# PBX - AIOD-A2
# GENERAL DESCRIPTION

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## 1. GENERAL

1.1 The purpose of this section is to provide an introduction to the circuits and equipment of the PBX-AIOD-A2 and to provide some technical background to assist in troubleshooting.

1.2 Automatic identified outward dialing (AIOD) is central office equipment providing the PBX centrex system with an automatic means for identification of a station or attendant making a direct dialed outward toll call. The AIOD system stores in memory the 4-digit number of the calling station or attendant for later use by the automatic message accounting (AMA) facility.

1.3 Prior to the PBX-AIOD facility, station identification for any outward toll call required the intercession of an operator at a centralized automatic message accounting (CAMA) office. This method of identified outward dialing (IOD) was necessary because the identity of the calling PBX station or attendant was not available to the central office equipment.

1.4 The PBX-AIOD-A2 uses 101 ESS type circuit packs.

1.5 For a description of the logic elements, symbology and signals defined, refer to CD-1C234, Section II, Paragraph 1.

1.6 For other general information refer to the BSP 951-332-100.

## 2. SYSTEM FOR AIOD SERVICE

2.1 Figure 1 shows a block diagram of PBX-AIOD-A2 connections to the PBX and to the Central Office.

2.2 On each Central Office call from the PBX, regardless of whether it is a charge call or not, the PBX-ANI will identify the calling party by the last four digits of his directory number (Station Number). The PBX trunk used for the call is also identified by the PBX-ANI via trunk's C.O. assigned 4-digit number. These two numbers are transmitted via a dedicated trunk (Data Trunk) to Central Office AIOD equipment and the AIOD-A2 registers the Trunk and Station Numbers, generates a 1-digit Data Link Number, and stores these three numbers in Memory using the Trunk Number as a store address. The receipt and storage of Identification Data by the AIOD is referred to as a PBX Request.

2.3 Should the call be a charge call (toll or message rate) the AMA equipment needs the billing information that the AIOD has stored in Memory. The AMA equipment (or the central office ANI) identifies the trunk of the calling party. Then, using the number assigned to this trunk at the C.O., the AMA Equipment requests the billing information from the AIOD frame. The request is passed to the AIOD frame through the AIOD Translator Connector and the AIOD Translator. The Station

Number and Data Link Number associated with the Trunk Number are retrieved from Memory. The Data Number is translated to a 1 out of 30 (1/30)Office Index. The Station Number and Office Index are transmitted to the AMA equipment to be used for billing purposes. This request is a NIR (Number Identification Request) or a Central Office Request.

3. AIOD-A2 ELEMENTS

3.1 Data Link Connector Circuit - This circuit provides a gating circuit to allow a connection to be made from one PBX at a time to the Station Identification Store and Control Circuit. It translates the data trunk appearance to a 2 out of 5 coded Data Link Number and sends this number to the Station Identification Store and Control Circuit. It also provides for access by the Station Identification Test Circuit.

3.2 Station Identification Test Circuit - This circuit provides for (a) simulating a PBX Request, (b) simulating a Central Office Request (Number Identification Request). (c) entering a Number Change, (d) monitoring the progression of a call through the SIS & C Circuit, and (e) monitoring the SIS & C Circuit for various types of trouble conditions.

3.3 Station Identification Store and Control Circuit (SIS & C) - This circuit provides for receiving the Station Identification Data pertaining to PBX trunk usage from the PBX, storing it in Memory, and transmitting it on request from the Central Office. The subsystems as shown in Figure 2 are:

3.301 Traffic Regulator - This circuit allows the SIS & C to function on only one request at a time, PBX or NIR.

3.302 Data Receiver - This circuit consists of:

(a) A Demodulator to convert the Frequency Shift Keying Signals of 1150 Hz and 1850 Hz to logical 0's and 1's respectively (a "0" being ground and a "1" being +6 or +12 volts). This is necessary for the Identification Data to be used by other subsystems of the SIS & C.

(b) A Receiver Clock Circuit that generates a bit frequency of 735.29 pps (a pulse every 1.36 ms). This is the incoming bit frequency of the data from the PBX. These pulses are used to shift the data into the Central Register.

3.303 Central Register and Control - This circuit contains 45 flip-flops set up as a serial shift register. Information is written into the Central Register in both serial and parallel form. When writing information in serial form, data is put on the TC and TS leads and then shifted from one stage to the next by clock pulses. When data is written in parallel form, all the flip-flops are set in a 2/5 pattern by applying a "1" to the appropriate S leads. The circuit is used as a temporary location for the Identification Data as it is shifted into and out of Memory.

3.304 Memory - The Memory consists of an integrated circuit static shift register memory arranged to store 10,254 bits accurately at a 1 MHz rate. With 6 bits of information contained in other shift registers, this memory can store a maximum of 228 45-bit words. The data passes through the output flip-flops (MO, MOL1, MOL2, MOL3, and MOL4) and is looped through the Steering Gates to the input flip-flop (MI). This closes a path so the data continuously circulates in Memory. The output flip-flops are needed to monitor the information that is circulating in Memory.

3.305 Steering Gates - These gates control looping of the Memory looping of the Central Register, transfer of information from the Central Register to Memory, transfer of information from Memory to the Central Register, and from the Data Receiver to the Central Register.

3.306 1 MHz Clock and 45 Bit High Speed Counter - This circuit generates command pulses which maintain the subsystems in synchronism and which mark the first bit in each section of each slot of the Memory.

3.307 Match Blank and Memory Erase Control - Controls the Steering Gates from information received from the Central Register 2/5 Check Circuit, Match Detector, Match Timer, Blank Detector, Blank Timer and Number Change Detector.

3.308 Central Register 2/5 Check - Checks the contents of the Central Register for valid Identification Data on a PBX-Request, on a NIR Request, and after data has been retrieved from Memory.

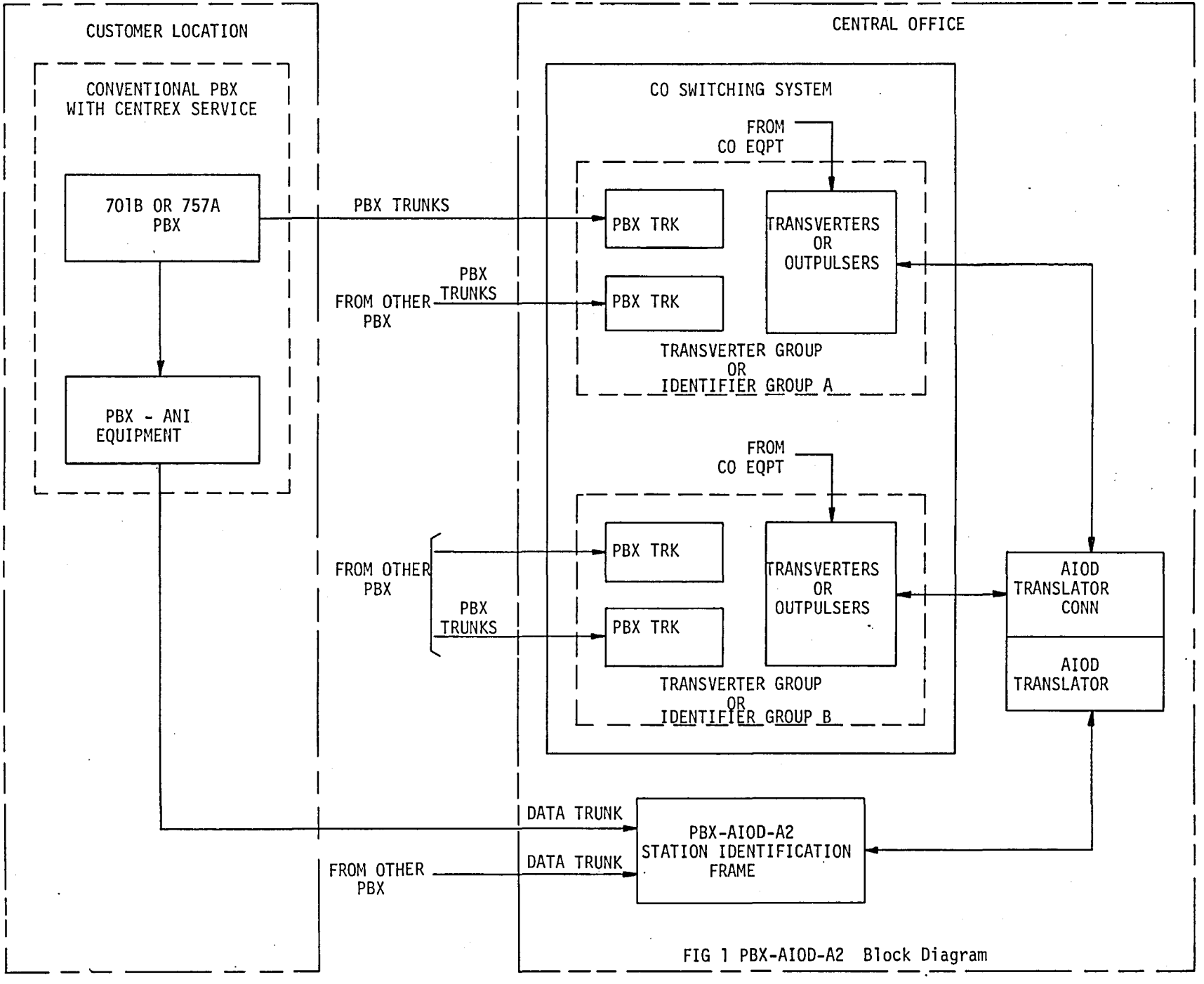



FIG 1 PBX-AIOD-A2 Block Diagram

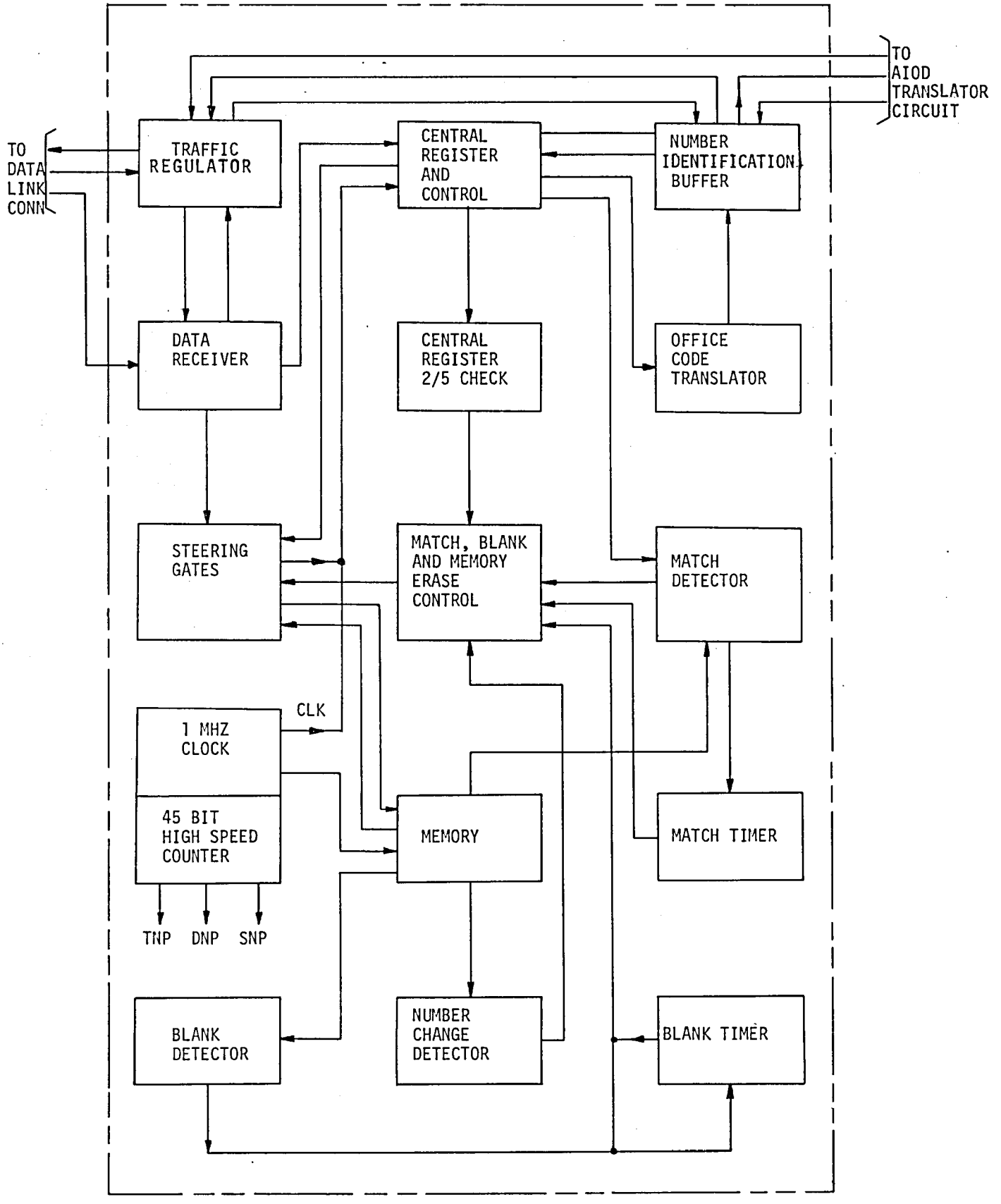



FIG. 2 -- SI Store and Control Circuit -- Block Diagram

3.309 Match Detector and Match Timer - With both the Central Register and the Memory looping, the Trunk Number in the Central Register is compared bit by bit with each Trunk Number in the Memory searching for a match of all 20 bits. The match timer assures that each Trunk Number in Memory has been checked. If no match occurs the timer times out. The Match Detector indicates if match occurs or if a match does not occur.

3.310 Blank Detector and Blank Timer - The Blank Detector checks flip-flops MOL1, MOL2, MOL3 and MOL4 for "0's" and will indicate a blank slot to the Control Circuit. The Blank Timer assures that each slot in Memory has been checked and contains data. If no blank is found the timer times-out and gives an alarm indication. If a blank slot is found the timer is restored and no alarm is given.

3.311 Number Change Detector - Checks the bits of the Data Number for all "1's" on a NIR Request to determine if a Number Change is to occur.

3.312 Number Identification Buffer - This circuit is used as an interface between the Central Register and the AIOD Translator.

3.313 Office Code Translator - Translates the 2/5 Data Number to a 1/10 coded number. The 1/10 coded number is translated to a 1/30 Office Index in a 3/8 code (1/3 Office Index Tens and 2/5 Office Index Units).

4. OTHER FUNCTIONS

4.1 Trap functions are used a prevent false billing. If an error occurs in the Trunk Number or Data Number on a PBX Request, a trap function will occur. If the error is in the Trunk Number the SIS & C circuit will lock onto the Data Number (trap the Data Number) and remove from Memory all Station Numbers associated with the trapped Data Number. If the Data Number is in error the SIS & C circuit will trap the Trunk Number and remove the Station Number associated with the trapped Trunk Number. If both the Trunk Number and Data Number are in error the Memory will be cleared.

4.2 Number Change - If a Trunk Number is to be changed in the Central Office and at some late data will be changed at the PBX, provisions are made to reference the New Trunk Number in the trunk number position of a memory slot, five "1's" are placed in the data number position and the Old Trunk Number is placed in the station number position. The Old Trunk Number, a Data Number and a Station Number are stored in Memory on a PBX-Request. On NIR-Request with the New Trunk Number, the SIS & C circuir recognizes the five "1's" in the data number position as a Number Change Request and performs a number shift (the Old Trunk Number is shifted to the trunk number position in the Central Register). The Memory is interrogated a second time using the Old Trunk Number as an address. The Station Number and Data Number are retrieved from memory and are sent to the billing equipment.

4.3 Repeat Test - The Repeat Test performs a PBX Request every 500 ms as long as trouble is not encountered. When performing a Long Loop Around Test from the central office test frame, repeated NIR Requests may be made if the AIOD is set up for a Repeat Test.

5. CALL PROGRESS ON A PBX REQUEST

5.1 PBX Connection - This description is intended to compare the lighting of the Progress Lamps with the handling of information by the AIOD-A2 Frame. The following description assumes the PBX Request is made from the test panel. On a call from the PBX, no lamp display will occur unless trouble is encountered.

5.2 In its normal state the PBX-ANI connects a -48 volt simplexed signal to the data trunk T and R conductors. The PBX-ANI initiates a request for service by replacing the -48 volt simplex signal on the data trunk T and R conductors with a ground signal. A ground is then placed on the ST lead from the Data Link Connector Circuit to the SIS & C circuit. When the SIS & C circuit is ready to serve a request, the PBX flip-flop is set, which lights lamp PBX and initiates the Connector to send back a simplex -48 volt signal as a signal to start transmission. The Connector passes a 2 out of 5 coded (2/5) Data Number to the Central Register of the SIS & C circuit.

5.3 The output of flip-flop PBX enables the 150-MS timer 1 TM. This is the overall timing to receive data from the

PBX by the SIS & C. The PBX then transmits 41 bits of Identification Data: 1 bit as a start bit, 20 bits as a 4x2/5 (4 digit, 2 out of 5) coded Trunk Number, and 20 bits as a 4x2/5 coded Station Number. This data is sent using bivalued frequency-shift signals. A frequency of 1850 Hz carries a logic value 1, while a frequency of 1150 Hz carries a logic value 0. The Data Receiver circuit converts the frequency-shift signals to their logical pulses. The Receiver Clock is synchronized by the start bit and resynchronized every time a change of status from "0" to "1" occurs. The start bit also sets flip-flop RC, which lights lamp RC indicating the Receiver Clock is enabled and data is being shifted into the Central Register. The Receiver Clock generates 735.29 Hz pulses which is the frequency of the incoming data. These pulses are used to shift the data into the Central Register bypassing the Data Number flip-flops of the Central Register. When the data has been completely entered into the Central Register, the start bit sets flip-flop CRF. This lights lamp CRF indicating the Identification Data has been received from the PBX.

5.4 The next TNPN Pulse sets flip-flop CRFA. This restores timer 1 TM before it times out and enables the 30-ms 2 TM timer, providing the time allowed to shift the data from the Central Register and store it in the Memory. This lights lamp CRFA indicating the start of the second timing cycle. The 2 out of 5 check circuits now check for the valid Trunk Number, Data Number and Station Number. If all nine digits are valid, flip-flop LP sets (a) lighting lamp LP, to indicate that the Central Register is now looping at a 1 MHz Rate and (b) enables 11.5-ms MAT (Match) Timer. While looping occurs the Trunk Number in the Central Register is compared bit by bit to the Trunk Numbers in the Memory. If a match is found the Data Number and Station Number are put into Memory with the Trunk Number. If no Trunk Number match is found within 11.5 msec, the 11.5-ms BLT (Blank) timer is enabled. If a match is found; or a blank slot is found, flip-flop WR is set, which sets flip-flop WER. With both flip-flops set lamps WR and WER light indicating that information is being written into Memory. While the data in the Central Register is being written into Memory, the data in Memory is written into the Central Register. The data memory is then looped at a 1 MHz rate. On a test call the contents of the Central Register will be displayed on the 45 lamps associated with the Trunk Number, Data Number and Station Number, and lamps TN, DN and SN light. Lamp SYC lights and the System is ready to receive a PBX Request or a NIR Request.

## 6. CALL PROGRESS ON A NIR REQUEST

6.1 (Number Identification Request) - This description assumes that NIR Request is made from the test panel. On an NIR Request from the central office, there will be no lamp display unless trouble is encountered.

6.2 The AIOD Test Circuit initiates a NIR by (1) connecting a 1 state on the appropriate TKO-19 leads, setting TN flip-flops in N.I. Buffer, (4x2/5 for four trunk number digits), and (2) then connecting a 1 state on lead TRI 5 to 10 ms later.

6.3 When flip-flop NIR is set, lamp NIR lights indicating type of request. The 150 ms 1 TM timer is enabled and gate NIRN removes the clear input from all TN- flip-flops in the NI Buffer allowing the Trunk Number to be written into the Central Register (flip-flops CR26 through CR45) in parallel form. A check is now made for a valid Trunk Number. CRF is then set lighting lamp CRF and indicating the data is in the Central Register. CRFA is then set lighting lamp CRFA. This restores 1 TM timer and enables 30 ms timer 2 TM. Flip-flop LP is now set, this lights lamp LP indicating that the Central Register is now looping. The Central Register is looped to be able to compare the Trunk Number in the Central Register with the Trunk Numbers in the Memory. When a match of Trunk Number occurs flip-flop WR is set which in turn set WER. These light lamps WR and WER indicationg that the Data Number and Station Number are transferred from the Memory to the Central Register and that the data which was in the Central Register in the Data Number and the Station Number positions is now in the Memory. These were all "0" therefore the Trunk Number now has no Data Number or Station Number associated with it in the Memory. A check is now made on the Data Number and Station Number in the Central Register. Lamp 2/5K lights if this check

is good. With a good 2/5 check the Station Number in the Central Register is transmitted to the SN-- flip-flops in the NI Buffer. The Data Number is transmitted to the NI Buffer which translates it first to a 1/10 code and then to a 3/8 code (1/3 OIT - and a 2/5 OIU-). The 2 TM timer is now restored and the 221.5 ms 3 TM timer is enabled. The data in the NI Buffer (4x2/5 Station Number and 3/8 Office Index) is now transmitted to the Test Register and is displayed on the test panel. The "1" state is removed from lead TRI. The 3 TM timer is restored. The system is returned to normal.

7. MAJOR ALARMS

7.1 Major Alarm indications:

7.11 Memory Loop Failure (MLF) - which represents a failure any time the output of the Memory does not match the input to the Memory. Lamps MLF and MJA indicate the failure.

7.12 Memory Write Failure (MWF) - which indicates that the Central Register output 0 and 1 are the same, therefore indicating a failure.

7.13 Match Failure (MAF) - which indicates a failure to match a Trunk Number in Memory with the Trunk Number from the AMA equipment on a Central Office request. Lamps MAF and MJA indicate this failure.

7.14 Match Blank Failure (MBF) - which indicates that a PBX Request to store failed to find a match of the Trunk Number or find a blank position in Memory. Lamps MBF and CLM indicate this failure.

7.15 Clock Failure (CLKF) - indicates a failure of the system clock circuit which is recognized by lamps CLKF and MJA.

7.16 A Second State Time-Out (2TM) - indicates that the SIS Control Circuit failed to clear within a 30 ms time interval after either a first stage time-out or after the CRFA flip-flop set. Lamps 2 TM and MJA indicate the failure. In this case, analysis of the Call Progress Register provides an additional aid in trouble location.

7.17 A Third State Time-Out (3TM) - indicates a failure of the Translator to release the SIS Control Circuit within a predetermined time period.

8. GENERAL, TROUBLE LOCATING INFORMATION

8.1 When performing a PBX-Request or a NIR Request from the test panel make sure that the error encountered is not due to operator control. This can be done by (1) being familiar with the typical lamp displays and (2) performing the test a second time and obtaining the same lamp display.

8.11 If it is determined that the trouble is caused by a failure within the AIOD-A2 frame, determine from the call progress lamp display and the trouble lamp that part of processing in which the error occurred. TLM-1C235 lists a number of circuit packs to change for specific lamp displays. If the changing of these circuit packs do not clear the trouble, these circuit packs can be used as a starting point for detailed troubleshooting. For detailed troubleshooting one must be proficient in the use of a scope and have a basic understanding of solid state logic circuitry.

8.2 Circuit Pack Replacement - the procedure to be followed is replacement of one circuit pack at a time. After each replacement a check should be made to see if the replacement cleared the trouble. If the trouble is not cleared, remove the replacement circuit pack, replace the original circuit pack, and proceed to the next replacement. When the trouble is cleared, leave the replacement circuit pack in the circuit and tag the original circuit pack.

8.3 Typical Problems

8.31 Table 1 lists problems frequently encountered and their probable cause.

8.4 Test Points

8.41 Circuit pack test points given in this section list the last three digits of the SD first, the circuit pack connector location second, and the connector terminal number third, e.g. 234 13C04-25 would be terminal 25 of the circuit pack located in position 13C04 of SD-1C234.

TABLE 1

| NO. | PROBLEM | PROBABLE CAUSE |
|---|---|---|
| 1 | Intermittant lighting of Call Progress or Trouble Lamps, or intermittant Alarms when performing PBX Requests. | Noise - Caused by missing contact protection networks in circuits remote from the AIOD frame, e.g. PBX registers or Alarm Relays. |
| 2 | Inability to perform PBX Simulated Requests and/or Simulated NIR Requests. | Switchboard cabling between the AIOD-A2 frame and the AIOD Translator is misconnected. |
| 3 | Various trouble after the application of CN's, DCS's or CRI's. | When applying changes leads were misconnected. Considerable trouble shooting time can be saved if the wiring changes are checked prior to performing tests. |
| 4 | DKMA and MAF lamps light when performing System Tests. | The Trunk Number assignments at the PBX-ANI and at the C.O. differ. |

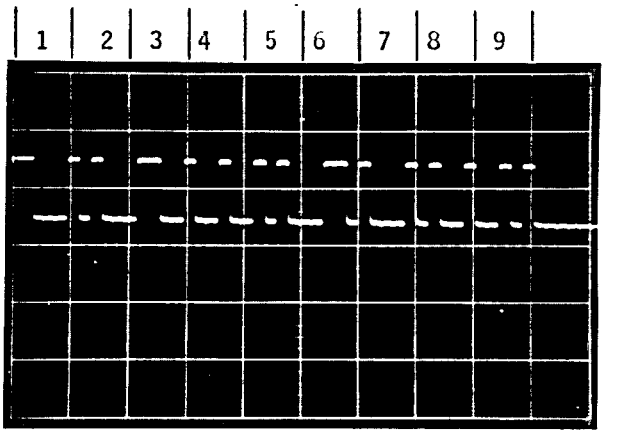
8.42 The following explanation describes how to determine the circuit pack connector location from the wiring side of the frame. Each tray, horizontal group of connector, is numbered in each J unit from frame bottom to frame top (numbering sequence: 01, 05, 09, 13, 17); the vertical rows are divided into alternating groups of light gray and dark gray connector, the first group is A, proceeding from right to left, and the last group is D; and each connector within a group is numbered from right to left (numbering sequence: 01, 04, 07, 10, 13, 16, 19, 22). Therefore, location 13C04 would be the 4th tray in the unit (13), third group of gray connectors from the right (C), and the second connector from the right in the C group.

8.5 Waveforms

8.51 The following waveforms illustrate 2/5 coding and control pulses. The control pulses should be verified if problems are encountered performing the Continous Transmission Test.

2 OUT OF 5 CODE

WF1 illustrates 2/5 coding of digits 1 thru 9 as they appear on the scope. Each centimeter depicts 1 digit (5 bits) of information with each .2 cm depicting 1 bit. The first cm from the left illustrates 2/5 coding of the digit 1 (a '0' bit and a '1' bit) the second cm illustrates 2/5 coding of the digit 2, etc....



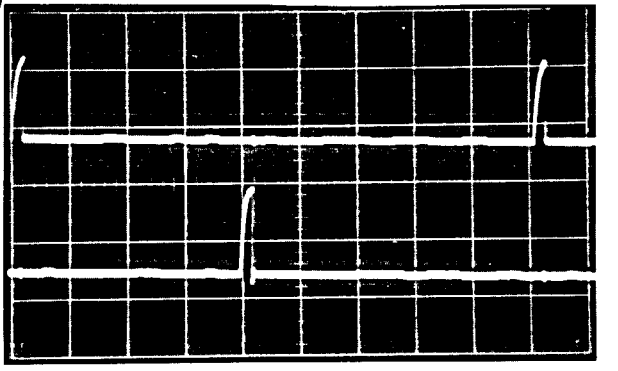

WF1

## TRUNK NUMBER AND DATA NUMBER PULSES

Trunk Number, Data Number and Station Number pulses provide the timed command pulses which maintain the various circuits in synchronism. It is imperitive that the time between these pulses is as shown. If these pulses are not displayed, verify the presence of CLK pulses as provided in WF4.

SYC 234 13C01-25(TNP)
Achan 234 13C01-25(TNP)
Bchan 234 13C01-28(DNP)

5v/cm
5us/cm



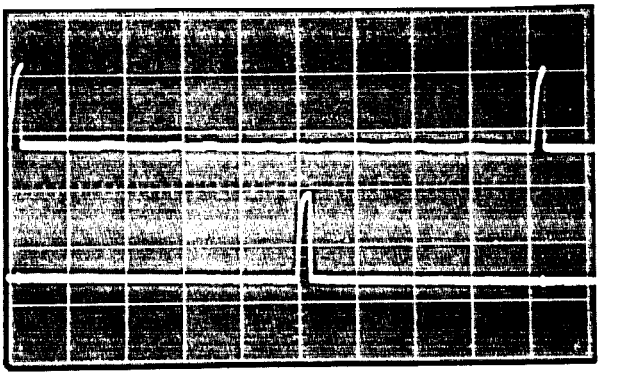
WF2

## TRUNK NUMBER AND STATION NUMBER PULSES

Trunk Number, Data Number and Station Number pulses provide the timed command pulses which maintain the various circuit in synchronism. It is imperitive that the time between these pulses is as shown. If these pulses are not displayed, verify the presence of CLK pulses as provided in WF4.

SYC 234 13C01-25(TNP)
Achan 234 13C01-25(TNP)
Bchan 234 13C01-7 (SNP)

5v/cm
5us/cm



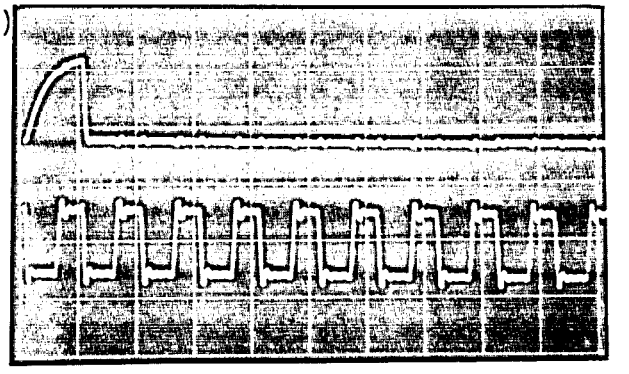
WF3

## TRUNK NUMBER AND CLOCK PULSES

CLKB is a 50-percent duty cycle square wave at a frequency of 1MHZ. Since this is an accurate clock, the scope is more likely to be slightly off calibration than the frequency of this clock be wrong, as is the case in WF4.

SYC 234 13C01-25(TNP)
Achan 234 13C01-25(TNP)
Bchan 234 13B10-16(CLKB)

5v/cm
1us/cm



WF4

8.6 Lamp Displays - in an idle state all of the Call Progress lamps and TBL lamps, except SYC, should be extinguished. Under normal conditions the momentary operation of switches MR and RES (clears the Memory and resets the SIS & C circuit) followed by the momentary operation of switch CLR (resets the Call Progress Register and the Test Register) and switch RS (resets alarms) will reset the system, thus extinguishing the lamps. The list provides probable source of trouble if lamps remain lit:

SD-1C235 FS1
SD-1C235 FS10

9. CONTINUOUS TRANSMISSION

9.1 Application - the Continuous Transmission Test verifies that a path can be established from the Test Register to the Central Register and that the data (Trunk Number and Station Number) transmitted by the Test Circuit can be written into the Central Register. This test should be performed if trouble is encountered performing the Memory Check Test or if trouble is encountered when PBX simulated requests are initially performed. Upon successful completion of this test perform the Memory Check per Section 278.

9.2 Description - Block Diagram 1 (BD-1) provides a simplified version of the functions performed during the Continuous Transmission (CTR). For a detailed description refer to the following CD paragraphs:

| CD | PARAGRAPH |
|---|---|
| 1C233 | 2. |
| 1C234 | 2.01 thru 2.37 |
| 1C235 | 7. |

9.3 Test Circuit Preparation - the following steps provide the operations and observation required to perform a Continuous Transmission Test.

| STEP | OPERATION | OBSERVATION |
|---|---|---|
| 1 | Operate switch SYD to the ON position. | Lamp SYD lights. |
| 2 | Using the PC cord (3P7B) patch jack TST to jack DRT. | |
| 3 | Set the DLN switch to the digit 7. | |
| 4 | Operate the MCK switch to the ON position. | |
| 5 | Operate the CTR switch to the ON position. | |
| 6 | Set switch SW0 to the 1 position. | |
| 7 | Set switches SW1 to SW40 in 2/5 code to obtain Trunk Number 7777 and Station Number 7777. | |
| 8 | Momentarily operate switch CLR and then switch LD. | Lamp PLB lights. The 2/5 coded Trunk Number 7777 and Station Number 7777 are displayed on the Data Register lamps. |
| 9 | Operate switches PBX and TST to the ON position. | Lamps PBX and RC light. The Trunk Number and Station Number lamps are dimly lit. SYC extinguishes. |

9.3 (Cont'd.)

| STEP | OPERATION | OBSERVATION |
|---|---|---|
| 10 | | Verify the waveforms of 9.4. |
| 11 | Return switches TST, PBX, CTR, and MCK to the OFF position. | Disregard lamp display. |
| 12 | Momentarily operate switches MR and RES simultaneously. | Clears the Memory and the Control Circuit lamp CLM lights. |
| 13 | Momentarily operate switches CLR & RS. | All lamps except SYC & SYD are extinguished. |
| 14 | Return switch SYD to the OFF position. Remove the PC cord from jacks TST and DRT. | Lamp SYD is extinguished. Lamp SYC is the only lamp lit. |

9.4 Waveforms CTR

9.41 The following waveforms provide examples of scope traces that verify normal operation during a Continuous Transmission Test.

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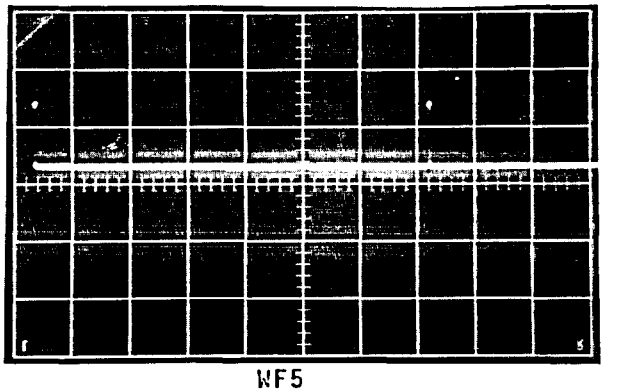
DATA RECEIVER CLOCK

WF5 shows the spacing (1.36 ms) between the 5 us Receiver Clock pulses used to serially shift data into the Central Register. Similar pulses are also generated in the Test Circuit to serially shift data out of the Test Register.

SYC 234 17B01-6(RSH)
Achan 234 17B01-6

5v/cm
.2ms/cm



WF5

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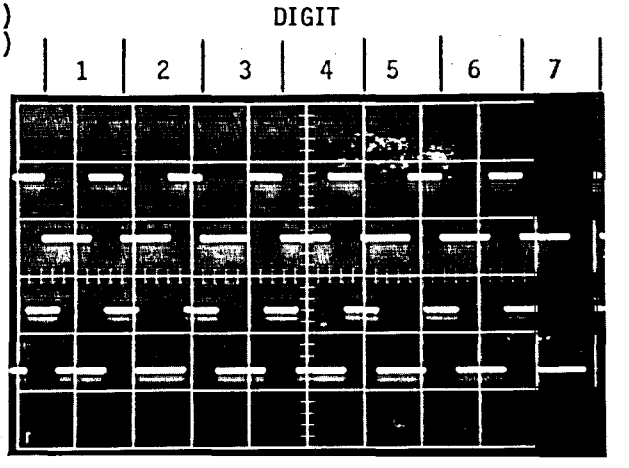
DATA DURING CTR

WF6 shows the 2/5 coded Trunk 7777 Number and Station Number 7777 as transmitted by the Test Circuit and received by the SIS & C Circuit. A repetitive pattern (all digits are the same) is utilized, this provides easier stabilization of the test pattern.

SYC 235 05A07-13(DATM1)
Achan 235 05A07-13(DATM1)
Bchan 234 09D10-12(CRCR)

5v/cm
5ms/cm




WF6

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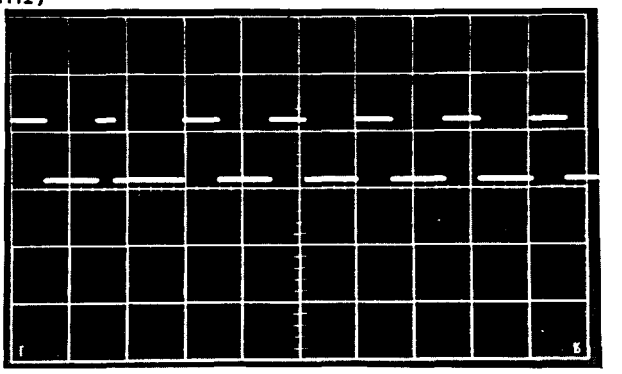
DATA DURING CTR - ERROR

WF7 shows an error in the 2/5 coded information. Although the error can be recognized, it is not possible to tell which digit of the Trunk Number is in error. The Sweep Rate is uncalibrated to stabilize the display.

SYC 235 05A07-13(DATM1)
Achan 235 05A07-13(DATM1)

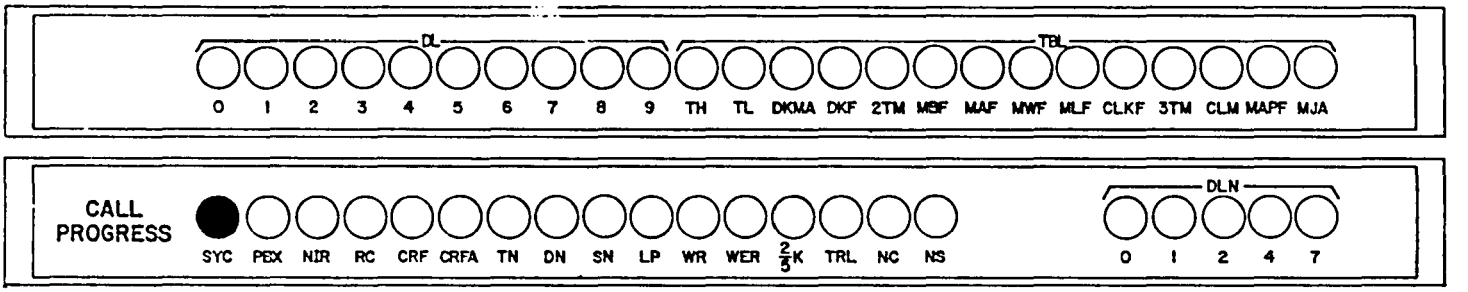
5v/cm
2ms/cm uncalibrated



WF7

9.5 Lamp Displays CTR - the following are displays that may be encountered when step 9, Paragraph 9.3 is performed. An analysis of the display and the source of trouble is provided with each display.

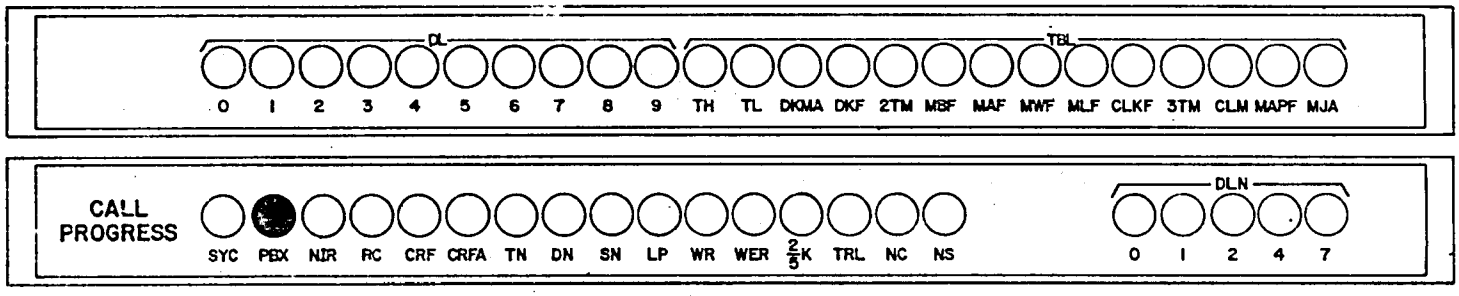
9.51 NO SEIZURE (Test Circuit)




Analysis: When attempting to perform the Continuous Transmission Test the Data Register lamps remained lit in 2/5 code, however, Relay SZR (SD-1C235) did not operate.

Source of Trouble: 1. SD-1C235, FS1, FS5

9.52 NO SEIZURE (SIS & C Circuit)



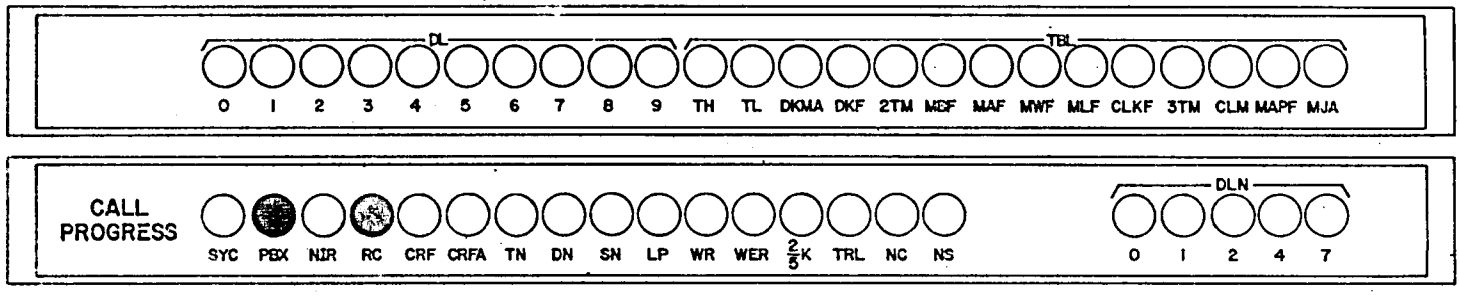

Analysis: When attempting to perform the Continuous Transmission Test the Data Register lamps remained lit in 2/5 code, however, Relay DT (SD-1C233) did not operate.

Source of Trouble: 1. SD-1C235 FS4
2. SD-1C233 FS1, FS3
3. SD-1C234 FS1

Analysis: When attempting to perform the Continuous Transmission Test the Data Register lamps remained lit in 2/5 code and Relay DT (SD-1C233) operated, however, Relay RC (SD-1C235) did not operate.

Source of Trouble: 1. SD-1C233 FS1
2. SD-1C235 FS4

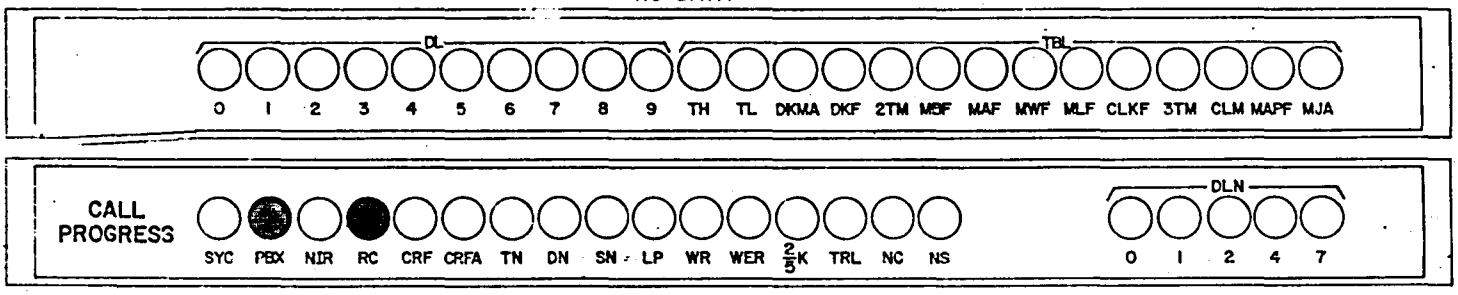
9.53 LOOSING DATA




Analysis: When attempting to perform the Continuous Transmission Test the Data Register lamps are extinguished (are not dimly lit) and the trace of WF6 can not be obtained.

Source of Trouble: 1. SD-1C235 FS8

9.54 NO DATA




Analysis: When attempting to perform the Continuous Transmission Test the Data Register lamps are dimly lit and the Achan trace of WF6 can be obtained, but the Bchan trace of WF6 can not be obtained.

Source of Trouble:
A. Bchan trace of WF6 can not be obtained at 234 17A07-14 (LDFF). SD-1C235 FS4, SD-1C234 FS4.
B. Bchan trace of WF6 obtained at 234 17A07-14 but can not be obtained at 234 09D13-4(CRI). SD-1C234 FS2, FS9.
C. Bchan trace of WF6 obtained at 234 09D13-4 but can not be obtained at 09D10-12(CRCR). SD-1C234 FS4, FS6.

10. MEMORY CHECK

10.1 Application - The following procedure is to check the Memory. The trace of WF6 must be obtained prior to utilizing this information.

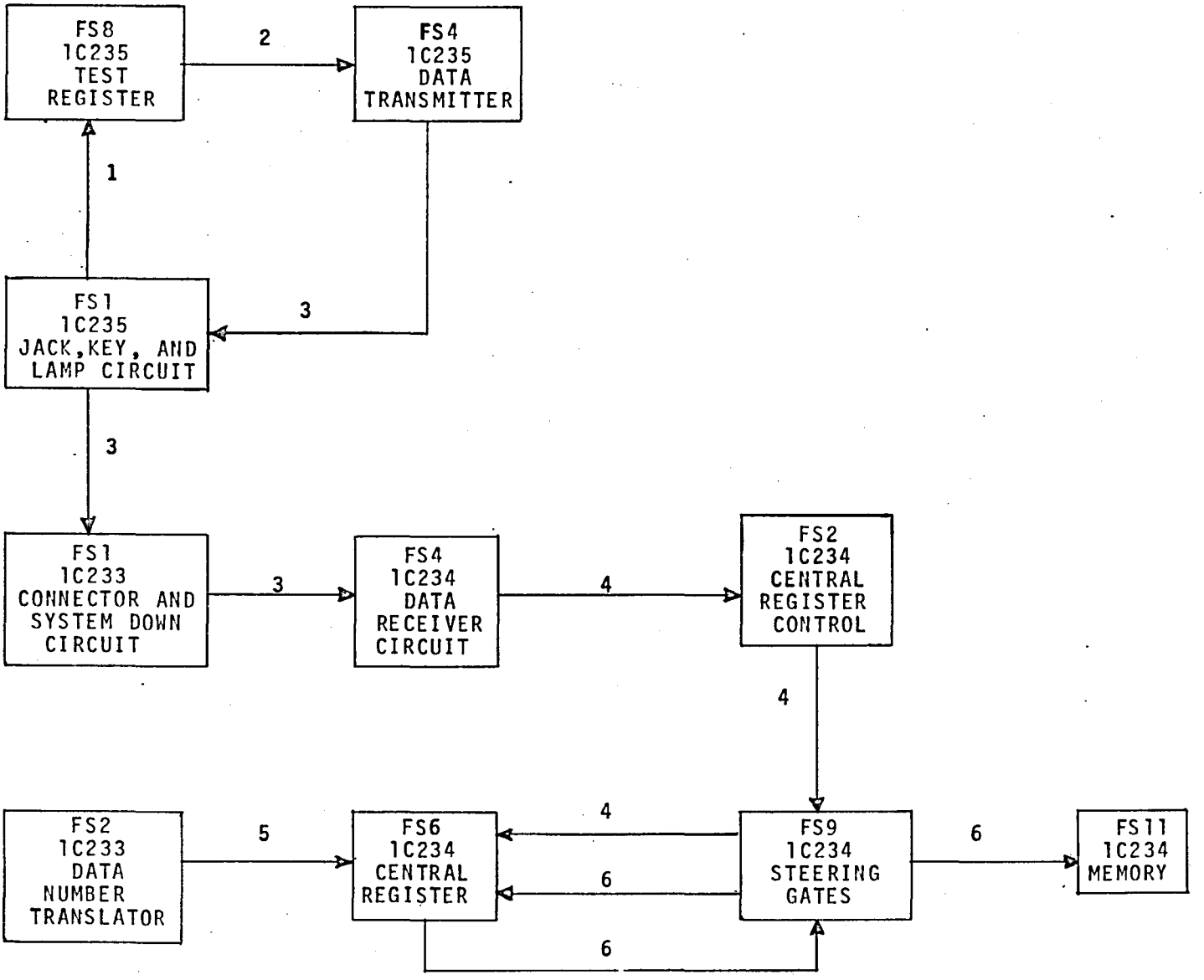
10.2 Description - Block Diagram 2 (BD2) and the associated Brief Description provide a basic description of the circuits utilized and the functions performed during the Memory Check Test. For a detailed description refer to the following CD paragraphs:

| CD | PARAGRAPH |
|---|---|
| 1C233 | 2. |
| 1C234 | 2.01 thru 2.42 |

10.3 Test Circuit Preparation - The following steps provide the operations and observations required to perform a Memory Check Test.

| STEP | OPERATION | OBSERVATION |
|---|---|---|
| 1 | Operate switch SYD to the ON position. | SYD lamp lights. |
| 2 | Using the PC cord (3P7B) patch jack TST to jack DRT. | |
| 3 | Set switch SW0 to the 1 position. | |
| 4 | Set the DLN switch to the digit 1. | |
| 5 | Operate switches MCK and MCK1 to the ON position. | Inhibits the timers. |
| 6 | Set switches SW1 to SW40 in 2/5 code to obtain Trunk Number 1211 and Station Number 1111. | |
| 7 | Momentarily operate switch LD. | Lamp PLB lights. The 2/5 coded Trunk Number 1211 and Station Number 1111 are displayed on the Data Register lamps. |

BD2




MEMORY CHECK - SIMPLIFIED

BRIEF DESCRIPTION:

1. The Control Panel is used to enter data into the Test Register

2. The data is shifted serially out of the Test Register at a bit rate of 735.29 PPS.

3. The logical pulses are converted to 1150 Hz (a 'zero') and 1850 Hz (a 'one') signals and sent to the SIS & C Circuit.

4. The 1150 Hz and 1850 Hz signals are reconverted to logical pulses and the data is shifted into the Central Register.

5. The Data Number is transferred to the Central Register.

6. A 1 MHz clock is used to shift the data out of the Central Register and into Memory. The Central Register is looped so that the data is continuously shifted into Memory.

10.3 (Cont'd.)

| STEP | OPERATION | OBSERVATION |
|---|---|---|
| 8 | Operate switches PBX and TST to the ON position. | Lamps A, A1, PBX, RC, CRF, CRFA, LP and MLF light. |
| 9 | Return switches TST and PBX to the OFF position. | |
| 10 | Momentarily operate switch CLR. | Verify the waveforms per 10.4. Lamps RC and MLF extinguish. |
| 11 | Return switches MCK and MCK1 to the OFF position. | Lamp CLM and MJA light. Disregard other lamps that light. |
| 12 | Momentarily operate switches MR and RES simultaneously. | Clears the Memory and the Control Circuit. |
| 13 | Momentarily operate switch CLR. | Extinguishes Trouble Indicator and Call Progress lamps. |
| 14 | Momentarily operate switch RS. | Extinguish alarm lamps. |
| 15 | Return switch SYD to the OFF position. Remove the PC cord from jacks TST and DRT. | Lamp SYD is extinguished. Lamp SYC is the only lamp lit. |

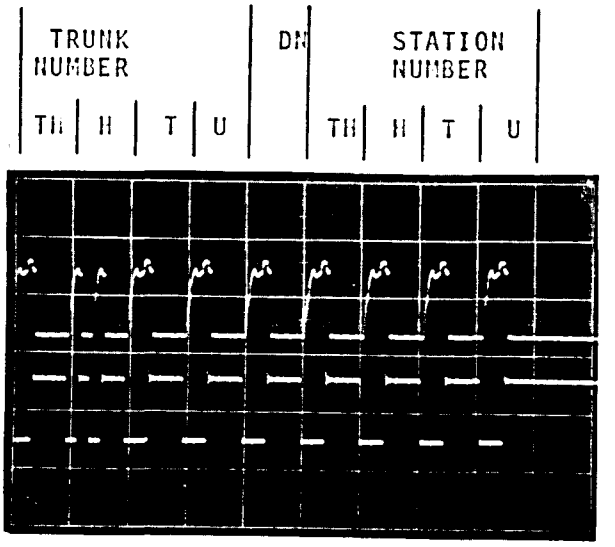
10.4 Waveforms - The following waveforms provide examples of scope traces to verify Normal operation during the Memory Check Test.

MEMORY INPUT - MEMORY OUTPUT

Trunk Number 1211, Data Number 1 and Station Number 1111 are shown on the scope trace WF8. 1 digit is displayed in each centimeter (Total 9 digits). For purposes of explanation data is shown in only one Memory slot, during the Memory Check Test this data will be written into all 228 Memory slots and therefore, will be repeated as shown in WF9.

SYC 234 13C01-25(TNP)
Achan 234 13C04-21(MI LEAD)
Bchan 234 13C04-14(MON LEAD)
or
Achan 234 13D10-14(MO LEAD)
Bchan 234 13D10-21(MIN LEAD)

5v/cm
5us/cm



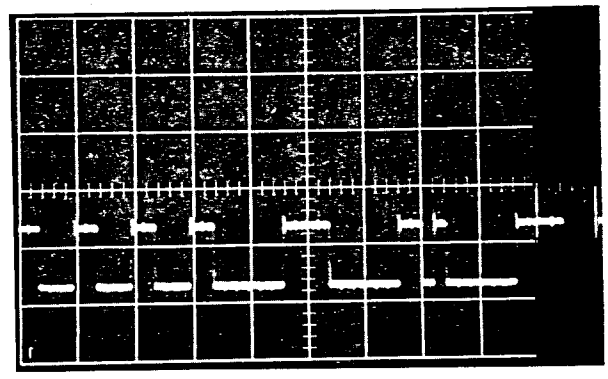

WF8

MEMORY INPUT

Trunk Number 1111, Data Number 0 and Station Number 1010 are shown on the scope trace WF9. WF9 illustrates two points: (1) an error in the Station Number tens digit and (2) the repetition of data (Trunk Number thousands digit in the 10th centimeter of the grid).

SYC 234 13C01-25(TNP)
Achan 234 13C04-21(MI LEAD)

5v/cm
5us/cm



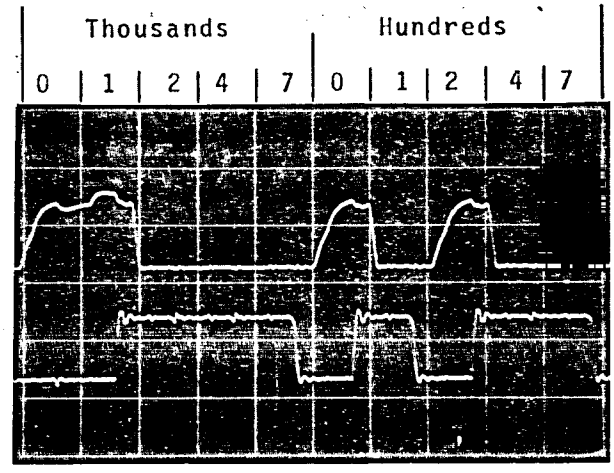
WF9

MEMORY INPUT - MEMORY OUTPUT

WF8 and WF10 should be used to verify proper Memory operation. NOTE: The memory output must lead the memory input as shown.

SYC 234 13C01-25(TNP)
Achan 234 13C04-21(MI Lead)
Bchan 234 13C04-14(MON Lead)

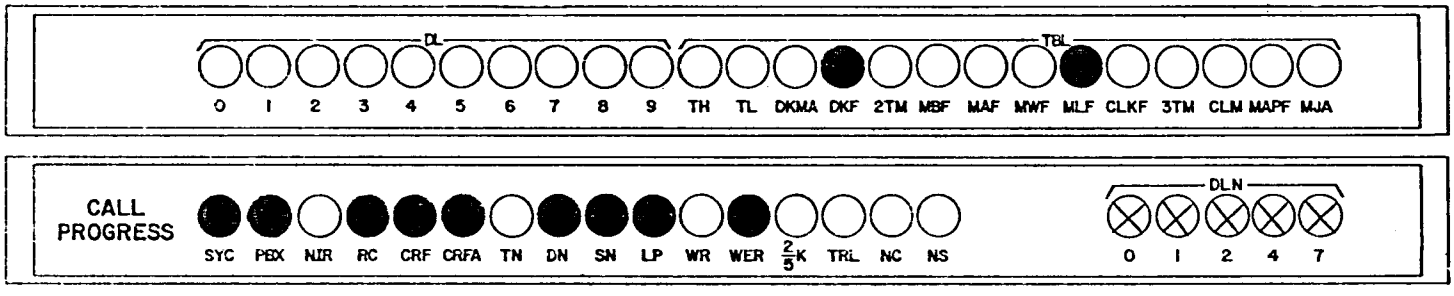
5v/cm
1us/cm




WF10

10.5 Lamp Displays Memory Check - The following are displays that may be encountered when the Memory Check Test is performed. An analysis of the display and the source of trouble is provided with each display.

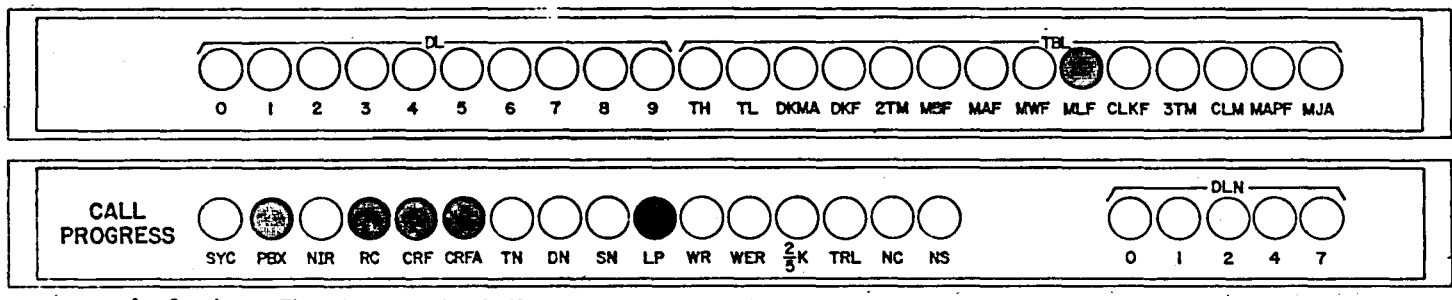
10.51 2/5 FAILURE




Analysis: The Memory Check Test was attempted, however there was an error in the Trunk Number (TN lamp extinguished). (X = DLN, 2/5 Code)

Source of Trouble: Refer to Paragraph 11.55.

10.52 GATING FAILURE




Analysis: The Memory Check Test was attempted, but information is not continuously written into Memory as described in WF8 and WF9.

Source of Trouble: 1. SD-1C234 FS2, FS9

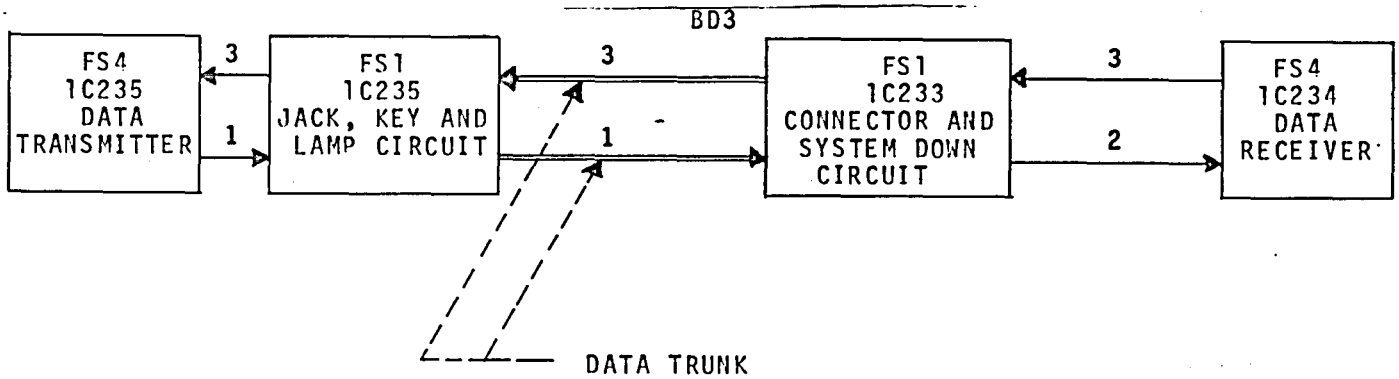
11. PBX Simulated Request

11.1 Application - The following procedures are to be utilized if trouble is encountered performing a PBX Request. These procedures are also used to verify that information is written into Memory. Refer to the General 8 prior to making the following verifications.

11.2 Description - Block Diagram 3 (BD3) and Block Diagram 4 (BD4) provide a simplified description of the functions performed during a PBX Request. For a description relating the lighting of the Call Progress lamps to the processing of data, refer to Paragraph 5. For a detailed description refer to the following CD paragraphs:

| CD | PARAGRAPH |
|---|---|
| 1C233 | 1. |
| 1C234 | 2. |
| 1C235 | 1. |

11.3 Test Circuit Preparation - Refer to Section 278 for the steps required to perform a PBX Simulated Request. If it is desired to perform repeated PBX Simulated Requests refer to Section 278 for the steps required to perform the Repeat Test.




ESTABLISHING A CONNECTION - SIMPLIFIED

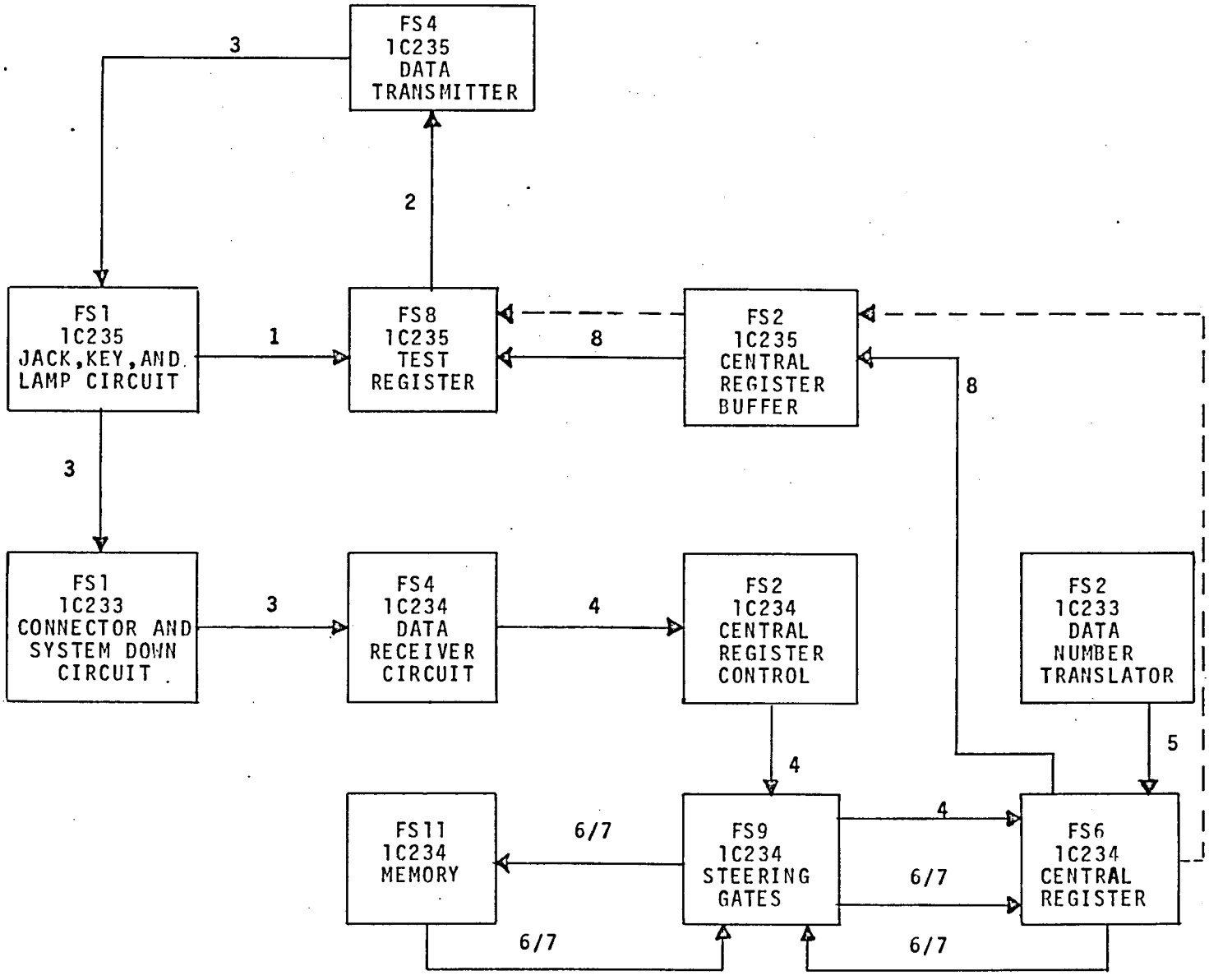
BRIEF DESCRIPTION:

1. In the idle state a simplex -48V battery is connected to the Tip and Ring of the Data Trunk. A Service Request is initiated by replacing the simplex battery with a simplex ground.

2. A transmission path is established between the Data Trunk and the Data Receiver.

3. A simplex -48V battery is connected to the Data Trunk. This is recognized as a signal to start data transmission.

BD4




dashed lines
illustrates the
path used to
display data when
an error occurs

PBX REQUEST - SIMPLIFIED

BRIEF DESCRIPTION:

1. The Control Panel is used to enter data into the Test Reqister.
2. The data (Trunk Number and Station Number) is shifted serially out of the Test Register at a bit rate of 735.29 PPS.
3. The logical pulses are converted to 1150 Hz (a 'zero') and 1850 Hz (a 'one' signals and transmitted to the SIS & C Circuit.
4. The 1150 Hz and 1850 Hz signals are reconverted to logical pulses and the data is written into the Central Register.
5. The Data Number is written into the Central Register.
6. The data in the Central Register is looped thru the Central Register at a 1 MHz rate. The Trunk Number in the Central Register is compared to each Trunk Number in Memory, searching for a match.
7. After a match occurs the contents of the Central Register are written into Memory and the contents of the Memory slot are written into the Central Register. If no match occurs the data is written into the first blank Memory slot.
8. The contents of the Central Register are displayed (test call only).

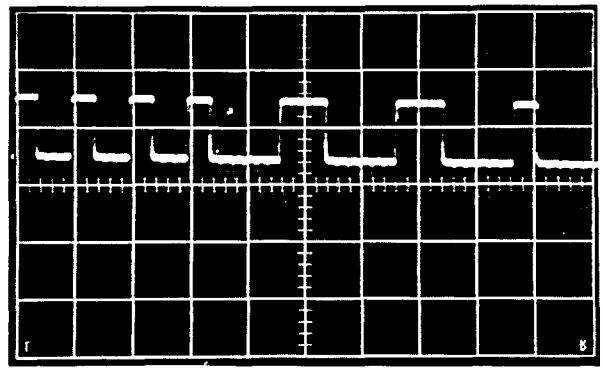
11.4 Waveforms - The following waveforms illustrate data circulating in Memory during normal operation. These waveforms verify that information is actually written into Memory on a PBX Simulated Request.

DATA IN MEMORY

WF11 illustrates Trunk Number 1111, Data Number 0 and Station Number 1010 circulating in Memory. To obtain this display clear the Memory (momentarily operate switches MR and RES simulataneously, then momentarily operate switch CLR and then switch RS) and then perform a single PBX Simulated Request.

SYC 234 13C01-25(TNP)
Achan 234 13D10-14(M0 Lead)

5v/cm
5us/cm



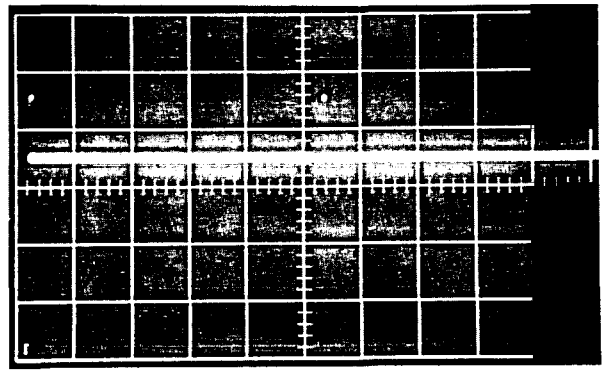
WF11

DATA IN MEMORY

WF12 illustrates the repetition rate of the information circulating in Memory. If pulses occur within the two pulses shown, there may be noise. A pulse will also occur between the two pulses shown for each PBX Simulated Request performed using a different Trunk Number. If pulses occur between the two pulses shown when repeated PBX Simulated Requests are performed they indicate trouble in the control circuitry.

SYC 234 13C01-25(TNP)
Achan 234 13D10-14(MO Lead)

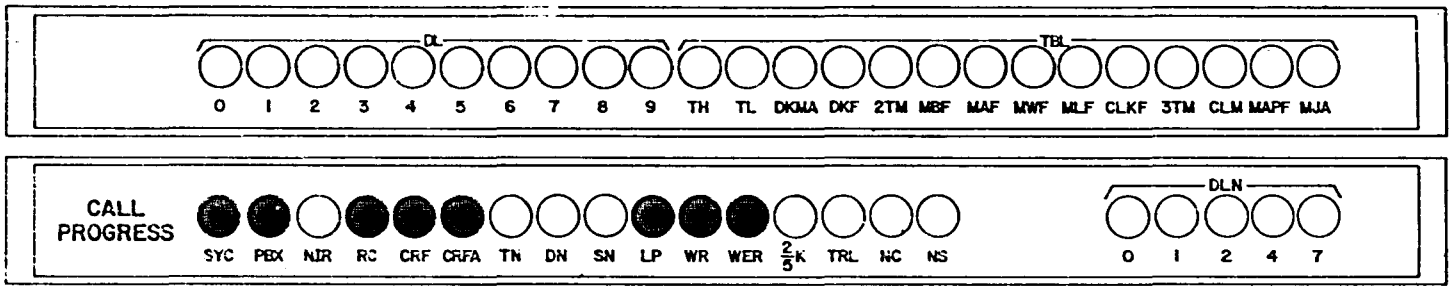
5v/cm
2ms/cm



WF12

11.5 Lamp Displays PBX Request - On a good PBX Request from the PBX-ANI there will be no lamp display, however, a DL- lamp will blink and lamp SYC will be momentarily extinguished. On a PBX Simulated Request from the frame test panel the Identification Data will be displayed on the 45 lamps of the Data Register (20 Trunk Number lamps, 20 Station Number lamps and 5 DLN lamps). Following are lamps displays frequently encountered with an analysis of the display and the source of trouble when problems are encountered.

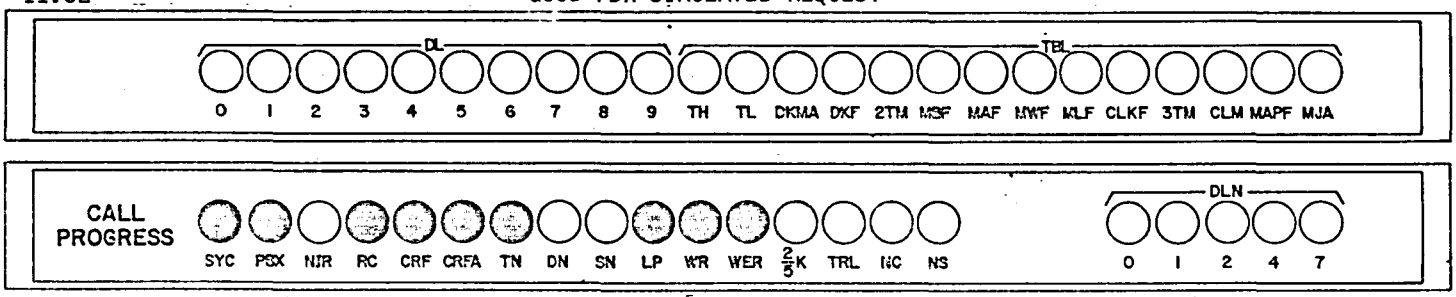
11.51 GOOD PBX SIMULATED REQUEST




Analysis: A good PBX Simulated Request was performed. A Trunk Number match did not occur, therefore, the 45 bits of data are written into a blank Memory slot. If two valid PBX Simulated Requests are performed, the second immediately after the first utilizing the same Trunk Number, and this display is obtained both times; trouble exists. Refer to WF13 for a verification procedure.

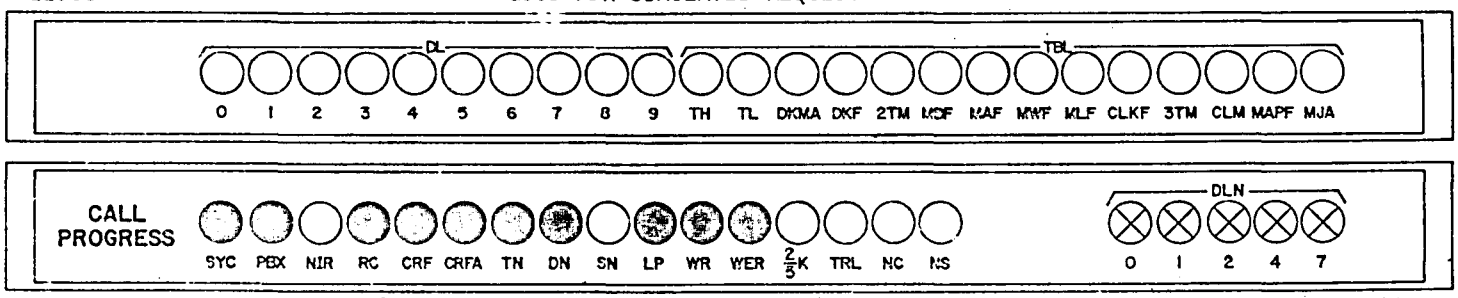
Source of Trouble: 1. SD-1C234 FS3

11.52 GOOD PBX SIMULATED REQUEST




Analysis: A good PBX Simulated Request was performed. A Trunk Number match occurred (TN lamp lit), however, neither a Data Number nor a Station Number was associated with the Trunk Number circulating in Memory (DN and SN lamps extinguished). This display can be obtained by: (1) performing a simulated PBX Request (puts Trunk Number, Station Number and Data Number in the Memory), (2) performing a NIR Request (removes Data Number and Station Number from Memory, leaves the Trunk Number in Memory), and (3) performing a second PBX Request which will give the lamp display as indicated.

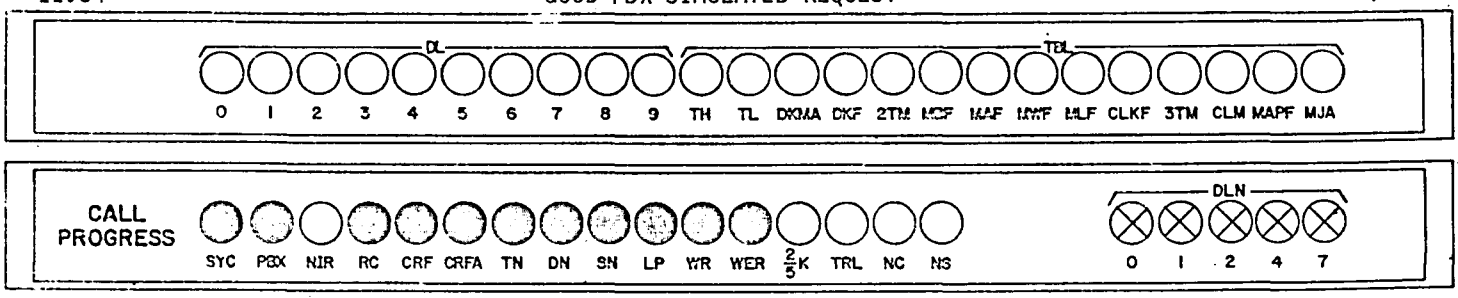
11.53 GOOD PBX SIMULATED REQUEST




NOTE

Analysis: A good PBX Simulated Request was performed. A Trunk Number match occurred (TN lamp lit) and a Data Number was associated with the Trunk Number circulating in Memory (DN lamp lit). However, a Station Number was not associated with the Trunk Number and Data Number circulating in Memory (SN lamp extinguished). This display indicates that a Trap function had occurred, Station Number removed from Memory, prior to the PBX Simulated Request.

11.54 GOOD PBX SIMULATED REQUEST

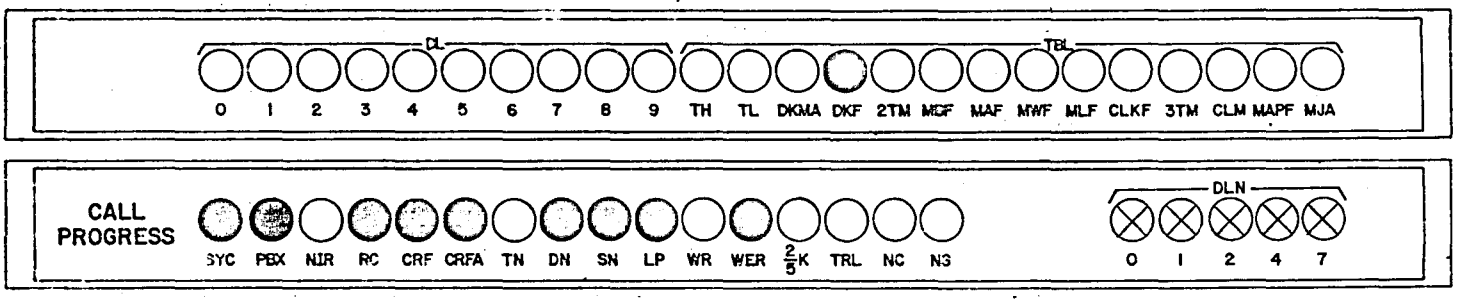



Analysis: A good PBX Request was performed. A Trunk Number match occurred (TN lamp lit); a Data Number and a Station Number were associated with the Trunk Number circulating in Memory and the data that was in Memory will be displayed on the Data Register lamps.

Note: X indicates DLN lamps lit in 2/5 code.

The following displays illustrate Troubles frequently encountered during both actual and simulated PBX Requests.

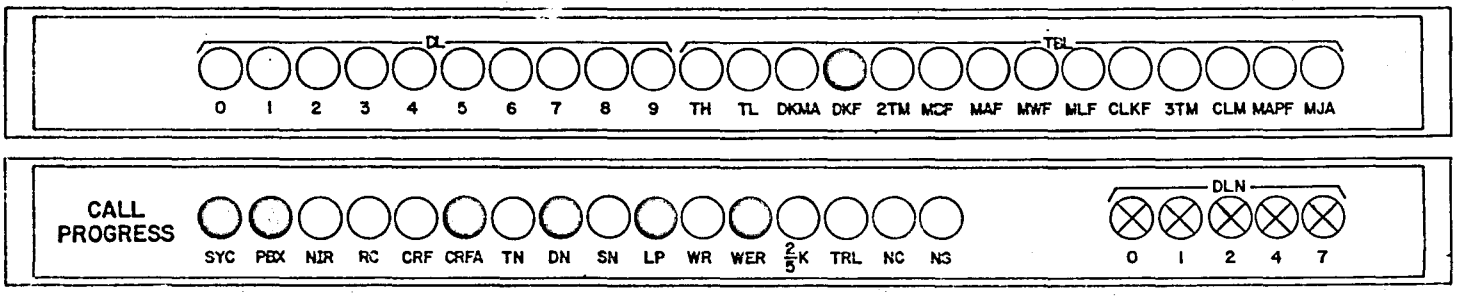
11.55 2/5 FAILURE




Analysis: A PBX Request was attempted, however, there was an error in the Trunk Number (TN lamp extinguished). When lamp DKF lights there is an error in the Identification Data. The data that is in error will be indicated by the TN, DN or SN lamp not lit and the error will be displayed on the Data Register lamps.

Source of Trouble:
1. Valid 2/5 coded data was not loaded into the Test Register.
2. Valid 2/5 coded data is displayed on the Data Register Lamps yet an error is indicated - SD-1C234 FS7.
3. Intermittant failures - SD-1C235 FS4 and SD-1C234 FS4.

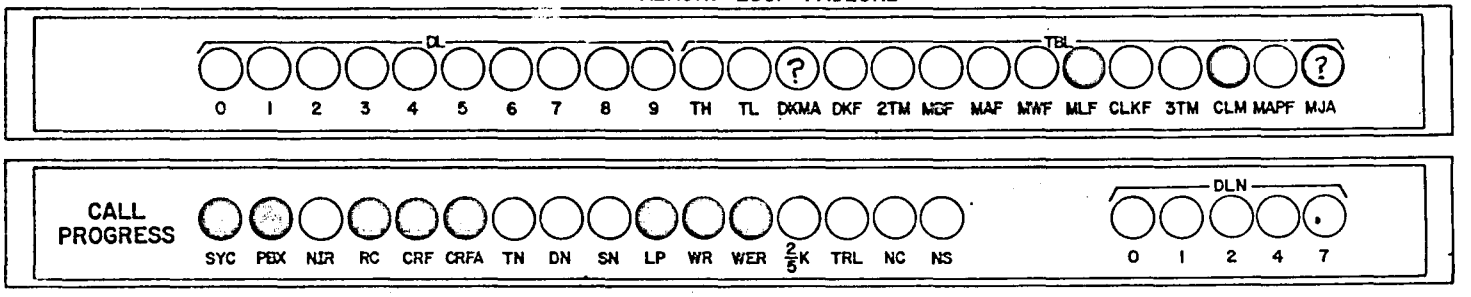
11.56 NO DATA




Analysis: A PBX Request was attempted, however, no Identification Data (PLB, Trunk Number and Station Number) was transmitted. The Data Link Number is generated by the AIOD frame and was valid (DN lamp lit).

Source of Trouble:
1. Make the verifications per Paragraph 9, Continuous Transmission.
2. SD-1C233 FS1.

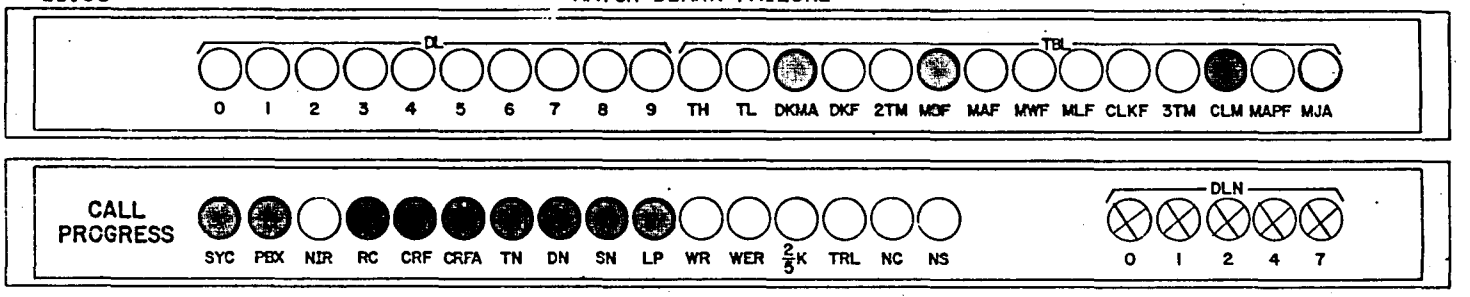
11.57 MEMORY LOOP FAILURE




Analysis: A PBX Request was attempted, during the Request the input to Memory did not match the output from Memory.

Source of Trouble: 1. SD-1C234 FS13.

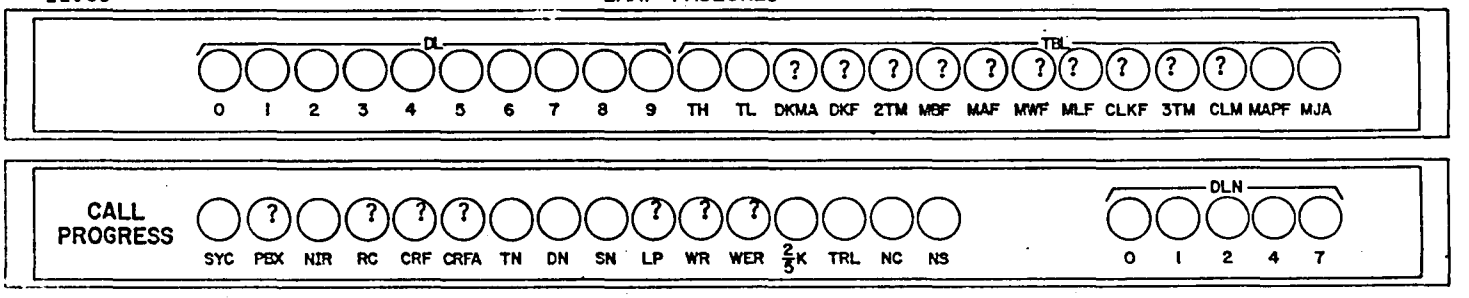
11.58 MATCH BLANK FAILURE




Analysis: A PBX Request was attempted, a Trunk Number match did not occur and a blank slot was not found in Memory.

Source of Trouble: 1. SD-1C234 FS3.

11.59 LAMP FAILURES




Analysis: When attempting to perform PBX Simulated Requests the Test can apparently be completed successfully, yet there are repeated or intermittant failure(s) of lamps.

Source of Trouble: 1. SD-1C235 FS1, FS10

12. SIMULATED NIR REQUEST

12.1 Application - The following procedures are to be utilized if trouble is encountered when performing a Simulated NIR Request to verify that the identification data can be read out of Memory.

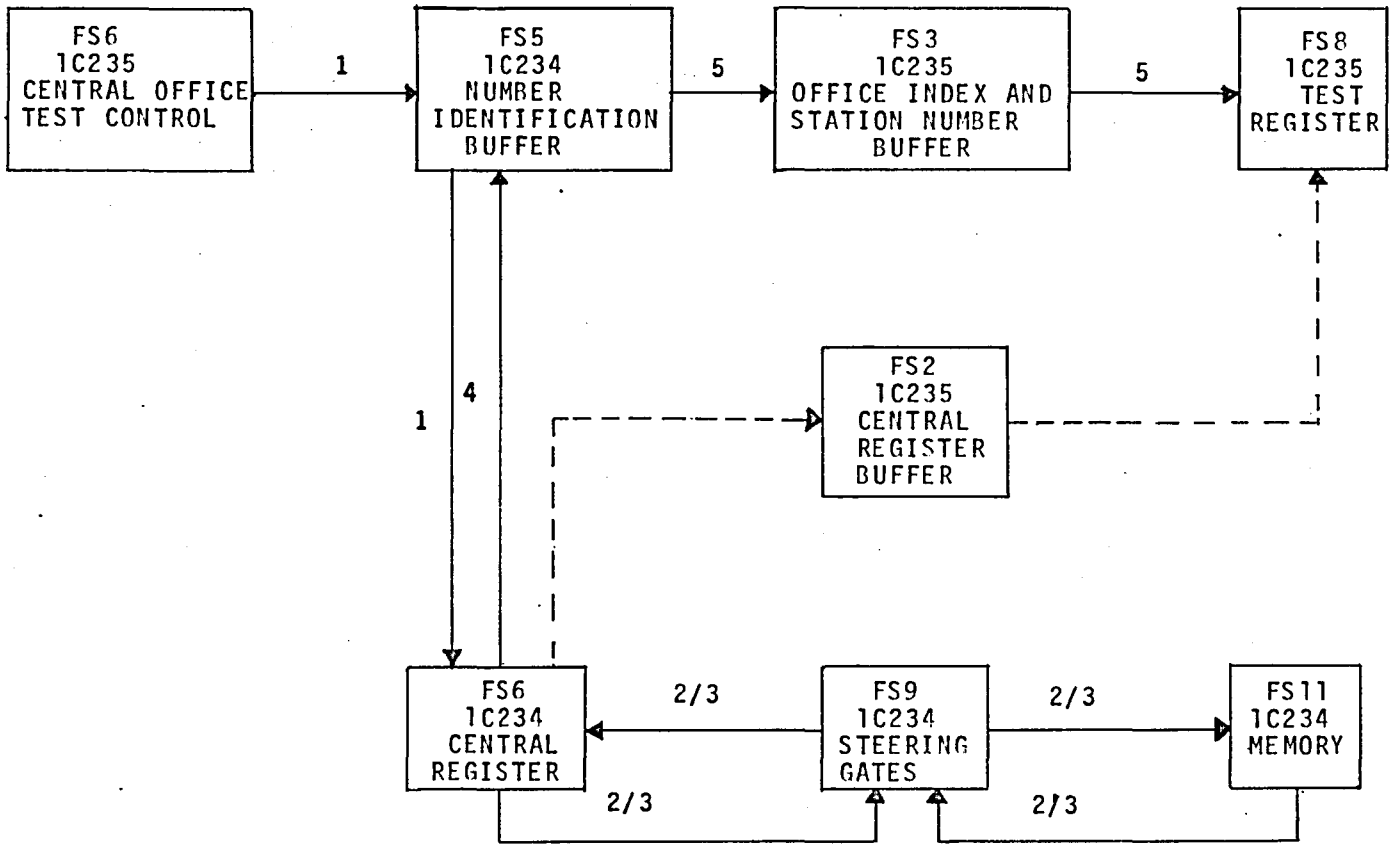
12.2 Description - Block Diagram 5 (BD5) provides a simplified verision of the functions performed during a NIR Request. For a description relating the lighting of the Call Progress lamps to the processing of data refer to Paragraph 6. For a detailed description refer to the following CD paragraphs:

| CD | PARAGRAPH |
|---|---|
| 1C234 | 3. |
| 1C235 | 3. |

12.3 Test Circuit Preparation - Refer to Section 278 for the steps required to perform a Simulated NIR Request.

12.4 Waveforms - The following waveforms illustrate that a Simulated NIR Request can be performed. This waveform verifies that the Data Number and Station Number are read out of Memory on a Simulated NIR Request.

BD5




dashed lines illustrate
the path used to display
data when an error occurs.

NIR REQUEST - SIMPLIFIED

BRIEF DESCRIPTION:

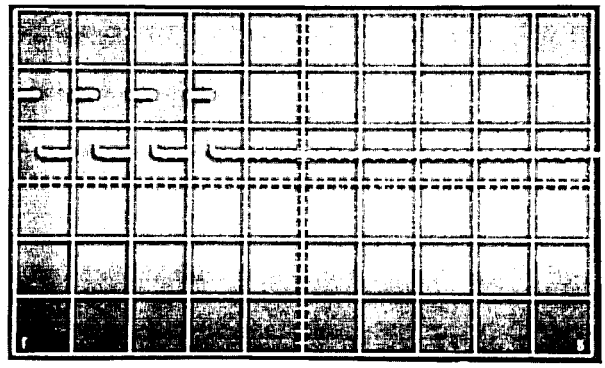
1. The Control Panel is used to write the Trunk Number into the Central Register.
2. The data in the Central Register is shifted at a 1 MHz rate; the Trunk Number in the Central Register is compared to each Trunk Number in Memory, searching for a match.
3. When a match of Trunk Numbers occurs the Data Number and Station Number in Memory are written into the Central Register and the Data Number and Station Number (all 'zeroes') in the Central Register are written into Memory.
4. The Data Number and the Station Number are written into the N.I. Buffer and the Data Number is converted to an Office Index.
5. The Office Index and the Station Number are displayed (test call only).

DATA IN MEMORY

To obtain the trace of WF13, the trace of WF11 must first be obtained. After the trace of WF11 is obtained, perform a Simulated NIR Request to obtain the trace of WF13, Trunk Number circulating in Memory. To take the Trunk Number out of Memory, the Memory must be cleared.

SYC 234 13C01-25(TNP)
Achan 234 13D10-14(MO Lead)

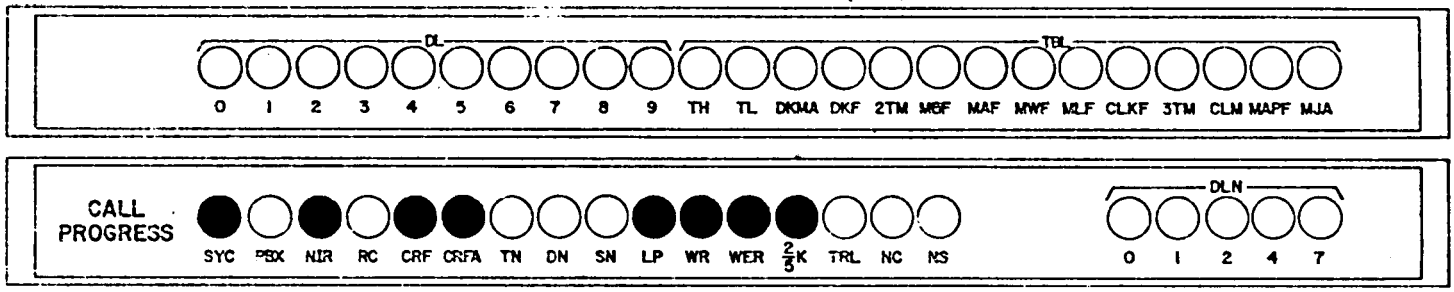
5v/cm
5us/cm



WF13

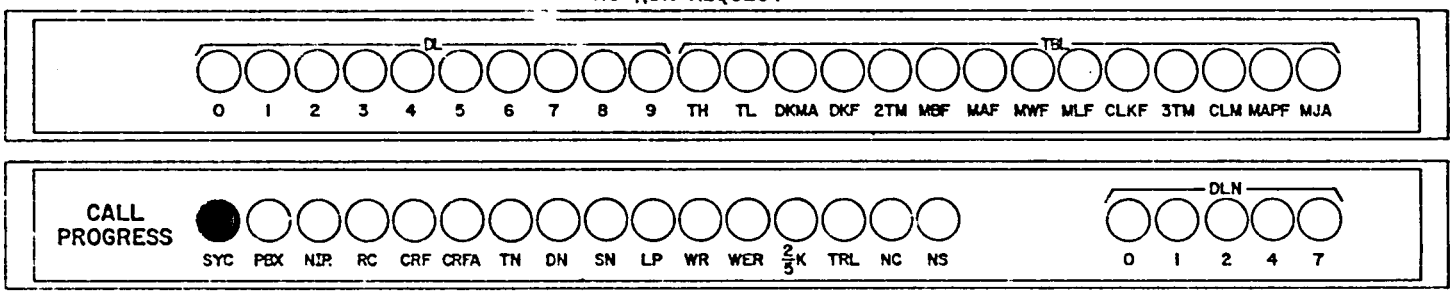
12.5 Lamp Displays NIR Request - On a good NIR (C.O.) Request from the C.O. billing equipment there will be no lamp display. On a good simulated NIR Request the display of 12.51 will be obtained, displays 12.52 thru 12.57 illustrate displays frequently encountered during both actual and simulated NIR Requests with an analization of the display.

12.51 GOOD SIMULATED NIR REQUEST




Analysis: A good Simulated NIR Request was performed. A 3/8 Office Index and a 4 x 2/5 Station Number will be displayed on the Data Register lamps.

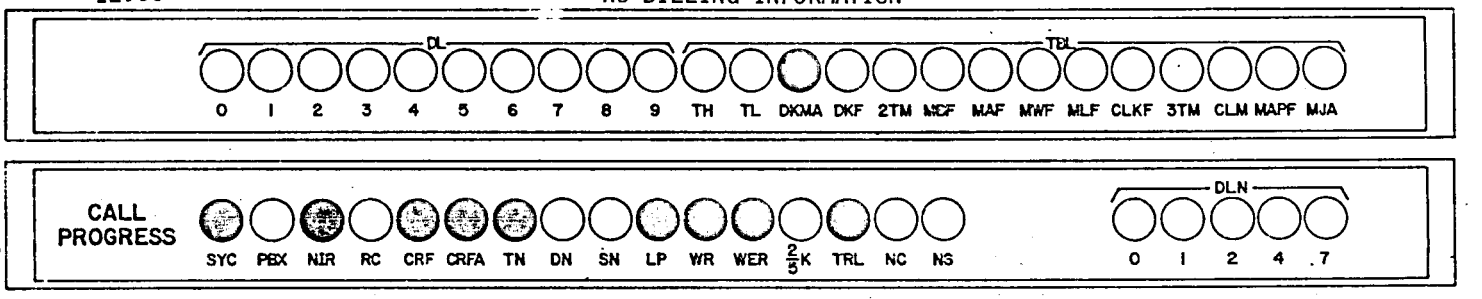
12.52 NO NIR REQUEST




Analysis: A Simulated NIR Request was attempted, yet no indication (Call Progress lamps) is given.

Source of Trouble: 1. Cabling between the AIOD frame and the AIOD Translator.
2. SD-1C234 FS1, FS5
3. SD-1C235 FS6

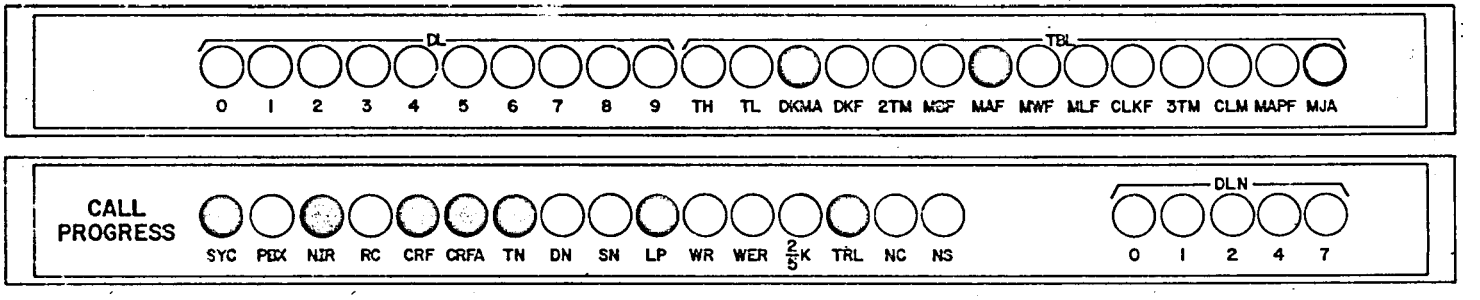
12.53 NO BILLING INFORMATION




Analysis: An NIR Request was attempted. The Trunk Number was in Memory but neither a Data Number nor a Station Number was associated with the Trunk Number. The 4 x 2/5 Trunk Number will be displayed on the Data Register lamps.

Source of Trouble: 1. The Trunk Number used for the NIR Request is not the same as the Trunk Number used for the PBX Request.
2. SD-1C235 FS5

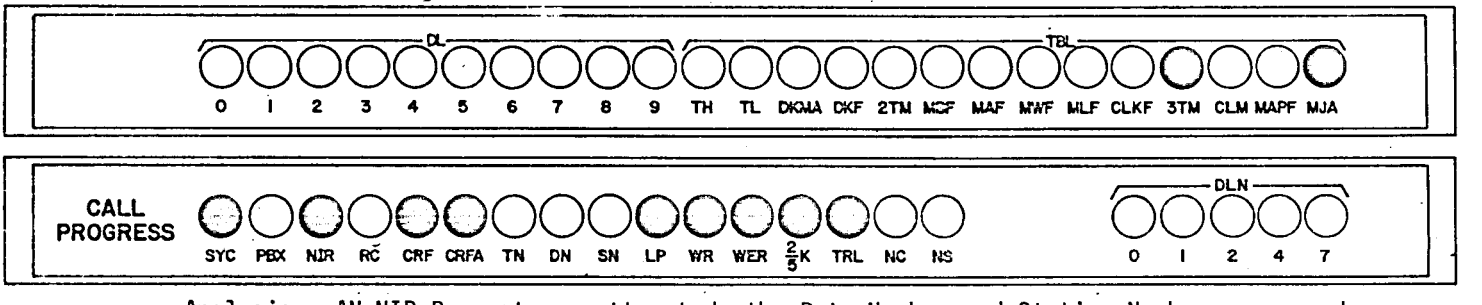
12.54 NO TRUNK NUMBER MATCH




Analysis: A NIR Request was attempted. The Trunk Number was not in Memory, therefore, a match failure occurred. This display will be obtained if Trunk Number assignments at the PBX-ANI and the C.O. differ.

Source of Trouble: 1. The Trunk Number used for the NIR Request is not the same as the Trunk Number used for the PBX Request.
2. Refer to WF12, clear the Memory and perform 2 PBX Simulated Requests and make the observations as specified.

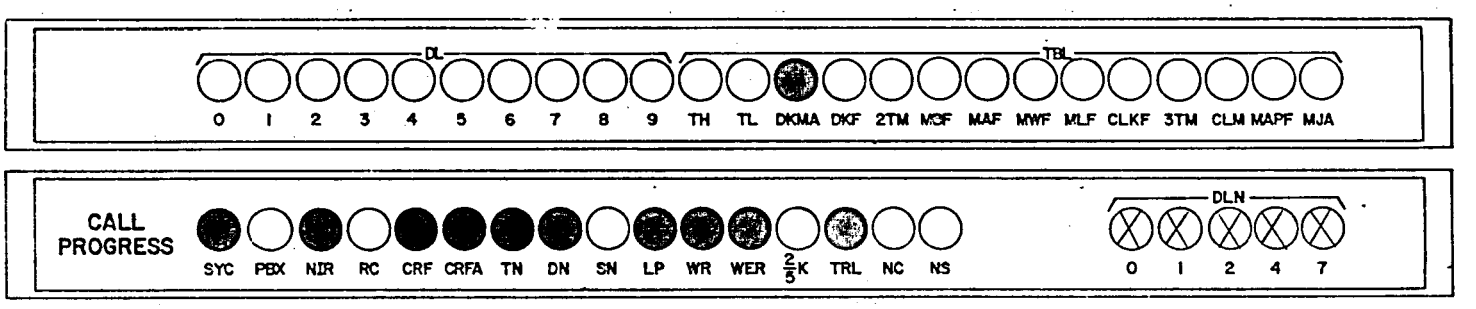
12.55 DATA TRANSFER FAILURE




Analysis: AN NIR Request was attempted, the Data Number and Station Number were read out of Memory (2/5K lamp lit) and transferred to the N.I. Buffer. Subsequently, there was a failure when transmitting the data to the AIOD Translator.

Source of Trouble: 1. Cabling (EX- leads) between the AIOD frame and the AIOD Translator

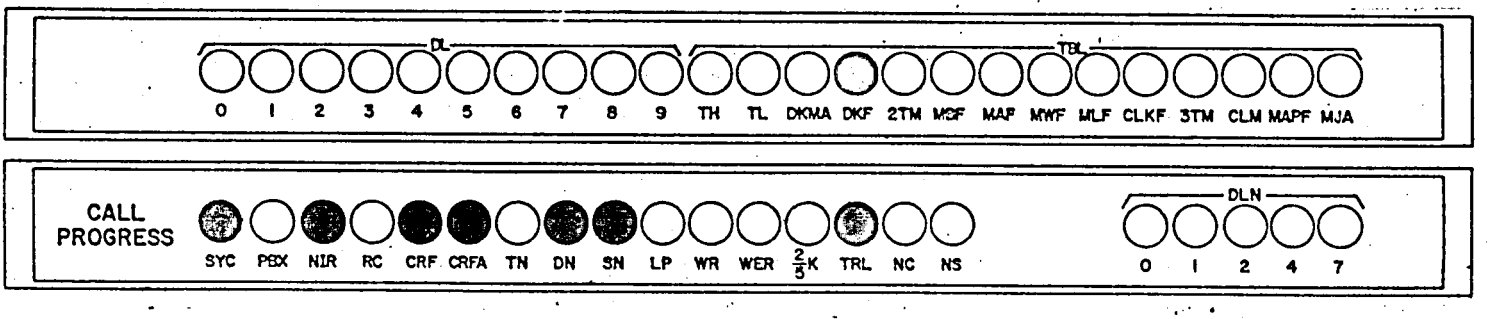
12.56 NO STATION NUMBER




Analysis: A NIR Request was attempted. The Trunk Number was in Memory, there was a Data Number associated with it but there was no Station Number. The Data Register's Station Number lamps are not lit.

Source of Trouble: 1. The previous PBX Request had an error in the 2/5 coded data thus removing the Station Number from Memory.

12.57 2/5 FAILURE TRUNK NUMBER




Analysis: An NIR Request was attempted, there was an error in the Trunk Number. The Trunk Number will be displayed on the Data Register lamps so that the digit in error can be determined.

Source of Trouble: 1. Operator Control - A valid 2/5 coded Trunk Number was not utilized.
2. Cabling (TK- leads) between the AIOD frame and the AIOD Translator.
3. SD-1C235 FS6

13. SYSTEM TEST

13.1 System Test refers to the initiation of a call from the PBX-ANI and allowing the Central Office billing equipment to request the billing information from the AIOD frame.

NOTE: The test is to be performed only at the Request of the local operating company.

13.2 An intermediate step between Long Loop Tests and System Test is to initiate a Request from the PBX-ANI and, using the Trunk Number supplied by the PBX-ANI Test Set, then perform a Simulated NIR Request and verify that the Office Index and Station Number are displayed.

13.3 Even though Long Loop Tests and the tests of Paragraph 13.2 can be performed, lamps DKMA and MAF will light if the Trunk Number assignments at the PBX-ANI and at the C.O. differ.

13.4 When requests are initiated at the PBX-ANI lamps DL- and SYC will blink, lamp DL- lit indicates the Data Trunk is use and lamp SYC extinguished indicates a request it being served.

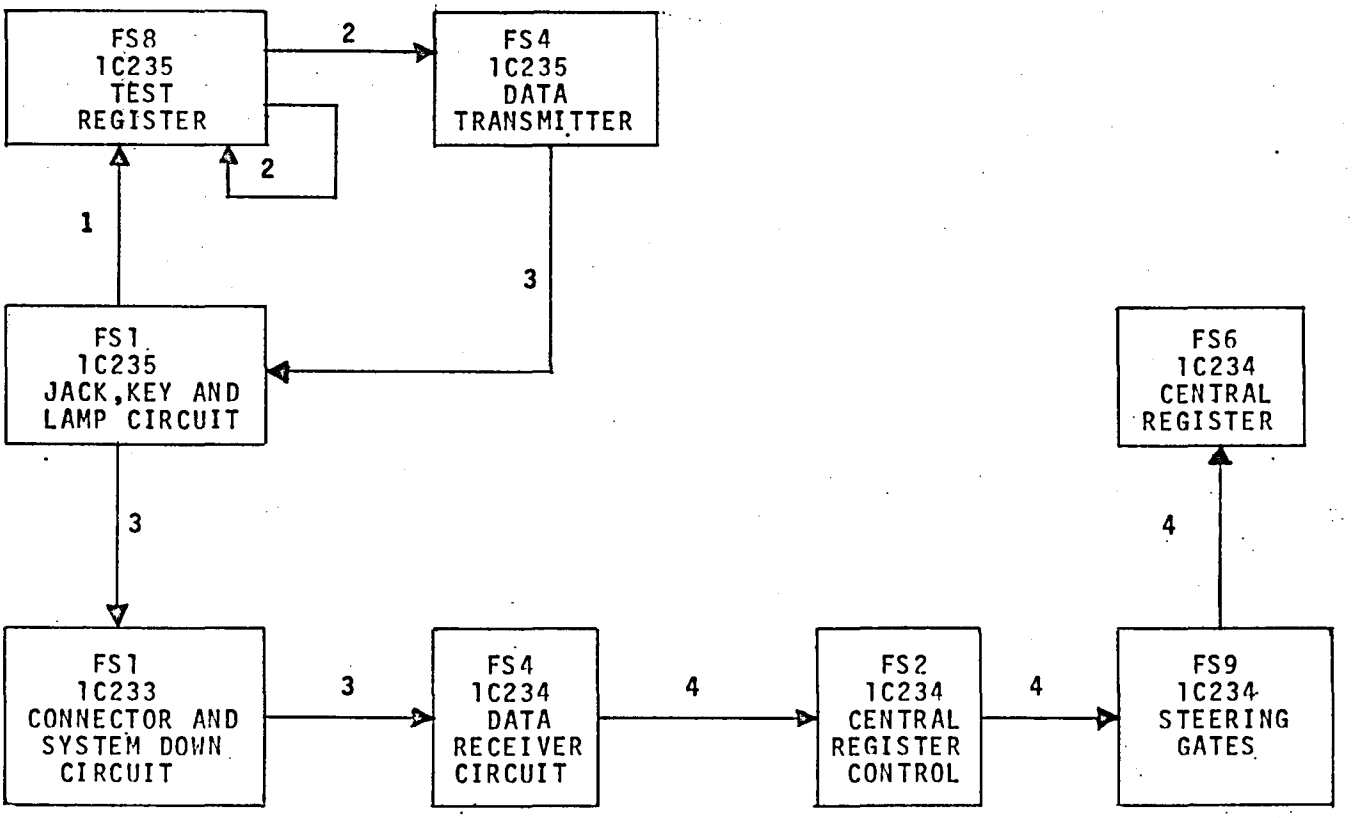
No changes are indicated due
to extensive revision.

ATTACHMENT
BD1 Continuous Transmission on Pg. 30.

Manager, Product Engineering
Control Center

Reason for Reissue:
To provide new testing procedures for use
with the new shift register memory.

BD1




CONTINUOUS TRANSMISSION - SIMPLIFIED

BRIEF DESCRIPTION:

1. The Control Panel is used to enter data into the Test Register.

2. The data is shifted serially out of the Test Register. The Test Register is looped so that data is continuously transmitted.

3. The logical pulses are converted to 1150Hz (a zero) and 1850Hz. (a one) signals and sent to the SIS & C circuit.

4. The 1150 Hz and 1850 Hz signals are reconverted to logical pulses and then serially shifted through the Central Register.