HILO 4-WIRE OPERATION AND MAINTENANCE
SOFTWARE SUBSYSTEM DESCRIPTION
2-WIRE NO. 1/1A ELECTRONIC SWITCHING SYSTEM

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1. GENERAL

INTRODUCTION

1.01 This section provides a description of the HILO 4-wire operational and maintenance software programs for No. 1/1A ESS. Under the two program divisions of operation and maintenance, the four program categories described are:

- Administration/Support
- HILO Call Processing
- Trunk Maintenance
- Diagnostic.

Table A (HILO 4-wire operation programs) and Table B (HILO 4-wire maintenance programs) identify the programs used in the HILO 4-wire feature.

1.02 When this section is reissued, the reason for reissue will be stated in this paragraph.

1.03 Part 5 of this section provides a list of abbreviations and acronyms with applicable terms used herein.

PURPOSE OF HILO 4-WIRE SWITCHING FEATURE

1.04 The purpose of a HILO 4-Wire switching feature is to provide two electrically independent transmission paths through the switching network for toll applications. The HILO feature is available for both trunk only toll offices and combined local/toll offices.

Note: The HILO 4-Wire feature is provided for 1AE4 and later generics.

BACKGROUND

1.05 Four-wire switching can be achieved by several different methods. The most obvious scheme is the provision of four switched metallic conductors as in No. 4A crossbar and 4-wire No. 1 ESS (AUTOVON) offices. Another method uses a combination of space-division and time-division switching, where separate time slots on different physical paths are used for each direction of the call. This scheme is used in the No. 4 ESS. The HILO technique used in No. 1/1A ESS provides equivalent 4-wire switching over two switched metallic conductors of the remreed trunk link network (TLN) and an unswitched metallic return (office ground).

1.06 The HILO feature is designed for small-to-medium size toll offices and is also applicable

TABLE A

HILO 4-WIRE OPERATION PROGRAMS

PIDENT	TITLE	PIDENT LISTINGS	
		NO. 1ESS	NO. 1AESS
DCNT	Dialing Connections	PR-1A130	PR-6A130
DPOP	Dial Pulse Outpulsing Control Program	PR-1A137	PR-6A137
HLCT	HILO 4-Wire CSTI Tables	PR-1A192	PR-6A192
HLDI	Disconnect Action for HILO 4-Wire Switching	PR-1A191	PR-6A191
HLIC	Dialing Connection for 4-Wire Switching	PR-1A193	PR-6A193
HLOP	Outpulsing Actions for HILO 4-Wire Switching	PR-1A194	PR-6A194
ICAL	Digit Analysis Trunks	PR-1A132	PR-6A132
ITCI	CCIS Incoming Trunk Test Termination Program	PR-1A079	PR-6A079
ISXS	Step-By-Step Incoming Calls	PR-1A132	PR-6A132
MFTL	Multifrequency Transmitting Control	PR-1A136	PR-6A136
OGTC	Outgoing Call Control Program	PR-1A135	PR-6A135
PMBT	Precut Multifrequency Bylink Trunk	PR-1A197	PR-6A197
RADR	Receiver Attachment Delay Report	PR-1A174	PR-6A174
TAND	Tandem Connect	PR-1A129	PR-6A129
WQUE	Queue Administration	PR-1A125	PR-6A125

TABLE B

HILO 4-WIRE MAINTENANCE PROGRAMS

PIDENT	TITLE	PIDENT LISTINGS	
		NO. 1ESS	NO. 1AESS
ATTT	Remote Office Test Line	PR-1A073	PR-6A073
ITTT	Incoming Trunk Test Terminations	PR-1A079	PR-6A079
TBTF	Through Balance Testing Facility	PR-1A039	PR-6A039
TLTA	Trunk and Line Test Panel Program Part A	PR-1A040	PR-6A040
TLTB	Trunk and Line Test Panel Program Part B	PR-1A040	PR-6A040
TLTC	Trunk and Line Test Panel Program Part C	PR-1A040	PR-6A040
TLTD	Trunk and Line Test Panel Program Part D	PR-1A040	PR-6A040
TLTE	Trunk and Line Test Panel Program Part E	PR-1A040	PR-6A040
TNHC	HILO Cama Diagnostic Program	PR-1A045	PR-6A045
TNHS	HILO Service Circuit Diagnostic Program Part 1	PR-1A045	PR-6A045
TNHT	HILO Trunk Circuit Diagnostic Program	PR-1A045	PR-6A045
TNHV	HILO Service Circuit Diagnostic Program Part 2	PR-1A045	PR-6A045
TNHW	HILO Intraprocessor Trunk Diagnostic	PR-1A045	PR-6A045

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.

1.07 Compared with the 2-wire No. 1 ESS currently available for toll applications, the HILO feature offers the following 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. Call supervision (when required) is coupled through the switching network, thus reducing cross-office answer delay to 8 to 16 ms. For intertoll trunks, the floor space requirement for the HILO trunk circuits is only one-half that required by the plug-in miscellaneous (CMT) trunks available for 2-wire offices. Translation work requirements are reduced since most of the HILO trunk circuits are treated as universal circuits rather than miscellaneous circuits; eg, there is a saving of eight translation words per multifrequency (MF) intertoll trunk. Significant real-time savings of 10 to 20 percent are realized for most toll trunk-to-trunk connections.

1.08 A No. 1/1A ESS 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 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. BRIEF DESCRIPTION OF HILO PROGRAMS (FIG. 1)

OPERATION

A. Dialing Connection (HLIC) for HILO 4-Wire Switching

2.01 The dialing connection for 4-wire switching provides the initial call setup actions with an incoming signal.

B. Outpulsing Actions (HLOP) for HILO 4-Wire Switch

2.02 The outpulsing actions for HILO 4-wire switching provides the outpulsing functions for HILO 4-wire outgoing trunks.

C. Step-By-Step Incoming Calls (ISXS)

2.03 The step-by-step incoming calls handle trunk seizures on HILO 4-wire incoming step-by-step trunks.

D. Disconnect Actions (HLDI) for HILO 4-Wire Switching

2.04 The disconnect actions for HILO 4-wire switching provides the disconnect functions for the HILO 4-wire connections which use a trunk-to-trunk memory block.

E. HILO 4-Wire CSTI Tables (HLCT)

2.05 The HILO 4-wire CSTI tables provide the trunk circuit transition information for change in circuit.

MAINTENANCE

A. Remote Office Test Line (ATTT)

2.06 The remote office test line provides the capability for remote selection of trunking on the Centralized Automatic Reporting on Trunks (CAROT) system for originating automatic transmission test calls via the remote office test line (ROTL) facilities.

B. Incoming Trunk Test Termination (ITTT)

2.07 The incoming trunk test termination provides HILO routines for terminating incoming trunk test calls for codes 100, 102, 103, 104, 105 and 108 test lines to a ROTL access port and to synchronous test lines.

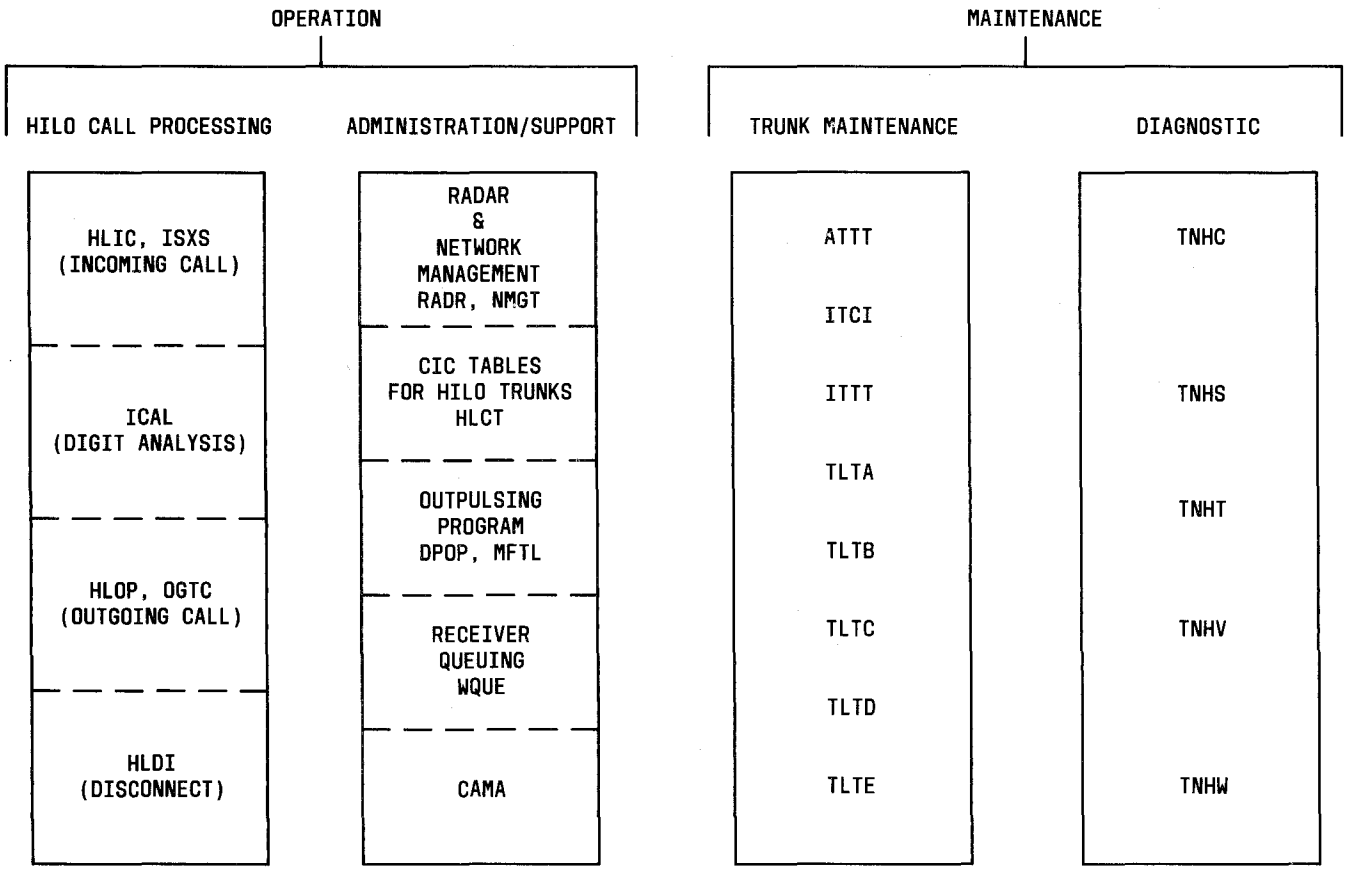


Fig. 1—Block Diagram of HILO Operation and Maintenance Programs

C. Manual Trunk Testing

2.08 Manual trunk testing consists of five programs (TLTA, TLTB, TLTC, TLTD and TLDE—PR-6A040). These programs operate from four test positions (TLTP, STTP, MTTP and RTTU).

D. Diagnostic Programs

2.09 The HILO diagnostic consists of five programs (TNHC, TNHT, TNHW, TNHS and TNHV). A diagnostic program is a program which attempts to (1) verify that a unit is free of faults, and (2) verify the faulty replacement entity of a faulty unit.

3. OPERATION

3.01 The flowchart in Fig. 2 shows the flow of HILO call processing.

DIALING CONNECTION FOR HILO 4-WIRE SWITCHING (HLIC)

3.02 The dialing connection for HILO 4-wire switching (HLIC) provides the initial call setup actions (much like dialing connection programs [DCNT] provides for conventional 2-wire trunks).

3.03 When an off-hook signal enters an office, a seizure request (from the appropriate hopper) is made for an incoming call register. HLIC determines whether the request can be serviced immediately or be placed on the incoming overload control queue. HLIC will then seize an incoming call register and initialize it with various trunk translation data. Based on the impulsing trunk type, HLIC seizes a trunk receiver service circuit. If no receivers are available, HLIC passes control to Queue Administration (WQUE), to queue the request for an appropriate receiver. HLIC initiates peripheral actions to connect the incoming trunk (ICT) to the digit receiver and

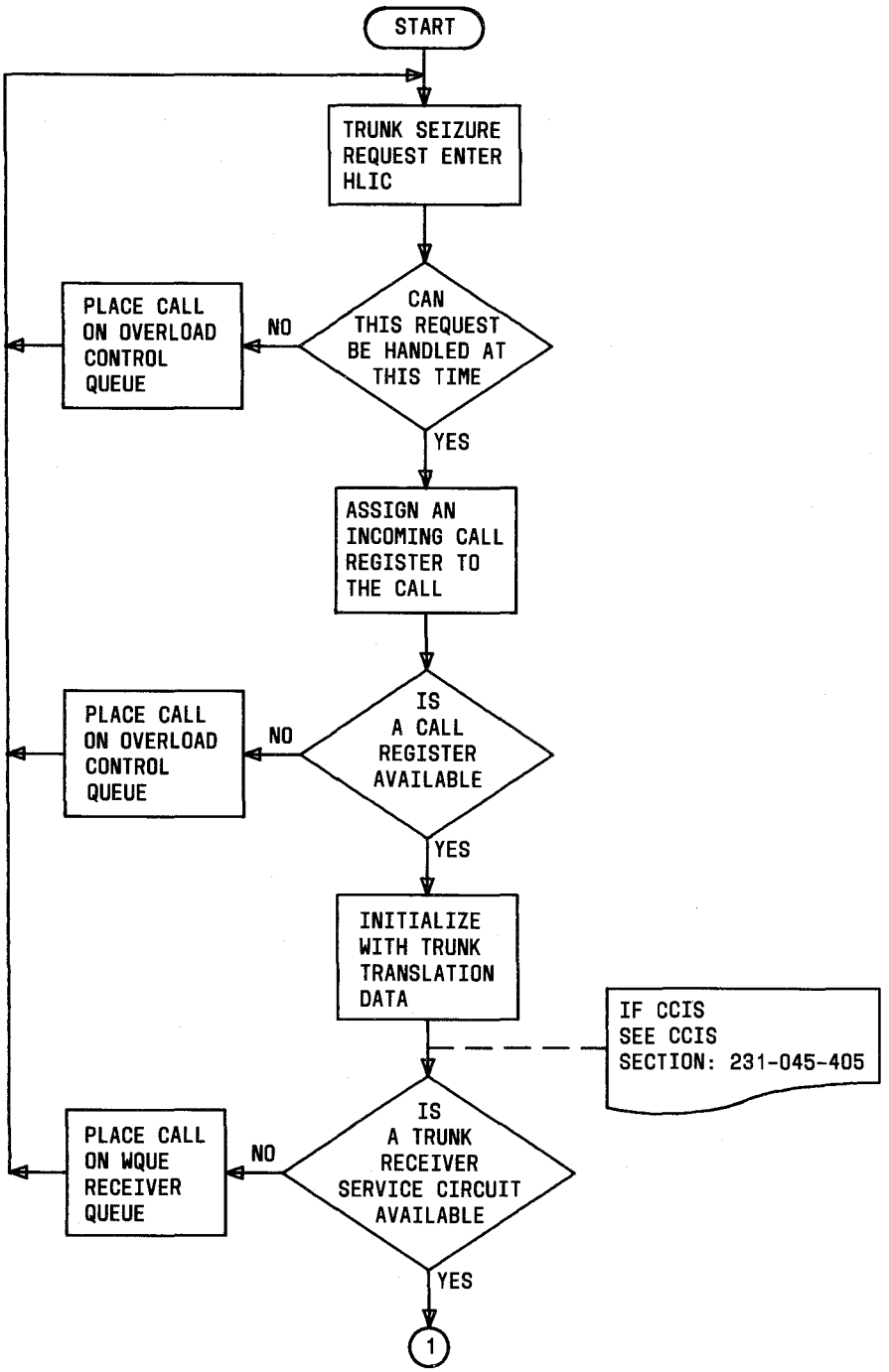


Fig. 2—HILO 4-Wire Call Processing (Sheet 1 of 5)

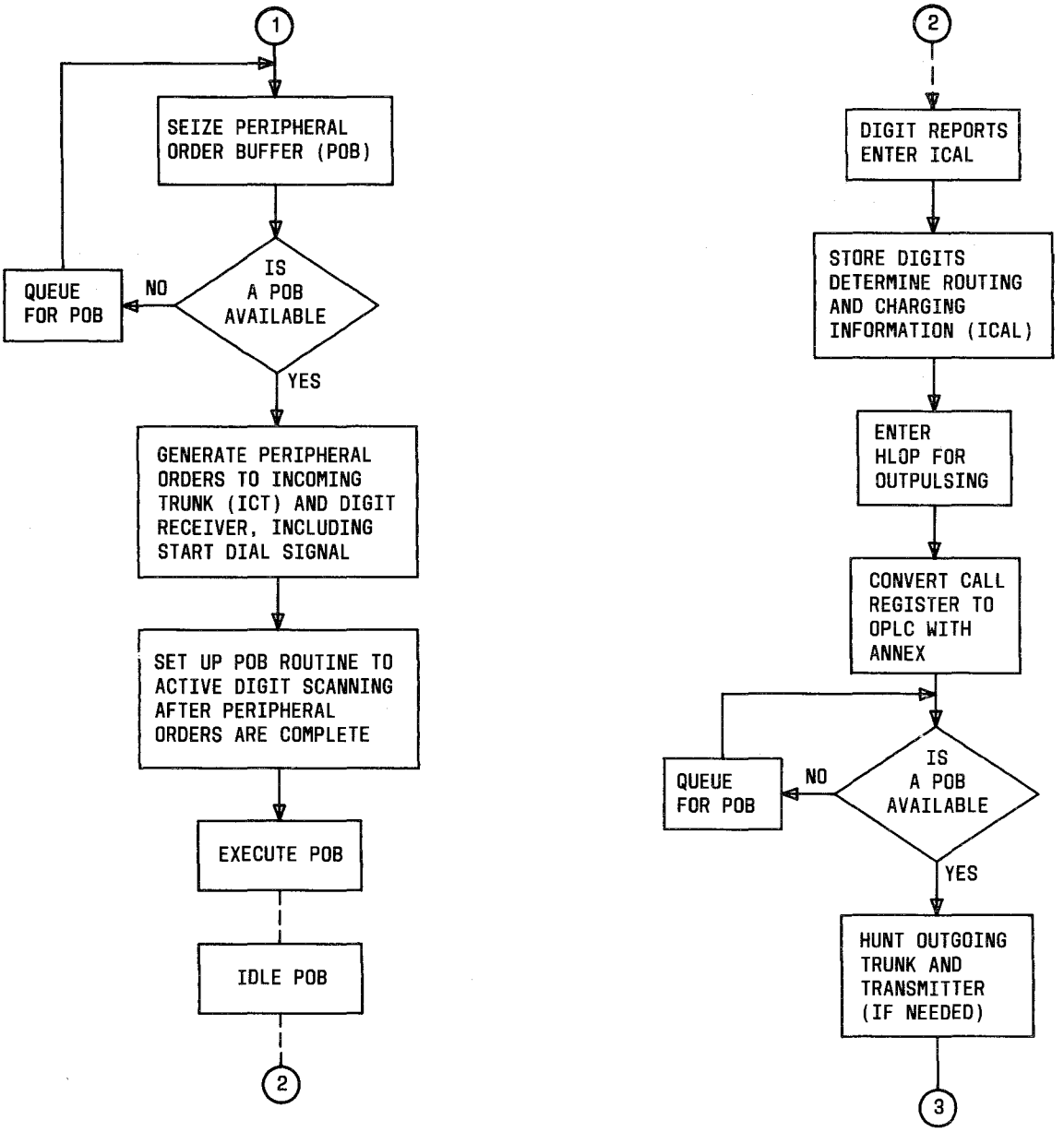


Fig. 2—HILO 4-Wire Call Processing (Sheet 2 of 5)

generates the appropriate start dial signal. Supervision is monitored at the digit receiver, since HILO trunks automatically pass supervision from ICT through the network. When the peripheral actions are complete, digit scanning is initiated.

3.04 When the start dial signal is a delay dial, HLIC must return the initial off-hook (ie, stop dial signal) if the request must queue. Delay dial operation for HILO is provided by software actions unlike the 2-wire counterpart which uses autonomous hardware logic. Digit Analysis Trunk Program (ICAL) provides digit analysis for HILO 4-wire (also 2-wire). The only difference between ICAL for 4-wire and ICAL for 2-wire is the outpulsing client to which control is given when the address information has been received. For HILO calls, control is transferred to the HILO 4-wire Outpulsing Program (HLOP).

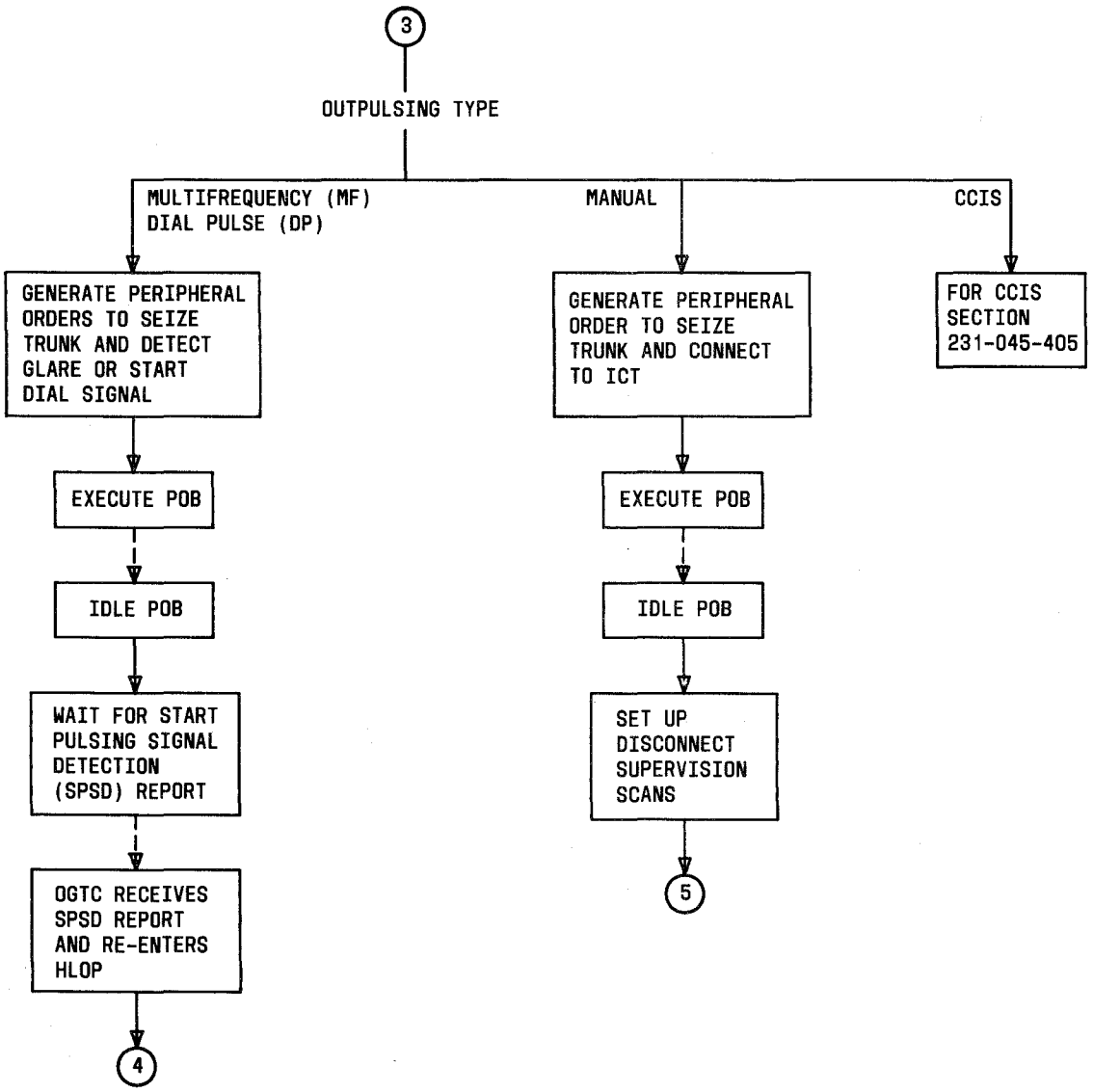


Fig. 2—HILO 4-Wire Call Processing (Sheet 3 of 5)

OUTPULSING ACTION FOR HILO 4-WIRE SWITCHING (HLOP)

3.05 The outpulsing action for HILO 4-wire switching program (HLOP) provides the outpulsing functions for HILO 4-wire outgoing trunks. Based on routing information determined by ICAL, HLOP seizes an idle outgoing trunk (OGT) circuit and an associated transmitter service circuit. Peripheral actions are initiated to seize the OGT, perform a glare check (if needed), provide the network connection to the transmitter, and invoke the start dial detection mechanism in the transmitter. The Outgoing Call Control Program (OGTC) unloads the start dial signal detection list and returns control to HLOP. HLOP can then initiate the digit transmission features of the Dial Pulse Outpulsing Control Program (DPOP), for dial pulse (DP) OGTs or multifrequency transmitting control (MFTL) for multifrequency (MF) OGTs. If no start dial signal is detected, OGTC would return control to HLOP via the normal client failure return mechanisms. In summary, HLOP is the HILO outpulsing client program which uses the services of the OGTC to provide the outpulsing capabilities. When outpulsing is completed, HLOP removes the outpulse control (OPLC) register from the call and places control either with an associated call

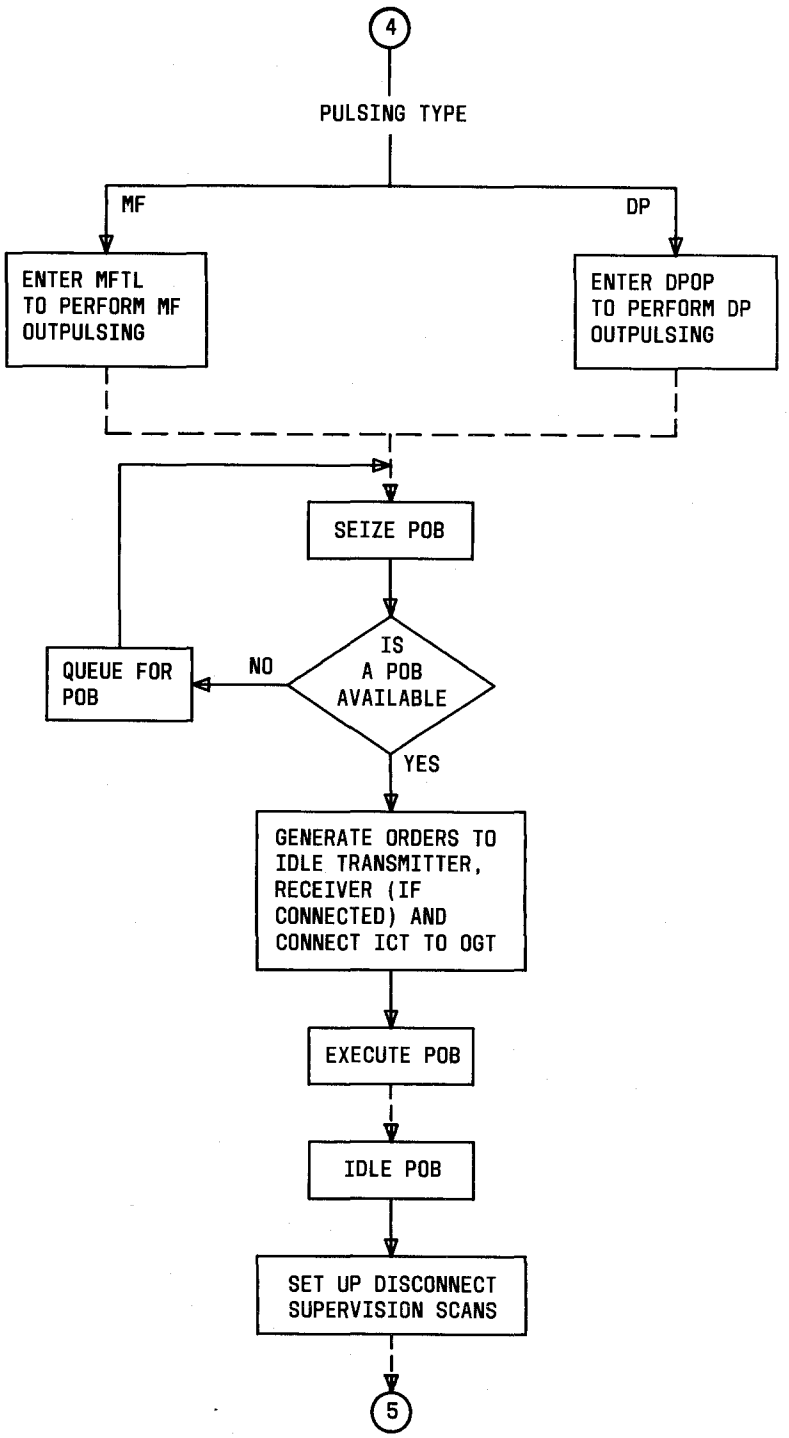


Fig. 2—HILO 4-Wire Call Processing (Sheet 4 of 5)

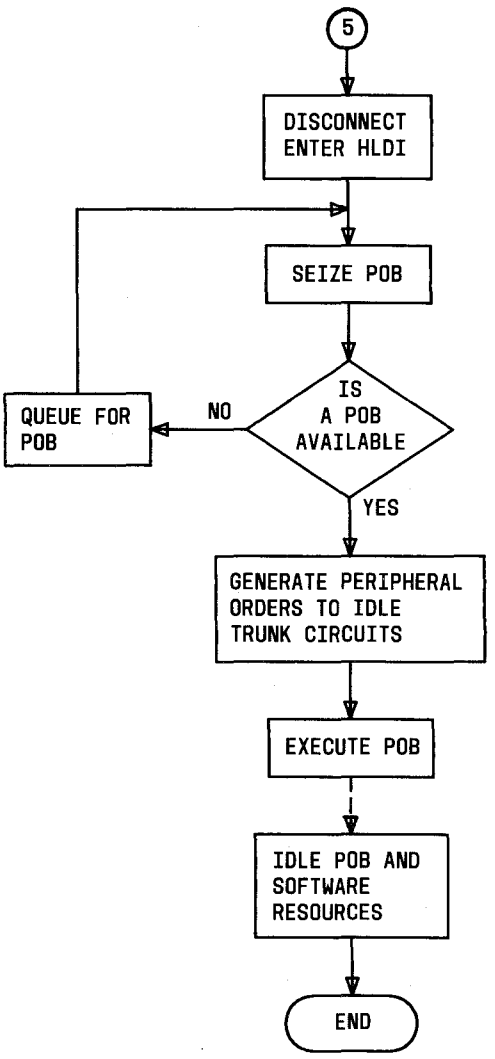


Fig. 2—HILO 4-Wire Call Processing (Sheet 5 of 5)

register (eg, AMA register) or a trunk-to-trunk path memory block (TTM).

STEP-BY-STEP INCOMING CALLS (ISXS)

3.06 Step-by-Step Incoming Calls Program (ISXS) handles trunk seizures on HILO 4-wire incoming step-by-step (SXS) trunks in a similar manner to 2-wire SXS trunks. The only difference is that a HILO 4-wire indicator is set in the incoming step-by-step register (ISR) to indicate that ICAL is to transfer control to the HILO programs when digit analysis is completed.

HILO 4-WIRE DISCONNECT PROGRAM (HLDI)

3.07 HILO 4-Wire Disconnect Program (HLDI) provides the disconnect functions for the HILO connections which have a TTM in control of the call. If a call register is associated with a HILO call, disconnect processing is provided by the client program activated by the register identifier/program tag (RI/PT) report mechanism of the call register. HLDI activates the peripheral action required to idle the ICT and OGT, and then returns all associated resources to their respective idle link list. Guard timing is activated for the OGT.

HILO 4-WIRE CSTI TABLES (HLCT)

3.08 The HILO 4-wire CSTI tables (HLCT) provide trunk circuit transition information much like

the peripheral order head table for change in circuit (CHIT) provides for 2-wire trunks. Using the HILO circuit program index (CPI) as an index into the Peripheral Order Translation Table for Change in Circuit (CHAT) head table, a pointer to the Change to Circuit State Transition Index (CSTI) table for the HILO 4-wire trunks is obtained. The CSTI is then used as an index to determine the valid relay sequence to provide the trunk circuit transition. The actual relay sequence is stored in pident CHAT.

3.09 HILO 4-wire call processing maintains a unique set of traffic counts for HILO operation much like 2-wire call processing. These traffic counts include:

- Number of HILO incoming call seizures
- Number of HILO tandem attempts
- MF transmitter timeouts
- DP transmitter timeouts.

3.10 In general, these counts are obtained by providing a "branch to" in the system routines which handle the various stimuli. Thus, HILO 4-wire call processing affects pidents OGTC, DCNT, MFTL, and TAND (Tandem Connection Program).

3.11 Since HILO requires separate service circuits for MF and DP digit reception, the Receiver Attachment Delay Report Program (RADR) function was modified to provide the receiver attachment delay analysis for HILO 4-wire digit receivers. The operation mirrors the 2-wire RADR function in that a pseudo-trunk seizure is created every 4 seconds and allows it to be processed by HLIC. HLIC returns control to RADR before initiating any peripheral action. RADR detects failures since it gets control 4 seconds after initiating a request. RADR analyzes these call attempts and provides its analysis via the HL15 output message and the associated network management interface. HILO 4-wire SXS and ICTS can be arranged for MF operation using the bylink multifrequency (BYMF) feature. This feature is provided by pident precut multifrequency bylink trunks (PMBT) which also allows a precutover testing mechanism.

3.12 Since HILO 4-wire requires a unique digit receiver service circuit, a separate queuing mechanism and queue processing is provided by pident WQUE in a manner similar to the 2-wire receiver queuing. The only difference is that a HILO 4-wire ICT is placed in an off-hook state (while on the queue) if it is a delay dial trunk. The capability exists for the glare resolution feature, but it is utilized by HILO which provides the software delay dial operation.

3.13 HILO combined local/toll offices must maintain separate groups of TLNs for local and toll applications. This separation is required because the toll HILO transmissions are sensitive to local signals such as ringing and coin control. Also, the trunk-to-trunk junctors must be arranged differently in a HILO TLN. All toll trunks are typically placed on the HILO TLN through toll-connecting trunks between the local office and some other toll offices are permitted on the local TLN.

3.14 The local and toll TLNs of a HILO combined local/toll office are connected by intraprocessor trunk groups. 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. Toll calls to/from lines are switched to the HILO TLNs via these intraprocessor trunks.

3.15 Intraprocessor trunks differ from ordinary loop-around trunks in the fact that no pulsing takes place over the intraprocessor trunks. Both ends of an intraprocessor trunk are recognized by software and the switching of these trunks is handled specially. The intraprocessor trunk is switched in directly between the line and the toll trunk without first connecting a transmitter to one end of the intraprocessor trunk, a receiver to the other end, and performing outpulsing. The outpulse digits are simply passed by software from the register administering the outgoing end of the intraprocessor trunk to the register administering the incoming end of the trunk. In this manner, the call is switched between the toll and local networks quickly and economically.

4. MAINTENANCE

REMOTE OFFICE TEST LINE

4.01 The Remote Office Test Line Program (ATTT) provides for remote selection of the Centralized Automatic Reporting on Trunks (CAROT) system. These trunks originate automatic transmission

test calls via the remote office test line (ROTL) facilities.

4.02 The CAROT system allows automatic transmission testing of a large number of trunks on a routine basis.

A. Outpulse Over a Trunk Under Test

4.03 For the HILO trunk under test (TUT) and test port, the normal transmission state used is talk 4. Being in the talk 4 state (TUT), the supervision it sends to its facility depends on the test port. This supervision must always be off-hook. In order for this to happen, the test port must be in the continuity state or the talk 4 state and depends upon the state of the ROTL applique to send off-hook to the test port. The transmission characteristics of the test port are identical in the continuity and talk states. The continuity state has a more reliable off-hook.

B. HILO 4-Wire Switch to 2-Wire Test Port

4.04 When a HILO ROTL is being used and the 2-wire test port is needed for a test, special actions are taken. The 4-wire test port is currently linked to the incoming register (IR) and cannot be restored until the seizures on it are removed.

> ***Note:*** A seizure is placed on the 4-wire test port whenever the M relay is released and the applique is in any state other than IDLE or SEND. At this point, the HILO applique has not placed a seizure on the 2-wire test port.

4.05 Therefore, this subordinate switches to the 2-wire test port by immediately operating the M relay, then seizing the 2-wire test port, restoring the 4-wire test port, and linking the 2-wire port to the IR (see Section 231-045-235).

INCOMING TRUNK TEST TERMINATION (ITTT)

A. ITTT Function

4.06 The Incoming Trunk Test Termination Program (ITTT) provides HILO routines for terminating incoming trunk test calls for codes 100, 102, 103, 104, 105, and 108 test lines to a ROTL access port and to synchronous test lines.

> ***Note:*** Program ITCI provides routines for terminating calls to test lines over HILO CCIS incoming trunks, see Section 231-045-235.

B. Code 100 Test Lines

4.07 The Code 100-Type Test Line (100TL) feature provides a termination at the end of an incoming trunk for making far-end to near-end loss and noise measurements.

HILO 4-Wire Trunk Testing

4.08 The operation of the 100TL feature (see Fig. 3) in a No. 1/1A ESS equipped for the HILO 4-wire switching feature is very similar to the 2-wire trunk testing (see Section 231-090-098). However, certain exceptions must be noted. The exceptions are the following:

(a) Incoming HILO 4-wire trunks are only tested in the talk state.

(b) Only RI 109 is used and correlates to pseudo route index (PRI) 005 which will contain some nonfixed RIs for the trunk group containing HILO 4-wire 100TL (SD-1A386) at TP0.

(c) If TP2 is specified by the trunk group number supplementary translator, the applicable route index expansion table will contain another nonfixed RI for the trunk group containing HILO 4-wire 100TL at TP2.

(d) Supervision for disconnect is set up by scanning the HILO 4-wire ICT.

(e) Certain translation data will differ.

C. Code 102 Test Lines

4.09 The Code 102-Type Test Line (102TL) feature provides connections to a 1kHz source for 1-way far-to-near transmission measurements.

HILO 4-Wire Trunk Testing

4.10 The operation of the 102TL feature (see Fig. 4) in a No. 1/1A ESS equipped for the HILO 4-wire switching feature is very similar to the 2-wire trunk testing (see Section 231-090-101). However, certain exceptions must be noted. The exceptions are the following:

(a) Incoming HILO 4-wire trunks are only tested in the talk state.

(b) Only RI 97 is used and correlates to PRI 005 which contains some nonfixed RI for the trunk

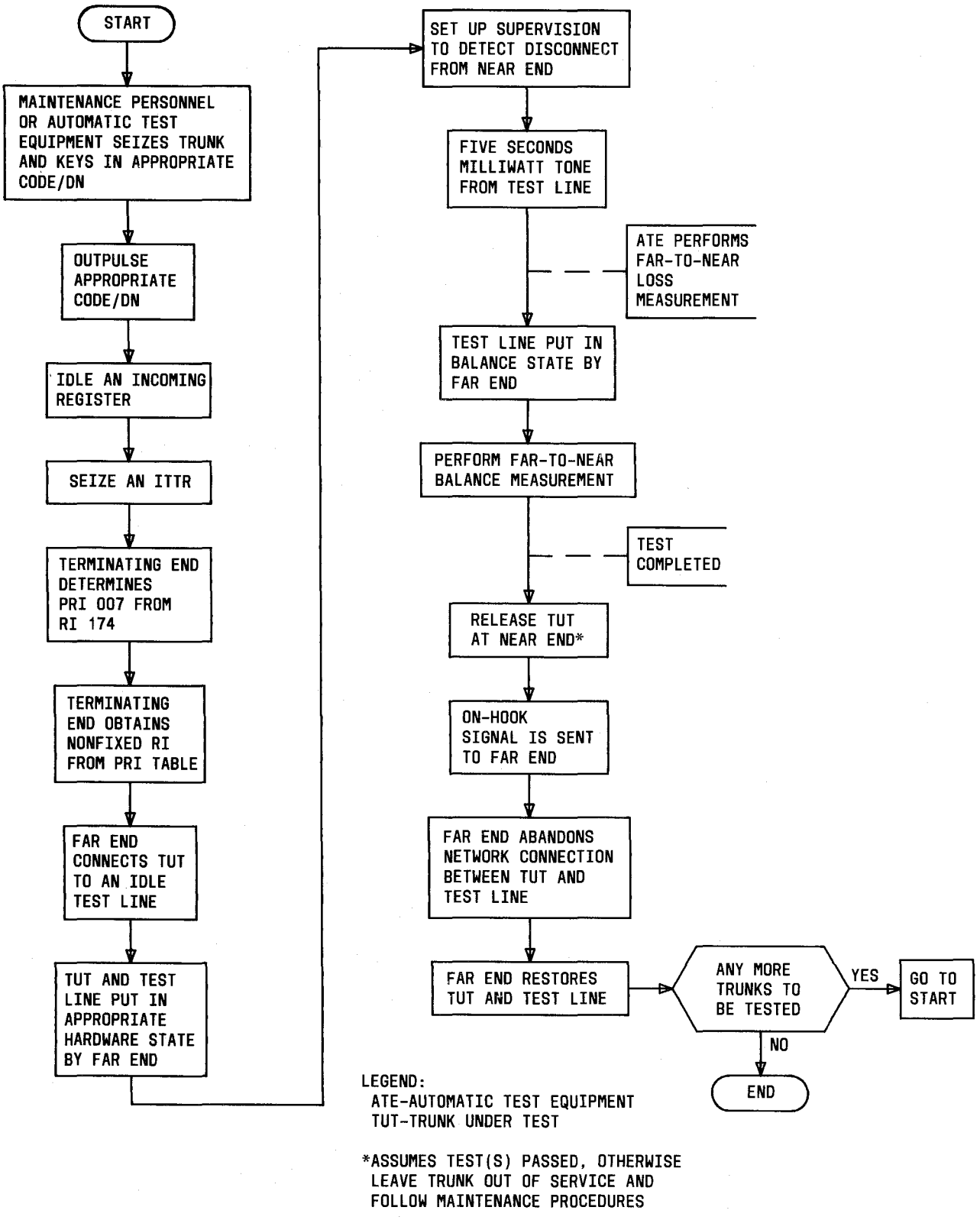


Fig. 3—User Operation of the 100TL Feature for Trunk Testing

group containing HILO 4-wire 102TL (SD-1A386) at TP0.

(c) If TP2 is specified by the trunk group number supplementary translator, the applicable route index expansion will contain another nonfixed RI for the trunk group for HILO 4-wire 102TL at TP2.

(d) Supervision for disconnect will be set up by scanning the HILO 4-wire ICT.

(e) Certain translation data will differ.

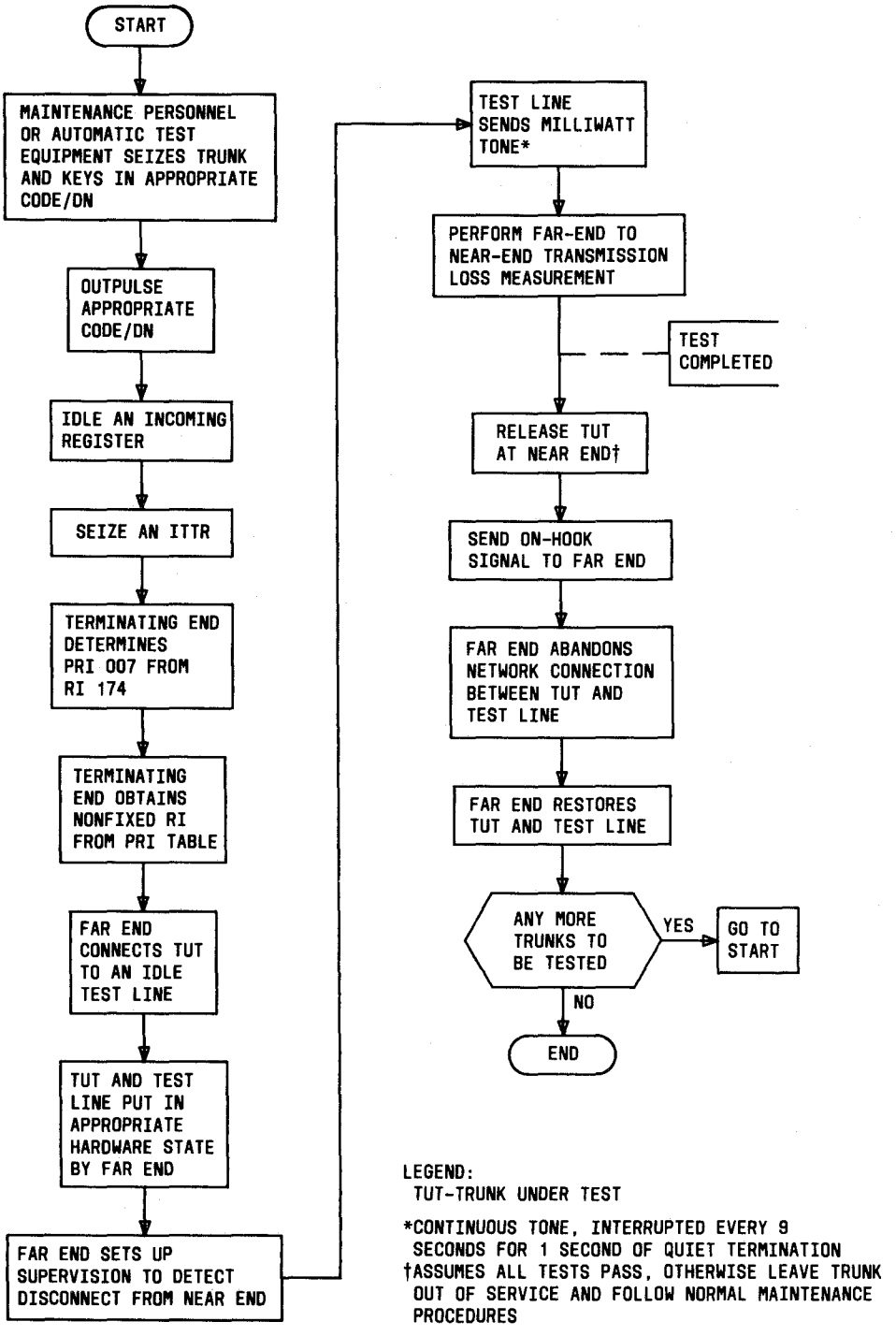


Fig. 4—User Operation of the 102TL Feature for Trunk Testing

D. Code 103 Test Lines

4.11 The Code 103-Type Test Line (103TL) feature provides a connection to a supervisory and signaling test circuit for overall testing on incoming intertoll trunks equipped with ring forward (re-ring) features.

HILO 4-Wire Trunk Testing

4.12 The operation of the l03TL feature (see Fig. 5) in an ESS office equipped for HILO 4-wire switching is very similar to the 2-wire intertoll trunk testing (see Section 231-090-094). However, certain exceptions must be noted as follows:

(a) Incoming HILO 4-wire trunks are only tested in the talk state.

(b) RI 174 correlates to PRI 007 which contains a nonfixed RI for the trunk group containing test termination circuits (SD-1A391).

(c) Supervision for disconnect is set up by scanning the HILO 4-wire ICT.

(d) Certain translation data differs.

E. Code 104 Test Lines

4.13 The Code 104-Type Test Line (104TL) feature provides a test termination for 2-way transmission testing and 1-way noise checking.

HILO 4-Wire Trunk Testing

4.14 The operation of the 104TL feature (see Fig. 6) in a No. 1/1A ESS equipped for the HILO 4-wire switching feature is similar to the 2-wire trunk testing (see Section 231-090-342). However, certain exceptions must be noted. The exceptions are the following:

(a) Incoming HILO 4-wire trunks are only tested in the talk state.

(b) Only RI 177 is used which correlates to PRI 008 which contains a nonfixed RI for the trunk group containing HILO 4-wire 104TL (SD-1A388) at TP0.

(c) If TP2 is specified by the trunk group number supplementary translator, the applicable route index expansion table contains another nonfixed RI for the trunk group containing HILO 4-wire 104TL at TP2.

(d) Supervision for disconnect is set up by scanning the HILO 4-wire ICT.

(e) Certain translation data differs.

F. Code 105 Test Lines

4.15 The Code 105-Type Test Line (105TL) feature provides access to a responder at the far end to permit automatic 2-way transmission loss and noise measurements to be made on trunks from a near-end office equipped with a suitable test frame (an Automatic Transmission Measuring System [ATMS] frame or a ROTL and responder).

HILO 4-Wire Trunk Testing

4.16 The operation of the 105TL feature (see Fig. 7) in a No. 1/1A ESS equipped for the HILO 4-wire switching feature is similar to the 2-wire trunk testing (see Section 231-090-099). However, certain exceptions must be noted. The exceptions are the following:

(a) Incoming HILO 4-wire trunks are only tested in the talk state.

(b) Only RI 108 is used and correlates to PRI 009 which contains some nonfixed RIs for HILO 4-wire 105TL at TP0.

(c) If TP2 testing is specified by the trunk group number supplementary translator, the applicable route index expansion table will contain another nonfixed RI for the trunk group containing HILO 4-wire 105TL at TP2.

(d) Supervision for disconnect is set up by scanning the HILO 4-wire ICT.

(e) Certain translation data differs.

G. Code 108 Test Lines

4.17 The Code 108-Type Test Line (108TL) feature provides far-end loop-around termination for in-service testing of echo suppressors and is to be used with the 58-type Echo Suppressor Measuring System (EMS).

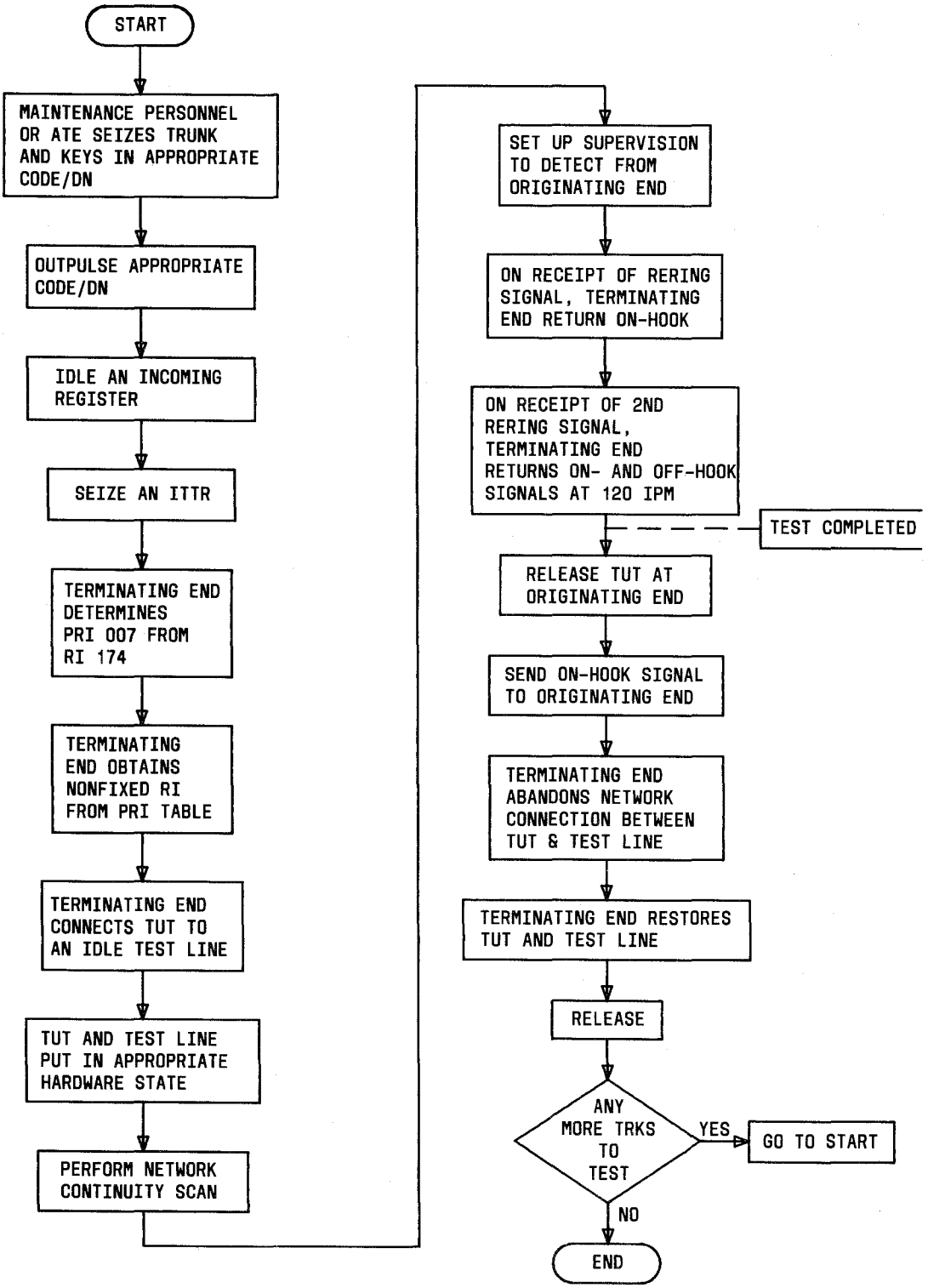


Fig. 5—User Operation of the 103TL Feature for Trunk Testing

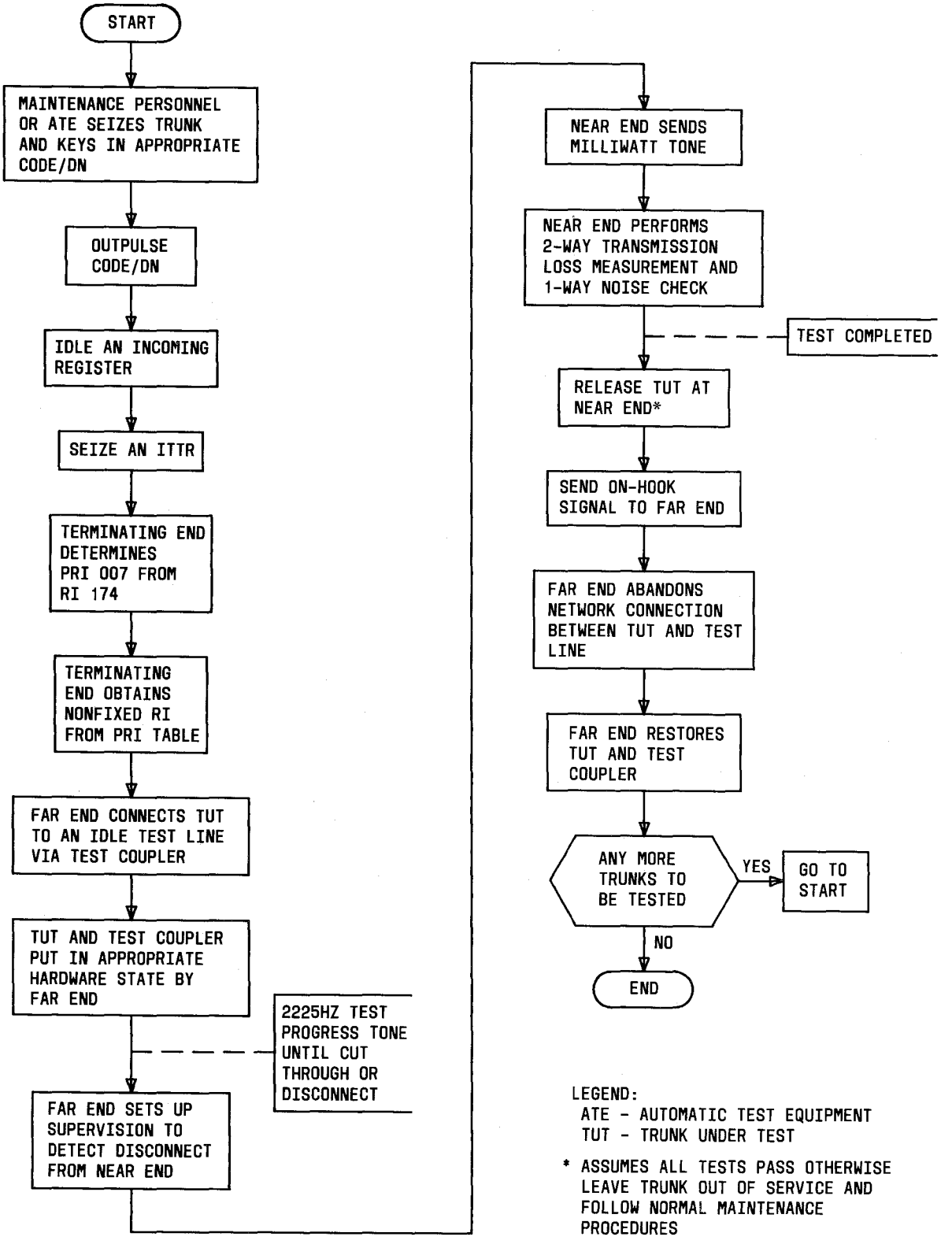


Fig. 6—User Operation of the 104TL Feature for Trunk Testing

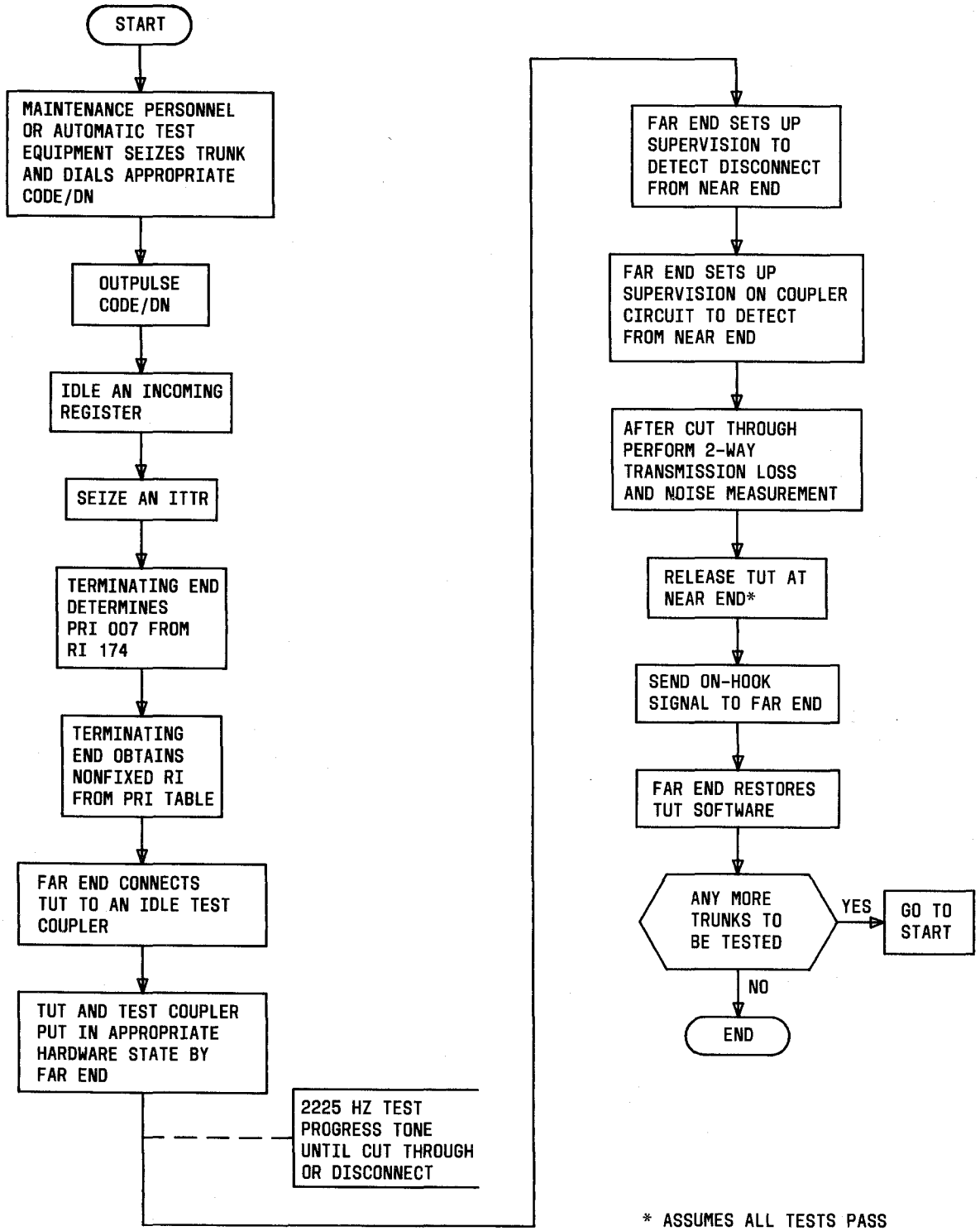


Fig. 7—User Operation of the 105TL Feature for Trunk Testing

HILO 4-Wire Trunk Testing

4.18 The operation of the 108TL feature (see Fig. 8) in a No. 1/1A ESS equipped for the HILO 4-wire switching feature is very similar to the 2-wire trunk testing (see Section 231-090-404). However, certain exceptions must be noted. These exceptions are the following:

(a) HILO 4-wire trunks are tested in the talk state.

(b) RI 178 correlates to PRI 010 which contains a nonfixed RI for test port 0 trunk group (SD-1A389).

(c) RI 179 does not correlate to a PRI for test port 1 trunk group. (TNN of test port 1 is in same TGN as TNN of test port 0.)

(d) Supervision for disconnect will be set up by scanning the HILO 4-wire ICT.

(e) Certain translation data will be different.

H. Synchronous Test Line

4.19 The Synchronous Test Line (SYNCTL) feature provides a marginal test of ringing, tripping, and supervision of incoming trunk equipment.

HILO 4-Wire Trunk Testing

4.20 Incoming synchronous test calls on HILO 4-wire trunks (see Fig. 9) are received and analyzed by normal call processing. From the applicable DN subtranslator (a type 4 entry word) or call indicator (a type 3 entry word), the calls are identified as test calls requiring an RI 98. RI 98 is assigned PRI 007, which contains a nonfixed RI that points to the trunk group containing operational test termination circuits (SD-1A391). The associated incoming register is released and an idle ITTR is seized.

4.21 After connection the line-side ferrods of both the incoming trunk circuit and the operational test termination circuit are scanned for nonsaturation. If the line-side ferrods are not saturated, the incoming trunk circuits are put in states to saturate their line-side ferrods. If the line-side ferrods are saturated, the ability to pass supervision through the network is verified. The operational test termination circuit is placed in the on-hook state which should unsaturate the line-side ferrod in the incoming trunk circuit (passed on-hook) and leave the ferrod saturated in the test termination. The line-side ferrod in the test termination is scanned for saturation and the incoming trunk circuit is scanned for nonsaturation. Finally, the incoming trunk circuit is put in the off-hook talk state and the operational test termination circuit put back into the off-hook state. Through software control, the synchronous test signals are returned to the distant office by operating and releasing the on/off-hook relay in the incoming trunk circuit. Supervision for disconnect is set up on the incoming trunk.

4.22 Upon near-end disconnect, the ESS affects the following actions: idles the TUT and test line hardware; abandons network connections; restores TUT and test line software; and releases the applicable ITTR.

4.23 If no idle operational test termination circuit is available, the 60-IPM signal is returned. The 120-IPM signal is returned if the ESS is congested or no idle incoming trunk test register is available. A scan point test failure results in a high and wet condition.

4.24 At the ESS, trunk-to-trunk network continuity supervisory scan failures result in an NT04 output message.

MANUAL TRUNK TESTING

4.25 The control program for manual trunk testing is divided into five pidents as follows:

- TLTA—Trunk and Line Test program part A
- TLTB—Trunk and Line Test program part B
- TLTC—Trunk and Line Test program part C
- TLTD—Trunk and Line Test program part D
- TLTE—Trunk and Line Test program part E.

4.26 These programs handle all the test panel positions (TLTP, STTP, MTTP and RTTU). The functions of these pidents are as follows:

(1) Report traffic and maintenance states of trunks

(2) Change the states of a trunk (out of service or service or active)

(3) Seize a trunk for test panel use

(4) Request diagnostic to run on a trunk

(5) Request repeat tests

(6) Request automatic transmission test on a trunk

(7) Print several trunk lists

(8) Place an outgoing call over a trunk

(9) Terminate an incoming call

(10) Monitor a traffic busy trunk

(11) Perform manual transmission, noise, and return loss measurements

(12) Perform signaling tests

(13) Control the trunk states

(14) Verify that HILO circuit (modulation, demodulation)

(15) Monitor scan points

(16) Loop on signal distribution

(17) Perform a traffic release on a busy trunk.

Note: All functions can be operated from any of the four test positions except for functions 11 through 16 which operate from MTTP only.

DIAGNOSTIC PROGRAMS

A. General

4.27 A diagnostic is a program which attempts to (1) verify that a unit is free of faults, and (2) identify the faulty replacement entity (ie, circuit packs) of a faulty unit. A diagnostic procedure is accomplished by applying inputs to a unit, observing the output from the unit, comparing the unit's output with known correct outputs and associating the failure pattern with faulty circuit pack(s).

4.28 The current version of diagnostic programs for ESS are data table-driven programs. These programs were developed using special programming language to avoid the extremely large and hard to understand programs which use ESS assembly language.

B. HILO Diagnostic Program

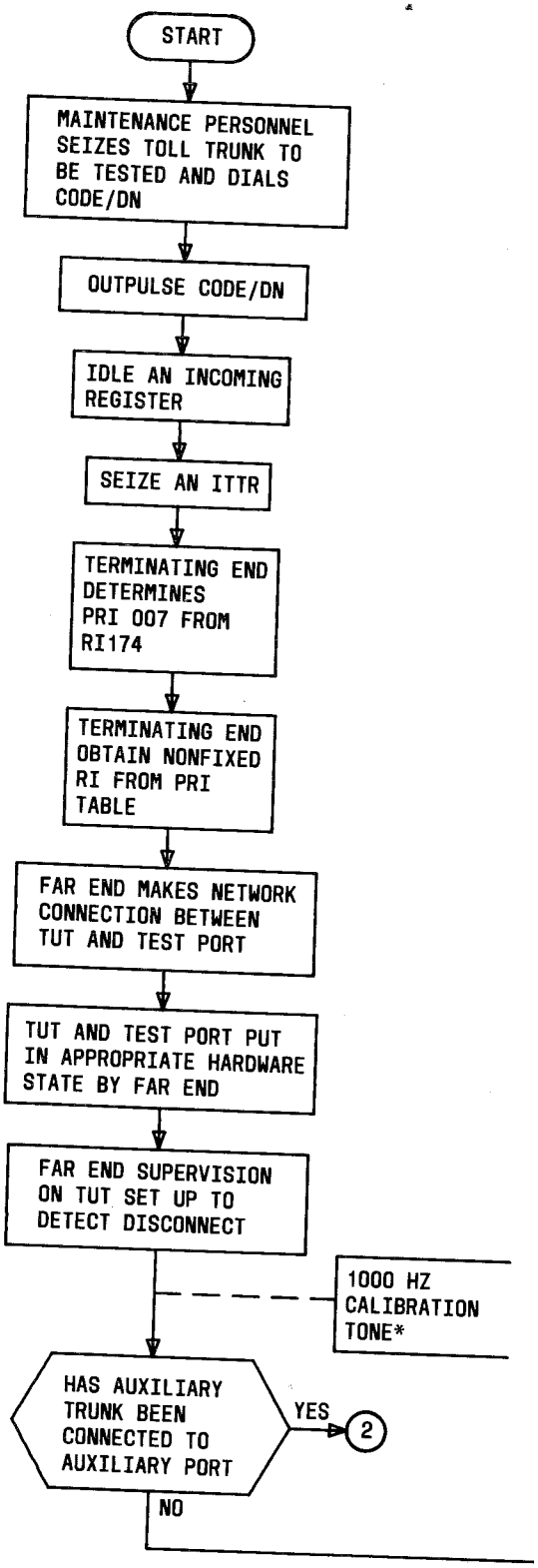
4.29 In a HILO package there are five pidents. They are:

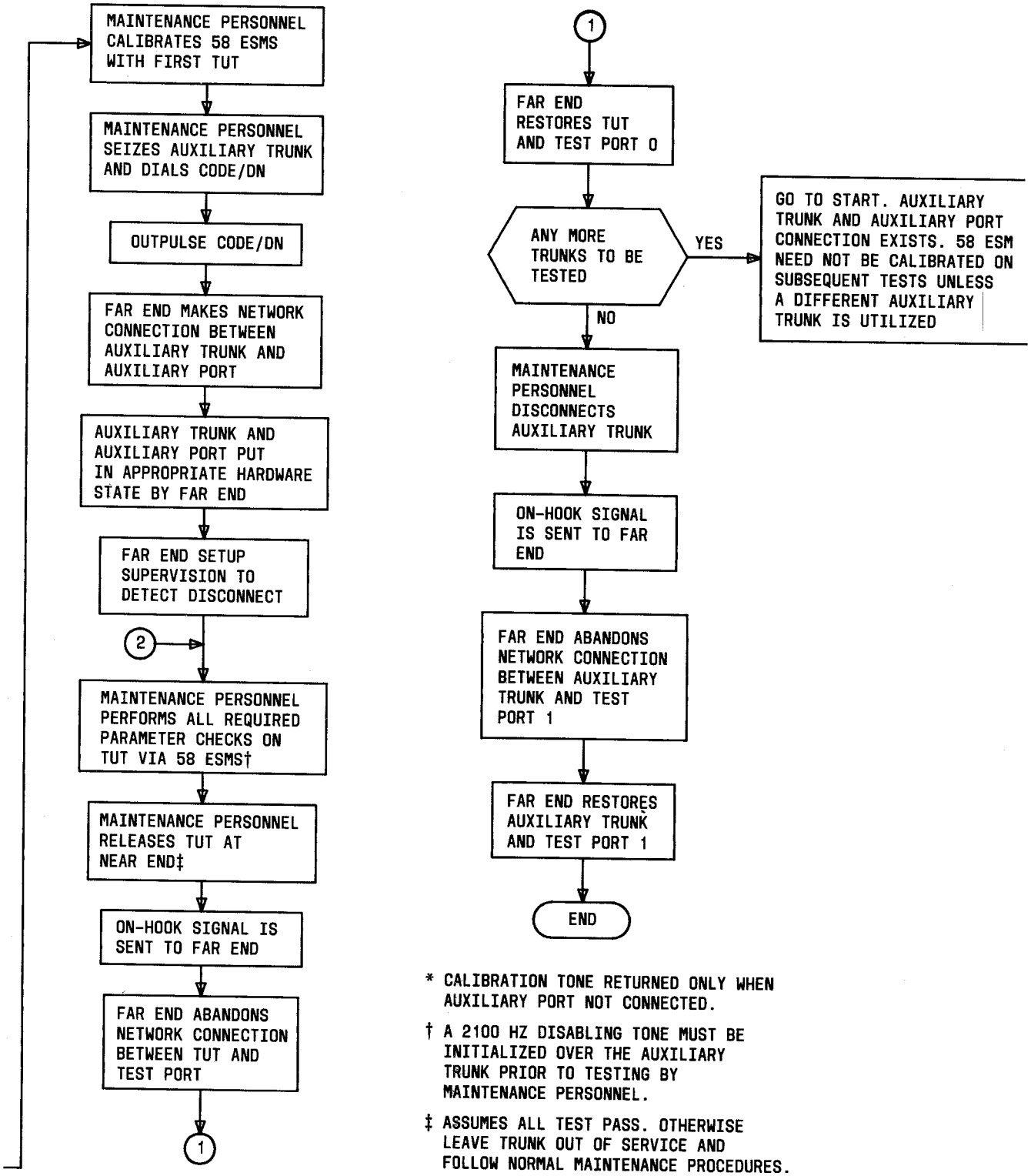
- TNHC—HILO CAMA diagnostic program
- TNHT—HILO Trunk Circuit diagnostic program
- TNHW—HILO Intraprocessor Trunk diagnostic
- TNHS—HILO Service Circuit diagnostic program part 1
- TNHV—HILO Service Circuit diagnostic program part 2.

5. ABBREVIATIONS AND ACRONYMS

5.01 The following abbreviations and acronyms are used within this section.

BYMF	Bylink Multifrequency
CAROT	Centralized Automatic Reporting on Trunks
CHAT	Peripheral Order Translation Table for Change in Circuit
CHIT	Peripheral Order Head Table for Change in Circuit
CPI	Circuit Program Index
CSTI	Change in Circuit State Transition Index
DP	Dial Pulse
ICT	Incoming Trunk
IR	Incoming Register
ISR	Incoming Step-By-Step Register
MF	Multifrequency
MFTL	Multifrequency Transmitting Control


START
MAINTENANCE PERSONNEL SEIZES TOLL TRUNK TO BE TESTED AND DIALS CODE/DN
OUTPULSE CODE/DN
IDLE AN INCOMING REGISTER
SEIZE AN ITTR
TERMINATING END DETERMINES PRI 007 FROM RI174
TERMINATING END OBTAIN NONFIXED RI FROM PRI TABLE
FAR END MAKES NETWORK CONNECTION BETWEEN TUT AND TEST PORT
TUT AND TEST PORT PUT IN APPROPRIATE HARDWARE STATE BY FAR END
FAR END SUPERVISION ON TUT SET UP TO DETECT DISCONNECT
1000 HZ CALIBRATION TONE*
HAS AUXILIARY TRUNK BEEN CONNECTED TO AUXILIARY PORT
YES
2
NO



* CALIBRATION TONE RETURNED ONLY WHEN AUXILIARY PORT NOT CONNECTED.

† A 2100 HZ DISABLING TONE MUST BE INITIALIZED OVER THE AUXILIARY TRUNK PRIOR TO TESTING BY MAINTENANCE PERSONNEL.

‡ ASSUMES ALL TEST PASS. OTHERWISE LEAVE TRUNK OUT OF SERVICE AND FOLLOW NORMAL MAINTENANCE PROCEDURES.

Fig. 8—User Operation of the 108TL Feature for Trunk Testing

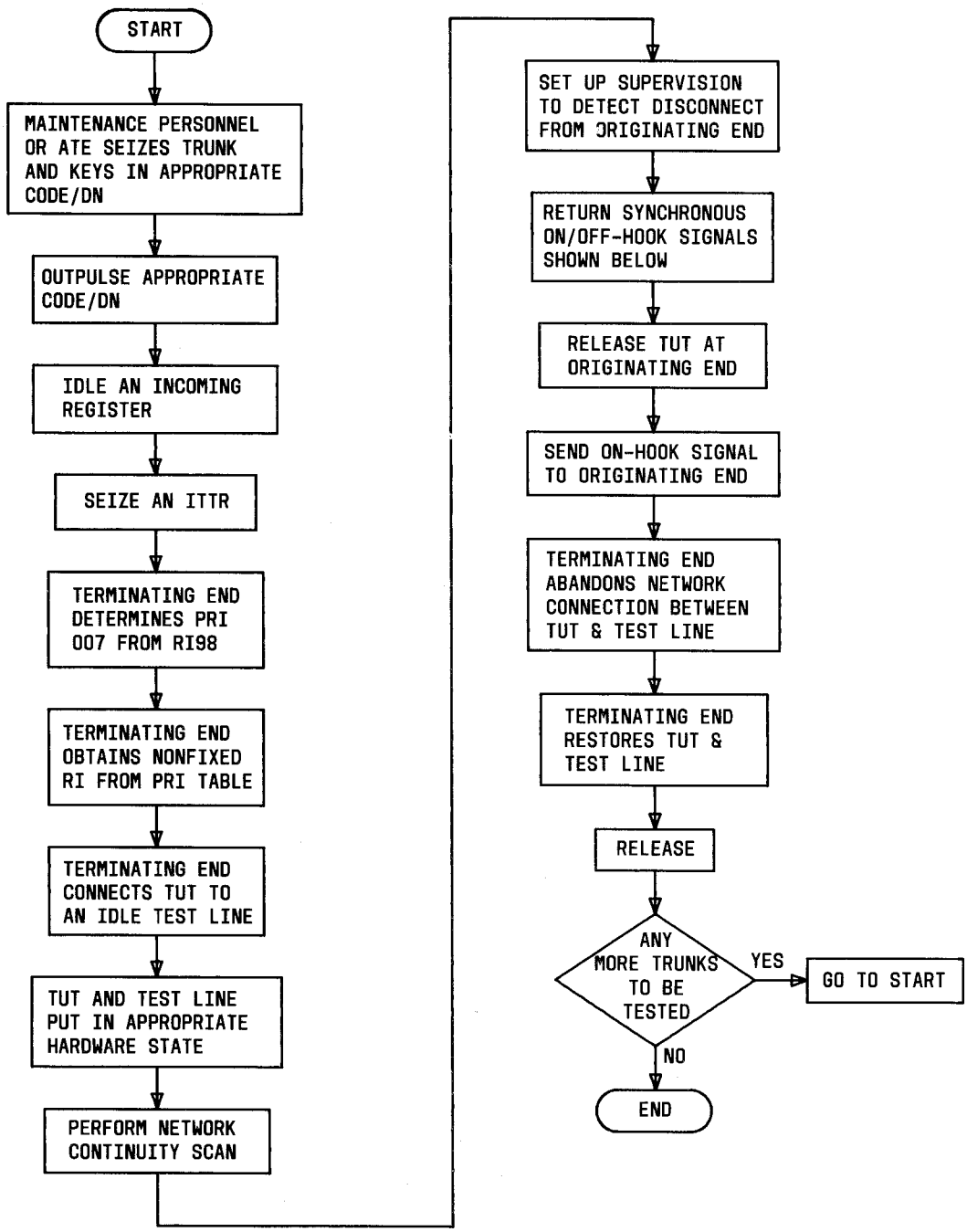


Fig. 9—User Operation of the Synchronous Test Lines Feature for Trunk Testing

OGT	Outgoing Trunk
OPLC	Outpulse Control Register
PRI	Pseudo Route Index
PTS	Per Trunk Signaling
RADAR	Radio Detection and Ranging
RI/PT	Register Identifier/Program Tag
ROTL	Remote Office Test Line
SXS	Step-By-Step
TTM	Trunk-To-Trunk Path Memory Block