# HILO 4-WIRE SWITCHING FEATURE

# FEATURE DOCUMENT

# 2-WIRE NO. 1 AND NO. 1A "ESS*" SWITCHES

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## *INTRODUCTION*

### 1. GENERAL INFORMATION

#### SCOPE

**1.01** This section contains the HILO 4-Wire Switching feature for the No. 1 and No. 1A ESS switches.

#### REASONS FOR REISSUE

**1.02** Revision arrows are used to emphasize significant changes. The reasons for reissue are listed below.

(a) To change schematic diagram trunk circuit numbers

(b) To restrict interchange of trunk circuits

(c) To change the rating of trunk circuits in Tables B and O

(d) To add text for remote trunk test unit (RTTU) providing manual and automatic trunk and line testing.

#### FEATURE AVAILABILITY

**1.03** The HILO 4-Wire Switching feature is available with all active generic programs. The

HL4W and manual trunk test panel (MTTP) feature packages are required for the HILO feature.

## 2. DEFINITION/BACKGROUND

### DEFINITION

**2.01** The HILO 4-Wire Switching feature is an electronic technique of achieving equivalent 4-wire switching in No. 1 and 1A ESS switches for toll applications. It provides two electrically independent transmission paths through the switching network. A similar capability exists with the No. 4A Crossbar System and the No. 4 ESS switch. The HILO feature is available for both trunk-only toll offices and combined local/toll offices.

### BACKGROUND

**2.02** Four-wire switching can be achieved by several different methods. The HILO technique used in the No. 1 and 1A ESS switches provides equivalent 4-wire switching over two switched metallic conductors of the remreed trunk link network (TLN) and an unswitched metallic return (office ground).

**2.03** The HILO feature is designed for pure toll offices and is also applicable to those offices in which the local and toll functions can be combined, using one processor to serve both functions. Applicability to an individual office is based on initial size, anticipated growth rate, and facility mix.

**2.04** An ESS switch with the HILO feature may provide the Common Channel Interoffice Signaling (CCIS) feature. Toll CCIS provides the ability to connect an intertoll trunk using CCIS to either a per trunk signaling (PTS) trunk or to another CCIS intertoll trunk. For additional details concerning CCIS, see reference A(40) in Part 18.

**2.05** Compared with the 2-wire No. 1/1A ESS switches for toll applications, the HILO feature offers several advantages. With the exception of the combined operator-office trunk (COOT), no transmission balance adjustments are required within the HILO intertoll or toll-connecting trunk circuits connected to 4-wire facilities since they have no 2-wire to 4-wire hybrids. The absence of hybrids also removes a potential source of echoes because of impedance mismatches. For intertoll trunks, the floor space requirement for the HILO trunk circuits is only one-half that required by the plug-in combined miscellaneous trunks (CMT) available for 2-wire offices. Translation word requirements are reduced since most of the HILO trunk circuits are treated as universal circuits rather than miscellaneous circuits; eg, there is a savings of eight translation words per multifrequency (MF) intertoll trunk.

**2.06** These advantages apply to both PTS and CCIS. For PTS only, call supervision (when required) is coupled through the switching network, thus reducing cross-office answer delay to 8 to 16 ms.

**2.07** A No. 1 or No. 1A ESS switch with the HILO feature offers all the toll features previously available and meets all established switching machine transmission requirements. These include:

(a) Centralized automatic message accounting (CAMA) operation, both automatic number identification (ANI) and operator number identification (ONI)

(b) Special digit translation capability for test and operator codes

(c) Multifrequency (MF) and dial pulse signaling, including immediate dial (bylink) operation

(d) All network management and real-time overload controls available to 2-wire toll or combined local/toll offices.

**2.08** Also, an ESS switch with the HILO feature may provide the Common Control Switching Arrangement (CCSA) feature and/or Enhanced Private Switched Communications Service (EPSCS) feature. The EPSCS feature is limited to the No. 1 ESS switch. The CCSA feature provides for the interconnection of customer locations by means of private network facilities using voice channels that are switched at the ESS switch or No. 5 Crossbar Switching Centers. The EPSCS feature provides a private network similar to CCSA, except it uses 4-wire transmission within the network and additional features over those offered with CCSA. The EPSCS feature utilizes exclusively the No. 1 ESS switch HILO 4-Wire Switching feature in the network switching locations. For details concerning CCSA and EPSCS, see references A(24) and A(46) in Part 18.

## *DESCRIPTION*

### 3. USER OPERATION

### CUSTOMER

**3.01** Not applicable.

### TELEPHONE COMPANY

#### A. General

**3.02** A No. 1 or 1A ESS switch with the HILO Switching feature appears as a 4-wire, 600-ohm machine at the toll terminal interface. Incoming pulsing methods are MF, dial pulse (senderized and immediate dial), and dual-tone MF. Outgoing methods are MF, dial pulse, and no pulsing. Revertive and panel call indicator pulsing are not available with the HILO feature. Also, CCIS is available; see reference A(40) in Part 18 for details.

**3.03** Equivalent 4-wire switching is achieved by providing two switched metallic conductors and an unswitched metallic common return path, rather than by providing four physical wires in the switching network. Each of the switched conductors (with the common return) forms an independent, unidirectional transmission circuit which is unbalanced to ground. To reduce the susceptibility of the unbalanced circuits to crosstalk and noise, the transmission mode is changed from the properly terminated mode to the so-called HILO current modulated mode. This arrangement is shown schematically in Fig. 1. At the other end of the switched circuit, a current detector (demodulator) transforms the audio signal back to the properly terminated mode. The impedances to ground as seen from the switched conductor are very high at the modulator end and very low at the demodulator end, which reduces the susceptibility to noise influences. The term ***HILO*** is derived from this high impedance/low impedance characteristic. (The HILO feature should not be confused with the No. 1 ESS switch 4-Wire AUTOVON System which switches four physical wires.)

**3.04** For PTS-to-PTS connections, the HILO feature passes supervision through the network by applying a bias voltage to a trunk circuit at one end of the network path and detecting it at a trunk circuit at the other end of the path. No software involvement is required to pass supervision from an incoming trunk to an outgoing trunk or vice versa. The delay in passing answer supervision is reduced.

#### B. Toll-Only Office

**3.05** In a HILO toll-only office, the switching toll-only network is similar to existing 2-wire ESS switch configurations. [See reference A(38) in Part 18.] The TLNs must have a 1:1 concentration ratio and may be either the 2048-TLN or 1024-TLN type, depending upon future plans for the office. However, TLN types cannot be mixed in an office.

#### C. Combined Local/Toll Office

**3.06** The network arrangement in a combined local/toll office differs from current configurations by the addition of a separate group of toll TLNs. This separation is required because HILO transmissions are sensitive to local signals such as ringing and coin control. Also, the trunk-to-trunk junctors in a HILO TLN connect tip to ring and ring to tip; whereas, in a 2-wire TLN they connect tip to tip and ring to ring. This reversal in the junctors creates an incompatibility between HILO trunks and existing 2-wire trunks on the same network.

**3.07** The local/toll network arrangement is shown schematically in Fig. 2. ***All*** toll trunks on both 2-wire and 4-wire facilities, except those toll-connecting trunks between the local office and some other toll office, must appear on the HILO TLNs. This insures that the office balance is easily maintained. The HILO network must have a 1:1 concentration ratio; either 1024 or 2048 terminal TLNs may be used. Where 1024 TLNs are used on both the HILO side and the local 2-wire side, the local 2-wire TLNs must also have a 1:1 concentration ratio. Where 2048 TLNs are used on the HILO side, the local 2-wire TLNs may be 2048 (1:1 concentration ratio) or 1024 (any valid concentration ratio).

**3.08** The local TLNs and toll TLNs of a combined office are connected by intraprocessor trunk groups. These trunk groups consist of 2-wire trunk circuits terminating on the local TLNs connected back to back with HILO trunk circuits terminating on the toll TLNs. The groups may be one-way or 2-way circuit pairs, except for the maintenance trunks, which must be 2-way. Recommended circuit pairings are given in paragraph 4.04.

**3.09** Since there are no direct connections (ie, junctors) between the line link networks (LLN) and the HILO TLNs, calls between the two network communities must be ***double switched.***

This means that 16 stages of switching are used instead of 8 but does not imply that pulsing is required between the two TLN communities. (Double-switched calls are recognized by the software, and no inter-TLN pulsing is performed.) If the local/toll office has the CCIS feature, calls between the two TLN communities are handled as a toll-to-toll connection. (No inter-TLN pulsing is performed.) Overall savings should compensate for any additional network that double switching may require.

**3.10** The usual local-related operator services are maintained on the local TLNs. These include directory assistance, dial 0, outgoing to Traffic Service Position System (TSPS), recording-completing circuits back to the local side, repair service intercept, and similar functions. Operator trunk types on the toll TLN community are incoming TSPS; incoming secondary intertoll (operator tandem); outgoing to a residual position for mobile, marine, and conference functions; inward toll operator for 121-type traffic; and outgoing to CAMA position.

### D. Manual Trunk Test Facilities

**3.11** The ***manual trunk test position (MTTP)*** replaces the supplementary trunk test panel (STTP) in offices using the HILO Switching feature. If an existing 2-wire office is converted to a HILO combined office, the STTPs may be retained for testing the 2-wire trunks. An appropriate number of MTTPs must also be provided for testing the HILO trunks. No STTPs are required in combined offices since the MTTP has all the 2-wire testing capabilities of the STTP, plus added HILO trunk testing capabilities.

**3.12** Manual trunk test (MTT) frames are normally provided in pairs with an associated ***auxiliary manual test (AMT)*** frame [Fig. 3(a)]. The basic AMT frame is equipped with a maintenance TTY. Optionally, the MTT/AMT frames may be ordered with a 4A pulsing test set, a 58 Echo Suppressor Measuring System (ESMS), a KS-20805 transmission measuring set, and a return loss measuring set. (See Part 10.)

**3.13** The MTTP can be used for the following types of transmission tests:

(a) Frequency response—loss versus frequency (404 Hz, 1004 Hz, and 2804 Hz)

(b) Noise measurements—message circuit

(c) Peak-to-average ratio (P/AR) measurements (portable test set only)

(d) Direct processor controlled interrogator-remote office test line (PCI-ROTL) transmission testing

(e) Echo suppressor tests

(f) Return loss measurements

(g) Pulsing test.

**3.14** The MTTP arrangement in a HILO-combined office is shown in [Fig. 3(b)]. For a detailed description and operation of the MTTP and AMT frame, see references A(5) and A(15) in Part 18.

**3.15** In combined offices, the ***trunk and line test panel (TLTP)*** test access trunks are connected to the 2-wire networks only and do not have direct access to HILO trunks for manual transmission or signaling tests. In HILO toll-only offices, TLTP access trunks are nonfunctional. The TLTP, therefore, has limited HILO testing capabilities compared to the MTTP. It can be used to establish double-switched talking connections on HILO trunks, to make 2-wire or HILO trunks busy or idle, and to request diagnostic and interrogator tests on 2-wire or HILO trunks.

### E. Remote Office Test Line and Processor Controlled Interrogator

**3.16** The ***ROTL*** in a combined local/toll office has appearances on both the HILO and 2-wire TLNs. Thus, a single ROTL can test both 2-wire and HILO trunks. The ROTL applique circuit in a HILO office is an SD-1A433 rather than the SD-1A314 used in 2-wire applications. Remote testing is performed under the control of Centralized Automatic Reporting on Trunks (CAROT) center. Three HILO foreign exchange (FX) trunks (SD-1A396) per ROTL are required in each ROTL-equipped HILO office for CAROT access and security callback. At least one PCI is required for HILO ROTL-equipped offices for local access to ROTL to verify troubles reported by CAROT. The PCI access is via TTY, TLTP, MTTP, or STTP.

**3.17** The ROTL can selectively conduct the following trunk transmission tests on most outgoing and 2-way trunks in the office, dependent upon the type of far-end test line (FETL).

(a) Code 100 FETL—one-way (far-to-near) loss and noise

(b) Code 102 FETL—one-way (far-to-near) loss

(c) Code 105 FETL with 51B responder—2-way loss and noise

(d) Code 105 FETL with 52A responder—2-way loss, noise, gainslope (405, 1004, and 2804 Hz, and noise with tone)

(e) Code 100, 102, or 105 FETL—connection appraisal (initiated by CAROT)

(f) Code 100, 102, or 105 FETL—home office test.

**3.18** In addition the PCI can be used to:

(a) Verify CAROT results.

(b) Localize transmission troubles reported by CAROT.

(c) Check out installation of new trunks.

(d) Verify trunk repairs.

(e) Measure level of milliwatt present on any outgoing, incoming, or 2-way trunk.

**3.19** For additional information on the ROTL and PCI, see reference A(32) in Part 18.

### F. Test Lines

**3.20** A full complement of test lines has been developed to provide test facilities for the HILO message trunks. Each test line is briefly described below. All test lines except the code 101-type test line have a trunk network appearance on a HILO TLN via the HILO interface circuit SD-1A392. The code 101-type test line is incorporated into the MTTP.

**3.21** The code 100-type test line and the code 102-type test line for HILO applications are contained in the combined 100/102 test line circuit SD-1A386. The code 100-type test line provides a test termination for one-way noise measurements. The code 102-type test line provides for one-way transmission loss measurements. For additional information, see references A(26) and A(29) in Part 18.

**3.22** The code 101-type test line provides a communication and test line to a test board or test position which can be reached over any trunk incoming to the switching system served by that test position. In HILO offices, the test position is the MTTP. For additional information, see reference A(28) in Part 18.

**3.23** For HILO applications, the code 103-type and synchronous test lines are combined in the operational test termination circuit SD-1A391. The code 103-type test line provides for overall tests of the supervisory and signaling capabilities of intertoll trunks. The synchronous test line provides a test termination for testing the supervisory features of incoming toll-connecting trunks. The HILO offices are equipped with synchronous test lines to satisfy the test frame requirements of the originating offices. For additional information, see references A(25) and A(30) in Part 18.

**3.24** The code 104-type test line provides a test termination for 2-way transmission loss and one-way noise measurements. The code 104-type test line provides a test termination for test calls directed to the transmission measuring and noise checking circuit SD-95698. The code 104-type test line circuit is FS 3 of SD-95698. The HILO 104/105 test coupler circuit SD-1A388 is required to provide the signaling interface between the code 104-type test line and the trunk under test. For additional information, see reference A(36) in Part 18.

**3.25** The code 105-type test line provides for 2-way transmission loss and noise measurements when used with an Automatic Transmission Measuring System (ATMS) responder at the terminating end and an ATMS director and test frame or a ROTL responder at the originating end. The code 105-type test line is normally provided as part of a ROTL. The circuit for HILO applications is FS 27 of SD-96601. The test line interfaces with either a 51B ATMS responder circuit SD-99747 or a 52A ATMS responder circuit SD-1C399 and a HILO 104/105 test coupler circuit SD-1A388. It also requires a test progress tone (TPT) generator and distributing circuit SD-96603. An office may have up to 15 code 105-type test lines. For additional information, see reference A(27) in Part 18.

**3.26** The code 108-type test line provides an echo suppressor test termination circuit that serves as the far-end, loop-around unit in the ESMS. The code 108-type test line with a 58 ESMS (J68658) at the originating end provides for in-service testing

of echo suppressors. The code 108-type test line circuit for HILO applications is SD-1A389. For additional information, see reference A(39) in Part 18 for the code 108-type test line and reference C(11) for the Echo Suppressor Control feature.

**3.27** The code 100-, 102-, 104-, and 105-type test lines are transmission test lines with an option for TP 0 or TP 2 (0 dB or 2 dB). Intertoll trunks are tested at TP 2; toll-connecting trunks may be tested at TP 0 or TP 2.

**3.28** Diagnostics are provided for all outgoing, 2-way, and intraprocessor trunks, as well as all diagnosable service circuits. Test circuits on the HILO network must be provided for these tests, which also test the cross-office signaling feature. No diagnostics are performed for operator trunks, incoming trunks, or the ROTL and MTTP access circuits. Test calls are made to code 103-type test lines on non-CCIS trunks and to synchronous (crossbar or ESS switch), nonsynchronous (step-by-step), or permanently busy (all types of offices) test lines on toll-collecting trunks. See reference A(14) in Part 18 for testing procedures related to HILO.

### ▶G. Remote Trunk Test Unit (RTTU)

**3.29** The ***RTTU*** provides remote manual and automatic trunk and line testing in 2-wire ESS switch offices equipped with the HILO 4-Wire Switching feature. Also, these tests can be performed in a pure HILO toll-only office. The RTTU is controlled by a Central Trunk Test Unit (CTTU) located at a central location (ie, switching control center [SCC] or CAROT). The interface between the RTTU and ESS switch is identical to that used by the MTTP providing 2- and 4-wire interfaces. Office security is provided through a speed callback line to the CTTU. The ROTL feature and the use of up to eight 105-type test lines are options that can be installed on the RTTU frame. See reference C(13) in Part 18.

**3.30** In offices with the 1E6/1AE6 and later generic programs, the RTTU can be used to provide the ROTL feature to access and test 2- and 4-wire trunks. When ROTL is accessed, the office interface is provided by 105 test coupler circuit SD-1A303 or SD-1A493 in 2-wire offices. In a HILO toll-only office, the 105 test coupler circuit SD-1A388 is used. Also, the RTTU is designed to receive access calls using the 105-type test line port. One HILO FX trunk SD-1A396 is needed to provide CAROT access in toll-only applications. Security callback is provided by a speed dial callback line to CAROT.

**3.31** The RTTU can provide up to eight 105-type test lines to the HILO offices. The interface is provided via the 104 or 105 test coupler circuit (SD-1A388) and uses the standard 105 call processing. The 105-type test line (SD-96601) ***cannot*** be connected in the same trunk group where a RTTU appears. The office translations are set up with only a single fixed route index (RI) for the standard 105 call processing. The CAROT performs one self-test of the far-end office equipment per trunk group test. Therefore, two different far-end responders in the same 105-test chain would violate the system test requirements.◀

### H. Switching Control Center Talk and Monitor Functions

**3.32** The SCC talk and monitor functions for HILO are provided through a dedicated FX trunk (SD-1A396). An incoming call via an FX trunk with a trunk program index (TPI) equal to 39 completes to a steady low tone circuit (pseudo route index equals 6). When the low tone is received at the SCC location, the SCC operator types a T-TNN-TK message to complete the talk function. This message causes the FX trunk to be switched from the tone circuit to the trunk specified in the message. The talking connection is abandoned by the SCC operator hanging up and typing a T-TNN-DC message, specifying the TNN of the trunk that was entered via the T-TNN-TK message.

**3.33** To monitor a traffic busy trunk, the SCC operator types a T-TNN-MO message following the receipt of low tone. The FX trunk is now connected to a no-test vertical (NTV) circuit, which is connected to the trunk specified in the message. When the monitor connection is established, the SCC operator can take any of the following actions after hanging up.

(a) Release the monitor connection (T-TNN-RM).

(b) Traffic release the monitored path (T-TNN-TR).

(c) Trace and hold the monitored path (T-TNN-TH).

(d) Release the path being held (T-TNN-RH).

**3.34** For additional details concerning operation with SCC, see references A(59) and A(60) in Part 18.

### I. Traffic and Overload Message

**3.35** Output message HL15 replaces the TC15 (2-wire) message in HILO toll-only offices providing information concerning traffic and overload conditions on the HILO network. Both HL15 and TC15 are applicable to combined local/toll offices. The HL15 message is automatically generated by the office overload and line load control programs. It may also be requested via the traffic or maintenance TTY using the LS-QUARTER- input message. See references B(1) through B(3) in Part 18 for details.

### J. Division of Revenue Peg Counts

**3.36** For calls via intraprocessor trunks (local-to-toll or toll-to-local), the division of revenue peg counts are made for an originating (incoming to local side of office) call when it is completely switched through the office and for a terminating (incoming to toll side of office) call when the toll portion of the call is completed. See reference A(37) in Part 18 for details.

## 4. SYSTEM OPERATION

## HARDWARE

### A. Major Hardware Items

**4.01** The major hardware items associated with the HILO 4-Wire Switching feature are summarized in Table A.

### B. Message Trunk Circuits

**4.02** A full complement of incoming, outgoing, and 2-way message trunk circuits is provided for the HILO 4-Wire Switching feature. Loop and E&M trunk circuits with either a 900-ohm, 2-wire or a 600-ohm, 4-wire facility interface are available. ⧫All the message trunk circuits listed in Table B plug into the HILO universal trunk frame, except for the following:

- Incoming step-by-step trunks SD-1A366/SD-1A608 and SD-1A371/SD-1A609
- COOT SD-1A393
- HILO CAMA operator trunk to remote TSPS SD-1A484.⧫

**4.03** Any incoming or 2-way HILO trunk circuit can be used for CAMA traffic. However, the trunk group is established as a one-way incoming group, even where 2-way circuits are used.

**4.04** In a combined local/toll office, the intraprocessor trunk groups consist of 2-wire trunk circuits terminating on the local TLNs connected back to back with HILO trunk circuits terminating on the toll TLNs. The trunk groups may be one- or 2-way and must be constructed of compatible pairs of trunk circuits. However, use of pairings other than those in Table C requires additional generic program development. A fixed 2-dB pad should be cross-connected into each intraprocessor trunk.

**4.05** A 2-way trunk group consisting of one 2-way pair of trunk circuits per MTTP must be provided in all HILO local/toll offices to facilitate the monitor function on 2-wire trunks.

**4.06** The long haul FX trunk circuit SD-1A396 is used for access to the ROTL from a remote test location and for the talk and monitor functions of the SCC. (See Part 3.)

### C. Service and Test Circuits

**4.07** A unique set of service and test circuits are provided for the HILO trunks. The service and test circuits are listed in Table O.

**4.08** All circuits that are mounted on a miscellaneous trunk frame (J1A033 type) require a HILO interface circuit SD-1A392 for HILO network terminations. This plug-in circuit contains the HILO modulators and demodulators which provide the conversion to the HILO mode of transmission. It has no scan or signal distributor points and is mounted on either the HILO universal or HILO step-by-step (or miscellaneous) frame. The service circuit is wired to the SD-1A392 via the intermediate distributing frame (IDF) and uses the network appearance of the SD-1A392. One SD-1A392 circuit is required for each trunk network number (TNN) of each circuit on a miscellaneous trunk frame.

**4.09** Two tone and recorded announcement circuits are available: SD-1A383 for tones and barge-in announcements and SD-1A384 for nonbarge-in announcements (ie, those announcements which should be cut through to only at the beginning of a cycle). Typical tones and announcements are summarized in Table D.

**4.10** The test lines provided for testing HILO trunks are summarized in Table E with their

functions and the HILO connecting circuit(s). The testing arrangements for these test lines are depicted in their respective references listed in Part 18.

## OFFICE DATA STRUCTURES

### A. Translations

**4.11** The translations associated with the HILO feature are similar to the trunk and routing translations in current use in 2-wire No. 1 and 1A ESS switches. Changes and variations required by the HILO feature are discussed below.

**4.12** The trunk network number to peripheral equipment number (TNN-PEN) translators for HILO universal trunk circuits are similar to those for existing universal trunk circuits. The variation is due to a difference in the size of the circuits. Existing universal trunk circuits are packaged 128 to the bay; whereas, a HILO universal trunk bay provides 256 circuits. The translation layout is shown in Fig. 4(a). The HILO universal trunk frame number must be even; the next higher odd frame number cannot be assigned since it is used internally to refer to bay 1 and the signal distributor associated with that bay. The miscellaneous trunk translator [Fig. 4(b)] is unchanged.

**4.13** The TNN-PEN auxiliary blocks for HILO miscellaneous and service circuits follow the pattern currently used. The auxiliary blocks for the following HILO circuits are shown in Fig. 5:

- SD-1A366/SD-1A608
- SD-1A371/SD-1A609
- SD-1A378
- SD-1A379
- SD-1A380
- SD-1A382
- SD-1A385
- SD-1A381
- SD-1A384
- SD-1A391
- SD-1A390
- SD-1A390/SD-1A173.

Detailed descriptions of the following HILO circuits are found in the references listed in Table F:

- SD-1A369
- SD-1A386
- SD-1A388
- SD-1A389
- SD-1A393
- SD-1A394
- SD-1A395
- SD-1A399
- SD-1A453
- SD-1A454
- SD-1A483
- SD-1A484.

**4.14** Trunk group translations are unchanged by the HILO feature. Refer to applicable existing documentation for these translations.

**4.15** Trunk class code (TCC) expansion tables are illustrated in Fig. 6 for the following HILO circuits:

- SD-1A361
- SD-1A362
- SD-1A366/SD-1A608
- SD-1A367
- SD-1A368
- SD-1A371/SD-1A609
- SD-1A373
- SD-1A374
- SD-1A378

- SD-1A379
- SD-1A380
- SD-1A381
- SD-1A382
- SD-1A383
- SD-1A384
- SD-1A385
- SD-1A390
- SD-1A390/SD-1A173
- SD-1A397.

Detailed descriptions of the TCC expansion tables for the following HILO circuits are depicted in the references listed in Table F:

- SD-1A364
- SD-1A369
- SD-1A386
- SD-1A388
- SD-1A389
- SD-1A391
- SD-1A393
- SD-1A394
- SD-1A395
- SD-1A396
- SD-1A399
- SD-1A453
- SD-1A454
- SD-1A483
- SD-1A484.

Where trunk circuits are used for intraprocessor trunk groups (paragraph 3.08), a HILO intraprocessor trunk indicator in word 3 of the TCC expansion is set to 1 for the circuits on both the HILO (toll) and 2-wire (local) networks. This indicator is shown in Fig. 6 for HILO circuits SD-1A361, SD-1A367, and SD-1A373. The corresponding 2-wire trunk circuits (not shown) are SD-1A252, SD-1A165, and SD-1A166, respectively.

**4.16** Route indexes (RIs) are generally required for HILO service circuit trunk groups and are assigned as pseudo RIs (Table G). Pseudo RIs appear in the pseudo RI translator (Fig. 7) which is indexed by the pseudo RI number. Pseudo RIs can never be routed to via the normal mechanism (for fixed RIs) of rate and route patterns. The pseudo RI should translate into a nonfixed RI, and expansion is similar to the equivalent 2-wire RI except that the trunk group number (TGN) is a HILO TGN. In a few cases, fixed RIs are used to point to the appropriate trunk group of the HILO circuits.

**4.17** The RI expansion for RI 161 is used to access a group of MF receivers that will be connected to CAMA operator positions. If the office provides both the CAMA function and HILO switching, the CAMA operator positions must be connected to the HILO network. The group of MF receivers pointed to by RI 161 must also be on the HILO network. The number of MF receivers in the group should equal the maximum number of CAMA operator positions that can be occupied at one time. Although the next RI equals 2047 (STOP), the system overflows to the proper receiver pool normally used for incoming MF trunks. See reference A(33) in Part 18 for details concerning RI 161.

**4.18** Test line access is achieved via the normal mechanism of pointing the rate and route pattern to the fixed (2-wire) RI. When the program detects a test call to the fixed RI (Table G), it determines if the incoming trunk is HILO. If it is a HILO trunk, the program accesses the pseudo RI for the test line. From the pseudo RI, the program accesses the proper nonfixed RI that points to the trunk group for that test line function. The fixed RI for the code 101-type test line accesses the test line (MTTP) directly since a pseudo RI is not associated with it. See references A(25) through A(30), A(36), and A(39) in Part 18 for details concerning the RIs associated with the test lines.

**4.19** The executed RIs shown in Fig. 8 are for maintenance access to intraprocessor trunk groups.

The type of RI expansion required (TYPE 2 or TYPE 3) is determined by the number of digits required for access. Pseudo RIs 48 and 49 (Table G) yield the nonfixed (true) RI. Both pseudo RIs must point to the appropriate end of the intraprocessor trunk group. Normal call processing access is gained from the RI as output from the rate and route pattern in the 3/6-digit translation. The format of the expanded RI differs from previous formats in that the prefix digit and delete digit fields can be nonzero when transmitter type equals 0, indicating continuity and polarity test.

**4.20** The HILO universal trunk frame appears in translations as two universal trunk frames—member numbers n and n + 1, where n is given. Frame n is the home frame; frame n + 1 is the mate frame. Each HILO universal trunk frame contains two universal trunk signal distributors and one universal trunk scanner. Each of these subunits requires a unit type auxiliary block (Fig. 9). The scan points are listed in Table H.

**4.21** The HILO step-by-step miscellaneous trunk frame consists of a miscellaneous trunk frame, a master scanner (unit type 5), and zero, one, or two optional supplementary signal distributors (unit type 21) combined into one package. The HILO universal trunk frame is assigned a master scanner member number n (odd or even), a miscellaneous trunk frame number m and optional supplementary signal distributor member numbers y and z. One unit type auxiliary block is required for the master scanner and for each supplementary signal distributor provided (Fig. 10). No subtranslator is required for the miscellaneous trunk frame. The HILO miscellaneous trunk frame has four scan points plus four other scan points assigned but not connected and 12 optional scan points for the optional supplementary miscellaneous trunk signal distributor(s). The scan points are listed in Table I.

**4.22** One word has been added to each trunk switch circuit auxiliary block (Fig. 11A) to indicate which HILO trunk frames are associated with a particular trunk switch circuit. This information is used in the derivation of the physical location of a universal or miscellaneous trunk circuit when given a TNN [Fig. 11(b)]. The relationship may be determined algorithmically since no trunk distributing frame is used with the HILO feature. Briefly, this algorithm assigns the 512 trunk circuits on a HILO universal trunk frame or HILO miscellaneous trunk frame to all levels on half the switches (0 through 3 or 4 through 7) on all grids in four trunk switching circuits (0 through 3 or 4 through 7). The physical assignment pattern is shown in Fig. 12. Cabling length variations are kept to a minimum by mapping the bottom circuits of the trunk frame to the top of the remreed TLN frame and vice versa.

**4.23** Each intraprocessor TNN on the HILO network is paired with an associated TNN on the local 2-wire network and vice versa. In order for the system to identify both sides of this "loop around" configuration, the TNN of the associated circuit is stored in word 2 of the trunk network number to trunk group number (TNN-TGN) auxiliary block for each intraprocessor TNN (Fig. 13). The class of service for the HILO incoming and/or 2-way trunk groups should be translated as direct distance dialing access groups. The class of service for the local incoming and/or 2-way trunk groups should be translated as either tandem (with tandem group 0) or locally completing 4- or 5-digit groups.

**4.24** The ROTL unit type 53 auxiliary block for HILO and combined 2-wire/HILO offices differs from the auxiliary block presently in use for 2-wire-only offices as follows:

(a) ***Word 1:*** The quantity of miscellaneous trunk directory numbers changes from 11 to 12.

(b) ***Word 5:*** The TNN of access port 0 is of an SD-1A361 trunk; not an SD-1A218 trunk.

(c) ***Word 6:*** Same as word 5 for port 1.

(d) ***Word 7:*** Unchanged in combined offices; set to zero in HILO-only offices.

(e) ***Word 25:*** This word (zero in 2-wire-only offices) contains the TNN of the SD-1A362 HILO test port.

(f) ***Word 28:*** The TNN of the PCI port must be that of an SD-1A361 rather than an SD-1A218.

If a 2-wire-only office grows to HILO capability, the 2-wire ROTL must be removed from service, converted to HILO use, and restored to service. As in the case of the 2-wire ROTL, the access port 0, the access port 1, the PCI port, the 2-wire test port, and the HILO test port must be assigned to different trunk groups.

**4.25** Fixed RIs 110, 111, and 170 are used with the HILO ROTL in the same manner as with the

2-wire ROTL. The only difference is that the trunk groups contain HILO trunks rather than 2-wire trunks.

**4.26** Three HILO FX trunks (SD-1A396) are required per ROTL in all HILO offices, either toll-only or local/toll, for CAROT access to the HILO ROTL. They are classed as 2-way and placed in a trunk group pointed to by fixed RI 105. This RI requires no directory number and is the same RI required for FX access to 2-wire ROTLs in 2-wire trunk-only offices. See reference A(32) in Part 18 for ROTL translations.

**4.27** Each MTTP is assigned a member number in unit type 8, which is shared with both the TLTP and, if present, the STTP. Member number 0 is always assigned to the TLTP, while member numbers 1 through 14 can be assigned to either an MTTP or an STTP.

**4.28** The MTTP requires the establishment of the following trunk groups for its associated trunks.

(a) Two-wire test access trunks (SD-1A322) require a single trunk group for all MTTPs. Two-wire access trunks from the MTTPs may be placed in the same trunk group as access trunks from the TLTP or STTP. These access trunks are not required if the office is HILO-only.

(b) The HILO access trunks 1 and 2 (SD-1A397) require a trunk group for trunks from all MTTPs. Access trunks 1 and 2 must be assigned to circuits 0 and 1, respectively, on the same SD-1A397 trunk unit. The trunk group containing the SD-1A397 test access trunks must be marked to test at TP 0 in the supplementary trunk group translator.

(c) The HILO access trunk 3 (SD-1A361) requires a trunk group for trunks from all MTTPs.

(d) The HILO master test line trunk (SD-1A367) requires a single trunk group for trunks from all MTTPs. In a HILO-only office, the TLTP master test line trunk is included in this group. In combined offices, the TLTP and STTP master test line trunks (SD-1A192) are placed in a trunk group separate from the MTTP trunk.

**4.29** There are no changes to the unit type 8 auxiliary block for the TLTP and STTP in combined local/toll offices. There is no STTP in HILO-only offices. Also, small changes are required in the auxiliary block for the TLTPs in HILO-only offices. In this case, test access trunks, line test trunks, and substitute trunks are not assigned. The master test line trunk TNN is for an SD-1A367 rather than an SD-1A192.

**4.30** The AMT frame which replaces the auxiliary test frame where MTTPs are used is assigned unit type 66. No subtranslator is associated with this unit type. The AMT frame has one supervisory scan point.

**4.31** Translation modifications in the network management (unit type 56, member number 2) auxiliary block are required to include five HILO machine status indicators. A network management reroute indicator has also been added [not part of the HILO feature, see reference A(47) in Part 18]. Since the block length remains unchanged, the maximum number of the TGN no-circuit indicator entries (two words each) is reduced from 112 to 109.

**4.32** Translation modifications in the data terminal group auxiliary block (unit type 57) are required to provide manual access to the voice-frequency link component of the CCIS data link. One SD-1A397 network access circuit is required per bay of the basic data terminal and for each supplementary frame. Two words in the unit type 57 auxiliary block are allocated for each SD-1A397. See reference A(40) in Part 18 for details concerning the unit type 57 auxiliary block.

**4.33** A unit type 56 (member number 18) auxiliary block is used for network management indicators for receiver attachment delay report (RADR) on the HILO network. For additional information concerning network management, see reference A(47) in Part 18; for RADR, see A(35) in Part 18.

### B. Parameters/Call Store

**4.34** The RADR feature for HILO requires parameter words R7HRDM and R7HCRA and the four set cards associated with parameter word R7HRDM. These parameter words and set cards pertain to RADR test calls performed on the HILO TLNs. For details, see reference A(35) in Part 18.

**4.35** In combined local/toll offices, fixed parameter word Y3IPR (Fig. 14) defines the quantity of

HILO intraprocessor incoming registers required for processing calls between the local 2-wire and the HILO network communities. The number of intraprocessor incoming registers in an office is defined by set card NIPR. The value of set card NOR (number of originating registers) must also include the value of set card NIPR.

**4.36** Parameter word C7HLRF is required for the Precut Test Billing Identification feature. The Precut Test Billing Identification feature enables a CAMA 2-wire office which is converting to a HILO 4-wire network to properly bill the 4-wire test calls during installation of the new network. See reference A(33) in Part 18 for details concerning parameter word C7HLRF.

**4.37** Parameter changes are required to provide data validation protection for HILO service circuits which are provided for customer use. Since service link networks and HILO are mutually exclusive, job type 5 in the data validation parameter table is used when the HILO feature is loaded (Fig. 15). Where an office is equipped with a group of service circuits as indicated by a set card (DPR4, DPT4, MFR4, MFT4, or TTDP4) and the group is provided for customer use, the value of that set card must be set to 1 (provide data validation protection). If the office is not equipped or if the office is equipped but the group of service circuits is not provided for customer use (eg, dial pulse receivers may be provided for maintenance use only), the value of the corresponding set card must be set to 0. (Data validation protection is not provided.) These set cards cannot be omitted. When one of the set cards is set to 1, the corresponding word in the data validation parameter table contains the pseudo RI of the HILO service circuits that are to be data validation protected.

**4.38** A 16-word network equipage table, N4LNE, is used to indicate if a TLN is used for HILO traffic. This table is initialized by set card HLTNii (where ii equals 00 through 15) being equal to 1 for TLNs that carry HILO traffic. Table N4LNE is shown in Fig. 16.

**4.39** In 2-wire offices, the parameter table beginning at RPADS contains values that are based on cable lengths from each ROTL to each TLN. These values specify the padding for ROTL transmission tests of a trunk appearing on a particular network. This method of switching in resistance is not used for HILO networks; instead, the resistance is applied manually by the use of strapped pads. Therefore, set card Rjji should be omitted for HILO TLNs (HLTNii equals 1) to indicate that no relay-controlled resistance pads are to be switched in.

**4.40** Three linked-type receiver queues are required for HILO MF receivers, trunk dial pulse receivers, and combined dual-tone MF trunk dial pulse receivers. The number of receiver queue entries is equal to the number of receivers of each type as defined by set cards HLMFQ, HLTDQ, and HLTTQ, respectively.

**4.41** The quantities of HILO MF transmitters and HILO trunk dial pulse transmitters are specified by set cards HLMFX and HLTDPX, respectively.

**4.42** Set card TAUD defines the data validation protection option for 2-wire audible ring circuits. It is required for all HILO offices. When set card TAUD equals 0 in combined local/toll offices, the 2-wire audible ring circuits are provided. When set card TAUD equals 1 in all HILO toll-only offices, the 2-wire audible ring circuits are not provided.

**4.43** For a definition of all set cards required for the HILO feature, refer to Part 9.

## FEATURE OPERATION

*Note:* Feature operation as described in the following paragraphs pertains only to PTS-to-PTS connections. For CCIS, see reference A(40) in Part 18.

### A. Toll-Only Call

**4.44** The HILO feature operation for a toll-only call (Fig. 17) is similar to a toll call through a 2-wire office with no LLNs; however, there are two important differences.

**4.45** First, a continuity check is not performed whenever an incoming trunk (ICT) is seized. Instead, the ICT is connected to a digit receiver, and abandon supervision is turned on at the receiver (not applicable if ICT is incoming from a step-by-step office). The off-hook (seizure) on the ICT is autonomously passed through the HILO network to the digit receiver. If an on-hook (disconnect) signal is detected at the digit receiver prior to the completion of digit collection, a continuity check will be performed on the network path. If the check passes, true abandon

(customer hung up) is assumed. When the continuity check fails, a TTY message is printed out identifying the failing network path.

**4.46** The second difference is in the handling of the disconnect supervision of a non-CAMA call. After the establishment of a stable connection, following the successful completion of outpulsing, disconnect supervision is applied to the HILO ICT only. (In 2-wire offices, disconnect supervision is applied to both the incoming and outgoing trunks.) Answer and disconnect signals from the terminating office are passed autonomously through (but not detected by) the HILO office. When the originating office performs disconnect operations, an on-hook signal is passed to the HILO office via the ICT and the HILO office initiates disconnect actions. Unlike 2-wire toll-only offices, the connection through the HILO office is taken down only when the disconnect signal is received from the originating office. Thus, a called-party abandon has no effect on the HILO office.

**4.47** For CAMA calls (where the HILO office records the bill information), supervision is also applied to the outgoing trunk (OGT). Called party answer and disconnect by either party are reported via the call register associated with the CAMA call.

**4.48** The HILO office has the capability of determining whether or not detection of answer is required. For a standard PTS-to-PTS connection, answer supervision is not required; therefore, supervision is not activated. In this case, the call is set up as ICT control—the true toll configuration. For CAMA operation and certain other applications, supervision is activated and the terminating disconnect function can be invoked. Whether or not supervision is autonomously sent forward is under software control in selecting the proper ICT/OGT circuit states.

### B. EPSCS Applications

**4.49** When a HILO 4-wire office functions as an EPSCS switch, the feature operation is similar to a toll-only call except that EPSCS has the ability to perform call supervision for all calls. [Refer to A(46) in Part 18.]

### C. Toll/Local (Intraprocessor) Call

**4.50** An incoming call on the toll side of a HILO combined local/toll office to a customer whose line terminates on the local side is handled essentially as if two separate offices were involved. However, one processor performs the role of both the toll and local offices, eliminating the requirement for transmission of digits between the two offices and the use of transmitters and receivers.

**4.51** In the toll side of the processor, the incoming call is handled in the same manner as a toll-only call until the outpulsing routines determine that the TCC for the hunted trunk indicates an intraprocessor trunk group (Fig. 17). At this point, the processor attempts to remove the 2-wire side of the intraprocessor trunk from the idle list (Fig. 18). The intraprocessor trunk is an intraoffice trunk outgoing from the HILO (toll) side looped to an ICT on the 2-wire (local) side. If the intraprocessor trunk is available and the connection is stable following seizure, an intraprocessor incoming register is seized if one is available. When the specified number of intraprocessor incoming registers in an office is in use, subsequent intraprocessor calls are blocked. The program does not allow incoming registers to be seized for intraprocessor calls since this could limit the completion of toll-only and local-only calls.

**4.52** When the intraprocessor incoming register is seized, it is initialized with the intraprocessor TNN of the 2-wire ICT obtained from the HILO OGT TNN-TGN auxiliary block (Fig. 13). In lieu of outpulsing, the digits received from the originating office are moved from the outpulsing control register (originally an incoming register) to the intraprocessor incoming register, and the outpulsing control register is released.

**4.53** The intraprocessor incoming register is placed on timing, and a seizure is placed on the HILO side of the intraprocessor trunk. When a seizure is detected on the 2-wire side of the intraprocessor trunk, the intraprocessor incoming register is removed from the timing list, digit analysis is performed using the class of service for local incoming intraprocessor trunk (paragraph 4.23), and local side setup continues. If the intraprocessor incoming register times out because of an intraprocessor trunk failure, the normal failure actions occur. When a ringing connection to the customer is established, the intraprocessor incoming register is released.

**4.54** As with a toll-only call, supervision is turned on for the HILO ICT only. The toll side waits for a disconnect (on-hook) signal from the originat-

ing office via the HILO ICT before taking down the HILO connections and idling the HILO trunk circuits.

**4.55** To summarize, the intraprocessor calls are double processed (toll and local sides of the processor) and double switched (toll and local TLNs). No outpulsing occurs between the two TLN communities.

### D. Local/Toll (Intraprocessor) Call

**4.56** A toll call originated by a customer whose line terminates on the local side of a combined local/toll office is treated identically to the toll/local call described above but in reverse. The intraprocessor trunk appears as an OGT to the local side and an ICT to the toll side. The local side utilizes an originating register which becomes an outpulsing control register and passes the dialed digits (prefixed or deleted, as necessary) to the intraprocessor incoming register on the toll side. A digit analysis is performed using the class of service for the HILO incoming intraprocessor trunk. As in the case of a toll-only call, HILO (toll side) supervision is turned on for the ICT only; therefore, the HILO connections are not taken down until a disconnect signal is received from the local side.

**4.57** All calls from local 2-wire outgoing loop-supervised TLNs to HILO toll TLNs require that continuity and polarity tests be performed. The holding time of the continuity and polarity test circuit is approximately 0.5 second. This additional holding time must be considered when these circuits are engineered.

**4.58** The CAMA calls originated on the local side do not use intraprocessor trunks to reach the toll side. Instead, regular CAMA trunks are used (2-wire OGT looped to the HILO CAMA ICT), and the call is handled as if two distinct offices were involved. (There is only one processor.) Transmitters and receivers are used, outpulsing is performed, and incoming registers are required by both sides. (Intraprocessor incoming registers are not used.)

**4.59** International direct distant dialing calls originating on the local side of a combined office do not use intraprocessor trunks or intraprocessor incoming registers because of the requirement of two stages of outpulsing. A separate intraoffice trunk group must be engineered for the expected international direct distance dialing traffic.

### E. Division of Revenue Peg Counts

**4.60** Normally, division of revenue peg counts are made upon the successful completion of outpulsing. [Refer to A(37) in Part 18.] When the sample is an intraprocessor call that requires no outpulsing between the two sides of the office, the peg count is not made upon a successful transfer of digits from the incoming register to the intraprocessor incoming register; rather, the peg count data is also transferred to a register on the other side. Therefore, the division of revenue peg count for an originating (local-to-toll side) call via an intraprocessor trunk is not made until the toll side to which the digits were transferred successfully completes outpulsing. The division of revenue peg count for a terminating (toll-to-local side) call via an intraprocessor trunk is not made until the digits are transferred to the local side, but before the completion of the connection.

## *CHARACTERISTICS*

### 5. FEATURE ASSIGNMENT

**5.01** The HILO 4-Wire Switching feature is provided on a per toll or combined local/toll office basis.

### 6. LIMITATIONS

#### OPERATIONAL

**6.01** Not applicable.

#### ASSIGNMENT

**6.02** In combined local/toll offices, all toll trunks that normally appear on a toll machine must be located on the HILO TLN community to insure proper transmission levels and office balance.

**6.03** Existing limits on software items in 2-wire toll offices are valid for HILO offices. Maximum values for items such as trunk groups, RIs, TLNs, and trunk group size are unchanged by this feature and reflect the total office configuration—both the toll side and, if present, the local side.

**6.04** All trunks and service circuits terminating on a HILO TLN must be HILO circuits. Mixing of HILO and 2-wire circuits is not allowed within a given TLN.

**6.05** The physical arrangements of the HILO universal trunk frame, HILO miscellaneous

trunk frame, and HILO TLNs must be such that no network path between any two HILO message trunk circuit plug-in units exceeds 220 feet. See reference A(62) in Part 18.

## 7. INTERACTIONS

### STATIC

**7.01** The HILO feature cannot be used in an office equipped with service link networks. If service link networks are present in an existing office, they must be removed before the HILO feature is added.

**7.02** Revertive pulsing is not supported by the HILO feature. If offices using revertive pulsing need to be served, calls must be trunked through some other type of office (eg, crossbar tandem or 2-wire No. 1/1A ESS switches).

**7.03** Type II E&M signaling is the only type of E&M signaling compatible with HILO trunk circuits. For interface with a type I or type III E&M unit, an E&M applique circuit SD-99774-01 must be used.

**7.04** Remreed TLNs must be used for the HILO feature; transmission limitations preclude the use of ferreed networks. Also, the only fractional TLN that can be used for the HILO TLN is the 1/2-fractional 2048 remreed TLN.

**7.05** Dial-pulse signaling on outgoing loop-supervised trunks is provided by loop pulsing rather than by the battery and ground method. This may limit the maximum loop length.

### DYNAMIC

**7.06** Where the HILO office has trunks to a No. 4A crossbar office, the crossbar office must have its senders equipped with the Satellite/Toll feature. Unmodified senders require the off-hook of the delay-dial signal to arrive within 300 ms after initial seizure of the trunk. When modified, the period from seizure to initial off-hook is extended to 5 seconds. Under overload conditions, unmodified senders run the risk of having their trunks locked out since the 300-ms interval cannot be guaranteed. See references C(9) and C(10) in Part 18 for a description of this feature and the required options. For delay-dial operation, the HILO wink trunk circuits are used, and the delay-dial signaling function is accomplished by software action rather than by autonomous hardware. The initial off-hook is returned as the first action of the HILO office; this action is independent of whether or not a receiver is available.

**7.07** Where trunks exist to a step-by-step machine in the same building, pulse repeaters are required since no sleeve lead control is provided by the HILO trunk circuits. (See paragraph 7.10.) Toll-connecting trunks to a local office in the same building generally require 2-dB pads in order to maintain proper transmission levels. In a combined local/toll office, 2-dB pads are also required on the intraprocessor trunk groups connecting the local and toll TLN communities.

**7.08** When HILO is replacing a 2-wire crossbar toll office, all TSPS trunks must be converted to wink start signaling since HILO provides no off-hook idle trunks.

**7.09** Any HILO trunk circuit may be used to connect to an operator position; however, in actual practice, the switchboard pulsing and transmission supervision requirements dictate which circuit(s) can be used. Where ring forward signaling is required, operator positions must be equipped with wink ring forward rather than the 130-volt simplex ring forward. All operator trunks must be on-hook idle; off-hook idle trunk circuits are not available with the HILO feature.

**7.10** Incoming loop-supervised trunks from a step-by-step machine equipped with certain types of repeaters may present an open interval when answer is returned from the HILO office. The CAMA trunks do not present this problem since the HILO office is in control of the supervision on these trunks at all times. For non-CAMA trunks, however, answer supervision is passed to the incoming trunk by the hardware, thus causing an unexpected open interval which may be interpreted as a disconnect. Therefore, repeaters that do not present an open interval must be used on incoming step-by-step, non-CAMA loop supervision trunks. Acceptable repeaters are SD-31779 (option ZR), SD-32087, SD-32240, and SD-32245.

**7.11** In a combined local/toll HILO CCIS office, all HILO intraprocessor trunks involved in call processing must be converted to CCIS. In addition, the office should be restricted from overflowing one-way trunk groups into 2-way trunk groups which are

typically used for maintenance. If overflow is allowed, a non-CCIS 2-way trunk group must be set up to provide maintenance connection.

## 8. RESTRICTION CAPABILITY

**8.01** Not applicable.

## *INCORPORATION INTO SYSTEM*

## 9. INSTALLATION/ADDITION/DELETION

**9.01** Installation and preliminary testing of HILO equipment, including alignment of the MTTP, are covered in the Western Electric Installation Handbook. Translations for a new office are provided via the input forms listed in paragraph 12.01. The operating telephone company has responsibility for interoffice trunk transmission testing and verification of routing and charging translations.

**9.02** The standard sequence of input messages (Fig. 19) should be used for the addition of the following HILO hardware components: TLNs, HILO universal trunk frames, HILO step-by-step miscellaneous frame, MTT frames, and trunks and service circuits.

**9.03** Adding the HILO feature to an existing local office requires planning and procedures similar to adding a 2-wire toll function. The major difference is the presence of the intraprocessor trunk groups, which require operational and transmission testing similar to that required for interoffice toll-connecting trunk groups.

**9.04** Adding the HILO feature to an existing 2-wire local/toll office implies the movement of all toll trunks from the 2-wire TLNs to the HILO TLNs. Since this is unlikely to be performed on a ***flash*** cutover basis, temporary routing patterns must be established to allow overflow traffic to flow both ways between the HILO and the 2-wire toll communities. Additional intraprocessor trunks may also be required during the transitional period. It is more feasible to provide the full complement of HILO TLNs initially rather than to attempt to reassign the existing 2-wire TLNs to HILO use because of the additional installation and transitional intervals that would be required. This approach also avoids possible multiple junctor rearrangements.

**9.05** The set cards that are required for the HILO feature are listed in Table J.

**9.06** Regular ringing and special ringing circuits have no counterparts on the HILO network. Therefore, the set cards in Table K must be omitted in new toll-only HILO offices or the associated parameters set to zero in existing 2-wire facilities that are converted to HILO.

## 10. HARDWARE REQUIREMENTS

***Note:*** This part contains cost factors and determination of quantities. Central Office Equipment Engineering System (COEES) Planning and Mechanized Ordering Modules are the recommended procedures for developing these requirements. See references C(12) and C(13) in Part 18 for details. However, for planning purposes or if COEES is not available, the following guidelines may be used.

### A. General

**10.01** Scan, signal distributor, and central pulse distributor points for the major hardware items associated with the HILO feature are summarized in Table A. More detailed listings of the scan points for the HILO universal frame and the HILO miscellaneous step-by-step frame are provided in Tables F and G, respectively.

### B. Trunk Frames

**10.02** Two trunk frames are introduced with this feature: the HILO universal trunk frame and the miscellaneous trunk frame arranged for HILO incoming step-by-step trunk circuits. The latter frame is also referred to as the HILO step-by-step trunk frame. Both frames are 6 feet 6 inches wide and provide mounting for 512 trunk circuits in 256 physical locations.

**10.03** The HILO universal trunk frame (J1A090A) is the functional equivalent of a combined home and mate universal trunk frame. The HILO universal trunk frame circuit SD-1A376-01 has one scanner and two signal distributors. The HILO universal trunk frame is identified with an even universal trunk frame number. The next higher odd frame number is used by the second signal distributor in the frame. All message trunks except incoming step-by-step (bylink) direct access trunks, HILO CAMA operator trunks to remote TSPS, and COOTs are plug-in units mounted in the HILO universal trunk frame. The HILO interface is an integral part of the plug-in

trunk circuit. All 256 mounting locations are provided with three signal distributor points and two scan points for each of the two possible circuits. The scan points are assigned in adjacent rows in the column. The SC0 points are in even rows, and SC1 points are in the next higher odd rows.

**10.04** The HILO miscellaneous trunk frame (J1A091A) houses the bylink trunks incoming from step-by-step offices. These trunks are identified as miscellaneous trunks in translations. The miscellaneous trunk frame circuit arranged for HILO incoming step-by-step trunks SD-1A377-01, option Z as provided in J1A091A, List 1, has a master scanner but no signal distributors. Option Y (List 1 and List 2) provides a signal distributor for bay 0. Option X (List 1 and List 3) provides signal distributors for bay 0 and bay 1. The master scanner is assigned to the 512 incoming step-by-step trunk circuits that can appear on the frame. If the quantity of signal distributors is insufficient, spare signal distributor points may be provided from the miscellaneous fields of HILO universal trunk frames. Although such usage is not recommended in order to keep HILO and 2-wire assignments separate, the signal distributors on the combined miscellaneous trunk frame or the miniaturized universal trunk frame can also be used.

### C. Trunk Link Networks (TLNs)

**10.05** Remreed TLNs (J1A075A) must be used for the HILO feature. They can be either 1024 or 2048. See reference A(2) in Part 18 for a general description of remreed networks. The HILO TLNs require a new false cross and ground circuit pack FB299 which appears on SD-1A329-01. This circuit pack provides both the false cross and ground function and access to the NTVs of the junctor switching circuits. The HILO TLNs also require the junctor grid node selector—FB293B and the trunk grid node selector—FB294B circuit packs which also appear on SD-1A329-01. The equipment orders for combined offices must indicate which TLNs are to be used for HILO. The NTVs for the HILO TLNs are terminated on the HILO TLNs, regardless of the absence of lines. An SD-1A383-01 tone circuit is required as an NTV interface to the HILO TLN. The assignment pattern must be the same as that which was established for 2-wire non-LLN offices.

**10.06** The TLNs used for HILO 4-wire switching are engineered using ten-high-day load estimates and the toll blocking criterion—0.5 percent first failure to match. Capacity numbers for both the 1024 and 2048 TLNs are provided in reference A(17) in Part 18 for the No. 1 ESS switch or A(19) for the No. 1A ESS switch. Because of the network configuration in combined local/toll offices (paragraphs 3.06 through 3.10), the line-to-trunk CCS (hundred call seconds) quantity is not included in the HILO engineering since all traffic on the HILO TLNs is trunk to trunk. Combined offices require intraprocessor trunks between the two network communities; what would normally be considered line-to-trunk traffic actually appears as trunk-to-trunk traffic on the HILO TLNs. This must also be considered in the local 2-wire engineering.

### D. Junctor Grouping Frame

**10.07** A different option of the junctor grouping frame [J1A047A, List 2 (9-file) or J1A085A, List 2 (12-file)] is required for the HILO feature to provide the junctor reversals associated with the HILO TLNs (paragraph 3.06). In a combined local/toll office, 9-file junctor grouping frames can be used for one TLN community and 12-file junctor grouping frames for the other TLN community. Equipment orders must indicate which junctor grouping frames are for HILO.

### E. Intermediate Distributing Frame

**10.08** In a HILO office, the intermediate distributing frame serves two functions. It connects facility equipment to trunk circuits and connects miscellaneous trunk frame circuits to the HILO interface circuit SD-1A392-01, -02. All HILO universal and HILO step-by-step frames are normally cabled to the intermediate distributing frame. To provide full flexibility for circuit movement, all eight wires (T, R, T1, R1, E, M, SB, and SG) are included for each circuit position in the trunk frame. Because of the large amount of cabling that must terminate on the intermediate distributing frame and the possibilities for cable congestion, the recommended intermediate distributing frame is the low profile frame per ED-97754-70 with high density terminal block (89 type).

### F. Message Trunk Circuits

**10.09** The scan and signal distributor points associated with the HILO 4-wire switching message trunk circuits are tabulated in Table B.

**10.10** Interoffice and intraoffice trunk engineering is not affected by the HILO feature. Howev-

er, the intraprocessor trunk groups must be considered. The decision to use one-way or 2-way pairs of trunk circuits is an economical decision that should encompass the coincidence or noncoincidence of the directionality of the traffic (local-to-toll and toll-to-local). The 2-way trunk pairs are more economical for groups of approximately 70 trunks or less; one-way trunk pairs are more economical for groups of more than 70 trunks. A 2-way intraprocessor group consisting of one 2-way trunk pair per MTTP must be provided in all HILO local/toll offices to facilitate the monitor function on 2-wire trunks. This is the minimum requirement when only a 2-way intraprocessor group is provided. Where one-way trunk groups are used, this is in addition to the one-way trunk groups; each one-way trunk group should alternate route to its respective end of the 2-way trunk group for overflow traffic. The one-way and 2-way intraprocessor groups should be engineered to provide Neal-Wilkinson B.01L grade of service. (In the absence of data, use a peakedness factor of 1.) See reference A(61) in Part 18. Transmitters and receivers are not required for intraprocessor trunks since no pulsing occurs between the TLN communities. However, continuity and polarity test circuits are required on the 2-wire side, and the 0.5-second holding times of these circuits must be considered.

> ***Note:*** A continuity and polarity test is not performed on E&M supervised trunks.

### G. Service and Test Circuits

**10.11** The scan and signal distributor points associated with the HILO 4-wire switching service and test circuits are tabulated in Table O. Refer to SD-1A101 for current drain data associated with the service and test circuits.

**10.12** Since the HILO service circuits have characteristics similar to existing 2-wire service circuits, in most cases existing engineering guidelines for service circuits can be used. See reference A(16) in Part 18 for details concerning service circuits. Receivers and transmitters should use published holding times together with ten-high-day call quantities to arrive at CCS loads. Tone and announcement provisioning is affected only by the fact that additional circuits are now provided for the toll portion of the office.

**10.13** Seven circuits are provided for trunk maintenance and diagnostics. While determination of quantities is normally left to the plant department, the following guidelines should be considered. Two circuits—TOUCH-TONE® service detector test SD-1A385-01 and MF test environment SD-1A381-01—need only be provided in limited quantities; one active circuit and one spare should be adequate. The quantity of 104/105 test couplers SD-1A388-01 is determined by the number of code 104 and code 105 transmission test lines provided on the 4-wire network. The quantities of combined 100/102 test line circuits SD-1A386-01 and operational test termination circuits SD-1A391-01 (103/synchronous test lines) should be based on the expected incoming testing load. The tone presence detector SD-1A382-01 is provided in quantities up to the number of simultaneous trunk diagnostics provided. This quantity is established by the value of set card NMSPAD. The 108 test line circuit SD-1A389-01 is provided one per office (maximum)—no spare is necessary.

### H. Manual Trunk Test (MTT) Frame

**10.14** The MTT frame (J1A042F) replaces the supplementary trunk test frame in HILO offices. Functionally, the MTT frame includes all the 2-wire testing capabilities of the STTP, plus HILO and additional 2-wire trunk testing capabilities. A pair of MTT frames is mounted on either side of an AMT frame (J1A042G). The basic AMT frame is equipped with a TTY. Options available with the MTT circuit SD-1A418-01 and AMT circuit SD-1A435-01 are described in reference A(5) in Part 18. The MTT frame network connections in a combined local/toll office are depicted in Fig. 3.

**10.15** The MTTPs should normally be provided on the basis of one MTTP per 2000 to 3000 testable trunks. Additional MTTPs may be required during installation of new HILO offices for precut testing. Each MTT frame requires the network connection circuits depicted in Fig. 3. The quantity of dual-tone MF trunk dial pulse receiver combinations (SD-1A173/1A390) accessed via pseudo RI 029 (Table H) must equal the number of MTTPs + 2 in a HILO toll-only office. In a combined local/toll office, the quantity of dual-tone MF trunk dial pulse receiver combinations required is equal to the number of MTTPs + 1. The difference is due to the TLTP; it has a trunk appearance in a toll-only office and a line appearance in a local/toll office.

### I. Remote Office Test Line (ROTL)

**10.16** In a combined local/toll office the ROTL (J1A076A) has appearances on both the 2-

wire and HILO networks. The ROTL applique circuit for HILO offices (combined or toll only) is SD-1A433-01. (The 2-wire offices use SD-1A314-01.) Three SD-1A396-01, -02 FX trunks per ROTL are always provided to a local office to allow the ROTL to be reached via the direct distance dialing network and to allow the ROTL to make security callback to the remote test location (eg, CAROT) whenever authorization to conditional trunks has been requested. The local office may be the LLNs in a combined local/toll office.

**10.17** One ROTL should be provided for every 10,000 testable outgoing and 2-way trunks. The circuits required to connect a ROTL and PCI to the network are depicted in reference A(32) in Part 18.

### ▮J. Remote Trunk Test Unit (RTTU)

**10.18** The RTTU (SD-1P173-01) provides a maximum of eight 105 test lines to the HILO offices. The access interface is provided through the 104/105 test coupler circuit SD-1A388 and uses the standard 105 call processing. The 105-type test line SD-96601 cannot be connected in the same trunk group where a RTTU appears. The office translations are set up with only a single fixed RI for the standard 105 call processing. The CAROT performs one self-test of the far-end office equipment per trunk group test. Therefore, two different far-end responders in the same 105-test line chain would violate the system test requirements.

**10.19** In offices with the 1E6/1AE6 and later generic programs, the RTTU may be used to provide the ROTL feature to access and test 2-wire and HILO trunks. The access interface for 2-wire trunks is test coupler circuit SD-1A303 or SD-1A493. For HILO trunks, test coupler circuit SD-1A388 provides the access interface. One HILO FX trunk SD-1A396 is used to provide CAROT access in toll-only applications.▮

## 11. SOFTWARE REQUIREMENTS

***Note:*** This part contains cost factors and determination of quantities. Central Office Equipment Engineering System (COEES) Planning and Mechanized Ordering Modules are the recommended procedures for developing these requirements. See reference C(12) and C(13) for details. However, for planning purposes or if COEES is not available, the following guidelines may be used.

### MEMORY

### A. No. 1 ESS Switch

#### Fixed

**11.01** The following memory is required whether or not the HILO feature is used:

(a) ***Base Generic Program (Program Store):*** The program storage size required is 1200 words.

(b) ***Fixed Parameters (Program Store):*** The storage size required is 6 words plus 16 existing modified words.

#### Conditional

**11.02** The following memory is required when the HILO feature is activated, but not yet applied:

(a) ***Optionally Loaded Feature Packages (Program Store):*** With all active generic programs, 8448 words for the HL4W feature group composed of only the HL4W feature package and 1536 words for the MTTP feature group composed of only the MTTP feature package are required. These values also include 237 words for HL4W patch space and 428 words for MTTP patch space.

(b) ***Call Store:*** Applicable only to combined local/toll offices, the approximate size required is 5 through 30 (normal range) 18-word intraprocessor registers.

**11.03** In combined local/toll offices, additional incoming registers must be provided because of the double switching and double processing of intraprocessor calls. These special incoming registers are designated as HILO intraprocessor registers. Incoming registers are normally provided in quantities equal to the number of receivers, plus one. Thus, whenever a receiver is available, an incoming register is also available. However, during the processing of an intraprocessor call, two incoming registers are required—one by the toll side and one by the local side. This second incoming register or intraprocessor register is not associated with a receiver since pulsing is not performed between the local and toll TLNs. To provide registers for the double switching of calls, combined local/toll offices normally provide intra-

processor registers on the basis of five (minimum) plus one additional per 100 intraprocessor trunk pairs up to a maximum of 30. The following formula can be used to calculate the number of intraprocessor registers in a combined office:

NIPR = 5 + n/100

The result is rounded to the next highest full integer (where n equals the number of intraprocessor trunk pairs). Set card NIPR defines the number of intraprocessor registers. The value of set card NIPR must be included in the total number of registers defined by set card NOR. The audited usage count of intraprocessor registers (Part 15) prevents the use of more incoming registers than the engineered quantity of intraprocessor registers. An intraprocessor register is an additional incoming register designated for processing intraprocessor calls. In a toll-only office, set card NIPR need not be input since there are no intraprocessor trunk pairs. The default value of NIPR is zero, and no intraprocessor incoming registers are generated.

**11.04** Basic call store registers that are shared or used exclusively by toll traffic should be engineered to meet the toll grade of service. Registers that are used only by the local side in combined offices should continue to be engineered as at present. Full details are included in references C(2) through C(4) in Part 18. Set cards are listed in Table J.

**11.05** For determination of memory impact, see references A(18), A(19) through A(22), and A(57) in Part 18.

**Variable**

**11.06** The following ***translations (program store)*** memory is required when the HILO feature is applied:

- 7 words per HILO universal trunk frame
- 3, 6, or 9 words per HILO miscellaneous trunk frame, depending upon supplementary signal distributor option
- 1 word per trunk switch circuit
- 1 word per universal trunk
- 5 to 17 words per miscellaneous trunk
- 4 words per trunk group
- 2 to 4 words per RI expansion
- 2 words per intraprocessor trunk pair (if any) (1 word for HILO and 1 word for 2-wire).

**B. No. 1A ESS Switch**

**Fixed**

**11.07** The following memory is required whether or not the HILO feature is used:

(a) ***Base Generic Program (Program Store, File Store):*** Approximately 1500 words storage size are required.

(b) ***Fixed Parameters (Unduplicated Call Store, File Store):*** The fixed storage parameter is 11 words plus 16 existing words modified.

**Conditional**

**11.08** The following memory is required when the HILO feature is activated, but not yet applied:

(a) ***Optionally Loaded Feature Packages (Program Store, File Store):*** With all active generic programs, 11,825 words for the HL4W feature group composed of only the HL4W feature package and 2150 words for the MTTP feature group composed of only the MTTP feature package are required.

(b) ***Duplicated Call Store:*** Storage requirements are the same as in call store for the No. 1 ESS switch. Refer to paragraphs 11.02 through 11.05.

**Variable**

**11.09** The following memory is required when the HILO feature is applied:

- ***Translations (Unduplicated Call Store, File Store):*** Translations are the same as translations for the No. 1 ESS switch. Refer to paragraph 11.06 for details.

**REAL-TIME IMPACT**

**11.10** A No. 1 ESS office with the HILO feature requires a 5 percent increase above and be-

yond the overhead cycle counts required of a 2-wire No. 1 ESS switch without the HILO feature. A No. 1A ESS switch with the HILO feature is not subject to this increase.

**11.11** The impact on processor capability in terms of processor time for typical calls through a HILO office is shown in Table L. See reference A(40) in Part 18 for CCIS cycle counts.

**11.12** The cycle time for the No. 1 ESS switch is 5.5 ms. The cycle time for the No. 1A ESS switch is 0.7 ms.

## 12. DATA ASSIGNMENTS AND RECORDS

### TRANSLATION FORMS

**12.01** The following ESS translation forms, detailed in reference C(1) in Part 18, are applicable to the HILO feature.

(a) ***ESS 1202—Trunk Group Record:*** This form provides TNN to trunk group and trunk member number translations for all trunks.

(b) ***ESS 1203A—Trunk Network Number Record:*** This form relates the TNN to the trunk group and trunk frame location.

(c) ***ESS 1204—Trunk Class Code Data:*** This form specifies data for TCC expansion tables.

(d) ***ESS 1212A/B—Mechanized Trunk Network Number Input:*** This form provides input for the generation of TNN assignments and equipment layout information.

(e) ***ESS 1216—Trunk Group Supplementary Record:*** This form provides proper input level (TP 0 or TP 2) for all HILO trunks and specifies that test access trunks 1 and 2 of the MTTP are to test at TP 0.

(f) ***ESS 1220—Universal Trunk Frame (HILO) Record:*** This form relates the HILO universal trunk equipment locations on a frame basis to the corresponding trunk network appearances and the HILO universal trunks assigned to these equipment locations.

(g) ***ESS 1221—Miscellaneous Trunk Frame (HILO) Record:*** This form relates equipment on a frame basis to TNN, trunk group, trunk number, TCC, central pulse distributor points, signal distributor points, and scan points.

(h) ***ESS 1222—TNN and TGN Miscellaneous Information Record:*** This form is used for intraprocessor trunks to pair HILO TNN with the associated 2-wire TNN and vice versa.

(i) ***ESS 1303A/B/C—Trunk and Service Circuit Route Index Record:*** This form specifies data for RI expansion table entries.

(j) ***ESS 1303D—Pseudo Route Index Record:*** This form specifies data for pseudo RIs.

(k) ***ESS 1400—Traffic Register Assignment Record:*** This form provides type measurement counts for peg, usage, and overflow counts.

(l) ***ESS 1500A—Head Table Capacity Record:*** This form contains translation information relating to hardware and memory items engineered on the basis of traffic orders, equipment orders, trunk assignments, routing and charging assignments, and traffic measurement assignments.

(m) ***ESS 1500B—General Information Record:*** This form specifies miscellaneous items associated with the TLTP, MTTPs, and, if applicable, STTPs.

(n) ***ESS 1500C—Network Configuration Record:*** This form identifies HILO TLNs, specifies TLN concentration ratios, and designates the frames equipped in each network.

(o) ***ESS 1506—Miscellaneous Assignment Information Record:*** This form specifies miscellaneous assignments not provided for elsewhere; eg, NTVs, trunk groups to record announcement frames, trunk make-busy keys, ROTL assignments, network management indicator, and for the No. 1 ESS switch only—trunk maintenance TTY and operation with SCC.

### RECENT CHANGES

**12.02** The following recent change (RC) message is affected by the HILO feature.

| RC MESSAGE | FUNCTION |
|---|---|
| RC:TGMEM:MOVE | This message changes the trunk group number in the TNN-TGN translator from zero to the number specified by using keyword OTN—other TNN of an associated 2-wire and HILO pair of TNNs (intraprocessor trunk). Refer to A(9), A(41), or A(48) in Part 18 for message details. |

## 13. TESTING

**13.01** The HILO Toll feature should be tested in the same manner as the 2-Wire Toll feature. Typically, per trunk and trunk group call-through tests are performed to verify trunk, trunk group, and routing translations. If errors are detected during the testing, the verification messages in Table M, should be used to isolate the problem. For details of these messages and system responses, see the references in Part 18B.

**13.02** The pseudo RIs required for the HILO test and service circuits (see Table H) should be verified separately.

## 14. OTHER PLANNING TOPICS

### A. General

**14.01** Normal toll considerations (trunk rearrangements, rehoming of office, overall office capacity, etc) apply when the HILO feature is added to an existing office or a new office with the HILO feature established.

**14.02** The full number (16) of remreed 2048-TLNs and HILO trunk frames requires approximately 60 feet by 40 feet of floor space.

**14.03** Figure 20 illustrates the elements of two possible floor plans. In plan A, the HILO trunk frames are positioned on both sides of the associated TLN. Plan B has the networks in the center with the trunk frames surrounding that area. In some cases, the space already reserved for future expansion of the network community may be sufficient for installing the HILO trunk frames.

**14.04** In a HILO office, the HILO junctor grouping frame should be positioned in the middle of the TLN-HILO trunk frame area, rather than at the end of the TLN area as in 2-wire toll offices. This middle positioning of the HILO junctor grouping frame minimizes cabling from the trunk circuits to outgoing HILO trunk circuits. Since a separate junctor grouping frame is required for HILO TLNs, planning for adding HILO to an existing office need only consider sufficient space for the entire HILO trunk frame TLN-JGF complex, not the position of the present 2-wire junctor grouping frame.

### B. Combined Local/Toll Office

**14.05** The basic planning guideline for a combined office is that the local and toll sides can be engineered independently. The most obvious items are TLNs and junctor grouping frames; however, this guideline also extends to receiver, transmitter, tone, announcement, test, and maintenance circuits.

**14.06** Trunks must be provided between the local and toll networks in a combined local/toll office. A single 2-way group may be advantageous where the amount of inter-TLN traffic does not justify two one-way groups. (The economic break-even point occurs at approximately 70 trunks.) A 2-way group must always be present for trunk maintenance reasons, and this group may also be used to carry overflow traffic in either direction. (See Part 10.)

**14.07** In addition to the central processor community, only a limited number of other hardware units are shared between the local and toll communities. The ringing and tone plant and the power plant are in this category. The ROTL and MTTP have access to both the 4-wire and 2-wire network communities.

### C. Assignment Recommendations and Guidelines

**14.08** Certain restrictions are necessary because of the absence of a trunk distributing frame. To ensure an even distribution of traffic, no 2048 TLN carrying HILO 4-wire traffic should have two HILO miscellaneous trunk frames assigned until all HILO TLNs have been equipped with one HILO miscellaneous trunk frame. No 1024 TLN can have two HILO miscellaneous trunk frames; one frame must always be a HILO universal trunk frame. Because of fixed NTV, TNN assignments and the requirement for a tone circuit SD-1A383 as an interface to the NTV, HILO miscellaneous trunk frames cannot be assigned to switches 0 through 3 on the TLN; they are restricted to switches 4 through 7.

**14.09** Wherever possible, each 2048 TLN should have two associated HILO universal trunk frames in order to provide adequate balancing of traffic and to use the standard NTV assignment pattern. When the first HILO universal trunk frame is provided with a fully-equipped 2048 TLN, the TNN assignment pattern for NTVs given in Table N is required. When a second HILO universal trunk frame is added, the new HILO universal trunk frame should be associated with trunk switching circuits 0 through 3 and the standard NTV assignment pattern should be implemented. See reference C(1) in Part 18. When the first HILO universal trunk frame is provided with a 1/2-fractional 2048 TLN, trunk switching circuits 0 through 3 must be used. Support programs must consider TLN equipage before NTV TNNs are assigned.

## *ADMINISTRATION*

## 15. MEASUREMENTS

**15.01** Eleven office counts with a traffic measurement code (TMC) of 005 are available for the HILO feature. These counts are available on the hourly H and C, selected quarter-hour DA15, and the special studies S schedules. See reference A(58) in Part 18 for details concerning traffic measurements.

**15.02** The HILO traffic measurements and equipment group or office count numbers (EGOs) are as follows:

| EGO | DESCRIPTION |
|---|---|
| 271 | ***HILO Incoming Calls Overflow (Matching Loss):*** This count is scored on last trial failures to reserve a talking path between an incoming HILO trunk and an OGT, between the incoming HILO trunk and a tone or announcement trunk, or between the transmitter and an outgoing HILO trunk. This includes the HILO portion of calls between 2-wire and HILO TLNs and calls that are both incoming and outgoing in the HILO network. |
| 272 | ***HILO CAMA—Misrouted CAMA Treatment:*** This is a count of the calls given intercept treatment because local (nontoll) calls are being received over a CAMA incoming trunk group on a HILO TLN. |
| 286 | ***HILO Incoming Calls:*** This is a count of incoming call attempts on the HILO network recognized by the seizure of an incoming or 2-way trunk on a HILO TLN. For nonbylink, this count is scored after the seizure of the incoming register. In the case of bylink, the count is scored after receipt of the first digit. Included are incoming calls from the 2-wire network to the HILO over intraprocessor trunks, HILO trunk-to-trunk calls, and off-hook hits that are of a duration sufficient to be recognized as a trunk seizure. |
| 289 | ***HILO Tandem Call Attempts:*** This is a count of attempts to complete calls on the HILO network that come in on intertoll or direct distance dialing access trunks and are destined to be outpulsed over intertoll or toll completing trunks. Calls coming into the HILO network over CAMA, secondary intertoll, or internetwork trunks are not included. |
| 292 | ***HILO Incoming Calls First Failure to Match:*** This is a count of first trial failures to reserve a talking path between the incoming HILO trunk and the initially chosen OGT or, if the OGTs in the final trunk group are busy, on first trial failures to reserve a path to the tone or announcement trunk. Incoming and outgoing trunks may be intraprocessor. Trunk group busy includes network management busy (blocked by network management control). |
| 307 | ***HILO Tandem Call Failures Due to All Outgoing Trunks*** |

| EGO | DESCRIPTION |
|---|---|
| | ***Busy (Outgoing No Circuit):*** This is a count of HILO tandem call attempts that failed to be routed successfully out of the office because all OGTs were busy. This count does not include calls blocked by network management controls. |
| 310 | ***HILO MF Transmitter Time-Outs:*** This register counts the number of times an MF transmitter on a HILO TLN times out while waiting for a receiver-attached signal from the distant end. |
| 315 | ***HILO Dial Pulse Transmitter Time-Outs:*** This register counts the number of times a dial pulse transmitter on a HILO TLN times out while waiting for a receiver-attached signal from the distant end. |
| 378 | ***HILO Intraprocessor Incoming Register Usage:*** This is the usage in hundred call seconds (CCS) of the intraprocessor registers. It is provided on a 100-second scan basis. |
| 379 | ***HILO Intraprocessor Incoming Register Peg Count:*** This is the number of attempts to seize a HILO intraprocessor register. |
| 380 | ***HILO Intraprocessor Incoming Register Overflow Count:*** This is the number of failures to seize an intraprocessor register because the engineered quantity of intraprocessor registers would have been exceeded. |

## 16. CHARGING

### AUTOMATIC MESSAGE ACCOUNTING

**16.01** Not applicable.

### UNIFORM SERVICE ORDER CODES

**16.02** Not applicable.

## *SUPPLEMENTARY INFORMATION*

## 17. GLOSSARY

**17.01** The following terms are defined as they apply to this feature.

(a) ***Combined Local/Toll HILO Office:*** This is an office in which the local (2-wire) and toll (HILO) functions are combined using one processor for both functions.

(b) ***HILO Switching:*** This is a switching scheme that provides the equivalent of 4-wire switching over two switched conductors and a common unswitched return path. A current modulator (high impedance) is used at the sending end, and a demodulator is used at the receiving end (low impedance).

(c) ***Intraprocessor Call:*** This is a call from the toll side of a combined local/toll office to the local side or vice versa. The call is double switched (toll and local TLNs), but no inter-TLN pulsing occurs.

(d) ***Intraprocessor Register:*** This is a special use of additional incoming registers in combined local/toll offices for the processing of intraprocessor calls. An intraprocessor register is not associated with a receiver as the digits are passed to the intraprocessor register internally to the processor.

(e) ***Intraprocessor Trunk Group:*** These are local 2-wire trunk circuits terminating on the 2-wire TLNs connected back to back with toll HILO trunk circuits.

## 18. REFERENCES

**18.01** The following documents are affected by or are applicable to the HILO 4-Wire Switching feature.

### A. Bell System Practices

(1) Section 231-031-004—Junctor Grouping Frame—Theory

(2) Section 231-031-010—Remreed Switching Network—Description

(3) Section 231-032-005—Trunk and Service Circuit Testing Capabilities

(4) Section 231-032-010—Trunk and Line Test Panel, Supplementary Trunk Test Panel, and Auxiliary Test Frame—Description

(5) Section 231-032-020—Manual Trunk Test Position and Auxiliary Manual Test Circuit Description

(6) Section 231-032-025—Remote Trunk Test Unit Description

(7) Section 231-034-020—HILO Universal Trunk Frame—Description and Theory

(8) Section 231-034-025—HILO Miscellaneous Step-By-Step Frame—Description and Theory

(9) Section 231-048-303—Trunk Translations Recent Change Formats for TG, TGBVT, TRK, CFTRK, TGMEM, CCIS, and TKCONV (1E6 and 1AE6 Generic Programs)

(10) Section 231-048-304—Rate and Route Translation Recent Change Formats for NOCNOG, DNHT, NOGRAC, RATPAT, DIGTRN, CCOL, RI, CHRGX, DITABS, TNDM, IDDD, TDXD, and RLST (1E6 and 1AE6 Generic Programs)

(11) Section 231-048-305—Recent Change Formats for PSWD, PSBLK, SUBTRAN, and GENT (1E6 and 1AE6 Generic Programs)

(12) Section 231-048-307—Traffic Measurement Recent Change Formats for DIGTRN, TRFSCB, TRFLCU, TRFHC, TNCTX, CTRF, and NUTS (1E6 or 1AE6 Generic Programs)

(13) Section 231-048-310—RC Formats for ANIDL, CAMA, CFG, CPD, JUNCT, MSN, NMTGC, PLM, ROTL, SIMFAC, TMBCGA, CLAM, PUC, RSP, RSSCB, RCHAN, and LRE (1E6 and 1AE6 Generic Programs)

(14) Task Oriented Practices 231-050-006—Trunk Test Panels and Test Lines

(15) Task Oriented Practices 231-050-007—Manual Trunk Test Position and Auxiliary Manual Test Position

(16) Section 231-060-210—Service Circuits, Network Switching Engineering

(17) Section 231-060-320—Trunk Link Network, Network Switching Engineering

(18) Section 231-061-450—Program Stores, Network Switching Engineering

(19) Section 231-062-460—Processor Community Engineering, Program Stores, Network Switching Engineering

(20) Section 231-062-465—Processor Community Engineering, Duplicated Call Store, Network Switching Engineering

(21) Section 231-062-470—Processor Community Engineering, Unduplicated Call Store, Network Switching Engineering

(22) Section 231-062-475—Processor Community Engineering, File Stores, Network Switching Engineering

(23) Section 231-070-661—HILO and Tandem Translations—Network Administration

(24) Section 231-090-085—Feature Document—Common Wire Control Switching Arrangement Feature

(25) Section 231-090-094—Feature Document—Code 103-Type Test Line Feature

(26) Section 231-090-098—Feature Document—Code 100-Type Test Line Feature

(27) Section 231-090-099—Feature Document—Code 105-Type Test Line Feature

(28) Section 231-090-100—Feature Document—Code 101-Type Test Line Feature

(29) Section 231-090-101—Feature Document—Code 102-Type Test Line Feature

(30) Section 231-090-103—Feature Document—Synchronous Test Line Feature

(31) Section 231-090-196—Feature Document—Operator Tandem Feature

(32) Section 231-090-219—Feature Document—Remote Office Test Line (ROTL) and Processor Controlled Interrogator (PCI) Feature

(33) Section 231-090-278—Feature Document—Centralized Automatic Message Accounting (CAMA) Feature

(34) Section 231-090-294—Feature Document—Combined Operator Office Trunk Feature

(35) Section 231-090-309—Feature Document—Receiver Attachment Delay Report Feature

(36) Section 231-090-342—Feature Document—Code 104-Type Test Line Feature

(37) Section 231-090-350—Feature Document—Division of Revenue Peg Counts Feature

(38) Section 231-090-372—Feature Document—2-Wire Toll/Tandem Operation Feature

(39) Section 231-090-404—Feature Document—Code 108-Type Test Line Feature

(40) Section 231-090-416—Feature Document—Toll Common Channel Interoffice Signaling Feature

(41) Section 231-118-323—Trunk Translation Recent Change Procedures for TG, TGBVT, TRK, CFTRK, and TGMEM (CTX-6 Through 1E5 Generic Programs)

(42) Section 231-118-324—Rate and Route Translation Recent Change Procedures for NOCNOG, DNHT, NOGRAC, RATPAT, DIGTRN, TOLDIG, CCOL, RI, CHRGX, DITABS, TNDM, IDDD, and TDXD (CTX-6 Through 1E5 Generic Programs)

(43) Section 231-118-325—RC Procedures for PSWD, GENT, PSBLK, and SUBTRAN (CTX-6 Through 1E5 Generic Programs)

(44) Section 231-118-329—Traffic Measurement Recent Change Procedures for DIGTRN, TRFSLB, TRFLCU, TRFHC, TNCTX, CTRF, and NUTS (CTX-6 Through 1E5 Generic Programs)

(45) Section 231-118-337—RC Procedures for ANIDL, CAMA, CFG, CPD, MSN, NMTGC, PLM, ROTL, SIMFAC, and TMBCGA (CTX-6 Through 1E5 Generic Programs)

(46) Section 231-190-127—Feature Document—Enhanced Private Switched Communications Service Feature

(47) Section 231-090-305—Feature Document—Network Management Feature

(48) Section 231-318-303—Trunk Translation Recent Change Procedures for TG, TGBVT, TRK, CFTRK, TGMEM, CCIS, and TKCONV (Through 1AE5 Generic Program)

(49) Section 231-318-304—Rate and Route Translation Recent Change Procedures for NOCNOG, DNHT, NOGRAC, RATPAT, DIGTRN, TOLDIG, CCOL, RI, CHRGX, DITABS, TNDM, IDDD, and TDXD (Through 1AE5 Generic Program)

(50) Section 231-318-305—RC Procedures for PSWD, PSBLK, SUBTRAN, and GENT (Through 1AE5 Generic Program)

(51) Section 231-318-307—Traffic Measurement RC Procedures for DIGTRN, TRFSLB, TRFLCU, TRFHC, TNCTX, and NUTS (Through 1AE5 Generic Program)

(52) Section 231-318-310—RC Procedures for ANIDL, CAMA, CLAM, CPD, JUNCT, MSN, NMTGC, PLM, ROTL, SIMFAC, TMBCGA, and CLAM (Through 1AE5 Generic Program)

(53) Section 660-440-010—Codes—Test Line Circuits and Communication Trunks Nationwide Distance Dialing Plan

(54) Section 780-402-210—Basic Trunk Tables—Wilkinson B and $\overline{B}$ Tables, Trunk Engineering, Network Operations Methods

(55) Section 781-040-100—Notes on Common Control Switching Arrangement (CCSA)—General Information

(56) Section 820-009-150—Limiting Conductor Conditions—Equipment Design Requirement

(57) Section 231-061-460—Call Stores, Network Switching Engineering

(58) Section 231-090-207—Feature Document—Traffic Measurements

(59) Section 231-190-405—Feature Document—Operation With Switching Control Center Feature

(60) Section 231-390-405—Feature Document—Operation With Switching Control Center.

**B. TTY Input and Output Manuals**

(1) Input Message Manual IM-1A001

(2) Output Message Manual OM-1A001

(3) Input Message Manual IM-6A001

(4) Output Message Manual OM-6A001.

**C. Other Documentation**

(1) Translation Guide TG-1A

(2) Office Parameter Specification PA-591001

(3) Office Parameter Specification PA-6A001

(4) Parameter Guide PG-1

(5) Parameter Guide PG-1A

(6) Translation Output Configurations PA-591003

(7) Translation Output Configurations PA-6A002

(8) GL 74-06-164—Trunk Maintenance

(9) GL 74-04-064 (EL 2796)—No. 4 Crossbar System—New Features for Incoming Senders

(10) GL 75-11-126 (EL 4270)—No. 4 Crossbar System, Signaling—Compatibility With No. 1 ESS Switch HILO, No. 4 ESS Switch, and TSPS/RTA Systems

(11) GL 77-09-153—Echo Supressor Control Feature

(12) 759-100-100 BISP— General Description—Central Office Equipment Engineering (COEES)—Business Information System Programs

(13) 759-100-000 BISP— Subject Index—Central Office Equipment Engineering (COEES)—Business Information System Programs.

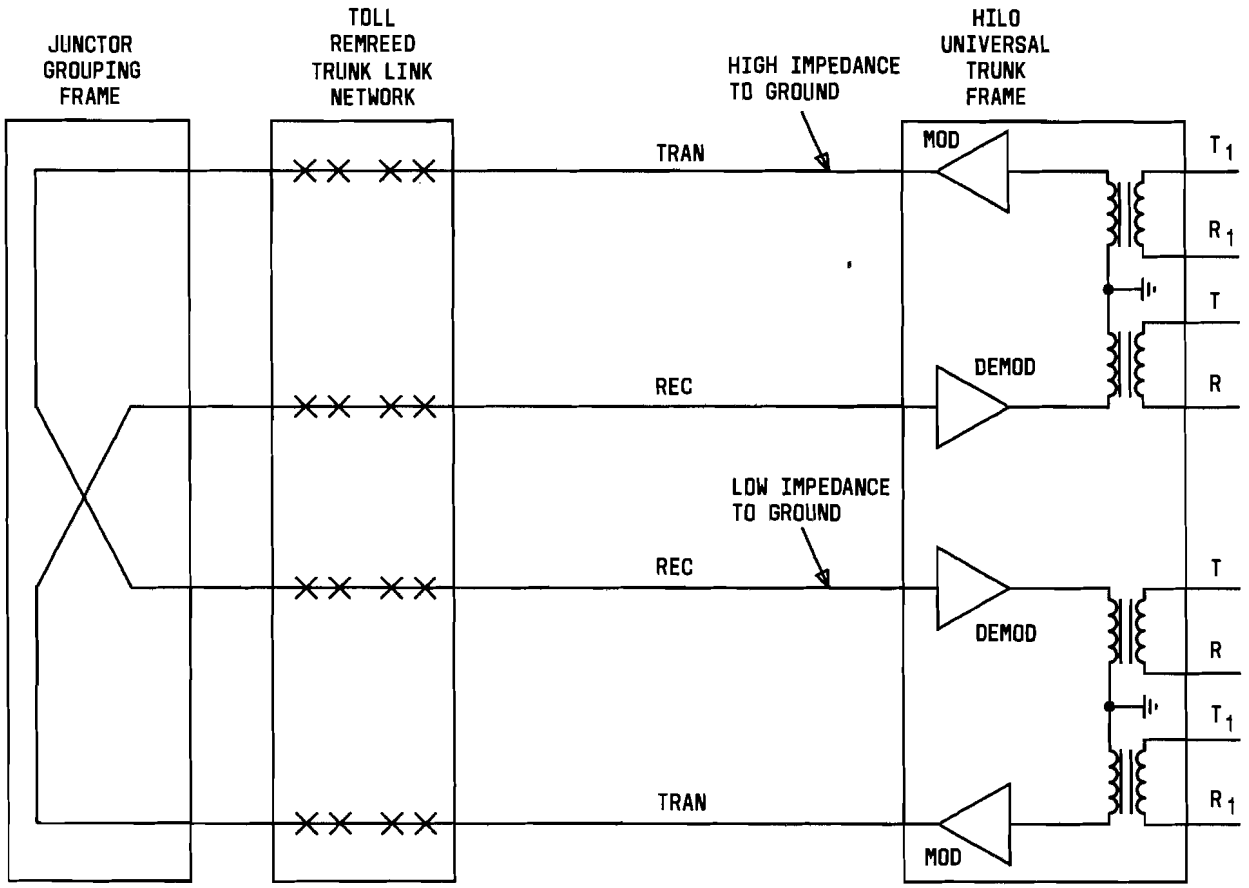



Fig. 1—HILO 4-Wire Toll-Only Office Showing Modulators (MOD) and Demodulators (DEMOD)

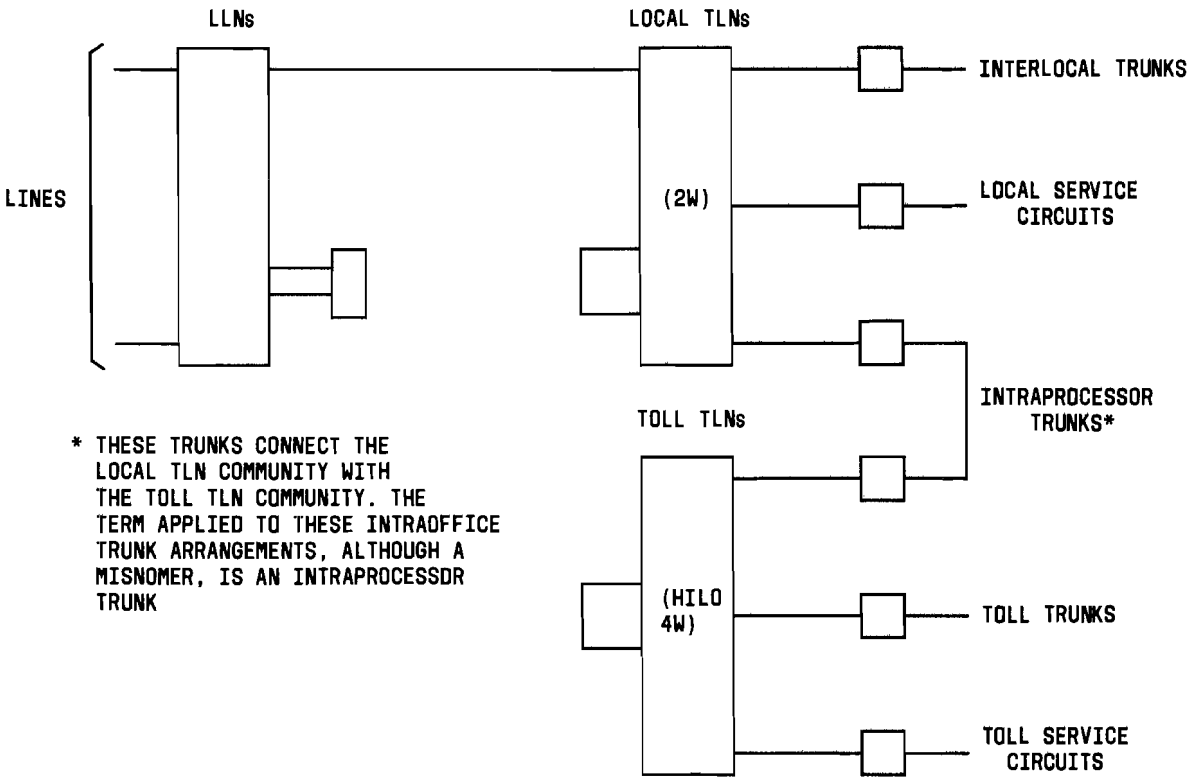
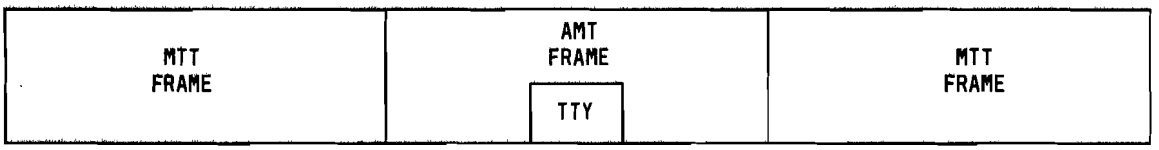
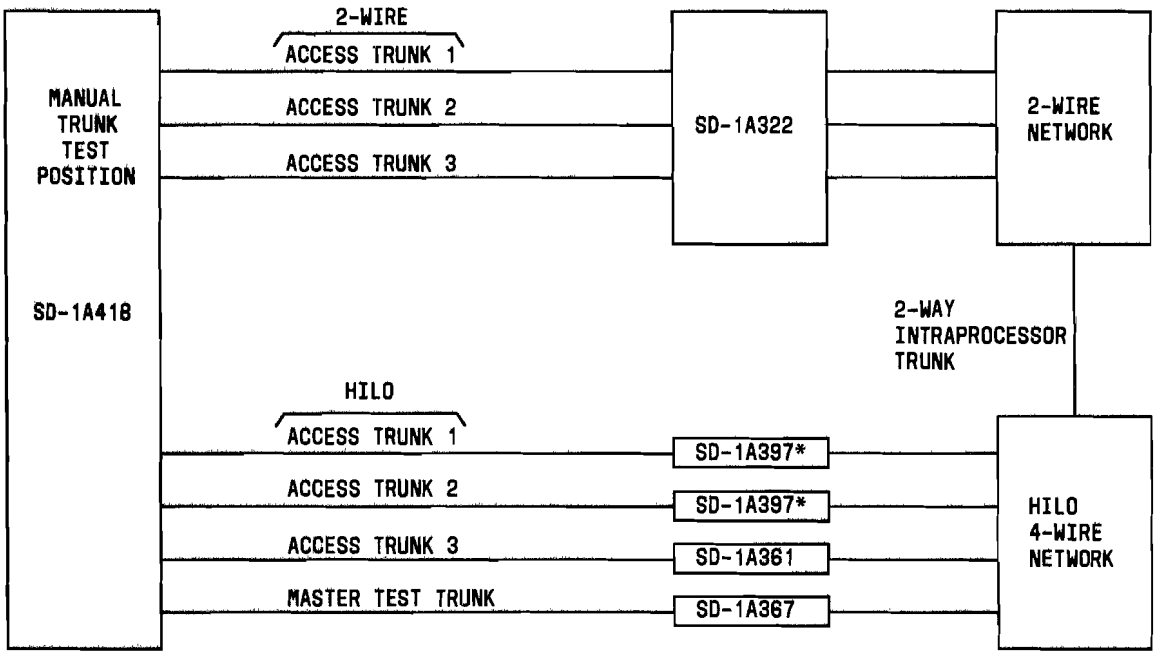



**Fig. 2—HILO Combined Local/Toll Office**



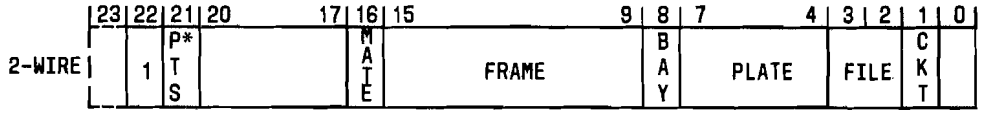

(a) Physical arrangement of MTT/AMT frames




* HILO ACCESS TRUNKS 1 AND 2 MUST BE ASSIGNED TO CIRCUITS 0 AND 1, RESPECTIVELY, ON THE SAME TRUNK UNIT.

(b) Network connections

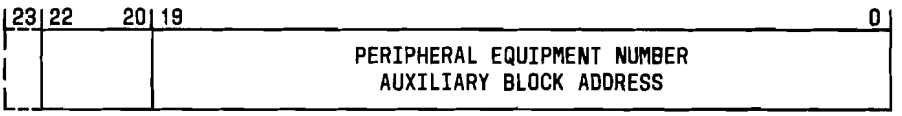
Fig. 3—MTTP Arrangement in HILO Combined Local/Toll Office





* PTS - CIRCUITS PER UNIT

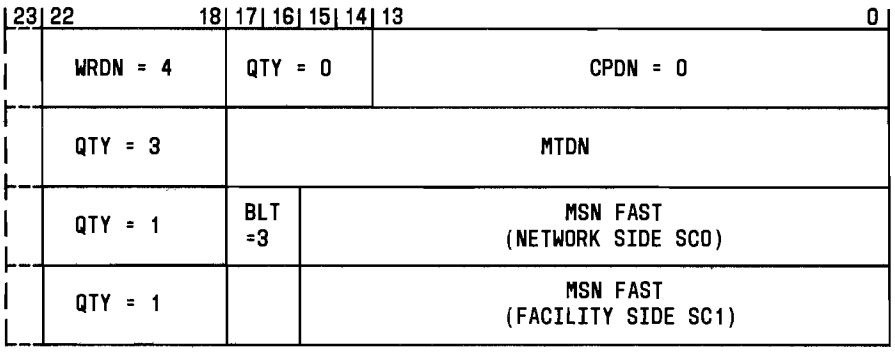
(a) Universal trunk



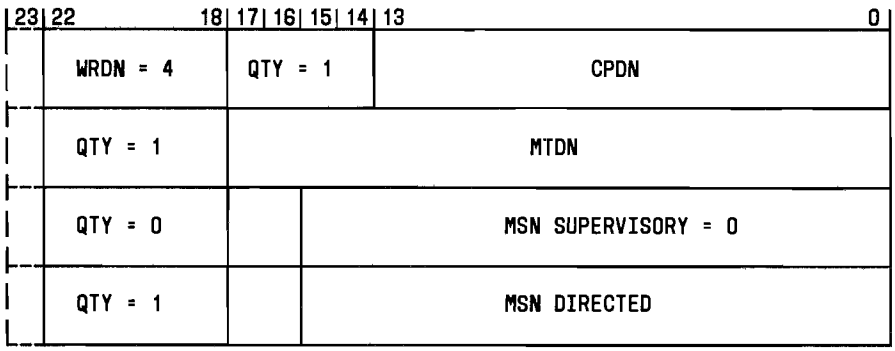

(b) Miscellaneous trunk

NOTE: BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

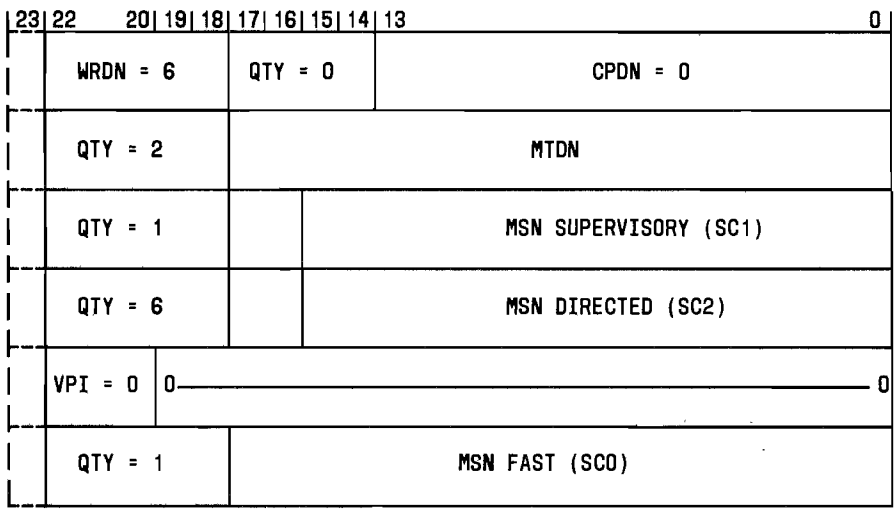
Fig. 4—Universal and Miscellaneous Trunk TNN-PEN Subtranslator Primary Translation Words




(a) Incoming from step by step SD-1A366/SD-1A608, 1A371/SD-1A609




(b) Dial pulse transmitter SD-1A378




(c) Multifrequency receiver SD-1A379

Fig. 5—TNN-PEN Auxiliary Blocks (Sheet 1 of 5)

| 23 | 22 — 18 | 17 | 16 | 15 | 14 | 13 — 0 |
|---|---|---|---|---|---|---|
| | WRDN = 4 | QTY = 7 | | | | CPDN |
| | QTY = 0 | MTDN = 0 | | | | |
| | QTY = 0 | | MSN SUPERVISORY = 0 | | | |
| | QTY = 4 | | MSN DIRECTED | | | |

(d) Multifrequency transmitter SD-1A380

| 23 | 22 — 18 | 17 | 16 | 15 | 14 | 13 — 0 |
|---|---|---|---|---|---|---|
| | WRDN = 4 | QTY = 0 | | | | CPDN = 0 |
| | QTY = 3 | MTDN | | | | |
| | QTY = 2 | | MSN SUPERVISORY | | | |
| | QTY = 0 | | MSN DIRECTED = 0 | | | |

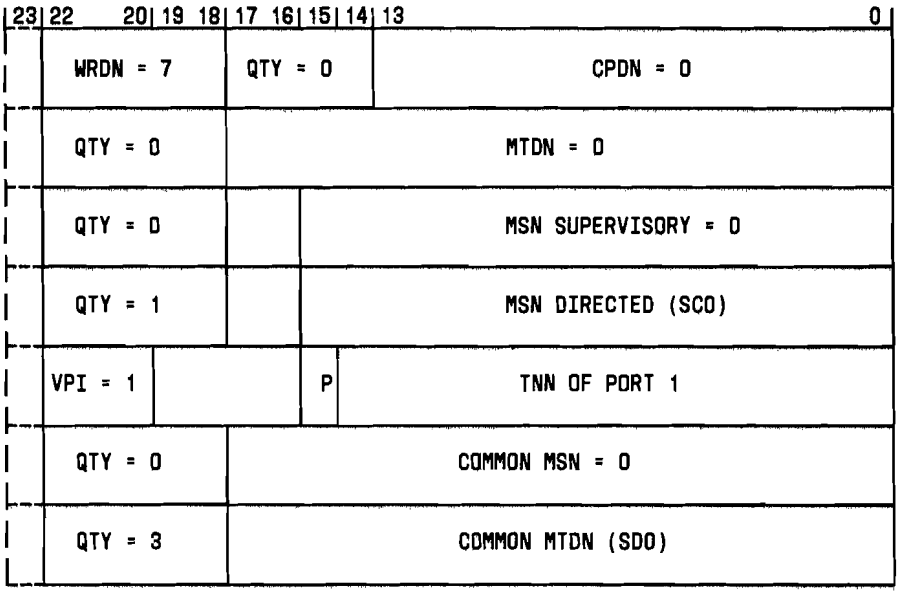
(e) Tone presence detector SD-1A382

| 23 | 22 — 18 | 17 | 16 | 15 | 14 | 13 — 0 |
|---|---|---|---|---|---|---|
| | WRDN = 4 | QTY = 4 | | | | CPDN |
| | QTY = 3 | MTDN | | | | |
| | QTY = 2 | | MSN SUPERVISORY | | | |
| | QTY = 0 | | MSN DIRECTED = 0 | | | |

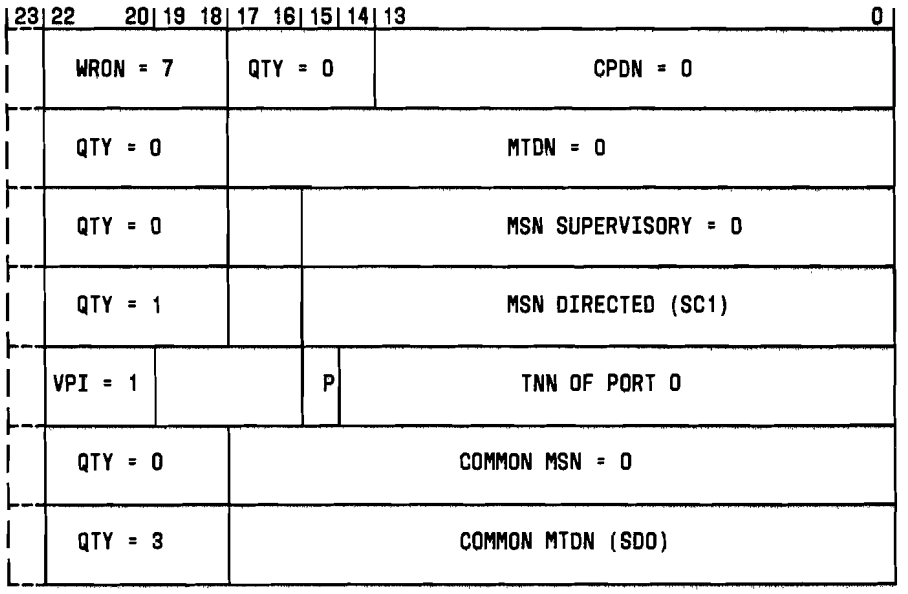
(f) TOUCH-TONE service detector test SD-1A385

LEGEND:
BLT - BYLINK TRUNK = 3
P - PORT INDICATOR. P = 0 FOR PORT 0 TNN; P = 1 FOR PORT 1 TNN
VPI - VARIABLE PART INDICATOR

Fig. 5—▶TNN-PEN Auxiliary Blocks (Sheet 2 of 5)◀



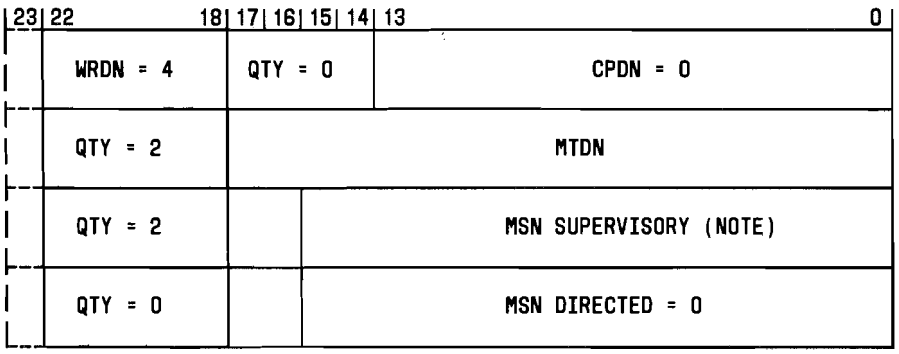

(a) Port 0




(b) Port 1

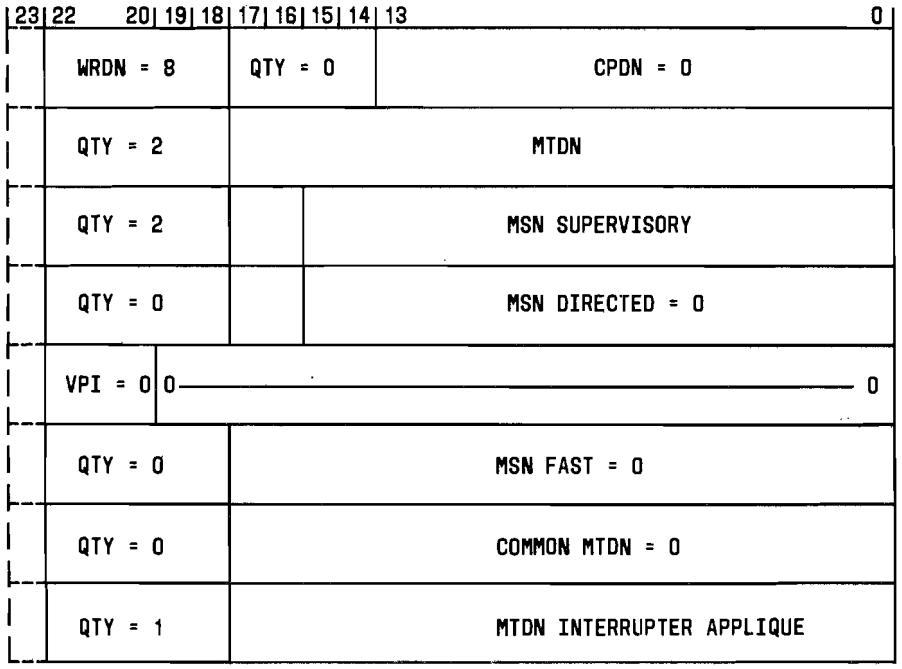
**(g) Multifrequency environmental SD-1A381**

**Fig. 5—TNN-PEN Auxiliary Blocks (Sheet 3 of 5)**

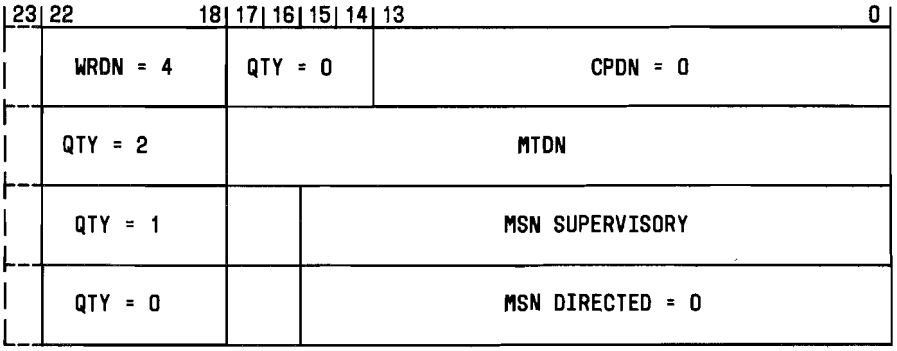



NOTE: SC1 USED WITH TRUNK ORDER CODES 13402, 13403, 13404, AND 13405 ONLY

(h) Audible ring and recorded announcement SD-1A384

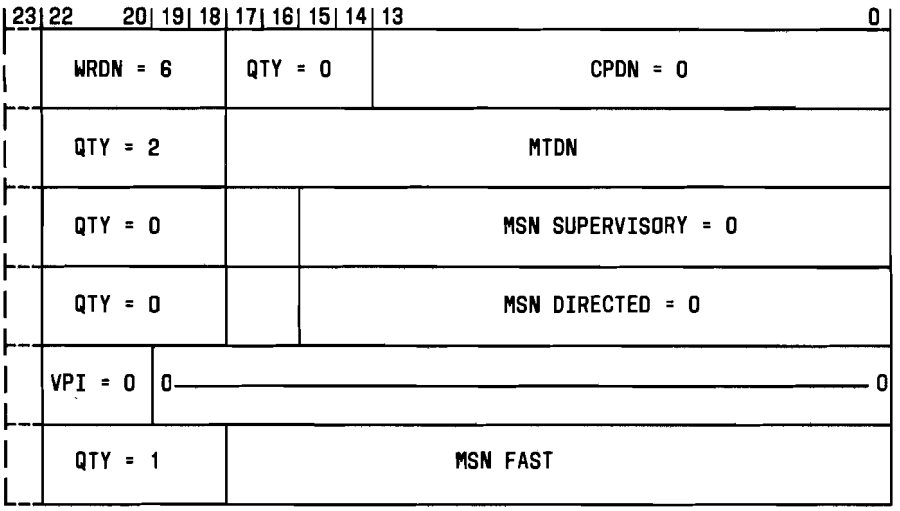



(i) Delay announcement SD-1A384, trunk order codes 13404 and 13405.

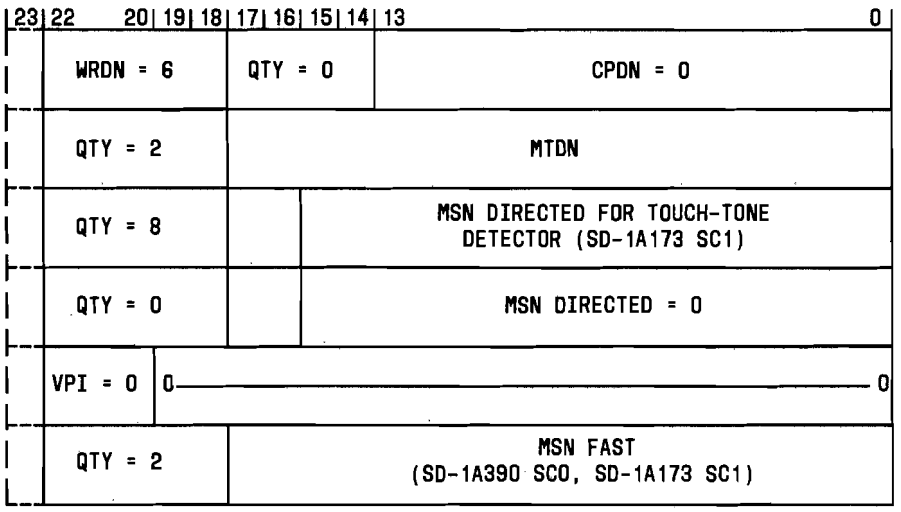



(j) Operational test termination SD-1A391

Fig. 5—TNN-PEN Auxiliary Blocks (Sheet 4 of 5)



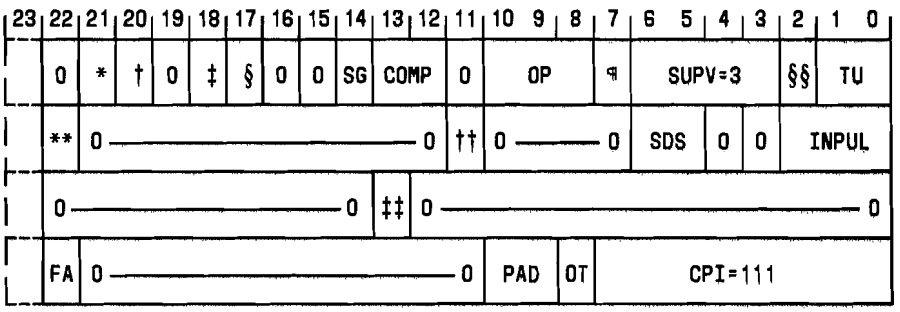

(k) Dial pulse receiver SD-1A390




(l) TOUCH-TONE service dial pulse receiver combination SD-1A390/1A173

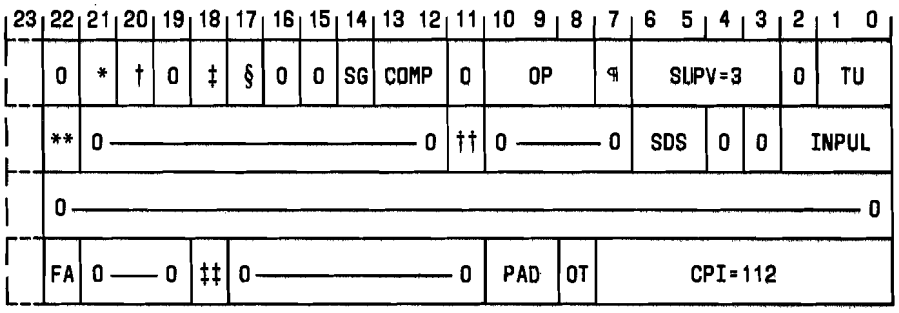
NOTE:
BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

Fig. 5—TNN-PEN Auxiliary Blocks (Sheet 5 of 5)



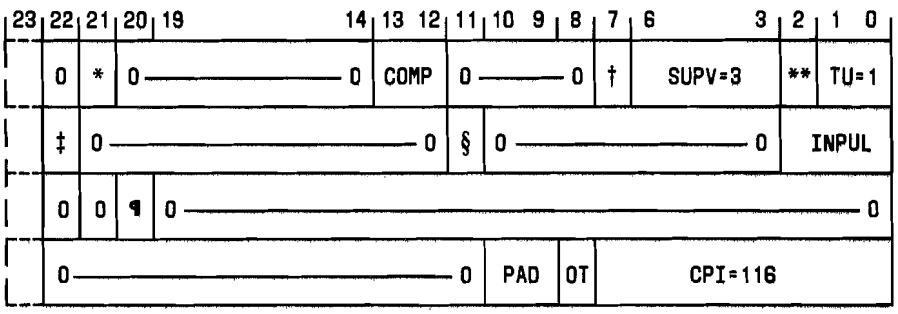

* CONF, † SDST, ‡ SDS, § WDD, ¶ ICT, ** CDFN, †† CAMA, ‡‡ HILO, §§ WORD 3

**(a) Two-way trunk, E&M lead supervision, wink or delay dial SD-1A361-01 and 1A361-02 (Notes 4, 5, and 8)**




* CONF, † SDST, ‡ SDS, § WDD, ¶ ICT, ** COFN, †† CAMA, ‡‡ PNT

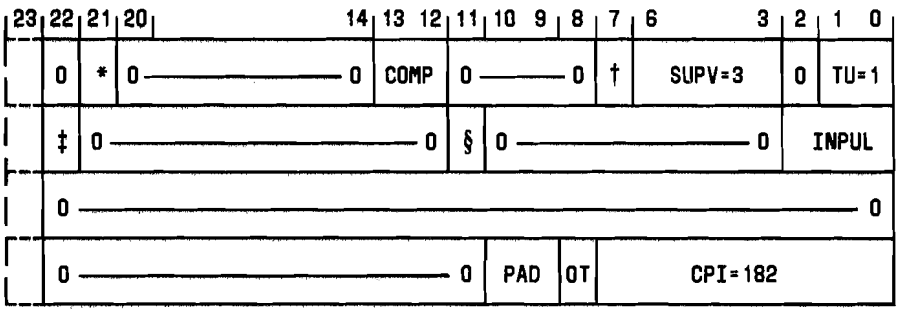
**(b) Two-way trunk, E&M lead supervision, wink or delay dial SD-1A362-01 and SD-1A362-02 (Notes 4 and 6)**




* CONF, † ICT, ‡ COFN, § CAMA, ¶ SXS, ** WD3

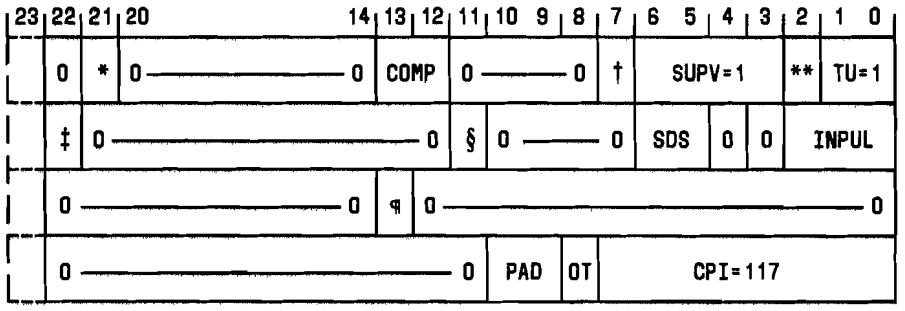
**(c) Incoming trunk, E&M lead supervision, immediate start SD-1A366-01**

**Fig. 6—Trunk Class Code Expansion Table Translations for HILO Circuits (Sheet 1 of 7)**



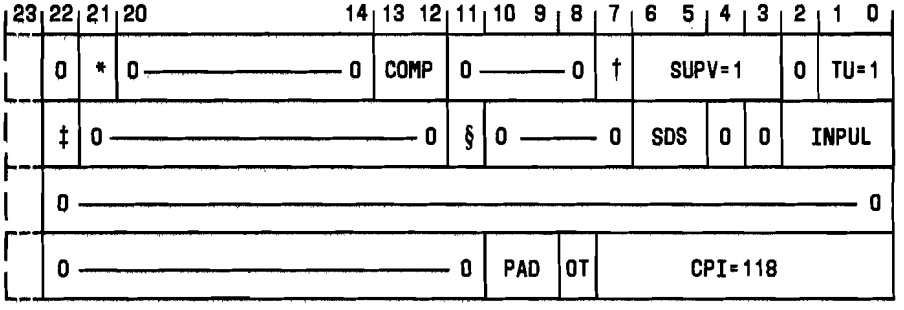

* CONF, † ICT, ‡ COFN, § CAMA,

(d) Incoming trunk, E&M lead supervision, immediate start SD-1A608-02




* CONF, † ICT, ‡ COFN, § CAMA, ¶ HILO, ** WD3

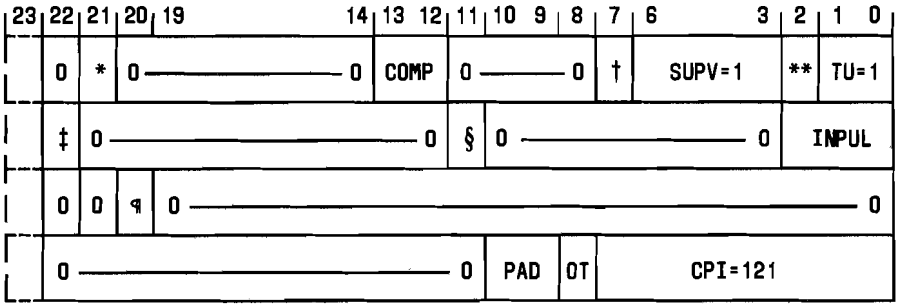
(e) Incoming trunk, loop reverse battery, wink or delay dial SD-1A367-01 or SD-1A367-02 (Notes 4, 7, and 8)




* CONF, † ICT, ‡ COFN, § CAMA

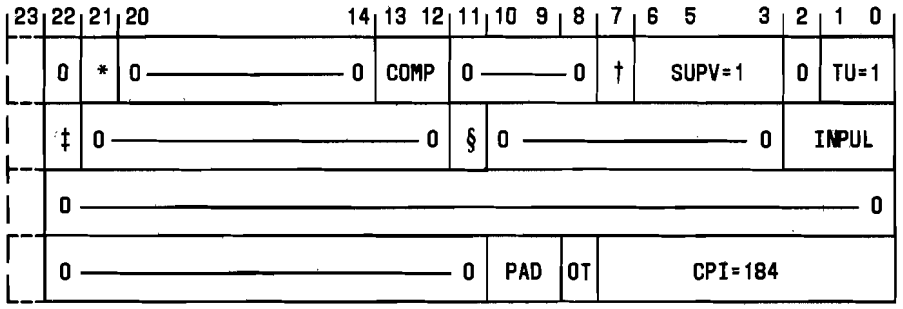
(f) Incoming trunk, loop reverse battery, wink or delay dial SD-1A368-01 and SD-1A368-01 (Note 4)

Fig. 6—Trunk Class Code Expansion Table Translations for HILO Circuits (Sheet 2 of 7)



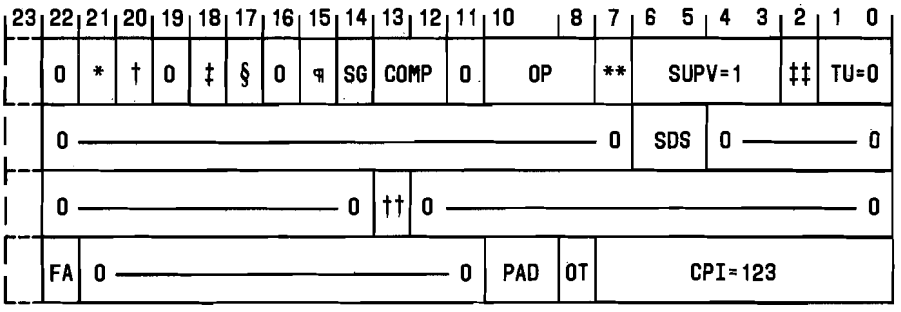

* CONF, † ICT, ‡ COFN, § CAMA, ¶ HILO, ** WD3

**(g) Incoming trunk, loop reverse battery, immediate start SD-1A371-01**




* CONF, † ICT, ‡ COFN, § CAMA

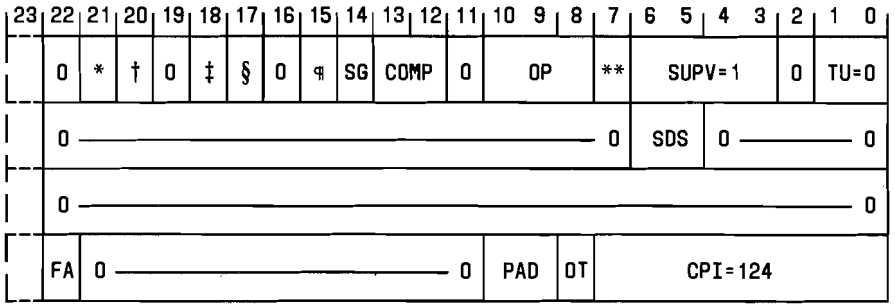
**(h) Incoming trunk, loop reverse battery, immediate start SD-1A609-02**




* CONF, † SDSTIM, ‡ SDS, § WDD, ¶ BAT, ** ICT, †† HILO, ‡‡ WORD 3

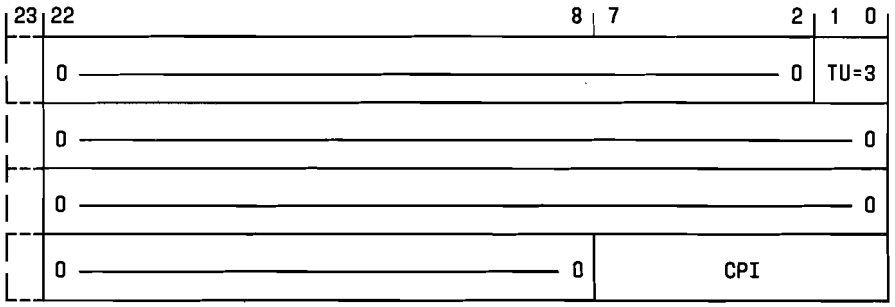
**(i) Outgoing trunk, loop reverse battery, SD-1A373-01 and SD-1A373-02**

Fig. 6—Trunk Class Code Expansion Table Translations for HILO Circuits (Sheet 3 of 7)



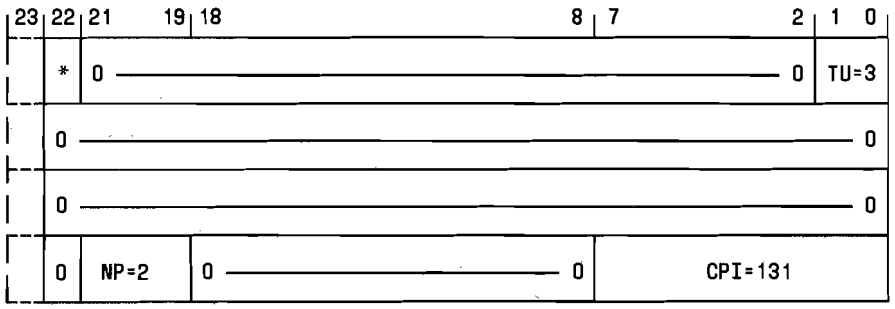

* CONF, † SDSTIM, ‡ SDS, § WDD, ¶ BAT, ** ICT

**(j) Outgoing trunk, loop reverse battery, SD-1A374-01 and SD-1A374-02 (Note 9)**




NOTE: CPI = 128 FOR SD-1A378-01
= 129 FOR SD-1A379-01 AND SD-1A379-02
= 130 FOR SD-1A380-01
= 132 FOR SD-1A382-01
= 135 FDR SD-1A385-01
= 140 FOR SD-1A390-01
= 147 FOR SD-1A397-01 AND SD-1A397-02
= 157 FOR SD-1A173-01/SD-1A390-01

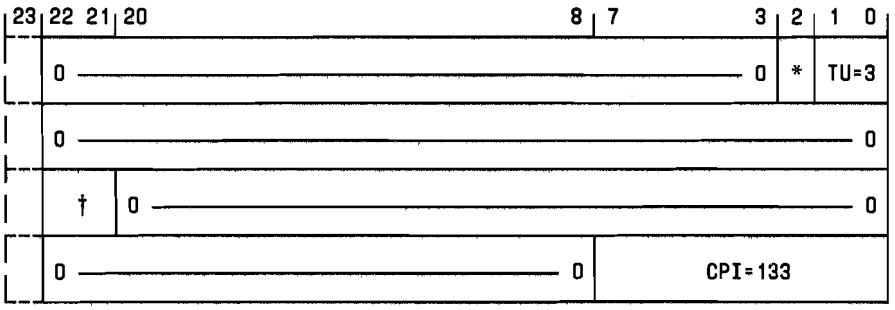
**(k) Dial pulse transmitter (SD-1A378-01), MF receiver (SD-1A379-01 or SD-1A379-02), MF transmitter (SD-1A380-01), tone presence detector (SD-1A382-01), TOUCH-TONE service detector test line circuit (SD-1A385-01), trunk dial pulse receiver circuit (SD-1A389-01), trunk test access circuit (SD-1A387-01), and TOUCH-TONE service trunk/dial pulse receiver combination (SD-1A173-01/SD-1A390-01)**




* MPT

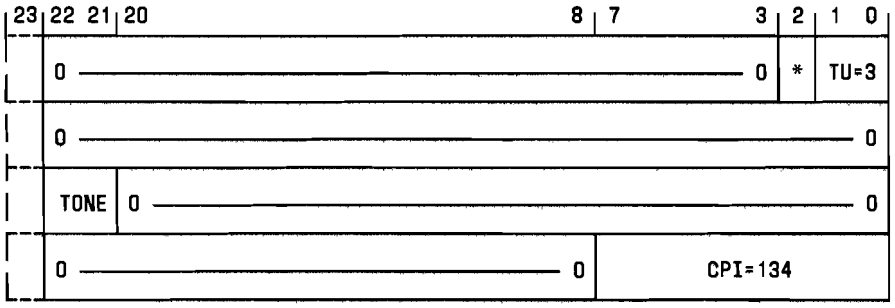
**(l) MF environmental test circuit (SD-1A381-01)**

**Fig. 6—Trunk Class Code Expansion Table Translations for HILO Circuits (Sheet 4 of 7)**




* WORD 3, † TONE

**(m) Tone or recorded announcement circuit (SD-1A383-01 or SD-1A383-02)**




* WORD 3

**(n) Audible ring and recorded announcement circuit (SD-1A384-01)**

NOTES:

1. BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

2. ALL VALUES ARE DECIMAL.

3. WHERE NO VALUES ARE SHOWN. REFER TO LEGEND FOR PERMMISSIBLE VALUES.

4. SD-1A361 AND SD-1A362 CAN BE USED AS INCOMING, OUTGOING, OR 2-WAY TRUNKS. IN ADDITION, SD-1A361, SD-1A362, SD-1A367, AND SD-1A368 CAN PROVIDE BOTH WINK START AND DELAY DIAL. THE FOLLOWING SUPERVISORY INDEXES ARE ASSOCIATED WITH THESE TRUNKS.

| USE | SPI |
|---|---|
| INCOMING WINK OR DIAL TONE | 32 |
| INCOMING DELAY DIAL | 33 |
| 2-WAY WINK OR DELAY DIAL | 34 |
| 2-WAY DELAY DIAL | 35 |
| OUTGOING | 36 |

5. WHERE SD-1A361 IS USED FOR ROTL ACCESS PORT, INTERROGATOR PORT, OR MTTP TEST ACCESS TRUNK, ALL ITEMS ARE ZERO EXCEPT: TRUNK USAGE=3, SUPERVISION=3, IDLE CIRCUIT TERMINATION=1, CONFERENCE RESTRICTED=1, AND CPI=111, THE SPI=0.

6. WHERE SD-1A362 IS USED FOR RDTL TEST PORT, ALL ITEMS ARE ZERO EXCEPT: TRUNK USAGE=1, SUPERVISION=3, IDLE CIRCUIT TERMINATION=1, CONFERENCE RESTRICTED=1, INPULSING=1, START DIAL SIGNAL=2, AND CPI=112. THE SPI=32.

7. WHERE SD-1A367 IS USED FOR MASTER TEST LINE TRUNK; ALL ITEMS ARE ZERO EXCEPT: TRUNK USAGE=1, SUPERVISION=1, IDLE CIRCUIT TERMINATION=1, CONFERENCE RESTRICTED=1, INPULSING=5, START DIAL SIGNAL=4, AND CPI=117. THE SPI=37.

8. THE SPIs FOR INTRAPROCESSOR TRUNK PAIRS ARE AS FOLLOWS:

| 2-WIRE TLN | HILO TLN |
|---|---|
| SD-1A165 SPI=7 | SD-1A367 SPI=41 |
| SD-1A166 SPI=41 | SD-1A373 SPI=36 |
| SD-1A252 SPI=40 | SD-1A361 SPI=40 |

9. THE SPI FOR SD-1A374 IS EQUAL TO 36.

**Fig. 6—Trunk Class Code Expansion Table Translations for HILO Circuits (Sheet 5 of 7)**

LEGEND:

BAT - BATTERY ON THE TIP OR RING. "1" IF BATTERY ON TIP, "0" IF BATTERY ON RING.

CAMA - CENTRALIZED AUTOMATIC MESSAGE ACCOUNTING. "1" IF INDICATED, "0" IF NOT INDICATED.

COFN - CHARGE ON FREE NUMBER. "1" IF INDICATED, "0" IF NOT INDICATED.

COMP - COMPENSATING RESISTANCE. "00" FOR NONE OR NO DIAL PULSE, "01" FOR 300 OHM, "10" FOR 600 OHM OR DIAL PULSE, "11" FOR 900 OHM (CAN BE NON-ZERO FOR SD-1A362-01 AND SD-1A362-02).

CONF - CONFERENCE RESTRICTED. "1" IF INDICATED, "0" IF NOT INDICATED (="1" FOR SD-1A608-02, AND SD-1A609-02; MAY EQUAL ONE OR ZERO FOR SD-1A361-01, SD-1A362-01, SD-1A362-02, SD-1A366-01, SD-1A367-01, SD-1A367-02, SD-1A368-01, SD-1A368-02, SD-1A371-01, SD-1A373-01, SD-1A373-02, SD-1A374-01, AND SD-1A374-02).

CPI - CIRCUIT PROGRAM INDEX.

FA - FAST ANSWER. "1" IF INDICATED, "0" IF NOT INDICATED (="1" FOR SD-1A373-01, SD-1A373-02, SD-1A374-01, SD-1A374-02, SD-1A361-01, SD-1A362-01, AND SD-1A362-02).

HILO - HILO INTRAPROCESSOR. "1" IF INDICATED, "0" IF NOT INDICATED (MAY EQUAL ONE OR ZERO FOR SD-1A361-01, SD-1A367-01, SD-1A367-02, SD-1A373-01, AND SD-1A373-02).

ICT - IDLE CIRCUIT TERMINAL. "1" IF INDICATED, "0" IF NOT INDICATED [="1" FOR SD-1A361-01, SD-1A362-01, SD-1A362-02 (TOC 11202), SD-1A608-02, SD-1A366-01, SD-1A367-01, SD-1A367-02, SD-1A368-01, SD-1A368-02, SD-1A609-02, SD-1A371-01, SD-1A373-01, SD-1A373-02, AND SD-1A374-01; MAY EQUAL ONE OR ZERO FOR SD-1A362-02 (TOC 11203)].

INPUL - IMPULSING. ="000" FOR NONE, ="001" FOR MULTIFREQUENCY, ="010" FOR DIAL PULSE, ="011" FOR REVERTIVE PULSE, AND ="101" FOR "TOUCH-TONE" SERVICE PULSING OR DIAL PULSE [="010" FOR SD-1A366-01,SD-1A608-02, SD-1A371-01, AND SD-1A609-02; CAN BE NON-ZERO ("000") FOR SD-1A361-01, SD-1A362-01, SD-1A362-02, SD-1A367-01, SD-1A367-02, SD-1A368-01, AND SD-1A368-02].

NP - NUMBER OF PORTS.

OP - OUTPULSING. ="000" FOR NONE, ="001" FOR MULTIFREQUENCY, TRAFFIC SERVICE POSITION, OR TRAFFIC SERVICE POSITION SYSTEM, ="010" FOR DIAL PULSE, ="011" FOR REVERTIVE PULSE, AND ="101" FOR "TOUCH-TONE" SERVICE PULSING (CAN BE NON-ZERO FOR SD-1A361-01, SD-1A362-01, SD-1A362-02, SD-1A373-01, SD-1A373-02, SD-1A374-01, AND SD-1A374-02).

OT - OPERATOR TRUNK. ="1" IF APPLICABLE, ="0" IF NOT APPLICABLE (MAY EQUAL ONE OR ZERO FOR SD-1A361-01, SD-1A362-01, SD-1A362-02, SD-1A368-01, SD-1A368-02, SD-1A373-01, SD-1A373-02, SD-1A374-01, AND SD-1A374-02).

PAD - 2DB SWITCHABLE PAD = 2 FOR MESSAGE TRUNK.

PNT - PRIVATE NETWORK TRUNK (CCSA OR EPSCS). ="1" IF INDICATED, ="0" IF NOT INDICATED (MAY EQUAL ONE OR ZERO FOR SD-1A362-01 AND SD-1A362-02).

SDS (FIRST WORD) - START DIAL SIGNAL ON OUTGOING TRUNK. ="1" IF INDICATED, ="0" IF NOT INDICATED (="1" FOR SD-1A361-01, SD-1A362-01, AND SD-1A362-02; MAY EQUAL ONE OR ZERO FOR SD-1A373-01, SD-1A373-02, SD-1A374-01, SD-1A374-02).

SDS (SECOND WORD) - START DIAL SIGNAL, ="00" FOR NONE, ="01" FOR DELAY DIAL, ="10" FOR WINK, ="11" FOR DIAL DIAL TONE (CAN BE NON-ZERO FOR SD-1A361-01, SD-1A362-01, SD-1A362-02, SD-1A367-01, SD-1A367-02, SD-1A368-01, SD-1A368-02, SD-1A373-01, SD-1A373-02, SD-1A374-01, AND SD-1A374-02).

Fig. 6—Trunk Class Code Expansion Table Translations for HILO Circuits (Sheet 6 of 7)

SDSTIM - START DIAL SIGNAL TIMING. ="1" FOR INTERTOLL AND OUTGOING DDD ACCESS TRUNKS, ="0" FOR OTHERWISE (="1" FOR SD-1A361-01, SD-1A362-01, AND SD-1A362-02; MAY EQUAL ONE OR ZERO FOR SD-1A373-01, SD-1A373-02, SD-1A374-01, AND SD-1A374-02).

SG - (SG/FHP) - STOP-GO FINAL HEAVY POSITIVE PULSE. ="1" IF INDICATED, ="0" IF NOT INDICATED (MAY EQUAL ONE OR ZERO FOR SD-1A361-01, SD-1A362-01, SD-1A362-02, SD-1A373-01, SD-1A373-02, SD-1A374-01, AND SD-1A374-02).

SXS - STEP BY STEP INCOMING TRUNK. WITH 1E6 AND LATER GENERIC PROGRAMS, THIS BIT MUST BE SET TO "1" TO IDENTIFY INCOMING SXS TRUNKS.

SUPV - SUPERVISION. = "0001" FOR REVERSE BATTERY, ="0011" FOR E&M OR F TYPE SIGNALING.

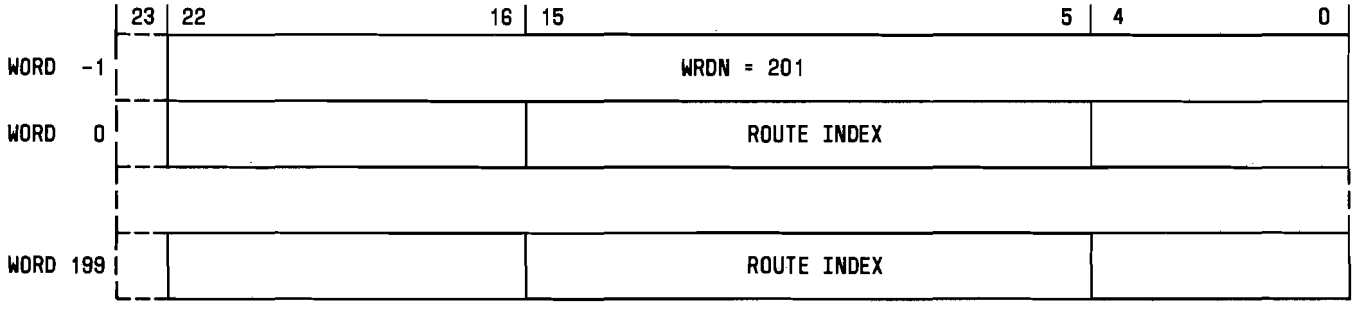
TONE - TONE. ="00" FOR NONE, ="01" FOR STEADY, ="10" FOR INTERRUPTED, ="11" FOR ANNOUNCEMENT OR RECEIVER OFF-HOOK (CAN BE NON-ZERO FOR SD-1A383-01 AND SD-1A383-02; ="11" FOR SD-1A384-01).

TU - TRUNK USAGE. ="00" FOR OUTGOING, ="01" FOR INCOMING OR SERVICE LINK NETWORK, ="10" FOR TWO-WAY, ="11" FOR MISCELLANEOUS (NOTE 3).

WDD - WINK START DIAL VERSUS DELAY DIAL. ="1" FOR WINK START DIAL, ="0" FOR DELAY DIAL (CANNOT EQUAL "1" UNLESS THE SDS ITEM IN FIRST WORD EQUALS "1").

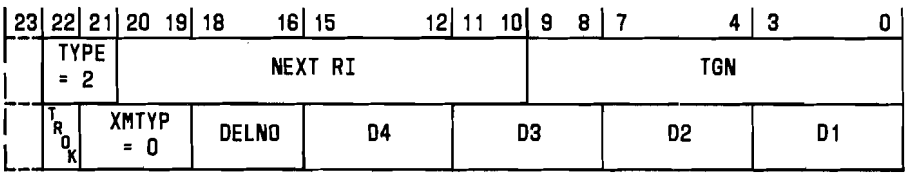
WORD 3 - WORD 3 (WD3). ="1" IF INDICATED, ="0" IF NOT INDICATED.

**Fig. 6—Trunk Class Code Expansion Table Translations for HILO Circuits (Sheet 7 of 7)**

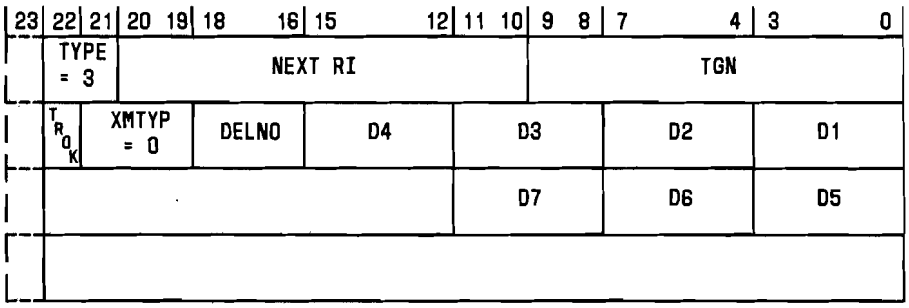



NOTE: BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

**Fig. 7—Pseudo Route Index Translator Trunk Groups**




(a) Up to 4 prefixed digits




(b) 5 to 7 prefixed digits

NOTE: BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

LEGEND:
DELNO - NUMBER OF DIGITS DELETED
RI - ROUTE INDEX
TGN - TRUNK GROUP NUMBER
TROK - TRANSFER OK, IF = 1
XMTYP - TRANSMITTER TYPE = 0
INDICATES CONTINUITY
AND POLARITY TEST

Fig. 8—HILO Route Index Expansion Tables for HILO Intraprocessor

| 23 | 22 — 18 | 17 — 14 | 13 — 0 |
|---|---|---|---|
| | WRDN = 1 | QTY = 4 | CPDN [EN00(0)] |

(a) Universal trunk scanner (unit type 19) member number n

| 23 | 22 — 18 | 17 16 | 15 14 | 13 — 0 |
|---|---|---|---|---|
| | WRDN = 3 | QTY = 4 | | CPDN [ED00(2)] |
| | QTY = 6 | | | MSN - DIRECTED [FO(0)] |
| | QTY = 2 | | | MSN - SUPERVISORY (SC00) |

(a) Member number n

| 23 | 22 — 18 | 17 16 | 15 14 | 13 — 0 |
|---|---|---|---|---|
| | WRDN = 3 | QTY = 4 | | CPDN [ED00(1)] |
| | QTY = 6 | | | MSN - DIRECTED [FO(1)] |
| | QTY = 2 | | | MSN - SUPERVISORY (SC00) |

(b) Member number n + 1

(b) Universal trunk signal distributor (unit type 20)

NOTE: BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

LEGEND:
CPDN - CENTRAL PULSE DISTRIBUTOR NUMBER
MSN - MASTER SCANNER NUMBER
QTY - QUANTITY
WRDN - WORD NUMBER

Fig. 9—HILO Universal Trunk Frame Unit Type Auxiliary Blocks

| 23 | 22 — 18 | 17 16 | 15 14 | 13 — 0 |
|---|---|---|---|---|
| | WRDN = 3 | QUAN = 4 | | CPDN [ENOO(0)] |
| | QUAN = 6 | | | MSN - DIRECTED (FO) |
| | QUAN = 1 | | | MSN - SUPERVISORY (SCOO) |

(a) Unit type 5, master scanner member number n.

| 23 | 22 — 18 | 17 16 | 15 14 | 13 — 0 |
|---|---|---|---|---|
| | WRDN = 3 | QUAN = 4 | | CPDN [ENOO(1)] |
| | QUAN = 6 | | | MSN - DIRECTED [FO(0)] |
| | QUAN = 2 | | | MSN - SUPERVISORY (SCOO) |

(b) Unit type 21, member number y (optional)

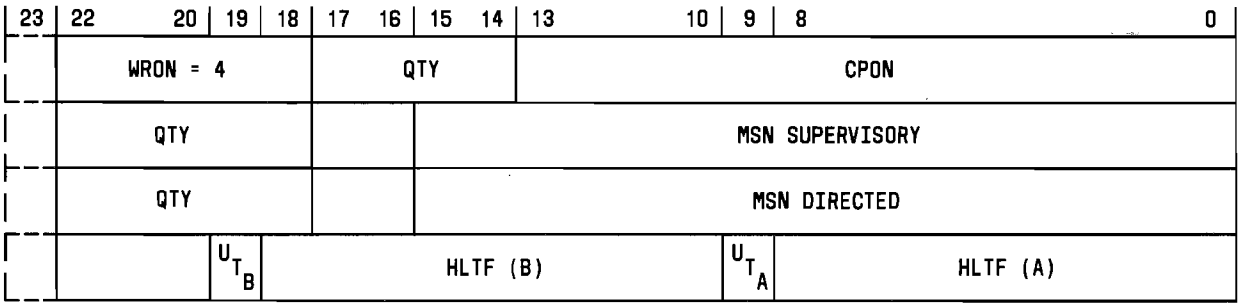
| 23 | 22 — 18 | 17 16 | 15 14 | 13 — 0 |
|---|---|---|---|---|
| | WRDN = 3 | QUAN = 4 | | CPDN [ENOO(2)] |
| | QUAN = 6 | | | MSN - DIRECTED [FO(1)] |
| | QUAN = 2 | | | MSN - SUPERVISORY (SCOO) |

(c) Unit type 21, member number z (optional)

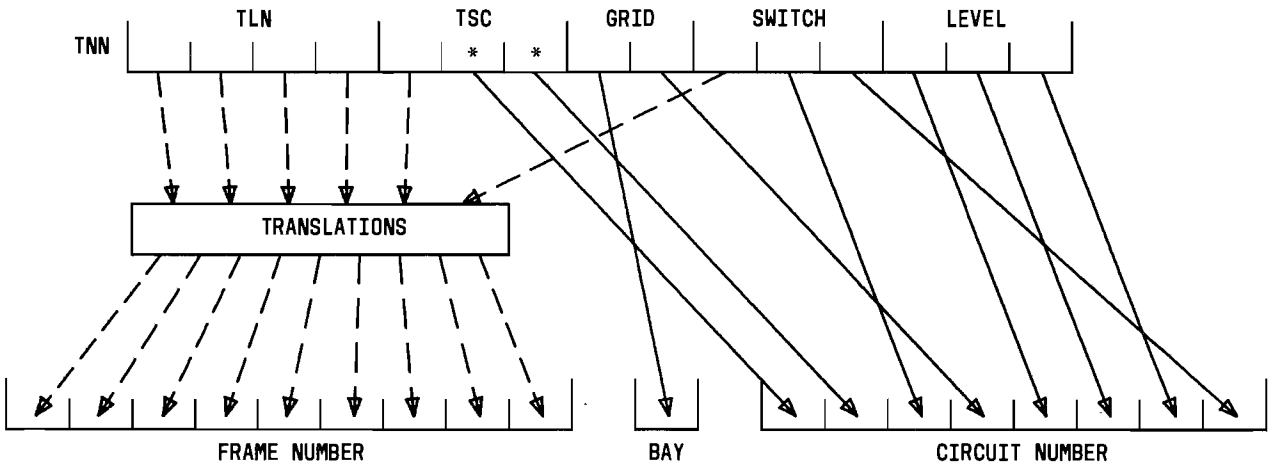
NOTE: BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

LEGEND:
CPDN - CENTRAL PULSE DISTRIBUTOR NUMBER
MSN - MASTER SCANNER NUMBER

Fig. 10—HILO Step-by-Step Miscellaneous Trunk Frame Unit Type Auxiliary Blocks




(a) Trunk switch circuit auxiliary block (unit type 16)



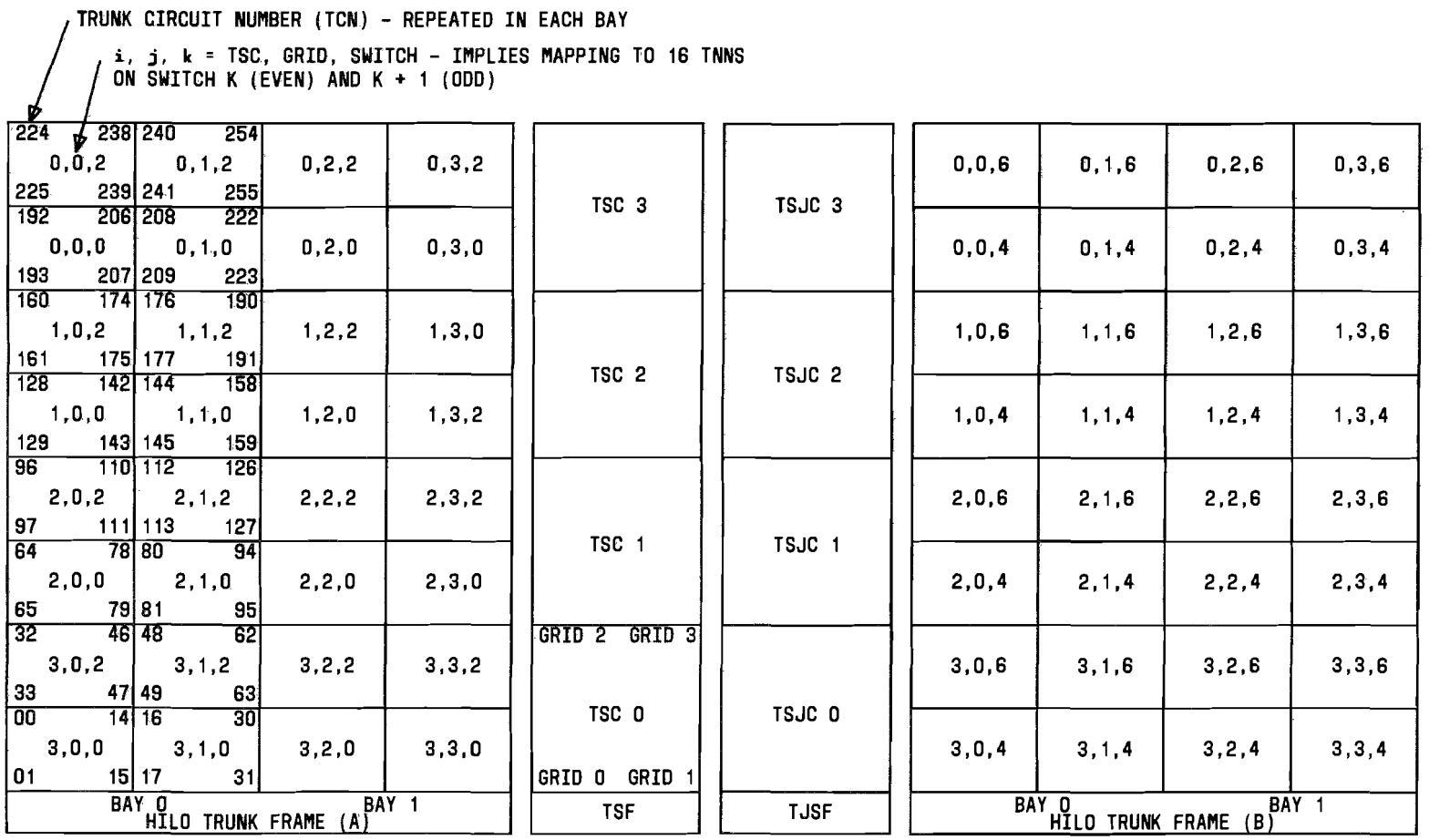

(b) TNN to physical location mapping

NOTE: BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

* THESE TSC BITS ARE COMPLEMENTED DURING MAPPING.

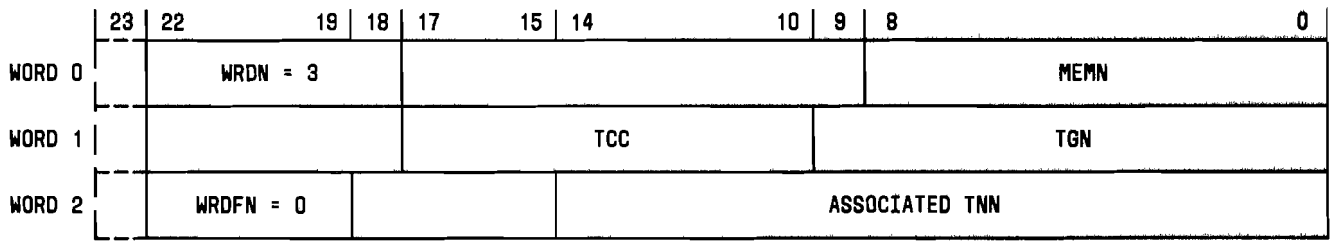
LEGEND:
CPDN - CENTRAL PULSE DISTRIBUTOR NUMBER
HLTF - HILO TRUNK FRAME NUMBER, (A) - ASSOCIATED WITH SWITCHES 0-3, (B) ASSOCIATED WITH SWITCHES 4-7
TLN - TRUNK LINK NETWORK
TSC - TRUNK SWITCHING CIRCUIT
UTA, UTB - UNIVERSAL TRUNK INDICATOR = 1 (UTA IS ALWAYS 1)

Fig. 11—TSC Auxiliary Block and Physical Location Mapping




NOTE:
A 2048 TRUNK NETWORK FOLLDWS THE SAME GENERAL PATTERN. HILO TRUNK FRAMES C AND D (NDT SHOWN) ARE ASSIGNED TO TNNS IN TSC 4-7

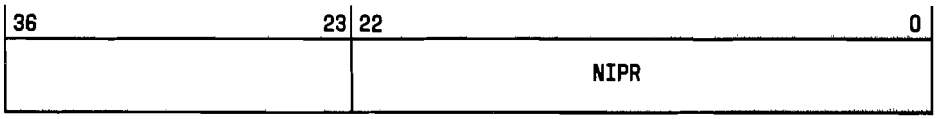
Fig. 12—Assignment of Physical Locations to Trunk Network (1024)



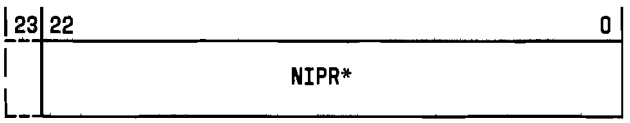

NOTE: BIT 23 EXISTS IN NO. 1A "ESS" SWITCH ONLY.

LEGEND:
MEMN - MEMBER NUMBER FOR 2-WAY TRUNKS, OTHERWISE ZEROS
TCC - TRUNK CLASS CODE
TGN - TRUNK GROUP NUMBER
ASSOCIATED TNN - TRUNK NETWORK NUMBER OF ASSOCIATED INTRAPROCESSOR TRUNK
WRDFN = 0 IMPLIES WORD 2 IS USED FOR MISCELLANEOUS ADDITIONAL INFORMATION RATHER THAN THE START OF TRUNK MAKE BUSY/CARRIER GROUP ALARM WORDS WHICH HAVE THESE BITS NON-ZERO. THE INTRAPROCESSOR TRUNK ITEM IN THE TRUNK CLASS CODE EXPANSION INDICATES THE PARTICULAR USAGE OF THIS WORD.

Fig. 13—TNN-TGN Auxiliary Block for HILO Intraprocessor TNN




(a) NO. 1 "ESS" SWITCH (program store)




(b) NO. 1A "ESS" SWITCH (unduplicated call store, file store)

* NIPR - NUMBER OF INTRAPROCESSOR INCOMING REGISTERS

Fig. 14—Parameter Word Y3IPR

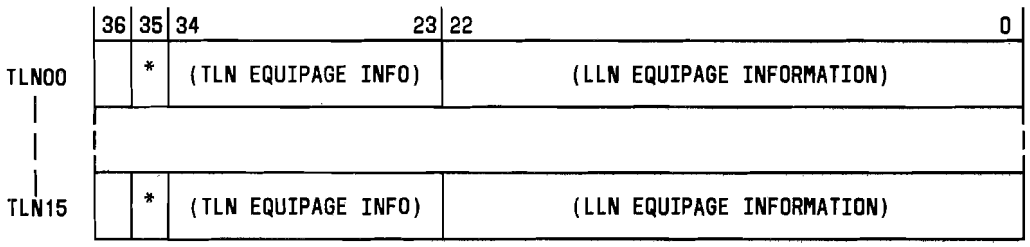
| | 36 — 23 | 22 — 20 | 19 — 0 |
|---|---|---|---|
| JOBT +40 | | 5 | 4FPRI002 (IF SET CARD MFR4 = 1) |
| +41 | | 5 | 4FPRI003 (IF SET CARD DPR4 = 1) |
| +42 | | 5 | 4FPRI004 (IF SET CARD TTDPR4 = 1) |
| +43 | | 5 | 4FPRI015 (IF SET CARD MFT4 = 1) |
| +44 | | 5 | 4FPRI016 (IF SET CARD DPT4 = 1) |

(a) NO. 1 "ESS" SWITCH (program store)

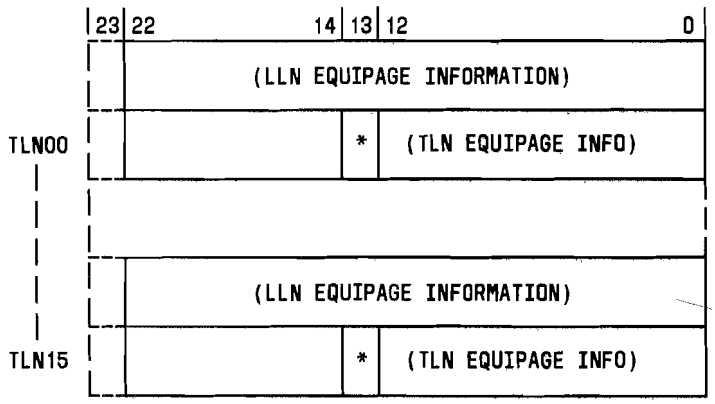
| | 23 | 22 — 20 | 19 — 0 |
|---|---|---|---|
| JOBT +80 | | 5 | 4FPRI002 (IF SET CARD MFR4 = 1) |
| 81 | | | |
| 82 | | 5 | 4FPRI003 (IF SET CARD DPR4 = 1) |
| 83 | | | |
| 84 | | 5 | 4FPRI004 (IF SET CARD TTDPR4 = 1) |
| 85 | | | |
| 86 | | 5 | 4FPRI015 (IF SET CARD MFT4 = 1) |
| 87 | | | |
| 88 | | 5 | 4FPRI016 (IF SET CARD DPT4 = 1) |
| 89 | | | |

(b) NO. 1A "ESS" SWITCH (unduplicated call store, file store)

Fig. 15—Portion of Data Validation Parameter Table (JOBT) for HILO Service Circuits



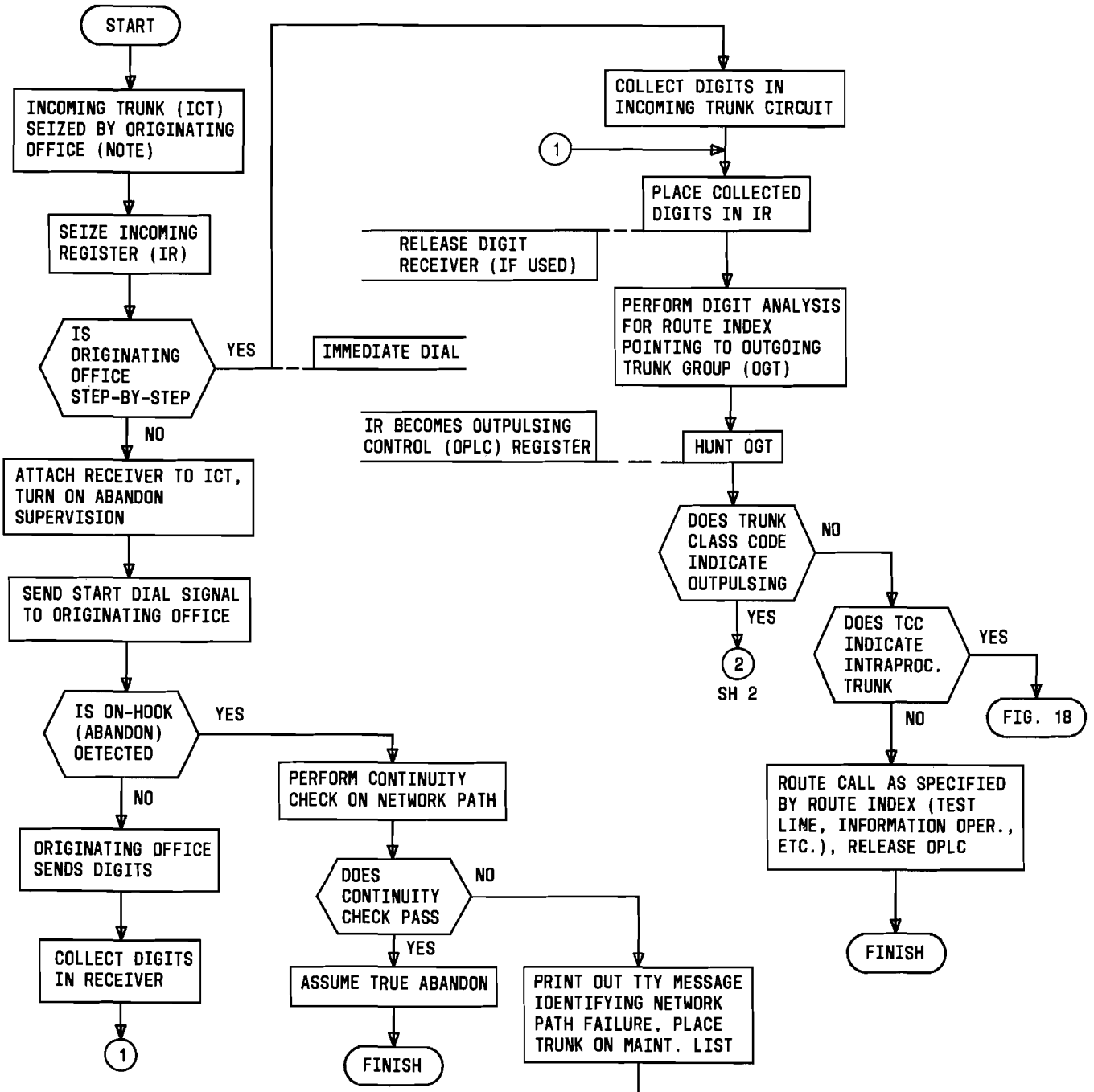

(a) NO. 1 "ESS" SWITCH (program store)




(b) NO. 1A "ESS" SWITCH (unduplicated call store, file store)

* HLTN = 1 IF TLNii CARRIES HILO TRAFFIC

Fig. 16—Network Equipage Table N4LNE




NOTE:
ORIGINATING OFFICE IS THE OFFICE THAT CALL IS COMING FROM INTO HILO OFFICE. TERMINATING OFFICE IS THE OFFICE THAT CALL IS SENT TO FROM THE HILO OFFICE. CALL DOES NOT NECESSARILY ACTUALLY ORIGINATE OR TERMINATE IN THESE OFFICES.

Fig. 17—HILO Feature Flow Diagram—Toll-Only Call (Sheet 1 of 2)

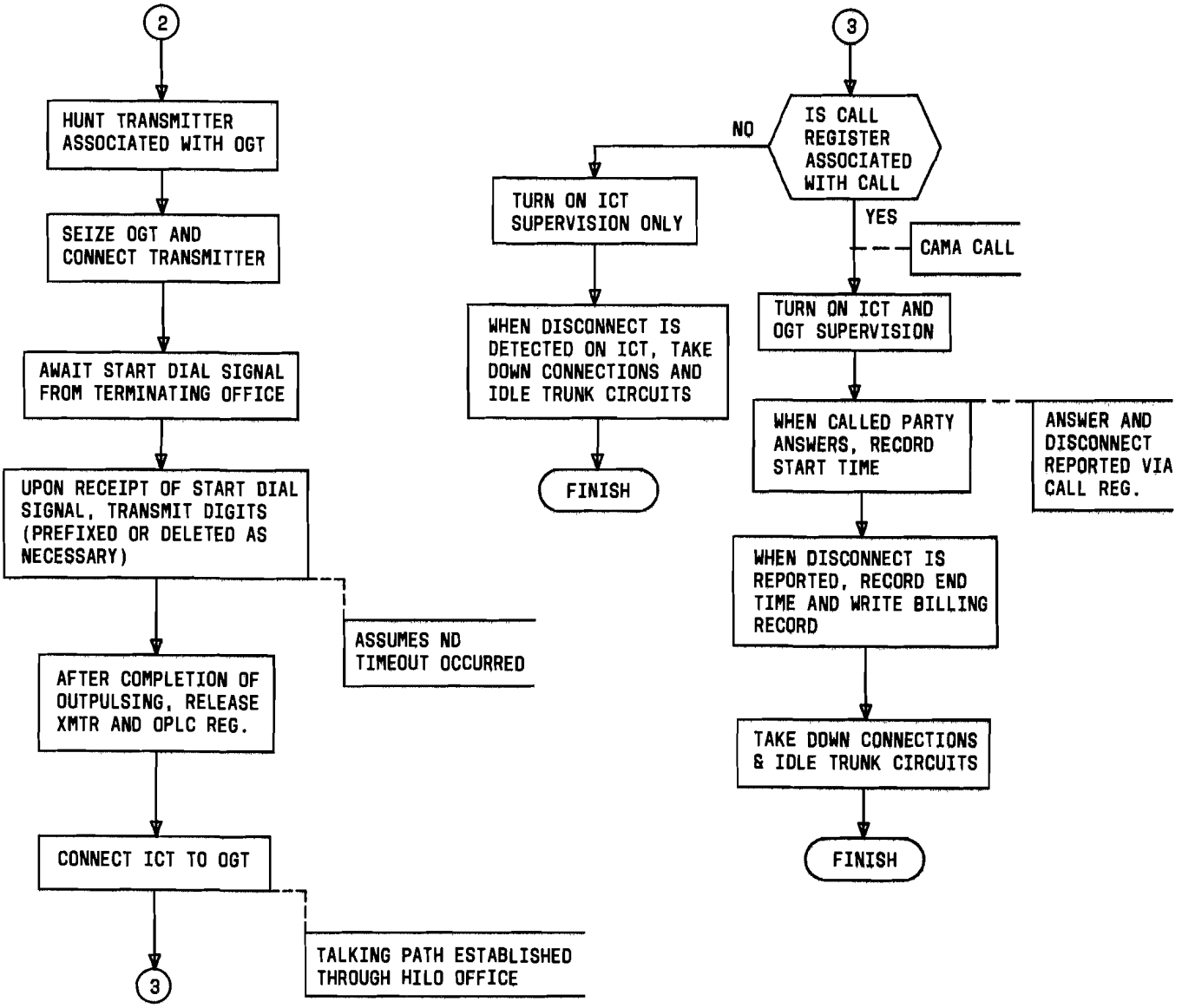



Fig. 17—HILO Feature Flow Diagram—Toll-Only Call (Sheet 2 of 2)

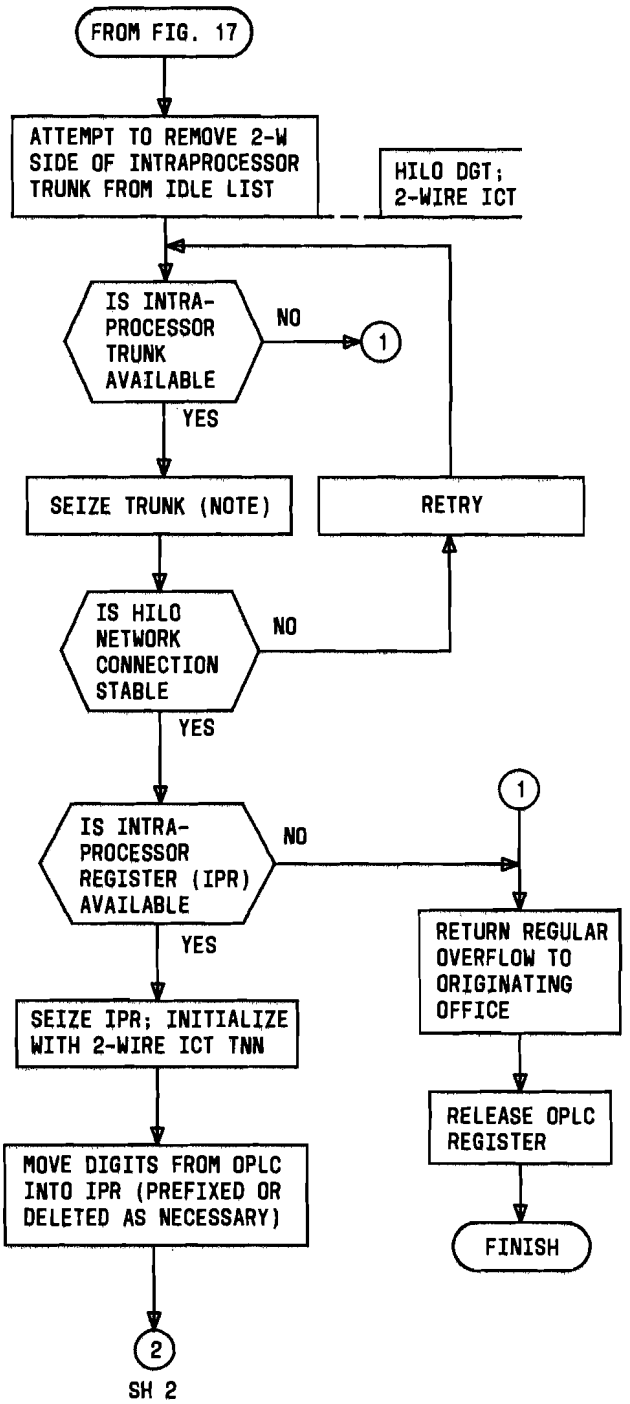
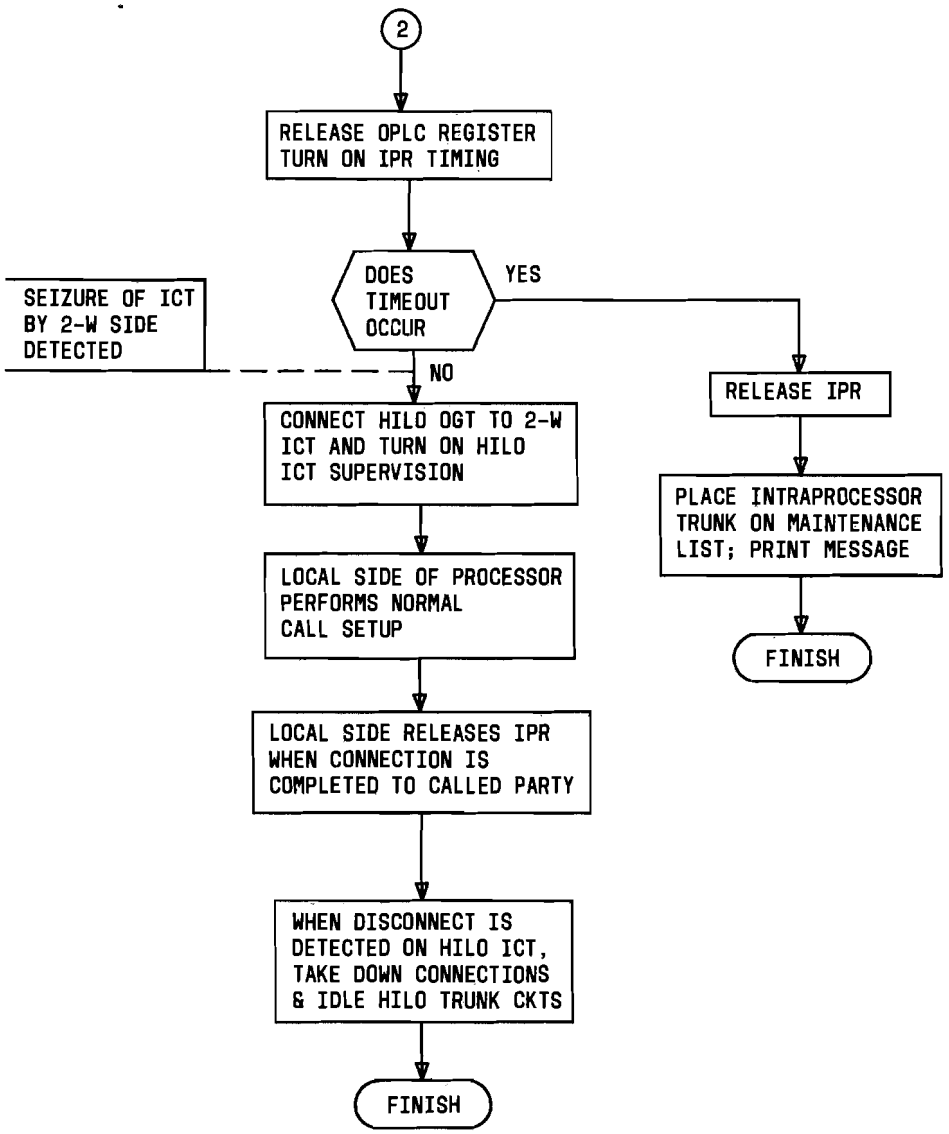



**Fig. 18—HILO Feature Flow Diagram—Toll/Local (Intra-processor) Call (Sheet 1 of 2)**




NOTE: A TRANSMITTER IS NOT REQUIRED ON THE HILO SIDE, NOR A RECEIVER ON THE THE LOCAL SIDE, SINCE NO PULSING IS PERFORMED. THE DIGITS RECEIVED FROM THE ORIGINATING OFFICE ARE PASSED FROM THE TOLL TO LOCAL SIDE WITHIN THE PROCESSOR.

**Fig. 18—HILO Feature Flow Diagram—Toll/Local (Intra-processor) Call (Sheet 2 of 2)**

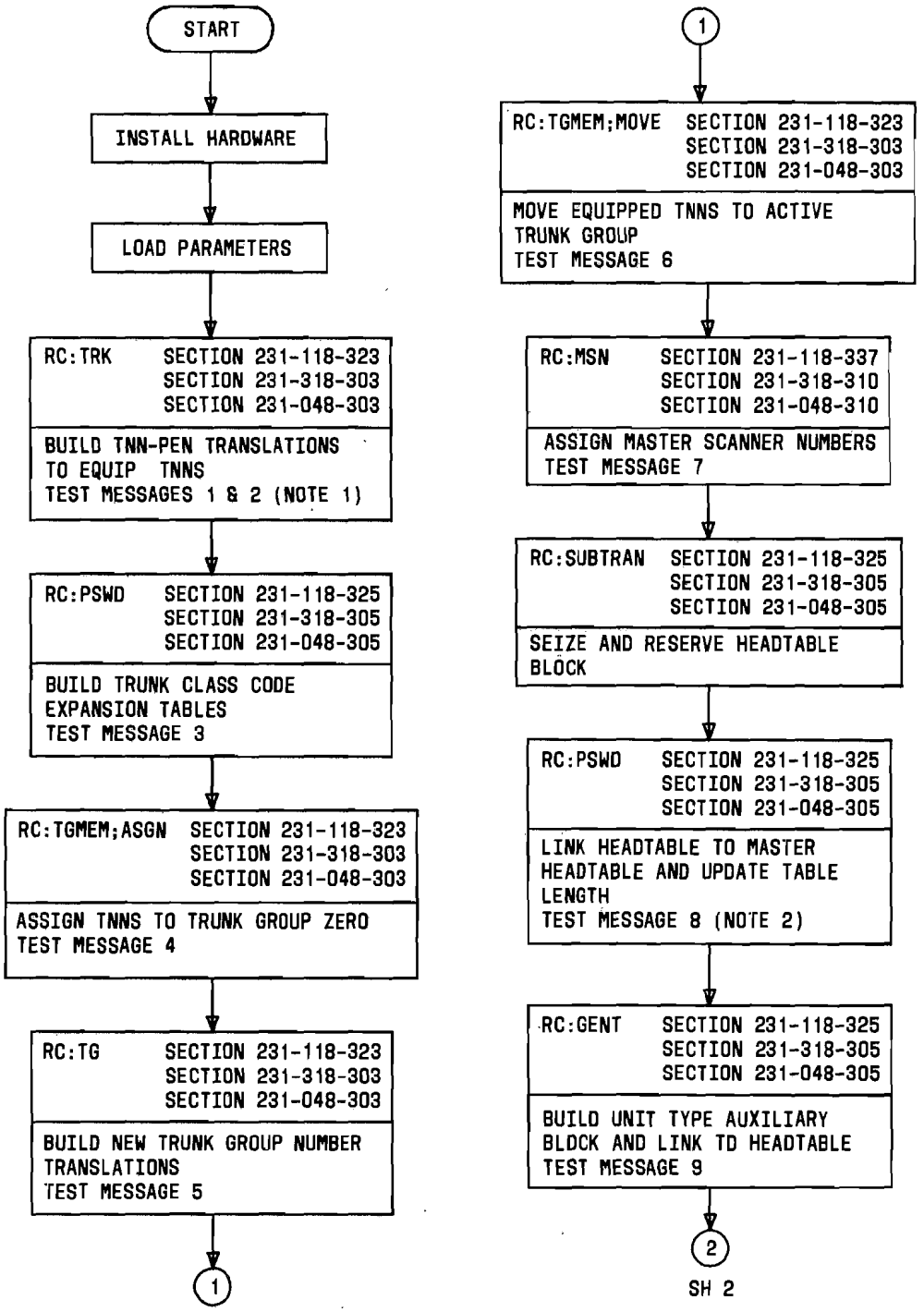
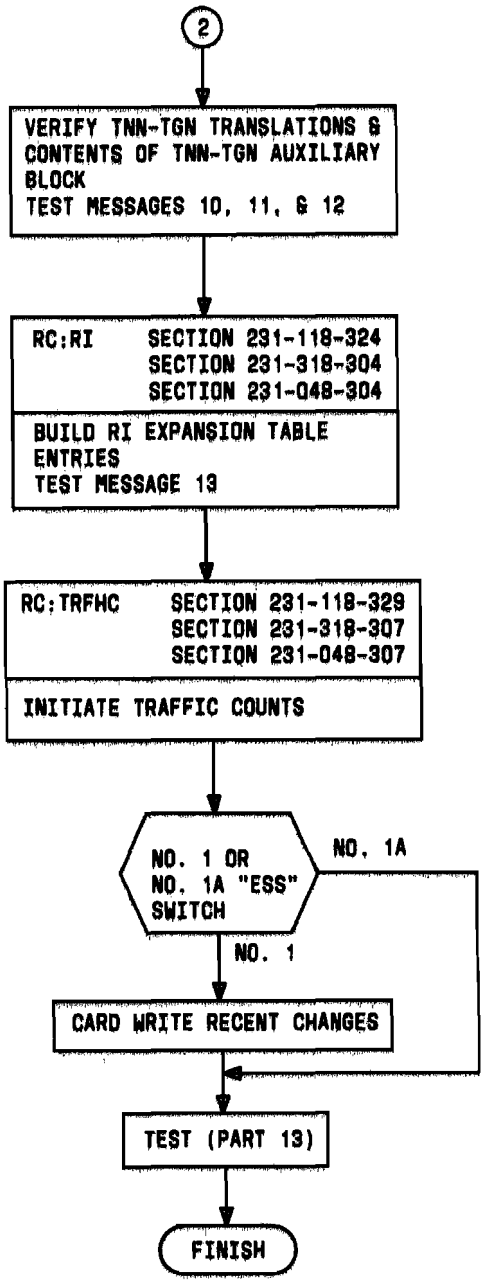



Fig. 19—Procedure for Adding the HILO Feature (Sheet 1 of 2)




NOTES:
1. TEST MESSAGES ARE KEYED TO TABLE M.

2. RC:SUBTRAN AND RC:PSWD INPUTS MUST BE CARD WRITTEN BEFORE PROCEEDING (NO. 1 "ESS" SWITCH ONLY).

**Fig. 19—Procedure for Adding the HILO Feature (Sheet 2 of 2)**

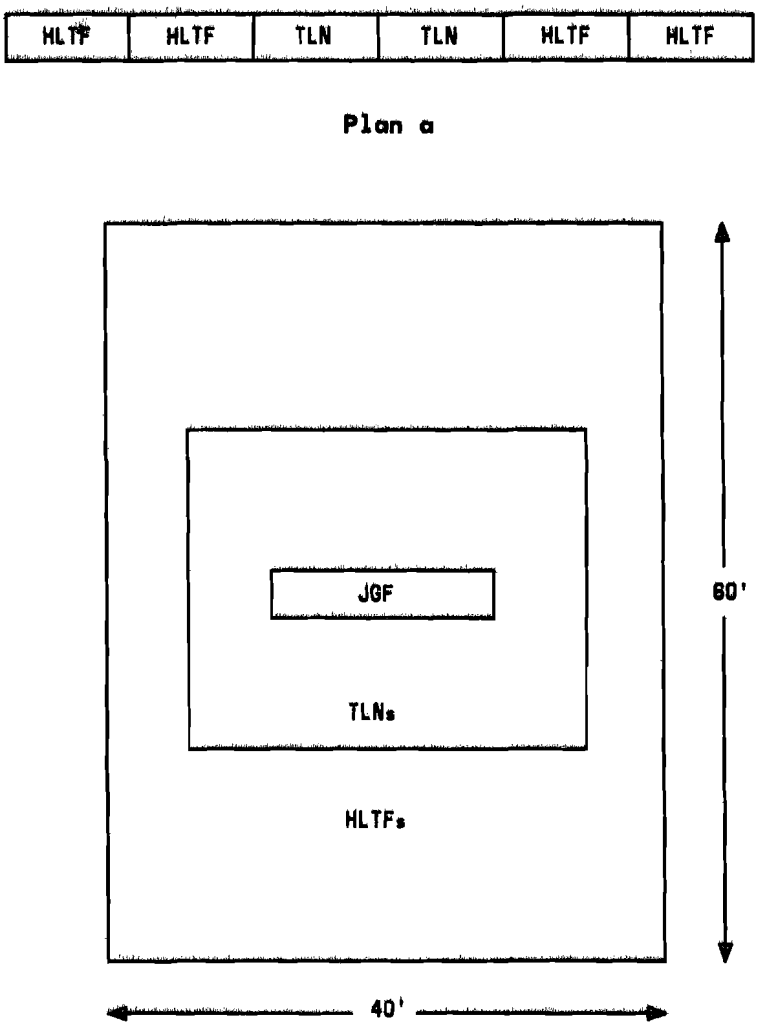



**Fig. 20—Possible Equipment Arrangements for HILO Trunk Frames and Associated TLNs**

▶TABLE A◀

## SCAN, SIGNAL DISTRIBUTOR, AND CENTRAL PULSE DISTRIBUTOR POINTS FOR MAJOR HILO HARDWARE ITEMS

| HARDWARE ITEM | J NUMBER | SD NUMBER | SCAN POINTS | SD POINTS | CPD POINTS |
|---|---|---|---|---|---|
| Manual trunk test frame | J1A042F | 1A418 | 41 | 42 | 8* |
| Auxiliary manual test frame | J1A042G | 1A435 | 2 | 0 | 0 |
| Remote office test line applique | J1A076A | 1A433 | 9 | 12 | 0 |
| Processor-controlled interrogator | — | 1C478 | 23 | 13 | 0 |
| HILO universal trunk frame | J1A090A | 1A376 | 14 | 0 | 12 |
| HILO step-by-step trunk frame | J1A091A | 1A377 | | | |
| With no SSD † | | Option Z | 8 | 0 | 4 |
| With 1 SSD † | | Option Y | 14 | 0 | 8 |
| With 2 SSD † | | Option X | 20 | 0 | 12 |

* May require central pulse distributor pulse stretcher circuit SD-1A431-01.
† SSD-supplementary signal distributor.

**TABLE B**

**MESSAGE TRUNK CIRCUITS (FOR HILO 4-WIRE SWITCHING)**

| SD NUMBER | CIRCUIT DESCRIPTION | SUPER VISION | FACIL-ITY | TRUNK ORDER CODE(S) | J-SPEC NUMBER | TRUNK FRAME | POINTS/CKT | | RATING | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | SCAN | SD | | |
| 1A361-01/ 1A361-02 | 2-Way Trunk | E&M or CCIS | 2-Wire | 11102/ 11103 | 1A090BA | H(U) | 2 | 3 | STD | 1,2,3,4,5 |
| 1A362-01/ 1A362-02 | 2-Way Trunk | E&M or CCIS | 4-Wire | 11202 11203 | 1A090BB | H(U) | 2 | 3 | STD | 1,2,3,4,5, 8,9 |
| 1A364-01/ 1A364-02 | Direct Access Trunk | E&M | 4-Wire | 11401 | 1A090BM | H(U) | 2 | 2 | STD | 1,2,5,9 |
| 1A366-01/ 1A608-02 | Incoming Step-by-Step | E&M | 4-Wire | 11600/ 18200 | 1A091BB | H(M) | 2 | 3 | A&M STD | 1,2,4,5 |
| 1A367-01/ 1A367-02 | Incoming Loop | RB or CCIS | 2-Wire | 11701 | 1A090BC | H(U) | 2 | 3 | MD/ STD | 1,2,4,6,9 |
| 1A368-01/ 1A368-02 | Incoming Loop | RB or CCIS | 4-Wire | 11801 | 1A090BD | H(U) | 2 | 3 | STD | 1,2,4,6,9 |
| 1A371-01/ 1A609-02 | Incoming Step-by-Step | RB | 2-Wire | 12100/ 18400 | 1A091BC | H(M) | 2 | 3 | A&M STD | 1,2,4,6, |
| 1A373-01/ 1A373-02 | Outgoing Trunk | RB or CCIS | 2-Wire | 12301 | 1A090BE | H(U) | 2 | 3 | STD | 1,2,6,9 |
| 1A374-01/ 1A374-02 | Outgoing Trunk | RB or CCIS | 4-Wire | 12400/ 12401 | 1A090BF | H(U) | 2 | 3 | STD | 1,2,6,9 |
| 1A393-01 | Outgoing Auxiliary Combined Operator-Office Trunk | E&M | 4-Wire | 14300 | 1A033BM | M | 4 | 3 | PROV | 1,2,5,7 |
| 1A396-01/ 1A396-02 | Long Haul FX Trunk | GS | 4-Wire | 14601 | 1A090BJ | H(U) | 2 | 3 | STD | 1,2,6,9 |

See notes at end of table.

TABLE B (Contd)

MESSAGE TRUNK CIRCUITS (FOR HILO 4-WIRE SWITCHING)

| SD NUMBER | CIRCUIT DESCRIPTION | SUPER VISION | FACIL-ITY | TRUNK ORDER CODE(S) | J-SPEC NUMBER | TRUNK FRAME | POINTS/CKT | | RATING | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | SCAN | SD | | |
| 1A484-01 | HILO CAMA Operator Trunk (HICOP) to Remote TSPS | E&M | 4-Wire | 19700 | 1A033BP | M | 4 | 9 | PROV | 1,2,5,7 |

***Note 1:*** All of the circuits except for SD-1A393-01 and SD-1A484-01 are plug-in. SD-1A393-01 and SD-1A484-01 require two 2-inch mounting plates per unit.

***Note 2:*** All of the circuits except for SD-1A393-01 and SD-1A484-01 have one TLN appearance. SD-1A393-01 does not have a TLN appearance, while SD-1A484-01 has two TLN appearances.

***Note 3:*** Two-way circuits may be used one-way, in or out.

***Note 4:*** All incoming and 2-way trunks can be used as incoming CAMA trunks.

***Note 5:*** All E&M trunk circuits are type II E&M signaling only.

***Note 6:*** Supervision — RB = reverse battery; GS = ground start.

***Note 7:*** SD-1A393-01 and SD-1A484-01 require a SD-1A392 interface circuit.

***Note 8:*** SD-1A362 order codes uses are:
11200/11202 — without controlled echo suppressors.
11201/11203 — with controlled echo suppressors.

***Note 9:*** The -02 trunk circuits can be mixed in the same trunk group as the corresponding -01 trunk circuits.

TABLE C

INTRAPROCESSOR TRUNK CIRCUITS

| 2-WIRE TLN | HILO 4-WIRE TLN | USE |
|---|---|---|
| SD-1A165* | SD-1A367 | One-way local-to-toll |
| SD-1A166 | SD-1A373 | One-way toll-to-local |
| SD-1A252 | SD-1A361 | 2-way |

* Toll grade trunks SD-1A165 (TOC 00205) and local/tandem grade SD-1A165 trunks (TOC 00200) may be put in the same trunk group if the trunk group is local/tandem. The mixing of these trunk order codes (TOCs) are not allowed in a toll trunk group.

## TABLE D

## HILO TONES AND ANNOUNCEMENTS

| TITLE | FUNCTION |
|---|---|
| Regular overflow | Calls blocked because of trunk, transmitter, and announcement overflow, equipment overloads, or network blockages. |
| Common overflow | Calls overflowing busy or audible ring tones. |
| Audible ring | Given to incoming code 101 test line calls and call queueing for CAMA operator. |
| Busy tone | Given to incoming 10X test line calls that overflow the available test lines. |
| Steady low tone | Used by trunk diagnostic programs. (Quantity should equal number of diagnostic scratch pads.) |
| Vacant code announcement (VCA) | For vacant NPA or NPA-NXX codes. |
| No circuit announcement | For calls blocked by network management controls or due to normal traffic conditions (all trunks or transmitters busy, signaling errors, or transmitter time-outs). Network management and regular groups are available. |
| Emergency announcement (EA1, EA2) | For use by network management. |
| Reorder announcement (ROA) | Given for calls encountering network blockage. If not provided, calls are routed to regular overflow. |
| CAMA access dialed in error | Used to block calls that should not be using CAMA trunks. |

## TABLE E

## HILO TEST LINES

| TEST LINE | FUNCTION | CIRCUIT | | TESTS AT | HILO CONNECTING CIRCUIT(S) REQUIRED |
|---|---|---|---|---|---|
| | | SD NUMBER | TITLE | | |
| 100 | One-way transmission loss and noise measurements | 1A386 | Combined 100/102 test line circuit | TP0/TP2 | SD-1A392 |
| 101 | Test-position interface (MTTP) | 1A367 | Incoming wink | TP0 | None |
| 102 | One-way transmission loss measurements | 1A386 | Combined 100/102 test line circuit | TP0/TP2 | SD-1A392 |
| 103 | Tests supervisory and signaling capabilities of intertoll trunks (rering) | 1A391 | Operation test termination circuit | TP0 | SD-1A392 |
| Synchro-nous | Tests supervisory features of toll connecting trunks | 1A391 | Operational test termination circuit | TP0 | SD-1A392 |
| 104 | 2-way transmission loss and one-way noise measurements | 95698, FS3 | 104 test line circuit | TP0/TP2 | SD-1A392, SD-1A388 |
| 105 | 2-way transmission loss and noise measurements | 96601, FS27 | 105 test line circuit | TP0/TP2 | SD-1A392, SD-1A388 |
| 108 | Echo suppressor tests | 1A389 | Type 108 test line circuit | * | SD-1A392 |

*Not applicable; varies with connecting office.

## TABLE F

## HILO CIRCUITS AND RELATED FEATURE DOCUMENTS

| CIRCUIT | FEATURE DOCUMENT |
|---|---|
| SD-1A364 | 231-190-133 |
| SD-1A369 | 231-190-134 |
| SD-1A386 | 231-090-098/ 231-090-101 |
| SD-1A388 | 231-090-342/ 231-090-099 |
| SD-1A389 | 231-090-404 |
| SD-1A391 | 231-090-094/ 231-090-103 |
| SD-1A393 | 231-090-294 |
| SD-1A394 SD-1A395 SD-1A484 | 231-090-278 |
| SD-1A375 SD-1A396 | 231-190-127 |
| SD-1A399 | 231-190-128 |
| SD-1A453 SD-1A454 | 231-090-416 |
| SD-1A483 | 231-190-140 |

## TABLE G

### HILO PSEUDO ROUTE INDEXES

| PSEUDO ROUTE INDEX | NEXT RI | EQUIVALENT 2W RI | DESCRIPTION |
|---|---|---|---|
| 002 | Stop | 65 | Receiver (trunk-multifrequency HILO) |
| 003 | Stop | 66 | Receiver (trunk-dial pulse HILO) |
| 004 | Stop | 147 | Receiver (trunk-TOUCH-TONE service dial pulse HILO) |
| 005 | — | 109/97 | Test (code 100/102 test line) |
| 006 | Stop | 114 | Tone (steady low) |
| 007 | — | 174/98 | Test (code 103/synchronous test line) |
| 008 | — | 177 | Test (code 104 test line) |
| 009 | — | 108 | Test (code 105 test line) |
| 010 | — | 178 | Test (code 108 test line) |
| 011 | 23* | 184 | Reorder announcement or tone |
| 012 | 23* | 183 | No order announcement or tone |
| 013 | 23* | 180 | Network management-no circuits available |
| 014 | Stop | 56 | Transmitter (HILO 4-wire manual-TGN 0) |
| 015 | Stop | 57 | Transmitter (HILO 4-wire multifrequency) |
| 016 | Stop | 58 | Transmitter (HILO 4-wire dial pulse) |
| 017 | Stop | None | Transmitter (HILO 4-wire reserved) |
| 018 | Stop | None | Transmitter (HILO 4-wire reserved) |
| 019 | Stop | None | Transmitter (HILO 4-wire reserved) |
| 020 | Stop | None | Transmitter (HILO 4-wire reserved) |
| 021 | Stop | None | Transmitter (HILO 4-wire reserved) |
| 022 | Stop | 81 | HILO 4-wire common overflow tone |
| 023 | Stop | 80 | HILO 4-wire regular overflow tone |
| 024 | Stop | 138 | Multifrequency environmental test circuit |
| 025 | Stop | 134 | Tone presence detector |
| 026 | 23* | 181 | Announcement (network management No. 1) |
| 027 | 23* | 182 | Announcement (network management No. 2) |
| 028 | Stop | 136 | TOUCH-TONE service detector test circuit |
| 029 | Stop | 69 | TOUCH-TONE service trunk dial pulse receiver for master trunk test panel |
| 030 | 34* | 40 | Audible (phase 1) |
| 031 | 35* | 41 | Audible (phase 2) |
| 032 | 33* | 42 | Audible (phase 3) |
| 033 | 37* | 43 | Audible (advance-phase 1) |
| 034 | 38* | 44 | Audible (advance-phase 2) |
| 035 | 36* | 45 | Audible (advance-phase 3) |
| 036 | Stop | 46 | Audible (second advance-phase 1) |
| 037 | Stop | 47 | Audible (second advance-phase 2) |
| 038 | Stop | 48 | Audible (second advance-phase 3) |
| 039 | Stop | 51 | 60-ipm busy tone |
| 042 | — | 160 | CAMA access dialed in error by HILO 4-wire incoming trunk |
| 043 | Stop | 89 | Vacant code announcement |
| 048 | † | None | Maintenance access to intraprocessor trunk group (local to HILO) |
| 049 | † | None | Maintenance access to intraprocessor trunk group (HILO to local) |
| 052 | Stop | None | TOUCH-TONE service transmitter test |
| 065 | 002 | 064 | Signaling irregularities multifrequency receiver |

* Nonfixed RI corresponding to this pseudo RI.

† Next RI must point to a 2-way intraprocessor trunk group. Where only a 2-way group is provided, next RI is Stop.

▶TABLE H◀

## HILO UNIVERSAL TRUNK FRAME SCAN POINTS

| LEAD | UNIT TYPE | MEMBER NUMBER (NOTE) | NONTRUNK PROGRAM INDEX |
|---|---|---|---|
| F0(0) | 20 | n | 0 |
| F1(0) | 20 | n | 0 |
| S0(0) | 20 | n | 0 |
| S1(0) | 20 | n | 0 |
| T0(0) | 20 | n | 0 |
| T1(0) | 20 | n | 0 |
| F0(1) | 20 | n + 1 | 0 |
| F1(1) | 20 | n + 1 | 0 |
| S0(1) | 20 | n + 1 | 0 |
| S1(1) | 20 | n + 1 | 0 |
| T0(1) | 20 | n + 1 | 0 |
| T1(1) | 20 | n + 1 | 0 |
| SC00* | 20 | n | 28 |
| SC01* | 20 | n | 62 |

***Note:*** Universal trunk frame number n (always even).

* Scan points SC00 and SC01 are supervisory; all others are directed.

▶TABLE I◀

HILO STEP-BY-STEP TRUNK FRAME SCAN POINTS

| LEAD | UNIT TYPE | MEMBER NUMBER | NONTRUNK PROGRAM INDEX | PROVIDED BY OPTION(S) |
|---|---|---|---|---|
| F0 | 5 | n | 0 | Z, Y, X |
| F1 | 5 | n | 0 | Z, Y, X |
| Not Connected (S0) | 5 | n | 0 | Z, Y, X |
| Not Connected (S1) | 5 | n | 0 | Z, Y, X |
| Not Connected (T0) | 5 | n | 0 | Z, Y, X |
| Not Connected (T1) | 5 | n | 0 | Z, Y, X |
| SC00* | 21 | m | 28 | Z, Y, X |
| SC01* | 21 | m | 62 | Z, Y, X |
| F0(0) | 21 | y | 0 | Y, X |
| F1(0) | 21 | y | 0 | Y, X |
| S0(0) | 21 | y | 0 | Y, X |
| S1(0) | 21 | y | 0 | Y, X |
| T0(0) | 21 | y | 0 | Y, X |
| T1(0) | 21 | y | 0 | Y, X |
| F0(1) | 21 | z | 0 | X |
| F1(1) | 21 | z | 0 | X |
| S0(1) | 21 | z | 0 | X |
| S1(1) | 21 | z | 0 | X |
| T0(1) | 21 | z | 0 | X |
| T1(1) | 21 | z | 0 | X |

* SC00 and SC01 are supervisory scan points; all others are directed.

▶TABLE J◀

## SET CARDS REQUIRED FOR THE HILO FEATURE

| SET CARD SYMBOL | DESCRIPTION | UNIQUE TO HILO | SET CARD SYMBOL | DESCRIPTION | UNIQUE TO HILO |
|---|---|---|---|---|---|
| BLH | Quantity of bylink digits received hopper entries | No | NAX | Transmitter outpulsing annexes | No |
| BLJA* | Bylink junior registers in Segment A | No | NDO | Trunk dial pulse XMTR junior registers | No |
| BLJB* | Bylink junior registers in Segment B | No | NHT† | Hit timing junior registers | No |
| BLJC* | Bylink junior registers in Segment C | No | NMB | Multibit scan junior registers | No |
| BLJS* | Bylink junior registers | No | NMF | MF XMTR junior registers | No |
| DOH | Number of trunk dial pulse outpulse report hoppers | No | NOR | Originating registers | No |
| DPR4 | Specifies whether or not data validation protection is requested for the HILO dial pulse receivers | Yes | PCii | Lead length-MTTP to electrical neutral TLN | No |
| DPT4 | Specifies whether or not data validation protection is requested for the HILO dial pulse transmitters | Yes | Pjjii | Lead length-MTTP to each TLN | No |
| HLMFQ | Quantity of HILO MF receivers | Yes | QRWii | MS frame and row address for TOUCH-TONE service-trunk dial pulse receiver | No |
| HLMFX | Quantity of HILO MF transmitter circuits | Yes | Rjji | Length of ROTL path to TLN | No |
| HLTDPX | Quantity of HILO trunk dial pulse transmitter circuits | Yes | SXFii | Number of bylink rows on each MS frame | No |
| HLTDQ | Quantity of HILO trunk dial pulse receivers | Yes | SXOR | Bylink senior registers | No |
| HLTN(II) | Designates if trunk line networks carry HILO 4-wire traffic | Yes | SXRii | Lowest number bylink row on each MS frame | No |
| HLTTQ | Quantity of HILO TOUCH-TONE service-trunk dial pulse receiver queues | Yes | TDH | Number of trunk dial pulse digits received hopper entries | No |
| MRWii | MS frame and row address for MF receiver | No | TDP | Number of trunk dial pulse receiver rows | No |
| | | | TQT | Quantity of trunk TOUCH-TONE service-trunk dial pulse receiver rows | No |
| | | | TTDP4 | Specifies whether or not data validation protection is requested for the HILO combined TOUCH-TONE service-trunk dial pulse receivers | Yes |

See footnotes at end of table.

**TABLE J (Contd)**

**SET CARDS REQUIRED FOR THE HILO FEATURE**

| SET CARD SYMBOL | DESCRIPTION | UNIQUE TO HILO | SET CARD SYMBOL | DESCRIPTION | UNIQUE TO HILO |
|---|---|---|---|---|---|
| KRWii | MS frame and row address for trunk dial pulse receiver | No | MFT4 | Specifies whether or not data validation protection is requested for the HILO multifrequency transmitters | Yes |
| LTP | Quantity of STT frames with line and trunk test panels plus quantity of MTT frames | No | TTFii | TLTP option A, STTP option F or G, or MTTP | No |
| MFH | Number of MF digits received hopper entries | No | TTH | Number of TOUCH-TONE service-trunk dial pulse receiver queue entries | No |
| MFR | Number of MF receiver rows | No | TTM | Number of trunk-to-trunk path memory registers | No |
| MFR4 | Specifies whether or not data validation protection is requested for the HILO multifrequency receivers | Yes | 9FHL4W | HILO feature package | Yes |
| | | | 9FMTTP | MTTP feature package | No |
| | | | 9SHL4W | HILO feature group | Yes |
| | | | 9SMTTP | MTTP feature group | No |

* Set card BLJS is applicable to SP offices only; set cards BLJA, BLJB, and BLJC are applicable to CC offices only. Not applicable if SXOR=0 or missing.

† SP offices only, not applicable if SXOR=0 or missing.

## TABLE K

## SET CARDS NOT REQUIRED FOR HILO TOLL-ONLY OFFICES DUE TO ABSENCE OF RINGING CIRCUITS

| SET CARD | DEFINITION | STORAGE NOT REQUIRED |
|---|---|---|
| NRR | Number of regular ringing registers | CS — Regular ringing registers (RR) |
| NSR | Number of special ringing registers | CS — Special ringing registers (SR) |
| RGT | Number of ring trip rows | CS — Ring trip scan table (RGTRS) and ring trip rows scan table (RTSC)<br>PS — Ring trip scan row data table (INRTS) |
| RRQ | Number of RP receiver queue entries | |
| RTH | Number of ring trip hopper entries | CS — Ring trip hoppers (HRT) |
| RTii | MS frame and row address of ring trip row | |
| SRG | 4-party full selective service ringing provided | |
| SRQ | Number of special ringing queue entries | |

▶TABLE L◀

TYPICAL HILO CALLS — CYCLE COUNTS

| TYPE OF CALL | | CYCLE COUNTS (NOTE) | |
|---|---|---|---|
| INCOMING | OUTGOING | NO. 1 ESS | NO. 1A ESS |
| 2-way E&M ICT MF pulsing 10 digits received | 2-way E&M OGT, MF pulsing, 10 digits | 4,425 | 8,850 |
| 2-way E&M ICT, MF pulsing 10 digits received | 1-way OGT, DP-immediate start pulsing, 10 digits | 4,225 | 8,450 |
| Bylink CAMA ANI ICT, 10 digits received | 2-way OGT E&M, MF pulsing, 10 digits | 6,475 | 12,950 |
| Bylink CAMA ONI ICT, 10 digits received (no operator queueing encountered) | 2-way OGT E&M, MF pulsing, 10 digits | 6,350 | 12,700 |
| 2-way E&M ICT, MF pulsing, 7 digits received | Via intraprocessor trunk to line in local/toll office | 6,925 | 13,850 |
| POTS line in local/toll office, DP pulsing, 10 digits received | MF outgoing from toll community, 10 digits | 7,650 | 15,300 |

***Note:*** Cycle counts are approximations. For No. 1 ESS switches, cycle counts are for signal processor (SP) offices. For No. 1A ESS switches, cycle counts are for slow stores; for fast stores multiply by 0.67. Fast stores are available with 1AE6 and later generic programs.

**▶TABLE M◀**

**HILO VERIFICATION INPUT/OUTPUT MESSAGES**

| TO VERIFY: | USE TTY MESSAGE | SYS RESPONSE |
|---|---|---|
| 1. Trunk network number assignments | V-HLTNN- | TR56 |
| 2. Universal and miscellaneous trunk circuit number assignments | V-HLCN- | TR56 |
| 3. Contents of trunk class code expansion tables | TAG-TNN-TCL<br>T-READ-* | TR21<br>TW02 |
| 4. Assignment of TNN to trunk group zero | V-HLTNN- | TR56 |
| 5. Trunk group number translations | VFY-TKGN-14 | TR10 |
| 6. Assignment of TNN to active trunk group | V-HLTNN- | TR56 |
| 7. Assignment of MSN scan points | VFY-MSN-13 | TR12 |
| 8. Linkage of a head table to the master head table | T-READ-* | TW02 |
| 9. Contents of a unit type auxiliary block | VFY-UNTY-15 | TR13 |
| 10. Address of TNN-TGN primary translation word | TAG-TNN-TGN | TR21 |
| 11. Address of TNN-TGN auxiliary block | V-HLTNN- | TR56 |
| 12. Contents of TNN-TGN auxiliary block | T-READ-* | TW02 |
| 13. Pseudo route indexes and contents of route index expansion tables | VFY-EXP- | TR05 |

* Use T-READ- message for No. 1 ESS switches only. For No. 1A ESS switches use DUMP:CSS,ADR-. System response is DUMP:CSS output message.

**TABLE N**

## NTV ARRANGEMENT FOR 2048 TLN WITH ONLY ONE HILO UNIVERSAL FRAME

| FIRST VERTICAL TJSC | TLN | TSC | GRID | SWITCH | LEVEL |
|---|---|---|---|---|---|
| 0 | N | 4 | 1 | 0 | 2 |
| 1 | N | 5 | 1 | 0 | 2 |
| 2 | N | 6 | 1 | 0 | 2 |
| 3 | N | 7 | 1 | 0 | 2 |
| 4 | N | 4 | 0 | 0 | 2 |
| 5 | N | 5 | 0 | 0 | 2 |
| 6 | N | 6 | 0 | 0 | 2 |
| 7 | N | 7 | 0 | 0 | 2 |
| **SECOND VERTICAL TJSC** | **TLN** | **TSC** | **GRID** | **SWITCH** | **LEVEL** |
| 0 | N | 4 | 3 | 0 | 2 |
| 1 | N | 5 | 3 | 0 | 2 |
| 2 | N | 6 | 3 | 0 | 2 |
| 3 | N | 7 | 3 | 0 | 2 |
| 4 | N | 4 | 2 | 0 | 2 |
| 5 | N | 5 | 2 | 0 | 2 |
| 6 | N | 6 | 2 | 0 | 2 |
| 7 | N | 7 | 2 | 0 | 2 |

## ▶TABLE O◀

### SERVICE AND TEST CIRCUITS

| SD NUMBER | CIRCUIT DESCRIPTION | TRUNK ORDER CODE(S) | J-SPEC NUMBER | CKTS/ UNIT | POINTS/CKT | | | RATING | INTERFACE CKTS (SD-1A392) REQD PER CKT | 2" MTG PLATES/ UNIT | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SCAN | SD | CPD | | | | |
| 1A369-01 | TOUCH-TONE Service Transmitter Test Circuit (EPSCS) | 11900 | 1A033NF | 1 | 10 | 3 | 0 | PROV | 1 | 2 | 1,2 |
| 1A375-01 | TOUCH-TONE Service Transmitter (EPSCS) | 12500 | 1A033MH | 1 | 3 | 0 | 9 | PROV | 1 | 2 | 1,2 |
| 1A378-01 | Dial Pulse Transmitter | 12800 | 1A033MC | 2 | 1 | 1 | 1 | PROV | 1 | 2 | 1,2 |
| 1A379-01 | Multifrequency Receiver | 12900/ 12901/ 12902 | 1A033MA | 1 | 8 | 2 | 0 | PROV | 1 | 2 | 1,2,3 |
| 1A380-01 | Multifrequency Transmitter | 13000 | 1A033MB | 1 | 4 | 0 | 7 | PROV | 1 | 2 | 1,2 |
| 1A381-01 | Multifrequency Test Environment | 13100 | 1A033NA | 1 | 2 | 3 | 0 | PROV | 2 | 2 | 1,2 |
| 1A382-01 | Tone Presence Detector | 13201 | 1A033NB | 1 | 2 | 3 | 0 | STD | 1 | 3 | 1,2,4 |
| 1A383-01/ 1A383-02 | Tone or Recorded Announcement | 13301 | 1A090BG | 2 | 2 | 3 | 0 | STD | 0 | Plug-In | 1,2,5 |
| 1A384-01 | Audible Ring and Recorded Announcement | 13400 thru 13405 | 1A033MD | 6 | 2 | 2 | 0 | PROV | 1 | 3 | 1,2,6 |
| 1A385-01 | TOUCH-TONE Service Detector | 13500 | 1A033NC | 1 | 2 | 3 | 4 | PROV | 1 | 2 | 1,2 |
| 1A386-01 | Combined 100/102 Test Line | 13600/ 13601 | 1A033ND | 2 | 1 | 2 | 0 | STD | 1 | 1 | 1,2,7 |
| 1A388-01 | 104/105 Test Coupler | 13800 | 1A033ME | 2 | 2 | 2 | 0 | PROV | 1 | 1 | 1,2 |

See notes at end of table.

▶TABLE O◀ (Contd)

SERVICE AND TEST CIRCUITS

| SD NUMBER | CIRCUIT DESCRIPTION | TRUNK ORDER CODE(S) | J-SPEC NUMBER | CKTS/ UNIT | POINTS/CKT | | | RATING | INTERFACE CKTS (SD-1A392) REQD PER CKT | 2" MTG PLATES/ UNIT | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SCAN | SD | CPD | | | | |
| 1A389-01 | Type 108 Test Line | 13900 | 1A033MF | 1 | 2 | 2 | 0 | STD | 2 | 1 | 1,2 |
| 1A390-01 | Dial Pulse Receiver | 14000 | 1A033MG | 2 | 1 | 2 | 0 | PROV | 1 | 2 | 1,2,11 |
| 1A390-01/ 1A173-01 | TOUCH-TONE Service Trunk Dial Pulse Receiver Combination | 15700 | 1A033MG/ 1A033DD | 2/2 | 1/9 | 2/0 | 0 | PROV/ STD | 1 | 2/3 | 1,2,11 |
| 1A391-01 | Operational Test Termination (103 and Synchronous Test Lines) | 14100 | 1A033NE | 2 | 1 | 2 | 0 | PROV | 1 | 1 | 1,2 |
| 1A392-01/ 1A392-02 | HILO Interface Circuit | 14201 | 1A090BH | 2 | 0 | 0 | 0 | STD | 0 | Plug-In | 1,2 |
| 1A394-01 | CAMA Operator in Remote Location (Loop Supervision) | 14400/ 14401 | 1A033BL | 1 | 4 | 8 | 0 | PROV | 2 | 2 | 1,2,8 |
| 1A395-01 | CAMA Operator in Same Building-Direct Supervision | 14500 thru 14505 | 1A033BN | 1 | 4 | 8 | 0 | PROV | 2 | 2 | 1,2,9 |
| 1A397-01/ 1A397-02 | Network Trunk Test Access Circuit | 14701 | 1A090BK | 2 | 2 | 3 | 0 | STD | 0 | Plug-In | 1,2 |
| 1A399-01 | 6-Port Conference Circuit (EPSCS) | 14900/ 14901 | 1A033MK | 1/2 | 6 | 7 | 0 | PROV | 1 | 14 | 1,2,10 |
| 1A431-01 | Central Pulse Distributor Pulse Stretcher Circuit (for MTTP) | 10101/ 10102 | 1A033GW | 32 | 0 | 0 | 32 | PROV | 0 | 2 | 1,2 |
| 1A453-01 | CCIS HILO Continuity Check Transceiver | 20300 | 1A033ML | 1 | 2 | 4 | 0 | PROV | 1 | 2 | 1,2 |

See notes at end of table.

**TABLE O (Contd)**

**SERVICE AND TEST CIRCUITS**

| SD NUMBER | CIRCUIT DESCRIPTION | TRUNK ORDER CODE(S) | J-SPEC NUMBER | CKTS/ UNIT | POINTS/CKT | | | RATING | INTERFACE CKTS (SD-1A392) REQD PER CKT | 2" MTG PLATES/ UNIT | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SCAN | SD | CPD | | | | |
| 1A454-01 | CCIS HILO Continuity Check Diagnostic Test | 20400 | 1A033NH | 1 | 2 | 7 | 2 | PROV | 1 | 2 | 1,2 |
| 1A483-01 | 3-Port Conference Bridge Circuit | 19800 | 1A033MR | 2 | 3 | 6 | 0 | STD | 3 | 2 | 1,2 |

***Note 1:*** All the circuits are mounted on the M frame except for the following whose frames are designated: SD-1A383[H(U)], SD-1A392[H(U) or H(M)], and SD-1A397[H(U)].

***Note 2:*** Only the SD-1A383, SD-1A392, and SD-1A397 circuits have a TLN appearance. They each have one TLN appearance.

***Note 3:*** SD-1A379 order code uses are:
12900 — MF receiver
12901 — MF receiver with Signaling Irregularities (SIGI) feature option (option Y)
12902 — MF receiver with single frequency mutilation reporting capability (option X).

***Note 4:*** SD-1A382 order code uses are:
13200 — tone presence detector
13201 — tone presence detector with milliwatt tone (option Y).

***Note 5:*** SD-1A383 is also used for HILO no-test vertical interface (8 per 1024 TLN or 16 per 2048 TLN).

***Note 6:*** SD-1A384 order code uses are:
13400 — announcement with 2-dB pad (options X,Y)
13401 — announcement without 2-dB pad (options X,Z)
13402 — with 2-dB pad and cut through to operator (options X,Z)
13403 — without 2-dB pad, with cut through to operator (options V,Z)
13404 — with 2-dB pad and delay announcement (options W,V,Y)
13405 — without 2-dB pad, with delay announcement (options W,V,Z)

***Note 7:*** SD-1A386 order code uses are:
13600 — for testing at TP0 (option Z)
13601 — for testing at TP2 (option Y)

***Note 8:*** SD-1A394 order code uses are:
14400 — for regular CAMA position
14401 — for CAMA position associated with TSPS

***Note 9:*** SD-1A395 order code uses are:
14500 — for regular CAMA position
14501 — for CAMA monitoring position
14502 — for 3CL switchboard position
14503 — for regular CAMA position with peg count register
14504 — for CAMA monitoring position with peg count register
14505 — for 3CL switchboard position with peg count register.

***Note 10:*** SD-1A399 order code uses are:
14900 — 1 ckt per unit
14901 — 2 ckts per unit
These order codes can be mixed in the same trunk group.

***Note 11:*** There must be at least one SD-1A378 pointed to by pseudo-RI4FPRI016.