STROMBERG-CARLSON CORPORATION

INSTRUCTION MANUAL

MODEL TDX-40F

DIAL-X® INTER-PHONE SYSTEM

Part No.
146011-291

STROMBERG-CARLSON CORPORATION, 100 CARLSON ROAD, ROCHESTER, NEW YORK 14603 • TELEPHONE (716) 482-2200 • A SUBSIDIARY OF GENERAL DYNAMICS CORPOF

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MODEL TDX-40F

DIAL-X INTER-PHONE SYSTEM

Important Notes Regarding TDX-40F verus TDX-40E

The TDX-40F is identical in function to the TDX-40E with the following exceptions:

1. The obsolete TDX-34X expander board facilities have been removed from the switchboard.

2. The TD-4500 desk telephone and the TD-4510 wall telephone supersede the TD-88 and TD-95 telephone compliment.

3. When an executive intercom application is desired the EXI (executive intercom) kit must be utilized with the TD-4500 and/or the TD-4510 telephone. (Supersedes TD-85 telephone.)

4. TD-4500/TD-4510, S-88067 and TD-4500/TD-4510, S-88068 supersedes TD-4500/TD-4510, S-88052 and TD-4500/TD-4510, S-88053.

5. The TD-82 has been superseded by the TD-4582.

SECTION I
INSTALLATION PLANNING

1.1 GENERAL INFORMATION

Valuable time can be saved and possible damage to the equipment avoided by installing the wiring before the telephone equipment is delivered. Before wiring or installation is attempted, however, Section I and II of this instruction book must be read carefully to insure a satisfactory installation.

IMPORTANT: When the wiring is installed prior to equipment delivery, excess wire must be left at both the telephone and switchboard location. The excess can be cut-off quickly but not so readily added. Before installation is attempted, it is essential that the person in charge of installation read carefully Section II "Installation".

1.2 FLOOR PLAN LAYOUT

The first step in planning an installation is to secure a blueprint of the building or if a print is not available, draw up a rough floor plan and show the location of each telephone, extension telephone, loud-ringing bell, etc. If the floor plan is drawn on a sheet of thin transparent paper over the blueprint, all walls, hallways and partitions will show and it will be easier to accurately determine the best or shortest routes for the wires.

1.3 SWITCHBOARD LOCATION

The second step in planning an installation is to locate the switchboard and mark the location on the floor plans. There are several considerations before a final decision can be made in regard to switchboard location. To keep wire and installation time to a minimum, it is important that the switchboard be located centrally in the area in which the majority of telephones will be located. In addition, the switchboard must be installed in a clean location reasonably free from excessive dust and moisture. Avoid locations subject to hazardous accumulations of readily ignitable materials or in locations where flammable gases or vapors are or may be present in the air in sufficient quantities to produce explosive or ignitable mixtures. Although the equipment is not critical as to temperature, avoid locations such as directly above or adjacent to heating equipment. On the other hand, the switchboard must be installed in a location which receives sufficient heat to keep the temperature above freezing at all times. The humidity at the switchboard location should be low enough to avoid condensation within the equipment. Avoid basements whenever possible as they are usually too damp and may be subject to flooding. Relay contacts can become inoperative due to film deposit from fumes or certain chemicals. Avoid areas in which paints are mixed; turpentine fumes are present; parts are cleaned with chemicals, etc. Distinct clicks will be heard from the cabinet as a result of operation of the switching mechanism. It is, therefore, not advisable to locate a switchboard in an area where this noise might be objectionable.

The cabinet is designed for floor mounting. It is not necessary to fasten the cabinet to the floor, however holes are provided in the top flange of the cabinet to permit fastening to a wall for greater rigidity. The cabinet dimensional drawing should be consulted for cabinet size, location of wiring entrance holes and clearance required for proper maintenance of the switchboard equipment. After the switchboard location has been determined, mark the location on the floor plan. Then indicate the shortest and most direct run for the wiring to each telephone. It may not always be possible to follow the indicated wiring runs but the floor plan will be of assistance in determining the shortest or most economical route.

1.4 WIRING REQUIREMENTS

For a satisfactory installation, wiring must be kept neat and as much out of sight as possible. Allow sufficient wire, on indoor installations, to permit carrying the wire around door or window frames. Wiring must never be run close to power, X-ray, diathermy, induction heating or radio transmitter equipment. These devices can cause interference under certain conditions.

Telephone wiring must be separated from water or steam pipes, electric sound system and loudspeaking intercom wiring. When it is necessary to parallel such circuits, telephone wiring must be kept at least two feet away.

The size and type of wire is covered in Installation, Section II of these instructions. Also outlined, are the requirements for paging circuits and extension telephones.

SECTION II
INSTALLATION

2.1 GENERAL INFORMATION

2.1.1 Station Number Card - Each Dial-X telephone is shipped with a station-number card S. C. Co. Part #176052 and a plastic card holder S. C. Co. #49772 in a small envelope. At the time of installation, this number card is to be stamped with the line number for that particular telephone.

The method of holding the plastic cover (card-holder) is not readily apparent and this feature discourages tampering by unauthorized persons. The cover is held in place by a spring with fingers to engage the three projections on the plastic cover. To assemble, place the station-number card in the proper position in the plastic cover and press the three projections on the cover into the three slots in the dial until the cover is fully seated, at which point it is flush with the dial fingerplate.

Use a thin-bladed screwdriver or similar instrument to remove the cover by levering between the dial fingerplate and the cover at the three points which locate the projections on the plastic cover. Each projection in turn should be raised an equal amount until the cover is projecting a sufficient distance above the fingerplate to allow gripping with the fingers to complete its removal.

2.1.2 Wiring Information - Important: When the wiring is installed prior to equipment delivery, leave excess wire at both the telephone and switchboard location. The excess can always be cut-off quickly but not so readily added. Wiring will enter the switchboard at the bottom. Allow not less than 6 feet of wire beyond the point where the wiring will enter the switchboard cabinet in order to reach wiring terminals within the cabinet. Label each line at the cabinet location so that the telephone location will be known when wiring to the switchboard is completed.

Whenever possible, use a continuous length of wire for each run. Outdoors, this is virtually a must. Indoors, on exposed runs if the wire is found too short to complete the run, a piece can be added. When conditions permit, the use of a Stromberg-Carlson #42-A terminal block is advised. This is the same terminal block which is supplied with the telephone instrument. Be sure to match conductor markings at the terminal block. When the use of a terminal block is not possible, the wire can be spliced. To secure a neat splice, stagger the splices of each of the three conductors. Before splicing, match the markings on the conductors so that the wires with the same markings will be spliced. After carefully removing the insulation from each conductor, twist the conductors closely together so that they are mechanically tight and then solder the connections with a soldering iron hot enough to cause the solder to flow through the connection. Each of the three individual splices must be covered with one layer of rubber tape or splicing compound. Two layers of friction tape should then be wrapped carefully around the entire splice.

Telephone wiring must not be included in the same conduit with conductors for other services such as light, power, or sound systems. Telephone wiring can be placed in the same duct or raceway with other services only if the telephone wiring is separated from other services by a metal partition. To avoid conflict with commerical telephone companies, keep intercom telephone wiring out of ducts or raceways enclosing their wiring unless permission is granted by the telephone company to share these facilities.

Exposed telephone wiring should always be separated from water or steam pipes, electric, sound system and loud-speaking intercom circuits. When it is necessary to parallel such circuits keep telephone wiring at least two feet away.

2.2 WIRE REQUIREMENTS

2.2.1 Wire Size - The size of wire to use depends on the length of the run between the switchboard and telephone location. Larger size wire can be used but do not use smaller size wire than is indicated in the following chart. When the telephone is to be located more than 2000 feet from the switchboard, see page 12a of this Instruction Book.

Copper Wire Size	Maximum Distance
#22AWG	750 ft.
#19AWG	1500 ft.
#18AWG	2000 ft.

2.2.2 Wire Type - Outdoors use weatherproof bridle wire. It is available from Stromberg-Carlson in #18AWG triplex (3 conductor twisted). The individual copper conductors are covered with a high-grade rubber compound and the 3 conductors are covered overall with abrasion proof and weather-resistant neoprene jacket. Circuit identification is easily made by ridged markers on the second and third conductors.

Indoors in ducts or raceways where the wire can be laid-in (NOT pulled) thermo-plastic insulated triplex wire can be used. (It cannot be pulled due to the danger of damage to the insulation). Plastic insulated wire is also used indoors for exposed surface wiring. It is available in #19AWG and #22AWG triplex. The individual copper conductors are insulated with polyvinyl chloride (thermo-setting) plastic. Circuit identification is obtained by ridged markers on the second and third conductors.

2.3 WIRING INDOORS, METHODS

2.3.1 Surface Wiring - The most economical indoor installation is of the exposed type. Wire is run along the top of baseboards, around door frames, under or over window frames. To avoid damage during cleaning, it is necessary to keep the wiring 5 inches or more above the floor line. In hot weather, pipes will often sweat, therefore wire must never be run in contact with water pipes. Any place where wiring is likely to get wet must be avoided. Excessively hot places such as directly above steam radiators, in contact with steam-pipes, boilers, tanks, etc., should be avoided because of possible damage to the insulation on the wire. Wiring should never be run close to exposed power wiring, X-ray, diathermy, induction heating, or radio transmitting equipment. Any of these devices can cause interference.

Always run exposed wiring where it is least likely to be broken or detached, over the shortest and most direct right-angle route. Do not run wiring where it will interfere with the operation of doors or windows or where the installers will be subject to injury from electric light or power wires, moving machinery or belts, elevators or dumbwaiters. When it is necessary to run wiring where it may be exposed to mechanical injury from passing hand-trucks, etc., follow the ceiling line rather than the baseboard. Telephone wiring should not be installed on temporary partitions unless another wire route is impractical or requires considerable additional wiring.

Staples or wiring nails in sufficient quantity must be used to hold the wire securely. Care must be taken not to crush the wire, or damage the insulation as short circuits will make the system inoperative. Avoid the use of stapling guns when using plastic insulated wire. Nails should never be bent over the wiring to hold it in place. When several wires are to be run in the same direction for a considerable distance, much time can be saved by the use of bridle rings. These are similar to large screw eyes with an opening in the eye so that wires may be inserted into the hole by slipping them into the opening. In this manner, a run can be made by screwing a row of bridle rings into a ceiling or a wall and slipping of wires into these rings as the wiring proceeds. Bridle rings are available in various sizes.

2.4 WIRING METHOD OUTDOORS

2.4.1 General - When telephone wiring is required between buildings, "bridle" weatherproof wire is required. This wire can be strung overhead or for the sake of appearance and to minimize service interruptions due to storms, or other causes, the wire can be installed underground. If the wire is exposed outdoors, a "protector" is required at each end of the span to prevent possible excessive voltages from power circuits or lightning reaching inside wiring or telephone apparatus. See paragraph 2.4.3.

2.4.2 Overhead - The installation of overhead wiring between buildings must meet the following requirements: (a) Clearance must be maintained in the wiring spans and on buildings. (b) The wire must be protected from abrasion. (c) The span must be laid out to avoid waste.

The established minimum clearance for wires in span is as follows: highways - 18 ft.; driveways - 15 ft.; driveways to car garage only - 10 ft.; sidewalks - 8 ft.; obstacles (roofs, etc.) - 2 ft. These are minimum clearances. Obtain more if possible.

The clearance for wires fastened on buildings must meet or exceed the following: electric supply (open power wiring not over 750 volts) - 4"; in conduit - 2"; radio antenna - 4"; lightning rods - 6'; neon signs - 6"; metallic objects - 2"; exposed or unexposed telephone wiring - 2". If these minimum clearances cannot be obtained, protect the wires with a plastic or porcelain tube (or equivalent). The tube must extend at least 2" beyond the other wire or obstruction.

Avoid long spans by attaching the wire to an intermediate building if possible. To provide proper clearance, raise the first attachment on the building. On low-roof buildings, a riser fastened to the side or rear wall may be needed to provide proper clearance.

Make the wire runs as neat as possible. Install the fasteners securely and make the installation as inconspicuous as conditions permit. Whenever possible, locate the first building attachments (after the aerial span) directly above the protector location. (The protector location should be next to the entrance hole.) This permits a short vertical run down the side of the building. If it is not possible to locate the first building attachment above the protector location, make a horizontal run to a point above the protector and then change to a vertical run. On low buildings, the horizontal run will be less conspicuous up under the eaves. On taller buildings the horizontal run can generally be made at the level of the first attachment. An angle run down and across a building is opposed to the normal lines of a building and is an eyesore.

Wires must not be pulled tight in a span. Taut wires in a span will wear rapidly because the outer covering has been stretched. In addition, a taut span places too much strain on the building attachments. The desirable minimum sag in a span of 50 ft. or less is 6"; 50 to 100 ft. - 1-1/2 ft.; 100 to 150 ft. - 3 ft.; 150 to 200 ft. - 4 ft.

2.4.3 Messenger Cable - When a number of wires must be run between buildings and especially when the distance between buildings exceeds 50 ft., the use of a messenger cable is advised. A messenger cable is a tightly strung galvanized steel cable used to take the strain off the copper wires. The copper wires are hung below the messenger cables in hangers spaced about a foot apart. Messenger cable is available in several sizes starting at 3/16" diameter with a strength of 1150 lbs. It is fastened to the building with large screw eyes or brackets bolted to the building. It is common practice to ground the messenger cable as a protection against lightning. Protectors are required at each end of all telephone lines run outdoors. See paragraph 2.4.5. Notice that wiring entering the building from outdoors should be bent down to form a drip-loop at the point of entrance.

2.4.4 Underground - For underground installation, conduit must be not less than 1" in diameter and must be rigid iron, buried not less than 18" below finished grade line. When placed in same ditch with other services (electric wiring, etc.) there must be a minimum separation of 1". If the conduit is terminated outdoors (as for example: at a pole or outside of building), the conduit should extend upward at least 5-1/2 ft. above grade line and a weatherhead must be used. When only one end of the conduit is terminated indoors, install conduit with slight drop to this end. This will allow moisture that may condense in the conduit to drain off.

Installation of wiring in underground pipe tunnels is best accomplished in the manner described for outdoor wiring. The use of a messenger cable is suggested. See paragraph 2.4.3. Use weatherproof bridle wire in tunnels and do not change back to indoor wire until a relatively dry area is reached. Use a terminal block at the wiring junction.

2.4.5 Lightning and Excessive Voltage Protection - Telephone wiring entering the building from outdoors must be connected to a station "protector" to prevent the possibility of excessive voltage from electric power circuits or lightning from reaching inside wiring or equipment. Protection is required at both ends of an outdoor end. The protector must be located as near as possible to the point where the telephone wiring enters the building. It can be installed either indoors or outdoors but must not be located in a hazardous location nor in the vicinity of easily ignitable material. Protectors are not available for three wires therefore two of the two-wire protectors are required for one line or three protectors for two lines.

The ground wire must be placed where it is least likely to be broken or detached. Run the ground wire as direct as possible from the protector's ground terminal to the ground clamp. Have no spirals or bends in the wire greater than a right angle. The ground connection is preferably made to a cold water pipe. In the absence of a cold water pipe, connection may be made to a grounded metallic structure or to a ground rod or pipe driven not less than 5 feet into permanently damp earth. Steam pipes, hot water pipes or lightning rod conductors must <u>not</u> be employed as ground. The ground conductor must be attached to the pipe or rod by means of a bolted clamp to which the conductor is soldered or otherwise connected in an effective manner. Make connection to the ground pipe as close to the earth as practicable.

IMPORTANT: To fulfill Underwriters' requirements, the ground wire must not be smaller than #14AWG copper wire.

2.5 TELEPHONE INSTALLATION

2.5.1 Wiring to Telephones - Building wiring to the telephones must be done in a uniform manner. The same coded wire must always be terminated at the same terminal in the terminal box or terminal in the telephone at every telephone in the system. Terminal markings in the telephones are L1, L2 and G. When a line cord is supplied, as on the TD-88 Telephone, the red conductor connects to L1, green to L2 and yellow to G. The terminal box supplied with the TD-88 Telephone is marked R, G and Y to correspond to the color-coding of the line cord.

The usual triplex cable is coded by means of ridges on the insulation of each conductor. If color coded wire is used for building wiring, establish the color-code before wiring is started and maintain color-coding throughout the entire wiring of the system.

The following chart lists the terminals and coding for the Dial-X telephone terminals.

Telephone Terminal Markings	Telephone Line Cord Color Code	Terminal Box Marking	Triplex Wire Coding
L1	Red	R	No ridge
L2	Green	G	One ridge
G	Yellow	Y	Two ridge

The correct method of dressing the building wiring and the telephone line-cord around the terminal block is shown in figure 6. This method provides a snubbing action and minimizes trouble resulting from normal pull on the wires. Notice that system wiring goes under the bottom flat washer under the terminal screw and the line-cord terminals go between the two flat washers. The "B" terminal in the terminal box is not used. All terminal screws must be turned down snug before the cover is replaced on the terminal box.

2.5.2 Desk Telephone Installation - As no two installations will be alike, it is impossible to give detailed instructions for installation of desk-type telephones. The following suggestions should be observed where they apply and a similar approach is recommended in determining the best method of installation for each job. A few extra minutes spent in determining the best method of installation will reduce call-backs to repair damaged wiring; to move poorly located wiring or to reinstall the telephone instrument in a more workmanlike manner.

Each desk telephone is supplied with a 5-1/2 ft. line-cord and terminal box. When the telephone is to be used on a desk, it is customary to screw this terminal box out of sight underneath the desk. System wiring to the terminal box is looped back and stapled lightly to the desk. Sufficient excess must be placed in the loop so that if the desk is moved the staples will pull out allowing the excess wire to be pulled loose thereby preventing breaking of the wire or pulling loose from the terminals. At least 3 feet of wire in the loop is advised. When the desk is located next to a wall, it is better practice to fasten the terminal box on the wall adjacent to the desk and not to fasten the telephone cord to the desk. When the desk is moved for cleaning, etc., the 5-1/2 ft. line-cord will provide enough play to avoid damage. Use a similar approach to other installations of desk-type telephones. Connect the building wiring to the terminal box as outlined in paragraph 2.5.1 and shown in figure 2.

2.5.3 Wall Telephone Installation - An installation instruction sheet is packed with each TD-95 Wall Telephone. The TD-85 Desk Telephone can be converted to a wall-mounting telephone by installing a different set of plungers (handset holders). The two new plungers, four mounting screws, a rubber grommet and a mounting template are available as a Model TK-5 Conversion Kit. To convert a desk telephone to wall-mounting proceed as follows: Remove the telephone housing by loosening (do not remove) one screw in the rear of the housing and lifting the housing off. The base is provided with a tongue at the front edge which engages a bracket moulded into the front of the housing. It will disengage when the rear of the housing is lifted.

To remove the desk-type handset plungers, depress the retaining spring (single wire) emerging from the rear of one of the plastic plungers and push out the plunger bearing-pin using a pencil or a similar pointed object. The bearing-pin is slotted and held in place by the retaining spring. Removal of the bearing-pin will release the plunger. Repeat for the second plunger.

The dial must be rotated 180 degrees for wall-mounting. The dial is held to the base by a bracket which hooks over a shaft (near the hookswitch) and snaps into an opening at the front of the base. Disengage the twin prongs of the dial bracket from the base by lifting up at the front edge of the dial. Remove the two dial mounting screws and lock washers. Rotate the dial 180 degrees and remount on the dial

brackets using the ends of the slots in the bracket closest to the hinged end of the bracket. Engage the hinged end of the dial bracket on the main bearing pin and press the twin prongs into the hole in the base. The line-cord to the telephone will not be required and should be removed by disconnecting from the terminals in the base of the telephone. A rubber grommet is supplied with the conversion kit for the 3/8" diameter hole along the right-side of the base. Insert the grommet in the hole and bring the wiring from the switchboard through the grommet into the telephone.

A mounting template for wall-mounting the telephone is supplied with the conversion kit. The mounting holes for the wall-mounted telephone are 7-57/64" apart in the vertical direction and 4-33/64" apart in the horizontal direction. Holes are provided through the rubber feet at each corner. Do not remove the rubber feet. Fasten the telephone to the wall using the screws supplied. Cut off the building wiring to the telephone 6" longer than required to reach the terminals. Connect each wire to the correct terminal. See paragraph 4.4.1 and figure 2. Dress the excess wire along the inside edge of the telephone base away from the dial and handset plunger mechanism.

Replace the housing on the telephone instrument by engaging the tongue (in the top of the wall-mounted base) in the slotted-bracket (in the top of the housing). Lower the housing while guiding the handset plungers into the slots of the housing. Seat the housing on the base and tighten the screw in the bottom of the housing.

2.5.4 Side Mounted Telephone Installation - The Model TD-91 Side Mounted (suspended handset telephone) is a self-contained instrument equipped with a buzzer. This telephone can be readily mounted at the end of a desk, on a column or in a restricted wall-space. The mounting bracket is drilled to allow the telephone case to be mounted on the bracket with the broad side of the case at the front or the narrow side in this position. Arrange the bracket to allow mounting the telephone in the desired position.

The telephone mechanism must be removed from the case in order to connect the building wiring to the telephone. To remove the case, loosen the plated (captive) screw in the center of the mounting bracket and lift the mechanism out of the box. Bring the building wiring into the case through the hole in the bottom which is also used for the handset cord. The terminals in this telephone starting from the top of the terminal board are L1, L2 and G. Terminal G is not marked in the TD-91 telephone.

When the telephone is desk-mounted, wiring to the telephone should be looped back and stapled lightly to the desk in an out-of-sight location. Sufficient excess must be placed in the loop so that if the desk is moved the staples will pull out allowing the excess wire to be pulled loose thereby preventing breaking of the wire or pulling loose from the terminals. At least 3 ft. of wire in the loop is advised. When this method of installation is used it will not be necessary to provide additional wire to allow removal of the telephone from the case.

When the TD-91 telephone is mounted on a wall or column, leave at least 6 inches of excess wire to allow removal of the telephone from its mounted case. The excess wire can be dressed into the case away from the hook-switch.

The TD-91 telephone is shipped with the handset hanger removed from the telephone. This hanger is more easily inserted with the mechanism out of the case, but it can be installed with the mechanism fastened in the case. Insert the notched end of the hanger partly into the slot provided in the mechanism. Lift up on the hanger and slide it into the mechanism until it locks. It is necessary to lift up while sliding the hanger into place so that the forked end in the hanger will properly engage the hook-switch shaft.

The dial can be turned to face in any direction and can be adjusted to any convenient angle. The entire dial housing is held to the top cover by a single bolt. The nut can be reached only with the telephone case removed. Using a 3/8 inch open-end wrench, loosen the nut holding the dial case to the top cover. Several turns will be required. If the dial assembly will not easily swivel to the desired position, loosen the nut an additional turn or two. When adjustment is satisfactory, tighten the nut holding the dial assembly and restore the telephone mechanism to the case. Tighten the captive (plated) screw in the center of the mounting bracket to secure the mechanism in the case.

2.5.5 Extension Telephones - Telephones on the same line are connected in parallel. Wiring can be from one telephone's terminal box to the next (extension) telephone or the building wiring for the telephone and its extension can each be carried back to the switchboard and connected in parallel at the switchboard terminals for this line.

See paragraph 2.7.3 for method of connecting Model TD-85 Dial-Xecutive Telephones to provide the additional services possible with these telephones.

2.6 SWITCHBOARD INSTALLATION

2.6.1 Cabinet Installation - Every effort has been made in packing the switchboard equipment to insure safe arrival. The plug-in selector units are individually packaged in specially designed containers to prevent damage. The switchboard cabinet is completely wired and terminals are provided for the termination of building wiring. A screwdriver is the only tool required to connect the switchboard; a soldering iron is not required. Install the equipment in the order listed in the following paragraphs. Do not connect ac power to the switchboard cabinet until the installation is complete.

Before deciding on the location of the cabinet, it is essential that paragraph 1.3 be read and the suggestions followed. Mounting dimensions for the cabinet are shown on figure 10.

2.6.2 Cabinet Wiring - All building wiring must enter the cabinet through the hole on the left side of the cabinet near the bottom. Allow not less than 6 ft. of wire beyond the point where the wiring will enter the cabinet in order to reach wiring terminals within the cabinet. Label each line at the cabinet location so that the telephone location will be known when connecting wiring to the switchboard.

A hole is provided directly below the switchboard terminals through which the building wiring must be carried to reach the terminals. Cable clamps are provided to the left of the terminals and there is sufficient room, behind the switchboard mechanism, at the bottom of the cabinet, to arrange a reasonable amount of excess wire.

CAUTION: Leave one foot or more slack in each wire so that there will be no strain on the wires when the mechanism is swung down (from the top) during servicing.

When the switchboard is not being used to capacity, it is suggested that the lines with low numbers be used first and that as the system is expanded, the higher numbers be used. Observe the color coding established at the telephone location. See paragraph 2.5.1. Using the usual triplex conductor with coding by ridged markers terminate the plain conductor (no ridge on "R", single-ridge coded conductor on "Y", two-ridge coded conductor on "G").

A good building ground such as a connection from a cold water pipe or the frame of a steel building must be securely attached to the switchboard cabinet ground terminal.

2.6.3 Connection to AC Supply - Power for the switchboard must be obtained from a 110-125 volt, 60 cycle, ac line. The cabinet is provided with a 6 ft. line cord to permit plugging into any convenience outlet. To prevent loss of telephone service due to power failure resulting from the blowing of fuses caused by overload or failure of other equipment, the use of a separate power circuit to the switchboard is desirable. This separately fused power line should be independent of any branch circuits. It can be terminated in a convenience outlet at the switchboard location but only the switchboard should be plugged into this outlet. The standby power consumption of the switchboard is less than 50 watts. The maximum power consumption of the switchboard does not exceed 200 watts. Voltage should not be connected to the cabinet until installation of the system is completed. There is no master ac switch provided but removal of the ac cord to the power supply will remove power from the system.

2.7 ADDITIONAL SERVICE INSTALLATION

2.7.1 Loud-Ringing Bells - When the telephone is installed in a large area or in an area with a high noise-level, the ringer in the telephone may not be loud enough to attract attention. In such cases a loud-ringing bell can be used. The ringer in the telephone can be left connected to ring simultaneously with the loud-ringing bell or it can be disconnected if not desired.

For stock rooms, factory assembly departments, etc. use a Model TB-4 loud-ringing bell with 6" gong. The TB-4 is designed to operate directly from the telephone ringing voltage. The 1 uf capacitor wired in series with the bell cannot be omitted. Using two conductor cable of the size recommended for the telephone (see paragraph 2.2.1), connect the loud-ringing bell to terminals Y and G as shown in figure 7. To disconnect the telephone ringer, remove the telephone base and disconnect one of the wires to the ringer. Tape the wire to prevent shorting and dress the wire out of the way so that it cannot become tangled with moving parts in the telephone.

For boiler rooms, machine shops and similar very high-noise areas, a horn or howler will be required. Such signal devices generally operate from 115 volts which must be obtained from an electric outlet in the vicinity of the signal device. Select a signal device designed to operate from the voltage and current (dc or ac at the proper frequency) available at this location. A relay, Stromberg-Carlson Model CR-107 which has a coil designed to operate from the telephone ringing voltage, will be required.

Ordinary relays are not satisfactory. This relay is used to apply voltage from the electric outlet to the signal device by closing the circuit when the relay is energized by the ringing voltage.

The CR-107 Relay is mounted in a pressed steel box suitable for general use indoors. The box measure 6" x 6" x 4" and is provided with two 1/2" and one 3/4" knockouts on all four sides. The black, moulded base of the relay is marked TOP and this marking must be observed. Mount the box so that the TOP marking is at the top or remount the relay in the box to accomplish this. A 1 uf capacitor, fastened to the base of the relay, is wired in series with the relay coil winding and cannot be omitted. Between the telephone and the relay coil use the same size wire as recommended for the telephone (see paragraph 2. 2. 1). Use wire size and type (recommended by the electric code) to connect the signal device to the power source. See figure 7 for method of connecting.

2. 7. 2. Visual Signal - In theatres and auditoriums, any audible signal may be distracting and the use of a visual signal may be desired. By connecting a lamp in place of the signal device (with relay) described in paragraph 2. 7. 1, a visual signal can be provided. Lamps can be obtained in various wattages and colors as desired.

In unusually noisy areas, a visual signal as well as an audible signal may be desired. In this case, the lamp can be connected in parallel with the signal device operated from a relay as described in paragraph 2. 7. 1.

2. 7. 3 Paging - Before recommending paging direct from a telephone as the only type of paging, it is well to call attention to the superiority of reproduction that will be obtained when using a public-address type of microphone. There is also an advantage in having one person properly trained for paging. It is much less annoying when the same voice in the same manner does all the paging. However, there are advantages in being able to page from any telephone when the paging operator is not present. It is for this reason that provision is made in the Dial-X system for a combination of paging using a public-address microphone during business hours, and direct-paging from any telephone after business hours, or at any time that the paging operator is not at the paging position. The following description of installation, outlines first, the recommended method and second, the use of direct paging only.

Whenever direct paging is used, a paging adapter Stromberg-Carlson Model TP-1 will be required. Space and facilities are provided in the switchboard cabinet to mount the adapter under the lower selector cell, above the duplex ac outlet. The paging adapter plugs into the receptacle in the switchboard terminal board marked PAGING. Remove the "dummy" plug (no external wiring) from the PAGING receptacle and plug in the paging adapter.

NOTE: The "dummy" plug with terminals 10 and 8 wired together must be in the PAGING receptacle whenever the paging adapter is NOT used.

Building wiring connections to the switchboard terminals are shown in figure 8 and the schematic of the Paging Adapter and connections to the switchboard are shown in figure 8B. Notice that the link which swings on screw terminal #5 (terminal strip marked PAGING) must be in the correct position for the particular service required. (A) If line 0 is used for telephone only (no paging of any type) the link must short terminal 5 to 4. This is the way the switchboard is shipped. (B) If line 0 is used for direct paging only (no telephone on the line - no DIRECT PAGE switch required), the link must short terminal 5 to 6. (C) If line 0 is used with a telephone and direct paging switch at the paging operator's location, the link must be removed.

The method of connecting the telephone at the paging location as well as the connection of the telephone system to the paging amplifier is shown in figure 8 and 9. A microphone with built-in switch, such as the Stromberg-Carlson MD-38, MD-37 or MD-30 will be required. Wiring between the Dial-X switchboard cabinet and the low level (unequalized phono) input of the amplifier can be #22AWG or larger twisted pair. Wiring between a high-impedance microphone and the high-impedance microphone input of an amplifier must be single conductor #22AWG or larger, shielded, microphone cable, which for best results should not exceed 50 ft. in length. When the length of the microphone cable exceeds 75 to 100 ft., a low-impednnce microphone should be used. Operation up to 5000 ft. from the amplifier will be satisfactory with a low-impedance microphone if care is taken that the cable does not parallel power or speaker lines at any point. A low-impedance microphone may be operated into a high-impedance amplifier input by using a well-shielded input transformer such as the Stromberg-Carlson Model TM-10 Microphone Cable Transformer. Low-impedance microphones require two-conductor #22AWG or larger twisted and shielded microphone cable. Additional information on microphones and the methods of connecting them to an amplifier are shown on the data sheets for the microphones in Section IV of the Sound Manual. Copies of these data sheets may be obtained from any Stromberg-Carlson Dial-X Equipment Distributor or direct from Stromberg-Carlson, Special Products Division, Rochester, New York.

When only direct paging is desired, the method of connecting the amplifier to the system is shown in figure 8. Inasmuch as there is no telephone on the paging line, a selector is not required at the switchboard. Therefore, when the number of telephones in the system is less than the capacity of the system, a selector may be omitted by not using the highest numbered line in the system. (Line "0", the paging line, and the line numbered 92 employs the same dual selector). If the system is equipped with telephones to the capacity of the system, the omission of a selector assembly is not possible. When the selector is omitted, the dummy plug (with terminals 10 and 8 wired together) which is shipped, plugged into the PAGING receptacle must be removed from the PAGING receptacle and must be plugged into the receptacle instead of the selector for line "0". Unless this dummy plug or a selector is used, direct paging will not function.

IMPORTANT: Loudspeakers must be located far enough away from any telephone where paging will originate so that acoustic feedback will not occur. The distance required to prevent feedback will vary depending on the type of loudspeaker being used and the volume level of that loudspeaker. When it is not possible to prevent acoustic feedback by relocation of the telephone or loudspeaker, it will be necessary to add a relay to cut off the offending loudspeaker when this particular telephone is used for paging. For information write the factory describing the particular installation.

In the event that paging is not used with the Dial-X system and the system is being operated to its capacity, line "0" may be used as a normal telephone line by connecting a telephone to line "0" terminals as shown on figure 8 and 9. Connection to the amplifier will be ignored.

IMPORTANT: The "dummy" plug (with pins 10 and 8 wired together) supplied with the switchboard, plugged into the PAGING receptacle, must be in position when line "0" is not used for paging.

It may be desirable to remove plate-voltage from the amplifier tubes during the time that the sound system is not in actual use for paging. The method of wiring the relay for automatic operation is shown on figure 9.

The choice of loudspeakers, their location and the determination of audio power requirements and selection of amplifiers will depend on the size of the area to be covered, the noise level, etc. This information can be obtained from your local Stromberg-Carlson Sound Equipment Distributor or write direct to Stromberg-Carlson, Special Products Division, Rochester, New York.

2.7.4 Executive Right-Of-Way - Executive Right-Of-Way permits certain "executive" lines to connect through to any telephone even though the called line is in use. The addition of a SC-827 Relay Assembly, Stromberg-Carlson part number 123744-000, permits the use of Executive Right-Of-Way on either or both line 3 and 5. The unit is mounted on the blank panel in the switchboard between switchboard assembly and power supply in the holes provided. Mounting hardware is provided with the relay assembly. Wiring to the unit is shown on figure 6.

The usual triplex wire between the telephone location and the switchboard is not used when the telephone is connected for Executive Right-Of-Way. Two twisted pairs of wires, #20AWG or larger, are used as illustrated in figure 6. A push-button switch (such as a door-bell push-button) is required at the telephone location, where it is usually located out of sight, but readily accessible. This is to prevent its use by unauthorized persons. The required wiring is shown in figure 6.

2.7.5 Dial-Xecutive Telephones -

(1) The Model TD-85 Dial-Xecutive Telephone is equipped with a push-button to permit signaling other Dial-Xecutive Telephones on the same line plus additional internal parts and special wiring to provide the services outlined in paragraph 3.4.

(2) When these services are desired, all telephones installed on the same line must be Model TD-85 Dial-Xecutive Telephones.

(3) The usual three wires are required from the Dial-X Switchboard to the first Dial-Xecutive Telephone on this line. Four wires are required between the first Dial-Xecutive Telephone and other Dial-Xecutive Telephones on this line. See figure 15 for the correct method of wiring to the Dial-Xecutive Telephones. To determine wire size, use the wiring distance between the switchboard and the Dial-Xecutive Telephone located at the greatest distance. When this distance does not exceed 750 feet use #22AWG wire. Use #19AWG when the distance does not exceed 1500 feet and use #18AWG when the distance is between 1500 and 2000 feet.

(4) Dial-Xecutive Telephones are shipped from the factory wired for ringing on incoming calls from the Dial-X Switchboard and manual ringing from other Dial-Xecutive Telephones on the same line. If manual ringing only is desired and ringing from the switchboard is not desired (if for example, on the telephone for an executive where the secretary is to answer incoming switchboard calls) a wire must be removed from the telephone.

Remove the telephone housing by loosening (do not remove) one screw in the rear of the housing and lifting the housing off. The base is provided with a tongue at the front edge which engages a bracket mounted in the front of the housing. It will disengage when the rear of the housing is lifted.

Cut and remove the wire referred to in the note on the schematic, figure 15. The wire to be removed connects C-2 and the frame of the buzzer. No other wiring changes are required.

(5) The method of making a desk telephone installation is given in paragraph 2.5.2 and a wall telephone installation in paragraph 2.5.3.

2.7.6 Retractile Handset Cords - Retractile (coiled) handset cords extend to the standard lengths of straight cord and retract to one foot of tightly coiled wire, out of the way when not in use. The coiled cord (Stromberg-Carlson #894828) is permanently molded into its spring-like shape without the use of a spring or other mechanical means. The cord is protected with an over-all jacket of neoprene.

The color code of the coiled cord conductors is not the same as the standard handset cord with which the telephone is equipped as shipped from the factory. Care must be exercised in replacing the standard cord as it is possible to connect the handset incorrectly so that transmission and reception are possible but at a reduced volume level. The schematic for the telephone shows the color code for the retractile cords in parentheses. Be careful to observe this coding when replacing cords.

Connection At Handset	Color Code Standard Cord	Color Code Retractile Cord	Connection At TD-88 Telephone
Transmitter	Yellow	White	#10
Receiver	Green	Black	#12
Common	Red	Red	#8

Before removing the standard handset cord, notice placement of the wiring lugs and the method used to fasten the cord in order to take strain off the connections. The new cord must be installed in a similar manner. The conductors at one end of the coiled cord are exposed for a greater distance than at the other end. Use the shorter exposed end at the handset; the longer exposed end to reach the terminals in the telephone base. Arrange the lugs in the handset so that they do not short to each other or to terminals or springs. The lugs can be bent down out of the way, if necessary.

2.7.7 Long Lines Adapter - When a telephone must be located more than 2000 feet from the switchboard, a Long Lines Adapter must be installed. See page 12a of this Instruction Book.

2.8 SELECTOR INSTALLATION

Installation of the selector should be the last operation before power is connected to the system and the system is placed in operation. Do not unpack the selectors until switchboard wiring is completed.

Immediately before installing the selectors, thoroughly clean out the switchboard cabinet. Remove all wire ends and insulation clippings, packing material, etc. If compressed air is available, use it to blow out any remaining foreign material and dust. If compressed air is not available use a dry soft-bristle brush (such as an unused paint brush). More time and greater care will be required if a brush is used. Use special care to see that each selector cell is clean.

Use care when unpacking the selectors. They are adjusted to close tolerances and like any fine mechanism deserve careful handling.

(NOTE: It is suggested that one or more selector cartons be saved in the event that it should ever become necessary to ship a selector. These special cartons hold the selector mechanisms solidly in place preventing shifting and damage. It would be extremely difficult to pack a selector without the special carton.)

Insert selectors starting at the bottom cell of the cabinet and progressing to the top. In this way it will be possible to see that each selector is correctly installed and locked in place. When the system is not being used to capacity, selectors will not be required in the lower cells, therefore, start with the selector that will be in the lowest position in use. Before inserting a selector into a cell see that the selector arms are at normal position with moving contacts protected by the nylon posts and the selector-arm resting against the turned-up front edge of the selector assembly. Hold the selector switch with turned-up edge toward you.

WARNING: If the selector is not properly seated in the switchboard cell the wiper fingers will be damaged when the selector is operated.

To install a selector depress the lock-spring on each side of the selector with the thumbs, slide the selector straight back into the cell as far as it will go and release the lock-springs. To be absolutely

certain that the selector is locked in the cell give a couple of sharp pushes with the heel of the hand at the right and left mid-section of the front turned-up lip. Visually inspect the lock-springs to see that they are locked and at the same time attempt to move the selector by pulling at each end of the front edge. If the selector is properly seated and securely locked in position it will not be possible to move the selector. If the selector is not properly seated and locked into position, faulty operation will result and the wiper fingers will be damaged. After double checking the installation of the selector, insert the polarized plug from the selector into the receptacle which is on the same level as the selector.

IMPORTANT: Plug the selector wiring plug into the switchboard receptacle after the selector is properly locked in the cell; never before. Always remove the selector plug from the receptacle before releasing the lock spring to remove a selector from its cell. If this procedure is not observed, damage to the selector can result.

2.9 INSTALLATION TESTS

2.9.1 General - Immediately after the system is installed and before the system is placed in operation, the tests outlined in paragraphs 2.9.2 and 2.9.3 must be made step-by-step as outlined. One person, working alone can make the tests at the switchboard location; two people are required for the balance of the tests, one to remain at the switchboard location; the second person to go from telephone to telephone to check system operation from each telephone in the system.

At the switchboard location connect a telephone instrument across the highest numbered line in the system, #90-906. If this line is in use, remove the building wiring before connecting the telephone. If the system is not being used to capacity, there may not be a selector in the cell for this line. In order to perform these tests a selector must be placed in this cell. Whenever possible, it is advised that this telephone be allowed to remain at the switchboard location and that a selector remain in this cell. In case of trouble it is much easier to check when a telephone is available at the switchboard location. In addition, this telephone or parts of this telephone as well as the additional selector unit are available for immediate replacement of other units in the system in case of trouble. The reason for choosing the highest numbered line for testing is that if each selector operates properly in selecting the highest line, it must be operating properly on all lower numbered lines.

Connect power to the system by plugging the ac plug from the switchboard cabinet into the 105-125 volt 50-60 cycle outlet provided at this location. The panel lamp located on the power supply should be lighted showing that the power supply is delivering its dc output voltage. Make the tests outlined in the following paragraphs.

2.9.2 Tests At Switchboard Location - Using the telephone at the switchboard location connected to the highest numbered line as described in paragraph 2.9.1, make the following tests. The correct indications and probable causes for failure to obtain correct indications are listed.

(1) With the handset hung up, check the speed of the dial by dialing "0". Approximately one second should be required for the return of the dial. This speed can be best determined by observing and checking against several other dials.

(2) Remove handset and listen. Ring-tone or busy signal should not be heard. If either are heard check the selector for improper seating in its switchboard cell.

CAUTION: Remove selector cable plug from the switchboard receptacle before removing selector.

(3) Blow lightly into the transmitter. Movement of the diaphragm should be heard in the receiver. If not, check the power supply output voltage by connecting a dc voltmeter between the cabinet frame and terminal #5 on the board marked EXECUTIVE RIGHT-OF-WAY. Voltage on this terminal will be negative with respect to the cabinet. If the reading is less than 48 volts or more than 52 volts with all telephones hung up, change the wiring to the taps on the power transformer to restore the voltage to approximately 50 volts dc. See figure 3.

Check placement of transmitter and receiver units in the handset handle. Check connections to the transmitter. Check connection of the line-cord to switchboard terminal block. Watch for transposed connections.

(4) Dial the number of the telephone being tested. Pause after each digit is dialed. Until after the final digit is dialed, neither the busy signal nor the ring-tone should be heard. After the final digit is dialed the busy signal should be heard. If the system fails to respond as listed, check the selector unit for this line by replacing with another selector unit.

(5) Hang up and proceed to check each telephone in the system as described below. Do not disconnect the telephone at the switchboard location and do not remove the selector for this telephone. It will be required to complete tests from each telephone.

2.9.3 Tests At Each Telephone Location - Each and every telephone in the system may be tested step-by-step as follows:

(1) With the handset hung up, check the speed of the dial by dialing "0". Approximately one second will be required for return of the dial. Normal dial speed is best established by observing the speed of several dials.

(2) Remove the handset and listen. Ring-tone or busy signal should not be heard. If ring-tone or busy signal is heard, selector may be improperly seated in switchboard cell. Remove and restore selector to insure proper seating. Replace selector if trouble persists.

(3) Blow lightly into the transmitter. Movement of the diaphragm should be heard in the receiver. If not, check placement of the transmitter and receiver units in the handset handle. Check connections to transmitter. Check connections of line-cord to terminal block and building wiring to terminal block. Check building wiring connections to switchboard. Watch for transposed connections.

(4) Dial the number of the telephone being tested. The steady busy signal should be heard. If not, check connections to building wiring for error. Check building wiring connection to switchboard. Check the speed of the dial.

(5) Dial the number of telephone located at switchboard. Pause after each digit is dialed. Until after final digit is dialed, the busy signal and the ring-tone should not be heard. After the final digit is dialed, the ring-tone should be heard indicating that the telephone at the switchboard is ringing. Failure of the system to respond as listed indicates wrong connections, wrong speed of dial or trouble at the switchboard selector.

(6) After not less than 3 rings, the operator at the switchboard location should answer the telephone and establish conversation. Observe the loudness of transmitted and received signal. If below normal, check handset wiring connections. If the handset cord has been replaced incorrectly, the telephone will operate but at less than normal volume level.

(7) Give the person at the switchboard the number of the telephone being tested so that a call can be initiated to the telephone being tested. The telephones must both be hung up long enough to release the selector mechanism and return the switchboard equipment to normal standby position.

(8) When the switchboard calls the telephone being tested, allow the telephone to ring at least three times before answering. Observe loudness of ring. If below normal, check telephone ringer by replacing the telephone instrument. After use and before continuing tests, the telephones must both be hung up at the same time long enough to release the selector mechanism and return the equipment to normal standby position.

(9) When direct paging is employed in the system, dial "0" and make a test announcement. (Paging switch when used, must be in DIRECT PAGE position).

(10) Hang up the telephone and proceed to next telephone to be tested.

(11) In the event that the above listed tests and corrections of faults fail to disclose the cause of improper operation, consult the maintenance and repair information in the following paragraphs in this instruction manual.

(12) When Dial-Xecutive Telephones are used on any line, check operation as outlined in paragraph 3.4.

2.10 INSTALLATION OF LONG LINES

2.10.1 General - When a telephone must be located more than 2000 feet from the switchboard, a TA-8 Long Lines Adapter and TD-4582 telephones must be used. The TA-8 Adapter consists of a surface-mounting, gray finished metal cabinet 12" x 6" x 4" housing the necessary transformer, capacitors, relays and connecting terminals to convert a two conductor line into the three conductor operation required by Dial-X Switchboards. It allows a distant telephone to be connected to the switchboard by means of a two wire circuit having up to 1200 ohms of loop resistance. This resistance corresponds to a distance of 28 miles with #16 gauge copper wire, 14 miles with #19 gauge or 7 miles with #22 gauge. One TA-8 Adapter is required for each long line connected to the system and a maximum of ten TA-8 Adapters can be connected to a TDX-20A Switchboard, seventeen TA-8 Adapters to a TDX-34X Switchboard or twenty TA-8 Adapters to a TDX-40E Switchboard. As with conventional Dial-X lines, one-half of a TX-2 Dual Selector is required for each long line.

A TD-82 Telephone, designed for two conductor lines, must be used on the long line connected to the TA-8 Adapter. Several TD-82's connected in parallel may be used as extension phones if desired.

A CR-107 Relay can be connected across the far end of the long line to operate a horn signaling unit connected as shown in Figure 7 (X-15471).

The station connected to the TA-8 Adapter utilizes the TDX Switchboard busy tone, ring tone, and automatic ringing sources. It can originate or respond to the "Wait-out Busy Signal" feature as does a conventional Dial-X phone but has limited participation in progressive conference circuits. It may initiate or terminate a progressive conference call but can not be an intermediate party.

2.10.2 Installation - The two conductor balanced line used to connect the TD-82 Telephone to the TA-8 Adapter should have a maximum loop resistance of 1200 ohms. The line should be free from grounds except that provided by high resistance lightning discharge devices and have a leakage resistance between conductors under all weather conditions greater than 15,000 ohms. The audio characteristics of the line should be equivalent to that of a conventional telephone line to ensure satisfactory voice transmission and reception. Lightning and excessive voltage protection should be provided for this line in accordance with Dial-X Instruction Manual paragraph 4.35.

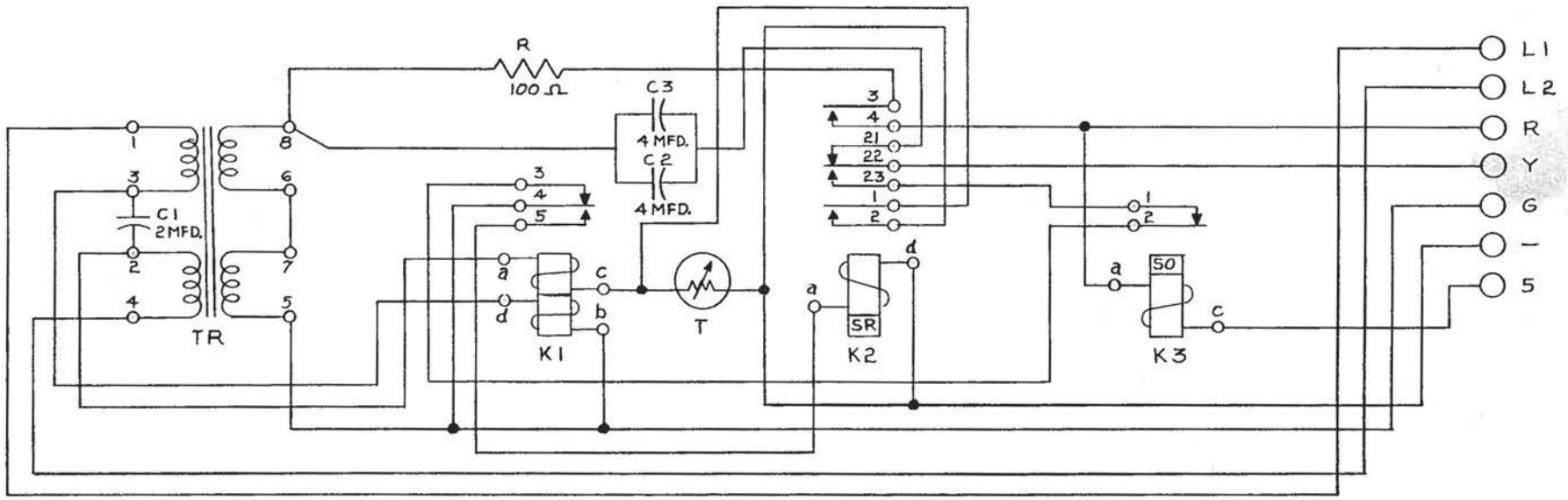
The TA-8 Adapter should be wall mounted, with the hinged side of the cover up, within a 15 foot wiring distance of the Dial-X Switchboard. A twisted pair of #22 gauge wire and a three conductor #22 gauge wire is required to interconnect the TA-8 Adapter and the switchboard. No AC power wiring is required to the TA-8 Adapter.

Knockouts are provided on four sides of the adapter to allow the line from the distant phone and the interconnecting wires with the switchboard to enter through bushings. Wiring Diagram #146894 shows the TA-8 and associated TD-4582 Telephone wired to switchboard line #3.

A second TA-8 can be associated with line #5 by wiring the R Y G terminals on the TA-8 to correspondingly marked switchboard terminals on line #5, wiring (-) terminal on the TA-8 to terminal (5) on the switchboard terminal strip marked EXECUTIVE RIGHT-OF-WAY and wiring terminal (5) on the TA-8 to EXECUTIVE RIGHT-OF-WAY terminal (3). TX-2 Dual Selector must be plugged into the switchboard receptacle associated with line #5.

Additional TA-8 Adapters may be connected to lines associated with the left side of the switchboard. The TA-8 wiring terminals marked R Y G are wired to corresponding terminals R Y G on the left side of the switchboard terminals strip associated with each line. The TA-8 terminal marked (-) always returns to the EXECUTIVE RIGHT-OF-WAY terminal #5. The wire from TA-8 terminal marked 5 must be soldered to terminal #5 at the rear of the 12 prong switchboard receptacle associated with the switchboard line. A TX-2 Dual Selector must always be plugged into this same switchboard receptacle.

Schematic Drawing for the TA-8 Long Lines Adapter is shown on #146893 on the back of this page.



STOCK LIST		
SYMBOL	DESCRIPTION	S.C. CO. PART NO.
K1	RELAY	361447
K2	RELAY	359037
K3	RELAY	353609
TR	TRANSFORMER	203925
C1	CAPACITOR 2 MFD. 200 V.	42371
C2, C3	CAPACITOR 4 MFD. 200 V.	42372
R	RESISTOR 100 OHM	149625
T	THERMISTOR	39504

TA-8 SCHEMATIC DWG.

146893 (1)

SECTION III
OPERATION

3.1 OPERATION FOR TELEPHONE OTHER THAN DIAL-XECUTIVE TELEPHONES

(1) Look up the Dial-X number of the desired party.

(2) Lift the handset. If there is an extension telephone on your line, be sure that the line is not in use. Otherwise immediately proceed to step 3. The system is always ready for instant use. There is no dial tone to wait for.

(3) Dial the first digit of the number by placing a finger in the dial hole opposite the correct digit and turning the dial until the finger strikes the stop on the dial.

(4) Raise the finger and without touching the dial, let the dial return to its original position. Do not force or retard the return motion of the dial.

(5) In the same manner, dial the remaining digits in the number.

(6) Listen for the ringing signal, an intermittent bur-r-ring sound, indicating that the called line is being rung.

(7) If the called line is busy, a steady loud buzz will be heard instead of the intermittent ringing signal. Either hang up and call back later or "wait-out" the busy signal. If you wait out the busy signal, when the called party completes the existing call and hangs up, the steady busy signal will immediately change to the intermittent ringing signal.

(8) Do not turn the dial while talking. The talking connection may be broken and a connection to other than the desired line may result.

(9) Always replace your handset in the cradle for several seconds between calls. Both the calling and called parties must hang up in order to release the switchboard equipment and allow it to return to its normal starting position.

(10) If an error occurs during dialing, immediately replace the handset, wait a few seconds, lift the handset and dial again.

3.2 HOW TO ESTABLISH A CONFERENCE

Any three or more telephones may engage in a secret "progressive" conference by proceeding as follows: the first party calls the second; the second calls the third, etc. Only the last party can add another and no other telephone can listen in.

To start a progressive conference, call one person and have him call the next party. When the conference is completed, each party to the conference must hang up and remain hung up until all parties have hung up and the switchboard mechanism is released to return to its normal starting position.

3.3 HOW TO INSTITUTE A PAGE

When the Dial-X System is equipped for paging, line 0 is reserved for this service.

(1) To institute a page, dial "0", as outlined in paragraph 3.1.

(2) If the line is busy, the busy signal will be heard. If the line is not busy the ringing signal will be heard.

(3) When the paging operator answers, request "Page Mr. Name for Dial-X #". Insert the correct name of the person to be paged and the number of your Dial-X telephone.

(4) In the operator's absence or when a paging operator is not used, a busy signal will be heard when the paging system is in use. Hang up and try again after 10 to 15 seconds.

(5) If the line is not busy, the telephone transmitter is connected directly to the paging amplifier input and neither the ringing signal nor the busy signal will be heard.

(6) Speak into the handset in a normal voice. Say "Mr. Name call Dial-X #". Insert the name of the person desired and the number of your Dial-X telephone.

(7) Hang up your telephone so that the paged party can call you. Hanging up the telephone immediately disconnects it from the paging amplifier and restores the selector to its normal standby position, thereby permitting the paged party to call you.

NOTE: In most installations, it is necessary to differentiate between normal telephone service and Dial-X intercom telephone service; therefore, the necessity of designating "Dial-X" in the paging announcement.

3.4 USE OF EXTENSION TELEPHONES

All telephone instruments connected on one line are in parallel; therefore, a call can be originated or answered at any telephone on that line. The manner of operation for any telephone is the same as described in paragraphs 3.1 to 3.3 inclusive.

In addition to the operation described, it is possible to originate a call on one telephone and after it has been answered, hang up and take the call on a second telephone on the same line by merely lifting the handset on the second telephone. It is possible to answer a call on one telephone, hang up and take the call on a second telephone on the same line. This type of operation is possible since once the called party has answered, the connection is not broken until both the called and calling party hang up.

3.5 EXECUTIVE RIGHT-OF-WAY

Executive Right-of-Way permits essential calls from certain "executive" telephones to take priority over all other calls even though the called telephone is busy. When the telephone is equipped for this service, operation is the same as desired for all other telephones in the system with the exception that it is not necessary for the executive to wait out a busy signal. Operate, for 2 to 3 seconds, the push-button (usually concealed) at this location to connect the executive's telephone to the called line after sounding a warning signal on the interrupted conversation. If secrecy is desired, it will be necessary for all parties to hang up for several seconds and for the executive to call the desired party or vice-versa.

3.6 OPERATION FROM DIAL-XECUTIVE TELEPHONES

(1) The Dial-Xecutive is a deluxe telephone equipped with a push-button to permit signaling other Dial-Xecutive Telephones on the same line plus additional internal parts and special wiring to provide the services outlined below. Two or three Dial-Xecutive Telephones can be installed on a line. Any Dial-Xecutive Telephone can be arranged to ring only on calls from other Dial-Xecutive Telephones on the same line and not on calls from the Dial-X Switchboard. These circuit features make possible the use of Dial-Xecutive Telephones in the following manner:

(2) Dial-Xecutive Telephones can be used for interoommunication with other telephones on the same line, without dialing. To establish intercommunication, lift the handset and listen. If line is not in use, signal the desired Dial-Xecutive Telephone by operating the push-button. Use code ringing when more than two Dial-Xecutive Telephones are installed on the same line. (For example: one ring, two rings, one long and one short ring.) Only Dial-Xecutive Telephones on the same line can listen in. If, during use of the Dial-Xecutive Telephone this line is called by a telephone on another line, a busy signal will be heard.

(3) Incoming call from the Dial-X Switchboard can be answered at any Dial-Xecutive Telephone and transferred to any other Dial-Xecutive Telephone on the same line or other Dial-Xecutive Telephones on the same line can be brought into the conversation. The executive's telephone can be arranged so as not to ring on incoming switchboard calls; his secretary can screen incoming calls and signal the executive by operation of the push-button when calls require his personal attention. The secretary can stay on the line or hang up without affecting the call.

NOTE: When a call is originated at a Dial-Xecutive Telephone, it is not possible to transfer the call as outlined. Operation of the push-button will cut off the existing switchboard call and set up the circuit for communication between Dial-Xecutive telephones on the same line.

3.7 PAGING OPERATOR'S INSTRUCTIONS

Satisfactory operation of the paging system depends to a large extent on proper use of the paging microphone. Each word spoken into the microphone must be clearly heard for the meaning of the announcement to be understood. Attention to the following suggestions is important.

(1) Place the Direct Page switch in the Operator position. This connects the telephone at the paging location to line 0 of the Dial-X System and disconnects line 0 from the paging amplifier.

(2) Answer the telephone at this location with the word "Paging". This reduces the time required to accept a call. Immediately after the call is accepted, replace the handset on the cradle.

(3) Operate the Mike Page switch to activate the paging microphone.

(4) Speak directly into the paging microphone in a normal voice with the lips about two inches from the front of the microphone.

(5) Maintain a constant voice level (always the same volume) and an even speed of speech. Sound each syllable of each word and the final consonant of each word.

(6) Think of each word as you speak it. Leave a space between words. Speak the final word of an announcement with the same emphasis as the first word.

(7) Release the Mike Page switch.

(8) Before leaving the paging microphone location unattended, operate the Direct Page switch to its On Position. This disconnects the telephone at the paging location and connects line 0 to the amplifier. It is now possible for direct paging from any telephone to go out over the paging system.

SECTION IV
MAINTENANCE AND REPAIR

4.1 GENERAL INFORMATION

In the design of the Dial-X System, Stromberg-Carlson has taken into consideration the fact that the system will be called upon to operate for long periods of time without attention. Therefore, circuits and components have been selected to provide rugged, dependable, trouble-free equipment. Once installed and placed in operation, the Dial-X System should require only occasional preventive maintenance to keep it in good operating condition. Paragraph 4. 3 outlines a yearly preventive maintenance routine which will minimize equipment failures. The cost of a good preventive maintenance program is more than offset by savings in repair costs, longer equipment life and reduction of loss of service time.

In spite of careful and complete preventive maintenance and regardless of how well equipment is designed and carefully manufactured, troubles occasionally occur. When such troubles occur, the serviceman must locate and correct them as quickly as possible. Paragraphs 4. 3 and 4. 4 contain information to aid in quickly locating the fault so that complete service can be restored with the least possible delay.

Repair of telephone components is an objectional and in some cases an impossible task in the field. Mechanical adjustments are critical. Yet, unless these repairs are properly made and unless the equipment is restored to original operating condition, dissatisfaction can result. To insure continued trouble-free operation of the Dial-X System, Stromberg-Carlson has established a repair and replacement policy for component parts that will insure full customer satisfaction. This policy is covered in paragraph 4. 2.

4.2 REPAIR AND REPLACEMENT OF DEFECTIVE PARTS

4.2.1 Guarantee - Stromberg-Carlson fully warrants the workmanship and material of the Dial-X System and component parts thereof and agrees to replace or repair at its option with as little delay as possible, any parts manufactured by it showing inherent defects which are returned for inspection to its factory, transportation charges prepaid, within a period of one year from the date of delivery, provided that such inspection discloses to the satisfaction of Stromberg-Carlson that the defects are as claimed by the purchaser. This guarantee does not cover the wearing out of cords or any injury to parts by lightning, foreign currents, exposure to excessive moisture, or from any cause not due to inherent defects.

4.2.2 Repair And Replacement of Parts After Expiration of Guarantee - Based on years of experience in the repair and replacement of telephone parts for operating telephone companies (city exchanges), Stromberg-Carlson has an established policy in regard to the repair and replacement of parts after the expiration of the guarantee. Even the large users of Stromberg-Carlson telephone equipment find it more profitable to return telephone equipment for rebuilding rather than to set up a repair department. The cost of the necessary accurate adjustment jigs is excessive when compared to the small volume of telephone repair work and the low cost of factory rebuilding.

The Stromberg-Carlson policy permits the return of telephone equipment, such as the selector assembly, dials, ringers, ring interrupter or complete telephone instruments for repair or rebuilding. The amount of the repair charge takes into consideration the reason for failure, and the cost of repair. All work is done by experienced factory personnel, thoroughly familiar with the electrical and mechanical requirements of the equipment to be repaired. Stromberg-Carlson has the tools, machinery and adjustment jigs to properly do this work. No substitute material is used or makeshift methods employed. It is general practice to dismantle the apparatus when necessary to replace or repair damaged or defective parts. On telephones, all soiled or badly worn cords are replaced. Molded parts like receiver caps and mouthpieces are cleaned, polished or replaced if badly damaged or broken. All repaired equipment is carefully tested for the regular operating values as established under our engineering standards for the original manufacture of this equipment and repaired equipment must pass the same rigid inspection as applied to new equipment.

To avoid the delay usually associated with the repair and return of equipment, a service stock of dials, ringers, selectors, ring interrupters and power supplies is carried at the factory in Rochester, New York. When one of these units is returned for repair, it is immediately replaced

When defective parts which cannot be rebuilt such as receivers, transmitters and induction coils are returned prepaid to the factory, an allowance is made against the purchase of a new part of the same type.

All items to be returned must be carefully packed and shipped prepaid to the factory at Rochester, New York. Transportation charges both ways and packing expenses are to be borne by the customer.

Address returned equipment to Stromberg-Carlson, Dial-X Repair Department, Special Products Division, Rochester, New York. A tag listing the name and address of the shipper as well as the reason for returning the part should be fastened to each part.

4.3 PREVENTIVE MAINTENANCE

4.3.1 General - Preventive maintenance is a systematic series of operations performed on the equipment at yearly intervals to eliminate break-downs, and unwanted interruptions in service, and to keep the equipment operating at top efficiency.

The equipment should be inspected once a year to detect minor defects and signs of worn, damaged or corroded parts which may later cause trouble. Although these minor defects may not have interferred with the performance of the equipment, correcting them before they lead to major break-downs saves valuable time and effort. It is necessary to be thoroughly familiar with the indications of normal functioning in order to recognize the first signs of defective equipment.

It is advisable to inspect for the following conditions: (1) Overheating: Look for discoloration, blistering or bulging of the parts and oxidation of material and contact surfaces. (2) Placement: See that all leads and cabling are in their operating positions, that insulation has not become damaged and that soldered connections are in good condition. (3) Cleanliness: Carefully examine all recesses in the units for accumulation of dust especially between connecting terminals. Parts, connections, and joints should be free of dust, corrosion and other foreign matter. Remove accumulated dust and dirt from the equipment with a clean lint-free cloth. Use a camel's-hair brush to remove dust from relay or switch assemblies where space is restricted. Perform cleaning operations carefully in order not to damage equipment or adjustment of equipment. In locations having high humidity, inspect for fungus growth and mildew.

In addition to the general instructions listed in this paragraph, specific maintenance instructions for some of the major components are listed in the following paragraphs.

4.3.2 Wire-Banks Maintenance - The wire-banks do not require maintenance. They are NOT to be lubricated but must remain dry at all times. The wire-banks are "self-cleaning" by the action of the "wiper" contacts of the selector assembly.

4.3.3 Selector Maintenance - After disconnecting the wiring plug, remove each selector from the switchboard cabinet. Using a camel's-hair brush or a blower, carefully remove all dust from the selector. With a brush and cleaning solvent such as chlorothene, remove any dirt and grease which adheres to the chassis and parts.

IMPORTANT: Keep cleaning solvents away from all electrical contacts. Use special care to see that the contact arms of the selectors and springs of the relays are not bent during the operation.

Certain points of the selector assembly should be oiled during the yearly preventive maintenance program.

IMPORTANT: Do NOT allow oil to reach the relay points or selector contacts. They must remain dry at all times. The oil used for lubrication is a very special product; no ordinary oil should ever be used on the selector mechanism. Stromberg-Carlson Lubricant, part #204806 must be used. One drop of lubricant is to be applied at certain points - a drop being the amount that adheres to a piece of #22 gauge wire after being immersed in the lubricant to a depth of 1/2 inch. The points to be lubricated are identified on the drawing figure 12.

4.3.4 Telephone Instruments - Replace worn-out cords before they can cause trouble. Except in an abnormally dirty location, it should not be necessary to open a telephone for cleaning. If it should become necessary to clean the interior of a telphone, use only a dry, clean, camel's-hair brush. If dust has penetrated into the hook-switch, remove the protective, clear plastic cover by sliding to the right. Restore the cover when cleaning is completed.

Do not attempt to clean the dial. Check the speed of the dial. Nominal speed is 10 pulses per second. The dial will operate satisfactorily if the speed is between 6 and 12 pulses per second. If the speed of the dial is slower than 6 or faster than 12 pulses per second, return it to the factory for repair or adjustment. See paragraph 4.2.

4.4 TROUBLE REPORT ANALYSIS

Before attempting to locate trouble in the system take time to analyze the trouble report. If the report is incomplete, ask for additional information. It is important to know under what conditions the trouble is evidenced. Is the same trouble reported from more than one telephone? Is the trouble always evident or is it intermittent? Questioning along these and similar lines will almost invariably result in a clue to the actual trouble. A correct analysis of the symptoms can save much time and trouble.

Watch out for reported troubles that are in reality misuse of the equipment or failure to observe operating instructions. It will be found that many of the so-called troubles reported in the operation of any dial telephone system are the result of human error or carelessness in the use of the system. These troubles are of the same nature as those reported on city dial telephone systems and can usually be readily recognized as such. The most common complaint of this nature is that the wrong party answers. This is generally the result of an error in dialing, often caused by carelessness. Sometimes it is the result of reliance on a poor memory rather than using the telephone directory. Riding the dial back to its starting point after dialing can cause a wrong selection if the dial speed is increased or retarded beyond the system tolerance.

Moving the dial at the calling station, during a conversation can advance the selector, breaking the existing conversation can advance the selector, breaking the existing conversation and causing a new line to be selected and rung. Moving the dial at the called station during a conversation can actuate the selector, ring a third party and in effect set up a conference circuit.

When there is more than one telephone on a line, and a second telephone (extension) on the line is dialed while the line is in use by the first telephone, the effect will be the same as if the dial on the first telephone is moved. The result will depend on whether this telephone was calling or called. See the previous paragraph.

Until both the calling and called telephones are hung up the calling selector is not restored to its normal standby position. Dialing before the selector has returned to its normal position will result in either a false selection or an unintentional conference circuit.

It can be seen that these conditions are the result of the misuse of certain features and are not the result of trouble in the equipment. For example, the selector mechanism cannot distinguish between operation of the dial by someone playing with the dial while talking and deliberate operation of the dial to set up a conference circuit.

4.5 TROUBLE SHOOTING

The first step in trouble shooting is to trace the cause of abnormal operation to the major component responsible for the trouble. The second step is to locate the particular part causing the trouble.

The design of the Dial-X System provides for the quick substitution of major components to permit immediate locating of the defective component. In addition, the telephone instrument design also provides for immediate substitution of parts to simplify tracing the fault to a particular part.

Trouble in a major component is more easily traced, when divided into two classifications. Troubles which effect operation at all stations are covered in paragraph 4.5.1. Troubles which effect operation at one station only are covered in paragraph 4.5.2. Paragraph 4.5.3 will assist in tracing the fault to a particular part.

4.5.1 Trouble At All Telephones - Trouble which affects <u>all</u> telephones must originate in the power supply or ring interrupter as these are the only portions of the Dial-X System which serve all telephones. A lamp on the power supply is lighted when the power supply is delivering its dc output voltage. The dc output voltage can also be checked by connecting a dc voltmeter between the cabinet frame and terminal #5 on the board marked EXECUTIVE RIGHT-OF-WAY. Voltage on this terminal will be negative with respect to the cabinet. This reading will vary over the range of 44 to 50 volts depending on the number of telephones that are in use at the moment. Taps are provided on the primary of the power transformer to compensate for line-voltage variations. If the voltage is above or below normal refer to paragraphs 4.6.3 for instructions.

The ring interrupter is powered from the system power supply, therefore, failure of the system to ring all telephones can be caused by trouble in the power supply <u>or</u> the ring interrupter. First check the power supply for output voltage. If normal, bypass the ring interrupter in the following manner. Remove the ring interrupter plug from the power supply and plug in a Jones #P-312 CCT plug (S. C. Co. #143618) wired as follows. Solder a wire between terminals #6 and #8. Solder another wire between terminals #11 and #12. The called telephone should ring without interruption when this plug is used in place of the ring interrupter.

NOTE: The ring interrupter can also be checked by replacement with a ring interrupter known to be good. The ring interrupter used in the Dial-X Demonstration Unit is identical and can be used. Conversely, the ring interrupter from the system can be tested in the demonstrator.

4.5.2 Trouble At One Telephone - Trouble existing in the operation of one telephone only, cannot be caused by the power supply or ring interrupter. Trouble experienced at one telephone only, is probably caused by the telephone itself, the wiring from the switchboard to the telephone or the selector for this telephone.

Because the selector is easily changed, it is suggested that trouble shooting by substitution start at the selector.

IMPORTANT: Always remove the selector wiring plug from the switchboard receptacle before releasing the lock-springs to remove a selector from its cell. This electrically disconnects the selector and causes the selector carriage to return to its normal position if it is not already in this position. If this procedure is not observed, damage to the selector will result. Before replacing the selector, see that the selector arms are at normal position with moving contacts protected by the nylon posts and the selector-arm resting against the turned-up front edge toward you. Depress the lock-spring on each side of the selector with the thumbs. Slide the selector straight back into the cell as far as it will go and release the lock-springs. To be absolutely certain that the selector is locked in the cell give a couple of sharp pushes with the heel of the hand at the right and left mid-section of the front turned-up lip. Visually inspect the lock-springs to see that they are locked and at the same time attempt to move the selector by pulling at each end of the front edge. If the selector is properly seated and securely locked in position it will not be possible to move the selector. If the selector is not properly seated and locked into position, faulty operation will result and damage to the selector is possible. After double checking the installation of the selector, insert the polarized plug from the selector into the receptacle which is on the same level as the selector.

CAUTION: Plug the selector wiring plug into the switchboard receptacle after the selector is properly locked in the cell; never before. Always remove the selector plug from the receptacle before releasing the lock-spring to remove a selector from its cell. If this procedure is not observed, damage to the selector can result.

If replacement of the selector clears up the trouble return the selector to Stromberg-Carlson for repair. See paragraph 4.2.

If replacement of the selector fails to remedy the trouble, replace the telephone. Be careful to maintain color-coding of connections. If replacement of the telephone eliminates the trouble refer to paragraph 4.5.3 for repair instructions.

If replacement of the telephone fails to remedy the trouble, check the building wiring. To check for leakage, disconnect the building wiring for this telephone from the switchboard. (It is not necessary to disconnect the telephone from the building wiring if it is hung up. Capacitors in the telephone provide dc isolation). With an ohmmeter read the resistance between the three possible combinations of wires (A to B, A to C, and B to C) and also between each wire and ground (switchboard cabinet). The reading in each case should be greater than 100,000 ohms. If the reading is less than 100,000 ohms, check the building wiring for shorts or leakage caused by moisture penetrating the insulation. If this test fails to indicate the trouble, check the building wiring for continuity. Temporarily short (connect together) the three wires at the switchboard location. At the telephone location read the resistance across the three possible combinations of building wiring (A to B, A to C and B to C). The resistance should be the same in all cases and will depend on the length of the line. The approximate resistance per thousand feet of wire of various sizes follows: #18AWG - 6.4 ohms, #19AWG - 8 ohms, #20AWG - 10 ohms, #22AWG - 16 ohms. The resistance measurements are being made through wire twice the length of the run (from the telephone location to the switchboard location and back to the telephone location). If the resistance of the three possible combinations is too high or too low as compared with the listed values, check the building wiring for this telephone.

4.5.3 Locating The Defective Part - The majority of faults can be traced to a particular part by observation of the symptoms and by the substitution of parts. By noting carefully the abnormal function, or lack of function, it becomes in most cases a simple process of the substitution of one or two parts concerned with this function, in order to isolate the actual cause of trouble.

For example: Failure of a particular telephone to properly select another line would indicate trouble in the dial. If the dial is too fast, it is possible that the step mechanism in the selector might not follow the pulses accurately. (The trouble could also be in the selector but the selector should have been

checked previously by substitution as described in paragraph 4. 4. 2). Replacement of the dial by one known to be operating normally, will check the analysis.

Failure of a telephone to transmit normally would indicate trouble in the transmitter. Substitute a transmitter from a telephone known to be operating normally to check the analysis.

This is an example of the type of analysis required to locate a faulty part. Familiarity with the system is required to locate a faulty part. Familiarity with the system is required in order to eliminate as many parts as possible from consideration as likely sources of trouble.

4. 6 SWITCHBOARD REPAIR

The switchboard mechanism is built on a frame, fastened into the cabinet, so that the mechanism can be swung out from the top, pivoted on a pair of shoulder screws near the bottom of the cabinet. This provides ready access to equipment on both sides of the frame. Before swinging out the mechanism, disconnect power from the cabinet.

To swing out the switchboard mechanism, remove the top four screws in the right and left sides of the cabinet. These screws are located about half-way between the front and back of the cabinet. Do NOT remove the bottom screws on each side. Carefully swing down the mechanism from the top, until it rests on the floor in front of the cabinet.

4. 7 COMPONENT REPAIR

4. 7. 1 Selector And Ring-Interrupter Repair - Although the selector assembly and ring-interrupter are relatively simple in construction and operation, adjustment jigs are required to achieve the close tolerance of adjustment desirable for long trouble-free life. Attempted repair in the field will usually fail due to the inability of the repairman to maintain tolerance of adjustments.

Selector assemblies to be returned, must be carefully repacked to avoid damage in shipment. Use a carton in which a selector was received. These cartons are designed to protect the mechanism. Selector assemblies or ring-interrupter assemblies returned to Stromberg-Carlson will be repaired and restored to their original operating condition before being returned.

4. 7. 2 Telephone Repairs - If desired, the complete telephone instrument can be shipped prepaid to the factory for repair or rebuilding. See paragraph 4. 2. 2.

Repairs in the field to telephones will consist principally of replacement of parts. For example, failure of a transmitter, receiver, ringer, dial or impedance-coil is corrected by replacement of the part. Return replaced parts prepaid to the factory. See paragraph 4. 2. 2.

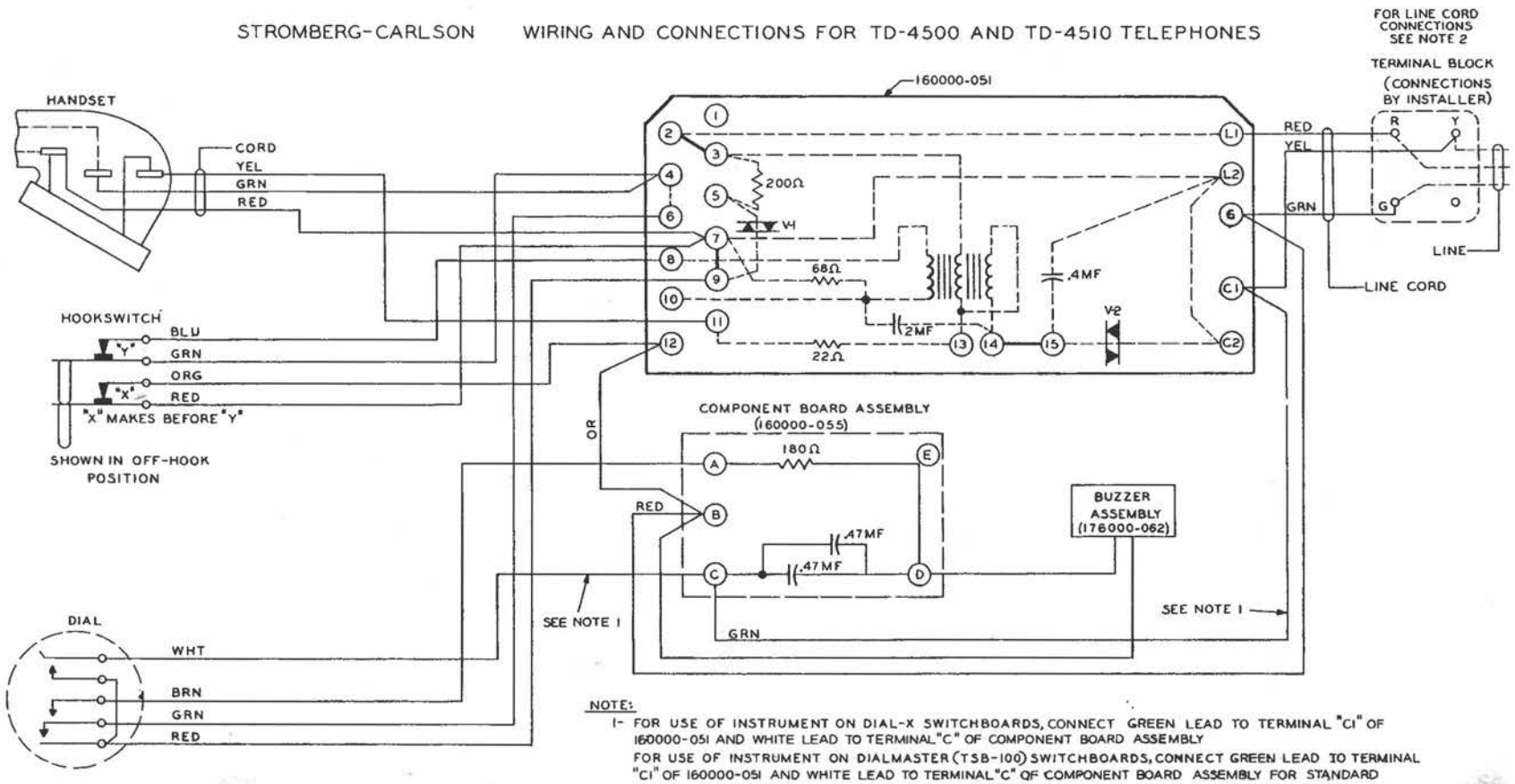
NOTE: The entire ringer must be returned for repair because magnetic structures using Alnico V magnets cannot be opened to replace a coil unless facilities are available for remagnetizing the structure. This requires a large magnetizer as well as correct alignment and adjustment by means of accurate jigs. The usual result of an attempted ringer repair in the field is a weak ringer.

4. 7. 3 Power Supply - The schematic for the power supply lists the voltages, resistance, capacity values, etc. The power supply can be serviced in the usual manner. The circuit is a silicon rectifier for dc output and direct connection to the transformer for ac output voltage.

The 48 volt dc output is nominal. With no load on this tap (switchboard disconnected from power supply) the voltage should not exceed 50 volts. Under full load the voltage should not drop below 44 volts. Full load can be simulated by connecting a 25 ohm, 100 watt resistor across the 48 volt dc output.

Taps are provided on the primary of the power transformer to compensate for variations in line voltage. Excessive no-load voltage output on the 48 volt dc output is usually caused by high line-voltage. Adjust transformer taps as outlined on figure 4.

STROMBERG-CARLSON WIRING AND CONNECTIONS FOR TD-4500 AND TD-4510 TELEPHONES



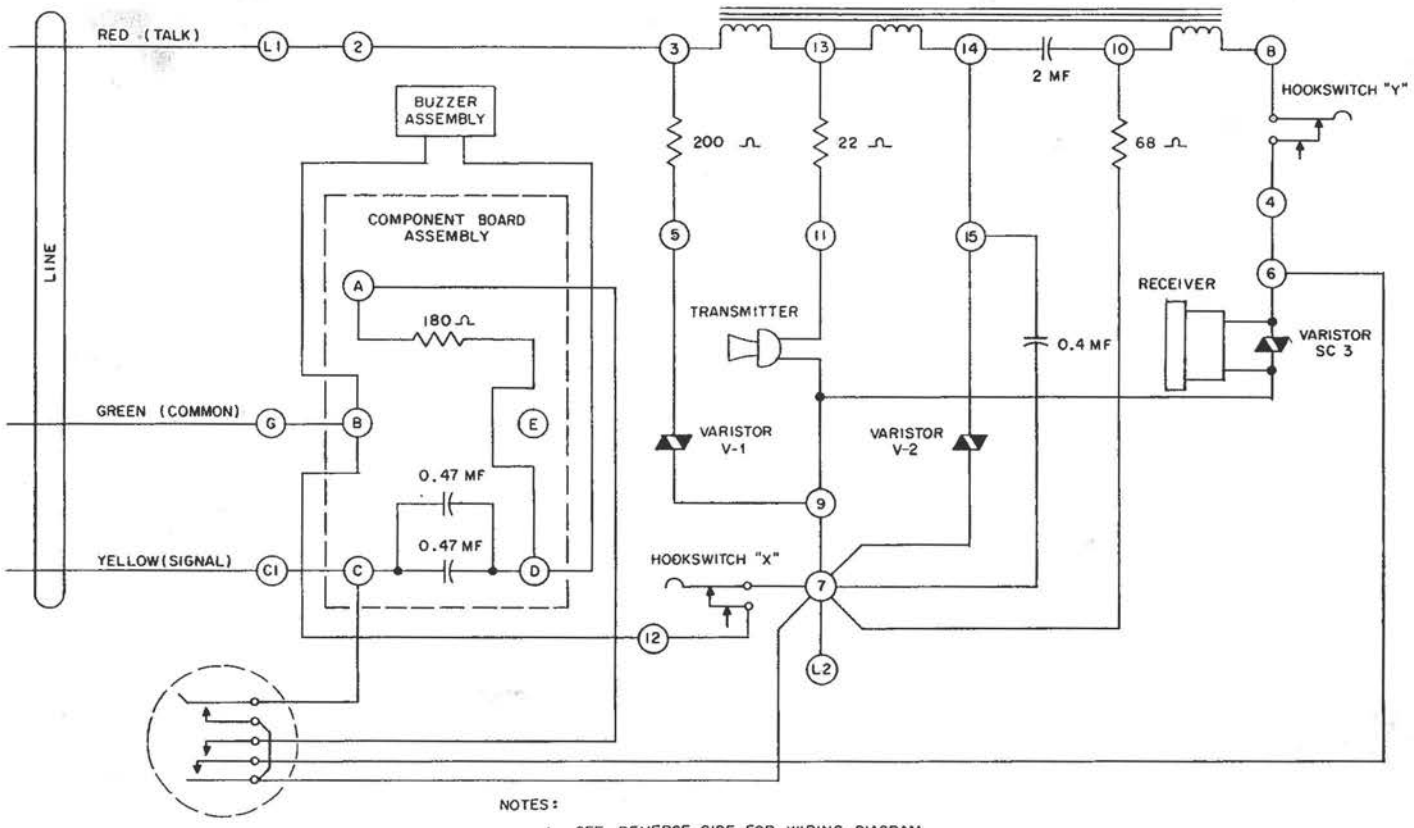
NOTE:

1- FOR USE OF INSTRUMENT ON DIAL-X SWITCHBOARDS, CONNECT GREEN LEAD TO TERMINAL "C1" OF 160000-051 AND WHITE LEAD TO TERMINAL "C" OF COMPONENT BOARD ASSEMBLY
FOR USE OF INSTRUMENT ON DIALMASTER (TSB-100) SWITCHBOARDS, CONNECT GREEN LEAD TO TERMINAL "C1" OF 160000-051 AND WHITE LEAD TO TERMINAL "C" OF COMPONENT BOARD ASSEMBLY FOR STANDARD RINGING. CONNECT GREEN LEAD TO TERMINAL "L1" OF 160000-051 AND WHITE LEAD TO TERMINAL "C1" OF 160000-051 FOR PARTY RINGING. IF NO RINGING IS DESIRED DISCONNECT BUZZER LEAD FROM TERMINAL "B" AND CONNECT TO TERMINAL "D" ON COMPONENT BOARD.

2- FOR PHONES USING BUZZER ASSY 176000-143 SEE DWG S-88067 FOR R,Y,G, CONNECTIONS.

S-88053 (4)

STROMBERG-CARLSON SCHEMATIC CIRCUIT FOR TD-4500 AND TD-4510 TELEPHONES



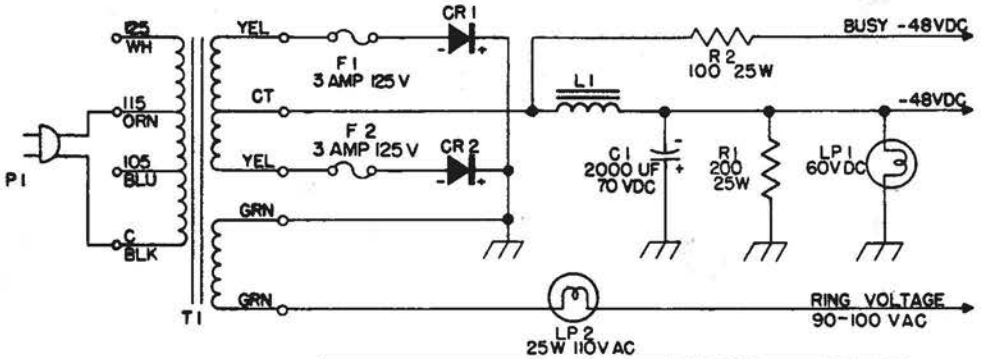
NOTES:

1. SEE REVERSE SIDE FOR WIRING DIAGRAM
2. HOOKSWITCH SHOWN IN OFF-HOOK CONDITION
3. HOOKSWITCH "X" MAKES BEFORE "Y".

S-88052 (3)

STROMBERG - CARLSON

A DIVISION OF GENERAL DYNAMICS CORPORATION
SCHEMATIC, POWER SUPPLY 169000-002



SYM.	S-C CO. NO.	DESCRIPTION
C1	111000-007	CAPACITOR
F1-F2	555020-125	FUSE
L1	161000-007	CHOKE FILTER
P1	46302-000	POWER CORD
R1	204206-000	RESISTOR
R2	149240-000	RESISTOR
T1	161000-006	POWER TRANSFORMER
CR1-CR2	162000-042	40J2 SILICON RECTIFIER
LP1	45271-000	LAMP
LP2	3490-628	LAMP

S-88029 (3)

FIG. 3

STROMBERG-CARLSON COMPANY
A DIVISION OF GENERAL DYNAMICS CORPORATION
SCHEMATIC CIRCUIT RING INTERRUPTER

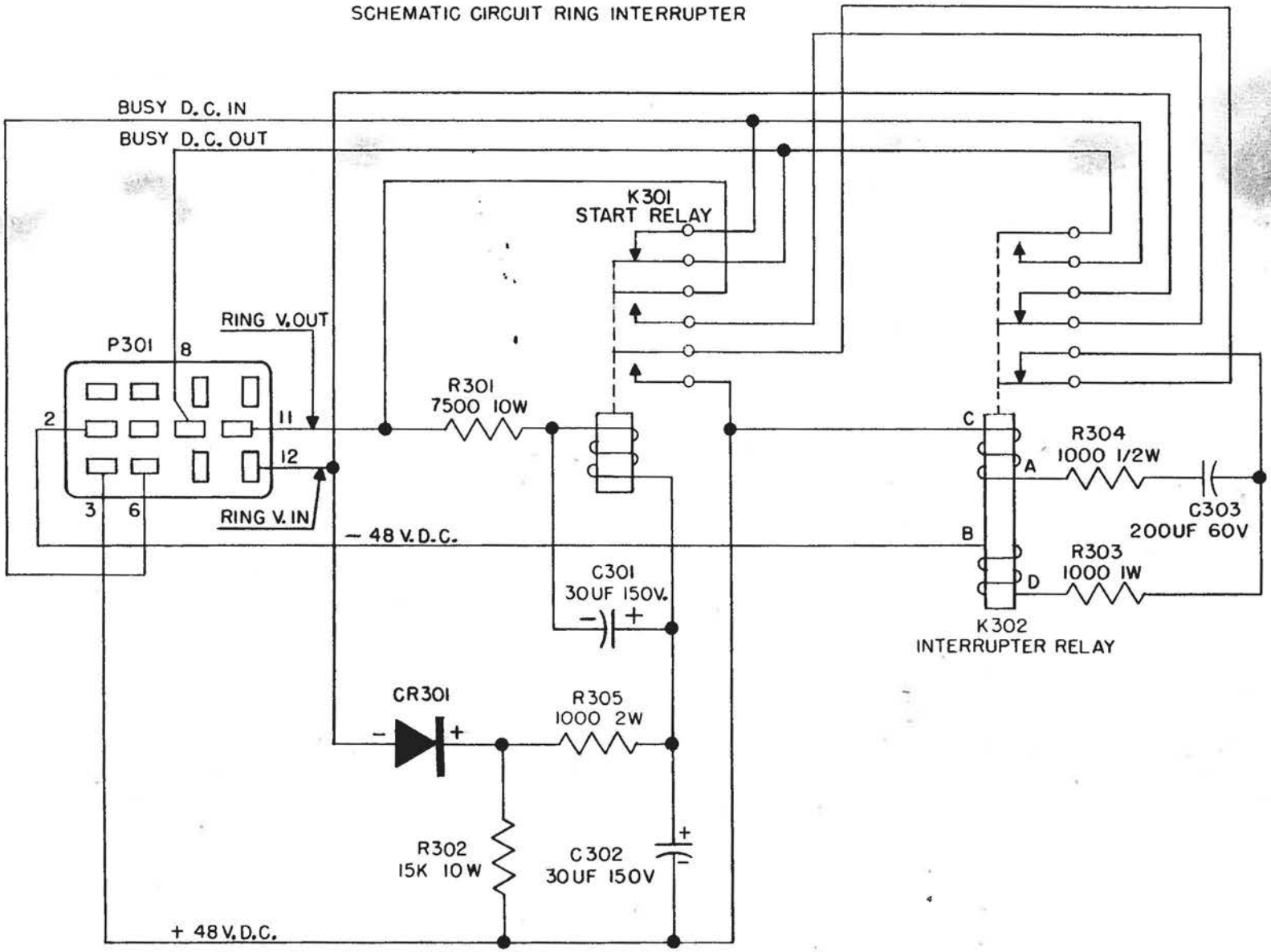
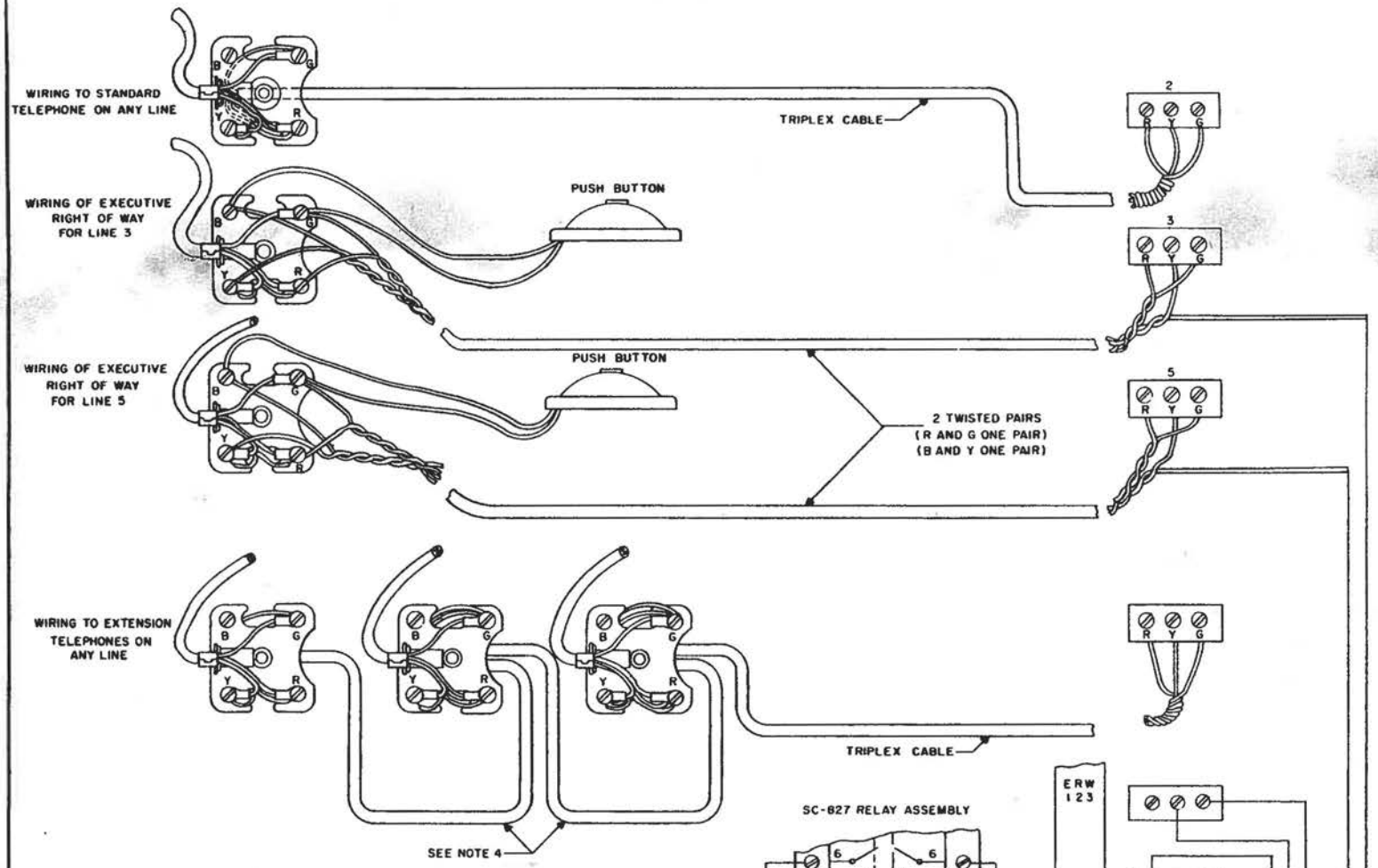


FIG. 4

S-88009(4)



NOTES

1- EXECUTIVE RIGHT OF WAY CAN BE USED ONLY WITH LINES 3 AND/OR 5. IT CAN BE OMITTED FOR EITHER OR BOTH LINES BY OMITTING PUSH BUTTON AND WIRING TO PUSH BUTTON.

2- TELEPHONE WIRING TO SWITCHBOARD TERMINALS, FOR LINES OTHER THAN 3 AND 5, IS TYPICAL WIRING REQUIRED FROM EACH TELEPHONE IN SYSTEM TO TERMINALS IN THE SWITCHBOARD CABINET.

3- TWISTED PAIR AND TRIPLEX SHOWN ON THIS DRAWING DO NOT REQUIRE OVERALL BRAID FOR SIZE SEE INSTRUCTION BOOK.

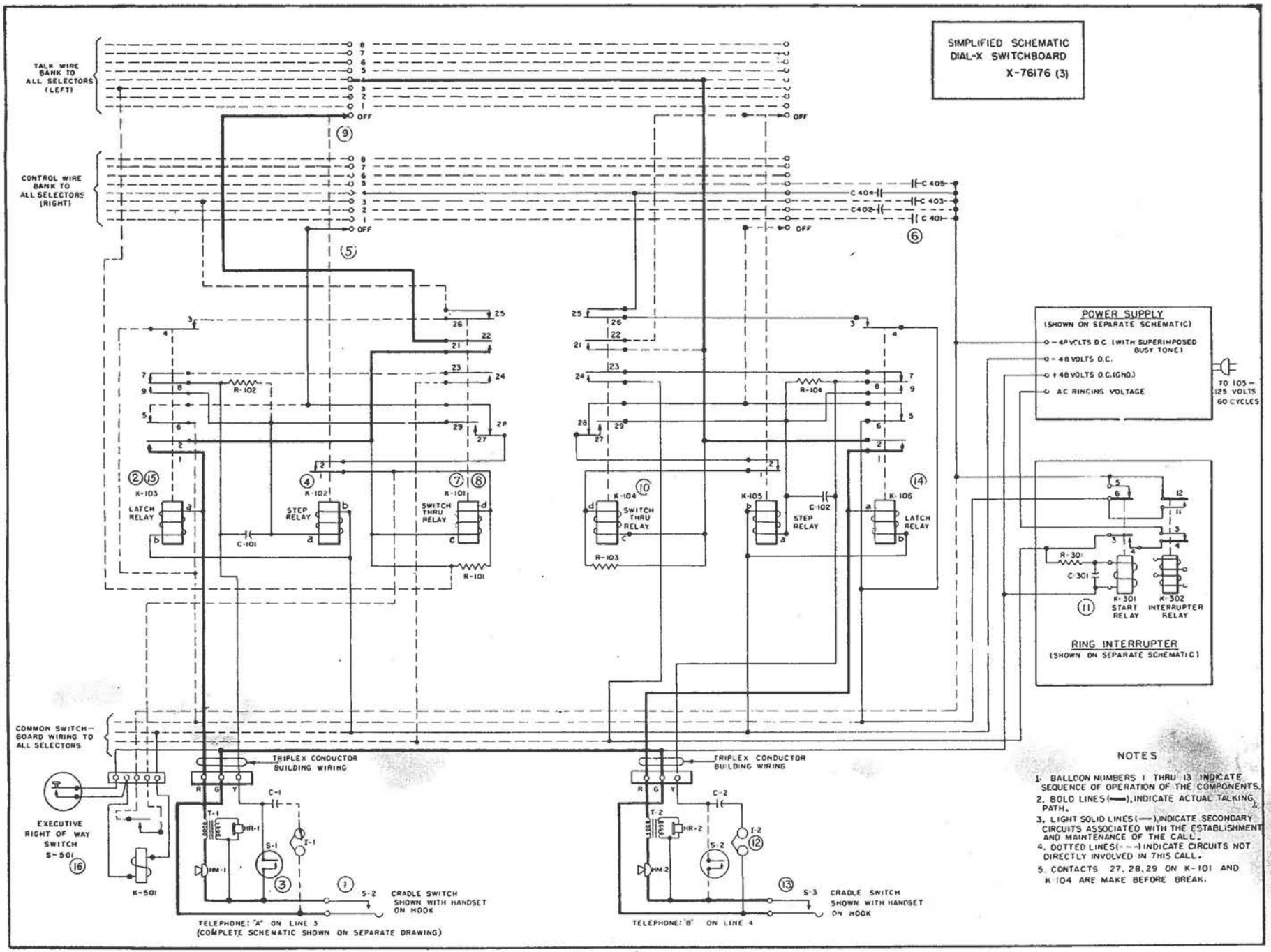
4- STANDARD TELEPHONES WHEN USED AS EXTENSION TELEPHONES REQUIRE 3 WIRES BETWEEN TELEPHONES. TD-85 DIAL-EXECUTIVE TELEPHONES REQUIRE 4 WIRES BETWEEN TELEPHONES ON THE SAME LINE AND 3 WIRES TO THE SWITCHBOARD.

5- THE AREA ENCLOSED IN DOTTED LINES WILL APPEAR ON THE TDX-40E ONLY.

DIAL-X SYSTEM WIRING

FIGURE 6

X-80012 (1)


SIMPLIFIED SCHEMATIC
DIAL-X SWITCHBOARD
X-76176 (3)
TALK WIRE BANK TO ALL SELECTORS (LEFT)
CONTROL WIRE BANK TO ALL SELECTORS (RIGHT)
OFF
C 405
C 404
C 403
C 402
C 401
R-102
R-104
R-101
R-103
C-101
C-102
K-103 LATCH RELAY
K-102 STEP RELAY
K-101 SWITCH THRU RELAY
K-104 SWITCH THRU RELAY
K-105 STEP RELAY
K-106 LATCH RELAY
POWER SUPPLY
(SHOWN ON SEPARATE SCHEMATIC)
- 48 VOLTS D.C. (WITH SUPERIMPOSED BUSY TONE)
- 48 VOLTS D.C.
+ 48 VOLTS D.C. (GND.)
AC RINGING VOLTAGE
70 105 - 125 VOLTS 60 CYCLES
R-301
C-301
K-301 START RELAY
K-302 INTERRUPTER RELAY
RING INTERRUPTER
(SHOWN ON SEPARATE SCHEMATIC)
COMMON SWITCH-BOARD WIRING TO ALL SELECTORS
TRIPLEX CONDUCTOR BUILDING WIRING
R G Y
C-1
C-2
T-1
T-2
HR-1
HR-2
HM-1
HM-2
S-1
S-2
I-1
I-2
EXECUTIVE RIGHT OF WAY SWITCH S-501
K-501
S-2 CRADLE SWITCH SHOWN WITH HANDSET ON HOOK
S-3 CRADLE SWITCH SHOWN WITH HANDSET ON HOOK
TELEPHONE "A" ON LINE 3
(COMPLETE SCHEMATIC SHOWN ON SEPARATE DRAWING)
TELEPHONE "B" ON LINE 4
NOTES
1. BALLOON NUMBERS 1 THRU 13 INDICATE SEQUENCE OF OPERATION OF THE COMPONENTS.
2. BOLD LINES (——), INDICATE ACTUAL TALKING PATH.
3. LIGHT SOLID LINES (——), INDICATE SECONDARY CIRCUITS ASSOCIATED WITH THE ESTABLISHMENT AND MAINTENANCE OF THE CALL.
4. DOTTED LINES (- - -) INDICATE CIRCUITS NOT DIRECTLY INVOLVED IN THIS CALL.
5. CONTACTS 27, 28, 29 ON K-101 AND K 104 ARE MAKE BEFORE BREAK.

DIAL-X SYSTEM WIRING TO LOUD RINGING BELLS AND HORNS

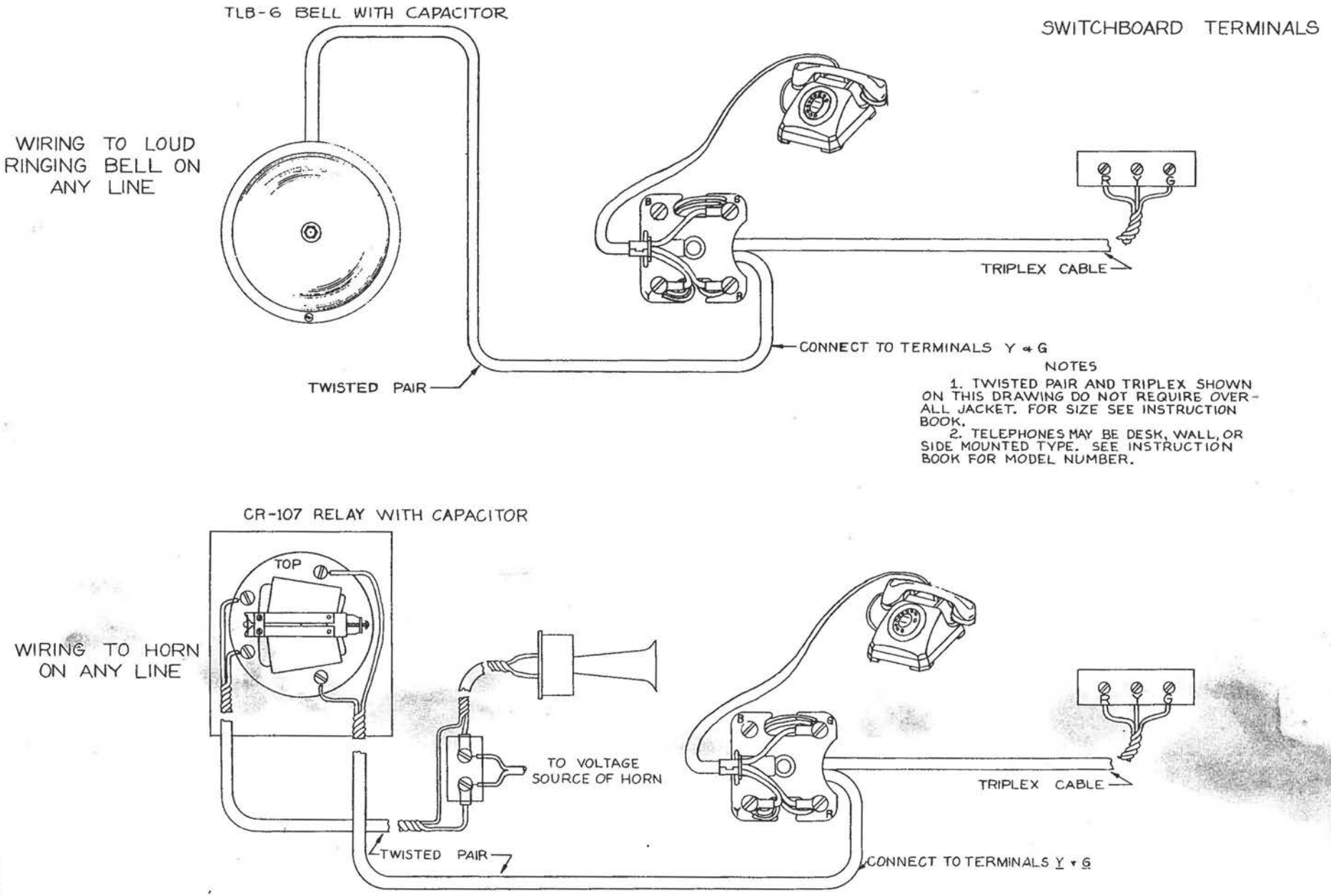


FIG. 7

X-15471 (3)

SCHEMATIC, PAGING ADAPTER MODEL TP-1 AND CONNECTIONS TO MODEL TDX-20 AND TDX-40 AND TDX-40E SWITCHBOARDS.

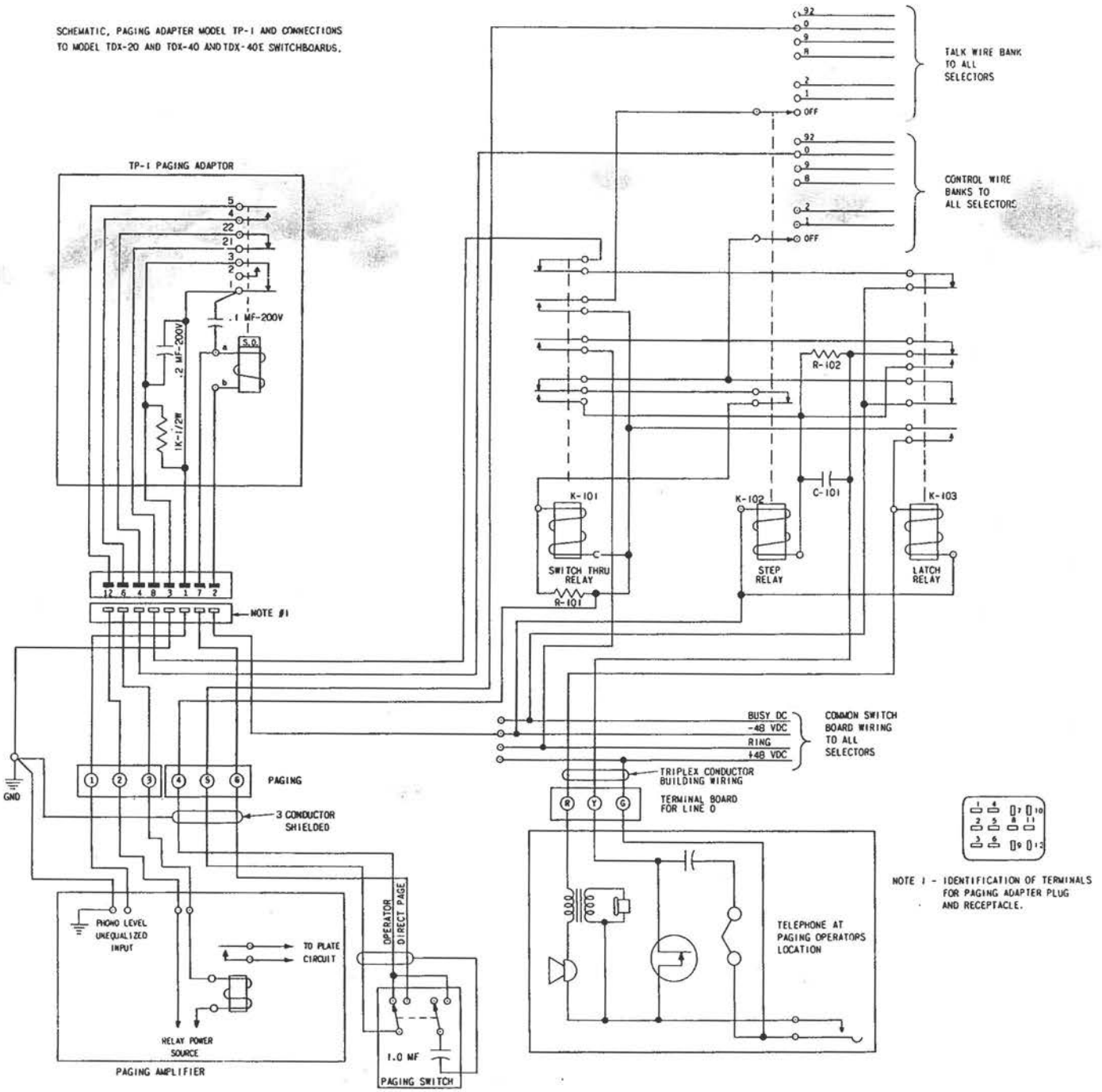
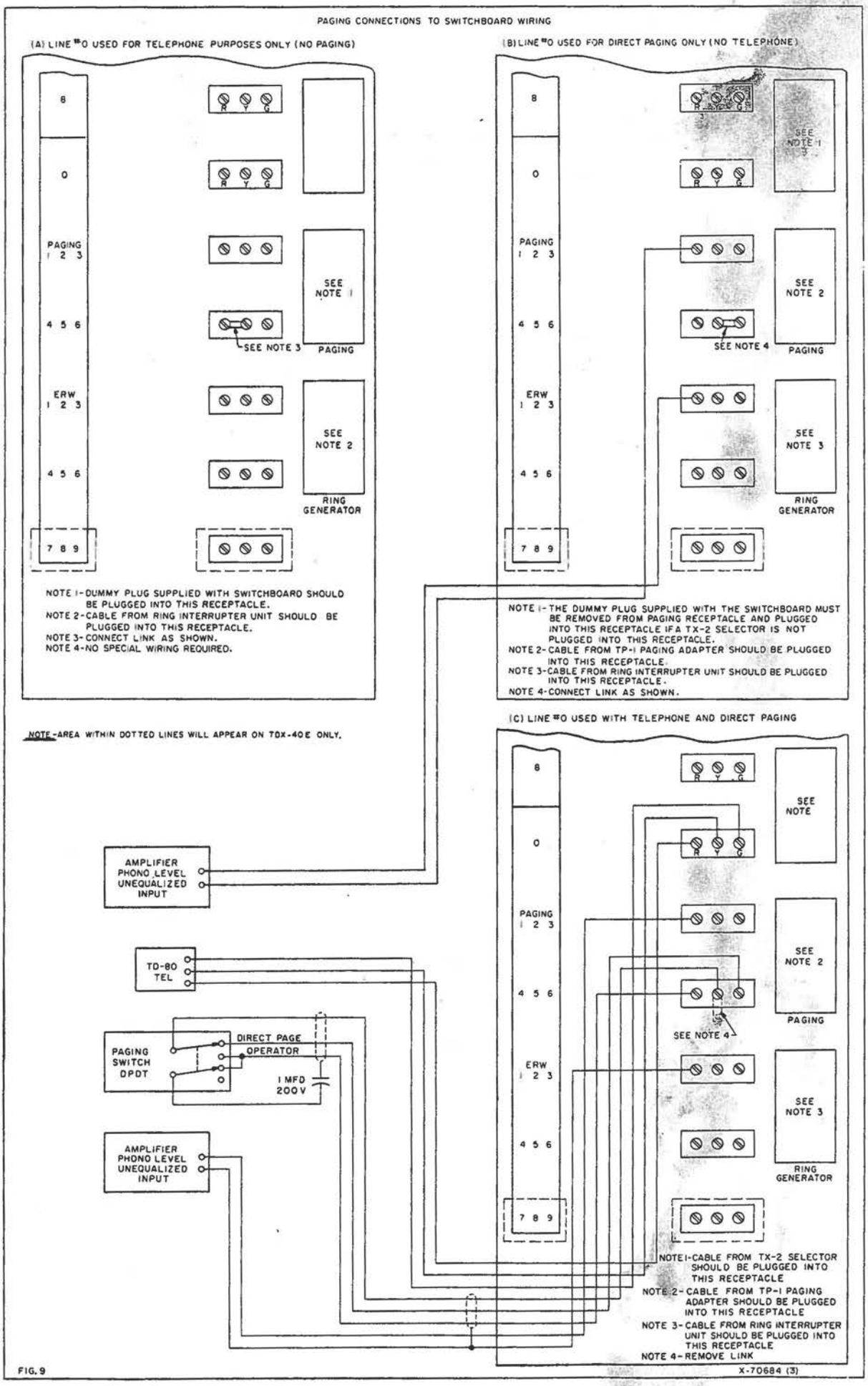


FIG. 8 X-15513 (3)


PAGING CONNECTIONS TO SWITCHBOARD WIRING
(A) LINE #0 USED FOR TELEPHONE PURPOSES ONLY (NO PAGING)
8
0
PAGING 1 2 3
4 5 6
ERW 1 2 3
4 5 6
7 8 9
R Y G
SEE NOTE 1
SEE NOTE 3
PAGING
SEE NOTE 2
RING GENERATOR
NOTE 1- DUMMY PLUG SUPPLIED WITH SWITCHBOARD SHOULD BE PLUGGED INTO THIS RECEPTACLE.
NOTE 2- CABLE FROM RING INTERRUPTER UNIT SHOULD BE PLUGGED INTO THIS RECEPTACLE.
NOTE 3- CONNECT LINK AS SHOWN.
NOTE 4- NO SPECIAL WIRING REQUIRED.
(B) LINE #0 USED FOR DIRECT PAGING ONLY (NO TELEPHONE)
SEE NOTE 4
NOTE 1- THE DUMMY PLUG SUPPLIED WITH THE SWITCHBOARD MUST BE REMOVED FROM PAGING RECEPTACLE AND PLUGGED INTO THIS RECEPTACLE IF A TX-2 SELECTOR IS NOT PLUGGED INTO THIS RECEPTACLE.
NOTE 2- CABLE FROM TP-1 PAGING ADAPTER SHOULD BE PLUGGED INTO THIS RECEPTACLE.
NOTE 3- CABLE FROM RING INTERRUPTER UNIT SHOULD BE PLUGGED INTO THIS RECEPTACLE.
NOTE 4- CONNECT LINK AS SHOWN.
NOTE - AREA WITHIN DOTTED LINES WILL APPEAR ON TDX-40E ONLY.
(C) LINE #0 USED WITH TELEPHONE AND DIRECT PAGING
AMPLIFIER PHONO LEVEL UNEQUALIZED INPUT
TD-80 TEL
PAGING SWITCH DPDT
DIRECT PAGE
OPERATOR
1 MFD 200V
AMPLIFIER PHONO LEVEL UNEQUALIZED INPUT
NOTE 1- CABLE FROM TX-2 SELECTOR SHOULD BE PLUGGED INTO THIS RECEPTACLE
NOTE 2- CABLE FROM TP-1 PAGING ADAPTER SHOULD BE PLUGGED INTO THIS RECEPTACLE
NOTE 3- CABLE FROM RING INTERRUPTER UNIT SHOULD BE PLUGGED INTO THIS RECEPTACLE
NOTE 4- REMOVE LINK
FIG. 9
X-70684 (3)

CABINET

MOUNTING DIMENSIONS

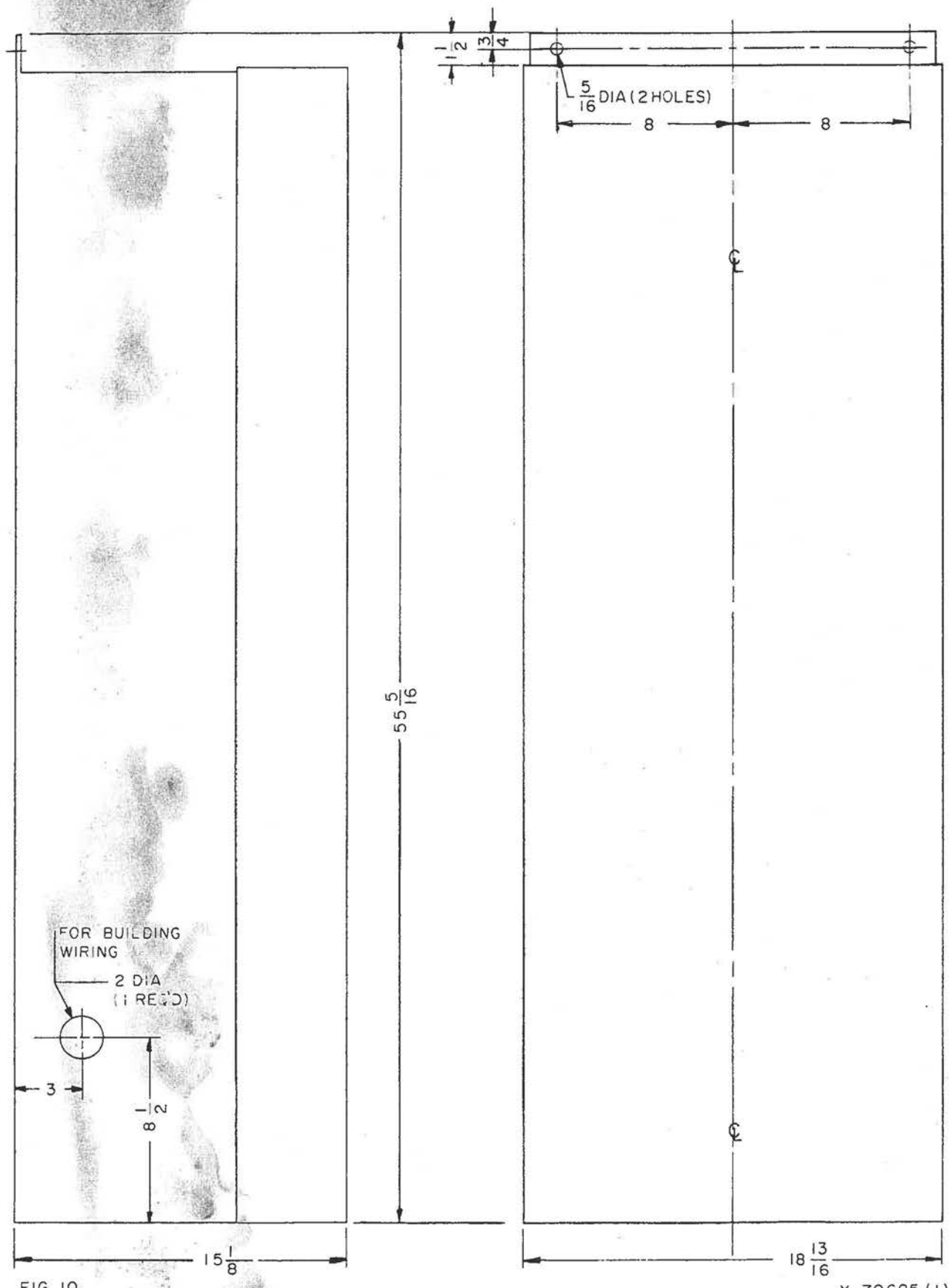
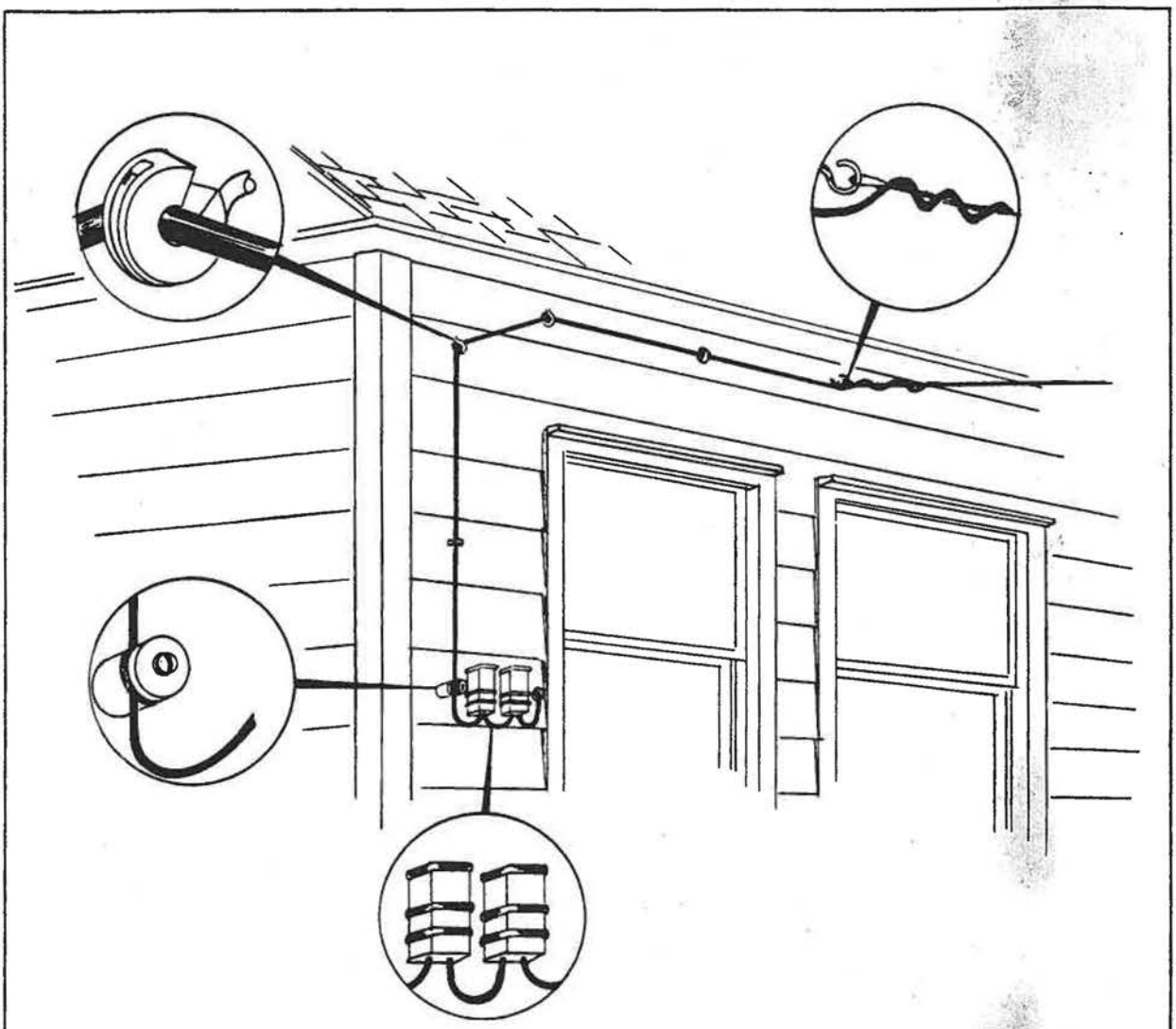


FIG 10

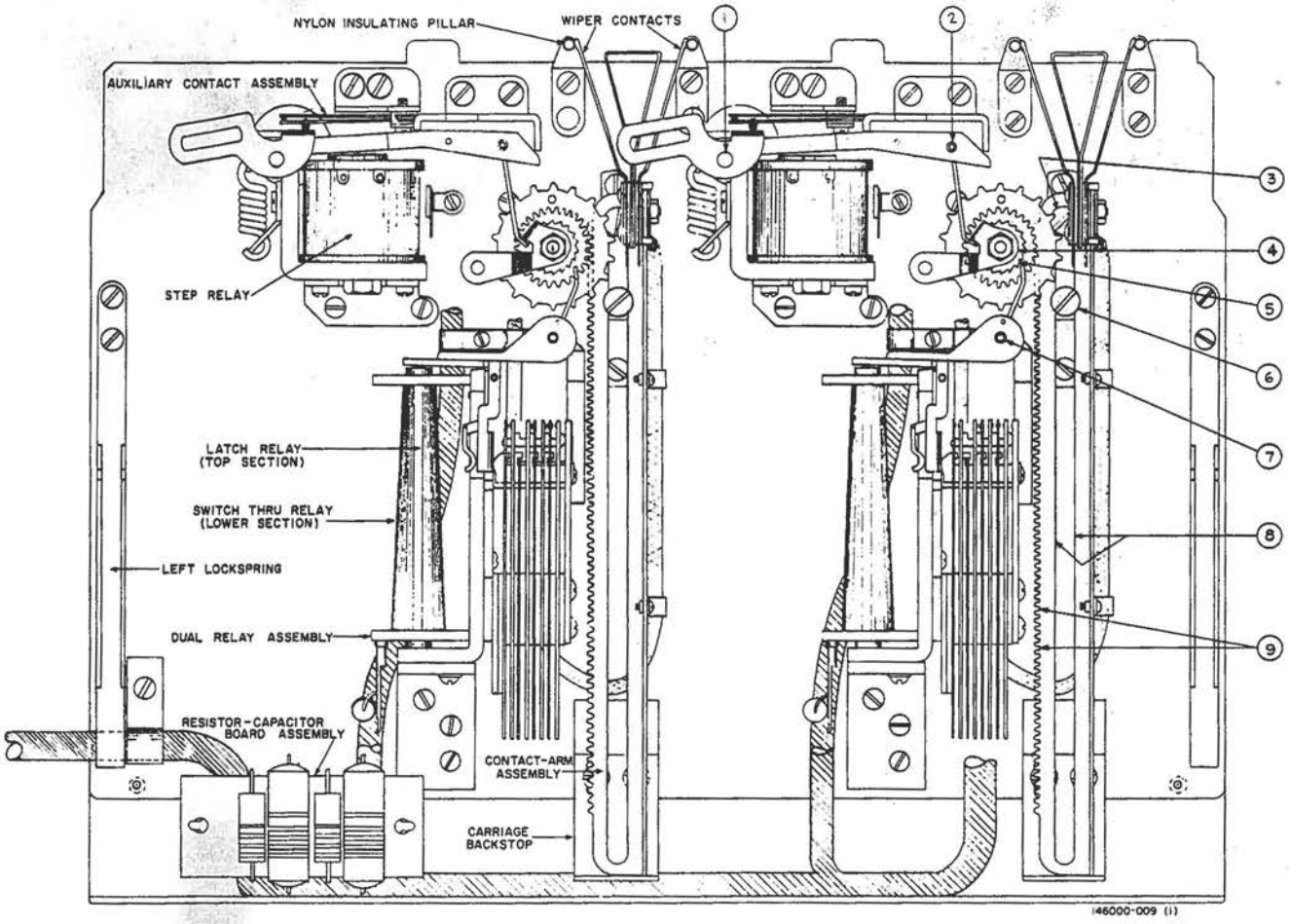
X-70685 (1)



A TYPICAL DROP WIRE INSTALLATION

X-71264 (2)

MODEL TX-2 DIAL-X SELECTOR
LUBRICATION CHART AND PARTS IDENTIFICATION



LUBRICATION

Each Dial-X Dual Selector Switch receives initial lubrication before shipment from the factory. However, both sections must be lubricated before installation in the switchboard and thereafter each Dial-X Switch must be lubricated regularly every six months. Use only the special Stromberg-Carlson Lubricating Oil #204806-000 for Dial-X Switch.

Apply the oil using the brush supplied with the bottle. After dipping the brush in the oil, draw the brush across the edge of the bottle to remove excess oil. Apply the lubricant sparingly to all parts indicated.

Parts on the left half of the selector are identified by name. Parts on right half are identical to parts on left half of selector. Parts to be lubricated are indicated only on the right half of the dual switch. Lubricate equivalent points on the left half of the selector also.

CAUTION: Do NOT allow oil to touch contact surfaces of wiper contacts and nylon insulating pillars.

Lubricate points indicated by ballooned numbers on right side and equivalent parts on left side of Dial-X Selector, as follows:

1, 2, 7 - Apply lubricant to each point.

3, 6 - Apply lubricant under each side of shoulder screws.

4 - Apply lubricant under bracket edge.

5 - Apply lubricant along ratchet teeth.

8 - Apply lubricant along each edge of long slot.

9 - Apply lubricant along teeth starting at gear cluster.

Instruction Sheet #146947-000 (2)
Figure 12, Switchboard Instruction Manual

STROMBERG-CARLSON TYPE TD-91 TELEPHONE

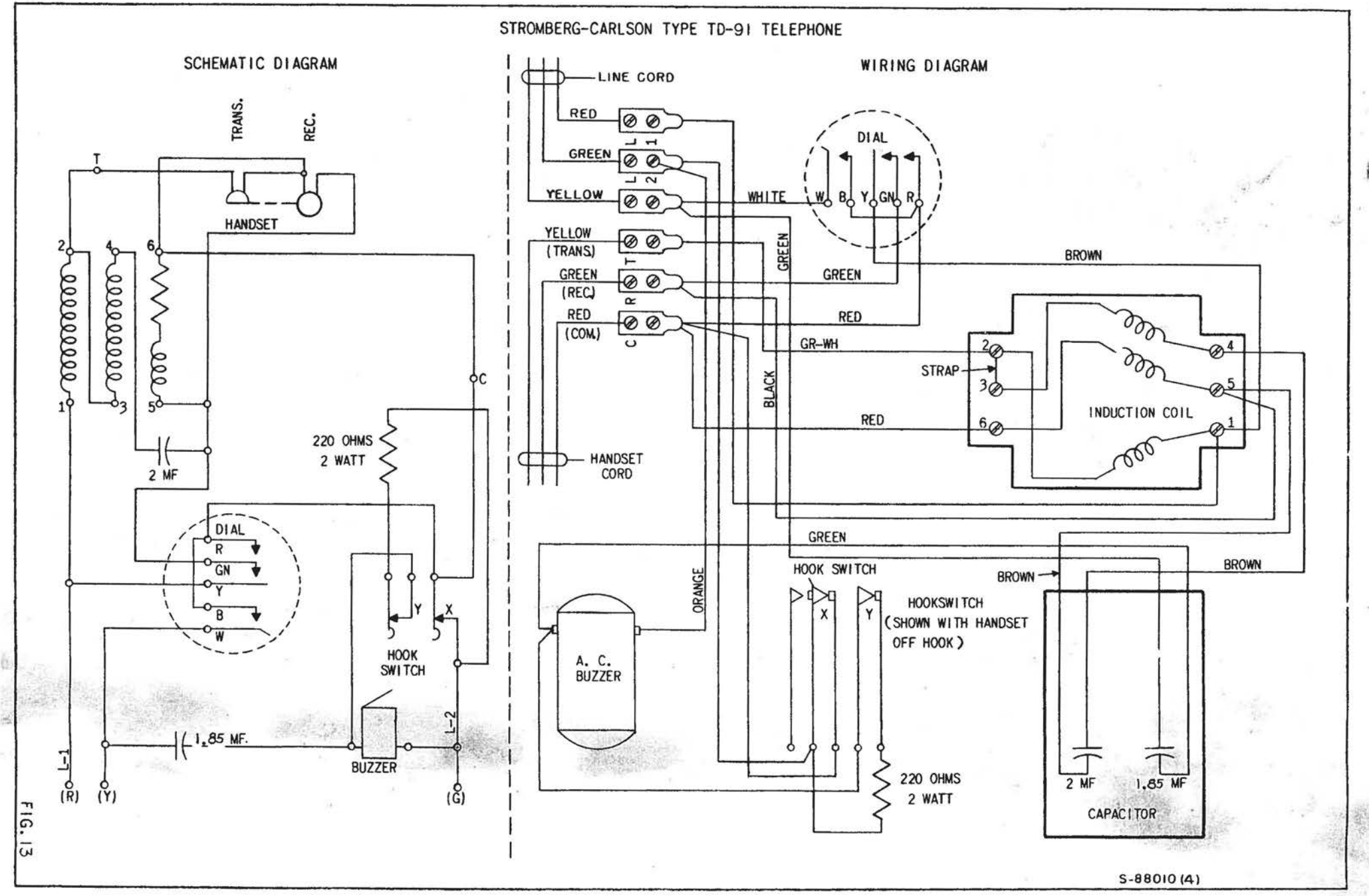
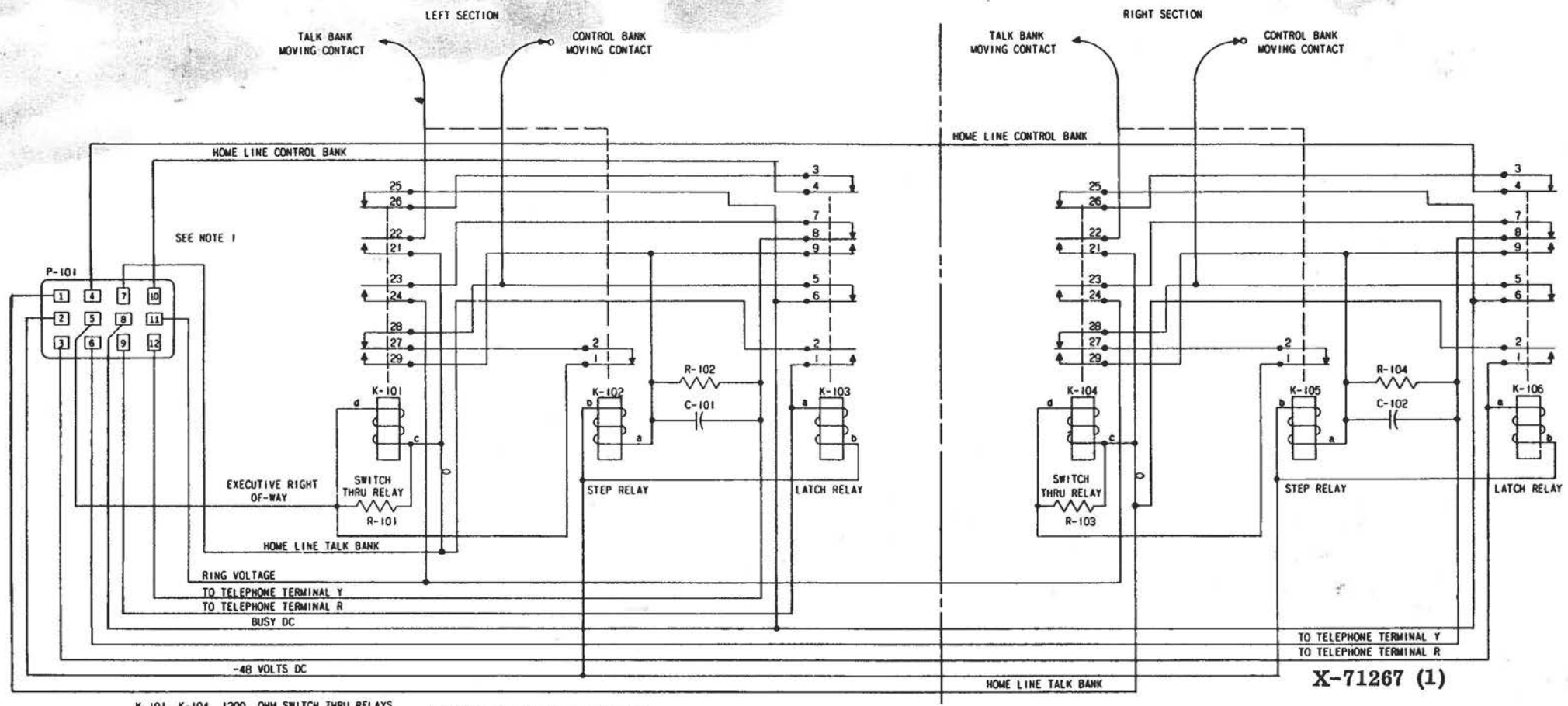


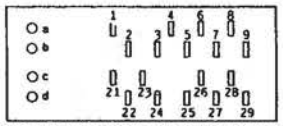
FIG. 13

STROMBERG-CARLSON CO.
TX-2 SELECTOR SCHEMATIC
FOR DIAL-X SYSTEM



X-71267 (1)

K-101, K-104 1200 OHM SWITCH THRU RELAYS
K-102, K-105 80 OHM STEP RELAYS
K-103, K-106 475 OHM LATCH RELAYS
R-101, R-103 RESISTOR 5,000 OHM 1/2 WATT
R-102, R-104 RESISTOR 15,000 OHM 2 WATT
C-101, C-102 CAPACITOR .022 MFD 400V
P-101 12 PRONG JONES PLUG.

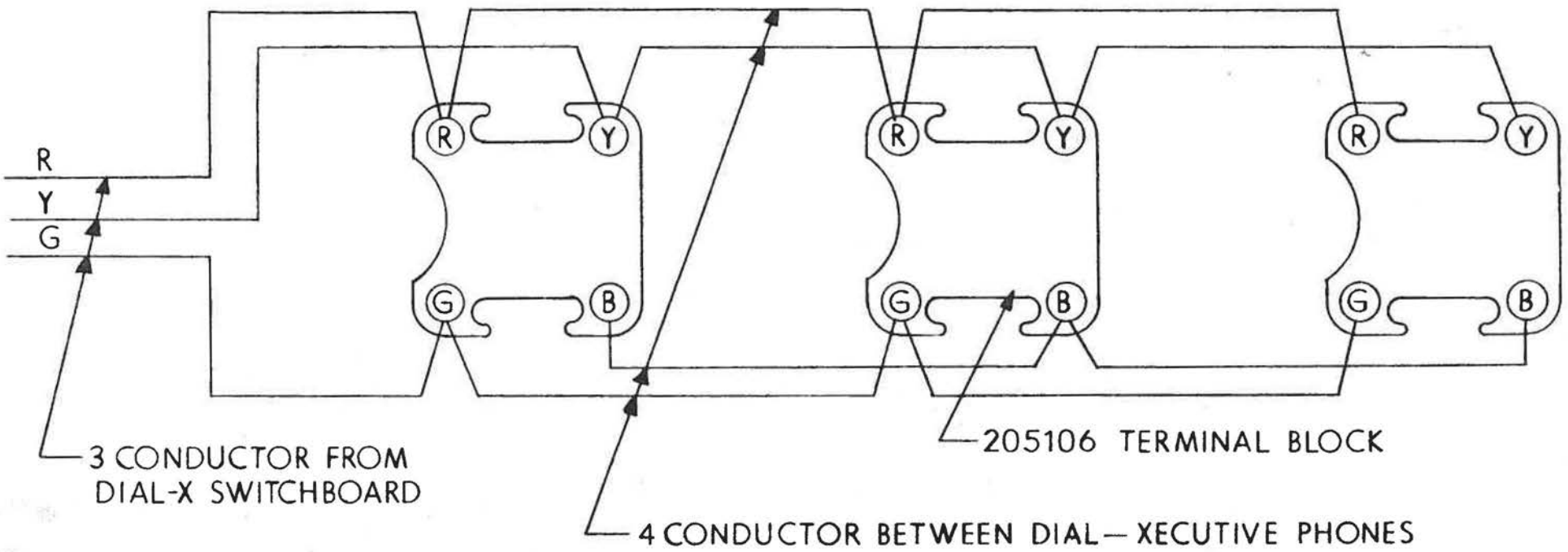


REAR VIEW OF LATCH AND SWITCH-THRU RELAYS SHOWING TERMINAL NUMBERING.

NOTE 1: LEFT SECTION OF SELECTOR CONNECTS THROUGH CONTACTS 9 AND 12 OF P-101 TO LEFT SWITCHBOARD TERMINALS R AND Y AT SAME LEVEL AS SELECTOR.
RIGHT SECTION CONNECTS THROUGH CONTACTS 3 AND 6 OF P-101 TO RIGHT SWITCHBOARD TERMINALS R AND Y AT SAME LEVEL AS SELECTOR.

NOTE 2: NUMBERS AND LETTERS SHOWN ON RELAYS ON SCHEMATIC ARE IDENTIFIED IN SKETCH ON LEFT.

TD-85 BUILDING WIRING DIAGRAM



S-88020(1)

STROMBERG-CARLSON CO. WIRING AND CONNECTIONS FOR DIAL-X TD-85 TELEPHONES

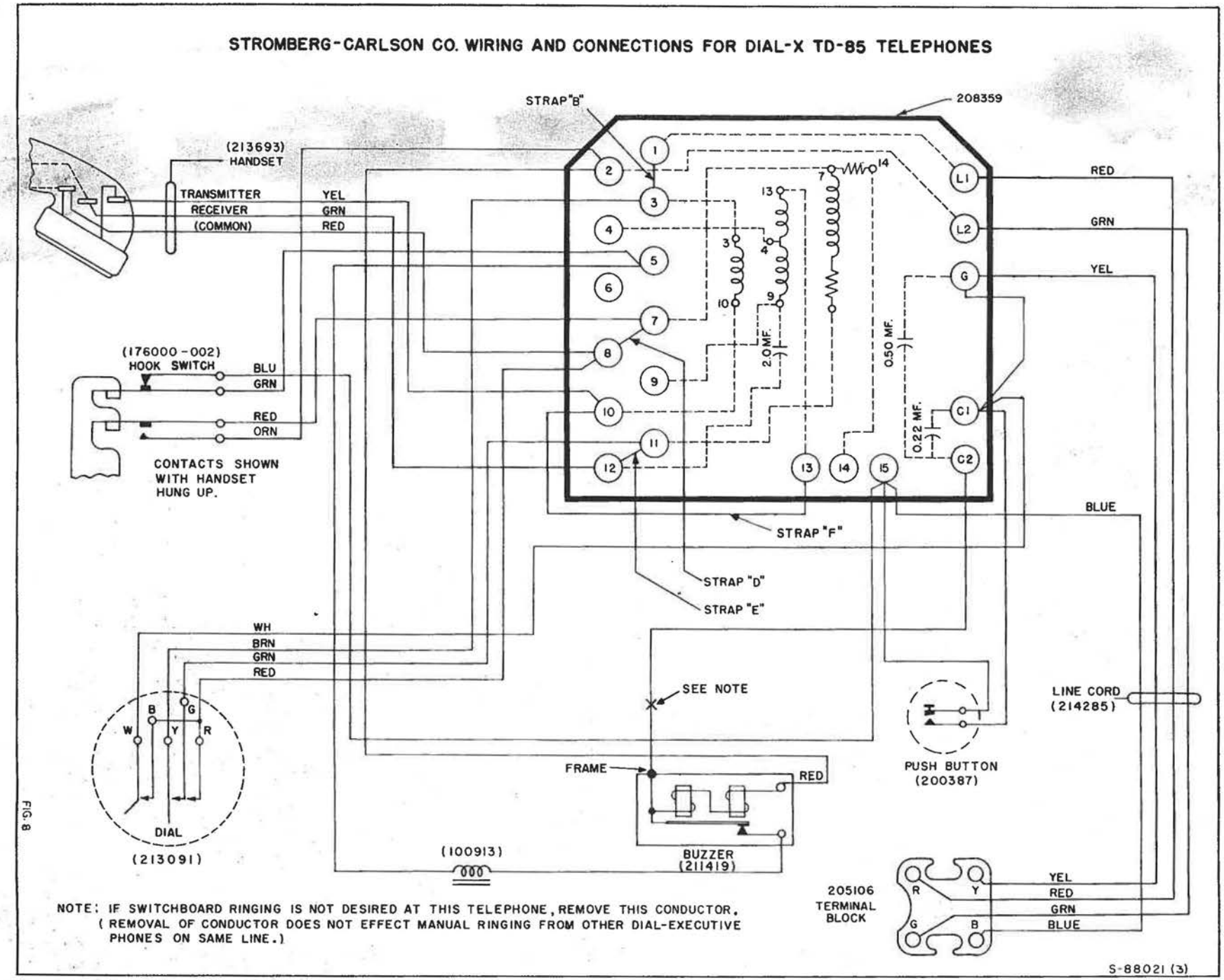
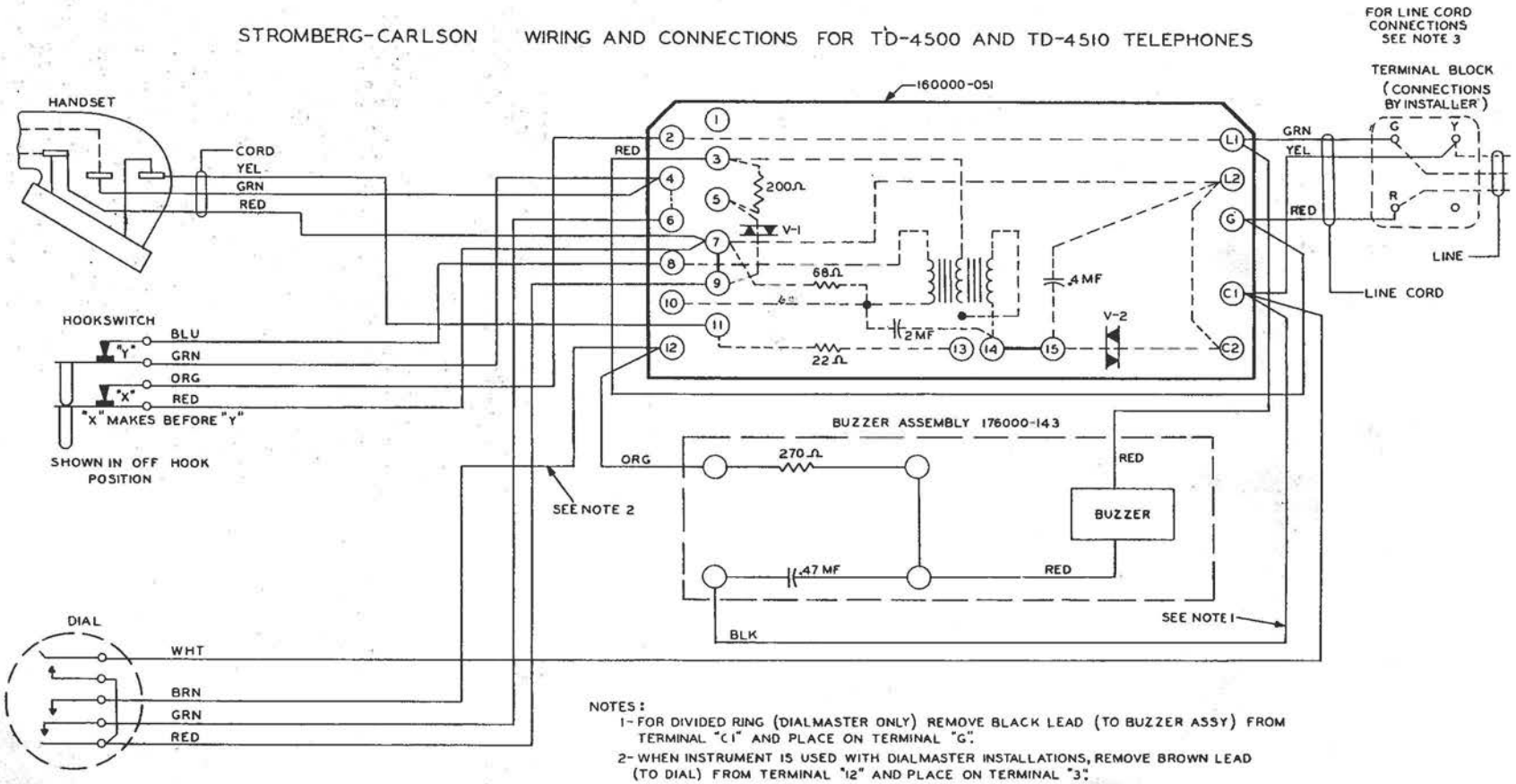


FIG. 8

NOTE: IF SWITCHBOARD RINGING IS NOT DESIRED AT THIS TELEPHONE, REMOVE THIS CONDUCTOR. (REMOVAL OF CONDUCTOR DOES NOT EFFECT MANUAL RINGING FROM OTHER DIAL-EXECUTIVE PHONES ON SAME LINE.)

STROMBERG-CARLSON WIRING AND CONNECTIONS FOR TD-4500 AND TD-4510 TELEPHONES



NOTES:

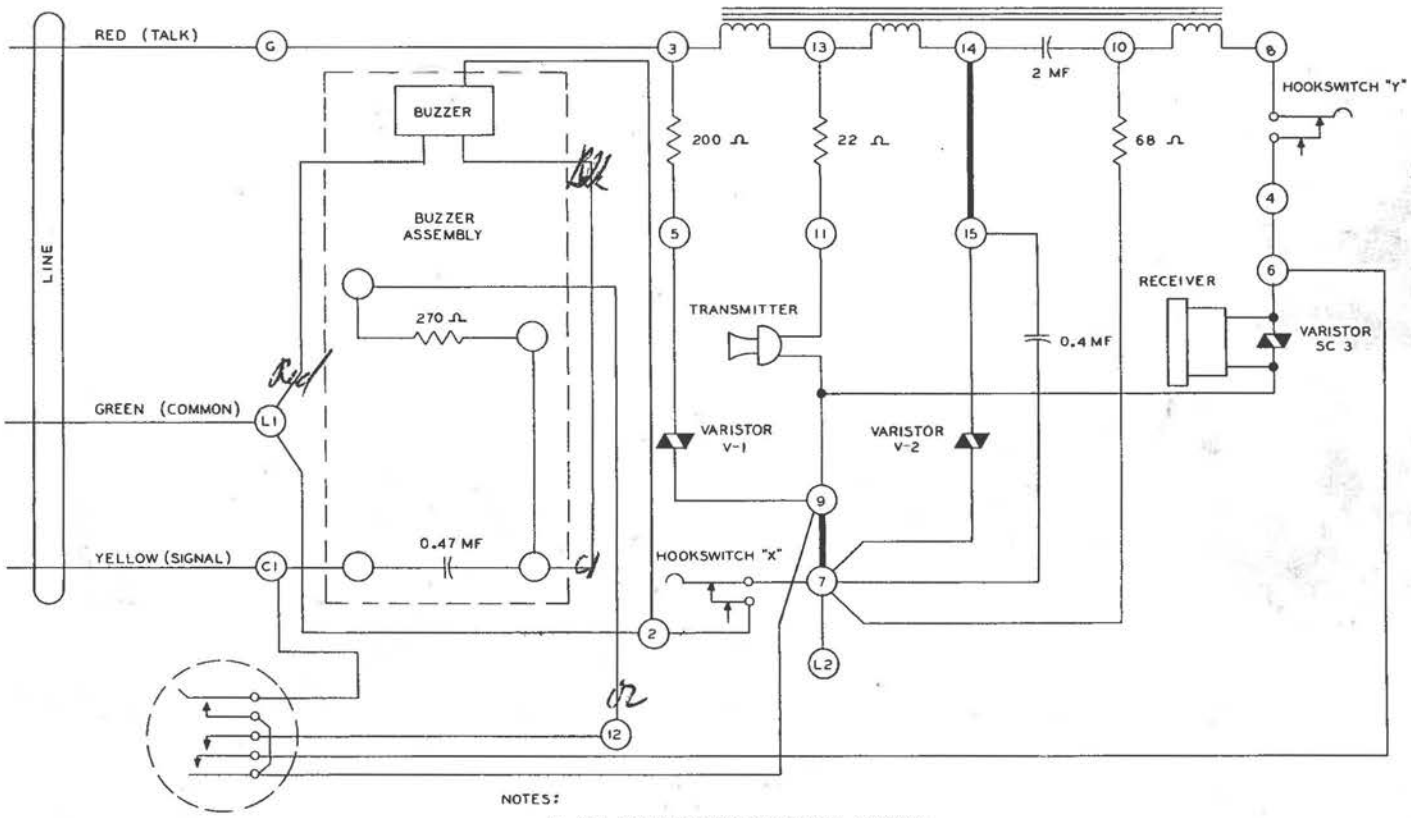
1- FOR DIVIDED RING (DIALMASTER ONLY) REMOVE BLACK LEAD (TO BUZZER ASSY) FROM TERMINAL "C1" AND PLACE ON TERMINAL "G".

2- WHEN INSTRUMENT IS USED WITH DIALMASTER INSTALLATIONS, REMOVE BROWN LEAD (TO DIAL) FROM TERMINAL "12" AND PLACE ON TERMINAL "3".

3- FOR PHONES UTILIZING BUZZER ASSY 176000-062, SEE DWG S-88053 FOR R,Y,G, CONNECTIONS.

S-88067 (2)

STROMBERG-CARLSON SCHEMATIC CIRCUIT FOR TD-4500 AND TD-4510 TELEPHONES



NOTES:

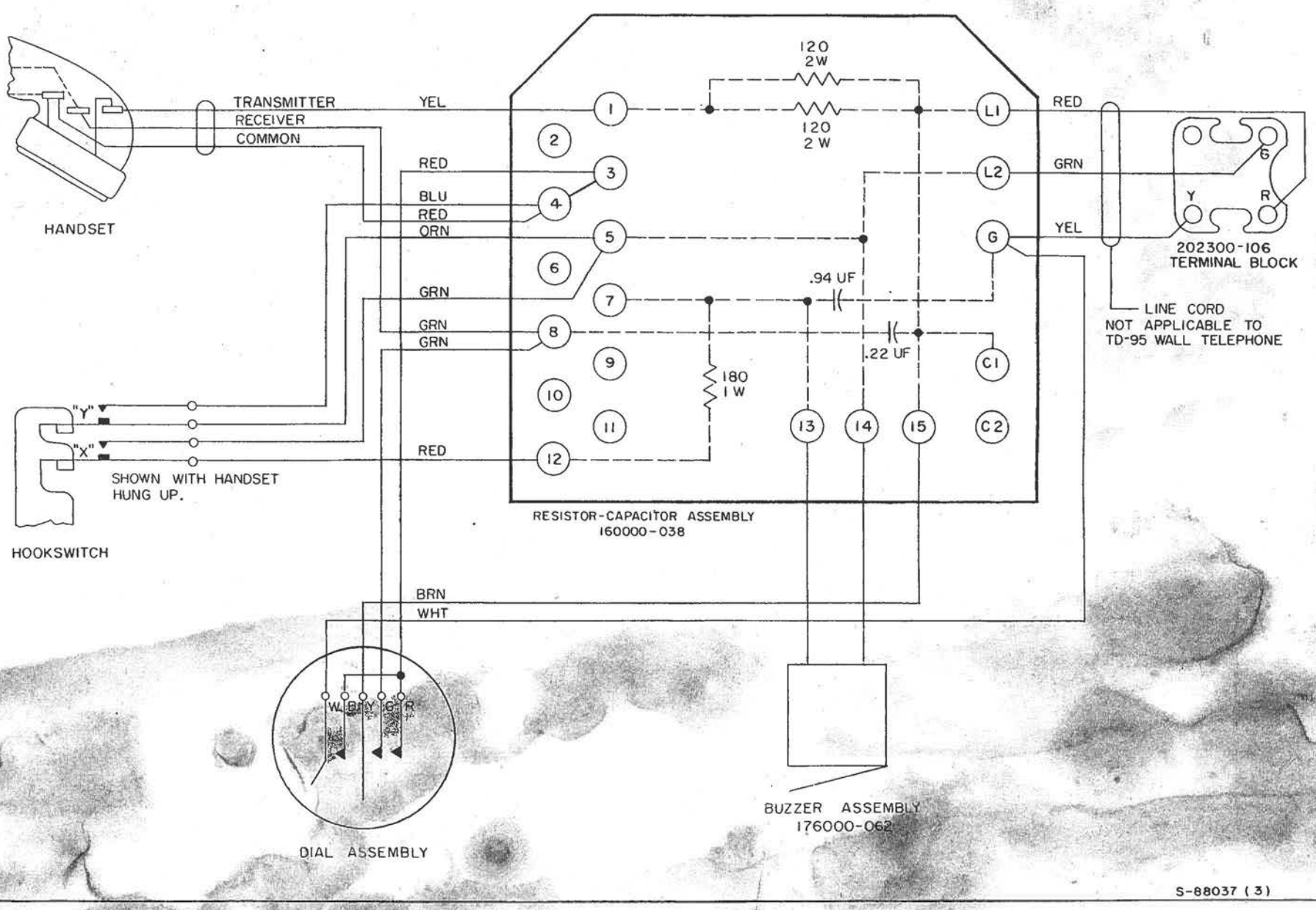
1- SEE REVERSE SIDE FOR WIRING DIAGRAM
2- HOOKSWITCH SHOWN IN OFF-HOOK CONDITION
3- HOOKSWITCH "X" MAKES BEFORE "Y"

S-88068 (1)

STROMBERG – CARLSON

A DIVISION OF GENERAL DYNAMICS CORPORATION

WIRING AND CONNECTIONS FOR DIAL-X TD-88 & TD-95 TELEPHONES



S-88037 (3)