E.A. Symanz
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NAVSHIPS 0967-284-7010 (NON-REGISTERED)

TECHNICAL MANUAL

FOR

SWITCH, RF TRANSMISSION LINE SA-1551(V)/GRT

DEPARTMENT OF THE NAVY
NAVAL ELECTRONIC SYSTEMS COMMAND

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SWITCH, RF TRANSMISSION LINE SA-1551(V)/GRT

DEPARTMENT OF THE NAVY
NAVAL ELECTRONIC SYSTEMS COMMAND

DELTA ELECTRONICS, INC.
ALEXANDRIA, VIRGINIA
U.S. PATENT NO. 3,223,812
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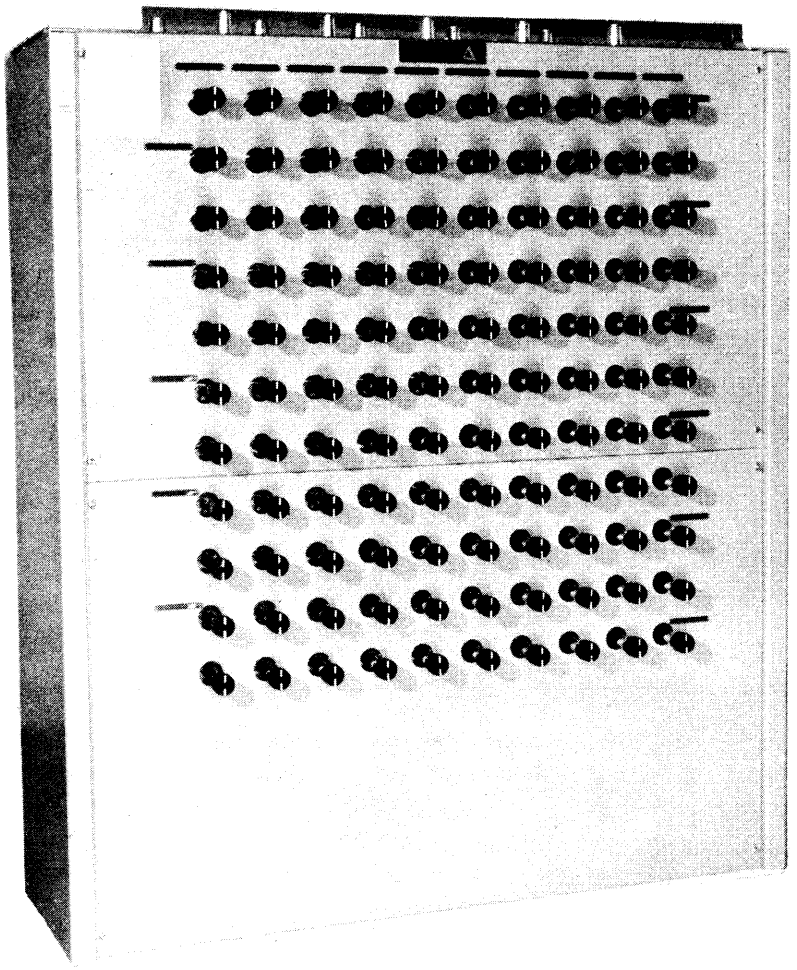
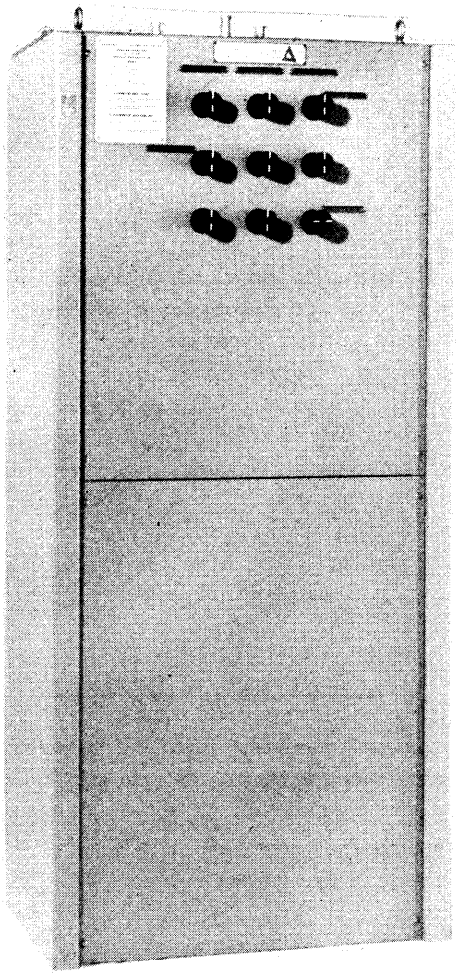


MODEL SA-1551(V)2/GRT
COLUMNS: 10
ROWS: 11



MODEL SA-1551(V)1/GRT
COLUMNS: 3
ROWS: 3

FIGURE 1-1. SWITCH, RF TRANSMISSION LINE, SA-1551(V)/GRT -
ILLUSTRATION OF TYPICAL EQUIPMENT MODELS

SECTION 1

GENERAL INFORMATION

1.1 SCOPE

1.1.1 This manual covers the description, installation, operation and maintenance of the Switch, RF Transmission Line, SA-1551(V)/GRT, a proprietary Strip Line Switch (SLS) manufactured by Delta Electronics, Incorporated, under U. S. Patent Number 3,223,812.

1.2 GENERAL DESCRIPTION

1.2.1 The SLS is a compact manually-operated, 50-ohm crossbar switch used to connect any one of a specified number of transmitters to any one of a specified number of antennas and/or dummy loads. The SLS is based on a new design principle that permits an extremely compact system with excellent power handling capability, impedance and crosstalk characteristics. It may be controlled by motor-driven actuators providing a remote operation capability.

1.2.2 Each RF switching circuit is composed of identical "building blocks" or "crosspoints" consisting of identical components. Each SLS model has a matrix containing the number of crosspoints required for the particular application, ranging from one column and one row (1X1) to 22 columns and 11 rows (22X11), and larger matrices can be constructed, if needed. Figure 1-1 shows the SA-1551(V)1/GRT, a model with a three-column and three-row matrix, and the SA-1551(V)2/GRT, a model with a 10-column and 11-row matrix.

1.2.3 The design of the SLS makes it inherently impossible to connect one transmitter to another transmitter, or two transmitters to one antenna. The manual control knobs are designed with a mechanical latch to prevent inadvertent switch operation. An electrical interlock system is built into the SLS so that power is removed from the active circuits associated with any switch before the switching operation can be made. At the completion of the switching sequence, the interlock circuit is reconnected and rerouted to protect the new active circuit. An additional switch circuit mounted on each switch module provides for remote indication of the switch status.

1.3 CONFIGURATION

1.3.1 The size and physical configuration of the SLS is extremely flexible and may be adapted to meet special installation requirements. The basic physical form of the unit is a free-standing, self-supporting structure in which the cabinet is an integral part of the switch and the RF connectors are 3 1/8" or 1 5/8" EIA male flanges. This basic configuration provides a maximum connector size of 3 1/8" EIA flanges. The column connectors are on two staggered rows facing upwards on the top of the unit and the row connectors are staggered on opposite sides of the unit facing to the rear. This unit may be inverted to permit the column connectors to exit from the bottom for installation in transportable vans.

1.4 REFERENCE DATA

AN NOMENCLATURE:	Switch, Radio Frequency Transmission Line SA-1551(V)/GRT
FREQUENCY RANGE:	DC to 32 Mcs
IMPEDANCE:	50 Ohms coaxial

VSWR:	1.15:1 Maximum
POWER RATING:	50 kW Average, 320 KW Peak
CROSS CHANNEL ISOLATION:	65 dB minimum
TERMINATIONS:	3 1/8" EIA Male Flanges (Standard) 1 5/8" EIA Male Flanges (Optional) Type LC or LT (Optional)
NUMBER OF VERTICAL CONNECTORS:	Variable (22 Maximum - Standard)
NUMBER OF HORIZONTAL CONNECTORS:	Variable (11 Maximum - Standard)
SIZE:	65" High x 20" Deep x Variable Width
SYSTEM COMPONENTS:	1 ea. Switch Matrix (D61-8) 1 ea. Indicator Cable Connector (ELCO #00-8017-130-217-004) 2 ea. TM's (NAVSHIPS 0967-284-7010) 4 ea. Floor Mounting Brackets (D80-145) 4 ea. Lag Screws 1/2" x 2" 4 ea. Lag Screw Shields 1/2" Short
ACCESSORIES AVAILABLE:	Antenna Remote Status Panel Linear Actuator (Remote Control) RF Connector Adapters
MANUFACTURERS DATA:	Delta Electronics, Inc. Alexandria, Virginia Model: SLS-1A Strip Line Switch

SECTION 2

INSTALLATION

2.1 INSTALLATION PROCEDURE

CAUTION!

This switch is top-heavy. Extreme care must be taken in handling prior to its being mounted securely to the floor.

2.1.1 The Installation Drawing Table of Dimensions (Figure 2-1) shows dimensions significant to the installation of the SLS. In accordance with the Installation Drawing (Figure 2-2), the switch should be placed in its final position and the four hold-down brackets should be positioned, as desired, inside the bottom of the switch. The four mounting bolt holes should be marked on the floor. Holes should be drilled and fitted with the appropriate anchors. The hold-down brackets should then be mounted and tightened, securing the switch to the floor.

2.1.2 The column RF connectors are on the top of the switch. The row connectors are on the rear of the main panel along the right and left hand edges. The basic connectors are standard 3 1/8" EIA male connectors with non-removable bullets. Adapter plates and connectors are available to provide 1 5/8" EIA male and Type LC and LT female connectors. When connecting 3 1/8" or 1 5/8" coax, care must be taken to accurately position the coaxial flange plates to align with the switch connectors so that strain will not be applied to the switch structure when the flange bolts are tightened. Proper length flange bolts must be used to prevent damage to the switch components; for 3 1/8" flanges, the bolts should project no more than 1/2" through the flanges so that they do not extend past the switch's top plate when the flange is installed. For 1 5/8" flanges, the bolts must not protrude through the adapter plates so far that they interfere with the teflon bullet support plate; bolts 5/16"-18 x 1" long are recommended and are supplied with the 1 5/8" EIA adapters.

CAUTION!

Care must be taken in mating the center conductor of the coax with the switch bullet. The bullet cover should be removed and the back end of the bullet stub should be supported when the coax is pushed into position. Misalignment of the center conductor, or undue pressure on the bullet, could damage the teflon support plate.

2.2 COLUMN AND ROW IDENTIFICATION

2.2.1 For general purpose identification, the columns and their connectors are identified by numbers (1, 2, etc.) numbering from left to right (from the front). The rows and their connectors are identified by letters (A, B, etc.) assigned from top to bottom.

2.3 INTERLOCK AND INDICATOR CONNECTIONS

2.3.1 Interlock. The interlock connections are made on terminal strips located on the front of the switch assembly below the main panel. Figure 2-3 shows the terminal configuration. Transmitter interlock connections are made to the terminals corresponding to the input connection (column or row). The

interlock circuit is completed to the common return with jumpers or external antenna or dummy load interlock switches placed on the terminal block corresponding to the load connections. The jumpers are shown installed on the row terminal block in Figure 2-3. A hole is provided adjacent to the terminal strips to permit the station wire harness to be dressed through the plate and out the rear of the assembly. The terminals are located on the front of the assembly to provide convenient access for circuit tracing and connection modification.

CAUTION!

The jumper must be omitted from paths that do not have loads connected or the transmitter may be accidently operated into an open circuit.

2.3.2 The interlock switch matrix has a common return. If the transmitters' interlock circuits do not work against a common (or ground) it will be necessary to install auxilliary isolation relays between the switch interlock circuit and the transmitter to obtain the required transmitter isolation. (See Section 4.2.4)

2.3.3 Indicator. The connections for a remote status panel (not supplied) are made with a multiconductor connector located on the rear of the switch assembly below the main panel. The table in Figure 2-3 gives the pin connections to be made in the cable connector (supplied). The indicator circuit is a Form A switch closure from the connector pin shown in the PIN column of the table to the common (COM) buss when the switch corresponding to the COLUMN # and ROW of the table is actuated. Since each SLS is made up of a quantity of identical modules (building blocks), the number of columns and rows in any given SLS is determined by the number of modules in that specific switch. The connector has enough pins for an SLS with 10 columns and 11 rows. On a smaller SLS of course, the pins corresponding to the non-existant higher numbers and letters are left unconnected.

NUMBER OF ROWS / ROW HEIGHT (BOTTOM ROW) (63.375-4Y)	
Y	A
1	59.37"
2	55.37"
3	51.37"
4	47.37"
5	43.37"
6	39.37"
7	35.37"
8	31.37"
9	27.37"
10	23.37"
11	19.37"

NUMBER OF COLUMNS / OVERALL WIDTH (4X+19.62")	
X	B
1	23.62"
2	27.62"
3	31.62"
4	35.62"
5	39.62"
6	43.62"
7	47.62"
8	51.62"
9	55.62"
10	59.62"
11	63.62"
12	67.62"
13	71.62"
14	75.62"
15	79.62"
16	83.62"
17	87.62"
18	91.62"
19	95.62"
20	99.62"
21	103.62"
22	107.62"

NOTE: BECAUSE UNITS ARE BUILT TO CONTAIN DIFFERENT NUMBERS OF COLUMNS (X) AND ROWS (Y) CERTAIN INSTALLATION DIMENSIONS VARY. THESE DIMENSIONS ARE GIVEN IN THESE TABLES AS A FUNCTION OF X AND Y. INSERT THE DIMENSIONS INTO THE PROPER BLANKS ON THE INSTALLATION DRAWING, FIGURE 2-2.

Figure 2-1. Installation Drawing Table of Dimensions

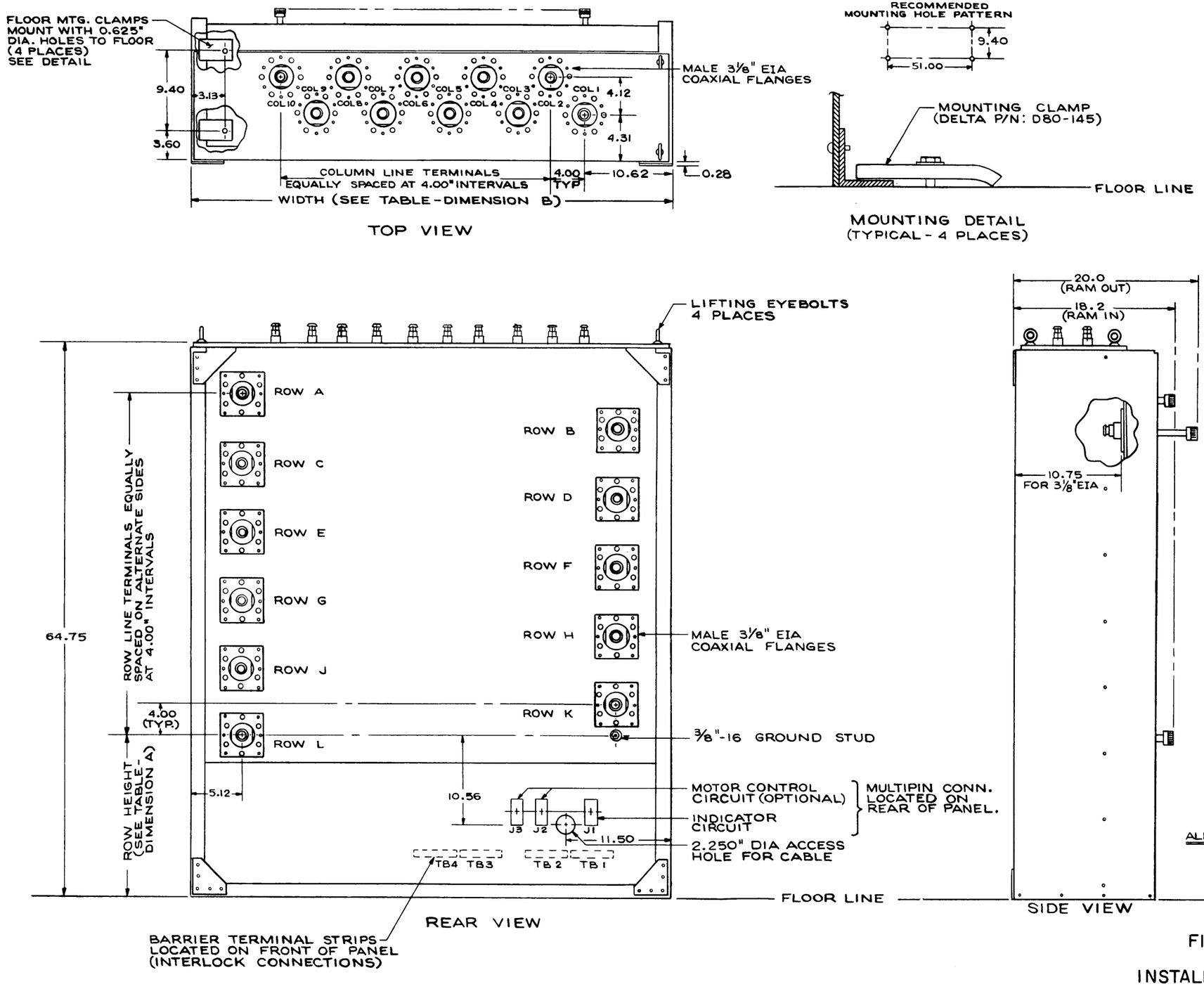
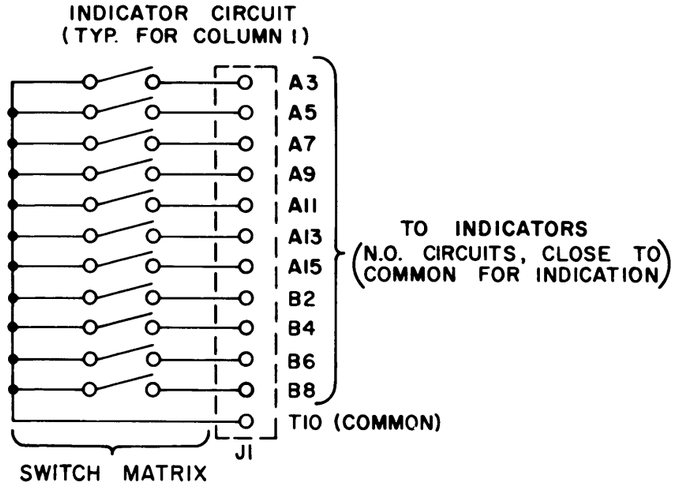


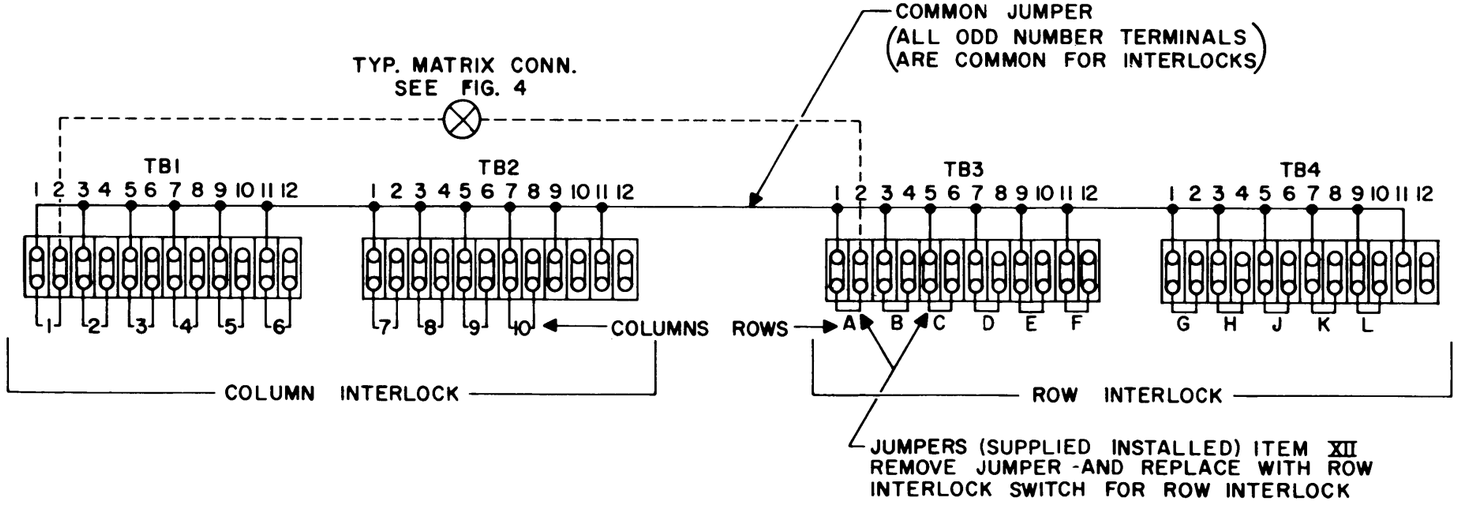
FIGURE 2-2

INSTALLATION DRAWING



INDICATOR CONNECTIONS

TABULATION OF CONNECTOR (J1) WIRING										
COL.	1	2	3	4	5	6	7	8	9	10
ROW	CONNECTOR (J1) PIN NUMBERS									
A	A3	B12	D6	E15	G9	J3	M4	N13	P7	S1
B	A5	B14	D8	F2	G11	J13	M6	N15	P9	S3
C	A7	C1	D10	F4	G13	J15	M8	02	P11	S5
D	A9	C3	D12	F6	G15	K2	M10	04	P13	S7
E	A11	C5	D14	F8	H2	K4	M12	06	P15	S9
F	A13	C7	E1	F10	H4	K12	M14	08	R2	S11
G	A15	C9	E3	F12	H6	K14	N1	010	R4	S13
H	B2	C11	E5	F14	H8	L1	N3	012	R6	S15
J	B4	C13	E7	G1	H10	L3	N5	014	R8	T2
K	B6	C15	E9	G3	H12	L13	N7	P1	R10	T4
L	B8	D2	E11	G5	H14	L15	N9	P3	R12	T6
AUX.	B10	D4	E13	G7	J1	M2	N11	P5	R14	T8
COM.	T10	T12	T14	U1	U3	U5	U7	U9	U11	U13



INTERLOCK CONNECTIONS

FIGURE 2-3

INTERLOCK AND INDICATOR CONNECTIONS

SECTION 3

OPERATION

3.1 RAM OPERATION

3.1.1 During operation the ram is locked into place by means of ribs on the knob. The white indicator bar on the face of the knob runs straight up and down when the ram is locked. To unlock the ram, rotate the knob clockwise 90° and then push or pull to perform the switching required. After switching, rotate the knob 90° counter-clockwise to lock the ram into the new position. The normal position of the rams is the OUT position. To make a connection between a row connector and a column connector, the ram at the intersection of that row and that column is pushed in and all other rams in the same row and column must be pulled out. The most common causes of an open interlock are a second ram in either the row or column accidently left in the IN position, or a knob left unlocked.

3.2 INTERLOCK AND INDICATOR CIRCUIT OPERATION

3.2.1 The interlock and indicator circuit micro-switches are operated by the knob when it is in the lock (full counter-clockwise) position. If the knob is not returned to this position after switching, the interlock circuit will be open and will prevent power from being applied to the transmitter. During normal operation all knobs should be in the locked position which may be determined by observing that all the knobs' indicator bars are oriented vertically.

3.2.2 To open an interlock circuit, the knob should never be just slightly turned since another operator might believe the knob had accidently been turned to an unlocked position and would restore it to its locked position. As a minimum, when it is desired to open an interlock circuit the knob should be fully unlocked and the ram pushed or pulled until it is halfway between its IN and OUT position. A much safer technique is to open the interlock circuit by removing the wire or jumper from the terminal board (key-lock switches may be supplied on the SLS to accomplish this on special order).

SECTION 4

PRINCIPLES OF OPERATION

4.1 FUNCTIONAL DESCRIPTION OF RF SWITCHING

4.1.1 The design of the SLS starts with a heavy aluminum vertical base plate as shown in a section view in Figure 4-1. On the rear of this plate, vertical channels are fabricated from rugged "I" beams and the channels are covered on the rear with mounting plates. A heavy rectangular brass conductor is suspended in this vertical channel by insulators which attach to the mounting plates; this forms a coaxial conductor assembly. The center conductor is mounted much closer to the base plate than to any of the other walls of the channel and actually operates as a "strip-line" rather than a concentric coaxial transmission line. The spacing between the center conductor and the base plate is such that the transmission line has a 50-ohm characteristic impedance.

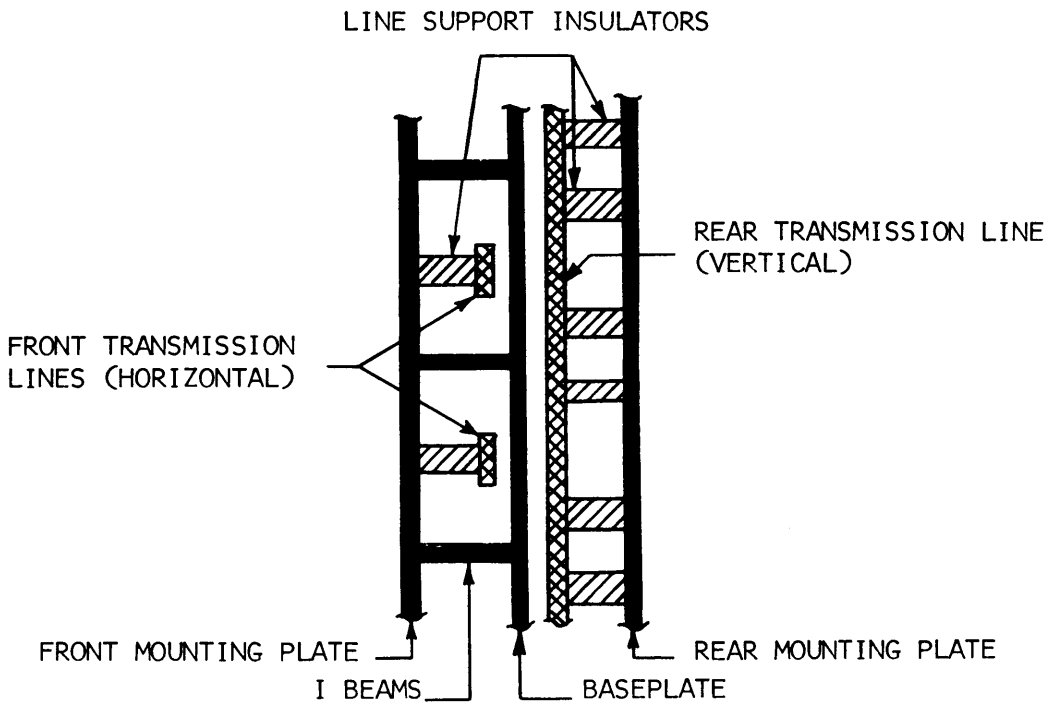


Figure 4-1. Basic Configuration

4.1.2 Identical channels are fabricated running horizontally on the front of the base plate and identical transmission lines are constructed within these channels. Figure 4-1 shows a cross section view of this assembly. Notice that each of the horizontal transmission lines on the front of the unit crosses over each of the vertical transmission lines on the rear of the unit even though the lines are separated by the base plate at these crossing points. For convenience, we will refer to the rear vertical transmission lines as "columns" and the front horizontal transmission lines as "rows".

4.1.3 To transform the transmission line assembly described above into a switching matrix, a system of connecting between the column and row connectors is required. This switching is accomplished through the use of a set of electrical contacts assembled into a moveable "ram". At the point where each row and column intersect, the RF conductors are interrupted with a gap and the ends of the conductors are equipped with contact springs. A hole is pierced in the base plate to permit a ram to pass through the plate and make contact between the front and rear transmission lines. One pair of contacts on the

ram is a set of insulated rectangular bars. When the ram is in the OUT or forward position, these bars close the gaps in the transmission lines and permit power to flow straight through the intersection as shown in Figure 4-2. These two "thru" contacts are insulated from each other and thus no power is transferred between the front and rear transmission lines; in addition, a contact spring (not shown in the figure) mounted between the thru contacts makes contact with the base plate and shields the transmission lines from each other in this feed-through connection.

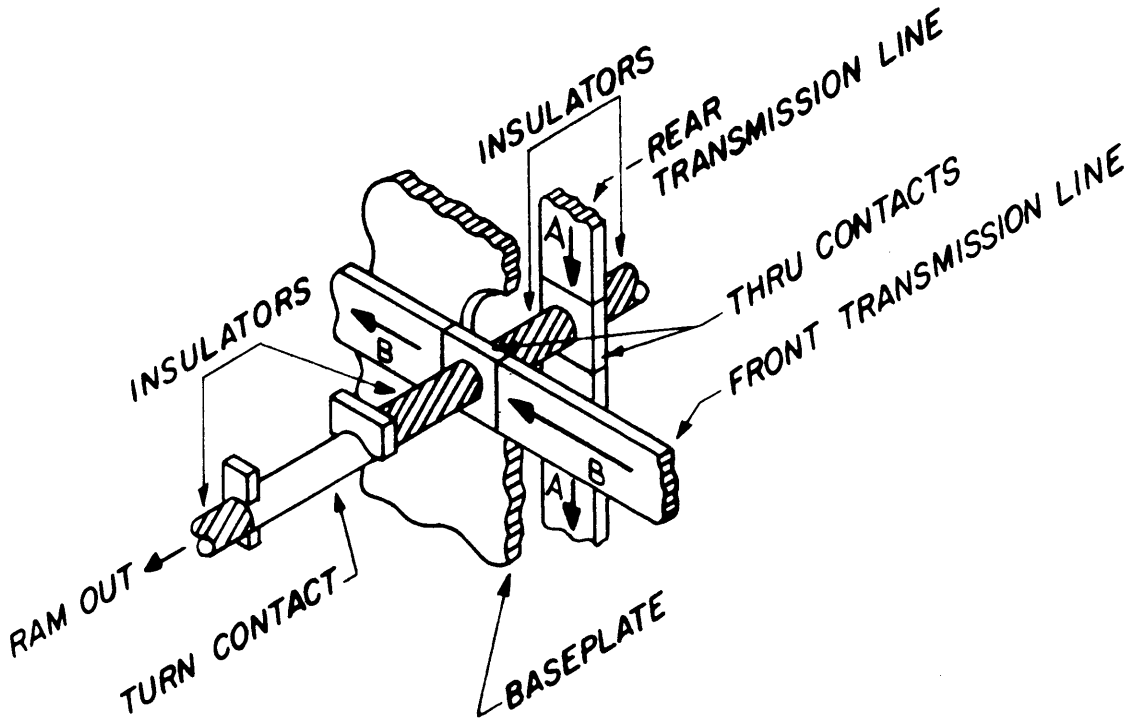


Figure 4-2. Feed Through Connection (Ram Out)

4.1.4 When the ram is pushed in, the thru contacts are removed from the circuit and a "turn" contact engages the transmission line as shown in Figure 4-3. This contact consists of a length of tubing with rectangular contacts oriented at right angles on each end as shown in the figure. Notice that the rectangular contacts are dimensioned so that they connect with only one side of the rear transmission line and one side of the front transmission line, thus opening the circuits in both the rear and the front while making a connection between the rear and the front. This removes all transmission line stubs from the RF circuit and at the same time prevents the accidental paralleling of inputs or outputs.

4.1.5 By repositioning and/or modifying the ram, either end of the rear transmission line may be connected to either end of the front transmission line. To establish ram terminology, it is assumed that the rear connection is always made on the top, and the ram is described by the connection that is made on the front; thus, the ram shown in Figure 4-3 is a "left-hand" ram since it connects to the left-hand side of the front transmission line.

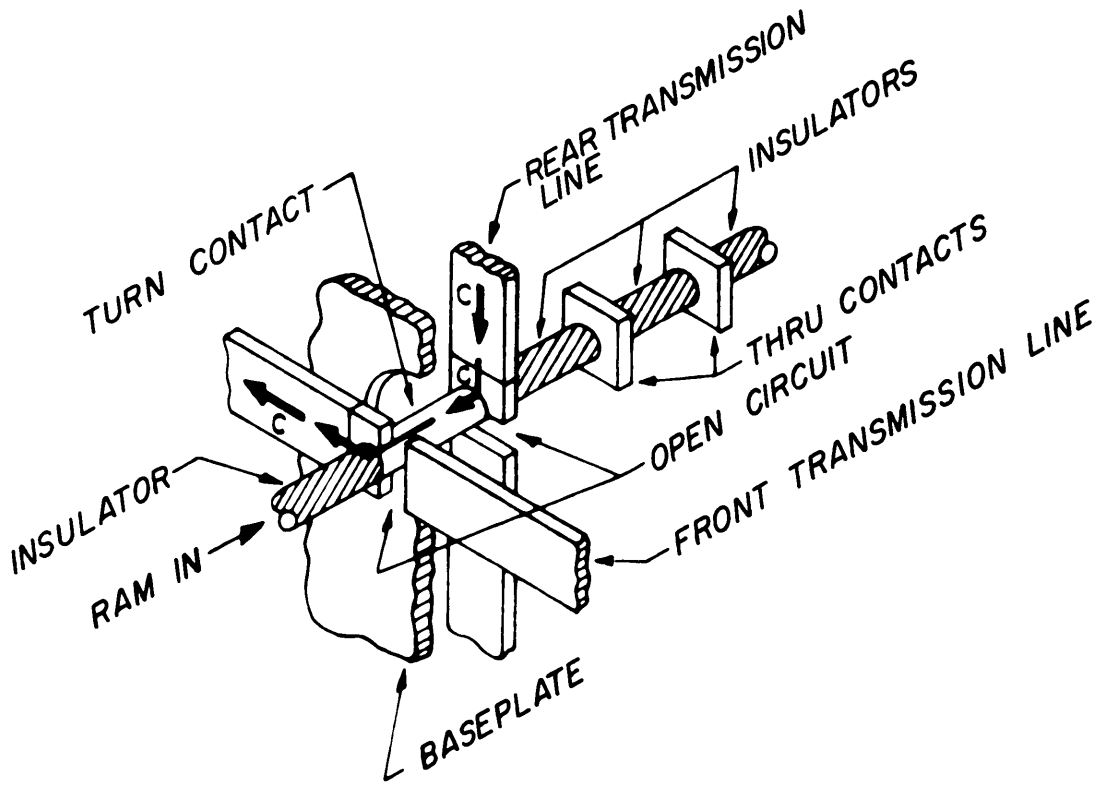


Figure 4-3. Transfer Connection (Ram In)

4.2 INTERLOCK CIRCUIT

4.2.1 Four microswitches are mounted on the front cover plate on each switch module for the interlock and remote indicator system.

4.2.2 Three microswitches are utilized on each switch module for interlock switching (S1, S2, S3; Figure 4-4). These microswitches, along with an additional microswitch used for the indicator circuit (S4, Figure 4-4), are mounted on the front mounting plate on manually operated crosspoints, and are mounted within the motor-actuator on power operated crosspoints. Two of the microswitches (S1 and S2) are closed when the ram is latched in the OUT position, and the other two switches (S3 and S4) are closed in the IN position.

4.2.3 The interlock switches duplicate the switching of the RF circuit to provide complete interlock. With all of the rams in the OUT position the column interlock buss is carried straight through by the S1 switches, and the row interlock is carried straight through by the S2 switches. When a ram is latched in the IN position the paths are interrupted by S1 and S2 and the column and row paths are connected together by S3 which is closed. The resulting interlock path for Ram B1-IN is marked on Figure 4-4.

4.2.4 The interlock circuit is a single wire circuit with a common return. Isolated interlocks may be supplied, when required, by the addition of external relays. This can be accomplished by the Model IIK Interlock Isolation Kit, supplied installed on the SLS as an optional item.

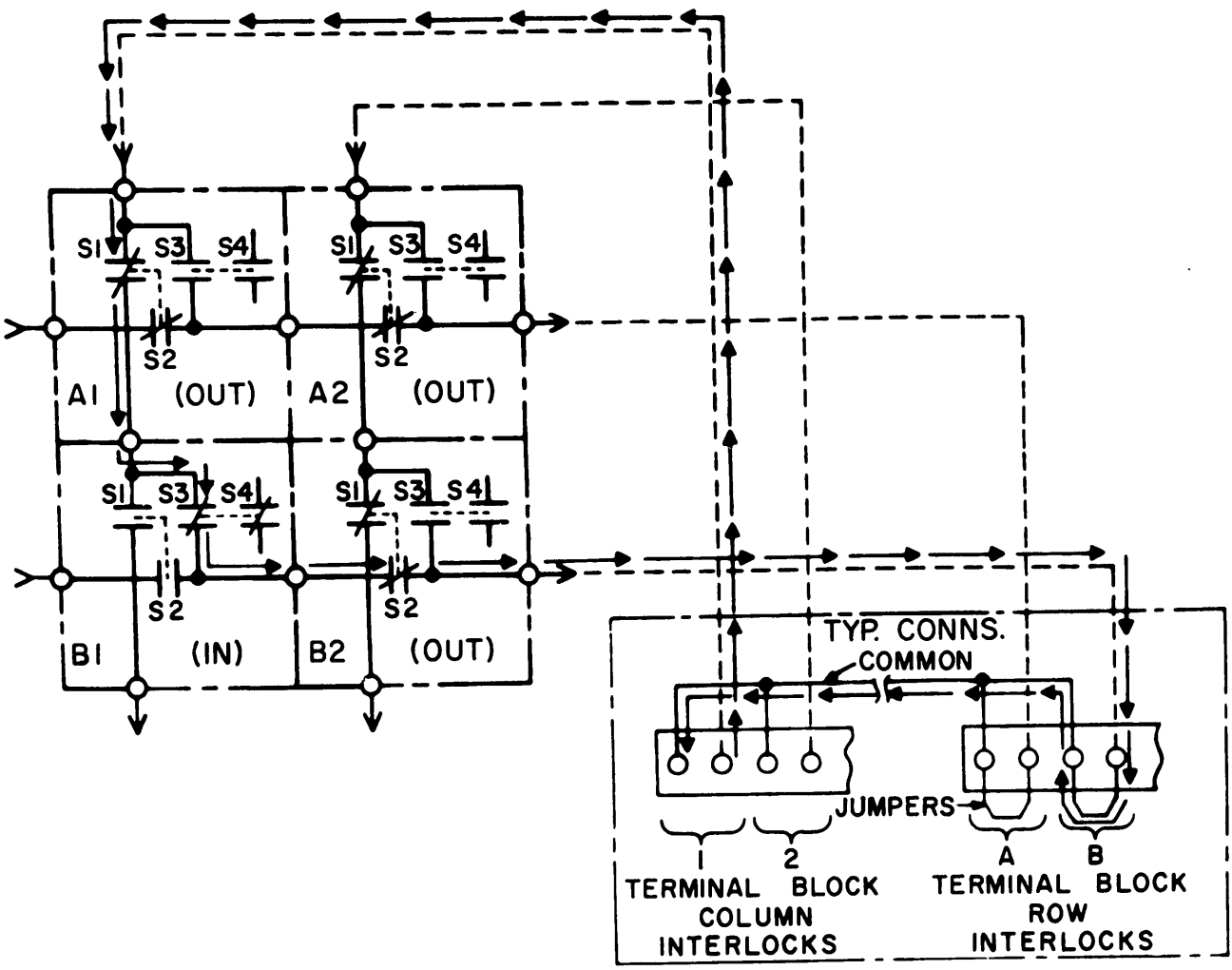


Figure 4-4. Interlock Circuit

4.3 INDICATOR CIRCUIT

The standard indicator circuit is composed of individual microswitches located on each module (S4, Figure 4-4). The microswitch is closed when the ram is latched in the IN position connecting the corresponding terminal on a multi-pin connector (mating connector supplied) to a common floating buss. This circuit may be used to energize the appropriate indicator on a remote readout panel to indicate the switching status of the system. An antenna status panel is available as an accessory. It utilizes rear projection readouts to indicate the status of up to a 10-column, 11-row matrix in only 3 1/2" of 19" wide rack space.

SECTION 5

MAINTENANCE/TROUBLE SHOOTING

5.1 CROSSPOINT REPAIR

5.1.1 The SLS has been designed to permit easy access to the RF switch contacts and rams. These parts can be changed in a matter of minutes without de-energizing the entire switch system. Only the vertical and horizontal lines associated with a crosspoint and the immediately adjacent rows and columns need be de-energized to change the ram or contact assemblies at that crosspoint. Care should be taken to insure against accidental switching of an active circuit through the crosspoint being serviced.

5.1.2 To remove a ram, first remove the knob by rotating the knob until one of the holes in the knob's sleeve (See Figure 5-1) aligns with the hole in the ram shaft. Insert a pin, such as a heavy nail or small drill shank, through the aligned holes and at the same time place an Allen wrench in the cap screw in the center of the knob. Apply equal and opposite torque to the pin and to the Allen wrench to loosen the cap screw. Remove the cap screw and withdraw the knob and sleeve assembly. Unlock and place in their middle or disengaged position, the four rams immediately adjacent to the ram being removed. If the ram is not securely held with a pin while loosening or tightening the cap screw, torque may be applied to the ram components with resultant damage to the ram assembly.

5.1.3 Remove the rear mounting plate, MP3, by removing the four mounting screws, II, with a Phillips screwdriver. Carefully withdraw the ram from the switch.

5.1.4 To gain access to the front (row) strip line contact, remove the front mounting plate, MP2, by removing the four mounting screws, II. The micro-switches and the micro-switches' mounting plate, IV, may be swung out of the way; it is not normally necessary to disconnect any of the wires from the micro-switches. The front mounting plate with its attached strip line contact may now be removed.

5.1.5 To replace a strip line contact, remove the mounting screws, III, from the insulators, E7. The insulators may then be unscrewed from the strip line contact, E3, E4, E5, or E6. Install the new strip line contact on the mounting plate with the hardware as shown in Figure 5-1 making sure the Teflon Insulator Washers, E8, are present at each end of the stand-off insulators.

5.1.6 Re-assemble components on the switch in the reverse order of their removal (see above). Before re-installing the ram, a light coating of conductive grease such as E-Kote 3028 (Epoxy Products Inc., Irvington, N.J.) should be applied to the contact surfaces. Carefully install the ram with proper orientation, the rear contacting surface of the ram's turn contact must face toward the column connector and the front contacting surface of the ram's turn contact must face toward the row connector.

5.2 TERMINAL REPAIR OR MODIFICATION

5.2.1 Arrangement of the terminal components and hardware is shown in Figure 5-2 for 1 5/8" and 3 1/8" EIA male flanges. To disconnect or remove the bullet, E9 or E10, hold the bullet with a thin strap of metal placed in one of the bullet's slots; do not hold the bullet with pliers. The bullet must be prevented from turning while loosening the nuts, IX, to prevent possible damage to the transmission line strap.

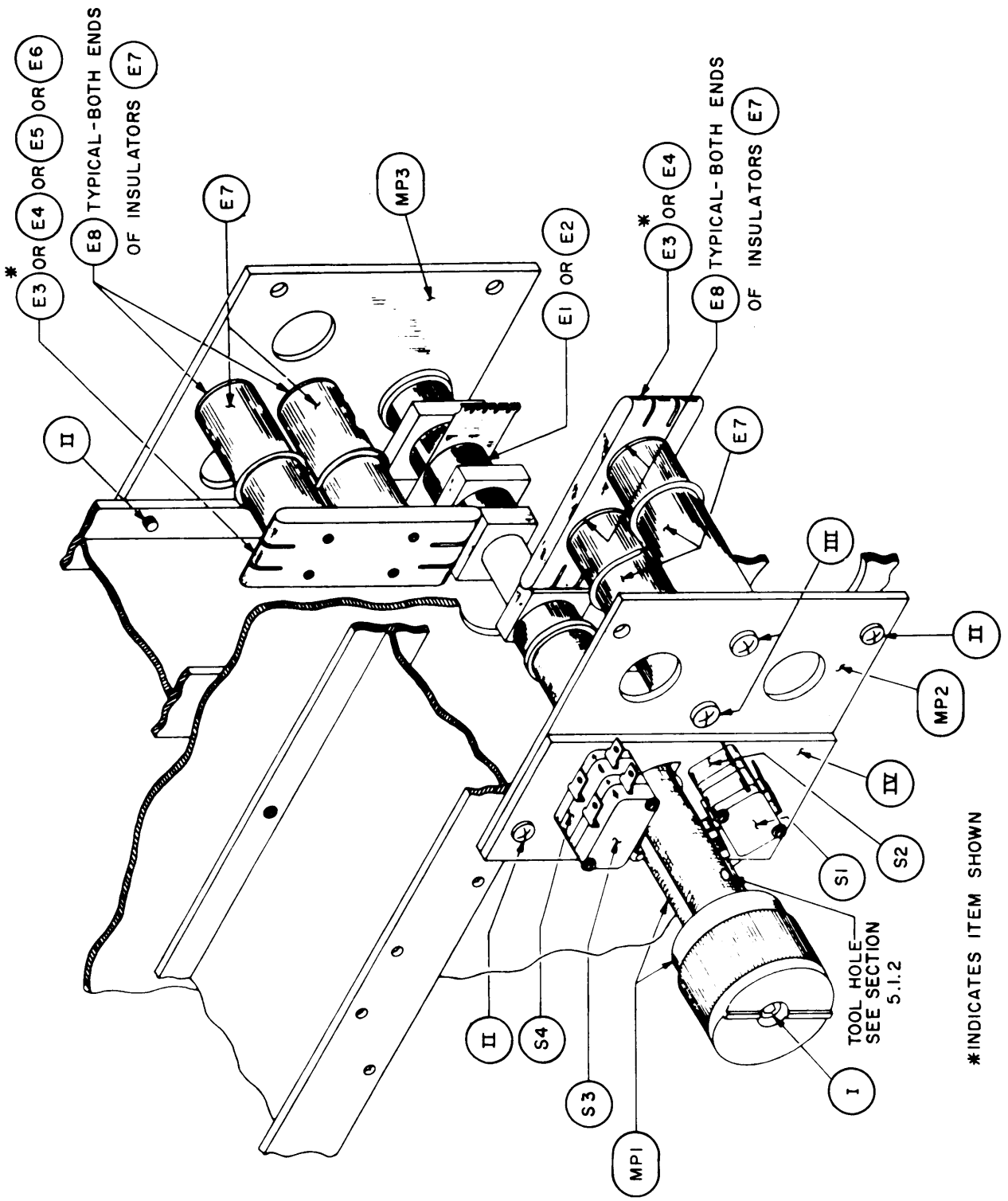


Figure 5-1. Cross-Point Components

5.2.2 To convert from 3 1/8" to 1 5/8" connectors or vice versa, simply add or remove the adapter plate, MP4, and change the bullet utilizing the hardware shown in Figure 5-2. To convert from 3 1/8" to 1 5/8", a Field Modification Kit Model No. FMK-1 5/8 is available. This kit contains all of the required components and hardware. To convert from 1 5/8" to 3 1/8", the 3 1/8" bullet, E9, is the only required part.

5.3 TROUBLE SHOOTING

5.3.1 The SLS has been designed for easy trouble shooting following a straight forward approach made possible by the mechanical nature of the equipment. Trouble shooting is principally concerned with the RF path, the interlock circuitry and the indicator circuitry. Failure indications are (1) the failure of a transmitter to turn on when a crosspoint switch is pushed IN, or (2) the failure of an indicator light to turn on when a crosspoint switch is pushed IN.

5.3.2 If the transmitter does not turn on when a crosspoint switch is pushed IN, remove the corresponding transmitter and antenna connectors from the SLS and check continuity between the associated row and column terminals. The lack of continuity indicates a break in the RF path between the terminals; and the presence of continuity indicates a closed RF path and a probably failure of the interlock circuitry.

5.3.3 To locate a break in the RF path, remove the front panels from the SLS and check the continuity of each strip line section, starting from the terminal at either end of the path and progressing towards the other terminal. Access to the strip line is provided by two inspection holes on each mounting plate. When the open strip line section and associated crosspoint switch are located, follow the procedures of Paragraph 5.1 to remove the faulty component and complete the repair.

WARNING!

EXERCISE EXTREME CAUTION WHEN MAKING CONTINUITY CHECKS ON A STRIP LINE TO MAKE SURE *ONLY THE INACTIVE LINE IS CHECKED*. ACCIDENTAL CONNECTION TO A STRIP LINE CARRYING FULL POWER MAY RESULT IN PERMANENT INJURY OR DEATH!

5.3.4 To locate a break in the interlock circuitry, remove the front panels from the SLS and remove the leads from the terminal board connections corresponding to the row and column that are inoperative (see Figure 2-3). Check the continuity of each interlock lead and microswitch starting from either terminal board and progressing towards the pushed IN crosspoint switch and the other terminal board.

5.3.5 To locate a break in the indicator circuitry, remove the front panels from the SLS and check the microswitch, wiring and connector pin associated with the pushed IN crosspoint switch (see Figure 2-3).

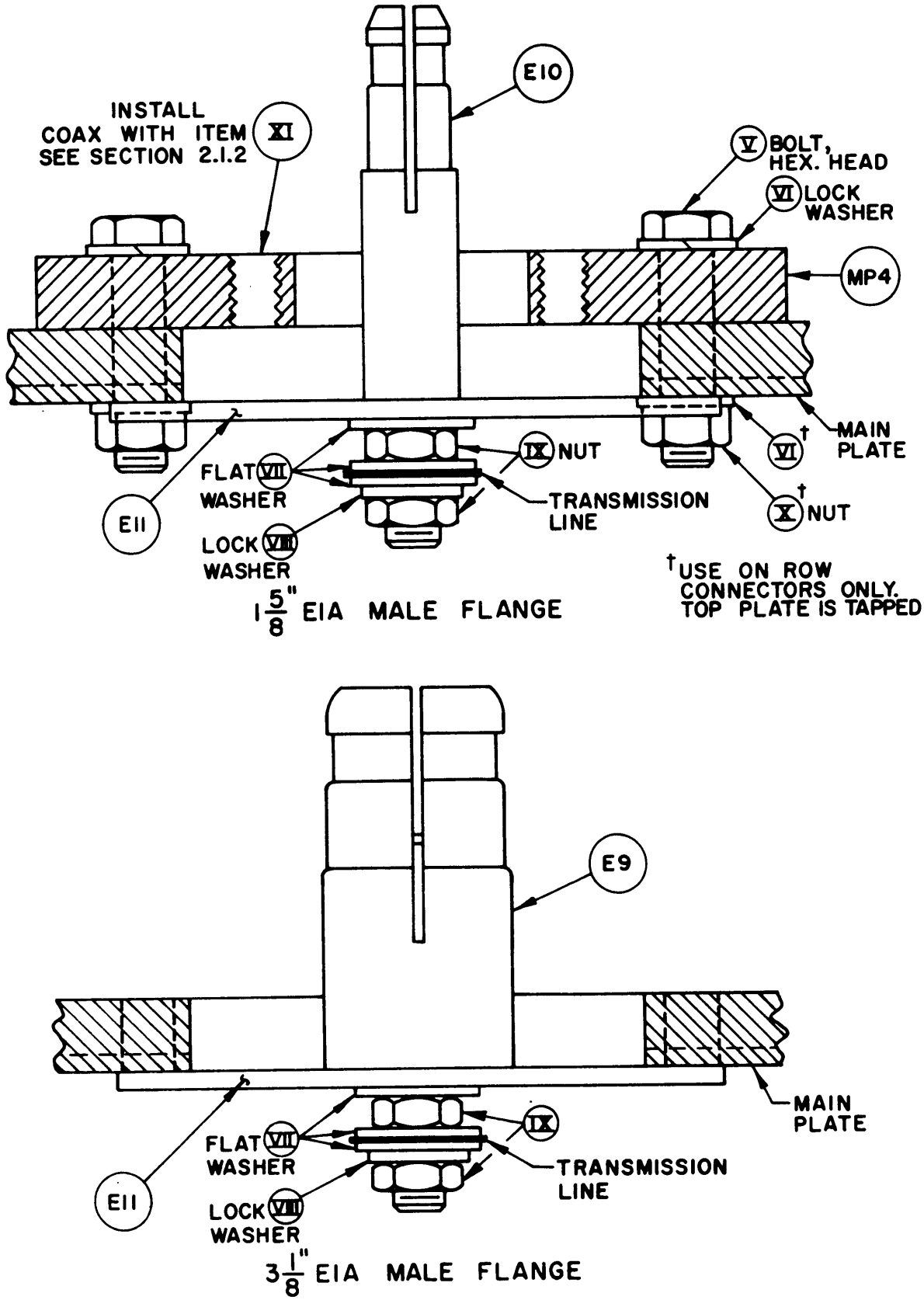


Figure 5-2. Terminal Components

SECTION 6

PARTS LIST

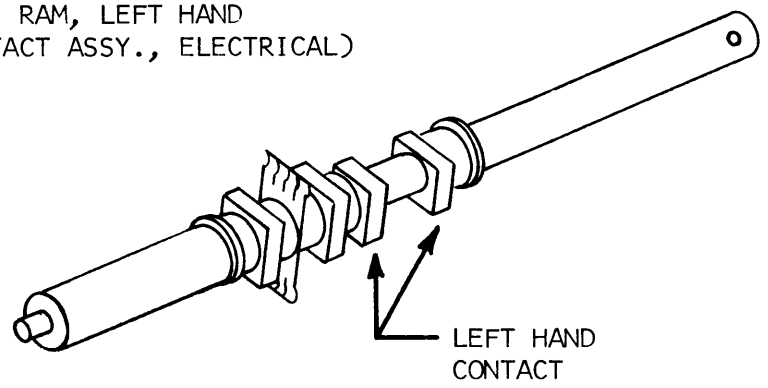
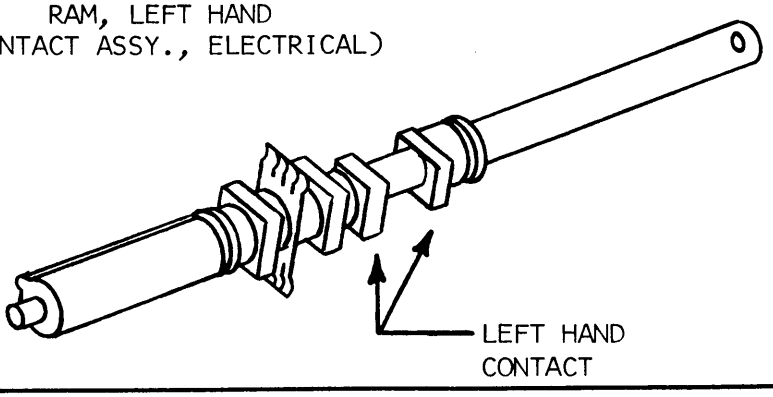
6.1 INTRODUCTION

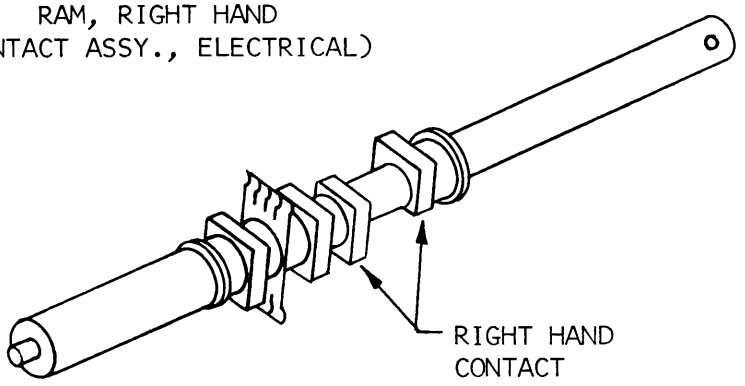
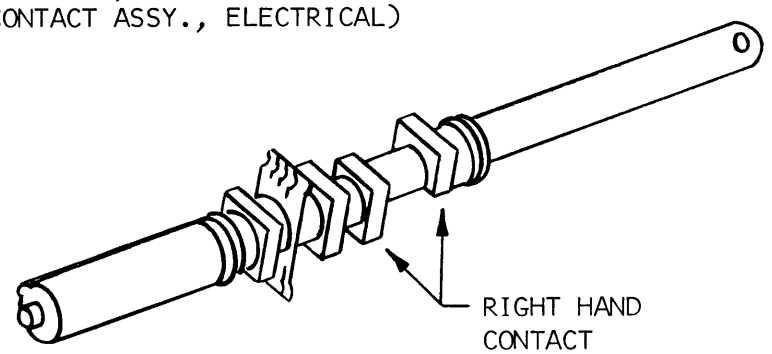
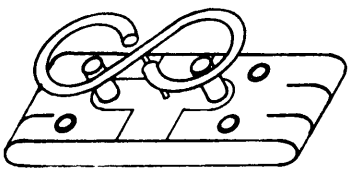
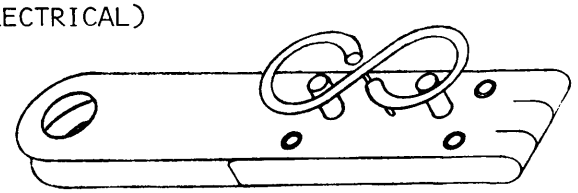
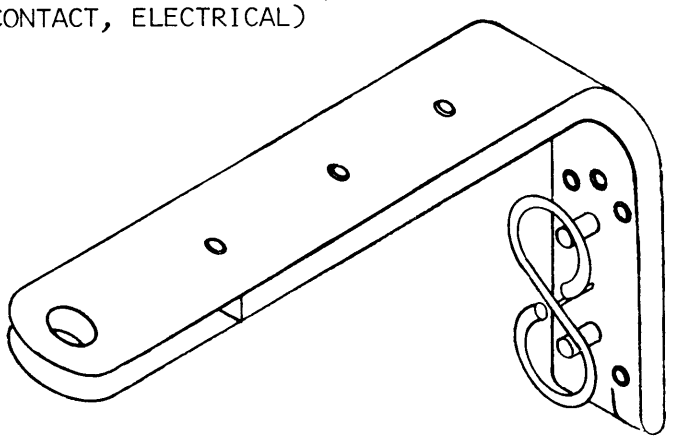
6.1.1 Maintenance parts in the system have been identified by reference designations. The designation have been used on the drawings and List of Materials to identify the components. The letter(s) in the reference designation identify the class of item such as a switch, electrical contact, or mechanical part. The number(s) following the letter differentiates between parts of the same class.

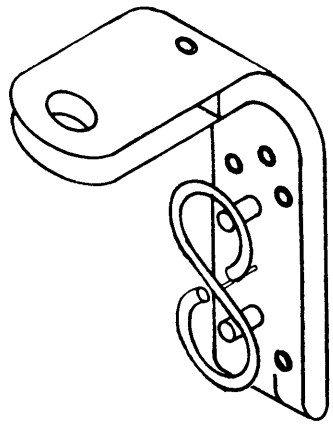
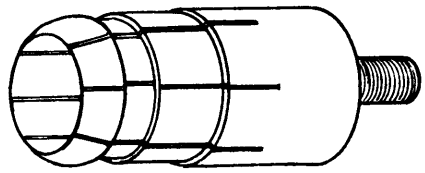
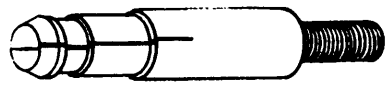
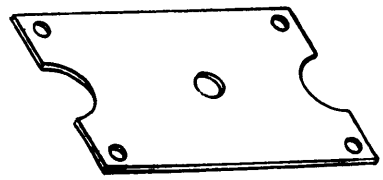
6.1.2 Due to the variable size of the assembly, designations and the List of Material have been oriented toward the common components in a crosspoint. All identical components carry the same reference designation with the exception of the connectors (J1 and J2), the switches (S1, S2, S3, S4) and the terminal boards (TB1, TB2, TB3, TB4) where sequential reference designations were assigned for reference on the schematic and wiring list.

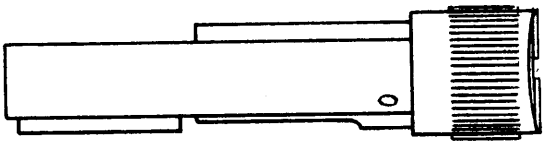
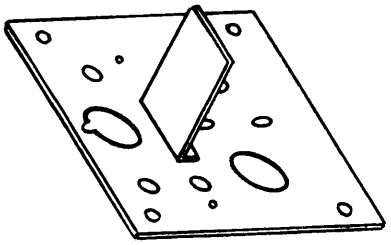
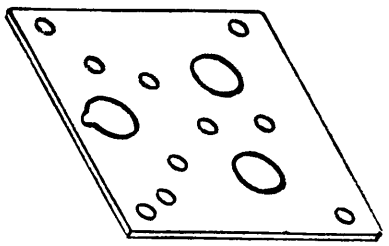
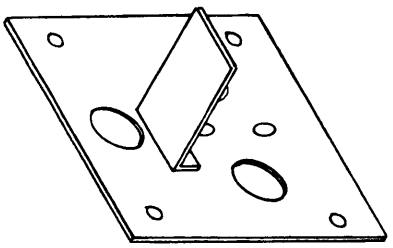
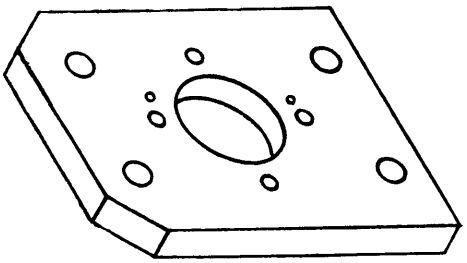
6.1.3 The peculiar components may be readily identified by reference to the Pictorial Parts List, Section 6.2, and the Crosspoint Components Drawing, Figure 5-1. Repair parts are listed in the List of Materials, Section 6.3. Those parts consisting of common hardware are identified by Roman Numeral (I, II, etc.) reference designations and are shown on the Reference List of Materials, Section 6.4.

6.2 PICTORIAL PARTS LIST - STRIP LINE SWITCH

ITEM	REF. DES.	DESCRIPTION (FEDERAL ITEM NAME)	PART NO.
1	E1	RAM, LEFT HAND (CONTACT ASSY., ELECTRICAL) 	D81-6-1 NOTE: USED ON SERIAL NUMBERS THROUGH 076.
		RAM, LEFT HAND (CONTACT ASSY., ELECTRICAL) 	D81-6-3 NOTE: USED ON SERIAL NUMBERS 077 AND ABOVE.

ITEM	REF. DES.	DESCRIPTION (FEDERAL ITEM NAME)	PART NO.
2	E2	RAM, RIGHT HAND (CONTACT ASSY., ELECTRICAL) 	D81-6-2 NOTE: USED ON SERIAL NUMBERS THROUGH 076.
		RAM, RIGHT HAND (CONTACT ASSY., ELECTRICAL) 	D81-6-4 NOTE: USED ON SERIAL NUMBERS 077 AND ABOVE.
3	E3	STRIP LINE CONTACT (CONTACT, ELECTRICAL) 	D81-10-1
4	E4	TERMINAL STRIP LINE CONTACT (CONTACT, ELECTRICAL) 	D81-10-2
5	E5	COL. TERM. STRIP LINE CONTACT, LONG (CONTACT, ELECTRICAL) 	D81-10-3

ITEM	REF. DES.	DESCRIPTION (FEDERAL ITEM NAME)	PART NO.
6	E6	COL. TERM. STRIP LINE CONTACT, SHORT (CONTACT, ELECTRICAL) 	D81-10-4
7	E7	STANDOFF INSULATOR (INSULATOR, STANDOFF) 	D04-10
8	E8	INSULATOR WASHER (INSULATOR, WASHER) 	D04-5-3
9	E9	3 1/8" BULLET (CONTACT, ELECTRICAL) 	D04-18
10	E10	1 5/8" BULLET (CONTACT, ELECTRICAL) 	D04-17
11	E11	BULLET INSULATOR (INSULATOR, PLATE) 	D82-1-1

ITEM	REF. DES.	DESCRIPTION (FEDERAL ITEM NAME)	PART NO.
16	MP1	KNOB (KNOB) 	D81-22
17	MP2	FRONT MOUNTING PLATE (PLATE, MOUNTING, CONTACT) 	D81-9-1 NOTE: USED ON SERIAL NUMBERS THROUGH 076.
17.5	MP2 + MP3	FRONT/REAR MOUNTING PLATE (PLATE, MOUNTING, CONTACT) 	D71-16-2 NOTE: USED ON SERIAL NUMBERS 077 AND ABOVE.
18	MP3	REAR MOUNTING PLATE (PLATE, MOUNTING, CONTACT) 	D81-9-2 NOTE: USED ON SERIAL NUMBERS THROUGH 076
19	MP4	1 5/8" ADAPTER PLATE (ADAPTER, RF CABLE) 	D80-12-1

6.3 LIST OF MATERIALS - STRIP LINE SWITCH

Item	Ref. Des.	Description (Item Name)	MFR FMC	Part No.
1	E1	RAM, LEFT HAND (CONTACT ASSEMBLY, ELECTRICAL)	DELTA 19482	D81-6-1 (See Note 1)
		RAM, LEFT HAND (CONTACT ASSEMBLY, ELECTRICAL)	DELTA 19482	D81-6-3 (See Note 1)
2	E2	RAM, RIGHT HAND (CONTACT ASSEMBLY, ELECTRICAL)	DELTA 19482	D81-6-2 (See Note 1)
		RAM, RIGHT HAND (CONTACT ASSEMBLY, ELECTRICAL)	DELTA 19482	D81-6-4 (See Note 1)
3	E3	STRIP LINE CONTACT (CONTACT, ELECTRICAL)	DELTA 19482	D81-10-1
4	E4	TERMINAL STRIP LINE CONTACT (CONTACT, ELECTRICAL)	DELTA 19482	D81-10-2
5	E5	COL. TERM. STRIP LINE CONTACT, LONG (CONTACT, ELECTRICAL)	DELTA 19482	D81-10-3
6	E6	COL. TERM. STRIP LINE CONTACT, SHORT (CONTACT, ELECTRICAL)	DELTA 19482	D81-10-4
7	E7	STANDOFF, INSULATOR (INSULATOR, STANDOFF)	DELTA 19482	D04-10
8	E8	INSULATOR WASHER (INSULATOR, WASHER)	DELTA 19482	D04-5-3
9	E9	3 1/8" BULLET (CONTACT, ELECTRICAL)	DELTA 19482	D04-18 (See Note 2)
10	E10	1 5/8" BULLET (CONTACT, ELECTRICAL)	DELTA 19482	D04-17 (See Note 2)
11	E11	BULLET INSULATOR (INSULATOR, PLATE)	DELTA 19482	D82-1-1
12	E12	CONNECTOR TERMINAL (CRIMP) (CONTACT, ELECTRICAL)	ELCO 91662	50-8017-0313 (See Note 3)
13	E13	CONNECTOR TERMINAL (SOLDER) (CONTACT, ELECTRICAL)	ELCO 91662	50-7015-9210
14	J1	CONTROL CONNECTOR (CONNECTOR, RECEPTACLE, ELECTRICAL)	ELCO 91662	00-8017-130 -000-007
15	J2	Same as J1		
16	MP1	KNOB (KNOB)	DELTA 19482	D81-22
17	MP2	FRONT MOUNTING PLATE (PLATE, MOUNTING, CONTACT)	DELTA 19482	D81-9-1 (See Note 4)
17.5	MP2 + MP3	FRONT/REAR MOUNTING PLATE (PLATE, MOUNTING, CONTACT)	DELTA 19482	D71-16-2 (See Note 4)
18	MP3	REAR MOUNTING PLATE (PLATE, MOUNTING, CONTACT)	DELTA 19482	D81-9-2 (See Note 4)
19	MP4	1 5/8" ADAPTER PLATE (ADAPTER, RF CABLE)	DELTA 19482	D80-12-1

Item	Ref. Des.	Description (Item Name)	MFR FMC	Part No.
20	S1	MICROSWITCH (SWITCH, SENSITIVE)	M.H. 91929	V3L-27-D8
21	S2	Same as S1		
22	S3	Same as S1		
23	S4	Same as S1		
24	TB1	TERMINAL BOARD (TERMINAL BOARD)	KULKA 75382	799-12-KT34
25	TB2	Same as TB1		
26	TB3	Same as TB1		
27	TB4	Same as TB1		

NOTES:
1. Rams D81-6-1 and -2 are used in Serial Numbers through 076; Rams D81-6-3 and -4 are used in Serial Numbers 077 and higher. Rams D81-6-3 and -4 may be used in earlier units (prior to Serial Number 077) if the existing Rear Mounting Plate D81-9-2 is replaced with new Front/Rear Mounting Plate D71-16-2. This substitution is recommended for increased life.

2. Connector components E9, D10 and MP4 are not required for normal maintenance. These items are required for modifying connector type.

3. Item E13 is field use replacement for Item E12.

4. Front Mounting Plate D81-9-1 and Rear Mounting Plate D81-9-2 are used in Serial Numbers through 076; Front/Rear Mounting Plate D71-16-2 is used in Serial Numbers 077 and higher.

REFERENCE LIST OF MATERIALS - STRIP LINE SWITCH - MODEL SLS-1

NOTE: The following items are standard hardware and are listed for reference only.

Item	Reference Designation	Description	Quantity†
1	I	Socket Head Cap Screw, 1/4:20 x 5/8"	
2	II	Machine Screw, Pan Head, 8:32 x 1/2", Cad. Plated Steel (with split Lockwasher).	
3	III	Machine Screw, Pan Head, 10:32 x 1/2", Cad. Plated Steel (with Internal Tooth Lockwasher).	
4	IV	Microswitch Mounting Plate; Delta P/N D71-28	
5	V	Bolt, Hex Head, 3/8:16 x 1", Stainless Steel	4
6	VI	Split Lockwasher, 3/8" I.D., Cad. Plated Steel	8
7	VII	Flatwasher, 3/8" I.D., Silver Plated Brass	
8	VIII	Split Lockwasher, 3/8" I.D., Silver Plated Phos. Bronze	
9	IX	Hex Nut, 3/8:16, Silver Plated Brass	
10	X	Hex Nut, 3/8:16, Stainless Steel	4
11	XI	Bolt, Hex Head, 5/16:18 x 1", Stainless Steel	4
12	XII	Terminal Board Jumper; Cinch-Jones P/N 141-J	

†Field Modification Kit Model FMK-1 5/8 Contains Quantities show plus 1 each 1 5/8" Bullet (P/N D04-17) and 1 each Adapter Plate (P/N D80-12-1) to convert from 3 1/8" connector to 1 5/8" connector.