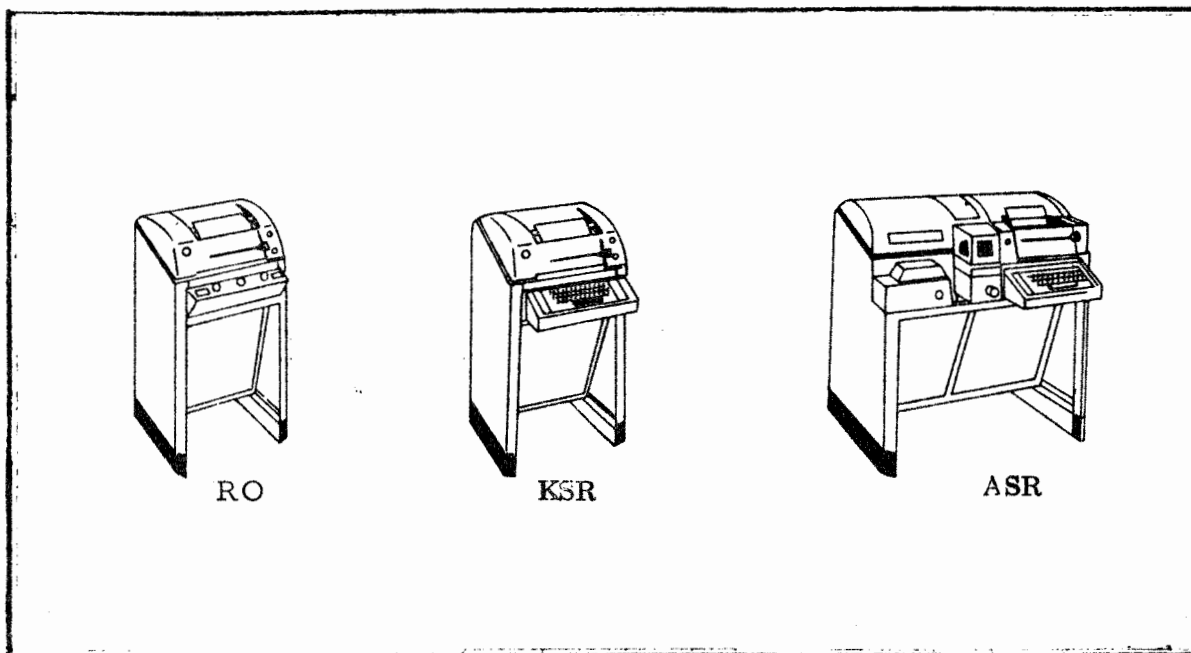


CHAPTER 4. PRINTING EQUIPMENTS

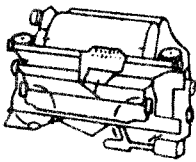
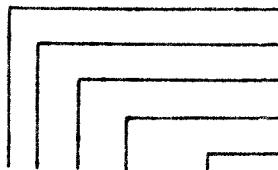
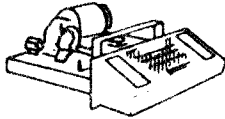
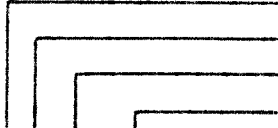
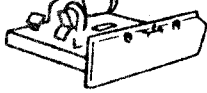
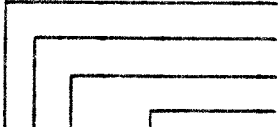
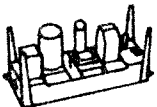
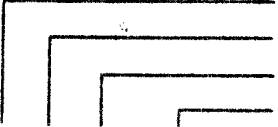
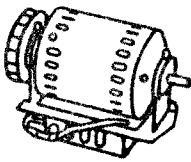

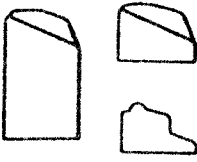
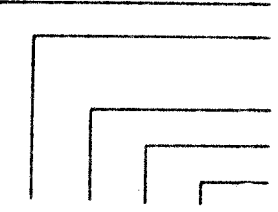
80. PRINTING EQUIPMENT, GENERAL. The Teletype Corporation's Model 28 (M-28) teletypewriters are the basic printing equipment used by FAA. The equipment is contained within the cabinets sketched in Figure 4-1. It has been FAA practice to paint the cabinets grey-green with a four-inch dark grey band around the base. See Appendix 3 of this handbook for dimensions and Table 2 of Handbook 6620.1, Chapter 3, Section 2, for technical characteristics.

FIGURE 4-1. MODEL 28 TELETYPEWRITERS



Electrical connection to a 115 VAC power source is made through a power cord and three prong locking plug. Signal and control connections are made to duct wiring by means of 24-conductor cables equipped with connectors that lock onto mating receptacles on the duct. Most FAA printers operate at 75 baud (100 wpm). The cabinets contain an electrical service unit (LESU), Relay Control Group, and cabinet terminal strips as well as the printing and/or tape handling mechanisms. Subassemblies of M-28 equipments are identified by the letter "L" followed by other letters and numbers as illustrated in Figure 4-2.

FIGURE 4-2. TELETYPE CORP. TYPE DESIGNATORS

| <u>ASSEMBLY</u> | <u>DESIGNATION</u> | <u>MEANING</u> |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <p>Typing Unit</p>  |  <p>L P 12 RE / AR</p> | <p>Model 28 Printer Model Number Typebox Arrangement Stunt Box Arrangement (Model Number includes accessories)</p> |
| <p>Transmitting Keyboard</p>  |  <p>L K 16 ARE</p> | <p>Model 28 Keyboard Model Number Keytop Arrangement (Model Number includes accessories)</p> |
| <p>OR Receive Only Base</p>  |  <p>L B 4 / 146</p> | <p>Model 28 Base Model Number Accessory Group (Model Number will later incorporate accessories)</p> |
| <p>Electrical Service Unit</p>  |  <p>L ESU 7 / 246</p> | <p>Model 28 Electrical Service Unit Model Number Accessory Group</p> |
| <p>Motor</p>  |  <p>L MU 3</p> | <p>Model 28 Motor Unit Model Number</p> |
| <p>Consoles</p>  |  <p>L AC 204 AB 222 (PC)</p> | <p>Model 28 Apparatus Cabinet (Floor—Table) (Printer Cover) (Rack Mount) Model Number Color Accessory Group</p> |

Chap. 4

Par. 87

| Slot | Function Bar | Function Lever | Function Pawl | Spring Plate | Switch & Slide | Function Bar | Switch Wired To | APPLICATION | REQUIRED AT | | | | |
|------|--------------|----------------|---------------|--------------|----------------|--------------|-----------------|----------------------------------------------------------|---------------------|-------------------------|------------------------|------------------------------|------------------------------------------|
| | | | | | | | | | Weather Bureau | ARTCC FLIDAP | L. S. RLA SVC "B" | SVC "A", "B" & "C" FST & FSS | |
| 1 | 152675 | 152641 | 152653 | 152660 | | LC-BL | | Suppresses Space On Blank | | | | | |
| 2 | 152666 | 152641 | 152653 | 152660 | | FIGS | | Figures Shift | | | | | |
| 3 | 152665 | 152641 | 152653 | 152660 | | LTRS | | Letters Shift | | | | | |
| 4 | 152671 | 152641 | 152653 | 152660 | | CR-LF | | Automatic Carriage Return | | | | | |
| 5 | 152667 | 152641 | 152653 | 152660 | | CR | | Carriage Return | | | | | |
| 6 | 152668 | 152121 | 152653 | 154613 | | LF | | Sequential Selection Slot 7 On LF | | | | | |
| 7 | 152667 | 152121 | 152653 | 154613 | | CR | | Sequential Selection Slot 8 On LF, CR | | | | | |
| 8 | 152665 | 152298 | 152653 | 154613 | | LTRS | Y-5 & Y-15 | Open N. C. Contacts On LF, CR, LTRS | END OF MESSAGE CODE | For Unlock | For Unlock | For Unlock | For Unlock |
| 9 | | 152121 | 152653 | 154613 | | SC # | | Sequential Selection Slot 10 On 1st Letter of Call | T. D. CONTROL | | | | |
| 10 | | 152298 | 152653 | 154613 | | # | Y-5 & Y-16 | Close Contacts On 1st + 2nd Letter of Call | | | SVC "B" T. D. Start | | SVC "B" T. D. Start |
| 11 | 152668 | 152642 | 153604 | 152660 | | LF | | Sequential Selection Slot 13 On LF | CONDI | | | | |
| 12 | 152667 | 152121 | 153598 | 154613 | | CR | | Sequential Selection Slot 13 On CR | TION | | | | |
| 13 | 152667 | 152121 | 152653 | 154613 | | CR | | Sequential Selection Slot 14 On LF, CR or CR, CR | CODES | | | | |
| 14 | 152665 | 152298 | 152653 | 154613 | | LTRS | | Move "O" Code Bar On LF, CR, LTRS or CR, CR, LTRS | | | | | |
| 15 | | 152121 | 152653 | 154613 | | SC # | | Sequential Selection Slot 16 on 1st Letter of Call | | For SVC "A" T. D. Start | | For SVC "A" T. D. Start | For SVC "A" T. D. Start |
| 16 | | 152121 | 152653 | 154613 | | # | | Sequential Selection Slot 17 on 1st + 2nd Letter of Call | | | | | |
| 17 | | 152298 | 152653 | 154613 | | # | Y-5 & Y-19 | Close contacts on 1st+2nd+3rd Letter of Call | | | | | |
| 18 | * | 152121 | 152653 | 154613 | | SC # | | Sequential Selection Slot 19 On 1st Letter of Call | | A, B & C PRINT CONTROL | A, B & C PRINT CONTROL | A, B & C PRINT CONTROL | A, B & C PRINT CONTROL |
| 19 | * | 152121 | 152653 | 154613 | | # | | Sequential Selection Slot 20 On 1st + 2nd Letter of Call | SELECT | | | | |
| 20 | * | 152298 | 152653 | 154613 | | # | Y-5 & Y-18 | Close Contacts On 1st + 2nd + 3rd Letter of Call | CODES | | | | |
| 21 | * | 152121 | 152653 | 154613 | | SC # | | Sequential Selection Slot 22 On 1st Letter of Call | | | | | |
| 22 | * | 152121 | 152653 | 154613 | | # | | Sequential Selection Slot 23 On 1st + 2nd Letter of Call | | | | | |
| 23 | * | 152298 | 152653 | 154613 | | # | Y-5 & Y-18 | Close Contacts On 1st+2nd+3rd Letter of Call | | | | | DISCRETE AREA OFFICE CALL SHIFT TO PRINT |
| 24 | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | |
| 27 | | | | | | SC # | | Sequential Selection Slot 28 On | | | | | |
| 28 | | | | | | # | | Sequential Selection Slot 29 On | SPECIAL RELAY CALL | | | | UNBLIND REPERFORATOR & PRINT |
| 29 | | | | | | # | | Sequential Selection Slot 30 On | | | | | |
| 30 | | | | | | # | Y-5 & Y-8 | Close Contacts On - + - + - | | | | | |
| 31 | 153432 | 152121 | 152653 | 154613 | | SC X | | Sequential Selection Slot 32 On X | | | | | NATIONAL EMERGENCY & ALL CIRCUIT CALL |
| 32 | 152701 | 152298 | 152653 | 154613 | | X | Y-5 & Y-18 | Close Contacts On X+X | | | | | |
| 33 | * | | | | | # | | | | | | | L. S. RLA |
| 34 | * | | | | | # | | | | | | | T. D. |
| 35 | * | 152298 | 152653 | 154613 | | # | | | | | CAT | | |
| 36 | | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | | |
| 38 | | | | | | | | | | | | | |
| 39 | 152671 | 152642 | 153598 | 152660 | | CR-LF | | Automatic Line Feed | | | | | |
| 40 | 153435 | 152641 | 152653 | 152660 | | SC-LF | | Line Feed | | | | | |
| 41 | 153437 | 152641 | 152653 | 152660 | | SC-UC S | Y-2 & Y-7 | Signal Bell | | BELL | BELL | BELL | BELL |
| 42 | 152668 | 152641 | 152653 | 152660 | | LF | | Suppresses Space On Single Line Feed | | | | | |

Use 4703 Function Bar Springs, 157240 Function Pawl Springs with 72522 Oilers, 90517 Function Lever Springs, 172525 Switch Assemblies.

- * = Call Letter, Function Bar as Required -
- See Bulletin 1149B For Part Number
- = Mechanical Linkage To Perform Function
- = Normally Closed Contacts Used
- = Normally Open Contacts Used
- LC = Lower Case
- UC = Upper Case
- SC = Stunt Case (special six-tined call letter function bar required). Where SC is used Condition Code must precede sequential Select Code.
- T. D. = Transmitter Distributor
- FLIDAP = Flight Data Position
- L. S. RLA = Low Speed (100 wpm) Relay
- # = Call Letter as required
- CAT = Clear Air Turbulence Reports

Figure 4-6. FAA TELETYPEWRITER FUNCTION BOX INFORMATION

SLOT SWITCH AND NO. SLIDE LOC. FUNCTION BAR APPLICATION

| SLOT NO. | SWITCH | SLIDE LOC. | FUNCTION BAR | APPLICATION |
|----------|--------|------------|-------------------------|---------------------------------------------------|
| 1 | | | LC-BL | SUPPRESS SPACE ON LC-BL S BAR & SUP BAR RIGHT |
| 2 | ○ | Y | FIGS | FIGURES-SHIFT S BAR LEFT; RIGHT T SLIDE UP |
| 3 | ○ | Y | LTRS | LETTERS-SHIFT S BAR RIGHT; LEFT T SLIDE UP |
| 4 | | | CR-LF | AUTOMATIC CARRIAGE RETURN O BAR RIGHT |
| 5 | | | CR | CARRIAGE RETURN |
| 6 | | | LF | SEQ. SELECT SLOT 7 ON LF |
| 7 | | | CR | SEQ. SELECT SLOT 8 ON LF, CR |
| 8 | E | | LTRS | OPEN N.C. CONTACT ON LF, CR, LTRS |
| 9 | | | STUNT CASE K | SEQ. SELECT SLOT 10 ON K |
| 10 | E | | A | CLOSE N.O. CONTACT ON K, A |
| 11 | | | LF | SEQ. SELECT SLOT 13 ON LF |
| 12 | | | CR | SEQ. SELECT SLOT 13 ON CR |
| 13 | | | CR | SEQ. SELECT SLOT 14 ON LF, CR OR CR, CR |
| 14 | ○ | Y | LTRS | MOVE "O" CODE BAR ON LF, CR, LTRS OR CR, CR, LTRS |
| 15 | | | N | SEQ. SELECT SLOT 16 ON N |
| 16 | | | N | SEQ. SELECT SLOT 17 ON NN |
| 17 | | | N | SEQ. SELECT SLOT 18 ON NNN |
| 18 | ○ | | N | OPEN N.C. CONTACT ON NNNN |
| 19 | | | STUNT CASE X | SEQ. SELECT SLOT 20 ON X |
| 20 | ○ | | X | CLOSE N.O. CONTACT ON X, X |
| 21 | | | SC F | STUNT CASE X |
| 22 | | M | F | SEQ. SELECT SLOT 23 ON X, F |
| 23 | ○ | | I | CLOSE N.O. CONTACT ON X, F, W |
| 24 | | A | STUNT CASE X | SEQ. SELECT SLOT 25 ON X |
| 25 | | SC M | X | SEQ. SELECT SLOT 25 ON X, A |
| 26 | E | | I | CLOSE N.O. CONTACT ON X, A, B |
| 27 | | | A | |
| 28 | | SC X | STUNT CASE X | |
| 29 | | | T | |
| 30 | E | | L | |
| 31 | | SC M | STUNT CASE O | SEQ. SELECT SLOT 32 ON O |
| 32 | | | K | SEQ. SELECT SLOT 33 ON OK |
| 33 | E | | A | CLOSE N.O. CONTACT ON OKO |
| 34 | | | | |
| 35 | | | | |
| 36 | | | | |
| 37 | | | | |
| 38 | | | | |
| 39 | | | CR-LF | AUTOMATIC LINE FEED O BAR RIGHT |
| 40 | | | SC-LF | LINE FEED SUP BAR RIGHT |
| 41 | E | | SC-UC S | SIGNAL BELL SUP BAR RIGHT; S BAR LEFT |
| 42 | | | LF | SUPPRESS SPACE ON SINGLE LINE FEED |

(SUP BAR TO RIGHT)

← SPACING SUPPRESSION

MIAMI IPSS FUNCTION BOX ARRANGEMENT

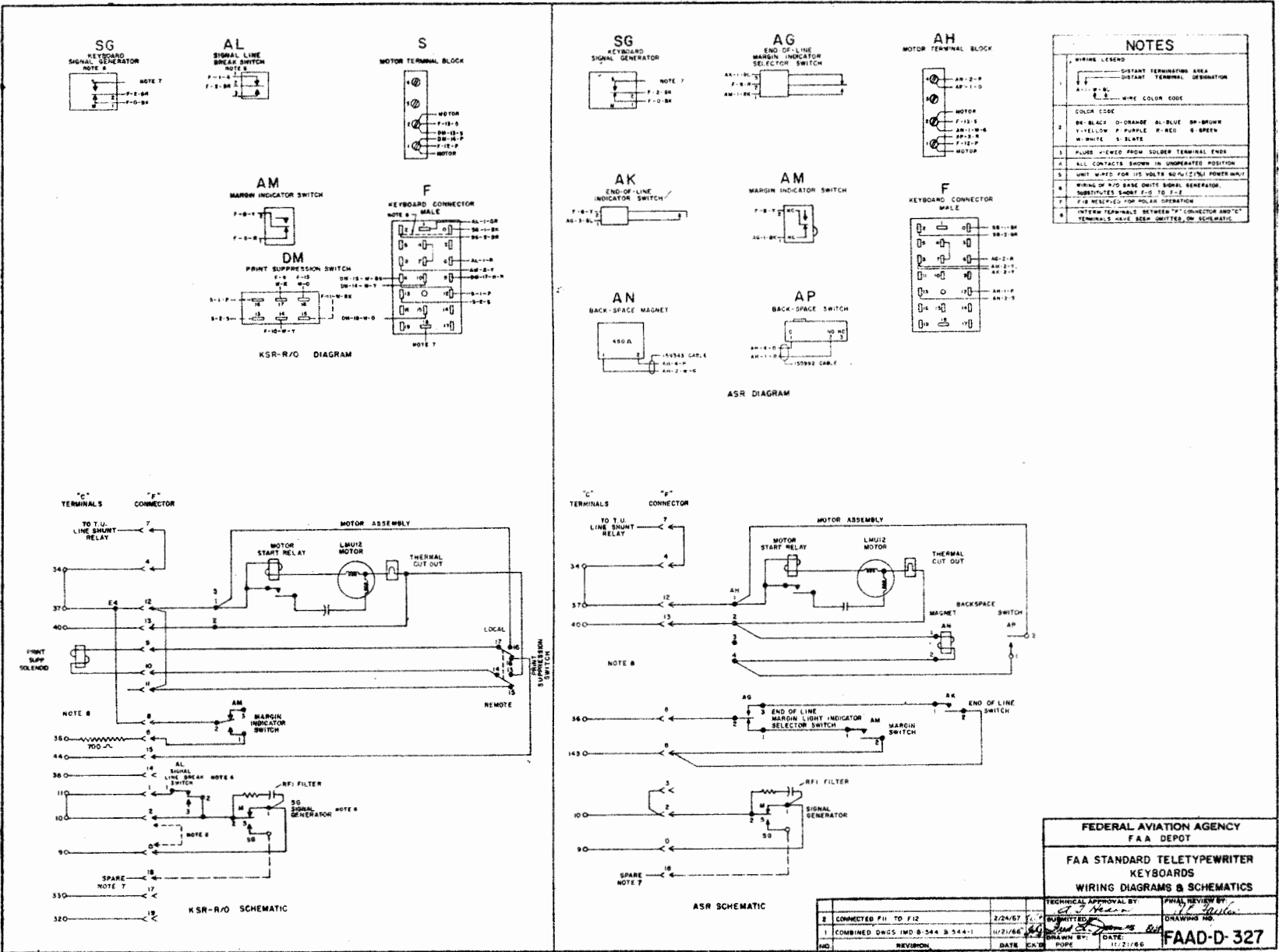
9255 (BDIS 009) answers <<v MIA

9281 (BDIS 110) answers <<v MIA

XXI Area Call
 XXB All Circuit Call
 KI TD Callup

FMIA
 XXB

FIGURE 4-8. KEYBOARDS AND R/O BASE WIRING



Chap. 4

Par. 87

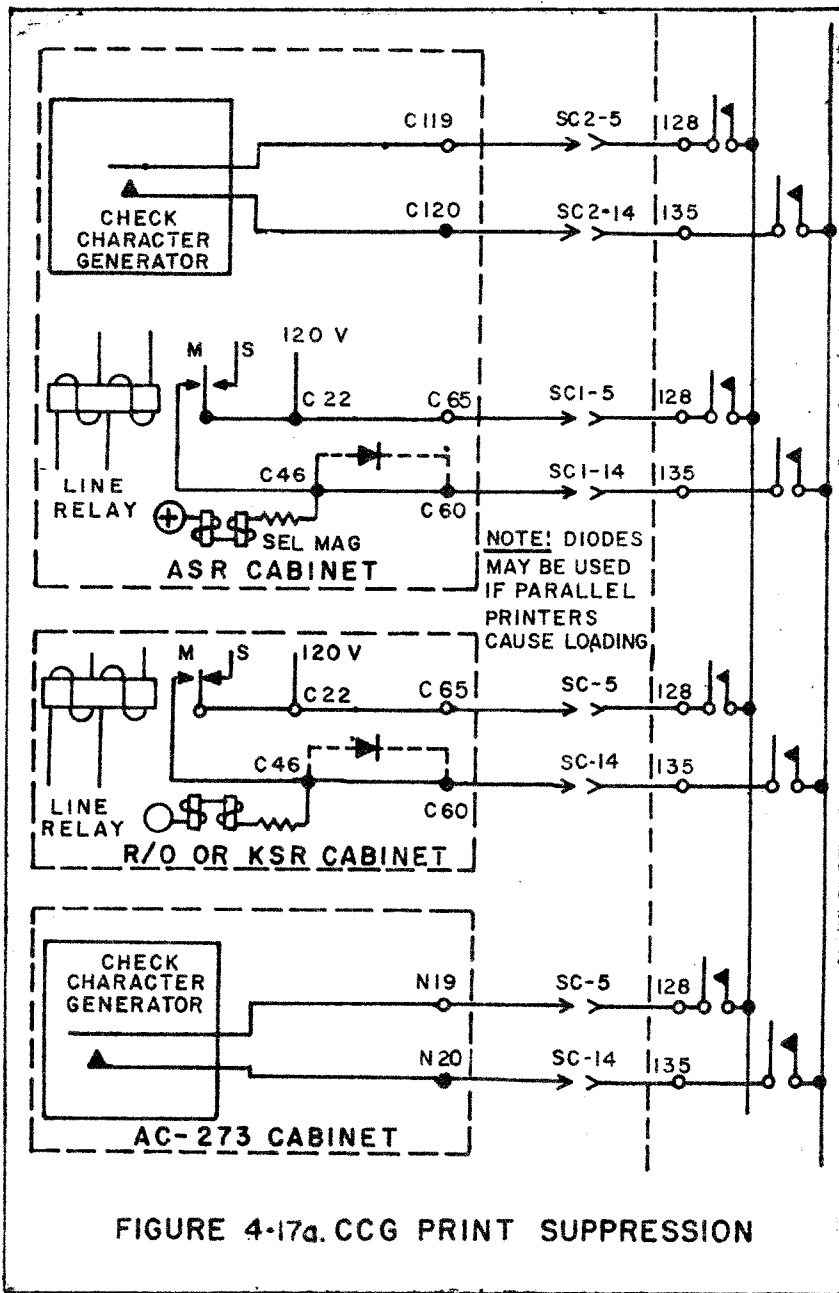


FIGURE 4-17a. CCG PRINT SUPPRESSION

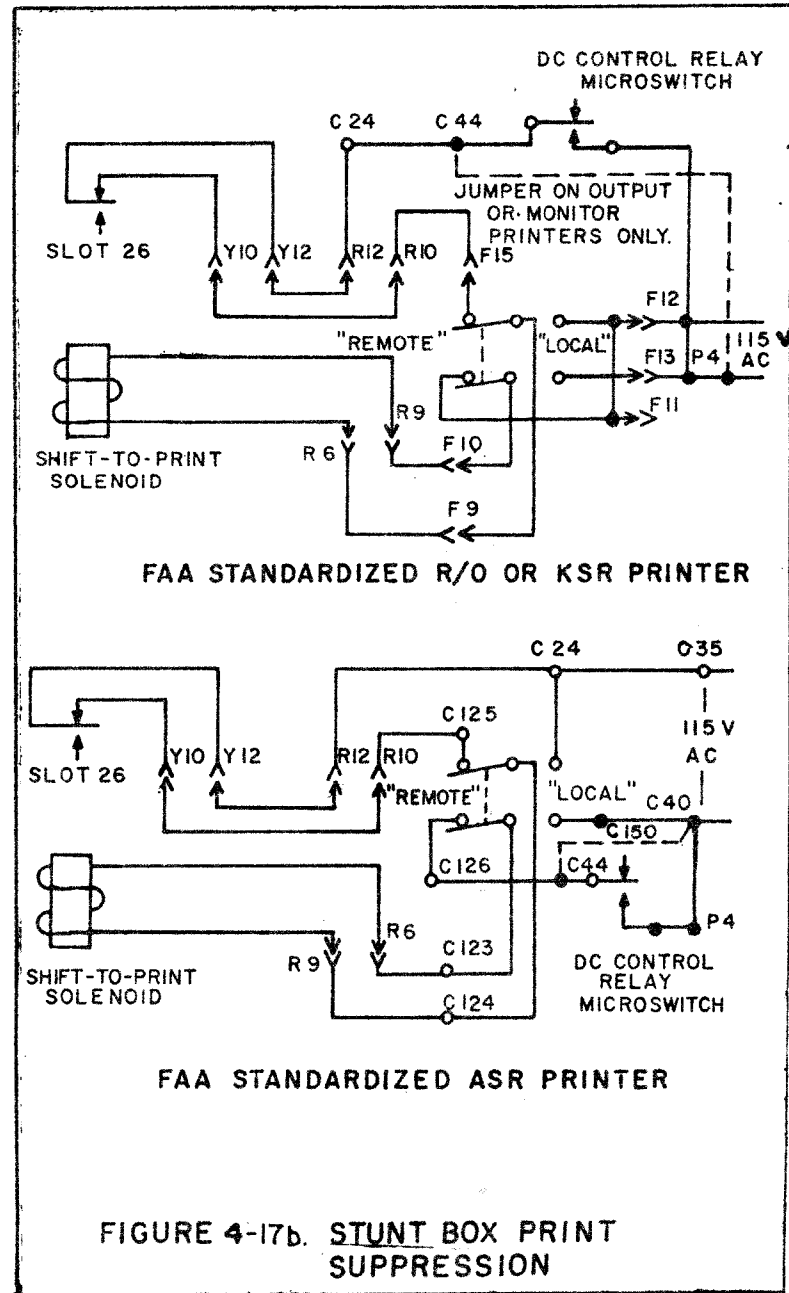


FIGURE 4-17b. STUNT BOX PRINT SUPPRESSION

CHAPTER 5. TRANSMITTING DEVICES

96. TRANSMITTERS, GENERAL. The keyboard, mentioned and illustrated in Chapter 4, is the device that converts manually typed data into the teletypewriter code. This may be accomplished directly to the circuit, in the case of the KSR printer, or via tape perforation and transmission from an ASR set. The latter method saves circuit time and is more accurate because the tape can be edited before transmission. It is generally mandatory that tape transmission be used on all but local circuits. The conversion from perforated tape to electrical pulses requires a sensing of the tape and a sequential transmission of mark or space pulses to the line. The sensing is usually accomplished a character at a time and positions a set of contacts according to the holes in the tape (to mark where there is a hole, to space if there is no hole). A distributor then sequentially connects the contacts to the signal line and ends each rotation by transmitting a stop (mark) pulse. Figure 5-2 is a simplified diagram of a basic transmitter-distributor (TD or XD).

FIGURE 5-1. MODEL 14 TRANSMITTER-DISTRIBUTOR

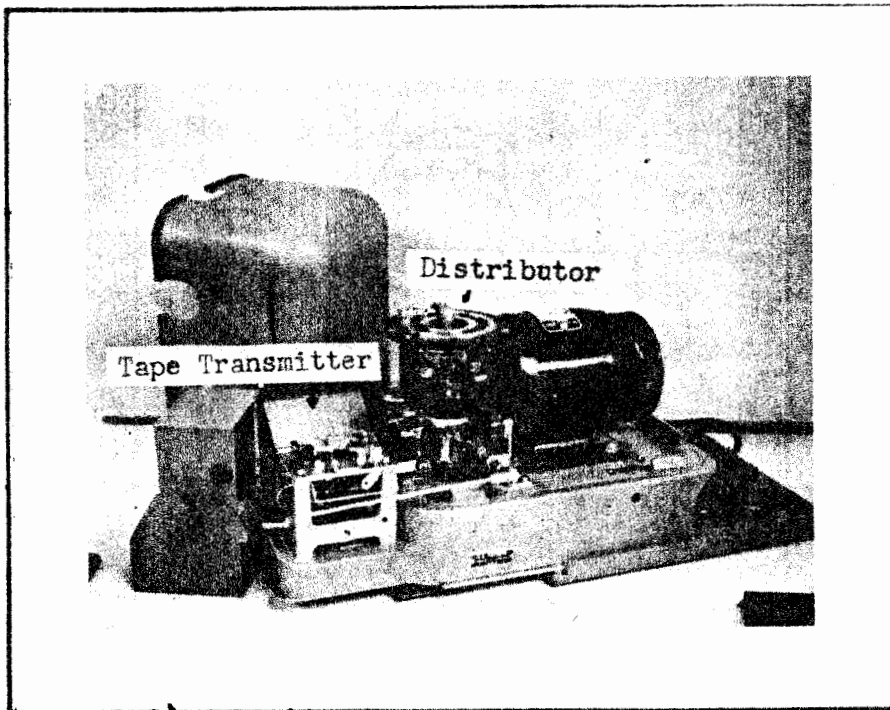
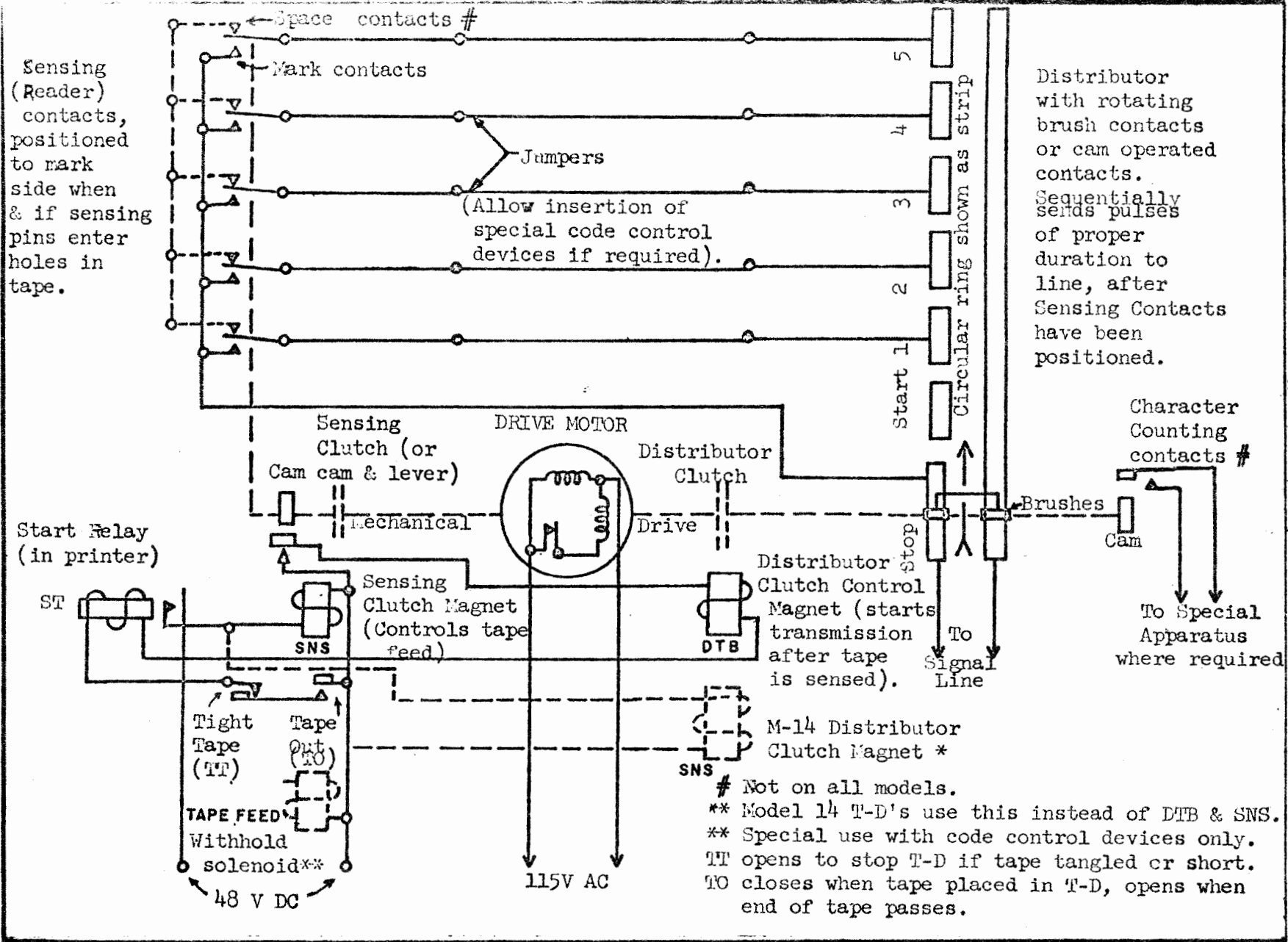


FIGURE 5-2. EXPLANATORY TRANSMITTER-DISTRIBUTOR SCHEMATIC

6170.4
6 May 1971

Par. 96

Chap. 5

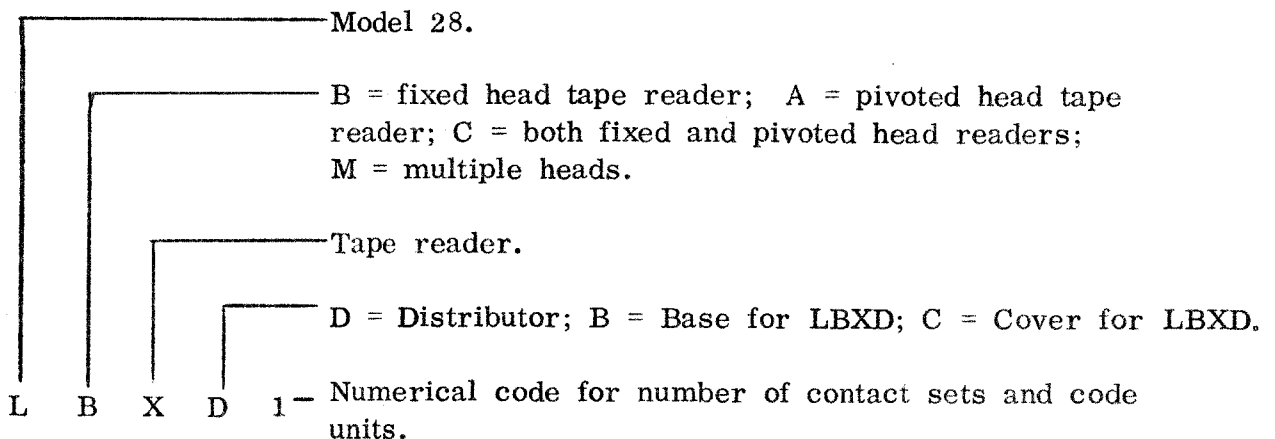


Distributor with rotating brush contacts or cam operated contacts. Sequentially sends pulses of proper duration to line, after Sensing Contacts have been positioned.

Character Counting contacts #
To Special Apparatus where required

Not on all models.
 ** Model 14 T-D's use this instead of DTB & SNS.
 ** Special use with code control devices only.
 TT opens to stop T-D if tape tangled or short.
 TO closes when tape placed in T-D, opens when end of tape passes.

97. MODEL 14 TRANSMITTER-DISTRIBUTOR. The Model 14 transmitter-distributor is a carryover from the earlier line of Model 14 and 15 tele-typewriter apparatus that preceded M-28 equipments. As a result of progressive updating, it is an effective tape transmitter at 100 wpm and limited usage is to be expected. Figure 5-1 shows this TD, while Figure 21 of Appendix 4 shows wiring details. Before installation, it should be ascertained that the unit is modified in accordance with Handbook 6170.1, Chapters 18 (installation of an all-steel clutch) and 19 (installation of a 32-point slip connector).
98. MULTIPLE MODEL 14 TD ASSEMBLIES. Two Model 14 TD's may be installed on an AC-273 cabinet and wired according to Figure 22 of Appendix 4. Although the diagram and Figure 14 of Appendix 4 indicate separate service cords are preferred, wiring via one service cord may be used if both TD's will be used on the same circuit. This also applies if a multiple TD with an alternate gate selection (flip-flop) panel within the AC-273 is to be reinstalled. New assemblies of such configuration shall not be assembled or installed. It is preferred that the panel be mounted in a printer cabinet. Refer to Chapter 8, Accessory Relay Panels, for further information.
- 99.-101. RESERVED.
102. MODEL 28 SERIES TRANSMITTERS. Model 28 transmitters are identified by letter groups containing the letter "X" (from xmtr = transmitter = tape reader). Identifications are assigned on the following basis:



or: LXD = Transmitter-Distributor, (uses single contact, similar to that on keyboard).

 LXDB = Base for LXD.

 LXDC = Cover for LXD.

103. THE LBXD TRANSMITTER-DISTRIBUTOR. The most commonly used TD is the LBXD, see Figure 5-3. The basic mechanical design consists of two shafts, each of which drives a cam assembly. One of the cam assemblies operates a set of contacts that are positioned in accordance with the tape perforations of a character aligned with a set of sensing pins. The second cam assembly sequentially closes a second set of contacts, each of which is in series with one pair of reading contacts. Electro-magnets control clutches to obtain proper synchronizing of reading and transmission. The shafts are driven from a common power source. In the ASR set, this is the same motor used to drive the typing unit, keyboard, and perforator. The nonshaded portions of Figure 5-4 (an excerpt from Figure 4 of Appendix 4) shows LBXD wiring in an ASR set. For other cabinets, the LBXD may be mounted on a separate LBXB (base) with LBXC (cover). The base also mounts an LMU - motor and connectors to mate with cabinet mounted receptacles when the base is slid into place on the cabinet.

FIGURE 5-3. LBXD TRANSMITTER-DISTRIBUTOR ON LBXB BASE

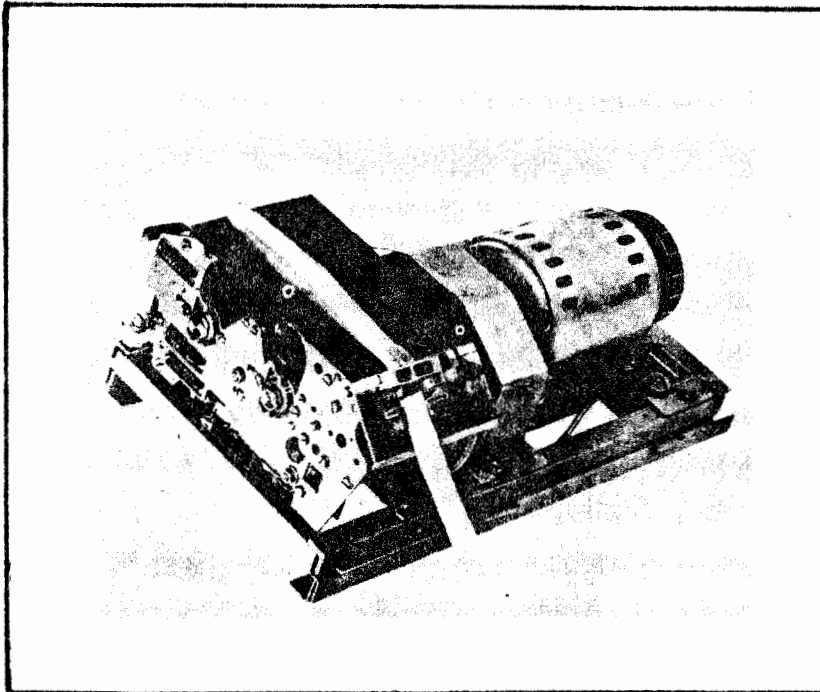


FIGURE 21

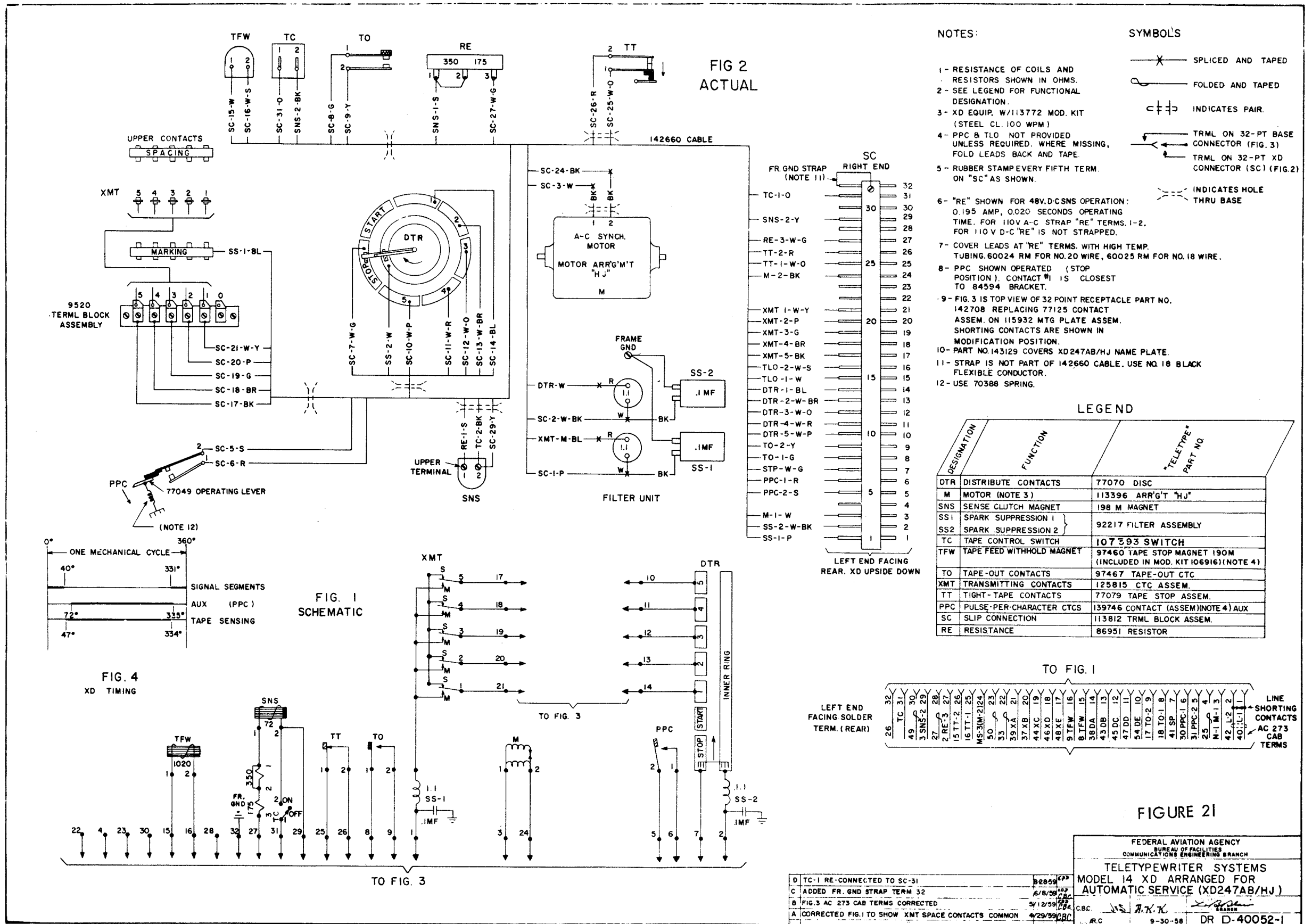
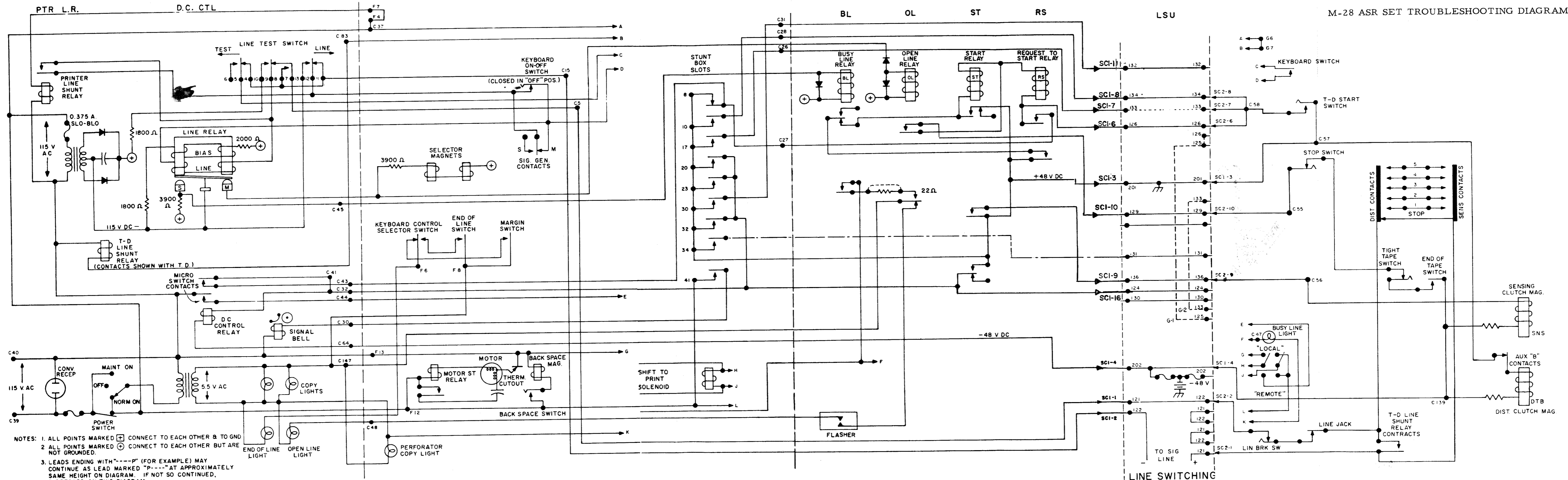


FIGURE 24

M-28 ASR SET TROUBLESHOOTING DIAGRAM



NOTES:
 1. ALL POINTS MARKED ⊕ CONNECT TO EACH OTHER & TO GND
 2. ALL POINTS MARKED ⊕ CONNECT TO EACH OTHER BUT ARE NOT GROUNDED.
 3. LEADS ENDING WITH "----P" (FOR EXAMPLE) MAY CONTINUE AS LEAD MARKED "P----" AT APPROXIMATELY SAME HEIGHT ON DIAGRAM. IF NOT SO CONTINUED, DISREGARD ON THIS DIAGRAM.

ASR LESU AND CABINET

ASR KEYBOARD

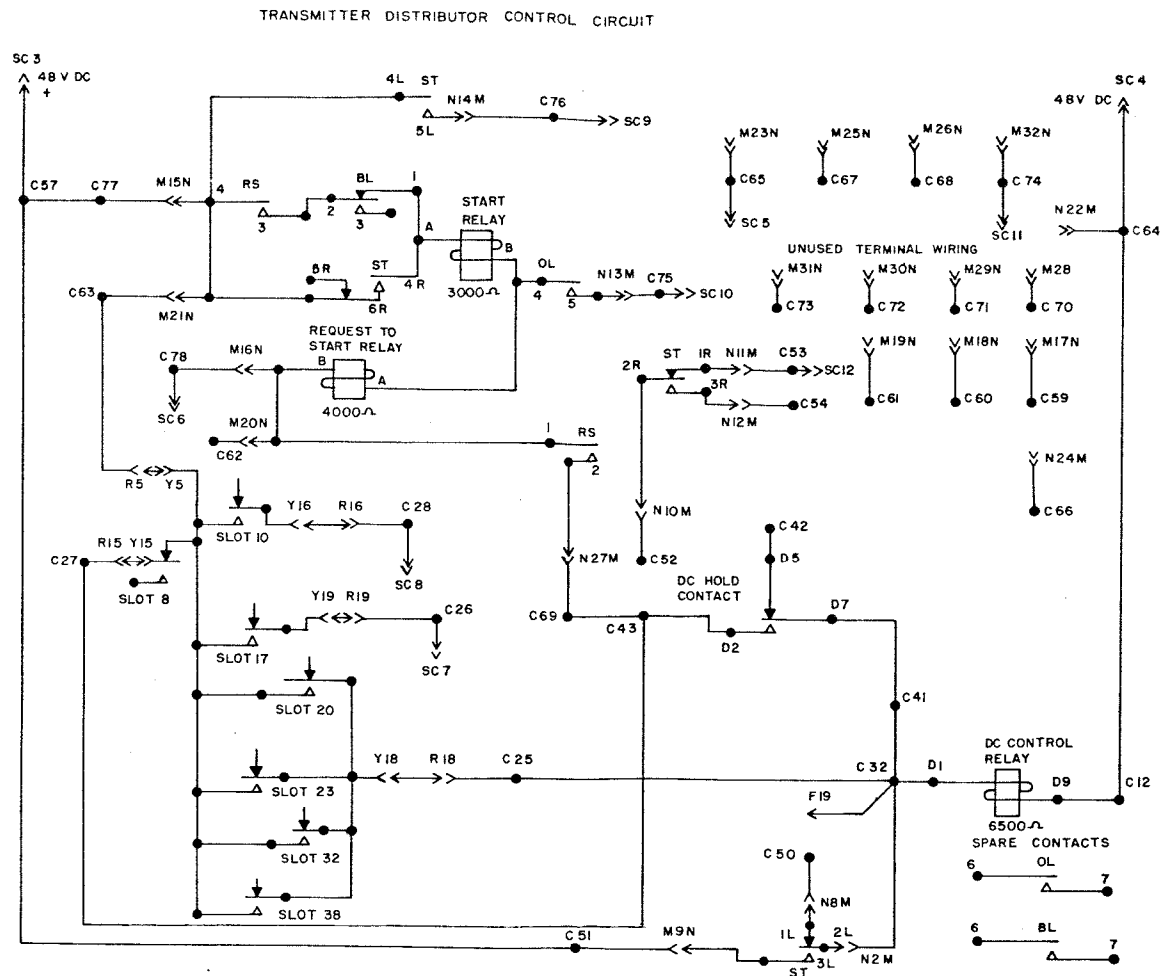
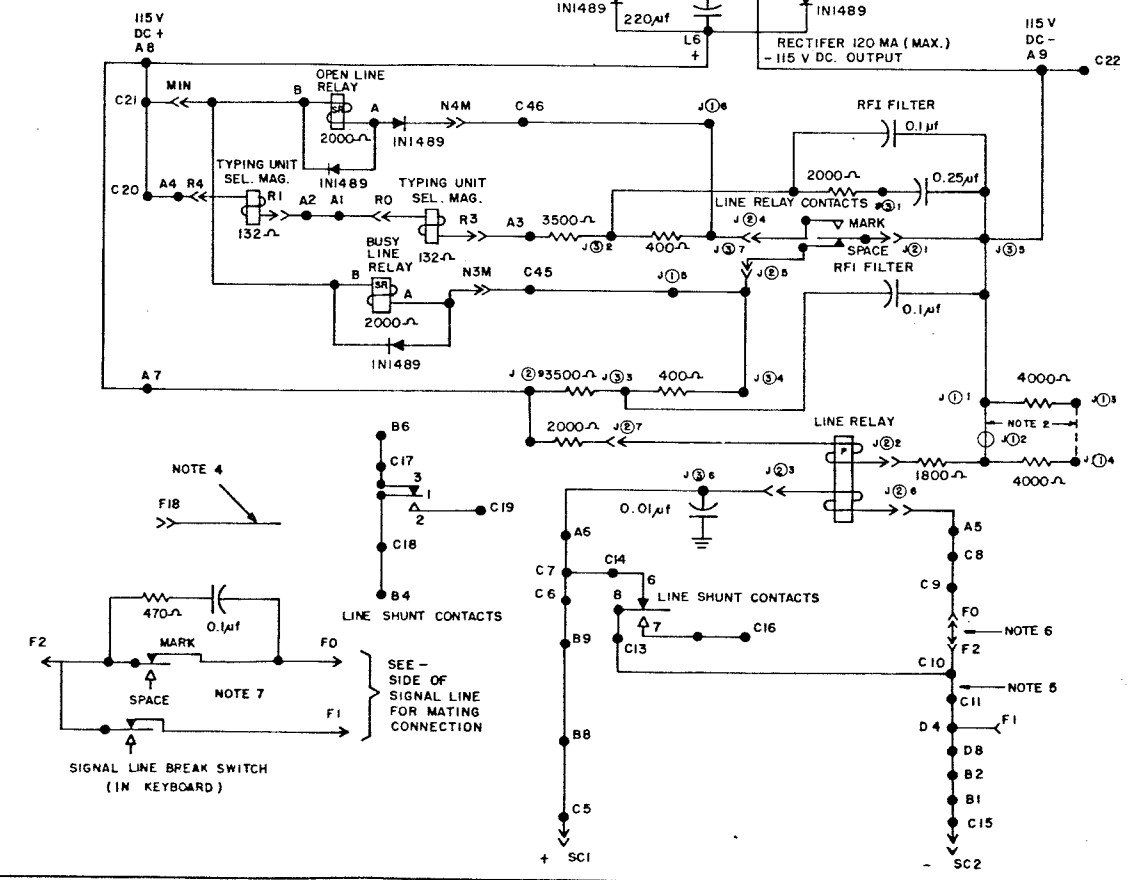
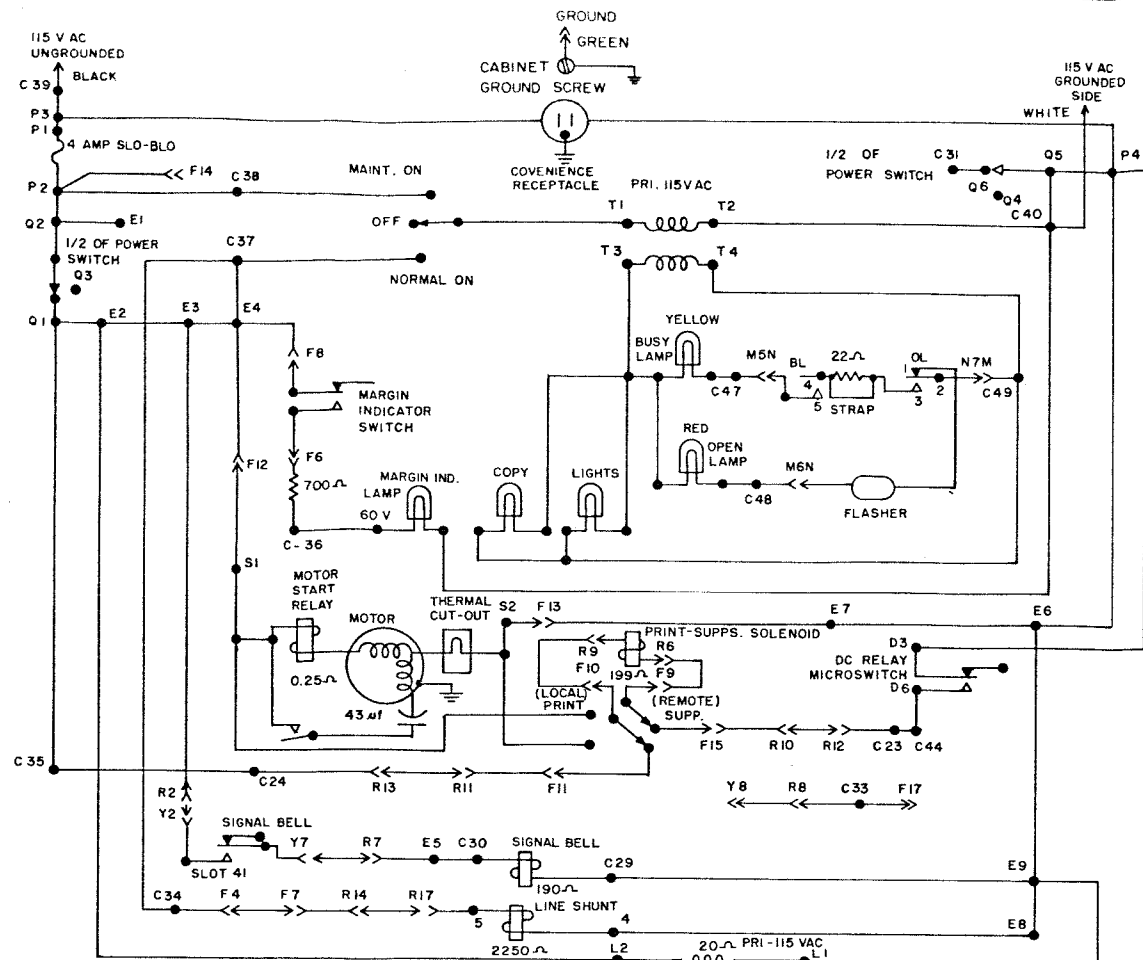
TYPING UNIT

RELAY CONTROL GROUP

LINE SWITCHING UNIT

ASR LBXD

FIGURE 24



- LEGEND
- A - Selector Magnet Terminal Block (LESU)
 - B - Line Test Key Terminals
 - C - Cabinet Terminals
 - D - D.C. Control Relay Block Terminals
 - E - Power Block Terminals (LESU)
 - F - Keyboard Connector
 - J① - Line Relay Terminal Strip
 - J② - Line Relay Terminal
 - J③ - Line Relay Filter Terminals
 - L - Rectifier (120 ma) Terminals
 - N-M) - (TD Relay) Control Device (Connector-Plug Terminals)
 - M-N) - (M-N) (M-N)
 - P - AC Receptacle & Fuse
 - Q - AC Power Switch
 - R - Typing Unit
 - Y - Stunt Box Connector
- Normally open contact or switch
 - Normally closed contact or switch
 - Relay, Solenoid or Magnet
 - Relay - Two Coil Polar
 - Relay - Slow Release

- NOTES
1. All apparatus is shown in unoperated or de-energized position.
 2. Circuits shown for .060 Amp. neutral signal line operation - for .020 Amp. line current, add dashed (---) connections and omit connections marked (⊖).
 3. Unit wired for 115V 60 cps (1 φ) AC power input. Control circuit wired for 48V DC input.
 4. Spare lead from F18 is reserved for polar operation of signal generator.
 5. Line Break Key is shown disabled with strap C10 - C11. To enable the break key, remove C10 - C11 strap.
 6. This strap in receiving-only base connector.
 7. Signal Generator as shown when keyboard is used.

STUNT BOX CONTACTS

| Slot | Function (Circuit) |
|----------------|--------------------|
| 8 | Unlock |
| 10, 17 | XD Start |
| 20, 23, 32, 38 | Print Off Line |
| 41 | Signal Bell |

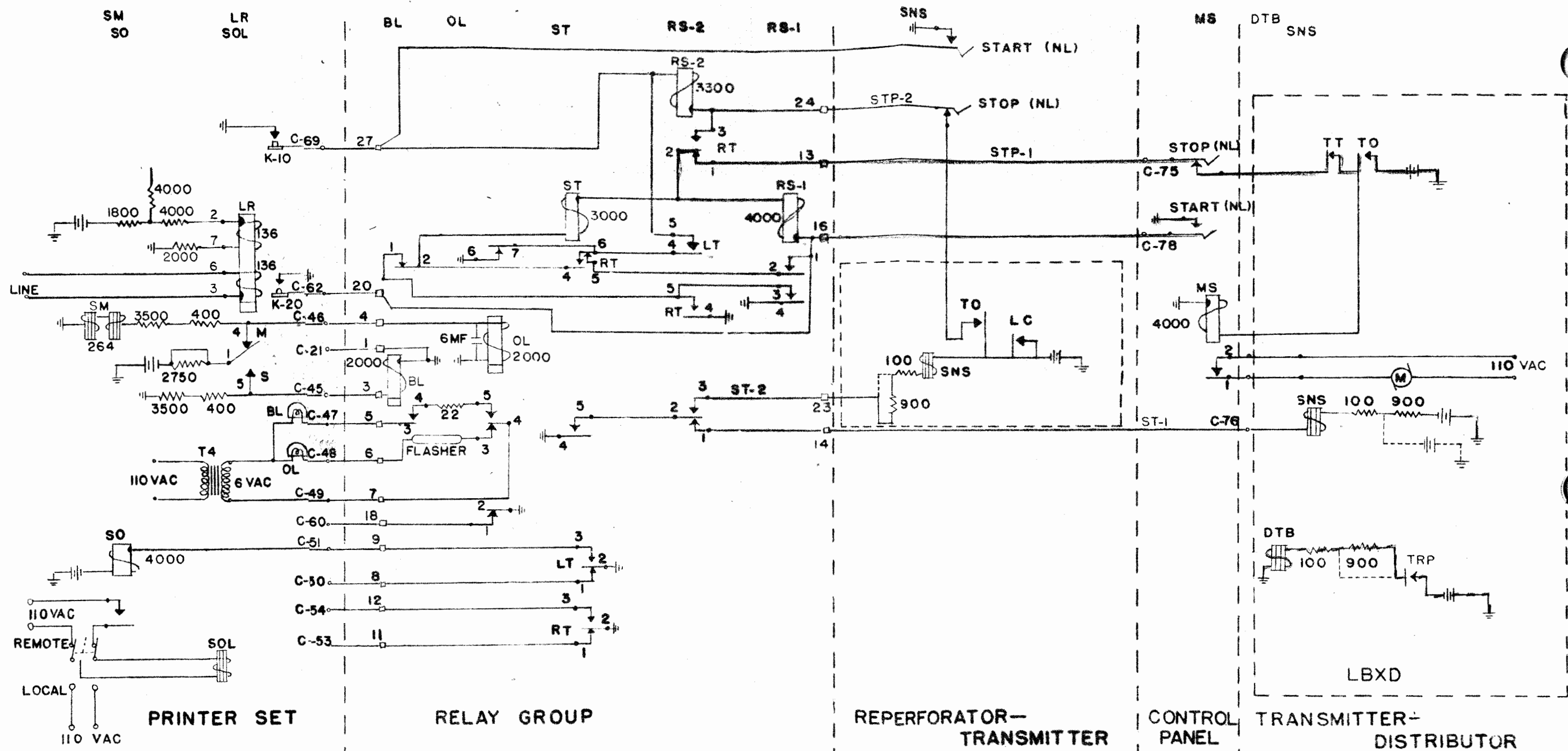
| NO. | REVISION | DATE | CK'D |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------|
| 7 | REMOVED NOTE 8, CHANGED SLOT 38 TO 32, ADDED SLOT 38 | 7-20-65 | MD |
| 6 | ADDED "KSR" TO TITLE | 6-2-65 | MD |
| 5 | CHANGE TERMINAL POINTS | 5-14-65 | MD |
| 4 | ADDED NOTE 8 | 3-22-65 | MD |
| 3 | INTERCHANGED F11 & F15 | 3-10-65 | MD |
| 2 | CORRECTED BL 3 TO 5, ADDED J③ 6 & 7 TERMINALS OMITTED EXCESS 0.1 μf RELEAS CONTACTS SLOT 10 ADDED GND ON MOTOR FRAME CHANGED WIRING C11 μf CAPACITOR TO J③ 3 | 3-8-65 | MD |
| 1 | ADDED DIODE TYPE, B CAPACITOR VALUE MODIFIED LEGEND REGARDING SR & P RELAYS | 2-24-65 | MD |

FEDERAL AVIATION AGENCY
INSTALLATION AND MATERIEL DEPOT

FAA STANDARD
MODEL 28 RO & KSR TELETYPEWRITER
WIRING DIAGRAM

TECHNICAL APPROVAL BY: *Walter J. ...*
SUBMITTED BY: *Walter J. ...*
DRAWN BY: *Clyde Mothey* DATE: 2-9-65

FINAL REVIEW BY: *Ray & Taylor*
DRAWING NO: **IMD-D-361**



NOTES

- (1) GROUND RETURN ILLUSTRATED FOR OPERATIONAL SIMPLIFICATION & DOES NOT REPRESENT FRAME OR PANEL GROUND.
- (2) BATTERY IS 110 VDC.
- (3) RESISTANCE VALUES IN OHMS.
- (4) ALL RELAYS SHOWN DE-ENERGIZED. (EXCEPT LINE RELAY)

LEGEND

- (1) BL-BUSY LINE RELAY.
- (2) OL-OPEN LINE RELAY.
- (3) LR-LINE RELAY.
- (4) SO-DC CONTROL RELAY.
- (5) SOL-OFF-LINE STUNT-SHIFT SOLENOID.
- (6) ST-START RELAY.
- (7) RS-1-REQUEST START RELAY. (XD)
- (8) RS-2-REQUEST START RELAY. (RT)

- (9) SM-SELECTOR MAGNET.
- (10) DTB-DISTRIBUTOR CLUTCH MAGNET.
- (11) SNS-SENSING CLUTCH MAGNET.
- (12) MS-MOTOR START RELAY.
- (13) TO-TAPE OUT CONTACTS.
- (14) TT-TIGHT TAPE CONTACTS.
- (15) LC-LAST CHARACTER CONTACTS.
- (16) TRP-CLUTCH TRIP CONTACTS.

- (17) NL-NON LOCKING PUSH BUTTON.
- (18) RT-RIGHT HAND SIDE CONTACTS.
- (19) LT-LEFT HAND SIDE CONTACTS.

FIG. _____