

BULLETIN 311B/RF
NAVSHIPS 0967-173-7030
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VOLUME 3 (Of 4 Volumes)

TECHNICAL MANUAL
28 KEYBOARD SEND-RECEIVE (KSR)
AND RECEIVE-ONLY (RO)
TELETYPEWRITER SETS



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INTRODUCTION

Volumes 3 and 4 have been added to Bulletin 311B to include Radio Frequency Interference Suppression features for the 28 Keyboard Send-Receive (KSR) and Receive-Only (RO) Teletypewriter Sets. These volumes are identified by an RF suffix and must be used with Volumes 1 and 2 which contain literature for the standard features. Volumes 1 and 2 must be used with all sets whether RFI modified or not.

Volume 3, identified as 311B/RF (NAVSHIPS 0967-173-7030), provides descriptive information and parts ordering information peculiar to sets with RFI features installed.

Volume 4, identified as 311B/RF (NAVSHIPS 0967-173-7040), provides wiring diagrams for sets and their components that are equipped with RFI features.

Each volume is made up of a group of appropriate independent sections. The sections are complete within themselves; they are separately identified by title and section number and the pages of each section are numbered consecutively, independent of other sections.

The identifying number of a section, a 9-digit number, appears at the top of each page of the section, in the left corner of left-hand pages and the right corner of right-hand pages.

To locate specific information, refer to the table of contents. The name of the involved component, the title of the section, and the 9-digit section number may then be found. The sections are arranged in the order shown in the table of contents. Turn to page one of the section indicated where the contents of the section will be found (except where a section is small and does not require a listing of contents).

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RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
FOR 28 TELETYPEWRITER EQUIPMENT
GENERAL DESCRIPTION

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1. GENERAL

1.01 This section, together with other associated sections, is intended for use as a supplement to standard literature covering teletypewriter equipment sets which have radio frequency interference (rfi) suppression features installed. It presents the general principle and purpose of radio frequency interference suppression as applied to 28 teletypewriter equipment. Only a broad view is taken in this section, since rfi has been applied to various equipment sets. For more detailed information regarding particular sets and component units, refer to associated sections in this series.

1.02 Rfi suppression as applied to teletypewriter equipment is accomplished by means of shielding and wave shaping a low level electrical telegraph signal throughout the equipment. The installations vary with each set, but produce the same results of insuring signal line privacy.

2. SIGNALING

2.01 The code is transmitted by means of a ± 6 volt polar signal through a network of shielded cables to the shielded container of the electrical service assembly. A +6 volt signal is mark; a -6 volt signal is space.

3. CABLING

3.01 The shielded cabling varies with each set according to need. Each component unit of a set is equipped with sufficient shielding, in the form of metallic enclosures and shielded cables, to suppress signal radiation. All signal generators and magnet assemblies in the signal circuitry are shielded by means of metal containers attached to their respective cables. Interconnecting cables join the component units to the electrical service assembly by means of metal connectors which screw together for a tight shielded connection.

4. ELECTRICAL SERVICE ASSEMBLY

4.01 The electrical service assembly is an electrically shielded container in which the shielded cables terminate. It also serves as a housing for certain components such as plug-in selector magnet driver circuit cards, clutch magnet driver circuit cards, keyer circuit cards, power supply circuit cards, and relays.

4.02 Electrical service assemblies which house low level keyers (LLK) and selector magnet drivers (SMD) have double shielded containers and double shielded cables with appropriate connectors for LLK and SMD connections to external equipment.

SECTION 573-600-100TC

5. CROSS REFERENCE CHARTS

5.01 These charts provide a cross reference of Navy coded sets and Teletype coded sets, list the components that make up a set, the electrical service assembly for each set, and the wiring diagram package (WDP) applicable to each set.

5.02 The abbreviations used in the charts are defined as:

ASR - Automatic Send-Receive
KSR - Keyboard Send-Receive

RO - Receive Only
ROTR - Receive-Only Typing Reperforator
SRTR - Send-Receive Typing Reperforator
ESA - Electrical Service Assembly
LLK - Low-Level Keyer
SMD - Selector Magnet Driver
CMD - Clutch Magnet Driver
PS - Power Supply
WDP - Wiring Diagram Package

5.03 A chart providing detailed information for the various electrical service assemblies can be found in Section 573-613-100TC covering the electrical service assemblies.

RADIO FREQUENCY INTERFERENCE (RFI)
 SUPPRESSED 28 TELETYPEWRITER SETS
 INSTALLATION

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1. GENERAL

1.01 This section covers the general installation procedures for teletypewriter sets equipped with rfi suppression. The purpose of this section is to provide information for the electrical connection of the electrical service assembly to a power source, telegraphic signal line, and other interrelated connections necessary for the operation of the set. Wherever applicable, reference should be made to appropriate standard literature covering the mechanical installation of set components such as typing unit, reperforator, motor unit, etc.

1.02 A wiring diagram package (WDP) is packed with each rfi set and contains pertinent schematic and actual wiring diagrams. Reference should be made to the appropriate WDP for specific wiring information.

1.03 References made to left or right, top or bottom, and front or rear apply to the set in its normal operating position as viewed from the front.

1.04 The photographs included in this section are of typical rfi installations and should be used in support of their associated text.

1.05 Check the cabinet ground connection before turning power on to prevent the hazard of electrical shock.

2. UNPACKING

2.01 All equipment is packed for maximum protection during shipment. However, due caution must be taken in unpacking and handling to prevent damage and to insure personal safety. In unpacking, observe all caution labels as well as any special instructions on the cartons. All small bags and loose parts should be kept with their associated apparatus until used in the installation.

3. INSTALLATION

A. Floor Model Automatic Send-Receive (ASR) Set (Figure 1)

3.01 Unpack and mount the typing unit, auxiliary typing reperforator, and tape winder. Connect all cable assemblies to their associated connectors. The power input cables for the paper winder have been factory installed on the cabinet. Route the power input cable to the paper winder by removing the coverplate from the right rear corner of the floor in the lower compartment of the cabinet. Route this cable upward on the outside of the cabinet to the associated cable on the paper winder.

3.02 Two junction boxes are provided on the bottom floor of the cabinet. The box on the right side is for power input; the one on the left is for signal line and clutch stepping control input.

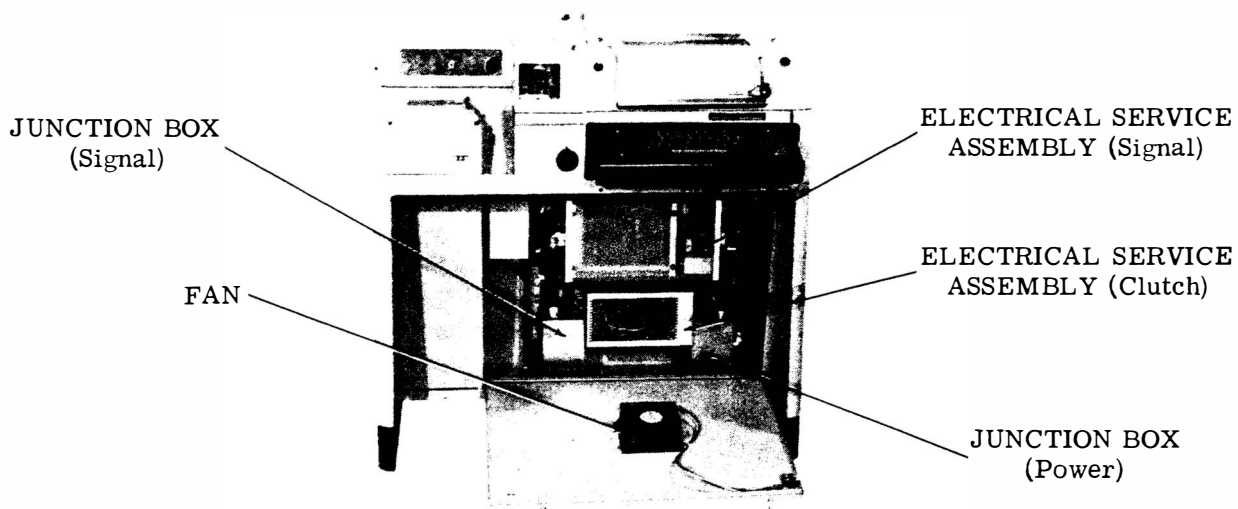


Figure 1 - Floor Model Automatic Send-Receive (ASR) Set

3.03 Power is distributed by means of a three-conductor shielded cable, routed through flexible conduit. Separate conduit is connected from the junction box to the electrical service assembly containing the clutch magnet drivers. Separate conduit is also routed to the electrical service assembly containing the selector magnet driver, polar line keyer, and to the power line filters in the upper compartment of the cabinet.

3.04 Power should be brought in from the bottom of the cabinet by means of conduit connected to the junction box. Two conduit connectors are attached to the junction box to provide two separate power line inputs: one power line for the clutch and signal electrical service assemblies and one for the cabinet power to motors, lamps, etc. The junction box is also compartmented to maintain power line separation. A five-point terminal block is provided on the left side of the junction box for the clutch stepping control and signal line electrical service assemblies. A three-point terminal block is provided on the right side of the junction box for the cabinet power. Where only one power source is used, power should be brought into either side of the junction box and routed to the other side through a knockout in the partition. Make certain that the shielding which surrounds the power input leads is connected to the appropriate terminals in the junction box.

3.05 The junction box on the left side of the cabinet provides for the signal line input and output and the transmitter stepping signal input. Terminal blocks are not

provided in this box since cable leads are routed directly to the appropriate electrical service assembly. The junction boxes permit connection of conduit (one or two) to the bottom of the cabinet. Clutch and signal cable leads can be routed through separate compartments. If a single conduit is used, it can be routed into one compartment and brought into the other through a knockout in the partition.

3.06 The transmitter step pulse input should be routed through the junction box to the lower electrical service assembly (clutch control). Remove the cover from the service assembly and any packing or shipping details from the container. Remove the circuit board assemblies to facilitate cable installation. Connect the step pulse input leads to the TD terminal block. Replace the circuit board assemblies and the cover on the container.

3.07 The signal input and output leads should be routed through the junction box and through the flexible conduit to the upper electrical service assembly (signal). Remove the outer and inner covers from the service assembly and any packing or shipping details from the container. Remove the circuit board assemblies to facilitate cable installation. A label on the terminal block cover identifies the end of the three terminal blocks on the left side of the electrical service assembly. Connect the signal input leads to the TC terminal block and the signal output leads to the TB terminal block. Replace the circuit board assemblies making certain that the keyer card is placed in the KA connector. Replace the inner and outer covers on the container. The signal electrical service assembly provides ± 6 v dc voltage for the polar line keyer. A terminal strapping option permits use of an external battery.

3.08 With the installation of the signal lines completed, the set is ready for operation. Place the power switch in each electrical service assembly in the ON position.

B. Keyboard Send-Receive (KSR) Set (Figure 2)

3.09 Power is distributed by means of a three-conductor shielded cable routed through flexible conduit. Separate conduit connects the junction box to the clutch magnet, selector magnet driver, and keyer of the electrical service assembly (signal) and to power line filters in the upper compartment of the cabinet.

3.10 Power should be brought in from the bottom of the cabinet. The junction box, located on the lower right side of the cabinet, is compartmented to provide for two separate power lines. One compartment contains five terminals which provide power connections for the clutch and signal electrical service assemblies. The other compartment contains three terminals which provide power connections for the cabinet (motor, lamps, etc). Where only one power source is used, power should be brought into either compartment and led to the other compartment

through a knockout in the partition. The shielding which surrounds the three power leads should be connected to the terminals in the junction box.

3.11 The junction box on the left provides the signal input and output and the transmitter stepping signal input. No terminal blocks are provided in this box since the leads are to run directly to the appropriate electrical service assembly. The junction boxes permit the connection of conduit to the bottom of the cabinet. Clutch and signal leads can be routed through separate compartments. If a single conduit is used, the leads can be brought into one compartment and routed to the other by means of a knockout in the partition. The transmitter step pulse input should be pulled through the flexible conduit leading to the electrical service assembly (clutch).

3.12 The signal input and signal output should be pulled through the flexible conduit to terminal block TB in the electrical service assembly (signal). A decal on the terminal block cover identifies each of the three terminal blocks.

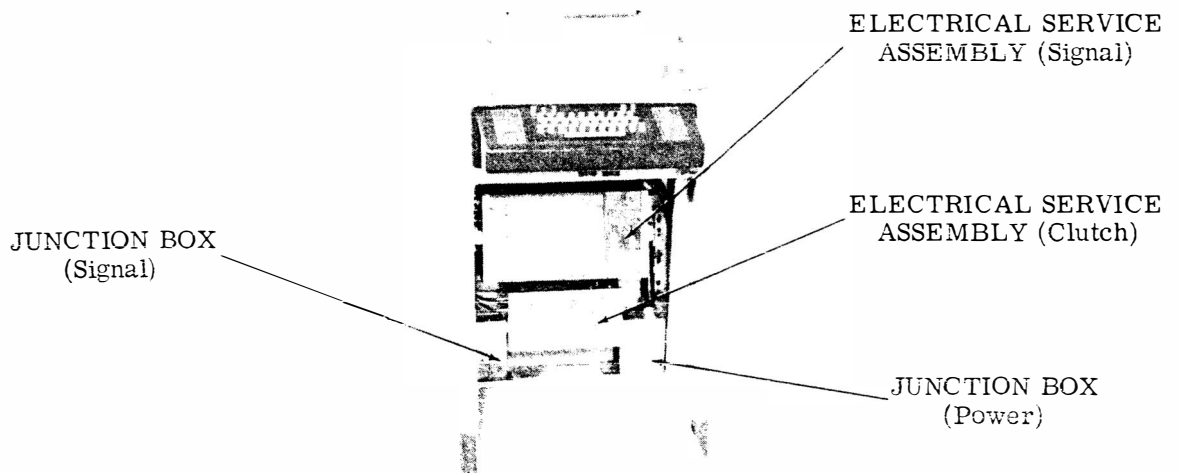


Figure 2 - Floor Model Keyboard Send Receive (KSR) Set

C. Floor Model Receive-Only (RO) Set

3.13 Power is distributed by means of a three-conductor shielded cable, routed through flexible conduit. Separate cables connect the junction box to the selector magnet driver in the electrical service assembly and power line filters in the upper compartment of the cabinet.

3.14 Power should be brought in from the bottom of the cabinet. The junction boxes are compartmented to provide for two separate power lines. One compartment provides five terminals for the electrical service assemblies clutch and signal power. The other compartment provides three terminals for cabinet power to motors, lamps, etc. Where only one power source is used, power should be brought into either compartment and routed to the other compartment through a knockout in the partition. The shields surrounding the three power leads are connected to terminals in the junction box.

3.15 The junction box on the left provides a means for the signal input. No terminal blocks are provided in this box since leads should be run directly to the appropriate electrical service assembly. The junction boxes permit the connection of conduit to the bottom of the cabinet. Clutch and signal leads can be routed to separate compartments. If a single conduit is used, the clutch and signal leads can be brought into one compartment and routed to the other through a knockout in the partition.

3.16 The signal input and output leads should be pulled through the flexible conduit to terminal block TB on the signal electrical service assembly. A label on the terminal block cover identifies each of the three terminal blocks on the left end of the electrical service assembly. Make the connections between the signal electrical service assembly and the appropriate selector magnet assembly. The mating connector pairs are identified.

D. Table Model Receive-Only Typing Reperforator (ROTR) Set, Receive-Only Page Printer (RO) Set, and Receive-Only Compact Page Printer (RO) Set (Figures 3 and 4)

3.17 A table mounted electrical service assembly (ESA) is used and can be mounted in space available anywhere near the set within the limit of the signal cable. Mounting brackets for the ESA are supplied, however, the customer must supply the hardware to fasten these brackets to a table or wall.

3.18 Route the signal line conduit or cable to the ESA container (the side opposite the fuse) and attach by means of a conduit fitting. The container has two 7/8-inch diameter knockouts for 1/2-inch conduit fittings.

3.19 Route the power line conduit or cable to the ESA container (the side with the fuse and power switch) and attach by means of a conduit fitting. The container has a 7/8-inch diameter knockout for 1/2-inch conduit fitting. A separate power cable should be brought into the base for the motor.

3.20 Route the signal cable from the ESA to the apparatus through the notch in the rear of the cover, through the nylon cable clamp at the rear of the base, and along the left side of the set to the selector magnet assembly connector. Tie the cable to the motor mounting post at the base to keep it clear of the fan.

E. Table Model 28/32 Compact Keyboard Send-Receive (KSR) Set, Keyboard Send-Receive (KSR) Set, and Send-Receive Typing Reperforator (SRTR) Set (Figures 5 and 6)

3.21 Mount the electrical service assemblies (ESA) in space available anywhere near the set within the limit of the signal cables. Mounting brackets for the ESA are supplied, however, the customer must supply the hardware to fasten these brackets to a table, wall, or cabinet.

3.22 Route the signal line conduit or cabling to the keyer selector magnet driver of the ESA. Route the signal line to the opposite side of the fuse and attach by means of a conduit fitting. The ESA container has two 7/8-inch diameter knockouts for 1/2-inch conduit fittings.

3.23 Route the synchronous pulse control conduit or cable to the ESA opposite the side of the fuse and attach by means of conduit fittings.

3.24 Route the power line conduit or cable to both ESA containers. Connect the power line to the side on which the fuse and power switch are located. Attach by means of a conduit fitting.

3.25 Route the clutch magnet driver output cable and signal cables through the notch in the rear of the cover. Route the cables through the nylon clamp on the base and connect to the appropriate terminal block and connector.

F. Rack Mounted Keyboard Send-Receive (KSR) Set (Figure 7)

3.26 Remove and retain the access plate and its mounting hardware at either or both sides of the electrical service assembly (ESA). Fasten 3/4-inch conduit for the ac power input to either side of the ESA. Route the power input leads through the conduit into the compartment on the left side of the ESA. Route the power leads to terminal block (TA) located on a bracket attached to the rear wall of the ESA. Turn the power switch to the OFF position.

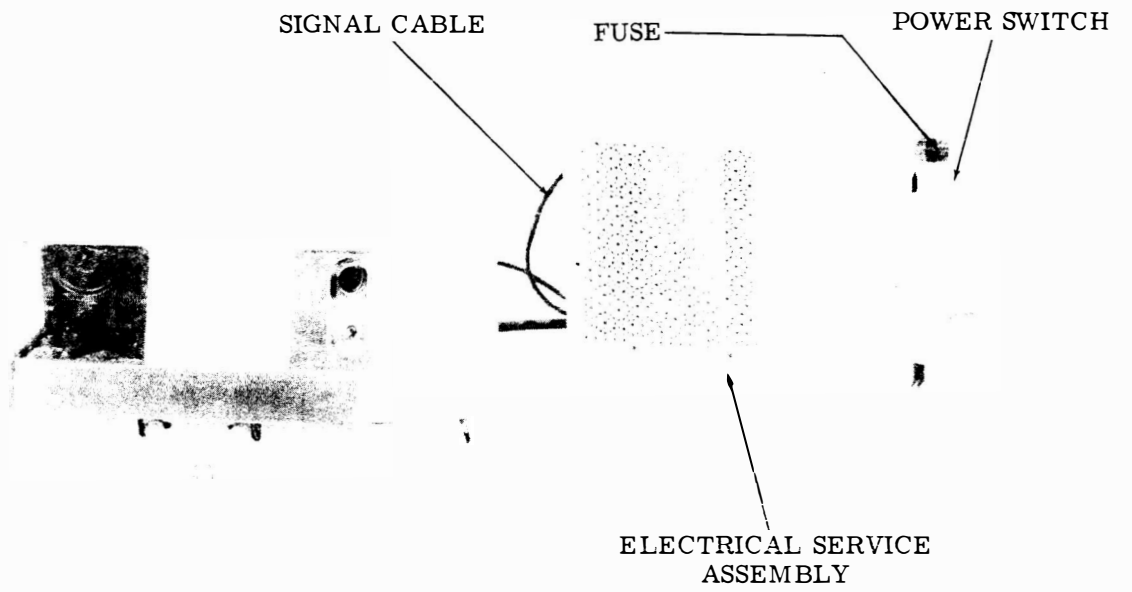


Figure 3 - Table Model Receive-Only Typing Reperforator (ROTR) Set

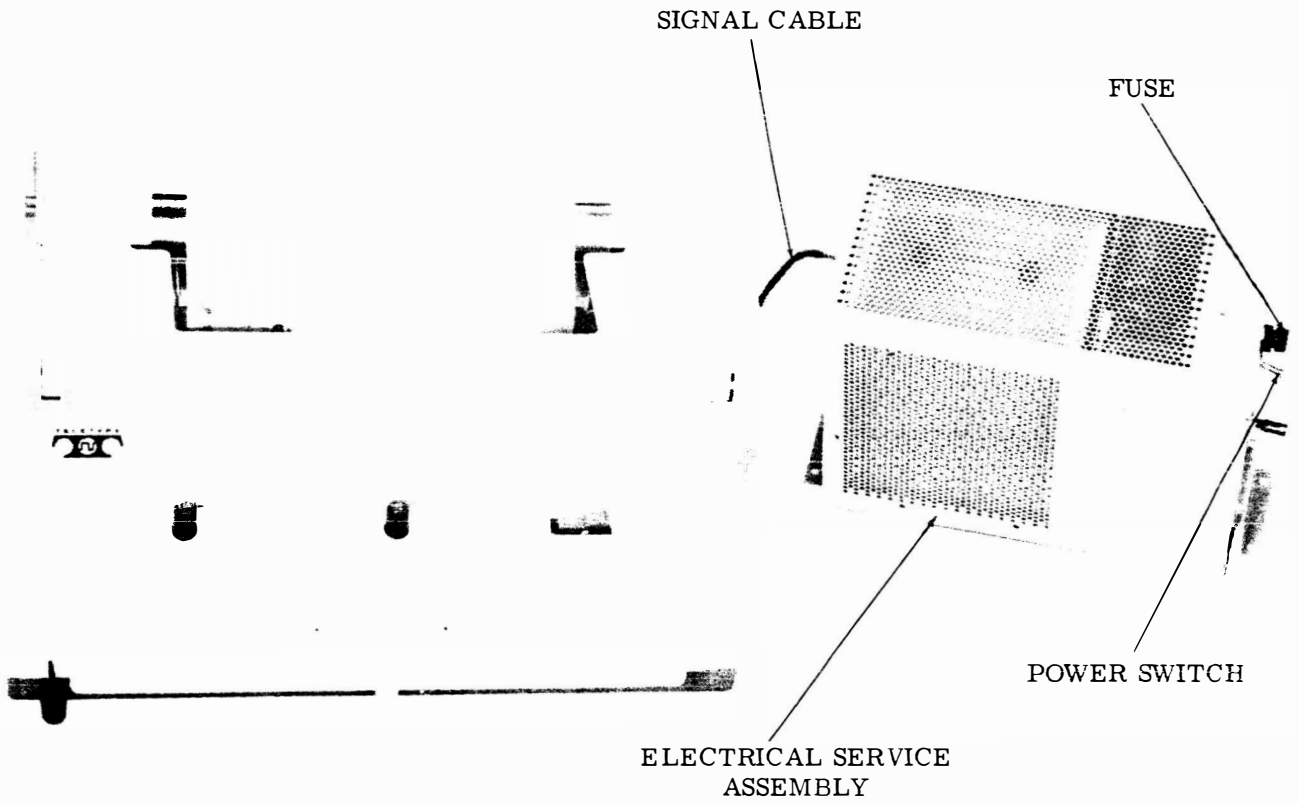


Figure 4 - Table Model Receive-Only Compact Page Printer (RO) Set

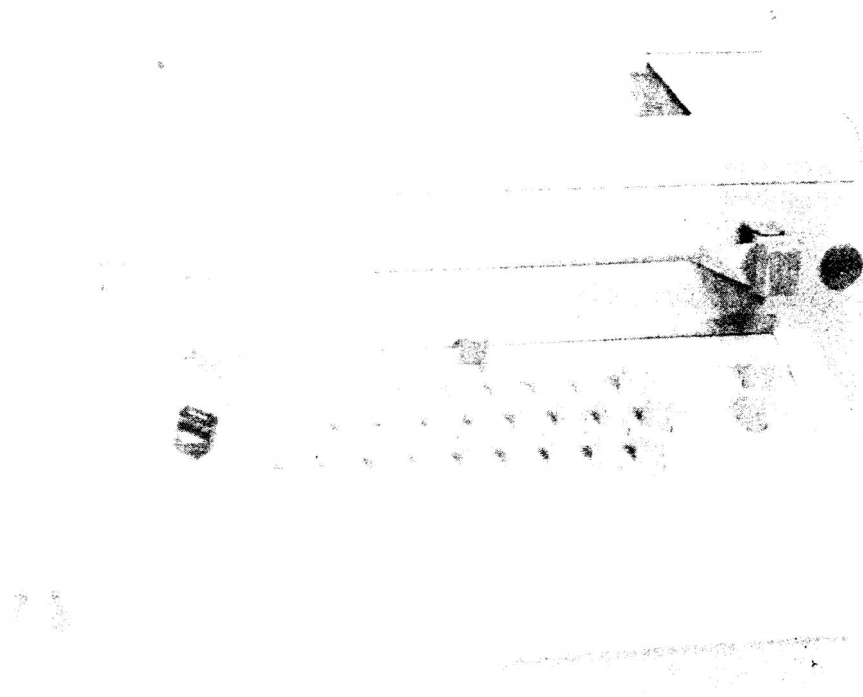


Figure 5 - Table Model 28/32 Compact Keyboard Send-Receive (KSR) Set

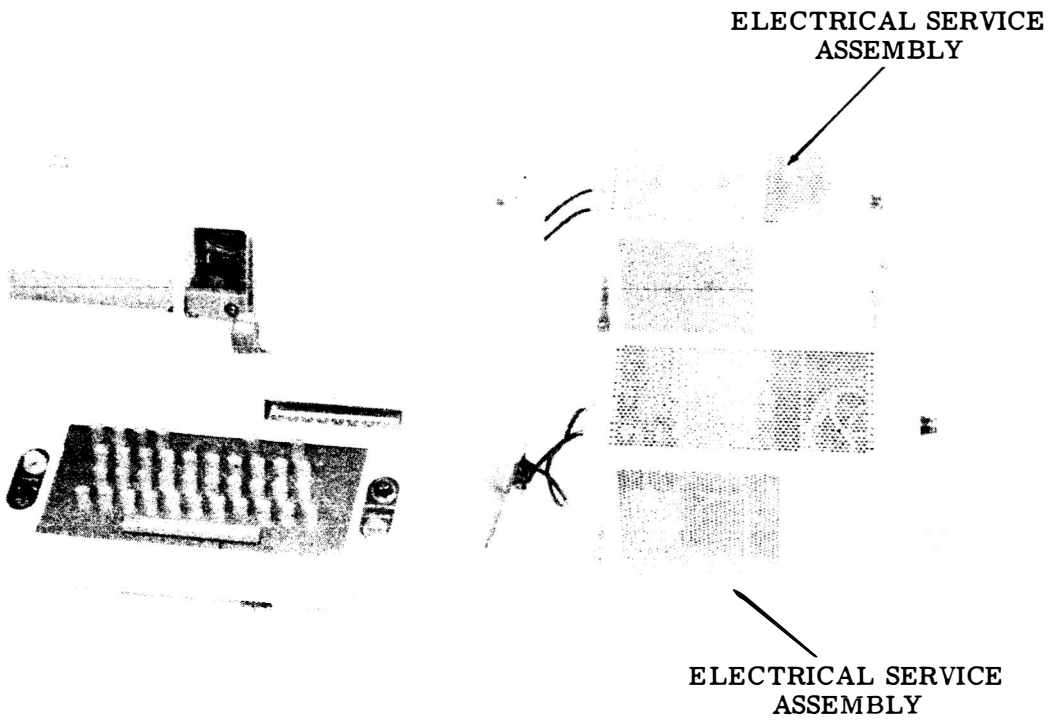


Figure 6 - Table Model Send-Receive Typing Reperforator (SRTR) Set

3.27 Fasten 3/4-inch conduit for the normal control input to either side of the ESA. Route the control leads for the typing unit stunt box through the conduit into the compartment of the right side. Route these leads to the 40-point terminal block (H) located on the hinged lid. A cable clamp has been provided to secure the leads.

3.28 Route the synchronous pulse control leads through the eyelet in the ESA partition, into the compartment on the left side, and to terminal block (TD). Replace the access plates previously removed.

Note: Synchronous pulse leads are normally brought in with control leads for the typing unit stunt box.

3.29 Fasten 3/4-inch conduit for the signal line input and output to the inner container of the ESA. Fasten the conduit by means of the 1.094-inch hole provided in the outer frame of the container. Make certain that the conduit fitting does not contact the inner frame of the container. Route the signal line leads through the conduit into the inner enclosure of the container. Connect signal leads to the upper 6-point (TB) terminal block. Tape the signal shielding to prevent its unintentional grounding.

Note: The container assembly provides ± 6 volt signal battery to the low-level keyer. If external signal battery is to be provided, follow the procedure outlined in the appropriate wiring diagram package.

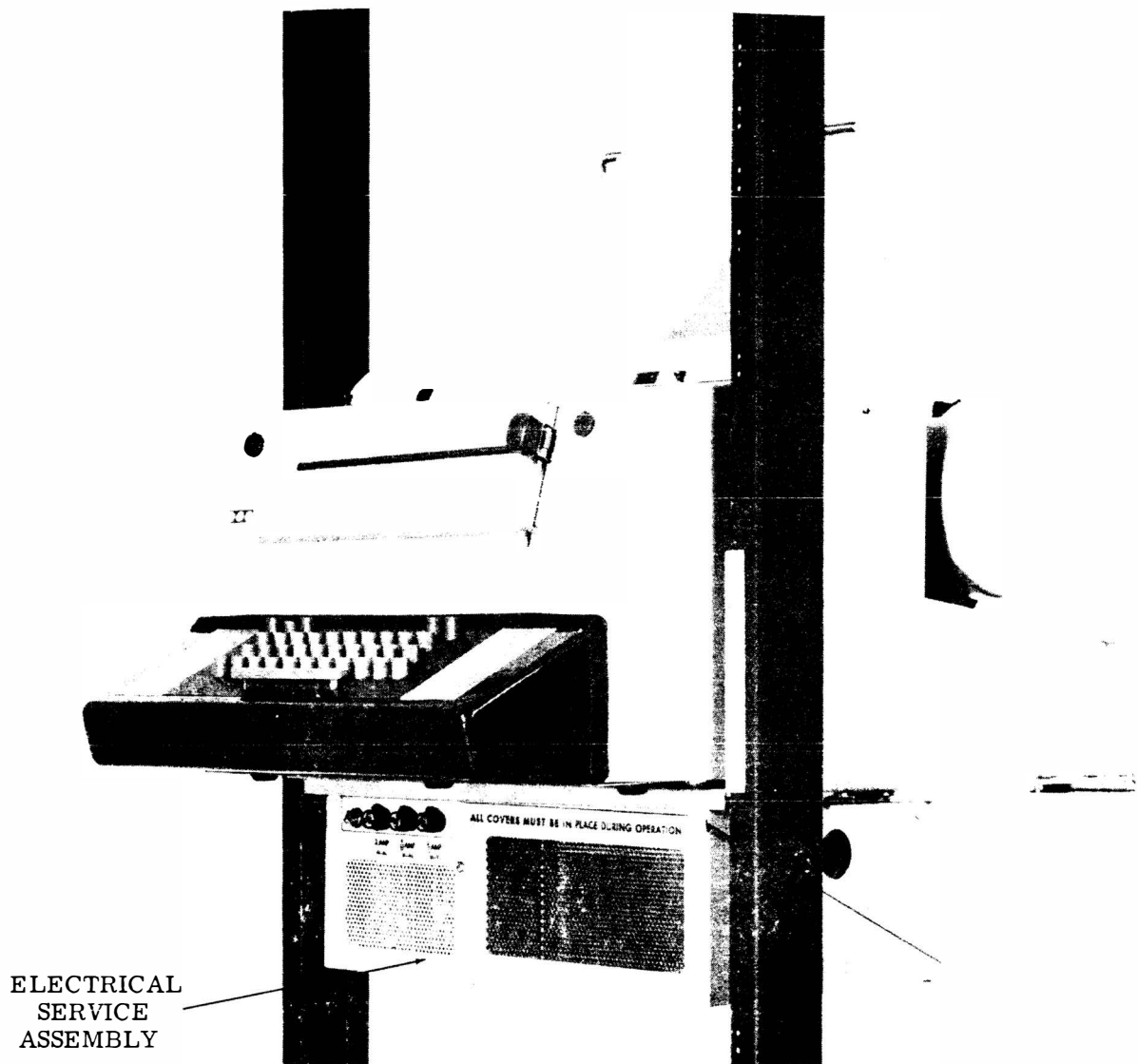


Figure 7 - Rack Mounted Keyboard Send-Receive (KSR) Set

3.30 Reassemble the terminal block cover and upper insulator previously removed from the container assembly.

3.31 Auxiliary conduit connections have been provided for the synchronous pulse control leads only. To install these leads proceed as follows:

- (a) Remove appropriate knockouts.
- (b) Connect 1/2-inch conduit directly to control circuitry.
- (c) Route control leads through conduit to terminal block (TD).
- (d) Connect leads.

3.32 Replace and secure the inner cover on the inner frame of the container assembly. Replace and secure the outer cover on the outer frame of the container. Close the hinged lid of the ESA and secure it by fastening the mounting screws in the lower side and upper side of the lid.

G. Rack Mounted Receive-Only (RO) Set (Figure 8)

3.33 Remove and retain the access plate and the mounting hardware at either or both sides of the ESA. Fasten 3/4-inch conduit for ac power input to either side of the ESA. Route the power input leads through the conduit into the compartment of the left side. Route the power input leads to terminal block (TA) located on a bracket attached to the rear wall. Turn the power switch to the OFF position.

3.34 Fasten 3/4-inch conduit for the normal control input to either side of the ESA. Route the control leads for the typing unit stunt box through the conduit into the compartment on the right side. Route the control leads to the 40-point terminal block (H) located on the hinged lid. A cable clamp has been provided to secure the leads. Replace the access plates.

3.35 Fasten 3/4-inch conduit for the signal line input to the container assembly inside the service assembly. Fasten the conduit by means of the 1.094-inch hole provided in the outer frame of the container assembly. Make certain that the conduit fitting does not contact the inner frame of the container. Route the signal line leads through the conduit into the inner enclosure. Route the signal line cable to the upper 6-point terminal block (TB) located on the right side of the container. Tape the signal shielding to prevent its unintentional grounding. Reassemble the terminal block cover and upper insulator.

Note: Auxiliary conduit connections have been provided for the synchronous pulse control leads only. They are intended for send-receive sets and are not applicable to receive-only sets.

3.36 Replace and secure the inner cover on the inner frame of the container assembly. Replace and secure the outer cover on the outer frame of the container. Close the hinged lid of the ESA and secure it by fastening the mounting screws in the lower and upper side of the lid.

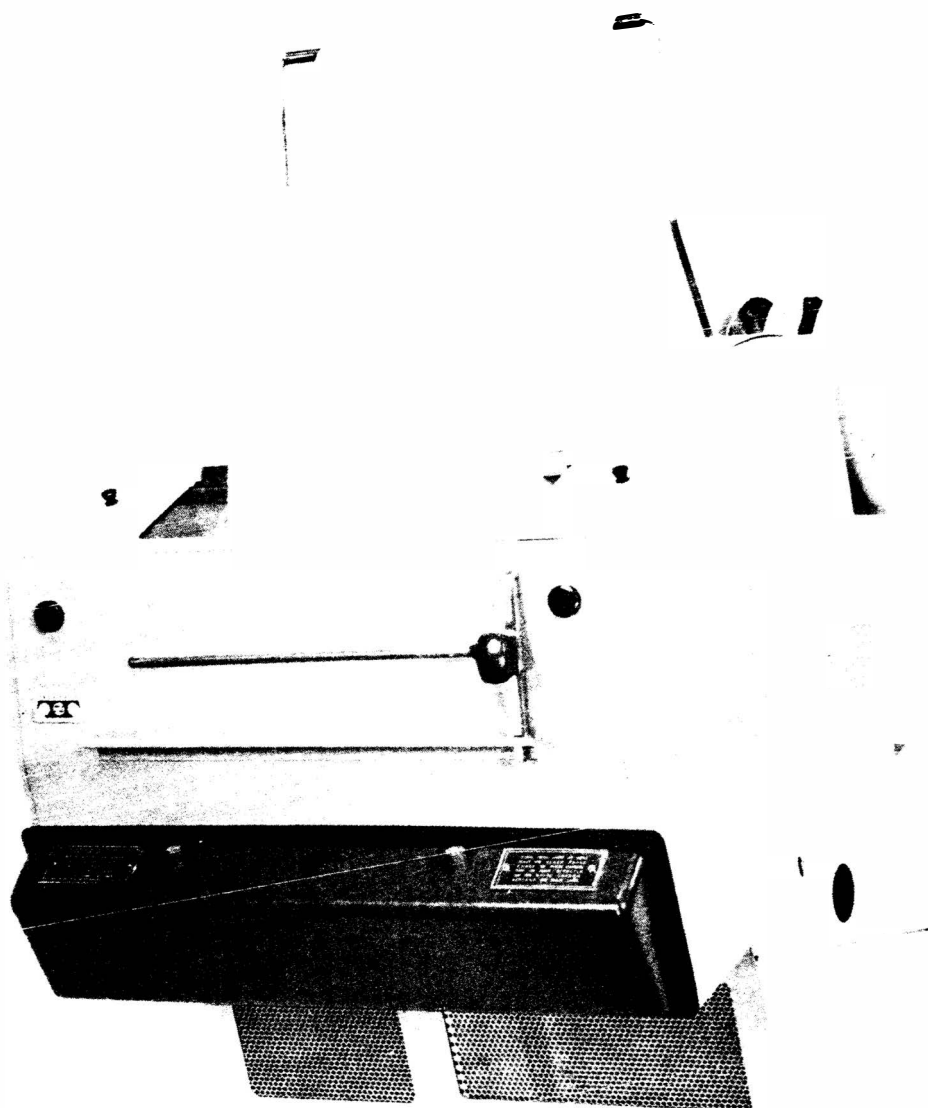
H. Multiple Page Printer Keyboard Send-Receive (KSR) Set

3.37 A junction box with three compartments is provided at the rear of the rack assembly which is fastened to the mounting panel at the bottom of the cabinet. Signal power input, cabinet motor and lamp power input, and signal line and clutch step control wiring should be brought in from the bottom of the cabinet by means of conduit connected to the junction box. Route the conduit through the wiring duct openings at the bottom of the cabinet up through the cutout at the rear of the mounting panel to the junction box.

3.38 Signal power is distributed by means of a three-conductor shielded cable, routed from the terminal block in the upper compartment of the junction box through flexible conduit to the signal and clutch electrical service assemblies. Separate conduit is connected from the junction box to the lower electrical service assembly containing the clutch magnet driver and to the upper electrical service assembly containing the selector magnet drivers and polar line keyer. A knockout for 1/2-inch diameter incoming conduit is provided in the upper compartment of the junction box.

3.39 Cabinet motor and lamp power is distributed by means of a three-conductor cable routed from the terminal block in the middle compartment of the junction box to the control panel on the rack assembly. A knockout for 1/2-inch diameter incoming conduit is provided in the middle compartment of the junction box. Where only one power source is used, power is brought into either the upper or middle compartment of the junction box and led to the other compartment through a knockout in the partition. Strap the appropriate terminals to achieve the proper connections.

3.40 The lower compartment of the junction box provides an entrance for the signal line input and output and transmitter stepping signal input. A terminal block is not provided in this compartment of the junction box since the signal leads must be routed directly into the appropriate electrical service assembly. A knockout for 3/4-inch diameter incoming conduit is provided in the lower compartment of the junction box.



ELECTRICAL SERVICE
ASSEMBLY

Figure 8 - Rack Mounted Receive-Only (RO) Set

3.41 The transmitter step pulse input should be routed through the lower compartment of the junction box to the clutch control electrical service assembly. Remove the cover from the service assembly. Remove and discard any packing or shipping details from the container. Remove the circuit board assemblies to facilitate cable installation. Connect the step pulse input leads in accordance with the appropriate wiring diagram. Replace the circuit board assemblies and the cover on the container.

3.42 The signal input and output leads should be routed through the lower compartment of the junction box to the signal electrical service assembly. Remove the outer and inner covers from the service assembly. Remove and discard any packing or shipping details from the container. Remove the circuit board assemblies to facilitate cable installation. Connect the signal leads in accordance with the appropriate wiring diagram. A label on the terminal block cover identifies each of the three terminal blocks on the left side of the electrical service assembly. Replace the circuit board assemblies and the inner and outer covers on the container.

3.43 The ESA provides ± 7 v dc voltage for the polar line keyer. A strapping option on the TD terminal board permits the use of external battery.

3.44 With the installation of the power and signal lines completed, the equipment is ready for operation. Place the power switch in each electrical service assembly in the ON position. Place the main power switch on the control panel in the ON position and check the equipment.

I. Multiple Page Printer Receive-Only (RO) Set

3.45 A junction box with three compartments is provided at the rear of the rack assembly which is fastened to the mounting panel at the bottom of the cabinet. Signal power input, cabinet motor and lamp power input, and signal line wiring should be brought in from the bottom of the cabinet by means of conduit connected to the junction box. Route the conduit through the wire duct openings at the bottom of the cabinet, up through the cutout at the rear of the mounting panel, and to the junction box.

3.46 Signal power is distributed by means of a three-conductor shielded cable routed from the terminal block in the upper compartment of the junction box, through flexible conduit, to the signal electrical service assembly containing the selector magnet drivers. A knockout for 1/2-inch diameter incoming conduit is provided in the upper compartment of the junction box.

3.47 Cabinet motor and lamp power is distributed by means of a three-conductor cable routed from the terminal block in the middle compartment of the junction

box to the control panel on the adjacent rack assembly. A knockout for 1/2-inch diameter incoming conduit is provided in the middle compartment of the junction box. Where only one power source is used, power is brought into either the upper or middle compartment of the junction box and routed to the other compartment through a knockout in the partition. Strap the appropriate terminals to achieve the proper connections.

3.48 The lower compartment of the junction box provides for the signal line input. A terminal block is not provided in this compartment of the junction box since the signal leads must be routed directly into the electrical service assembly. A knockout for 3/4-inch diameter incoming conduit is provided in the lower compartment of the junction box.

3.49 The signal input leads should be routed through the lower compartment of the junction box to the electrical service assembly. Remove the outer and inner covers from the service assembly. Remove and discard any packing or shipping details from the container. Remove the circuit board assemblies to facilitate cable installation. Connect the signal leads in accordance with the appropriate wiring diagram. A label on the terminal block cover identifies each of the terminal blocks on the left side of the electrical service assembly. Replace the circuit board assemblies and the inner and outer covers on the container.

3.50 With the installation of the power and signal lines completed, the equipment is ready for operation. Place the power switch in the electrical service assembly in the ON position. Place the main power switch on the control panel in the ON position and check the equipment.

J. Transmitter Distributor (Self-Contained)

3.51 A table mounted electrical service assembly (ESA) is used and can be mounted in space available anywhere near the set within the limit of the signal cable. Mounting brackets for the ESA are supplied, however, the customer must supply the hardware to fasten these brackets to a table or wall.

3.52 Route the synchronous pulse and signal line conduit or cabling to the opposite side of the fuse and attach by means of 3/4 inch conduit fitting. Connect the power line to the side of the ESA on which the fuse and power switch are located and attach by means of a 3/4 inch conduit fitting. Route the signal cable, the clutch magnet driver cable, and the monitoring cable to the apparatus through a notch in the rear of the transmitter distributor cover. A Receive-Only (RO) Set may be connected to the monitoring cable for the purpose of monitoring the signals from the transmitter distributor. Connect the power cord from the distributor to a power source. Connect all grounding straps such as the snap panel to mounting plate and cover to mounting plate.

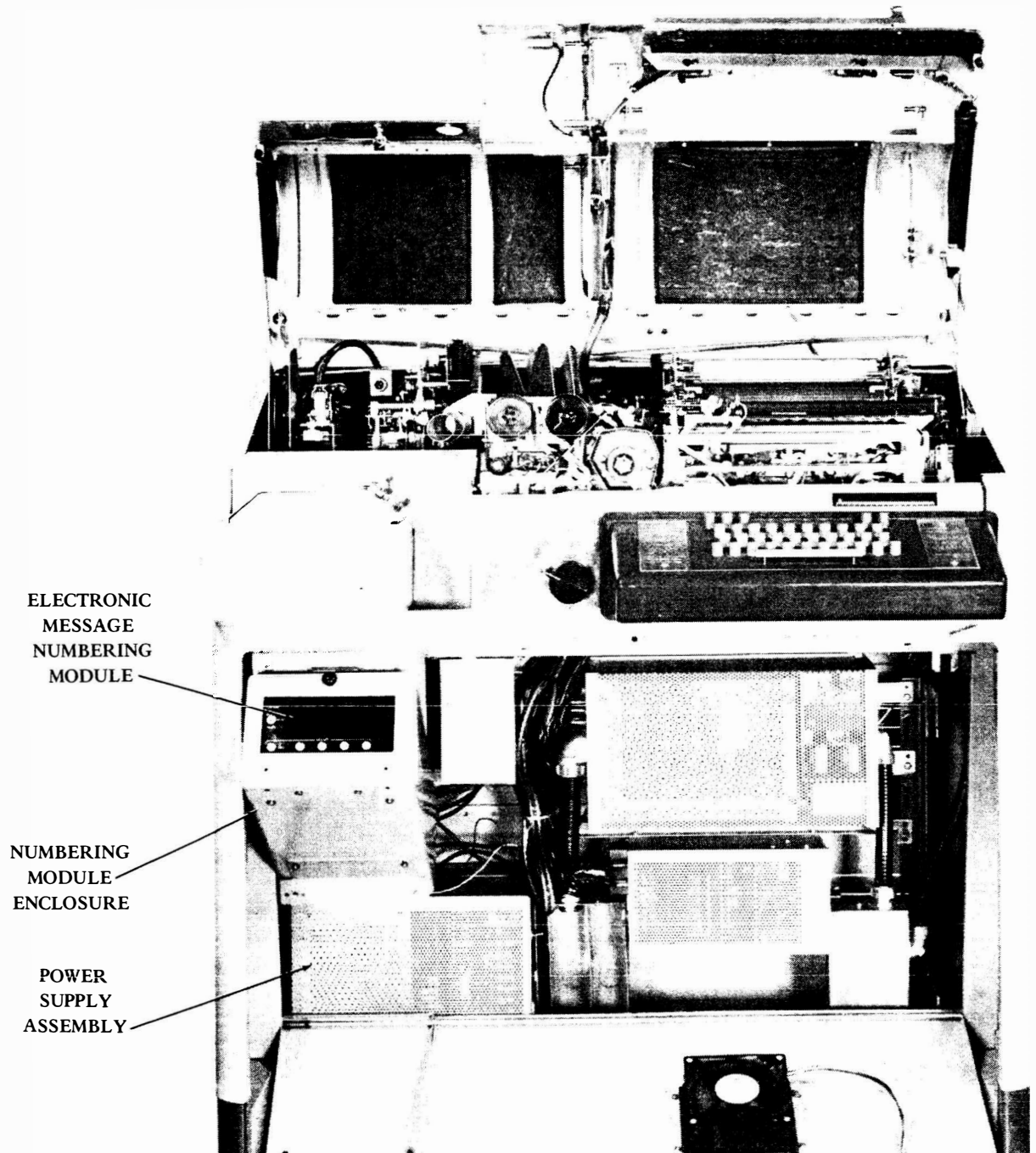


Figure 9 - Floor Model Automatic Send-Receive (ASR) Set With Electronic Message Numbering

K. Floor Model Automatic Send-Receive (ASR) Set With Electronic Message Numbering

3.53 Two junction boxes are provided at the bottom of the cabinet. The junction box on the right side is for power, the box on the left is for signal line input and output and stepping signal (clutch) input.

3.54 Power is distributed by means of three-conductor shielded cables, routed through flexible conduit. Separate conduit is connected from the junction box to the electrical service assembly containing the clutch magnet drivers. Separate conduit is also routed to the electrical service assembly containing the selector magnet driver and polar line keyer and to the power line filters in the upper compartment of the cabinet, and the numbering module power supply.

3.55 Power should be brought in from the bottom of the cabinet by means of conduit connected to the junction box. Two conduit connectors are attached to the junction box to provide two separate power line inputs; one power line for the clutch and signal electrical service assemblies and one for the cabinet power to motors, lamps, etc. The junction box is also compartmented to maintain power line separation. A five-point terminal block is provided on the left side of the junction box for the clutch stepping control, signal line electrical service assemblies, and numbering module power supply. A three-point terminal block is provided on the right side of the junction box for the cabinet power. Where only one power source is used, power should be brought into either side of the junction box and routed to the other side through a knockout in the partition. Make certain that the shielding which surrounds the power input leads is connected to the appropriate terminals in the junction box.

3.56 The junction box on the left side of the cabinet provides for the signal line input and output and the transmitter stepping signal input. Terminal blocks are not provided in this box since cable leads are routed directly to the appropriate electrical service assembly. The junction boxes permit connection of conduit (one or two) to the bottom of the cabinet. Clutch and signal cable leads can be routed through separate compartments. If single conduit is used, it can be routed into one compartment and brought into the other through a knockout in the partition.

3.57 The transmitter step pulse input should be routed through the junction box to the lower electrical service assembly (clutch control). Remove the cover from the service assembly and any packing or shipping details from the container. Remove the circuit board assemblies to facilitate cable installation. Connect the step pulse input leads to the appropriate terminal block. Replace the circuit board assemblies and the cover on the container.

3.58 The signal input and output leads should be routed through the junction box and through the flexible conduit to the electrical service assembly (signal). Remove the outer and inner covers from the service assembly and any packing or shipping details from the container. Remove the circuit board assemblies to facilitate cable installation. A label on the terminal block cover identifies the end of the three terminal blocks on the left side of the electrical service assembly. Connect the signal input leads to the appropriate terminal block in the electrical service assembly. Should the set be installed as it is shipped from the factory and without any wiring changes, be sure to remove the TP303142 low-level keyer circuit card from the KB connector. Replace the inner and outer covers on the container. The signal electrical service assembly provides ± 6 volts dc voltage for the polar line keyer. A terminal strapping option permits use of an external battery.

3.59 Make the electrical connections between the electrical service assembly (signal) to the appropriate selector magnet assembly and the electrical service assembly (clutch) to the cabinet terminal strip (C strip). The mating connector pairs for these connections are identified.

Note: The TP330520 tool kit may be utilized to loosen and adjust the cradle railing in the cabinet.

3.60 Remove the numbering module from its carton. Reference should be made to Section 573-614-100TC for information concerning the installation of the crystal and programming the format option. Open the door of the numbering module enclosure by loosening the retaining screw on top of the door. Insert the module into the inner frame of the enclosure. Push the module in until the rear connector plugs are fully seated in their receptacles. Close the door and tighten the retaining screw.

RADIO FREQUENCY INTERFERENCE (RFI)
SUPPRESSION FOR 28 TYPING UNITS AND TYPING AND
NONTYPING REPERFORATORS
DESCRIPTION AND ADJUSTMENTS

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2. DESCRIPTION	1
SELECTOR MECHANISM	1
3. ADJUSTMENTS	2
Selector Mechanism	
Selector armature	2
Selector armature alignment	3
Selector armature spring	3
Selector base (magnets energized)	4

inner and outer shields. The inner and outer braided shields are electrically separated from each other and the three electrical conductors by flexible solid dielectric. The metallic container functions as a shielded enclosure for the selector magnet assembly.

2.03 Enclosed within the metallic container are the selector magnet coils, coil mounting bracket and selector armature. Each selector magnet coil contains an electrostatic shield which surrounds the coil windings. The selector coil mounting bracket provides mounting facilities for the coils, armature, and biasing spring. The receptacle, shielded cable, metallic container, and selector coils provide rfi suppression when used with associated rfi equipment.

1. GENERAL

1.01 This section presents a description of components necessary for radio frequency interference (rfi) suppression as applied to 28 typing units and typing and nontyping reperforators. In addition, this section is intended for use as a supplement to standardized literature. For more detailed information regarding the apparatus refer to Sections 573-115-100TC and 573-118-100TC.

2. DESCRIPTION

SELECTOR MECHANISM

2.01 The rfi selector mechanism mounts on the upper right side frame of the typing unit or the main frame of the reperforator. The selector consists of a special three-pin electrical receptacle, double shielded cable and metallic container.

2.02 The three-pin electrical receptacle insures a secure and shielded electrical connection to other associated apparatus. The double shielded cable electrically connects the three-pin electrical receptacle to the selector magnets. The shielded cable is composed of three electrical conductors encircled by braided



Rfi Selector Mechanism

3. ADJUSTMENTS

3.01 The following adjustments are arranged in a sequence that should be followed if a complete readjustment of the selector mechanism is undertaken.

3.02 Tools and spring scales required to perform these adjustments are listed in Section 570-005-800TC. After an adjustment

3.04 Selector Mechanism

is complete be sure to tighten any nuts or screws that are loosened. The adjusting illustrations indicate tolerances, positions of moving parts, spring tensions, and angles at which spring scales should be applied when measuring spring tensions.

3.03 References made to left or right, front or rear, up or down etc apply to the unit in its normal operating position facing the selector mechanism.

Note: To facilitate making the following adjustments, remove the selector cam-clutch assembly and range finder assembly in accordance with disassembly and reassembly Sections 573-115-702TC and 573-118-702TC. Remove the metallic container (base and cover) which house the selector magnets by unscrewing the magnet and base assembly mounting post from its associated nut plate. The nut plate is located in the rear of the selector mounting plate (refer to drawing in 3.06). The metallic container and enclosed selector magnets will detach from the selector mounting plate as an assembly. Detach the coil mounting bracket from the base by removing the coil mounting bracket nuts.

SELECTOR ARMATURE

(1) Requirement

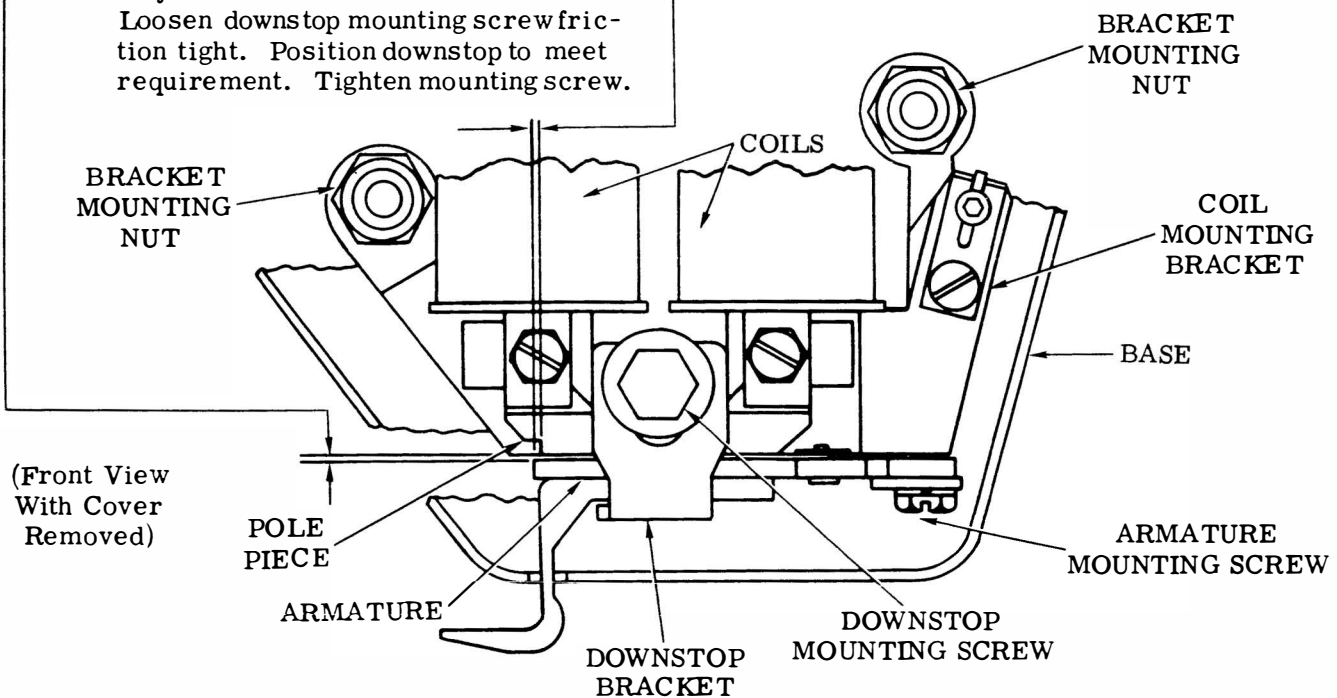
With the magnet assembly de-energized, removed from its base, and armature resting against its downstop, there should be
 ---Min 0.025 inch---Max 0.030 inch
 clearance between the end of armature and left edge of left pole piece.

To Adjust
 Loosen downstop mounting screw friction tight. Position downstop to meet requirement. Tighten mounting screw.

(2) Requirement

The left edge of the armature should be flush within 0.010 inch with the left edge of the left pole piece.

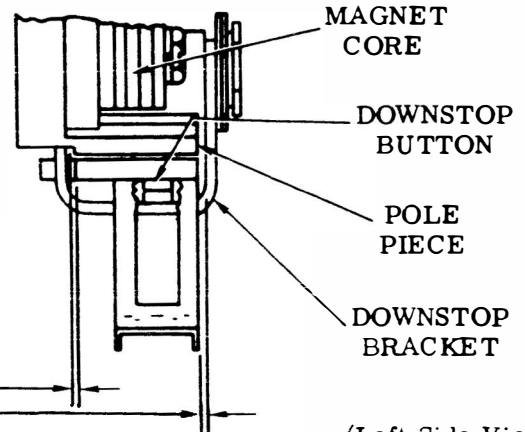
To Adjust
 Position the armature with the mounting screws loosened. Tighten screws.



3.05 Selector Mechanism (continued)

SELECTOR ARMATURE ALIGNMENT

- (1) Requirement
Rear edge of armature should be flush within 0.010 inch with rear edge of pole pieces.
- (2) Requirement
Clearance between front edge of armature and pole piece and inside of downstop bracket should be
Min some ---Max 0.020 inch



(Left Side View)

To Adjust

Armature spring must have enough initial tension to hold armature firmly against pivot edge of casting. Position armature with mounting screws loosened. Tighten screws.

SELECTOR ARMATURE SPRING

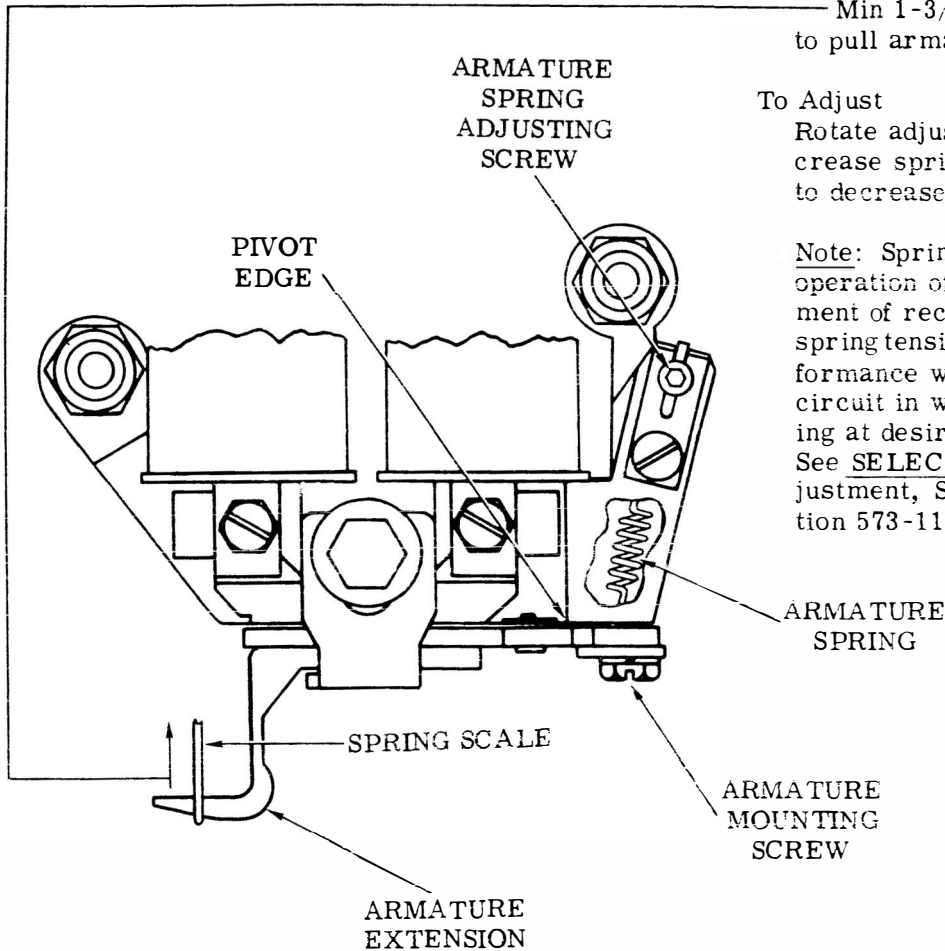
Requirement

Apply spring scale as nearly vertical as possible at end of armature extension. It should require
—Min 1-3/4 oz---Max 2-1/4 oz
to pull armature to marking position.

To Adjust

Rotate adjusting screw clockwise to increase spring tension; counterclockwise to decrease spring tension.

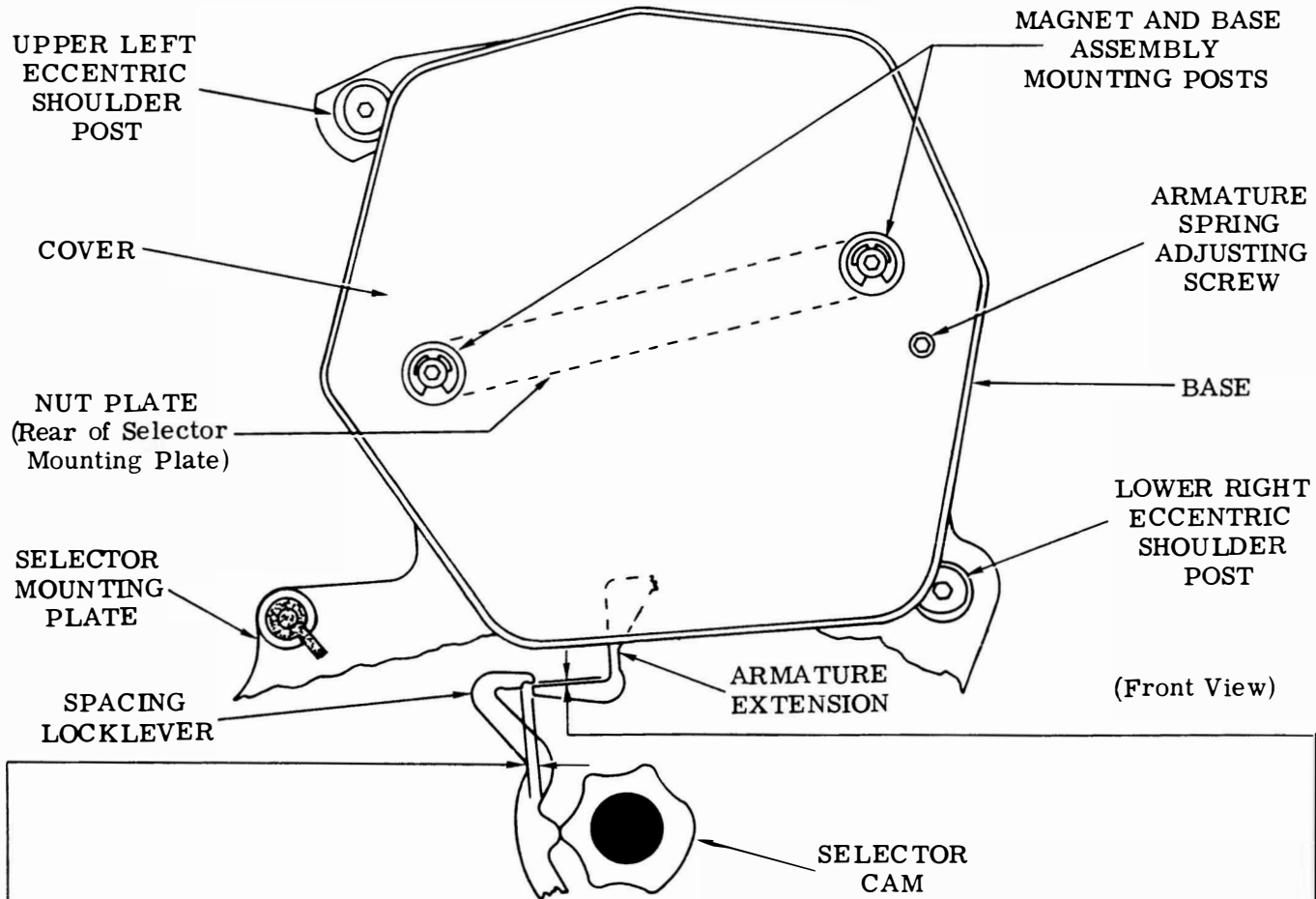
Note: Spring tensions given will permit operation of printer prior to measurement of receiving margins. Refine spring tension for maximum selector performance with unit connected to specific circuit in which it is to function (operating at desired speed and line current). See SELECTOR RECEIVING MARGIN adjustment, Section 573-115-700TC or Section 573-118-700TC.



(Front View
Coils and Associated
Bracket Removed
From Base)

3.06 Selector Mechanism (continued)

Note: Before making the adjustment on this page, reassemble the magnet assembly by reversing the disassembly procedure (see note in 3.04). Reassemble and install on the typing unit, the cam-clutch assembly, the metallic container, and range finder; then proceed with the following adjustment.

**SELECTOR BASE (MAGNETS ENERGIZED)****(1) Requirement**

Spacing locklever on high part of cam. Armature in contact with left pole piece.
Clearance between end of armature extension and shoulder of spacing locklever should be
Min 0.020 inch--Max 0.035 inch

(2) Requirement

Clearance between upper surface of armature extension and upper step of spacing locklever should be
Min some---Max 0.003 inch
when locklever is held downward.

To Adjust

With a 1/16 inch hex wrench, loosen two magnet and base mounting posts friction tight. Adjust lower right eccentric to meet requirement (1). Adjust upper left eccentric to meet requirement (2). Tighten magnet and base assembly mounting posts securely.

Note: Initial positions of eccentric are: Lower right at 6 o'clock; upper left at 9 o'clock.

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
 FOR 28 KEYBOARDS, 28 TRANSMITTER DISTRIBUTORS, AND 28/32 KEYBOARDS
 DESCRIPTION AND ADJUSTMENTS

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28 RFI KEYBOARDS AND TRANSMITTER DISTRIBUTOR	1
RFI COMPONENTS OF 28 KEYBOARDS AND TRANSMITTER DISTRIBUTOR	2
28/32 RFI COMPACT SEND-RECEIVE (KSR) SET	2
SYNCHRONOUS PULSE FOR 28 RFI KEYBOARDS	2
SYNCHRONOUS PULSE FOR 28/32 RFI COMPACT KSR SETS	2
3. ADJUSTMENTS	2
28/32 RFI COMPACT KSR SET	2
Distributor Mechanism	
Armature spring	10
Clutch drum	5
Clutch shoe lever	5
Clutch shoe lever spring	9
Clutch shoe spring	9
Clutch trip lever	6
Distributor gear	7
Latch bail	8
Latch bail spring	10
Latchlever spring	10
Magnet blocking lever spring	10
Magnet plate	6
Reset lever	7
Trip lever spring	10
Keyboard Transmitter Mechanism	
Shutter window gap	3
Universal link	4
Universal link spring	4

1. GENERAL

1.01 This section presents a description of the components used in radio frequency interference (rfi) suppression as applied to 28 keyboards, 28 transmitter distributors, and 28/32 keyboards. It also presents the adjusting procedure for the 28/32 keyboard. In addition, this section is intended for use as a supplement to the following standard literature: Sections 573-116-100TC, 573-116-102TC, 573-116-703TC, and 573-127-102TC.

2. DESCRIPTION

28 RFI KEYBOARDS AND TRANSMITTER DISTRIBUTOR

2.01 Rfi as applied to 28 keyboards and transmitter distributors, consists of a double shielded contact box, a contact assembly, a filter card assembly, and a double shielded signal line cable with receptacle.



RFI Signal Generator
 Contact Box Assembly

RFI COMPONENTS OF 28 KEYBOARDS AND TRANSMITTER DISTRIBUTORS

2.02 The rfi signal generator contact box is composed of two metallic boxes. An inner box completely enclosed by an outer box. The two boxes are mechanically fastened together with fiber hardware and insulating material to electrically isolate each box from the other.

2.03 The contact assembly is provided with gold-plated contacts for low voltage operation. The assembly is enclosed within and electrically insulated from the inner box. The filter card assembly is mounted to and above the contact assembly. The filter is a network of three resistors and a capacitor mounted on a circuit board. When used in conjunction with associated shielded cables, power supplies, and keyer the filter provides a low-level interface and rfi suppression.

2.04 A double shielded cable assembly is provided to electrically connect the contact box to a three-pin electrical receptacle. The shielded cable is composed of three electrical conductors encircled by braided inner and outer shields. Two of the three internal wires are electrically insulated and transfer the telegraphic signals to associated equipment. The remaining wire is bare and electrically connected to the inner contact box, inner braid shield, and cable receptacle. The inner and outer braided shields are electrically separated from each other and the wires by flexible solid dielectric. The inner braid is electrically connected to the inner contact box and the outer braid is electrically connected to the outer contact box. The cable assembly provides rfi suppression when used with associated rfi equipment.

28/32 RFI COMPACT SEND-RECEIVE (KSR) SET

2.05 The rfi application for 28/32 compact (KSR) sets consists of photoelectric cells, shielded line signal cable, and a photoelectric distributor.

2.06 The signal generating mechanism utilizes photoelectric cells instead of a contact mechanism to generate a signal. A lamp assem-

bly provides the necessary light source to electrically activate the cells. A mechanical shutter assembly, linked with the keyboard codebars and located between the photocells and lamp assembly, provides windows to either allow light from the light assembly to pass and activate the cells (mark) or block the light and not activate the cells (space). The photocells will generate a parallel electrical signal of approximately 300 microamperes (ua). The generated signal travels along a shielded cable to a photoelectric distributor. The photoelectric distributor serializes the signal, and by means of shielded cables, routes it to the input of a polar line keyer.

SYNCHRONOUS PULSE FOR 28 RFI KEYBOARDS

2.07 A synchronous pulse mechanism on 28 rfi keyboards provides a means of remotely controlling the signal generator mechanism in order to govern the rate of signal transmission.

2.08 The incoming low-level synchronizing pulse is applied to the clutch magnet driver circuit which in turn supplies power necessary to operate the clutch trip magnet. The clutch magnet conditioning contacts are gold-plated and have an associated filter circuit to provide rfi suppression. In addition, the clutch magnet conditioning contacts control the clutch magnet driver circuit.

SYNCHRONOUS PULSE FOR 28/32 RFI COMPACT KSR SETS

2.09 Synchronous pulsed transmission is accomplished by the reset mechanism and pulsed operation of the photoelectric distributor clutch magnet.

3. ADJUSTMENTS

28/32 RFI COMPACT KSR SET

3.01 The adjustments are presented in an order which should be followed if a complete readjustment of the rfi portion of the keyboard and base is made.

3.02 References made to left, right, front or rear, up or down, apply to the unit in its normal operating position.

3.03 Keyboard Transmitting Mechanism

SHUTTER WINDOW GAP

To Check

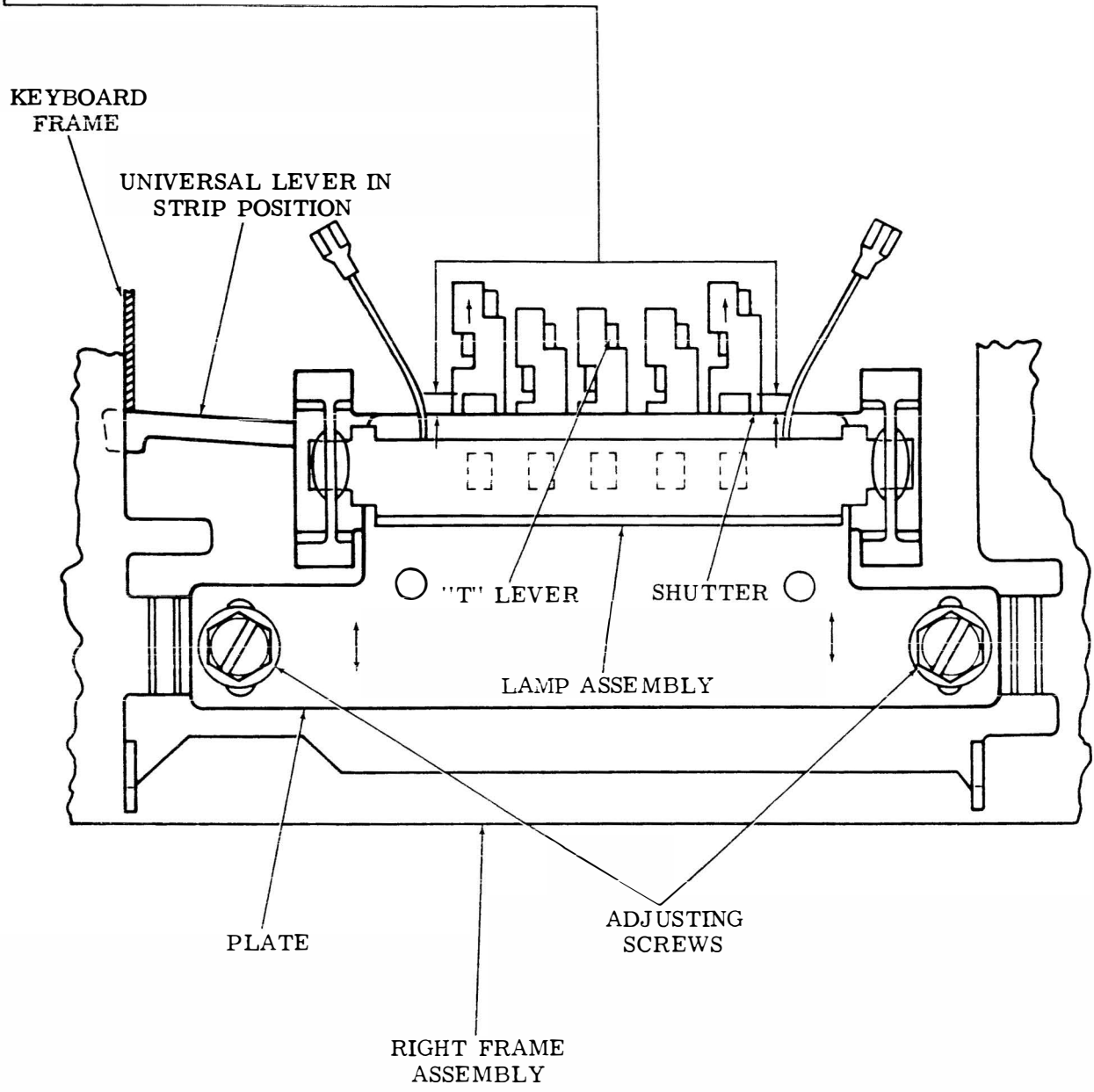
Depress LTRS key to move all T levers to their lowermost position.
Lift up first and last shutter with approximately one oz of force.

Requirement

There should be
Min 0.065 inch---Max 0.075 inch
gap between the upper edge of shutter window and shutter plate.

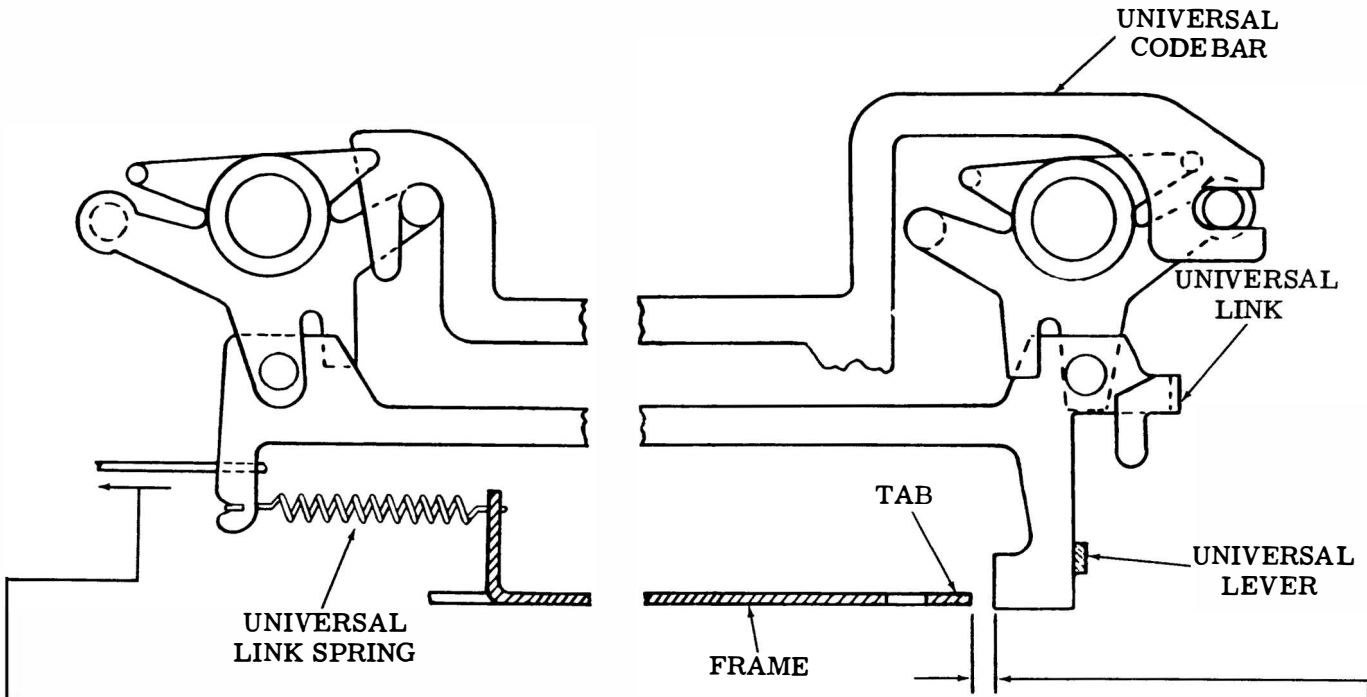
To Adjust

Loosen adjusting screws. Position lamp assembly to meet requirement.



3.04 Keyboard Transmitting Mechanism (continued)

Note: Remove keyboard from subbase to facilitate the making of the following adjustments. For disassembly instructions, see Section 573-116-705TC.



UNIVERSAL LINK SPRING

Requirement
 With keyboard tripped
 Min 1/2 oz---Max 1-1/4 oz
 start universal link moving.

UNIVERSAL LINK

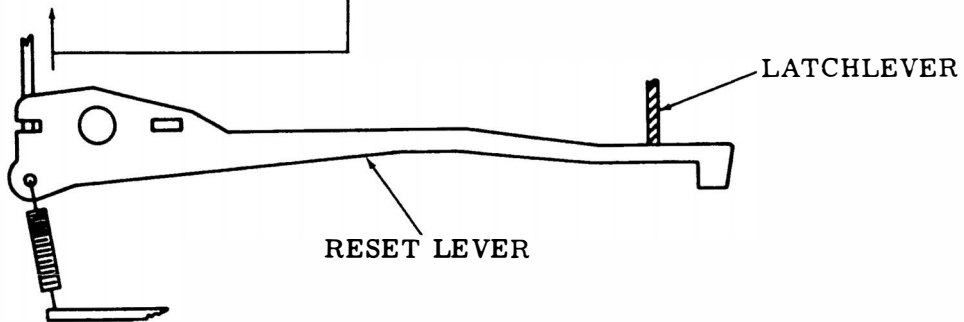
To Check
 Push universal lever down until latched
 by latchlever.

Requirement
 Min 0.089 inch---Max 0.103 inch
 between universal link and frame.

KEYBOARD RESET LEVER SPRING

Requirement
 With keyboard reset lever latched
 Min 24 oz---Max 28 oz
 to start reset lever moving downward.

To Adjust
 Place screwdriver through opening in front
 of frame and bend tab.



3.05 Distributor Mechanism

CLUTCH DRUM

(1) Requirement

With the clutch manually disengaged and pressed against the clutch drum, there should be

Min 0.005 inch---Max 0.010 inch between the ring and the hub protrusion.

To Adjust

Loosen clutch drum mounting screw and position clutch drum on its shaft.

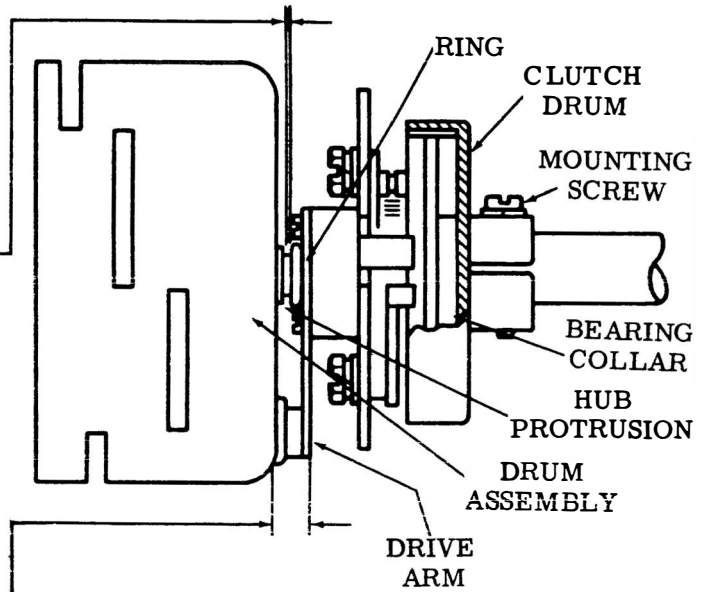
Note: Do not distort ring when measuring gap between ring and hub protrusion.

(2) Requirement

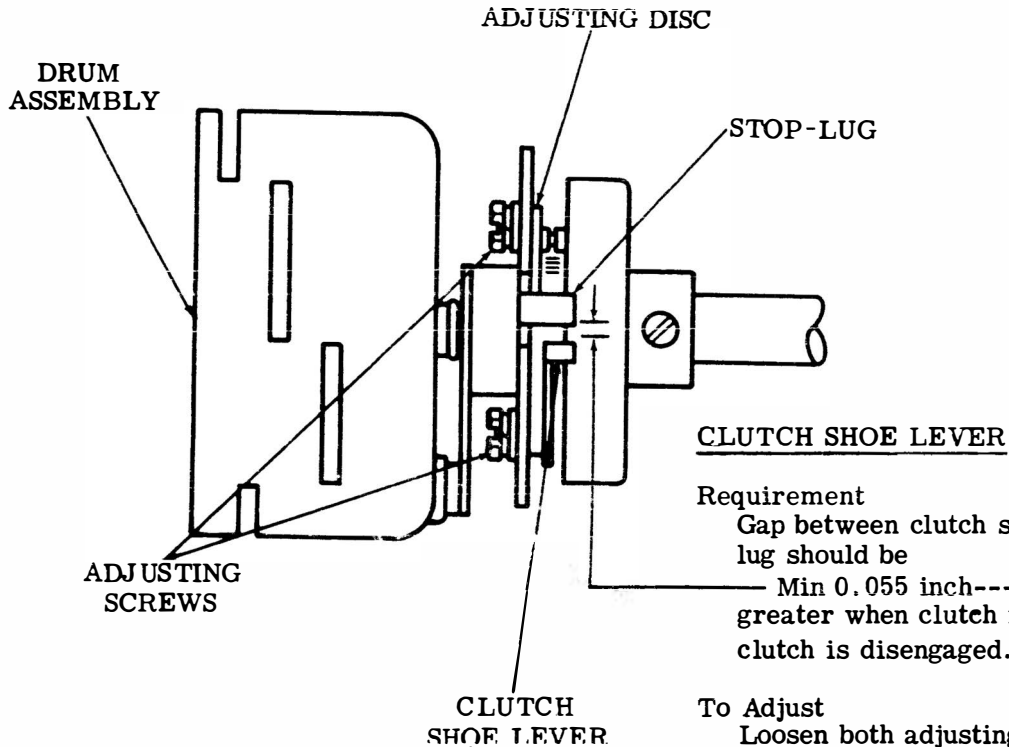
The drive arm should be parallel to the surface of the drum assembly.

To Adjust

Gauge by eye and manually bend drive arm to meet requirement.



Note: Clutch shoes should fully engage drum after adjustment.



Requirement
Gap between clutch shoe lever and its stop-lug should be
Min 0.055 inch---Max 0.085 inch greater when clutch is engaged than when clutch is disengaged.

To Adjust
Loosen both adjusting screws and rotate disc.

3.06 Distributor Mechanism (continued)

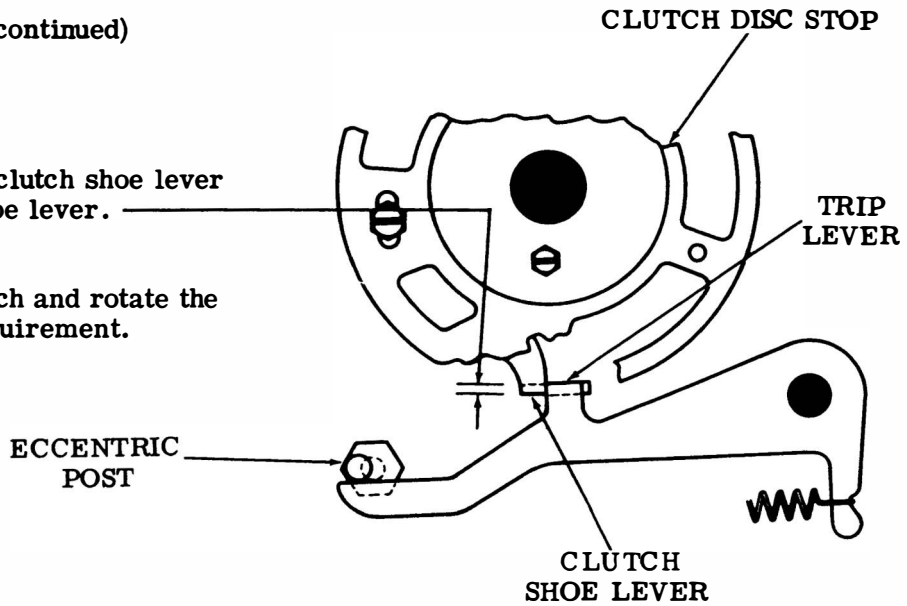
CLUTCH TRIP LEVER

Requirement

Clutch trip should engage clutch shoe lever by full thickness of the shoe lever.

To Adjust

Disengage distributor clutch and rotate the eccentric post to meet requirement.



MAGNET PLATE

Requirement

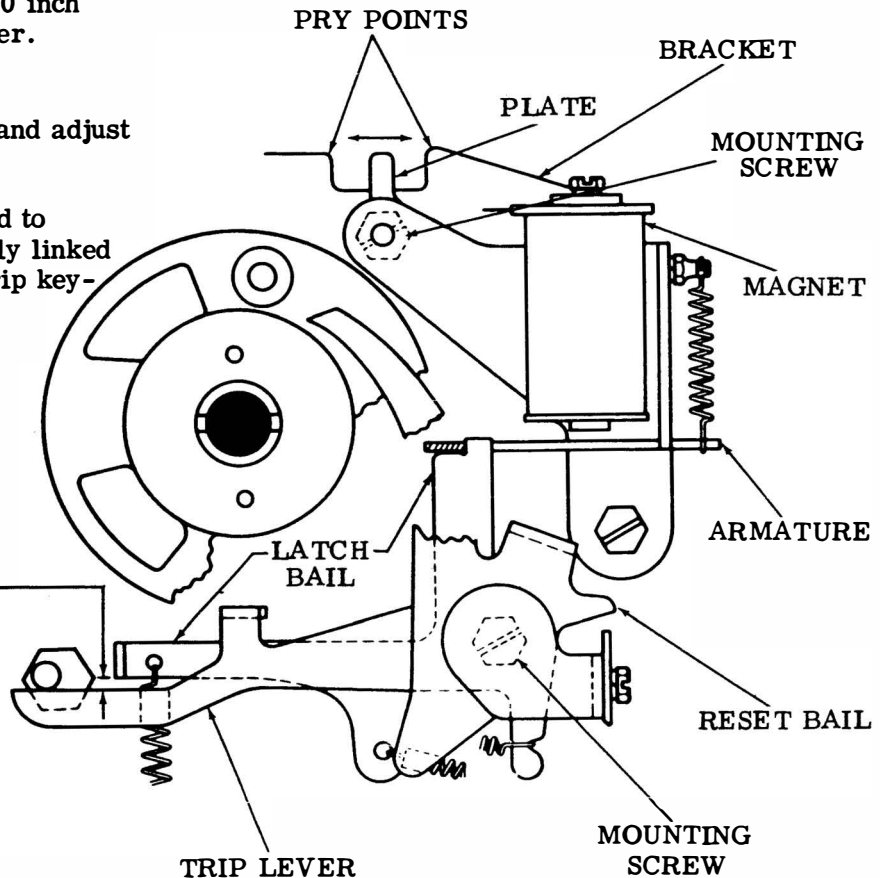
With distributor in its stop position, control lever in remote position, and latch bail against armature, there should be

Min 0.020 inch---Max 0.040 inch between latch bail and trip lever.

To Adjust

Loosen both mounting screws and adjust gap by moving pry points.

Note: If distributor is mounted to keyboard base and mechanically linked to keyboard, depress key to trip keyboard.



3.07 Distributor Mechanism (continued)

DISTRIBUTOR GEAR

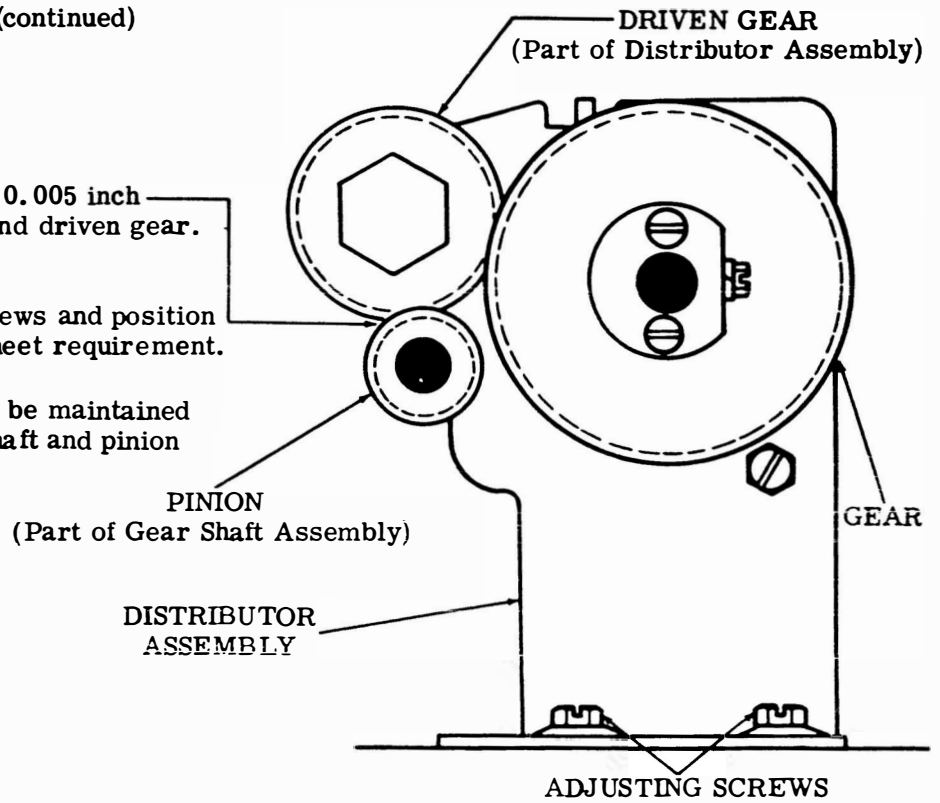
Requirement

There should be
Min 0.002 inch---Max 0.005 inch
backlash between pinion and driven gear.

To Adjust

Loosen four adjusting screws and position distributor assembly to meet requirement.

Note: Parallelism should be maintained between the distributor shaft and pinion gear shaft.



RESET LEVER

To Check

Rotate distributor so that roller is in contact with reset bail at high point of its travel.

(1) Requirement

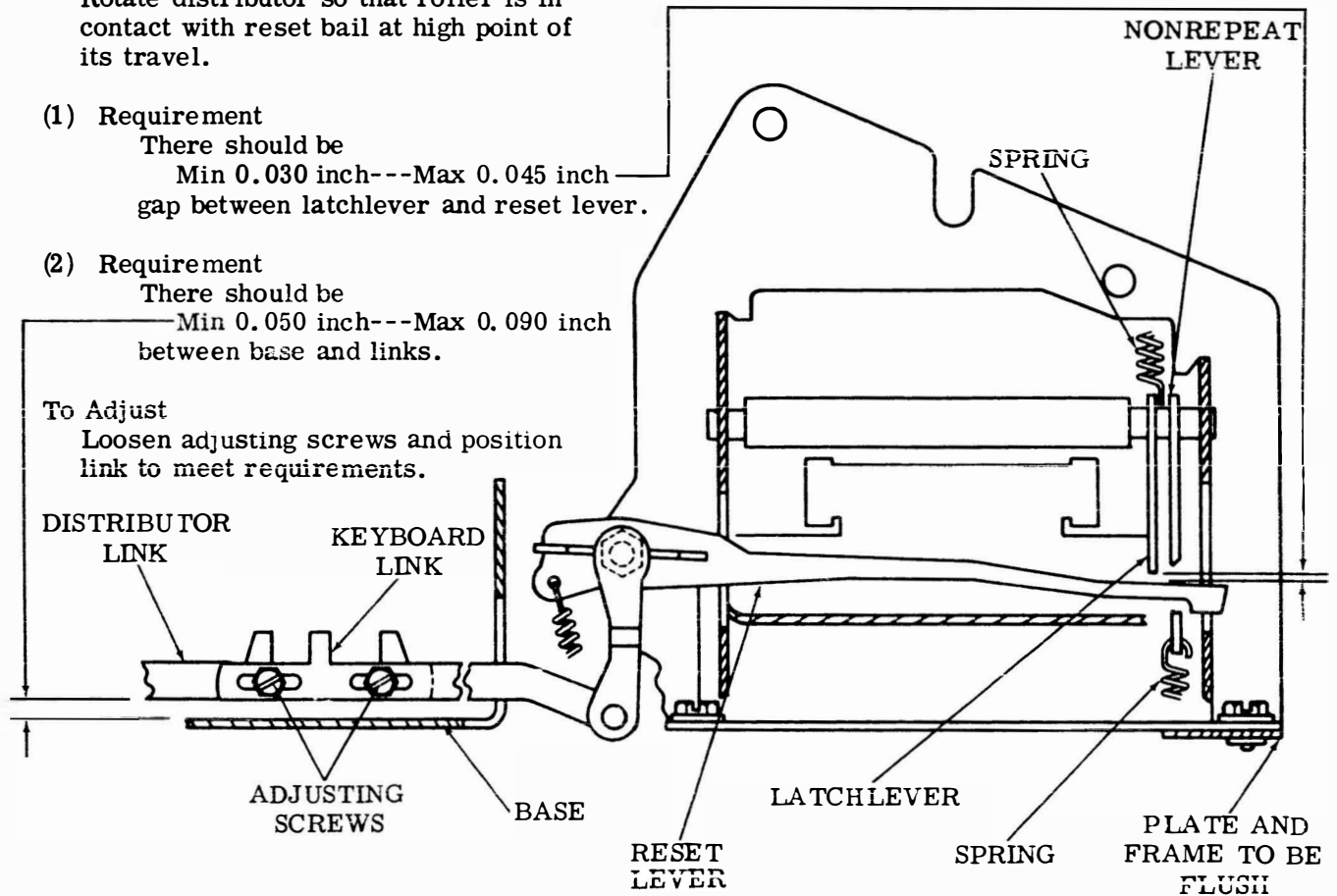
There should be
Min 0.030 inch---Max 0.045 inch
gap between latchlever and reset lever.

(2) Requirement

There should be
Min 0.050 inch---Max 0.090 inch
between base and links.

To Adjust

Loosen adjusting screws and position link to meet requirements.



3.08 Distributor Mechanism (continued)

LATCH BAIL

To Check

With distributor in stop position, keyboard in reset position, and control lever in remote position, insert a 0.025 inch gauge between latch bail and armature.

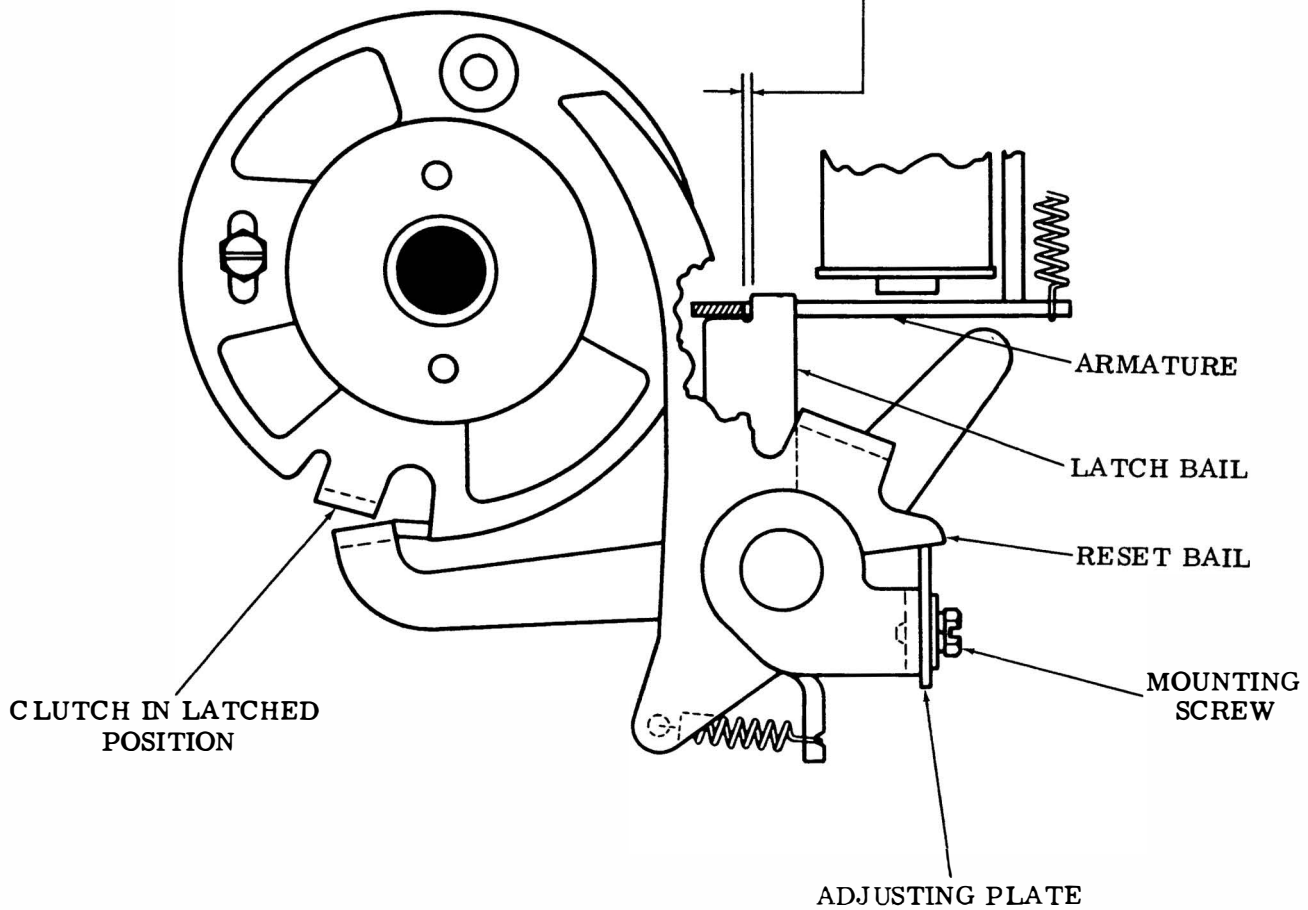
Requirement

There should be

Min 0.010 inch---Max 0.018 inch
gap between the latch bail and the armature.

To Adjust

Loosen mounting screw and move adjusting plate so that it contacts reset bail. Tighten mounting screw.



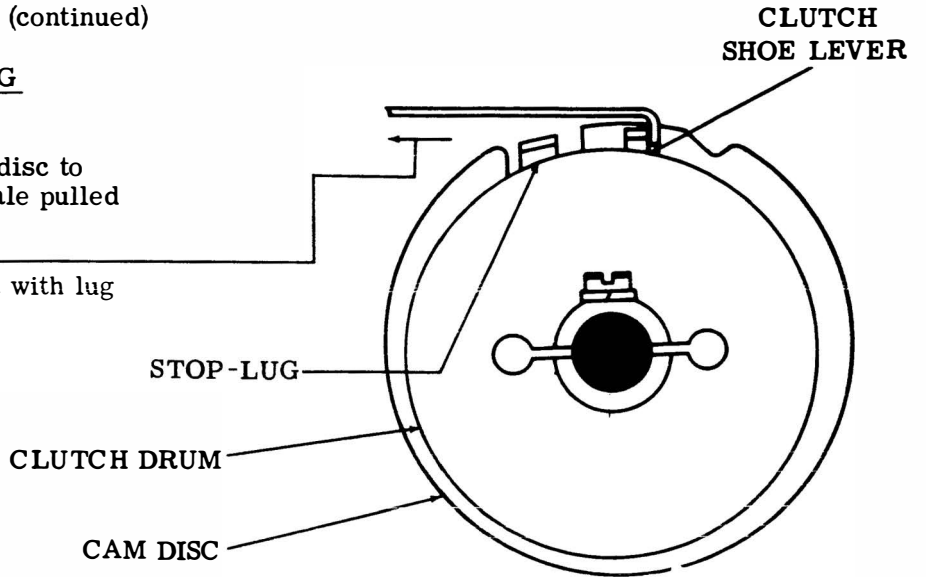
3.09 Distributor Mechanism (continued)

CLUTCH SHOE LEVER SPRING

Requirement

Clutch engaged. Hold cam disc to prevent turning. Spring scale pulled at tangent to clutch.

Min 15 oz---Max 20 oz
to pull shoe lever in contact with lug on clutch disc.



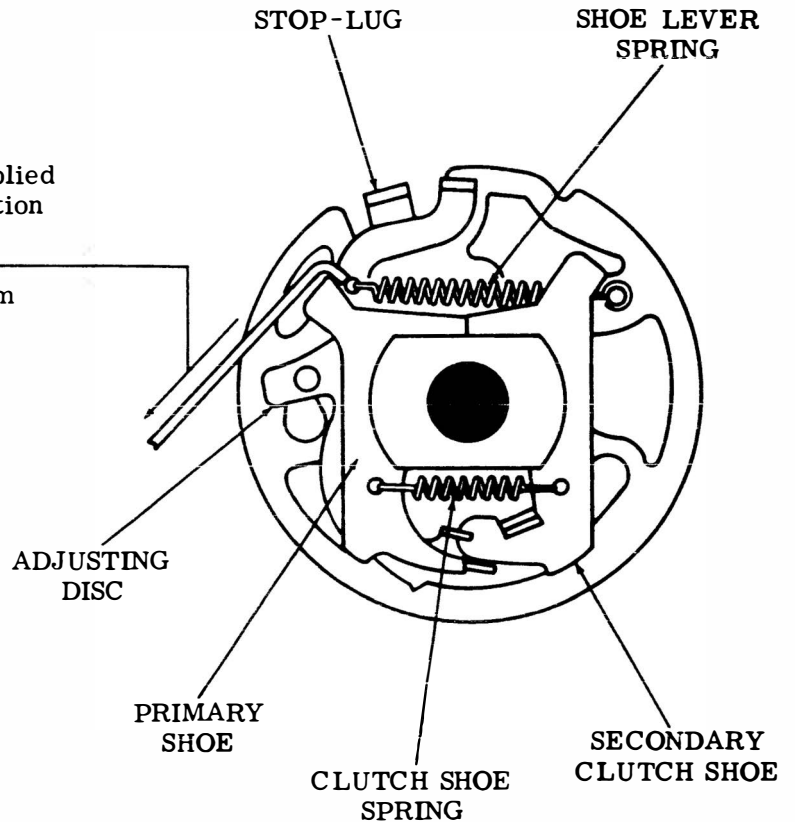
Note: As it requires removal of clutch from shaft, the following spring tension should not be checked unless there is good reason to suspect that it will not meet its requirement.

CLUTCH SHOE SPRING

Requirement

Clutch drum removed, spring scale applied to primary shoe at a tangent to the friction surface.

Min 3 oz---Max 5 oz
to start primary shoe moving away from secondary shoe at point of contact.

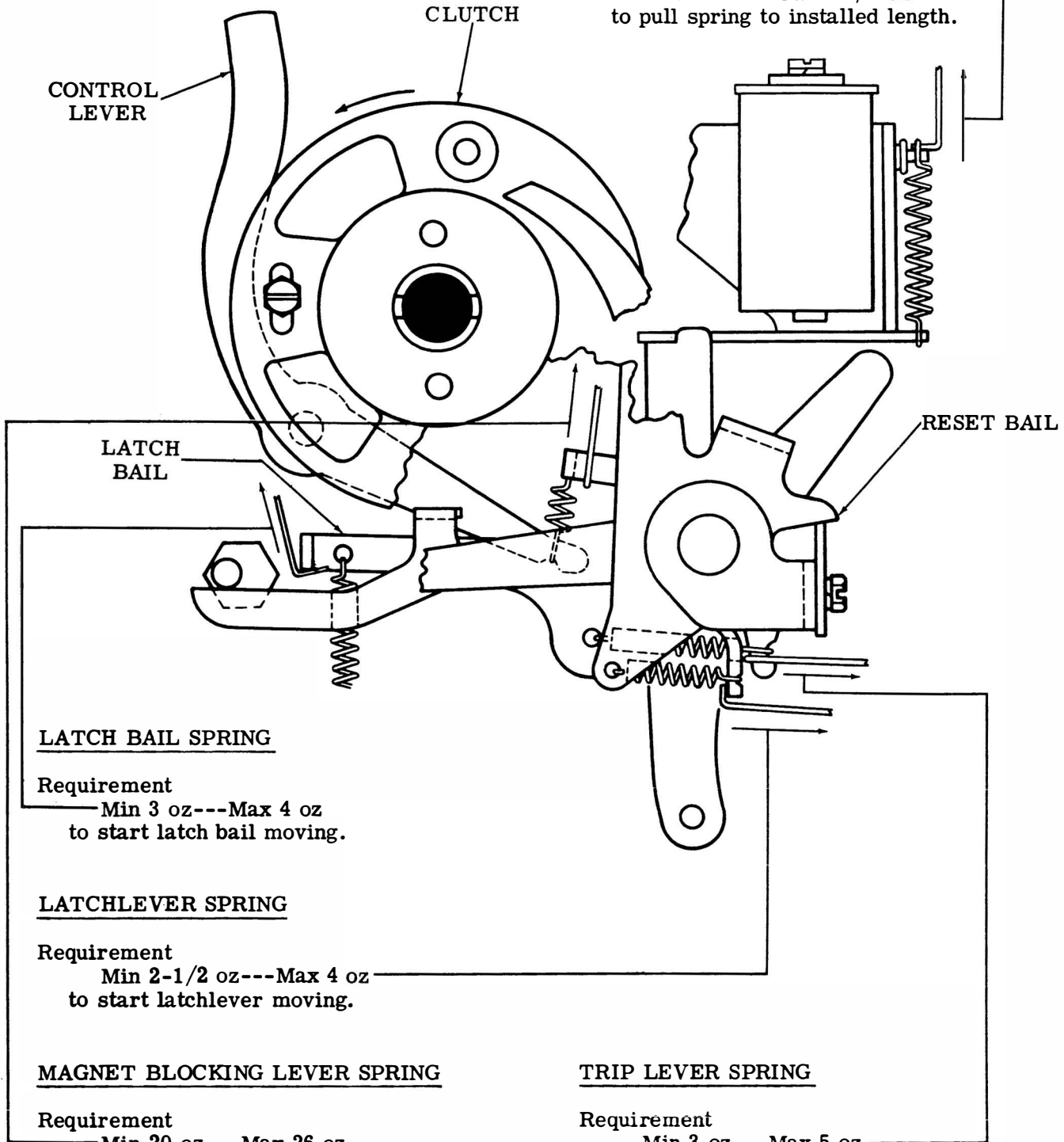


3.10 Distributor Mechanism (continued)

ARMATURE SPRING

Requirement

Spring unhooked from post
Min 6 oz---Max 7-1/2 oz
to pull spring to installed length.



LATCH BAIL SPRING

Requirement

Min 3 oz---Max 4 oz
to start latch bail moving.

LATCHLEVER SPRING

Requirement

Min 2-1/2 oz---Max 4 oz
to start latchlever moving.

MAGNET BLOCKING LEVER SPRING

Requirement

Min 20 oz---Max 26 oz
to start blocking lever moving.

TRIP LEVER SPRING

Requirement

Min 3 oz---Max 5 oz
to start trip lever moving.

RADIO FREQUENCY INTERFERENCE (RFI)

SUPPRESSION FOR 28 CABINETS

DESCRIPTION

1. GENERAL

1.01 This section presents a general description of components necessary for radio frequency interference (rfi) suppression as applied to 28 Cabinets. In addition, this section is intended for use as a supplement to standardized literature. For more detailed information regarding the apparatus refer to Sections 573-134-100TC, 573-134-101TC, 573-100-101TC and 573-135-100TC.

2. DESCRIPTION

2.01 Cabinets used with rfi applications are similar to those used with standard applications. The major differences are a shielded power cable, flexible conduit, mounting racks, electrical service assemblies (ESA) and power and signal junction boxes.

2.02 Power is supplied to the cabinets and associated apparatus by means of two 3-conductor shielded cables. One cable provides power for the motor unit, cabinet

lighting etc, and the other cable provides power for the ESA. In the case of floor model cabinets, the cable is routed through the bottom of the cabinet, continues through flexible conduit and terminates at terminal junction boxes. On table model cabinets, the power cable is brought directly to the ESA. Signal and cabinet power cables are routed through a notch in the rear of the cabinet.

2.03 Flexible conduit is used in most cabinets to interconnect junction boxes, power line filters, and associated ESA's.

2.04 The junction boxes, which are located in the lower compartment of floor model cabinets, provide for connection of signal input, output, and transmitter stepping signal inputs.

2.05 Some floor model cabinets have a fan for ventilation, usually located near the ESA. Its function is to reduce the temperature of the electrical components in the ESA.

**ELECTRICAL SERVICE ASSEMBLIES FOR
 LOW-LEVEL RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
 DESCRIPTION AND PRINCIPLES OF OPERATION**

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL	1	7. CLUTCH MAGNET DRIVER (CMD) ..	10
2. DESCRIPTION	2	TECHNICAL DATA (TP321991 OR TP333069 (CMD)	10
3. PRINCIPLES OF OPERATION	3	ELECTRICAL THEORY (TP321991 AND TP333069 CMD)	11
ESA USING 0.5 AMPERE POWER SUPPLY CARD	3		
ESA USING 1.0 AMPERE POWER SUPPLY CARD	4		
4. SELECTOR MAGNET DRIVER (SMD)	4	1. GENERAL	
TECHNICAL DATA	5	1.01 This section presents a general descrip- tion of the various electrical service assemblies (ESA) housing low-level radio fre- quency components in 28 teletypewriter sets. It is to be used with other related sections to form a complete shielded electrical system for rfi suppression in the set.	
PRINCIPLES OF OPERATION	5		
5. LOW-LEVEL KEYER (LLK)	6	1.02 Since the physical structure of the ESA differs for many installations, no attempt is made to give detailed description of each. The general characteristics and component elements are described with reference to schematic wiring diagrams in the associated wiring diagram pack- age (refer to charts in Section 573-600-100TC).	
TECHNICAL DATA	6		
PRINCIPLES OF OPERATION	7		
A. TP303142 Keyer	7		
B. TP323130 Keyer	8		
6. POWER SUPPLY CARD	8	1.03 The chart, Figure 1, indicates the quan- tity of major components required in each ESA, and the type of mounting employed. The abbreviations used in the chart are defined as follows:	
TECHNICAL DATA	8	CMD - Clutch Magnet Driver	
A. One-Half Ampere Power Supply. .	8	IR - Isolation Relay	
B. One Ampere Power Supply	9	LLK - Low-Level Keyer	
PRINCIPLES OF OPERATION	9	SMD - Selector Magnet Driver	
A. One-Half Ampere Power Supply. .	9		
B. One Ampere Power Supply	10	1.04 The text is supported by photographs of typical ESA, Figures 2 through 10, and circuit cards, Figures 11 through 14. For	

Electrical Service Assembly	Circuit Card Connectors						Type of Mounting	
	Power Supply		LLK	SMD	CMD	IR	Table	Rack
	0.5A	1.0A						
TP321225	1				1			X
TP321226	1			1				X
TP321228		1		4				X
TP321230	1				1		X	
TP321231	1			1			X	
TP323120	1				1		X	
TP323121	1		1	1			X	
TP323811	1		2	2		2		X
TP323812	1				2	3		X
TP323813	1		1	1			X	
TP323815	1		2	3		3		X
TP323820	1		1	1				X
TP324060	1			1				X
TP324061	2		1	1	1			X
TP325918	1		1	1	1			X
TP326471	1			1				X
TP326792	1		1		1		X	
TP332726	2		1	3	1			X
TP332727	1			4				X

Note: For appropriate wiring diagram package, refer to charts in Section 573-600-100TC

Figure 1 - Electrical Service Assembly Component Chart

detailed wiring refer to the wiring diagram package (WDP) listed in the charts of Section 573-600-100TC.

2. DESCRIPTION

2.01 The electrical service assemblies are metal shielded containers which vary in configuration for different applications. They are used as a housing for electronic components which serve to suppress radio frequency interference and provide low-level transmission of telegraph signals.

2.02 Electrical service assemblies differ from one another primarily because of the number of isolation relays and circuit board connectors which are provided for the associated keyers and drivers (Figure 1). Another difference is the mounting design; some are designed

for rack mounting and others are designed for cabinet mounting.

2.03 Electrical service assemblies which house LLK and/or SMD circuit cards require double-shielded box construction. An inner aluminum box functions as an electrostatic shield and is electrically isolated from an outer box which serves as a magnetic shield. CMD circuit cards do not require a double box construction. Single box construction is adequate for the CMD and serves as a combined electrostatic-magnetic shield.

2.04 The inner box contains a mounting plate with printed circuit board connectors to accommodate a power supply printed circuit board assembly and the required number of CMD, SMD, and LLK circuit cards. A screw terminal strip is provided for connecting the signal line. The power supply

rectifier filter capacitor is also located in the inner box.

2.05 The outer box contains the inner box, a power supply transformer, power line filter, and a screw terminal block for ac power connections. A power switch and fuse are located on one side of the outer box.

2.06 The power supply transformer and rectifier filter capacitor form an assembly capable of meeting the power supply requirements specified in 2.07 when used in conjunction with a power supply card.

2.07 Power Supply Technical Data

POWER SUPPLY	0.5 AMP	1.0 AMP
Input	100 to 130 volts ac, 45 to 66 hertz. Nominal Power: 55 watts at 115 volts ac for 25 watts output.	100 to 130 volts ac, 45 to 66 hertz. Nominal Power: 100 watts at 115 volts ac for 50 watts output.
Output	(a) +47 to +53 volts dc at 0.5 amp max (b) +6.6 to +7.8 volts dc at 0.018 amp max (c) -6.6 to -7.8 volts dc at 0.018 amp max	+47 to +53 volts dc at 1.0 amp max
Operating Temperature	+40 ⁰ to +110 ⁰ F with cooling fan in cabinet	+40 ⁰ to +110 ⁰ F with cooling fan in cabinet
Fusing	(a) ac — 0.8 amp slow-blowing (TP162360) (b) dc — 0.5 amp fast-blowing (TP131807)	ac — 2.0 amp slow-blowing (TP120166) dc — 1.0 amp fast-blowing (TP115358)

3. PRINCIPLES OF OPERATION

ESA USING 0.5 AMPERE POWER SUPPLY CARD (Figure 13)

3.01 Power supply transformer T1, diodes CR1, CR3, and power supply rectifier filter capacitor C8 form a full-wave rectifier to obtain a minimum of 58 volts unregulated dc.

3.02 Transistors Q1 and Q2 form a two-stage series voltage regulating element. Both transistors are always conducting, and the base-emitter drop of each transistor is approximately 0.7 volt. The voltage drop across R2 is negligible. (Resistor R2 is used in conjunction with capacitor C5 for rfi noise suppression.) In effect, then, the emitter of Q1 is clamped to the same potential as the reference diode combination CR7 and CR12, ie, the dc output of Q1 is nominally 47 volts. The difference between

the Q1 dc output and the unregulated dc appears across the collector-emitter junction of Q1.

3.03 Transistor Q2 is a gain stage for Q1. Resistor R1 limits the current that divides between the CR7-CR12 reference diodes and the base of Q2. The base current of Q1 or the collector current of Q2 is equal to the base current of Q2 multiplied by the dc current gain (H_{FE}) of Q2.

3.04 Resistor R7 acts as a bleeder and assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R7 and no load connected, the output would rise to the same value as the unregulated dc. However, a minimum load of 0.150 ampere must also be applied to maintain the +53 volt regulation limit.

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3.05 The +7 volt output is obtained by dropping the unregulated dc voltage through resistor R4 to supply the zener reference diode CR6 which is connected across the output.

3.06 Resistor R5 and zener diode CR5 provide a -7 volt output in a manner similar to that described in 3.05. However, a full-wave rectifier consisting of rectifier diodes CR2 and CR4 and capacitor C4 is required to obtain the negative unregulated potential with respect to the circuit common.

3.07 Capacitors C1, C2, and C3 suppress rfi noise transients which occur due to rectifier switching. Capacitors C6 and C7 and inductors L3 and L4 suppress zener diode noise.

3.08 The transformer shields and a low-pass filter consisting of L1, L2, C9, C10, C11, and C12 provide noise isolation between power line and power supply.

3.09 The electrical service assemblies are normally wired so that one 250 ohm (25 watt) resistor is connected across the collector-emitter of Q1 when each associated SMD or CMD is inserted in its connector to reduce power dissipation in Q1. (This is equivalent to paralleling Q1 with 250 ohms for each 0.150 ampere, approximately, of load current.)

3.10 Fuse F102 limits the output current to a total of 0.5 ampere.

ESA USING 1.0 AMPERE POWER SUPPLY CARD

3.11 Power supply transformer T1, diodes CR1, CR2, and power supply rectifier filter capacitor C5 form a full-wave rectifier to obtain a minimum of 58 volts unregulated dc.

3.12 Transistors Q1 and Q2 form a two-stage series voltage regulating element. Both transistors are always conducting, and the base-emitter drop of each transistor is approximately 0.7 volt. The voltage drop across R2 is negligible. (Resistor R2 is used in conjunction with capacitor C4 for rfi noise suppression.) In effect, then, the emitter of Q2 is clamped to the same potential as the reference diode combination CR3 and CR8, ie, the dc output of Q2 is nominally 47 volts. The dif-

ference between the Q2 dc output and the unregulated dc appears across the collector-emitter junction of Q2.

3.13 Transistor Q1 is a gain stage for Q2. Resistor R1 limits the current that divides between CR3-CR8 reference diodes and the base of Q1. The base current of Q2 or the collector current of Q1 is equal to the base current of Q1 multiplied by the dc current gain (H_{FE}) of Q1.

3.14 Resistor R4 acts as a bleeder and assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R4 and no load connected, the output would rise to the same value as the unregulated dc.

3.15 Capacitors C1, C2, and C3 suppress rfi noise transients which occur due to rectifier switching.

3.16 The transformer shields and a low-pass filter consisting of L1, L2, C6, C7, C8, and C9 provide noise isolation between power line and power supply.

3.17 Fuse F102 limits the output current to a total of 1.0 amperes.

4. SELECTOR MAGNET DRIVER (SMD) (Figure 11)

4.01 The TP323810 selector magnet driver is a 15-pin circuit card assembly designed to plug into an associated electrical service assembly as an integral part of its components. When used in conjunction with proper power supply and filter assemblies, it is intended for radio frequency interference suppression of receiving selector noise in systems requiring this suppression.

4.02 This selector magnet driver provides two inputs and makes possible reception from either one of two separate transmitters (single input operation) while the input line from the other transmitter is open. A spacing signal at either input will provide a spacing output.

4.03 In order to function properly, this selector magnet driver should be installed in a double-shielded enclosure and used in conjunction with the appropriate electrical service

assemblies where extreme rfi suppression is required. It is not intended for general use.

TECHNICAL DATA

- 4.04 The input current to the TP323810 selector magnet driver (SMD) is a low-level +6 volt for a marking state, and a -6 volt for a spacing state.
- 4.05 The output current of the SMD is 60 milliamperes $\pm 10\%$ during the marking state. The output is zero during the spacing state.
- 4.06 The SMD assumes the marking state with positive input voltages not greater than 0.5 volt and the spacing state with negative voltages not greater than 0.5 volt. The marking and spacing switching levels are adjustable within 10% of each other. This requirement applies to either input.
- 4.07 Each input of the SMD has a minimum input resistance of 50,000 ohms.
- 4.08 The maximum input capacitance of either input is 2500 picofarads.
- 4.09 Overall receiving margins of properly adjusted 28 type selectors driven by this SMD (polar rectangular wave input) should exceed 70 points at either input.
- 4.10 The SMD provides a marking output when both inputs are open.
- 4.11 Both inputs cannot be in the marking condition simultaneously without producing a garbled output.
- 4.12 The SMD operates at bit rates up to 75 baud.
- 4.13 It operates in a free-air ambient temperature of 70°C (158°F). Storage temperature should not exceed 85°C (185°F).
- 4.14 The SMD operates from a power supply delivering 47 to 53 v dc.
- 4.15 The power consumption under any combination of power source, environmental, and component conditions is 8.5 watts maximum.
- 4.16 The TP323810 selector magnet driver, together with associated electrical service assembly and power supply, is intended

for use with equipment requiring low-level rfi (polar - EMC) operation.

PRINCIPLES OF OPERATION

- 4.17 The following electrical theory requires reference to Figure 1, and the appropriate wiring diagram package.
- 4.18 The TP323810 selector magnet driver (SMD) is basically a direct coupled amplifier providing a current gain of approximately 80 db. The first two stages (Q1, Q6, or Q5, Q7) provide the necessary gain to drive a Schmitt trigger (Q8 and Q9). Q2, Q3, and Q4 comprise a power regulator stage which provides the power supply with a constant load.
- 4.19 In the marking state with a positive voltage with respect to common applied to each input (or a positive voltage on one input, the other open), Q1 and Q5 conduct, which in turn saturate Q6 and Q7. In this marking state the voltage drop from the emitter of Q6 to the collector of Q7 is less than the voltage drop from the CR15 anode to the Q8 emitter. Under this condition, the base-emitter junction of Q8 is reverse biased, thus turning Q8 off. With Q8 off, the Q9 base will conduct through R26 and thus energize the external selector magnet in the collector circuit. Transistor Q9 base current is sufficient to saturate the collector. In this condition, selector magnet current is determined primarily by the value of the limiting resistor R23 and the power regulator output voltage.
- 4.20 In the spacing state, with a negative voltage on input 1, input 2, or both inputs, the respective input transistor or transistors (Q1, Q5) are off. In this condition Q6-Q7 collector current is cut off and the base of Q8 conducts. Transistor Q8 base current is sufficient to saturate the collector. The Q8 emitter-collector saturation voltage is less than the forward drop across CR13 thus reverse biasing the base emitter junction of Q9. With this junction reverse biased, Q9 collector current is cut off and the selector magnet is de-energized.
- 4.21 Because of the difference in magnitude of Q8 and Q9 load currents, the drop across R21 will be greater in the marking state than in spacing. This means that the input voltage to the third stage (Q6 VCE + Q7 VCE) necessary to change the state of Q8 will be dif-

ferent depending on the previous state. Specifically, a larger combined Q6 and Q7 collector-emitter voltage is required to turn on Q8 than to turn off Q8. This hysteresis, peculiar to Schmitt triggers, enables positive driver input signals to energize the selector coil and negative going input signals to de-energize the coil.

4.22 Resistors R4, R16, and potentiometers R3 and R15 serve to bias Q1 and Q5 and set the center of the switching interval. Emitter resistors R7 and R18 assist in gain stabilization. Resistors R6, R8 and R19, R20 form voltage dividers to bias CR2, 3, 4 and CR10, 11, 12. These diodes exhibit temperature characteristics such that together with R7 and R18, effective temperature compensation is obtained to stabilize the switching level of the SMD. Diode CR5 establishes a voltage reference for the first stages to insure switching level stability.

4.23 When low resistance transmitters (about 100 ohms) are used to key the driver, R1 and R13 have no significant effect on the operation of the circuit. However, when the line resistance is high (open line), R1 and R13 apply sufficient bias to drive Q1 and Q5 into conduction. This operation will maintain the terminal equipment in the idle state when input lines are open, or allow single line operation by simulating a marking signal on the other input.

4.24 In the power regulator, CR8 and the base-emitter junction of Q4 establish a voltage reference for R11 which determines the current drain of the unit. Diode CR6, CR7 and the base-emitter junction of Q3 serve to clamp the Q4 collector at a low voltage so as to minimize power dissipation in Q4. As the power requirement of the circuitry following the regulator decreases, the output voltage of the regulator will begin to rise. This rise corresponds to a decrease in Q4 collector-base voltage. The effect is to increase the forward bias on the base-emitter junction of Q3 and cause increased collector conduction. This collector current increases the conduction of Q2 whereby Q2 and R10 absorb the excess power. Q2 functions as a variable resistance so as to maintain a constant resistance across the output of the regulator regardless of the state of the driver circuitry. As a consequence of this, the power supply sees a constant load, regardless of driver state.

4.25 Capacitors C4 and C5 provide negative feedback to reduce transient generation in the driver. Capacitors C3 and C7 and C8 are radio frequency bypass capacitors to eliminate

any parasitic oscillations that may occur as a result of switching.

5. LOW-LEVEL KEYSER (LLK) (TP303142 Figure 12, and TP323130)

5.01 The low-level keyers (LLK) are circuit card assemblies approximately 2-1/4 by 4-1/2 inches. They are designed to plug into a 15-pin connector that is wired into the electrical service assembly where it becomes an integral component for the suppression of radio frequency interference (rfi).

5.02 The TP303142 LLK, when used in conjunction with the TP321268 filter card assembly, is intended for use with the TP323644 and TP323645 signal generator (one contact) assemblies. This LLK is adaptable to various types of 28 type equipment when used with the applicable ESA and is designed to operate from one set of contacts. Two signal generator outputs (filter card outputs), however, may be paralleled to drive one signal line from either of two signal generators.

5.03 The TP323130 LLK is for use in photoelectric systems (such as 28/32 keyboard) requiring a low-level interface and extreme rfi suppression. It is used in conjunction with a TP333069 CMD.

5.04 Each keyer is designed to operate into a high resistance load such as the TP323810 SMD.

5.05 An external power source, mounted in the associated electrical service assembly, is required to operate the keyers.

TECHNICAL DATA

5.06 All low-level keyer features for the TP303142 and TP323130 given in the following paragraphs assume the use of the TP321268 filter card assembly.

5.07 Maximum unloaded power consumption of each keyer is less than 50 milliwatts.

5.08 The output of the TP303142 keyer is +6.0 volts +1.0 corresponding to the marking state and -6.0 volts +1.0 corresponding to the spacing state. The output of the TP323130 keyer is also +6.0 volts +1.0 for marking and -6.0 volts +1.0 for spacing.

- 5.09 The marking and spacing output voltages should be balanced to within 10 percent of each other.
- 5.10 The TP303142 keyer operates from the spacing contacts (mark contact open, space contact closed) of the TP323645 or TP323644 signal generator assembly.
- 5.11 The outputs from two TP321268 filter card assemblies may be paralleled for parallel operation of either of two transmitters.
- 5.12 The nominal output impedance is 100 ohms.
- 5.13 The keyers operate at bit rates up to 75 baud.
- 5.14 Maximum short circuit output current is 60 milliamperes.
- 5.15 The TP303142 and TP323130 keyers operate into a load resistance of 5000 ohms minimum.
- 5.16 The keyers and TP321268 filter card assembly operate in a maximum free-air ambient temperature of 70°C (158°F). Storage temperature should not exceed 85°C (185°F).
- 5.17 The TP303142 keyer operates from a power source delivering +7.2 volts dc +0.6 v. The TP323130 keyer also operates from a power source delivering +7.2 volts dc +0.6 v. Maximum unloaded power consumption is less than 50 milliwatts.
- 5.18 The mark and space symmetry at zero volt (output waveform) is adjustable by means of the signal generator position adjustment for the TP303142 keyer. It may be adjusted within 10 percent of each other by the 5 meg-ohm potentiometer on the keyer card for the TP323130 keyer.
- 5.19 The keyer is intended for use on signal lines less than 1000 feet in length. However, operation is possible with line lengths up to 5000 feet.
- 5.21 The TP303142 low-level keyer is a neutral to polar converter which, by means of passive and active filtering, shapes the output waveform.
- 5.22 In the marking state the signal generator contact is open and Q1 conducts to a level established by resistors R1, R2, and R11. Transistor Q1 conducts sufficient current to saturate the collector of Q2 which rises to slightly less than the positive supply voltage. With Q2 conducting, Q4 and Q6 also conduct. Transistor Q4 base current (equal to the total output load current divided by the product of Q4 and Q6 gains) is small and consequently the voltage drops across R6, R10, and R7 are insignificant. Transistor Q6 base current (equal to total output load current divided by the gain of Q6) is also small resulting in an insignificant voltage drop across R8. Thus, the output voltage is the power supply voltage minus the sum of Q2 voltage with collector-emitter saturated, Q4 base-emitter voltage and Q6 base-emitter voltage. The drop across R9 for normal output loads is insignificant.
- 5.23 In the spacing state the signal generator contact is closed. In this state R1 is shunted by the series combination of R13, R14, and R15 thus reducing Q1 base voltage below the emitter voltage established by the voltage divider R3, R11. With the emitter being at a higher potential than the base, Q1 is turned off. With Q1 off, Q2 is off and its collector voltage approaches the negative supply voltage. In this state Q3 and Q5 conduct. For the same reasons as in the marking state, the output voltage is primarily a function Q3 base-emitter voltage and Q5 base-emitter voltage. Diode CR1 is added to compensate the unsymmetrical properties associated with the second stage.
- 5.24 During transitions, the nonsymmetric low-pass contact filter prefilters the input to the keyer. In addition, common mode effects due to the unbalanced strap capacitance of the contact assembly, are reduced. Capacitors C1 and C6 limit the high frequency response of stages 1 and 2 thus providing additional shaping.

PRINCIPLES OF OPERATION

A. TP303142 Keyer

- 5.20 All circuit references in the following paragraphs are made with respect to the schematic wiring diagrams in the wiring diagram package applicable to the set.
- 5.25 Stage 3 (Q4 and Q3) is a low-pass active filter. By means of C2 charging and discharging through the feedback network, consisting of R6, R10, R7, and C2, the rise and fall times are lengthened to produce an acceptable spectrum (from rfi standpoint). Capacitors

C3, C4, and C5 provide additional shaping by bypassing undesirable frequency components generated in Q3, Q4, Q5, and Q6. C7 is a radio frequency bypass capacitor to decouple the power supply.

B. TP323130 Keyer

5.26 All references in the following paragraphs are made with respect to the schematic wiring diagrams in the wiring diagram section or the wiring diagram package applicable to the set.

5.27 The TP323130 keyer takes a 250 ua (min) photocell signal from the distributor and by means of passive and active filtering, shapes the output.

5.28 In the marking state (photocell illuminated), Q5 is turned off causing the bases of Q1 and Q2 to go positive through the passive shaping network made up of R2, C1 and R4. With the bases of Q1 and Q2 positive, Q1 will turn on turning Q4 off and Q2 will turn off turning Q3 on. Capacitor C2, resistor R6, R9, and capacitor C3 further shape the wave by providing feedback and phase shift thereby controlling the rate at which the active filter Q1, Q2, Q3, Q4 will switch.

5.29 In the spacing state (photocell dark), Q5 is turned on providing a negative signal to the bases of Q1 and Q2. The switching occurs as in 5.28 except, transistors that are off turn on and those that are on turn off.

5.30 During the transition from on to off and off to on, one of the output transistors of the active filter is always conducting. This will provide a smooth transition from plus volts through 0 volts to minus volts and back again. The rate of switching being controlled by the feedback and phase shift of C2, R6, R9 and C3.

5.31 Diode CR1 compensates for the nonsymmetry of the first stage. Resistors R10 and R5 and capacitors C6 and C7 provide for the proper output impedance and some additional shaping.

6. POWER SUPPLY CARD (Figure 13)

6.01 Two power supply circuit cards are employed in the ESA used with 28 type equipment; one a 0.5 ampere, and the other a 1.0 ampere. The 0.5 ampere and 1.0 ampere

circuit cards, when installed in a shielded electrical service assembly (ESA) containing the proper transformer and filter assembly, are intended as radio frequency interference suppression power sources in systems requiring low-level rfi.

6.02 The required power supply should be plugged into the 15-pin TP148458 connector in the ESA that has a TP198650 polarizing key between pins M and N for the 0.5 ampere power supply and between pins K and L for the 1.0 ampere power supply. Refer to the chart, Figure 1, for information regarding the applicable power supply card to be used with the particular set and to the wiring diagram package for the applicable wiring diagrams. See Figure 13 for a typical card.

6.03 The transformer and filter circuits for both power supplies are located in part of their associated electrical service assemblies. The power transistor and heat sink for the 1.0 ampere power supply is also part of the electrical service assembly. The power transistor and heat sink for the 0.5 ampere power supply are included as part of the TP321290 circuit card assembly.

6.04 The amperage rating and quantity of power supply circuit cards to be used (one per electrical service assembly) will depend upon the equipment used. Each power supply circuit card assembly is a part of some ESA. Each ESA is part of equipment used in low-level operation.

TECHNICAL DATA

6.05 In the following paragraphs, the technical data refers to the complete power supply, including transformer and filter components in the associated electrical service assembly.

A. One-Half Ampere Power Supply

6.06 The following technical data applies to 0.5 ampere power supplies when installed in an electrical service assembly that accommodates from one to three selector magnet drivers (SMD) or clutch magnet drivers (CMD).

(a) Input: 100 v ac to 130 v ac, 45 to 66 hertz

(b) Output

(1) +47 v dc to +53 v dc at 0.5 ampere maximum

- (2) +6.6 v dc to +7.8 v dc at 0.018 ampere maximum
- (3) -6.6 v dc to -7.8 v dc at 0.018 ampere maximum

(c) Fusing

- (1) ac: 0.8 ampere, slow-blowing (TP162360)
- (2) dc: 0.5 ampere, fast-blowing (TP131807)

(d) Operating Ambient Temperature: +40°F to +120°F with cooling fan in Automatic Send-Receive Set (ASR)

B. One Ampere Power Supply

6.07 The following technical data applies to the 1.0 ampere power supply installed in an electrical service assembly that accommodates from one to six selector magnet drivers (SMD) or clutch magnet drivers (CMD).

- (a) Input: 100 v ac to 130 v ac, 45 to 66 hertz (cps)
- (b) Output: +47 v dc to +53 v dc at 1.0 amperes maximum
- (c) Fusing
 - (1) ac: 2 ampere slow-blowing
 - (2) dc: 1.5 ampere fast-blowing
- (d) Operating Ambient Temperature: +40°F to +120°F with cooling fan in a multiple page printer monitor cabinet (LBAC).

PRINCIPLES OF OPERATION

6.08 The following paragraphs explain the general operation of each power supply circuit card assembly when it is installed in an electrical service assembly (ESA). The transformer, filter, and the 1.0 ampere power transistor with heat sink are included as part of the ESA. For more detailed information, refer to the wiring diagram package of the specific set that is used.

A. One-Half Ampere Power Supply

6.09 Transformer T1, capacitor C8, filter components L1, L2, C9, C10, C11, and C12 are all located in the electrical service

assembly, not on the circuit card assembly. (Refer to Figure 13 and wiring diagram package.)

6.10 Transformer T1, diodes CR1, CR3, and capacitor C8 form a full-wave rectifier to obtain a minimum 58 volts unregulated dc.

6.11 Transistors Q1 and Q2 form a two stage series voltage regulating element. Both transistors are always conducting with the base-emitter drop of each transistor at approximately 0.7 volt. The drop across R2 (used in conjunction with C5 for noise suppression) is negligible. In effect, the emitter of Q1 (dc output) is clamped to the same potential as the reference diode combination CR7-CR12 (nominally 47 v). The difference between the dc output and unregulated dc appears across the collector-emitter junction of Q1.

6.12 Resistor R1 limits the current that divides between the CR7-CR12 reference diodes and the base of Q2, which is a gain stage for Q1. The base current of Q1 (Q2 collector current) is the base current of Q2 multiplied by the dc current gain (H_{FE}) of Q2.

6.13 Resistor R7 across the output acts as a bleeder and also assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R6, the output would rise to the same value as the unregulated dc with no load connected.

6.14 The +7 volt output is obtained by dropping the unregulated dc voltage through resistor R4 to supply the zener reference diode CR6, which appears across the output.

6.15 R5 and CR5 provide -7 volts in a similar manner; however, a full-wave rectifier consisting of rectifier diodes CR2, CR4, and capacitor C4 is required to obtain the negative unregulated potential with respect to circuit common.

6.16 Capacitors C1, C2, and C3 are used to suppress noise transients which occur due to rectifier switching. Capacitors C6 and C7 and inductors L3, L4 suppress zener diode noise.

6.17 A low-pass filter consisting of L1, L2, C9, C10, C11, C12, and transformer shielding are used to obtain noise isolation between power line and power supply.

B. One Ampere Power Supply

6.18 Transformer T1, capacitor C101 and low-pass filter components L1, L2, C102, C103, C104, C105, transformer shielding, and power transistor with heat sink Q2 (Q1 of ESA) are located in and are parts of the associated electrical service assembly. (Refer to Figure 13 and wiring diagram package.)

6.19 Transformer T1, diodes CR1, CR2, and capacitor C101 form a full-wave rectifier to obtain a minimum 58 volts unregulated dc.

6.20 Transistors Q1 and Q2 form a two-stage series voltage regulating element. Both transistors are always conducting with the base-emitter drop of each transistor at approximately 0.7 volt. The drop across R2 (used in conjunction with C4 for noise suppression) is negligible. In effect, the emitter of Q2 (dc output) is clamped to the same potential as the reference diode combination CR3-CR8 (nominally 47 v). The difference between the dc output and unregulated dc appears across the collector emitter junction of Q2.

6.21 Resistor R1 limits the current that divides between the CR3-CR8 reference diodes and the base of Q1, which is a gain stage for Q2. The base current of Q2 (Q1 collector-emitter current) is the base current of Q1 multiplied by the dc current gain (H_{FE}) of Q1.

6.22 Resistor R4 across the output acts as a bleeder and also assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R4, the output would rise to the same value as the unregulated dc with no load connected.

6.23 Capacitors C1, C2, and C3 are used to suppress noise transients which occur due to rectifier switching.

6.24 A low-pass filter (in ESA), consisting of L1, L2, C102, C103, C104, C105, and transformer shielding, is used to obtain noise isolation between power line and power supply.

6.25 Fuse F102 limits current output to a total of 1.0 amperes.

7. CLUTCH MAGNET DRIVER (CMD)

7.01 The following paragraphs describe the TP321991 and the TP333069 clutch magnet driver circuit cards and outline the electrical theory when installed (plugged) into a shielded electrical service assembly containing the proper power supply and filter assemblies.

7.02 The clutch magnet driver (CMD) is a solid state, direct coupled amplifier built as a plug-in circuit card assembly approximately 2-1/2 by 4-1/4 inches (Figure 14). It requires an external power source. All connections are made through a 15-pin circuit card connector.

7.03 The CMD output drive a 28 type transmitting clutch upon receipt of a low-level input pulse. It is to be used with the proper associated equipment and is not for general use.

7.04 These clutch magnet drivers (CMD) are adaptable to various 28 type equipment sets through the use of associated modification kits. Each CMD (one or more) is part of, or associated with, some electrical service assembly (ESA). The number of CMDs used depends on the number of clutch magnets used in the set.

TECHNICAL DATA (TP321991 OR TP333069 CMD)

7.05 The clutch magnet drivers (CMD) receive low-level signals (+6 volt clutch coil energized, -6 volt coil de-energized, nominal) and operate a 28 type clutch.

7.06 The TP321991 CMD is designed for use with 256M or 252M coils, depending on the type of transmitting equipment used. The TP333069 CMD is for use with 278M magnet coils. The output current during the energized state for the CMD is:

252M Coil (single coil for LK/LAKs)
107 to 132 ma

256M Coils (two coils in series for LXD)
124 to 156 ma

278M Coil (single coil for photoelectric distributor clutch) 36 to 56 ma

(Use two TP323354 cores for LXD coils)

7.07 Operation is considered satisfactory when the incoming synchronous pulse complies with the following requirements:

- (a) Minimum sync pulse duration = 20 ms.
- (b) Maximum sync pulse duration = 40 ms or 2 bit lengths, whichever is longer.
- (c) Minimum sync pulse period = 110 percent of transmitted character length.

Note: When operating an LK or LAK at the maximum pulsing rate (minimum period), the machine may not respond to each synchronous pulse when in the REPEAT mode.

7.08 Under the conditions of 7.07 (c), start pulse delay should be between 15 and 35 ms. (Delay is measured from zero volt of the positive going input synchronous pulse signal to the beginning of the start pulse at the signal generator contacts. If the TP321268 filter card assembly and TP303142 keyer are used, a nominal 6 ms must be added to the delay to account for delay in the keyer.)

7.09 The TP321991 or TP333069 clutch magnet driver assumes the energized state with positive input voltages not greater than +0.5 volt and the de-energized state with negative voltages not greater than -0.5 volt.

7.10 The energized and de-energized switching levels as defined in 7.09 are adjustable to within 10 percent of each other.

7.11 The TP321991 or TP333069 clutch magnet driver should have a minimum input resistance of 50,000 ohms.

7.12 The maximum input capacitance is 2500 picofarads.

7.13 The CMD provides a spacing (de-energized) output when the input line is open.

7.14 The clutch magnet driver operates in a free air ambient temperature range of 0°C to 65°C (150°F). Storage temperature should not exceed 85°C (185°F).

7.15 The TP321991 or TP333069 clutch magnet driver operates from a power supply delivering +47 to +53 v dc.

7.16 Power consumption under any combination of power source, environmental, and component conditions is 13 watts maximum.

7.17 The TP321991 or TP333069 CMD is intended for use on clock lines less than 1000 feet in length. However, operation is possible with line lengths up to 5000 feet.

7.18 The TP321991 or TP333069 CMD, when used with associated power supplies, is intended for use with interfaces conforming to the following requirements:

- (a) Fed. Std. 222 Section 3102 b
- (b) MIL STD. 188B

ELECTRICAL THEORY (TP321991 AND TP333069 CMD)

7.19 All circuit references in the following paragraphs are made with respect to Figure 14, the circuit board assembly drawing, and schematic wiring diagram of the respective clutch magnet driver (CMD). Refer to wiring diagram package and/or Section 573-600-400TC.

7.20 The driver is basically a direct coupled amplifier providing a current gain of approximately 80 db (60 db on TP333069 CMD). The first two stages (Q1 and Q2) provide the necessary gain to drive a Schmitt trigger (Q3 and Q4). Q5 and CR2 comprise a power regulator stage which provides the power supply with a constant load.

7.21 In the marking state, with a positive voltage with respect to common applied to the input side of the Q1 base resistor R5, Q1 conducts, which in turn saturates Q2. In this condition, the sum of the voltage drops around the loop R14, Q2 collector-emitter and Q3 base-emitter is in a condition to reverse bias the base-emitter junction of Q3 and thus cut off Q3 collector current. The Q4 base current increases the voltage drop across R15 in order to satisfy loop conditions established by the power regulator voltage, R14, CR8, and Q4 base-emitter voltage. The Q4 base current is sufficient to saturate the collector. In this condition, load current is determined primarily by the load resistance, R17, and the power regulator output voltage.

7.22 In the spacing state, with a negative input voltage, Q1 is cut off with reverse base-emitter bias established by the reverse transient

protection diode CR3. With Q1 off, Q2 does not conduct. Consequently, to satisfy loop conditions established by R13, Q3 base-emitter, R14, and the regulator voltage, Q3 conducts to raise the voltage across R13. Base current is sufficient to saturate the Q3 collector. The Q3 collector-emitter voltage is less than CR8 voltage, which in turn reverse biases the base-emitter junction of Q4. With the latter junction reverse biased, the Q4 collector is cut off.

7.23 The collector circuit at Q2 has been interrupted and brought out to the connector contacts at the bottom of the card. This circuit must be completed externally or Q3 cannot be turned off and the magnet coils are held de-energized. The circuit thus affords a degree of local magnet control.

7.24 Because of the difference in magnitude of Q3 and Q4 load currents, the drop across R14 will be greater in the marking state than in spacing state. This means that input voltage to the third state (Q2 VCE) necessary to change the state of Q3 will be different depending on the previous state. Specifically, a larger Q2 collector-emitter voltage is required to turn on Q3 than to turn off Q3. This hysteresis, peculiar to Schmitt triggers, enables positive driver input signals to energize the load coil and negative going input signals to de-energize the load coil.

7.25 Resistor R6 and potentiometer R7 serve to bias Q1 and set the center of the switching interval. Emitter resistor R8 assists in gain stabilization. R11 and R9 form a voltage divider to bias CR4, CR5, and CR6. These diodes exhibit temperature characteristics such that together with R8, effective temperature

compensation is obtained to stabilize the switching level of the driver. CR7 establishes a voltage reference for the first stage to insure switching level stability.

7.26 When a low resistance transmitter (about 100 ohms) is used to key the driver, R4 has little significance on the operation of the circuit. However, when the input resistance is extremely high, R4 applies sufficient bias to Q1 to cut off. This operation will maintain the terminal equipment in the idle state when the input line is open circuited.

7.27 In the power regulator, CR1 and the base-emitter junction of Q5 establish a voltage reference for R1 and R2 which determines the current drain of the unit. As the driver demands less power from the regulator, such as being in the de-energized state, the excess current (excess over energized current) is shunted through zener diode CR2. This operation maintains a relatively constant load for the external power supply. R2 is adjusted to set minimum CR2 current for voltage regulation.

7.28 Coil L1 and capacitor C1 serve to reduce noise generated by zener diode CR2.

7.29 Capacitors C3 and C6 provide negative feedback to reduce transient generation in the driver. C5 and C7 are radio frequency bypass capacitors to eliminate any parasitic oscillations that may occur during high speed switching.

7.30 Diode CR9, C4 and R16 form a transient limiting network to protect Q4 from excessive reverse transient present when switching inductive loads.

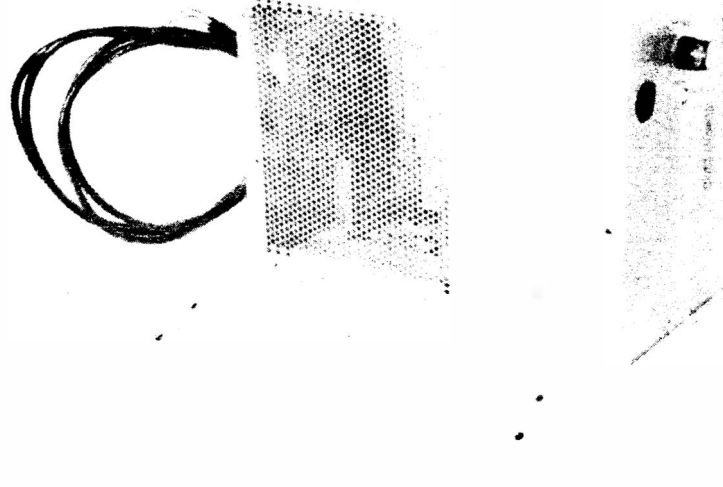


Figure 2 - ESA for Rack Mounting – Single Box Construction

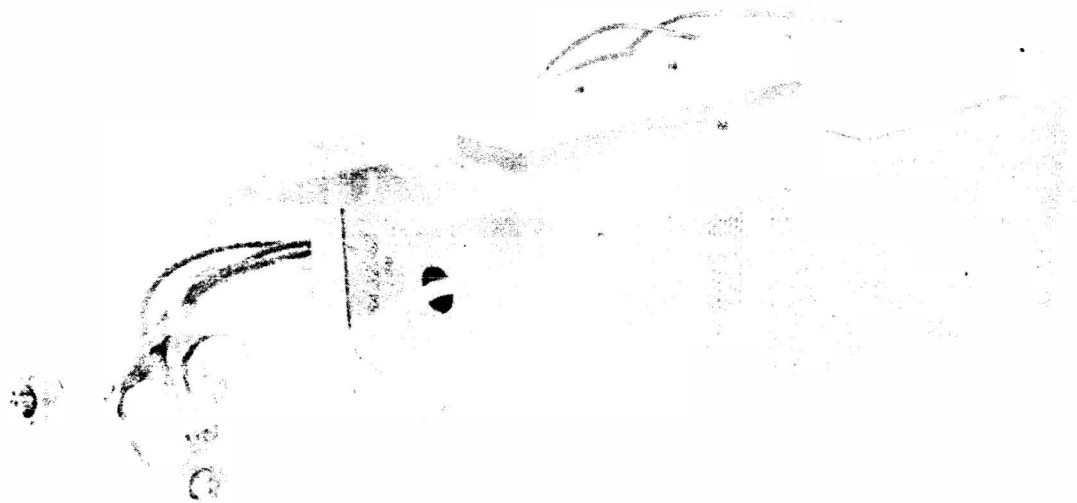


Figure 3 - ESA for Rack Mounting – Double Box Construction

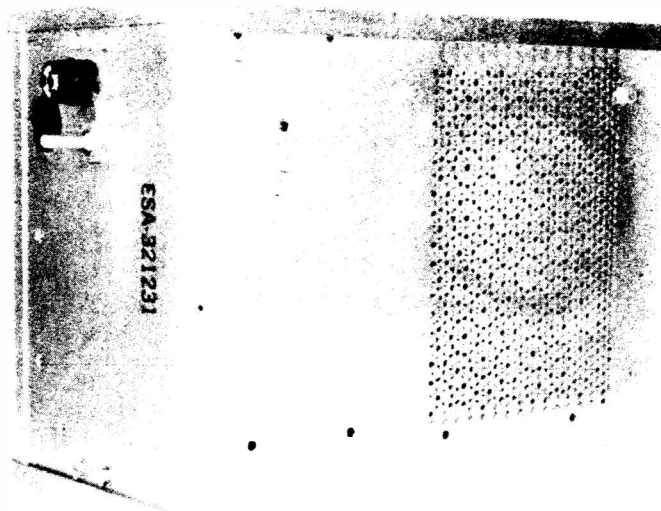


Figure 4 - ESA for Table Mounting - Double Box Construction



Figure 5 - ESA for Rack Mounting - Single Box Construction with Isolation Relays

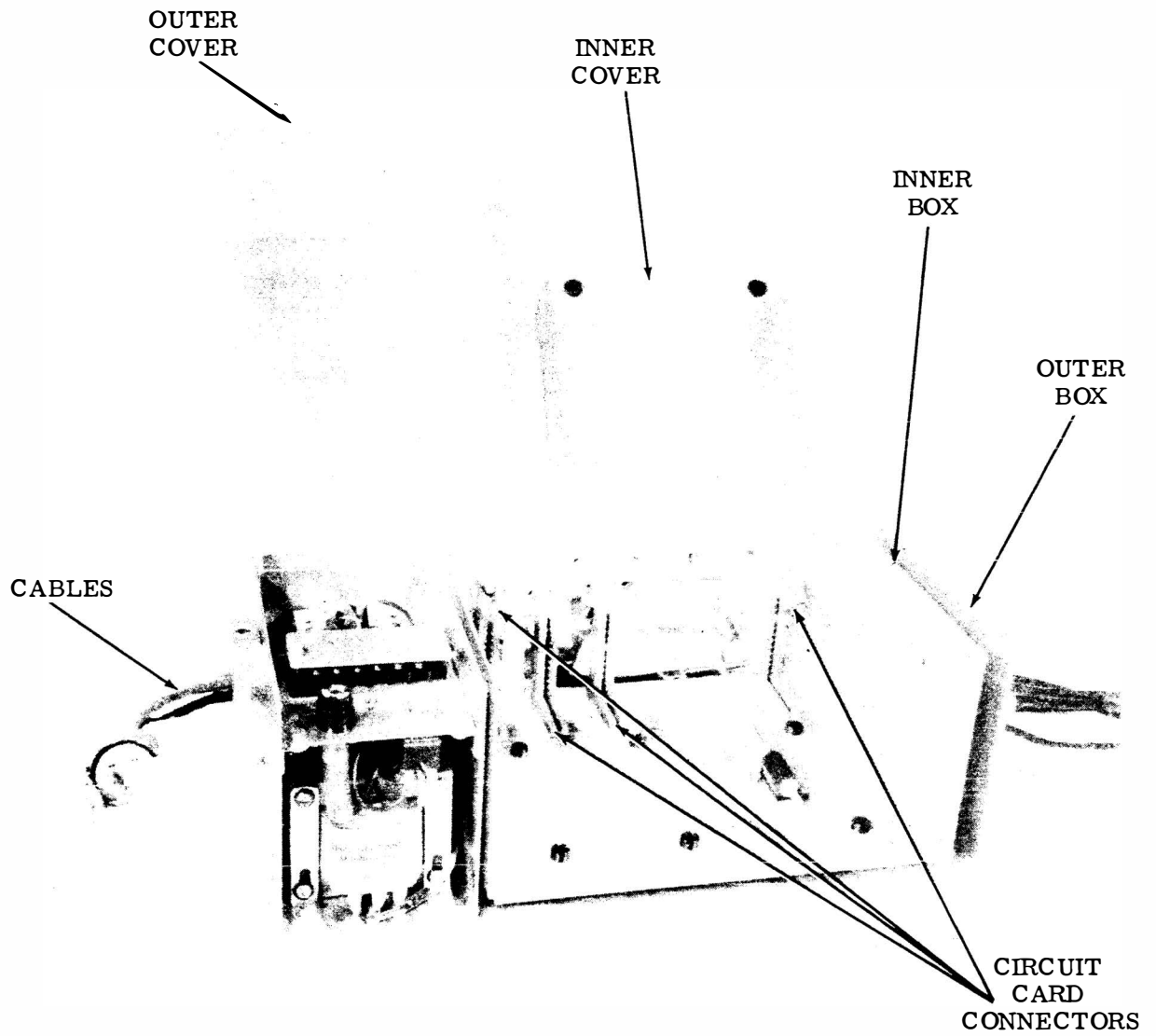


Figure 6 - ESA Showing Circuit Card Connectors

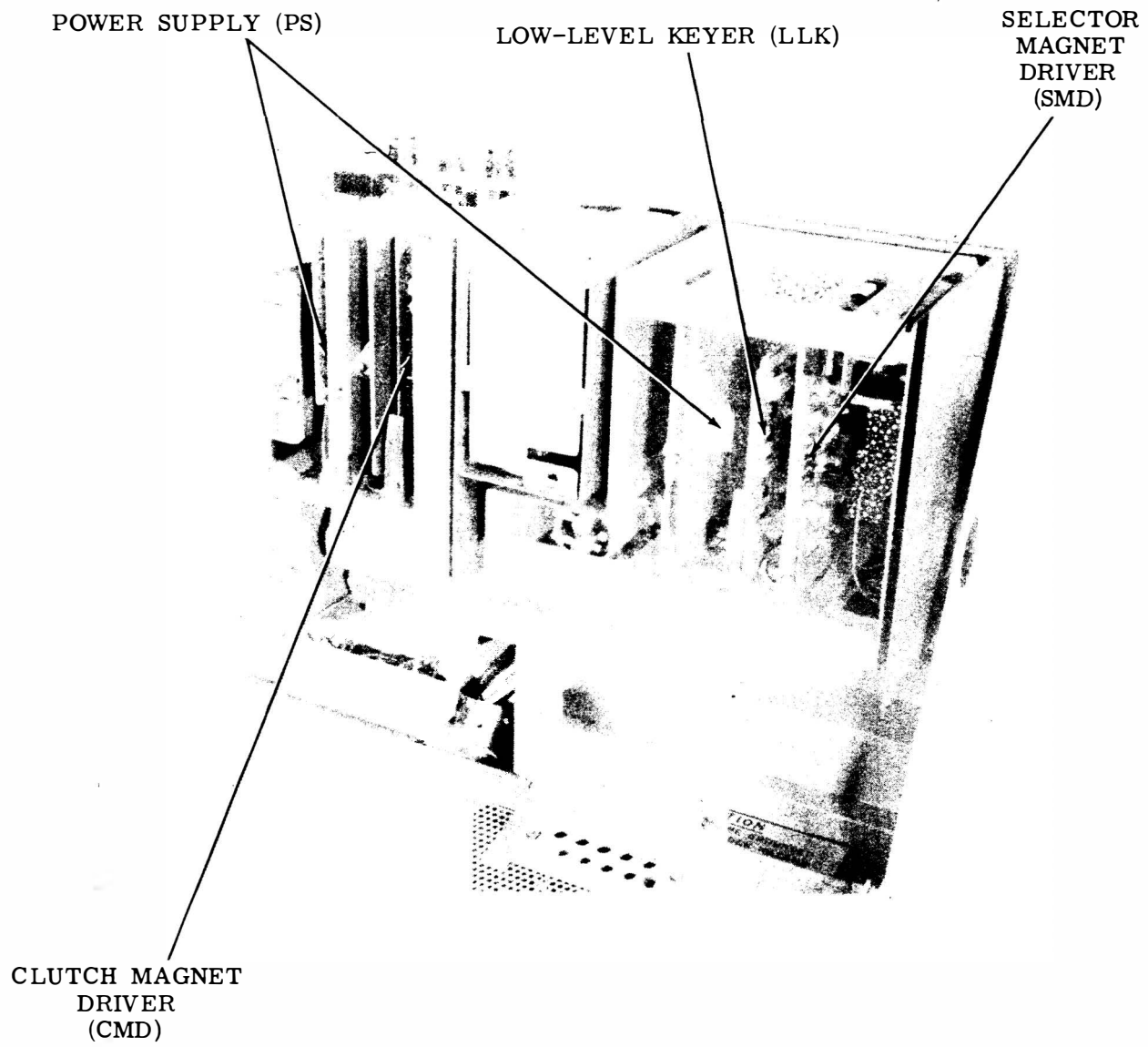


Figure 7 - ESA Showing Typical Circuit Cards

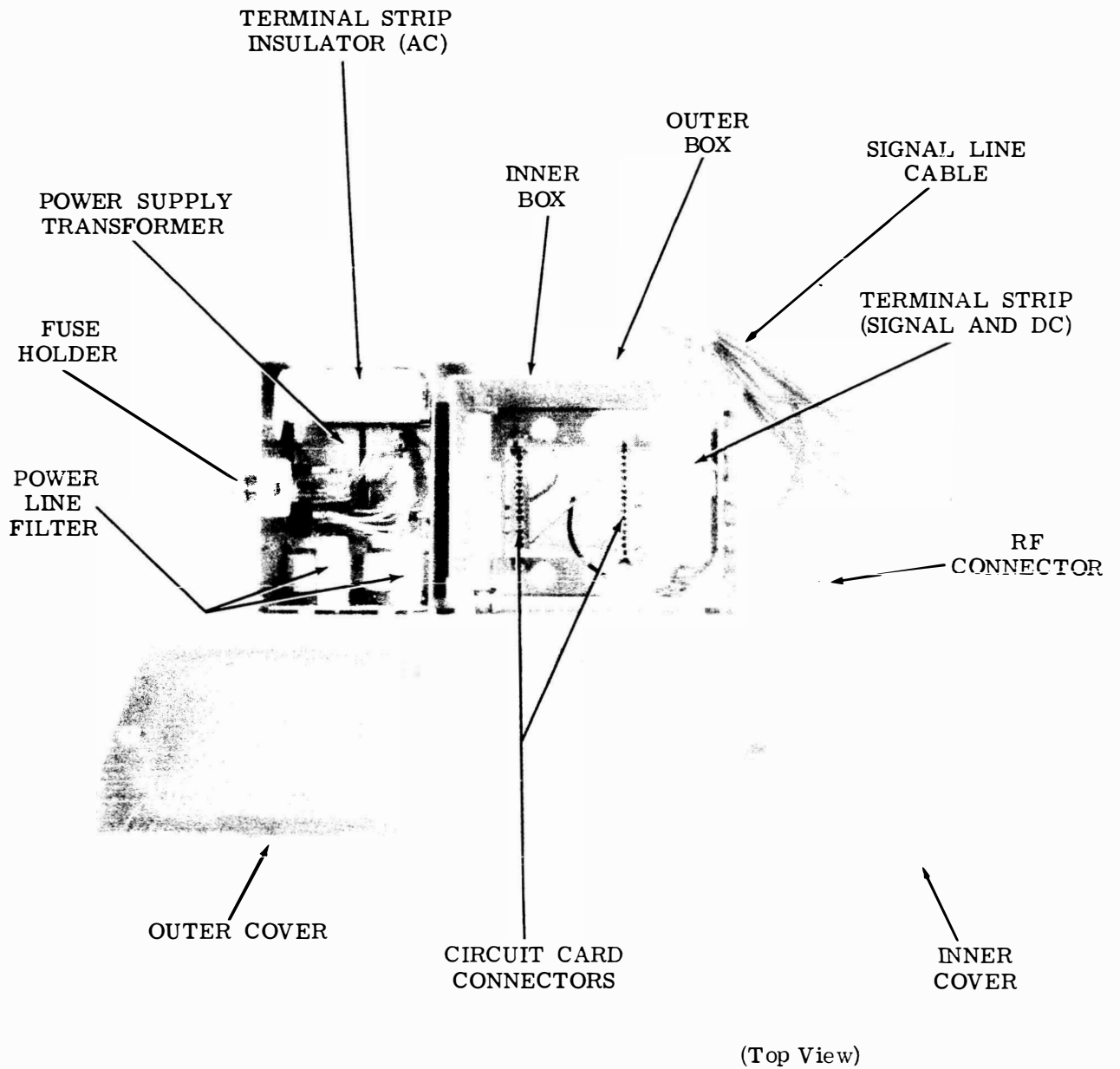
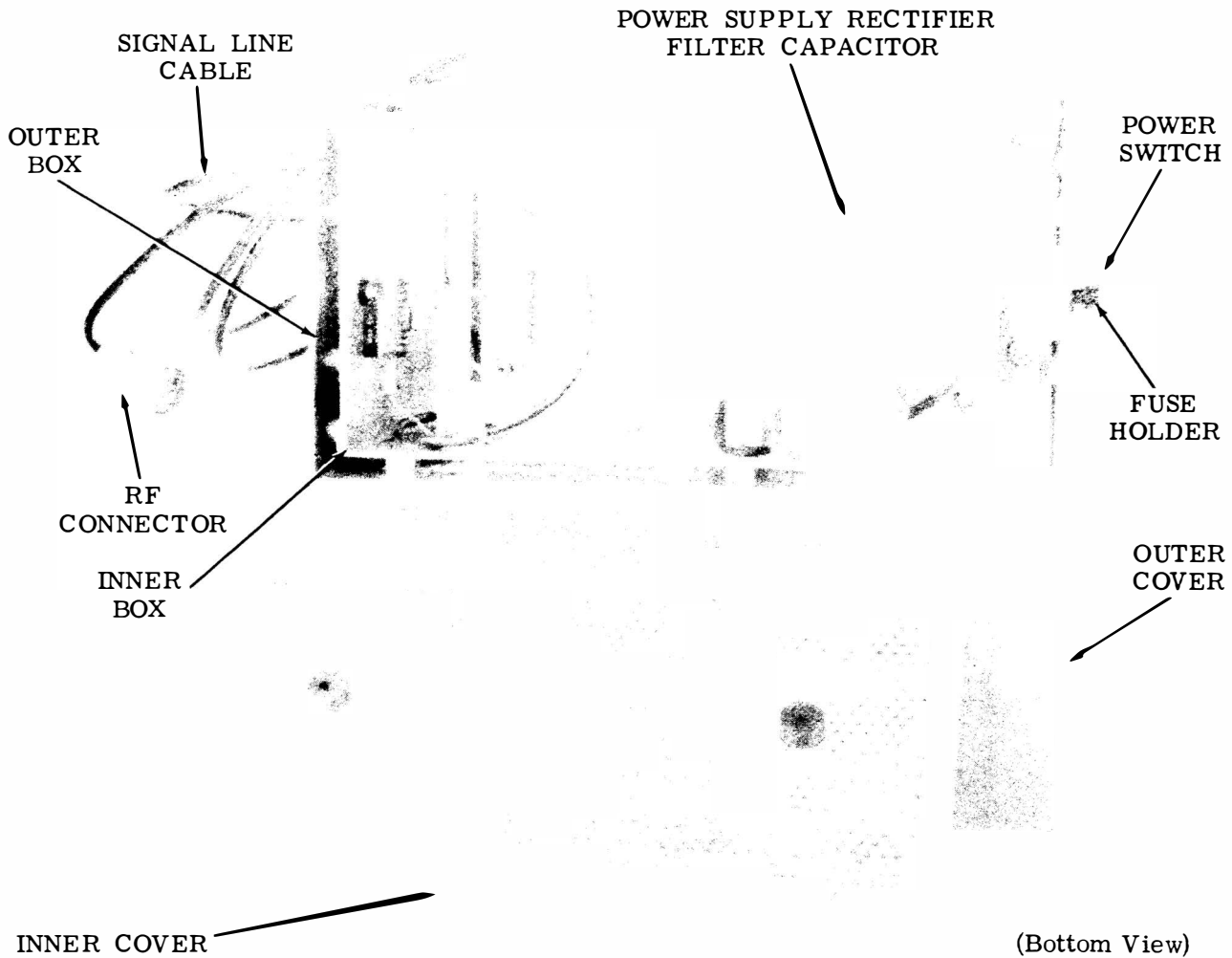


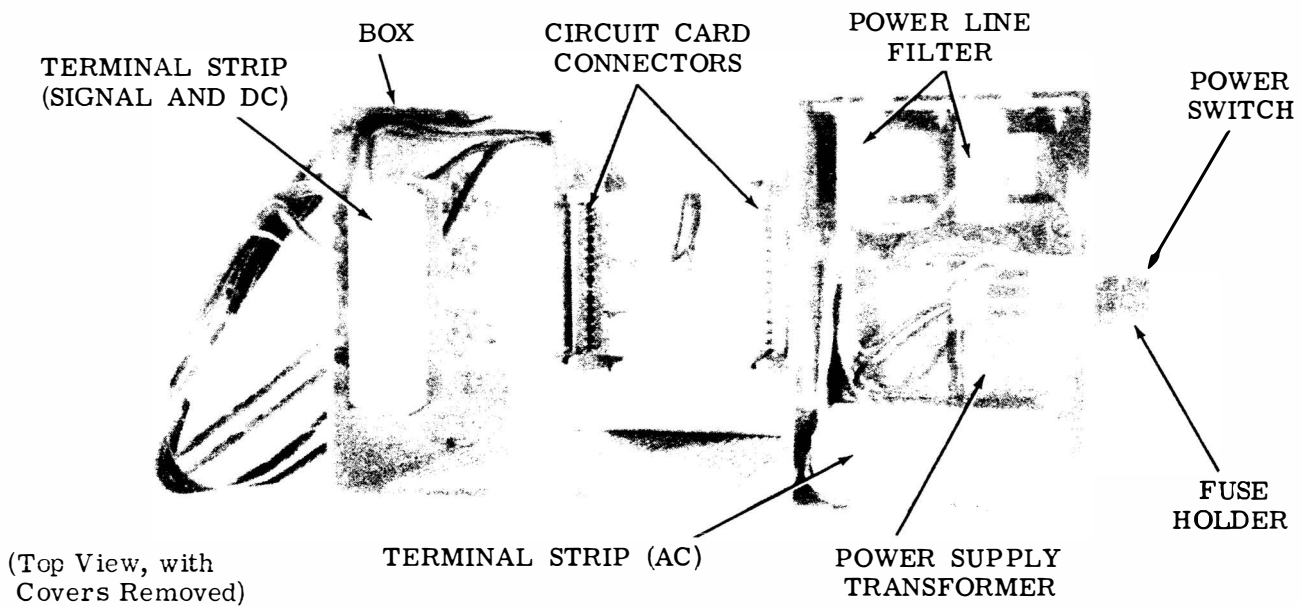
Figure 8 - Typical Parts of an ESA - Double Box Construction



INNER COVER

(Bottom View)

Figure 9 - Typical Parts of an ESA — Double Box Construction



(Top View, with Covers Removed)

Figure 10 - Typical Parts of an ESA — Single Box Construction

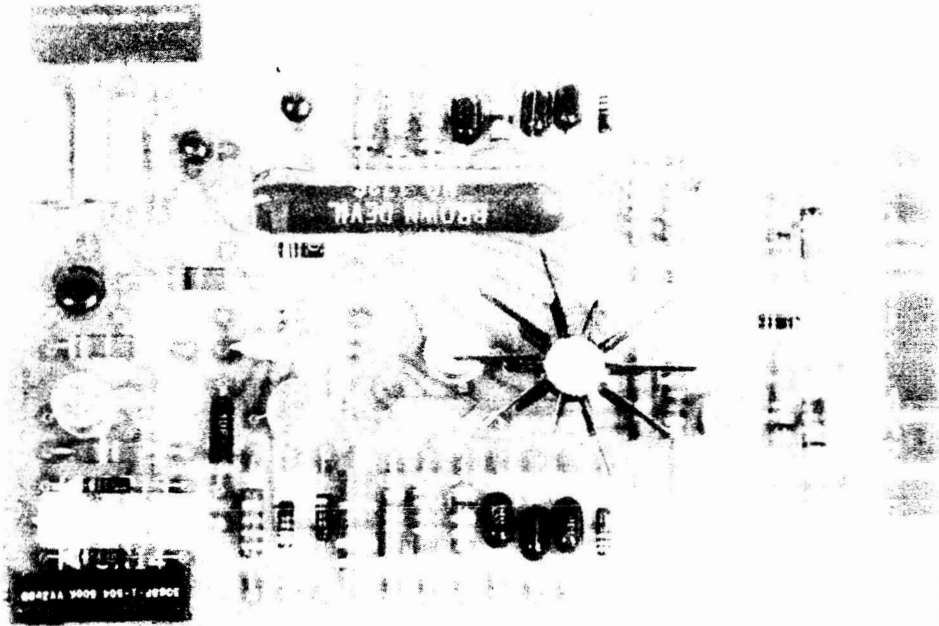


Figure 11 - Selector Magnet Driver (SMD) TP323810

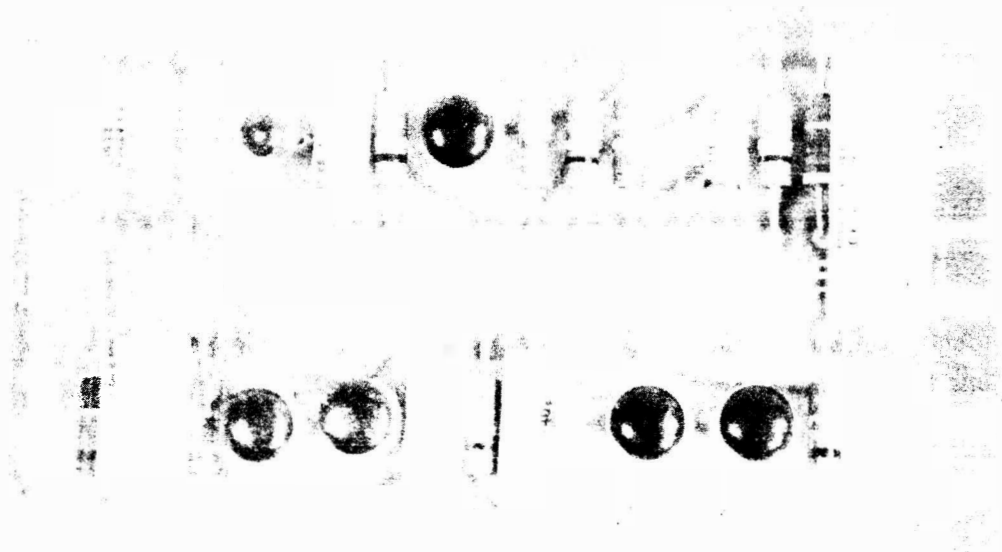


Figure 12 - Low-Level Keyer TP303142

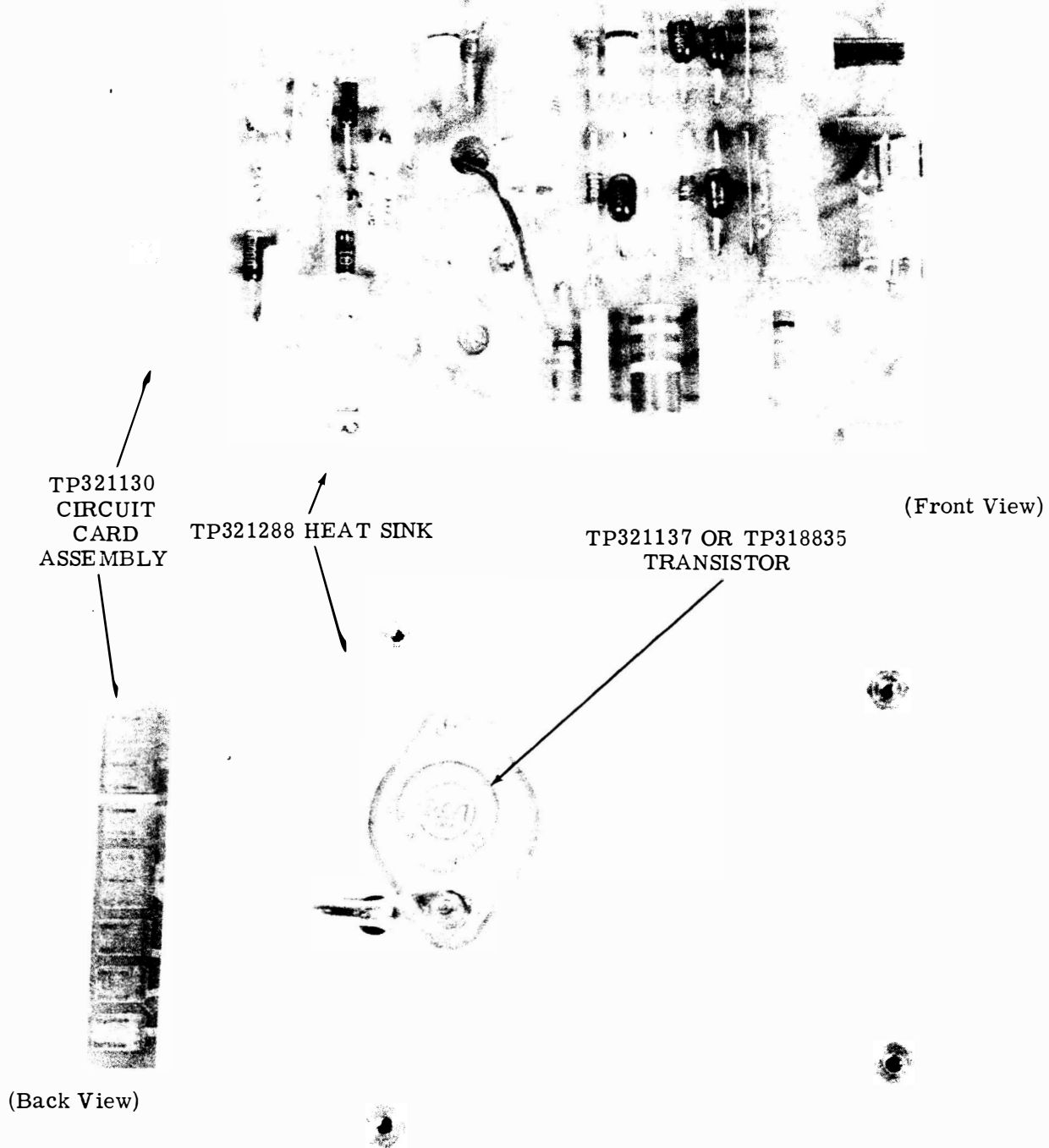


Figure 13 - One-Half Ampere Power Supply (TP321290)

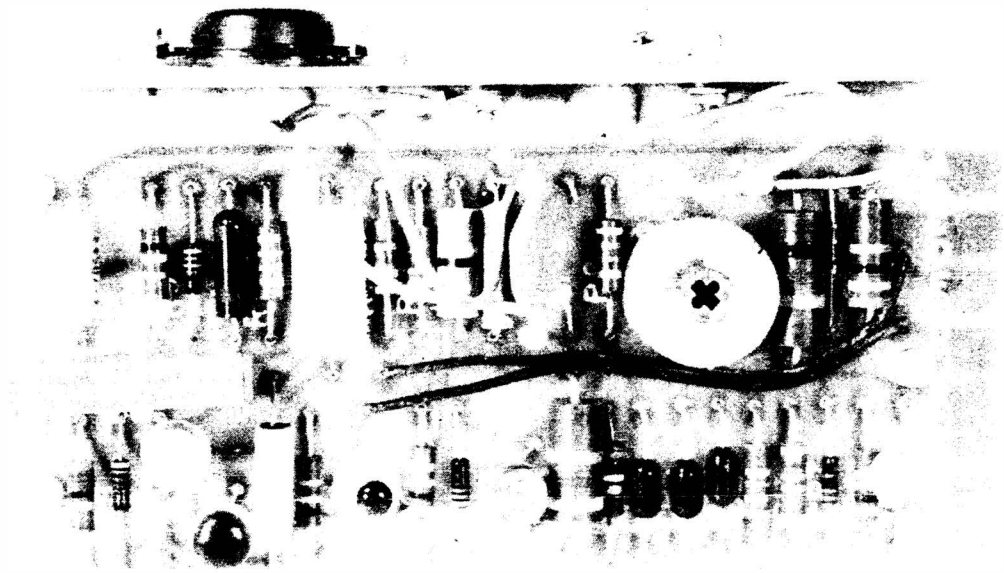


Figure 14 - Clutch Magnet Driver (CMD) TP321991 for Low-Level Operation

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
FOR 28 ELECTRICAL SERVICE ASSEMBLIES AND ASSOCIATED COMPONENTS
TROUBLESHOOTING

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1. GENERAL

1.01 This section presents an outline for checking some of the difficulties that may be encountered in the operation of the electrical service assembly (ESA) and its associated components. It also outlines a suggested procedure for field repair where adequate facilities are not available.

1.02 Since the ESA encloses and is dependent on other component circuits for its operation, the field troubleshooting and repair for these components are also included in this section. Reference should be made to wiring diagram section for each set and/or the wiring diagram package for circuit tracing and identification of components.

2. TROUBLESHOOTING

ELECTRICAL SERVICE ASSEMBLY

2.01 Troubleshooting for an ESA is required only to repair the power supply or correct wiring in case of loose, broken, or faulty wiring. Wiring can be checked by following the different circuits on the appropriate wiring diagram, point-to-point, and comparing with the actual equipment wiring.

2.02 Before attempting to repair a power supply fault, one should familiarize himself with the power supply card and ESA wiring. Refer to the circuit description in Section 573-613-100TC and the wiring diagrams in section for each set or the wiring diagram package listed in the chart of Section 573-600-100TC.

2.03 If trouble should develop, it may be found by performing the test outlined in the troubleshooting charts of Figures 1 and 2 with a multimeter.

2.04 Colored test point jacks are provided on top of the power supply circuit card to accept standard meter probes.

2.05 When a fault in the power supply is suspected but not obvious, disconnect all power from the ESA. Remove all keyer (LLK), selector magnet driver (SMD), and clutch magnet driver (CMD) circuit cards. Apply 100 to

SECTION 573-613-300TC

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
1	Check voltage from -7 test jack.	COM -7	Meter reading should be: Min -6.6 volts Max -7.8 volts If normal, proceed to Step 2.	<u>RESPONSE</u> : Meter reading of zero volt. <u>DIFFICULTY</u> : CR5 shorted or R5 open. <u>PROCEDURE</u> : Remove power supply card and repair or replace. Recheck Step 1. <u>RESPONSE</u> : Meter reading of +57 volts to +90 volts. <u>DIFFICULTY</u> : CR5 open. <u>PROCEDURE</u> : Remove power supply card and repair or replace. Recheck Step 1.
2	Check voltage from +7 test jack.	COM +7	Meter reading should be: Min +6.6 volts Max +7.8 volts If normal, proceed to Step 3.	<u>RESPONSE</u> : Meter reading of zero volt. <u>DIFFICULTY</u> : CR6 shorted or R4 open. <u>PROCEDURE</u> : Remove power supply card and repair or replace. Recheck Step 1. <u>RESPONSE</u> : Meter reading of +57 volts to +90 volts. <u>DIFFICULTY</u> : CR6 open. <u>PROCEDURE</u> : Remove power supply card and repair or replace. Recheck Step 1.
3	Check voltage from UNREG. test jack.	COM UNREG.	Meter reading should be: Min +57 volts Max +90 volts If normal, proceed to Step 4.	<u>RESPONSE</u> : Meter reading of zero volt. <u>DIFFICULTY</u> : Loose or blown fuse. <u>PROCEDURE</u> : Remove power supply card and secure or replace fuse. Proceed to Step 5. <u>RESPONSE</u> : Meter reading indicates voltage which is too low. <u>DIFFICULTY</u> : CR1 and/or CR4 open or shorted. C8 defective. T1 and power line filter defective. <u>PROCEDURE</u> : Remove power supply card or defective parts and repair or replace. Recheck Step 1.

Figure 1 - Power Supply Troubleshooting Procedure (0.5 Ampere Card)

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
4	Check voltage from +50 test jack.	COM +50	<p>Meter reading should be: Min +47 volts Max +53 volts</p> <p>If normal, end test.</p>	<p><u>RESPONSE:</u> Meter reading of zero volt.</p> <p><u>DIFFICULTY:</u> Q1 and/or Q2 open.</p> <p><u>PROCEDURE:</u> Remove power supply card and repair or replace. Recheck Step 1.</p> <p><u>RESPONSE:</u> Meter reading of more than zero volt but less than +47 volts.</p> <p><u>DIFFICULTY:</u> Too many shorting straps across CR8, CR9, CR10, and CR11.</p> <p><u>PROCEDURE:</u> Remove power supply card and remove straps, as necessary, to increase voltage. Replace card. Recheck Step 1.</p> <p><u>RESPONSE:</u> Meter reading of +57 volts to +90 volts.</p> <p><u>DIFFICULTY:</u> Q1 and/or Q2 shorted.</p> <p><u>PROCEDURE:</u> Remove power supply card and repair or replace. Recheck Step 1.</p>
5	Check voltage from UNREG. test jack.	COM UNREG.	<p>Meter reading should be: Min +57 volts Max +90 volts</p> <p>Return to Step 4.</p>	<p><u>RESPONSE:</u> Meter reading of zero volt.</p> <p><u>DIFFICULTY:</u> Repeated fuse blowing.</p> <p><u>PROCEDURE:</u> Disconnect power and remove power supply card. Make continuity checks between card terminals B and N, N and H, B and H. A zero or near zero reading on the 1-ohm scale of a multimeter indicates a short. Check continuity between Q1 case and its heat sink (Q1 must be electrically isolated from heat sink with mica insulators). If the power supply card checks satisfactorily, check power line filter, T1, and C8 for shorted condition. Repair or replace card. Recheck Step 1.</p> <p><u>RESPONSE:</u> Meter reading indicates voltage which is too low.</p> <p><u>DIFFICULTY:</u> CR1 and/or CR4 open or shorted. C8 defective. T1 and power line filter defective.</p> <p><u>PROCEDURE:</u> Remove power supply card or defective parts and repair or replace. Recheck Step 1.</p>

Figure 1 - Power Supply Troubleshooting Procedure (0.5 Ampere Card) (Continued)

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Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
1	Check voltage from UNREG. test jack.	COM UNREG.	<p>Meter reading should be: Min + 57 volts Max + 90 volts</p> <p>If normal, proceed to Step 2.</p>	<p><u>RESPONSE</u>: Meter reading of zero volt.</p> <p><u>DIFFICULTY</u>: Loose or blown fuse.</p> <p><u>PROCEDURE</u>: Remove power supply card and secure or replace fuse.</p> <p>Proceed to Step 3.</p> <p><u>RESPONSE</u>: Meter reading indicates voltage which is too low.</p> <p><u>DIFFICULTY</u>: CR1 and/or CR2 open or shorted. C5 defective. T1 and power line filter defective.</p> <p><u>PROCEDURE</u>: Remove power supply card or defective parts and repair or replace.</p> <p>Recheck Step 1.</p>
2	Check voltage from + 50 test jack.	COM +50	<p>Meter reading should be: Min + 47 volts Max + 53 volts</p> <p>If normal, end test.</p>	<p><u>RESPONSE</u>: Meter reading of zero volt.</p> <p><u>DIFFICULTY</u>: Q1 and/or Q2 open.</p> <p><u>PROCEDURE</u>: Remove power supply card and repair or replace.</p> <p>Recheck Step 1.</p> <p><u>RESPONSE</u>: Meter reading of more zero volt but less than +47 volts.</p> <p><u>DIFFICULTY</u>: Too many shorting straps across CR4, CR5, CR6, and CR7.</p> <p><u>PROCEDURE</u>: Remove power supply card and remove straps, as necessary, to increase voltage. Replace card.</p> <p>Recheck Step 1.</p> <p><u>RESPONSE</u>: Meter reading of +57 to +90 volts.</p> <p><u>DIFFICULTY</u>: Q1 and/or Q2 shorted.</p> <p><u>PROCEDURE</u>: Remove power supply card and repair or replace.</p> <p>Recheck Step 1.</p>

Figure 2 - Power Supply Troubleshooting Procedure (1.0 Ampere Card)

Step	Action	Probe Position	Normal Response	Abnormal Response and Procedure
3	Check voltage from UNREG. test jack.	COM UNREG.	Meter reading should be: Min +57 volts Max +90 volts Return to Step 2.	<p><u>RESPONSE</u>: Meter reading of zero volt.</p> <p><u>DIFFICULTY</u>: Repeated fuse blowing.</p> <p><u>PROCEDURE</u>: Disconnect power and remove power supply card. Make continuity checks between card terminals D and S, S and K, D and K. A zero or near zero reading on the 1-ohm scale of a multimeter indicates a short. Check continuity between Q2 case and its heat sink (Q2 must be electrically isolated from heat sink with mica insulators). If the power supply card checks satisfactorily, check power line filter, T1 and C5 for shorted condition. Repair or replace card.</p> <p>Recheck Step 1.</p> <p><u>RESPONSE</u>: Meter reading indicates voltage which is too low.</p> <p><u>DIFFICULTY</u>: CR1 and/or CR2 open or shorted. C5 defective. T1 and power line filter defective.</p> <p><u>PROCEDURE</u>: Remove power supply card or defective parts and repair or replace.</p> <p>Recheck Step 1.</p>

Figure 2 - Power Supply Troubleshooting Procedure (1.0 Ampere Card) (Continued)

130 volt ac power to the ESA and proceed with the troubleshooting procedure as outlined in Figures 1 and 2.

CAUTION: BE EXTREMELY CAREFUL WITH CAPACITORS; THEY MAY BE CHARGED. A SEVERE ELECTRICAL SHOCK MAY BE RECEIVED FROM A CAPACITOR OR LEADS CONNECTED TO THE POWER SUPPLY WHILE IT IS IN OPERATION.

2.06 In following the procedure outlined in the troubleshooting chart, perform Step 1. If a normal response is received, proceed to Step 2. If an abnormal response is received, repair or replace card. After this procedure, return to Step 1. Next, perform Step 2 and so on in the same manner.

2.07 If this troubleshooting fails to reveal the difficulty, check for loose or cold solder connection or a broken or misplaced wire in the ESA. Recheck all wiring as indicated in 1.02.

2.08 Fuse blowing - Continually blowing fuses indicate a shorted component or components. Disconnect power, remove the circuit card assembly and make continuity checks between circuit card connector terminals B and N, N and H, and B and H. A zero or near zero reading on the one ohm scale of a multimeter indicates a short; disregard any other reading. Also, check continuity between the power transistor case and its heat sink; the power transistor must be electrically isolated from the heat sink with mica insulators. If the board assembly checks satisfactorily, examine the power line filter, power transformer, and rectifier

SECTION 573-613-300TC

filter capacitor for a shorted condition. (These components are located within the electrical service assembly.)

2.09 Failure to detect the fault using the methods described above normally indicates a loose or cold solder connection, broken or misplaced wire in the service assembly. Check all wiring according to appropriate wiring diagrams.

SELECTOR MAGNET DRIVER

Note: The TP323810 selector magnet driver (SMD) is a circuit card assembly that needs only to be plugged into a properly keyed (polarizing key between pins E and F) 15-pin receptacle which is wired into the electrical service assembly (ESA).

2.10 It is recommended that any damaged TP323810 selector magnet driver (SMD) unit be replaced in the field and maintained in a repair center. The repair center should have equipment capable of simulating normal operating condition.

2.11 It is also recommended that the SMD be radio frequency interference (rfi) suppression tested after servicing and prior to final installation. Failures from this standpoint are not necessarily recognized by monitoring a typical communications operation.

A. Troubleshooting

2.12 The following information may be used as a guide for troubleshooting:

<u>Symptom</u>	<u>Probable Cause</u>
(a) Switching levels out of tolerance	(1) Improper adjustment of R3 and/or R15 (2) Q1 and/or Q5 low gain (3) CR5 defective or out of tolerance
(b) Circuit always marking	(1) Q8 open (2) Q1, Q5, Q6, Q7, or Q9 collector-emitter shorted

<u>Symptom</u>	<u>Probable Cause</u>
(c) Circuit always spacing	(1) Q1, Q5, Q6, Q7, or Q9 collector-emitter open (2) Q8 collector-emitter shorted (3) CR13 open
(d) Output current too high	R23 out of tolerance
(e) Output current too low	R23 out of tolerance
(f) Transient suppressor network ineffective	(1) CR14 open (2) R24 open (3) C6 open
(g) Loss of receiving margin	(1) Q8, Q9 improper gain (2) C4, C5, or C6 out of tolerance or defective (3) CR14 shorted

B. Adjustments

Note: No mechanical adjustments are required on the TP323810 selector magnet driver. If necessary, the driver may be electrically adjusted as follows.

- 2.13 Terminate the output of the driver with a 28 selector wired for 60 ma operation (pins A or B and H, J, K, L, or M).
- (a) Apply +47 to +53 v dc to the driver (pins C or D to H, J, K, L, or M).
 - (b) With input 2 (pins E, F) open circuited, short input 1 to common (pins N, P to H, J, K, L, or M).
 - (c) Adjust R3 until the selector magnet changes state. Note the position of the potentiometer.
 - (d) Rotate R3 until the selector returns to its initial state.
 - (e) Set the potentiometer midway between the two positions obtained in (c) and (d).

(f) Secure the adjustment by applying an appropriate cement to the potentiometer adjustment screw.

2.14 Repeat 2.13 (a) through (f), this time adjusting R15 with input 1 (pins N, P) open circuited and input 2 shorted to common (pins E, F to H, J, K, L, or M).

LOW-LEVEL KEYER (TP303142 AND TP323130)

2.15 The keyer is a circuit card assembly that needs only to be plugged into a properly keyed 15-pin receptacle which is wired into an appropriate ESA.

2.16 It is recommended that any damaged keyer card be replaced in the field and maintained in a repair center. The repair center should have equipment capable of simulating normal operating conditions.

2.17 It is also recommended that the keyer and associated filter cards (if any) be radio frequency interference (rfi) suppression tested after servicing and prior to final installation. Failures from this standpoint are not necessarily recognized by monitoring a typical communications operation.

A. Troubleshooting for the TP303142 Keyer

2.18 The following information may be used as a guide for troubleshooting:

<u>Symptom</u>	<u>Probable Cause</u>
(a) Circuit always marking	(1) Q1 and/or Q2 shorted (2) Excessive signal generator contact resistance
(b) Circuit always spacing	Q1 and/or Q2 open
(c) Mark - space bits detectable but will not go positive on mark	Q4 and/or Q6 open
(d) Mark - space bits detectable but will not go negative on space	Q3 and/or Q5 open

B. Adjustments for the TP303142 Keyer

Note: No mechanical or electrical adjustments are required on the TP303142 low-level keyer or its associated TP321268 filter card. The adjustments given in this part apply to the contact box or signal generator and are for reference only.

2.19 This adjustment is to be made with the contact box installed in the appropriate transmitter or keyboard and may be used in place of the adjustment in 2.21.

(a) Remove the TP325951 nut, TP320043 outer cover, TP325951 nut, TP321273 inner cover, and, without unsoldering the leads to the filter card, remove the TP321268 filter card assembly.

(b) With the contact box bracket mounting screw loosened friction tight, position the box by means of the eccentric, so that the marking and spacing gaps are equal when there is a maximum clearance between the contacts, as determined by engaging the clutch and rotating the main shaft. Tighten the mounting screws and recheck the adjustment.

(c) After completing the adjustment, replace all parts removed in 2.19 (a).

2.20 The following electromechanical adjustment pertains to the signal generator after installation of the TP303142 polar line keyer and associated signal generator assembly. It may be used in place of the adjustment in 2.19 with the signal generator and low-level keyer in place.

2.21 Alternate adjustment procedure:

(a) Using an oscilloscope to view the output of the polar line keyer (transmitter sending repeated Y character), adjust the oscilloscope to trigger at zero volt on the keyer output waveform. Be sure to properly zero the vertical amplifier on the scope before beginning the adjustment.

(b) Adjust the scope sweep rate so as to display one complete mark-space portion of the signal.

(c) Adjust the position of the signal generator until the mark to space transition crosses zero volt at the center of the horizontal

scale. When the signal generator is properly adjusted, the three points at which the waveform passes through zero volt will divide the horizontal axis into two equal segments.

(d) After the adjustment is made, tighten the signal generator bracket screws securely.

C. Troubleshooting for the TP323130 Keyer

2.22 The following information is a guide for troubleshooting:

<u>Symptom</u>	<u>Probable Cause</u>
(a) Circuit always marking	Photocell in keyboard or distributor shorted
(b) Circuit always spacing	Photocell in keyboard or distributor open circuited
(c) Mark - space bits detectable but will not go positive on mark	Q3 open and/or Q2 shorted
(d) Mark - space bits detectable but will not go negative on space	Q4 open and/or Q1 shorted

D. Adjustments for the TP323130 Keyer

2.23 Using an oscilloscope to view the output of the polar line keyer (transmitter sending repeated Y character), adjust the oscilloscope to trigger at zero volt on the keyer output waveform. Be sure to properly zero the vertical amplifier on the scope before beginning the adjustment.

(a) Adjust the scope sweep rate so as to display one complete mark-space portion of the signal.

(b) Adjust the 5 megohm trimpot of the keyer until the mark to space transition crosses zero volt at the center of the horizontal scale. When the keyer is properly adjusted, the three points at which the waveform passes through zero volt will divide the horizontal axis into two segments that are within 10 percent of each other. The output voltage peaks will also be within 10 percent of each other.

(c) After the adjustment is made, the adjusting screw may be sealed. This completes the adjustment.

CLUTCH MAGNET DRIVER (TP321991)

Note: The clutch magnet driver (CMD) is a circuit card assembly that needs only to be plugged into a properly keyed 15-pin receptacle which is wired into an appropriate electrical service assembly (ESA).

2.24 It is recommended that any damaged clutch magnet driver (CMD) unit be replaced in the field and maintained in a repair center. The repair center should have equipment capable of simulating normal operating conditions.

2.25 It is also recommended that the CMD be radio frequency interference (rfi) suppression tested after repair and prior to final installation. Failures from this standpoint are not necessarily recognized by monitoring a typical communications operation.

A. Troubleshooting

2.26 The following information may be used as a guide for troubleshooting the TP312991 clutch magnet driver:

<u>Symptom</u>	<u>Probable Cause</u>
(a) Switching levels out of tolerance	(1) Improper adjustment of R7
	(2) Q1 low gain
	(3) CR7 defective or out of tolerance
(b) Circuit always marking	(1) Q3 open
	(2) Q1, Q2, or Q4 collector-emitter shorted
(c) Circuit always spacing	(1) Q1, Q2, or Q4 open
	(2) Q3 collector-emitter shorted
	(3) CR8 open
(d) Output current too high	(1) CR2 open
	(2) R17 out of tolerance

<u>Symptom</u>	<u>Probable Cause</u>
(e) Output current too low	(1) R2 improperly adjusted or defective
	(2) R17 out of tolerance
(f) Transient suppressor network ineffective	(1) CR9 open
	(2) R16 open
	(3) C4 open

B. Adjustments

Note: No mechanical adjustments are required on the TP321991 clutch magnet driver. If necessary, the driver may be electrically adjusted as outlined below.

2.27 The following instruments are required for making TP321991 clutch magnet driver (CMD) electrical adjustments (refer to schematic wiring diagram for location of circuit elements):

- (a) Milliammeter (to measure 15 ma) with accuracy of ± 10 percent.
- (b) Plus 6 volts ± 20 percent dc source (required power less than 6 milliwatts).
- (c) Transmitter distributor with series connected 256M clutch coils.

2.28 Terminate the output of the driver with a transmitter distributor clutch assembly utilizing two 256M coils in series (pins A or B and K, L, or M).

2.29 Place a milliammeter in series (connect positive terminal of meter to test point T4) with the zener regulator diode CR2 (mounted on the heat sink).

2.30 With normal power applied to the circuit (+47 to +53 v dc and -6 v dc), and a +6 volt input to pin N or P, adjust R2 for 15 ma of zener current. Secure the wiper of R2, by applying an appropriate cement, to prevent accidental rotation. Remove the +6 volt input.

2.31 Short the input to common (pins N or P to K, L, or M) and adjust R7 until the clutch magnet changes state. Note the position of the potentiometer.

2.32 Rotate R7 back until the clutch magnet returns to its initial state.

2.33 Set the potentiometer midway between the two positions obtained in 2.31 and 2.32.

2.34 Secure the adjustment by applying an appropriate cement to the potentiometer adjustment screw.

2.35 Remove power and solder the zener diode lead to the cathode pin nearest the component side of the card.

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION FEATURES
FOR LOW LEVEL SETS
28 TYPING UNIT

PARTS

FIGURE	CONTENTS	PAGE
1	319204 Selector Assembly	2
2	319204 Selector Assembly (Continued)	3
3	319200 Selector Mounting Parts	4
	Numerical Index	5

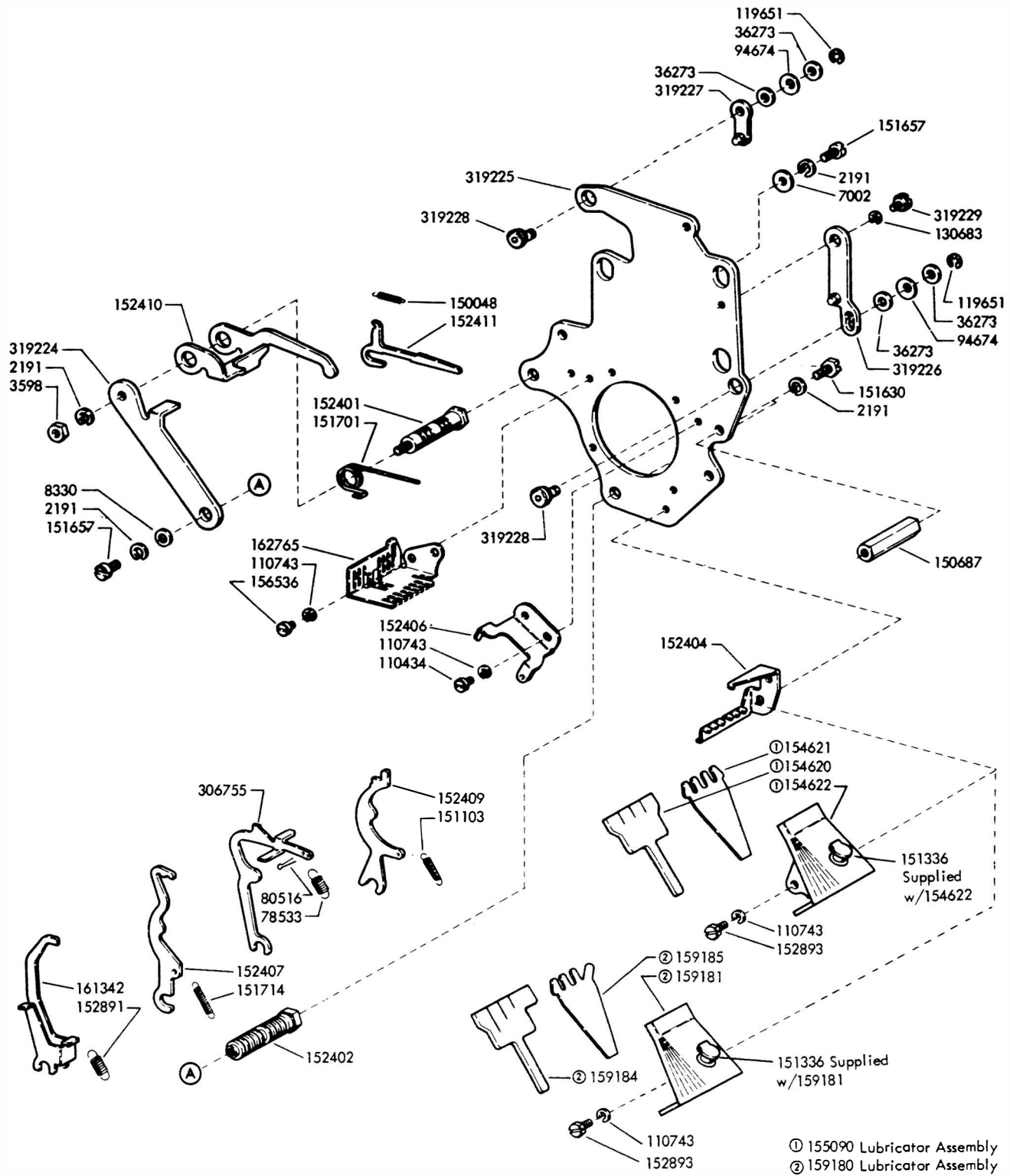
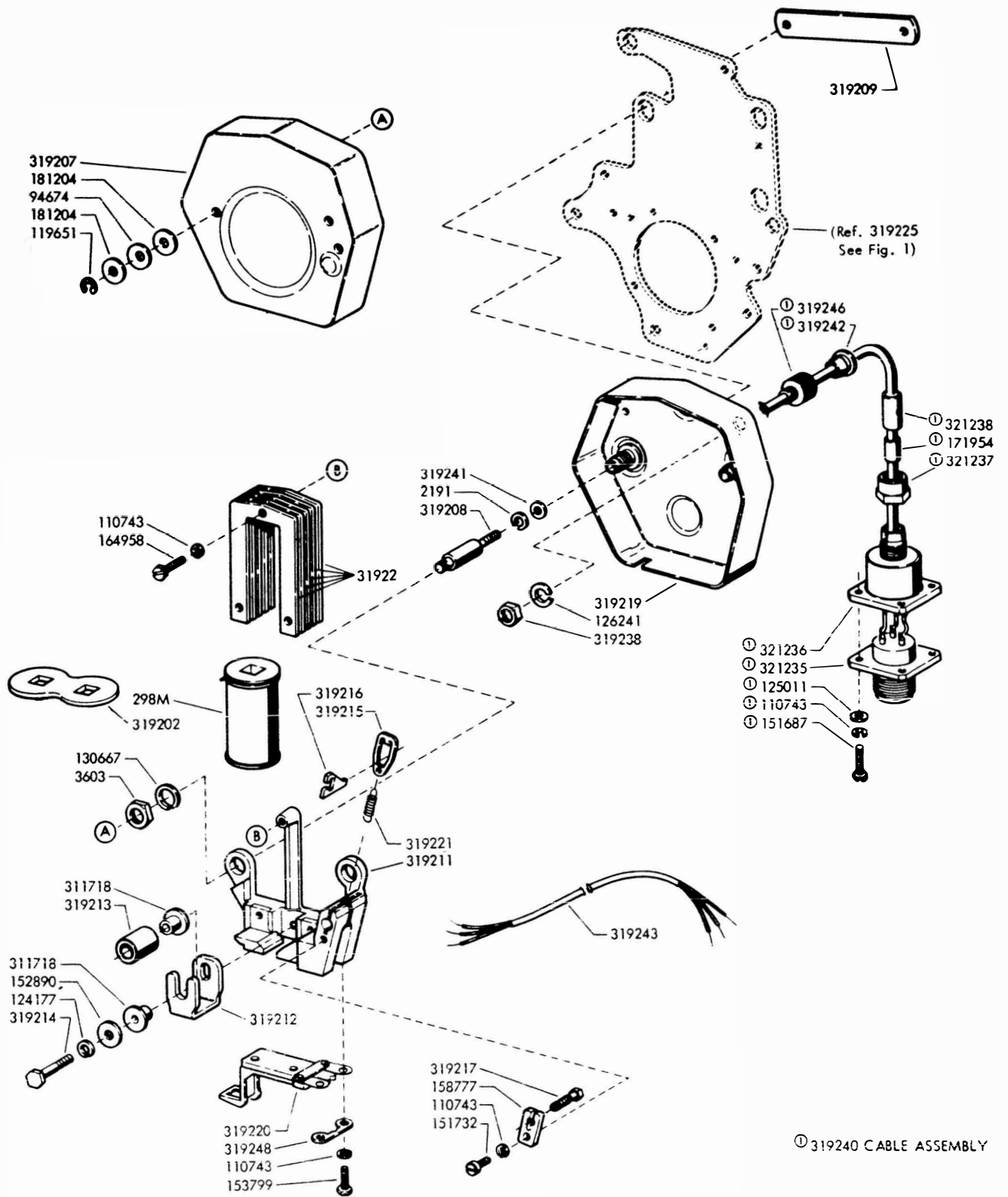


FIGURE 1. 319204 SELECTOR ASSEMBLY



① 319240 CABLE ASSEMBLY

FIGURE 2. 319204 SELECTOR ASSEMBLY (Continued)

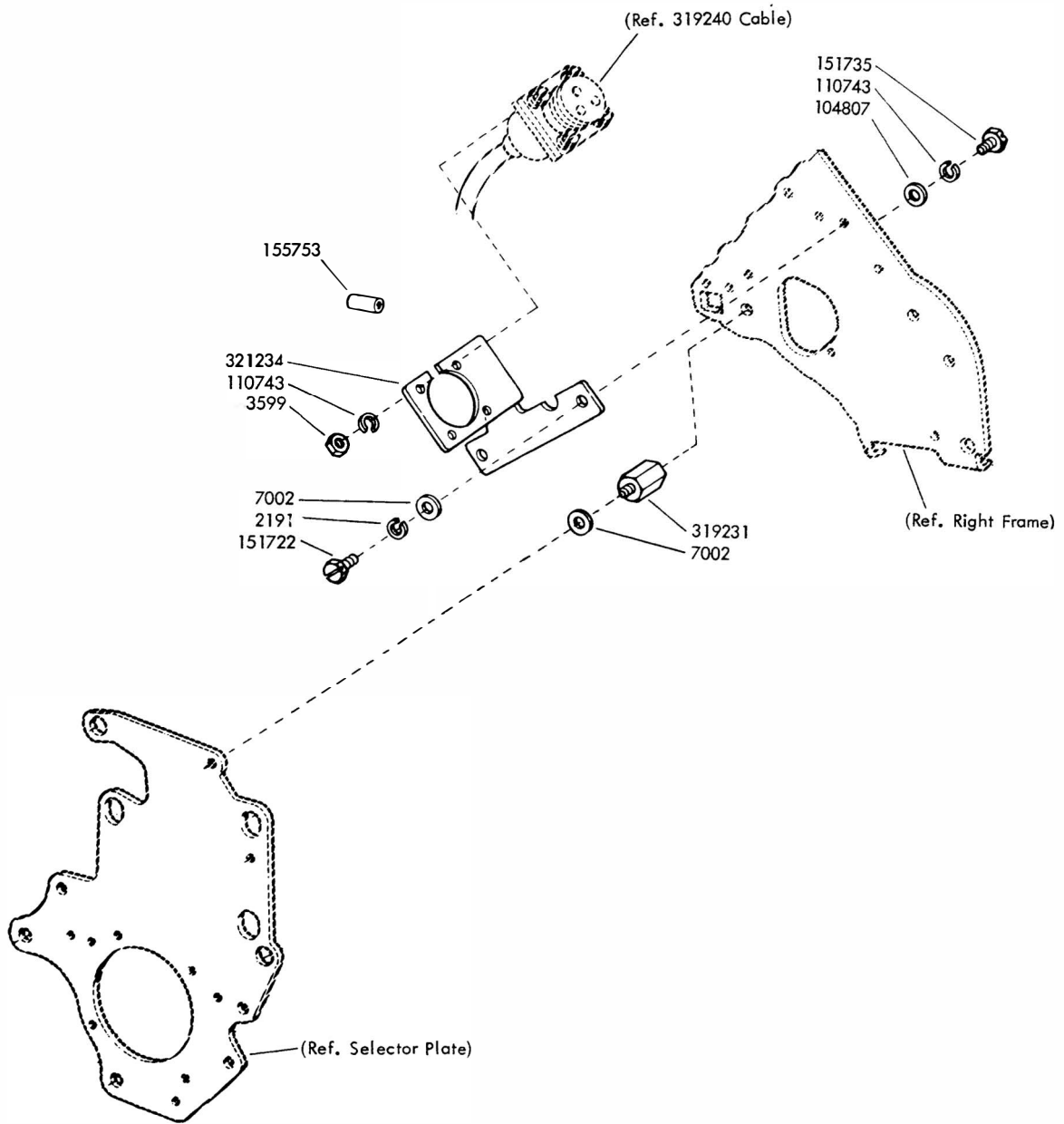


Figure 3. 31920 SELECTOR MOUNTING PARTS

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
298M	Coil, Magnet 3	152404	Bracket, Spring 2	319208	Post 3
2191	Washer, Lock 2,3,4	152406	Bracket, Spring 2	319209	Plate, Nut 3
3598	Nut, 6-40 Hex 2	152407	Lever, Spacing Lock 2	319211	Bracket, Coil Mounting 3
3599	Nut, 4-40 Hex 4	152409	Lever, Selecting 2	319212	Bracket w/Button 3
3603	Nut, 1/4-32 Hex 3	152410	Bail, Reset 2	319213	Bushing 3
7002	Washer, Flat 2,4	152411	Lever, Push 2	319214	Screw, 6-40 Spl 3
8330	Washer, Flat 2	152890	Washer, Flat 3	319215	Anchor, Spring 3
36273	Washer, Flat 2	152891	Spring 2	319216	Wedge 3
78533	Spring 2	152893	Screw, 4-40 x 1/4 Hex 2	319217	Screw, Adjusting 3
80516	Pin, Cotter 2	153799	Screw, 4-40 x 21/64 Hex 3	319219	Base w/Bushing 3
94674	Washer, Cup 2,3	154620	Wick, Leather 2	319220	Armature 3
104807	Washer, Flat 4	154621	Retainer, Wick 2	319221	Spring 3
110434	Screw, 4-40 x 3/16 Fil 2	154622	Lubricator 2	319223	Lamination, Magnet 3
110743	Washer, Lock 2,3,4	155090	Lubricator Assembly 2	319224	Plate, Tie 2
119651	Ring, Retaining 2,3	155753	Sleeve, 1/8 ID x 1/2" Lg	319225	Plate, Selector Mounting 2,3
124177	Washer, Lock 3		Insulating 4		
125011	Washer, Flat 3	156536	Screw, 4-40 x 1/8 Fil 2	319226	Link 2
126241	Washer, Lock 3	158777	Holder, Screw 3	319227	Link 2
130667	Washer, Lock 3	159180	Lubricator Assembly 2	319228	Post 2
130683	Washer, Lock 2	159181	Lubricator 2	319229	Screw, 4-40 Shoulder 2
150048	Spring 2	159184	Wick, Lubricating 2	319231	Post 4
150687	Stud 2	159185	Retainer, Wick 2	319238	Nut, 12-32 Hex 3
151103	Spring 2	161342	Lever, Start 2	319240	Cable Assembly 3,4
151336	Oiler 2	162765	Bracket 2	319241	Washer, Captive 3
151630	Screw, 6-40 x 1/4 Hex 2	164958	Screw, 4-40 x 1/2 Hex 3	319242	Bushing, Slotted 3
151657	Screw, 6-40 x 1/4 Fil 2	171954	Connector, Blue Shielding 3	319243	Strip, 5" Shielded 3
151687	Screw, 4-40 x 7/16 Fil 3			319246	Bushing 3
151701	Spring, Torsion 2	181204	Washer, Flat 3	319248	Strap 3
151714	Spring 2	306755	Lever, Marking Lock 2	321234	Bracket, Connector Mounting 4
151722	Screw, 6-40 x 3/16 Hex 4	311718	Bushing, Shoulder 3		
151732	Screw, 4-40 x 11/32 Fil 3	319200	Set of Parts 1,4	321235	Receptacle, 3 Pt Connector 3
151735	Screw, 4-40 x 5/16 Hex 4	319202	Insulator 3		
152401	Guide 2	319204	Selector Assembly 1,2,3	321236	Coupling, Connector 3
152402	Guide, Selector Lever 2	319207	Cover 3	321237	Nut, 3/8-32 Spl 3
				321238	Sleeve 3

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION FEATURES
FOR LOW LEVEL SETS
28 and 28/32 KEYBOARDS and BASES (LK, LTRK, LAK, LLK and LB, LLB)

PARTS

FIGURE	CONTENTS	PAGE
1	323645 Contact Box Assembly (LK and LTRK)	2
2	326357 Contact Assembly (LK and LAK)	3
3	Signal Generator Magnet Assembly (LK and LAK)	3
4	Signal Generator Cable and Components (LK)	4
5	Mounting Components for Contact Box Cable (LK and LTRK)	4
6	323644 Contact Box Assembly (LAK)	5
7	Signal Generator Cable and Components (LAK)	6
8	Mounting Components for Contact Box Cable (LAK)	6
9	326730 Intermediate Gear Assembly (LAK & LB)	7
10	Receive-Only Base Components (LLB)	8
11	Cables for Receive-Only Base (LLB)	9
	Numerical Index	10

SECTION 573-611-800TC

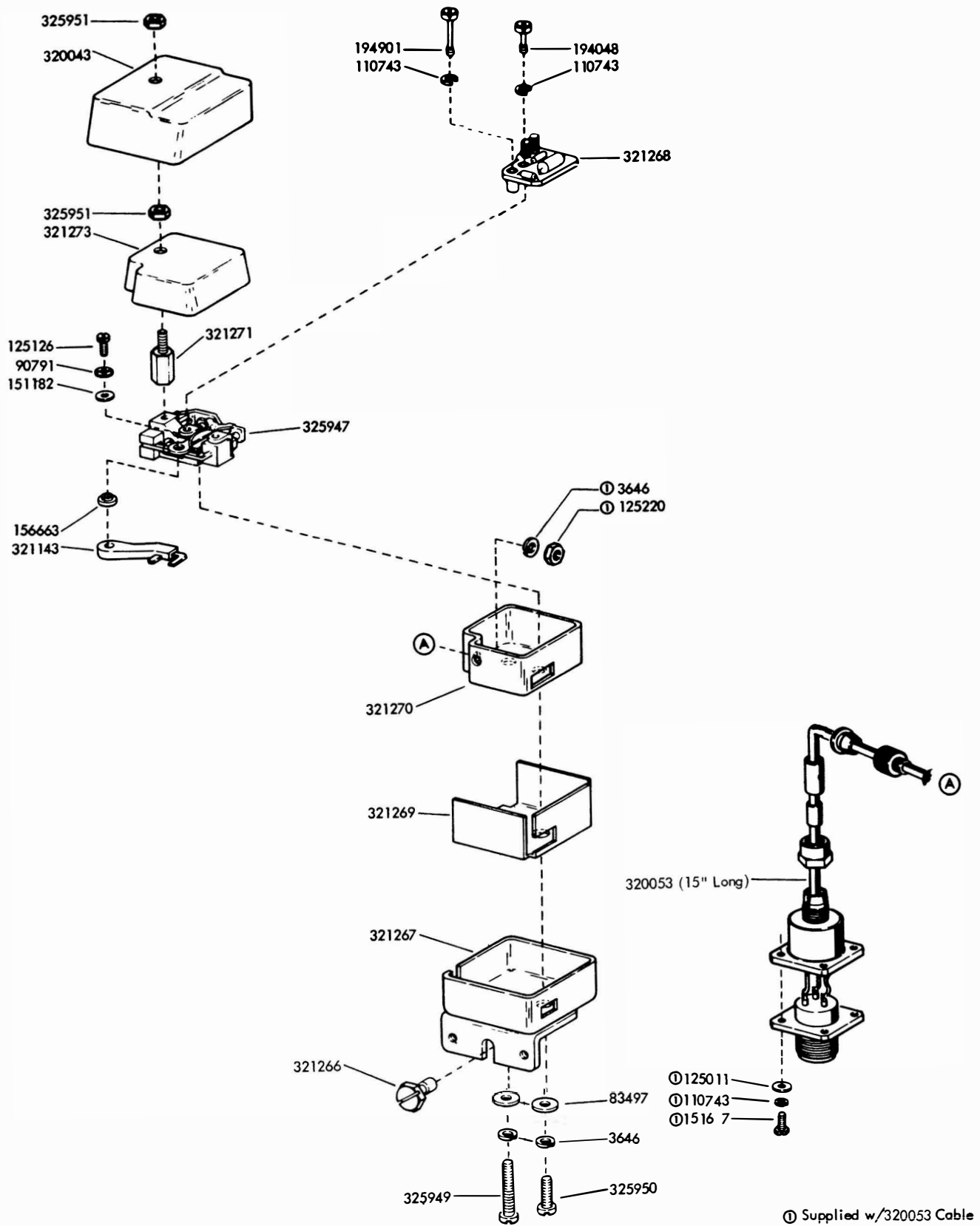


FIGURE 1. 323645 CONTACT BOX ASSEMBLY (LK and LTRK)

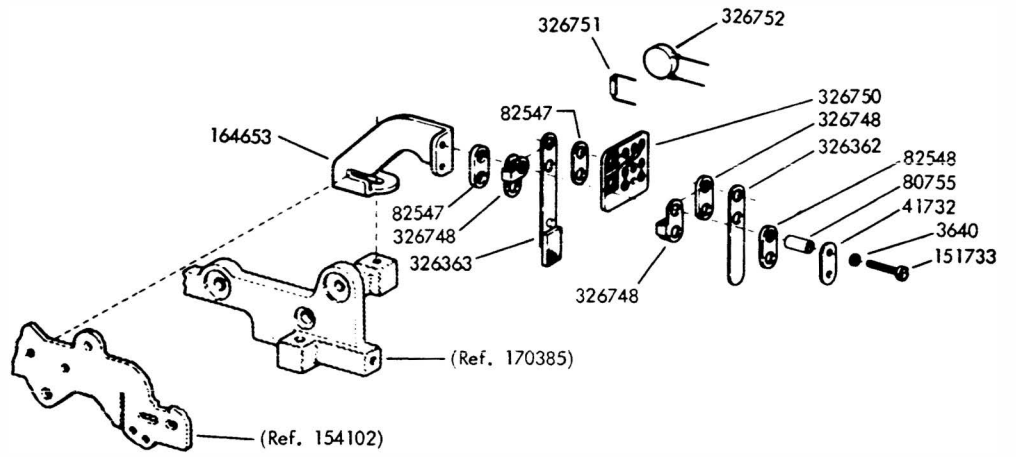


FIGURE 2. 326357 CONTACT ASSEMBLY (LK and LAK)

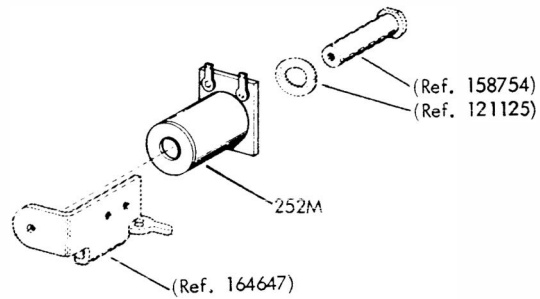


FIGURE 3. SIGNAL GENERATOR MAGNET ASSEMBLY (LK and LAK)

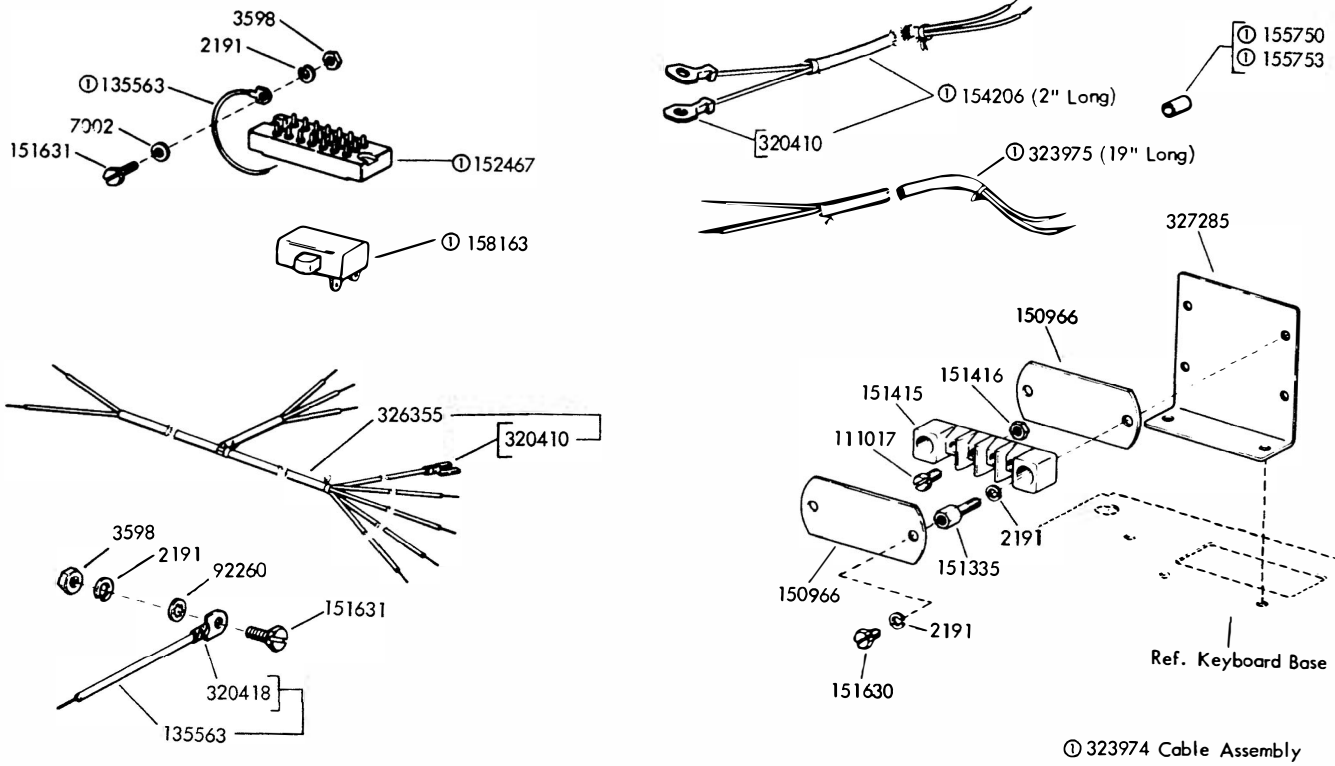


FIGURE 4. SIGNAL GENERATOR CABLE AND COMPONENTS (LK)

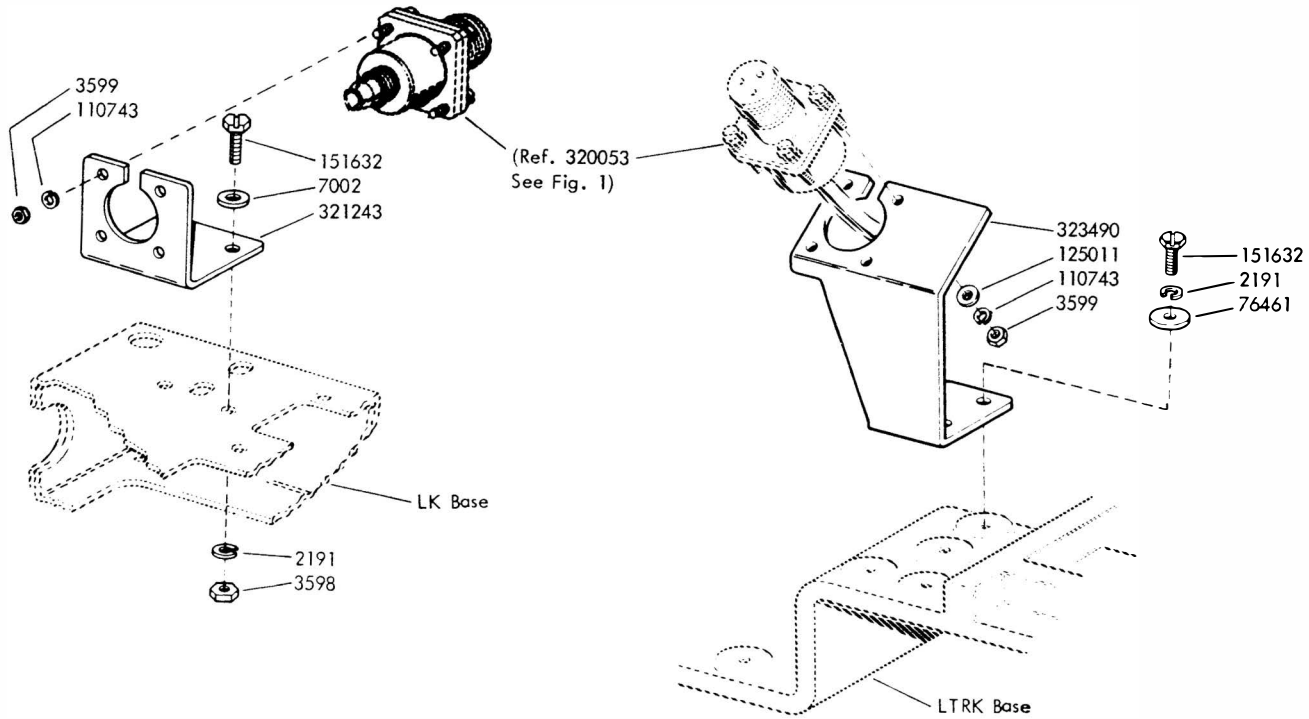


FIGURE 5. MOUNTING COMPONENTS FOR CONTACT BOX CABLE (LK and LTRK)

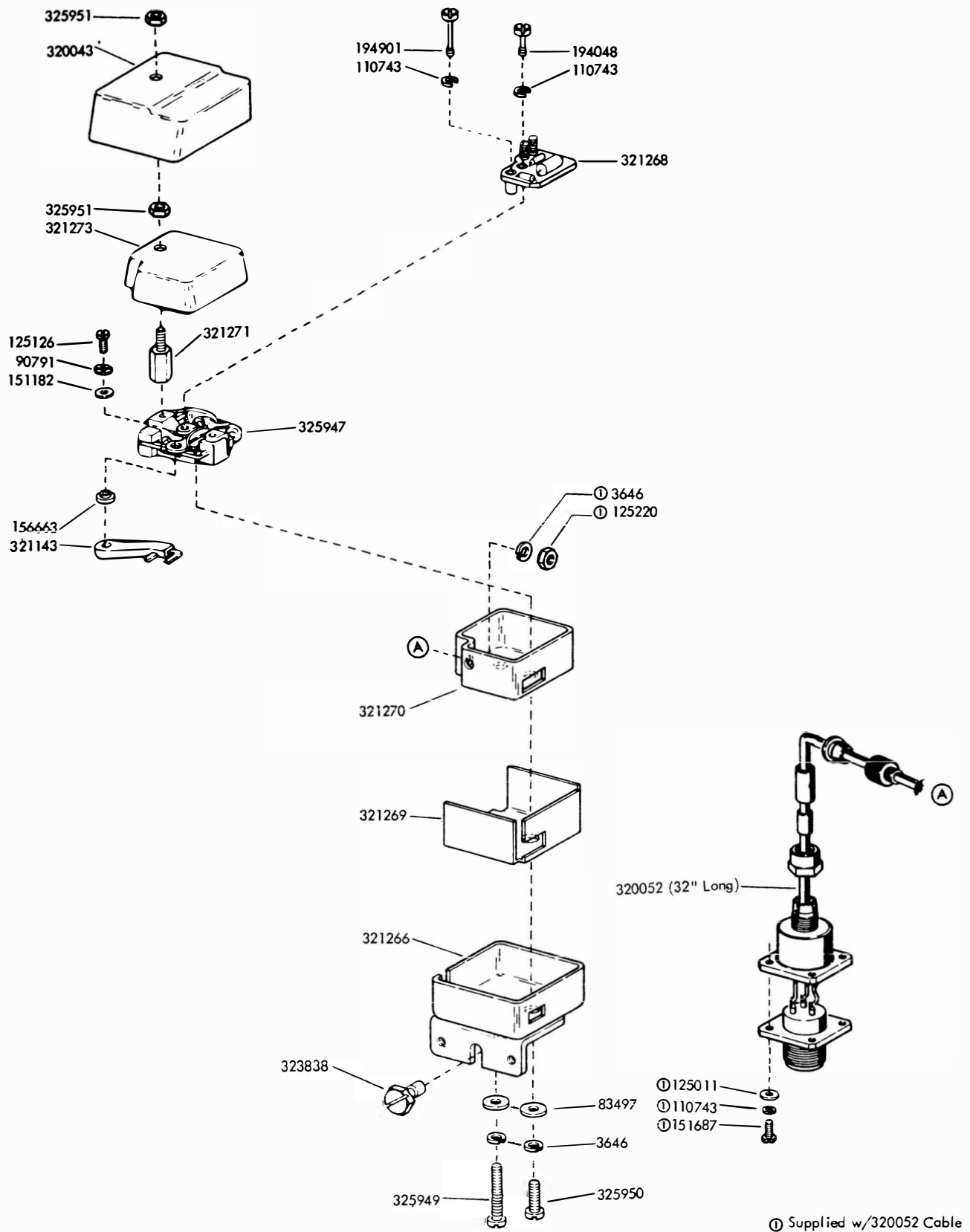


FIGURE 6. 323644 CONTACT BOX ASSEMBLY (LAK)

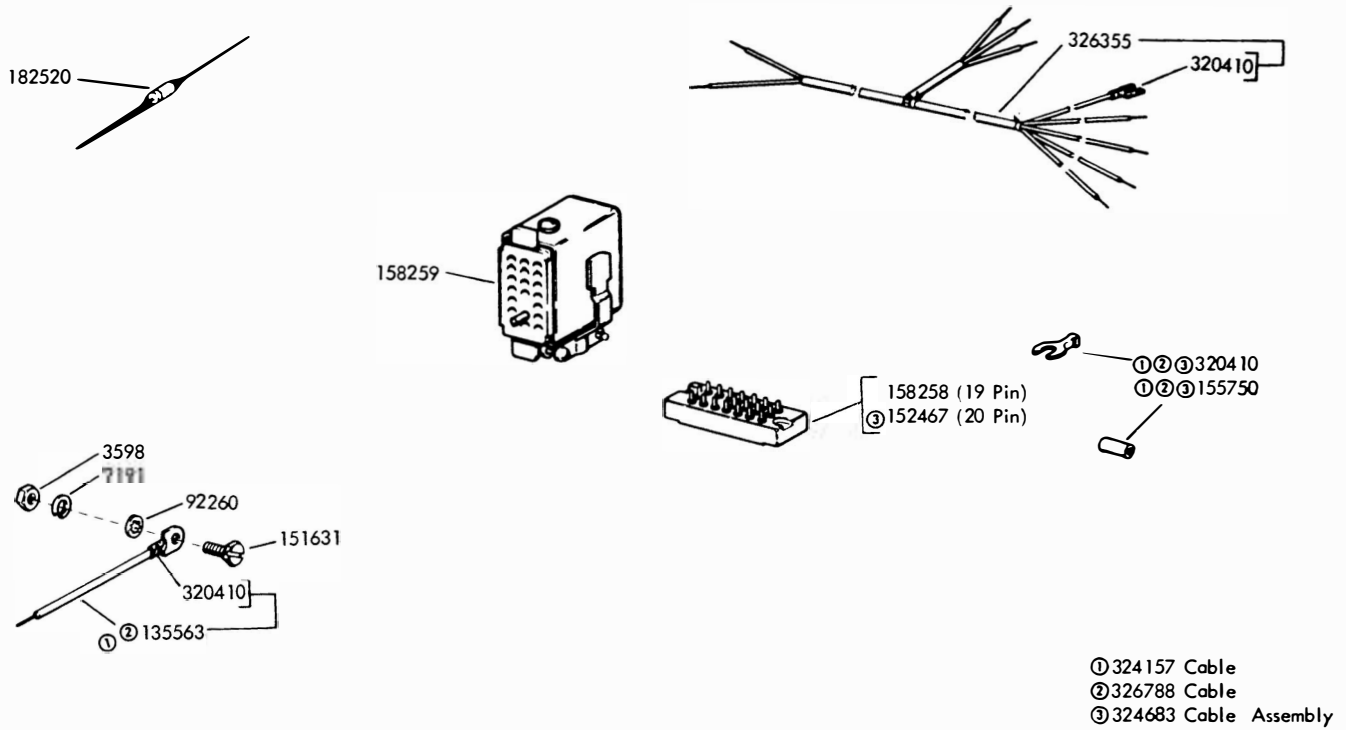


FIGURE 7. SIGNAL GENERATOR CABLE AND COMPONENTS (LAK)

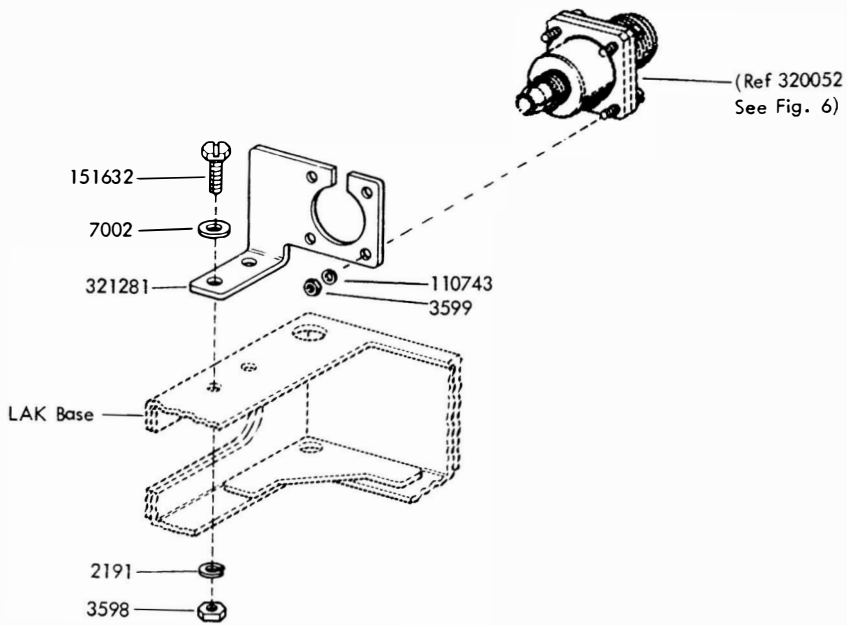
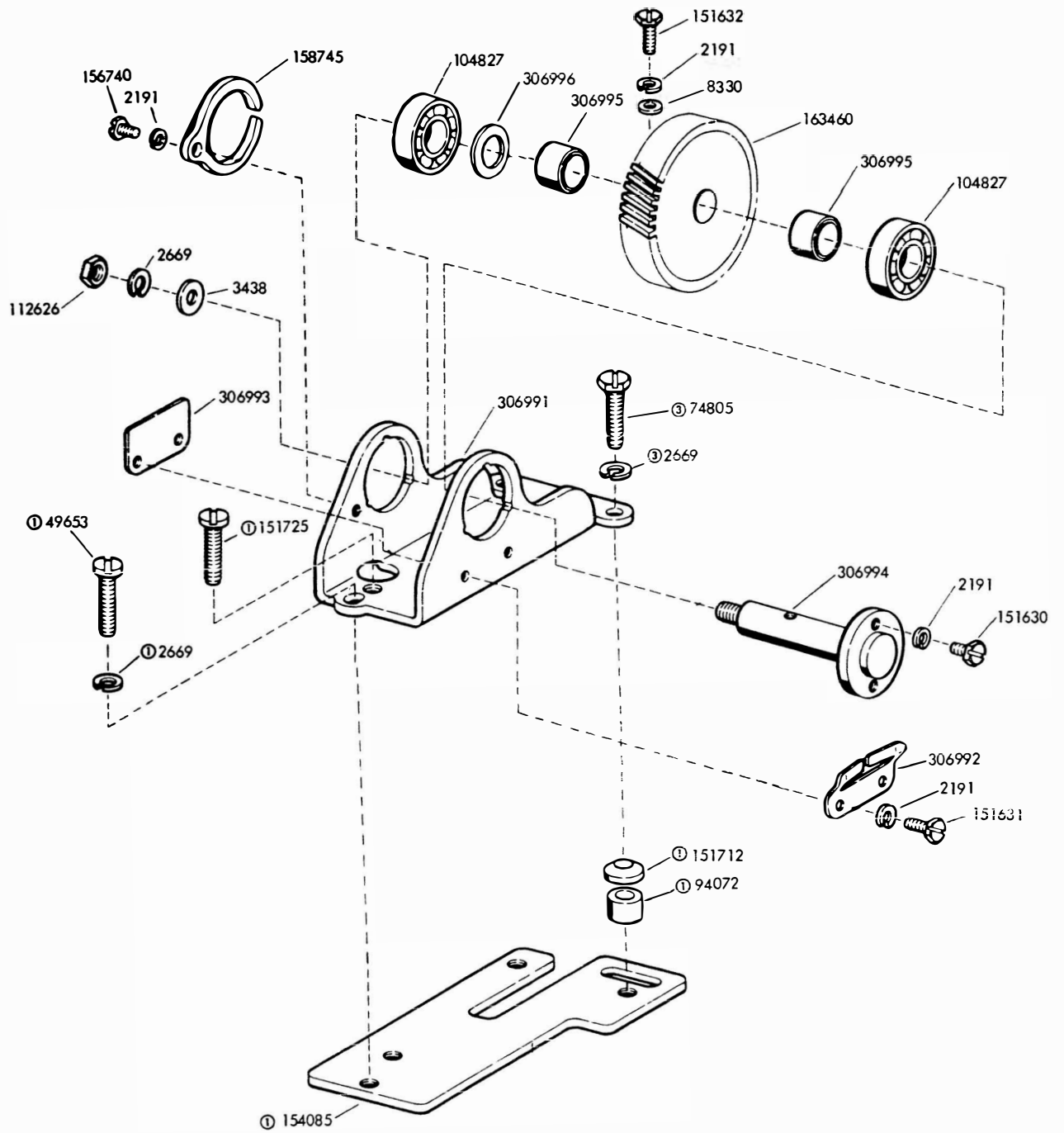
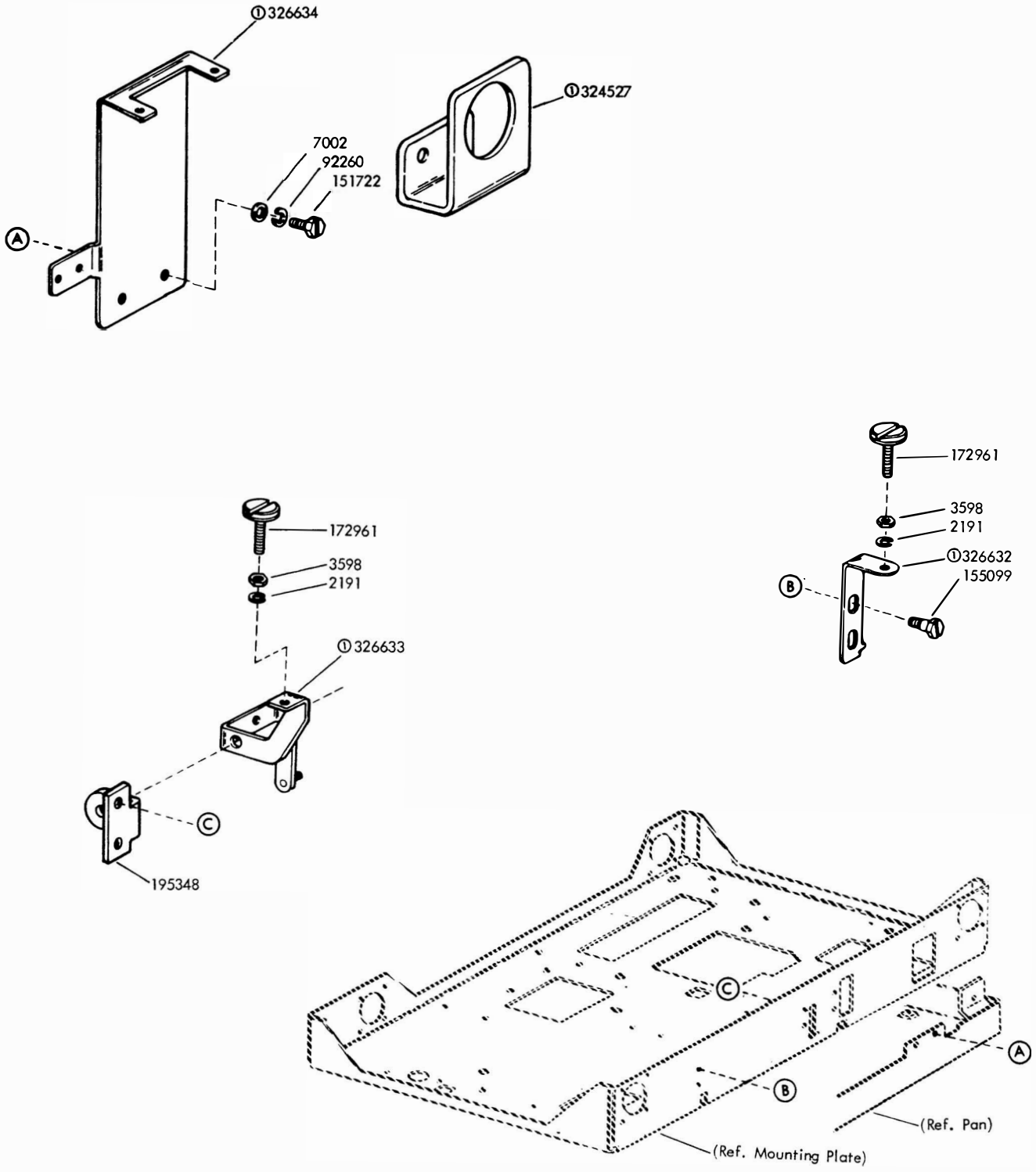


FIGURE 8. MOUNTING COMPONENTS FOR CONTACT BOX CABLE (LAK)



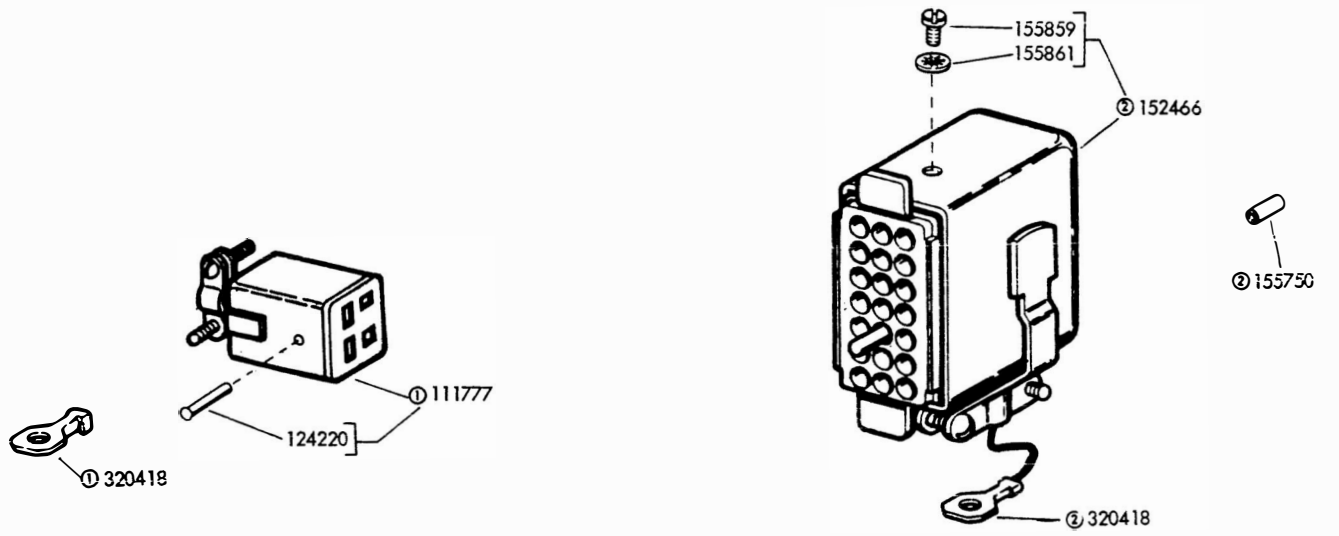
③ Not part of 326730

FIGURE 9. 326730 INTERMEDIATE GEAR ASSEMBLY (LAK and LB)



① Peculiar to (RFI) base, all others are common parts.

FIGURE 10. RECEIVE-ONLY BASE COMPONENTS (LLB)



- ① Supplied w/324523 Cable Assembly
- ② Supplied w/324497 Cable Assembly

FIGURE 11. CABLES FOR RECEIVE-ONLY BASE (LLB)

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
252M	Coil, Magnet 3	151725	Screw, 10-32 x 3/4 Fil 7	321266	Box w/Bracket 2,5
2191	Washer, Lock 4,6,7,8	152466	Connector, 21 Pt Receptacle 9	321267	Box w/Bracket 2
2669	Washer, Lock 7	152467	Connector, 20 Pt Plug 4,6	321268	Network, Filter 2,5
3438	Washer, Flat 7	154085	Plate 7	321269	Insulator 2,5
3598	Nut, 6-40 Hex 4,6,8	154102	Plate, Rear 3	321270	Box, Inner 2,5
3599	Nut, 4-40 Hex 4,6	154206	Cable 4	321271	Post, Nylon 2,5
3640	Washer, Lock 3	155099	Screw, 6-40 Shoulder 8	321273	Cover, Inner 2,5
3646	Washer, Lock 2,5	155750	Sleeve, 3/32 ID x 1/2" Lg Insulating 4,6,9	321281	Bracket 6
7002	Washer, Flat 4,6,8	155753	Sleeve, 1/8 ID x 1/2" Lg Insulating 4	323490	Bracket, Connector Mounting 4
8330	Washer, Flat 7	155859	Screw, 4-40 Spl 9	323644	Box Assembly, Contact 1,5
41732	Plate, Clamp 3	155861	Washer, Lock 9	323645	Box Assembly, Contact 1,2
49653	Screw, 10-32 x 13/16 Fil 7	156663	Bushing, Insulating 2,5	323838	Eccentric 5
74805	Screw, 10-32 x 3/4 Hex 7	156740	Screw, 6-40 x 7/32 Hex 7	323974	Cable Assembly 4
76461	Washer, Flat 4	158163	Switch, Sensitive 4	323975	Cable Assembly 4
80755	Bushing, Insulating 3	158258	Connector, 20 Pt Plug 6	324157	Cable Assembly 6
82547	Insulator, .094" Thk 3	158259	Connector, 20 Pt Receptacle 6	324497	Cable Assembly 9
82548	Insulator, .062" Thk 3	158745	Clamp, Bearing 7	324523	Cable Assembly 9
83497	Washer, Flat 2,5	158754	Core, Magnet 3	324527	Bracket 8
90791	Washer, Lock 2,5	163460	Gear, 55T 7	324683	Cable Assembly 6
92260	Washer, Lock 4,6,8	164647	Bracket 3	325947	Contact Assembly 2,5
94072	Bushing 7	164653	Bracket 3	325947	Screw, 8-32 x 1 Nylon Fil 2,5
104827	Bearing, Ball 7	170385	Frame w/Bushing 3	325950	Screw, 8-32 x 1/2 Nylon 2,5
110743	Washer, Lock 2,4,5,6	172961	Screw, 6-40 Stop 8	325951	Nut, 6-32 Nylon Hex 2,5
111017	Screw, 6-40 x 5/16 Fil 4	182520	Rectifier 6	326355	Cable 4,6
111777	Connector, 4 Pt Receptacle 9	194048	Screw, 4-40 Spl 2,5	326357	Contact Assembly 1,3
112626	Nut, 10-32 Hex 7	194901	Screw, 4-40 Spl 2,5	326362	Spring, Contact 3
121125	Washer, Spring 3	195348	Bracket, Loc C R 8	326363	Spring, Contact 3
124220	Pin, Drive 9	306991	Bracket 7	326632	Lever, Slide 8
125011	Washer, Flat 2,4,5	306992	Clamp 7	326633	Bail w/Stud 8
125126	Screw, 2-56 x 9/32 Fil 2,5	306993	Plate 7	326634	Bracket, Switch 8
125220	Nut, 8-40 Hex 2,5	306994	Shaft 7	326730	Gear Assembly, Intermediate 1,7
135563	Jumper, 2-3/4" Green 4,6	306995	Spacer 7	326748	Strap, Contact 3
150966	Insulator, Terminal Block 4	306996	Shim, .05" Thick 7	326750	Board, Filter 3
151182	Washer, Insulating 2,5	320043	Cover, Outer 2,5	326751	Resistor, 22 Ohm 3
151335	Stud 4	320052	Cable Assembly 5,6	326752	Capacitor, .03 MFD 3
151415	Block, Terminal 4	320053	Cable Assembly 2,4	326788	Cable Assembly 6
151416	Nut, 6-40 Hex 4	320410	Terminal, Spade Type 4,6	327285	Bracket 4
151630	Screw, 6-40 x 1/4 Hex 4,7	320418	Terminal, Ring Type 4,9		
151631	Screw, 6-40 x 5/16 Hex 4,6,7	321143	Link 2,5		
151632	Screw, 6-40 x 3/8 Hex 4,6,7	321243	Bracket, Connector Mounting 4		
151687	Screw, 4-40 x 7/16 Fil 2,5				
151712	Button, Pivot 7				
151722	Screw, 6-40 x 3/16 Hex 8				
151733	Screw, 4-40 x 9/16 Fil 3				

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
FEATURES FOR LOW LEVEL SETS
28 ASR/KSR CABINET

PARTS

FIGURE	CONTENTS	PAGE	FIGURE	CONTENTS	PAGE
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4	336011** Enclosure and Power Supply Assembly	5	17	Table Mounted Cabinet and Pad	17
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6	330650 Numbering Module Without Circuit Cards	7	19	Front Panel Fan Mounting	19
7	328017 Front Plate Assembly (Part of 330650 See Figure 6)	8	20	Cable Components - Keyboard Send-Receive Cabinet	19
8	333605 Power Supply Assembly (Part of 336011** See Figure 4)	9	21	Compact Printer Cover Components	20
9	333605 Power Supply Assembly (Continued)	10	22	Components for Receive-Only and Send-Receive Sets	21
10	333621 A, C, Power Plate Assembly (Part of 333605 See Figure 8 & 9)	11	23	Components for Transmitter-Distributor Base	22
11	333610 Plate Assembly (Part of 333605 See Figure 8 & 9)	12	24	322417 Circuit Card w/Cable	23
12	324149 Modification Kit To add junction Boxes to Cabinet	13	25	303160 Circuit Card	24
13	324149 Modification Kit To add junction Boxes to Cabinet (Continued)	14	26	303164 Circuit Card	24
			27	322080 Circuit Card	25
			28	303811 Circuit Card	25
			29	322023 Circuit Card	26
			30	322022 Circuit Card	26
			31	322024 Circuit Card	27
			32	322025 Circuit Card	27
			33	333620 Circuit Card	28
				Numerical Index	29

PAINT FINISH COLOR CODE CHART (for parts and assemblies requiring a paint finish)									
Color	Finish Suffixes				Color	Finish Suffixes			
	Wrinkle Finish	Smooth Finish	Textured Vinyl	Smooth Vinyl		Wrinkle Finish	Smooth Finish	Textured Vinyl	Smooth Vinyl
Beige		EL		HC	Gray, Federal		BV	GG	
Beige, Light		ER			Gray, Green	AB	BK	GA	
Beige, Rose					Gray, Light		EJ		HB
Black	AA				Gray, Covert				HE
Black, High Gloss		BA			Gray, Olive		EW	GE	HF
Black, Semi Gloss		BB			Gray, Maritime Deck	AJ			
Blue, Aqua		EK			Gray, Oxford		BJ		
Blue, Brussels Light		EC			Green, Gray	AB	EP		
Blue, Medium		ES			Green, Moss		BK	GA	HD
Brown, Dark	AD				Ivory		EN		
Brown, Light	AC				Pink, Rose		EM		
Fawn				HG	Turquoise		EU		
Gray, Beige			GC		White		EV		
Gray, Charcoal	AL	BZ	GF	HA	Yellow, Pastel		EH		
Gray, Dark			GB				EG		
Gray, Navy Light		BR							

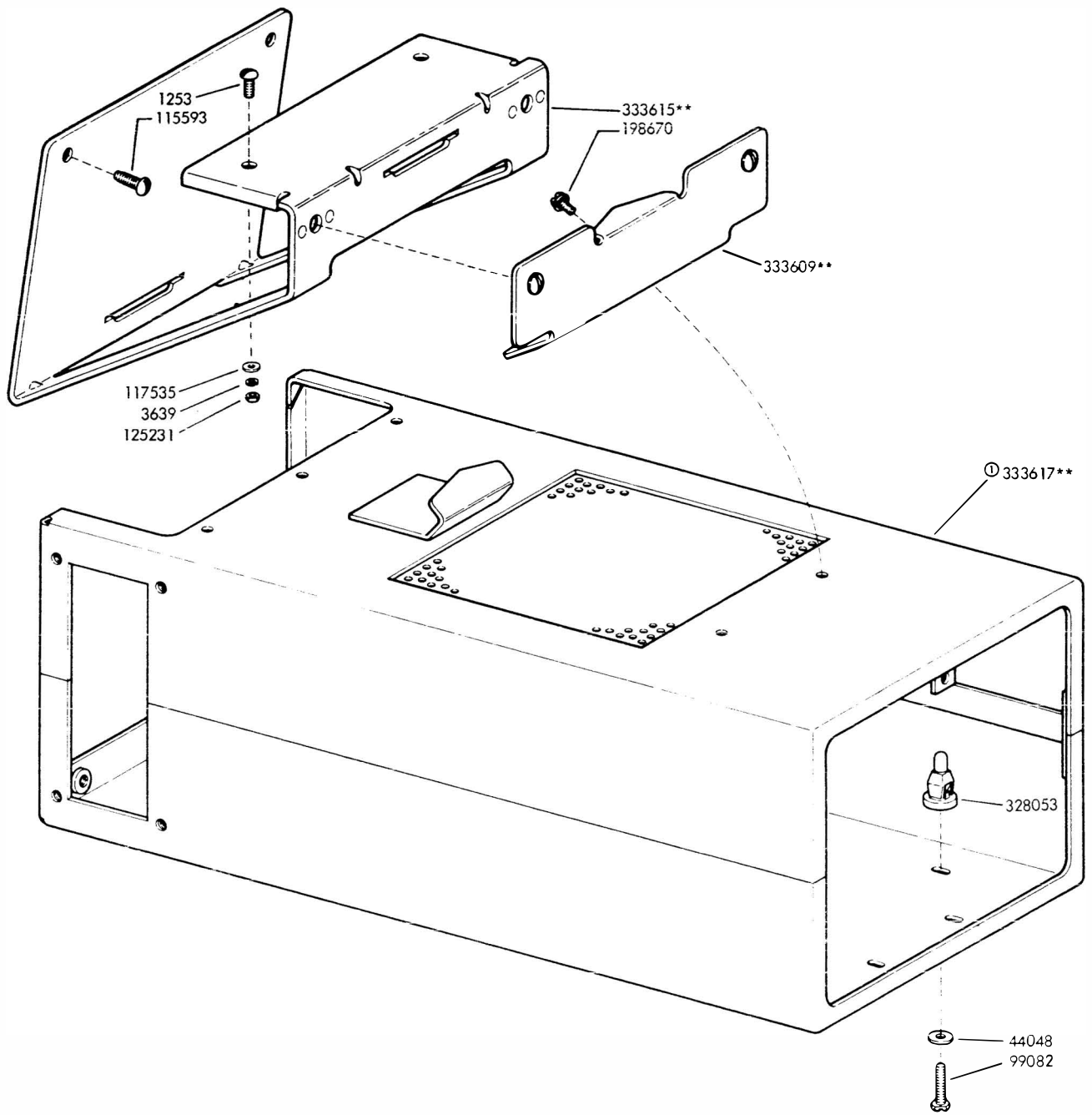
The double asterisk (**) denotes a painted part. Suffix to be applied following the part number.

	With Line Assurance					Without Line Assurance				
	334541**	334542**	334543**	334544**	334545**	336014**	336015**	336016**	336017**	336018**
Used with a 7.00 Unit Code Set having a band rating of	75	50	45.5			75	50	45.5		
Used with a 7.42 Unit Code Set having a W.P.M. rating of		67.5	60	100	75		67.5	60	100	75
322080 Line Assurance Circuit Card, Shown on figure 27	●	●	●	●	●					
333605 Power Supply Assembly, Shown on figures 8 & 9	●	●	●	●	●					
Crystals, Shown on figure 6	328003	328006	328007	328004	328005	328003	328006	328007	328004	328005
161592 Plate w/Studs Shown in Transmitter Distributor Section.		●	●	●	●		●	●	●	●
303160 Duel Circuit Magnet Drive-Circuit Card, Shown on figure 25	●	●	●	●	●	●	●	●	●	●
303164 Clock Amplifier-Circuit Card, Shown on figure 26	●	●	●	●	●	●	●	●	●	●
303811 Contact Latch and Filter-Circuit Card, Shown on figure 28	●	●	●	●	●	●	●	●	●	●
324681 Cable Assembly, Shown in transmitter Distributor Section		●	●	●	●		●	●	●	●
328010 Numbering Module w/Cards, Shown on figure 8	●	●	●	●	●	●	●	●	●	●
333610** Numbering Module Enclosure, Shown on figures 2,3 & 4	●	●	●	●	●	●	●	●	●	●
333633 Cable Assembly, Shown on figure 23	●	●	●	●	●	●	●	●	●	●
333634 Bracket Shown on figure 23	●	●	●	●	●	●	●	●	●	●
336010 Cap, Protective Shown on figure 22	●	●	●	●	●	●	●	●	●	●

**Refer to page 1 for finish suffix

●Indicates - Used on

FIGURE 1. MODIFICATION KITS TO EQUIP LOW LEVEL AUTOMATIC SEND-RECEIVE SETS WITH MESSAGE NUMBERING FEATURES



**Refer to page 1 for finish suffix

① Not part of 333601**, Supplied with 336011** See Figure 4

FIGURE 2. 333601** NUMBERING MODULE ENCLOSURE

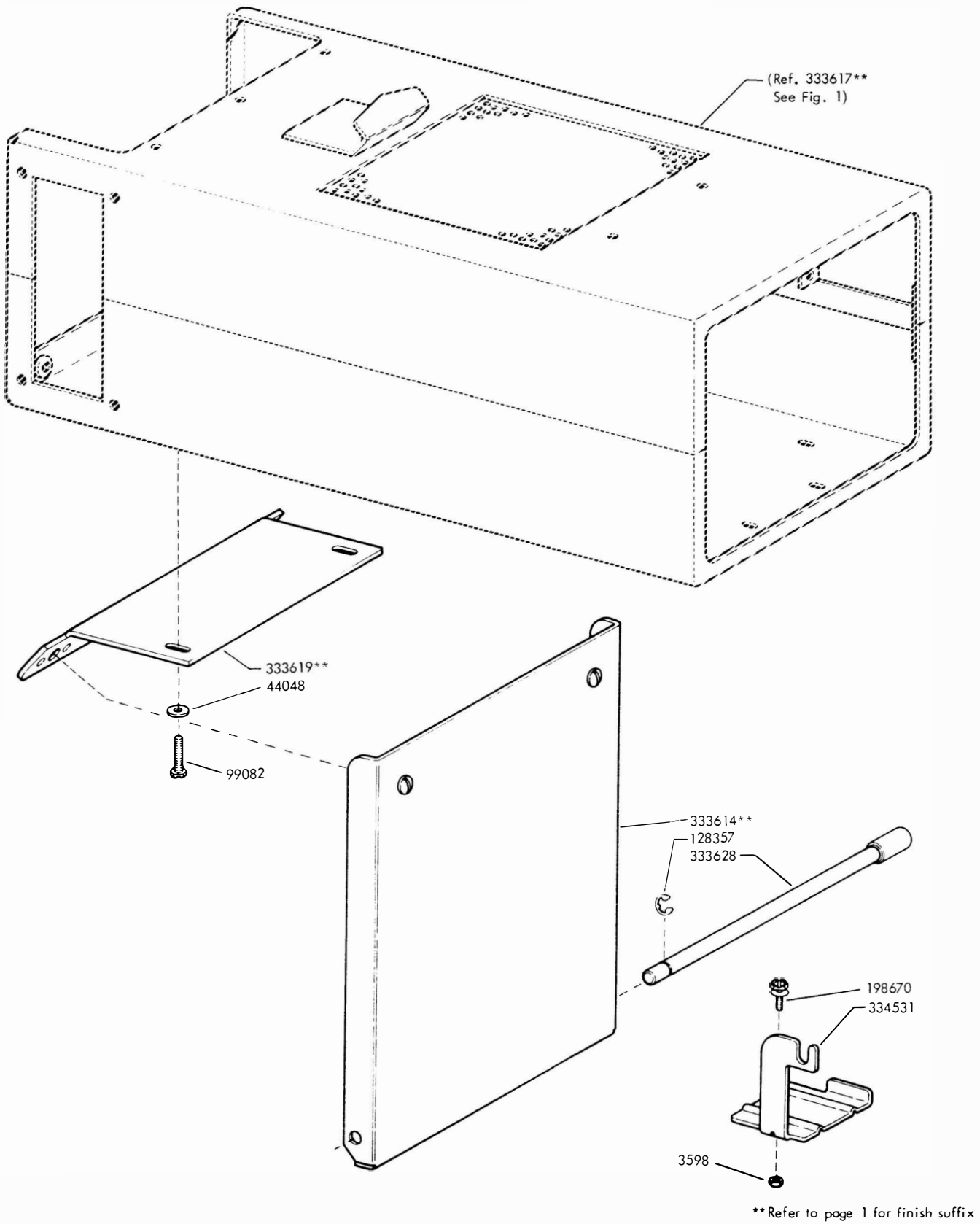
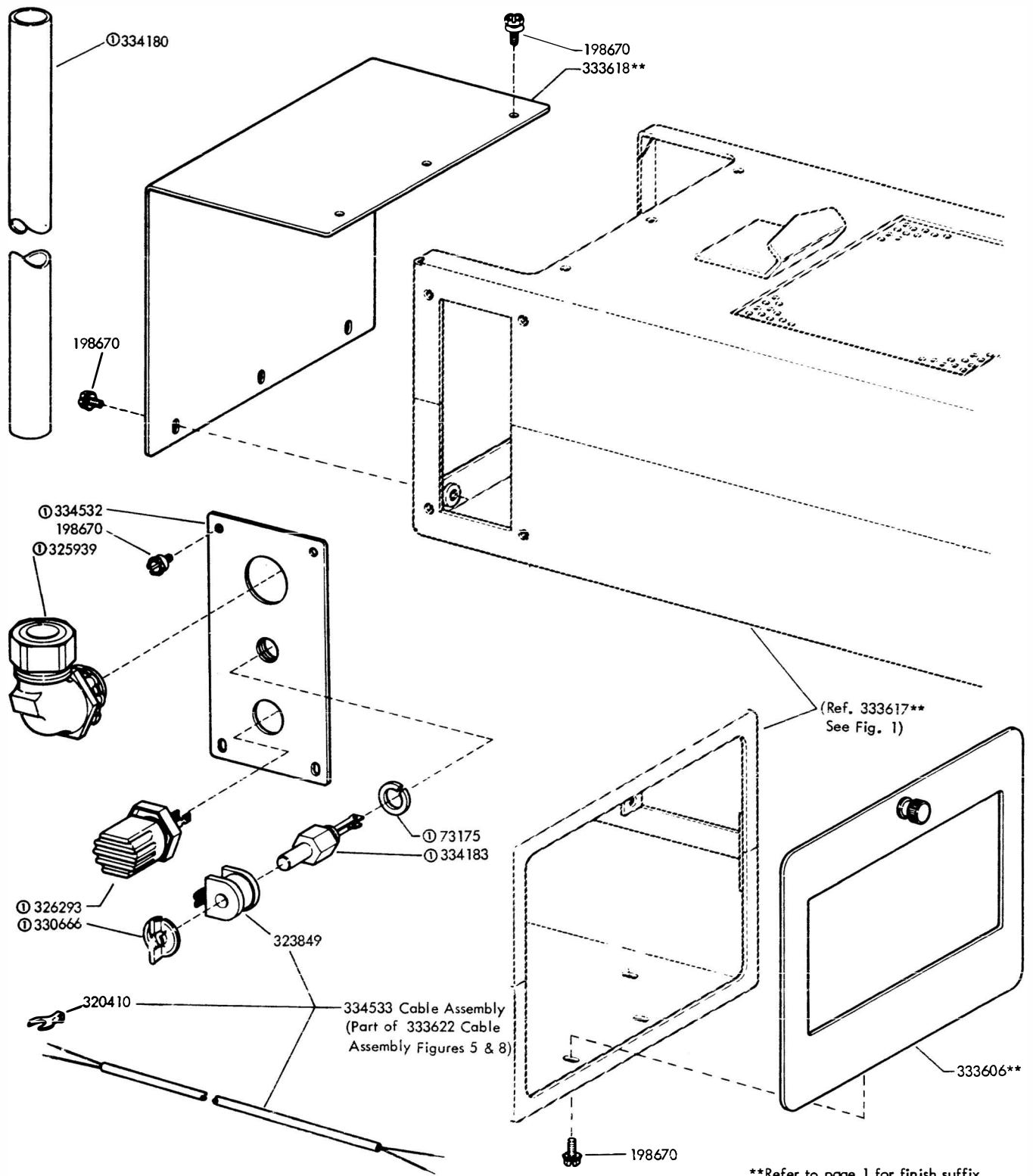


FIGURE 3. 333601** NUMBERING MODULE ENCLOSURE (Continued)



**Refer to page 1 for finish suffix
 333622 Cable Assembly (Parts also shown on figure 8)

FIGURE 4. 336011** ENCLOSURE AND POWERS SUPPLY ASSEMBLY
 (PART OF 333601** SEE FIGURES 1 & 2)

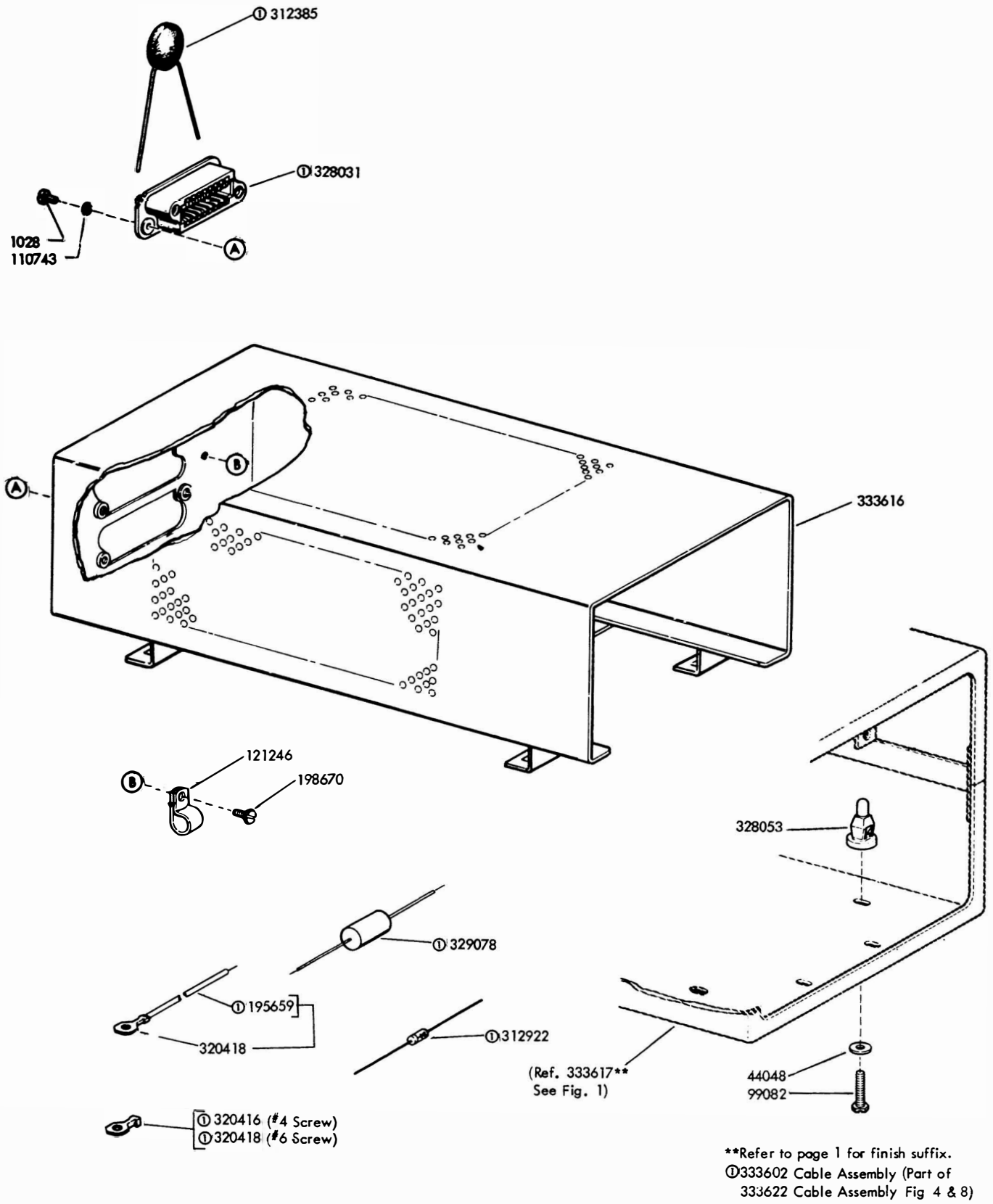
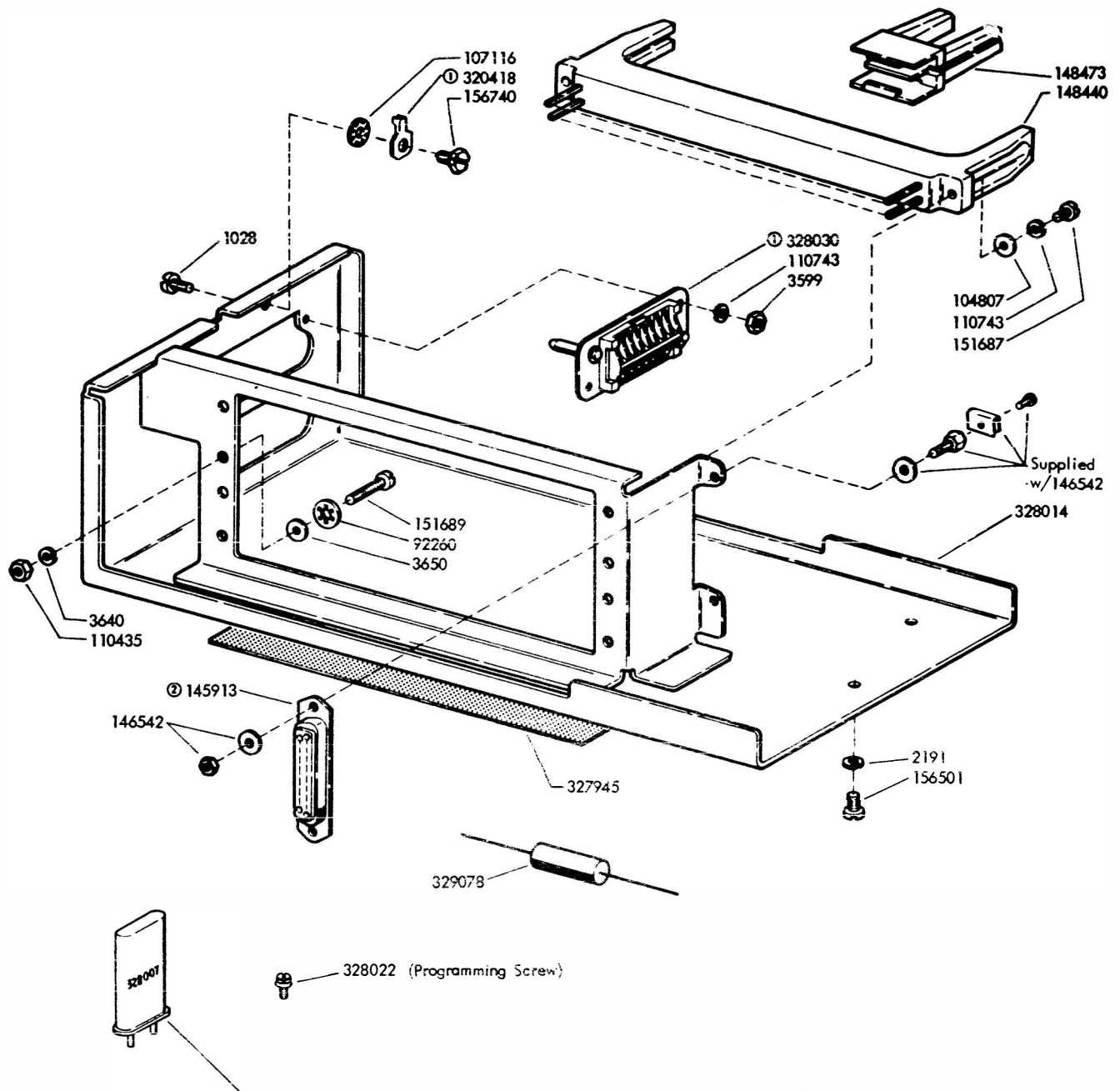


FIGURE 5. NUMBERING MODULE CHASSIS



CRYSTAL OPTIONS		
Number	Baud	Frequency
328003	75.00	38.400 K Hz
328004	74.20	37.990 K Hz
328005	56.83	29.097 K Hz
328006	50.00	25.672 K Hz
328007	45.53	23.211 K Hz

Numbering Module Component Chart		
Numbering Module		Components and Location
328000	328010	
X	X	330650 Numbering Module w/o card - Figure 6
X	X	322022 Message Counter Card - Figure 30
X	X	322023 Format Scanner Card - Figure 29
X	X	322024 Serialized Card - Figure 31
X	X	322025 Seizure & Tandem Delay Logic Card - Figure 32

① Supplied w/328025 Cable Assembly
 ② Supplied w/328011 Cable Assembly

FIGURE 6. 330650 NUMBERING MODULE WITHOUT CIRCUIT CARDS.

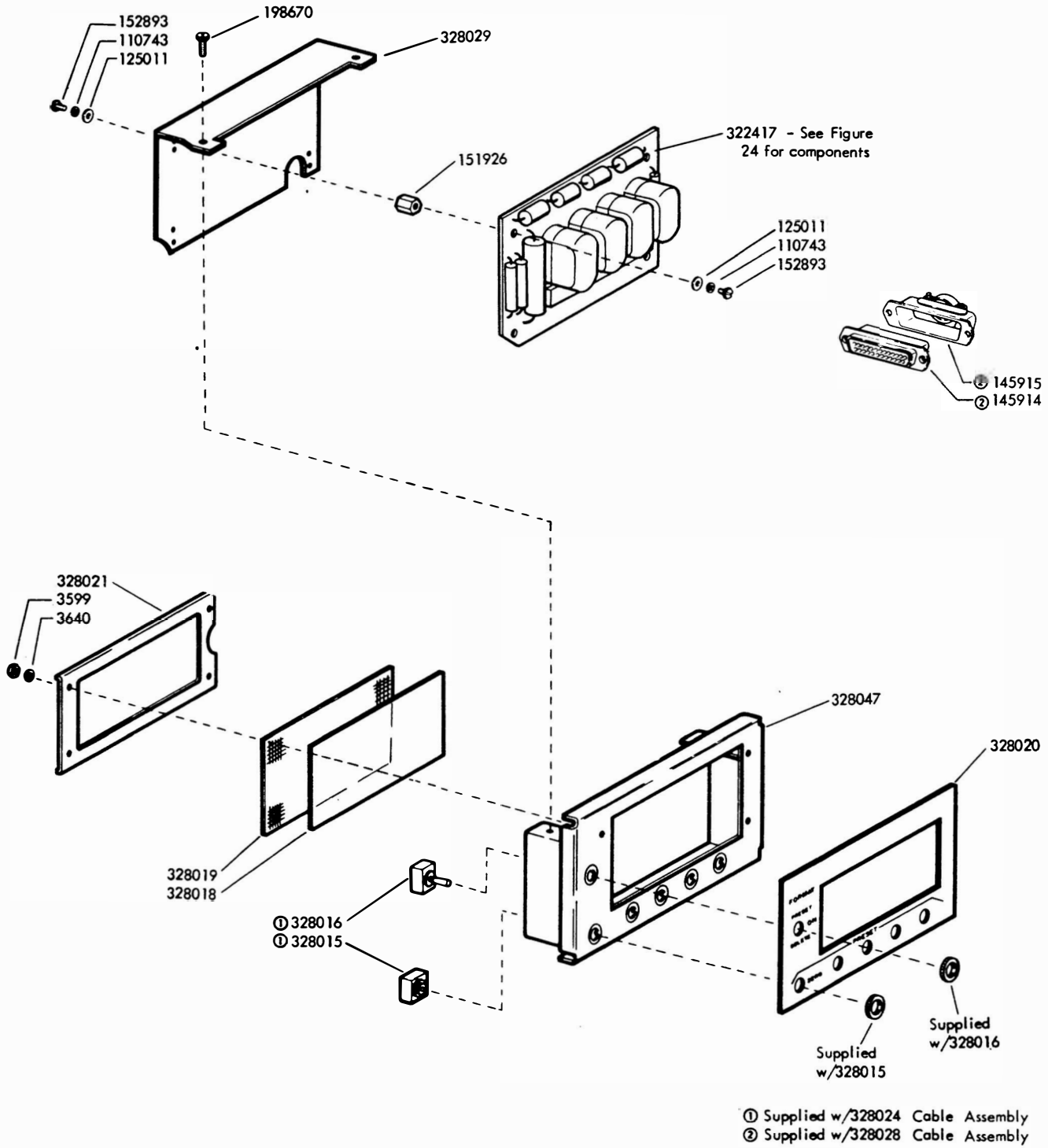


FIGURE 7. 328017 FRONT PLATE ASSEMBLY (PART OF 330650 SEE FIGURE 6)

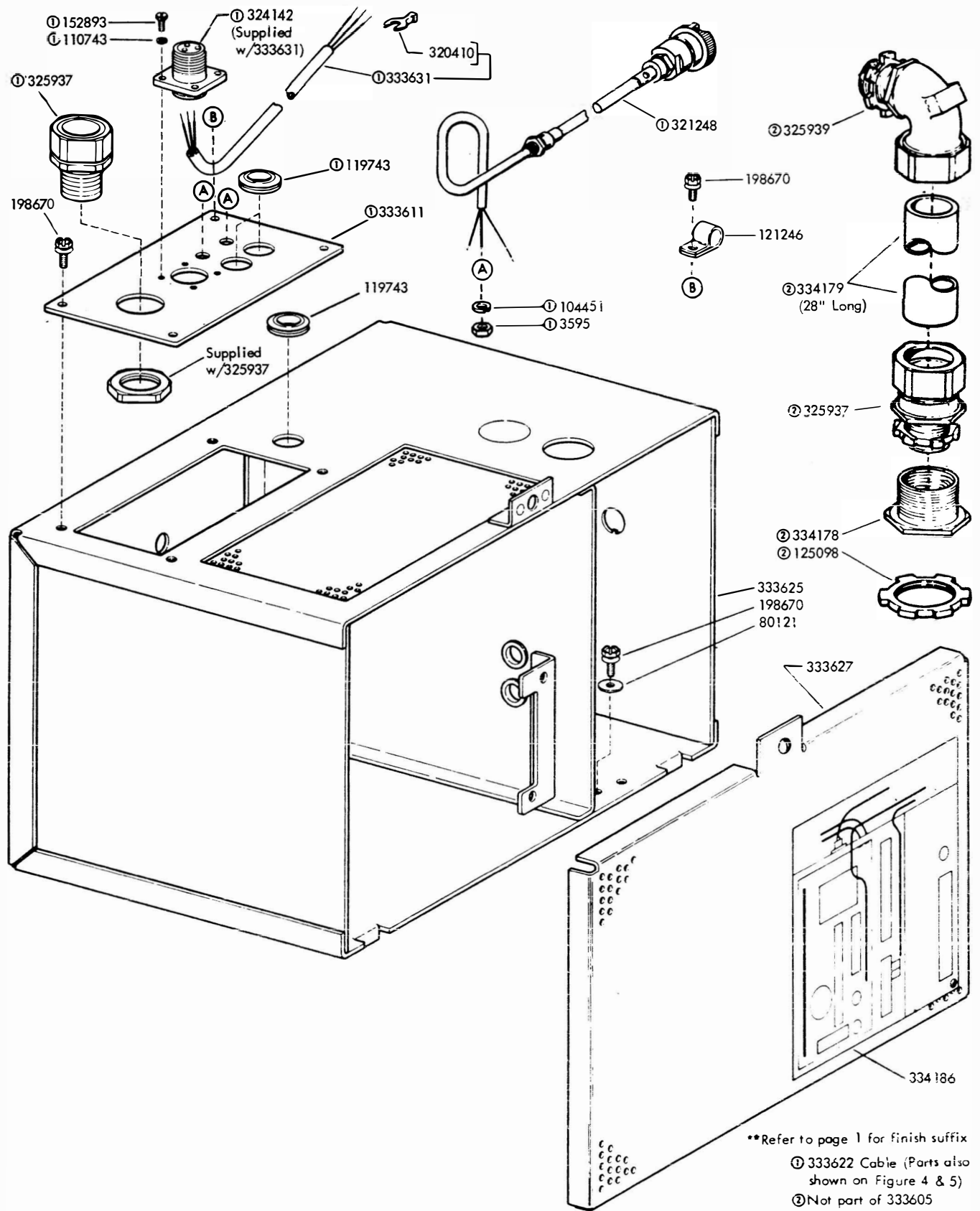


FIGURE 8. 333605 POWER SUPPLY ASSEMBLY (PART OF 336011** SEE FIGURE 4)

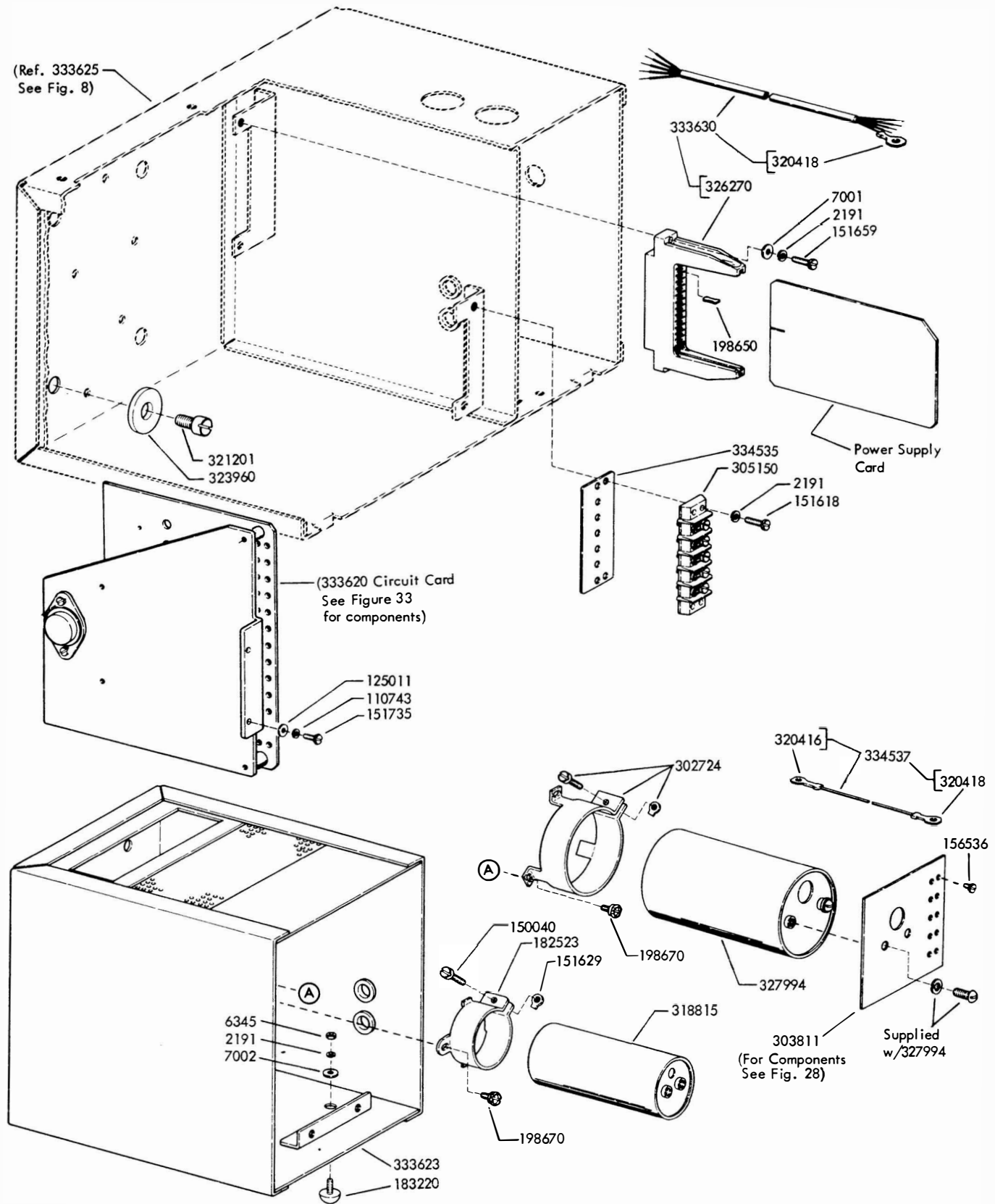
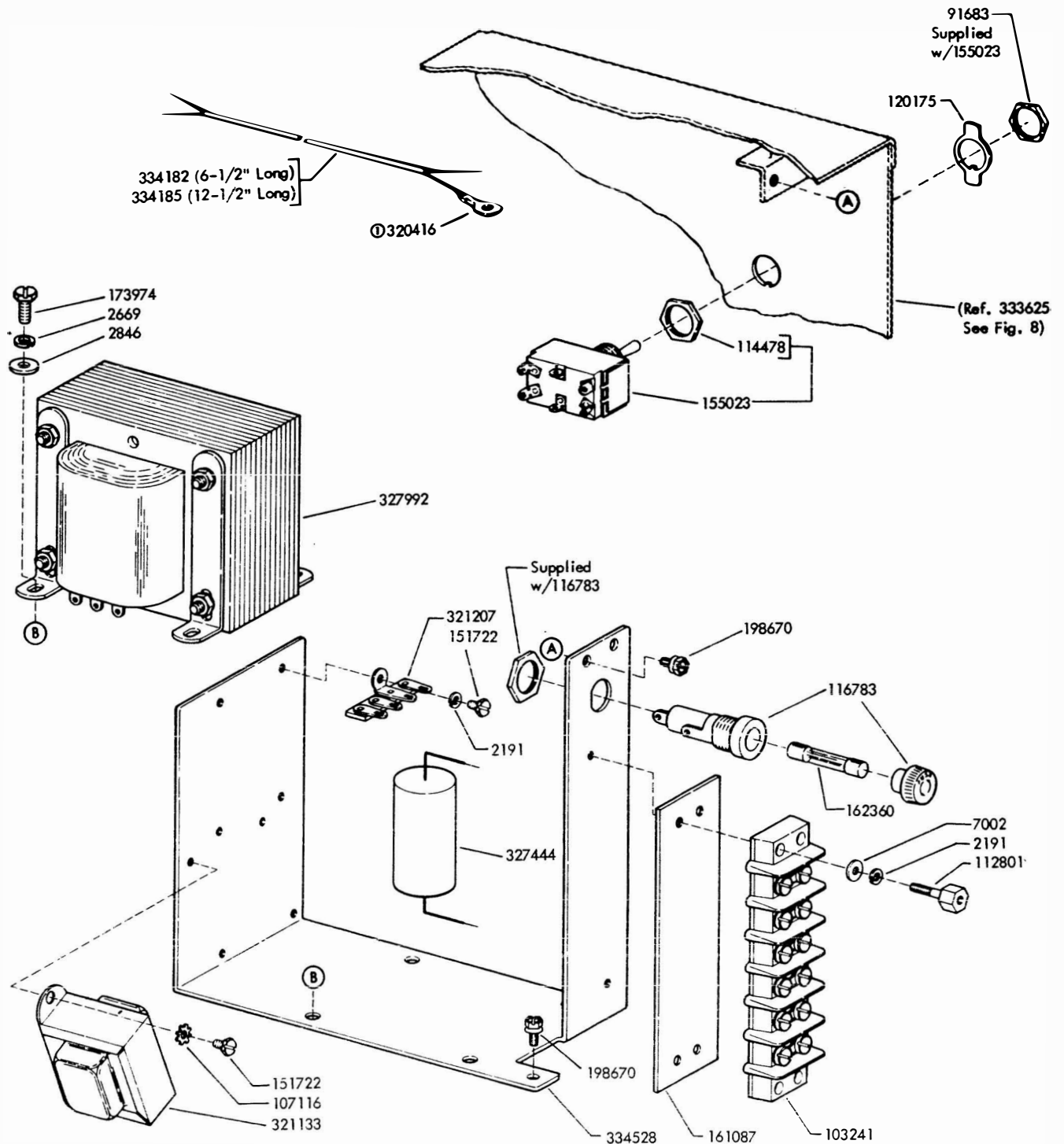


FIGURE 9. 333605 POWER SUPPLY ASSEMBLY (Continued)



① Supplied w/334182 and 334185

FIGURE 10. 333621 A.C. POWER PLATE ASSEMBLY (PART OF 333605 SEE FIGURES 8 & 9)

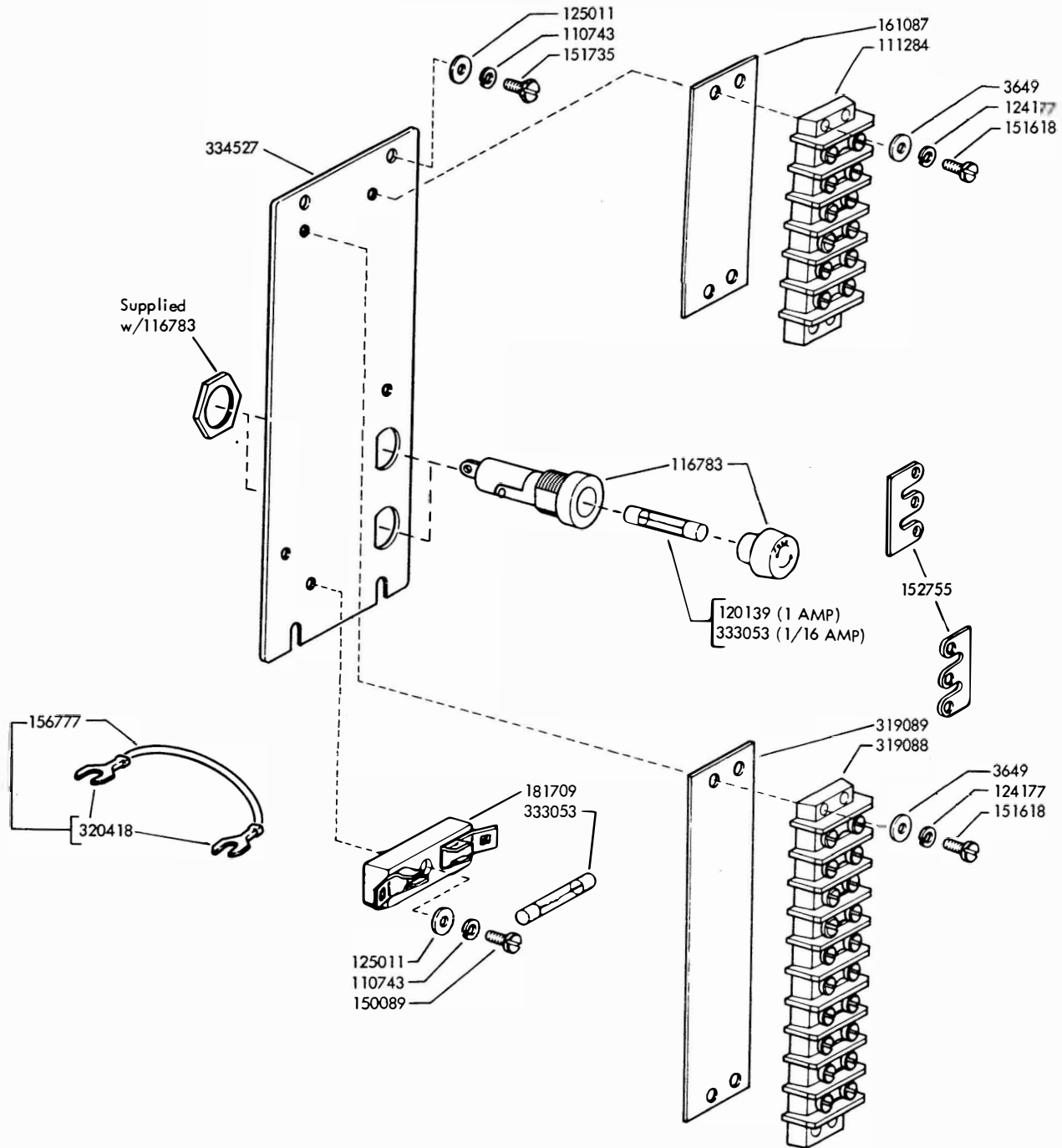


FIGURE 11. 333610 PLATE ASSEMBLY (PART OF 333605 SEE FIGURES 8 & 9)

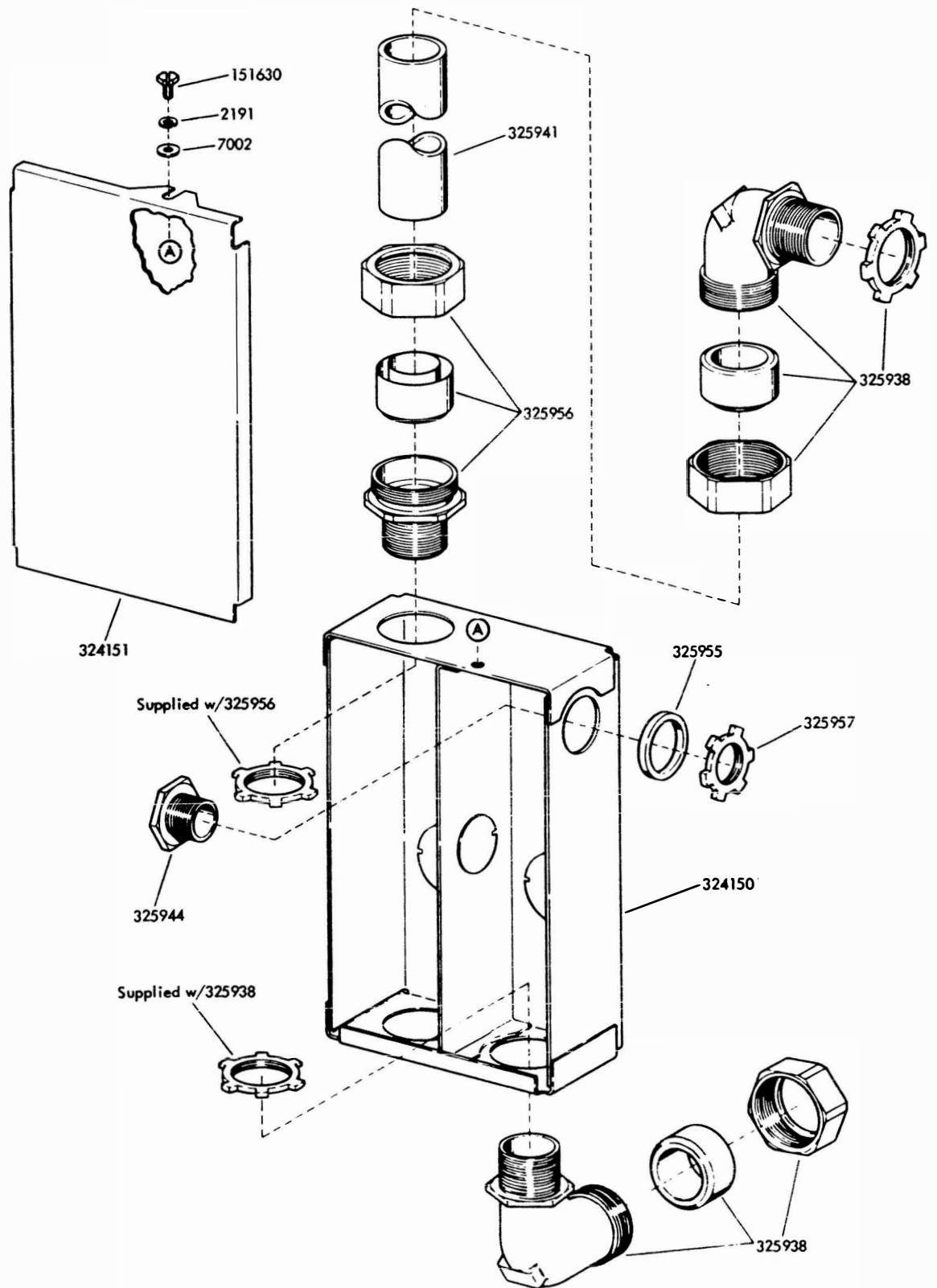


FIGURE 12. 324149 MODIFICATION KIT TO ADD JUNCTION BOXES TO CABINET

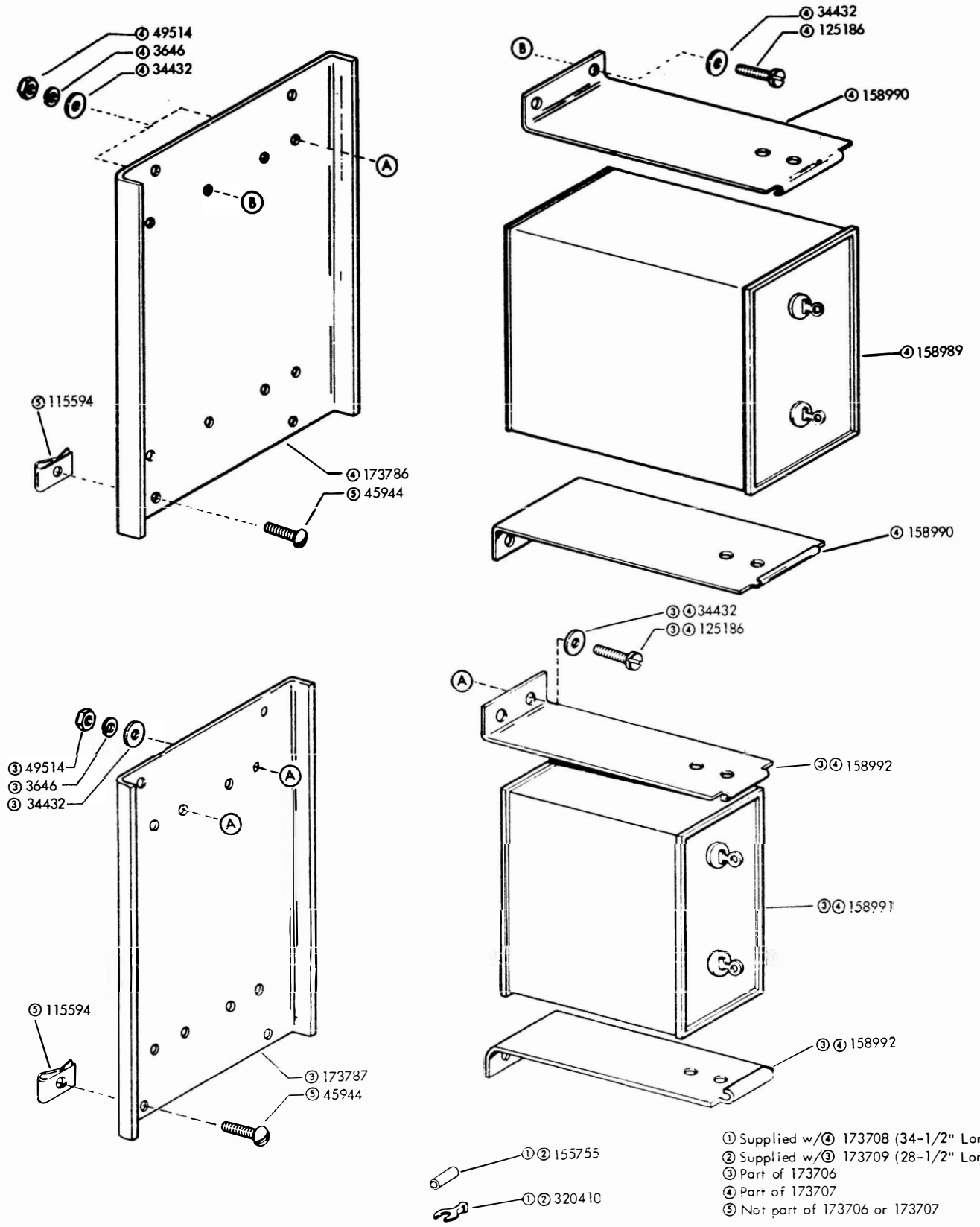
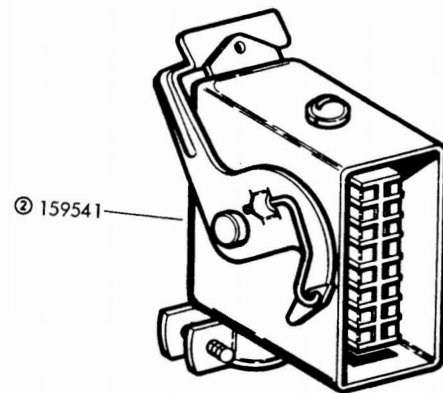
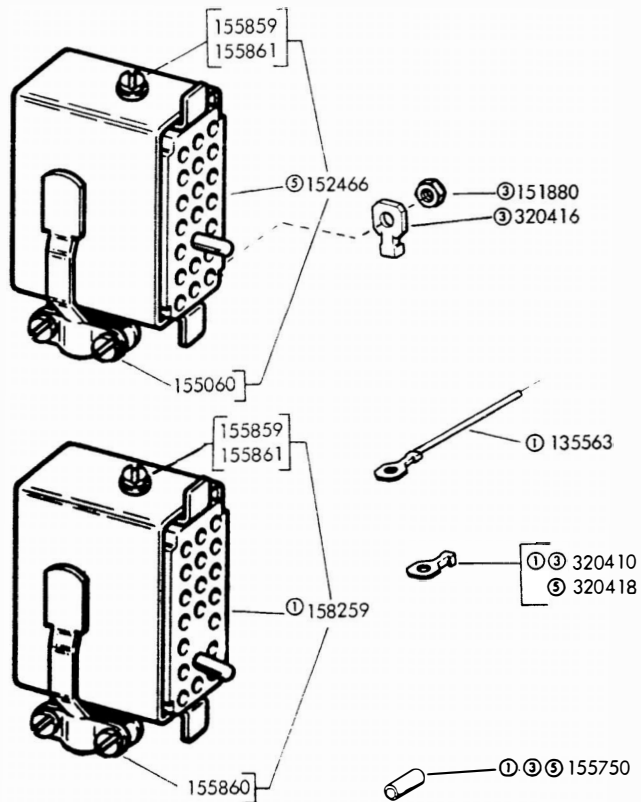
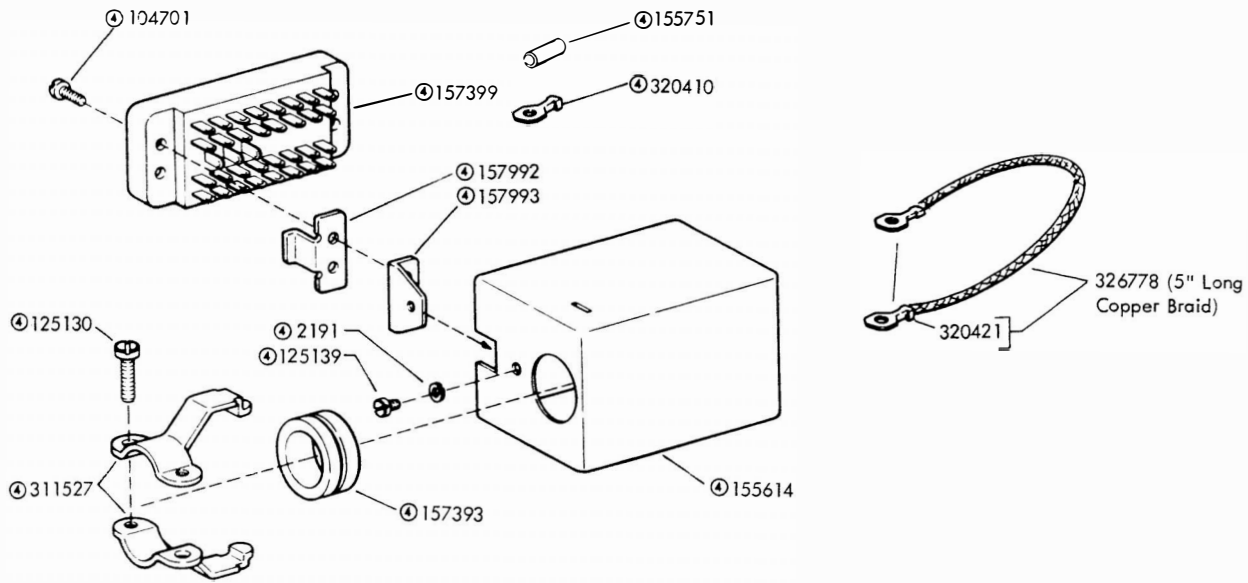


FIGURE 14. 173706 AND 173707 MODIFICATION KITS TO ADD POWER FACTOR CORRECTION TO CABINET



- ① 324157 Cable - Trans Base
- ② 324158 Cable - Auxil. Base
- ③ 324159 Cable - Keyboard
- ④ 324156 Cable - Page Printer
- ⑤ 324695 Cable - Page Printer

FIGURE 15. CABLE COMPONENTS FOR AUTOMATIC SEND-RECEIVE CABINET

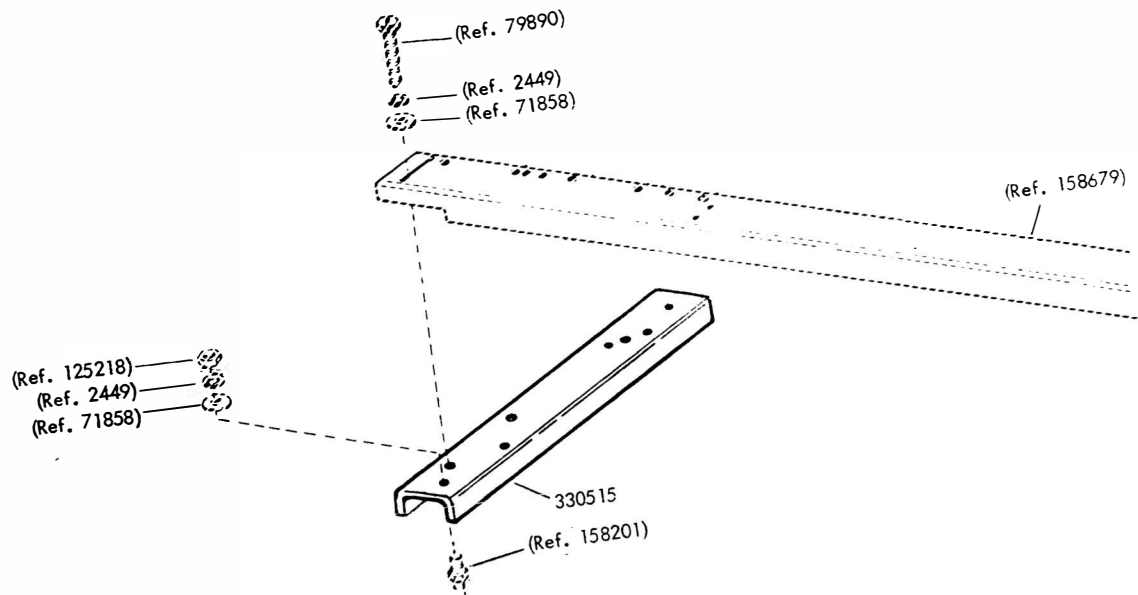
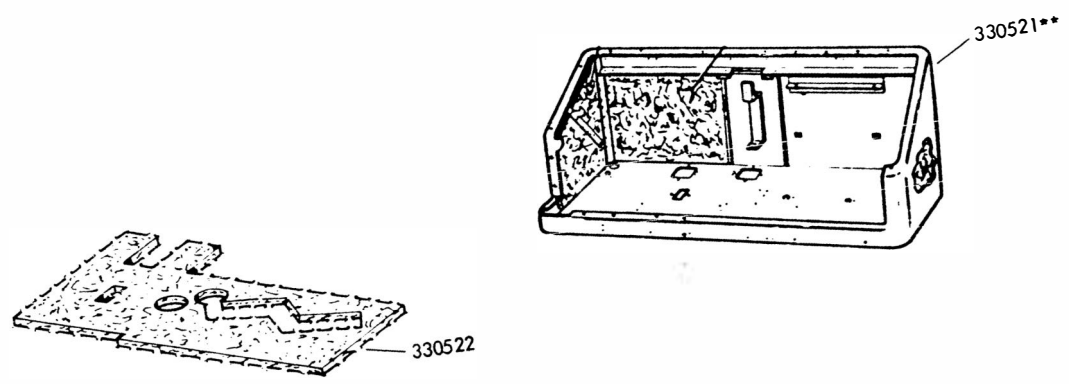


FIGURE 16. MOUNTING RAILS FOR AUTOMATIC SEND-RECEIVE CABINET



**Refer to page 1 for finish surf

FIGURE 17. TABLE MOUNTED CABINET AND PAD

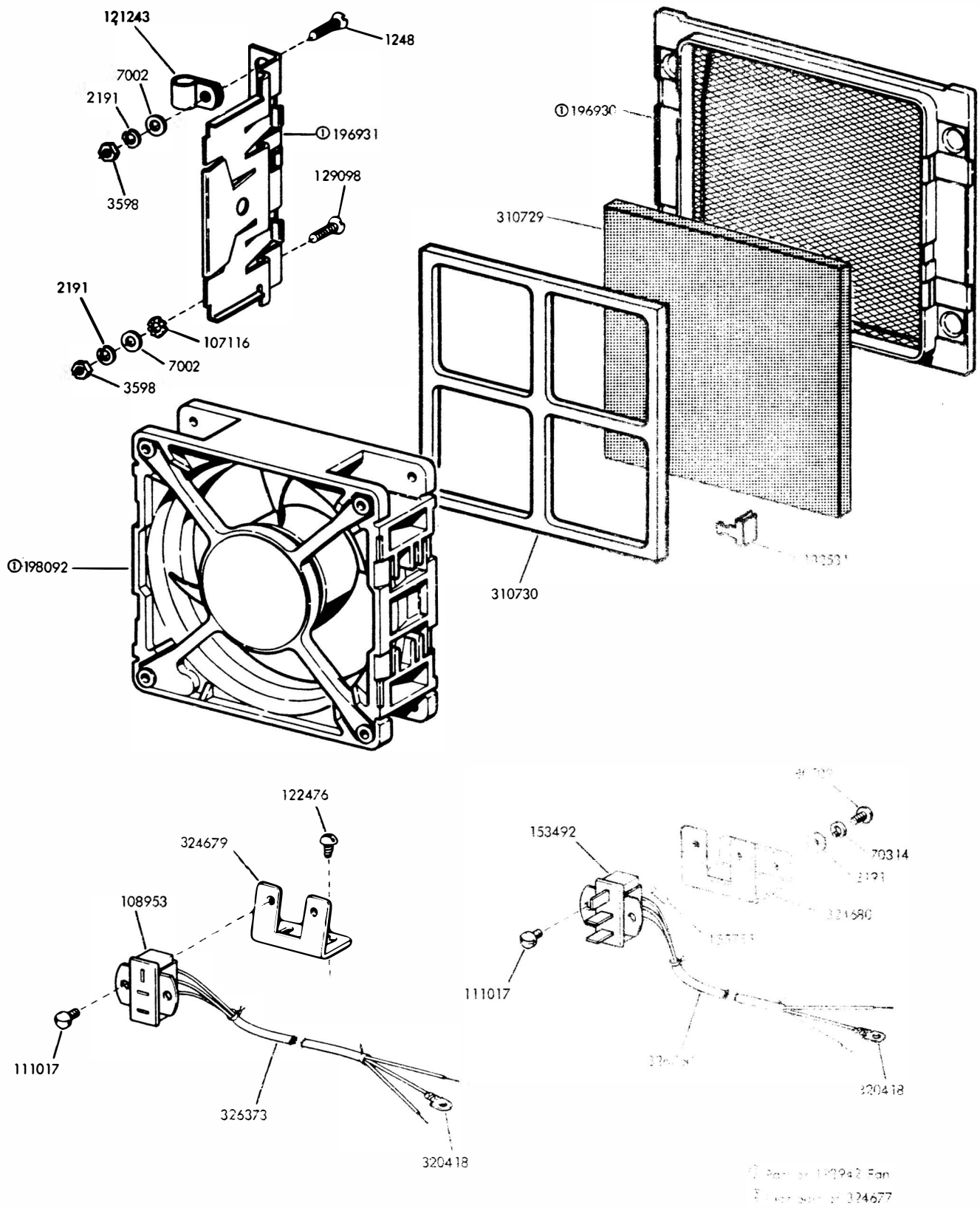
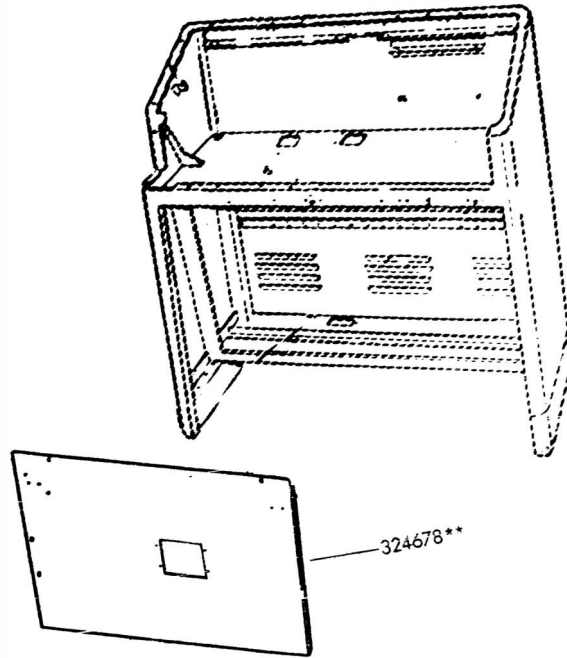
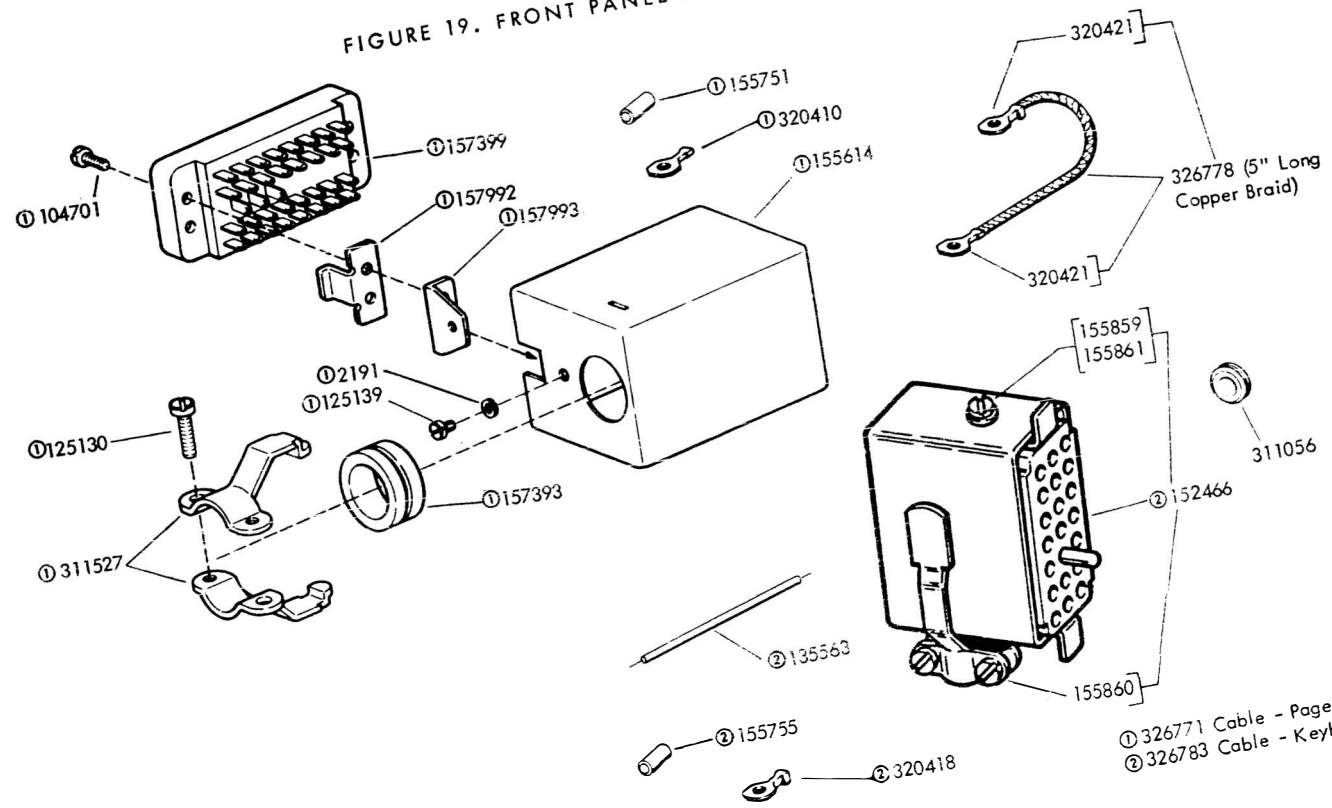


FIGURE 18. 324677 MODIFICATION KIT TO ADD FAN TO CABINET



**Refer to page 1 for finish suffix

FIGURE 19. FRONT PANEL FAN MOUNTING



① 326771 Cable - Page Pri
② 326783 Cable - Keyboar

FIGURE 20. CABLE COMPONENTS - KEYBOARD SEND-RECEIVE CABINET

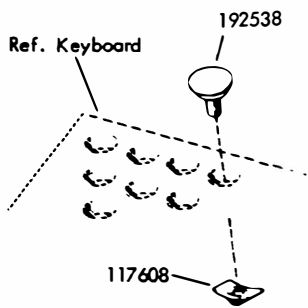
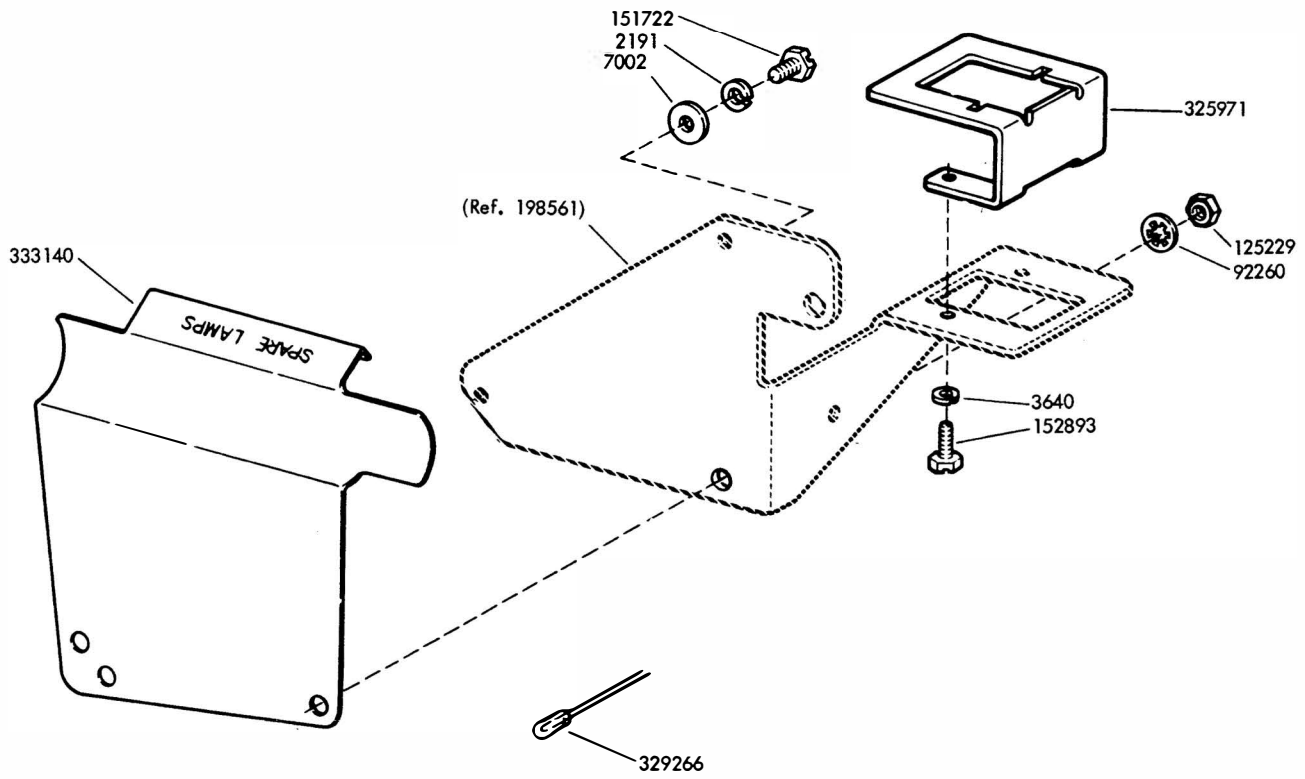


FIGURE 21. COMPACT PRINTER COVER COMPONENTS

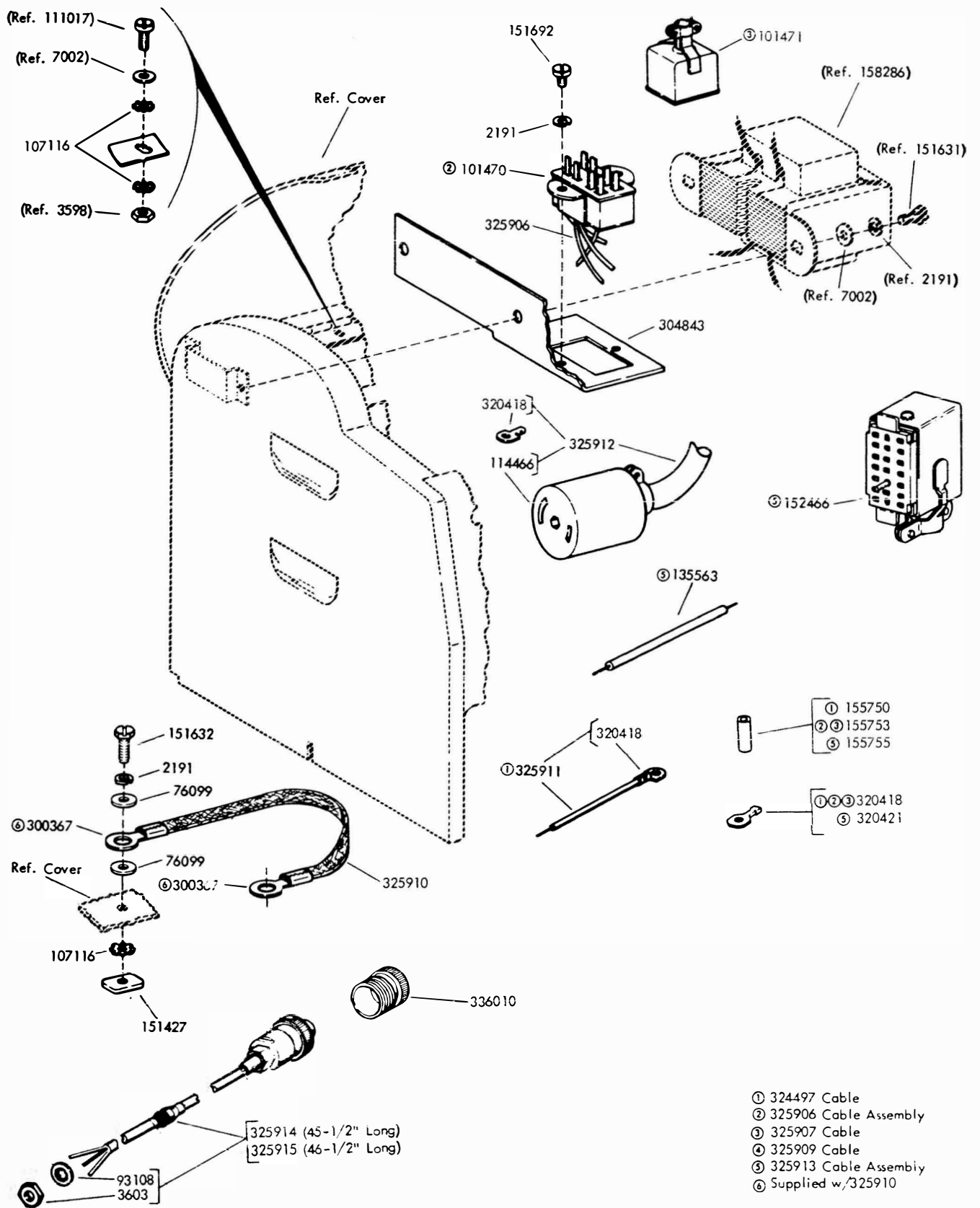


FIGURE 22. COMPONENTS FOR RECEIVE-ONLY AND SEND-RECEIVE SETS

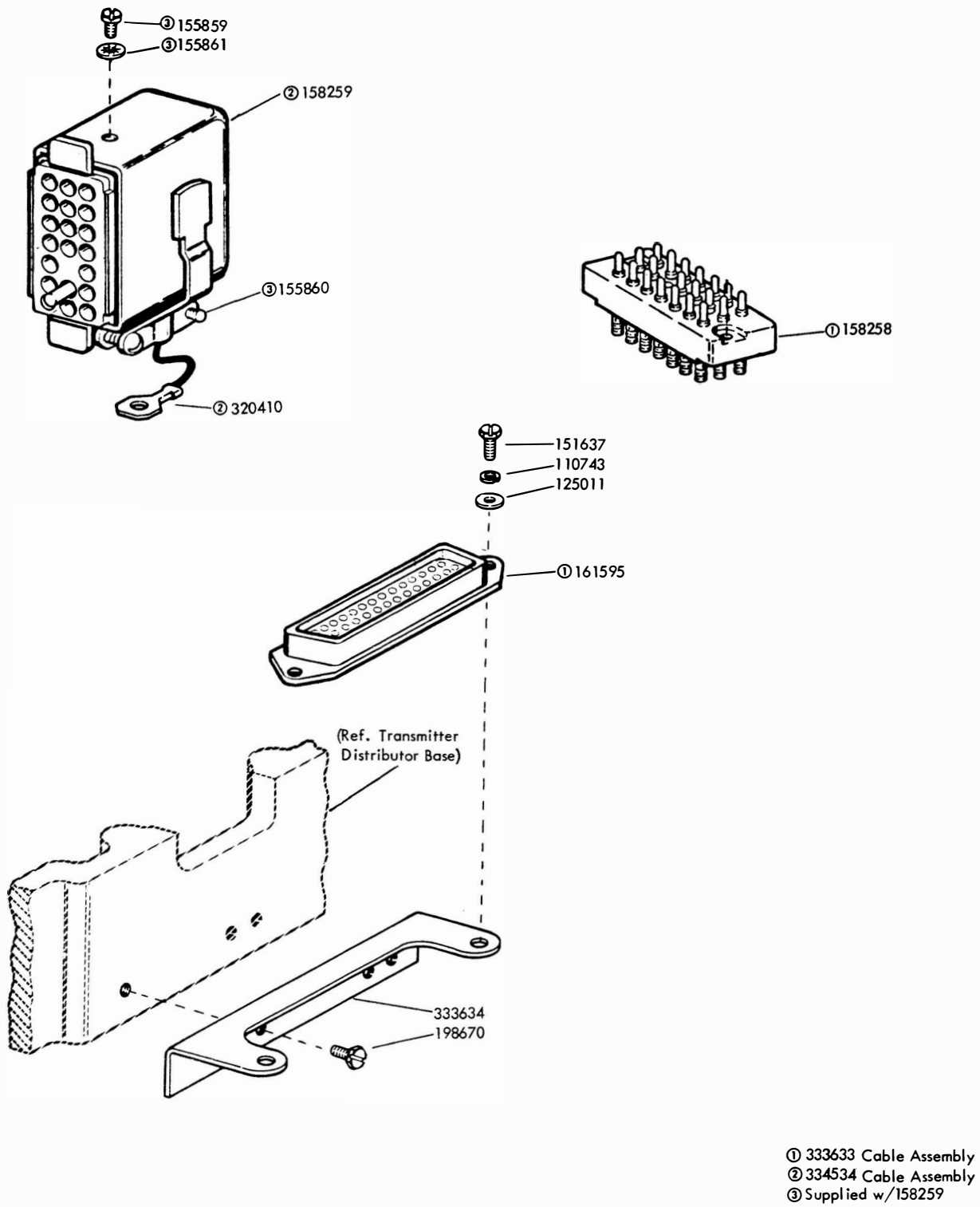
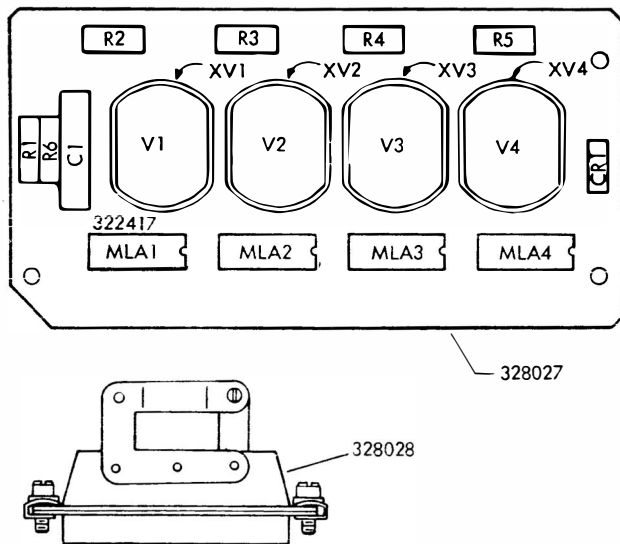
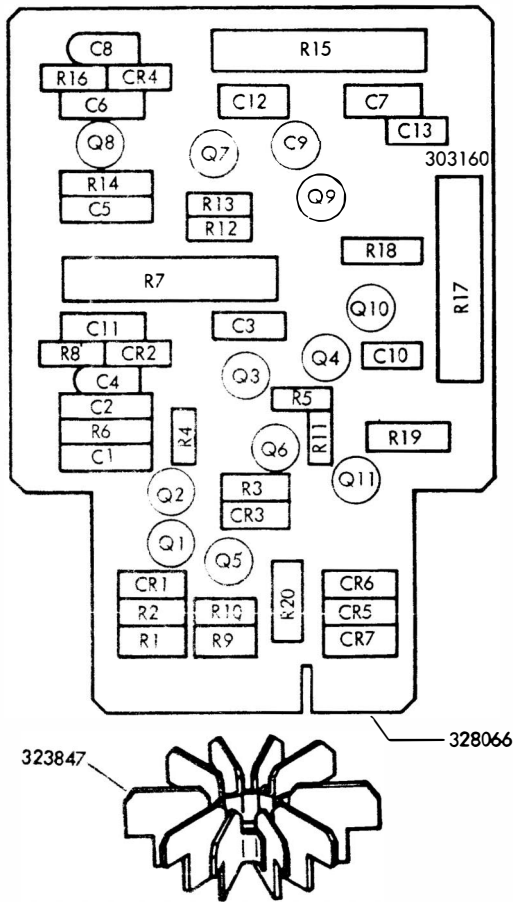


FIGURE 23. COMPONENTS FOR TRANSMITTER-DISTRIBUTOR BASE



Reference Designation	Part No.	Description
R1	137602	Resistor, 470 Ohm
R2, 3, 4&5	118197	Resistor, 47,000 OHM
R6	118169	Resistor, 1 Meg Ohm
C1	327969	Capacitor, .01 MFD
V1, 2, 3&4	328002	Tube, Readout
CR1	181653	Diode, 1N645
XV1, 2, 3&4	328001	Socket, Tube

FIGURE 24. 322417 CIRCUIT CARD w/CABLE



Reference Designation	Part No.	Description
R1, 4, 9 & 12	323148	Resistor, 18,000 Ohm
R2 & 10	330643	Resistor, 56,000 Ohm
R3 & 11	323147	Resistor, 36,000 Ohm
R5 & 13	315955	Resistor, 2200 Ohm
R6 & 14	178863	Resistor, 3300 Ohm
R7, 15 & 17	193229	Resistor, 300 Ohm
R8 & 16	315957	Resistor, 3300 Ohm
R18	118180	Resistor, 10,000 Ohm
R19	120424	Resistor, 4300 Ohm
R20	327793	Resistor, 18 Ohm
C1,2,3,5,6,7,11&12	330593	Capacitor, .02 MFD
C4 & 8	321264	Capacitor, 2.7 MFD
C9, 10 & 13	321157	Capacitor, 500 PF
CR1, 3, 5, & 6	321156	Diode, 1N482A
CR2 & 4	321154	Diode, 1N457A
CR7	321161	Diode
Q1, 2, 5 & 6	315930	Transistor
Q3, 7 & 10	302865	Transistor
Q4 & 8	321261	Transistor
Q9	323844	Transistor
Q11	323845	Transistor



FIGURE 25. 303160 CIRCUIT CARD

Reference Designation	Part No.	Description
R1	330644	Resistor, 390,000 Ohm
R2	118156	Resistor, 56,000 Ohm
R3	330642	Resistor, 1,300,000 Ohm
R4	118166	Resistor, 560,000 Ohm
R5,6,7	118177	Resistor, 22,000 Ohm
R8	137438	Resistor, 100 Ohm
R9	165072	Resistor, 9100 Ohm
R10	137441	Resistor, 1200 Ohm
C1	315976	Capacitor, 470 PF
C2	310926	Capacitor, .15 MFD
C3	312385	Capacitor, .1 MFD
CR1,2	197464	Diode, 1N914
Q1,2	323934	Transistor, 2N3565

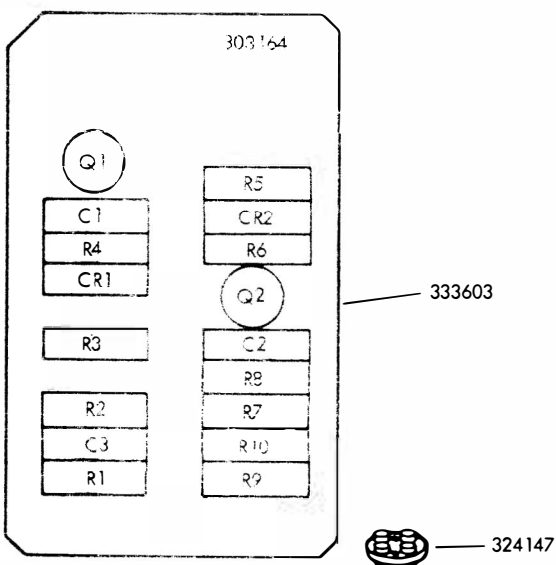
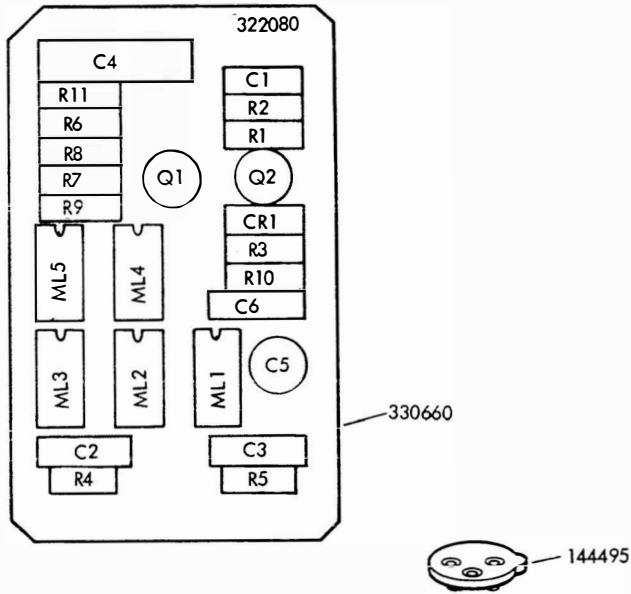
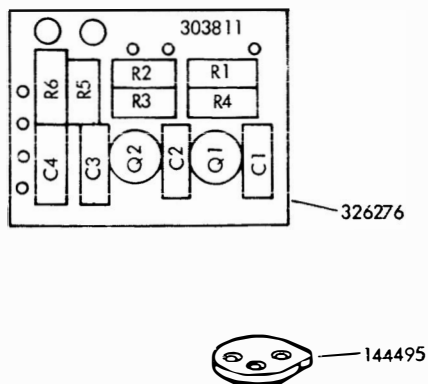


FIGURE 26. 303164 CIRCUIT CARD



Reference Designation	Part No.	Description
R1,2	137441	Resistor, 1,200 Ohm
R3	118153	Resistor, 33,000 Ohm
R4,5,10	129856	Resistor, 150 Ohm
R6	145032	Resistor, 3,900,000 Ohm
R7	118185	Resistor, 3,300,000 Ohm
R8	118189	Resistor, 1,800,000 Ohm
R9	137438	Resistor, 100 Ohm
R11	120120	Resistor, 20,000,000 Ohm
C1	315976	Capacitor, 470 PF
C2,3,6	181618	Capacitor, .01 MFD
C4	320047	Capacitor, 2 MFD
C5	312385	Capacitor, .1 MFD
CR1	197464	Diode, 1N914
Q1	327946	Transistor, D13T2
Q2	315930	Transistor, 2N3568

FIGURE 27. 322080 CIRCUIT CARD



Reference Designation	Part No.	Description
R1,2	315955	Resistor, 2,200 Ohm
R3,4	321545	Resistor, 12,000 Ohm
R5,6	315948	Resistor, 100 Ohm
C1,2,3,4	312385	Capacitor, .1 MFD
Q1,2	315930	Transistor, 2N3568

FIGURE 28. 303811 CIRCUIT CARD

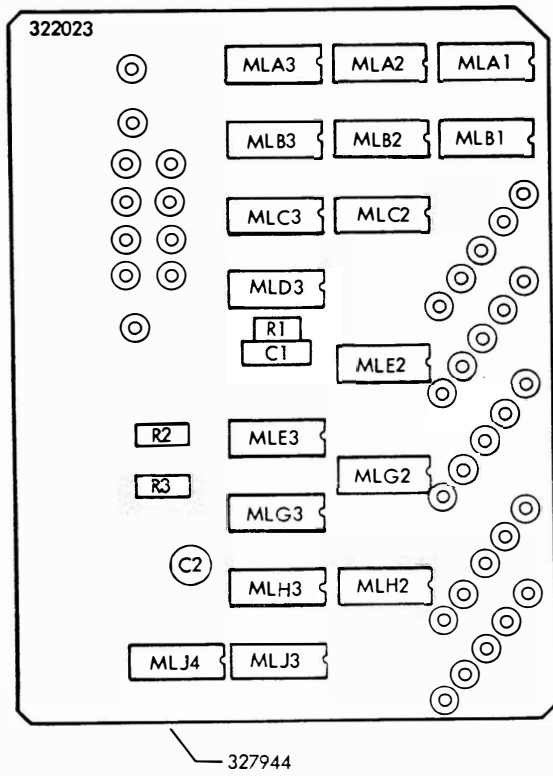


FIGURE 29. 322023 CIRCUIT CARD

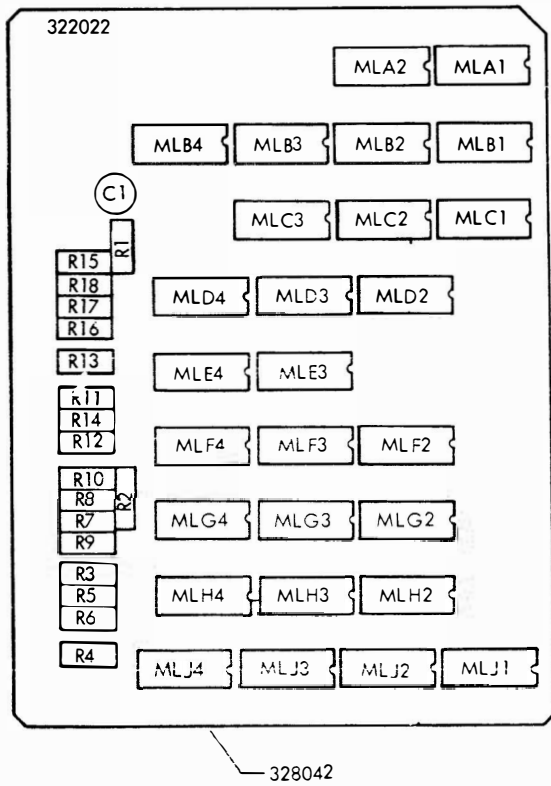
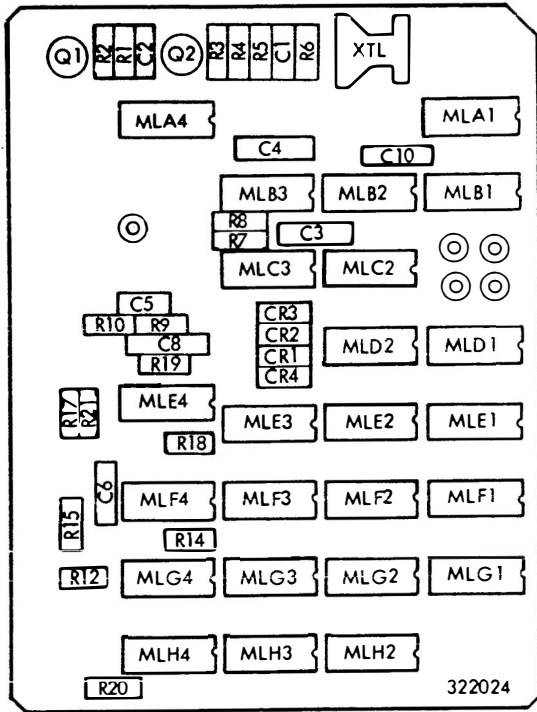


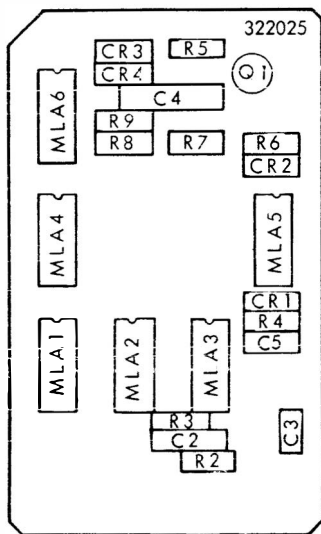
FIGURE 30. 322022 CIRCUIT CARD



328045

FIGURE 31. 322024 CIRCUIT CARD

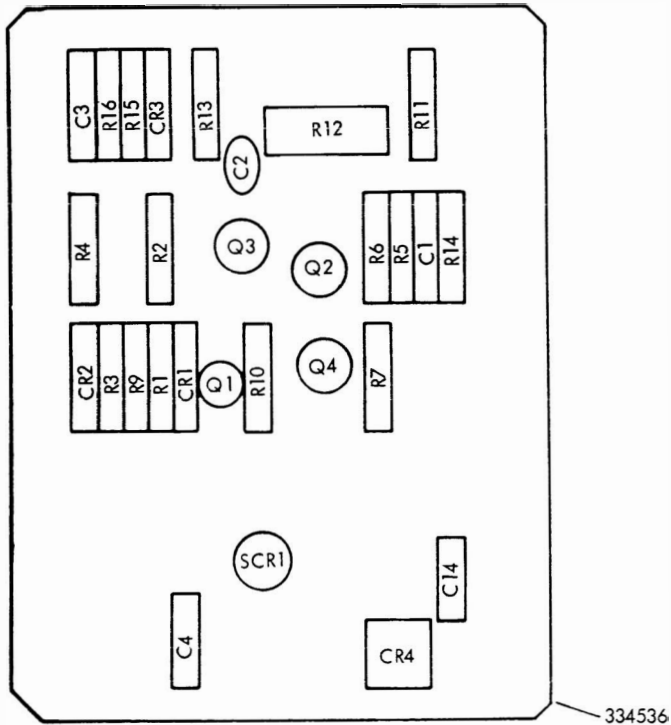
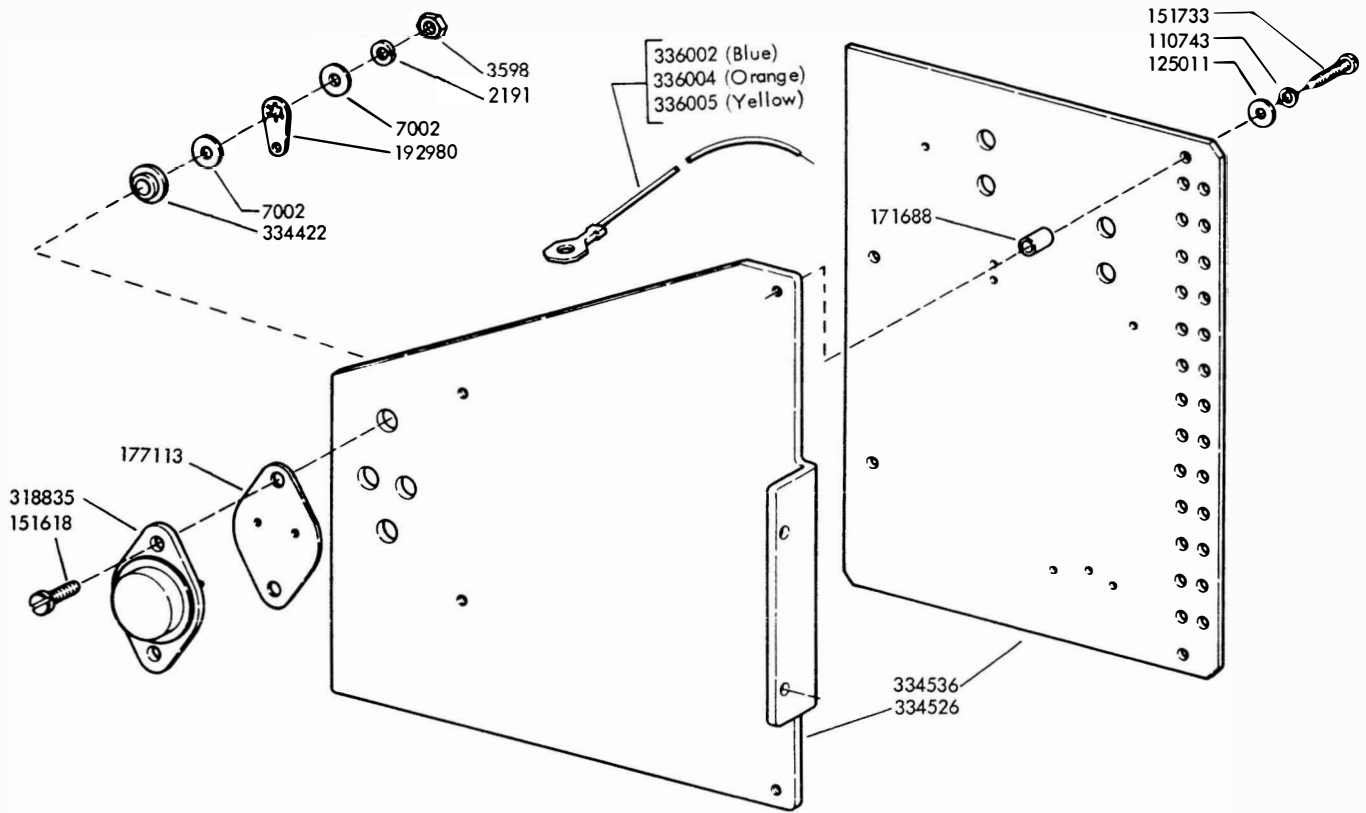
Reference Designation	Part No.	Description
R1, 12, 15, 18 & 20	315956	Resistor , 2700 Ohm
R2	321510	Resistor , 51,000 Ohm
R3	315959	Resistor , 4700 Ohm
R4	315974	Resistor , 300,000 Ohm
R5	315947	Resistor , 51 Ohm
R6	321545	Resistor , 12,000 Ohm
R7, 8, 14 & 19	330640	Resistor , 150 Ohm
R9, 10, 17 & 21	315960	Resistor , 5600 Ohm
C1 & 5	315976	Capacitor , 470 MFD
C2	310926	Capacitor , .15 MFD
C3, 4, 6, & 8	300370	Capacitor , .01 MFD
C10	312385	Capacitor , .1 MFD
CR1, 2, 3 & 4	197464	Diode , 1N914
Q1 & 2	315930	Transistor , 2N3568
	144495	Pad, Transistor Mounting
XTL	328043	Socket, Crystal
	328022	Screw



328050

FIGURE 32. 322025 CIRCUIT CARD

Reference Designation	Part No.	Description
R3, 5 & 9	330640	Resistor , 150 Ohm
R2 & 4	321510	Resistor , 51,000 Ohm
R6	330645	Resistor , 560,000 Ohm
R7	315972	Resistor , 22,000 Ohm
R8	318801	Resistor , 47,000 Ohm
C2	300370	Capacitor , .01 MFD
C3	312385	Capacitor , .1 MFD
C4	320048	Capacitor , .5 MFD
C5	319999	Capacitor , .01 MFD
CR1 & 2	181653	Diode , 1N645
CR3 & 4	197464	Diode , 1N914



Reference Designation	Part No.	Description
R1	182180	Resistor, 200 Ohm
R2, 6, 14	118725	Resistor, 270 Ohm
R3	137601	Resistor, 68 Ohm
R4	321150	Resistor, 549 Ohm
R5, 10, 13, 16	137438	Resistor, 100 Ohm
R7	137441	Resistor, 1200 Ohm
R9	118727	Resistor, 47 Ohm
R11, 15	178861	Resistor, 27 Ohm
R12	300024	Resistor, 100 Ohm
C1, 3, 4	182628	Capacitor, 10 MFD
C2	312385	Capacitor, .1 MFD
C14	194690	Capacitor, 2 MFD
CR1	312922	Diode, 1N4733A
CR2	315894	Diode, 1N4370A
CR2	321135	Diode, 1N4735A
CR4	326292	Diode
SCR1	324662	Rectifier
Q1	321261	Transistor, 2N4036
Q2, 3, 4	321145	Transistor, 2N2270

FIGURE 33. 333620 CIRCUIT CARD

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
1028	Screw, 4-40 x 1/4 FIL 6, 7	118725	Resistor, 270 Ohm 28	155750	Sleeve, 3/32 ID x 1/2" Lg Insulating 16, 21
1248	Screw, 6-40 x 1/2 Flat 18	118727	Resistor, 47 Ohm 28	155751	Sleeve, 1/8 ID x 1" Lg Insulating 16, 19
1253	Screw, 8-32 x 3/8 Rd 3	119743	Grommet, Rubber 9	155753	Sleeve, 1/8 ID x 1/2" Lg Insulating 21
2191	Washer, Lock 7, 10, 11, 13, 14, 16, 18, 19, 20, 21, 28	120120	Resistor, 20 Meg Ohm 25	155755	Sleeve, 11/64 ID x 5/8" Lg Insulating 15, 18, 19, 21
2449	Washer, Lock 17	120139	Fuse, 1 Amp 12	155859	Screw, 4-40 x 3/8 Rd 16, 19, 22
2669	Washer, Lock 11	120175	Plate, On-Off 11	155860	Screw, 4-40 x 3/8 Rd 16, 19, 22
2846	Washer, Flat 11	120424	Resistor, 4,300 Ohm 24	155861	Washer, Lock 16, 19, 22
3595	Nut, 1/4-32 Hex 9	121243	Clamp, 3/16 ID Cable 18	156501	Screw, 6-40 x 7/32 Fil 7
3598	Nut, 6-40 Hex 4, 18, 21, 28	121246	Clamp, 3/8 ID Cable 6, 9	156536	Screw, 4-40 x 1/8 Fil 10
3599	Nut, 4-40 Hex 7, 8	122476	Screw, #6 Self-Tapping 18	156740	Screw, 6-40 x 7/32 Hex 7
3603	Nut, 1/4-32 Hex 21	124177	Washer, Lock 12	156777	Jumper, 2" Block 12
3639	Washer, Lock 3	125011	Washer, Flat 8, 10, 12, 22, 28	157393	Grommet, Rubber 16, 19
3640	Washer, Lock 7, 8, 20	125098	Nut, Lock 9	157399	Connector, 3.5 Pt Receptacle 16, 19
3646	Washer, Lock 15	125130	Screw, 6-32 x 1/2 Fil 16, 19	157992	Bracket 16, 19
3649	Washer, Flat 12	125139	Screw, 4-40 x 1/8 Fil 16, 19	157993	Bracket 16, 19
3650	Washer, Flat 7	125186	Screw, 8-32 x 3/4 Fil 15	158201	Stud 17
6345	Nut, 6-32 Hex 10	125218	Nut, 1/4-32 Hex 17	158258	Connector, 20 Pt Plug 22
7001	Washer, Flat 10	125229	Nut, 6-32 Hex 20	158259	Connector, 20 Pt Receptacle 16, 22
7002	Washer, Flat 10, 11, 13, 14, 18, 20, 21, 28	125231	Nut, 10-32 Hex 3	158286	Transformer 21
34432	Washer, Flat 15	128357	Ring, Retaining 4	158679	Rail, Front Base 17
44048	Washer, Flat 3, 4, 6	129098	Screw, 6-40 x 11/32 Flat 18	158989	Capacitor, 20 MFD 15
45944	Screw, 8-32 x 5/8 Rd 15	129856	Resistor, 150 Ohm 25	158990	Bracket, Mounting 15
49514	Nut, 8-32 Hex 15	135563	Jumper, 2-3/4" Green 16, 19, 21	158991	Capacitor, 15 MFD 15
70314	Washer, Flat 18	137438	Resistor, 100 Ohm 24, 25, 28	158992	Bracket, Mounting 15
71858	Washer, Flat 17	137441	Resistor, 1,200 Ohm 24, 25, 28	159541	Connector, 16 Pt Plug 16
73175	Washer, Lock 5	137601	Resistor, 68 Ohm 28	161087	Insulator, Terminal Block 11, 12
76099	Washer, Flat 21	137602	Resistor, 470 Ohm 23	161592	Plate w/Studs 2
79890	Screw, 1/4-32 x 7/8 Hex 17	144495	Pod, Transistor Mounting 24, 25, 27	161595	Connector, 3.6 Pt Receptacle 22
80121	Shim, .095" Thk 9	145032	Resistor, 3.9 Meg Ohm 25	162360	Fuse, SL-BL .8 Amp 11
80709	Screw, 6-40 x 1/4 Rd 18	145913	Connector, 25 Pt Receptacle Type 7	165072	Resistor, 9,100 Ohm 24
91683	Nut, 15/32-32 Hex 11	145914	Connector, 25 Pt Plug Type 8	171688	Bushing, .265" Thk 28
92260	Washer, Lock 7, 20	145915	Clamp, Cable 8	173706	Modification Kit 1, 15
93108	Washer, Lock 21	146542	Post, Assembly 7	173707	Modification Kit 1, 15
99082	Screw, 8-32 x 11/16 Hex 3, 4, 6	148440	Connector, 36 Pt Circuit Card 7	173708	Cable, w/Terminals 15
93108	Connector, 8 Pt Plug 21	148473	Guide, Circuit Card 7	173709	Cable, w/Terminals 15
101470	Connector, 8 Pt Receptacle 21	150040	Screw, 6-40 x 5/8 Fil 10	173786	Plate, Mounting 15
101471	Connector, 8 Pt Receptacle 21	150089	Screw, 4-40 x 1/2 Fil 12	173787	Plate, Mounting 15
103241	Block, Terminal 11	151427	Plate, Clamp 21	173974	Screw, 10-32 x 5/16 Hex 11
104451	Washer, Lock 9	151618	Screw, 6-40 x 7/16 Fil 10, 12, 28	177113	Insulator 28
104701	Screw, 4-40 x 9/32 Fil 16, 19	151629	Nut, 6-40 Lug 10	178861	Resistor, 27 Ohm 28
104807	Washer, Flat 7	151630	Screw, 6-40 x 1/4 Hex 13, 14	178863	Resistor, 3, 300 Ohm 24
107116	Washer, Lock 7, 11, 18, 21	151631	Screw, 6-40 x 5/16 Hex 21	181618	Capacitor, .01 MFD 25
108953	Connector, 3 Pt Receptacle 18	151632	Screw, 6-40 x 3/8 Hex 21	181653	Diode 23, 27
110435	Nut, 4-40 Hex 7	151637	Screw, 4-40 x 1/4 Fil 22	181709	Holder, Fuse 12
110743	Washer, Lock 6, 7, 8, 9, 10, 12, 22, 28	151659	Screw, 6-40 x 1/2 Fil 10	182180	Resistor, 200 Ohm 28
111017	Screw, 6-40 x 5/16 Fil 18, 21	151687	Screw, 4-40 x 7/16 Fil 7	182523	Clamp, 1-3/8" ID Mounting 10
111284	Block, Terminal 12	151689	Screw, 4-40 x 3/4 Fil 7	182531	Clip, Speed 18
112801	Stud 11	151692	Screw, 6-40 x 3/16 Fil 21	182628	Capacitor, 10 MFD 28
114466	Connector, 3 Pt Receptacle 21	151722	Screw, 6-40 x 3/16 Hex 11, 20	183220	Bumper 10
114478	Nut, 10-32-32 Hex 11	151733	Screw, 4-40 x 9/16 Fil 28	192538	Plug, Button 20
115593	Screw, 10-32 Self-Tapping 3	151735	Screw, 4-40 x 5/16 Hex 10, 12	192980	Lug, Terminal 28
115594	Nut, Speed 15	151880	Nut, 4-40 Hex 16	193229	Resistor, 300 Ohm 24
116783	Holder, Fuse 11, 12	151926	Nut, 4-40 Spl 8	193942	Fan, Assembly 18
117535	Washer, Flat 3	152466	Connector, 21 Pt Receptacle 16, 19, 21	194690	Capacitor, 2 MFD 28
117608	Nut, Speed 20	152755	Strap, Terminal 12	195659	Jumper, 3" Black 6
118153	Resistor, 33,000 Ohm 25	152853	Screw, 4-40 x 1/4 Hex 8, 9, 20	196930	Grille 18
118156	Resistor, 56,000 Ohm 24	153492	Connector, 3 Pt Plug 18	196931	Clip 18
118166	Resistor, 56 Meg Ohm 24	153539	Screw, 6-40 x 11/16 Hex 14	197464	Diode 24, 25, 27
118169	Resistor, 1.0 Meg Ohm 23	155023	Switch, DP-DT Toggle 11	198092	Fan 18
118177	Resistor, 22,000 Ohm 24	155614	Cover 16, 19	198561	Bracket, Transformer 20
118180	Resistor, 10,000 Ohm 24				
118185	Resistor, 33,000 Ohm 25				
118189	Resistor, 1.8 Meg Ohm 25				
118197	Resistor, 47,000 Ohm 23				

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
198650	Key Polarizing 10	322023	Card, Circuit 1, 7, 26	326778	Strap, 5" 16, 19
198670	Screw w/Lockwasher 6-40 x 5/16 Hex 3, 4, 5, 6, 8, 9, 10, 11, 22	322024	Card, Circuit 1, 7, 27	326783	Cable Assembly 19
300024	Resistor, 100 Ohm 28	322025	Card, Circuit 1, 7, 27	327444	Capacitor, 2 MFD 11
300367	Terminal, Ring Type 21	322080	Card, Circuit 1, 2, 25	327793	Resistor, 18 Ohm 24
300370	Capacitor, .01 MFD 27	322417	Card, Circuit 1, 8, 23	327944	Card, Circuit 26
302724	Clamp, Capacitor 10	323147	Resistor, 36,000 Ohm 24	327945	Decalcomania 7
302865	Transistor 24	323148	Resistor, 18,000 Ohm 24	327946	Transistor 25
303160	Card, Circuit 1, 2, 24	323844	Transistor 24	327969	Capacitor, .01 MFD 23
303164	Card, Circuit 1, 2, 24	323845	Transistor 24	327992	Transformer 11
303811	Card, Circuit 1, 2, 10, 25	323847	Sink, Heat 24	327994	Capacitor, 220 MFD 10
304843	Bracket, Connector 21	323849	Coil, 132 Ohm 5	328000	Module 7
305150	Block, Terminal 10	323934	Transistor 24	328001	Socket, Tube 23
310729	Filter, Air 18	323960	Spacer 10	328002	Tube, Readout 23
310730	Support, Filter 18	324142	Connector, 3 Pt Plug 9	328003	Crystal 2, 7
310926	Capacitor, 15 MFD 24, 27	324147	Pad, Transistor Mounting 24	328004	Crystal 2, 7
311056	Grommet, Rubber 19	324149	Modification Kit 1, 13, 14	328005	Crystal 2, 7
311527	Clamp, Cable 16, 19	324150	Container 13	328006	Crystal 2, 7
312385	Capacitor, .1 MFD 6, 24, 25, 26, 27, 28	324151	Cover 13	328007	Crystal 2, 7
312922	Diode 6, 28	324156	Cable Assembly 16	328010	Module 2, 7
315894	Diode 28	324157	Cable Assembly 16	328011	Cable Assembly 7
315930	Transistor 24, 25, 27	324158	Cable Assembly 16	328014	Frame, Inner 7
315939	Capacitor, .002 MFD 26	324159	Cable Assembly 16	328015	Switch, Pushbutton 8
315947	Resistor, 51 Ohm 27	324497	Cable Assembly 21	328016	Switch, SP-DT Toggle 8
315948	Resistor, 100 Ohm 25	324662	Rectifier 28	328017	Plate Assembly, Front 1, 8
315955	Resistor, 2,200 Ohm 24, 25, 26	324677	Modification Kit 1, 18	328018	Window, Polarized 8
315956	Resistor, 2,700 Ohm 27	324678**	Panel, Lower Right 19	328019	Screen 8
315957	Resistor, 3,300 Ohm 24	324679	Bracket, Mounting 18	328020	Label 8
315959	Resistor, 4,700 Ohm 26, 27	324680	Bracket, Mounting 18	328021	Frame, Window 8
315960	Resistor, 5,600 Ohm 27	324681	Cable Assembly 2	328022	Screw w/Washer, 2-56 Spl 7, 27
315972	Resistor, 22,000 Ohm 27	324695	Cable Assembly 16	328024	Cable Assembly 8
315974	Resistor, 300,000 Ohm 27	325906	Cable Assembly 21	328025	Cable Assembly 7
315976	Capacitor, 470 PF 24, 25, 27	325907	Cable Assembly 21	328027	Card, Circuit 23
318801	Resistor, 47,000 Ohm 27	325909	Cable w/Terminals 21	328028	Cable Assembly 8, 23
318815	Capacitor, 5,500 MFD 10	325910	Strap, 10-1/2" Lg 21	328029	Bracket 8
318835	Transistor 28	325911	Jumper, 6-1/2" Lg Green 21	328030	Connector, 16 Pt Plug Type 7
319088	Block, Terminal 12	325912	Cable Assembly 21	328031	Connector, 16 Pt Receptacle Type 6
319089	Insulator, Terminal Board 12	325913	Cable Assembly 21	328042	Card, Circuit 26
319999	Capacitor, .01 MFD 27	324914	Cable Assembly 21	328043	Socket, Crystal 27
320047	Capacitor, 2 MFD 25	325915	Cable Assembly 21	328045	Card, Circuit 27
320048	Capacitor, .5 MFD 27	325937	Connector, 1/2" ID 9, 14	328047	Bracket, Front 8
320410	Terminal, Spade Type 5, 19, 15, 16, 19, 22	325938	Connector, 3/4" 90 Degree 13, 14	328050	Card, Circuit 27
320416	Terminal, Ring Type 6, 10, 11, 16	325939	Connector, 1/2 ID 90 Degree 5, 9, 14	328053	Nut, Toggle 3, 6
320418	Terminal, Ring Type 6, 7, 10, 12, 16, 18, 19, 21	325940	Connector, 1/2 ID 45 Degree 14	328066	Card, Circuit 24
320421	Terminal, Ring Type 16, 19, 21	325941	Conduit, 3/4 ID x 7" Lg 13	329078	Choke 6, 7
321133	Inductor 11	325942	Conduit, 1/2 ID x 7-1/2" Lg 14	329266	Lamp 20
321135	Diode 28	325943	Conduit, 1/2 ID x 18" Lg 14	330515	Rail, Left 17
321145	Transistor 28	325944	Nipple 13, 14	330521**	Cabinet 17
321150	Resistor, 549 Ohm 28	325953	Container 14	330522	Pad, Base 17
321154	Diode 24	325954	Cover 14	330593	Capacitor, .02 MFD 24
321156	Diode 24	325955	Spacer 13, 14	330640	Resistor, 150 Ohm 26, 27
321157	Capacitor, 500 PF 24	325956	Connector, 3/4 ID 13	330642	Resistor, 1.3 Meg Ohm 24
321161	Diode 24	325957	Nut, 1/2-14 Lock 13, 14	330643	Resistor, 56,000 Ohm 24
321201	Screw, 1/4-20 x 1/2 Fil 10	325958	Insulator, Terminal Block 14	330644	Resistor, 390,000 Ohm 24
321207	Strip, Terminal 11	325959	Insulator, Terminal Block 14	330645	Resistor, 560,000 Ohm 27
321248	Cable Assembly 9	325960	Block, Terminal 14	330650	Module, Numbering 1, 7, 8
321261	Transistor 24, 28	325961	Block, Terminal 14	330660	Card, Circuit 25
321264	Capacitor, 2.7 MFD 24	325971	Bracket, Connector 20	330666	Fastener, Wing Type 5
321510	Resistor, 51,000 Ohm 26, 27	326270	Connector, 15 Pt Circuit Card 10	333053	Fuse, 1/16 Amp 12
321545	Resistor, 12,000 Ohm 25, 27	326276	Card, Circuit 25	333140	Holder 20
322022	Card, Circuit 1, 7, 26	326292	Diode 28	333601**	Enclosure, Module 2, 3, 4, 5
		326293	Resistor, 22 Ohm 5	333602	Cable Assembly 6
		326350	Box Assembly, Power 14	333603	Card, Circuit 24
		326373	Cable Assembly 18	333605	Supply Assembly, Power 1, 2, 9, 10, 11, 12
		326760	Cable Assembly 18	333606**	Plate, Front 5
		326771	Cable Assembly 19	333609**	Bracket 3

**Refer to page 1 for finish suffix

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
333610	Plate Assembly 1, 12	333634	Bracket 2, 22	334536	Card, Circuit 28
333611	Plate, Mounting 9	334178	Reducer 9	334537	Jumper, 8" 10
333614**	Panel, Left Lower 4	334179	Conduit, 5/8 ID x 28" Lg 9	334541**	Modification Kit 2
333615**	Bracket 3	334180	Conduit, 5/8 ID x 21" Lg 5	334542**	Modification Kit 2
333616	Chassis 6	334182	Cable w/Terminal 11	334543**	Modification Kit 2
333617**	Container 3, 4, 5, 6	334183	Relay 5	334544**	Modification Kit 2
333618**	Cover, Rear 5	334185	Cable w/Terminal 11	334545**	Modification Kit 2
333619**	Bracket 4	334186	Label 9	336002	Jumper, 6-1/2" Blue 28
333620	Card, Circuit 1, 10, 28	334422	Bushing 28	336004	Jumper, 6-1/2" Orange 28
333621	Plate Assembly 1, 11	334526	Sink, Heat 28	336005	Jumper, 6-1/2" Yellow 28
333622	Cable Assembly 5, 6, 9	334527	Plate 12	336010	Cap, Protective 2, 21
333623	Container, Inner 10	334528	Bracket 11	336011**	Enclosure & Power Supply 1, 3, 5, 9
333625	Container, Outer 9, 10, 11	334531	Bracket, Door 4	336014**	Modification Kit 2
333627	Cover, Outer 9	334532	Plate, Mounting 5	336015**	Modification Kit 2
333628	Shaft 4	334533	Cable Assembly 5	336016**	Modification Kit 2
333630	Cable Assembly 10	334534	Cable Assembly 22	336017	Modification Kit 2
333631	Cable Assembly 9	334535	Insulator, Terminal Block 10	336018**	Modification Kit 2
333633	Cable Assembly 2, 22				

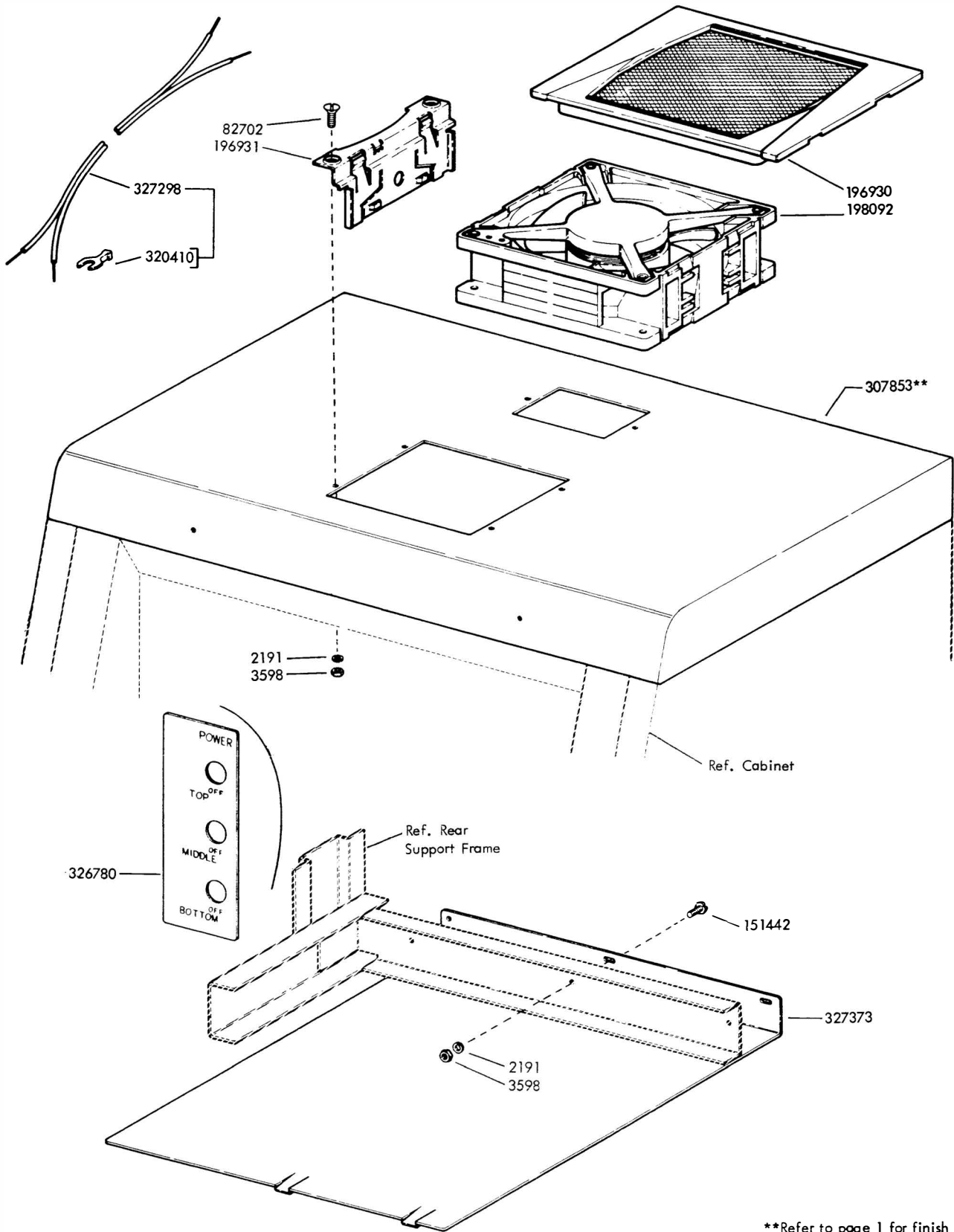
**Refer to page 1 for finish suffix

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
FEATURES FOR LOW LEVEL SETS
28 MULTI-PAGE PRINTER CABINET
PARTS

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2	326727 and 326730 Intermediate Gear Assemblies	3	11	Power Container (3 Drawer Cabinet)	12
3	146901 Rectifier Assembly	4	12	Circuit Magnet Driver Mounting Component, (3 Drawer Cabinet)	13
4	305143 Rectifier Assembly	5	13	Power Container (4 Drawer Cabinet)	14
5	323821 Electrical Service Assembly	6	14	321991 Circuit Magnet Driver Assembly	15
6	323821 Electrical Service Assembly (Continued)	7	15	323810 Circuit Card - Selector Magnet Driver	16
7	323822 Electrical Service Assembly	8	16	303142 Circuit Card	17
8	323822 Electrical Service Assembly (Continued)	9	17	321132 Circuit Card	17
9	321228 Electrical Service Assembly	10	18	Cable Components	18
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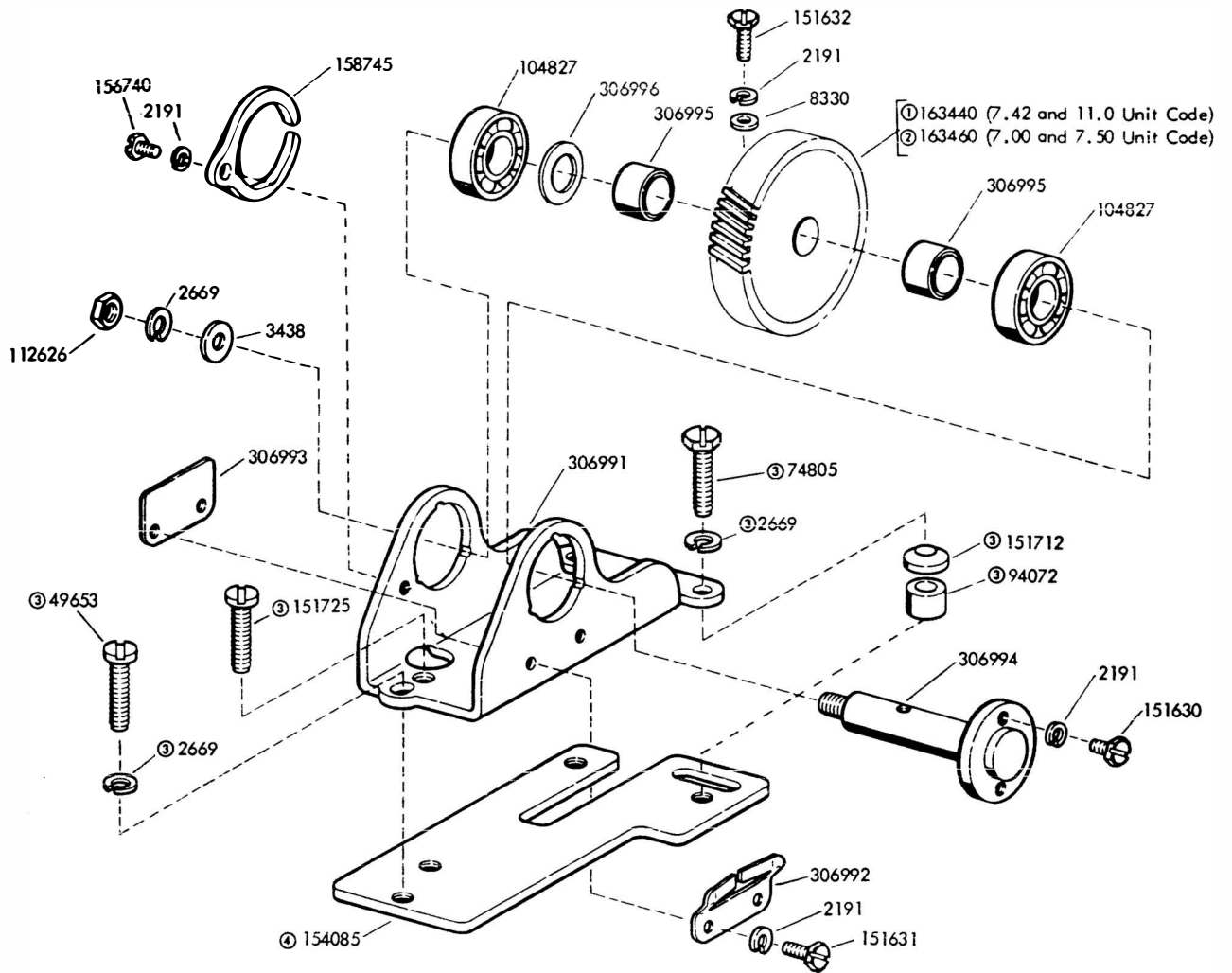
PAINT FINISH COLOR CODE CHART (For parts and assemblies requiring a paint finish)									
COLOR	Finish Suffix				COLOR	Finish Suffix			
	Wrinkle Finish	Smooth Finish	Textured Vinyl	Smooth Vinyl		Wrinkle Finish	Smooth Finish	Textured Vinyl	Smooth Vinyl
Aluminum		FA			Gray, Dark Metallic		BW		
Aqua, Light				HK	Gray, Federal		BV	GG	
Beige		ET			Gray, Light		EJ		HB
Beige, Light		EL		HC	Gray, Light Olive		EW	GE	HF
Beige, Rose		ER			Gray, Maritime Engine		BY		
Black	AA		GK		Gray, Maritime Deck	AJ	BJ		
Black, High Gloss		BA			Gray, Medium		BS		
Black, Semi Gloss		BB			Gray, Oxford		EP		
Blue, Aqua		EK			Green, Gray	AB	BK	GA	
Blue, Brussels Light		EC			Green, Moss		EN		HD
Blue, Medium		ES			Ivory		EM		HJ
Brown, Dark	AD				Pink, Rose		EU		
Brown, Light	AC				Red, Cherry		EF		
Brown, Mahogany		EQ		HG	Turquoise		EV		
Fawn					White		EH		
Gray, Beige			GC	HA	Yellow, Pastel		EG		
Gray, Charcoal	AL	BZ	GF						
Gray, Dark			GB	HE					
Gray, Dark Covert		FC							
Gray, Navy Light		BR							

The double asterisk (**) denotes a painted part. Suffix to be applied following the part number.



**Refer to page 1 for finish suffix

FIGURE 1. FAN AND DUST PLATE



- ① Peculiar to 326727
- ② Peculiar to 326730
- ③ Not part of 326727 and 326730

FIGURE 2. 326727 AND 326730 INTERMEDIATE GEAR ASSEMBLIES

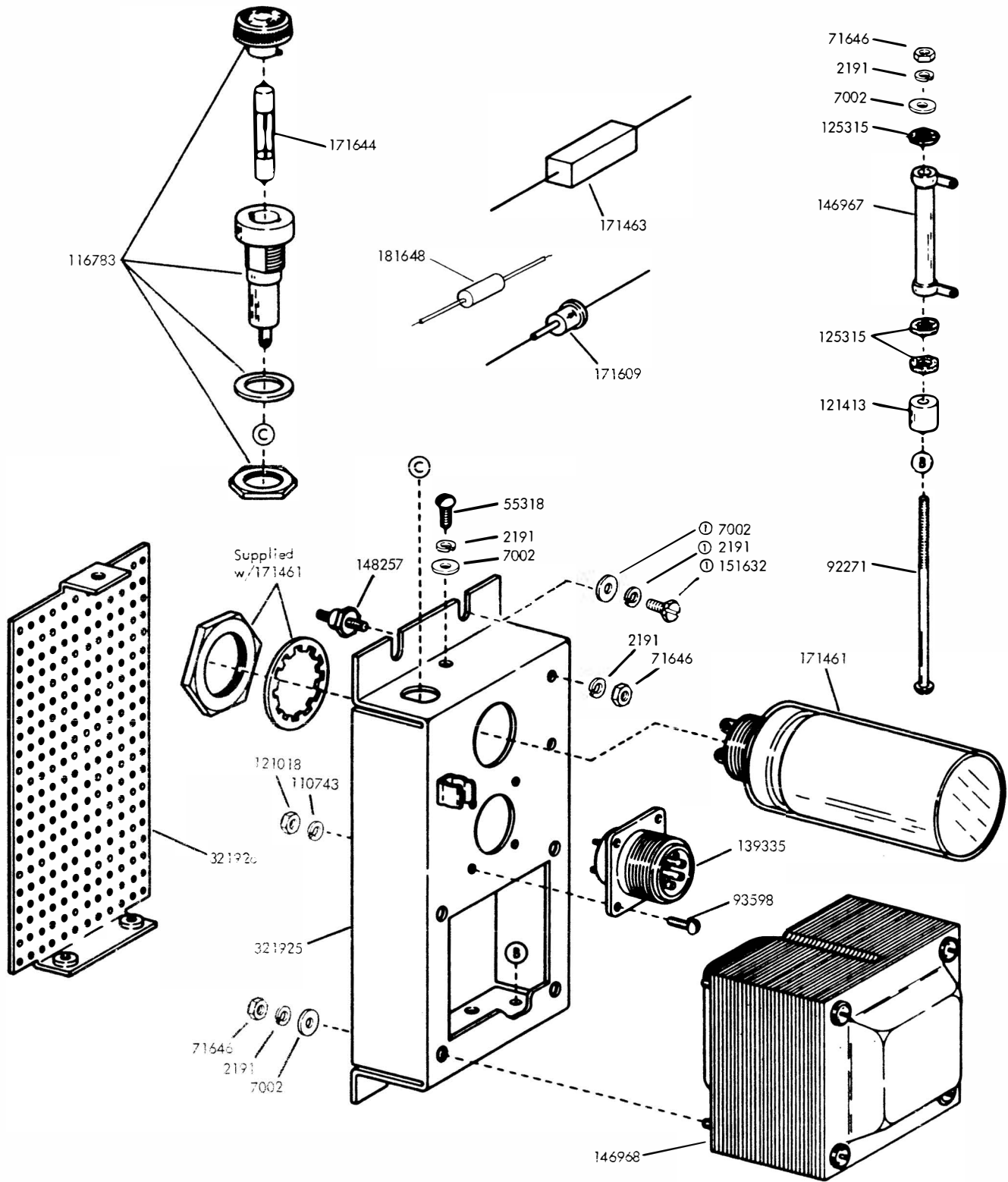


FIGURE 3. 146901 RECTIFIER ASSEMBLY

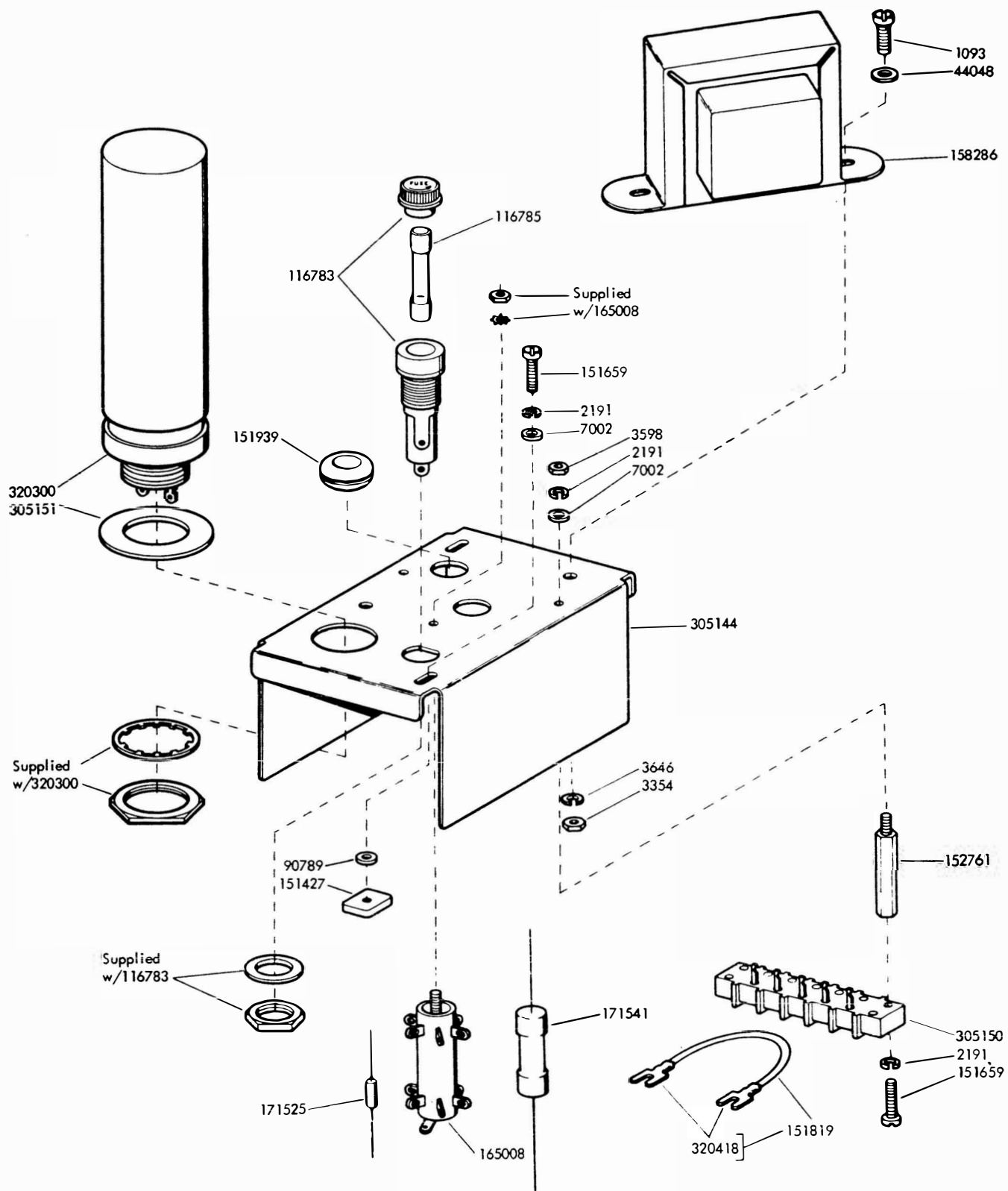


FIGURE 4. 305143 RECTIFIER ASSEMBLY

SECTION 573-612-801TC

Cable No.	A	B
327294	140"	11.5"
327295	135"	12.75"
327296	130"	14.5"
321252	122"	18"

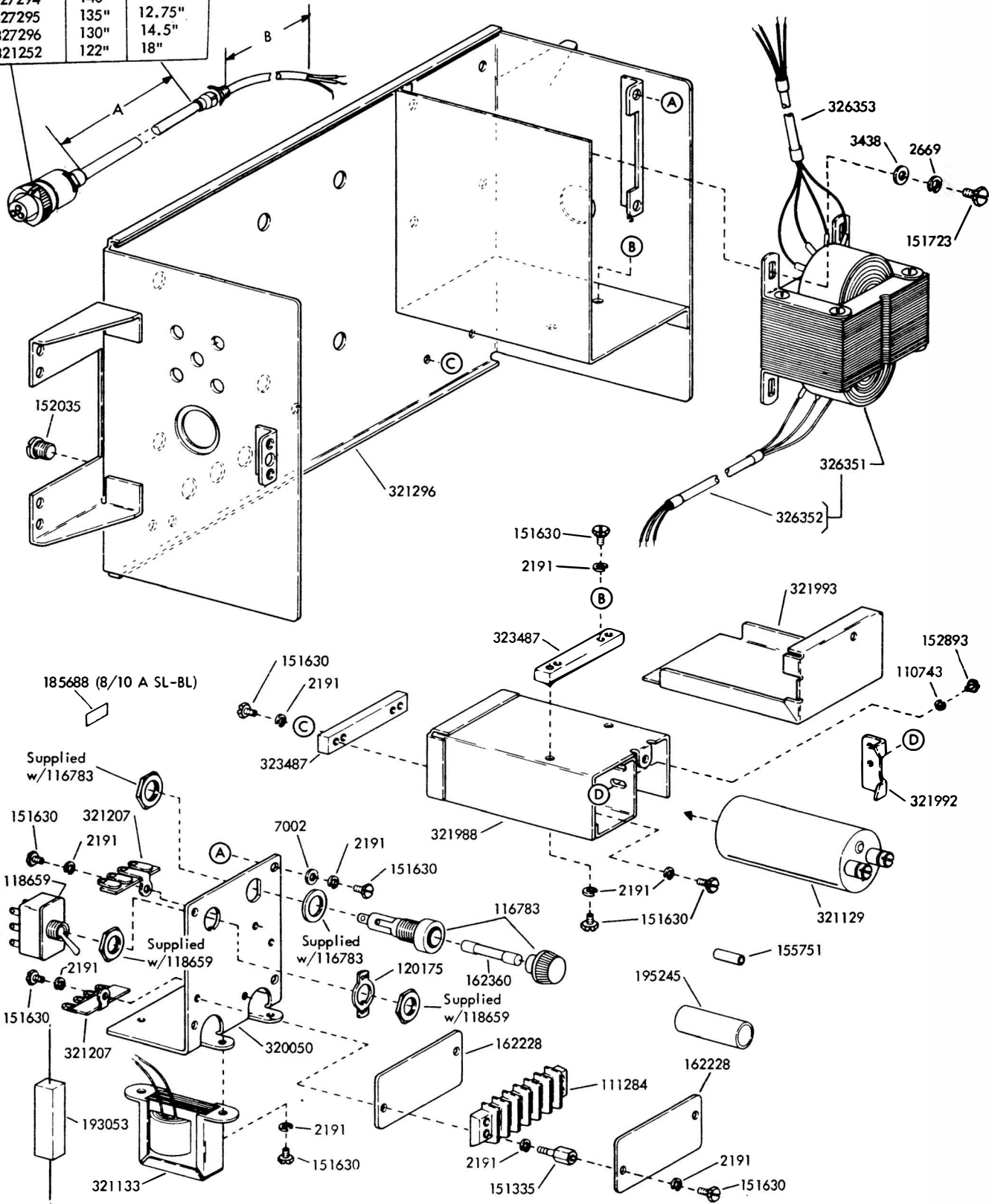


FIGURE 5. 323821 ELECTRICAL SERVICE ASSEMBLY

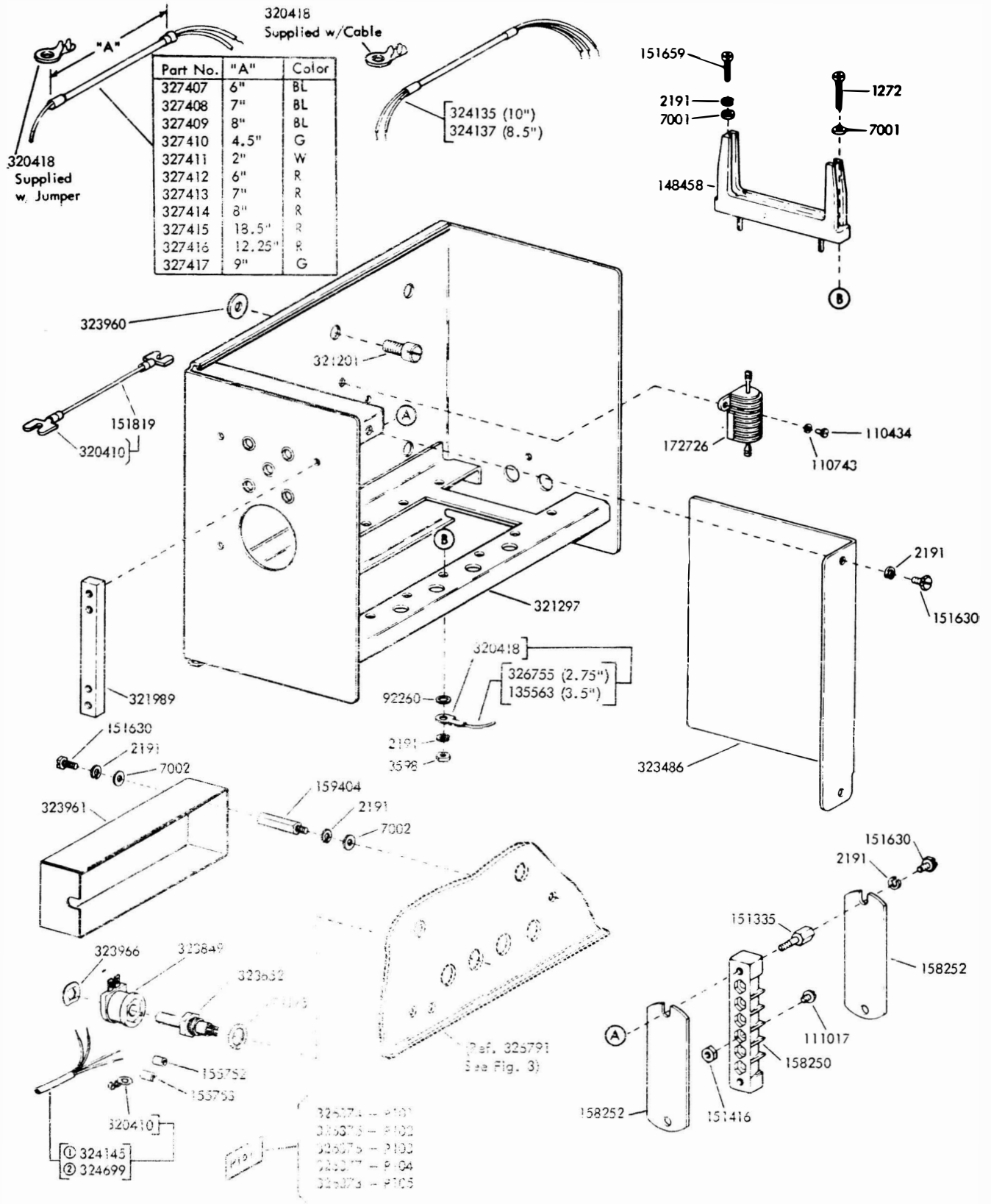


FIGURE 6. 323821 ELECTRICAL SERVICE ASSEMBLY (Continued)

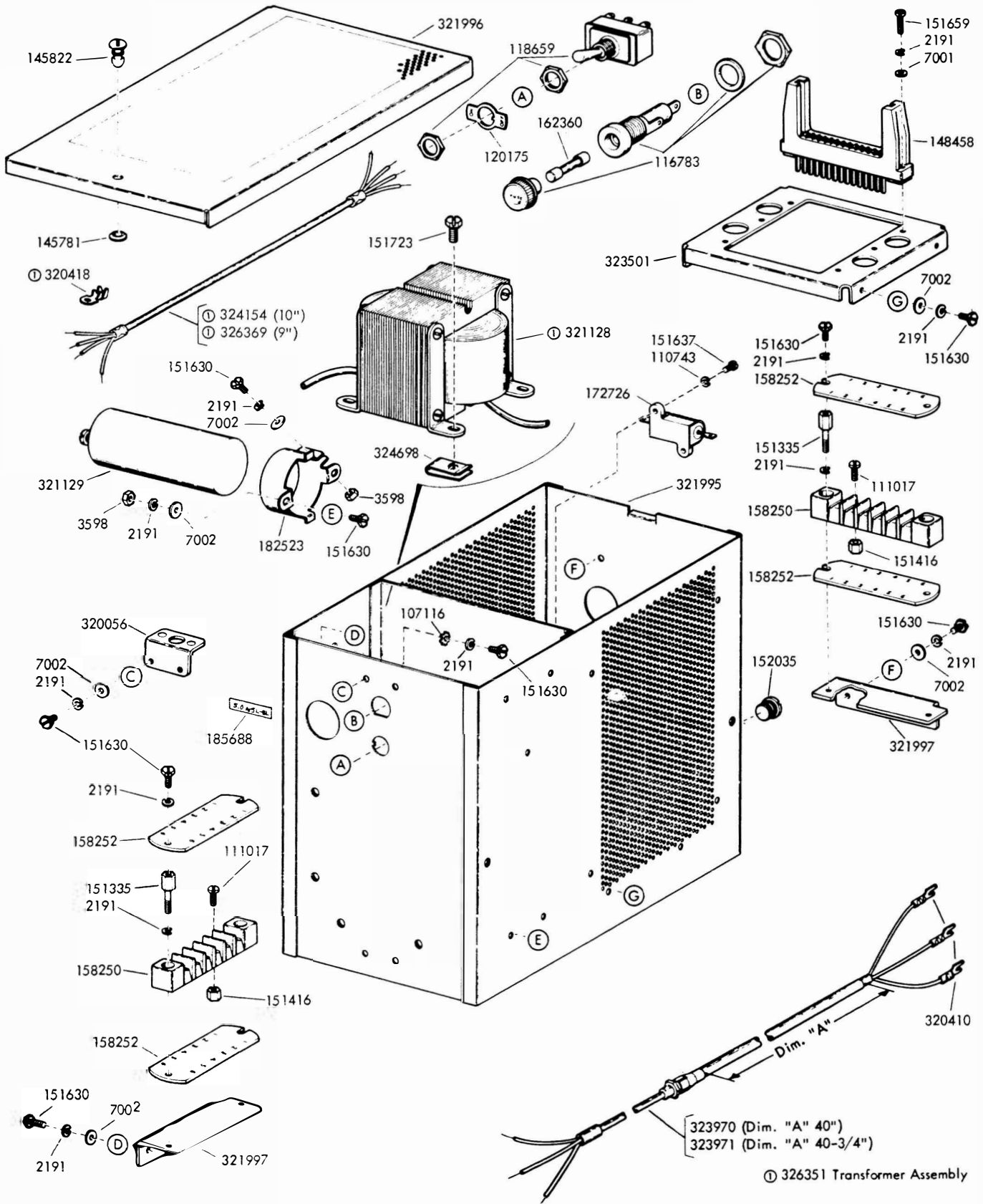
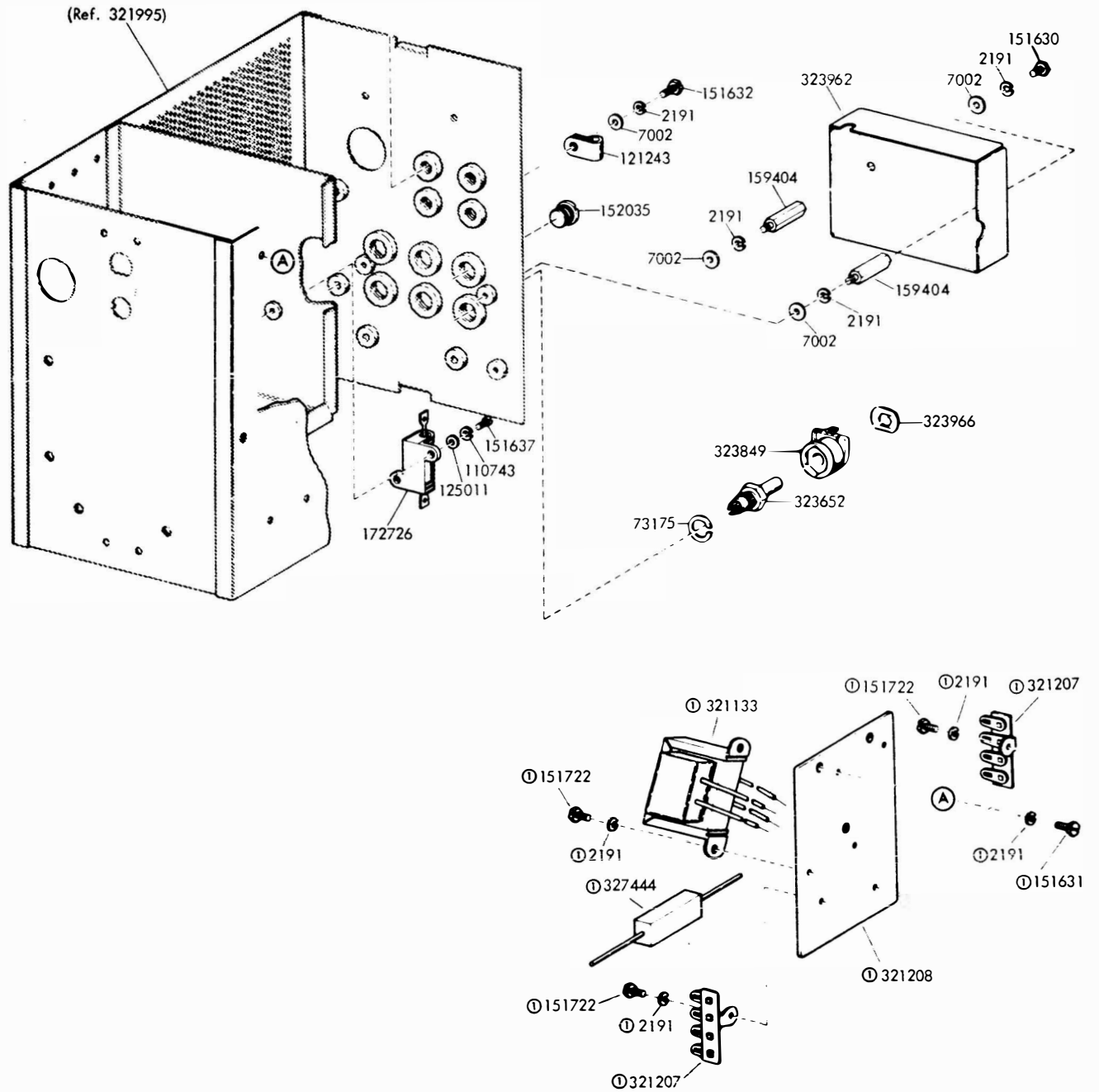


FIGURE 7. 323822 ELECTRICAL SERVICE ASSEMBLY



ⓐ Part of 321205 Filter Assembly

FIGURE 8. 323822 ELECTRICAL SERVICE ASSEMBLY (Continued)

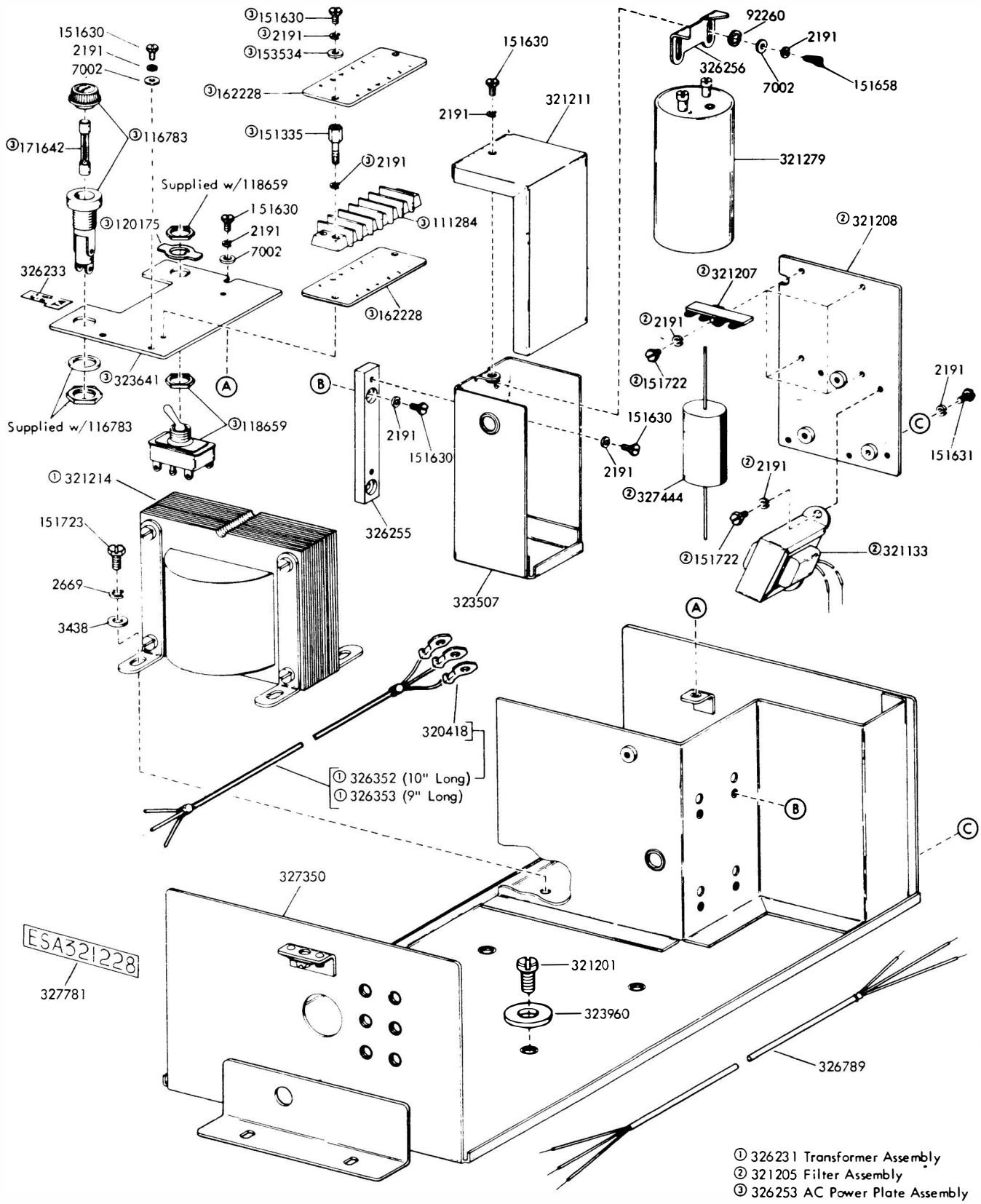


FIGURE 9. 321228 ELECTRICAL SERVICE ASSEMBLY

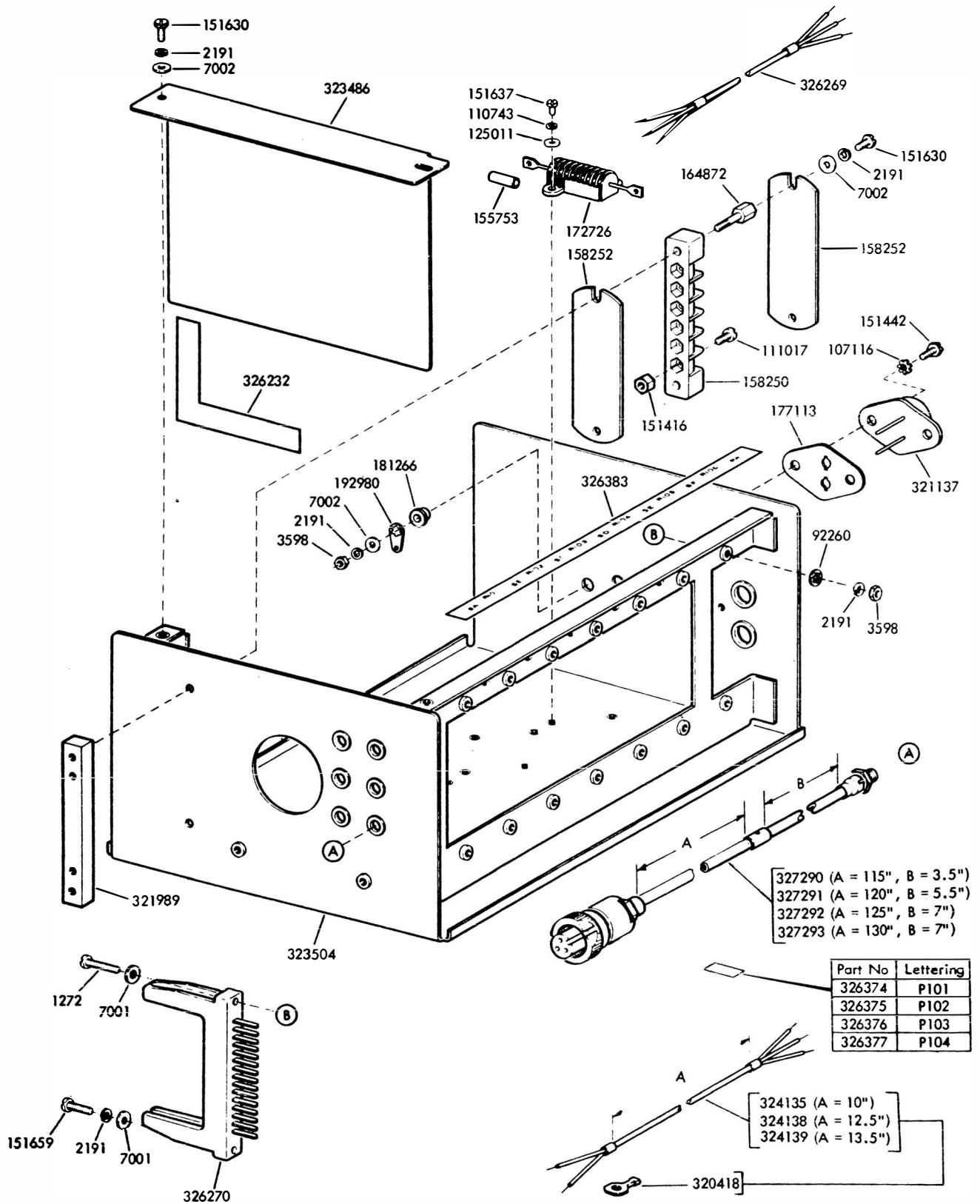


FIGURE 10. 321228 ELECTRICAL SERVICE ASSEMBLY (Continued)

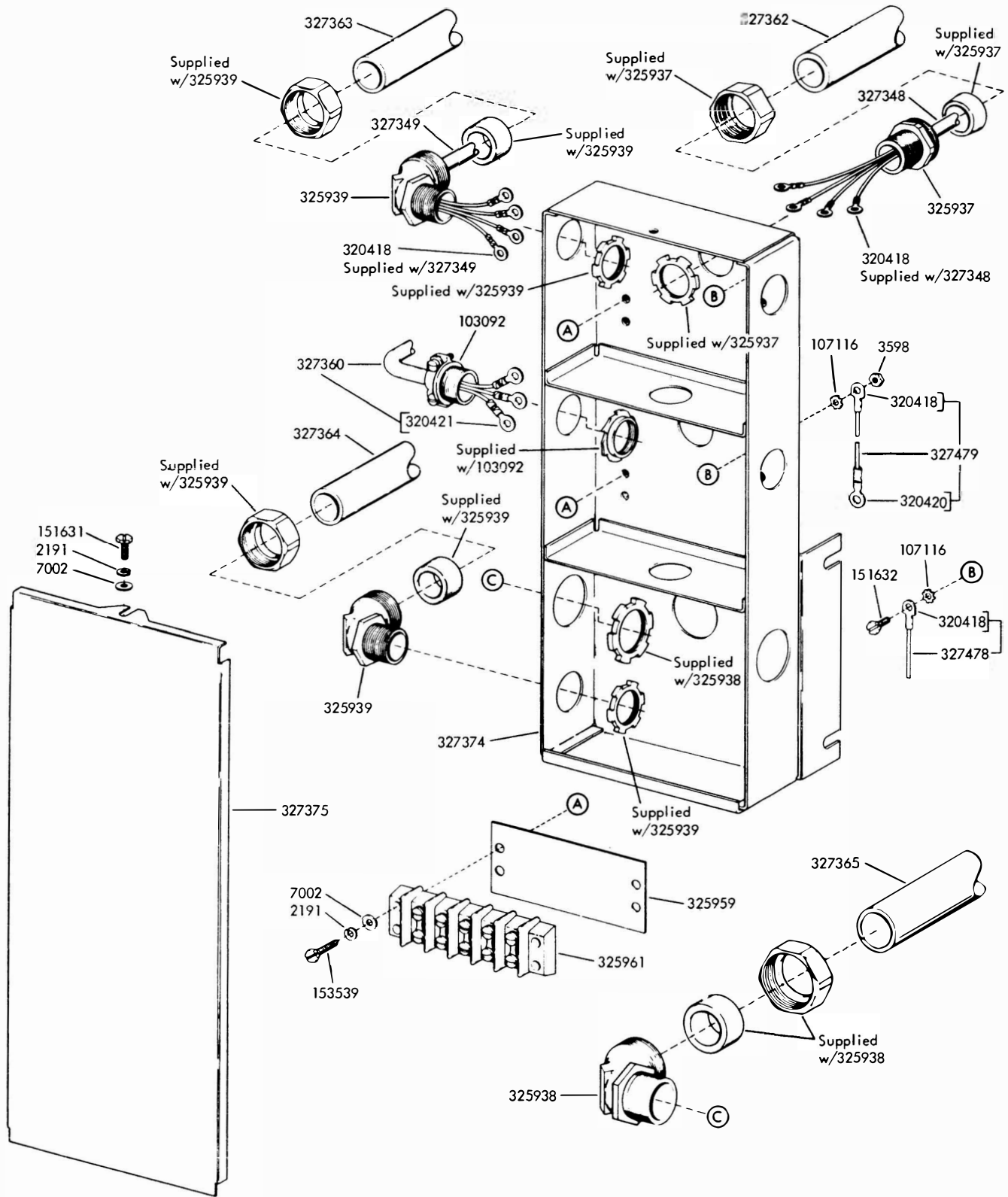


FIGURE 11. POWER CONTAINER (3 Drawer Cabinet)

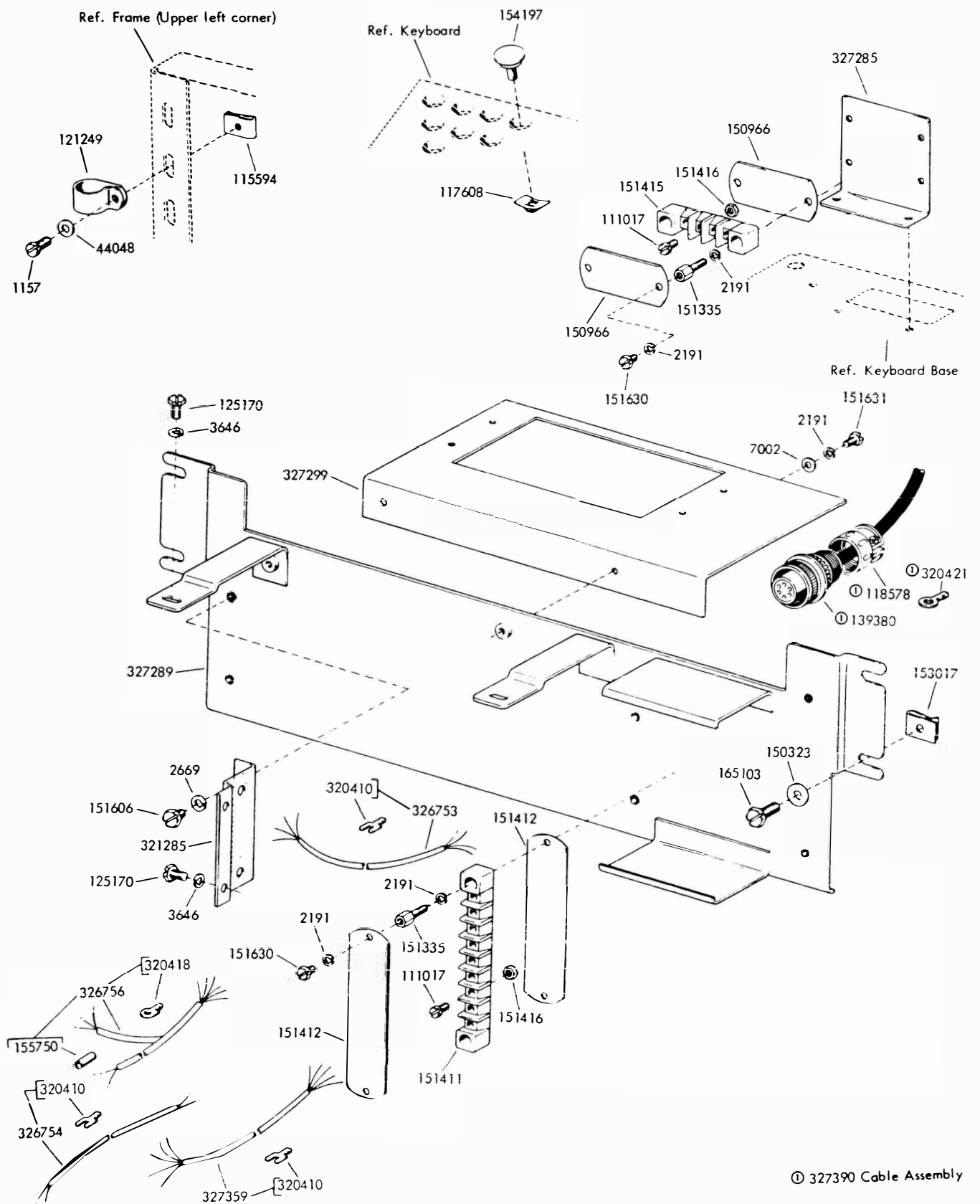
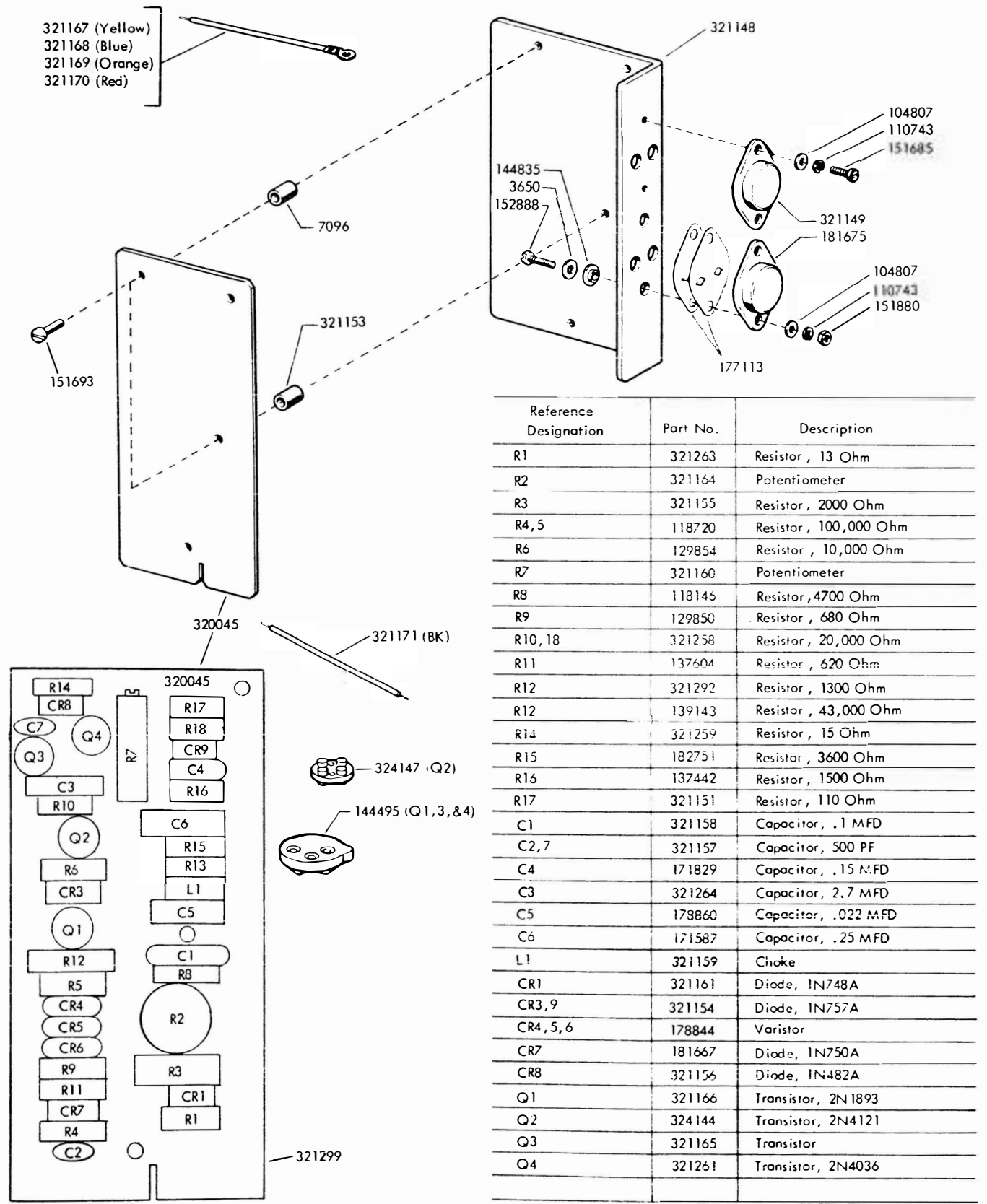
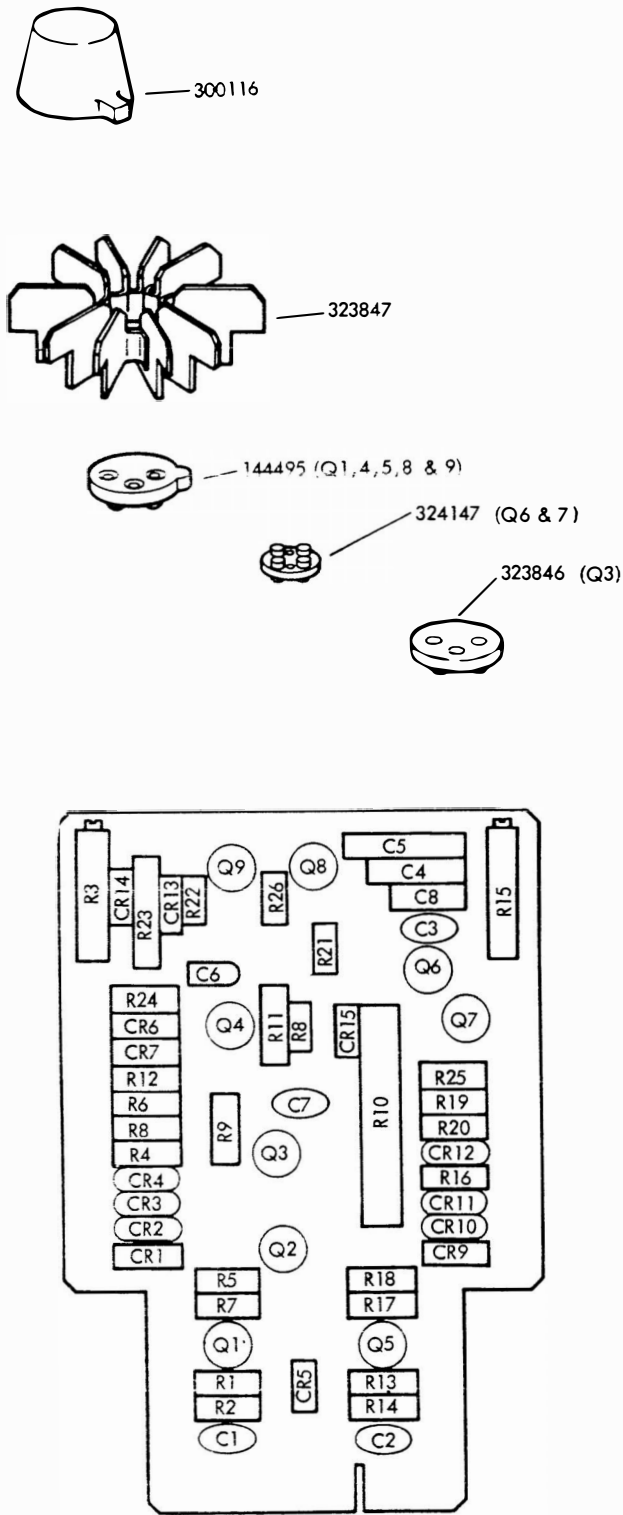


FIGURE 12. CIRCUIT MAGNET DRIVER MOUNTING COMPONENTS (3 Drawer Cabinet)



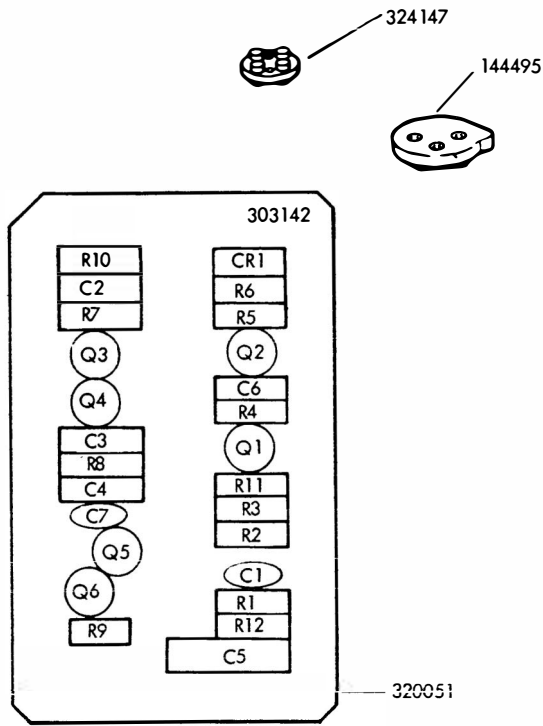
Reference Designation	Part No.	Description
R1	321263	Resistor, 13 Ohm
R2	321164	Potentiometer
R3	321155	Resistor, 2000 Ohm
R4,5	118720	Resistor, 100,000 Ohm
R6	129854	Resistor, 10,000 Ohm
R7	321160	Potentiometer
R8	118145	Resistor, 4700 Ohm
R9	129850	Resistor, 680 Ohm
R10, 18	321258	Resistor, 20,000 Ohm
R11	137604	Resistor, 520 Ohm
R12	321292	Resistor, 1300 Ohm
R12	139143	Resistor, 43,000 Ohm
R14	321259	Resistor, 15 Ohm
R15	182751	Resistor, 3600 Ohm
R16	137442	Resistor, 1500 Ohm
R17	321151	Resistor, 110 Ohm
C1	321158	Capacitor, .1 MFD
C2,7	321157	Capacitor, 500 PF
C4	171829	Capacitor, .15 MFD
C3	321264	Capacitor, 2.7 MFD
C5	179860	Capacitor, .022 MFD
C6	171587	Capacitor, .25 MFD
L1	321159	Choke
CR1	321161	Diode, 1N748A
CR3,9	321154	Diode, 1N757A
CR4,5,6	178844	Varistor
CR7	181667	Diode, 1N750A
CR8	321156	Diode, 1N482A
Q1	321166	Transistor, 2N1893
Q2	324144	Transistor, 2N4121
Q3	321165	Transistor
Q4	321261	Transistor, 2N4036

FIGURE 14. 321991 CIRCUIT MAGNET DRIVER ASSEMBLY



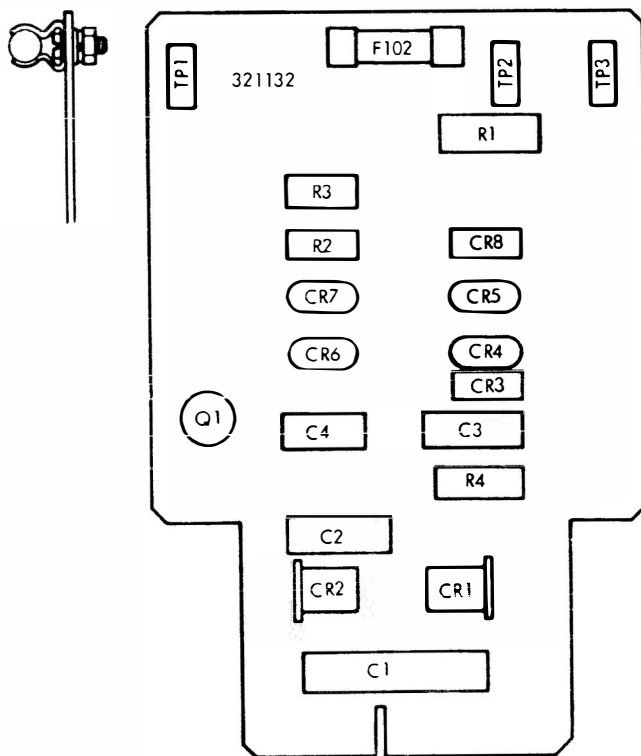
Reference Designation	Part No.	Description
C1, C2, C3, C7	321157	Capacitor, 500 PF
C4	171829	Capacitor, .15 MFD
C5	326776	Capacitor, .47 MFD
C6	321260	Capacitor, 1 MFD
C8	178860	Capacitor, .022 MFD
R1, R2, R13, R14	118720	Resistor, 100,000 Ohm
R3, R15	323964	Potentiometer
R4, R16	129854	Resistor, 10,000 Ohm
R5, R17, R22	118177	Resistor, 22,000 Ohm
R6, R19	137604	Resistor, 620 Ohm
R7, R18	118146	Resistor, 4,700 Ohm
R8, R20	129850	Resistor, 680 Ohm
R9	309868	Resistor, 1,300 Ohm
R10	323841	Resistor, 300 Ohm
R11	323842	Resistor, 21 Ohm
R12	178864	Resistor, 3,900 Ohm
R21	321975	Resistor, 33 Ohm
R23	323843	Resistor, 590 Ohm
R24	137442	Resistor, 1,500 Ohm
R25	118154	Resistor, 47,000 Ohm
R26	120424	Resistor, 4,300 Ohm
CR1	321154	Diode, 1N457A
CR2, CR3, CR4,	178844	Varistor
CR10, CR11, CR12	178844	Varistor
CR5	181667	Diode, 1N750A
CR6, CR7, CR13,	321156	Diode, 1N482A
CR15	321156	Diode, 1N482A
CR8	321161	Diode, 1N748A
CR9, CR14	321154	Diode, 1N457A
Q1, Q5	321166	Transistor, 2N1893
Q2	323844	Transistor, 2N3053
Q3	321261	Transistor, 2N4036
Q4	323845	Transistor, 40319
Q6, Q7	324144	Transistor, 2N4121
Q8	321165	Transistor, 2N3638A
Q9	321261	Transistor, 2N4036
	324147	Pad, Transistor Mounting
	144495	Pad, Transistor Mounting
	323846	Pad, Transistor Mounting
	323847	Sink, Heat
	300116	Cover, Insulating
	323835	Card, Circuit

FIGURE 15. 323810 CIRCUIT CARD - SELECTOR MAGNET DRIVER



Reference Designation	Part No.	Description
R1&3	118720	Resistor, 100,000 Ohm
R2	118178	Resistor, 220,000 Ohm
R4&8	129854	Resistor, 10,000 Ohm
R5&6	321204	Resistor, 13,000 Ohm
R7&10	118147	Resistor, 6800 Ohm
R9	137438	Resistor, 100 Ohm
R11&12	118146	Resistor, 4700 Ohm
CR1	181619	Diode, 1N482
C1&7	321157	Capacitor, 500 PF
C2	320048	Capacitor, .5 MFD
C3&4	320049	Capacitor, .15 MFD
C5	320047	Capacitor, 2 MFD
C6	181618	Capacitor, .01MFD
Q1,4&6	315930	Transistor, 2N3568
Q2	324144	Transistor, 2N4121
Q3&5	315931	Transistor, 2N368

FIGURE 16. 303142 CIRCUIT CARD



Reference Designation	Part No.	Description
C1	312284	Capacitor, 1.5 MFD
C2, C3	171585	Capacitor, .22 MFD
C4	178860	Capacitor, .022 MFD
CR1, CR2	321136	Diode, 1N4722
CR3, CR8	321286	Diode, 1N4749A
CR4, CR5, CR6,	178844	Varistor
CR7	178844	Varistor
R1	198937	Resistor, 2,700 Ohm
R2, R3	182180	Resistor, 200 Ohm
R4	305298	Resistor, 3,300 Ohm
Q1	321145	Transistor, 2N2270
F102	330517	Fuse, 1.5 Amp
TP1	320039	Jack, Black Test
TP2	320040	Jack, Orange Test
TP3	320038	Jack, Red Test
FC1, FC2	311068	Clip, Fuse
	151637	Screw, 4-40 x 1/4 Fil
	125011	Washer, Flat
	110743	Washer, Lock
	3599	Nut, 4-40

FIGURE 17. 321132 CIRCUIT CARD

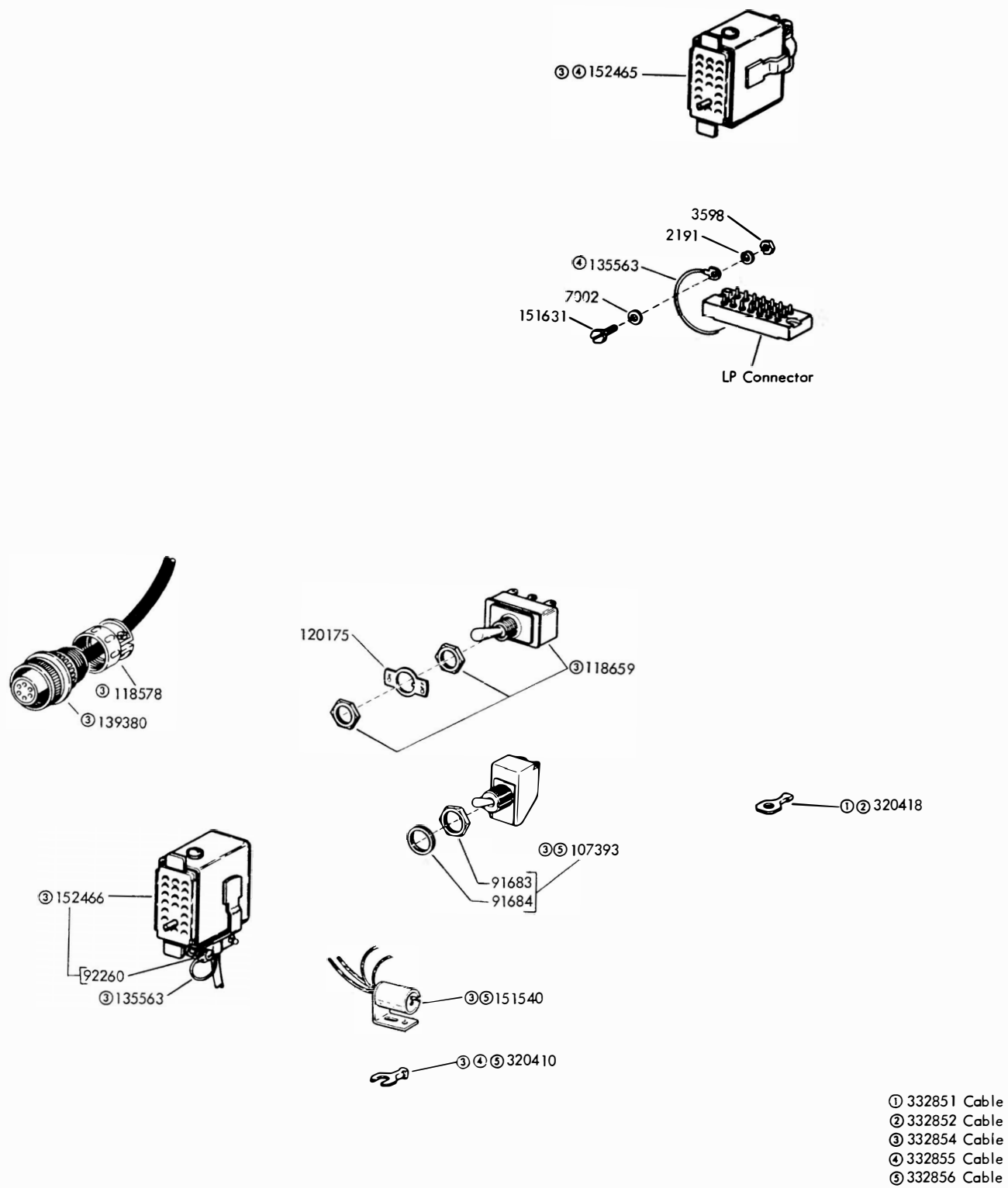


FIGURE 18. CABLE COMPONENTS

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
1093	Screw, 8-32 x 7/16 Fil 5	137604	Resistor, 620 Ohm 15,16	158286	Transformer 5
1157	Screw, 8-32 x 1/2 Fil 13	139143	Resistor, 43,000 Ohm 15	158745	Clamp, Bearing 3
1272	Screw, 6-40 x 11/16 Fil 7,11	139335	Connector, 6 Pt Plug 4	159404	Post 7,9
2191	Washer Lock 2 to 14,18	139380	Connector, 6 Pt Receptacle 13,18	162228	Insulator, Terminal Block 6,10
2669	Washer, Lock 3,6,10,13,14	144495	Pad, Transistor Mounting 15,16,17	162360	Fuse, SL-BL .8 Amp 6,8
3354	Nut, 8-32 Hex 5	144835	Bushing, Spring 15	163440	Gear, 48T 3
3438	Washer, Flat 3,6,10,14	145781	Grommet 8	163460	Gear, 55T 3
3598	Nut, 6-40 Hex 2,5,7,8,11,12,14,18	145822	Stud, Oval Head 8	164872	Stud 11
3599	Nut, 4-40 Hex 17	146901	Rectifier Assembly 1,4	165008	Turret, Terminal 5
3646	Washer, Lock 5,13	146967	Resistor, 750 Ohm 4	165103	Screw, 12-24 x 5/8 Rd 13
3650	Washer, Flat 15	146968	Transformer 4	171461	Capacitor, 900 MFD 4
7001	Washer, Flat 7,8,11	148257	Terminal, Insulated 4	171463	Resistor, 1 Ohm 4
7002	Washer, Flat 4 to 14,18	148458	Connector, 15 Pt Circuit Card 7,8	171525	Resistor, 1,000 Ohm 5
7096	Bushing, Insulating T5	150323	Washer, Flat 13	171541	Diode 5
8330	Washer, Flat 3	150966	Insulator, Terminal Block 13	171585	Capacitor, .22 MFD 17
44048	Washer, Flat 5,13	151335	Stud 6,7,8,10,13	171587	Capacitor, .25 MFD 15
49653	Screw, 10-32 x 13/16 Fil 3	151411	Block, Terminal 13	171609	Diode 4
55318	Screw, 6-32 x 1/4 Rd 4	151412	Insulator, Terminal Block 13	171642	Fuse, SL-BL 1.6 Lamp 10
71646	Nut, 6-32 Hex 4	151415	Block, Terminal 13	171644	Fuse, 1.5 Amp 4
73175	Washer, Lock 7,9	151416	Nut, 6-40 Hex 7,8,11,13	171829	Capacitor, .15 MFD 15,16
74805	Screw, 10-32 x 3/4 Hex 3	151427	Plate, Clamp 5	172726	Resistor, 250 Ohm 7,8,9,11
76461	Washer, Flat 14	151442	Screw, 6-40 x 1/2 Hex 2,11	177113	Insulator 11,15
82702	Screw, 6-40 x 9/32 Hex 2	151540	Lampholder 18	178844	Varistor 15,16,17
90789	Washer, Flat 5	151606	Screw, 10-32 x 1/4 Hex 13	178860	Capacitor, .022 MFD 15,16,17
91683	Nut, 15/32-32 Hex 18	151630	Screw, 6-40 x 1/4 Hex 3,6 to 11,13	178864	Resistor, 3,900 Ohm 16
91684	Nut, 15/32-32 Ring 18	151631	Screw, 6-40 x 5/16 Hex 3,9,10,12,13,14,18	181266	Bushing, Insulating 11
92260	Washer, Lock 7,10,11,18	151632	Screw, 6-40 x 3/8 Hex 3,4,9,12,14	181618	Capacitor, .01 MFD 17
92271	Screw, 6-32 x 2-3/4 Rd 4	151637	Screw, 4-40 x 1/4 Fil 8,9,11,17	181619	Diode 17
93598	Screw, 4-40 x 5/16 Rd 4	151658	Screw, 6-40 x 5/16 Fil 10	181648	Capacitor, .1 MFD 4
94072	Bushing 3	151659	Screw, 6-40 x 1/2 Fil 5,7,8,11	181675	Transistor, Power 15
103092	Connector, Cord 12,14	151685	Screw, 4-40 x 5/16 Fil 15	181667	Diode 15,16
104807	Washer, Flat 15	151693	Screw, 6-40 x 9/16 Fil 15	181890	Sleeve, 1/16 ID x 1" Lg Insulating 14
104827	Bearing, Ball 3	151712	Button, Pivot 3	182180	Resistor, 200 Ohm 17
107116	Washer, Lock 8,11,12,14	151722	Screw, 6-40 x 3/16 Hex 9,10	182523	Clamp, 1-3/8" ID Mounting 8
107393	Switch, SP-ST Toggle 18	151723	Screw, 10-32 x 3/8 Hex 6,8,10	182751	Resistor, 3.6K Ohm 15
110434	Screw, 4-40 x 3/16 Fil 7	151725	Screw, 10-32 x 3/4 Fil 3	185688	Plate, Identification 6,8
110743	Washer, Lock 4,6 to 9,11,15,17	151819	Jumper, 3" Black 5,7	192980	Lug, Terminal 11
111017	Screw, 6-40 x 5/16 Fil 7,8,11,13	151880	Nut, 4-40 Hex 15	193053	Capacitor, 2 MFD 6
111284	Block, Terminal 6,10	151939	Grommet, Rubber 5	195245	Sleeve, 1/2 ID x 1-1/2" Lg Insulating 6
112626	Nut, 10-32 Hex 3	152035	Plug 6,8,9	196930	Grille 2
115594	Nut, Speed 13	152465	Connector, 20 Pt Receptacle 18	196931	Clip 2
116783	Holder, Fuse 4,5,6,8,10	152466	Connector, 21 Pt Receptacle 18	198092	Fan 2
116785	Fuse, .3 Amp 5	152761	Stud 5	198937	Resistor, 2700 Ohm 17
117608	Nut, Speed 13	152888	Screw, 4-40 x 7/16 Hex 15	300116	Cover, Insulating 16
118146	Resistor, 4,700 Ohm 15,16,17	152893	Screw, 4-40 x 1/4 Hex 6	303142	Card, EC142 Circuit 1,17
118147	Resistor, 6,800 Ohm 17	153017	Nut, Speed 13	305143	Rectifier Assembly 1.5
118154	Resistor, 47,000 Ohm 16	153442	Screw, 10-32 x 1/2 Hex 14	305144	Plate, Mounting 5
118177	Resistor, 22,000 Ohm 16	153534	Washer, Flat 10	305150	Block, Terminal 5
118178	Resistor, 220,000 Ohm 17	153537	Screw, 6-40 x 11/16 Hex 12,14	305151	Washer, Insulating 5
118578	Clamp, 3/4 ID Cable 13,18	154085	Plate 3	305298	Resistor, 3300 Ohm 17
118659	Switch, Toggle 6,8,10,18	154197	Plug, Button 13	306991	Bracket 3
118720	Resistor 100K Ohm 15,16,17	155750	Sleeve, 3/32 ID x 1/2" Lg Insulating 13	306992	Clamp 3
120175	Plate, ON-OFF 6,8,10,18	155751	Sleeve, 1/8 ID x 1" Lg Insulating 6	306993	Plate 3
120424	Resistor, 4300 Ohm 16	155752	Sleeve, 5/64 ID x 1/2" Lg Insulating 7	306994	Shaft 3
121018	Nut, 4-40 Hex 4	155753	Sleeve, 1/8 ID x 1/2" Lg Insulating 7,11	306995	Spacer 3
121243	Clamp, 3/16 ID Cable 9	156740	Screw, 6-40 x 7/32 Hex 3	306996	Shim, .05" Thk 3
121247	Clamp, 7/16 ID Cable 14	158250	Block, Terminal 7,8,11	307853**	Cover, Top 2
121249	Clamp, 5/8 ID Cable 13,14	158252	Insulator, Terminal Block 7,8,11	309868	Resistor, 1300 Ohm 16
121413	Spacer, .344" Thk 4			311068	Clip 17
125011	Washer, Flat 9,11,17			312284	Capacitor, 1.5 MFD 17
125170	Screw, 8-32 x 5/16 Fil 13			315930	Transistor 17
125315	Washer, Insulating 4			315931	Transistor 17
129850	Resistor, 680 Ohm 15,16			320038	Jack, Red Test 17
129854	Resistor, 10,000 Ohm 15,16,17			320039	Jack, Black Test 17
135563	Jumper, 2-3/4" Green 7,18			320040	Jack, Orange Test 17
137438	Resistor, 100 Ohm 17			320045	Card, Circuit 15
137449	Resistor, 1500 Ohm 15,16			320047	Capacitor, 2 MFD 17

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Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
320048	Capacitor, .5 MFD 17	321991	Driver Asm, Circuit Magnet 1,15	326730	Gear Assembly, Intermediate 1,3
320049	Capacitor, .15 MFD 17	321992	Bracket 6	326753	Cable w/Terminals 13
320050	Plate, Mounting 6	321993	Cover 6	326754	Cable w/Terminals 13
320051	Card, Circuit 17	321995	Container, Outer 8,9	326755	Jumper, 3-1/2" Green 7
320056	Bracket 8	321996	Cover 8	326756	Cable w/Terminals 13
320300	Capacitor, 5,000 MFD 5	321997	Bracket 8	326776	Capacitor, .47 MFD 16
320410	Terminal, Spade Type 2,7,8,13,18	323486	Cover 7,11	326779	Bracket 14
320418	Terminal, Ring Type 5,7,8,10 to 14,18	323487	Spacer 6	326780	Plate, Identification 2
320420	Terminal, Ring Type 12	323501	Bracket, Connector Mounting 8	326789	Cable 10
320421	Terminal, Ring Type 12,13,14	323504	Frame, Inner 11	326791	Frame, Outer 7
321128	Transformer, Power 8	323507	Container 10	327285	Bracket 13
321129	Capacitor, 750 MFD 6,8	323641	Plate 10	327289	Bracket 13
321132	Card, Circuit 1,17	323652	Relay, SP-ST Isolation 7,9	327290	thru
321133	Inductor 6,9,10	323810	Card Assembly, Circuit 1,16	327293	Cable Assembly 11
321136	Diode 17	323821	Service Asm, Electrical 1,6,7	327294	Cable Assembly 6
321137	Transistor, Power 11	323822	Service Asm, Electrical 1,8,9	327295	Cable Assembly 6
321145	Transistor 17	323835	Card, Circuit 16	327296	Cable Assembly 6
321148	Sink, Heat 15	323841	Resistor, 300 Ohm 16	327298	Cable w/Terminal 2
321149	Diode 15	323842	Resistor, 21 Ohm 16	327299	Bracket 13
321151	Resistor, 110 Ohm 15	323843	Resistor, 590 Ohm 16	327347	Cable w/Terminals 14
321153	Spacer 15	323844	Transistor 16	327348	Cable w/Terminals 12
321154	Diode 15,16	323845	Transistor 16	327349	Cable w/Terminals 12
321155	Resistor, 2000 Ohm 15	323846	Pad, Transistor Mounting 16	327350	Frame, Outer 10
321156	Diode 15,16	323847	Sink, Heat 16	327351	Box, Power 14
321157	Capacitor, 500 PF 15,16,17	323849	Coil, 132 Ohm 7,9	327352	Cover 14
321158	Capacitor, .1 MFD 15	323960	Spacer 7,10	327353	Conduit, 1/2 ID x 3/4" Lg 14
321159	Choke 15	323961	Cover 7	327354	Conduit, 3/4 ID x 8-3/4" Lg 14
321160	Potentiometer 15	323962	Cover 9	327359	Cable w/Terminals 13
321161	Diode 15,16	323964	Potentiometer 16	327360	Cable w/Terminals 12
321164	Potentiometer 15	323966	Retainer 7,9	327361	Cable w/Terminals 14
321165	Transistor 15,16	323970	Cable Assembly 8	327362	Conduit, 1/2 ID x 2-1/2 Lg 12
321166	Transistor 15,16	323971	Cable Assembly 8	327363	Conduit, 1/2 ID x 19-1/4 Lg 12
321167	Jumper, 2-7/8" Yellow 15	324135	Cable 7,11	327364	Conduit, 1/2 ID x 21-1/8 Lg 12
321168	Jumper, 2-7/8" Blue 15	324137	Cable 7	327365	Conduit, 3/4 ID x 30 Lg 12
321169	Jumper, 2-7/8" Orange 15	324138	Cable 11	327373	Plate 2
321170	Jumper, 2-7/8" Red 15	324139	Cable 11	327374	Container, Power Supply 12
321171	Jumper, 3-3/4" Black 15	324144	Transistor 15,16,17	327375	Cover 12
321201	Screw, 1/4-20 x 1/2 Fil 7,10	324145	Cable, Relay 7	327390	Cable Assembly 13
321204	Resistor, 13,000 Ohm 17	324147	Pad, Transistor Mounting 15,16,17	327407	Cable w/Terminals 7
321205	Filter Assembly 9,10	324154	Cable 8	327408	Cable w/Terminals 7
321207	Strip, Terminal 6,9,10	324698	Nut, #10 Speed 8	327409	Cable w/Terminals 7
321208	Plate 9,10	324699	Cable, Relay 7	327410	Cable w/Terminals 7
321211	Cover 10	325937	Connector, 1/2" ID 12	327411	Cable w/Terminals 7
321214	Transformer 10	325938	Connector, 3/4" 90 Degree 12	327412	Cable w/Terminals 7
321228	Service Assembly, Electrical 1,10,11	325939	Connector, 1/2 ID 90 Degree 12,14	327413	Cable w/Terminals 7
321252	Cable Assembly 6	325956	Connector, 3/4 ID 14	327414	Cable w/Terminals 7
321258	Resistor, 20,000 Ohm 15	325959	Insulator, Terminal Block 12,14	327415	Cable w/Terminals 7
321259	Resistor, 15 Ohm 15	325961	Block, Terminal 12,14	327416	Cable w/Terminals 7
321260	Capacitor, 1 MFD 16	326231	Transformer Assembly 10	327417	Cable w/Terminals 7
321261	Transistor 15,16	326232	Decalcomania 11	327444	Capacitor, 2 MFD 9,10
321263	Resistor, 13 Ohm 15	326233	Decalcomania 10	327477	Jumper, 7" Green 14
321264	Capacitor, 2.7 MFD 15	326253	Plate Assembly, AC Power 10	327478	Jumper, 6" Green 12,14
321279	Capacitor, 1300 MFD 10	326255	Spacer 10	327479	Cable w/Terminals 12
321285	Bracket, Mounting 13	326256	Bracket 10	327781	Decalcomania 10
321286	Diode 17	326256	Bracket 10	330517	Fuse, 1.5 Amp 17
321292	Resistor, 1300 Ohm 15	326269	Cable 11	332851	Cable w/Terminals 18
321296	Frame, Outer 5	326270	Connector, 15 Pt Circuit Card 11	332852	Cable w/Terminals 18
321297	Frame, Inner 7	326351	Transformer Assembly 6,8	332854	Cable Assembly 18
321299	Card, Circuit 15	326352	Cable Assembly 6,10	332855	Cable Assembly 18
321925	Cover, Rectifier 4	326353	Cable Assembly 6,10	332856	Cable Assembly 18
321926	Cover 4	326369	Cable 8		
321975	Resistor, 33 Ohm 16	326374	Label 7,11		
321988	Container 6	326375	Label 7,11		
321989	Spacer 7,11	326376	Label 7,11		
		326377	Label 7,11		
		326378	Label 7		
		326383	Decalcomania 11		
		326727	Gear Assembly, Intermediate 1,3		

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
FEATURES FOR LOW LEVEL SETS
28 ELECTRICAL SERVICE ASSEMBLIES (ESA)
PARTS

SECTION 573-613-800TC

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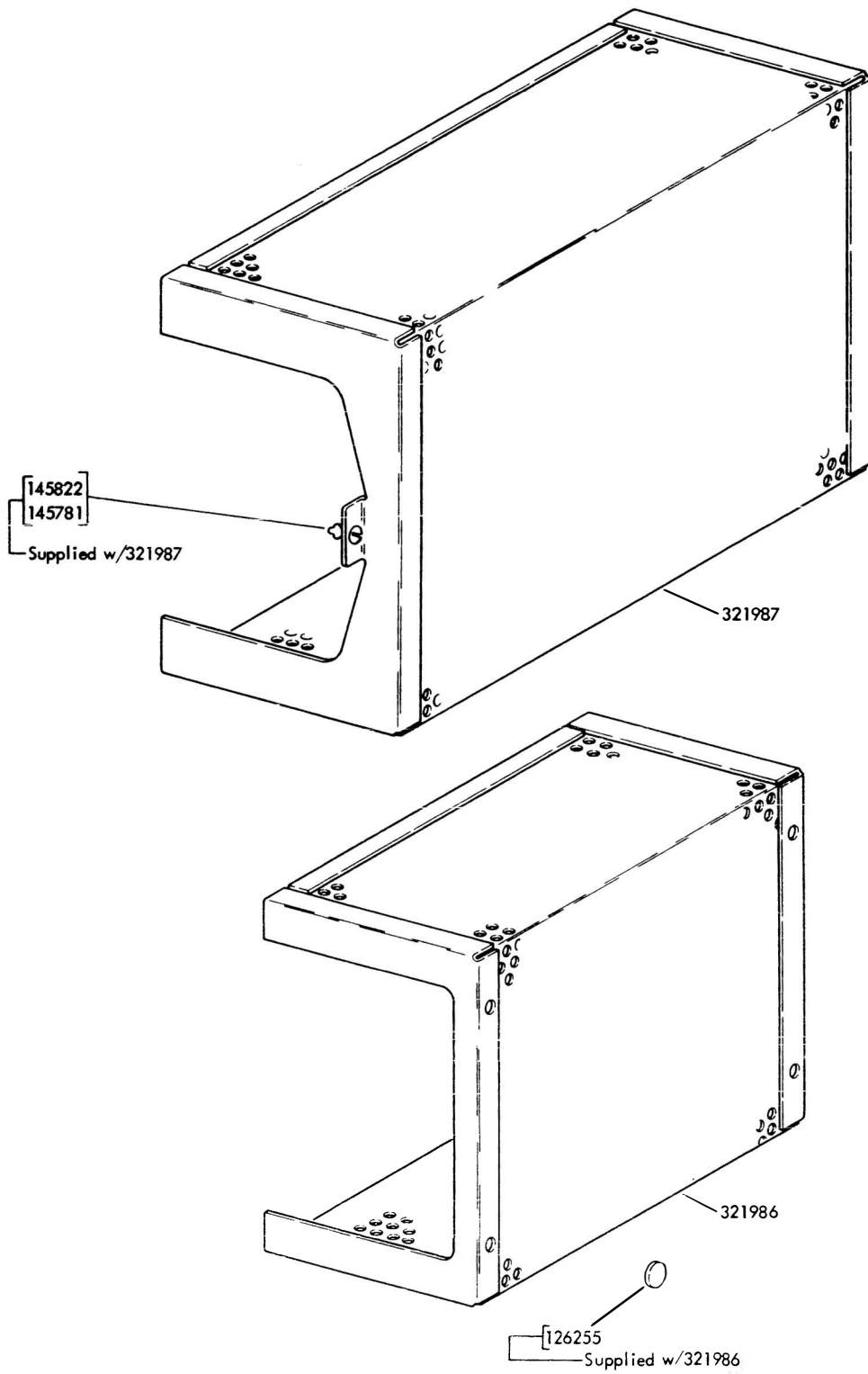


FIGURE 1. ELECTRICAL SERVICE ASSFMRIY COVERS

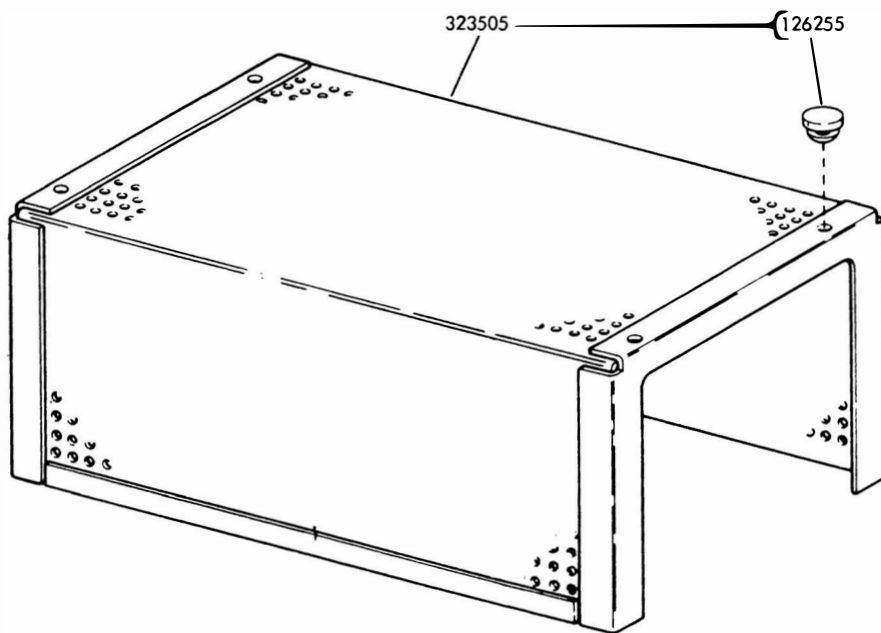
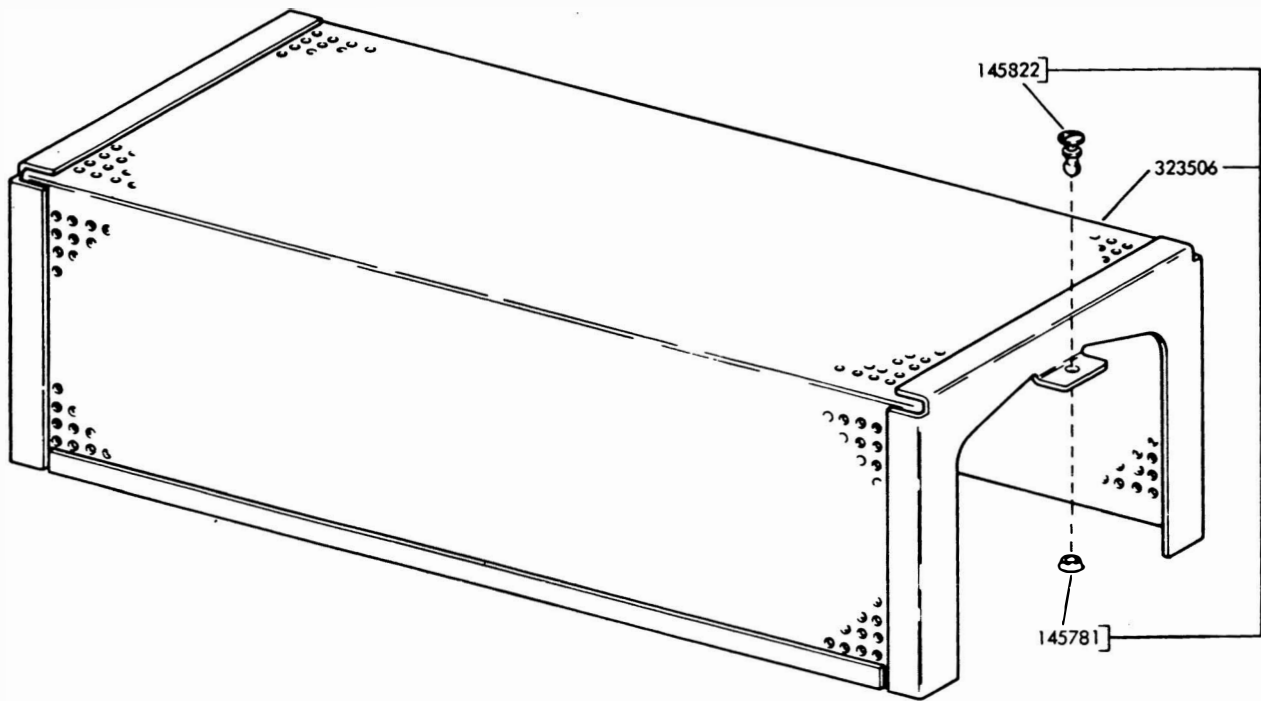
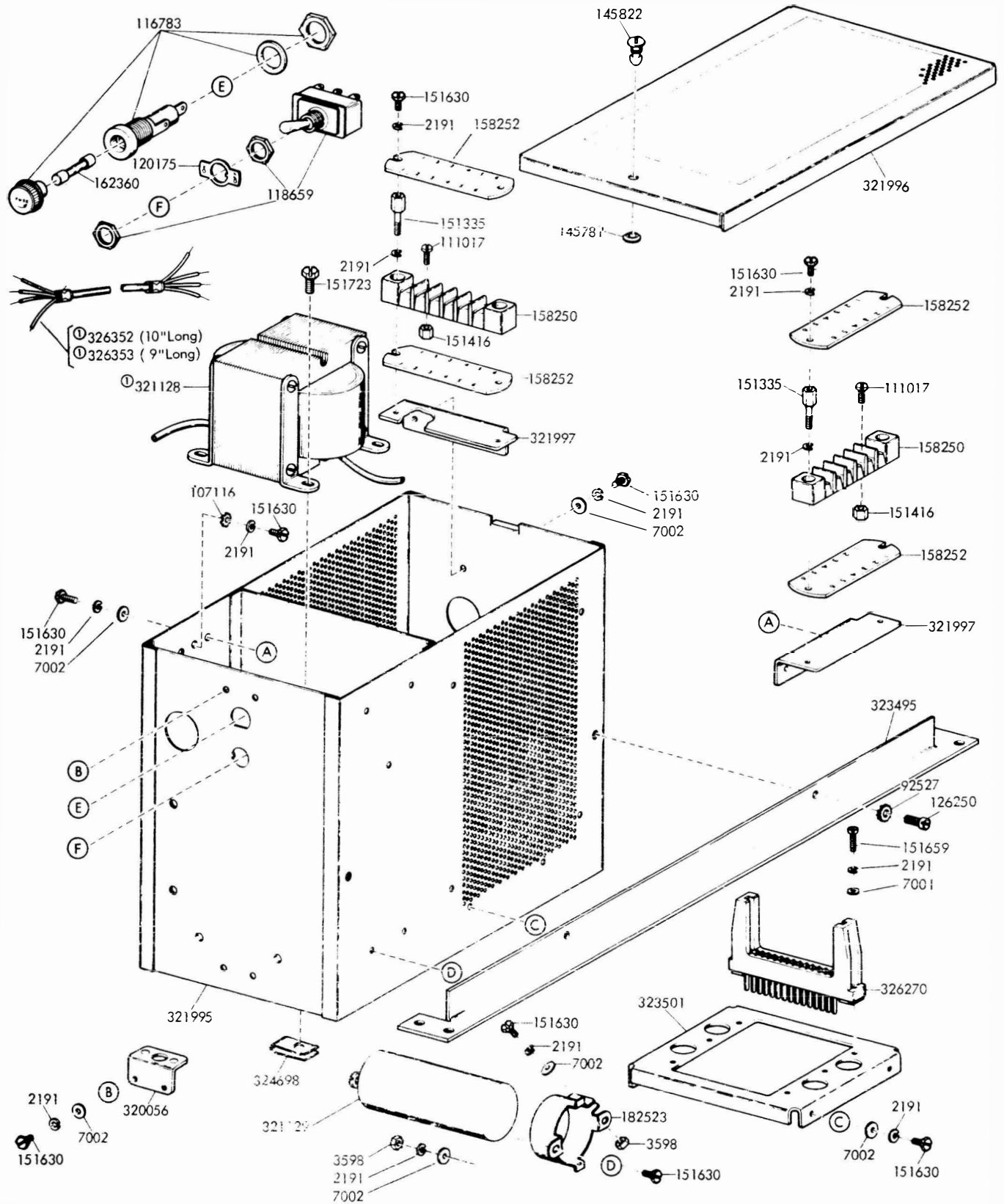


FIGURE 2. ELECTRICAL SERVICE ASSEMBLY COVERS (Continued)



ⓐ 326351 Transformer Assembly

FIGURE 3. 323812 ELECTRICAL SERVICE ASSEMBLY -Used w/ASR Set

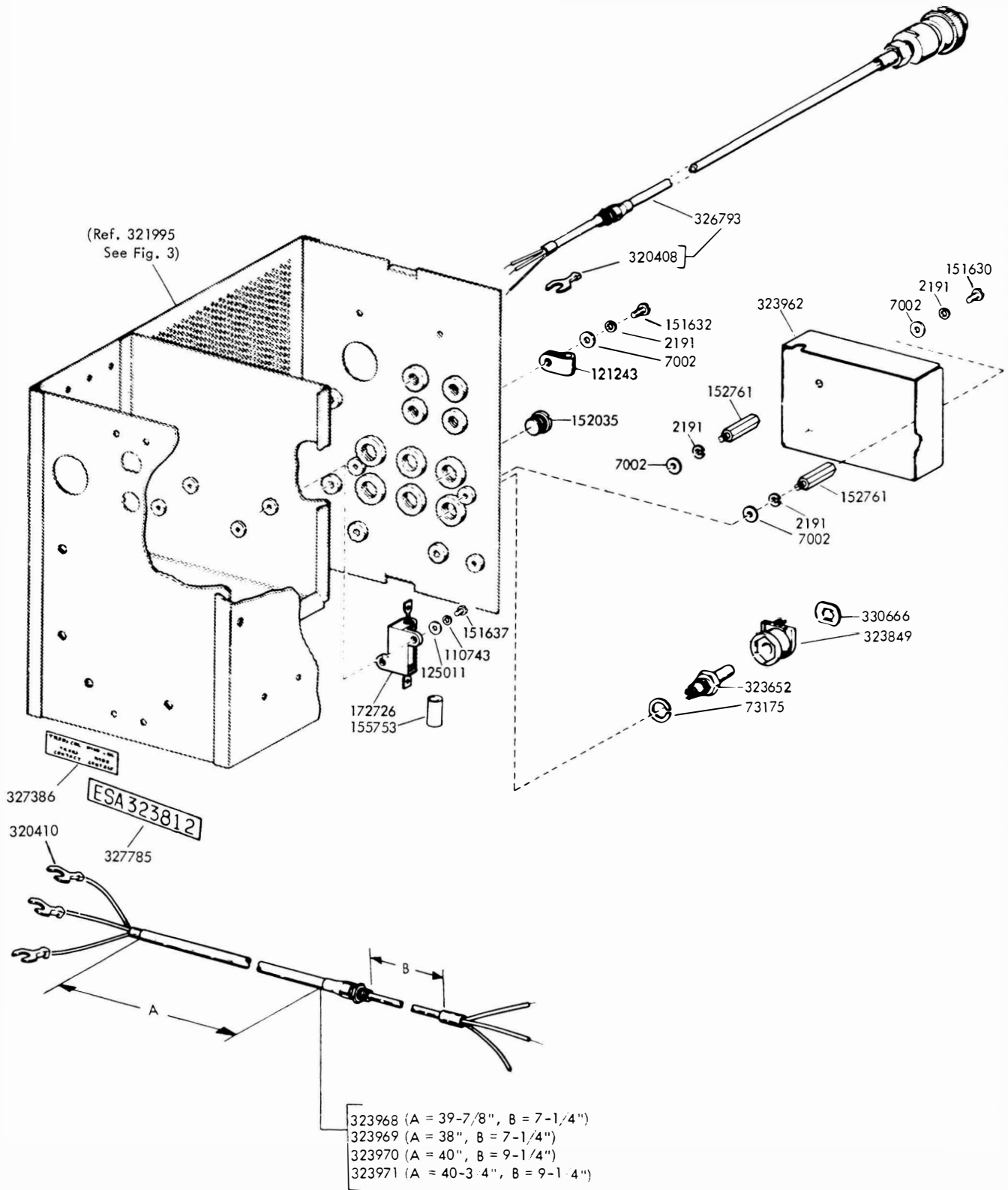


FIGURE 4. 323812 ELECTRICAL SERVICE ASSEMBLY (Continued)

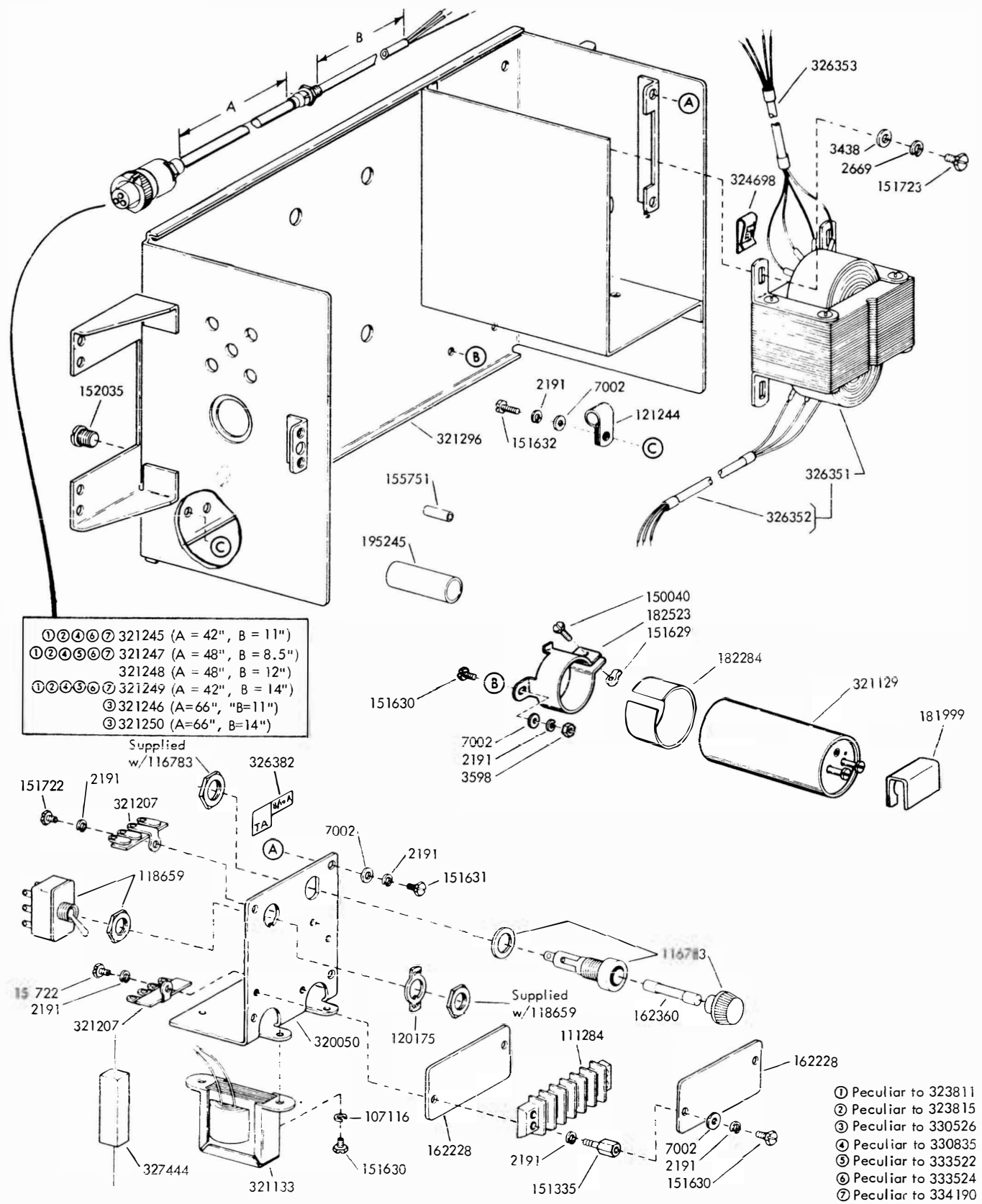


FIGURE 5. 323811, 323815, 330526, 330835, 333522, 333524 and 334190 ELECTRICAL SERVICE ASSEMBLIES - Used w/ASR Set

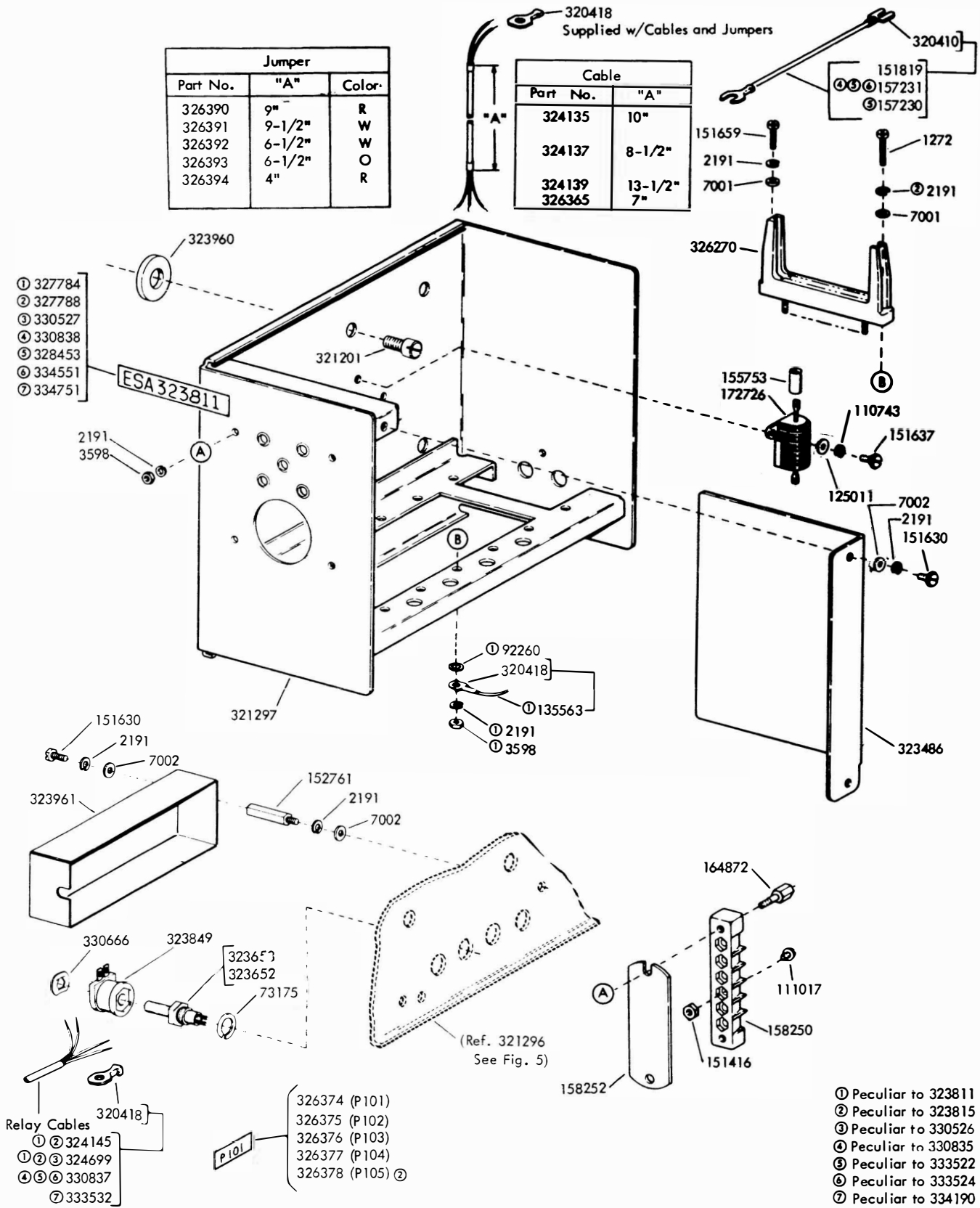


FIGURE 6. 323811, 323815, 330526, 330835, 333522, 333524 and 334190 ELECTRICAL SERVICE ASSEMBLIES (Continued)

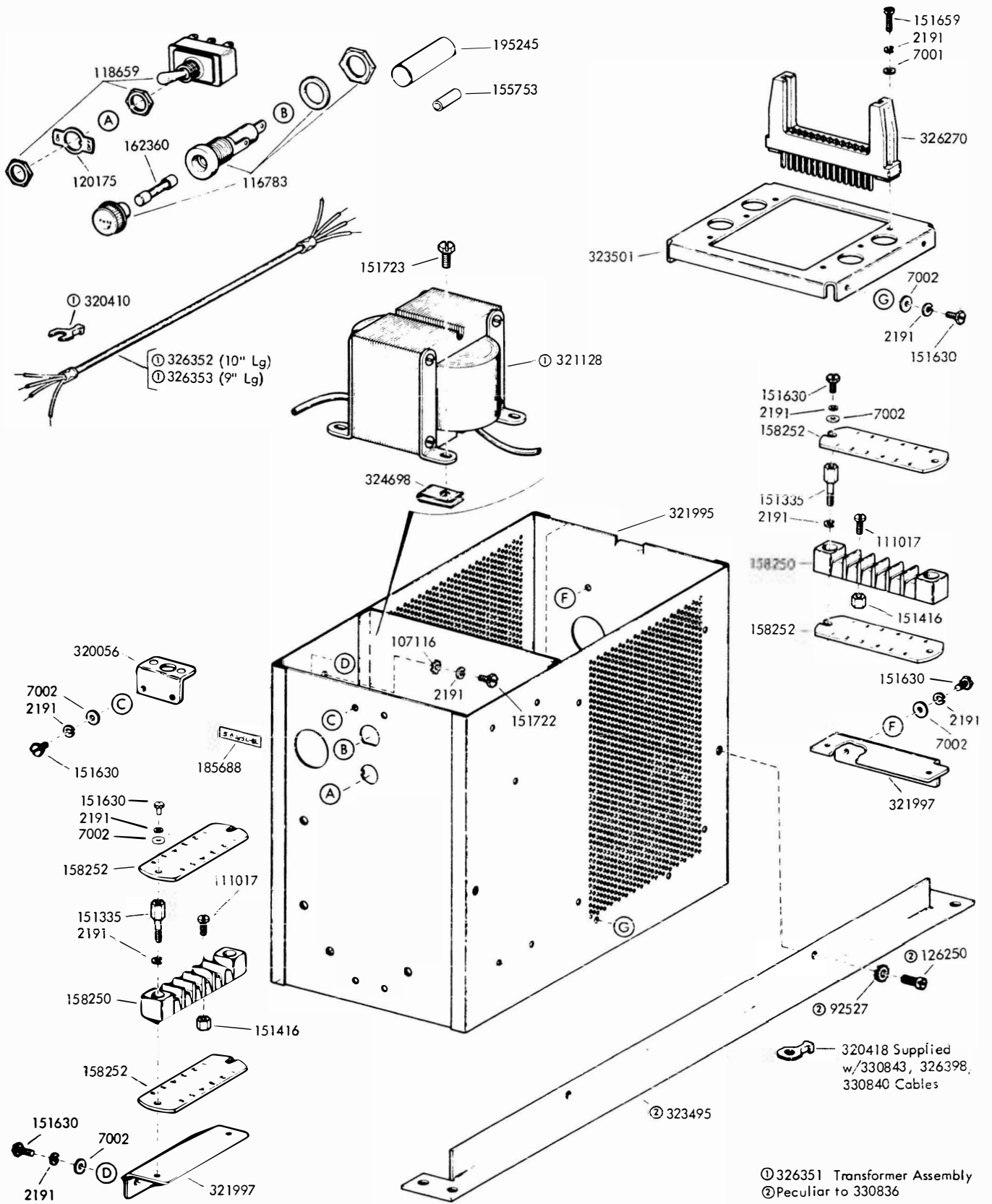


FIGURE 7. 330836 and 333523 ELECTRICAL SERVICE ASSEMBLIES -
Used w/ASR Set

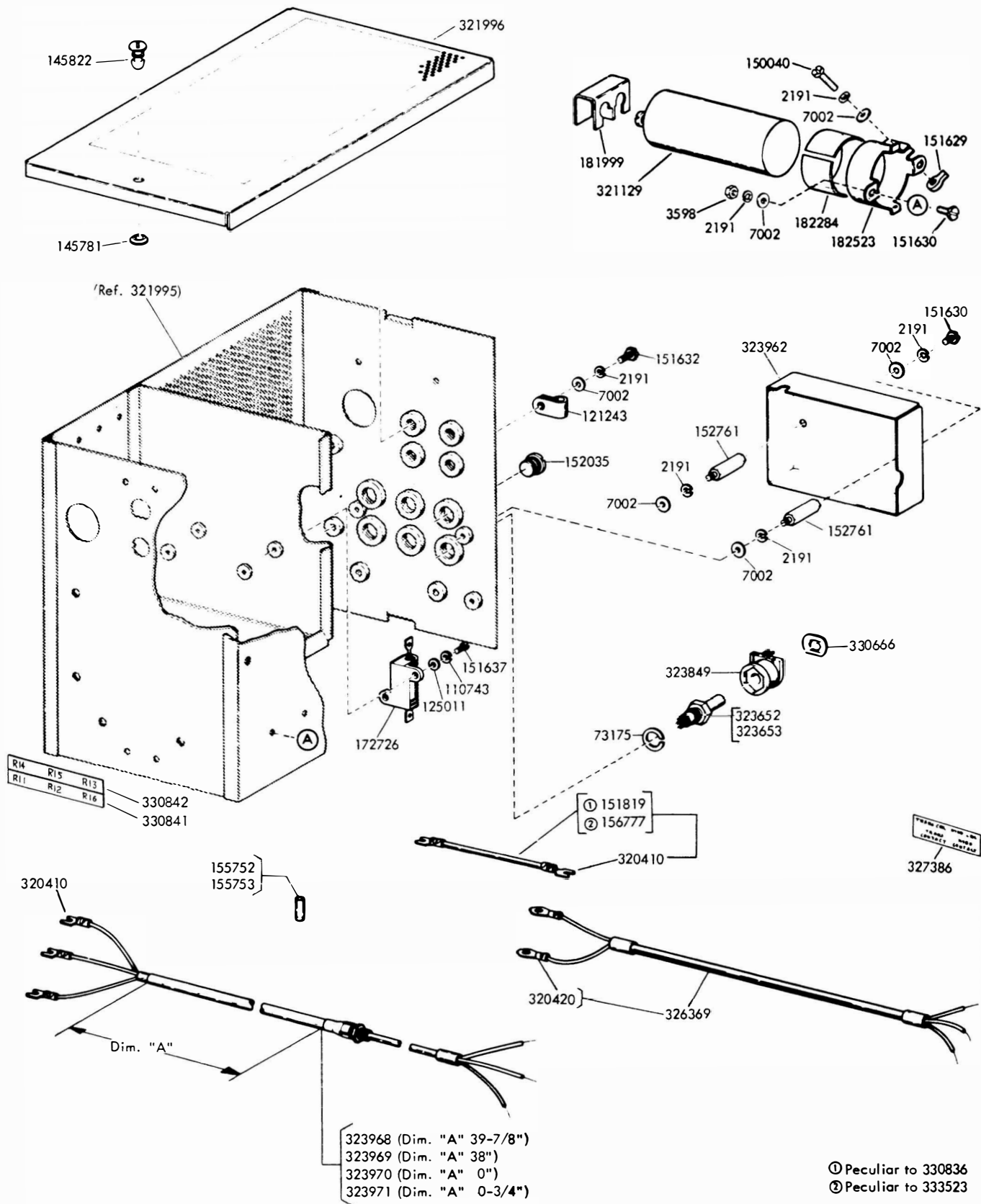


FIGURE 8. 330836 and 333523 ELECTRICAL SERVICE ASSEMBLIES (Continued)

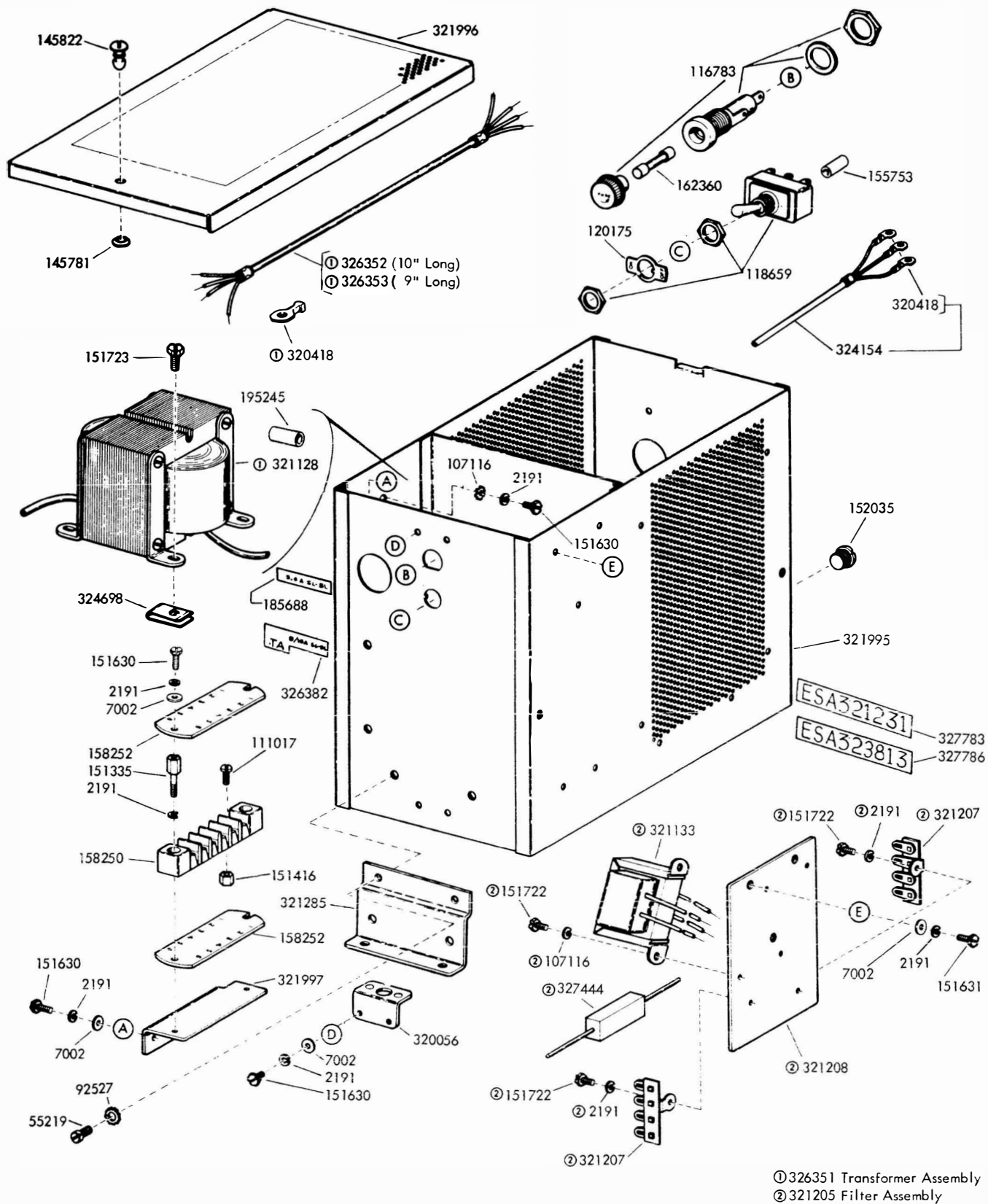


FIGURE 9. 321231 ELECTRICAL SERVICE ASSEMBLY - Used w/ROTR, KSR and RO Sets and 323813 ELECTRICAL SERVICE ASSEMBLY - Used w/ROTR Set

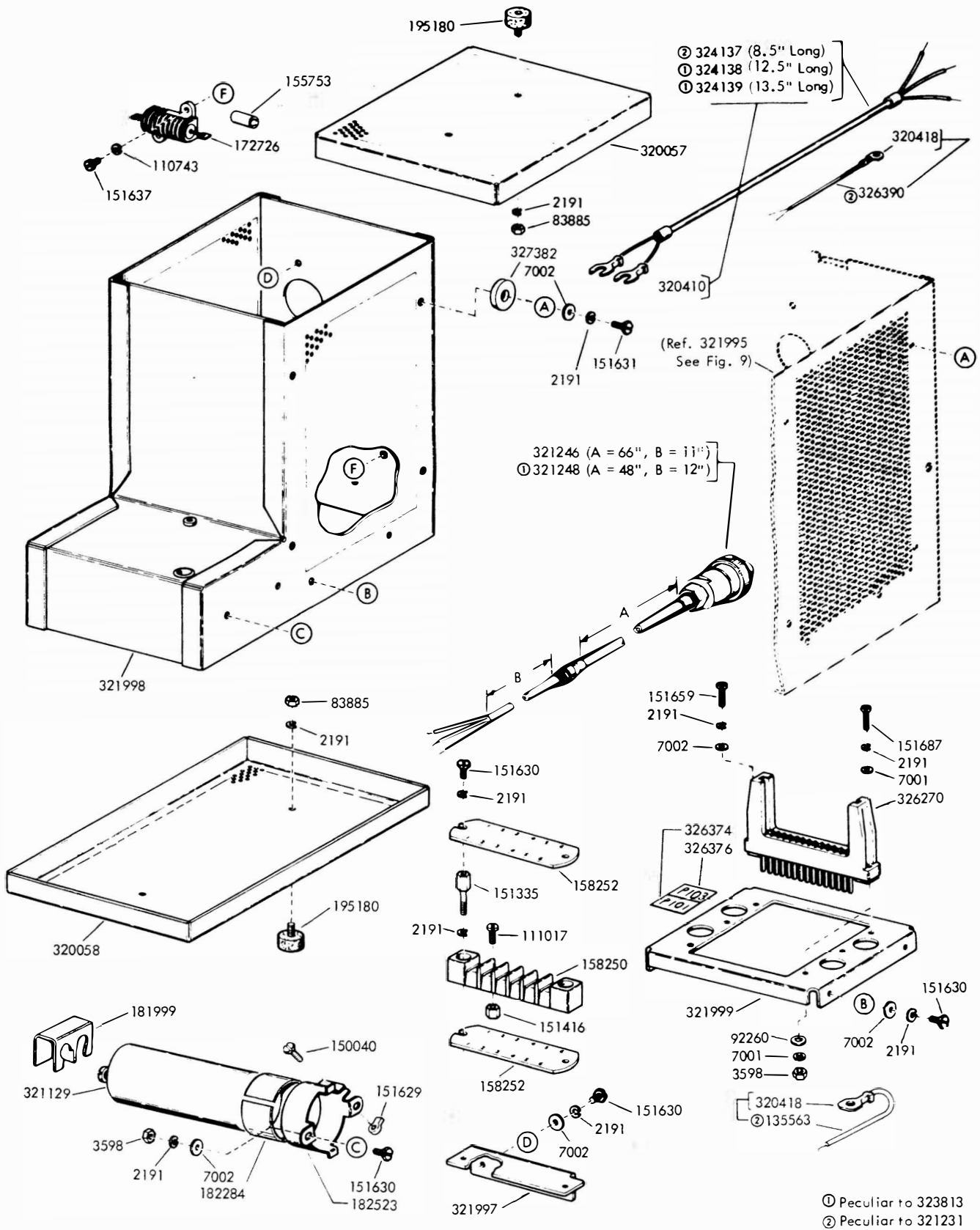


FIGURE 10. 321231 and 323813 ELECTRICAL SERVICE ASSEMBLIES (Continued)

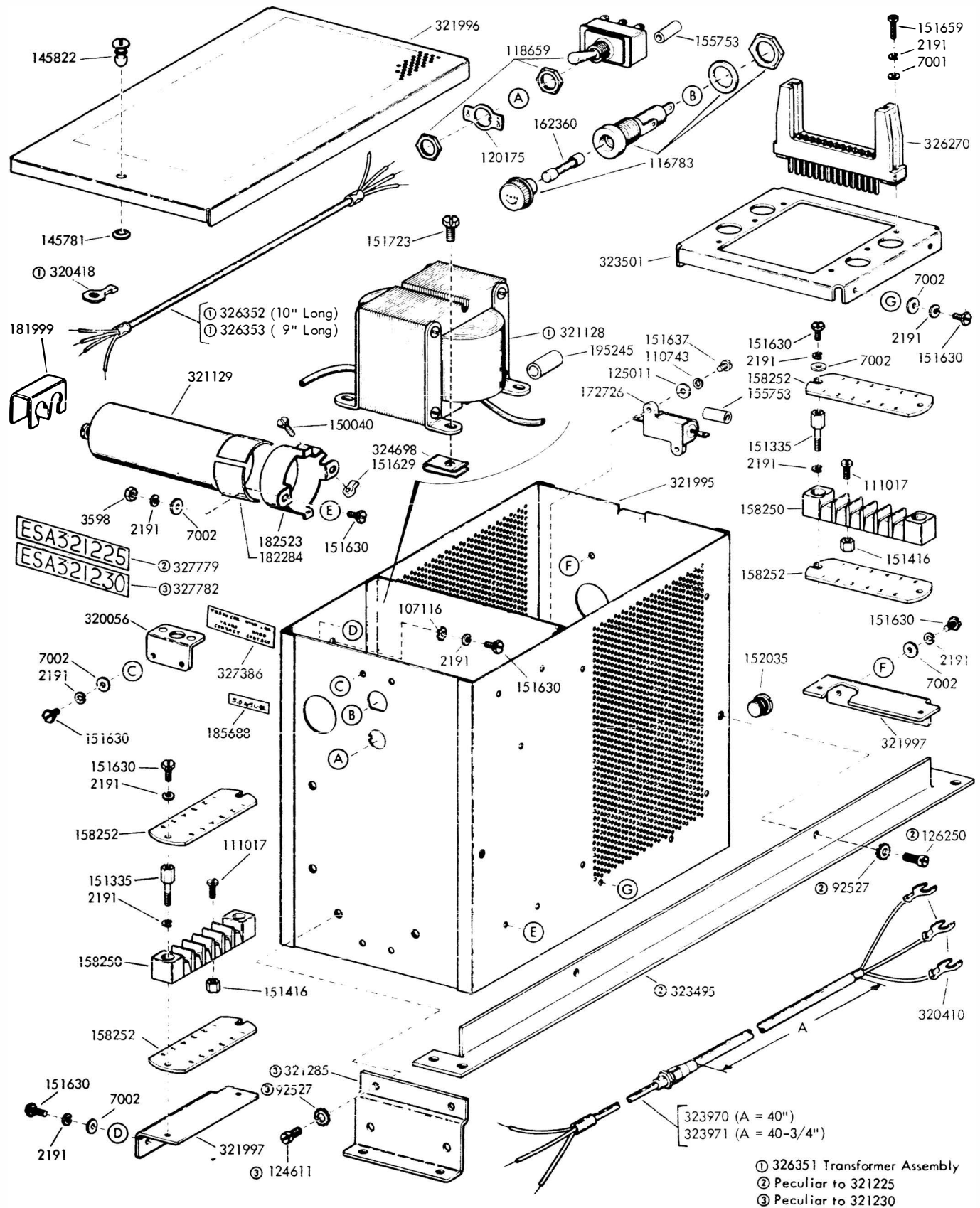


FIGURE 11. 321225 ELECTRICAL SERVICE ASSEMBLY - Used w/KSR and RO Sets and
 321230 ELECTRICAL SERVICE ASSEMBLY - Used w/ROTR Set

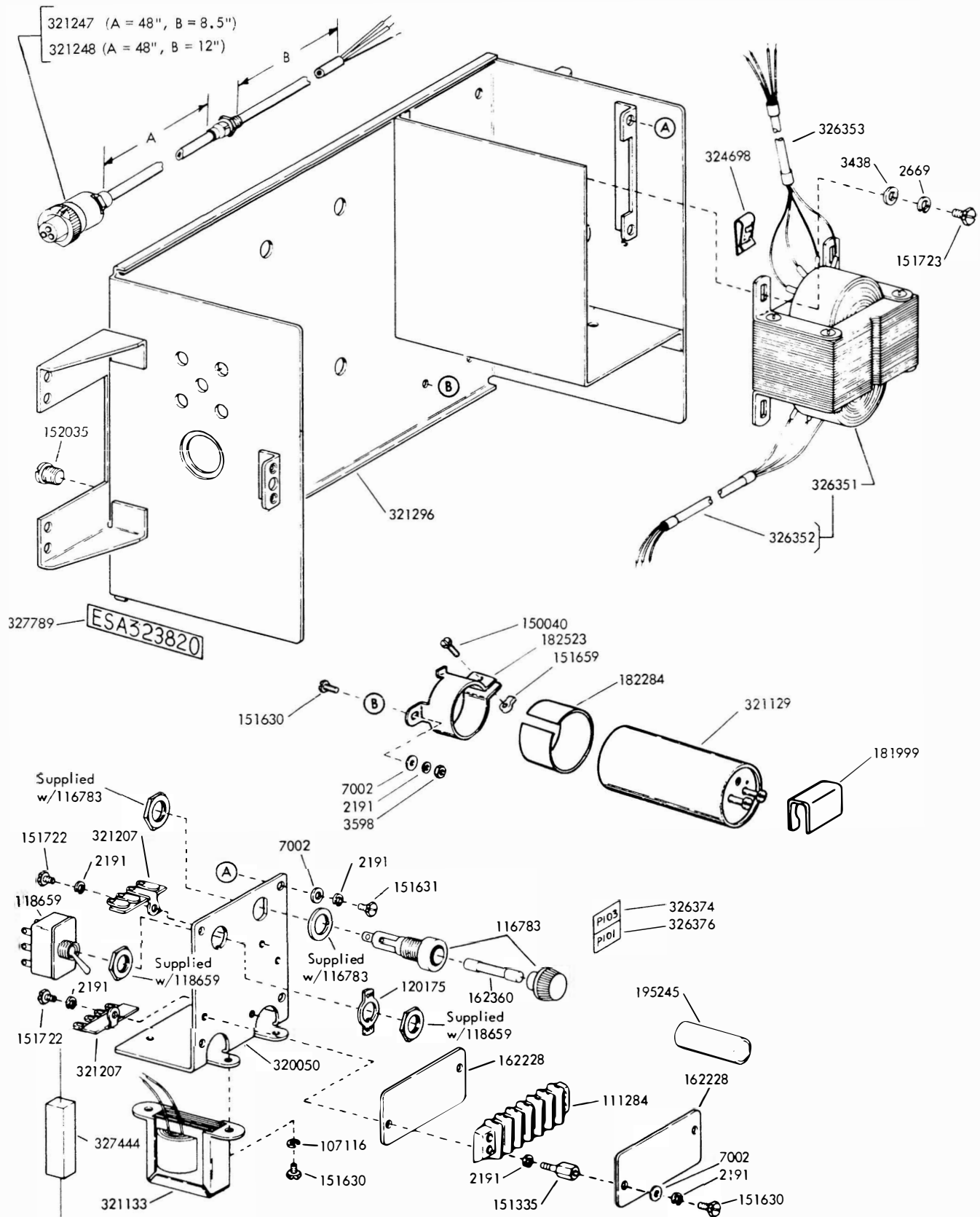


FIGURE 12. 323820 ELECTRICAL SERVICE ASSEMBLY - Used w/KSR and RO Sets

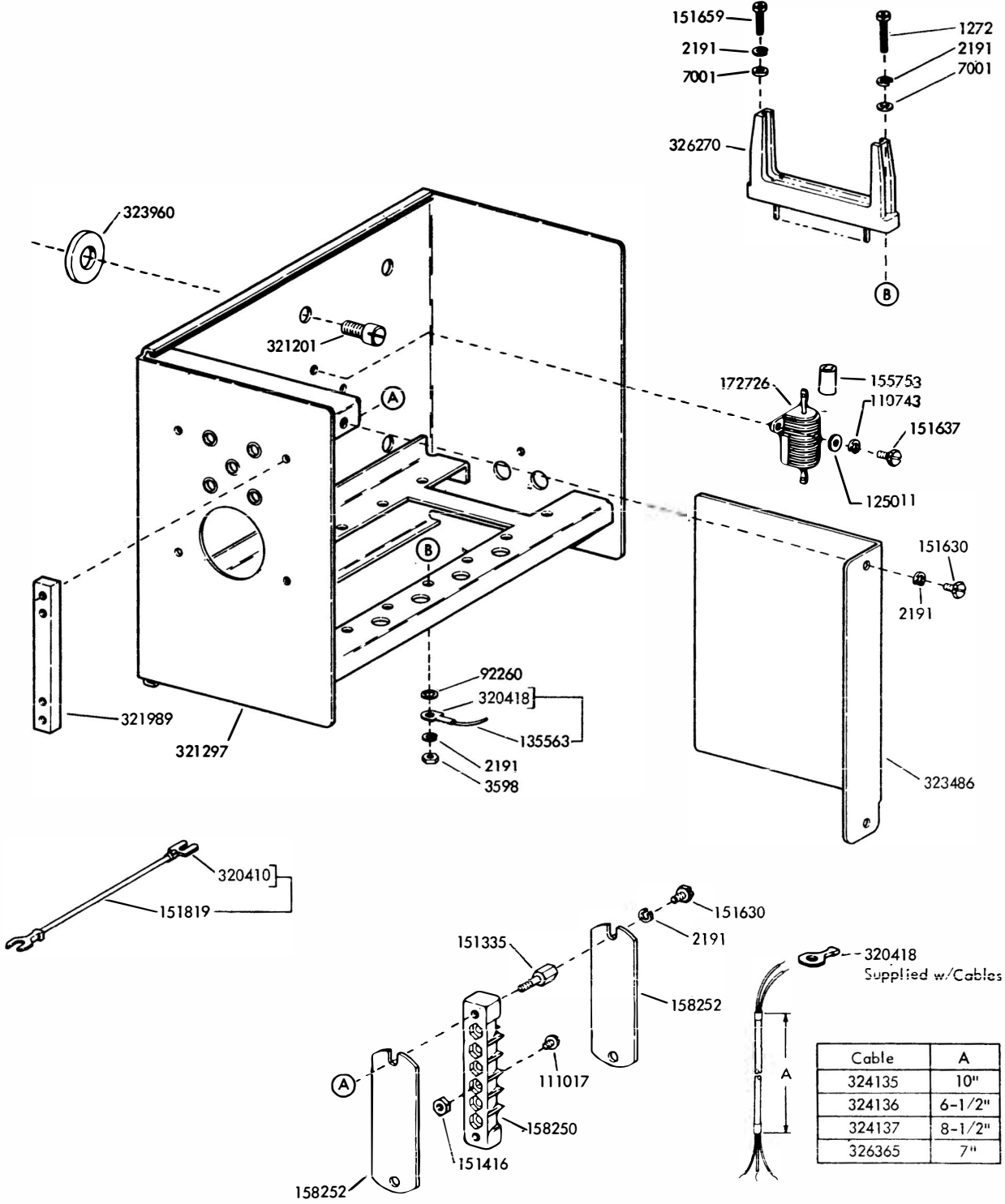


FIGURE 13. 322820 ELECTRICAL SERVICE ASSEMBLY (Continued)

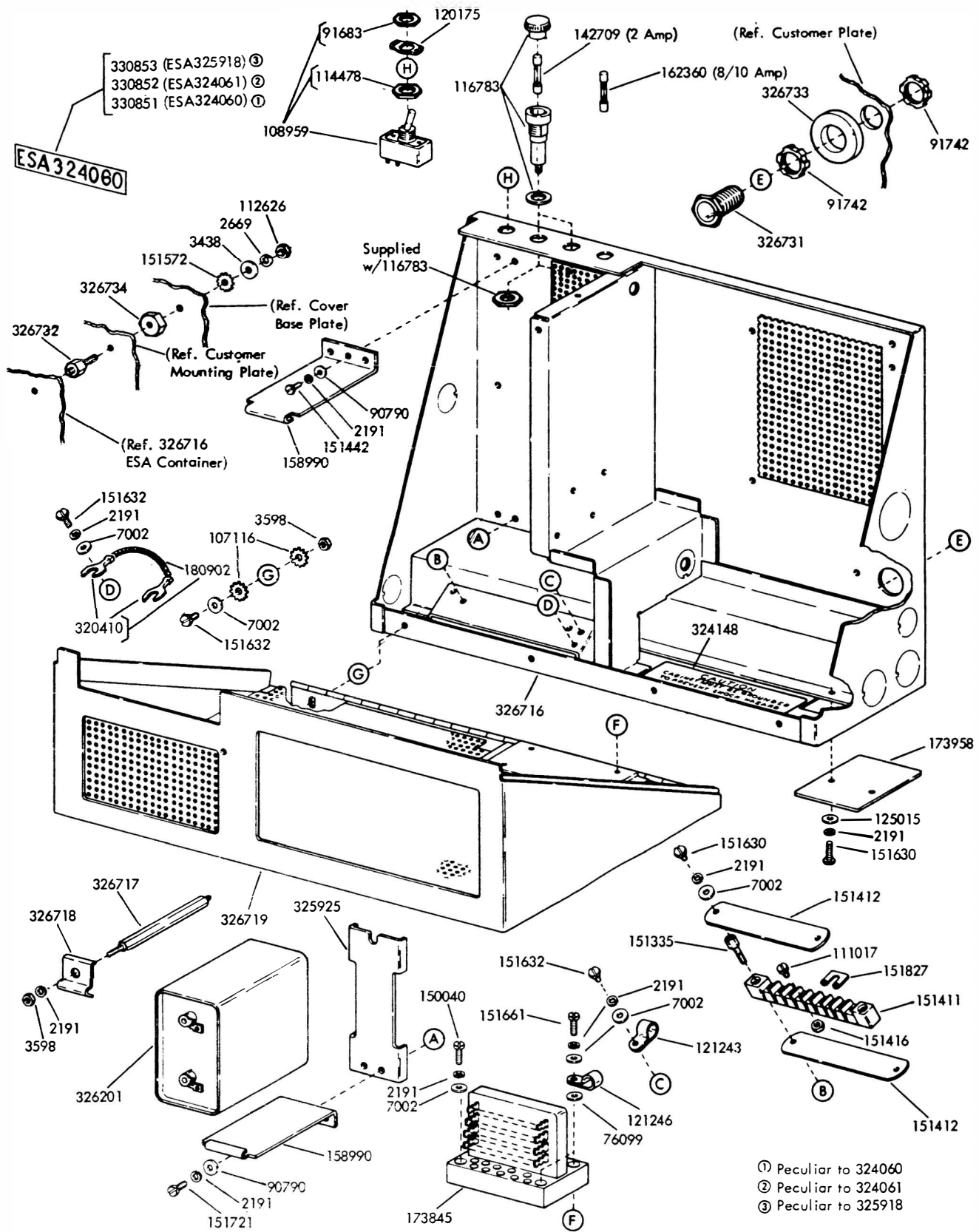


FIGURE 14. 324060, 324061 and 325918 ELECTRICAL SERVICE ASSEMBLIES - Used w/KSR and RO Sets

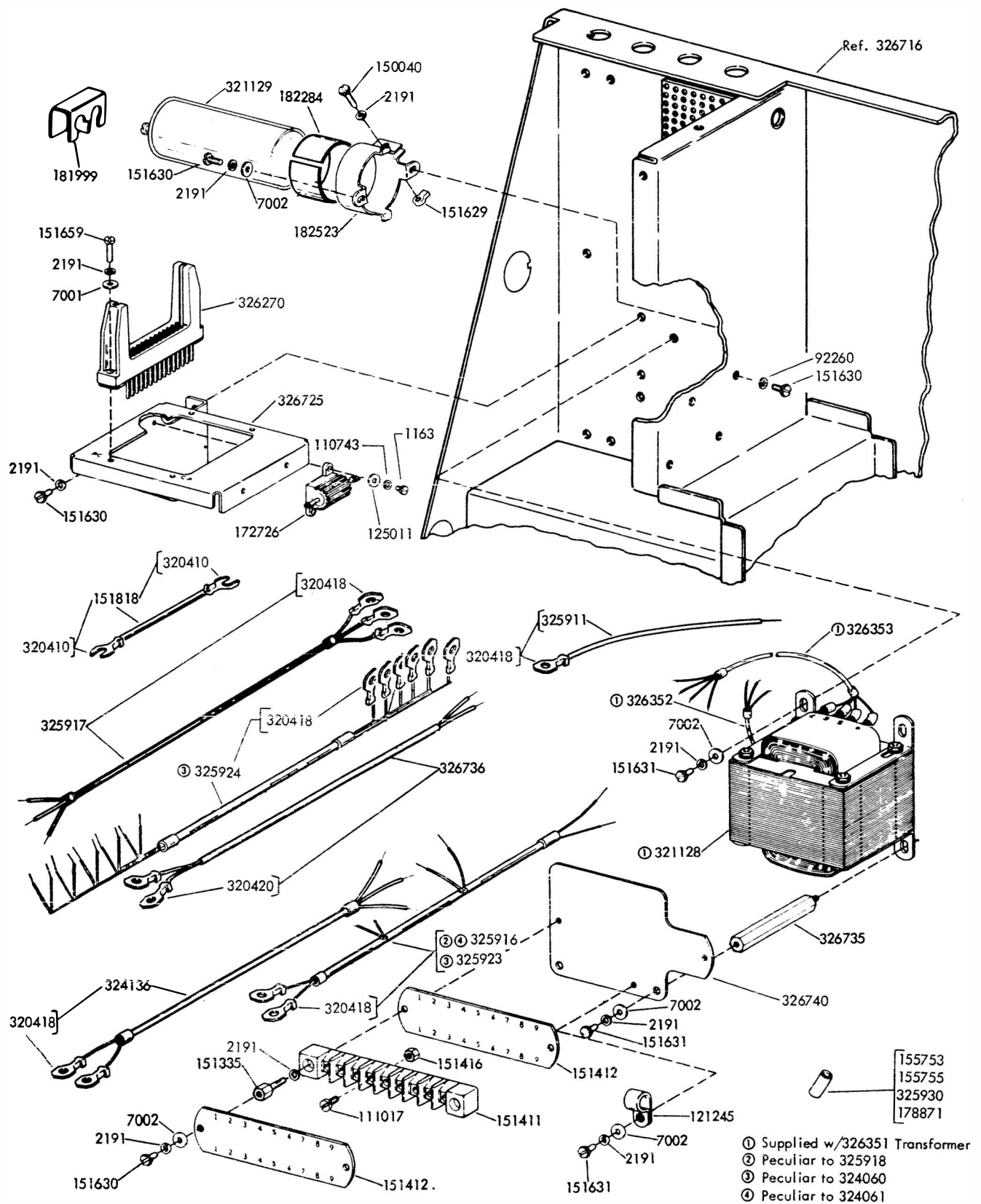


FIGURE 15. 324060, 324061 and 325918 ELECTRICAL SERVICE ASSEMBLIES (Continued)

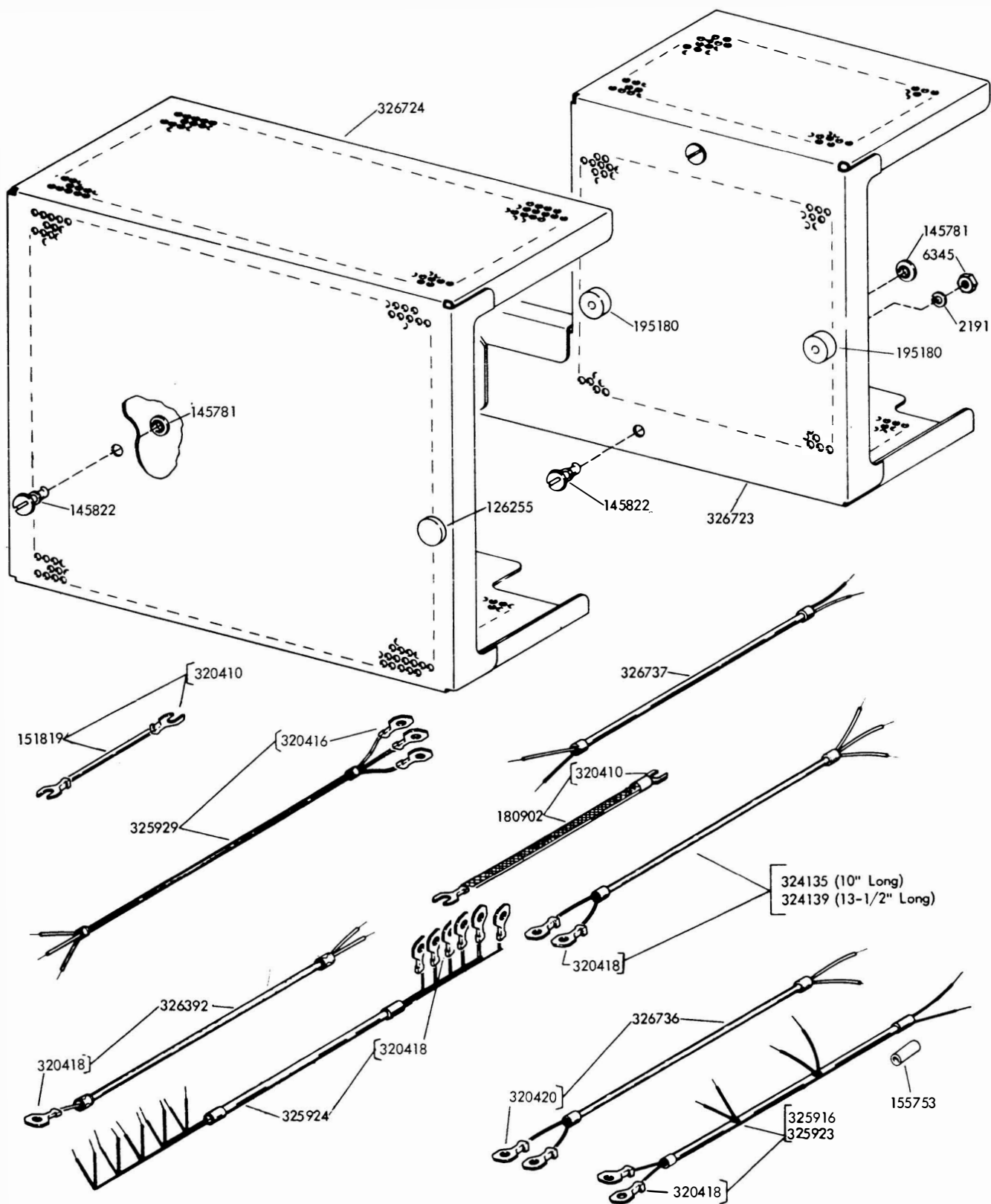


FIGURE 16. 325919 CONTAINER ASSEMBLY (Part of 324060,324061 and 325918 Electrical Service Assemblies)

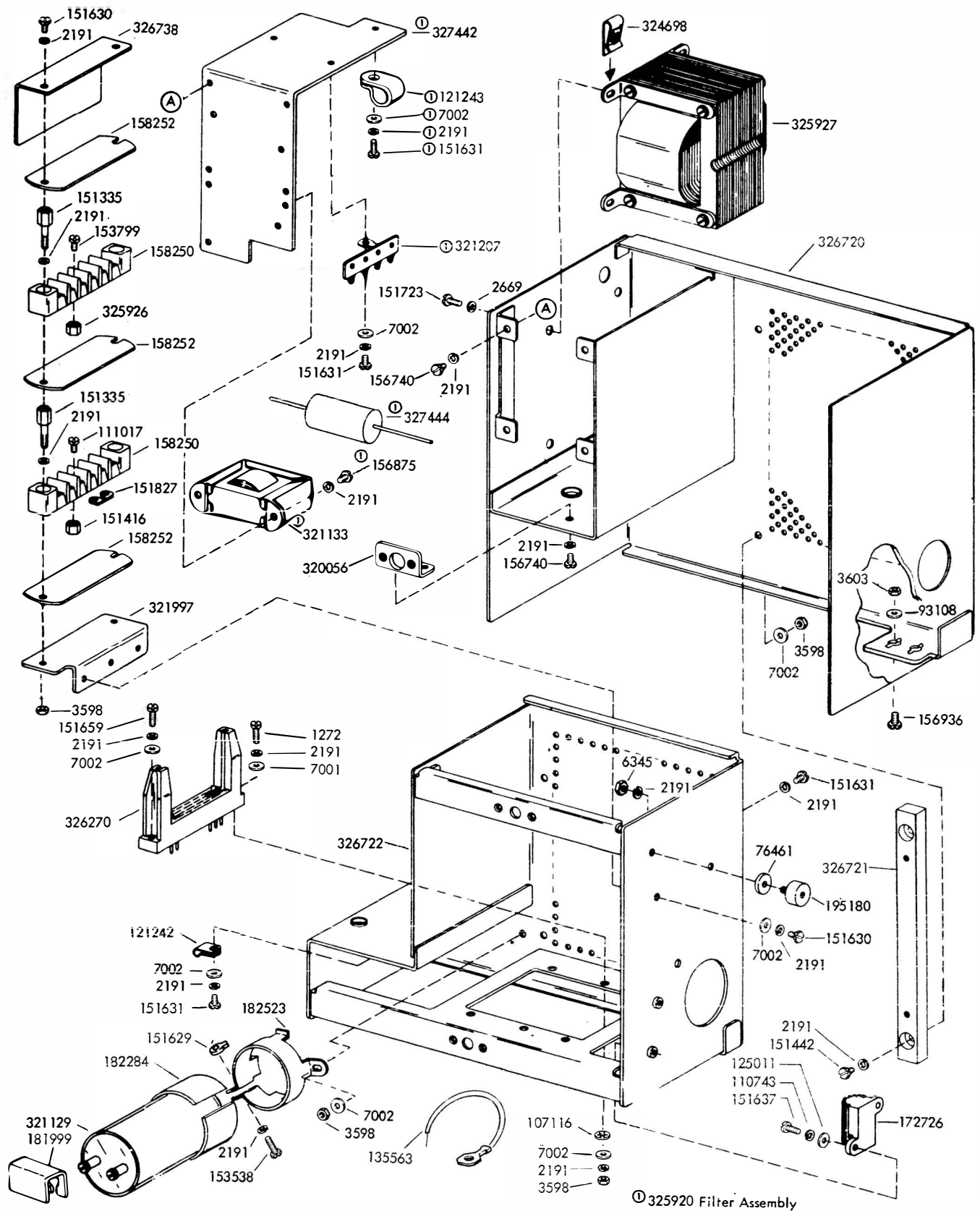


FIGURE 17. 325919 CONTAINER ASSEMBLY (Continued)

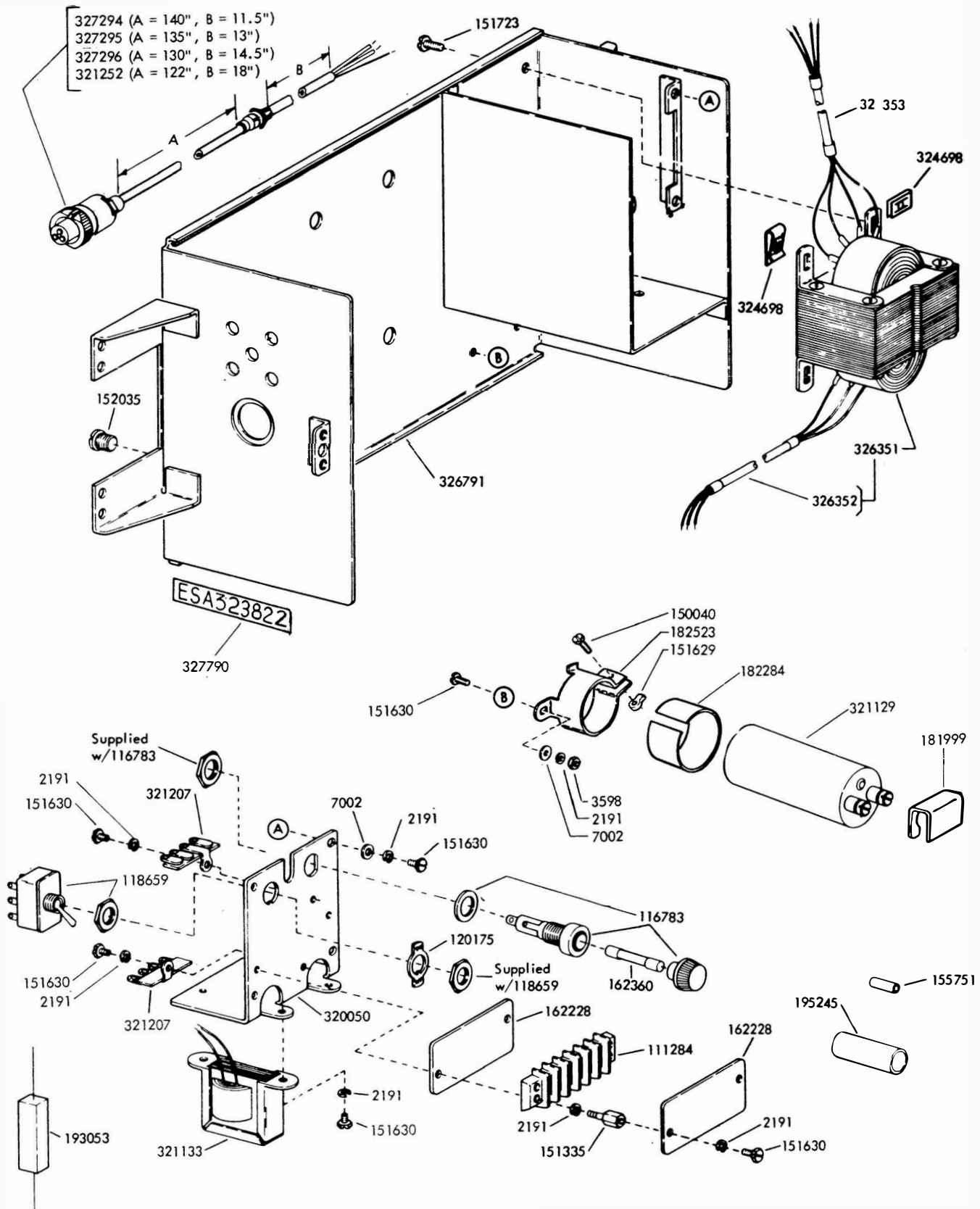


FIGURE 18. 323821 ELECTRICAL SERVICE ASSEMBLY - Multiple LP Set

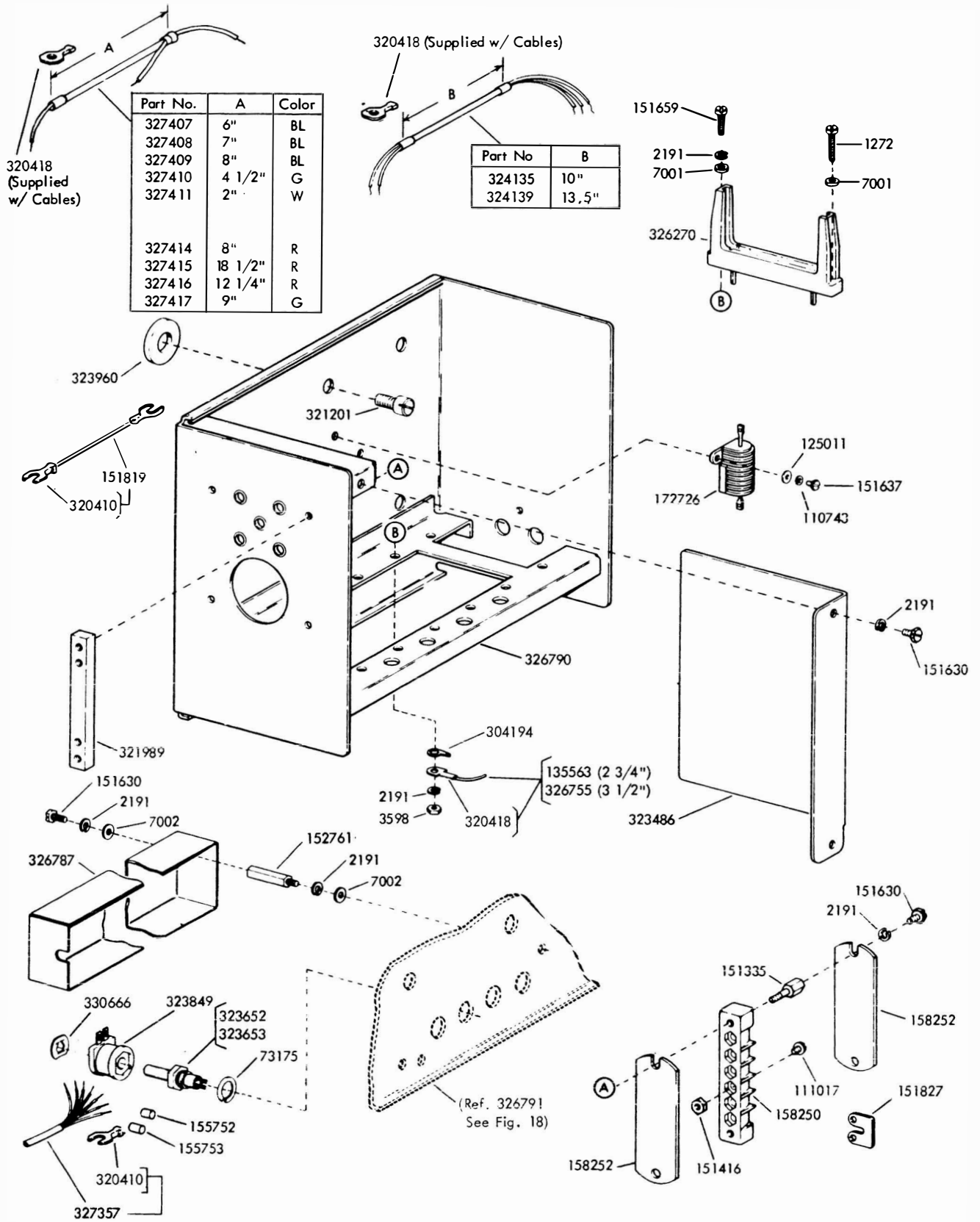


FIGURE 19. 323821 ELECTRICAL SERVICE ASSEMBLY (Continued)

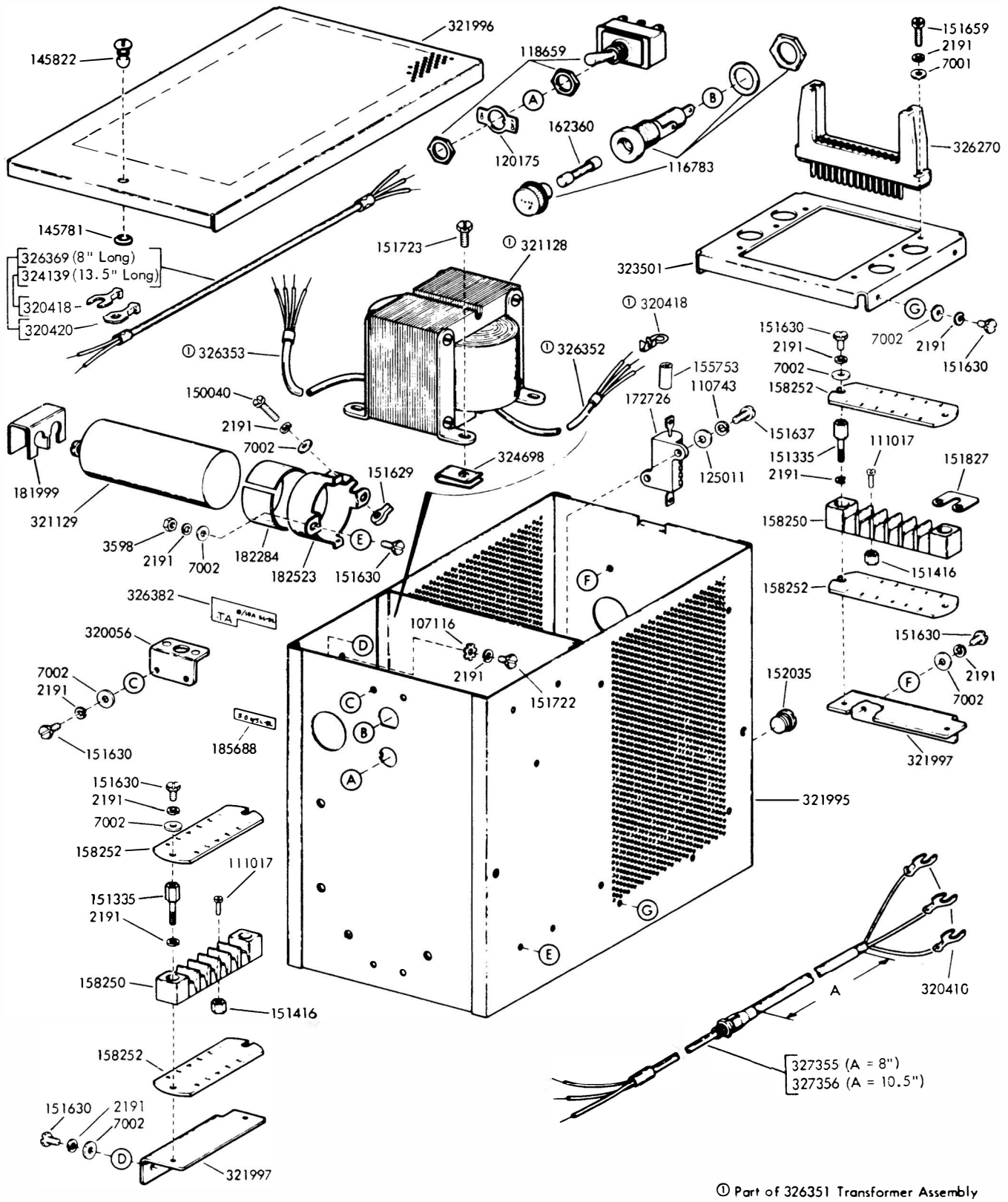
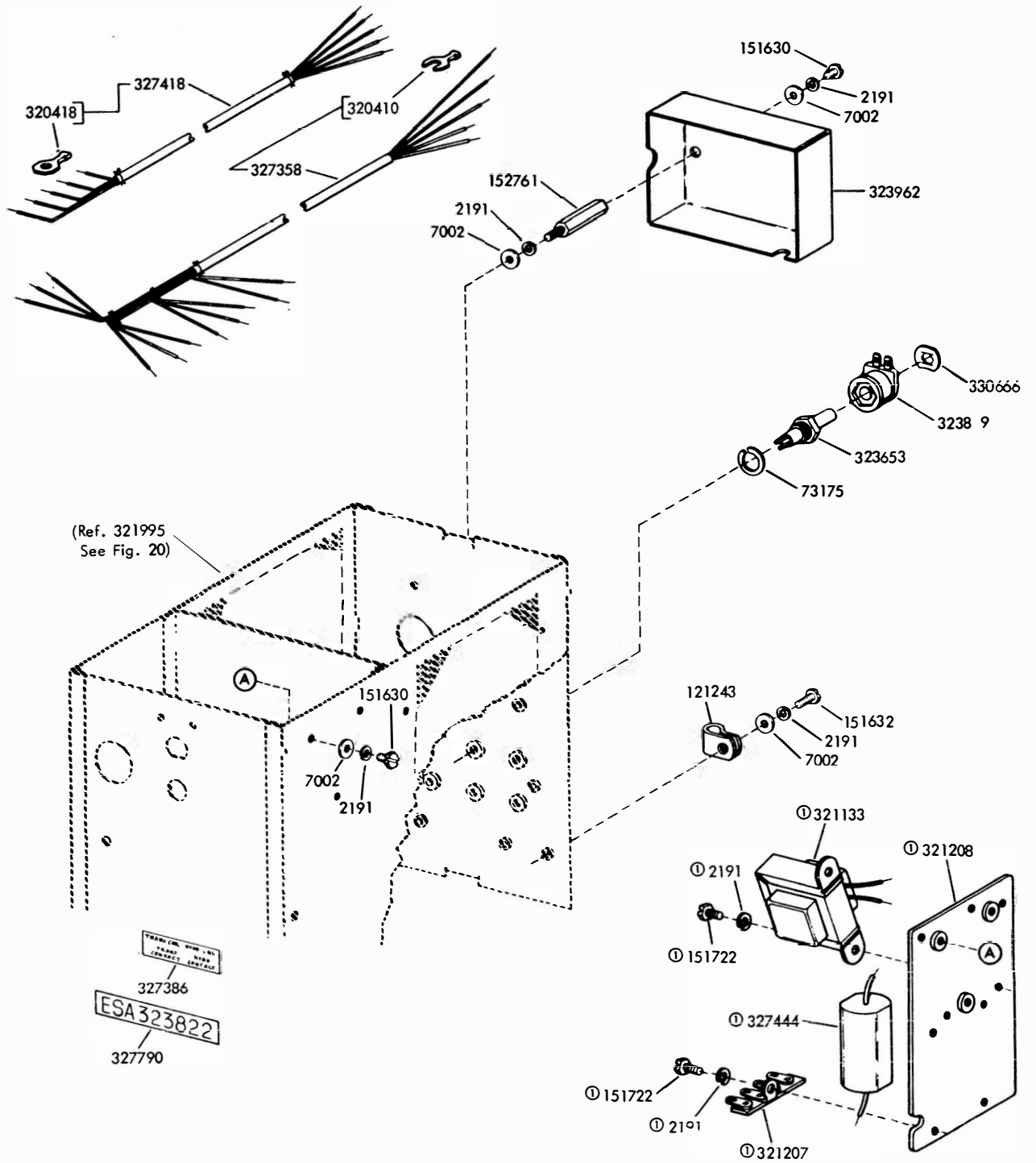


FIGURE 20. 323822 ELECTRICAL SERVICE ASSEMBLY - Multiple LP Set



ⓐ Part of 321205 Filter Assembly

FIGURE 21. 323822 ELECTRICAL SERVICE ASSEMBLY (Continued)

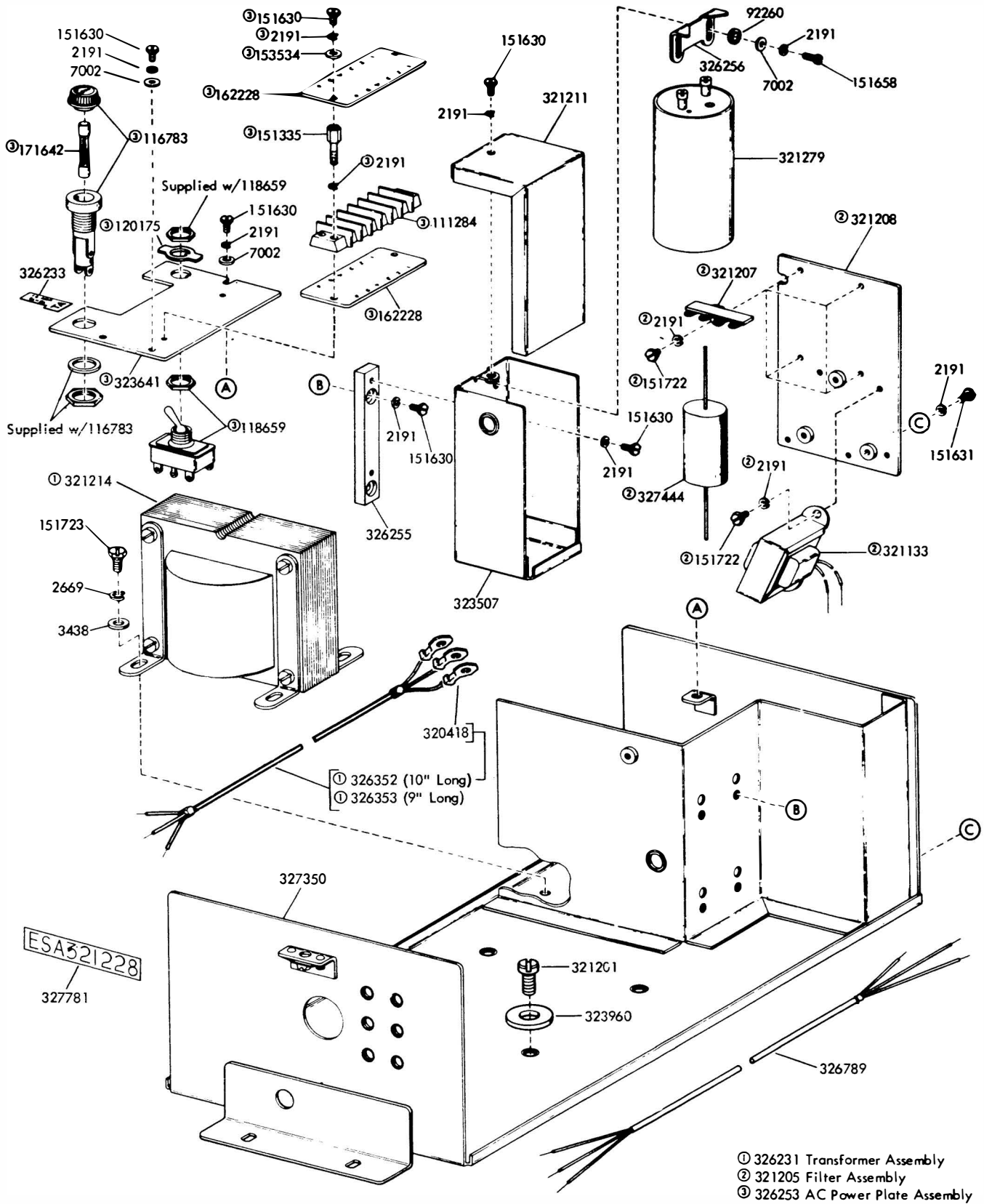


FIGURE 22. 321228 ELECTRICAL SERVICE ASSEMBLY - Multiple LP Set

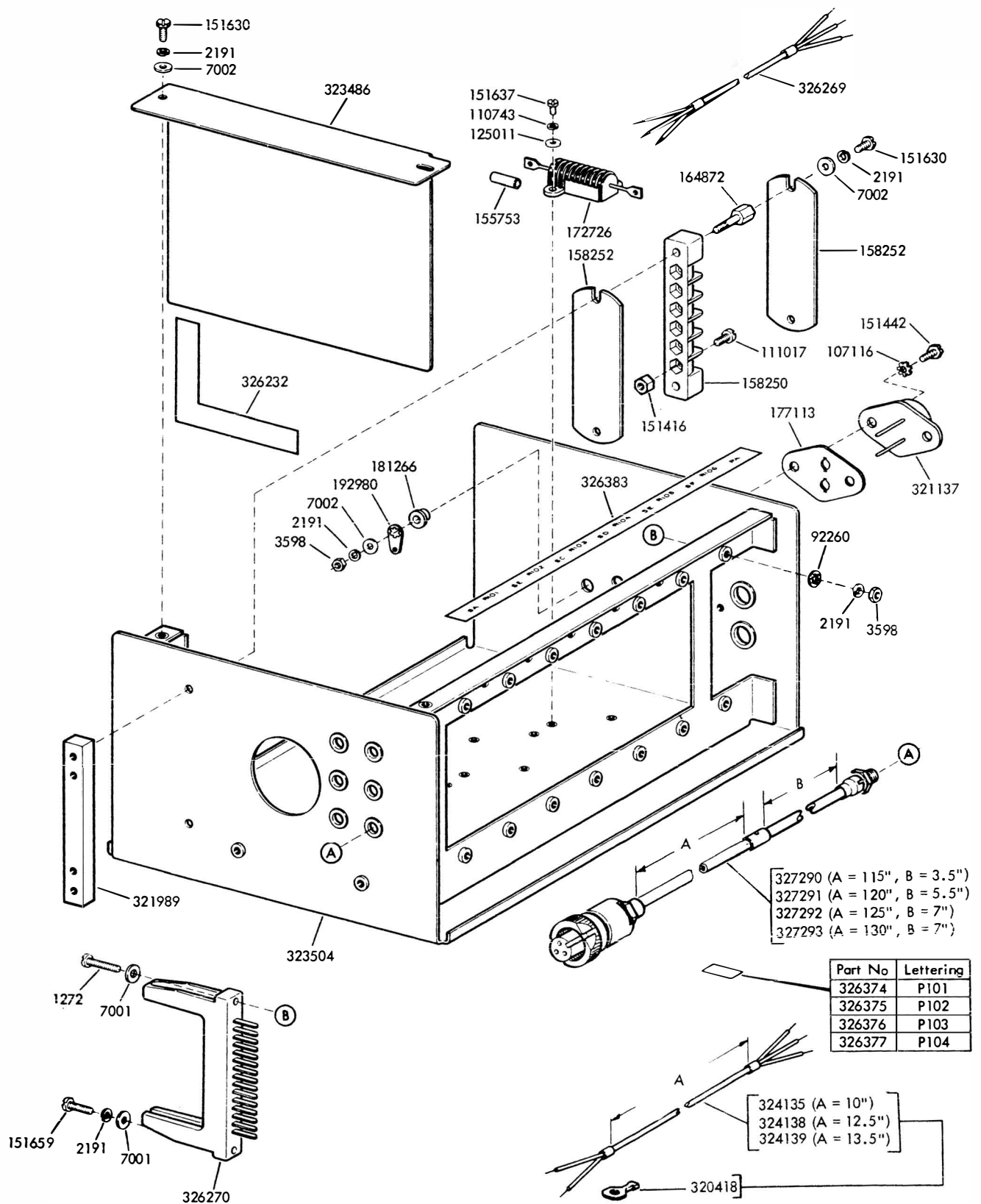


FIGURE 23. 321228 ELECTRICAL SERVICE ASSEMBLY (Continued)

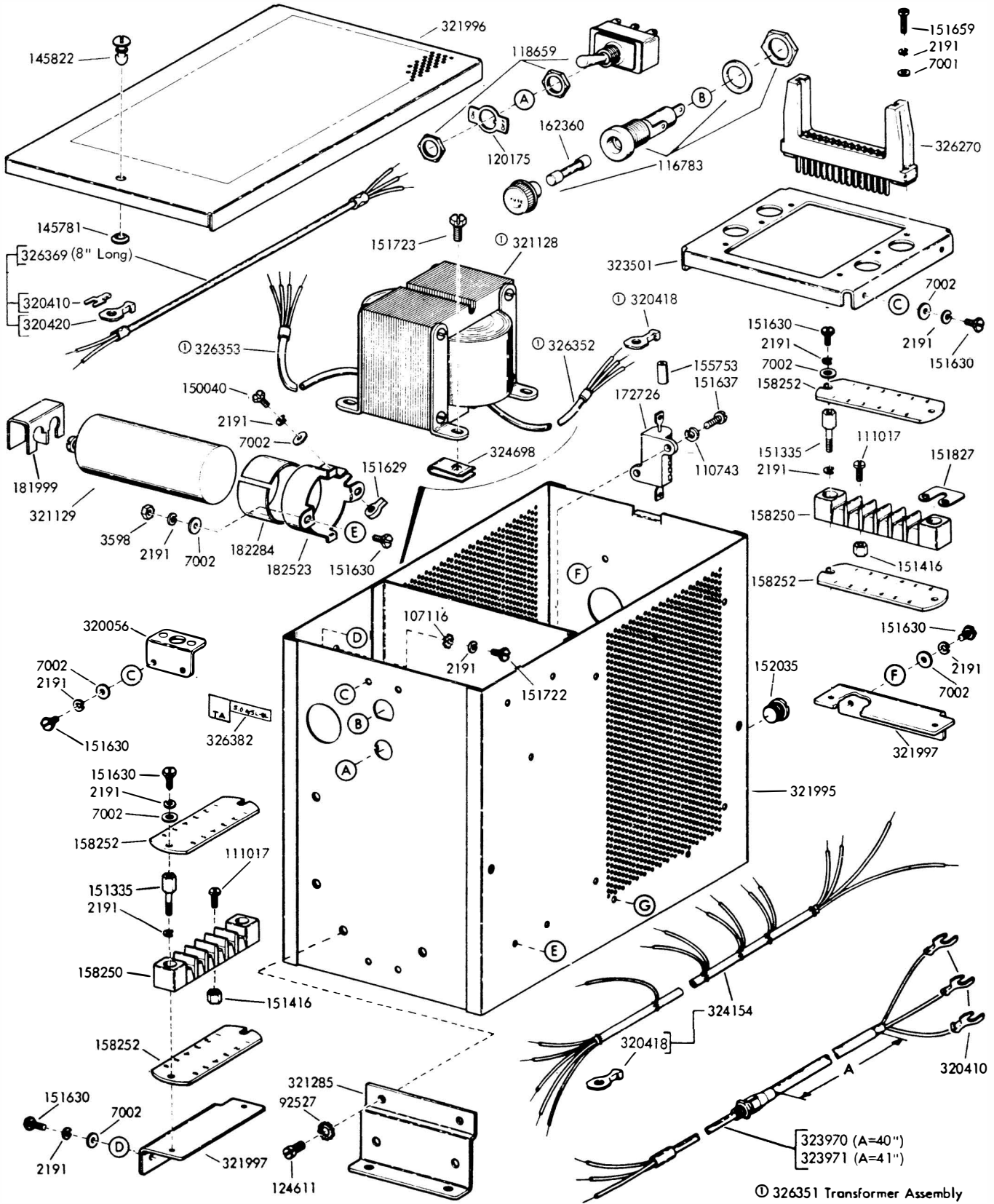


FIGURE 24. 326792 ELECTRICAL SERVICE ASSEMBLY - Used w/Mini-TD Set

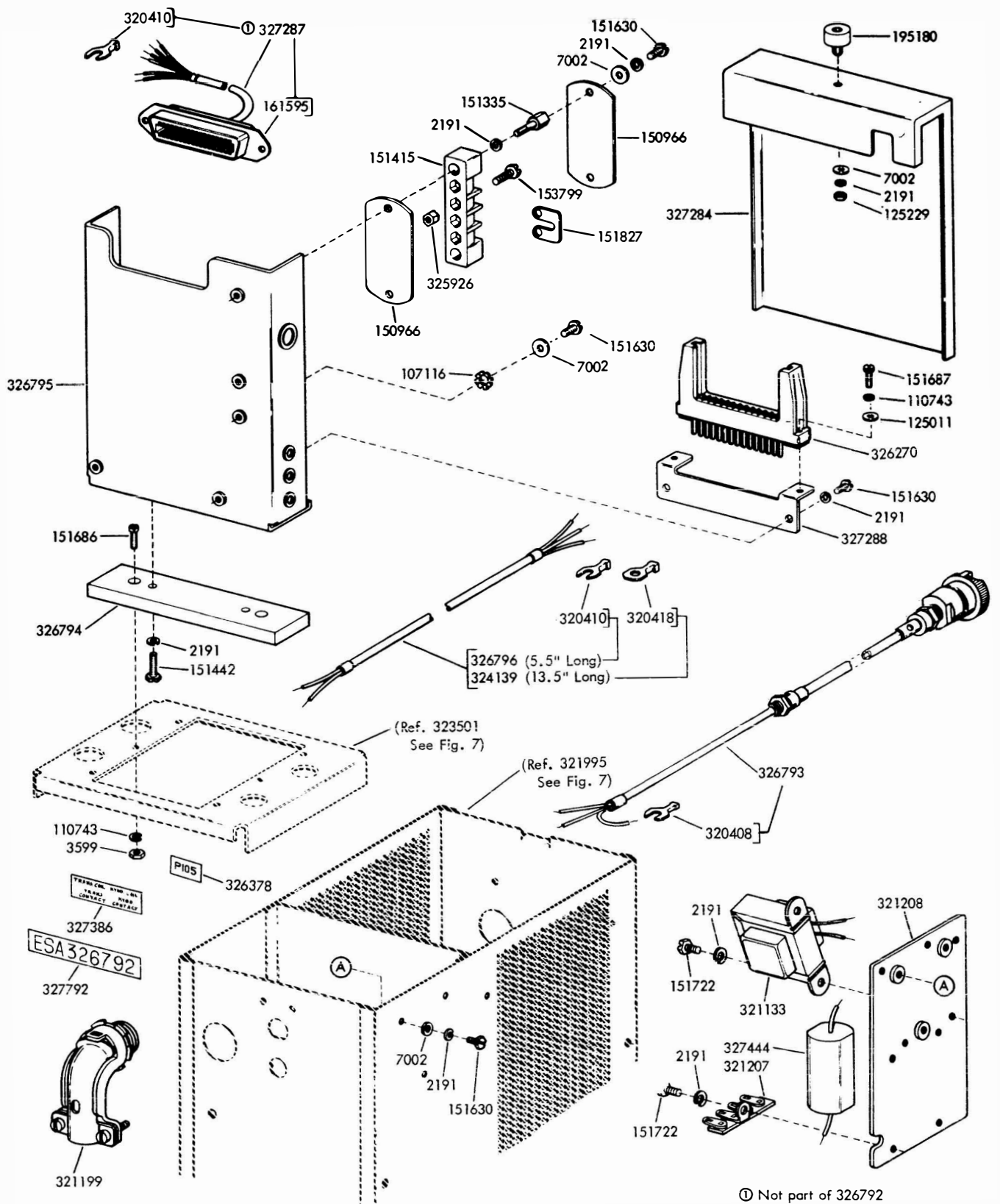


FIGURE 25. 326792 ELECTRICAL SERVICE ASSEMBLY (Continued)

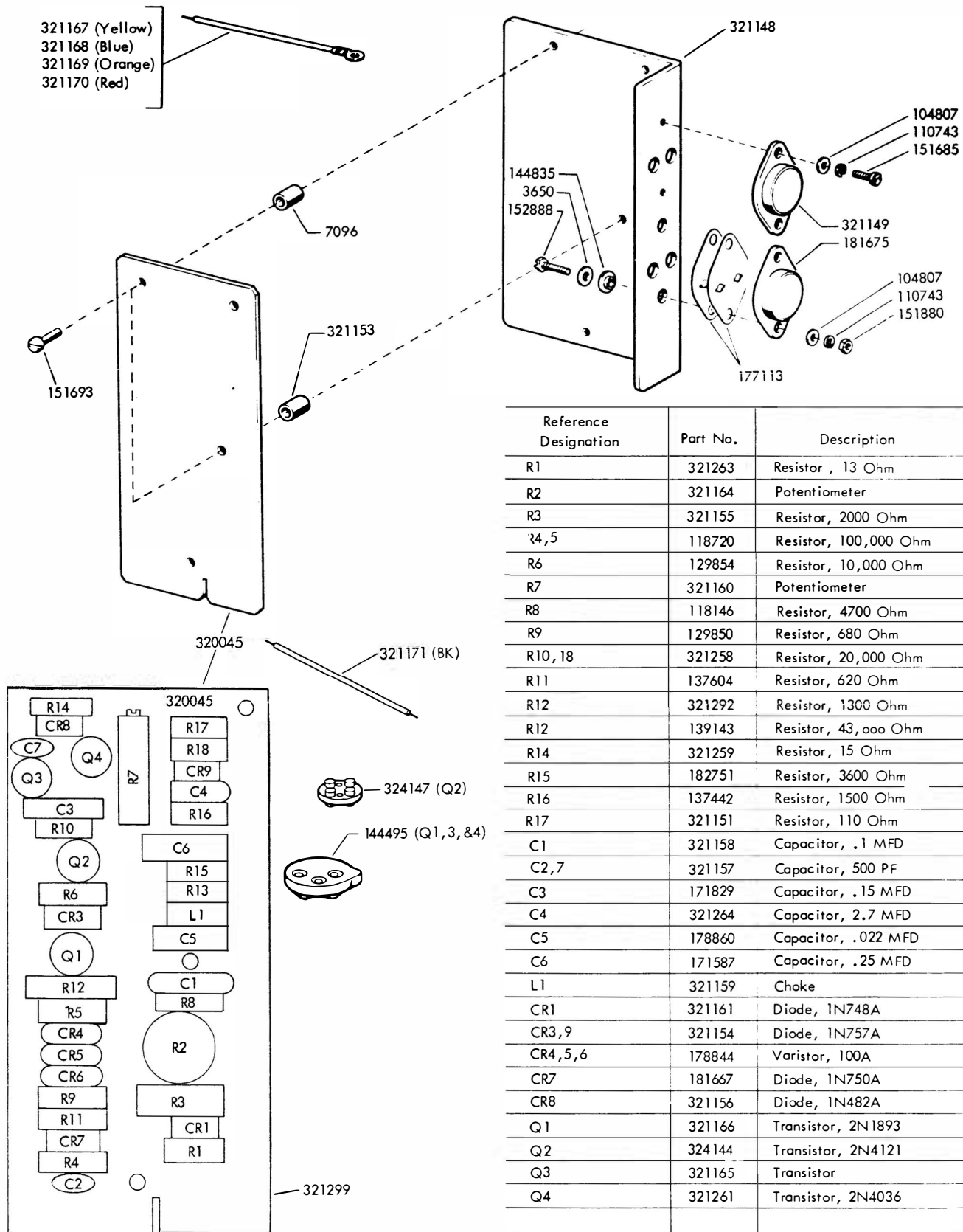
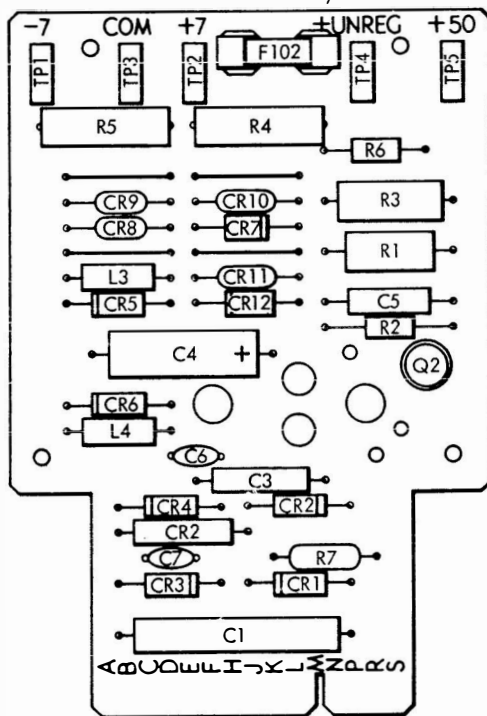
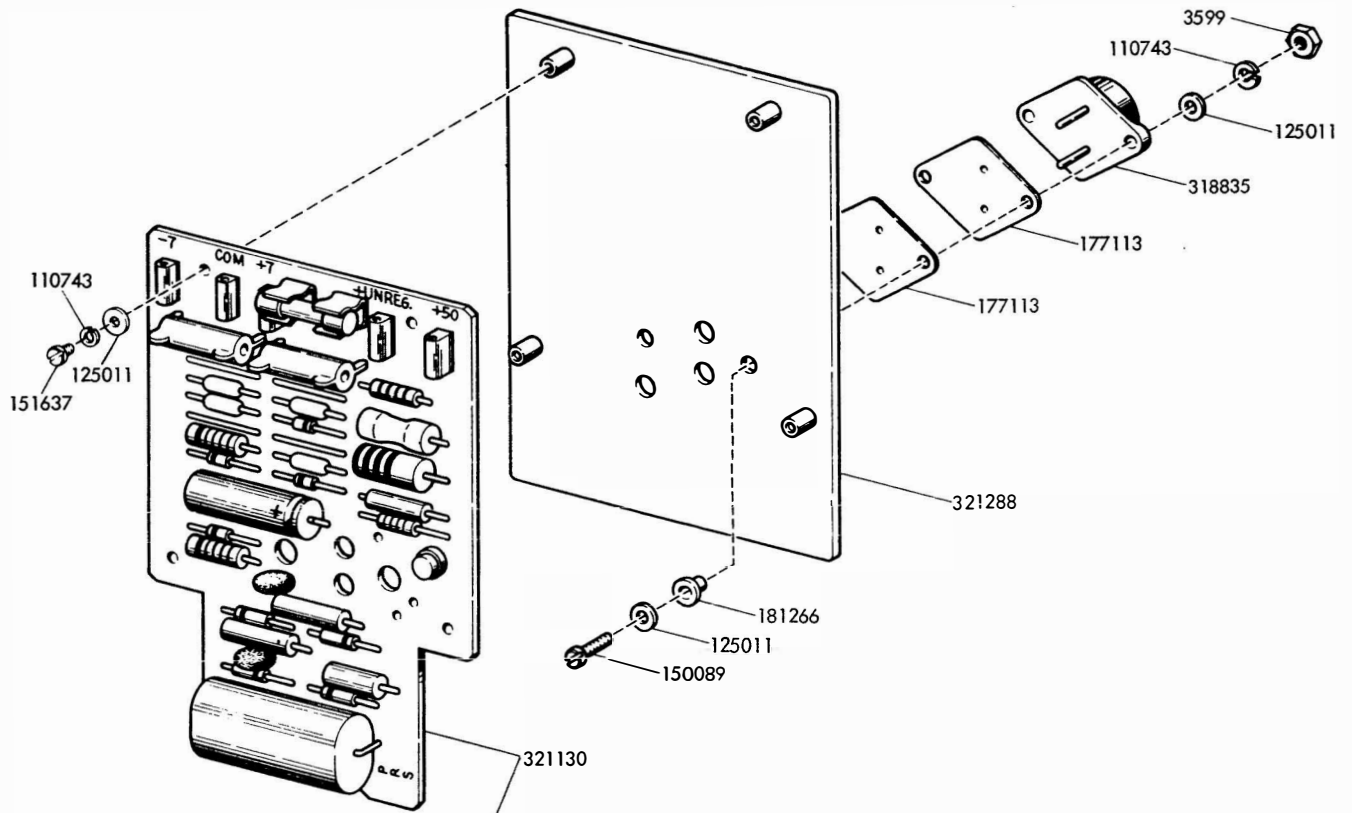
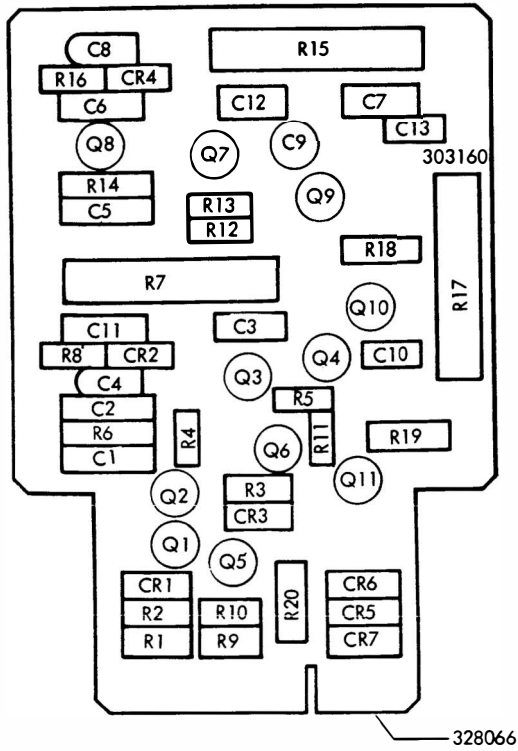


FIGURE 26. 321991 CIRCUIT MAGNET DRIVER ASSEMBLY
Used w/KSR and ASR Set



Reference Designation	Part No.	Description
C1	312284	Capacitor, 1.5 MFD
C2, 3	171585	Capacitor, .22 MFD
C4	171831	Capacitor, 10 MFD
C5	178860	Capacitor, .022 MFD
C6, 7	312385	Capacitor, .1 MFD
R1	198937	Resistor, 2700 Ohm
R2, 6	182180	Resistor, 200 Ohm
R3	171533	Resistor, 4 Ohm
R4, 5	311664	Resistor, 2500 Ohm
R7	305298	Resistor, 3300 Ohm
CR1,2,3,4	182520	Diode, 1N4383
CR5, 6	327794	Diode, Zener (7.2V)
CR7, 12	321286	Diode, 1N4749A
CR8,9,10,11	178844	Varistor, 100A
L3, 4	321159	Choke
Q2	321145	Transistor, 2N2270
TP1	320042	Jack, Test (Slate)
TP2	320041	Jack, Test (Green)
TP3	320039	Jack, Test (Black)
TP4	320040	Jack, Test (Orange)
TP5	320038	Jack, Test (Red)
F102	131807	Fuse, .5 Amp

FIGURE 27. 321290 CIRCUIT CARD- Used w/RO, KSR and ASR Set



Reference Designation	Part No.	Description
R1, 4, 9 & 12	323148	Resistor, 18,000 Ohm
R2 & 10	330643	Resistor, 56,000 Ohm
R3 & 11	323147	Resistor, 36,000 Ohm
R5 & 13	315955	Resistor, 2200 Ohm
R6 & 14	178863	Resistor, 3300 Ohm
R7, 15 & 17	193229	Resistor, 300 Ohm
R8 & 16	315957	Resistor, 3300 Ohm
R18	118180	Resistor, 10,000 Ohm
R19	120424	Resistor, 4300 Ohm
R20	327793	Resistor, 18 Ohm
C1, 2, 3, 5, 6, 7, 11 & 12	330593	Capacitor, .02 MFD
C4 & 8	321264	Capacitor, 2.7 MFD
C9, 10 & 13	321157	Capacitor, 500 PF
CR1, 3, 5, & 6	321156	Diode, 1N482A
CR2 & 4	321154	Diode, 1N457A
CR7	321161	Diode, 1N748A
Q1, 2, 5 & 6	315930	Transistor, 2N3568
Q3, 7 & 10	302865	Transistor, 2N4354
Q4 & 8	321261	Transistor, 2N4036

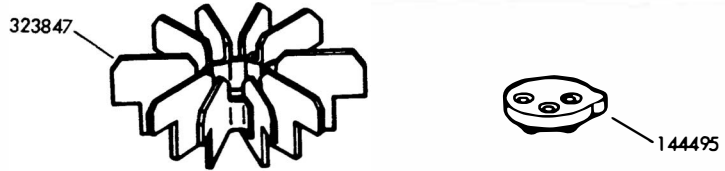
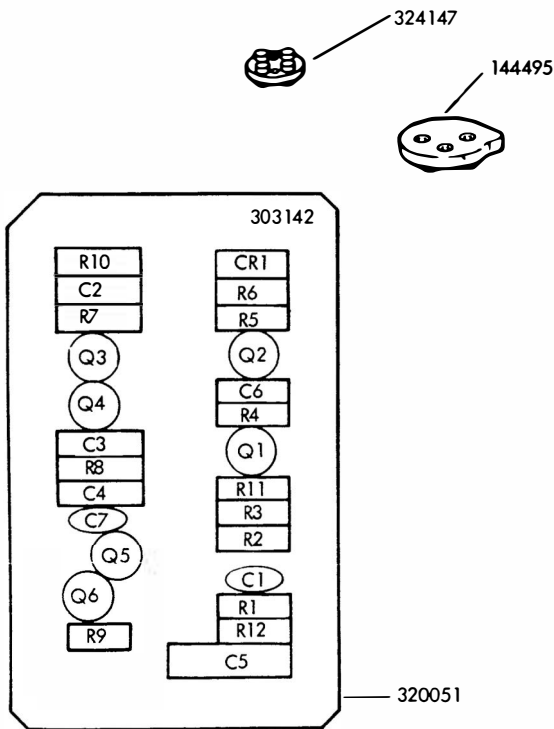
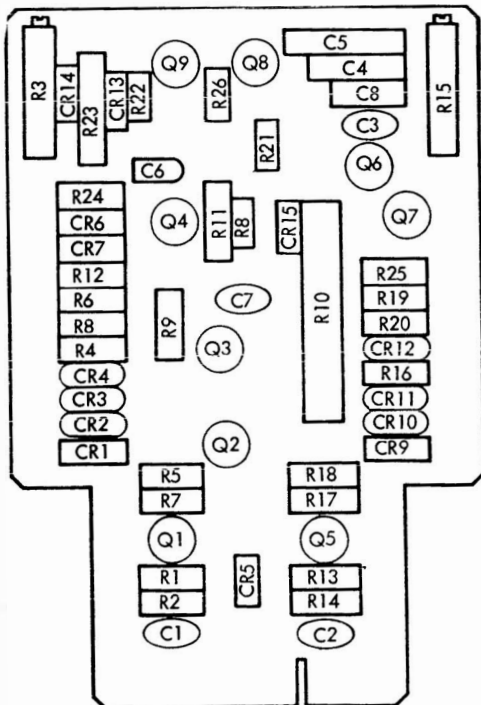
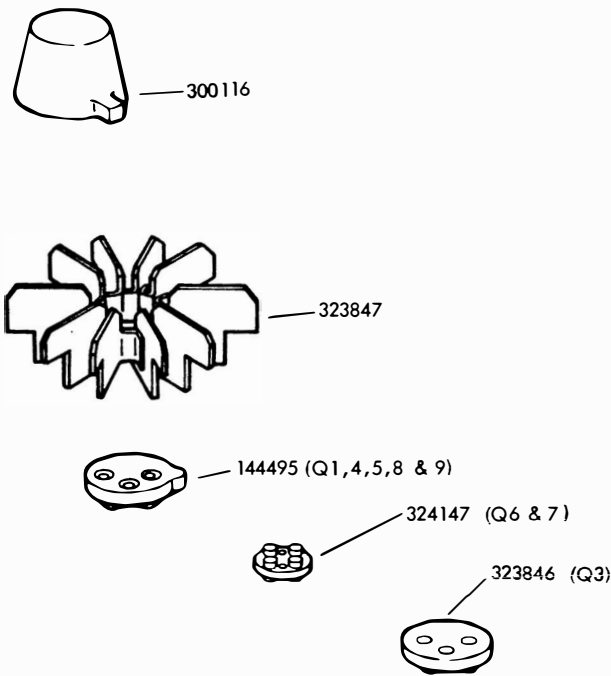


FIGURE 28. 303160 CIRCUIT CARD



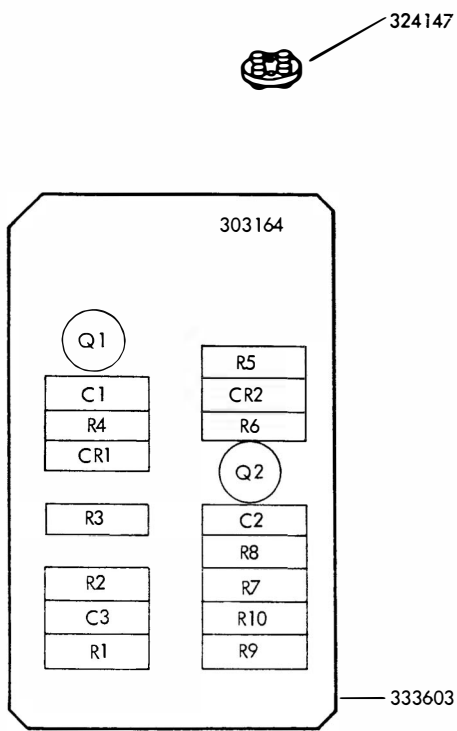
Reference Designation	Part No.	Description
R1&3	118720	Resistor, 100,000 Ohm
R2	118178	Resistor, 220,000 Ohm
R4&8	129854	Resistor, 10,000 Ohm
R5&6	321204	Resistor, 13,000 Ohm
R7&10	118147	Resistor, 6800 Ohm
R9	137438	Resistor, 100 Ohm
R11&12	118146	Resistor, 4700 Ohm
CR1	181619	Diode, 1N482
C1&7	321157	Capacitor, .500 PF
C2	320048	Capacitor, .5 MFD
C3&4	320049	Capacitor, .15 MFD
C5	320047	Capacitor, 2 MFD
C6	181618	Capacitor, .01 MFD
Q1, 4 & 6	315930	Transistor, 2N3568
Q2	324144	Transistor, 2N4121
Q3 & 5	315931	Transistor, 2N3638

FIGURE 29. 303142 CIRCUIT CARD



Reference Designation	Part No.	Description
C1, C2, C3, C7	321157	Capacitor, 500 PF
C4	171829	Capacitor, .15 MFD
C5	326776	Capacitor, .47 MFD
C6	321260	Capacitor, 1 MFD
C8	178860	Capacitor, .022 MFD
R1, R2, R13, R14	118720	Resistor, 100,000 Ohm
R3, R15	323964	Potentiometer, 500,000 Ohm
R4, R16	129854	Resistor, 10,000 Ohm
R5, R17, R22	118177	Resistor, 22,000 Ohm
R6, R19	137604	Resistor, 620 Ohm
R7, R18	118146	Resistor, 4,700 Ohm
R8, R20	129850	Resistor, 680 Ohm
R9	309868	Resistor, 1,300 Ohm
R10	323841	Resistor, 300 Ohm
R11	323842	Resistor, 21 Ohm
R12	178864	Resistor, 3,900 Ohm
R21	321975	Resistor, 33 Ohm
R23	323843	Resistor, 590 Ohm
R24	137442	Resistor, 1,500 Ohm
R25	118154	Resistor, 47,000 Ohm
R26	120424	Resistor, 4,300 Ohm
CR1	321154	Diode, 1N457A
CR2, CR3, CR4,		
CR10, CR11, CR12	178844	Varistor, 100A
CR5	181667	Diode, 1N750A
CR6, CR7, CR13,		
CR15	321156	Diode, 1N482A
CR8	321161	Diode, 1N748A
CR9, CR14	321154	Diode, 1N457A
Q1, Q5	321166	Transistor, 2N1893
Q2	323844	Transistor, 2N3053
Q3	321261	Transistor, 2N4036
Q4	323845	Transistor, 40319
Q6, Q7	324144	Transistor, 2N4121
Q8	321165	Transistor, 2N3638A
Q9	321261	Transistor, 2N4036
	324147	Pad, Transistor Mounting
	144495	Pad, Transistor Mounting
	323846	Pad, Transistor Mounting
	323847	Sink, Heat
	300116	Cover, Insulating
	323835	Card, Circuit

FIGURE 30. 323810 CIRCUIT CARD



Reference Designation	Part No.	Description
R1	330644	Resistor, 390,000 Ohm
R2	118156	Resistor, 56,000 Ohm
R3	330642	Resistor, 1,300,000 Ohm
R4	118166	Resistor, 560,000 Ohm
R5,6,7	118177	Resistor, 22,000 Ohm
R8	137438	Resistor, 100 Ohm
R9	165072	Resistor, 9100 Ohm
R10	137441	Resistor, 1200 Ohm
C1	315976	Capacitor, 470 PF
C2	310926	Capacitor, .15 MFD
C3	312385	Capacitor, .1 MFD
CR1,2	197464	Diode, 1N914
Q1,2	323934	Transistor, 2N3565

FIGURE 31. 303164 CIRCUIT CARD

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Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
1163	Screw, 4-40 x 3/16 Fil 17	125229	Nut, 6-32 Hex 27	151819	Jumper, 3" Black 8,10,15,18,21
1272	Screw, 6-40 x 11/16 Fil 8,15,19,21,25	126250	Screw, 8-32 x 1/4 Fil 5,9,13	151827	Strap, Terminal 16,19,21,22,26,27
2191	Washer, Lock 5 to 27	126255	Bumper, Rubber 3,4,18	151880	Nut, 4-40 Hex 28
2669	Washer, Lock 7,14,16,19,24	129850	Resistor, 680 Ohm 28,31	152035	Plug 6,7,10,11,13,14,20,22,26
3438	Washer, Flat 7,14,16,24	129854	Resistor, 10,000 Ohm 28,30,31	152761	Stud 6,8,10,21,23
3598	Nut, 6-40 Hex 5,7,8,10,12 to 16,19 to 22, 25,26	131807	Fuse, .5 Amp 29	152888	Screw, 4-40 x 7/16 Hex 28
3599	Nut, 4-40 Hex 27,29	135563	Jumper, 2-3/4" Green 8,12,15,19,21	153534	Washer, Flat 24
3603	Nut, 1/4-32 Hex 19	137438	Resistor, 100 Ohm 30,32	153538	Screw, 6-40 x 7/16 Hex 19
3650	Washer, Flat 28	137441	Resistor, 1200 Ohm 32	153799	Screw, 4-40 x 21/64 Hex 19,27
6345	Nut, 6-32 Hex 18,19	137442	Resistor, 1500 Ohm 28,31	155751	Sleeve, 1/8 ID x 1" Lg insulating 7,20
7001	Washer, Flat 5,8,9,12,13,15,17,19,21,22,25,26	137604	Resistor, 620 Ohm 28,31	155752	Sleeve, 5/64 ID x 1/2" Lg insulating 10,21
7002	Washer, Flat 5 to 14,16,17,19 to 27	139143	Resistor, 43,000 Ohm 28	155753	Sleeve, 1/8 ID x 1/2" Lg insulating 10,21
7096	Bushing, Insulating 28	142709	Fuse, 2 Amp 16	155755	Sleeve, 11/64 ID x 5/8" Lg Insulating 17
55219	Screw, 8-32 x 3/8 Fil 11	144495	Pad, Transistor Mounting 28,30,31	156740	Screw, 6-40 x 7/32 Hex 11
73175	Washer, Lock 6,8,10,21,23	144835	Bushing, Spring 28	156777	Jumper, 2" Black 10
76099	Washer, Flat 16	145781	Grommet 3,4,5,10,11,13,18,22,26	156875	Screw, 6-40 x 5/32 Fil 19
76461	Washer, Flat 19	145822	Stud, Oval Head 3,4,5,10,11,13,18,22,26	156936	Screw, 1/4-32 x 5/16 Hex 19
83885	Nut, 6-32 Hex 12	150040	Screw, 6-40 x 5/8 Fil 7,10,12,13,14,16,17,20,22,26	157230	Jumper, 6" Black 8
90790	Washer, Flat 16	150089	Screw, 4-40 x 1/2 Fil 29	157231	Jumper, 8" Black 8
91683	Nut, 15/32-32 Hex 16	150966	Insulator, Terminal Block 27	158250	Block, Terminal 5,8,9,11,12,13,15,19,21,22,25,26
91742	Nut, Lock 16	151335	Stud 5,7,9,11 to 17,19 to 22,24,26,27	158252	Insulator, Terminal Block 5,8,9,11,12,13,15,19,21,22,25,26
92260	Washer, Lock 8,12,15,17,24,25	151411	Block, Terminal 16,17	158990	Bracket, Mounting 16
92527	Washer, Lock 5,9,11,13,26	151412	Insulator, Terminal Block 16,17	161595	Connector, 36 Pt Receptacle 27
93108	Washer, Lock 19	151415	Block, Terminal 27	162228	Insulator, Terminal Block 7,14,20,24
104807	Washer, Flat 28	151416	Nut, 6-40 Hex 5,8,9,11,12,13,15,16,17,19,21,22,25,26	162360	Fuse, SL-BL .8 Amp 5,7,9,11,13,14,16,20,22,26
107116	Washer, Lock 5,7,9,11,13,14,16,19,22,25,26,27	151442	Screw, 6-40 x 1/2 Hex 16,19,25,27	164872	Stud 8,25
108959	Switch, DP-ST Toggle 16	151572	Washer, Lock 16	165072	Resistor, 9,100 Ohm 32
110743	Washer, Lock 6,8,10,12,13,15,17,19,21,22,25 to 29	151629	Nut, 6-40 Lug 7,10,12,13,17,19,20,22,26	171533	Resistor, 4 Ohm 29
111017	Screw, 6-40 x 5/16 Fil 5,8,9,11,12,13,15,16,17,19,21,22,25,26	151630	Screw, 6-40 x 1/4 Hex 5 to 17,19 to 27	171585	Capacitor, .22 MFD 29
111284	Block, Terminal 7,14,20,24	151631	Screw, 6-40 x 5/16 Hex 7,11,12,14,17,19,24	171587	Capacitor, .25 MFD 28
112626	Nut, 10-32 Hex 16	151632	Screw, 6-40 x 3/8 Hex 6,7,10,16,23	171542	Fuse, SL-BL 1.6 Lamp 24
114478	Nut, 15/32-32 Hex 16	151637	Screw, 4-40 x 1/4 Fil 6,8,10,12,13,15,19,21,22,25,26,29	171829	Capacitor, .15 MFD 28,31
116783	Holder, Fuse 5,7,9,11,13,14,16,20,22,24,26	151658	Screw, 6-40 x 5/16 Fil 24	171831	Capacitor, 10 MFD 29
118146	Resistor, 4,700 Ohm 28,30,31	151659	Screw, 6-40 x 1/2 Fil 5,8,9,12 to 15,17,19,21,22,25,26	172726	Resistor, 250 Ohm 6,8,10,12,13,15,17,19,21,22,25,26
118147	Resistor, 6,800 Ohm 30	151661	Screw, 6-40 x 1 Fil 16	173845	Block, 4 Row Terminal 16
118154	Resistor, 47,000 Ohm 31	151685	Screw, 4-40 x 5/16 Fil 27	173958	Plate 16
118156	Resistor, 56,000 Ohm 32	151686	Screw, 4-40 x 3/8 Fil 27	177113	Insulator 25,28,29
118166	Resistor, 560,000 Ohm 32	151687	Screw, 4-40 x 7/16 Fil 12,27	178844	Varistor 28,29,31
118177	Resistor, 22,000 Ohm 31,32	151693	Screw, 6-40 x 9/16 Fil 28	178860	Capacitor, .022 MFD 28,29,31
118178	Resistor, 3,000 Ohm 30	151721	Screw, 6-40 x 3/4 Hex 16	178863	Resistor, 3,300 Ohm 30
118180	Resistor, 10,000 Ohm 30	151722	Screw, 6-40 x 3/16 Hex 7,9,11,14,22,23,24,26,27	178864	Resistor, 3,900 Ohm 31
118659	Switch, Toggle 5,7,9,11,13,14,20,22,24,26	151723	Screw, 8-32 x 3/8 Hex 5,7,9,11,13,14,19,20,22,24,26	178871	Sleeve, 1/2 ID x 1-1/8" Lg Insulating 17
118720	Resistor, 100K Ohm 28,30,31	151818	Jumper, 4-1/4" Black 17	180902	Jumper, 3-1/2" Braided 16,18
120175	Plate, ON-OFF 5,7,9,11,13,14,16,20,22,24,26			181266	Bushing, Insulating 25,29
120424	Resistor, 4,300 Ohm 30,31			181618	Capacitor, .01 MFD 30
121242	Clamp, 1/8 ID Cable 19				
121243	Clamp, 3/16 ID Cable 6,10,16,19,23				
121244	Clamp, 1/4 ID Cable 7				
121245	Clamp, 5/16 ID Cable 17				
121246	Clamp, 3/8 ID Cable 16				
124611	Screw, 8-32 x 3/8 Hex 13,26				
125011	Washer, Flat 6,8,10,13,15,17,19,21,22,25,27,29				
125015	Washer, Flat 16				

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Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
181619	Diode 30	321130	Card, Circuit 29	321986	Cover w/Bumpers 3
181667	Diode 28,31	321133	Inductor 7, 11, 14, 19,20, 23, 24,27	321987	Cover w/Studs 3
181675	Transistor, Power 28			321989	Spacer 15,21,25
181999	Insulator 7,10, 12, 13,14, 17, 19, 20,22,26	321137	Transistor, Power 25	321991	Driver Assembly, Circuit Magnet 2,28
182180	Resistor, 200 Ohm 29	321145	Transistor 29	321995	Container, Outer 5,6,9 to 13,22,23,26,27
182284	Insulator, .015" Thk 7,10,12, 13,14,17, 19,20,22,26	321148	Sink, Heat 28	321996	Cover 5,10,11,13,22,26
182520	Rectifier 29	321149	Diode 28	321997	Bracket 5,9,11,12,13,19, 22,26
182523	Clamp, 1-3/8" ID Mounting 5,7, 10,12,13,14,17,19,20,22,26	321151	Resistor, 110 Ohm 28	321998	Container 12
182751	Resistor, 3.6K Ohm 28	321153	Spacer 28	321999	Bracket, Connector Mounting 12
185688	Plate, Identification 9,11,13,22	321154	Diode 28,30,31	323147	Resistor, 36,000 Ohm 30
192980	Lug, Terminal 25	321155	Resistor, 2000 Ohm 28	323148	Resistor, 18,000 Ohm 30
193053	Capacitor, 2 MFD 20	321156	Diode 28,30,31	323486	Cover 8,15,21,25
193229	Resistor, 300 Ohm 30	321157	Capacitor, 500 PF 28,30,31	323495	Bracket 5,9,13
195180	Bumper, Rubber 12,18,19,27	321158	Capacitor, .1 MFD 28	323501	Bracket, Connector Mounting 5,9,13,22,26,27
195245	Sleeve, 1/2 ID x 1-1/2" Lg Insulating 7,9,11,13,14,20	321159	Choke 28,29	323504	Frame, Inner .25
197464	Diode 32	321160	Potentiometer 28	323505	Cover w/Bumpers 4
198937	Resistor, 2700 Ohm 29	321161	Diode 28,30,31	323506	Cover w/Studs 4
300116	Cover, Insulating 31	321164	Potentiometer 28	323507	Container 24
302865	Transistor 30	321165	Transistor 28,31	323641	Plate 24
303142	Card, EC142 Circuit 2,30	321166	Transistor 28,31	323652	Relay, SP-ST Isolation 6,8, 10,21
303160	Card, Circuit 2,30	321167	Jumper, 2-7/8" Yellow 28	323653	Relay, Isolation 8,10,21, 23
303164	Card, Circuit 2,32	321168	Jumper, 2-7/8" Blue 28	323810	Card Assembly, Circuit 2,31
304194	Lug, Terminal 21	321169	Jumper, 2-7/8" Orange 28	323811	Service Assembly, Electrical 2,7,8
305298	Resistor, 3,300 Ohm 29	321170	Jumper, 2-7/8" Red 28	323812	Service Assembly, Electrical 2,5,6
309868	Resistor, 1,300 Ohm 31	321171	Jumper, 3-3/4" Black 28	323813	Service Assembly, Electrical 2,11,12
310926	Capacitor, 15 MFD 32	321199	Connector, 90 Degree Angle 27	323815	Service Assembly, Electrical 2,7,8
311664	Resistor, 2,500 Ohm 29	321201	Screw, 1/4-20 x 1/2 Fil 8, 15,21,24	323820	Service Assembly, Electrical 2,14,15
312284	Capacitor, 1.5 MFD 29	321204	Resistor, 13,000 Ohm 30	323821	Service Assembly, Electrical 2,20,21
312385	Capacitor, .1 MFD 29,32	321205	Filter Assembly 11,23,24	323822	Service Assembly, Electrical 2,22,23
315930	Transistor 30	321207	Strip, Terminal 7,11,14,19, 20,23,24,27	323835	Card, Circuit 31
315931	Transistor 30	321208	Plate 11,23,24,27	323841	Resistor, 300 Ohm 31
315955	Resistor, 2200 Ohm 30	321211	Cover 24	323842	Resistor, 21 Ohm 31
315957	Resistor, 3300 Ohm 30	321212	Transformer 24	323843	Resistor, 590 Ohm 31
315976	Capacitor, 470 PF 32	321225	Service Assembly, Electrical 2,13	323844	Transistor 31
318835	Transistor 29	321228	Service Assembly, Electrical 2,24,25	323845	Transistor 31
320038	Jack, Red Test 29	321230	Service Assembly, Electrical 2,13	323846	Pad, Transistor Mounting 31
320039	Jack, Black Test 29	321231	Service Assembly, Electrical 2,11,12	323847	Sink, Heat 30,31
320040	Jack, Orange Test 29			323849	Coil, 132 Ohm 6,8,10,21, 23
320041	Jack, Green Test 29	321245	Cable Assembly 7	323934	Transistor 32
320042	Jack, Slate Test 29	321246	Cable Assembly 7,12	323960	Spacer 8,15,21,24
320045	Card, Circuit 28	321247	Cable Assembly 7,14	323961	Cover 8
320047	Capacitor, 2 MFD 30	321248	Cable Assembly 7,12,14	323962	Cover 6,10,23
320048	Capacitor, .5 MFD 30	321249	Cable Assembly 7	323964	Potentiometer 31
320049	Capacitor, .15 MFD 30	321250	Cable Assembly 7	323968	Cable Assembly 6,10
320050	Plate, Mounting 7,14,20	321252	Cable Assembly 20	323969	Cable Assembly 6,10
320051	Card, Circuit 30	321258	Resistor, 20,000 Ohm 28	323970	Cable Assembly 6,10,13,26
320056	Bracket 5,9,11,13,19,22,26	321259	Resistor, 15 Ohm 28	323971	Cable Assembly 6,10,13,26
320057	Cover, Top 12	321260	Capacitor, 1 MFD 31	324060	Service Assembly, Electrical 2,16,17,18
320058	Cover, Bottom 12	321261	Transistor 28,30,31	324061	Service Assembly, Electrical 2,16,17,18
320408	Terminal, Spade Type 6,27	321263	Resistor, 13 Ohm 28	324135	Cable 8,15,18,21,25
320410	Terminal, Spade Type 6,8,9, 10,12,13,15 to 18, 21,22,23, 26,27	321264	Capacitor, 2.7 MFD 28,30		
320416	Terminal, Ring Type 18	321279	Capacitor, 1300 MFD 24		
320418	Terminal, Ring Type 8,9,11, 12,13,15,17,18,21 to 27	321285	Bracket, Mounting 11,13,26		
320420	Terminal, Ring Type 10,17, 18,22,26	321286	Diode 29		
321128	Transformer, Power 5,9,11,13, 17,22,26	321288	Sink, Heat 29		
321129	Capacitor, 750 MFD 5,7,10,12, 13,14,17,19,20,22,26	321290	Card, Circuit 2,29		
		321292	Resistor, 1300 Ohm 28		
		321296	Frame, Outer 7,8,14		
		321297	Frame, Inner 8,15		
		321299	Card, Circuit 28		
		321975	Resistor, 33 Ohm 31		

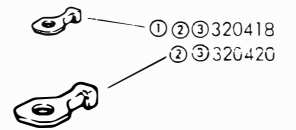
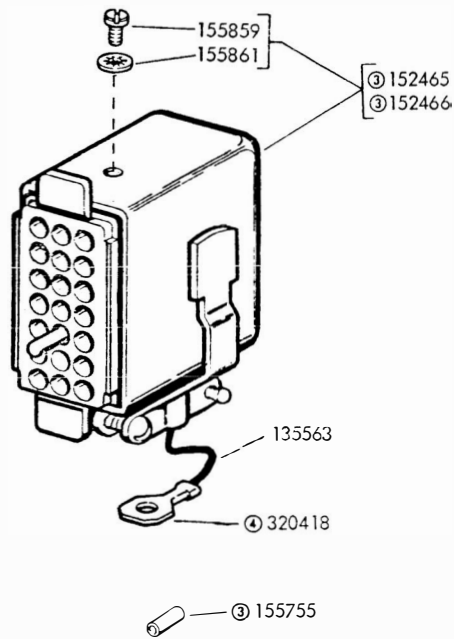
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Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
324136	Cable w/Terminals 15,17	326394	Jumper, 4" Red 8	327417	Cable w/Terminal 21
324137	Cable 8,12,15	326398	Cable 9	327418	Cable w/Terminals 23
324138	Cable 12,25	326716	Container 16,17	327442	Bracket 19
324139	Cable 8,12,18,21,22,25,27	326717	Post 16	327444	Capacitor, 2 MFD 7,11,14,19,23,24,27
324144	Transistor 28,30,31	326718	Clamp 16	327779	Decalcomania 13
324145	Cable, Relay 8	326719	Lid, Container 16	327781	Decalcomania 24
324147	Pad, Transistor Mounting 28,30,31,32	326720	Frame, Outer 19	327782	Decalcomania 13
324148	Label 16	326721	Spacer 19	327783	Decalcomania 11
324154	Cable 11,26	326722	Frame, Inner 19	327784	Decalcomania 8
324698	Nut, #10 Speed 5,7,9,11,13,14,19,20,22,26	326723	Cover, Inner 18	327785	Decalcomania 6
324699	Cable, Relay 8	326724	Cover, Outer 18	327786	Decalcomania 11
325911	Jumper, 6-1/2" Lg Green 17	326725	Bracket, Mounting 17	327788	Decalcomania 8
325916	Cable, Resistor 17,18	326731	Bushing 16	327789	Decalcomania 14
325917	Cable w/Terminals 17	326732	Stud 16	327790	Decalcomania 20,23
325918	Service Assembly, Electrical 2,16,17,18	326733	Spacer, 11/32" Thk 16	327792	Decalcomania 27
325919	Container Assembly 2,18,19	326734	Nut, 10-32 Hex 16	327793	Resistor, 18 Ohm 30
325920	Filter Assembly 19	326735	Post 17	327794	Diode 29
325923	Cable, PF Capacitor 17,18	326736	Cable w/Terminals 17,18	328066	Card, Circuit 30
325924	Cable, Switch & Fuse 17,18	326737	Cable w/Terminals 18	328453	Decalcomania 8
325925	Plate, Mounting 16	326738	Cover w/Insulator 19	330526	Service Assembly, Electrical 2,7,8
325926	Nut, 4-40 Hex 19,27	326740	Plate 17	330527	Decalcomania 8
325927	Transformer 19	326755	Jumper, 3-1/2" Green 21	330593	Capacitor, .02 MFD 30
325929	Cable w/Terminals 18	326776	Capacitor, .47 MFD 31	330642	Resistor, 1,300,000 Ohm 32
325930	Sleeve, 1-1/2" Lg Insulating 17	326787	Cover, Switch 21	330643	Resistor, 56,000 Ohm 30
326201	Capacitor, 24 MFD 16	326789	Cable 24	330644	Resistor, 390,000 Ohm 32
326231	Transformer Assembly 24	326790	Frame, Inner 21	330666	Fastener, Wing, Type 6,8,10,21,23
326232	Decalcomania 25	326791	Frame, Outer 20,21	330835	Service Assembly, Electrical 2,7,8
326233	Decalcomania 24	326792	Service Assembly, Electrical 2,26,27	330836	Service Assembly, Electrical 2,9,10
326253	Plate Assembly, AC Power 24	326793	Cable Assembly 6,27	330837	Cable w/Terminal 8
326255	Spacer 24	326794	Insulator 27	330838	Decalcomania 8
326256	Bracket 24	326795	Container, Inner 27	330840	Cable w/Terminal 9
326269	Cable 25	326796	Cable w/Terminals 27	330841	Decalcomania 10
326270	Connector, 15 Pt Circuit Card 5,8,9,12,13,15,17,19,21,22,25,26,27	327284	Cover, Inner 27	330842	Decalcomania 10
326351	Transformer Assembly 5,7,9,11,13,14,17,20,22,26	327287	Cable Assembly 27	330843	Cable w/Terminal 9
326352	Cable Assembly 5,7,9,11,13,14,17,20,22,24,26	327288	Bracket 27	330851	Decalcomania 16
326353	Cable Assembly 5,7,9,11,13,14,17,20,22,24,26	327290	Cable Assembly 25	330852	Decalcomania 16
326365	Cable 8,15	327291	Cable Assembly 25	330853	Decalcomania 16
326369	Cable 10,22,26	327292	Cable Assembly 25	333522	Service Assembly, Electrical 2,7,8
326374	Label 8,12,14,25	327293	Cable Assembly 25	333523	Service Assembly, Electrical 2,9,10
326375	Label 8,25	327294	Cable Assembly 20	333524	Service Assembly, Electrical 2,7,8
326376	Label 8,12,14,25	327295	Cable Assembly 20	333532	Cable w/Terminal 8
326377	Label 8,25	327296	Cable Assembly 20	333603	Card, Circuit 32
326378	Label 8,27	327350	Frame, Outer 24	334190	Service Assembly, Electrical 2,7,8
326382	Label 7,11,22,26	327355	Cable Assembly 22	334551	Decalcomania 8
326383	Decalcomania 25	327356	Cable Assembly 22	334751	Decalcomania 8
326390	Jumper, 9" Red 8,12	327357	Cable w/Terminals 21		
326391	Jumper, 9-1/2" White 8	327358	Cable 23		
326392	Jumper, 6-1/2" White 8,18	327382	Spacer 12		
326393	Jumper, 6-1/2" Orange 8	327386	Decalcomania 6,10,13,23,27		
		327407	Cable w/Terminal 21		
		327408	Cable w/Terminal 21		
		327409	Cable w/Terminal 21		
		327410	Cable w/Terminal 21		
		327411	Cable w/Terminal 21		
		327414	Cable w/Terminal 21		
		327415	Cable w/Terminal 21		
		327416	Cable w/Terminal 21		

RADIO FREQUENCY INTERFERENCE (RFI) SUPPRESSION
FEATURES FOR LOW LEVEL SETS
28 ELECTRICAL SERVICE UNITS

PARTS

FIGURE	CONTENTS	PAGE
1	305143 Rectifier Assembly (6 Volt)	2
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- ① 324685 Cable w/ Terminals
- ② 326763 Cable w/ Terminals
- ③ 324152 Cable Assembly
- ④ Supplied w/ 135563

FIGURE 2. CABLE COMPONENTS

NUMERICAL INDEX

Part Number	Description and Page Number	Part Number	Description and Page Number	Part Number	Description and Page Number
1093	Screw, 8-32 x 7/16 Fil 2	151659	Screw, 6-40 x 1/2 Fil 2	158286	Transformer 2
2191	Washer, Lock 2	151819	Jumper, 3" Black 2	165008	Turret, Terminal 2
3354	Nut, 8-32 Hex 2	151939	Grommet, Rubber 2	171525	Resistor, 1000 Ohm 2
3598	Nut, 6-40 Hex 2	152465	Connector, 20 Pt Receptacle 3	171541	Diode 2
3646	Washer, Lock 2	152466	Connector, 21 Pt Receptacle 3	305143	Rectifier Assembly 1,2
7002	Washer, Flat 2	152761	Stud 2	305144	Plate, Mounting 2
44048	Washer, Flat 2	155755	Sleeve, 11/64 ID x 5/8" Lg Insulating 3	305150	Block, Terminal 2
90789	Washer, Flat 2	155859	Screw, 4-40 Spl 3	305151	Washer, Insulating 2
116783	Holder, Fuse 2	155861	Washer, Lock 3	320300	Capacitor, 5000 MFD 2
116785	Fuse, .3 Amp 2			320418	Terminal, Ring Type 2,3
135563	Jumper, 2-3/4" Green 3			320420	Terminal, Ring Type 3
151427	Plate, Clamp 2			324152	Cable Assembly 3
				324685	Cable w/Terminals 3
				326763	Cable w/Terminals 3

CHART C

	WDP	COMPONENTS							SETS OF GEARS										
		LP149RN/AJG	LP150RN/AJG	LBAC280BR	LBAC281BR	LK71/ARN	ESA321228*	ESA332726*	ESA332727*	LMU3	LMU21	LMU28	LMU38	LMU41	LMU52	Baud			
																74.2	74.2	75	75
																Part No.			
159700	161295	163505	312705																
28 MULTIPLE PAGE PRINTER SETS																			
AN/UGR-10 28RFL7400B/004/AMB/BR	0100	28RFC7400B/004/AMB/BR 4		1		1	1		4								4		
AN/UGR-10X 28RFL7400B/004/AZB/BR	0100	28RFC7400B/004/AZB/BR 4		1		1	1							4				4	
AN/UGC-61 28RFL7300A/004/AAA/BR	0099	28RFC7300A/004/AAA/BR 3		1		1	1		1	2							3		
AN/UGC-61X 28RFL7300A/004/AJA/BR	0099	28RFC7300A/004/AJA/BR 3		1		1	1					1		2			3		
AN/UGC-61Y 28RFL7300A/004/ABA/BR	0099	28RFC7300A/004/AJA/BR 3		1		1	1			2			1						

* For components of ESA, see chart in Section 573-613-100TC.

CHART D

	WDP	COMPONENTS													SETS OF GEARS							
		LPC202BR	LPC211BR	LPR85BRP	ESA323813*	ESA321230*	LLK303142	SMD323810	CMD321991	PS321290	LPR72BRP	LPR88AWA	LTRK11ARN	LSRC200BR	LRE8**	LRE62**	TP174459 Sliding Base	ESA321231*	LMU3	LMU56	Baud	
																					74.2	74.2
																					Part No.	
161295																						
28 TYPING REPERFORATOR SRTR AND RO SETS																						
TT-571/UG RFP6000A/005/AAX/BR	0061	28RFC6000A/005/AAX/BR X								X				X			X	X				
TT253()/UG 28RFP6200A/005/AAX/BR	0031	28RFC6200A/005/AAX/BR			X	X	X	X	X	X			X	X					X			X
TT605/UG 28RFP6000B/004/XXX/BR	0111	28RFC6000B/004/XXX/BR X									X				X	X	X		X			

* For components of ESA, see chart in Section 573-613-100TC.

** Gear Shift Assembly for 60, 75, 100 W.P.M.

CHART E

TRANSMITTER DISTRIBUTOR SETS	WDP	COMPONENTS								SETS OF GEARS			
		LXDC201BR	ESA326792*	CMD321991 Card	PS321290 Card	LLK303142	LXD37	LXD38	LXDB20	LMU19	ESA326792*	Baud	
												75	74.2
												Part No.	
173595	156659												
TT570/UG 28RFT5000B/XXX/AAS/BR	0058	RFT5000B/XXX/AAS/BR X X X X X	X	X	X	X	X	X	X	X	X		
TT603/UG 28RFT5000A/XXX/AAB/BR	0058	RFT5000A/XXX/AAB/BR X					X	X	X	X		X	

* For components of ESA, see chart in Section 573-613-100TC

CHART F

28/32 COMPACT PRINTER SETS	WDP	COMPONENTS										SETS OF GEARS										
		LPC402BR	LPC403BR	LP139RN/AJG	LP156RN/AJG	LLB5 **	LLK4CRN **	LMU37	LMU51	ESA321231*	ESA323120*	ESA323121*	SMD323810	LLK323130	CMD321991	PS321290	Baud					
																	**	*	*	*	*	*
																	Part No.					
145365	145366	198576	198580	304668	304669																	
AN/UGR-9 28RFH8000B/002/AAA/BR	0029	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
AN/UGR-9X 28RFH8000B/002/AAB/BR	0029	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
AN/UGC-20A 28RFH8001A/002/AAC/BR	0123	X	X	X	X	X	X	X	X	X	X	X	X	X	2	X	X	X	X	X		

* For components of ESA, see chart in Section 573-613-100TC.

** Gear Shift Assembly for 45.5, 50, and 75 WPM.