

AUXILIARY SENDER EQUIPMENT FOR DIRECT DISTANCE DIALING
GENERAL DESCRIPTIVE INFORMATION
DECODER PANEL AND NO. 1 CROSSBAR SYSTEMS

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1. INTRODUCTION

1.01 This section provides general descriptive information for the auxiliary

sender and associated equipment to be applied to decoder panel and No. 1 crossbar switching systems to provide direct distance dialing (DDD) facilities for customers served by these types of offices. With DDD, customers are able to dial directly their own station-to-station calls to points outside their local or extended service area provided the requirements for direct distance dialing are satisfied.

1.02 Telephone numbers for direct distance dialing will consist of two parts:

(a) A 7-digit directory number, consisting of the first two letters of the central office name followed by five numerals, commonly referred to as 2-5 numbering.

(b) A 3-digit area code consisting of three numerals (X O/1 X) to designate the geographical numbering plan area.

Only the 7-digit directory number is required to reach destinations within the home numbering plan area. If, however, the call is to a foreign numbering plan area, the proper area code must normally be prefixed to the 2-5 number of the called station. Thus a call into a foreign numbering plan area will usually require the customer to dial ten digits. Since the subscriber senders in decoder panel and No. 1 crossbar offices have a capacity of only eight digits, the auxiliary sender is used to register the two additional digits required for DDD. Due to the limited and decreasing use of party letters and numbers over 10,000, no provision is made to complete foreign area DDD calls from No. 1 crossbar and decoder panel offices to manual telephones with these types of numbers. Should a customer attempt to dial an 11-digit number, only ten digits will be pulsed forward. The call will be intercepted at the terminating office and the customer advised to place the call through his local operator.

1.03 The auxiliary sender provides for multifrequency (MF) outputting of all DDD 10-digit calls and also, where economically desirable, of certain 7- or 8-digit calls.

1.04 In all cases, 10-digit DDD calls from decoder panel and No. 1 crossbar offices will be routed first to a crossbar tandem office equipped with centralized automatic message accounting facilities (CAMA) for automatic recording of customer billing information. Modifications to allow

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those No. 1 crossbar offices equipped with local AMA to record 10-digit calls will be developed at a later date. Seven- or eight-digit calls beyond the charging range of the originating offices, that is those which cannot be handled on a flat rate, single-unit message rate, local control zone registration, or local AMA basis, will also be routed to a CAMA tandem for charging purposes.

1.05 A general description of operator identified CAMA in crossbar tandem offices is given in Section 960-310-100.

2. EQUIPMENT ELEMENTS

A. General

2.01 In addition to certain modifications required in existing subscriber senders, decoders, and originating markers, two new equipment elements are required for providing DDD facilities in decoder panel and No. 1 crossbar offices. These are the auxiliary sender and the auxiliary sender link. The physical appearance and functions of these new elements plus the features added in existing equipment are described in this part.

B. The Auxiliary Sender

2.02 The auxiliary sender is a wire-spring relay equipment unit, four of which may be mounted on a standard single-bay frames as shown in Fig. 1. A maximum of ten auxiliary senders (nine for traffic and one for maintenance) constitute an auxiliary sender group. It is expected that auxiliary sender groups will be installed on the basis of one per sender test frame group for ease in maintenance; however, offices with high auxiliary sender usage may require more than one group of auxiliaries per test frame group, and conversely, one group of auxiliaries may be adequate for an entire building with light auxiliary sender traffic.

2.03 The main functions of the auxiliary sender are listed below:

- (a) Registers two dialed digits, thus supplementing the 8-digit capacity of the subscriber sender to enable the customer to dial 10-digit foreign area calls.
- (b) Makes trunk test toward the distant office when dialing is completed, and when the remote incoming sender is attached, gives the subscriber sender an indication that it is ready to receive the digits registered in the subscriber sender.
- (c) Receives the digit stored in the subscriber sender on a PCI basis in the order dialed and outpulses each digit,

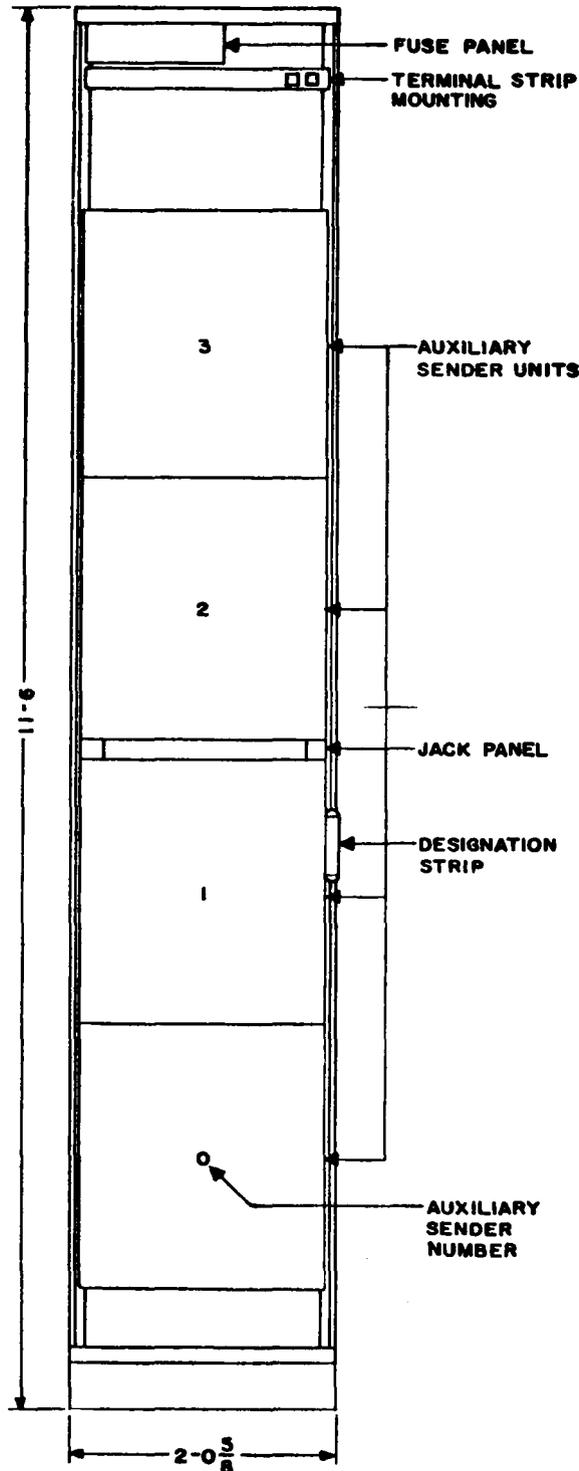


Fig. 1 - Auxiliary Sender Frame

after it is received, on an MF basis to the distant office.

(d) Notifies the subscriber sender when outpulsing is completed so that both senders may release.

2.04 An equipment sketch of an auxiliary sender frame and relation of circuits within the auxiliary sender are shown in Figs. 2 and 3, respectively.

C. The Auxiliary Sender Link

2.05 The auxiliary sender link provides the connecting path between any one of a maximum of 100 subscriber senders and their associated auxiliary senders. This frame may be partially equipped in individual units, each with capacity for ten subscriber senders and, when fully equipped, consists of ten auxiliary sender link units mounted as shown in Fig. 4. An auxiliary sender link unit is illustrated in Fig. 5 and consists of a 200-point, 6-wire crossbar

switch with associated relays. The subscriber senders appear on the verticals of the unit (two verticals per sender) and may be either the No. 1 crossbar or decoder panel type (only one type per unit). The auxiliary senders appear on the horizontals and may be multiplied over as many link units on as many link frames as auxiliary sender traffic will permit.

2.06 To provide a certain degree of service protection, the subscriber senders in the same subscriber sender group should be spread over two or more auxiliary sender link frames. Duplicate control equipment will be provided so that trouble in one frame will not affect service to subscriber senders appearing on the other link frame(s). It is also possible to split the subscriber senders on a particular auxiliary sender link frame between two groups of auxiliary senders by providing control circuits for each group. Both of these link frame features are illustrated in a typical cabling arrangement as shown in Fig. 6.

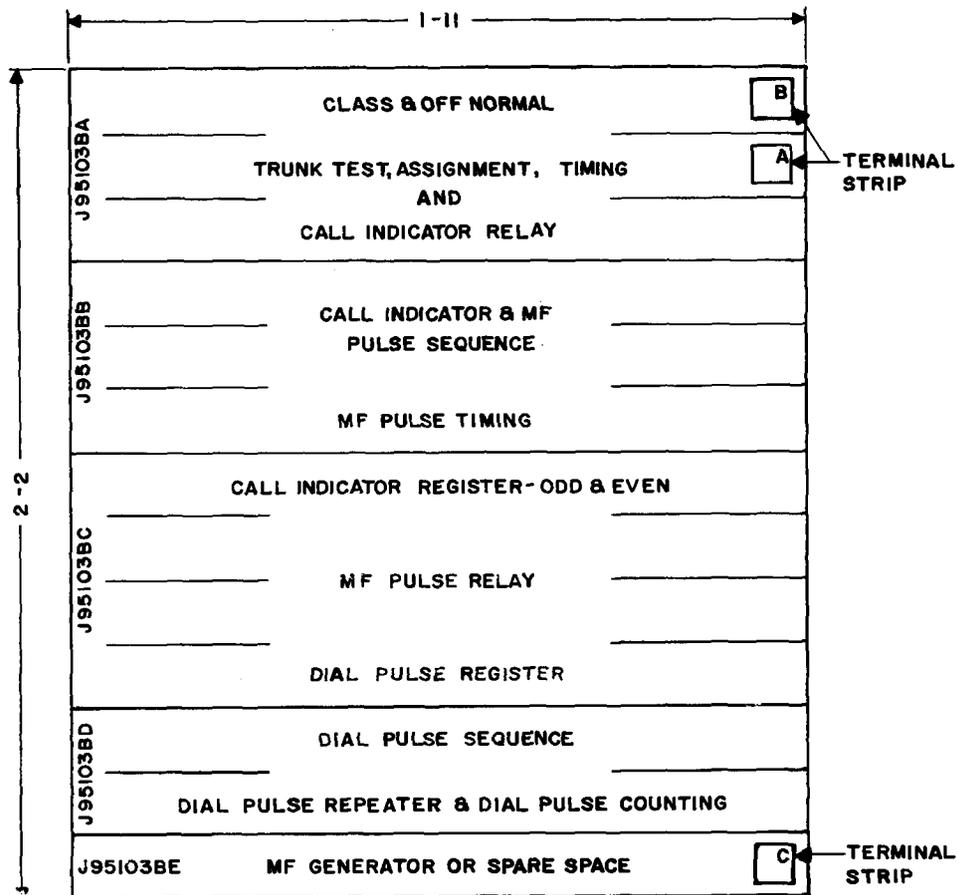
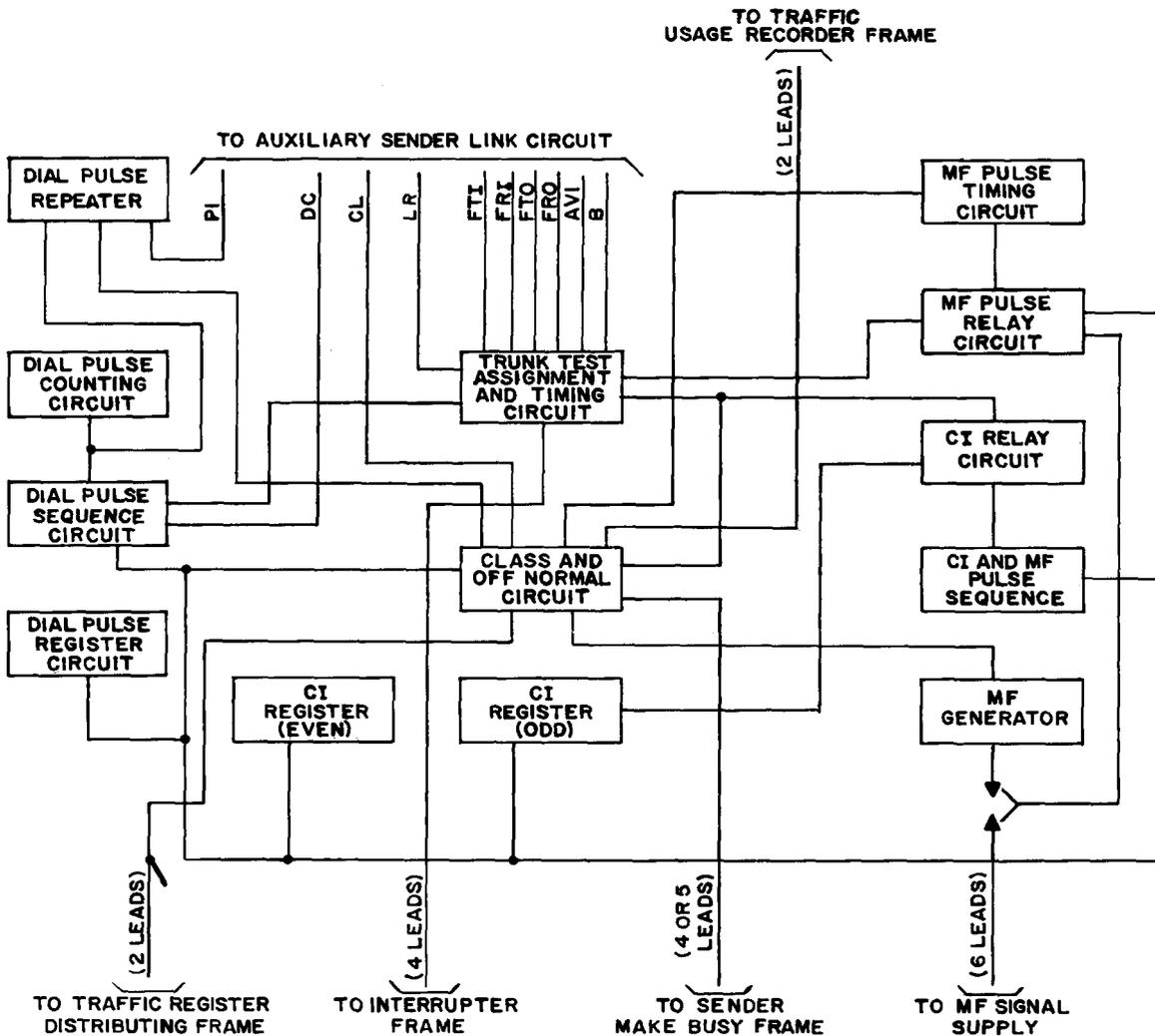


Fig. 2 - Auxiliary Sender Unit



RELATION OF CIRCUITS WITHIN THE
AUXILIARY SENDER &
RELATION OF THE AUXILIARY SENDER
TO OTHER CIRCUITS

Fig. 3 - Relation of Circuits Within the
Auxiliary Sender

D. Outgoing Trunk Circuit

2.07 In decoder panel and No. 1 crossbar offices, a momentary open occurs in the fundamental tip and ring as the district advances to talking position (trunk closure) after the subscriber sender has released. In crossbar offices, this open interval is too short to affect operation at the terminating office. In decoder panel offices, however, this interval may be long enough to appear as an abandoned call and cause false release of the MF sender at the terminating point.

2.08 The MF incoming CAMA tandem sender has a timing feature which will permit the sender to hold over this open interval on

calls from decoder panel offices. The older, non-CAMA tandem MF incoming senders and the MF incoming senders and registers in No. 1 and No. 5 crossbar offices do not have this timing feature; therefore, an outgoing trunk circuit (which maintains a bridge across tip and ring during the open interval) must be provided in decoder panel offices for those trunks to the above mentioned offices over which pulsing will be on an MF basis using the auxiliary sender.

E. The Subscriber Sender

2.09 Certain modifications have been made to existing subscriber senders in order for them to function properly with the auxiliary sender and auxiliary sender link.

2.10 Relays have been added to these senders to enable them to perform the following functions:

- (a) Recognize calls which require an auxiliary sender either through the "0" or "1" in the second digit of the foreign numbering plan area code for 10-digit calls or on instructions from the decoder or originating marker for 7- or 8-digit calls.
- (b) Tell the auxiliary sender on instructions from the decoder or originating marker, the number of digits to be deleted, if any, as explained in 3.07.
- (c) Route to overflow any 10-digit call for which an auxiliary sender is not connected in time to register the first pulse of the ninth digit.
- (d) PCI pulse its eight digits in the order dialed into the auxiliary sender instead of sending the stations digit ahead of the thousands digit as is presently done when eight digits are outpulsed PCI.

F. Decoders and Originating Markers

2.11 The decoders and originating markers have been modified to tell the subscriber sender when an auxiliary sender is required on 7-digit calls. Also, the decoders and markers will tell the auxiliary sender via the subscriber sender the number of digits to be deleted as described in 3.07.

3. METHOD OF OPERATION

A. General

3.01 This part describes the general method of operation of the auxiliary sender for both 10-digit foreign area calls and 7- or 8-digit home area calls. Since the functions and method of operation of the auxiliary sender in decoder panel and No. 1 crossbar systems are identical, only the No. 1 crossbar system will be described in detail. Block diagrams of both systems are shown in Figs. 8 and 9.

B. Ten-digit Call

3.02 A customer originating a call to a foreign area is connected to a subscriber sender in the usual manner and first dials the X 0/1 X foreign area code followed by the 7-digit directory number. The subscriber sender recognizes the "0" or "1" in the second digit as an indication that an auxiliary sender may be required to aid in the completion of the call. (Service codes in the X-1-1 series indicate only 3-digit calls which do not require use of the auxiliary sender.) After the third digit is dialed, the subscriber sender calls for

an originating marker as at present. When one is connected, it decodes the foreign area code in the same manner as a local office ABX code, completes a path to the outgoing CAMA tandem trunk, transmits to the subscriber sender the usual selection information, and releases.

3.03 Meanwhile, the subscriber sender continues to receive dialed digits and when the seventh digit is registered, it makes a bid for an auxiliary sender through the auxiliary sender link frame. Before the first pulse of the ninth digit, a connection is made to an auxiliary sender for registration of the ninth and tenth digits as they are dialed. If, for any reason, an auxiliary is not connected in time, the subscriber sender sends the call to overflow.

3.04 The auxiliary sender tells the subscriber sender when dialing is completed. The subscriber sender reacts by making PCI trunk test toward the auxiliary sender. The auxiliary then signals for a distant office sender via the subscriber sender, and when one is connected, gives the assignment signal to the subscriber sender. The eight digits in the subscriber sender are then PCI pulsed, in the order dialed, into the auxiliary sender. These digits are received in the auxiliary on either one of two dual function register circuits which are capable of receiving PCI digits and controlling the outpulsing of MF digits to the distant office. While one register circuit is receiving a PCI digit, the other register is controlling the MF outpulsing of the preceding digit and preparing to receive the next PCI digit. Since the MF outpulsing overlaps with the PCI inpulsing, this is referred to as the "overlap" method of operation. Therefore, the eight digits in the subscriber sender are MF outpulsed at the PCI rate. The two digits registered in the auxiliary sender are outpulsed at the regular MF rate.

3.05 After the eight digits in the subscriber sender and the ninth and tenth digits in the auxiliary are MF outpulsed, the auxiliary tells the subscriber sender that outpulsing is completed and both circuits release.

C. Seven-digit Call

3.06 The auxiliary sender may also be used to MF outpulse 7- or 8-digit calls. The only difference in handling this type of call compared with a 10-digit call is that the indication that an auxiliary sender is to be used comes from the originating marker rather than from the second

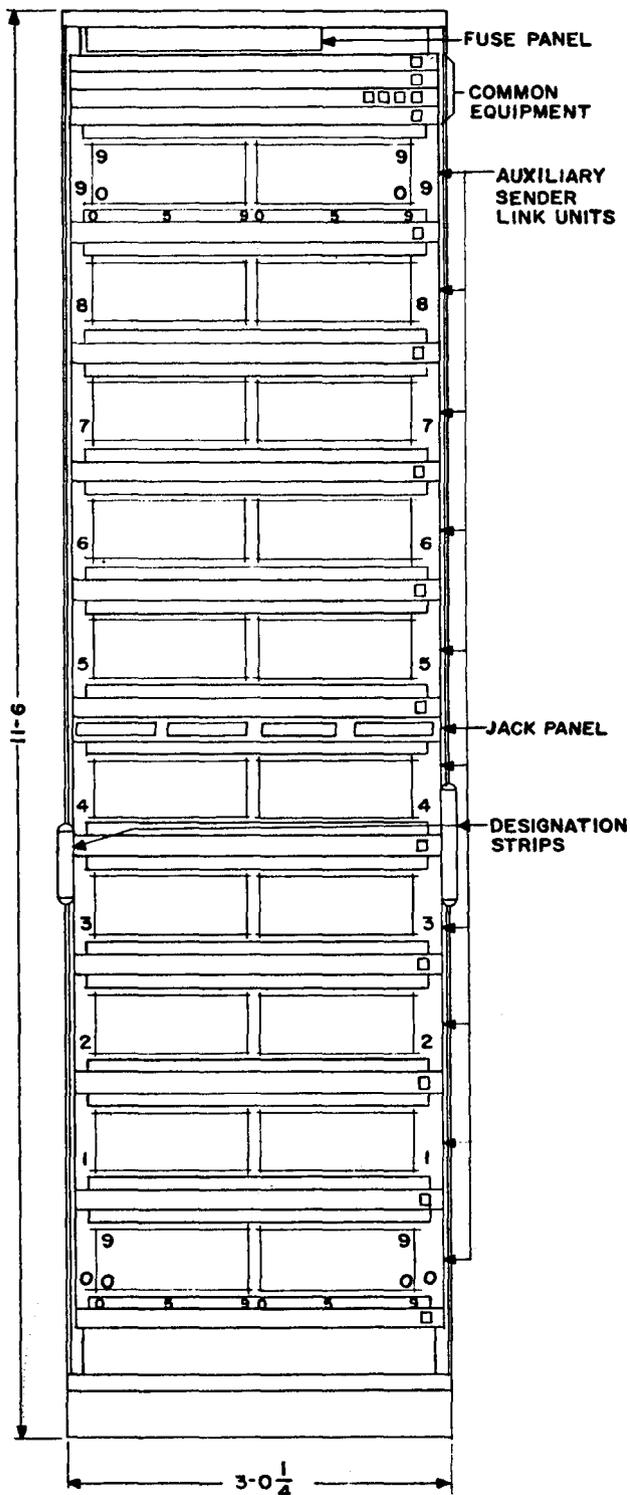


Fig. 4 - Auxiliary Sender Link Frame

dialed digit. Once the auxiliary sender is connected and a distant incoming sender is attached, outpulsing proceeds as described in 3.04.

D. Digit Deletion

3.07 There is a feature in the auxiliary sender which permits it to delete the first two (skip 2) or three (skip 3) digits received from the subscriber sender. On 7-digit calls, this feature enables the use of MF pulsing over direct trunks to No. 1 or No. 5 crossbar offices which are equipped with MF receivers and are within the charging range of the originating office. For 10-digit traffic, the skip 3 feature may be used to delete the area code on calls going into an adjacent area through a "directional" CAMA crossbar tandem office used only for calls to this particular area.

E. One-One Dialing

3.08 A "one-one" prefix may be used as a directing code for calls into an adjacent numbering plan area from panel and No. 1 crossbar offices. These calls may be routed to a "directional" CAMA tandem for recording of charge data and subsequent routing. Before development of the auxiliary sender pulsing was done on a PCI basis. This method of operation may be used in conjunction with auxiliary senders or the auxiliary may be used to outpulse "one-one" traffic on an MF basis.

F. Toll Diversion

3.09 Certain PBX trunks recognize a reverse battery signal sent back from "0" or "211" operator trunks and divert the call to the PBX attendant. An optional feature in the subscriber sender enables this diversion signal to be returned from the sender when the charge for the call exceeds a certain predetermined level. This feature will remain unchanged in that it can be applied to both 7- and 10-digit calls.

4. SERVICE OBSERVING

4.01 Facilities for service and complaint observing of 10-digit calls will be provided at the CAMA tandem office as outlined in Section 960-310-100 CAMA - Operator Identified - Crossbar Tandem Office. Observing of home area calls outpulsed by the auxiliary will be accomplished through the usual line observation methods in the local office.

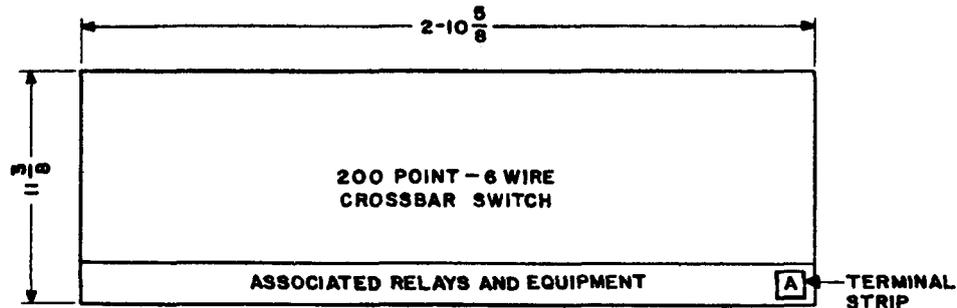


Fig. 5 - Auxiliary Sender Link Unit

5. TRAFFIC MEASURING FACILITIES

5.01 Connections to the following traffic measuring facilities have been provided in the auxiliary sender development:

- (a) 10-digit call peg count - one per group of auxiliaries.
- (b) 7-digit call peg count - one per group of auxiliaries.

5.02 The design of the auxiliary sender has anticipated the use of the traffic usage recorder through the provision of two leads. One lead indicates a sender busy for any reason, that is, normal call, test call, or plugged busy. The other lead indicates a sender plugged busy only.

6. POWER

6.01 The auxiliary sender and auxiliary sender link will require only the usual 48-volt signal power source. The multifrequency supply may come either from a building MF supply or from an optional transistor oscillator MF generator in each auxiliary sender.

7. MAINTENANCE AND TESTING

7.01 The maintenance and testing features included in the auxiliary sender development are discussed in this part.

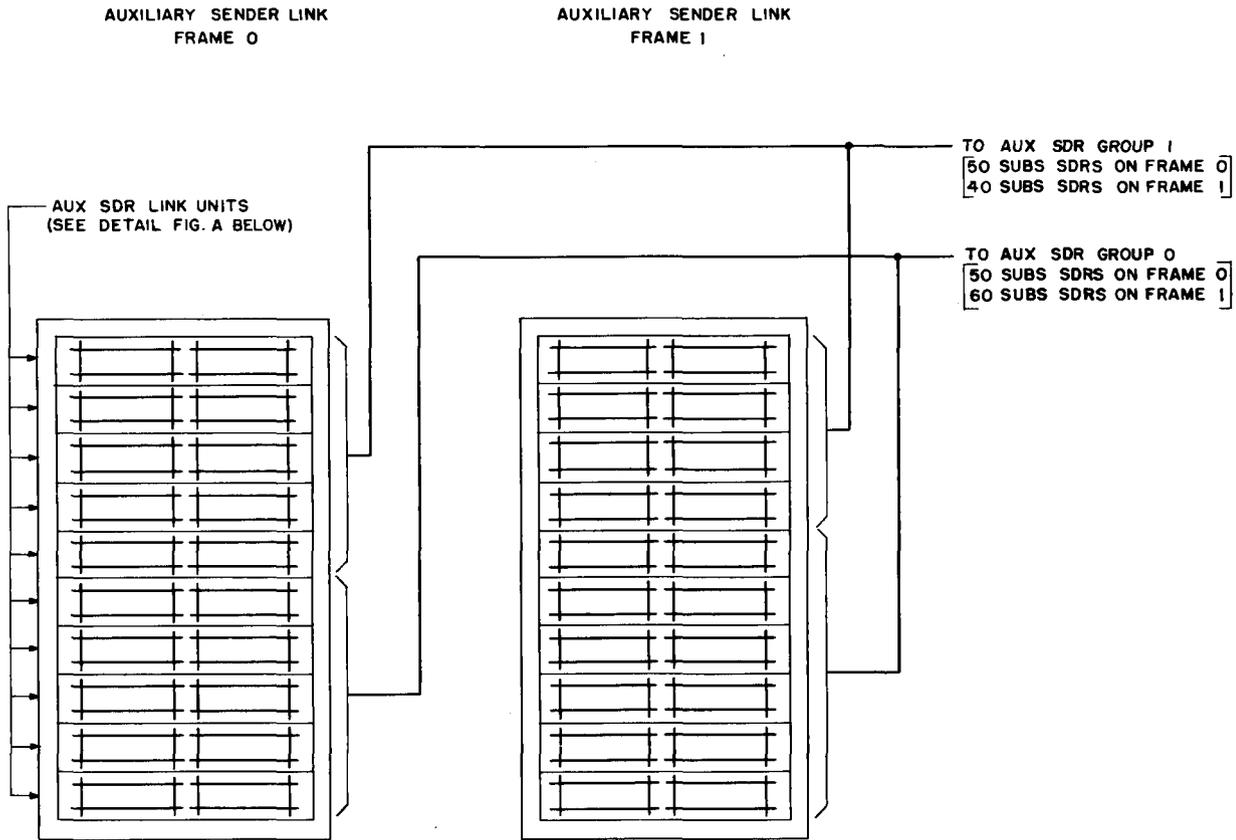
7.02 There will be a make-busy jack, a cancel-timed release (CTR) key, and a busy lamp per auxiliary sender mounted on the subscriber sender make-busy frame. The CTR key, when operated, will cancel the timed release feature of the auxiliary and stick it with the subscriber sender involved

providing the CTR key associated with the subscriber sender is also operated. Under this stuck sender condition, the outgoing trunk will be held by the auxiliary sender. A circuit feature will prevent any more than one stuck auxiliary sender per group to be held at one time. The busy lamp will light when the sender is busy and change to a flash for a stuck sender condition. In addition, a stuck sender register will operate and a single bell tap alarm will sound for each sender that times out, accompanied by a minor alarm if a sender is held in the stuck condition. In buildings where a group of auxiliary senders serves subscriber senders in more than one test frame group, the removal from service of auxiliary senders in this group will be under the control of one test center designated the master test center, which will have the only appearance of the busy jacks and CTR keys associated with these auxiliaries. The auxiliary sender busy lamp will appear in all test centers with access to the particular group of auxiliary senders. Therefore, heavy traffic conditions or an excessive number of auxiliary senders made busy in the auxiliary sender group are apparent before any testing is attempted.

7.03 A minor load alarm will sound whenever an all-auxiliary-sender busy condition has existed for more than 15 to 30 seconds. This alarm will be locked in and will be accompanied by an all-auxiliary-sender busy lamp appearing on the sender make-busy frame.

7.04 An auxiliary sender link minor alarm will sound whenever a subscriber sender is unable to reach an auxiliary sender due to conditions other than all-auxiliary senders busy. This alarm can only be retired by operation of a key at the link frame itself.

7.05 Several timing features are incorporated in the auxiliary sender to



NOTE: WHERE AN AUXILIARY SENDER GROUP SERVES SUBS SDRS ON MORE THAN ONE LINK FRAME, CONTROL EQUIPMENT FOR THIS GROUP IS PROVIDED ON EACH FRAME SO THAT A LINK TROUBLE ON ONE FRAME WILL NOT AFFECT SERVICE TO SUBS SDRS ON OTHER FRAMES SERVED BY THE SAME GROUP OF AUXILIARIES.

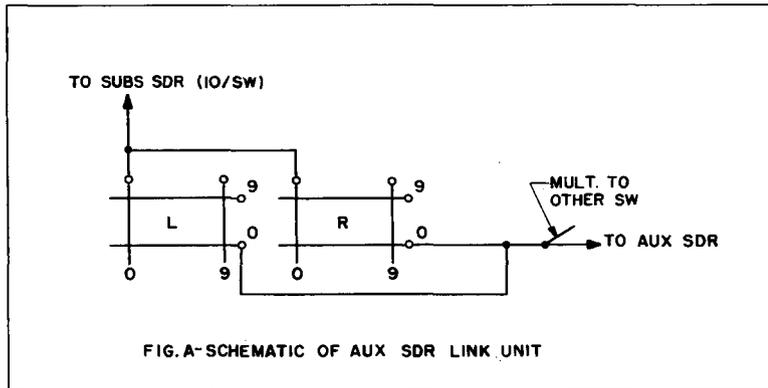


Fig. 6 - Typical Auxiliary Sender Link Frame Cabling Arrangement

STAGE OF CALL	INTERVAL IN SECONDS	BEGINS	ENDS	CLASS OF CALL	EFFECT OF TIMEOUT	REGISTER	REMARKS
CUSTOMER DIALING 8TH AND 9TH DIGITS	6-12	AUX SDR SEIZURE	FIRST PULSE OF 9TH DIGIT	10 DIGIT	STUCK SUBS AND AUX SDRS (SEE NOTE)	STUCK SENDER	
CUSTOMER DIALING 10TH DIGIT	6-12	LAST PULSE OF 9TH DIGIT	FIRST PULSE OF 10TH DIGIT	10 DIGIT	STUCK SUBS AND AUX SDRS (SEE NOTE)	STUCK SENDER	
SEIZURE OF DISTANT OFFICE SDR	6-12	COMPLETION OF DIALING BY CUSTOMER	DISTANT OFFICE SDR ATTACHED	10 DIGIT	STUCK SUBS AND AUX SDRS (SEE NOTE)	STUCK SENDER	
SEIZURE OF DISTANT OFFICE SDR	6-12	AUX SDR SEIZURE	DISTANT OFFICE SDR ATTACHED	7 DIGIT	STUCK SUBS AND AUX SDRS (SEE NOTE)	STUCK SENDER	
OUTPULSING NUMBER TO DISTANT OFFICE	6-12	DISTANT OFFICE SDR ATTACHED	COMPLETION OF MF OUTPULSING BY AUX SDR	10 DIGIT 7 DIGIT	STUCK SUBS AND AUX SDRS (SEE NOTE)	STUCK SENDER	APPROX 1 SEC AFTER TIMEOUT DISTANT OFFICE SDR IS RELEASED
STUCK SDR TO AUTOMATIC TIMED RELEASE	6	STUCK AUX SDR	RELEASE OF SUBS AND AUX SDRS	10 DIGIT 7 DIGIT	—	—	SEE NOTE

NOTE:

ONLY THE FIRST AUXILIARY SENDER TO STICK WILL BE HELD ALONG WITH THE ASSOCIATED SUBSCRIBER SENDER, PROVIDING THE (CTR) KEYS OF BOTH SENDERS ARE IN THE "CANCEL TIMED RELEASE" POSITION. SUCCEEDING STUCK AUXILIARY SENDERS WILL AUTOMATICALLY TIME OUT AND RELEASE, THE CUSTOMER RECEIVING OVERFLOW TONE.

Fig. 7 - Auxiliary Sender Timing Functions

prevent excessive use through slow customer dialing and to release the call in the event of trouble conditions which may prevent satisfactory completion of outpulsing. These timing functions are shown in table form in Fig. 7.

7.06 All testing of the auxiliary sender will be done by the subscriber sender test frame. This circuit will simulate

7- and 10-digit calls and provide for testing any particular auxiliary sender with any subscriber sender associated with the same auxiliary sender group. A test failure will stick the test circuit, sound a minor alarm, and indicate through call progress lamps the stage of the call at which the failure occurred. Remote control operation of the test frame is provided both at the auxiliary sender bays and the auxiliary sender link frame.

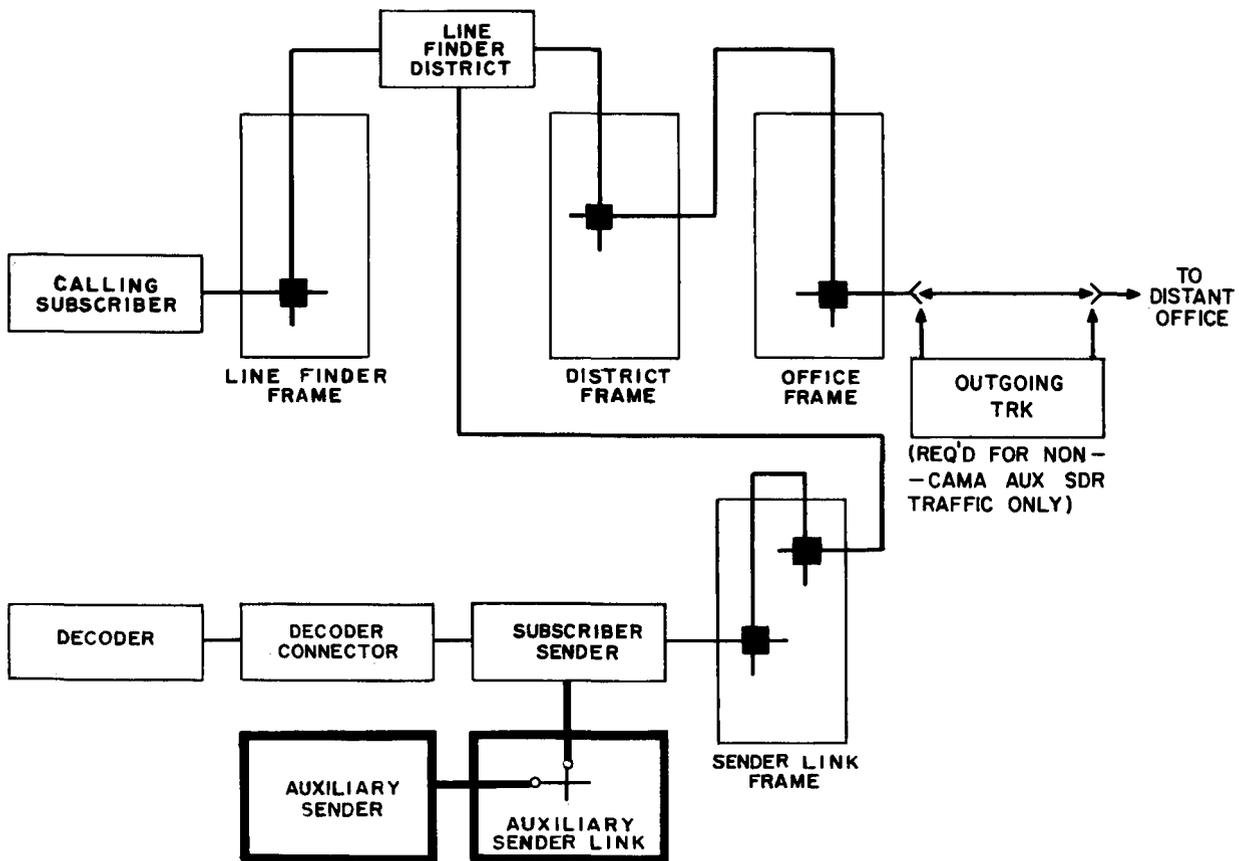


Fig. 8 - Diagram of Auxiliary Sender Applied to Decoder Panel Equipment

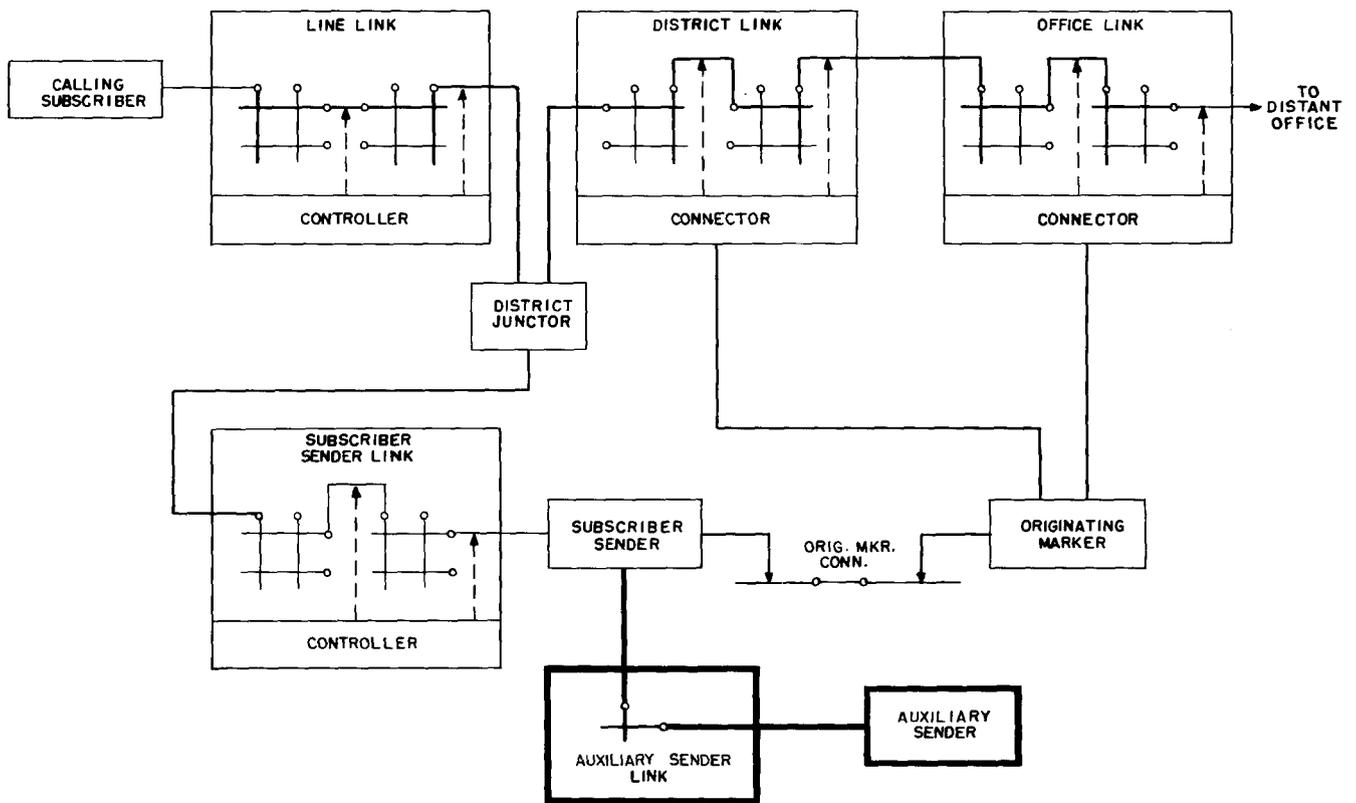


Fig. 9 - Diagram of Auxiliary Sender Applied to No. 1 Crossbar Equipment