LOCAL AUTOMATIC MESSAGE ACCOUNTING VIA MARKER SCANNING (LAMA-C) GENERAL DESCRIPTIVE INFORMATION NO. 5 CROSSBAR SYSTEM

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1. INTRODUCTION

A. General

1.01 This section describes in general terms, the Local Automatic Message Accounting via marker scanning (LAMA-C) operations in a No. 5 crossbar telephone switching system. Section 958-110-100 describes the switching features of the system.

1.02 LAMA-C uses a computer system, control, and interface equipment/facilities to assemble charge (or statistical) call data for recording on magnetic tape remotely (by data link) at a No. 1 AMA recording center (AMARC). The call record information is assembled into a single line entry format and is recorded on magnetic tape at a density of 1600 bits per inch. The system obtains the call information by scanning the completing markers for "initial entry" information and by scanning the associated trunk for answer and disconnect information. Figure 1 shows a basic block diagram of the LAMA-C system which is essentially a duplicated processing system. The two processing systems operate in an asynchronous mode such that one system is actively performing the complete LAMA-C job while the second system is on standby performing a sufficient portion of the LAMA-C job to permit a smooth transition in the event of an active system failure.

B. Capacity

1.03 A LAMA-C system can accomodate an office having a maximum of 16 completing markers (in two marker groups) and a maximum of 4000 AMA trunks. Larger offices may use more than one LAMA-C system.

1.04 The LAMA-C system will provide billing information for a maximum of 288 remote message register (Hotel/Motel) lines.

1.05 A maximum rate of 40,000 calls per hour may be recorded by a LAMA-C at a remote location using 4 data links.

1.06 The system can utilize a maximum of 32 office indices (compressed office codes) and 64 billing classes. Of the 64 possible billing classes, 40 are presently specified as follows:

(a) 16 Flat Rate (FR)

(b) 8 Message Rate (MR)

(c) 4 Coin zone (for division of revenue)

(d) 8 Remote Message Register (Hotel/Motel)

(e) 2 WATS

(f) 1 DTWX

(g) 1 Non-AMA

C. Features

1.07 Some of the features of the LAMA-C system are as follows:

(a) Central recording (via data link to No. 1 AMARC)

(b) Single entry format (recorded at 1600 bits per inch on magnetic tape at AMARC)

(c) Precise timing (records answer and disconnect indication in less than one second after answer without special modifications)

(d) Marker and trunk scanning under control of a processor to determine "initial, answer, and disconnect" entries

(e) Compatible with AIOD (toll and message rate calls)

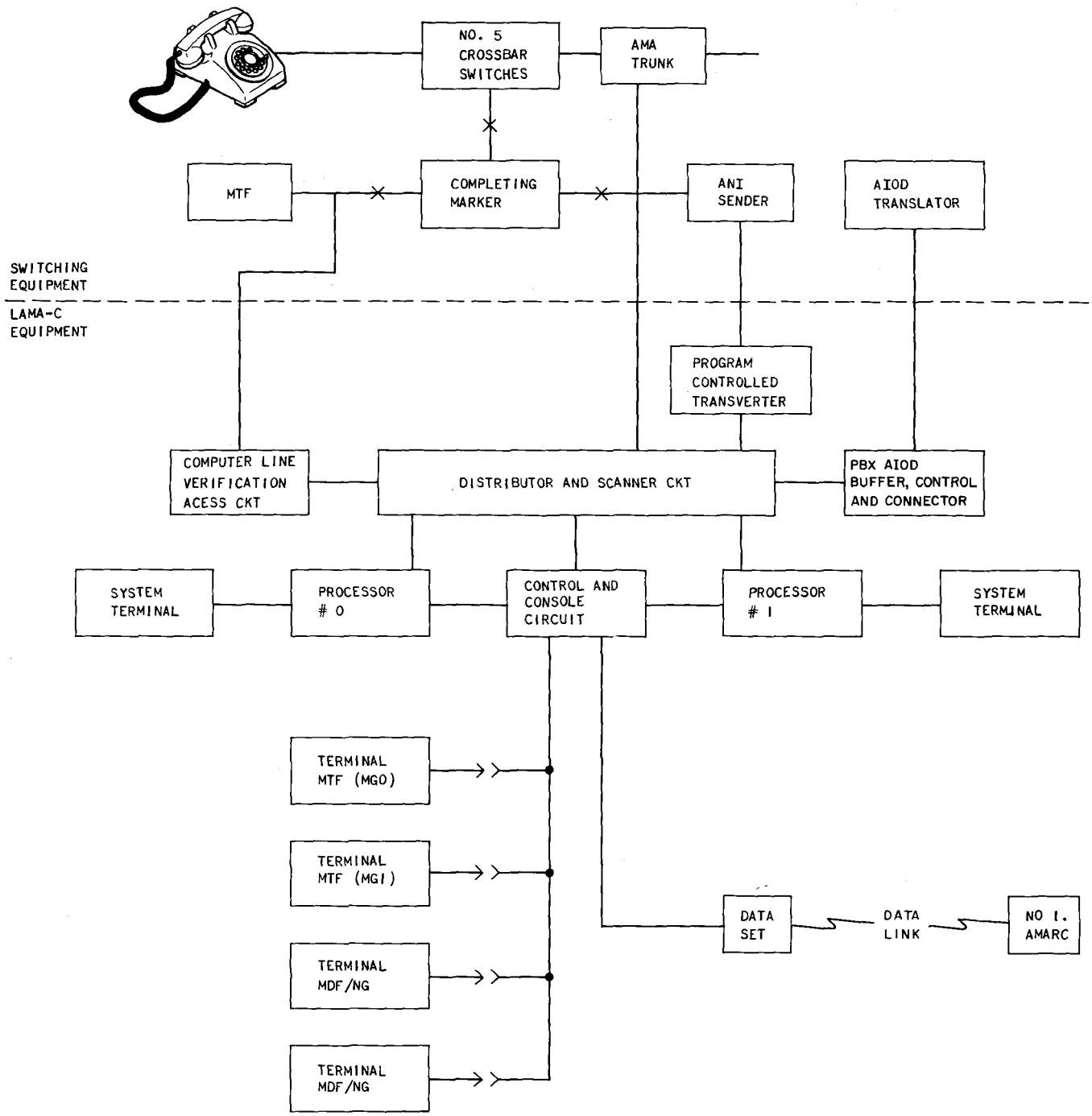


Fig. 1—LAMA-C Block Diagram

(f) Provides a method for advancing a remote message register to allow Hotel/Motel determination of charges for calls

(g) Limited modifications to existing central office equipment

(h) Conversion from other AMA systems to LAMA-C may be accomplished without interruption of service (LAMA-C does not interface to existing AMA equipment and therefore the two systems may run concurrently during transition)

(i) Existing AMA equipment (AMA translators, call identity indexers, transverters, and recorders) may be removed

(j) Reduced sender usage and holding time (compared to existing AMA)

(k) Reduced wiring effort in completing service orders (AMA translator wiring is not required, translation information is typed into system at terminal)

(l) Customer billing class change does not require line link frame circuit change since billing class is independent of line link frame class of service

(m) Real time trunk data analysis (sixteen consecutive unanswered calls to a particular trunk will cause a printout at terminal)

(n) ANI service for TSP/TSPS.

2. EQUIPMENT ELEMENTS

A. Trunk and Junctor Circuits

2.01 Any trunk or junctor circuit capable of supplying a seizure and answer indication may be equipped for LAMA-C. A typical modification of a trunk or junctor circuit in equipping that circuit for LAMA-C, consists of adding S1 and CS leads from that circuit to the distributor and scanner circuit on which a ground is connected when the trunk S and CS relays respectively are operated.

B. Computer

2.02 The basic element of the LAMA-C system is a computer. The efficiency in packaging of the computer and its peripheral equipment may result in sizable savings in floor space over other AMA systems. The computer (Fig. 2) is made up of three cabinets; a processor cabinet containing the processor and basic core memory, a supplementary cabinet containing additional core memory and two data set controllers, and a disk memory cabinet. The basic core memory is 32K (K equals 1024) words, and with the supplementary cabinet the core memory may be expanded to 96K words. The processor cabinet core memory may be expanded to 64K and the supplementary cabinet may contain 32K resulting in the 96K maximum. The size of the memory for a particular office is determined by office size (equipment and customer lines), and types of billing required. The basic disk memory size is 64K words and may be expanded to 256K words.

2.03 A minimum of manual control is required for normal operation of the computer. Control of the system required in working service orders or performing maintenance routines is at a computer terminal (a device similar to the teletypewriter) or the control panel of the control and console circuit. The keys on the processing unit are locked and are not used in the LAMA-C system except by the computer maintenance personnel. A wired program, the Read Only Memory (ROM), allows the loading of the executive program, thereby starting the computer without the use of the processor keyboard.

2.04 The general functions of the computer are data processing, and operating input/output devices under control of a stored program. Data processing is accomplished by a processor containing multiple, high speed, general purpose registers. The general purpose registers are used to (1) transfer data to and from memory, (2) perform logic and arithmetic operations, and (3) transfer data between memory and the input/output devices (in either direction). The processor is under control of a stored program (stored in memory) which specifies the sequence and instruction to be performed.

2.05 A system for connecting the computer and other parts of LAMA-C is shown in Fig. 3. The computer elements and the system interface units (distributor and scanner circuit [DAS] etc), are connected together with a multiple lead, high speed transmission bus (UNIBUS®). Each of the 56 signal leads of the bus is terminated with its characteristic impedance of approximately 120 ohms. Thirty-six of the leads are actively used as follows:

(a) Address—17 leads

(b) Data—16 leads

(c) Master sync—1 lead

(d) Slave sync—1 lead

(e) Control—1 lead

2.06 Communications on the bus are asynchronous and bi-directional. When the bus is in use,

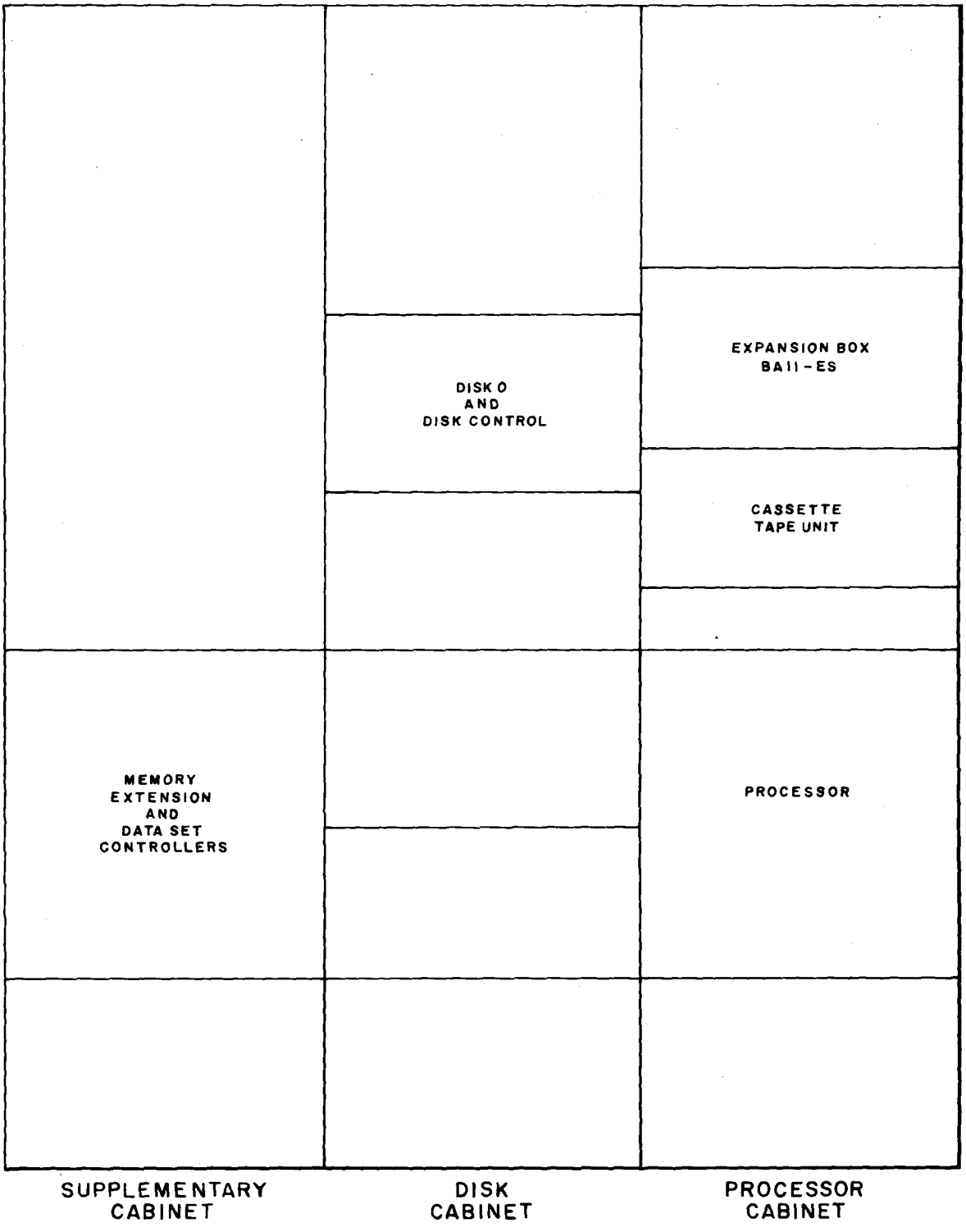


Fig. 2—Computer

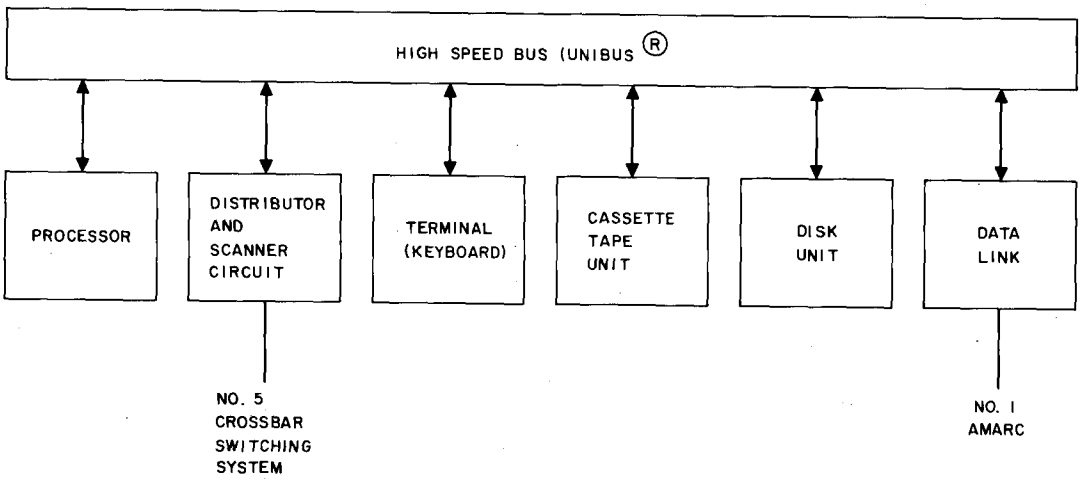


Fig. 3—Bus System for LAMA-C

other units cannot access the bus. Should two units try to access the bus at the same time a priority structure determines which unit is allowed first access. A unit transferring data to or from memory always has priority over units not using the memory. When a unit accesses the bus to communicate with another unit, a response (slave sync) from the called unit is always required.

2.07 The human-machine interface unit in the LAMA-C system is a terminal or teletypewriter type device. The terminal is used to (1) enter new information into the system (service orders, etc), (2) perform maintenance procedures on the system, and (3) monitor system operation. At least two terminals must be provided (one for each computer) for the LAMA-C system. Other terminals may be used for efficiency and convenience at the master test frame (for performing test procedures), and at the main distributing frame or number group areas (for working service orders).

2.08 A 5KVA inverter is used in the input power supply of computer 0 to provide 115 volts AC from the −48 volt battery supply so that power will be supplied to that computer during a commercial power failure.

C. Distributor And Scanner Circuit

2.09 The interface between the No. 5 crossbar switching system and the computer is the distributor and scanner (DAS) circuit. The DAS circuit is mounted on a double bay 4 foot 4 inch by 7 foot frame (Fig. 4). The LAMA-C system may use a maximum of five (depending on equipment quantities and billing classes) DAS frames for two marker groups with a maximum of three DAS frames in one marker group.

2.10 The DAS circuit scan points are used by the processor to "read" information from connecting circuits. A scan point (shown in Fig. 5) is basically a resistor-capacitor filter network connected to each information lead from; for example, markers and trunks. The network is designed so that when the lead is at ground potential, the output (at the scan point) is approximately +4 volts. When the lead is open or at −48 volts the network output at the scan point will be a very low potential (approximately −0.7 volt).

2.11 The DAS circuit distribute points are used by the processor to control the DAS and other circuits. A distribute point is illustrated in Fig. 6. The distribute point is operated by a single set of reed relay contacts and is always associated with a scan point which permits the processor to verify the distribute point operation.

2.12 Each processor periodically interrogates each marker scanner (via "reading" the marker scan points) in the DAS circuit to obtain information on each outgoing or intraoffice call (except coin but including coin zone) and passes information, such as, called number, calling line location, trunk location, trunk selected, type of call, and marker progress indications. Likewise, under control of the processor,

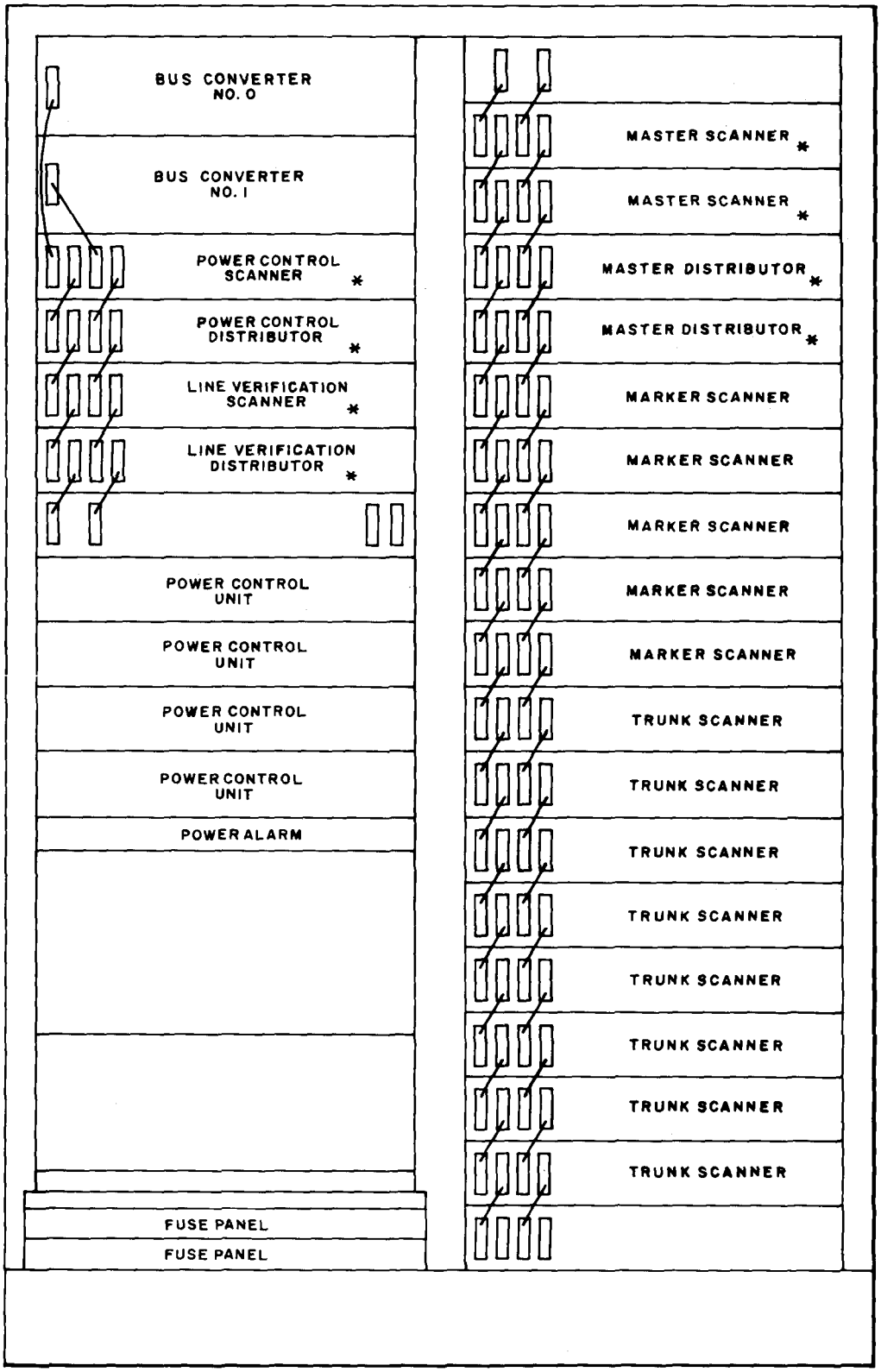


Fig. 4—Distribute and Scanner Circuit (Typical)

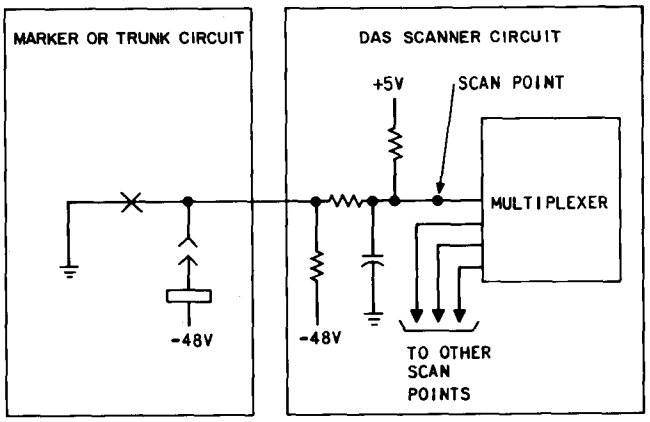


Fig. 5—Basic Scan Point

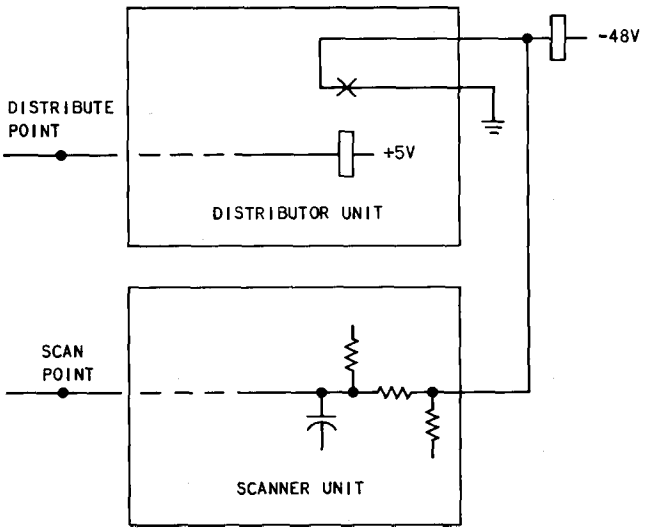


Fig. 6—Typical Distribute Point

all trunks arranged for LAMA-C are scanned periodically to determine their answer or disconnect state.

2.13 Each scan (and distribute) point in the system is connected to both processors via the DAS frames. Each processor has basically, independent access to each scan or distribute point.

2.14 The information flow between the scanners, distributors, and the processor is shown in Fig. 7. When a processor, for example, scans the DAS circuit; information is sent to the bus converter containing the address of the scan row containing 16 scan points to be read. The bus converter decodes the address and causes the state of the 16 scan points to be simultaneously cut thru from the particular scan unit addressed to the processor. The following paragraphs contain a brief description of the DAS circuit components.

Bus Converter

2.15 Two bus converters (one for each processor) are used in each DAS circuit. The bus converter receives information from its associated processor, performs frame identity by decoding the nine (9) high order address bits, and forwards information to the scanners and distributors. The bus converter also receives information from scanners and forwards it to the processor.

Power Control Scanner

2.16 The DAS circuit contains one power control scanner for up to three DAS frames per marker group. The power control scanner contains the scan points for determining the status of all power control units except those associated with bus converters, power control scanners, and power control distributors. The power control scanner also contains the scan points for determining if an out-of-service request has been granted.

Power Control Distributor

2.17 The DAS circuit contains one power control distributor for three or less DAS frames per marker group. The power control distributor contains the distribute points to allow the processor to remove from service the scanners and distributors associated with a particular power control unit.

Line Verification Scanner (LVS)

2.18 One line verification scanner is provided for each marker group of the LAMA-C system. The LVS is used in conjunction with the line verification distributor and the computer line verification access circuit to verify the line equipment location connected in the number group frames in the No. 5 crossbar office. The LVS is used during installation to generate the line translation data base and in normal operation to perform the line verification job.

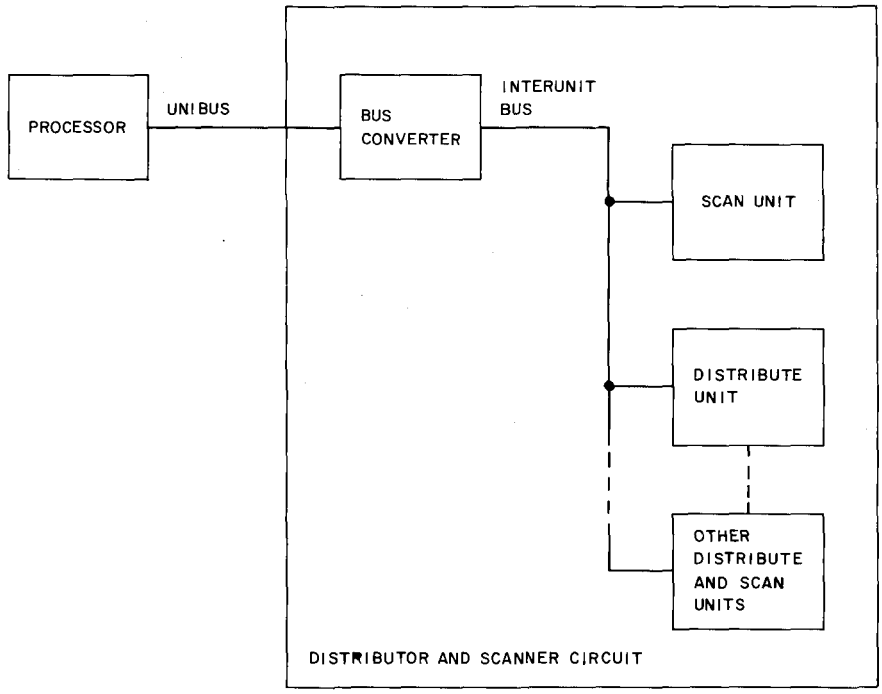


Fig. 7—Distribute and Scan Information Flow

Line Verification Distributor (LVD)

2.19 One line verification distributor is provided per marker group in the LAMA-C system. The LVD is used in conjunction with the line verification scanner and the computer line verification access circuit to verify the line equipment location connected in the number group frame in the No. 5 crossbar office. The LVD contains the distribute points required to control the No. 5 crossbar equipment in completing the line verification job.

Power Control Unit (PCU)

2.20 One power control unit is provided for each bus converter, distributor, or scanner. A maximum of seven power control units may be mounted on a DAS frame panel and a maximum of four panels may be provided on each DAS frame. The power control unit is used to manually remove from service the associated bus converter, distributor, or scanner. The processor associated with a bus converter, master distributor, or master scanner must be in the maintenance-busy state before removing these units from service. The interlocking keys of the PCU must be operated in a prescribed sequence to prevent accidental removal from service of the associated units.

Power Alarm

2.21 One power alarm is provided per DAS unit. A major alarm will be initiated by this circuit when a power failure is detected.

Power Converter 71D

2.22 The 71D power converter supplys the +5 volts to power the solid state DAS circuits. The power for the power converter is supplied by the −48 volt battery. Monitor circuits within each power converter detect erroneous voltage conditions and bring in a major alarm via the DAS alarm circuit. The remaining power converters will carry the load until the trouble is cleared.

Fuse Panel

2.23 The fuses for the DAS circuit −48V DC and +5V DC are located on the DAS frame fuse panels. Fuse alarms connect into the No. 5 crossbar system either directly or via alarm sending circuits. Arrangements are also provided for connections

into the Centralized Status Alarm and Control System (CSACS).

Master Scanner (MAS)

2.24 The master scanner is a simplex unit which responds to its associated processor. Its functions are as follows:

(1) It contains the system status scan points for allowing the control and console circuit to display system status (on-line, standby, operational, maintenance-busy, cassette load, cross-load, and failure).

(2) It contains scan points for making power control unit tests on bus converters, power control distributors, and power control scanners.

(3) It contains the scan points for the diagnostic program horizontal and vertical test which verifies that all row addresses and data bits may be reached from the processor.

(4) It contains the scan points associated with the audit bits which defer audit procedures when some information is invalid (other processor is not in SB or OP state).

Master Distributor (MAD)

2.25 The master distributor is a simplex unit which responds to its associated processor. Its functions are as follows:

(1) It contains the distribute points to allow the processor to control the system status indicator lamps on the control and console circuit.

(2) It contains the distribute points to allow the processor to take power control distributors and scanners out of service.

(3) It contains the distribute points to allow the processor to perform the horizontal and vertical test of the diagnostic program.

Marker Scanner (MKS)

2.26 One marker scanner is provided for each completing marker in the LAMA-C office. The marker scanner allows either processor access to information (via scan points) in the associated marker. The scanner passes information to the processor such as the calling line location, called number, translator marks, and trunk location. The scanner also passes marker progress marks to the processor to allow the processor to determine the type of call, that the call was completed by the marker, and the AMA information should be processed.

Trunk Scanner (TKS)

2.27 One trunk scanner is provided for each 127 equipped trunks except the first trunk scanner on each DAS 1, 2, 3, 4, and 5 which can accommodate only 104 trunks. The trunk scanner contains two scan points per trunk to allow the processor to receive trunk supervisory signals for seizure, answer, and disconnect.

ANI/AIOD Scanner (AAS)

2.28 Two ANI/AIOD scanners are provided per LAMA-C system when either ANI or AIOD is provided. The ANI/AIOD scanner works in conjunction with the program controlled transverter (ANI) or the PBX AIOD buffer, control and connector (AIOD) to determine the calling number for either ANI (to TSP or TSPS) or AIOD.

ANI Distributor (AND)

2.29 Two ANI distributors are required per LAMA-C system when ANI is provided. The ANI distributor allows the processor to cause the calling number to be stored in the program controlled transverter for transmission to TSP or TSPS.

AIOD Distributor (AID)

2.30 Two AIOD distributors are provided per LAMA-C system when AIOD is provided. The AIOD distributor contains the distribute points to allow the processor to cause operation of the AIOD translator (through the PBX AIOD buffer, control and connector) to determine the calling number.

Miscellaneous Scanners (MS)

2.31 The LAMA-C system may use a maximum of 18 miscellaneous scanners. Initially the miscellaneous scanner will be used only in the remote message register (Hotel/Motel) control function to allow the processor to determine that

the remote registers have operated properly. Each remote message register control unit requires one row of the miscellaneous scanner or one miscellaneous scanner will serve a maximum of sixteen remote message register control units. Future features included in the LAMA-C system requiring scan points will use miscellaneous or new dedicated scanners.

Miscellaneous Distributors (MD)

2.32 The LAMA-C system may use a maximum of 22 miscellaneous distributors of which five may be used for remote message registers. Initially the miscellaneous distributor will be used only in the remote message register control function, to allow the processor to operate the remote message registers. Each remote message register unit requires one row of the miscellaneous distributor or one miscellaneous distributor will serve four remote message register units. Future features included in the LAMA-C system requiring distribute points will use miscellaneous or new dedicated distributors.

D. Control and Console Circuit (C&C)

2.33 The control and console circuit is mounted in a 2 foot, 2 inch frame 7 foot high (see Fig. 8). The control and console circuit contains the keys for manual control and lamps for indicating the status of the LAMA-C processors. This frame also contains the data sets required for the remote recording at AMARC.

2.34 The primary functions of the control and console circuit are:

(a) To provide system control without the use of the processor keys.

(b) To assure only one processor is on line.

(c) To provide a major alarm and transfer to stand-by processor upon failure of on-line processor.

(d) To initiate major and minor alarms under processor control.

(e) To automatically initiate recovery procedures (on processor) after a power failure.

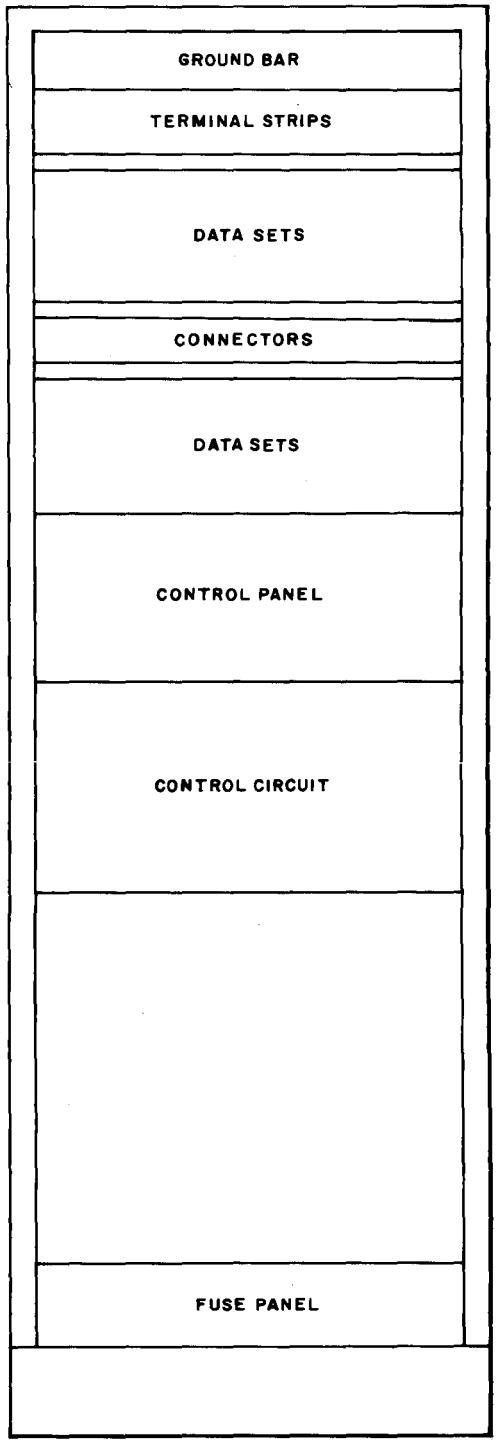


Fig. 8—Control and Console Circuit

(f) To switch data links and terminals to the on-line processor.

(g) To inhibit distribute points associated with the off-line processor except those of the master and power control distributors.

(h) To provide reload (XL key) of a maintenance-busy processor from the on-line processor.

(i) To provide loading (CL key) from cassette tape.

(j) To permit local loop-around test of 202S and 202T data sets (remote recording at AMARC).

(k) To provide power control and alarms for master scanners, master distributors and bus converters.

2.35 The required data sets for recording at AMARC are mounted on the control and console frame. Facilities are provided for a maximum of four primary data links (shown in Fig. 9) using 202T-type data sets (two for each data link). If a failure should occur on a primary data link, AMARC has the capability to establish a back-up link between the LAMA-C and AMARC via the DDD facilities using a 202S-type data set.

2.36 The control panel of the control and console circuit provides the keys and lamps to control and monitor the status of the LAMA-C system. The control panel shown in Fig. 10 contains two sets of key lamps, one associated with each processor, an alarm release key, a spare jack, and A, B telephone jacks.

E. Computer Line Verification Access Circuit (CLVA)

2.37 The computer line verification access circuit is used in conjunction with the line verification distributor and line verification scanner to verify line cross-connections in number groups and class of service cross-connections in line link frames. These tests check all cross-connections for a subscriber station on one test from a central location. CLVA tests are made before a new subscriber station is put into service, after number changes, reassignment or reclassifying, and for trouble location tests after trouble records or subscribers report. During LAMA-C installation, the CLVA is used to access AMA or ANI translators in order to generate the data base.

3. SOFTWARE

A. General

3.01 The computer requires step-by-step instructions or programs to perform its function. These instructions (programs) and other information (data base) are known as software and are inputted into the LAMA-C system by cassette tape and stored in memories for use during system operation. The major types of software used in the LAMA-C system are listed below.

(a) Executive or Load Program

(b) Generic Program

(c) Data Base

(d) Recent Change Program

(e) Diagnostic Program

(f) Installation Program

3.02 The major types of software are briefly described in the following paragraphs.

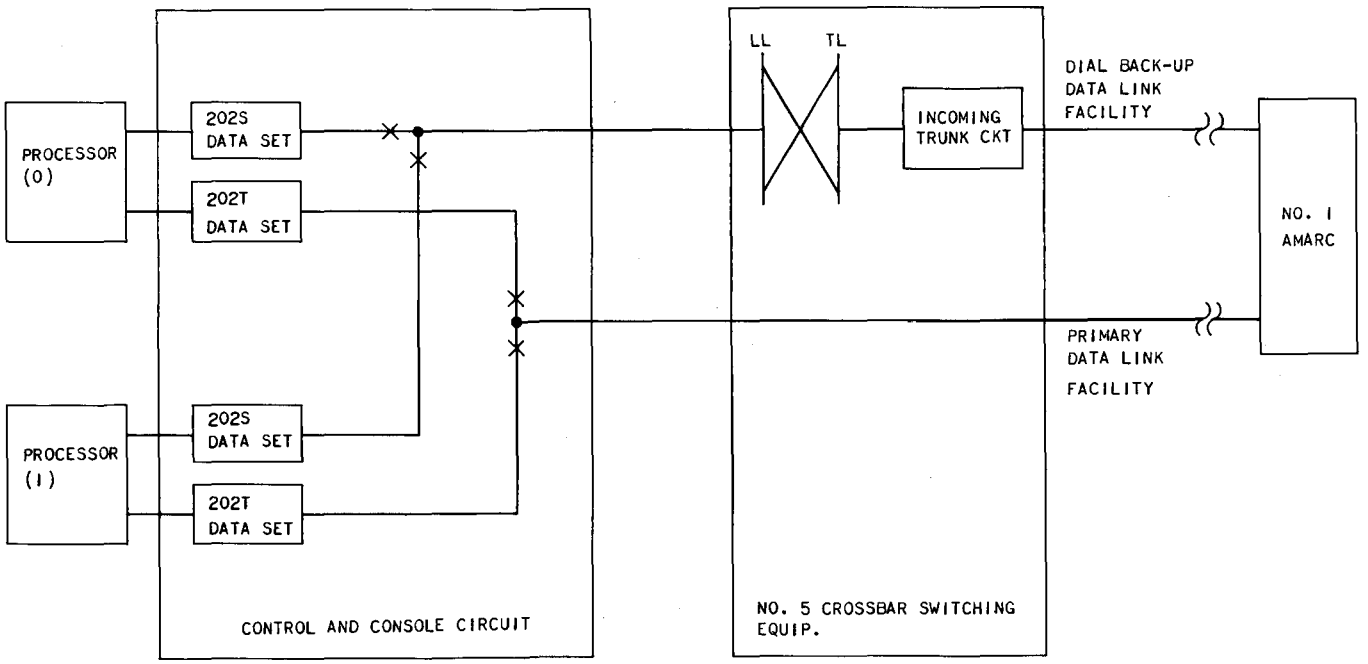
B. Executive or Load Program

3.03 The executive or load program contains the instructions to allow the processor to interpret and store data inputted on cassette tapes.

C. Generic Program

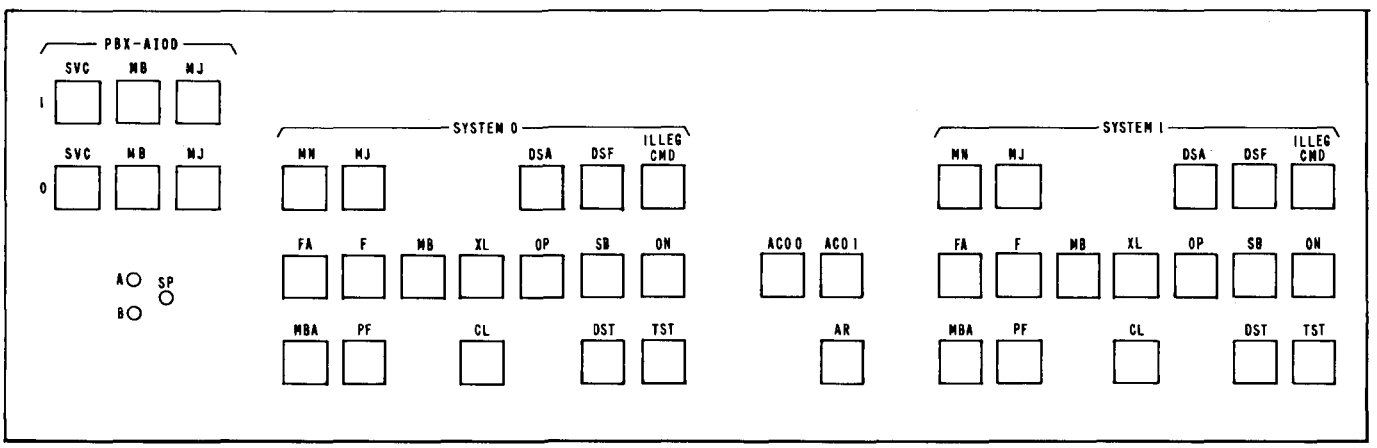
3.04 The generic program contains instructions to allow the processor control of the operating system (hardware), AMA, and self checking functions. The generic program for all No. 5 crossbar offices with LAMA-C will be identical. The generic program contains from 150 to 200 functional programs varying in word/length from 20 to 1500 words. The major parts of the generic program and a brief description follow.

(a) ***Table Directory (TABDIR)***—A fixed length table, 329 words long, stored in core. It provides for setting of memory registers and contains pointers to all other data items in both core and disk memories.



NOTE:
FIG. SHOWS ONE PRIMARY AND ONE BACK-UP DATA LINK, A MAXIMUM OF FOUR PRIMARY AND ONE BACK-UP DATA LINKS MAY BE PROVIDED.

Fig. 9—LAMA-C Remote Recording Data Transmission Facilities



NOTE:
KEY-LAMPS MN, MJ, DSA, DSF, ILLEG CMD, FA, F, OP, PF, SVC ARE WIRED FOR THE LAMP FUNCTION ONLY.

Fig. 10—Control and Console Circuit Control Panel

(b) ***Scheduler Program***—Contains the instructions to allow the processor to run other programs periodically or on demand by TELCO personnel.

(c) ***Scan-loop Program***—Contains the instructions to allow the processor to scan all trunk and marker scan points periodically.

(d) ***Marker Processing Program***—Contains the instructions to allow the processor to process marker scan data (such as called number, class of call, trunk location, translator indication, progress marks, etc) on a per call basis.

(e) ***Trunk Processing Program***—Contains the instructions to allow the processor to process trunk scan data on a per call basis.

(f) ***Translation Program***—Contains the instructions to allow the processor to relate the line equipment number to a billing number and billing class.

(g) ***Formatting Program***—Contains the instructions to allow the processor to format output data for data link recording.

(h) ***Recent Change Programs***—Consist of instructions to allow processor to receive data (inputted in a predetermined format) from the terminal and store it in the memory associated with the proper table.

(i) ***Audit Programs***—Consist of instructions to allow processor to compare its data with other processor (via interprocessor communication channel). Audit programs also consist of instructions to allow the processor to perform certain checks on table data to determine validity.

D. Data Base

3.05 The data base contains data relating to office parameters (equipment quantities and features), billing translation, trunk translation and line translation. The data base is unique to an office. The data base is generated initially by installation personnel and is kept up-to-date by recent change procedures and periodic meshing of the data base with recent changes. Recent change procedures allow additions, deletions, and changes to the data base. Recent changes are inputted to the system (stored in memory) from a terminal and are also recorded on cassette tape for backup purposes. The tables containing the data base with a brief description of each are listed below.

DATA BASE 1

(a) ***Office Parameter Table (PARAM)***—This table requires 22 words of core memory. It contains equipment quantity and provides feature information for the LAMA-C office.

(b) ***Distributor and Scanner Unit Status Table (DASTAT).*** The DASTAT table contains a dedicated slot in core for each functional DAS unit (16 slots for marker scanners, 32 slots for trunk scanners, etc) for maintaining status information of the DAS unit. This table requires 110 words of core. Each slot contains the following information about the associated DAS unit.

(1) An offset representing the address (frame and unit number) of the associated DAS unit.

(2) A maintenance indication for trunk scanners (Is the trunk scanner arranged for special testing with 104 trunk scan points instead of 127?).

(3) A marker group indication.

(4) The state of the associated unit (except master scanners and master distributors) indicating if the unit is equipped, operating normally, out-of-service, or in a power off condition.

(c) ***Distributor and Scanner unit Address Directory (DASAD).*** The DASAD table contains one slot of core for each possible DAS unit to indicate the virtual address of the first row of the associated scanner or distributor. This table requires 110 words of core.

(d) ***Marker Scanner Number Conversion Table (MKNEXP).*** This table contains information which allows the processor to associate each marker scanner with its physical marker number for outputting maintenance messages. The table requires 48 words of core and is not used in call processing.

(e) ***Distributor And Scanner Last Look directory (DASLL).*** This table contains

the pointers for the last look memory for each scan unit and the last sent memory for each distribute unit. The pointer for a specific DAS unit is determined by use of the offset stored in the DASTAT table. The table requires 110 words of core.

(f) ***Distributor And Scanner unit Buffer Area (DASBUF).*** This table reserves space in core for the processor to temporarily store the last look and last sent information for all DAS units. The table may require from 144 to 1420 words of core.

(g) ***Remote Message Register Directory (RMRDIR).*** This table contains DAS unit location information associated with remote message registers when that feature is provided. The table requires 36 words in core or two words for each of the eighteen possible remote message register units (288 registers maximum). The information contained in the directory for each remote message register is listed below.

(1) The location of the DASTAT word in memory associated with the remote message register.

(2) The number of the scanner row associated with the associated remote message register unit.

(3) The offset in the DASTAT table for the distributor unit associated with the remote message register unit.

(4) The specific row (0, 1, 2, 3) of the distributor associated with the remote message register unit.

(h) ***Trunk Translation Data Table.*** This table allocates space in core for a trunk register consisting of nine words for each LAMA-C equipped trunk. This table contains information which allows the processor to associate a marker trunk number (TLF, TB, TS) with the associated trunk register. The trunk register contains storage space for billing data such as the line equipment number, calling number, called number, answer, and disconnect times.

(i) ***Billing Translation Table.*** The billing translation table allows the processor to:

(1) translate the line equipment number to a billing class,

(2) translate compressed office code to an NPA and three digit office code,

(3) translate called number and billing class to a billing treatment (TOLL, FR, MR-MBI).

DATA BASE 2

(j) ***Line Translation Table.*** The line translation table allocates a slot in memory (disk) for each equipped line equipment number (LEN). Each slot contains a line equipment number with its associated compressed office code (COC), billing class, and two bits for indicating a line trap or complaint observing. When the line trap bit for a particular LEN is set, a record is made for all calls initiated from the associated line location. When the line trap bit is set, all recorded calls from the associated line location will be printed out at the system terminal.

E. Diagnostic Program

3.06 The diagnostic program contains instructions to allow the processor to conduct tests under control of maintenance personnel. The diagnostic program does not normally reside in the computer memory. Prior to performing diagnostic tests, the diagnostic program must be loaded into memory (processor in MB state) from cassette tape. The diagnostics assist in isolating and correcting hardware malfunctions. The specific diagnostic test to be performed must be selected by the craft. After selection, some tests proceed automatically while others require the assistance of craft as directed by system terminal messages. For automatic tests, an "OK" message will usually be printed at the system terminal if all equipment is operating correctly. A list of the diagnostic tests and a brief description (for details see BSP on Diagnostic Task Program and Procedures) of each follows.

(a) ***MAS, MAD, PCS, PCD Selection Test.*** This test checks that the master scanner, master distributor, power control scanner, and power control distributor can be addressed by the processor and that the addressed unit will

respond via connecting busses with the slave sync (SSYN).

(b) ***Horizontal and Vertical Tests.*** This test checks that addresses and data may be transmitted correctly on the busses.

(c) ***MKS, TKS Bit 00 Test*** This test checks that an operated out-of-service (OS) scan point in a marker scanner or trunk scanner will set its associated bit 00 in the processor. This test also checks that each marker scanner and trunk scanner can be addressed by the processor.

(d) ***Power Control Unit Test*** This test checks any power control unit, as selected by TELCO craft, for the status of manually operated switches and that alarms are brought in correctly.

(e) ***Control and Console Test*** This test checks the part of the control and console circuit associated with the processor into which the diagnostic program is loaded.

(f) ***Data Set Test*** This test allows the processor to check the data sets and data set controllers by looping two data sets, at a time, together. Verification is made, by the processor, that a signal transmitted by one data set is correctly received by the other.

(g) ***Directed Scan Test*** This test allows the craft to obtain a display of any selected row of any scanner. The display will appear at the system terminal and will contain 16 digits 0 or 1, to indicate the status of each scan point in the row is either unoperated or operated respectively.

(h) ***Directed Distribute Test*** This test allows the craft to operate any distribute point of any selected row of any distributor from the system terminal. The craft may initiate an automatic cycle which will cause the designated distribute points of the selected row to operate and release every 10 milliseconds for troubleshooting intermittents.

(i) ***DAS Scan/Distribute X-Ray*** This test is used by the Western Electric Co. installation team to check out newly installed DAS frames. Attempts to run this test on a working system without the required special instructions and precautions may result in a system failure.

F. Installation Program

3.08 The installation program was designed to work in conjunction with the computer line verification circuit as an aid to the LAMA-C installation. The major function of the program is the generation of part of the initial data base. This program is used by installation personnel only, and will not be supplied to the LAMA-C office.

4. METHOD OF OPERATION

A. General

4.01 The method of operation for LAMA-C calls covers primarily those operations peculiar to LAMA-C equipment and describes only briefly the marker, register, and sender jobs since these jobs are covered in Section 958-110-100.

4.02 Numbers in parentheses in Fig. 11 and 13 indicate the order of connections. Arrows on the connecting lines indicate the direction of the connection or communication.

B. Switching Equipment Operation for a LAMA-C Outgoing Call

4.03 When the customer has completed dialing over the dialing connection (Fig. 11), the originating register (OR) connects to a marker through an originating register marker connector (connection 1). The OR transmits the calling line location, class of service (or calling line), and called number to the marker.

4.04 The marker determines from the called number that an outgoing trunk is required and the type of sender to be used. If this type of call is to be charged (message rate or toll), the trunk will contain scan points. The marker then connects to an outgoing sender through an outgoing sender connector (connection 2), and primes the sender with the number to be outpulsed. The sender performs no AMA function for an outgoing call in LAMA-C operation.

4.05 The marker selects an idle trunk to the desired location and connects to the idle trunk through the trunk link connector (connection 3). If the trunk is arranged for LAMA-C, the S1 relay will operate, in turn operating the S1 scan point indicating trunk seizure.

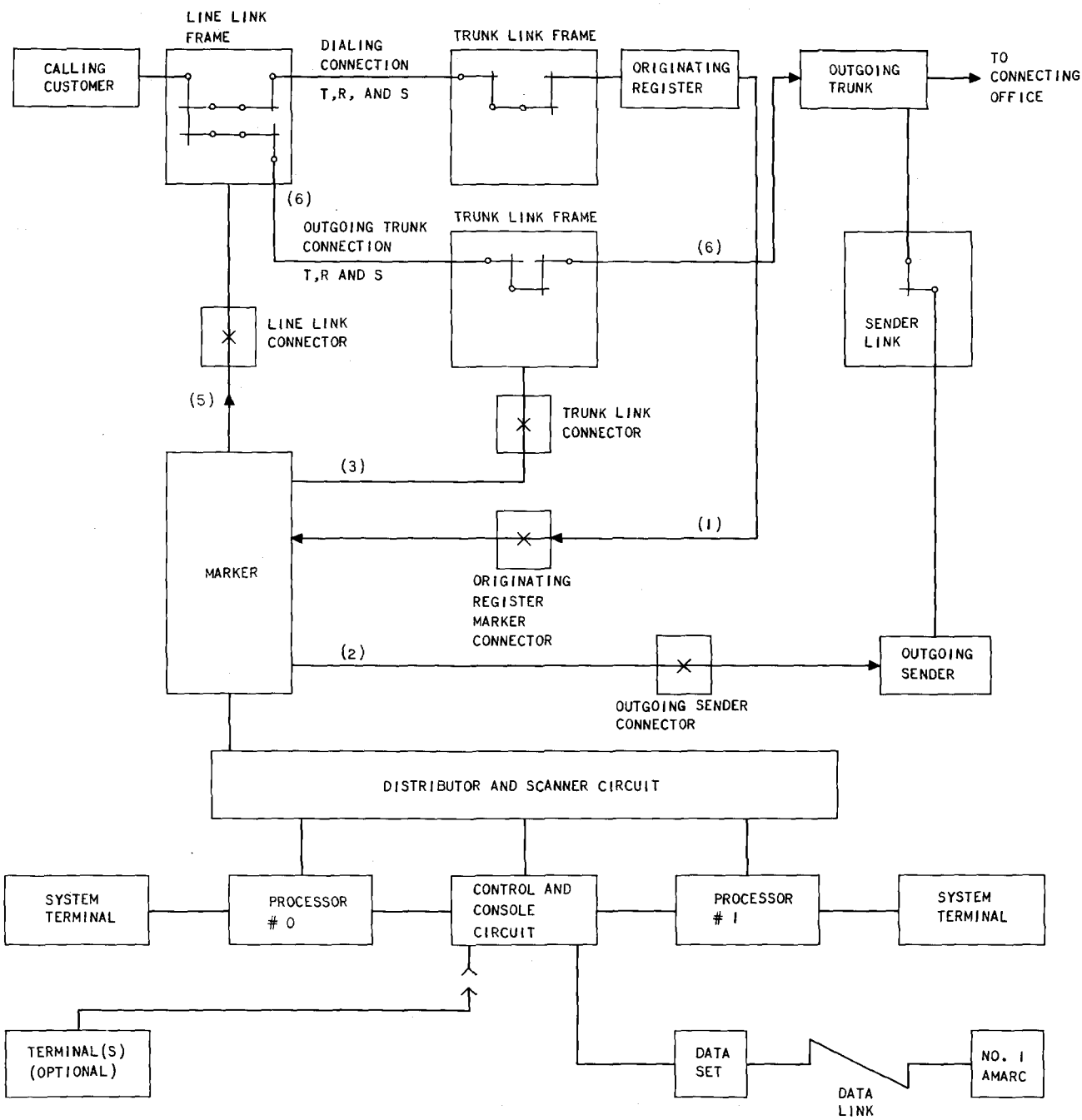


Fig. 11—Establishing LAMA-C Outgoing Trunk Connection

4.06 A connection between the sender and the outgoing trunk (connection 4) is established by the marker through the outgoing sender link. It then connects to the calling customer line link (connection 5) and tests for an idle channel between the line link and trunk link frames.

4.07 A connection is established by the marker between the calling line and the outgoing trunk (connection 6). The marker releases itself, the outgoing sender connector, the line link connector, and the trunk link connector, thereby leaving the call under control of the outgoing sender. The sender will then outpulse and release.

4.08 When the connection between the customers line and the trunk is completed, the S relay in the trunk will operate. The S relay operated will hold operated the S1 relay and S1 scan point.

4.09 When the called customer in the distant office answers, the CS relay in the trunk will operate. If the trunk is arranged for LAMA-C, the CS relay operated will operate the CS scan point associated with the outgoing trunk used in this call, indicating an answered call to the processor. When the customer(s) disconnects, the CS and/or S relays will release indicating a customer disconnect to the processor. Upon release of the S1 scan point, the processor will transfer the billing data (in a predetermined format) for the call to the formatted call buffer for recording.

C. LAMA-C Call Processing for an Outgoing or Intraoffice Call (Fig. 12)

4.10 The on-line processor under control of software will periodically initiate a scan sequence of each marker and each trunk such that all marker status bits (progress marks) and trunk S1 scan points are scanned every 16 2/3 milliseconds. All trunk CS scan points are scanned every 200 milliseconds. The information pertinent to a particular call is stored in the trunk register associated with the trunk used in the call until the call is completed and the customers have disconnected. The trunk register (one for each equipped trunk) is a dedicated slot in memory consisting of nine core words of 16 bits per word.

4.11 During the marker scan sequence, when the processor determines from the status bits that the markers HMS1 relay is operated, information such as calling line location, called number, translator indications, trunk location, and status (progress marks) is read by the processor via the marker scanner. When the processor determines that a call is being set up to a LAMA-C equipped trunk (by translating the trunk location into a core address of the associated trunk register), the call processing information such as the calling number (translated by processor from the line location) and the called number are stored in the trunk register. If a marker disconnects prior to the operation of the HMS1 progress indication or the trunk used is not equipped for LAMA-C, the processor discards the marker information for that call.

4.12 During the trunk scan sequence, information on the trunk state (trunk seizure, call answered, or call disconnect) of each LAMA-C equipped trunk is determined by the processor via the trunk scanners. The processor will compare the trunk state information of the present scan (for each trunk) with the information in the trunk register (last look). If the trunk state information has changed since the last scan for a particular trunk, processing of the state change may result, for example, in the answer or disconnect time being entered in the associated trunk register. Trunks which handle only non billable calls do not have scan points or an associated trunk register (not equipped for LAMA-C) and are not monitored by the LAMA-C processor.

4.13 When the processor determines that a call which has been answered for at least 600 to 800 milliseconds has disconnected, it will extract information required for a call record from the trunk register, and write it in a prearranged format in the formatted call buffer (an area of core memory). The call record is thus in a single entry format with all billing information for the call together in one record. Formatted calls are then moved from the formatted call buffer to the data set buffer or are temporarily stored in the disk buffer before being transmitted to AMARC.

4.14 The 202S and 202T type data sets are included for transmission of call records to AMARC. A data set buffer is included in memory to temporarily store a block of data (two to four call records) for transmission to AMARC. AMARC controls the data transmission and the LAMA-C acts as a slave. AMARC will transmit requests for data when it is ready to record data. If LAMA-C has a block of data ready for transmission when AMARC requests data, LAMA-C will respond

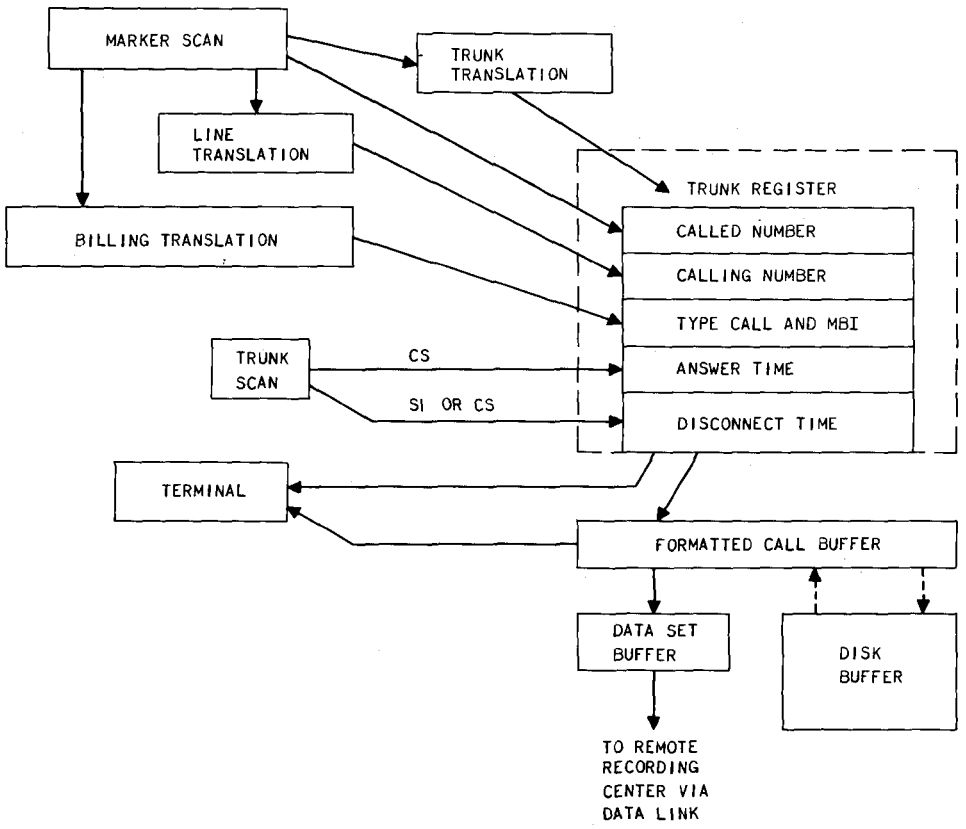


Fig. 12—LAMA-C Call Processing Flow Diagram

by transmitting the data block. If LAMA-C has no data ready for transmission when AMARC requests data, LAMA-C will respond with a no data message.

D. Switching Equipment Operation for A LAMA-C Intraoffice Call

4.15 When the customer has completed dialing over the dialing connection, Fig. 13, the originating register connects to a marker through an originating register marker connector (connection 1). The originating register transmits the calling line location, class of service (of calling line), and the called number to the marker.

4.16 The marker determines from the called number that the call is to another customer in the same marker group and thus requires an intraoffice trunk. If this type of call is to be charged the trunk selected will contain S1 and CS scan points (equipped for LAMA-C). The trunk link frames are checked by the marker for an idle intraoffice trunk. It connects to the number group through the number group connector (connection 2). The number group performs translation functions, transfers the equipment location of the called number to the marker, and releases.

4.17 An idle intraoffice trunk is selected by the marker on a previously selected trunk link frame. The marker also sets the ringing selection switch (connection 3). If the trunk is arranged for LAMA-C, the S1 relay will operate, in turn operating the S1 scan point indicating trunk seizure.

4.18 The marker then connects to the line link frame of the called line through the line link connector (connection 4). It establishes the terminating connection between the called line and B appearance of the intraoffice trunk (connection 5), connects to the line link frame of the calling line (connection 6), and establishes the originating connection between the calling line and the A appearance of the intraoffice trunk (connection 7).

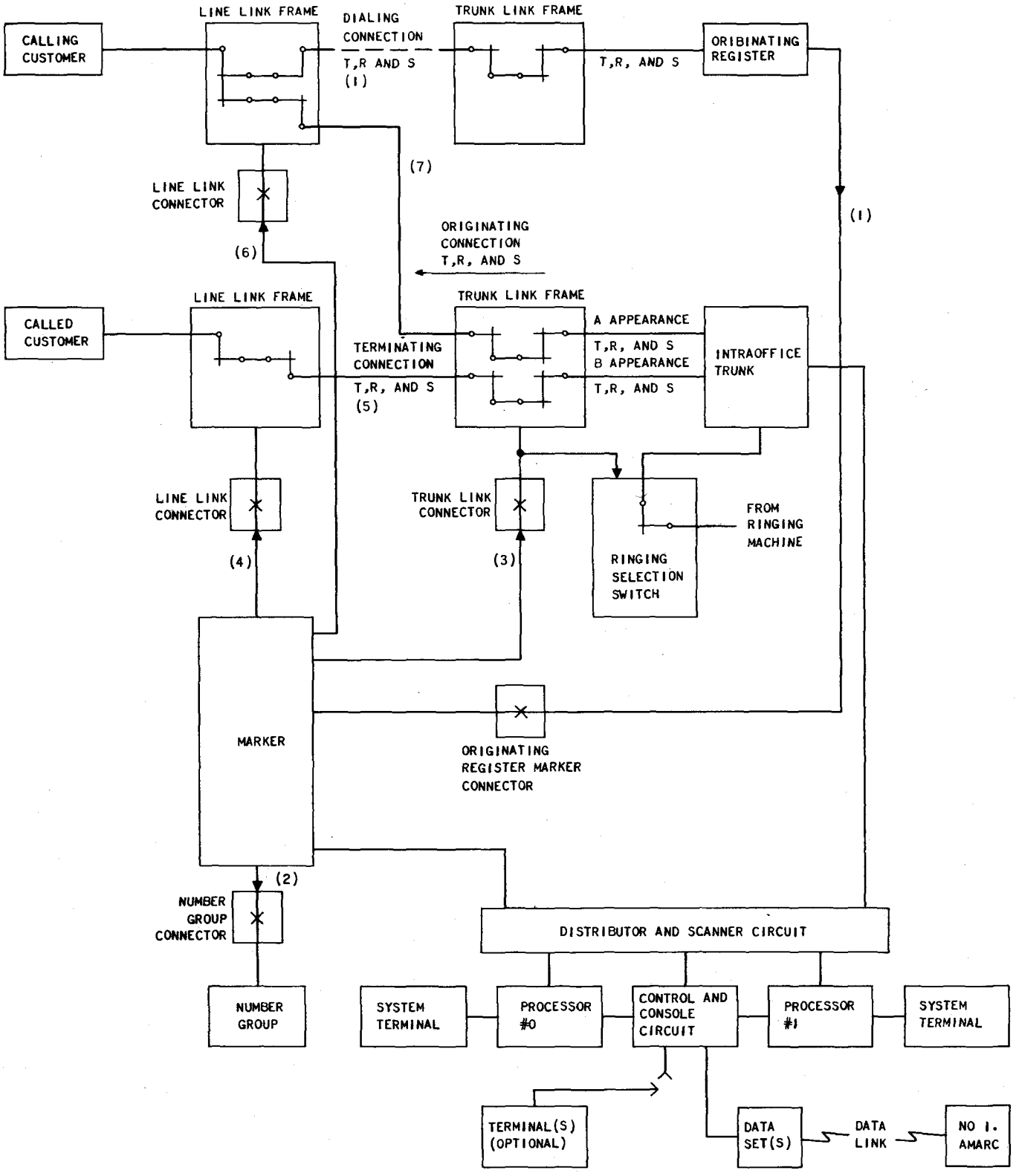


Fig. 13—Establishing LAMA-C Intraoffice Trunk Connection

A sender is not used for an intraoffice call when LAMA-C is provided.

4.19 When the connection between the customers line and the trunk is completed, the S relay in the trunk will operate. The S relay operated will hold operated the S1 relay and the S1 scan point.

4.20 When the called customer answers, the CS relay in the trunk will operate. If the trunk is arranged for LAMA-C, the CS relay operated will operate the CS scan point associated with the intraoffice trunk used in this call indicating an answered call to the processor. When the customer(s) disconnects, the CS and S relays will release indicating a customer disconnect to the processor. Upon release of the S1 scan point, the processor will then transfer the billing data for the call to the formatted call buffer for recording at a remote location.

E. Other Types of Calls and Features

4.21 ***An intraoffice charge call to a LLP line circuit*** does not require a junctor circuit to provide facilities for making a charge record in a LAMA-C office. Any intraoffice trunk with S and CS scan points may be used for a charge call to a LLP line circuit in a LAMA-C office, thus saving the additional marker usage and sender connection for charge purposes.

4.22 ***A charge call from a PBX station with AIOD features*** causes the LAMA-C processor to prime the AIOD translator (through the PBX AIOD buffer, control and connector) with the PBX trunk number. The AIOD translator will respond through the PBX AIOD buffer, control and connector with the PBX station's billing number. The processor is then able to complete its call record as in a regular outgoing or intraoffice call. If the processor is unable to obtain the PBX station billing number from the AIOD translator, the call will be recorded with the PBX listed directory number.

4.23 ***A charge call using TSPS facilities*** will cause the processor to receive the line equipment number (LEN) of the calling customer from the ANI sender via an ANI program controlled transverter, translate the LEN to a billing number; and distribute the billing number to the sender again via the ANI program controlled transverter. The outgoing sender will then transmit the billing number to TSPS so that the correct charging rate may be determined. A call record will not be assembled by the LAMA-C equipment for this type of call. If the processor is unable to obtain the billing number, the call will complete to an operator for calling number identification.

4.24 ***A charge call from a line with a remote message register (Hotel/Motel)*** will cause the LAMA-C processor to peg the remote register via the miscellaneous distributor the correct number of times to indicate the charges on the call. The processor will assemble a call record in the trunk register in the usual manner.

4.25 ***Tandem CCSA calls*** entering the office via an incoming network trunk will cause the LAMA-C processor to assemble a call record for the call. The calling number in the line translation table for the line link frame appearance of the trunk is associated with the network customer. The scan points for accumulating the charge data of the call are located in the intraoffice, outgoing, or other trunks (announcement or directory assistance), and the system operates as in a regular intraoffice or outgoing call.

4.26 ***Directory assistance calls*** may be charged if the directory assistance trunks are modified with scan points. The system operates as described in the paragraphs on the various types of calls.

5. OBSERVING FACILITIES

A. General

5.01 Two types of observing facilities, service and complaint, are provided in a No. 5 crossbar LAMA-C office. Service observing is used to ensure that customers are receiving the grade of service to which they are entitled and are made by an observer at a central observing bureau. Complaint observing is used to verify that calls are billed properly on customers lines for which complaints have been received. A detailed record is made for each observed charge call originated at the customers line.

B. Service Observing

5.02 Access to a customer line for service observing is obtained by plugging an observing line to a service observing jack at the service observing patching panel. A trunk connected directly to a

central observing bureau is used for connecting to the customer line. Only originating calls may be observed. The observer monitors on an originated call by means of an amplifier acting as a one-way repeater which prevents noise transfer from the observing trunk to the customer line.

5.03 When a call is originated by a customer on a line to be service observed, the marker recognizes it as a service observed call. During the scan cycle the marker scanner (for the marker associated with the call) will receive an OBS indication from the marker and forward it to the processor. The processor will recognize the service observing indication and will include a service observed indication in the trunk register and subsequently in the formatted call record. Incompleted calls that would have been recorded had they completed, will be recorded when service observed.

C. Complaint Observing

5.04 A customers line is put on complaint observing by a recent change procedure using a system terminal. This procedure causes the "complaint observed" bit associated with the customers calling number to be set (in the line translation table).

5.05 When a charge call is originated by a customer on a line designated for complaint observing, the marker scanner will obtain information from the marker and pass it to the processor. The processor will translate the line equipment number into a calling number and will determine that the associated "complaint observed" bit is set. On call disconnect, the call record will be formatted for recording with a type of call indication for an observed call.

6. MAINTENANCE FACILITIES

A. General

6.01 No additional test frames are required for LAMA-C operation. The master test frame (MTF) may be modified for testing the LAMA-C features of the completing markers and trunks. The LAMA-C equipment uses a duplicated system for critical equipment and contains built in hardware and software to aid in the maintenance of the system. The built in features allow many self checks with appropriate terminal maintenance messages to aid in identifying and correcting troubles (or isolating trouble to commercial equipment).

B. Hardware

6.02 The master test frame has been modified for LAMA-C by adding CS, S1 lamps (for detecting operated scan points in trunk tests) and a LAMA-C key (to cause a display of marker information at a terminal on marker and trunk tests). Other lamps and keys are provided at the DAS and the control and console circuits. These lamps will indicate equipment failures, alarm conditions, and equipment states. The keys are used to change equipment states, retire alarms, initiate tests, etc.

6.03 The computer line verification access circuit is provided to verify that the number group cross connections (associated with a customers lines) are correctly installed and that the customers line equipment number is correctly associated with his calling number in the line translation table of the LAMA-C computer. Tests using the computer line verification access circuit are performed at a terminal. The computer line verification access circuit is used to perform the line verification job which is done in offices without LAMA-C at the MTF or the line verification test circuit.

C. Software

6.04 The on-line LAMA-C processor, under control of software, periodically performs audits of its data and makes comparisons of its data against the stand-by processor. If the processor detects a minor error during its self checking routines, it will initiate a maintenance message at a terminal to notify maintenance personnel of a possible equipment malfunction and the probable faulty equipment. If the processor detects a fault which would cause a billing error, it will cause an alarm to be sounded, switch control to the stand-by processor causing it to advance to the on-line state, and move to the failure state. A processor in the failure state will provide messages to be printed at the terminal to aid in clearing the trouble.

6.05 A diagnostic program tape may be loaded into a processor in the maintenance busy state to allow maintenance personnel to perform tests (from the system terminal) to assist in isolating and correcting hardware malfunctions. A list of the diagnostic tests and a brief description of each is contained in part 3 of this section.

D. Special Maintenance Features

6.06 Many special maintenance features are possible with the LAMA-C system. The special features may be automatic or requested by maintenance personnel. Some of the special features which may aid in maintaining the system are described below.

(a) ***Charge call up longer than twenty four hours***—Each day at midnight the processor will cause a printout at the terminal of the call record data for any call which has been in progress longer than twenty-four hours. The maintenance personnel may wish to verify that a call is in progress and not a switching equipment malfunction.

(b) ***Sixteen consecutive unanswered charge calls to same trunk***—The processor will cause a message to be displayed at a terminal when a trunk is connected on sixteen consecutive unanswered charge calls as an aid in locating switching equipment malfunctions.

(c) ***Line Trap***—When the line trap bit is set (for a particular line) in the line translation table of the processor, a message giving the details of the call will be displayed at the terminal for each call initiated by the line. This feature was designed as an aid in troubleshooting switching equipment and may be initiated by a procedure performed at a terminal.

(d) ***Trunk Trap***—When the trunk trap bit is set (for a particular trunk) in the trunk register of the processor, a message will be displayed at the terminal, giving the details of each call using the trunk. This feature was designed as an aid in troubleshooting switching equipment and may be initiated by a procedure performed at a terminal.

(e) ***Watch Dog Timer (WDT)***—The watch dog timer, aided by software, will detect a stopped or runaway processor. Two one shot multivibrators are used to control the operate current to the WDT relay. One determines the maximum while the other determines the minimum rate at which the timer must be retriggered. In order for the relay to remain operated, each multivibrator must be retriggered before the timer times out. The software is designed so that an instruction will retrigger the multivibrators periodically. Two inputs (one per multivibrator) are required in the proper sequence and at the proper rate to retrigger the timer. The WDT relay will remain operated, only, if the two multivibrators receive a trigger in the proper sequence at a rate which is neither too high nor too low. A released WDT relay will cause a processor switch over and a major alarm. Maintenance messages will then be displayed at the system terminal giving possible troubles and suggested corrective actions.

7. LAMA-C SYSTEM ADMINISTRATION

A. General

7.01 The LAMA-C system requires some operating procedures which are new to the No. 5 Crossbar System. This part of the description will briefly describe some of the procedures unique to LAMA-C which are necessitated by use of the computer and other procedures for gathering data (for engineering, maintenance, etc) which are facilitated by use of the computer. Details of the procedures are found in other BSPs in the 218-79□-___ division.

B. Manual Processor Switch-Over

7.02 Occasionally it may be necessary (for routine maintenance, etc) to move an on-line processor to off-line. This procedure may be performed, when the off-line processor is in the stand-by state, by moving the stand-by processor to on-line. The previously on-line processor will automatically move to the stand-by state as the other processor goes on-line. The stand-by processor may then be moved to the operational or maintenance-busy state, if required.

C. Handling Major and Minor Alarms

7.03 The major and minor alarms associated with the LAMA-C system are connected to the central office alarm system. Major alarms are usually used in the LAMA-C system to indicate the presence of a processor malfunction which takes the processor to the "FAIL" state. Such a failure in an on-line processor would cause a switchover to the other processor. Minor alarms are used in LAMA-C to indicate the presence of a malfunction which may or may not affect service, but does not require a processor switchover.

7.04 Four types of malfunctions which cause major alarms are as follows:

(1) AC/DC power failure of processor

(2) Equipment failure in control and console circuit (fuse alarm)

(3) Major unit failure in the DAS circuit (fuse alarms)

(4) Processor programs not functioning properly.

7.05 Major alarms are accompanied by terminal messages and lighted lamps at the control and console circuit and the DAS circuit to aid in trouble clearing.

7.06 Minor alarms are sounded for non-critical malfunctions in the control and console circuit, the DAS circuit, a processor problem, or an incorrect (illegal command) operation by maintenance personnel. Minor alarms in the LAMA-C system are accomplished by lighted lamps at the control and console circuit, and DAS circuit to aid in trouble clearing.

D. Time and Date Changes

7.07 The time of day and date is required for all billable calls. A clock and calendar function is performed by the computer in the LAMA-C system.

7.08 Accurate time and date will be maintained by periodic (automatic) checks between AMARC and the LAMA-C on-line processor. A manual time check of the computers clock and calendar may be performed by typing instructions on the system terminal.

E. Handling, Storing, and Updating LAMA-C Program and Data Cassette Tapes

7.09 Cassette tapes are used in the LAMA-C system to input the programmed instructions and data into the processor and as a backup of that information normally stored in the processors core or disk memories. A listing of LAMA-C cassette tapes with a brief description of their contents follows.

(a) Generic Program Tape—This tape contains the programmed instructions required to perform the AMA function.

(b) Data Base #1 Tape(s)—These tapes contain the office parameters such as equipment quantities and features, trunk locations, billing translation tables, etc.

(c) Data Base #2 Tape(s)—These tapes contain only the line translation data such as the line equipment number, billing class of service, billing number, and other information pertaining to a particular subscriber.

(d) Recent Change Tape(s)—These tapes contain the modifications to data base #2 caused by additions, changes, and disconnections of customers lines and other customer associated data.

(e) LAMA-C Diagnostic Tape—This tape contains programs used in trouble locating by maintenance personnel.

(f) LTT Generation Tapes—These tapes contain programs which aid the installation team in generating line translation data. These tapes are prepared and maintained by the WECo installation division and are not normally available to TELCO personnel.

(g) Data Compiler Tapes—These tapes contain programs to aid the installation team in compiling the data base. These tapes are prepared and maintained by the WECo Installation Division and are not normally available to TELCO personnel.

(h) Manufacturer's Diagnostic Tapes—These tapes contain programs to aid manufacturer's field service personnel in locating trouble in manufacturer supplied hardware. These tapes are prepared and maintained by the manufacturer and are not normally available to TELCO personnel.

7.10 The accuracy and efficiency of the LAMA-C system is dependent upon the condition and accuracy of the cassette tapes. It is, therefore, very important that these tapes be handled, stored, used, and updated correctly.

7.11 ***Care in Handling Cassette*** tapes is essential for reliable operation of the LAMA-C system.

The following precautions should be followed to avoid the loss or mutilation of data contained on the cassette tapes.

(a) Keep the cassette tape in its container except when in use.

(b) Properly maintain tape transport to keep the magentic heads clean.

(c) To avoid tape edge damage, no abnormal pressure should be applied to any part of the cassette.

(d) Avoid the contact of the exposed tape with contaminates such as food particles, tobacco ashes, and clothing. Also use caution to avoid touching the exposed tape with the fingers or any part of the body.

(e) Cassette tapes should not be exposed to strong magnetic fields resulting from AC or DC currents in relays, motors, generators, magnetic detection devices, or any other magnetic apparatus.

(f) Cassette tapes should not be exposed to extremes in temperature or humidity.

7.12 ***Storing Cassette Tapes*** in a convenient place away from strong magnetic fields at the proper temperature and humidity level will aid the efficient operation of the LAMA-C system. The generation of some extra cassette tapes (containing generic program and data base) and storing some back issues of the data base and recent change tapes for back up may be desirable since the loss or mutilation of the data base (in the computer memory as well as on the cassette tapes) would require reconstruction of the data base. The reconstruction of the data base would be time-consuming as well as costly in the loss of revenue. It is recommended that duplicate issues (and associated recent changes) of tapes be stored in different areas to lessen the possibility of loss of the data base. The cassette tapes should always be stored in their containers and preferably on end, vertically to minimize damage to the tape edges.

7.13 ***Updating of the Data Base Tapes*** is a process by which the information on recent change tapes is combined with the information of the current data base tapes. The procedure for updating the data base tapes does not require physical use of the current data base or recent change tapes since all the required information is stored in memory. The recent change tapes are recorded and stored to use in the event that the data in memory is mutilated or lost. If such an event should occur, the data base tapes and all its associated recent change tapes would have to be manually reloaded into the processor. It will be recognized that a procedure is needed for periodically (some period of time or some quantity of service orders) updating the data base tapes to eliminate tracking, storing, and the possibility of manually loading a large quantity of recent change tapes.

7.14 Some of the other reasons for updating data base tapes are (1) Installation of new equipment (the installation division will furnish updated data base #1 tapes but the operating company should update its data base #2 tapes to be current with the updated data base #1 tapes.), (2) Adding another office code, (3) Billing rate or class changes, and (4) Rearranging trunk assignments.

F. Billing Changes—Bulk and Detail

7.15 A procedure is provided to change bulk-billed calls to detail-billed in the LAMA-C system which allows the AMA recording center to accumulate detail-billed information for traffic analysis. A procedure is also provided to change detail-billing back to bulk-billed. These procedures contain the instructions for typing into the system at a terminal keyboard.

G. Network Completion Study

7.16 Procedures are provided in the LAMA-C system to perform a network completion study for traffic analysis. During a network completion study, unanswered charge calls using trunks equipped with scan points or directory assistance (DA) trunks will yield an AMA record. The types of calls included in the network completion study are TOLL (direct dialed station paid, IDDD station paid, coin zone, DA information when information charging is provided, PICTUREPHONE®, DATAPHONE®), dial typewriter exchange (DTWX), common control switching arrangements (CCSA) with marker LT3 translation, wide area telephone service (WATS), WATS with automatic flexible routing (WATS-AFR). Outgoing information calls will be included since outgoing trunks are used in

the connection. The call records for the study will contain the calling number, called number, and trunk information (scan unit number, row number and bit position). The procedure for starting the study consists of an instruction for inputting at the system terminal keyboard. A similar procedure is provided for revoking the study and returning the LAMA-C to a normal AMA function.

H. Local 411 and 555-1212 Information Study

7.17 A feature is provided in the LAMA-C system allowing AMA records to be made for all no charge information call attempts (both completed and uncompleted calls). This study may be initiated by entering the instruction at the system terminal keyboard and may be canceled by entering a similiar instruction at the terminal keyboard. Information trunks must be equipped with scan points to be included in study.

I. Line and Trunk Traps

7.18 The LAMA-C system will initiate output messages of all the call data associated with a call originated from any specified line location or to any specified trunk on request. This feature, known as line or trunk trapping, is provided as a maintenance aid and may be initiated or canceled by entering an instruction at the terminal keyboard. The trap features may be used in conjunction with the MTF in trunk testing or without the MTF for trouble shooting equipment on service calls.

J. Observing Facilities (See Part 5)

7.19 Two types of observing facilities, service and complaint, are provided in a No. 5 crossbar LAMA-C office. Service observing is used to ensure that customers are receiving the grade of service to which they are entitled and are made by an observer at a central observing bureau. Complaint observing is used to verify that calls are billed properly on customers lines for which complaints have been received. A detailed record is made for each observed charge call originated at the customers line. A record is also printed out at the LAMA-C system terminal for each recorded complaint observed call.