GENERAL DESCRIPTION - PBX AIOD

CONTENTS

1. GENERAL

1.1 The purpose of this Section is to provide an introduction to the circuits and equipment of the PBX-AIOD System. It is not intended to prescribe requirements, methods or instructions for the System.

1.2 "General Test Procedures" for PBX-AIOD and specific "Station Identification Frame Test Methods" are furnished in Sections 275 and 275.1 of this handbook.

1.3 Refer to Section 275 of this handbook, Paragraph 3, for a glossary which defines words and terms not explained in the text of this section as well as some of the more important terms associated with PBX-AIOD.

1.4 The material in this section is also contained in G.I.C. 9.69. In addition, the G.I.C. contains a discussion of the electronic switching devices utilized in PBX-AIOD and the concepts which govern their use. Among the devices described are magnetic cores, ferrite sheets, ferreeds, bipolar ferreeds, ferrods and basic logic circuits.

1.5 The development of high speed electronic devices and the advent of very large information storage systems or bulk memories have opened the door to new and different switching systems. PBX-AIOD exemplifies the expansion of the use of these electronic switching techniques.

1.6 Automatic identified outward dialing (AIOD) provides the PBX centrex system with an automatic means for identification of a station or attendant making a direct dialed outward toll call. The AIOD system stores in memory the 4-digit number of the calling station or attendant for later use by the automatic message accounting (AMA) facility.

1.7 Prior to PBX-AIOD, station identification for any outward toll call required the intercession of an operator at a centralized automatic message accounting (CAMA) office. This method of identified outward dialing (IOD) was necessary because the identity of the calling PBX station or attendant was not available to the central office equipment.

1.8 The PBX-AIOD method used to determine the identity of a PBX station or attendant originating a call into a local central office is to have PBX-ANI equipment, located at the PBX, identify both the station making the call and the PBX trunk being used. The station number and trunk number are forwarded by PBX-ANI to the AIOD station Identification Frame at the central office where they are stored until required for charging. Identification and storage of the station number is performed for every central office call regardless of whether or not it is a toll call. The station number remains in storage in the central office until requested by the AMA facility or, should the AMA facility not request the station number, it will remain in storage until it is updated by new information identifying another call.

2. PRINCIPLES OR OPERATION

2.1 Figure 2-1 shows a block diagram of PBX-AIOD service for both conventional PBX'S and the No. 101 ESS.

2.2 Both the 701B and 757 PBX, when providing a centrex service, are equipped with a PBX-ANI system for station identification on calls to a central office. The No. 101 ESS system is designed to provide station identification when handling this type of call.

2.3 With PBX-AIOD, a PBX station dialing a central office access code (usually "dial 9") is identified by its 4-digit number along with the 4-digit number assigned to identify the PBX trunk seized for the call. The identification process is performed by PBX-ANI and, upon completion of the process, the two 4-digit numbers are temporarily stored in the PBX-ANI station and trunk number memories to await transmission over a data trunk to the PBX-AIOD station identification (SI) frame in the connecting central office.

2.4 The No. 101 ESS PBX has AIOD features designed within it and uses these facilities to identify, process, and store its station identification numbers in memory with the 4-digit trunk number again as an address tag.

2.5 The SI frame is a receiving, processing, and storage system designed to handle a maximum of 60 data trunks. This system is capable of handling identifications for a maximum of 1800 PBX trunks distributed over a maximum of 60 PBXs.

2.6 Upon completion of the identification process and temporary storage by a PBX-ANI installation, a bid signal is sent by the PBX-ANI equipment over its data trunk to the SI frame which returns a transmit signal to indicate its readiness to receive, process, and store the identification information. PBX-ANI then transmits its stored identification information over the data trunk. All data trunk transmission is in two-out-of-five code using frequency shift keying (FSK).

2.7 The PBX trunk numbers are the numbers assigned by the central office to the PBX trunks used by the PBX for the outgoing call. The four-digit numbers are determined by the trunks' central office equipment location when the serving central office is a No. 1 or No. 5 crossbar (transverter) office or is an assigned number from a special AIOD number network when the serving central office is a step-by-step, panel, or No. 1 crossbar office equipped with ANI-B. Step-by-step offices equipped with ANI-C use the number assigned to the connector that is used for the PBX trunk.

2.8 The 4-digit trunk number is used by the SI frame to address a specific memory location in its station identification store into which the 4-digit station number is stored. The memory location also stores the number of the data trunk used in transmitting the information from the PBX-ANI equipment. The 4-digit station number remains in storage until called for by the AMA equipment via the AIOD translator and translator connector. This request is initiated only if the stored station identification number is needed by the AMA facilities for billing.

3. FRAMEWORK

3.1 Figure 3-1 is a sketch of the AIOD SI frame. The 2-bay bulb angle framework is 11'-6" high and 4'-1/4" wide arranged for 23-inch mounting plates.

3.2 No. 101 ESS tray assemblies are used for circuit packs, most of which are of existing design. A basic circuit pack is 4-inches high by 6 inches deep with a 28-pin connector. The tray assemblies hold a maximum of 32 circuit packs. Designation strips are provided on the face of the unit for identification of the circuit packs contained in the assembly.

3.3 Connection and cross connection facilities are provided as part of the SI frames.

3.4 Each digit register connector switch unit has a capacity of 16 PBX data trunk connections with the exception of SW3 which has a capacity of 12. The fully equipped connector thus provides service for a maximum of 60 PBX data trunks.

3.5 DC to DC converters supply +6, +12 and +24 volts to the SI frame from -48 volt office supply.

4. SYSTEM DESCRIPTION

4.1 General

4.11 Figure 4-1 shows a simplified block diagram of the PBX-AIOD station identification frame and interface equipment. The PBX-AIOD system is capable of receiving station identification information over data trunks. The output of the system is interfaced to the control office by AIOD interface equipment which performs the preferencing and control of data to and from the central office equipment and a language conversion, when needed.

4.12 The SI frame is composed of five major circuits with a sixth circuit providing the fuse alarm and miscellaneous functions. The combination of the six circuits integrates into a system which provides storage and buffering for the station identification numbers received from the remote PBX .

4.13 The PBX-AIOD is a sequential. clock-timed system performing a write-in and readout function. The storage write-in serves to write into memory the station number digits when received over a data trunk. The storage readout serves an AMA request for data providing a readout of the station number digits and a 2-digit office index from the storage location to be used by the AMA equipment.

4.2 Digit Register Connector

4.21 The digit register connector circuit provides the means of automatically connecting a data trunk from a PBX to one of two digit registers in the digit register circuit.

4.22 The digit register connector provides a metallic switch path using ferreeds for a maximum of 60 data trunks. This circuit scans the ferrods, on which all of the data trunks terminate when idle, for PBX service requests and, in the absence of a request, completes the scan in less than 1 millisecond. When a request is recognized, the digit register connector circuit connects the data trunk to one of the two digit registers and returns a transmit signal to the PBX-ANI equipment over the trunk. The scan stop and transmit signal takes approximately 65 milliseconds after which the scan is continued. A similar scan stop occurs on a second request. If a third request is detected while both digit registers are busy handling PBX data, the scan stops and waits for the release of one of the two digit registers. This release occurs when all the PBX data has been received by one of the digit registers which requires a maximum of 190 milliseconds.

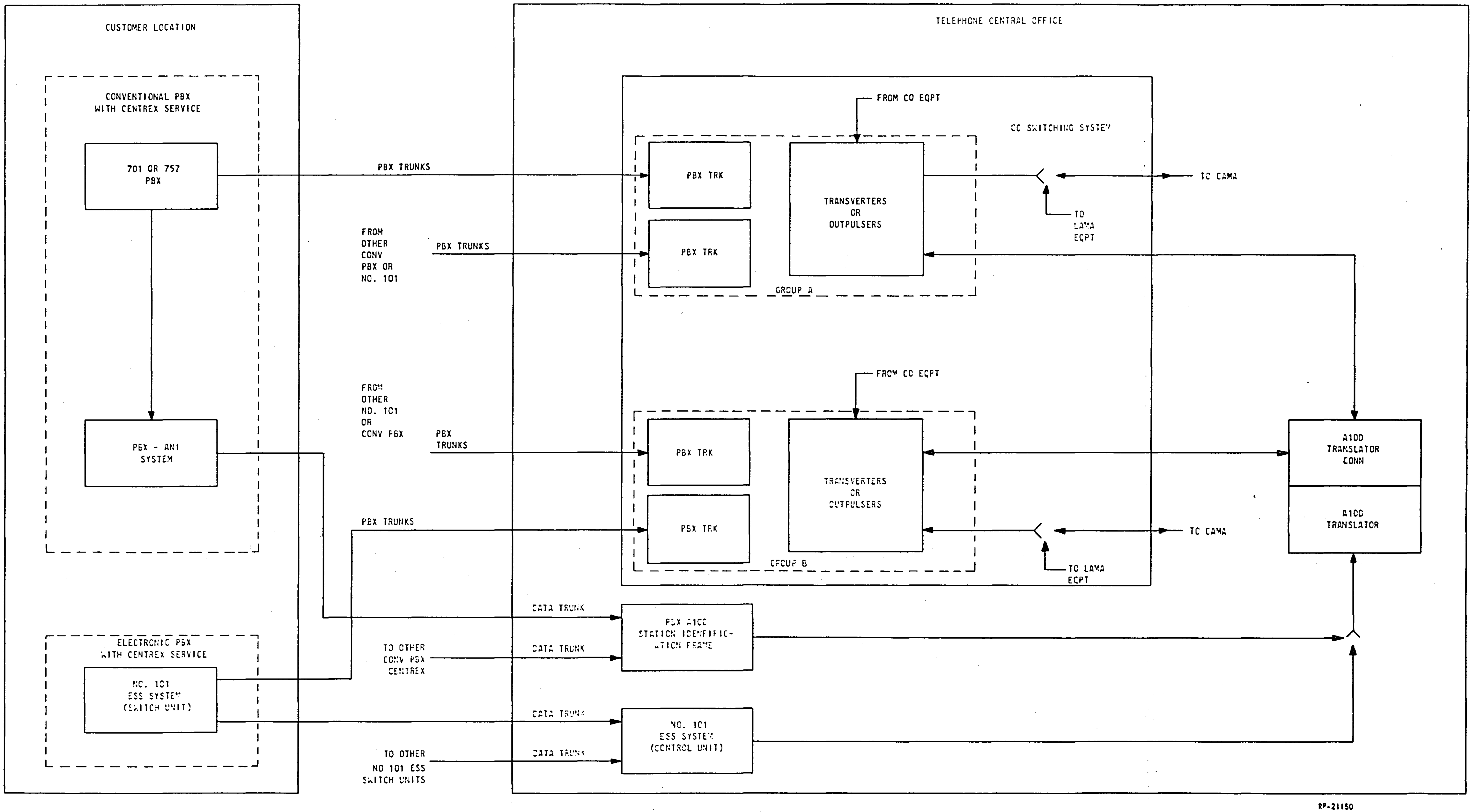


FIG. 2-1 PBX AIOD SYSTEM INTERCONNECTIONS

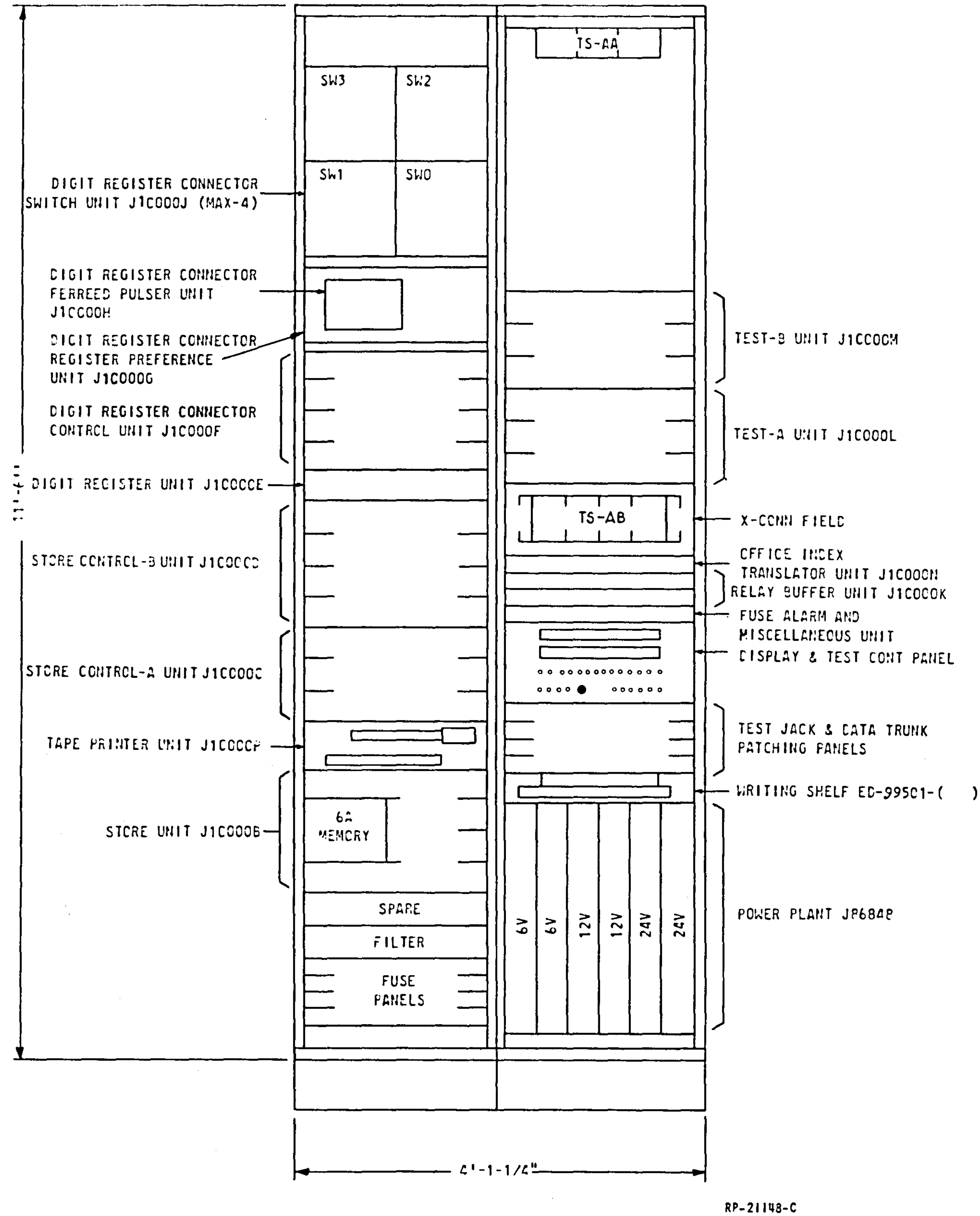


FIG. 3-1 AIOD STATION IDENTIFICATION FRAME

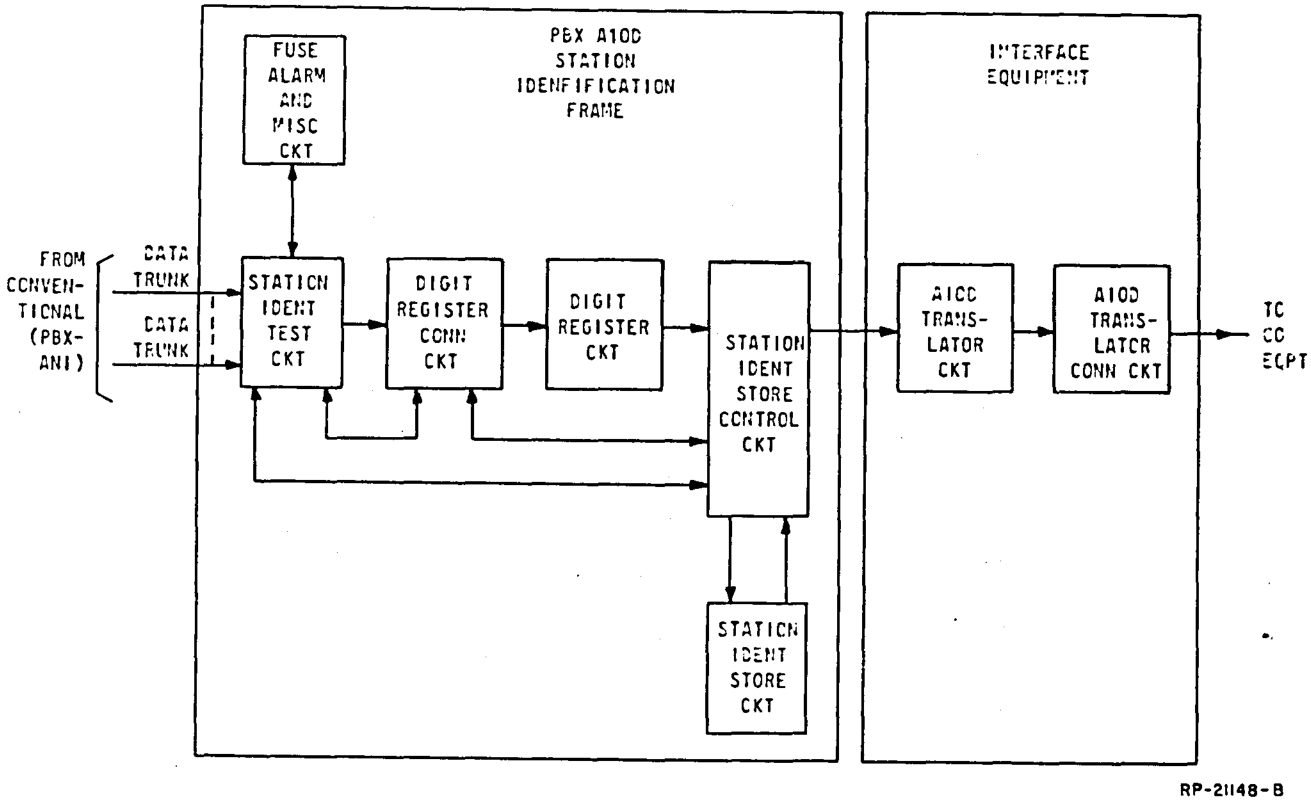


FIG. 4-1 PBX - AIOD STATION IDENTIFICATION FRAME - BLOCK DIAGRAM

4.3 System Digit Register Circuit

4.31 The two digit registers within the digit register circuit are simultaneously connected to serve data trunks, thus providing sufficient capacity under a heavy load condition.

4.32 The frequency shift signals that are transmitted over the data trunk from the PBX-ANI system must be converted from frequency shift form to a form usable by the data processing SI frame. This is done by the selected digit register.

4.33 The received frequency shift message consists of 41 bits; a start bit, 20 bits for the trunk number, and 20 bits for the station number. The transmission rate is 735 bits per second. A "1" bit is transmitted as 1850 cps and a "0" is transmitted as 1150 cps over the data trunk. The receiver frequency shift signals are first converted into their DC logical "1" marks and "0" spaces and then transformed from serial to parallel form.

4.4 Station Identification Store Circuit

4.41 The station identification store circuit uses the 6A memory module from No. 1 ESS. The memory uses coincident current word selection, with access, read and write circuitry provided in the SI store circuit. Of the 2048 word locations of 24 bits each, only 1920 memory locations are connected to access circuitry since the address bits are in 2-out-of-5 code and will not perfectly map into all 2048 memory locations.

4.42 Functionally, the 6A memory contains 64 Y planes, 32X planes and 24 Z (bit) planes. Only 30 X planes are connected to access circuitry because only 1920 word locations of the memory are used.

4.43 Three external inputs are required for the station identification store circuit operation. These are (a) a command signal which specifies the type of read and/or write operation to be performed, (b) an address which selects the memory word location, and (c) data information which specifies the bit configuration of words to be written into the 6A memory.

4.44 The trunk number addresses are divided into A000 through A899 and B000 through B899, where A and B are any two different thousands digits.

4.45 The selected thousands bit and the 1, 2, 4 and 7 bits of the hundreds, tens and units digits of the trunk number are translated to develop a 1-out-of-30 X plane current and a 1-out of-64 Y plane current.

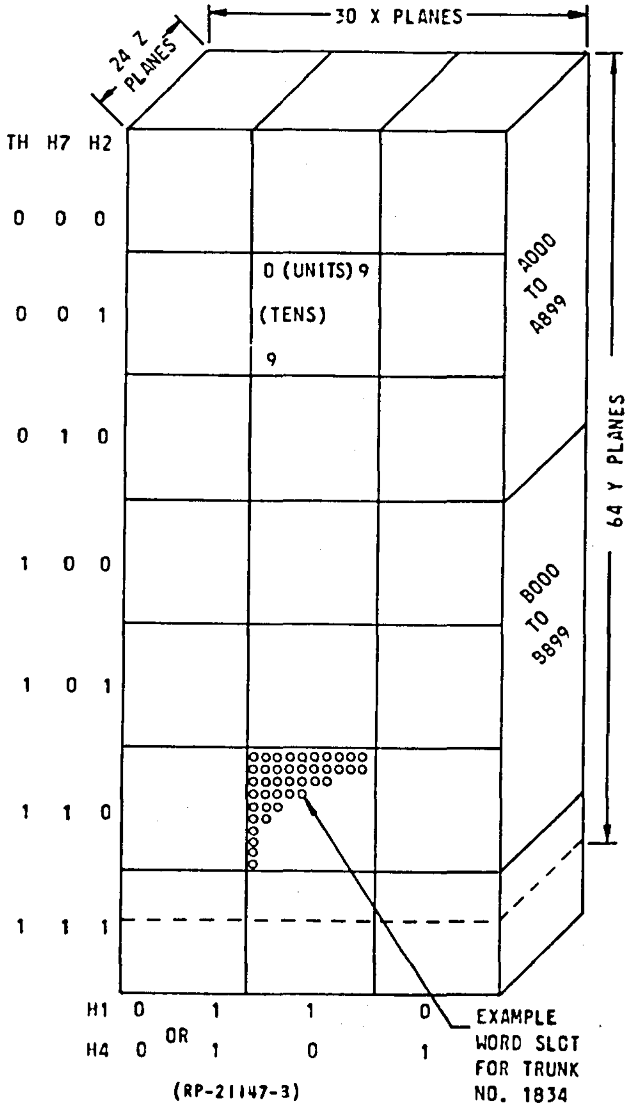


FIG. 4-2 STATION IDENTIFICATION STORE-BLOCK REPRESENTATION

4.46 Figure 4-2 is a block representation of the SI store showing how access to a specific word is derived from the 2-out-of-5 coded trunk number. The thousands digit selects block A or block B of the store, each block containing 900 word slots. Each of these is subdivided into blocks of 100 word slots which are selected horizontally by the 7 bit and 2 bit of the hundreds digit, and vertically by the 1 bit and 4 bit of the hundreds digit. A "1" gives significance to a bit place. The address is further selected by the tens digit (horizontally) and units digit (vertically) being translated into 1-out-of-ten. An example of a trunk number location is shown in Figure 4-2.

4.5 Station Identification Store Control

4.51 The station identification store control circuit provides the logic to control the station identification frame in assembling and transferring data in and out of the store.

4.52 Provision has been made to permit reassigning a PBX trunk at the central office without immediately changing the AIOD trunk number at the PBX. To do this the new trunk location in the store is tagged to indicate that the station number should be obtained at the old trunk location.

4.53 For reliability, timing circuits are duplicated. Parity and 2-out -of-5 checks are made and transferred data is compared with the original data. All alarm and error indications are handled by the test circuit for printout on its tape printer.

4.6 Station Identification Test Circuit

4.61 The station identification test circuit provides the means for performing operational on-line and off-line tests and routine maintenance on the PBX AIOD station identification frame.

4.62 The test circuit performs these basic functions:

(a) Error detecting and encoding provides the means for monitoring information being processed by the digit register connector, S.I. store control and the fuse alarm and miscellaneous circuit.

(b) Errors and circuit failures are printed out in code on paper tape. This code is then translated into a probable equipment trouble area by reference to a trouble location manual.

(c) Input/output checking of the S.I. store is provided in three operating modes. These are: destructive readout, nondestructive readout and repetitive write in.

(d) The control panel provides a means of simulating a PBX making a bid for service over a data trunk and transmission of trunk and station identifying information into the system. A picture of the control panel is shown in Figure 4-3.

5. TYPICAL OPERATION

5.1 PBX Data

5.101 Figure 5-1A shows a block diagram of some of the circuits involved in processing and storing data from the PBX.

5.102 The trunk scanner within the digit register connector detects a service request over a data trunk and assigns a preference to the service request. The digit register preference and selection circuit selects and makes busy an idle digit register in the digit register circuit. If both digit registers are idle, it will select the digit register that has been idle the longest period of time.

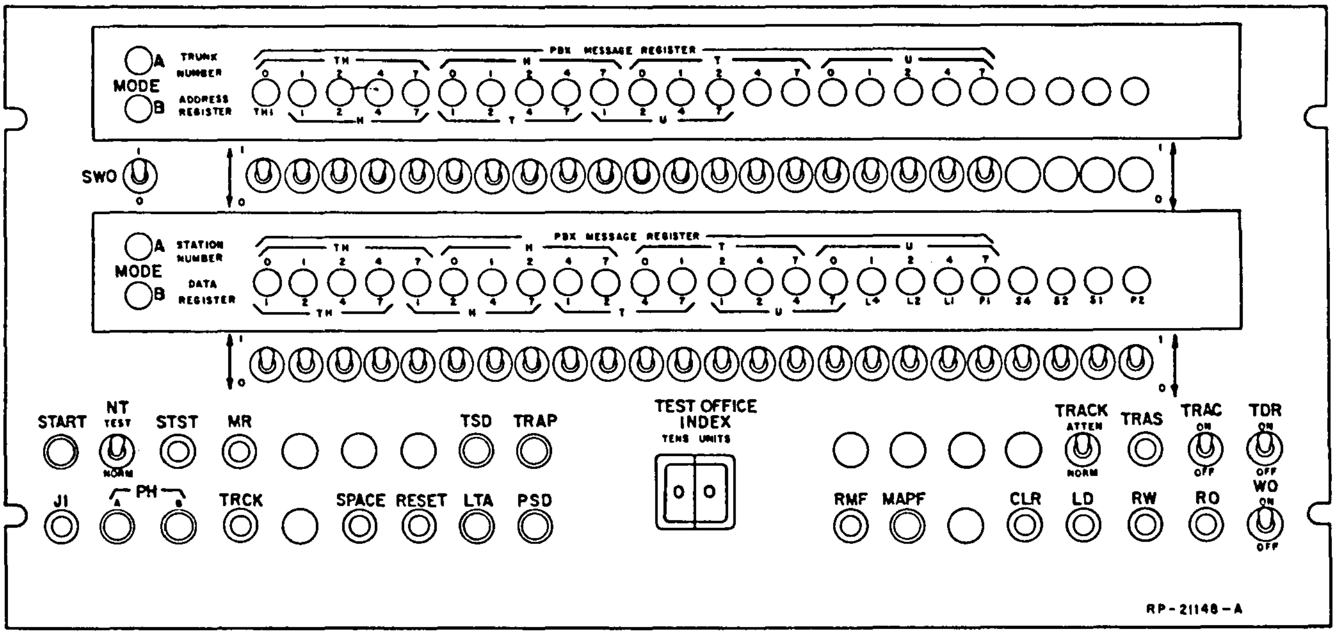


FIG. 4-3 STATION IDENTIFICATION TEST CONTROL PANEL

5.104 The received transmit signal at the PBX initiates the transmission of the 41-bit message over the data trunk, through the established channel in the connector switch network of the digit register connector to the digit receiver of the digit register circuit. The channel through the connector switch network is determined by the path selection circuit.

5.105 Figure 5-1B shows how the bits of the PBX data are arranged and used. The digit receiver accepts the 41-bit message which is in frequency shift form and converts each serial bit to a logic "1" or "0".

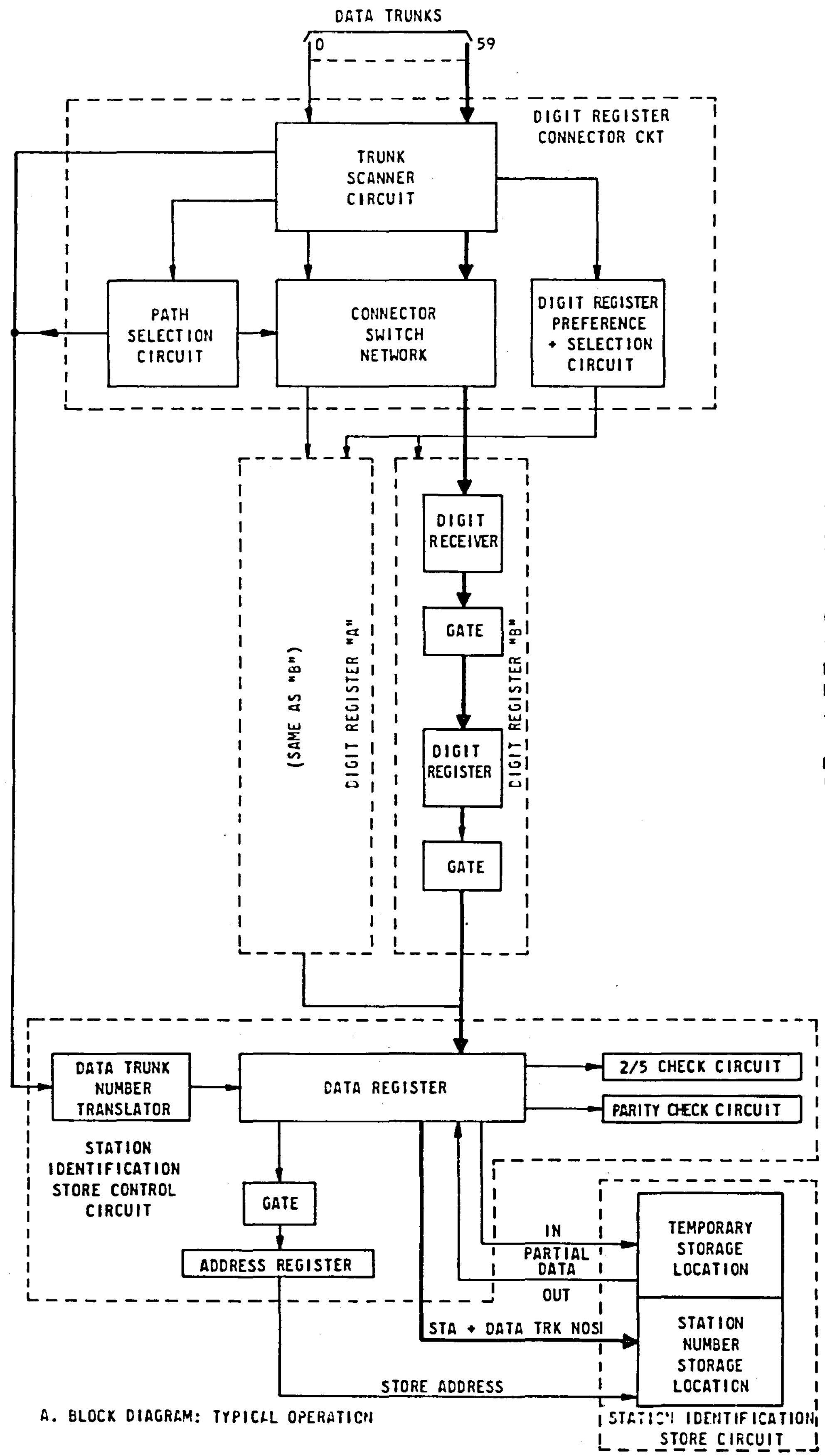
5.106 Each serial bit is gated into the digit register which is a 6-bit shift register. When the six stages of the shift register are full, the contents are gated out in parallel form to the data register in the station identification store control circuit and five more bits are serially shifted in. The first six bits consisted of the premessage bit and the five bits of the trunk number thousands digit. Since the remaining portion of the 41-bit message is composed of five bits per digit, a "1" bit is reinserted into the 6-bit shift register prior to the gating in of the trunk number hundreds digit. This "1" bit serves to initiate parallel readout of the hundreds digit from the shift register in the same manner as the premessage bit initiated parallel readout of the thousands digit from the shift register. This "1" bit reinsertion procedure occurs once for each digit of the message until the total message has been gated through to the data register in the station identification store control circuit.

5.107 The total message takes on a slightly different format as it is gated, digit-by-digit, out of the 6-bit shift register.

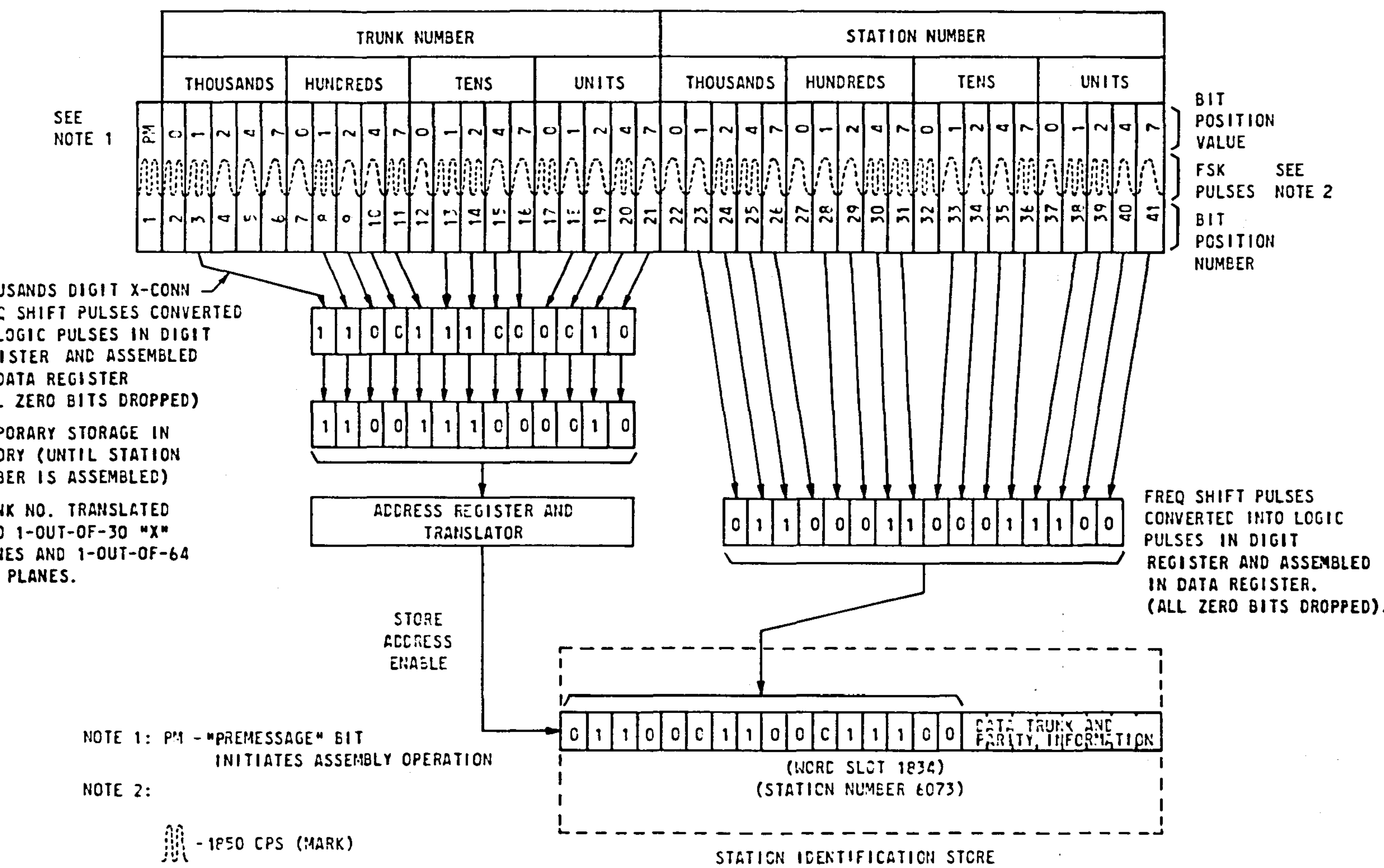
(a) The trunk number thousands digit is converted by means of cross-connections to a single bit - a logic "1" or "0".

(b) The least significant bit ("0" bit) is dropped from the five bits of each succeeding digit making each digit a 4-bit code rather than a 5-bit code. Thus the total message is a 30-bit word consisting of one premessage bit; one trunk number thousand digit bit; four trunk number hundreds, tens, and units digit bits; and four station number thousands, hundreds, tens, and units digit bits.

5.108 As each digit is registered in the data register, it is given a two-out-of-five check before being shifted into position after which it is gated into a temporary storage location in the station identification store. Prior to the gating of a new digit from the digit register into the data register, the previous digit is taken from its temporary storage location and placed back in its proper location in the data register and an odd parity check is made. The new digit is gated into the data register where it takes its place with the previous digit and the contents of the data register are again gated into the temporary storage location. This process continues until the units digit of the station number is received in the data register, at which time the trunk number portion of the word is gated from the data register into the address register. The station number portion remains in the data register.



A. BLOCK DIAGRAM: TYPICAL OPERATION



B. DATA DISTRIBUTION: TYPICAL OPERATION

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FIG. 5-1A&B PBX ANI MESSAGE-RECEPTION AND STORAGE

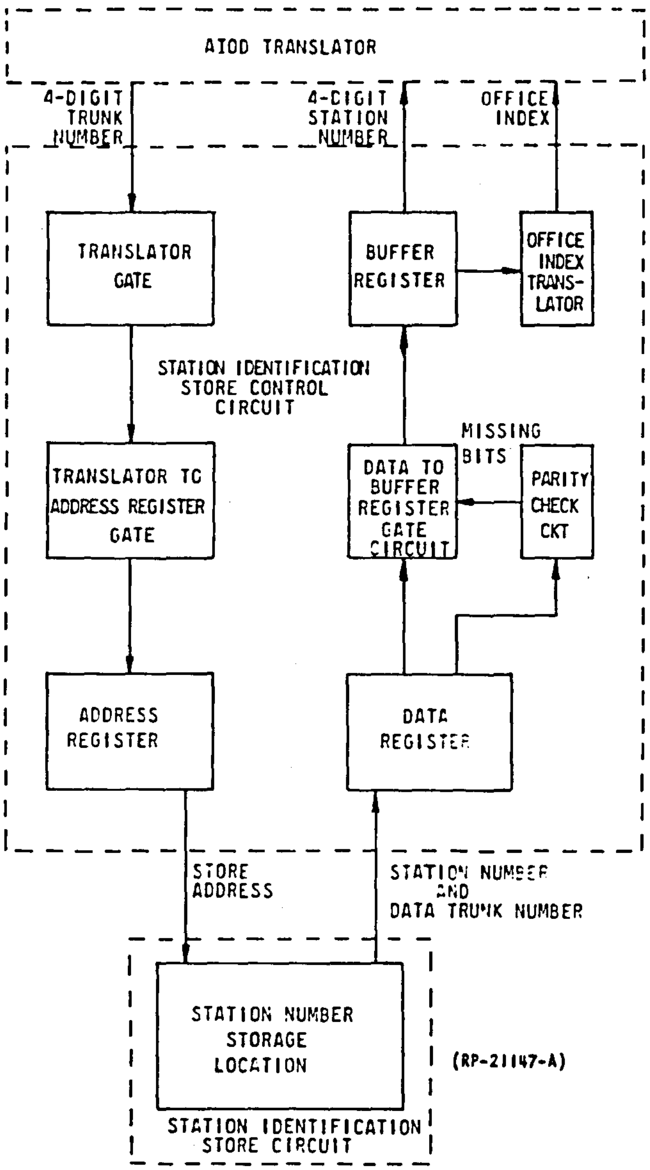

FIG. 5-2 TYPICAL OPERATION ON C.O. REQUEST-BLOCK DIAGRAM

5.109 The control circuit interrogates the trunk number translator which returns a 6-bit binary data trunk number and two parity bits. The trunk number translator generates its output from the contents of the trunk scanner and path selection in the digit register connector. This 6-bit binary information is registered in the data register, taking its place with the remaining 16 station number bits.

5.110 The address register addresses the memory location in the station identification store with the trunk number registered in the register. A write command is given to the store which writes in the station number, data trunk number, and parity bits to the addressed location in the station identification store and the data, address, and digit registers are reset.

5.111 The station identification frame is now ready to process data on a new PBX request for service.

5.2 Central Office Request

5.21 Figure 5-2 shows a block diagram of some of the circuits involved in processing and transferring data to the central office.

5.22 The translator gate, part of the station identification store control circuit, detects a request for a station number associated with a PBX trunk. Information in the form of a two-out-of-five trunk number is received by the translator gate via the AIOD translator and connector and transferred to the address register via the translator to address register gate circuit. The thousands digit is converted to a logic "1" or "0" and the least significant bit is dropped from the remaining digits resulting in the address register receiving a 13-bit word.

5.23 The address register addresses the memory location with its registered trunk number. The station number and data trunk number stored in that memory location are gated out to the data register. The parity check circuit is used to compute parity over each of the four station number digits in the data register. The result of this parity check determines whether a logic "1" or "0" was dropped as the least significant bit of each digit during the data assembly process. The parity check circuit will reconstruct the missing bits and gate them through the data to buffer register gate circuit along with the station number and the data trunk number digits from the data register to the buffer register. In the buffer register the least significant bits are registered in their proper slot with their respective station number digits.

5.24 The six binary bits representing the data trunk number are transferred from the buffer register to the office index translator where a relay tree establishes a one-out-of-sixty octal output. The output of this tree is brought to a cross connect field where the 60 leads can be cross-connected to any of 30 office index leads. These 30 office index leads are further translated by a diode matrix to the required one-out-of-three tens and two-out-of-five units digit code.

5.25 The 20 bits registered in the buffer register, representing the 4-digit station number, and the eight bits from the office index translator are applied directly to the AIOD translator for AMA billing by the AMA equipment.

6. INTERFACE EQUIPMENT

6.1 General

6.11 The AIOD translator and AIOD translator connector form a preference and control circuit in the central office which furnishes the interface between existing central office equipment and the PBX-AIOD station identification (SI) frame. The central office connecting equipment can be AMA or ANI transverters in No. 5 crossbar offices, ANI outpulsers in panel, No. 1 crossbar, and step-by-step offices, or AMA transverters in No. 1 crossbar offices. The AIOD translator and translator connector function according to the type of central office used.

6.12 It should be noted that all word transmission to and from the AIOD system, whether an SI frame or No. 101 ESS, is based on the two-out-of-five code. Also, the transverters in the transverter type office furnish to the AIOD translator and translator connector an equipment location for the PBX trunk handling the call. The AIOD translator and translator connector convert the equipment line location to a 4-digit PBX trunk number in two-out-of-five code for handling by the SI frame or No. 101 ESS. This 4-digit trunk number is used to address a memory location in the SI frame or No. 101 ESS. Station number readout and the office index readout from the SI frame is in two-out-of five code for station number and one-out-of-three and two-out-of-five code for office index. The AIOD translator and connector convert this two-out-of-five and one-out-of-three readout code into one-out-of-ten code to properly interface with the central office transverters.

6.13 When interfacing between an outpulser type office and SI frame, a language conversion by the AIOD translator and translator connector is not necessary because the outpulser is designed to use the two-out-of-five code.

6.14 In addition to language conversion, when required, the AIOD translator and translator connector, acting as a preference and control circuit, function to permit only one transverter or outpulser access to the SI frame at a time and in a predetermined order. Since one AIOD translator and translator connector can serve a maximum of two separate central office number identification systems with a definite combination of identifiers and transverters, preference and control are required. The AIOD translator, in processing its input and output information, checks for word errors to assure proper word structure during its control, conversion, and transfer of information.

6.15 Upon receipt of the PBX station number from the AIOD translator and translator connector, the transverter or outpulser follows the normal routine in forwarding the information to the AMA facility.

6.16 Should the AIOD translator and translator connector detect a failure or error within its own circuit or within other equipment required in the identification process, the central office equipment is notified to perform an alternate billing routine. In AMA or ANI transverter type offices, alternate billing is made to the PBX listed number by using the regular AMA translator. In ANI outpulser type offices, CAMA operator identification is used as the alternate billing routine.

6.2 AIOD Translator Connector

6.21 The translator connector consists of a preference circuit and multicontact relay connectors. The preference circuit allows only one transverter or outpulser access to PBX-AIOD translator at one time and in a predetermined order, thus guarding against a double connection. The multicontact relays provide the multileads necessary between the central office switching system equipment and the PBX-AIOD translator.

6.3 AIOD Translator

6.31 The AIOD translator is composed of nine basic functional circuits. Five of these circuits as shown in Figure 6-1 are: (1) trunk number thousands, tens and units digit register circuit, (2) trunk number hundreds digit register circuit, (3) trunk number hundreds-tens digit translator circuit, (4) trunk number 2/5 check circuit, and (5) trunk number sending circuit. These five circuits perform the trunk number registration, translation, checking, and transmission of the PBX trunk number to the PBX-AIOD SI frame. The four remaining circuits as shown in Figure 6-1 are: (1) station number register circuit, (2) station number and office index 2/5 check circuit, (3) office index sending circuit and (4) station number sending circuit. These four circuits perform the station number registration, translation, checking, and transmission to the central office switching system via the translator connector.

7. POWER

7.1 The DC power for the control unit is derived from DC to DC converters. These converters operate from the central office -48 volt battery. They produce +6, +12, and +24 volt supplies. The plug-in units are duplicated, normally operating continuously with each carrying half the load and capable of carrying the full load if one fails. Solid state control circuitry for each supply is mounted on a plug-in wiring board.

Superintendent, Panel and Step-by-Step
Switching Systems Engineering

ATTACHMENT
Figure 6-1 on Page 13.

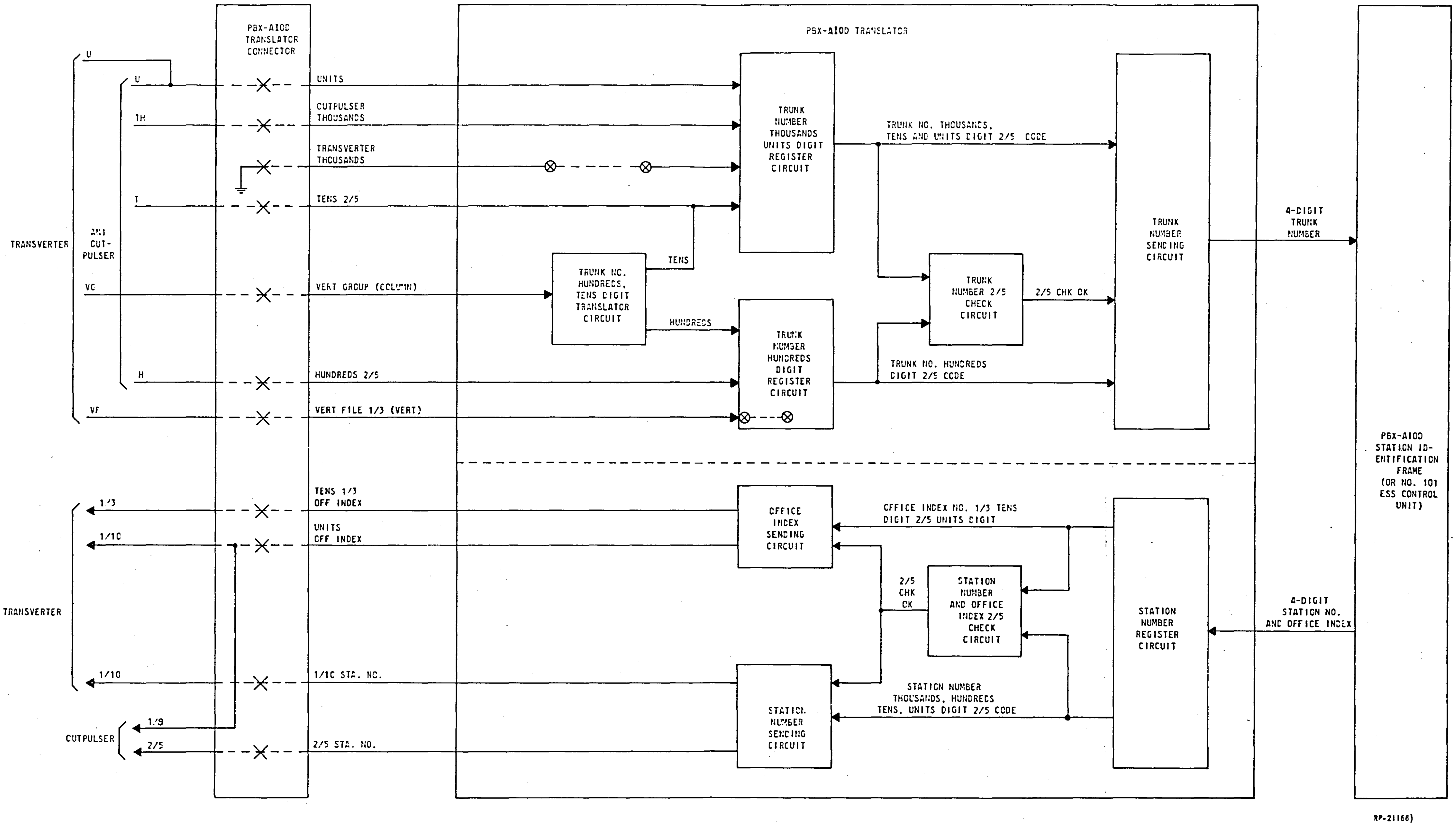

FIG. 6-1 PBX AIOD TRANSLATOR AND CONNECTOR-BLOCK DIAGRAM