

**TRUNKS, LINE CIRCUITS, MISCELLANEOUS
CIRCUITS AND SCANNERS
NETWORK SWITCHING ENGINEERING
NO. 3 ELECTRONIC SWITCHING SYSTEM**

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1. GENERAL	
1.01 This section covers the requirements and provisions of No. 3 ESS trunk and line circuits, test and miscellaneous circuits, and associated scanner assignments. Worksheets and procedures for determination of circuit quantities are also included.	
1.02 Whenever this section is reissued, the reason(s) for reissue will be listed in this paragraph.	
1.03 Trunk circuits are used to interface the No. 3 ESS network with a transmission facility to another office or switching unit. Line and miscellaneous circuits are required for subscriber sleeve lead functions, maintenance and testing, and circuit applique requirements. Scanner scan points are the sensor locations required by the 3A processor for monitoring the busy/idle status of all trunks, lines, and miscellaneous circuits.	
1.04 The term “facility,” as used in this section, defines a communication channel between two switching entities. It begins at the outgoing terminal of the switching network in the originating office and ends at the incoming terminal on the switching network of the terminating office. This facility includes all required transmission equipment at both offices.	
1.05 The No. 3 ESS universal trunk is a circuit used to originate and terminate calls on the facilities between offices. The trunk provides a means for transmitting and receiving various supervisory signals associated with interoffice and operator handled calls. Circuits are classified as outgoing, incoming, or 2-way, depending on the direction of the call and facility between the originating and terminating offices.	
1.06 Traditionally, trunk circuits converted supervisory information, (off-hook/on-hook) from another central office for local use, and conversely converted local supervision for transmission in the opposite direction. In all electronic switching	

systems, the trunk circuit retains few of these functions. Coin control, ringing, tone applications, etc, are provided by service circuits to which lines and trunks are connected via the network frame.

1.07 The equipment arrangements covered in Part 2 of this section cover the hardware aspects of the trunks, line, and miscellaneous circuits, including the trunk order code (TOC) for each circuit.

1.08 Part 3 describes the operation and use of these circuits and associated scanners.

1.09 The methods used in determining the quantities of trunks, lines, and miscellaneous circuits, and for verifying scan point requirements are covered in Part 4 of this section. Example worksheets for Section 233-060-825, Trunks, and Section 233-060-865, Scanner Field Verification, uses forecast data for the office, *Ruraltown*.

1.10 References in this section to methods, planning, data requirements, service levels, and equipment quantities are based on American Telephone and Telegraph Company recommendations.

2. EQUIPMENT ARRANGEMENTS

GENERAL

2.01 The No. 3 ESS uses a 5-digit number, designated TOC, to identify the various service circuits, trunks, line circuits, miscellaneous circuits, and the combinations of options that are available with this equipment. The first digit represents the circuit function of the trunk such as service circuit, outgoing trunk circuit, miscellaneous circuit, etc, as shown on Table A (Fig. 1). The second and third digits provide the circuit identification, Table B (Fig. 1). The fourth and fifth digits define the options or features available with each circuit, Table C (Fig. 1).

TRUNKS

2.02 All interoffice trunk circuits in No. 3 ESS offices are universal type. Each trunk circuit contains one scan point and a maximum of three distributor points per circuit. Universal trunks are provided on circuit packs with one circuit per circuit pack.

2.03 Universal trunk circuit packs are located on a frame mounting unit with a capacity of 24 trunk circuits per unit. Each office network frame is equipped with one trunk mounting unit. Additional units, when required, are located on the central control frames (one unit per frame) and office miscellaneous frames.

LINE AND MISCELLANEOUS CIRCUITS

2.04 Line circuits in No. 3 ESS offices are required for interfacing customer lines with line switching functions and services requiring the use of sleeve leads. Miscellaneous or applique circuits are used for ESS access to non-ESS equipment or facilities. Test circuits are required to perform the various testing operations associated with office maintenance and customer service.

2.05 Line and applique circuits are mounted only on miscellaneous frames or toll equipment frames. Test circuits mount in the peripheral test circuit unit located on the test frame behind the line and trunk test panel. Information concerning the number of circuits per circuit pack, circuit packs per unit, and required scan points are contained in the "Trunks" portion of the Network Switching Engineering Worksheets, Section 233-060-825.

SCANNERS

2.06 Two types of scanners are provided in No. 3 ESS offices: the master scanner and the universal scanner. Each scanner contains 512 current-sensing devices called ferrod sensors. These sensors are used to check the status of talking paths, monitor trunk and service circuits, and to check other miscellaneous circuit functions in the office. The master scanner is located only on control frame 0. The universal type scanners are provided one per network frame.

3. OPERATION AND USE

GENERAL

3.01 The operation and use of the various trunks, line circuits, and miscellaneous circuits used in the No. 3 ESS office are covered in this part. An explanation of the master scanner and universal scanners is also included.

TRUNKS

3.02 The following is a brief description of how each universal trunk circuit may be used in a No. 3 ESS office. These trunk circuits are simpler than those of electromechanical systems since their functions are limited mainly to transmission and supervision. All other functions of conventional trunks such as pulsing, timing, etc, are performed by the office program or service circuits.

3.03 The type of supervision for a particular trunk circuit is fixed. It is a function of the circuit design to monitor, connect and disconnect signals to and from the distant end. The types of trunk supervision for No. 3 ESS are as follows:

- (a) Reverse Battery
- (b) Two-Way E&M Lead
- (c) High-Low Reverse Battery
- (d) Direct Interface With T-Carrier.

A. Reverse Battery—Incoming

3.04 *Incoming Reverse Battery—Delay Dial:* This circuit terminates incoming transmission facilities from a No. 4 type toll switching system using MF signaling and provides the transmission supervision and control elements required for processing these incoming calls.

3.05 The 3A processor connects an MF receiver to the incoming trunk via the switching network. A check of this connection is made and the circuit is placed in a state which provides for a receiver to be connected directly to the incoming transmission facility. Supervision is maintained by the receiver during digit reception. After the digits have been received and the receiver released the trunk circuit maintains circuit supervision.

3.06 Audible ringing is returned to the calling party by the junctor. Ringing is applied from the ringing circuit to the called party. When the called party answers, the trunk circuit is connected to the called line via a previously reserved network path and switched to the appropriate state by the 3A processor. Supervision toward the distant end is maintained at the trunk circuit until disconnect when the circuit is idled.

3.07 *Incoming Reverse Battery—Wink or Immediate Start (By-Link):* This circuit provides transmission and supervisory functions on incoming calls from common control type or from step-by-step central offices. Reverse battery supervision, DP or MF pulsing and wink start are provided for common control central offices. Reverse battery supervision and immediate start (by-link) operation is required for terminating calls from step-by-step offices. An MF receiver is attached to this trunk to register incoming MF pulses. All incoming dial pulsed digits are detected at the incoming trunk circuit and recorded in temporary memory for processing by the central control.

3.08 This circuit is switched to a specific state by the 3A processor when the call is local terminating and the called line is idle. Audible ringing tone is provided to the calling customer by the junctor when ringing current is applied to the called customer line. The called line is connected to this trunk through the switching network upon answering. The trunk circuit maintains supervision of the call until disconnect and the circuit is idled.

B. Two-Way E&M Lead Trunk

3.09 This trunk provides the incoming and outgoing trunk circuit functions required for connection to transmission facilities arranged for E&M lead supervision and MF or DP pulsing. This circuit may be used for either local completion or tandem calls in the No. 3 ESS office.

3.10 *Incoming Calls—MF:* An MF receiver is connected to the trunk circuit when seized by a distant office arranged to outpulse MF frequencies. Circuit supervision is maintained at the trunk after all digits are received, the MF receiver has been released and for the duration of the call.

3.11 *Incoming Calls—DP:* A receiver is not required for incoming dial pulsed calls. After seizure from the distant office, the trunk detects and registers the dial pulsed digits which are then stored for processing in the temporary memory of the office program. Supervision is maintained at the trunk circuit during the connect time and to the termination of the call.

3.12 *Outgoing Calls—MF:* An MF transmitter is connected to the trunk, via the network,

for MF outpulsing. Digits are outpulsed under the supervision of the trunk circuit after a check of the interoffice facility is made and upon receipt of a receiver attached signal from the distant office. Distant office call supervision is retained at the trunk circuit at the originating office.

3.13 Outgoing Calls—DP: A dial pulse transmitter is connected to the trunk circuit through the office network for outpulsing digits to noncommon control type offices or to an office arranged to receive dial pulses. Originating office trunk supervision of the calling connection is maintained at the trunk circuit.

3.14 Tandem Operation—E&M: Three signaling configurations are available when using E&M trunks for tandem operation; E&M to E&M, E&M to loop, and loop to E&M.

3.15 Two-way E&M trunks are provided when it is necessary to interface with trunk facilities in the same building such as "N" carrier channel units. E&M type trunks used in No. 3 ESS are arranged for Type II or Type III interface to the carrier facilities. The type interface required is dependent on the transmission facility provided in the office.

3.16 Dial pulse transmitters are not required for DP outpulsing when E&M trunks are provided to interface with interoffice trunking facilities. Digit pulsing is performed by the E&M trunk under control of the office program.

C. Outgoing Reverse Battery High-Low Supervision

3.17 The outgoing trunk provides the functions required at the originating end of an interoffice trunk loop to complete a call to a customer served at another central office location.

3.18 The control unit connects the required type of transmitter (DP or MF) to the trunk circuit. The trunk circuit and the junctor are then placed in a bypass state, connecting the transmitter directly to the outgoing transmission facility. During outpulsing, supervision is maintained at the trunk if an MF transmitter is being used, and at the transmitter if dial pulse is being used. After the digits are outpulsed, supervision of the distant office is transferred to the trunk, and the transmitter is released. The trunk then recognizes an answer,

provides a transmission path for talking, and recognizes a distant end disconnect. The outgoing reverse battery high-low trunk also provides for a remote "make busy" from the incoming office.

D. Direct Interface With T-Carrier

3.19 This feature provides the 3A processor, in No. 3 ESS offices, direct access to T-Carrier Systems using D4 channel units. The D4 channel units are arranged to provide the trunk circuit and channel unit functions required for direct interface capability.

3.20 The T-Carrier direct interface feature is available for all No. 3 ESS offices. This interface arrangement will result in the elimination of most universal trunk circuits required for interoffice switching functions. The following universal trunks may be replaced with this feature:

- Outgoing—Reverse Battery
- Incoming—Reverse Battery/Wink
- Two-Way E&M Lead—Type II and Type III Interface.

3.21 The T-Carrier direct interface operation is similar to the conventional arrangements which require the use of E&M lead signaling and supervision. The direct interface arrangement passes the same information between the switching system and the carrier as the standard trunk circuit using E&M lead signaling.

3.22 The T-Carrier direct interface feature is provided on a per network frame basis. **Only trunk circuits located on network frames may be replaced** with this feature. Universal trunks located on the control frame or miscellaneous frames **will not** be replaced.

3.23 All 24 trunks on a network frame should be used as T-Carrier direct interface trunks. The No. 3 ESS end of the trunks must be identified as using E&M signaling while the distant end may be E&M, loop, etc, as required.

3.24 The channel banks in the No. 3 ESS office may be partially equipped and any mix of direct interface trunk channel units, conventional channel units, and special services channel units is permitted.

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3.25 The universal emergency service number (911) trunk cannot operate through the T-Carrier direct interface arrangements.

3.26 Distant step-by-step outgoing trunk circuits or pulsing channel units require an outpulsing modification when terminating on a No. 3 ESS T-Carrier direct interface facility.

LINE CIRCUITS

3.27 No. 3 ESS line circuits are provided on a per line basis. These line circuits are required to interface customer lines with the switching system for various distribution and sleeve lead functions. Line circuits are mounted on the miscellaneous frame or toll equipment frame, as required. The following line circuits are located on the miscellaneous frame.

A. Noise Immunity Line Circuit—Ground Start

3.28 This circuit is provided on a per line basis and is used to eliminate false service requests caused by externally induced voltages on ground start customer lines. When this circuit is required, it is installed between the customer line and the associated line ferrod.

B. Dial-Tone-First Coin Line Circuit

3.29 The dial-tone-first coin line circuit and associated office program instructions provide dial tone when an assigned coin station goes off-hook. This feature permits customers to dial certain calls without an initial coin deposit. These include operator assisted calls (0, 0+) directory assistance calls (411), and emergency service bureau calls (911). These calls may be allowed to complete without a deposit while all other calls are blocked until a deposit is made. Modification of coin stations is required when they are assigned to lines equipped with this feature.

C. Autoconnect Line Circuit

3.30 This is an auxiliary line circuit provided in No. 3 ESS to automatically access a teletypewriter location whenever a dedicated facility is not provided. The **autoconnect** arrangement will automatically dial a designated administration teletypewriter at a predetermined time and print the office traffic data stored on magnetic tape.

COMMON SYSTEMS CIRCUITS

3.31 Common systems trunk circuits are provided in No. 3 ESS offices for special services and emergency functions. Common system units are not located or mounted on frames in the ESS area. When provided, these units are mounted in the toll facilities area. The following is a brief description of these trunks and their application and use by the No. 3 ESS. The common system features covered here are associated with designated lines in the office. These circuits are not covered on the trunk worksheets.

A. Emergency Manual Line Circuit

3.32 This circuit provides manual service to an operator switchboard for designated lines when a service affecting failure occurs in the No. 3 ESS. A direct connection is established by the operation of a transfer key at the switchboard location. Once this connection is made, all ESS functions are bypassed until the transfer key is restored to normal.

B. Public Emergency Reporting Line Circuit

3.33 The public emergency line circuit is used for completing calls from the No. 3 ESS office to the public emergency reporting circuit. This circuit may also be used for fire reporting and other alarms and will serve up to 10 connections simultaneously.

C. Group Alerting Line Circuits

3.34 The Group Alerting system provides the means for signaling one or more customer groups of lines, simultaneously, for oral or recorded announcements.

D. Emergency Line Circuits

3.35 This circuit permits a distant operator to interrupt existing telephone conversations to an emergency line (police, fire, etc) to complete an emergency call.

APPLIQUE CIRCUITS

3.36 Two applique circuits, remote scanner and distribute point, are provided in No. 3 ESS offices. The following is a description of each of these circuits.

A. Remote Master Scanner Applique Circuit

3.37 This circuit provides a means to connect miscellaneous circuits outside the central office to the master scanner or universal scanner to convert relay operations from connecting circuits into current (battery and ground) suitable for ferrod sensor operations. Connecting circuits may be outside or within central office. In addition, this circuit provides lightning protection and a balanced loop for each circuit.

B. Distribute Point Applique Circuit

3.38 The purpose of this circuit is to provide facilities for operating relays, message registers, and lamps locally or at remote locations; ie, hotel, motel, and PBX. The distribute point applique circuit is under the control of a peripheral decoder point.

TEST CIRCUITS

3.39 The test circuits used in No. 3 ESS are described in the following paragraphs. All test circuits are mounted in the test frame except those which are part of the vertical test unit located in the control frame. All manual test circuits are located on the test frame.

3.40 The peripheral test circuit is made up of the test circuits located in the test frame. Under call processing software control, the peripheral test circuit verifies the condition of the following peripheral circuits:

- Trunk circuits
- Junctor circuits
- Service circuits
- Network fabric.

A. Continuity and Polarity Test Circuit

3.41 This circuit is used for testing continuity and reverse battery supervision on MF and DP transmitters. It is also used to check supervisory elements for off-hook and on-hook supervision, particularly junctors and incoming trunk circuits.

B. Automatic Line Insulation Test Circuit

3.42 The line insulation test circuit provides automatic testing for shorts and crosses on subscriber lines. This circuit will also detect foreign battery on the line.

C. Station Ringer Test Circuit

3.43 This circuit provides a station installer with the capability to make "on premise" station tests of a customer's service. It also allows access to the local test desk for testing by the customer under local test desk direction and monitoring.

D. Transmission Test Termination Circuit

3.44 This test circuit provides two independent test terminations for testing trunk circuits and customer lines via the switching network. Testing procedures identify opens or shuts.

E. Milliwatt and Transmission Environment Test Circuit

3.45 This circuit provides the facilities for two testing functions:

- (1) Produces a milliwatt (MW) tone for testing circuit loss on trunk circuit to and from other offices.
- (2) Generates MF test signals for extreme conditions to assure that MF receivers and transmitters which perform satisfactorily under test will also perform adequately in actual service use.

F. Dial Pulse Receiver Test Circuit

3.46 This circuit is used to test customer dial pulse receivers, simulating varying pulsing intervals and loop conditions.

G. TOUCH-TONE® Receiver (Detector) Test Circuit

3.47 This test circuit produces the tones required to perform functional tests on the tone detector circuits of the TOUCH-TONE receivers. A group of test signals are applied to any TOUCH-TONE receiver via the office network. With the application of a test signal, an observation of the detector output will indicate whether the

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receiver circuit is operational or will detect and indicate a trouble location.

H. Tone Presence Detector

3.48 The purpose of this circuit is to monitor the tone of recorded announcement circuits, verify the return of busy or overflow tone from a distant office, or test the continuity through the network.

I. Loop Environment Test Circuit

3.49 This test circuit provides the terminations required for making tests on regular or superimposed ringing circuits, coin control circuits, false cross and ground tests and the power cross test circuit.

J. Trunk and Line Test Panel and Circuitry

3.50 The trunk and line test panel and associated circuits provide facilities for manually testing all trunk circuits, junctors, lines, and service circuits in the No. 3 ESS office.

K. Local Test Desk Trunk Circuit

3.51 This trunk circuit is located on the test frame and provides the means for establishing a test path from a local test desk (LTD) to a customer line through the No. 3 ESS network.

SCANNERS

A. General

3.52 The No. 3 ESS scanner consists of *one* scanner controller and a maximum of *eight* ferrod arrays. One ferrod array contains 512 ferrod sensors. Each ferrod sensor represents an individual scan point used to monitor subscriber lines, check the status of a talking path, and check test points and miscellaneous points.

3.53 The main section of each scanner is the ferrods, which are wired to each point to be scanned and supervised, and the scanner controller is required to interface each scan point ferrod with the 3A processor central control. Each scan point is interrogated, on a programmed basis, during each base level loop of the central control. After each scan, the status of each point is recorded in memory for future reference and use.

3.54 An office is equipped with two types of scanners: universal scanners and a master scanner. The universal scanners provide for monitoring all customer line scan points, junctor scan points, and selected trunk and service circuits scan points. The master scanner is required for trunks and service circuits with more than one scan point for supervisory, test, and alarm scan points.

B. Scanner Fields

3.55 The No. 3 ESS has dedicated scanner fields. The traffic engineer is required to verify that the equipment provided will not exhaust the capacities of the following five scanner fields designated receiver supervisory (RS), ringing circuit supervisory (RCS), service supervisory (SS), directed/trunk (D/T), and directed (D). Detailed scanner engineering will be done by Western Electric.

3.56 The following is a brief description of each scanner field to be verified.

(a) **RS Field:** This field provides the supervisory and signal present scan points for the MF receivers and customer dial pulse receivers and the signal present scan points for the TOUCH-TONE receivers.

(b) **RCS Field:** This field provides ferrods for the supervisory scan points of the ringing circuits, both regular or superimposed.

(c) **SS Field:** This field provides ferrods for the first scan point of the other service circuits (nonreceiver and nonringing circuits). The ferrods in this field normally perform a supervisory function.

(d) **D/T Field:** This field provides ferrods for trunks, MF receivers, and TOUCH-TONE receivers. It also is used for circuits that cannot be assigned to the "D" field because of the limitation of size of that field.

(e) **D Field:** This field provides ferrods for nonsupervisory or nonsignal present scan points of certain service circuits. It also provides ferrods for key scan points required for remote-make-busy indications for PBX lines and multiline hunt groups. Functions for this field can overflow to the D/T field.

3.57 In addition to the above five scanner fields, the No. 3 ESS scanners contain three additional scanner fields. These fields each contain fixed assignments and do not require verification by the traffic engineer. The following is a brief description of each of these three fields.

(a) **Line (L) Field:** This field contains ferros used to detect line originations. There are 384 ferros on each line scanner reserved for this field. This would permit the assignment of a line to every terminal on the network frame.

(b) **Junctor (J) Field:** This field contains the ferros used by the junctor circuits for supervising lines after originations. There are 64 ferros assigned to this field on each line scanner, two scan points per junctor circuit, allowing the junctor to maintain supervision in both directions on intraoffice calls.

(c) **Miscellaneous (M) Field:** This field provides ferros for monitoring the system status of the No. 3 ESS equipment, test circuits, office and building alarms, and miscellaneous alarms.

3.58 Each of the scanner fields has a dedicated location on each scanner. Master scanner field locations are shown on Fig. 2. The assignment fields on the universal scanners are identified on Fig. 3.

4. DETERMINATION OF QUANTITIES

GENERAL

4.01 This part covers the determination of quantities and the methods used for completing the “**B. Trunks**” and “**E. Scanner Field Verification**” portions of the No. 3 ESS Network Switching Engineering Worksheets. These worksheets are included in Sections 233-060-825 and 233-060-865, respectively. Sample calculations, shown on the attached worksheets, are hypothetical data for the example office *Ruraltown*.

TRUNKS

A. General

4.02 The quantity of interoffice trunk circuits provided by the traffic engineer is based on

a trunk forecast prepared by the trunk engineer. The type of trunk, the numbers of trunks and trunk groups, and any scheduled operational or routing changes for the engineering period are included in this forecast. Spare trunks for administration and maintenance are provided in accordance with company policy.

4.03 Service circuit quantities, included on the worksheets, are determined by the traffic engineer in accordance with the information furnished in Section 233-060-210, Service Circuits. Data used on the attached worksheets are taken directly from the service circuit worksheet summaries.

4.04 The “B. Trunks” portion of the Network Switching Engineering Worksheets is divided into the following four parts: B1.0 Network Terminations Required—Cutover (Fig. 4); B2.0 Service Circuits—EOP/Growth (Fig. 5); B3.0 Universal Trunks—EOP/Growth (Fig. 6) and B4.0 Line and Miscellaneous Circuits—EOP/Growth (Fig. 7).

B. Network Terminations Required—Cutover

4.05 The service circuits, universal trunks, and miscellaneous terminations required at cutover for the No. 3 ESS are listed in Fig. 4. This worksheet is used only for **initial office engineering**. It is used to determine the initial number of networks required based on terminations. (See Section 233-060-310).

4.06 On this worksheet, multiply the number of circuits required at cutover by the network terminations per circuit to determine the total network terminations required for that circuit. The network terminations are then summed for service circuits, universal trunks, and miscellaneous circuits.

C. Service Circuits—EOP/Growth

4.07 The service circuits that are available for use in the No. 3 ESS are listed in Fig. 5. They are identified by the schematic drawing (SD) number of the unit in which they are mounted.

4.08 The following steps outline the procedure for completing the service circuit portion (B2.0) of the Trunk Network Switching Engineering Worksheets.

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(a) Enter the quantity of service circuits provided for EOP/Growth in column D. These quantities are determined on the "A. Service Circuit" Worksheets.

(b) Multiply the number of circuits provided (column D) by the number of network terminations per circuit (column E) to determine the number of network terminations required for service circuits (column F).

(c) To determine the number of units required to mount the circuits provided, divide (column D) by the circuits per unit (column G). Round the units required to the next higher integer for each type unit. The customer digit receivers and regular ringing circuits mount in the same unit. This unit is included on every network frame; therefore, the number of units required (column H) must equal the number of network frames provided.

(d) Multiply the quantity of units required (column H) by the scan points required per unit (column I) to determine the number of scan points required in a scan point field (column J). With more than one number in column I, the product of the first number is entered in the first blank in column J; the product of the second number is entered in the second blank space. The scan points determined are based on **full units**, even though there may be vacant slots in the unit. With all scan points assigned on a unit, a service circuit may be installed during the forecast period without a Western Electric job where there is a vacant slot.

(e) Summarize the circuits provided, network terminations required, and associated scan points.

D. Universal Trunks—EOP/Growth

4.09 All the universal trunk circuits designed for No. 3 ESS offices are shown on Network Switching Engineering Worksheet "B. Universal Trunks" (Fig. 6). All trunk circuits indicated mount on the same hardware unit except the direct interface trunk arrangement.

4.10 The procedures for completing this worksheet are described as follows:

(a) Determine the quantity, including spare, of each type universal trunk from the latest office trunk forecast and enter in column D.

(b) Multiply the circuits provided (column D) by the network terminations per circuit (column E) to determine the network terminations required (column F).

(c) Summarize, by column, the circuits provided and the network terminations required. Divide the **total** circuits provided (column D) by 24 (circuits per unit) to determine the units required (column H) and round to the next higher integer. Installed universal trunk units should be less than or equal to the number of network frames installed.

(d) Multiply the **total** units required (column H) by scan points per unit (column I) to determine the total scan points required (column J).

(e) Direct interface D4 channel units require one network termination and one scan point per unit. These units should be entered on the worksheet in the same manner as the universal trunks.

E. Miscellaneous Line and Test Circuits—EOP/Growth

4.11 All miscellaneous line and test circuits utilized in No. 3 ESS offices are include on Worksheet "B. Miscellaneous Line and Test Circuits" (Fig. 7). All test circuits in the peripheral circuit test unit, located on the test frame, are fixed quantities or limited as indicated.

4.12 The remote master scanner applique circuit is shown twice on this worksheet. Scan points for scanner applique circuits required for alarms are fixed and do not require identification by the traffic engineer. Scanner applique circuits provided for remote functions, ie: PBX and multiline make busy require scan point determination by the traffic engineer. The following outlines the procedures used in completing this worksheet: (B. Trunks 4.0).

(a) Enter the quantities of all circuits provided in column D. Test circuits associated with the peripheral test circuit unit are provided as

shown. Determination of local test desk trunks and autoconnect circuits are made by the equipment engineer.

(b) Divide the circuits provided (column D) by the circuits per unit (column G) to determine the units required. ***It is recommended that these line and miscellaneous circuits be provided in full unit quantities.***

(c) Multiply the units required (column H) by the scan points per unit (column I) to determine the scan points required (column J). Summarize both network terminals and scan points required.

SCAN POINT FIELD VERIFICATION

4.13 Identification and requirements for variable scan points and scan point assignments are covered in this portion. The following information is for the variable scan points determined on the "B. Trunk" Worksheets and does not include dedicated scan points for the master scanner or universal scanner.

4.14 The "F. Scan Point Field Verification" Worksheet (Fig. 8), provides the traffic engineer with the methods of determining the scan points required in each scanner field. It also indicates the number of scan points available in each field for these variable assignments. By comparing the scan point requirements to those available, the traffic engineer can determine if there are adequate scan points available in each field. If scan points for a particular field are not available, steps must be taken to reduce the scan point requirements, ie, reduce the number of circuits requiring those particular scan points, etc.

A. Directed Field (D)

4.15 Service circuit scan points are assigned in the (D) directed scan point field of the master scanner or universal scanner. Except for the directed scan points for regular ringing circuits mounted on network frames, service circuits are assigned scan points by wiring from the unit to the scanner. Scan points should be assigned for every circuit position in a service circuit unit whether the circuit is equipped or not. When required, additional D scan points may be assigned in the D/T scan point field.

4.16 The total D scan points to be assigned (Item F1.0d) is determined by subtracting the dedicated D scan points for MF transmitters and regular ringing circuits from the total required. The dedicated scan points for MF transmitters are for the MF transmitter unit which mounts only on control frame 0. The dedicated scan points for ringing circuits, regular or superimposed, are also subtracted to determine the number of assignable D scan points. If the total D scan points to be assigned (Item F1.0d) are greater than the 36 assignable D scan points (Item F1.0e), then the remainder will be assigned in the D/T scan point field.

B. Directed/Trunk Field (D/T)

4.17 The D/T scan point field provides scan points for trunk circuits, key scan points required for remote make busy indications on PBX and multiline groups and for service circuit scan points which cannot be assigned in the D field.

4.18 The calculations for the D/T scan field are divided into two parts: D/T Assignable Scan Points (Item F2.1); and D/T Scan Points Required (Item F2.2).

4.19 ***Item F2.1, D/T Assignable Scan Points:*** This field consists of dedicated scan points on both the master scanner and universal scanners. Thirty-two scan points on the master scanner and 37 scan points on each universal scanner are dedicated to the D/T field.

4.20 ***Item F2.2 D/T Scan Points Required:*** Compute the difference for required universal trunk scan points and scan points installed for universal trunks. Add to the results of this subtraction the D/T scan point requirements for Direct Interface D4 channel units, TOUCH-TONE and MF receivers, and the D scan points to be assigned in the D/T field.

4.21 If the number of D/T scan points to be assigned is greater than the total scan points available for assignment, the scan point requirements for the D/T field must be reduced. This is done by either reducing the number of circuits requiring D/T or D scan points or reducing the number of scan point leads. The scan point leads may be reduced by wiring only the scan points for circuits provided rather than the entire unit. This applies only to the optional units provided on the control

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frames, or units on the miscellaneous frame. As a last resort, an additional network frame, which includes a universal scanner, could be added.

C. Receiver Supervisory Field (RS)

4.22 This field provides supervisory and signal present scan points for MF receivers, supervisory scan points for customer dial pulse receivers, and signal present scan points for TOUCH-TONE receivers. A total of 96 scan points are available in the RS field. A maximum of 24 scan points are reserved for fixed MF receiver assignments. Two scan points are required for peripheral test units. The remaining 70 scan points are distributed as shown on the scanner worksheet.

D. Service Supervisory Field (SS)

4.23 Forty SS scan points are available for assignment to MF and DP transmitters and added custom engineered coin control circuits. One MF transmitter unit mounted on control frame 0 is always provided. The unit scan points (4) are assigned on a fixed basis in the SS field and are not included in the calculation for assignable scan points.

E. Ringing Circuit Supervisory Field (RCS)

4.24 There are 58 assignable RCS scan points for regular ringing or superimposed ringing circuits. If the total number of RCS scan points to be assigned (Item 5.0d) is greater than 58, regular ringing circuits or superimposed ringing circuits must be reduced.

CIRCUIT FUNCTION DIGIT

TABLE A

FUNCTION	DIGIT 1
Outgoing Trunk Circuits	0
Incoming Trunk Circuits	1
OGT To An Operator SWBD	2
Inc Trk From An Operator SWB	3
Two-Way Trk To An Operator SWB	4
Two-Way Trunk Circuits	5
Service Circuits	6
Test and Maintenance Circuit	7
Miscellaneous Circuits	8
Unassigned	9

CIRCUIT IDENTIFICATION

TABLE B

TITLE OF CIRCUIT	SD NO.	DIGITS 2 & 3
Dial Tone First Coin Line	3H205-01	00
Noise Immunity Line	3H208-01	01
Universal Trunk	3H220-01	02
TOUCH-TONE® Calling Detector	3H401-01	03
MF Receiver	3H402-01	04
Dial Pulse Transmitter	3H403-01	05
MF Transmitter	3H404-01	05
Superimposed Ringing	3H406-01	07
Customer Dial Pulse Receiver & Regular Ring	3H410-01	08
Coin Control, Tone and Recorded Announcement, Remote Recording Circuit, and Conference Circuit	3H411-01	09
Trunk and Line Test Circuit	3H520-01	10
Distribute Point Applique Circuit	3H911-01	11
Remote Master Scanner Applique Circuit	1A210-01	12
No. 3 ESS Channel Unit	3C328-01	13

Fig. 1—Trunk Order Code Description (Sheet 1 of 2)

FEATURE OR OPTION

TABLE C

FEATURE OR OPTION	DIGITS 4 & 5
Standard Configuration	00
Reverse Battery Supervision	01
Reverse Battery Supervision, MF Signaling, Delay Dial	02
Reverse Battery Supervision, Wink Start, DP or MF Pulsing	03
E&M Lead Supervision - Type II Signaling	04
E&M Lead Supervision - Type III Signaling	05
Reverse Battery - HILO Supervision	06
Regular Ring	07
Customer Dial Pulse Receiver - Used Without TOUCH TONE Detector	08
- Used With TOUCH TONE Detector	09
Tone and Recorded Announcement	10
Coin Control	11
Remote Recording	12
3-Port Conference	13
Loop Start	14
Ground Start	15
Continuity and Polarity Test	16
Dial Pulse Receiver Test	17
Transmission Test Termination	18
Milliwatt and Transmission Environment Test	19
Loop Environment Test	20
Tone Presence Detector Test	21
Station Ringer Test	22
Line Insulation Test	23
TOUCH-TONE Receiver Test	24
Incoming Local Test Desk Trunk	25
TTY Line Circuit	26
Direct Interface With E&M Type Signaling	27
Office To Office Test Trunk	28

Fig. 1—Trunk Order Code Description (Sheet 2 of 2)

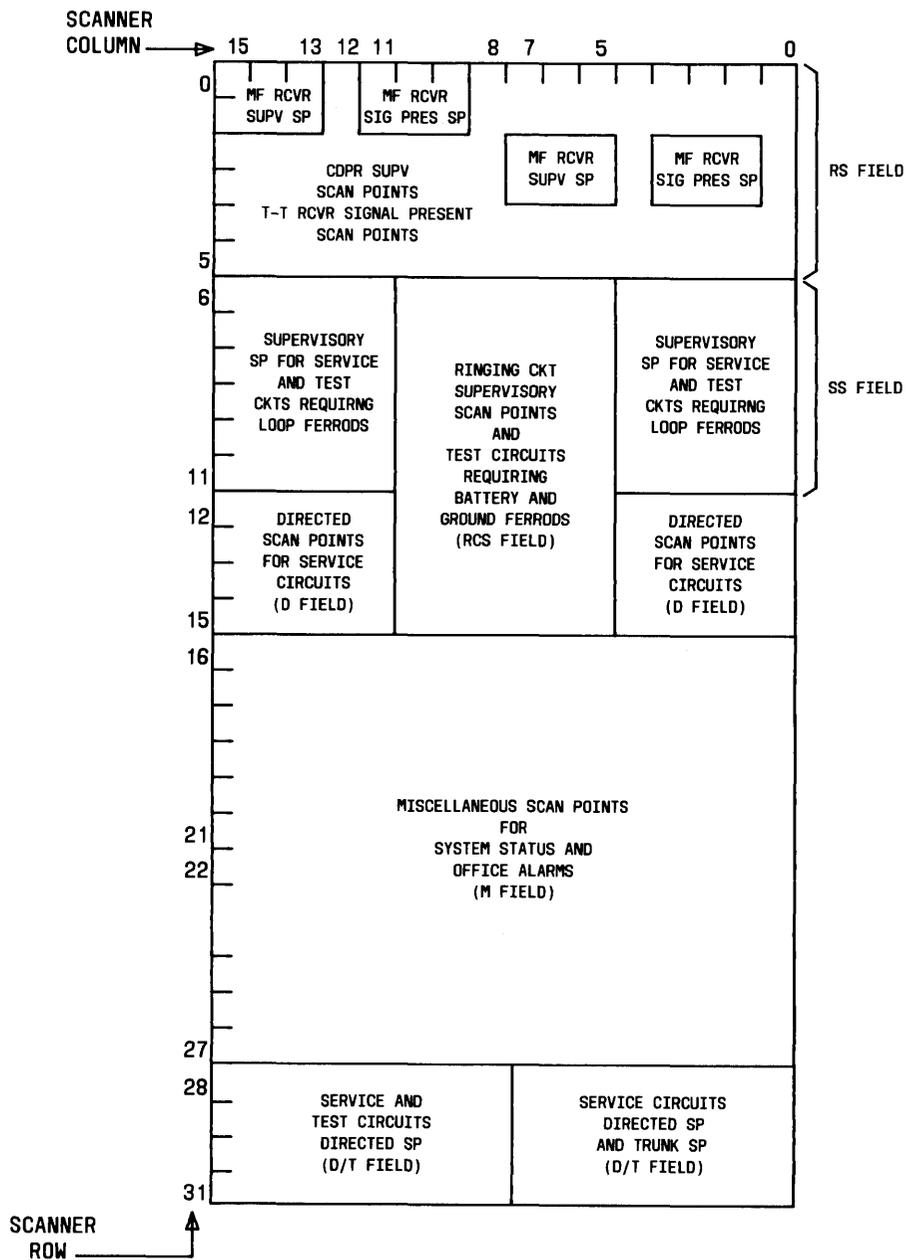


Fig. 2—Master Scanner Assignments

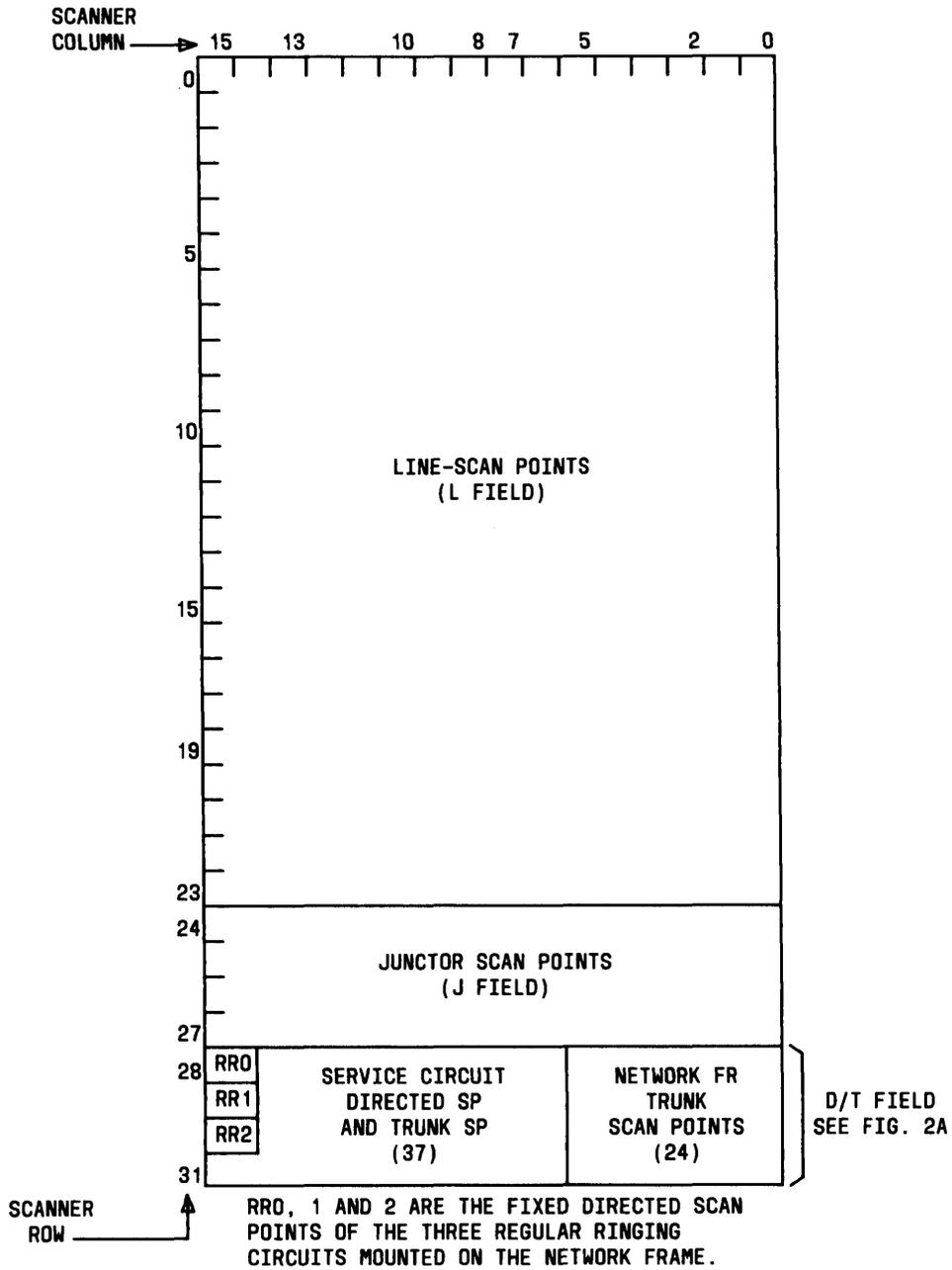


Fig. 3—Universal Scanner Assignments

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B. TRUNKS

1.0 Network Termination Required - Cutover

CIRCUIT	UNIT SD.	CKTS PROVIDED	NET TERM/ CKT	NET TERM REQD
Customer Digit Receiver	3H410	21	1	21
Regular Ringing	3H410	16	1	16
Interoffice Transmitter - MF	3H404	6	1	6
Interoffice Transmitter - DP	3H403	9	1	9
Interoffice Receiver - MF	3H402	6	1	6
TOUCH-TONE Receiver	3H401	6	0	0
Superimposed Ringing	3H406	7	1	7
Tone and Announcement	3H411	40	1	40
Remote Recording of Announcement (max 1)	3H411	1	1	1
Coin Control Circuit (max 8)	3H411	4	1	4
Conference Circuit	3H411	4	3	4
TOTAL SERVICE CIRCUIT TERMINATIONS		120		114
Two-Way E&M Lead	3H220	-	1	-
Incoming Reverse Battery (Delay Dial)	3H220	-	1	-
Incoming Reverse Battery (Wink or Immediate Bylink)	3H220	27	1	27
Two-Way E&M Lead with Type 2 Interface	3H220	-	1	-
Two-Way E&M Lead with Type 3 Interface	3H220	17	1	17
Outgoing Reverse Battery High-Low	3H220	43	1	43
Direct Interface D4 Channel Unit	3C328	48	1	48
TOTAL UNIVERSAL TRUNK TERMINATIONS		135		135
Peripheral Test Circuit Unit	3H520	10		14
Incoming LTD (max 2)	3H520	2	1	2
TTY Line Circuit (Autoconnect) (max 4)	3H520	4	1	4
TOTAL MISCELLANEOUS TERMINATIONS		16		20

Fig. 4 - Network Termination-Cutover



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B. TRUNKS

2.0 Service Circuits – EOP/Growth

A SERVICE CIRCUITS	B ORDER CODE	C UNIT SD	D CKTS PROVIDED	E NET TERM/ CKT	F NET TERM REQD	G CKTS/ UNIT	H UNITS REQD	I SCAN PTS/ UNIT	J SCAN POINT FIELDS				
									H X I				
									D	D/T	RS	SS	RCS
Custom Digit Receiver		3H410	21	1	21	4	6*	4			24		
Regular Ringing		3H410	16	1	16	3	6*	3-3	18				18
Interoffice Transmitter – MF		3H404	6	1	6	4	2	8-4	16			8	
Interoffice Transmitter – DP		3H403	9	1	9	12	1	12-12	12			12	
Interoffice Receiver – MF		3H402	6	1	6	1	6	6		36			
TOUCH TONE Receiver		3H401	6	0	-	2	3	16-2		48	6		
Superimposed Ringing		3H406	7	1	7	6	2	6-6	12				12
Combination Unit		3H411					†						
Tone and Announcement		3H411	40	1	40								
Remote Recording of Announcement (max 1)		3H411	1	1	1								
Coin Control (max 8) (See Note)		3H411	4	1	4								-
Conference Circuit		3H411	4	3	12								
TOTAL SERVICE CIRCUITS			120		122				58	84	30	20	30

Note: Four additional coin control circuits mounted on the miscellaneous frame may be provided on a custom engineered basis. Indicate service supervisory scan points for added circuits only.

* CDR/RR unit – provide units based on the larger of the CDR and RR units required – whichever is larger.

† Units required for combination tone and announcement, remote recording of announcement, coin control and conference circuits – SD-3H411.

CIRCUIT	CIRCUITS PROVIDED	CKTS. CKT. PACK		CIRCUIT PACKS REQD
Tone and Announcement	40	2		20
Remote Recording	1	1	+	1
Coin Control	4	1	+	4
Conference	4	1	+	4
Total			=	29

(Only coin control circuits can mount in these slots.)

÷ 12 = (2.4) 3 units reqd

Fig. 5—Service Circuits-EOP/Growth

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B. TRUNKS
3.0 Universal Trunks – EOP/Growth

A	B	C	D	E	F	G	H	I	J					
					D X E		D ÷ G		H X I					
UNIVERSAL TRUNKS	ORDER CODE	UNIT SD	CKTS PROVIDED	NET TERM/ CKT	NET TERM REQD	CKTS/ UNIT	UNITS REQD	SCAN PTS/ UNIT	SCAN POINT FIELDS					
									D	D/T	RS	SS	RCS	
Two-Way E&M Lead		3H220	-	1	-									
Incoming Reverse Battery (Delay Dial)		3H220	-	1	-									
Incoming Reverse Battery (Wink or Immediate-Bylink)		3H220	47	1	47									
Two-Way E&M Lead With Type 2 Interface		3H220	-	1	-									
Two-Way E&M Lead With Type 3 Interface		3H220	18	1	18									
Outgoing Reverse Battery High-Low		3H220	67	1	67									
TOTAL UNIVERSAL TRUNKS			132		132	24	+ 6	24		144				
Direct Interface D4 Channel Unit		3C328	48	1	48			48*		48				
TOTAL TRUNKS			180		180			192		192				

* Direct interface circuit requires one scan point per channel unit.

† Units must be ≥ number of networks provided.

Fig. 6—Universal Trunks-EOP/Growth

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B. TRUNKS

4.0 Line and Miscellaneous Circuits – EOP/Growth

A LINE AND MISCELLANEOUS CKTS	B ORDER CODE	C SD	D CKTS PROVIDED	E NET TERM/ CKT	F NET TERM REQD	G CKTS/ UNIT	H UNITS REQD	I SCAN PTS/ UNIT	J SCAN POINT FIELDS					
									H X I					
									D	D/T	RS	SS	RCS	
Noise Immunity Line Ckt – Ground Start		3H208	36	0	0	16	3							
Dial Tone First Coin Line Ckt		3H205	26	0	0	16	2							
Distribute Point Applique		3H911	32	0	0	4	8							
Remote Master Scanner Applique – Alarms		1A210	10	0	0	8	2							
Remote Master Scanner Applique – Nonalarms		1A210	30	0	0	8	4	8	32					
Peripheral Test Ckt Unit*		3H520												
Continuity and Polarity Test		3H520	1	1	1									
Dial Pulse Receiver – Test		3H520	1	1	1									
Transmission Test Termination		3H520	1	1	1									
MW and Transmission Environment Test		3H520	1	2	2									
Loop Environment Test		3H520	1	1	1									
Trunk and Line Test Panel		3H520	1	3	3									
TPD Amplifier and Timer		3H520	1	1	1									
Station Ringer Test		3H520	1	2	2									
Line Insulation Test		3H520	1	1	1									
TOUCH-TONE Receiver Test		3H520	1	1	1									
Incoming LTD (max 2)		3H520	2	1	2									
TTY Line Ckt (Autoconnect) (max 4)		3H520	4	1	4									
TOTAL					20				32					

* The peripheral test circuit unit, SD-3H520 is mounted on the test frame.

Fig. 7— Miscellaneous Line and Test Circuits—EOP/Growth

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F. SCAN POINT FIELD VERIFICATION (Variable Scan Points)

1.0 Directed Field (D)

- | | |
|---|--------|
| a. Total D scan points required (B2.0 and B4.0) | 90 |
| b. Less dedicated D scan points for MF transmitters located on CF 0 | - 8 |
| c. Less dedicated D scan points for regular or superimposed ringing
(RR = No. of units <u>8</u> × 3) | = 24 |
| d. Total D scan points to be assigned (F1.0a-F1.0b-F1.0c) | = 68 |
| e. Assignable D scan points | - 36 |
| f. D scan points to be assigned to D/T field | = 32 * |

2.0 Directed/Trunk Field (D/T)

2.1 Directed/Trunk Field (D/T) -- Assignable Scan Points

- | | |
|--|-------|
| a. Master scanner D/T scan points | 40 |
| b. Universal scanner D/T scan points
(No. of Non-D4 networks <u>6</u> × 37) | + 222 |
| (D4 networks <u>2</u> × 13) | + 26 |
| c. Total assignable D/T scan points | = 288 |

2.2 D/T Scan Points Required

- | | |
|---|---------|
| a. D/T scan points required for universal trunks (B3.0) | 132 |
| b. Network frames for universal trunks (Total - NF for D4) ‡ <u>6</u> | - |
| c. Installed universal trunk D/T scan points
(F2.2b <u>6</u> × 24) | - 144 |
| d. Additional universal trunk D/T scan points required | = 0 * |
| e. D/T scan points required for TOUCH-TONE receivers (B2.0) | + 48 |
| f. D/T scan points required for MF receivers (B2.0) | + 36 |
| g. D/T scan points required for PBX keys (3E3 generic) | + - |
| h. D scan points to be assigned in D/T field (F1.0f) | + 32 |
| i. D/T scan points to be assigned (F2.2c to F2.2h) | = 116 † |

* If ≤ 0 enter 0.

† If F2.2i > F2.1c, the D/T scan point requirements must be reduced. This is accomplished by either reducing the number of circuits requiring D/T or D scan points or reducing the number of scan point leads. The scan point leads may be reduced by having only the scan points wired for the circuits being provided rather than the entire unit. This applies only to the optional units provided on the control frame or units on the miscellaneous frame. As a last resort, an additional network frame may be provided for universal scan points.

‡ Network frames for D4 include scan point requirements.

Fig. 8—Scan Point Field Verification (Sheet 1 of 2)

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F. SCANNER FIELD VERIFICATION (Variable Scan Points)

3.0 Receiver Supervisory Field (RS)

a. Total assignable RS scan points		<u>70</u>
b. RS scan points required for CDRs (B2.0)		<u>24</u>
c. RS scan points required for TOUCH-TONE receivers (B2.0) (Max. 34)	+	<u>6</u>
d. Total RS scan points to be assigned (F3.0b + F3.0c)	=	<u>30</u> *

4.0 Service Supervisory Field (SS)

a. Total assignable SS scan points		<u>40</u>
b. MF transmitter SS scan points required (B2.0)		<u>8</u>
(Assignable MF transmitter units <u>2</u> · 4)	=	<u>8</u>
c. SS scan points required for DP transmitters (B2.0)	+	<u>12</u>
d. SS scan points required for added coin control circuits (B2.0)	+	<u>-</u>
e. Total SS scan points to be assigned (F4.0b + F4.0c + F4.0d)	=	<u>20</u> †

5.0 Ringing Circuit Supervisory Field (RCS)

a. Total assignable RCS scan points		<u>58</u>
b. RCS scan points required for regular ringing (B2.0)		<u>18</u>
c. RCS scan points required for superimposed ringing (B2.0)	+	<u>12</u>
d. Total RCS scan points to be assigned (F5.0b + F5.0c)	=	<u>30</u> ‡

* If F3.0d > F3.0a, then use CDR requirement A1.7C in F3.0b. If F3.0d is still > 70, then CDR and/or TT receiver circuits must be reduced.

† If F4.0e > F4.0a, circuits requiring SS scan points must be reduced.

‡ If F5.0d > F5.0a, circuits requiring RCS scan points must be reduced.

Fig. 8—Scan Point Field Verification (Sheet 2 of 2)