AUTOMATIC IDENTIFIED OUTWARD DIALING (AIOD) DESCRIPTION NO. 2 AND NO. 2B ELECTRONIC SWITCHING SYSTEMS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the feature of Automatic Identified Outward Dialing (AIOD) used with a Centrex-CU configuration and a No. 2 and No. 2B Electronic Switching System (ESS) central office, equipped with EF-1 generic or later and local AMA. From this point on, the term No. 2 ESS will be used to represent both No. 2 ESS and No. 2B ESS.

1.02 This section is being reissued to include a description of software changes since the last issue. Since this reissue is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The purpose of the AIOD feature is the identification of calling stations in Centrex-CUs or PBXs making outward calls requiring Automatic Message Accounting (AMA) billing or sampling. Prior to AIOD, this function required the manual intervention of an operator. With AIOD, the station identification may be used in Local Automatic Message Accounting (LAMA) billing. A PBX with Direct Inward Dialing (DID) and AIOD is defined as a Centrex-CU, but the implementation of AIOD in No. 2 ESS is independent of all other features except LAMA. The office ***must*** have LAMA before the AIOD feature can be implemented.

1.04 Centrex-CO does not require any special equipment to bill individual centrex stations for charged calls since ***all*** stations terminate on the line trunk network. In Centrex-CU operation, a station may use one of a number of PBX central office trunks, so the AIOD hardware and software are used to make the association of the calling centrex station and the central office trunk being used. This information is then made available to the AMA program.

> ***Note:*** In this document the term central office trunk is used to describe the talking connection that exists between the No. 2 ESS central office and the Centrex-CU. The central office trunk is treated as a line at the No. 2 ESS and as a trunk at the Centrex-CU.

1.05 No. 2 ESS AIOD is compatible with any version of PBX Automatic Number Identification (ANI) units (SD-1E007), and No. 101 ESS ANI (SD-1H089).

> ***Note:*** For convenience of reference in this document, the data link together with either the PBX-ANI (SD-1E007) or No. 101 ESS (SD-1H089) ANI circuit is called an ANI. An ANI together with a No. 2 ESS, AIOD Interface Circuit (SD-1A301) is called an AIOD system.

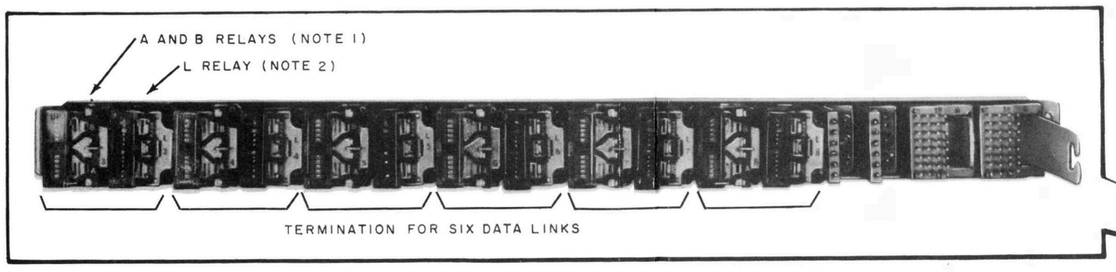
2. AIOD HARDWARE

2.01 There are three basic hardware items in the AIOD system.

- AIOD Interface Circuit (SD-1A301).
- Station Number and Trunk Number Identification Equipment, ANI (SD-1E007 or SD-1H089)
- Data Link (a tip-ring pair from the customer's location to the central office).

A. Automatic Identified Outward Dialing Interface Circuit

2.02 In a No. 2 ESS office, the central office data link terminating and receiving equipment is the AIOD Interface Circuit (SD-1A301) which is mounted on a miscellaneous trunk frame. Figure 1 shows the basic AIOD interface circuit. The main purpose of the AIOD interface circuit is to receive the coded station and trunk numbers from the Centrex-CU and to perform data validation checks. The AIOD interface circuit system includes relays, data receivers, check circuits, shift registers, test transmitters and an ANI Connecting Unit. The major items of AIOD interface circuit are duplicated for service reliability. The components are organized so that the duplicated halves can function independently. Figure 2 shows a simplified block diagram of the AIOD interface circuit. Each half consists of a data receiver, check circuitry, and a 41-bit shift register. Diagnostic circuitry and two test transmitters are shared between the halves and are not used in routine call processing.



ANI CONNECTING UNIT

NOTES:

1. WHEN THE A RELAY IS OPERATED, THE ANI ASSOCIATED WITH THAT RELAY IS CONNECTED TO DATA RECEIVER 0. WHEN THE B RELAY IS OPERATED, THE ANI ASSOCIATED WITH THAT RELAY IS CONNECTED TO DATA RECEIVER 1.

2. WHEN THE L RELAY IS OPERATED IT INDICATES THAT A DATA LINK IS CONNECTED TO THE RELAY. WHEN THE L RELAY IS RELEASED IT INDICATES THAT THE ANI CONNECTED TO THIS RELAY IS BIDDING FOR SERVICE.

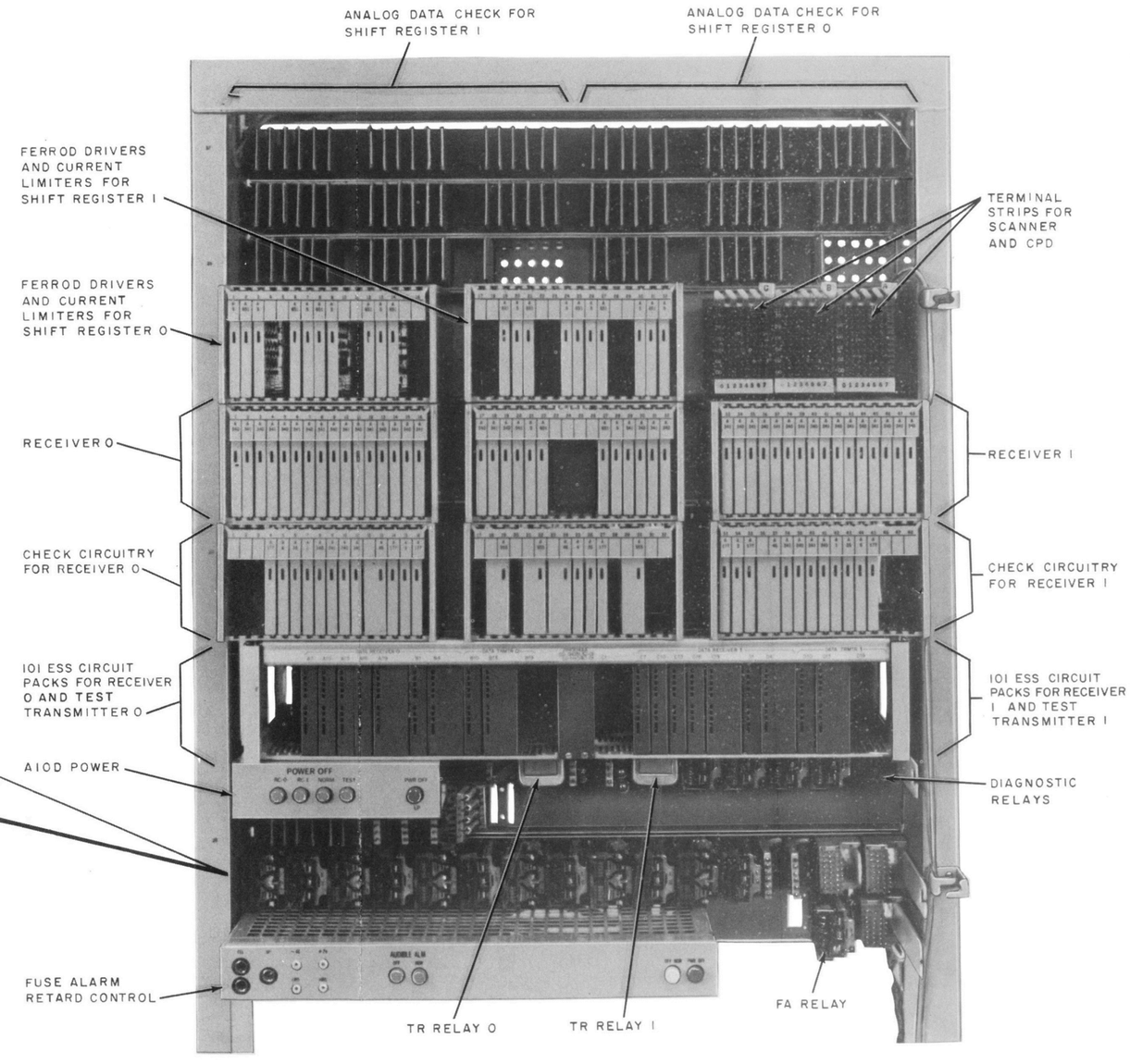


Fig. 1—Automatic Identified Outward Dialing Interface Circuit

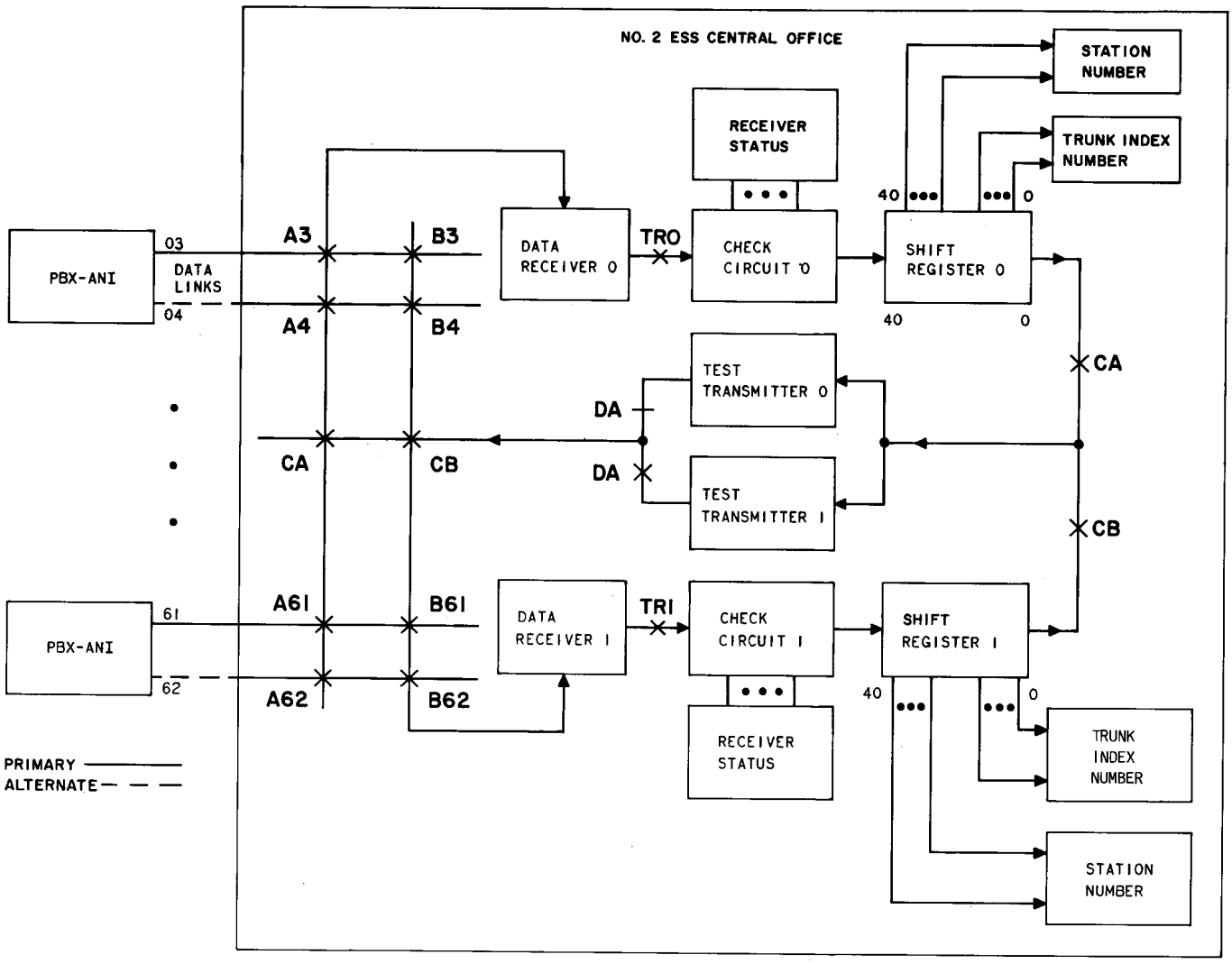


Fig. 2—Automatic Identified Outward Dialing (AIOD) Interface Circuit Block Diagram

DATA RECEIVER

2.03 The function of the data receiver is to convert the frequency-shifted analog signals received from the PBX-ANI or No. 101 ESS to logic 1 or 0 values (1150HZ = 0, 1850HZ = 1). Since the AIOD message rate, 735.29 BPS (Table A) is the same as the No. 101 ESS data link rate, No. 101 ESS data receivers (SD-1H031) are used in AIODIC. The two data receivers are assigned unit member numbers 0 and 1.

TABLE A

AIOD MESSAGE CHARACTERISTICS

LENGTH	41 BITS CONSISTING OF: A PREMESSAGE BIT* 20 BITS FOR TRUNK INDEX 20 BITS FOR STATION NUMBER
SIGNALING	FREQUENCY SHIFT KEYING 1150 HZ = 0 1850 HZ = 1
RATE	735.29 BITS PER SECOND
DURATION	55.75 MS
CODE	TRANSMITTED IN 2/5 CODE CONVERTED TO TRUNCATED 2/5 AT CENTRAL OFFICE

*The premessage bit is always a one initializing the AIOD control circuit.

CHECK CIRCUIT (AIOD CONTROL CIRCUIT)

2.04 The AIOD check circuit is used to reset the data receiver and prevent data from entering the shift register indiscriminately. The check circuit administers the output of each data receiver and TR relay. Using the output from the data receiver and the TR relay, the check circuit either allows or prevents data from flowing into the shift register.

Other functions performed by the check circuit are as follows:

- Detecting the premessage bit
- Signaling receipt of premessage bit with Signal Present Message (SPM) scan point
- Generating a clear pulse for the shift register and shift pulse counter
- Gating and regeneration of the shift pulse
- Providing a noise blanking interval after connection to an ANI (4.5 ms)
- Counting shift pulses arriving with and following the premessage bit by means of a 6-cell binary counter
- Determining when the Complete Message has been received and indicating the reception with the Complete Message scan point (CM = 0)
- Accessing the maintenance circuitry through operation of the diagnositc relays (CA, CB, DA, and DB)

SHIFT REGISTER

2.05 The shift register accepts incoming data and stores it for eventual readout via the master scanner. The data from the ANI is received in serial form and available in parallel form in the shift register.

2.06 Each shift register is 41 bits long and is used to buffer a premessage bit and 8 digits of information. Cells 0 and 1 are called premessage bit (PMB) and first information bit (FIB), respectively. The premessage bit is the first bit transmitted by the ANI and is always a 1, initializing the AIOD control circuit. Figure 3 shows a layout of the AIOD message as it appears in the shift register.

2.07 The information enters serially at cell 40 and propagates to cell 39, then to cell 38, and so on toward cell 0. The incoming data enters the shift register so that the 0 weighted bit in the code precedes the other weighted bits.

2.08 Cells 1, 6, 11, 16, 21, 26, 31, and 36, which correspond to the 0 weighted bit of the code,

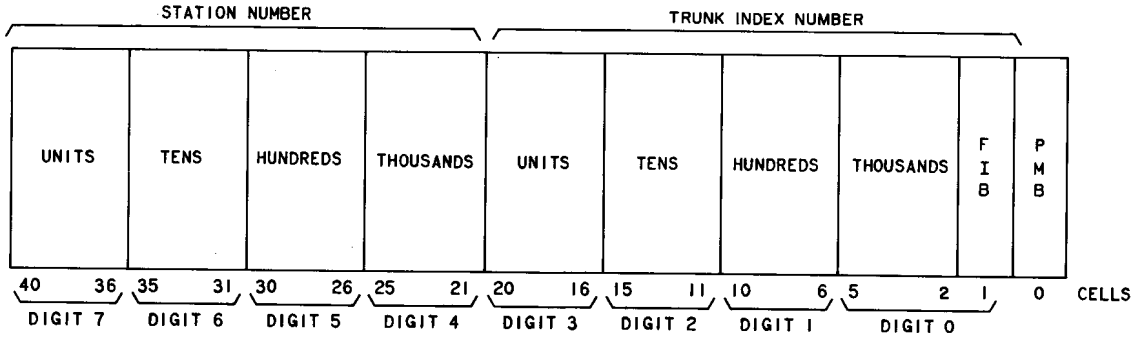


Fig. 3—Layout of AIOD Shift Register

are used for error checking only. They are used to verify that their respective digits contain a valid number in a 2-out-of-5 code. The information in these cells is not used in determining the value of the digit.

2.09 The outputs of the shift register cells are all used as inputs to driver gates. The driver gates energize a current limiting network connected to the scan points. Figure 4 shows the relationship between register cells and scan points. Each of the ferrod driver gates also drives part of a 2-out-of-5 check circuit. This circuit checks each group of five bits for a valid 2-out-of-5 code. These parity checks are performed on each of the eight digits and are monitored by the corresponding shift register error ferrod. The shift register error ferrods monitor this check circuit, and the 0 weighted bit of their respective digits. The shift register error ferrod reads 1 (unsaturated) when a valid digit exists in that group of five bits.

2.10 The logic 1 output of cells 40 through 36 drives 5 gates that are monitored by the ANI Parity Error ferrod. When five logic 1s appear in bit locations 40 through 36, the ANI Parity Error ferrod reads unsaturated. This indicates an ANI parity error. The reason for this check is that the ANI sends all 1s for the station number whenever it fails to identify the Centrex-CU station making the call, and all 1s for the remainder of a message when it detects an invalid 2-out-of-5 code. Since the station number is the last information sent, only cells 40 through 36 must be monitored to detect this error.

Note: The term "ANI Parity Error" at the central office is known as "Word Error" and/or "Station Number Failure" at the Centrex-CU.

TEST TRANSMITTER

2.11 The AIOD interface circuit contains two test transmitters. Their function is to assist in diagnosis of the two AIOD data receivers. When diagnosis is necessary, the circuit can be reconfigured to circulate the contents of the shift register through either of the two transmitters, the data receiver and check circuitry, and into the shift register (Fig. 2). In the process, the data in the shift register is converted to frequency-shifted information by the test transmitters and sent to the data receiver where it is reconverted to a digital message and stored in the shift register.

2.12 When the test transmitter is connected to a receiver, it converts the logic level state of cell 0 of the shift register into a frequency-shifted signal and then transmits this signal to the data receiver. In this configuration, the test transmitter simulates an ANI. When the transmitted data enters cell 40, the contents of the shift register are shifted (toward cell 0) so that cell 0 now contains what cell 1 contained before the shift. This process continues until all 41 bits are converted and transmitted. The test transmitter sends the information at a rate governed by the oscillator in the data receiver (735.29 BPS). After this interchange of data, the contents of the shift register should

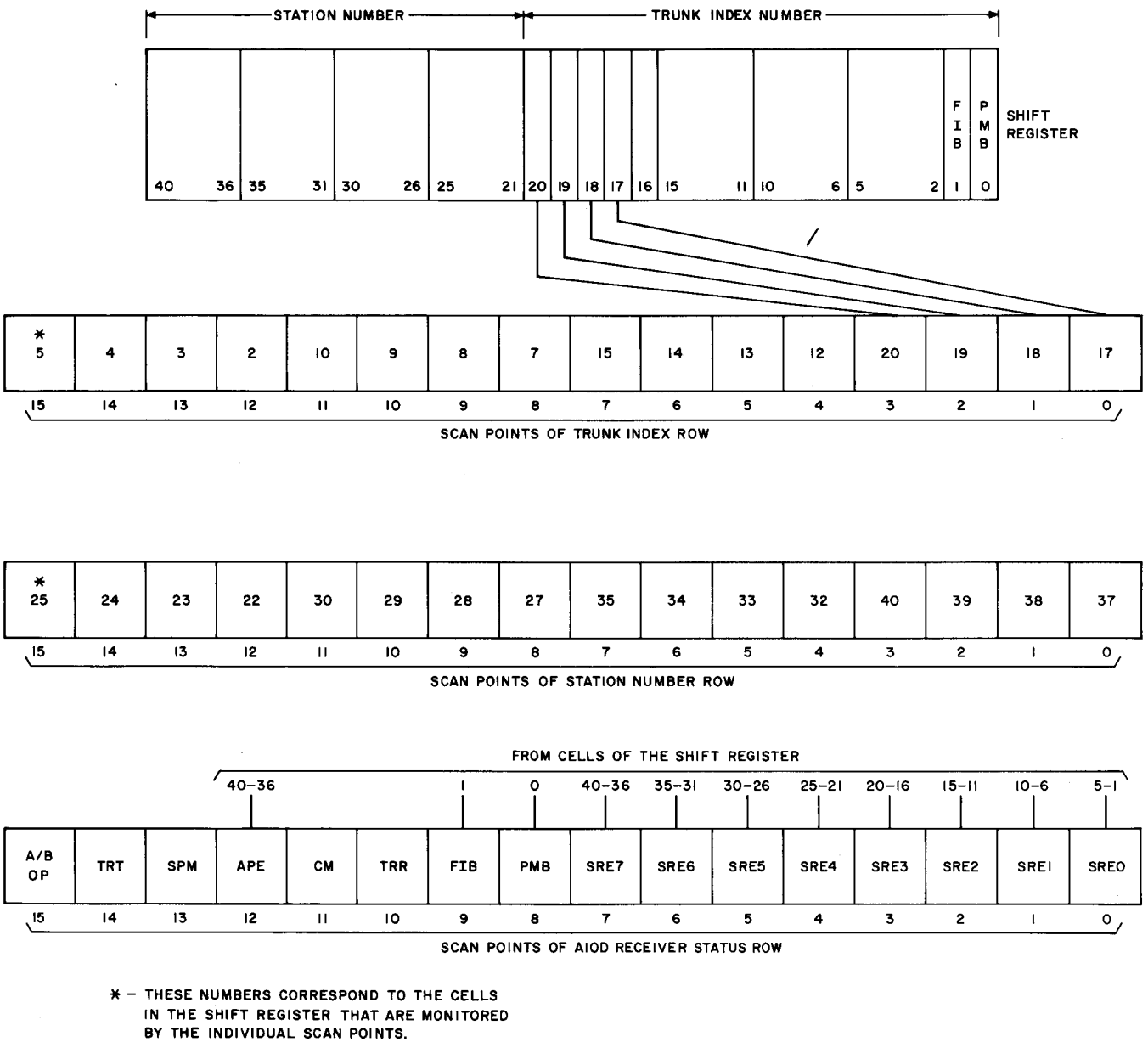


Fig. 4—Scan Points Associated With Shift Register Cells

appear identical to the contents of the shift register before the transmission.

2.13 Both test transmitters are used during the diagnostic. This is done to prevent a good receiver from being removed from service due to a faulty test transmitter. If both transmitters fail to circulate the data correctly, the receiver is then removed from service. Because of power, fusing, alarm, and program requirements, the two test transmitters are given a single unit member number of 2.

ANI CONNECTING UNIT

2.14 The ANI connecting unit is comprised of a 2-inch mounting plate located on the AIOD frame. Each unit can terminate up to six data links. The maximum number of ANI connecting units is ten. There are six L relays on each connecting unit (Fig. 1). Each relay is used to terminate one data link. Associated with every L relay is an A and B relay. These relays are used to connect an ANI to either data receiver 0 or data receiver 1. Relay A connects the data link to data receiver 0 and relay B connects the data link to data receiver 1.

2.15 The ANIs are assigned data link numbers 3 through 62. An ANI can be assigned to more than one data link for redundancy purposes.

2.16 The basic AIOD interface circuit comes equipped with one ANI connecting unit (Fig. 5). A fully equipped AIOD frame has 10 ANI connecting units. (Fig. 6).

2.17 For additional information on the AIOD interface circuit, refer to CD-1A301 and SD-1A301.

B. Station Number and Trunk Number Identification Equipment

2.18 The second basic hardware item in the AIOD system is the equipment used to identify the Centrex-CU station and the particular central office trunk being used to connect the station to the central office. In the case of the 701B and 757A electromechanical PBXs, this is the ANI (SD-1E007) equipment which is located on the customer's premises. In the case of No. 101 ESS, this equipment is the ANI circuit (SD-1H089) which is a mounting plate associated with the No. 101 ESS control unit located at a central office. Figure 7 shows a block diagram of a Centrex-CU facility for both conventional PBXs and the No. 101 ESS.

C. Data Link

2.19 The third basic hardware item in the AIOD system is a data link which is a dedicated voice grade pair—between the ANI and the AIOD interface circuit. Physically, the AIOD data link is the same as the associated Centrex-CU talking paths. The data link terminates on the ANI connecting unit.

2.20 The data link (Fig. 7) is used to signal between the ANI and the AIOD interface circuit and also to transmit information from the ANI to the AIOD interface circuit. The data link is used as follows:

(1) When no message is being received by the AIOD interface circuit, the data link is in an idle state and the ANI is applying -48 volts on the tip and ring of the data link.

(2) When the ANI sends a bid signal (request for service) to the central office, it does so by removing -48 volts from the tip and ring of the data link.

(3) When the AIOD interface circuit is ready to accept the data from the ANI, it sends a transmit signal over the data link to the ANI by applying -48 volts to the tip and ring of the data link.)

(4) After the ANI receives a transmit signal, it sends information to the AIOD interface circuit over the data link. This information is a coded representation of the station making the call and the trunk being used.

(5) When the ANI has finished transmitting the information, the AIOD interface circuit removes the transmit signal. The ANI responds by applying -48 volts to the tip and ring of the data link putting the data link in an idle state.

2.21 To maintain service reliability, it is advisable to dedicate a second data link as an alternate for each ANI. This alternate data link is wired at the central office and assigned a Centrex-CU number in translations. To activate the alternate data link into service it must be manually switched at the ANI frame, which is located at the customer's location. The alternate data link would have the same Centrex-CU number in translations as would the primary data link. Thus call processing would treat the data received from the alternate data link in the same manner as data from the primary data link. When the need for the alternate data link has ended, the primary data link must be switched back, since ANI error counts are correct only when the primary data link is used.

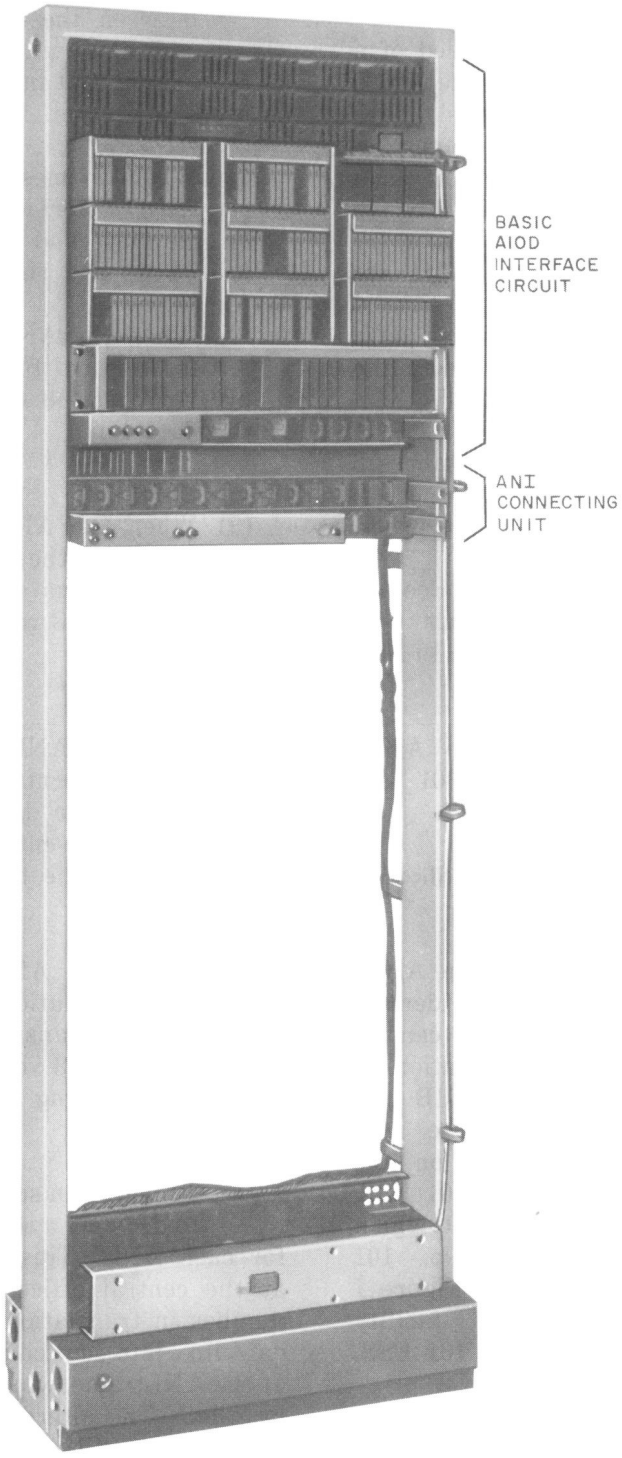


Fig. 5—Basic AIOD Frame

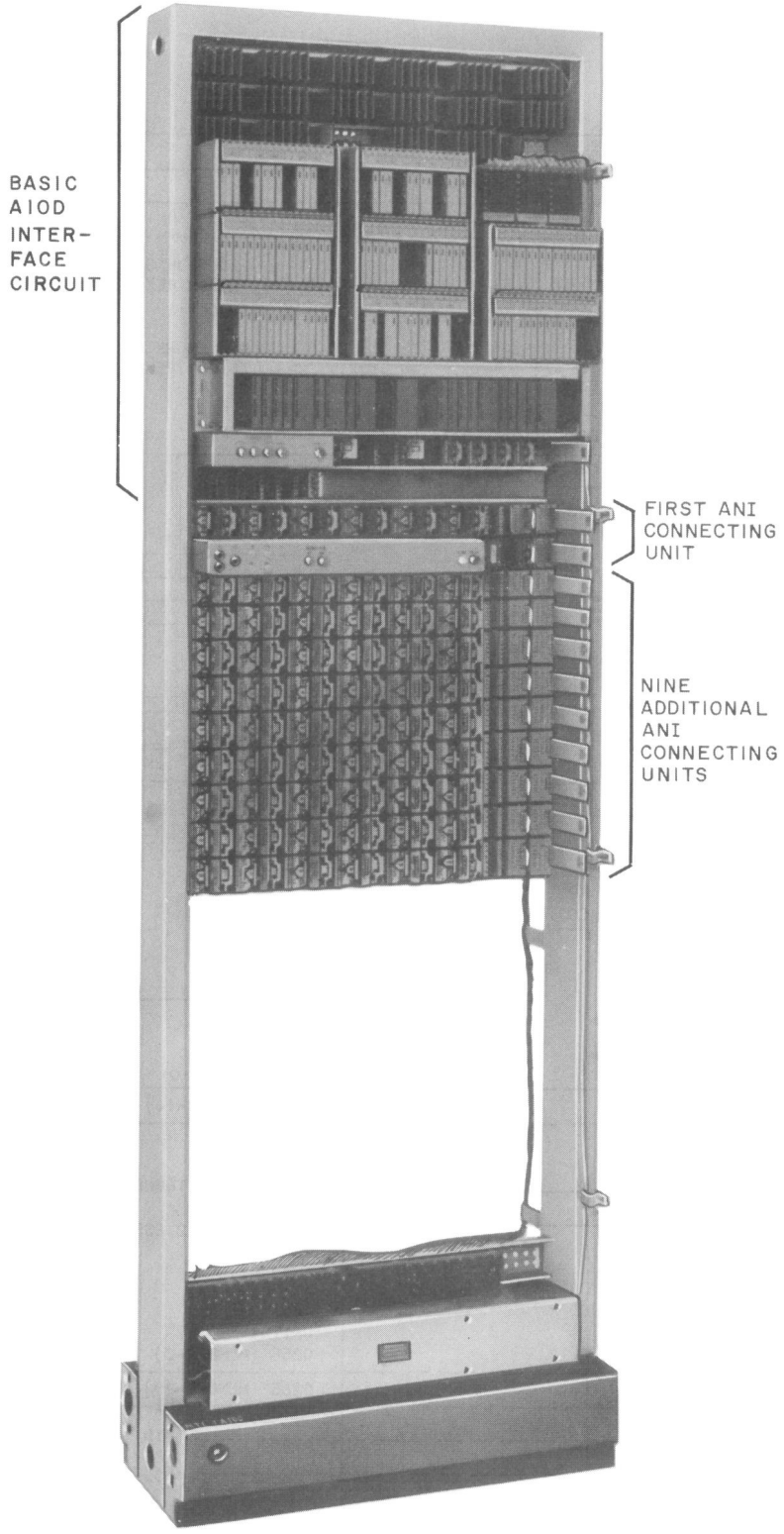


Fig. 6—Fully Equipped AIOD Frame

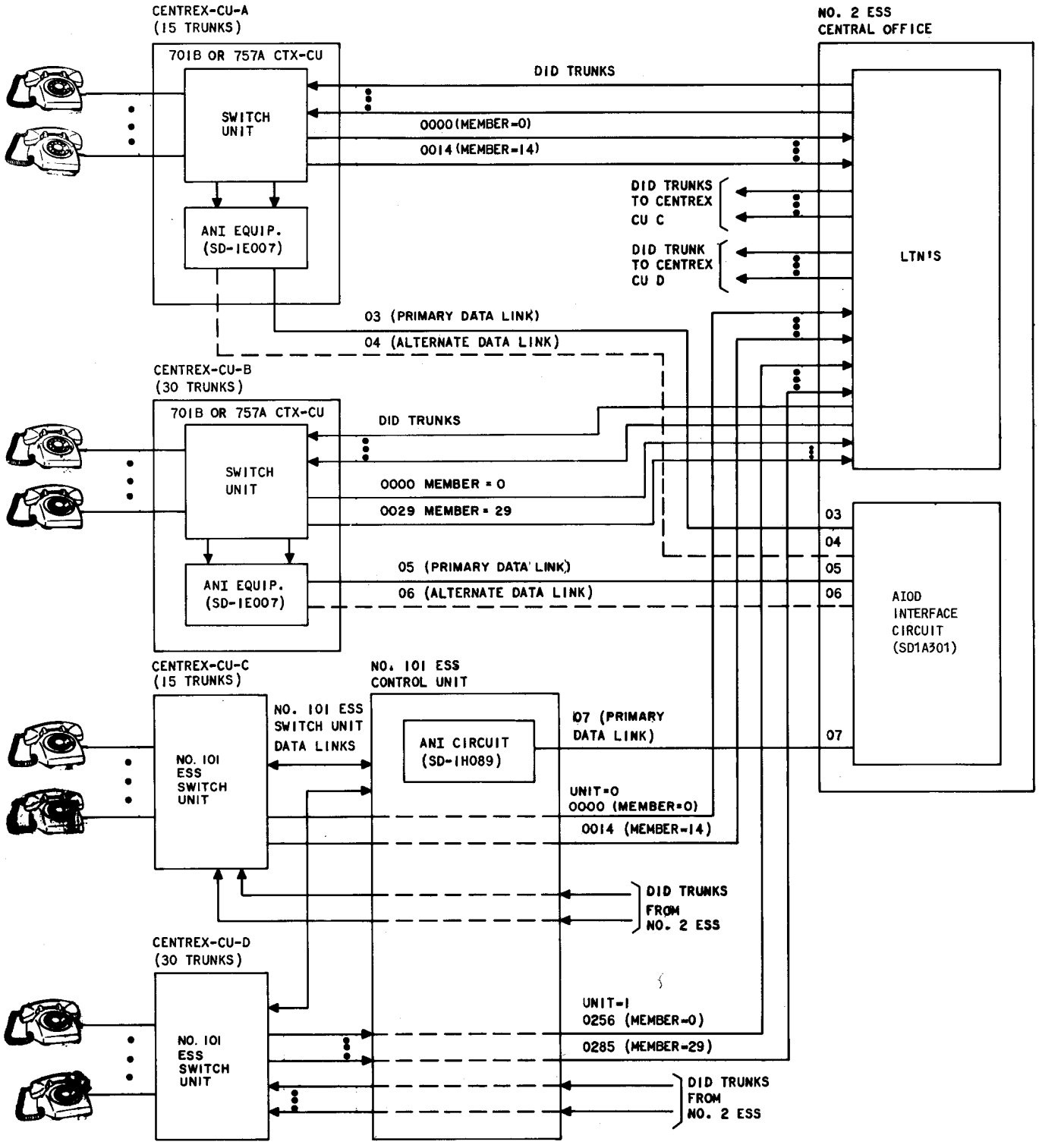


Fig. 7—Block Diagram of AIOD System

3. AIOD SOFTWARE

GENERAL

3.01 The Automatic Identified Outward Dial Program (CTXIOD, PD-2H306) provides the software interface between the No. 2 ESS and the AIOD interface circuit. The program and circuit accomplish the identification of the calling station in customer located centrex systems (Centrex-CU) making outward calls requiring AMA billing. See Fig. 8 for the detailed flow of program activity for AIOD.

PROGRAM DESCRIPTION

3.02 The CTXIOD program consists of four major sections:

- Initial Base Level Call Processing Sequence
- IO25 Interrupt Level Call Processing
- AMA Base Level Call Processing
- Diagnostic Sequence

A. Initial Base Level Call Processing

3.03 The Line Origination and Digit Reception Program (ORIG, PD-2H203) identifies every originating line terminal equipment number (TEN) and obtains the line's major class code. If a line associated with a Centrex-CU (Fig. 7) originates (major class 09) ORIG informs the CTXIOD program of the origination. The CTXIOD program initiates the call store buffer table entry indicating that a Centrex-CU line has originated (Fig. 9). CTXIOD then clears the appropriate buffer table entry unless station digits are present and have been present for less than four seconds.

B. Interrupt Level Processing

3.04 Every 50 milliseconds, the Input/Output 25 Millisecond Interrupt Program (IØ25M PD-2H107) calls the subroutine AIODE in the CTXIOD program. First, the subroutine determines if the office provides the AIOD feature. If the AIOD is ***not*** provided the subroutine returns immediately to IØ25M.

3.05 If AIOD is provided, every 100 ms the data links are scanned to detect bid signals from ANI circuits. If a bid is discovered, an available receiver is connected to the data link. The ANI at the customer's location bids for service when a customer in a Centrex-CU dials the central office access code.

3.06 After the receiver is connected to the data link a message is transmitted from the ANI to the central office. A 4-digit station number and a 4-digit central office trunk index number are received in the completed message. The central office trunk index number and the data link number are used to obtain the call store address of the buffer table entry for the line.

3.07 The station digits are stored temporarily in the call store buffer table. The starting address of this table is contained in the MLHG originating subtranslator and is indexed by the member number of the CO trunk (line) times 2. Also stored in this table is a time out constant to be used by the processing programs in the event of an abandoned call. (See Fig. 10.)

C. Automatic Message Accounting Base Level Call Processing

3.08 As the call progresses, the program determines if AMA billing is required. If a Centrex-CU call is made and the call requires billing, the AMA Initial Fetch (AIFTCH) routine is called in the CTXIOD program. The AIFTCH routine examines the appropriate call store buffer table entry for station digits. The station digits are returned to the AMA program and the call is billed to the station identified by the station digits. If the station digits are ***not*** present, the group billing number is returned as it is given in translation. This is referred to as "LDN billing."

D. Diagnostic Sequence

3.09 The diagnostic section of the program accepts automatic requests from the Peripheral Unit Maintenance Monitor Program (PUMON, PD-2H045) for removal, restoration, exercise, and diagnostics. In addition, maintenance messages that are entered on the teletypewriter, interface with PUMON. In all cases if the office does ***not*** provide AIOD, an immediate reject message is given for AIOD maintenance requests.

3.10 The diagnostic section consists of several tests that are able to detect possible faults

in the AIOD hardware. In conjunction with the diagnostic data, the Trouble Locating Manual (TLM-2H301) may be used to identify and isolate malfunctions that may occur in the AIOD circuits.

4. METHOD OF OPERATION

GENERAL

4.01 The following paragraphs describe the sequence of events involved in a typical AMA-AIOD call. Part A covers the trunk member and unit number assignment scheme and Part B through H covers the events from a customer dialing the central office access code at the customer's location, to recording the information on the AMA tape at the central office.

A. Trunk Member and Unit Number Assignments

4.02 The 4-digit trunk index number received from the ANI consists of a unit number and a trunk member number. The ***unit*** number is usually zero, unless the number of central office trunks exceeds 255, or unless the data link corresponds to a No. 101 ESS with more than one customer group sharing this data link. The range of the unit number is 0-15.

4.03 The ***trunk member*** number received from the ANI must be the same number as the ***member number*** used to determine the TEN for the trunk in the No. 2 ESS translation. (This member number can be found on the 2105 Translation Input Form in the No. 2 or No. 2B ESS Translation Guide—TG-2H). The range of this member number is 0-255.

> ***Note:*** The first trunk of each customer group has member number zero.

4.04 Each line or trunk from a Centrex-CU with the AIOD feature ***must*** be assigned an AIOD member number. The member number starts at 0 and can go up to 255 for each customer group or group of 256 trunks.

4.05 Each customer group in a No. 101 ESS must be assigned a unit number, or if more than 256 central office trunks are required, a unit number must be assigned to each group of 256 trunks. The unit number is obtained by dividing the received trunk index number by 256. The remainder becomes the trunk member number. For example, if 0515 was received as a trunk index number, the unit would be 2 and the trunk member number would be 3.

B. Centrex-CU Station Dials Central Office Access Code

4.06 When a Centrex-CU station originates an outgoing call (dials central office access code), a trunk is seized which terminates at the No. 2 ESS line trunk network. (See Fig. 7.) The ANI equipment at the customer's location detects the seizure and identifies the trunk index number and station numbers. The ANI then bids for service. When the selected CO trunk originates in the No. 2 ESS, the program recognizes this as a line origination with major class 09 and initializes the buffer table stored in call store.

C. AIOD Reaction to Bid Signals

4.07 The change in state of the bid ferrod is detected by the scanning portion of the program CTXIOD. The program then connects an idle receiver to the data link. If both receivers are busy, the change in state will not be detected until a receiver becomes idle.

D. Transmit Signal

4.08 When the change in state is detected, the data link is connected to the receiver and the transmit signal is given to the ANI. The transmit signal persists for the time interval required to receive the coded trunk index and station number.

E. Complete Message Indication

4.09 Saturation of the complete message (CM) ferrod indicates that the Complete Message has been received. The program CTXIOD does a scan of the message status ferrods to determine that the message is valid. The central office must then remove the transmit signal, since it cannot receive a new bid until the transmit signal is removed.

F. Storage of Station Number in Call Store Buffer Table

4.10 If the message is valid, the Centrex-CU number (obtained from the AIOD translator) and the trunk member number are used to determine

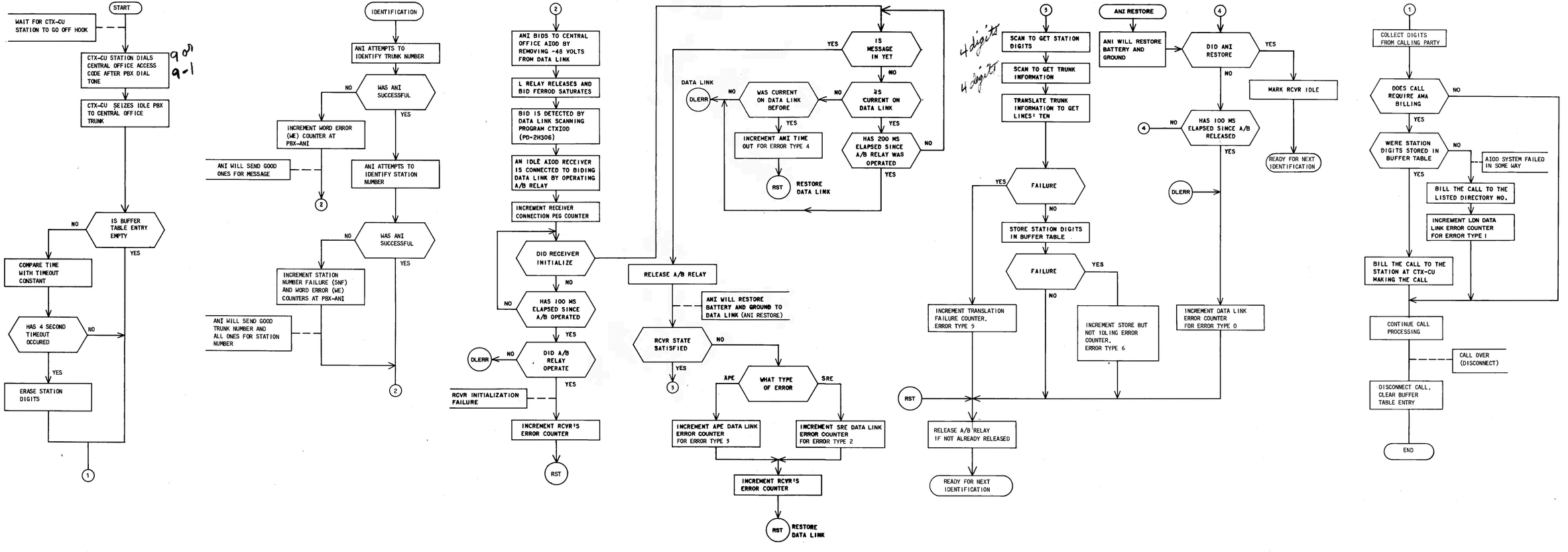


Fig. 8—Program Activity for AIOD

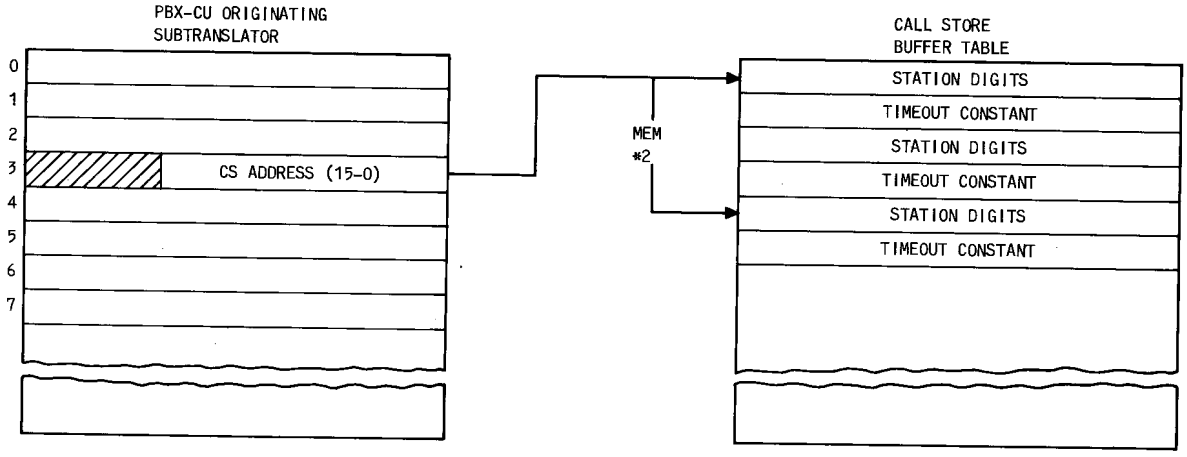


Fig. 9—Call Store Buffer Table

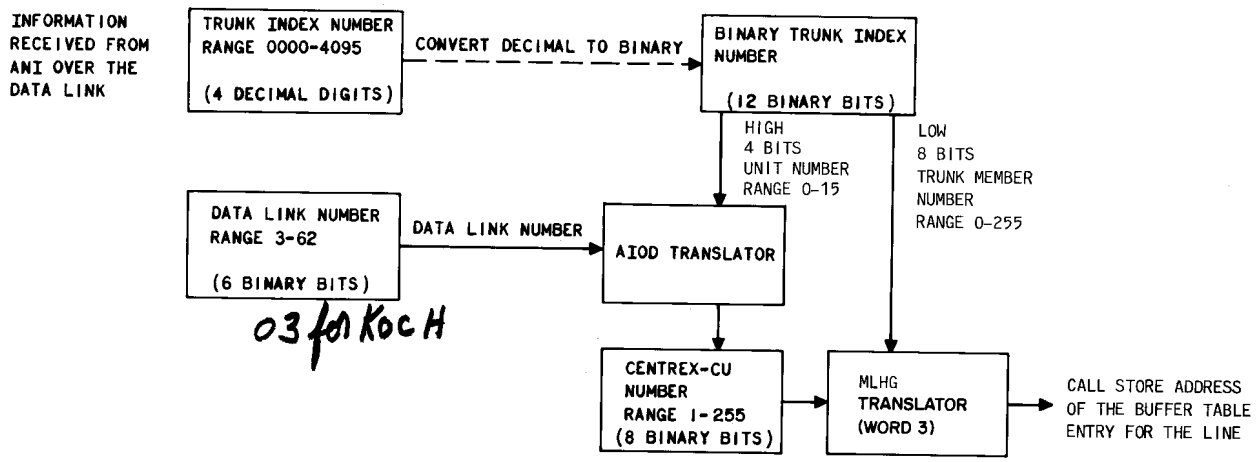


Fig. 10—Conversion of the Trunk Index and Data Link Number to the Address of Call Store Buffer Table

the call store address of the buffer table entry for the line. The AIOD translator is entered with a unit number and a data link number. This translator outputs a Centrex-CU number. The MLHG translator is entered with a Centrex-CU number and a trunk member number. Word 3 of this translator contains the start address of the call store buffer table associated with the customer group (see Fig. 8). This address is then indexed by two times the member number of the CO trunk. The station digits are written at this derived address in the buffer table. At the next sequential address the program also stores a time out constant. This is used to ensure that the station digits are not held in the buffer too long and become associated with a different call on the same CO trunks (see Fig. 9).

G. Fetch Cycle

4.11 The fetch cycle is independent of the interrupt level processing that has just been described. The fetch cycle is just an extension of the normal call processing programs. When an AMA billed call is made from a Centrex-CU line, the program, CTXIOD, expects to find the station digits stored in the call store buffer table. Otherwise the normalized office code, obtained from translation

on the Centrex-CU number, and the station digits obtained from the buffer table entry are used to bill the call. If the station digits are ***not*** present the listed directory number (LDN) obtained from the translation is billed.

4.12 For successful operation, the storing of the station digits in the call store buffer table must be accomplished before the initial entry is made on the AMA tape. The initial entry is made on the AMA tape when the customer finishes dialing. If the initial entry is made on the AMA tape before the station digits are stored in the buffer table, a billing identification failure occurs (LDN billed call).

H. Alternate Billing

4.13 The outcome of the call from a Centrex-CU customer is independent of the AIOD system. In the event of some ANI or AIOD interface circuit malfunction, charged calls will be completed normally and will be billed to the LDN.

5. MAINTENANCE

GENERAL

5.01 When a fault occurs in the AIOD-ANI equipment, which invalidates the data being received, the normal call processing procedures of connecting originating customers to terminating customers are not affected. The LDN is billed rather than the station making the call. Fault detection and location is accomplished by the maintenance portion of the CTXIOD program.

FAULT DETECTION

5.02 In a sense, the CTXIOD program is an error analysis program, which interfaces with the peripheral unit maintenance monitor program (PUMON) for AIOD diagnostic requests. When a call processing detects a malfunction in the AIOD system, it reports the malfunction to maintenance. If the malfunction can be traced to the AIOD interface circuit, automatic diagnostics will be requested. If the diagnostic fails, the faulty equipment is removed from service.

FAILURES OF AIOD

5.03 There are three types of failures that may occur in the AIOD system.

- Immediate action failures
- Error analysis failures
- Message printing failures

A. Immediate Action Failures

5.04 Immediate action failures may be due to power failure, scanner failure, failure of the data link's A or B relay to release, or failures in the central or supplementary pulse distributor. These failures require removing a receiver from service.

B. Error Analysis Failures

5.05 When the AIOD fails to get the proper results from the directed scanning of the message status ferrods, the malfunction cannot be solely attributed to a particular receiver or an ANI. Error analysis is required to determine the fault location. For example, when an ANI detects an invalid 2-out-of-5 code within its own equipment, the ANI sends all 1s for the remainder of the message, causing the ANI parity error ferrod to unsaturate. (Refer to Table B.)

TABLE B

TWO-OUT-OF-FIVE ENCODING

DIGITS	2/5 ENCODING *(Note 1)* BITS 7	4	2	1	0	TRUNCATED 2/5 ENCODING *(Note 2)* BITS 7	4	2	1
1	0	0	0	1	1	0	0	0	1
2	0	0	1	0	1	0	0	1	0
3	0	0	1	1	0	0	0	1	1
4	0	1	0	0	1	0	1	0	0
5	0	1	0	1	0	0	1	0	1
6	0	1	1	0	0	0	1	1	0
7	1	0	0	0	1	1	0	0	0
8	1	0	0	1	0	1	0	0	1
9	1	0	1	0	0	1	0	1	0
0	1	1	0	0	0	1	1	0	0

NOTES:

1. Two-out-of-five encoding is a way of representing ten digits by using all the possible combinations of two ones and three zeros. The 0-weighted bit is used only for error checking.
2. When the station number is stored in the AIOD buffer table, it is in truncated two-out-of-five code. The 0-weighted bit is not used when representing a number in truncated two-out-of-five code.

Note: Other failures ***may*** cause all logic 1s to be sent. Those failures could be any of the following:

(1) The station is not able to be identified by ANI

(2) The receiver is failing in such a way that it is receiving only logic 1s.

(3) The ANI parity error circuitry is failing in the AIOD circuit.

5.06 The errors mentioned in the previous paragraph could be attributed to either the ANI or AIOD. Error analysis determines where the failure exists by counting the number of errors that occur on each of the AIODs receiver. If one receiver is receiving an unusally high number of errors, automatic diagnostics are requested. If the receiver fails the diagnostic, it is removed from service. If both receivers are getting an unusually large number of errors a fault probably exists in any one of the ANI units. ANI error counters must be used to determine which ANI is at fault.

5.07 The error counter associated with each of the AIOD data receivers is incremented for the following reasons:

(1) Receiver initialization failures, (occurs when no current exists on the data link after the transmit signal was sent).

(2) ANI parity errors

(3) Shift-register errors

C. Message Printing Failures

5.08 ANI error counters are used to determine if a particular ANI is failing. In the processing of a call from a Centrex-CU that has AIOD, anytime an error occurs that can be attributed to a particular ANI, an error counter is pegged. If requested by the maintenance personnel, output message MI AD AER is printed indicating the type of error, the number of the data link on which the error occurred, the value of the error counter, and also the contents of the scan rows associated with the error, or the TEN of MLH member as appropriate. (Refer to output message manual OM-2H200 for a more complete explanation of the message). This message is printed automatically for the first and 255th occurrence of the error. The seven error types and their meaning are shown in Table C.

TABLE C

AIOD ERROR TYPES

ERROR TYPE	DESCRIPTION
0	Data Link Error. Errors attributed to the tip and ring pair (data link) between the customer premises and the central office (e.g., a shorted or open cable pair).
1	Listed Directory Number (LDN) Error. This error occurs because an AMA billed call is made from a CENTREX-CU and no station identification digits are present.
2	Shift Register Error (SRE). This error occurs as a result of the ANI sending the AIOD a message that fails the 2 out of 5 check.
3	ANI Parity Error (APE). This error occurs as a result of the ANI being unable to properly identify the station making the call; i.e., the low four bits in the station field are 1's.
4	ANI Time Out Error. This error occurs as a result of the ANI not receiving or responding to a transmit signal from the AIOD in a specified amount of time.
5	Translation Error. This error occurs because of an error in translation or the ANI is sending the AIOD incorrect information.
6	Storing But Not Idling Error (SBNI). This error occurs when new data being shifted from the ANI to the call store buffer table tries to overwrite old data that has not yet been cleared.

5.09 The values for all of the ANI error counters are printed during the AD section of the plant traffic schedule, which is usually printed daily.

5.10 The printing of the MI AD AER message can be ***enabled*** with the following input message:

M PO:CTL:5 1!

When enabled, each occurrence of any of the above seven errors from any ANI unit prints out on the maintenance teletypewriter.

5.11 The printing of the MI AD AER message can be ***disabled*** with the following input message:

M PO:CTL:5 0!

When disabled, only the first occurrence and the 255th occurrence of any of the above seven errors from any ANI unit print out on the maintenance teletypewriter.

5.12 The LDN (billed call) error indicates ultimate failure in the AIOD system, and could be caused by any of the following:

(1) The ANI is in a state in which it ***cannot bid.***

(2) Invalid data is transmitted from ANI (this could result in either and APE or SRE)

(3) Both receivers are out of service

(4) Inconsistent translations exist

(5) Data link difficulties

Note: Refer to Section 232-203-301 for more detailed information of the AIOD maintenance procedures.

DIAGNOSTIC PROGRAM

5.13 The requirement of the AIOD diagnostic program is to test a given receiver (0 or 1). When the request is automatically generated and the test fails diagnostics, the receiver is removed from service. When a receiver fails diagnostics, a dictionary number is produced. The dictionary number is cross-referenced with a matching number in the Trouble Locating Manual (TLM) indicating the faulty circuit pack(s).

5.14 Refer to Section 232-203-301 for detailed information on the AIOD maintenance procedures.

5.15 The diagnostic program is divided into eleven sections, each of which produces a sequence number. The eleven sections are described along with their sequence numbers in the order that they are executed in Table D.

TABLE D

DIAGNOSTIC PROGRAM SEQUENCE

SECTION	TEST(S) PERFORMED	SEQUENCE NUMBER
1	Test the initialization of receiver	100
2	Test the bits in the shift register cleared from 1 to 0	200
3	Test the shift register	800
4	Test the ANI parity error circuitry	800
5	Test the shift register error circuitry	800
6	Test the bid check ferrod and associated circuitry	300
7	Test the complete message delayed timing circuit	400
8	Test the extraneous pulses affecting the shift pulse counter	500
9	Test the counting ability of the shift pulse counter	600
10	Test the test transmitter tone production circuits, (both transmitters)	700
11	Test the tone detection circuits in the receiver (one receiver).	700

5.15 Refer to Section 232-203-301 for detailed information on the AIOD maintenance procedures.

Section	Test(s) Performed	Sequence Number
1	Initialization of receiver test	100
2	Bits in the shift register cleared from 1 to 0	200
3	Test of the shift register	800
4	Test of ANI parity error circuitry	800
5	Test of the shift register error circuitry	800
6	Test of the bid check ferrod and associated circuitry	300
7	Test of the complete message delayed timing circuit	400
8	Test for extraneous pulses affecting the shift pulse counter	500
9	Tests the counting ability of the shift pulse counter	600
10	Test the test transmitter tone production circuits, (both transmitters)	700
11	Tests the tone detection circuits in the receiver (one receiver).	700

6. GLOSSARY

6.01 The following is a glossary defining terms used in No. 2 ESS.

AIOD—Automatic Identified Outward Dialing

AIOD System—Consists of the AIODIC, ANI Unit and the data link between central office and Centrex-CU

AMA—Automatic Message Accounting

ANI—Automatic Number Identification

APE—ANI parity error

Buffer Table—A table in call store used to pass station digits received over the AIOD Data Link to call processing for billing purposes. Each customer has a separate buffer table.

Central Office Trunk—The talking connection that exists between the No. 2 ESS central office and the Centrex-CU. The central office trunk is treated as a line in the No. 2 ESS central office and as a trunk at the Centrex-CU.

Centrex-CO—A centrex in which all switching occurs in the central office.

Centrex-CU—A PBX with DID and AIOD

Centrex-CU Number—A number obtained from the AIOD translator given a data link number and a unit number. This Centrex-CU number corresponds to a multiline hunting group number.

CM—Complete Message

DID—Direct Inward Dialing

EF-1—Extended Feature Generic Program

FIB—First Information Bit

OR—Originating Register

LAMA—Local Automatic Message Accounting

LDN—Listed Directory Number

LTN—Line Trunk Network

MLHG-Multiline Hunt Group—MLHG provides a means of grouping lines within No. 2 ESS for the purpose of sharing certain call processing characteristics. For AIOD, these include the LDN billing number, the originating major class, and the buffer table.

PBX—Private Branch Exchange

PMB—Pre-Message Bit

SBNI—Storing But Not Idling Error

SRE—Shift Register Error

TEN—Terminal Equipment Number

TLM—Trouble Locating Manual

Trunk Index Number—A number received from the ANI indicating what trunk the call is using

Trunk Index Number—A remainder that is obtained after the trunk index number is divided by 256.

Unit Number—The quotient after the trunk index number is divided by 256.