DETAILED CIRCUIT OPERATION

COMPLETING CALLS TO TX SWITCHBOARD POSITIONS

NO. 4A TOLL SWITCHING OFFICES

CONTENTS

1. GENERAL

1.01 This is one of a group of sections having the base number A828.121. These sections describe the detailed circuit operations of the 4A Toll Switching System.

1.02 This section describes the circuit operations necessary for completing TX calls. Such calls are routed over TX trunks to particular switchboard positions called TX positions. One TX operator number is assigned to a team of three or four operators attending TX switchboard positions. This number can be a 1-, 2-, or 3-digit number. In addition to other duties, the operators attending TX positions make attempts to complete toll calls which have been delayed because the called party is not available.

1.03 Two types of TX calls are included in this description: (1) calls to TX operators which are initiated by a calling subscriber and (2) calls to TX operators which are initiated by a called subscriber. In addition this section describes the different operations required on either of the above types of TX calls due to the use of 1- 2- or 3-digit TX operator postion numbering, or when the use of a "digit absorbing" trunk is required.

1.04 The following is a brief description of a TX call initiated by a calling subscriber. Suppose subscriber A (South Bend) calls long distances and an outward operator attempts to complete his call to subscriber B (Kokomo). If there is no answer, the operator asks if she should try to complete the call in 20 minutes. If subscriber A says that he will be out for awhile and will try later, the operator says that he should call operator 52 when he is ready to make the call again. The original ticket for the call is then sent to one of the TX operators with the number 52. She holds the ticket, awaiting subscriber A's subsequent attempt to complete the call. When subscriber A wishes to try the call again he dials 211 to get long distance in the regular manner and then asks for operator 52. The outward operator seizes a manual interposition trunk to connect subscriber A to a TX operator with the number 52. (See Fig. 1.) The TX operator verifies the call with subscriber A, locates the ticket for the call and completes the call to subscriber B by seizing a tandem trunk and keying the called subscriber number.

1.05 The following is a brief description of a TX call initiated by a called subscriber. Suppose subscriber B (Kokomo) places a person-to-person call to subscriber A (South Bend). Assume that called subscriber A is out and that the person who answers his phone at South Bend is not sure when subscriber A will return. The operator suggests to subscriber B that she request subscriber A to call when he returns. If this is all right with subscriber B, the operator then leaves a message for subscriber A to call operator 3 in Kokomo when he returns. The ticket for the call is then sent to operator 3 at Kokomo. This call differs from the call in the previous example in that the called subscriber (instead of the calling subscriber) initiates the subsequent attempt (TX call).

1.06 When subscriber A returns and wishes to answer the call, he dials 211 to reach long distance (South Bend operator)

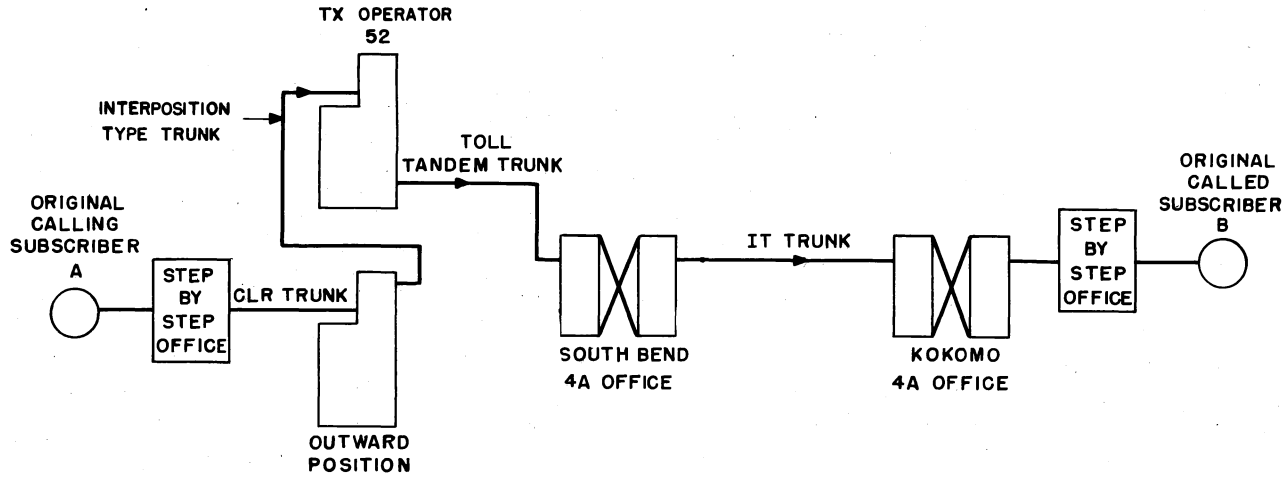


FIG.1— TX CALL INITIATED BY CALLING SUBSCRIBER

in the regular manner, and asks operator 3 at Kokomo. As indicated on Fig. 2, the South Bend outward operator seizes a toll tandem trunk and keys Kokomo's toll center code and the TX code. The toll center code is a 3-digit code assigned to a particular toll center. Its purpose is to enable the distant toll operators to originate TX and service calls to the particular office. The TX code consists of the TX operator code preceded by 11. Thus the TX code in this case is 113. The Kokomo TX operator completes the call by seizing a direct switching trunk to the step by step office and keying the telephone member for subscriber B.

1.07 The above examples illustrate the basic types of TX calls. The switching problems involved in handling 1-, 2- or 3-digit TX codes, variable skip control, etc., which are described in later paragraphs, are equally applicable to both basic types of TX calls. Note that TX codes always contain a 1-, 2- or 3-digit TX operator number preceded by 11. A TX code like 1138 is referred to as a 2-digit TX code.

1.08 From a plant operating standpoint any 1-, 2- or 3-digit number can be used as a TX operator number. However, the numbers 0, 00 to 09 and 000 to 099 are

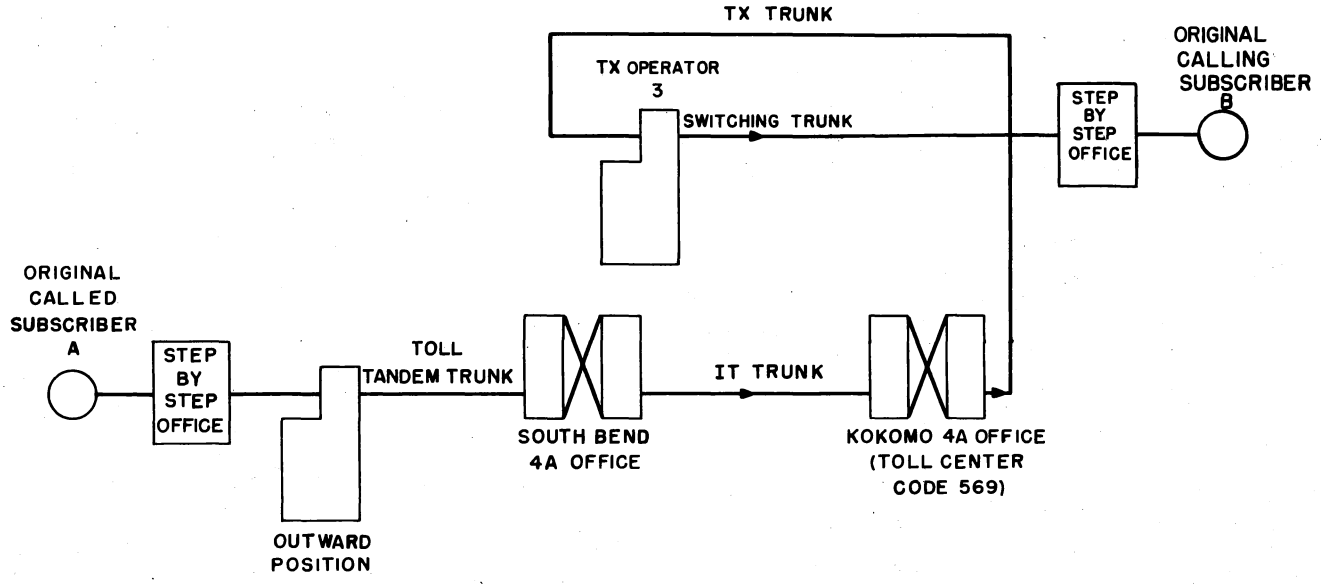


FIG.2 - TX CALL INITIATED BY CALLED SUBSCRIBER

not used because they are considered undesirable from a traffic standpoint.

1.09 Wiring options in the incoming senders (shown on OS 124-1, 136-1, 162-1 and 194-1) are provided so that any particular 4A office can be arranged to handle either 1-, 2- or 3-digit TX codes, or a combination of 2- and 3-digit TX codes. When 2- and 3-digit TX numbering is used in the same office, care must be taken to avoid code conflicts. That is, 2-digit codes 20 to 99 and 3-digit codes 100 to 199 may be used in the same office, provided the correct wiring options are connected in the incoming senders. Two-digit codes 10 to 19 could not, however, be used in this office since they would conflict with 3-digit codes 100 to 199. The important thing to remember is that a 2-digit code must not duplicate the first two digits of any 3-digit code.

1.10 Fig. 3 illustrates applications of 1-, 2- or 3-digit TX codes and of a digit absorbing trunk. As previously stated, these examples are applicable to both basic types of TX calls shown in Figs. 1 and 2.

1.11 The notes on Fig. 3 list the cards and their key functions for completion of TX calls as follows:

Example (1). Incoming call to a 2-digit TX trunk (operator 52) at a 4A office.

Example (2). Call to a one-digit TX trunk (operator 3) at distant 4A office in same area.

Example (3). Call to a 3-digit TX trunk (operator 329) at a distant 4A office in a foreign area.

Example (4). Same call as Example 3 except that the intertoll trunk to the distant area is selected from an AR card.

1.12 The two zeros required to drop the 115-200 card (see Fig. 3, Example 1) are provided by the sender when the CA4A relay operates indicating the call is to a 2-digit TX operator. The zero required to drop the 113-290 card (Examples 3 and 4) is similarly supplied by the sender when the CA5A relay operates indicating a call to a 3-digit TX operator. These extra digits are provided to convert the TX codes containing 4 or 5 digits (including the 11 prefixed) to 6-digit codes so that the card translator can drop a 6D card.

1.13 When a call is placed to a TX operator in a foreign area, the TX code may be preceded by both the area and the toll center code. In Example 3 of Fig. 3 the 317-891-6D card is used (at South Bend) to select an Indianapolis trunk. This card carries an SK6 mark; consequently the South Bend sender pulses forward only 11329 to Indianapolis, resulting in the selection of a trunk to TX position 329 at Indianapolis.

1.14 Example 4 of Fig. 3 assumes that there are more than 40 South Bend trunks and that the 317-891-6D card carries RR (relay-to-relay) routing instruction. It is further assumed that all trunks on the 317-891-6D card are busy and that an Indianapolis trunk is selected from an AR card. AR cards do not carry any enlarged variable spill punches. The decoder uses code matching to determine the variable spill information, as described in Section A828.121.3. The code matching process cannot provide an SK6 indication, but in this case provides an SK3 which results in the South Bend sender pulsing forward 891-11329. This makes it necessary to provide some means of absorbing the extra three digits (891) at Indianapolis.

1.15 The digit absorbing trunk (see Fig. 3, Example 4) is provided for this purpose. Actually, this trunk does not absorb the extra digits, but provides a means of switching the call through the Indianapolis 4A office a second time so that the 891 digits are eliminated by using the SK3 feature in the first sender used at Indianapolis. The TX operator's connection completing the call to the subscriber is not shown on Fig. 3.

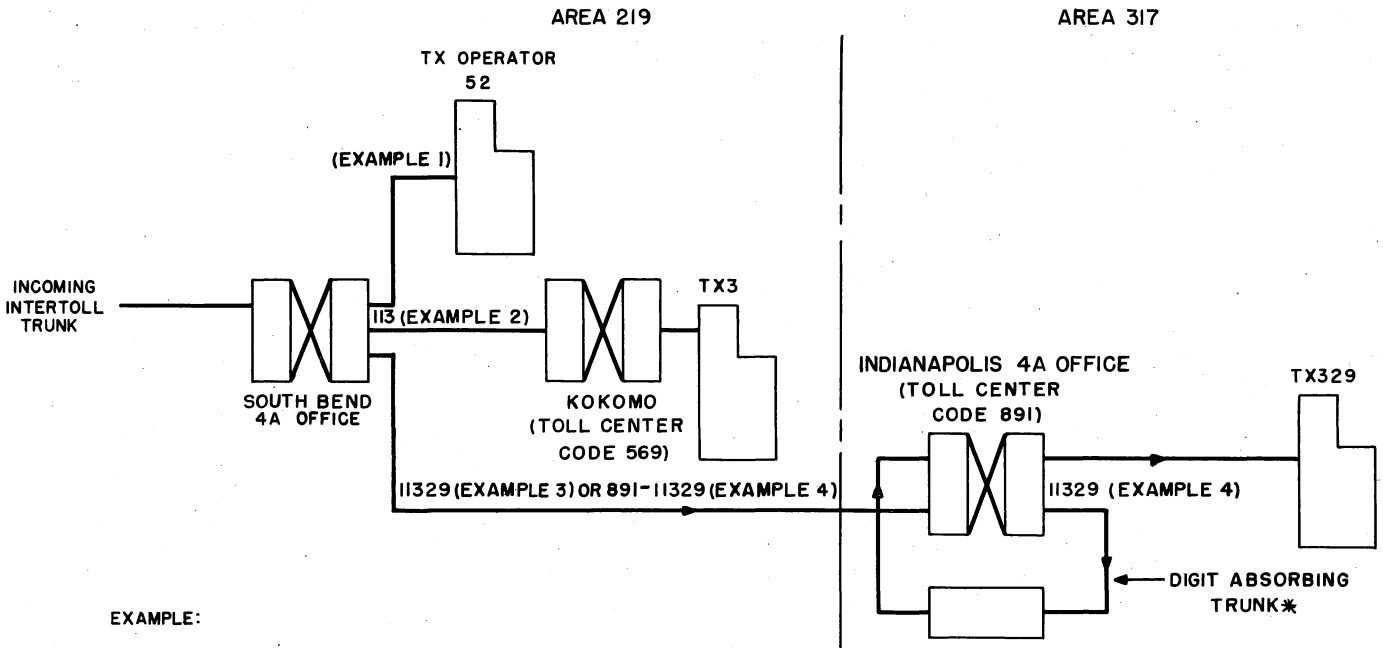
2. DETAILED DESCRIPTION

(A) One-Digit TX Call

2.01 In Example 2 shown on Fig. 3, the South Bend operator keys 569-113 to reach TX operator 3 at Kokomo. The South Bend 4A office uses the 569-3D card to select a Kokomo trunk on a 3-digit translation basis. This card is punched SK3; consequently the South Bend sender sends only the 113 code to Kokomo. The call is completed at Kokomo directly from the 113 card in the same manner as any other 3-digit translation call. The Kokomo 4A office must have individual 3D cards for each 1-digit TX code (max. 9) i.e., 111, 112, 113 to 119.

(B) Two-Digit TX Call

2.02 Example 1 on Fig. 3 illustrates a call received on an incoming intertoll trunk for South Bend TX operator 52. For the purposes of this illustration it is assumed that only 1152 is pulsed forward to the South Bend office. The sender, when it has registered 115, causes an idle decoder to be seized, via the decoder connector, as described in (C) and (D) of Section A828.121.2.



EXAMPLE:

INCOMING CALL FOR TX OPERATOR 52 AT SO. BEND.
1152 IS RECEIVED AT SO. BEND.
CARD 115-3D: CA4 DIRECTS DECODER TO BOX CONTAINING 6D CARD.
CARD 115-200-6D: SELECTS TX TRUNK, SK6.

2. SO. BEND TO REACH KOKOMO TX OPERATOR 3, KEYS 569-113.
CARD 569-3D (SO. BEND): SELECTS KOKOMO TRUNK; SK3.
CARD 113-3D (KOKOMO): SELECTS TRUNK TO TX OPERATOR 3, SK3.

3. SO. BEND TO REACH INDIANAPOLIS TX OPERATOR 329 KEYS 317-891-11329
CARD 317-3D (SO. BEND): CA6-DIRECTS DECODER TO BOX CONTAINING 6D CARD.
CARD 317-891-6D (SO. BEND). SELECTS INDIANAPOLIS TRUNK WITH RR ROUTING INTR.; SK6; SENDER OUTPULSES 11329. >
CARD 113-3D: CA5 DIRECTS DECODER TO BOX CONTAINING 6D CARD.
CARD 113-290-6D: SELECTS TRUNK TO TX OPERATOR 329; SK6.

4. NO TRUNK AVAILABLE ON 317-891-6D CARD; INDIANAPOLIS TRUNK SELECTED ON AN AR CARD. CODE MATCHING PROVIDES SK3, SENDER OUTPULSES 891-11329. >
CARD 891-3D: CA6 DIRECTS DECODER TO BOX CONTAINING 6D CARD.
CARD 891-113-6D: SELECTS DIGIT PULSE ABSORBING TRUNK SK3.
CARD 113-3D: SAME CARD AS SHOWN IN EXAMPLE 3 ABOVE.
CARD 113-290-6D: SAME CARD AS SHOWN IN EXAMPLE 3, ABOVE.

* THE CODE MATCHING PROCESS USED FOR PROVIDING THE VARIABLE SPILL INFORMATION ON AN AR CARD PROVIDES ONLY FOR NSK OR SK3. THIS RESULTS IN THE "HOME TOLL CENTER CODE" BEING SENT FORWARD TO INDIANAPOLIS. THE DIGIT ABSORBING TRUNK SWITCHES THE CALL BACK THROUGH THE 4A SYSTEM ON A SK3 BASIS TO ABSORB THE UNNECESSARY DIGITS (891).

FIG. 3 - COMPLETING A CALL TO A TX TRUNK.

2.03 When the decoder is attached, it causes the 115-3D card to drop in the home translator. This card is punched CA4. The decoder, therefore, reading the card, causes the CA4 relay to operate, (OS 164-1) followed by operation of relays CAK and DRL, ARC and RLT (OS 166-1). With the above relays operated the decoder grounds leads CA4 and DRL to the sender (OS 136-1), causing relays CA4, CA4A, CA5A and DRL to operate in the sender. Relay DRL in the sender releases relay MS2, and in addition opens the start lead to the decoder connector, causing the release of the decoder. It may be noted here, by analysis of OS 136-1, that pretranslation always takes place on 2- or 3-digit TX calls. This is necessary because the CA4A (or CA5A) relay in the sender must operate in order for the sender to manufacture the extra one or two zeros for sending to the decoder (OS 162-1).

2.04 Operation of the DRL relay in the sender starts the release of slow-releasing relay DRL1 (OS 136-1) which upon release again closes the start lead to the decoder connector. Assuming that the D digit (2) is now registered in the sender, relay DDR operates (OS 135-1), completing the path for reoperating relay MS2 which again connects battery to the decoder connector start lead, causing seizure of a decoder.

2.05 The decoder again drops the 115-3D card and reads the translator box number which contains the 115-200-6D card. The decoder now causes its home translator to restore the 3D card, releases the home translator, and seizes the decoder foreign area translator which drops the 115-200-6D card as in any other pretranslation call.*

* In the majority of cases the 6D TX cards are in the home box. In these cases the decoder causes the home translator to restore the 3D card and drop the 6D card. The home translator is not released.

2.06 The A, B, C and D digit code bars in the decoder foreign area translator are operated from the sender input information. The code bars for the two zeros in the E and F digits are operated over leads E4B, E7B, F4B and F7B which are grounded at the make contacts of relays CA4A and CA5A (OS 162-1). The code grouping bars CG2 and CG4 (6D) drop in the same manner as for any other 6-digit translation call.

2.07 The 115-200-6D card is punched with the necessary trunk block information for routing the call to the trunk group for TX position 52 and the following additional information.

Position Punched	Output Information
TC	TX trunks appear on TC outgoing frames
RIO,RI4	Follow with reorder
SK6	Skip 6
CLTO,CLU4,7	Manual class
CDCO,CDC2	Sender expects no digits other than 4-digit code and cancel loop continuity test.
CCHN,CCTN,CCUN	No code conversion
TS-	As assigned

2.08 When the marker has established the connection to a trunk for TX operator 52, it passes the necessary information back to the sender and releases.

2.09 The manual class mark enables the incoming sender to complete its SL check immediately upon receipt of the ST (start pulse) signal (OS 139-1). The manual class mark also prevents the operation of the OP and OP1 relays (OS 140-1), which in turn prevents the release of relay MS1. This permits the sender to operate relays AV and AV1 and thereby release from the connection after completion of the SL check.

2.10 The cancel delayed loop closure indication performs no function on this call other than to permit the marker to complete its RCK check (OS 197-1), since the loop continuity test is not effective on manual class calls (LPD relay normal, OS 216-1).

2.11 No attempt is made here to describe the operation of the TX trunk itself, since TX trunks terminate on numerous types of toll switchboards and relay equipments. This description is based on SD-68304-01, TX Trunk to 3CL Switchboard.

2.12 Operation of the trunk SL relay, on completion of the sender SL check described above, causes the incoming trunk lamp to light. When the TX operator answers the line, the lamp is extinguished; and an off-hook signal is returned to the calling operator.

(C) Three-Digit TX Call

2.13 Example 3 of Fig. 3 illustrates a call to Indianapolis TX operator 329. The South Bend sender pulses 11329 forward to Indianapolis. When the Indianapolis

sender has registered 113, a decoder is selected which in turn drops the 113-3D card in its home translator. This card carries a CA5 (come again 5) mark, and thus pretranslation takes place as described above for the 2-digit TX call. In this case, however, the second decoder seizure occurs when the Indianapolis sender has registered five digits (11329) and the sender supplies a 0 for the F position only (OS 162-1).

2.14 When the second decoder has again read the 113-3D card to determine the location of the 6D card (113-290), it restores the 3D card and drops the 6D card as described for the 2-digit TX call. The remainder of the operation is the same as described for the 2-digit TX call.

(D) Digit Control

2.15 The 115-200-6D card used on the 2-digit TX call previously described had the continuity and digit control punches CDC0 and CDC2 enlarged. This caused the ODG relay in the marker to operate (OS 194-1), closing through the ODG lead from the marker to the sender.

2.16 The MF senders used on the calls described in this section do not require digit control since the ST pulse sent by the calling operator informs the sender that impulsing is completed. The MF sender merely places 48-volt resistance battery back to the marker over the ODG lead to enable the marker to complete its integrity check of the lead (OS 194-1).

2.17 The DP incoming sender, however, does use the digit control information. OS 194-1 shows how the ODG lead is shifted from the GPS to the FPS relay by the CA5A relay to accommodate for 3-digit TX codes, or to the EPS relay when both the CA4A and CA5A relays are operated, to accommodate for the 2-digit TX codes. It should be noted on OS 136-1 that the CA5A relay is operated on both 2-digit and 3-digit TX calls.

(E) Digit Absorbing Trunks

2.18 As mentioned in Pars. 1.14 and 1.15, the toll center code is spilled forward to a distant office when a TX, 121, 151 etc., call is sent to the distant office over a trunk selected from an AR card.

2.19 The 3-digit home toll center card 891-3D (see Fig. 3, Example 4) could be used to select a digit absorbing trunk; however, if this were done, a digit absorbing trunk would be required on every call on which the home toll center code is received.

2.20 By using 6-digit translation on these calls it is necessary to use the digit absorbing trunk only on 2- and 3-digit TX calls, for example:

The 891-121-6D card contains	121 trunks (SK6)
The 891-151-6D card contains	151 trunks (SK6)
The 891-113-6D card contains	Digit absorbing trunks and SK3

2.21 The first two cards contain direct trunks to the 121 or 151 operator because the complete code is included in the six digits. The third card cannot contain TX trunks because the complete TX code is not represented. This card selects a digit absorbing trunk and carries an SK3 mark. The incoming sender (see Fig. 3, Example 4) spills 11329 to the second incoming sender at Indianapolis which is seized by the digit absorbing trunk. From this point the TX call is handled in the same manner as described for the 3-digit TX call.

2.22 Referring again to Fig. 3 it will be noted that no digit absorbing trunk is shown at Kokomo. Kokomo does not require digit absorbing trunks because the one-digit TX codes can be handled directly from the 6D card as described for service codes 121, etc. The digit absorbing trunk at South Bend is omitted from the drawing to conserve space.