

CROSSED OR FALSELY GROUNDED NUMBER GROUP CONNECTOR NS LEADS NO. 1 CROSSBAR OFFICES

1. GENERAL

1.01 This section covers methods to be followed in connection with analyzing and locating trouble conditions due to crossed or falsely grounded number group connector NS leads.

1.02 The terminating marker circuit is designed to test for falsely grounded or crossed number group connector NS leads, during light traffic conditions. When successive calls are handled by a terminating marker with less than approximately one-half second between calls the NS leads are not tested.

2. INDICATIONS OF TROUBLE CONDITION

2.01 Terminating trouble indicator displays (during light traffic only).

2.02 Reports of false busy on subscriber lines.

2.03 Reports of double connection or crosstalk on subscriber lines.

2.04 Can't call or no dial tone report on a particular subscriber line.

3. REACTIONS DUE TO TROUBLES

3.01 Depending upon the location and nature of a particular trouble condition one-tenth or one-twentieth of the calls to subscribers in a number group may be affected. A false busy signal may be returned in some cases and in others double connections may occur.

4. IMMEDIATE PROCEDURE TO FOLLOW

4.01 A sufficient number of terminating trouble indications should be recorded to permit analysis of the trouble condition.

4.02 Analyze the terminating trouble indicator record.

4.03 When the trouble condition has been analyzed it may be desirable to make use of the TRO jacks until the trouble is cleared.

4.04 If analysis indicates a particular terminating marker is in trouble make it busy.

4.05 Investigate trouble reports of false busy, crosstalk, etc. to determine the equipment involved. Analyze the information obtained to determine if the trouble is associated with a particular number group.

4.06 By means of tests and inspections locate and clear the trouble condition.

5. ANALYSIS OF TROUBLE CONDITION

5.01 Crosses or false grounds on number group connector NS leads affect the completion of calls to subscriber lines in various ways, depending upon the nature and location of a particular trouble. This section treats trouble conditions due to crossed or falsely grounded number group connector NS leads under the six following classifications illustrated in Fig. 1:

(a) Grounded NS lead - Individual contact on TB relay.

(b) Grounded NS lead - Common contact on TB or MCB relay.

(c) Crossed NS leads - Two individual contacts on TB relay.

(d) Crossed NS lead - Individual and common contact on TB relay.

(e) Crossed NS leads - Two common contacts on TB or MCB relay.

(f) Crossed NS lead - Individual and common contact on MCB relay.

5.02 Trouble (a) - Grounded NS Lead - Individual Contact on TB Relay. A ground on an individual contact of a TB relay will operate the associated line hold magnet, thereby denying the subscriber both outgoing and incoming service. The attention of the maintenance forces is usually directed to trouble conditions of this nature through subscriber reports, as no trouble indications are received. Make tests and inspections to locate and clear the trouble.

5.03 Trouble (b) - Grounded NS Lead - Common Contact on TB or MCB Relay.

(a) Light Traffic Operation in the Terminating Marker - The terminating markers

make a test of the NS leads, prior to the operation of the number group connector TB relay, when serving calls under light traffic conditions. The test is made by completing the operating path of the XS relay through contacts of the operated XS3 relay, the windings of all S relays, through normal contacts of associated L relays to the NS leads, and through the operated contacts of the number group connector MCB relay to the multiple wiring of the number group connector TB relays. A grounded common contact on a TB or MCB relay will cause the XS relay to operate followed by the operation of the X relay. Terminating trouble indications of X, XS will be received involving a particular number group on calls from any terminating marker to any subscriber line in the number group. The particular NS lead in trouble may be determined by testing terminals 20 to 39 inclusive on the terminal strips associated with the number group connector TB or MCB relays.

(b) Heavy Traffic Operation in the Terminating Marker or Second Trial by the Terminating Marker - When these conditions prevail terminating trouble indications will not be received. This is due to circuit design in the terminating marker which cancels the test of NS leads under heavy traffic or second trial conditions. A busy signal will be returned on calls to any number within the number group associated with the grounded NS lead. As a result reports of false busy may be received on lines associated with the grounded NS lead. Double connections may occur in connection with calls to numbers, within the number group, not associated with the grounded NS lead. When any TB relay associated with the number group involved operates, the false ground is extended over the corresponding NS lead to the associated LS punching. If the line number associated with the LS punching is working, the line hold magnet will operate. As a result a double connection may occur. To illustrate this consider that the number 20 common contacts on the TB relays in number group 1 serving subscriber lines from 0800 to 1599 inclusive are falsely grounded (see Fig. 1). A call to 0825 will result in the associated number group TB relay operating. Due to heavy traffic or second trial conditions in the terminating marker the false ground is not detected. The line hold magnet associated with 0820 will operate, due to the false ground, as well as the line hold magnet associated with 0825. If these two numbers appear in the same line link horizontal group a double connection will occur. Double connection may also occur if

the equipment assignments for 0820 and 0825 are in different line choices, in connection with a simultaneous originating or terminating call involving a subscriber line appearing on the same horizontal line group as 0820. In this case the double connection may involve a line number in a different number group from the one in trouble. A report of double connection from the line doubled with 0820 would, in this case, be misleading. Therefore it would be necessary to determine both line numbers involved in a double connection to analyze accurately the trouble condition. In the same manner, double connections may occur when any TB relay associated with the number group in trouble is operated. An analysis of double connection reports, when both line numbers involved are known, should indicate the particular number group and NS lead in trouble.

5.04 Trouble (c) - Crossed NS Leads - Two Individual Contacts on TB Relay. The individual NS leads are connected into the terminating marker circuit with the operation of the number group connector TB relay. However the terminating marker test for grounded or crossed NS leads is completed before the TB relay operates; hence crosses on individual leads are not detected by the marker. If both lines involved in the cross are idle when either one of them is called both line hold magnets will operate. Double connections may occur in the same manner described under (b) in 5.03. If either line involved in the cross is busy, outgoing service will be denied the other line and a false busy signal will be received on incoming calls. An analysis of reported trouble should indicate the particular NS leads that are crossed.

5.05 Trouble (d) - Crossed NS Lead - Individual and Common Contact on TB Relay.

(a) Light Traffic Operation in the Terminating Marker - If, under this condition, the line number involved in the cross is busy, a terminating trouble indication of X, XS will be received on calls to any other number within the number group in trouble. If the line associated with the cross is idle, double connections may occur on calls to other numbers within the number group associated with an NS lead corresponding to the one in trouble, in the manner described under (b) in 5.03. Double connections, however, will only occur on the horizontal line group location of the number involved in the cross.

SKETCH OF NS LEADS

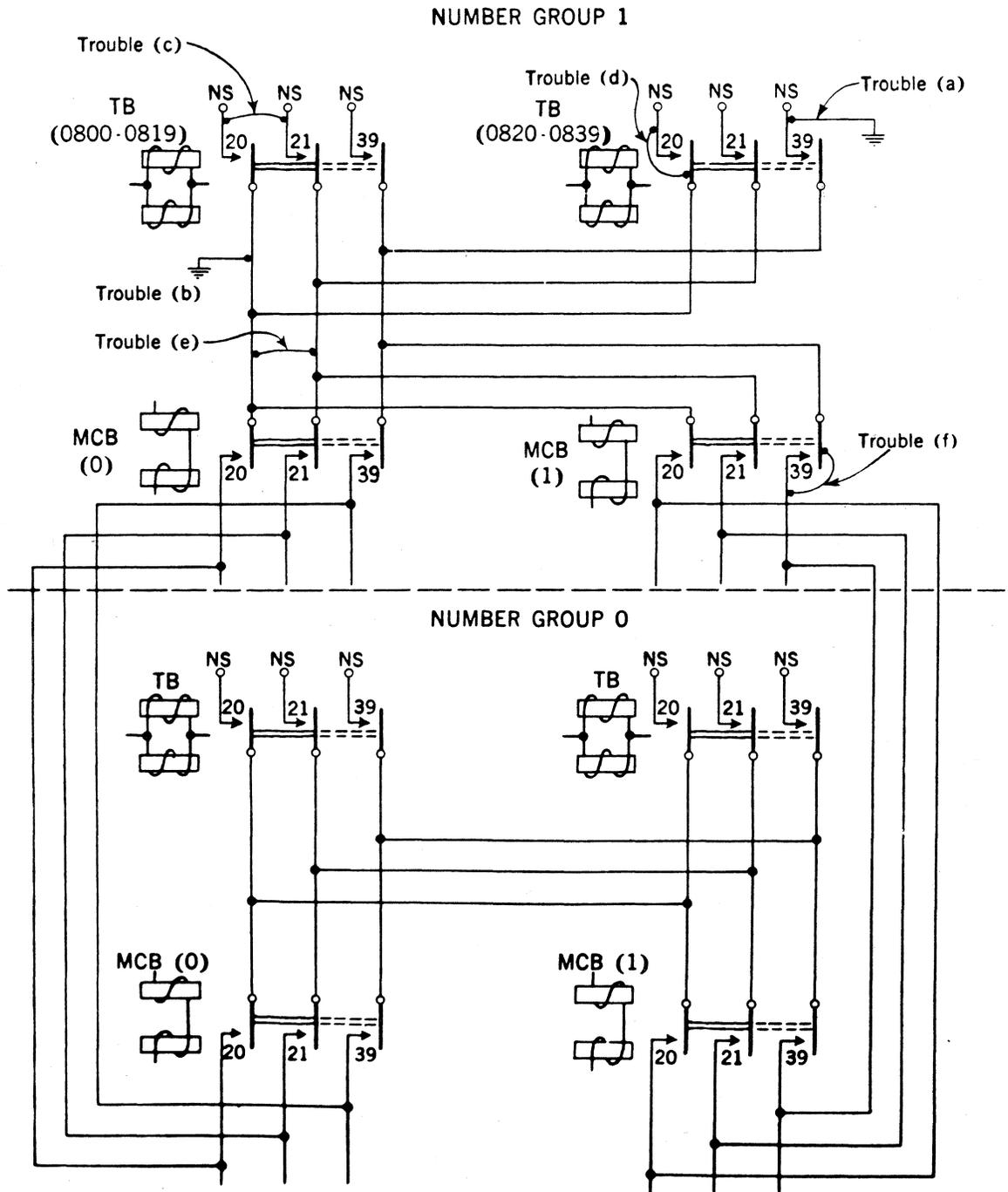


Fig. 1

(b) Heavy Traffic Operation in the Terminating Marker or Second Trial by the Terminating Marker - If the line associated with the cross is busy, a false busy signal will be returned on calls to other numbers, within the number group, requiring the use of the NS lead in trouble. If the line associated with the cross is idle its line hold magnet will operate on calls to other numbers within the number group, associated with the NS lead in trouble. Under this condition double connections may occur in the manner described under (b) in 5.03 on the horizontal line group location of the number involved in the cross.

5.06 Trouble (e) - Crossed NS Leads - Two Common Contacts on TB or MCB Relay.

(a) Light Traffic Operation in the Terminating Marker - Under this condition the terminating marker makes a test for crossed number group connector NS leads. This test is made at the start of a call in the terminating marker by the operation of relays XS4, XS5 and the L for the number registered in the marker. Ground over the XNS lead from the terminating trouble indicator is connected through these relays to the NS lead associated with the operated L relay. A cross between this NS lead and any other will result in the ground being returned to the terminating marker circuit through contacts of the unoperated L relay associated with the crossed NS lead through the S relay winding associated with the unoperated L relay, operated contacts of the XS3 relay to battery on the winding of the XS relay causing it to operate. The X relay will follow the operation of the XS and a terminating trouble indication will be received. Analysis of the trouble indications received should indicate the crossed NS leads.

(b) Heavy Traffic Operation in the Terminating Marker or Second Trial by the Terminating Marker - Under these conditions the test for crossed NS leads is not made. Double connections or a false busy signal may occur in the manner described in 5.03(b) and in 5.04, respectively. Analysis of reported troubles as outlined in 5.03(b) should indicate the crossed NS lead.

5.07 Trouble (f) - Crossed NS Lead - Individual and Common Contact on MCB Relay. The reactions experienced due to this trouble condition occur in connection with simultaneous calls to two number groups, provided one of the calls is to a number group other than the one associated with the MCB relay in trouble and is being served by the terminating marker associated with the MCB relay with the crossed contacts, and the other call is to the number group in trouble.

(a) Light Traffic Operation in the Terminating Marker - Under this condition terminating trouble indications of X, XS will be received, provided ground is connected to the NS lead in trouble, either by the terminating marker serving the call in the number group associated with the MCB relay in trouble or due to the subscriber line served by the crossed NS lead being busy. Trouble indications occurring in this manner will not involve the number group associated with the MCB relay in trouble but may indicate any of the other number groups. If the call to the number group in which the trouble condition locates is to a line number that is not associated with the crossed contacts and a call to some other number group is being served by the terminating marker associated with the MCB relay in trouble and is to a number associated with the crossed NS leads, a double connection may occur involving a subscriber line served by the number group in trouble in the manner described in 5.03(b). Double connections may occur involving a subscriber line in a number group other than the one in trouble, provided the simultaneous calls are to line numbers that do not require the use of the crossed NS lead and the subscriber line in the number group in trouble associated with the crossed NS lead is busy.

(b) Heavy Traffic Operation in the Terminating Marker or Second Trial by the Terminating Marker - On simultaneous calls the reactions experienced will be similar to those outlined in 5.07(a) with the exception that X, XS indications will not be received.

6. SUGGESTED PROCEDURE FOR LOCATING AND CLEARING TROUBLE

6.01 Trouble (a) - Grounded NS Lead - Individual Contact on TB Relay. No trouble indications will be received in connection with this type trouble. Reports of can't call and/or false busy on a particular subscriber line may be received. Check to determine if the line hold magnet is permanently operated and if it is, locate and clear the trouble.

6.02 Trouble (b) - Grounded NS Lead - Common Contact on TB or MCB Relay.

TROUBLE INDICATIONS RECEIVED

<u>DR</u>	<u>NGC</u>	<u>L</u>	<u>X</u>
1	1	19	X, XS
2	1	2	X, XS
0	1	6	X, XS
3	1	10	X, XS
5	1	7	X, XS
4	1	9	X, XS

These trouble indications involve any terminating marker on calls to any line number in number group 1. The trouble may be due to a ground on one of the 20 NS leads or a cross between an individual and common NS lead, when the line associated with the individual NS lead is busy. Test the 20 NS leads for permanent ground. If none of the NS leads test grounded test for the presence of battery (assuming line may become idle if a common and individual NS lead cross is the cause of the trouble indications). On finding permanent ground or battery on a particular NS lead open the NS lead multiple to determine the particular shelf of TB relays involved and isolate this shelf. To check for common and individual NS leads crossed, test both contacts involved for similar condition on all TB relays on the shelf.

6.03 Trouble (c) - Crossed NS Leads - Two Individual Contacts on TB Relay. No terminating trouble indications will be received in connection with this type trouble. Reports of can't call, false busy or double connection may be received due to this trouble condition. The reports of trouble may involve subscriber lines that are not associated with the number group in trouble, and will tend to confuse rather than aid in analyzing the trouble condition unless the connections in the line link frame causing the report are traced. Tracing the connections should reveal that a particular subscriber line is involved in the trouble reports. The number group in trouble and one of the crossed NS leads can be determined from this number. A test of the NS leads on the TB relay determined in the foregoing manner should reveal the crossed leads.

6.04 Trouble (d) - Crossed NS Lead - Individual and Common Contact on TB Relay. This trouble condition is covered in 6.02.

6.05 Trouble (e) - Crossed NS Leads - Two Common Contacts on TB or MCB Relay.

TROUBLE INDICATIONS RECEIVED

<u>DR</u>	<u>NGC</u>	<u>L</u>	<u>X</u>
0	1	0	X, XS
2	1	1	X, XS
3	1	1	X, XS
1	1	0	X, XS
6	1	0	X, XS
5	1	1	X, XS
4	1	0	X, XS

These trouble indications involve any terminating marker, on calls to number group 1 and either NS 0 or NS 1, indicating that these two leads are crossed in number group 1. At the terminal strip associated with each shelf of TB relays make successive opens in the multiple wiring of one of the NS leads in trouble, testing for the cross on each shelf as the opens are made, until the shelf in trouble is located. The wires removed in connection with making these tests should be replaced immediately, if the associated shelf tests clear. After the shelf in trouble is located and until the trouble is cleared, close the NS lead involved in the trouble to the shelves not affected by placing a temporary jumper, strapping out the shelf in trouble. This method can be followed in locating the cross on the shelf in trouble.

6.06 Trouble (f) - Crossed NS Lead - Individual and Common Contact on MCB Relay.

TROUBLE INDICATIONS RECEIVED

<u>DR</u>	<u>NGC</u>	<u>L</u>	<u>X</u>
2	1	2	X, XS
1	3	15	X, XS
0	1	7	X, XS
3	1	5	X, XS
1	6	12	X, XS
1	2	3	X, XS
0	1	19	X, XS
4	1	0	X, XS
1	4	16	X, XS
1	5	8	X, XS

These trouble indications involve any marker, except number 1, on calls to any line number associated with number group 1. The fact that marker 1 does not fail on calls to number group 1 indicates that there is a cross between an individual and common contact on the MCB relay associated with marker 1 on number group 1. Make the marker busy and test for crossed NS leads on the MCB relay.

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7. TROUBLE CONDITIONS CAUSING REACTIONS MAY BE LISTED BELOW

- 7.01 Trouble (a) - Individual contact 39 grounded, on TB relay serving 0839, by solder cross at LDF.
- 7.02 Trouble (b) - Common contact 20 on a TB relay in number group 1 grounded by wire clipping.
- 7.03 Trouble (c) - Individual contacts 20 and 21 crossed on TB relay serving 0800, due to a breakdown between the contacts.
- 7.04 Trouble (d) - Individual and common contacts crossed, on TB relay serving 0820, by excess solder.
- 7.05 Trouble (e) - Common contacts 20 and 21 crossed, on MCB 0 relay associated with number group 1, by metallic sliver.
- 7.06 Trouble (f) - Common and individual contacts crossed, on MCB 1 relay associated with number group 1, by wire clipping.

TERMINATING TROUBLE INDICATOR RECORD
CROSSBAR OFFICES

OFFICE _____

DATE _____ SHEET NO. _____

NO.	TI	CT	DT	GR	DR	DL	CF	CH	SN	TH	H	T	U	F	TR2	RO	OAB	NGC	HB	MP	L	JF	JC	ALI	ALZ	LCF	LLG	LOG	HF	RF	TF	CA	CB	IF	LC	M	CH	LJ	JPH	JP	JQ	FS	MAN	TOL	CM	RC	RV	RP	TC
1	✓				3		1	3	4	9	9	9	9	0				11	11	8				✓										0	9	1-7		0	✓		A	✓						✓	
2	✓				2		0	1	2	9	5	2	3	2				11	7	2				✓										2	8	0-6		0	✓		A	✓						✓	
3	✓				0		1	3	3	1	4	0	0	1				1	6	0				✓									1	2	1-7		0	✓		A	✓						✓		
4	✓				1		0	1	2	1	0	6	1	2				1	2	3				✓									2	4	0-5		0	✓		A	✓						✓		
5	✓				2		2	2	0	0	9	3	1	0				1	4	1				✓									0	0	0-2		0	✓		E	✓						✓		
6	✓				2		0	1	3	0	7	0	2	2				0	7	0				✓									2	2	0-2		0	✓		A	✓						✓		
7	✓				1		1	2	2	2	7	0	5	3				3	3	0				✓									3	4	0-6		0	✓		A	✓						✓		
8	✓				0		2	0	4	0	3	2	7	2				0	0	2				✓									2	2	1-2		0	✓		A	✓						✓		
9	✓				3		1	3	4	0	5	4	5	0				0	0	4				✓									0	3	1-5		0	✓		A	✓						✓		
10	✓				1		0	0	1	5	0	3	2	3				6	3	2				✓									3	3	0-3		0	✓		A	✓						✓		

11 Column A - Trouble indication.
 12 Columns B and E - Lines 1 and 2: Any marker on calls to number group 11. Lines 3, 4 and 5: Any marker on calls to number group 1. Lines 6 to 10: Marker 1 with any number group.
 13 any marker with number group 0.
 14 Cols. D & E - Lines 1 and 2: Any number in number group 11. Lines 3, 4 and 5: Involve LC and LI. Lines 6 to 10: Any line number.
 15 Columns C, F, G, H, I, J, K, L, M, N, O, P and Q - Have no significance.
 16 Column R - Call handled under light traffic condition.
 17 Column S - Indicates a cross or ground on NS leads.
 18
 19
 20
 21
 22
 23
 24 A B C D E F G H I
 25

NO.	LIN	LTI	TTI	OF	BB	SPL	BC	NT	NTX	NN	NNX	NNX	NTT	GS	IP	IT	IPT	PN	TH	PTH	CRG	K1	K2	K3	TBK	LE	PC	AK	TK	LRL	RLL	TE	BC	GJ	SL	GC	GLN	CON	STZ	RL	PG	MKO	MKI	FL	NFL	AL	NAL	LTR	HTR	SDT	TCT	TRL	FCB	X	TIME						
1																						✓	✓	✓	✓	✓	✓	✓	✓																											X	XS	9:20AM			
2																						✓	✓	✓	✓	✓	✓	✓	✓																													X	XS	9:56AM	
3																						✓	✓	✓	✓	✓	✓	✓	✓																														X	XS	2:15PM
4																						✓	✓	✓	✓	✓	✓	✓	✓																													X	XS	2:17PM	
5																						✓	✓	✓	✓	✓	✓	✓	✓																													X	XS	2:20PM	
6																						✓	✓	✓	✓	✓	✓	✓	✓																													X	XS	3:02PM	
7																						✓	✓	✓	✓	✓	✓	✓	✓																												X	XS	3:03PM		
8																						✓	✓	✓	✓	✓	✓	✓	✓																													X	XS	3:04PM	
9																						✓	✓	✓	✓	✓	✓	✓	✓																													X	XS	3:06PM	
10																						✓	✓	✓	✓	✓	✓	✓	✓																													X	XS	3:06PM	

11 Analysis of Indications: A - Indications received as a result of a cross between a common and individual NS contacts on a TB relay, or a false ground on a common contact of a TB or MCB relay.
 12 B - Indications received as a result of a cross between two common NS contacts on a TB or MCB relay.
 13 C - Indications received as result of a cross between a common and individual contact on an MCB relay (in this case contacts on the MCB relay associated with marker 1 are crossed in number group 1).
 14
 15
 16
 17 Immediate Procedure to Follow: A and B - Test NS leads in number group in trouble.
 18 C - Make terminating marker busy (in this case marker 1).
 19
 20 Procedure to Locate and Clear Trouble: After determining NS leads in trouble open multiple wiring of NS leads at terminal strips to isolate and clear trouble.
 21
 22
 23
 24 J K L M N O P Q R S
 25