SWITCHED SERVICE NETWORKS (SSN)
USING CENTRAL OFFICE SWITCHING MACHINES
CCSA AMA SAMPLING

CONTENTS PAGE

1. INTRODUCTION

1.01 This section contains a general description of Automatic Message Accounting (AMA) sampling used on a Common Control Switching Arrangement (CCSA) Switched Service Network (SSN).

1.02 When this section is reissued, the reason for reissue will be given in this paragraph.

1.03 Other sections containing information relative to AMA sampling are listed in Part 9.

1.04 CCSA AMA sample data is collected for use by the various telephone companies for communications engineering purposes. The data is also used for identifying problem areas on the customer network. Certain troubles that are difficult to locate or that may go undetected are often found by analyzing AMA sample data (see Part 7).

1.05 CCSA SSN customers do not receive conventional billing statements listing each individual network call (100 percent detail). In lieu of a 100 percent listing, a statistical sample of up to 20 percent is supplied to the customer for their internal use.

1.06 The need for accurate and timely AMA sample data by both the customer and the telephone companies dictate that the sample data be processed under the same standards of accuracy and promptness as data for normal telephone billing.

2. AUTOMATIC MESSAGE ACCOUNTING (AMA)

2.01 AMA is a system which records call details when billing information about a particular call is required. The AMA system is used for CCSA AMA sampling and is machine oriented

(automatic) in that no human intervention is necessary in the recording process.

2.02 The AMA system used for sampling incorporates recording equipment located at a CCSA or Centrex (CO) switching machine location. This equipment is engaged when required to record the sample data and released when the record entry is completed.

2.03 Normally, three record entries are necessary for a complete call record. These entries are as follows:

(a) Initial Entry — The calling number and the called number accompanied by appropriate processing data.

(b) Answer Entry — The time that the call was answered accompanied by appropriate processing data.

(c) Disconnect Entry — The time that the sampled call is terminated accompanied by appropriate processing data.

3. SAMPLING POINTS

3.01 AMA sampling is performed at serving switch centers and at Centrex (CO) locations that have AMA capability. In No. 5 Crossbar systems, every fifth originating network call is sampled for a 20 percent sample (every tenth call for a 10 percent sample) whether or not the call is completed. The RAO removes incompleted calls from the recorded data before it is given to the customer. No. 1 ESS systems, however, record 100 percent of the completed calls. The RAO reduces the sample to 20 percent. ESS makes no record of incompleted calls.

3.02 Figure 1 represents a typical homing arrangement. Shown are the sampling points and representative network numbers which are recorded as the calling number in the sample records.

A. PBX

3.03 PBX "A" and "B" (Fig. 1) are non-Centrex systems which are connected to the CCSA switch by PBX access line groups. PBX "A" has been assigned the network address of 222-0000 and PBX "B" the address of 223-0000. These network addresses follow the standard CCSA structure for a PBX (NNX-X000) in which (X) may be any numeral (0 to 9) and the assigned NNX is unique to that PBX.

3.04 Sampling of calls originated at PBX "A" and PBX "B" is done at the CCSA switch, and the AMA recorded originating number, an access line group identity, consists of four digits (NNX-X). During processing at the Revenue Accounting Office (RAO), this identity will be expanded to a seven digit number.

B. Directly-Homed Access Lines

3.05 Directly-homed access lines are typically terminated in keyset telephones (stations "A" and "B" in Fig. 1). These stations terminate directly on the CCSA switch; therefore, it is not necessary to dial a network access code (usually 8) from these stations. All directly-homed stations terminating on a given switch share the same NNX but are assigned individual line numbers as their network address.

3.06 Sampling on directly-homed access lines is done at the CCSA switch. The AMA recorded number is the four digit line number associated with the access line group. In the example shown in Fig. 1, this is 2311 and 2312 for stations "A" and "B," respectively.

C. Centrex (CU) Without Automatic Identification Outward Dialing (AIOD) Features

3.04 Traffic sampling on a Centrex (CU) service without AIOD features is generally handled the same as a PBX. The sampling is done at the CCSA switch using line group identification. The NNX-X portion of the address is recorded.

D. Centrex (CU) With AIOD Features

3.05 Sampling on a Centrex (CU) service with AIOD features is also done at the CCSA switch. The AMA, however, records the originating station line number. The originating station is identified by the AIOD system which is discussed in Part 5.

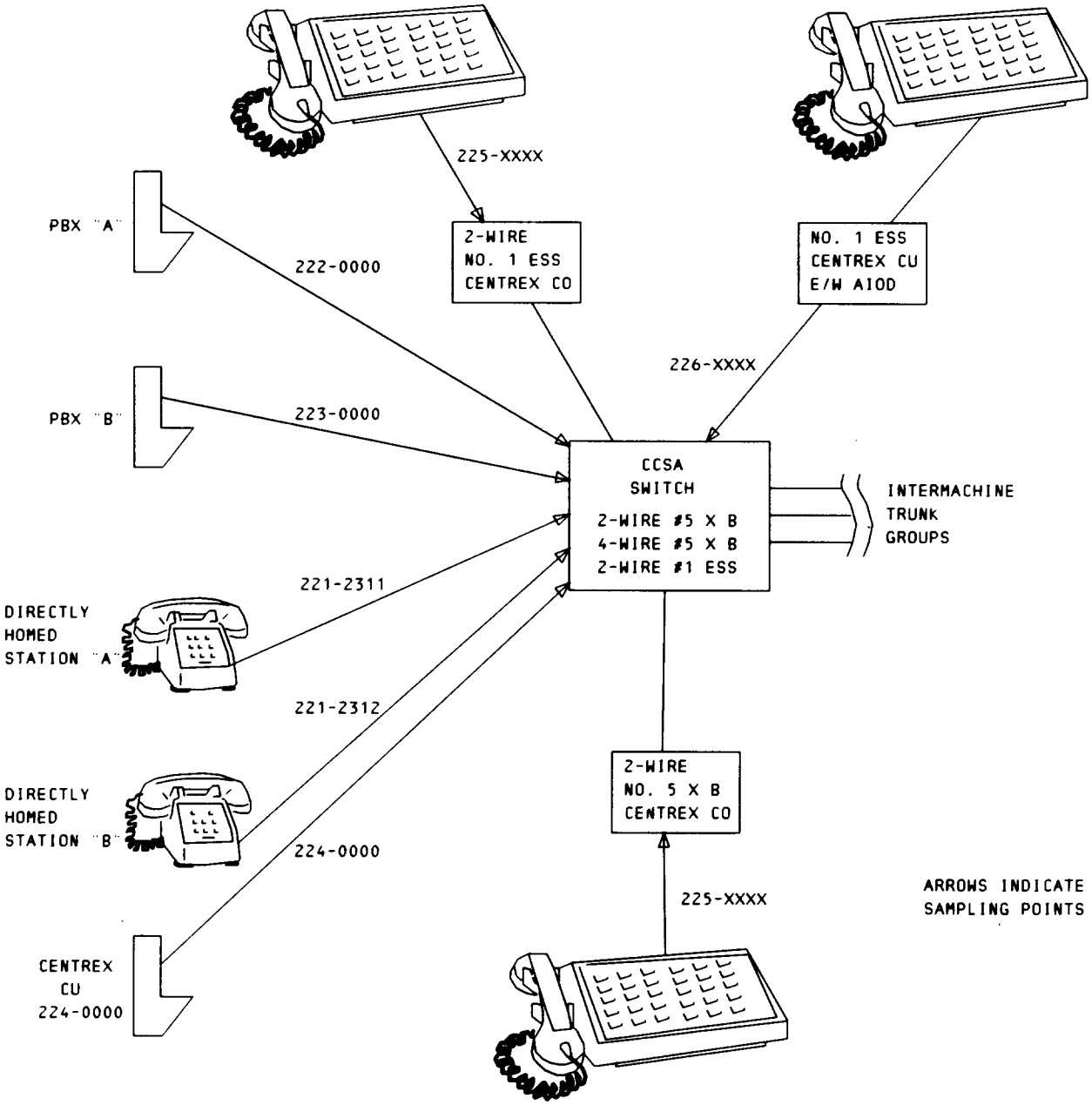


Fig. 1—Typical CCSA SSN Homing Arrangement

E. Centrex (CO)

3.06 Sampling of network calls originated on a Centrex (CO) is done at the Centrex (CO). No. 5 Crossbar Centrex (CO) AMA records the station line number of the originator whereas No. 1 ESS Centrex (CO) AMA records the station directory number.

4. SAMPLING PROCESS

4.01 There are three basic types of switching machines where associated AMA equipment may collect CCSA sample data. They are as follows:

(a) 2-wire No. 5 crossbar switching machines

(b) 4-wire No. 5 crossbar switching machines

(c) 2-wire No. 1 ESS switching machines.

4.02 The sampling methods and procedures are the same for both the 2-wire and 4-wire

No. 5 crossbar machines. The No. 1 ESS uses different equipment and sampling techniques. It will be necessary, therefore, to describe the processes separately.

A. No. 5 Crossbar

4.03 Figure 2 is a block schematic showing the main elements involved in CCSA sample recording at a No. 5 crossbar machine.

4.04 There are six main units in the machine that are involved in the sampling procedure. These are as follows:

(a) Traffic Sampling Counter — An electromechanical counter which tallies the call originations on the network and initiates sampling routines.

(b) Translator — Provides the number information identifying the call source.

(c) Transverter — Interface between the translator and the AMA recorder.

(d) Transverter Connector — Establishes a path between the outgoing sender and the transverter.

(e) Call Identity Indexer — Provides AMA trunk identity.

(f) Recorder Perforator — Perforates call details on AMA tape.

4.05 In addition to the units listed in 4.04, the completing marker and outgoing sender are also involved during an AMA sample routine. The completing marker controls all machine activities in establishing and routing a call. The outgoing sender passes the information necessary to complete the call to the distant switcher. Both the completing marker and the outgoing sender are used in all calls whether or not AMA is involved.

Method of Operation

4.06 All lines that are included in the sample universe must have a class of service mark to indicate to the completing marker that a sample routine may be required on calls originated by the line. The class of service mark indirectly identifies a CCSA network.

4.07 Each time a call is originated on the line link frame from a line with the proper class of service mark, the completing marker will cause

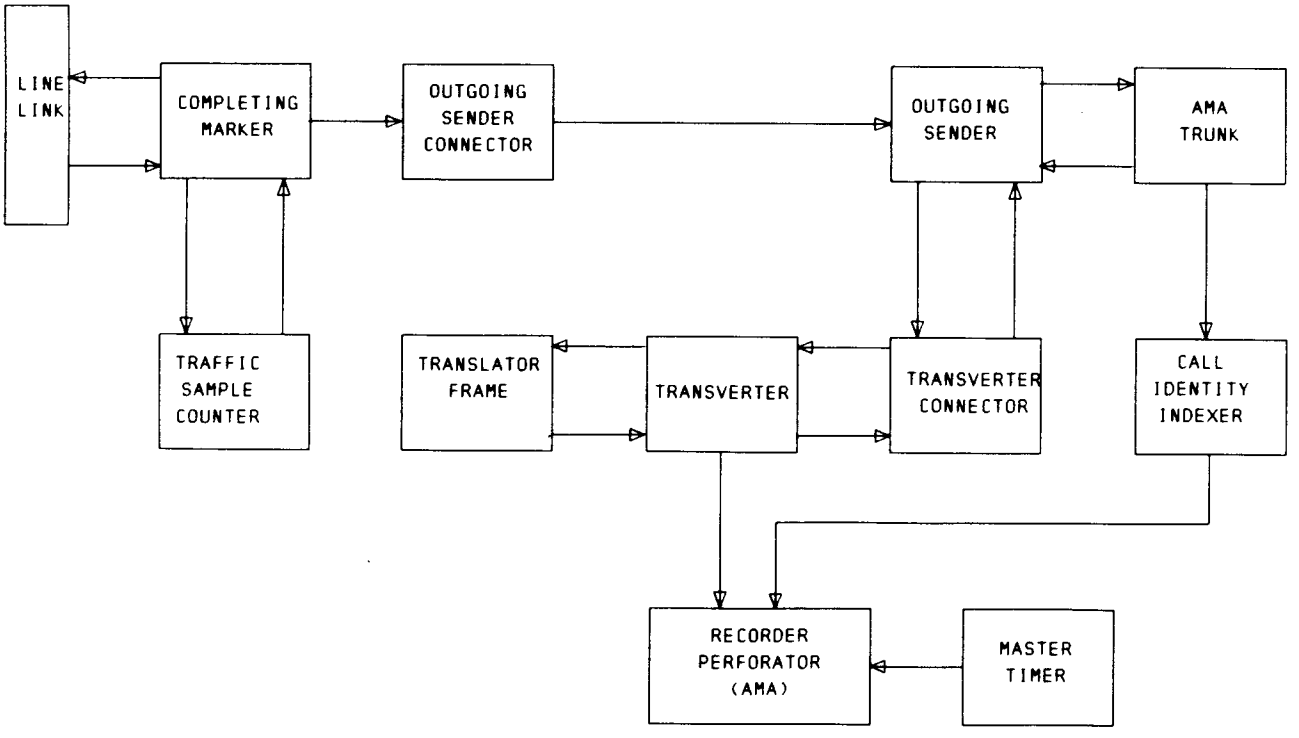


Fig. 2—Elements Involved in No. 5 Crossbar Sample Recording

the traffic sample counter to reduce its value one step (4 to 3, etc).

Note: When more than one marker serves a network, each marker must have a traffic sample counter. Also, there must be a separate counter for each network served by the marker.

4.08 When the traffic sample counter reaches step (0), it indicates to the marker that an AMA routine is required on the call. It then resets to its initialized value; (4) for a 20 percent sample rate and (9) for a 10 percent sample rate. Once the counter has indicated a need for an AMA routine, it takes no further action on that particular call.

4.09 When the marker receives a signal from the traffic sample counter, it gains access to an outgoing sender via an outgoing sender connector, and primes the outgoing sender for AMA and regular outgoing call operation. The marker also seizes a trunk link frame with an idle AMA equipped outgoing trunk and connects the sender to the trunk through the sender link. As soon as the trunk link frame is seized, the marker establishes a connection between the calling customer and the outgoing trunk.

4.10 By the time the connection between the calling customer and the outgoing trunk is established, the marker has primed the sender with:

(a) Identity of the calling station in terms of equipment location by line link frame number, horizontal group, vertical group, and vertical file.

(b) The Message Billing Index (MBI).

(c) The number of the recorder serving the outgoing trunk.

(d) The called number.

4.11 The marker, having completed its functions, releases itself and associated connector and is available to process other calls.

Record Entries

4.12 There are certain blocks of information that are included in all No. 5 crossbar AMA initial records. These entries and their sources are as follows:

(a) Message Billing Index (MBI) — This two digit block defines the type of call to be recorded. Examples are; test calls (MBI 00); data phone (MBI 17); and CCSA sample (MBI 10). These digits are supplied by the marker based on the class of service mark of the originating line.

(b) Call Identity Index (CII) — This two digit block identifies the AMA equipped trunk used on the call. One AMA recorder serves a call identity indexer which may contain up to 100 trunks. The CII is supplied by the call identity indexer.

(c) Calling Office Index (COI) — This two digit block identifies the customer. These digits are supplied by the translator.

(d) Call Class Index (CCI) — This one digit block identifies the category of the call originator such as; noncoin (0), coin (1), WATS class 3 or higher MTS office (6), etc. The information for this digit is obtained from the completing marker.

(e) Entry Index — This one digit block defines the number of lines in the AMA entry; (1, 2, 4, 5, 6, or 7 lines) and the type of entry. This digit is supplied by the recorder.

4.13 In addition to the blocks of information listed in 4.12, the initial entry for CCSA sampling requires the location calling number and the called line directory number.

4.14 To obtain the calling location number, the sender selects a transverter through a transverter connector. On the basis of information received from the sender, the transverter selects the translator frame to which the calling customer line has been assigned. The line location is transmitted to the translator which translates this information into the calling number of the line. The calling number and the COI, also supplied by the translator, are registered in the transverter.

4.15 The called line number is transmitted from the originating register to the marker, then to the outgoing sender, and finally to the transverter where it is ready for sending to the recorder.

Recording

4.16 As soon as the transverter has the calling line number, it can engage the proper recorder since it has received the number of the recorder serving the outgoing trunk from the outgoing sender.

4.17 All information necessary to complete the initial AMA entry is registered in the transverter except the MBI and the CII, which are recorded in the last line of the entry. The marker has previously primed the sender with the MBI, hence, the sender can transmit it to the recorder via the transverter at the appropriate time. To obtain the CII, the transverter signals the trunk serving the call through the transverter connector, outgoing sender, and sender link to identify itself. The trunk then signals the call identity indexer circuit which transmits the CII of that trunk directly to the recorder.

4.18 The physical action of recording the initial entry on the tape is performed by the recorders and perforators under control of the transverter.

4.19 The sender carries on its regular outgoing call operations and the AMA operations simultaneously, and while the initial entry is being recorded, it outpulses all except the last digit to the distant office. The last digit is outpulsed when the recording of the initial entry on the tape has been completed.

4.20 When the called station answers, the call identity indexer, under control of the trunk, brings the recorder in on the connection a second time to record the answer entry. In order that the answer entry may be associated with the proper initial entry, the time information is accompanied by the CII from the call identity indexer to identify the trunk and an entry index from the recorder itself which identifies the entry type (1 line entry).

4.21 When the call is terminated, the process is repeated to record the disconnect time. The connection time or conversation time is the difference between the answer time and the disconnect time. There are two types of disconnect entry. They are:

(a) Standard disconnect—when calling party disconnects (goes on hook).

(b) Delayed disconnect—when the called party disconnects (goes on hook) and the calling party delays his disconnect. In this case, the trunk initiates a delayed disconnect. The tape perforation for this type entry is different from the standard disconnect. The RAO recognizes this type of disconnect and will deduct time from the overall connect time to allow for this delay.

4.22 Figure 3 illustrates a CCSA initial entry and a timing entry.

AMA Recorder-Perforator (Paper Tape)

4.23 As its name implies, this unit controls the recording of call data on the AMA tape. The recorder directly controls the operation of its associated perforator which punches the holes in the tape.

4.24 The recorder, as previously stated, operates under control of the transverter and the call identity indexer for the initial entries and the call identity indexer and master timer for answer and disconnect timing entries. Under control of the master timer, the recorder registers time in minutes and tenths of minutes past the hour and at the start of every hour causes an hour and date entry to be recorded on the tape. Also, under control of the master timer, the recorder causes an end-of-tape (splice) pattern to be punched in the tape at 3:00 A.M. each day. The hour and date are recorded immediately before and after the splice pattern. This pattern shows where the tape should be cut when it is sent to the accounting center for processing.

4.25 Each recorder may serve a maximum of 100 trunks.

4.26 The AMA perforator records call data by punching holes in a 3-inch wide paper tape. The punchings are arranged across the width of the tape in six groups (A through F), each group representing one digit. By using a two-out-of-five code (Fig. 4), any numeric value between zero and nine can be recorded in the B through F groups. The "A" group is limited to numerics between zero and three as only three punch positions are available in this group.

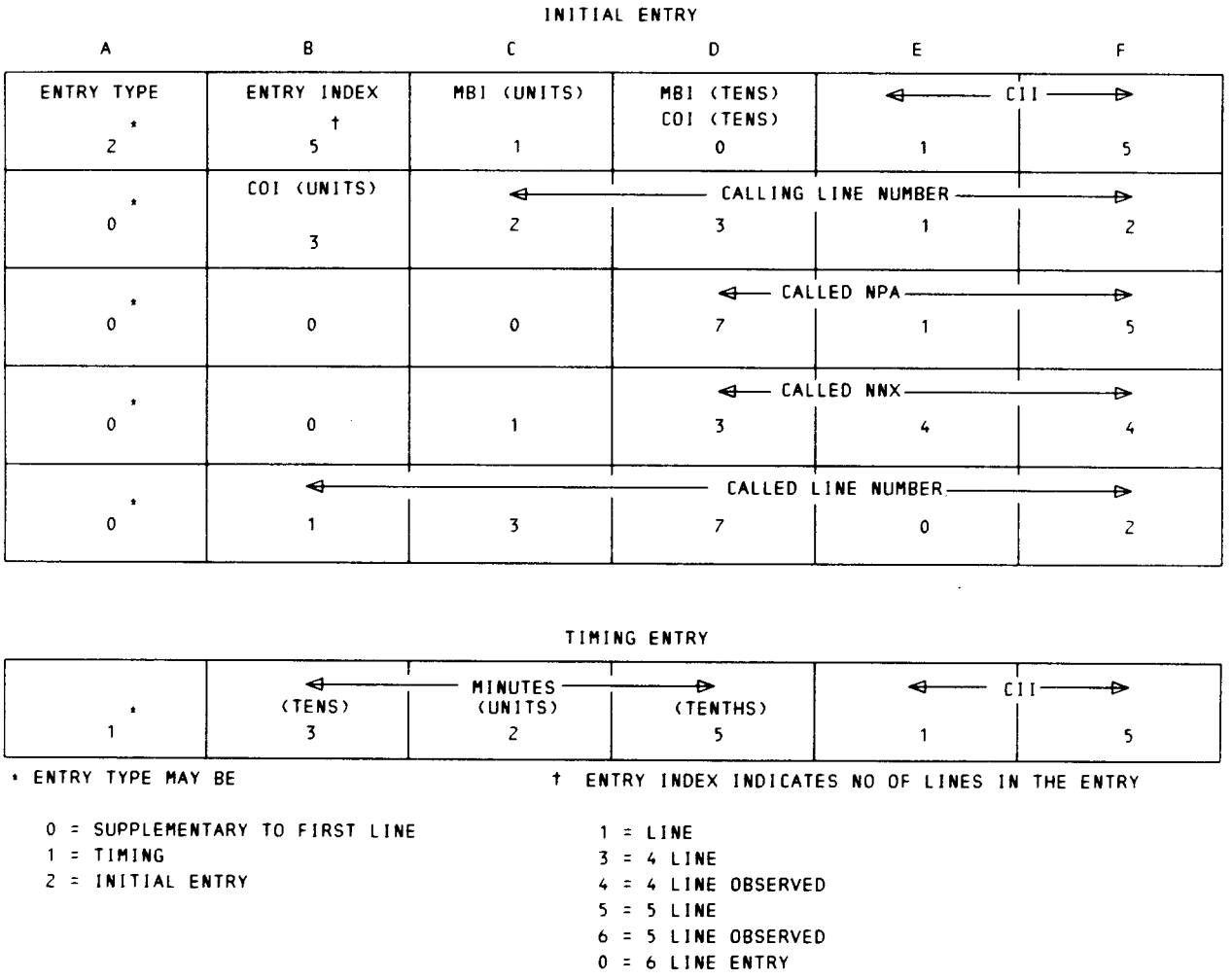


Fig. 3—Examples of CCSA 5-Line Initial and 1-Line Timing AMA Entries

AMA Recorder (Magnetic Tape)

4.27 A magnetic tape recorder (MTR) has been developed to replace the paper tape recorder-perforator. Each MTR can serve a maximum of 2000 trunks and will replace 20 of the tape recorder-perforator units.

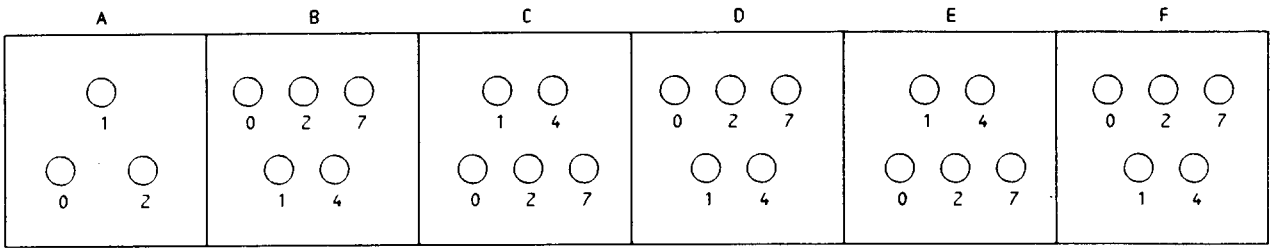
4.28 The MTR uses No. 2 ESS software and a multiple entry system similar to the paper tape recorder. With MTR, the call timing entries contain only seconds. Minute entries, in addition, to the hourly entries are recorded each minute.

B. No. 1 ESS

4.29 No. 1 ESS is a computer controlled switching system. The computer portion of the system is composed of the central control which may be supplemented by a signal processor and two memory areas referred to as program store and call store.

4.30 The program store is a semi-permanent store which contains the generic program, parameter data, and translation information. Basically, the generic program defines the type of office and runs the entire system. The parameter area defines the size of the office involved. The translation area of program store is basically a hierarchical system of tables which contain all the information about lines and trunks terminating in the office necessary to process calls. Included in the translation is routing information.

4.31 The call store is a temporary memory area which stores information regarding the



2 OUT OF 5 CODE

DIGIT	PUNCH	DIGIT	PUNCH
0	4 AND 7	5	1 AND 4
1	0 AND 1	6	2 AND 4
2	2 AND 0	7	0 AND 7
3	1 AND 2	8	1 AND 7
4	0 AND 4	9	2 AND 7

Fig. 4—AMA Tape Line Format

progress of calls, equipment status, circuit status, translation changes (until written into program store), and AMA billing details prior to being recorded on AMA tape.

4.32 Lines and trunks interface with the ESS on line link networks (LLNs) and trunk link networks. Each LLN appearance (termination for one line) has an associated Line Equipment Number (LEN) for identification.

4.33 When a bid for service is received at a LLN appearance (an off-hook signal), it is detected by the line scanner associated with the LLN. The originating line identified by the scanner location has a translation sequence performed which provides the class of service information necessary to continue processing the call and the LEN.

4.34 As the call progresses through the dialing, ringing, answering, and disconnect stages, the necessary call details are stored in call store.

4.35 If the call is not completed, the data is ignored and no AMA entry is made.

4.36 After the call has been completed, the calling number, the connect time and disconnect time (in hours, minutes, seconds and tenths of seconds), called number, and called NPA are transmitted from the call store with other necessary data to a magnetic tape buffer area and eventually to the magnetic tape in a single entry format.

5. AUTOMATIC IDENTIFICATION OUTWARD DIALING (AIOD)

5.01 At most Centrex (CU) installations, the AMA sample data includes originating station identification. The station identification is supplied by the AIOD system.

5.02 The AIOD system is composed of an Automatic Number Identification (ANI) frame at the Centrex (CU), a Station Identification Frame (SIF) at the switching office and a data link connecting them (see Fig. 5).

5.03 AIOD is available for both No. 5 crossbar and No. 1 ESS switching machines. A simplified description of the AIOD system for No. 5 crossbar follows. For more detailed information, refer to Part 9.

System Operation

5.04 Each station, attendant circuit, tie trunk circuit, and dialed conference connecting circuit that may be used to originate a network call is identified by a four-digit number at the Centrex (CU). Also, each access line between the Centrex (CU) and the central office switching machine is identified by a four-digit number which corresponds to the line link frame location in the No. 5 crossbar switcher.

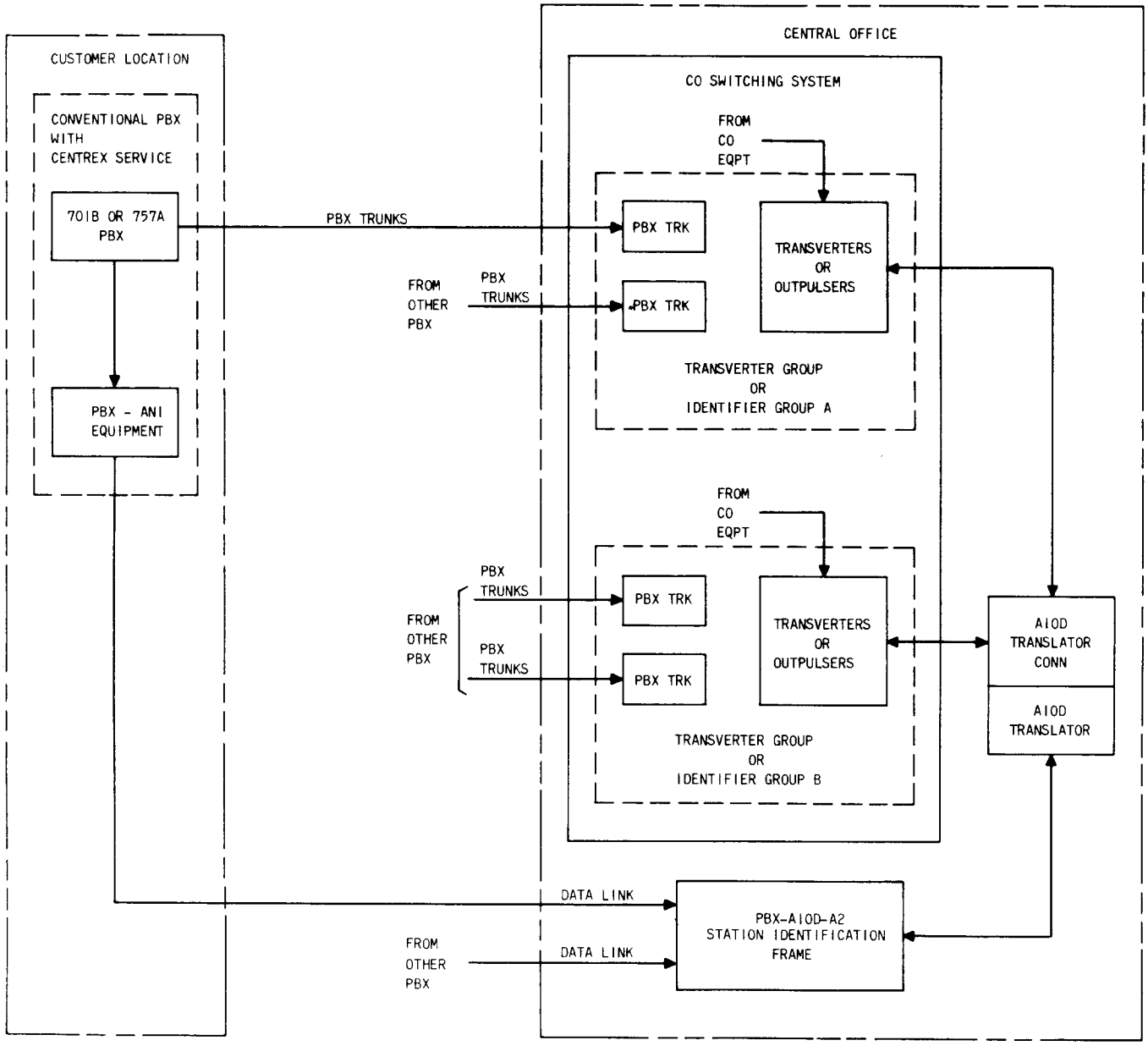


Fig. 5—PBX AIOD-A2 Block Diagram

5.05 When a network call is originated at the Centrex (CU) (usually level 8 for CCSA), the ANI equipment determines the four-digit station line number from an internal matrix of line numbers and frame appearances of served stations. The ANI equipment also supplies the four-digit number identifying the central office access line used for the call. These two four-digit identifiers, station and access line, are moved to a storage register in the ANI memory. This data remains in the ANI memory until it is either transmitted to the central office SIF or is updated by subsequent information.

5.06 When the ANI equipment has the necessary data in its memory, a "bid for service" signal is transmitted to the SIF located at the CCSA switch via the data link.

5.07 At the CCSA switch, the SIF scans each channel of the data link and on receiving the bid for service from the ANI, sends a "go" signal which causes the ANI to transmit the access line number and station line number identification data.

5.08 The SIF, upon receiving the data, stores the station line number in a store location corresponding to the access line number. It also stores the data channel number over which the data was received. The data channel number becomes the calling office index (COI). The access line number is not stored as it has determined the storage address for the station line number and is no longer needed.

5.09 If a sample record is to be taken, the routine follows a normal AMA sequence except that the transverter receives the station number and COI from the SIF instead of the translator.

5.10 The transverter queries the SIF for the station number and COI by sending the line link number which corresponds to the access line number (the storage address). The SIF references the storage address, retrieves the data, and transmits it to the transverter.

5.11 If the ANI equipment fails to provide a station number or if the data channel fails, an alternate translator frame routine is initiated. In this case, the transverter obtains a line group identity number from the translator frame and records it with the COI on the tape.

> ***Note:*** Separate COIs must be assigned at the SIF and the translator frame to insure correct processing by the RAO.

Data Transmission

5.12 The identification data sent by the ANI to the SIF is in the form of a 41-bit word transmitted at 735.5 bits per second. The first bit is a premessage bit which serves to synchronize the ANI and SIF. The remaining 40 bits identify the access line and the station number by the use of a two-out-of-five code (see Fig. 4 for code).

5.13 Data transmission is via a frequency shift keying process in which 1850 Hz are transmitted for a logic 1, and 1150 Hz are transmitted for a logic 0.

5.14 The ANI equipment includes a data transmitter, and the SIF equipment includes a data receiver; therefore, separate data sets are not required in the data link.

Data Link

5.15 The bid for service signal sent by the ANI and the start transmission signal sent by the SIF (see 5.06 and 5.07) are transmitted via dc signaling. For this reason, the data link must have dc signaling features. Simplex signaling may be used on loops whose resistance is less than 1500 ohms. When the loop resistance exceeds 1500 ohms, E&M lead signaling should be used with a signaling converter at each end.

5.16 The SIF requires receipt of the ANI message within 221.5 ms after the start of transmission signal is sent. Due to the short timing interval involved, the use of DX equipment to extend the E&M leads from a central office to an intermediate office or to the customer location is not recommended. The increased signaling delay may cause the circuit to be inoperative or marginal.

5.17 The data transmit and receive levels are -4.0 dBm and -12 dBm, respectively. Figure 6 shows a typical AIOD data link layout.

AIOD Coordination

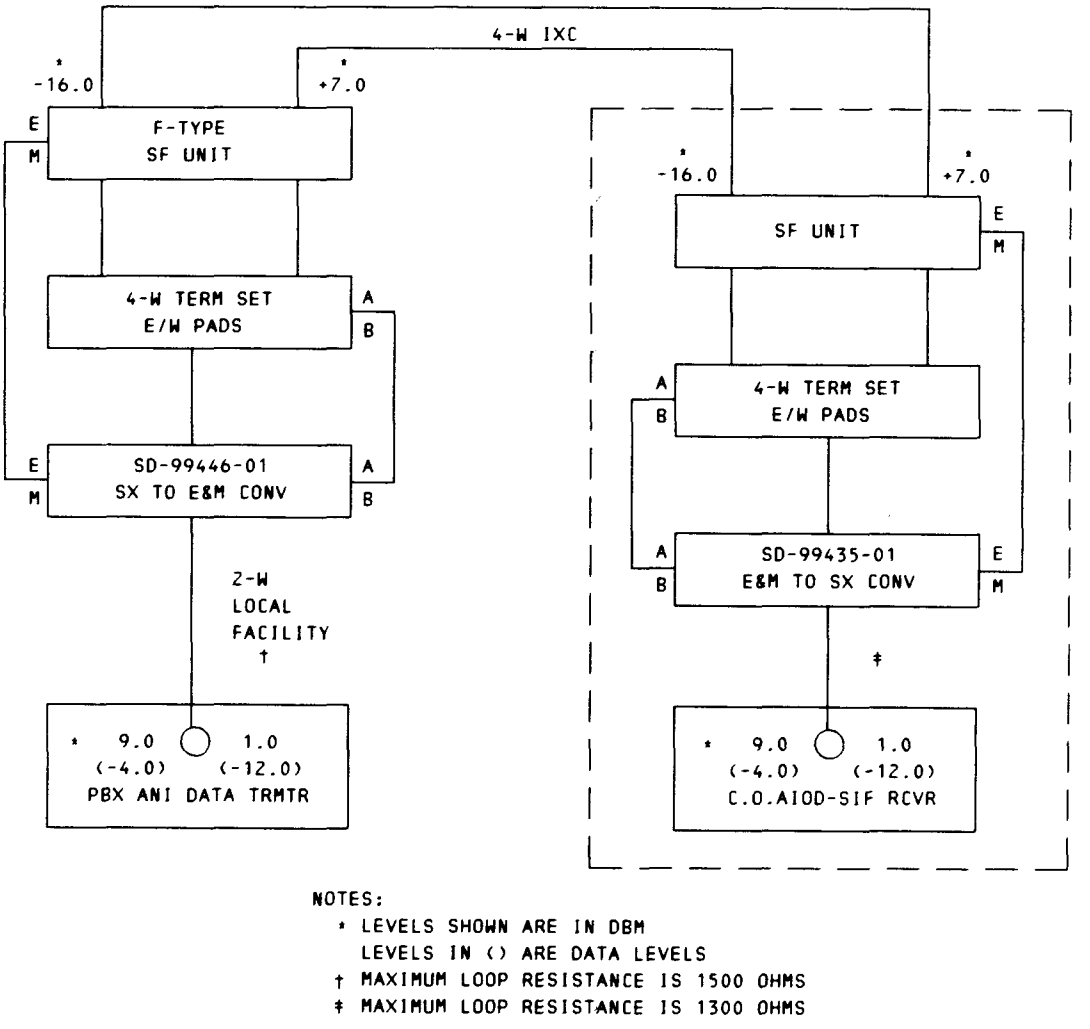
5.18 In order to obtain accurate data, it is essential that the AIOD system be thoroughly tested at the time of installation and whenever any changes are made that may affect the system. Examples of changes that may affect the AIOD operation are: addition or removal of stations, addition or removal of access lines, facility changes on the data links, and any other modifications in the AIOD system.

5.19 In order that the tests be coordinated properly and that the necessary records be kept up to date, the AIOD system including the data link circuit should be controlled by the Switched Services Bureau (SSB) at the switching central office where the SIF and AMA recorder are located.

6. TRUNK GROUP TRAFFIC SAMPLING (TGTS)

No. 5 Crossbar Switchers

6.01 When traffic sample counters (TSC) are used for CCSA sampling (see 4.04, 4.08, and 4.09), all trunks, both intramachine and intermachine, must be equipped for AMA. To allow for expansion of the trunk capacity without increasing the number of AMA trunks, the TGTS circuit was developed.



NOTES:
* LEVELS SHOWN ARE IN DBM
LEVELS IN ( ) ARE DATA LEVELS
† MAXIMUM LOOP RESISTANCE IS 1500 OHMS
‡ MAXIMUM LOOP RESISTANCE IS 1300 OHMS

Fig. 6—Typical AIOD Data Link

With TGTS, non-AMA equipped trunks may be used in the network without jeopardizing the validity of the AMA sample records. A ratio of 60 percent nonequipped to 40 percent equipped is recommended.

6.02 Both TSC and TGTS circuits may be used in the same office, however, both cannot be used in the same switch on the same network.

6.03 When TSC circuits are used to determine which calls to sample, all network trunks must be AMA equipped. When the TSC reaches zero, a bid is sent to the marker for a sample routine and an AMA record is initiated. With TGTS, the network trunk make-up includes both AMA equipped and non-AMA equipped trunks. Therefore, the assumption that an AMA record is initiated on each bid for a sample is not valid. The AMA equipped trunks are interspersed among the non-AMA equipped trunks. Due to the random trunk selection used in No. 5 crossbar, an AMA equipped trunk may or may not be selected when the TGTS circuit requests a sample.

6.04 When a call is originated on a TGTS equipped switching machine, the TGTS counter is inspected. If the counter value is less than four, it is stepped one increment. If the counter value is equal to or greater than four, an AMA routine is requested. Through the marker, the TGTS circuit determines if an AMA equipped trunk is used. If so, a sample is taken and four increments are subtracted from the TGTS counter. If an AMA

equipped trunk is not used, the TGTS counter is increased by one increment.

6.05 To illustrate the TGTS operation, assume the counter value to be three. The next network call origination will cause the counter to increment to four. Another network call is originated and an AMA sample routine is requested, but an AMA equipped trunk is not used and the counter value goes to five. The following call, because the counter value is four or greater, will also trigger an AMA routine request. Assuming this call and two subsequent calls did not use AMA equipped trunks, the counter value would go to eight. On the next call, an AMA equipped trunk is used, an AMA routine is initiated and four is subtracted from the counter leaving a value of four. The next call will also trigger an AMA request (the counter value being four), and if an AMA equipped trunk is used, the counter value will go to zero.

6.06 In the preceding example, AMA routines were initiated on two of the ten or 20 percent of the calls. It should be noted that although the TGTS determines that an AMA trunk is used, it does not insure that the recorder actually made a record of the call.

7. AMA ADMINISTRATION AND RESPONSIBILITIES

7.01 Close coordination and cooperation between the various companies and departments within the companies are necessary to supply accurate and timely AMA sample data.

7.02 The Operations Department (Plant) supplies the initial data in the form of paper or magnetic tape. Therefore, errors introduced by plant, regardless of the reason, will be reflected in all subsequent uses made of the data.

7.03 It is the responsibility of the operations department to insure that each switching machine and Centrex (CO) serving a SSN is capable of producing accurate AMA sample data. In order to fulfill this responsibility, each central office must;

(a) Thoroughly test all AMA equipped trunks to verify that AMA requirements are met. This must be done before the trunks are placed in service.

(b) Verify wiring (translations for ESS) to insure that the billing assignments are correct.

(c) Perform routine maintenance on all AMA and associated equipment at the prescribed intervals.

(d) Keep AMA equipment, trunk, and data link outages at an absolute minimum.

(e) Promptly investigate all sampling and billing complaints and clear indicated troubles as soon as possible.

(f) Keep the Operations Network Manager informed of all AMA outages and abnormal conditions that affect the validity of the AMA sample.

(g) Insure that the daily sampling rate at No. 5 crossbar machines is set at 20 percent or other as specified.

(h) Work closely with other departments to locate and rectify problem areas.

(i) Maintain the necessary AMA records of the switching machine.

(j) As part of the SSB responsibility, perform control office functions on the AIOD equipment at the central office and served Centrex locations including data link circuits.

7.04 At prescribed intervals, the AMA tapes are collected at the individual switching machines and sent to the serving RAO. Using data extracted from these tapes, the RAO prepares reports tailored to the needs of the various organizations involved.

7.05 One report returned to the switching center, sometimes called the, "Recorder Group Information Report," "Straddle Report," or "Trunk Error Record," presents a broad brush picture of the activity of the positions in the AMA recorders. Each recorder position represents an AMA equipped trunk terminating on the machine.

7.06 Diligent analysis of these reports by trained persons will uncover and assist in locating troubles that the switching machine circuitry may not detect.

7.07 Certain troubles or trouble indications may be recognized and isolated by an immediate inspection of the reports. Possibly a more important use of the reports, however, is the development of trend charts or graphs.

7.08 Each office should immediately investigate wide fluctuations and particularly zero volumes in recorder group and calling office index volumes. These may be indications of major troubles, and if so, must be corrected as soon as possible.

7.09 Other indicators of possible trouble that should be investigated are as follows.

(a) Recorder positions that never receive answers.

(b) Positions with single time line entries (answer entries without disconnect entries).

(c) Faulty records.

(d) Sample rates varying or out of limits.

(e) Any large variance of data (current vs long range).

7.10 The analysis process is a useless activity unless action is taken to correct indicated troubles or disprove the suspected problems. Due to the time lag caused by the processing of the AMA data and the analysis process, many troubles may be cleared by the exercising of equipment or maintenance activities before the analysis process is complete. This, however, should not deter the maintenance forces from thoroughly investigating troubles indicated by the analysis process.

7.11 The following are some of the benefits to be realized by investigating and clearing troubles using AMA sample data:

(a) Customer satisfaction

(b) More efficient use of the network

(c) Improved accuracy of AMA samples

(d) Clearance of intermittent troubles

(e) Improved maintenance practices and techniques

(f) More efficient use of personnel, time, and talent.

8. WATS RECORDING ON CCSA NETWORKS

8.01 Wide Area Telecommunications Service (WATS) is offered as a fixed period of usage for a flat monthly charge. Usage beyond the fixed period in a given month is billed to the customer at an overtime rate. AMA is used to record WATS calls and these records are used to time usage on the WATS lines.

8.02 WATS lines are used to provide off-net calling access from CCSA networks. All CCSA calls exiting the network on WATS lines are recorded regardless of where in the network they were originated. Consequently, calls tandeming through a CCSA switch to a WATS line as well as calls originating on the same switch and routing to a WATS line must be recorded.

8.03 When WATS lines serving a CCSA network terminate on a CCSA switch, special recording procedures are required. Three conditions will occur:

(a) Call originating from one switch and going off net at a WATS equipped switch will be recorded as WATS calls originating at the second switch.

(b) A network call originating on a WATS switch and going off net on its WATS lines will be AMA recorded as a WATS call if the traffic sample counter or TGTS has not indicated that a CCSA sample record of the call must be taken.

(c) A network call, originating on a WATS switch and going off net on its WATS lines when a CCSA sample record of that call is required, will be AMA recorded. The MBI and CCI combinations recorded indicate that the single AMA record represents both a CCSA sample and a WATS call. This condition is satisfied through alteration in the stored but not perforated initial entry information.

8.04 MBI 10 and CCI 0 (zero) are recorded in initial entries of CCSA sample calls. An MBI of 00 through 05 and CCI 6 specifies a WATS call. The COI in both cases identifies the customer.

8.05 When a call must be recorded as both a CCSA sample and a WATS call, MBI 10 and CCI 0 are established for the initial entry. As the call is advanced to a WATS group, the

completing marker causes the MBI to be changed to some value between 10 and 15. At the same time, the CCI value is changed from 0 to 6. The calling number and the COI obtained from the translator frame are not changed. The resulting entry is now coded so that the RAO, while processing the record, can recognize the dual purpose of the record.

8.06 At the RAO, a program inspects the value of the CCI. If the CCI is 6, the MBI is inspected. When the MBI is less than 10, the program treats the record as a WATS-only call and produces a WATS timing record with the calling number determined from the units value of the MBI. The calling number is subsequently used to identify the band of the WATS line.

8.07 Should the MBI be 10 or higher, the RAO program;

(a) Creates a CCSA sample record whose calling number is that taken from the translator frame.

(b) Creates a WATS timing record with a calling number determined from the units value of the MBI. The calling number is directly associated with the band of the WATS line used.

8.08 In summary, all WATS calls are AMA recorded in a CCSA network. When a call is both CCSA sampled and routed over a WATS line in the same switch, a special routine is needed to code the AMA record as a WATS/sample call.

9. REFERENCES

9.01 The following is a list of documents which contain additional information related to AMA sampling at No. 5 Crossbar offices.

SECTION	TITLE
010-520-105	Intercompany Services Coordination Plan—Order Status Control and Reporting (OSCAR) Procedures
218-122-523	Combined and Completing Marker Circuits—Part 23 Tests Using Master Test Frame—No. 5 Crossbar Offices. Test CJ for PBX-AIOD calls. This test checks that the marker recognizes AIOD calls from a PBX station.
218-124-501	Traffic Sampling Circuit SD-27681-01—Test Using Master Test Frame—No. 5 Crossbar Offices. Older mechanical sampling circuit.
218-124-502	Trunk Group Traffic Sample Circuit SD-27826-01 Tests—No. 5 Crossbar Offices. TGTS circuit, tests using test circuit SD-27827-01.
231-132-101	AIOD—Description—2-Wire No. 1 ESS
231-132-301	AIOD Maintenance Procedures Using Maintenance Teletypewriter 2-Wire No. 1 ESS
534-600-301	ANI Circuit (SD-1E505-01)— Trouble Locating Informaton Using Test Set J59204AJ—770A, 801A, and 812A PBXs
534-600-501	ANI Circuit (SD-1E505-01)—Verification Procedures and Operation Tests of ANI Alarm and Message Registers 770A, 801A, and 812A PBXs
540-518-300	ANI Circuit SD-1E007-01—General Maintenance Procedures—Step-by-Step Type PBX
540-518-302	ANI Circuit SD-1E007-01—Trouble Locating Procedures Using Test Set J58853J (SD-1E056-01) and 716C Test Receiver—Step-by-Step Type PBX
540-518-303	ANI Circuit SD-1E007-01 Trouble Locating Procedures Using Test Set J58853J (SD-1E056-01) and Tektronix Oscilloscope Model 221T (Type 453 or 453A)—Step-by-Step Type PBX
540-518-304	ANI Circuit SD-1E007-01 Verification Procedures Using Test Set J58853J

SECTION	TITLE
	(SD-1E056-01) Step-by-Step Type PBX
540-518-305	ANI Circuit SD-1E007-01 Manual Verification Procedure—Step-by-Step Type PBX
540-518-306	ANI Circuit SD-1E007-01 Verification Procedures Using Test Set J59204AJ (SD-1E506-01)—Step-by-Step Type PBX
809-110-150	ANI Equipment Units—701A, 701B, 711A, 711B, and 757A PBXs Equipment Design Requirements—PBX Systems
801-801-152	Station Identification Frame PBX AIOD Type A2 Equipment Design and General Equipment Requirements
814-106-151	PBX-AIOD Translator and Connector Equipment—AMA or ANI Equipment Design and General Equipment Requirements
951-331-110	AIOD Central Office Arrangements for PBX-General Descriptive Information
819-050-151	Access Group Controller Unit, Called Number Detector Unit, Trunk Group Traffic Sample—Frames and Units—Equipment Design Requirements—No. 5 Crossbar Systems
819-106-150	PBX AIOD Translator and Connector Equipment—AMA or ANI
951-332-100	AIOD Type A2—General Description for PBX-AIOD-A2
951-350-100	CCSA for Switched Service Networks—General Descriptive Information
958-120-100	No. 5 Crossbar Centrex Service—General Descriptive Information
958-310-100	Centralized AMA—General Descriptive Information No. 5 Crossbar System
981-013-100	PBX Arrangement for ANI (SD-1E505-01) General Descriptive Information
981-601-100	PBX Arrangement for ANI Circuit (SD-1E007-01) General Descriptive Information