

SYSTEM CENTURY®
DIGITAL CENTRAL OFFICE

GLOSSARY OF FEATURES

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1.	INTRODUCTION	
1.01	This section provides a glossary of the various features that can be provided in a SYSTEM CENTURY [®] Digital Central Office (DCO) switching system. A brief description is given for each of these features to better understand the capabilities of the system.	
1.02	This section is reissued to remove information previously contained in paragraph 2.02 and to add paragraph 4, International Features.	
2.	RELATED INFORMATION	
2.01	A Sales and Instructional Literature Index of the latest available publications can be obtained from your Stromberg-Carlson sales representative or from Publications Services, Stromberg-Carlson Corporation, P.O. Box 1698, Sanford, Florida 32771.	
3.	SYSTEM FEATURES	
3.01	General.	
	The features described in this section are pre- sented in alphabetical order, regardless of their standard or optional status. Meanings of abbreviations and mne- monics used throughout the descriptions are listed at the end of this section. A six-digit code has been assigned to each feature. The first of the six digits indicates the soft- ware generic package required to implement the feature. Digit 0 indicates base generic, digit 1 indicates generic package 1, and digit 2 indicates generic package 2. The last of the six digits indicates the standard/optional sta- tus of the feature. Digit 0 indicates a standard feature, digit 8 indicates that part of the feature is standard with extra units optional, and digit 9 indicates an optional feature with additional charge.	
3.02	Abbreviated Dialing.	
a.	Abbreviated Dialing – Eight Codes (101949). Abbreviated dialing, or speed calling, is made available to any single-party subscriber to make local	

or toll calls by dialing a single-digit address code. (2 through 8). This is made possible by storing eight frequently called numbers in memory. To enter a number into memory, the telephone user dials a write-in code followed, sequentially, by an address code and the normally dialed destination number. (The user receives confirmation tone indicating storage of the number.) To make an abbreviated dialing call, the telephone user dials the address code associated with the stored number. When no additional digits are received within approximately three seconds, or immediately if the button marked with a number or pound symbol (#) is keyed from a TONE-DIAL® telephone, the stored number is read from memory and the call is processed.

b. Abbreviated Dialing – 30 Codes (101979).

Similar to abbreviated dialing for 8 codes, except that 30 two-digit address codes (20 through 49) are used to enter 30 numbers, each of which can be read from memory and processed by dialing its associated access code.

3.03 Alarms and Fault Printout (053110).

This feature provides both audible and visual alarm indicators at the maintenance panel and fault printout messages at the designated terminal(s).

a. Alarms Classification.

Alarms and their respective indications, centralized on the maintenance panel, are classified in accordance with their effect on the system. Presently, two schemes are available: Version 1, which meets the requirements of REA specification 522; and Version 2, which offers an extended classification scheme. Both classifications are detailed on the following page.

1. In each version, a distinctive audible alarm is provided for each classification.
2. The audible alarms are accompanied by visual indications in the form of lamps or light emitting diodes (LEDs), located throughout the system on printed wiring boards and panels.

b. Fault Printouts.

Diagnostic error messages that are automatically printed at the designated local and/or remote terminal, are initiated by hardware or software faults. The

diagnostic message may be accompanied by an office alarm, depending on the type of fault.

3.04 Alarm Sending and Checking.

Alarm indications are sent to an operators position, a managers alarm box, or a 7- or 10-digit number. On receipt of the alarm indication, an alarm checking number must be dialed to obtain specific information on the alarm.

a. Alarm Sending.

1. Alarm Sending via Operator Trunk (053700).

Fault indications are forwarded via the regular operator trunk group. When a fault occurs, an operator trunk is seized and a request for service generated. On answer, the operator receives a distinctive tone indicating that the alarm checking number should be dialed.

2. Alarm Sending via Dedicated Trunk (053710).

Similar to alarm sending via operator trunk except that a trunk is dedicated to alarm sending. This trunk may be one-way outgoing only or two-way with the incoming route being used for busy verification.

3. Alarm Sending to Managers Alarm Box (053730).

A spare dial leg(s) is used to send battery or ground to a managers alarm box to operate a relay, light a lamp, or do some similar function.

4. Alarm Sending to 7- or 10-Digit Number (053740).

- a) The DCO switching system is programed to send a recorded announcement to a 7- or 10-digit number when an alarm occurs. A list of up to 10 alarm reporting numbers can be programed.
- b) When an alarm occurs, the first alarm reporting number is automatically dialed and a recorded announcement is sent to the line. A timer is started and, if the alarm checking number is not dialed within a predetermined programable interval, the next number on the list is dialed. The system continues through the

CLASSIFICATIONFUNCTION**Version 1**

Catastrophic	Indicates system faults requiring immediate action such as: system inoperative, administration and diagnostics in inoperative, calls blocked system wide, loss of service at one or more remote satellites, etc.
Major	Indicates degraded service or loss of redundancy in addition to carrier failure, charger failure, ac failure, etc.
Minor	Indicates individual port faults, cumulative line or trunk permanent faults, and, optionally, sensor reported faults such as cable pressure, environmental controls, etc.

Version 2

Office emergency	Indicates loss of service to 240 or more ports, or loss of service to police, fire departments, etc.
Group emergency	Indicates loss of service to 30 or more ports.
Alert	Indicates a condition that requires attention but does not immediately affect service; for example, loss of redundancy, environmental sensors, etc.
Nonemergency	Indicates degradation in service such as reduced traffic, inadequate equipment performance, etc.

list (recycling if necessary) until the alarm checking number is dialed. (If one of the numbers programed is the operator, cycling stops and the operator is called repeatedly until the alarm checking number is dialed.)

c) The recorded announcement is normally made by the telephone company and tells the called party the name of the office, advises that an alarm condition exists, and gives the alarm checking number to be dialed for further information.

b. Alarm Checking.

1. When the alarm checking number is dialed, the caller hears an audible signal indicating the actual alarm classification.

2. Two versions of audible signaling are available to agree with the alarm classification schemes covered in paragraph 3.03. The classification and audible signals are as follows:

<u>ALARM</u>	<u>SIGNAL</u>
Version 1	
Catastrophic	No tone
Major	60-ipm busy tone
Minor	1-ring code RBT
No trouble	2-ring code RBT
Version 2	
Office emergency	No tone
Group emergency	Steady high tone

ALARMSIGNAL**Version 2 (Cont)****Alert:**

Redundancy loss, environmental or charger failure	1-ring code RBT
Commercial ac failure	60-ipm busy tone
Carrier or radio failure	120-ipm busy tone
Miscellaneous No trouble	Tick tone 2-ring code RBT

3.05 Alternate Routing.**a. Alternate Routing -- Standard (026510).**

The DCO switching system is programed to provide multiple routes for a specific code (area, office, special, etc.). On receipt of the code, the busy/idle status of the first choice (primary) route is tested. When an "all-trunks-busy" (ATB) condition is encountered, the busy/idle status of the second choice (first alternate) route is tested. This procedure continues until an idle path is found or until an ATB condition is encountered on the last (final) available route. When an ATB condition is encountered on the final route, an equipment busy (recorder) signal is returned to the calling party.

NOTE. Any code can be programed to initiate busy/idle tests on one primary and up to three alternate routes. The capability to initiate busy/idle tests on three additional routes also is available.

b. Alternate Routing -- Expansion (026529).

This feature can be used to expand the alternate routing capability from one primary, three alternate routes, and reorder to one primary, as many alternate routes as needed, and reorder.

3.06 Announcers.**a. Cook Four-Channel Announcer (022938).**

The Cook four-channel announcer is used to return recorded messages to telephone users. Messages

can be provided for intercept, revertive call (called and/or calling party), permanent signal, emergency situations, etc. Message length can be up to 14 seconds. Although 4 channels are standard, the Cook announcer can also be provided with as many as 12 channels.

b. Audichron Four-Channel Announcer (022949).

The Audichron announcer does the same function as the Cook announcer. Similarly, a message length of 14 seconds can be selected for any channel. The Audichron announcer also can be provided with as many as 12 channels.

c. Additional Channel Announcer (022939).

This feature provides one additional channel for either announcer in paragraph a or b.

3.07 Automatic Intercept System (AIS) Interface (122339).

The AIS interface is used to permit a dedicated trunk group to gain access to a remote AIS system. Calls to changed numbers, unassigned numbers, and lines out of service due to a fault condition are routed to the AIS trunk group. MF sending is used to forward the dialed number and the directory number of the calling line to the AIS system. An identifying digit, used to indicate the type of intercept (unassigned number, changed number, or out of service), also is sent.

3.08 Automatic Number Identification (ANI).

The DCO switching system is capable of automatic number identification and can be arranged for one-, two-, and four-party identification. (See also *Circle Digit Identification.*)

a. One- and Two-Party ANI (031110).

1. Directory numbers of one- and two-party lines are identified using standard Bell marking (ground through the ringing coil). During identification, the two line conductors are connected together in the central office (CO) and a total resistance of less than 3900 ohms (including simplex conductors, instrument resistance, and ground return) is treated as Party 2.

2. On one-party lines, only one directory number is associated with the line.

3. Identified directory numbers are recorded locally (LAMA or USR) or forwarded to a toll center for recording. (See also *ANI/ONI Send*.)

b. Four-Party Identification (031129).

1. Detection of which party originates a call on a four-party line is accomplished as follows. Party 2 is marked as in paragraph a and parties 3 and 4 are marked with diodes connected in series with the ringer coil. Testing is accomplished by first applying the two-party test followed by a test using the same voltage value but positive relative to ground.

2. Identified directory numbers are recorded locally (LAMA or USR) or forwarded to a toll center for recording. (See also *ANI/ONI Send*.)

3.09 ANI/ONI Send (ANI Fail).

a. The DCO switching system is capable of sending calling number information to a toll center for recording when the directory number can be identified. However, if the directory number cannot be identified (such as on multiparty lines), an indication that operator number identification (ONI) is required is sent to the toll center and the call is routed to an ONI operator. Although an identification failure is improbable in a common control system, the DCO switching system can send an ANI fail indication to the toll center for appropriate action.

b. The system is capable of sending calling number information in various formats, depending on the type of recording equipment used at the toll center. These include the following:

1. Standard Bell CAMA/TSPS (031300).
2. NT-400 or NT-500 (131319).
3. Pentaconta (131329).
4. Canadian Automatic Ticketing (131339).
5. SATT 62 (131359).

3.10 Busy Verification Conference Circuit.

a. Busy Verification (002748).

1. One busy verification conference circuit is always provided. The circuit is a three-way conference bridge that enables an operator to verify the busy/idle condition of a subscriber line. Upon request of a party attempting to reach a specified directory number, the operator dials the called line number to determine if the line is in use, if the receiver is off the hook, or if the line is in lockout due to a fault condition. The operator then returns to the party trying to reach the directory number and states the condition of the line. Lines with data security can not be accessed for busy verification when the line is in use (refer also to *Data Security*).

2. Three ports are assigned to each busy verification conference circuit. One port is for operator access and two ports are used to split an existing connection. To verify the busy/idle condition of a line, the operator establishes a connection to the operator access port and dials the directory number of the line to be verified. If the line is in use, the existing connection is broken and immediately reestablished through the other two ports of the busy verification circuit without interruption to the established speech path. The busy verification conference circuit is controlled by access code. A dedicated trunk can be used but is not necessary.

3. The busy verification conference circuit also can be used for test verification from the wire chiefs test panel.

b. Additional Busy Verification Conference Circuits (002749).

3.11 Call Forwarding.

a. Variable (101939).

1. Variable call forwarding enables a telephone user to forward incoming calls to another directory number. Calls may be forwarded within the

toll-free network or over the toll network. When calls are forwarded over the toll network, the charges for the connection from the forwarding line to the forward-to line are applied to the forwarding line, not the originating line. It should be noted that call recording (LAMA) is a prerequisite for call forwarding over the toll network.

2. To place a line in the call forwarding mode, the telephone user dials the call forwarding write-in code, receives second dial tone, and then dials the directory number of the line to which calls are to be forwarded (forward-to line). Acknowledgement of the call forwarding mode being put into operation is returned to the calling party in the form of a confirmation tone. If the calling party stays on-line for four seconds, the forwarded-to line is rung. (Originating calls can be made from a line when it is in the call forwarding mode.)

3. Activation of the call forwarding mode from a hunt group may be limited to one number of the hunt group. For this situation, calls are forwarded in the same manner as described.

4. On an incoming call to a line in the call forwarding mode, one burst of ringing is sent to the line as a reminder that the call forwarding mode is in operation, and the call is then routed to the forward-to line. To release a line from the call forwarding mode, the telephone user dials the call forwarding erase code.

b. Fixed by Code (101929).

This feature, formerly known as Subscriber Line Transfer, enables a subscriber to have his calls transferred to another fixed location. Call forwarding is put into operation by dialing a two-digit transfer code; removal of call forwarding is accomplished by dialing a two-digit release code. When call forwarding is in operation, one ring is received on each incoming call. Originating calls can be made from a line which is the call forwarding mode. This feature is not subscriber-changeable.

c. Fixed by Ring Count (101959).

Call forwarding by ring count provides rerouting for incoming calls when the called line is not answered within a predetermined length of time, as defined by ring count (selectable by customer). For-

warded calls are always routed to the same preassigned destination within the DCO switching system, which can be another station line, answering service, etc. If the forwarded-to line is busy, the called line continues to ring, and the timer is reset for additional forwarding attempts. This feature is not subscriber-changeable.

3.12 Call Waiting (101909).

Call waiting enables a telephone user to place a call on hold and answer an incoming call. If a call comes into a line that is busy on an incoming or outgoing call and does not have a previously waiting call, a burst of call-waiting tone is placed on the line. The telephone user then flashes the hookswitch to place the original call on hold and answer the incoming call. A second hookswitch flash places the incoming call on hold and answers the incoming call. A second hookswitch flash places the incoming call on hold and returns the telephone user to the original call. Subsequent hookswitch flashes switch the telephone user from one call to the other.

3.13 Centralized Automatic Message Accounting (CAMA) (241539).

a. CAMA provides recording of 1+, station-to-station, sent-paid, noncoin DDD calls from tributary offices. Since CAMA is an extension of LAMA (Local Automatic Message Accounting), which provides the recording capability, LAMA is a prerequisite for CAMA. (See also *Local Automatic Message Accounting*.)

b. After the last digit of a called number has been received over a CAMA trunk, a request for identification (steady off-hook signal) is returned to the tributary office over the CAMA trunk. On receipt of the signal, the tributary office forwards the calling number to the DCO switching system in standard Bell System CAMA format. When the call is answered, the called and calling number, data and time, etc. are recorded for subsequent transfer to magnetic tape.

3.14 CAMA Loop-Around Test (091559).

a. CAMA loop around enables a testperson at a distant office to select any outgoing trunk from the DCO switching system to be tested at the distant of-

fice. The tests that can be made depend on the other test facilities provided in the DCO switching system.

b. The testperson gains access to the CAMA loop-around test by dialing a seven-digit directory number over an access trunk from the distant office to the DCO switching system. A 1004-Hz signal is returned so that the transmission loss of the access trunk can be measured and recorded. The testperson then dials the trunk group code followed by the number of the trunk to be tested. The testperson connects a milliwatt source to the trunk to be tested and measures the level of the signal looped back over the access trunk. The loss through the trunk being tested is determined by subtracting the loss of the access trunk from the level of the measured signal. The testperson then dials the trunk number of the next trunk to be tested.

c. Additional directory numbers can be assigned to the CAMA loop-around test. Each additional directory number enables the testperson to do a different type of test. For example, a directory number can be assigned for milliwatt testing. When the testperson gains access to the CAMA loop-around test by dialing the directory number for milliwatt testing, the testperson can dial the trunk group code followed by the number of the trunk to be tested. The milliwatt supply is then connected directly to the trunk to be tested, thereby enabling a direct transmission loss measurement to be made.

d. Directory numbers can be assigned to provide connection of outgoing trunks to milliwatt supply, frequency cycling, quiet termination, etc. assuming these features exist in the office.

3.15 Circle Digit Identification (031139).

a. Circle digit identification is a method that provides all line identification (ALI). When a DCO switching system is arranged for circle digit identification, all subscribers, including single-party subscribers, must dial a party-identifying digit after dialing the toll access code. (The digit is called a circle digit because it usually appears within a circle on the number plate of the telephone set.) Digits 2 through 9 can be assigned as party-identifying digits.

b. When the directory number of the calling party is determined by receipt of the party-identifying digit, it is stored until it is entered into the local ticketer (LAMA or USR) or until an ANI request is received from a distant toll center.

3.16 Class of Service (COS).

Class-of-service assignments are used to allow or disallow features and routings and to arrange for special call handling and routing.

a. Class of Service — Lines (002750).

Up to 1024 class-of-service combinations are available for lines.

b. Class of Service — Trunks (012750).

Up to 512 class-of-service combinations are available for trunks.

3.17 Coin Service.

Three basic types of coin service are available: semipostpay, prepay, and local prepay toll postpay.

a. Semipostpay Coin Service (001308).

1. When the telephone receiver is removed from the paystation telephone, dial tone is returned to the caller. After the telephone user has completed dialing and the connection to the called line is established, the telephone user listens to determine when the call is answered. Upon answer, the transmitter in the telephone is disabled and conversation is inhibited. The telephone user must then deposit a coin to enable the transmitter, thereby permitting conversation. Once a coin has been deposited, it cannot be returned.

2. On calls from semipostpay coin lines to the operator, a special paystation identification tone is given to the operator on answer. (This tone is controlled by class-of-service assignment.) If supervision is not given, conversation is allowed on calls to the operator as well as other lines with a free terminating class of service.

3. Semipostpay coin service requires no special DCO switching systems equipment, and operator rering capability is permitted.

b. Prepay Coin Service.

1. Prepay coin service provides coin collect, coin return, and rering capability. The DCO switching system does not require special prepay trunks or trunk groups.

2. On local calls, coins are automatically collected on completed calls and returned on incompleting calls. On toll calls, the operator has full control of coin collect, coin return, and rering functions. Any coin not returned by the operator will be collected on disconnect.

3. Two basic methods are used for operator control of paystations in the DCO switching system: inband signaling and multiwink signaling. For inband signaling, coin collect, refund, and rering functions are controlled by MF signals applied to the voice path. For multiwink signaling, coin collect and refund signals are controlled by a series of up to five supervisory winks (momentary on-hook signals). (See following chart for inband and multiwink signaling arrangements.)

4. A ± 130 -volt power supply is required for prepay station operation to provide coin collect and coin refund voltages. In addition, certain types of paystation instruments also require a +48-volt supply.

<u>TYPE</u>	<u>INBAND SIGNALING</u>	<u>MULTIWINK SIGNALING</u>
Coin first	Rotary dial, except W.E. 1C (002339)	W.E. 1C (002389)
	Rotary dial W.E. 1C (002369)	Other than W.E. 1C (002359)
	DTMF (002349)	
Dial tone first	Rotary dial, except W.E. 1C (002309)	W.E. 1C (002399)
	Rotary dial (002379)	Other than W.E. 1C (002329)
	DTMF (002319)	

c. Local Prepay/Toll Postpay Coin Service (001329).

1. Prepay line circuits and circuit unit assemblies are required for coin collect and refund on local calls. Local prepay service requires a coin deposit

before dialing can proceed. On local calls, coins are automatically collected when the called party answers. On toll calls, the initial deposit is returned before the operator answers.

2. Answer provides reverse battery supervision, which locks the coin mechanism of the paystation in the collect position. Deposits made on operator instruction are not refundable.

3.18 Console Desk (099459).

The console desk is used to mount the dual disk drive in systems that have an ultimate in excess of 1920 ports and in which the PDP-11/34 processor is not furnished.

3.19 Data Security (092610).

a. Data security prevents access to a line for monitoring and testing when the line is in use. Thus, the line is reached only when idle or in lockout. Data security also prevents interruption of data flow on data lines, and protects privacy on special lines such as those for government agencies that require secrecy.

b. Data security inhibits access by the busy verification circuit when the line is in use, and it inhibits access to the test access relay when the line is in use. (See also *Test Access Relays*.) Lines requiring data security should be clearly marked at the protector and office sides of the combined distributing frame (CDF).

3.20 Dc-to-Ac Inverter (099469).

The dc-to-ac inverter option is used to produce a 110-volt, 1000-watt ac output for operating ac-powered equipment such as a floppy disk drive, a teleprinter, etc. Whether this unit functions as a primary or backup source of ac power is dependent upon the customer. Methods 1 and 2 explain the recommended standard and alternate hookups for the dc-to-ac inverter.

a. Method 1 (Standard Hookup).

For this method, the dc-to-ac inverter is powered continuously by the -48-volt dc office battery; if inverter failure occurs, the peripheral equipment is automatically switched to commercial ac power.

b. Method 2 (Alternate Hookup).

For this method, the ac load is powered continuously by commercial ac power with the office battery and dc-to-ac inverter serving as an alternate power source.

3.21 Denied Originating (022730).

The denied originating feature permits the telephone user to receive incoming calls but denies dial tone to the line. Equipment busy tone (EBT) is provided on attempted originations.

3.22 Denied Terminating (022740).

The denied terminating feature allows the telephone user to make outgoing calls but blocks all incoming calls. Calls to lines with denied terminating class of service are routed according to intercept treatment provided in the office.

3.23 Digit Translation on Digit Trains of Varying Lengths (027100).

This feature permits reception of different quantities of digits on the same incoming trunk group. For example, an incoming trunk group from a step-by-step office may deliver a different number of digits for different destinations.

3.24 Directory Assistance Routes to CAMA Office (022720).

This feature provides for routing directory assistance calls to an operator who is accessed by outgoing CAMA trunks.

3.25 Directory Numbers (027118).

a. Directory numbers are furnished on software tables. Each table represents a particular thousands/hundreds group (e.g., 25XX). In this respect, they are analogous to 100 terminal connector groups in a step-by-step system.

b. Initially, the required quantity should be specified in 100 number units, using a base of 1.5 times the number of lines required. If additional directory numbers are required, they should similarly be ordered in groups of 100 (027119). The DCO switching system is capable of handling 25,000 directory numbers.

3.26 Doors.

Doors can be provided for the front and rear of the common control, maintenance and administration, and central processing frames. Doors can also be provided for the front (096229) and for the rear (096239) of the line and trunk, common equipment, and power frames. A rear door is also available for the automatic message accounting frame.

3.27 E&M Trunk Lead Signaling and Supervision (011100).

a. Type I and Type II E&M signaling can be provided. Type I E&M signaling, which was designed to operate with electromechanical switching systems, uses a single E lead and a single M lead with a return over a common ground path. Type I E&M signaling in the DCO switching system requires that signaling battery and ground be supplied for the associated signaling equipment (external to DCO switching system equipment). Type II E&M signaling, which was designed to operate with electronic switching systems, uses balanced paired leads (E and E return, M and M return). Using balanced paired leads minimizes noise pickup that could impact operation of the electronic switching system.

b. Resistance battery from the switching system applied to the M lead results in the application of ground to the E lead at the distant office. Conversely, resistance battery applied to the M lead at the distant office results in the application of ground to the E lead at the DCO switching system. Normally, resistance battery on the M lead and the resultant ground on the E lead at the distant end represents the off-hook state. The following table lists typical E and M lead conditions during each state:

STATE	NEAR END		DISTANT END	
	E LEAD	M LEAD	E LEAD	M LEAD
On-hook	Open	Open or grounded	Open	Open or grounded
Off-hook	Open	Resistance battery	Grounded	Open or grounded
Call Answered	Grounded	Resistance battery	Grounded	Resistance battery

3.28 Extended Area Service (EAS).

The DCO switching system can be arranged so that selected subscribers can have their toll-free calling area expanded for incoming service or outgoing service. (See also *Three-Digit Code Translation for EAS Routing*.)

a. Expanded Incoming EAS (121509).

Expanded incoming EAS to selected subscribers requires an EAS route from the adjacent toll area to the DCO switching system. Telephone users in an adjacent toll area normally dial 1 + 7 digits to reach most lines in the DCO switching system over the toll route. To reach lines with expanded incoming EAS, the telephone users need only dial the 7-digit directory number, and the call is routed over the EAS route. The incoming calls over the EAS route are screened. If the call is to a line that has expanded incoming EAS class of service, the call is routed to the line. Otherwise, it is routed to a recorded announcement, equipment busy, or similar destination.

b. Expanded Outgoing EAS (Inherent).

Expanded outgoing EAS to selected subscribers requires an EAS route from the DCO switching system to the adjacent toll area. Subscribers without expanded outgoing EAS must dial 1 + 7 digits, and the call is routed over the EAS route even if the DDD access code is dialed in error.

3.29 External Alarm Provisions (Unassigned).

a. Alarm leads for telephone company use are extended from each common control sector to the CDF. Six contact closure inputs and two alarm stud inputs are available per 1920 ports (24 and 8 per system, respectively). The contact closure input operates with contacts having a rating of not less than 0.5 ampere at 48 volts dc, and a wetting current of not more than 1 milliamper. Stud inputs accept -48 volts dc.

b. Sensors are suggested for the following:

1. Air-conditioning failure.
2. Temperature exceeding outside limits.
3. Humidity exceeding outside limits.
4. Loss of emergency source of power.

5. Low pressure in cable.

6. Carrier failure.

7. Radio failure.

8. Open door.

9. Forced entry.

3.30 Fixed Call Address — Manual.

a. Fixed call addressing enables a telephone user to call a specified destination without dialing any digits. All the user has to do is remove the receiver from the hookswitch. When an off-hook indication is received on a line with the fixed call address feature, the directory number or code of the destination is read from memory and the call is automatically routed to the destination. If the line is also to be used for regular telephone service, a critical timeout is required after dial tone is returned to the line. If no digits are received within this customer specified time period, the call is routed to the specified destination. Otherwise, it is routed in accordance with the dialed digits.

b. Calls can be routed to the following destinations:

1. To an operator (022100).
2. To a terminal in the DCO switching system (021189).
3. To a terminal in another central office (021549).

3.31 Foreign Exchange (FX) Lines.

A subscriber with a foreign exchange line receives telephone service from a central office other than the office serving his geographical area. For example, a subscriber in a small resort area can be served by a central office in a nearby city. The resort would be listed in the city telephone directory and city residents wanting reservations would call the local number to reach the resort via the foreign exchange line. The foreign exchange line could be used by resort employees to make toll free calls to the city or calls to the city could be blocked. (See also *Denied Originating*.) At the subscriber's premises, the foreign exchange line could be terminated on a telephone instrument, a key system, or a switchboard.

a. **DCO Switching System Serving a Distant Subscriber (007129).**

The DCO switching system is arranged to provide originating office (FXO) service to a subscriber located in a distant exchange area. The subscriber terminates in the DCO switching system on a line circuit, an analog trunk, or a direct digital trunk depending on the routing facility from the subscriber location. In all cases, the incoming termination is treated as a line circuit.

b. **Subscriber Service by a Distant Central Office (007139).**

The DCO switching system is arranged to provide subscriber office (FXS) functions to a subscriber receiving dial tone from a distant office. The DCO switching system provides power and ringing when the subscriber is routed to the distant (FXO) office via carrier or SF circuits which bypass the DCO switching system. It can also be arranged to provide access to a distant office via a direct digital trunk.

3.32 Four-Wire EAS and Toll Trunk (011159).

The four-wire E&M trunk is used to interface four-wire analog or PCM derived carrier channels, and can be used in four-wire special service applications. The trunk is arranged for tip and ring send, tip and ring receive, and types I and II E&M signaling.

3.33 Free Terminating (041110).

Certain lines such as official telephone company lines are arranged to prevent charges on terminating local calls and, if required, on terminating incoming trunk calls. On such free terminating lines, answer supervision is returned on chargeable calls but inhibited on nonchargeable calls. With answer supervision inhibited, calls are treated as unanswered calls, coins in paystations are returned, message metering peg counts are not incremented, and usage sensitive recording does not enter time of answer.

3.34 Glare Guard (012770).

"Glare" is the simultaneous seizure of a two-way trunk from both ends. The senders at each end wait for a wink start or for the removal of a delay-dial signal. The glare guard feature ensures that, under this condition, the trunk is used in one direction only and the incoming call has preference.

3.35 Ground Start (007180).

a. Two methods of line seizure are available in the DCO switching system. Normally, the line circuit is seized by closure of the station loop. However, some prepay paystations and some PBXs ground the ring side of the line to seize the line circuit.

b. Lines using ground start must be assigned to a one-party line circuit, which has optional wiring that permits loop start or ground start operation. Ground start lines cannot be served by a distributed network interface (DNI) subsystem. (See also *Loop Start*.)

3.36 Hotel/Motel Reverse Battery Supervision (006100).

Reversal of battery feed polarity may be extended to a subscriber line as an indication of call answer. Typically, this capability is required for hotel/motel lines as a signal of chargeable calls placed by a guest using that central office line.

3.37 Hundreds Digit Routing (027300).

Hundreds digit routing is used to route calls to a DID trunk group. When a block of 100 numbers is reserved for direct inward dialing to a PBX, the thousands-hundreds digit combination is screened on local and incoming calls. When the data base indicates that the thousands-hundreds group is assigned to a DID group, the call is routed to the DID trunk group and the required digits are outpulsed to the PBX. In DCO switching systems with more than one office code, the office code must be screened with the thousands-hundreds digits. For large PBXs, thousands digit routing may be required.

3.38 Improved Mobile Telephone Service (IMTS).

IMTS provides dialed selection of mobile stations and direct outward dialing (DOD) from the mobile stations to the switching network. Further, IMTS may be equipped with ANI equipment. IMTS systems that are compatible with the DCO switching system include: the Motorola Communications, Inc. Pulsar* series, Motorola Communications Inc. Model T-1281C, and the General Electric Co. MDA series.

*Pulsar is a trademark of Motorola Communications Inc.

NOTE. Other systems can be considered, but will require engineering evaluation. (The DCO switching system is not compatible with the General Electric Co. MEA series.)

a. General.

1. The DCO switching system can provide the necessary 48-volt power and tones required by Model T-1281C and the MDA series units.
2. The ringing supply required by the MDA series units can be supplied from a source other than the ringing plant of the DCO switching system.
3. The Pulsar series units are ac operated and self-contained.
4. Model T-1281C can be equipped with a "busy-back" option. This requires provision of a sleeve lead on the outgoing line circuit of the DCO switching system.

b. IMTS With Identification of Calling Mobile Subscriber (096109).

1. Both Motorola Communications Inc. models must be equipped with adapter chassis TDN-6029 (two per radio channel) when identification of the calling mobile subscriber is to be provided by the DCO switching system.
2. The Pulsar series units are interfaced with an outgoing loop trunk (one per radio channel) to provide DID service to IMTS subscribers. DOD service from IMTS subscribers requires one line circuit per subscriber plus one additional line circuit to handle roamer stations, if required.
3. Access to Model T-1281C is provided by one eight-party line circuit for each eight (or less) radio subscribers. DOD service from radio subscribers is provided by one line circuit per radio subscriber plus one additional line circuit to handle roamer stations, if required.

c. IMTS Without Identification of Calling Mobile Subscriber (096119).

1. When identification of the calling mobile subscriber is not provided in the IMTS terminal, the Motorola Communication Inc. units do not require the use of adapter chassis TDN-6029.

2. The Pulsar series unit is interfaced by one loop trunk per radio channel for traffic to the radio subscribers and one non-DNI line circuit for traffic from these subscribers.

3. Model T-1281C, for traffic to the radio subscribers, is interfaced by one eight-party ground start line circuit for each group of eight (or less) subscribers. Traffic from radio subscribers is handled by a non-DNI line circuit (one per radio channel).

4. The MDA series units are interfaced by one direct port or DNI subscriber line circuit for each radio subscriber. These line circuits handle both originating and terminating traffic. It should be noted that, by the application of DCO switching system capabilities, these lines can be identified.

3.39 Inspectors Test Terminal (091109).

a. The inspectors test terminal enables one installer/repairperson to verify the operation of three separate features of a telephone set: that the correct party is identified on party tests, that the speed of a rotary dial is within preset limits, and that the DTMF signals generated by a telephone with a DTMF keypad are within tolerances.

b. A directory number (access number) must be assigned to the inspectors test set. (If desired, separate directory numbers can be assigned for a rotary-dial speed test and a DTMF telephone keyset test.)

1. ANI Party Verification.

After the directory number of the inspectors terminal has been dialed or keyed, the following coded tones are returned to indicate the party arrangement of the calling line:

- a) One to four bursts of tone at 120 ipm indicate party 1, 2, 3, or 4, respectively, on four-party lines if the DCO switching system is arranged for four-party ANI.
- b) One or two bursts of tone at 60 ipm indicate party 1 or 2, respectively, on two-party lines.
- c) Six bursts of tone at 120 ipm indicate ONI lines.
- d) A single 1-second burst of tone indicates one-party lines including PBX lines.

NOTE. After the coded tones have been returned, tone is returned to indicate that a rotary-dial speed test or a DTMF telephone keyset test can be made.

2. Rotary-Dial Speed Test.

After tone has been returned, the digit 0 is dialed to test the speed of the dial. After the digit has been dialed, one, two, or three bursts of tone are returned to indicate dial speed: one burst, fast-dial; two bursts, within preset limits; three bursts, slow dial or missing pulse. The dial speed limits can be set at 8.5 to 11.5 pulses per second (pps), 8 to 12 pps, or 9 to 11 pps.

3. DTMF Telephone Keyset Test.

After tone has been returned, digits are keyed into the inspectors test set. The sequence to be followed is 1 through 0 on 10-button keysets and 1 through 9, *, 0, and # on 12-button keysets. After the digits are keyed, one, two, three, or four bursts of tone are returned.

- a) One burst of tone indicates improper keying sequence, incomplete keying within timeout interval, or failure to receive one of the two tones for a digit.
- b) Two bursts of tone indicate satisfactory reception of all digits in the proper sequence.
- c) Three bursts of tone indicate that fewer than eight digits were received.

- d) Four bursts of tone indicate that 9 digits were received (10-button keyset) or that 9, 10, or 11 digits were received (12-button keyset).

3.40 Integrity and/or Polarity Check (012760).

When impulsing delays are not used, delay-dialing signals (delay-dial, wink-start, and stop-dial signals) are used to check the integrity (continuity and polarity) of interoffice signals. The polarity check provides a means of verifying the presence of battery feed on outgoing loop trunks.

3.41 Intercept.

Normally, calls to unassigned numbers, changed numbers, and vacant codes are routed to some type of intercept. Prefix errors also can be routed to intercept. In the DCO switching system, the following types of intercept arrangements are possible:

- a. Interface to Announcing Machine (022300).

Intercepted calls are routed to a recorded announcement. One announcer channel is required for each message.

- b. Interface to Announcing Machine with Cut-Through to Operator (022319).

Intercepted calls are routed to a recorded announcement. Further, if the calling party does not disconnect after the message, the call is routed to an operator. The call can be routed over the regular operator trunk group, a dedicated trunk group, or an AIS trunk group. One announcer channel is required for each message.

- c. Interface to Operator (022320).

Intercepted calls are routed directly to the operator via the regular operator trunk group or a dedicated trunk group.

- d. Interface to AIS Trunk Group.

See *Automatic Intercept System (AIS) Interface*.

3.42 Interchangeable Office and Area Codes (Inherent).

As the number of required office codes increase in heavily populated numbering plan areas (NPAs) and as the number of NPAs increase, a conflict may exist be-

tween office and NPA codes. To resolve this, the DCO switching system uses critical timing to differentiate between office and area codes. A 3.5-second timing cycle is initiated after the seventh digit of the called number is received. Completion of timeout indicates that the last digit has been received. The receipt of only seven digits indicates that the ABC digits are an office code, and the call is routed accordingly. Cancellation of critical timing by the reception of additional digits indicates that the ABC digits are an area code, and the call is routed accordingly.

3.43 International Direct Distance Dialing (IDDD).

The DCO switching system is arranged to accept IDDD prefix codes and country codes, and routes calls accordingly. Calls that are to terminate outside the North American integrated DDD network (world zone 1) are forwarded through the appropriate switching centers to an outlet to other world zones. Single stage outpulsing (026500) is normally used in end offices except when IDDD nonoperator assisted calls are recorded in that office. Two-stage outpulsing (026110) may be used for AMA recording offices only.

3.44 Key Telephone Interface (007170).

Key systems are used to provide multiline telephone service, and the lines to a key system are arranged for multiline hunting. Key systems have line holding capability, which is accomplished by maintaining loop closure through a relay coil. Under certain conditions, the loop closure can maintain a permanent signal on the line. When a key system line goes into permanent signal, the DCO switching system returns a wink-off to the line to assure removal of a hold condition. This is controlled by the key system class-of-service mark.

3.45 Line Load Control – Manual (056509).

Line load control is used for selective removal of subscriber lines from service during emergency or overload situations. Subscribers are divided into three separate priority groups. For example, emergency services such as fire, police, medical, etc., could have the highest priority and residential service could have the lowest priority. During an emergency or overload situation, lines with the lowest priority are removed from service first, followed by lines with the next lower priority. A priority group is removed from service by password protected keyboard entry.

3.46 Line Lockout (022900).

After a permanent signal timeout period, lines are placed in lockout to prevent the holding of XOH timeslots. A permanent signal is a continuous request for service which can be caused by any of the following:

- a. No dialing after seizure.
- b. Partial dialing.
- c. Calling party fails to disconnect; called party disconnected after conversation.
- d. Called party fails to disconnect; calling party disconnected after conversation.
- e. Timeout or busy tone.

3.47 Live Service Observing (077229).

a. Live service observing is implemented in the DCO switching system by using internal system software programming in conjunction with the Alston Call Selector Model 371 and Alston Service Monitor Model 389-1 (or equivalent).

b. One of the call selector's monitor outputs is connected to two DCO switching system ports via an interface circuit. The input side of the call selector is connected to a Model 389-1 Service Monitor, locally or remotely, via dedicated facility or dial-up access. The service monitor is a desk-mounted unit which provides the man/machine interface.

c. The assignment of lines and/or trunks to be observed is done in software under control of a terminal. A maximum of three software tables can be equipped, each with capacity for 600 entries; one table is provided per call selector. When more than one call selector is equipped, all software table entries have full availability access to the other equipped selectors. The terminal used for table programming is located locally, remotely via dedicated facility, or on a dial-up basis. (When dial-up is used, multitasking [feature code 151709 or 151719] is a prerequisite.) The terminal is, as required, dedicated to live service observing programming or other functions.

d. When, during an observation period, one of the preselected lines/trunks goes off-hook, it is identified as a port to be observed and an attempt is made to route it via the call selector interface circuit. If this interface is in use to monitor another call, this call is routed in the normal manner and live service observing is not attempted. If the interface is free, the call is routed via the call selector to its destination. The call selector monitors the call and the observed conditions are passed to the service monitor. The system is arranged to drop the call from observation after a predetermined interval (normally 12 seconds after answer supervision) or on command from the service monitor.

e. The feature is designed to ensure that call monitoring functions do not interfere with normal call progress and do not provide any indication of call monitoring to either calling or called party.

f. A tape recorder is optionally available for connection to the call selector and/or the service monitor.

3.48 Local Automatic Message Accounting (LAMA) (241529).

a. LAMA is used to provide recording and readout of detailed billing information on 1+, station-to-station, sent paid (SSSP), noncoin DDD calls from local lines. During a call requiring ticketing, call information is accumulated in memory. This information includes called and calling numbers, date and time of call answer, identity of equipment used on the call, etc. On final disconnect, call data is read out in ASCII (American Standard Code for Information Interchange) or EBCDIC (Expanded Binary Coded Decimal Interchange Code). Data is stored on magnetic tape.

b. The AMA cabinet contains dual magnetic tapes and tape controls. Call data is accumulated on one tape until switchover because of a full tape or until the tape is removed to be sent to the accounting center. The magnetic tape is also used to store call data for CAMA and usage sensitive recording (USR) when the DCO switching system is arranged to provide these features.

3.49 Local Office Codes.

Office codes are provided in the DCO switching system as follows:

a. Four Active Office Codes in Base (026108).

Four office codes are provided in the basic system as a standard.

b. Additional Office Codes (026119).

Eleven additional office codes are provided.

3.50 Loop Range Extension.

a. Loop range extension increases the operating limits of noncoin lines beyond the 1900-ohm limit of the DCO switching system. It also increases the loop limit beyond the 1200-ohm limit for prepay coin lines and the 1000-ohm limit for semipostpay coin lines. The 1900-, 1200-, and 1000-ohm limits include the resistance of the telephone set.

b. Loop range extension equipment comprises loop extenders, voice-frequency (VF) repeaters, combination loop extenders, and VF repeaters. Loop extenders provide elevated voltage to maintain transmitter current within acceptable limits. The VF repeaters provide gain to maintain the transmission loss of the station line at 8 dB or less. Loop range extension equipment is provided on an individual line basis or on a group basis (common mode).

1. Individual Line Treatment (001779).

Loop range extension equipment is provided on a per line basis on non-DNI or DNI lines.

2. Common Mode (001759).

DCO switching systems with DNI operation are arranged to provide common pools of loop range extension equipment. The DNI matrix concentrates lines into ports at a ratio of 100 lines to 25 ports. Fifteen of the ports are dedicated to the 100-line group; the remaining 10 ports are common and are shared by up to four additional 100-line groups. The ports can be equipped with loop range extension equipment to provide common mode operation for lines in 100-line increments. The quantity of loop range extension equipment required per 100-line group is listed as follows:

NO. OF LINES	QUANTITY	
	ADDED	TOTAL
100	25	25
200	15	40
300	15	55
400	15	70
500	15	85

NOTE. Above quantities repeat for next 100 to 500 lines.

3.51 Main Distributing Frame (MDF) Double Density Protector (096269).

The modular MDF is designed to accommodate Reliable R710 and Cook C310 series protectors. With this feature, a double-density protector mounting bracket is available that enables accommodation for Reliable R305 and Cook C377 series high-density protectors on the modular MDF.

3.52 MDF Test Shoe Capability (091149).

An MDF test shoe is used to isolate an outside cable pair from the equipment pair on the DCO switching system. The test shoe is inserted in place of a protector module, and the plug of the test shoe cord is inserted into a jack, or equivalent, on the MDF. Insertion of the plug into the jack, which is wired to keys on the wire chiefs test panel, extends the cable and equipment pairs to the wire chiefs test panel. The cable pair and the equipment pair can be split so that various tests can be made on the line (cable) side and on the equipment side.

3.53 Malicious Call Handling.

Call tracing is required in the industry for tracing malicious calls and medical or other emergency calls. Malicious call printout and call trap and trace are extensions of call tracing.

a. Malicious Call Printout (021700).

Malicious call printout assignment can be given to any line. When a line has this assignment, a record of each call incoming to that line is printed on the fault printer. Printout includes the called line number, the calling line or incoming trunk number, the date, and the time an alarm is sounded at the system terminal. Malicious call printout is inherent to the DCO switching system.

b. Call Trap and Trace (021719).

When the call trap and trace feature is provided, malicious call trap and trace printout, an audible signal, and call release are controlled by hookswitch flash. When the hookswitch is flashed during an incoming call to a line with malicious call trap and trace, the following events take place:

1. A record of the call is printed on the fault recorder. The printout includes the called line number, the calling line or incoming trunk number, the date, and the time.
2. An audible signal is given at the system terminal.
3. Dial tone is returned to the called party to allow them to report the malicious call to the proper authority.
4. Release of local connection is placed under control of the called party. Release of calls incoming from trunks are not controlled by the called party.

3.54 Man/Machine Interface.

a. Terminal Arrangements.

Terminal devices provide the man/machine interface to the DCO switching system. Two terminal arrangements are available.

1. Basic Arrangement.

- a) The system is arranged for one terminal port equipped with a Multiple Terminal Interface (MTI), which expands the ports capability to four outputs. Each of these outputs is strap selectable for either 20-milliampere current loop (CL) or RS-232B (EIA) (or C) operation. One of these ports is, as a standard, equipped with an acoustic-coupled modem to allow the Stromberg-Carlson Assistance Team (SCATSM) access to the system, under telephone company control, to aid in the solution of problems when required. (This is known as the SCAT Package, Feature 051529.) A second output is usually used for the local office terminal. The remaining two outputs can be connected to

additional local and/or remote terminals. If remote, the terminals are connected via acoustic-coupled or full period modems (features 051509 and 051539, respectively).

b) With this arrangement, all connected terminals receive all output messages from the system. However, only one terminal, manually selected, serves as an input. Arrangements are provided to allow one other preassigned terminal to have carrier-controlled override access to the system.

2. Multitasking.

a) This arrangement allows up to seven additional terminals to be added to the system. Each terminal port can operate independent of, and concurrently with, all other terminal ports.

b) Terminals connected to the seven additional ports (all arranged for RS-232) are assigned specific functions, such as administration, maintenance, etc. Password protection and port task rights are used to provide security.

c) The additional ports can be connected to local or remote terminals. If remote, the terminals are connected via acoustic-coupled, full period, or auto-answer modems (features 051509, 051539, and 051519, respectively). A port is assigned for polled traffic output from a remote master station (feature 146369) by connection of a Universal Data Converter.

d) The multitasking feature is available as follows:

- 1) Multitasking start-up (151709).
- 2) Each multitasking port (seven maximum) (151719).

b. Terminals.

A wide arrangement of terminal devices can be connected to the system. These include, but are not limited to, the following teleprinters and CRTs.

1. Teletype Corporation, Model 4320 AAK teleprinter (051119).

2. Digital Equipment Corporation, Model LA-36 teleprinter (051129).

3. Digital Equipment Corporation, Model LA-38 teleprinter (unassigned).

4. Hazeltine, Model 1500 CRT (051139).

5. Perkin-Elmer, Model Fox 1100 CRT (051149).

c. Modems.

Three basic modem arrangements available for use with the system include the following:

1. Acoustic Coupled Modem (051509).

2. Direct-Coupled, Full Period Modem (051539).

3. Auto-answer Modem (051519) (Can be used only with multitasking feature.)

3.55 Modems For Remote Teleprinter and CRTs.

A remote terminal (teleprinter or CRT) requires two data modems — one located in the DCO switching system and one located at the remote site. (See also *Multitasking* under *Man/Machine Interface*.)

3.56 Multifrequency (MF) Sending/Receiving.

MF signaling is a system of transferring number information over telephone trunks. Digits of called numbers and calling numbers are transferred by using pulses of various tone combinations within the voice band. The pulse for each of the digits through 0 consists of a specified combination of 2-out-of-5 tones. A sixth tone is used for signal and control pulses (KP and ST signals, coin control, etc.).

a. MF Sending (012738).

A toll MF generator and MF senders are required for sending the called number over an MF trunk group and for sending ANI signals to a toll center for recording. The toll MF generator supplies the six tones used for MF sending and the MF sender selects the proper combination for each digit to be out-pulsed. Two toll MF generators are provided, for redundancy, in the DCO switching system whereas MF senders are provided on a traffic basis.

b. MF Receivers (012748).

MF receivers are required for receiving the called number over an MF trunk group, ANI/ONI/ANI fail signals from a tributary office when the DCO switching system is equipped for CAMA/LAMA, and inband coin control signals. MF receivers for incoming MF and CAMA trunks are provided on a traffic basis.

3.57 Multiline Hunt (007100).

a. Multiline hunting (frequently called PBX hunting) is required for PBXs, key telephone systems, and some two- and three-line telephones. Lines to each PBX, key system, or two- or three-line telephones are arranged in a multiline hunt group, and a pilot number (listed directory number) is assigned to the group. When the pilot number is dialed, the DCO switching system tests the busy-idle condition of the first line in the group. If the first line in the group is busy, the busy-idle condition of the next line in the group is tested. The DCO switching system continues testing the busy-idle condition of lines in the group until an idle line is found or until all lines have tested busy.

b. The associated line equipment numbers assigned to the lines do not have to be consecutive. Multiline hunting always starts with a predetermined number and proceeds in a fixed sequence through the equipment number group.

c. All lines requiring multiline hunting are assigned the PBX class of service.

3.58 Multitasking.

See *Man/Machine Interface*.

3.59 Network Management.

a. Network management is a system for controlling traffic during periods of traffic congestion. The usual arrangement is to have the higher class (controlling) office control the incoming traffic by reducing traffic output from lower class (controlled) offices. This is accomplished by a series of transmit and receive control signals (Refer to AT&T "Notes on the Network," 1980.)

b. DCO switching system features for controlled and controlling offices are:

1. Automatic Trunk Made Busy for Controlled Office (156109).

2. Directional Reservation of Two-Way Trunks and Automatic Cancellation of Routes for Controlled Office (156129) (Future).

c. Controlling Office Feature (256359) (Future).

3.60 Operator Number Identification (ONI).

ONI is used to manually obtain the calling number on SSSP calls originated on multiparty lines that cannot be automatically identified. For this method, the operator keys the calling number into the DCO switching system LAMA or CAMA/LAMA system. ONI can also be used to obtain the calling number on ANI failures from tributary offices.

a. ONI Operator Capability.

ONI links to ONI positions or modified toll positions provide for operator entry of calling numbers into the LAMA or CAMA/LAMA recording system. The following arrangements can be made available:

1. Local link with Local S-C Standard Turret (242529).

2. Link to Collocated Ticketing System.

a) S-C No. 3 Toll Board (242119).

b) S-C Type 75 Ticketing System (242139).

b. Link to Remote Ticketing System.

1. S-C No. 3 Toll Board (242109).

2. Bell or similar TSPS Position (242309).

3.61 Outpulsing Delays.

Outpulsing delays are used on trunk groups to common control offices to ensure that common equipment has been made available to receive signaling. Out-

pulsing is inhibited until the distant office indicates that it is ready to receive pulses. The indication can be a delay-dial signal or a wink-start signal.

a. Delay-Dial Signal (012500).

When the distant office is arranged for delay-dial operation, an off-hook signal is returned to the office at seizure. Outpulsing is inhibited until the off-hook signal is removed.

b. Wink-Start Signal (012510).

When the distant office is arranged for wink-start operation, outpulsing is delayed until a wink-start signal is received from the distant office. A wink-start signal is the transition from on-hook to off-hook to on-hook.

3.62 Pad Control.

The DCO switching system has the capability of providing pad switching on direct digital trunks to meet the requirements of the Digital Loss Plan. In addition, in a Class 5/4 office, pads can be switched in on calls that originate or terminate in the class 5 portion of the office.

a. Incoming Trunks (211189).

1. A switchable pad is provided with each incoming or two-way analog E&M trunk in a Class 5/4 office that carries local and tandem toll traffic. The pad is switched in on calls to local stations and switched out on calls to outgoing trunks.

2. Pads are provided in direct digital trunks and are switched in or out, as required to meet the Digital Loss Plan.

b. Outgoing Trunks (211199).

A switchable pad is provided with each outgoing or two-way analog E&M trunk in a Class 5/4 office that carries local or tandem toll traffic. The pad is switched in on calls from local stations and switched out on trunk-to-trunk calls.

3.63 PBX Direct Inward Dialing (DID)/Direct Outward Dialing (DOD).

a. PBX DID (007110).

Direct inward dialing provides direct calling to PBX stations without the assistance of the PBX attendant. A block of directory numbers in the DCO

switching system must be reserved for each PBX arranged for DID. On DID calls, the PBX is identified by the first four or five digits of the directory number, and the call is routed to the DID trunk hunting group dedicated to the PBX. The DCO switching system then outpulses the two-, three-, four-, or five-digit station number to the PBX depending on the numbering scheme of the PBX. Calls to the listed directory number of the PBX also can be routed to the attendant over the DID trunk group.

b. PBX DOD without PBX ANI (007120).

When a PBX is not arranged for ANI, toll calls are billed to a designated billing number.

c. PBX DOD with ANI.

When the PBX is equipped for ANI, toll calls are billed to the PBX station number. The calls are recorded in the DCO switching system or the calling number can be forwarded to a distant toll center for recording. (See also *Hotel/Motel Reverse Battery*.)

1. DOD Toll Recorded in DCO Switching System (031520).

If the DCO is equipped for LAMA, a request for identification (reverse battery) is sent to the PBX after the last digit of the called number has been received. On receipt of the identification request, the PBX identifier identifies the station and forwards Bell System CAMA format.

2. DOD Toll Recorded in Distant Toll Center (031510).

On outgoing toll calls from a PBX, the DCO switching system routes the call to the toll center, forwards the called number, and sets up a connection between the PBX and the toll center. When the toll center requests identification, the PBX identifier forwards the identification through the DCO to the toll center. (This is sometimes called "whistle-thru" operation.)

3.64 Permanent Signal Sequence (022920).

a. When a line or trunk seizes the common equipment, a timing sequence is started in the common control. The timing sequence is cancelled when a digit is received, and it is restarted during the interdigital period. If the timing cycle is not cancelled, a timeout

occurs and the line or trunk is placed in the permanent signal sequence which is:

1. If a line is marked for a key system, the line is momentarily opened to attempt release.
2. The call is routed to a recorded announcement.
3. The call is rerouted to ROH tone (howler) (lines only).
4. The line or trunk is placed in lockout. (Trunks do not receive ROH tone.)

NOTE. Step 2 or 3 (above) can be eliminated by customer choice.

- b. The permanent signal sequence also occurs when the calling party fails to disconnect after the called party disconnects, or when the called party fails to disconnect after the calling party disconnects.

3.65 Remote Test Facility Capability (091959).

A Badger 612A Test Set is used to test subscriber lines assigned to the DCO switching system. The test set is seized from a remote location by dialing an access code from a Badger Master Station. When the station number of the line to be tested is dialed, the test set is connected to the test access relay of the line circuit via the switched maintenance access network (SMAN). The test set is connected to the line for testing outside plant, testing towards the DCO switching system, or monitoring the connection. The results of the tests are signaled back to the remote location.

3.66 Revertive Call.

Revertive calling enables party line subscribers to dial another telephone on their line, and provides inspectors ringback capability. Revertive calling in the DCO switching system is software controlled; revertive call trunks are not required. Once a revertive call is established, it has no traffic impact on the system. Assignment of the revertive call capability to one-party lines is on a system rather than an individual basis.

a. Revertive Call Dialing.

Three methods of dialing revertive calls are available in the DCO switching system:

1. Directory Number (021100).

2. Prefix Plus Directory Number (021110). (Can also be accomplished by prefix plus four-digit station number.)

3. Directory Number Plus Ring Code (021120). (Used in offices where both calling and called parties are to receive ringing.)

b. Revertive Call Signal to Calling Party.

The signal to the calling party on completion of dialing can be one of the following:

1. Revertive Call Tone (021150).
2. Recorded Announcement (021160).
3. Silence Only (until other party answers) (021170).

c. Revertive Call Signal to Called Party.

The signal to be given when ringing is tripped may be one of the following:

1. Revertive Call Tone (021130).
2. Recorded Announcement (021140).
3. Silence Only (until other party answers) (021170).

3.67 Six-Digit Code Translation.

Six-digit translation provides for examining the first six digits of the called number and routing the call accordingly. Six-digit translation provides for separate routing of toll calls to the same foreign numbering plan area (FNPA) with calls being routed according to the office code.

a. Six-Digit Translation for Three FNPAs (026310).

Six-digit translation for up to three FNPAs is provided as part of the base DCO switching system.

b. Additional FNPAs (026319).

Six-digit translation for additional FNPAs up to a maximum of 15 (including initial 3 FNPAs) is provided.

3.68 Sleeve Lead Line Circuit (Unassigned).

A sleeve lead line circuit is available for use in the DCO switching system. While the line circuit is in

use, a ground is applied to the sleeve lead; when idle, the sleeve presents a high resistance battery. An external ground applied to the sleeve lead of an idle line will make the line circuit busy. This circuit is capable of up to eight-party service: bridged or divided ringing on four parties, and divided ringing only on eight parties. It also provides reverse battery supervision. The primary purpose of this circuit is to provide interface to peripheral equipment such as IMTS or external non-DCO switching system fire alarm systems. (See also *Subscriber Service*.)

3.69 Spare Parts Packages.

The following is a list of spare parts packages which are available:

- a. DCO Spare Parts Package (061249).
- b. DNI Spare Parts Package (061229).
- c. DSU-R Spare Parts Package (061239).
- d. DSI Spare Parts Package (061219).
- e. DTI Spare Parts Package (061269).
- f. Enhanced Maintenance and Diagnostic Spare Parts Package (061259).
- g. LAMA Spare Parts Package (061289).
- h. Synchronous Network Clock Spare Parts Package (Unassigned).

3.70 Speed Calling.

See *Abbreviated Dialing*.

3.71 Step-by-Step (S x S) Interunit Trunks.

The S x S interunit trunks provide the interface between the DCO switching system and collocated S x S offices.

- a. Selector Bank to DCO Switching System Trunk (011139).

This trunk is provided to route calls from the S x S office to the DCO switching system. The trunk, which is an interface between the selector bank and a DCO switching system port, provides S (or C) and HS (or EC) lead control.

- b. DCO Switching System to Selector or Connector Trunk (011149).

This trunk is provided to route calls from the DCO switching system to the S x S office. The trunk, which is an interface between a DCO switching system port and a selector or connector circuit, provides for S (or C) and HS (or EC) lead sensing.

3.72 Subscriber Line Transfer.

See also *Call Forwarding - Fixed by Code*.

3.73 Subscriber Service.

The following types of subscriber line service are provided in the DCO switching system:

- a. One- to Four-Party Bridged Ringing (001108).
Provides telephone service with up to four-party lines.
- b. One- to Eight-Party Bridged/Divided Ringing (001118).
Provides telephone service with up to eight-party lines; also provides reverse battery supervision.
- c. One-Party Bridged/Divided Ringing (001128).
Provides telephone service for one-party lines; also provides reverse battery supervision and optional ground start operation.

3.74 Synchronous Network Clock (SNC) (071119).

- a. The DCO switching system is arranged to operate as a slave office in the switched digital network when connected on a direct digital basis to a No. 4 ESS (or equivalent) system.
- b. The DCO switching system is arranged to synchronize with the incoming T-1 line signal from an upstream master office via primary and secondary T-1 span lines, using phase-locked loop techniques. If timing is lost over the primary span line, the DCO switching system switches to the secondary span line. If timing is lost over both span lines, the free-running clock in the DCO switching system assumes control of the slave (DCO switching system) until timing from the master clock is restored. The free-running clock in the DCO switching system has a long term stability of 1 part in 10^9 .

3.75 Test Access Relays (091130).

a. Line and trunk circuits are equipped with test access relays that provide a means of isolating the DCO switching system from cable pairs and external equipment such as signaling sets, carrier channels, etc. Access to the relays is provided via the SMAN. The maintenance man dials up a port from the wire chiefs test panel via the SMAN and operates the test access relay to split the tip and ring leads. With the leads split, tests are made into the DCO switching system or out toward the line.

b. The test call generator also has access to the test access relays for automatic testing of ports. (See also *Test Call Generator*.)

c. The DCO switching system can be arranged to provide a Badger 612A Test Set with access to the test access relays of line circuits. (See also *Remote Test Facility Capability*.)

3.76 Test Call Generator (091910).

a. The test call generator does a series of port-to-port routines to test the operation, features, and components of the DCO switching system. During routining, the test call generator tests each major area of the system as frequently as possible. Port-to-port routining is also the primary method of testing the nonredundant portions of the system. The pattern of routining ensures that each port is routined approximately once a day.

b. For a port-to-port routine, the test call generator, with the aid of the maintenance processor, establishes a path between two idle ports. The path is via the test access relays of the calling and called ports. When the path has been established, tests that are applicable to the circuits assigned to the ports are done. Some of the signals, such as the transmission tones, are injected by the test call generator. The following is a list of some of the tests done.

1. Dial Tone Test.
2. DTMF Test.
3. MF Sending Test.

4. Ringing Test.

5. Ringback Test.

6. Reverse Battery Test.

7. Transmission Test.

3.77 Test Codes and Trunking.

The following test codes and trunking can be provided in the DCO switching system. (Refer to AT&T "Notes on the Network," 1980.)

a. Code 100/103 Test (091709).

The same circuit is arranged to function as a Code 100 Balance Termination or as a Code 103 Signal-Supervisory Test.

1. Code 100 Balance Termination.

The Code 100 balance termination test provides a means of making one-way transmission loss and noise measurements on a single dial-up call. The Code 100 balance termination provides off-hook supervision and a 0.3-second silent period after answer, followed by a 5-second period of 1004-Hz tone and then by quiet termination.

2. Code 103 Signal-Supervisory Test.

The Code 103 signal-supervisory test provides off-hook supervision after answer. Off-hook changes to on-hook after first ring forward (rering). On-hook changes to 120 ipm on-hook/off-hook flashes on receipt of second rering.

b. Code 101 Communications and Test Line (091909).

The Code 101 communications and test line provides a communications and test line for a testboard or test position which serves the DCO switching system. The line is reached over any incoming trunk to the system.

c. Code 102 Milliwatt Test (091919).

The Code 102 milliwatt test provides a means of making one-way transmission loss measurements. The Code 102 milliwatt test provides off-hook supervision and 0.3-second silent period after answer, followed by a 9-second period of 1004-Hz tone and then by on-hook supervision.

d. **Code 104 Transmission Measuring and Noise Checking Test.**

The Code 104 transmission measuring and noise checking test provides a test termination for two-way transmission testing and one-way noise checking. The termination can be used to test trunks from offices equipped with suitable automatic test equipment and test frames. Manual two-way measurements also can be made by one person from a testboard or maintenance center.

1. **Basic Code 104 Test (091729).**

The basic Code 104 test is implemented with one test line.

2. **Code 104 – Additional Test Lines (091739).**

Additional test lines are provided to gain access to the Code 104 test.

e. **Code 105 Automatic Transmission Measuring Test Line.**

It should be noted that the Code 105 responder in the DCO switching system does not presently provide full remote office test line (ROTL) features, although these features are planned. The Code 105 automatic transmission measuring test line permits automatic two-way transmission loss and noise measurements to be made from an office equipped with suitable test frames and automatic test equipment (master station). Test trunks and a Code 105 responder can be provided at the DCO switching system. The test trunks provide access to the responder, which enables the master station to make transmission and noise measurements. The following Code 105 arrangements are available:

1. **Code 105 Responder With One Test Line (091759).**

2. **Code 105 – Additional Test Lines (091779).**

f. **Code 161 Communications Lines (091939).**

The Code 161 communications line is provided for use by an operator to report trunk troubles to a trouble reporting location.

g. **Code 958 Communications Line (091949).**

The Code 958 communications line enables personnel at a maintenance center to receive calls requesting assistance in clearing intersystem trouble.

3.78 Thousands Digit Routing (027310).

Thousands digit routing is used to provide call handling treatment in accordance with the thousands digit. For example, thousands digit routing can be used to route tandem calls through the DCO switching system. The calls could be routed to another central office or to a PBX DID trunk group.

a. **Routing to Another Central Office.**

The DCO can process tandem (trunk-to-trunk) calls. When only four digits are received on incoming calls from another central office, the DCO switching system examines the thousands digit and routes the call to a local station or to another central office depending on the first digit received. There can be no conflict in numbering. Neither can the thousands group or groups used in the distant central office be assigned in the DCO switching system nor can they be assigned in another central office requiring thousands digit routing through the system.

b. **Routing to a PBX Trunk Group.**

Thousands digit routing is used to route calls to a DID trunk group. When a block of 1000 numbers is reserved for indirect inward dialing to a PBX, the thousands digit is screened on local and incoming calls. When the data base indicates that the thousands digit is assigned to a DID group, the call is routed to the DID trunk group and the required digits are outpulsed to the PBX. In DCO switching systems with more than one office code, the office code digit must be screened with the thousands digits. (See also *Hundreds Digit Routing*.)

3.79 Three-Digit Code Translation for EAS Routing (026300).

Three-digit translation provides for distinguishing EAS office codes from the local office codes and routing the EAS calls in accordance with the office code.

3.80 Three-Way Calling (101919).

a. **Three-way calling** enables a telephone user to make an outgoing call while maintaining a previously established connection. When the second connection is established, the telephone user can bridge the two connections into a three-way conference arrangement. Three-way calling is controlled by a series of hookswitch flashes. To establish a second connection, the telephone user (calling party) flashes

the hookswitch to place the established call on hold, get dial tone, and dial a third party. If the called line is busy or not answered, the telephone user releases the call attempt by flashing the hookswitch and returning to the original connection. If the call is answered, hookswitch flash establishes a three-way conference. A hookswitch flash during a three-way conference releases the second connection but leaves the original connection intact.

- b. If either of the parties disconnects during a three-way conference, the connection to the remaining party is maintained. If the conference originator disconnects, both connections are released.
- c. The three-way calling circuit, which is provided on a traffic basis, is a conference bridge similar to the busy verification bridge.

3.81 Toll Denial (007150).

Lines in the DCO switching system are arranged such that any attempt to dial 1+, 0+, or 0- calls are denied, and the caller receives equipment-busy tone.

3.82 Tone Signaling (002738).

The DCO switching system receives and processes standard DTMF tone signals received from 10- and 12-button keysets. Lines using DTMF can also be used by normal rotary dial telephones; the reverse, however, is not true.

3.83 Traffic Measurement and Recording System (TMRS).

The DCO switching system provides a comprehensive traffic measurement recording system (TMRS) for counting events and measuring usage. Peg counts (PC), overflows (OVFL), and durations of usage are accumulated in internal registers for later readout to an output device such as a teleprinter or magnetic tape. The readout is periodic or on command. The readout device can be located in the DCO switching system or at a remote location. Three metering packages are available; one is provided.

- a. Basic DCO TMRS REA Package (046100).
- b. Enhanced DCO TMRS Package (146319).
- c. Enhanced DSU/DSI Package (146359).

3.84 Transmission Test Terminations.

Transmission test terminations provide a means of testing trunks incoming to the DCO switching system. The tests, which are controlled from the distant office, provide a means of measuring the transmission loss of the facility. The following terminations can be provided:

a. Milliwatt Test Without Cycling (091509).

The milliwatt termination of 1004 Hz is inherent to the DCO switching system; access is via dial code.

b. Milliwatt Test With Cycling.

This type of milliwatt termination is provided by a dedicated E&M interface that has access to an external source of several milliwatt signals. When the directory number assigned to the milliwatt supply is dialed from the distant end, the call is routed to the E&M interface and each signal is sequentially returned to the distant end. The duration of the first frequency is factory adjustable between 5 and 10 seconds; all other frequencies remain on for one-half the duration of the first frequency.

1. Frequency Cycling with Three Frequencies (091539).

Three sources of milliwatt signals are provided.

2. Additional Frequencies (091549).

Additional frequencies up to a maximum of nine (including the initial three) are provided.

c. Transmission and Loop-Around Test Without Cycling (091529).

The transmission and loop-around test is used to provide a means of making two-way transmission and noise tests. Two directory numbers are assigned for transmission and loop-around testing. One directory number provides a termination to a milliwatt source; the other provides a balanced (quiet) termination. If a call to either directory number is held and the other directory number is called, the two incoming trunks are connected together for loop-around testing. The milliwatt supply in the DCO switching system should be used as the milliwatt source.

d. Transmission and Loop-Around Test With Cycling (091519).

The transmission and loop-around test with cycling is similar to transmission and loop-around without cycling. The difference is the tone source. Cycling

requires a source of several milliwatt signals which are sequentially returned to the distant end when the directory number for the milliwatt termination is dialed. The duration of the first frequency is factory adjustable between 10 and 50 seconds; all other frequencies are on for one-half the duration of the first frequency. (See *Milliwatt Test with Cycling*.)

3.85 Trunk Control of Call Path — CLR Holding (011170).

The CLR trunk provides operator hold and paystation rering capability. The toll operator can hold the connection to the calling line after the calling party has disconnected and, in case of paystation, apply rering.

3.86 Usage Sensitive Recording (USR) (241509).

USR is provided for the recording and readout of detailed call accounting information on EAS/local calls that is used for billing purposes. When a DCO switching system is equipped with USR, all one-party and optional two-party lines in the system have USR capability. However, by customer choice, USR can just be provided on some selected lines. For example, some subscribers could have flat rate service and others could have message rate service with messages (calls) recorded by USR. USR could also be used to provide expanded EAS to some subscribers, with calls to the expanded area recorded by USR. The LAMA magnetic tape, or separate dedicated tape, is the storage medium for USR. (See also *LAMA*.)

3.87 Volunteer Fire Alarm System (001509).

- a. The Volunteer Fire Alarm System uses a Tellabs 291 system that handles up to 30 volunteer fireman's lines. In addition to the Tellabs unit, each fireman requires a DCO switching system or DNI line circuit. The volunteer fireman's line is a DNI line circuit or a standard one-party, bridged ringing line circuit. This arrangement provides for the return of ringback tone to the calling number when the called number is engaged in a fire reporting conference call.
- b. It is not necessary for all lines connected to the Tellabs unit to ring with the same ringing frequency. All frequencies available in the office can be used.
- c. When the fire reporting conference circuit is seized, all free fireman's lines are disengaged from the DCO switching system and distinctive ringing is

applied to their lines. Busy fireman's lines either receive a warning tone or the existing conversation is immediately cut off. The choice is an on-site system option. If alerting tone is chosen, the fireman needs only to depress the hookswitch long enough to break the existing connection to be automatically routed to the conference circuit. The basic system provides siren control activated by pushbutton from any or selected fireman's lines. Once activated, the siren sounds until the conference circuit is released.

d. Several options available with the Tellabs system are:

1. Automatic Conference Activation.

- a) This is the same as most existing fire alarm systems in use today. A caller, by dialing a fire reporting number, automatically initiates a fire reporting conference.
- b) The automatic conference activation equipment is furnished either as a single unit or with redundancy.
- c) A DCO switching system line circuit (one-party, bridged) is required for the fireman's line.

2. Manual Conference Activation.

- a) In this mode, a caller dialing the fire reporting number reaches a telephone located in the fire company's dispatch office. When the dispatcher has ascertained the caller's needs, the dispatcher starts a fire reporting conference from a second telephone directly connected to the fire reporting conference system.
- b) Manual activation equipment is furnished either as a single unit or with redundancy.
- c) In this mode, a DCO switching system one-line circuit is required for the fire reporting line. In addition, the telephone company would have to supply two dial-less telephones at the dispatch office — one connected to the DCO switching system line circuit, and one to the Tellabs unit.

- d) This system requires that the dispatch office be staffed on a full-time basis.

3. Combined Manual/Automatic Conference Activation.

a) This option is a combination of the operations described in paragraphs d.1 and d.2. When the dispatch office is staffed, operation is as described in paragraph d.2.a. When the dispatcher goes off-duty, he operates a key (not supplied with the system) which busies out the normal access and places the system in an automatic mode, as described in paragraph d.1.

b) This option does not provide redundancy on either the manual or automatic conference activation equipment.

c) To enable this feature, two DCO switching system one-party, bridged ringing line circuits arranged as a PBX hunt group are required — line 1 being associated with manual conference activation equipment, and line 2 with automatic conference activation equipment.

4. Siren Interval Timer.

This option provides enhancement to the basic siren activation system. With this option, the siren is arranged to sound for a predetermined interval. This interval is programed on site for intervals between 1 second and 26 minutes. Additionally, this option can be arranged, on site, to override the preprogramed sounding interval by a second depression of a station pushbutton.

5. Conference Remote Answer Trunk.

This option allows a fireman who may be away from his telephone to access the conference when he hears the siren. This is achieved by the fireman dialing a preassigned telephone number (preferably unlisted) that gives access to the fire conference system. The fire system can be equipped with up to three such access lines. Each of these access lines requires a one-party, bridged ringing line circuit in the DCO switching system. When more than one such access line is required, the lines should be arranged as a PBX hunt group.

e. Equipment Not Furnished.

It should be noted that the following equipment is not furnished with the Tellabs 291 system:

1. Community siren(s).
2. Siren activation pushbutton.
3. Dispatcher telephones.
4. Manual/automatic conference switchover key.

NOTE. In addition to its feature content, the 291 system carries a 5-year warranty from Tellabs.

3.88 Wide Area Telecommunications Service (WATS).

WATS is a telephone service designed to meet the needs of heavy users of the toll network who make or receive substantial volumes of long distance calls to or from many areas of the country. This service is available by geographical areas called WATS service areas or bands. A user may subscribe to any band and have service to that band in addition to service to any band geographically closer, excluding intrastate. The latter is handled as a separate band. A WATS user is connected to the nationwide dialing network by special WATS access lines. Charges for WATS service are on a measured time basis with a basic allowance per month.

a. WATS (Outgoing).

This feature includes screening of area codes to ensure that the call destination is within the band limits of the WATS line being used. Calls to denied bands can be routed to intercept. Two methods of usage measurement are available.

1. WATS With Line Usage Meter (041719).

An individual line usage meter (LUM) is provided per access line that accumulates usage and peg counts.

2. WATS With LAMA (206149).

Each call is recorded in the LAMA equipment with output to magnetic tape.

b. In-WATS (Incoming).

The current trend now is to call this "800" service rather than in-WATS due to the characteristic 800

code used to distinguish these calls. This is a non-charge toll service to the calling party with charges made to the called party and measured at the terminating end. Two methods of measurement are available for this feature.

1. In-WATS With Line Usage Meter (041709).

Individual line usage metering (LUM) is provided for each terminating line to accumulate usage and provide peg count and overflow.

2. In-WATS With LAMA (206139).

Each incoming call to these lines is recorded in the LAMA equipment with output to magnetic tape.

3.89 Wire Chiefs Test Panel (091110).

The wire chiefs test panel provides for testing lines and trunks. It uses the test access selectors and SMAN to gain dial-up access to line and trunk ports. Line ports are dialed up by directory number or equipment number; trunk ports are dialed up by equipment number for inward and outward testing. Various conditions such as ringing, coin collect, coin return, howler, etc., are applied to a line from the wire chiefs test panel. An MDF test shoe enables the wire chiefs test panel to be used for isolating a line cable pair from an equipment pair to allow inward and outward testing. Binding posts are provided to connect external test equipment, such as a Wheatstone bridge, to the wire chiefs test panel.

3.90 "0" With and Without Timeouts (021520).

An office that homes on a TSPS or similar office offers person-to-person, collect, special (PPCS) DDD service. On PPCS DDD calls (0+ calls), the telephone user dials the digits necessary to complete the call, and the operator is called in to perform special functions, such as to start timing on a person-to-person call, ask the called party to accept charges, key a credit card number into the system, etc. In offices providing 0+ or 0-service, critical timing is used to make a distinction between 0+ PPCS DDD calls and 0- operator assistance calls. On receipt of the digit "0", a 3.5-second timing cycle is started. If the timing cycle is not cancelled by the receipt of another digit, the call is processed by the operator as an assistance call. Otherwise, the call is completed as a 0+ DDD call with an operator called in to provide whatever PPCS service is required. In offices not providing 0+ service, there is no need to distinguish between 0+

and 0-calls; all PPCS calls and operator assistance calls are routed to the operator immediately upon receipt of the digit "0".

3.91 "0+" and "1+" Address Digits (021510).

A DCO switching system that homes on a TSPS or similar office can route 0+ and 1+ traffic over a common trunk group. Coin and noncoin traffic can also be routed over a common trunk group. The type of call is identified by the MF start signal sent with the called number (MF trunk group) or the calling number (DP trunk) group. Four start signals are available to identify the type of call. The signals are ST (start), STP (ST prime), ST2P (ST 2 prime), and ST3P (ST 3 prime). The following combinations of traffic can be routed over a common trunk group:

- a. Noncoin 0+ and 1+.
- b. Coin 0+ and 1+.
- c. Coin and Noncoin 0+ and 1+.

NOTE. The appropriate ST signal is used to indicate type of traffic.

3.92 911 Emergency Routing (022710).

Three digit emergency number 911 has been adopted by the telephone industry as a nationwide emergency number. Emergency calls (911 calls) are routed to a public service answering point (PSAP) that can quickly obtain the requested emergency assistance (fire, police, ambulance, etc.) for the calling party. When a DCO switching system serves more than one PSAP because of geographical boundaries, selective routing according to geographical area is provided regardless of municipal and wire center boundaries. Telephone users in each geographical area have emergency calls routed to the PSAP serving their area. Other features available with 911 emergency calling are described below.

a. Coin Free Dialing.

The DCO switching system can provide dial tone first operation to allow coin-free emergency calling from paystations.

b. Emergency (911) From a PBX.

Depending on the capability of the PSAP, the PBX can provide the following features:

1. Called Party Hold.

Called party hold enables the PSAP attendant to maintain the connection after the called party disconnects, thereby enabling the PSAP attendant to rering the calling party or have the call traced.

2. Rering.

Rering enables the PSAP attendant to ring back a calling party that has been disconnected, thereby enabling the attendant to verify information previously obtained or to obtain additional information.

3. Forced Disconnect.

Forced disconnect enables the PSAP attendant to release a held incoming call, thereby keeping the emergency line open.

4. INTERNATIONAL FEATURES

4.01 CCITT No. 5 Signaling System (321019).

a. The CCITT No. 5 signaling system is intended for use on 4-wire international links, particularly on international circuits which have long propagation times. It may be used for both automatic (subscriber-originated) and semi-automatic (operator-originated) calls, over satellite circuits and with Time Assignment Speech Interpolation (TASI) circuits. It is also suitable for bothway working of circuits, and is normally used in this manner. Echo suppressor capability is enabled during register signaling and during the conversation period, and disabled during line signaling.

b. The "line" (supervisory) signals and the "register" (numerical/routing) signals are handled by separate equipment. The line signaling is accomplished by means of two voice-frequency (in-band) tones, which can be sent either singly or together in both forward and backward directions. A dedicated line sender/receiver is permanently associated with each CCITT No. 5 trunk circuit.

c. The register signaling takes the form of multifrequency in-band tones, sent in the forward direction only, using 2-out-of-6 code. The frequencies and digit codes are identical to those used in the CCITT R1 signaling system but are sent at a faster rate. An MF sender (at the outgoing end) is part of the No. 5

trunk circuit, and an MF receiver (at the incoming end) is connected to a No. 5 trunk circuit, from a pool, for the duration of the call set-up only.

4.02 Digital Tone Plant (308010).

The Digital Tone Plant consists of single frequency generators which can be programed to mix, modulate, level control, and interrupt tones in accordance with the requirements for the area or country in use. This is accomplished by using customized Programmable Read Only Memories (PROMs) to control the output of the frequency generators to produce the unique requirements for a specific area or country.

4.03 Digital Trunk Interface – CEPT (312019).

a. The Digital Trunk Interface (DTI) provides a direct digital interface for the Digital Central Office (DCO) and the Congress of European Postal Telecommunications (CEPT) Carrier System as specified in CCITT recommendation G.732. This is accomplished without rate conversion since both the CEPT system and the DCO port group highways operate at 2048 kb/s and is transposed from the CEPT format to the port group highway format without analog conversion.

b. The CEPT format consists of 32 channel timeslots per frame. Thirty of the timeslots are used for voice channels – one is used for signaling, and one for administration and synchronization. This digital trunk interface is available as either "A", a transparent unit, or optional μ /A-law converter for connection into an A-law digital switch.

4.04 Local Paystation with 3-Minute Cutoff (323029).

Local-only paystations are restricted to calls of three-minute duration. A warning tone is applied in three bursts, two and one half minutes after answer supervision. At three minutes, the circuit is disconnected.

4.05 Open Numbering Plan (316010).

The DCO can accommodate an open numbering plan containing any number of digits, up to sixteen.

4.06 Operator Re-ring (Korea) (320019).

On operator-handled trunk calls, the operator has the capability of recalling the on-hook originating

subscriber by applying rectified ringing signals to indicate a ringing signal over the held 4-wire E&M trunk. The DCO detects the pulses and applies a ring command to the line circuit port causing the original subscriber's telephone to ring. Normal answer supervision occurs.

4.07 Overlap Outpulsing (311030).

The DCO can provide overlap pulsing for any signaling system, e.g., dial pulse, MF, R2, etc. The overlap can be controlled for any number of digits. This feature allows the transfer of digits, as they are individually received, from an incoming port to an outgoing port.

4.08 R2 Inter-register Signaling (311029).

a. R2 inter-register signaling is a compelled multifrequency code system that offers the possibility of end-to-end signaling and provides a signaling capability in both directions. It uses six signaling frequencies (1380, 1500, 1620, 1740, 1860 Hz) in the forward direction and six signaling frequencies (1140, 1020, 900, 780, 660, and 540 Hz) in the backward direction. However, for national application, fewer signaling frequencies may be adequate.

b. Forward signals are identified in two groups, designated GROUP I and GROUP II, and backward signals are identified in two groups, designated Group A and Group B. Since the specific use of these signals can vary internationally and nationally as well as the fact that all signals are not required in all situations, a customized data base is required for each application.

4.09 R2 Line Signaling.

The following three types of R2 line signaling are available:

- a. North American loop trunk, continuous signaling.
- b. North American E&M trunk, continuous signaling.
- c. L.M. Ericsson E&M trunk, discontinuous signaling (traffic type 1).

4.10 Single-Rate Meter Pulsing (315029).

Single-rate meter pulsing provides meter pulsing at a common single rate for local line-to-line and line-to-trunk calls. The rate is variable from 1 second to 15 minutes, with one rate selectable per exchange. At the telco's option, certain types of local calls — such as

police, fire, operator, may be excluded from metering. This system records the number of meter pulses generated per call by the calling directory number and adds them to that subscriber's existing pulse counts which are stored in memory. The telco can then use the \$METER TTY input command to print on TTY each subscriber's directory number and meter pulse count in order to generate bills based on usage.

4.11 Special Subscriber Line Circuits Terminating on DNI (313019).

a. Special subscriber line circuits are available for connection to a Digital Network Interface (DNI). The loop characteristics of these circuits are as follows:

Characteristic Impedance: 600 ohms

Maximum Resistance (including telephone sets): 1,800 ohms

Battery Feed: 2 x 400 ohms

Loop Current: 50 mA to 20 mA

b. In addition, it should be noted that these circuits are for single party lines equipped with μ -law CODECs.

5. ABBREVIATIONS AND MNEMONICS

AIS	Automatic Intercept System
ALI	All Line Identification
AMA	Automatic Message Accounting
ANI	Automatic Number Identification
ASCII	American Standard Code for Information Interchange
ATB	All Trunks Busy
BAT	Battery
C	Control
CAMA	Centralized Automatic Message Accounting
CDF	Combined Distributing Frame
CL	Current Loop
CLR	Combined Line and Recording (Dial 0, Operator)
COS	Class of Service
DCO	Digital Central Office
DDD	Direct Distance Dialing

DID	Direct Inward Dialing	ONI	Operator Number Identification
DNI	Distributed Network Interface	OVFL	Overflow
DOD	Direct Outward Dialing	PBX	Private Branch Exchange
DP	Dial Pulse	PC	Peg Counts
DTMF	Dual-Tone Multifrequency	PPCS	Person-to-Person, Collect, Special
E&M	Receive and Transmit (Trunk Signaling)	PPS	Pulses Per Second
EAS	Extended Area Service	PSAP	Public Service Answering Point
EBCDIC	Expanded Binary Coded Decimal	RBT	Ringback Tone
	Interchange Code	REA	Rural Electrification Administration
EBT	Equipment Busy Tone	ROH	Receiver Off-Hook
EC	Extra Control	ROTL	Remote Office Test Line
ESS	Electronic Switching System	S	Sleeve
FNPA	Foreign Numbering Plan Area	SCAT	Stromberg-Carlson Assistance Team
FX	Foreign Exchange	SMAN	Switched Maintenance Access Network
FXO	Foreign Exchange Office	SNC	Synchronous Network Clock
FXS	Foreign Exchange Subscriber	SSSP	Station-to-Station, Send Paid
HS	Helper Sleeve	ST	Start
IDDD	International Direct Distance Dialing	ST2P	Start 2 Prime
IMTS	Improved Mobile Telephone Service	ST3P	Start 3 Prime
In-WATS	Incoming Wide Area Telecommunications Service	STP	Start Prime
IPM	Interruptions Per Minute	S x S	Step-by-Step
LAMA	Local Automatic Message Accounting	TMRS	Traffic Measurement and Recording System
LED	Light Emitting Diode	TSPS	Traffic Service Position System
LUM	Line Usage Meter	USR	Usage Sensitive Recording
MDF	Main Distributing Frame	VF	Voice Frequency
MF	Multifrequency	WATS	Wide Area Telecommunications Service (Outgoing)
MTI	Multiple Terminal Interface		
NPA	Numbering Plan Area	XOH	Cross-Office Highway