83B3 TELETYPEWRITER SELECTIVE CALLING SYSTEM
GENERAL DESCRIPTION

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1. INTRODUCTION

1.01 General

1.011 This section covers the description and operating principles of the 83B3 Teletypewriter Selective Calling System, which replaces the 83B2 system.

1.012 The service provided by the 83B3 system is, in general, similar to that furnished by the 83B2 system. The basic selection functions and method of assigning call directing codes (CDCs) and transmitter start codes (TSCs) have not been changed from those of the 83B2 system. This makes it possible to add 83B3 non-control stations to an existing 83B2 line and to use 83B2 non-control stations on the same line with an 83B3 control station.

1.013 The 83B3 system is designed for use with 28-type teletypewriter apparatus, operating at 60, 75, or 100 words per minute, at locations where 60-cycle, 110-volt AC power is available.

1.02 Summary of Changes

1.021 The following lists the major improvements and new features of the 83B3 system:

(1) Automatic connection of the home station is provided when sending. This eliminates the necessity for inserting the home CDC as part of the address in an originated tape.

(2) Improvements are provided for torn tape operation. If a remnant of tape remains in the transmitter after a message has been sent, a visual alarm is given, so the attendant will remove the tape. If the attendant fails to remove the tape and release the alarm, a no-traffic response (the character V) is generated on receipt of the next TSC, whereupon the transmitter start circuit polls the next station in order. An optional arrangement is to not give the alarm when the tape remnant remains after the message has been sent. In this case the remnant (consisting of LTRS) is picked up and sent to the line on receipt of the next TSC, whereupon the transmitter start circuit times out after 2 seconds, sends the end-of-message (EOM) combination FIGS H LTRS, followed by the character M, to the line and polls the next station in order.

(3) If a called station fails to return an answerback (also the character V) within 2 seconds, an intercept receiving-only typing reperforator (ROTR) is connected automatically at the control station and an M answerback is sent from that station. This restarts the transmitter, which then sends the message to the intercept machine. Receipt of M (instead of the usual V) at the sending station indicates that the message is being sent to intercept. The intercept function is also provided when no CDCs precede the end-of-address (EOA) combination, thus guarding against lost messages.

(4) Pushbutton calling is provided for use with continuous tape operation. After the EOM combination of a message has been sent, the send "bid", provided by the tape of the next message remaining in the transmitter, is maintained only if an address for that message has been registered by the operation of at least one pushbutton.

(5) The pushbutton calling circuit is so arranged that when a message is addressed to a station on a foreign line, the CDC for the relay reperforator-transmitter (RT) is inserted automatically ahead of the first off-line CDC.

(6) The idle line alarm, formerly 10 seconds, is reduced to 2 seconds for tape sending. For keyboard sending, it is increased to 20 seconds. For business machine sending, it may be either 2 or 20 seconds, depending upon the installation. For business machine receiving, it is 20 seconds.

(7) An interface with business machines is provided, permitting use on an 83B3 line of a customer-furnished machine. A sequence selector is furnished to control the sending and receiving by the business machine.

(8) An interface with the 1A High Speed Data Selective Calling System is provided. This arrangement is similar to the interconnection of two 83B3 lines, except that one of the lines is a 1A line.

(9) When there is no traffic on the line, the transmitter start circuit pauses for 2 seconds between sending successive transmitter start codes, thus reducing wear on the stepping selector considerably.

(10) The design of the stuntbox contact assembly has been improved over that used in early 83B2 systems. The contacts are more reliable and less subject to chatter. Where practicable, front contacts are now used rather than rear contacts. Also, the use of transfer contacts is avoided where possible. In the 83B2 system, difficulties were experienced with the adjustment of the universal contacts, due to special timing requirements of the circuit. These contacts have now been changed so they are more reliable and the 83B3 circuit design is such that the contacts will operate satisfactorily with a standard adjustment which can be made without the use of the 1A TTY test set.

(11) New equipment arrangements are provided for certain stations. The 7-foot equipment cabinet, formerly used at the control station when all the apparatus could not be mounted in the base of the teletypewriter cabinet, has been replaced by a cabinet similar in external contour to that used to mount 28-type reperforator-transmitters. This cabinet is arranged with two pull-out relay racks capable of mounting a sequence selector, a reperforator-transmitter control unit, a transmitter start unit, and a pushbutton calling unit, as well as the necessary power supply. It is lined with soundproof material to reduce the noise caused by operation of the sequence selector and the stepping selectors of the circuits. If a pushbutton calling unit is provided at an ASR control station, it and the transmitter start unit may be mounted in a smaller apparatus cabinet instead of in the standard apparatus cabinet referred to above. The keys and lamps of the pushbutton calling circuit are mounted in a cabinet located above the right end of the teletypewriter cabinet, in order to be convenient to the station attendant. This cabinet is so arranged that it does not interfere with opening the teletypewriter cabinet for maintenance. The same arrangement is provided for mounting the skip keys and lamps of the transmitter start circuit at a control station, or these keys may be mounted in the shelf of the apparatus cabinet, if it is provided. Both pushbutton calling keys and skip keys may be mounted adjacent to each other above the right end of the teletypewriter cabinet, if desired.

2. METHOD OF OPERATION

2.01 General

2.011 The 83B3 system operates on a half duplex basis, with 40 automatic sending and receiving (ASR), keyboard sending and receiving (KSR) or receiving only (RO) 28-type teletypewriter stations connected to the line. A control station (one of the sending and receiving stations) controls the flow of traffic on the line. The transmitters at both the control and the non-control sending and receiving stations are polled for traffic, in a set order, by means of two-character transmitter start codes (TSCs). These codes are sent by a transmitter start circuit located at the control station.

2.012 An ASR station with a perforated tape in its transmitter has the transmitter started when it is polled, otherwise the station returns a no-traffic response (the character V) to the transmitter start circuit, which then polls the next station in order. When a transmitter which has made a "bid" to send is started, the message is sent to one or more stations on the line, in accordance with two-character call directing codes (CDCs) perforated at the head of the tape or generated by a pushbutton calling unit. After sending a CDC, the transmitter stops and awaits an answerback (the character V) from the called station. On receipt of the answerback, the transmitter restarts, sending the next CDC (multiple address message) or the end of address (EOA) combination (CAR RET LINE FEED LTRS) followed by the message text. The text is followed by the end of message (EOM) combination (FIGS H LTRS). This is recognized by the transmitter start circuit, which then polls the next station in order.

2.013 At a KSR station (normally there is little keyboard sending on the line), the attendant operates a non-locking key to place a "bid" to send. When the station is polled, an alarm is given. This is an indication to the attendant to start sending. The attendant retires the alarm, sends the first CDC, awaits the answerback, sends the next CDC, etc, until all have been sent. After the last answerback, the attendant sends the EOA, message text, and EOM. This latter combination is recognized by the transmitter start circuit, which then polls the next station in order.

2.014 In the idle condition, the teletypewriter at an ASR, KSR, or RO station is normally in a select, non-print condition, so that it can respond to CDCs sent over the line. When a station receives its CDC, it is shifted to the print condition, and generates a V answerback, which is typed on the copy. It, thereafter, copies everything sent over the line, including CDCs for other stations (in the case of multiple address messages), the answerbacks from such stations, and the EOA, text and EOM sent by the sending station. On receiving the EOA, the station is shifted to the non-select condition; and on receiving the EOM, it is shifted to the select, non-print idle condition. When a station on the line which has not received its CDC (and is, therefore, in the select, non-print condition) receives EOA, it is shifted to the non-select condition, so that it will not be selected in error by a combination in the message text which corresponds to its CDC. On receiving EOM, the station is shifted to the select, non-print idle condition.

2.015 In addition to teletypewriter stations, a manual or automatic relay station may be connected to an 83B3 line. The former employs a receiving-only typing reperforator (ROTR) as a receiver and a transmitter-distributor (TD) as a sender, the tape received by the ROTR of one line being torn off and inserted in the TD of another line as a manual relay. An automatic relay station employs a reperforator-transmitter (RT) to send and receive, a given reperforator receiving on one line and the associated transmitter sending the received tape on another line. Normally, the relay is to another 83B3 line, and 28-type RTs are used. However, if the relay is to a 1A High Speed Data Selective Calling System, low-high and high-low RTs, furnished as part of the 1A system, are used. The reperforator and the transmitter connected to the 83B3 line operate at 100 words per minute, while the associated transmitter and reperforator operate at the higher speed of the 1A line. A sequence selector (SS) is used at both manual and automatic relay stations, to receive the CDCs and cut on the ROTR or the RT and to receive the TSCs and control the TD or the transmitter of the RT.

2.016 Means are also available to connect a customer-owned business machine to an 83B3 line. This type of station uses a sequence selector to control receiving and sending by the business machine, and functions as another line station, that is, it is connected to receive and polled to send in the same manner as an ASR station. An interface provides for the orderly exchange of control logic with the business machine. An ASR station is normally provided at a business machine station, for handling teletypewriter traffic.

2.017 A pushbutton calling circuit is available for use at an ASR station or at a manual relay station, for sending CDCs to the line preceding the text of messages which do not have the CDCs perforated in the tape. This circuit includes a maximum of 40 pushbuttons, to each of which a CDC may be assigned. Prior to inserting the text tape in the transmitter, the non-locking pushbuttons corresponding to the desired CDCs are operated. When the TSC for the station is received, the CDCs corresponding to the previously operated pushbuttons are sent to the line, followed by the EOA. The text tape, with the EOM perforated at its end, is then sent to the line.

2.02 Stuntbox Control

2.021 The control of both sending and receiving at a station is by means of the teletypewriter stuntbox (or the sequence selector stuntbox in those cases where the receiving unit does not include a stuntbox, such as a reperforator-transmitter or a business machine). The stuntbox is part of the typing unit and is driven by the selector unit, monitoring the line signals continuously.

2.022 The stuntbox used at an 83B3 ASR friction-feed station is shown in Fig. 1A, and includes three types of contacts, which operate on single characters or on a sequence of two or three characters. One type of contact operates momentarily, a second operates and latches until the next character is received, while the third operates and latches under control of a latch release bail which, in turn, operates on receipt of EOM (FIGS H LTRS). The stuntbox includes 42 positions (or slots), some of which are reserved for standard teletypewriter functions, such as FIGS and LTRS shift, CAR RET, LINE FEED, HOR TAB, VERT TAB, FORM FEED, and BELL. Other slots are reserved for functions of the 83B3 system, such as EOM and EOA. Five

groups of two slots each are reserved for two-character CDCs. Three of these groups are equipped with contacts in the slots, since it is expected not more than three CDCs will be required at most stations. If the remaining two groups are to be used, contacts and associated parts must be added in the reserved locations. No function bars are provided in the CDC slots, as these bars vary from station to station. Each stuntbox must be equipped locally in accordance with the specified codes. Two slots are reserved for the two-character TSC used at the station. This code normally uses M as the second character, and a function bar coded for M is provided in the second slot, but the first slot must be equipped in accordance with the specified TSC. If more than 20 sending stations are connected to the line, the TSC at certain stations uses G as the second character. A function bar coded for G must be provided in the second slot at those stations. Two special contacts should be noted. These are the Y-M/V contact in slot 19, which is controlled by the reception of Y followed by either M or V, and the M-V/LTRS contact in slot 37, which is closed by the reception of the characters M or V and remains closed until the reception of any character other than M, V, or LTRS. The function bars in slots 19 and 38 are coded for either M or V by breaking off the proper tine. At a station which uses G as the second character of its TSC, the function bar in slot 38 must be coded for M or V or G by breaking off two tines.

2.023 The stuntbox is also arranged to mechanically shift into the select condition (so it can respond to CDCs and its TSC) on receipt of the EOM (FIGS H LTRS) and into the non-select condition (so it cannot respond to CDCs or its TSC) on receipt of the EOA (CAR RET LINE FEED). Also, the typing unit is shifted into the print condition by operation of a stunt shift control magnet, and into the non-print condition by release of this magnet. This magnet is controlled by the 83B3 station control circuit.

2.03 Message Preparation

2.031 Figs. 1B and 1C illustrate the control characters which must prefix and terminate the message text. Each length of tape may contain one or several messages, but only one message is sent on receipt of a TSC, even though the tape may include several messages. Fig. 1B represents a message sent to two stations on the same line as the sending station, while Fig. 1C represents a message sent to one station on the home line and relayed to two stations on a foreign line.

2.032 The required sequence of control characters in a message tape is as follows:

(1) Codes valid on the home line should be perforated first, i.e., AA and AB in Fig. 1B and AA and AY in Fig. 1C. Each two-character CDC must be followed by a single LTRS.

(2) When the message is directed to stations on another line, the cross-office code (for the machine which is to relay the message, in this case AY) should be the last of the home line CDCs, followed by the CDCs valid on the foreign line (i.e., BA and BB).

(3) EOA (CR LF LTRS) must follow the last address code and precede the message text.

(4) EOM (FIGS H LTRS) must terminate the message text.

(5) When two or more messages are included in a single tape, at least three LTRS should follow the EOM before the first CDC for the following message.

(6) At least six LTRS should follow the last EOM in the tape. The exact number is not important; the only requirement is that the EOM be fully transmitted before the tape-out contacts open.

2.04 Sequence of Functions, Single Line Operation

2.041 The sequence of functions for the message shown in Fig. 1B, to stations on the same line as the sending station, is as follows:

(1) After the message has been perforated and torn from the perforator, it is inserted in the transmitter, and the TD control lever is operated to RUN. This places a send "bid" on the line.

(2) On receipt of the TSC for this station, the contact in slot 11 (Fig. 1A) of the stuntbox closes. This results in the operation of the

stunt shift control magnet, shifting the typing unit to the print condition, to connect the sending station. The M (or G) of the TSC also operates the contact in slot 37, which results in the operation of the transmitter-distributor clutch magnet, to start the message tape.

(3) Any LTRS at the start of the tape are sent, since the contact in slot 37 remains closed on LTRS, but when the first A of the first CDC is read, the contact opens. This causes the TD clutch magnet to release, but not until the following A and LTRS (the complete CDC) have been sent.

(4) Assuming the called station is connected, the contacts in slots 20 and 21 at that station close. This causes the stunt shift control magnet at that station to operate, so the typing unit will copy any further signals on the line, and also causes the operation of circuitry at that station to send a V answerback on the line.

(5) When transmission ceases (item (3) above), the transmitter start circuit at the control station starts to time. If, due to trouble, the called station is not connected, it does not send its answerback. Within 2 seconds, the intercept ROTR at the control station (if provided) is connected, and the transmitter start circuit sends an M answerback.

(6) On receipt of either the M or V answerback, the contact in slot 37, opened in (3) above, recloses, reoperates the TD clutch magnet, and starts sending the next CDC (AB in Fig. 1B). Again the transmitter stops after sending the CDC, awaits the V answerback, and restarts. This continues until EOA is sent. The contact in slot 37 opens as before on CR, but receipt of CR LF closes the contact in slot 15, to short out the contact in slot 37. The TD, therefore, continues to send the text of the message.

(7) On receipt of EOA, the stuntboxes at all stations on the line, whether selected or not, are shifted to the non-select condition, so selection cannot occur during the transmission of text.

(8) At the end of the message, EOM (FIGS H LTRS) is sent from the tape, opening contacts in slots 31 and 8 (connected in parallel) and closing contacts in slot 7. The former releases relays which have been locked until the EOM — stopping the TD, while the latter (at the control station) causes the transmitter start circuit to resume polling. Also, receipt of EOM causes all stuntboxes on the line to shift to the select condition.

(9) If another message follows in the tape, it will be picked up the next time the station receives its TSC; and the above procedure will be repeated. When the last message is sent, a remnant of LTRS usually remains in the transmitter. On receipt of the next TSC for this station, these LTRS will be picked up and sent to the line. Since the tape contains no EOM, the transmitter start circuit will time out in 2 seconds after the line goes marking, send EOM, and poll the next station in order.

(10) If single message tapes are always sent, an option is available whereby when EOM is sent, a visual alarm is given to signal the attendant to remove the remnant of tape. If this is not done by the time the next TSC is received, the station returns a no-traffic V, whereupon the next station is immediately polled without the tape remnant being sent to the line.

(11) If an open line condition or "break" (double blank) occurs while the station is sending, the contact in slot 36 closes, energizing an alarm relay which stops the transmitter and gives a visual alarm. Also, if transmission stops without an EOM being sent, the control station times out in 2 seconds and sends EOM to restore the line to normal, giving a visual alarm at the originating station to mark the incomplete message.

2.05 Sequence of Functions, Multiple Line Operation

2.051 The delivery of a message, directed via manual or automatic relay, to stations on a foreign line as well as on the home line is shown in Fig. 1C. It should be noted that the codes used on the two lines are not duplicated.

(1) The first CDC, the V answerback, and the second (cross-office) CDC, AY, are sent and received as described in 2.041.

(2) The relay station which responds to the cross-office code is served by a sequence selector. The circuit associated with this selec-

tor is arranged to send a single LTRS to the relay machine. Operation of the receive auxiliary contacts of the relay machine on receipt of LTRS causes the V answerback to be sent; however, this V is not perforated in the tape copy to be relayed.

(3) When the sending station registers the Y of the cross-office CDC (such CDCs must always have Y as one character; it is recommended that it be the second character) followed by the V answerback from the relay station, the Y/V contact in slot 19 operates (it would also operate on YM in case of a response from intercept). This combination, YV or YM, is known as the end-of-line code, since no more CDCs for the home line follow it.

(4) Operation of the Y/V contact causes the TD to resume sending, not stopping for any additional CDCs (the off-line CDCs) preceding the EOA.

(5) The text is, therefore, received at stations on the home line to which it is addressed, including the relay RT (in the case of automatic relay), preceded by the off-line CDCs. The RT transmitter is associated with the foreign line and upon receipt of its TSC (the reperforator having received EOA) sends the text in the normal manner, in accordance with the CDCs received from the originating line.

(6) In the case of manual relay, the relay machine is an ROTR instead of an RT. In this case, the tape received at the relay point is removed from the ROTR and sent from a TD associated with the foreign line.

3. STATION ASSEMBLIES

3.01 System Arrangements

3.011 Five basic system arrangements that are commonly used with the 83B3 system are illustrated in Fig. 2. These arrangements include single, two, and three line systems, with manual and automatic relaying between lines. The table in Fig. 2 refers to other figures which give more detail as to the teletypewriter and control circuitry required at each station. One station on each line must be selected as the control station, i.e., equipped with the transmitter start circuit and the intercept ROTR. This latter unit is normally furnished, but may be omitted for economic reasons. In this case, a visual alarm is given at the calling station if no answerback is received from the called station, instead of the intercept ROTR being connected. On multiple line systems (arranged for either automatic or manual relay) the relay station should be designated the control station.

3.012 The detailed station figures refer to a typing perforator. This is a unit which types the copy on the tape as it is being perforated for transmission. This unit is optional with the usual non-typing perforator, and may be furnished with any ASR teletypewriter.

3.013 The pushbutton calling circuit and intercept ROTR are optional features; however, their use will improve circuit efficiency, reduce operating time and simplify resending delayed traffic.

3.014 The number of sending stations assigned to each line should be based on traffic loads and economic considerations. Although provision is made for 38 transmitter start codes, the use of more than 20 per line is not recommended.

3.02 Control and Non-control ASR Stations

3.021 Figs. 3 and 4 illustrate the equipment and mounting arrangements for a non-control station and a control station on either a single line or multiple line system.

3.022 The station control circuit in Fig. 3A mounts in the base of the teletypewriter cabinet, while the station control key and lamp panel mounts in the perforator-transmitter base at the right of the keyboard. This panel is arranged as shown in Fig. 16A. The connection from the station control circuit to the terminal strip of the ASR cabinet is by means of cords which plug onto connectors in the control circuit. Practically all connections between units in the 83B3 system are by means of similar cords. These cords have spade connectors at one end in cases where they connect to terminal strips; in other cases they terminate in plugs or sockets at each end. Optional wiring within the various equipment units is, in general, effected by opening or closing circuits by means of screw terminal

strips. If an auxiliary ROTR is provided in Fig. 3A, it mounts in the upper left cavity of the ASR cabinet. Power for the station control circuit is obtained from the 48-volt rectifier of the teletypewriter electrical service unit.

3.023 The station control circuit, the pushbutton calling circuit and the 48-volt rectifier in Fig. 3B mount in the base of the ASR cabinet, while the pushbutton key and lamp panel circuit, which includes the station control key and lamps, arranged as shown in Fig. 16D, mounts in a cabinet located above the right end of the ASR cabinet, convenient to the station attendant. The key cabinet is so arranged that it does not interfere with opening the ASR cabinet for maintenance. The 28-type distributor used with the pushbutton calling circuit mounts in the upper left cavity of the ASR cabinet, below the location assigned to the ROTR. The 48-volt rectifier is required to supply power to both the station control circuit and the pushbutton calling circuit, the capacity of the 48-volt rectifier of the teletypewriter electrical service unit not being adequate for this purpose.

3.024 The station control circuit, the transmitter start circuit and the 48-volt rectifier in Fig. 4A mount in the base of the ASR cabinet, while the skip key and lamp panel circuit, arranged as shown in Fig. 16C, mounts in a cabinet located above the right end of the ASR cabinet. The station control key panel mounts in the perforator-transmitter base in this case, while the intercept ROTR mounts in the upper left cavity of the ASR cabinet.

3.025 When both a pushbutton calling circuit and a transmitter start circuit are provided at an ASR station, there is not room for both of them in the base of the ASR cabinet. As shown in Fig. 4B, only the station control circuit mounts in the base in this case, while the ROTR and the 28-type distributor mount in the upper left cavity of the cabinet. The pushbutton calling circuit, the transmitter start circuit, and the power distribution circuit, which includes 48-volt and 130-volt rectifiers, mount in an apparatus cabinet similar in contour to the 28 RT apparatus cabinet shown in Fig. 10 and finished to match that cabinet. The pushbutton key and lamp panel circuit, including the station control key and lamps and the skip key and lamp panel circuit, shown in Fig. 16D and 16C, both mount in a cabinet located above the right end of the ASR cabinet. If desired, the skip key and lamp panel circuit may be mounted in the shelf of the apparatus cabinet instead of above the ASR cabinet. The power control panel, shown in Fig. 17A, mounts above the shelf of the apparatus cabinet.

3.026 The arrangement described in 3.025 provides extra mounting space in the apparatus cabinet. This space is required at automatic or manual tape relay control stations, but may not be needed at an ASR control station. As an option, a smaller apparatus cabinet, approximately 26″ wide, 11″ deep, and 24″ high, finished to match the ASR cabinet, may be employed. This cabinet mounts only the pushbutton calling circuit and the transmitter start circuit, the associated 48-volt rectifier being mounted in the base of the ASR cabinet. Power is furnished to the apparatus cabinet by means of a "Y" cord, which connects between the terminal strip of the ASR cabinet and the two circuits mounted in the apparatus cabinet.

3.03 KSR and RO Stations

3.031 KSR and RO stations are always non-control stations and the KSR station never uses pushbutton calling. The same station control circuit is used at a KSR station as is used at an ASR station, mounted in the base of the teletypewriter cabinet. The station control key panel mounts in the keyboard base at the right of the keyboard. This panel is arranged as shown in Fig. 16B.

3.032 A station control circuit which does not provide for transmitter-distributor or keyboard control is used at an RO station, mounted in the base of the teletypewriter cabinet. No control keys or lamps are required in this case, the station control circuit merely shifting the RO machine to the print condition on receipt of its CDC, shifting it to the non-select condition on receipt of EOA, and shifting it to the select, non-print idle condition on receipt of EOM. The control circuit also generates the V answerback on receipt of the CDC for the station.

3.04 Automatic Relay Control Stations

3.041 Figs. 5 and 6 illustrate the arrangement at automatic relay stations interconnecting three lines and two lines, respectively.

3.042 An interconnecting control circuit, with an associated sequence selector, is furnished at a relay station in place of the station control circuit normally associated with a teletypewriter. The sequence selector includes a stuntbox which serves the same purpose as the stuntbox of the teletypewriter and a distributor connected to a transmitter start circuit to send TSCs, as the relay station is normally the control station. The interconnecting control circuit is, in effect, two control circuits, designated A and B, respectively. It is capable of controlling four RTs, for interconnecting three lines, or two RTs and one teletypewriter (equipped with a non-selective stuntbox) if it is desired to relay to only one line.

3.043 An RT control circuit is used with the interconnecting control circuit to provide the connection to the RT. This circuit also includes A and B sections, so it can control four RTs when relaying to two foreign lines. The circuit controls the reperforator of the RT receiving on the line (relaying to the foreign line) and the transmitter of the RT sending on the line (relaying from the foreign line). If the circuit is used to relay to only one line, one-half is not used.

3.044 As shown in Fig. 5, the interconnecting control circuit, the RT control circuit, the sequence selector, the transmitter start circuit, the power distribution circuit and the control keys and lamps (Figs. 16C, 17A and 17B) are all mounted in one apparatus cabinet. This cabinet is similar in contour to the 28 RT cabinet, shown in Fig. 10, and is arranged with two pull-out relay racks, on which are mounted the equipment units and the sequence selector, the latter on spring mounts. The cabinet is normally located adjacent to the associated 28 RT cabinet, although it may be standing free. The keys and lamps controlling the RTs (Fig. 17C) are mounted in the panel above the shelf of the 28 RT cabinet.

3.045 As shown in Fig. 6, the same equipment arrangements as described in 3.044 are used, for interconnecting two lines, except a pushbutton calling circuit is also shown mounted in the cabinet. In this case, the A section of the interconnecting control circuit is shown controlling an ASR teletypewriter equipped for pushbutton calling, as only two RTs are required. The A section is used for this purpose as it can be connected to a pushbutton calling circuit, while the B section cannot be so connected. The B section of the circuit is associated with one section of the RT control circuit, to control the reperforator receiving on the line and the transmitter (of the second RT) sending to the line. The sequence selector associated with the interconnecting control circuit provides the selective feature; therefore, the typing unit of the teletypewriter connected to the A section of the control circuit is a non-selective unit. The key and lamp panel of the pushbutton calling circuit associated with the ASR is mounted above the right side of the ASR cabinet, for the convenience of the station attendant.

3.046 As shown in Fig. 6, the RTs which relay messages between the two lines are associated with an RT control circuit. If line B is a 1A High Speed Data Selective Calling System, the RTs are not 28-type machines, as indicated in the figure, but are units which receive high speed signals on the 1A line and resend the received tape at 100 words per minute to the 83B3 line. These units also receive at 100 words per minute from the 83B3 line and resend the received tape at high speed to the 1A line. The 1A system furnishes the cords which connect to the TA, T1A, and LA connectors of the line A apparatus cabinet shown in Fig. 6. Means are provided in the 1A system so that a message received by the reperforator connected to the 83B3 line is not retransmitted to the 1A line until it has been completely received; otherwise, the relatively low speed reception on the 83B3 line would hobble the transmission on the high speed 1A line.

3.05 Manual Tape Relay Control Station

3.051 Fig. 7 illustrates the equipment required to provide manual relay of messages between separate lines. As shown, it uses the A section of the interconnecting control circuit to connect to the ROTR receiving on the line and to the TD sending on the line. This figure also shows a pushbutton calling circuit associated with the sending TD. The B section of the interconnecting control circuit is indicated as controlling a non-selective ASR station.

3.052 The equipment arrangements for Fig. 7 are the same as for Fig. 6 except no RT control circuit is required. This circuit is, therefore, omitted from the apparatus cabinet.

3.06 Business Machine Control and Non-control Stations

3.061 Figs. 8 and 9 illustrate the arrangement at business machine control and non-control stations, respectively. Whenever possible, the control station should be at a business machine location, if such stations are connected to the line.

3.062 An interconnecting control circuit, with an associated sequence selector, is furnished at a business machine station, to act as the interface with the machine. This circuit controls the connection of the machine to the line on receipt of the proper CDC or TSC, to receive or to send. The business machine may send or receive on a parallel or serial basis. In the former case, code reading contacts are furnished with the sequence selector, to repeat incoming signals on a parallel basis to the business machine, while a distributor (normally furnished with the sequence selector, for use of the transmitter start circuit at a control station) is also used to convert the business machine sending from parallel to serial. Other leads are provided in the interface to repeat serial signals between the interconnecting control circuit and the business machine, if signals of this type are used.

3.063 The business machine uses only the B section of the interconnecting control circuit; therefore, the A section may be used to control a 28 ASR station, usually provided for sending to and receiving from other teletypewriter stations. This ASR teletypewriter is equipped with a non-selective stuntbox.

3.064 As shown in Fig. 8, the interconnecting control circuit, the sequence selector, the transmitter start circuit, the pushbutton calling circuit (if provided), and the power distribution circuit are all mounted in one apparatus cabinet. The pushbutton key and lamp panel circuit (including the station control key and lamps) and the skip key and lamp panel circuit both mount in a cabinet located above the right end of the ASR cabinet, although the skip keys and lamps may be mounted in the shelf of the apparatus cabinet, if desired.

3.065 As shown in Fig. 9, the equipment arrangements for a non-control business machine station are quite similar to those for a control station, the only difference being the omission of the transmitter start circuit. It should be noted that code reading contacts are required in the sequence selector only if the business machine receives on a parallel basis, and that a distributor is required in the sequence selector only if the business machine sends on a parallel basis or if a pushbutton calling circuit is furnished.

4. ASSIGNMENT OF CALL DIRECTING CODES

4.01 General

4.011 Twenty-one of the 26 alphabetics may be used for station CDCs, as shown in Fig. 11C. H and Y are reserved for special CDCs, as discussed below, leaving 19 characters for general use. T, O, M, V, and G are not used.

4.012 Although random selection among the 19 available alphabetics can be used to assign mnemonic codes, a preferred method is to make the initial assignment compatible with pushbutton selection. This uses a common first letter for all stations on a line and limits the number of second letters to 13, as covered in 4.054.

4.02 Relay Cross-Office Codes

4.021 The letter Y is normally used as the second letter of the cross-office code assigned to connect an RT for automatic relay or an ROTR for manual relay of messages between two lines. As covered in 2.051 (3), this is required to perform the YV function in the stuntbox, to permit sending CDCs for the foreign line without stopping the sending transmitter. There are no restrictions on the choice of the first letter of the cross-office code. Receipt of YV at stations on the home line, which have not been selected, prevents those stations from generating a V answerback if they are selected in error, due to a hit on the line or an error in tape preparation.

4.03 Business Machine Codes

4.031 The letter H is used as the first letter of a business machine code. There are no restrictions on the choice of a second letter. The H indicates to the transmitter start circuit that a business machine is to be connected, so the start circuit can be arranged to perform special control functions.

4.04 Group Codes

4.041 A CDC may be assigned to connect a group or all of the stations on a line. Only one station of the group is arranged to return the V answerback on receipt of the CDC. Answerback is prevented at the other stations by means of a wiring option or by the use of a clip in the stuntbox, to prevent closure of the contact associated with the CDC. The loss of positive connect assurance from the stations in the group which do not respond with an answerback should be carefully considered before assigning a group code.

4.05 Pushbutton Calling

4.051 Pushbuttons may be provided to generate CDCs automatically. Automatic generation of the cross-office code is provided ahead of the first foreign line code selected. Therefore, use of this optional equipment simplifies the preparation of relayed messages and the resending of intercepted messages. The codes sent by the pushbuttons are somewhat restricted, as discussed in 4.054, but since a designation strip is associated with each key position (Fig. 16D) a mnemonic code different from the code actually sent can be associated with each key, if desired. However, this arrangement may lead to confusion and should be carefully considered before it is employed.

4.052 Forty positions on a 50-point rotary selector, assigned to pushbutton keys, are used to generate CDCs. Seven positions, not associated with keys, are used to generate cross-office codes (with Y as a second character). The selection of one or more non-locking keys conditions the circuit to send the associated CDC, followed by LTRS. Operation of a key lights an associated lamp. After one or more keys are operated, and on reception of the TSC for the station, the selected CDCs, followed by the EOA, are automatically sent. The station control circuit operates in the same manner as if the CDCs were perforated in the tape. Following the sending of EOA, the selected station lamps are extinguished and the message tape, which should end in EOM, is sent to the line.

4.053 A non-locking cancel key (CA) is provided to permit restoring the circuit to normal in case a pushbutton is operated in error. To be effective, this key must be operated before receipt of the station TSC.

4.054 Any one of the available 19 alphabetics can be used for the first letter of a given CDC. However, the choice at a given station is limited to four letters. Each key can be wired to send any one of the four letters selected. Thirteen letters, repeated three times with the first letter repeated a fourth time, are used for the second letter of the 40 CDCs which can be sent by means of pushbuttons. One example of the strapping required for the generation of the first letter of the CDCs is shown in Fig. 11A. The use of A, B, and C (as illustrated) is an arbitrary choice of first letters. The available fourth choice first letter can be used with any key position, although it is shown as H (business machine first letter) associated with the fortieth pushbutton in Fig. 11A.

4.055 The alphabetics used as second letters for all 40 pushbutton keys are also shown in Fig. 11A, together with the selector positions at which these letters are generated and the key numbers associated with the selector positions. Fig. 11B indicates CDCs which might be sent from pushbuttons on a single line with 40 stations.

4.056 The letter Y is used as a second letter at selected positions which separate the groups of 13 second letters and also after the eighth letter of each group, in order to insert cross-office codes, if desired, at these points. The first letter of these codes can, of course, be any of the four chosen as first position letters. The windings of relays BY and CY, indicated in Fig. 11A, are strapped to the key positions assigned to stations on foreign lines. The contacts of one of these relays are strapped to the selector position ahead of each group of 13 foreign line key positions assumed in Fig. 11A. Therefore, the selection of any foreign line CDC will automatically prefix the first of these CDCs (which are non-valid on the originating line) with the proper cross-office CDC.

4.057 As discussed in 2.032, the home line CDCs must be sent first, followed by the cross-office CDC for the first foreign line, the CDCs valid on that line, the cross-office CDC for the

second foreign line, etc. This makes it necessary to strap the pushbutton keys to generate different CDCs at the stations of each line. Charts are provided to give examples of typical CDC assignments at four commonly used relay systems as follows:

(1) Automatic Relay — Three Line Delta — Fig. 12

(2) Automatic or Manual Relay — Three Line Tandem — Fig. 13

(3) Manual Relay — Fig. 14

(4) Automatic Relay — Two Line — Fig. 15

Examples of typical messages which might be sent over these systems are shown in each figure.

5. ASSIGNMENT OF TRANSMITTER START CODES

5.01 Polling Patterns

5.011 Forty positions on a 50-point rotary selector are used to generate TSCs. The remaining 10 positions are unused. Five different polling patterns are provided, patterns A and B for a maximum of 10 stations, patterns C and D for a maximum of 20 stations, and pattern E for a maximum of 38 stations. In pattern A (Fig. 16C) a SKIP key is associated with each of the 10 stations (max.), and each station is polled four times during one rotation of the selector. In pattern B, two SKIP keys are associated with each of the 10 stations and each station is polled four times during one rotation of the selector. By operating one of the SKIP keys associated with a given station, that station will be skipped on every second polling round. This may be desirable for stations which generate only a small amount of traffic.

5.012 Patterns C (Fig. 16C) and D are similar to patterns A and B except one or two SKIP keys are associated with each of the 20 stations (max.), and each station is polled twice during one rotation of the selector. In pattern E, a SKIP key is associated with each of the 38 stations and each station is polled once during one rotation of the selector. Positions 15 and 35 of the selector cannot be used in this case, as discussed in 5.013.

5.013 In patterns A and B, one of ten letters is used as the first character of the TSC and the letter M is used as the second character. In patterns C and D, one of twenty letters is used as the first character of the TSC and the letter M is used as the second character. In pattern E, 19 of the TSCs are the same as in pattern C or D (TSC 15 is not used) while the second 19 TSCs repeat the 19 first characters but use the letter G as the second character. TSCs 15 and 35 cannot be used in pattern E, as these TSCs use the letter G as the first character. Since G is used to start the sending transmitter, if there are more than 20 stations on the line as covered in 2.022, it cannot be used as the first character of a TSC when it is used as a second character.

5.014 The lamp associated with each SKIP key lights as the TSC is being generated and remains lighted if the polled station originates a message. Twenty SKIP keys are always provided, and when pattern A is used, keys 11 to 20 are not assigned. When more than 20 stations are connected to the line, those stations with G as the second character of their TSC must recognize G in the TSC and in the M-V/LTRS functions of the stuntbox, as discussed in 2.022.

5.015 The polling pattern which uses the smallest number of unassigned positions should always be selected. This reduces selector wear and, more importantly, speeds the pickup of messages. Since the number of line stations is usually less than the 10 or 20 key positions, unused keys may be assigned, by multiple coding of the first letter of the TSC, to those stations which it is desired to poll more frequently. Multiple coding is accomplished by breaking off tines of the function bar in slot 10 of the stuntbox so that the bar will go into selection on the desired characters. As shown in Table A of Fig. 16, key positions 1 and 3 can be assigned to one station by arranging that station to respond to either A or E as the first character of its TSC, while key positions 3, 9, 13 and 19 can be assigned to one station by arranging that station to respond to E, S, D or F as the first character of its TSC.

5.02 Slow Polling

5.021 A slow polling feature is provided to reduce wear on the selector caused by continuous stepping during an idle period, when no traffic is being originated. The circuit determines

when the selector has made a complete rotation (through all 50 positions) without a message being originated. When this occurs, a 2-second delay is inserted between successive polls. When a message is next originated, the circuit reverts to normal polling, i.e., no delay between successive polls. This prevails until another complete selector rotation without traffic origination is encountered. When the circuit is in the slow polling condition, momentary operation of a non-locking key (AR) at the control station also causes the circuit to revert to normal polling.

5.022 The above arrangement delays the pickup of the first message made available during an idle circuit condition, the exact amount depending upon the position of the selector with respect to the station which makes the bid to send. This delay can be minimized by arranging the TSC assignment to use the smallest number of selector positions per round, i.e., to use patterns A or B instead of C or D when there are 10 or less stations on the line. This is because the 2-second delay occurs between every step of the selector, whether associated with a station or not.

5.03 Double Polling

5.031 Double polling of stations may be provided as an option. This option is useful to provide circuit assurance or to provide deferred sending at certain stations on the line. For circuit assurance, which requires some additional line time, each station on the line is arranged to send the second time it is polled, by means of a wiring option at the station. The first time it is polled the station returns a no-traffic response, indicating that it has received the TSC and that the circuit between the control station and the outlying station is capable of transmission. On receipt of the no-traffic response, the station is again polled. It then returns a second no-traffic response or starts to send. Additional line time is consumed in sending two TSCs instead of one and in receiving the first no-traffic response.

5.032 The deferred sending option is useful only when some of the stations on the line are arranged to send the first time they are polled and others are arranged to send the second time they are polled. In effect, this provides deferred sending at those stations which send only the second time they are polled. Assume a line with the transmitter start circuit sending polling pattern C or D. During the first round of polling, each station is polled in the usual manner. However, during the second round, each station is polled twice. Assume non-control stations 1, 2 and 3 arranged to send on the first poll and stations 4, 5 and 6 arranged to send on the second poll, and that each station has traffic to send. When the first round of polling occurs, stations 1, 2 and 3 will each send one message. When stations 4, 5 and 6 are polled, they will not send, as they are arranged to send on the second poll. When the second round of polling starts, stations 1, 2 and 3 will each send a second message. When station 4 is polled, it will not respond to the first poll, but since it is polled a second time before the selector steps, it will send its message on receipt of that poll. Likewise, stations 5 and 6 will have an opportunity to send on this second round of polling, each when it is polled for the second time.

5.033 If only single polling is provided but a station on the line is arranged to send only on the second poll, it may never have a chance to send, as the sending of traffic on the line cancels the record of the first poll at such a station. Assume only single polling on the above line. Again, stations 1, 2 and 3 send on the first round of polling, but stations 4, 5 and 6 do not, since they are polled only once. If the second round of polling is also single polling, stations 1, 2 and 3 send a second time, but sending by station 1 cancels the record of the first poll at stations 4, 5 and 6. Therefore, when they are polled (once) on the second round, they cannot send. As long as station 1, 2 or 3 (any station arranged for single polling) has traffic to send, stations 4, 5 and 6 (any station arranged for double polling) never get a chance to send. Therefore, if any station on a line is arranged to send only on receipt of the second TSC, double polling should be provided.

6. OTHER SERVICE FEATURES

6.01 Intercept Option

6.011 The transmitter start circuit (located at the control station) is arranged to connect an intercept ROTR when a called station fails to return a V answerback within 2 (or 20) seconds. In this case, the transmitter start circuit gener-

ates an M answerback to restart the sending transmitter, and gives audible and visual alarms, to alert the control station attendant.

6.012 If EOA is received without a preceding CDC, the intercept ROTR is connected, thus guarding against lost messages. A locking (MON) key is provided for manual connection of the ROTR to the line, to read all line signals. The intercept machine can also be connected by an assigned CDC, if the stuntbox at the station is so arranged.

6.013 If, for economic reasons, no intercept ROTR is provided at the control station, the intercept function is disabled. In this case, an alarm is given at the calling station in about 2 (or 20) seconds if the control station does not recognize an answerback from the called station.

6.014 Provision of an intercept ROTR permits sending a multiple address message even if one of the addresses is temporarily out of service, and permits storage at the control station of all delayed traffic.

6.02 Cut-on of Non-selective ASR

6.021 When an ASR station is sending, the typing unit is normally shifted to the print condition automatically, upon receipt of the station TSC, as described in 2.041(2). This makes it unnecessary to perforate the home station CDC in the original tape. However, when a non-selective ASR is used, as shown in Figs. 6 through 9, this feature is not available, since the ASR employs a simpler (non-selective) stuntbox. Therefore, when preparing a tape at this type of station, the home CDC should be the first one perforated in the tape.

6.03 Multiple Message Tapes with Pushbutton Calling

6.031 As mentioned in 1.021(4), pushbutton calling may be used with continuous tape operation. While the text of a message is being sent, the pushbutton(s) for the next message in the tape should be operated. This maintains a send "bid" on the line when the EOM for the first message is sent, and on receipt of the next TSC, the second message is sent. If no pushbutton is operated before the EOM of the first message is sent, the tape stops on EOM, and a visual alarm is given. If the alarm is not retired, a no-traffic response is generated on receipt of the next TSC. If the pushbutton(s) for the next message in the tape are operated and the alarm retired, the message is sent on receipt of the next TSC.

6.032 If the alarm is retired without operating a pushbutton (this should not be done), the message is picked up (without addresses) on receipt of the next TSC and sent, three characters at a time, with an M answerback from intercept or a V answerback from a station connected in error after each group of three characters, until the first CAR RET LINE FEED (which is interpreted at EOA) is reached, after which it is sent continuously until EOM is reached.

6.033 A locking key (CT) is provided for use if continuous tape with CDCs perforated at the head of each message is used. With this key operated, a message is sent in the normal manner on receipt of a TSC, the next message is sent on receipt of the second TSC, etc.

6.04 Duplicate Coding

6.041 The messages shown in Figs. 1C, 12, 13, 14 and 15 are all illustrations of non-duplicate coding, that is, no codes used on one line are duplicated on another line of the same system. Another arrangement is to duplicate codes on different lines of the system. In this case, for example, a two-line message is coded with the CDCs for the home line, including the cross-office CDC, after which EOA is inserted, followed by the CDCs for the foreign line and a second EOA, text and EOM.

6.042 After the home line CDCs, including the cross-office CDC, have been sent and the answerbacks received, the first EOA is sent. This shifts all home line stuntboxes to non-select, and the CDCs for the foreign line, the second EOA and the rest of the tape are sent without stopping. If any of the foreign line codes duplicate non-selected home line codes, those stations are not selected since they are in the non-select mode.

6.043 The tape in the foreign line transmitter includes only the codes for that line, fol-

lowed by the second EOA, text and EOM and is sent in the usual manner upon receipt of its TSC.

6.05 Reperforator-Transmitter Cut-on

6.051 The reperforator which receives the home line message for retransmission to a foreign line and the transmitter (of another RT) which sends the foreign line message to the home line are controlled by an interconnecting control circuit and an associated reperforator-transmitter control circuit. The reperforator is held in a local closed circuit during the idle condition, and when the CDC for the reperforator is received by the sequence selector of the interconnecting control circuit, the local dummy is opened momentarily, sending LTRS to the reperforator.

6.052 On receipt of LTRS, the auxiliary contact of the reperforator closes, causing the V answerback to be sent to the sending station. This V is not perforated in the RT tape since the reperforator is still in the local dummy, not connected to the line. On receipt of the answerback, the sending station sends steadily, as covered in 2.051(4). If CAR RET LINE FEED follows the RT cut-on code (duplicate coding), receipt of this by the sequence selector switches the RT from the local dummy to the line circuit, with the CDC following LINE FEED the first thing perforated in the tape following the initial LTRS.

6.053 In the case of non-duplicate coding, where the first foreign line CDC follows the RT cut-on code immediately, the Y/V contact of the sequence selector is used to switch the RT from the local dummy to the line circuit. In this case, the CDC following the RT cut-on code is the first thing perforated in the tape following the initial LTRS.

6.06 Break

6.061 The BREAK key of the ASR or KSR teletypewriter at a sending station is in series with the keyboard signal generator and transmitter signal generator in the usual manner. However, these contacts are normally short-circuited, the short being removed only when the station is in a sending condition. Therefore it is not possible for a station to send a "break" while it is receiving.

6.062 If the line goes open for at least two characters (double blank) while an ASR teletypewriter or RT is sending, contacts in the stunt-box of the teletypewriter or sequence selector close to energize an alarm relay. This relay releases the distributor clutch release magnet, stopping transmission.

6.063 If the line goes open while a KSR station is sending, the keyboard lockbar switch short-circuits the keyboard signal generator, stopping transmission.

6.07 Timing of V and LTRS Generators and Transmitter Start Delay

6.071 The V answerback sent by a station control circuit consists of a timed open, generated by a relay circuit. This time varies, depending upon the speed of the line signals (60, 75, 100 words per minute). A speed switch is provided to adjust the circuit for the proper timing.

6.072 The TD at an ASR station is conditioned to stop when it sends the first character of a CDC, but does not stop until the second character and the following LTRS are sent. This delay also varies, depending upon the speed of the line signals. A speed switch is provided to adjust this delay correctly.

6.073 Similar timing variations are required for both the V answerback and the LTRS generators of the interconnecting control circuit, as well as the TD control. Speed switches are included in this circuit to adjust for the proper timing.

7. ALARMS AND CONTROLS

7.01 General

7.011 Lamps are provided at both control and non-control stations, to indicate various operating conditions and alarms. These lamps are mounted separately or associated with keys. An audible alarm (buzzer) is provided at KSR stations and at the control station.

7.02 ASR Station

7.021 A lamp and a combined key and lamp are mounted in the perforator-transmitter base at the right of the keyboard (Fig. 16A) if pushbutton calling is not provided or with the

pushbutton keys and lamps (Fig. 16D) where these are furnished. The white (BD) lamp lights when a tape is placed in the transmitter and the transmitter control lever is operated to RUN. The lamp is extinguished after the tape has run out or, for continuous tape operation, in the case of taut tape. The red alarm (AL) lamp mounts in the alarm release (AR) non-locking key. The lamp lights and remains locked in under the following conditions:

(a) Upon receipt of a "break" (double blank) signal.

(b) Upon receipt of EOM from the transmitter start circuit, after a 2-second idle line time-out. This idle line condition may be caused by torn or jammed tape, by failing to terminate a message with EOM, by sending LTRS in a remnant of tape or because of circuit trouble.

(c) With torn tape operation, immediately after sending EOM, if the wiring option which prevents sending a remnant of LTRS is provided.

The momentary operation of key AR releases the alarm condition and extinguishes the lamp.

7.03 KSR Station

7.031 Two combined keys and lamps are mounted in the keyboard base at the right of the keyboard (Fig. 16B). The white bid (BD) lamp lights when the attendant operates the associated non-locking key (KS) to place a bid to send. Upon receipt of the TSC for this station, the BD lamp is extinguished, the red (AL) lamp lights, and a buzzer mounted in the KSR cabinet sounds, whereupon the attendant has 20 seconds to start sending. The buzzer may be silenced and the AL lamp extinguished by operation of the non-locking key (AR). When EOM is sent, the AL lamp relights and the buzzer sounds, and may again be retired by operation of key AR.

7.04 Pushbutton Keys and Lamps

7.041 Pushbutton calling keys and lamps (Fig. 16D) mount in a cabinet above the right end of the ASR cabinet at an outlying station. They mount in the same location or in the shelf of the apparatus cabinet at a control station.

7.042 Non-locking pushbuttons corresponding to CDCs of stations to which it is desired to send the message are operated. The associated lamp lights as each key is depressed. Upon operation of the TD control lever to RUN and upon receipt of the TSC for the station, the CDCs corresponding to the lighted lamps are sent, followed by EOA, after which the lamps are extinguished and the tape (text) sent. The CDCs for the following message may be selected while the text of a message is being transmitted. If at least one key is not depressed for the following message, the tape stops upon sending EOM, lamp AL lights, and the tape is not sent on receipt of the next TSC. After the CDCs for the next message have been selected, the AL lamp should be extinguished by operation of the non-locking key (AR).

7.043 Operation of the non-locking cancel (CA) key prior to receipt of the TSC restores the pushbutton calling circuit to normal, extinguishing the lamps associated with the previously operated pushbuttons.

7.044 The locking continuous tape (CT) key and its associated guard lamp are provided for use when CDCs are perforated in the tape. With this key operated, the tape stops when EOM is sent but lamp AL does not light, and the tape restarts on receipt of the next TSC. If LTRS are sent, because no more tape is perforated, the transmitter start circuit sends EOM after the 2-second idle line time-out and resumes polling.

7.05 Skip Keys and Lamps

7.051 Skip keys and lamps (Fig. 16C) mount in a cabinet above the right end of the ASR cabinet or in the shelf of the apparatus cabinet at a control station. The locking twist keys are normally non-operated.

7.052 The skip key corresponding to the TSC of a station is operated when it is desired to "skip" (i.e., not poll that station) and is restored when it is desired to resume polling the station. The lamp associated with the key lights when the station is polled, remains lighted if the station responds with traffic, and is extinguished when the next station in order is polled.

7.053 The locking stop (SP) key is operated when it is desired to stop all polling on the line. If the key is operated while transmission is in progress, the transmitter start circuit times out 2 seconds after transmission stops, sends EOM, and restores to normal. When the SP key is released, polling resumes with the first station of the polling cycle rather than the one following the last to have been sent.

7.054 Failure of a polled station to respond with either a traffic or a no-traffic V causes the line to time out (2 seconds for ASR station and 20 seconds for KSR station). In the case of an ASR station, the ALT lamp at the control station lights, the audible alarm sounds, EOM is sent to the line, and polling is resumed. In the case of a KSR station, the visual and audible alarms are given (as an option, a momentary visual signal is given), and polling is resumed without sending EOM. In either case, the control station attendant should operate the locking (V TST) key and retire the alarm key by operation of the non-locking (AR) key. When the station which failed to respond is again polled, it presumably again fails to respond. In this case, the line again times out, the audible and visual alarms are given, lamp V TST lights, and polling ceases. The control station attendant should then operate the SKIP key of the station which failed to respond, indicated by the lighted lamp associated with the key. The audible and visual alarms should be retired and the V TST key restored to normal, after which polling is resumed, and the station which is in trouble is skipped.

7.055 Operation of the locking (MON) key connects the intercept ROTR to the line permanently, so it copies all signals sent over the line, and causes the associated (IAL) lamp to light. Restoring the key to normal extinguishes the lamp. If the intercept ROTR is cut on due to failure of a called station to respond to its CDC, lamps IAL and ALT light, and the audible alarm is given. The alarm may be retired and lamp ALT extinguished by operation of key AR, and lamp IAL is extinguished when the intercept ROTR is disconnected from the circuit on receipt of EOM.

7.06 RT Control Circuit Keys and Lamps

7.061 Keys and lamps are mounted in the RT machine cabinet panel (Fig. 17C) associated with the left and right RTs, while additional lamps are mounted in the apparatus cabinet shelf (Fig. 17B) associated with the RT control circuit.

7.062 When the RT associated with the A or B section of the control circuit is sending, lamp BTA or BTB flashes. When the HOLD key of the associated RT is operated, to stop sending at the end of the message in progress, lamp BTA or BTB lights steadily, as well as lamp STR or STL. A no-traffic response is generated if a TSC is received for the transmitter while the HOLD key is operated.

7.063 When the RT associated with the A or B section of the control circuit is receiving, lamp BRA or BRB flashes. When the HOLD IN key of the associated RT is operated, to stop receiving at the end of the message in progress, lamp BRA or BRB lights steadily, as well as lamp RTR or RTL. Any message directed to the RT while the HOLD IN key is operated is diverted to intercept.

7.064 When the BUSY key of the associated RT is operated, transmission stops immediately and lamp WBA or WBB lights steadily.

7.065 When a torn tape or tape-out (6th pin) condition occurs in either RT, lamps CTO and STR or STL light steadily and an audible alarm, located in the apparatus cabinet, sounds. The audible alarm is silenced by operation of non-locking key BR (Fig. 17A), while the lamps are extinguished by operation of non-locking key TR after the trouble condition is cleared. If there is tape in the bin to be sent, the bid for the line, which was removed when the trouble condition occurred, may be restored after the trouble is cleared by momentary operation of key BID HOLD RLS.

7.066 When a machine trouble occurs in either RT such that the main bail does not operate while signals are being received, or in case of low tape in the supply reels, lamps CMA and RTR or RTL light steadily and the audible alarm sounds. The intercept ROTR is automatically connected in the case of machine trouble, to receive incoming traffic, while the HOLD IN key should be operated in the case of low tape, to make the RT busy to further incoming traffic. The audible alarm is silenced by operation of

non-locking key BR, while the lamps are extinguished by the operation and release of HOLD IN key.

7.07 Power Control Keys and Lamps

7.071 Keys, lamps, and a buzzer, associated with the power distribution circuit, are mounted in the apparatus cabinet panel (Fig. 17A). The PWR switch controls primary AC power to the distribution circuit, lamp AC being a pilot to indicate the switch position.

7.072 Failure of a 48-volt or 120-volt fuse causes lamps FA and CAB ALM to light and the audible alarm to sound. The audible alarm is silenced by operation of non-locking key BR, while replacing the fuse extinguishes lamps FA and CAB ALM.

7.073 Failure of the 48-volt rectifier causes lamps —48 FAIL and CAB ALM to light and the audible alarm to sound. Restoring 48-volt power extinguishes the lamps.

7.074 Failure of the 120-volt rectifier causes lamps +120 FAIL and CAB ALM to light and the audible alarm to sound. Restoring 120-volt power extinguishes the lamps.

7.075 Failure of both 48-volt and 120-volt rectifiers causes lamps AC FAIL and CAB ALM to light and the audible alarm to sound. Restoring both 48-volt and 120-volt power extinguishes the lamps.

8. OPERATION WITH 83B2 SYSTEM

8.011 An 83B3 non-control station may be added to an existing 83B2 line, or an existing 83B2 control station may be replaced by an 83B3 control station without replacing the 83B2 non-control stations. It is not practicable to intermix 83B2 and 83B3 circuitry at the same station. For example, an 83B3 pushbutton calling circuit cannot be added at an existing 83B2 non-pushbutton station.

8.012 When an 83B3 station is added to an existing 83B2 line, the same format is used for message preparation at all stations, as indicated in Fig. 1B. Since the 83B3 pushbutton calling circuit is somewhat restricted as to the CDCs it can generate, as discussed in 4.054, it may be necessary to recode the CDCs at 83B2 stations if 83B3 pushbutton stations are added to an existing 83B2 line.

8.013 When an 83B2 pushbutton station is connected to a line with an 83B3 control station, tube (T) in the 83B2 pushbutton circuit must be removed, to prevent that circuit from sending EOM after a 2-second time-out in case EOM was omitted from the sent tape. Sending EOM after a 2-second time-out is provided by the 83B3 transmitter start circuit, so this feature should not be furnished by the pushbutton circuit. It is necessary to operate a pushbutton in the 83B2 circuit to generate any cross-office code required, since this is not done automatically, as in the 83B3 circuit.

9. LIST OF DRAWINGS AND BSPs

9.01 Circuit Drawings

SD-70868-01—Reperforator-Transmitter Control Circuit

SD-70928-01—Transmitter Start Circuit

SD-70929-01—Interconnecting Control Circuit

SD-70930-01—Pushbutton Calling Circuit

SD-70931-01—Station Control Circuit for 28ASR or 28KSR Station

SD-70934-01—Power Distribution Circuit

SD-70935-01—Station Control Circuit for 28RO Teletypewriter

SD-70936-01—Key and Lamp Panel Circuit

9.02 Equipment Units

J70158A, L1—Reperforator-Transmitter Control Unit

J70158B, L1—Transmitter Start Unit

J70158C, L1—Interconnecting Control Unit

J70158D, L1—Pushbutton Calling Unit

J70158E, L1—Station Control Unit for ASR and KSR Teletypewriter

J70158F, L1—Reperforator-Transmitter Key and Lamp Unit

J70158G, L1—Power Distribution Unit

J70158H, L1—Station Control Unit for RO Teletypewriter

J70158L, L1—Alarm Panel

J70158M, L1—Rectifier and AC Power Assembly

9.03 Equipment Drawings

ED-71292—( ) Interconnecting Cords

ED-71293—( ) Cabinet Framework

ED-71294—( ) Typical Station Arrangements

ED-71295—( ) Transmitter Start Unit—Timing Assembly

ED-71296—( ) Interconnecting Control Unit—Letters Generator

ED-71297—( ) Interconnecting Control Unit—V Generator

ED-71298—( ) Framework and Assembly for Key and Lamp Unit

9.04 Equipment Specification

J70158 (AA286.063)—83B3 Teletypewriter Selective Calling System

9.05 BSPs

581-100-104—83B3 Teletypewriter Selective Calling System—Description of Interface Connection to a Customer-Owned Business Machine

581-100-501—83B3 Teletypewriter Selective Calling System—Over-all Test Procedures

592-850-100—1A High Speed Data Selective Calling System — Description and Principles of Operation

FIG. IA

STUNT BOX ON 28AF TYPING UNIT

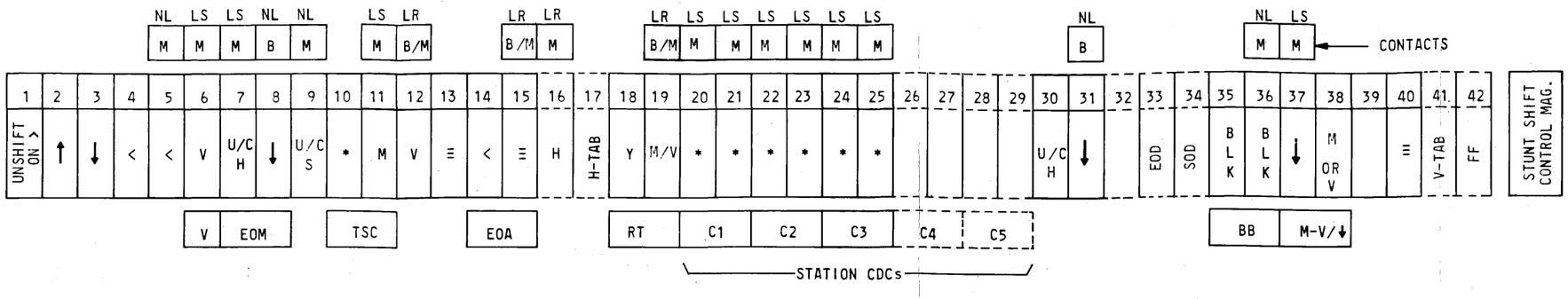


FIG.IB MESSAGE DIRECTED TO STATIONS ON LINE A

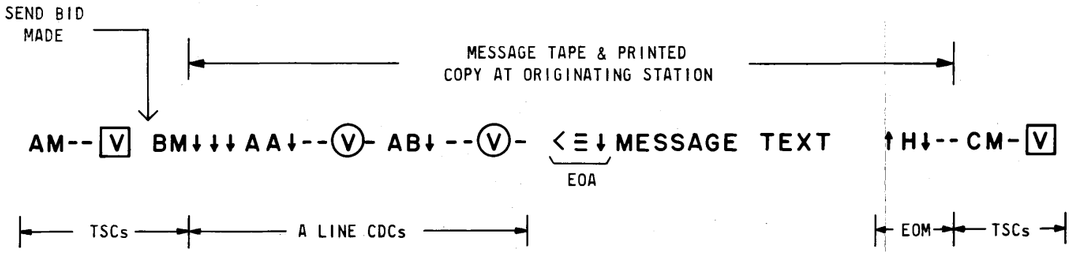
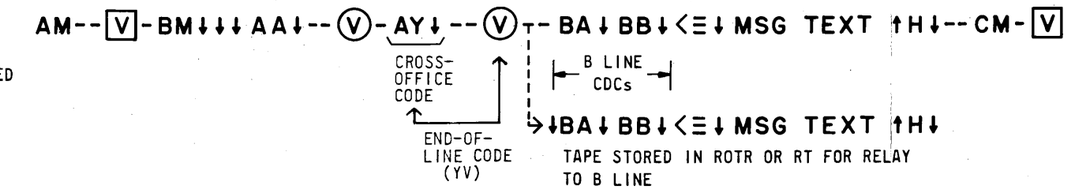


FIG.IC MESSAGE DIRECTED TO STATIONS ON LINE A AND RELAYED TO STATIONS ON LINE B



KEY TO SYMBOLS

---- STUNT BOX POSITIONS RESERVED FOR SPECIAL FUNCTIONS

* POSITIONS EQUIPPED WITH FUNCTION BARS CODED TO RESPOND TO ASSIGNED CODES

↓ LETTERS SHIFT

↑ FIGURES SHIFT

> SPACE

< CARRIAGE RETURN

≡ LINE FEED

U/C UPPER CASE

NL ☐ CONTACT OPERATES MOMENTARILY

LS ☐ CONTACT LATCHED UNDER CONTROL OF STRIPPER BLADE

LR ☐ CONTACT LATCHED UNDER CONTROL OF LATCH RELEASE BAIL

EOM END OF MESSAGE

TSC TRANSMITTER START CODE

EOA END OF ADDRESS

RT REPERF.-TRANS. CONTROL

CDC CALL DIRECTING CODE

SOD START OF DATA

EOD END OF DATA

BB OPERATES ON BLANK-BLANK

[V] V-NO TRAFFIC RESPONSE

(V) V-ANSWER BACK

AA, AB — STATION CDCs

AY CROSS-OFFICE CODE - TO RELAY FROM LINE A TO LINE B

AM, BM, CM — TSCs -BM ASSIGNED TO ORIGINATING STATION

FIG. 2A
SINGLE LINE SYSTEM

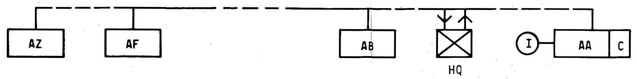


FIG. 2B
AUTOMATIC RELAY
THREE LINE DELTA SYSTEM

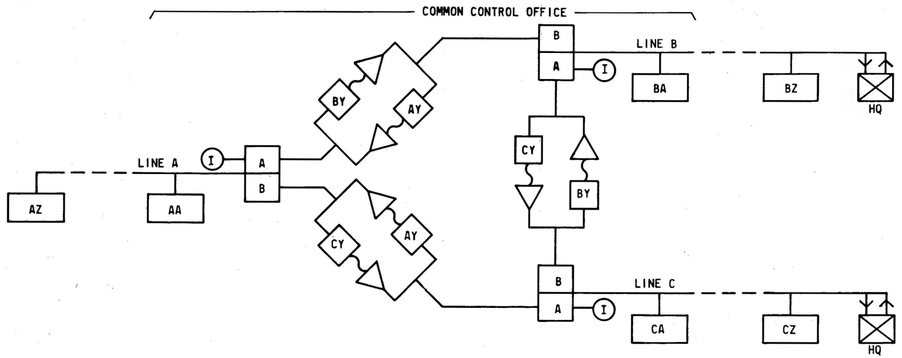


FIG. 2C
AUTOMATIC RELAY - TWO LINE SYSTEM

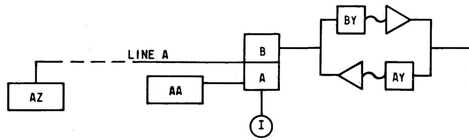


FIG. 2D
AUTOMATIC RELAY
THREE LINE TANDEM SYSTEM

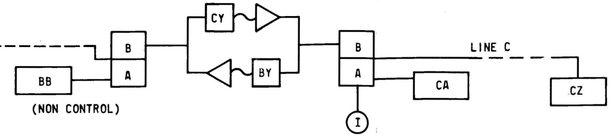
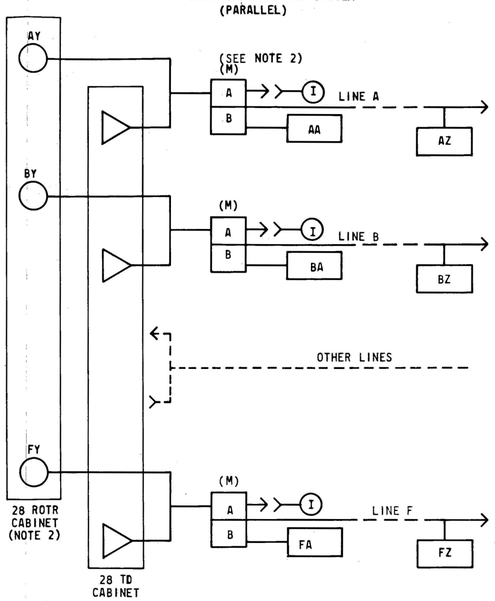


FIG. 2E
MANUAL TAPE RELAY SYSTEM
(PARALLEL)



KEY TO SYMBOLS — TABLE

		STATION EQUIPMENT FIGURES
AB	28 ASR NON CONTROL STATION & CDC (WITH OR WITHOUT PUSHBUTTON)	FIG. 3 A & B
AA C	28 ASR CONTROL STATION & CDC (WITH OR WITHOUT PUSHBUTTON)	FIG. 4 A & B
(I)	28 ROTR INCPT STATION	FIG. 4 TO 8
AY / BY	28 RT MOUNTED IN MACHINE CABINET & RELAY CROSS OFFICE CODE	FIG. 5 & 6
A / B	AUTOMATIC RELAY STATION CONTROL CABINET	FIG. 5 & 6
(M) A / B	MANUAL TAPE RELAY STATION CONTROL CABINET	FIG. 7
◁	CABINET MOUNTED 28 TD (WITH OR WITHOUT PUSHBUTTON)	FIG. 7
(AY)	CABINET MOUNTED 28 ROTR & RELAY CROSS OFFICE CODE	FIG. 7
⊠	CUSTOMER FURNISHED BUSINESS MACHINE INTERFACE STATION	FIG. 8 & 9

NOTES:

1. FIGURES 2C & 2D ILLUSTRATE THREE LINE TANDEM SYSTEM.
2. THE RELAY ROTR MAY BE USED FOR INTERCEPT.

N

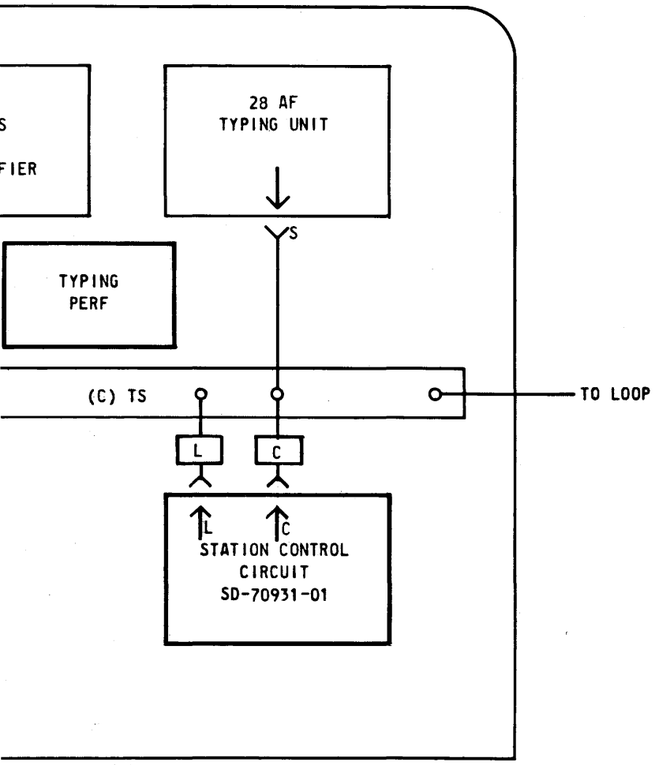


FIG. 3B

28 ASR WITH PUSHBUTTON SELECTION

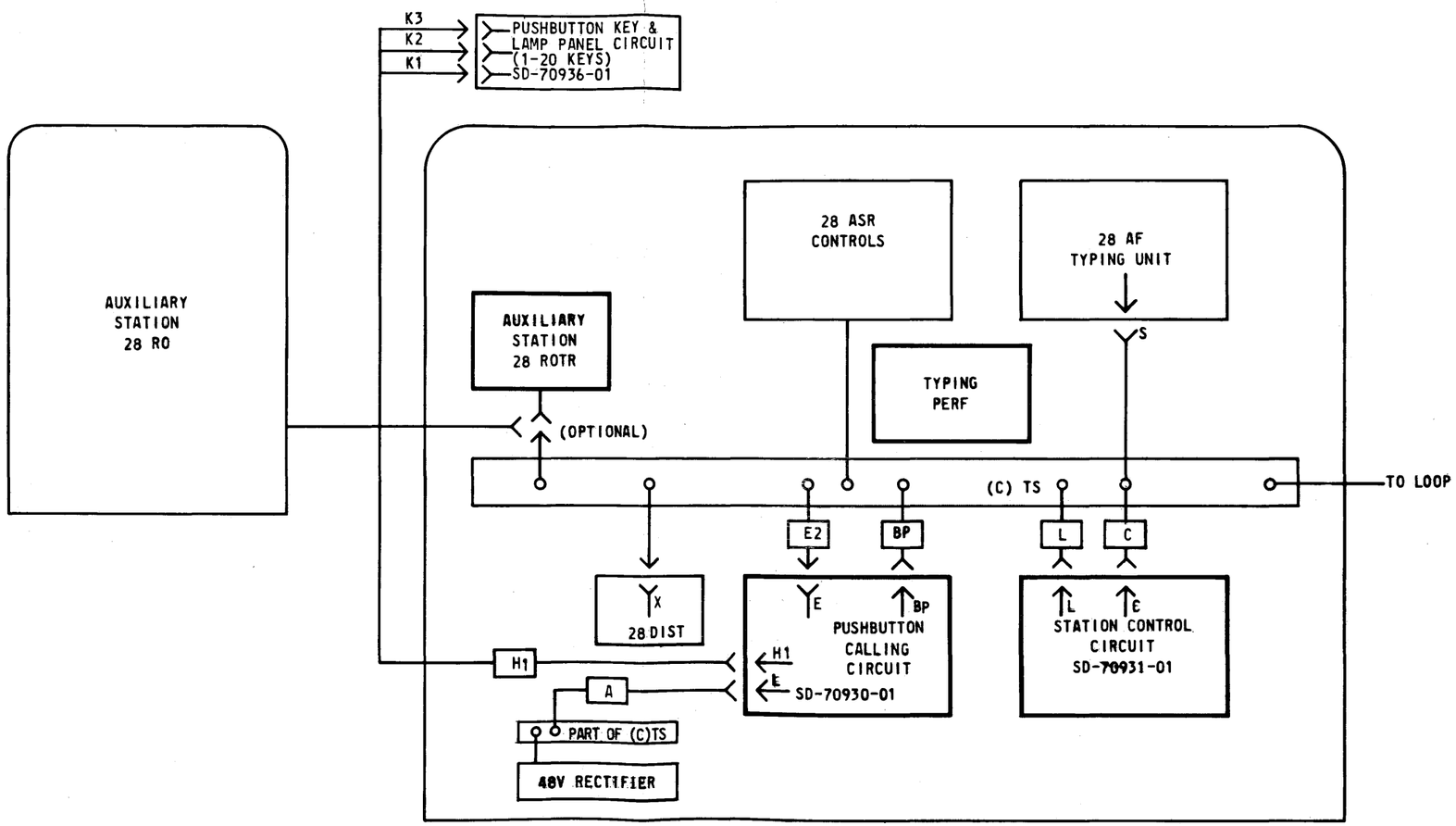
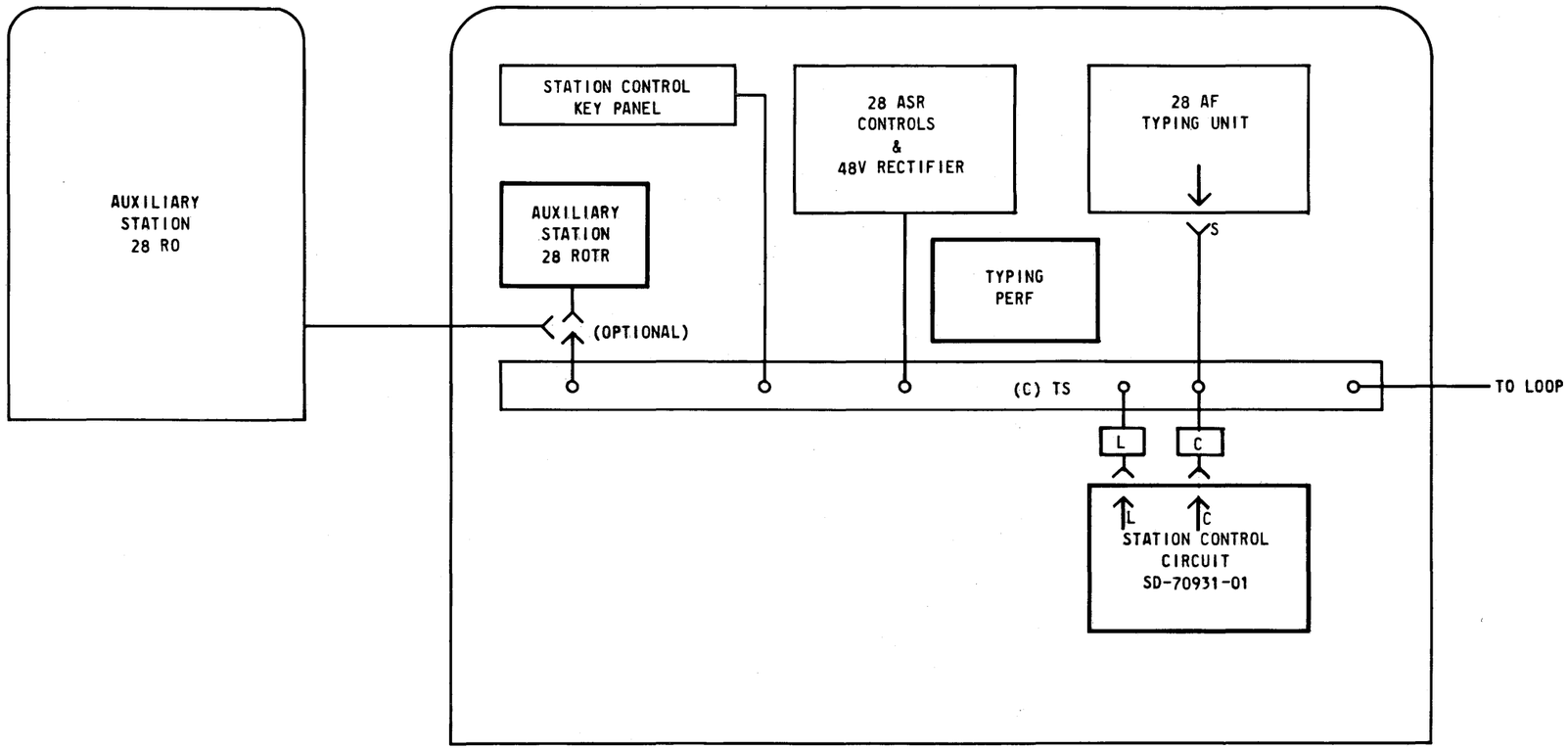


FIG. 3A

28 ASR WITHOUT PUSHBUTTON SELECTION



AUXILIARY STATION 28 RO

FIG. 4A

28 ASR WITHOUT PUSHBUTTON SELECTION

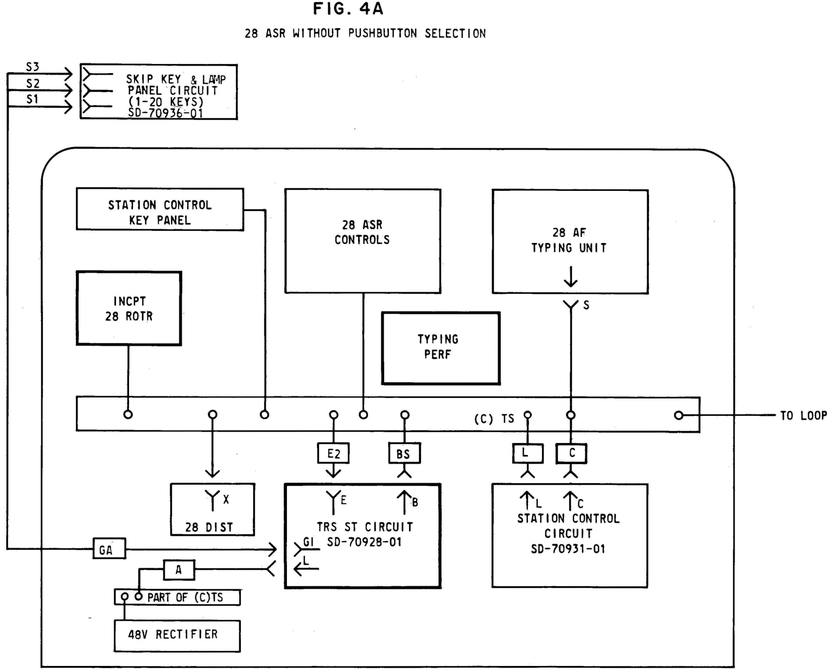


FIG. 4B

28 ASR WITH PUSHBUTTON SELECTION

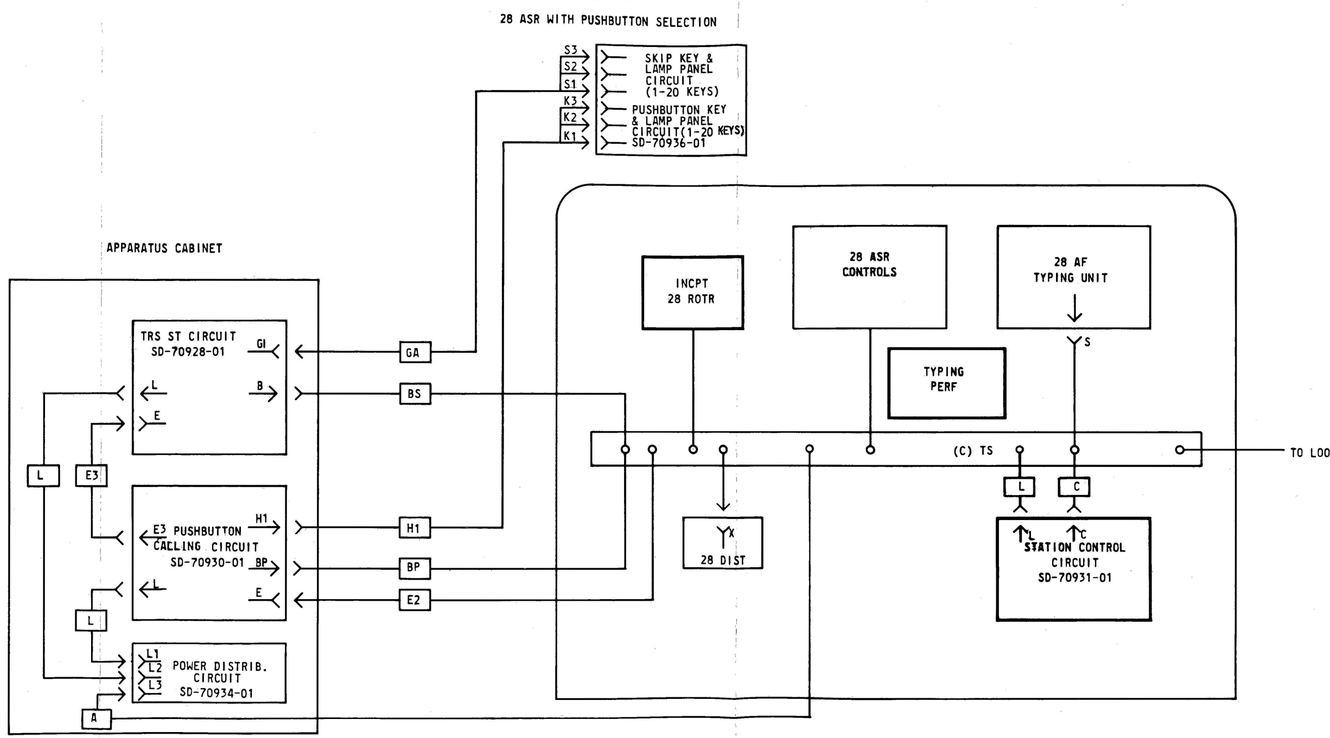


FIG. 5

AUTOMATIC RELAY CONTROL STATION
(THREE LINE)

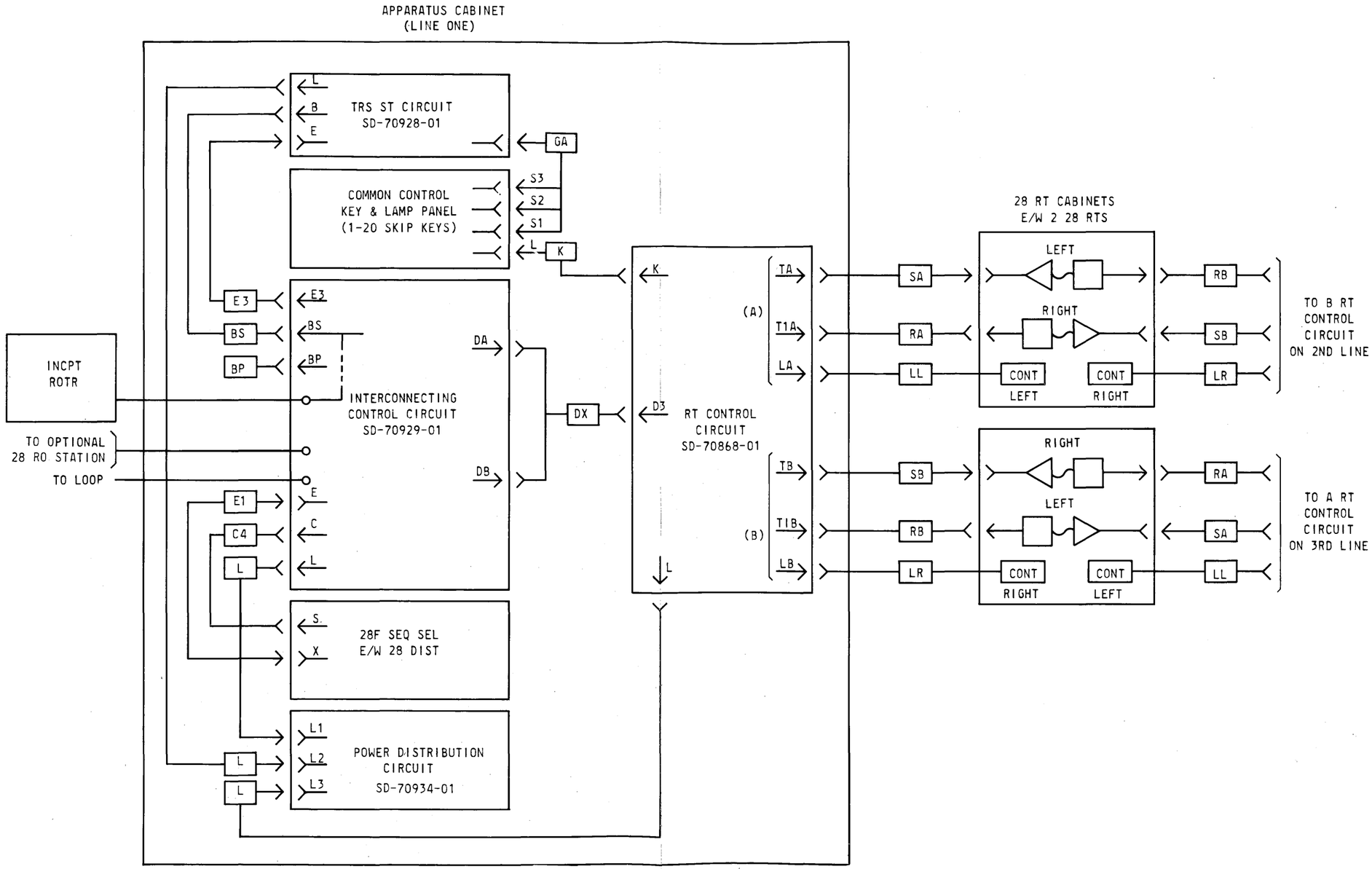


FIG. 6

AUTOMATIC RELAY CONTROL STATION
(TWO LINE)

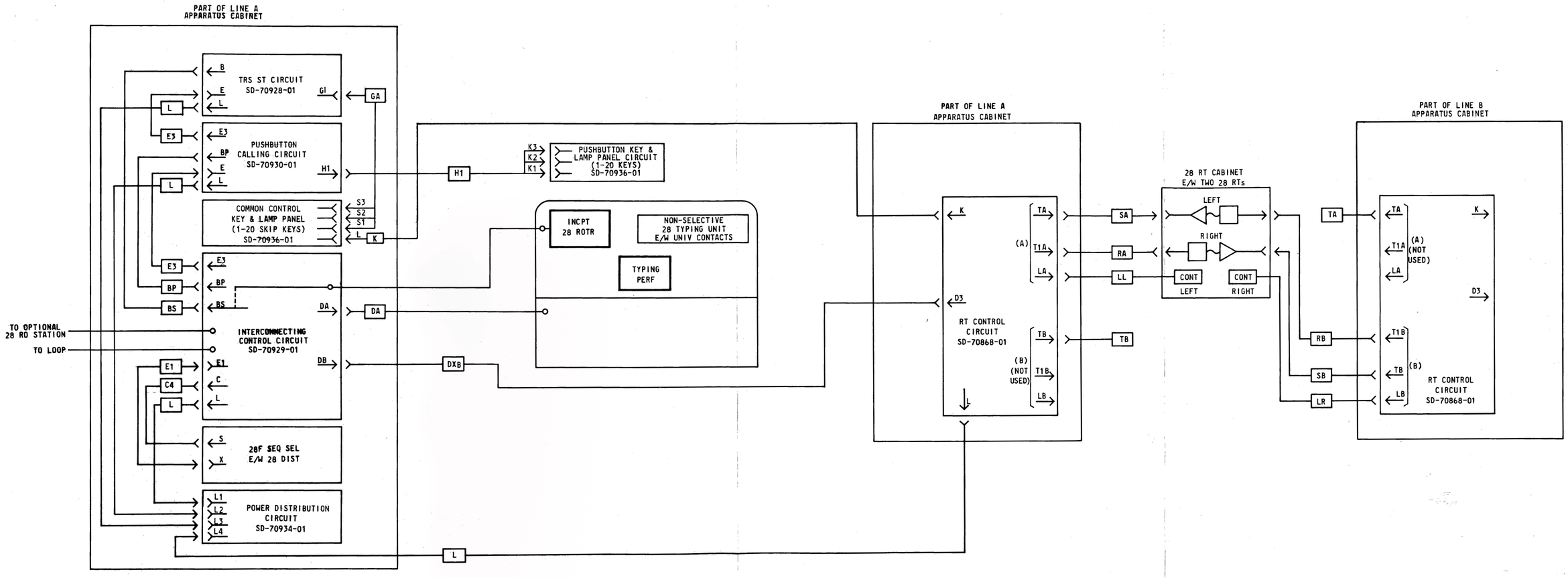


FIG. 7

MANUAL TAPE RELAY
CONTROL STATION

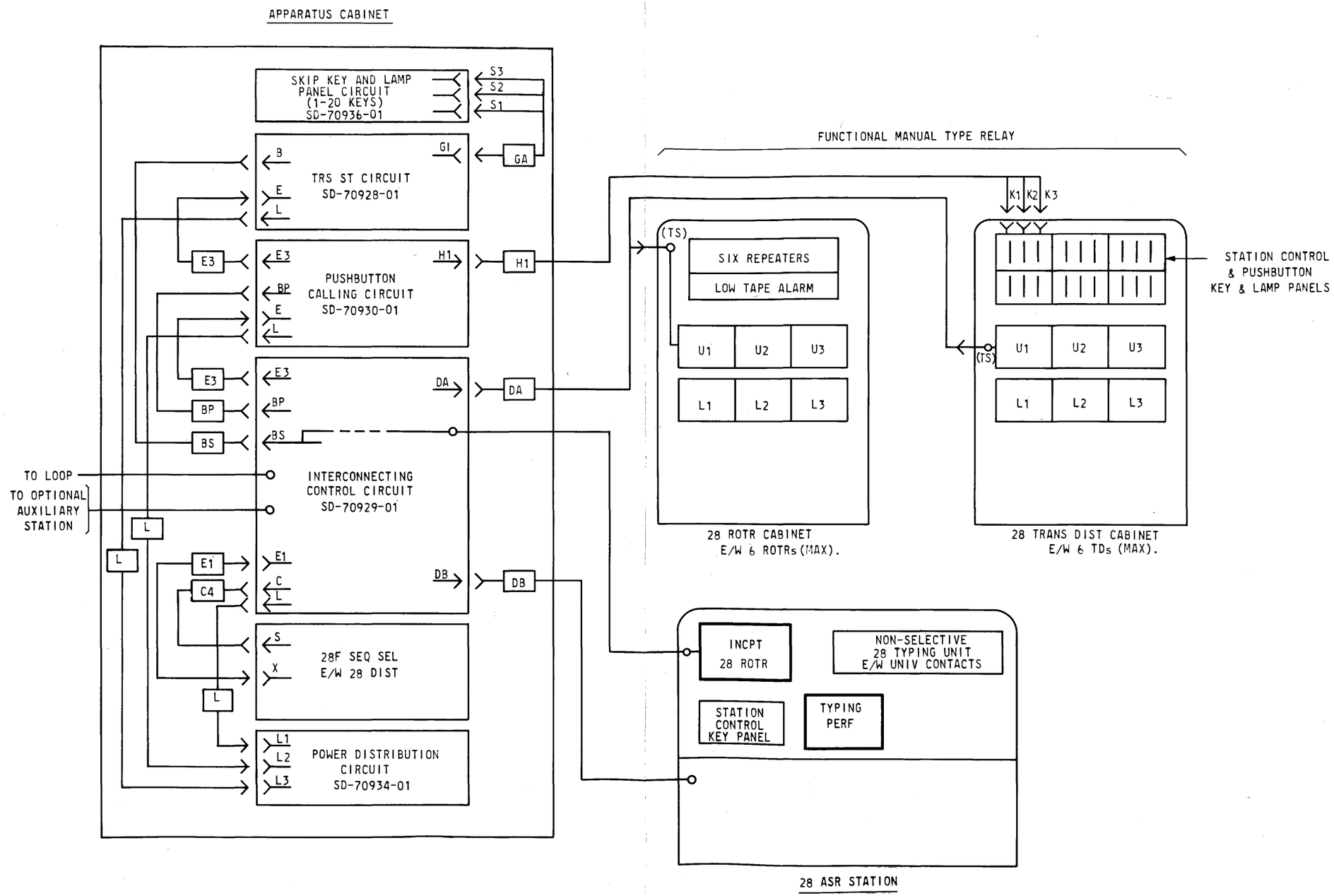


FIG. 8
BUSINESS MACHINE
CONTROL STATION

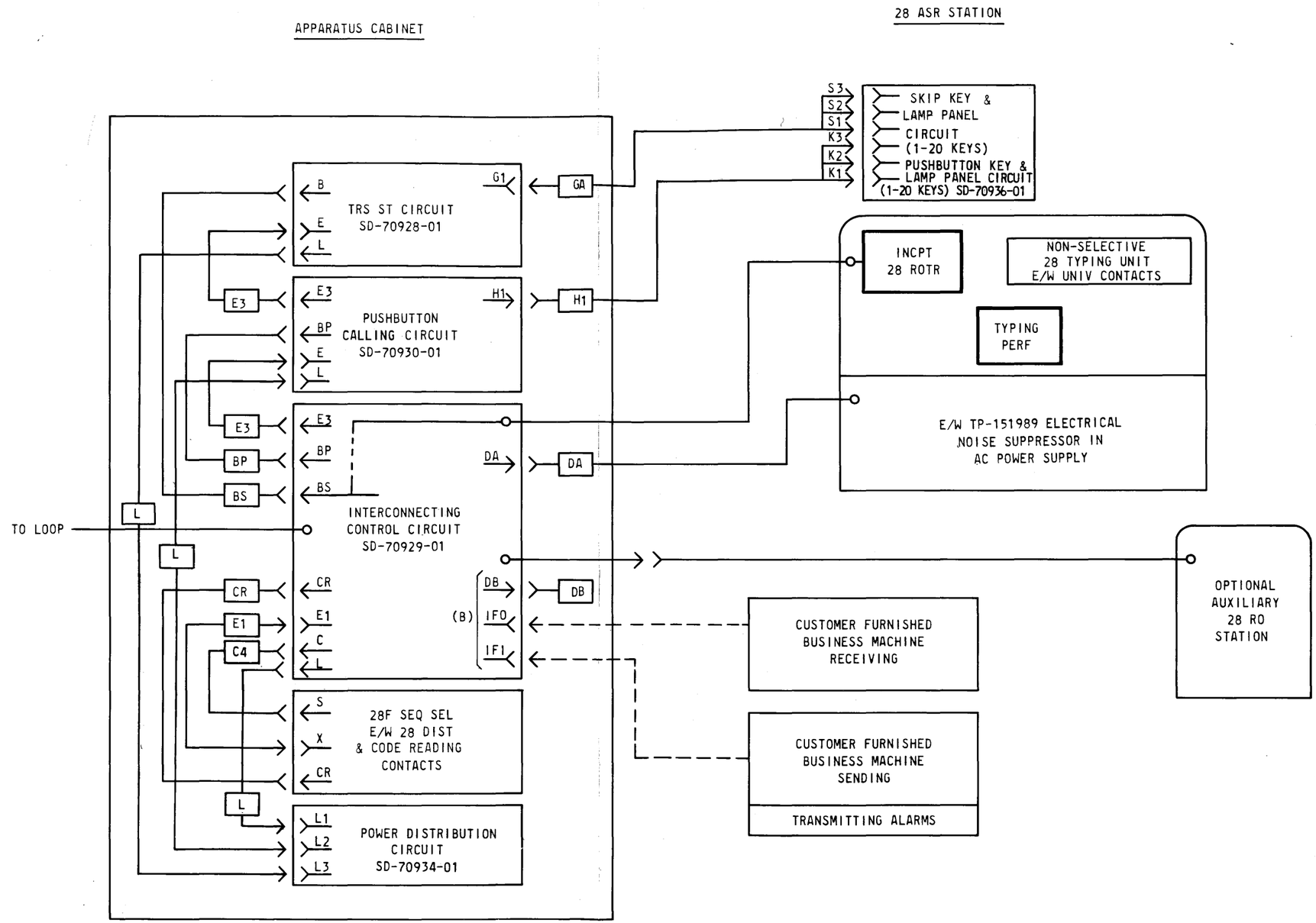
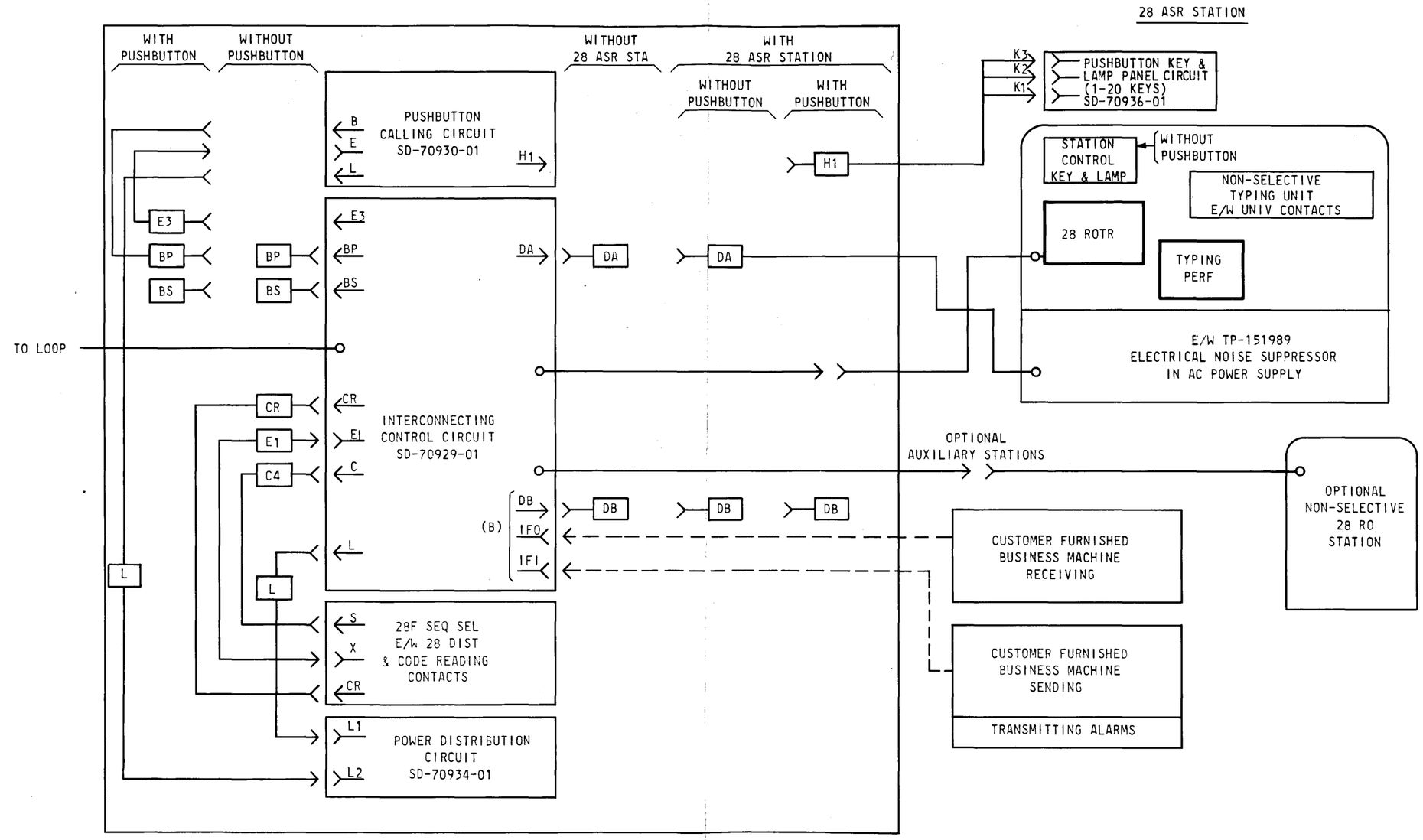


FIG. 9

BUSINESS MACHINE
NON CONTROL STATION



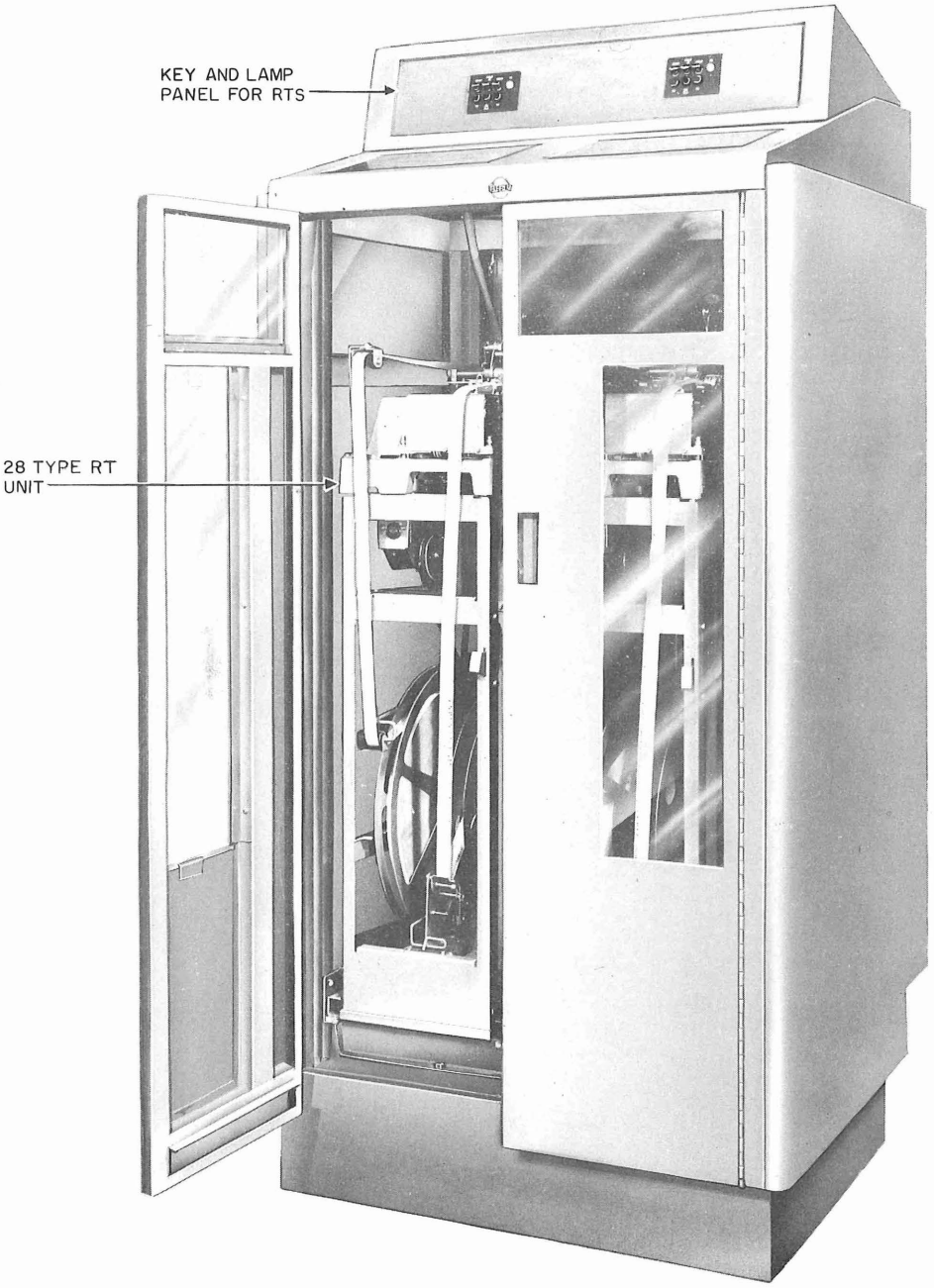

KEY AND LAMP
PANEL FOR RTS
28 TYPE RT
UNIT

FIG. IIA

EXAMPLE OF STRAPPING REQUIRED FOR INSERTION OF FIRST LETTER & RT CUT-ON CODES

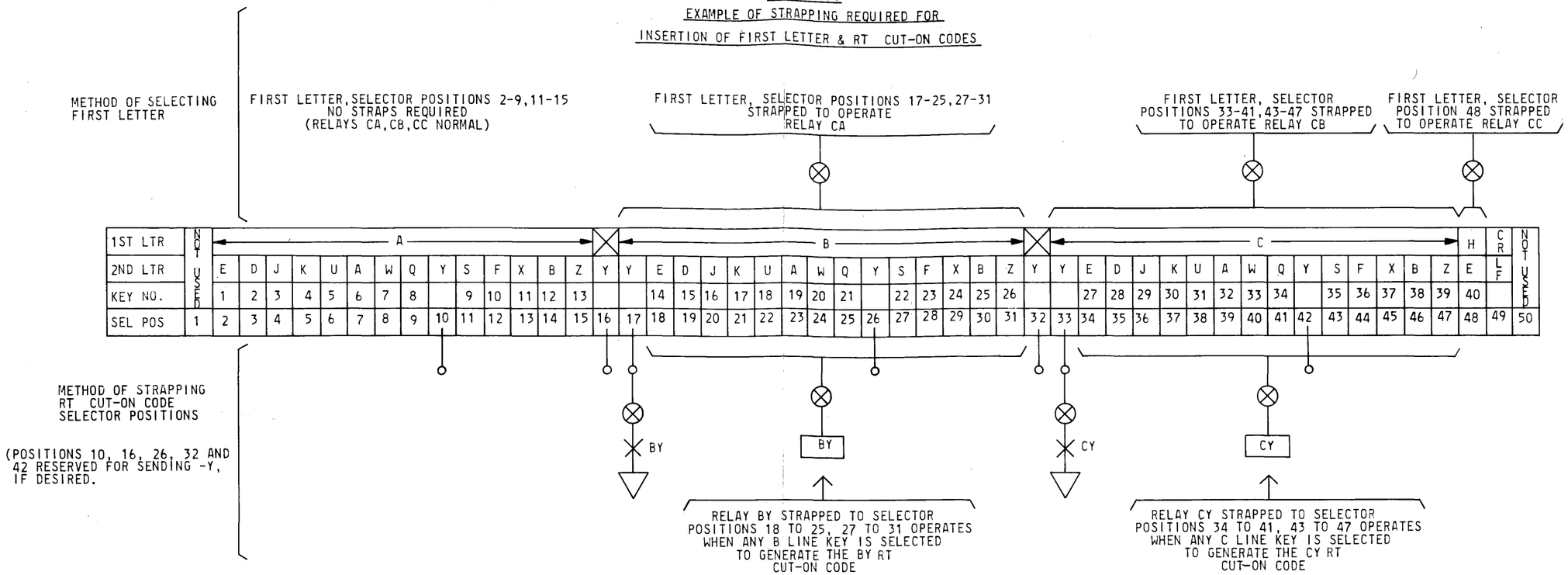


FIG. IIB

TYPICAL ASSIGNMENTS FOR SINGLE LINE USE

KEY NO.	1ST	2ND
1	A	E
2	A	D
3	A	J
4	A	K
5	A	U
6	A	A
7	A	W
8	A	Q
9	A	S
10	A	F
11	A	X
12	A	B
13	A	Z

KEY NO.	1ST	2ND
14	B	E
15	B	D
16	B	J
17	B	K
18	B	U
19	B	A
20	B	W
21	B	Q
22	B	S
23	B	F
24	B	X
25	B	B
26	B	Z

KEY NO.	1ST	2ND
27	C	E
28	C	D
29	C	J
30	C	K
31	C	U
32	C	A
33	C	W
34	C	Q
35	C	S
36	C	F
37	C	X
38	C	B
39	C	Z
* 40	H	E

* THIS ILLUSTRATES USE OF THE FOURTH FIRST LETTER IN THIS POSITION. THE H IDENTIFIES A BUSINESS MACHINE STATION.

FIG. IIC

STATION & SPECIAL CODE CHARACTERS

FIRST AND SECOND LETTERS AVAILABLE FOR STATION CDC

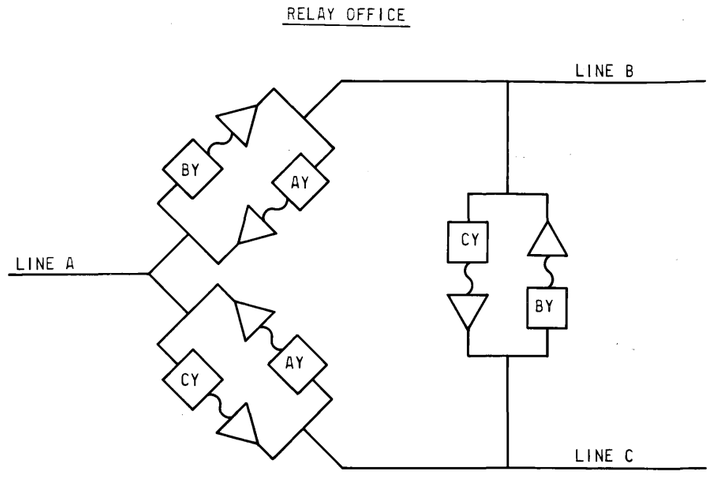
A	I	Q	Z
B	J	R	
C	K	S	
D	L	U	
E	N	W	
F	P	X	
H		Y	

SPECIAL CODES

RT CUT-ON CODE (SECOND LETTER)	BUSINESS MACHINE CODE (FIRST LETTER)
Y	H
(EXAMPLE-AY)	(EXAMPLE- HE)

FIG. 12

PUSHBUTTON OPERATION
AUTOMATIC RELAY
THREE LINE DELTA



KEY ASSIGNMENTS

KEY POS	1 — 12	* 13		14 — 25	* 26		27 — 38	* 39
CROSS OFFICE CDC			SEL POS 17	PRECEDES CDCs 14-26		SEL POS 33	PRECEDES CDCs 27-39	
LINE A CDCs	A+(E TO B)	HZ	BY	B+(E TO B)	HZ	CY	C+(E TO B)	HZ
LINE B CDCs	B+(E TO B)	HZ	AY	A+(E TO B)	HZ	CY	C+(E TO B)	HZ
LINE C CDCs	C+(E TO B)	HZ	AY	A+(E TO B)	HZ	BY	B+(E TO B)	HZ

1. RELAY FROM A TO B-KEYS 7, 12, 25 & 26 SELECTED

   A, SENT ON LINE A — AW↓ ----AB↓ ----BY↓ ---- BB↓ HZ↓ < Ξ↓ TEXT ↑H↓

   B, STORED AND SENT ON LINE B — BB↓ ----HZ↓ ----<Ξ↓ TEXT ↑H↓

2. RELAY FROM A TO B TO C-KEYS 4, 19 & 39 SELECTED

   A, SENT ON LINE A — AK↓ ----BY↓ ---- BA↓ CY↓ HZ↓ <Ξ↓ TEXT ↑H↓

   B, STORED AND SENT ON LINE B — BA↓ ----CY↓ ---- HZ↓ <Ξ↓ TEXT ↑H↓

   C, STORED AND SENT ON LINE C — HZ↓ ----<Ξ↓ TEXT ↑H↓

KEY ARRANGEMENT ON LINE A

	KEY POS	1ST LTR	2ND LTR	SEL POS	
				1	
1			E	2	
2			D	3	
3			J	4	
4			K	5	
5			U	6	
6		A	A	7	
7			W	8	
8			Q	9	
9			S	11	
10			F	12	
11			X	13	
12			B	14	
* 13		H	Z	15	

	KEY POS	1ST LTR	2ND LTR	SEL POS	
			Y	16	
			Y	17	← BY
14			E	18	
15			D	19	
16			J	20	
17			K	21	
18			U	22	
19		B	A	23	
20			W	24	
21			Q	25	
22			S	27	
23			F	28	
24			X	29	
25			B	30	
* 26		H	Z	31	

	KEY POS	1ST LTR	2ND LTR	SEL POS	
			Y	32	
			Y	33	← CY
27			E	34	
28			D	35	
29			J	36	
30			K	37	
31			U	38	
32		C	A	39	
33			W	40	
34			Q	41	
35			S	43	
36			F	44	
37			X	45	
38			B	46	
* 39		H	Z	47	
** 40			E	48	
		<	≡	49	
				50	

---- INDICATES TRANSMISSION STOP FOR V ANSWER BACK

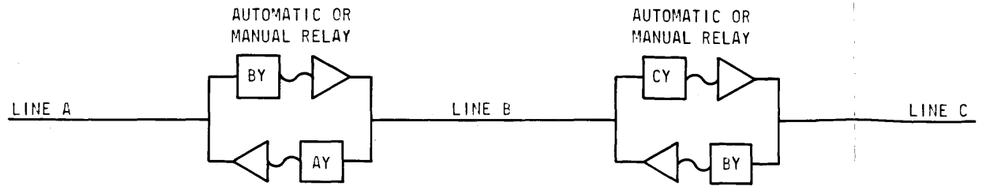
✳→ RELAY REPERF.-TRANS. CONNECTED AT THIS POINT

* USE OF FOURTH CHOICE FIRST LETTER FOR A BUSINESS MACHINE CODE

** KEY POSITION 40 NOT USED

FIG. 13

PUSHBUTTON OPERATION
AUTOMATIC OR MANUAL RELAY
THREE LINE TANDEM



KEY ASSIGNMENTS

KEY POS	1 — 13		14 — 26			27 — 39
CROSS OFFICE CDC		SEL POS 17	PRECEDES CODES 14-26	SEL POS 32	33	PRECEDES CODES 27-39
LINE A CDCs	A+(E TO Z)	*BY	B+(E TO Z)		CY	C+(E TO Z)
LINE C CDCs	C+(E TO Z)	*BY	B+(E TO Z)		AY	A+(E TO Z)
LINE B CDCs	B+(E TC Z)	AY	A+(E TO Z)	**BY	CY	C+(E TO Z)

1. RELAY FROM A TO B TO C-KEYS 11,24, & 37 SELECTED

A, SENT ON LINE A — AX↓----BY↓----BX↓ CY↓ CX↓<Ξ↓TEXT ↑H↓

B, STORED AND SENT ON LINE B — BX↓ ----CY↓ ----CX↓ <Ξ↓ TEXT ↑H↓

C, STORED AND SENT ON LINE C — CX↓ ----<Ξ↓ TEXT ↑H↓

*2. RELAY FROM A TO C-KEYS 3 & 29 SELECTED

A, SENT ON LINE A — AJ↓----BY↓----CY↓ CJ↓ <Ξ↓ TEXT ↑H↓

B, STORED AND SENT ON LINE B — CY↓ ----CJ↓ <Ξ↓ TEXT ↑H↓

C, STORED AND SENT ON LINE C — CJ↓ ----<Ξ↓ TEXT ↑H↓

**3. RELAY FROM B TO A TO C-KEYS 12, 25, & 38 SELECTED

A, SENT ON LINE B — BB↓----AY↓----AB↓ BY↓ CY↓ CB↓ <Ξ↓ TEXT ↑H↓

B, STORED AND SENT ON LINE A — AB↓ ----BY↓ ----CY↓ CB↓ <Ξ↓ TEXT ↑H↓

C, STORED AND SENT ON LINE B — CY↓ ----CB↓ <Ξ↓ TEXT ↑H↓

D, STORED AND SENT ON LINE C — CB↓ ----<Ξ↓ TEXT ↑H↓

KEY ARRANGEMENT ON LINE B

KEY POS	1ST LTR	2ND LTR	SEL POS		KEY POS	1ST LTR	2ND LTR	SEL POS		KEY POS	1ST LTR	2ND LTR	SEL POS	
							Y	16	← BY		BY	Y	32	← ** BY CY
			1				Y	17				Y	33	← CY
1		E	2		14		E	18		27		E	34	
2		D	3		15		D	19		28		D	35	
3		J	4		16		J	20		29		J	36	
4		K	5		17		K	21		30		K	37	
5		U	6		18		U	22		31		U	38	
6		A	7		19		A	23		32		A	39	
7	B	W	8		20	A	W	24		33	C	W	40	
8		Q	9		21		Q	25		34		Q	41	
9		S	11		22		S	27		35		S	43	
10		F	12		23		F	28		36		F	44	
11		X	13		24		X	29		37		X	45	
12		B	14		25		B	30		38		B	46	
13		Z	15		26		Z	31		39		Z	47	
										*** 40		E	48	
											<	≡	49	
													50	

*ON LINES A & C THE BY ON SELECTOR POSITION 17 WILL ALWAYS BE SENT WHEN ANY KEY IN POSITIONS 14 TO 39 ARE SELECTED

**ON LINE B THE BY ON SELECTOR POSITION 32 WILL BE SENT WHEN CODES FOR BOTH LINES A AND C (POSITIONS 14 TO 26 AND 27 TO 39) ARE SELECTED

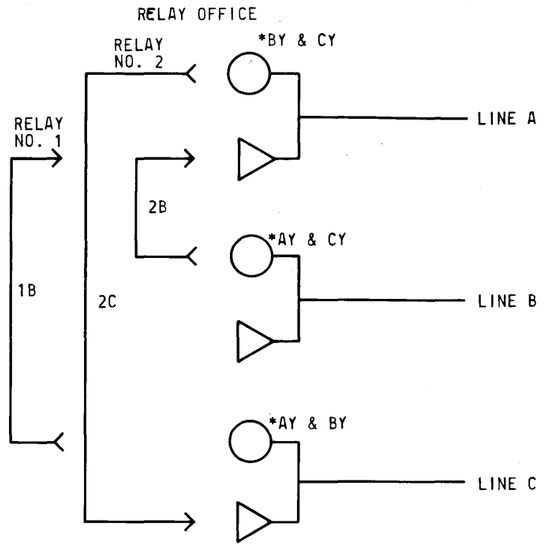
----INDICATES TRANSMISSION STOP FOR V ANSWER BACK

✳ RELAY REPERF.-TRANS. OR ROTR CONNECTED AT THIS POINT

*** KEY POSITION 40 NOT USED

FIG. 14

PUSHBUTTON OPERATION
MANUAL RELAY



KEY ASSIGNMENTS

KEY POS	1 — 13		14 — 26		27 — 39
CROSS OFFICE CDC		SEL POS 17	PRECEDES CDCs 14-26	SEL POS 33	PRECEDES CDCs 27-39
LINE A CDCs	A+(E TO Z)	BY	B+(E TO Z)	CY	C+(E TO Z)
LINE B CDCs	B+(E TO Z)	AY	A+(E TO Z)	CY	C+(E TO Z)
LINE C CDCs	C+(E TO Z)	AY	A+(E TO Z)	BY	B+(E TO Z)

1. RELAY FROM C TO A-KEYS 5 & 18 SELECTED

   A, SENT ON LINE — CU↓----AY↓----AU↓<Ξ↓TEXT ↑H↓

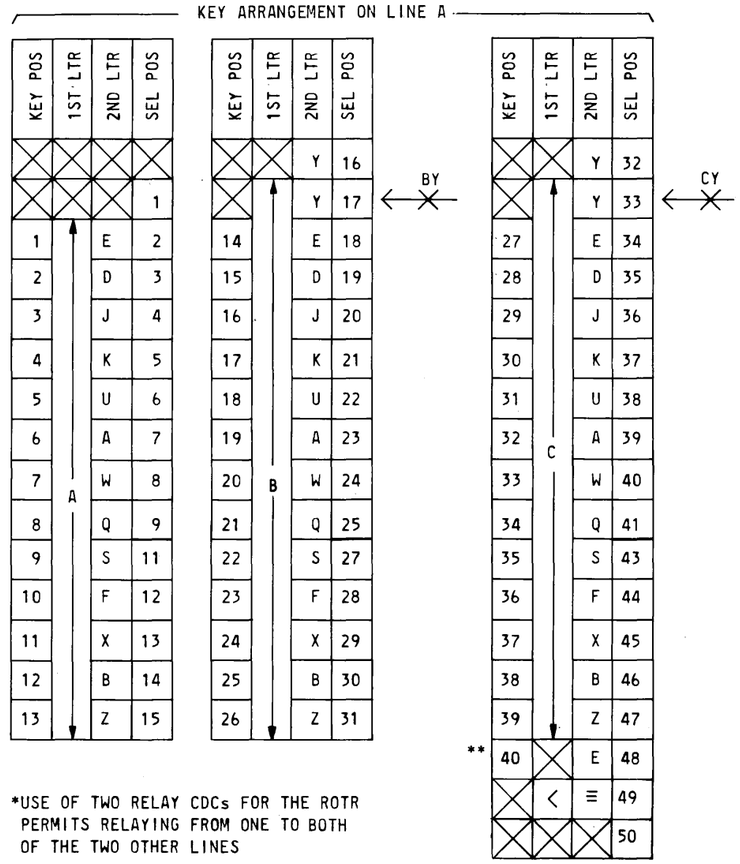
   B, STORED IN LINE C ROTR AND SENT ON LINE A — AU↓ ----<Ξ↓ TEXT ↑H↓

2. RELAY FROM B TO A TO C-KEYS 10,23 & 36 SELECTED

   A. SENT ON LINE B — BF↓----AY↓----AF↓CY↓CF↓<Ξ↓TEXT ↑H↓

   B. STORED IN LINE B ROTR AND SENT ON LINE A — AF↓----CY↓----CF<Ξ ↓TEXT ↑H↓

   C. STORED IN LINE A ROTR AND SENT ON LINE C — CF↓----<Ξ ↓TEXT ↑H↓



*USE OF TWO RELAY CDCs FOR THE ROTR PERMITS RELAYING FROM ONE TO BOTH OF THE TWO OTHER LINES

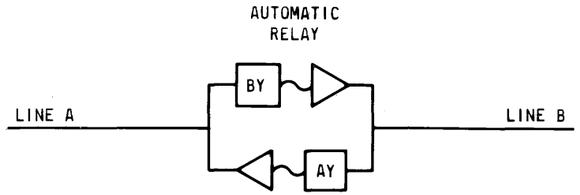
----INDICATES TRANSMISSION STOP FOR V ANSWER BACK

✳ RELAY ROTR

↳ CONNECTED AT THIS POINT

FIG. 15

PUSHBUTTON OPERATION
AUTOMATIC RELAY
TWO LINE



KEY ASSIGNMENTS

KEY POS	1 —— 13	14	15	17	18	20	SEL POS 26	22 —— 34	35	36	38	39	40
CROSS OFFICE CDC								PRECEDES CDCs 22-36 AND 38-40					
LINE A CDCs	A+(E TO Z)	BE	BD	BK	BU	BW	BY	B+(S TO Q)	AS	AF	AB	AZ	AE
LINE B CDCs	B+(E TO Z)	AE	AD	AK	AU	AW	AY	A+(S TO Q)	BS	BF	BB	BZ	BE

1. RELAY FROM LINE A TO B KEYS 10, 20, 28 & 40 SELECTED

   A, SENT ON LINE A — AF↓ ----BW↓ ----BY↓ ---- BD↓ AE↓ <Ξ↓ TEXT ↑H↓

   B, STORED AND SENT ON LINE B — ✳→ BD↓ ----AE↓ ----<Ξ↓ TEXT ↑H↓

2. RELAY FROM LINE B TO A KEYS 1, 14, 27 & 40 SELECTED

   A, SENT ON LINE B — BE↓ ----AE↓ ----AY↓ ---- AE↓ BE↓ <Ξ↓ TEXT ↑H↓

   B, STORED AND SENT ON LINE A — ✳→ AE↓ ----BE↓ ----<Ξ↓ TEXT ↑H↓

KEY ARRANGEMENT ON LINE A

	KEY POS	1ST LTR	2ND LTR	SEL POS
				1
	1		E	2
	2		D	3
	3		J	4
	4		K	5
	5		U	6
	6		A	7
	7		W	8
	8	A	Q	9
	9		S	11
	10		F	12
	11		X	13
	12		B	14
	13		Z	15
	14		E	18
	15	B	D	19
*	16		J	20
	17		K	21
	18	B	U	22
*	19		A	23
	20	B	W	24

	KEY POS	1ST LTR	2ND LTR	SEL POS	
*	21		Q	25	
			Y	26	←✳ BY
	22		S	27	
	23		F	28	
	24		X	29	
	25		B	30	
	26		Z	31	
	27		E	34	
	28	B	D	35	
	29		J	36	
	30		K	37	
	31		U	38	
	32		A	39	
	33		W	40	
	34		Q	41	
	35		S	43	
	36	A	F	44	
*	37		X	45	
	38		B	46	
	39	A	Z	47	
	40		E	48	
		<	Ξ	49	
				50	

----INDICATES TRANSMISSION STOP FOR V ANSWER BACK

✳→ RELAY ROTR OR RT CONNECTED AT THIS POINT

* KEY POSITIONS 16,19, 21 AND 37 NOT USED

FIG. 16A

STATION CONTROL
KEY & LAMPS
MOUNTED IN 28 ASR
PERF -TRANS BASE

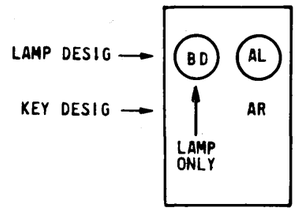


FIG. 16B

STATION CONTROL
KEYS & LAMPS
MOUNTED IN KSR
KEYBOARD BASE

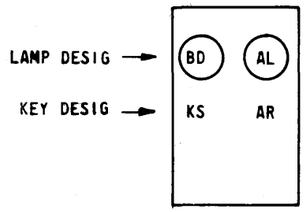


TABLE A

MULTIPLE CODING OF
1ST LETTER IN TSC

SKIP KEY POS	POLLING PATTERN	
	A	C
1-3	A-E	
2-6	C-N	
1-11		A-W
6-19		N-F
2-8-12-18		C-R-K-J
3-9-13-19		E-S-D-F
4-7-14-17		I-P-U-Q

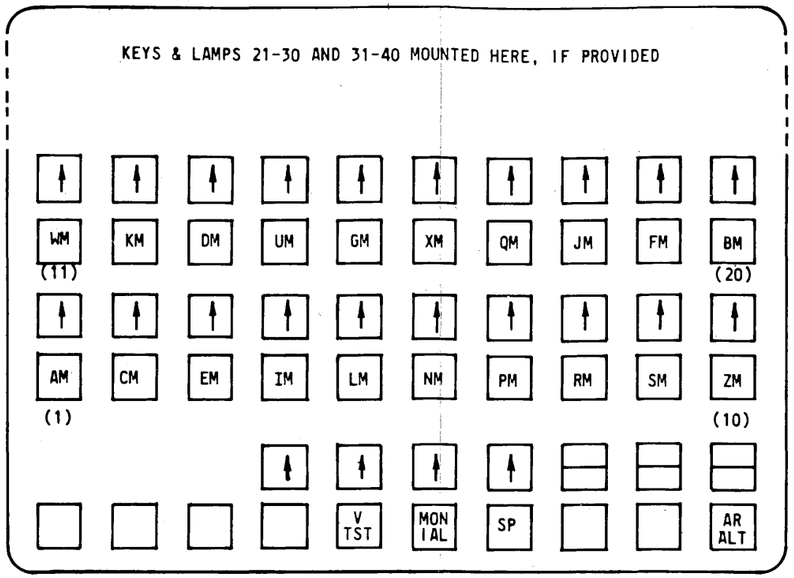


FIG. 16C

STATION CONTROL AND SKIP KEYS & LAMPS

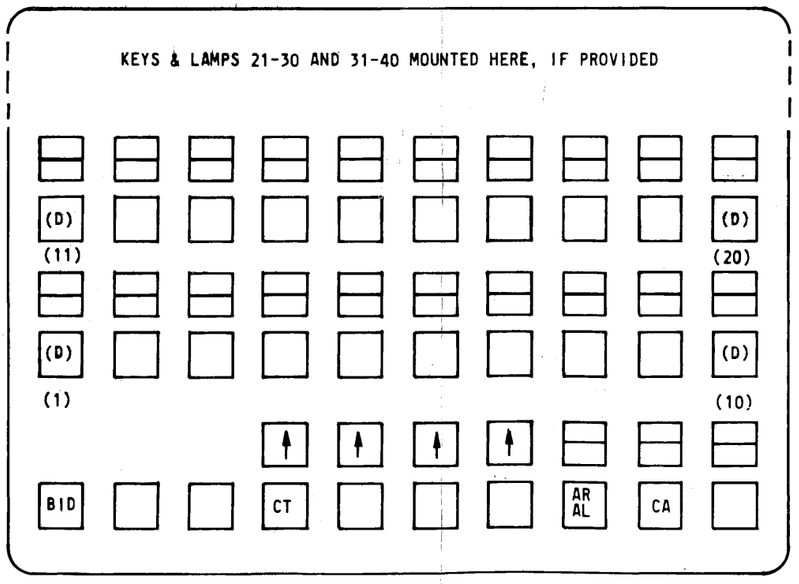


FIG. 16D

STATION CONTROL & PUSHBUTTON CALLING KEYS & LAMPS

FIG. 16A PROVIDED AT ALL 28 ASR STATIONS WHEN PUSHBUTTON SELECTION IS NOT USED.

FIG. 16B PROVIDED AT ALL 28 KSR STATIONS.

FIG. 16C PROVIDED AT ALL CONTROL STATIONS.

FIG. 16D PROVIDED AT ALL 28 ASR & MANUAL TAPE RELAY STATIONS WHEN PUSHBUTTON SELECTION IS USED.

KEY TO SYMBOLS

- D — DESIGNATION STRIP
- NL KEY E/W LAMP
- LOCKING KEY E/W LAMP
- LAMP
- NL KEY E/W LAMP

FIG. 17A

KEY & LAMP POWER CONTROL PANEL
(MOUNTED IN APPARATUS CABINET)

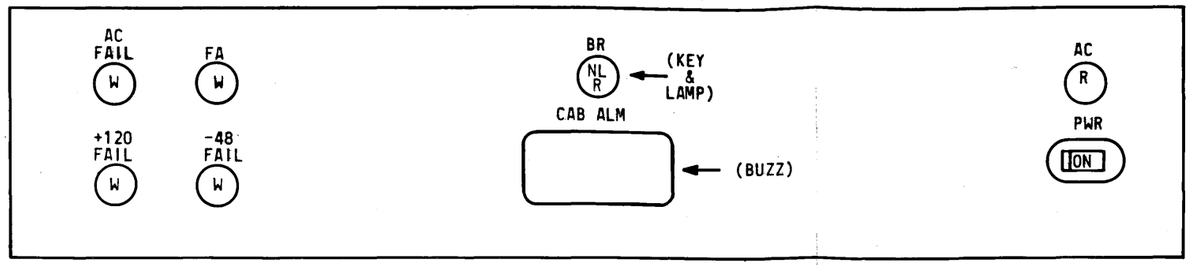


FIG. 17B

RT CONTROL CIRCUIT LAMP PANEL
(MOUNTED IN APPARATUS CABINET)

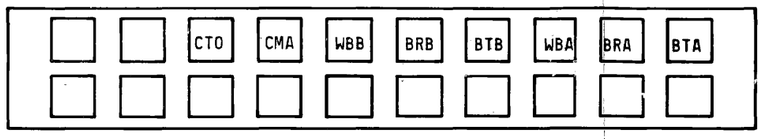
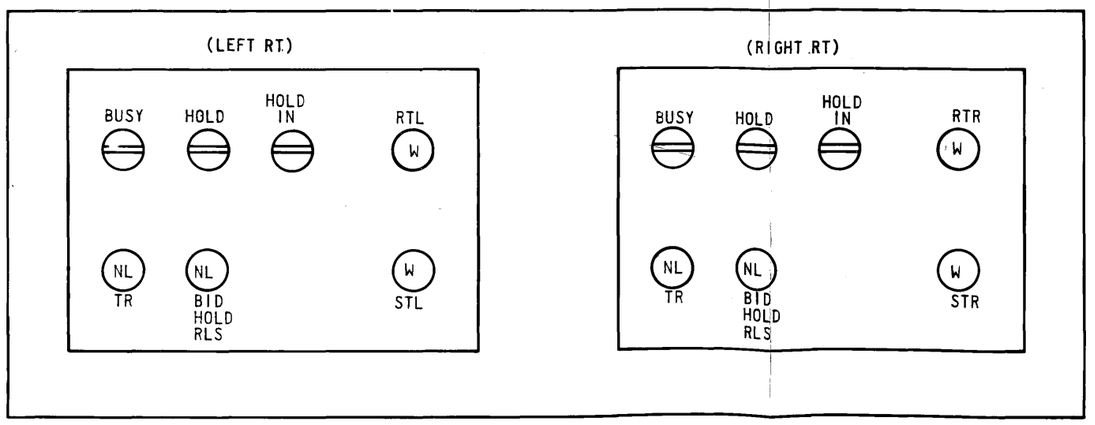


FIG. 17C

KEY & LAMP CONTROL PANEL
(MOUNTED IN 28RT MACHINE CABINET)



KEY TO SYMBOLS

- (W) LAMP & COLOR OF CAP
- ⊖ TWO POSITION LOCKING KEY
- (NL) NON LOCKING KEY