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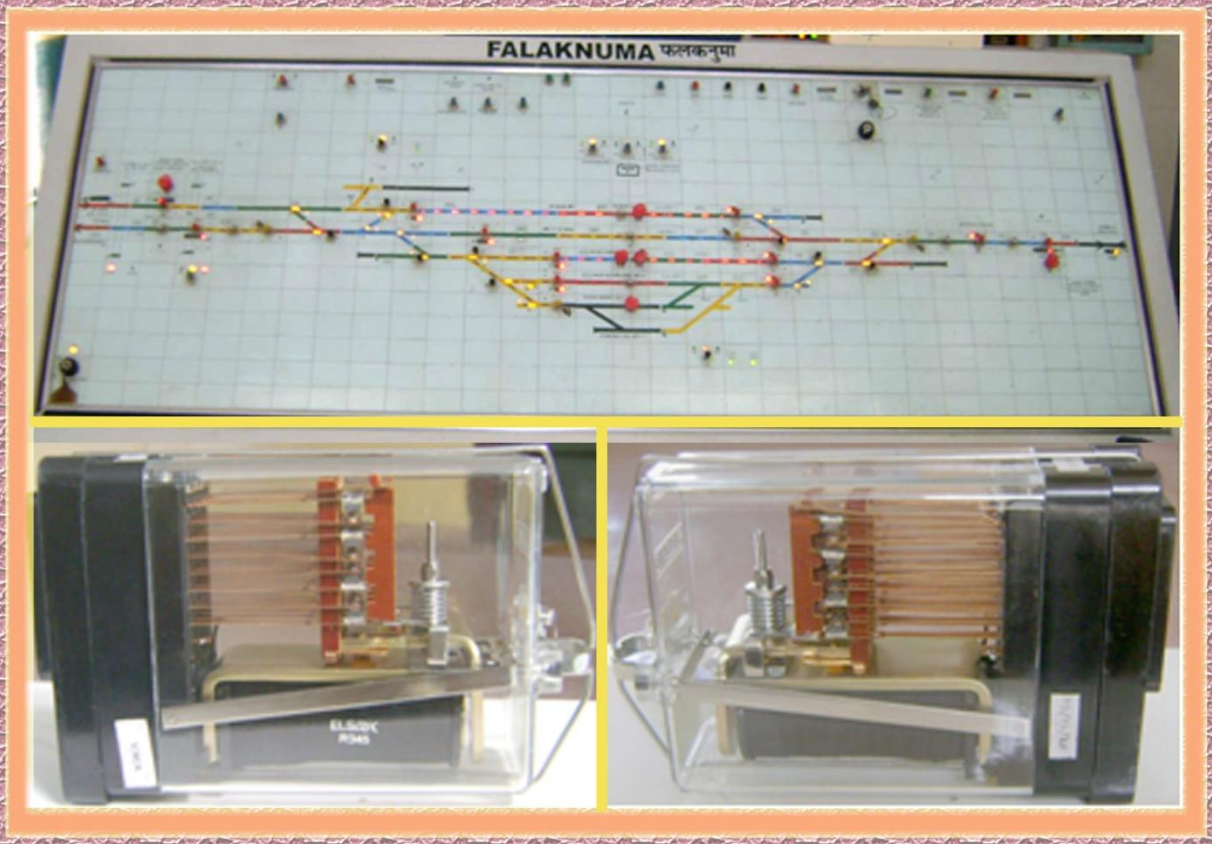
S 12

RELAY INTERLOCKING

(METAL - CARBON RELAYS) (BRITISH)



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

S 12

RELAY INTERLOCKING METAL - CARBON RELAYS (BRITISH)

VISION :	TO MAKE IRISET AN INSTITUTE OF INTERNATIONAL REPUTE, SETTING ITS OWN STANDARDS AND BENCHMARKS
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INDIAN RAILWAYS INSTITUTE OF

SIGNAL ENGINEERING & TELECOMMUNICATIONS

SECUNDERABAD - 500 017

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S-12
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CHAPTER 1: INTRODUCTION TO RELAY INTERLOCKING

1.1 Introduction

Interlocking is an arrangement between various functions like signals, points, sidings, Track circuits, slots, LC gates, etc, operated from a panel or a lever frame, so interconnected to operate in a predetermined sequence to ensure safety.

When ever signals, points and other controlling device / apparatus are to be operated for train movements, interlocking is must among them to ensure safety. Normally interlocking is provided and proved at least in 2 stages.

1.2 Types of Interlocking

S.No	Type of Interlocking	No of Stages	How achieved
I)	**Mechanical Interlocking**	First stage	At locking tray of the lever frame.
		Second stage	Near functions with Mechanical detectors etc.
II)	**Electromechanical Interlocking**	First stage	At locking tray of the lever frame
		Second stage	By means of electrical controls on the functions (EPD's/TPR's etc)
III)	**Relay Interlocking**	First stage	At route checking stage(UCR)
		Second stage	At signal clearance stage(HR)
IV)	**Electronic Interlocking**	In EI the interlocking provided and achieved in 2 stages.	
		i) Single software & duplicate hardware.(2 of 2 or 2 of 3)	
		ii) Duplicate software & single Hardware	
		iii) Diverse software & single Hardware	

1.3 Relay Interlocking

When the interlocking between various functions is achieved by means of relays, then it is termed as Relay Interlocking.

The specifications for relay interlocking: IRS S-36-87/96.

(a) Relay Interlocking is of 2 types.

(i) Non-Route setting Type or Panel Interlocking

(ii) Route setting type or Route Relay Interlocking

1.3 Working of PI and RRI

1.3.1 Panel Interlocking (Non – Route Setting Type)

"Panel Interlocking is provided for small and way side stations in S/L and D/L sections with a panel for operations and indications. Small Junction stations with some considerable traffic and shunting movements may be provided with End panels, with slot working between the panels. All the signals, points etc are provided with switches. The panel is provided with illuminated indications for signals, points, Track circuits, Crank Handles, LC gate, sidings, etc as per their geographical position. The panel is provided with SM's key to prevent unauthorized operation.

In this system, to take 'OFF' a signal for a particular line, either for a through train or for a stopping train, all the points in the route, in overlap and in isolation are to be set first individually, by turning the required point knob/switch (S) to the required position. when satisfied with the setting of route, then the signal knob(S) is to be turned to Reverse. On reversing the signal knob, route checking relay UCR picks up, after checking the route, which drops Approach stick relay ASR. Then the signal control relay HR picks up and the signal is taken OFF. Track route indications for the set route will appear as white illuminated indications along the length on the panel. As and when the train passes the signal, travels over the route, the illuminations first changes to red on occupation of tracks concerned and then again to white on clearing . Finally all the illuminations will extinguish when the train cleared entire the route and the signal switch is normalized. In PI stations, route buttons are not compulsory, but may be provided as an additional facility.

1.3.2 Route Relay Interlocking (RRI)

Route-Setting Type is also called NX-system (Entrance-Exit System). For big and major yards where traffic is considerably more, setting of route by individual operation of points is time consuming as well as sometimes confusing and causes unnecessary delay. Hence another system `RRI' is adopted. In this system all the points required for a signal are automatically, operated to the required position, then UCR picks up and the signals are taken `off' , by simply turning the signal switch to reverse or pressing a signal button and by pressing the suitable Route button simultaneously. In this system, route buttons are compulsory.

Provision for manual operation of points is also given for individual point for maintenance. In this system sectional route release (SRR) also may be provided which facilitates more parallel movements in the yard. In RRI (British), there are two systems, British system I for big yards and system II for major yards. Detailed explanation about both the systems are given in subsequent chapters.

1.3.3 Advantages & Disadvantages of Relay Interlocking

Advantages	Disadvantages
(a) Quick and efficient operation (b) Easy Installation and maintenance (c) No overhauling procedure (d) Suitable for all types of yards. (e) Less detention to traffic (f) Suitable for RE and Non RE (g) Long range of operation (h) Increase in Section capacity (i) Less operating staff.	(a) Initial installation cost may be more comparatively. (b) Reliable and stable power supply is required. (c) Efficient and high quality maintenance is required.

Note. Convention used in this book are

Panel interlocking --- Non Route setting type
Route Relay interlocking ---- Route setting type

1.4 Differences between PI and RRI

S.No	PANEL INTERLOCKING	ROUTE RELAY INTERLOCKING
1	Non route setting type	Route setting type (NX system)
2	Route is set by setting the points individually and then the signals are taken `OFF'	Setting of route and taking `OFF' signal is done by pressing the route button concerned and by pressing the signal button or turning the signal switch to reverse simultaneously.
3	For smaller yards and way side stations	For bigger / major yards
4	Route buttons not compulsory	Route buttons compulsory
5	CLS is optional	CLS is compulsory
6	Sectional Route Release is not provided normally	Sectional route release is provided for better Flexibility.
7	Track circuits/Axle counters between home to home	Track circuit/ Axle counter between outermost signals.
8	Point knobs are of two position (N-R) Type (if knobs are provided)	Point knobs are three position Type (N-C-R) (if knobs are provided)
9	Emergency point operation is not Compulsory.	Emergency points operation is Compulsory.

Note:

(a) As per subsequent & recent specifications, PI stations should also be provided with route setting type feature. And the panel should be of Domino type with self restoring type buttons and with automatic route release facility on complete arrival of a train.

1.5 Basic Requirements of Metal to Carbon Relay Interlocking

(a) Control cum indication Panel with switches / buttons, only self restoring type buttons for operation of various functions. These functions ie. Points, signals, track circuits are represented geographically on the panel.

(b) Provision of Track Circuits with demarcations and fouling protection with different colours on panel.

(c) In PI, points are provided with 2 position switches (N-R) and in RRI, 3 position switches (N-C-R).

(d) All other switches are normally 2-position type.

(e) In RRI, all routes with different overlaps will have separate route button and they are marked alphabetically.

(f) Relays with metal to carbon contacts are used generally.

(g) Colour Light Signals are provided.

(h) Yard is track circuited completely between outer most stop signals in case of PI and between outermost signals in case of RRI.

(i) Crank Handle, level crossing, siding, interlocking are through EKT/RKT.

(j) PVC 16 strand 0.2 mm dia flexible wire is used for relay wiring.

(k) All indications of signals, points, track circuits and various other functions are provided with 12V / 1.2 W lamps or LEDs.

(l) A stabilized 110V AC is used for signals and unstabilised 110V AC is for track circuit feed. Battery 110V DC with charger used for point operation.

(m) A 24V Battery bank one each for INT, EXT and Axle counters with battery charger is provided. When necessary more number of sets can be provided to cater for the load.

(n) 12VDC/AC (or) 24VDC for panel indication.

(o) **Power supply:** It should be Stable & Reliable.

(i) Non Railway Electrified (NON-RE) Area: AC 230V,50Hz is drawn from station feeder(Local) in addition two standby diesel generators are provided.

- RE D/L : Up AT, Down AT and Local
- RE S/L : AT, Local, One Diesel Generator

(ii) In big yards, DG sets of adequate capacity shall be installed in addition to supply from ATs

(p) Condition of Block section / Block Instruments on panel.

(q) In case of cancellation of a signal, a certain time delay is required to release the route, provided the train has stopped in rear of the signal.

(r) Emergency point operation with sealing arrangements & counters.

(s) SM's key is to be provided to lock the panel to prevent unauthorized operation

1.6 Control Panel:

(a) All signals are provided with rotary type switches or buttons nearer to the geographical location with indications.

(b) All points are provided with 2 posn. / 3 posn. switches for PI & RRI respectively with indications for normal (yellow), Reverse (Green), Locked (Red), Free (White)

(c) Track circuits as per yard, demarcation are provided with different colours and occupied/failed indication is given in RED.

(d) Controls for sidings, Level Crossings, Crank Handles are also provided with button/switches & indications.

(e) When route is set and locked, white strip light indications will appear in the route and will be extinguished on arrival of train or on cancellation.

(f) Controls for emergency signal and route cancellation, emergency point operations with counters are provided.

(g) SM's key will be provided to lock the panel to prevent unauthorized operation.

In a control panel, there is no physical interlocking between various switches and buttons like mechanical level frame, but the associated controlling relays will not pick up unless all the conditions required are favourable.

1.7 Panels are of two types.

1.7.1 Conventional Panel (Single plate - Non Domino Type)

(a) In conventional type, only a single large plate of required size is taken and holes/slots are cut to provide switches, buttons, indications, counters, keys etc.

(b) The Top plate (console) of the operating panel has only one complete plate and holes/slots are cut to provide switches, buttons, indications, counters, keys etc. Addition or deletion of the lines over the panel leads to disconnect all the connections in the panel.

(c) For major yards (RRI) when knobs are used for signals, buttons for route, the panel becomes considerably big due to big size of the knobs. Operator will have difficulty in reaching the knobs and buttons. To overcome this inconvenience it is required to provide two panels, one for operation and another for Indication purpose.

(d) Indication units inside the panel made up of Bakelite are big in size. So at Points & Crossings or at any other place where indications are nearby, fixing of the indication units at back side get congested .Thereby it becomes very difficult for wiring and soldering.

Due to the above disadvantages in the conventional panels, domino type panel are preferred.

1.7.2 Domino Type Panel.

(e) In Domino type, the entire panel is made up of assembling together small rectangular plates/boxes of sizes 63mmx38mm and 54mmx34mm on a frame. The buttons, switches & indications, etc are fitted to the dominos and its bases. Wiring is also terminated into male/female multiple sockets for easy removal/ assembly.

As per existing Railway Board's guidelines all panels must be of Domino Type, with only self restoring type buttons and have the facility for "Route setting Type", even for smaller and wayside stations.

The Domino type panels have the following advantages.

(i) Miniature push button operation for each function.

(ii) All buttons are Self-restoring type.

(iii) Route gets released as the train clears the route, no extra operation is required.

(iv) Operating panel becomes compact & neat though yard is very big.

(v) Easy to make deletion and addition on the operating panel during yard modification.

(vi) As Domino has got spring loaded silver tipped contacts, the lamp and button contact failures are less comparatively.

***Note**: If required, depending upon the size of the installation the control panel can be separated. A separate indication panel at a suitable place and an operating panel with SM's key, button & switches can be provided at a suitable place.*

1.8 Indications of Panel

1.8.1 Track circuits indications

Track clear	-	No indication
Track clear, Route set and Locked	-	White
Track Occupation / failure	-	Red

It is to note that adjacent / continuous track circuits are identified and demarcated with different numbers and different colours on panel.

1.8.2 Points indications

(a) Method I : Near the point knob/switch

Normal & Locked	-	Yellow
Reverse & Locked	-	Green
Locked in Route	-	Red
Point Free	-	Yellow / White
Siding point Normal and key IN	-	Yellow
Siding control key out	-	No light

(b) Method II :

White strip indication of Normal/Reverse may also be shown on the panel near the point zone.

During the operation of a point, the light/strip light for the intended position will flash till points are correctly set and locked.

When no signal is taken off and route is not set & locked over a point, the free indication if provided will appear. Free indication will extinguish when the point is locked in a route or concerned point zone track circuit failed or SM's key is removed. Then point locked 'Red' indication will appear if provided.

1.8.3 Signal Indication

Stop Signal	'ON'	- Red
	'OFF'	- Yellow/green/double yellow
Route	'ON'	- No indication
	'OFF'	- White strip
Permissive (Distant)	'ON'	- Yellow
	'OFF'	- Green/Double yellow
Shunt Signal	**On a separate post**	
	ON	- 2 White lights Horizontal
	OFF	- 2 White lights Diagonal / slanting
		(One light common in both)
	On a post below a stop signal	
	'ON'	- No indication
	'OFF'	- 2 White lights Diagonal / slanting
'Calling 'ON' Signal	'ON'	- No indication
	'OFF'	- Miniature yellow indication

***Note**: Some times in domino type panel, for main signals 'OFF' aspect is 'Green' on the panel where as the aspect at signal unit may be Y/ G/ YY.*

1.8.4 Colours of Buttons / Switches used on the Panel

S.No.	Description	Type	Colour (as per S.E.M.)	Colour (practice)
1	Signal (GN)	Button / switch	Red	Red
2	Calling 'on' signal (GN)	Button / Switch	Red with white dot	Red with white dot
3	Common calling 'on' (CoGGN)	Button	Red	Red
4	Shunt signal (GN)	Button / switch	Yellow	Yellow
5	Route(exit/through) (UN)	Button	White	Grey
6	Route(alternate overlap) (UN)	Button	White with black dot	Grey
7	Route(alternate route) (UN)	Button	Grey	Grey
8	Point (WN)	Button / switch	Black	Blue/ Black
9	Common point-normal NWN / WWN	Button	Black with red dot	Blue
10	Common point-reverse RWN / WWR	Button	Black with red dot	Blue
11	Crank handle (CHN)	Button	Blue	Blue
12	Siding control (ZNN)	Button / switch	Blue/Black	Black/ Blue
13	Emer. Sig. Canc.(EGGN)	Button	Red	Red
14	Emer. Full route canc.(EUUYN)	Button	Grey	Grey
15	Emer. Point operation(EWN)	Button	Black with Red dot	Blue
16	Slot (trans) (YYN)	Button	Green	Grey/ Green
17	Slot (receive) (YRN)	Button	Green	Grey/ Green
18	Power ' ack '	Button	Red	Red
19	Point ind. Failure ack. (WXYN)	Button	Grey	Grey
20	Sig lamp. Failure ack. (GXYN)	Button	Grey	Grey
21	Button stuck up ack. (ACKNR)	Button	Grey	Grey
22	Level crossing gate control (LXN/LXYN/LXYRN)	Buttons	Green / Brown	Green/ Brown
23	S.M.'s key	2 Pos. Switch	Metallic white	Metallic white

Indication Colours of Points, Signals, etc on Panel			
S.No.	**Description**	**Aspect/Condition**	**Colour**
1	Signal	ON	Red (distant - yellow)
2		OFF	Yellow/green/ double yellow
3		Route	White strip
4	C 'on' Signal	ON	No light
5		OFF	Miniature yellow
6	Shunt Signal(separate)	ON	2 Hoz.White Lights
7		OFF	2 Cross White Lights
8	Shunt Signal(combined)	ON	No Light
9		OFF	2 Cross White Lights
10	Point	Normal	Yellow / White strip
11		Reverse	Green / White strip
12		Locked / Free	Red / White
13	Crank Handle	IN	Green
14		OUT	Red
15		Free	White
16	Track Circuit	Occupied	Red
17		Clear (When Signal is 'ON')	No light
18		Clear (When Signal is 'OFF')	White strip
19	L.C.gate	Open	Red
20		Close	Yellow / Green
21	Slot	Grant / Receive	Yellow
22	Power ‘ack’	Failed	Red
23	Signal lamp failure	Lamp fused	Yellow
24	Point ind. failure	Ind. Failed	Yellow
25	Button stuck up	Button Stuck Up	Yellow

Answer the following questions

State True / False

1. Conflicting signal-to-signal locking is proved in at least two stages. ( )
2. In relay interlocking, the interlocking is checked at UCR, ASR & HR stages. ( )
3. The two types of relay interlocking are Non route setting type and Route setting type. ( )
4. The two types of relay interlocking are panel interlocking and RRI. ( )
5. The two types of interlocking are Non route setting type interlocking & panel interlocking.( )
6. The two types of interlocking are route setting type interlocking and RRI. ( )
7. Track indications on the panel when track is clear and route set and locked is white strip lights. ( )
8. Track indication on the panel when track is occupied or failed is red. ( )
9. Track indications on the panel when the track is clear and route set & locked is yellow strip lights (LEDs) ( )
10. Track indications on the panel when the track is clear and route set & locked is green strip lights (LEDs) ( )
11. When no route is set and no track failed, the indications on the panel for tracks is blank.( )

CHAPTER 2: SEQUENCE OF OPERATIONS ON PANEL

2.0 Various stages of operations for setting the route, Locking and clearing a signal & release the route on arrival of train and various other operations performed on the panel are explained in this chapter. Typical Block diagrams for panel Interlocking and Route Relay Interlocking are shown. The sequence of operations slightly varies between PI & RRI.

2.1 Setting of Route and Clearing a signal

2.1.1 Non Route Setting Type (Panel Interlocking)

In PI, the setting of route and clearing a signal are done separately.

(a) Manual Operation of Points: The route is set by operating individually the points in the route, overlap and in isolation by turning the point switches either to `N' or `R' or by pressing the individual point button (WN) located near the point and a common point operation button as required. Incase the knobs used for point operation, they will be of 2 positions type ie. Normal and Reverse. When the points are correctly set and locked in the required position then the concerned indication NWKR/RWKR will appear on the panel. It is to note that before a point is operated, all the condition like SM key `IN', point is free from any route, crank handle `IN' and track is clear, must be fulfilled.

(b) Signal Knob Reversed for Clearing the Signal: After ensuring that all the required points are correctly set and locked and indications are available, the concerned signal switch is turned to 'Reverse' (R) and RR is energized proving conflicting RRs in drop condition.

(c) UCR picking up: The concerned UCR relay picks up after ensuring the route which was set manually is correct and the conflicting ASRs (pick up)/UCRs(drop) are in favorable condition.

(d) ASR/ALSR Dropping: As an when the route checking relay UCR is energised, the concerned (signal) ASR along with overlap controlling relays OVSR's will drop and there by, all the points in the route, overlap and isolation are locked.

The ASR dropping ensures WLRs to remain in drop condition and thereby locks the points.

(e) Signal clearing by picking up HR: UCR picks up , ASR drops and the route is locked, then the signal is taken off, provided all other conditions required for clearing of a signal are fulfilled . The signal 'OFF' indications will appear on panel.

Schematic Diagram for Clearing a Signal in PI and RRI

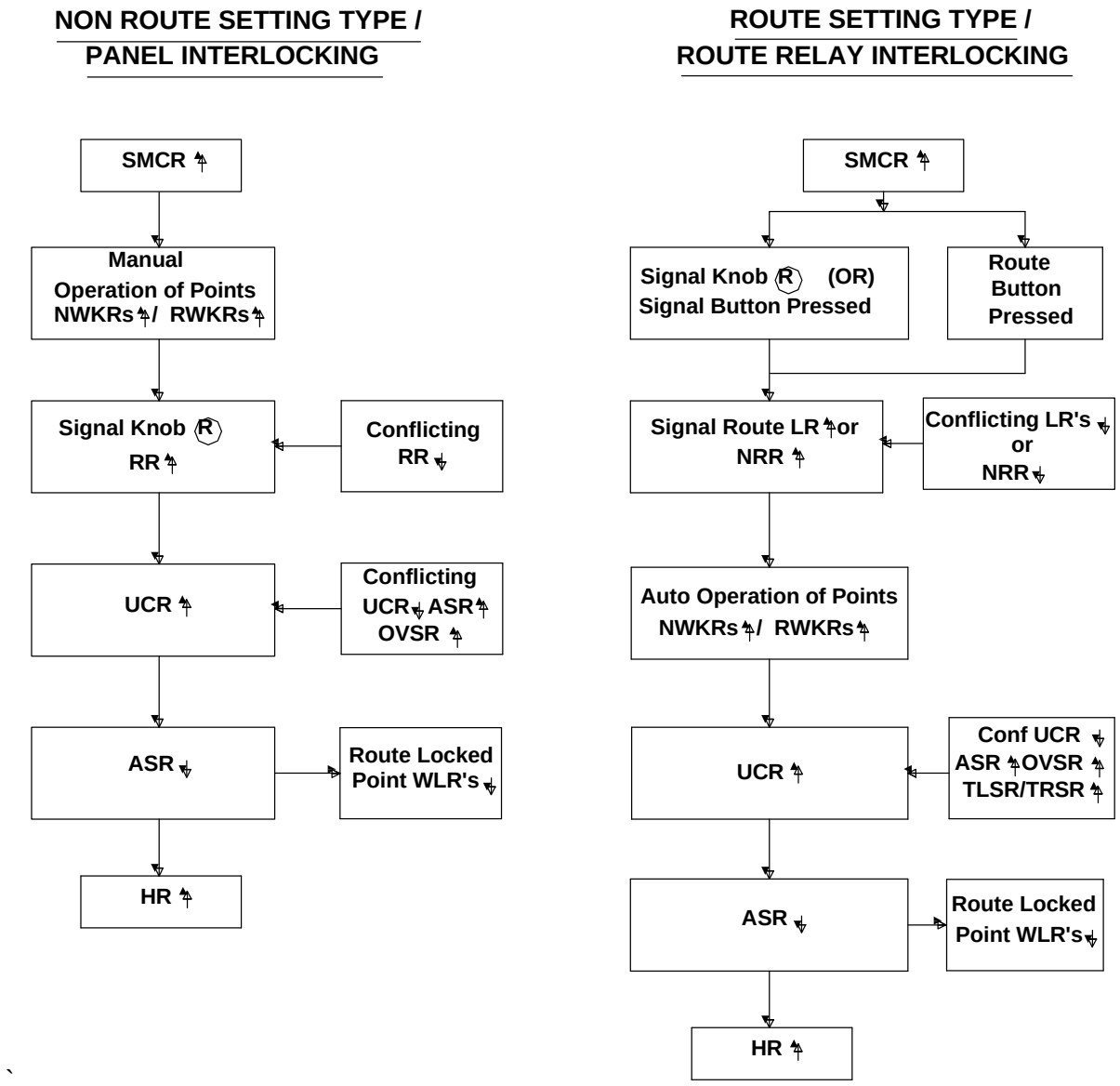


Fig No : 2.1

2.1.2 Route Setting Type / Route Relay Interlocking

This system is called NX system (Entrance –EXIT). In this system, setting of route, Locking of Route and clearance of a signal are done simultaneously at the same time. At first the vacant route on which the train would be received will be decided. Then a route button (EXIT) provided on that route along with the signal button/switch are pressed/operated simultaneously, thereby the route selection/initiation relay (NRR) will pick up.

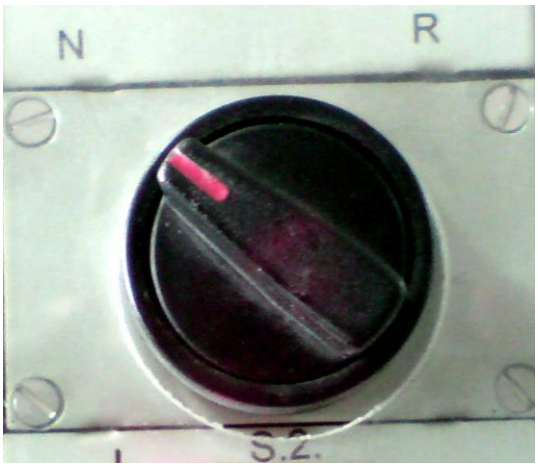
When the signal switch/Button and Route button are operated simultaneously, concerned route initiation relay, NRR picks up. Every signal will have as many NRRs as that of number of routes. (Ex. In a S/L station with 2 loops on either side of M/L with sand humps on either sides, Home signal will have 5NRR's i.e., $1A_1$NRR, $1A_2$NRR, IBNRR, IC_1NRR, IC_2NRR.) The picked up NRR decides the point position for a given signal route. The picked up NRR contacts are used in the required point control circuits, to operate them to correct position for that signal route, in case those points are not already in favourable condition.

Once the required points are correctly set and locked and concerned point indications (NWKR/RWKRs) Relays are picked up, the route checking relay UCR will pick up. Immediately ASR/ALSR along with overlap controlling relays OVSRs and TLSRs/ TRSRs (depending upon the direction of movement of train) will drop and there by all points in the route, overlap and isolation are locked (Route locked). Then the signal is taken 'off' immediately provided all other conditions for clearing a signal are available.

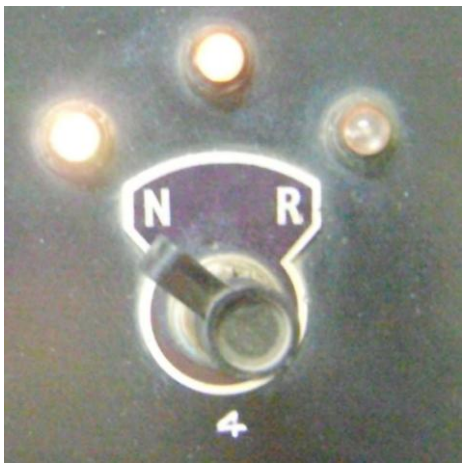
2.2 Manual operation of points

In RRIs the points are required to be operated manually for points testing and automatically through route initiation. In case of knobs, 3 position point knobs are provided which will have N-C-R positions. Normally the switch will be in 'centre' position for automatic operation and for manual operation it is to be operated as required and brought back to centre position for subsequent auto operation. Where buttons are provided, the concerned point button and common point button (N or R) are pressed simultaneously to set the point to the required side. As buttons are self restoring type, relevant button relay drop contacts are used for auto operation of points through route initiation.

2.3 SWITCHES:



Signal – 2 Positions



Point – 2 Positions

KNOBS:
Point – 3 Positions

SWITCH POSITION	MAKE	BREAK
CENTRE	NC RC	N R
NORMAL	N NC	C R RC
REVERSE	R RC	C N NC

POINT (3 Pos. Normal / Centre / Reverse)

Fig No : 2.2

2.4 Other Controls and Operations on Panel

2.4.1 Releasing of Route for a Signal.

On passage of train, the signal will be automatically replaced to `ON' and the train on entering and clearing the route, the track circuits will operate sequentially and the sequential route release relays (UYRs) will pick up. When the train completely clears the last back lock track circuit and signal knob normalised, then the concerned ASR picks up and the route gets released. The ASR picks up and the sequential route release relays will drop. Similarly, for an RRI with SRR, TLSR/TRSR's will also pick up after ASR picks up and remain in up. The OVSR's will pick up after 120 seconds for a stopping train OR after passage of train beyond the overlap with starter taken 'OFF'.

2.4.2 Crank Handle & Siding Controls.

Crank Handles are provided for manual operation of motor operated points when ever a point fails to operate electrically. As per working convenience, they are grouped in CH zone. Crank handles are interlocked with signals. When signals are taken 'off' CH can not be taken out and vice versa.

Similarly siding points are also interlocked with signals. The Knob is to be turned or buttons are to be pressed for the purpose of CH/ Sdg Key transmission or for taking back. Indications are provided on panel for CH 'in' and Sdg 'Normal'. Similarly controls for L-Xing gate open and close with indications are provided on panel.

2.4.3 Cancellation of Signal and Releasing of Route (Points)

A Signal can be cancelled by simply turning the Signal knob to normal position or by pressing signal button along with Emergency signal cancellation button. But the route releasing depends upon approach locking provided.

Case (1) Where Sufficient length of track circuit is provided (in approach) in rear of a signal, the route can be released with out time delay, when the approach track is clear and with time delay when approach is occupied.

Case (2) Where sufficient length of track circuit is not provided then the route releasing is possible with time delay only irrespective of position of train.

The length of approach track depends upon sectional permissible speed, the type of signalling etc. Counters are provided for registering all emergency operations.

2.4.4 Misc. Controls, operations and Indications

Controls and Indications for slot working, Emergency point operation, signal lamp failure, point indication failure, power failure indication, etc. are provided with buzzers and muting facility. In case of buttons, button stuck –up indication with buzzer and muting is provided.

2.4.5 Authorised Operation

SM's Control key is provided on panel for authorized operations. To prevent un-authorised operations, SM can lock the panel by removing the key.

Answer the following Questions

1. Draw and explain the block diagram how route is set and signal cleared in panel interlocking/Non-route setting type interlocking?

2. Draw and explain the block diagram how route is set and signal cleared in Route relay interlocking/Route setting type interlocking?

State True / False

1. Point knobs used in RRI are of 3 position type. ( )
2. In route setting type inter locking points are to be operated to correct position before signal is taken off. ( )
3. Non route setting type / panel interlocking the points are to be operated manually before clearing the signal. ( )
4. When UCR picks up, ASR/ALSR concerned will be dropped either in PI or in RRI. ( )
5. The points will be set automatically in RRI when signal button and route button are pressed & release simultaneously. ( )
6. In panel interlocking LR/NRR relay sets all the relevant points to the correct position automatically. ( )
7. The point switches used in route setting type inter locking will have three positions i.e. N, C and R. ( )
8. For automatic operation of points in RRI , the point knob has to be set to centre (C) position. ( )
9. When the point switch 3 positions is kept in the centre (C) position then both NC & RC switch contacts are made to facilitate automatic point operation. ( )

CHAPTER 3: SIGNALLING PLAN - CONTROL TABLE

3.1 Signalling Plan

On receiving the approved Engineering plan, a signalling plan is prepared by Drawing office. The prepared signalling plan is sent to traffic department (COM) and Sr.DSTE/Division for their comments about the signalling plan. If required alterations are done in the signalling plan as per the comments received. Then the signal plan is put up for approval by CSTE for executing works.

3.2 Numbering pattern Practice - 1

(a) Running signals - DN direction – ODD Numbers 1,3,5,7

(b) Running signals - up direction – Even Numbers 2,4,6,8.

(c) Subsidiary signal like shunt signals etc. - DN direction – ODD number 41, 43 ….

(d) Subsidiary signal like shunt signals etc. - Up direction - Even number 42, 44….

(e) Points - 101, 102, 103

(f) Siding control – 201, 202, 203

(g) LC gate control – 301,302, …

3.3 Numbering pattern Practice - 2

Running signal pertaining to one direction with LHS to RHS of operator facing towards the panel – Home signal, main line starter, loop line starter, Advance starter and L.C. gate, shunt signal, Points at one End , points at other end , shunt signal , L.C. gate, Running signals- Advance starter, L/L starter, M/L Starter and Home signal.

***Note**: some railways adopt mechanical numbering pattern, where signals, points etc are numbered serially starting from 1,2,3 as that of mechanical lever frame.*

3.4 Signal / Route Control Table

For designing circuits of a Yard, the Table (Selection Table/RCC) is to be prepared first as per the approved SIP. The control Table provides necessary information for the preparation of circuits. It is equivalent to “Locking Table” of Mechanical Interlocking. It consists of the following information:-

(a) Details of signals with aspects

(b) Routes governed by signal

(c) The method for Route holding i.e. either approach locking with track circuits included in the approach or dead approach locking and back locking etc.

(d) The points of Route, overlap and isolation which are detected and locked by the signals.

(e) The conflicting signal/Route locked by this signal.

(f) Any other controls like interlocked level crossing, interlocked siding, Lighting of Route indicators, Block control etc.

It is customary to send the selection table to CRS for approval along with other documents. Selection table is a user-friendly data, which gives entire information about the interlocking and various conditions for setting the route, holding the route and clearing a signal. The selection table is a basic requirement for testing various signals in a yard during commissioning and after wards also. Each column of selection table is utilized for each circuit and for attending failures quickly.

Prior to designing of circuits, the selection table will be prepared by Drawing Office. It will be checked by Chief Drafts man/ Drg. Office and ASTE/DSTE before getting approved by CSTE.

A typical selection table is given for reference.

3.5 Point Control Table

A point control Table is also given. From this table, information regarding point (s) such as crank handles interlocking, Track locking, Locking of various signals / Routes reading over the points both in ‘Normal’ and in ‘Reverse’.

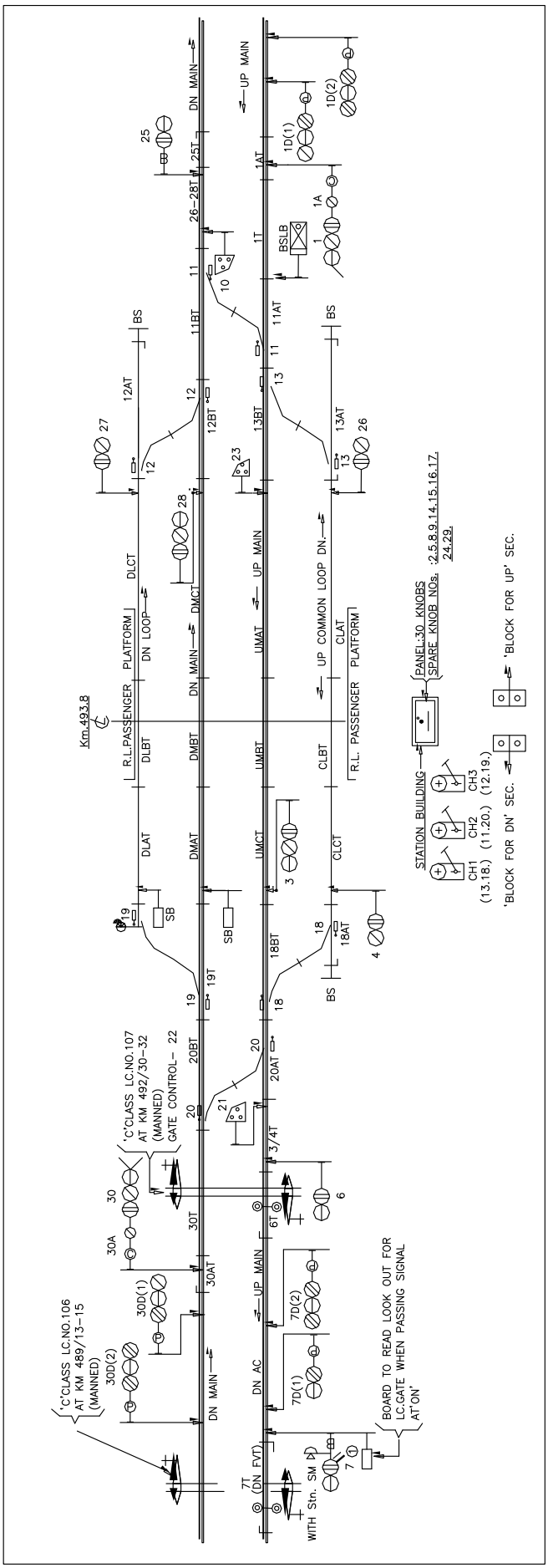

'C'CLASS LC.NO.106
AT KM 489/13-15
(MANNED)
30D(2)
30D(1)
30A
30
30T
30AT
'C'CLASS LC.NO.107
AT KM 492/30-32
(MANNED)
GATE CONTROL- 22
20BT
20
20AT
21
3/4T
3
6T
6
7T
(DN FYT)
WITH Stn. SM (P)
7
7D(1)
7D(2)
DN AC
UP MAIN
DN MAIN
BOARD TO READ LOOK OUT FOR
LC.GATE WHEN PASSING SIGNAL
AT'ON'
19T
19
SB
DLAT
DMAT
UMCT
CLCT
18BT
18
18AT
4
BS
CLBT
UMBT
CLAT
R.L. PASSENGER PLATFORM
UP COMMON LOOP DN.
UMAT
UP MAIN
DMCT
DLCT
DN LOOP
PLATFORM
R.L.PASSENGER
Km.493.8
DLBT
DMBT
12BT
12
12AT
27
28
23
13BT
13
13AT
26
11BT
11
11AT
10
26-28T
25T
25
1T
1AT
1A
1
BSLB
1D(1)
1D(2)
UP MAIN
DN MAIN
PANEL:30 KNOBS
SPARE KNOB NOs. :2,5,8,9,14,15,16,17,
24,29.
STATION BUILDING
CH1
(13.18.)
CH2
(11.20.)
CH3
(12.19.)
'BLOCK FOR DN' SEC.
'BLOCK FOR UP' SEC.

Fig N0: 3.1

CONTROL TABLE (FOR LAYOUT in Fig 3.1)

SL. NO.	SIGNAL NO.	DESTINA-TION	OPERATE KNOB / BUTTON		LOCKS / DETECTS POINT						CONTROLLED BY TRACK CIRCUITS			OTHER CONTROLS IF ANY	APPROACH LOCKED BY TRACK CIRCUITS	BACK LOCKED BY TRACK CIRCUITS	LOCK ROUTES	AHEAD SIGNAL ASPECT	REMARKS
			SIGNAL BUTTON	ROUTE BUTTON	ROUTE		ISOLATION		OVERLAP		ROUTE	OVERLAP	FOULING	CH, LXC, SDG SLOT, etc.					
					NOR	REV	NOR	REV	NOR.	REV.									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	19	**20**
1	1D(2)	1D(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	DG CONTROLLED BY 1D(1) DG/HHG WITH POINT NO 13N
2	1D(1)	S1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DG Controlled by 1 DG HHG Controlled by 1 HG
3	1	UP MAIN	1	-	11, 13	-	-	-	18, 20	-	1T,11AT, 13BT,UMT	18BT, 20AT, 3/4T	-	CH1,CH2	DEAD APPROACH	1T, 11AT, 13BT	1A,21	3 RG / HG / DG	TIME RTELESE 120 SEC , Dg Controlled by 3DG
4	1	COMMON LOOP SET TO BS	1		11	13	-	-	18	-	1T,11AT, 13BT,13AT, CLT	18AT	-	CH1,CH2	DEAD APPROACH	1T, 11AT, 13BT, 13AT	1A,21	4 RG	TIME RTELESE 120 SEC 1UGR REQUIRED
5	1	COMMON LOOP SET TO MAIN	1	-	11	13	-	-	20	18	1T,11AT, 13BT,13AT, CLT	18AT, 18BT, 20AT, 3/4T	-	CH1,CH2	DEAD APPROACH	1T, 11AT, 13BT, 13AT	1A,21	4 RG/HG	TIME RTELESE 120 SEC 1UGR REQUIRED
6	1A	UP MAIN	1A	-	11, 13	-	-	-	-	-	1AT OCCUPIED	-	-	CH1,CH2	DEAD APPROACH	-	1,3,4,21 (30,30AW20R)	-	TIME RELEASE 240 SEC APPROACH CLEARED AFTER 120 SEC COGGN
7	1A	COMMON LOOP	1A	-	11	13	-	-	-	-	1AT OCCUPIED	-	-	CH1,CH2	DEAD APPROACH	-	1,4,21, (30AW20R)	-	TIME RELEASE 240 SEC APPROACH CLEARED AFTER 120 SEC COGGN
8	3	UP MAIN	3	-	18, 20	-	-	-	-	-	18BT,20AT, 3/4T	-	-	CH1,CH2	UMT (1W13N)	18BT, 20AT	(1AW13N), (10W11R13N) ,21,23	6 RG/DG	TIME RLEASE 120 SEC DG CONTROLLED BY 6DG
9	4	UP MAIN	4	-	20	18	-	-	-	-	18AT,18BT, 20AT, 3/4T	-	-	CH1,CH2	CLT	18AT, 18BT, 20AT	1A, (10W11R), 21,26	6 RG/DG	TIME RELESE 120 SEC
10	6	7D(2)	6	-	20	-	-	-	-	-	6T, UP ACPR	-	-	CH2,22LX	-	-	21	-	-
11	7D(2)	7D(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DG CONTROLLED BY 7D(1) DG
12	7D(1)	7 UP IBS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DG CONTROLLED BY 7 DG
13	7	UP MAIN	7	-	-	-	-	-	-	-	7T	-	-	-	-	-	-	-	CONTROLLED BY UP SIDE BLOCK INSTRUMENT

SL. NO.	SIGNAL NO.	DESTINA-TION	OPERATE KNOB / BUTTON		LOCKS / DETECTS POINT						CONTROLLED BY TRACK CIRCUITS			OTHER CONTROLS IF ANY	APPROACH LOCKED BY TRACK CIRCUITS	BACK LOCKED BY TRACK CIRCUITS	LOCK ROUTES	AHEAD SIGNAL ASPECT	REMARKS
			SIGNAL BUTTON	ROUTE BUTTON	ROUTE		ISOLATION		OVERLAP		ROUTE	OVERLAP	FOULING	CH, LXC, SDG SLOT, etc.					
					NOR	REV	NOR	REV	NOR.	REV.									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	19	**20**
14	10	DN LOOP	10	-	11	12	-	-	-	-	11BT,12BT, 12AT	-	-	CH1,CH3	26-28T	11BT, 12BT, 12AT	25,27 (30, 30AW20N)	-	TIME RELEASE 120 SEC
15	10	DN MAIN	10	-	11, 1 2	-	-	-	-	-	11BT,12BT	-	-	CH1,CH3	26-28T	11BT, 12BT	25,28,30,30A	-	TIME RELEASE 120 SEC
16	10	UP MAIN	10	-	13	11	-	-	-	-	11BT,11AT, 13BT	-	-	CH1,CH2	26-28T	11BT, 11AT, 13BT	3,4,23,25, (21W18N), (30AW19R12R), (30,30AW19N)	-	TIME RELEASE 120 SEC
17	10	COMMON LOOP	10	-	-	11, 13	-	-	-	-	11BT,11AT, 13BT,13AT	-	-	CH1,CH2	26-28T	11BT, 11AT, 13BT, 13AT	4,25,26, (21W18R), (30AW19R12R), (30,30AW19N)	-	TIME RELEASE 120 SEC
18	21	UP MAIN	21	-	20, 18	-	-	-	-	-	20AT,18BT	-	-	CH1,CH2	3/4T	20AT, 18BT	1,1A,3,6,26, (10W11R13N)	-	TIME RELEASE 120 SEC
19	21	COMMON LOOP	21	-	20	18	-	-	-	-	20AT,18BT, 18AT	-	-	CH1,CH2	3/4T	20AT, 18BT, 18AT	1,1A,4,6,26, (10W11R13R)	-	TIME RELEASE 120 SEC
20	23	DN MAIN	23	-	13	11	-	-	-	-	13BT,11AT, 11BT	-	-	CH1,CH2	UMT	13BT, 11AT, 11BT	3,10,25, (30AW20N19N) (30AW19R12R)	-	TIME RELEASE 120 SEC
21	25	DN MAIN	-	-	-	-	-	-	-	-	25T	-	-	-	-	-	10,23	-	CONTROLLED BY DN SIDE BLOCK INSTRUMENT
22	26	DN MAIN	26	-	-	11, 13	12	-	-	-	13AT,13BT, 11AT,11BT, 26-28T	-	-	CH1,CH2, CH3	CLT	13AT, 13BT, 11AT, 11BT,	4,10,21, (30AW19N)	25 RG/DG	TIME RELEASE 120 SEC
23	27	DN MAIN	27	-	11	12	-	-	-	-	12AT,12BT, 11BT, 26-28T	-	-	CH2,CH3	DLT	12AT, 12BT, 11BT	10, (30AW20N)	25 RG/DG	TIME RELEASE 120 SEC
24	28	DN MAIN	28	-	11, 12	-	-	-	-	-	12BT,11BT, 26-28T	-	-	CH2,CH3	DMT (30W19N20N)	12BT, 11BT	10, (30AW19N20N)	25 RG/DG	DG CONTROLLED BY 25 DG TIME RELEASE 120 SEC
25	30	DN LOOP SET TO BS	30	-	20	19	-	-	12	-	30T,20BT, 19T,DLT	12AT	-	CH2,CH3, 22LX	DEAD APPROACH	30T, 20BT, 19T	(10W11N), 30A	27 RG	30 UGR REQUIRED TIME RELEASE 120 SEC
26	30	DN LOOP SET TO MAIN LINE	30	-	20	19	-	-	11	12	30T,20BT, 19T,DLT	12AT, 12BT, 11BT, 26-28T	-	CH2,CH3, 22LX	DEAD APPROACH	30T, 20BT, 19T	10,30A	27 RG/HG	30 UGR REQUIRED TIME RELEASE 120 SEC

SL. NO.	SIGNAL NO.	DESTINA-TION	OPERATE KNOB / BUTTON		LOCKS / DETECTS POINT						CONTROLLED BY TRACK CIRCUITS			OTHER CONTROLS IF ANY	APPROACH LOCKED BY TRACK CIRCUITS	BACK LOCKED BY TRACK CIRCUITS	LOCK ROUTES	AHEAD SIGNAL ASPECT	REMARKS
			SIGNAL BUTTON	ROUTE BUTTON	ROUTE		ISOLATION		OVERLAP		ROUTE	OVERLAP	FOULING	CH, LXC, SDG SLOT, etc.					
					NOR	REV	NOR	REV	NOR.	REV.									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	19	**20**
27	30	DN MAIN	30	-	19, 20	-	-	-	11, 12	-	30T,20BT, 19T,DMT	12BT, 11BT, 26-28T	-	CH2,CH3, 22LX	DEAD APPROACH	30T, 20BT, 19T	10,30A	28 RG/ HG/DG	TIME RELEASE 120 SEC DG Controlled by 28 DG
28	30	COMMON LOOP SET TO BS	30	-	-	20, 18	19	-	13	-	30T,20BT, 20AT,18BT, 18AT,CLT	13AT	-	CH1,CH2, CH3,22LX	DEAD APPROACH	30T, 20BT, 20AT, 18BT, 18AT,	1A,30A, (10W11Ror12N)	26 RG	30 UGR REQUIRED TIME RELEASE 120 SEC
29	30	COMMON LOOP SET TO MAIN	30	-	-	20, 18	19	-	-	13, 11	30T,20BT, 20AT,18BT, 18AT,CLT	13AT, 13BT, 11AT, 11BT, 26-28T	-	CH1,CH2, CH3,22LX	DEAD APPROACH	30T, 20BT, 20AT, 18BT, 18AT	10,30A	26 RG/HG	30 UGR REQUIRED TIME RELEASE 120 SEC
30	30A	DN LOOP	30A	-	20	19	-	-	-	-	30AT OCCUPIED	-	-	CH2,CH3, 22LX	DEAD APPROACH	-	(10W11Nor12R), (23W12R),27,30	-	TIME RELESE 240 SEC APP CLEARED AFTER 120 SEC COGGN
31	30A	DN MAIN	30A	-	20, 19	-	-	-	-	-	30AT OCCUPIED	-	-	CH2,CH3, 22LX	DEAD APPROACH	-	10,23,26, 27, 28,30	-	TIME RELESE 240 SEC APP CLEARED AFTER 120 SEC COGGN
32	30A	COMMON LOOP	30A	-	-	20, 18	19	-	-	-	30AT OCCUPIED	-	-	CH1,CH2, CH3, 22LX	DEAD APPROACH	-	1A,26,30, (10W11Ror12N)	-	TIME RELESE 240 SEC APP CLEARED AFTER 120 SEC COGGN
33	30D(2)	30D(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DG CONTROLLED BY 30D(1) DG/HHG WITH POINT 19N 20N
34	30D(1)	S30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DG Controlled by 30 DG HHG Controlled by 30 HG

Note : As per SEM part I Para 7.19.5 (f) For reception signals, 5 rail length calling-on track circuit and 60 seconds time delay should be adopted. For dispatch signals, no time delay is required for calling ON signal. However, that the train has stopped shall be covered in SWR and ensured by operating staff.

POINT CONTROL TABLE (For Layout in Fig 3.1)

S NO	POINT	TRACK LOCKED BY	LOCKED BY SIGNAL	REMARK
1	11	11AT,11BT	1,1A,10,23,26,27,28,(30 W19R 12R) , (30 W19N 20N) (30 W13R 20R)	CH2
2	12	12AT,12BT	(10 W11N),26,27,28,(30W 20N)	CH3
3	13	13AT,13BT	1,1A,(10 W11R),23,26,(30 W20R)	CH1
5	18	18AT,18BT	1,3,4,21,(30,30A W20R)	CH1
6	19	19T	30,30A	CH3
7	20	20AT,20BT	(1 W13N OR18R),3,4,6,21,30,30A	CH2
8	22 LX	-	6,30,30A	TIME RELEASE 120 SEC

Any information regarding the point (s) can be mentioned in remarks column such as type of point, type of layout, etc.

Answer the following Questions

1. Prepare control table for the signal No.1 for the lay out given in this chapter.
2. Prepare control table for the signal No.3 for the lay out given in this chapter.
3. Prepare control table for the shunt signal No.21 for the lay out given in this chapter.

State True / False

1. To ensure the signal ahead is not blank in the HR of home, only Main line starter HECR & DECR in parallel are proved. ( )
2. The points in isolation must be proved in HR circuit of calling on signal. ( )
3. All tracks in the route overlap and berthing shall be proved in home signal HR. ( )
4. For shunt signal, the route locking is up to berthing track included. ( )
5. For approach locking of loop line starter, the berthing track alone is proved. ( )
6. Calling signal detects all the points, which the main signal above it detects excluding the overlap points. ( )
7. Generally Dead Approach locking is provided for a home signal of wayside station. ( )
8. The CO signal will have that many numbers of routes as many overlaps available. ( )
9. The CO signal locks the starter ahead and vice versa. ( )
10. The shunt signal is provided with approach locking. ( )
11. In panel interlocking, the CO signal cancellation period is 240 m seconds. ( )
12. In panel interlocking, all signals except CO signal will have cancellation period of 120 seconds. ( )
13. In panel interlocking for way side stations, the starter signal is provided with cancellation period of 240 seconds. ( )

CHAPTER 4: NOMENCLATURE OF RELAYS AND CIRCUITS

4.1 Nomenclature and description of some of the relays used in "Relay Interlocking" (British) are given below.

S.No	Nomenclature	Description	Remark /Function
1	SMR/SMCR	Station Master's (control) Relay	Authorised Operation
2	TSR	Track Stick Relay	One Signal - One Train
3	RR	Signal Knob / Switch Reverse Relay	For taking "OFF" Signal in PI
4	LR/NRR	Route Selection / Initiation Relay	For setting Route and taking "OFF" Signal in RRI
5	UCR	Route Checking Relay	Ensures Correct Route Set
6	Co UCR	Calling 'ON' Signal Route Checking Relay	Ensures Correct Route Set For calling 'ON'
7	HR/HHR/DR	Signal control Relays for Yellow / Double Yellow/ Green	Allows Signal to take 'OFF'
8	UHR/UR/UGR	Signal control Relays for Route	Allows Route Lamps to burn
9	HPR/HHPR/DPR	Repeater relays of Signal control Relays	Used in Locations
10	RECR/HECR/ DECR/UECR	Signal Lamp proving Relays for Red/Yellow/Green /Route etc.	When picked up, Proves Lamp is burning
11	ASR/ALSR	Approach Lock Stick Relay	When pick up , Route free When drop , Route locked
12	OVSR	Over lap Stick Relay	When drop , locks points in Overlap
13	UYR1, 2, 3...	Sequential Route Release Relays	Proves directional arrival of a train in the set route.
14	TLSR	Track Left Stick Relay	Used in RRI for Sectional Route Release for Leftward movement
15	TRSR	Track right Stick Relay	Used in RRI for Sectional Route Release for rightward movement
16	GNR	Signal Button Relay	Picks up when signal button is pressed
17	UNR	Route Button Relay	Picks up when Route button is pressed
18	WNR	Point Button Relay	Picks up when point button is pressed
19	CH1NR,CH2NR	Crank Handle Button Relays	Picks up when crank handle button is pressed
20	Z1NR, Z2NR.	Siding Control Button Relay (S)	Picks up when siding control button is pressed
21	NWWN	Point common button Relay (normal)	Pressed along with point button for Normal operation.
22	RWWN	Point common Button Relay (Reverse)	Pressed along with point button for Reverse operation.
23	GNCR	All Signal Button Normal Relay	Drops when any signal button is pressed
24	UNCR	All Route button Normal Relay	Drops when any Route button is pressed
25	WNCR	All point button Normal Relay	Drops when any Point button is pressed

S.No	Nomenclature	Description	Remark /Function
26	NNCR	All panel Button Normal Relay	Drops when any panel button is stick-up
27	GXJR	Signal Lamp Proving Relay	All Signals Burning
28	WXJR	Point Indication Proving Relay	Point Indication OK
29	GXYNR	sig amp Failure Ack. Button Relay	Buzzer Mute
30	GECR	Signal Aspect Checking / Proving Relay	Signal Not Blank
31	MECR	Signal lamp Main Filament Proving Relay	Indicates Main Filament Burning when in picked up condition
32	WLR/NWLR/RWLR	Point Lock Relay Normal/Reverser	Point Free
33	WNR / WRR	Point Normal / Reverse control Relay	First Relay to pick up in point control cct.
34	WJR	Point Time control Relay	Controls DC 110V to point motor for a fixed time.
35	WXR	Point Special Relay	Controls DC 110V to point motor
36	NWR / RWR	Normal / Reverse point operating Relay	Final Relay for point operation
37	NWKR	Normal Point indication Relay	Picks up when point set and locked in Normal
38	RWKR	Reverse point indication Relay	Picks up when point set and locked in Reverse
39	NWSR / RWSR	Normal / Reverse point indication stick Relay	Indication stick relay
40	NCR / RCR	Point Normal / Reverse Contact Relay	Switch control relays
41	EGGNR	Emergency (Group) signal cancellation button relay	To put back signal to ”ON”
42	EUUYNR	Emergency Route cancellation button Relay	To release Route
43	EWNR	Emergency Point Operation Button Relay	Point operation in case of Track cct. Failure
44	LVR	Low voltage Relay	Drops for low AC 230 voltage
45	SLR	Power ‘ON’ Ack. Relay	-
46			-
47	JSR	Time Stick Relay	Pick up with HOT contact
48	JR	Timer Relay	Pick up with Cold contact make
49	JSLR	Timer Stick lock Relay	Initiates Timers
50	NJPR	Normal Timer (out) proving Relay	Pick up after 120 sec.
51	RJPR	Reverse Time proving Relay	Proves JSLR‘s and NJPR’s are dropped
52	CHLR	Crank Handle Lock Relay	
53	CHNR	Crank Handle Normal Relay	
54	CHPR	Crank Handle Proving Relay	
55	CH (IN) PR	Crank Handle (IN) Proving relay	
56	CHYNR (T)	Crank Handle slot Relay (Trans)	
57	CHYRR (R)	Crank Handle slot Relay (Receive)	
58	Sdg. NPR	Siding Normal Proving relay	
59	LXPR	Level Crossing Proving Relay	
60	LXNR	Level Crossing Normal Relay	

S.No	Nomenclature	Description	Remark /Function
61	LX(IN) PR/LXCR	Level Crossing Key 'IN' Proving Relay	Used at Location
62	ASIWR	Auto set point Relay – one	Auto setting starting relay – for chain operation
63	AS2WR	Auto set point Relay – Two	Auto setting starting relay – for chain operation
64	WWR	Auto chain point control Relay	Maintain the time 3 sec. Time gap between points
65	WWFR	Auto point operation final normal Relay	When picks up, confirms that the chain operation command is sent to all points and feed to chain operation is seized

***Note** : - All types of relays mentioned above are not necessarily be used in every RI (British) systems. Depending upon the type of panel, using switches or buttons or a combination of both, the relays with specific nomenclature are used. Similarly the list of nomenclature of relays mentioned above is not complete. Zonal railways may use different nomenclature relays to suit local conditions and requirement.*

4.2 Description of Relays with Circuit (Ref. Layout Fig No 3.1)

4.2.1 SMCR/SMR: Station Masters Control Relay

This relay is energized when the SM's panel key is `IN' and turned to Normal. The Energisation of SMCR/SMR relay provides authorized operation of all the functions on the panel. When SM's key is turned to reverse and taken out from panel by SM, prevents un-authorized operation and locks the panel in the last operated position.

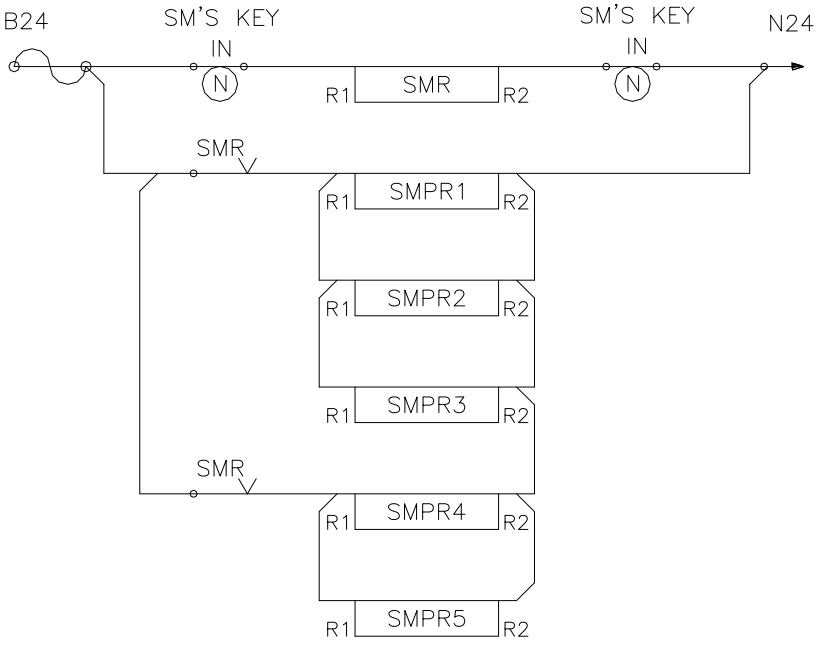


Fig No : 4.1

The pick up contacts of SMCR are used in knob circuits, button circuits, point operation circuits, route initiation circuits, route cancellation circuits, emergency circuits, crack handle circuits, timer circuits etc. Repeaters of SMCR may be made as required.

4.2.2 Track Stick Relay (TSR) Circuits.

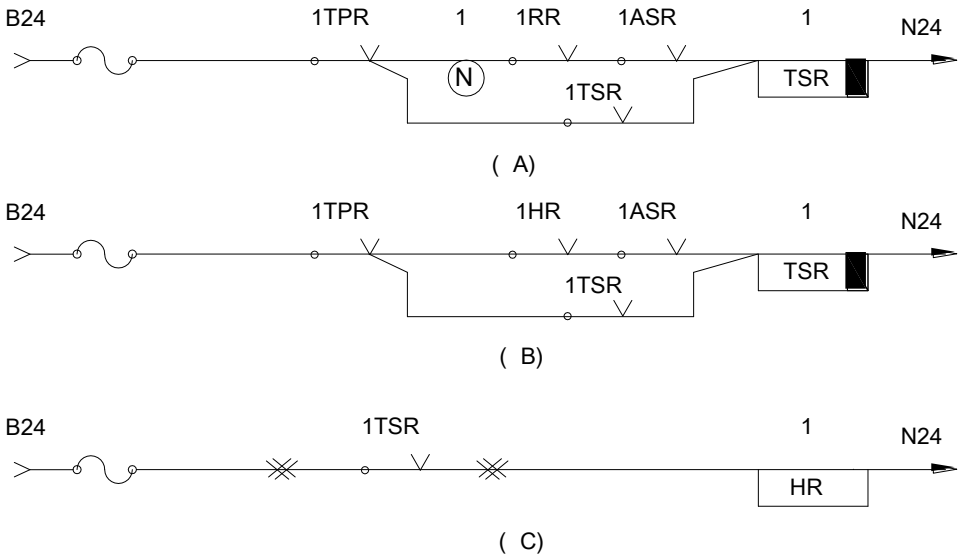


Fig No : 4.2

This is a one signal-one train (one movement) circuit. When a signal is taken off for a train and the train passes the signal, the TSR ensures that the signal is put back to 'ON' immediately. The TSR also ensures that the signal does not Reclear automatically, though knob is left in Reverse and all other conditions favourable. The stick relay is controlled by the first track circuit immediately in advance of the signal and the normal position of the concerned signal knob.

The pickup contact of the relay is used in the signal control circuit (HR). After the train passes the signal and the control track is occupied, TSR drops and the signal is put back to `ON'. To pick up TSR again, the signal switch has to be made normal and/or the dropping of controlling relays RR, HR and picking up of ASR. Only after picking of TSR, the signal knob can be reversed to take off signal for the next train. Thereby TSR ensures one signal – one train feature.

FIG 4.2(A) is with signal switch, FIG 4.2(B) is with signal Button.

A combined TSR circuit can be made for signals leading to the same route (ie.signals conflicting in nature) and having common controlling track circuit. For Home signal with `CO' ON & Shunt on the same post or starter signals of different lines leading towards same route or a starter signal with shunt below it. It is only to reduce power consumption and economise number of TSR relays and associated wiring.

Figure 4.3 is combined TSR circuits with separate switches for signals.

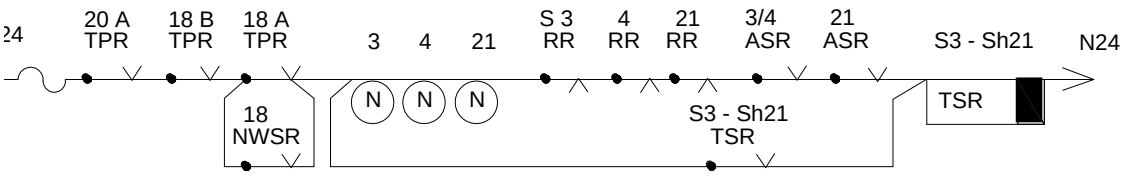


Fig No : 4.3

It may be noted that the track circuit immediately after the signal or nearest common TC must be taken to replace the signal soon after the train passes. Hence in big yards where it is not possible, separate TSR may be made.

4.2.3 Signal knob Reverse Relay (RR) Circuit

On panels where knobs/switches are provided for operation of signals, the knob reverse relay `RR' is used. After the points are correctly set and locked, the signal knob is turned with SM's key `IN', the `RR' picks up, then the UCR picks up, ASR drops and HR picks up and the signal is taken off. On complete arrival of train the signal knob is turned back to normal position and RR drops and the route gets released.

The switches used are 2 position type – NORMAL and REVERSE. They can be turned to clockwise or anti-clock wise depending upon the direction of movement of train.

NORMAL : Signal will be at 'ON' condition.

REVERSE: Knob reverse relay RR picks up provided conflicting RRs in drop. The signal will be taken off provided all other conditions are favourable.

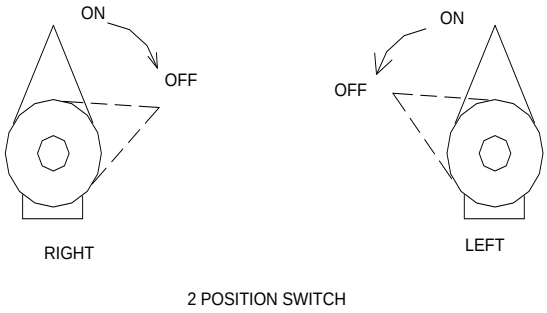


Fig No : 4.4

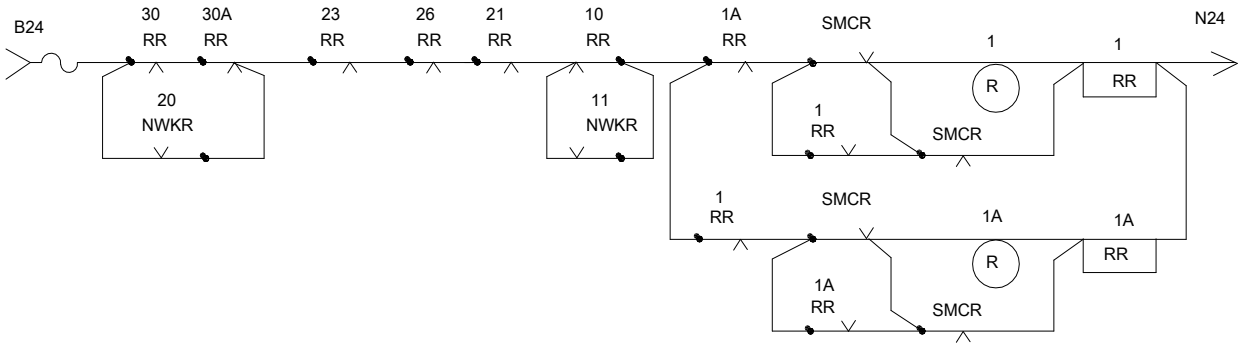


Fig No : 4.5

Bridging of SMCR front contact with respective RR front contact facilitates locking up of SM's panel after signal is taken off and prevents rising of signal when panel is locked. Similarly bridging of R band of signal switch with drop contact of SMCR prevents unauthorized normalization of signal in case SM locks up the panel.

4.2.4 ROUTE CHECKING RELAY CIRCUIT (UCR)

Once the points are set in to the required position by operating point knobs manually, the setting of route is completed.

Energisation of NWKR/RWKR indicates that the points are set and locked. After setting the route, it is to be checked. This is achieved by picking up UCR (Route Checking Relay).

The features of UCR circuits are as follows:

(a) Each signal will have its own UCR. UCR will be named after the signal number.

(b) This relay is normally de-energized relay. It energizes when ever signal knob is reversed or signal knob reversed and route button pressed, provided all other required conditions are available, viz.,

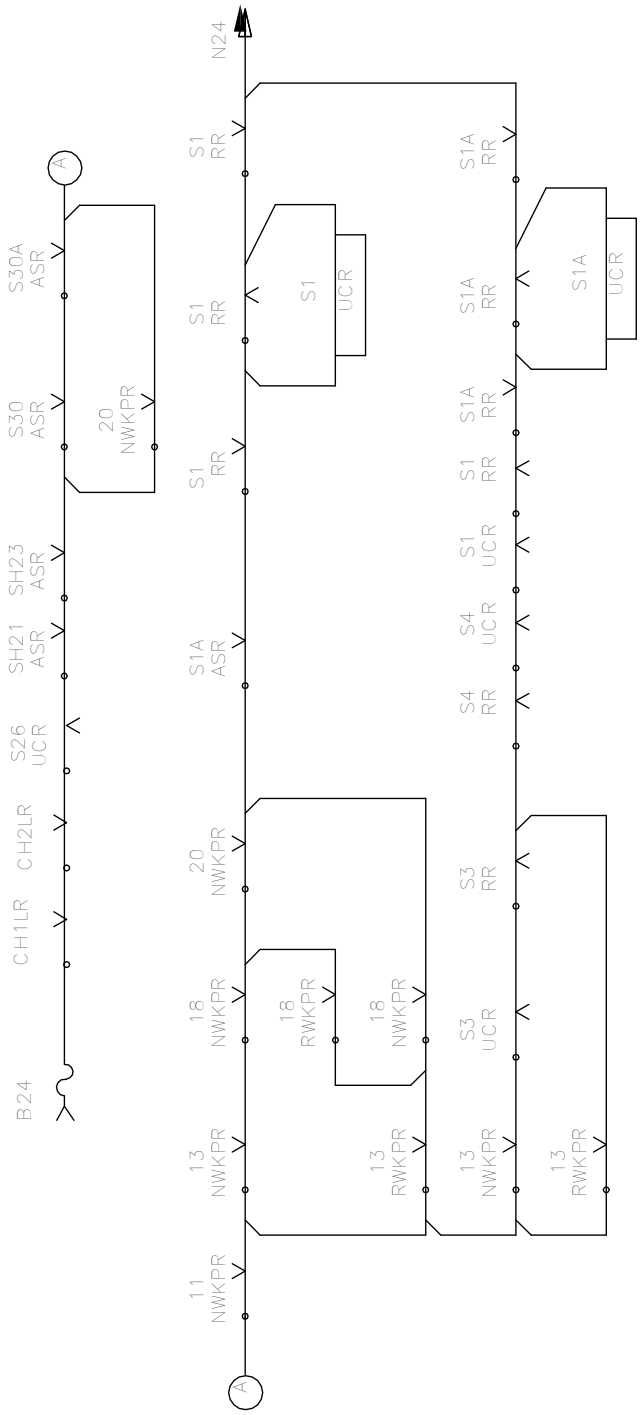
(c) In UCR circuit all points in route, overlap and isolation (set& locked) are proved.

(d) To achieve locking of conflicting signals, Front Contact of ASRs or back contacts of UCRs of conflicting signals are proved in UCR circuit.

(e) CH IN is also proved in UCR, so that once checking completed and route locked, further route should not be altered mechanically by cranking.

(f) UCR front contact is proved in HR circuit.

(g) UCR back contact is proved in ASR circuit. This is utilised to drop ASR as soon UCR picks up i.e., to lock the Route as soon as it is checked. Back contact of UCR in ASR circuit also ensures that Signal knob is normalised before releasing the route.



UCR CIRCUIT
Fig : 4.6

4.2.5 Approach (Lock) Stick Relay Circuits (ASR/ALSR) with Sequential Route Release (UYR1, 2,3, TSSLR) and Timer Cancellation Circuits: -

ALSR is a normally energized relay. Whenever a route is set and route-checking relay UCR is energized it causes ALSR to drop and there by locks the route i.e., locks all the points in the route including in overlap & isolation.

It is necessary to lock the route before a signal is taken off. Every signal will be having one ALSR and the drop contact of ALSR is proved in HR pick up circuit to ensure locking of that signal route before the signal is cleared.

It mainly consists of 3 circuits

(a) Indication locking.
(b) Back locking.
(c) Approach locking

Once ASR picks up the locking effect on the signal route is released and all the points will become free. Hence before a route is released, it must be ensured that the signal is normal and the movement is completed and the route tracks are clear. To achieve that indication locking, route locking & approach locking applicable to a signal, are proved in ASR circuit.

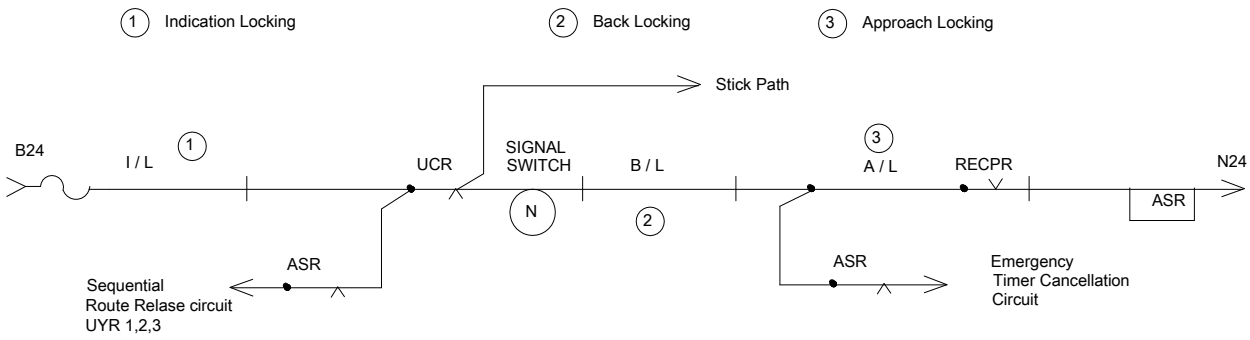


Fig No : 4.7

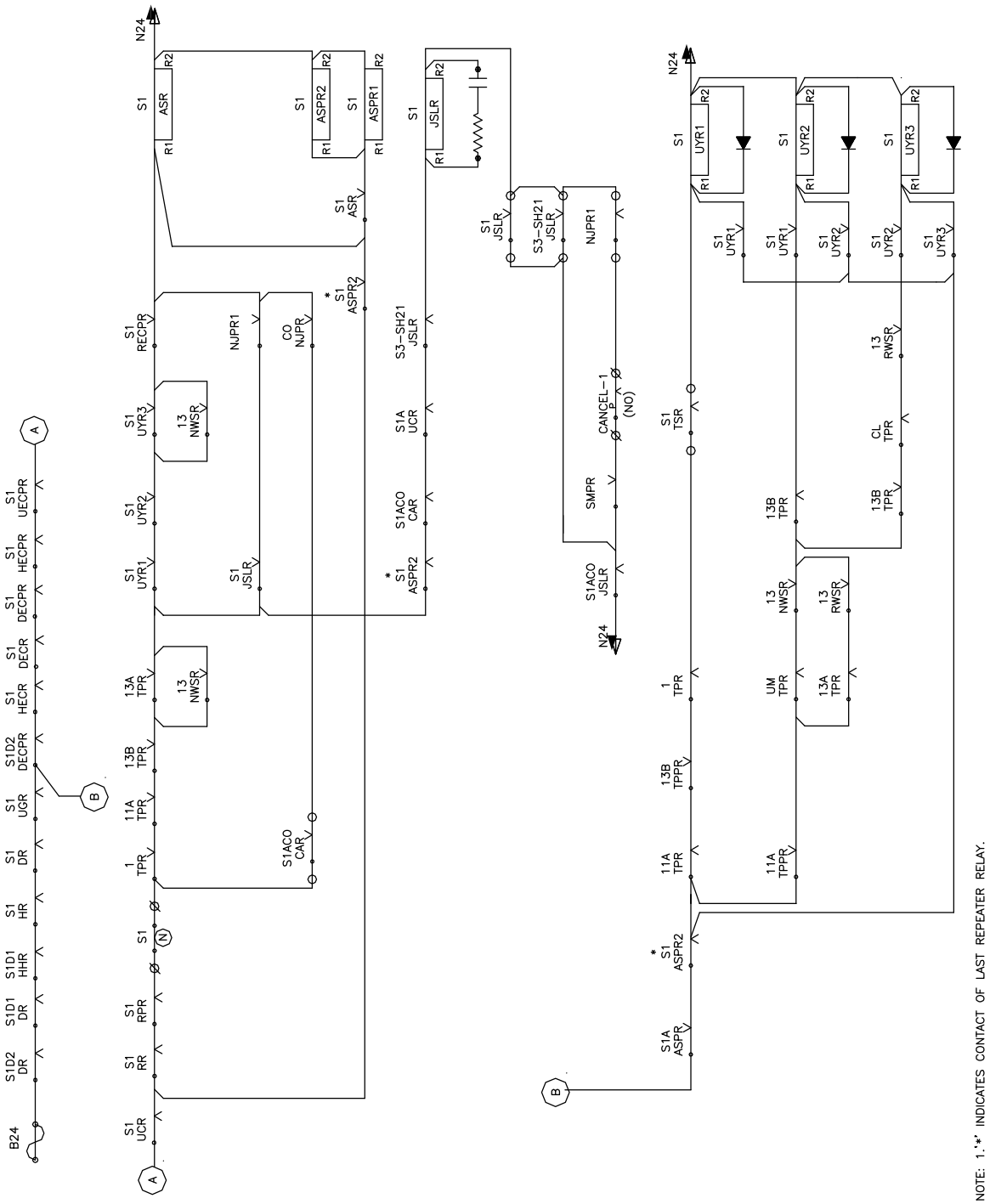
ASR can be energized by 4 ways.

(i) Only after the train travels on the entire route sequentially and clears the route.

(ii) On cancellation with time delay when dead approach provided or approach track occupied.

(iii) On cancellation without any time delay when approach track provided and not occupied by train.

(iv) **Calling on Cancellation**: When ever due to Back locking track circuit failures, the route is locked (ASR not picked) to cancel the locked route operate calling on knob Reverse there by calling on ASR drop. Immediately calling on knob is normalized and calling on cancellation is initiated (CO-CAR up). Calling on NJPR picks up after 120 seconds time delay which picks up the Main signal ASR. This way the route is released with out S&T Person's intervention.



ASR CIRCUIT
Fig No: 4.8

(i) 1ST WAY - By actual travel of train on the entire route sequentially and clears the route:

Picking up of route checking relay UCR disconnects the positive feed to ASR, the relay drops. When ASR drops, all the points in the route & isolation are locked, since ASR pick up contact is used in the point control circuit, the point can not be operated and the route is held locked. Subsequently the signal controlling relays. HR/DR etc, and the indication relays HECPR, DECPR etc will pick up.

Then the train travels over the set route and ASR picks up only on the following conditions:

- The train has traveled over the set route and cleared the entire back lock tracks
- The sequential route release relays UYR 1,2,3 have picked up through ASR"s back contact indicating the sequential, directional movement and arrival of train.
- The signal is put back to `ON' and the controlling relays & indication relays have dropped.
- The controlling switch if any, has been normalized.
- The track circuits in the entire route upto Berthing track have picked up behind the train.

Once picked up, ASR gets its stick feed, bypassing the switch normal contact, Back lock track circuits and approach locking circuits etc. This is to prevent dropping of ASR, due to back lock track circuit drop during other signal movement, track circuit failure and switch contact failure etc. subsequently when signal is not given. Once ASR picks up , the locking on the points is released. Once ASR pick up, on arrival of a train, these UYR relays drop, to be activated for another signaling movement. The ASR stick path bypasses this sequential route release path also once it picks up.

(ii) 2nd WAY - On cancellation with time delay when dead approach provided or approach track occupied.

Sometimes, it becomes necessary to cancel the route given for a train. The reasons can be

- The signal failed to take `off' and needs to be tried again.
- The train may required to be admitted into another route or another train from another route may need to be admitted first.

In any case it must be first ensured that the signal put back to `ON' (if already taken `off') and the train has not passed the signal and stopped in rear of the signal. In such case emergency cancellation is adopted.

After normalising the signal the SM operates Emergency Cancellation button/switch to initiate cancellation circuit. As shown in the circuit JSLR picks up through RJPR pick up (or ASR drop) and cancel switch/button pressed. Once JSLR relay picks up, it gets stick path. Through JSLR front contacts supply is extended to timer, which gives output after a predetermined time (for running signals 120 seconds and subsidiary signals like shunt etc 60 seconds) and picks up NJPR. The pick up of JSLR & NJPR allows ASR to pick up and stick. Once ASR picks up, the timer circuit drops.

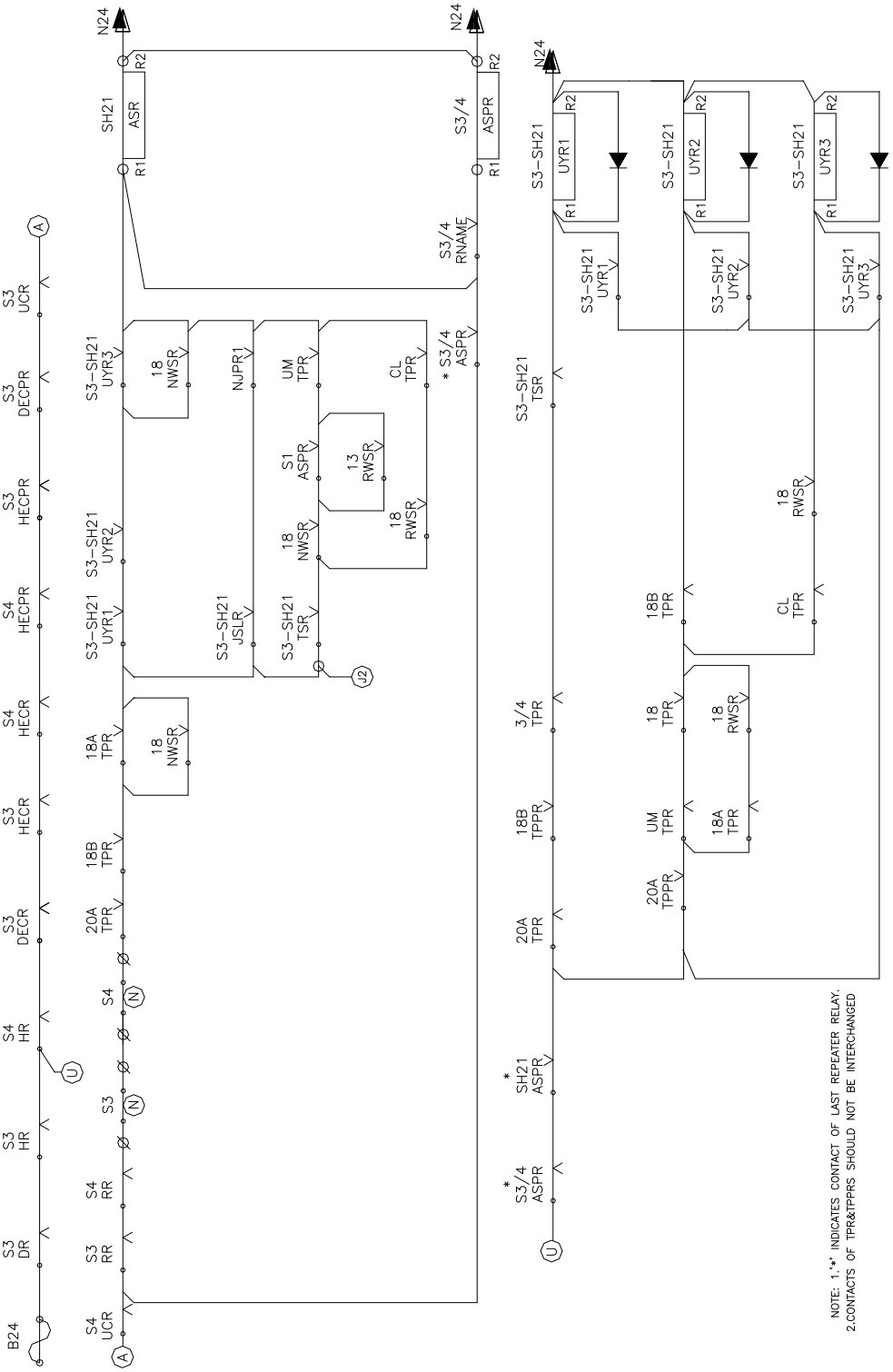
(iii) 3rd WAY- On cancellation without any time delay when approach track provided and not occupied by train.

Once ASR drops on clearance of signal, it can also be energized on cancellation without any time delay. But this is possible only when the train is not in approach, but sufficiently far away and not occupied the approach track. Then the SM cancels the signal & route, ASR picks up immediately without any time delay. To ensure that the train is not in approach of the signal and is far away, sufficient length of track circuit (normally the length equivalent to breaking distance) is provided in rear of a signal and the track circuit clear is proved in cancellation path without time delay.

For home signal cancellation the length of track circuit between Home and Distant including Calling 'ON' Track circuits, for M/line starter, berth in track plus other track circuits in rear, of sufficient length are provided as approach track. For L/Line starter only berth in Track and for other signals such as shunt, only one track in rear are provided as approach track for cancellation without time delay. If the approach track is clear, then the ASR picks up immediately. If they are already occupied at the time of cancellation, then timer circuit will be activated.

It may be noted that every signal will have one ASR. But a signal with Calling ON signal, and/or a shunt signal below it can have a common ASR. Similarly starter signals leading to same route can also have a common ASR. This is purely for economical reasons and the circuits becomes smaller and no. of relays & wiring can be reduced considerably in major yards.

Every cancellation is registered in a counter.



Combined ASR Circuit of Starter Signal 3 & 4

Fig No : 4.9

4.2.6 SEQUENTIAL ROUTE RELEASE CIRCUITS: (UYRs)

The Route locked for a signalled Train movement should get released only after the train has arrived on proper signal in proper direction and the track circuits have been sequentially actuated by the train. This is registered by picking up of sequential proving relays UYR's. (some railways call them as TPZR, TSSLR etc.). The pick up contact of UYR's are used to energise ASR in the normal route release path.

To ensure that the route is getting released only after the sequential occupation of tracks by a train arriving in proper direction, the UYRs are picked up in a pre-determined fashion and not by accidental dropping /bobbing of back lock track circuits or power supply fluctuations.

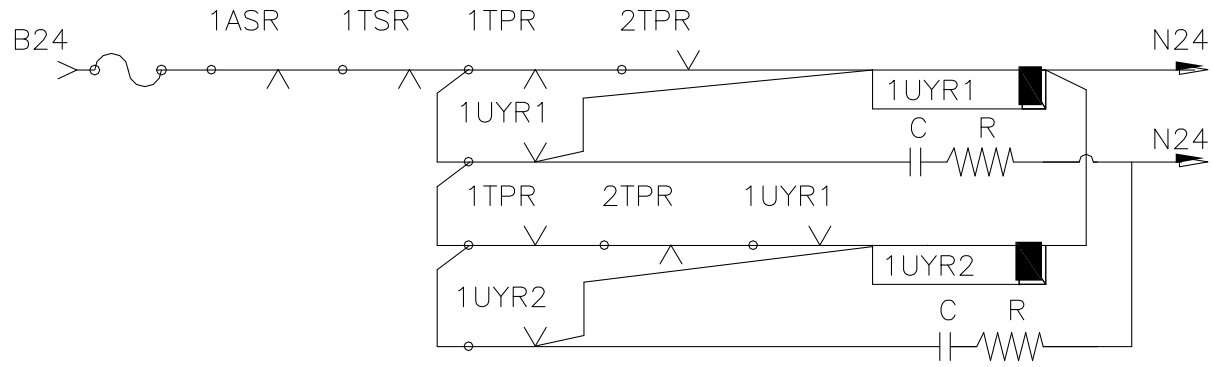


Fig No: 4.10

Following is the sequence of train movement and sequential operation of TPR's.

When the train is on 1st track only, 1TPR down, 2 TPR up
When the train clears 1T and occupies 2T, 1TPR up, 2TPR down.

With the first sequence, UYR_1 picks up. With the second sequence and UYR1 picks up, UYR_2 picks up. These above two sequences are possible only with the passage of train and not due to battery failure or track bobbing or power failure.

Now days in these circuits, the de-energized contacts of two consecutive track circuits TPRs and pick up contact of next track are proved together to pick up UYRs.

In addition to this, it is also a practice to include the back contacts of all track circuits in the route including berthing track in route release circuit relays sequentially to guard against permanent energisation of any track relay either due to mechanical or electrical problems.

Why UYR's are made slow to release?

ASR picks up through UYR's front contacts and UYR's will be up through drop contact of ASR. Therefore, it is necessary to ensure that after the train arrival, UYR's do not drop unless sufficient time is given for ASR to pick up and stick.

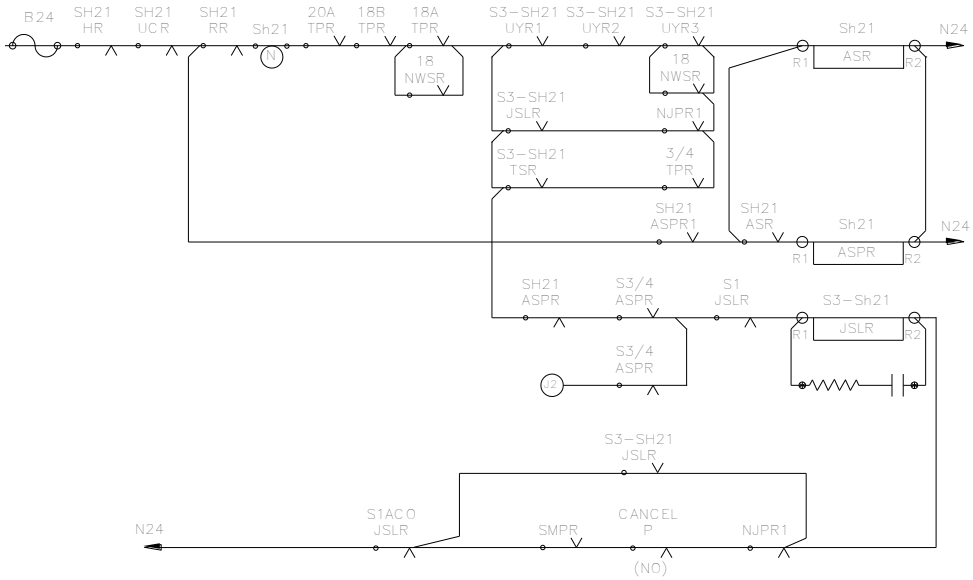
4.2.7 ROUTE RELEASE BY TIME DELAY (EMERGENCY CANCELLATION)

While dealing with ASR, it was explained that in case of Dead approach locking, the route will be released only two minutes after the normalisation of signal knob, if the train has not passed the signal.

Let us examine how the time delay, is made effective. This is made effective by one of the following means:

(a) Thermal element relay (QJ1).

(b) Electronic Timer Relay (ET).



Note: j2 connected to Fig No: 4.9
Fig No: 4.11

At some stations, a common time element Relay is used for releasing routes of a group of signals or all yard signals. In that case, two more relays are used along with it, viz. RJPR & NJPR. In addition an individual 'JSLR' is provided, one for each signal or for a small group of conflicting signals. This, along with the common NJPR, provides route release with time delay. While NJPR picks up at the end of Timer operation, RJPR is used to prove the dropping of all concerned JSLR's and NJPR's before a Timer operation is initiated i.e., one timer operation for cancellation of one signal at a time.

When SM has to cancel the route, he puts back Signal switch to normal. With this HR drops following which HECR etc, drops. JSLR picks up through ASR drop contact when route cancillation button is pressed. Now a day's thermal Timer is getting replaced by Electronic Timer.

4.2.8 ELECTRONIC TIMERS

To get the required time delay, now-a-days electronic timers are used. The electronic timers are having solid state electronic circuits inside. This gives an output, two minutes after the input is given.

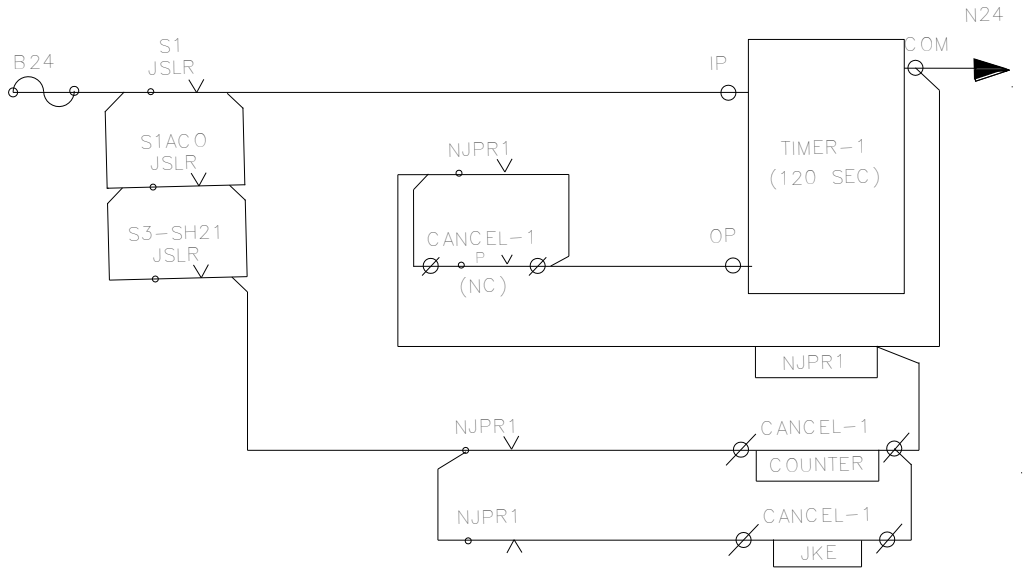


Fig No: 4.12

4.2.9 Overlap Stick Relay Circuits - OVSR & OVJSLR

Whenever a signal is taken off, the points in the route, in overlap and in isolation are to be held in locked position till the train completely passes and clears them. As far as points in the route are concerned, they are locked till the train clears and the back lock tracks have picked up and the ASR picks up. But once ASR pick up, the locking affect on overlap points is released and the points in the overlap can be operated, which is undesirable.

If the points in the overlap are also controlled by another signal in advance and that signal is also taken `off', then the points can not be operated even though ASR of signal in rear is picked up. But/otherwise while the train is approaching the overlap and before it is ensured that the train has stopped in rear of the overlap points, they become free and can be operated which is not safe.

For example, home signal S1, ASR is picked up after the train clears the back lock tracks, but the train is still rolling on berthing track, where as the overlap points beyond starter become free if starter is not given. This is considered undesirable. If starter is given then they are held further. In case starter is not given, still the overlap points should be held in locked position for a specified time (120 seconds) to ensure that the train stopped in rear of starter, only then the points should become free. During this time, if the train over shoots, then the points can not be operated. To achieve this feature, OVSR circuit is adopted. OVSR is normally energized and drops whenever the signal is taken 'OFF' leading towards that overlap.

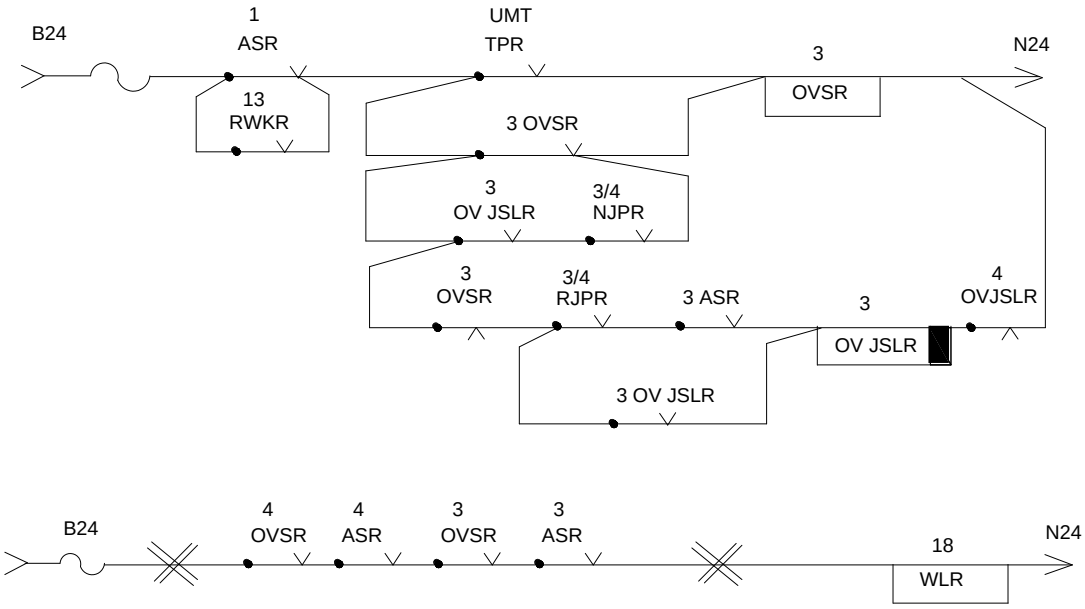
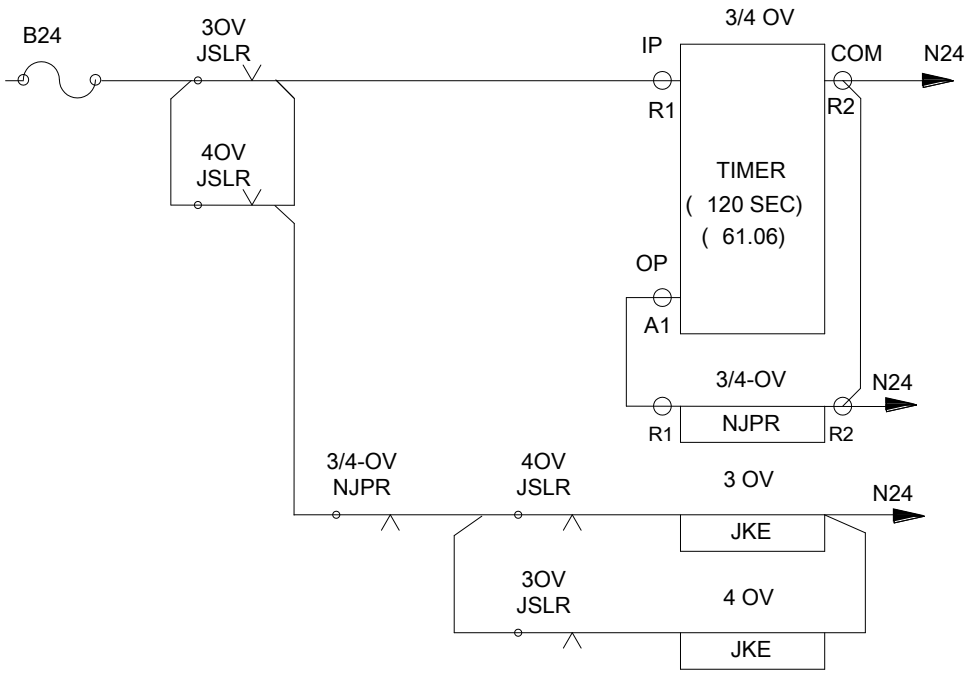


Fig No : 4.13



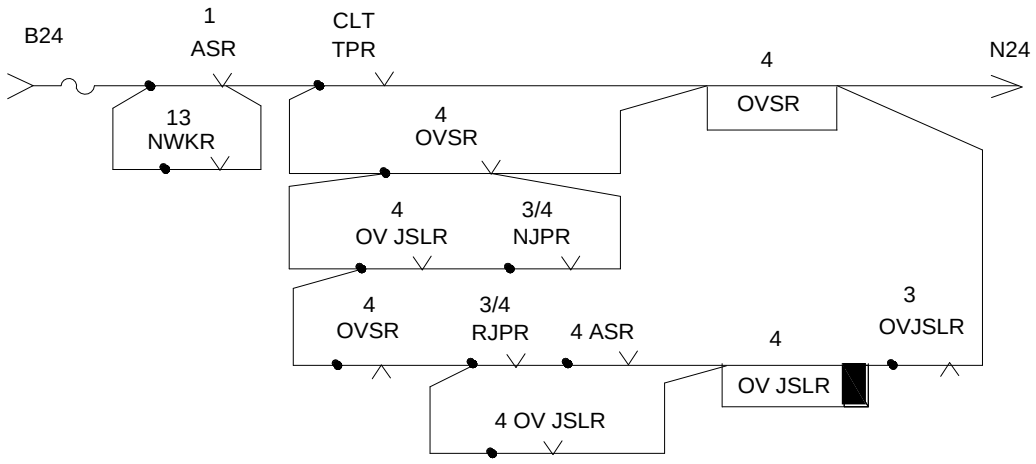
OVNJPR Circuit

Fig No : 4.14 (a)

When a signal has more than one route, then the no. of OVSR relays will be equal to the no. of routes available for that signal. OVSR relay is designated with starter number, beyond which the overlap is considered.

In the above circuit, 3 OVSR is a normally energized relay. When Home signal No.1 is taken `off' to up main line then 1 ASR drops which in turn drops 3 OVSR. Thereby 18 & 20 WLRs drop and the overlap points 18 & 20 for Home signal no.1 are locked. On clearing the back lock tracks by the train, 1 ASR picks up. But OVSR relay does not energize, since UMT is occupied by the train. To pick up 3 OVSR the train has to run through and clear UMT. In such case starter No. 3 will be given and 3 ASR locks the point.

On the other hand, if the train has to be stopped, 3 OVJSLR will pick up with 3 ASR pick up contact. With 3 OVJSLR up, timer circuit starts and after 120 seconds NJPR picks up. With JSLR & NJPR up, 3 OVSR pick up and gets its stick feed. The stick path of OVSR is to prevent dropping of OVSR during track circuit failure. Once OVSR picks up OVJSLR drops which in turn cut off power to timer & NJPR drops.



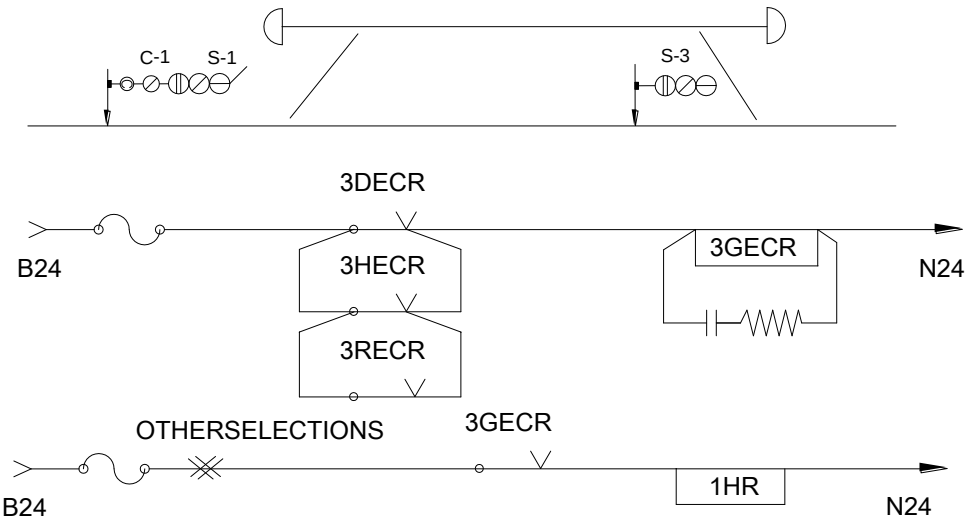
4 OVSR

Fig No : 4.14 (b)

4.2.10 PROVING OF THE ASPECT OF SIGNAL AHEAD (GECR) (Red Lamp Protection)

In colour light signalling, there is a possibility of signal going blank due to lamp failures or power supply interruptions. This is undesirable since the Drivers are likely to miss the signal, which may result in an accident. To avoid this, it is a practice to prove the aspect of signal ahead, in the rear signal. For example, for clearing a home signal, any one of the aspect of starters in advance will be proved.

GECR is made slow to release to cater for the aspect changing of signal in advance.



GECR CIRCUIT & ITS USE IN HR

Fig No : 4.15

4.2.11 SIGNAL CONTROL RELAY CIRCUIT

The second stage of interlocking is carried out at signal clearance stage i.e. at HR stage. At HR stage all the conditions to be satisfied for clearing a signal are proved.

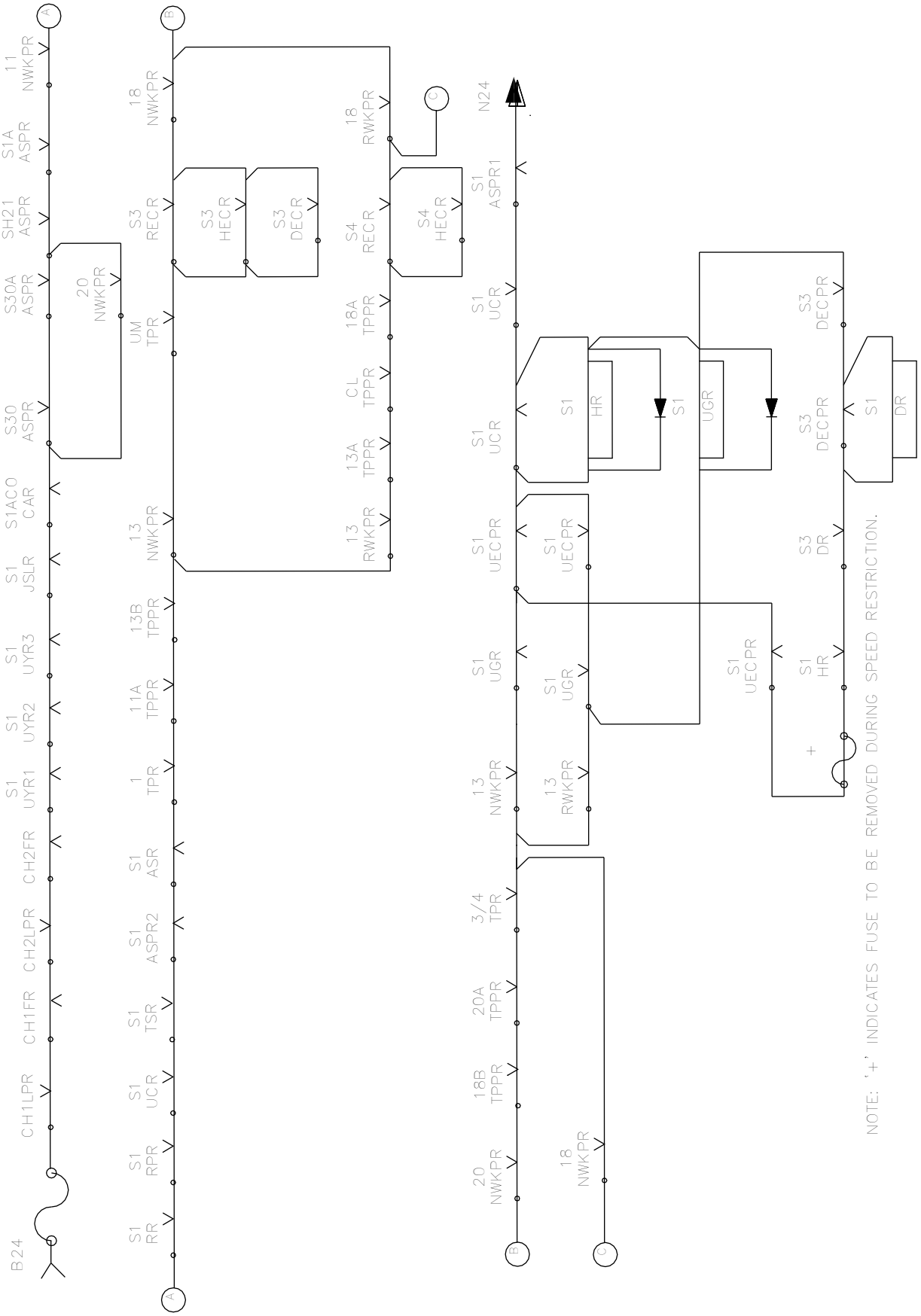
(a) Crank handles are 'in', i.e. proved by CHLRs up and CHFRs down.
(b) Route Release Relays have de-energized after the last train movement (UYR1, UYR2 etc., are down) (In Southern Railways UYR_1 and UYR_2 are called as TSSLR and TPZR respectively)
(c) No cancellation is initiated i.e. JSLR down.
(d) Interlocked LCs if any in the Route and overlap are locked and closed against Road traffic (LXPR up) and held locked till the passage of that train is over.
(e) Conflicting signals are at 'ON' is proved by proving the front contact of ASRs or back contacts UCRs of conflicting signals.
(f) All points in the route, overlap and isolation are set and locked i.e. Concerned NWKRs, RWKRs are in up condition.
(g) Concerned to its own signal i.e.
  - RR is up.
  - UCR is up.
  - ASR is down.
  - One signal - one train feature TSR up.

(h) All Back lock and controlling tracks are clear i.e. TPRs concerned are up.
(i) Signal ahead is not blank (GECR up or RECR/HECR/DECR UP)
(j) Route Indicator lamps are not lit for straight line (UHRs / UGRs and UECR down) (compulsory in case of Junction type Indicator)
(k) Route Indicator lamps are lit for loop lines (UGR or UHR and UECR up)
(l) Sidings in the route & overlap are kept normal siding KLPR/NPR up.
(m) Cross protection is provided for the signal control relay, by the Front contact of ASR or Back contact of UCR. These contacts are not favorable for signal clearance.
(n) Double cutting is provided by UCR up & ASR down.

4.2.12 Signal Control Circuits HR, HHR, DR.

The caution aspect of a signal is controlled by HR. Attention aspect and clear aspect are controlled by HHR & DR respectively. The 'ON' aspect (Red) is maintained through drop contact of HR. For Advance starter, the `ON' aspect is controlled by DR drop and for distant signal the normal aspect (ON) is single yellow, controlled by DR drop.

In the layout No 3.1, there are 3 routes for home signal No 1. It may be seen that the common loop line has two overlaps, i.e. with overlap point set to sand Hump and with overlap point set to main line. Therefore, HR of Home signal No 1 can pick up in 3 ways. The No. of paths depends upon no. of reception lines for a signal.



HR CIRCUIT
Fig No: 4.16

4.2.13 CALLING - ON SIGNAL

Calling-on signals are used now a days very widely to increase the efficiency of signalling system. Calling-on signal is an emergency manager, in the sense that, this is used when the main signal above has failed. C.O signal is taken off even for receiving a train on an occupied line. Therefore it is useful to deal with traffic during track circuit failure also. In all the latest installations C.O signals are being provided. With C.O signals, the detentions are minimized. The features of Calling-on signal are as follows.

(a) A Calling-on signal is a subsidiary signal.
(b) It has no aspect in the ON position.
(c) It shall be a miniature colour light provided with a `C' marker.
(d) C.O signals can be provided below any stop signal except Last Stop Signal.
(e) A Calling-On signal, when taken 'OFF' calls on the Driver of a train to draw ahead with caution, up to the next Stop Signal after the train has been brought to a stop even though the stop signal above it is at ON.
(f) C.O signal indicates to the Driver that he should be prepared to stop short of any obstruction.

(g) The calling-on signal shall not be capable of being worked at the same time as the main signal above or shunt signal below it, if any.
(h) It is desirable to provide track circuits at a suitable distance in rear and a time delay circuit to ensure that the C.O signal is taken OFF only after the train has been brought to a stop.
(i) A C.O signal shall detect all points in the route, which the main signal above detects excluding those in the overlap.

It is not required to prove any track circuit in Route and overlap for C.O Signal clearance. However, other conditions related to interlocking shall be the same as that of main signal above it. Calling-on track should be occupied for the prescribed time for clearing a Calling-on signal. This time delay is achieved by timers.

Calling on signal also has a control switch. Route is to be set as usual. To take 'OFF' a Calling 'ON' signal, the train must be stopped in rear of the main signal (below which the calling 'ON' is provided). A Calling-on Track circuit is provided, which drops on Train arrival there by S1A-COAR relay picks up by proving the following conditions. Co-on TPR↓, S1ACO-CAR↓, S1RPR↓and S1ARPR by passed by S1A-COAR front contact. when S1A COAR picks up SM gets buzzer and calling on circuit initiated. There by JSLR picks up, after time delay NJPR Picks up. JSLR and NJPR front contacts proved in HR circuit.

C.O signal will have separate UCR, ASR, JSLR, and HR. Route indicator above main signal is not lit for C.O signals.

On passage of train, the calling-on Route get released after a time delay of 120/240 sec after cancellation or sequential route release if route track circuits are not failed.

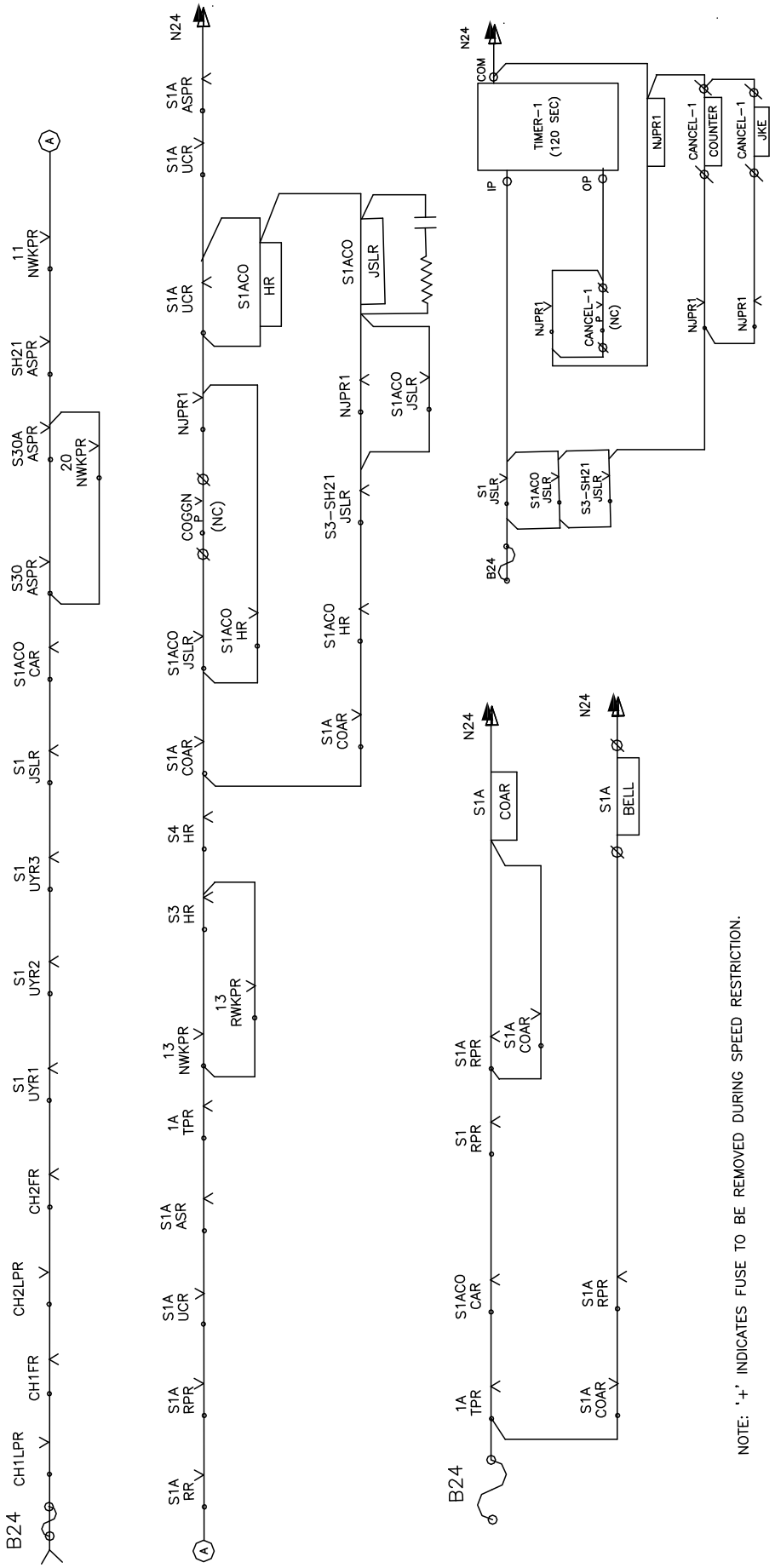

B24
CH1LPR
CH1FR
CH2LPR
CH2FR
S1 UYR1
S1 UYR2
S1 UYR3
S1 JSLR
S1ACO CAR
S30 ASPR
20 NWKPR
S30A ASPR
SH21 ASPR
11 NWKPR
S1A RR
S1A RPR
S1A UCR
S1A ASR
1A TPR
13 NWKPR
13 RWKPR
S3 HR
S4 HR
S1A COAR
S1ACO JSLR
S1ACO HR
COGGN P (NC)
NJPR1
S1A UCR
S1ACO
HR
JSLR
S1A ASPR
N24
S1ACO HR
S3–SH21 JSLR
NJPR1
S1ACO JSLR
S1A COAR
S1 JSLR
B24
COM
TIMER–1 (120 SEC)
IP
OP
N24
NJPR1
CANCEL–1 P (NC)
CANCEL–1 COUNTER
CANCEL–1 JKE
S1 JSLR
S1ACO JSLR
S3–SH21 JSLR
B24
N24
S1A COAR
S1A RPR
S1 RPR
1A TPR
S1ACO CAR
S1A COAR
S1A RPR
B24
N24
S1A BELL
NOTE: '+' INDICATES FUSE TO BE REMOVED DURING SPEED RESTRICTION.

Fig No: 4.17

4.3 POINT CONTROL & OPERATION CIRCUITS (WLR normally de-energized)

4.3.1 NCR / RCR circuit

In this, a two position point switch is provided with two relays, NCR (normal control relay) and RCR (Reverse Control Relay).

NCR is energized for normal operation of point when point knob is turned to normal.

RCR is energized for reverse operation of the point when point knob is turned to reverse.

The normal and reverse contacts of knob are bridged by SMR back contacts, thereby point remains in last operated position when the SM locks the panel. Either NCR or RCR always remains in energized position till the point knob is turned to the other side.

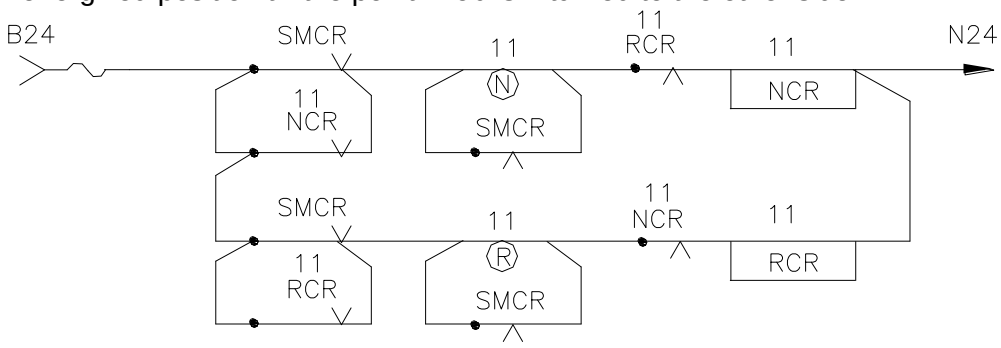


Fig No: 4.18

4.3.2 POINT LOCK RELAY - WLR

Here WLR is normally a de-energized relay. So normally the point is locked electrically. WLR relay gets energized whenever the point knob is turned from R to N i.e. NCR energized or point knob turned from N to R i.e. RCR energized, provided all other conditions are satisfied. When the point is set and indication relay is energized, drops the WLR and locks the point electrically.

(a) All the signal ASRs in whose route that point is included, are proved in up condition.

(b) All OVSRs for that point are proved in up condition.

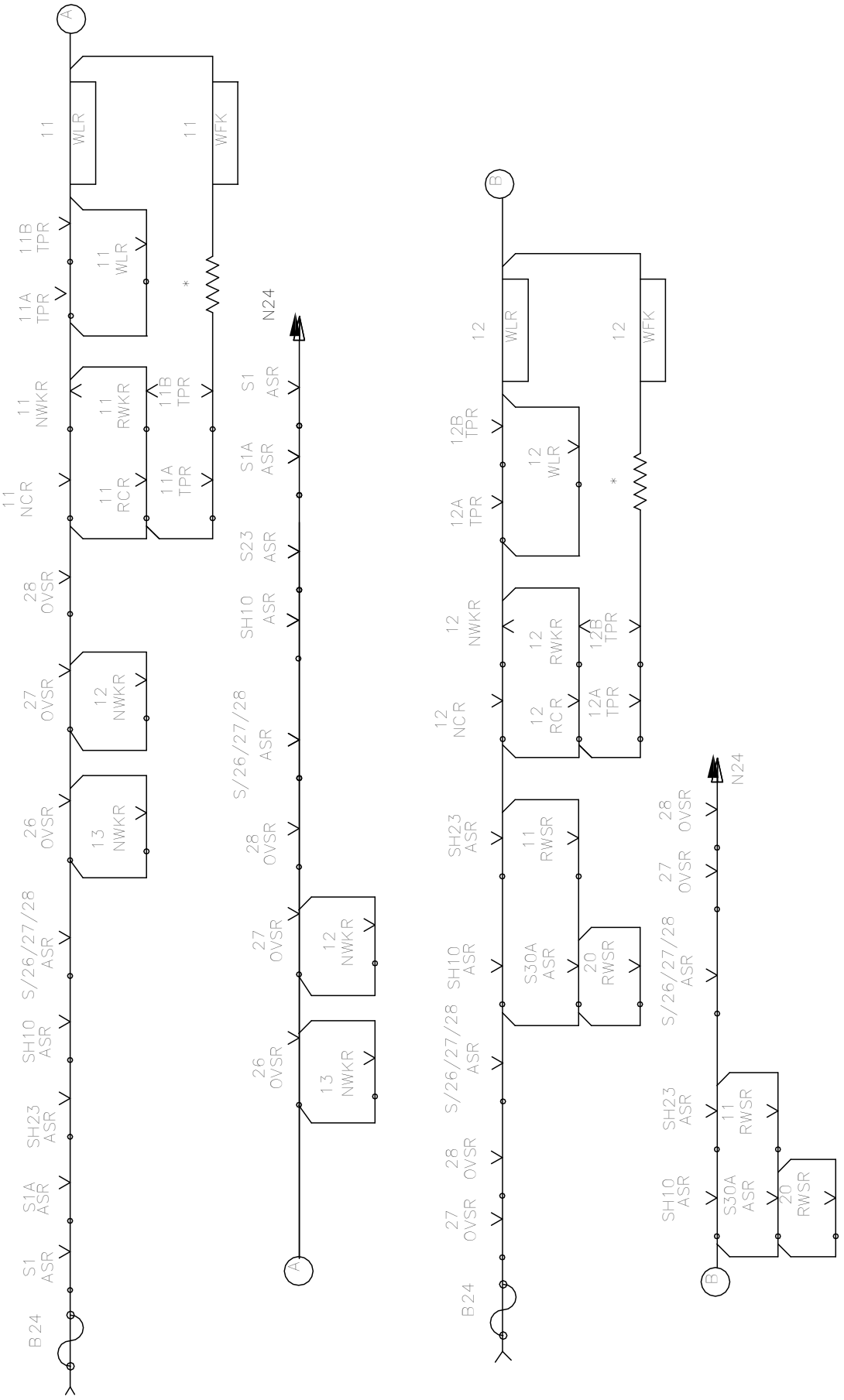
(c) Track locking is proved by its point zone tracks.

(d) Track locking is bypassed by its own WLR front contact as stick path. So that once a point movement is started, it completes its operation even the track down occurs during operation.

(e) In some railways crank handle 'IN' is also proved.

(f) When ever the signal is taken off, the concerned ASR drops and locks the point i.e. it does not allow WLR to pick up though the point knob is turned.

(g) WLR picks up when ever NCR or RCR is picked up by knob movement, provided all other conditions stated above are in favour. When WLR picks up it in turn picks up PCR (power control relay)-heavy duty QBCAI relay. Through PCR front contacts 110V DC for point operation is extended to location, point gets operated by point control circuit. Through the Indication circuit, NWKR/RWKR at relay room is picked up and makes WLR to drop. In nutshell it can be concluded that point operation initiated, point unlocked, point operated & set, point indication obtained and point locked again.



WLR CIRCUIT
Fig. No.4.19

4.3.3 NWR/RWR, POINT OPERATION CIRCUIT, POINT INDICATION CIRCUIT AT LOCATION (WNKR/WRKR) & AT RELAY ROOM (NWKR/RWKR)

(a) Whenever the point knob is turned, NCR/RCR picked up (reference to Fig. No.4.18) Provided SM's key is in.

(b) With NCR/RCR picked up, WLR is picked up. (Reference to Fig No.4.19)

(c) With WLR picked up, PCR1/PCR2 picks up. (Reference to Fig No.4.20)

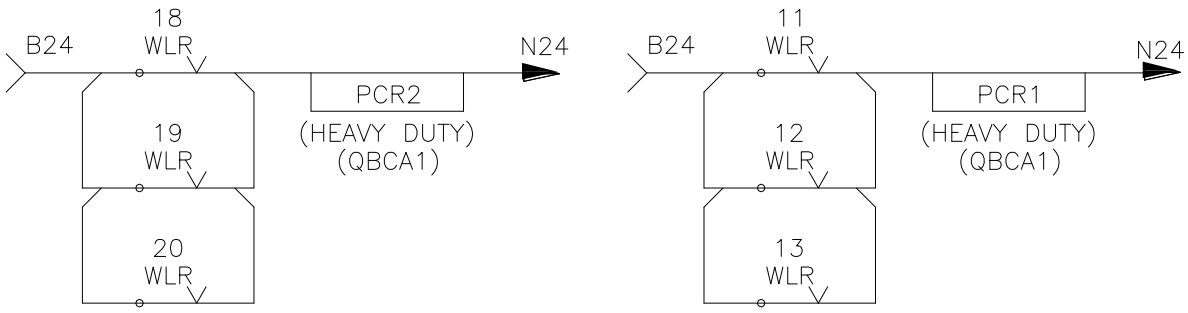


Fig. No.4.20

(d) PCR1/PCR2 picked up, 110 V DC for point operation is extended to location. (Reference to Fig No.4.21)

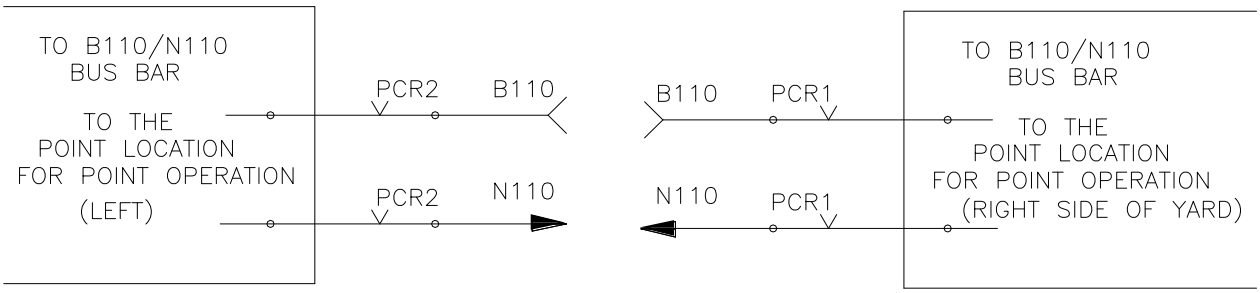


Fig. No.4.21

(e) With WLR up NCR down and RCR up, NWKR also drops. Thereby all indication relays& its repeater relays (NWKPRs, NWKSRs) drop. (Reference to Fig No. 4.27)

(f) With WLR up, all indication relays drop, NCR/RCR up, NWR/RWR will pick up at location (Reference to Fig No.4.22)

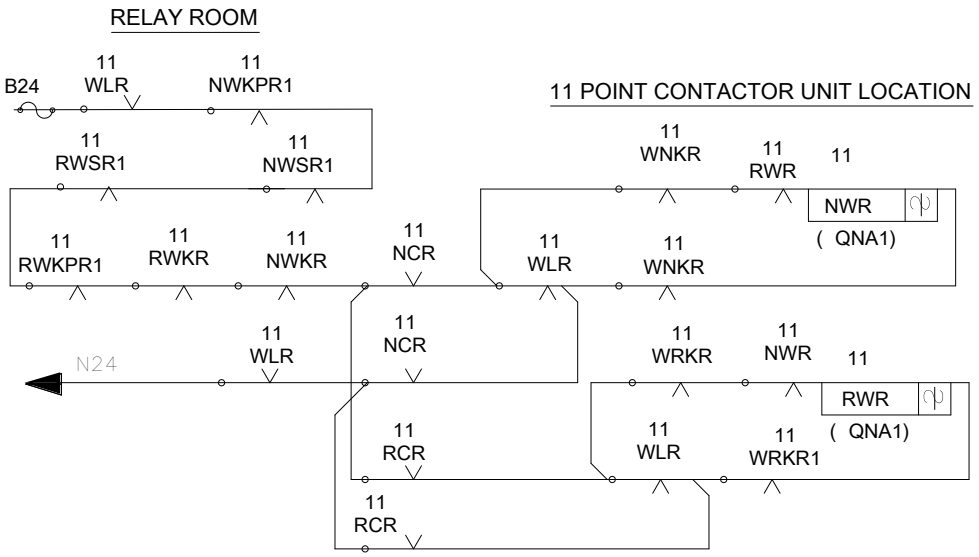


Fig. No.4.22

(g) With NWR/RWR picks up, WJR picks up. There by WXR picks up and sticks with its own front contact. With WXR picking up, normal feed to WJR removed but WJR held in pick up through time delay condenser circuit. (Reference to Fig No.4.23) with RWR pick up, 11WNKR drops.

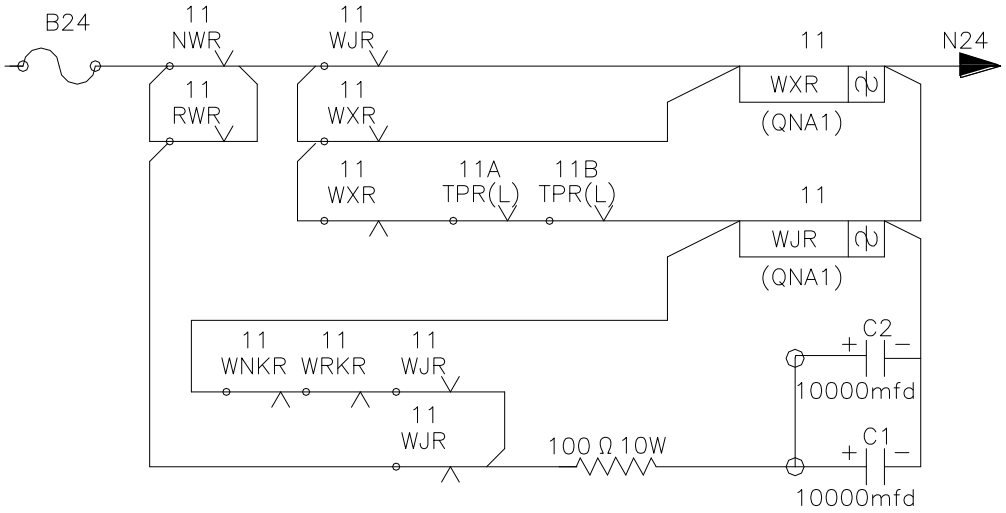


Fig. No.4.23

(h) With WXR, WJR, NWR/RWR up and WNKR/WRKR drop, WCR (QBCAI relay) picks up. (Reference to Fig No 4.24)

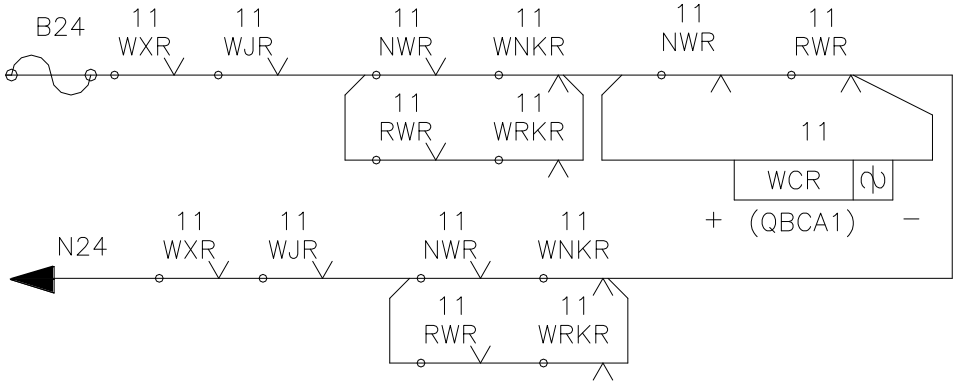


Fig. No.4.24

(i) With WCR & NWR/RWR up, 110V DC available on bus bar is extended to point machines at A end & B end parallelly. Both points are set to Normal or Reverse. (Reference to Fig No.4.25)

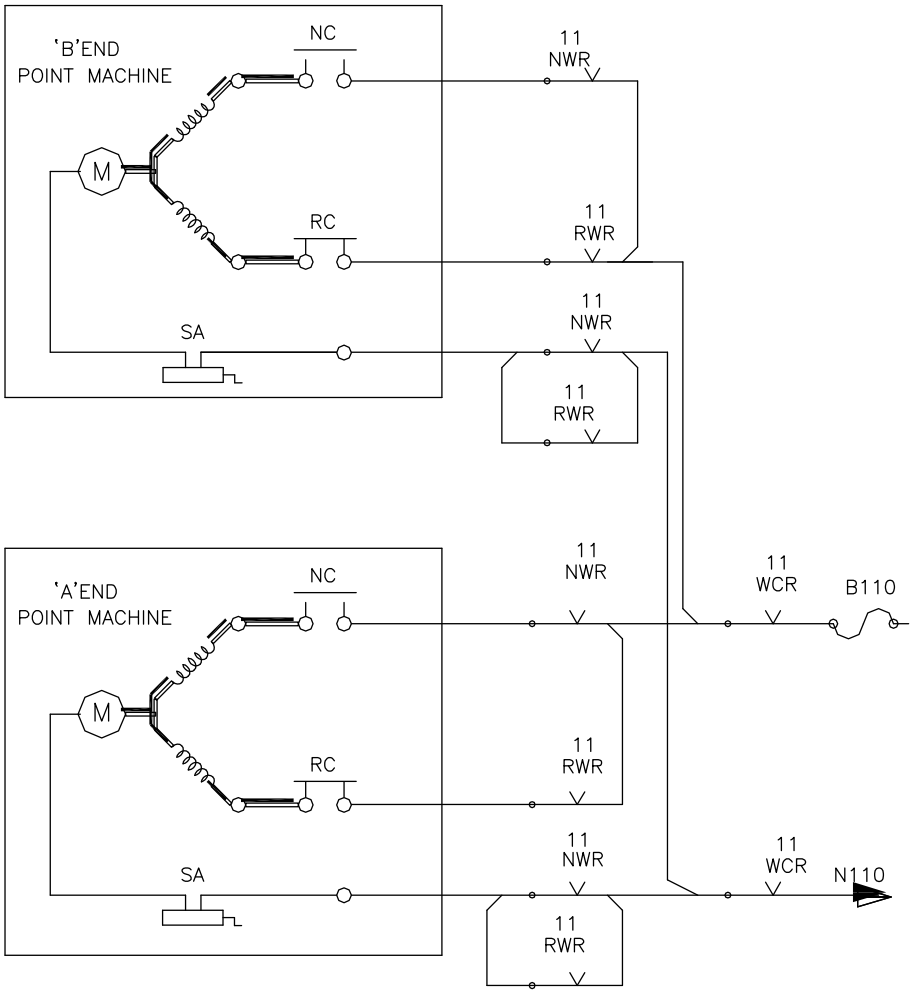


Fig. No.4.25

(j) There by WNKR/WRKR picks up. (Reference to Fig No.4.26) through point machine detection contacts.

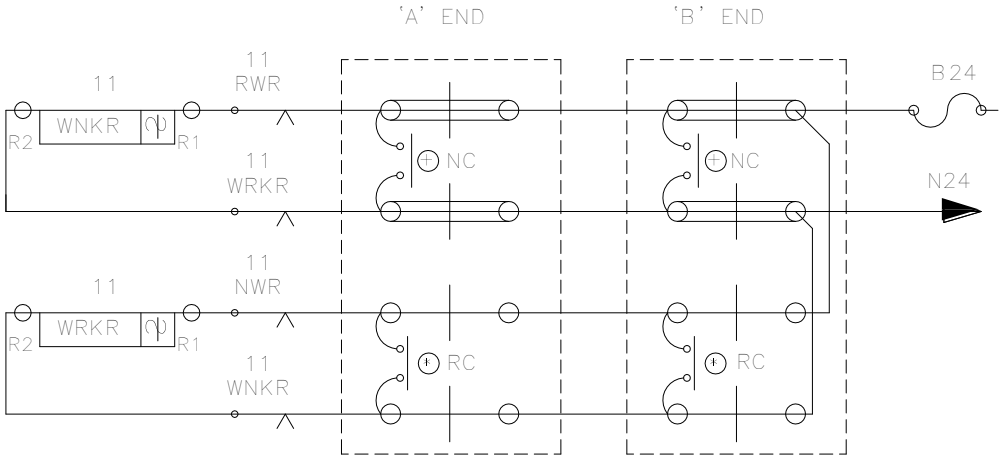


Fig. No.4.26

(k) Energisation of WNKR/WRKR results in dropping of WJR, WCR, NWR/RWR, there by WXR drops.

(l) Due to all controlling relays (WCR, WJR, WXR, NWR, RWR) at location dropping and WNKR/WRKR picking up, energizes indication relay NWKR/RWKR at relay room. (Reference to Fig No.4.27)

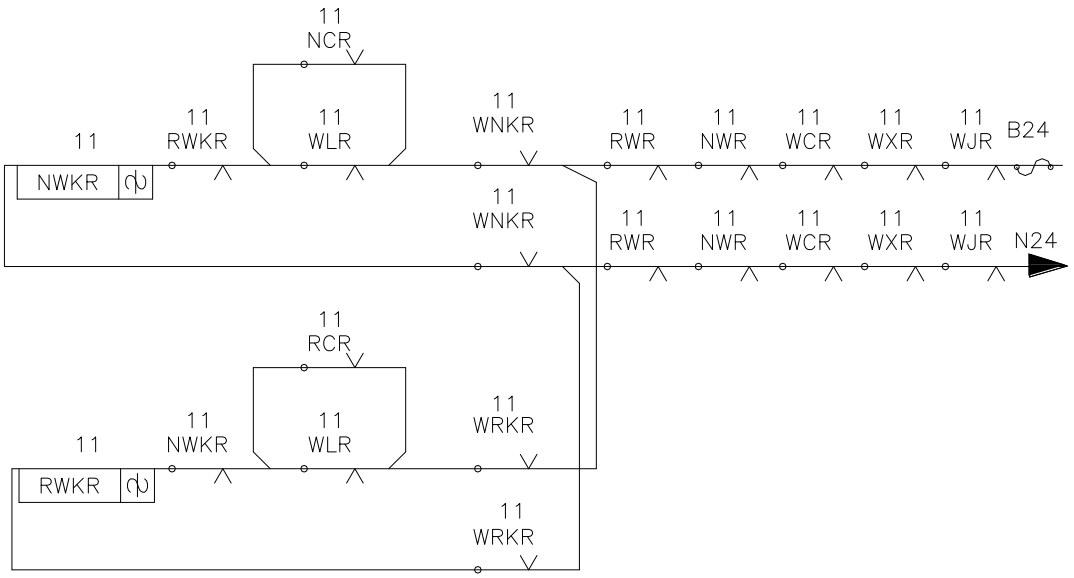


Fig. No.4.27

(m) Energisation of NWKR/RWKR results in dropping of WLR and locks the point electrically.

(n) De-energisation of WLR in turn drops PCR1 /PCR2, thereby 110V DC is withdrawn from the location bus bar.

(o) In nutshell it can be concluded that point operation initiated, point unlocked, point operated & set, all point controlling relays de-energized, point indication obtained and point locked again.

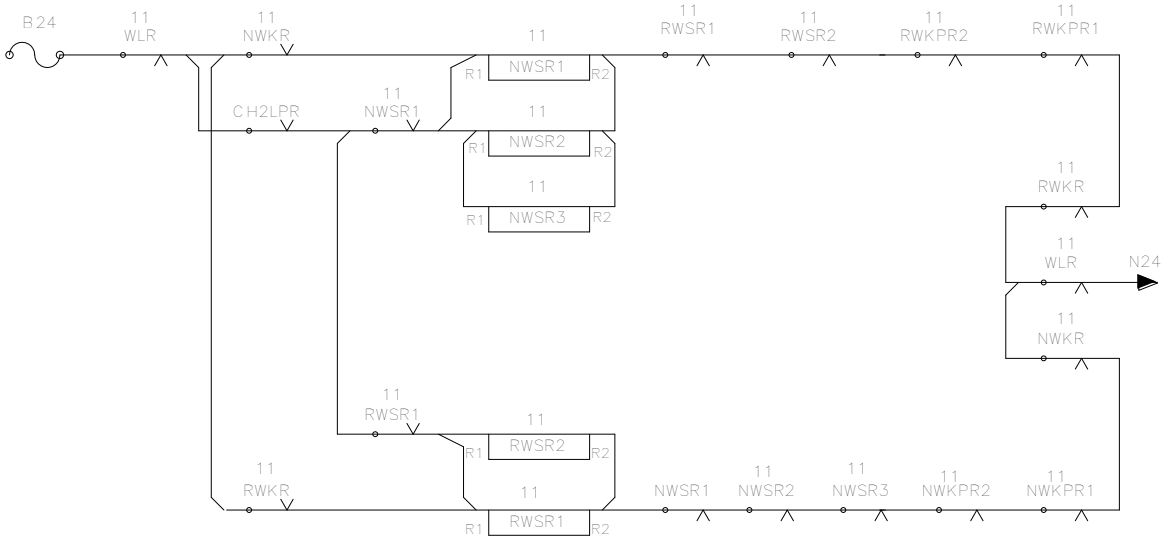


Fig. No.4.27 (a)

4.5 CRANK HANDLE INTERLOCKING CIRCUITS (CHLR/CHR)

Where point motors operate points, crank handles are provided to facilitate operation of points mechanically (manually) in case of point failure. The manual operation of point, after a signal is cleared, may endanger the train operation. Therefore, it is necessary that crank-handle be interlocked with signals suitably.

It is not possible to provide CH interlocking for every point individually. At the same time it is not proper to have only one crank handle common for all the points also. Therefore, points are grouped to achieve optimum flexibility.

In our layout Fig No 3.1 points are divided into three groups. CH1 group covers 13, 18 points, CH2 covers 11, 20 and CH3 covers 12,19 points. When 13 has failed crank handle from CH1 EKT only will be taken out and signals Sh 23, S 26 to DN main line & 1,1A, Sh10 to UP main and common loop will fail. Other signals will function normally.

4.5.1 Crank handle interlocking

(a) Whenever a signalled movement has to take place over the points it will not be possible to release the concerned CH which is kept locked inside an electrical key transmitter (RKT/EKT).

(b) When the crank handle is OUT it shall not be possible to
- Operate the points from panel.
- Clear any signal concerned.

(c) It shall not be possible to insert the crank handle taken out from one group in any other group point machine.

To achieve the above interlocking, the crank handle should be chained and welded to the EKT key. When the key is inserted in the EKT and turned to clockwise, crank handle in proving relay CHLR picks up and sticks through its own front contact.

Crank handle EKT will be kept locked in a glass-fronted box provided with pad lock. The keys will be under the personal custody of S.M. S.M has to make entries in CH register whenever crank handle is released for the manual operation of the point.

Instead of HR back contact ASR front contacts are used to ensure that Signals are at 'ON' for releasing Crank handle by certain Railways, wherever end panels are provided. In this case an emergency release system also is to be provided to release crank handle when ASR fails.

4.5.2 Crank handle free relay -CHFR

When all the concerned signal knobs are in normal i.e. RRs dropped, then CH1FR will be in energized condition. Then crank handle free indication will be in lit condition in the CH box. There by it gives indication to SM that CH1 can be extracted if need arises.

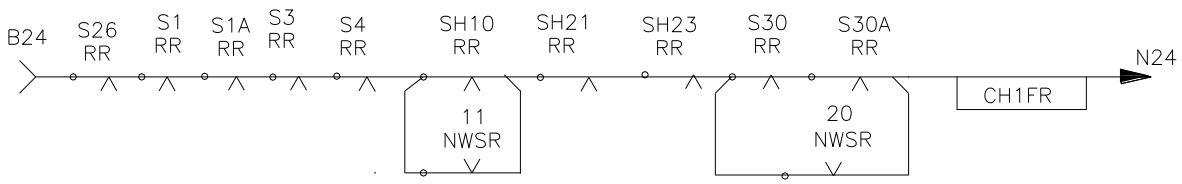


Fig. No.4.28

Whenever any of the signals concerned taken off i.e. RR picked up, then CH1FR will be dropped. Crank handle free indication extinguishes. Thereby SM understands that CH1 cannot be extracted unless the signal is normalized.

4.5.3 Crank handle in proving relay –CHLR

In the EKT, while the key is inserted and being turned contact No.1, 2 and 3, 5 will be made and CHLR will be picked up. Once the turning is over and the key is left, contact Nos.3& 5 will be broken. Therefore a stick path is provided to feed CHLR by passing contacts 3 & 5 with its front contact. CHLR front contact is proved in UCR & HR circuits.

When a signal is taken off, CH1FR will be dropped. At that moment if SM tries for extraction of crank handle by pressing economizer push button, CH1LR does not drop as feed extended to CH1LR through CH1FR back contact. Thereby EKT lock coil is not energized and crank handle key can not be extracted. At the same time, the signals taken off remain in the same condition.

When a signal is not taken off, CH1FR remains in energized condition. When SM presses the economizer push button, CHLR drops. There by Lock coil is energised the key is extracted. Hence the signals interlocked with it can not be taken off. To ensure that CHLR drops before the actual extraction of the key, the CHLR circuit is designed in such a way, when the economizer push button is pressed for extracting the crank handle, it breaks the supply to CHLR and CHLR drops. Unless CHLR drops extraction of crank handle is not possible.

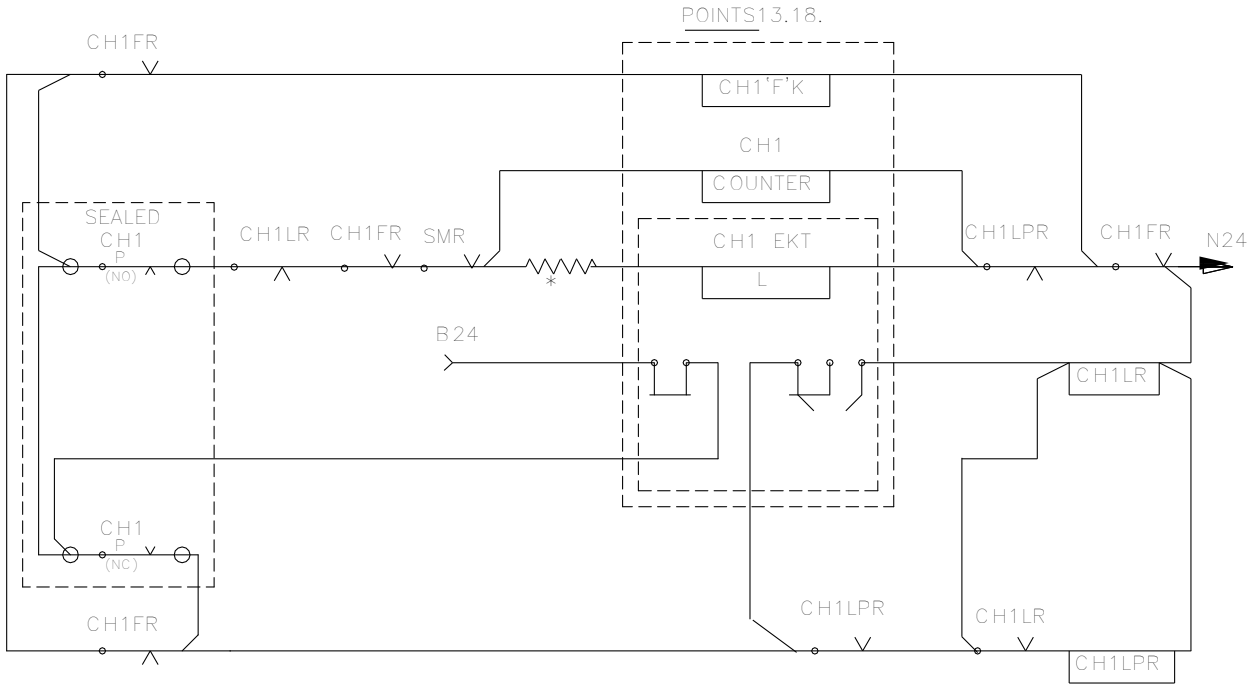


Fig No: 4.29

4.6 SIDING CONTROL CIRCUITS (SIDING NPR/KLPR).

Siding points may either be (a) operated from the panel directly or (b) operated locally but controlled by panel.

Operation of siding points directly from the panel is resorted to, only if the movements over these points (into and out of siding) are frequent. In such cases these points are interlocked directly and also these sidings may be provided with shunt signals to control the movements.

Where there are no frequent movements from/into the sidings, then these points are operated locally, but controlled from the panel. The siding points remain locked in Normal position and the same can be released only when there is no signaled movement towards it.

Siding points are also operated from a Ground Lever frame situated near siding point. Ground lever frame can be released only when the concerned 'E' type key, either physically brought from the panel room or transmitted electrically, is inserted in the Ground Lever. 'E' type key at the panel is extracted after reversing the siding control knob of the panel provided the routes concerned are normal.

Where siding points interlocking is provided through electrical transmission of the 'E' type key, the following arrangements are provided.

A pair of electrical key transmitters is provided one at the panel and the other at the siding in a location. The key at the siding remains locked in the EKT. The siding key in and locked the Ground frame lever in normal is proved in the siding NPR circuit and NPR is proved energized in the concerned signal HR circuit.

Thus these signals can not be taken off if the key has been transmitted to the siding as NPR drops when once the key is extracted.

To reduce the time taken for shunt movements over the siding point, the key is kept locked in the EKT inside a location box adjacent to the siding. EKT is energized through a relay, "Siding YR" which is controlled from the panel.

Siding YR can be energized only when:

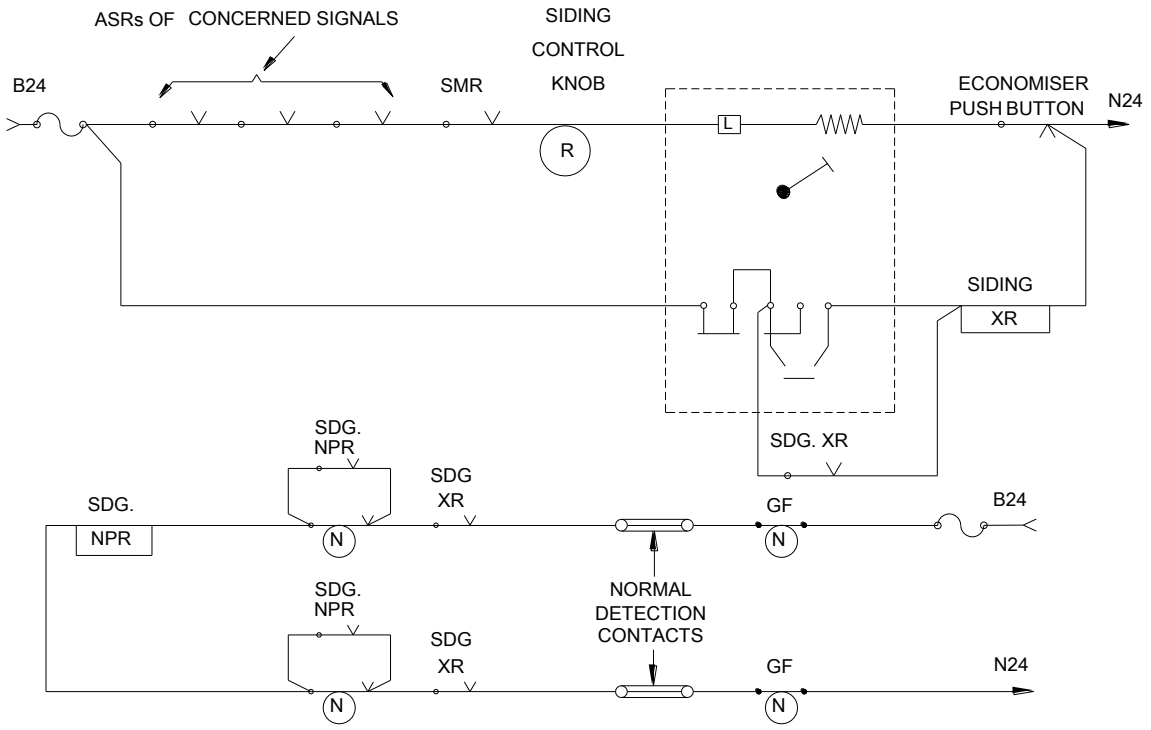
(a) The signals concerned are at ‘ON’ and the
(b) Respective siding control knob is reversed

When siding YR is energized free indication at the EKT appears and the siding key is released by pressing the economizer push. The siding key thus extracted is inserted in the lock on Ground frame lever and siding point is operated. After the completion of the shunt movements over the siding point, the Ground frame lever is normalized and the key is taken out, inserted in EKT and turned to right.

When the key is turned a relay "Siding NPR" picks up at the panel. The signals concerned can be taken off only when the siding NPR is energized.

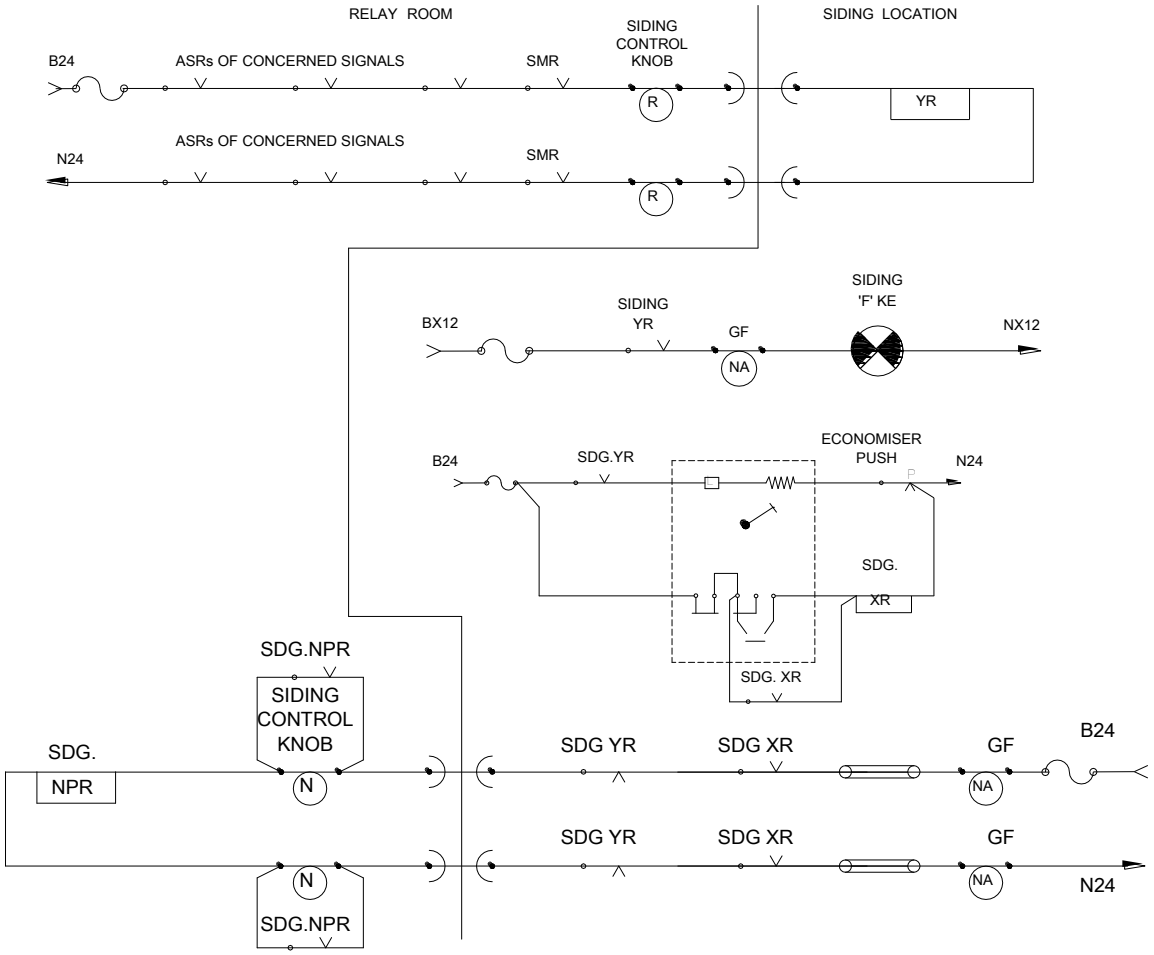
Siding can be signalled or non-signalled according to frequency of the shunting operations. The siding controlled from the panel will be invariably provided with signal. If a signal is provided to control the entry into the siding, the movement from the siding shall also be controlled by a signal.

Where siding point is not protected by a signal, the responsibility of locking the siding point and holding it for shunting operations rests with the traffic department.



SIDING NPR CIRCUIT WITH MANUAL TRANSMISSION OF SIDING CONTROL KEY

Fig.No: 4.30



SIDING NPR CIRCUIT WITH ELECTRICAL TRANSMISSION OF SIDING CONTROL KEY.

Fig No: 4.31

4.7 INTERLOCKING OF LEVEL CROSSING GATE

4.7.1 LC Gate interlocking (Ref. Fig No 3.1)

(a) Gate man closed LC gate, SM acknowledges, takes off signal, further gateman has no control over the LC gate for opening without SM's co-operation.

SM communicates to the gateman on phone to close the gate. The gateman closes the gate, locks the boom and extracts key. The gateman inserts the in key in EKT and turns it clockwise to transmit control. Thereby LXR relay energizes & sticks through its own front contact. Therefore once LXR picked up, the gateman can leave the key in the EKT. (Refer Fig No. 4.32)

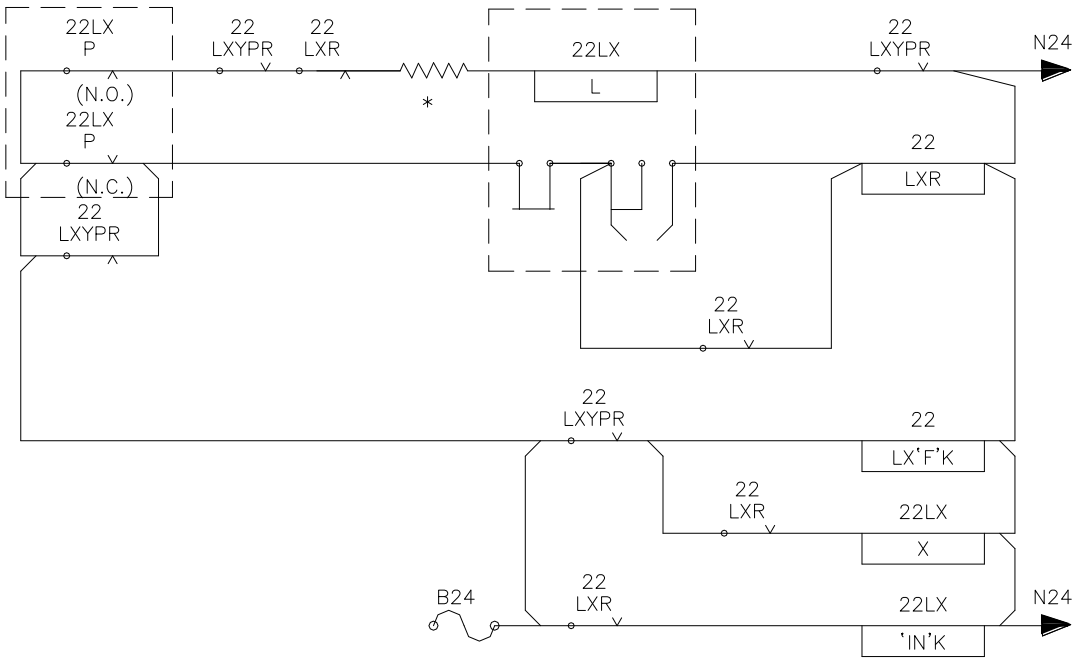


Fig. No.4.32

Energisation of LXR relay at gate lodge energizes LXCR at relay room. (refer Fig No.4.33)

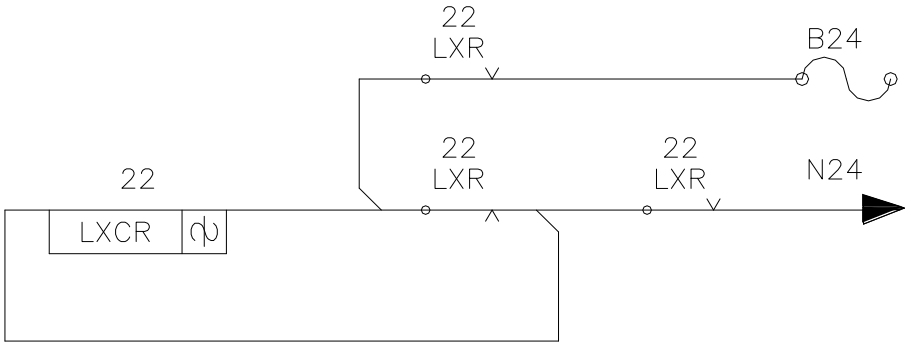


Fig. No.4.33

Due to LXCR up & LXPR in drop, flasher supply 12V DC will be connected to LC closing indication LXK (W) and it flashes. There by SM comes to know that LC gate was closed by gateman. Then SM acknowledges by turning LC control know22 to Normal position which results in dropping of LX22-RR.

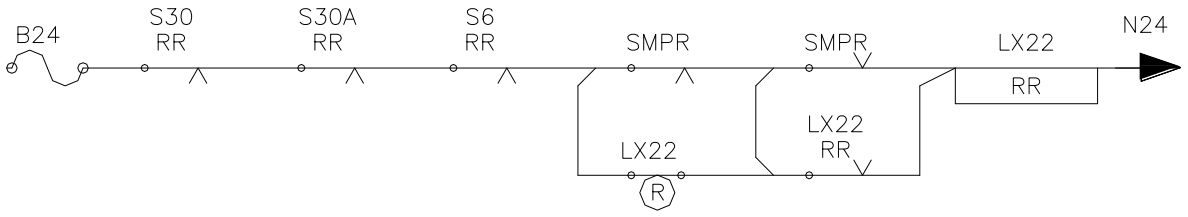


Fig. No.4.34

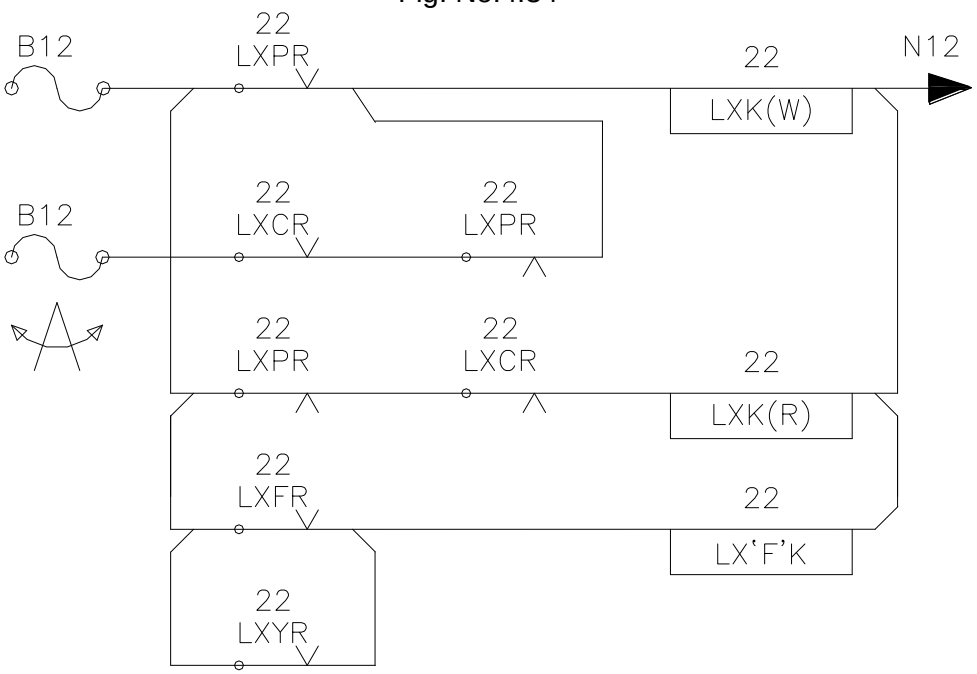


Fig. No.4.35

The dropping of LX22-RR, results in dropping of LXYR.

Due to LX22-RR drop, LXYR drop, LXCR already in up, and 22LXJSLR normally dropped relay result in energisation of LXPR relay. LXPR front contact proved in concerned HR/DR concerned.

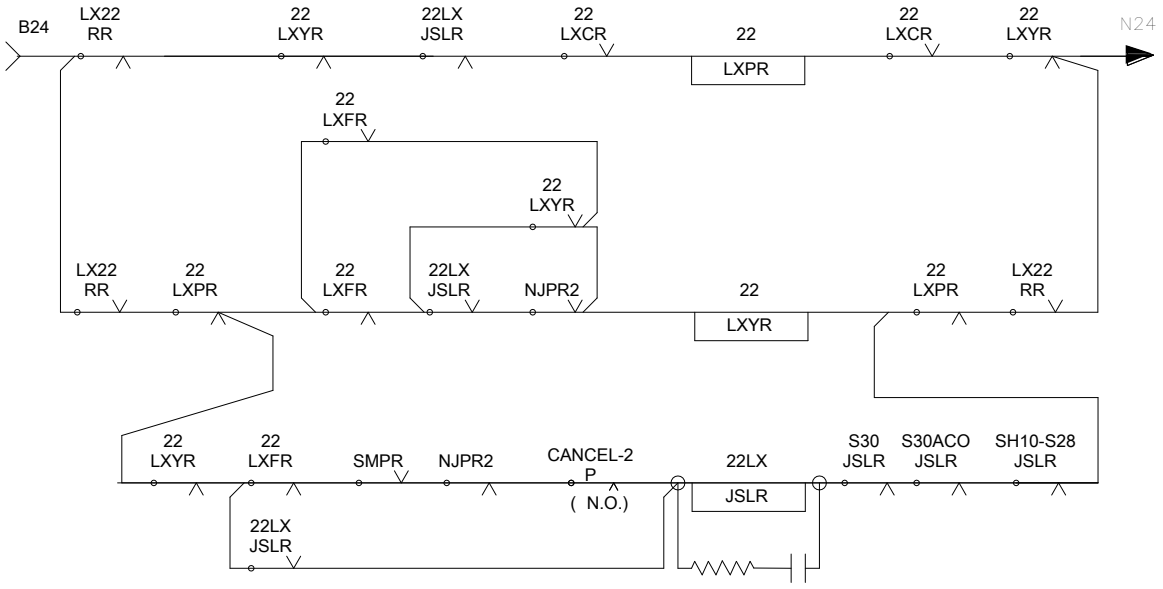


Fig. No.4.36

The energisation LXPR disconnects flasher supply to LCK (W) and connects B12 steady supply, there by LCK (W) indication becomes steady.

At this juncture, if the gateman tries for opening the gate, he can not open it. Suppose the gateman presses economizer push (22 LX), the supply B24 is extended to LXR relay through the back contact of LXYPR (since LX22RR in dropped condition, LXYR in drop which in turn keeps LXYPR in drop condition). Further supply to lock coil is not extended as LXYPR in drop, LXR in up. So the key from EKT can not be extracted.

Now suppose the signal S30 is taken off, which makes S30 ASR to drop, there by drops LXFR.

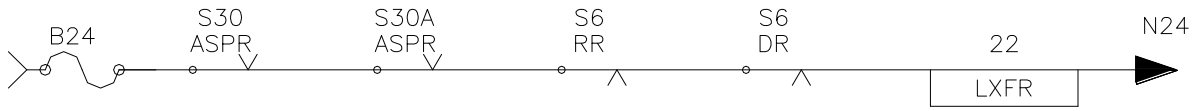


Fig. No.4.37

At this moment if SM inadvertently press LXN and GSBN button simultaneously, still LX-22 RR does not pickup due to S30 NRR concerned to route is in pickup condition. Hence slot is not extended to gate lodge (LXYPR remains in drop), thereby gateman can not extract key from EKT.

(b) Gate opening during normal working

On complete arrival of a train after a signal S30 taken off, the route releases & picks up ASR and LX22 FR also. Now SM press and release LXN and GSRBN buttons simultaneously which picks up LX22 RR. Thereby LXPR drops. As LX22RR in pick up, 22LXPR in drop and LXFR in pick up LXNR drop energizes 22 LXYR, which in turn picks up 22LXYPR at gate lodge.

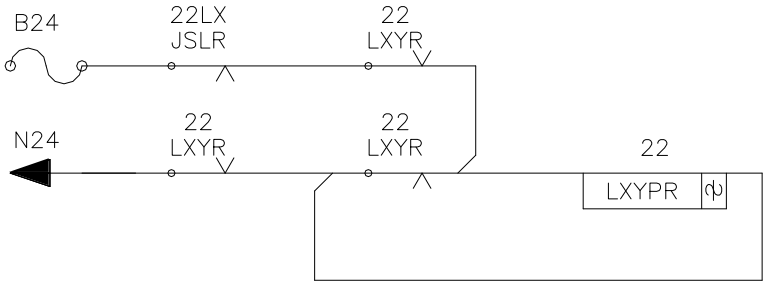


Fig. No.4.38

The moment LXYPR picks up at gate lodge, it gives out audible buzzer and lights up LC gate free indicator (LX ‘F’ k). The audible buzzer alerts the gateman that slot has been extended to him for opening the gate (LXYPR in up condition)

The gateman presses the Economizer push button, which cuts off supply to LXR, thereby drops LXR and silences the buzzer & energizes the lock coil. Thereby gateman is enabled in extracting the key from EKT and he opens the gate.

(c) Gate opening during rout locked condition by cancellation with time delay.

Suppose on complete arrival of train, route is not released (ASR did not pickup) due to one of the back lock track circuits failed. Then 22LXFR will not pick up. Therefore, SM press and releases LXN&GSBN buttons to extend slot to gate lodge, which picks up LX22RR and drops LXPR.

Since LXFR is in drop condition, 22 LXYR can not pickup without time delay. At this juncture, SM presses LC gate cancellation button to pick up JSLR. After 120 Seconds, NJPR2 picks up thereby LXYR picks up. Thereby slot is extended to gate lodge by picking up LXYPR. Thereby gateman extracts the key and opens the gate in route locked condition with time delay of 120 seconds.

EMERGENCY KEY: A Spare key for LC Gate is kept in EKT without electrical lock arrangement. The EKT is provided inside the box which is pad locked and sealed. When all the methods are failed to transmit slot for gate opening , then SM breaks the sealed box and open the lock, then SM take out emergency key from EKT and bring physically to the site for opening of LC gate. Once this key is out supply to the LC gate controlling circuit is disconnected therefore no signal can be taken OFF unless emergency key is reinserted in EKT.

4.8 INDICATION CIRCUITS

4.8.1 Track Indications

Track occupied indications are given through the back contact of TPR. This should appear at all times whenever a track is occupied, irrespective of route set or not. Two lamps are given to overcome the problems due to bulb failure. If one bulb fails at least other will maintain the indication. “Track circuit occupied” indication is very important for safety point of view.

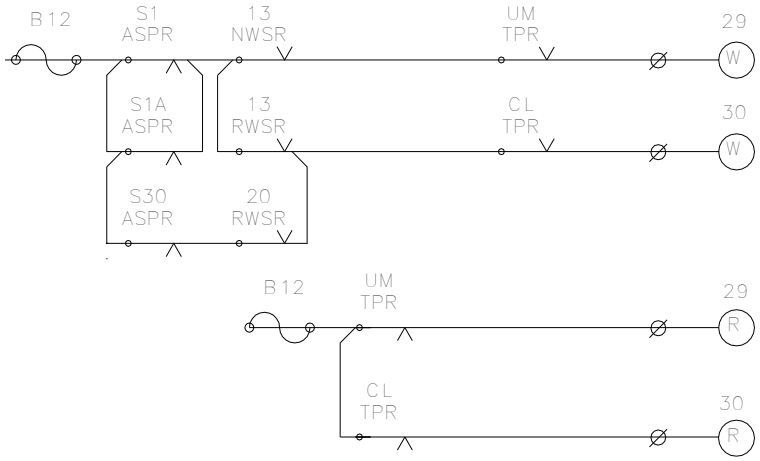


Fig. No : 4.39

4.8.2 Point Indications

Point indications are given through NWKR/RWKR front contact. Conventionally ‘white’ colour is used for normal and ‘green’ for reverse position. Point free indication can be given through WLR contacts. Point locked condition ‘RED’ can be given with WLR dropped condition. Point flashing indications are also given. Respective indication either Normal or Reverse will flash during the operation of point or due to failure.

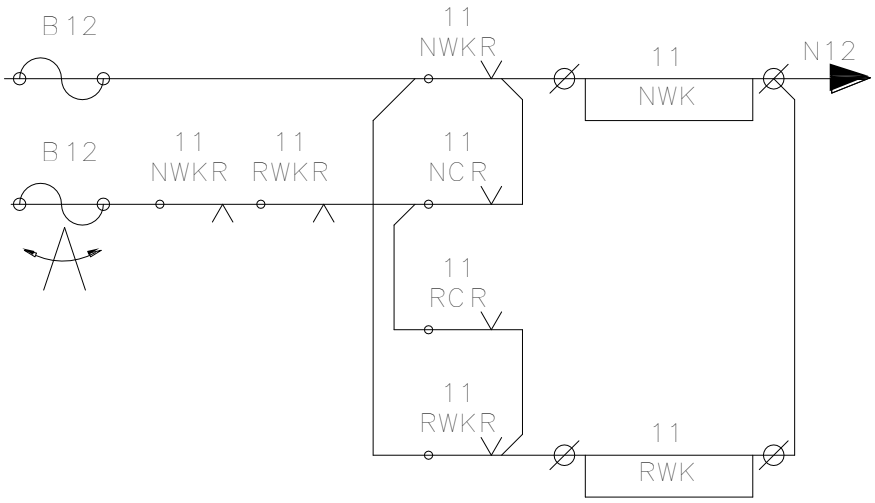


Fig. No.4.40

4.8.3 Flashing Indications

Flashing indications are also given to indicate that the point is under operation or point indication has failed. Flashing supply is derived from a mercury pendulum flasher unit or flashers.

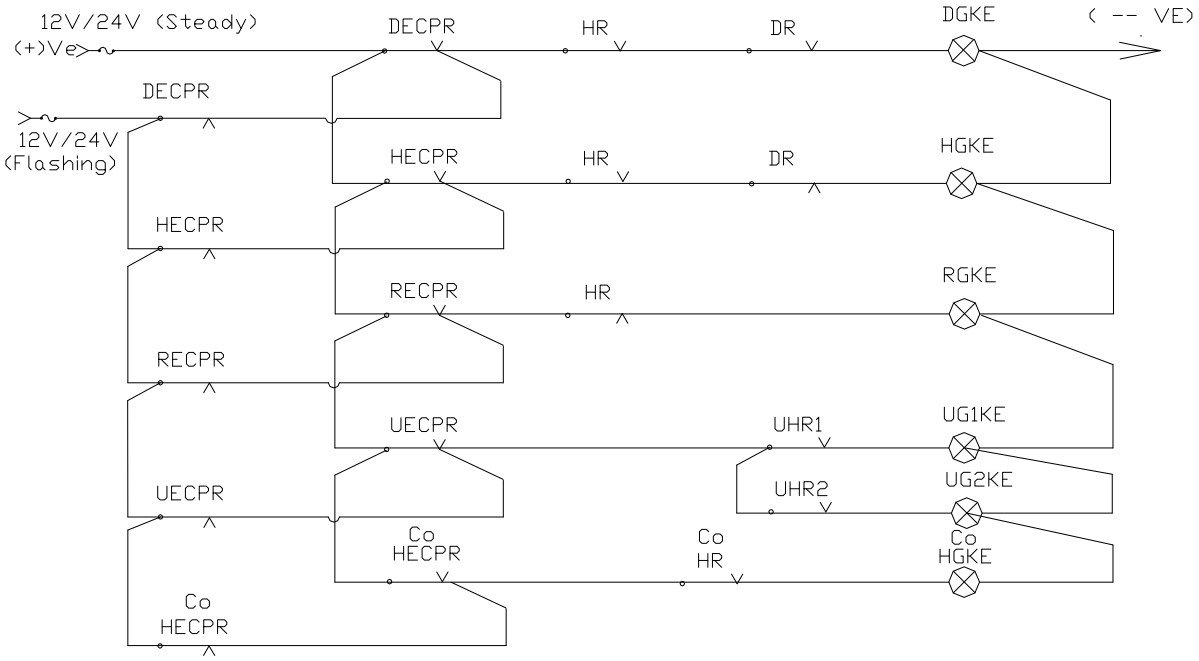


Fig No: 4.41

4.9 Lamp Failure Indication Relay Circuit

The relay GXJR is a normally energized relay. When all the signals in the yard are displaying any one of the aspects, then GXJR will remain up. If any signal becomes blank, then GXJR will drop giving Buzzer and visual indication. Buzzer can be muted, but indication will remain, till the fault is rectified and GXJR is energized. Relay GXJR is made slow to release to prevent it from dropping during the change over period of aspects.

When each signal in the yard is displays any one of the possible aspect to that signal (Red, Yellow and Green) then GXJR remains in pick up condition.

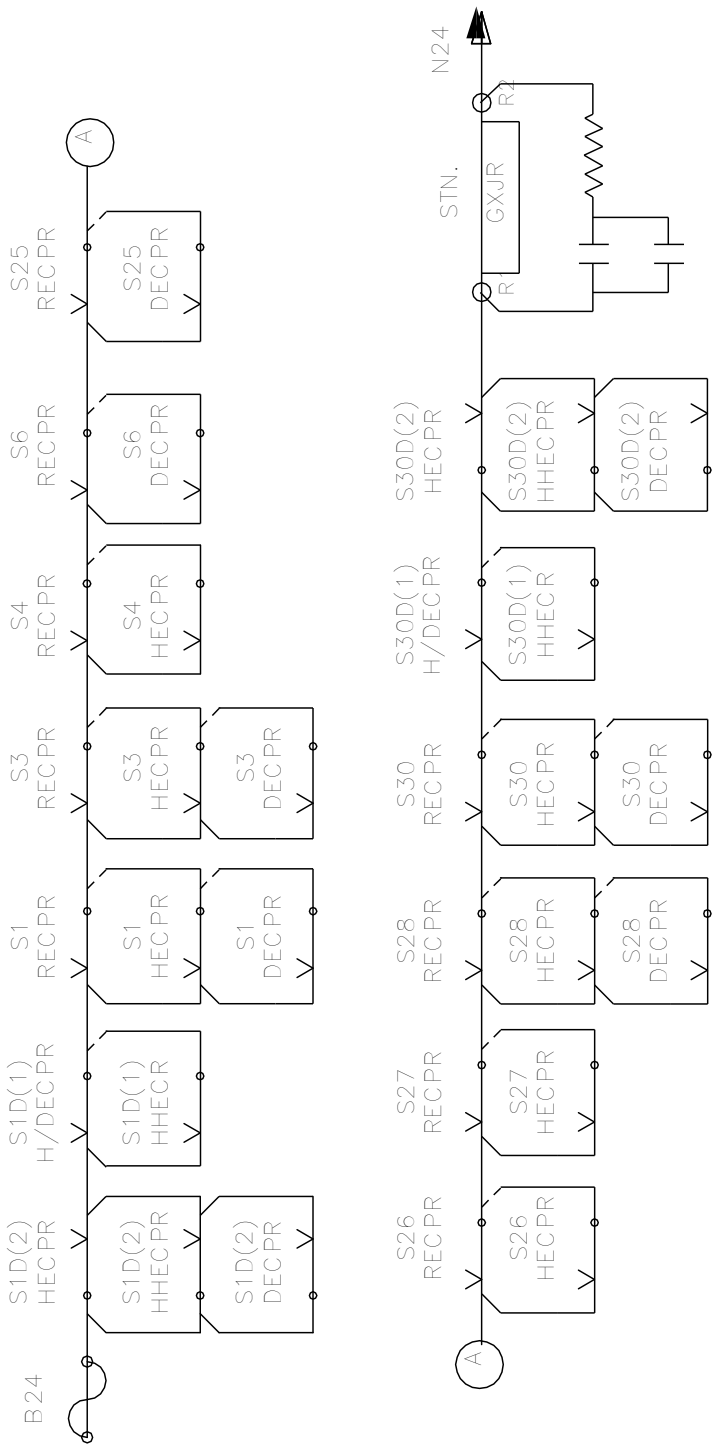


Fig No : 4.42

4.10 Route Setting type interlocking / Route relay interlocking (RRI)

In our Indian railways route setting type interlocking is provided with two types of arrragements.

1. Route setting type interlocking with knobs for signal, points and buttons for route.
2. Route setting type interlocking with all buttons for signals, points and routes.

4.11 Route setting type interlocking / Route relay interlocking (RRI) with knob for signal, points and button for route.

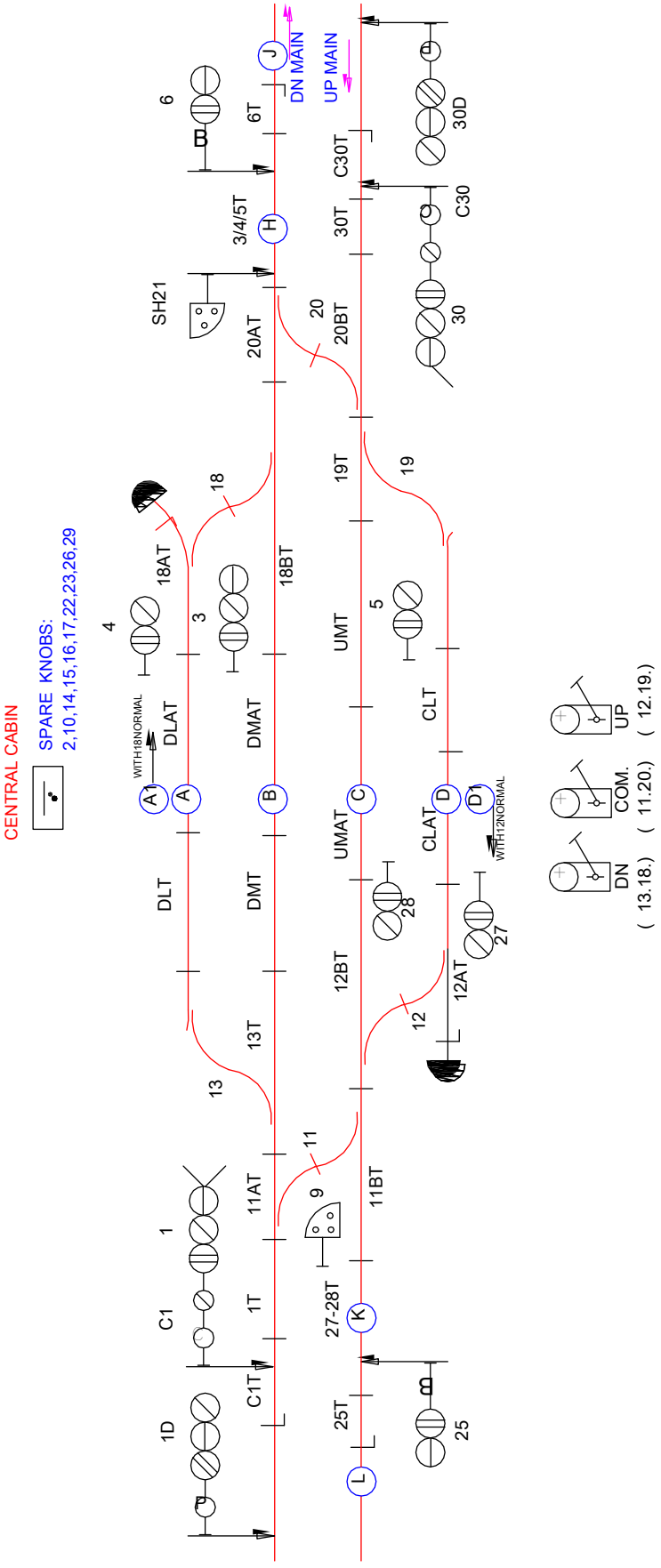


Fig No: 4.43

4.11.1 LR circuits, Route selection/Route initiation circuits (RRI's).

In big and major yards (RRI's), where number of points are more, the non-route setting type i.e., setting of points individually and then giving signal can not be adopted as it takes more time and also sometimes confusing. Hence, route setting type must be provided, where the required points are to be operated automatically by the selection of a signal route. The signal `RR' relay can not decide the route, since the route is already set in non-route setting type.

A signal route selection relay " LR " has to be energised which will decide a particular route to a signal and all the points required for that route including in isolation, overlap will be operated to the required position by the route selection relay (LR). The pick up contact of the route selection relay will be incorporated in appropriate side i.e., normal or reverse of the point control circuit.

Every signal will have that many no. of LR's, as the no. of routes that the signal can lead to including different overlaps. Some signals such as advance starter, starters, etc will have only one LR as there is only one route.

Every route and overlap including alternate route and overlap must have a route button and they are identified with alphabets (A1, A2, B, C,…., D1, D2…etc) or with the concerned route number / name. It may be noted that route buttons are compulsory in "Route-Setting" type installations. Every route, alternate route and alternate overlap will have separate route buttons designated either alphabetically or with their route/overlap name.

The signals and points are provided either with switches and / or buttons. The no. of LR's will be equal to the no. of signal routes possible for the yard.

For subsidiary signals like shunt and Calling 'ON', only one route will be allowed and alternate overlaps will not be allowed.

4.11.2 LR CIRCUIT

When route button is pressed, the concerned route button relay is picks up.

As the signal knob is reversed and the route button is pressed, the concerned LR picks up by proving all other conflicting route LRs in drop. Once LR pickup it sticks through its own front contact as shown in Fig No 4.44 (a) & 4.44 (b).

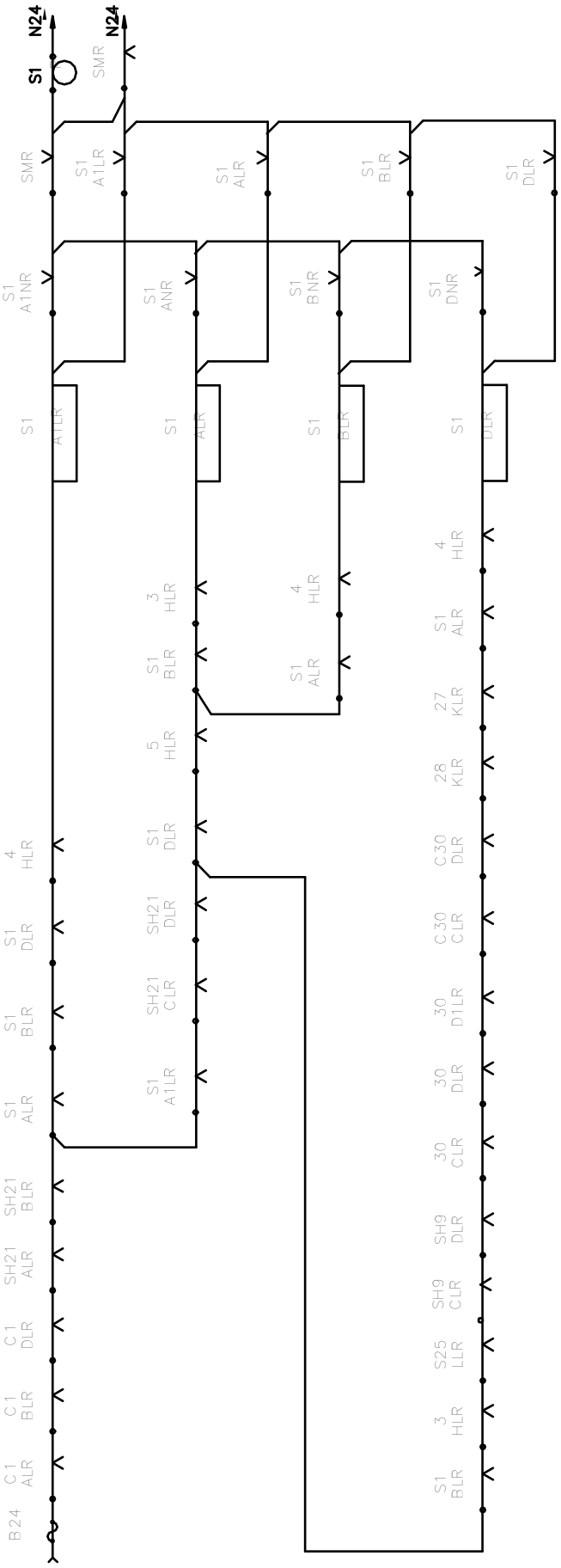

N24
S1
N24
SMR
SMR
S1 A1LR
S1 ALR
S1 BLR
S1 DLR
S1 A1NR
S1 ANR
S1 BNR
S1 DNR
S1 A1LR
S1 ALR
S1 BLR
S1 DLR
3 HLR
4 HLR
S1 BLR
S1 ALR
5 HLR
27 KLR
28 KLR
4 HLR
S1 ALR
C30 DLR
4 HLR
S1 DLR
SH21 DLR
C30 CLR
S1 BLR
SH21 CLR
30 D1LR
S1 A1LR
S1 ALR
30 DLR
SH21 BLR
30 CLR
SH21 ALR
SH9 DLR
C1 DLR
SH9 CLR
C1 BLR
S25 LLR
C1 ALR
3 HLR
B24
S1 BLR

Fig No: 4.44 (a)

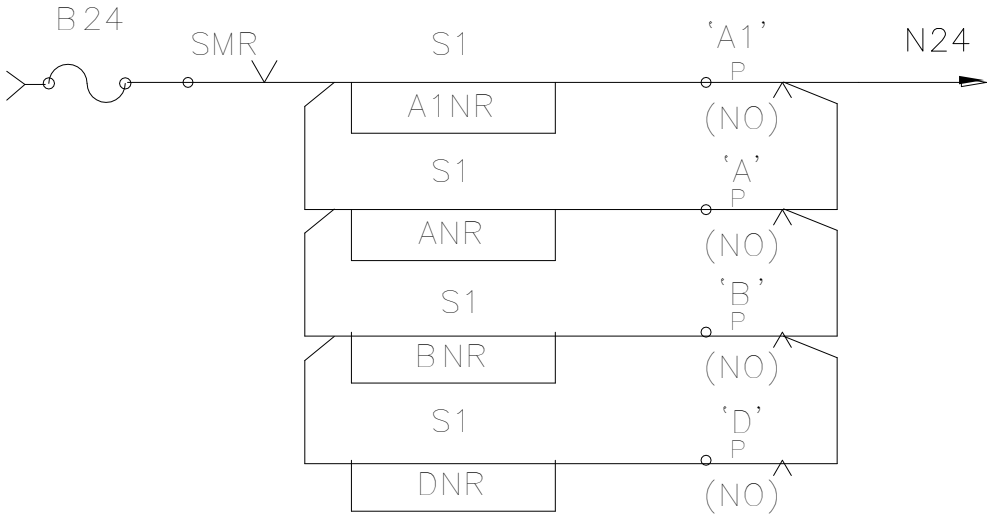


Fig No: 4.44 (b)

4.11.3 Operation of Points in RRI (Route Setting Type)

In this, 3-position point switches (N-C-R) are used. The switch remains in center position for automatic operation and can be used for manual operation also by turning either to `N' or `R' from center position when all other condition for manual operation are favourable.

Either through LR or by manual operation, NCR/RCR (WNR/WRR) will energize. Further, the operation of point will be same as explained earlier for non route setting type. The sequence of pick up and drop of NWKR/RWKR, WJR, WXR etc. will be same.

Fig No : 4.45

SW Position	Contact Make	Contacts Break
Centre	`NC', `RC'	`N', `R'
Normal	`N`, `NC'	`R', `RC'
Reverse	`R', `RC'	`N', `NC'

But for automatic Operation of point through route setting, the switch must be brought back to centre 'C', position only. The NC & RC contacts for operation of point are required for automatic operation either to normal or reverse. But if the switch is either in N or R, only one ie. NC or RC will only be available and manual operation only is possible.

4.11.4 AUTOMATIC OPERATION OF POINT CIRUITS

When signal knob is reversed and route button is pressed, the concerned LR relay picks up as explained in the above.

WLR Circuit:

The moment LR energises it ensures that concerned WLR is energized, proving all concerned ASRs , OVSRs in pickup, track locking TPRs in pick up. Fig no 4.47 & Fig no 4.48 are to read in continuation.

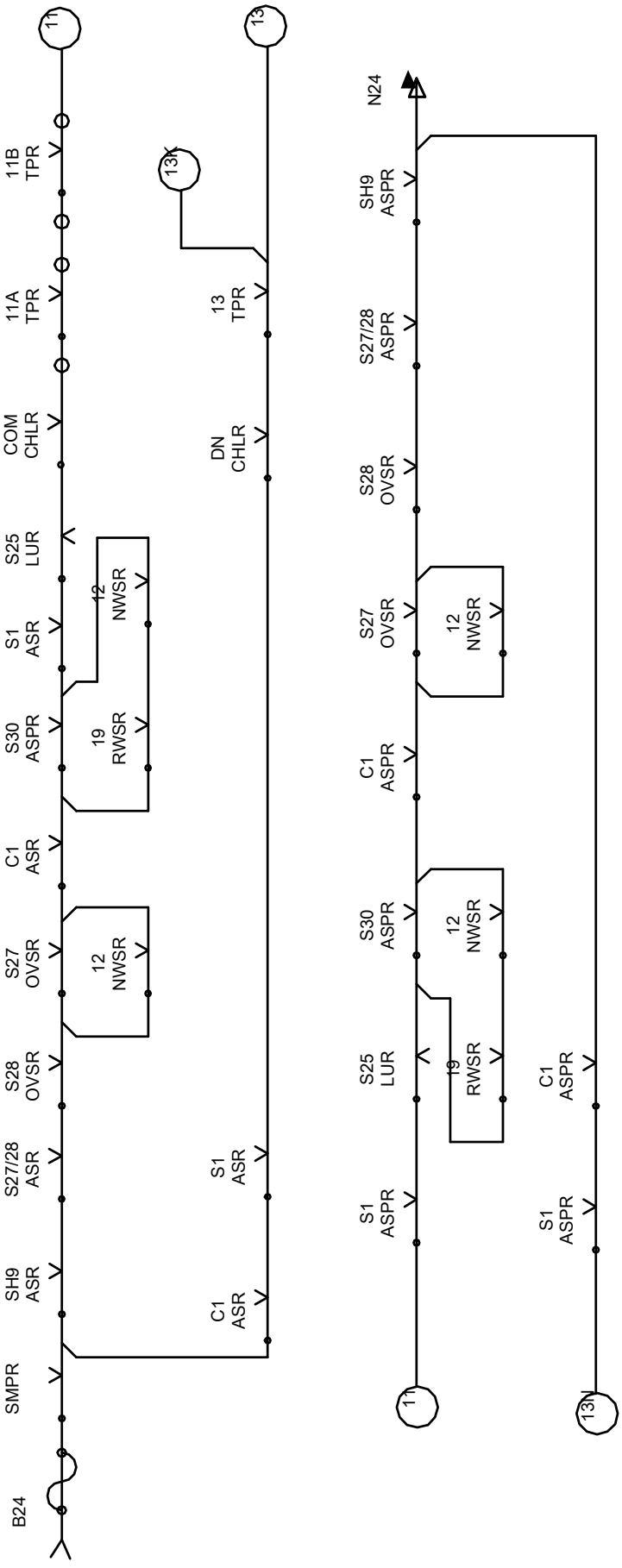

11
13
13X
N24
B24
SMPR
SH9 ASR
S27/28 ASR
S28 OVSR
S27 OVSR
S30 ASPR
C1 ASR
S1 ASR
S25 LUR
COM CHLR
11A TPR
11B TPR
DN CHLR
13 TPR
S1 ASR
C1 ASR
12 NWSR
19 RWSR
SH9 ASPR
S27/28 ASPR
S28 OVSR
S27 OVSR
C1 ASPR
S30 ASPR
S25 LUR
S1 ASPR
12 NWSR
19 RWSR
C1 ASPR
S1 ASPR
11
13X

Fig No: 4.46

4.11.5 NCR/RCR (WNR/WRR)

Depending upon the route to be set, the concerned point NCR/RCR (WNR/WRR in some railways) will energize through NC/RC contact & WLR pick up contact.

The moment NCR/RCR picks up , the rest of the point operation is exactly similar to the non-route setting type panel point operation. In this way all the points required for the concerned signal route will be set automatically.

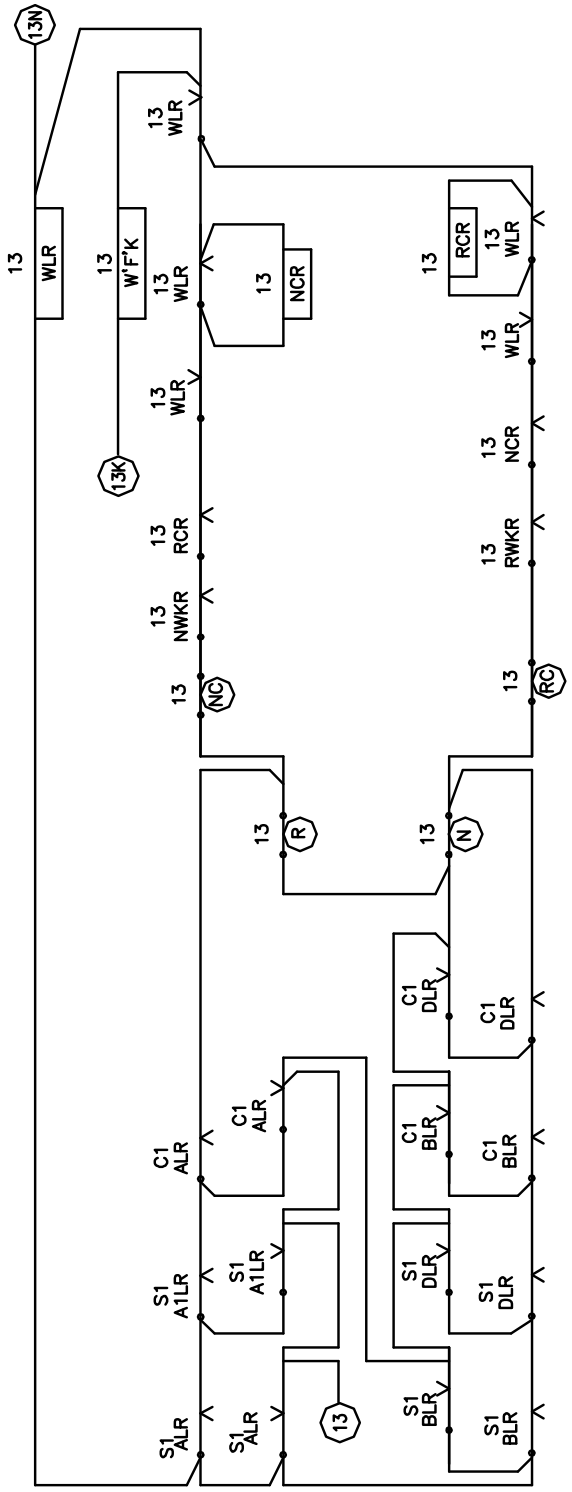


Fig No: 4.47

Once all the points are set for the route required, UCR checks the route and energizes. Energization of UCR drops the concerned ASR and route will be locked . Then signal controlling relay HR picks up and signal will be taken off.

4.12 Sectional Route Release Circuits (TLSR/TRSR)

The Back route locking provided on signal is sometimes cumbersome & time consuming since all the points in the entire route are locked till the train clears the full route it entered and the points cleared by a train can not be utilized for other movements. In big/Major yard with busy traffic the complete route locking hampers the efficiency and causes un necessary detention.

Hence another type of Route locking is adopted. In this system, the entire route is divided into small sub-route sections, according to the point zones. When the signals are given for a particular route all the sub routes sections in the route are locked, thereby the entire route is locked. But, the train on clearing each sub section of the route entered clears the locking effecting of that sub route thereby those points cleared by the train can be utilized for other movements thereby increasing the flexibility of the yard.

The first route section is directly controlled by the concerned ASR. The subsequent route sections are controlled by the TLSR/TRSR's. For leftward movement i.e. from RIGHT to LEFT, TLSR and for rightward movement i.e., from left to right, TRSR is used. Depending upon the direction of signal movement, TLSR/TRSR's are designed.

The TLSR/TRSR's do the same job as that of ASR and TLSR/TRSR picks up contact is used in WLR pick up circuit. When the signal is given, ASR drops which in turn drops the required TLSR/TRSR's to achieve complete route locking.

ASR picks upon clearing the first route section and the point(s) in the first route section becomes free. Subsequent route sections are still locked as the train clears the section by section and the points are released accordingly and they can be utilized for other movements.

With TLSR/TRSR'S, the ASR circuit shall be modified accordingly with back lock track circuits up to first route section or up to the first point.

TLSR / TRSR ccts are normally adopted in big / major yards. (RRI's)

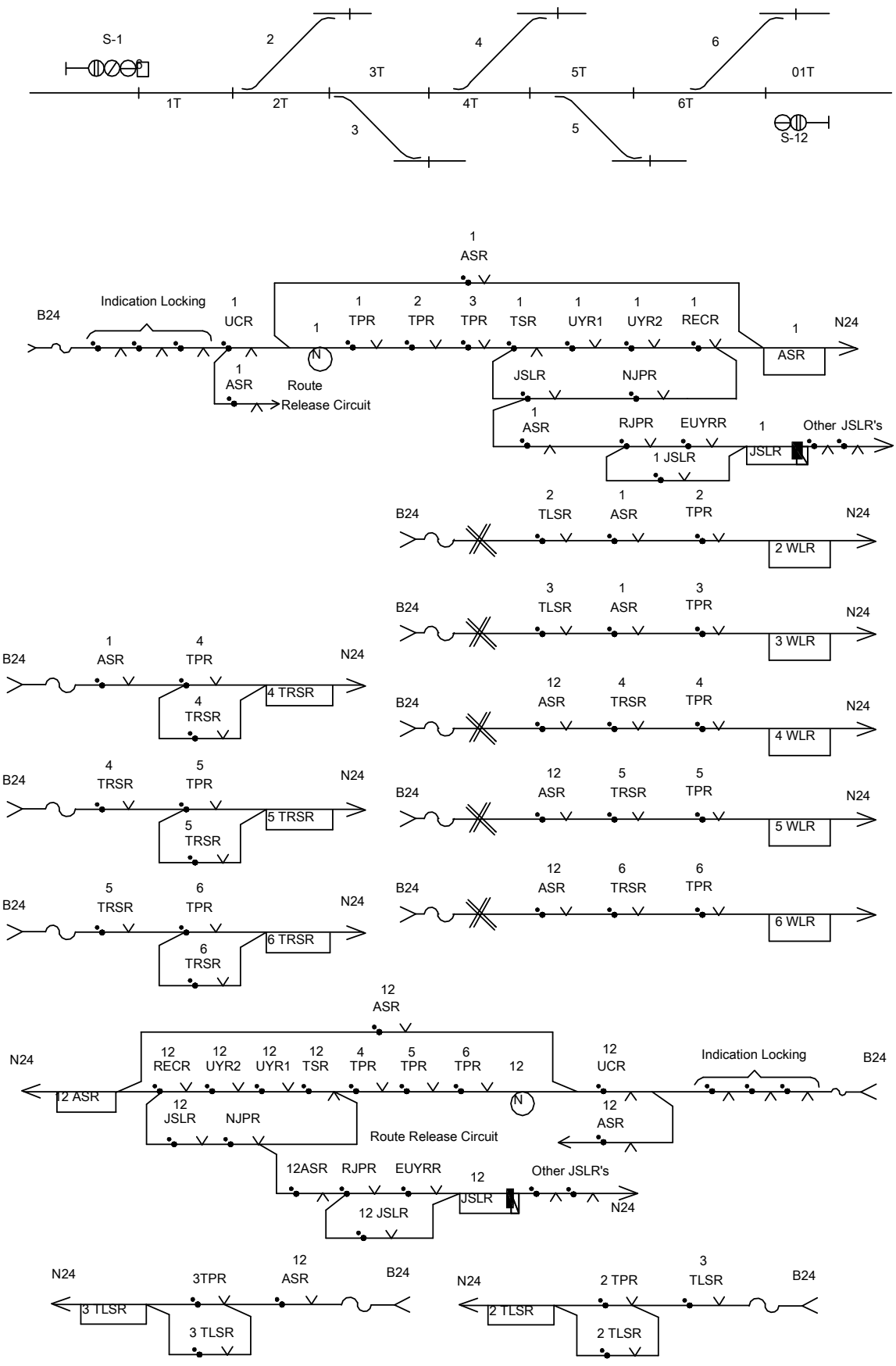

S-1
2
4
6
3T
5T
01T
1T
2T
4T
6T
3
5
S-12
1
ASR
Indication Locking
B24
1
UCR
1
TPR
2
TPR
3
TPR
1
TSR
1
UYR1
1
UYR2
1
RECR
1
N24
1
ASR
N
Route
Release Circuit
JSLR
NJPR
1
ASR
RJPR
EUYRR
1
Other JSLR's
1 JSLR
JSLR
B24
2
TLSR
1
ASR
2
TPR
N24
2 WLR
B24
3
TLSR
1
ASR
3
TPR
N24
3 WLR
B24
1
ASR
4
TPR
N24
4
TRSR
4 TRSR
B24
12
ASR
4
TRSR
4
TPR
N24
4 WLR
B24
4
TRSR
5
TPR
N24
5
TRSR
5 TRSR
B24
12
ASR
5
TRSR
5
TPR
N24
5 WLR
B24
5
TRSR
6
TPR
N24
6
TRSR
6 TRSR
B24
12
ASR
6
TRSR
6
TPR
6 WLR
12
ASR
N24
12
RECR
12
UYR2
12
UYR1
12
TSR
4
TPR
5
TPR
6
TPR
12
12
UCR
Indication Locking
B24
12 ASR
N
12
JSLR
NJPR
12
ASR
Route Release Circuit
12ASR
RJPR
EUYRR
12
Other JSLR's
JSLR
12 JSLR
N24
N24
3TPR
12
ASR
B24
3 TLSR
3 TLSR
N24
2 TPR
3
TLSR
B24
2 TLSR
2 TLSR

Fig No: 4.48

CHAPTER 5: ROUTE SETTING TYPE RELAY INTERLOCKING (RRI)

5.1 ROUTE SETTING TYPE RELAY INTERLOCKING WITH ALL BUTTONS FOR SIGNALS, POINTS &ROUTES:-

As e*xplained earlier, the panels in PI* &RRI's are provided with switches for signals, points and other functions. For RRI's route button are also provided for Automatic setting of points. On arrival of a train, both in PI and RRI, the signal switch is to be normalised to release the locked route.

But as per the directions of RDSO/LKO for both PI&RRI, Switches must be eliminated & Self-restoring type buttons shall be provided. Instead of single plate panel, Domino type panel shall be provided. Also provision for Automatic route setting (Entrance – Exit) in way side stations, like RRI shall be given.

By this system the points are automatically set to required position by a single combined action i.e by pressing signal button at the entrance and route button at the Exit end .Similarly on the arrival of train, the locked route releases immediately after the Train clears Back lock tracks. Since Signal button is restored to normal automatically.

Now onwards let us refer yard diagram fig No:5.1 for the rest of the explanation mention under this topic.

The buttons used are push buttons, Self-restoring type as used in Siemens. The signal button (GN's) are provided near the signal concerned on the Panel. For stop signal Red, for calling ON signal Red with dots, for Shunt signal Yellow button are used.

Route buttons (UN's) are provided in the middle of each berthing track/overlap track/Exit track on the panel, one button for each route/overlap/exit route ,colour of route/overlap button are grey/white. They are marked alphabetically as A,B,C or with the respective track name.

In addition to the above the Following buttons are also provided on the panel.

S.No	Description	Button Name	Button colour
1	Point button nearer to the point concerned	WN	Blue
2	Common point group button for normal	NWWN	Blue
3	Common point group button for Reverse	RWWN	Blue
4	Emergency point operation button along with ceiling locking arrangement	EWWN	Blue
5	Crank handle control button	CHN	Blue
6	Slot Transmit button	GSBN	Grey
7	Slot Receive button	GSRBN	Grey
8	Emergency signal cancellation button with counter	EGGN	Red
9	Emergency route cancellation button with counter	EUUYN	Grey
10	Calling on initiation button	COGGN	Red
11	Signal lamp failure acknowledgement button	GX ACKN	Red
12	Point failure Acknowledgment button	WX ACKN	Blue
13	Button stuck-up acknowledgement button	NN ACKN	Grey
14	LC gate control button	LXN	Green
15	Siding control button	KLN	Grey

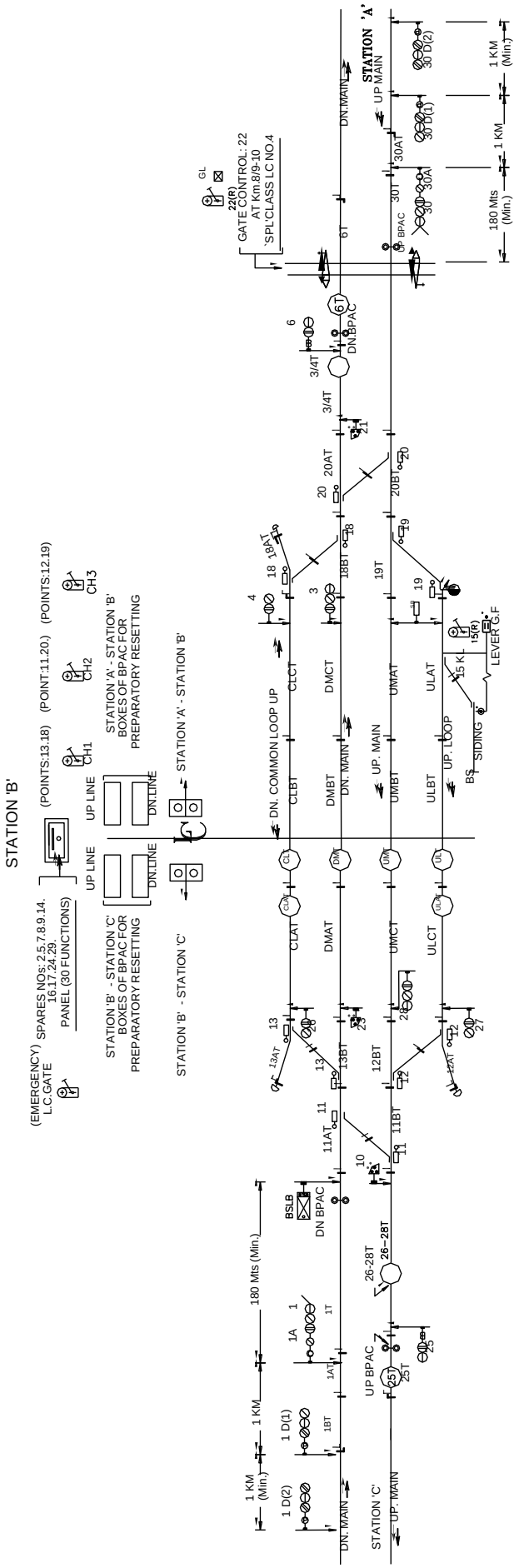

STATION 'B'
(EMERGENCY) L.C.GATE
SPARES NOs: 2.5.7.8.9.14. 16.17.24.29.
PANEL (30 FUNCTIONS)
(POINTS:13.18)
(POINT:11.20.)
(POINTS:12.19)
CH3
CH2
CH1
UP LINE
DN.LINE
STATION 'B' - STATION 'C' BOXES OF BPAC FOR PREPARATORY RESETTING
STATION 'A' - STATION 'B' BOXES OF BPAC FOR PREPARATORY RESETTING
STATION 'B' - STATION 'C'
STATION 'A' - STATION 'B'
DN. COMMON LOOP UP
CLBT
CLCT
DMBT
DMCT
DN. MAIN
UP. MAIN
UMBT
UMAT
ULBT
ULAT
UP. LOOP
BS
SIDING
15 K
LEVER C.F
CLAT
DMAT
UMCT
ULCT
GL
22(R)
GATE CONTROL: 22
AT Km.8/9-10
'SPL'CLASS LC NO.4
STATION 'A'
UP MAIN
DN.MAIN
DN.BPAC
UP BPAC
BSLB
180 Mts (Min.)
1 KM
1 KM (Min.)
1 D(2)
1 D(1)
30 D(2)
30 D(1)
STATION 'C'
UP. MAIN
DN. MAIN

Fig No: 5.1

5.2 SIGNAL BUTTON RELAY (GNR)

The signal button relay GNR is normally a de-energised relay. When a signal button (GN) is pressed ,the signal button relay (GNR) concerned picks up by proving the following conditions .

- No other signal button (GN) is pressed i.e No other GNR relay is in energized condition.
- No point button (WN) is pressed i.e All point button normal relay is in energized condition (WNCR).

At a time only one signal button relay can be energised. When a signal button relay is in energised condition if another signal button is pressed, the signal button relay concerned to second button will not get energised. The signal button relay which is in energised condition remains in the same state till the signal button concerned is not released.

In GNR &EGGNR circuits, SMR is not proved, to facilitate to throw the signal to danger in case of emergency, though the panel is in locked condition.

All Signal Button Normal Relay:

The relay GNCR is normally a picked up relay proving all signal button relays are in de-energised condition (i.e no signal button is in the pressed /stuck up condition)
When a signal button is pressed, the GNR concerned is energised and drops GNCR.

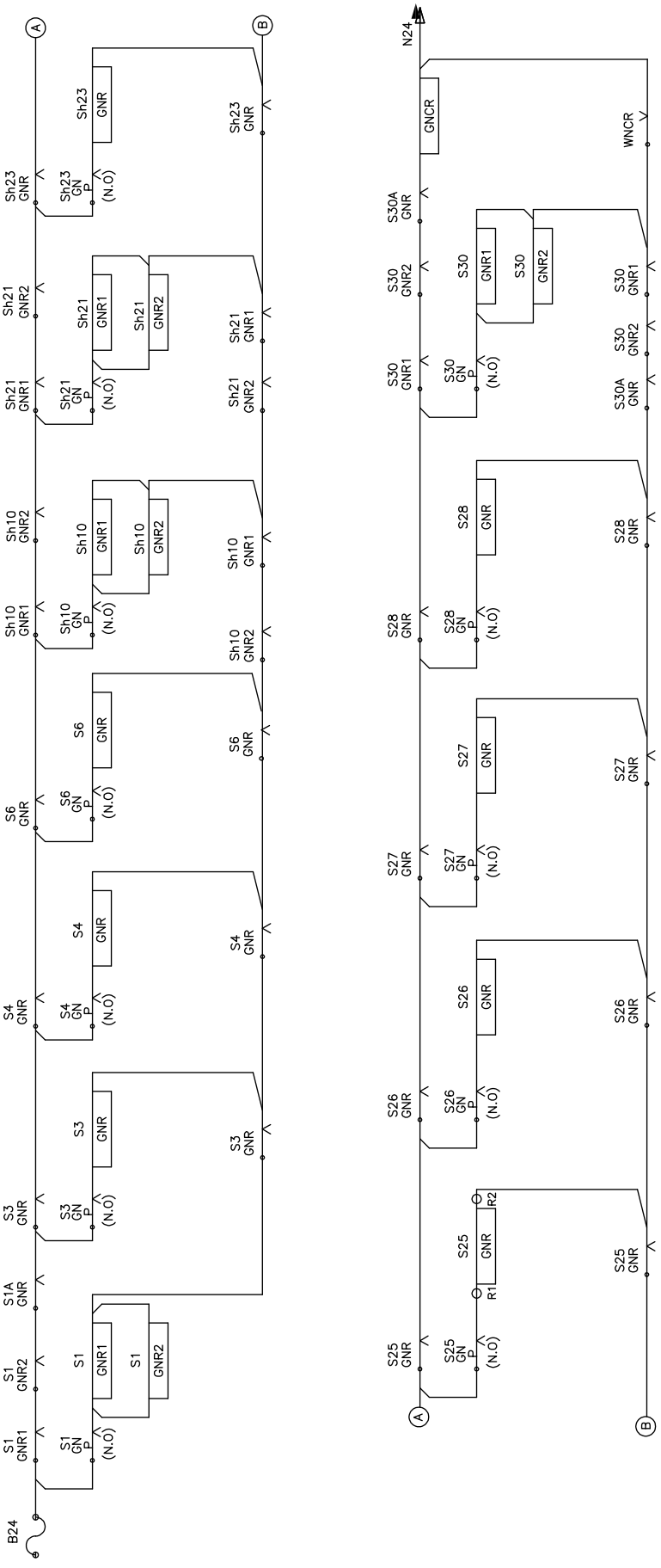


Fig No: 5.2 GNR / GNCR CIRCUIT

5.3 BUTTON CIRCUITS FOR ROUTE

1. All Route button Normal Relay(UNCR)
2. Route button Relay(UNR)

5.3.1 All Route button Normal relay (UNCR): UNCR is normally an energised relay proving that no route button is in pressed condition (or in stuck up condition). Whenever any route button is pressed for selection of a signal route, UNCR drops immediately. On selection of a signal route, when route button is released, UNCR picks up immediately.

5.3.2 Route button Relay (UNR): The Route button relay is normally a dropped relay. Whenever the route button is pressed the route button relay (UNR) energises provided the following conditions are met.

- All other route button relays are in the de-energised condition i.e no other route button is in the pressed condition /stuck up in the pressed condition
- The station master's control relay (SMR) is in the picked up condition ie SM's key in
- All point button Normal proving relay (WNCR) is in the picked up condition i.e no point button is in the pressed condition /stuck up in the pressed condition.
- When a route button relay is in energised condition if another route button is pressed the route button relay concerned to the second button will not be energised. The route button relay which is in energised condition remains in the same state till the route button concerned to that relay is not released.

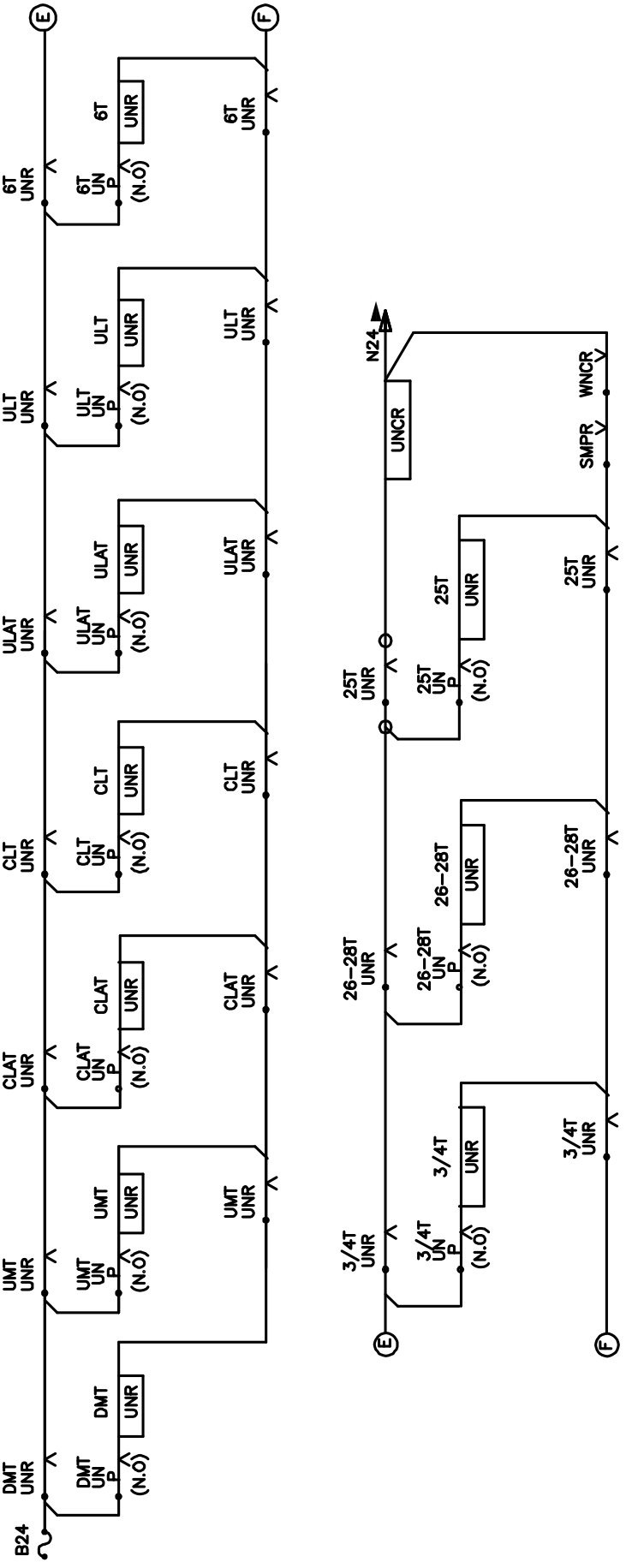


Fig No: 5.3 UNR / UNCR CIRCUIT

5.4 BUTTON CIRCUITS FOR A POINT:

(a) All Point button normal relay (WNCR)
(b) Point button relay (WNR)

5.4.1 All Point Button Normal Relay (WNCR): All point button normal relay (WNCR) is normally a picked up relay it drops when any one of the following button is pressed.

- Point –WN
- Crank handle-CHN
- LC Gate-LXN
- Siding-KLN
- Common point button normal-NWWN
- Common point button Reverse-RWWN
- Emergency point operation button-EWWN

5.4.2 Point button relay (WNR): When a point button (WN) is pressed , the point button relay (WNR) Concerned energises provided the following condition are met.

- All other point button relays are in dropped condition i.e no other point button is in the
- Pressed condition /stuck up in the pressed condition.
- ALL crank handle button relays, LC gate and siding button relays in dropped condition
- All signal button normal relay GNCR, All route button normal relay (UNCR) and station master's relay (SMR) are in the energised condition.

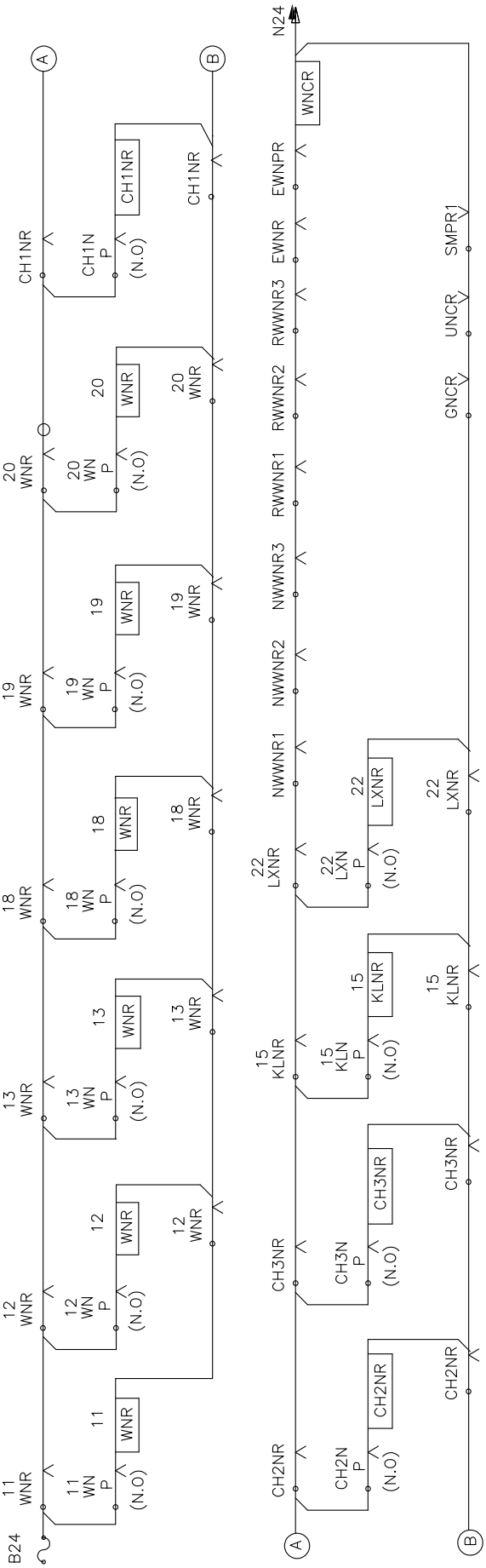


Fig No: 5.4 WNR / WNCR CIRCUIT

SEQUENCE OF OPERATIONS FOR SIGNAL CLEARANCE

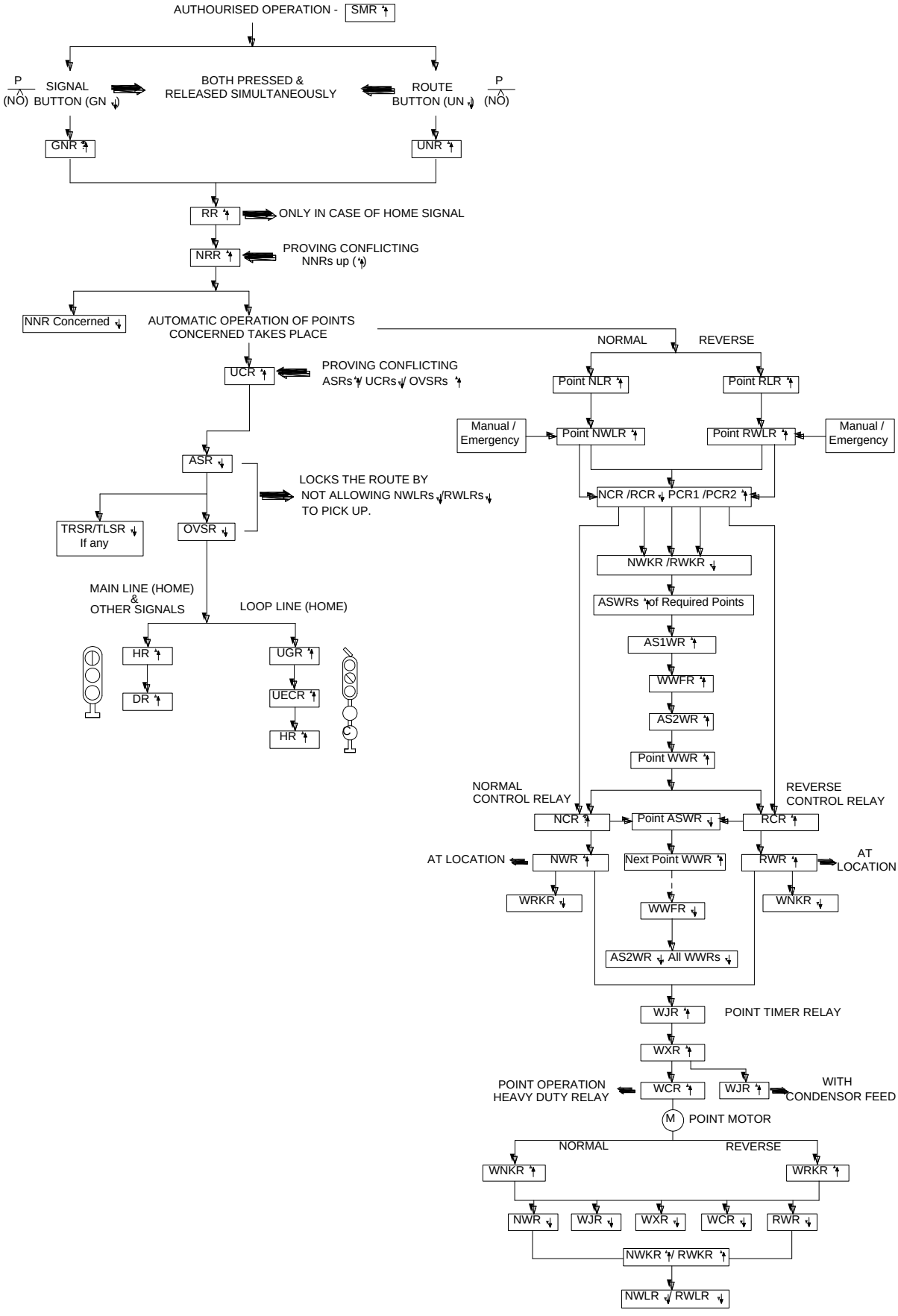


Fig No: 5.5

5.5 Common button circuits

1. Slot transmission button relay (GSBNR):-

When slot transmit button (GSBN) is pressed, slot transmit button relay(GSBNR) is energised proving SMR↑ and GNCR ↑.

2. Slot receive button relay(GSRBNR):-

When slot receive button (GSRBN) is pressed, slot receive button rely (GSRBNR) is energised provided the station masters control relay (SMR) and all signal button normal relay (GNCR) are in picked up condition.

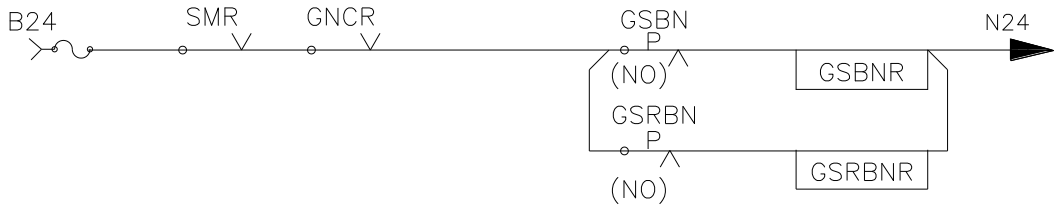


Fig No: 5.6

3. Normal common point button relay(NWWNR):-

When normal common point button (NWWN) is pressed ,normal common point button relay (NWWNR) is energised provided SMR is in picked up condition and Reverse common point button relay (RWWNR) is in dropped condition.

4. Reverse common point button relay (RWWNR):-

When reverse common point button (RWWN) is pressed, reverse common point button relay (RWWNR) is energised provided SMR is in picked up condition and the normal common point button relay (NWWNR) is in dropped condition.

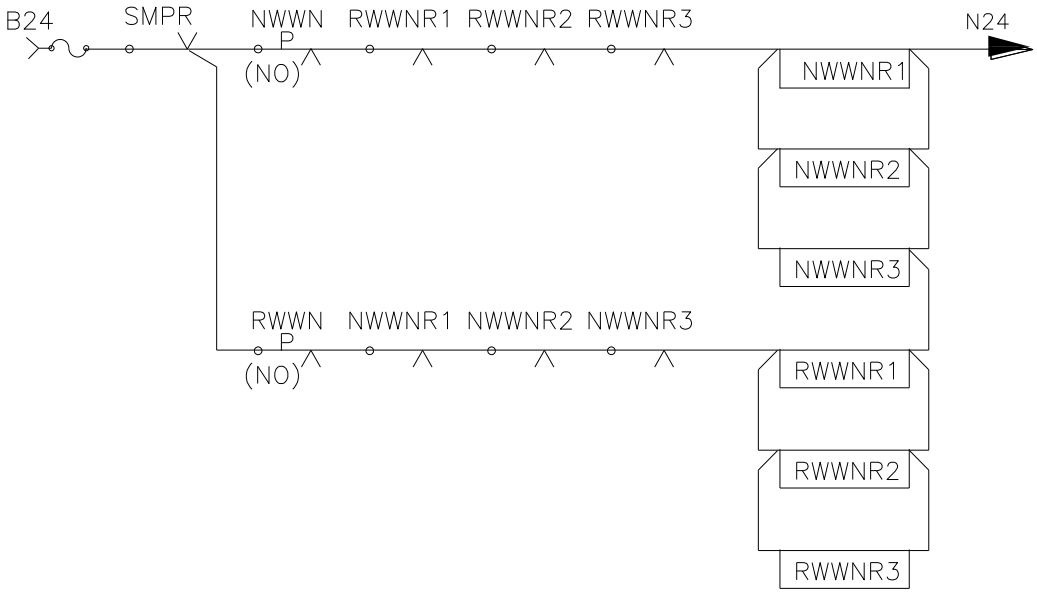


Fig No: 5.7

5. **Calling – ON initiation button relay (CO-GGNR) :-** When main signal button (S1 or S30) and COGGN button are pressed, then the calling-ON initiation button relay COGGNR is energised and sticks through its own front contact which results in energisation of calling ON GNR (S1A GNR/S30A GNR)

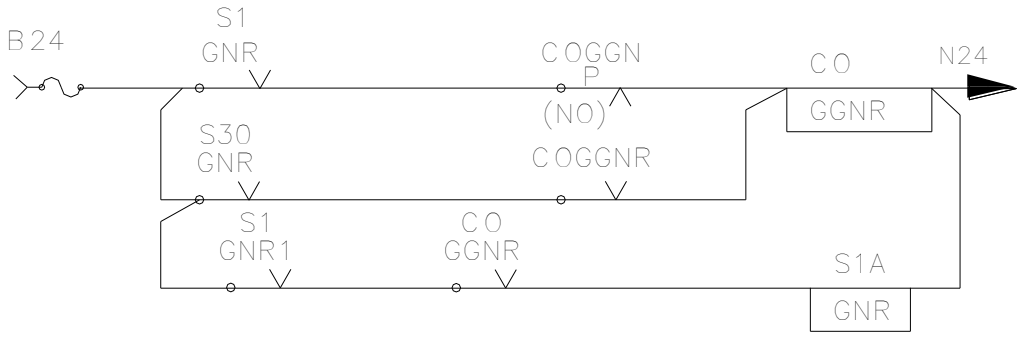


Fig No: 5.8

Emergency Signal Cancellation Button relay:

The Relay EGGNR is Normally dropped relay. When emergency signal cancellation button EGGN is pressed, EGGNR picks up. In EGGNR circuits, SMR front contact is not proved, to facilitate to throw the signal to danger in case of emergency, though the panel is in locked condition.

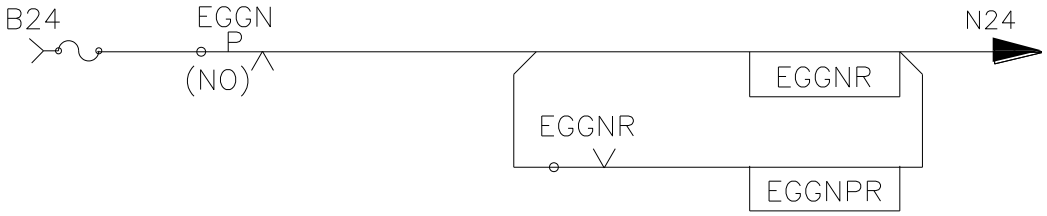


Fig No: 5.9

5.6 Button Reverse Relay –RR: The Relay RR, is used for reception signals only .The RR is normally a dropped Relay. When S1 signal button and CLAT Route button are pressed & released simultaneously, S1GNR and CLAT-UNR are energised there by S1-RR gets energised provided following conditions are met (all are normally dropped relays)

- Sequence route release relays in drop –S1UYR1 ↓
- Calling on signal (conflicting signal) RR in drop -S1A RR ↓
- Emergency signal cancellation Relay in drop –EGGNR ↓
- Calling on initiation button Relay in drop-COGGNR ↓

Then S1 RR sticks through its own front contact by passing S1 GNR up , CLAT –UNR up& COGGNR down.

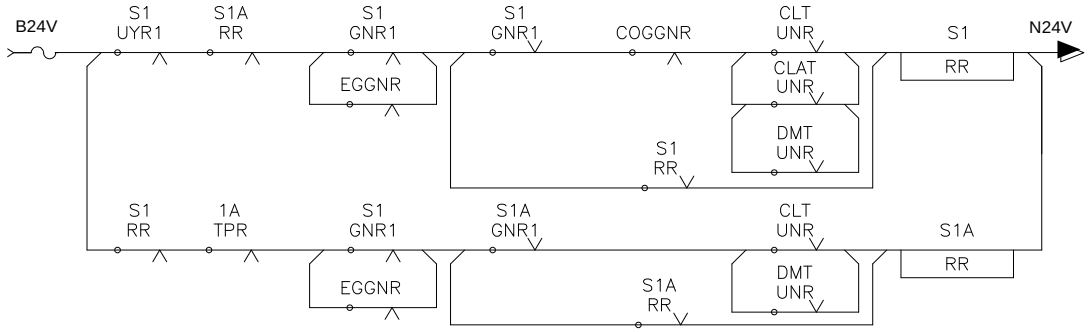


Fig No: 5.10

5.7 BLOCK CLEARENCE CIRCUIT: This relay (S1RR) is proved in block clearance circuit to pick up ZR1, This helps in normalisation of block, though the reception signal fails to take off (HR does not pick up)

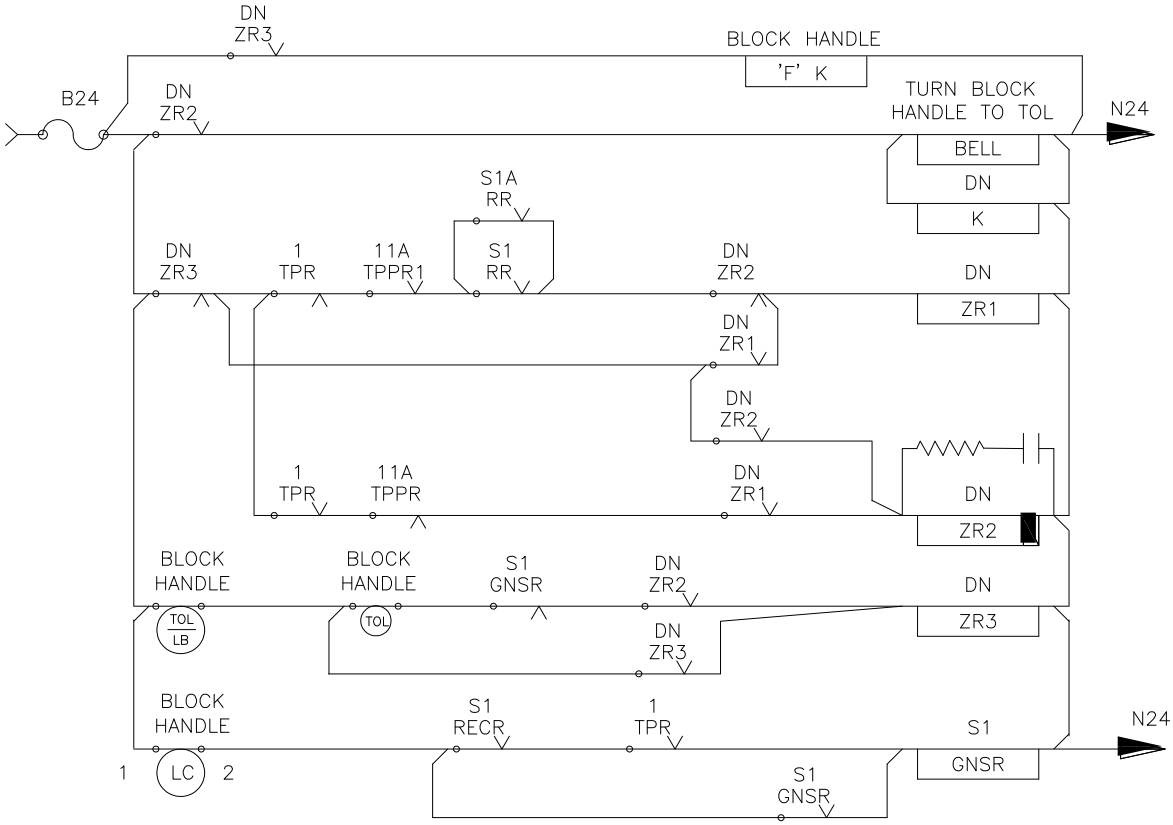


Fig No: 5.11 BLOCK CLEARENCE CIRCUIT

TSR Circuit : Compare this circuit with non route setting type TSR circuit. (Fig No : 4.3)

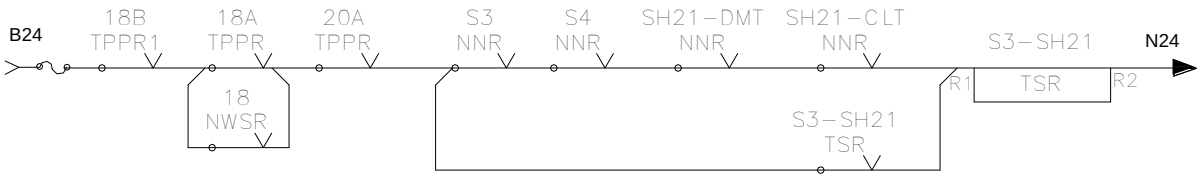


Fig No: 5.11 (a) TSR CIRCUIT

5.8 ROUTE NORMAL RELAY (Button Normal Relay) - NNR:- Route normal relay is normally an energised relay and sticks through Its own front contact by passing its own ASR relay.

The moment NRR picks up, it drops NNR concerned immediately.

The NNR picks up, when NRR drops and ASR picks up.

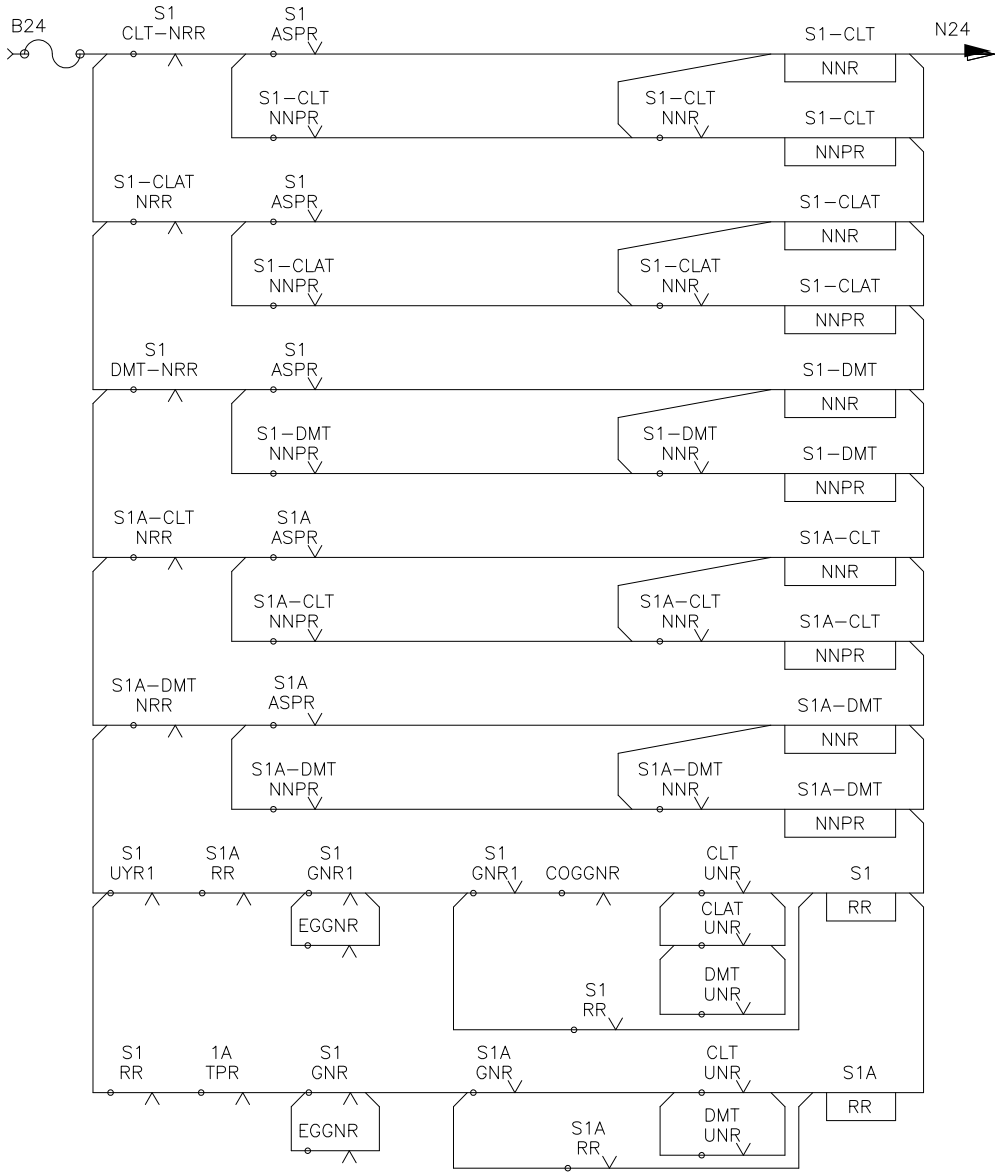


Fig No: 5.12 NNR / S1 RR CIRCUIT

5.9 ROUTE REVERSE RELAY (Button Reverse Relay)-NRR :- Route Reverse relay is normally a de-energised relay . Its picks up, when signal button (GN) and route (UN) are pressed and released simultaneously, proving that conflicting movements are not initiated (NNR up). Once NRR picks up, it sticks through its own front contact. When signal button S1 and route button CLAT are pressed and released simultaneously then S1GNR and CLAT UNR picks up, there by S1-CLAT NRR picks up and sticks through its front contact proving the following conditions

- Crank handles are in –CH1LR ↑ ,CH2LR↑
- Button reverse relay is in picked up –RR ↑ (RR is used for reception signal only)
- Conflicting routes are not set –all NNRS up as shown in circuit diagram
- Overlap stick relays in pickup -26 OVSR ↑ , 3-OVSR↑
- Calling on signal button relay in drop-S1A GNR ↓
- Signals own route is not set –S1 ASPR↑ , 4-OVSR ↑

The moment NRR picks up it initiates two actions

- The NNR Concerned drops.- S1CLAT NNR↓
- Initiates point chain operation

Route reverse relay NRR drops on two occasions

- When signal cancellation is done
- When the train travels over the set route and sequential route release relays are picked up

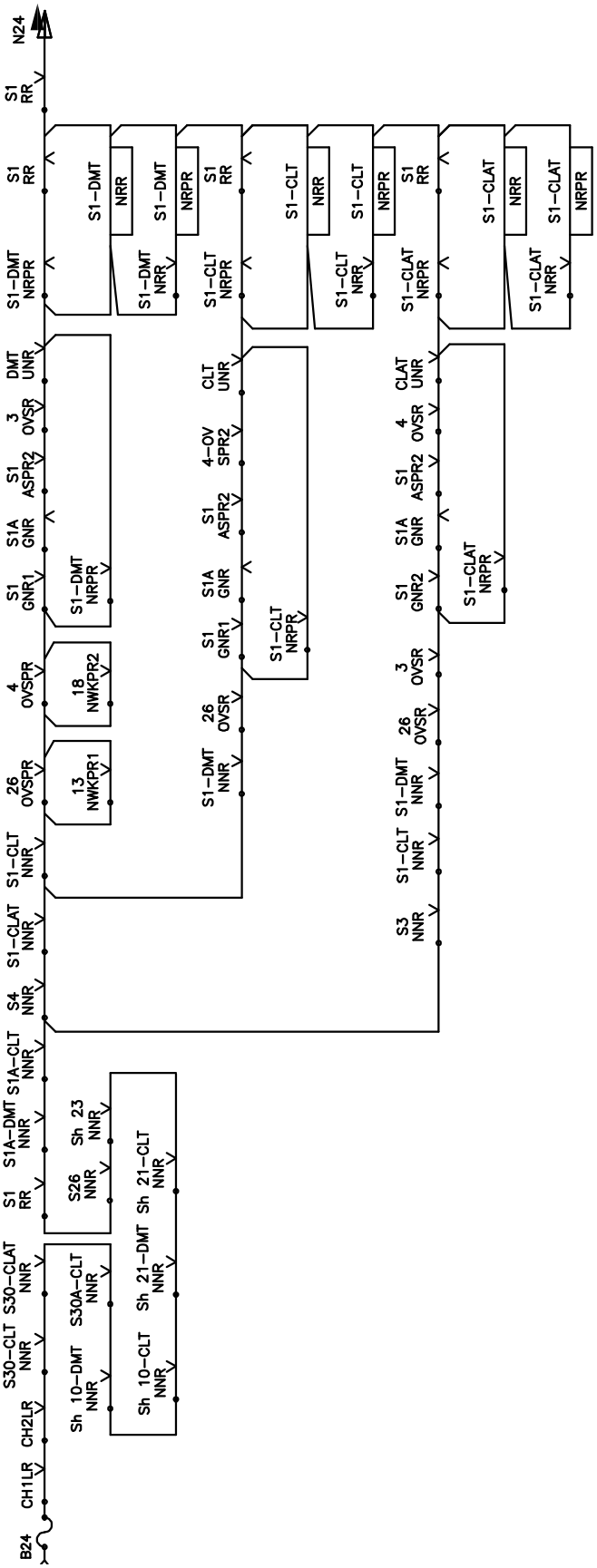


Fig No: 5.13 NRR CIRCUIT

5.10 Automatic Operation of Points: When route reverse relay NRR picks up it initiates automatic point operation. To take off the signal S1 to common loop overlap set to mainline , S1 signal button and CLAT route button are pressed and released simultaneously there by S1-CLAT NRR picks up and sticks through its own front contact.

5.10.1 POINT INITIATION RELAY FOR NORMAL/REVERSE :- The moment S1-CLAT NRR picks up. It energises point initiation relays for normal 11NLR, 20NLR and point initiation relays for reverse 13RLR,18RLR simultaneously for the route i.e common loop overlap set to mainline.

Point initiation relay (11NLR) picks up by proving the following conditions

- Particular signal route is initiated (S1-CLAT –NRR) ↑
- Signal route normal relay dropped (S1-CLAT-NNR) ↓
- Conflicting route settings NRRs in drop(for example SH10-DMT-NRR) ↓
- Point Normal Indication relay NWKR in drop (11NWKLR) ↓
- Point initiation relay for reverse in drop (11RLR) ↓

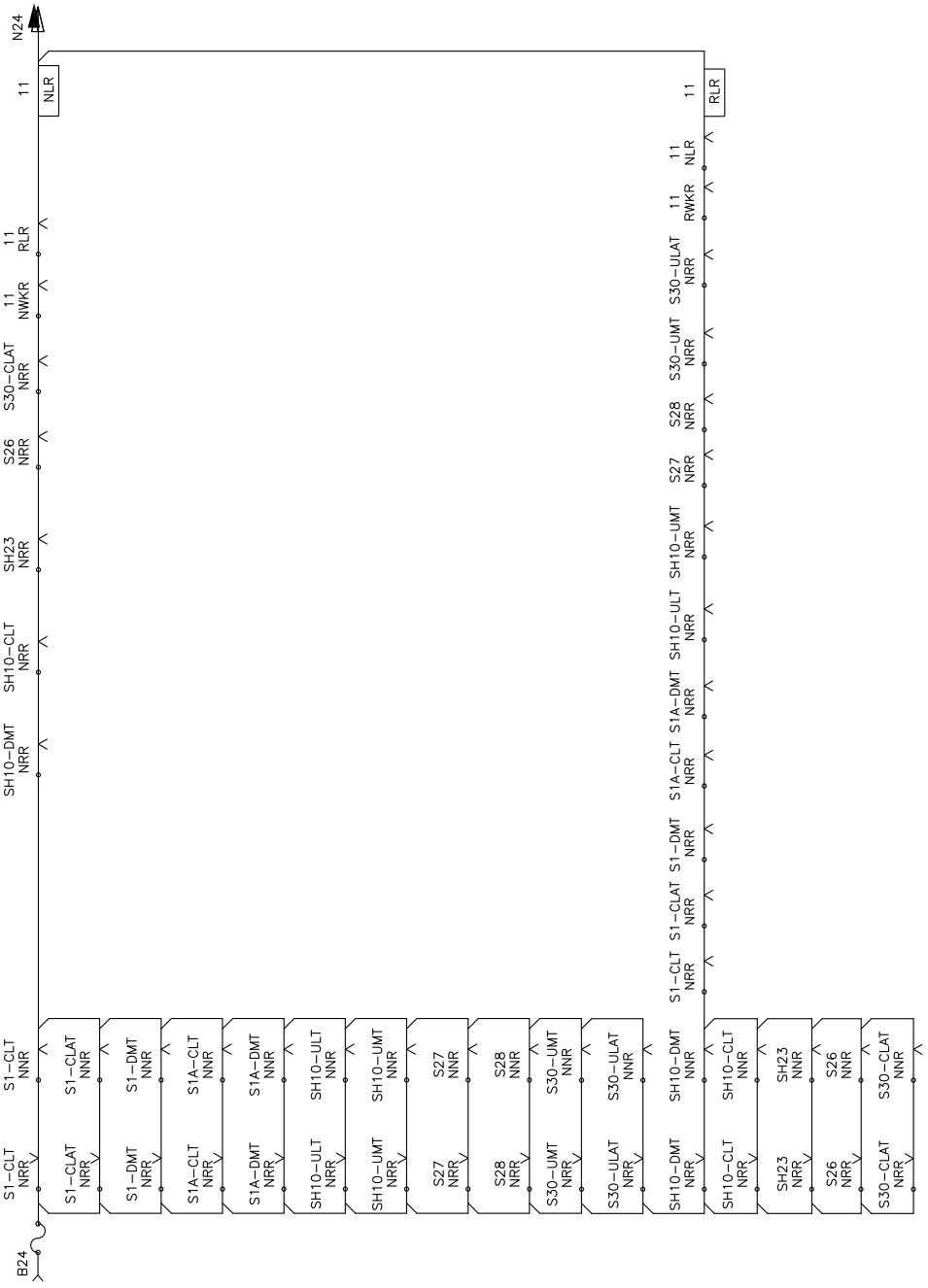


Fig No: 5.14 11 NLR/RLR

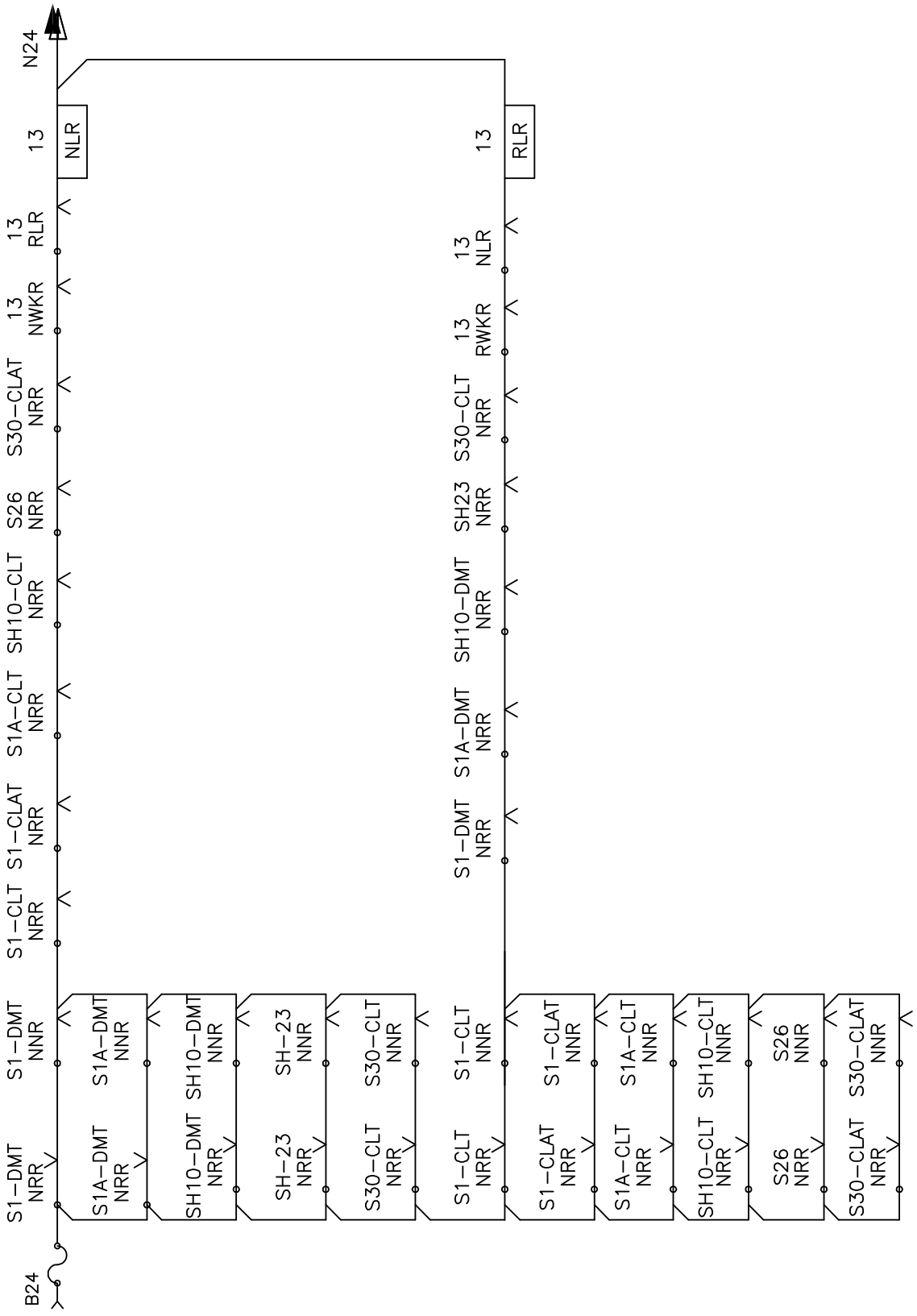


Fig No: 5.15 13 NLR/RLR

5.10.2 POINT LOCK RELAY NORMAL/REVERSE (NWLR/RWLR):- The moment point initiation relay for normal (11NLR & 20 NLR) is picked up then point lock relay for normal NWLR (11NWLR & 20 NWLR) is picked up. Similarly the point initiation relay for reverse (13RLR , 18 RLR) will pickup point lock relay for reverse RWLR (13 RWLR &18 RWLR)
NWLR **/**RWLR picks up by proving following conditions (11NWLR ↑)

- Emergency point key 'IN 'checking relay in drop EW(N/R) CR↓
- ALL signals ASRs in whose route point (No 11) is required are proved in pickup (S1 ASR ↑, S1A ASR ↑ etc)
- ALL signal OVSR s in whose overlap point (No11) is required , are proved in pickup
- Track locking is proved by TPRS in up (11A TPR ↑ , 11B TPR↑)
- Emergency point operation is not initiated (EWNR↓)
- Individual point button or normal common point button and Reverse common point Buttons are not in pressed position (11 WNR ↓ , 11NWWNR↓ / RWWNR↓)
- Automatic point operation is initiated by NLR/RLR up (11 NLR↑)
- Point is not set in Normal/Reverse (11 NWKR ↓)
- RWLR/NWLR in drop (11 RWLR↓)

Note : All the ASRs and OVSRs are proved in by double cutting arrangement.

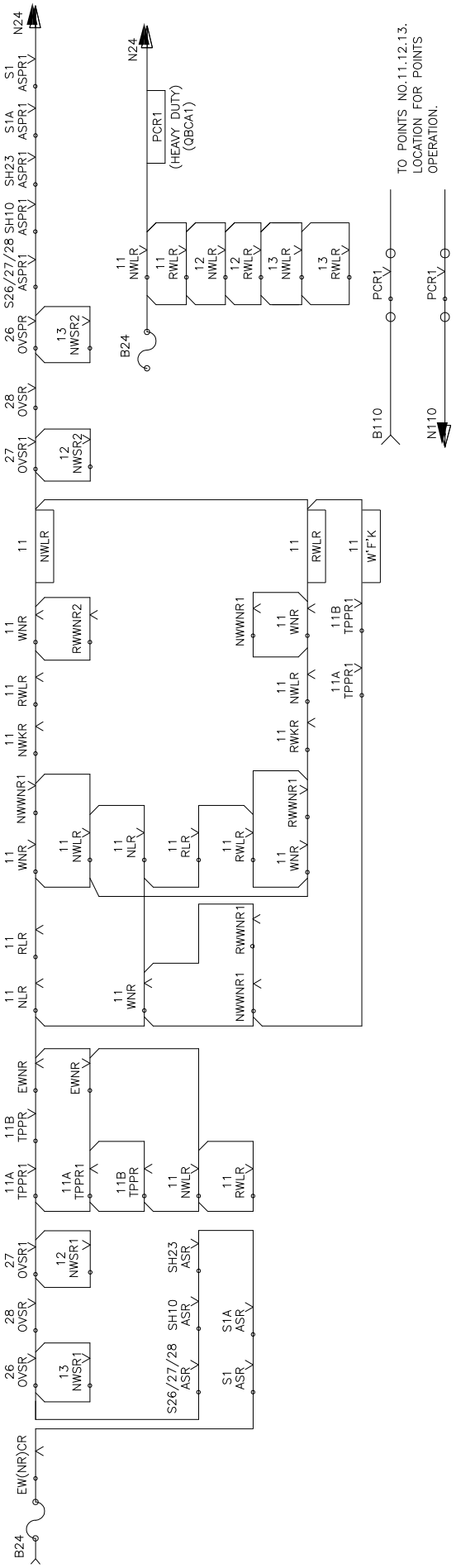


Fig No : 5.16 NWLR / RWLR CIRCUIT

Due to picking up of NWLRS & RWLRS, the following actions takes place simultaneously.

(a) NCR/RCR s drop
(b) NWKR/RWKR s drop
(c) PCR1,PCR2 pick up
(d) ASWRs pick up

(a) **NCR/RCRs** drop:- When the NWLR/RWLR picks up, the RCR/NCR concerned drop.

For S1 signal to common loop overlap set to main line, 11RCR , 20 RCRs drop as 11NWLR &20 NWLR are picked up .Also 13 NCR and 18 NCRs drop as 13 RWLR & 18 RWLR are picked up.

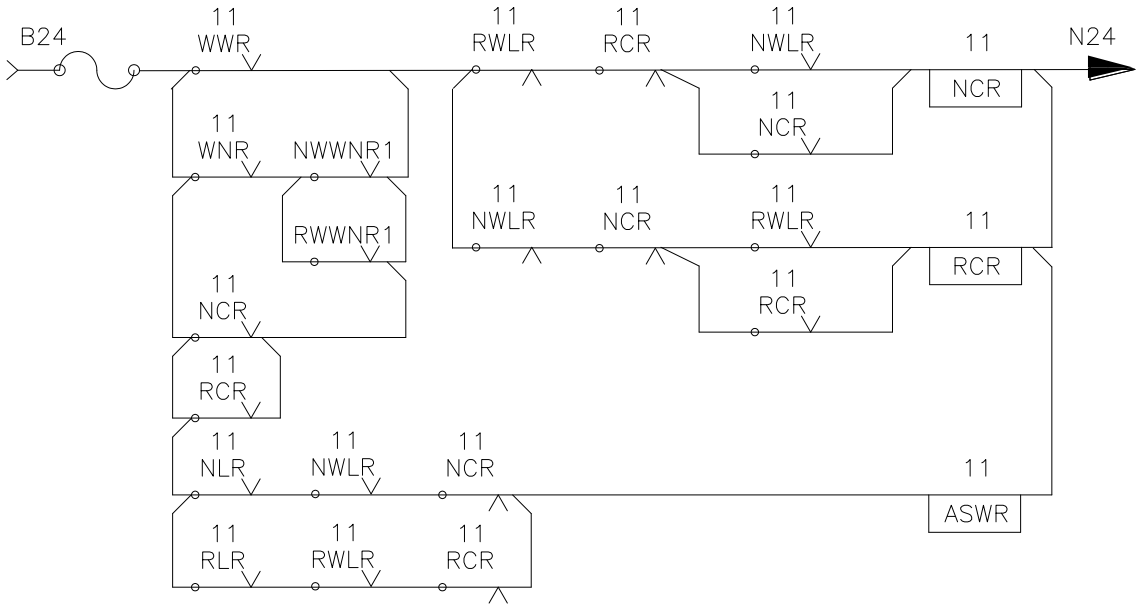


Fig No: 5.17 NCR / RCR CIRCUIT

(b) **NWKR/RWKR** s drop

The picking up of NWLR/RWLRs result in dropping of NWSRs, RWSRs, NWKPRs, RWKPRs. The dropping of NCR/RCR (11 RCR) and picking up of NWLR/RWLR (11 NWLR) results in dropping of RWKR /NWKR (11 RWKR↓, NWKR is already in dropped condition). Therefore the point indication relays and all their repeaters are dropped.

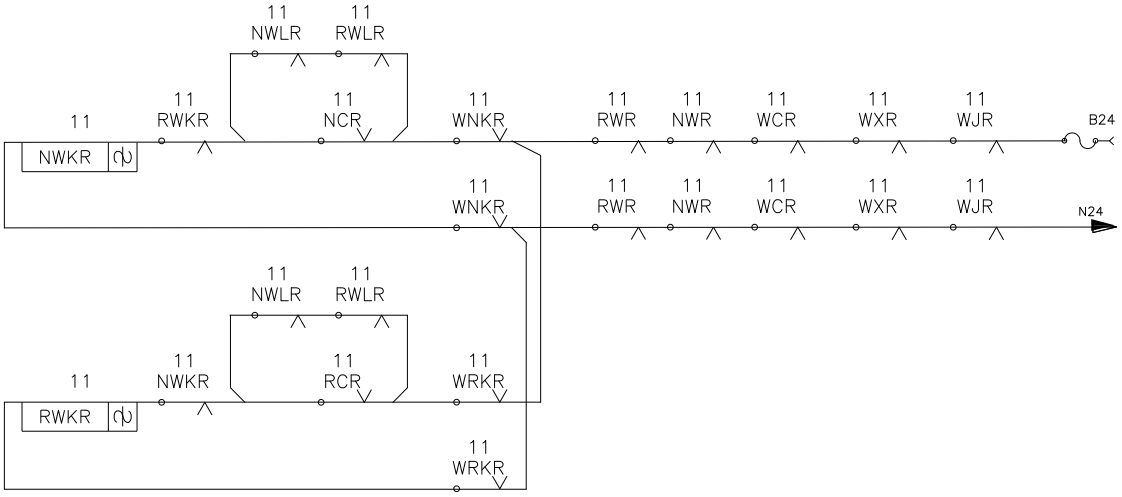


Fig No: 5.18 11NWKR / RWKR CIRCUIT

(c) **PCR1, PCR2** pickup :-

The moment NWLRs, RWLRs (11 NWLR, 20 NWLR, 13 RWLR↑, 18 RWLR↑) picks up, the point power control relays PCR1, PCR2 pick up. Then the 110 V DC for point operation is connected to point location Bus Bar, but 110 V DC is not connected to point machine. (waiting for the command from Relay room)

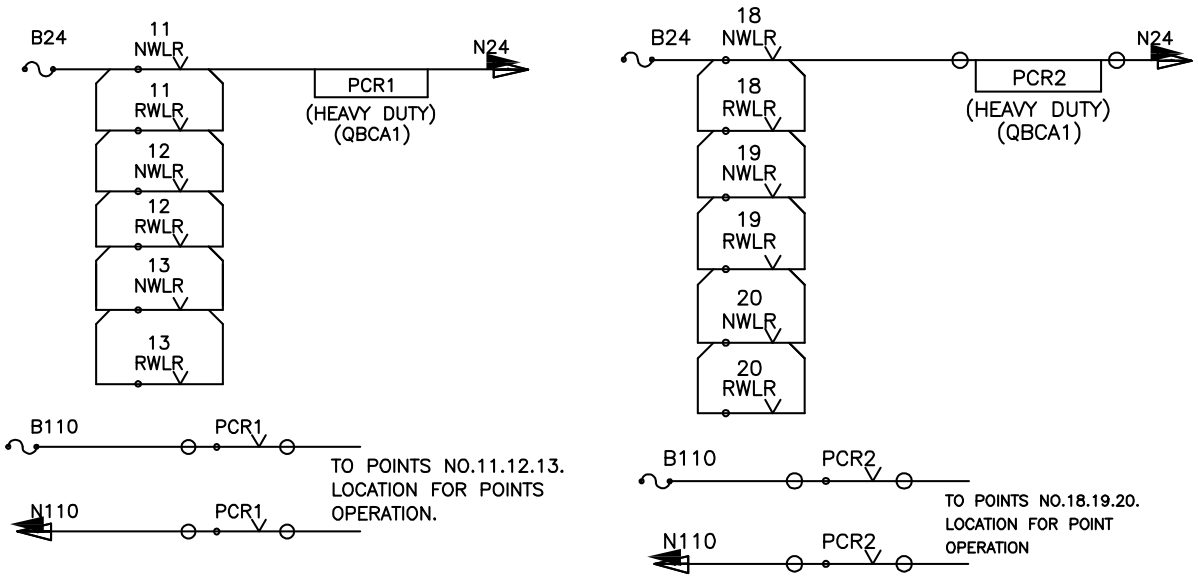


Fig No: 5.19 PCR1/PCR2 CIRCUIT

(d) **Automatic Switching of point chain operation relay (ASWR):-**

The energisation of NWLR/RWLRs (11NWLR↑, 20 NWLR↑ ,13 RWLR↑, 18 RWLR↑) results in picking up of ASWRs (11ASWR, 20ASWR,13 ASWR & 18 ASWR) concerned to that route (S1 to CLAT) .11ASWR picks up through the front contacts of 11NLR,11NWLR and 11 NCR drop contact.

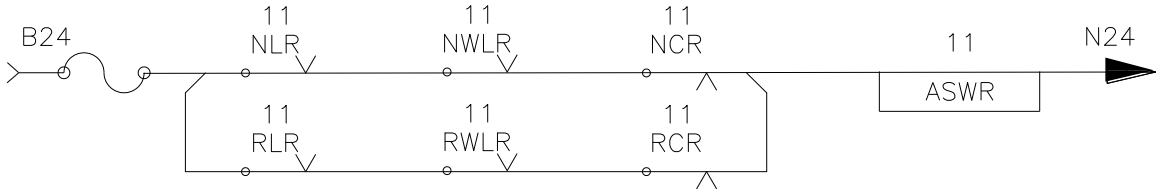


Fig No: 5.20 11 ASWR CIRCUIT

5.11 Picking up of Auto set point relay AS1WR :- Auto set point relay AS1WR is normally a de-energised relay and provided with slow to release arrangement .

When NLR/RLR (11NLR ↑ ,20 NLR ↑ ,13 RLR ↑, 18 RLR ↑) and ASWRs (11 ASWR ↑ , 13 ASWR↑ ,18 ASWR↑ ,20 ASWR↑) concerned to the particular route are picked up, then Auto set point relay one AS1WR picks up , proving the following conditions and sticks through its own front contact by passing WWFR↓.

- Auto set point relay two in drop (AS2WR↓)
- Auto chain point control relays 11WWR and 12 WWR are in drop
- Auto point operation final normal relay (WWFR) in drop.

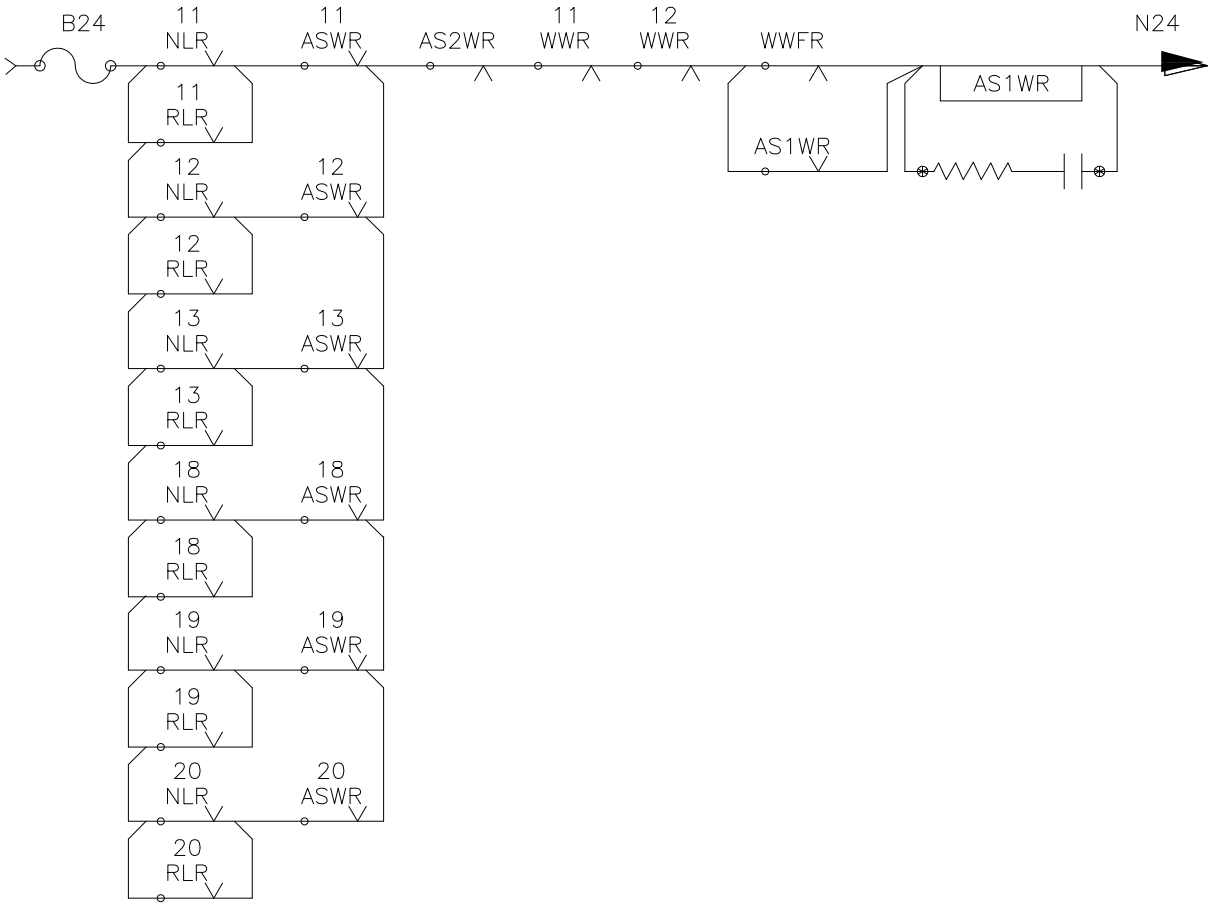


Fig No : 5.21 AS1WR CIRCUIT

Auto point operation final normal relay WWFR :- WWFR is normally a dropped relay .it picks up through 20 WWR ↓ , AS1WR ↑ and sticks through its own front contact by passing AS1WR↑

Auto set point relay two –AS2WR: The moment WWFR is picked up, the auto set point relay two (AS2WR) picks up through WWFR ↑ & AS1WR ↑ and sticks through its own front contact by passing AS1WR.

Dropping of AS1WR and picking up of 11WWR:- The moment AS2WR picks up ,AS1WR drops with a time delay .

The moment AS1WR drops it results in picking up of 11WWR through AS2WR↑ , WWFR↑ , AS1WR↓ , 13WWR ↓ ,18WWR ↓ ,19 WWR↓ and 20 WWR ↓ .

The 11WWR sticks through its own front contact by passing WWFR ↑ and AS1WR ↓.

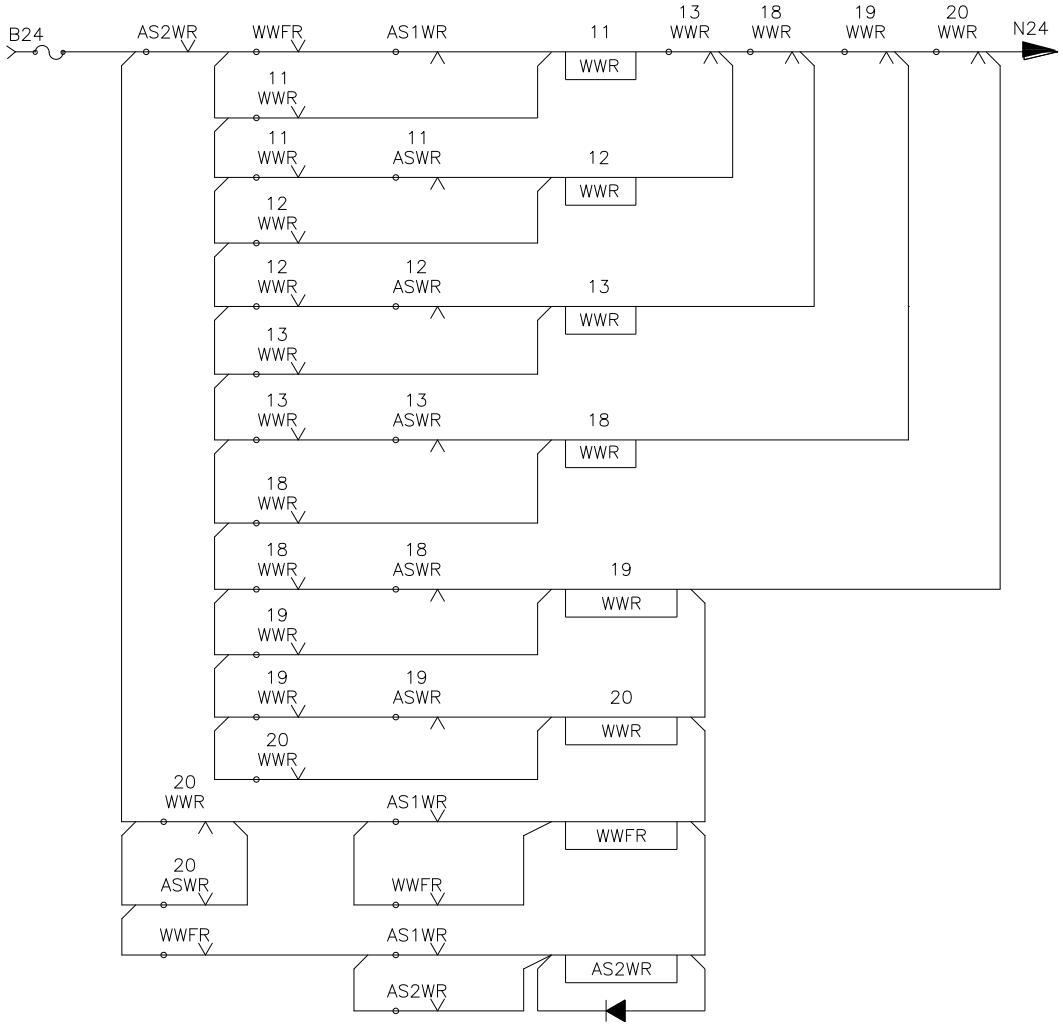


Fig No : 5.22

5.12 Point Normal Control Relay / Point Reverse Control Relay (NCR / RCR) picks up :-

The point Normal control relay 11NCR picks up ,the moment 11WWR picks up because of other conditions ie 11RWLR ↓ , 11RCR ↓ , 11NWLR ↑ are already available.

Then 11 NCR sticks through its own front contact by passing 11NWLR↑and 11WLR.

This 11NCR will drop only when the point no11 is initiated to reverse during next automatic points operation cycle or manual operation.

5.12.1 Picking up of 11NCR results in two Operations:

(a) Point operation at location
(b) Point chain operation

(a) **Point Operation at Location**: The moment 11 NCR picks up ,it sends command to 11 point contractor unit by picking up 11NWR at location, further the point operation at location is exactly as explained in Non- Route setting type interlocking.

(b) **Point Chain Operation**: The moment 11 NCR picks up, it results in dropping of 11ASWR. The dropping of 11ASWR results in picking up of 12 WWR and sticks through its own front contact by passing 11WWR ↑ , 11ASWR ↓.

12 WWR checks for 12 ASWR is in pick up for initiating the chain operation. Since for the S1-CLAT route, point N0 12 is not required hence ASWR is in drop. Therefore immediately 13 WWR picks up through 12 WWR ↑ and 12 ASWR ↓ and sticks through its own front contact. The moment 13 WWR picks up , it results in dropping of 11WWR.

The 13WWR checks whether 13ASWR is in pick up for the point chain operation or not. As the point No13 is required for the route , 13ASWR is already available in pickup.

Hence point No13 is initiated for reverse by picking up 13RCR .The command goes to point location for reverse operation. The moment 13RCR picks up ,it drops 13ASWR.The point chain operation continues by picking up 18 WWR ,19 WWR and finally 20 WWR.

The moment 20 WWR picks up, 20 ASWR drops there by the point chain operation final normal relay WWFR drops which results in dropping AS2WR. The moment AS2WR drops, all the WWRs in the chain operation drop. Therefore the point chain operation circuit is ready for the next chain operation.

5.12.2 Individual point operation

The points remain in the last operated position. To set a point to normal /Reverse , the point button (WN) and common point group button Normal (NWWN)/common point group button Reverse (RWWN) are pressed and released simultaneously.

Let us understand Normal point operation sequence referring the flow chart shown in fig no
Let us assume point No 11 is reverse. To set point No11 to Normal, 11WN button and NWWN buttons pressed and released simultaneously. Then 11 NWLR picks.

Picking up of NWLR

11 NWLR picks up proving the following conditions for individual point operation.

- Emergency point key in checking relay is in dropped condition EW(N/R)CR ↓
- All the signals ASR's in whose route point no 11is Associated are proved in up S1ASR ↑, S1A ASR ↑, Sh 23 ASR↑, Sh 10 ASR↑, S26/27/28 ASR↑. All OVSR s in whose route point no 11 is associated are proved in up 26 OVSR ↑ , 27 OVSR ↑, OVSR ↑
- Track locking is proved by the track circuits concerned to that point. 11A TPR↑ , 11B TPR↑ ,
- Neither emergency point operation nor Automatic point operation is initiated. EWNR↓, 11NLR ↓, 11RLR ↓.
- Point button 11WN and Common group Point button Normal NWWN are pressed 11 WNR↑, NWWNR↑.
- Point is not set already in normal 11 NWKR↓
- Point is not initiated for Reverse is proved by 11RWLR ↓
- Reverse common point button is not pressed RWWNR ↓

Once Normal point lock relay (11NWLR) picks up, it holds through its own front contact by passing track locking TPRs.

Picking up of 11NWLR results in

- Dropping of NCR/ (RCR)
- Picking up of PCR1

- Dropping of RWKR
- Picking up of NCR

Dropping of RCR : (Refer Fig No: 5.17)

The Moment 11 NWLR picks up, 11 RCR drops (We assumed pt no 11 in Reverse prior to the operation) When 11 RCR drops , the stick path is removed , there by 11 RCR remains in drop condition .

Picking up of PCR1: (Refer Fig No:5.19)

When 11NWLR picks up PCR1 picks up and 110 v DC is connected to Pt no 11,12,13 location Bus bar .But supply is not connected to point machine for operation .

Dropping of RWKR: (Refer Fig No:5.18)

When 11 NWLR is picked up and 11 RCR is dropped results in dropping of 11 RWKR. As NWLR is picked up all 11 NWKPRs, 11 RWKPRSs,11 NWKRs and 11RWSRs in drop. Therefore 11 NWKR, 11RWKR and all repeaters (KPRS & SRS) will be dropped in condition .

Picking up of NCR: (Ref Fig No : 5.17)

Through the front contacts of 11WNR, NWWNR and back contacts of 11 RWLR, 11 RCR and 11 NWLR front , point normal control relay 11 NCR picks up . It holds through its front contact by passing 11NWLR↑ and 11WNR ↑and NWWNR↑ front contacts.

Picking up of 11 NWR at location

The Normal point operating relay is Normally a de-energised relay . The 11 NWR at picks up the back contacts of all 11NWSRS,11RWSRS , 11 NWKPRS, 11RWKPRS , 11NWKR, 11RWWKR and front contacts of 11NCR , 11NWLR by double cutting.

The cross-protection is provided through the back contact of 11 NWLR.
The moment 11NWR picks up ,the point operation is initiated and the point No 11 will be set to Normal .

Note: After the 11NWR picking up at the location, the point operation is exactly
Same as explained in non-route setting type interlocking.

5.12.3 Emergency Point operation

The facility to provide to operate a point under point zone track circuit failure, thereby the flexibility of yard is not lowered much during track circuit failure.

The emergency point operation when the conditions below are satisfied.

- Point Zone track is in failed condition
- Point is not locked in the route set
  Before adopting emergency point operation the SM must ensure that point track is in failed condition and no vehicle is standby on that track and point is not locked in the route set.

The button for emergency point operation is kept in sealed condition. A counter is provided on the panel to record all such emergency point operations.

Now let us think that Point No 11 is in reverse position and its point Zone track circuit 11ATPR/11BTPR or both have failed.

(a) Insertion of Emergency Point operation key (EWWN key)↑
SM inserts EWWN key on the panel after verifying no vehicle is standing on the Point zone.

(b) Picking up of emergency point operation button relay EWWNR and emergency Point operation Key in relay EW(N/R) ↑

Then SM cuts the sealing of the EWWN button , turns the disc and presses the EWWN button, there by EWWNR picks up through SMPR↑ pickup contact. Through the front contacts of EWWNR↑, the EW(N/R)CR relay picks up.

(c) Press the individual point button keeping EWWN in the pressed condition.
Then SM presses the point button keeping EWWN in the pressed condition. Thereby Point no 11 button relay 11 WNR picks up.

Then through the front contacts of 11 WNR↑ and EW (NR) CR↑, emergency Point operation relay EWNR picks up on sticks through its own front contact by passing EW (NR) CR.

Emergency Point operation counter incremented by one count through the front contacts of EWNR↑ and EW (NR) CR↑

The Emergency Point operation indication (EWKE) is lit through EWNR. AS the 11 WNR is in the energized condition , the supply to the EW(NR)CR is cut-off but the relay drops after some time delay as it made slow to release. There by for each operation , only one count is incremented.

(d) Keeping the Point button in the pressed condition, release emergency Point operation button and press the NWWN/RWWN and release them both.
SM presses the EWWN button and 11 WN button , releases EWWN and presses NWWN thereby NWWNR and 11WNR both are energized. Which causes to energisation of 11 NWLR ↑.

Picking up of NWLR/RWLR

11 NWLR is energized when the following conditions are satisfied.

- Emergency Point operation key in checking relay has dropped after incrementing the counter by one number. EW(NR)CR↓
- All the signals ASRs in whose route , the point no11 is required is proved in up condition –S 1 ASR↑, S1A ASR↑, Sh 23 ASR ↑, Sh 20 ASR↑, S26 /27/28 ASR↑
- All OVSR in Whose overlap point no11 is available are proved in up condition – 26 OVSR↑ , 27OVSR ↑ , 28 OVSR ↑
- Point zone tracks in the failed condition and Emergency point operation is initiated – 11A TPR ↓ / 11B TPR ↓ or both and EWNR↑
- Automatic point operation is not initiated –NLR↓, RLR↓
- Point no 11 button and common point button for normal are pressed -11 WNR ↑ , NWWNR↑
- Point is not initiated for reverse opertation-11 RWLR↓
- Reverse common point button is not pressed –RWWNR↓

The moment 11 NWLR is energized, the further Point operation is exactly like individual point operation.

Comparision of UCR , ASR and HR circuits (PI & RRI)

UCR, ASR & HR Ref Fig Nos : 4.6 , 4.8 & 4.16 respectively

These circuits same as non route setting type interlocking. The comparison is done and main additions or differences are listed out below for our understanding .

UCR CIRCUIT:

S30 UCR in Route setting type interlocking is shown in Fig No:5.23

S30 UCR in Non-Route setting type interlocking is shown in Fig No: 4.6

The difference or addition to UCR circuit in route setting type interlocking as compared to UCR circuit in Non–route setting type interlocking are given below .

S.No	Non-Route setting type	Route setting type
1	S6 UCR in drop proved	S6 NRR in drop proved
2	------	Concerned to each route NNR↓,NNPR↓,NRR↑ is proved in UCR
3	LXRR↓ is proved	LXRR ↓ is proved in NRR Circuit and NRR↑ is proved in UCR
4	Double cutting RR↑ is proved	Double cutting NRR↑ is proved
5	For cross protection RR↓ is proved	For cross protection NRR↓ is proved

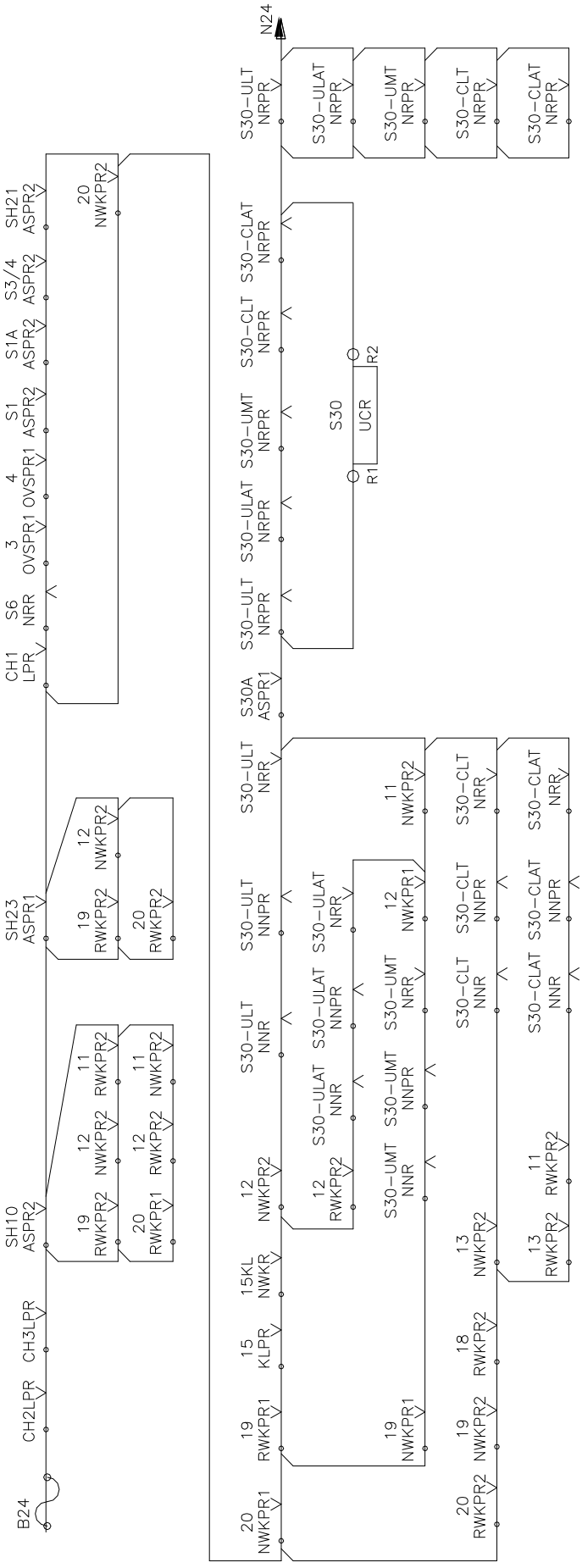


Fig No:5.23 UCR CIRCUIT

ASR CIRCUIT:

S30 ASR in Route setting type interlocking is shown in Fig No : 5.24
S30 ASR in Non-Route setting type interlocking is shown in Fig No:4.8
The comparison between the Route setting and the Non route setting

S.No	Non-Route setting type	Route setting type
1	Knob normal band is proved	No knob used hence not proved
2	RR↓,RPR↓ are proved	All NRRs↓ concerned to that signal are proved
3	Not applicable	In case of Home signal RR↓ is also proved

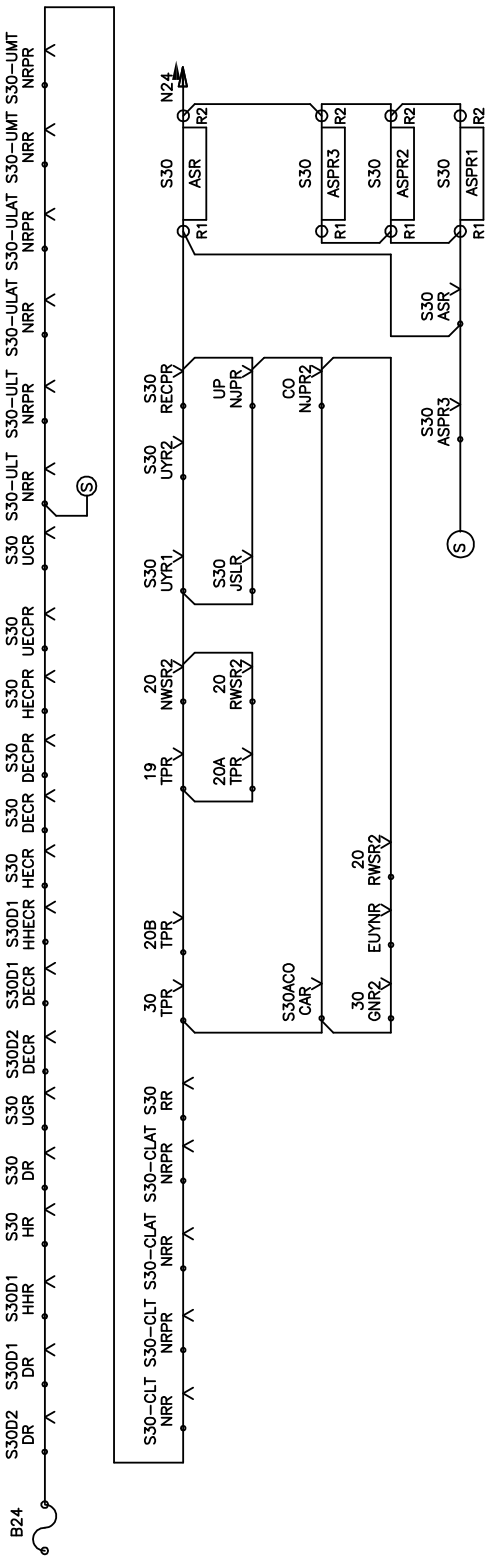


Fig No: 5.24 ASR CIRCUIT

HR CIRCUIT:

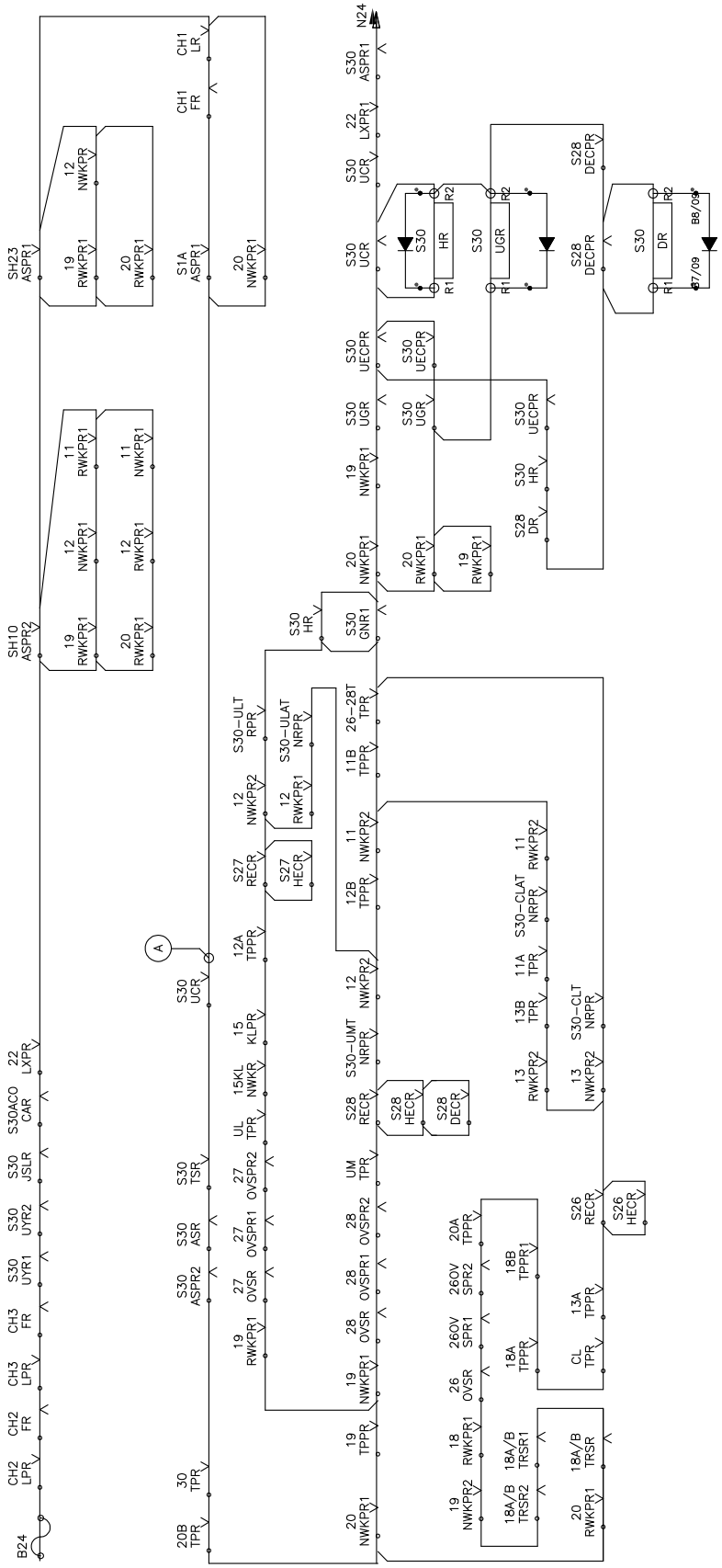


Fig No: 5.25 HR CIRCUIT

S30 HR in Route setting type interlocking in shown in Fig No:5.25

S30 HR in Non-Route setting type interlocking in shown in Fig No:4.16

The comparison between the Route setting and the Non route setting HR circuit is given below.

S.No	Non-Route setting type	Route setting type
1	S30 RR is proved in common path to all routes	S30 NRR concerned to the particular route is proved in its route (path)
2	Not applicable	S30 signal button released ie. S30 GNR↓ by passed by S30 HR↑ is proved in common path to all possible routes of S30 signal
3	Sectional Route Release is not Encorporated	Sectional route release TRSR ↓ is proved in that particular route.

5.13 CRANK HANDLE INTERLOCKING CIRCUITS (CHLR/CHRR)

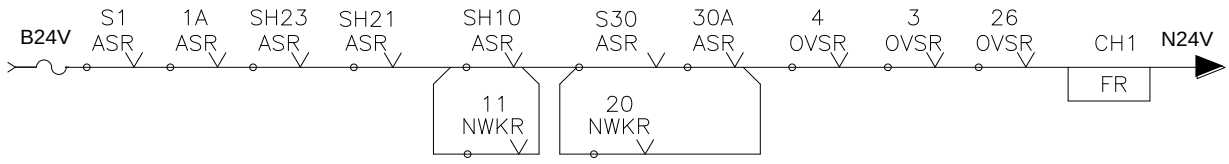
Where point motors operate points, crank handles are provided to facilitate operation of points mechanically (manually) in case of point failure. The manual operation of point, after a signal is cleared, may endanger the train operation. Therefore, it is necessary that crank-handle be interlocked with signals suitably.

CH1 group covers point no 13 & 18; CH2 covers 11, 20 and CH3 covers 12, 19 points.

5.13.1 Crank handle free relay –CHFR (Ref Lay out No : 5.1)

When the concerned signal are at ON (ASR'S up), there by CH1FR will be energized through ASR and OVSR Front contacts. Then crank handle free indication will be in lit condition in the CH box and gives indication to SM on the panel also (CH1 can be extracted if need arises).

Whenever any of the signals concerned is taken OFF, the ASR concerned drops and causes to drop CH1FR. There by Crank handle free indication extinguishes and SM understands that CH1 can be not be extracted unless the signal is normalized.



CHFR CIRCUIT
Fig No: 5.26

5.13.2 Crank handle in proving relay – CH1CR/CHLR (Ref Fig No : 5.28)

In the EKT, while the key is inserted and being turned to RH side contact No.1, 2 and 3, 5 will be made and CH1CR will be picked up. Once the turning is over and the key is left, contact Nos.1&2, 3& 4 will be made and CH1CR held in picked up condition through stick path. SM will ack by pressing CH1 and GSRBN buttons causing to pick up CHLR in the relay room and SM gets crank handle IN indication on the panel. CHLR front contact is proved in UCR & HR circuits.

When S1 signal is taken OFF for main line S1 DMT NRR pick up there by S1 ASR drops and causes to drop CH1FR. At that moment if SM tries for extraction of crank handle by pressing CH1 and GSBN buttons CH1RR does not pick up, there by CH1LR does not drop as feed extended to CH1LR through CH1RR back, CH1CR Front contacts and held through stick path. As CH1LR not dropped, Lock coil in EKT does not energized , thereby crank handle key cannot be extracted. At the same time, the signals taken off remain in the same condition.

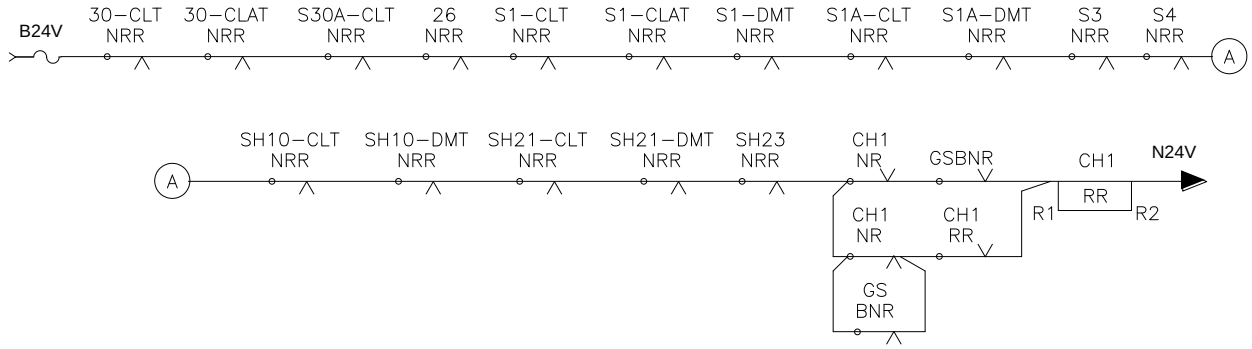


Fig No: 5.27 CH1RR CIRCUIT

5.13.3 Crank Handle release when ASR UP.

When a signal is not taken off, CH1FR remains in energized condition. When SM presses and releases the CH1N & GSBN buttons from panel , CH1RR pickup, thereby CH1LR drops. SM presses economizer push button provided on CH Box there by CH1CR drop and through CH1LR, CH1CR back contacts Lock coil is energized and key is extracted. Hence the signals interlocked with it cannot be taken off. Ref Fig No : 5.28 & 5.29.

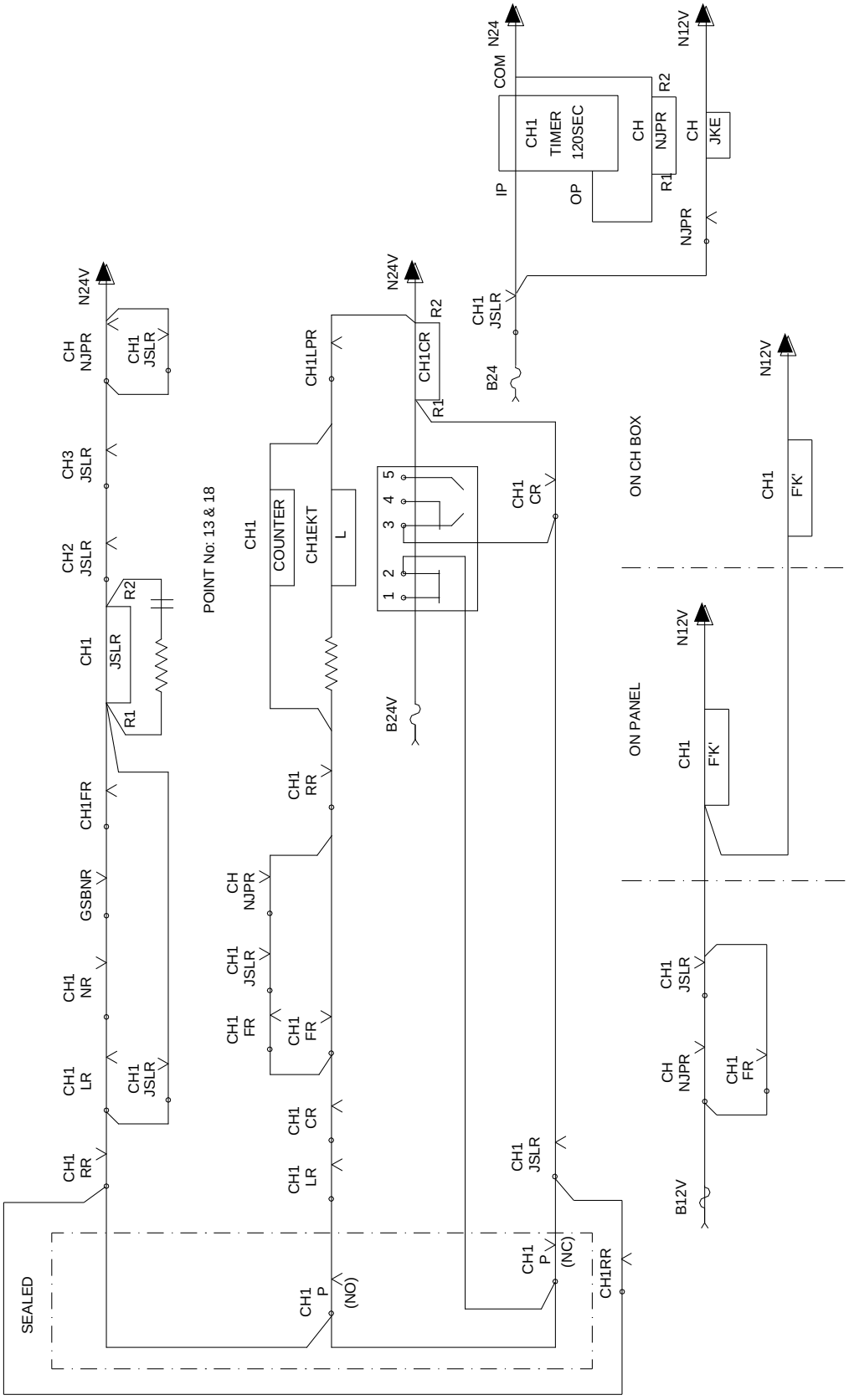


Fig No: 5.28 CH1CR CIRCUIT

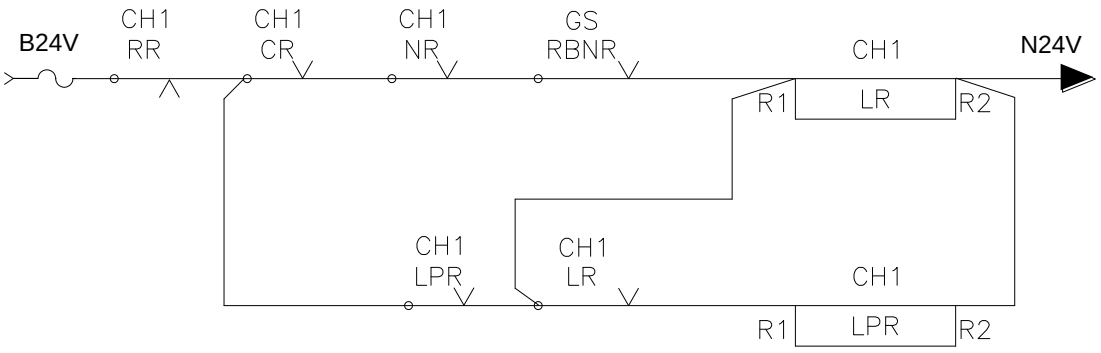


Fig No: 5.29 CH1LR CIRCUIT

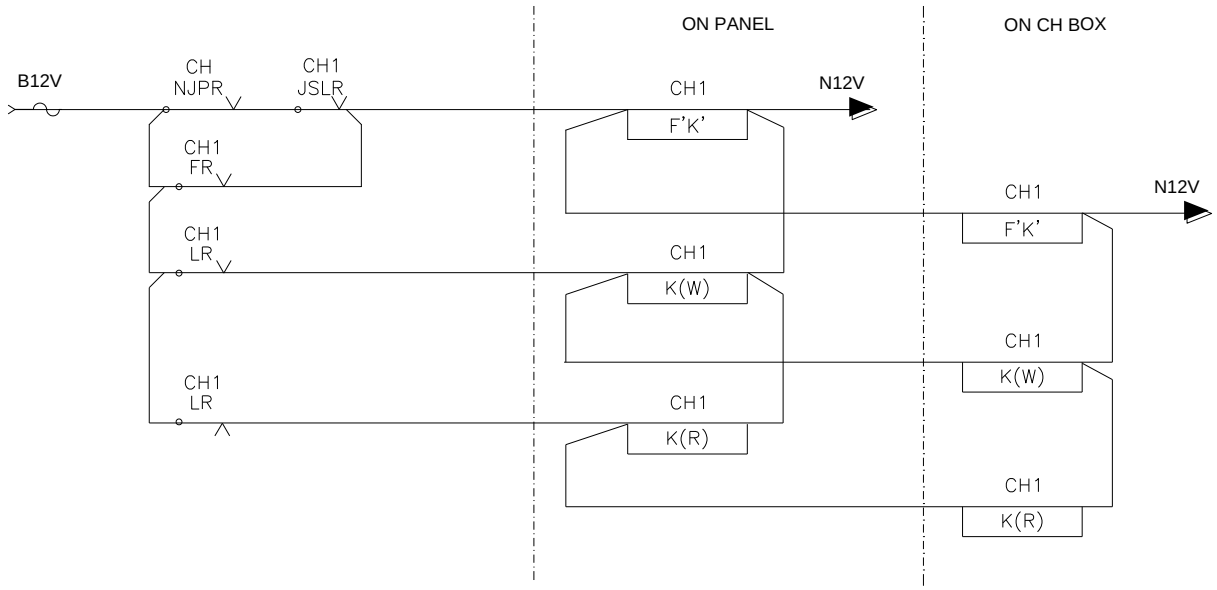


Fig No: 5.30 CH INDICATION CIRCUIT

Emergency crank handle release (ASR Down).

After train arrival on set route, if any back lock track circuit failed causes to stop automatic route release (ASR not pick up). Therefore in route locked condition SM cannot extract CH to operate point manually to receive a train by piloting to other route.

Then SM presses and releases CH1 and GSBN buttons for emergency CH release, there by CH1RR picks up and JSLR also picks up. After time delay (120 sec.) NJPR picks up then CHJKE extinguishes. After that SM presses the Economizer push button, CH1CR drops. Through JSLR, NJPR front contact and CH1FR back contact lock coil energises there by key can be extracted for point cranking.

5.14 POINT OPERATION CIRCUIT WITH OUT CHAIN GROUP (Ref. layout No: 5.31)

Individual point operation

The points remain in the last operated position. To set a point to normal /Reverse , the point button (WN) and common point group button Normal (NWWN)/common point group button Reverse (RWWN) are pressed and released simultaneously.

Let us understand Normal point operation sequence.
Let us assume point No 7 is reverse. To set point No7 to Normal, 7 WN button and NWWN buttons pressed and released simultaneously. Then 7 NWLR picks up.

Picking up of NWLR (Ref.fig no-5.32)

7 NWLR picks up proving the following conditions for individual point operation.

- All the signals ASR's in whose route point no 7is Associated are proved in up S1ASR ↑, S1A ASR ↑, Sh 2 ASR↑, S 16/18 ASR↑
- All OVSR's in whose route point no 7is associated are proved in up 16 OVSR ↑ , 18 OVSR ↑,
- Track locking is proved by the track circuits concerned to that point. 7A TPR↑ , 7B TPR↑ ,
- Automatic point operation is not initiated.
  7NLR ↓, 7RLR ↓.
- Point button 7WN and Common group Point button Normal NWWN are pressed 7 WNR↑, NWWNR↑.
- Point is not set in normal 7 NWKR↓
- Point is not initiated for Reverse is proved by 7RWLR ↓
- Reverse common point button is not pressed RWWNR ↓
  Once Normal point lock relay (7NWLR) picks up, it holds through its own front contact by passing track locking TPRs and 7WNR& NWWNR

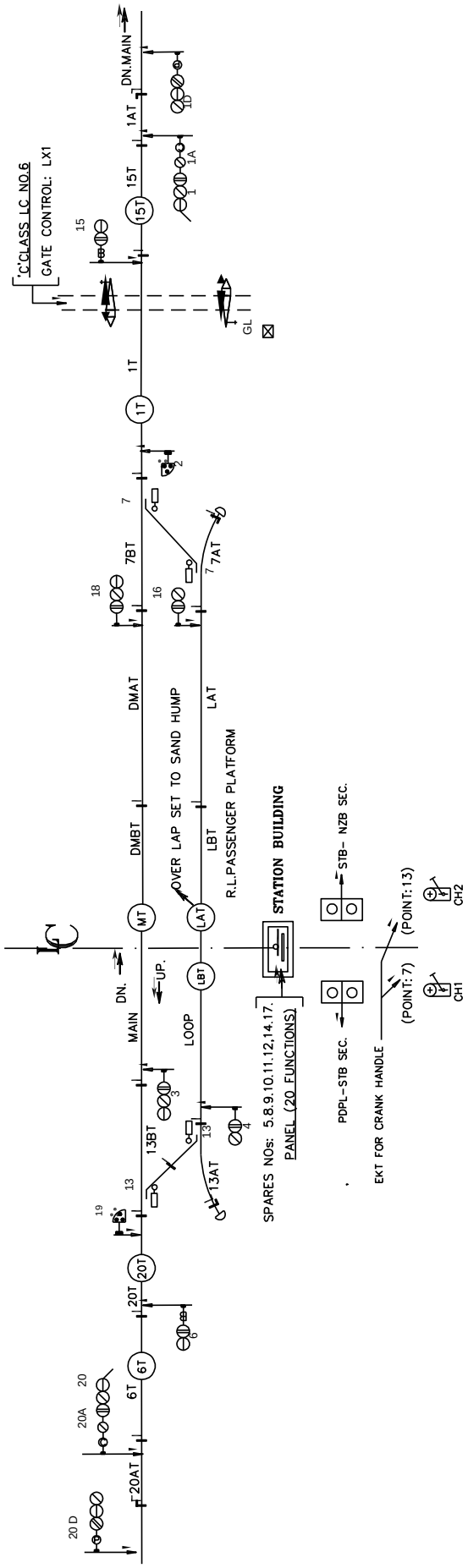


Fig No : 5.31 YARD DIAGRAM

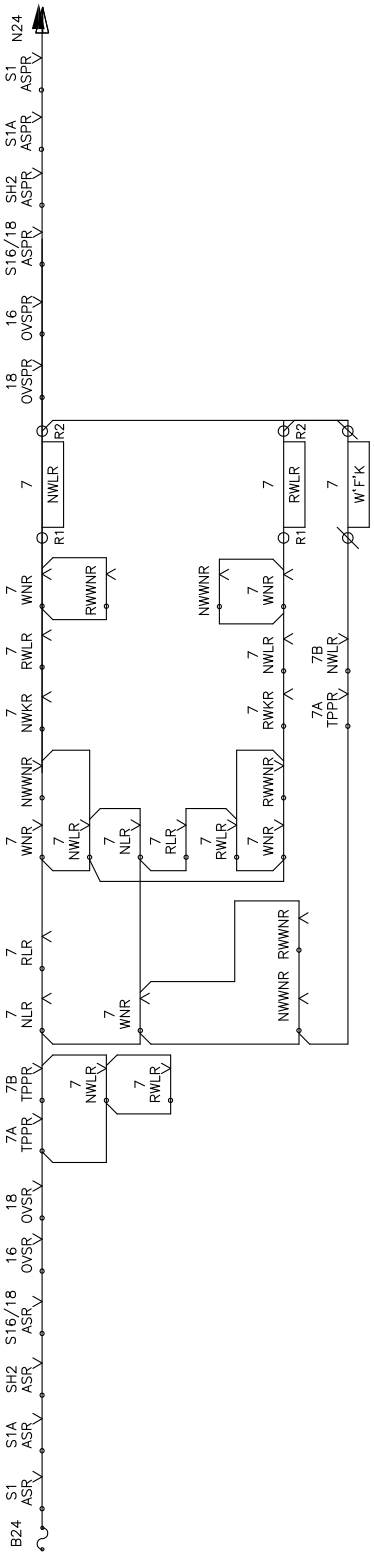


Fig No : 5.32 NWLR/RWLR CIRCUIT

Picking up of 7NWLR results in

- Picking up of PCR1
- Dropping of 7RCR
- Picking up of 7NCR
- Dropping of 7RWKR
-

Picking up of PCR1: (Ref Fig No: 5.33)

When 7NWLR picks up PCR1 picks up and 110 v DC is connected to Pt no 7 location Bus bar .But supply is not connected to point machine for operation .

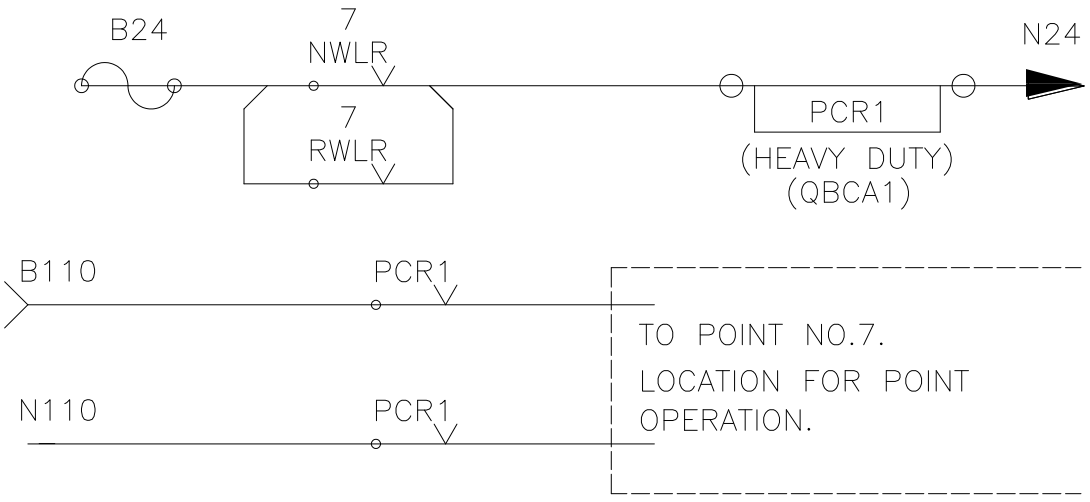


Fig No: 5.33 PCR1 CIRCUIT

Dropping of RCR : (Ref Fig No :5.34)

The Movement 7 NWLR picks up, 7 RCR drops (We assumed pt no 7 in Reverse prior to this operation) When 7 RCR drops , the stick path is removed , there by 7 RCR remains in drop condition .

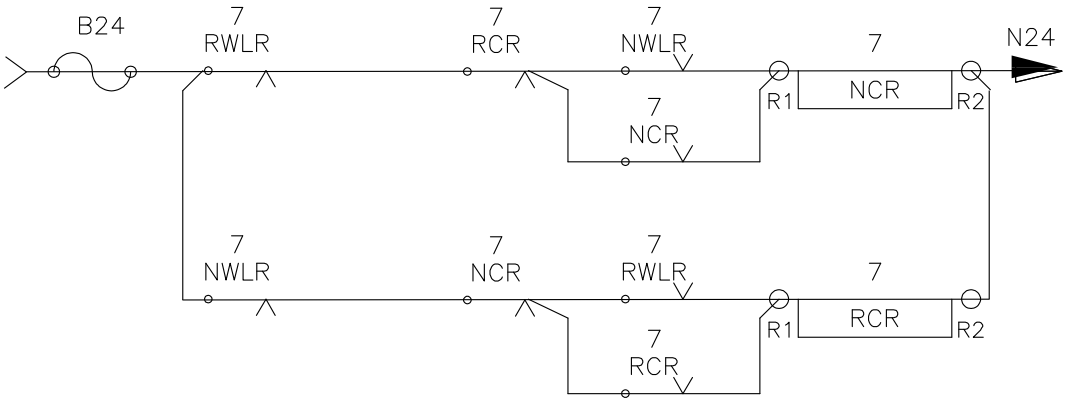


Fig No :5.34 NCR/RCR CIRCUIT

Picking up of NCR : (Ref Fig No :5.34)

Through the back contacts of 7 RWLR, 7 RCR and 7 NWLR front , point normal control relay 7NCR picks up . It holds through its own front contact by passing 7NWLR↑.

Picking up of 7 NWR at location

The Normal point operating relay is Normally a de-energized relay (7 NWR)
The 7 NWR relay picks up at location through the back contacts of all 7NWSRs, 7RWSRs, 7 NWKPRs, 7RWKPRs, 7NWKR, 7RWWKR and front contacts of 7NCR , 7NWLR.

The cross-protection is provided through the back contact of 7 NWLR.
The moment 7NWR picks up ,the point operation is initiated and the point No 7 will be set to Normal.

Dropping of RWKR: (Ref Fig No :5.38)

When 7 NWLR is picked up and 7 RCR is dropped results in dropping of 7 RWKR. As NWLR is picked up all 7 NWKPRs, 7 RWKPRSs, 7 NWSRs and 7RWSRs will drop. Therefore 7 NWKR, 7RWKR and all repeaters (KPRS & SRS) will be in dropped condition .

Note: After the 7NWR picking up at the location, the point operation is exactly Same as explained in non-route setting type interlocking

5.15 AUTO OPERATION OF POINT

Automatic Operation of Points: When route reverse relay NRR picks up it initiates automatic point operation.

To take off the signal S1 to loop line overlap set to sand hump , S1 signal button and LAT route button are pressed and released simultaneously there by S1-LAT NRR picks up and sticks through its own front contact.

POINT INITIATION RELAY FOR NORMAL/REVERSE: - The movement S1-LAT NRR picks up, It energizes point initiation relays for reverse 7RLR, 13 NLR for the route i.e loop line overlap set to sand hump.(point 13 Normal)

Point initiation relay (7RLR) picks up by proving the following conditions (Ref Fig No:5.35)

- Particular signal route is initiated (S1-LAT –NRR ↑)
- Conflicting route settings NRRs in drop (for example SH2-MT NRR ↓)
- Point Reverse Indication relay RWKR in drop (7 RWKLR ↓)
- Point initiation relay for Normal in drop (7 NLR↓)

POINT LOCK RELAY NORMAL/REVERSE (NWLR/RWLR):- The moment point initiation relay for Reverse 7 RLR is picked up then point lock relay 7 RWLR is picked up. (Ref Fig No:5.32)

RWLR picks up by proving following conditions (7RWLR ↑)

- ALL signals ASRs in whose route point (No 7) is required are proved in pickup (S1 ASR ↑, S1A ASR ↑ etc)
- ALL signal OVSR s in whose overlap point (No7) is required , are proved in pickup (18 OVSR ↑ , 16 OVSR ↑)
- Track locking is proved by TPRS in up (7A TPR ↑ , 7B TPR↑)
- Individual point button or normal common point button and Reverse common point Buttons are not in pressed position (7 WNR ↓ , 7NWWNR↓ / RWWNR↓)
- Automatic point operation is initiated by RLR up (7 RLR↑)
- Point is not set in Reverse (7 RWKR ↓)
- RWLR/NWLR in drop (7 NWLR↓)

Note : All the ASRs and OVSRs are proved in by doubling cutting.

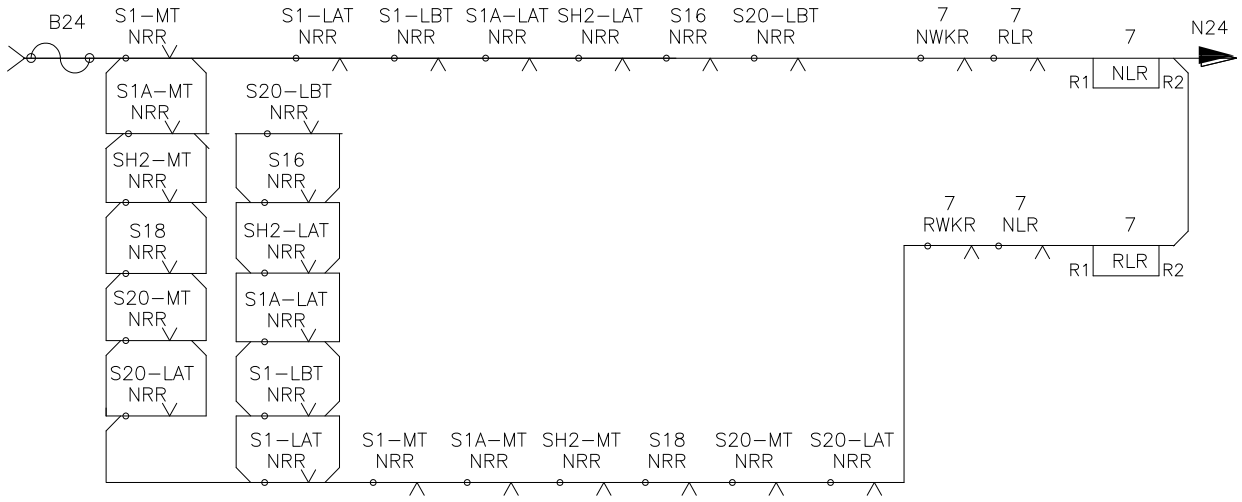


Fig No : 5.35 NLR/RLR CIRCUIT

Due to picking up of RWLRS & NWLRS, the following actions take place simultaneously.

a) Picking up of PCR1 (Ref Fig No :5.33)
b) Dropping of 7NCR (Ref Fig No :5.34)
c) Picking up of 7RCR (Ref Fig No :5.34)
d) Dropping of 7RWKR (Ref Fig No :5.38)

(a) **PCR1, pickup** :-

The moment 7RWLRs, picks up, the point power control relays PCR1, pick up. Then the 110v DC for point operation is connected to point location Bus Bar, but 110V DC is not connected to point machine .(waiting for the command from Relay room)

(b) **Droping of 7NCR:-**

The moment 7 RWLR picks up, 7 NCR drops (We assumed pt no 7 in Reverse prior to this operation) When 7 NCR drops, the stick path is removed, there by 7 NCR remains in drop condition. For S1 signal taken off for loop line set to sand hump, 7NCR drop as 7RWLR is picked up .

(c) **Picking up of 7RCR : (Ref Fig No :5.34)**

Through the back contacts of 7 NWLR, 7 NCR and 7 RWLR front, point reverse control relay 7RCR picks up. It holds through its front contact by passing 7RWLR↑.

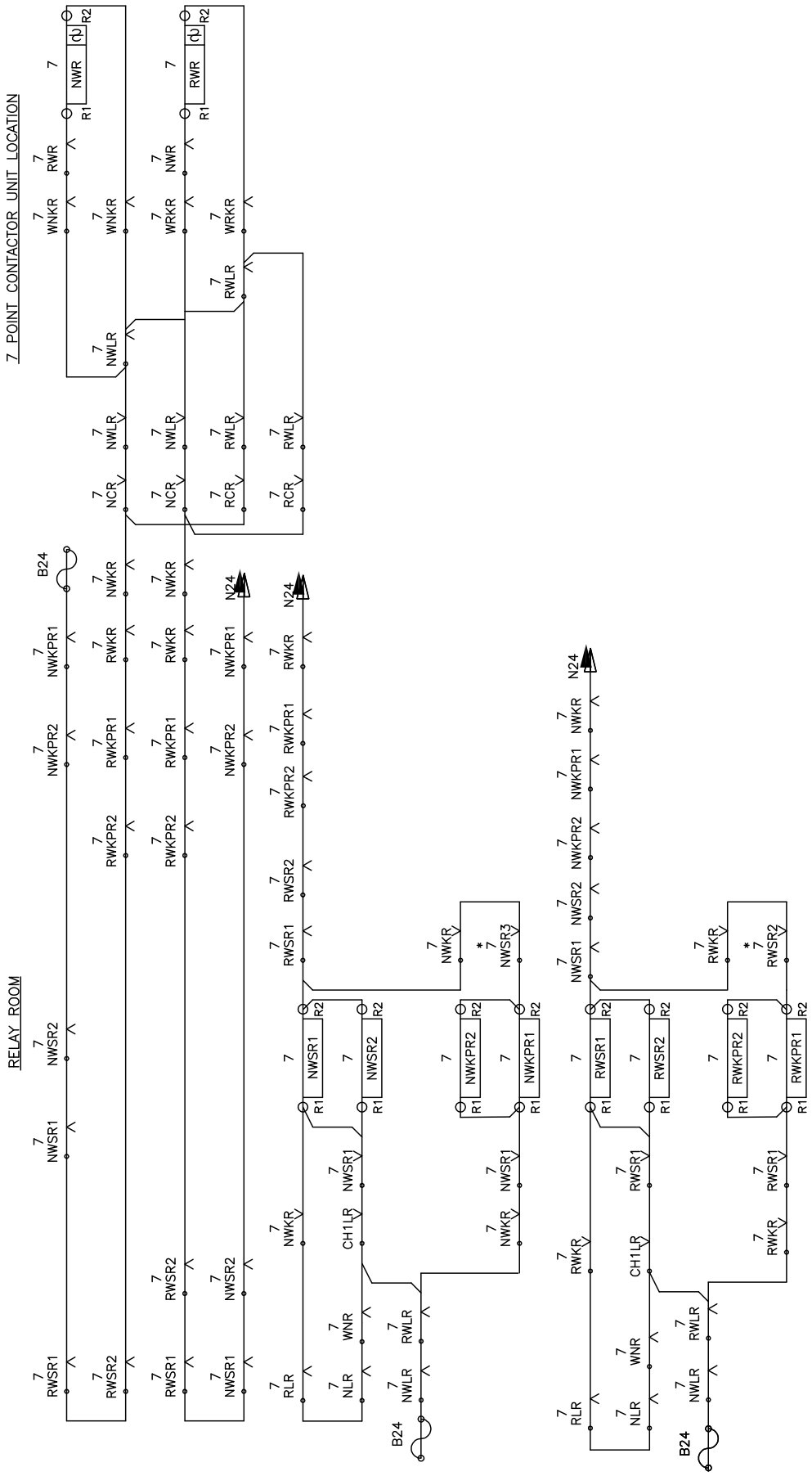


Fig No: 5.36 NWR/RWR CIRCUIT

Picking up of 7 RWR at location

The reverse point operating relay is Normally a de-energized relay (7 RWR)
The 7 RWR relay picks up at location through the back contacts of all 7NWSRs, 7RWSRs, 7 NWKPRs, 7RWKPRs, 7NWKR, 7RWKR and front contacts of 7RCR , 7RWLR.

The cross-protection is provided through the back contact of 7 RWLR.
The moment 7RWR picks up ,the point operation is initiated and the point No 7 will be set to reverse.

(d) **Dropping of RWKR**

The picking up of 7 RWLRs result in dropping of NWSRs, RWSRs, NWKPRs, RWKPRs. The dropping of NCR and picking up of RWLR results in dropping of RWKR (7 NWKR↓, is already in dropped condition). Therefore the point indication relays and all their repeaters are dropped.

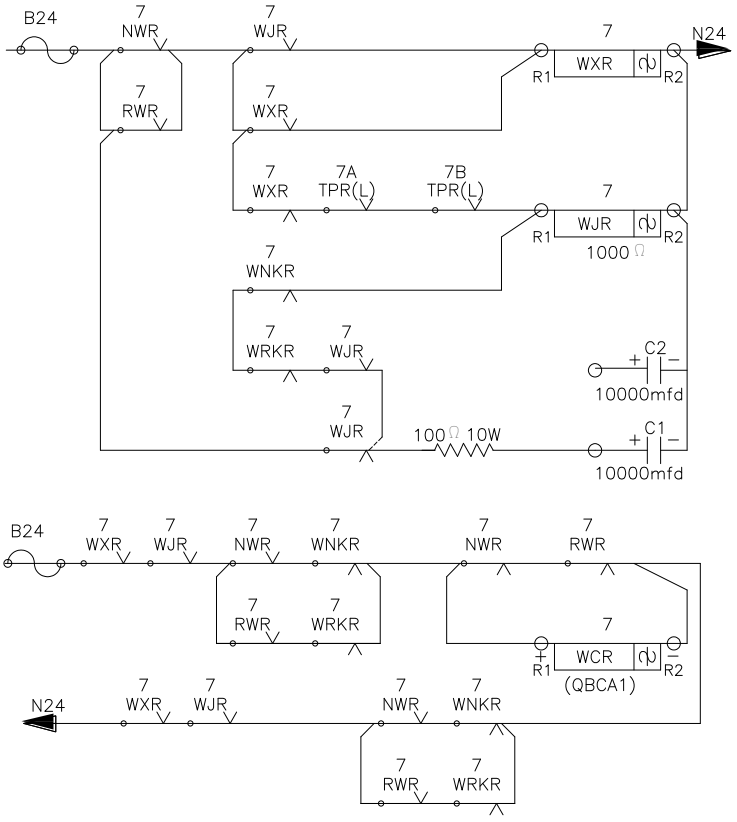


Fig No: 5.37 WXR/WJR CIRCUIT

Note: Remaining circuit operation is same as individual point operation.

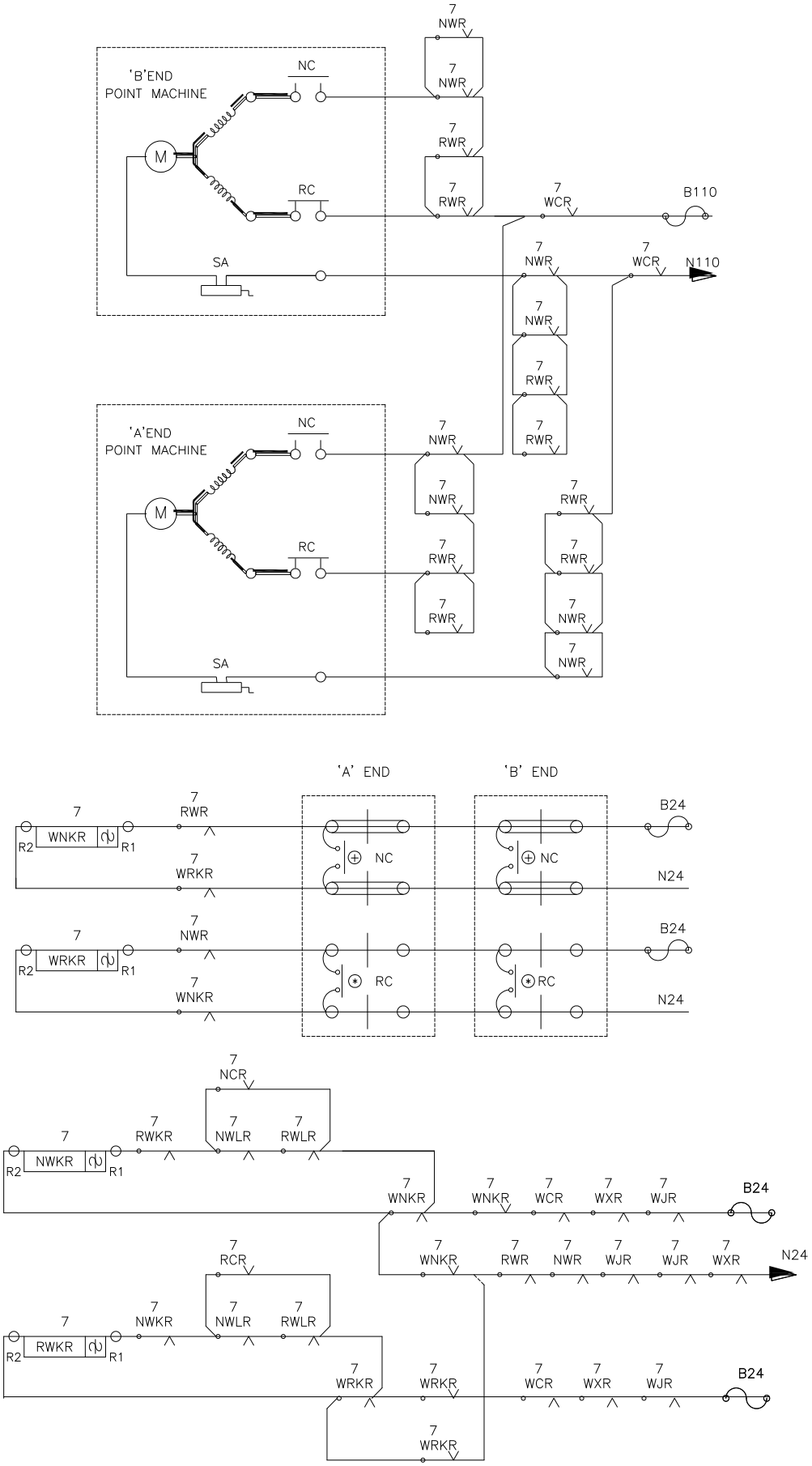


Fig No: 5.38 POINT INDICATION CIRCUIT

5.16 Button stuck up, Signal lamp failure and point Indication failure circuits with buzzers and acknowledgement/muting circuits.

(a) Button stuck up relay ckt.

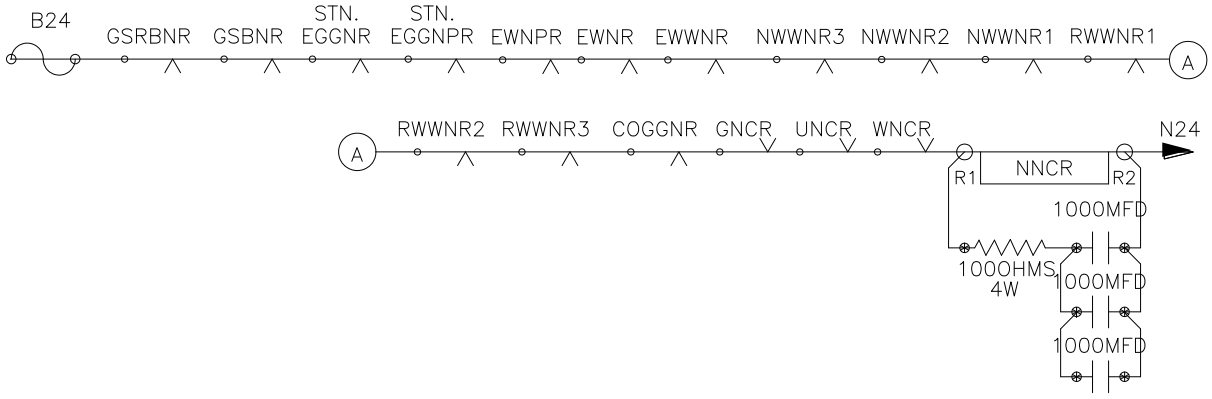


Fig No : 5.39

NNCR is a normally energized relay. When any button is pressed for more than the required time, the relay NNCR drops to give an audible warning with indication. The buzzer can be muted but the indication continues to glow till the fault is rectified. The NNCR relay is provided with a condenser to hold the relay in energized condition for a specific time period. Even if any button is pressed, the NNCR will not drop immediately. But if the button is pressed for more time or stuck up, then NNCR will drop and activates Buzzer cum indication circuit.

(b) Point Indication failure Relay

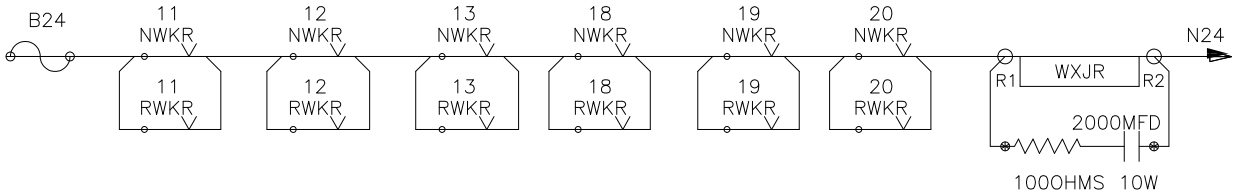


Fig No: 5.40

WXJR is a normally energized relay. When any point indication is not available, WXJR will drop and gives buzzer & indication. Buzzer is muted but indication persists. Relay WXJR is made slow to release to prevent if from dropping during operation of point from N-R (or) R-N. Only after a specified period, still point indication is not available, then WXJR will drop.

(c) Signal Lamp Failure Indication Relay

The relay GXJR is a normally energized relay. When all the signals in the yard are displaying any one of the aspects, then GXJR will remain up. If any signal becomes blank, then GXJR will drop giving Buzzer and visual indication. Buzzer can be muted, but indication will remain, till the fault is rectified and GXJR is energized. Relay GXJR is made slow to release to prevent it from dropping during the change over period of aspects.

When each signal in the yard is displays any one of the possible aspect to that signal (Red, Yellow and Green) then GXJR remains in pick up condition.

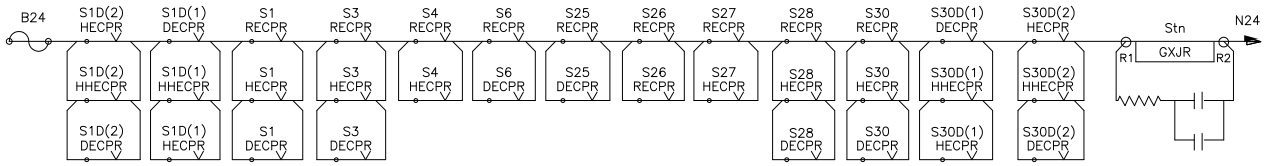


Fig No: 5.41

(d) Buzzer & Indication cct. of NNCR, GXJR & WXJR ckt. With buzzer muting.

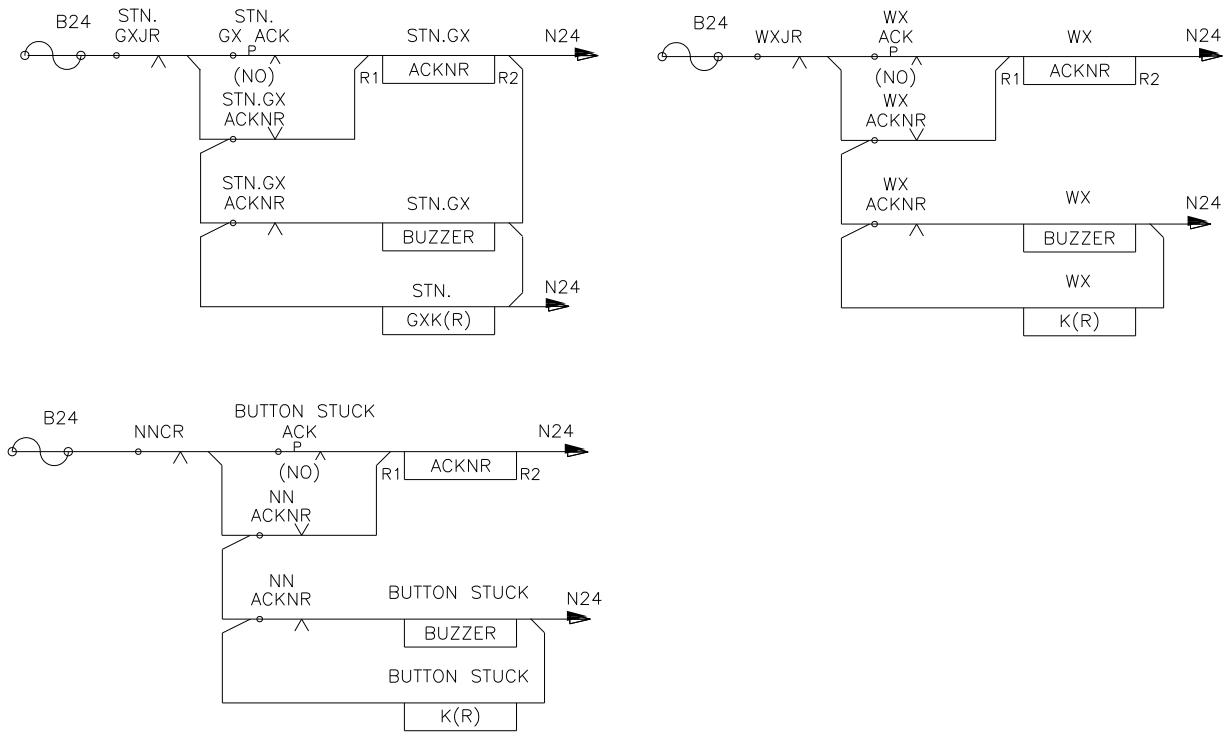


Fig No: 5.42

When the relay (s) NNCR/GXJR/WXJR drop the respective indication will glow. It will be extinguished only after the fault is rectified and the dropped relay(s) NNCR/GXJR/WXJR pick up. At the same time the buzzer will sound with the drop contact of acknowledgement relay(s) ACKNR. When the Acknowledgement button is pressed the concerned acknowledgement relay will energise and the buzzer is muted.

Answer the following Questions

1. Prepare the TSR circuit for the signal No.1
2. Prepare the UCR circuit for the signal No.1
3. Prepare the UCR circuit for the signal No. 1A
4. Draw the block diagram of ASR and by utilizing it draw ASR circuit for shunt sigNo.10
5. Draw the combined ¾ ASR and mention the advantage.
6. Draw the OVSR circuit for signal No.3 and explain the necessity of using OVSR.
7. Draw the HR circuit for sigNo.1
8. Explain the point operation from N to R referring circuit diagrams from the notes.
9. Draw the WLR circuit for point No.11
10. Draw the crank handle circuit for CH1 group

State True / False

1. It shall not be possible to insert the crank handle extracted from one group of points in the point machine of any other group of points. ( )
2. For cross protection of HR relay, UCR front contact is used. ( )
3. On complete arrival of the train, SM normalized the signal knob but route not released due to one of the back lock track failed, but SM reversed the gate control knob and slot was sent to gate lodge with a time delay 120 seconds to open the gate. ( )
4. For home signal DR to pick up, it is sufficient that main line starter DR is in pick up condition. ( )
5. When economizer pushbutton is pressed to extract the crank handle, the lock coil is energized only after dropping of CHLR. ( )
6. When SM's key is taken out, still it is possible to take off a signal from the panel. ( )
7. In route setting type interlocking, when signal knob is reversed, the route setting relay LR is energized to operate points to required position. ( )
8. In RRI, point knob has to be kept in 'C' position, for automatic operation of points. ( )
9. In route setting panel interlocking with domino type panel with all buttons, two common point group buttons are provided i.e. one for normal and other for reverse. ( )
10. OVSR relay picks up automatically when run through signals are given and train cleared berthing track. ( )
11. LC gate opening is possible without any time delay, after complete arrival of train but route not released. ( )
12. In all buttons route setting type panel, the NNR drops the moment NRR picks up. ( )
13. One signal one train movement is achieved through TSR circuit. ( )
14. When SM locks the panel, RR dropping is prevented by SMCR front contact bridging the knob reverse contact. ( )

15. When signal is taken off the CHFR relay drops , thereby Crank handle is locked in the EKT can not be taken out. ( )
16. In ASR circuit indication, back & approach lockings were proved. ( )
17. For cancellation of a signal, JSLR picks up through its own ASR drop contact only after the signal knob is normalized. ( )
18. The track locking is proved in WLR circuit of a point. ( )
19. With the help of one front contact maximum three repeater relays can be energized. ( )
20. OVSR relay picks immediately when the train clears the back lock tracks, occupies berthing track and stops at the foot of the starter. ( )
21. UYRs are made slow to release because ASR picks up through UYRs up and UYRs pick up through ASR back contact. ( )
22. UCR front contact is proved in ASR so that ASR drops the moment route checking is completed. ( )
23. When the train arrives on the berthing track and stops at the foot of the starter, the overlap cancellation takes place automatically and OVSR picks up after 2 minutes time delay. ( )
24. The calling signal locks the main signal above it. ( )
25. When the signal is in taken off condition, if the SM turns LC gate controlling knob to reverse, then the gate man can extract the LC gate key for the opening the gate. ( )
26. In route setting panel interlocking, NNR picks up through the back contact of NRR, the moment ALSR picks up. ( )
27. When the ASR (proved in point WLR ckt) drops, the WLR still can pick up and point can be operated. ( )
28. The GECR relay remains in pickup when any one of the aspects is burning in the signal.( )

ANNEXURE – 1: INSTALLATION, TESTING & COMMISSIONING OF RELAY INTERLOCKING

1 Installation

(a) While preparing panel diagram ensure correct orientation of panel with SM's panel Room, yard and Interlocking plan.
(b) Actual Signals, Points, Track circuits etc are marked geographically, depicting the yard similarly and exactly.
(c) While marking the track circuit ensure clearance of fouling mark i.e; if a train is standing beyond fouling mark then that track should show occupation.
(d) Signal, points, Location Boxes etc. should be marked and placed according to plan without any deviation to deviating schedule of dimensions and with out obstruction.
(e) Special care is to be taken while erecting signal in AC 25 KV RE area.

Other Details

(i) Installation of various racks, shall be done as per standard practice and drawing.

(ii) Fixing of relay bases, cable terminal blocks.

(iii) Drawal of jumper wires as per jumpering sheet between:

- Relay bases.
- Relay bases and fuses.
- Relay bases and bus bars.

The ends of each jumper wire are kept near the fuse terminal/bus bar terminal or IDE the relevant compartment of relay base as the case may be.

(iv) Crimping and soldering of wire ends to connectors and insertion to the respective relay base compartment/soldering of wire ends to fuse terminal termination of wire ends to terminal blocks. This is done after cutting the wire into the required length.

(v) Conducting bell test for each jumper wire according to the jumpering chart.

(vi) Repeating the bell test for each jumper wire as per the wiring diagram.

(vii) Checking of circuits for the integrity of each contact involved in it in the following sequence. This check shall be done for all circuits.

- Plug in the relay to be energised. (No other relay is plugged in).
- Loop the front/back contact of all relays on the plug board which are required for energising the relay in item (a) so that the relay picks up
- Remove and put back the loop one after another (at a time only one loop shall be not available), so that each time a loop is removed, the relay shall drop and when the same is put back the relay shall pick up again.
- Wire count and contact analysis shall be done and record the same .

(viii) Insertion of all relays to the respective relay bases and fixing retaining clips.

2 Testing of Electrical Signalling Installations (As per SEM) in detail.

Testing can be divided into 5 categories.

(a) Physical Inspection of Installation.

(b) Checking of wiring and cables.

(c) Testing of individual circuits.

(d) Testing of individual apparatus.

(e) System Testing of installation

Systematic methods such as marking on selection table, circuit diagrams, track circuit plans, etc. to complete check.

A procedure / proforma for recording the test results to ensure availability of records for future reference & guidelines or for analysis.

It must be ensured that work has been carried out as per approved plans, and standard practice, without any deviations from G&SR and SEM. The equipment & materials used are of standard quality from approved firms with proper inspection certification.

3 Details

a) The signals, location boxes and other outdoor equipment are as per approved plans and are in good condition. Arrangements for proper ventilation, where provided, are not choked.

b) Each location contains all the apparatus required as per approved plans, the apparatus is of approved type and that the power supply equipment, batteries, fuses, etc., are installed according to the approved plan and specification.

c) The location of insulation joint, jumper wiring, traction bonding in electrified areas, point machines, switch locks and other apparatus is as per approved plans and their condition is satisfactory.

d) The electrolyte, inter-connections between cells, cell voltage etc., are in required condition as per relevant specifications or instructions.

e) Each wire is tagged or marked where feasible so that it can be identified at each end and the nomenclature on-the tag corresponds to that on the wiring diagram. The tags or other sleeves of identification shall be of insulating material.

f) The number of wires terminated on each terminal or relay terminal boards or other devices are counted and tallied with the number of wires shown in the wiring diagrams.

g) All connections on terminals and binding posts are properly secured.

h) The lightning arrestors are properly connected and earthed as per plan.

i) Detailed specifications & instructions for inspection and testing of different types of equipment as applicable to them should be available.

i) Detailed specifications & instructions for inspection and testing of different types of equipment as applicable to them should be available.

k) All other equipment such as cable sheaths, signal screens, location huts, etc., in A.C. electrified areas are property earthed.

l) No equipment including relays are due for overhauling.

4 Checking of the wiring

a) Wiring shall be checked to ensure that it has been carried out as per approved wiring diagram. Point to point testing shall be carried out before plugging in the relays. Wires shall be tested one by one for continuity and insulation.

b) Prior to conducting continuity and insulation test, contact occupancy test must be carried out for each relay as per the contact analysis available. The number of contacts allotted must tally.

c) During the course of continuity testing, wire count test shall also be done simultaneously to verify the number of wires actually available on each contact.

5 Test of individual circuits

a) It shall be checked that each individual circuit is actually controlled by the proper contacts of the relays or other devices as per wiring diagram.

b) Where feed to a particular device is controlled through two or more paths in parallel, the check of each path must be carried out separately.

c) Cases of intermittent or continuous extraneous feed of even small magnitude or wrong operation of any relay observed shall be investigated thoroughly and remedial action taken to rectify the fault.

d) Once the indoor wiring works are completed before conducting the system testing simulation test shall be conducted. This will ensure the correctness of indoor system, complete. System testing shall be carried out after all the field functions are connected to the relay room.

6 Testing of individual apparatus

Testing shall be done as per specifications & instructions applicable to each individual apparatus and as per schedule.

7 System Testing of Installation

(a) After the tests mentioned in previous paras have been carried out, the electrical installation shall be subject to the detailed operational/system tests.

(b) These tests shall be planned carefully. Requisite number of staff considered essential for carrying out such tests shall be selected and deputed to concerned locations. They should be equipped with requisite tools, meters, portable telephones and/or walkie talkie sets so that they are in contact with the official in charge of testing and other testing parties and take such action as directed.

(c) These tests shall be carried out against approved Selection Table/Control Table/Route Chart and Signaling Plan.

(d) Complete tests shall be carried out against approved Selection Table/Control Table/Route Chart. Checks against signaling plans for main signal routes and a few spot checks of the remaining routes shall also be carried out.

8 Following guide lines are laid down for carrying out system tests:

(a) Signal Control Circuits

Each route shall be set individually by operating control lever or switch (es) and/or button(s) as the case may be. After checking that the signal for this particular route has been cleared, each track circuit controlling the signal shall be shunted individually to check that the signal goes back to danger. Similar tests shall again be made by de-energizing point detection relays and other relays controlling this route. Each such relay will be de-energised individually and it shall be checked that the signal goes back to danger.

(b) Approach Locking

Each route shall be set up individually. After ensuring that the signal for this particular route has been cleared, each track circuit controlling the approach locking shall be de-energised in turn. The signal shall be put back to 'ON'. Efforts shall be made to alter the route under test and to set up conflicting route. It shall be checked that it is not possible to cancel the route set up and/or to set up a conflicting route and/or to individually operate any point in the route under test. This locking shall be effective till the set route is cancelled and the time release circuit has operated provided the track beyond the signal is not occupied.

(c) Route Lock (Back Locking)

(i) Tests shall be carried out to ensure that once a signal is cleared for a particular route, position of none of the points in the route can be changed when track circuit immediately in advance of the signal is de-energised.

(ii) Where sectional route release is provided, it shall be ensured that a sub route does not release only by picking up of the concerned track relay(s) but the same should be released only after the next track circuit has also dropped and picked up.

(iii) Where sectional route release is not provided tests shall be made to ensure that the entire route remains locked when any of the track circuits beyond the signal up to the track circuit controlling the last point is de-energised.

(iv) In cases where the route is controlled by single track circuit the route shall be released after prescribed time delay to be effective after the concerned track circuit has been occupied and cleared by the train.

(d) Time Release

Time release, where provided, shall be tested to ensure that it will be possible to alter the route or set up a conflicting route or change the position of the points in the route only after the signal is put back to 'ON' and the prescribed time interval has lapsed. Similar tests shall be carried out for overlap release, where time release is provided for releasing the overlap after the occupation of the berthing track.

(e) Dead Approach Locking

Where dead approach locking is provided, the same test procedure as in (b) will be adopted except that there is no controlling track circuit to be de- energised. After the signal has been taken 'OFF', the approach locking shall be effective till the signal is put back to 'ON' and time release circuit has operated.

(f) Signal Indication Circuits

Indication of 'ON' aspect of all signals shall be checked for its correspondence with aspect displayed at site. Each signal shall then be cleared after setting its route and the indication of each aspect shall be checked for its correspondence with the aspect displayed at the site. This test shall be carried out for each signal as well as for direction type route indicator where provided. In the case of later, it shall also be ensured that the indication relay is not energised and the indication does not appear until the minimum number of lamps as required are actually lit.

(g) Point Controlling Circuits

Each point shall be set to reverse position by operating the controlling lever/switch/button. After the point has been fully reversed, each track circuit controlling the point shall be individually shunted in turn and operation of points to normal position shall be attempted. It shall not be possible to operate the point under these conditions. These tests shall be repeated with the point set in normal position, attempt being made to operate it to the reverse position.

With the obstruction in the points, the point shall be operated from normal to reverse and reverse to normal and it shall be checked that the over-load relay where provided gets energised and the feed to the motor is cut off immediately. Where over load relay is not provided, the feed to the motor shall be cut off after the lapse of a prescribed time.

The out of correspondence test shall be carried out by opening cut out contact of one end of point machine and the point lever/knob/button operated. The other end of the point may operate but the point indication relay shall not energise.

(h) Point Indication Circuit

The point shall be operated from normal to reverse and reverse to normal and the position of point detection relay as well as the indication of the point in the cabin/panel shall be checked for correspondence with the position of the points at site. It shall also be checked that with the obstruction in the point, the detection relay is de-energised and both normal and reverse point indication in the cabin/panel are extinguished in case of electromechanical signal and flash in case of P1 /RRI installations.

The operation of the detection relay to the correct position as well as its de-energisation should be checked by making and breaking the relevant point detector contacts at site.

(I) Crank handle interlocking

It shall be checked that when the crank handle is removed from its normal position in Electric Key Transmitter/other approved Relay interlocking arrangement, the signals reading over the concerned route/zone can not be taken 'OFF' nor the points could be operated from the cabin/ panel. It shall also be checked that when the signal reading over the concerned route/zone is taken 'OFF' the crank handle can not be released from its normal position in Electric Key Transmitter/other approved Relay interlocking arrangement.

(J) Testing of Track Circuits

Testing and inspection of track circuits shall be done as per normal practice and record the readings.

9 Typical testing Procedure for Panel Interlocking/Route Relay Interlocking Installations

Typical testing procedure for panel interlocking /Route Relay interlocking installations are given below. It shall be ensured that the interlocking system conforms to the approved relay interlocking specification.

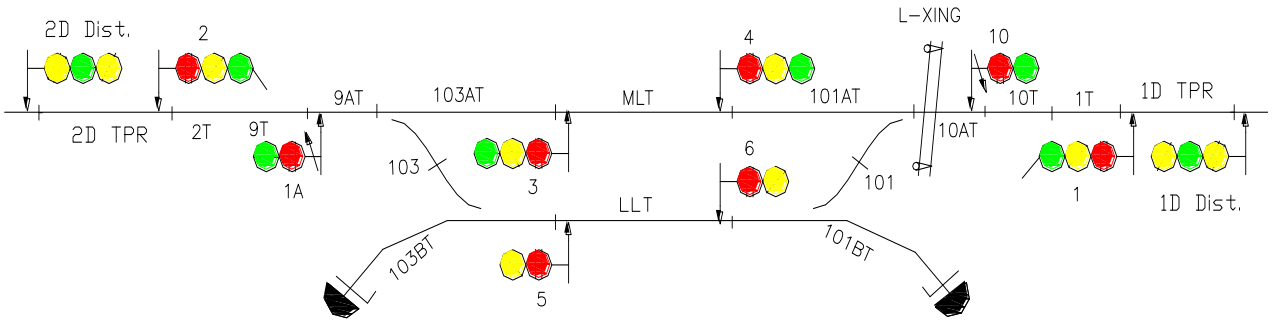


Fig No : A1.1

S.No	SIGNAL No.	ROUTE	ROUTE HELD BY		CONTROLLED BY TRACKS	LOCKS & DETECTS POINTS		LOCKS ROUTES/ SIGNALS	REMARKS
			Approach Tracks	Back Lock track		Normal	Reverse		
1	1	ML	1 D TPR (120 sec time delay)	1T , 10T, 10AT, 101AT ,	1T, 10T, 10AT,101AT, MLT, 103 AT, 9AT.	101, 103	-	2,4,6,10	Controlled by closed position of LC gate
2	2	ML	2D TPR (120 sec time delay)	2T, 9T, 9AT, 103AT .	2T, 9T, 9AT, 103AT, MLT, 101AT, 10AT.	101, 103	-	1,3,5,9	Controlled by closed position of LC gate

(a) Point Locking

Clear signal No. 1 by operating signal switch/button. Operate point knob 101, 103 to Reverse. The points should remain locked. Restore the point knob to Normal. De-energise 101, 103 NWKR. Signal No 1 shall go to 'ON'. Restore the signal switch/button to normal. When point No. 101 and 103 are free, drop 101 AT / BT , 103 AT / BT . Operate point knobs 101 , 103. Point should be locked and must remain locked. Restore point track circuits and operate points.

(b) Approach locking

Take 'OFF' signal No1 to Main Line by setting the points in required position. Normalize the signal switch with Approach track 1D TPR clear. The signal assumes 'ON' position. Try to alter the route, it should be free.

Again take OFF' signal No.1. Shunt the approach Track 1D TPR. Normalize the signal switch/button. Try to alter the route. Route should be held till the route is cancelled after 120 secs. time delay only.

(c) Interlocking of Signals

Clear the signal No1 after setting the route. Try to clear the signals 2, 4, 6, 10 by operating the relevant switch/button. Signals should remain in 'ON' position and signal No 1 should continue to display 'OFF' aspect. Similar tests shall be carried out for signals also.

(d) Track Circuit Controls

Clear the signal No1 again. Shunt the track 1T. Signal should go to 'ON'. Remove the shunt, the signal should not re-clear. Normalize signal and re-clear again. Shunt other controlling track circuits one by one. Signal should go to 'ON' in all cases and re-clear after the shunt is removed.

(e) Back locking

(i) Clear the signal No 1 to ML again. Shunt the track 1T. The signal should go to 'ON'. Normalize the signal switch/button. The route should be held. Shunt and clear all the back locking tracks as per selection table in sequence. The route shall be released by sequential proving of tracks as per the provisions of para 4.3.3 of Relay interlocking specification IRS: S 36-87.

(ii) Clear the signal No1 again and de-energize the L-xing gate control relay. The signal should go to 'ON'. Re-energize the relay, the signal should assume 'OFF' aspect.

9.1 Testing of each signal for all routes one after another to ensure the following. The simulation panels for track circuits ("ON" & "OFF" switches), points (with DPDT or DT switches) and signals (with 110 V signal lamps) shall be connected for conducting this test

(a) Clearing the signal on the simulation panel after simulating the required conditions of TC, points, slots, line clear etc.

(b) Checking that the relevant ECR picks up and back indication available.

(c) Checking after interrupting the conditions provided through the simulating panel one after another -to see that the signal goes to 'ON' if any one condition is disturbed.

(d) Checking that the signal which goes to "ON" due to dropping of the first controlling track relay does not re-clear when the track relay is again picked up.

9.2 After clearing a signal, conduct the following:

(a) Test all the conflicting signals one after another as per the table of control. Conflicting signal shall not be cleared.

(b) Try to operate points in the route / overlap / isolation. Points control shall not get operated.

9.3 Test the following

(a) Approach/dead approach locking.

(b) Back locking.

(c) Indication locking.

(d) Sectional release.

(e) Track locking.

(f) Sectional route release

(g) Emergency route release.

Not : *Verify the correctness of back indications on the control panel in all the cases.*

9.4 Using a testing/contactor relay group in the relay room, all the points at site shall be tested to verify

(a) Proper operation of the points.

(b) Picking up of relevant detection relays at site.

(c) Proper functioning of the overload protection circuit.

(d) Declutching of transmission assembly in the point machine at the end of each operation/obstruction in the point.

9.5 Testing of Track Circuits:

(a) Test each track circuit to verify that they are not over-energised, and the track relay drops when TSR is applied.

(b) Put through the links on the Main Cable Terminals in the cabin and in the track relay location. The relevant TPR should pick up.

(c) Shunt the track at site, the TR & TPR must drop and red strip indication must appear on the control panel and the same must disappear when the shunt is removed.

9.6 Adjust each points at site by operating with crank handle.

9.7 Put through the cables of all points and conduct the tests to ensure the following

(a) Operations of points from N to R and R to N, picking up of relevant detection relays and correspondence between the points controlling relays and the points at site.
(b) Track locking by short circuiting the points, zone track at site.

(c) Back indications on the control panel.

9.8 Correctness of aspect being lit at site when 11O V AC is directly applied on the main cable terminal after disconnecting the link.

Put though the cable and conduct the following tests:

(a) Take ‘Off’ the signal and see that the relevant ‘Off’ aspect is lit at site. ‘OFF ECR is picked up and indication appears on the control panel. The ECR must drop and off indication must disappear/flash when the lamp is removed.

(b) Drop the controlling relay, the ‘ON’ aspect must burn at site and its ECR pick up. Remove the ‘ON’ aspect lamp, the ECR drops.

9.9 All the functional tests which have been conducted with the help of simulation panel shall now be done again from the working control panel and satisfy.

ANNEXURE -1

10 SELECTION TESTING OF PI / RRI

The following basic steps are involved in selection table testing of PI/RRI for each signal movement.

10.1 MAIN SIGNALS:

a) TRACK CIRCUITS AND BACK LOCKING :

(i) Clear the concerned signal. Flicker each TPR in the run of the signal except TSR controls TPR. Its overlap and Isolation. The signal should go to danger when the TPR is dropped and should re-clear when the track circuit is made up. This proves that the concerned track circuit has been taken in HR circuit.

(ii) Now fails the TSR controls TPR .The signal should not re-clear indicating that the one train one signal feature is functioned.

(iii) Again fail the TPR permanently and do three button cancellation by pressing GN and EGGN buttons and leave the buttons with TPR failed. In case the track circuit is berthing track or overlap track or Isolation track the routes will get released even the TPR dropped . In case of dead approached signals the above testing must be done after the final timer relay LNJPR has picked up. It is important to release the buttons once .

(iv) During the above testing for each EUUYN cancellation it must be checked that the counter is incrementing . Also it must be checked that when any track is failed only the indication of that particular track must show Red indication on Indication panel.

b) RED LAMP PROTECTION

Clear the concerned signal and remove the RG fuse of ahead signal its indication should be flashing Red. The rear signal should go to danger. On re-insertion of RG lamp fuse of ahead signal the rear signal should re-clear if ahead signal aspect is cleared.

c) UECR TESTING

For all signal movements with diversion, remove the route lamps supply fuse. The route indication should start Flashing. The signal should go to Danger and should re-clear with the fuse reinserted. At this juncture, it must be checked that all UECPRs have been picked up. It must be tested that UECR does not pick up with three or more lamps fused in the junction type route indicator. It must be checked that, in HR circuit the front contact of UECPR is taken in series.

d) POINTS TESTING

(i) The procedure is identical to that of track circuits.

(ii) Also it must be checked that panel indication corresponds to the point.

(iii) After clearing each signal it must be ensured that concerned points are locked and can not be operated from Panel.

(iv) It is very important that the Normal and Reverse positions of points at site must be checked.

e) CHLR / KLCRs and SLOTs TESTING

These have to be tested both ways as detailed below :-

(i) Clear the signal and try to give concerned CHLR / KLCR. CHLR / KLCR permission should not go and signal should not go to danger. Fail the KLCPR (or YCR) coming from site the signal should go to danger. On failing CHLR / KLCPR (or YCR) the CH indication becoming flashing RED.

(ii) Give the slot for concerned KLCR and then try to clear the signal. The route will not initiate the point will get locked .i.e. LR will drop and the point will not operate. The panel indication with slot given must be flashing white and with CHLR /KLCR key Extracted as Flashing Red.

(iii) Give the slot for the concerned CHLR/KLCR , the visual indication at site will lit. Now extract the key at site and see that the slot can not be taken back. Insert the key and take back the slot, now it must not be possible to extract the key at site.

f) ASPECT CONTROL AND CASCADING

(i) The Aspect control should be tested in two steps. First clear, all the signals and change the aspects of the Last Stop Signal and ultimately make it Blank. Check the aspect of the signals in rear and cascading of signal whose aspects are being changed.

(ii) Then, change the aspects of the signal in rear of the LSS till we reach the First Stop Signal. In the second step, we clear one signal at a time, starting from the First Stop Signal and again check , the aspect control till we reach the Last Stop Signal. In both steps the Inter Cabin Controls (I.C.C.) must be checked as the signal aspects all are being changed.

(iii) Cascading of each signal must be checked individually apart from above. While checking cascading of signals, it must be ensured that Panel Indications correspond to those given in SWR of the station.

10.2 CALLING-ON SIGNALS

(a) The Calling-on signal should clear only after two minutes Of Calling ‘ON’ track circuit is occupied and should go to danger when this track circuit is picked up.

(b) When the Calling ‘ON’ is given the corresponding counter must increment.

(c) It must be tested that it shall not be possible to clear the Calling ‘ON signal with the Main Signal showing ‘OFF’ aspect and it must be possible to clear the Calling “ON” Signal with the Main signal showing Blank aspect.

10.3 TESTING OF GATES

For interlocked LC Gates it must be tested that :-

(a) It must not be Possible to open the gate when gate track circuit failed. At many places this has been done only for signalled movements.

(b) Testing of road warning bell, pedestrian warning bell, boom lights and road signals must be done. Pedestrian warning bell must be separately tested for each line separately by falling concerned track circuits.

10.4 GENERAL TESTING

The following testing must invariably be carried out:-

(a) Random Testing of Signals and route release and overlap release by passage of trains must be done. The correct picking up of UYR1 and UYR2 must be checked. Run through movements on main line and loop lines must be simulated and tested.

(b) With berthing track occupied the OV timer must initiate and OV must release automatically after two minutes.

(c) With Double Yellow burning remove the fuse of HG bulb. The RG aspect should not lit and signal should display only top yellow. This is to test if HHECR back contact is taken in RG lamp circuit.

(d) For inter cabin controls when double yellow is burning and bottom yellow fuses the ICC should not become blank.

(e) All keys on the panel must be tested. The Station Master's key can be taken out only when it has been turned to make the panel inoperative. With Station Masters key out GNCR, UNCR, WNCR must drop and panel must become inoperative except for throwing signals to danger.

(f) The point failure indication and signal failure indication (Blanking of signal) and buzzer must be tested. On failing any point or signal, an illuminated indication appear along with buzzer. On silencing the buzzer by pressing corresponding button, the illumination should remain until the point or signal failure is attended to.

(g) All the buzzers must be tested like power supply change over buzzer.

(h) While testing correspondence of outdoor gears with indoor gears both links on C.T. rack must be disconnected one at a time to ensure that the correct outdoor gear/indoor relay fails.

(i) Fouling Track circuits must invariably be checked and proved as isolation tracks in corresponding signal movements.

(j) Main Signal movements, Calling-on movements over 1 in 8 ½ ordinary turnouts must not be permitted.

(k) With main signal in rear given the shunt signal ahead can not be cleared and with shunt signal ahead cleared the main signal in rear can not be cleared. Thus Main signal movements leading to Shunt movements should not be possible except where starters are used for shunting.

(l) It must not be possible to take 'OFF' both Main signal and Shunt signal on the same post at the same time.

(m) Main Signals or Shunt Signals on either side of a berthing track can not be cleared at the same time as both signals on either side of berthing trick leading to the same berthing track or both leading away from the berthing track at the same time. This means that if any signal on one side of the berthing track has been cleared as leading away from the berthing track or leading to the berthing track. Then at this time the signal on the other side of the berthing track can not be cleared leading away from the berthing track or leading to the berthing track respectively.

(n) With RG lamp fused the first route after the signal should not release by train movement.