ANALYZING AND LOCATING TROUBLE IN SIGNAL DISTRIBUTORS 2-WIRE AND 4-WIRE NO. 1 ELECTRONIC SWITCHING SYSTEM

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can occur in the controllers and the relay contact tree of the Signal Distributor (SD).

1.02 This section is reissued to include the DR02 message for CTX-7 Issue 9 and 1E4 generic programs and to make minor corrections.

Note: Effective with what would have been CTX-8 Issue 4 of No. 1 ESS, the equivalent generic program designation is 1E4.◆

2. GENERAL DESCRIPTION

cycle when the Central Pulse Distributor (CPD), as instructed by Central Control (CC), transmits an enable signal over a private bus. This causes a particular signal distributor to gate the selection data from the peripheral unit address bus into its buffer register (Fig. 1). The buffer register stores this data until the selected magnetic latching relay has operated or released. When the signal

distributor senses the completion of the magnetic latching relay action, it releases the established path through the relay contact tree and becomes available for a new order.

- 2.02 The function of the network controller in the Signal Distributor is to:
 - (a) Receive address information
 - (b) Check address information for errors
 - (c) Block further action if errors are found and notify CC
 - (d) Operate preselector relays
 - (e) Receive verification that the selected magnetic latching relay worked as intended.

If all circuit conditions are satisfied, the controller resets for the next cycle of operation.

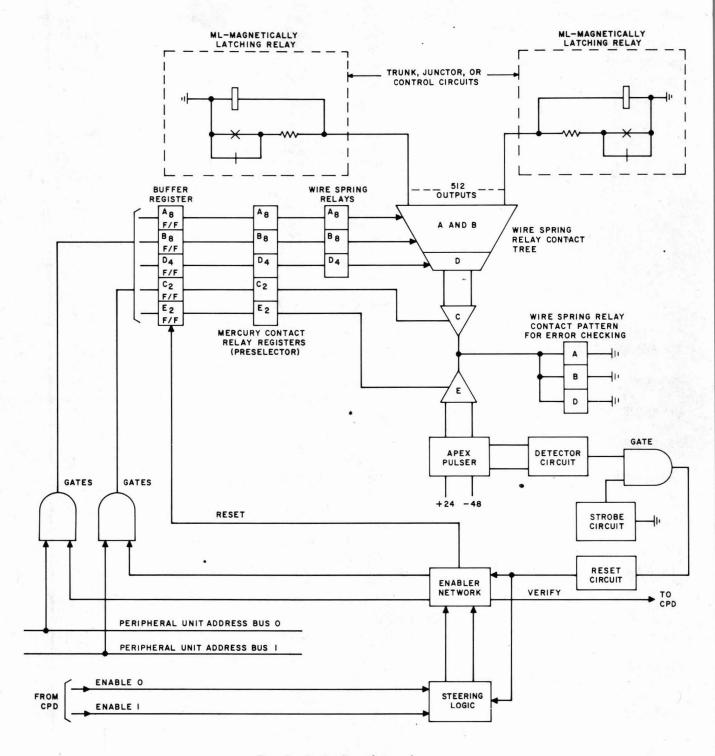


Fig. 1—Basic Signal Distributor

2.03 The relay contact tree consists of an organized system of wire-spring relays which provide a unique electrical connection called a selection path from the apex pulser to the addressed output.

A typical selection path to operate or release a magnetic latching relay within a basic unit is shown in Fig. 2.

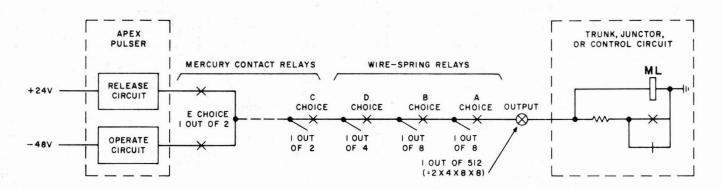


Fig. 2—Selection Path to Operate or Release a Magnetic Latching Relay

3. REFERENCE D	OCCUMENTS	CD-1A128	Circuit Description for Miscellaneous Signal Distributors
PD-1A028	TITLE Diagnosis Program Description	SD-1A128	Schematic Diagram for Miscellaneous Signal Distributors
PK-1A028	Raw Data Analysis	PF-1A028	Program Flowchart
TLM-1A216	Trouble Locating Manual for Signal Distributor	IM-1A001	Input Message Manual
CD 14010.		OM-1A001	Output Message Manual
CD-1A216 *	Circuit Description for Signal Distributor	Other Sections	Referenced:
SD-1A216	Schematic Diagram for Signal Distributor	040-272-701	RELAYS 286, 287, AND 288 TYPES REQUIREMENTS AND ADJUSTING PROCEDURES
CD-1A247	Circuit Description for Supplementary Signal Distributor	100-136-301	MAGNETIC LATCHING TIMING RELAY TEST SET J94735A
SD-1A247	Schematic Diagram for Supplementary Signal Distributor		OPERATION
CD-1A113	Circuit Description for Junctor Signal Distributor	231-130-301	TRUNK AND LINE TEST PANEL AND SUPPLEMENTARY TRUNK TEST PANEL—METHOD OF OPERATION
SD-1A113	Schematic Diagram for Junctor Signal Distributor		
CD-1A127	Circuit Description for Universal Signal Distributor	4. TOOLS, MAT	TERIALS, AND TEST APPARATUS
SD-1A127	Schematic Diagram for Universal Signal Distributor	SPEC. NO.	DESCRIPTION

662A

Adjuster for fixed contacts

453A

Tektronix Oscilloscope or Equivalent

MATERIALS

Bond paper

Trichloroethane

TEST APPARATUS

J94735A

Magnetic Latching Relay Test Set

KS-20538-L1

Volt-Ohmmeter or Equivalent

5. NETWORK CONTROLLER DIAGNOSTIC FAILURES

printouts or TBL lamps at the MCC. If detected by TBL lamps, use NETSD-TBL message to determine the failing unit. Refer to IM-1A001 Input Message Manual for complete message. The system will respond with an MA06 NTSD TBL message. Refer to OM-1A001 Output Message Manual for complete message. The controller enable word is shown in Fig. 3.

22	20	19		17	16	14	13		11	10	9		7	6	5	4		1	0
	GROUP IN CPD		ROW IN CPD		COLU	N		CPD PAIR		C P D	TRA	CC NSLAT	OR	NO 2	EE TE		STATUS BITS SEE NOTE I		

Fig. 3—Layout of Network and SD Enable Word

Note 1: Bit 1 = 1—controller is in trouble and out of service.

Bit 2 = 1—controller is bus or CPD sensitive.

Bit 3 = 1—fault recognition is in progress on controller.

Bit 4 = 1—both controllers are faulty.

Note 2: Bits 5 and 6 indicate maintenance responses to CC:

Bit 5 = 1—look for ASW, always 0.

Bit 6 = 1—look for enable verify, normally 1.

EXAMPLE:

MA06 NTSD TBL UTSD SEC MEMN

00 05603502 05603500

Note 3: Member number = 00. Octal digits 05603502 represent controller 0 and octal digits 05603500 represent controller 1. Bit 1 of controller 0 word equals 1; therefore controller 0 is out of service.

5.02 Using the information obtained in 5.01, request a diagnostic using NET DGN message as per IM-1A001 Input Message Manual. The system will respond with a DR01 TBL message. Refer to OM-1A001 Output Message Manual for complete output message.

5.03 Repeat 5.02 to insure that trouble is not random. Numerous circuit failures can be the cause of network frame controllers failing a diagnostic. Refer to TLM 1A216 for UTSDs and JSDs and to TLM 1A247 for SSDs and MSDs, and if an exact match is found, replace the designated circuit packs one at a time. Repeat diagnostic each time a pack is replaced. If the same universal trouble number occurs, replace the old pack and proceed to the next pack listed. If this fails to fix the trouble, or if the original trouble did not yield an exact match, the next step will be to request a raw data printout.

- 5.04 Analysis of the raw data printout will be made easier if the fundamental operation of the **Signal Distributor** (SD) is understood.
- 5.05 SD diagnostic tests are predicated on sending a series of orders to the suspected controller and monitoring the internal relay operations from private master scanner points. The following paragraphs show the basic operations for the SD internal circuitry.

Steering Logic-FS4

- 5.06 Each controller can be enabled by either of two CPD signals. For a given controller, each enable originates from a different CPD and allows the controller to receive orders from either PU address bus (Fig. 4).
- an enable verify pulse will be sent back to the CPD, and the timing sequence to receive and carry out the order is started. Successful completion of the order results in resetting the controller via an output from the apex pulser. If the controller is not reset by completion of the order, it may be reset by a CC pulse (lead 36) sent to all controllers at the end of each cycle.

Maintenance Relays—FS5

- 5.08 The F, S, and T points are connected over private pairs to a master scanner. These points reflect the state of the controller, and also the source of the controller reset (Fig. 4).
- 5.09 In addition to the F, S, and T points, FS5 contains the maintenance relays used for changing states of a controller. This circuitry is controlled by a CC order to the mate controller, and is designed to prevent mate units from being placed in conflicting states.

Relay Contact Matrix—FS3

5.10 The peripheral order received in FS1 should have operated one X and one Y relay in FS2. In FS3 this "one and only one" concept is tested. If more than one relay is operated in either group, the R/LCKP or R/LCKS lead will be grounded and will prevent the controller from affecting an external relay.

Apex Pulser-FS6

- 5.11 When the relay path has been established to the output point, the apex pulser will attempt to operate or release the external relay. If the external relay functions properly, a step current will be detected, resulting in an R/LOP pulse to reset the controller.
- 5.12 At the MCC-TTY request raw data diagnostic as described in 5.02.
- 5.13 The following examples represent typical raw data failures on a UTSD. In each case, analysis of the printout will narrow the trouble possibilities to a relatively small area.
- 5.14 Controller diagnostic programs perform a logical sequence of tests to isolate internal circuitry problems. When analyzing raw data results, it is usually advantageous to examine the data from all preceding and succeeding tests which may have passed.
- 5.15 Example #1—UTSD CONTROLLER 0. Phases 2 and 3 fail identical tests using PK 1A028 and the raw data printout. The information derived is as follows:

DR02 RAW DGN RES UTSD 0 CONTR 0

PH 1 ATP

PH 2 STF	PH 3 STF.
00000000	00000000
02104000	02104000
00210420	00210420
00000000	00000000
00000000	00000000

s.16 All failing bits refer to Note 88 in PK-1A028, which in turn refers to Note 87. Note 87 explains why the AP point on the diagnostic bus will read zero (saturated). This occurs when the LSO or LSR (the failure is in controller 0) relays operate. These relays operate when either the operate or release current flows.

- 5.17 A check of each failing bit shows the problem always to be AP = 0. For each of these test orders, a Y relay is supposed to operate without any X or W relays operating. If the controller functions properly, the operate or release potential should not be closed through. Therefore, the AP point would be unsaturated.
- 5.18 There are 8 LY relays (0 through 7), but only 7 bits failed in the raw data test.Checking the remaining test orders shows that bit 0 of word 3 passes. In this instance, the LY3 relay is being operated.
- 5.19 FS3 of SD-1A216 contains the relay matrix. If more than one relay in any group operates, a shunting ground is placed in the path of the operate or release potential.
- 5.20 Since the LY3 is the only relay that passes the test, it can be assumed that this relay is operating falsely on the other seven test orders, resulting in a "more than one" failure.
- 5.21 It would appear that the L03 relay, make contacts 3 to 10, are stuck closed. Using an ohmmeter, check contacts, change the circuit packs associated with the LY3, and inspect the wiring or use NET-ONE order (6.29) to locate the trouble.
- 5.22 Example #2 UTSD CONTROLLER 0. In this case, only one failing bit is indicated in the printout:

24 DR02 RAW DGN RES UTSD 0 CONTR 0

PH 1 ATP

5.23 The fact that only one bit is shown as failing does not mean that all other tests passed. In this case the remainder of the tests were

bypassed once a failure was encountered. The indication that the diagnostic phase has ended can be obtained from the PK sheets as shown by the notation "terminate points". In this case, phase 2 or 3 will be terminated after bit 7 if any failure occurs between bits 4 through 7.

- 5.24 Bit 4 indicates a DC check failure on point AR. These points can be located by using the lead index in the SD. This point tests the normal state of relays L08 through L15 through a contact of the LTA relay.
- 5.25 For offices with CTX-7 Issue 9, IE4 or later generic programs, the DR02 message is basically the same. The differences are as follows:
 - A 12-digit phase trouble number is printed
 - A 12-digit universal trouble number is printed
 - The word number in decimal of the failing raw data is printed
 - All raw data words which contain only zeros are not printed

6. RELAY TROUBLE LOCATING PROCEDURES

6.01 Using Fig. 5 flowchart with numbered Procedures listed in 6.02 through 6.29, this section can be used as a guide to locating most problems encountered in the relay section of Signal Distribution Frames.

PROCEDURE 1—ANALYZING NN10 MESSAGE FOR SD POINTS

6.02 At MCC-TTY type in:

NM-SNAP-ALL0001111.

System response:

OK-followed by

NN10 message when a failing order is detected.

6.03 Analyze NN10 message as follows:

 Variable field:

bbb = Frame type

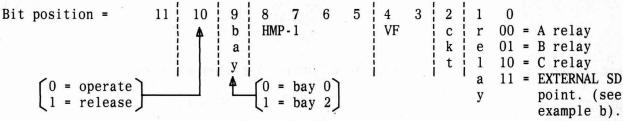
ccc = Network or Frame no.

ppppppp = Network order in octal

gggg ---- = order as it appears on the PU bus.

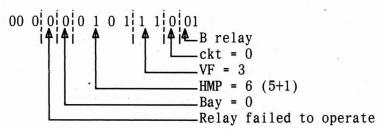
6.04 Analyze ppppppp as follows: for 2-wire No. 1 ESS

Note: If bit position 0 and 1 = 11, then it is an EXTERNAL SD point (MT) (see example b).

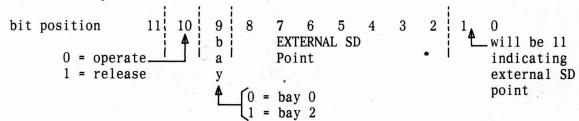


(a) EXAMPLE: Internal SD point

ppppppp = 0000271



(b) EXTERNAL SD point



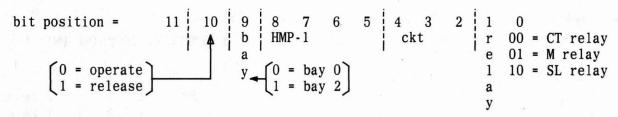
To determine SD point: convert binary bits 2 thru 8 to octal, convert octal to decimal for SD point for bay "0", if bay is 1, add 128 to decimal number for SD point. SD points 000 through 127 appear on bay 0 and SD points 128 through 255 appear on bay 2.

Use the 1201 form (MT Frame Assignments) to locate the TNN. Use office base T drawing to locate signal distributor points.

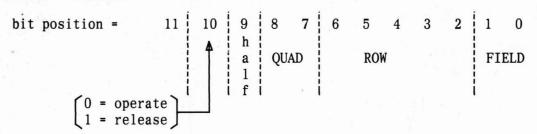
SECTION 231-007-305

(c) EXAMPLE:

6.05 Analyze ppppppp as follows: for 4-wire



6.06 Analyze ppppppp for SUPPLEMENTARY SIGNAL DISTRIBUTOR POINTS



EXAMPLE: ppppppp = 0002023
0 1 0 0 0 0 1 0 0 1 1
FIELD = 3
ROW = 4
QUAD = 0
HALF = 0
Point did not release

Using TABLE A, this SD point is No. 388. Refer to office base T drawings to find assignments.

PROCEDURE 2 CONVERTING UT APPEARANCE TO TNN

6.07 At MCC-TTY type in:

VFY-UTCN-12bb c ddd.

bb = UT Frame no. from NN10 message

c = bay (0=bay 0, 1=bay 2) from NN10 message

ddd = CKT no. (from Fig. 6)

System response:

TR11 aaa b ¢¢c d ¢¢e ff gh ij

44a b ¢¢c = trunk circuit no. specified in input message.

d = 0-not a trunk circuit

= 1-valid trunk circuit

#e = program index
ff gh ij = TNN of trunk

PROCEDURE 3—ANALYZING ppppppp OF NN10 MESSAGE FOR X AND Y PATTERN

6.08 As in Table B, the second and third least significant digit is the NN10 message which can be translated into the X and Y relay selection. Bit 2 of the order designates which digit represents each relay.

Example:

- (a) pppppppp = 0002044
- (a) Bit 2 = 1 (bits 3-5 = X relay, bits 6-8 = Y relay)
- (a) Bit 9 = 0 = left half
- (a) Bits 3-5 = 4 = LX4 relay operated

- (a) Bits 6-8 = 0 = LY0 relay operated
- (b) ppppppp = 0002040
- (b) Bit 2 = 0 (bits 3-5 = Y relay, bits 6-8 = X relay
- (b) Bit 9 = 0 = left half
- (b) Bits 3-5 = 4 = LY4 relay operated
- (b) Bits 6-8 = 0 = LX0 relay operated

120	121	122	123	124	125	126	127
112	113	114	115	116	117	118	119
104	105	106	107	108	109	110	111
096	097	098	099	100	101	102	103
088	089	090	091	092	093	094	095
080	081	082	083	084	085	086	087
072	073	074	075	076	077	078	079
064	065	066	067	068	069	070	071
056	057	058	059	060	061	062	063
048	049	050	051	052	053	054	055
040	041	042	043	044	045	046	047
032	033	034	035	036	037	038	039
024	025	026	027	028	029	030	031
016	017	018	019	020	021	022	023
008	009	010	011	012	013	014	015
000	001	002	003	004	005	006	007
т о	1	0	ī	0	1	0	1
							3
	112 104 096 088 080 072 064 056 048 040 032 024 016 008 000 T 0	112 113 104 105 096 097 088 089 080 081 072 073 064 065 056 057 048 049 040 041 032 033 024 025 016 017 008 009 000 001	112 113 114 104 105 106 096 097 098 088 089 090 080 081 082 072 073 074 064 065 066 056 057 058 048 049 050 040 041 042 032 033 034 024 025 026 016 017 018 008 009 010 000 001 002 T 0 1 0	112 113 114 115 104 105 106 107 096 097 098 099 088 089 090 091 080 081 082 083 072 073 074 075 064 065 066 067 056 057 058 059 048 049 050 051 040 041 042 043 032 033 034 035 024 025 026 027 016 017 018 019 008 009 010 011 000 001 002 003 T 0 1 0 1	112 113 114 115 116 104 105 106 107 108 096 097 098 099 100 088 089 090 091 092 080 081 082 083 084 072 073 074 075 076 064 065 066 067 068 056 057 058 059 060 048 049 050 051 052 040 041 042 043 044 032 033 034 035 036 024 025 026 027 028 016 017 018 019 020 008 009 010 011 012 000 001 002 003 004 T 0 1 0 1 0	112 113 114 115 116 117 104 105 106 107 108 109 096 097 098 099 100 101 088 089 090 091 092 093 080 081 082 083 084 085 072 073 074 075 076 077 064 065 066 067 068 069 056 057 058 059 060 061 048 049 050 051 052 053 040 041 042 043 044 045 032 033 034 035 036 037 024 025 026 027 028 029 016 017 018 019 020 021 008 009 010 011 012 013	112 113 114 115 116 117 118 104 105 106 107 108 109 110 096 097 098 099 100 101 102 088 089 090 091 092 093 094 080 081 082 083 084 085 086 072 073 074 075 076 077 078 064 065 066 067 068 069 070 056 057 058 059 060 061 062 048 049 050 051 052 053 054 040 041 042 043 044 045 046 032 033 034 035 036 037 038 024 025 026 027 028 029 030 016 017

Fig. 6—Circuit Location for UTs

TABLE B
PPPPPPP OF NN10 MESSAGE

BIT	PURPOSE
0-1	Selects L/RWO through L/RW3 relays. L/RW3 is used for external points.
2	Selects circuit within PLUG-IN-UNIT.
3-5	X or Y relay selection Bit 2 = 0 = Y relay selection Bit 2 = 1 = X relay selection
6-8	X or Y relay selection Bit 2 = 0 = X relay selection Bit 2 = 1 = Y relay selection
9	Left or right half Bit 9 = 0 = bay 0 Bit 9 = 1 = bay 2
10	Operate or release Bit 10 = 0 = operate Bit 10 = 1 = release

PROCEDURE 4—RUNNING CONTROLLER IN COMBINED MODE

6.09 Run each controller in the combined mode.

This procedure will determine whether the failure is associated with a relay path or the internal controller circuitry.

Example: If controller 1 fails only to points in bay 2 when running in either the normal or combined mode, the trouble would most likely be with the right half relay tree (R relays), since the controller can crossfire without trouble to the left relay tree (L relays). To further isolate trouble, run controller 0 in the combined mode. If failures occur in the right half while controller 0 is running combined, the trouble will be proven into the right relay tree. If the failure does not occur with controller 0 combined, the RX and RY relays (the relay tree) can be eliminated, since these relays operate properly from one controller. In this case, the trouble area to suspect would be the R00 through R25 relays.

PROCEDURE 5—STRAPPING AROUND SUSPECTED RELAY CONTACTS

6.10 If failing orders always show the L19 relay, rather than the L18 relay, the trouble might

be caused by the L18 relay failing to restore properly after completing an order. If the next order requires the operation of the L19 relay, the pulse path would be open and thus fail.

6.11 Figure 7 shows where strap would be applied, for test purposes.

WARNING: Before applying any external strap, be sure to study SD 1A216-01 and CD 1A216 carefully for possible side effects.

6.12 276A AND 276AA RELAYS

(a) These relays are used to reset the controller (L/R 29 etc), and if they occasionally stick, will cause random failures.

PROCEDURE 6—TESTING TIMING OF L29 OR R29 RELAY

6.13 At the UT Frame, connect trace lead of oscilloscope to pin 1 of the LCO or RCO relay (depending on the relay to be timed). Normally this relay should never operate. If it does, connect the oscilloscope to pin 8 break of the L29 or R29 relay.

- (a) Connect sync lead of the oscilloscope to the active enable.
- (b) Set timing on the oscilloscope at 5 ms.
- (c) The waveform shown in Fig. 8 should be observed.
- (d) The pulse observed should occur between 17-18 msec. If the timing is 19 msec or more, the relay should be replaced.
- (e) Check the timing on the new relay after it is installed.

Note: Several new relays have been found to be troublesome.

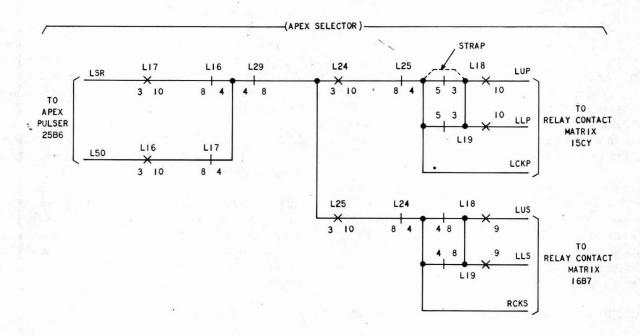


Fig. 7-Apex Selector

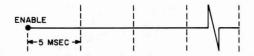


Fig. 8—Timing Pulse

PROCEDURE 7—ANALYZING NN10 MESSAGE PU BUS

6.14 Analyze NN10 message as follows:

N.	N10	aaaa
_		

gggg gggg gggg gggg gggg gggg gggg

Using Table C determine L or R relays that are operating.

6.15 Fault could be relay that never appears in failure message. By keeping a stroke record of the L or R relays (313A) appearing in NN10 messages, sticky relays can be elected. If one relay never appears in the NN10 message, it could be this relay is sticking.

Example: If random failures are being received which never involve the R08 relay, this relay should be suspected. If this relay is occasionally sticking, it would cause a "more than one" failure on any subsequent order. However, if the next order involves the R08 relay, it will pass because this relay's contacts are already closed.

PROCEDURE 8-LOCATING X AND Y RELAY TROUBLE

CAUTION: This procedure should be used only during periods of light traffic.

6.16 At the TLTP make most predominant TNN TWIN BUSY.

System response:

TN06 TNN TN06 TNN

- 6.17 At UT frame—Remove the trunk pack in question. Reinsert trunk pack using the 169A trunk pack adapter.
- 6.18 At the MCC-TTY type in:

NET-ONE-aaa bbc de ffffffff gggggggg hhhhhhhh.

Variable e in NET-ONE message = 0

Variable gggggggg is the same as variable ppppppp in NN10 message or word 4 of MN01 message (6.30).

6.19 At the UT frame determine which 286N relays are pulsing by observation.

WARNING: These relays CANNOT be removed from service. DO NOT interfere with their normal operation.

- 6.20 Using Table D, determine where the sync lead of the oscilloscope should be attached for the 286N relays determined in 6.19. Attach sync lead to the designated pin of the circuit pack. Only one lead is needed. If there are excessive extraneous pulses, use other relay circuit packs for sync pulse.
- 6.21 Attach oscilloscope trace lead on the battery side of relay winding of the relay determined from ppppppp in the NN10 message.
- 6.22 Adjust oscilloscope so entire pulse can be seen clearly. The operate pulse (-48V) and the release pulse (+24V) will be seen superimposed. The pulses should appear to be uniform and clean on the oscilloscope (no nipples, spikes, variation in length, etc).
- 6.23 If pulses appear distorted, look for the following conditions on 286N relays in the path set up by the NET-ONE message:
 - (a) Foreign elements in contacts
 - (b) Excessive spacing between fixed and moving contacts (compare with other relays in the tree)
 - (c) Vertical alignment of contacts not uniform from top to bottom (compare with other relays in the tree).

Clean contacts with bond paper saturated with trichloroethane. **DO NOT** BURNISH THESE CONTACTS.

6.24 Test and adjust 286N relays as per Section 040-272-701. Special attention should be given to the problem of sticking armatures on 286N relays, a condition which frequently causes relay chatter well beyond the 4 ms allowed tolerance.

- 6.25 Remove all oscilloscope leads. At the MCC, abort the NET-ONE message by depressing PROGRAM CONTROL KEY 20.
- 6.26 At the UT frame, remove the 169A Adapter. Reinsert the trunk pack.
- 6.27 At the TLTP make both TNN's idle. Call through on both TNNs.
- 6.28 Start with 6.16 on next trouble. It is possible that some of the existing NN10 messages may now be clear due to adjustments already accomplished.

PROCEDURE 9—CONSTRUCTING A NET-ONE MESSAGE

6.29 This message will allow a single order to be repeatedly sent to the signal distributor frame. Refer to IM-1A001 for the complete message structure.

6.30 This example of a NET-ONE message is constructed in long binary as taken from raw data failure (Fig. 9). This failure is on a UTSD controller 0 and bit 0 failed:

ffffffff of NET-ONE message = 00000400 for long binary

gggggggg of NET-ONE message are bits 0 through 22 of the order as it goes out on the bus (Fig. 9) = 01200400

hhhhhhh of NET-ONE message are bits 23 through 35 of the order as it goes out on the bus (Fig. 9) = 00000012

The message would be as follows:

NET-ONE USD00000 00000200 00500200 00000012.

TABLE C ORDER ON PU BUS

	L/R 0 L/R 1 L/R 2 L/R 3 L/R 4 L/R 5 L/R 6 L/R 7 L/R 8 L/R 9 L/R 10 L/R 11 L/R 12 L/R 13	PERATED		RELAY O	PERATED
BIT	1ST	/R 0 L/R Y0 /R 1 L/R Y1 /R 2 L/R Y2 /R 3 L/R Y3 /R 4 L/R Y4 /R 5 L/R Y5 /R 6 L/R Y6 /R 7 L/R Y7 /R 8 L/R X0 /R 9 L/R X1 /R 10 L/R X2 /R 11 L/R X3 /R 12 L/R X4 /R 13 L/R X5	BIT	1ST	2ND ·
0	L/R.0	L/R YO	15.	L/R 15	L/R X7
1	L/R 1	L/R Y1	16	L/R 16	
2	L/R.2	L/R Y2	17	L/R 17	=
3	L/R 3	L/R Y3	18	L/R 18	
4	L/R 4	L/R Y4	19	L/R 19	
5	L/R 5	L/R Y5	20	L/R 20	L/R WO
6	L/R 6	L/R Y6	21	L/R 21	L/R W1
7	L/R 7	L/R Y7	22	L/R 22	L/R W2
8	L/R 8	L/R*XO	.23	L/R 23	
9	L/R 9	L/R X1	24	L/R 24	-
10	L/R 10	L/R X2	25	L/R 25	¥
11	L/R 11	L/R X3	26	L/R 26	
12	L/R 12	L/R X4	27	L/R 27	
13	L/R 13	L/R X5			
14	L/R 14	L/R X6		* * *	

TABLE D
SYNC LEADS FOR UTSD TREE RELAYS

RELAY	CKT-PKT	PIN	RELAY	CKT-PKT	PIN
LWO	120-16	2	RWO	120-44	2
LW1	120-16	1	RW1	120-44	1
LW2	120-16	0	RW2	120-44	0
LX0	120-04	2	RX0	120-30	2
LX1	120-04	1	RX1	120-30	1
LX2	120-04	0	RX2	120-30	0
LX3	120-04	26	RX3	120-30	26
LX4	120-08	2	RX4	120-32	2
LX5	120-08	1	RX5	120-32	1
LX6	120-08	0	RX6	120-32	0
LX7	120-08	26	RX7	120-32	26
LY0	120-12	2	RY0	120-34	2
LY1	120-12	1	RY1	120-34	1
LY2	120-12	0	RY2	120-34	0
LY3	120-12	26	RY3	120-34	26
LY4	120-14	2	RY4	120-40	2
LY5	120-14	1	RY5	120-40	1
LY6	120-14	0	RY6	120-40	0
LY7	120-14	26	RY7	120-40	26

	ВІТ	CAUSE OF FAILURE											ORE	ER	S	AS	тн	ΕY	GO	ou	T	ON	THI	E	BUS						16						
	ВП			34	33	32	31	30 2	9 2	8 27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ıx	0	DR = I NO Y OR W							T	T	x		x						x		x						1		x								П
	1	AP = 0 XI ENERGIZED NO Y OR W				- 20					x		x						X		x							x									
	2	AR = O									x		x						X		X							X									
	3	BR = I	1								x		x						x		x							x									П

Fig. 9—Raw Data Failure