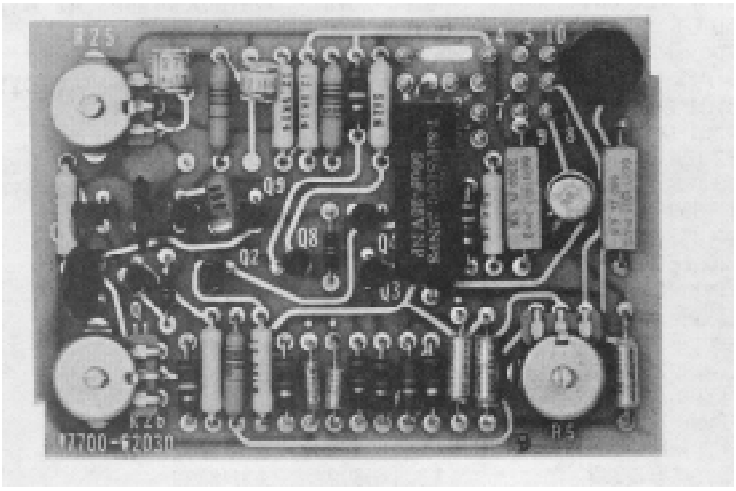


Figure 1. Driver Amplifier Assembly (Model 7700-02 B).

REF.	STOCK NO.	DESCRIPTION	QTY.
		LISTING FOR FIGURE 2	
C1	0180-1846	CAPACITOR, Fixed, Ta, 2.2 UF, 35Vdcw	1
C2	0180-2079	CAPACITOR, Fixed, my, 0.39 UF, 35Vdcw	1
C3	0180-2006	CAPACITOR, Fixed, elect, 50 UF, 25Vdcw	1
C4	0160-2632	CAPACITOR, Fixed, cer, 200 pF, 50OOVdcw	1
C5	0180-2077	CAPACITOR, Fixed, Ta, 0.082 UF, 35Vdcw	1
C6	0150-0081	CAPACITOR, Fixed, cer, 0.01 UF, 500Vdcw	1
C7	0150-0081	CAPACITOR, Fixed, cer, 0.01 UF, 50OOVdcw	1
C8	0180-0228	CAPACITOR, Fixed, Ta, 22 UF, 15Vdcw	1
C9	0180-0228	CAPACITOR, Fixed, Ta, 22 UF, 15Vdcw	1
CR1	1901-0033	DIODE, Scon, Si, Type IN4853	1
CR2	1901-0033	DIODE, Scon, Si, Type IN4853	1
Q1	5080-7310	TRANSISTOR, Type 2N3393 (matched with Q2)	1
Q2	5080-7310	TRANSISTOR, Type 2N3393 (matched with Q1)	1
Q3	1854-0099	TRANSISTOR, Type 2N3393	1
Q4	1854-0099	TRANSISTOR, Type 2N3393	1
Q5	1853-0045	TRANSISTOR, Type 2N4036	1
Q8	1854-0099	TRANSISTOR, Type 2N3393	1
Q9	1853-0020	TRANSISTOR, Type SM9143	1
Q10	1853-0020	TRANSISTOR, Type SM9143	1
Q11	1854-0215	TRANSISTOR, Type 2N3904	1
R1	0811-2235	RESISTOR, Fixed, ww, 2750 ohms $^{+}_{-}$1%, 1/lOW	1
R2	0698-5946	RESISTOR, Fixed, flm, 3750 ohms ± 1%, 1/2W	1
R3	0811-2412	RESISTOR, Fixed, ww, 2150 ohms ± 1%, 1/SW	1
R4	0698-5938	RESISTOR, Fixed, flm, 3K ohms ± 1%, 1/2W	1
R5	2100-2112	RESISTOR, Variable, 2K ohms ± 20%	1
R6	0686-2215	RESISTOR, Fixed, comp, 220 ohms ± 5%, 1/2W	1
R7	0686-1025	RESISTOR, Fixed, comp, 1K ohms ± 5%, 1/2W	1
R8	0698-5914	RESISTOR, Fixed, flm, 12. 5K ohms ± 1%, 1/2W	1
R9	0698-5914	RESISTOR, Fixed, flm, 12. 5K ohms ± 1%, 1/2W	1
R10	0698-5966	RESISTOR, Fixed, flm, 5K ohms ± 1%, 1/2W	1
R11	0686-1535	RESISTOR, Fixed, flm, 15K ohms ± 5%, 1/2W	1
R12	0757-0839	RESISTOR, Fixed, flm, 10K ohms ± 1%, 1/2W	1
R13	0698-5966	RESISTOR, Fixed, ftim, 5K ohms ± 1%, 1/2W	1
R14	0698-5914	RESISTOR, Fixed, flm, 12. 5K ohms ± 1%, 1/2W	1
R15	0686-1015	RESISTOR, Fixed, comp, 100 ohms ± 5%, 1/2W	1
R16	0686-1015	RESISTOR, Fixed, comp, 100 ohms ± 5%, 1/2W	1
R17	0686-3325	RESISTOR, Fixed, comp, 3300 ohms ± 5%, 1/2W	1
R18	0686-1025	RESISTOR, Fixed, comp, 1K ohms ± 5%, 1/2W	1
R19	0811-2334	RESISTOR, Fixed, ww, 680 ohms ± 5%, 2W	1
R20	0698-5965	RESISTOR, Fixed, flm, 50 ohms ± 1%, 1/2W	1
R21	0811-2333	RESISTOR, Fixed, ww, 2200 ohms ± 5%, 2W	1
R24	0811-2292	RESISTOR, Fixed, ww, 2.5 ohms ± 1%, 1W	1
R25	2100-2113	RESISTOR, Variable, 50K ohms, 1/8W	1
R26	2100-2113	RESISTOR, Variable, 50K ohms, 1/8W	1
R27	0757-0843	RESISTOR, Fixed, flm, 15K ohms ± 1%, 1/2W	1
R28	0686-1535	RESISTOR, Fixed, flm, 15K ohms ± 5%, 1/2W	1



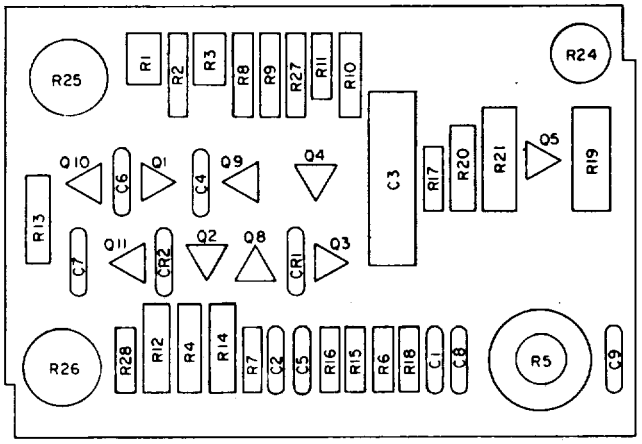


Figure 2. Printed Circuit Board Assembly (07700-62030).

REF. DESIG.	DESCRIPTION	SANBORN PART NO.	VENDOR PART NO.	VENDOR CODE	SEE FIG. & INDEX NO.
	REFERENCE DESIGNATION INDEX (See Figure 3)				
C1	CAPACITOR, 2.2 UF, 35Vdcw	0180-1846	K2RJ35S	05397	2
C2	CAPACITOR, 0.39 UF, 35Vdcw	0180-2079	150D394X9035A2-DYS	56289	2
C3	CAPACITOR, 50 UF, 25Vdcw	0180-2006	7-85PSD50-25NPS	05844	2
C4	CAPACITOR, 200 pF, 500Vdcw	0160-2632	D6-201	71590	2
C5	CAPACITOR, 0.082 UF, 35Vdcw	0180-2077	150D823X0935A2-DYS	56289	2
C6	CAPACITOR, 0.01 UF, 500Vdcw	0150-0081	29C985	56289	2
C7	CAPACITOR, 0. 01 UF, 500Vdcw	0150-0081	29C985	56289	2
C8	CAPACITOR, 22 UF, 15Vdcw	0180-0228	150D226X9015B2-DYS	56289	2
C9	CAPACITOR, 22 UF, 15Vdcw	0180-0228	150D226X9015B2-DYS	56289	2
CR1	DIODE, Type IN4853	1901-0033	IN4853	79727	2
CR2	DIODE, Type IN4853	1901-0033	IN4853	79727	2
J1	CONNECTOR, 20-contact	1251-1730	01-2220-115-004	91662	1-9
Q1	TRANSISTOR, Type 2N3393MP	5080-7310	5080-7310	52983	2
Q2	TRANSISTOR, Type 2N3393MP	5080-7310	5080-7310	52983	2
Q3	TRANSISTOR, Type 2N3393	1854-0099	2N3393	89473	2
Q4	TRANSISTOR, Type 2N3393	1854-0099	2N3393	89473	2
Q5	TRANSISTOR, Type 2N4036	1853-0045	2N4036	02735	2
Q6	TRANSISTOR, Type 2N2869/301	1850-0126	2N2869/301	02735	1-3
Q7	TRANSISTOR, Type 2N3054	1854-0072	2N3054	02735	1-14
Q8	TRANSISTOR, Type 2N3393	1854-0099	2N3393	89473	2
Q9	TRANSISTOR, Type SM9143	1853-0020	SM9143	01295	2
Q10	TRANSISTOR, Type SM9143	1853-0020	SM9143	01295	2
Q11	TRANSISTOR, Type 2N3904	1854-0215	2N3904	04713	2
R1	RESISTOR, 2750 ohms ± 1%, 1/lOW	0811-2235	Type C10	01686	2
R2	RESISTOR, 3750 ohms ± 1%, 1/2W	0698-5946	CEC M-COAT	75042	2
R3	RESISTOR, 2150 ohms ± 1%, 1/8W	0811-2412	R343	01686	2
R4	RESISTOR, 3K ohms ± 1%, 1/2W	0698-5938	Type CEC	75042	2
R5	RESISTOR, Variable, 2Kohms+ 20%	2100-2112	RM7765 (UPE 200RE)	71450	2
R6	RESISTOR, 220 ohms ± 5%, 1/2W	0686-2215	EB2215	01121	2
R7	RESISTOR, 1K ohms ± 5%, 1/2W	0686-1025	EB1025	01121	2
R8	RESISTOR, 12. 5K ohms ± 1%, 1/2W	0698-5914	Type CEC	75042	2
R9	RESISTOR, 12. 5K ohms ± 1%, 1/2W	0698-5914	Type CEC	75042	2
R10	RESISTOR, 5K ohms ± 1%, 1/2W	0698-5966	MF7C T-O	19701	2
R11	RESISTOR, 15K ohms ± 5%, 1/2W	0686-1535	EB1535	01121	2
R12	RESISTOR, 10K ohms ±1%, 1/2W	0757-0839	MF7C T-O	19701	2
R13	RFSISTOR, 5K ohms ± 1%, 1/2W	0698-5966	MF7C T-O	19701	2
R14	RESISTOR, 12. 5K ohms ± 1%, 1/2W	0698-5914	Type CEC	75042	2
R15	RESISTOR, 100 ohms ± 5%, 1/2W	0686-1015	EB1015	01121	2
R16	RESISTOR, 100 ohms ± 5%, 1/2W	0686-1015	EB1015	01121	2
R17	RESISTOR, 3300 ohms ± 5%, 1/2W	0686-3325	EB3325	01121	2
R18	RESISTOR, 1K ohms ± 5%, 1/2W	0686-1025	EB1025	01121	2
R19	RESISTOR, 680 ohms ± 5%, 2W	0811-2334	Type PW2	75042	2
R20	RESISTOR, 50 ohms ± 1%, 1/2W	0698-5965	CEC M-COAT	75042	2
R21	RESISTOR, 2200 ohms ± 5%, 2W	0811-2333	Type PW2	75042	2
R22	RESISTOR, 7.5 ohms ± 5%, 3W	0811-2335	Type PW3	75042	1-5
R23	RESISTOR, 7.5 ohms ± 5%, 3W	0811-2335	Type PW3	75042	1-5
R24	RESISTOR, 2.5 ohms ± 1%, 1W	0811-2292	0811-2292	52983	2
R25	RESISTOR, Variable, 50K ohms, 1/8W	2100-2113	RM7766(UPE200RE)	71450	2
R26	RESISTOR, Variable, 50K ohms, 1/8W	2100-2113	RM7766(UPE20ORE)	71450	2
R27	RESISTOR, 15K ohms ± 1%, 1/2W	0757-0843	MF7C T-O	19701	2
R28	RESISTOR, 15K ohms ± 5%, 1/2W	0686-1535	EB1535	01121	2

APPENDIX B

REFERENCES

DA Pam 310-4	Index of Technical Publications: Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX E
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

E-1. General.

This appendix provides a summary of the maintenance operations for RO-460(V) I/U(HP-7702B). It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

E-2. Maintenance Function.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristicswith prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressd air supplies.

d. Adjust. To maintain, within prescribed limits, bybringing into proper or exact position, or by setting theoperating characteristics to the specified parameters

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard to known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. *Repair.* The application of maintenance services(in-spect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely servicea-ble/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publica-tions. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

E-3. Column Entries.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column

2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C - Operator/Crew
O - Organizational
F - Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

E-4. Tool and Test Equipment Requirements (Sect. III).

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. Nationai/NA TO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

E-5. Remarks (Sect. IV).

a. Reference Code. This code refers to the appropriate item in section H, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

(Next printed page is E-3)

SECTION II MAINTENANCE ALLOCATION CHART FOR

OSCILLOGRAPH RECORDER RO-460(V)1/U(HP-7702B)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT	(6) REMARKS
			C	O	F	H	D		
00	OSCILLOSCOPE RECORDER RO-460(V)1/U	Inspect		0.2					10
		Test				0.3			1 thru 4, 6, 8;9
		Service				0.4			1 thru 4, 6, 8, 9
		Align				0.5			1 thru 4, 8, 9
		Repair						2.0	1 thru 9
		Overhaul						6.0	1 thru 9

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR

OSCILLOGRAPH RECORDER RO-460(V)1/U(HP-7702B)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL NATO STOCK NUMBER	TOOL NUMBER
1	H, D	MULTIMTER AN/USM-223	6625-00-999-7465	
2	H, D	OSCILLOSCOPE AN/USM-281C	6625-00-228-2201	
3	H, D	DIGITAL VOLTMETER AN/GSM-64	6625-00-870-2264	
4	H, D	FUNCTION GENERATOR SG-747	6625-00-118-6736	
5	D	STYLUS PRESSURE TESTER, SANBORN 14105A		
6	H, D	FREQUENCY COUNTER AN/USM-207	6625-00-911-6368	
7	D	WATTME'ER TS-430/U	6625-00-649-5393	
8	H, D	VOLTAGE DIVIDER ZM-58/U	6625-00-585-4915	
9	H, D	TOOL KIT, ELECTRONIC EQUIPMENT TK-105/G	5180-00-610-8177	
10	0	TOOLS AND TEST EQUIPMENT AVAILABLE TO ORGANIZATIONAL PERSONNEL BECAUSE OF ASSIGNED MISSION		

APPENDIX G. REPAIR PARTS AND SPECIAL TOOLS LISTS

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	REPLACEMENT PART NUMBER	REPLACEMENT FSCM	REPLACEMENT NATIONAL STOCK NUMBER
AC3G	82389	5935-00-058-9423			
AGC-1/2	71400	5920-00-280-8344	F02A250V1-2A	81349	5920-00-280-8344
B8122EX-300C	07829	3010-00-635-0810			
CB1025	01121	5905-00-097-9533			
CB3325	01121	5905-00-716-4841	RCR07G332JS	81349	5905-00-126-6683
CB4725	01121	5905-00-911-3753			
CB6813’	01121	5905-00-577-9492	RCR07G681JS	81349	5905-00-135-6046
CMS-7175	04919	5935-00-927-6863			
EB1005	01121	5905-00-415-1579	G320905J100	01714	5905-00-415-1579
EB1015	01121	5905-00-899-4974			
EB1025	01121	5905-00-415-1581	G320905J102	01714	5905-00-415-1581
EB1535	01121	5905-00-951-9633			
EB1815	01121	5905-00-415-1592	G320905J181	01714	5905-00-415-1592
EB2215	01121	5905-00-807-0065	RCR20G221JS	81349	5905-00-104-8350
EB2715	01121	5905-00-171-2006	RCR20G271JS	81349	5905-00-114-5407
EB3325	01121	5905-00-556-5254	RCR20G332JS	81349	5905-00-104-8348
EB4115	01121	5905-00-818-0036			
MDL-8/10	71400	5920-00-199-3968			
P8292ZN	00656	5910-00-256-3771	3105-113	28569	5910-00-256-3771
SD61OS	95354	5935-00-899-8252	SMB540638	80063	5935-00-577-8713
SR1358-8	04713	5961-00-060-8638			
SS-50	78488	5930-00-539-7661			
TYPE45	71450	5905-00-088-0164	2100-0190	28480	5905-00-088-0164
TYPE130	76854	5930-00-246-5046			
WMF2S22	14655	5910-00-706-4130	CTM223VBJ	81349	5910-00-835-2936
01-4220-115-001-000	91662	5935-00-844-2718			
0150-0096	28480	5910-00-542-1196	TAO-05MFD	91418	5910-00-784-4531
0160-0904	28480	5910-00-175-5938			
0160-2632		5910-00-173-4389			
0340-0404	28480	3120-00-240-8003			
0370-0151	28480	5355-00-779-0647			
0370-1005	28480	5355-00-100-6778			
0683-1005	28480	5905-00-960-0099			
0686-1015	28480	5905-00-997-9575	RCR20GL01JS	81349	5905-00-106-9344
0686-1025	28480	5905-00-997-9574	RCR20G102JS		5905-00-110-0196
0686-1535	28480	5905-00-886-8664	RCR20G153JS	81349	5905-00-106-1273
0686-2215	52983	5905-00-807-0065	RCR20G221JS	81349	5905-00-104-8350
0757-0839	28480	5905-00-931-9909			
0757-0843	28480	5905-00-830-6751			
0811-2235	28480	5905-00-828-6775			
0811-2292	28480	5905-00-828-6802			
0811-2334	28480	5905-00-833-7120			
0811-2412	28480	5905-00-308-7714			
0811-2334	28480	5905-00-833-7120			
10A5-LFX	52983	5935-00-972-9364			
10OB4-6FX	52983	5935-00-240-8157	77MIP4TM	02660	5935-00-129-3081
10B4-1MWA	52983	5935-00-351-3723	103151PC1	96795	5935-00-552-3053
10OG2-25FX	52983	5935-00-444-8492			
1OG3-34FW	52983	5935-00-972-8828			
10OG3-34MX	52983	5935-00-972-8829			
10G16-LFX	28480	5935-00-927-6863			
117P	14907	3010-00-330-9795	SX101	14907	3010-00-330-9795
1251-1842	28480	5935-00-927-6863			
1251-1843	28480	5935-00-928-1372			
1251-1894	52983	5935-00-173-4391	1251-1894	28480	5935-00-173-4391
1251-1895	28480	5935-00-520-4824			
126-221	02660	5935-00-721-2862			
1390-0127	28480	5365-00-422-0576			
14015A	28480	6625-00-116-7864			
1450-0048	28480	6241-00-761-8898			

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	REPLACEMENT PART NUMBER	REPLACEMENT FSCM	REPLACEMENT NATIONAL STOCK NUMBER
150D125X9035A2	56289	5910-00-840-3041	M39003-01-3078	81349	5910-00-270-2659
150D225X9035B2	56289	5910-00-717-0647			
154-100-C3	52983	6625-00-614-9814			
158-119	52983	4935-00-971-5931			
158-614	52983	3010-00-671-2955			
158-OO000-C	52983	5845-00-785-1125			
158-OO000-C10IO	52983	5940-00-087-2420			
158-1007	28480	6625-00-013-4501			
158-1022	52983	6625-00-972-1576			
158-1033	52983	6625-00-972-1582			
16A-39	52983	5961-00-975-7229			
16T-31	28480	5961-00-882-2906			
16T-33	52983	5961-00-893-0288	JAN2N1306	81349	5961-00-892-3405
16T-38	28480	5961-00-938-5099			
16T-78	52983	5961-00-913-2894	16T-78	28480	5961-00-913-2894
16T-78MP	52893	5961-00-928-3226			
16T-81	52983	5961-00-062-1435	1853-0020	28480	5961-00-904-2540
1850-0126	28480	5961-00-925-6280			
1853-0020	28480	5961-00-904-2540			
1853-0045	28480	5961-00-068-1985			
1854-0215	28480	5961-00-892-8706			
1901-0033		5961-00-821-0710			
1902-0551	28480	5961-00-483-6600			
192P56292-PTS	56289	5910-00-497-7598			
2JX38	56289	5915-00-993-0386			
2N137N	01295	5961-00-882-2906			
2N1306	01295	5961-00-892-3405			
2N2552	01295	5961-00-938-5099			
213054	02735	5961-00-012-4215			
2N3904	04713	5961-00-892-8706			
2N4036	02735	5961-00-068-1985	2N4036	80131	5961-00-068-1985
201298-1	00779	5935-00-944-3647			
2100-2112	28480	5905-00-175-8652	RM7765	71450	5905-00-175-8652
2100-2113	28480	5905-00-175-8653			
2110-0004	28480	5920-00-798-5710			
2110-0012	28480	5920-00-898-0400			
26H-2	52983	5920-00-543-0517	FPHN26GL	81349	5920-00-892-9311
29C214A1	56289	5910-00-076-1617	CK63AY103M	81349	5910-00-109-1987
37A-10A	52983	5120-00-953-3389	R3322-2	96508	5120-00-062-8454
38B-37	28480	6105-00-349-9743			
312.250	75915	5920-00-280-4181	F02A250V1-4A	81349	5920-00-043-2641
320-100-C16	28480	4935-00-071-8112			
320-100-C18	52983	5895-00-073-7725			
320-100-C19	52983	5895-00-073-7726			
320-100-C22	52983	5895-00-968-1469			
320-100-C28	52983	4935-00-916-7396			
320-123	28480	4935-00-071-4214			
320-125	28480	4935-00-071-8113			
320-164	52983	5895-00-968-1474			
350E-103F	52983	5905-00-931-9909			
358-122	28480	5935-00-833-7075			
358-140	52983	5340-00-739-4111			
358-705	28480	4920-00-975-5325			
358-706	28480	4920-01-020-2939			
398	52983	6625-00-975-5328			
40T-10	52983	5310-00-655-6534			
41	82389	5935-00-683-6148			
44J-4-28	52983	5315-00-271-7529	MS16562-5	96906	5315-00-240-1014
411-10	52983	4920-00-079-2726			
5A-33	52983	3120-00-844-4118			

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	REPLACEMENT PART NUMBER	REPLACEMENT FSCM	REPLACEMENT NATIONAL STOCK NUMBER
5A-43	52983	3120-00-844-4783			
5C-4	52983	4920-00-975-5326			
5G-32	52983	3020-00-237-3609			
50-34	52983	3020-00-740-5522			
5G-35	52983	3020-00-740-5523			
5G-73	52983	5895-00-968-1479			
50-75	28480	3020-00-780-4866			
5S-7	28480	5895-00-968-1482			
50E-102F	28480	5905-00-830-6677	RNC65K 001FS	81349	5905-00-252-4003
50E-153F’	28480	5905-00-830-6751			
56R-4	52983	5905-00-996-7619			
59A-9	52983	5365-00-263-5954	MS16624-1031	96906	5365-00-803-7313
66B-115MS	52983	5950-00-349-9881			
606B	52983	5895-00-807-1540			
608E	28480	6625-00-857-4352			
608-103	28480	5835-00-833-7073			
613-100-CLL11	52983	5895-00-073-7731			
651-52	52983	7530-00-603-7714			
6510C	79727	5930-00-226-0487			
7700-02B	28480	6625-00-880-1941			
7700-72030	28480	6625-00-013-8283			
8B-42A	28480	5910-00-928-1392			
8B-136	52983	5910-00-889-4451	CTM394VAJ	81349	5910-00-834-9762
8C-91	52983	5910-00-974-7771			
8E-6	52983	5910-00-080-5753	15-43	28480	5910-00-851-7794
80A-632-8D	52983	5305-00-010-1011	MS35198-29	96906	5305-00-958-0999
824-32	52983	4935-00-971-5935			
827-5	52983	5895-00-968-1487			
858-C/NE2E	08717	6210-00-961-9598			
868-500A-C6	52983	4920-00-909-2915			
97-3102A-14S-5S	02660	5935-00-928-1654	MS3102R14S5S	96906	5935-00-807-9308

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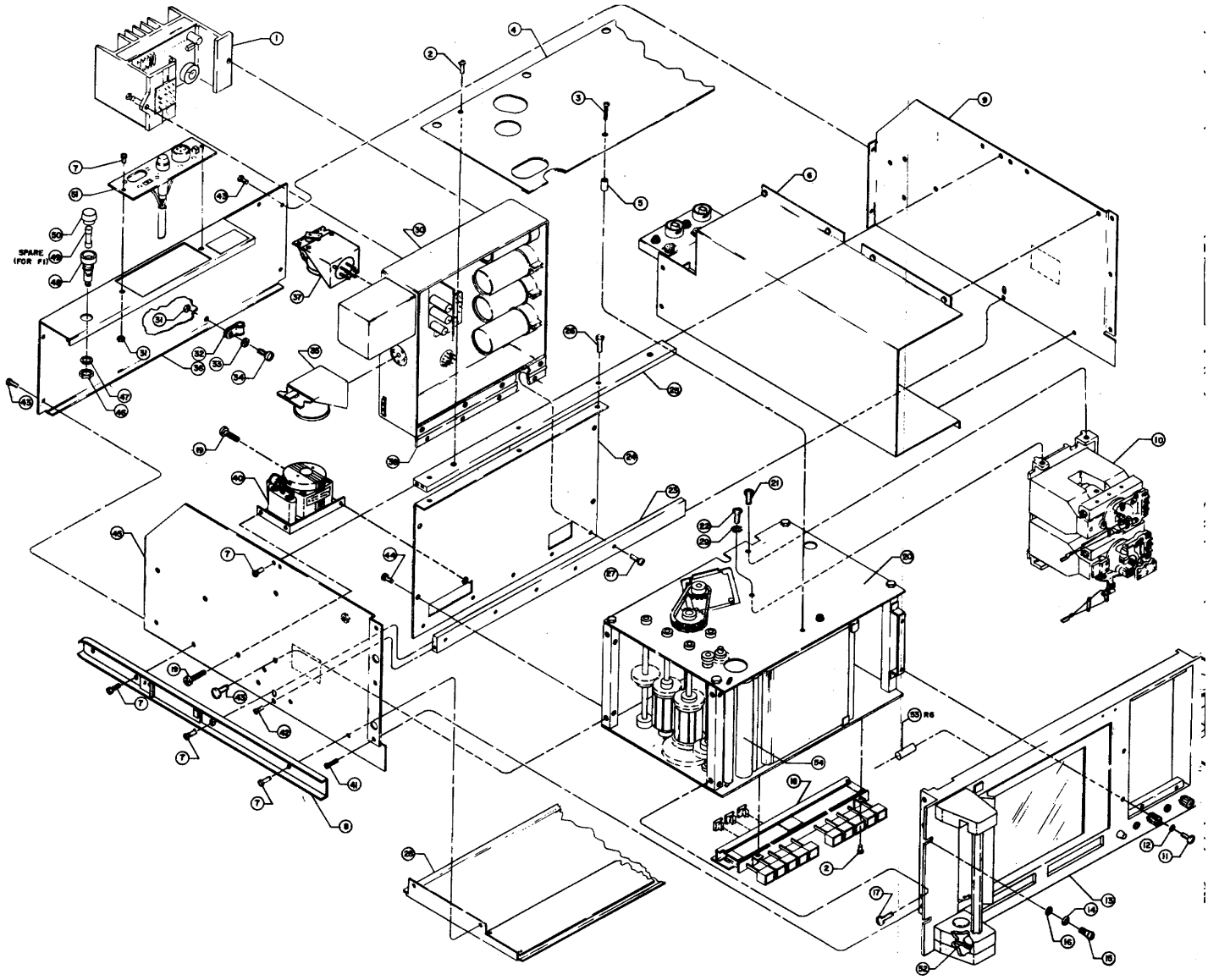
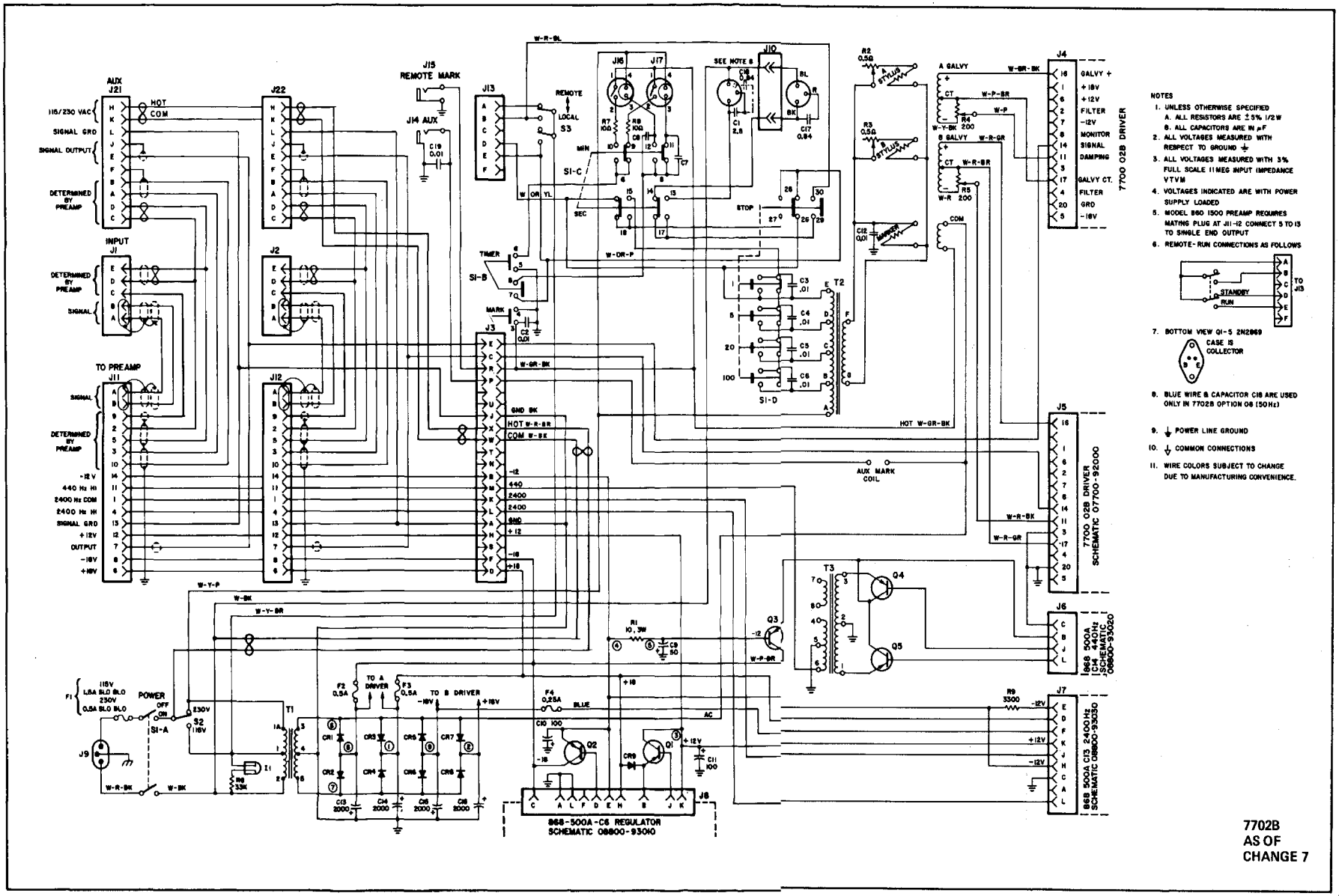


Figure 2. Two-Channel Thermal Recorder 115/230V, 60Hz

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 2 (Cont.)	
45	07702-00121	PLATE, Left side	1
46	No Number	NUT, Fuseholder, P/O item 48	2
47	No Number	WASHER, Rubber, P/O item 48	2
48	26H-2	FUSE HOLDER	2
49	26B-27	FUSE, Slo blo, 1.5 amp, 115V (Spare)	1
	26B-6	FUSE, Slo blo, 0.8 amp, 230V (Spare)	1
50	No Number	CAP, Fuse holder, P/O item 48	2
51	07702-60040	POWER INPUTPLATE ASSEMBLY (See fig. 13, item 2)	1
52	77A-66	BELT	1
53	50AB-33J	RESISTOR, 33K ohms (R6)	1
54	320-100-C28	PAPER GUIDE ASSEMBLY	1

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 3	
1	16S-7	COVER, Transistor	1
2	86D-6-8B	SCREW, Sheet metal, no. 6	2
3	16T-68	TRANSISTOR, Type 2N2869/301 (06)	1
4	74T-5	WASHER, Anodized	1
5	53B-7R5JA	RESISTOR, 7. 5 ohms + 5%o (RZZ, R23)	2
6	126-17	CLAMP	2
7	86B-4-4P	SCREW, Sheet metal, no. 4	1
8	40D-10	NUT, Speed	2
9	1OE20-3MX	CONNECTOR, 20-contact (J1)	1
10	86D-4-6B	SCREW, Sheet metal, no. 4	2
11	07700-62010	PRINTED CIRCUIT BOARD ASSEMBLY (See fig. 4)	1
12	07700-62020	CHASSIS ASSEMBLY (Inseparable)	1
13	74T-8	WASHER, Anodized	1
14	16T-74	TRANSISTOR, Type 2N3054 (Q7)	1
15	0700-02020	SCREW, Retaining	2
16	71A-8/32	WASHER, Split	2



Schematic Diagram 07702-91000, Model 7702B Recorder

MANUAL CHANGES MODEL 7702A, 7702B

Delete ground wire between Preamp connector Pin 13 and Auxiliary connector Pin L.

4. Remove from ground the shield around wires from Preamp connector Pins 2 and 5 to Input connector Pins D and E.
   Reconnect shield of this wire to Preamp connector Pin 9 and Input connector Pin C.
5. Add jumper from Input connector pin C to auxiliary connector Pin J.
6. Remove from Auxiliary connector Pin J the shield around the wire on Auxiliary connector Pin E.
   Reconnect shield of this wire to Auxiliary connector Pin L, signal ground.
7. Remove from Preamp connector Pin 9 the shield around wire on Preamp connector Pin 7.
   Reconnect shield of this wire to Preamp connector Pin 13, signal ground.
8. Reverse connection of AC HOT and AC COM on pins H and K of Auxiliary connector. (This wiring is completely deleted by Change 12.)

CHANGE 11: Page 12, Item 9, and following Paragraph 2-25:
Add following CAUTION note:

CAUTION

TO MINIMIZE ELECTRICAL SHOCK HAZARD TO PATIENT AND OPERATOR IN CERTAIN MEDICAL APPLICATIONS, USE THREE WIRE POWER CORD. CONNECT ONLY TO PROPERLY GROUNDED THREE WIRE OUTLET. CONNECT GROUND STRAP FROM THIS UNIT OR EQUIPMENT RACK TO UNPAINTED METAL COLD WATER PIPE.

CHANGE 12: On schematic diagram for 7702B unit (included with Change 7), delete wiring from P3, Pins X and W to J21 and J22, Pins H and K, to remove 115/230 volt ac wiring from Auxiliary connectors. Remove connections from S1A Power Switch to J3, Pins X and W.
Page 1-1, Paragraph 1-9:
After entry c, add Option 09, 50 Hz Recorder with medical speeds (2.5, 5, 25 and 50 mm/sec.
Page 1-1, Paragraph 1-9:
Delete Options 16 and 17, added by Change 8.
IPB, Page 22, Item 48:
Add following components:
0160-2554 Capacitor (Option 09)
3140-0337 Drive Motor, 450 RPM (Option 09)
3140-0398 Drive Motor, 375 RPM (Option 09)
07702-00330 Bracket (Option 09)

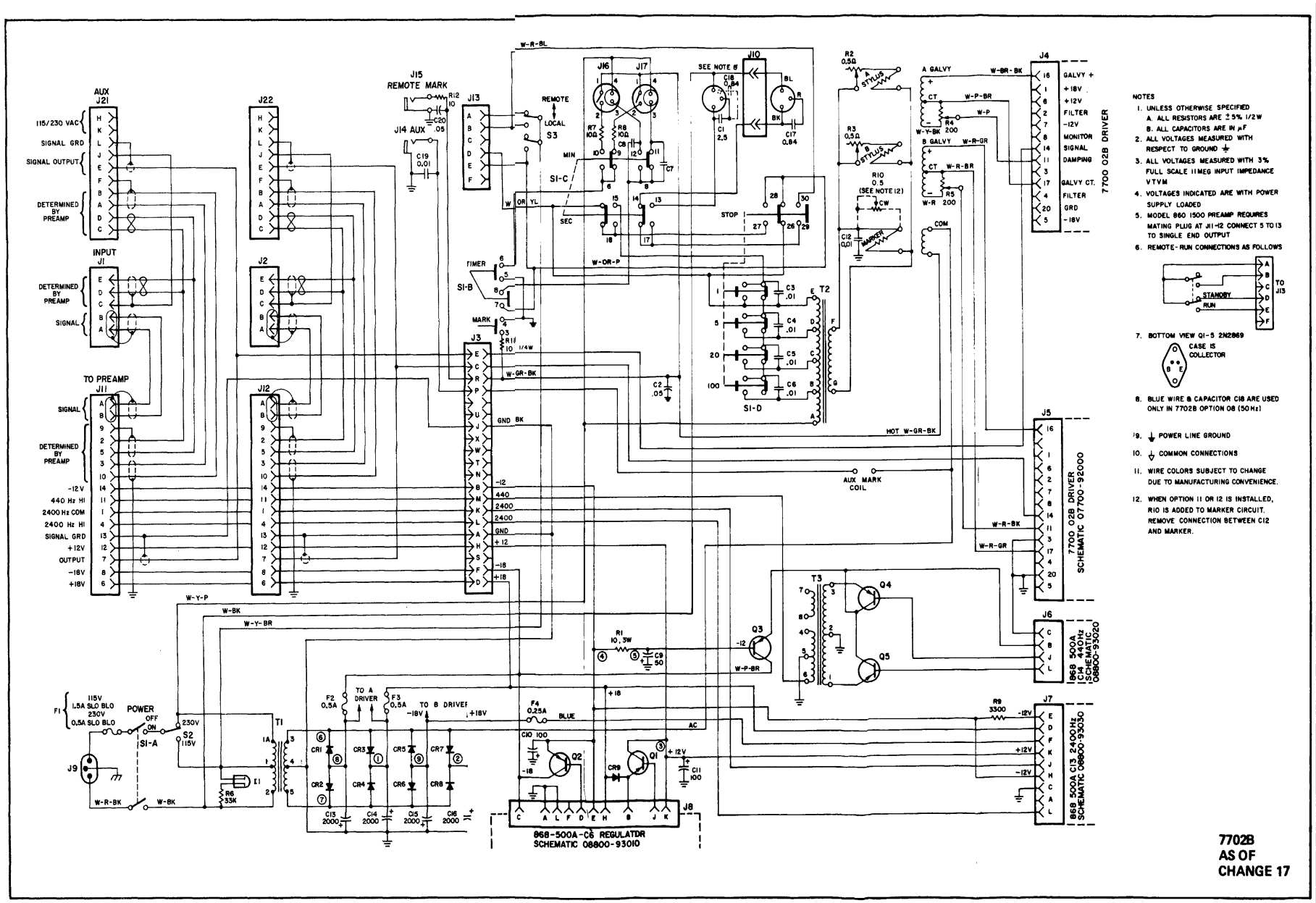
CHANGE 13: On schematic diagram for 7702B unit (included with Change 7), add optional R 10 (Option 12 only), between T2 and the Marker stylus.

MANUAL CHANGES MODEL 7702A, 7702B

IPB Page 44, Recorder Assembly Parts List:
Add C20, CAPACITOR, .05 MFD 100 WVDC, Ceramic, 0150-0096, 845-Y5V-5032, 15450.

IPB Page 45, Recorder Assembly Parts List:
Add R12, RESISTOR, 10 ohms, 0683-1005, CB-1005, 01121.

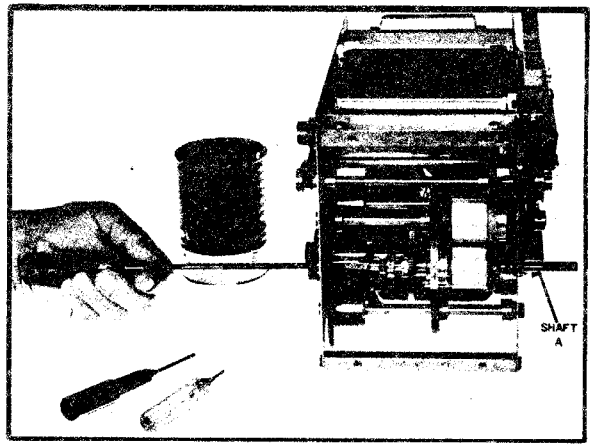
IPB Page 18, Ref 10:
Change Part No. to 5000-0358.



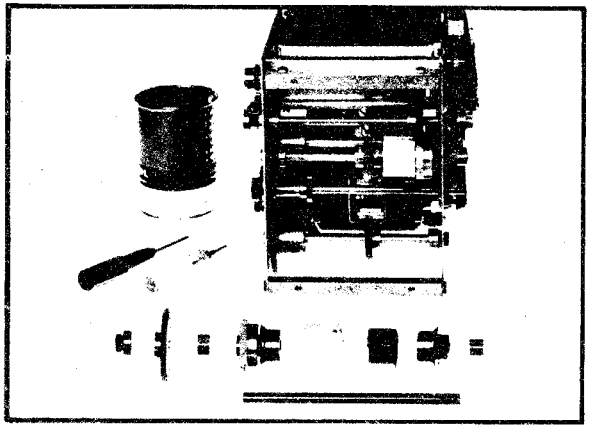
NOTES

1. UNLESS OTHERWISE SPECIFIED
   A. ALL RESISTORS ARE ±5% 1/2W
   B. ALL CAPACITORS ARE IN μF
2. ALL VOLTAGES MEASURED WITH RESPECT TO GROUND ⏚
3. ALL VOLTAGES MEASURED WITH 3% FULL SCALE 11MEG INPUT IMPEDANCE VTVM
4. VOLTAGES INDICATED ARE WITH POWER SUPPLY LOADED
5. MODEL 860 1500 PREAMP REQUIRES MATING PLUG AT J11-12 CONNECT 5 TO 13 TO SINGLE END OUTPUT
6. REMOTE-RUN CONNECTIONS AS FOLLOWS
7. BOTTOM VIEW Q1-5 2N2869
8. BLUE WIRE & CAPACITOR C18 ARE USED ONLY IN 7702B OPTION 08 (50Hz)
9. ⏚ POWER LINE GROUND
10. ⏚ COMMON CONNECTIONS
11. WIRE COLORS SUBJECT TO CHANGE DUE TO MANUFACTURING CONVENIENCE.
12. WHEN OPTION 11 OR 12 IS INSTALLED, R10 IS ADDED TO MARKER CIRCUIT. REMOVE CONNECTION BETWEEN C12 AND MARKER.

Schematic Diagram 07702-91000, Model 7702B Recorder

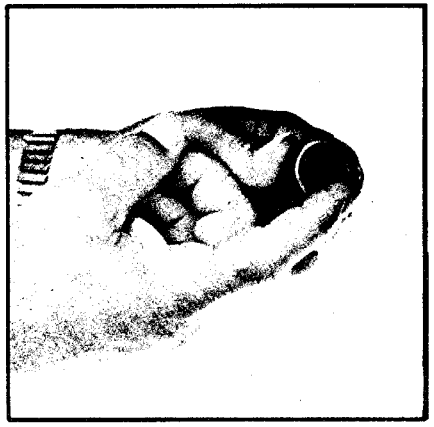


(a) Shaft A removal



(b) Shaft A components

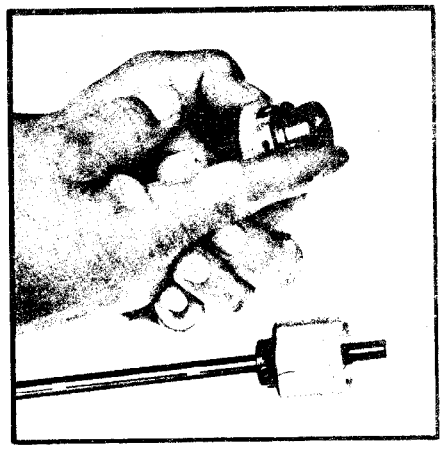
(c) Shaft adapter lubrication



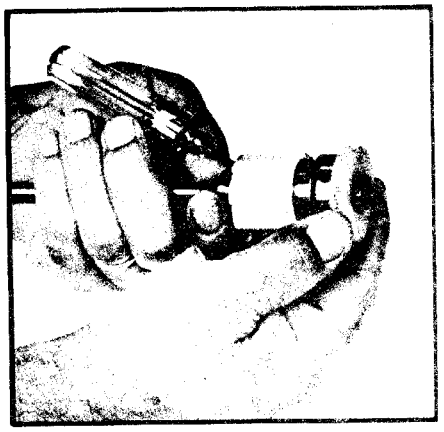
(d) Spring lubrication

(e) Shaft adapter and spring lubrication

(f) Lubrication of spring interior wtih sleeve added



(g) Hub assembly lubrication



(h) Reassembly of clutch

Figure 5-12 . Shaft A Lubrication Procedures

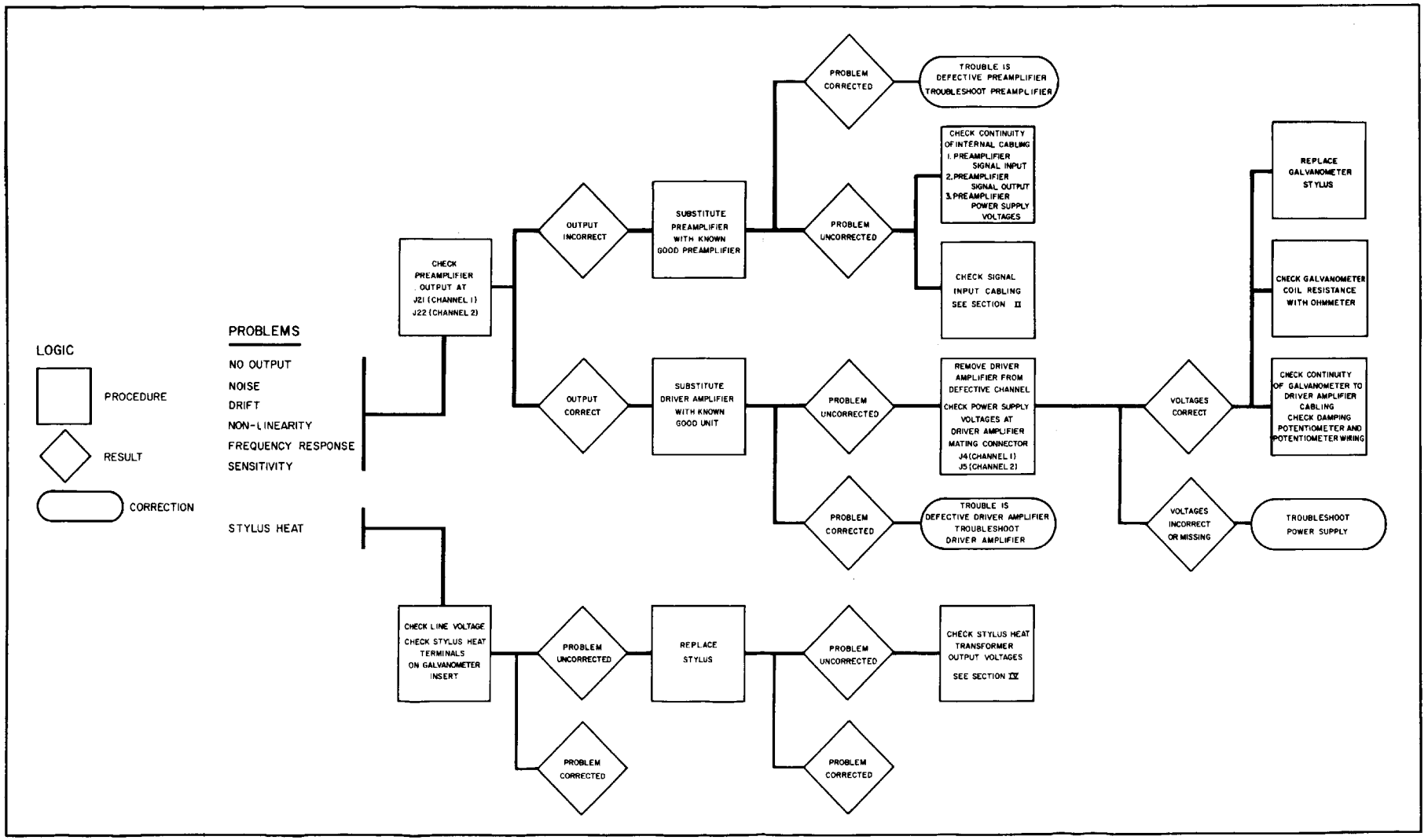


Figure 5-17 (a) . Troubleshooting Chart Problems in One Channel

Section V
Figure 5-17(b)

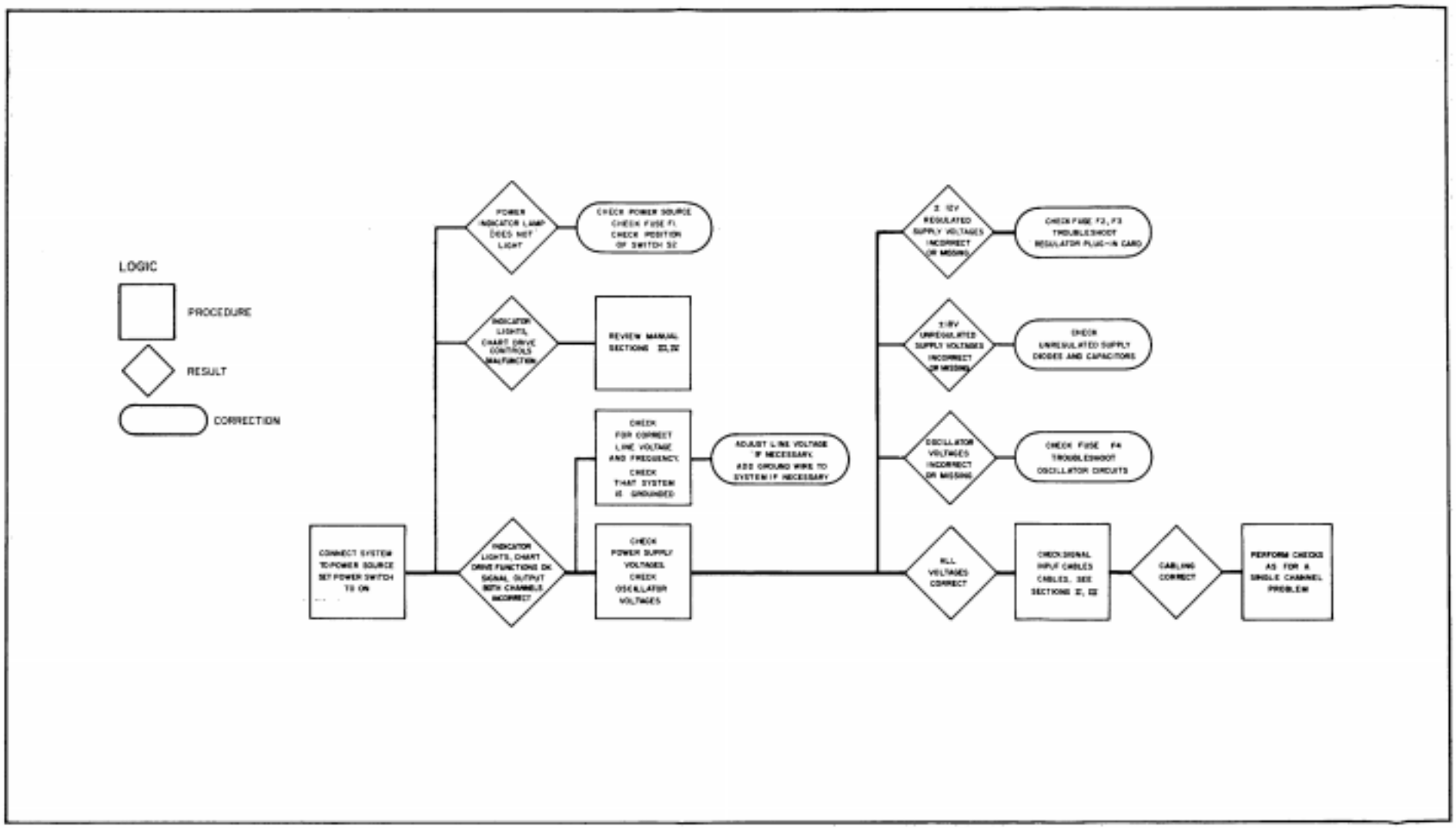


Figure 5-17(b) . Troubleshooting Chart Problems in Both Channels

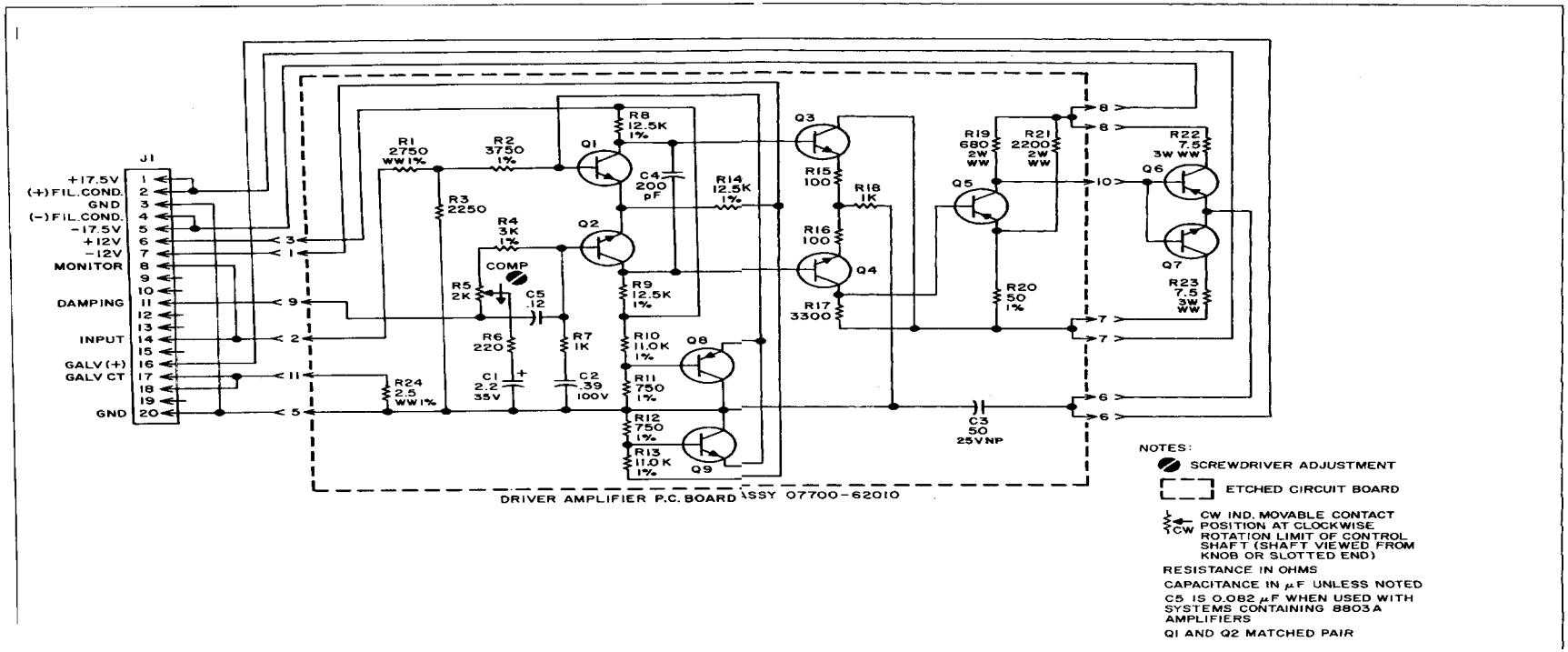


Figure 3. Model 7700-02A Driver Amplifier, Schematic Diagram

VENDOR'S CODE

Code No.	Name Address
01121	Allen-Bradley Co. Milwaukee, Wisconsin
01295	Texas Instruments, Ins. Transistor Products Division Dallas, Texas
01686	RCL Mfg. Co. Riverside, N.J.
05397	Union Carbide Corp. Linde Div. Kemet Dept. Cleveland, Ohio
05844	Callins Industries, Inc. Greenfield,Tenn.
52983	Sanborn Company Division of Hewlett Packard Waltham, Mass.
714450	CTS Corp. Elkhart, Ind.
71785	Cinch Mfg. Co. And Howard B. Jones Div. Chicago,Illinois
71590	Centralab Division of Globe-Union, Inc. Philadelphia, Pa.
84411	Good-All Electric Mfg. Co. Ogallala, Nebraska
89473	General Electric Distr. Corp. Schenectady, N.Y.
91662	Elco Corp. Philadelphia, Pa.

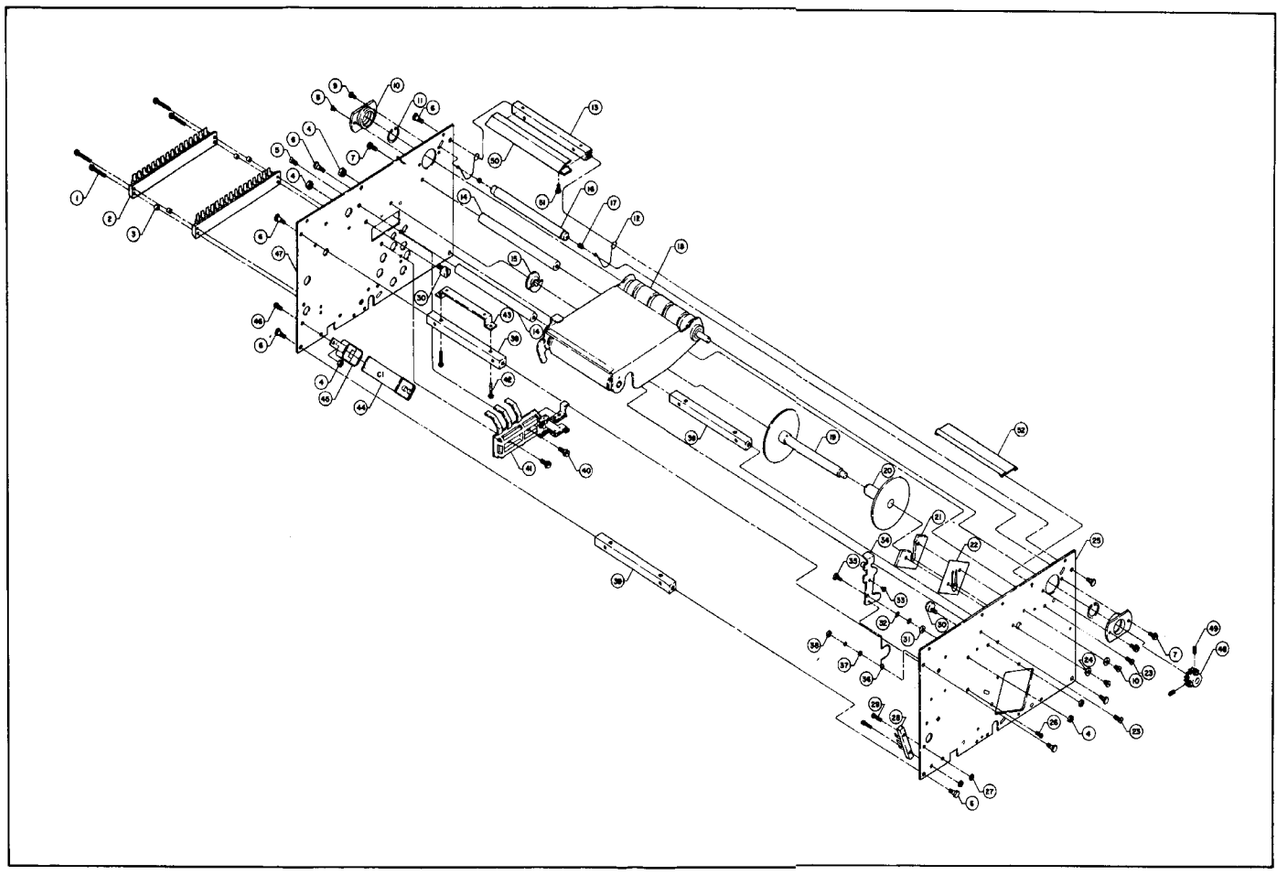


Figure 9. Paper Drive Assembly (table, brake and associated parts)

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Figure 9. Paper Drive Assembly (table, brake and associated parts)

Recording Sub-system 7702A

REF.	STOCK NO.	DESCRIPTION	QTY.
51	5-G-73	gear, 24 tooth	1
	5G-29	GEAR, 48 tooth (Option 10 only)	1
52	5G-33	Gear, 72 tooth	2
53	77A-66	BELT (see fig. 2, item 52)	Ref
54	5B-68	CHAIN (see fig. 20, item 11) (Options 11 and 12 only)	Ref
55	5S-28	Sprocket (See fig. 20, item 13) (Options 11 and 12 only)	Ref

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 10	
1	72A-8A	LOCKWASHER	3
2	83A-8-10B	SCREW, Sems, no. 8-32 x 5/8 in. lg	5
3	80A-832-10D	SCREW, Flat, hd, no. 8-32 x 5/8 in. lg	1
4	827-7	COLLAR	1
5	5G-95	GEAR	1
6	81D-8-32	SETSCREW, Spline, no. 8-32 x 3/16 in. lg	20
7	81D-6-22	SETSCREW, Spline, no. 6-32 x 1/8 in. lg	2
8	5G-96	GEAR PULLEY	1
9	825-22	SHAFT, No. 3	1
10	83A-6-3B	SCREW, Sems, no. 6-32 x 3/16 in. lg	4
11	320-165	COVER, Gear	1
12	703-16D-312-14	SPACER	1
13	07702-20011	SHAFT, No. 4	1
14	710A-2P4	WASHER	3
15	81D-10-42	SETSCREW, Spline no. 10-32 x 1/4 in. lg	4
16	358-704	ADAPTER, Clutch	2
17	5G-32	GEAR, 24 tooth	2
17A	5G-32	GEAR, 24 tooth	1
	5G-30	GEAR, 48 tooth (Option 10 only)	1
18	320-100C19	CLUTCH HUB ASSEMBLY	1
19	358-706	SPRING, Clutch	2
20	358-705	SLEEVE	2
21	825-25	SHAFT	1
22	320-100C18	CLUTCH HUB ASSEMBLY	1
23	07702-20013	SHAFT, No. 2	1
24	5G-90	GEAR, 36 tooth	1
	5G-32	GEAR, 24 tooth (Option 10 only)	1
25	827-5	COLLAR	2
26	No Number	SETSCREW, P/O item 22	4
27	SC-4	MINI CLUTCH	2
28	07702-20012	SHAFT, No. 7	1
29	No Number	SETSCREW, P/O item 27	4
30	5G-34	GEAR, 120 tooth	1
30A	5G-34	GEAR, 120 tooth	1
	5G-31	GEAR, 96 tooth (Option 10 only)	1
31	5G-91	GEAR	1
	5G-92	GEAR, 120 tooth (Option 10 only)	1
32	710A-15	WASHER	4
33	320-124	STUD	1
34	5G-75	GEAR, 60 tooth	1
35	59A-9	RING GRIP	1
36	5B-46	DRIVE CHAIN	1
	5B-3	DRIVE CHAIN (Option 08 only)	1
37	No Number	SETSCREW, P/O item 38	2
38	5C-10	OVER-RUNNING CLUTCH	1
39	1500-0065	SPROCKET, 30 tooth	1
	5S-28	SPROCKET, 25 tooth (Option 08 only)	1
40	81D-8-4Z	SETSCREW, Spline no. 8-32 x 1/4 in. lg	1
41	5S-7	SPROCKET, 20 tooth	1
42	703 -16D312 -29	SPACER	1
43	5G-35	GEAR, 72 tooth	1
44	83A-10-8G	SCREW, Sems, no. 10-32 x 3/8 in. lg	4
45	320-160	PLATE, Motor mounting	1
46	825-24	SHAFT, No. 5	1
47	827-6	COLLAR	1
48	38B-37	MOTOR, 60 cycle	1
49	5A-61	BEARING	8
50	5A-33	BEARING	4

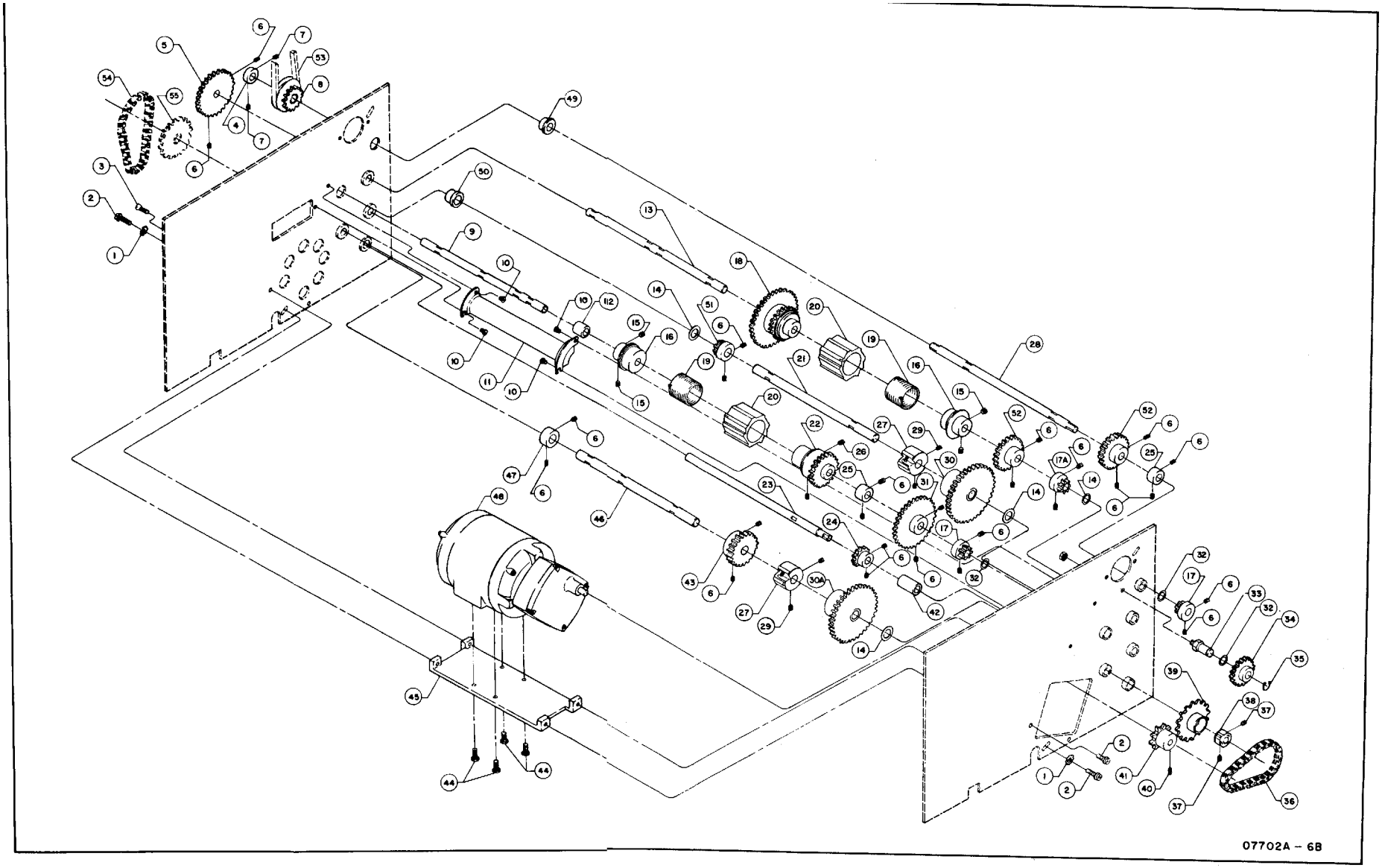

Figure 10. Paper Drive Assembly (gear train and associated parts)

REF.	STOCK NO.	DESCRIPTION	QTY.
		Listing for Figure 11	
1	83A-8-6B	SCREW, Sems, no. 8-32 x 3/8 in. lg	1
2	320-175	LIFT, Table	1
3	8-3	NUT, Pin	2
4	320-112	TABLE, Paper drive	1
5	4S-4	BEARING, Ball	2
6	703-16D315-8	SPACER, Drive roll	2
7	320-100-C16	DRIVE ROLL ASSEMBLY	1
8	320-141	STUD	1
9	5A-45	BEARING, Flange	1
10	81A-1032-8K	SETSCREW, Slotted cup, pt, 1/2 in	1
11	151-158	PIVOT, Brake adjust	1
12	6A-4	BALL, Steel, 3/8 in. dia	1
13	151-154	SPRING	1
14	151-100-C18P2	BRAKE, ROLL	1
15	151-159	BRAKE, Shoe	1
16	320-139	PIVOT, Brake roll	1
17	320-140	HOUSING, Brake shoe	1
18	44J-4-20	ROLL PIN	1
19	320-114	GUIDE, Paper drive roll	1
20	83A-4-3B	SCREW, Sems, no. 4-40 x 3/16 in. lg	4
21	320-164	PLATEN	1
		Listing for Figure 12	
1	83A-4-5B	SCREW, Sems, no. 4-40 x 5/16 in. lg	2
2	320-123	PLATE, Molded	1
3	07702-00210	CAM	3
4	83A-4-3B	SCREW, Sems, no. 4-40 x 3/16 in. lg	6
5	320-159	BRACKET, Upper	1
6	320-127	ACTUATOR, Upper	1
7	320-109	SUPPORT	1
8	824-33	SPRING, Clutch	2
9	320-163	BRACKET, Actuator spring	1
10	83A-6-4B	SCREW, Sems, no. 6-32 x 1/4 in. lg	1
11	83A-6-6B	SCREW, Sems, no. 6-32 x 3/8 in. lg	2
12	320-126	ACTUATOR, Lower	1
13	320-158	BRACKET, Lower	1

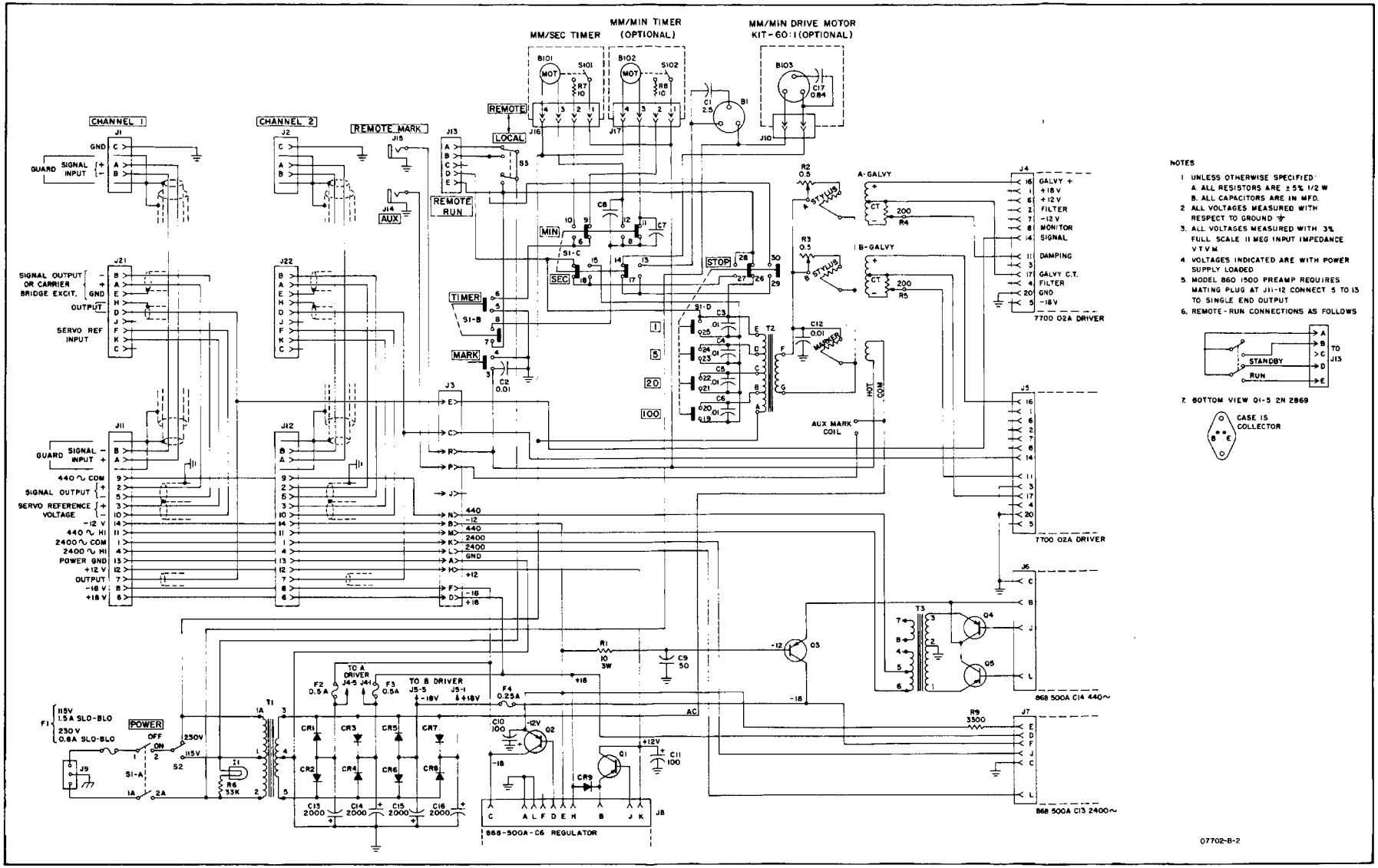

Figure 23A. 7702-01A Recorder Schematic

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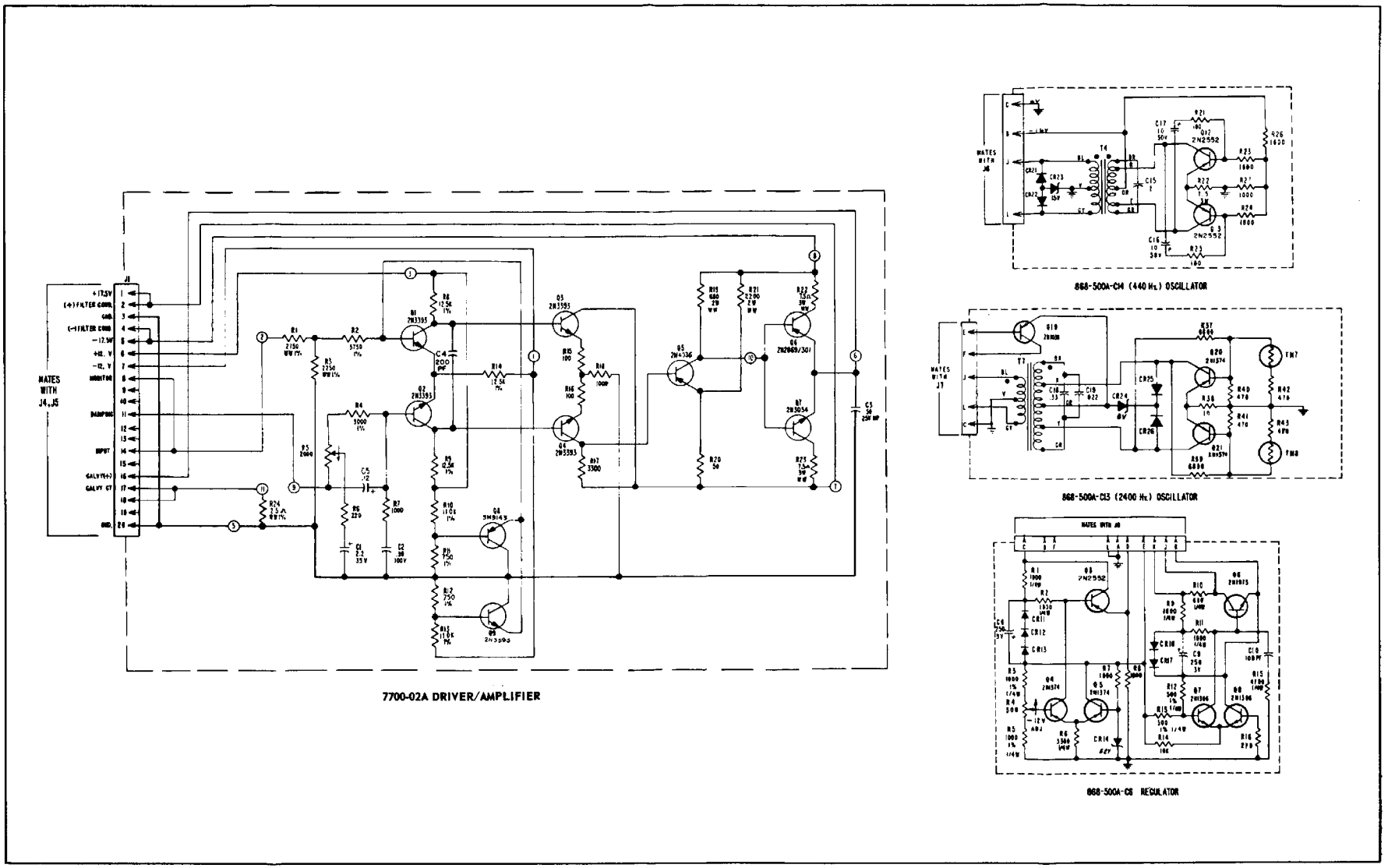

Figure 23B. Model 7702A Power Supply Plug-in Assemblies, Schematic Diagram

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