

IMPROVEMENTS IN 81D1 TELETYPEWRITER
SWITCHING SYSTEM
INCLUDING 100-SPEED OPERATION
DESCRIPTION

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either 75- or 100-speed applications. In the case of existing 75-speed installations upgraded to 100 speed, a repackaged 28-type reperforator-transmitter, coded 28F and mounted on a base of the same major dimensions as the 14-type reperforator-transmitter, is used so that existing 100E cabinets may be retained. In this case the reperforator-transmitter and its associated adapter unit are substituted for the 14-type machine, space being available on each shelf of the cabinet for an adapter. Other minor changes are also required in the cabinet.

1.04 The 28-type reperforator-transmitter is provided with two manually operated gear shifts, one on the reperforator and one on the transmitter-distributor, so that each unit may be operated independently at 60, 75, or 100 speed, as required for the condition under which it is used.

1.05 At the station a new control circuit capable of operation at 60, 75, or 100 speed is provided. This control circuit uses 28-type teletypewriters and typing reperforators and includes an electronic receiving selector which, in cooperation with other circuitry, replaces the SOTUS unit heretofore employed in the station control circuit.

1.06 Other changes at the switching center include several made to reduce undesirable effects of bidding contention by directors and resulting sequence circuit instability, director changes to improve operation when routing on the first character of a code, means for readily replacing the crossbar switches which comprise the fan circuits of the multiple-address director, means to permit the use of 4- and 5-character codes when connecting to a foreign system, and a number of other relatively minor improvements, as discussed in detail hereinafter.

1.07 The changes made to reduce sequence circuit instability involve the sequence circuit itself, the director circuits, and the outlets to which the directors connect. It is therefore necessary that if these changes are made in existing switching centers that they be coordinated. The outlet changes should be made first, followed by the sequence circuit changes, and finally the director changes.

1.08 Since the changes involved in 100-speed operation and the other changes have been made on the same drawing issues in some cases, all changes in a given circuit are discussed under one item rather than under separate categories.

2. INCOMING LINE OR TRUNK CIRCUIT

2.01 A new circuit, SD-70887-01, Issue 4AR, has been made available to provide a unit capable of operation at 100 speed as well as at 60 and 75 speed. This circuit has the same functions as the former circuit, SD-70670-01, Issue 8D, now rated A&M Only, which is not satisfactory for 100-speed operation. Slow-release relay A1 of the former circuit has been replaced by relay A1 under control of a tube-timing circuit in Figure 1 of the new circuit, in order to obtain faster operation and a more accurately controlled release time.

2.02 The faster operation is required to assure that relay A1 operates prior to the operation of relay HH when a "no traffic" response is received from an outlying station, in order to continue the polling by the transmitter-start circuit. The more accurately controlled release time is required to assure that relay A1 does not remain operated too long after a "no traffic" response. If the relay were too slow in releasing, traffic from the next station polled (assuming that station is located close to the switching center and has traffic to send) might be received before the relay had released. In this case a "no response" alarm would be recorded, even though traffic was being received, and the transmitter-start circuit would hold the outgoing line, so outgoing transmission could not take place. Also the sending transmitter at the station would continue to send after tape had run out because no LTRS character would have been sent to the station, so the transmitter-start condition at the station would not have been terminated. These undesirable possibilities have been eliminated by the use of an accurate timing circuit to release relay A1.

2.03 Because tube T is used to control relay A1, as outlined previously, the tube cannot be removed when the circuit is used as an incoming trunk or single-station incoming line circuit with which a tape changing machine is associated, as before. However, in this case it is necessary to disable one function of the tube provided when the circuit is used as a multistation line circuit, namely the operation of relay HH in case the line remains marking for about 50 seconds. To permit relay HH to operate during such a pause might cause a false switchover to the tape changer. By omitting Z wiring in Figure 3 in this case, relay HH is prevented from operating due to a pause in transmission, such as might occur when setting up a multiple-address connection at the switching center at the distant end of the trunk.

2.04 The new incoming line or trunk unit (J70110AT, List 1) occupies the space of five 1-3/4 inch mounting plates. Eight such units may be mounted in cabinet J70109M, List 1. It is not practical to modify an older incoming line or trunk unit (J70110D) to provide a new unit.

2.05 The 100E cabinet requires the addition of a TP172950 modification kit when it is used to mount two 28F reperforator-transmitters and their associated adapter units. This kit consists of two adapter unit mounting plates, a new tape chute for guiding the tape from the upper level to the lower level, and a new tape transport belt. If the cabinet is equipped with a Barcol motor to drive the tape transport belt, that motor must be replaced by the newer TP126964 Bodine motor.

2.06 Improved slides are being made available for the 28B apparatus cabinet, for use in those cases where it is felt that the effort required of the attendant to pull the reperforator-transmitter forward, out of the cabinet, is too great. The new slides, which may be readily installed in the cabinet, greatly reduce this effort. The TP176139 modification kit provides the new slides which will be furnished as part of all new 28B cabinets.

2.07 The TP174472 modification kit provides lighting for the tape bin of the 28A reperforator-transmitter stand. In cases where it is felt that the general room lighting is not adequate, provision of these lights should improve the situation. The lights may be readily mounted on the 28A stand in the field.

3. ORIGINATING STATION CIRCUIT

3.01 The originating station, SD-70881-01, Issue 3D, has been reissued to provide for horizontal and vertical tabulation and form feedout. This requires that LTRS (or FIGS) signals be sent to the line after a tabulate or form feed-out combination has been sent and while the home typing unit, which must be connected to the line under this mode of operation, is moving to the next tabulate stop. These signals are necessary so that after the tabulate combination has been registered at the receiving teletypewriter, nonprinting characters will be received while the teletypewriter is moving to the next tabulate stop, since the sending transmitter (outgoing line, director, or multiple-address level) will continue to send during this time.

3.02 In order to accomplish this, the TP161302 modification kit is added to the sending 28 ASR teletypewriter to provide automatic character feedout, connected as shown in Figure 6. After a tabulate combination is sent, this set of parts stops the transmitter on the first or second following character (LTRS or FIGS), but energizes the distributor clutch-release magnet. The character over the transmitter pins is now sent continuously until the tabulator stop is reached by the typing unit. At that time the character which may be in process of being sent is completed, after which the transmitter is again permitted to sense and send the tape. This results in enough so-called "LTRS fill" characters being sent to the line and finally to the receiving teletypewriter so that the first significant character in the original tape following a tabulate combination is not received until the receiving typing unit has been positioned to type that character in the proper location.

3.03 The preceding operation of the automatic character feed-out set of parts is disabled when the typing unit of the sending set is connected for checking tape during perforation, so that it cannot interfere if nontabulate tape is being sent blind from the station.

4. DIRECTOR CIRCUIT

4.01 The director circuit, SD-70668-01, Issue 9D, has been reissued to cover a number of changes as described in detail in the following paragraphs.

4.02 The first CDC fan relay contacts are rearranged to some extent and relay F7 is added, in parallel with relay F2, to effectively add contacts to the latter relay. The former arrangement, Figure A, rated Mfr Disc., is replaced by Figure B. This change is made to eliminate contact bunching due to make-before-break contacts, which resulted in incorrect operation in some cases when connecting to an outlet on the first character of the directing code.

4.03 Option G, rated Mfr Disc., is replaced by option H. Relay SB in Figure 1 is replaced by a polar relay in order to obtain faster and more stable operation. This results in a somewhat faster bid by the director into the sequence circuit and permits the removal of capacitors A and B from the test lead. These capacitors, formerly required to hold relay BT during the operate time of relay SB, provided a path for

possible false operation of relay J in an outlet if a large number of directors were testing simultaneously to that outlet. Diode GA has also been inserted in this path as added protection. Relay HM is replaced by a new relay with additional contacts in order to release the sequence circuit sooner, and so speed up operation after a successful bid, and to open the test lead to an outlet sooner after making a connection, so as to eliminate the possibility of a re-bid into that outlet in the case where a selector in the outlet has stepped to an idle level of the outlet.

4.04 Means are also provided by option H to break down a connection when the director has attempted to connect to an outlet on the first character of the code and is unable to complete the connection, for example, because the outlet is busy. Heretofore there was no way to release relay FC under this condition. Relay FC is normally released by relay FL when the director starts to scan the second character of the code, but when connecting on the first character relay FL is not operated. By furnishing battery to relay FC through added resistor FC, and the addition of diodes DT1 and DT2, a circuit is provided to shunt down relay FC when keys DIR STOP and FIGS H & INT are operated.

4.05 Option M is added in Figure 1, replacing option K now rated Mfr Disc. This change includes the addition of relay KG and diode FH and the replacement of relay MD, and is made in order to delay transmission of the first CDC when the multiple-address code (and the following LTRS) is discarded by the director. This delay is necessary with a 28-type reperforator-transmitter operating at 100 speed so that relay AB may operate and close the transmission path before the first CDC is sent. The provision of relay KG, which is operated via relay MD from the transmitter auxiliary contact on the transmission of LTRS, delays the operation of the transmitter clutch-release magnet for the following character until relay AB has operated. At this time the transmission path is closed and the following character can be transmitted. When the director is associated with an originating station using a 19-type teletypewriter set (75 speed) the operation of relay AB occurs early enough so that the action of relay KG is unnecessary. In this case the office wiring is so arranged that relay KG is not operated.

4.06 Option ZA is added in Figure 1, replacing option A now rated Mfr Disc. This change is required for use with 28-type reperforator-

transmitters and includes the replacement of relay TO and the addition of diodes TO1, TO2, and TO3. The tape-out contact of the 28D and 28F reperforator-transmitters is normally closed and is converted to a normally open contact, similar to that of the 14F and 14G reperforator-transmitters, by relay FF of the 28A or 28B adapter unit. The pulse received from the contact of the 28-type transmitter is shorter however, than that received from the 14-type transmitter. To assure operation of relay TO, a faster operating relay with fewer springs is employed. Diodes TO1 and TO2 are provided to separate two circuits operated from one set of contacts, which were operated from separate contacts of the former relay. Diode TO3 is provided to slow the release of relay TO, to assure it remains operated long enough to operate other relays from its contacts. Option ZA may of course be used with 14-type reperforator-transmitters and requires no additional mounting space.

4.07 Figure 16 is added to show the 28D reperforator-transmitter and its associated 28A adapter unit used in new installations, and the 28F reperforator-transmitter and its associated 28B adapter unit used in existing installations upgraded to 100 speed.

4.08 Option B is provided in Figure 6 to permit the directing codes at the head of a message to appear in the local copy of an originating station associated with the director. When this option is omitted only the text of the message appears on the originating station typing unit.

4.09 The director unit, J70110E, List 4, provides the new apparatus as covered previously. To modify a director in the field it is necessary to replace one mounting plate as well as to make the replacements and additions outlined previously.

5. SEQUENCE CIRCUIT

5.01 The sequence circuit, SD-70588-01, Issue 9D, has been reissued to improve the circuit operation and to provide a new means for substituting the spare for the regular circuit, since the switches formerly used for this purpose are no longer available.

5.02 Option N is rated Mfr Disc., replaced by option R. Relays H and M of the control circuit, Figure 1, have been replaced and the circuit rearranged so that relay H, formerly

held by a chain circuit through all relays SE- and SS- normally released, except one relay SS- operated, is now held on a second winding from relay M released. This eliminates possible chatter of relay H when a number of directors make simultaneous bids for use of the sequence circuit, after the circuit has been released by a director which has been using it. If relay H chatters there is a possibility that the SE- relay which should receive preference will release and another SE- relay be successful in seizing the sequence circuit. When relay M operates, indicating only one SE- relay is operated, the holding path for relay H is opened and the relay is held on its secondary winding by the director associated with the operated SE- relay. Option M is rated Mfr Disc., replaced by option K in Figure 4 to provide wiring in the sequence relay circuit compatible with option R in Figure 1.

5.03 Figure 7 is rated Mfr Disc., replaced by Figures 11, 12, and 13. Formerly three multi-contact switches were furnished to permit replacement of the regular sequence circuit by the spare circuit. This replacement is now effected by the use of four patch cords, mounted in the spare sequence cabinet. The regular and spare circuits each appear on four sets of connector plugs, and the external circuits terminate on four cords with connector bodies attached. The connector bodies may be patched to either set of connector plugs, as desired.

5.04 The sequence control unit, J70110H, List 3, provides the new relays and wiring. Space vacated by the replaced relays may be used for mounting the new relays when modifying a unit in the field. The sequence relay unit, J70110J, List 3, provides the new wiring. The new sequence patching unit is covered by J70110AW, List 1.

5.05 The regular sequence cabinet, J70109E, Lists 6 and 7, includes the new J70110H sequence control unit and the new J70110J sequence relay unit. The spare sequence cabinet, J70109AT, Lists 3 and 4, includes the new J70110H sequence control unit, the new J70110J sequence relay unit, and the new J70110AW patching unit.

6. OUTGOING LINE OR TRUNK CIRCUIT

6.01 The outgoing line or trunk circuit, SD-70624-01, Issue 10AC, has been revised to provide for 100-speed operation, to ensure that a seized level will indicate busy before another director can bid for the outlet, and to make certain other minor changes.

6.02 The CAR RET—LINE FEED maze contact of the outgoing line reperforator-transmitter was formerly used to shunt down relay FH during circuit operation. At 100 speed this contact does not remain closed long enough for the purpose. Relay FHR is therefore added in Figure 1 as option ZT to ensure correct operation. When the maze contact closes, relay FHR operates, releasing relay FH. The former wiring, including resistor CR, is now shown as option ZV and rated Mfr Disc.

6.03 Option ZW is added to eliminate a previously unguarded interval during which the outlet appeared idle to a testing director even though it had previously been seized by another director. With ZW wiring, lead H1 is made busy before the first director releases the sequence circuit, so another testing director finds the outlet busy until alternation to the second level occurs, assuming that level is idle.

6.04 Varistor AD is added (option ZR) to reduce the effect of a shunt path via the primary winding of relay AD on the No. 2 transmitter clutch-release magnet when relay AD is operated and the No. 2 transmitter stop contact opens as the transmitter comes to the end of the tape. Under this condition if the clutch magnet is slow in releasing, it may pull the tape in the punch block. The addition of varistor AD speeds up the release of the clutch magnet, thus eliminating any tendency toward tape pulling.

6.05 Option ZN is added in Figure 1 and 6, replacing option ZM now rated Mfr Disc., to provide faster operating relays R1, R2, and R3, which are required for use with the shorter tape-out pulse received from 28-type reperforator-transmitters, as described in 4.06. In this case the relays lock locally, so are only required to operate on the shorter pulse they receive. A resistor, R1, R2, or R3, is connected in series with each relay winding as a current limiter. Option ZN may of course be used with 14-type reperforator-transmitters.

6.06 Figure 11 is added to show the 28D reperforator-transmitter and its associated 28A adapter unit used in new installations, and the 28F reperforator-transmitter and its associated 28B adapter unit used in existing installations upgraded to 100 speed.

6.07 In addition, options are added to provide for capacitors and networks capable of withstanding higher operating temperatures, and the code of the control board BUSY OUT lamp has been changed to provide greater brilliancy.

6.08 The outgoing line or trunk unit for levels 1 and 2, J70110B, List 4, provides the new apparatus and wiring. Space is available on an existing mounting plate to add relay FHR and resistors R1 and R2 when modifying a unit in the field. The level 3 unit, J70110R, List 3, provides the new apparatus and wiring. Space is available on an existing mounting plate to add resistor R3 when modifying a unit in the field.

7. LOCAL OUTLET AND INTERCEPT CIRCUIT

7.01 The local outlet and intercept circuit, SD-70622-01, Issue 12A, has been revised to ensure that a seized level will indicate busy before another director can bid for the outlet and to make certain other minor changes.

7.02 Option YZ, replacing option YX now rated Mfr Disc., is added in Figure 4 to eliminate a previously unguarded interval during which the outlet appeared idle to a testing director even though it had previously been seized by another director. With YZ wiring, lead H1 is made busy by the operation of relay B before the first director releases the sequence circuit, so another testing director finds the outlet busy until the appearance sequence circuit has stepped to an idle level, if one is available.

7.03 The early operation of relay B, covered previously, would normally initiate a false tape feedout in the associated typing reperforator. To prevent this, relay FO is added (option YZ), and the tape feed-out start circuit is carried through make contacts on the relay. This delays the start of tape feedout until the end of a message.

7.04 Figure 26 is added to show the 28D reperforator-transmitter and its associated 28A adapter unit used in new installations, and the 28F reperforator-transmitter and its associated 28B adapter unit used in existing installations upgraded to 100 speed.

7.05 Resistor R34 is added (option YW) in parallel with resistor R19 to provide sufficient operating current for the tape feed-out magnet when a 28-type typing reperforator is used. In addition, the code of the control board BUSY OUT (or INCPT BUSY) lamp has been changed to provide greater brilliancy.

7.06 The local outlet individual unit, J70110T, List 5, provides the new apparatus and wiring. Space is available on existing mounting plates to add relay FO and resistor R34 when modifying a unit in the field.

8. MULTIPLE-ADDRESS CIRCUIT (ONE STAGE)

8.01 The one-stage multiple-address circuit, SD-70619-01, Issue 17AC (also used as the first stage of a two-stage circuit), has been revised to ensure that a seized level will indicate busy before another director can bid for the outlet and to provide for 100-speed operation.

8.02 Option AT, replacing option AS now rated Mfr Disc., is added in the level circuit, Figure 5, to eliminate a previously unguarded interval during which the level appeared idle to a testing director even though it had been seized by another director. With AT wiring, lead HR or HP is made busy by the operation of relay B before the first director releases the sequence circuit, so another testing director finds the circuit busy until the level sequence circuit has stepped to an idle level, if one is available.

8.03 Relay LCS is added (option AW) to the director, Figure 9, so that for 100-speed operation the seized outlets will be in the text condition before the CAR RET marking the end of addresses is sent to them. Heretofore the operation of relay CL initiated both these actions simultaneously by the operation of relay LC and the distributor clutch-release magnet. With option AW, relay CL operates relay LC, shifting the connected outlets to text. Relay LC in turn releases normally operated slow-release relay LCS, which in turn operates the clutch-release magnet to send CAR RET. This delay assures that the outlets are in the text condition before CAR RET is sent. The former wiring, option AV, is now rated Mfr Disc.

8.04 Option ZB is added in Figure 5, replacing option ZA now rated Mfr Disc., to provide a faster operating relay TO, required for use with the shorter tape-out pulse received from 28-type reperforator-transmitters, as described in 4.06. In this case the relay locks locally, so is only required to operate on the shorter pulse it receives. Resistor TO is connected in series with the relay winding as a current limiter. Option ZB may of course be used with 14-type reperforator-transmitters.

8.05 Figure 26 is added to show the 28D reperforator-transmitter and its associated 28A adapter unit used in new installations, and the 28F reperforator-transmitter and its associated 28B adapter unit used in existing installations upgraded to 100 speed.

8.06 Wear had been observed at the hinges of vertical units of the crossbar switches

comprising the director fan circuits in some installations. These switches operate almost continuously during the busy periods in large offices, and it has been estimated that a given vertical may operate as many as three million times per year. Since these are standard switches with adequate life for use in telephone switching systems (and as link switches in the 81D1 system) it does not seem practicable to provide switches with greater life. Of course, normal maintenance, with particular attention to lubrication, should be given the switches.

8.07 In order to cope with the situation mentioned in 8.06, the two switches of the director have been made patchable, and spare switches provided, in order to perform maintenance on the switches as required. The first and second fans, Figure 12, heretofore wired directly to Figure 10 and thence to the director, are now wired to Figure 10 via Figures 24 and 25, which provide a patching cord and plug so the regular fans can be replaced by the spare fans. Likewise the final fan, now shown in Figure 21, replacing Figure 13 rated Mfr Disc., is wired to the final code points, now shown in Figure 23, via Figure 22. These figures provide patching cords and plugs so the final fan can be replaced by the spare fan. The first and second fans (one switch) and the final fan (a second switch) are wired together permanently, so both must be patched at the same time.

8.08 In connection with the preceding, it is reported that at one installation where wear on a vertical unit resulted in trouble, the worn unit was removed and replaced by another unit (obtained from the same switch, which has two spare units). It is reported that this replacement was effected during a relatively idle period, when the multiple-address circuit could be taken out of service, and took about one-half hour to effect. In view of the wiring problem of adding the spare switches in existing offices, especially where 24-hour service must be maintained, consideration might be given in such offices to keeping close watch for wear on the switches and replacing any vertical units which appear to be wearing excessively rather than providing complete spare switches and patching facilities.

8.09 When sending to a "foreign" system, it is in some cases desirable to use all 26 alphabetic characters in the directing code, instead of the 20 characters normally used in the 81D1 system. It is also desirable in some cases to use 4- or 5-character codes instead of the

3-character (two significant characters plus LTRS) codes used in the 81D1 system. These requirements are no problem with single-address messages, since a regular 81D1 code is used to route the message to the foreign system, and any subsequent characters (4- or 5-character codes, with any of the 26 alphabetic characters) is considered text by the 81D1 system. In the case of multiple-address messages, 4- or 5-character codes can be provided for by building out to six characters, as the multiple-address director passes codes on to the foreign system in groups of three, and passes on any character it reads (if the character is valid). Therefore if a 4-character code is followed by two LTRS or a 5-character code is followed by a single LTRS, that code will be passed on to the foreign system.

8.10 In order that the six normally invalid alphabetic characters of the multiple-address director (T, O, M, V, Z, H) be passed on to the foreign system as well as LTRS when that character appears in the fifth (actually second) position in the code, arrangements have been made to validate these characters after a foreign system code has been sent. This is accomplished by the addition of relay SWC, option AX in Figure 18, and the provision of wiring option AX in Figure 12. When connection is made to the intersystem switching circuit (Figure 18), relay SWC is operated if the particular foreign system to which connection is made is to receive 4- or 5-character codes. Operation of relay SWC causes the leads representing the characters T, O, M, V, Z, and H in the first fan and the leads representing the characters T, O, M, V, Z, H, and LTRS in the second fan to be disconnected from the "bad first code" or "bad second code" lead of the director and instead to be connected in such a manner that the character is passed on to the foreign system.

8.11 When this circuit is used as the first stage of a two-stage multiple-address circuit and group codes are used, if a code normally requiring connection to both second-stage unit is received from a distant switching center and if the only outlet included in the group served by one of the two second stages is the trunk to the switching center from which the message was received, the message should not be passed on from the first stage to that particular second stage. If the message were passed on it could not be handled in that second stage, as the only outlet to which it should be sent would be the trunk, which in this case would be excluded (the trunk would not be excluded, of course, if the message originated locally).

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8.12 The above feature of not sending the message to one of the second stages in certain cases is provided by option AL in Figure 17. This provides a ground to the first-stage group-code circuit whenever a group code is received from a distant switching center, to operate a relay in the group-code circuit which will prevent the message from being relayed to the particular second-stage circuit which should not receive it. One case which the preceding arrangement does not cover is when there are three or more switching units in a system, but there are not trunks between each switching unit. In this case one second-stage unit should be excluded when the code is received from one distant switching center but should not be excluded when it is received from another. This case has not been provided for, since it seems very unlikely that a system large enough to have three or more switching centers provided with two-stage multiple-address circuits will not have direct trunks between each switching center. However, should such a case arise it can be provided for readily by furnishing additional exclusion relays in the first-stage group-code circuit.

8.13 The level circuit with the preceding changes is covered by J70110N, List 7, while the director is covered by J70110M, List 5. The first-stage multiple-address code transmission unit is covered by J70110AK, List 2, while the intersystem switching relay unit is covered by J70110AP, List 2. Space is available on an existing mounting plate of the level unit to add resistor TO when modifying a unit in the field, while space is available on the director unit to add relay LCS when modifying a unit in the field. Space is also available on the intersystem switching unit to add relay SWC when modifying a unit in the field.

8.14 The multiple-address link switch cabinets J70109D which mounted the multiple-address link and fans have been rated A&M Only and replaced by two cabinet codes. Cabinet J70109AU mounts the multiple-address link equipped as required per various lists for use either in a one-stage or two-stage installation, while cabinet J70109BA mounts the multiple-address fans (regular and spare) together with the necessary patching arrangements.

9. MULTIPLE ADDRESS CIRCUIT (SECOND STAGE)

9.01 The second stage of a two-stage multiple-address circuit, SD-70746-01, Issue 5D,

has been revised to add relay LCS as option AJ to the director, Figure 9, so that for 100-speed operation the seized outlets will be in the text condition before the CAR RET marking the end of addresses is sent to them. This change is similar to one made in the one-stage multiple-address circuit and described in detail in 8.03.

9.02 The two fan switches in the director of this circuit have been made patchable in the same manner as described for the one-stage circuit in 8.06, 8.07, and 8.08. In this case the first and second stage fans, Figure 12, are wired to the director via Figures 23 and 24, which provide a patching cord and plug so the regular fans can be replaced by the spare fans. Also the final fan, Figure 20, is wired to the final code points, now shown in Figure 22, via Figure 21, to provide patching cords and plugs so that it may be replaced by the spare fan.

9.03 Arrangements have been provided in this circuit to use all 26 alphabetic characters in the directing code in certain cases when sending to a foreign system, in the same manner as described for the one-stage circuit in 8.09 and 8.10. This is accomplished by the addition of relay SWC, option AE in Figure 17, and the provision of wiring option AE in Figure 12, the first and second fans.

9.04 The level unit is covered by J70110AM, List 2, while the director is covered by J70110AL, List 3. The intersystem switching unit used for the second stage of a two-stage system is the same as that used for the one-stage system and is covered by J70110AP, List 2. Space is available on the director unit to add relay LCS when modifying a unit in the field. Space is also available on the intersystem switching unit to add relay SWC when modifying a unit in the field. The new link switch cabinets, including the director fans, are the same as used for the one-stage circuit and are covered in 8.14.

10. GROUP-CODE CIRCUIT

10.01 The group-code circuit, SD-70669-01, Issue 7D, has been reissued to provide a feature in the first-stage group-code circuit, Figure 10, required when it is desired to exclude a group-code message from a second-stage unit to which it would normally be routed, because that particular message should not be sent to any outlet from that second stage. The reason for this is discussed in more detail in 8.11, under the first-stage multiple-address circuit.

10.02 Relay EX is added in Figure 10 to provide the preceding feature. Only one two-stage multiple-address circuit has been installed in the field and since the first-stage group-code circuit associated with that circuit has been modified to provide relay EX, no option record is being kept on the drawing.

10.03 When the first-stage multiple-address circuit receives a routing code from a distant switching center it passes that code on to the second-stage multiple-address circuit. In doing so it grounds lead TK to Figure 10, operating relay EX. If a particular group code is to be excluded from unit No. 1 of the second-stage circuit, the final code point representing that code is connected to lead GC5, while if the code is to be excluded from unit No. 2 the final code point is connected to lead GC4. With relay EX operated, either relay GC1 or GC2 is operated, routing the message to second-stage unit No. 1 or No. 2, while with relay EX released, the final code points (connected to leads GC4 and GC5) operate relay GC3, which in turn operates both relays GC1 and GC2 so the message is sent to both second-stage units.

10.04 The first-stage group-code circuit is not a coded J- unit, but is wired in the field by the installer, and is mounted in one of the initial group-code cabinets J70109R provided for the two second stages. Drawing J70109R() shows the location of the added relay.

11. SUPPLEMENTARY MULTIPLE-ADDRESS CIRCUIT

11.01 The supplementary multiple-address circuit, SD-70658-01, Issue 4D, has been reissued to ensure that a seized cross-office circuit will indicate busy before another director can bid for the circuit and to make certain other minor changes.

11.02 Option Q is added to eliminate a previously unguarded interval during which a cross-office circuit appeared idle to a testing director even though it had previously been seized by another director. With Q wiring, the H lead is transferred to the next idle cross-office circuit (or made busy if there is no idle circuit) by the operation of relay BY before the first director releases the sequence circuit, so that another testing director tests the next cross-office circuit, if one is available.

11.03 Figure 16 is added to show the 28D re-perforator-transmitter and its associated

28A adapter unit used in new installations, and the 28F re-perforator-transmitter and its associated 28B adapter unit used in existing installations upgraded to 100 speed.

11.04 Capacitors CH and CJ in the cross-office circuit have been designated option J and rated Mfr Disc., replaced by capacitors CH1 and CJ1, options K and L. The former capacitors were used for 75-speed operation. Capacitors CH1 and CJ1, options K and L, are now used for 75 speed, while capacitor CJ1, option L, is used for 100 speed.

11.05 In addition, options are added to provide for capacitors and networks capable of withstanding higher operating temperatures and the value of resistor RV in the cross-office circuit is changed to eliminate a possible false count in the character timer of that circuit.

11.06 The equipment specification list number of the cross-office circuit has not been changed to reflect the preceding apparatus changes, equipment units with the new apparatus being furnished as J70110AG, List 1. The new apparatus may be mounted in place of the apparatus it replaces when modifying a unit in the field.

12. TEST BENCH CIRCUIT

12.01 The test bench circuit, SD-70621-01, Issue 9D, has been reissued to provide for testing 28-type apparatus.

12.02 Figures 49, 50, and 151 provide means for testing the two-shaft transmitter-distributor of a 28 ASR teletypewriter associated with an originating station circuit. The transmitter-distributor, Figure 50, may be set on a portable transmitter-distributor mounting at the test bench, and connected by means of the patch cord, Figure 49, to either Figure 151 or Figure 2. Figure 151 is provided in new installations and Figure 2, with X option, is provided at upgraded installations, which will use both 14- and 28-type transmitter-distributors during the conversion period. Figure 151 or Figure 2, together with Figure 13, provides means for checking transmission and auxiliary contact operation of the transmitter-distributor. The transmitter-distributor may be patched to the unit test cabinet by means of the trunk terminated in Figure 43 for use when testing an originating station circuit associated with a 28 ASR.

12.03 Figure 153 provides a single-shaft transmitter-distributor for use in sending

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tape, such as when testing an incoming line circuit. The transmitter-distributor may be set on a portable transmitter-distributor mounting at the test bench, and patched to any circuit to which it is desired to send. Figure 155 provides an ac power supply at the test bench to which the power cord of either the single-shaft or two-shaft transmitter-distributor mounting may be connected, replacing Figure 36, now rated Mfr Disc.

12.04 Figure 154 provides a 28 receiving-only typing reperforator, with electrical service unit, for use as a monitoring machine at the machine test cabinet in place of the 14-type teletypewriter, Figure 29, formerly used. Figure 156 provides a power outlet capable of receiving the typing reperforator power cord.

12.05 Figure 158 provides a line relay circuit for use with a 28A adapter unit when the unit is associated with a 28D reperforator-transmitter set for testing at the test bench. This circuit replaces a similar circuit in the 28B apparatus cabinet in which the reperforator-transmitter set and adapter unit normally mount.

12.06 Figure 159 provides a 28D electrical service unit and power cord, to which may be connected the magnet and power circuits of a 28 receiving-only typing reperforator brought to the test bench for test. Signals from a transmitter-distributor or other source may then be sent to the machine.

12.07 Figure 160 provides a 28 sequence selector base, with motor unit and gears, on which may be mounted a 28 typing unit brought to the test bench for test. The magnet of the unit is connected to the selector base by means of a patch cord associated with the base. Since the magnet requires 0.030 ampere for operation, Figure 161 provides a repeating relay to furnish this current. This relay, which may be operated by signals from a transmitter-distributor or other source, is arranged for 0.020 ampere in its line winding.

12.08 Figure 162 provides a 28 receiving-only teletypewriter for use either as a monitoring machine or for testing a typing unit equipped with universal and FIGS H contacts (such as used as a "drop-off" machine on an incoming line). This machine terminates on the test bench in Figure 42, where it may be patched to Figure 1 for testing the contacts.

12.09 Figure 163 shows the 28D reperforator-transmitter set and the 28F reperforator-transmitter (with associated adapter units) which may be brought to the test bench for testing. In the case of the 28D machine, Figure 158 is used to provide a line relay to operate the magnet. A similar line relay is provided as part of the 28B adapter unit used with the 28F machine.

12.10 The test bench, J70109W, List 3, and the machine test cabinet, J70109AY, List 1, provide means for testing 28-type teletypewriter apparatus. A test bench and test cabinet originally provided for testing 14- and 15-type teletypewriter apparatus may be modified in the field for testing 28-type apparatus if an existing switching unit is modified to use 28-type apparatus.

13. ADAPTER UNIT TEST SET CIRCUIT

13.01 A test set circuit, SD-70916-01, Issue 1, is provided to permit testing the 28A or 28B adapter unit. This test set is portable (approximately 14 inches by 15 inches by 6 inches) and consists of panel mounting keys, lamps, potentiometers, a meter, and plugs and sockets for associating an adapter unit with the test set. Five relays and a number of resistors mount beneath the panel and a patch cord is furnished for connecting 48-volt power to the set. Two extension patch cords are also furnished, for use when it is desired to test the adapter unit without removing it from the cabinet in which it normally mounts.

13.02 An adapter unit is usually tested at the test bench, being connected to the test set by means of the cords which normally connect the unit to the reperforator-transmitter. Various conditions may be set up by the keys of the set, to simulate either the reperforator or the transmitter-distributor. When checking the reperforator portion of the adapter unit the position of the reperforator code reading contacts for various characters can be simulated by key operation. Lamps in the set light to indicate that the adapter relays have closed through the leads representing those characters. Operation of a relay in response to universal contact closure can likewise be checked, as well as the adapter wiring associated with the reperforator line relay and the receiving auxiliary contact.

13.03 Other keys of the test set simulate the conditions applied to the adapter unit by

the transmitter-distributor. These include the closure of the transmitter contacts for different characters, and cause lamps to light indicating that the adapter relays have closed through the leads representing various characters in the maze. The operation of a relay providing tape-out contact closure can likewise be checked, as well as the adapter wiring associated with the distributor and the various magnets and contacts of the transmitter-distributor. Current through the windings of the 303F relays of the adapter unit can be adjusted by means of the potentiometers and meter so that the operate and release of the relays can be checked by the operation of certain keys and the lamp responses.

13.04 The test set is furnished as J70142A, List 1.

14. UNIT TEST CIRCUIT

14.01 The unit test circuit, SD-70678-01, Issue 15D, has been reissued to provide for testing the new originating station circuit, to provide for the use of 28-type reperforator-transmitters and teletypewriters with the various test circuits, and to make other minor changes and improvements.

14.02 Figure 38 provides means for testing an originating station circuit associated with a 28 ASR machine, the circuit to be tested being brought to the unit test cabinet by means of a test trunk. A two-shaft 28-type transmitter-distributor located at the test bench and two reperforator-transmitters are also patched to the test circuit at the unit test cabinet. It is then possible to check the operation of various functions of the originating station circuit in the same manner as in normal operation.

14.03 In order to test an originating station circuit associated with either the 14 transmitter-distributor of a 19 teletypewriter set or with a 28 ASR during a conversion period from 19 to 28 ASR sets, option AL is provided in Figure 12, the test circuit formerly used for testing an originating station circuit using a 19 teletypewriter set. This option provides a locking key and two relays, as well as one additional lamp. With the key normal, the original wiring is provided, so a station circuit using a 14-type transmitter-distributor may be tested. With the key operated, the circuit of Figure 38 is provided, so a station circuit using a 28 ASR may be tested.

14.04 The outgoing line test circuit, Figure 26, has been modified to permit the use of either a 14-type or a 28-type transmitter-distributor at the test bench as a source of signals. When a 14-type unit is to be used, wiring option AH should be provided, while if a 28-type unit is to be used, wiring option AG should be provided. Wiring option AF is also provided in this figure, replacing option H now rated Mfr Disc., to facilitate testing.

14.05 Wiring option AJ is added in Figure 18 to assure the release of relay MA when key MK BSY is operated during level tests. Heretofore it was possible for the relay to remain operated, due to a holding current in its winding.

14.06 Figures 39 and 40 show the 28D reperforator-transmitter set and the 28F reperforator-transmitter (with associated adapter units) and the 28B and 100E cabinet circuits used in making unit tests. Figure 39 shows the ORT machine, while Figure 40 shows the IRT machine.

14.07 The unit test cabinet, J70109AB, List 9, is arranged for use with the two-shaft 28-type transmitter-distributor, while List 10 provides the equipment and wiring to arrange a cabinet for testing an originating station associated with either a 19 teletypewriter set or a 28 ASR.

15. STATION CONTROL CIRCUIT

A. Station Control Circuit With SOTUS

15.01 The station control circuit employing the SOTUS unit, SD-70466-01, Issue 16D, has been reissued to provide for horizontal and vertical tabulation and form feedout when a 28 ASR teletypewriter is employed. Normally a single-contact transmitter-distributor is used with the 28 ASR, as shown in Figure 22, but for the preceding application, a multicontact transmitter-distributor is required, as shown in Figure 34.

15.02 The provision of tabulation and form feedout requires that LTRS (or FIGS) signals be sent to the line after a tabulate or form feed-out combination has been sent and while the home typing unit, which must be connected to the line under this mode of operation, is moving to the next tabulate stop. These signals are necessary so that after the tabulate combination has been registered at the receiving teletypewriter, nonprinting characters will

be received while the teletypewriter is moving to the next tabulate stop, since the sending transmitter (outgoing line, director, or multiple-address level) will continue to send during this time.

15.03 In order to accomplish this, the TP161302 modification kit is added to the 28 ASR to provide automatic character feedout, connected as shown in Figure 34. After a tabulate combination is sent, this set of parts stops the transmitter on the first or second following character (LTRS or FIGS), but energizes the distributor clutch-release magnet. The character over the transmitter pins is now sent continuously until the tabulate stop is reached by the typing unit. At this time the character which may be in process of being sent is completed, after which the transmitter is again permitted to sense and send the tape. This results in enough so-called "LTRS fill" characters being sent to the line and finally to the receiving teletypewriter so that the first significant character in the original tape following the tabulate combination is not received until the receiving typing unit is positioned to type that character in the proper location.

15.04 The preceding operation of the automatic character feed-out modification kit is disabled when the typing unit of the sending set is connected for checking tape during perforation, so that it cannot interfere if nontabulate tape is being sent blind from the station.

15.05 Resistors A1 and A2, option ZC, have been added in the control unit (Figure 1) in place of resistor A, option ZB, now Mfr Disc., to provide for operation with 28 ASR teletypewriters. Resistor A provided battery for operation of the STOP magnets of the two 14-type transmitter-distributors which may be associated with the unit when 19-type teletypewriter sets are used. When a 28-type single-contact transmitter-distributor is used an additional resistor must be inserted in the circuit to provide the proper current for the clutch magnet. This additional resistor is not required with the 28 multicontact transmitter-distributor, which has an internal resistor in series with the transmitter clutch magnet. Resistors A1 and A2, one for each transmitter-distributor circuit, are tapped so that when a multicontact transmitter-distributor is used, ZA wiring straps out part of the resistor, thus providing the proper value.

15.06 Space for the added resistor is available in the control unit, so existing units may

be modified in the field, if desired. For new installations, control unit J70095B, List 5, provides the new resistors. The control cabinet, J70095E, Lists 11 and 12, includes the new control unit. This control circuit is satisfactory for 60- or 75-speed operation only.

B. Station Control Circuit With Electronic Selector

15.07 A new station control circuit, SD-70883-01, Issue 5D, has been made available for 60-, 75-, or 100-speed operation. This circuit includes an electronic receiving selector in place of the SOTUS unit, and is therefore capable of 100-speed operation. The selector circuit is shown on SD-70882-01, Issue 3B.

15.08 The new circuit has the ability to recognize a maximum of 120 cuton codes (any 6 of 20 first-code characters and 20 second-code characters) as compared with 16 codes for the older circuit. When arranged (optionally) as a master station it is also capable of recognizing any invalid code, including one among a series of codes comprising the address of a multiple-address message. In the case of the older circuit the receipt of any valid code in a series caused the master station function to be disabled.

15.09 The control unit is capable of controlling either one or two sending and receiving stations located adjacent to it. The 28 ASR teletypewriters with multicontact transmitter-distributors are used for sending and 28 RO teletypewriters or one 28 RO teletypewriter and one 28 RO typing reperforator may be used for receiving. The distributor of the ASR teletypewriter is used for sending the no-traffic H response from the station.

15.10 An optional line-release delay feature is provided whereby after a message tape has run out of the transmitter another tape may be inserted, within about 20 seconds, and immediately transmitted. Another optional feature provides a noninterfering tape feedout for messages received on a typing reperforator, so that the message may be torn off without mutilating the tape.

15.11 The station control cabinet, J70095W, List 1, is approximately 2 feet, 2-1/2 inches wide, 4 feet, 4 inches high, and 1 foot, 5 inches deep (the same size as the present station control cabinet) but is furnished with a

gray-green wrinkle enamel finish only. The receiving selector electronic and relay units, J70139A, List 1, and J70139B, List 1, together with the associated power supply unit, J86489A, List 1, occupy approximately 14 inches vertically at the bottom of the cabinet alongside the local line receiving unit, J70095P, List 1. Together these units occupy the full 23-inch width of the cabinet. A 6-inch vertical space above these units is reserved for mounting the optional line-release delay unit, J70095T, List 1, and the tape feed-out unit, J70095U, List 1 (these units packaged together are covered by J70095S, List 1), and the master station code verification unit, J70095R, List 1. Above this space is mounted the station control unit, J70095N, List 1, and the 48-volt and 130-volt rectifiers required to power the various units. The power switch and keys for manual control of the teletypewriter apparatus in case of trouble in the station control unit are mounted in the upper part of the front cabinet door.

15.12 The control keys and lamps associated with each sending and receiving station mount in a panel which in turn mounts in the 28 ASR cabinet. The panel mounted in the cabinet of the first set includes lamps and keys associated with the control circuit, such as the power failure and open-line alarm lamps and the alarm-release and buzzer-release keys. In addition, it includes lamps and keys associated with the operation of the station, such as the emergency stop lamp, the nonvalid alarm lamp (if provided), and the priority start key (if provided). The panel mounted in the cabinet of the second set includes the emergency stop lamp and the priority start key (if provided). Power for the operation of the lamps is obtained from the power supply of the first ASR, so the alarms will be available in case of power failure to, or a blown fuse in, the station control cabinet. In the case of an RO station, the control keys, lamps, and buzzer are mounted in a control unit which in turn mounts on the side of the teletypewriter cabinet.

15.13 The key and lamp panel mounted in the 28 ASR is covered by J70095Y, List 1 to 5, as required, while the transformer which mounts in the first ASR and supplies power to the lamps is covered by J70095AA, List 1. The control unit which mounts on the side of the teletypewriter cabinet in the case of a receiving-only station is covered by J70095AE, List 1.

16. AUTOMATIC ADDRESS CIRCUIT

16.01 The automatic address circuit, SD-70625-01, Issue 7D, is arranged for

operation with the 114-type reperforator-transmitter, which is capable of 60- or 75-speed operation only. Since this reperforator-transmitter is no longer available, the drawing has been rated Mfr Disc.

16.02 A new automatic address circuit, SD-70917-01, Issue 5D, has been made available for 60-, 75-, or 100-speed operation. This circuit is arranged to use the 28-type reperforator-transmitter and is similar to the circuit employed with the 114-type reperforator-transmitter when arranged for 20-key operation, minor differences being required because of differences in the tape-out contacts of the two machines. A 28A reperforator-transmitter adapter unit is used with the storing reperforator-transmitter to provide the necessary maze contacts. A circuit using the 114-type reperforator-transmitter may be modified to operate with a 28-type reperforator-transmitter if it is desired to upgrade an existing circuit to operate at 100 speed.

16.03 The new automatic address circuit is covered by J70095AD, List 3, which includes the cabinet with front and rear relay rack units. J70095AB, List 1, and J70095AC, List 1, 48-volt and 130-volt rectifiers KS-15620, List 9, and KS-15898, List 1, and certain keys and lamps required for 81D1 operation, J70095AB, List 3. The two reperforator-transmitter units required for the cabinet are covered by J70095AD, List 2. The operator control unit is covered by J70095K, List 1.

17. SINGLE-STATION LINE OPERATION

17.01 When only one station is connected to a full-duplex line a station control circuit is unnecessary, since all messages received over the line from the switching center are intended for that station and the station is free to send to the switching center at any time.

17.02 The receiving teletypewriter is therefore connected to the receiving loop in the normal manner, and receives all copy sent over the line, including the call-directing code at the start of the message, which is normally used to cut the station on the line. No transmitter-start patterns are sent over a single-station line.

17.03 The sending teletypewriter is also connected to the sending loop in the normal manner, except that it must be arranged so the keyboard cannot send directly to the line. The sending station for the case of a 28 ASR is

shown on SD-70885-01, Issue 1. FS1 covers the 28 ASR without keyboard sending and without tabulation or form feedout, while FS3 covers the 28 ASR without keyboard sending and with tabulation or form feedout. In either case a TP160347 stop stud should be installed to prevent operation of the keyboard-tape switch to

the K position and the line-test key should be disabled by reversing the linkage at the key handle.

18. CIRCUIT DRAWINGS

18.01 The following tables list new and reissued circuit drawings.

TABLE A
NEW CIRCUIT DRAWINGS — 81D1 SYSTEM

Title	Number	Issue
Incoming Line or Trunk Circuit	SD-70887-01	4AR
Originating Station Circuit (With 28 ASR)	SD-70881-01	3D
Test Set Circuit (For Adapter Unit)	SD-70916-01	1
Station Control Circuit (With Electronic Selector)	SD-70883-01	5D
Electronic Receiving Selector Circuit	SD-70882-01	3B
Automatic Address Circuit (With 28 Reperforator-Transmitter)	SD-70917-01	5D
Teletypewriter Station Connecting Circuit	SD-70885-01	1

TABLE B
REISSUED CIRCUIT DRAWINGS — 81D1 SYSTEM

Title	Number	Issue
Incoming Line or Trunk Circuit	SD-70670-01	8D
Director Circuit	SD-70668-01	9D
Sequence Circuit	SD-70588-01	9D
Outgoing Line or Trunk Circuit	SD-70624-01	10AC
Local Outlet and Intercept Circuit	SD-70622-01	12A
Multiple Address Circuit (One Stage)	SD-70619-01	17AC
Second Stage Multiple Address Circuit	SD-70746-01	5D
Group Code Circuit	SD-70669-01	7D
Supplementary Multiple Address Circuit	SD-70658-01	4D
Test Bench Circuit	SD-70621-01	9D
Unit Test Circuit	SD-70678-01	15D
Station Control Circuit (With SOTUS)	SD-70466-01	16D
Automatic Address Circuit (With 114 Reperforator-Transmitter)	SD-70625-01	7D

19. THEORY SCHEMATIC DRAWINGS

19.01 Five new theory schematic drawings have been issued in connection with the use of 28-type machines. Drawing B-130696 shows the incoming line or trunk circuit, SD-70887-01, when the circuit is used as an incoming line with a drop-off receiving-only teletypewriter. Drawing B-130697 shows the same circuit used as a single-station incoming line or trunk circuit with an associated tape-changing reperforator-transmitter. The 28-type reperforator-transmitter is shown only in schematic form on the preceding drawings, as is the case on the various other theory drawings employing this unit. A complete theory schematic of the 28F reperforator-transmitter unit, the 28B reperforator-transmitter adapter unit, and

the 100E cabinet is shown on Drawing B-130544, while a complete theory schematic of the 28D reperforator-transmitter set, the 28A reperforator-transmitter adapter unit (furnished as part of the cabinet), and the 28B apparatus cabinet is shown on Drawing B-130545. The 115-volt direct current shown on Drawing B-130544 is obtained from a rectifier which is part of the 28F reperforator-transmitter unit, while the 115-volt direct current shown on Drawing B-130545 is obtained from a rectifier which is part of the 28B cabinet. The originating station circuit, SD-70881-01, is shown in theory schematic on Drawing B-130624.

19.02 The drawing numbers of all the theory schematic drawings are listed in Table C.

TABLE C
THEORY SCHEMATIC DRAWINGS — 81D1 SYSTEM

Title	Drawing Number	Issue
Incoming Line or Incoming Trunk Circuit (75-Speed Operation — With RO TTY)	ES-883383	4
Incoming Line or Incoming Trunk Circuit (75-Speed Operation — With Tape-Changing Typing Reperforator)	ES-883384	5
Originating Station Circuit (With 19 TTY)	ES-883385	6
Director Circuit (Arranged to Not Discard Multiple Address Codes)	ES-883386	5
Sequence Circuit	ES-883387	5
Outgoing Line or Single Outgoing Trunk Circuit	ES-883388	9
Transmitter Start Circuit	ES-883389	4
Willful and Miscellaneous Intercept Circuits	ES-883390	11
Local Outlet Circuit	ES-883391	7
Group Code Circuit	ES-883392	4
One-Stage Multiple Address Circuit	ES-883393	8
Multiple Address Intercept Circuit	ES-883394	6
Station Control Circuit	ES-883395	6
Automatic Address Circuit	ES-883396	5
Director Fan Circuits	ES-883397	3
48-Volt Power Circuit	ES-883400	4
130-Volt Power Circuit	ES-883401	3
Outgoing Multichannel Trunk Circuit	ES-897013	5
Supplementary Multiple Address Circuit	ES-897014	5

TABLE C (Cont)
THEORY SCHEMATIC DRAWINGS — 81D1 SYSTEM

Title	Drawing Number	Issue
Incoming Line or Incoming Trunk Circuit (75-Speed Operation — With Tape-Changing Reperforator-Transmitter)	ES-897133	3
Director Circuit (Arranged to Discard Multiple Address Codes)	ES-897523	5
One-Stage Multiple Address Circuit (Arranged to Not Receive Local Multiple Address Code)	ES-897524	6
Originating Station Circuit (Shown With Director Arranged to Discard Multiple Address Codes and 19 TTY)	ES-897525	4
Two-Stage Multiple Address Circuit	ES-941694	5
28F Reperforator-Transmitter Unit With Adapter (For 100E Cabinet)	B-130544	1
28D Reperforator-Transmitter Set With Adapter (For 28B Cabinet)	B-130545	1
Originating Station Circuit (With 28 TTY)	B-130624	1
Incoming Line or Incoming Trunk Circuit (With 28 Reperforator-Transmitter and RO TTY)	B-130696	1
Incoming Line or Incoming Trunk Circuit (With Tape-Changing 28 Reperforator-Transmitter)	B-130697	1

20. DESIGN AND PERFORMANCE REQUIREMENTS

20.01 The equipment design requirements (J specifications) for the 81D1 system have been reissued to cover the preceding changes. Section AA285.512 (J70109), Issue 4, and Appendices 1, 2, 3, and 4 thereto cover the switching center equipment, while Section AA 285.511 (J70110), Issue 4, and Appendices 1, 2, 3, and 4 thereto cover the relay units for the switching center. Section AA286.049 (J70142), Issue 2 covers the test set for the reperforator-transmitter adapter unit.

20.02 Section AA285.510 (J70095), Issue 6 covers the station control circuit employing the SOTUS unit (60 or 75 speed), the circuit employing the electronic receiving selector (60, 75, or 100 speed), and the automatic address circuit. The details of the electronic selector are covered by Section AA285.519 (J70139), Issue 1.

20.03 The new and revised J- specification units are listed in Table D.

TABLE D
J-SPECIFICATION UNITS — 81D1 SYSTEM

Unit	Number
Switching Center	
Incoming Line or Trunk Unit (New)	J70110AT, L1
Director Unit	J70110E, L4
Sequence Control Unit	J70110H, L3
Sequence Relay Unit	J70110J, L3
Sequence Switching Unit (New)	J70110AW, L1
Sequence Cabinet — Regular	J70109E, L6 and L7
Sequence Cabinet — Spare	J70109AT, L3 and L4
Outgoing Line or Trunk Unit (Levels 1 and 2)	J70110B, L4
Outgoing Line or Trunk Unit (Level 3)	J70110R, L3
Local Outlet Individual Unit	J70110T, L5
Multiple Address Level Unit	J70110N, L7
Multiple Address Director Unit	J70110M, L5
First-Stage Multiple Address Code Transmission Unit	J70110AK, L2
Intersystem Relay Switching Unit	J70110AP, L2
Multiple Address Link Switch Cabinet (New)	J70109AU, L1, L2, L3, and L4
Multiple Address Fan Switch Cabinet (New)	J70109BA, L1 and L2
Second Stage Multiple Address Level Unit	J70110AM, L2
Second Stage Multiple Address Director Unit	J70110AL, L3
Test Bench	J70109W, L3 and L4
Machine Test Cabinet	J70109AY, L1
Unit Test Cabinet	J70109AB, L9
Test Set (For Adapter Unit — New)	J70142A, L1
Station Control (With SOTUS)	
Station Control Common Unit	J70095B, L5
Station Control Cabinet Equipment	J70095E, L11 and L12
Station Control (With Electronic Receiving Selector — New)	
Station Control Cabinet Equipment	J70095W, L1
Receiving Selector — Electronic Unit	J70139A, L1
Receiving Selector — Relay Unit	J70139B, L1
Power Supply Unit	J86489A, L1

TABLE D. (Cont)
J-SPECIFICATION UNITS - 81D1 SYSTEM

Unit	Number
Station Control (With Electronic Receiving Selector - New) (Cont)	
Station Control Unit	J70095N, L1
Master Station Code Verification Unit	J70095R, L1
Line Release Delay and Tape Feedout Unit	J70095S, L1
Line Release Delay Unit	J70095T, L1
Tape Feedout Unit	J70095U, L1
Control Panel for 28 ASR	J70095Y, L1, L2, L3, L4, and L5
24-Volt Transformer Unit	J70095AA, L1
Control Unit for 28 RO	J70095AE, L1
Automatic Address Station (New)	
Automatic Address Cabinet	J70095AD, L3
Front Relay Unit	J70095AB, L1 and L3
Rear Relay Unit	J70095AC, L1
Reperforator-Transmitters (2)	J70095AD, L2

20.04 The 81D1 performance requirements, Section AA 638.109, Issue 3, have been reissued to add sections covering the two-stage multiple address circuit and the intersystem connection unit used with the multiple address circuit, as well as to make minor corrections in other sections. No reference is made in Issue 3 to the use of 28-type reperforator-transmitters in testing, but where switching centers use 28-type machines, these may be used in place of the 14F and 14G machines referred to in the section. The adapter unit used

with the 28-type machine must of course be wired so that the machine plus the adapter unit is the equivalent of either a 14F or 14G reperforator-transmitter as required. The tests of the new originating station circuit and the incoming line circuit are in general similar to those of the older circuits, but the minor differences have not been reflected in the performance requirements as yet. The details as to how the new circuits may be tested are covered in the circuit description of the unit test circuit.