

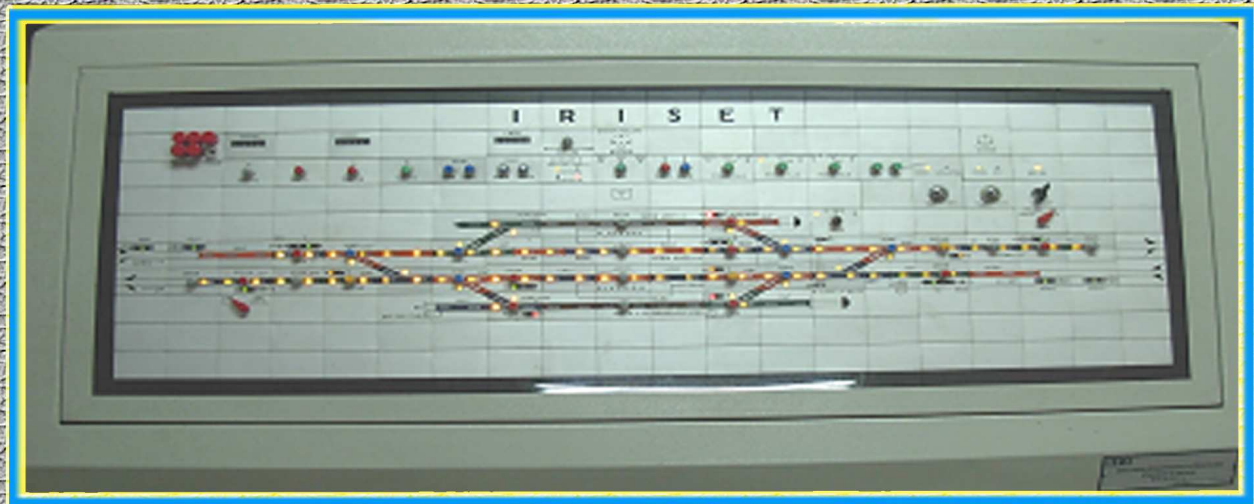
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IRISET

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PANEL INTERLOCKING WITH METAL - METAL RELAYS (SIEMENS)



Indian Railways Institute of
Signal Engineering and Telecommunications
SECUNDERABAD - 500 017

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Issued in November 2009



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(SIEMENS)**

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CHAPTER 1

INTRODUCTION

1. In this system for clearing a signal the route has to be correctly set by operating the points individually to the required position with the help of concerned point button and the common point buttons. As the points are electrically operated, the range of operation is extended. This results in less no. of cabins and thus bringing economy of man power and reducing human elements in signalling.
2. This system is generally provided at way side stations or small installations or for end cabin operations.
3. Multiple Aspects colour light signalling is provided with this system though it is not mandatory.
4. Combined type (operating cum indication) domino pattern control panels along with self restoring type of push buttons are generally used.
5. In order to prevent unauthorised operation of the panel a station master key is provided for locking all the operations except putting back a clear signal to danger in case of emergency.
6. Rational method adopted for numbering of various components enable the system to be more informative.
7. System is more flexible and transparent due to the provision of more number of facilities such as emergency operations and recording the same through counters.
8. Sectional route release facility and Signal aspect cascading arrangements are in built feature for this system.
9. Remote control of the complete installation is possible from a centralized location and hence suitable for modern signalling like CTC , ATC etc.,
10. Out of correspondence of signal and points are indicated by suitable flashing indication with audible alarm.
11. Grouping of relays, fuses and circuits makes the system more economical, reliable and flexible.
12. Relay groups used for PI/RRI are the same except the point control group as individual operation of point are only possible. For P.I minor point group is used. In route operation of the point adopted in RRI , this group will not be able to operate the point by route setting. Therefore a major point group has to be used to facilitate this feature along with point chain group.

CHAPTER 2

TABLE OF CONTROL, ROUTE SECTION PLAN

2.1 Selection Table/Control Table is a tabular representation of Signaling arrangements provided in a particular Signal layout taking into consideration about the safety requirements, operational requirements and flexibility of train moves. It comprises of several columns and furnishes the details about various operating conditions for clearing the signals concerned, for holding the routes and also for cancellation of a cleared signal or a set route. The selection table for a station is helpful for designing the circuits of that station and also is used for undertaking functional test of various signaling functions existing in the yard. The details given in the selection table is the basis of Interlocking Table. Different Railways have different formats for the Selection Table. The columns provided in selection table and details to be furnished are discussed below.

Separate columns for each sub route and overlap for the same signal movements are written. If a signal path has more than one overlap then separate row for each overlap are to written. (Refer to Route section plan and Table of controls on pages 5 and 6 respectively).

Col. No.2: Signal/Route:

This is written as the signal number and the route to which it is being cleared. The route can be identified as the signal to which it is leading, the road to which it is leading or the track to which it is leading. For example road to which it is leading or the track to which it is leading. For example

- a) S1 to S13 (ahead signal number) OR
- b) S1 to Loop 1 OR
- c) S1 to Loop 2 OR
- d) S1 to U/D Mn OR
- e) S1 to Sh. Signal ahead.

The information about alternative overlaps is also given.

Col.No. 4 & 5: -- Push Buttons (Entry and Exit buttons):

These columns give the details of signal button and the route button to be operated for clearing a route. In case of calling on signals where three buttons (GN, COGGN, and UN) are involved in clearing calling-on signal, in the GN column it is written as GN + COGGN. For example S1 GN + COGGN and LP2T UN.

Col. No. 6,7 and13: “In the Route”.

- a) Col.No.6 refers to the Route Sections to be set for clearing a signal.
- b) Col.No.7 refers to the route sections conflicting to the route section written in col.No.6. These are to be proved NOT SET before setting the route section written in Col.6
- c) In case of PI, Col.No.13 refers to the overlap sections, conflicting to the route section written in col.No.6. In case of RRI, Col.No. 13 refer to the route sections conflicting to the overlap section written in the Clo. No. 13. These are to be proved NOT SET before setting the route section written in Col.6.

Col No. 8 and 9:- Points set in the route/overlap/isolation

These columns refer to the points requires to be set and locked in route section, overlap section and for isolation purposes. These are written for the Route section and overlap section written in col.no. 6 and Col.No 12 respectively.

Col.No.10 and 11: - Track circuits in the route/overlap

These columns refer to the track circuits to be proved clear in the route (col.10) and in the overlap section (col.11) respectively.

Col No.12: in the overlap

In these columns the information about overlap sections required to be set for the signal is given.

Col.No.12 refers to the OV section required to be set. For example OV 13 or in case of alternate overlaps OV 13/1, OV 13/2 Etc.

Col. No.14: Signal to ON Track Circuit:

This column gives the first track circuit in advance of a signal and occupation of which will replace the concerned signal to ON.

Col. No.15:- Approach Locking Track Circuits:

In this column the track circuits in the approach locking distance to be proved are within. Guidelines regarding approach locking distances are as follows:

For Main line Home in absolute Block	Dead approach
For Main line starter	Up to Home if Main home cleared otherwise berthing track
For loop line starter	Berthing track
Shunt signal	Track circuit just in rear of shunt signal
For L.S.S	Free (No approach locking required as there are no points ahead of LSS)
For signals which do not have track circuits behind the signal or the track circuited portion behind the signal is does not cover full approach locking distance	Dead approach

Col.No 16, 17,18 :- Aspect of Signal ahead proved.

Before any main signal is cleared it is important to prove that the Signal ahead is burning. The aspects of the signal ahead are written in this column. This is generally taken from the aspect control chart of the station as shown in the signaling plan.

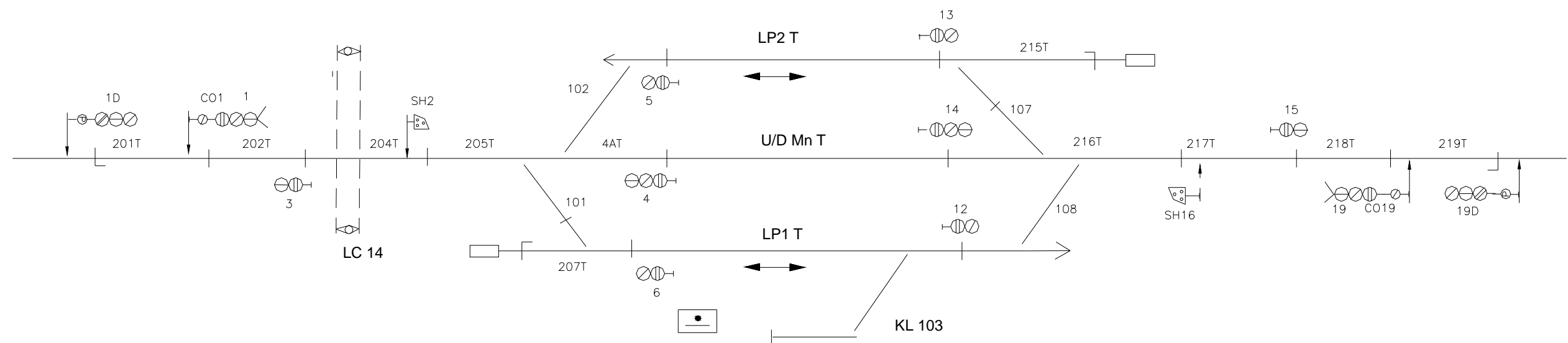
Col. No. 20:- Position of Route Indicators:

This column caters for information about Route indicators to be cleared / lit for a diverging signal to assume 'OFF' aspect. (In case of junction type route Indicators, it is mandatory to prove that the route Indicator is lit before the signal control relays are picked up).

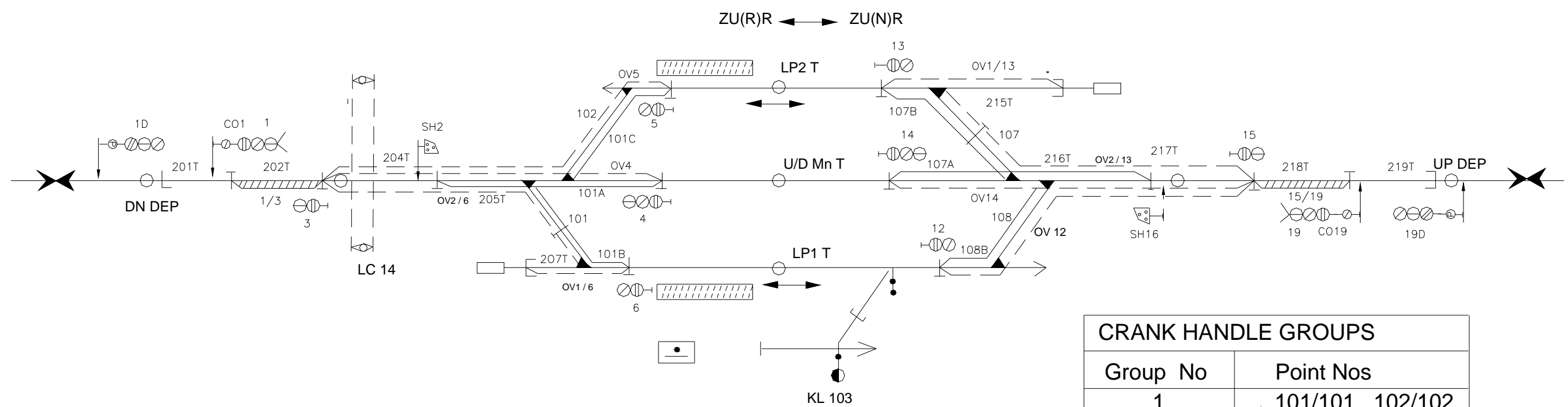
Col. No.22: Remarks:

This column contains the slots that are to be received before the signal can be cleared. The slots can be from the next cabin, SM, from Ground frames that may be controlling some points in the path of the route, LC, etc. In case of Last Stop Signal, which depends upon the receipt of Line clear from the next station, it is mentioned as "Line clear" in this column.

Any details not covered in the preceding columns can be written in remarks column simultaneous movements to be locked, crank handle Zones, timer release etc. can be mentioned.



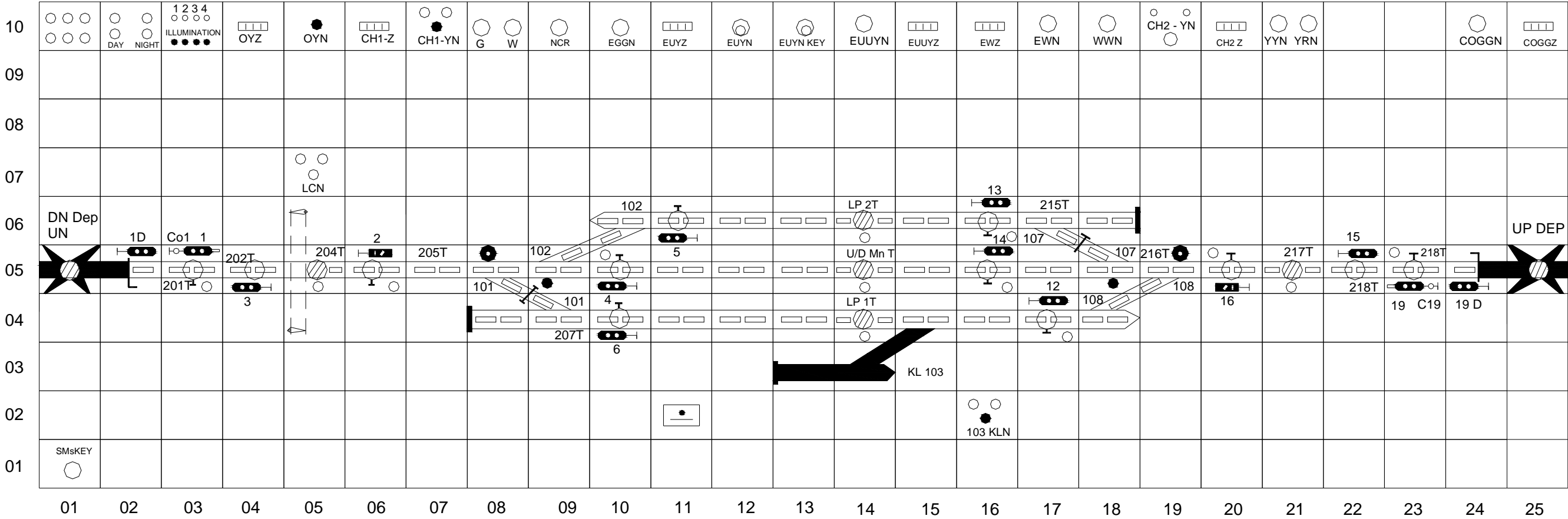
SIGNALING PLAN



ROUTE SECTION PLAN

CRANK HANDLE GROUPS	
Group No	Point Nos
1	101/101 , 102/102.
2	107/107 , 108/108.

P I (SIEMENS) IRISET



CONTROL PANEL DIAGRAM	
DRG.NO.	S15

CONTROL TABLE – PI (SIEMENS) IRISET

Sl.No	Sig. Route	Description of Main & CO Routes.	Push Buttons		Route Sections		Points		Track Circuits Free in		Overlap		Signal to Danger	App. Locking 120sec.	Sig. Aspect			'A' Marker / CO	Route Indication	Locked by CH. Group No.	Remarks
			GN	UN	Set	Eliminated in Route	in Route	in OV	Route	OV	Set	Eliminated			'Y' if	'YY' if	'G' if				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	S1 (1)	Up main to up loop no 2 home	S1	LP 2	101C, S1/3 U(R)S	101A, 101B	101/101 N 102/102 R	107/107N OR (107/107R, 108/108N)	202T, 204T, 205T LP2 T	215T(216T,217T W 107/107R)	OV ₁ 13 OR OV ₂ 13	OV4, OV5, OV ₂ 6	202T	Dead Approach	\ominus S1 \emptyset	-	-	CO	LH	Gr.1, 2	1. LC Closed 2. Locks Sh16Move on U/D mn
2	CO1 (1)	Calling on from up mn to up LP 2	S1	LP 2, COGGN	101C,S1/3 U(R) S	101A, 101B	101/101 N 102/102 R	107/107N OR (107/107R,108/108N)	-	-	OV ₁ 13 OR OV ₂ 13	OV4, OV5, OV ₂ 6	-	-	-	-	-	-	-	Gr. 1, 2	1. LC Closed 2. Locks Sh16 Move On U/D mn 3. 201T↓
3	S1 (2)	UP mn to UP mn Home	S1	U/D mn	101A, S1/3 U(R) S	101B, 101C	101/101 N 102/102 N	107/107N, 108/108N	202T, 204T, 205T, Mn T	216T, 217T	OV14	OV4, OV5, OV ₂ 6	202T	Dead Approach	\ominus S14 \emptyset	-	S14 \emptyset	CO	-	Gr. 1, 2	LC Closed
4	CO1 (2)	Calling on from UP mn to UP mn	S1	U/D mn, COGGN	101A,S1/3 U(R)S	101B, 101C	101/101N, 102/102 N	107/107N, 108/108N	-	-	OV14	OV4, OV5, OV ₂ 6	-	-	-	-	-	-	-	Gr. 1, 2	1. 201T ↓, 2. LC Closed
5	S1 (3)	UP mn to up LP no.1 Home	S1	LP 1	101B,S1/3 U(R)S	101A, 101C	101/101R 102/102N	107/107N, 108/108R	202T, 204T, 205T, 207T, LP1 T	216T,217T	OV 12	OV4, OV5, OV ₁ 6, OV ₂ 6	202T	Dead Approach	\ominus S12 \emptyset	-	-	CO	RH	Gr. 1, 2	1. LC Closed 2. Sdg Pt. Normal
6	CO1 (3)	Calling on from UP mn to UP LP 1	S1	LP1 COGGN	101B,S1/3 U(R)S	101A, 101C	101/101 R 102/102 N	107/107N, 108/108 R	-	-	OV12	OV4, OV5, OV ₁ 6, OV ₂ 6	-	-	-	-	-	-	-	Gr. 1, 2	1. 201T ↓ 2. LC Closed 3. Sdg pt Normal
7	S3	Dn Adv Stg.	S3	DN Dep.	S1/3 U(R)S	-	-	-	201T, 202T	-	-	-	202T	-	-	-	-	-	-	-	Controlled through Block inst.
8	S4	Dn Mn Stg.	S4	204	101 A	101B, 101C	101/101 N 102/102 N	-	204T, 205T	-	-	OV ₅ , OV ₂ 6	205T	Mn T (216T, 217T, 218T W107N,108N, 107A Not set) (D. Approach W 107A Set)	S3 \ominus	-	S3 \emptyset	-	-	Gr.1	LC Closed
9	S5	Dn LP 2 Stg.	S5	204	101C	101A 101B	101/101 N 102/102 R	-	204T, 205T	-	-	OV4, OV ₂ 6	205T	LP2 T	S3 \ominus \emptyset	-	-	-	-	Gr.1	1.Locks Sh16 Moved on U/D mn 2. LC Closed
10	S6	Dn LP 1 Stg.	S6	204	101B	101A 101C	101/101 R 102/102 N	-	204T, 205T 207T	-	-	OV4, OV5, OV ₁ 6	207T	LP1 T	S3 \ominus \emptyset	-	-	-	-	Gr.1	1. Locks Sh16 Moved On U/D mn 2. LC Closed 3. Sdg Pt Normal
11	S12	UP LP 1 Stg.	S12	217	108B	107A, 107B	107/107 N 108/108 R	-	216T, 217T	-	-	OV ₂ 13. OV14	216T	LP1 T	S15 \ominus \emptyset	-	-	-	-	Gr. 2	1. Locks Sh 2 Moved on U/D mn 2. Sdg Pt Normal
12	S13	UP LP 2 Stg.	S13	217	107B	107A, 108B	107/107 R 108/108 N	-	215T, 216T 217T	-	-	OV ₁ 13, OV14, OV12	215T	LP2 T	S15 \ominus \emptyset	-	-	-	-	Gr. 2	1. Locks Sh 2 Moved on U/D mn
13	S14	UP Mn Stg.	S14	217	107A	107B, 108B	107/107 N 108/108 N	-	216T, 217T	-	-	OV12 OV ₂ 13	216T	MN T, (202T, 204T, 205T W 101N 102N, 101A Not Set) (D.App.W101A set)	S15 \ominus	-	S15 \emptyset	-	-	Gr. 2	-
14	S15	UP Adv Stg.	S15	UP Dep.	S15/19 U(R)S	-	-	-	218T, 219T	-	-	-	218T	-	-	-	-	-	-	-	Controlled Through Block inst.
15	S19 (1)	Dn Mn to Dn LP 1 Home	S19	LP1	S15/19 U(R)S, 108B	107A, 107B	107/107 N 108/108 R	101/101 N OR 101/101R, 102/102N	LP1 T, 216T, 217T, 218T	207T(205T,204T W 101R)	OV ₁ 6 OR OV ₂ 6	OV12, OV ₂ 13 OV14	218T	Dead Approach	\ominus S6 \emptyset	-	-	CO	LH	Gr.1, 2	1.Locks Sh 2 Move on U/D mn 2. Sdg. Pt Normal 3. LC Closed W 101 R
16	CO19 (1)	Calling on from Dn mn to Dn LP1	S19	LP1, COGGN	S15/19 U(R)S, 108B	107A, 107B	107/107 N 108/108 R	101/101 N OR 101/101 R 102/102 N	-	-	OV ₁ 6 OR OV ₂ 6	OV12, OV ₂ 13, OV14	-	-	-	-	-	-	-	Gr.1, 2	1. Locks Sh 2.Move on U/D mn 2. 219T↓ 3.LC Closed W 101 R 4. Sdg. Pt. Normal
17	S19 (2)	Dn mn to Dn mn Home	S19	U/D mn	S15/19 U(R)S, 107A	107B, 108B	107/107 N 108/108 N	101/101 N 102/102 N	216T, 217T, 218T, Mn T	204T, 205T	OV4	OV12, OV ₂ 13, OV14	218T	Dead Approach	\ominus S4 \emptyset	-	S4 \emptyset	CO	-	Gr.1, 2	LC Closed
18	CO19 (2)	Calling on from Dn mn to Dn mn	S19	U/D mn, COGGN	S15/19 U(R)S , 107A	107B, 108B	107/107 N 108/108 N	101/101 N 102/102 N	-	-	OV4	OV12, OV ₂ 13. OV14	-	-	-	-	-	-	-	Gr. 1, 2	1. 219T↓ 2. LC Closed
19	S19 (3)	Dn mn to Dn Lp.2 Home	S19	LP 2	S15/19 U(R)S, 107B	107A, 108B	107/107 R 108/108 N	101/101 N 102/102 R	215T, 216T, 217T, 218T, LP2 T	204T, 205T	OV5	OV12, OV ₁ 13, OV ₂ 13, OV14	218T	Dead Approach	\ominus S5 \emptyset	-	-	CO	RH	Gr.1, 2	LC Closed
20	CO19 (3)	Calling on from Dn mn to Dn Lp 2	S19	LP 2	S15/19 U(R)S, 107B	107A, 107B	107/107 R 108/108 N	101/101 N 102/102 R	-	-	OV5	OV12, OV ₁ 13, OV ₂ 13, OV14	-	-	-	-	-	-	-	Gr.1, 2	1. 219T↓ 2. LC Closed
21	Sh2 (1)	UP mn to Up LP 2 Shunt	Sh2	LP 2	101C	101A 101B	101/101 N 102/102 R	-	205T	-	-	OV4, OV5, OV ₂ 6	205T	204T	-	-	-	-	-	Gr.1	LC Closed
22	Sh2 (2)	UP mn to UP mn Shunt	Sh2	U/D mn	101A	101C, 101B	101/101 N 102/102 N	-	205T	-	-	OV4, OV5, OV ₂ 6	205T	204T	-	-	-	-	-	Gr.1	1. Locks Signal Route S19(1) CO19(1) S12, S13 2. LC Closed
23	Sh2 (3)	UP mn to UP LP1 Shunt	Sh2	LP1	101B	101A, 101C	101/101 R 102/102 N	-	205T, 207T	-	-	OV4, OV5, OV ₁ 6, OV ₂ 6	205T	204T	-	-	-	-	-	Gr.1	1. Sdg Pt. Normal 2. LC Closed
24	Sh16 (1)	Dn mn to Dn Lp.1 Shunt	Sh16	LP 1	108B	107A, 107B	107,107 N 108/108 R	-	216T	-	-	OV12, OV ₂ 13, OV14	216T	217T	-	-	-	-	-	Gr. 2	Sdg Pt. Normal
25	Sh16 (2)	Dn mn to Dn Mn Shunt	Sh16	U/D Mn	107A	107B 108B	107/107 N 108/108 N	-	216T	-	-	OV12, OV ₂ 13, OV14	216T	217T	-	-	-	-	-	Gr. 2	Locks Signal Route S1(1), CO1 (1), S5, S6
26	Sh16 (3)	Dn mn to Dn Lp.2 Shunt	Sh16	LP 2	107B	107A, 108B	107/107 R 108/108 N	-	216T, 215T	-	-	OV12, OV ₁ 13, OV ₂ 13, OV14	216T	217T	-	-	-	-	-	Gr. 2	-

BUTTON RELAYS AND BUTTON CHECKING RELAYS

Self-restoring type push buttons are used for operation. Each push button is provided with one relay, which energises when concerned push button is pressed. Button relay circuit enables a single operation from a panel at a time.

- 3.1 GNR : Signal push button relay.**
GNCR : All signal push button normal checking relay.

GNR relay is provided in the respective Signal groups. When a signal button GN is pressed, GNR picks up in the respective signal group. EGNR back contact is proved in this circuit to ensure that one operation (clearance or cancellation) is possible at a time. Each GNR is repeated by a GNPR. The circuit entire station zone are grouped together in a cascading way that only one 'GNPR' will pick up at a time. SM's control is provided in GNPR circuit to prevent unauthorized clearing of Signals.

A common relay GNCR is picked up proving all Signal buttons normal (GNR'S down). This relay drops immediately when any one GN is pressed and its GNPR has energised.

GNR and EGNR relays in the Signal group pick up even when SM key of the panel is taken out. This is to facilitate restoration of cleared signal to 'ON' position in case of emergency but GNPR relay picks up proving the SM's key is IN.

A front contact of WNCR and back contact of WWNR, EWNR is proved in the GNPR circuit to ensure that the point operation does not take place along with signal clearance

For Relay Control Circuit (Refer Fig No. 3.1, 3.2, 3.3)

- 3.2. UNR : - Route push button relay.**
UNCR: - All route push button normal checking relay.

The UNR relays are provided separately in a K-50 mini group, which picks up when the respective route button is pressed on panel. The UNRs are repeated by UNPRs as required.

The UNRs are grouped in the same way as GNPRs such that only one route button relay picks up at a time.

A common relay UNCR remains in the energised condition through the back contacts of all the UNR and UNPR relays in series. This relay drops immediately when any one of the route buttons is pressed on panel and UNR has energised.

A front contact of WNCR and back contact of WWNR, EWNR is proved in the UNPR circuit to ensure that the point operation does not take place with signal clearance.

The SM key contact is proved in the pick up circuit of UNR, UNPR relays.

For Relay Control Circuit (Refer Fig. No. 3.3)

3.3. WNR :- Point push button relay.
WNCR :- All point button normal checking relay.

The WNR relays are provided separately in a K-50 mini group, which picks up when respective push button is pressed on a panel and proved that S.M key is 'IN' and turned.

The WNR relays are grouped in the same manner as the GNPRs and UNRs such that only one WNR picks up at a time.

A common relay WNCR remains in the energised condition through the back contacts of all the WNRS in series proving that no point button is pressed on panel. When any one of the button is pressed WNCR drops.

A front contact of GNCR and UNCR is proved in the WNR circuit to ensure that signal clearance operation does not take place along with point operation.

For Relay Control Circuit (Ref. No.3.4)

3.4 . Alarm Circuit

NNCR :- All (NNCR) button Normal checking relay :

When all the button checking relays (GNCR, UNCR, WNCR), EUUYNR, EUYNR, EGGNR, ZDUCR, EWNCR, WWNR, their repeater relays are in dropped condition, the button-checking relay NNCR relay energizes. This relay is made slow to release by the provision of 3000 μ f condenser in series with 100 ohm resistance across the relay coil. Releasing time of NNCR is about 15 Sec

When any button is pressed, the button relay energized the button checking relay drops. This in turn breaks the circuit for NNCR relay. NNCR now holds for 15 seconds-and then drops if the button is not released or in case the button got stuck up in depressed condition.

The de-energised condition of this relay gives a visual indication on panel and also audible indication to draw the attention of the operator. Both these failures indications continue till the fault is set right

Illuminated indications for GNCR, UNCR and WNCR are provided on the panel.

Note: GNCR,	-	'S' indication
UNCR	-	'R' indication
WNCR	-	'P' indication

For relay control circuit ref. Fig. No 3.5(a)&(b)

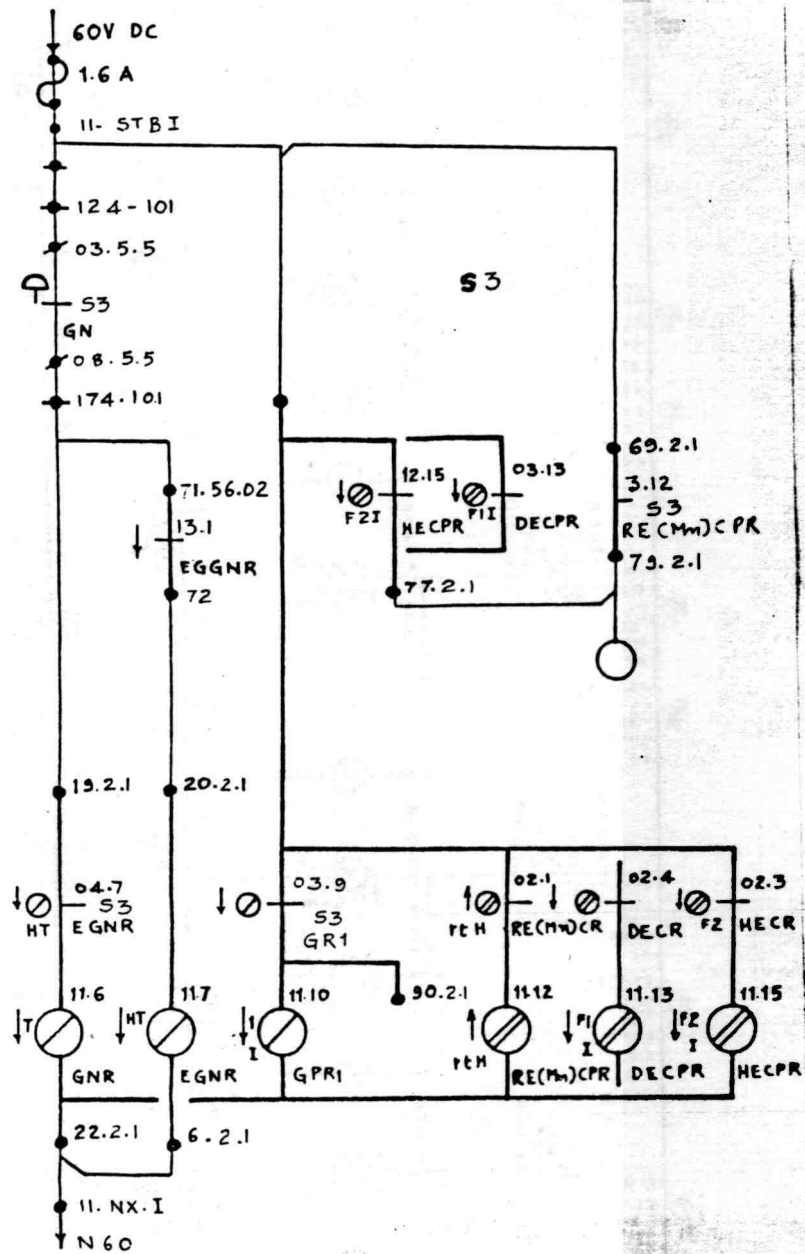


Fig : 3.1 GNR/EGNR CIRCUIT

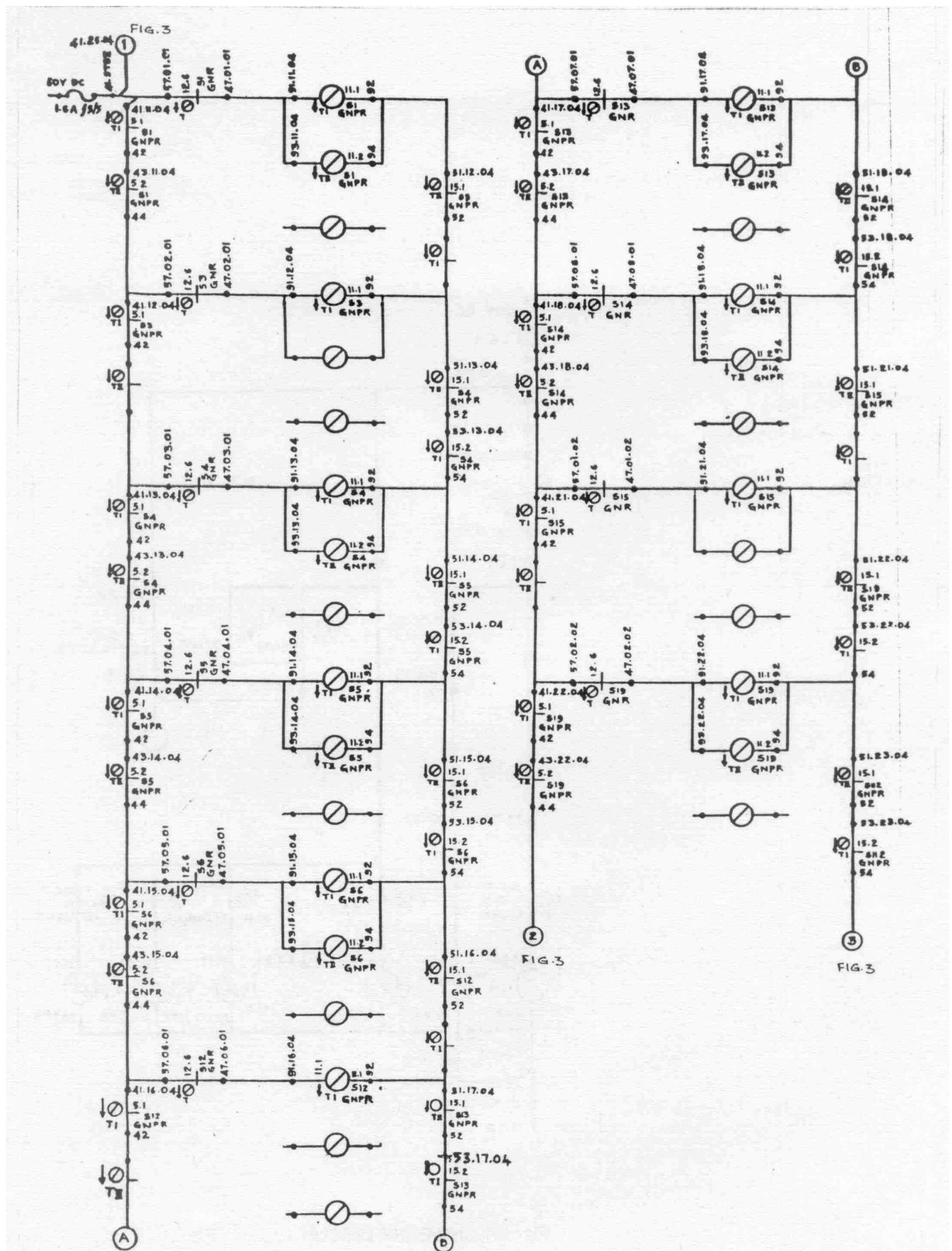


Fig : 3.2 GNPR CIRCUIT

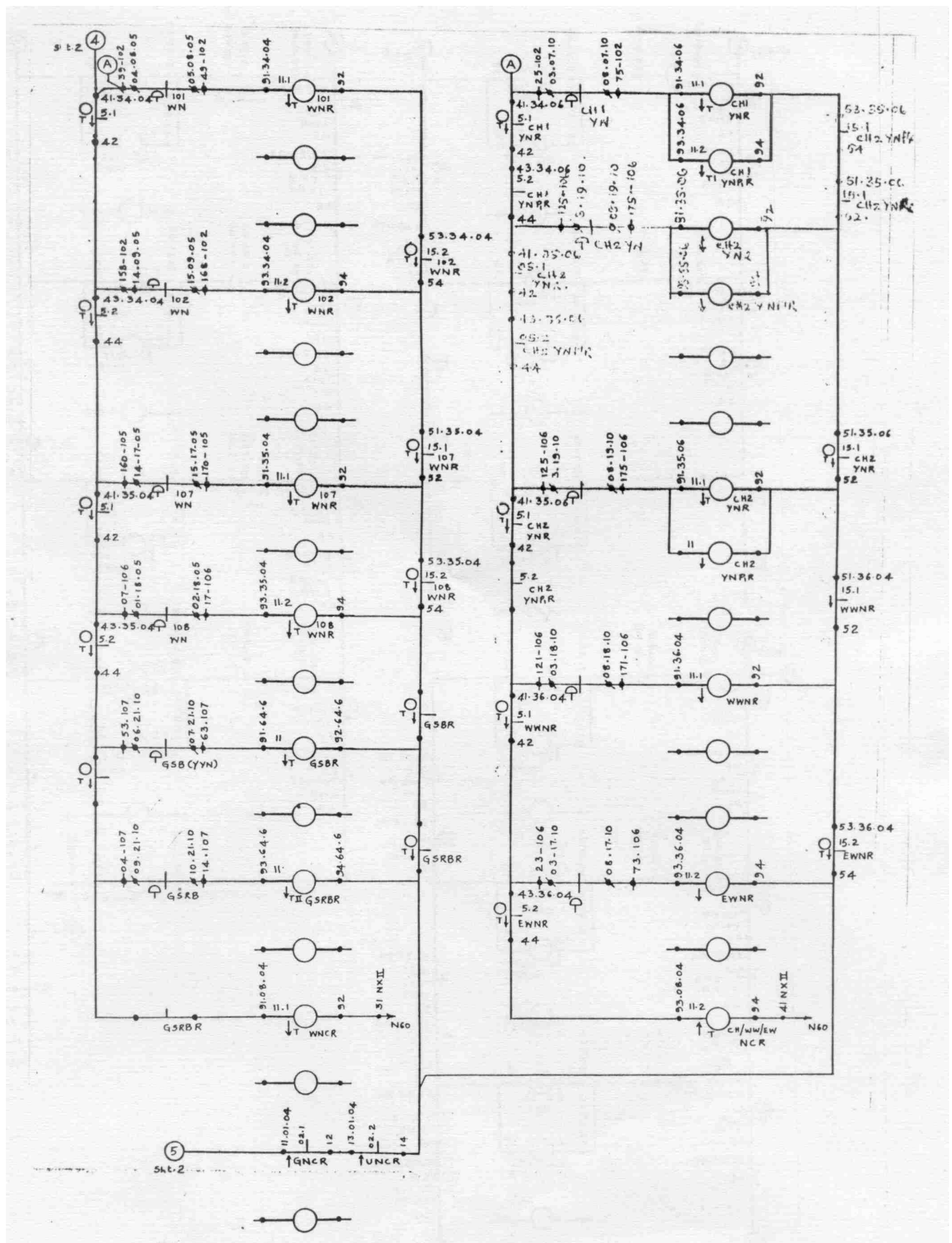


Fig : 3.4 WNR/WNCR CIRCUIT

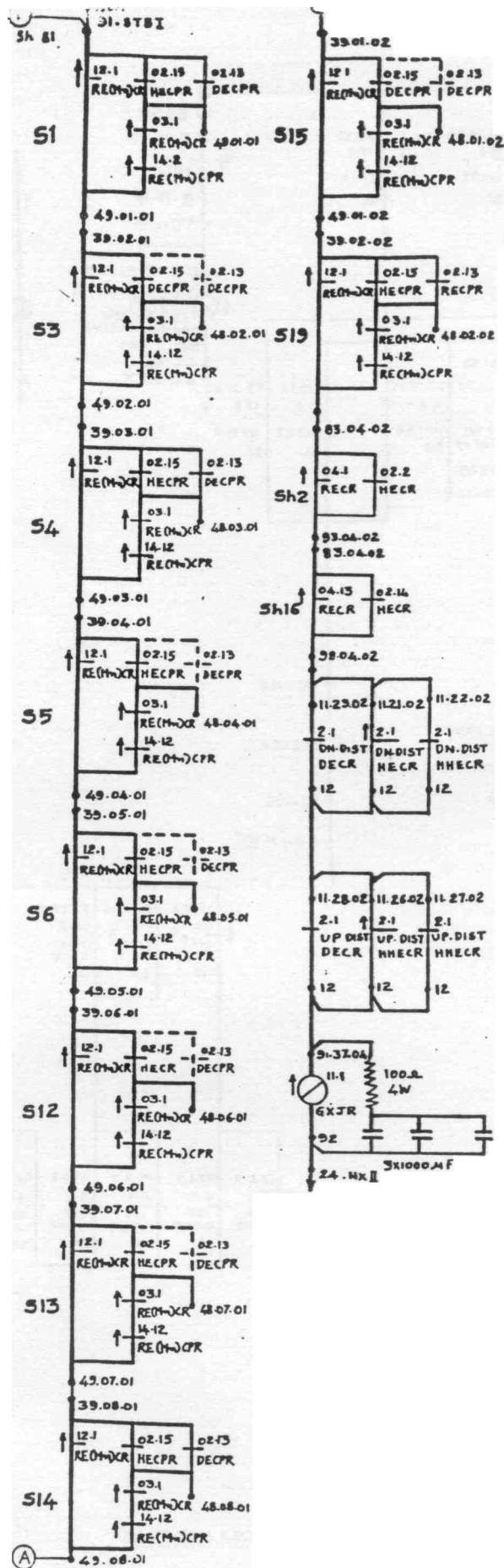


Fig : 3.5 (a) ALARM CIRCUIT

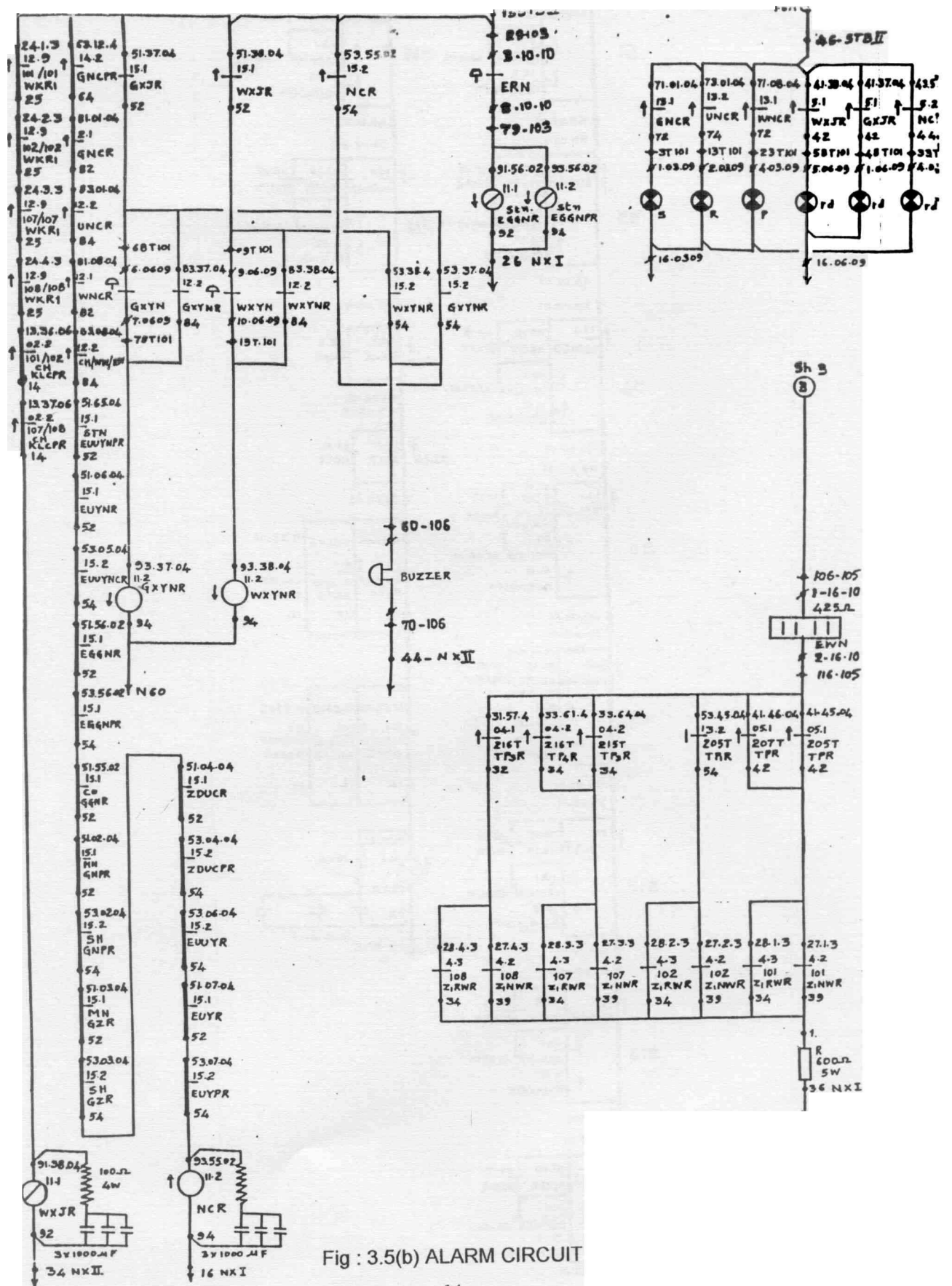


Fig : 3.5(b) ALARM CIRCUIT

Fig : 3.5(b) ALARM CIRCUIT

POINT OPERATION

In this system, Points shall be operated individually before any Route can be set involving them.

4.1 The relays involved in *point control initiation* are:-

Sl. No.	Relay Nomenclature	Location	Description	Purpose
1.	WNR	Mini Group	Point Button Relay	Represents button operation in relevant circuits.
2.	GNCR	Mini Group	Signal Button Repeater Relays Normal Proving Relay.	Proved energized in WNR circuit to prevent any Point operation when a Signal button repeater or Route button relay is picked up.
3.	UNCR	Mini Group	Route Button Relays Normal Proving relay.	
4.	WWNR	Mini Group	Common Point Button Relay for regular operation.	Represents button operation in circuits.
5.	EWNR	Mini Group	Common Point Button Relay for emergency operation.	Represents button operation in circuits.
6.	Z ₁ WR ₁ (1) Z ₁ WR ₁ (2)	Point Group Point Group	Pick up coil of First Point control Initiating Relay (common for 'N' & 'R' operations) Hold coil of the above relay.	Proves Route and Track locking conditions of the point to be operated.
7.	WKR ₃ (1)	Point Group	Pickup coil of Third Point Detection Relay.	Detects Normal condition of Point control disconnects detection supply for initiating its Reverse operation.
8.	WJR	Point Group	Point operation Time limiting Relay.	Proves Reverse condition of point control for initiating its Normal operation
9.	WKR ₁	Point Group	First Point Detection Relay.	Drops to remove Point detection before initiating its operation.
10.	<u>W(R)R</u> W(N)R (Interlocked)	Point Group	Points Operating circuit <u>switching Relay</u> . Points Detection circuit switching Relay.	Latches in Reverse to connect the operating feed to motor when final control relay (WR) is energised.
11.	Z ₁ NWR	Point Group	Point Normal control Initiating relay	Energises when normal point control is established and remain in energised condition as long as the buttons are in pressed condition,
12.	Z ₁ RWR	Point Group	Point Reverse control Initiating relay	Energises when Reverse point control is established and remain in energised condition as long as the buttons are in pressed condition.

4.2.1 Point Normal and Reverse Control Initiation:

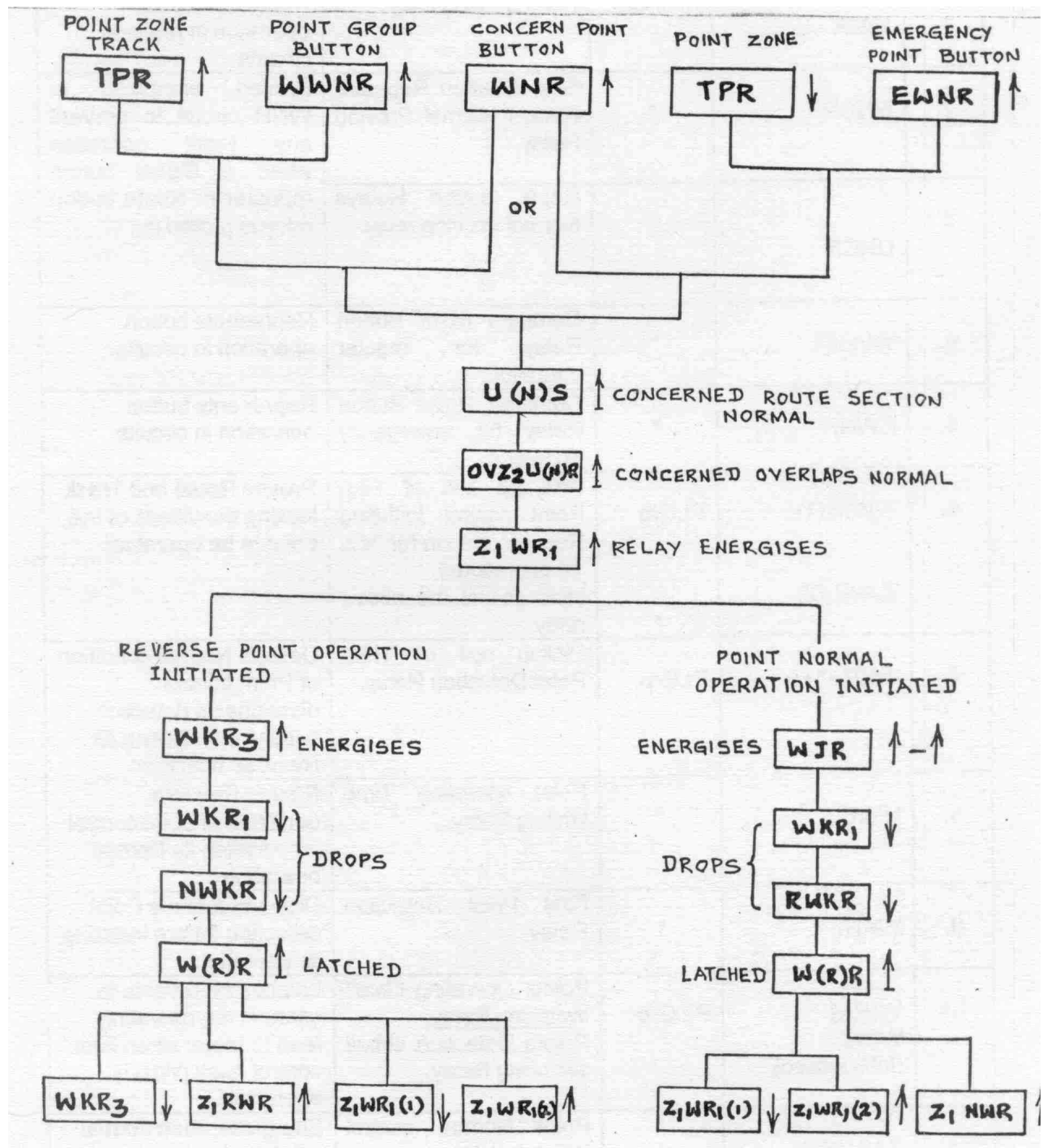


Fig.4.1

There are two stages in point control initiation.

I. In the first stage which is common for normal and reverse initiations. Z₁WR₁ picks up proves that.

- 1) When the point zone track circuits are clear, the point operation can be initiated by the operation of, concern point button WN and common point button WWN simultaneously. This operation is called as normal point operation.
- 2) When the point zone track circuit is in failed condition, the point operation can be initiated by the operation of concern point button WN and Emergency point button EWN simultaneously. This operation is called as emergency point operation.
- 3) The point is not engaged by any signal move for any route or overlap or isolation.

In the second stage, since (N) WLR is in latched condition from the previous operation, the group is not disturbed until the current operation when Z₁WR₁ picks up, WKR₃ picks up to drop WKR₁. When this relay drops, Normal Detection of the Point is removed due to the dropping of NWKR and its repeaters.

Now W(R)R latches to switch over the point from detection mode to operation mode. The Inter locked relay W (R) (R) and W (N) R enables to provide super imposed detection facility in seimen's Point.

This completes the Reverse control Initiation process with Z₁RWR picking up and holding. As soon as W (R) R has latched, WKR₃ drops so that it can pick up again to detect the completion of Point operation.

II. Z₁WR₁ relay PU coil and Hold coil circuits: - (Refer Fig.No.4.2 circuits 1(1) & 1(2))

- 1) WR dropped contact in the circuit of Z₁WR₁ proves that WR has dropped after the previous operation.
- 2) W (N)R normal contact is proved in the PU coil circuit to check for its proper working during the last operation.
- 3) The Hold coil is fed through W(R)R operated contact to keep Z₁WR₁ energised until the last stage of control and ensure initiation conditions throughout.

III. Only the P.U. coil of WKR₃ is energised during the Reverse control Initiation as its operation here is momentary.(Refer Fig.4.2 Circuit No.2(a))

IV. WKR₃ contact in WKR₁ circuit makes it drop during the Reverse control initiation and WJR contact makes it drop during the Normal control initiation, as can be seen in the detection circuit of points.(Refer Fig.4.2 Circuit No.3(a)).

V. W(R)R operates proving the initiation conditions a second time to reinforce safety.(Refer Fig.4.2 Circuit No.1(1)).

VI. Z₁RWR & Z₁NWR P.U. coil is energised proving the initiation conditions a third time. It is energised only so long as the buttons are pressed. Its second (Hold) coil is energised to ensure that this relay does not drop if buttons are released prematurely. .(Refer Fig.4.2 Circuit No.6(a)).

Normal Initiation and Reverse Detection:

The sequence is similar to that in reverse control initiation. In this, WJR picks up instead of WKR₃ to drop WKR1 and RWKR. At the end Z₁NWR operates in place of Z₁RWR.

For relay control circuits (Refer Fig.no.4.2 Circuit No.1(1) & 1(2) & Fig.4.3 circuit No.2(b))

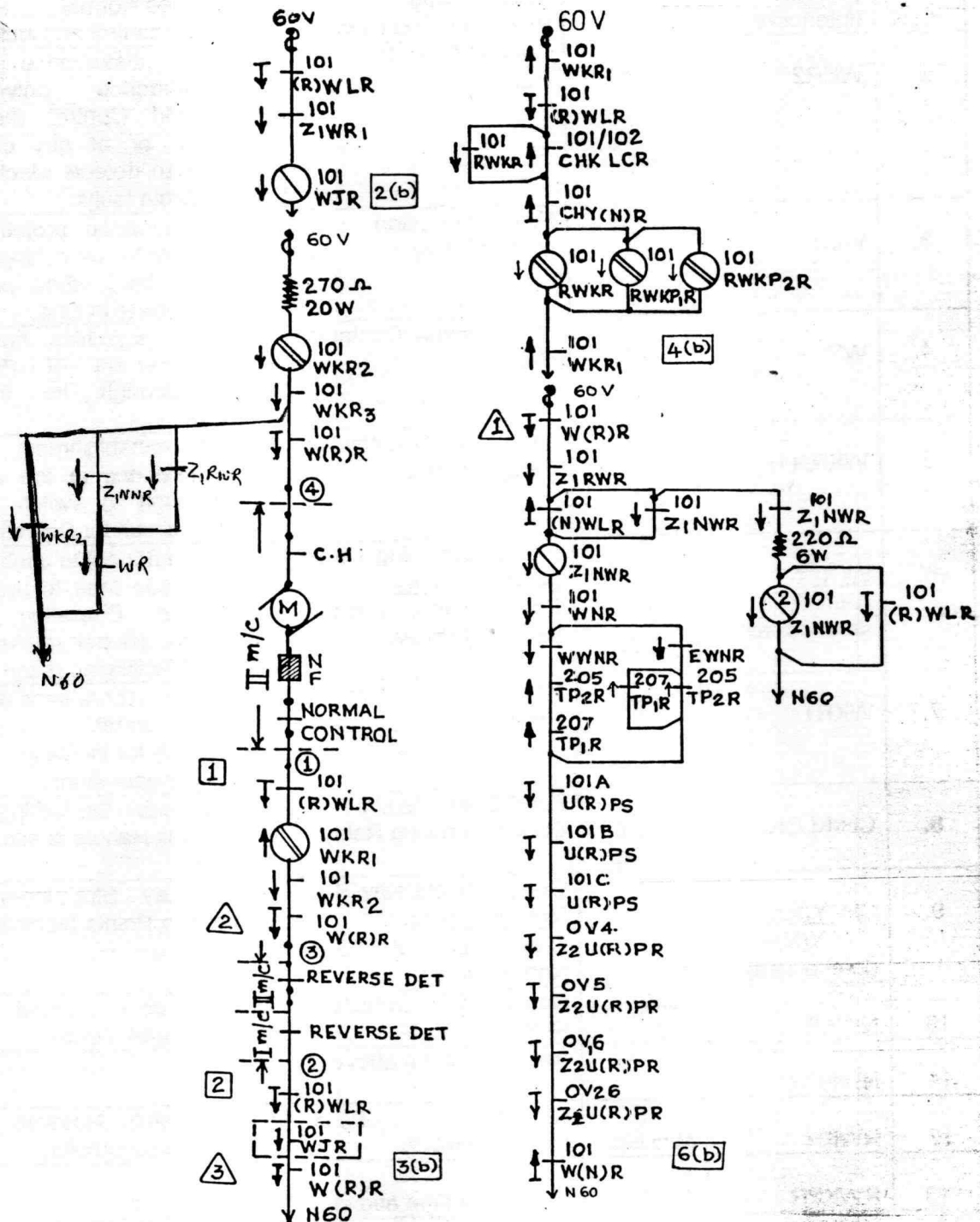


Fig 4.3

4.3 The relays involved in the *Point Operation control and Detection* are :-

S.No.	Relay Nomenclature	Location	Description	Purpose.
1.	(R)WLR (N)WLR (Interlocked)	Point Group	Relay locking Point control in Reverse Relay locking Point control in Normal.	Establishes Reverse operation control and locks Establishes Normal operation control and locks it
2.	WKR2	Point Group	Second Point Detection Relay.	Detects disturbance of correspondance between Point and Control during operation or at any other time. Also detects Machine circuit Cable faults.
3.	WJR	Point Group	Point operation Time limiting Relay.	Affords overload protection to Point motor by cutting off operation feed when point fails to operate in time.
4.	WR	Point Group	Point control Contactor Relay.	Used for switching heavy starting current of Point motor through its front contacts.
5.	WKR3(1)	Point Group	Third Point Detection Relay P.U.coil	Detects establishment of correspondance at the end of operation to switch the machine circuit for Detection.
6.	W(R)R (W(N)R (Interlocked)	Point Group	Points Operating circuit switching Relay Points Detection circuit switching Relay.	Latches in normal to connect the Detection feed to motor when the Operation is completed. (Super imposed detection facilitating relay)
7.	WKR1	Point Group	First Point Detection Relay	Detects correspondance of Point and Control continuously for indication and further operations.
8.	CH-KLCR	Mini group	Point Crank Handle Key Lock 'In' Proving Relay.	Proves in cabin the locking 'In' of Crank Handle at site
9.	CH- Y(R)R Y(N)R (Interlocked)	Mini group	Crank Handle Key Slot Release Relay Crank handle Key Slot Normal Relay	Proves Key Slot Normal condition in Points Detection circuit.
10.	NWKR	Mini group	Normal Point Detection Relay	Detects Points Normal in various control circuits.
11.	NWKPR	Mini group	Repeater of NWKR	Detects Points Normal in various control circuits.
12.	RWKR	Mini group.	Reverse Point Detection Relay	Detects Points Reverse in various control circuits.
13.	RWKPR	Mini group	Repeater of the above.	Detects Points Reverse in various control circuits.

4.3.1 POINT OPERATION CONTROL

Point Normal and Reverse Operation Control

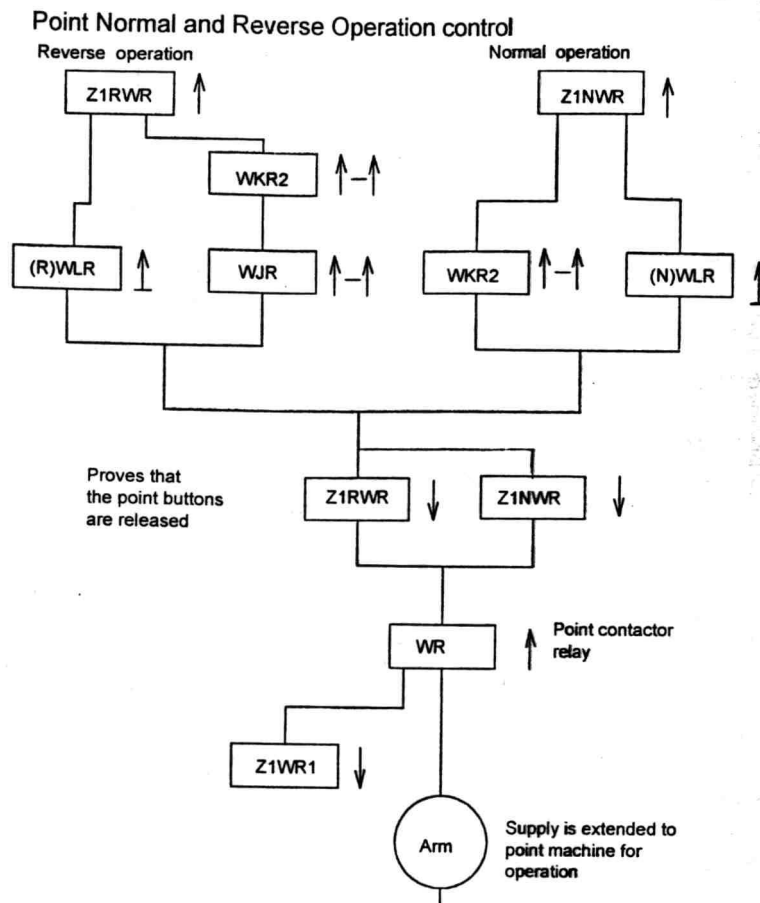


Fig. 4.4

(A) Reverse Operation Control :

- 1) At this stage, WKR₂ picks up and remains so to keep WKR₁ circuit open during Point operation.
- 2) Then WJR picks up and is held through a condensor discharge circuit for a maximum period of 10 seconds, in case of Point failing to operate fully. Otherwise, it drops as soon as WKR₃ picks up at the end of operation.
- 3) Z₁RWR drops after latching (R) WLR and releasing the point buttons so that Normal Initiation will be possible during the next operation.
- 4) WR is the last relay to operate at this stage and drop Z₁WR₁ to keep it ready for next Initiation.

(B) Normal Operation Control

The sequence is similar as in the case of Reverse control. In this case, WJR is already picked up during Initiation but it drops only after WKR₃ picks up or after 10 seconds. Instead of Z₁RWR relay, Z₁NWR relay picks up.

Relay control circuits:- Refer Fig.4.5 & Fig.4.6

REVERSE OPERATION

The diagrams illustrate the reverse operation of a motor control system, showing the flow of current and the state of various components during the reverse sequence. The components and their ratings are as follows:

- Resistors:** 101 (1W), 270 (20W), 18K (1W), 39 (1W), 500 (25W).
- Capacitors:** 2500μF (100V).
- Relays/Switches:** WKR2, WKR3, WJR, ZIRWR, ZINWR, W(N)R, W(R)R, W(R)WLR, W(N)WLR.
- Motor:** M (C.H. - Continuous Duty).
- Voltages:** 60V, 110V.
- Currents:** 1.6A.
- Control Points:** REVERSE DETECTION, REVERSE CONTROL.

The diagrams are labeled 1(a) through 8, showing the sequence of events during the reverse operation. The diagrams include various control points like REVERSE DETECTION and REVERSE CONTROL, and show the flow of current through the system components.

Fig : 4.5 REVERSE OPERATION

I. (R) WLR or (N) WLR latches proving a second time that WR dropped after previous operation and that Initiation has taken place (Z₁RWR / Z₁NWR operated). (Refer Fig.4.5 Circuit 1(a) & Fig.4.6 Circuit 1(b)).

II. WKR₂ picks up proving Initiation a second time and sticks through its own Front contact as Z₁RWR/ Z₁NWR drops soon. It proves WR dropped after previous operation a third time during its pick up.(Refer Fig.4.5 Circuit 2(a) & Fig.4.6 Circuit2(b)).

(III) WJR proves -

- a) W(R)R reversing a third time
- b) Reverse or Normal initiation a third time and
- c) WKR₂ picking up.

WJR Holding condensor is normally kept charged through its own back contact. The 18 Kilo Ohm resistance across this contact is for spark quenching and protection. WJR operated contact across the two limbs provides isolation between the relay pick up circuit and the condensor charging circuit.(Refer Fig.4.5 Circuit 3(a) & Fig.4.6 Circuit 3(b)).

IV WR Circuit: Due to the high inductance of WR coil, caused by its initial pick up current surge , the back e.m.f generated causes a high current to be discharged through a rectifier across it. To avoid interference of this current with other circuit contacts, a WR back contact is included in the circuit with a 500 Ohm resistance across it for protection. This resistance also keeps the relay circuit closed after its NC (back) contact is opened. .(Refer Fig.4.5 Circuit 4).

V. Point Machines operating circuit: Four feed lines are connected between the control relay group and the first end Point Machine. Five feed lines are between the first Machine and the second Machine where provided.

Reverse Operation: 110V D.C Operating Feed is switched to the first machine through line No.2 by W(R)R reverse contacts in series with WR and (R)WLR operated contacts. The negative is connected through line No.4. The first machine circuit is opened at the end of its operation when its reverse control contacts open to close reverse detection contacts.

Now, the Operating circuit is extended to the second machine through the Reverse detection contact of first machine to close through line No.4 as before. When the operation of second machine is completed, its Reverse Control contacts open and Reverse Detection contacts are closed, with the point operation supply WKR₃ relay picks up and disconnects a supply to WR relay thus WR drops and disconnects a supply to point machine. In case of any machine failure to complete the operation, the feed gets cut off with the dropping of WR caused by the dropping of WJR after 10 seconds.(Refer Fig. 4.5 Circuit 5(a)).

Normal Operation: This operation takes place in a similar way except that lines No.1 & 4 connect feed to the machines.(Refer Fig.4.6 Circuit 5(b)).

4.3.2 POINT OPERATION AND DETECTION

DETECTION OF CORRESPONDANCE BETWEEN POINTS & CONTROL:

This takes place in the same manner after both Normal and Reverse operation.

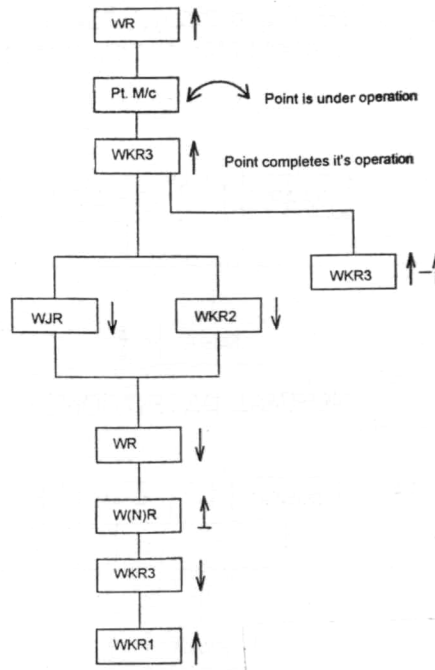


Fig.4.7 POINT OPERATION & DETECTION

I. **WKR3 circuits:** When the operation of last point machine is completed, 110V operating feed is diverted through its Reverse or Normal Detection contact (as the case may be) and line No.3 to the first (PU) coil of WKR3 relay with a 1000 Ohm resistance in series. WKR3 picks up to drop WJR and WKR2 relays. (Refer Fig.4.5 Circuit 6(a) & Fig.4.6 Circuit 6(b)).

Then the second coil of WKR3 gets 60V feed through its own N.O (front) contact as this relay shall not drop prematurely during the latching of W (N) R. (Refer Fig.4.5 Circuit 7(a) & Fig.4.6 Circuit 7(b)).

II. **W(N)R circuit:**

- (i) WR back contact ensures that the operation supply is disconnected.
- (ii) WKR2 back contact ensures that the point is in correspondance.
- (iii) Z1WR1 back contact to check the integrity of the relay.
- (iv) W(R) R front contact is the economiser contact

III **WKR1 circuit:**

- (a) The circuit current is so limited by a 270 Ω resistance in series that WKR2 of 52.3 Ohm coil resistance cannot pick up but WKR1 of 1840 Ohm coil can pick up. This is because the voltage drop across the relays is such for the given circuit current that only WKR1 can pick up.

WKR₂ is connected in WKR₁ circuit so that it can pickup with rise in circuit current caused by cable short or earth faults and drop WKR₁.

- (b) WKR₁ circuit is completed through all the 4 lines between control and the first Point machine, and through 3 lines between the first and second machines. (5 lines are there between Ist & IInd m/c)

With Point in Reverse, the circuit can be traced through line no.4, II M/c motor & NC contact, Line No.1, WKR₁ relay, Line No.3, RD contact of II M/c, RD contact of I M/C and line No.2. (Refer Fig.4.3 Circuit 3(b)).

With point in normal, the circuit can be traced through line no.4, I M/c motor & RC contact, line no.2, WKR₁ relay, Line No.3, ND contact of I M/c, ND contact of II M/c and line no.1.(Refer Fig.4.2 Circuit 3(a)).

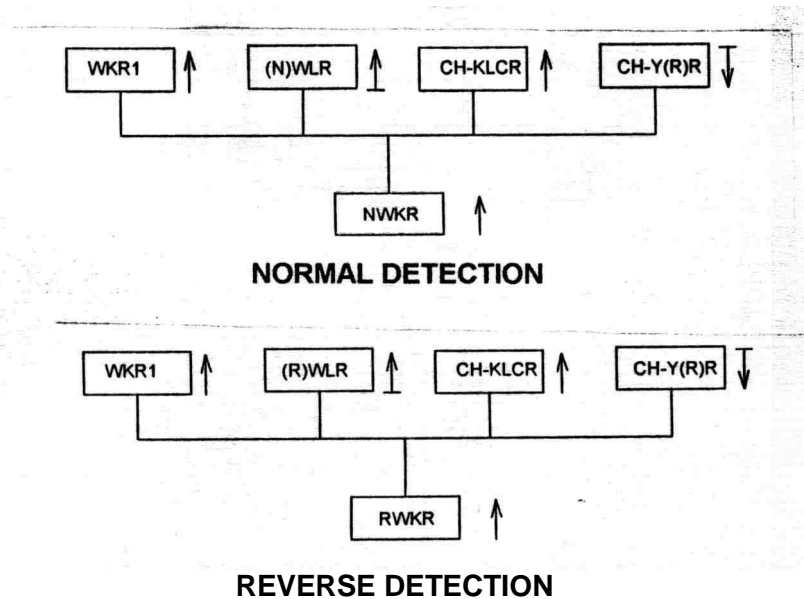


Fig.4.8

Relay control circuits : Refer Fig. 4.2 Circuit 4(a) & Fig.4.3 Circuit 4(b)).

For **NWKR**s and **RWKR**s, holding circuits are provided through their own front contacts across CHKLCR pick up. This is because they shall not drop as soon as CHKLCR is disturbed from site by pressing CHKLR button until after the release of crank handle key from cabin. The condition may not be favourable for releasing crank handle key immediately on demand from site.

Combined Circuit diagrams of Point Relay Group, Machine Operation & Detection.

Refer Figs.4.9, 4.10, 4.11.

Combined Circuit Diagrams of point Relay Group, Machine Operation & Detection.

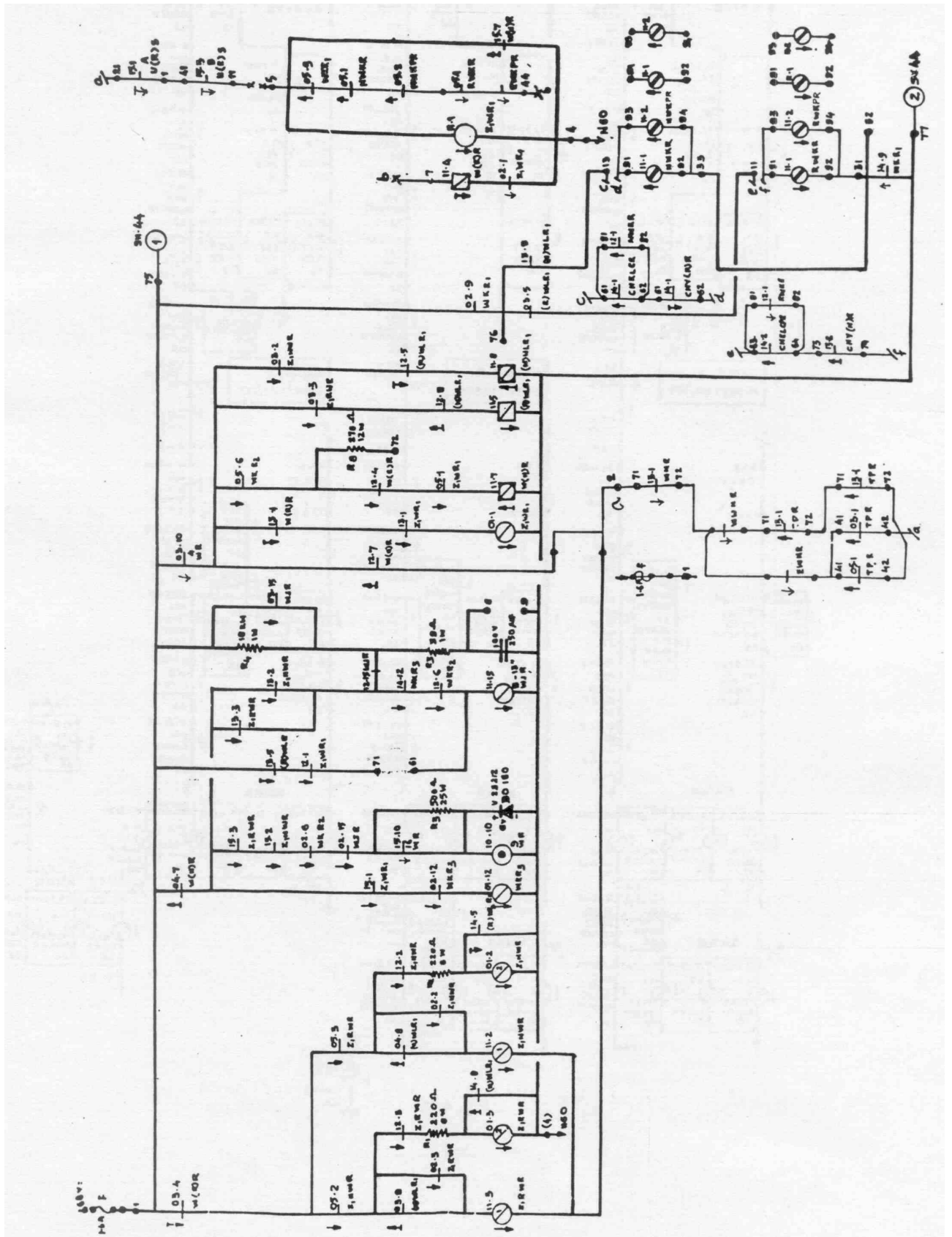


Fig. 4.9

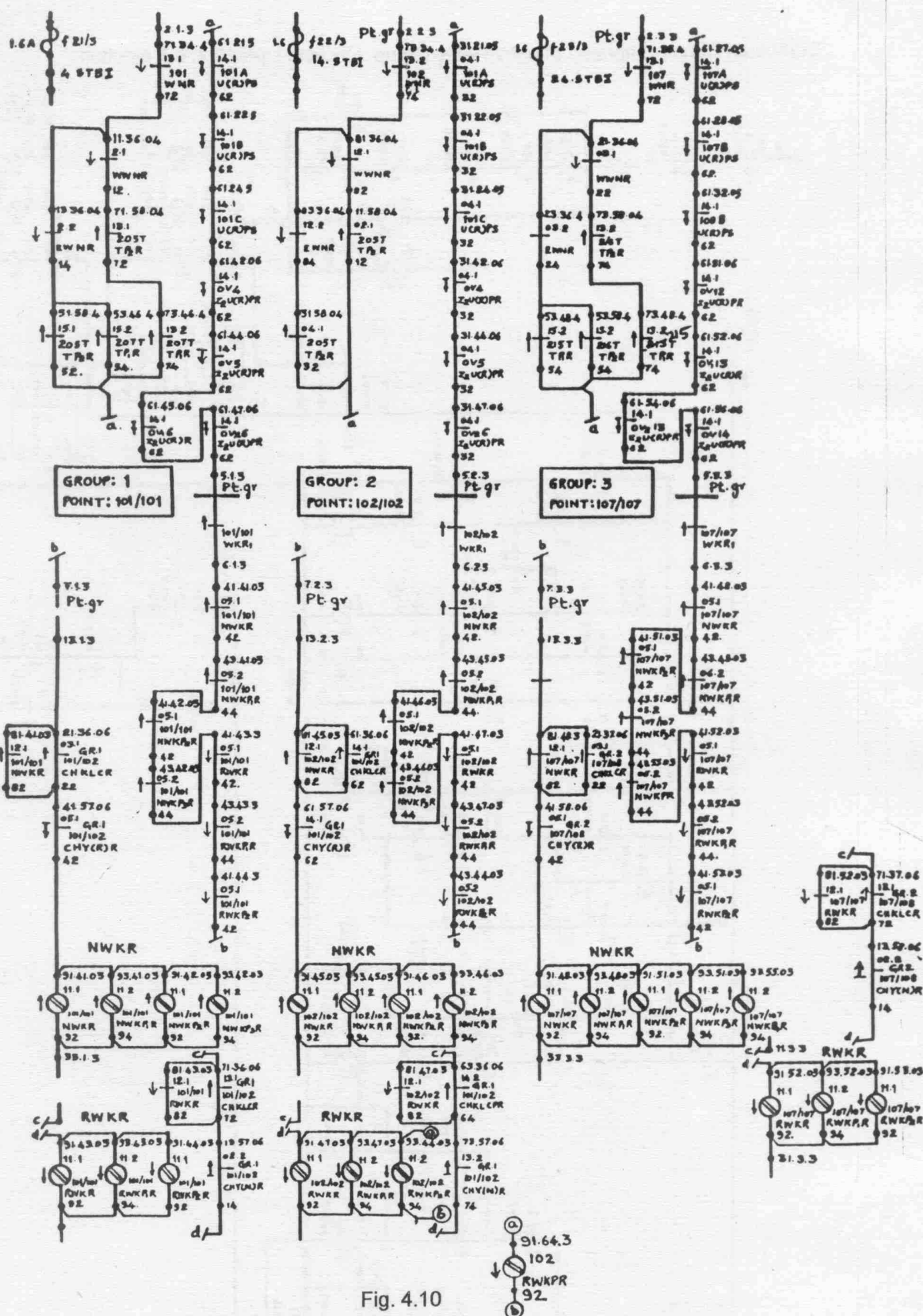


Fig. 4.10

SLOT CONTROL

5.1 POINT CRANK HANDLE KEY RELEASE

The relays involved are:-

S.No.	Relay Nomenclature	Location	Description	Purpose
1.	CH1- YNR, CH2- YNR etc.	Mini group (in cabin)	Point Group-1 Crank Handle Release Button relay etc.	Represents button operation in circuits
2.	YYNR	Mini group (in cabin)	Common Slot Release Button Relay	Represents button operation in circuits
3.	YRNR	Mini group (in cabin)	Common Slot Return ack. Button Relay	Represents button operation in circuits
4.	CH1KLCR, CH2KLCR etc.	Mini group (in cabin)	Crank Handle key locked 'IN' Proving relay for Pt.Grp1, 2 etc.	Proves the condition of CH key at site. This is provided in the cabin.
5.	CH1-KLCPR, CH2-KLCPR etc.	Mini group (in cabin)	Repeaters of the above.	Proves the condition of CH key at site. This is provided in the cabin.
6.	CH1-KLR, CH2- KLR etc.	Mini group (at site)	Crank Handle Key Lock Relays.	Mechanically lock the point CH key when inserted to release it on receiving slot from the cabin.
7.	Gr1, 2 etc. CH -Y(R)R Y(N)R (Interlocked)	Mini group (in cabin)	Crank handle Slot Release relay .	Releases key at site <u>when latched in reverse</u>
			Crank handle Slot Normal Relay	Withdraws slot after key is reinserted at site.

A common Key with a specific ward controls the entry of Crank Handle in a group of Point machines. Normally this Key remains locked mechanically in a Key Lock Relay kept in a location box at site close to the concerned Points. The key locked 'In' condition at site is proved in the cabin by CH-KLCR. CH KLCR in the cabin and CHKLR at site are connected to feed from either end by a common pair of lines. A two wire circuit is in use between cabin and the location at site.

OPERATION:

After reaching the site, the authorised person presses a Push Button on the CHKLR box so that CHKLCR drops in the cabin. This causes a *red* indication to *flash* near CHYN button and the existing *yellow* indication to its left to disappear on the panel. On seeing this, the Panel Operator presses CHYN and YYN, provided no route is set involving the Points concerned. This makes CH-Y(R)R to operate and the relevant panel counter to progress by one number.

Due to this, at site, CHKLR operates even as the P.B. on the box is still kept pressed to light a *red* indicator on the box. Then the key is extracted from the relay and taken for use on the Points.

CH/EW/WW-NCR dropped contact in the CH-Y(R/N)R circuits checks for its proper working.

Relay & Indication circuits: (Refer Fig.5.2 & Fig 5.3)

5.1.1 Sequence of Relay operation : –

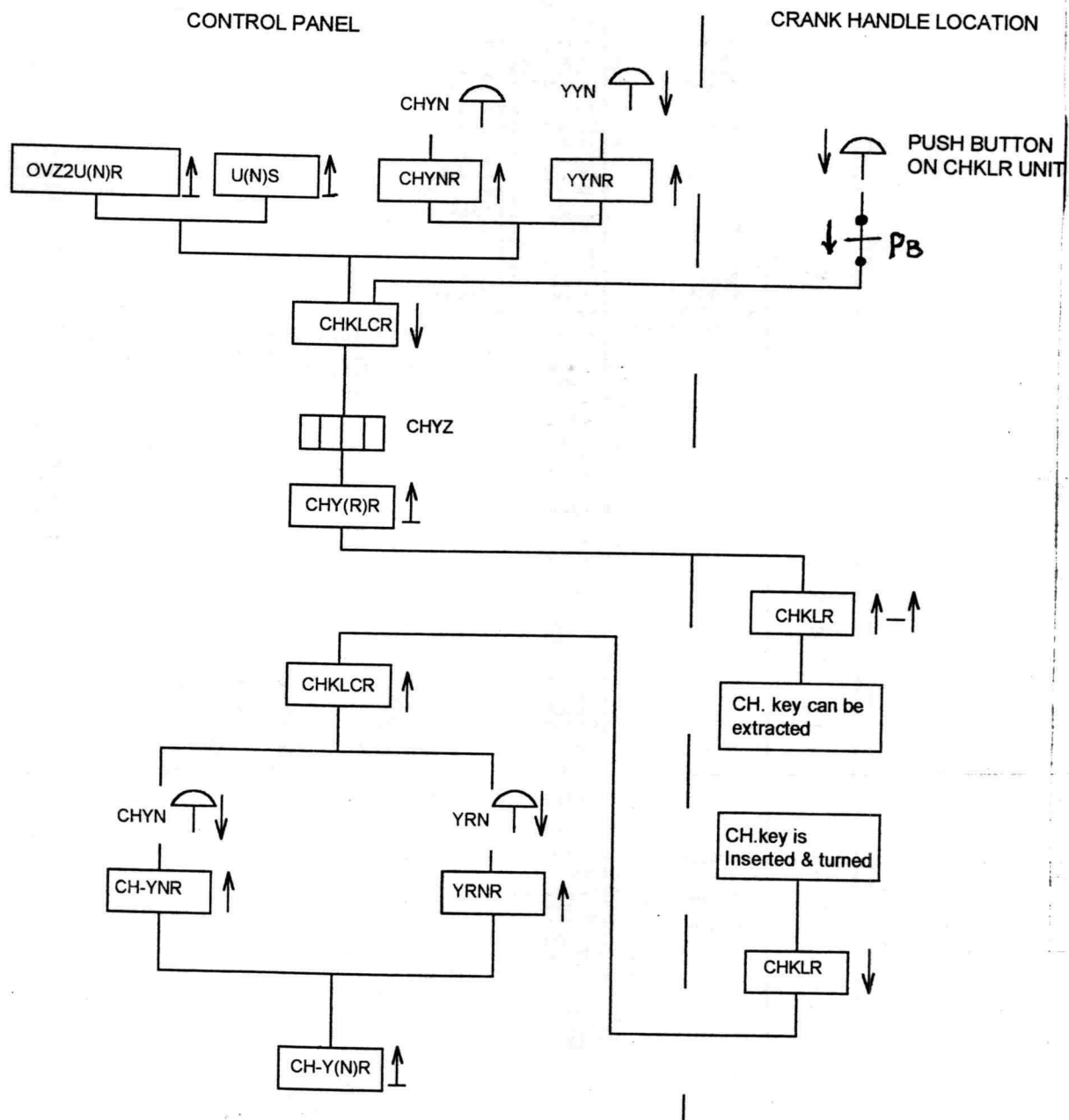


Fig. 5.1

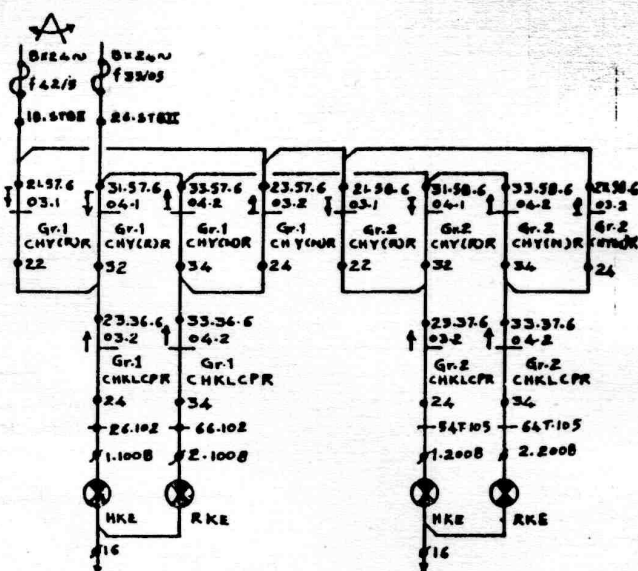
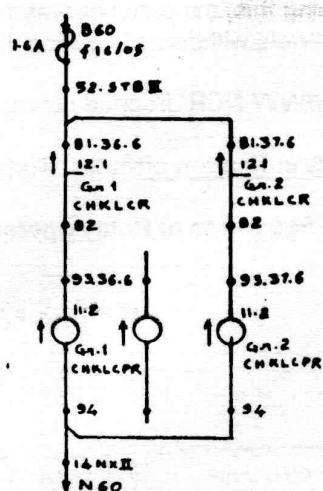
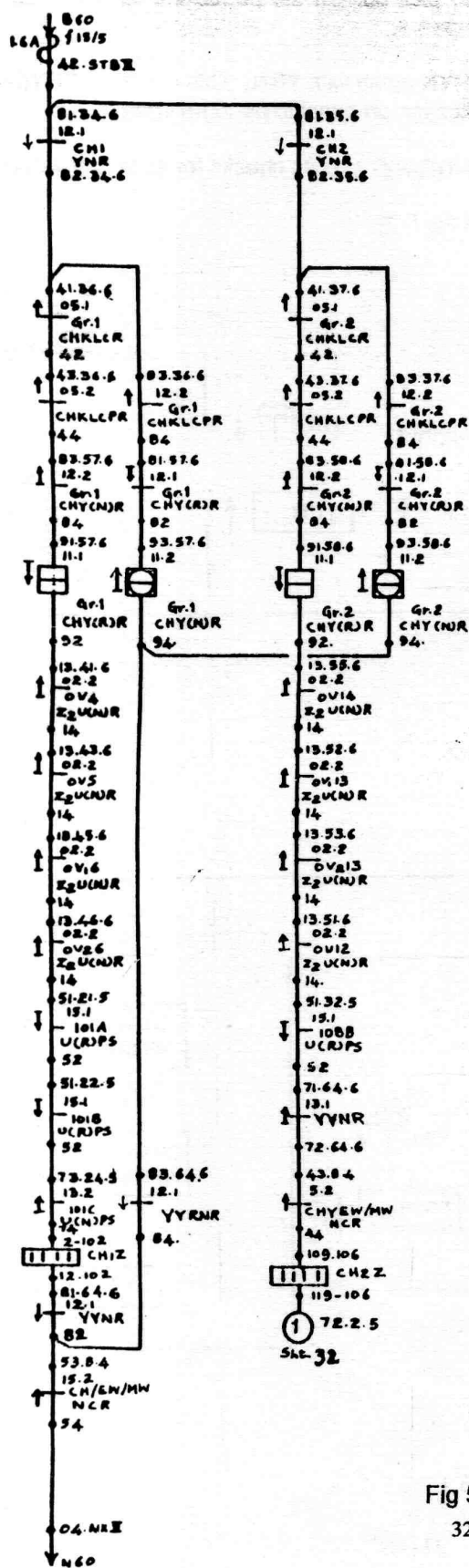


Fig 5.2

Fig 5.2

5.2 LEVEL CROSSING GATE CONTROL

The relays involved are :-

S.No.	Relay Nomenclature	Location	Description	Purpose
1.	LXNR	Mini Grp (in cabin)	Level Crossing control Button Relay	Represents button operation in circuits.
2.	YYNR	Mini Grp (in cabin)	Common Slot Control Button Relay	Represents button operation in circuits.
3.	YRNR	Mini Grp (in cabin)	Common Slot Return ack. Button Relay	Represents button operation in circuits.
4.	LXCPRS	Mini Grp (in cabin)	Level Crossing Slot key in Proving relays.	Prove the condition of Gate key at site. Provided in the cabin.
5.	LXPR	Mini Grp (at the gate)	Level Crossing Key Lock Relay	Mechanically locks the Control Key normally and releases it when Slot is received from the cabin.
6.	LX(R)R LX(N)R (Interlocked)	Mini Grp (in cabin)	Level Crossing control Release relay	Releases Key at site <u>when latched in Reverse.</u> Withdraws slot after key is reinserted at site.
			Level crossing control Normal relay.	

Unlike in the case of Crank Handle Key release, a Gateman is always present at the gate to receive control whenever conditions are favourable. Hence, the Gate Slot is released directly from the panel without asking for co-operation from the Gate end. A Six wire circuit is provided between cabin and the location with no separate feed at site.

Normally the gate slot key is locked up in LXPR at the gate hut. 60V DC feed is taken on lines No.3 & 4 from cabin to the Gate hut and proving LXPR dropped there, it is carried back on lines No.5 & 6 to energise LXCPR at the cabin. When Gate Slot is not released and LXCPR is energised, a *steady yellow* indication is displayed near LXN on the panel.

With no Route set in the Gate region, when LXN is pressed along with YYN on the panel, LXCPR drops and LX(R)R operates at the cabin. This causes *yellow* panel indication to *flash* and 60V DC to be sent on lines No. 1 & 2 to the Gate hut where an 'LED' is lit to give slot received indication. On seeing this, the Gateman presses a push button on the relay box and takes out key from LXPR. With the dropping of LXCPR, the *yellow* indication disappears and a *red* indication is displayed near LXN on the panel.

After clearing the road traffic, when the Slot key is re-inserted in LXPR and turned, it gets locked and the relay drops. This picks up LXCPR in the cabin causing '*red*' indication to disappear and '*yellow*' indication to *flash* near LXN on the panel. On seeing this, the panel operator presses LXN along with YRN to withdraw control. LX(N)R operates and the '*yellow*' indication on the panel becomes *steady*.

For sequence of relay operation and control circuit ref fig. 5.4 & 5.5

5.2.1 Sequence of relay operation

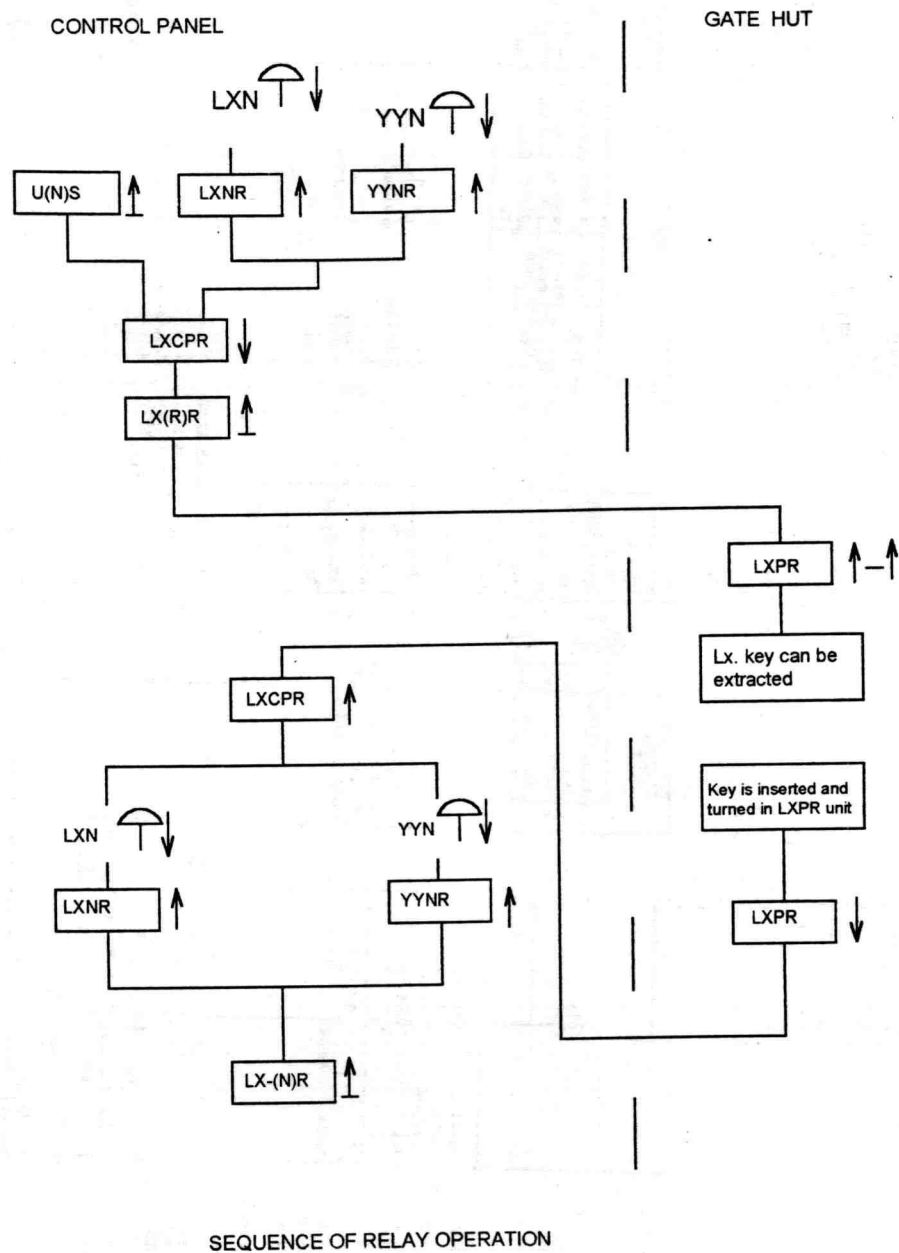
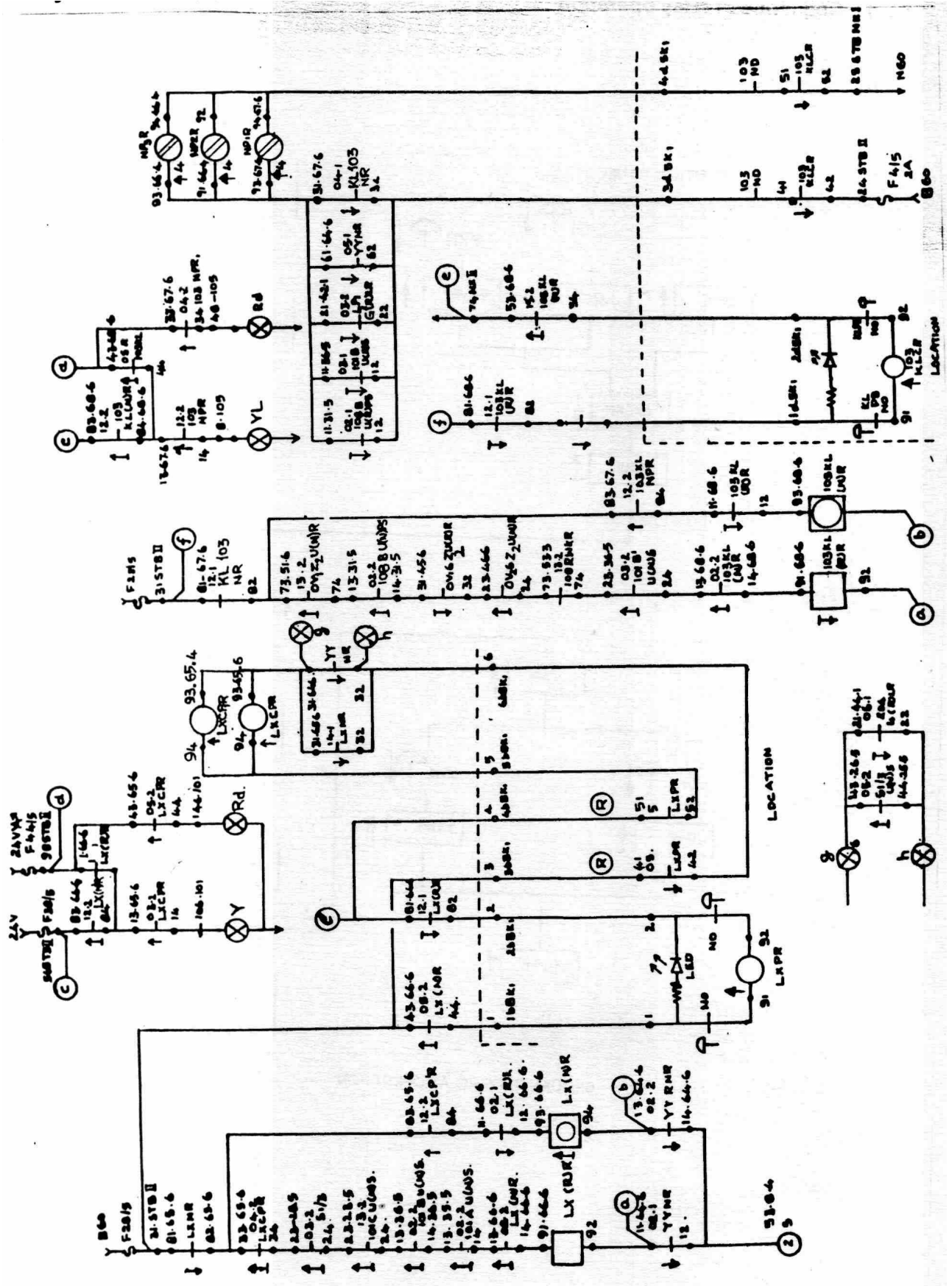


Fig 5.4

Relay Control circuit



5.3. POINT KEY LOCK CONTROL

The relays involved are:--

S.No.	Relay Nomenclature	Location	Description	Purpose
1.	KLNR	Mini Grp (in cabin)	Key Lock control Button relay	Represents the button operation in circuits.
2.	YYNR	Mini Grp (in cabin)	Common Slot Release Button relay	Represents the button operation in circuits.
3.	YRNR	Mini Grp (in cabin)	Common Slot Return ack. Button relay	Represents the button operation in circuits.
4.	KLCR	Mini Grp (at site)	Key locked 'In' Proving Relay	Mechanically locks the key when dropped. Releases key when slotted from the cabin.
5.	NP1R NP2R NP3R etc.	Mini Grp (in cabin)	(Key Lock) Normal proving relays	Prove the condition of point lock release key at site. Provided in the cabin.
6.	<u>KL (R) R</u> KL(N)R Interlocked	Mini Grp (in cabin)	<u>Key lock release relay</u> Key lock normal relay	Releases key at site when operated.
				Withdraws control after key is inserted and turned at site.

Its working is similar to that of Level Crossing Gate control. A 4-wire circuit is used between cabin and location with a 60V feed source at site. (Refer Fig.5.5)

Normally the Point lock control Key is held in KLCR when it is de-energised. Proving this condition at site, when no Route is set involving the Key Lock points, NPRs are energised in the cabin. A steady *yellow* indication is displayed near KLN button on the panel.

When no Route or Overlap is set involving the Key Lock Point and when the concerned loop line is connected ahead to the arrival or departure road, KLN and YYN are pressed together on the panel to release slot. KL(R) R operates in the cabin and the concerned *yellow* indication *flashes* on the panel. This makes KLCR at site to be energised and a *red* LED indication displayed on the Box.

On seeing this, the man at site presses a Push Button on the relay box and takes out the key. NPRs drop in the cabin. *Yellow* indication disappears and a *steady red* indication appears on the panel.

After the traffic into or out of the Siding is passed, and the Key is reinserted in the KLCR, the relay drops. This makes NPRs to pick up in the cabin. On the panel, the *red* indication disappears and a *flashing yellow* indication appears.

Now the panel operator presses KLN and YRN together to withdraw the slot KL(N)R operates in the cabin. This makes the *yellow* panel indication *steady*.

SIGNAL OPERATION

6. After ensuring that :-

- a) All Points in the Route, Overlap and Isolation as necessary are correctly set, locked and detected.
- b) All relevant Slots including Point Crank Handle controls are withdrawn after previous release, the concerned GN and UN buttons are pressed together, and released.

This causes sequentially: -

- 1) Route and Signal Initiation.
- 2) Route Setting, Checking and Locking.
- 3) Signal Clearance.

6.1 ROUTE & SIGNAL INITIATION

During Route and Signal initiation, it is verified whether the route to be set is free from any other ongoing or completed movement.

In the case of Main and Shunt signals, Signal Initiation takes place followed by Route Initiation whereas only Route Initiation takes place for Calling on signals. Route Initiation also take place for identifying the Route sections to be normalised during Manual Route Release operation in emergencies of traffic management.

Route and Signal initiation or cancellation takes place in stages.

In the first part directly opposing/conflicting moves are verified, whether it is signal clearance or cancellation.

In the next part free availability of Route Sections to be set for the intended move is verified along with over lap or isolation requirements.

6.1.1 The Relays involved in this process are –

S.No	Relay Nomenclature	Location	Description	Purpose
1.	GNR	Signal Grp	Signal Button Relay	Represents Sig. button operation in circuits.
2.	GNPR	Mini grp	Repeater of the above	Represents Sig. button operation in circuits.
3.	GNCR	Mini grp	Signal Button Relays Normal proving relay.	Drops to prove a Signal button operation for the route to be initiated.
4.	GN CPR	Mini grp	Repeater of the above.	Drops to prove a Signal button operation for the route to be initiated.
5.	UNR	Mini grp	Route Button Relay	Represents Route button operation in circuits.
6.	UNPR	Mini grp	Repeater of the above	Represents Route button operation in circuits.

7.	UNCR	Mini grp	Route Button Relays Normal proving relay.	Drops to prove a Route Button operation for Signal initiation.
8.	UNCPR	Mini grp	Repeater of the above	Drops to prove a Route Button operation for Signal initiation.
9.	WNCR	Mini grp	Point Button Relays Normal proving relay	Proved energised in GNPR and UNR circuits to prevent Signal operation when a Point button relay fails to drop.
10	MN - GNPR	Mini Group	Common relay to repeat the operation of any Main Signal Button relay.	Used to separately initiate the Route sections for Main Signal operations and Shunt Signal operations providing interlocking between them initially.
11.	SH - GNPR	Mini grp	Common relay to repeat the operation of any Shunt Signal Button relay.	
12.	SH- <u>G(R)R</u> <u>G(N)R</u> (Interlocked)	"Mini grp	Shunt Signal selection relay Main & C.O. Signal selection relay	Initiates Shunt Signal and <u>Route when reversed</u> Initiates Main/C.O Signal and Route when normal.
13.	Road- <u>ZU(R)R</u> <u>ZU(N)R</u> (Interlocked)	Mini grp "	Direction determining relay to set reverse direction of movements (Right to Left) Direction determining relay to maintain normal direction of movements.(Left to Right)	Provided to interlock Signals in opposite direction on a road Initiates Route for 'left to right' movement normally.
14.	Road - <u>ZU (R)PR</u> <u>ZU(N)PR</u>	Mini grp	Repeaters of the above	"
15.	Road - <u>G(R)LR</u> <u>G(N)LR</u> (Interlocked)	Mini grp	<u>Signal Locking Relay</u> Signal Un-locking relay.	Proved dropped in Signal initiation to ensure that no conflicting Main Signal is operated. Latches when Route is normalised after previous Main Signal operation.
16.	Slotted point <u>KL(R)R</u> <u>KL(N)R</u>		Point Key Lock <u>Release Relay</u> Point Key Lock Normal relay.	Proved normal in Signal initiation circuit for Point to Signal locking.
17	KLNPR	Mini grp	Relay checking the condition of Key Lock at site and its Slot in the cabin.	Proved normal in Signal initiation circuit for Point to Signal locking.

18	COGGNR	Mini grp	Common Calling on Signal Button relay	Repeats Button operation in circuit.
19.	COULR ₂	Mini grp	Second Calling on Signal Control relay.	Proved normal in MN/SH Signal initiations for interlocking.
20	Z ₁ UR	Mini grp	Sub Route initiating relay (common for all Route sections in a sub route	(1) Proves normalisation of the previous setting of Route sections. (2) Enforces interlocking with conflicting Route sections.
21.	Z ₁ UPR	Mini grp	Repeater of the above	“
22.	EUUYNR	Mini grp	Emergency Route Release Button relay.	Proved dropped in Route initiation for setting and proved energised in Route initiation for manual release.
23.	STN - EUUYNPR	Mini grp	Repeater of the above	“
24.	EUYNR	Mini grp	Emergency Route Section Release Button relay.	Proved dropped in Route initiation.
25.	STN EUYPR	Mini grp	Repeater of the EUYR, the Route-section release relay. (Common for all R.S. in Sub Route)	“
26.	OVZ2U(R)R/ Z2U(N)R (Interlocked)	Mini grp	<u>Overlap Setting relay</u> Overlap Release relay	Proved normalized after previous Main Signal movement on the concerned Route or its cancellation.
27.	OV - <u>Z₂U(R)PR</u> Z ₂ U(N)PR	Mini grp	Repeater of the above	“
28	NWKR	Mini grp	Normal Point Detection Relay	Proved energized to interlock conflicting Route sections during initiation
29.	NWKPRS	Mini grp	Repeaters of the above	“

30.	RWKR	Mini grp	Reverse Point Detection relay.	“
31.	RWKPRs	Mini grp	Repeaters of the above	“
32.	MN-GZR	Mini grp	Main Signal Initiating Relay (Common for all signals in a yard)	Initiates Main Signal to be cleared
33.	SH-GZR	Mini grp	Shunt Signal Initiating relay (Common for all signals in a yard)	Initiates Shunt Signal to be cleared.
34.	ZDUCR	Mini grp	Route Permissibility checking relay Common for all sub-routes in a yard.	Ensures availability of all required Route sections, before any one could be set.
35.	ZDUCPR1, ZDUCPR2,	Mini grp	Repeaters of the above	Represent ZDUCR in circuits.
36.	EUUYNCR	Mini grp	Relay checking EUUYN operation with Route initiation for release in emergency. Common relay for all Routes.	Makes identification of the Route sections to be released in an Emergency Release operation .

6.1.1: -- Initiation for Signal Clearance and emergency cancellation: -

6.1.2 INITIATION

- (a) Route and Signal Initiation for shunt & Main Signal
- (b) Route Initiation for calling ON Signal
- (c) Route initiation for emergency full route cancellation by operator.

Initiation stage Continuous till ZDUCR ↑

Sequence of Relay operation

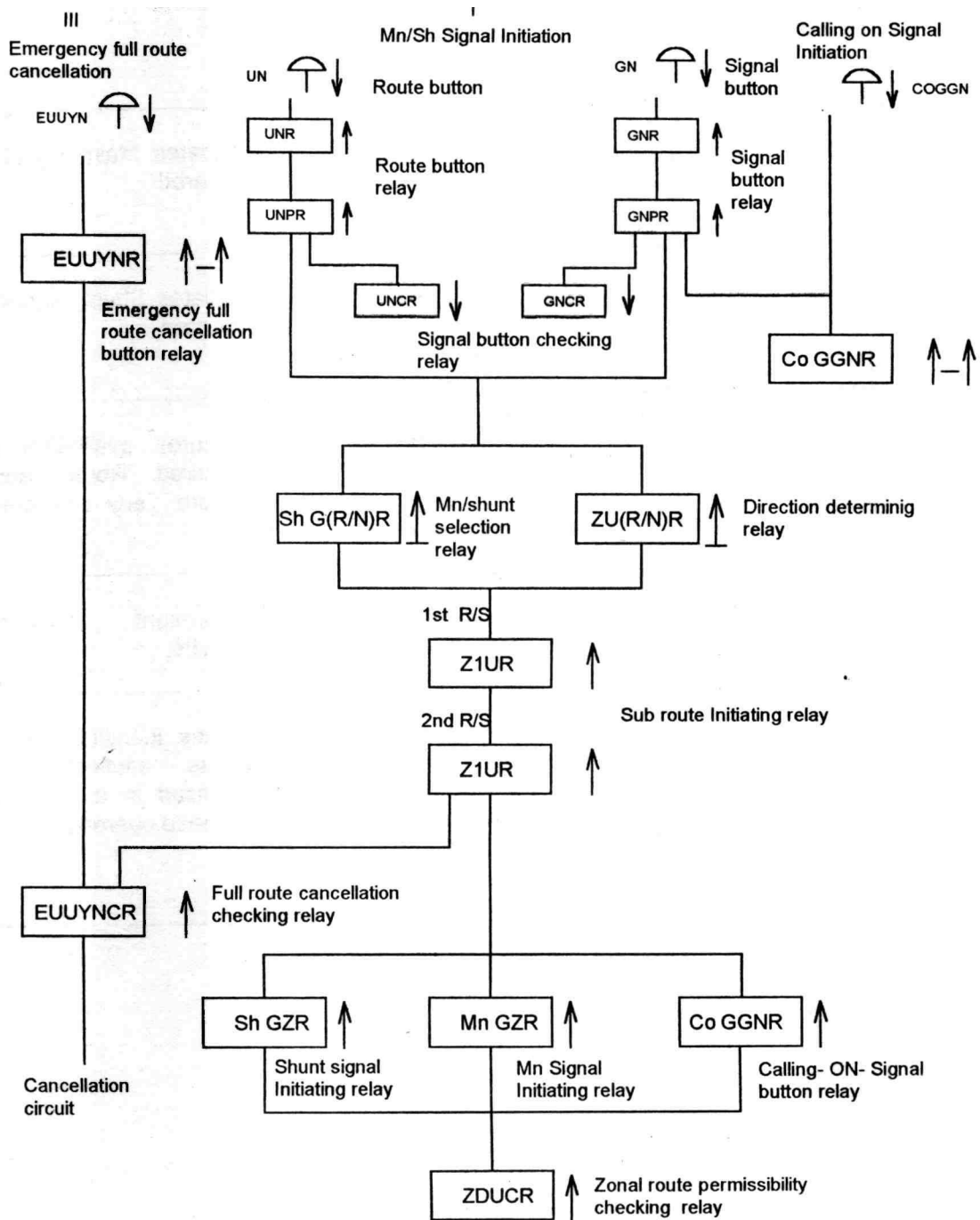


Fig.6.1

6.1.2(a) :- ZU (R/N)R :- This is an interlocked relay and is designated after destination/Berthing track. Normally for Right to left movement ZU(R)R is operated and left to right movement ZU(N)R is operated. This is used to establish the direction of traffic and avoids initiation of directly opposite conflicting movements one interlocked relay is provided for each Berthing Track Circuit or exit track circuit.

Following conditions are proved:-

- ZU(R)R :-**
- (i) Concerned signal button & Route button pressed simultaneously
 - (ii) Concern route sections and overlaps on either side of berthing track or exit track circuit are normal.
 - (iii) ZU(N)R front contact is used as economiser contact.

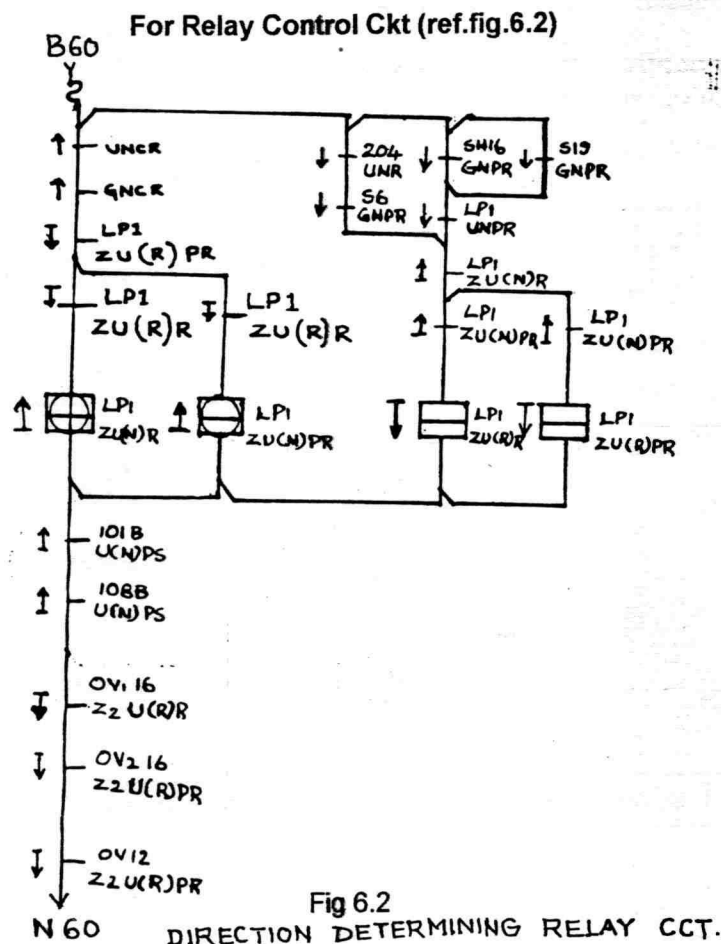
ZU(N)R :- Latches automatically after the designated movement is completed and all signal and Route buttons are normal.

After the previous train has completely arrived on the road or has left the road in the reverse direction. Route section and Overlap immediately next to the road shall be released behind it.

GNPR and UNR relays have dropped after previous operation as proved by the energisation of GNCR and UNCR.

Proving these conditions soon after the release of last route section and overlap behind the train passed in reverse direction ZU(N)R operates and remains so normally.

For Relay Control Ckt (ref.fig.6.2)



6.1.2 (b) :- SH G(R/N)R (Main Signal/Shunt Signal selecting Relay) :-

This is an interlocked relay provided to achieve an interlocking between main signal & shunt signal leading towards the same direction. When SH G(N)R picked up, it permits main signal/Calling ON Signal route initiation and when SH G(R)R picked up, it permits shunt signal route initiation.

Following Conditions are proved in Sh. G(R/N)R:--

(I) SH. G(N)R:

- (a) Ensures that no Signal buttons and route buttons are in pressed condition.
- (b) All the route sections & overlaps falling in the SH-signal route are Normal.
- (c) SH G(R)R front contact is used as a economizer contact.

(II) Sh G(R)R :-

- (a) Shunt signal button and concerned route button is pressed.
- (b) All the route sections & overlaps falling in the SH-signal route are Normal.
- (c) SH G(N)R front contact is used as a economizer contact.

(III) Common Conditions for Sh G(R/N)R:

- (a) concerned route sections are proved normalised after previous operation.
- (b) Over laps falling in the Shunt signal route are proved normal.
This prevents initiation of main signal / calling ON Signal in Single line section of the road in same direction and opposite direction.

For relay control circuit ref Fig. 6.4
Sequence of relay operation

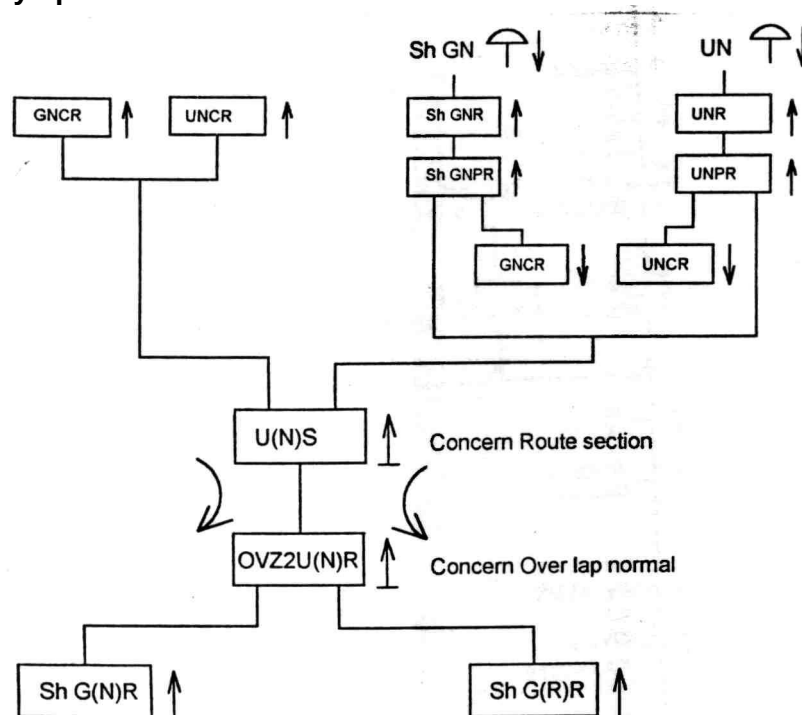


Fig No. 6.3

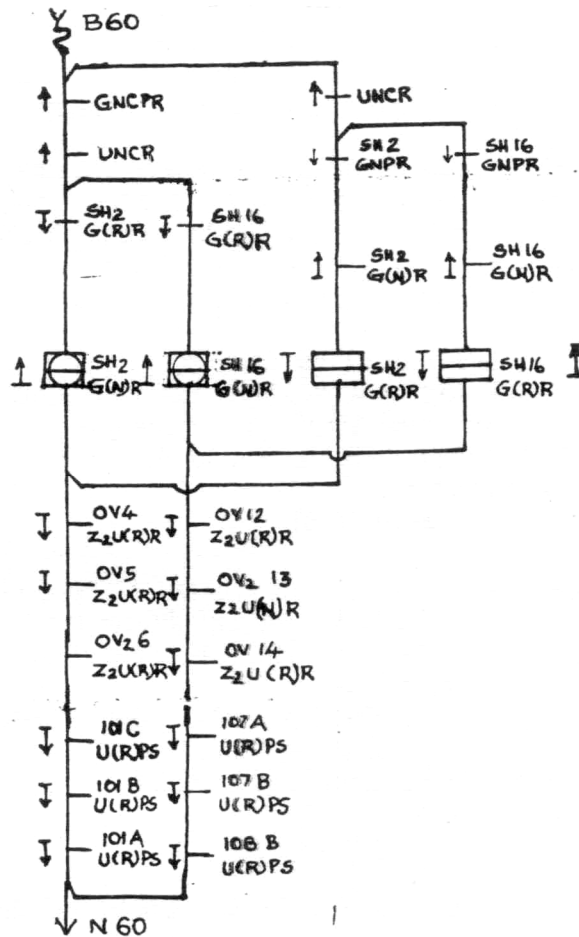


Fig. NO.6.4

6.1.2(c) Z1UR :-

Sub route initiating relay :- For each sub route one relay is provided if the signal governed by a route have more than one sub route, the sub route initiating relays of each sub routes operate in cascade manner commencing from the last sub route. i.e. Z1UR of all sub routes operate in succession.

This relay energises during route initiation for signal clearance and also during emergency full route cancellation by SM. The energisation of this relay during cancellation ensures that the relevant sub route only will get released, as the cancellation relay "EUJR" is a common relay for the entire yard.

In this process, individual Route sections are initiated with the operation of their Z1URS.

Following conditions are proved: -

- (i) ZU (N) R or ZU (R) R operated to interlock Signals of the road in opposite direction.
- (ii) SH-G(N) R operated to interlock Shunt Signals of the same road
- (iii) GNCR and UNCR dropped to prove the operation of signal and route buttons.
- (iv) Points in the sub route and isolation, if any, are correctly set and detected.

6.1.2 (d) Signal and Route Permissibility Checking :-

Main GZR :- Main Signal Initiation relay.
Sh GZR :- Shunt Signal Initiation relay.
ZDUCR :- Zonal Route permissibility checking relay.

These are neutral and common relays for entire station or zone. If the station is divided in to two or more zones then each zone will have one such relay.

Main GZR or SHGZR relay operates when any main /shunt Signal is initiated and only when the entire route including the overlap is free for setting. Even when any one of the point in the route to be initiated is engaged by a conflicting movement this relay does not operates and makes the push button operation ineffective. When it is operated it permits the initiation of route setting and signal clearance circuits.

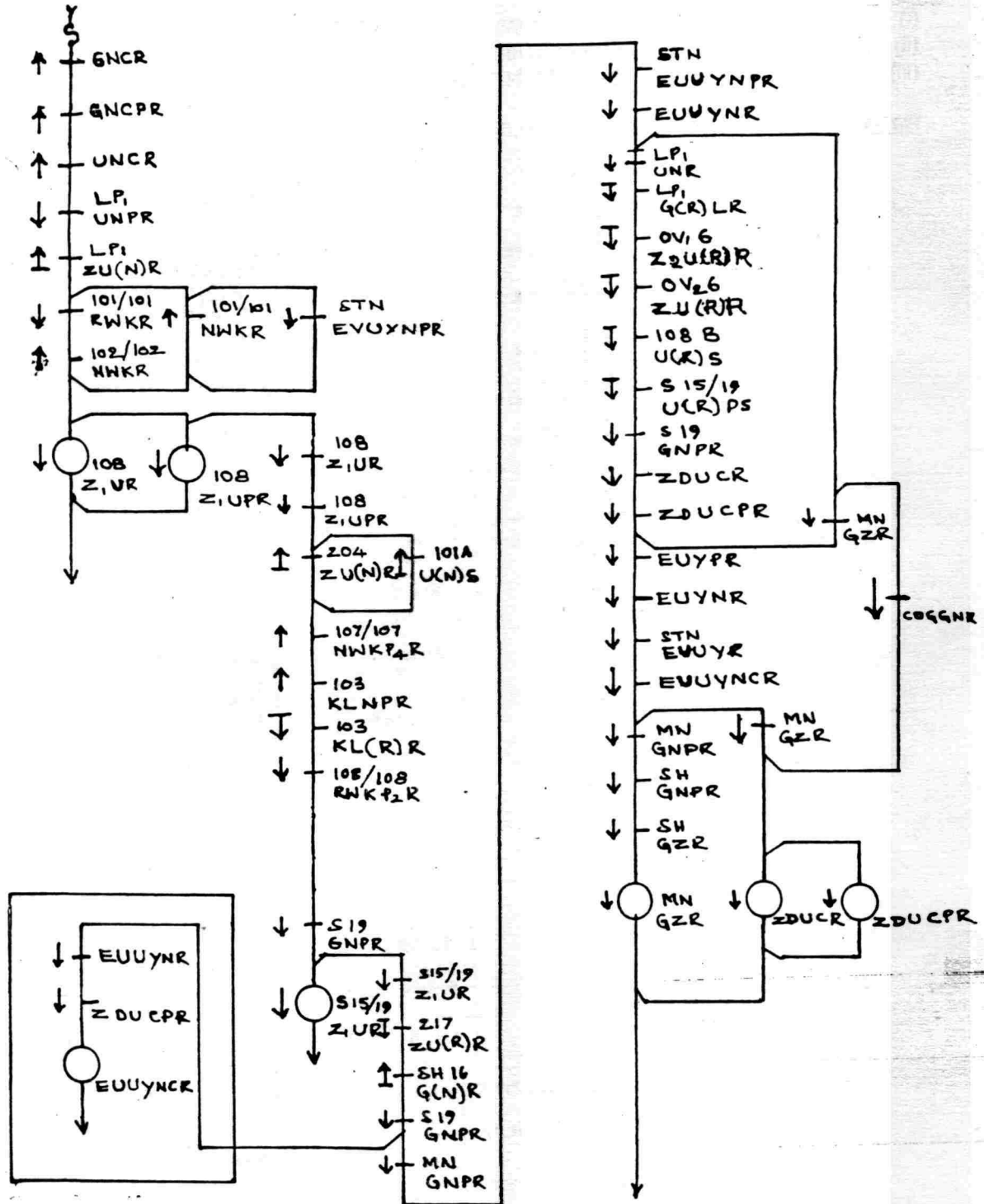
Whenever main signals are to be cleared, ZDUCR relay operates only after the energisation of MNGZR and for shunt signal after the energisation of Sh. GZR. But in case of calling ON signal clearance ZDUCR relay energises directly as there is no GZR for calling On Signal. A common relay is used for the entire yard so that only one signal and Route can be initiated at a time.

Relay control circuit (Ref Fig.6.5).

Now Signal Initiation takes place with the operation of Mn GZR or Sh GZR or COGGNR and ZDUCR.

- (i) Initiation of Route sections in a cascade manner.
 - (ii) Detection of Route section and Overlap Points as well as freed slotted Points,
 - (iii) Conflicting Route sections and overlaps are normalised after the previous operation,
 - (iv) Conflicting Main Signal of the road is not cleared.
 - (v) Emergency cancellation is not in progress.
- This leads to the operation of ZDUCR.

Relay Control Circuits:



ROUTE PERMISSIBILITY CHECK FOR MAIN SIGNAL AND CALLING ON SIGNAL CLEARANCE AS WELL AS MAIN/C.O. SIGNAL ROUTE RELEASE IN EMERGENCY.

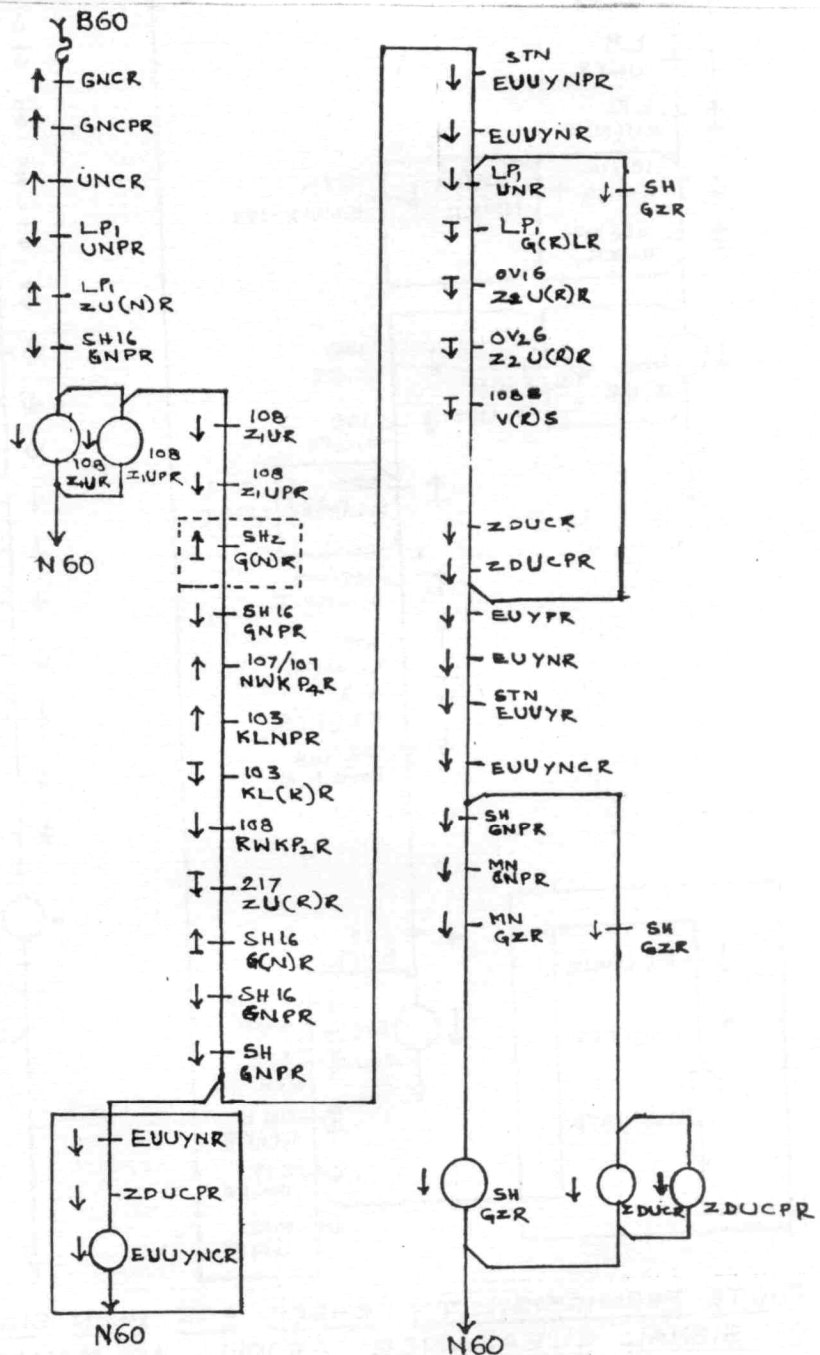
Fig. 6.5

Route permissibility check for Shunt Signal clearance and its emergency route release (S19 to Loop1)

In this process

- (i) SH-G(R)R operation is proved instead of SH-G(N)R
- (ii) Overlap Pt detection is not proved, and
- (iii) SH-GZR operates instead of MN-GZR

Relay Control Circuit: (Refer to Fig.6.6)



ROUTE PERMISSIBILITY CHECK FOR SHUNT SIGNAL CLEARANCE
AND ITS EMERGENCY RELEASE (SH16 to Loop1)

Fig 6.6

6.1.3 RELEASE OF SIGNAL LOCKING PROVED IN INITIATION.

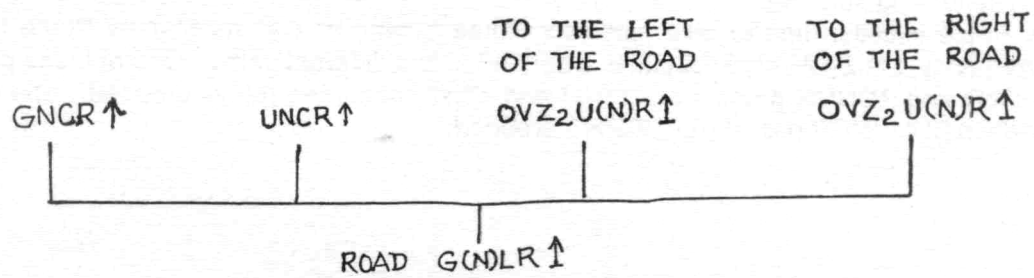
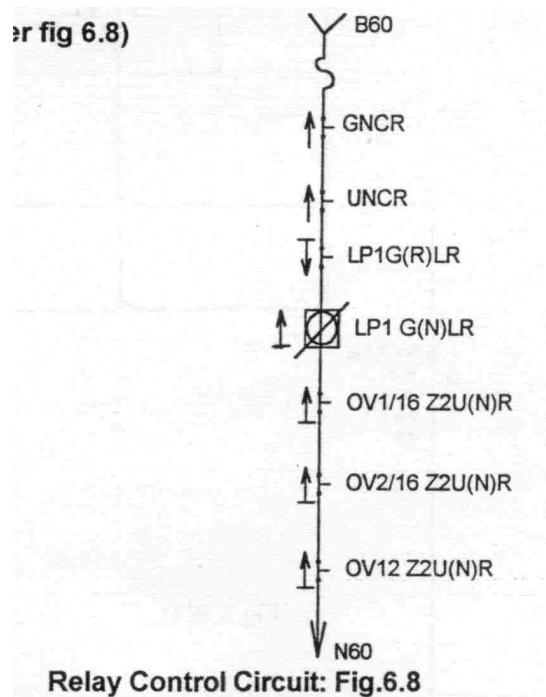


Fig.6.7

Before any Main Signal is cleared, a Signal Locking Relay for the road, (G(R)LR latches for locking all conflicting Signals of the road. Its normalisation is proved during initiation of any Signal of the road to provide for its direct interlocking with other Signals of the same road. This relay latches in normal as soon as a concerned *Signal Overlap* is normalised following the concerned route release as shown below.

OV-Z2U(N)R contacts prove normalisation of Main Signal Routes on either side of the road after the signalled train has reached its destination.

For relay control circuit (Refer fig 6.8)



Relay Control Circuit: Fig.6.8

6.1.4 Combined Signal & Route Section Initiation Circuits of the Yard

Refer to Fig. 6.9 (1- 8)

1. Initiation circuits for all Routes and Signals are combined and made in a geographical format similar to the yard layout.
2. For signals in opposite direction involving the same Route sections, their Z₁URs are energized in the same chain circuit with different button relay contacts proved in parallel.

3. For Shunt Signal selection, the OV-Z₂U(R)R contacts are bypassed with SH-G(N)R dropped contacts.
4. As initiation for Shunt Signal Route setting and Emergency Route Release do not prove Overlap Point detection, their N/RWKR operated contacts are bypassed with SH-GNPR and STN-EUUYNPR operated contacts in parallel.
5. Since MN-GZR and SH-GZR initiate conflicting Signals, their NC. (Back) contacts are proved in each other's circuits. COGGNR NC (back) contact is proved in MN-GZR and SH-GZR circuits for interlocking purpose.
6. As Route initiation has to take place for Route Setting as well as Manual Route Release in emergency, the Z₁UR chain circuit is extended in two different paths. One of these paths leads to GZR and ZDUCR proving EUUYNPR and other concerned relays dropped. The other path leads to EUUYNCR proving ZDUCPRS dropped.

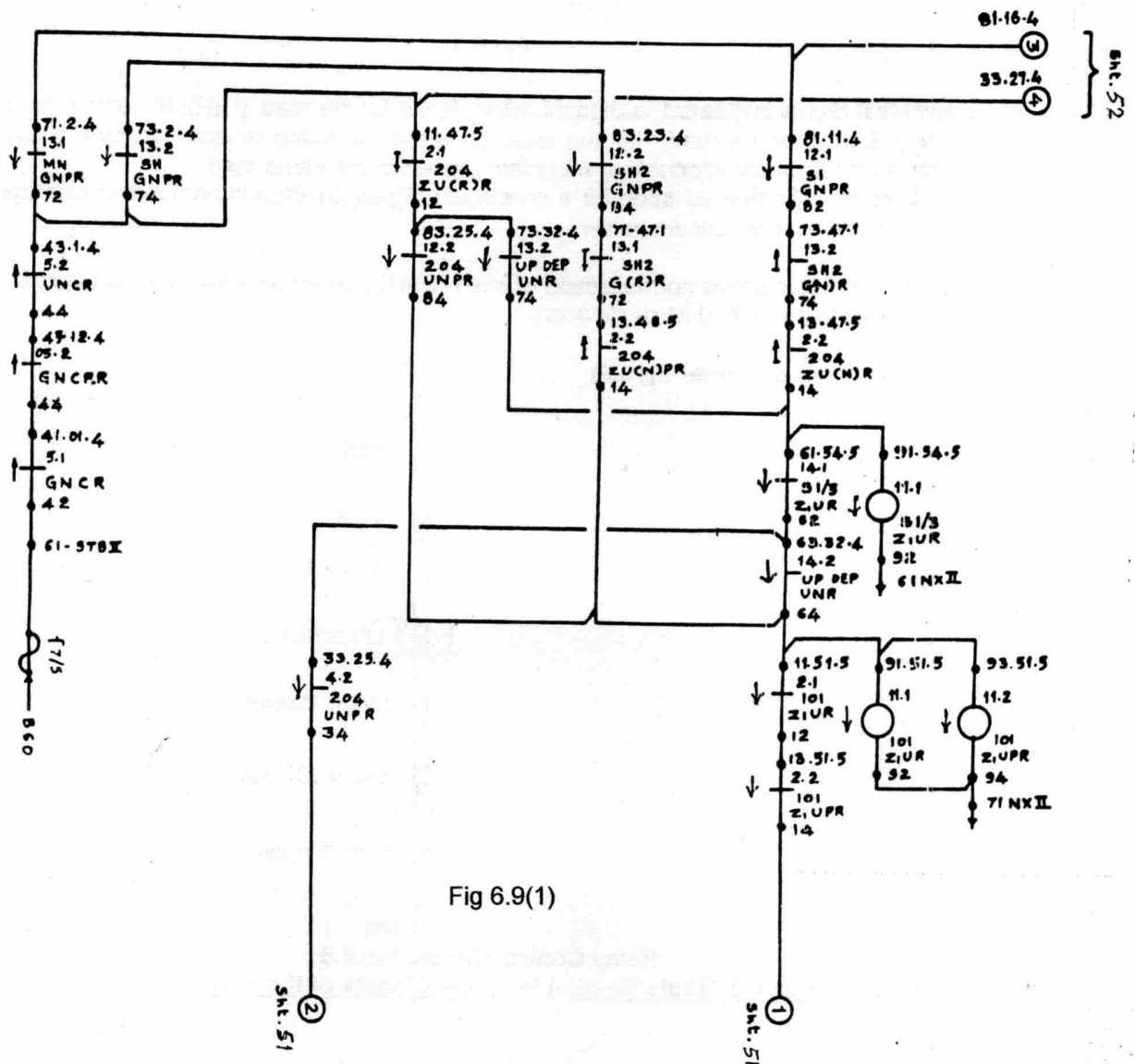


Fig : 6.9 (1)

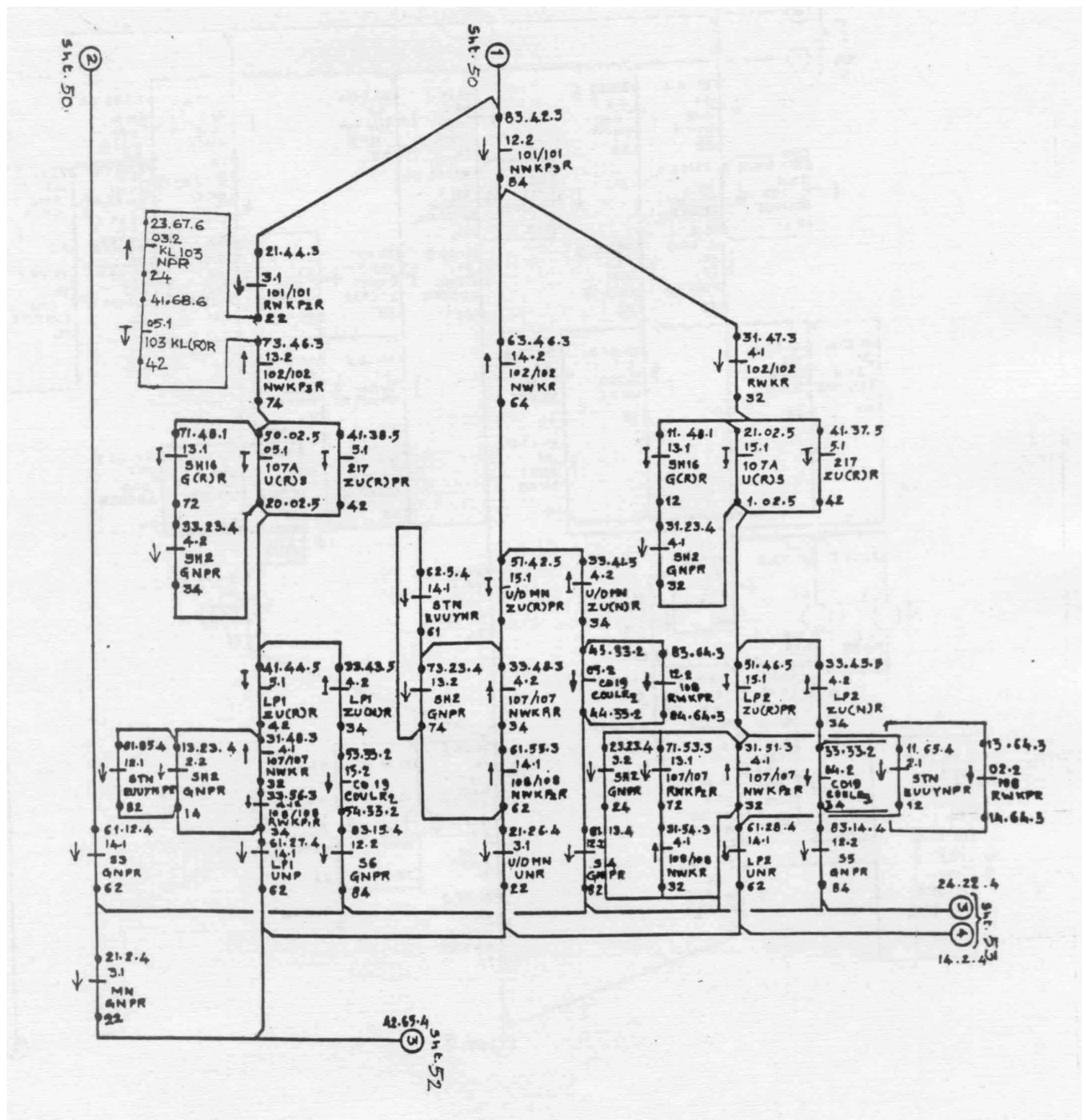


Fig : 6.9 (2)

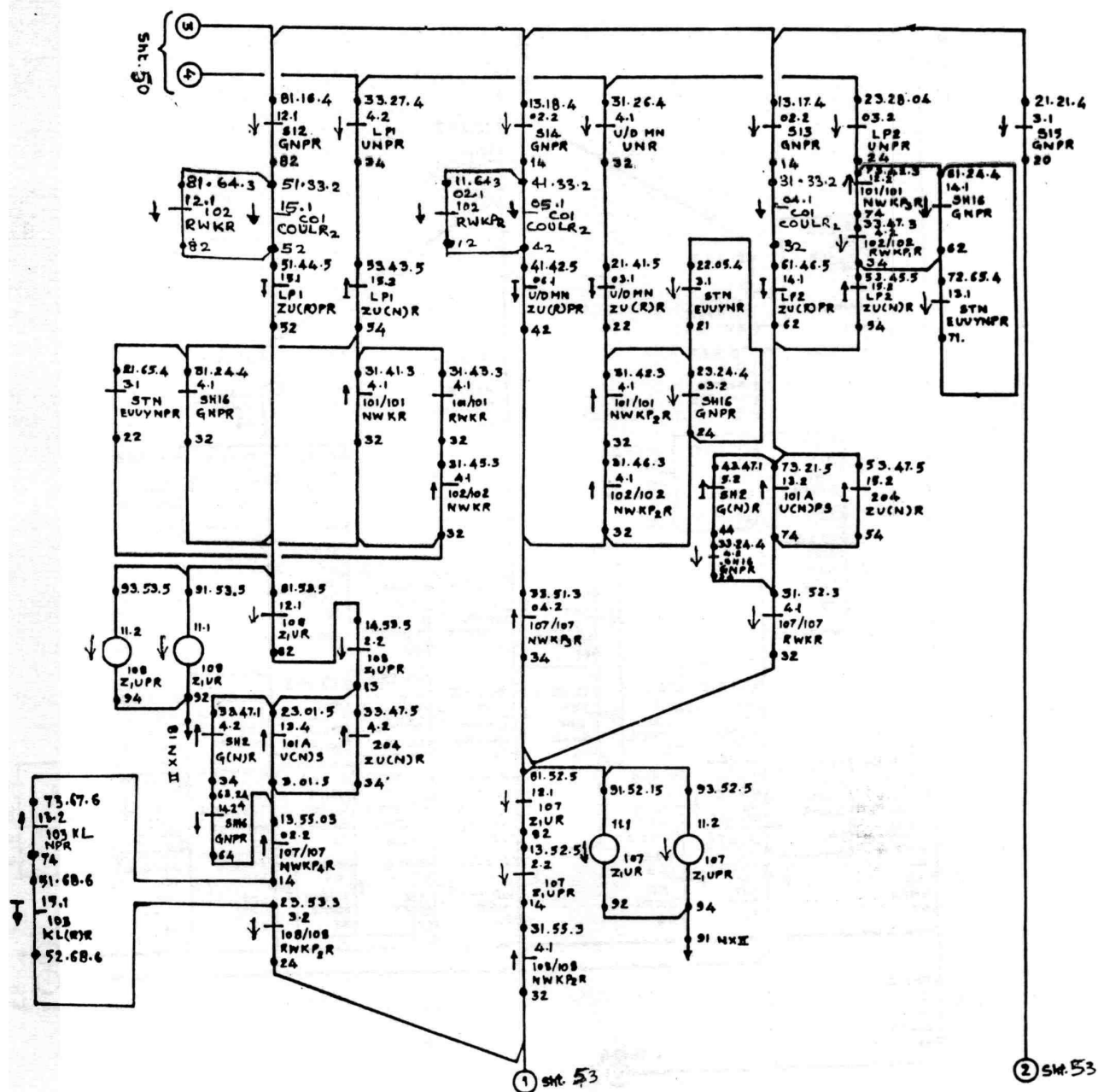
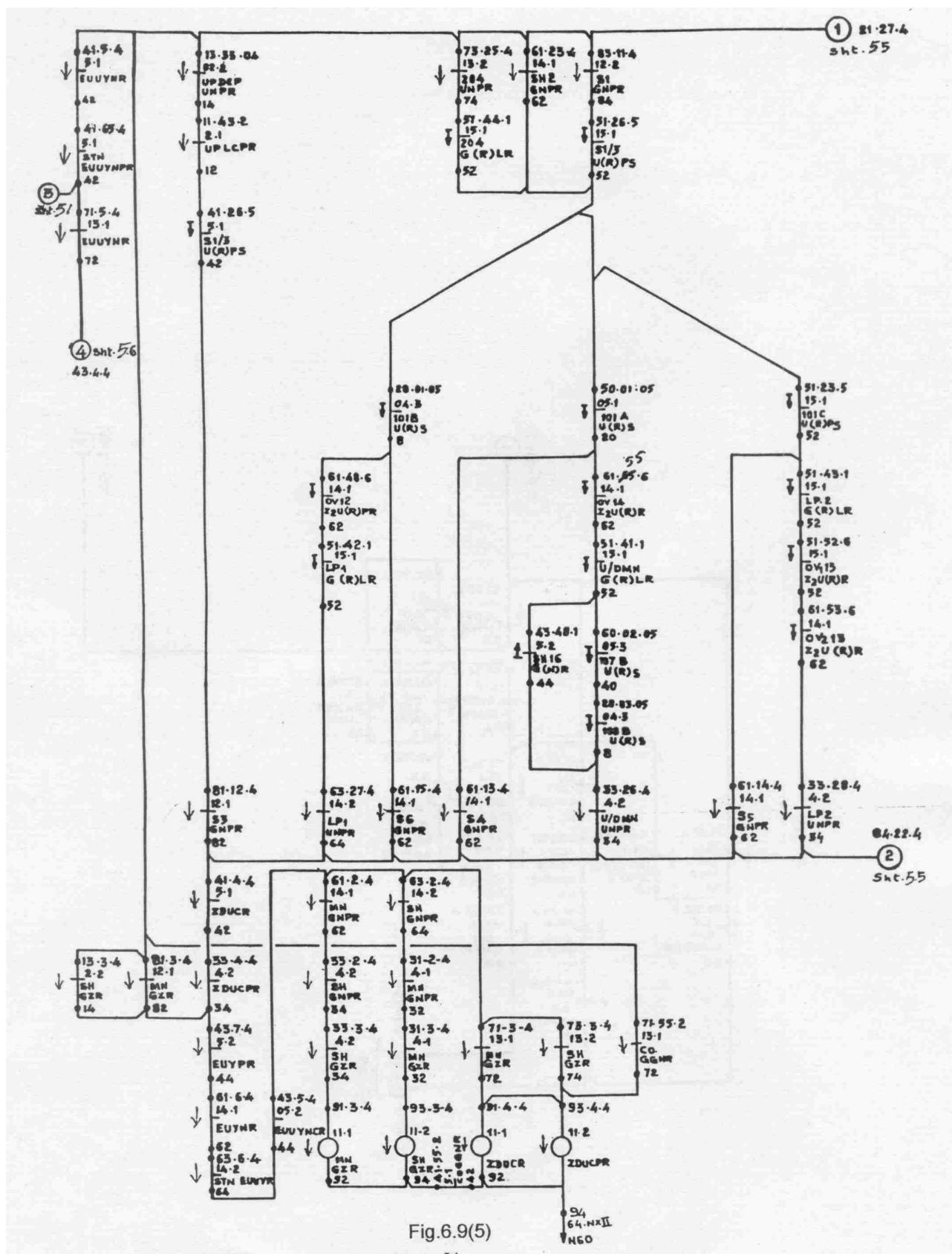


Fig : 6.9 (3)



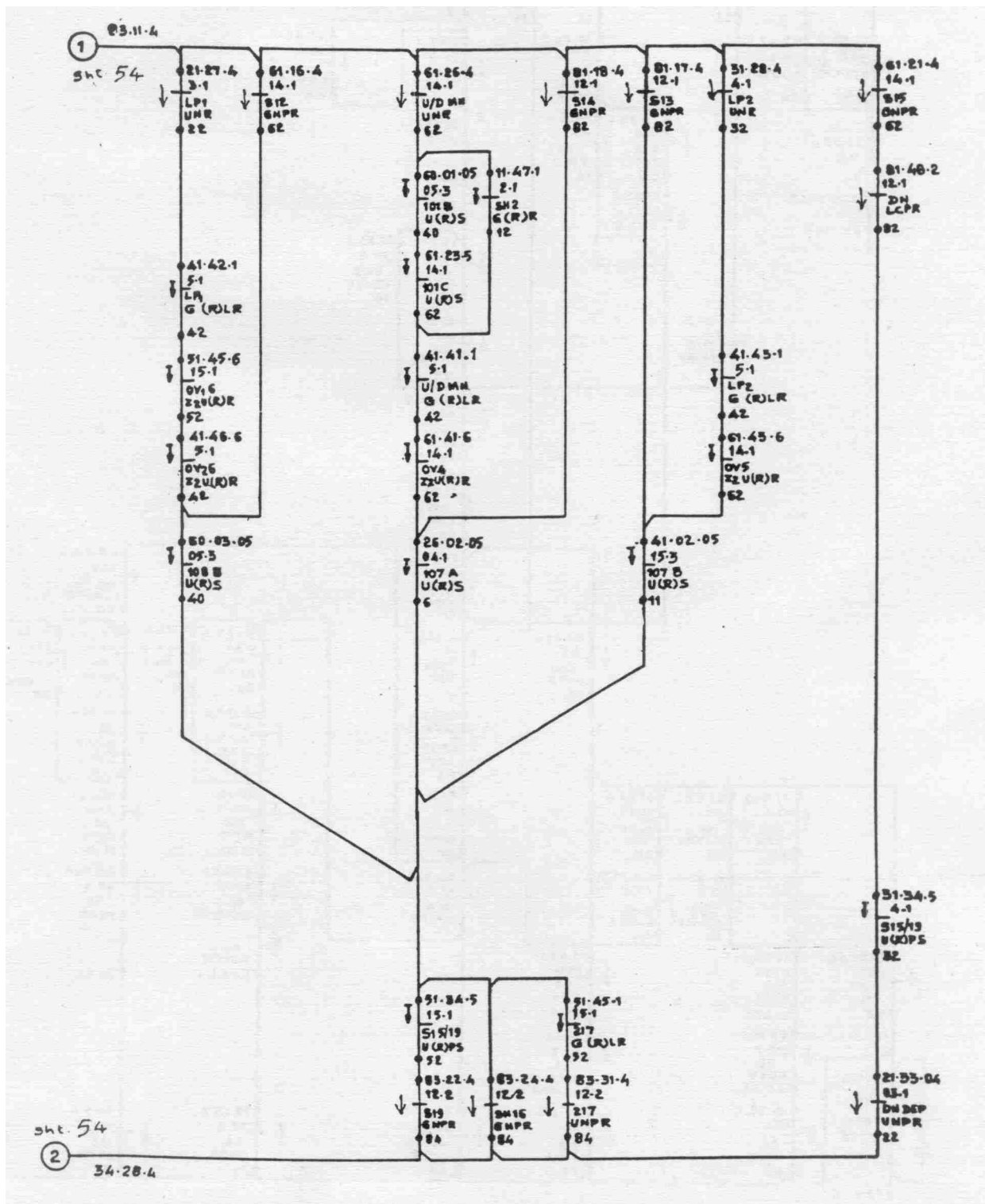


Fig 6.9(6)

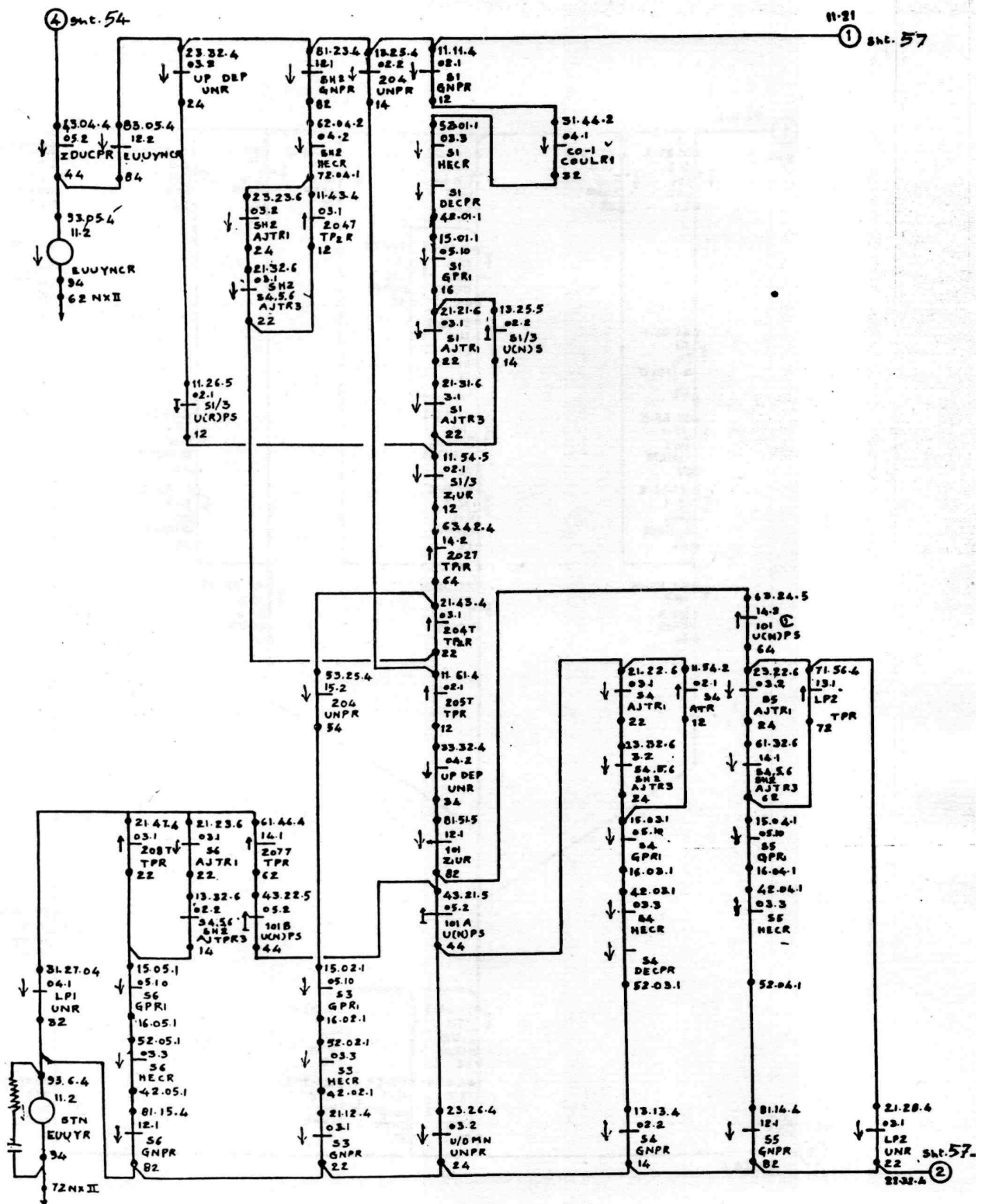


Fig 6.9(7)

6.2 Route setting Checking and locking and overlap setting

Once the Route and signal is initiated, all the route sections in the route and overlap will get set, checked and locked.

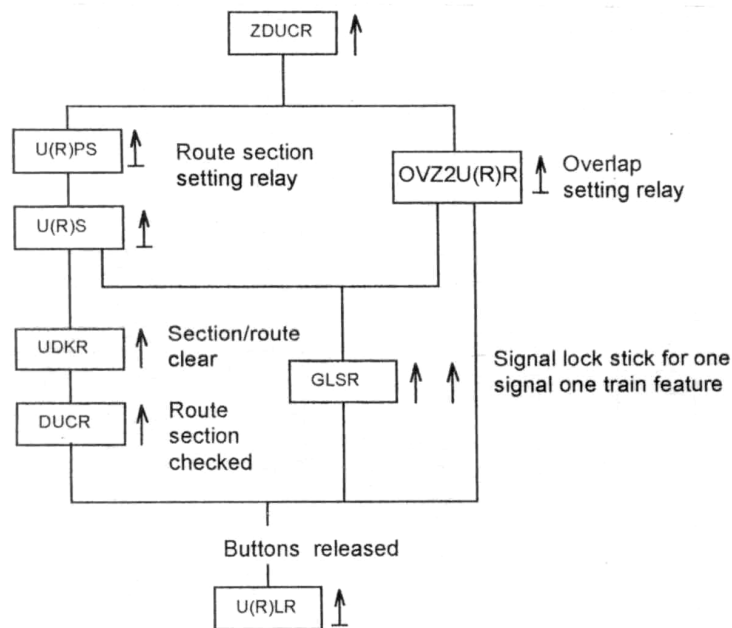


Fig.6.10

6.2.1 OVERLAP SETTING RELAY: OVZ₂U(R)R

After Route Initiation, overlap setting takes place. It is an Interlocked relay. When the main signal or calling on signal in S/Line Section is initiated overlap setting relay reverse coil operates and latches to lock the overlap points. One such relay is provided for each overlap. The energisation of this relay proves that.

1. The route initiated is for main signal or for calling ON Signal in Single line section.
2. Concerned signal and route buttons are pressed simultaneously.
3. Points in the overlap are set and detected to the required position correctly
4. Conflicting overlaps and Route Section are normal and not set some times two conflicting overlaps of a signal may require points in the same position.
5. OV Z₂U(N)R front contact is used as a economizer contact

Sequence of relay operation (Fig 6.11)

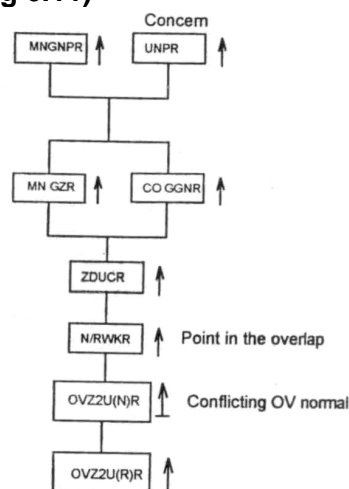


Fig : 6.11

Relay control circuit (Fig 6.12)

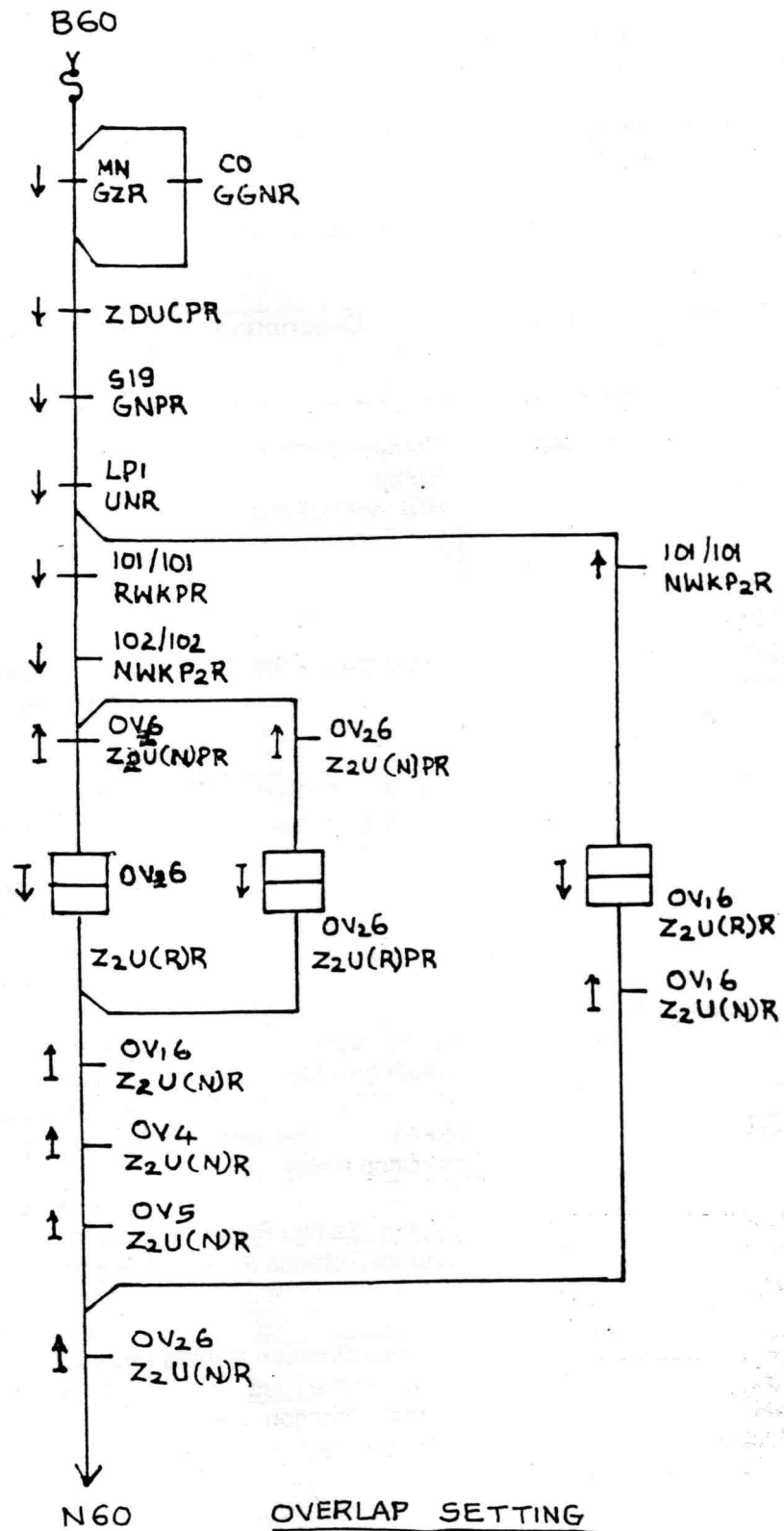


Fig. 6.12

6.2.2 ROUTE SETTING, CHECKING AND LOCKING

After route initiation, route setting takes place section wise to lock Points and Slots in each section.

Then Route checking takes place in each section, proving Route Setting along with Route section Point detection and its track circuit vacancy.

This is followed by *Route Locking*, section wise to hold the Route Setting, enforcing on it Indication, Approach and Back lockings.

Relays involved in Route Setting, Checking & Locking are:-

S.No.	Relay Nomenclature	Location	Description	Purpose
1.	A/B/C/a - <u>U(R)S</u> <u>U(N)S</u> (Interlocked)	Route group	Route section setting Relay R/S normalizing Relay	Operates to lock R/S Points and Slots as required in set position Drops to prove the above condition in circuits.
2.	A/B/C/a - <u>U(R)PS</u> <u>U(N)PS</u> (Interlocked)	Route group	Repeaters of the above	Unlike other relays the repeater relay operates earlier than the main relay
3.	A/B/C/a - DUCR	Route group	Route section Clear checking Relay	Proves that a R/S is set, its points are correctly detected and it is not occupied. Proved dropped in R/S setting to check for proper working.
4.	Z ₁ UR	Mini Grp	Route Section Initiating Relay	Prove that the concerned R/S is initiated along with other required sections.
5.	ZDUCR	Mini Grp	Route Permissibility checking Relay	
6.	OV - <u>Z₂U(R)R</u> <u>Z₂U(N)R</u> (Interlocked)	Mini Grp	<u>Overlap Setting Relay</u> Overlap Release Relay	Interlocks the R/S being set with Main Signals of this road in opposite direction a <i>second time</i> .
7.	ROAD <u>ZU(R)R</u> <u>ZU(N)R</u> (Interlocked)	Mini Grp	Reverse direction Setting Relay for the road Normal direction Setting Relay for the road.	Interlocks R/S being set with all Signals of opposite direction on the road a second time.

8.	S/SH- AJTR ₁	Mini Grp	App. lock Release Timer relay No.1 (concerned with the R/Section)	Proved dropped after previous operation in Route Setting and Checking to check for its proper working.
9.	R/S Pt - N/RWKR _s	Mini Grp	Point position Detection Relays	Proved for interlocking conflicting Route sections.
10.	UYR ₁	Route group	Route Section App. lock Release Relay No.1	Proved dropped in DUCR circuit to check for their dropping after previous operation.
11.	UYR ₂	Route group	R/S App. lock Release Relay no.2	
12.	UDKR	Route group	Route section Cleared Indicating relay (for releasing back locking.)	Proved energised before occupation of R/S to check for its working.
13.	EUJR	Mini Grp	(Common) Emergency R/S Release Relay	Proved dropped after previous operation during the locking of R/S.
14.	MN-GZR	Mini Grp	Main Signal Initiating Relay	Proved dropped with the release of GN and UN before locking the Route section.
15.	SH-GZR	Mini Grp	Shunt Signal Initiating Relay	
16.	R/S - <u>U(R)LR</u> <u>U(N)LR</u> (Interlocked)	Route group	<u>R/S Locking Relay</u> R/S Release Relay (common for a Sub Route)	Effects Indication, Approach & Back lockings on R/Section. Releases the above lockings on Route section. Proved normal during R/S setting to check for its proper working.

6.2.2(a) SETTING OF ROUTE SECTIONS.

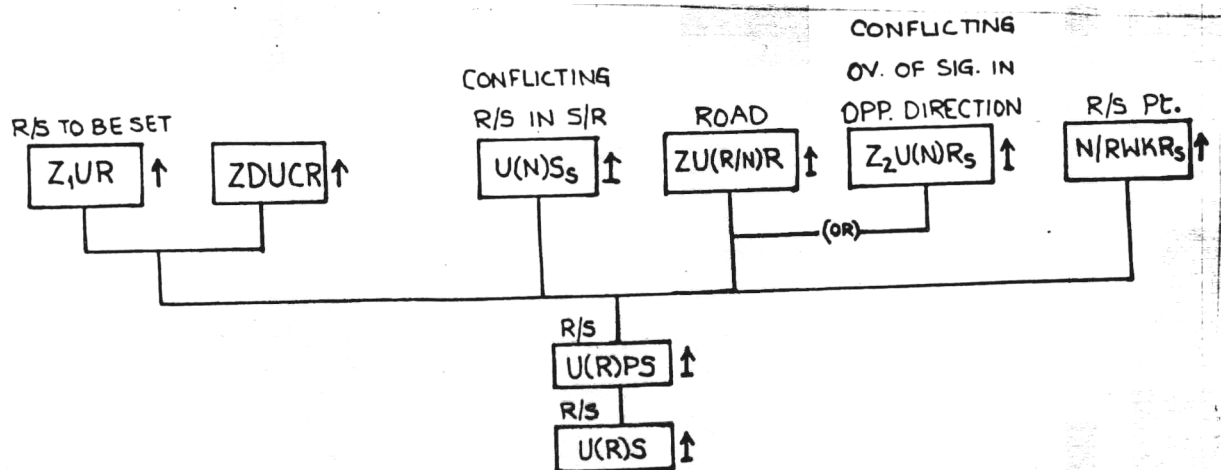


Fig.6.13

Setting a route section engages it for movement of traffic after making its Points and Slots inoperative until after its Normalization.

U(R)S operation proves that:-

- i) The Route section to be set is initiated along with all other required sections.
- ii) Conflicting Route sections of the Subroute and overlaps are normal
- iii) Either the R/S to be set is in advance of a Signal in the same direction or Overlap of Signals in rear falling in the Route section are normal, and
- iv) The concerned Route section Points are correctly detected so that conflicting Route sections of the Sub-route are indirectly locked.

All the required route sections of the Route will set simultaneously.

1. U(R)S / U(R)PS circuit is combined with Route section Checking, Locking and Release circuits as most of the concerned relays are located and interconnected in a minor group.
2. OV-Z2U(R)R normal contacts of Signal Overlaps falling in the Route section are cut over by ZU(R/N)R contacts of the same direction. This facilitates a train 'run through' in a direction.
3. U(R)PS operates first to be followed by U(R)S. This is to ensure possibility of all further operations before a Route section is set as some of them are controlled by the repeater.
4. In the U(R)S circuit, U(N)S operated contact is the economizer contact. Also in this, U(N)PS dropped proves the operation of its repeater first. U(R) PS operated contact is not used for this purpose, as the operation of this interlocked relay is complete only with the dropping of its counterpart.

Relay Control Circuit (ref. to Fig. No. 6.14)

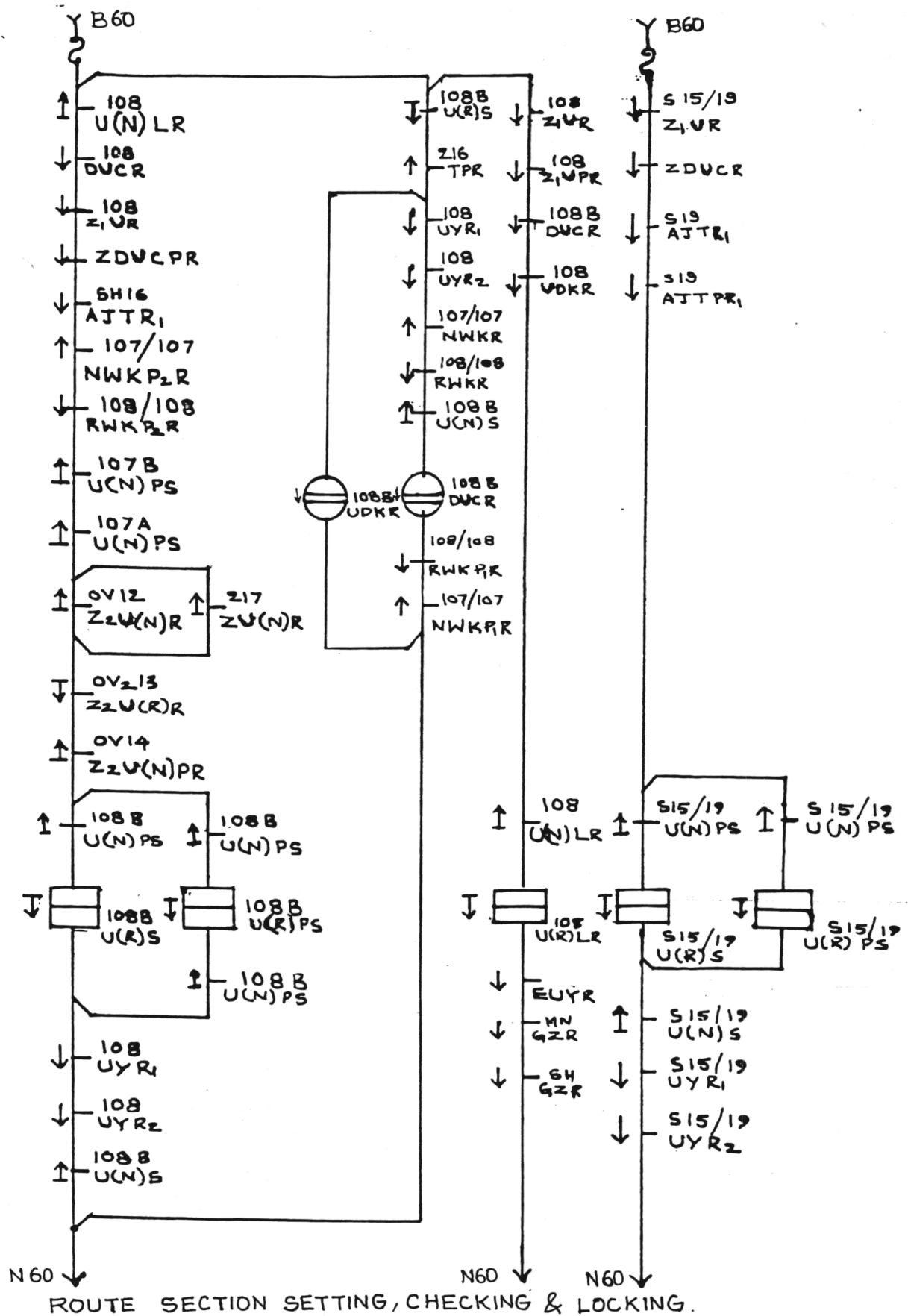


Fig. 6.14

6.2.2(b) :- ROUTE CHECKING

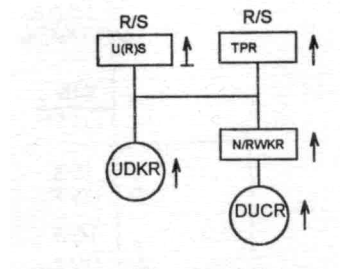


Fig : 6.14 (a)

A. Each Route section gets checked for its correct setting simultaneously with other sections concerned, when its DUCR picks up, proving that -

- i) U(R)S operated and R/S track circuits are not occupied, and
- ii) R/S Points are correctly detected and crank handle is inside the unit
- iii) UYR1 and UYR2 back contacts to prevent energisation of DUCR once UYR1 and UYR2 picks up.

Simultaneously in each Subroute, UDKR is checked for its operation at this stage. This is later required to operate again for releasing back locking on Route Section when a train passes over it.

6.2.2(c) ROUTE LOCKING

Sequence of relay operation

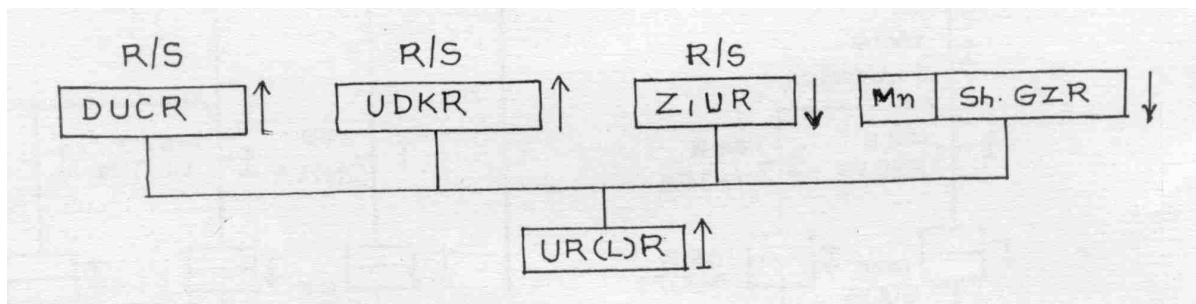


Fig 6.15

After this, the Signal and Route Buttons have to be released for the set Route section to be locked.

For U(R)LR operation, it is proved that -

- i) The Route section and Signal initiating relays could drop when buttons are released, locking of Route Section takes place only after releasing the buttons.
- ii) UDKR pick up proves that the route section is set and clear.
- iii) The set Route section is checked is proved by the relevant DUCR.
- iv) EUYR back contact is proved to check for its dropping after previous operation

Relay control circuit (Fig 6.14)

6.2.2 .(d):- ROUTE SECTIONS WITHOUT POINTS.

Generally Route Sections are formed to hold Points and Slots in them until after a train movement over them. But some times, one may come across Route sections without a point in them as in between an Advance Starter and Home signal of an Absolute Block station in single line section. The later Route sections are formed to achieve interlocking between conflicting signals on either side of them directly.

Alternately, direct interlocking between the signals is achieved through a Direction Determining Relay provided for the Advance starter track circuit.

An example of such a Route section, viz R/S-S15/19 is found in Fig.6.14. Checking and locking of this route section does not take place as no points are involved in this. UDKR relay is provided for proving the back lock condition.

6.3 MAIN SIGNAL CONTROL

6.3.1 One Train only on One Signal Clearance

Soon after Route setting and before buttons are released, GLSR picks up to enforce a Signal operation on panel for every train. GLSRs also provide interlocking between Main and Shunt Signals of the same route. This is because a MN/Sig. GLSR proves Route sections set for picking up while a SH/Signal -GLSR proves Route sections normal and remains energised normally. This interlocking is in addition to that provided by SH-G(R/N)R and Main G(R/N) LR.

The relays involved in Main Signal- GLSR operation are :-

S.No	Relay Nomenc-lature	Location	Description	Purpose
1.	GLSR	Signal Group	Signal Lock Stock Relay	1. Picks up after route setting to allow Signal clearance. 2. Drops before signal clearance to enforce all conditions again in the next signal operation.
2.	EGNR	Signal Group	Relay proving operation of Signal Button along with EGGN	Proved dropped after previous operation in GLSR circuit.
3.	GPR ₁	Signal Group	Repeater for first Signal Aspect control Relay	It serves to drop GLSR by picking up later.
4.	COULR ₁	Mini Grp	First relay to prove locking of Route Points for C.O. Signal control.	Proved dropped in GLSR hold circuit as it controls a conflicting Calling on signal.

GLSR picks up proves that :-

Route and Signal initiating relays operated to ascertain that the route sections are not lying set from the previous operation.

- Signal and route buttons are kept pressed.
- The concerned Route sections are set
- GPR₁ dropped after previous operation, To disconnect GLSR stick feed supply when it picks up and
- EGNR back contact is proved to drop GLSR relay during manual cancellation effected when the signal control relay GR1 fails to pick up, after a route is set & locked.

GLSR remains picked up until the operation of G(R)LR when buttons are released to lock route.

This includes first R/S- U(R) S condition, not to let GLSR remain energized without Route setting if it is picked up by hand. The stick circuit is maintained till the GR1, GPR, is picked up. The signal lock relay G (R)LR is made to operate after GPR₁ picks up but before GLSR drops. For this reason the GLSR is made slow to release.

Sequence of relay operation (Fig 6.16).

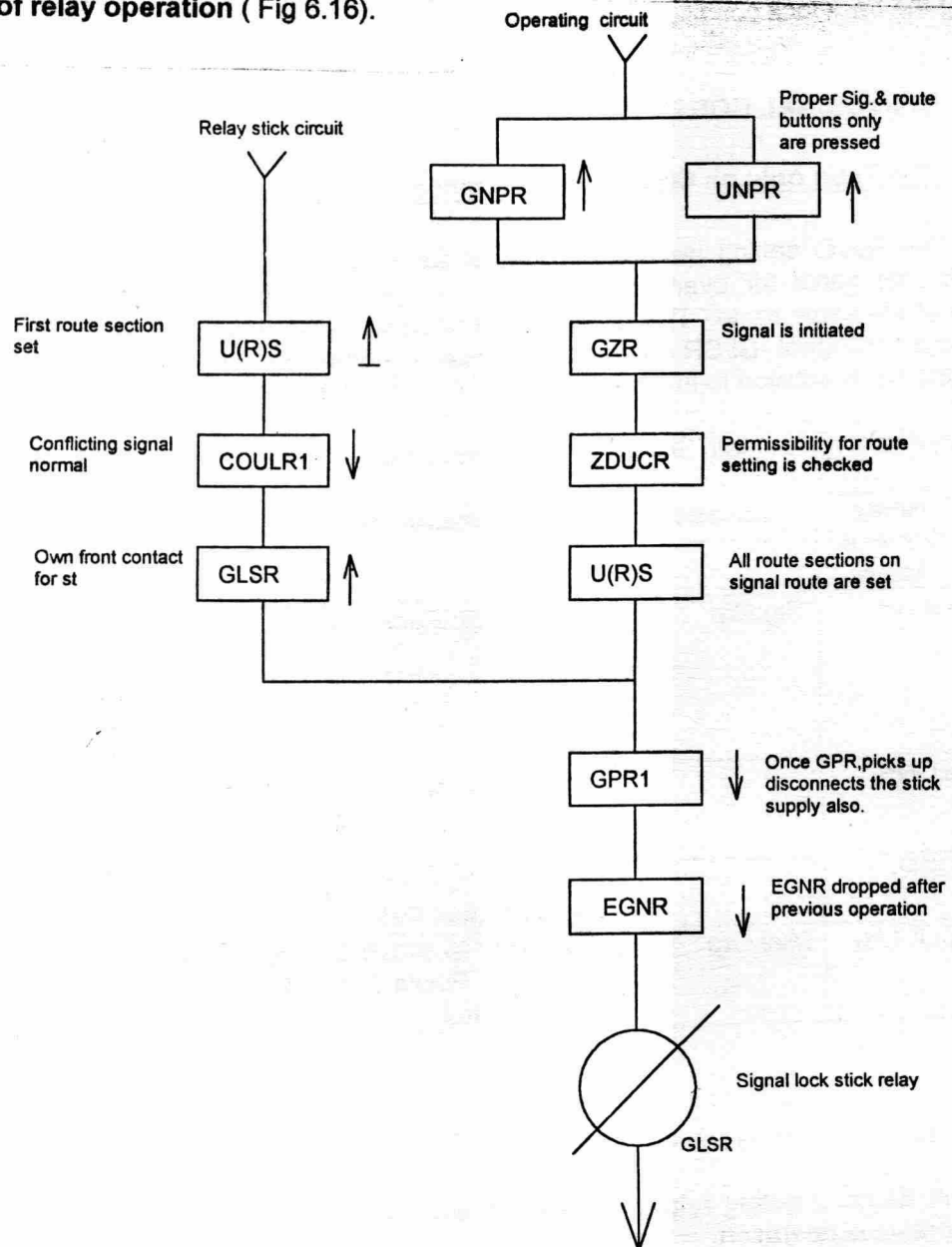


Fig 6.16

Relay control circuit: (Refer to Fig. 6.18 (1) Circuit)

6.4 MAIN SIGNAL CONTROL AND SIGNAL LOCKING

Relays involved in this are:-

S.No	Relay Nomenclature	Location	Description	Purpose
1.	GR ₁	Signal group	First Signal Aspect control relay	Proves all Signal clearance conditions directly and controls its 'Off' aspects along with GR ₂
2.	GPR ₁	Signal group	Repeater of the above.	i) Feeds route indicator where provided. ii) Cuts off feed to GLSR to prove its dropping in GR ₂ circuit.
3.	Signal in Advance RE(Mn) CPR	Concerned Signal group	Repeater of Red Aspect main filament Proving relay of Signal in advance.	Proved in parallel to prevent clearing of a Signal in case the Signal in advance of it is blank.
4.	Signal in Advance. HECPR	"	Caution Aspect Proving relay of Sig. in advance.	
5.	Signal in Advance. DECPR	"	Clear Aspect proving relay of Sig. in advance.	
6.	<u>LX(R)R</u> <u>LX(N)R</u> (Interlocked)	Mini Grp	Level crossing Release relay.	Releases Gate when signal is at ON.
			Level crossing control Normal relay.	Locks Gate control normal for clearing Signal.
7.	LXCPR	"	Level Crossing 'closed' Proving relay	Detects that Gate is closed for clearing a concerned Signal.
8.	KLNPR	"	(Point) Key Lock Normal Proving relay.	Detects that Key Lock is not released while a concerned Signal is being cleared.
9.	GR ₂	Signal group	Second Signal Aspect control relay.	(i)Proves dropping of GLSR after GR ₁ picked up. (ii)Controls 'Off' aspects along with GR ₁ .

10	Road - <u>G(R)LR</u> <u>G(N)LR</u> (Interlocked)	Mini Grp	<u>Signal locking relay</u> Signal unlocking relay.	Locks conflicting signals by preventing another initiation on the route.
11.	GR ₃	Sig.Grp	Third Signal Aspect control relay	Controls DG aspect along with GR ₁ & GR ₂
12.	GR ₄	Mini Grp	Fourth signal Aspect control relay	Controls HHG along with GR ₁ & GR ₂ .

6.4.1 After locking all the sub routes in the signal route. Signal locking and Signal clearance will take place.

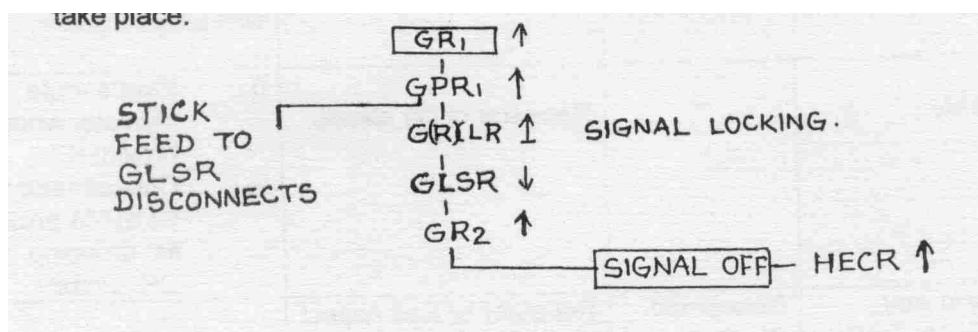


Fig : 6.17 (a)

GR1 picks up proving the following conditions:-

- i) Signal in advance is not blank
- ii) Interlocking with conflicting Main Signals on the road and with all conflicting Shunt signals is ensured.
- iii) Overlap is set, its Point and Track detections are continuously available.
- iv) Route and Berthing tracks are clear Route sections are checked and locked.
- v) Signal button is released (This condition is again proved as Route locking relays do not get feed continuously)
- vi) Only one train can pass on one cleared Signal.

GR1, sticks through its own energised contact across GNR de-energised and GLSR energised contacts. GR1 stick circuit is necessary because it shall not drop -

- i) When GLSR drops subsequently and
- ii) Even if signal button is pressed unintentionally later.

2. GR1 also has a condensor discharge circuit across its coil to prevent its dropping in times of momentary failure of power and track circuits.

3. EGNR dropped contact is proved in GR₁ circuit so as to drop it and put the Signal to 'ON' by an emergency operation.

Relay control circuits: (Refer to Fig 6.17 & 6.18 Circuit 2)

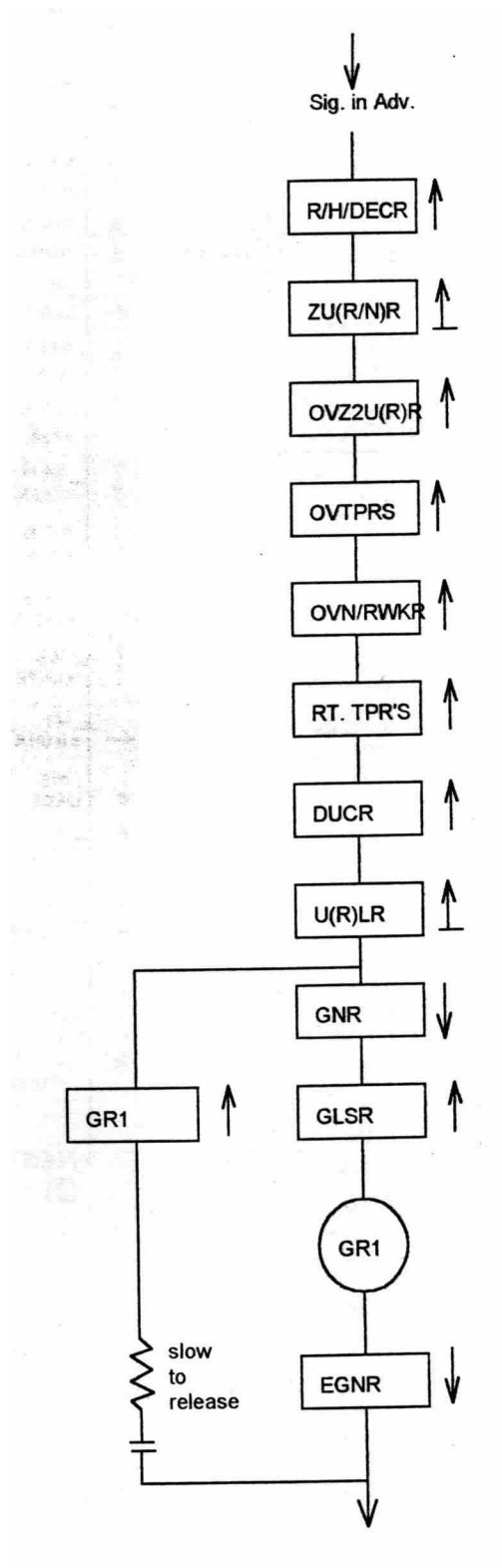


Fig 6.17

6.4.1(b) Route Indicator Control:-

In UG lamp control, not only GPR₁ but also the detection of Route points detection (with double cutting) is proved

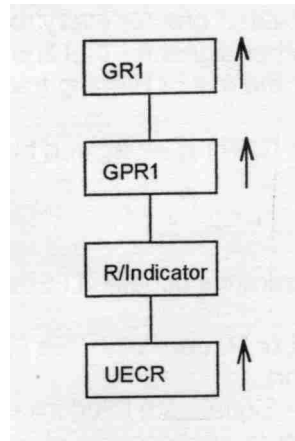


Fig.6.19

Route Indicator lamp Control Circuit (Refer Fig. 6.20)

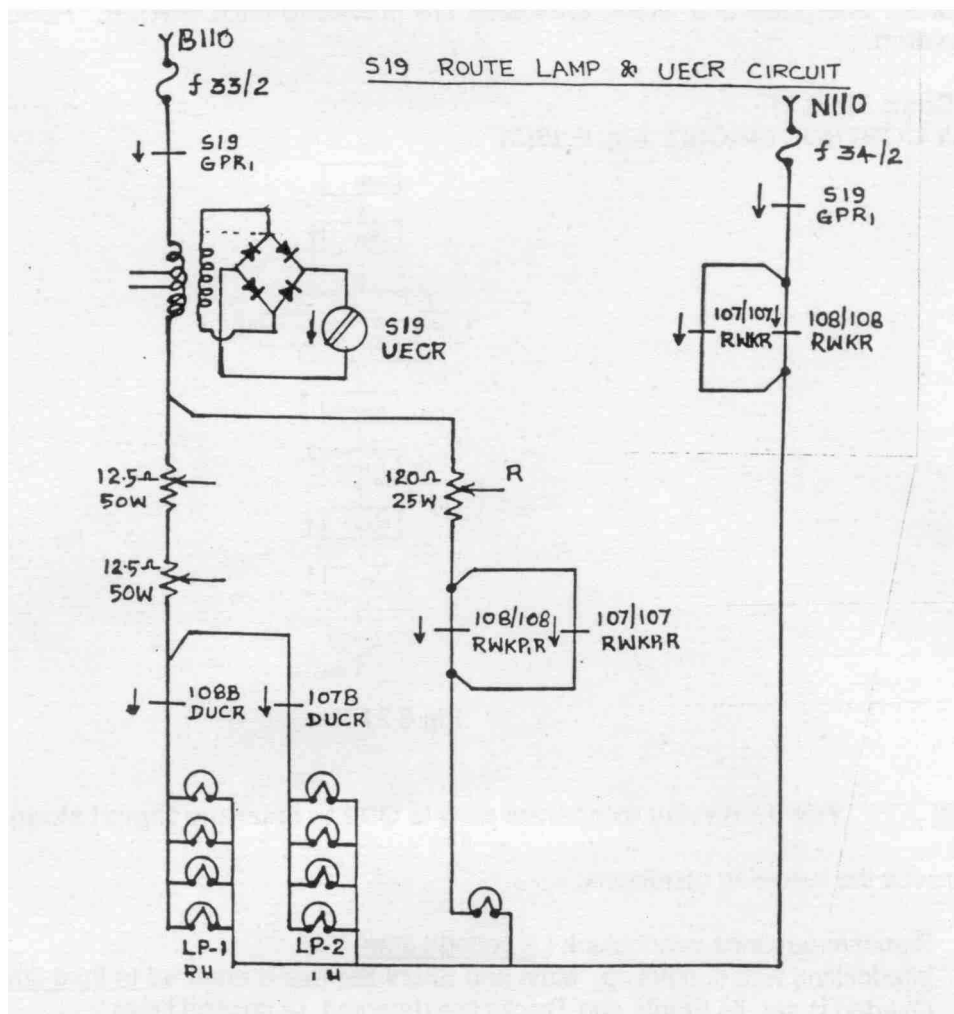


Fig.6.20

6.4.1(c):-- G(R)LR :- Signal locking Relay :-

This relay is an interlocked relay. The energisation of top relay G(R)LR locks the signal and bottom relay G(N)LR unlocks the signal.

The signal lock relay is provided one for every exit track and is common for both directions. It prevents the clearance of any other signal for that line from any direction after a signal has been cleared. This relay is named after the Exit or Berthing track.

The relay G(R) LR energizes once GPR1 is energised but before the de-energisation of GLSR.

It proves –

- (i) One train on one Signal clearance condition (proved a second time in this stage)
- (ii) GPR₁ operated
- (iii) Either Route indicator is lit or Route Points are in Normal (this condition is required only for Signals with Route indicator)
- (iv) Conflicting Main and Shunt Signals are interlocked (proved a second time in this stage) and
- (v) Route tracks are clear; Route sections are checked and locked (proved a second time in this stage)

Feed to GLSR is cut off when GPR₁ deenergised contact is broken soon after GR₁ picks up. But both GPR1 energized and GLSR energised are proved to latch G(R)LR. Hence GLSR is made slow to drop.

Flow Chart Fig.6.21

RELAY CONTROL CIRCUIT Fig. 6.18(3)

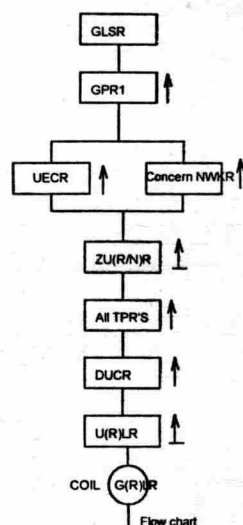


Fig 6.21

6.4.1(d) The third relay to operate now is GR2 to clear the Signal along with GR1 :--

GR₂ proves the following conditions: -

- (i) Signal in advance is not blank (a second time)
- (ii) Interlocking with conflicting, Main and Shunt Signals is ensured (a third time in this stage)
- (iii) Overlap is set, its Points and Tracks are detected (a second time).
- (iv) G(R)LR operated locking all conflicting Signals of the road,
- (v) Route and berthing tracks are clear, Route sections are checked and locked (a third time)
- (vi) Route Indicator is lit or Route Points are in normal (a second time), and
- (vii) GLSR dropped after the operation of GR₁

Signal clearance conditions are proved by two relays at the final stage, at the same time economising on relay contacts.(Refer Fig.6.18 Circuits 2 & 4).

Sequence of relay operation:--

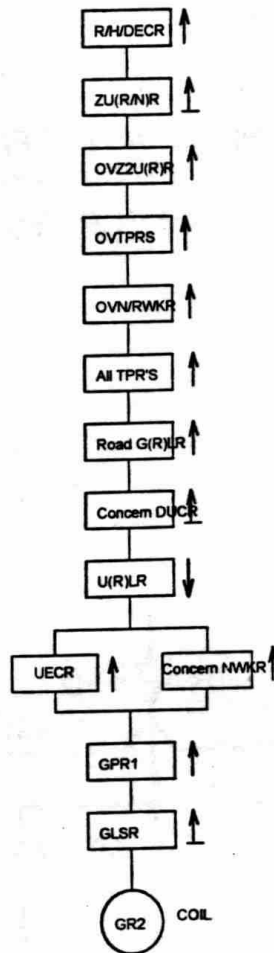


Fig 6.22

6.4.1 (e) CLEAR ASPECT CONTROL: GR3 :--

Route points are proved Normal in this so that, for a train being received on diversion line, clear aspect shall not be displayed if Main line Starter is taken off for another departing train.

Relay control circuit : (Refer Fig.6.18 Circuit 5)

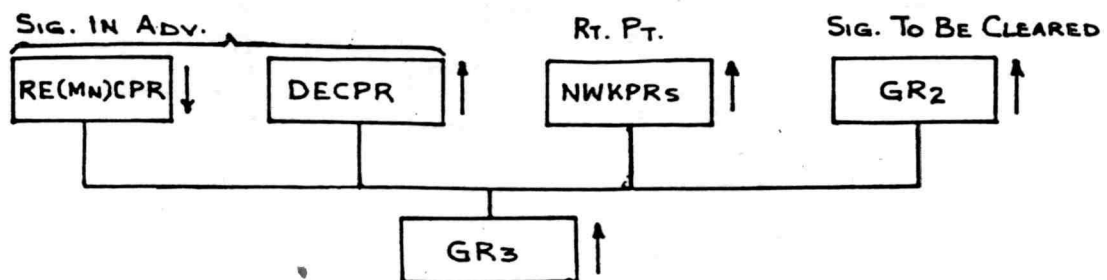


Fig.6.23

Main Signal Lamp Control Circuit. (Refer to Fig.6.24)

Both GR₁ and GR₂ contacts are proved in HG aspect control.

While GR₃ (with double cutting) is proved to light DG lamp, GR₄ (with double cutting) is proved in HHG lamp control in addition to GR₂.

Both GR₁ and GR₂ contacts are proved in HG aspect control.

While GR₃ (with double cutting) is proved to light DG lamp, GR₄ (with double cutting) is proved in HHG lamp control in addition to GR₂.

RG lamp circuit proves only GR₂ back contact or OFF ECR back contacts.

An 80 Ohm 50W resistance regulates the ECR current in all lamp circuits

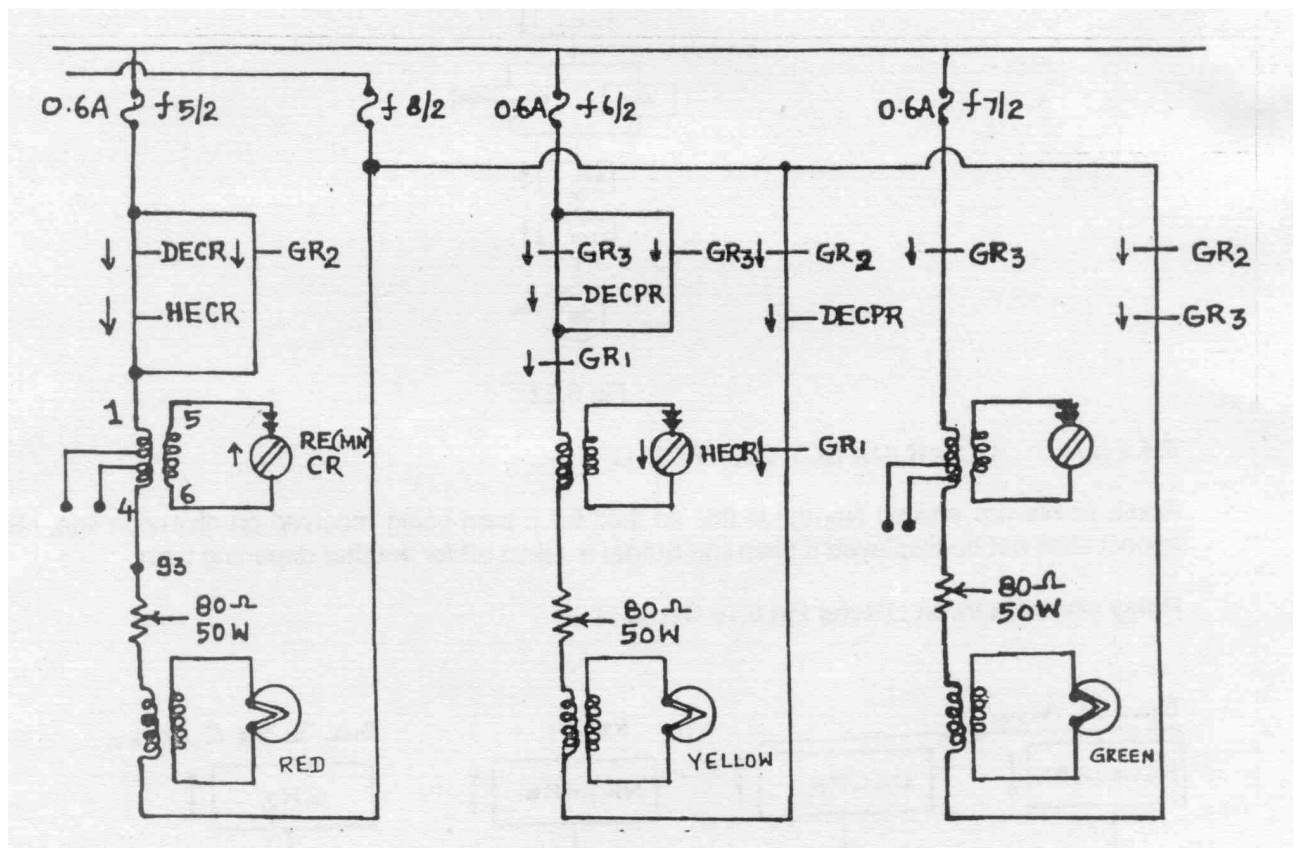


Fig.6.24

6.5 SHUNT SIGNAL CONTROL

6.5.1 One Train only on One Signal Clearance

The relays involved are:-

S.No.	Relay Nomenclature	Location	Description	Purpose
1.	SH-GLSR	SH-Sig.Grp	Shunt Signal Lock Stick Relay	1. Normally remains energised 2. Drops as the route is set & SH button is released. 3. Picks up again after its Route is normalised.
2.	SH-GZR	Mini Grp.	Shunt Signal Initiating Relay	Proved operated after Shunt Signal operation to hold SH-GLSR until the buttons are released.
3.	SH-GNR	Sh Sig Grp	Shunt Signal Button Relay (common)	

SH-GLSR is normally kept energised proving that :-

- (i) the concerned Route sections are normalised after previous operation,
 - (ii) Overlaps of Signals in opposite direction falling in the Shunt Signal Route are normal to interlock them with the Shunt Signal to be taken off, and
 - (iii) GR₁ dropped after previous operation
- When buttons are pressed to set the route for Shunt Signal, GLSR is held until the buttons are released.

This is required to hold until GR₁ picks up. This drops when buttons are released to pick up again after the route is normalized.

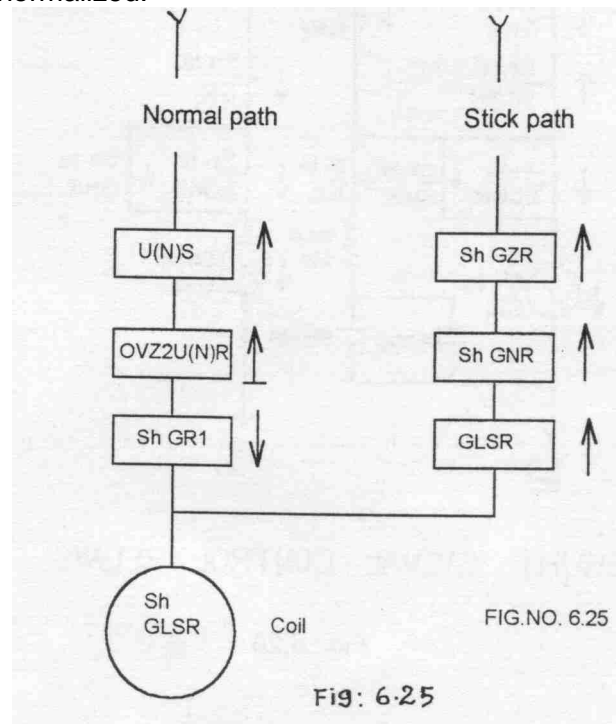
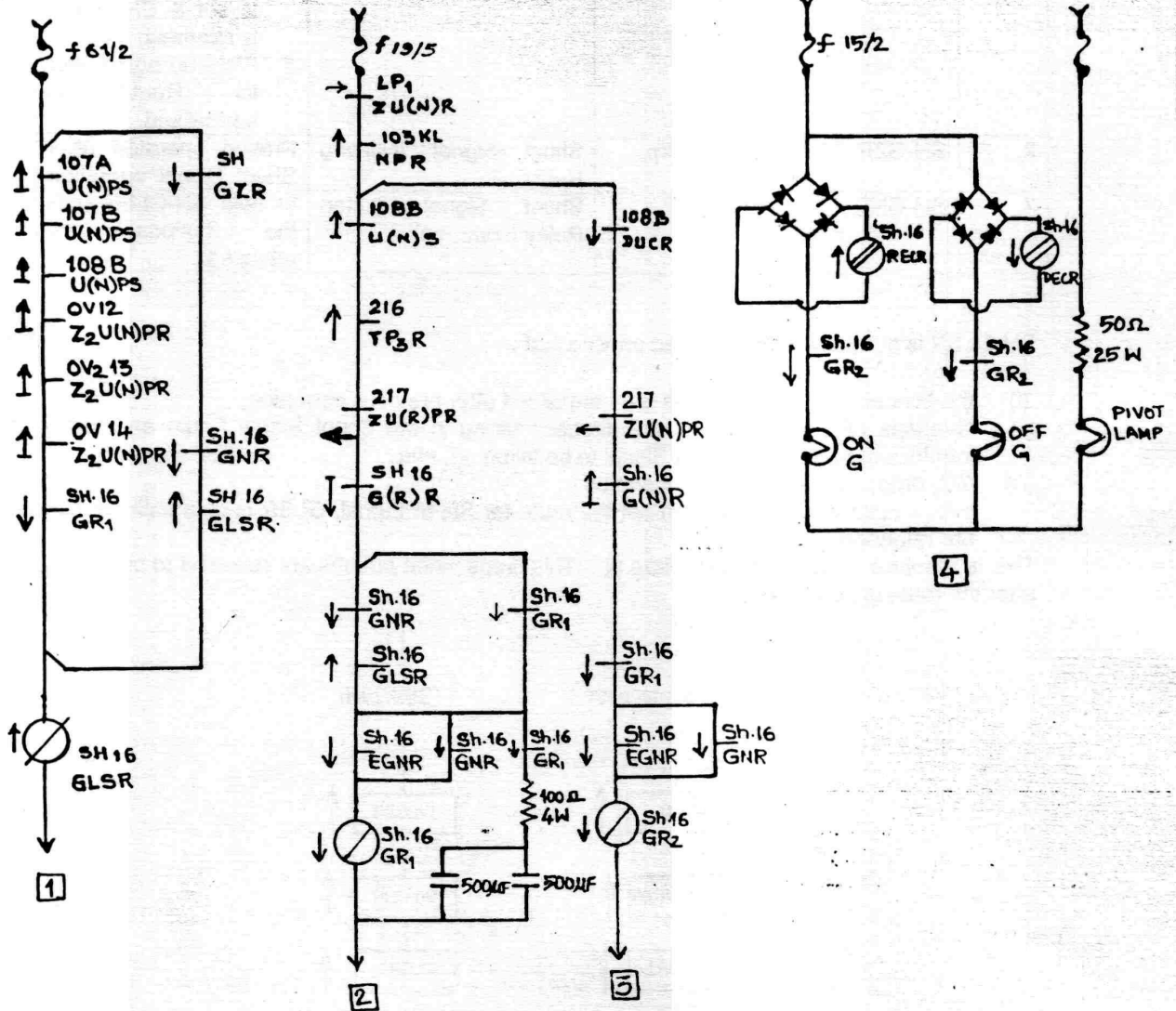


Fig : 6.25

Relay control circuit: (Refer Fig. 6.26 Circuit 1)



SHUNT SIGNAL CONTROL RELAYS

Fig : 6.26

6.5.2 SIGNAL CLEARANCE

The relays involved are:-

S.No.	Relay Nomenclature	Location	Description	Purpose
1.	SH-GR ₁	Sh- Signal group	First Shunt Signal control Relay	Proves Shunt Signal Clearance conditions like GNR & GLSR operations Shunt Signal selection and Route setting.
2.	SH-GR ₂	"	Second Sh.Sig.control Relay.	Proves GR ₁ operation with the above conditions.

Buttons are not released before clearance of a Shunt Signal because-

- (i) GLSR shall not drop before GR₁ picking up and
- (ii) One cannot mark the time between operations of GR₁ and GR₂

Since the buttons are not released early, U(R)LRS of the route do not operate and hence cannot be proved for Shunt Signal clearance. Due to this G(R)LR of the road also does not operate.

(ii). GR₁ GR₂ Picks up as below :-

In this, U(R)S is proved instead of DUCR because Shunt Signal GR₁ need not to be dropped even when a Route Point indication is lost after Signal clearance. But signal will fly back to ON position since DUCR front contact is proved in GR₂ Circuit.

As in the case of MN-GR₁, Shunt Signal GR₁ also is made slow to release.

In this, Key lock Point control Key 'In' condition is also proved along with R/S - U(R)S

In GR₁ and GR₂ circuits, EGNR dropped and GNR dropped are proved in parallel as both pick up during emergency signal replacement. (In the present circuit DUCR contact is proved for GR₂ instead of U(R)S)

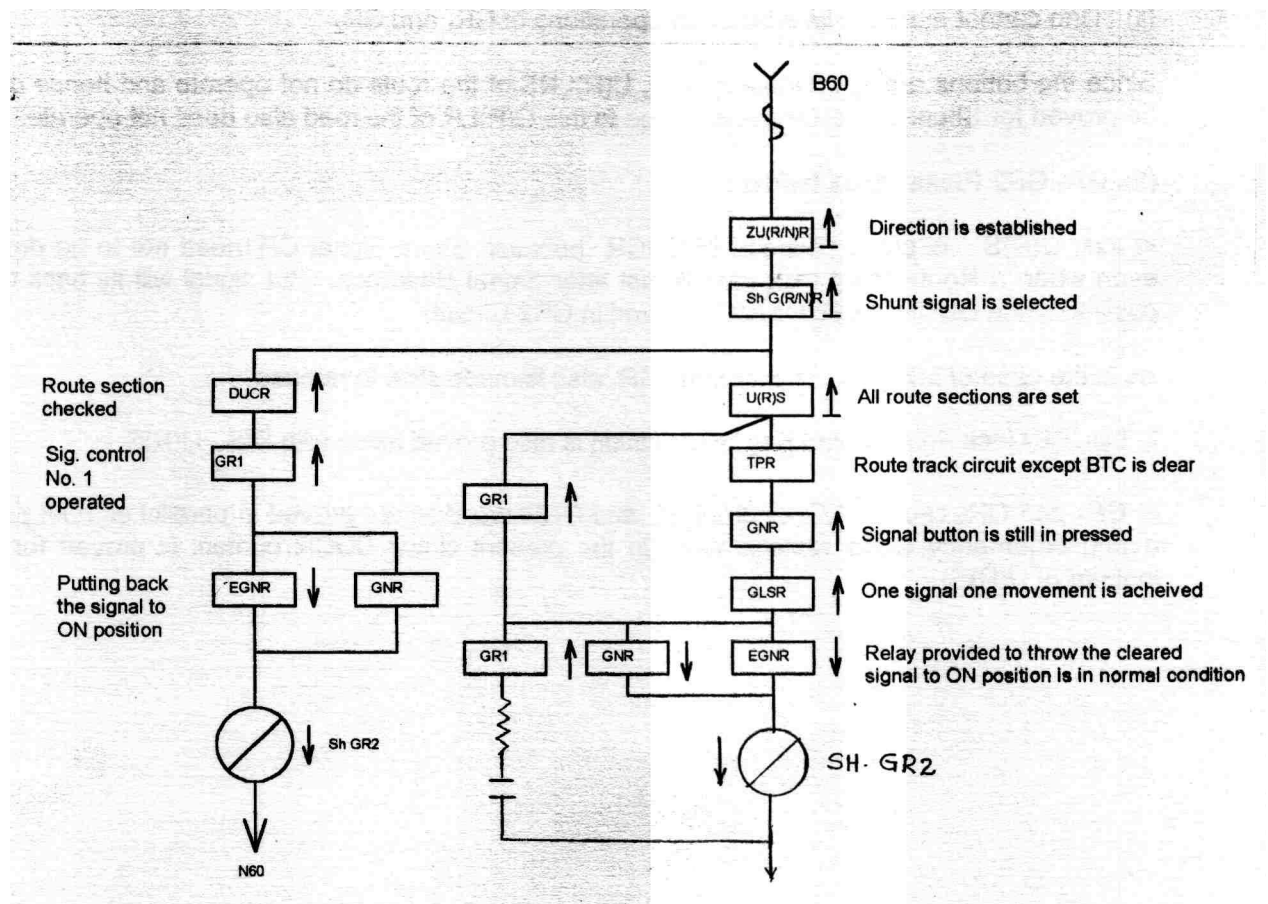


Fig : 6.27

Relay and lamp control circuit (Ref Fig. No. 6.26(2), (3) (4))

6.6 CALLING ON SIGNAL CONTROL

6.6.1 Relays involved in this are:-

S.No	Relay Nomenclature	Location	Description	Purpose
1.	COATR	Mini Grp	C.O.Signal Approach Track Relay	Proves train halting at the C.O. Signal before its clearance.
2.	COULR ₁	"	First C.O. Signal Route Locking relay	Proves C.O. Signal Route setting and its interlocking to set time for its clearance.
3.	AJTR ₁	"	First App Lock Release Time control relay	Proves the operation of COULR ₁ for setting time to clear C.O.Signal.
4.	AJTPR ₁	"	Repeater of the above.	"
5.	AJTR ₂	"	Second App. Lock Release Time control relay.	Proves dropping of Time Setting relay AJTR after previous operation.
6.	AJTPR ₂	"	Repeater of the above	"
7.	AJTR	"	App. Lock Release Time Setting relay.	Sets a pre-determined time for C.O. Signal clearance as well as for App.Lock Release.
8.	AJTR ₃	"	Third App. Lock Release Time control relay	Proves the operation of AJTR for clearance of a particular signal.
9.	AJTPR ₃	"	Repeater of the above	"
10.	COULR ₂	"	Second C.O.Signal Route Locking relay.	Clears C.O. Signal after necessary time lapse.

(I) First, COULR₁ operates, when C.O. Signal approach track is occupied and the concerned panel buttons are pressed proving the necessary conditions like Route setting and interlocking,
as below:-

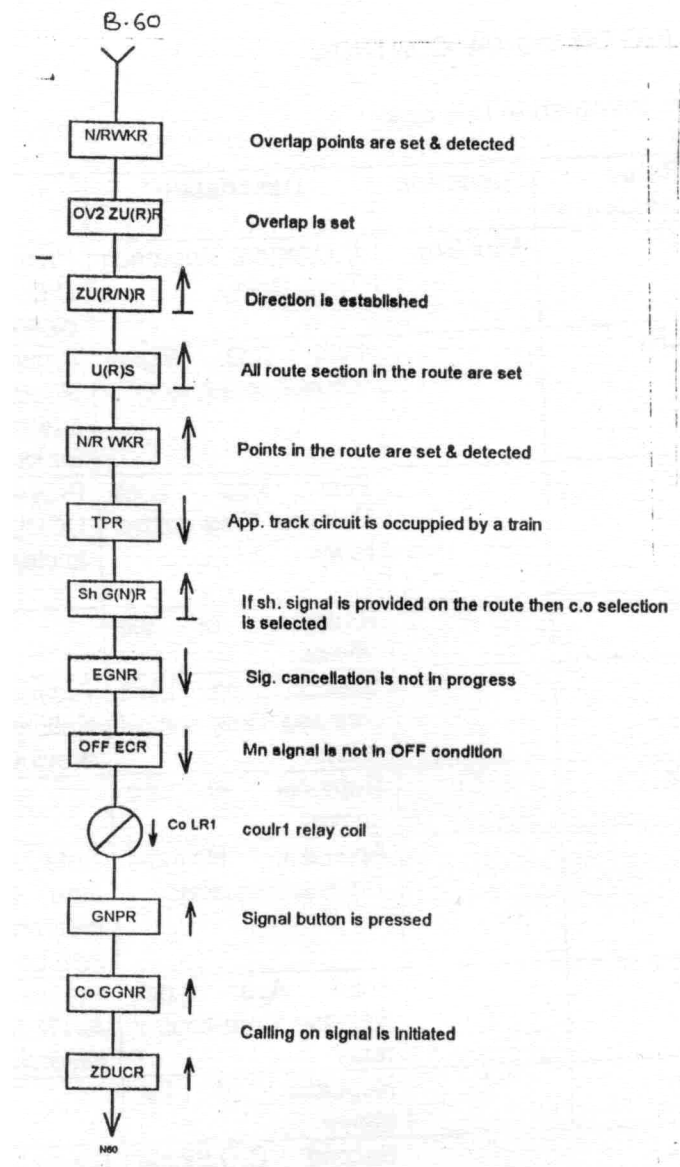


Fig : 6.28

- Since there is Automatic Signalling section in approach of C.O. Signal and the next train may be following closely behind.
- (I) To set time for clearing a C.O. Signal as well as for releasing Approach Lock on Route in emergency, a set of Time Setting relay AJTR and its control (or helper) relays AJTR₁, AJTR₂ and AJTR₃ are provided as already stated.

The sequence of their operation in this case is –

- First, AJTR₁ picks up proving-
 - that MN Sig. Button is still pressed.
 - MN Sig. GR₁ and MN Sig. GLSR are dropped.
 - Route sections concerned are set.
 - COULR₁ operated, and that
 - AJTR₂ and AJTR₃ dropped after previous operation.

This relay remains picked up even as AJTR₂ and AJTR₃ pick up afterwards until the time of COULR₂ picking up as shown below through a holding arrangement.

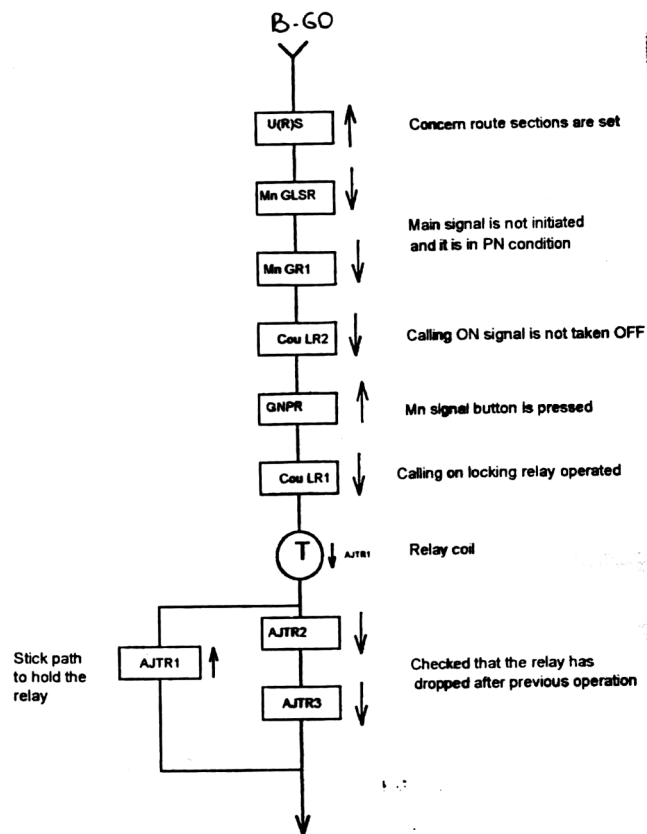


Fig.6.29 (AJTR₁ Flow Chart)

b. In the second stage, AJTR₂ picks up to operate AJTR and sticks until after the operation of AJTR₃ as below:-

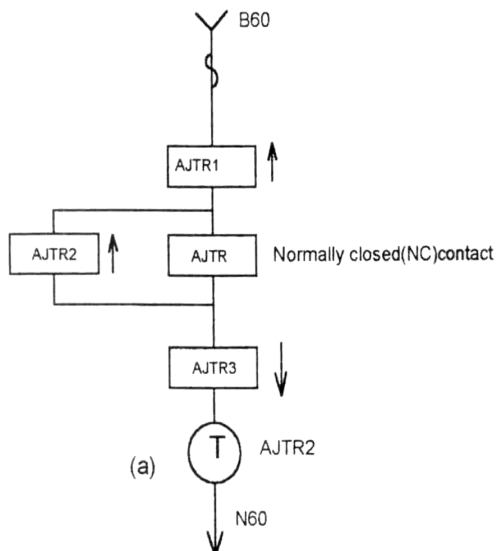


Fig.6.30(a)AJTR₂

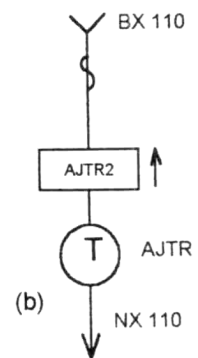


Fig.6.30(b) (AJTR)

c. Finally AJTR₃ picks up through the operated contact of AJTR and sticks until the dropping of AJTR₁ as below:-

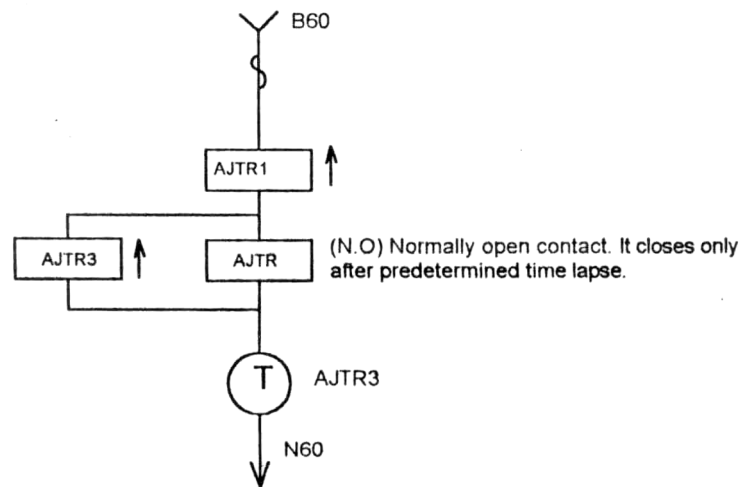


Fig.6.31(AJTR3)

Even as AJTR₂ drops with the picking up of AJTR₃, AJTR₁ and AJTR₃ remain picked up until the time of COULR₂ operation.

Now, COULR₂ picks up getting feed through a counter as below

The counter COGGZ registers the number of C.O.Signal operations progressively. With COULR₂ picking up AJTR₁, AJTR, AJTR₂ and AJTR₃ drop

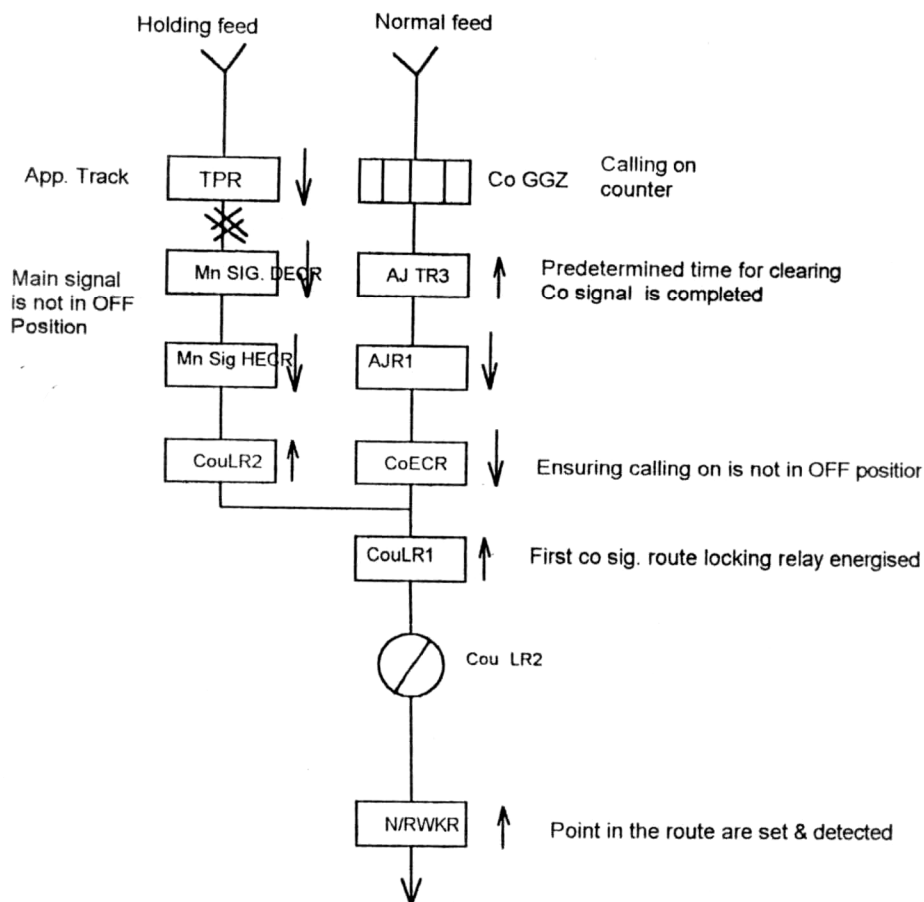


Fig.6.32 (Flow Chart of COULR2)

Now C.O. Signal comes off and COECR picks up as below:-

COULR₁ and COULR₂ drop when COAT is cleared by the train to enter the route and COATR picks up .

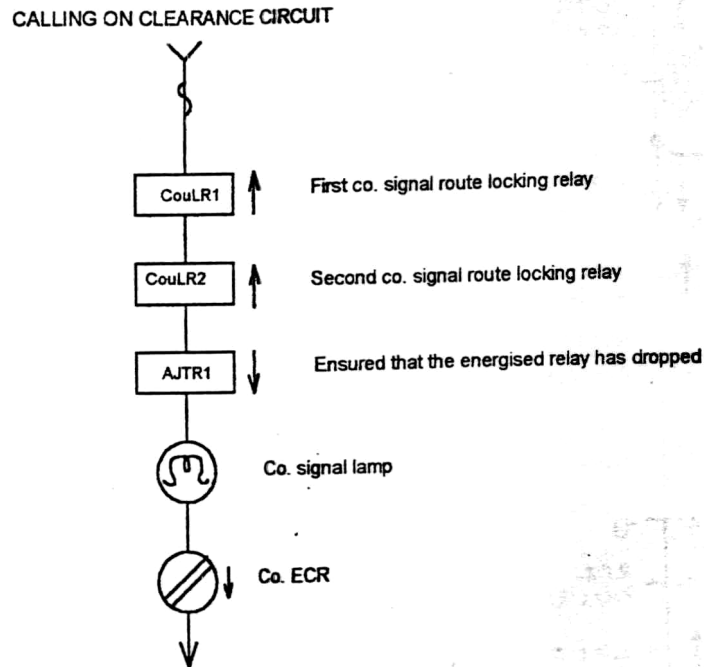
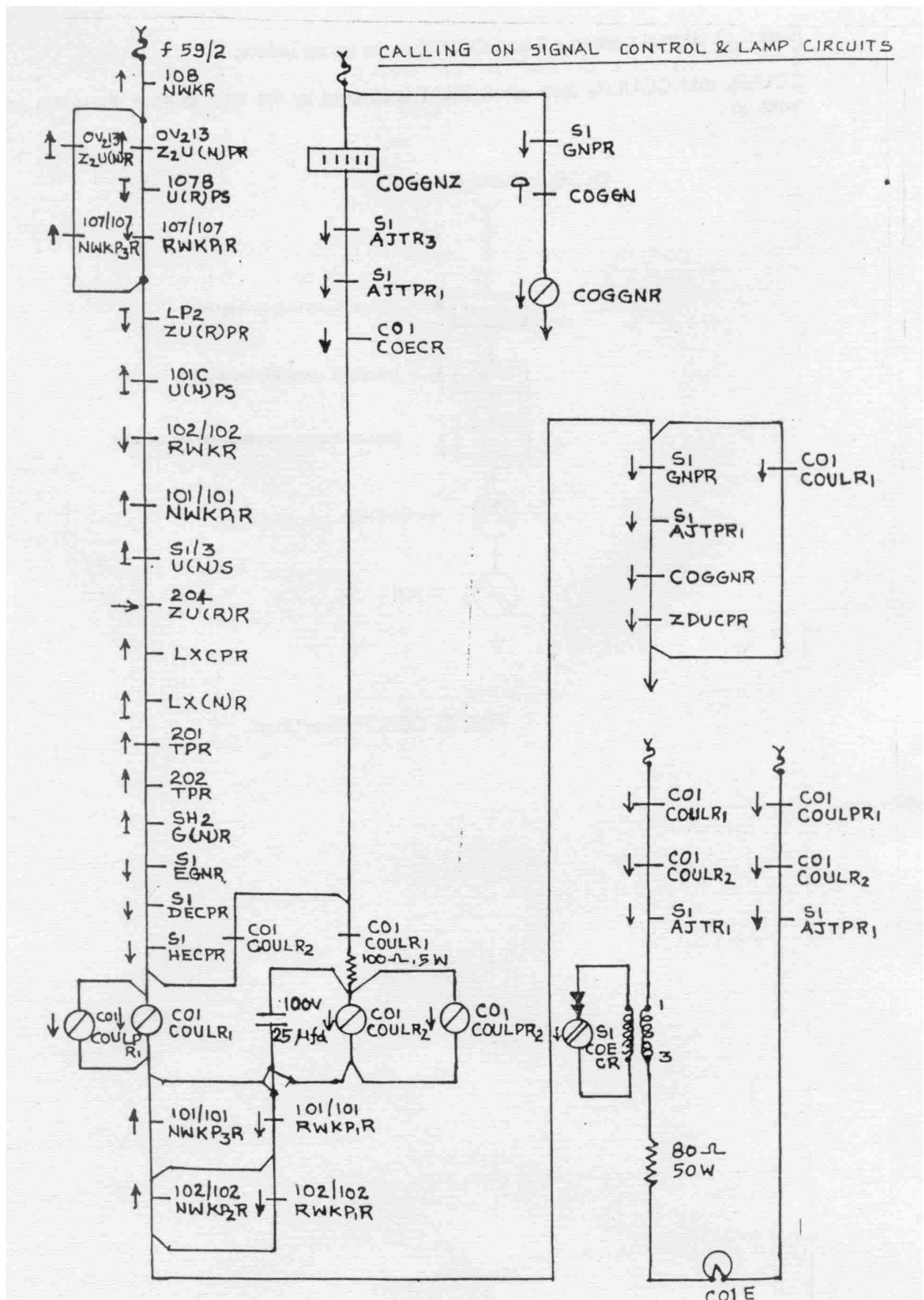


Fig.6.33 COECR Flow Chart



Relay and Lamp control circuits: (Refer Fig.6.34)

CALLING ON SIGNAL APPROACH TIME RELAY CIRCUIT.

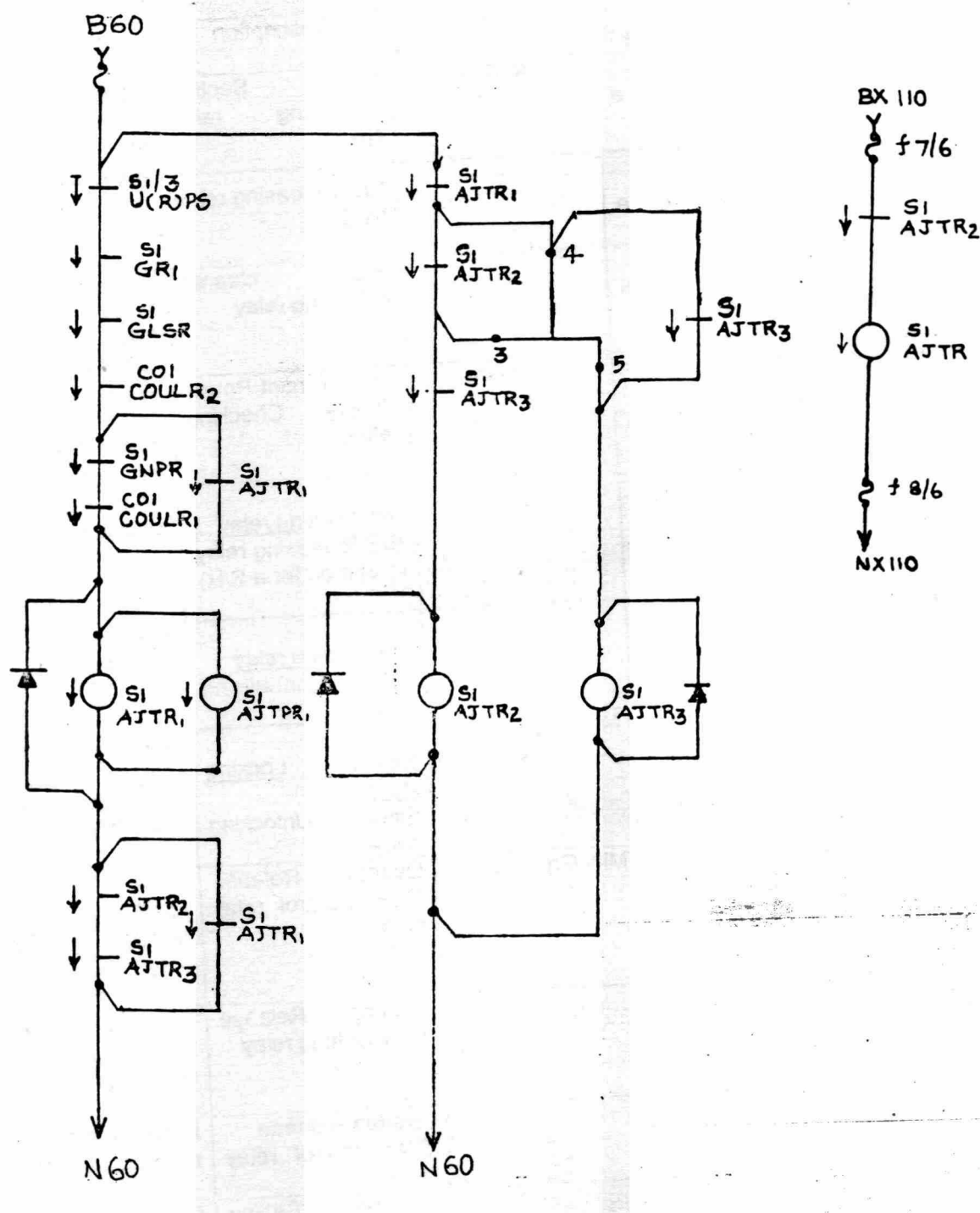


Fig. 6.35

AUTOMATIC ROUTE RELEASE

7.1 The relays involved in the process are:-

S.No	Relay Nomenclature	Location	Description	Purpose
1.	UYR ₁ (common for a S/Route)	Route group	Route Section Releasing relay No.1	Operate sequentially as the train moves ahead in the R/S to release it from approach locking
2.	UYR ₂ (common for a S/Route)	"	R/S Releasing relay No.2	
3.	UDKR (common for a S/Route)	"	R/S cleared Indicating relay	Operates to release back locking on R/S when the train completely passes out of it.
4.	ZR	Mini Group	Track Circuit Power Supply Checking relay.	Proved energised during app. lock release to ensure that TPRs drop only with train movement.
5.	R/S- <u>U(R)LR</u> <u>U(N)LR</u> (interlocked)	Route group	<u>R/S Locking relay</u> R/S Releasing relay (common for a S/R)	Normalised to release locking on a set R/S.
6.	<u>R/S</u> <u>U(R)S</u> <u>U(N)S</u>	"	<u>R/S Setting relay</u> R/S Normalising relay	Normalised to make Points and Slots in the R/S free
7.	Road - <u>G(R)LR</u> G(N)LR	Mini Group	Signal Locking relay	Normalised to release locking on Signals conflicting, with the cleared Main Signal.
			Signal Unlocking relay	
8.	OV-AJTR ₂	„	Overlap Release Time Control relay no.2	Proves necessary conditions for Overlap release before setting time.
9.	OV AJTR	"	Overlap Release Time Setting relay	Provides for time lapse before an Overlap is released.
10.	OV-AJTR ₃	"	Overlap Release Time control relay No.3	Proves time lapse for releasing overlap.
11.	OV <u>Z₂U(R)R</u> <u>Z₂U(N)R</u>	"	<u>Overlap Setting relay</u> <u>Overlap Release relay</u>	Releases Overlap either after 2 min. on train stopping at the Signal in advance or soon after the train has run through.

As a train passes over each set Route section, the Route section gets released automatically behind the train and its setting gets normalised. This results in locking getting released on Signals conflicting with the Signal cleared for the train.

7.2 RELEASE OF INDICATION LOCKING:-

With the occupation of first control track, GR_1 and GR_2 drop to release indication locking as below:-

7.2.1 On Route section set for a Main Signal

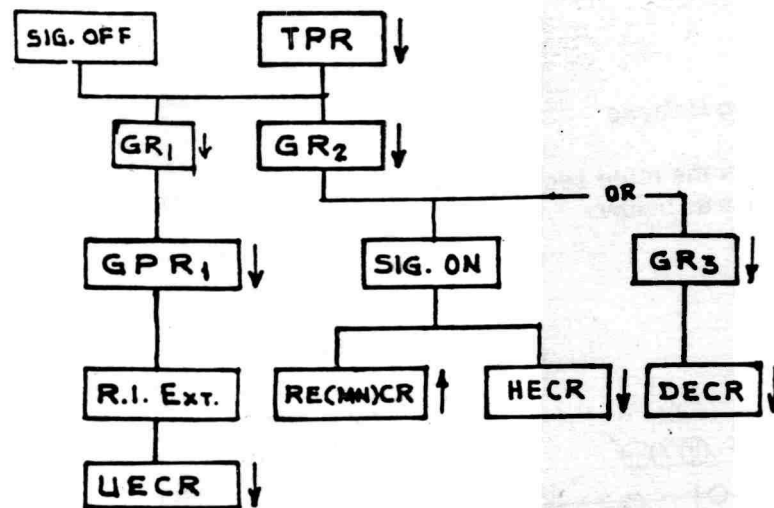


Fig.7.1

7.2.2 On Route Section set for a Shunt Signal.

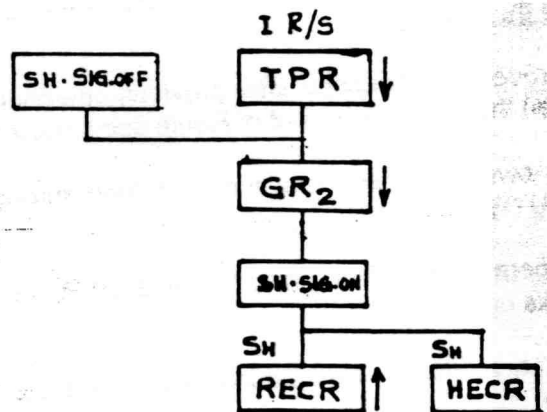


Fig.7.2

7.2.3 On Route section set for a Calling 'On' signal

As train enters the Route, clearing C.O.Sig. Approach track,

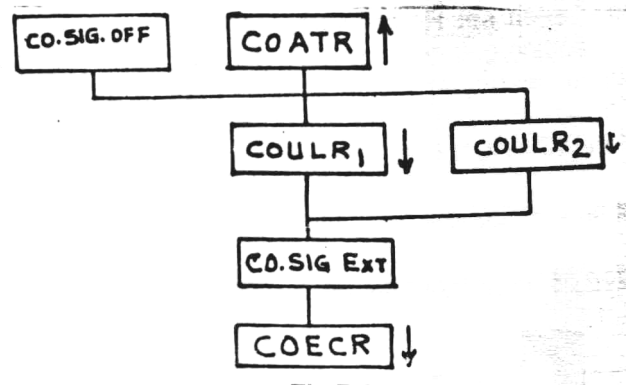


Fig.7.3

7.3 Approach locking Release

7.3.1 As train moves in the route section, UYR₁ operates first proving that the train occupied the first two R/S track circuits as below:-

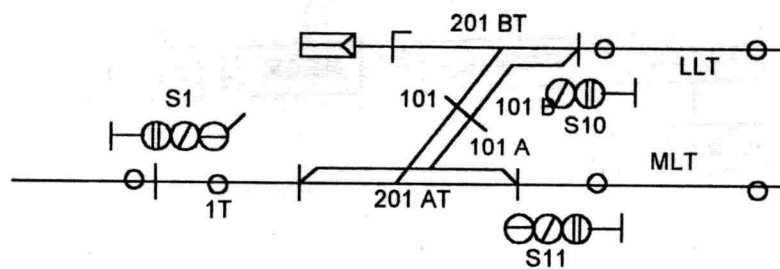


Fig.7.4

UYR₁ also proves ZR energised to ensure that TPRs dropping caused by track circuit power supply failure does not release the locking.

Also, at this stage UDKR is proved de-energised after previous operation during Route checking, so that it can pick up again when the train passes out of Route section later.

UYR₁ sticks first through its own operated condition and then through UDKR de-energized condition until the operation of UYR₂.

Later, it sticks through the operated condition of UYR₁ and UYR₂ until the Route section is normalised, even as UDKR picks up.

- i) UYR₂ picks up after UYR₁ as the train progresses and clears the first control track of the route section as below:-

Berthing track is proved occupied for operating UYR₂ of the last section of Route.

UYR₂ also sticks in two stages just as UYR₁ sticks after operation until the Route section is normalized as below:-

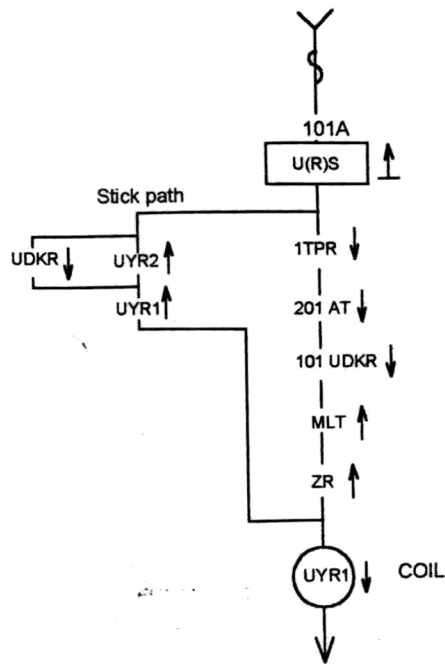


Fig. 7.5

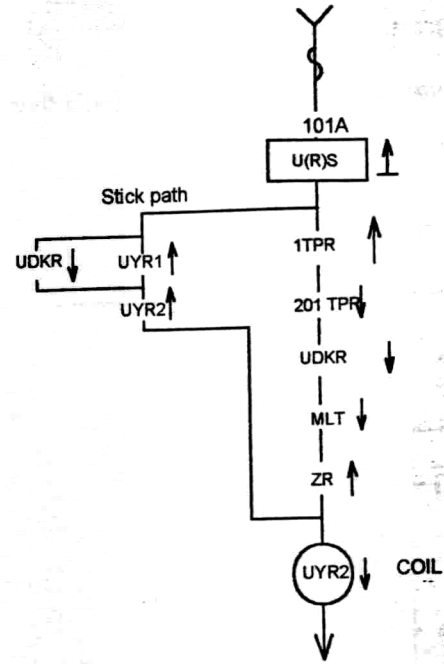


Fig. 7.6

7.4 Back locking release

As the train clears all the concerned Route section track circuits

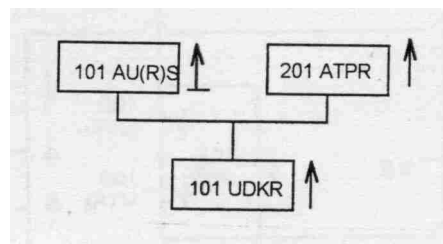


Fig. 7.7

7.5 ROUTE SECTION RELEASE AND NORMALISATION:-

Proving all the three above lockings free on each R/Section, its U(N)LR and U(N)S operate as below:-

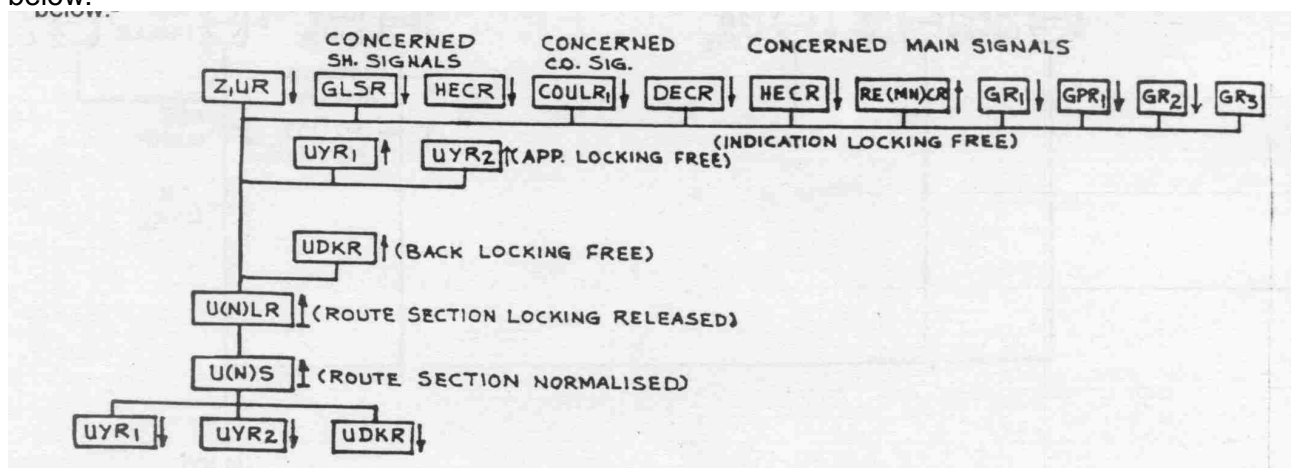


Fig. 7.8

Relay Control Circuits : (Refer Fig.7.9)

In case of Route sections with out points , U(N)S directly operates as below :

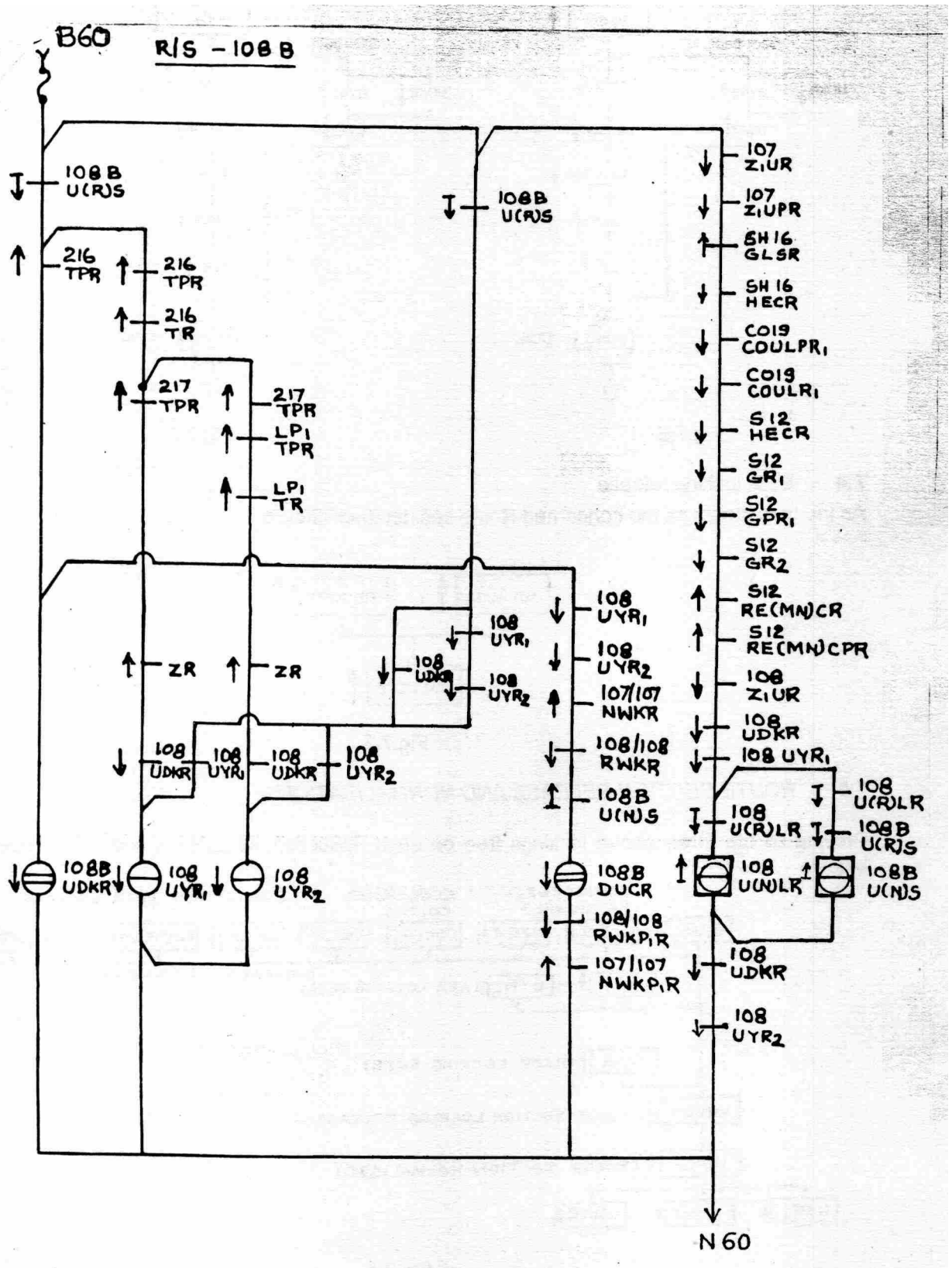


Fig : 7.9

7.6 OVERLAP RELEASE FOR MAIN SIGNAL ROUTES AND SINGLE LINE SECTION C.O. SIGNAL ROUTES.

In Siemens practice, the Overlaps are numbered after the Signal in advance of the Route.

7.6.1 For stopping trains, the Overlap gets released after a time lapse of 2 minutes on the train occupying berthing track provided the last Route section is released.

To set time for Overlap release, OV-AJTR and its controlling relays OV-AJTR₂ and OV-AJTR₃ operate. AJTR₁ is not provided to prove the necessary conditions as in the case of Approach Lock Release on routes. A common set of these relays is used for releasing Overlaps on either side of the road.

First AJTR₂ picks up to operate AJTR as below:-

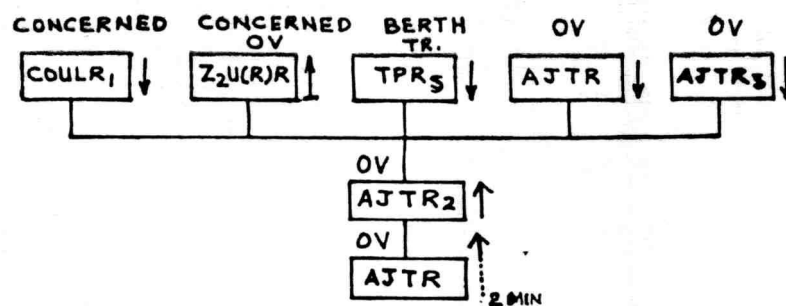


Fig.7.12

OV-AJTR₃ operates after OV-AJTR and then feed to AJTR₂ & AJTR gets cut off.

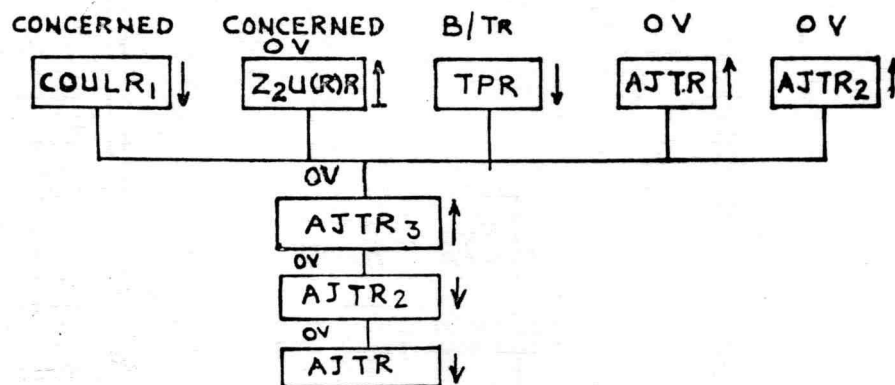


Fig.7.13

OV-AJTR₃ is held in its energised position through its own pick up contact, even as AJTR₂ drops and AJTR operated contact breaks, until the time OV-Z₂U(N)R operates.

Now OV-Z₂U(N)R operates to normalise the Overlap setting

In the OV-Z₂U(N)R circuit, MN-GZR and SH-GZR NC (back) contacts are proved to ensure their dropping after previous operation

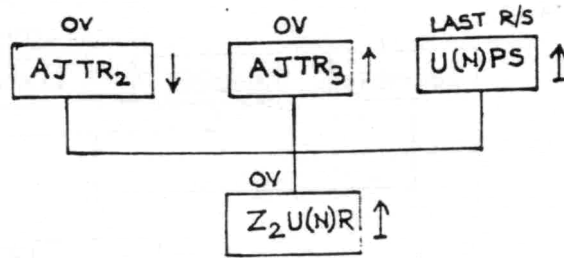


Fig.7.14

7.6.2 In case of a train running through on a set Route ahead, the Overlap gets released without time delay, as soon as the Route section of signal in advance falling in the Overlap is released with the passage of train over it:-

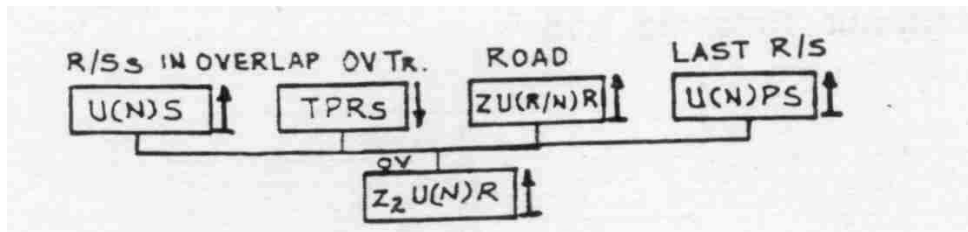


Fig.7.15

7.6.3 Emergency overlap release with the help of OYN button.

In the regular process, a Main Signal Overlap gets released only after two minutes on train occupying berthing track, if the train is not running through.

But in case of failure of this process, an Emergency Overlap Release facility can be utilised to release Overlap instantly. For this OYN or EUYN, if OYN is not provided shall be pressed along with the concerned UN on the panel.

Then OV-Z₂U(N)R operates to release the Overlap instantly, if the last Route section concerned is normalised before.

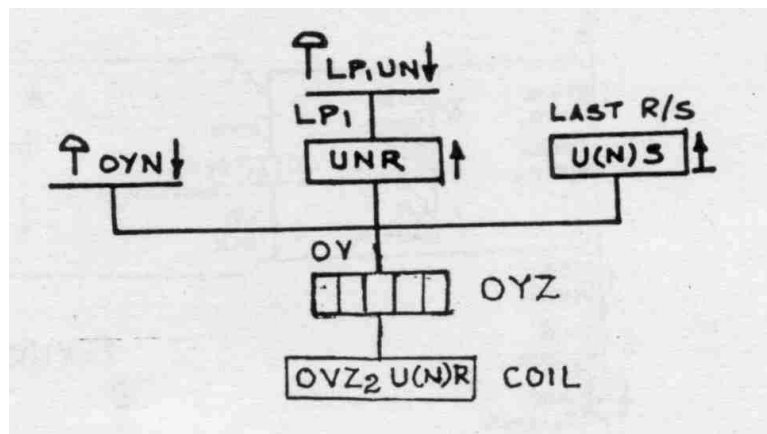
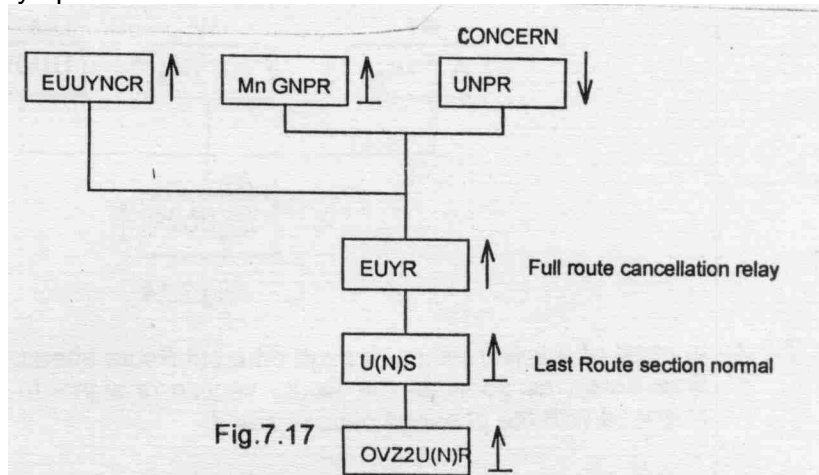


Fig.7.16

7.6.4 Overlap will get released automatically when the operator initiates emergency full route cancellation. This cancellation will be register in EUUYZ counter only.

Sequence of relay operation:



Relay Control Circuit : Refer Fig. 7.18.

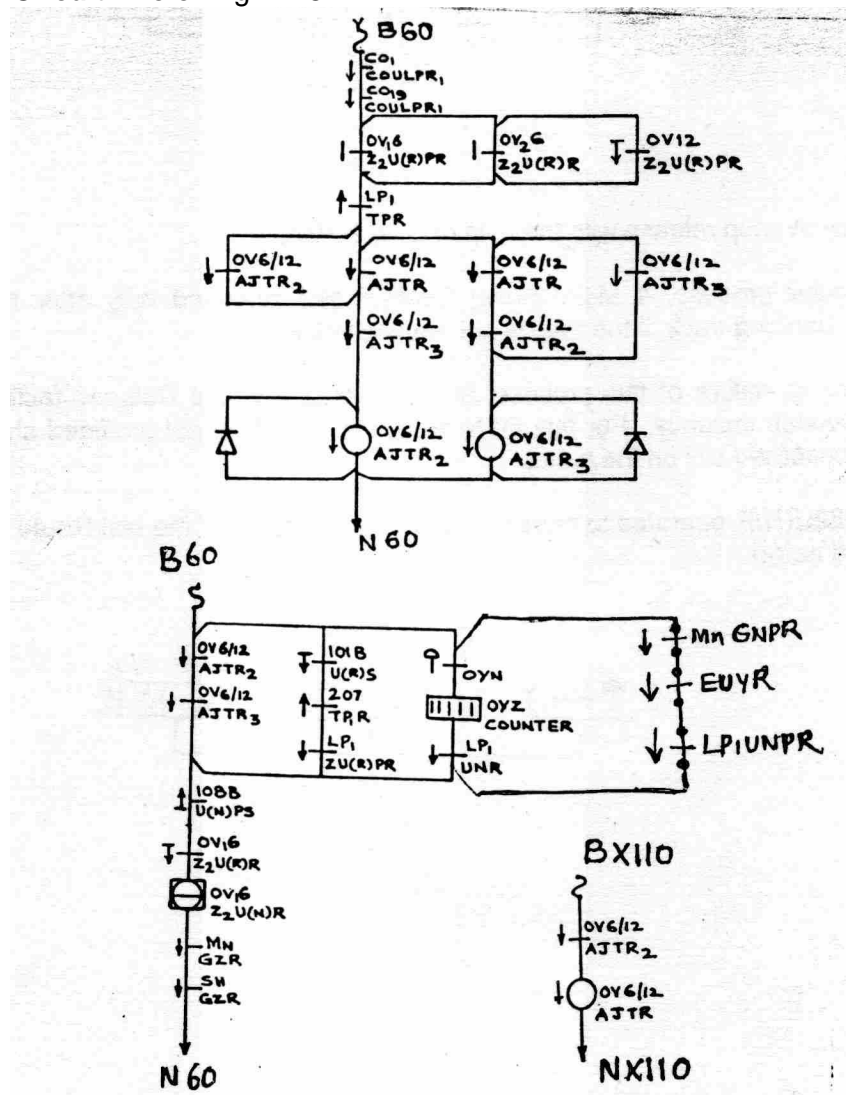


Fig.7.18

SIGNAL LOCKING RELEASE:

When route is set for a Main Signal, a Signal Locking relay operates to lock all conflicting Signals. This relay gets normalised when the set Route and Overlap are normalised as below:-

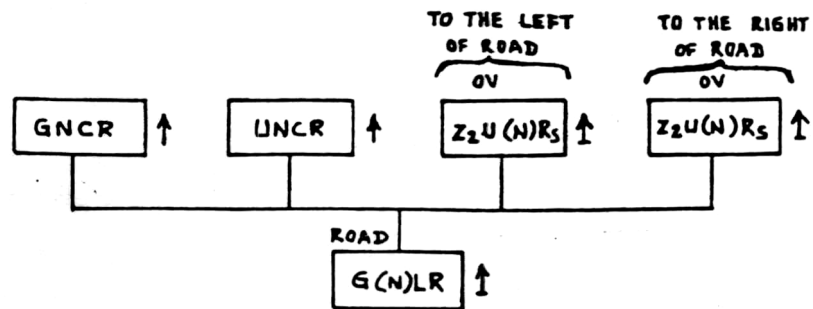


Fig.7.19

Relay control circuits: (Refer Fig.6.8)

In G(N)LR circuit, OV-Z₂U(N)R normal contacts prove normalisation of the route set on either side of the road after the signalled train has passed.

EMERGENCY OPERATIONS

MANUAL ROUTE RELEASE DUE TO TRAFFIC EMERGENCY

8.1 The relays involved are:-

S.No.	Relay Nomenclature	Location	Description	Purpose
1.	GNR	Signal group	Signal Button Relay	Proves SB operation.
2.	EGGNR	Mini group	Emergency Signal Replacement Button relay	Proves Button operation in circuits.
3.	EGNR	Signal group.	Emergency Signal Replacement control relay	Cuts off GR ₁ circuit to replace Signal at 'On'
4.	STN-EUUYNR	Mini group	Emergency Route Release Button Relay (common for the station yard.)	Proves Button operation in circuits.
5.	EUUYNPR	"	Repeater of the above	"
6.	STN-EUYNR	"	Emergency R/Section Release Button relay (Common for the station yard)	Proved dropped in EUUYNR circuit to allow only one operation at a time
7.	EUUYNCR	"	Relay proving Route Initiation during Emergency Route Release	Identifies the route sections to be released during emergency.
8.	MN-GNPR	"	Common relay to prove the operation of any MN-GNR	Provided to save individual GNR contacts while proving their operation in circuits.
9.	SH-GNPR	"	Common relay to prove the operation of any SH-GNR	"
10.	STN-EUUYR	"	Emergency Route Release Relay (common for station yard)	Releases all sections of the Route with manual operation in emergency.
11.	STN-EUYR	"	Emergency Route Section Release relay (common for a station yard).	Releases concerned R/Sections both during Whole Route release and Individual R/S release operations.

If there are no Track Circuits in approach of a Signal, Dead Approach locking will be effective on it during Emergency release of the Route. If there are Approach Track Circuits for the Signal and they are occupied before Emergency Route Release operation, the Route gets released only after two minutes, after the first Emergency Route Release operation, the operation is repeated. If the approach tracks are not occupied, immediate release of Route is possible. Operation of GN, EUUYN and UN after Signal is replaced to 'On', releases the Route in this case.

Back locking is not effective so long as the train has not entered the Route.

Before Manual Route Release operation, to release Indication locking on the route, first GN and EGGN are pressed together and released.

Mn or Shunt signals

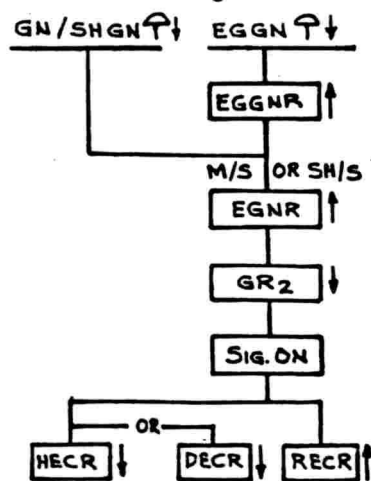


Fig.8.1

C.O. signals.

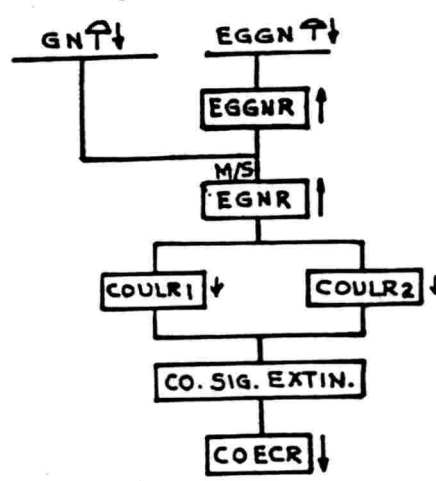


Fig.8.2

Now to release the Route, GN and EUUYN are pressed. Then releasing EUUYN and keeping GN pressed, UN is pressed.

With this, first, EUUYNR operates and sticks. Then as GN and UN are pressed, Route sections get initiated to operate EUUYNCR as below:-

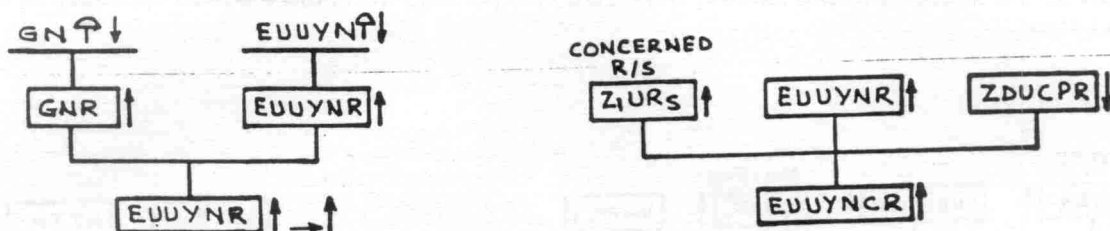


Fig.8.3

FOR RELEASING MN.SIG & S/L C.O. SIGNAL ROUTES PROVIDED WITH DEAD APPROACH LOCKING.

Time Setting and its control relays AJTR₁, AJTR₂, AJTR and AJTR₃ operate in succession as below:-

Proving the operation of GNPR and EUUYNCR and other conditions, AJTR₁ picks up and sticks, even as AJTR₂ and AJTR₃ pick up and buttons are released later.

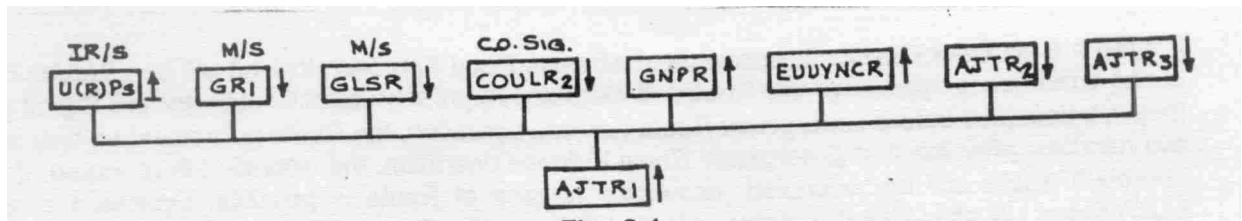


Fig . 8.4

With AJTR₁ picking up, a *flashing white spot indication* appears near Signal demarcation on the panel. Now, AJTR₂ picks up proving the de-energised condition of AJTR and AJTR₃ to stick until the pick up of AJTR₃, even as AJTR operates after AJTR₂.

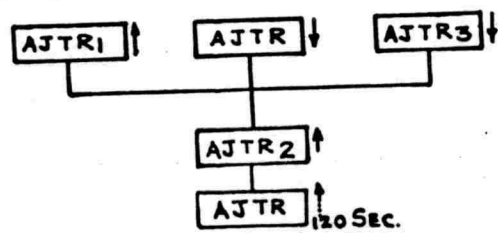


Fig.8.5

Now, finally AJTR₃ picks up and sticks until the dropping of AJTR₁.

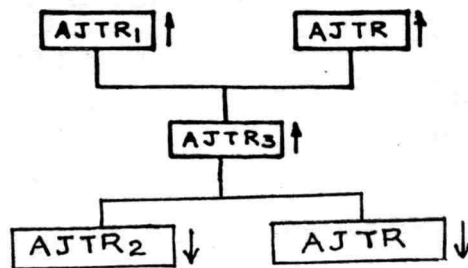


Fig.8.6

With AJTR₃ operating, the *white* indication near Signal demarcation on the panel becomes *steady*. Now as the necessary time lapsed, STN-EUUYR operates when the 3 button operation is repeated as below.

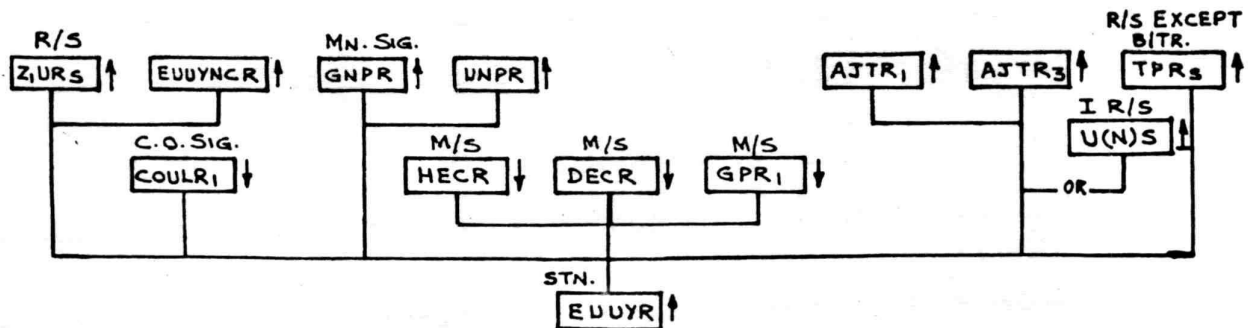


Fig.8.7

Following the operation of STN-EUUYR, STN-EUYR is energised (which operates both during Manual Route Release as well as Individual Route Section release in emergency. This relay operates through EUUYZ counter, which registers the operation as evidence. Now all sections of the set Route get released and normalised as below:-

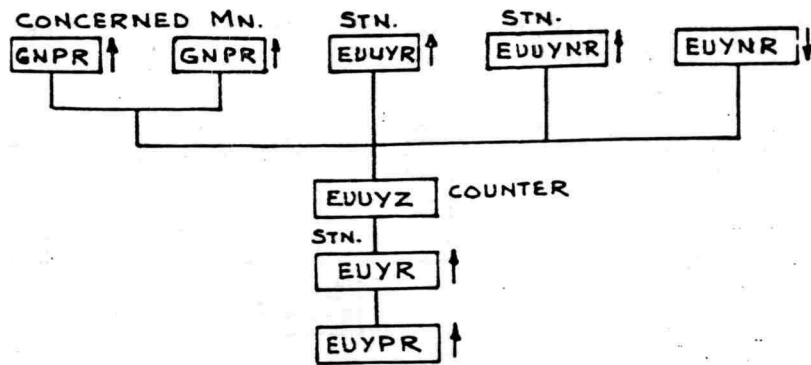


Fig.8.8

With the last Route section is normalised, MN Sig. or S/L CO Sig. Overlap is released before GN and UN buttons are released as below:-

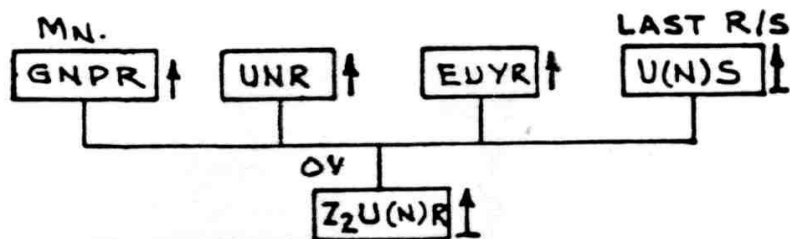


Fig.8.9

Signal Locking gets released, as below

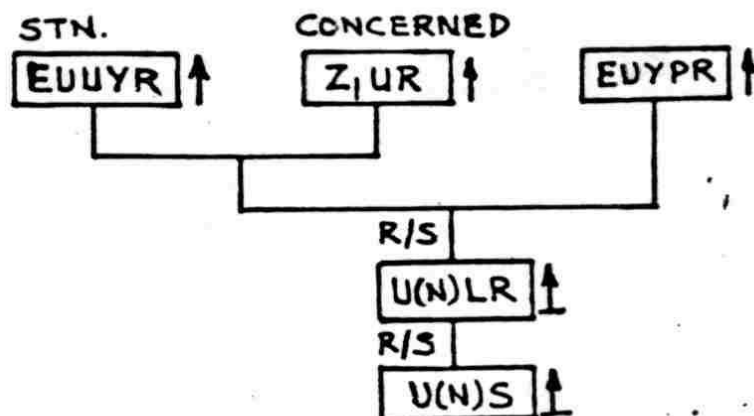


Fig.8.10

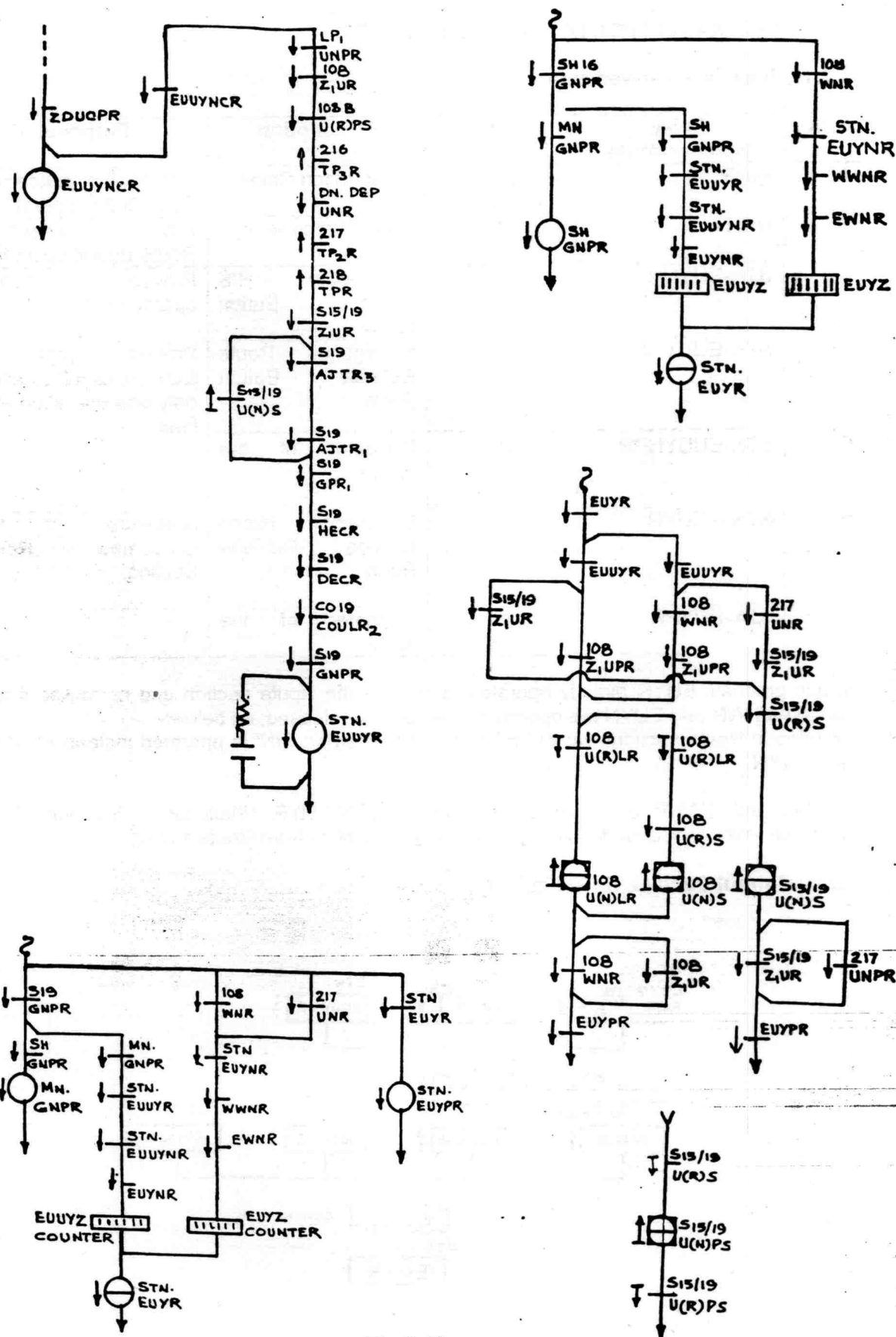


Fig.8.13

8.2 EMERGENCY ROUTE SECTION RELEASE

8.2.1 The relays involved are:-

S.No.	Relay Nomenclature	Location	Description	Purpose.
1.	WNR	Mini group	Point Button Relay	Proves the concerned Point Button operation.
2.	UNR	"	Route Button Relay	Proves the concerned Route Button operation
3.	STN-EUYNR	"	Emergency Route Section Release Button Relay	Proves the button operation.
4.	STN-EUUYNR	"	Emergency Route Release Button Relay	Proved dropped in EUYNR circuit to allow only one operation at a time.
5.	STN-EUUYNPR	"	Repeater of the above	
6.	STN – EUYR	"	Emergency Route Section Release Relay	Releases the concerned Route Section.
7.	STN-EUYPR	"	Repeater of the above	"

In this process, EUYR directly operates to release the Route section and normalise it when the concerned WN and EUYN are operated together and released, as below:-

To release Route sections without a point, the concerned 'UN' is operated instead of 'WN' along with EUYN.

WWNR and EWNR de-energized contacts in STN-EUYR circuit prove the normalization of Common Point control Buttons before releasing the Points from Route setting.

Relay Control Circuits: Refer Fig.8.14

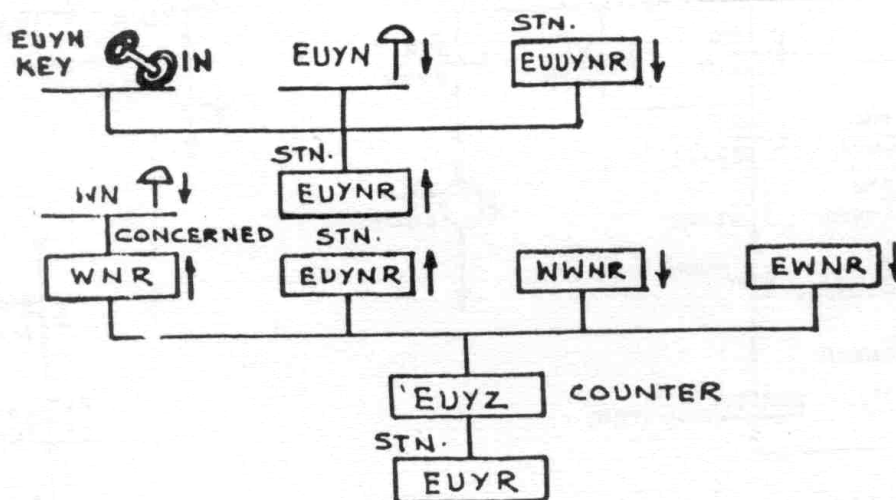


Fig.8.14

PANEL AND RELAY GROUP INDICATION CIRCUITS

9.1 Function and Control conditions are indicated on the 'Operating Panel' and Signal / Point / Route Relay groups, as detailed below: -

Refer Fig. 2.2

As can be seen in Sheet No.5

(A) Point Position indications are displayed permanently through slits of domino strips nearer to the Point demarcation.

Points Normal indications on straight track and Points Reverse indications on diversion. Each slit has two lamps, the one close to the junction gives White indication (when track is clear) and the one away from the junction gives *Red* indication (when track circuit is occupied or has failed) *Steady* indications are controlled by WKR_1 front contact and *flashing* indications are controlled by WKR_1 , back contact in series with (R/N)WLR operated contact.

In the layout given in Fig 9.1(1), they are A(W), B(R), C(W), D (R) for Normal position and E(W), F(R), G(W), H(R) for Reverse position of Pt.No.107/107. They are A_1 (W), B_1 (R) for Normal position and C_1 (W), D_1 (R) for Reverse position of Pt.No.108/108.

Note: 'W' stands for White indication lamp and 'R' stands for Red indication lamp.

(B) Point Track indications other than the Position indications form part of Route set indications. They are controlled by Z_2WR_1 or Z_2WR_2 in addition to the concerned TPR energised /deenergised contacts.

It may also be noted that U(R) S or OV- Z_2U (R) R of a straight road energises Z_2WR_1 whereas U(R) S or OV- Z_2U (R)R of a diversion road energises Z_2WR_2 . These relays directly control Point track indications and WKR_1 energisation is indirectly proved in U(R) S and OV- Z_2U (R) R circuits.

Point track indications of the given layout are :-

1. On 216T:-

I(W), J(R), K(W),L(R), M(W), N(R), P_1 (R) and Q_1 (W).

(a) I and J are called NKEs as they are lit only with Points in Normal.

(b) K, L, P_1 and Q_1 are called CKEs as they are lit both with Points in Normal and Reverse.

(c) M and N are called RKEs as they are lit with Points in Reverse.

2. On 215T:

O(W), P(R) , Q(W) and R(R)

Of these, O and P are CKEs

Q and R are NKEs.

- (C) Points locked (in route) indication, viz. L_1 and L_2 of Pts. 107/107 and L_3 and L_4 of Pts 108/108 are controlled through Z_2WR_1/Z_2WR_2 operated contacts of concerned Route sections

(D) Berthing and other Track indications:-

As can be seen in Sheets No 2 and 3

- (i) On berthing tracks, viz LP1T, LP2T & MN/L-T, *white* (route locked) indication lamps are lit through G(R) LR operated and TPR contacts. (These lamps are lit only when a Main Signal is operated on the Route. They are not lit when a Shunt or C.O. Signal is operated).
- (ii) On the Starter Signal control tracks in approach of Shunt Signals, viz 204T and 217T, the *white* lamps are lit through their G(R) LR reverse contacts or through the adjacent R/S-U(N)LR reverse and SH G(R) R normal contacts in series. The first selection is for Starter Signal route and the second selection is for Home Signal route.
- (iii) On C.O.Signal approach tracks, viz .201T and 219T, the white lamps are lit through Sig.R/S-U(N)S reverse and the nearest berthing track ZU(N)R reverse contacts in series.
- (iv) On the first control track of Home Signals, viz.202T and 218T, the white lamps are lit through the concerned U(N)S reverse contacts.

The red lamps of all those track circuits are lit only through TPR deenergised contacts.

- (E) **Main Signal lock indications** near the UN button on panel are controlled by the concerned G(R) LR reverse contacts. Refer Fig.105. Sheet No.3

(F) Signal aspect indications:-

- (i) For Main Signal aspect indications, refer sheet Nos. 4 and 5
DGKE, the common 'OFF' aspect indication is controlled by not only the respective ECR operated contacts but also the control relay contacts in series.
- (ii) For Route aspect indications, refer sheet No. 4 Drg. No.2
- (iii) For Shunt Signal aspect indications, refer Sheet No. 4 Drg. No.3
- (iv) For CO Signal aspect indications, refer sheet No. 4 Drg. No.4

- (G) **Approach lock time relay indications** near Signal demarcations: Refer Sheet No. 6 Drg. No.1 and 2

- (H) **Crank handle control indications:** refer sheet no. 6 Drg. No. 3

- (I) **Gate & Point key lock slot indications:** - refer sheet no. 6 Drg. No.4

- (J) **Alarm buzzer & indication circuits:** refer Sheet No. 7

- Signal lamp failure alarm is actuated by the dropping of GXJR which is normally kept energised through any one ECR picked up contact of all Signals proved in series When any Signal goes blank, GXJR circuit is interrupted. With the pressing of GXYN on panel, GXYNR picks up and cuts off buzzer supply. Failure indication lamp is extinguished only when the failure is rectified as the concerned ECR picks up.
- Point detection failure is proved similarly in a WXJR circuit and the alarm buzzer is silenced by WXYNR.
- NCR is a common Button Checking relay which proves the normally energized condition of GNCR, UNCR, WNCr, CH/WW/EWNCr relays and dropped condition of Common control Button relays, Signal and Route Initiation relays as well as Route Release relays. Dropping of this relay activates the alarm buzzer and *red* indication lamp continuously. This relay can pick up again to stop the buzzer and extinguish the lamp only when 'NCR' is re-energised with the removal of fault.

(K) Relay Group indications:

- (a) *Point Relay Group:* As can be seen in sheet No1, WKR₁ picked up contact controls the steady red indication whereas WKR₁ de-energised contact controls the flashing red indication.
- (b) *Route Relay Group:* As can be seen in Sheet No.8, the Route Set indication is steady red, the Route Checked and Locked indication is steady yellow.
- (c) *Main Signal Relay Group:* Refer Sheet No. 4
- (d) *Shunt Signal Relay Group:* Refer Sheet No. 4

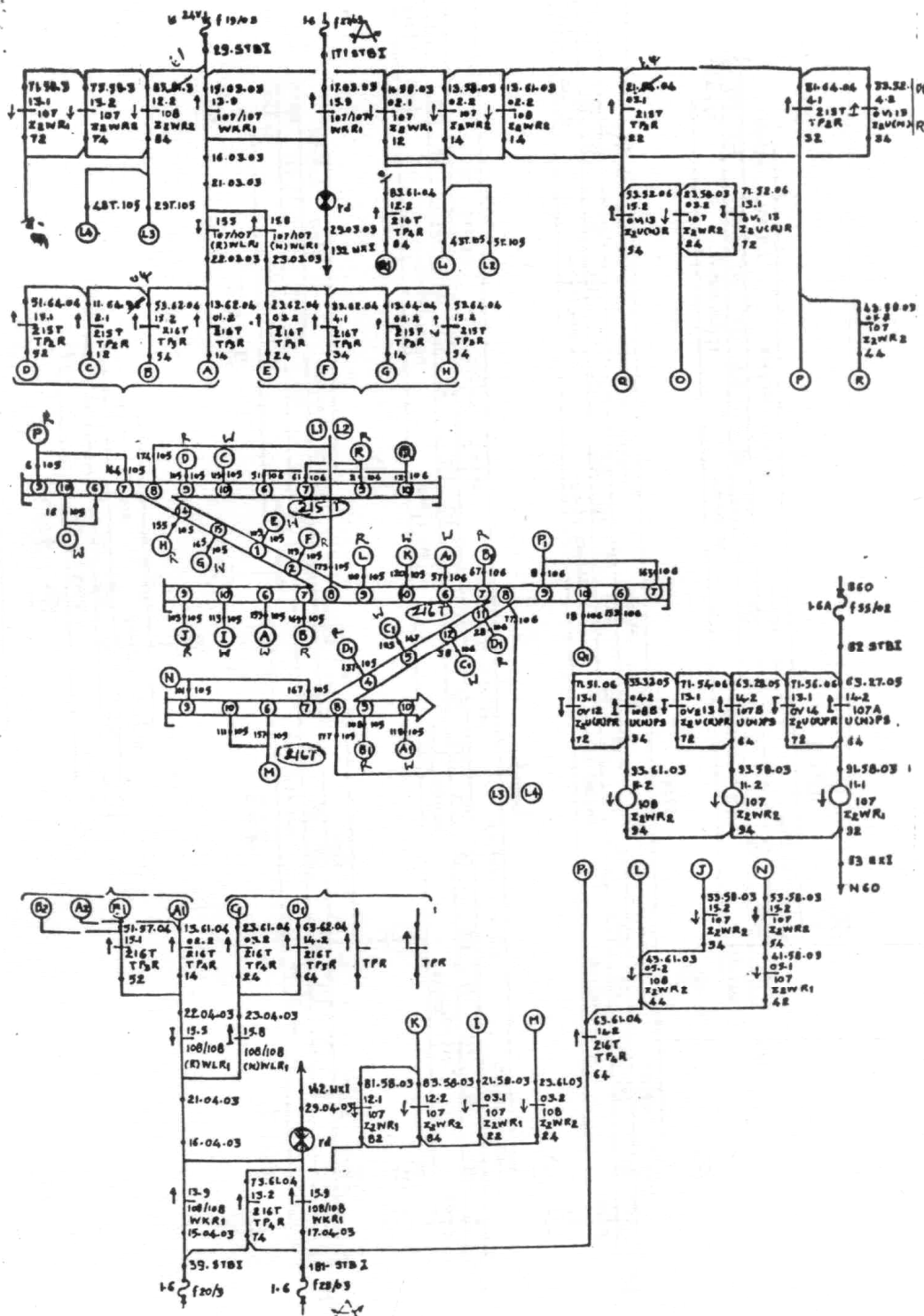


Fig.9.1(1)

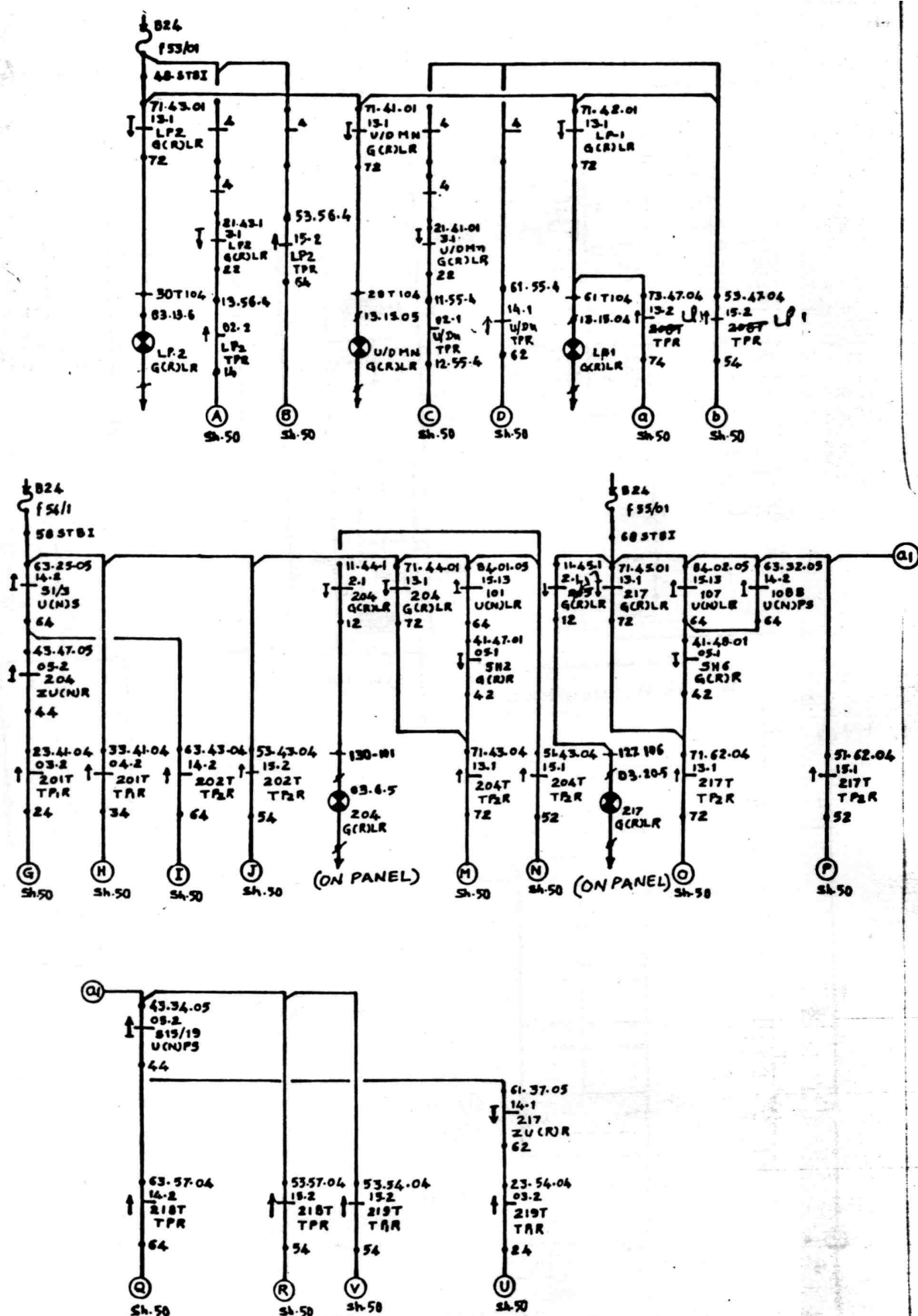


Fig.9.1(3)

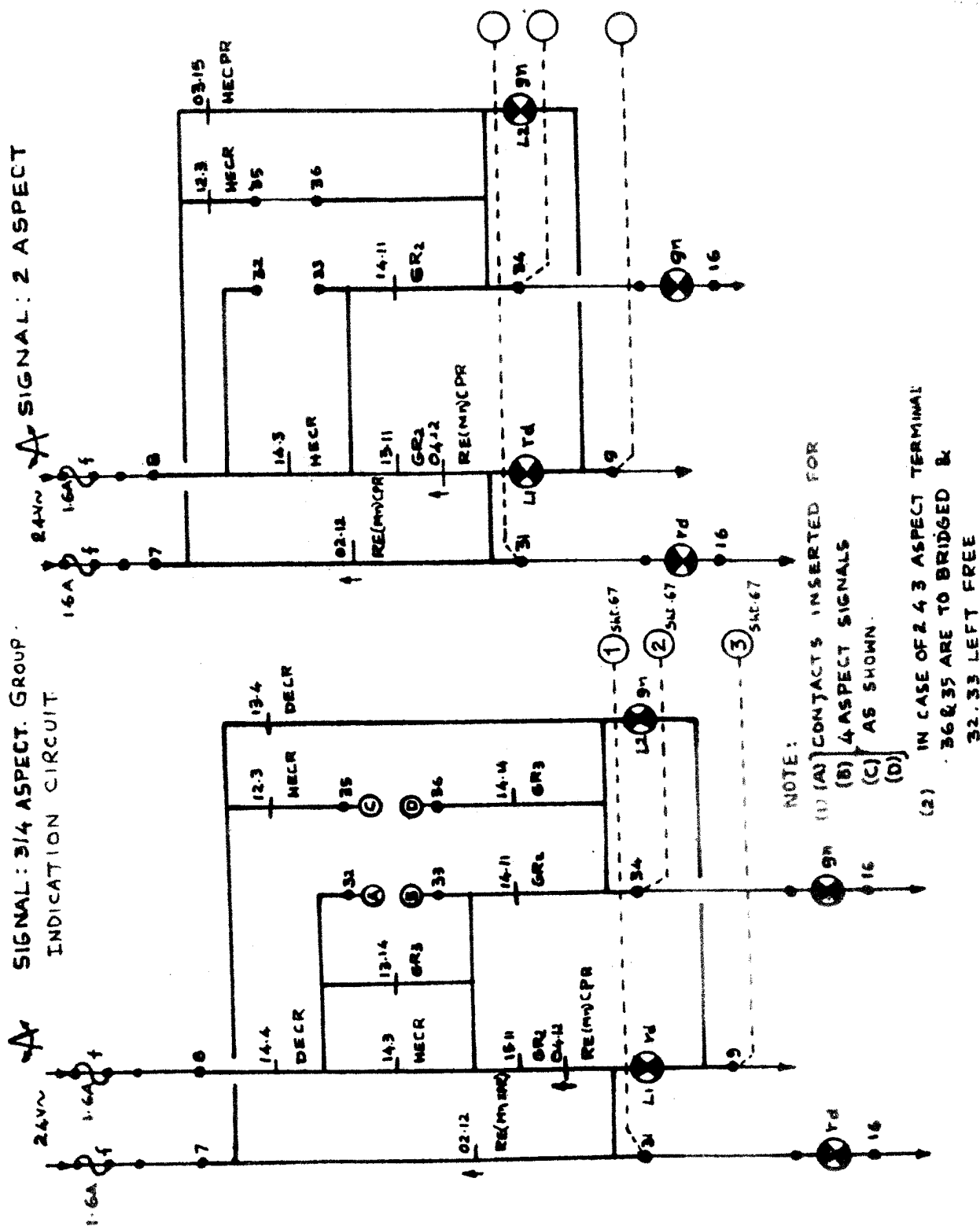


Fig.9.1(4)

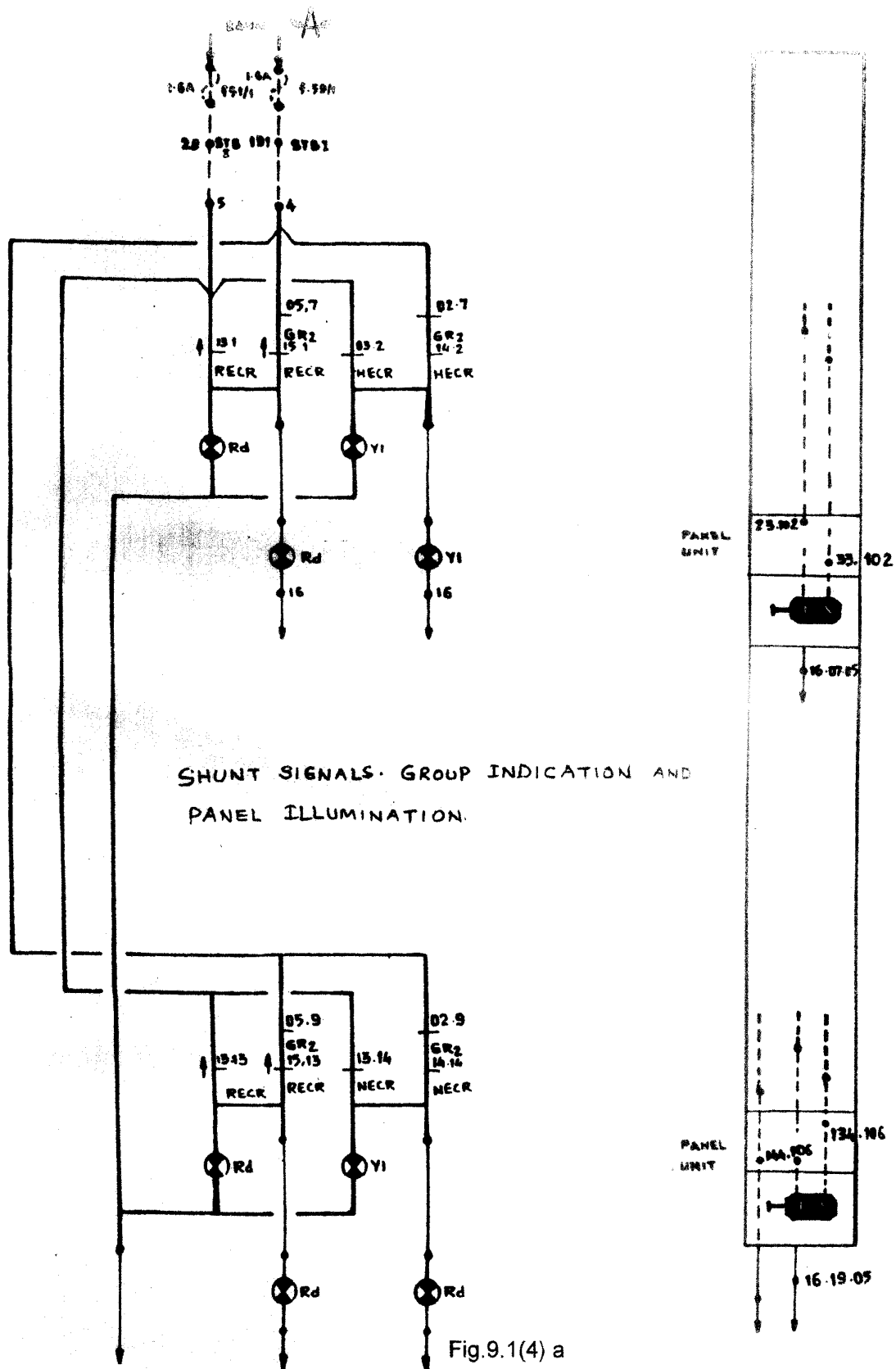


Fig.9.1(4) a

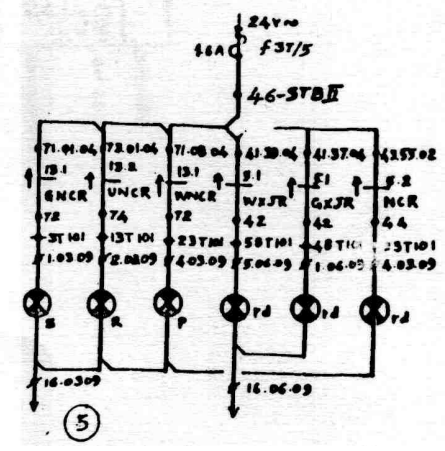
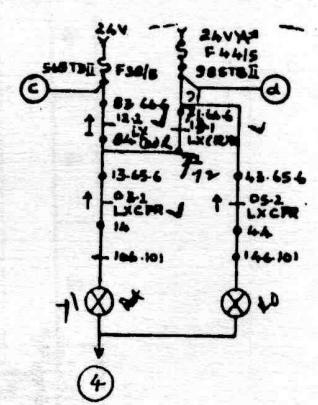
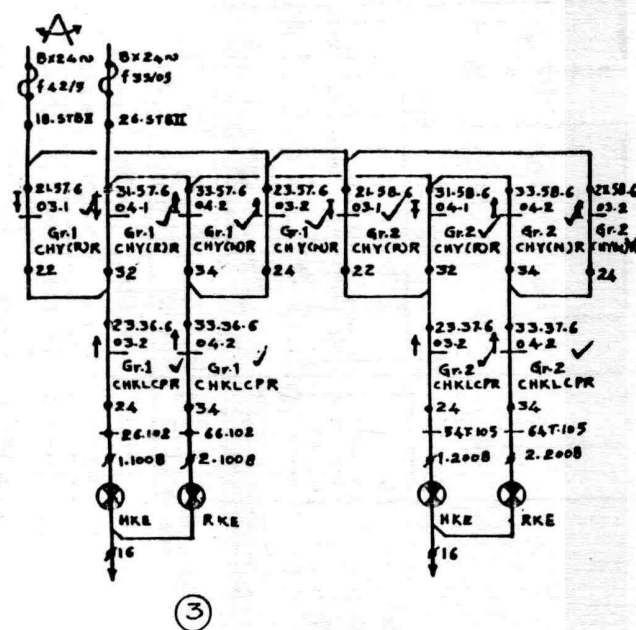
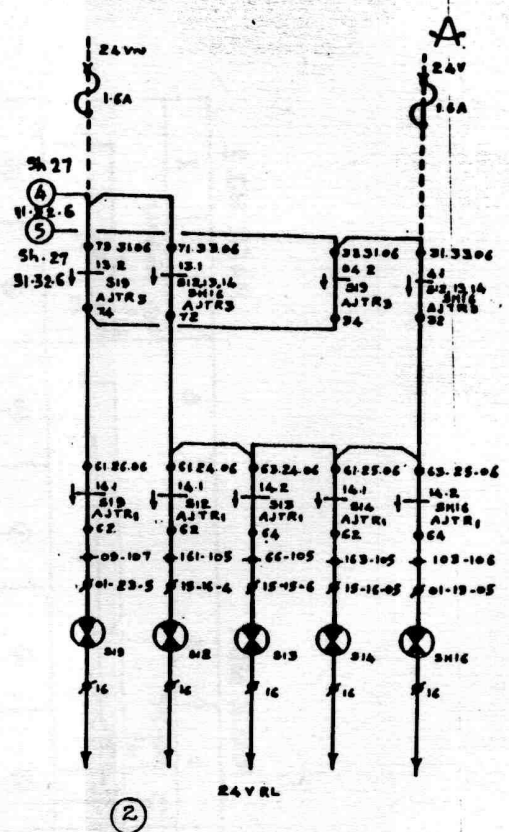
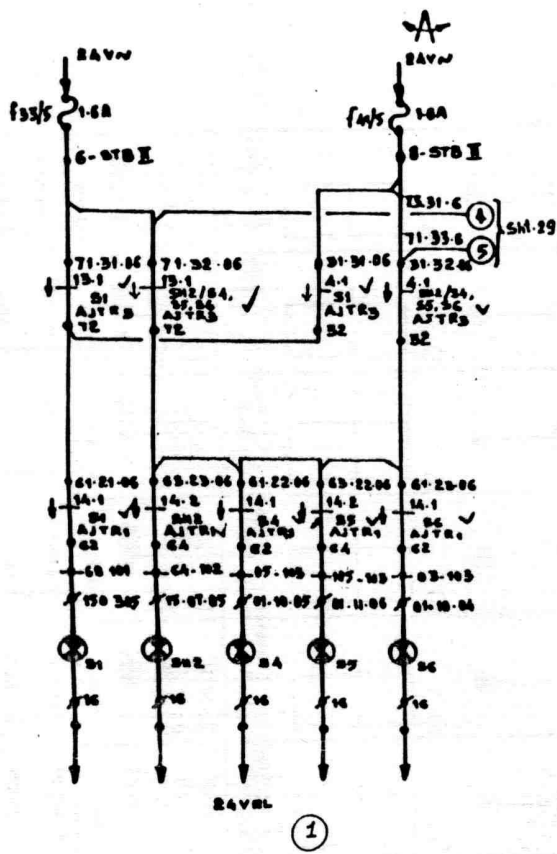


Fig 9.1(6)

Fig 9.1(6)

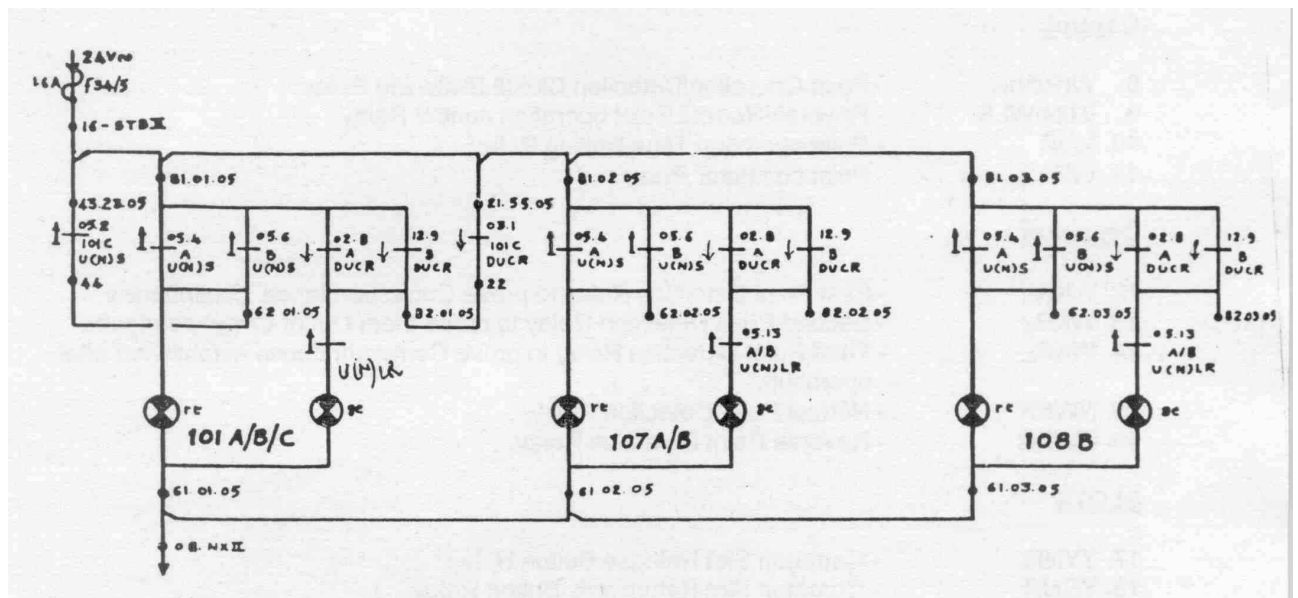


Fig 9.1(7)

ANNEXURE

RELAYS USED IN SIEMENS P.I

POINTS:

- | | |
|---------|---|
| 1. WNR | - Point Button Relay |
| 2. WNCR | - Point Button Relays Normal (dropped) Proving Relay. |
| 3. WWNR | - Common Points Button Relay for Regular operation. |
| 4. EWNR | - Common Points Button Relay for Emergency operation. |

Initiation:

- | | |
|---------------------------------------|--|
| 5. Z ₁ WR ₁ (1) | - First Point control Initiation Relay (P.U.Coil) |
| Z ₁ WR ₁ (2) | - First Point control Initiation Relay (Hold coil) |
| 6. Z ₁ NWR(1) | - Point Normal control Initiation Relay (P.U.Coil) |
| Z ₁ NWR(2) | - Point Normal control Initiation Relay (Hold coil) |
| 7. Z ₁ RWR (1) | - Point Reverse control Initiation Relay (P.U.Coil) |
| Z ₁ RWR (2) | - Point Reverse control Initiation Relay (Hold coil) |

Control.

- | | |
|-------------|---|
| 8. W(R/N)R | - Point Operation/Detection Circuit Switching Relay |
| 9. (R/N)WLR | - Reverse/Normal Point operation control Relay |
| 10. WJR | - Point operation Time limiting Relay |
| 11. WR | - Point contactor Relay |

Detection

- | | |
|----------------------|--|
| 12. WKR ₁ | - First Point Detection Relay to prove Correspondance continuously |
| 13. WKR ₂ | - Second Point Detection Relay to prove them Out of Correspondance |
| 14. WKR ₃ | - Third Point Detection Relay to prove Correspondance established after operation. |
| 15. NWKR | - Normal Point Detection Relay. |
| 16. RWKR | - Reverse Point Detection Relay. |

SLOTS

- | | |
|-----------------------|---|
| 17. YYNR | - Common Slot Release Button Relay |
| 18. YRNR | - Common Slot Return ack. Button Relay |
| 19. KLN R | - (Point) Key Lock control Button Relay |
| 20. LXNR | - Level Crossing gate control Button Relay. |
| 21. CH1 YNR | - Crank Handle Release Button Relay |
| CH2 YNR etc. | for Grp.1, Grp 2 etc. |
| 22. CH/WW/EW NCR | -CH YNRs, WWNR and EWN R Normal proving Relay. |
| 23. KL(R/N)R | - (Point) Key Lock Release/Withdrawal Relay. |
| 24. KLCR | - Key lock Slot release Proving Relay (electro – mechanical Relay, provided at site.) |
| 25. NP ₁ R | |
| NP ₂ R | - KLCR normal repeating Relays (in cabin) |
| NP ₃ R | |
| 26. LX(R/N)R | -Gate control Release/Withdrawal Relay |
| 27. LXPR | - Gate Slot release Proving Relay
(Electro – mechanical Relay – provided at site) |

- | | |
|---|--|
| 28. LXCP
LXCP ₁ R | - LXPR Normal Proving Relay
and its repeater (provided in cabin) |
| 29. Grp.1-
CHY(R/N)R
Grp.2 -
CHY(R/N)R
etc. | - I Pt Grp. Crank Handle Release/Withdrawal Relay

- II Pt.Grp. Crank Handle Release/Withdrawal Relay etc. |
| 30. Grp.1-
CHKLR
Grp.2-
CHKLR etc. | - I Pt.Grp. C.H. Slot Release Proving Relay

- II Pt. Grp. C.H. Slot Release Proving Relay
etc (Electro-mechanical Relays – provided at site) |
| 31. Grp.1-
CHKLCR
Grp.2-
CHKLCR
Etc. | - I Pt.Grp. CHKLR normal Proving Relay

- II Pt.GRP CHKLR Normal Proving Relay etc. (in cabin). |
| 32. CHKLCPR | Repeater for CHKLR |

ROUTES & SIGNALS

- | | |
|----------|---|
| 33. UNR | - Route Button Relay |
| 34. UNCR | - Route Button relays Normal Proving Relay. |

Initiation

- | | |
|---|--|
| 35. ZU(R/N)R | - (Reverse/Normal) Direction Setting Relay. |
| 36. SH.G(R/N)R | - Shunt/Main or C.O.Signal Selecting Relay. |
| 37. Z ₁ UR
Z ₁ UR ₁ | - Route section Initiating Relay (Common for a Subroute)
- Diversion Selection Initiating Relay |
| 38. MN-GZR | - Main Signal control Initiating Relay. |
| 39. SH-GZR | - Shunt Signal control Initiating Relay. |
| 40. ZDUCR | - Route Permissibility Checking Relay |
| 41. OV-Z ₂ U(R/N)R | - Overlap Setting / Releasing Relay. |

R/S Setting.

- | | |
|-------------|--|
| 42. U(R/N)S | - Route section Setting / Normalising Relay. |
|-------------|--|

R/S Checking & Locking

- | | |
|--------------|--|
| UDKR | - Route Clear Indication Relay |
| 43. DUCR | - Route section Clear (vacancy) Proving Relay. |
| 44. U(R/N)LR | - Route Section Locking/Releasing Relay. |

Signal Control & Locking.

- | | |
|------------------------|---|
| 45. GLSR | - Signal Lock Stick Relay. |
| 46. GR ₁ | - First Signal Aspect control Relay |
| 47. GR ₂ | - Second Signal Aspect control Relay |
| 48. GPR ₁ | - Repeater of GR ₁ (Controls Route Indicator of a Main Signal) |
| 49. G(R/N)LR | - Signal Locking / Unlocking relay (locks conflicting Signals of a Main Signal) |
| 50. GR ₃ | - Third Signal Aspect control Relay (controls DG along with GR ₁ & GR ₂) |
| 51. GR ₄ | - Fourth Signal Aspect control Relay (Controls HHG along with GR ₁ & GR ₂ . |
| COGGR | - Calling On Signal Button Relay |
| 52. COULR ₁ | - First C.O. Signal Route Locking Relay |
| 53. COULR ₂ | - Second C.O. Signal Route Locking Relay |

54. RE(Mn)CR	- (Main Signal) Red lamp Main Filament Checking Relay
55. RECR	- (Shunt Signal) 'On' Aspect Checking Relay
56. HECR	- (Main Signal) Caution Aspect Checking Relay (or) (Shunt Signal) 'Off' Aspect Checking Relay
57. DECR	- (Main Signal). Clear Aspect Checking Relay
58. HHECR	- (Main Signal) Attention Aspect Checking Relay.
59. UECR	- Route Indicator Lamp Checking Relay
60. COECR	- C.O. Signal Lamp Checking Relay.
61. GXJR	- Signal Lamp Failure Alarm Timer Relay.
62. WXJR	- Point detection Failure Alarm Timer Relay
63. GXYNR	- Signal lamp Failure Alarm Release Button Relay.
64. WX YNR	- Point detection Failure Alarm Release Button Relay.
65. NCR	- Common Checking Relay for Button checking and other concerned Relays.

Emergency Releases.

66. EGGNR	- Emergency Button Relay to replace Signal at 'On'
67. EGNR	- Relay Proving EGGN operation alongwith a GN/Sh.GN
68. EUUYNR	- Emergency Route Release Button Relay.
69. EUYNR	- Emergency Route section Release Button Relay.
70. EUUYNCR	- Relay Proving EUUYN operation with Route Initiation.
71. ATR	- Approach Track Relay
72. AJTR ₁	- First Approach Lock release Time control Relay.
73. AJTR ₂	- Second Approach Lock release Time control Relay.
74. AJTR	- App.Lock release Time setting Relay.
75. AJTR ₃	- Third App. Lock release Time control Relay.
76. EUUYR	- Emergency Route Release Relay.
77. EUYR	- Emergency Route section Release Relay.
78. OYNR	- Overlap Release Button Relay.
79. OV-AJTR ₂	- Second Overlap release Time control Relay.
80. OV- AJTR	- Overlap Release Time Setting Relay.
81. OV-AJTR ₃	- Third Overlap release Time control relay.

REVIEW QUESTIONS

S-15 :PANEL INTERLOCKING SIEMENS

1. Expand the following Relay Nomenclature.

- i) ZDUCR.-----
- ii) WKR1._____
- iii) OVZ2U(R)R._____
- iv) WKR3 _____
- v) Z1WR1 _____

2. STATE TRUE or FALSE.

- 1. When Point Track Circuit is failed, Point can be operated by pressing concerned WN and common EWN Button ()
- 2. Even though the SM Key is taken out, the signal may be throw back to on position. ()
- 3. In GR1 Circuit EGNR back Contact is proved. ()
- 4. GR1 is slow to release relay ()
- 5. W(R)R/W(N)R Relay is used for achieving Super Imposed circuit in point operation. ()
- 3. Prepare Flow Chart for Main Signal Clearance Circuit in case of Non Route Setting type Siemens Relay Interlocking System?
- 4. Prepare Flow Chart for Point Operation in case of Non Route Setting type Siemens Relay Interlocking System?
- 5. Explain the Crank-Handle Circuit.
- 6. Explain the Level Crossing Gate Circuit?
- 7. Why following Relays are made slow to release?
i) GLSR ii) GR1 iii) WJR vi) NNCR
- 8. Write Short notes
i) ZDUCR ii) GLSR iii) G(R) LR iv) ZU(R/N) R v) WKR3 vi) WKR2