FEATURE DOCUMENT
AUTOMATIC IDENTIFIED OUTWARD DIALING
(AIOD)
NO. 2 ELECTRONIC SWITCHING SYSTEM

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FEATURE DEFINITION AND DESCRIPTION

1. DEFINITION

1.01 The Automatic Identified Outward Dialing (AIOD) feature provides the means for identifying a PBX or Centrex-CU telephone extension number when that telephone is used to make an outward call requiring automatic message accounting (AMA) recording. In the past, calls requiring billing of the extension number required the manual intervention of an operator. The AIOD feature provides a means of billing the PBX or Centrex-CU extension number.

1.02 In the No. 2 Electronic Switching System (ESS), the AIOD feature is available to any PBX or Centrex-CU customer. However, the PBX or Centrex-CU customer must be equipped with automatic number identification (ANI) equipment.

1.03 In order to implement this feature, the No. 2 ESS must be equipped with the EF-1 generic program, LAMA, and a 2-foot 2-inch wide AIOD frame.

2. DESCRIPTION

A. Customer (User) Perspective

2.01 When a Centrex-CU station originates an outgoing call (dials the central office access code), the calling party number, timing of the call, and other information are automatically recorded on the AMA tape. This permits individual customer billing of each outgoing toll call made by the customer originating the call.

2.02 All outgoing toll calls made by the attendant, including completion of calls for station, are billed to the listed directory number (LDN). In addition, all outgoing toll calls made by dial repeating tie trunks and common control switching arrangement (CCSA) access lines are billed to the LDN. However, the Centrex-CU machines must be arranged to send the LDN to the No. 2 ESS for these kinds of calls.

2.03 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.

B. System Implementation

Introduction

2.04 There are four principal items of equipment involved in providing AIOD with No. 2 ESS:

- ***A Central Office Trunk***—Central office trunk is used to describe the talking connection that exists between the Centrex-CU and the No. 2 ESS. The central office trunk is treated as a line in the No. 2 ESS and it is treated as a trunk at the Centrex-CU. At the No. 2 ESS, each line is a member of a multiline hunt group (MLHG), not because of any need to do multiline hunting, but because all of the lines need to be grouped, need to share a common LDN billing number, and need to use the buffer table associated with the MLHG.

- ***ANI Equipment At Customer's Location***—The ANI equipment is used to identify the Centrex-CU station and the particular central office trunk being used to connect the station to the central office. This equipment is usually located on the customer's premises. See 10.18 for details.

- ***AIOD Interface Circuit***—The AIOD interface circuit (AIODIC) is used to receive the coded station and trunk numbers from the ANI equipment and to perform data validation checks. This equipment is located in the No. 2 ESS office. The AIODIC consists of the receiver, check circuitry, shift register, test transmitter, and ANI connecting unit. See 10.02 through 10.17 for details. See Figure 1.

- ***Dedicated Data Link***—The data link is a dedicated voice grade pair between the ANI and AIODIC. It is used to signal between the ANI and the AIODIC and to transmit the coded information from the ANI to the AIODIC. See 10.19 and 10.20 for details.

2.05 When a Centrex-CU station originates an outgoing call, a trunk is seized which terminates as a line at the No. 2 ESS line trunk network. The ANI equipment at the customer's location detects the seizure and identifies the trunk and station numbers. The ANI then bids for service

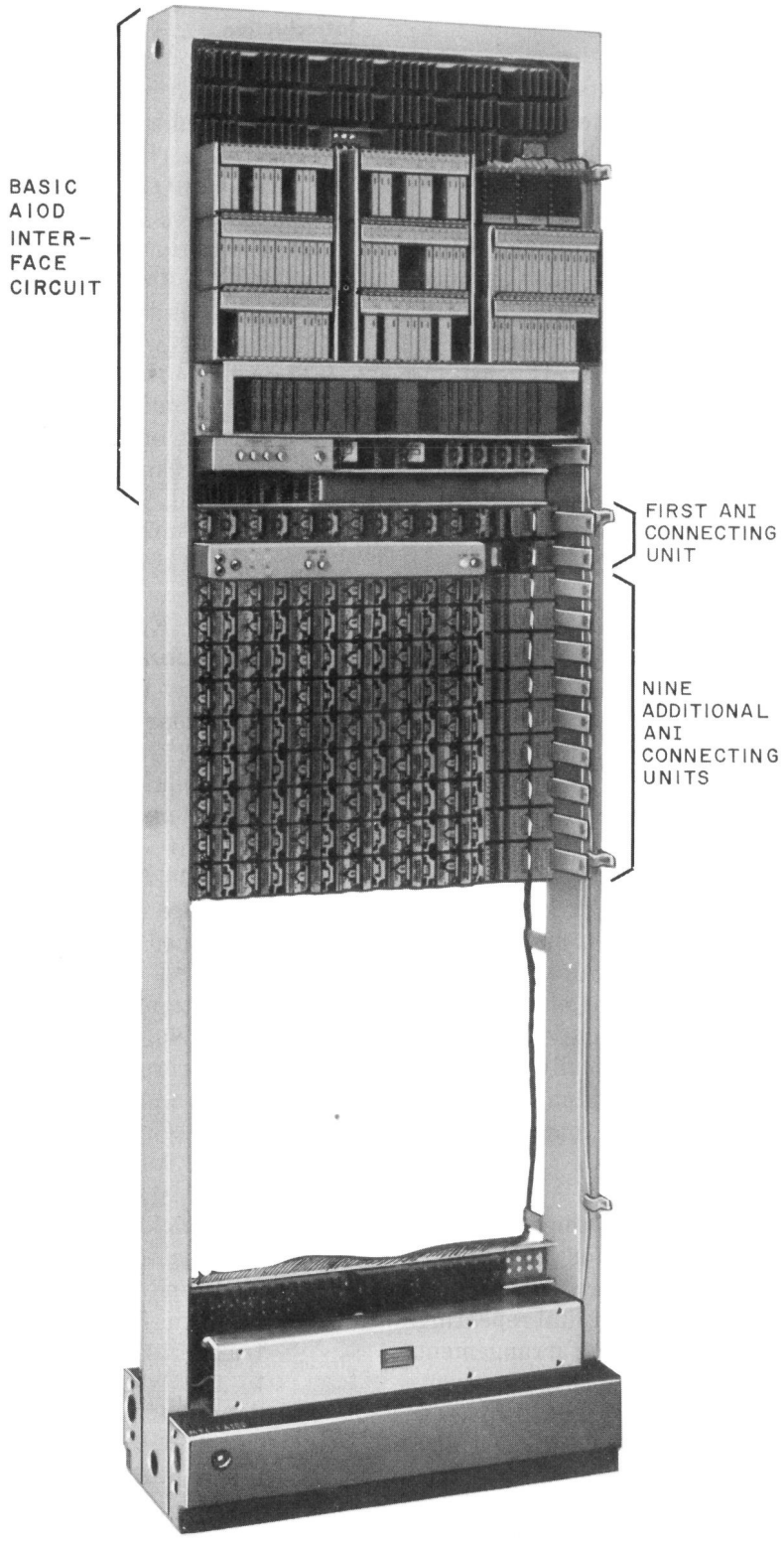


Fig. 1—Fully Equipped AIOD Frame

over the data link. Every outgoing call that originates in the Centrex-CU and goes through the central office requires AIOD.

2.06 Every 100 milliseconds the data links are scanned to discover bids. If a bid is discovered, an available receiver in the AIODIC is connected to the data link.

2.07 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 sent as the completed message. The station number is then stored in the buffer table associated with the Centrex-CU customer. If AMA billing is to be applied for the call, this information is translated and used to determine the particular station line that originated the call and is to be billed.

2.08 In the event the AIOD system, for some reason, fails to receive the trunk and/or station information, the call will be billed to the Centrex-CU's listed directory number.

Trunk Member and Unit Number Assignments

2.09 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 from a given Centrex-CU customer, or, unless the data link corresponds to a No. 101 ESS with more than one customer group sharing the data link. The unit number is derived from the 4-digit trunk index number by dividing the trunk index number by 256. The range of the unit number is 0-15.

2.10 Each customer group in a No. 101 ESS must be assigned a unit number. If more than 256 central office trunks are required, a unit number must be assigned to each group of 256 trunks.

2.11 The ***trunk member*** number received from the ANI must be the same number as the ***member number*** used to determine the terminal equipment number (TEN) for the central office trunk in the No. 2 ESS translation. The trunk member number is derived by taking the remainder after the trunk index number is divided by 256. The range of this member number is 0-255. The first central office trunk of each customer group has member number zero.

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

Centrex-CU Station Originates "Dial 9" Call

2.13 When a Centrex-CU station originates an outgoing call, a central office trunk is seized which terminates at the No. 2 ESS line trunk network (see Figure 2). The selected central office trunk originates in the No. 2 ESS as a line origination. The program recognizes this as an origination from a Centrex-CU and loads word 7 of the originating register (OR) extension with the preidentification message, line's TEN, and also initializes the buffer table entry associated with the line. Dial tone is then given to the line.

2.14 During the dialing interval, the AIOD system is in the process of identifying the station number of the station making the call. If the AIOD system is successful, the billing number station digits are stored in the buffer table entry before call processing needs them for AMA recording.

2.15 When the calling station completes dialing, the program decides if the call is to be AMA billed. If AMA billing is to be done and if the station digits are present in the buffer table entry, the station digits are used to bill the call. If AMA billing is to be done and the station digits are not present, the LDN obtained from translations is used to bill the call.

2.16 For successful operation, the storing of the station digits in the buffer table entry 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, a billing identification failure occurs (LDN billed call).

AIOD-ANI Communication (Figure 2)

2.17 When a Centrex-CU station originates an outgoing call, a central office trunk is seized. The ANI equipment at the customer's location detects the seizure and identifies the trunk index

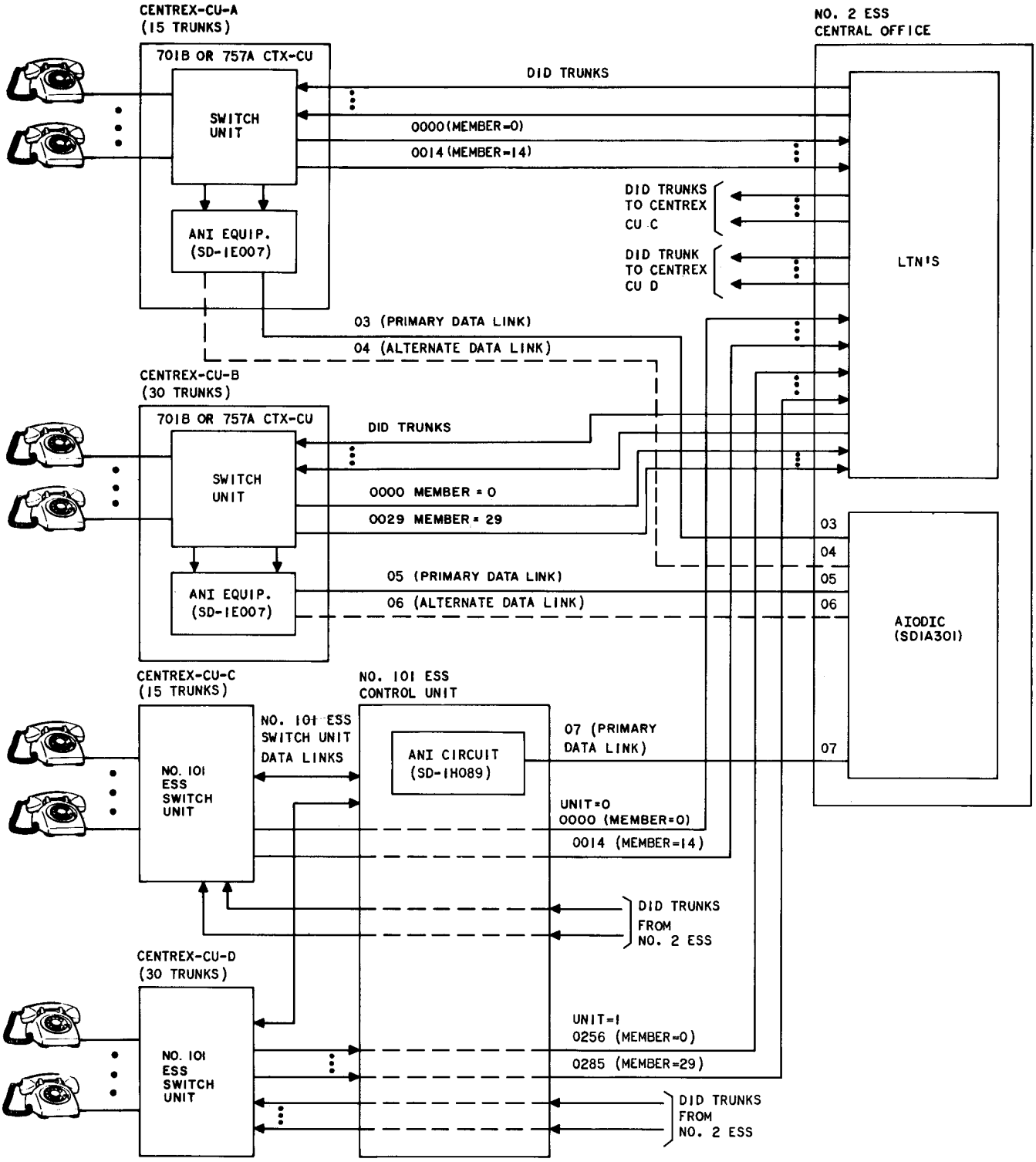


Fig. 2—Block Diagram AIOD System

number and station number. The ANI then bids for service. The change in state of the bid ferrod is detected by the scanning portion of the AIOD program. The program connects an AIOD idle receiver to the data link. If both receivers are busy, the change in state is not detected until a receiver becomes idle.

Transmit Signal

2.18 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.

Complete Message Indication

2.19 Saturation of the complete message ferrod indicates that the complete message has been received. The AIOD program 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.

Storage of Station Number in the Buffer Table

2.20 If the message is valid, the call store address of the buffer table entry of the line associated with the call must be determined. The AIOD translator is entered with a unit number and a data link number. The translator outputs the Centrex-CU number of the line and this Centrex-CU number is then used to enter the MLHG translator where the call store address of the buffer table is given. At the same time, the buffer entry is set up with station digits and a time-out constant. This time-out constant is used to ensure that the station information is indeed associated with the present call, and not from a previous call that failed.

Program Control Flow

2.21 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. 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

2.22 The Line Origination and Digit Reception Program (ORIG, PD-2H203) identifies every originating line TEN and obtains the line's major class code. If a line associated with a Centrex-CU (refer to Figure 2) originates a call (major class 09), ORIG informs the CTXIOD program of the origination. The CTXIOD program sets a flag in word 6 of the OR extension, indicating that a Centrex-CU line has originated. CTXIOD further clears the appropriate buffer table entry, unless station digits are present and have been present less than four seconds.

B. Interrupt Level Processing

2.23 Every 50 milliseconds, the Input/Output 25 Millisecond Interrupt Program (IO25M, PD-2H107) calls the subroutine AIODE in the CTXIOD program. First the subroutine determines if the office provides the AIOD feature. If AIOD is ***not*** provided, the subroutine returns to IO25M.

2.24 If AIOD is provided, every 100 milliseconds 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.

2.25 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 (see Figure 3).

2.26 This call store address is used to locate the appropriate buffer table and entry. The

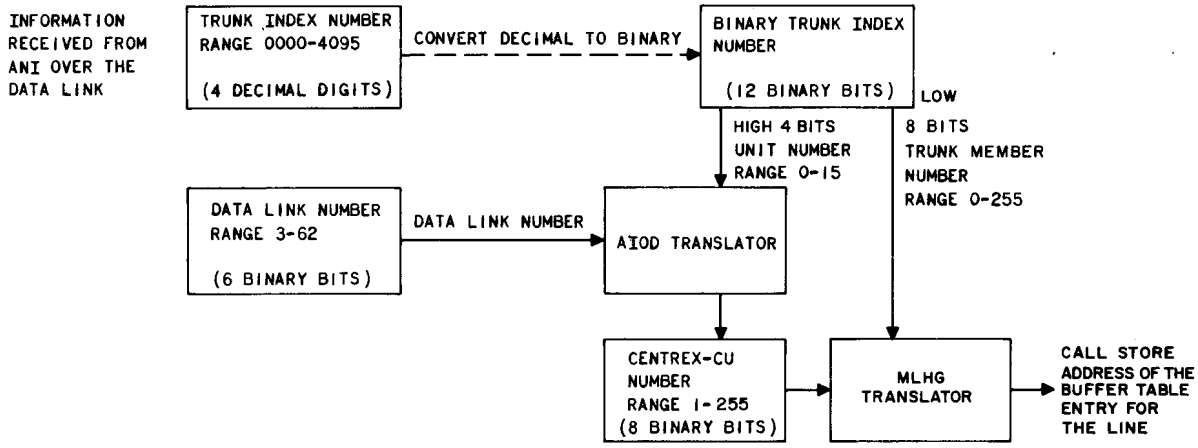


Fig. 3—Conversion of the Trunk Index and Data Link Number to the Call Store Address of the Buffer Table Entry for the Line

station digits and time-out constant are then stored in the buffer table entry.

C. Automatic Message Accounting Base Level Call Processing

2.27 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 buffer table entry for 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." If the station digits are present (the normal case), the station so identified is billed for the call.

D. Diagnostic Sequence

2.28 The diagnostic section of the program accepts requests from the Peripheral Unit Maintenance Monitor Program (PUMONA, PD-2H105) for removal, restoration, exercise, and diagnostics. The 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.

2.29 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 interface circuits.

Fault Detection

2.30 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.

2.31 When a malfunction occurs in the AIOD system, it is the responsibility of the AIOD call processing program to report the malfunction, and if the malfunction can be traced to the AIOD interface circuit, automatic diagnostics are requested. If the diagnostic fails, the faulty equipment is removed from service.

Failures of AIOD

2.32 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

2.33 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 pulse distributor or supplementary pulse distributor. These failures require removing a receiver from service.

B. Error Analysis Failures

2.34 Error analysis failures occur when the AIOD fails on the directed scan of the message status ferrods; the malfunction cannot be solely attributed to a particular AIOD receiver or an ANI. For example, when an ANI detects an invalid 2/5 code within its own equipment, it sends all 1s for the remainder of the message, causing the ANI parity error ferrod to unsaturate.

> ***Note:*** Other failures may cause all 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 1s

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

2.35 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 AIOD's receiver. If one receiver is receiving an unusually 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.

2.36 The error counter associated with each of the AIOD 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

2.37 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. The seven errors that fit this classification along with their appropriate error type are as follows:

(0) ***Open or Shorted Data Link***—This error is associated with the tip-ring pair between the remote location and the central office, and is caused by either the tip-ring pair being shorted together or being open.

(1) ***Listed Directory Number (LDN) Calls***—These are calls that have been billed to the LDN as a result of an AMA billed call having been made from a Centrex-CU with no station digits present to be identified.

(2) ***Shift Register Errors (SRE)***—These errors occur as a result of the ANI sending the AIOD a message that fails the 2-out-of-5 check.

(3) ***ANI Parity Errors (APE)***—These errors occur as the 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 ones.

(4) ***ANI Time-out***—This occurs as a result of the ANI circuit not receiving or responding to a transmit signal from the AIOD in a specified amount of time.

(5) ***Translation Error***—This occurs because of an error in translation or the ANI is sending the AIOD incorrect information.

(6) ***Storing But Not Idling (SBNI) Error***—This occurs due to the receipt of an invalid trunk number or incorrect translations, allowing storing of new data in the appropriate buffer table entry where data from a previous call was never cleared.

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

2.39 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.

2.40 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 prints out on the maintenance teletypewriter.

2.41 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 an APE or SRE)

(3) Both receivers are out of service

(4) Inconsistent translations exist

(5) Data link difficulties.

3. FEATURE FLOW DIAGRAM

3.01 The flow diagram illustrated in Figure 4 is a graphical overview of the AIOD feature.

4. INTERACTIONS

4.01 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.

ATTRIBUTES

5. STATION/SYSTEM

5.01 The AIOD feature is provided on a system basis.

6. LIMITATIONS

6.01 The following limitations apply to the AIOD feature:

- Only one AIOD frame can be supported in a No. 2 ESS central office.
- A maximum of 60 data links can be supported in the central office.
- Each unit number can serve up to 256 central office trunks.
- Each data link can serve 16 unit members.
- Only 4-digit station numbering is allowed.
- The trunk member number transmitted from the ANI to the AIOD circuit must correspond exactly to the MLHG member number as specified in the No. 2 ESS translations. The first member of the group has member number 0, and the maximum value for a member number is 255.

7. RESTRICTION CAPABILITY

7.01 There are no specific restrictions that apply to the AIOD feature other than those mentioned in 6.01.

8. COST DATA

A. Program Cost

8.01 Generic Program: The AIOD feature requires approximately 1500 program store words and approximately 25 call store words, plus a buffer table for each MLHG, the size of which is two call store words per MLHG member.

8.02 When an office is equipped with the EF-1 generic program and AIOD, an additional 99 words of translation space is required independant of the number of data links served. In addition,

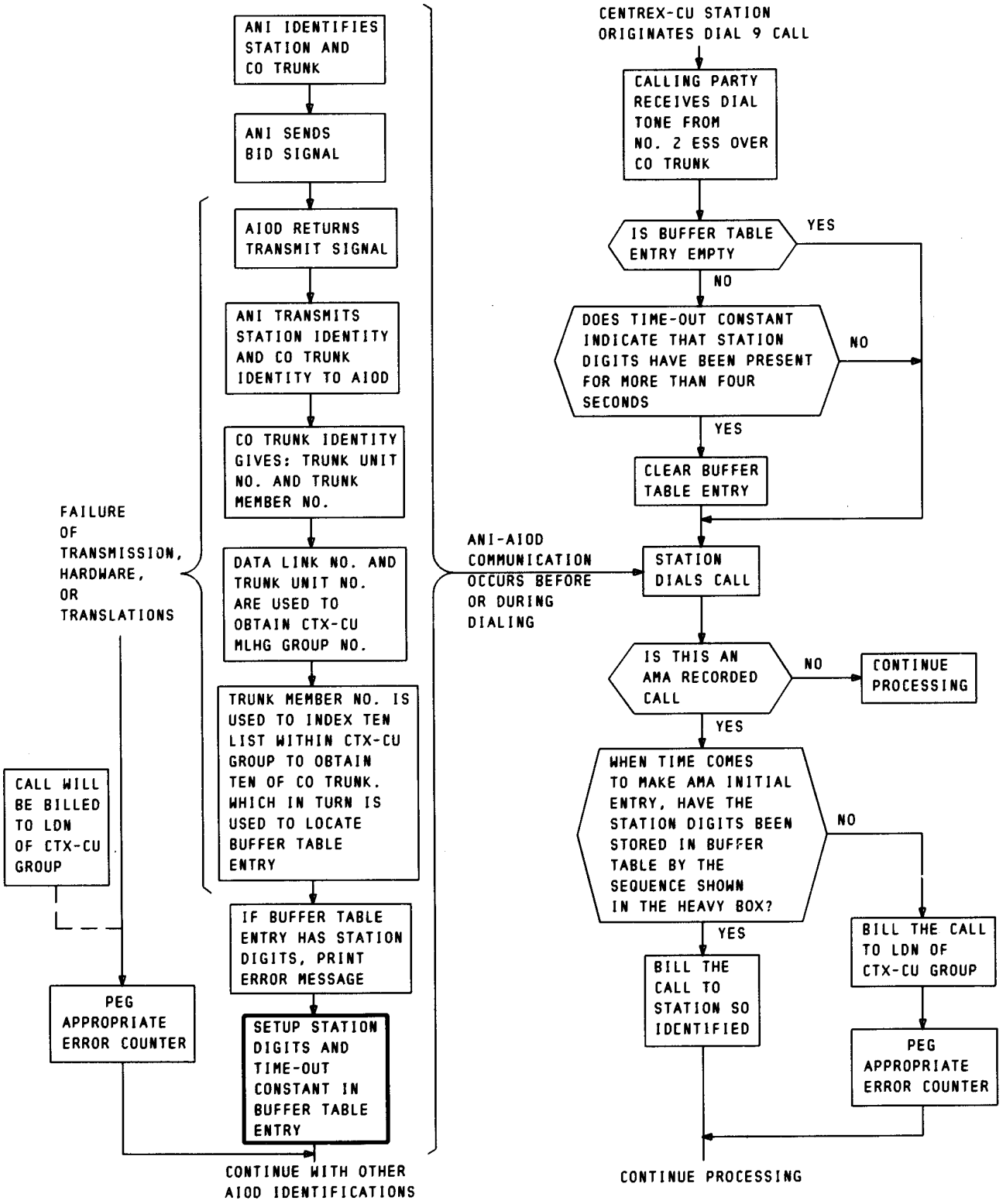


Fig. 4—Feature Flow Diagram Overview—AIOD

for each group of two data links an additional six words of call store are required.

B. Real Time Cost

8.03 The real time cost of the AIOD feature is not available at this time.

INCORPORATION INTO SYSTEM

9. PLANNING

9.01 The AIOD feature operates in the No. 2 ESS equipped with EF-1 generic program and LAMA.

10. HARDWARE ENGINEERING

10.01 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 (AIODIC)

10.02 In a No. 2 ESS office, the central office data link terminating and receiving equipment is the AIOD interface circuit (AIODIC, SD-1A301) which is mounted on a miscellaneous trunk frame. Figure 5 shows the basic AIODIC. The main purpose of the AIODIC is to receive the coded station and trunk numbers from the Centrex-CU and to perform data validation checks. The AIODIC system includes relays, data receivers, check circuits, shift registers, test transmitters, and an ANI connecting unit (ACU). The major items of AIODIC are duplicated for service reliability. The components are organized so that the duplicated halves can function independently. Figure 6 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.

Data Receiver

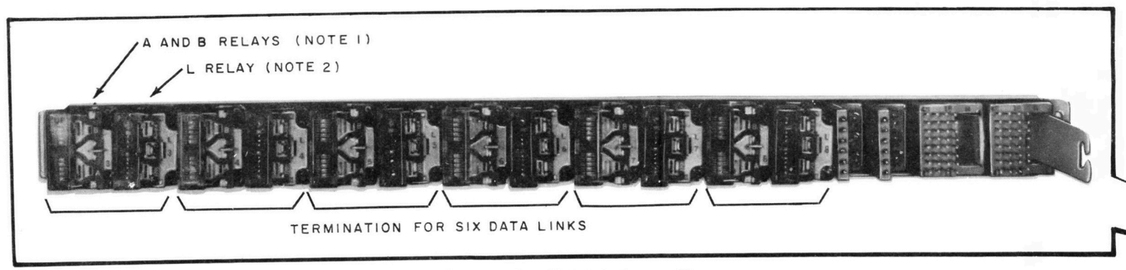
10.03 The function of the data receiver is to convert the frequency-shifted analog signals received from the PBX-ANI or No. 101 ESS to logic 0 or 1 values (1150HZ = 0, 1850HZ = 1). Since the AIOD message rate, 735.29 BPS is the same as the No. 101 ESS data link rate, the No. 101 ESS data receivers (SD-1H031-01) are used in AIODIC. The two data receivers are assigned unit member numbers 0 and 1.

Check Circuit (AIOD Control Circuit)

10.04 The AIOD check circuit is used to reset the data receiver and to 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 diagnostic relays (CA, CB, DA, and DB).



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.

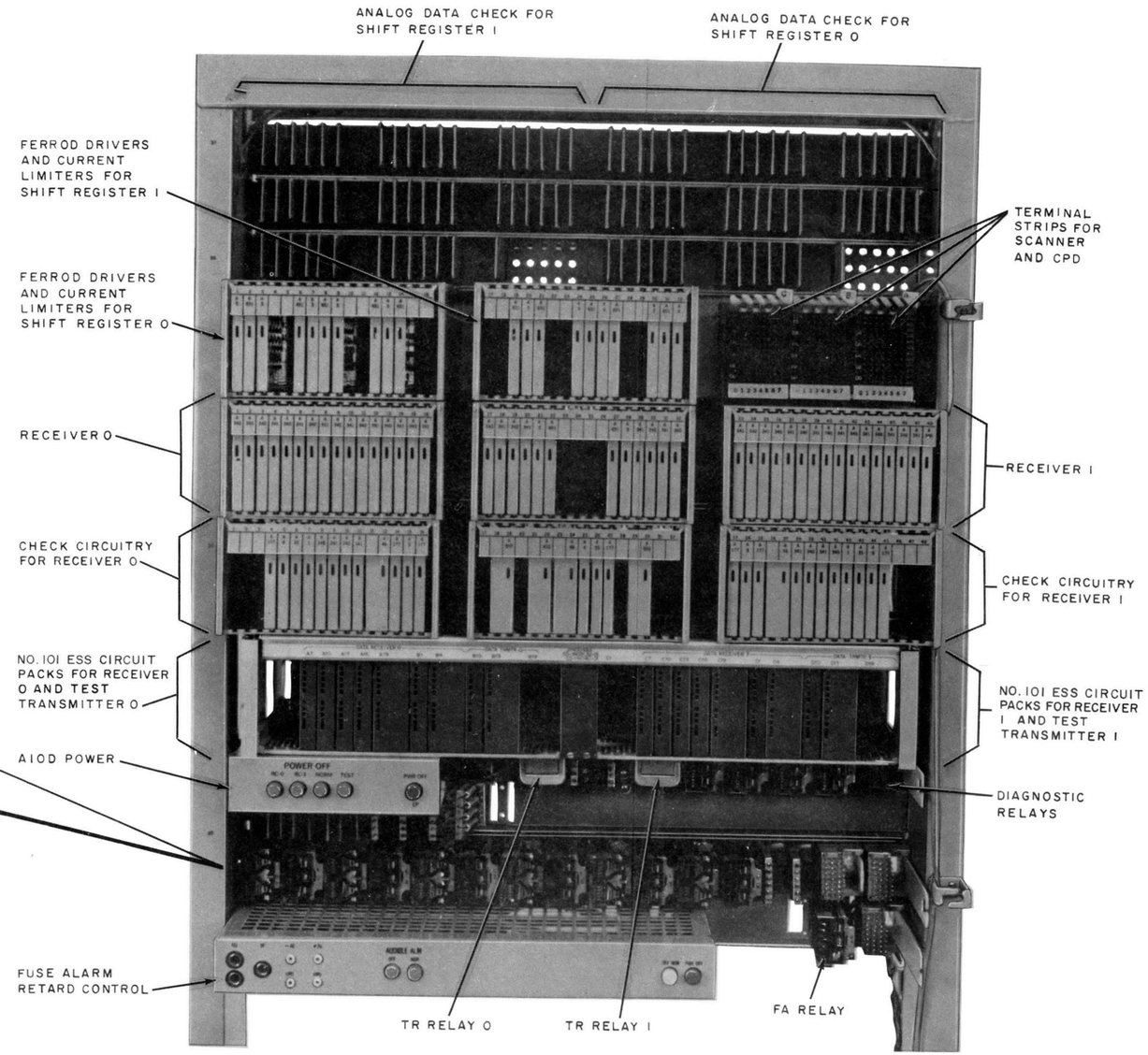


Fig. 5—AIOD Interface Circuit

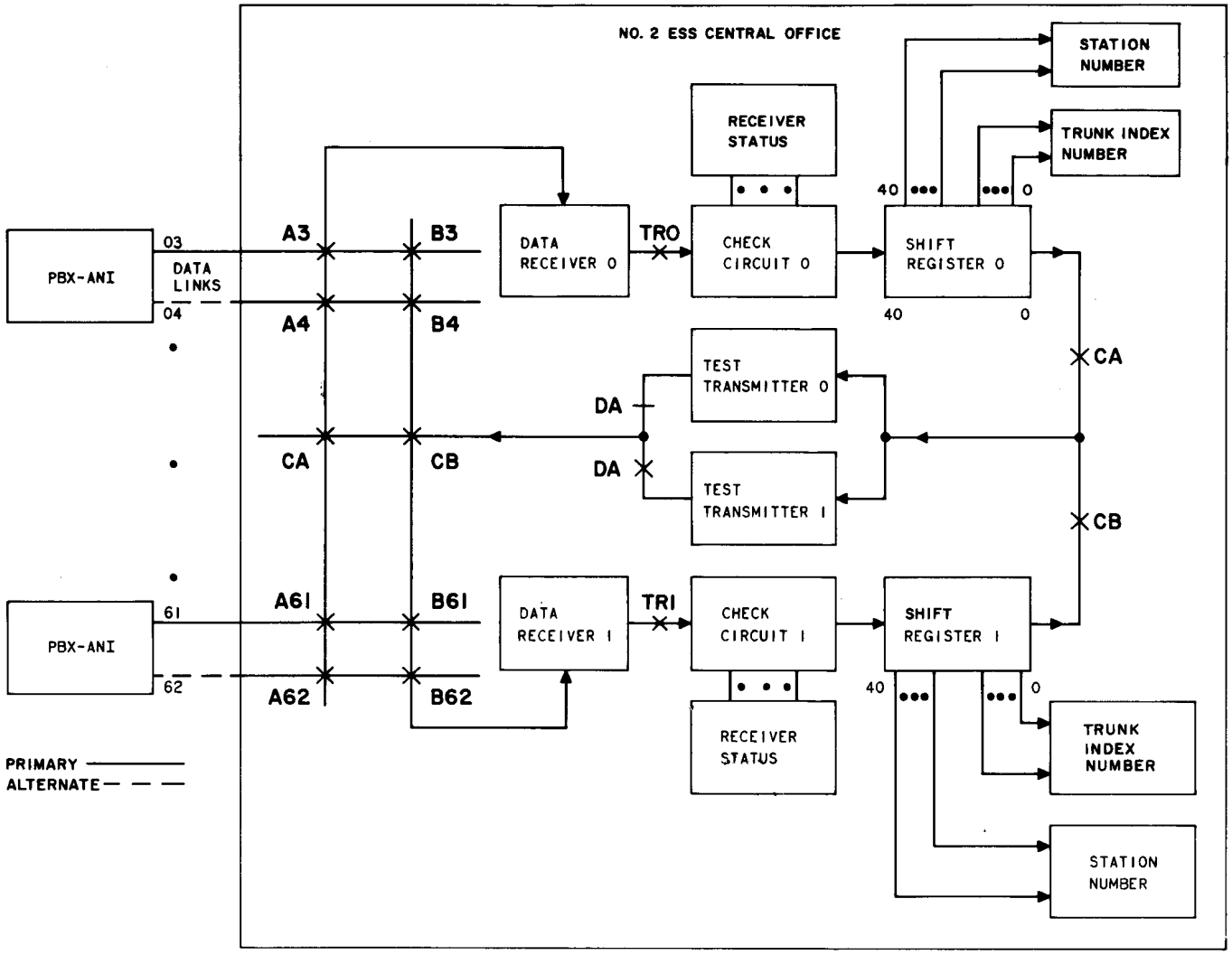


Fig. 6—AIOD Interface Circuit Block Diagram

Shift Register

10.05 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.

10.06 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 7 shows a layout of the AIOD message as it appears in the shift register.

10.07 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.

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

10.09 The outputs of the shift register cells are used as inputs to driver gates. The driver gates energize a current limiting network connected to the scan points. Figure 8 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 digit. 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 the group of five bits.

10.10 The logic 1 output of cells 40 through 36 drives five 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 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

10.11 The AIOD interface circuit contains two test transmitters. Their function is to assist in diagnosis of the two AIOD data receivers.

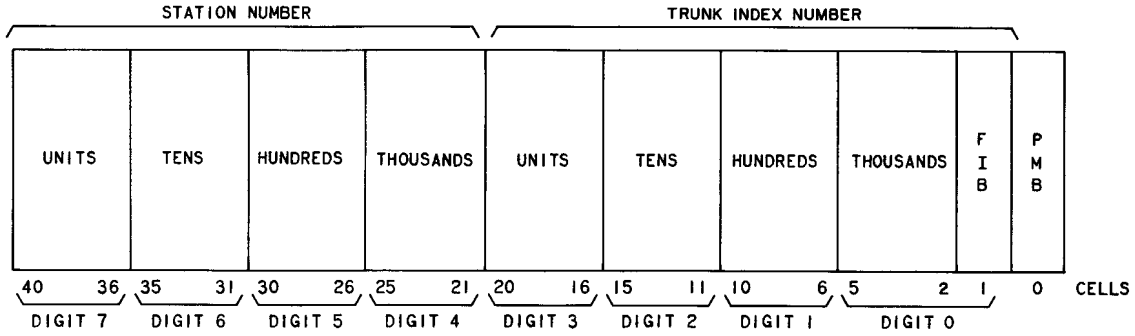


Fig. 7—Layout of AIOD Shift Register

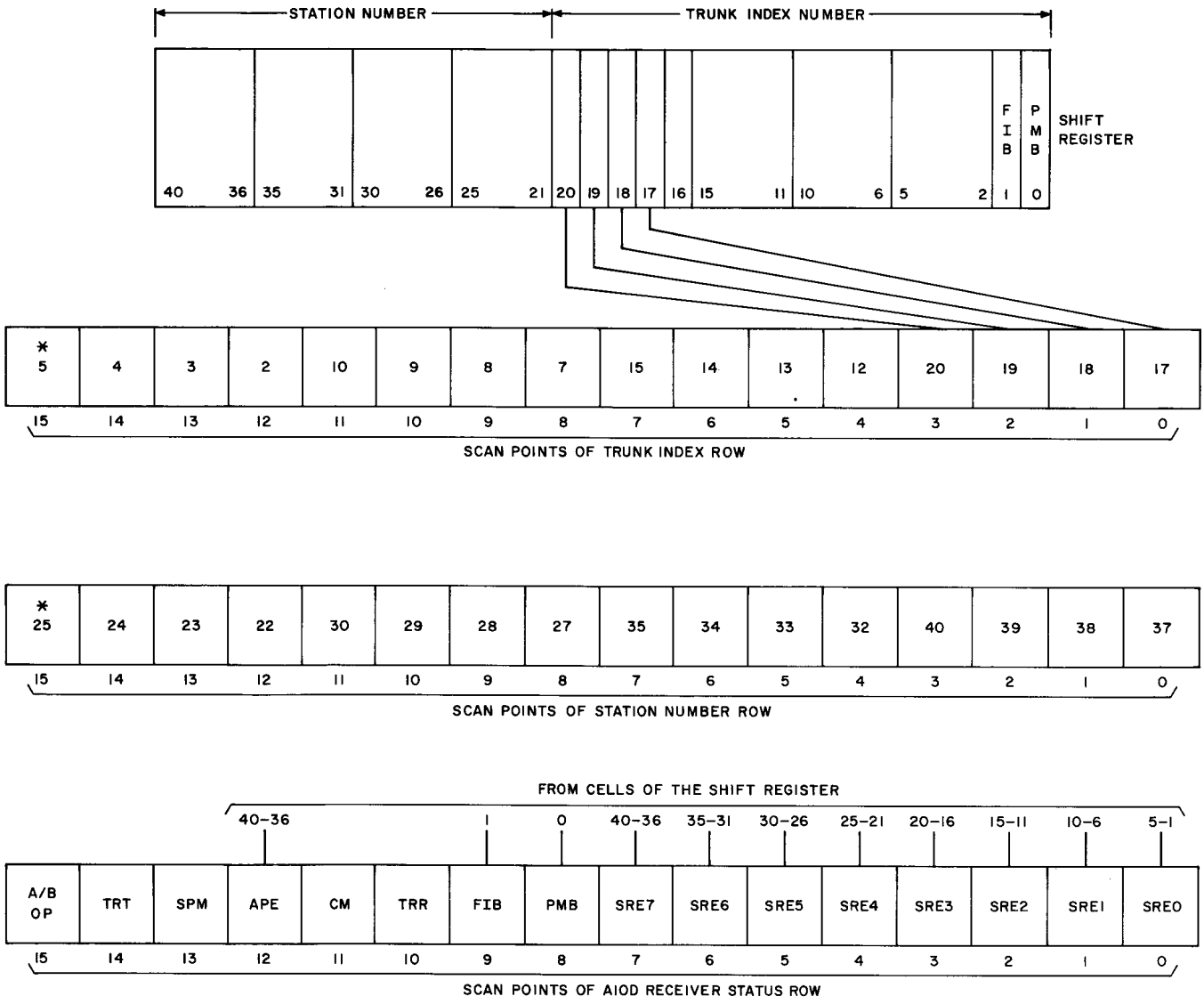


Fig. 8—Scan Points Associated with Shift Register Cells

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 (Figure 6). 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.

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

10.13 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

10.14 The ANI connecting unit is 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 (Figure 5). 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 receiver 0 and relay B connects the data link to receiver 1.

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

10.16 The basic AIOD interface circuit comes equipped with one ANI connecting unit. A fully equipped AIOD frame has ten ANI connecting units (Figure 1).

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

B. Station Number and Trunk Number Identification Equipment

10.18 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 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 2 shows a block diagram of a Centrex-CU facility for both conventional PBXs and the No. 101 ESS.

C. Data Link

10.19 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.

10.20 The data link is used to signal between the ANI and the AIODIC and is used to transmit information from the ANI to the AIODIC. The data link is used as follows:

(1) When no message is being received by the AIODIC, the data link is in an idle state. (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 over the data link by removing -48 volts from the tip and ring of the data link.

(3) When the AIODIC is ready to accept the data from the ANI, it sends a transmit signal over the data link to the ANI. (AIODIC applies -48 volts on the tip and ring of the data link.)

(4) After the ANI receives a transmit signal, it sends information to the AIODIC 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 AIODIC 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.

10.21 To maintain service reliability, it is advisable to dedicate a second data link as an alternate for each ANI. The alternate data link is wired at the central office and assigned a Centrex-CU number in translations. To put 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 has the same Centrex-CU number in translations as the primary data link. Thus, call processing treats 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 has ended, the primary data link should be switched back, since ANI error counts are correct only when the primary data link is used.

10.22 The following equipment quantities are required in order to install the AIOD in a No. 2 ESS Central Office.

- ANI—One per Centrex-CU.

  For the 701B or 757A Centrex-CU, use J58853 (SD-1E007). See Section 809-110-150 for ordering details.

  For the No. 101 ESS Centrex-CU, use J1H003AJ and AK (SD-1H089). See Section 832-211-150 for ordering details.

- Data Link—One per Centrex-CU. A spare may be desired for each Centrex-CU.

- AIODIC—One AIODIC, J1A033, (SD-1A301) is required per each No. 2 ESS. This includes one ANI connecting unit which handles up to six data links.

  Additional ANI connecting units may be added up to a maximum of 10 to handle additional data links. See Table A for additional information and Section 820-031-150 for ordering details.

- Frame—A miscellaneous trunk frame, J2H018A, is required for mounting the AIODIC.

TABLE A

EQUIPMENT NEEDED AS A FUNCTION OF NUMBER OF DATA LINKS SERVED

<table>
<tr><th>GROUP</th><th>NUMBER OF DATA LINKS SERVED</th><th>ACCESS & CONNECTING UNITS</th><th>PERIPHERAL DECODERS</th><th>TRUNK PERIPHERAL DECODER APPLIQUES</th><th>SCAN ROW</th></tr>
<tr><td>1</td><td>1 through 6</td><td>ACU 0</td><td rowspan="2">PD 00, PD 01,

PD 10, PD 11:</td><td rowspan="2">PDA 0

PDA 1</td><td rowspan="5">9</td></tr>
<tr><td>2</td><td>7 through 12</td><td>ACU 0,
ACU 1</td></tr>
<tr><td>3</td><td>13 through 18</td><td>ACU 0
through
ACU 2</td><td rowspan="2">PD 00 through PD 02</td><td rowspan="4"></td></tr>
<tr><td>4</td><td>19 through 24</td><td>ACU 0
through
ACU 3</td><td rowspan="2">PD 10 through PD 12</td></tr>
<tr><td>5</td><td>25 through 30</td><td>ACU 0
through
ACU 4</td><td rowspan="2">PD 00 through PD 03</td><td rowspan="3">PDA 0

through

PDA 3</td></tr>
<tr><td>6</td><td>31 through 36</td><td>ACU 0
through
ACU 5</td><td rowspan="2">PD 10 through PD 13</td><td rowspan="5">10</td></tr>
<tr><td>7</td><td>37 through 42</td><td>ACU 0
through
ACU 6</td><td rowspan="2">PD 00 through PD 04</td><td rowspan="4"></td></tr>
<tr><td>8</td><td>43 through 48</td><td>ACU 0
through
ACU 7</td><td rowspan="2">PD 10 through PD 14</td><td rowspan="3">PDA 0

through

PDA 5</td></tr>
<tr><td>9</td><td>49 through 54</td><td>ACU 0
through
ACU 8</td><td rowspan="2">PD 00 through PD 05</td></tr>
<tr><td>10</td><td>55 through 60</td><td>ACU 0
through
ACU 9</td><td>PD 10 through PD 15</td></tr>
</table>

11. SOFTWARE ENGINEERING

11.01 Provisions must be made for AIOD in the program store and call store. Refer to Traffic Facilities Practices, Division D, Section 121 for details in engineering the stores.

12. COMPATIBILITY

12.01 The AIOD feature is compatible with PBX-ANI unit SD-1E007 and No. 101 ESS-ANI SD-1H089.

13. OFFICE DATA

A. Translations

13.01 For new installations, the following input forms should be prepared and submitted to the WECo Regional Center. Refer to Division 4, Section 2j of the Translation Guide, TG-2H, for additional details.

- ***ESS 2105***—Multiline Hunting Group Table. This form is used to define the central office trunks used in the AIOD system.
- ***ESS 2213-1, -2***—The -1 form is used for the assignment of Frame and Peripheral Unit and -2 is used for the Data Link Assignment.

B. Recent Change (RC) Messages

13.02 There are no recent change messages associated with the AIOD feature.

14. GROWTH/RETROFIT PROCEDURES

A. GROWTH

14.01 The standard package ordered to incorporate the AIOD feature will serve six data links; however, the number of data links served may be expanded in ten groups of six data links.

14.02 Table A illustrates the equipment needed as a function of the number of data links served.

B. RETROFIT

14.03 An existing Centrex-CU may be retrofitted with AIOD provided the No. 2 ESS has LAMA and the hardware described in 10.01 is installed. Growth procedures are provided in Section 232-019-101.

15. TESTING

15.01 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 trouble number is produced. The trouble number is cross-referenced with a matching number in the Trouble Locating Manual TLM-2H301 indicating the faulty circuit pack(s) and/or relays.

15.02 The diagnostic program is divided into 11 sections, each of which produces a sequence number. The 11 sections are described along with their sequence numbers in the order that they are executed. Refer to Table B for the 11 sections.

TABLE B

DIAGNOSTIC PROGRAM

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	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

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

ADMINISTRATION

16. MEASUREMENTS

16.01 The following traffic and plant measurements are available for the AIOD feature. Refer to Section 232-120-301 for additional details.

A. Office Total Measurements (Traffic Measurement)

- ***OFT 62*** Peg count of AIOD receiver connection to AIOD data link

B. Automatic Identified Outward Dialing ANI Error Counter (Plant Measurement)

- AD1—AIOD data link number
- AD2—Number of errors associated with the tip-ring pair between the Centrex-CU and the central office
- AD3—Number of calls billed to LDN
- AD4—Number of shift-register errors
- AD5—Number of ANI parity errors
- AD6—Number of ANI time-outs
- AD7—Number of AIOD translation errors
- AD8—Number of storing but not idling errors

17. RECORD KEEPING

17.01 There is no special record keeping for the AIOD feature.

18. CHARGING

18.01 There are no special charging requirements for the AIOD feature. Refer to 2.01, 2.02, and 2.03.

AVAILABILITY

19. NEW INSTALLATIONS

19.01 The AIOD feature is available for application with the EF-1 generic program.

20. GROWTH/RETROFIT

20.01 The AIOD feature may be retrofitted into any office equipped with the EF-1 generic program and local AMA.

SUPPLEMENTARY INFORMATION

21. GLOSSARY

21.01 The following list identifies terms used in this feature document.

- ***AMA—Automatic Message Accounting:*** The overall facility for automatically recording on paper tapes or magnetic tapes the numbers of the calling and called customers and other information required for automatically computing charges for customer-dialed calls.

- ***ANI—Automatic Number Identification:*** Equipment located in a local central office or PBX and used to automatically identify the calling subscriber's number. One- and two-party stations only may be identified on outward long distance calls or for other purposes.

- ***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.

- ***CCSA—Common Control Switching Arrangement:*** A switched services network which provides private line facilities between customer locations via common control switching machines which are shared with other users.

- ***Central Office Trunk***—The talking connection that exists between the Centrex-CU machine and the No. 2 ESS central office. 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-CU:*** A PBX with DID and AIOD. In this document, Centrex-CU is used interchangeably with the term PBX.

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

- ***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.

- ***EF-1—Extended Feature Generic Program***

- ***DID—Direct Inward Dialing:*** The feature which permits a customer outside of a PBX to reach a PBX or centrex extension without attendant assistance.

- ***LAMA—Local Automatic Message Accounting:*** Facilities located in a local central office for automatically recording billing data for message rate call (bulk billing) and for customer-dialed station-to-station toll calls.

- ***LDN—Listed Directory Number***

- ***MLHG—Multiline Hunting Group:*** MLHG provides a means of grouping lines within the 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.

- ***OR—Originating Register:*** Eight words of call store used for control and digit storage during the receiving and outpulsing phases of a call.

- ***OR Extension:*** Additional call storage used for AIOD and other centrex service.

- ***PBX—Private Branch Exchange:*** A switching system which provides internal telephone communications between stations located on a customer's premises as well as between these stations and exterior networks. In this document, Centrex-CU is used interchangeably with the term PBX.

- ***TEN—Terminal Equipment Number:*** A 6-digit number representing the physical location of a line, trunk, or service circuit in the switching network.

- ***TLM—Trouble Locating Manual:*** A document containing information used to

locate trouble in a system employing a diagnostic program.

- ***Trunk Index Number:*** A number received from the ANI indicating which trunk the calling party is using.

- ***Trunk Member 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.

22. REASONS FOR REISSUE

22.01 This is the initial issue of this document.

23. REFERENCES

23.01 The following documents may be referred to for supplementary information concerning the AIOD feature.

- PD-2H107, Program Specification—Input/Output 25 Millisecond Interrupt Program

- PD-2H203 Program Document—Line Origination and Digit Reception

- PD-2H306, Program Specification—Automatic Identified Outward Dialing Program

- Translation Guide, TG-2H

- Traffic Facilities Practices, Division D, Section 12

- TLM 2H301, AIOD Interface Circuit Trouble Locating Manual

- Bell System Practices

  Section 232-203-101 Automatic Identified Outward Dialing Description, No. 2 Electronic Switching System

  Section 232-203-301 Automatic Identified Outward Dialing Maintenance Procedure, No. 2 Electronic Switching System

  Section 232-120-301 Traffic and Plant Measurements, No. 2 Electronic Switching System