TELEPHONE ANSWERING SYSTEMS
LINE CONCENTRATOR-IDENTIFIER (J93021, J93022)
WITH OR WITHOUT
TONE SIGNALING CIRCUIT (J59202)
FOR USE WITH ELECTRO-MECHANICAL CENTRAL OFFICES
AND ELECTRONIC SWITCHING SYSTEMS (NO. 1 ESS)
GENERAL DESCRIPTIVE INFORMATION

CONTENTS PAGE

CONTENTS PAGE

1. GENERAL

1.01 This section describes the line concentrator-identifier (CI) for use with the Telephone Answering Systems. The purpose of the line concentrator-identifier is to connect the called subscribers line (capacity of 100 subscribers per concentrator-identifier) over any one of six trunks to a telephone answering service bureau and to signal the identity of the called line. The originating end (line concentrator) is located at the central office and the terminating end (identifier) is located at the Telephone Answering Service Bureau. The Telephone Answering System uses different concentrators for Electronic Switching Systems (No. 1 ESS) and electro-mechanical central offices, but only one type identifier located at the answering bureau. The associated SDs and Equipment Drawing Numbers are:

Concentrator

SD-99449-01, J93022 for ESS, Fig. 1
SD-95964-01, J93021 for Electro-Mechanical CO, Fig. 2.

Identifier

SD-95962-01, J93021 for use with either concentrator, Fig. 3.

Because of the similarity of concentrators, the material in this section will apply to both concentrators. However, if a part of this section refers to only one concentrator, the concentrator referred to will be indicated by the corresponding SD number.

1.02 This section is reissued to make reference to the latest SD changes and the optional tone signaling circuit. It contains information formerly contained in Section 951-833-100 which is hereby canceled. The title is changed to include the additional contents. Since this is a general revision, arrows normally used to indicate changes are omitted.

1.03 The CI System comes equipped for use with either dc signaling (basic) or tone signaling (optional). Part 7 of this section covers the tone signaling circuit.

1.04 The concentrator is designed to do five things in order to process a call:

(1) Detect ringing on a called line

(2) Encode the identity of the called line into a 2-digit number (00-99) and pulse this information to the identifier

(3) Select an idle trunk between the concentrator and identifier and attach this trunk to the called line

(4) If the attendant answers, it holds the trunk until the attendant disconnects

(5) If the attendant does not answer, it releases the trunk in approximately 2 seconds.

1.05 The identifier is also designed to perform five functions:

(1) Receive and decode the number which was pulsed from the concentrator

(2) Identify and light the correct lamp at the associated attendant position

(3) Connect the trunk, which was selected by the concentrator, to the jack (or key) associated with the lighted lamp

(4) If the attendant answers, it holds the trunk until the attendant disconnects

(5) If the attendant does not answer, it extinguishes the subscribers lamp of the switchboard in approximately 2 seconds.

DESCRIPTION

1.06 The CI System provides originating equipment at the central office and terminating equipment at the Telephone Answering Bureau which permits 40, 60, 80, or 100 subscriber lines to be concentrated and served by two to six (maximum) trunks. At the answering bureau, each subscriber line is associated with a switchboard line lamp and jack circuit which has an associated ringup circuit at the concentrator in the central office.

1.07 The switchboard line lamp lights approximately 0.9 second after the ringing cycle has been detected by the concentrator. This permits the bureau attendant to count the number of times the lamp is illuminated and to answer, when required.

Note: One ringing cycle has a time duration of 6 seconds. When the CI is connected to subscriber lines having both Code 1 and Code 2 ringing, one ringing cycle is defined as 2 seconds of ringing and 4 seconds of silence for Code 1 ringing; for Code 2 ringing, one ringing cycle is defined as 1 second of ringing, 1 second of silence, 1 second of ringing, and 3 seconds of silence. When a subscriber line is arranged for Code 2 ringing, it is possible for the subscriber station set to ring two times while the bureau attendant is answering on the first ring at the bureau switchboard (Fig. 4).

1.08 The method of handling an individual subscriber call is determined by mutual agreement between the subscriber and the answering bureau personnel. The attendant may answer all calls or only those occurring at certain times. In some cases, the attendant is instructed to answer calls only on the third or fourth ring, thereby allowing time for the subscriber to answer personally if desired.

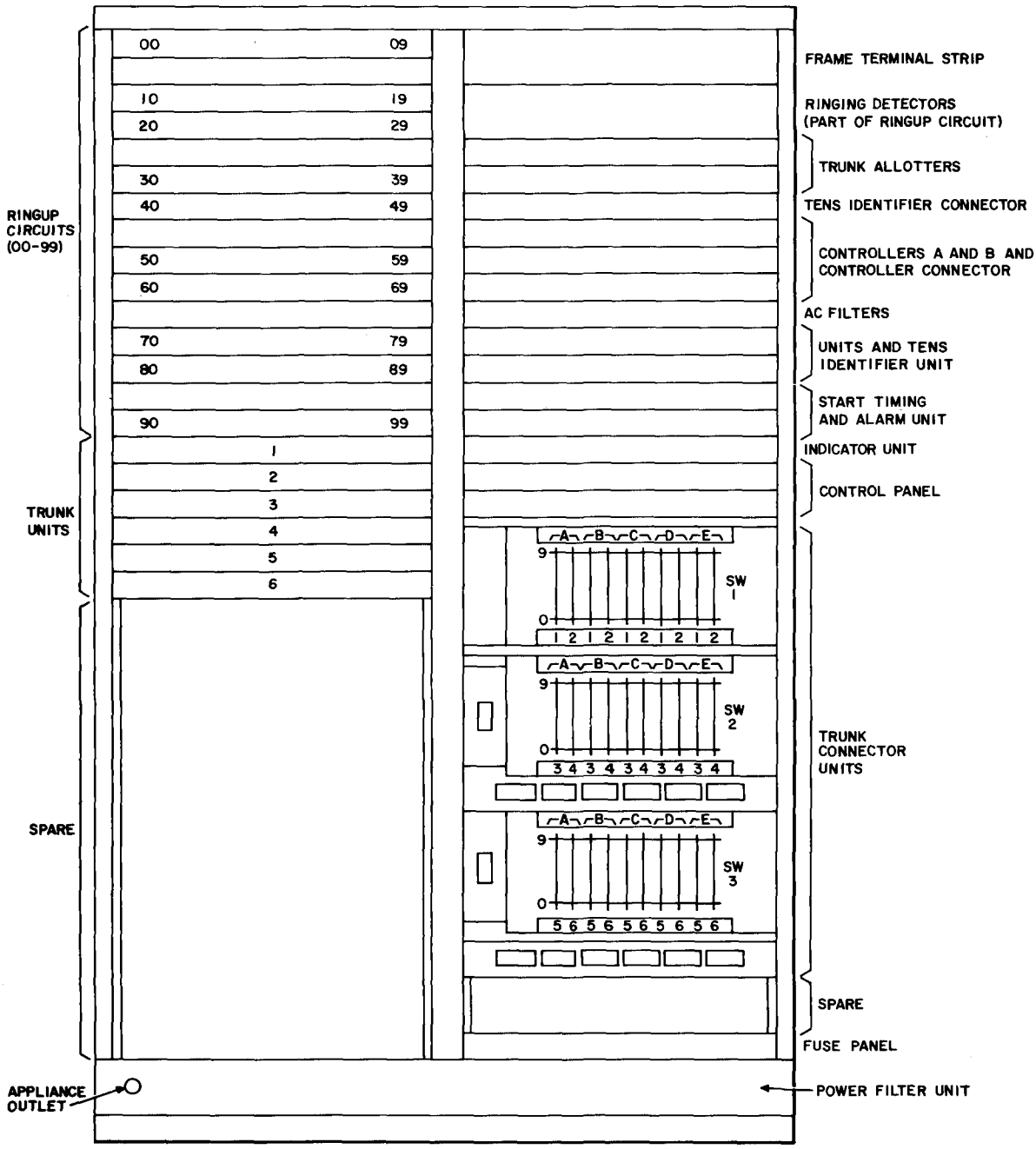


Fig. 1—Concentrator SD-99449-01 for Use With Electronic Switching Systems—Front View

FIELD OF USE

1.09 The purpose of the Telephone Answering System is to answer calls to subscribers such as business concerns, doctors, lawyers, etc, and other people desiring telephone answering service. The CI System has been designed to work with the 1A Telephone Answering System, 557-type PBXs, foreign exchange lines, and the Occasional Service System (Fig. 5 and 6).

1.10 Without the CI System, each subscriber would be required to have an individual pair of wires between the central office and the answering bureau. Under this condition, the answering bureau would be located as near as

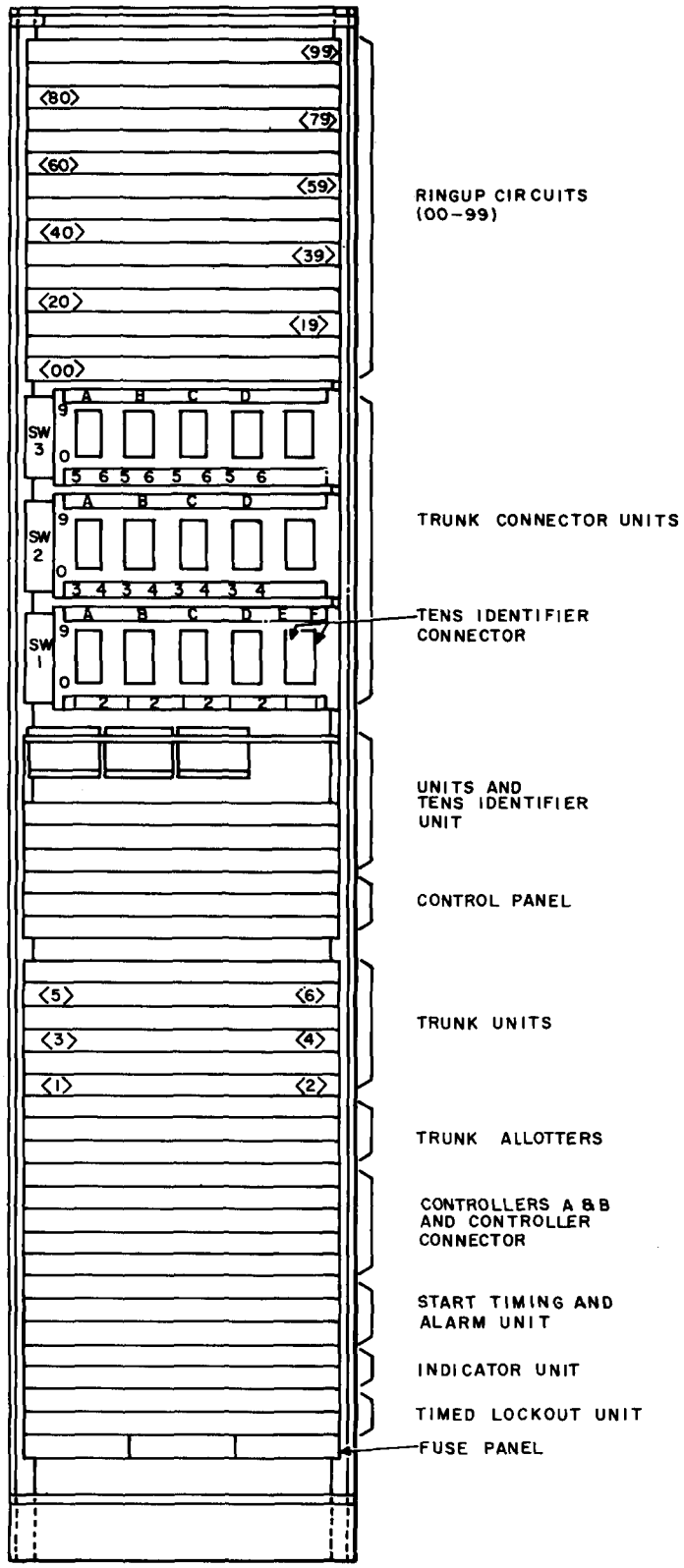


Fig. 2—Concentrator SD-95964-01 for Use With Electro-Mechanical Central Offices—Front View—Single Bay

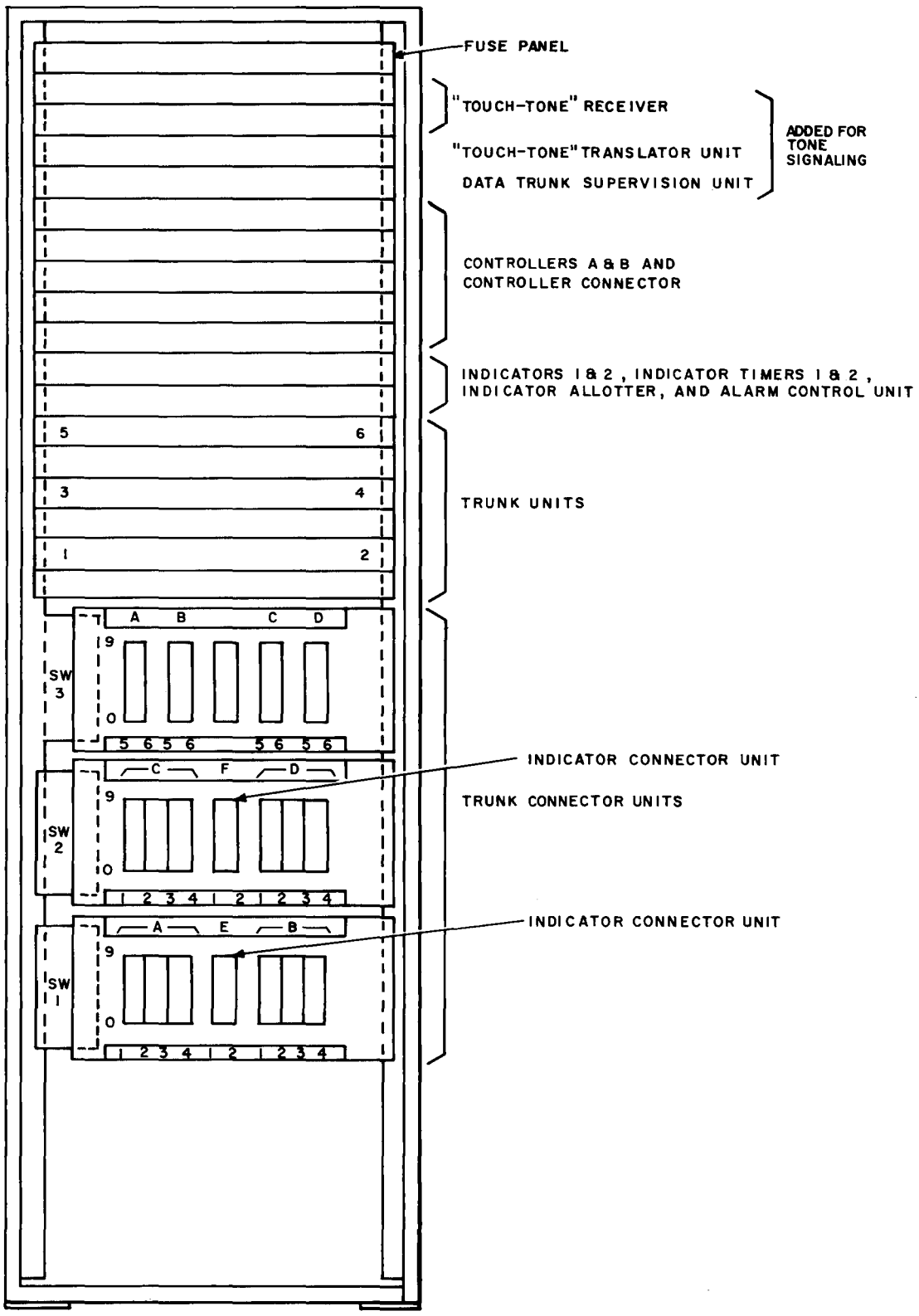
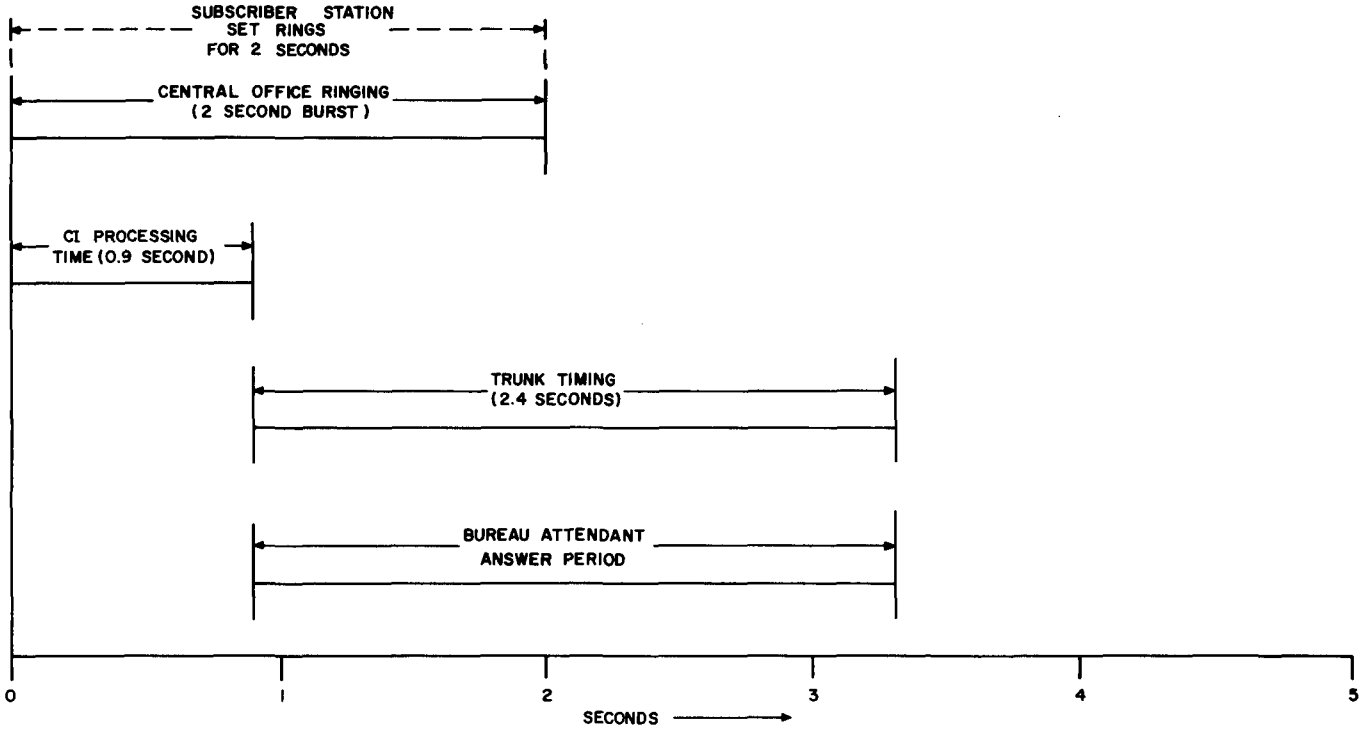
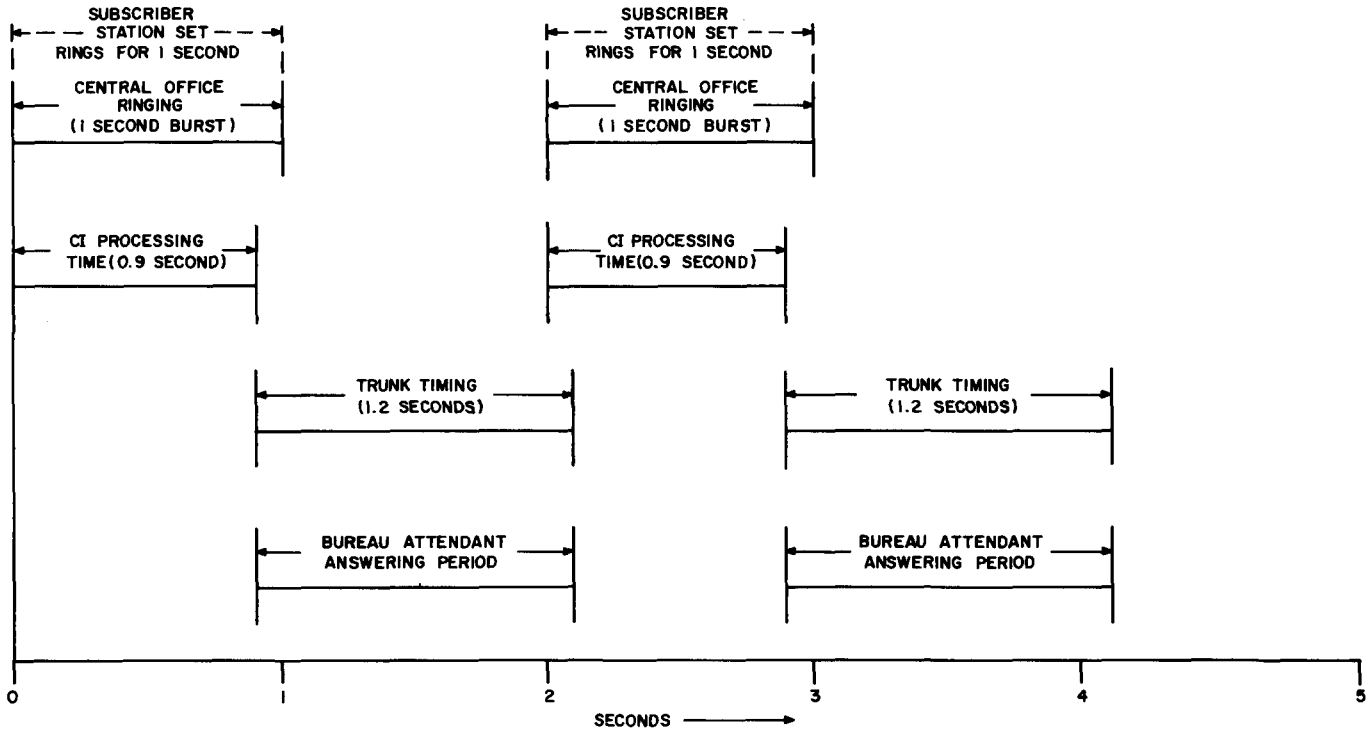


Fig. 3—Identifier SD-95962-01—Front View



CI TIMING INTERVALS – CODE 1 RINGING



CI TIMING INTERVALS – CODE 2 RINGING

Fig. 4—Concentrator-Identifier Timing Intervals for Code 1 and Code 2 Ringing

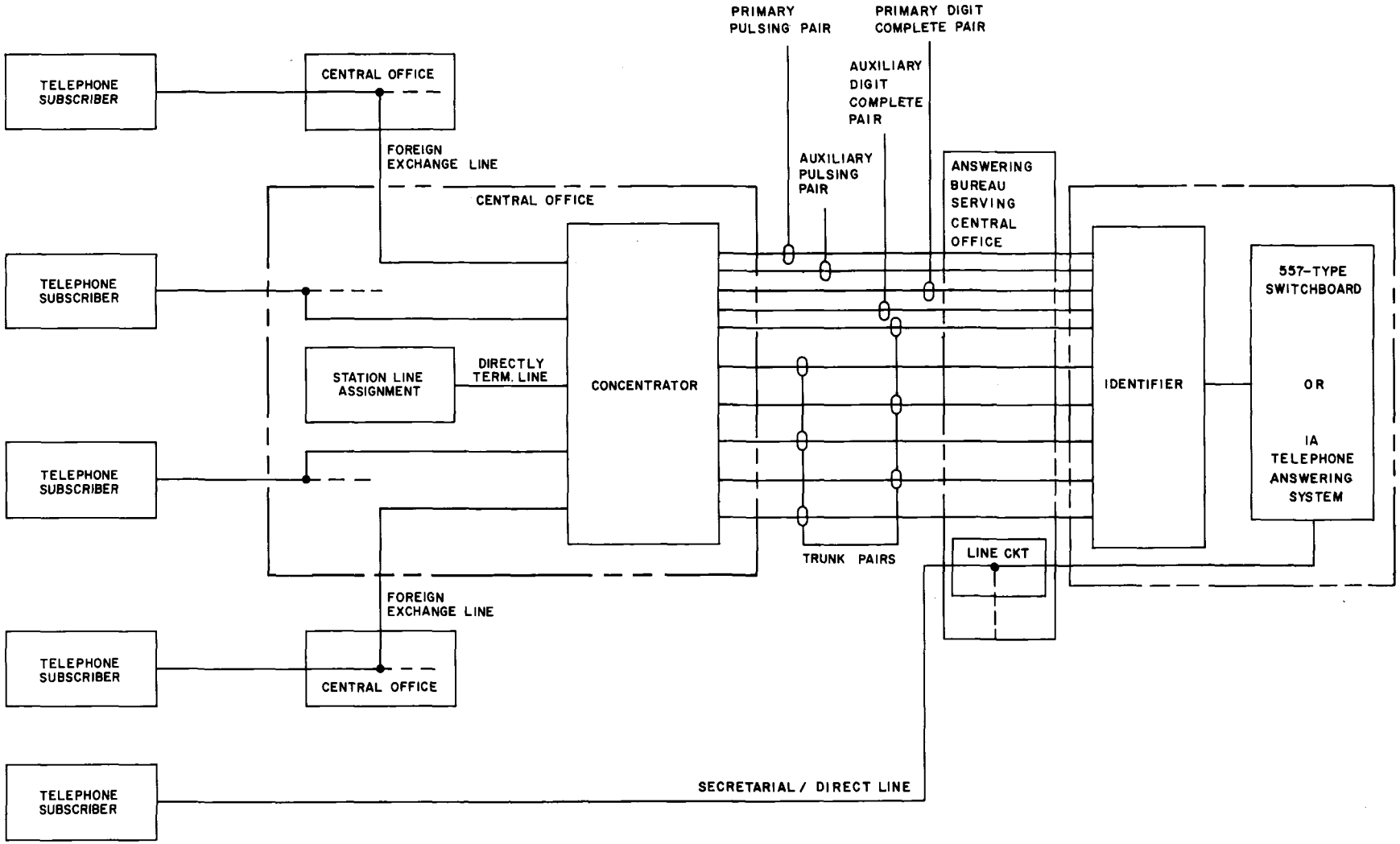


Fig. 5—Line Concentrator-Identifier Telephone Answering System When Used With Foreign Exchange Lines, 1A and 557-Type Telephone Answering System

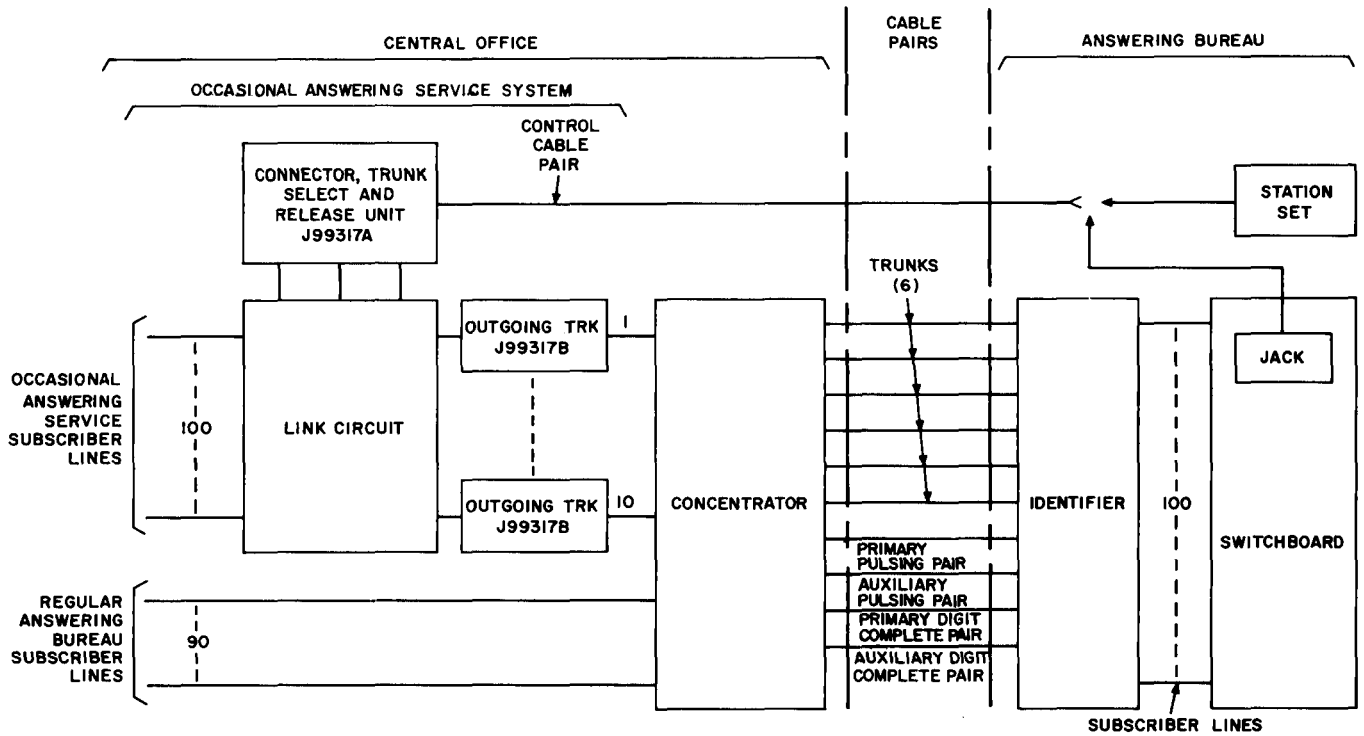


Fig. 6—Line Concentrator-Identifier When Used With Occasional Answering Service—Block Diagram

possible to the central office, reducing mileage costs.

1.11 With the CI System, the subscriber and the answering bureau may be located in the same or different geographical central office areas. Subscribers in remote central office areas are normally served by a CI system. Subscribers in the answering bureau central office area, depending upon mileage costs, are connected by a CI system or by direct secretarial lines.

CAPACITY

1.12 The basic CI System is arranged to serve 40 subscribers on individual or 2-party lines (concentrator SD-95964-01 can also serve 4-party lines). Additional lines may be added in multiples of 20 up to a maximum of 100 subscriber lines. A minimum of two trunks plus one pulsing pair and one digit complete pair must be provided between the originating equipment and the terminating equipment. The number of trunks may be expanded to a maximum of six to handle increased volume of traffic. An auxiliary pulsing and digit complete pair may be provided on an optional basis.

1.13 The capacity of one CI system is 100 subscriber lines, six trunks, two pulsing pairs, and two digit complete pairs.

1.14 The originating and terminating equipment is operated only on an equal trunk-to-trunk basis. All unused trunk equipment must be removed from service.

PRINCIPAL FEATURES

1.15 The principal features of the Line Concentrator-Identifier Telephone Answering System are:

(a) The concentrator (originating equipment), concentrates a maximum of 100 lines over two or more trunks (six maximum) to the answering bureau.

(b) The identifier (terminating equipment), located at the answering bureau, expands two or more trunks to a maximum of 100 jack and/or key appearances.

(c) Calls are processed one at a time in approximately the order of arrival.

(d) Concentrator-Identifier subscriber lines are answered in the same manner as direct secretarial lines.

(e) The bureau attendant cannot monitor on a subscriber line since the attendant can connect to the subscriber line only during the interval the switchboard line lamp is illuminated.

(f) All incoming calls are indicated by lighting switchboard line lamps even though all talking trunks are busy.

(g) All-trunks-busy and calls-waiting information is recorded on registers at both originating and terminating ends.

(h) A digit (start) timing control circuit is provided to cause a system time out when the CI fails to complete a call due to a trouble condition. The system time out produces alarm indications at both the originating and terminating ends and makes the defective unit busy.

(i) An alternate trunk allotter operates at the concentrator when the regular trunk allotter fails to select an idle trunk. The operation of the alternate allotter produces an alarm indication at originating equipment.

(j) A remote alarm release circuit may be provided, permitting the release of time-out and alternate allotter alarms from a remote location by calling a subscriber line associated with the alarm release circuit.

(k) The system provides optional audible and visual alarm features at the answering service bureau. This permits flexibility in alarm connections, as required by local policies.

(l) A control panel at the concentrator permits easy maintenance by the centralization of keys, lamps, and jacks used for testing and monitoring the progress of a call through the CI.

(m) Cabinets and mounting arrangements have been designed to reduce room noise created by the operation of the terminating equipment.

2. EQUIPMENT

ORIGINATING END

2.01 The line-concentrator, Fig. 1 and 2 consists of the following:

(1) ***Ringup Circuit:*** The ringup circuit functions to detect ringing on a subscriber line and assigns a 2-digit identity number (00-99) for use in the system.

(2) ***Timed Lockout Unit (SD-95964-01):*** The timed lockout unit permits the call to be served only once for each ringing interval. Concentrator SD-99449-01 contains this feature in the ringup circuit.

(3) ***Trunk Circuit:*** Each trunk circuit consists of a transmission path and a simplex path. The simplex path is used for trunk supervision and for the transfer of alarm information to the terminating end. The trunk circuit also contains a relay delay timer for timing functions.

(4) ***Trunk Connector Unit:*** The trunk connector unit consists of a crossbar switch. Each trunk connector (maximum three) serves two trunks and can connect either trunk unit to any subscriber line.

(5) ***Common Control Unit:*** The common control unit consists of the following circuits:

(a) A ***units identifier,*** which consists primarily of ten relays corresponding to the units digit (0-9) assigned to the ringup circuit. Its function is to indicate to the system the units digit assigned to the called line.

(b) A ***tens identifier connector*** which serves as an interface between the units and tens identifier and trunk connector unit.

(c) A ***tens identifier,*** which consists primarily of ten relays corresponding to the tens digit (0-9) assigned to the ringup circuit. Its function is to indicate to the system the tens digit of the called line.

(d) Two ***controllers,*** which operate on alternate calls to pulse the line code number to the terminating equipment.

(e) A ***controller connector,*** which provides a means of transferring from one controller to another controller on successive calls.

(f) Two ***trunk allotters*** are provided to select an idle trunk. The alternate allotter functions when the regular allotter fails to select an idle trunk.

(g) A ***start timing unit*** which times the digit outpulsing from the originating to the terminating end.

(h) An ***indicator unit*** which provides visual indications of the condition of the CI as calls are being processed.

(i) An ***alarm unit*** that supplies alarm information to the originating and terminating ends.

(j) The ***power unit*** provides interfacing for central office batteries and fuse protection.

(6) ***Control Panel:*** A control panel is provided which consists of lamps, keys,and jacks. The control panel provides visual indications as calls are being processed and visual aids and equipment necessary for normal maintenance.

TERMINATING END

2.02 The secretarial answering bureau equipment (Fig. 3) is mounted in one floor-supported cabinet 2 feet 2-1/4 inches wide by 1 foot 5 inches deep by 6 feet 11-7/8 inches high. The cabinet is supplied with an olive gray finish and has built-in soundproofing to reduce room noise created by the operation of the equipment. Cabinet circuitry is unitized on a functional basis, surface wired, and interconnected by local cabling.

2.03 All trunk units and the trunk connector unit are set up to be equipped on a plug-in basis via the use of connector cables. Space is available in the cabinet for the optional tone signaling units.

2.04 The cabinet is provided with holes in the four corners of the base assembly for fastening the cabinet to the floor. Fastening to the floor will be determined by customer installation requirements.

2.05 The answering bureau equipment shall be powered by local or building battery or local rectifier located external to the identifier cabinet.

2.06 The answering bureau equipment contains the following units:

(a) Two, four, or six ***trunks,*** each consisting of a transmission path and a simplex signal path.

(b) A ***controller connector*** which provides a means of transferring from one controller to another controller on successive calls.

(c) Two ***controllers*** (A and B) which operate alternately to receive the digits pulsed by the originating end and to operate the indicating equipment at the terminating end.

(d) An ***indicator allotter*** which provides a means of transferring from one indicator to another on successive calls.

(e) Two ***indicator timers*** (1 and 2) which control an associated indicator for each call and determine the length of time the switchboard lamp is lighted.

(f) Two ***indicators*** (1 and 2) which light the proper switchboard lamps through the indicator connector.

(g) Two ***indicator connectors*** controlled by respective indicators provide the operate path for the switchboard line lamp.

(h) A ***trunk connector*** which consists of select and hold magnets on a crossbar switch and associated trunk connector relays. The trunk connector completes the transmission path from a trunk to the switchboard.

(i) ***Power distribution and fuse alarm circuit*** which provides power and fuse protection to the identifier and fuse alarm indication to the identifier and switchboard (optional).

(j) ***Alarm control unit*** which provides digit timing of the controller at the identifier. The alarm control unit also provides indication and release of a system time-out.

SWITCHBOARD EQUIPMENT

2.07 The 557-type PBX switchboard and the 1A Telephone Answering System Console are used with the CI System. The general descriptive information for the 557A and B PBXs are contained in Sections 981-530-100 and 981-531-100, respectively. Section 981-240-100 contains the general description for the 1A Telephone Answering System Console.

INTERCONNECTING FACILITIES

2.08 The maximum number of interconnecting facilities between the concentrator and identifier consists of six talking trunk pairs, two pulsing pairs, and two digit complete pairs.

2.09 The six trunks are equipped with simplex-type trunk facilities for trunk supervision. Alarm and alarm release signals are transmitted from the concentrator to the identifier on the simplex legs of trunks one and two, respectively.

2.10 The primary pulsing and digit complete pairs provide the loop for digit pulsing and control. Auxiliary pulsing and digit complete pairs can be provided on an optional basis. The auxiliary pulsing and digit complete pairs are placed in service after a system time-out occurs.

3. METHOD OF OPERATION

3.01 The CI equipment (Fig. 7) operates for each ringing interval of an incoming call to an answering bureau subscriber. Each subscriber line is bridged to the originating equipment (concentrator) by a pair of wires at the central office main distributing frame (MDF). Each bridged line is assigned an arbitrary two-digit number from 00 through 99. Each digit of the two-digit identifying number consists of three pulses as shown in Table A. Ringing on a called subscriber line causes a ringup circuit to operate, energizing a digit (start) timing circuit and a units and tens identifier.

3.02 The units and tens circuit identifies the two-digit number of the line being called by lighting two lamps (a units lamp and a tens lamp) at the concentrator and passes this number to a controller circuit.

3.03 After the units and tens identification, one of the two controllers provided is selected to process the call. A lamp is illuminated on the concentrator to indicate which controller is processing the call. The selected controller is attached to the primary pulsing and digit complete pairs.

3.04 Prior to digit pulsing, the controller checks for pulsing path continuity and terminating end availability. If the pulsing channel is available, the controller prepares to send the units digit.

3.05 The units digit is pulsed by a combination of three pulses (Table A) to a receiving controller in the identifier. The identifier decodes the pulses and stores the unit digit until the tens digit is received.

3.06 At the start of units pulsing, the trunk allotter selects an idle talking trunk, if available.

3.07 After the units digit is pulsed out, the concentrator transmits a signal over the digit complete loop to energize a digit complete test in the identifier. After performing the digit complete test, the identifier transmits a signal over the digit complete pair to signal the concentrator to pulse the tens digit. The concentrator first checks the pulsing channel for continuity and then proceeds to pulse the tens digit.

3.08 At the start of tens pulsing, the allotted trunk is seized at the identifier. Seizure occurs by the concentrator placing a signal on the simplex leg of the allotted trunk.

3.09 The tens digit is a combination of three pulses. The identifier decodes the pulses and awaits the removal of the digit complete signal from the concentrator before processing the call further.

3.10 The concentrator signals the end of the tens digit by opening the digit complete pair. This signal permits the identifier to complete the call.

3.11 After the removal of the digit complete signal, the indicator in the identifier operates and lights the switchboard line lamp associated with the number assigned to the called subscribers line. Simultaneously, the trunk connector connects the trunk to the subscribers jack corresponding to the lighted switchboard lamp.

3.12 The attendant can answer by inserting a switchboard cord in the subscriber jack only during the interval the switchboard lamp is illuminated. This answering interval is 2.4 seconds for Code 1 ringing and 1.2 seconds for Code 2 ringing.

3.13 When the attendant answers, a signal is applied to the simplex leg of the allotted trunk. This signal causes the trunk circuit in the concentrator to operate and trip ringing.

3.14 When the attendant disconnects, the trunk is restored to normal and is available for another call. The disconnect signal is placed on the simplex leg of the seized trunk and causes the trunk circuit to release in the concentrator. The trunk circuit released at the concentrator releases the trunk circuit in the identifier.

3.15 If the attendant does not answer, the trunk timer at the concentrator will release the allotted trunk. At the identifier, the indicator control circuit will release the indicator and extinguish the subscriber lamp. The release of the trunk and extinguishing of the lamp occurs approximately simultaneously.

3.16 Trunk timing is dependent upon the type of ringing applied to a subscriber line and the number of calls awaiting answering. The maximum trunk available time is 2.4 seconds for Code 1 ringing and 1.2 seconds for Code 2 ringing. If only one trunk is available and more than two subscriber lines request service, the trunk timing is reduced by the second call.

3.17 Called line lamp display is independent of trunk talking path availability. When all trunk talking paths are busy and another call requests service, the equipment will continue to display the line lamps associated with other calls.

3.18 The terminating equipment is able to display a maximum of six calls every 6 seconds with a maximum of two line lamps displayed at any one time. Each call corresponding to the ringing interval on the line is displayed by a lighted line. During the silent ringing interval, the line lamp is extinguished. The ringup (SD-99449-01) or timed lockout (SD-95964-01) circuit prevents a call from being indicated a second time during any one ringing interval (one ringing interval equals 2 seconds for Code 1 ringing and 1 second for Code 2 ringing).

3.19 Two controllers (A and B) are provided at both concentrator and identifier to serve calls. The controllers alternate on successive calls (if controller A served the last call, controller B will serve the next call).

3.20 Two indicators (1 and 2) at the identifier are provided to light the switchboard lamp of the called subscriber. Like the controllers, the indicators also alternate on successive calls.

3.21 The trunk allotter will allot the trunk circuits in a regular sequence. The allotter will select the lowest trunk available for the first call. On the next and succeeding calls, the allotter will select the next higher-numbered available trunk. When the last trunk is selected, the trunk allotter will recycle and repeat the process.

4. ALARMS

4.01 Four alarms can occur in the concentrator-identifier system. The four alarms are:

(a) System Time-out Alarm

(b) Alternate Allotter Alarm

(c) Trunk Timing Alarm (SD-99449-01, only)

(d) Fuse Alarms.

4.02 A digit (start) timing circuit in the concentrator is provided to time the units and tens digits pulsing. If pulsing takes longer than the allotted time, the circuit will produce a system time-out. A system time-out will function to bring in an audible and visual alarm at the central office, release the digit register in the terminating equipment, and cause the CI System to switch to the auxiliary pulsing and digit complete pairs, if provided. The controllers at both the originating and terminating equipment and the indicator at the identifier that were in service at the time of the trouble condition, will be removed from service. The units and tens lamp and controller lamp at the control panel of the concentrator will indicate the progress of the call at the point of the system time-out. The alarm lamp at the concentrator and the time-out (TO) at the identifier will also be lighted. If another system time-out occurs, before the Alarm Release (AR) key at the originating equipment has been operated, the identifier will function to cause the terminating circuits previously

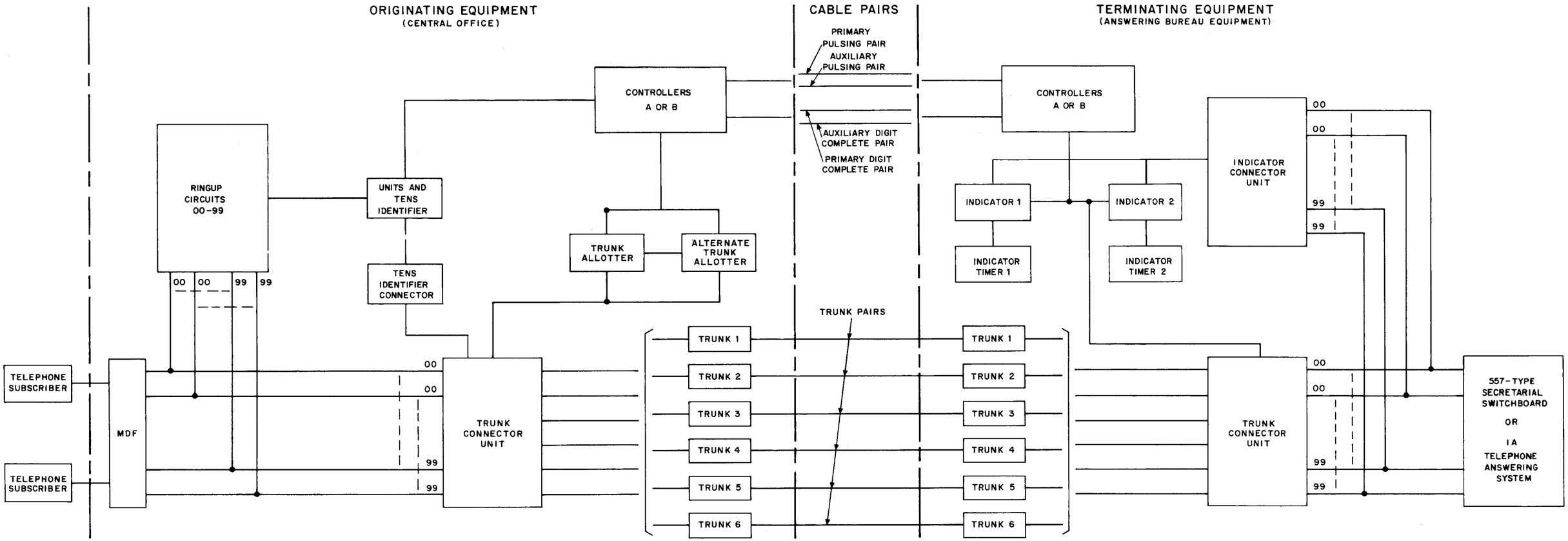


Fig. 7—Line Concentrator-Identifier for Secretarial Answering Service—Block Diagram

TABLE A

UNITS AND TENS DIGITS PULSES

UNITS OR TENS DIGITS	FIRST PULSE	SECOND PULSE	THIRD PULSE
0	CC—*	Blank	Blank
1	CC—	CC—	CC+†
2	CC—	CC—	CC—
3	CC—	CC+	CC—
4	CC—	CC+	CC+
5	CC+	Blank	Blank
6	CC+	CC—	CC+
7	CC+	CC—	CC—
8	CC+	CC+	CC—
9	CC+	CC+	CC+

* (— 130 volts dc)
† (+ 130 volts dc)

locked out of service to be released and tried again. The alarm circuits at the originating equipment remain energized until the AR key is operated.

4.03 A timing circuit in the alarm control unit in the identifier monitors the progress of each call. If a call can not be processed in the allotted time, the timing circuit will prevent the controller allotter from shifting to the other controller and will open the pulsing pair. The open pulsing pair will cause the concentrator to produce a system time-out on the next attempt to process a call.

4.04 A system time-out alarm may be manually released by operating the AR key at the concentrator. If the equipment is located in an unattended office, the alarm can be released by calling a subscriber line associated with the alarm release circuit (optional). An alarm may be cut off audibly but not released, by the manual operation of the alarm cutoff (ACO) key located on the concentrator control panel.

4.05 If a call is originated and the trunk allotter cannot allot an available idle trunk due to a trouble condition, the concentrator will activate the alternate allotter. The alternate allotter will take the regular allotter out of service and will bring in an audible and visual alarm at the central office. The alternate allotter in concentrator SD-95964-01 will select trunk one only, while concentrator SD-99449-01 will select the lowest trunk available. The alarm and alternate allotter may be released by operating the AR key. For maintenance purposes, the alternate allotter may be operated by depressing the AA key at the concentrator.

4.06 A trunk timing alarm (SD-99449-01, only) occurs only if a trunk fails to release after the allotted time or releases immediately after the trunk is selected. The trunk timing alarm will produce an audible and visual alarm at the central office and will light lamp TTA on the concentrator. The trunk timing alarm may be released by depressing the TTA key at the concentrator.

4.07 A fuse alarm may occur at the concentrator, identifier, or switchboard. Alarms at these locations will be indicated by visual and/or audible indicators.

4.08 The CI System provides optional audible and visual alarm features at the identifier and at the switchboard. The optional features are ordered and installed by the Telephone Company on a job basis. This permits flexibility in alarm connections as required by local policies.

5. SIGNALING

5.01 Signaling between the concentrator and identifier is transmitted over the pulsing pair, digit complete pair, and simplex legs of the trunks. Auxiliary pulsing and digit complete pairs may be provided on an optional basis. Table B shows the dc signaling functions that take place and the signaling channel involved.

6. MAINTENANCE FEATURES

6.01 Test set KS-21056 has been designed to test the concentrator. Refer to Section 473-500-101 for a description and operation of the test set.

6.02 At the concentrator, a control panel containing the following keys, lamps, and jacks has been provided for centralization of visual lamps and equipment for normal maintenance functions.

(1) SD-99449-01

TABLE B

SIGNALING FUNCTIONS OF THE CONCENTRATOR-IDENTIFIER
WHEN USED WITH DC (METALLIC) SIGNALING

ORIGINATING END	CHANNEL	TERMINATING END
Tests for Terminating End Availability and for Pulse Path Continuity →	Pulsing Channel	→
Ends Continuity Test; Starts Units Digit Pulsing ←		← Controller Available; Continuity Provided
Units Digit Pulsing →	Pulsing Channel	→ Receives Units Digit
Transmits a Signal That Units Digit Pulsing is Completed →	Digit Complete Channel	→ Receives Signal and Performs Digit Complete Test
Receives Digit Complete Signal ←		← Signals Result of Digit Complete Test
Tests for Pulsing Path Continuity →	Pulsing Channel	→
Ends Continuity Test; Starts Tens Digit Pulsing ←		← Continuity Provided
Tens Digit Pulsing →	Pulsing Channel	→ Receives Tens Digit
Transmits a Signal That Tens Digit Pulsing is Completed →	Digit Complete Channel	→ Receives End of Tens Digit; Proceeds to Light Switchboard Lamp
Transmits a Signal to Seize Allotted Trunk → *Note:* Occurs at the Beginning of Tens Digit Pulsing	Simplex Leg of Allotted Trunk	→ Trunk Seized
Trips Ringing ←		← Attendant Answers and Sends a Signal to Trip Ringing
Trunk Releases at Originating End and Releases Terminating End ← →		← Attendant Disconnects and Sends Trunk Release Signal → Trunk Releases
Call Not Answered → Trunk Timer Releases Trunk		→ Trunk Releases
Transmits Signal to Indicate Time-out Alarm →	Simplex Leg of Trunk 1	→ Receives Alarm
Transmits Signal to Indicate Time-out Alarm Released →	Simplex Leg of Trunk 2	→ Receives Alarm Release Signal

(a) ***CA Key:*** An illuminating push-to-lock, push-to-unlock key. A steadily lighted CA key indicates that controller A is being used to serve a call in progress. A flashing CA key (60 ipm) indicates that controller A has been made busy by operation of the key.

(b) ***CB Key:*** An illuminating push-to-lock, push-to-unlock key. A steadily lighted CB key indicates that controller B is being used to serve a call in progress. A flashing CB key (60 ipm) indicates that controller B has been made busy by operation of the key.

(c) ***AA Key:*** An illuminating push-to-lock, push-to-unlock key. A steadily lighted AA key indicates that the alternate allotter is being used to serve a call in progress. A flashing AA key (60 ipm) indicates that the alternate allotter has been made busy by the operation of the key.

(d) ***TB-1 through TB-6 Keys:*** Illuminating push-to-lock, push-to-unlock keys. Steadily lighted keys indicate the trunk(s) being used to serve a call in progress. A flashing TB- key (60 ipm) indicates the trunk(s) made busy by operation of the associated TB- key.

(e) ***TTA Key:*** An illuminating nonlocking key which, when steadily lighted, indicates that a trunk-timing alarm has occurred. To release the alarm, the TTA key must be momentarily operated.

(f) ***AR Key:*** An illuminating nonlocking key which, when steadily lighted indicates a system alarm. To release the alarm, the AR key must be momentarily operated.

(g) ***ACO Key:*** An illuminating nonlocking key which, when steadily lighted, indicates the key has been operated to cut off the audible alarm signal. Operation of the AR key automatically restores the ACO circuit to normal.

(h) ***U-0 through U-9 Lamps:*** A steadily lighted lamp which indicates the units digit of the ringup circuit being used by the call in progress.

(i) ***T-0 through T-9 Lamps:*** A steadily lighted lamp which indicates the tens digit of the ringup circuit being used by the call in progress.

(j) ***FA Lamp:*** Fuse alarm lamp.

(k) ***TEL A&B Jacks:*** Used for talking circuit within the ESS office.

(l) ***Code 1 RING Jack:*** Provides access to the ESS ringing supply for testing ringup circuits.

(m) ***PGA Jack:*** Used for testing the pulse generator relay (PG) in controller A.

(n) ***PGB Jack:*** Used for testing the pulse generator relay (PG) in controller B.

(o) ***PA Jack:*** Used for monitoring the pulse relay of controller A.

(p) ***PB Jack:*** Used for monitoring the pulse relay of controller B.

(q) ***TLK Jack:*** Used for talking circuit between originating and terminating equipment.

(r) ***SP Jack:*** Spare jack for local optional use.

(s) Also provided are battery and ground terminals (−48 volt dc and 24-volt dc), high-resistance ground (HRG), and ground (GRD) terminals.

(2) SD-95964-01

(a) ***CA Key:*** A locking key used to busy controller A.

(b) ***CB Key:*** A locking key used to busy controller B.

(c) ***AA Key:*** A locking key used to busy the regular trunk allotter and exercise the alternate trunk allotter.

(d) ***TB1-TB6 Keys:*** Locking keys used to busy out the associated trunk.

(e) ***AR Key:*** A nonlocking key that releases the locked in alarm.

(f) ***ACO Key:*** A nonlocking key that silences the audible alarm.

(g) ***LA-LE Keys:*** Locking keys that transfer the associated lockout relays from that units group to the next higher lettered group (operating key LE transfers the lockout to LA).

(h) ***UI0-UI9 Lamps:*** A lamp that indicates the units digit assigned to the call in progress.

(i) ***TI0-TI9 Lamps:*** A lamp that indicates the tens digit assigned to the call in progress.

(j) ***C (A, B) Lamp:*** Lamps that indicate the controller serving the call.

(k) ***TK1-6 Lamps:*** Lamps that indicate the trunk serving the calls in progress.

(l) ***AA Lamp:*** A lamp that indicates the alternate trunk allotter is in service.

(m) ***AL Lamp:*** Alarm indication lamp.

(n) ***ACO Lamp:*** Indicates the audible alarm is silenced.

(o) ***20 A, AL, FL:*** Fuse alarm lamps.

(p) ***TEL A and TEL B Jacks:*** Used for a talking circuit within the central office.

(q) ***PG(A) and PG(B) Jacks:*** Used for testing the pulse generator relay (PG) of the respective controller.

(r) ***LC(A) and LC(B) Jacks:*** Used when adjusting the pulsing pair line current (K and KA resistors) of the respective controller.

(s) ***P(A) and P(B) Jacks:*** Used for monitoring the pulse relay of the respective controller.

(t) ***TLK Jack:*** Used for a talking circuit between originating and terminating equipment.

(u) ***SWMN Jack:*** Used for a connection to a switchman talking circuit.

(v) ***48V Jack:*** Provides −48V central office battery for testing purposes.

(w) Also provided are battery (−48V), and (G), and high-resistance ground (HRG) terminals.

6.03 The following keys, lamps, and jacks are provided at the identifier for maintenance functions:

(a) ***CA and CB Keys:*** Locking keys used to busy the respective controller.

(b) ***I1 and I2 Keys:*** Locking keys used to busy the respective indicator.

(c) ***IT1 and IT2 Lamps:*** Indicate which indicator is serving a call.

(d) ***T-1 through T-6 Lamps:*** Indicate which trunk is serving a call.

(e) ***TL Lamp:*** Indicates the test line is in use.

(f) ***TO Lamp:*** Indicates a system time-out has occurred.

(g) ***FA Lamp:*** Fuse alarm lamp.

(h) ***TL Jack:*** A jack used to terminate a test line.

6.04 The following optional features at the switchboard are extended indications from the identifier.

(a) ***ATB Lamp:*** All-trunks-busy (calls-waiting) condition.

(b) ***FA Lamp:*** Fuse alarm.

(c) ***TO Lamp:*** System time-out.

(d) ***FA1 Lamp, FA Audible Alarm, and AS Key:*** Fuse alarm. The AS key silences FA and FA1 audible alarms.

(e) ***FA1 Audible Alarm:*** Audible fuse alarm installed at a remote location in the answering bureau.

(f) ***AB Register:*** All-trunks-busy (calls-waiting) condition.

7. TONE SIGNALING CIRCUIT

GENERAL

7.01 This section describes the tone signaling circuit SD-99556-01 for use with the line concentrator-identifier. The tone signaling circuit (TSC) makes possible the use of other transmission facilities in addition to metallic trunks between the originating and terminating ends. This allows the system to work over longer distances between the concentrator and identifier. Where appropriate, this feature can also be used to reduce the per mile cost of the service.

7.02 This circuit is used to convert the present dc signaling between the concentrator and identifier to inband tone signaling using standard TOUCH-TONE and SF signaling frequencies. The use of inband signaling enables the link between the concentrator and identifier to be either carrier facilities (N, O, or T) or 4-wire lines equipped for SF Signaling. Refer to Fig. 8 for a diagram of the CI used with the tone signaling circuit.

7.03 The tone signaling circuit is for use with either concentrator SD-95964-01, Issue 16B or SD-99449-01, Issue 7B and identifier SD-95962-01, Issue 9B. The TSC is located with the concentrator at the originating end (originating central office) and at the terminating end (serving central office and identifier location). When used with carrier facilities, part of the TSC will be located in the central office housing the carrier facilities which may or may not be the same central office containing the concentrator (see 7.05). The TSC is equipped for a plug-in basis and is bay-mounted adjacent to the concentrator at the originating end. At the terminating end, part of the TSC is mounted in the serving central office and part in the identifier cabinet at the answering bureau.

PRINCIPAL FEATURES

7.04 The principal features of the TSC are:

(a) All connections to the concentrator and identifier are made on a plug-in basis.

(b) The distance between the originating equipment and terminating equipment is practically unlimited.

(c) Only the signaling functions of the CI are changed. Other functions occur in a normal manner.

(d) All DC signaling between the originating and terminating equipment is converted to inband SF (Single Frequency) and TOUCH-TONE frequencies.

(e) Provides two data trunks that serve respective controllers at both originating and terminating ends.

(f) Provides six talk trunks (maximum) interfaced with a line facility at both ends that serve respective CI trunk circuits.

(g) Alarm signals and alarm release signals are converted to TOUCH-TONE frequencies and transmitted via the data trunk.

(h) Provides a means to transfer either data trunk at the originating end for maintenance purposes. In addition, the controller at the concentrator must be locked out of service.

(i) Provides manual lockout of either controller at the identifier and permits the operating controller to have access to both data trunks.

(j) Provides a means of manually testing the TOUCH-TONE generator using a standard central office TOUCH-TONE receiver.

EQUIPMENT

7.05 The TSC originating equipment is located in the originating central office with the concentrator when 4-wire, SF signaling facilities are used. When carrier facilities are used, the data trunk control circuit and TOUCH-TONE generator control circuit are located in the concentrator central office; the data trunk supervision circuit and talk trunk supervision circuit are located in the central office housing carrier facilities which may or may not be the same central office containing

the concentrator. The TSC originating equipment consists of the following:

(1) ***Data Trunk Control Circuit*** An interface with the concentrator controller circuit. The functions of the data trunk control circuit are:

(a) Provides dc loop signaling to the data trunk supervision circuit

(b) Controls the output (on and off) of the TOUCH-TONE generator

(c) Provides a key for manual transfer of data trunks.

(2) ***Data Trunk Supervision Circuit*** which interfaces with the line facility. The functions of the data trunk supervision circuit are:

(a) Completes the dc signaling loop with the data trunk control circuit

(b) Provides E&M lead control toward the line facility.

(3) ***TOUCH-TONE Generator Control Circuit*** receives dc signaling from the concentrator and generates TOUCH-TONE frequencies to provide line identification to the terminating equipment. A selector switch and jack are provided for testing the output frequencies of the TOUCH-TONE generator.

(4) ***Talk Trunk Supervision Circuit*** converts dc simplex signals to E&M lead control toward the line facility. The line facility transmits line status supervision over the talking trunks to the terminating end equipment.

7.06 The TSC terminating equipment located in the identifier serving central office and in the identifier cabinet at the customer premises consists of the following:

(1) ***Talk Trunk Supervision Circuit*** converts dc simplex signaling to E&M lead control toward the line facility. This circuit is essentially the same as that provided at the originating end and is located in the terminating central office.

(2) ***Data Trunk Supervision Circuit*** consists of two units. The first unit is located in the serving central office and provides E&M lead control toward the line facility and dc loop signaling to the second unit. The second unit is located in the identifier cabinet at the customer location. The second unit provides:

(a) Completion of the dc signaling loop with the first unit

(b) Alarm control relays that control alarm and recycle signals received from the concentrator

(c) Manual lockout of either controller.

(3) ***TOUCH-TONE Receiver and Translator Circuit*** is located in the identifier cabinet and provides the following functions:

(a) Receives, detects, and translates the TOUCH-TONE frequencies sent by the originating end

(b) Operates the respective code relays in the digit registration circuit in the identifier to provide line identification

(c) Operates the respective alarm control relays (AL and RC) when alarm information is sent by the concentrator.

(4) ***Data Trunk Control Circuit*** located in the identifier cabinet provides the following functions:

(a) Controls the dc signaling loop of the data trunk supervision circuit

(b) Detects the units digit to initiate the digit complete function

(c) Controls the receiving of the units and tens digit within the identifier.

METHOD OF OPERATION

Note: A general knowledge of dc signaling between the concentrator and identifier is helpful in understanding the operation of the tone signaling circuit.

7.07 Ringing on a called subscriber line causes the ringup circuit in the concentrator to operate which assigns a two-digit identifying number

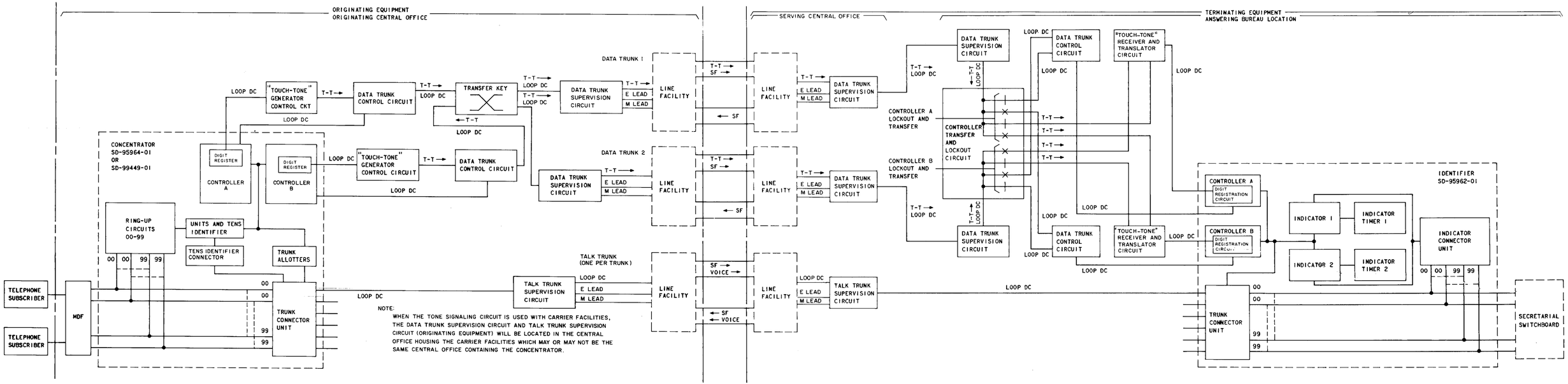


Fig. 8—Line Concentrator-Identifier When Used With the Tone Signaling Circuit—Block Diagram

(00-99) to the subscriber line. The ringup circuit operates a units and tens identifier which identifies the two-digit number of the line being called and passes the number to a controller circuit.

7.08 The purpose of the controller circuit is to transmit this two-digit number to the identifier. Prior to units digit transmission, the controller checks the data trunk to determine if the identifier equipment is clear and ready to accept digit information. Instead of using dc signaling over the pulsing pair (Table B), the controller activates the TSC. The TSC interfaces at both originating and terminating ends with a line facility equipped with carrier (N, O, or T) or a 4-wire line equipped with SF signaling. The TSC causes the line facility to signal the terminating end. The TSC changes the M lead of the line facility from ground to battery to produce the signaling function (see Table C). If a controller is available at the terminating end, the TSC signals the originating end via the line facility to send the units digit.

7.09 At the start of sending the units digit, the trunk allotter selects an idle talking trunk, if available. (This occurs as if the CI is equipped with dc signaling.)

7.10 The units digit frequency is transmitted over the data trunk by a TOUCH-TONE generator in the TSC. The duration of the units frequency is approximately 100 milliseconds and is timed by the existing pulsing circuit and the digit complete signal received from the identifer (7.11).

7.11 Upon receiving the units digit, the TSC at the terminating end causes the line facility to signal the originating end that the units digit was received.

7.12 When the units digit frequency is removed, the TSC at the terminating end via the line facility signals the originating end that the data trunk is clear and ready to receive the tens digit.

7.13 At the start of tens transmission, the allotted trunk is seized at the identifier. Seizure occurs by the concentrator placing a dc signal on the simplex of the allotted trunk. This dc signal causes the line facility of the talk trunk to signal the terminating end and seize the allotted trunks.

7.14 The tens digit frequency is transmitted over the data trunk by a TOUCH-TONE generator in the TSC. The duration of the tens digit is controlled by the existing pulsing circuit and is approximately 100 milliseconds. When the tens digit frequency is removed, the terminating equipment is permitted to return to normal. The data trunk at the originating end releases which releases the data trunk at the terminating end.

7.15 At this point, the switchboard lamp is illuminated and the attendant can answer during this period (2.4 seconds for Code 1 ringing or 1.2 seconds for Code 2 ringing).

7.16 If the attendant answers, a dc signal is applied to the simplex of the allotted trunk. This signal causes the line facility to signal the originating end and causes the trunk circuit in the concentrator to trip ringing.

7.17 When the attendant disconnects, the trunk is restored to normal and is available for another call. The dc disconnect signal is placed on the simplex of the seized trunk and causes the line facility to signal the originating end, and release the trunk circuit in the concentrator. The trunk circuit released in the concentrator via the line facility releases the trunk circuit in the identifier.

7.18 If the attendant does not answer, the trunk timer at the concentrator will release the allotted trunk at the concentrator and at the identifier via the line facility. At the identifier, the indicator control circuit will release the indicator and extinguish the subscriber lamp.

SIGNALING

7.19 Signaling between the CI using the TSC is provided by two data trunks and six talk trunks. The data and talk trunks interface with carrier facilities (N, O, or T) or 4-wire lines equipped with SF signaling. The dc signaling between the CI is converted to inband tone signaling using standard TOUCH-TONE and SF Signaling Frequencies. Table C shows the signaling functions that occur, the trunk involved, type of signaling, and condition of E & M leads at originating and terminating ends when the concentrator-identifier is connected with the TSC.

MAINTENANCE FEATURES

7.20 The TSC at the originating end contains the following maintenance features:

(a) ***TRF Key:*** A turn-type key that is used to initiate a data trunk transfer in case trouble should occur in either data link. The CA or CB key at the controller must be operated in addition to the TRF key to produce a data trunk transfer.

(b) ***TST Key and SEL Rotary Selector Switch:*** A key and rotary selector that provides for individual selection of the TOUCH-TONE digits when testing the TOUCH-TONE generator. Controller selection is provided by operating the CA or CB key at the concentrator.

(c) ***TT (A or B) Jack:*** A jack that provides a means to test the output of the TOUCH-TONE generator. The jack can be connected to a transmission measuring set or to the central office TOUCH-TONE test receiver.

7.21 The TSC at the terminating end provides the following maintenance features:

(a) ***BSY Key:*** A turn-type key that is used to busy controller A or B at the identifier. Operation of the BSY key to the A position permits both data trunks to use controller B. Operation of the BSY key to the B position permits both data trunks to use controller A. With tone signaling, identifier keys CA and CB are disabled.

(b) ***MB Lamp:*** Indicates that controller A or B has been made busy in the identifier.

(c) ***TO Lamp:*** Indicates that a system time-out has occurred.

(d) ***AMP IN Jack:*** A jack used in testing and adjusting the amplifier located in the TOUCH-TONE receiver and translator circuit.

(e) ***AMP OUT Jack:*** A jack used to measure the output of the amplifier located in the TOUCH-TONE Receiver and Translator Circuit.

TABLE C

SIGNALING FUNCTIONS OF THE CONCENTRATOR-IDENTIFIER WHEN USED WITH THE TONE SIGNALING CIRCUIT

ORIGINATING END	*M LEAD OF LINE FACILITY	†E LEAD OF LINE FACILITY	TRUNK	TYPE OF SIGNALING	*M LEAD OF LINE FACILITY	†E LEAD OF LINE FACILITY	TERMINATING END
Tests for Terminating End Availability	BAT	OPEN	DATA	SF→	GRD	GRD	Tests for Availability
Terminating End Available Starts Units Digit Signaling	BAT	GRD	DATA	←SF	BAT	GRD	Terminating End Available
Units Digit Signaling	BAT	GRD	DATA	T-T→	BAT	GRD	Receives Units Digit
Receives Digit Complete Signal	BAT	OPEN	DATA	←SF	GRD	GRD	Transmits Digit Complete Signal
Units Digit Signaling Stopped	BAT	OPEN	DATA	T-T→	GRD	GRD	Removed T-T Frequency; Starts Availability Check
Terminating End Available; Starts Tens Digit Signaling	BAT	GRD	DATA	←SF	BAT	GRD	Terminating End Available
Tens Digit Signaling	BAT	GRD	DATA	T-T→	BAT	GRD	Receives Tens Digit
E Lead Returns to Normal	BAT	OPEN	DATA	←SF	GRD	GRD	Terminating Signaling Ended Proceeds to Light Switchboard Lamp
Tens Digit Signaling Stopped	BAT	OPEN	DATA	T-T→	GRD	GRD	Removed T-T Frequency Permits Terminating End to Return to Normal
Data Trunk Releases	GRD	OPEN	DATA	SF→	GRD	OPEN	Data Trunk Releases
Transmits a Signal to Seize Allotted Talk Trunk *Note:* Occurs at Beginning of Tens Digit Pulsing	BAT	OPEN	TALK	SF→	GRD	GRD	Talk Trunk Seized
Trips Ringing	BAT	GRD	TALK	←SF	BAT	GRD	Attendant Answers and Sends a Signal to Trip Ringing
Talk Trunk Releases at Originating End	BAT	OPEN	TALK	←SF	GRD	GRD	Attendant Disconnects and Sends Talk Trunk Release Signal
Released Talk Trunk Releases Terminating End	GRD	OPEN	TALK	SF→	GRD	OPEN	Terminating Talk Trunk Releases
Call Not Answered; Trunk Timer Releases Talk Trunk	GRD	OPEN	TALK	SF→	GRD	OPEN	Terminating Talk Trunk Releases
‡ Transmits Signal to Indicate Time-Out Alarm	BAT		DATA	SF→ T-T→		GRD	Receives Alarm
‡ Transmits Signal to Indicate Time-Out Alarm Released	BAT		DATA	T-T→ SF→		GRD	Receives Alarm Release Information

* For SF signaling, GRD on the M lead produces a 2600-Hz signal; battery on the M lead removes the signal.

† For SF signaling, E lead is open when 2600-Hz signal is transmitted; E lead is ground when signal is removed.

‡ Alarm and alarm release information is transmitted over both data trunks simultaneously.

8. RELATED REFERENCES

8.01 The following list contains information pertaining to the Line Concentrator-Identifier Systems.

SECTION	EQUIPMENT	DESCRIPTION
473-500-101	KS-21056 Test Set	Description, Calibration, and Operation of Test Set Used to Test Concentrators (SD-95964-01 and SD-99449-01)
473-500-501	Tone Signaling Circuit (SD-99556-01, J59202)	Tests and Adjustments of Tone Signaling Circuit Used With CI
473-501-201	CI (SD-95964-01 and SD-95962-01)	Tests and Inspection at Time of Installation
473-501-202	CI (SD-95964-01 and SD-95962-01) and Test Set KS-21056	Tests and Inspection at Time of Installation Using Test Set KS-21056
473-501-501	CI (SD-95964-01 and SD-95962-01)	Circuit Tests and Trouble Analysis
473-501-502	CI (SD-95964-01 and SD-95962-01) and Test Set KS-21056	Circuit Tests and Trouble Analysis Using Test Set KS-21056
473-505-201	CI (SD-99449-01 and SD-95962-01)	Tests and Inspection at Time of Installation
473-505-202	CI (SD-99449-01 and SD-95962-01) and Test Set KS-21056	Tests and Inspection at Time of Installation Using Test Set KS-21056
473-505-501	CI (SD-99449-01 and SD-95962-01)	Circuit Tests and Trouble Analysis
473-505-502	CI (SD-99449-01 and SD-95962-01) and Test Set KS-21056	Circuit Tests and Trouble Analysis Using Test Set KS-21056
809-301-150	CI (SD-95964-01 and SD-95962-01)	Equipment Design Requirements
809-301-151	CI (SD-99449-01 and SD-95962-01)	Equipment Design Requirements
809-301-152	Tone Signaling Circuit (SD-99556-01, J59202)	Equipment Design Requirements