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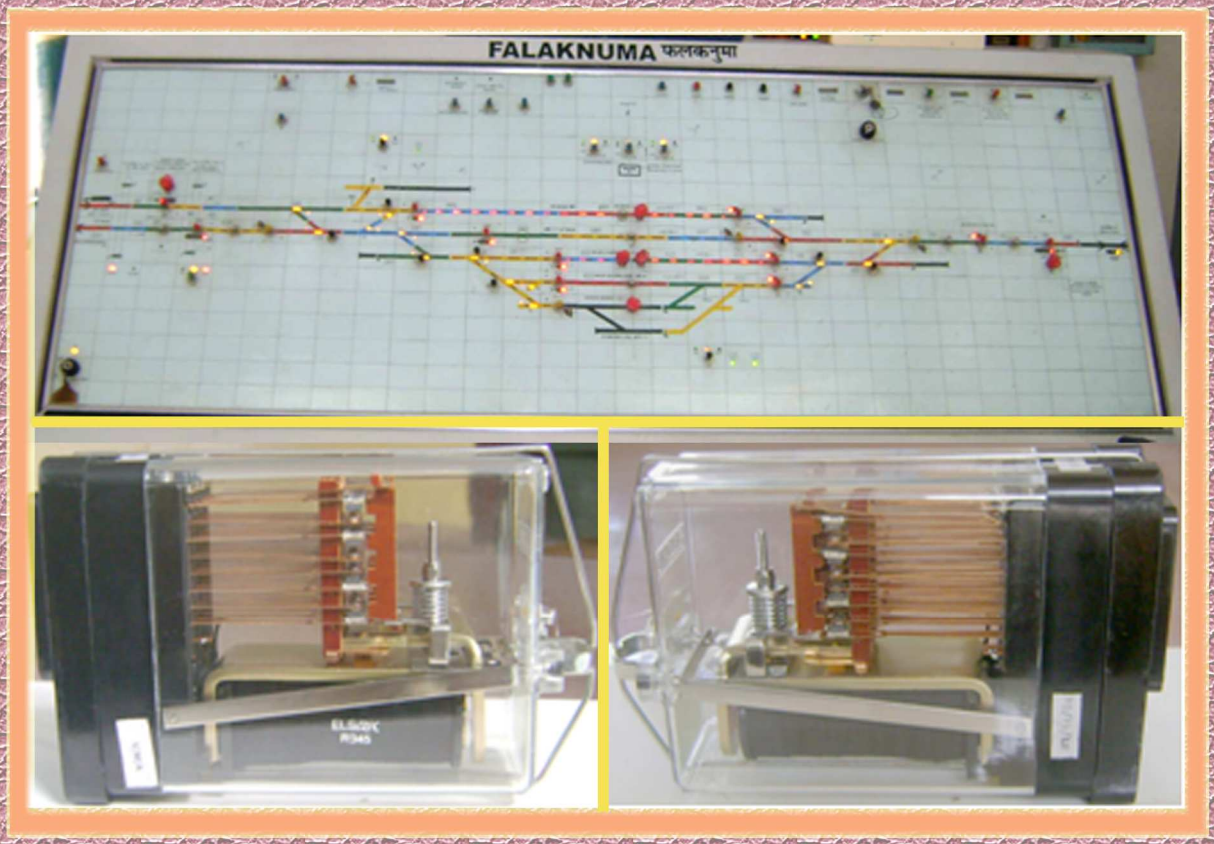
RELAY INTERLOCKING

(METAL - CARBON RELAYS) (BRITISH)



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

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INTERLOCKING WITH METAL - CARBON RELAYS (BRITISH)

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RELAY INTERLOCKING (METAL - CARBON RELAYS) (British)

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CHAPTER 1: INTRODUCTION TO RELAY INTERLOCKING

1.1 Introduction

Interlocking is an arrangement between various functions like signals, points, sidings, 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 devices / apparatus are to be operated for train movements, interlocking is a must among them to ensure safety. Normally interlocking is provided and proved in 2 stages.

1.2 Types of Interlocking

I)	**Mechanical Interlocking**	First stage	At locking tray of the lever frame.
		Second stage	Near functions with Mechanical detectors etc.
II)	**Electro-mechanical**	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.	
		ii) Duplicate software & single Hardware	

1.3 Relay Interlocking

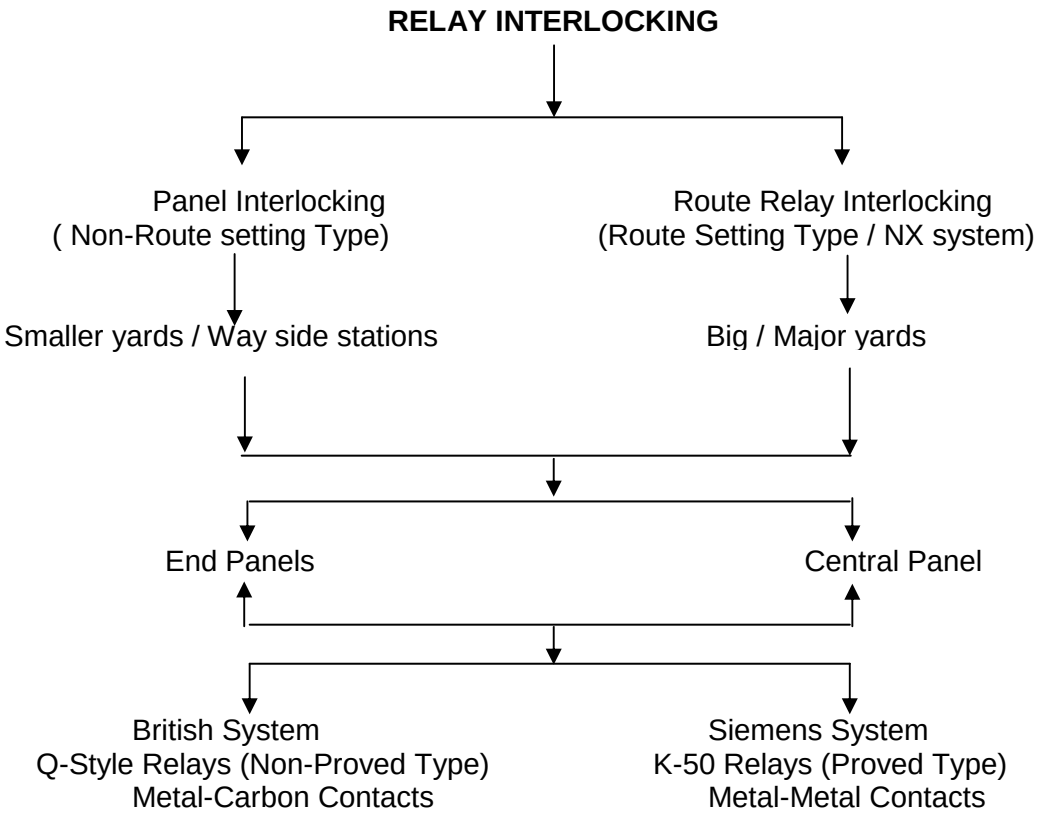
When the interlocking between various functions is achieved by means of relays, then it is termed as Relay Interlocking.

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



British Relay Interlocking : -

RRI (System – I) --→ For Bigger Yards
RRI (System – II) --→ For Major yards

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 unauthorised 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 normalised.

In PI stations, route buttons are not compulsory, but may be provided as an additional facility.

1.3.2 Route Relay Interlocking (RRI) (System-I)

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. 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 Sectional 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.

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 compulsory
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.
10	Only one system is available	System –I&II are available in RRI

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 arrival of a train.

1.5 Basic Requirements of Relay Interlocking

(a) Control cum indication Panel with switches and / or 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 base contact wiring.

(k) All indications of signals, points, track circuits and various other function are provided with 12V / 1.2 W pencil type 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) Incase 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, or buttons nearer to the relevant point position 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.

Panels are of two (2) types.

(i) Conventional Panel (Single plate - Non Domino Type)

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 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

(ii) Domino Type Panel.

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 Railway Board's directions 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.

1.7 Provision of Domino type Panel

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

(a) 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.

(b) 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.

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

The Domino type panels have the following advantages.

(i) Miniature push button operation.

(ii) Self-restoring type of buttons.

(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 on 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 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'	Same as above.
'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 Miscellaneous indications

Power Failure	Red
Point indication failure	White/yellow
Route, Signal lamp failure	White/yellow
Button struck up	White/yellow
Route Cancellation	White miniature
SLOT	Yellow
LC gate open	Red
LC gate Close	White

Colours of buttons / switches used on 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	Blue/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. (NCNYN)	Button	Grey	Grey
22	Level crossing gate control (LXN/LXYN/LXYRN)	Buttons	Green / Brown	Green/ Brown
23	Day / night	Button	White	White
24	S.M.'s key	2 Pos. Switch	Metallic white	Metallic white

* In Sealed Condition.

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.Wht. Lights
7		OFF	2 Cross Wht. Lights
8	Shunt Signal(combined)	ON	No Light
9		OFF	2 Cross Wht. 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.

As explained earlier, the panel is provided with SM's key, switches and / or buttons for signals, Pts, and various other functions for all operations with geographical illumination of yard, with indications for signals, points, track circuits, counter, etc.

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 favourable 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

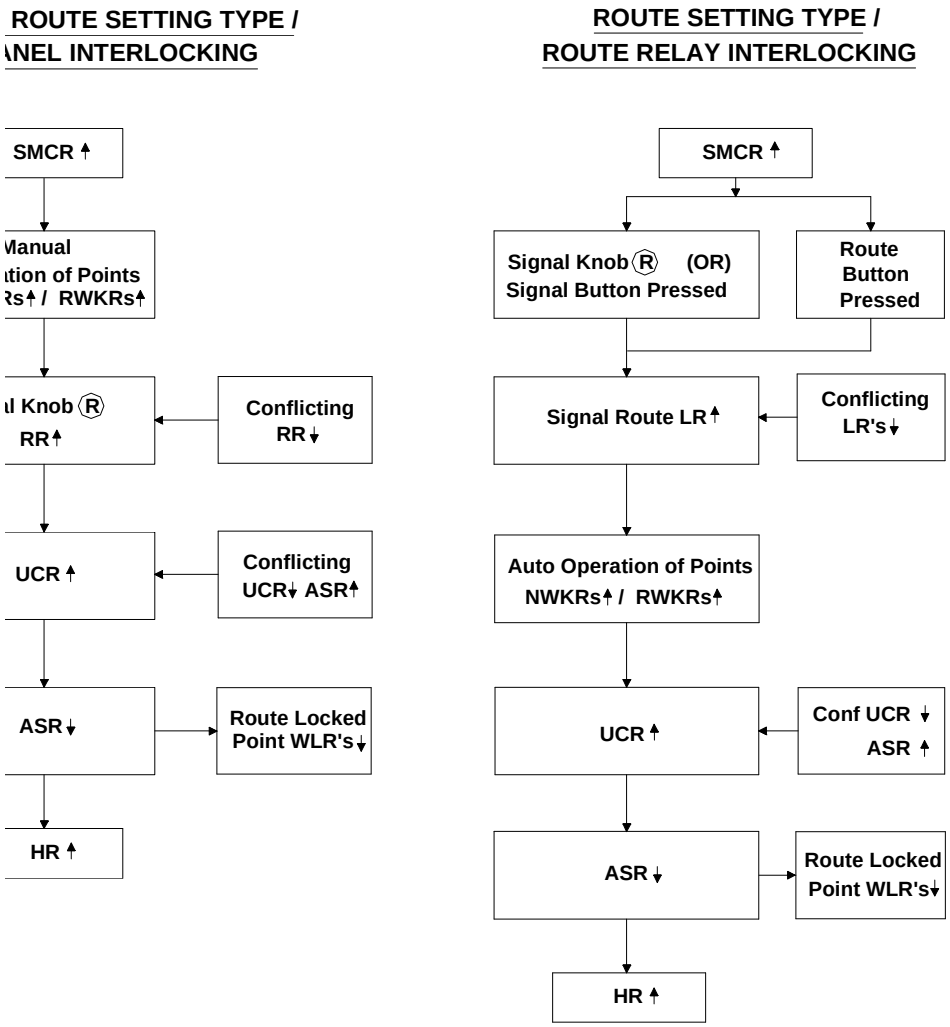


Fig No : 2.1

2.1.2 Route Setting Type / Route Relay Interlocking (System-I)

This is otherwise called NX system (Entrance –EXIT). In this system, setting of route, Locking 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 (LR) will pick up.

When the signal switch/Button and Route button are operated simultaneously, concerned route initiation relay, LR picks up. Every signal will have as many LRs 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 5LR's i.e., $1A_1LR$, $1A_2LR$, IBLR, IC_1LR, IC_2LR.) The picked up LR decides the point position for a given signal route. The picked up LR 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 are available, the route checking relay UCR will pick up. Immediately ASR along with overlap controlling relays OVSR's and TLSR / TRSR's (depending upon the direction of movement of train) will drop and there by all points in the route, overlap and isolation are locked ie. 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

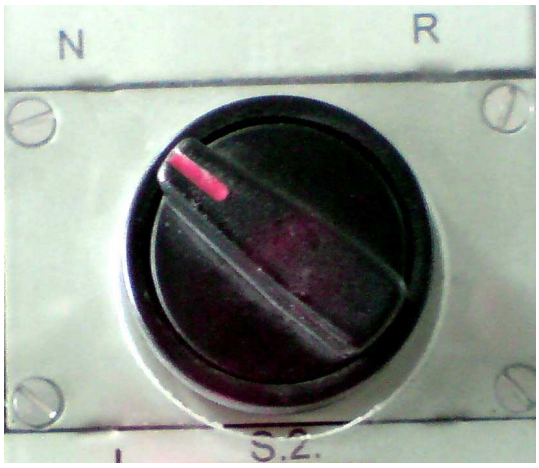
In RRI's the points are required to be operated manually for points testing and automatically through route initiation. In case of knobs, 3 position point knobs are provided which have N-C-R positions. Normally the switch will be in 'centre' position for automatic operation and for manual operation it 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 initiations

In this system sectional route release (SRR) also may be provided which facilitates more parallel movements in the yard.

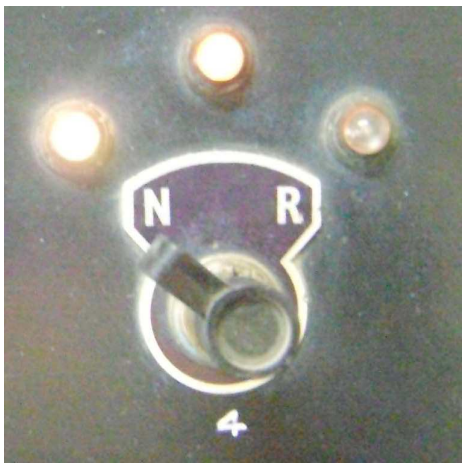
In RRI (British), there are two systems, British system I for big yards and system II for major yards. Detailed explanation about both the systems are given in subsequent chapters.

(PTO)

2.3 SWITCHES:



Signal – 2 Positions



Point – 2 Positions

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 (UYR's) 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 correctly and electrically. As per working convenience, they are grouped. 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. A control is provided for taking out CH, sdgs keys, etc. on panel. 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(i) When 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 if occupied , then with time delay only.

Case(ii) When 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.

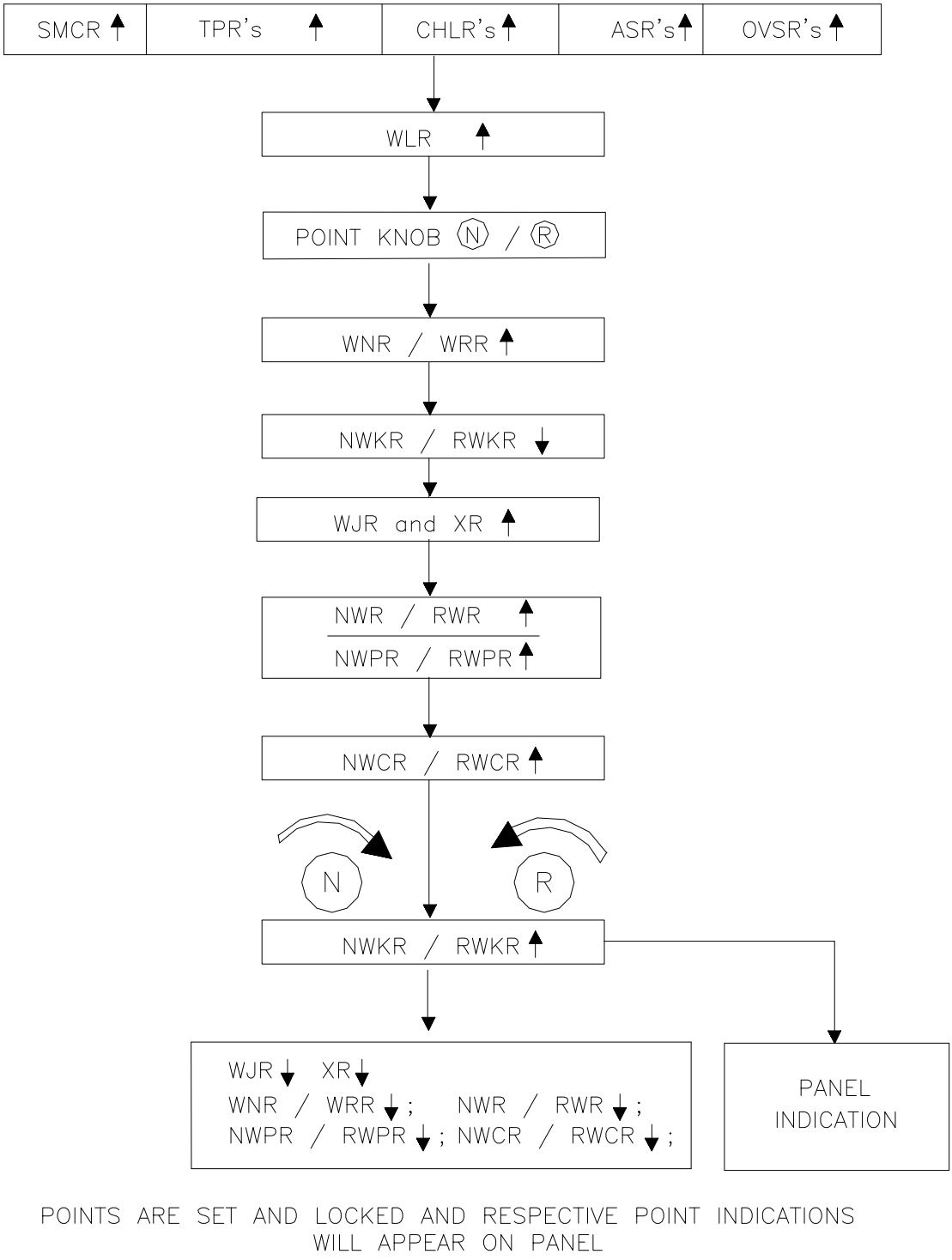
2.4.5 Authorised Operation

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.

RELAY INTERLOCKING - SEQUENCE OF OPERATIONS

A) PANEL INTERLOCKING (NON – ROUTE SETTING TYPE)

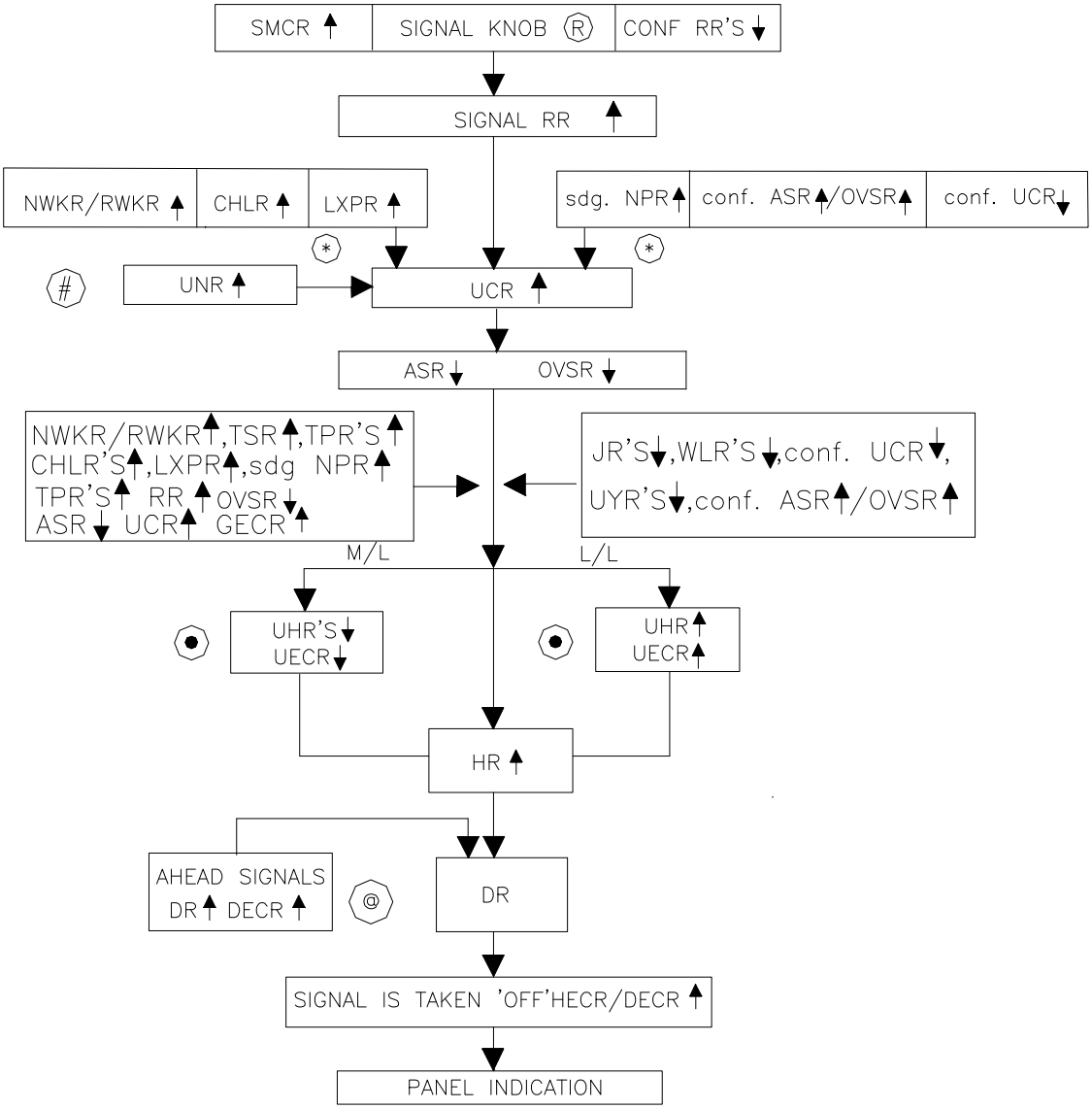
1) SETTING OF ROUTE (POINTS)



POINTS ARE SET AND LOCKED AND RESPECTIVE POINT INDICATIONS WILL APPEAR ON PANEL

Fig No: 2.3

(b) LOCKING THE ROUTE AND CLEARING THE SIGNAL



WHEN CONCERNED UCR PICKS UP ASR/OVSR IS DROPPED, ALL THE POINTS IN THE ROUTE, OVERLAP AND ISOLATION ARE LOCKED (i.e ROUTE LOCKED) AND THEN SIGNAL IS CLEARED

(*) TO BE PROVED IF AVAILABLE

(#) IF ROUTE BUTTON PROVIDED

(●) COMPULSORY WHERE JN TYPE ROUTE INDICATOR IS PROVIDED ON MAIN SIGNAL

(@) FOR SIGNALS WITH GREEN ASPECT

Fig No : 2.4

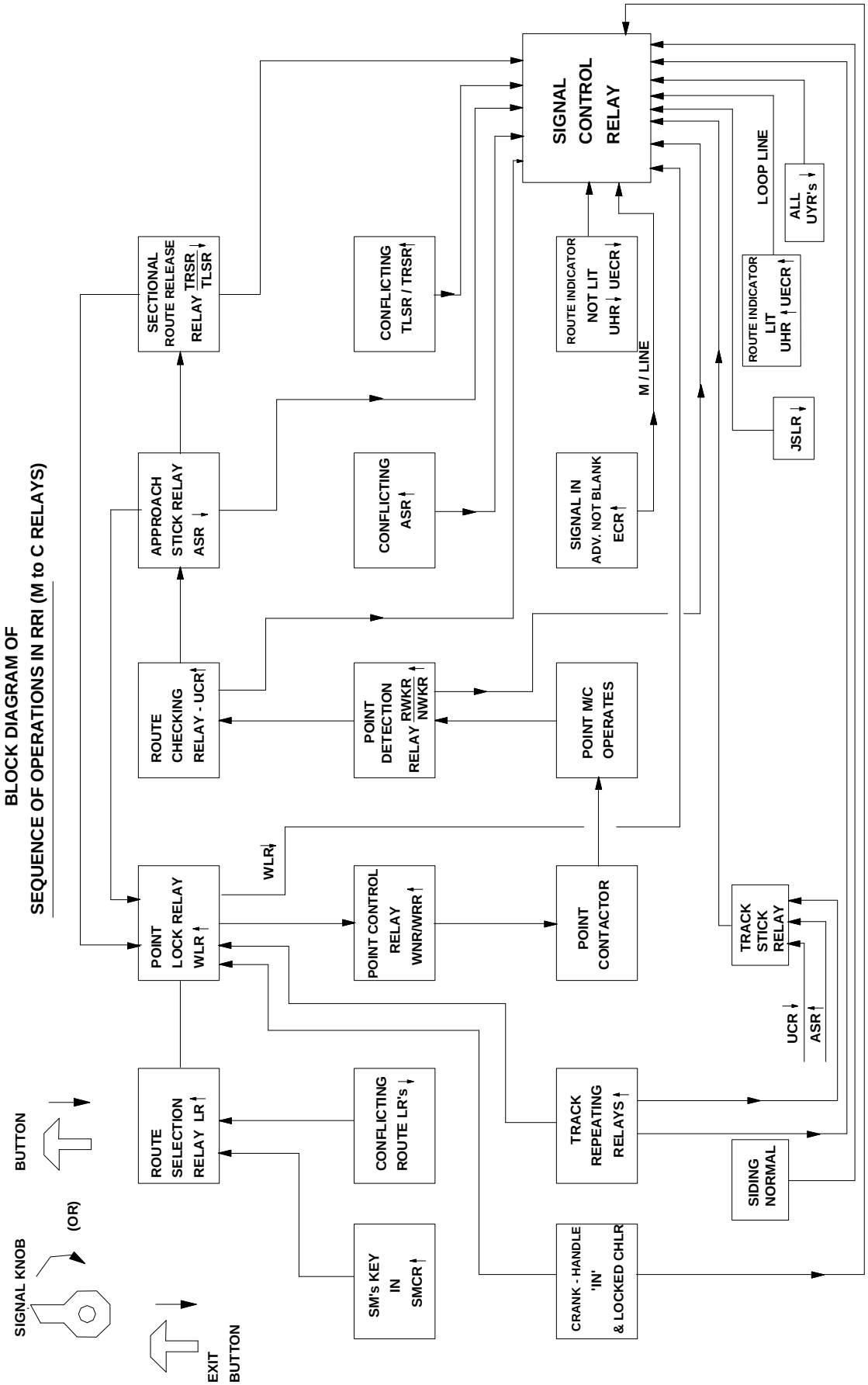

BLOCK DIAGRAM OF
SEQUENCE OF OPERATIONS IN RRI (M to C RELAYS)
SIGNAL CONTROL RELAY
LOOP LINE
ALL UYR's
ROUTE INDICATOR LIT UHR UECR
ROUTE INDICATOR NOT LIT UHR UECR
JSLR
M / LINE
SECTIONAL ROUTE RELEASE RELAY TRSR TLSR
CONFLICTING TLSR / TRSR
APPROACH STICK RELAY ASR
CONFLICTING ASR
SIGNAL IN ADV. NOT BLANK ECR
ROUTE CHECKING RELAY - UCR
POINT DETECTION RELAY RWKR NWKR
POINT M/C OPERATES
WLR
POINT LOCK RELAY WLR
POINT CONTROL RELAY WNR/WRR
POINT CONTACTOR
TRACK STICK RELAY
UCR
ASR
ROUTE SELECTION RELAY LR
CONFLICTING ROUTE LR's
TRACK REPEATING RELAYS
SIDING NORMAL
SM's KEY IN SMCR
CRANK - HANDLE 'IN' & LOCKED CHLR
SIGNAL KNOB
(OR)
BUTTON
EXIT BUTTON

Fig No: 2.5

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 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 simultaneously. ( )
6. In panel interlocking LR 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.

3.2 Numbering pattern

(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,

***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.*

3.3 Signal / Route Control Table

For designing circuits of a Yard, the Table of Control' (also known as Selection Table) is to be prepared first as per the approved signalling plan. 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 or dead approaching with the track circuits included for Approach locking. The back locking and controlling track circuits, crank handle group and aspect ahead of the concerned signal, 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 also for early rectification.

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.

3.4 Point Control Table

A point control Table is also given. From this table , information regarding point (s) such as crank handle interlocking, Track locking, Locking of various signals / Routes reading over the points both in 'Normal' and in 'Reverse'. Specific information such as type of point, Layout Emergency operation, etc can be mentioned in the remarks column.

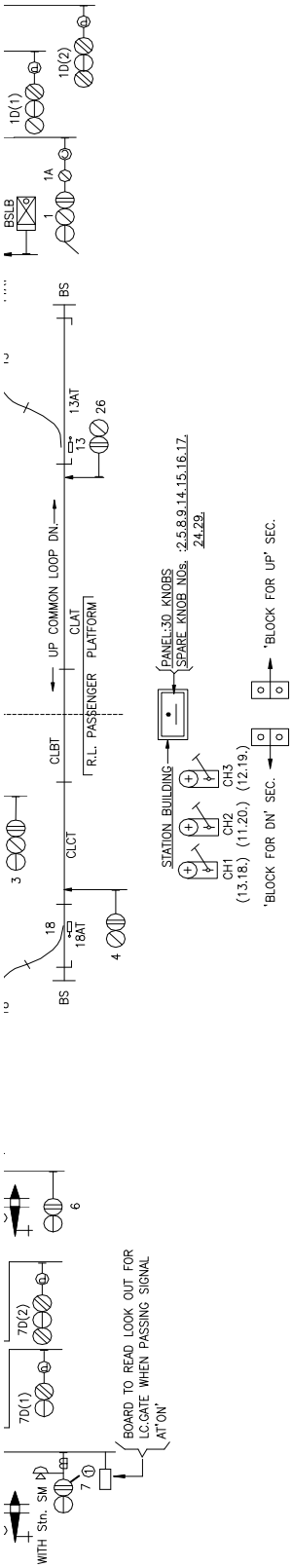


Fig N0: 3.1

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	SIGNAL ASPECT				REMARKS
			SIGNAL BUTTON	ROUTE BUTTON	ROUTE		ISOLATION		OVERLAP		ROUTE	OVERLAP	FOULING	CH, LXC, SDG SLOT, etc.				Y WITH ROUTE IF	Y IF	YY IF	G IF	
					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	21	22	23
1	1D(2)	1D(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1D(1) HG/ HHG/ DG	1D(1) DG/ HHG	DG CONTROLLED BY 1D(1) DG/HHG WITH POINT NO 13N
2	1D(1)	S1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 RG /HG/ DG	1 HG/ DG	1DG	
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/H G/DG	-	3DG	TIME RTELESE 120 SEC
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 1UG 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 1UG 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	-	6RG/ DG	-	6DG	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	-	6RG/ DG	-	-	TIME RELESE 120 SEC
10	6	7D(2)	6	-	20	-	-	-	-	-	6T, UP ACPR	-	-	CH2,22LX	-	-	21	-	-	-	7D(2) HHG/ HG	-
11	7D(2)	7D(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7D(1) HG	7D(1) HG/ DG	DG CONTROLLED BY 7D(1) DG
12	7D(1)	7 UP IBS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7 RG/ DG	-	7DG	DG CONTROLLED BY 7 DG
13	7	UP MAIN	7	-	-	-	-	-	-	-	7T	-	-	-	-	-	-	-	-	-	-	CONTROLLED BY UP SIDE BLOCK INSTRUMENT

SIGNALLING PLAN – CONTROL TABLE

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	SIGNAL ASPECT				REMARKS
			SIGNAL BUTTON	ROUTE BUTTON	ROUTE		ISOLATION		OVERLAP		ROUTE	OVERLAP	FOULING	CH, LXC, SDG SLOT, etc.				Y WITH ROUTE IF	Y IF	YY IF	G IF	
					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	21	22	23
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	-	-	10, 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	-	25 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 UG 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	-	-	-	30UG 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	SIGNAL ASPECT				REMARKS
			SIGNAL BUTTON	ROUTE BUTTON	ROUTE		ISOLATION		OVERLAP		ROUTE	OVERLAP	FOULING	CH, LXC, SDG SLOT, etc.				Y WITH ROUTE IF	Y IF	YY IF	G IF	
					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	21	22	23
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	-	28 DG	TIME RELEASE 120 SEC
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	-	-	-	30UG 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	-	-	-	30UG 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)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30D(1) /HG /HHG /DG	30D(1) / DG HHG	DG CONTROLLED BY 30D(1) DG/HHG WITH POINT 19N 20N
34	30D(1)	S30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30 RG /HG /DG	30 HG /DG	30 DG	

NOTE: - 1. * POINT ARE LOCKED IN THE POSITION MENTIONED BUT NOT DETECTED.
2. UMT DENOTES UMAT, UMBT, UMCT.
3. DMT DENOTES DMAT, DMBT, DMCT.
4. CLT DENOTES CLAT, CLBT, CLCT.
5. DLT DENOTES DLAT, DLBT, DLCT.

POINTCONTROL 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 the table control for the signal No.1 for the lay out given in this chapter.
2. Prepare the table control for the signal No.3 for the lay out given in this chapter.
3. Prepare the table control 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 circuit 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 signal is provided with approach locking. ( )
11. In panel interlocking, the CO signal cancellation period is 240 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	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	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	WR	Point Button Relay	Picks up when point button is pressed
19	CH1R, CH2R.	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	WWNR	Point common button Relay (normal)	Pressed along with point button for Normal operation.
22	WWRR	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	ZNCR	Misc. Button normal Relay	Crank Handle, Sdg. Control etc.
* 27	NNCR	All panel Button Normal Relay	Drops when any panel button is stick-up
28	NNCYNR	Button Stick up Ack. Relay	Stops Buzzer
* 29	GXJR	Signal Lamp Proving Relay	All Signals Burning
* 30	WXJR	Point Indication Proving Relay	Point Indication OK
31	GXYNR	Lamp Failure Ack. Button Relay	Buzzer Mute
32	WXYNR	Point Indication Failure Ack. Button Relay	Buzzer Mute
* 33	GECR	Signal Aspect Checking / Proving Relay	Signal Not Blank
* 34	MECR	Signal Main Filament Proving Relay	Indicates Main Filament Burning when in picked up condition
* 35	WLR	Point Lock Relay	Point Free
36	WNR / WRR	Point Normal / Reverse control Relay	First Relay to pick up in point control cct.
37	WJR	Point Time control Relay	Controls DC 110V to point motor for a fixed time.
38	XR	Special Relay	Controls DC 110V to point motor
39	NWR / RWR	Normal / Reverse point operating Relay	Final Relay for point operation
40	NWPR / RWPR	Repeaters of NWR / RWR	Final Relay for point operation
41	NWCR / RWCR	Point Contactor Relay (Normal / Reverse)	Switches 110 v DC to point motor
* 42	NWKR	Normal Point indication Relay	Picks up when point set and locked in Normal
* 43	RWKR	Reverse point indication Relay	Picks up when point set and locked in Reverse
* 44	NWSR / RWSR	Normal / Reverse point indication stick Relay	Indication stick relay
* 45	NWKLR/ RWKLR	Normal / Reverse point indication stick Relay	Indication stick relay, Proves all controlling relays are down
46	NCR / RCR	Point Normal / Reverse Contact Relay	Switch control relays
47	EGGNR	Emergency (Group) signal cancellation button relay	To put back signal to ”ON”
48	EGCR	Emergency Signal Cancellation Relay	To put back signal to “ON”
49	EUUYNR	Emergency Route cancellation button Relay	To release Route
50	EUYRR	Emergency Route cancellation Initiation Relay	Initiates Timer Circuits
51	EWNR	Emergency Point Operation Button Relay	Point operation in case of Track cct. Failure
* 52	POR	Power ‘ON’ Relay	
* 53	LVR	Low voltage Relay	Drops for low AC 230 voltage
54	SLR	Power ‘ON’ Ack. Relay	-
55	THT / EJ / ET	Timer relays (Mech., Thermal, Electronic)	-

S.No	Nomenclature	Description	Remark /Function
56	JSR	Time Stick Relay	Pick up with HOT contact
57	JR	Timer Relay	Pick up with Cold contact make
58	JSLR	Timer Stick lock Relay	Initiates Timers
59	NJPR	Normal Timer (out) proving Relay	Pick up after 120 sec.
60	RJPR	Reverse Time proving Relay	Proves JSLR's and NJPR's are dropped
61	CHLR	Crank Handle Lock Relay	
62	CHNR	Crank Handle Normal Relay	
63	CHPR	Crank Handle Proving Relay	
64	CH (IN) PR	Crank Handle (IN) Proving relay	
65	CHYNR (T)	Crank Handle slot Relay (Trans)	
66	CHYRR (R)	Crank Handle slot Relay (Receive)	
67	Sdg. NPR	Siding Normal Proving relay	
68	LXPR	Level Crossing Proving Relay	
69	LXNR	Level Crossing Normal Relay	
70	LX (IN) PR	Level Crossing Key 'IN' Proving Relay	Used at Location
71	TPZR	Track proving SPL Relay	Pick up when WLR & point Zone track at pick up condition used in point operation
72	ASIWR	Auto set point Relay – one	Auto setting starting relay – for chain operation
73	AS2WR	Auto set point Relay – Two	Auto setting starting relay – for chain operation
74	ACWWR	Auto chain point control Relay	Maintain the time 3 sec. Time gap between points
75	AWFNR	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 :- S.no-71-75 are being used in SECRly)

Relays Used in RRI (System II)			
1	CR	Checking Relay	(For Point Normal)
2	NR	Normal Relay	(For Point Normal)
3	RR	Reverse Relay	(For Point Reverse)
4	(R) UR	Right Route Relay	
5	(L) UR	Left Route Relay	
6	(R) OHR	Right Overlap Holding Relay	
7	(L) OHR	Left Overlap Holding Relay	
8	(R) OCR	Right Overlap Checking Relay (For Main Signal)	
9	(L) OCR	Left Overlap Checking Relay (For Main Signal)	
10	(R) ZR	Spl. Relay (Right) For Main Signal	
11	(L) ZR	Spl. Relay (Left) For Main Signal	

***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.*

- Relays Normally in Pick up condition.

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.

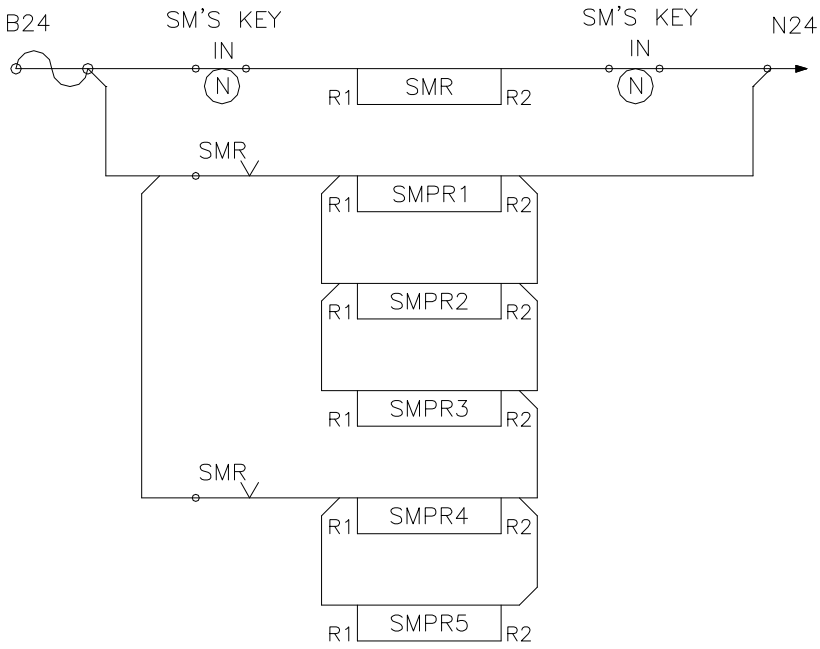


Fig No : 4.1

The energised 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.

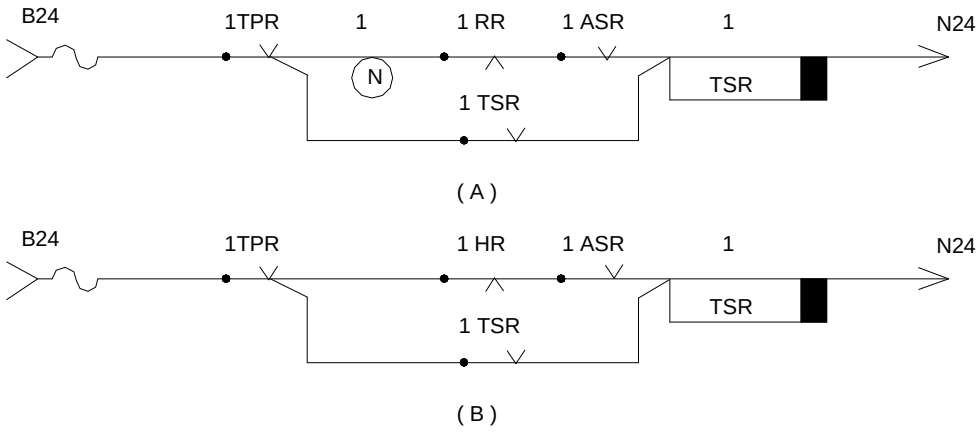


Fig No : 4.2

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 economise number of TSR relays , wiring and to reduce the circuits size.

Figure 4.3 (A) & (B) are combined TSR circuits with separate switches for signals.

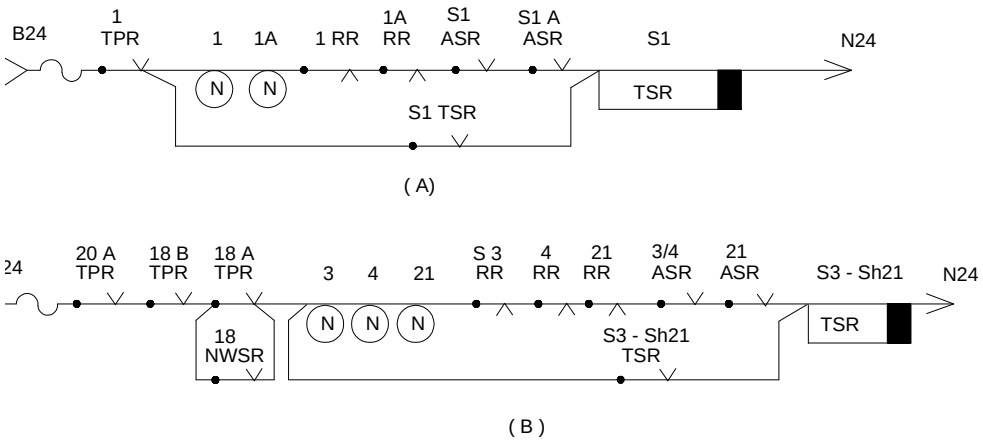


Fig No : 4.3

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.

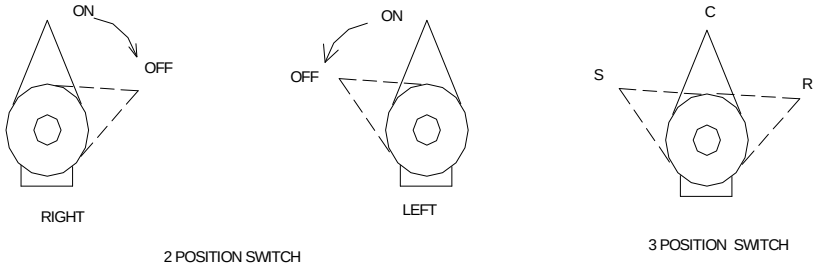


Fig No : 4.4

In old panels 3 position switches are used for signals. The same switch is used for dispatch and reception of trains.

'S' position : The despatch signal, starter will be taken off as per the route set.
'R' position : The reception signal, home will be taken off to the set route.
'C' position : This is the normal position of the switch and also it works as Cancellation position when a signal is taken off and brought to Centre position.

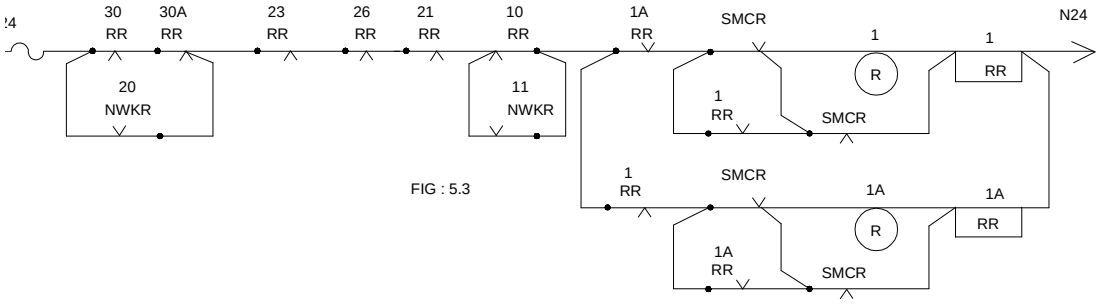


Fig No : 4.5

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 CIRCUITS (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.,

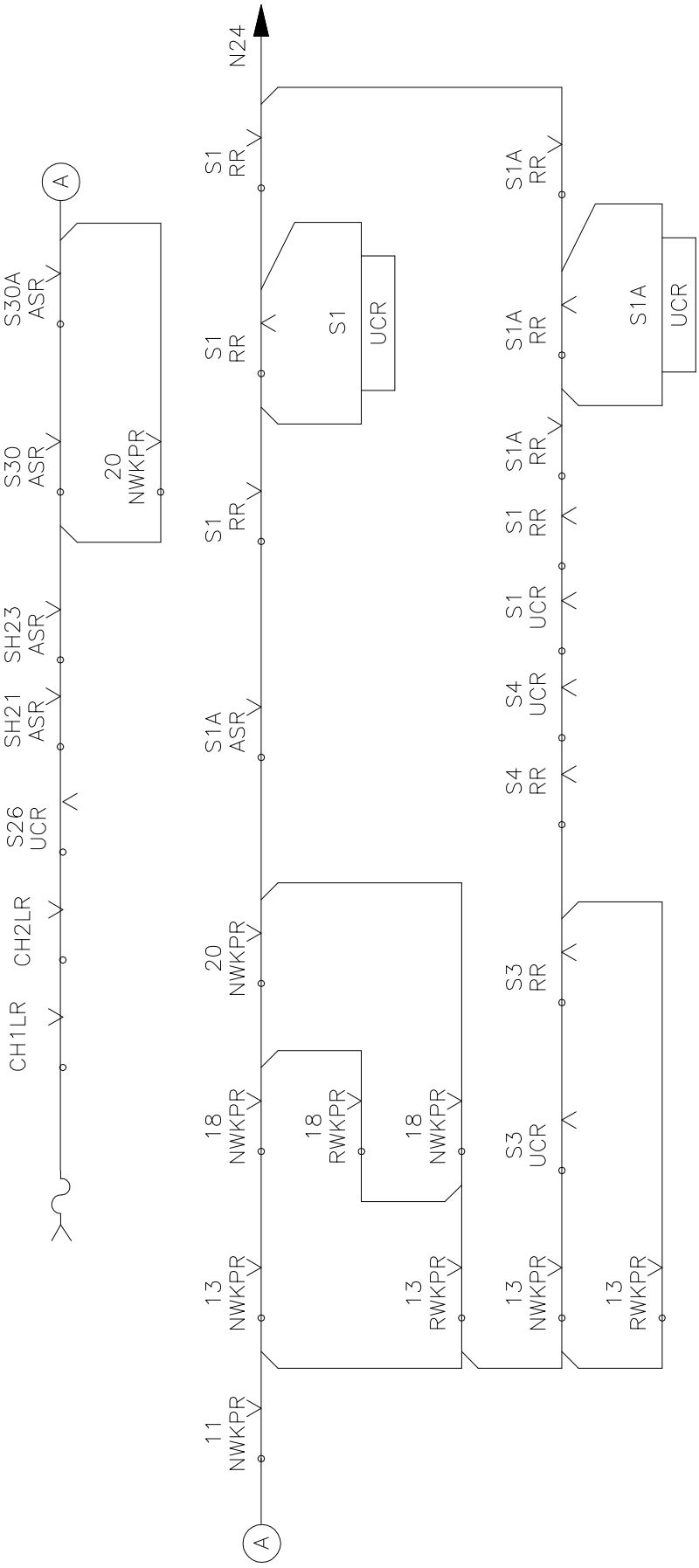
(c) In UCR circuit all points in route, overlap and isolation (set& locked) are proved.

(d) To achieve locking of conflicting signals, Front Contact of ASRs or back contacts of UCRs of conflicting signals are proved in UCR circuit. Concerned LR front contact also will be proved in UCR Circuits.

(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.

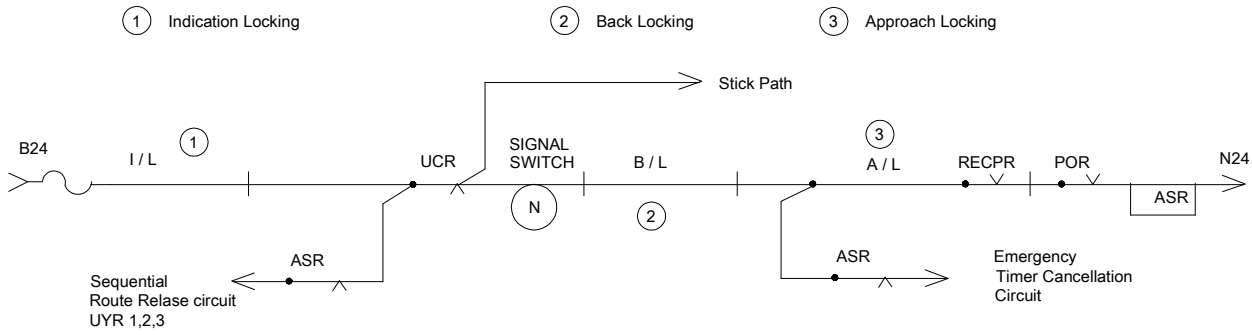


Fig No : 4.7

ASR can be energized in 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) then calling on knob reversed and calling on ASR drops. Immediately calling on knob is normalized and calling on cancellation is applied (CO-CAR up) calling on NJPR picks up after 240 seconds time delay which picks up the Main signal ASR.This way the route is released with out S&T Person's intervention.

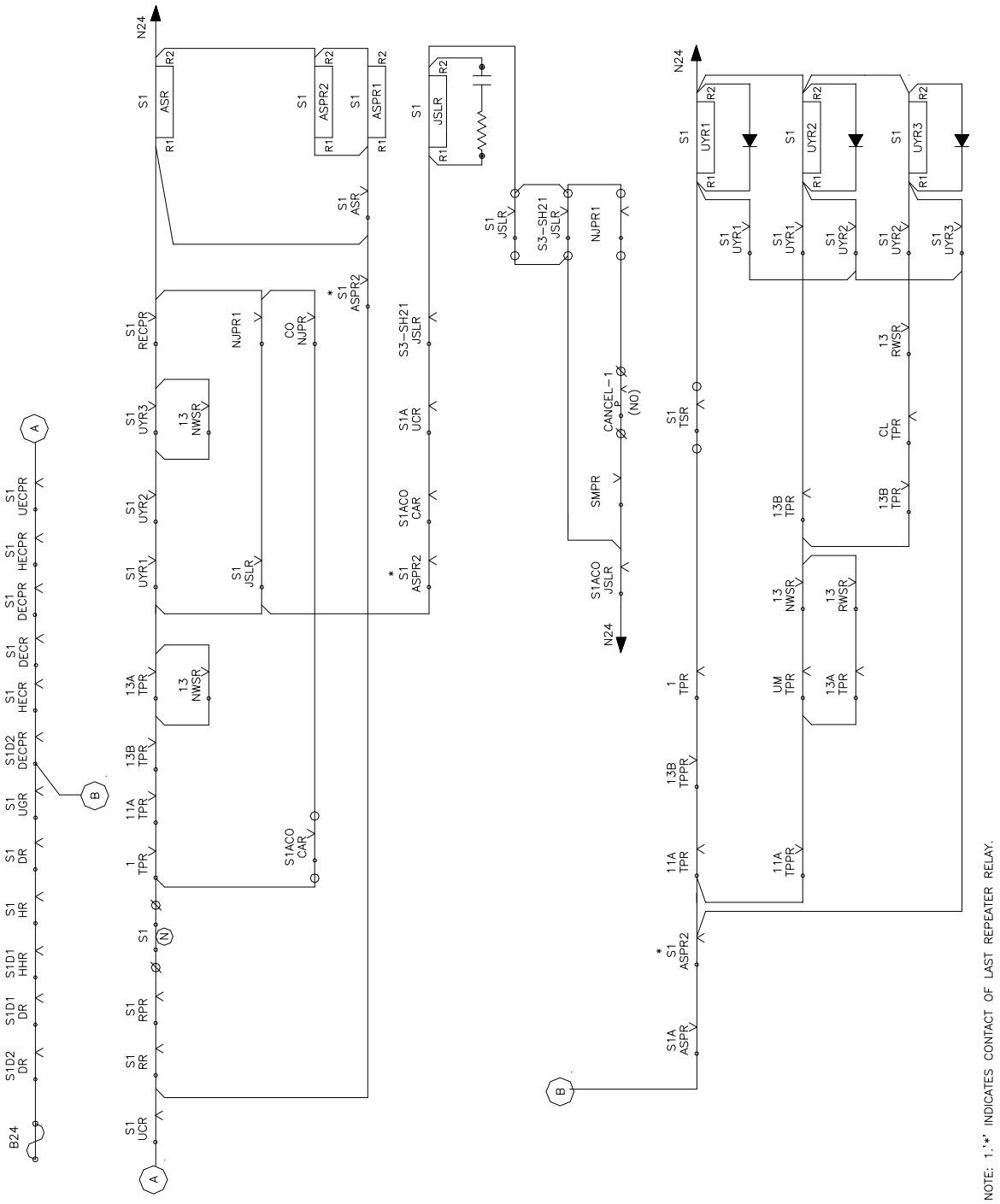


Fig No: 4.8

(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 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 normalised and
- 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, 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. It may also be noted that the sequential route release relays will energize only when ASR drops and the train arrives sequentially. Once ASR pick up, on arrival of a train, these relays drop, to be activated for another signalled 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 signals are 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 signals 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 o/p 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.

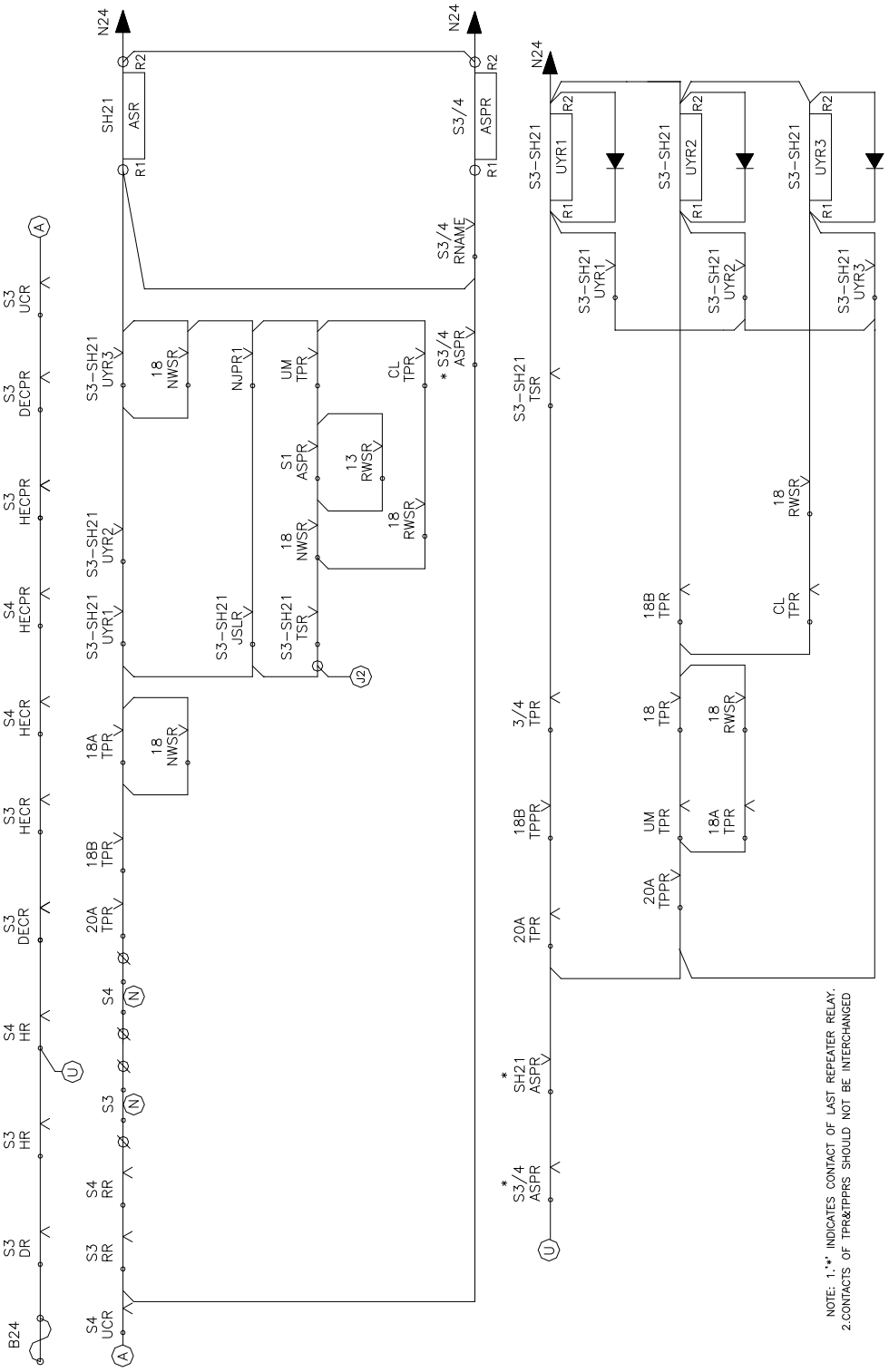
Once ASR drops on clearance of signal , it can also be energized on cancellation without any time delay. But this is possible only when the train is not in approach, but sufficiently far away and not occupied the approach track. Then the SM cancels the signal & route, ASR picks up immediately without 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 `C' 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.

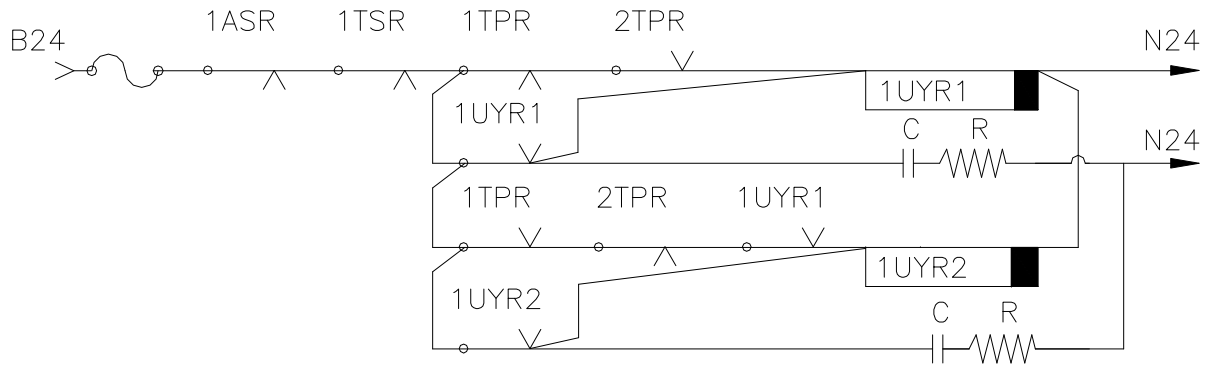


Fig No: 4.10

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 TPR's are proved together to pick up UYRs. Three UYR's - UYR1, UYR2 and UYR3 are energised for more reliability using 3 track circuits sequentially.

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. Any failure in the time delay arrangement will not give sufficient time for ASR to pick up resulting to a failure and this aspect is to be taken care during maintenance for a trouble free working.

Summary of UYR's

(a) UYR's are normally in de-energised condition.

(b) UYR's are picked up to assist ASR to pick up, and it proves that train has sequentially traveled over the route by sequentially occupying and clearing all the tracks in the route.

(c) These relays are named after signal concerned.

(d) Front contact used in ASR circuits and also for its own stick path.

(e) Back contact proved in HR circuit.

(f) UYR's are having slow to release feature.

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) Mechanical Time Release Relay operated by a Mechanical timer with reduction gear.
(b) Thermal element relay (QJ1).
(c) Electronic Timer Relay (ET).

IN MECHANICAL TIME RELEASE, the rotation of a gear system makes the Reverse contact after two minutes. The reverse contact is used in picking up ASR. This is not used now a days.

QJ1 is a Q series timer relay, which has a thermal coil and a bimetallic strip. This is used along with another Q series relay called NJPR (JR). The circuit is as follows:

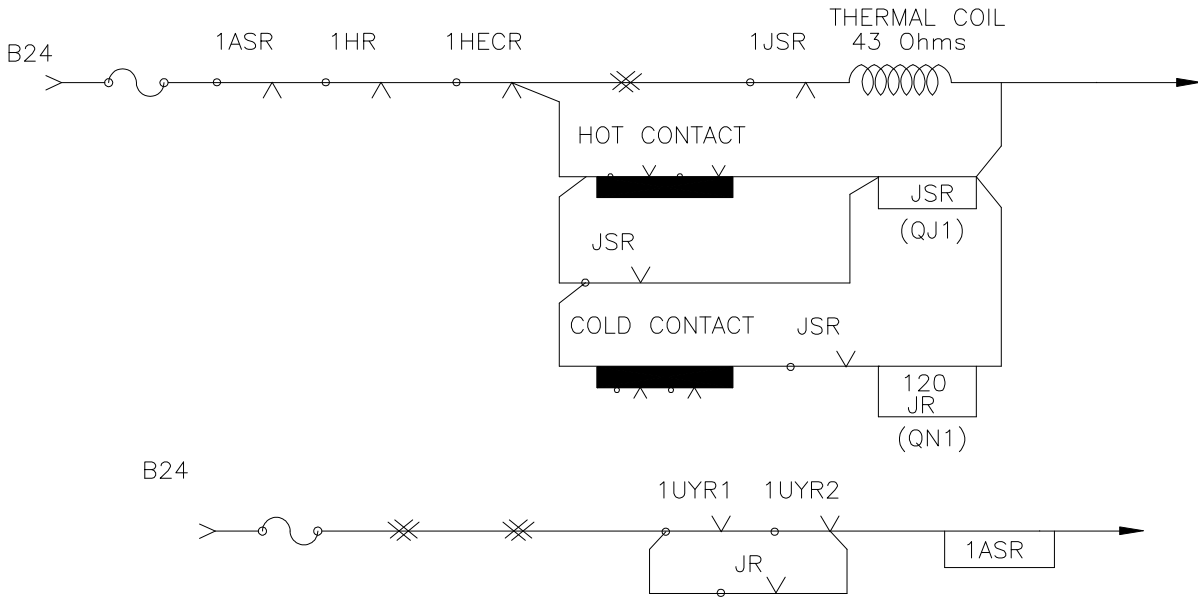


Fig No: 4.11

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 for selection of time release in the concerned ASR circuit. 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. Through JSLR up contact the thermal coil gets feed. Due to the difference in the coefficient of linear expansion of Invar and brass, the bimetallic strip under goes an upward bend and this makes Hot contact. The thermal unit is fed through the back contact of JSR (JSR is the Neutral Relay in the same enclosure). As soon as hot contact is made, JSR picks up and sticks through its own contact. Once JSR picks up, the feed to the thermal coil gets cut off and the strip starts cooling down. After a time lapse, bimetallic strip goes back to original position and a set of contacts called cold contact will be made. (refer S21 IRISET notes for more details). The cold contact and JSR front contact together pick up JR or NJPR, which is a Q series relay connected externally. When JR picks up the ASR energises and releases the route.

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 (for details of the working principle of timers please refer S21 IRISET Notes on Relays). Since the Electronic circuits using semi conductors, which are not treated as fully reliable, it is a practice to use two Timers in parallel and their contacts in series for releasing the route as shown below.

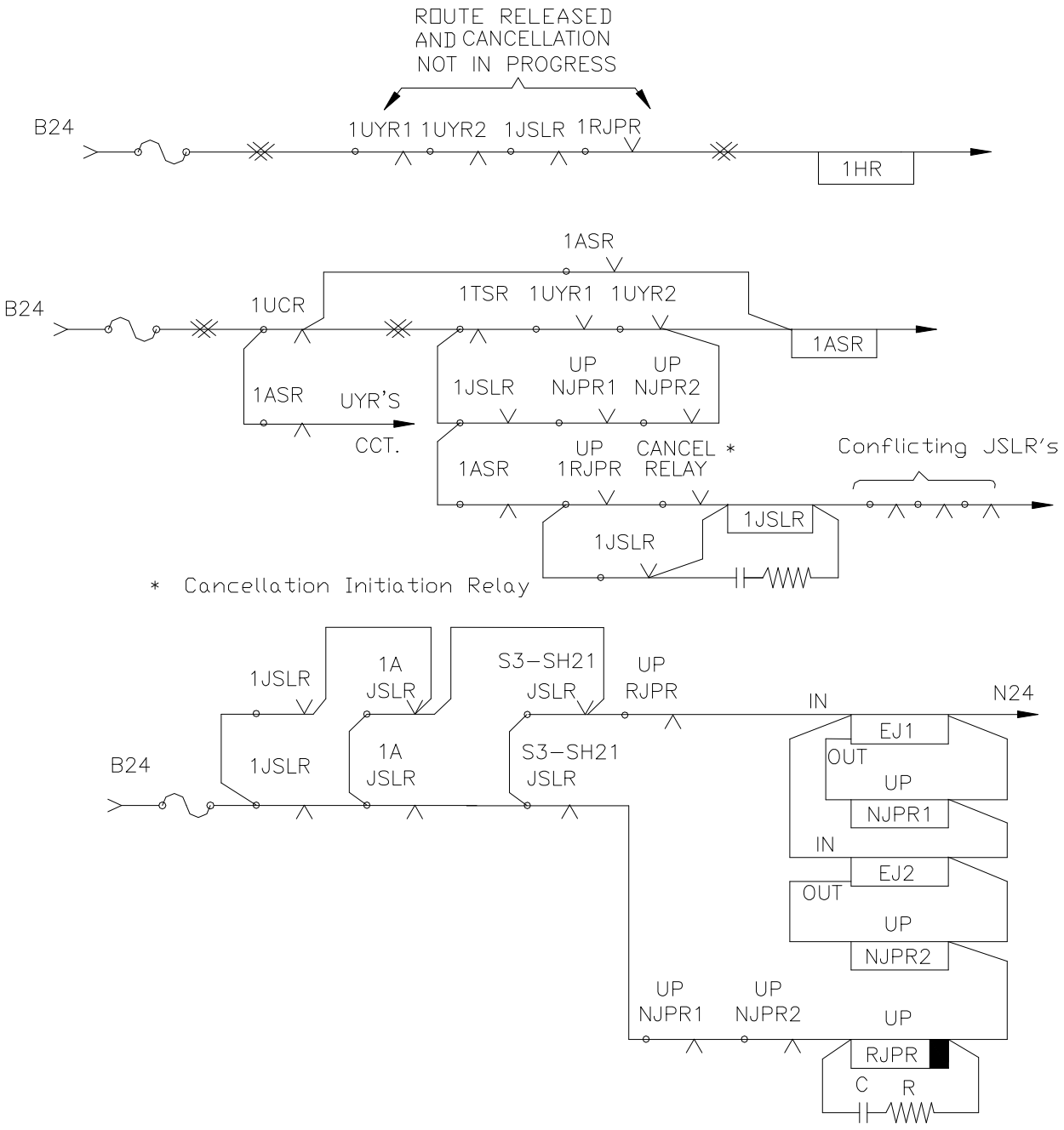


Fig No: 4.12

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.

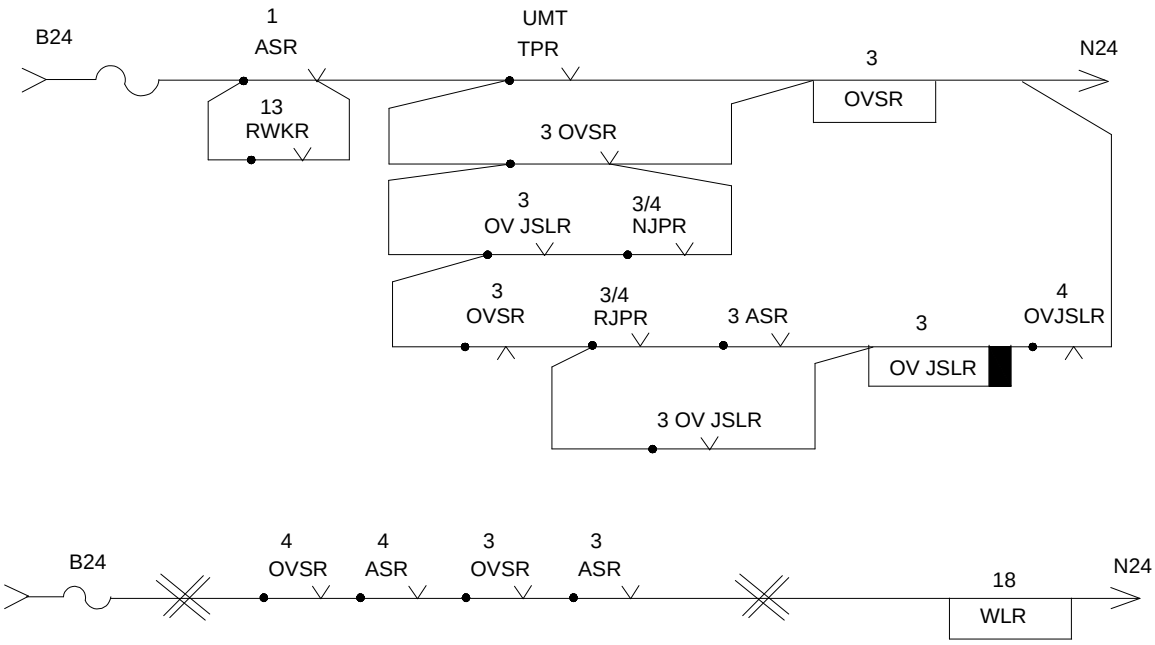


Fig No : 4.13

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

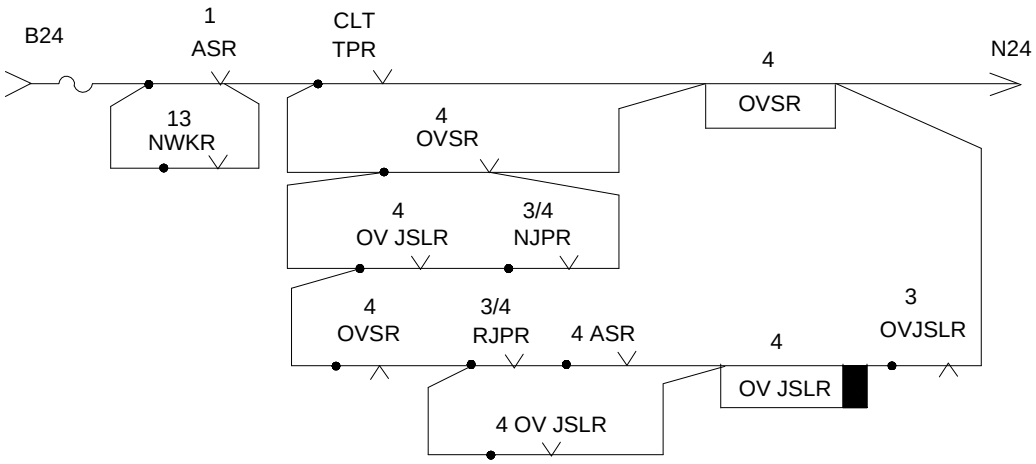
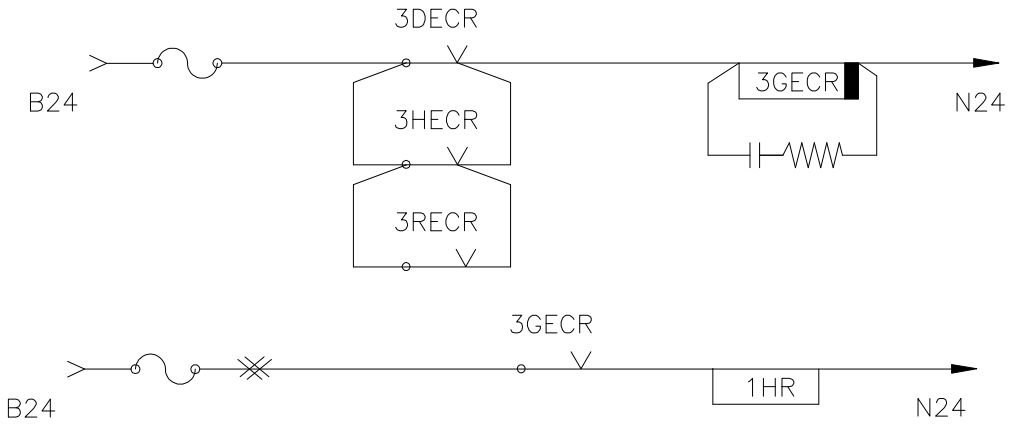


Fig No : 4.14

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
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 and held (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 HHR & DR drop.

In the layout No 3.1, there are 2 routes for home signal No 1. Again 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.

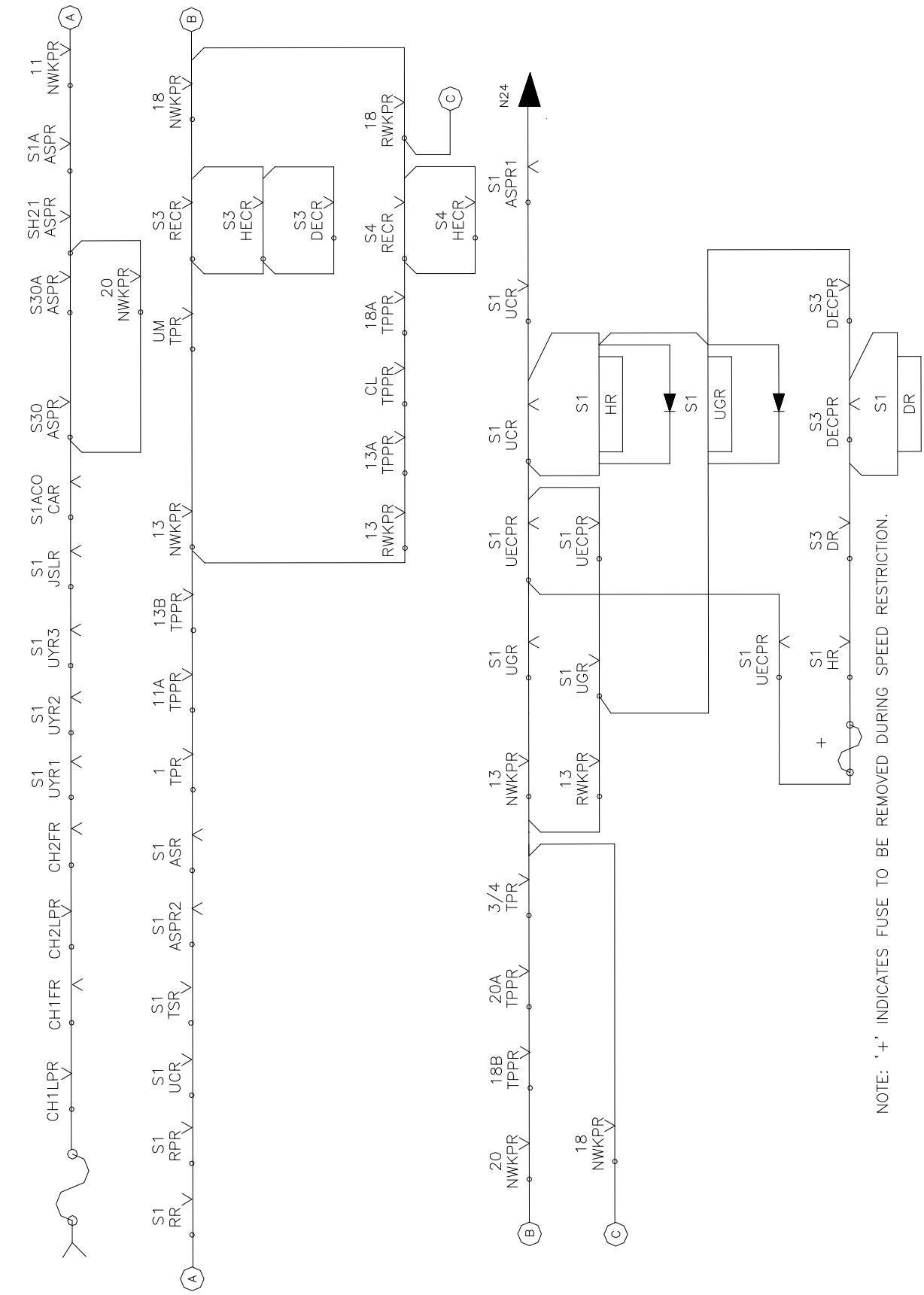

A
B
C
11 NWKPR
S1A ASPR
SH21 ASPR
S30A ASPR
20 NWKPR
S30 ASPR
S1ACO CAR
S1 JSLR
S1 UYR3
S1 UYR2
S1 UYR1
CH2FR
CH2LPR
CH1FR
CH1LPR
S1 RR
S1 RPR
S1 UCR
S1 TSR
S1 ASPR2
S1 ASR
1 TPR
11A TPPR
13B TPPR
13 NWKPR
UM TPR
S3 RECR
S3 HECR
S3 DECR
18 NWKPR
S4 RECR
S4 HECR
18 RWKPR
18A TPPR
CL TPPR
13A TPPR
13 RWKPR
N24
S1 ASPR1
S1 UCR
S1 UECPR
S1 UGR
13 NWKPR
13 RWKPR
3/4 TPR
20A TPPR
18B TPPR
20 NWKPR
18 NWKPR
S1 HR
S1 UGR
S1 UECPR
S3 DECPR
S3 DR
+
NOTE: '+' INDICATES FUSE TO BE REMOVED DURING SPEED RESTRICTION.

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.

GR.3.13

(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.

SEM 7.19.5

(a) 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.
(b) 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.
(c) A C.O signal shall detect all points in the route, which the main signal above detects excluding those in the overlap.
(d) At stations where SM controls the reception and despatch of trains, such control shall be extended to Calling-on signals also.

Further, 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. However, Calling-on track should be occupied for the prescribed time for clearing a Calling-on signal. This time delay is achieved by timers as mentioned earlier.

Like a main signal, C.O 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 occupation and then the calling 'ON' signal circuit is initiated. The 'CO' ON signal will be cleared after 120 sec.

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.

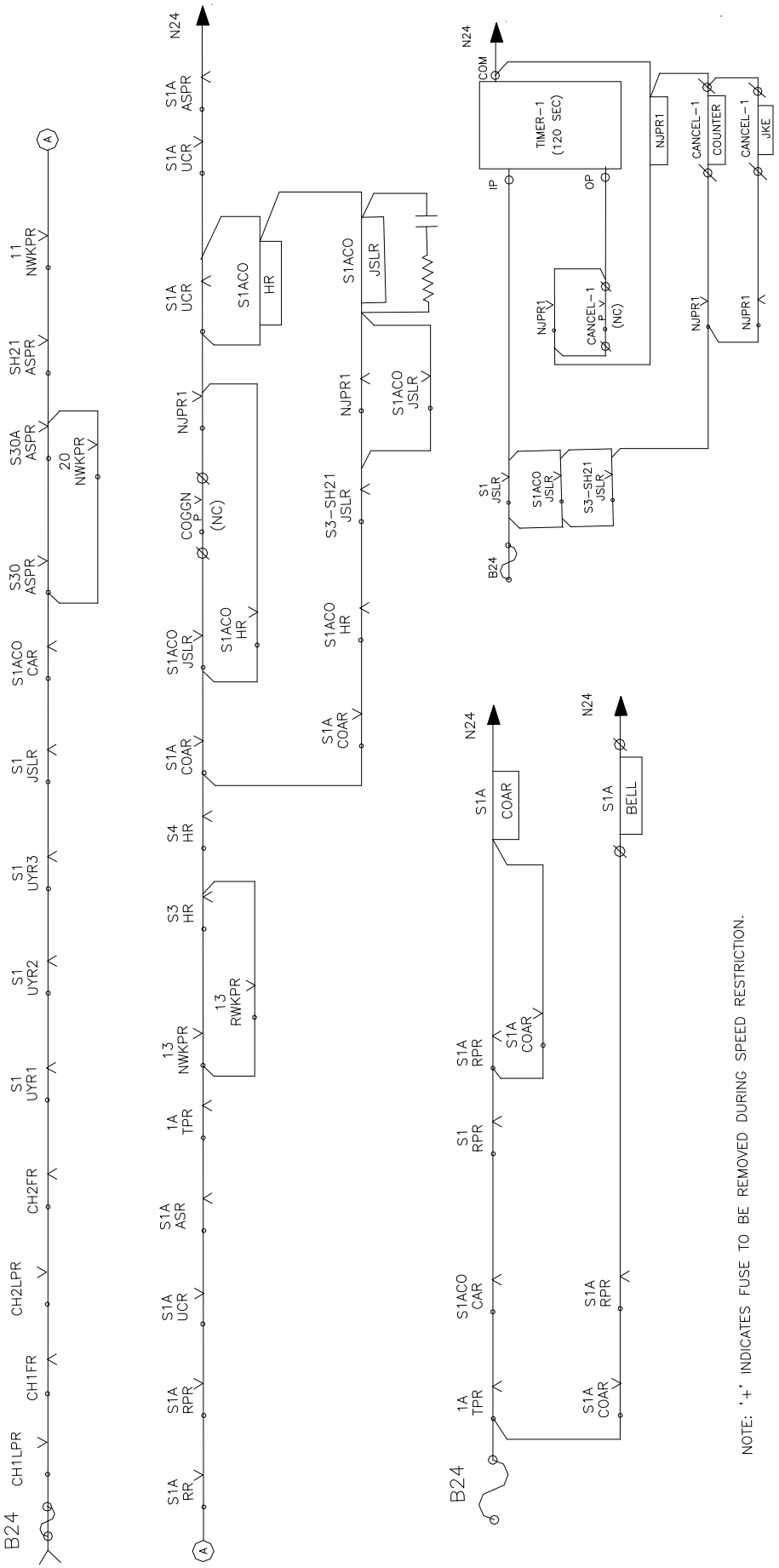

B24
CH1LPR
CH1FR
CH2LPR
CH2FR
S1 UYR1
S1 UYR2
S1 UYR3
S1 JSLR
S1ACO CAR
S30 ASPR
S30A ASPR
20 NWKPR
SH21 ASPR
1.1 NWKPR
S1A RR
S1A RPR
S1A UCR
S1A ASR
1A TPR
1.3 NWKPR
1.3 RWKPR
S3 HR
S4 HR
S1A COAR
S1ACO JSLR
S1ACO HR
COGGN P (NC)
NJPR1
S1A UCR
S1A ASPR
N24
S1ACO HR
S1ACO
JSLR
S1ACO JSLR
S3-SH21 JSLR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

Fig No: 4.17

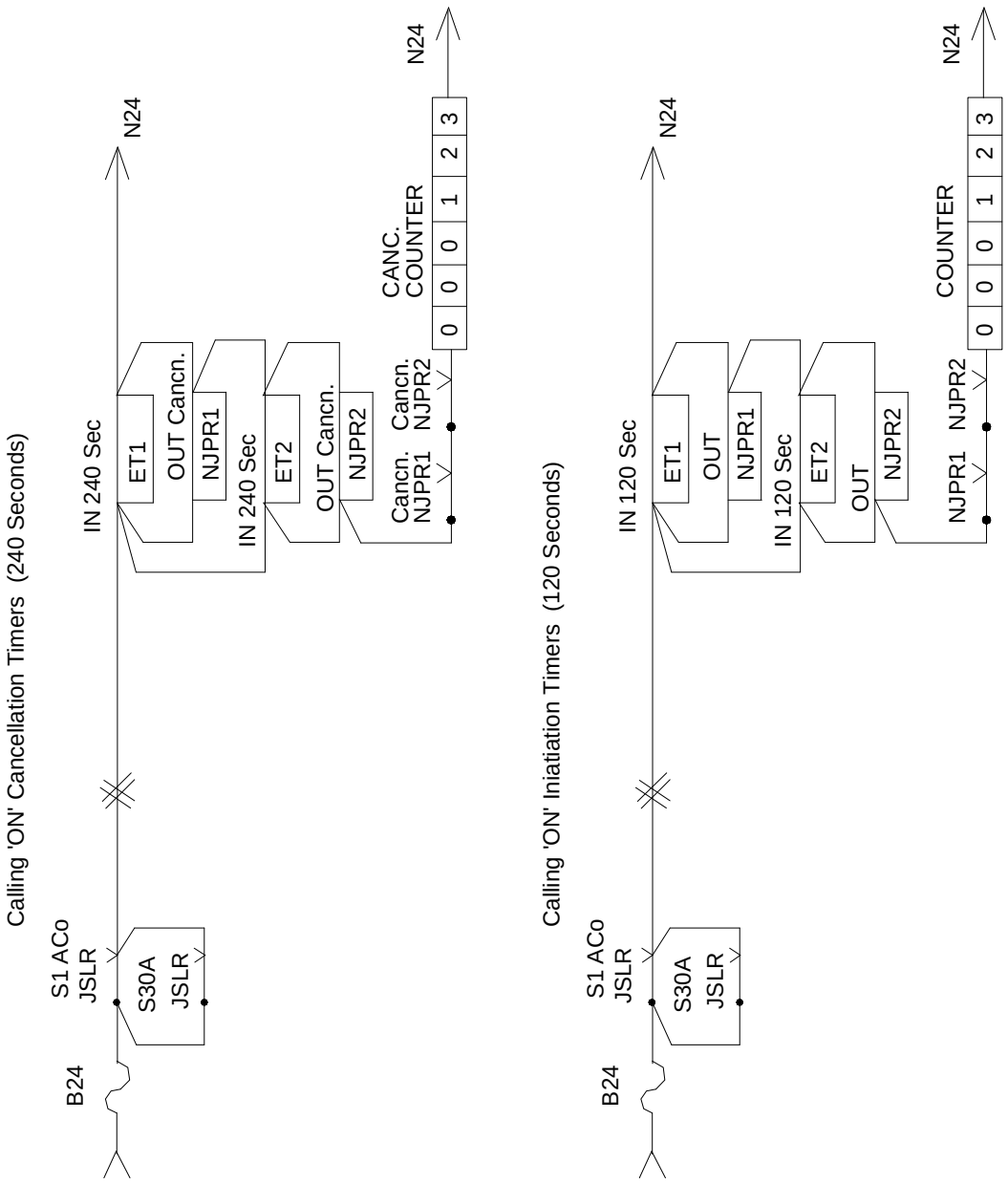


Fig No: 4.18

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.

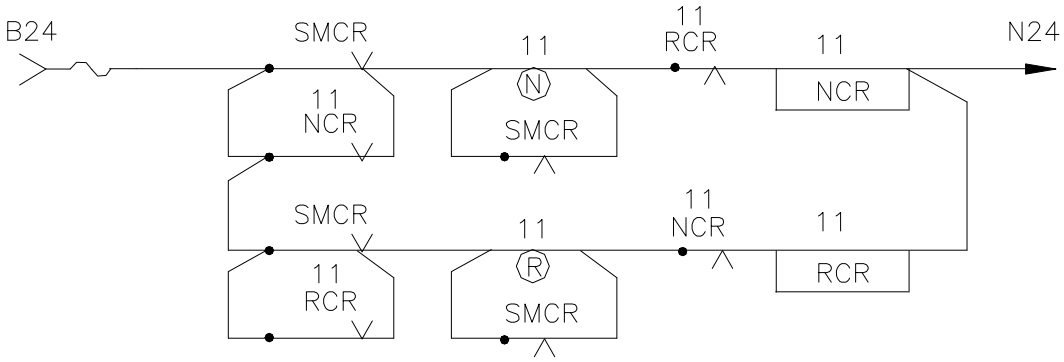


Fig No: 4.19

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.

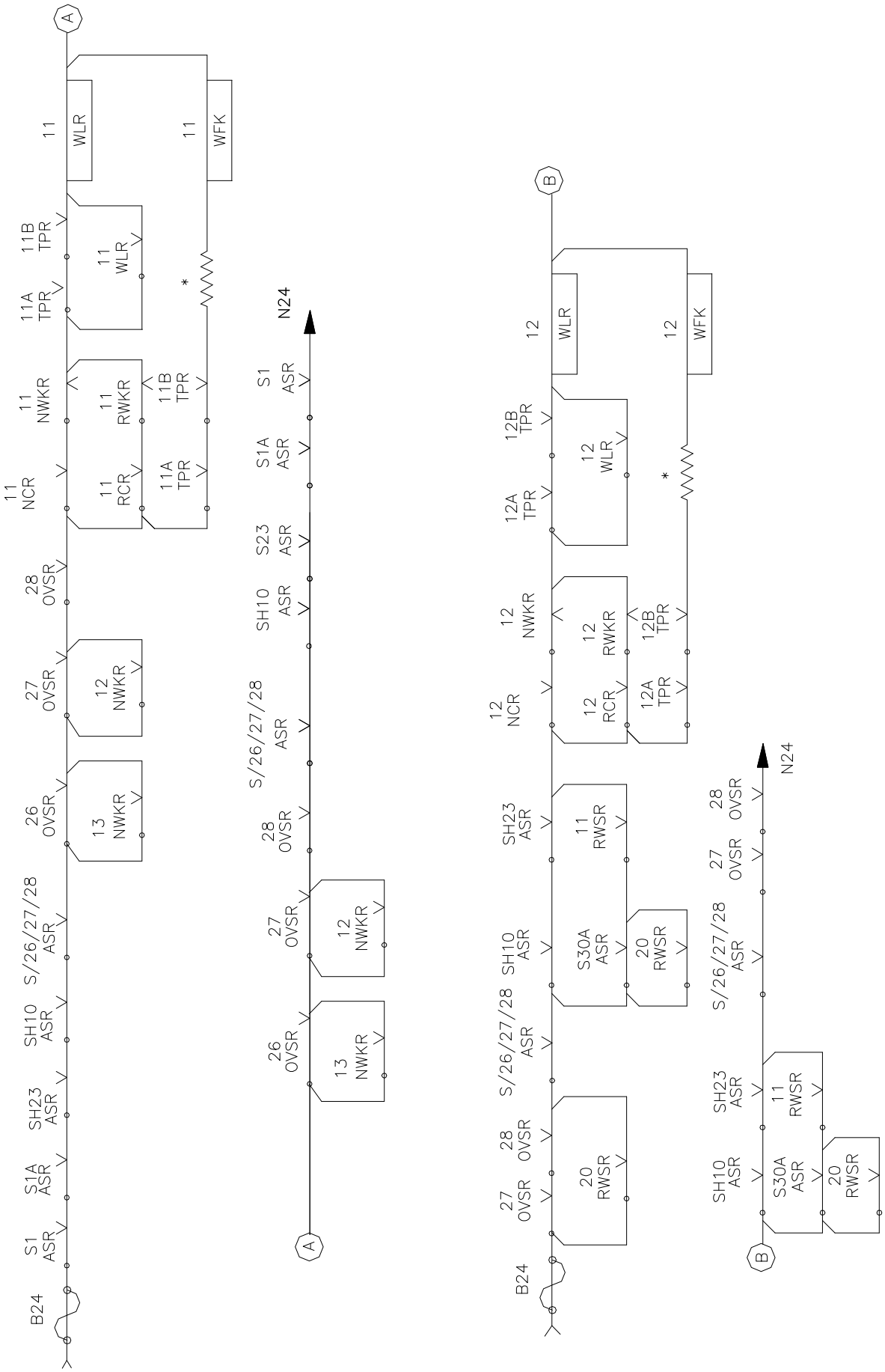
(d) Track locking is bypassed by its own WLR front contact as stick path. So that once a point movement is started, it completes its operation even the track down occurs during operation.

(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.

(Note: In some zonal railways WLR is normally energized relay, such circuits are also shown in para 4.4.)



WLR CIRCUIT
Fig. No.4.20

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.4.19) Provided SM's key is in.

(b) With NCR/RCR picked up, WLR is picked up. (Reference to Fig No.4.20)

(c) With WLR picked up, PCR1/PCR2 picks up. (Reference to Fig No.4.21)

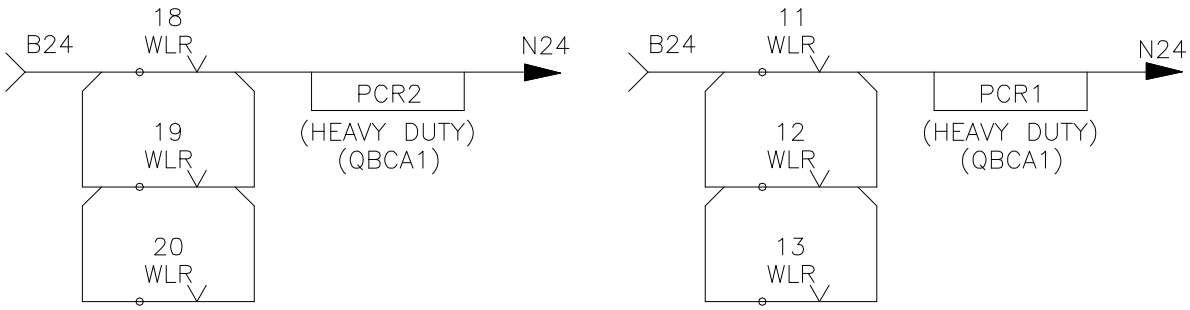


Fig. No.4.21

(d) PCR1/PCR2 picked up, 110 V DC for point operation is extended to location. (Reference to Fig No.4.22)

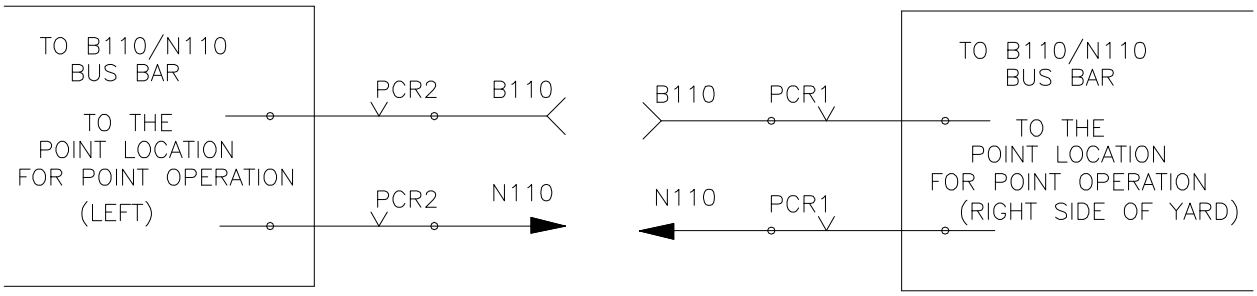


Fig. No.4.22

(e) With WLR, RCR/NCR picked up, NWKR/RWKR drops. Thereby all indication relays& its repeater relays (NWKPRs, RWKPRs, NWKSRs, RWKSRs) drop. (Reference to Fig No. 4.28)

(f) With WLR up, all indication relays drop, NCR/RCR up, NWR/RWR will pick up at location (Reference to Fig No.4.23)

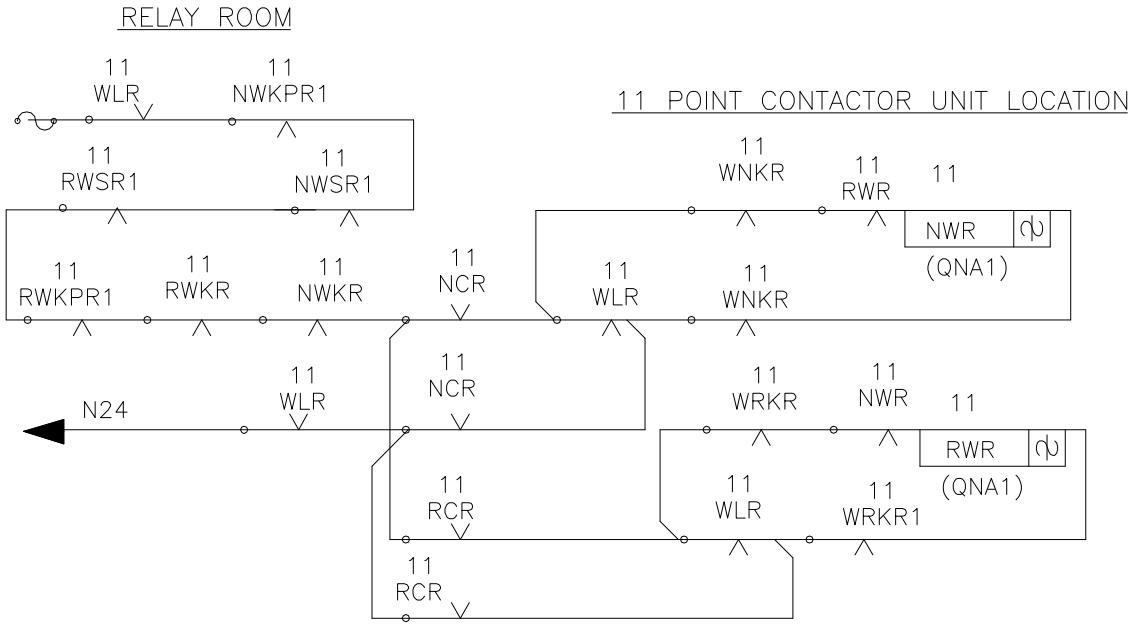


Fig. No.4.23

(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.4.24)

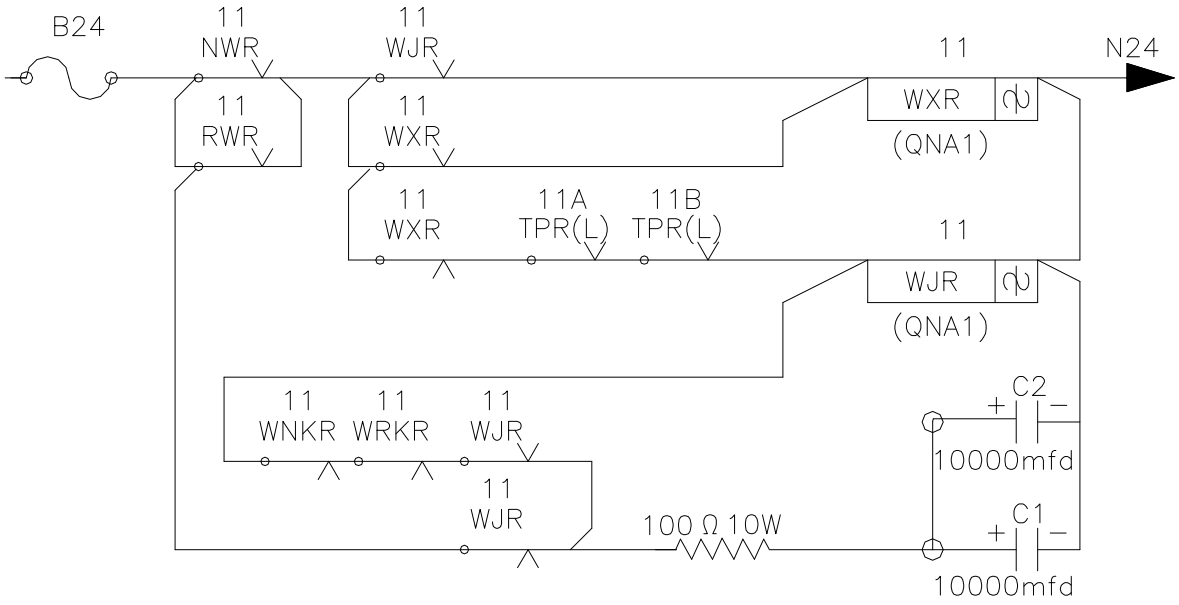


Fig. No.4.24

(h) With WXR, WJR, NWR/RWR up and WNKR/WRKR drop, WCR (QBCAI relay) picks up. (Reference to Fig No 4.25)

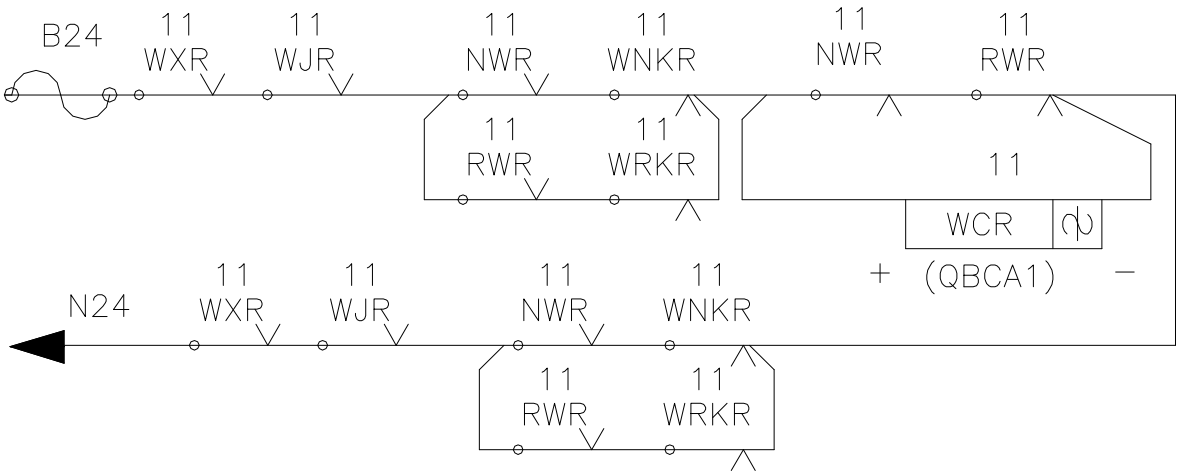


Fig. No.4.25

(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.4.26)

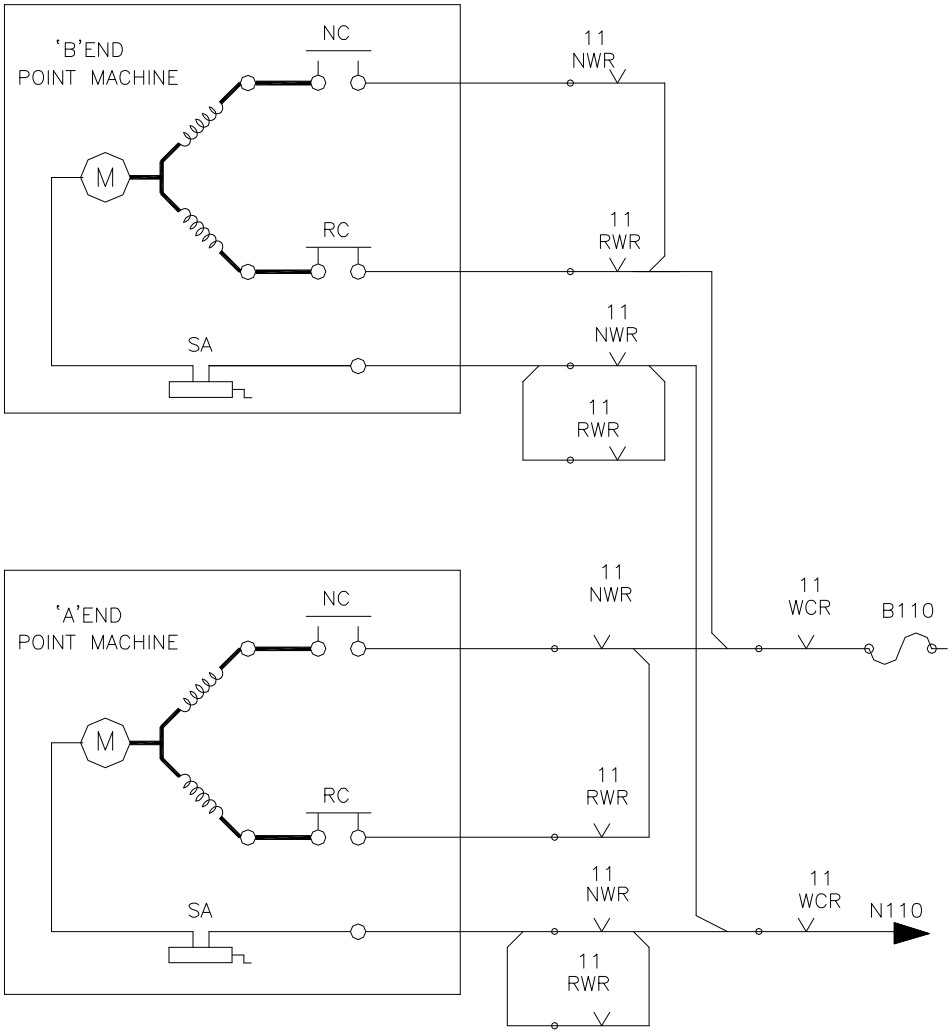


Fig. No.4.26

(j) There by WNKR/WRKR picks up. (Reference to Fig No.4.27)

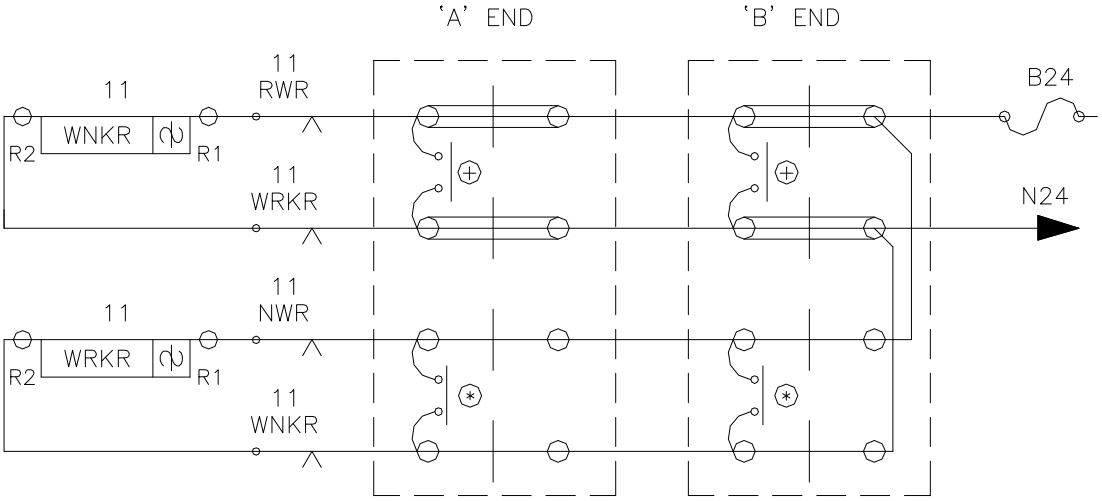


Fig. No.4.27

(k) Energisation of WNKR/WRKR results in dropping of WJR, WCR, and NWR/RWR.

(l) With WJR dropping, WXR drops.

(m) 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.4.28)

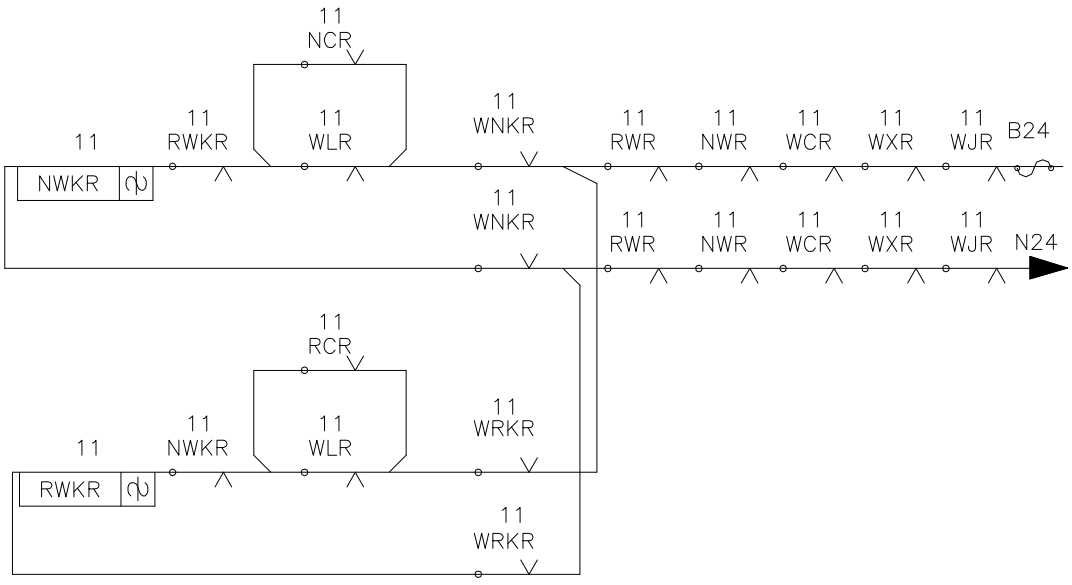


Fig. No.4.28

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

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

(p) 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.

4.4 When WLR is normally energized (Ref . Lay Out Fig No 4.30)

4.4.1 In some railways WLR is kept in normally energized condition and drops when ever any signal is taken off (due to concerned ASR dropping).

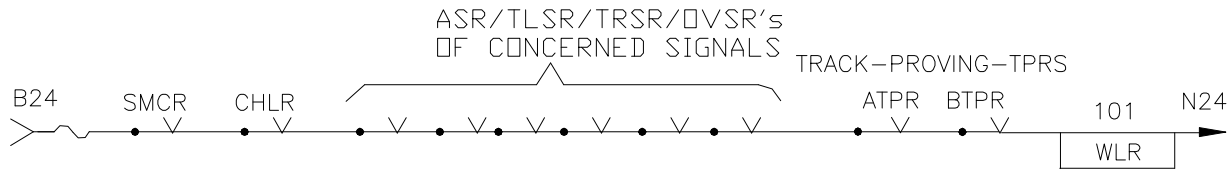


Fig No: 4.29

Note : *WLR drops as soon as point indication is obtained and / or when SM's key is removed and / or any signal is given and concerned ASR / TLSR /TRSR / OVSR drops.*

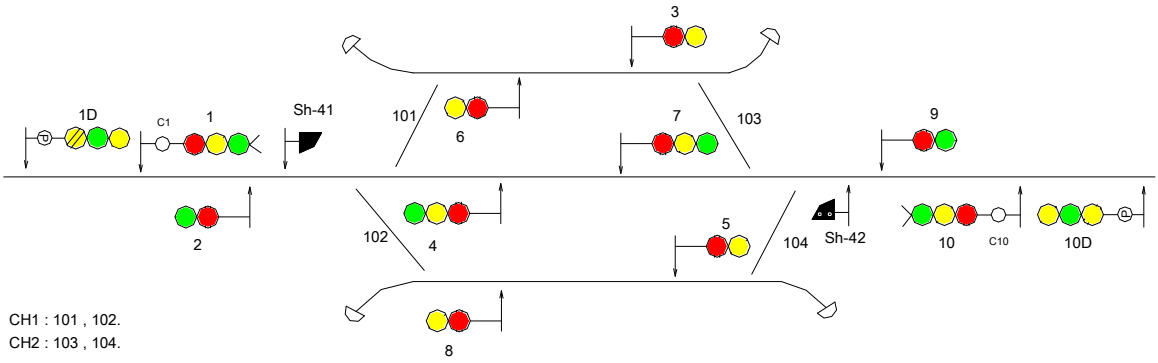


Fig. No.4.30

4.4.2 Point Lock, Point Control Operation and Indication Circuits (WLR, WNR/WRR, WJR/XR, NWR/RWR, NWPR/RWPR, NWCR/RWCR, NWKR/RWKR).

In conventional PI, the points are operated individually to the required position and then the signal switch is turned, UCR picks up and the signal is taken `OFF'. In this, 2-position, point switches (`N' & `R') are used. The switch remains either in `N' position or in `R' position depending upon the actual position of the point at site.

Point lock relay, WLR is normally energized to enable the point to be operated as and when required (In some railways, WLR is kept normally de-energised to save power).

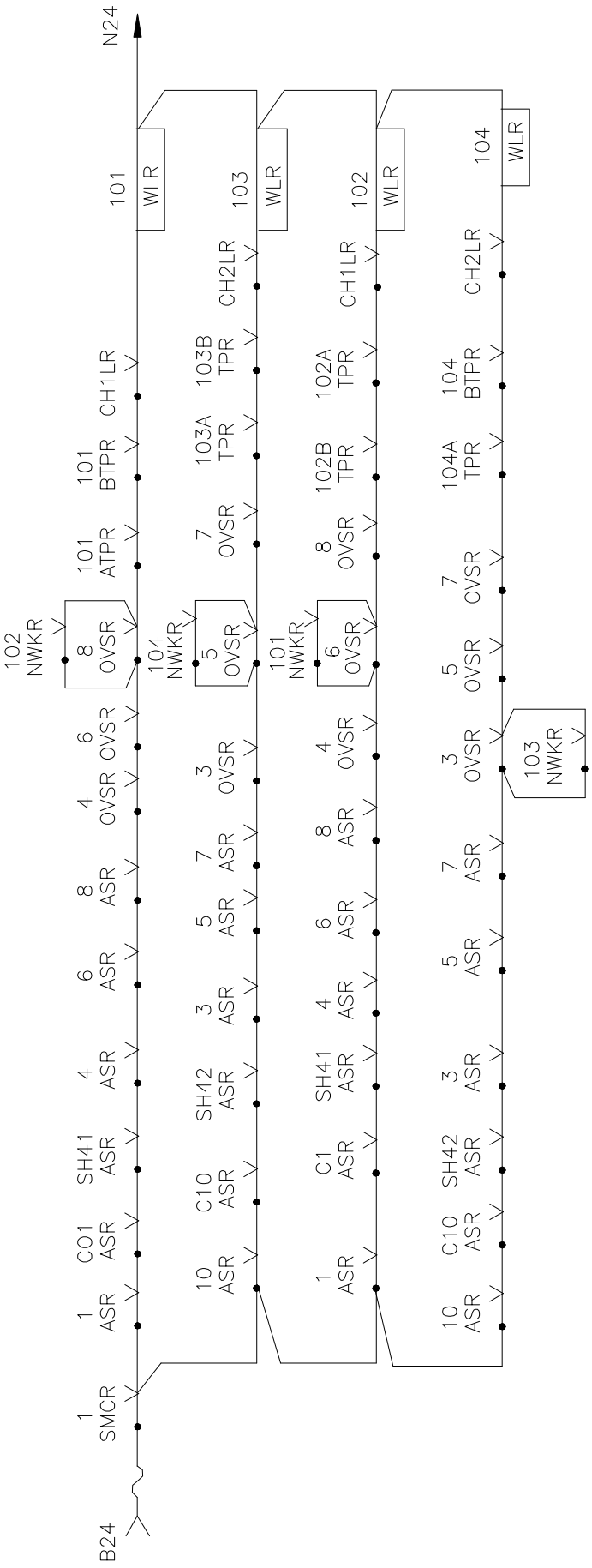


Fig. No.4.31
Point Control Circuit with 2- Position Switch

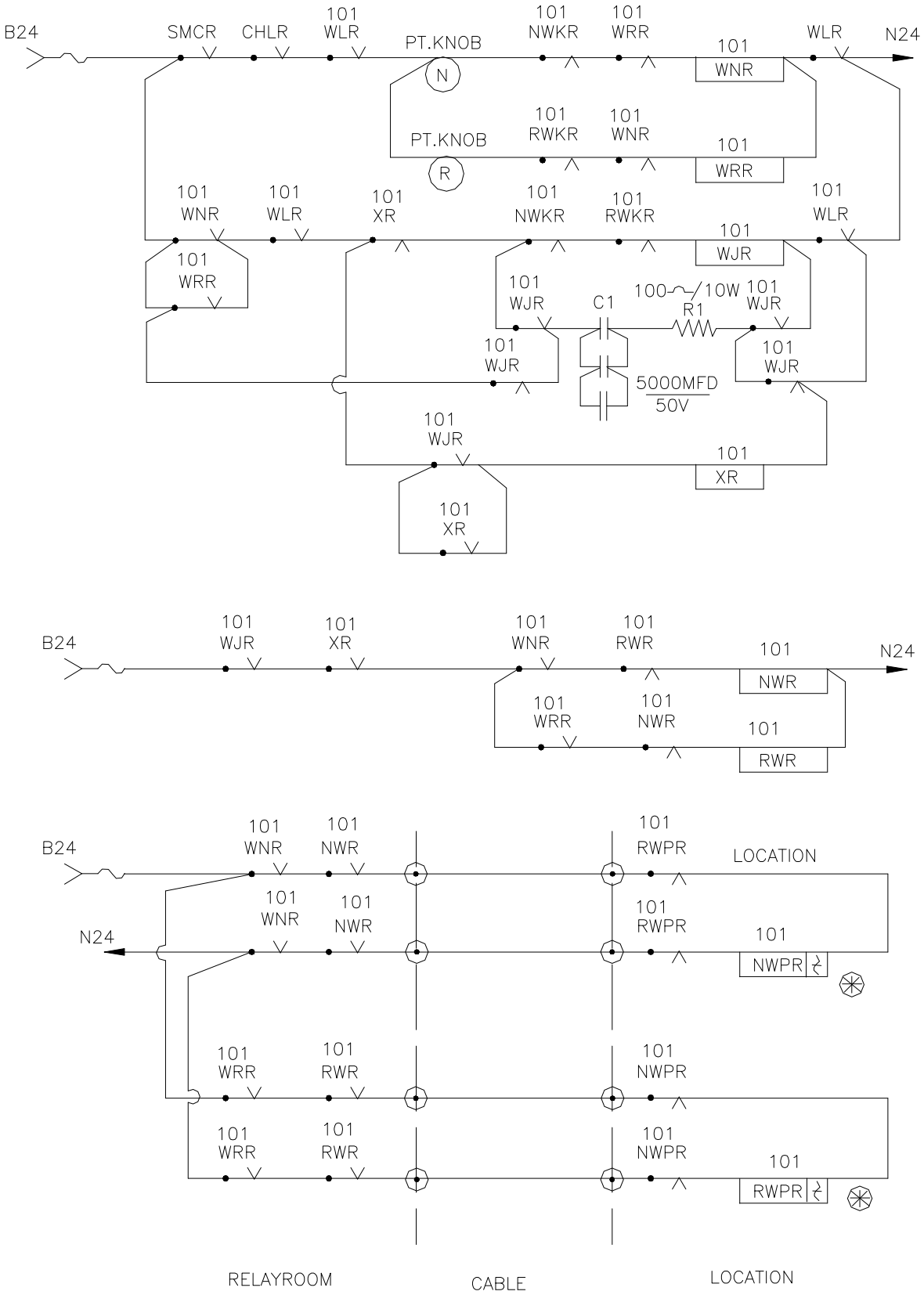

B24
SMCR
CHLR
101 WLR
PT.KNOB
N
101 NWKR
101 WRR
101 WNR
WLR
N24
PT.KNOB
R
101 RWKR
101 WNR
101 WRR
101 WNR
101 WLR
101 XR
101 NWKR
101 RWKR
101 WLR
101 WJR
101 WRR
101 WJR
C1
100
10W
R1
101 WJR
101 WJR
101 WJR
5000MFD
50V
101 WJR
101 XR
101 XR
B24
101 WJR
101 XR
101 WNR
101 RWR
101 NWR
N24
101 WRR
101 NWR
101 RWR
B24
101 WNR
101 NWR
101 RWPR
LOCATION
N24
101 WNR
101 NWR
101 RWPR
101 NWPR
101 WRR
101 RWR
101 NWPR
101 WRR
101 RWR
101 NWPR
101 RWPR
RELAYROOM
CABLE
LOCATION

Fig No: 4.32

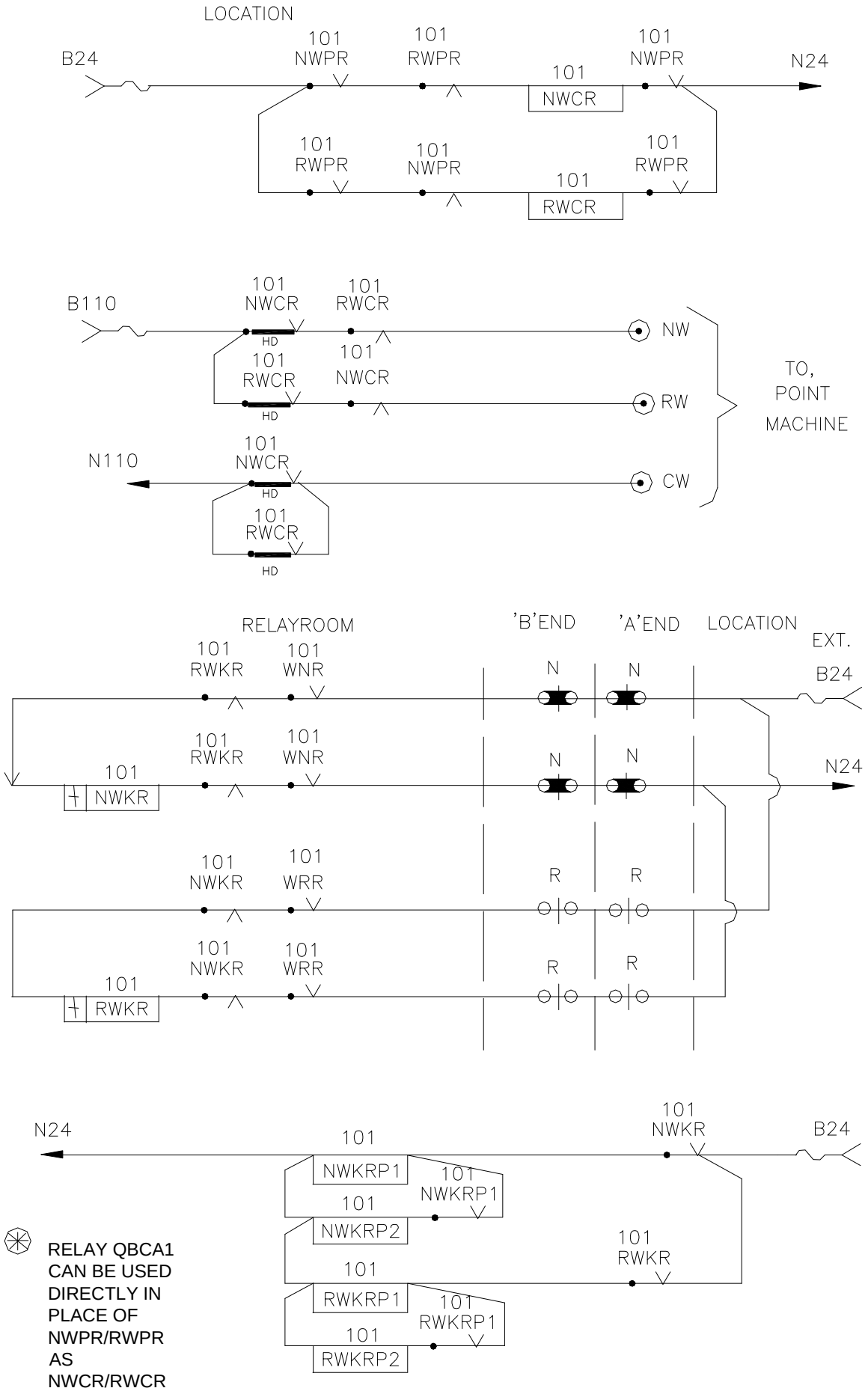

LOCATION
B24
101 NWPR
101 RWPR
101 NWCR
101 NWPR
N24
101 RWPR
101 NWPR
101 RWCR
101 RWPR
B110
101 NWCR
101 RWCR
HD
NW
101 RWCR
101 NWCR
HD
RW
TO, POINT MACHINE
N110
101 NWCR
HD
CW
101 RWCR
HD
RELAYROOM
'B'END
'A'END
LOCATION
EXT.
101 RWKR
101 WNR
N
N
B24
101 NWKR
N24
101 NWKR
101 WRR
R
R
101 RWKR
N24
101
101 NWKR
B24
NWKRP1
101 NWKRP1
101 NWKRP2
101 RWKR
101 RWKRP1
101 RWKRP1
101 RWKRP2
RELAY QBCA1 CAN BE USED DIRECTLY IN PLACE OF NWPR/RWPR AS NWCR/RWCR

Fig No: 4.33

Let us assume that the point is in normal position with switch in normal and indication is also normal (NWKR ↑)

Relays WNR, WRR, WJR, XR, NWR/RWR etc. are normally de-energised relays. With SM's key 'IN', SMCR is up and WLR is Normally up .To operate the point from Normal to Reverse.

Steps : -

(a) Switch is turned from `N' to `R' position.

(b) Relay WRR picks up proving RWKR ↓ WNR ↓

(c) Normal indication relay, NWKR drops (since, WRR drop is proved in NWKR). ↑

(d) Point Time Relay WJR picks up with WRR ↑ XR ↓ NWKR ↓ RWKR ↓ and WLR ↑

(e) Special (pt. time control) Relay XR picks up through WJR↑ and disconnects feed to WJR.

(f) With WJR ↑ , the direct feed to condenser through WJR drop contacts is also disconnected. Now WJR remains up with condenser feed through its own front contact and drop contacts of NWKR, RWKR. The timing of WJR ↑ depends upon the capacity of condensers. The time will be normally 3-4 times then the time required for operation of point under normal conditions.

(g) With WJR ↑, XR ↑ and through WRR ↑ RWR will be energized proving Normal operation relay NWR drop.

(h) With RWR, the DC110 feed for point operation is directly fed through a point contactor relay RWCR. If the point is far away, then a repeater of RWR ie. RWPR is energized near the point location. Through RWPR , the point contactor relay RWCR is energised and 110 V DC extended to point for operation.

(i) The point operation to reverse completed , reverse detection contacts are made and the relay RWKR pick up at Relay Room with NWKR ↓ WNR ↓

(j) RWKR pick up causes WJR to drop immediately, and WRR, XR relays also drop.

(k) With all the point controlling relays dropped, the feed to point is cut off.

(l) For the operation of point from 'R' to 'N', the point knob is turned from reverse to normal and the corresponding relays for normal operation at relay room and location pick up. Finally the point is set to normal and NWKR is picked up at relay room.

In case, the point indication fails due to any obstruction, etc, the feed to point will extend only for a limited time till WJR remains up with condenser feed discharge path and subsequently WJR drops and cut off supply to point. This is to limit DC110 to point, to prevent excess drainage which may damage Battery, Motor, Charger, Cable, Relay Contacts etc., in case of point not setting in time due to any obstruction.

But Relay XR remains up through WNR/WRR up (not dropped since no indication) and its own front contact. It is a special relay controls WJR and feed to point.

Now the point switch is turned once again to `N' and then to `R' to drop XR. Then allows WJR to pick up and try once again to set the point. The sequence of pick up of relays remains same.

4.4.3 NWSR / RWSR Circuits (Stick Relays of NWKR/RWKR)

(a) When WLR is normally de-energised.

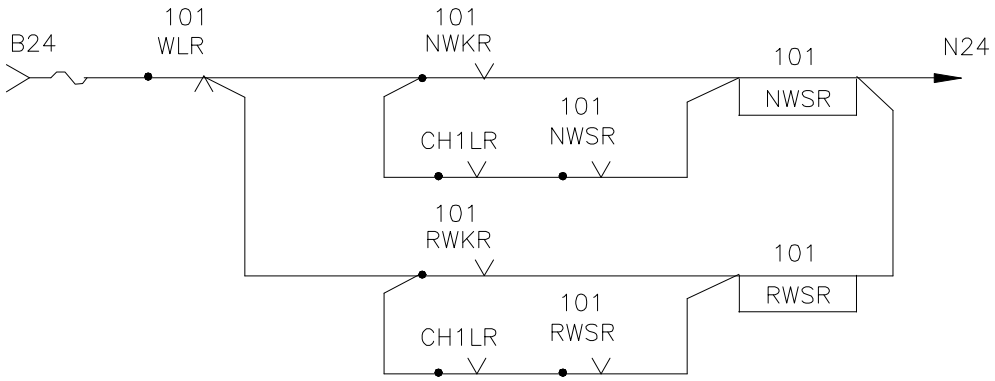


Fig No : 4.34

(b) When WLR is normally energised

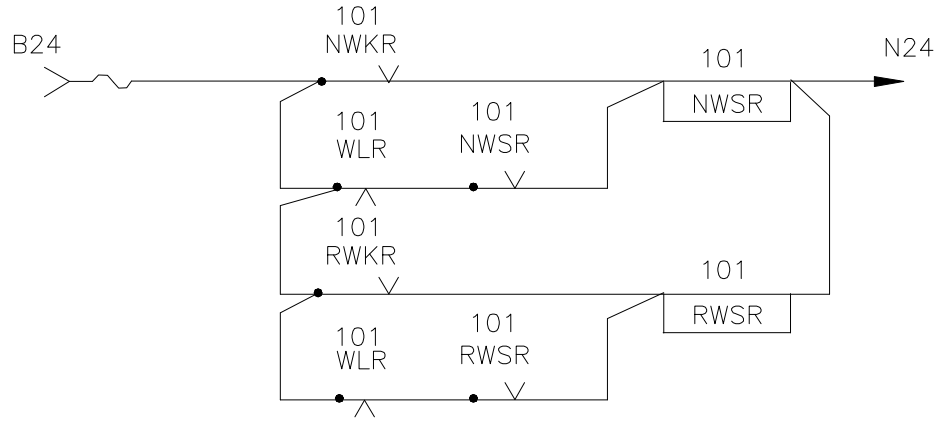


Fig No: 4.35

Relays NWSR/RWSR are repeaters of NWKR/RWKR respectively, but they remain stick through their own front contact and WLR & CHLR front and back contact.

These stick relays does not drop when the point indication flickers while passage of a train and/or due to loose packing etc.

Relay NWSR/RWSR drops as and when the point operation is initiated and the concerned controlling relays drops.

The reason for picking up stick relays for point indications is to prevent dropping of certain relays such as ASR/TLSR/TRSR/OVSR etc. which are not involved in a particular route and not required to drop for other signal routes and overlaps, are by passed by point NWSR/RWSR otherwise, the relays which need not be dropped, may also drop during passage of train due to flickering of point.

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 (HKT/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 (see Fig 4.39)

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.

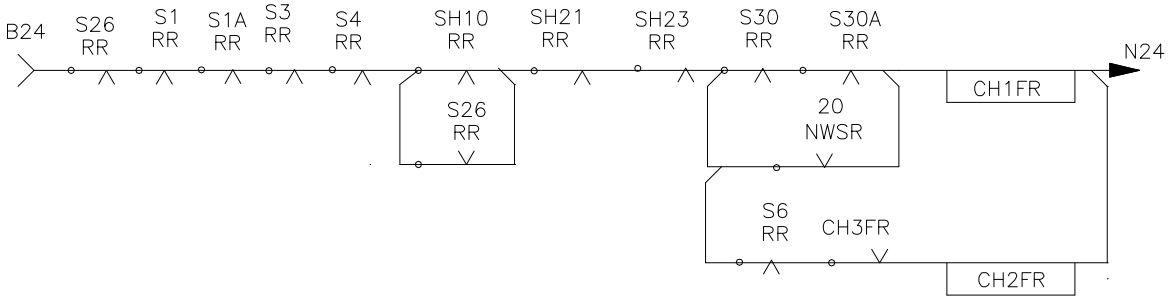


Fig. No.4.36

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 can be not 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.

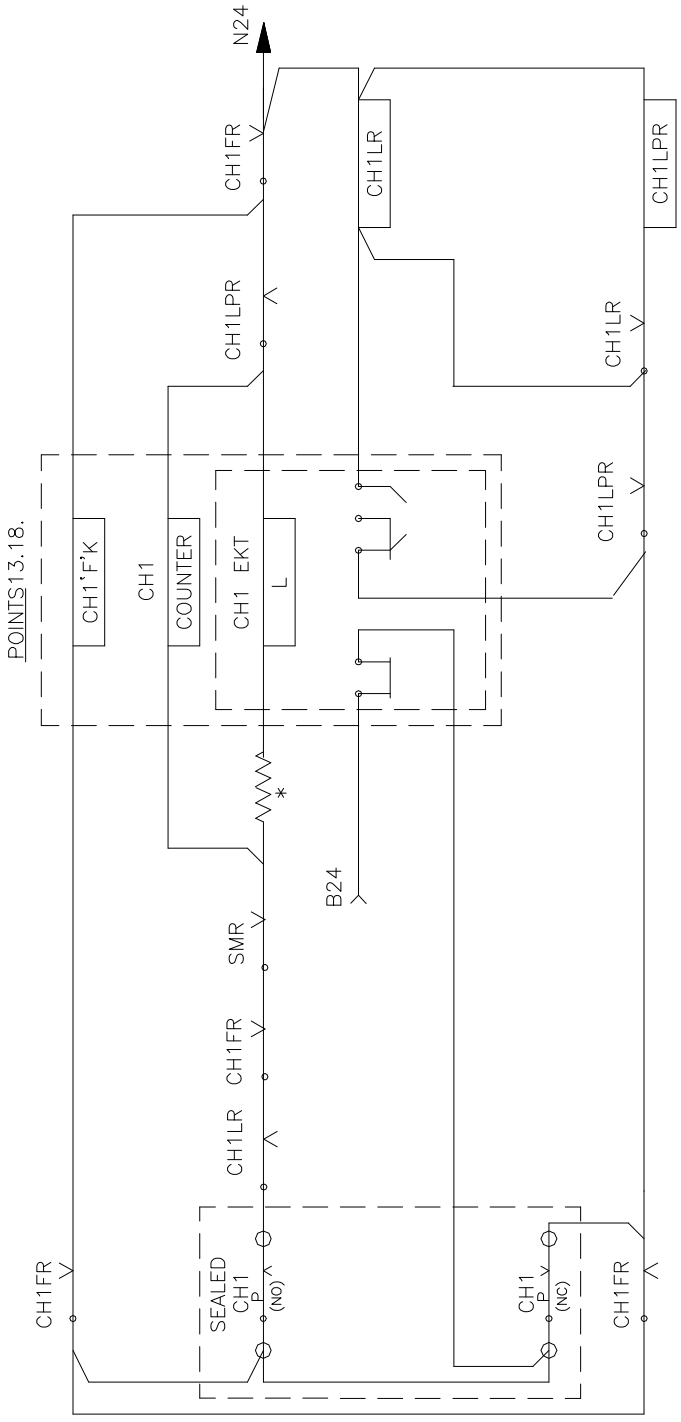
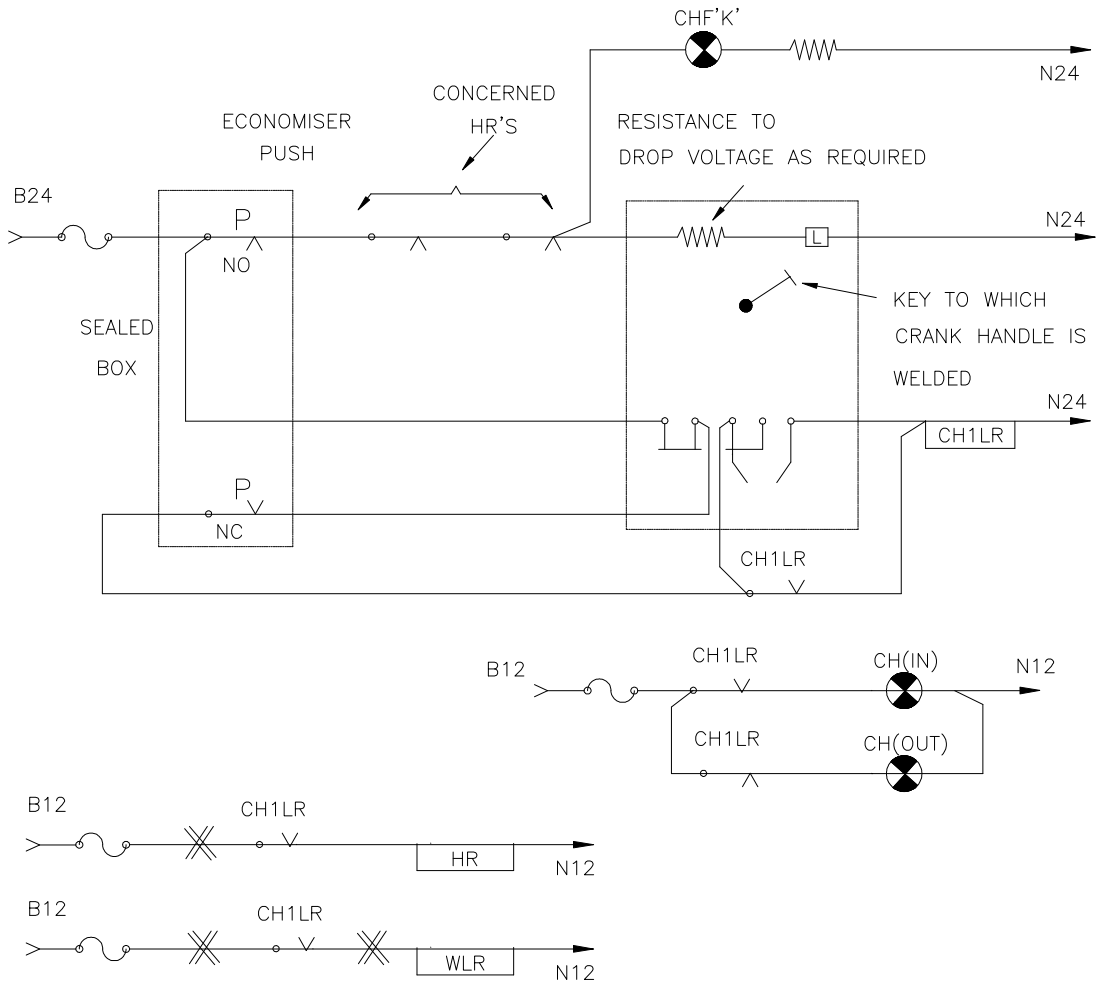
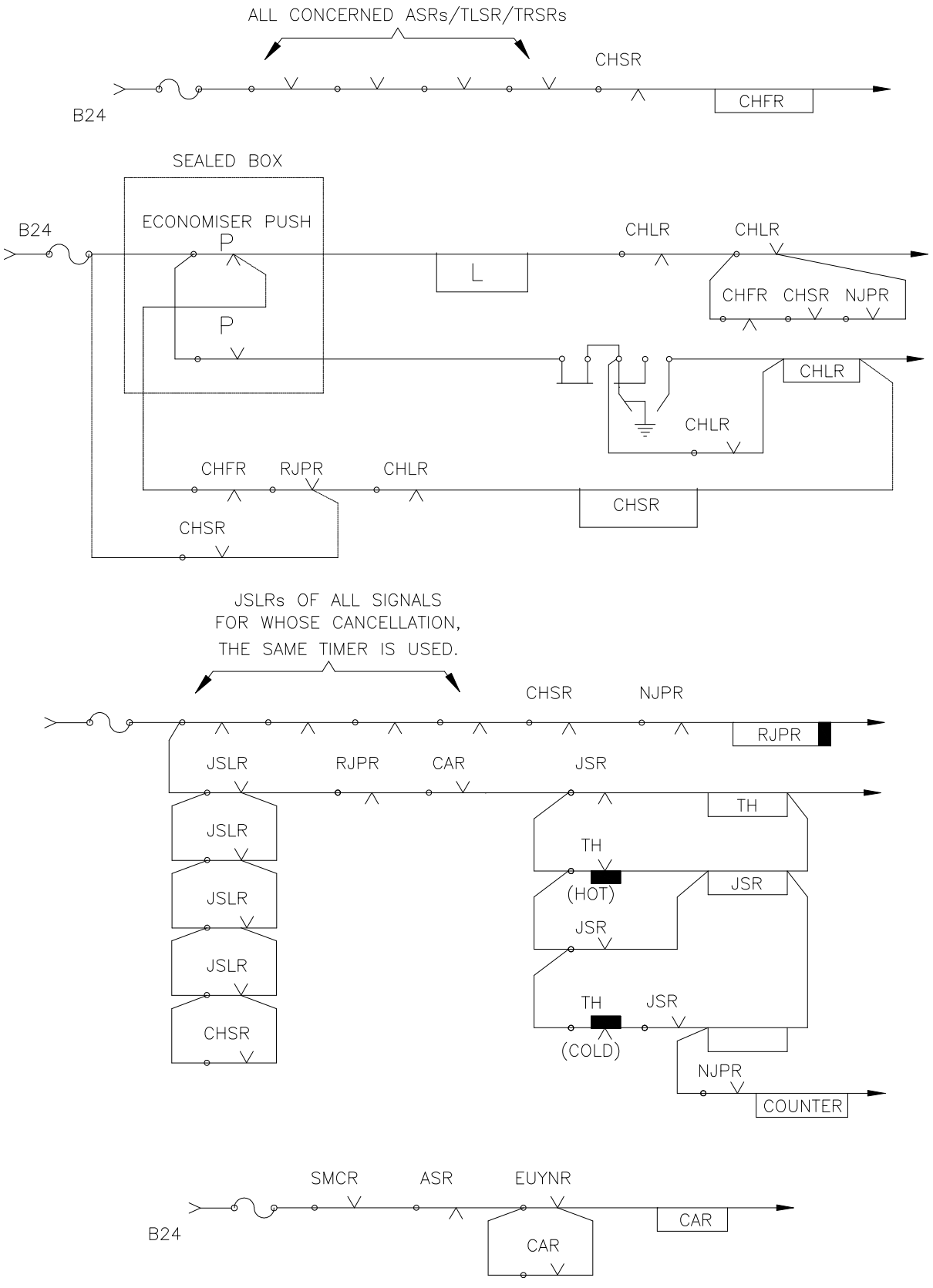


Fig No: 4.37



CRANK HANDLE CONTROL CIRCUIT WITHOUT EMERGENCY RELEASE

Fig No: 4.38



CRANK HANDLE CONTROL CIRCUIT IF EMERGENCY RELEASE OF C.H IS CATERED FOR

Fig No: 4.39

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:

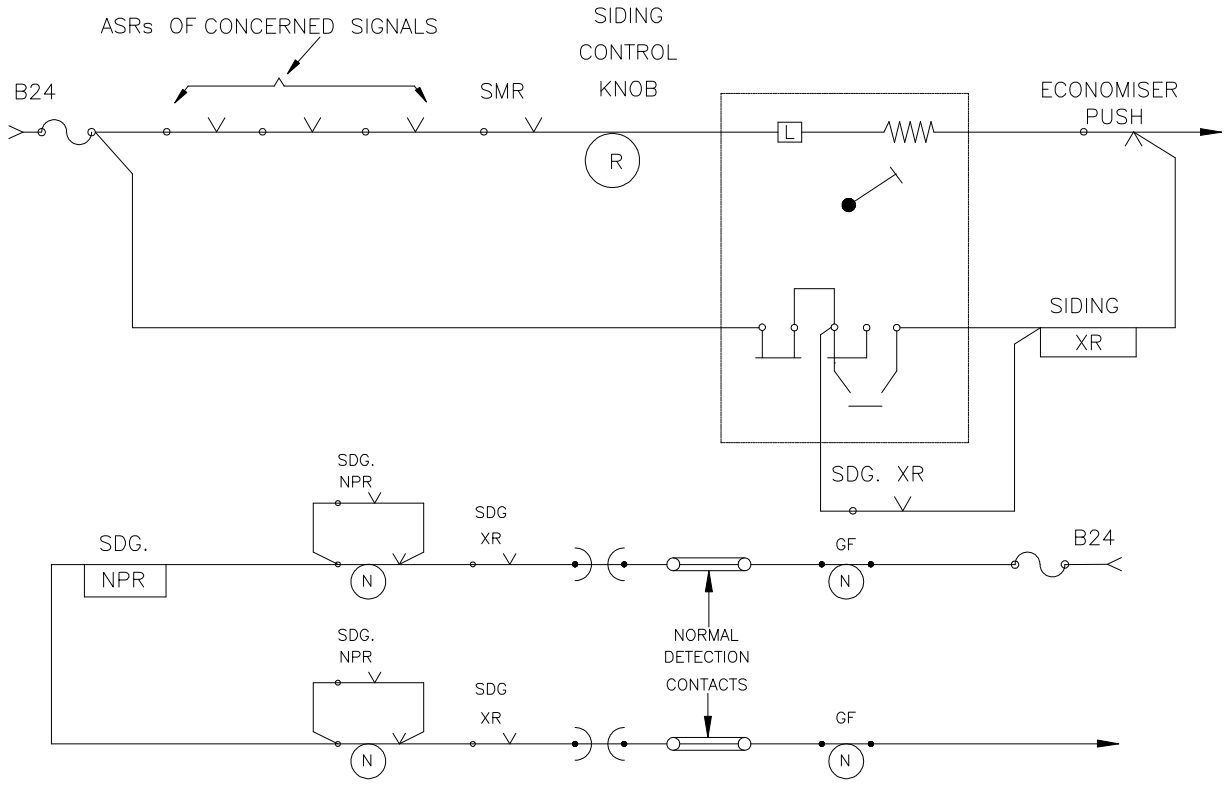
(a) The signals concerned are at ‘ON’ and the
(b) Respective siding control knob is reversed

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.

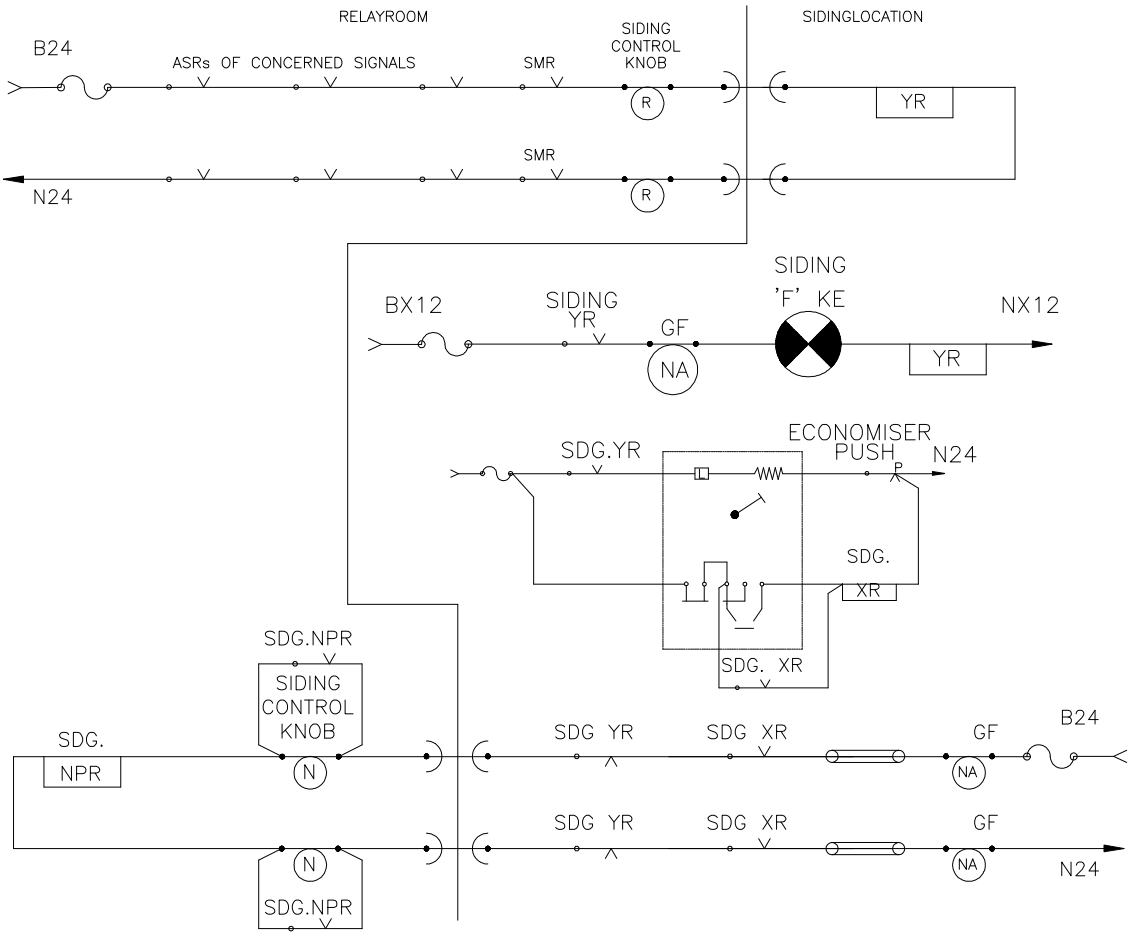
When the key is turned a relay "Siding NPR" picks up at the panel. The signals concerned can be taken off only when the siding NPR is energized.

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: 4.40



SIDING NPR CIRCUIT WITH ELECTRICAL TRANSMISSION OF SIDING CONTROL KEY.
Fig No: 4.41

4.7 INTERLOCKING OF LEVEL CROSSING GATE

4.7.1 Method – I

In this method, the level crossing annunciation relay (LCAR) is kept normally energized in the gate lodge when no route over the level crossing has been set. As soon as any route is set, the concerned ASR/TRSR/TLSR drops which in turn de-energizes LCAR. This causes the road signal on either side of the level crossing to display red aspect and the bells also start ringing. The Gate-man closes the gate and locks it, by taking out the key. The key is inserted in the 'E' type lock provided in the gate lever (GF) and turned for unlocking the lever. The lever is then reversed. Through the reverse contact of the gate lever, the LXPR relay picks up in the relay room, which in turn causes the HR of the concerned signal to pick up as the front contact of LXPR is proved in the circuits, thus permitting the signal to be taken OFF.

After the movement is completed, the route is released i.e. ASR/TRSR/TLSR/OVSR picks up. LCAR picks up in the lodge and give 'Free indication. The lever lock is energized permitting the gate lever to be normalized. The key is taken out from the lever and the gate is opened.

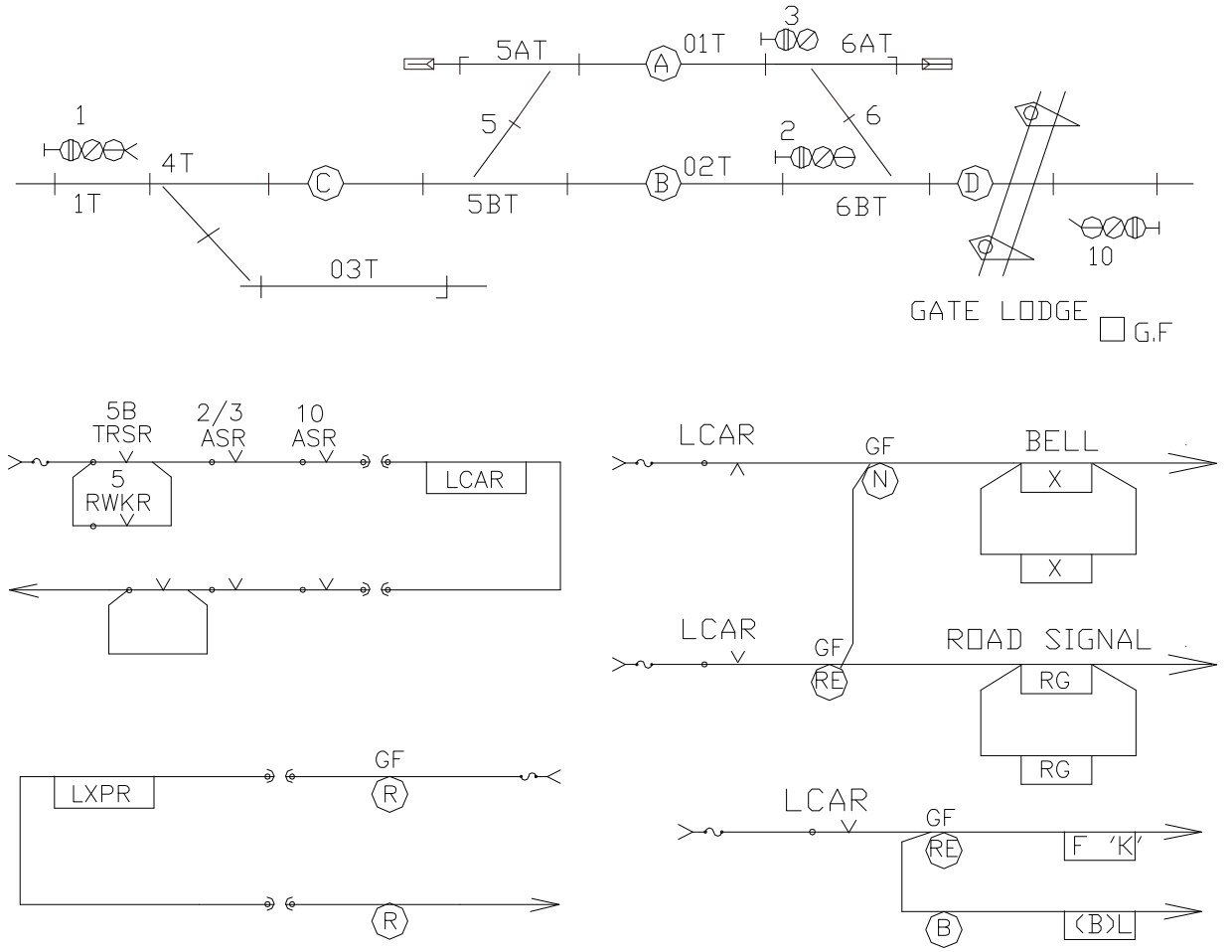


Fig No: 4.42

LC GATE'S INTERLOCKING IN SIGNALLING.

4.7.2 METHOD – II

In this method, the Gate-man is instructed on phone to close the gate whenever any movement over the gate is to take place. The Gate-man closes the gate and transmits the key through the EKT. The Station Master takes out the key from the EKT connected to the gate and inserts the key in the LC-EKT and turns. LXPR relay picks up and sticks provided the gate knob is normal. Energisation of LXPR permits the HR to pickup and the signal is taken OFF.

After the movement is completed, the route is released. ASR/TRSR/TLSR picks up. The gate knob is reversed for releasing the key. Gate RR picks up. The key is extracted by pressing the push button and then transmitted through the other EKT. The Gate-man takes out the key from his EKT and opens the gate. LXPR relay is de-energized as the key is taken out and locks the concerned signals.

The above arrangement can be used for LCs, which are not busy. If road signals are to provided, Method I can be adopted.

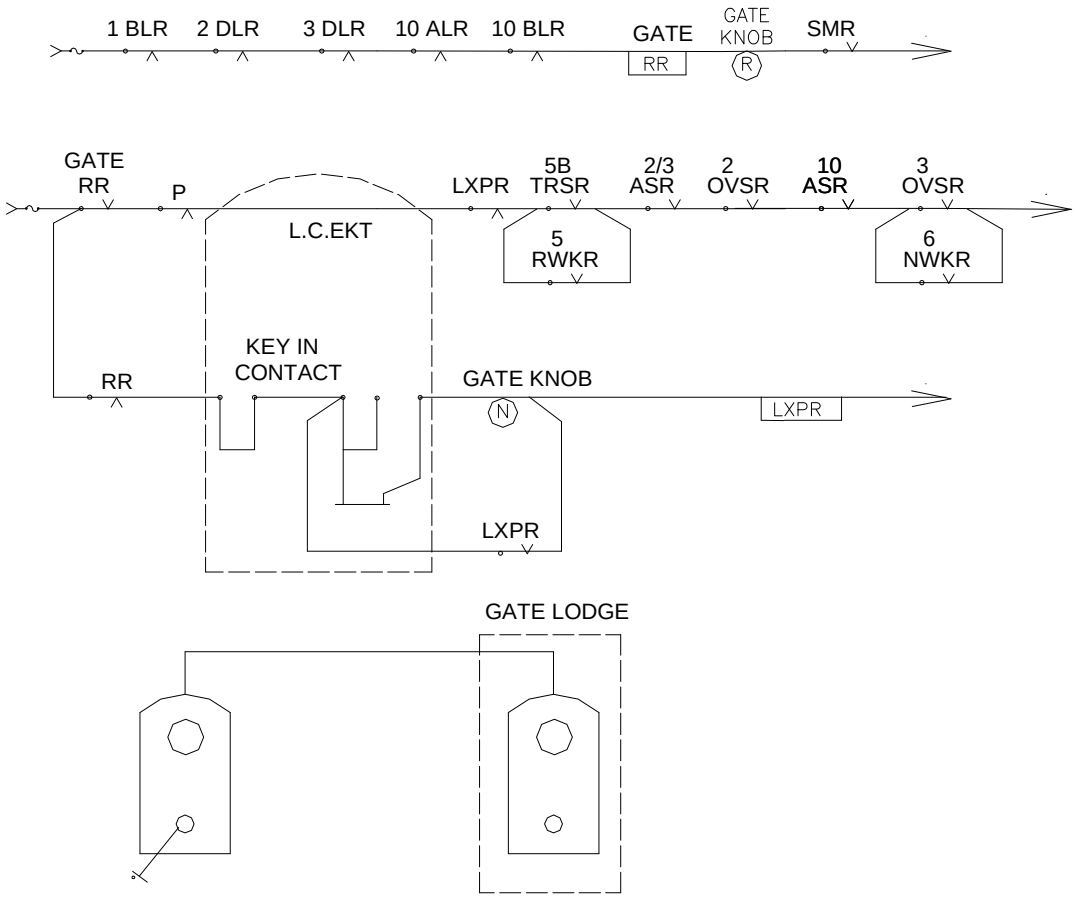


Fig No : 4.43

4.7.3 LC Gate interlocking (Ref. Fig No 3.3.1)

(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. 4.44)

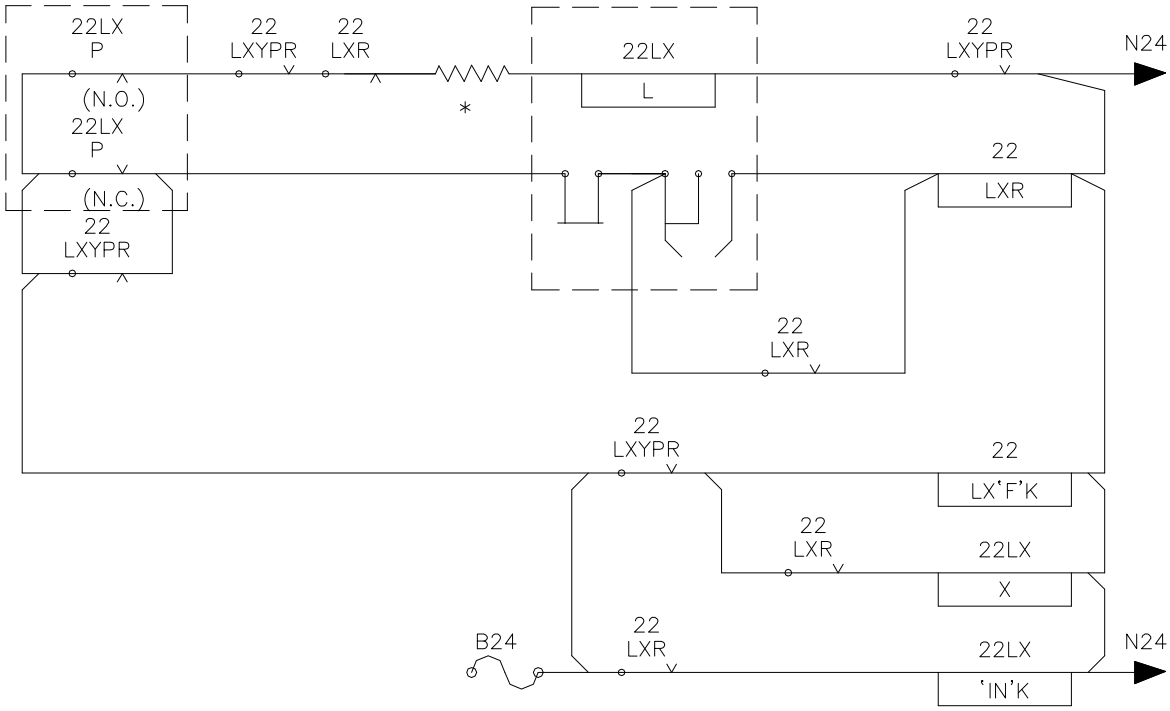


Fig. No.4.44

Energisation of LXR relay at gate lodge energizes LXCR at relay room. (refer Fig No.4.45)

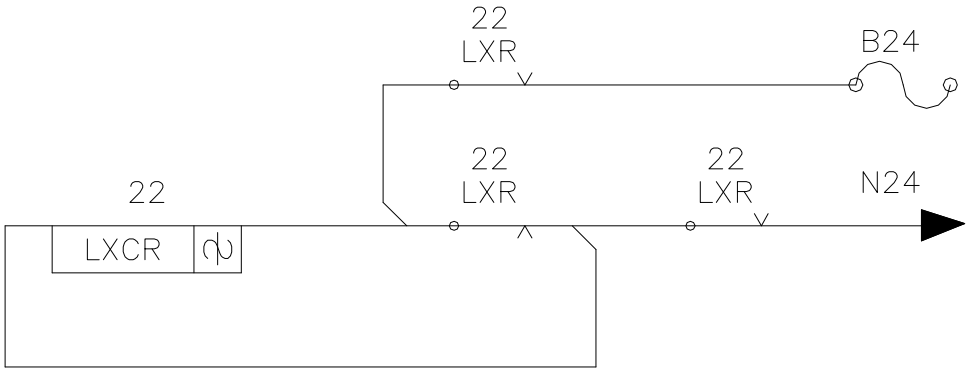


Fig. No.4.45

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.

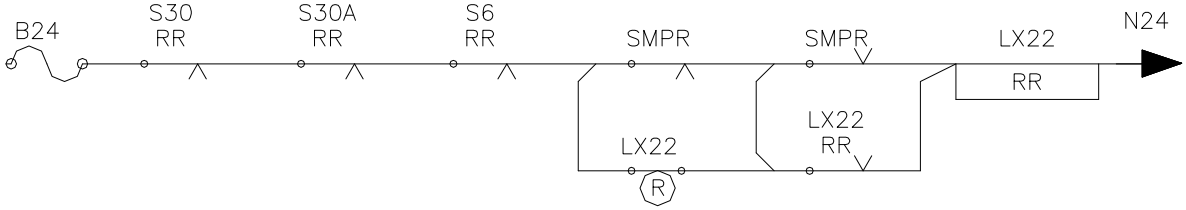


Fig. No.4.46

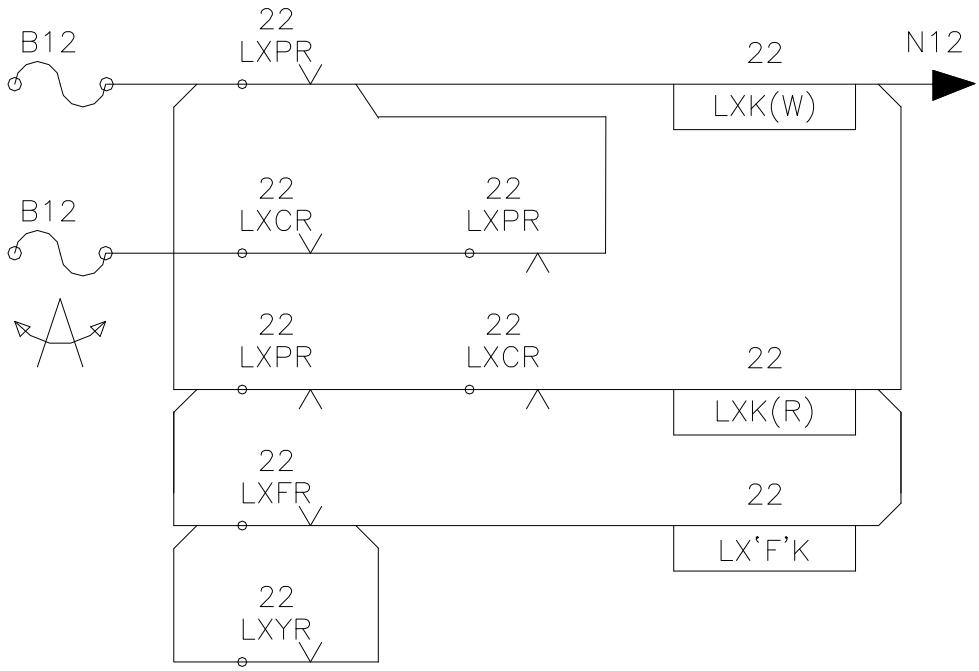


Fig. No.4.47

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.

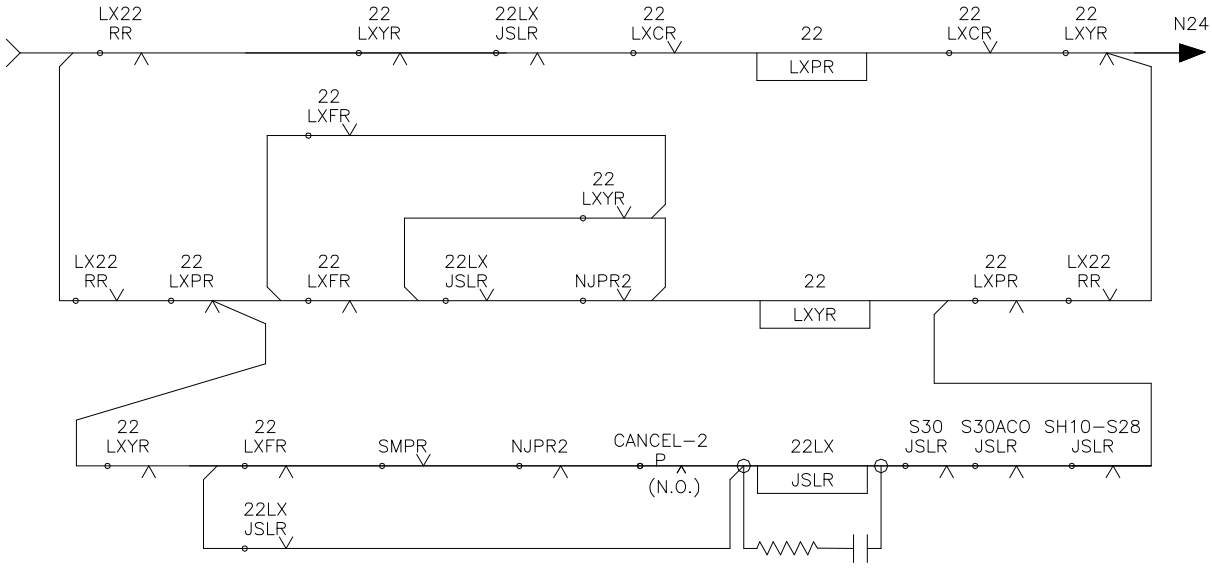


Fig. No.4.48

The energisation LXPR disconnections 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, 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.

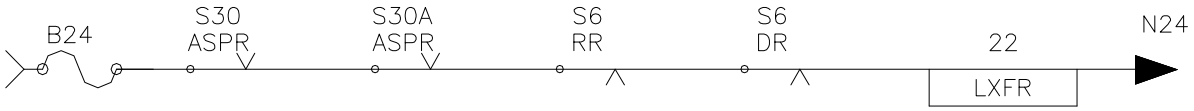


Fig. No.4.49

At this moment if SM inadvertently turns knob 22 to reverse, still LX-22RR does not pickup. 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 on normalization of knob (S30) and 22LXFR picks up. Now SM turns knob 22 to reverse, picks up LX22 RR. Thereby LXPR drops. As LX22RR in pick up, 22LXPR in drop and LXFR in pick up, energizes 22 LXYR, which in turn picks up 22LXYPR at gate lodge.

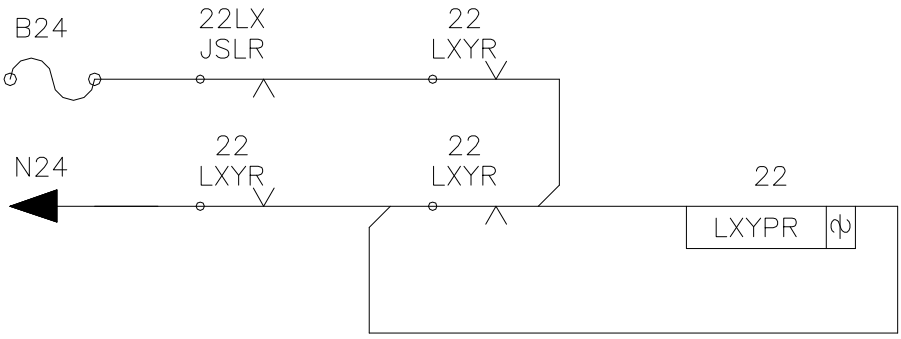


Fig. No.4.50

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. On complete arrival of train , SM normalizes the signal knob. Therefore, when SM turns LC gate controlling knob 22 to reverse 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.

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.

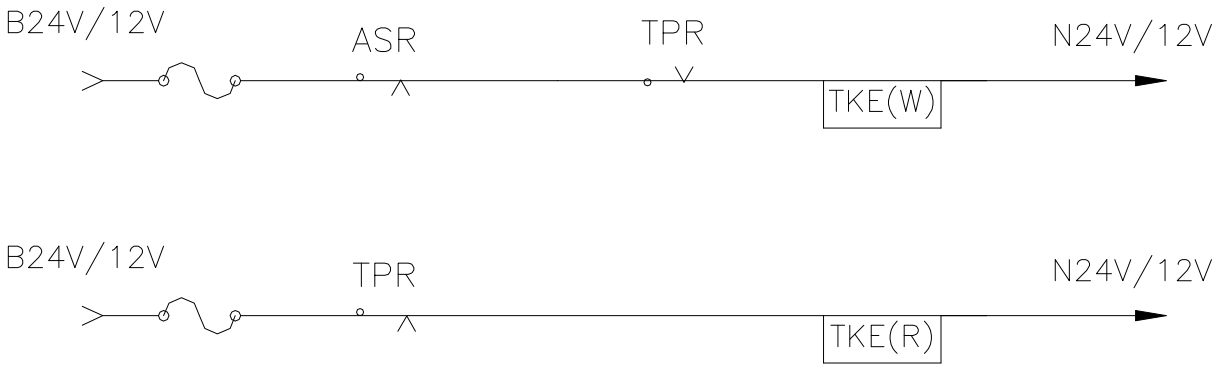


Fig. No : 4.51

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.

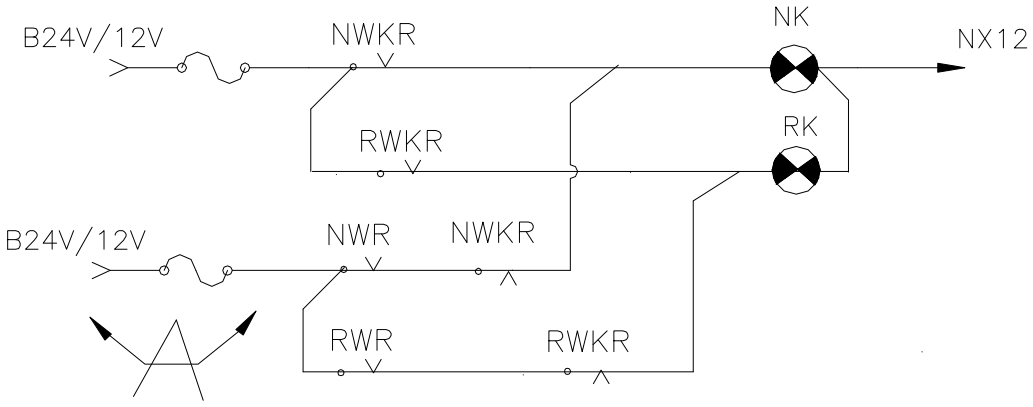


Fig. No.4.52

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.

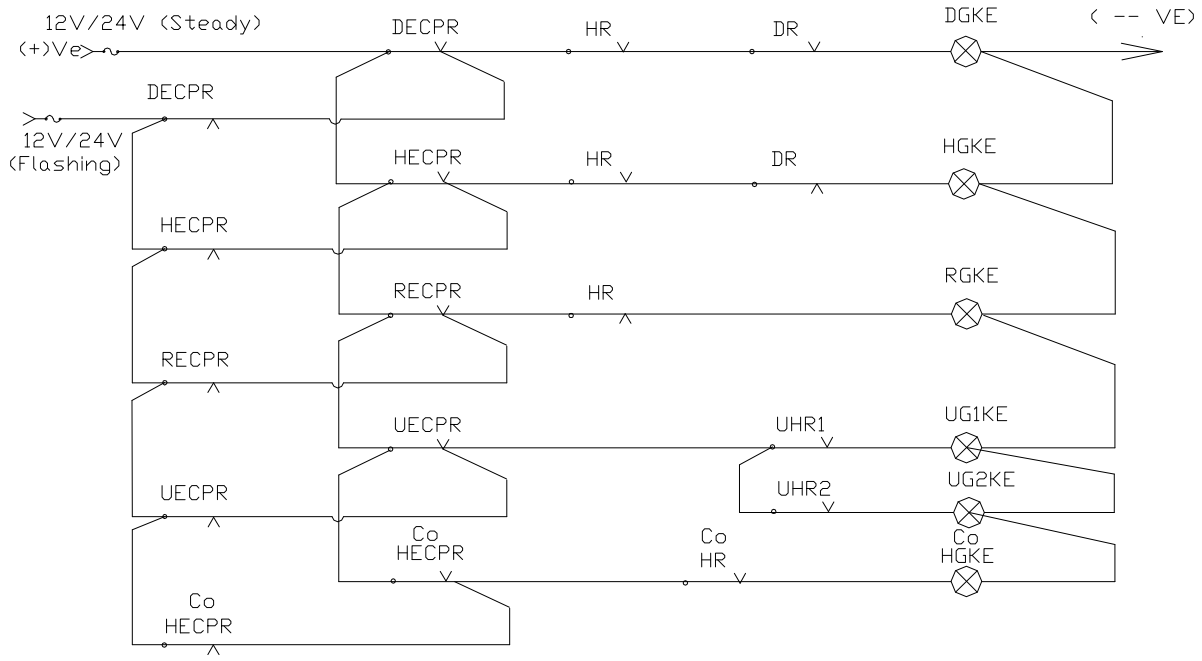


Fig No: 4.53

4.8.4 Panel Indication Circuits

When route is not set, no indication is given on the panel. When a signal is cleared and points are locked in a route, a row of white lights light up the whole length of the route.

These lights are given through the back contact of ASR and the relevant track circuit relay front contact. When the train occupies the track circuits the lights turn to Red through the TR back contact.

The point indications are given through point indication relay front contacts and signal indication through lamp proving relay, front contacts.

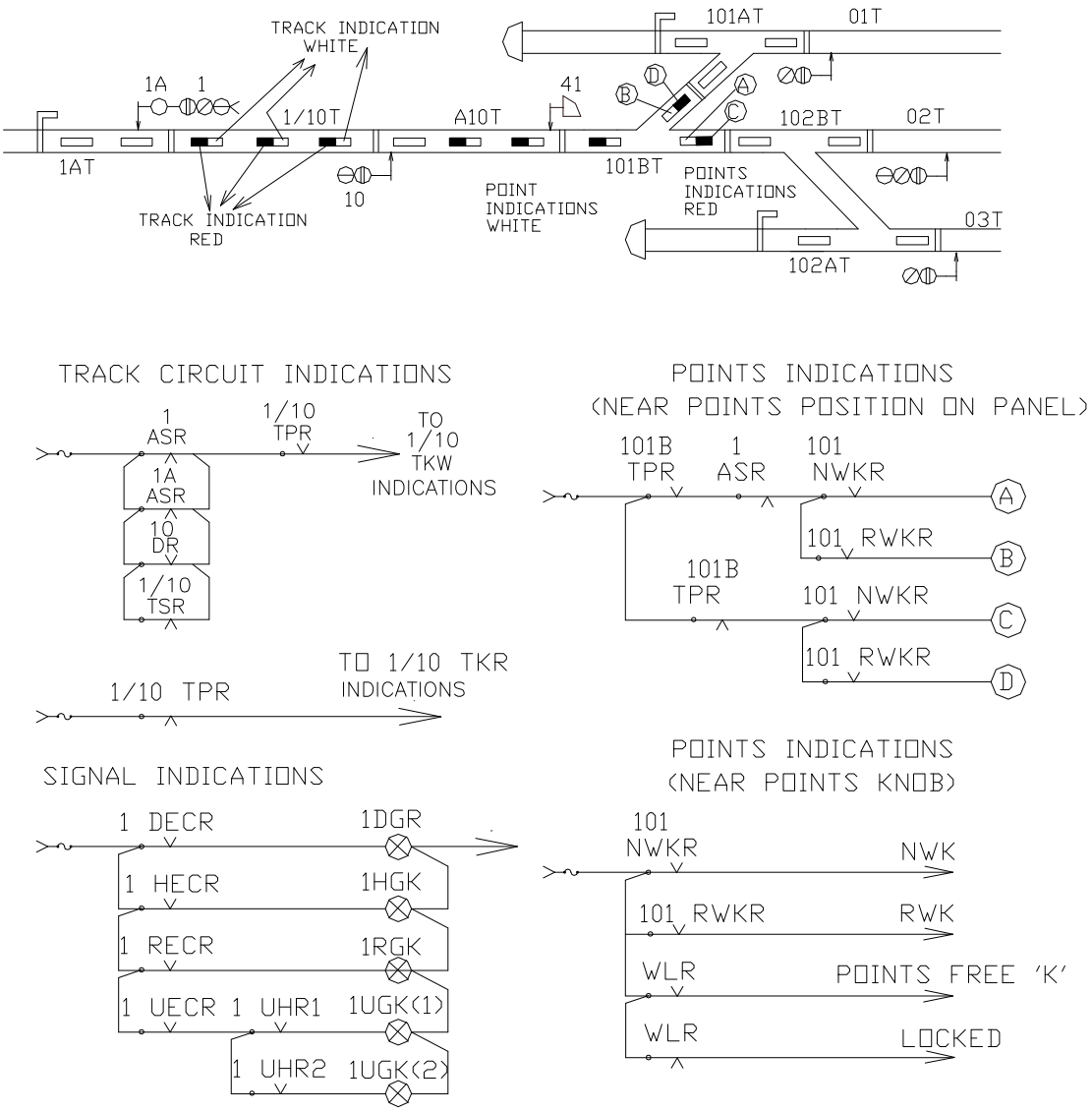


Fig No: 4.54

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. But if 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.

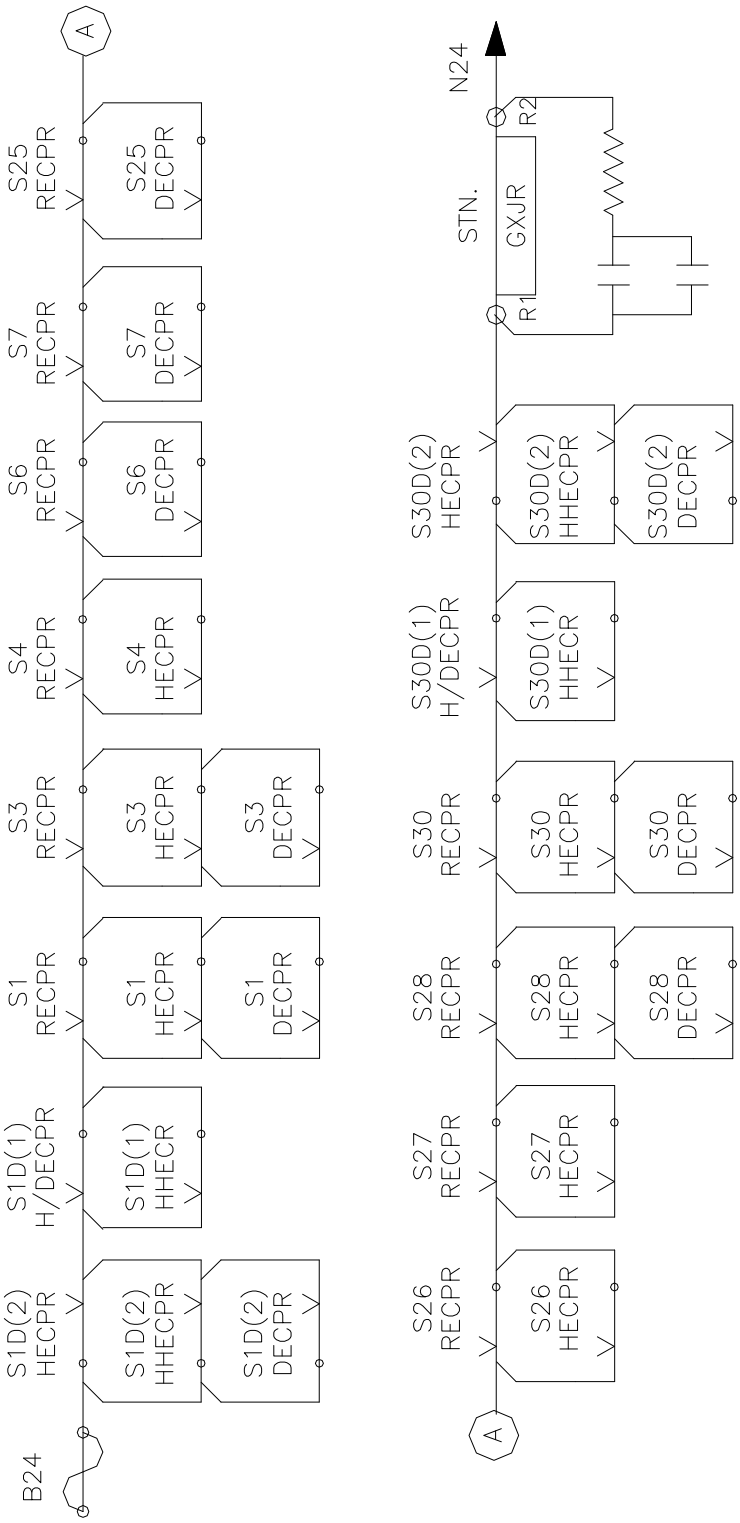


Fig No : 4.55

4.10 Power supply arrangement for indication Circuits

12V/24V DC or AC can be used for indications supply. 12V, 1.2W pencil type lamps or LEDs are used. The DC is preferred to AC because of its stability and consequent increase in life of lamps. The power supply failure does not affect indication if DC is used. If AC supply is used, it is desirable to make it stabilised and uninterrupted.

Recently LEDs are used to give indication to avail the benefits of long life and very less power drain. At 12V, 1.2W rated bulb consumes 100mA whereas LED drain will be around 2 to 5 mA only.

4.11 VOLTAGE DETECTING CIRCUIT

As all relays in the cabin, track relays etc., are fed by DC voltages derived by transforming and rectifying AC supply, any fluctuation in the AC voltage will result in the random dropping away or picking up of relays.

Suppose a route has been set and signal cleared and at that time a very quick momentary voltage fluctuation occurs; Track relay used in TSSLR & TSR relays may drop and pick up. Now if the signal knob is restored to normal the route may get released instantaneously without any time delay. To eliminate such a contingency the front contact of Relay in voltage protecting circuit is used in the ASR; TSSLR and time element circuit.

The circuit diagram for the voltage detecting circuit is given below:

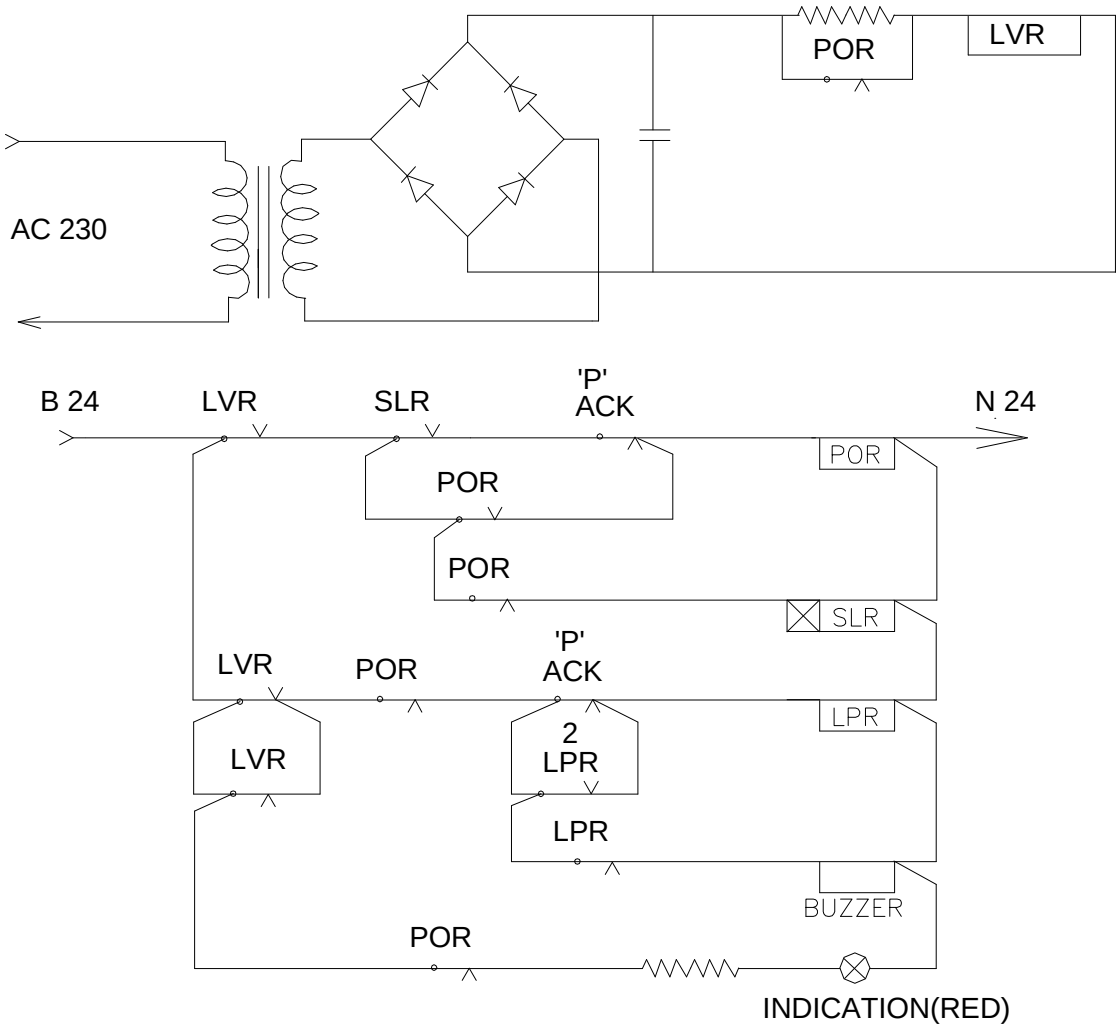


Fig No: 4.56

Normally relays LVR and POR are kept energised. LVR is directly connected across the supply. A resistance connected in series brings down the holding current of relay LVR to a value closer to its drop away value to make it more sensitive to voltage fluctuations. POR relay normally remains picked up through LVR front contact.

When AC voltage goes below a certain pre-determined value, LVR drops and consequently relay POR drops. Bell circuit is completed through LVR (B) – POR (B) – LPR (B). This circuit is connected to battery so that the bell rings even when supply fails. SM presses power acknowledgement button 'P' ack., LPR relay picks up and sticks. Bell is stopped.

When voltage comes back to normal, LVR picks up. (Shunting of series resistance by POR back contact permits LVR to operate). SLR slowly picks up through back contact of POR proving that the power supply is stable. Meanwhile operation of LVR disturbs the LPR stick circuit and LPR drops, connecting the bell in circuit. SM acknowledges the restoration of power by pressing 'P-Ack' button .LPR relay picks up and holds through LVR front and POR relay back contacts, cutting off the bell once again. Simultaneously POR relay picks up through SLR front contact and sticks. The back contact of POR relay cuts off SLR, LPR & bell circuits. Circuit is now normal with POR and LVR in energised condition.

4.12 Route Setting type interlocking panel / Route relay interlocking (RRI)

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

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.

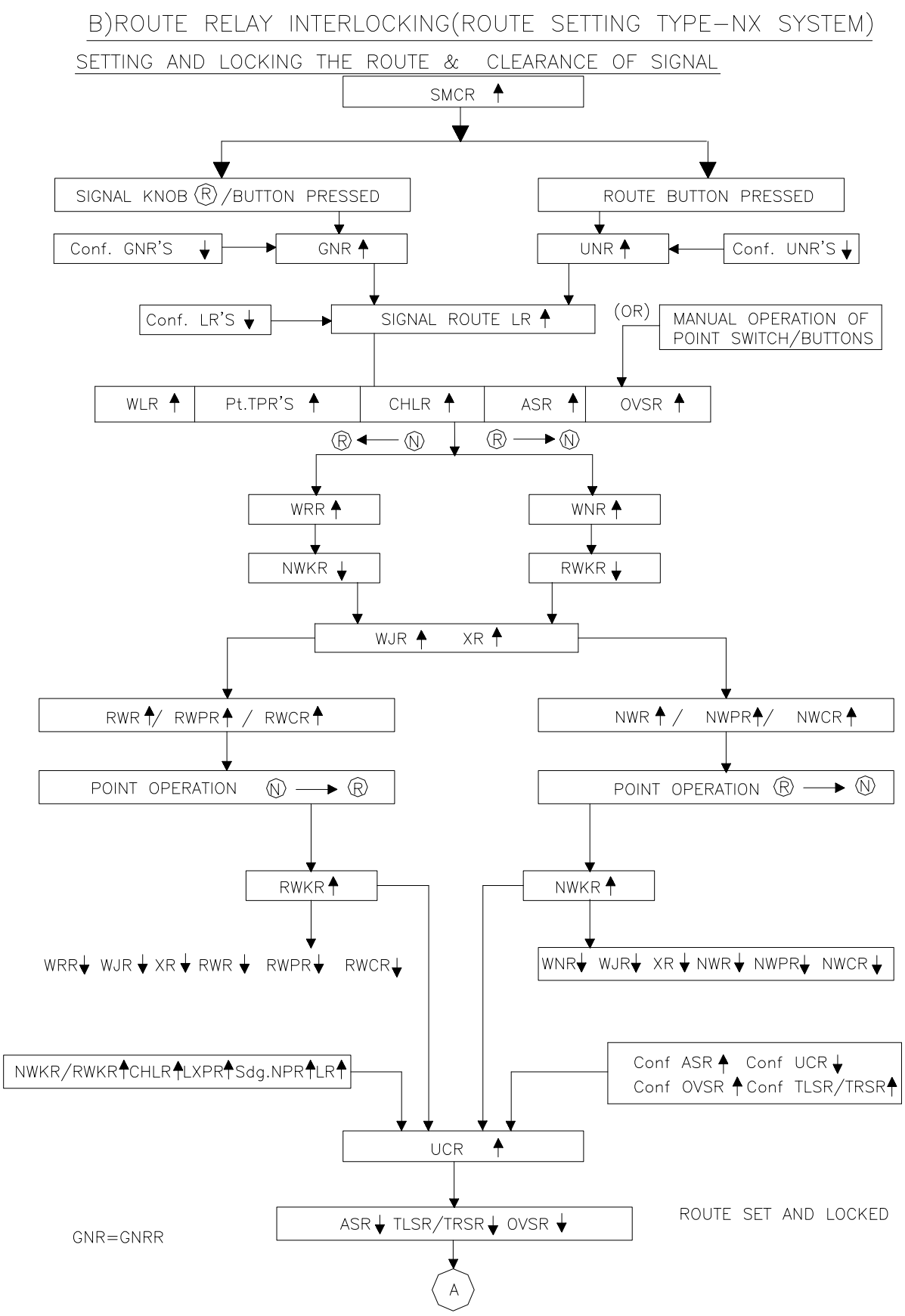

B)ROUTE RELAY INTERLOCKING(ROUTE SETTING TYPE–NX SYSTEM)
SETTING AND LOCKING THE ROUTE & CLEARANCE OF SIGNAL
SMCR
SIGNAL KNOB (R) /BUTTON PRESSED
ROUTE BUTTON PRESSED
Conf. GNR'S
GNR
UNR
Conf. UNR'S
Conf. LR'S
SIGNAL ROUTE LR
(OR)
MANUAL OPERATION OF POINT SWITCH/BUTTONS
WLR
Pt.TPR'S
CHLR
ASR
OVSR
(R) (N) (R) (N)
WRR
WNR
NWKR
RWKR
WJR XR
RWR / RWPR / RWCR
NWR / NWPR / NWCR
POINT OPERATION (N) (R)
POINT OPERATION (R) (N)
RWKR
NWKR
WRR WJR XR RWR RWPR RWCR
WNR WJR XR NWR NWPR NWCR
NWKR/RWKR CHLR LXPR Sdg.NPR LR
Conf ASR Conf UCR
Conf OVSR Conf TLSR/TRSR
UCR
ASR TLSR/TRSR OVSR
ROUTE SET AND LOCKED
GNR=GNRR
A

Fig No.4.57

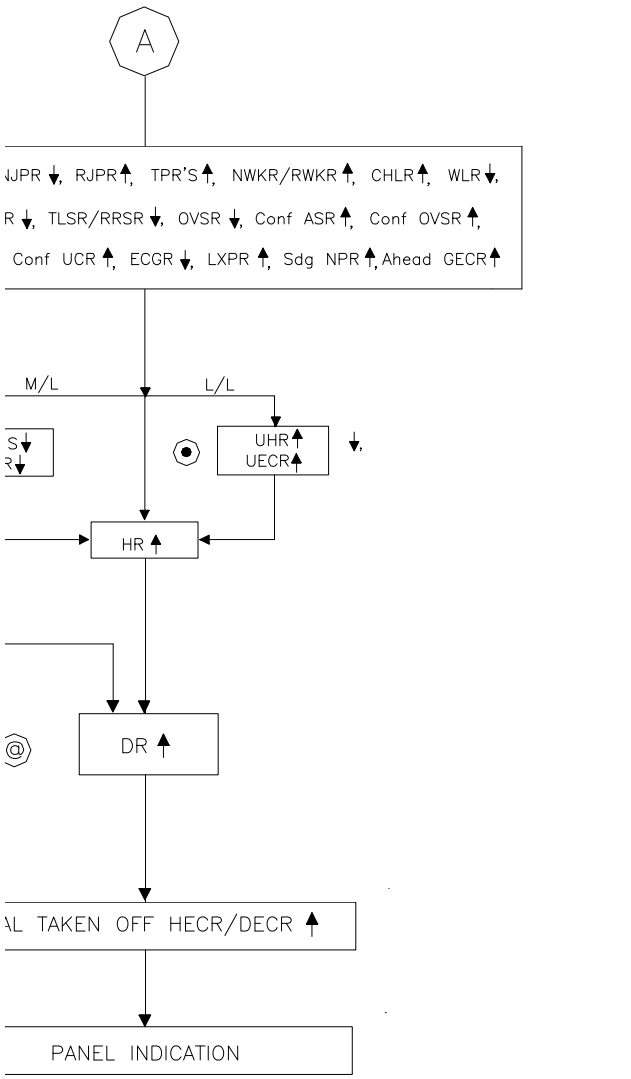


Fig. No.4.58

4.13 Sectional Route Release Circuits (TLSR/TRSR)

The Backed 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 effect of that route thereby those points cleared by the train can be utilized for other movements thereby increasing the flexibility of the yard.

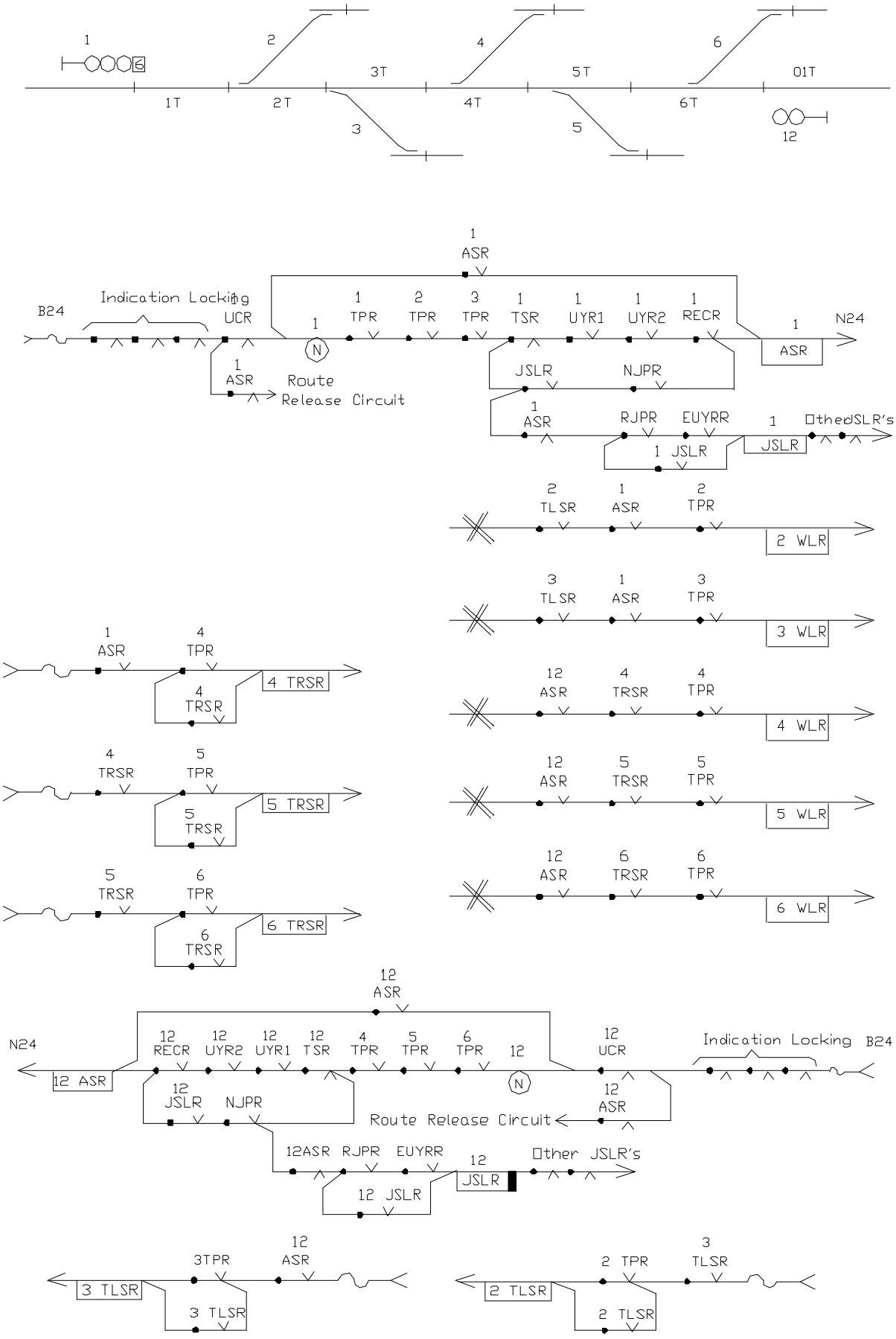
The first route section is directly controlled by the concerned ASR. The subsequent route sections are controlled by the TLSR/TRSR's. For leftward movement i.e. from RIGHT to LEFT, TLSR and for rightward movement i.e., from left to right, TRSR is used. Depending upon the direction of signal movement,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


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

Fig No: 4.59

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

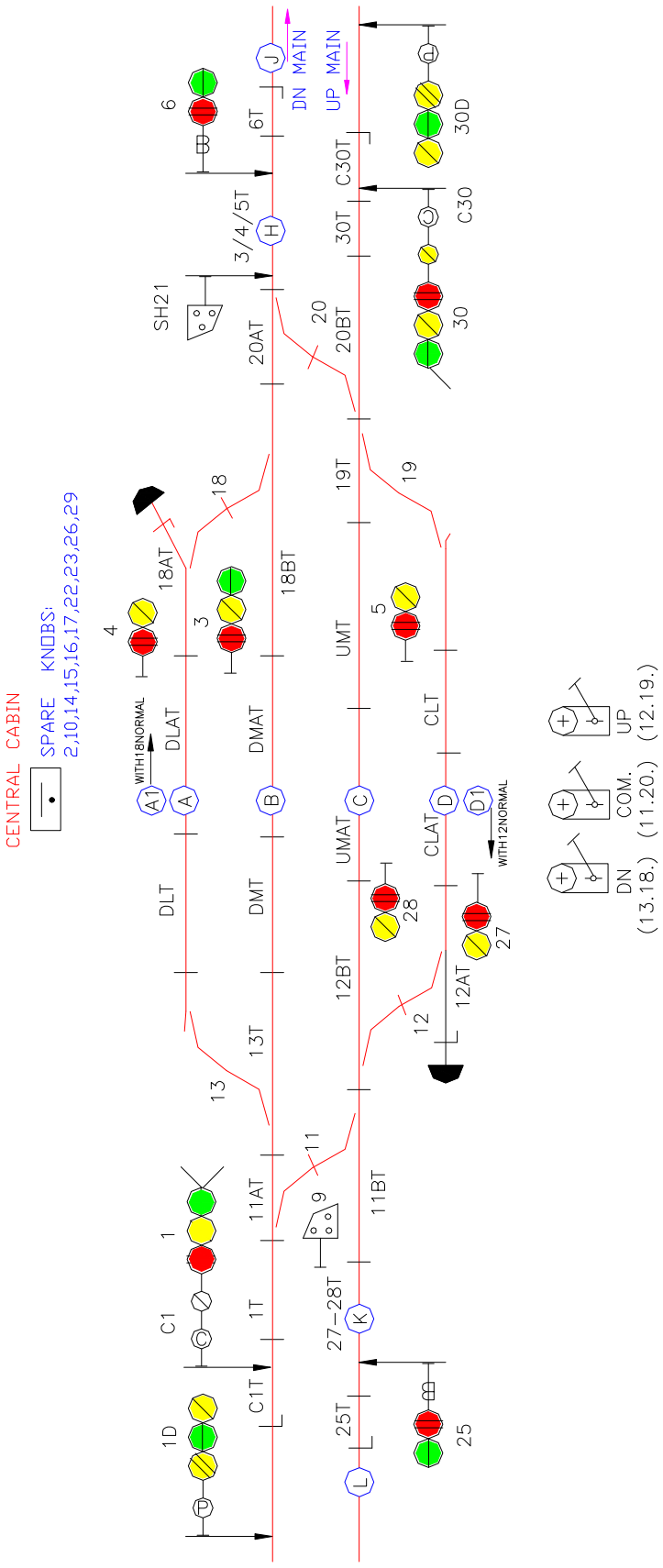


Fig No: 4.60

4.14.1 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.

4.14.2 LR CIRCUIT

When signal knob is reversed, the signal RR concerned picks up proving all conflicting route NRs in pickup

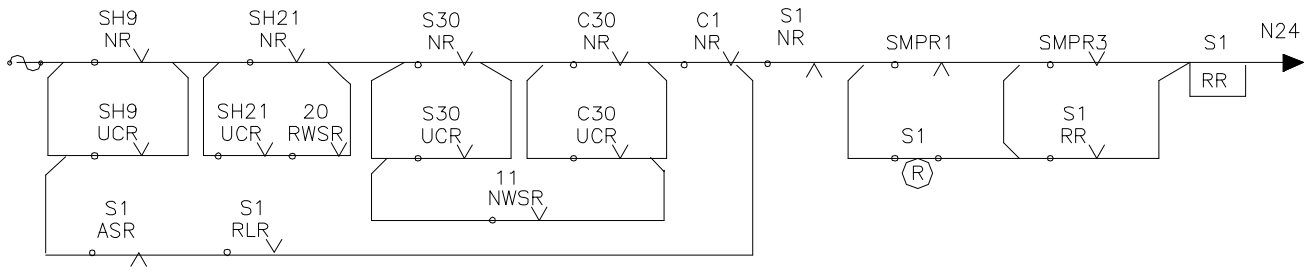


Fig No : 4.61(a)

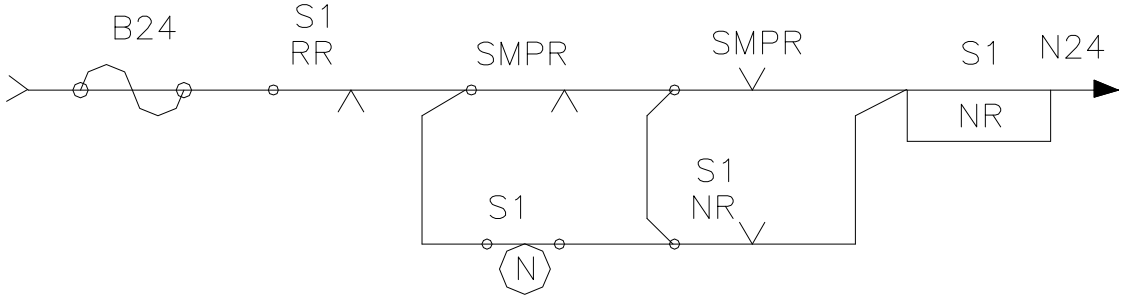


Fig No : 4.61(b)

When route button is pressed, the concerned route button relay ANR , BNR etc. picks up as per Fig No 4.62(a) or 4.62(b).

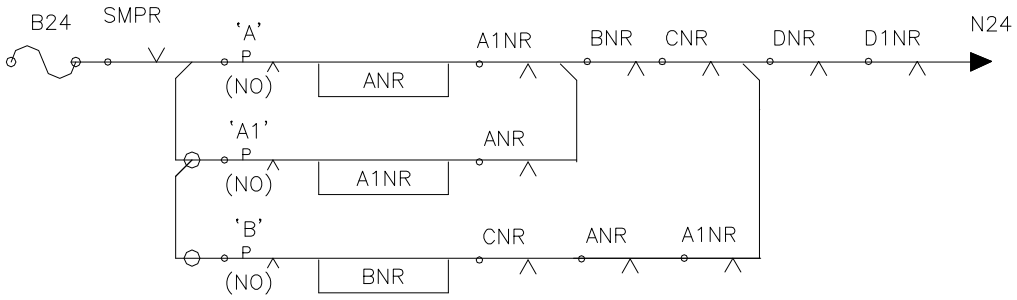


Fig No : 4.62 (a)

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 and conflicting ASRs in pick up.
Once LR pickup it sticks through its own front contact.

Some Railways are using the LR circuit shown in Fig No 4.63(a) and some are using the circuit shown in Fig No 4.63(b).

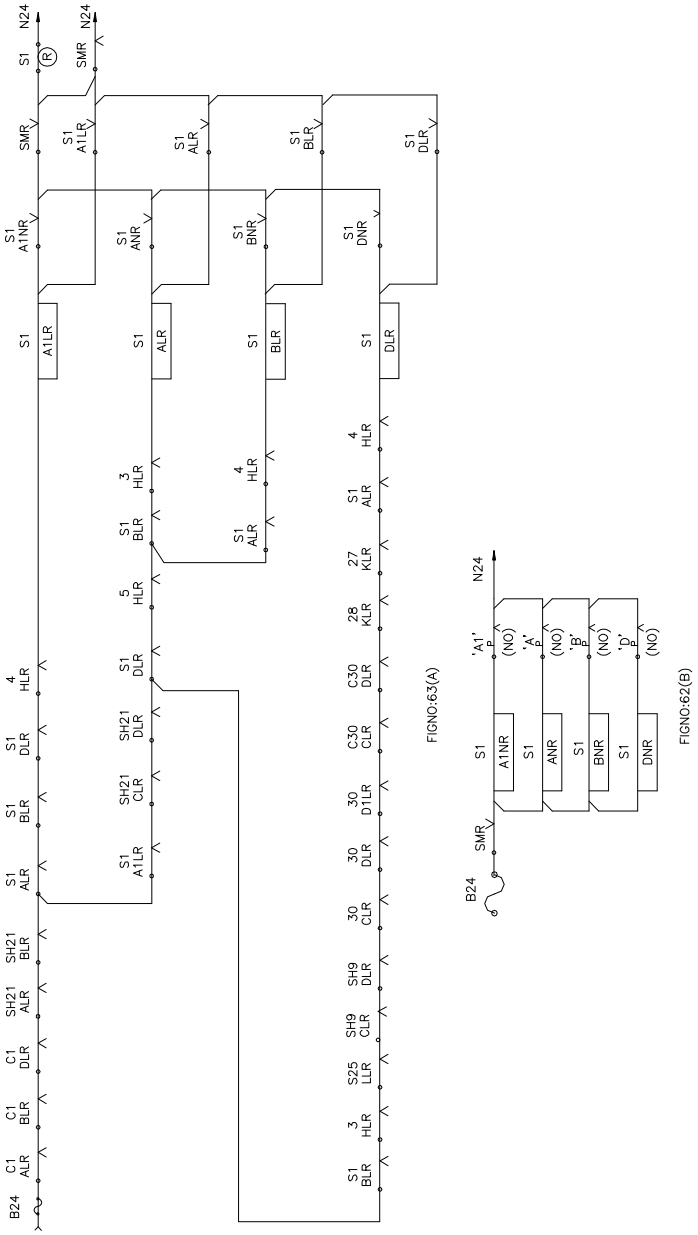


Fig No : 4.63 (a) & 4.62 (b)

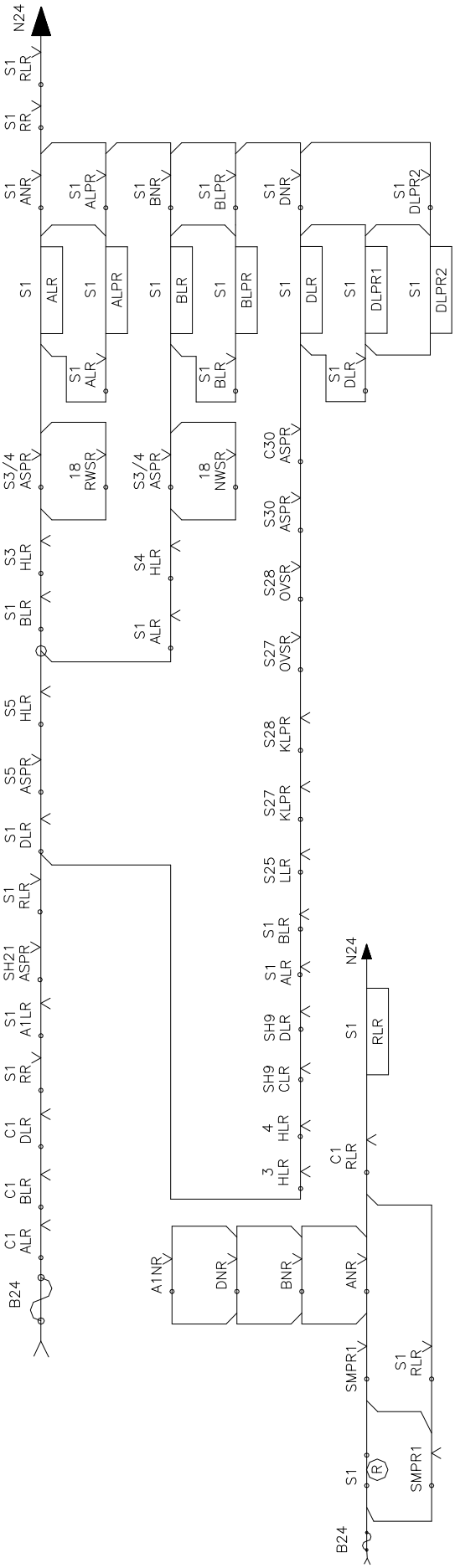

N24
S1 RLR
S1 RR
S1 ANR
S1 ALPR
S1 BNR
S1 BLPR
S1 DNR
S1 DLPR2
S1 ALR
S1 ALPR
S1 BLR
S1 BLPR
S1 DLR
S1 DLPR1
S1 DLPR2
S1 ALR
S1 BLR
S1 DLR
S3/4 ASPR
18 RWSR
S3/4 ASPR
18 NWSR
C30 ASPR
S30 ASPR
S3 HLR
S4 HLR
S28 OVSR
S1 BLR
S1 ALR
S27 OVSR
S5 HLR
S28 KLPR
S5 ASPR
S27 KLPR
S1 DLR
S25 LLR
S1 RLR
S1 BLR
SH21 ASPR
S1 ALR
S1 A1LR
SH9 DLR
S1 RR
SH9 CLR
C1 DLR
4 HLR
C1 BLR
3 HLR
C1 RLR
S1
RLR
N24
C1 ALR
B24
A1NR
DNR
BNR
ANR
SMPR1
S1 RLR
S1
R
SMPR1
B24

Fig No: 4.63 (b)

4.14.3 Operation of Points in RRI (Route Setting Type)

In RRI, the points are operated automatically to the required position. By turning the signal switch or by pressing the signal button and pressing the route button, concerned LR picks up and this LR operates the point automatically. 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, XR etc. will be same.

Fig No : 4.64

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

4.14.4 AUTOMATIC OPERATION OF POINTS CIRUIT

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 4.65 & Fig no 4.66 are to read in continuation.

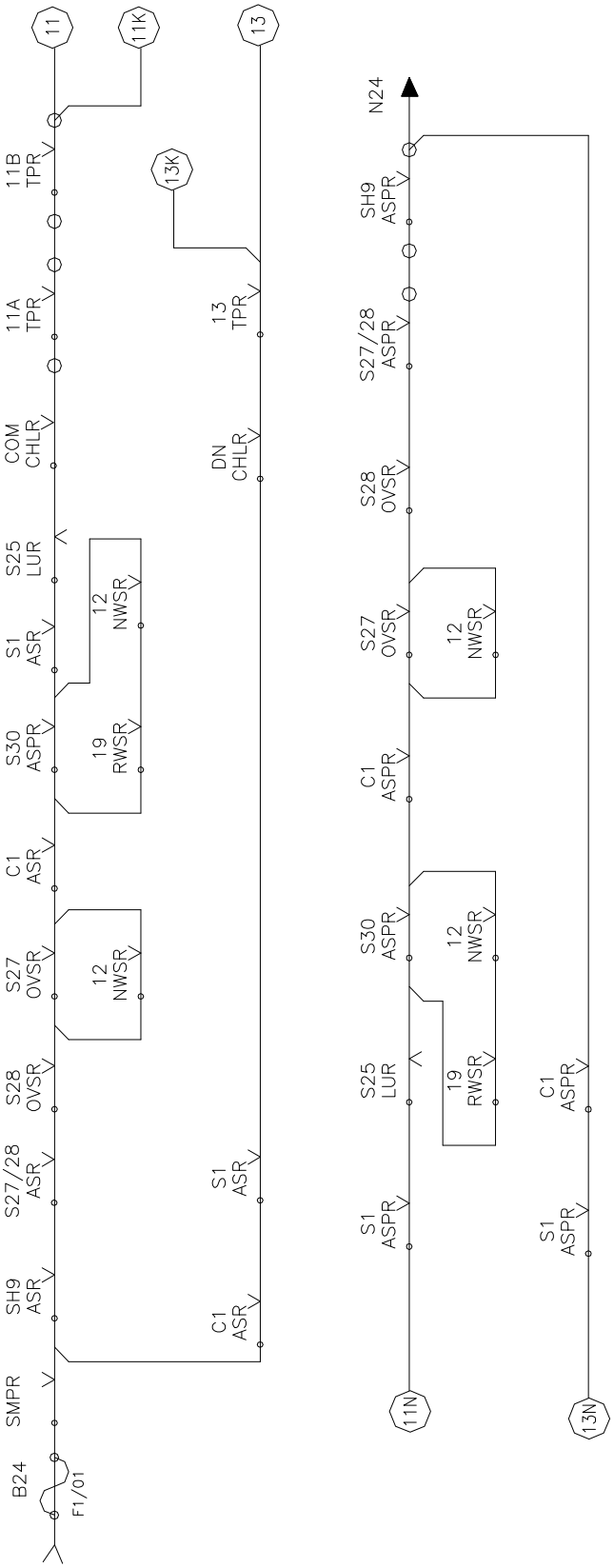


Fig No: 4.65

4.14.5 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.

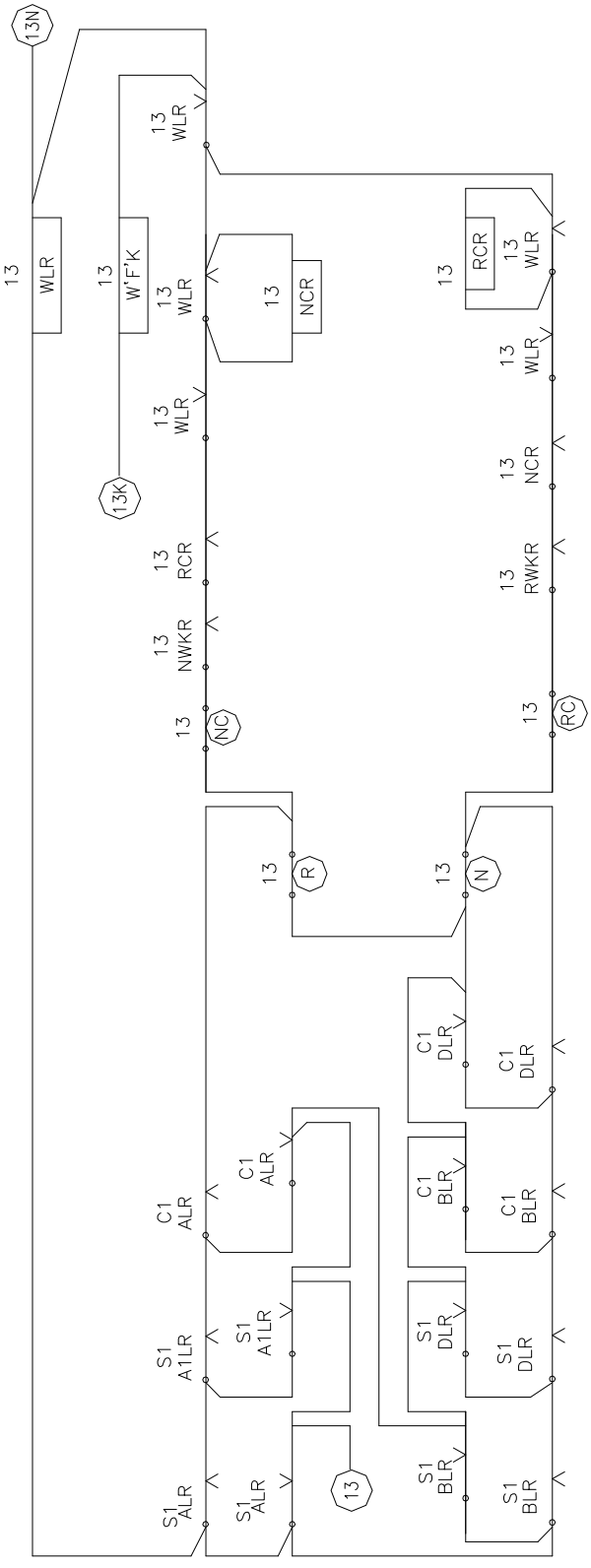


Fig No: 4.66

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.

4.15 Route setting type panel interlocking with all buttons for signals, points & routes

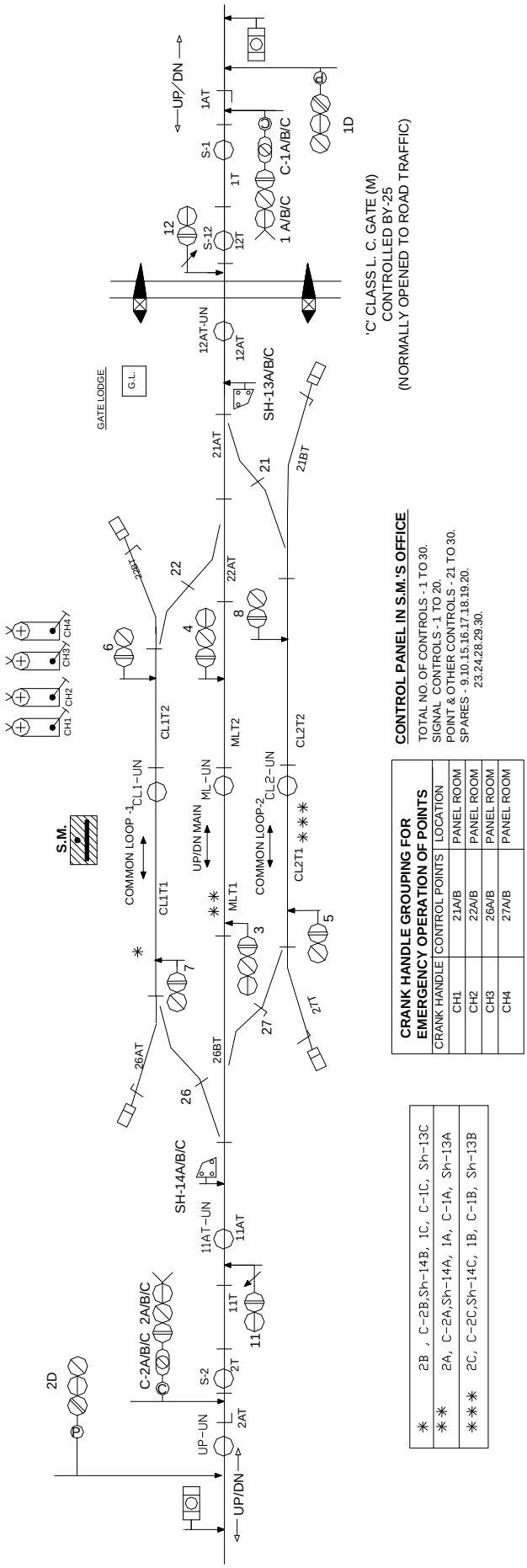
As explained earlier, the panels in PI & RRI's are provided with switches for signals, points and other functions. For RRI's route buttons are also provided for automatic setting of points. But in PI, the route is to be set by individually operating the point knobs to be the required position and then turn the signal switch to take off the signals. Similarly on arrival of a train, both in PI and RRI, the signal switch is to be normalised to release the route lock.

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 PI, 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 arrival of train, the locked route releases immediately after the train clears since, signal button is restored to normal automatically.

The buttons used are push buttons, self-restoring type as used in Siemens. The signal buttons (GN's) are provided near the concerned signal on the panel, (one button for each signal with distinct colours. For stop signal `Red' for calling `ON' signal Red with White dots for shunt signal `Yellow' button etc) and are numbered 1,2,3 etc.

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 etc or with the respective route number.

In addition, point buttons (WN) nearer or on the concerned point and common point group button WWN (NWN) & WWR (RWN) and Emergency point operation relay EWNR, Crank Handle Control Button CHN and common CH buttons CHYYN, CHYRN, Emergency signal cancellation button EGGN & Emergency route cancellation button EUYYN with counters, siding control key buttons etc are provided on the panel. All other general requirements of panel remain same and the colours of button remain as mentioned in previous paras.



CONTROL PANEL IN S.M.'S OFFICE

TOTAL NO. OF CONTROLS - 1 TO 30.
SIGNAL CONTROLS - 1 TO 20.
POINT & OTHER CONTROLS - 21 TO 30.
SPARES - 9.10.15.16.17.18.19.20.
23.24.28.29.30.

CRANK HANDLE GROUPING FOR EMERGENCY OPERATION OF POINTS

CRANK HANDLE	CONTROL POINTS	LOCATION
CH1	21A/B	PANEL ROOM
CH2	22A/B	PANEL ROOM
CH3	26A/B	PANEL ROOM
CH4	27A/B	PANEL ROOM

*	2B , C-2B,Sh-14B, 1C, C-1C, Sh-13C
**	2A, C-2A,Sh-14A, 1A, C-1A, Sh-13A
***	2C, C-2C,Sh-14C, 1B, C-1B, Sh-13B

Fig. No.4.67

4.15.1 Button Relays Circuits

(a) Signal button Relay Circuits

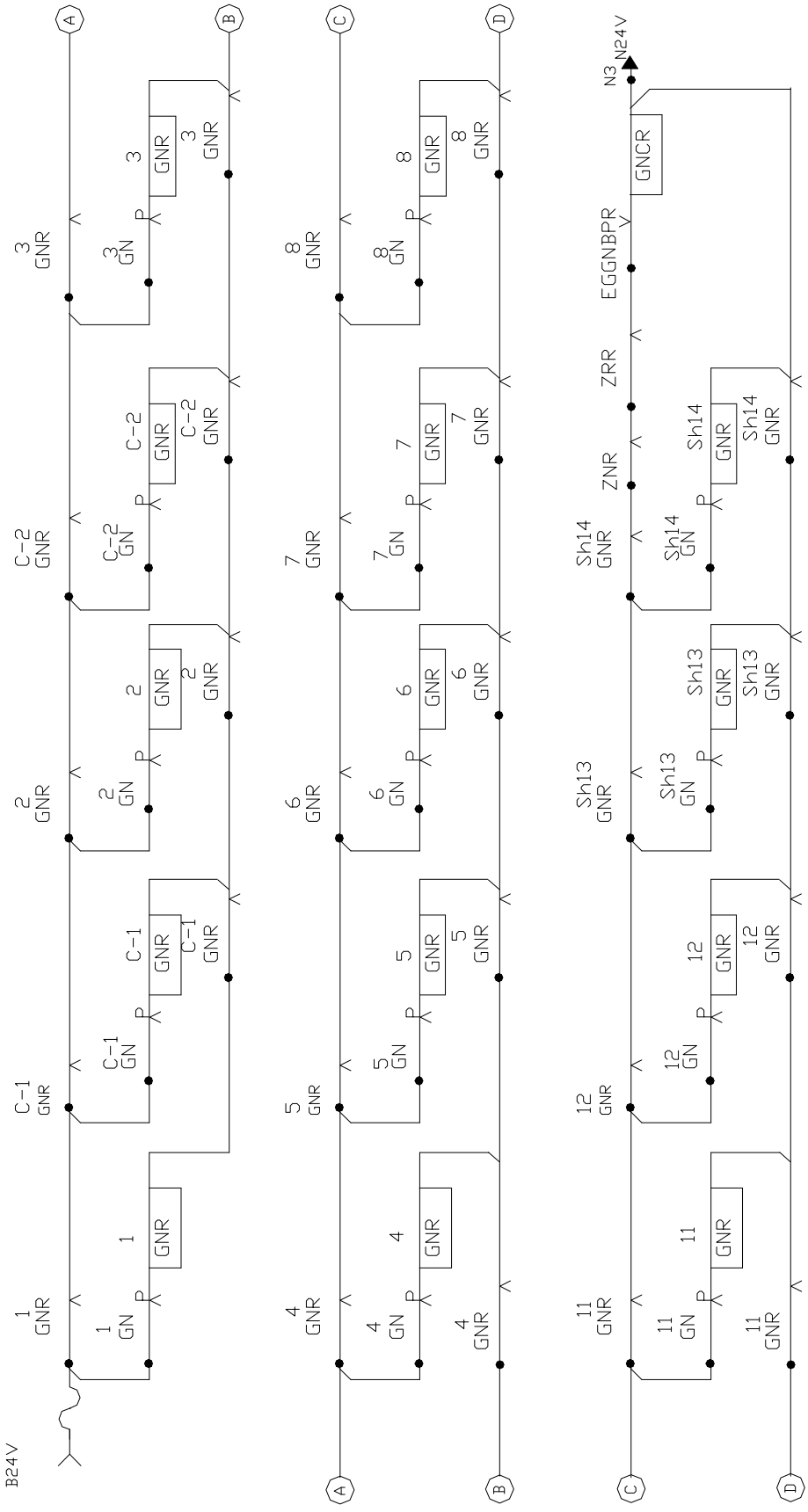


Fig. No.4.68

The circuit is self-explanatory. Any button pressed, the concerned signal button relay will pick up providing all other buttons relays are dropped and no button remain pressed. Relay GNCR is normally pick up, proving that all signal button relays are in de-energised condition and no button is in pickup condition. EGGNR is a emergency signal cancellation initiation relay which also picks up with out SMCR. The reason behind this is to allow the signal to be thrown back to danger in case required in emergencies even with or with out SMCR. With concerned signal GN pressed to pick up GNR along with EGGNR pick up to drop NRR and the signal will be replaced to `ON' immediately. (Reference Fig No 4.76 & 4.91)

(b) Route Button Relays circuits**:**

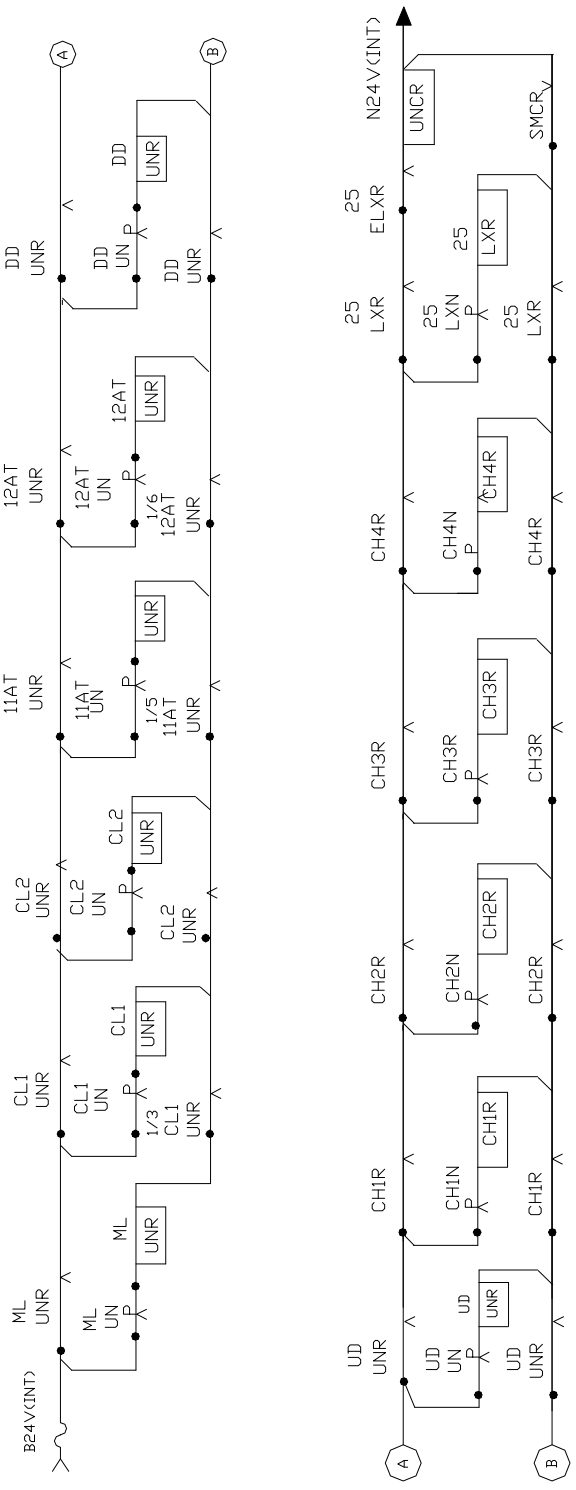


Fig. No.4.69

The relay UNCR is a normally energised relay proving that no route button is pressed and all the route button relays are in de-energized condition. Required route button is pressed to energize the route button relay. Only one route button is required to be pressed at one time. Relay EUUYNR is an emergency (Full) Route cancellation initiation button relay. After cancellation of signal by pressing concerned signal button with EGGN button, keeping signal button pressed, EUUYN button is pressed. The cancellation relay EUYRR will pick up and the route will be cancelled directly without time delay if conditions are favourable or timer circuit will be initiated which will cancel the route after a predetermined time of 60sec/120sec.

(c) Point Button Relay Circuits

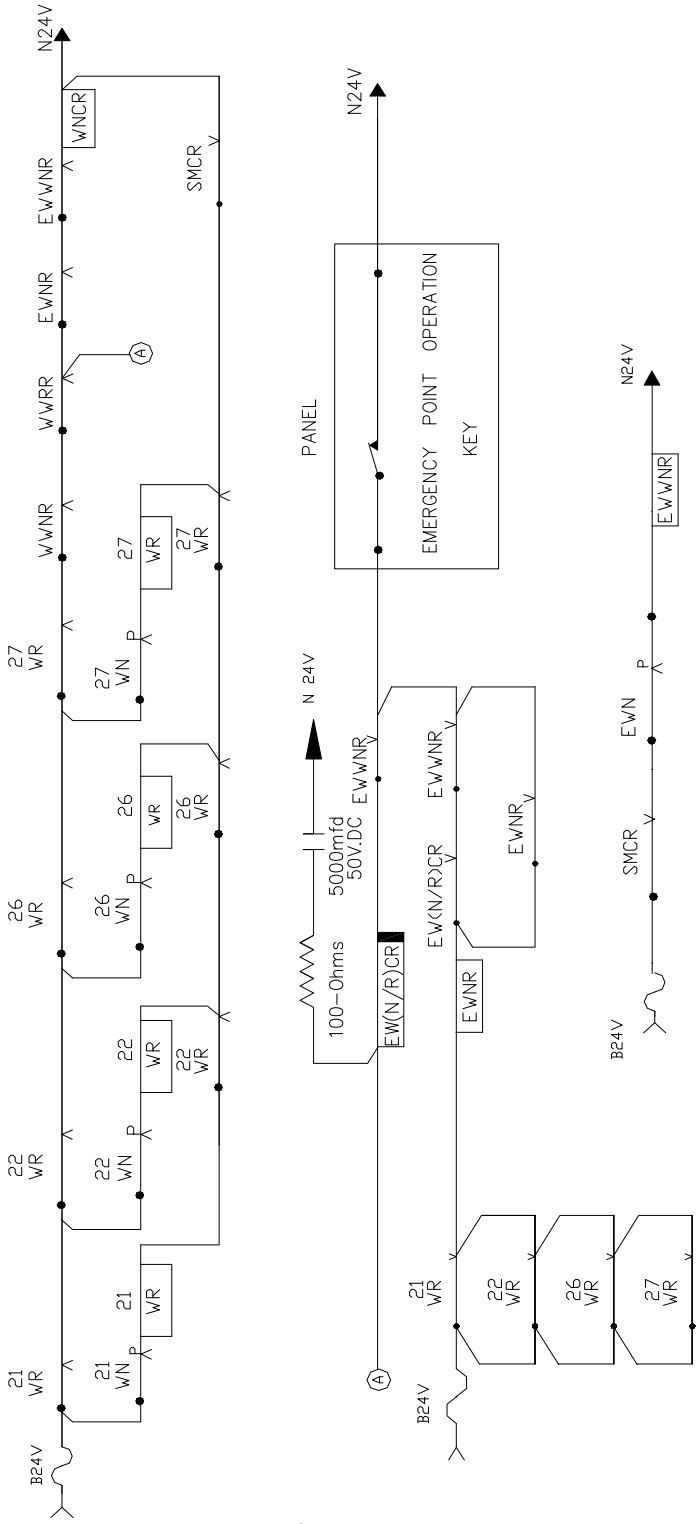


Fig. No.4.70

When the point button WN is pressed concerned WR will pick up proving all other point buttons are normal. WNCR is a normally energised relay proving that all point buttons are normal including common point operation Buttons for normal, reverse and emergency point operation buttons.

(d) Common Buttons Circuits, Route Cancellation, ETC

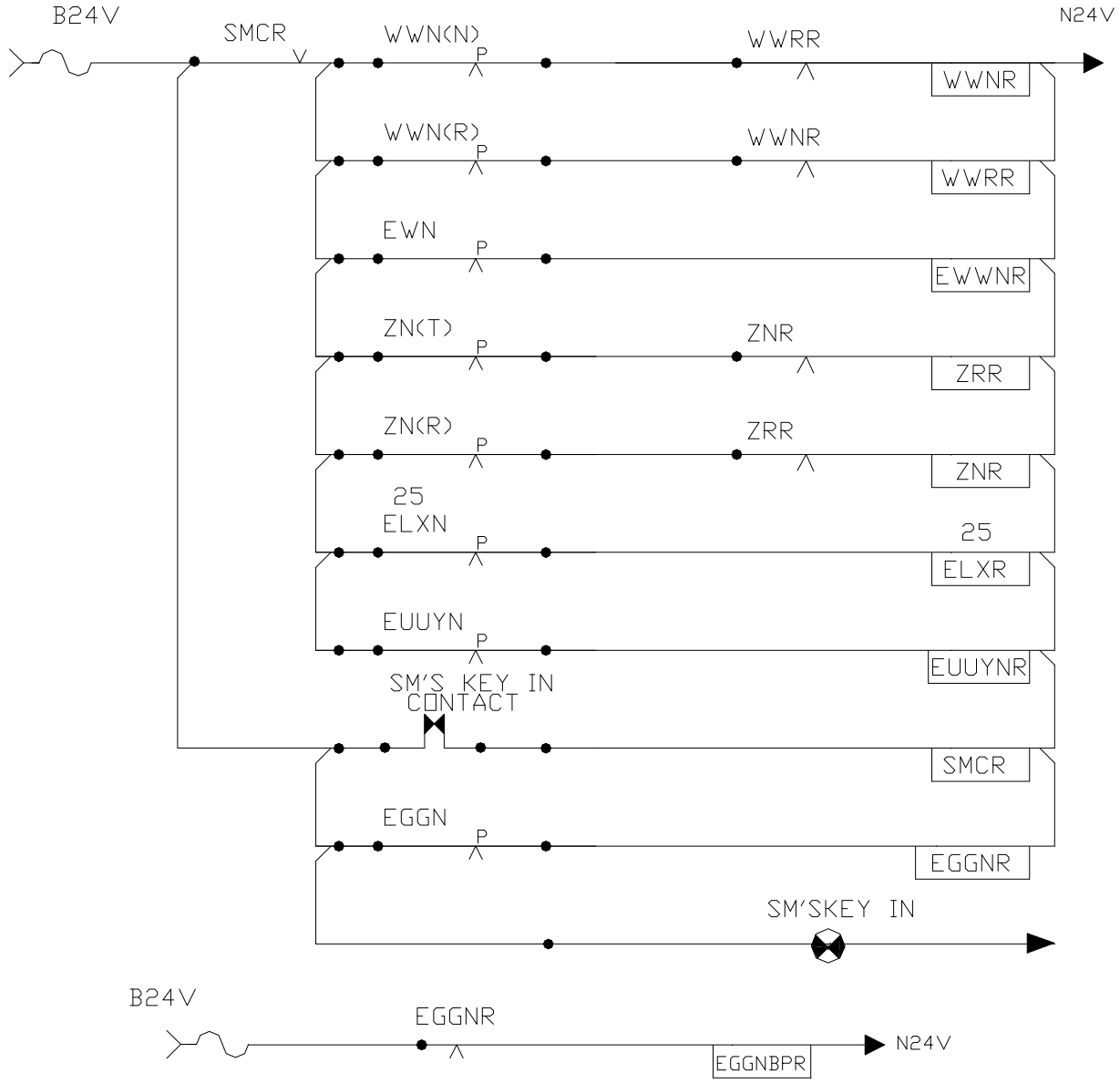


Fig. No.4.71

To operate the point, or to transmit/receive crank handle and/or sidings keys, with SMCR up the concerned common button pressed along with individual button of point/crank handle/siding, etc(T=Transmit; R=Receive)

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

(a) Button struck up relay cct.

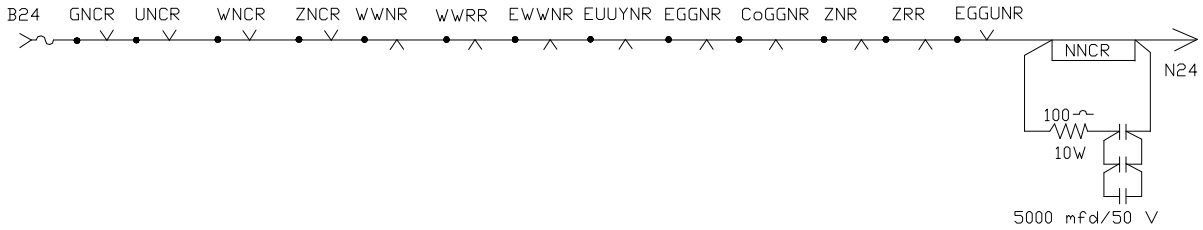


Fig No : 4.72

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. Normally it requires 2-3 seconds time for any functional relay to pick up. But if the button is pressed for more time or if stuck up, then after the predetermined time of approximately 10-15 seconds NNCR will drop and activates Buzzer cum indication circuit.

(b) Point Indication failure Relay

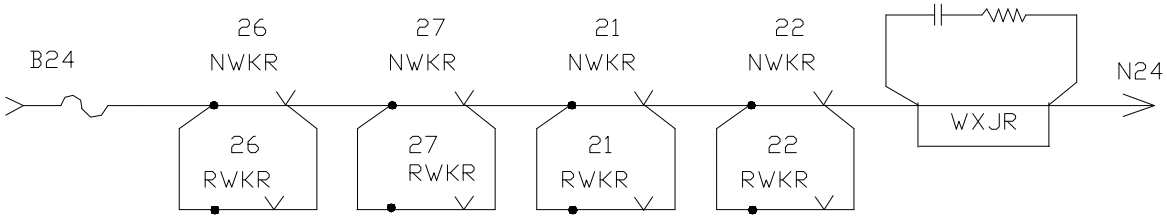


Fig No : 4.73

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. It may be noted that the holding period of WXJR is more than GXJR since it takes 1-2 seconds for aspect to change, but it takes nearly 5 -10 seconds for point to unlock, operate & lock before the point indication relay NWKR/RWKR is energized.

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

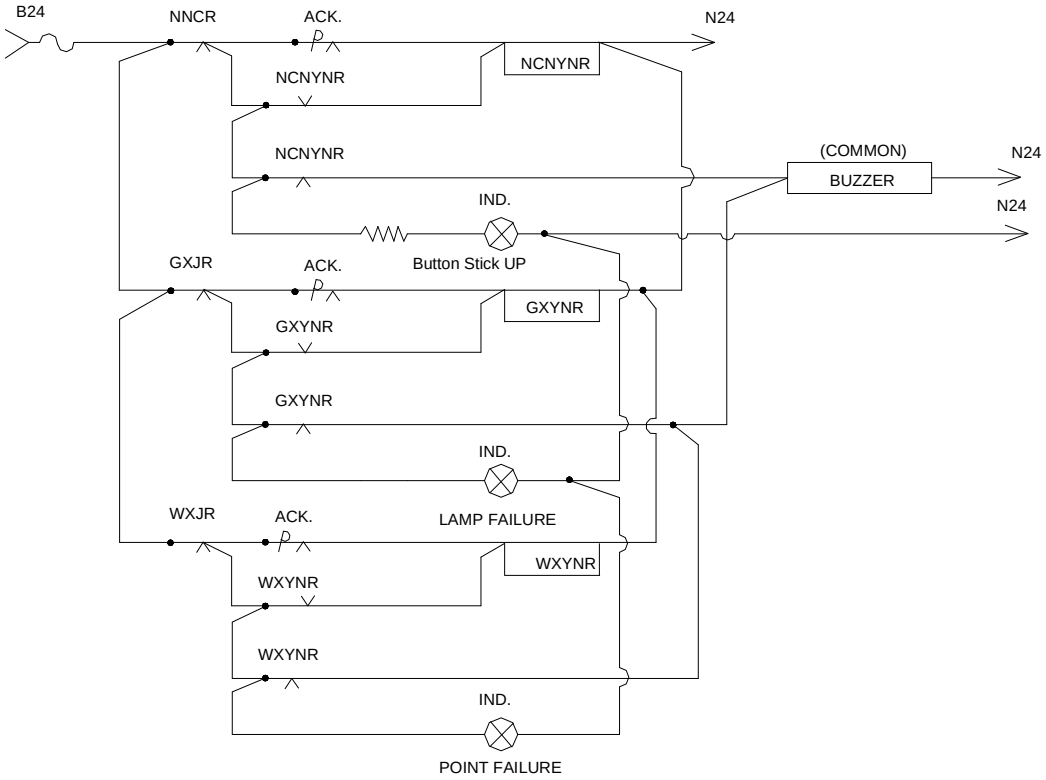


Fig No : 4.74

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) NCNYNR/GXYNR/WXYNR. When the Acknowledgement button is pressed the concerned acknowledgement relay will energise and the buzzer is muted.

4.16 Operation of Points

4.16.1 Automatic operation of points

In the previous paras we have seen that for automatic operation of points in RRI, LR's are used. LR picks up with GN & UN pressed OR signal switch turned & UN pressed. The no. of LR's for a signal is equal to no. of route & overlaps for that signal. This LR decides a signal route, operates the points to the required position. LR drops either on arrival of a train or when cancelled. In the system, all the LR's required for a point to be included in the point control circuit and the circuit becomes bigger & complex.

Here another method is adopted. In the system every signal is provided with two types of relays, NNR & NRR. Every signal will have that many no. of NNR's and NRR's as many no. of routes/movements available for that signal. (Ex: Home signal No:1 will have 1ANNR, 1BNNR, 1CNNR,1ANRR, 1BNRR,1CNRR).

NNR is a normally energized relay and proves that the signal is at `ON' and normal. NRR is normally de-energized relay and picks up when GN & UN buttons are pressed proving that conflicting movements are not initiated i.e NNRs are picked up. NNR picks up with NRR drop and ASR pick up. ASR pick up contact is by passed by its own front constant. It drops only when NRR picks up. But once dropped, it picks up only when NRR dropped & ASR picks up i.e. to prove that the signal is normal and concerned route not locked. By passing of ASR pick up contact with NNR pick up contact is to prevent dropping of unconcerned NNR's. Therefore that NNR only drops for which NRR of a particular signal route is picked up.

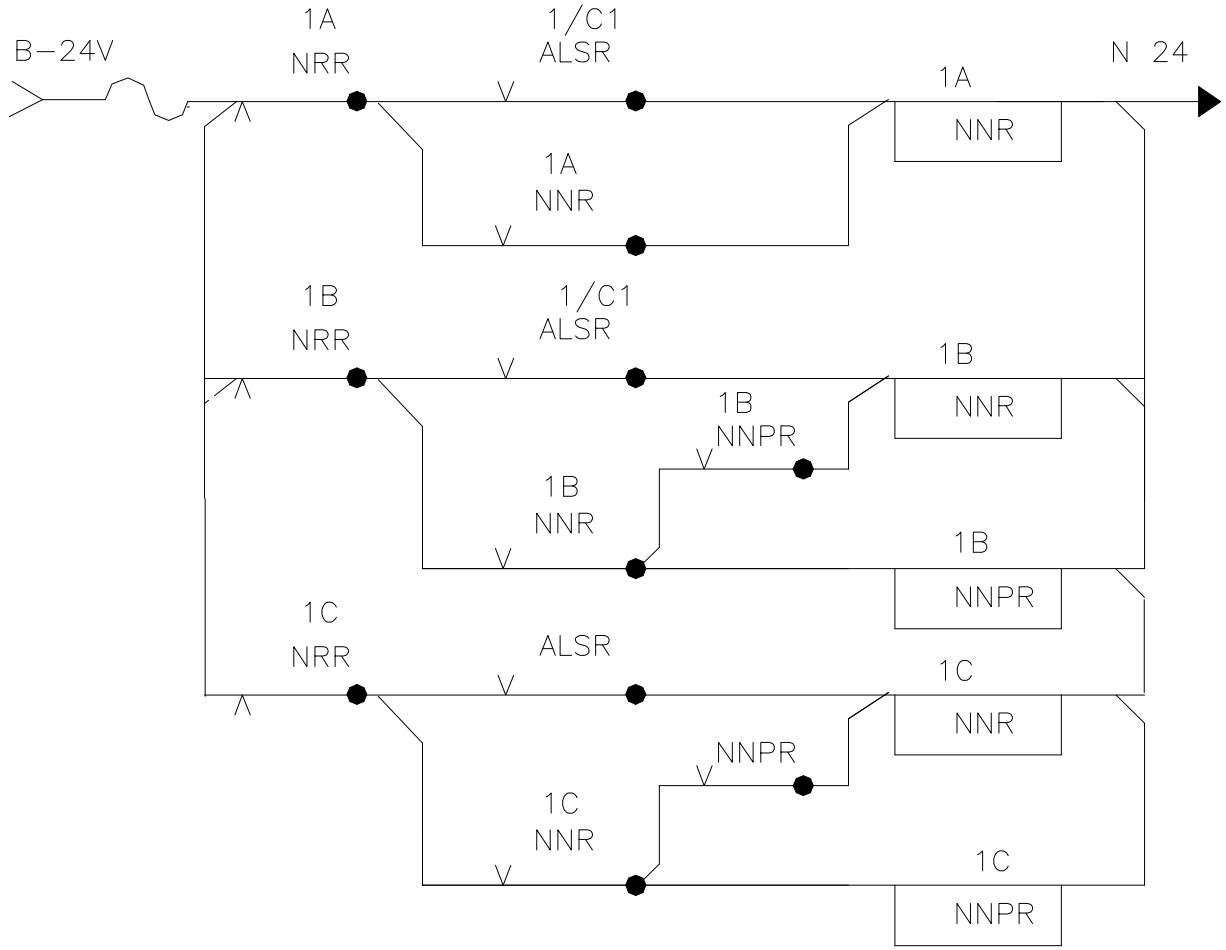


Fig No : 4.75

NRR picks up through conf. NNR's pick up and GNR(GNRR) & UNR pick up. The button relay contacts are bypassed with its own pick up contact. On the negative side it picks up through EGGNR drop contact bypassed by GNR drop contact. The sequential route release relay UYR2/UYR3/UYR4 drop is also proved on the negative side. NRR drops as soon as train passes the signal and UYRs pick up or when GN & EGGN button are pressed simultaneously to pick up GNR & EGGNR to cancel the signal.

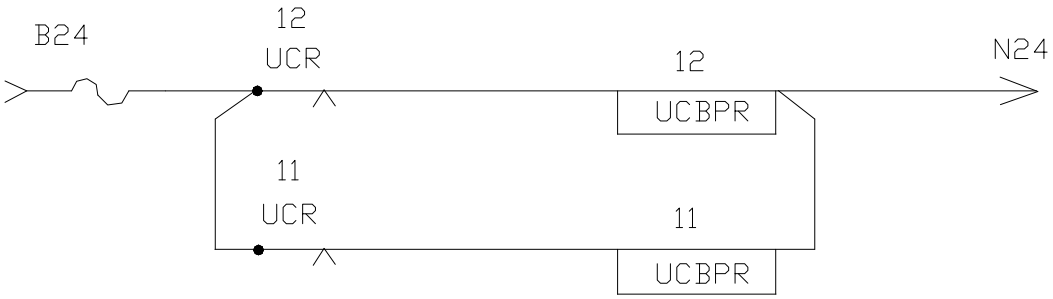
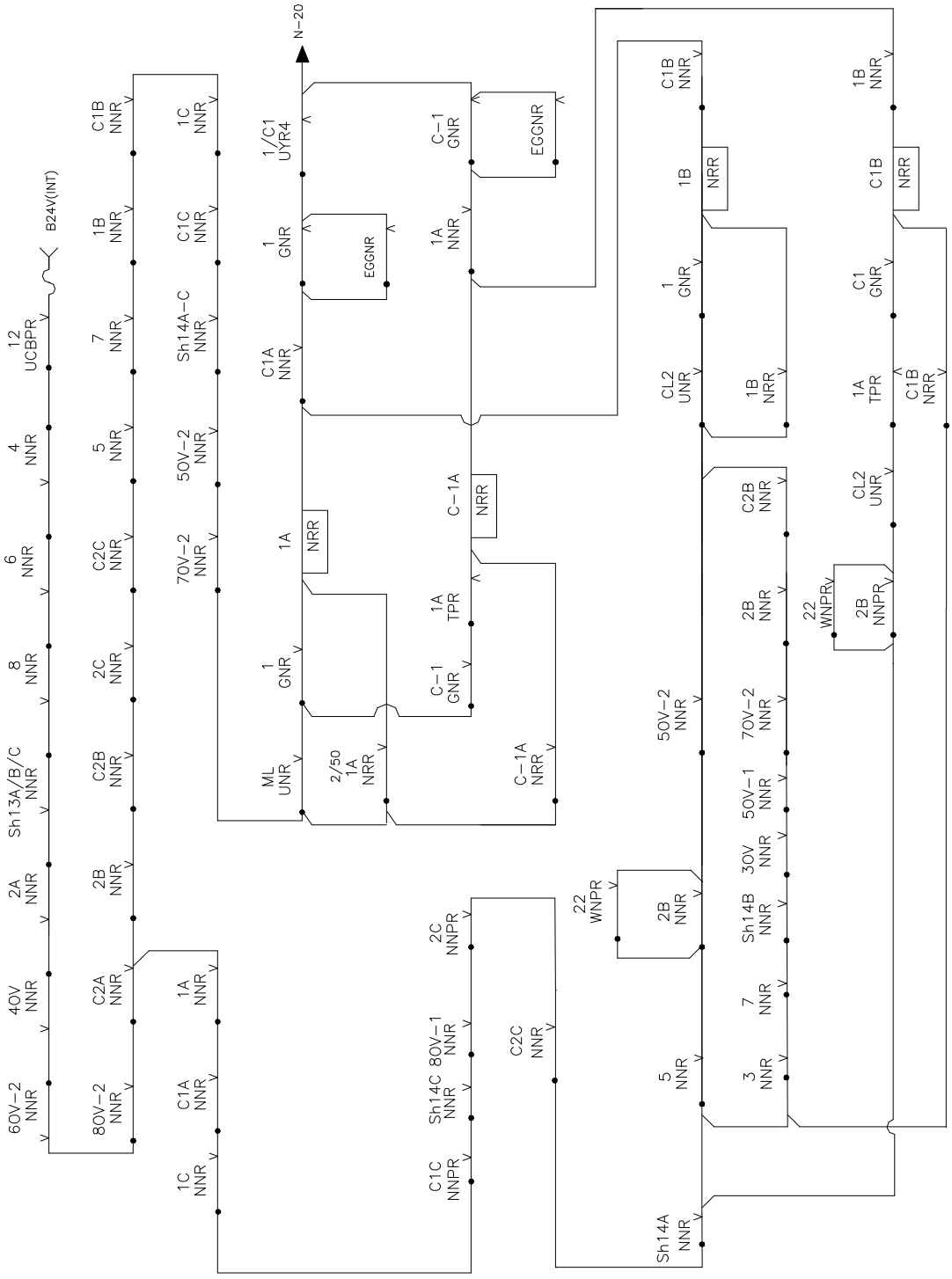


Fig No : 4.76(a)



NRR CIRCUIT

Fig No : 4.76 (b)

Similarly we have NRR's for all the routes of all signals which need operation of points.

In addition to the signal route NNR's and NRR's there are overlap relays, OV-NNR, OV-NRR named after the starter signal beyond which the overlap is considered for a signal. If beyond a straight signal for example Sig.No.7 there are two overlaps namely sand hump / through i.e. to main line, then 7 OV-1 NNR/7 OV-1NRR and 7 OV-2NNR, 7 OV-2NRR are provided respectively. This overlap NRR's referred with signal no, will operate the points in overlap area. For example 7 OV –1NRR will pick up 26 NLR and operated point to Normal. 7 OV2-NRR will pick up 26 RLR and sets point to Reverse (Reference to Fig 4.80).

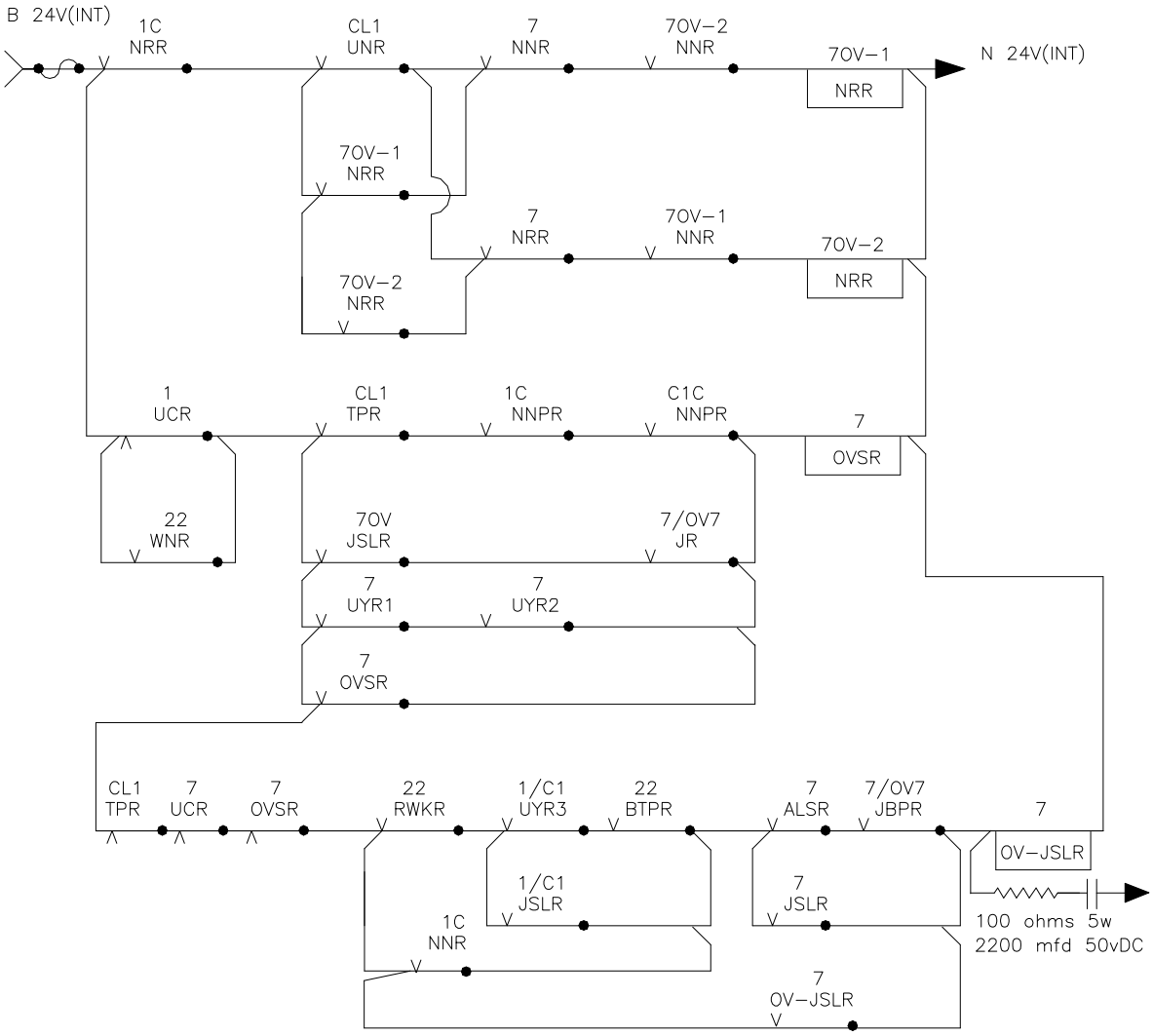


Fig No: 4.77

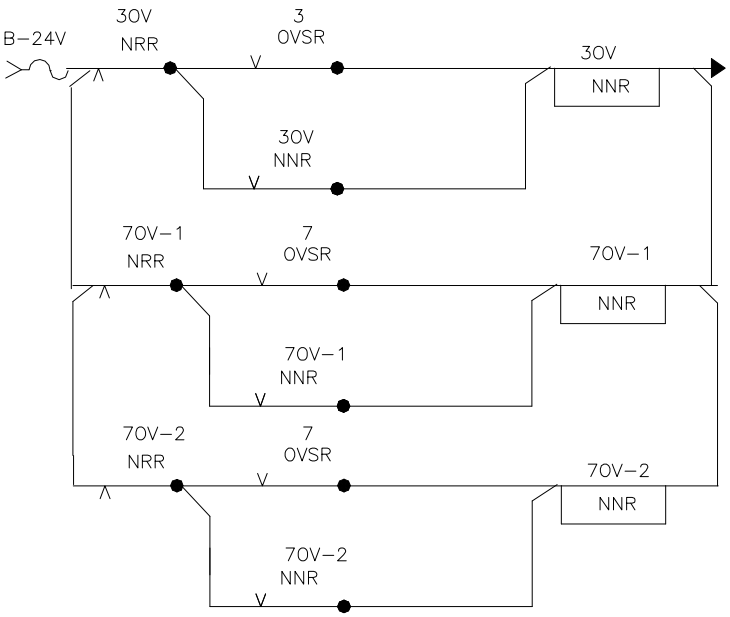


Fig No: 4.78

All this NRR's of all signals and overlap are used to pick up concerned point NLR/RLR relays for operating of points to the required position as per the signal Route. Every point will have one NLR and RLR each. NLR and RLR are numbered with concerned point No. and they pick up WNR or WRR which in turn initiates point control and operates the point to normal or reverse respectively.

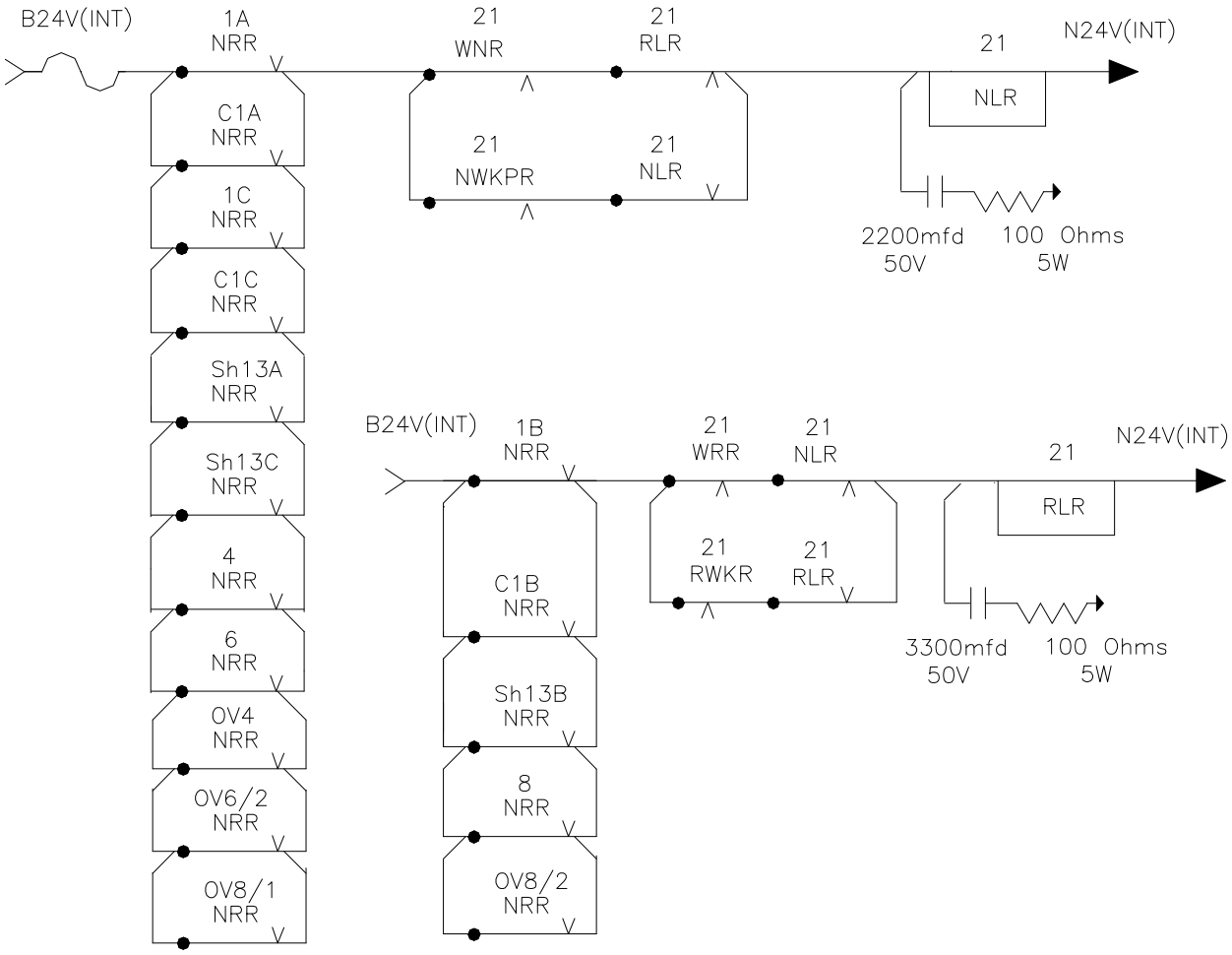


Fig No: 4.79

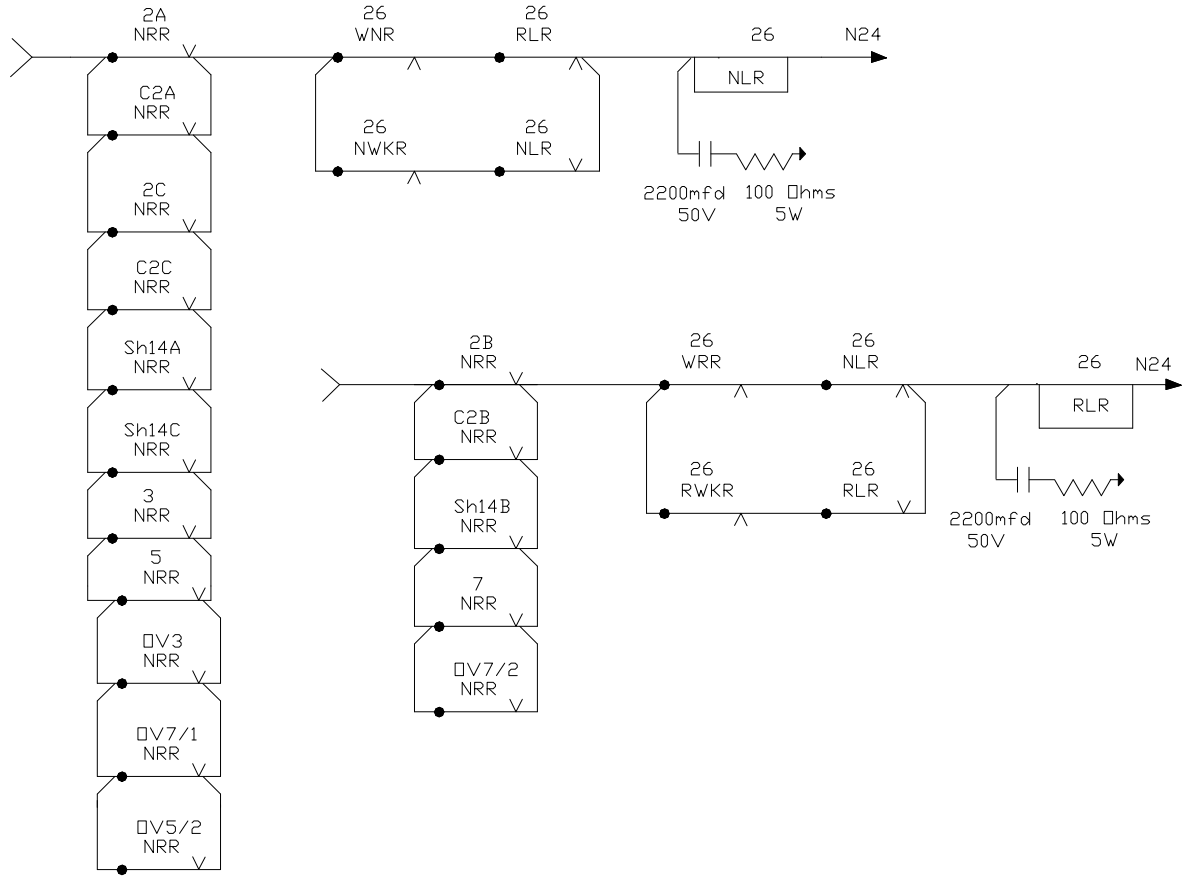


Fig No : 4.80

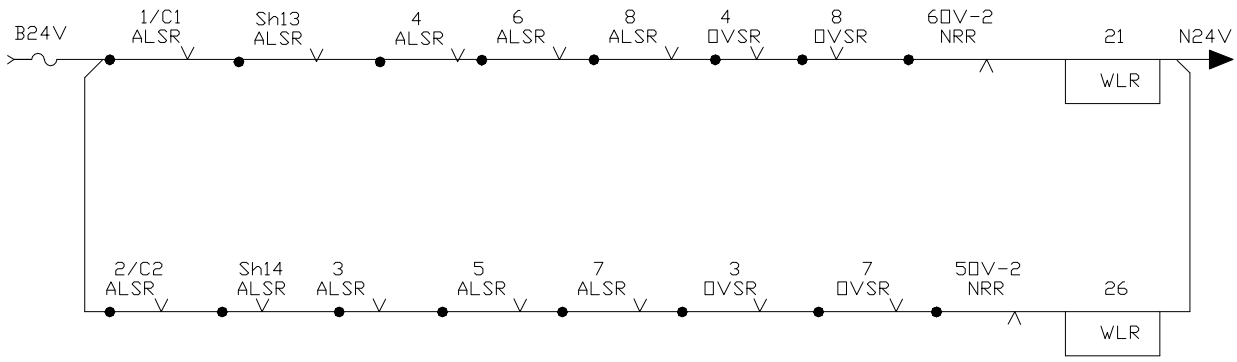


Fig No : 4.81 (a)

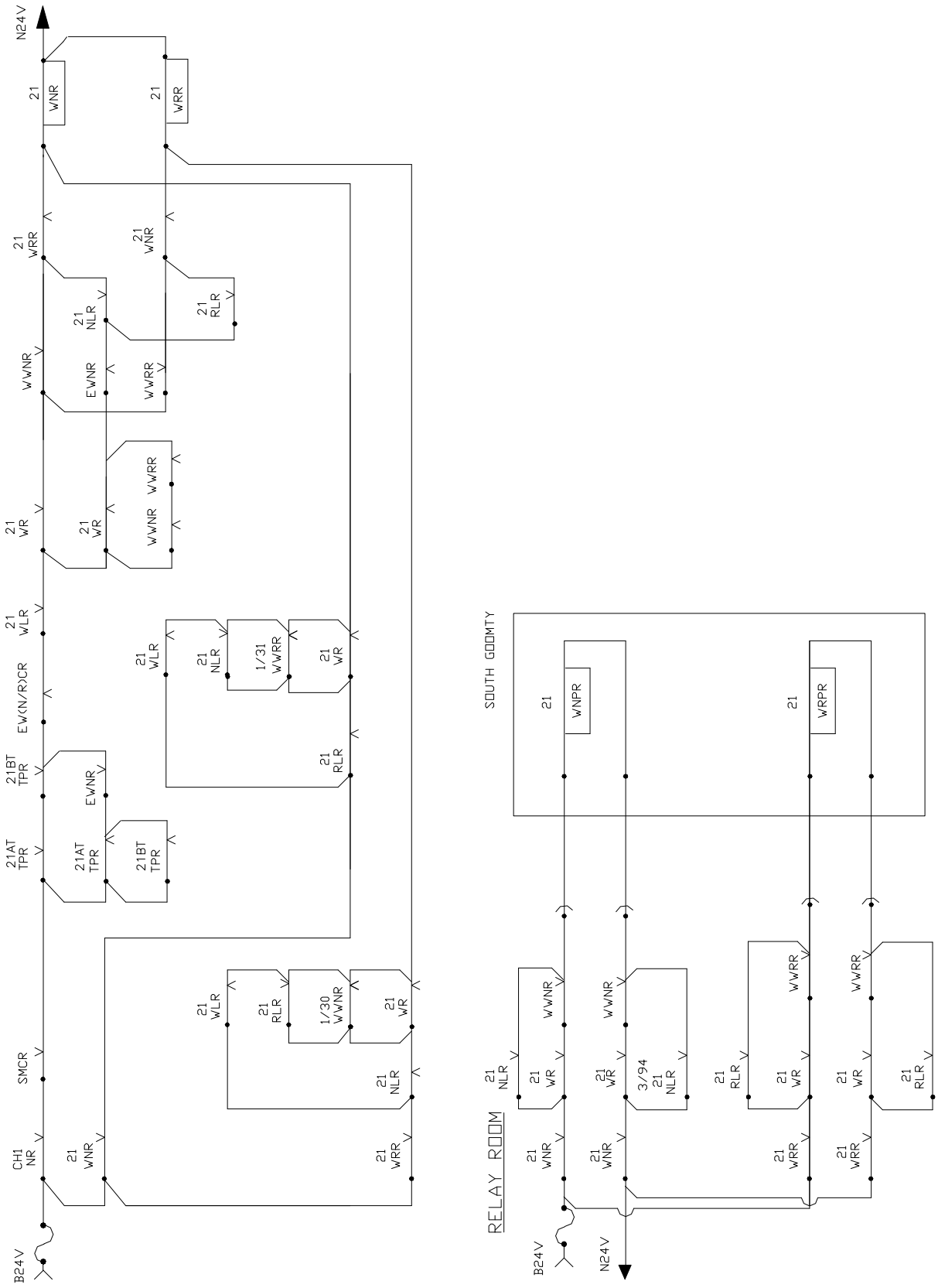


Fig No : 4.81 (b)

WNR/WRR will energise WNPR/WRPR at location/ goomty and operate the point to Normal/reverse respectively.

4.16.2 Manual Operation of Points

For manual operation of points, the concerned point button (21) WN and common point Group button WWN(N) for normal or WWN(R) for reverse operation as required will be pressed simultaneously. Point (21) button relay 21 WR with WWNR/WWRR will pick up which in turn pick up directly point (21) WNR/WRR and get stick and operates the point (Reference Fig 4.82 & 4.81(b)).

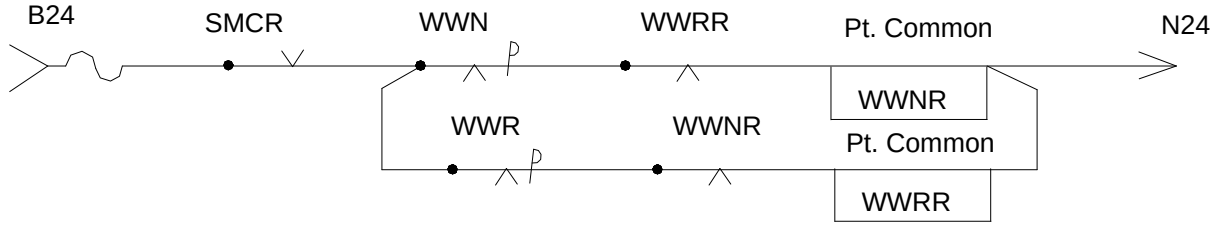


Fig No : 4.82

4.16.3 Emergency Operation of Points

In Big/major relay interlocking installations,"emergency operation of points" i.e. operation of points when point zone track circuits failed, is given to enable the operator (SM) to alter the point in case of failure of track circuit in point zone provided point is not locked in the route set. This is to avoid time delay in case of a failure of T.C. But before adopting such operation, the SM must ensure that it is only a failure and no vehicle is standing on it. The key/button for emergency operation if normal kept in locked/sealed position and it is provided with a counter to record such operations.

EOP is possible under point zone Track circuit (S) failure condition. For emergency operation of points SM has to insert the EW SM's Key on the panel. Then the concerned point button WN along with EWN button is to be pressed simultaneously.

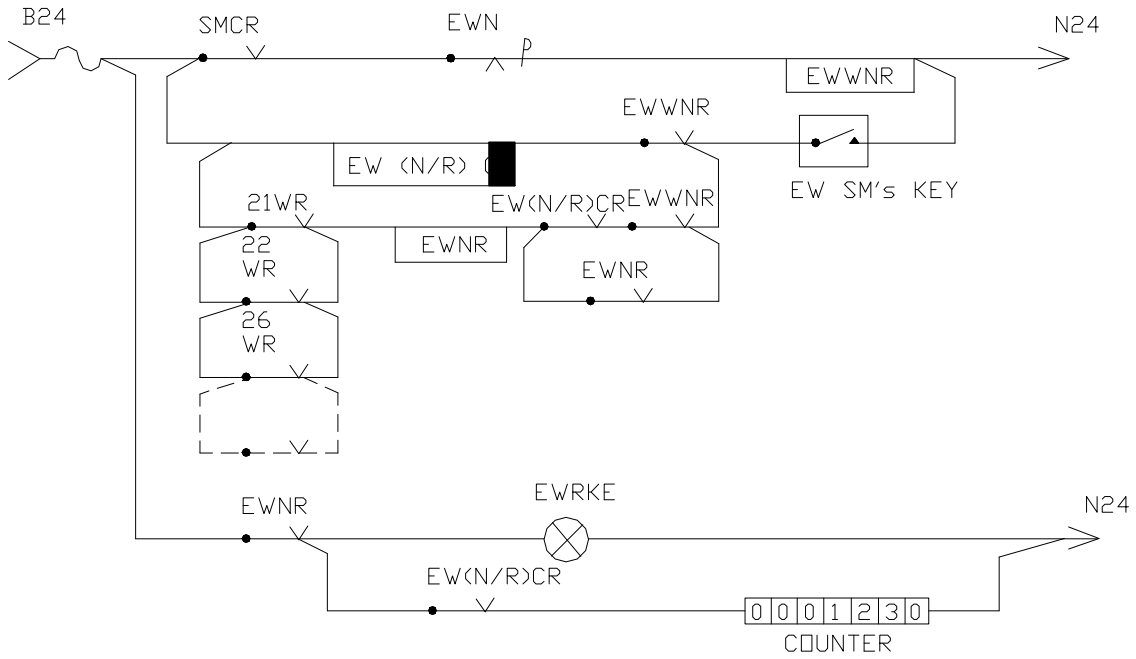


Fig No : 4.83

Relay EWNR picks up as shown above. Now keeping point WN button pressed, concerned WWN(N)/WWN(R) is pressed which well in turn energises WNR/WRR which in turn operator point to the required side. WN with WWN(N)/WWN(R) is to be kept pressed till the operation of the concerned point is completed and the indication relay NWKR/RWKR is energised. By each emergency operation of points, the counter provided for it will be incremented by one count.

4.17 Chain Operation of Points

Provision is also made to operate the points in a chained manner i.e., operation of points in the required route one after the other, not simultaneously at a time but one after the other to restrict load current through bus bar & fuse. The following circuits are employed to achieve chain operation. But operation of points in chain manner is possible only when the points are automatically operated during route setting but not during individual or emergency operation.

The following circuits are adopted to achieve automatic operation of points in chain manner during route setting.

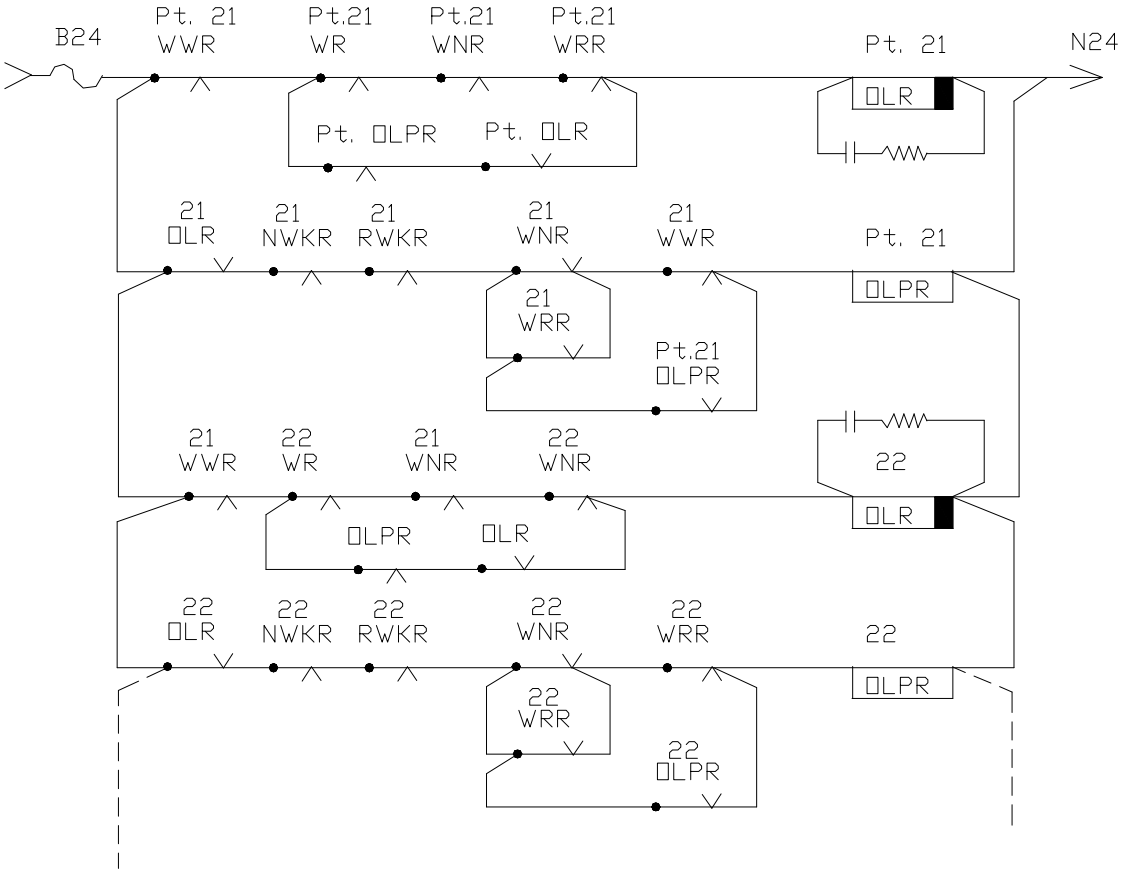


Fig No: 4.84

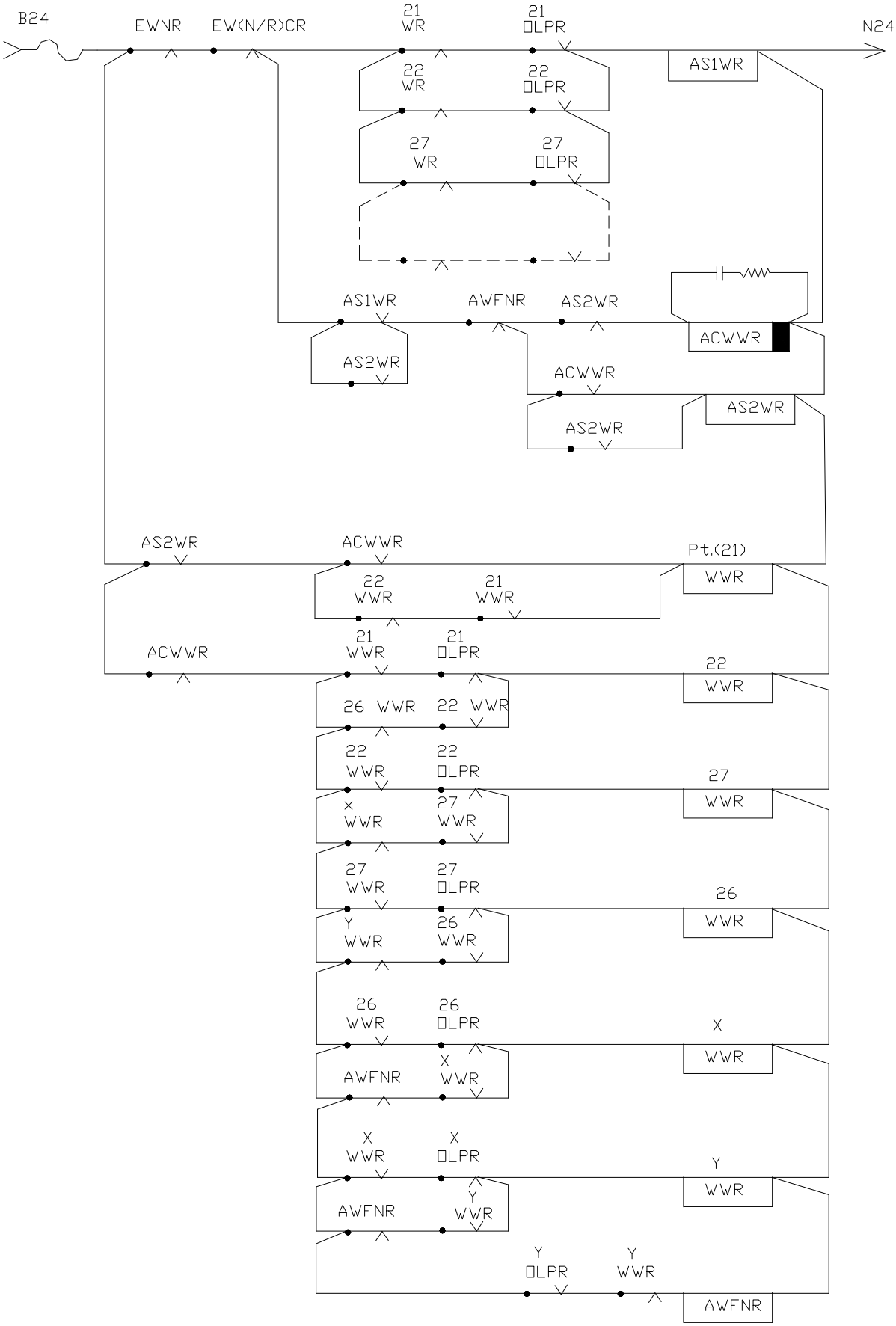

B24
EWNR
EW(N/R)CR
21 WR
21 □LPR
N24
AS1WR
22 WR
22 □LPR
27 WR
27 □LPR
AS1WR
AWFNR
AS2WR
ACWWR
AS2WR
ACWWR
AS2WR
AS2WR
ACWWR
Pt.(21) WWR
22 WWR
21 WWR
ACWWR
21 WWR
21 □LPR
22 WWR
26 WWR
22 WWR
22 WWR
22 □LPR
27 WWR
X WWR
27 WWR
27 WWR
27 □LPR
26 WWR
Y WWR
26 WWR
26 WWR
26 □LPR
X WWR
AWFNR
X WWR
X WWR
X □LPR
Y WWR
AWFNR
Y WWR
Y □LPR
Y WWR
AWFNR

Fig No : 4.85

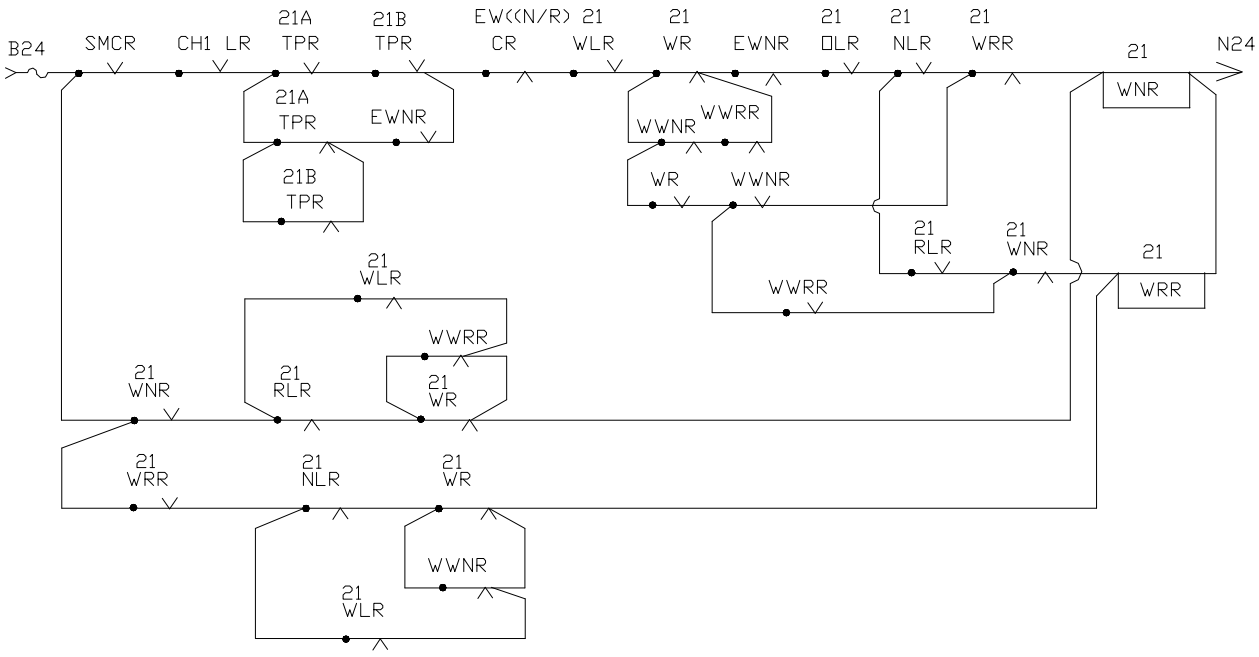


Fig No : 4.86

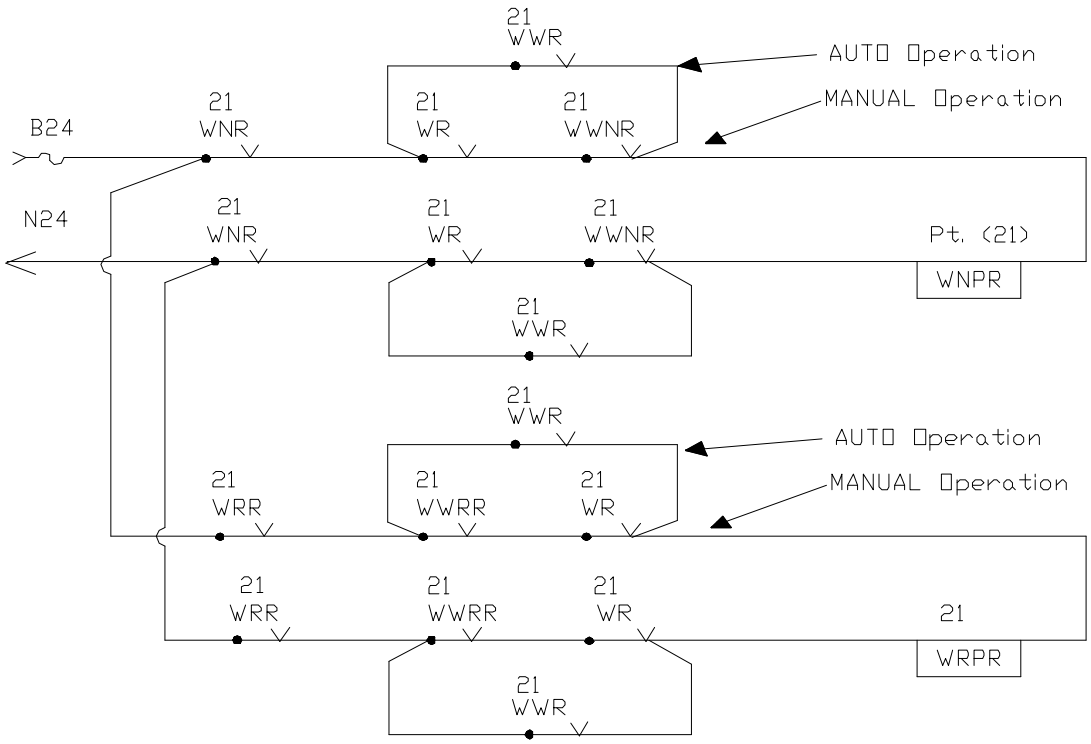
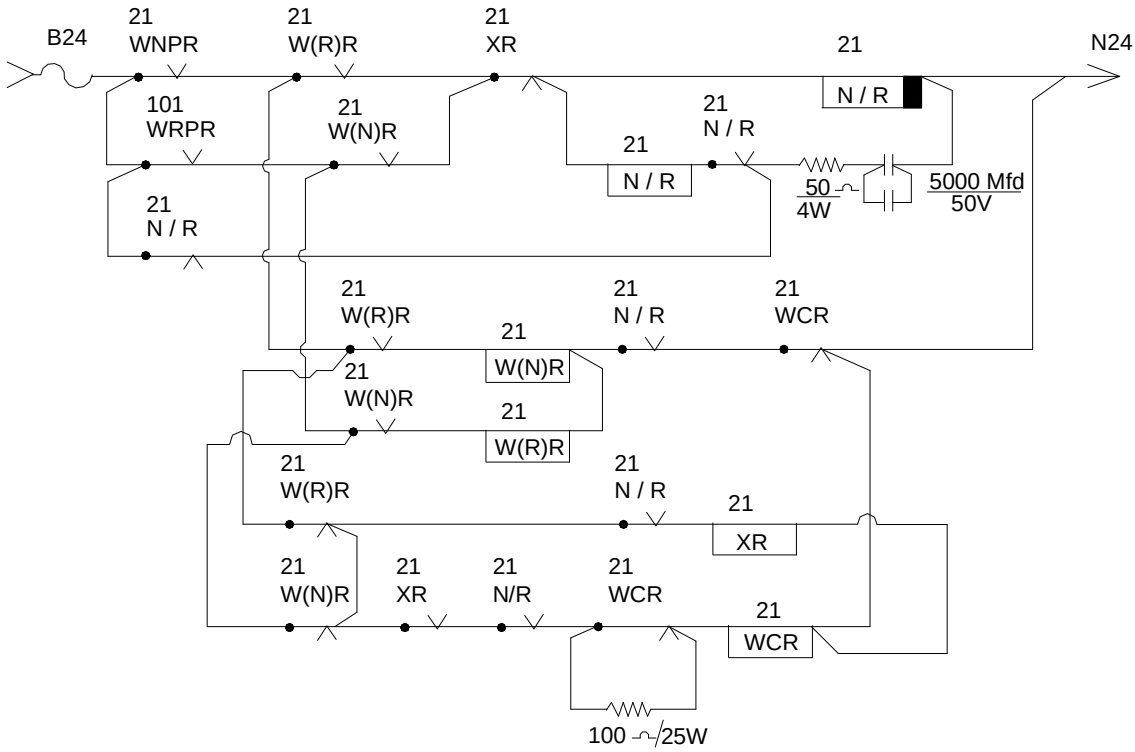


Fig No: 4.87



SIEMEN'S POINT CONTACTOR UNIT
Fig No : 4.88

Relay OLR is normally energised with drop contacts of Point controlling relays WR, WNR & WRR and chain operation relay WWR and sticks through its own pick up contact and OLPR drop contact. It will drop only when automatic chain operation relay WWR pick up. Once dropped it needs for picking up, other point control relays WR, WNR/WRR to drop after the operation is over.

It will not drop during manual or emergency operation of points.

All other relays like OLPR, WWR etc are normally de-energised relays. They will pick up point by point during automatic route setting time for automatic chain operation of points and will drop as and when the points are sequentially operated as designed.

All the points in a yard are considered either route wise or group/zone wise to suit the requirement.

Relay WNR/WRR picks up as per requirement through front contact of NLR/RLR and OLR. These relays WNR/WRR as the case may be sticks through their respective front contact and with other relays drop contacts.

Now relay OLPR of a point picks up through pick up contacts of OLR (made slow to release) and WNR/WRR pick up contact which sticks up through its own pick up contact and triggers point chain group relays circuits.

Pick up of OLPR of a point extends feed to AS1WR (Auto Set Point Relay No.1) and ACWWR (Auto Chain Point Group Relay) and them AS2 WR (auto set point Relay No.2)

The relay AS2WR pick up contact with ACWWR pick up contact energise WWR of the first point (21) which extends feeds to the concerned point. (Reference Fig No 4.85 & 4.87)

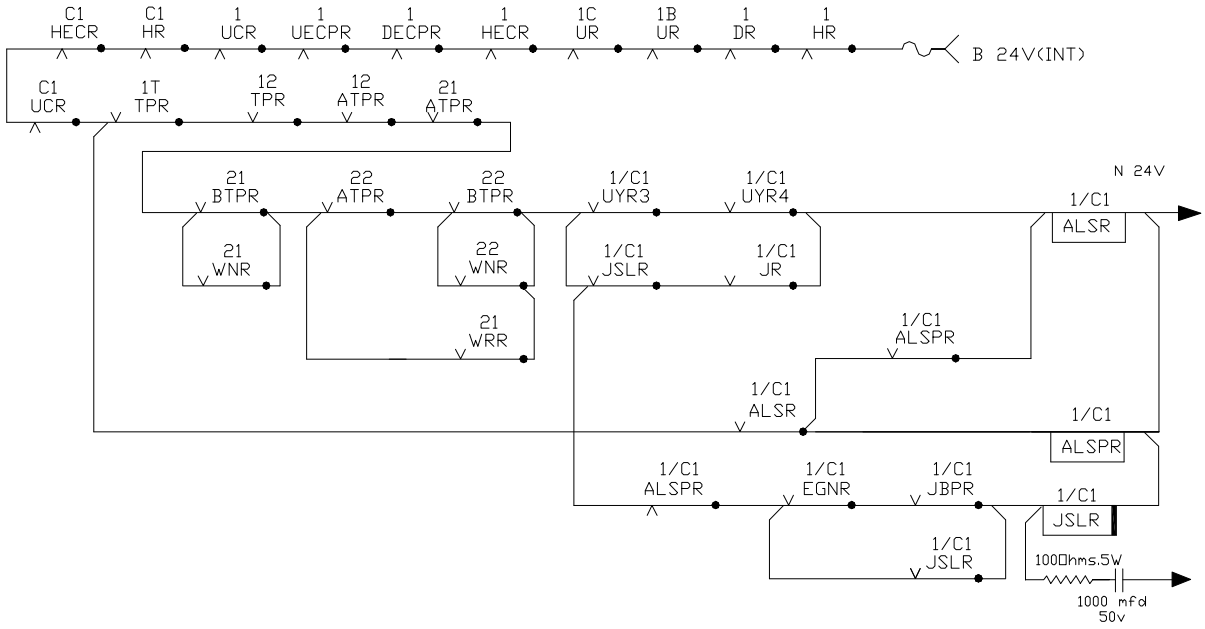
Also WWR of first point will extend feed to WWR of second point and so on. Lastly AWFNR (Auto Point Finish Relay) will pick up indicating the completion of chain operation of points. With WWR pick up along with WNR/WRR, energised WNPR/WRPR as the case may be which in turn triggers N/R relay let to complete the operation of point and the concerned detection relay NWKR/RWKR is energised.

In the WNPR/WRPR at a II path is provided with WR pick up & WWNR/WWRR for picking up of WNPR/WRPR during individual operation of points.

Similarly, in the WNR/WRR circuit (with OLR & NLR/RLR) the stick path of WNR consists of its own front contact in series with RLR & WR drop contact bypassed by WWRR drop contact and the total is bypassed by WLR drop contact.

Similarly for WRR the stick provided by its own front contact in series with NLR & WR drop contact bypassed by WWNR drop contact and the total is bypassed by WLR drop contact.

All other circuits of ASR, UCR, HR etc may remain same or slightly modified.
These circuits are appended below for comparison with PI circuits.



COMBINED ASR FOR SIGNAL No.1 & CALLING ON
Fig No : 4.89

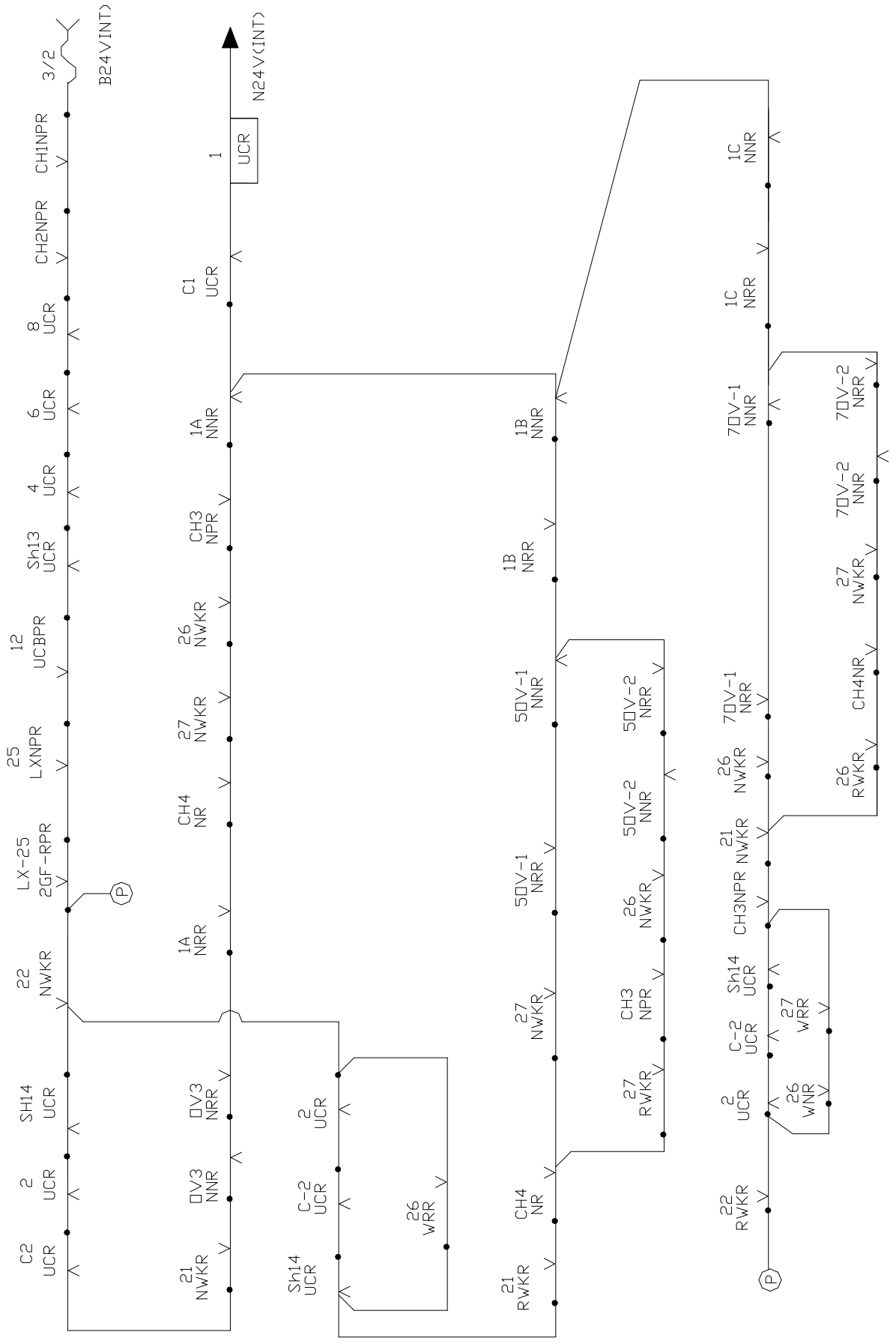

B24VINT)
N24V(INT)
3/2
CH1NPR
CH2NPR
8 UCR
6 UCR
4 UCR
Sh13 UCR
12 UCBPR
25 LXNPR
LX-25 2GF-RPR
22 NWKR
SH14 UCR
2 UCR
□V3 NNR
C2 UCR
21 NWKR
□V3 NRR
1A NRR
CH4 NR
27 NWKR
26 NWKR
CH3 NPR
1A NNR
C1 UCR
1 UCR
2 UCR
C-2 UCR
Sh14 UCR
26 WRR
21 RWKR
CH4 NR
27 NWKR
5□V-1 NRR
1B NRR
5□V-1 NNR
1B NNR
CH3 NPR
26 NWKR
5□V-2 NNR
27 RWKR
5□V-2 NRR
1C NNR
1C NRR
7□V-1 NNR
7□V-2 NRR
7□V-2 NNR
27 NWKR
CH4NR
26 RWKR
7□V-1 NRR
26 NWKR
21 NWKR
CH3NPR
Sh14 UCR
C-2 UCR
27 WRR
2 UCR
26 WNR
22 RWKR
P

Fig No : 4.90

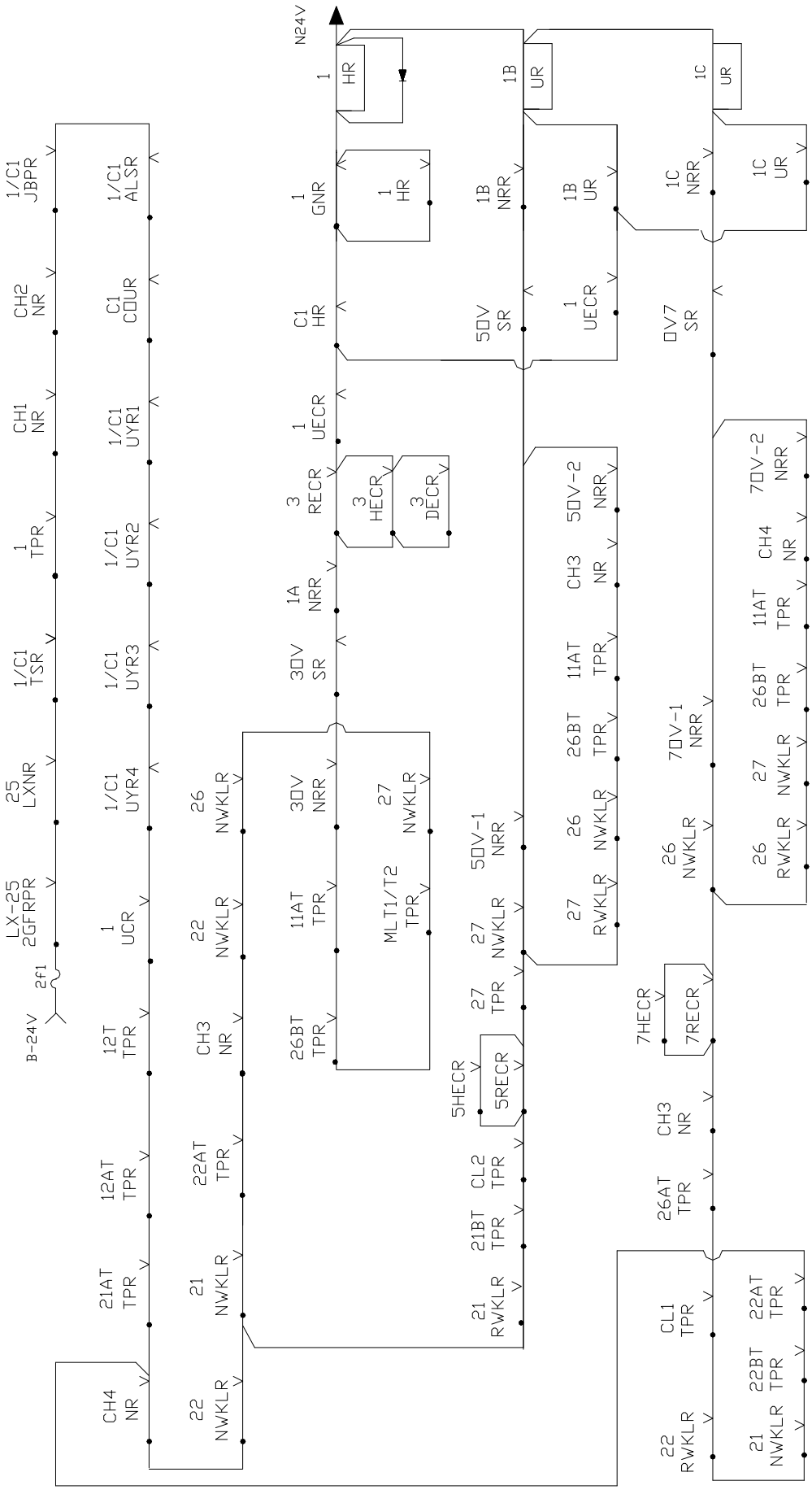

N24V
1
HR
1B
UR
1C
UR
1/C1 JBPR
CH2 NR
C1 COUR
1/C1 ALSR
CH1 NR
1/C1 UYR1
1 GNR
1 HR
1B NRR
1B UR
1C NRR
1C UR
1/C1 UYR2
1 TPR
C1 HR
5DV SR
1 UECR
DV7 SR
1/C1 UYR3
1/C1 TSR
1 UECR
3 RECR
3 HECR
3 DECR
1A NRR
3DV SR
1/C1 UYR4
25 LXNR
26 NWKLR
3DV NRR
27 NWKLR
11AT TPR
22 NWKLR
1 UCR
MLT1/T2 TPR
26BT TPR
CH3 NR
12T TPR
27 TPR
5HECR
5RECR
5DV-1 NRR
27 NWKLR
26BT TPR
11AT TPR
CH3 NR
5DV-2 NRR
26 NWKLR
27 RWKLR
7DV-1 NRR
26 NWKLR
7HECR
7RECR
27 NWKLR
26BT TPR
11AT TPR
CH4 NR
7DV-2 NRR
26 RWKLR
LX-25 2GFRPR
B-24V
2f1
12AT TPR
22AT TPR
CL2 TPR
CH3 NR
21AT TPR
21 NWKLR
21BT TPR
21 RWKLR
26AT TPR
CL1 TPR
22AT TPR
22 NWKLR
22BT TPR
21 NWKLR
CH4 NR
22 RWKLR

Fig No : 4.91

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 cct) 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.( )

CHAPTER 5: INTRODUCTION TO ROUTE RELAY INTERLOCKING SYSTEM – II

5.1 INTRODUCTION

System -II is adopted for major yards (For Ex. Katpadi In S.Rly) where more number of parallel movements and shunt signal movements are involved. In system II, the point control circuits are prepared in geographical manner. All other circuits are same as system - I. Instead of many LRs in point control circuits only 3 relays i.e., ANR, BNR and RR only will be used in System - II. ANR or BNR controls the operation of point to normal and RR will control the operation of points to reverse.

To appreciate the utility of this system, let us consider the yard given in figure 5.1. We may assume that all signals read to all possible roads. Thus we have 4 routes for each signal, and a total of 8 x 4 i.e., 32 routes. Considering point 7, we have 24 routes requiring the point in normal position and 8 routes in reverse. The point control circuit (WNR/WRR) become too Big with large number of LR contacts. Also the number of route lock relays required is prohibitive. Therefore, system- I, so far used is suitable only for small stations and not for big yards with more movements.

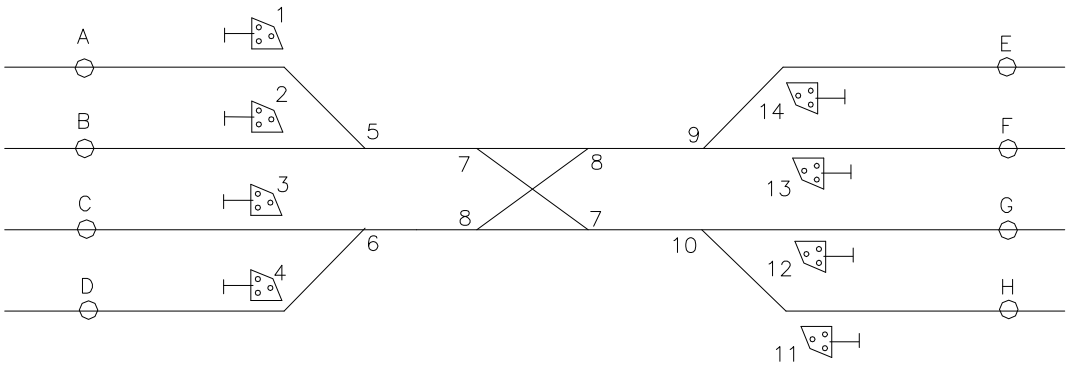


Fig No : 5. 1

To illustrate the principle employed in this system, let us consider the layout given in Fig.5.2(a). The route selection circuit is drawn in a geographical manner, i.e., the circuit, when drawn will resemble the track layout closely.

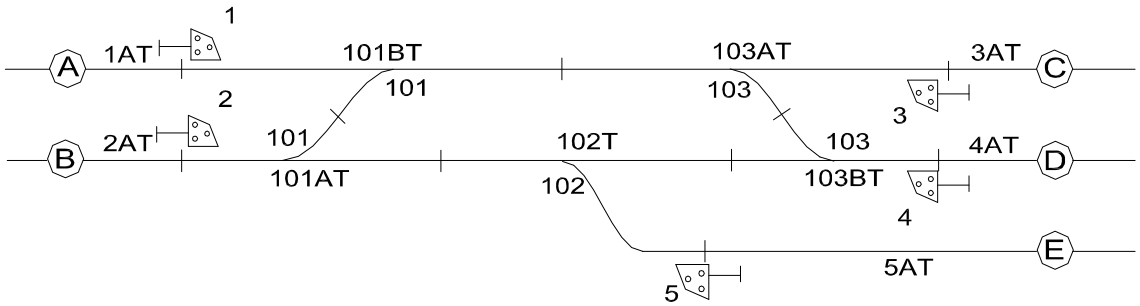


Fig No : 5. 2(a)

The ends of cross over points are designated as ‘A’ end and ‘B’ end. Single ended points will have no alphabet to specially designate the end, as there is only one end. For example in the yard at Figure 5.2(a) above the ends of cross over points 101 are called '101 A' and '101 B' and the end of points 102 is '102'. Each end of point is associated with 2 relays for normal setting of points, one of them is designated as 'CR' and the other NR. CR will pick up when points are free i.e., not used by any other route requiring these points in normal position and NR will pick up after ensuring that the complete route is free. There is also a reverse relay,

RR associated with each point. Only one RR is used, irrespective of whether the point is double ended or single ended. RR relay will also energise only after checking the availability of the entire route like NR relay and sets the point to reverse when energised. Thus we have 5 relays for a cross over ANR, ACR, BNR, BCR & RR (e.g., for 101 point 101 ANR, 101 ACR, 101 BNR, 101 BCR & 101 RR). Any one of the NR relays either ANR or BNR will set the point to normal. All the five relays are required for a crossover, where we have movements on both ends with points normal and with points reverse. In case of a cross over with one end having a sand hump, only 3 relays are required, NR and CR for the end having no sand hump and RR for reverse setting of points. For single ended points like points 102 in Fig.5.2(b), only 3 relays are required NR and CR for the end having no sand hump and RR for reverse setting of points.

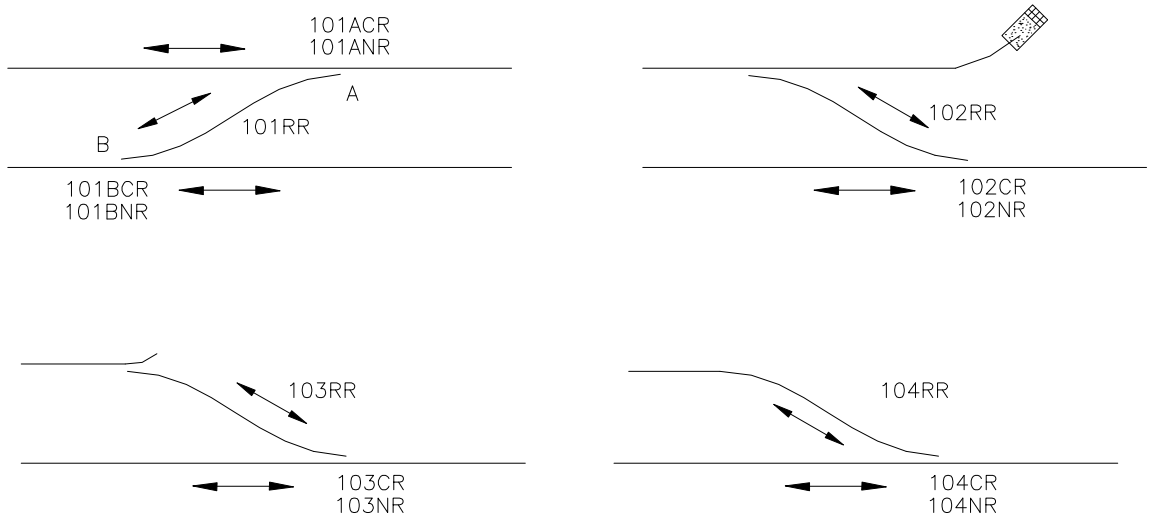


Fig No : 5.2 (b)

The Route Selection Circuits are in Two (2) Parts

Forward Flow Circuit : The Circuit for any signal starts from the entrance end ie. From signal end and advances geographically to the exit end ie, upto Route and overlap which is called “Forward flow Circuit”.

Reverse Flow Circuit : Then the circuit folds / flows back in the same route geographically back wards to the entrance end ie, . to the signal end.

The forward flow circuit starts from the signal with signal switch reversed contact. While progressing ahead, the availability of the route is ' checked. When a trailing point is encountered in the normal position, in addition to proving the point is not used by a route requiring these points in reverse position, a relay known as CR (Checking Relay) is energised. This CR relay prevents any other conflicting route being initiated. When a CR relay energises, a circuit for the operation of the associated NR relay is also prepared in parallel but NR relay will operate only after proving the entire route is free.

When a facing point is encountered and if it is required in Normal, in the forward flow circuit it merely checks it is available and not used for Reverse by any other route. No checking relay (CR) is picked up in this forward flow circuit, but these points will have their CR & NR relays picked up in the return direction in RFC. When the route involves facing point in reverse position, circuit for RR is either prepared in the forward flow circuit and operated after ensuring the entire route is free or prepared and operated in the return circuit. Therefore, the RR relay for any point will be located in the forward or return circuit. Thus the forward flow circuit extends proving the availability of route to the exit end where it proves the opposing signal knob (if any) is normal and energises push button relay through the exit push button operated contacts.

When the push button relay is energised, the circuit folds back and extend towards the entrance end. The conditions proved are exactly similar to the forward flow circuit. As stated already the trailing points in the return direction have NR operated. Where the route is through reverse setting of points, RR relays of relevant points are energised.

The operation of point control relays NR & RR is done sequentially in the return direction irrespective of whether they are facing or trailing. The first point NR or RR in return direction is controlled by the push button relay. The second point NR or RR is energised by the first point NR or RR relay, the third point NR or RR by the second point relays and so on. Thus the NR and/or RR contacts of the points on either side; or push button contacts energise an NR or RR relay in the absence of points.

Finally, for points to be set in normal, NR and CR relays of the ends on which the route extends and for points to set in reverse RR relays operate. These relays control the point controller circuits (WNR / WRR) for setting the points in the required direction.

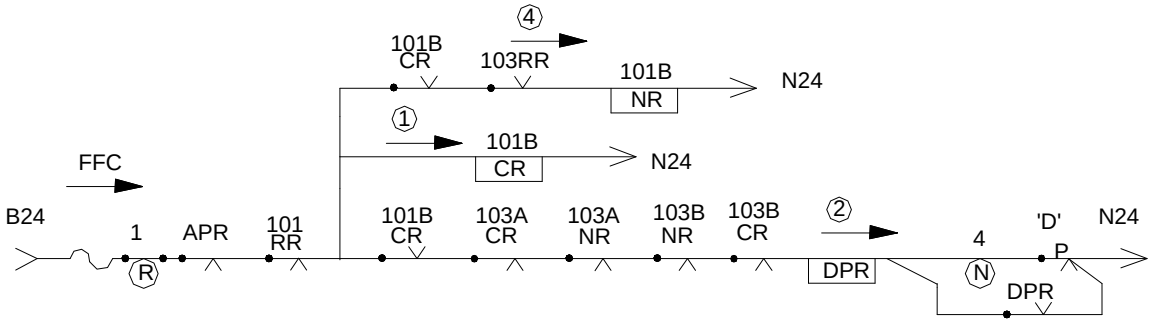


FIG.5.3 (a)

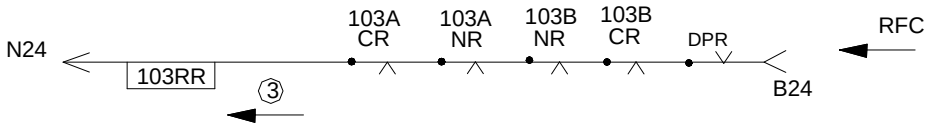


Fig No : 5. 3 b

The detailed circuits for route 1D figures 5.3 (a) and 5.3 (b) are now discussed. The forward flow circuit starts with ‘R’ contact of shunt signal No.1 knob reversed. APR back contact is proved to ensure that no opposite Movement is already initiated. As the points 101 are approached in trailing direction and they are required in normal position, 101 RR is proved de-energised. This ensures that no route requiring 101 reverse is already set. With these conditions the checking relay for B end 101 BCR is picked up which prepares the circuit for 101 BNR – Relay. 101 BNR will pick up only after proving the entire route is free. If this relay were allowed to operate immediately after 101 BCR has picked up, 101 point would unnecessarily operate even when full route is not available.

With 101 BCR operated the circuit extends further. The next point 103 is approached in facing direction, but it is required in reverse position. Normal position checking relays and control relays of both ends (103 ACR, 103 BCR, 103 ANR & 103 BNR) are, therefore, proved de-energised. To ensure that this path of the circuit is available only for movement with 101 point normal and not with 101 reverse, 101 BCR front contact is included. As there are no further points and the exit end is reached, the push button relay DPR is energised proving the opposing signal knob is normal and the push button D pressed. These contacts are shunted by a stick contact of DPR to hold the relay after the release of push button and also to prevent a disturbance to this circuit by subsequent wrong operation of knob 4.

The return circuit Fig. 5.3(b) commences with DPR front contact and advances towards the entrance end proving 103 point is not used in normal position (103 BCR, 103 BNR, 103 ANR & 103 ACR all de-energised) to pick up 103 RR- Even though these contacts are already proved in the forward circuit and appear redundant, they are repeated to combine the route selection circuits of other signals also with this circuit. DPR contact in 103RR circuit proves that full route is already checked in the forward flow circuit. The next point NR circuit (101 BNR) has already been prepared in the forward flow circuit. Therefore, a front contact of 103 RR is used to energise 101 BNR. The return circuit terminates at this stage as there are no more trailing points or points required in reverse position.

103 RR and 101 BNR relays operate 103 point to reverse and 101 to normal respectively. The Point control circuits are similar to those in system-I except that the routes Initiation relay contacts (LR) are replaced by NR and RR relay contacts. Cross-over points are controlled by either ANR or BNR for normal. Only one NR is used for single end point, its contact will set the points to normal and RR will set all type of point ie S/E or D/E to reverse.

We will now consider the circuits of 4A route, refer Fig no 5.2(a) the route directly opposite to 1D. The forward flow circuit of 4A route Fig.No.5.4(a) starts with R contact of shunt signal no.4 knob reversed. The circuit proves DPR in de-energised position to ensure that opposite movement to 4A is not initiated. As 103 point is required in reverse position, 103 BCR, 103 BNR, 103 ANR, 103 ACR are proved de-energised. Circuit for 103 RR is also prepared simultaneously, but 103 RR will operate only after proving that the entire route is free. The circuit also proves the back contact of 101 RR (101 point is not used in reverse position) and energises APR through opposing signal knob normal contact and exit button ‘A’ pressed. It may be noted that no CR for 101 point is picked up in this circuit as these points are approached in facing direction.

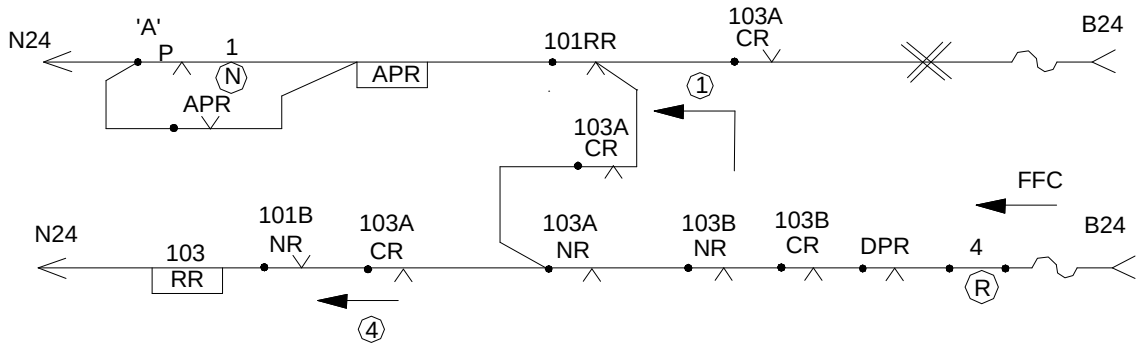


Fig No: 5. 4 (a)

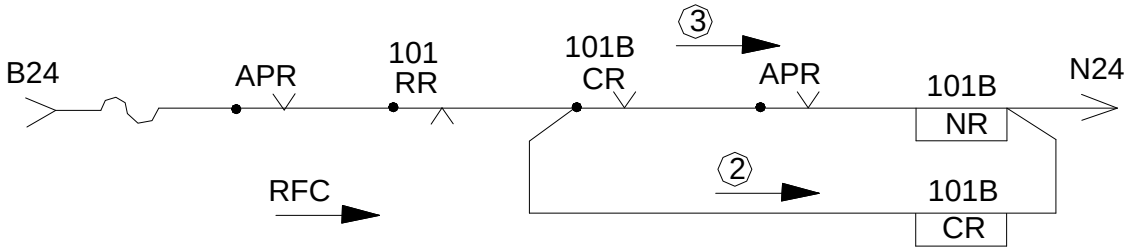


Fig No: 5. 4 (b)

When APR picks up, the return flow circuit is initiated in Fig.5.4(b) and 101 BCR picks up proving 101 is not used in reverse position. 101 BCR operates 101 BNR as the entire route is already proved to be free, through APR. 101 BNR operates 103 RR.

Figs. 5.3(a) and 5.4(b) are having identical conditions to prove, so they can be combined to form a single circuit as shown in figure 5.5 below.

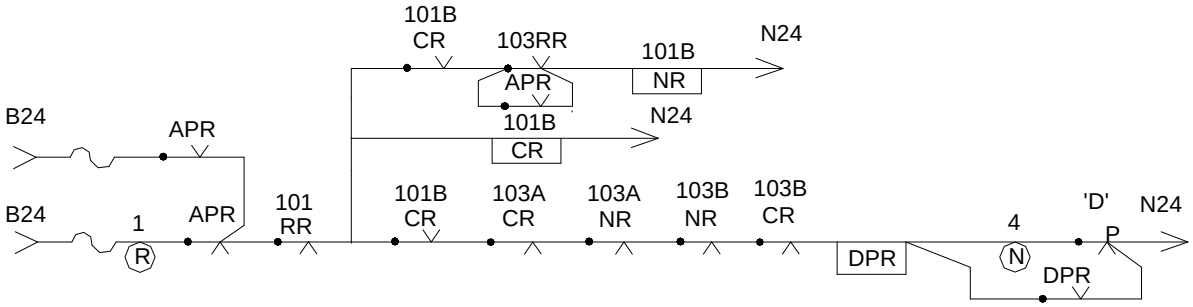


Fig No: 5. 5

Fig.5.3 (b) and Fig.5.4 (a) are similarly combined as shown in Fig.5.6.

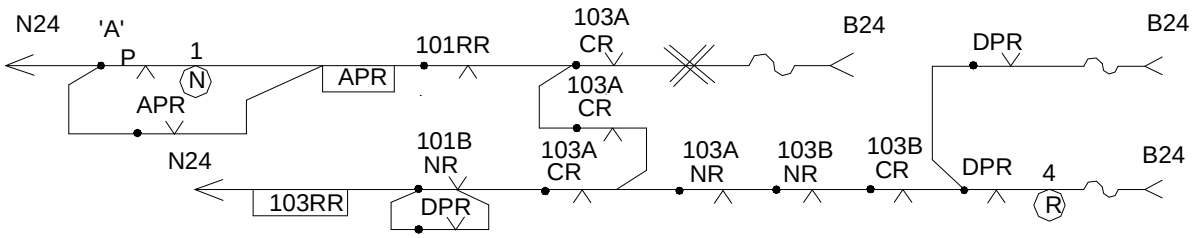


Fig No :5. 6

Figs. 5.7(a) and (b) represent the forward and return flow circuits for route 2D. As no points are required in reverse position, no RR relay is energised in these circuits. In other respects, the circuits are similar to those of route ID.

Circuits for Route 2D

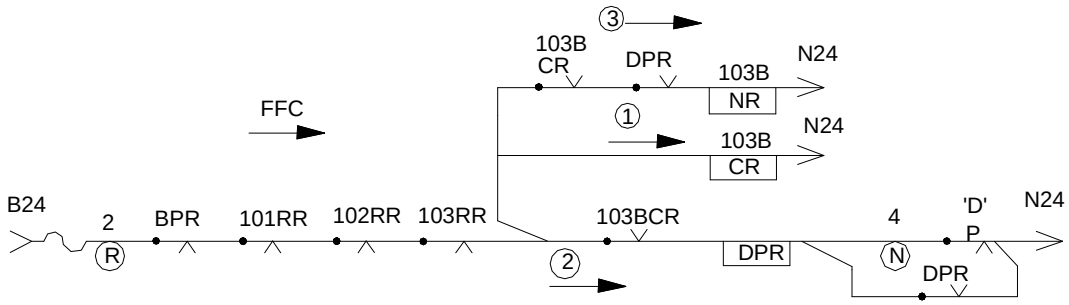


Fig No : 5.7 (a)

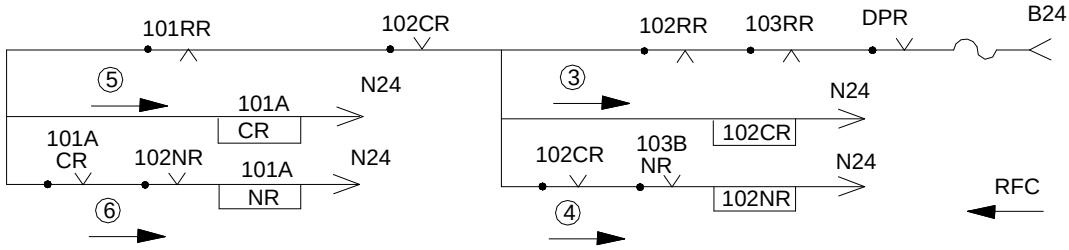


Fig No : 5.7 (b)

Figure 5.8(a) and 5.8(b) are the circuits for route 4B. The circuits for route 2D and its directly opposite route 4B are combined and given in figures 5.9(a) and 5.9(b).

Circuits for Route 4B

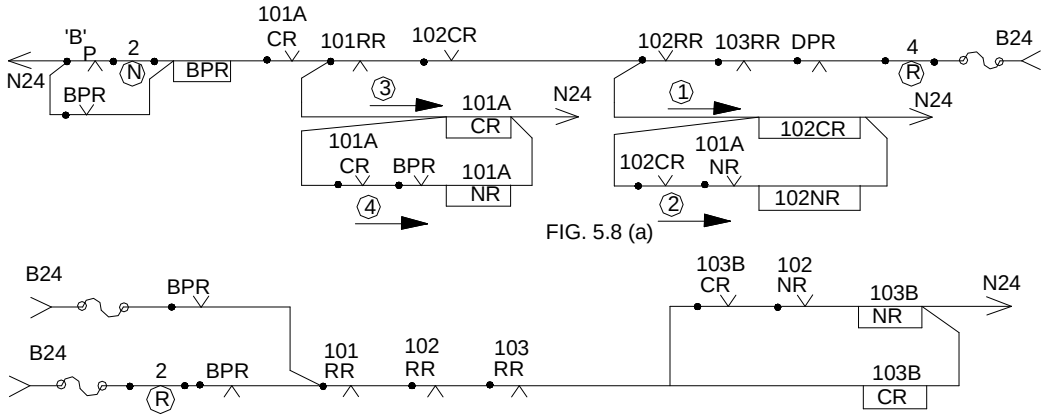


FIG. 5.8 (a)

Fig : 5.8 (b)

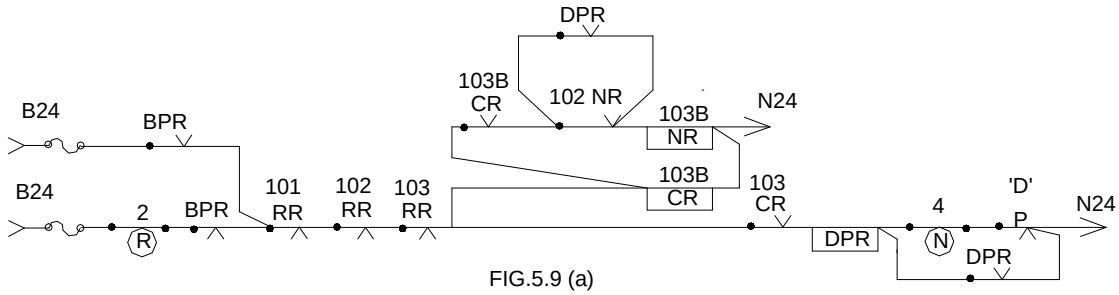


FIG.5.9 (a)

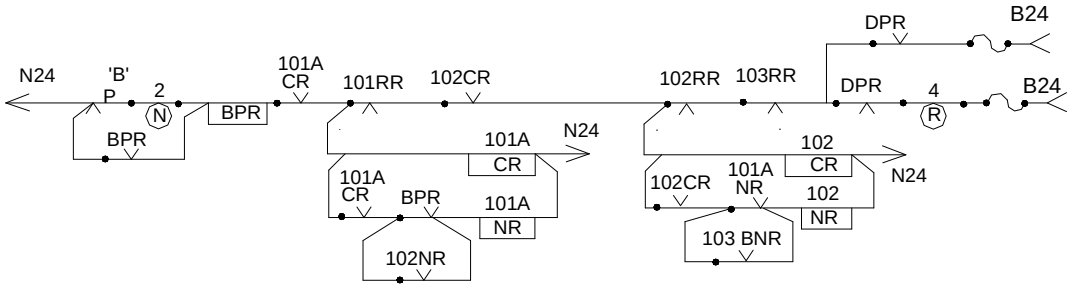


Fig No 5. 9 (b)

To illustrate the principle of grouping the circuits of different routes the combined circuits of all the 4 routes discussed above is shown in figures 5.10(a) and 5.10(b). Thus the route selection circuits of the entire yard can be combined to form one forward flow circuit and one return flow circuit, to achieve the necessary interlocking using the least number of relay contacts. The circuits are also easy to design.

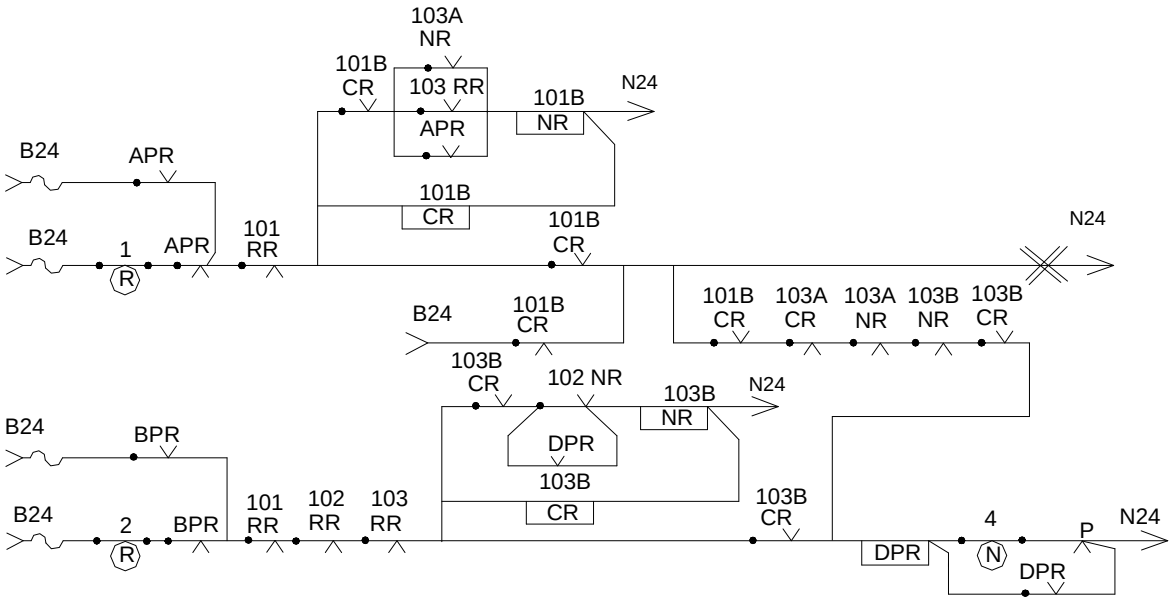


Fig No.5.10 (a)

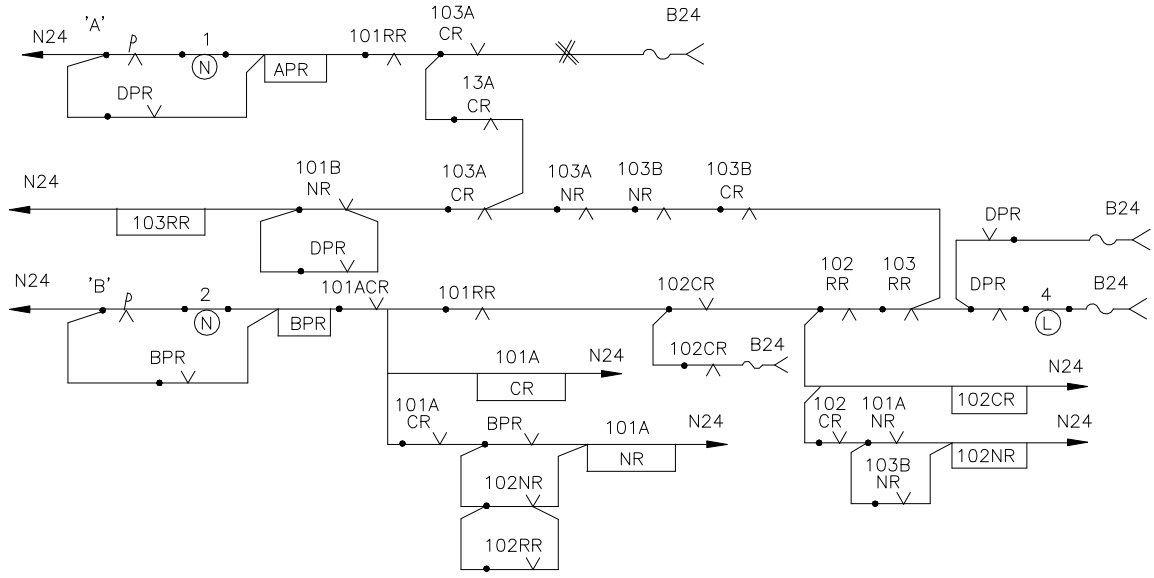


Fig No.5.10 (b)

The UCR and HR circuits are also generally drawn in the geographical manner for economy.

The layout given at Fig.5.2 (a) has shunt signals only and hence, setting and holding of overlap points is not required and thus not shown.

But in practice, setting of overlap points and holding them play key role. Let us consider the yard given in Fig no. 5.11. It is necessary to achieve locking between signals, set and hold the overlap points. The requirement of overlap differs for main, shunt and calling-on signals.

Lets us know about the necessity and function of relays associated with point circuits in system – II

5.2 Checking Relay (CR)

It checks whether the complete route is free or not. It also checks whether trailing points in forward flow and return flow circuit are free and normal.

These are the following conditions under which this CR relay is energised.
It picks up when a route is initiated and proving that :-

a) Points are in normal position i.e., RR down.
b) For trailing points CR picks up during forward flow. For facing points CR picks up during reverse flow (for A end ACR, B end BCR and so on.)

The function of this relay is to select the Straight route when it is energised and Diverging route when it is not energised or to prove that the point is not used in reverse position.

This relay is energised either in the forward flow or in return flow depending up on the position of the point in the route initiated. This relay prevents conflicting route initiation (by using back contact of CR in conflicting route relay circuit in the forward flow).
This relay proves that points are free and not used by any route (by picking up of route relay UR concerned). This relay prepares the circuit for normal relay (NR). This relay proves that points are not used in reverse (by proving reverse relay back contacts i.e, RR)

5.3 Normal Relay (NR): (for setting the point to normal.)

This relay picks-up when :

(a) concerned checking relay (CR) is energised.
(b) Route button relay picked up or
(c) Adjacent point normal relay or reverse relay is energised for successive operation..
(d) Concerned reverse relay (RR) back contact to prove this point is not used in reverse by any other route.

NR picks up only after CR is energised & controls WNR relay.

5.4 Reverse Relay (RR): (for setting the point to reverse.)

This relay picks-up when:

(a) The route button relay is energised.
(b) Concerned NR & CR back contacts.
(c) This relay picks up in succession by the

(i) Route button relay or
(ii) Adjacent point normal relay (NR) or
(iii) Adjacent point reverse relay (RR)

Only one RR is used irrespective of Double end or single end points.

5.5 Route Button Relays UR

All the berthing tracks are provided with route button which is also called exit button. When this is pressed, proving other conditions a relay picks up called UR. For Right side movement RUR and for left side movement LUR, followed by the Route alphabet.

For example ‘A’ RUR/ ‘A’ LUR- A stands for the A route button, 'R' for right, L for left, U for route and R for relay.

The route relay contacts used in the flow circuit, if back contacts are used it is for conflicting route, if pick up contacts are used it is to start the return flow circuit.

When this route relay (UR) energises, it completes the circuit for NR or RR for the first point in the return circuit.

5.6 Special Relay ZR:

To differentiate and to achieve the locking between main signal, calling-on signal and shunt signal there is a special relay called ZR. For each signal route initiating circuit, one ZR is used. They are:-

R/L ZR. for main signal	R for Right
R/L COZR for calling-on Signal	L for Left
R/L SHZR for shunt signal	M for Mn. signal
	Calling-on
	SH Shunt Signal

5.7 OVERLAP RELAYS

In system II separate overlap setting relays are to be provided for all home signal route, as the route initiation circuit is common for home and shunt signal.

Once Route Relay UR picks up, it operates the overlap setting relays. In overlap setting relays also, left, right movements and main signal shunt signal movement can be separately provided to differentiate between main signal only, shunt signal and calling-on signal and for overlap setting & locking. These overlap relays are called as OCRs.

ROCR & LOCR	Right, left overlap checking relay for main signal.
ROCR–C & LOCR - C	Right & left overlap checking relays for calling-on signal.
RSHOCR & LSHOCR	Right & Left overlap checking relays for shunt signal.
OCR1	Controls WLR/WNR if the overlap point is required normal.
OCR2	Controls WLR/WRR if the overlap point is required in reverse condition.

If there is alternate overlap OCR1 Controls WLR/WNR, for normal OCR2 controls WLR/WRR, for reverse.

The conditions to pickup OCR relay are

(a) Concerned signal knob is operated. LR up

(b) Concerned route relay is energised UR up

(c) The ANR or BNR or RR relay of all the points required to be operated either to normal or to reverse in the that particular signal route are energised that means OCR before picking up ensures points in the route are set.

(d) When required conflicting route relay back contacts are proved in OCR circuit.

5.8 Successive Operation of Points

In system II all the points in the route are not switched on at a time. They are made to switch on in succession. First the NR/RR of last point in the route picks up then the next point NR/RR will pick up and so on. As soon as NR/RR picks up, the point starts operating. The staggering in the picking up of NR/RR as explained above, makes the staggering for point operation switching also. This will reduce the instant heavy battery drain. (This is equivalent to chain group of Siemen's System.)

(a) First point in Return flow circuit either NR or RR is controlled by Route button relay (UR).

(b) Second point NR/RR is controlled by NR/RR of the first point, then third point NR/RR is controlled by the second point NR/RR and continues so till the first point NR/RR in the forward flow circuit is picked up. Push button relay contact is used in absence of point ahead.

The model circuits for the yard given at Fig no 5.11 are given in the next pages: -

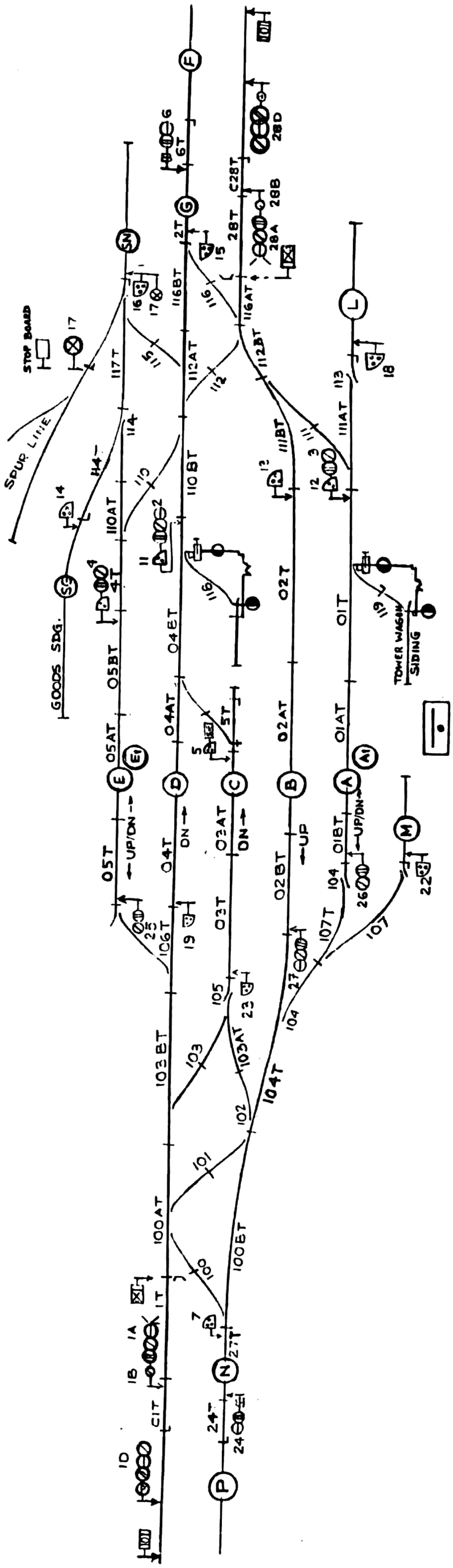


Fig No : 5. 11

5.9 Overlap Holding Relays OHR

Every route will have a overlap holding relay depending upon direction of the movement. For example, if ‘A’ route train moves to the left side, ALOHR. If it is to right side - AR0HR. This relay proves that points are not held by the concerned overlap for the route set. 'This relay picks up when: a) concerned route is not locked. i.e,. ASR is up, b) last route section in the route is not locked i.e,. last TRSR up or TLSR up of the route, c) It is held through its own stick path by-passing the last route section lock relay contacts.

The pick up contacts are used in conflicting UCR circuit where required and in point control circuit WLR and front contact in conflicting HR & back contact for same route HR circuit.

The first relay to pickup after the route initiation i.e., pressing the route button and turning the signal knob is Route Initiating Relay (LR)

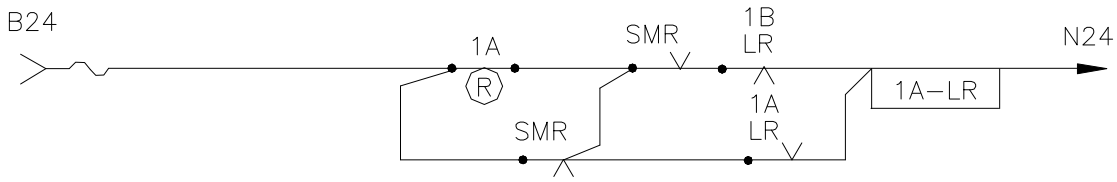
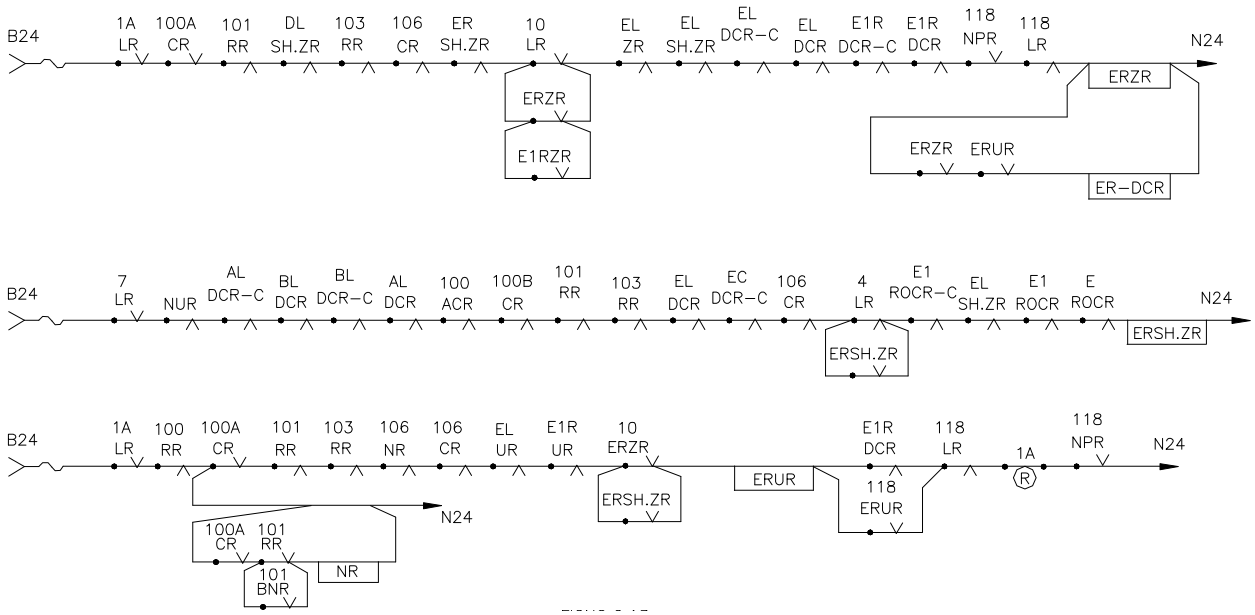


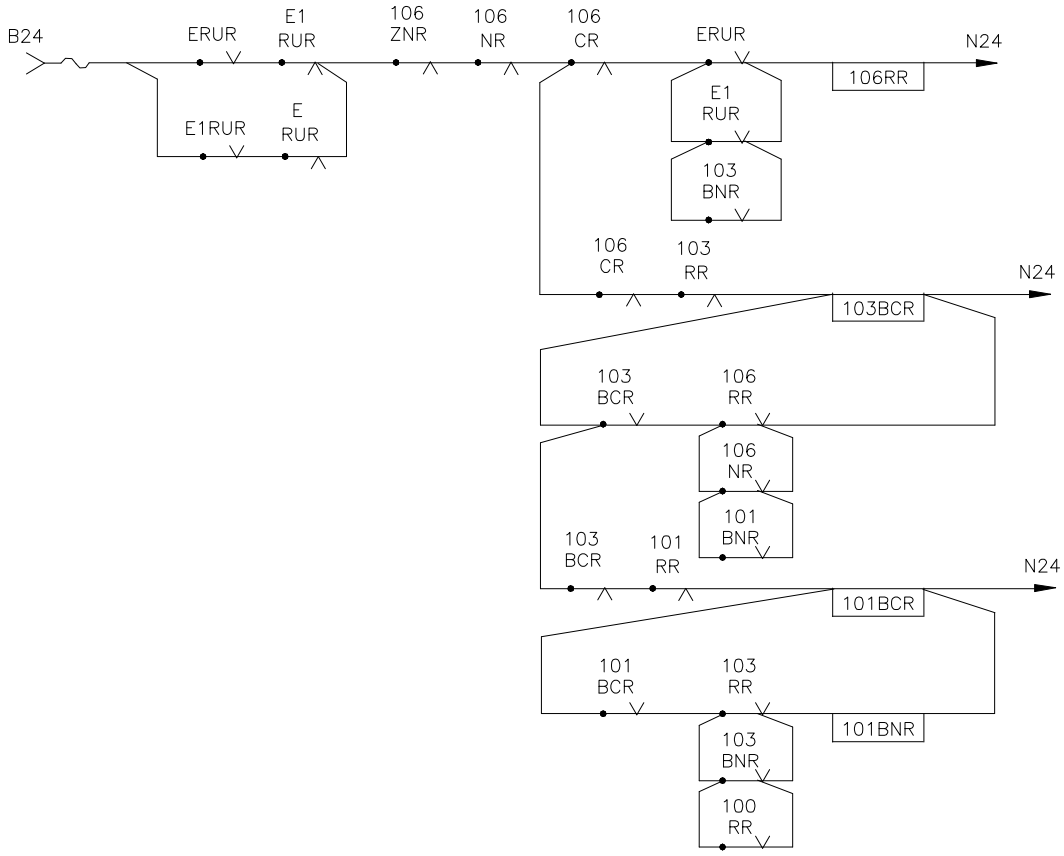
Fig No : 5. 12 a

The picking-up of LR picks-up ERZR proving normal position of conflicting signal and initiates the ‘Forward flow’ circuit and picks-up the route relay for which the route button is pressed say ERUR, through front contact of ERZR



FORWARD FLOW CIRCUIT

Fig No: 5.12 (b)



RETURN CIRCUIT
Fig No : 5.12 (c)

After ERUR picking-up, EROCR (overlap checking relay of E route right-ward movement) picks-up.

The ANR/BNR of concerned point sets the point to normal and RR sets the point to Reverse according to the relay picked-up. The EROCR sets the points in the overlap to required position.

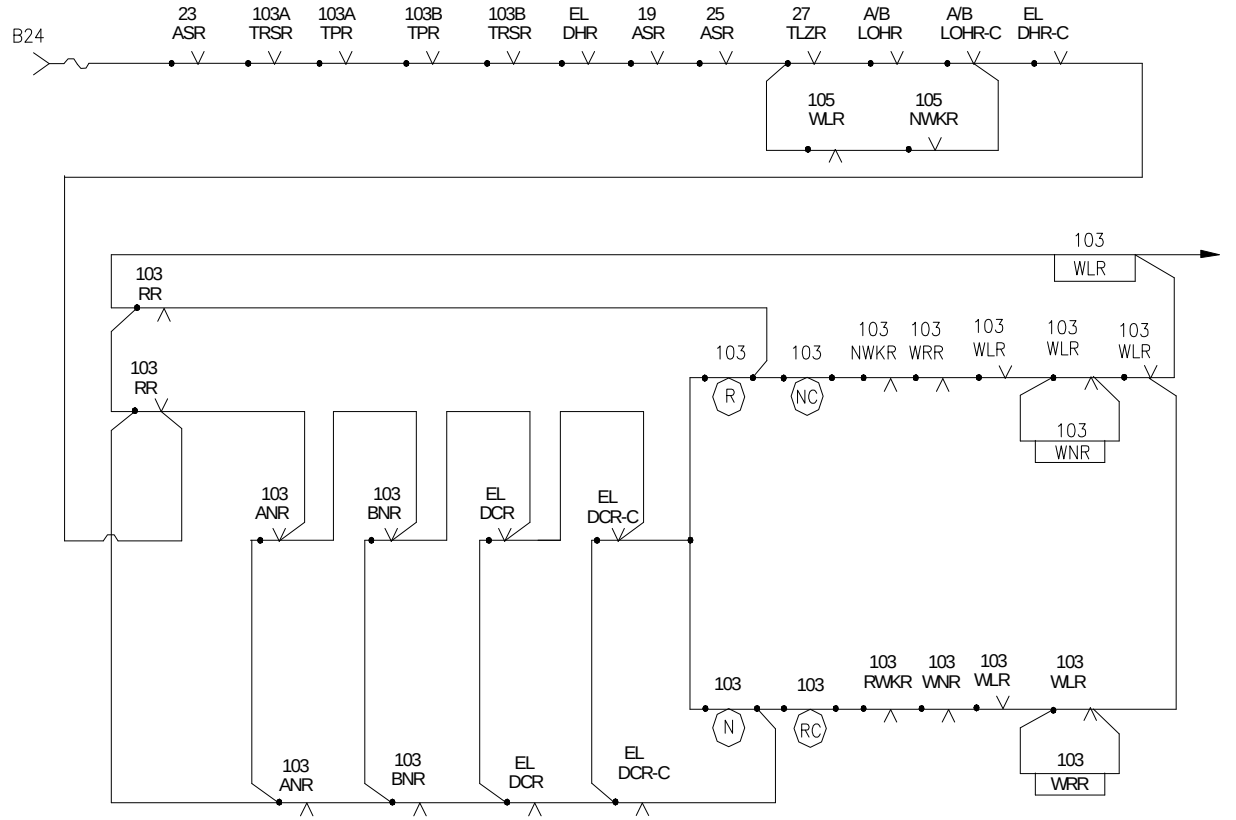


Fig No : 5.12 (d)

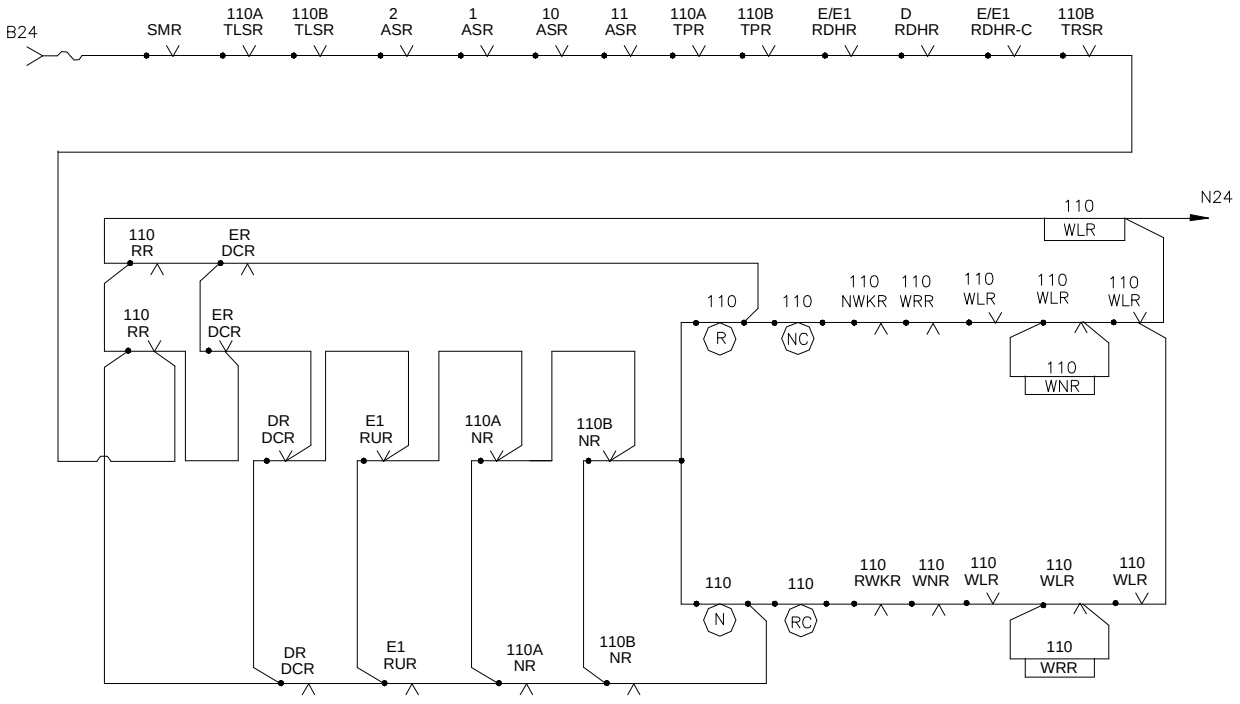


Fig No: 5.12 (e)

Overlap holding relay (OHR): The overlap holding relay picks-up through the concerned signal ASR pick-up contact and the last directional relay in the route of the signal i.e., 106 TRSR and holds through its own contact by-passing 106 TRSR.

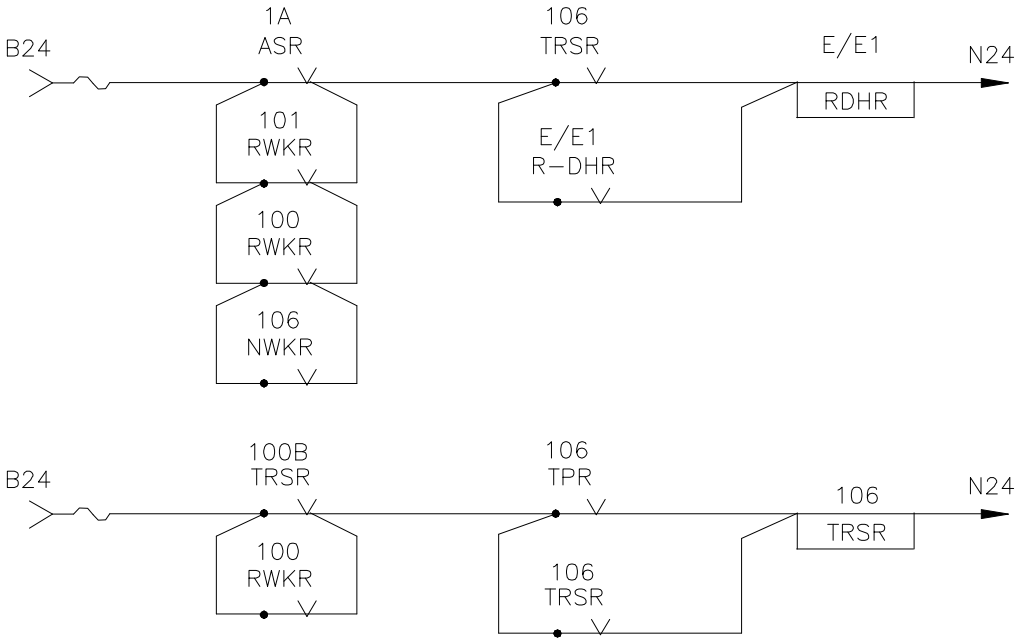


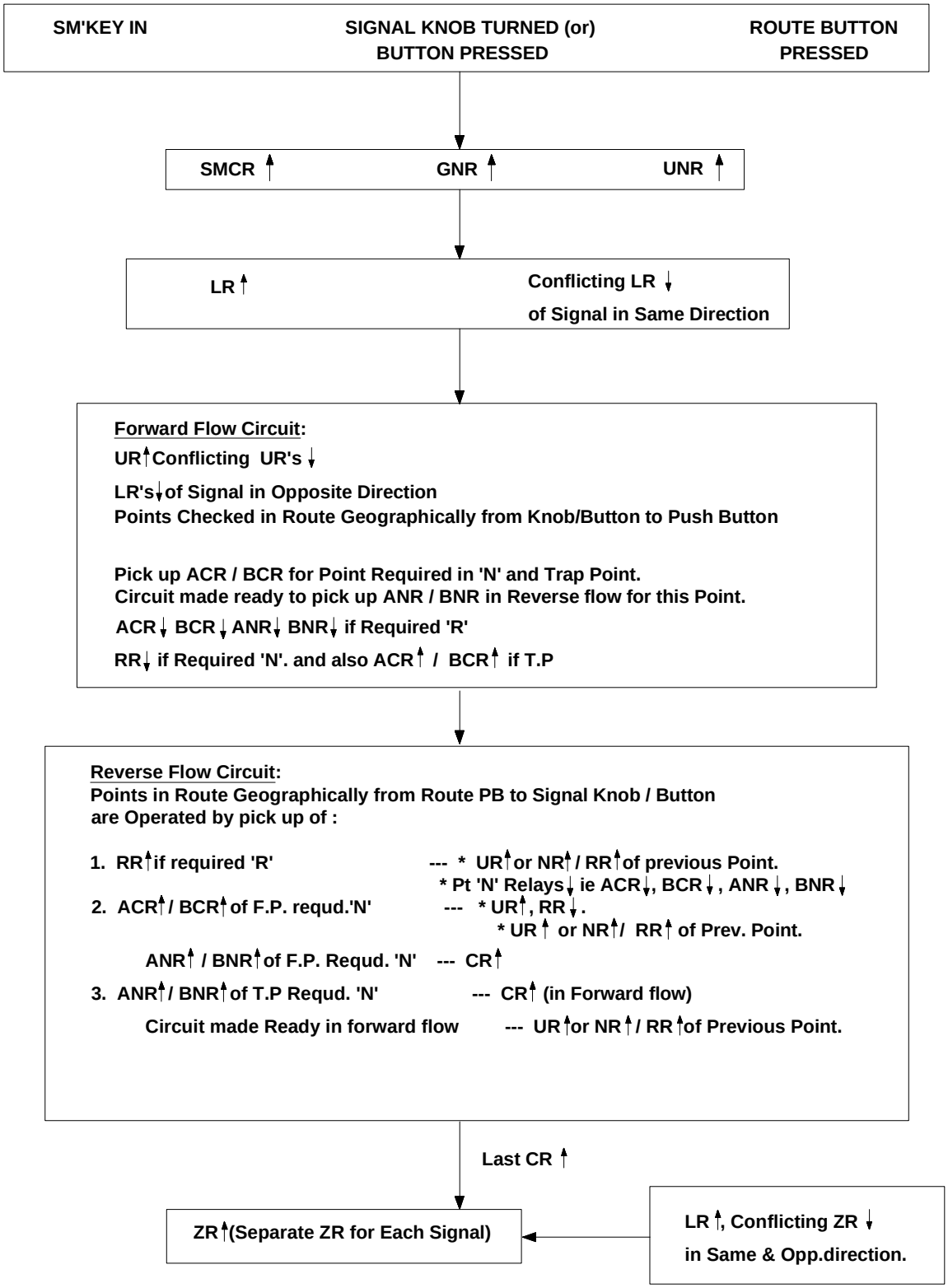
Fig No : 5.12 (f)

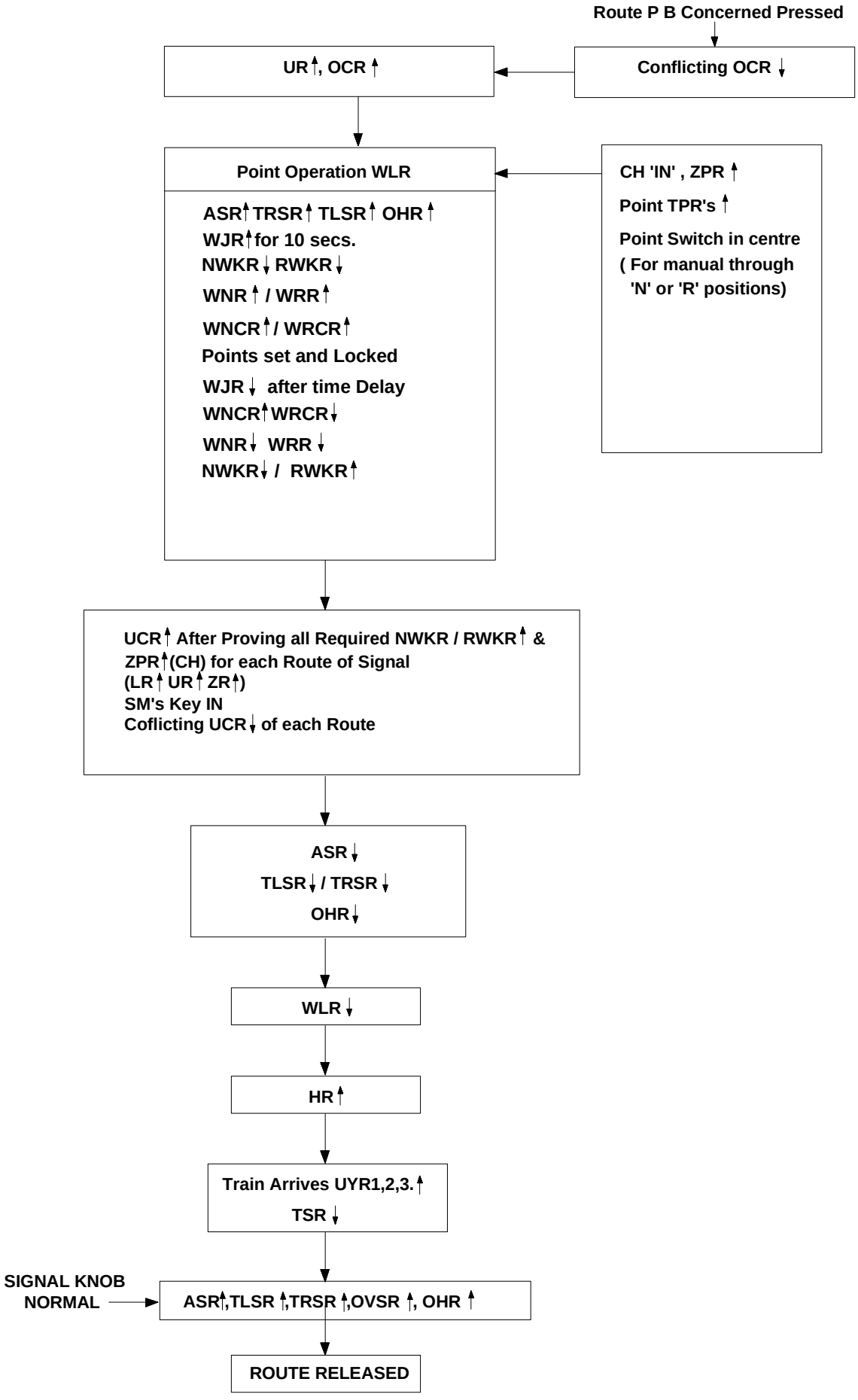
This OHR pick-up contact is proved in all the point WLR circuits in the overlap of signal No.1A i.e., points No. 110, 112W110R, 114, 115W 110R, 116W110R thereby locking these points in case signal No. 1A is taken off to route E

The ASR, TSR circuits are same as in system 1

RELAY INTERLOCKING (BRITISH) - SYSTEM II - BLOCK DIAGRAM

SETTING OF ROUTE, LOCKING AND SIGNAL CLEARANCE




Route P B Concerned Pressed
UR ↑, OCR ↑
Conflicting OCR ↓
Point Operation WLR
ASR ↑ TRSR ↑ TLSR ↑ OHR ↑
WJR ↑ for 10 secs.
NWKR ↓ RWKR ↓
WNR ↑ / WRR ↑
WNCR ↑ / WRCR ↑
Points set and Locked
WJR ↓ after time Delay
WNCR ↑ WRCR ↓
WNR ↓ WRR ↓
NWKR ↓ / RWKR ↑
CH 'IN' , ZPR ↑
Point TPR's ↑
Point Switch in centre
(For manual through
'N' or 'R' positions)
UCR ↑ After Proving all Required NWKR / RWKR ↑ &
ZPR ↑ (CH) for each Route of Signal
(LR ↑ UR ↑ ZR ↑)
SM's Key IN
Coflicting UCR ↓ of each Route
ASR ↓
TLSR ↓ / TRSR ↓
OHR ↓
WLR ↓
HR ↑
Train Arrives UYR1,2,3. ↑
TSR ↓
SIGNAL KNOB
NORMAL
ASR ↑,TLSR ↑,TRSR ↑,OVSR ↑, OHR ↑
ROUTE RELEASED

CHAPTER 6: INSTALLATION, TESTING & COMMISSIONING OF R.I

6.1 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.

6.2 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.

6.3 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.

6.4 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.

6.5 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.

6.6 Testing of individual apparatus

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

6.7 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 Signalling Plan.

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

6.8 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.

6.9 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.

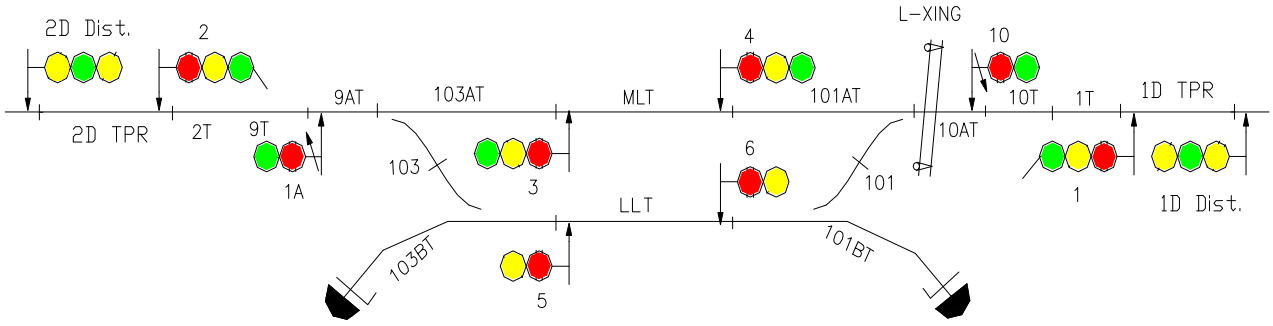


Fig No : 6.1

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.

6.10.1 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.

6.10.2 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.

6.10.3 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.*

6.10.4 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.

6.10.5 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.

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

6.10.7 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.

6.10.8 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.

6.10.10 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.

6.11 SELECTION TESTING OF PI / RRI

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

6.11.1 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.

6.11.2 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.

6.11.3 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.

6.11.4 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.

(o) As a part of whole system, the Block Working shall also be checked as per existing system of Block Working in conjunction with panel working.

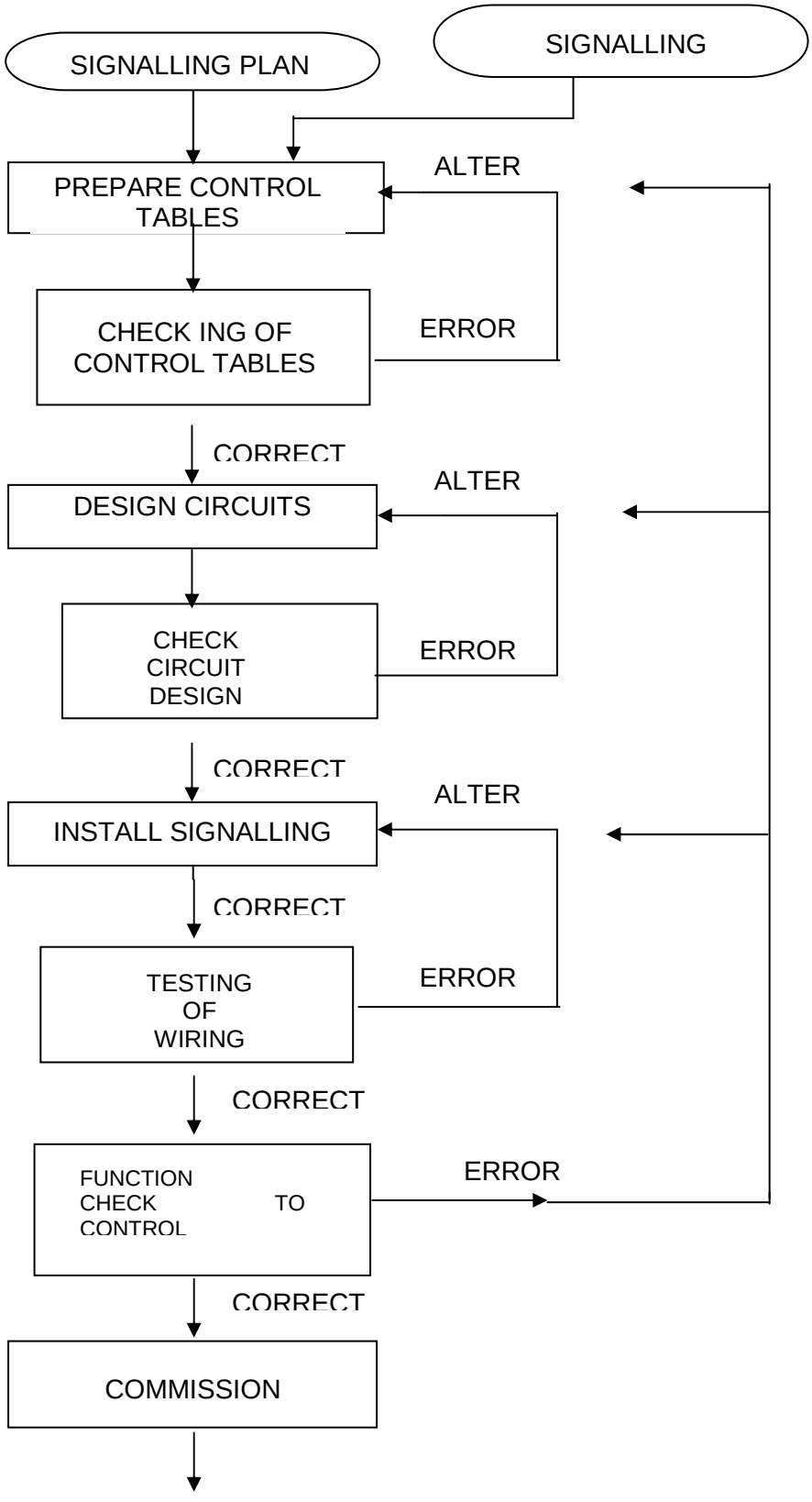


Fig No: 6.2

6.12 SUMMARY OF TESTING OF ELECTRICAL SIGNALLING CIRCUITS

(a) Physical Inspection of the Installation (Once in a year or earlier)

(i) The works has been carried out as per approved plans.

(ii) No Deviation from SEM, G&SR and other safety manuals.

(iii) No Infringements to Schedule of dimensions.

(iv) All the apparatus required as per approved plans, the apparatus is of approved type and specification.

(v) The number of wires terminated on each terminal or relay terminal boards or other devices are counted.

(vi) The lightening arresters are properly connected and earthed.

(vii) All other equipments in AC electrified areas are properly earthed and suitably immunized.

(viii) No equipment is due for overhauling.

(ix) Wiring shall be carried out as per approved wiring diagram.

(x) Insulation testing, continuity testing, wire count test shall also be done.

(xi) Simulation test shall be conducted.

(xii) Fuses with proper rating and type are used for all equipments and circuits.

(b) System / Operational testing of Installation (Once in 3 years or earlier)

These tests shall be carried out against approved selection table / Control Table / Route chart and Signalling plan.

(a) Signal Control Circuits:

The signal for a particular route has been cleared, each point detection relay controlling the signal shall be dropped by de-energising point detection relays track circuits, and other relays controlling this route at site. The signal should go back to 'ON' and resume 'OFF' when the relay is energized. In case of TSR controlling track circuit, the signal shall not resume 'OFF' till it is taken off again freshly.

(b) Approach Locking:

Each track circuit controlling the approach locking shall be de-energized, alter the route under test to set up conflicting route.

(c) Route Release :

(i) 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 should be released only after the next track circuit has also dropped and picked up.

(iii) The route shall be released after prescribed time delay to be effective after the concerned track circuits has been occupied and cleared.

(d) Time release:

Time release 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. Overlap time release also to be checked to ensure that timer starts only after previous route is released and berthing track is occupied.

(e) Dead Approach Lock:

When there is no track circuit in rear of a signal , ensure that the route gets released only after a certain time lapse after the signal has been put back to ‘ON’ and cancellation is initiated.

(f) Signal Indication circuits:

Each aspect shall be checked for its correspondence with the aspect displayed at the site and corresponding indication on panel. Ensure proper functioning of lamp failure circuit and buzzers.

(g) Point controlling circuits:

Each track circuit controlling the point shall be individually shunted in turn and operation of points to normal position shall be attempted. 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 energized and the feed to the motor is cut off immediately. 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.

(h) Point indication circuit:

The indication of the point on the panel shall be checked for correspondence with the position of the point 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 indications in the panel are extinguished.

(i) Crank Handle Interlocking:

It shall be checked that when the crank handle is removed from its normal position in electric key transmitter or 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 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 or other approved relay interlocking arrangement.

(j) Testing of Track Circuit:

Installation and testing of track circuits shall be done as per track circuit parameters and record the observations.

Precautions During test:

(a) No Signal Taken “OFF” for a train movement is thrown to “ON” in the face of the train.
(b) No Signal which will create a conflicting or unsafe movement is taken “OFF”
(c) No point and isolation in a route set for a train movement is disturbed.
(d) No track relay of an occupied track circuit is energized.
(e) No voltage higher than permissible voltage is applied to the equipment.
(f) There should be no risk of electric shock to testing or operating personnel.

CHAPTER 7: SPECIFICATION OF RELAY INTERLOCKING (IRS-S36-87/96)

REQUIREMENTS OF RELAY INTERLOCKING INSTALLATIONS
(Including Amendment 1 of June/96, Amendment 2 of may/97)

1.0 SCOPE

1.1 This specification lays down the minimum requirements of general design, performance and electrical circuits etc, to ensure the required amount of safety. In relay interlocking installations. The installations can be of:

(a) Route setting type by entry/exit. (NX-System – RRI's)
(b) Non-Route setting type i.e., Route is set with individual operation of points. (PI's)

1.2 The equipment used in the system shall, as far as practicable, comply with the requirements of IRS, IS, BRS and BS specifications and drawing laid down in the various clauses given below. Wherever specifications and drawings have not been given, the material and equipment shall conform to the specifications given by the railways.

1.3 For areas having 25 KV AC traction, all equipments and circuitry shall comply to the requirements as per approved Railway Electrification Practice.

2.0 GENERAL REQUIREMENTS

2.1 The signalling and interlocking arrangements for the yard shall be in accordance with the signalling plan and selection (control) tables.

2.2 The system and equipment used shall fully comply with the requirements laid down in the Signal Engineering Manual.

2.3 The system as a whole be so designed that the system functioning is reliable under the conditions as specified by the railways.

2.4 Detailed wiring diagrams including control panel diagrams, Route control chart, Cable diagrams, track bonding diagrams, Relay contact analysis, Relay rack arrangement, Terminal charts, Fuse charts, Power supply arrangements shall be supplied by the supplier. Any special technical literature required by the railways shall also be provided.

3.0 CONTROL PANEL

3.1 The reproduction of the layout on the front of the panel referred to as the illustrated diagrams shall be well proportioned. The areas covered by each track circuit shall be clearly distinguished (with different colours).

3.2 The illustrated diagram shall be so mounted as to be conveniently viable to the operator. The control panel shall be easily accessible for operation. The inside wiring, etc, should be such that it is easily accessible for maintenance staff.

3.3 The operating members, namely switches/buttons, etc, referred to in the following clauses shall normally be provided on the illuminated diagram itself. In geographical order unless a separate illuminated diagram and 'Console' containing all the operating members are specially asked for.

3.4 The Route setting shall be on the basis of 'Entrance - Exit' Principle for installations provided with route setting facility.

3.4.1 In Non-Rote setting type installations, the route may be set with individual operation of points.

3.5 In route setting system, each route shall be controlled either by means of Two Push buttons – One at the Entrance and the other at the exit of the route concerned or by means of One switch at the Entrance and one push button at the exit of the route. The entrance switch/button shall be of two position type as required.

3.5.1 In Non-route setting type installations, after setting the route by individual operation of points is completed, signal can be cleared by individual push button in conjunction with a group button or by an individual switch controlling each signal or one push button at the entrance and the other at the exit end.

3.6 Individual push button in conjunction with a common push button or two/three position switches, shall be provided for individual operation of points.

3.7 Where a route has more than one overlap it shall be possible to select and set the desired overlap beyond the exit signal of the route.

3.7.1 Where the route has alternate approach routes, it shall be possible to select and set the desired route with desired overlap.

3.8 The switches /Buttons shall have distinctive colours so that they can be readily distinguished, such as running signal RED, shunt signal YELLOW, calling-on signal RED with WHITE dot, Exit button white, etc.

3.9 The control panel shall be provided with suitable covers with locking and sealing facility, which shall be easily removable to facilitate access to the internal wiring, etc.

3.10 The control panel shall be provided with suitable controls as that :-

3.10.1 The points can be operated individually.

3.10.2 Approach locking or time release locking shall be provided .

3.10.3 Provision shall be made for emergency operation of points during point track circuit failure. Emergency group point button, for such operation must be kept normally sealed. Each such individual operation shall be recorded on a suitable electric counter.

3.10.4 It shall be possible to switch over from manual control to automatic working for the routes specified by the Railways.

3.10.5 Necessary slotting facilities for adjacent cabins panels, ground –frames, level crossings and crank handle, etc, are available.

Slot shall be controlled by operation of two buttons or a switch similar to route setting principle for individual line. For cancellation of slot, a group slot cancellation button to be operated along with entrance/exit button shall be provided. Where switch is provided , the switch shall be normalized and the common slot cancellation button shall be pressed. Each such cancellation should be effective after a pre determined time delay as specified by the railway and each cancellation must be recorded in the counter specially provided for this purpose.

3.10.6 The supply voltage for panel indication circuit can be adjusted to control the intensity of illumination by selecting different supply voltages with the help of button/switches provided on the panel, if required by the railways.

3.10.7 Suitable control to select the power supply from Mains/DG set/ catenary 1 or 2 shall be provided on control panel.

3.10.8 SM's lock up key shall be provided in the control panel. When SM's key is taken out, all points shall remain in- operative and signals except those that have been operated shall also are in-operative. It shall be possible to put back any signal to danger in case of emergency but no route can be altered.

3.10.9 An indication Panel giving position of the yard and important indications required for maintenance staff shall be provided inside the relay room in major yards, if required by the railways.

3.11 CONTROL PANEL INDICATIONS

The control panel shall be provided with the following indications:-

3.11.1 POINT INDICATIONS

3.11.1.1 The position of the points shall be indicated either by white (for normal) and green (for reverse) lights near each individual point switch/button or by white strip light on the leg of the point switch. During operation of the points, the light/strip light of the intended position (desired) will flash till points are correctly set and locked. If the points do not set within the predetermined time, a warning bell will sound which can be stopped by acknowledging the same and flashing indication on the point will continue till the defect is put right.

3.11.1.2 The point locked indication in route shall be given by illumination of a small red/white light near the point or points switch/button which shall be extinguished when the point is free. Where required by the railways, point free indication shall also be provided.

3.11.2 ROUTE INDICATIONS

3.11.2.1 Route indication lamps shall be provided to indicate setting and locking of the route, when any route is not set, route indication lamps shall be extinguished

3.11.2.2 The complete route over which the movement is to take place shall be lit with a row of white lights when the route is correctly set and locked. Few selected or first track circuit indication lights of the concerned route in advance of the signal at the entrance shall flash from the time the route is initiated till the route is correctly set and locked if required by the railways.

3.11.2.3 As the train moves over the route, the portion of the route occupied shall change to RED and after the train has cleared the particular track, it should change back to white lights until the sectional route, entire route is released, when the white light is extinguished.

3.11.3 SIGNAL INDICATION

3.11.3.1 Indication that a stop signal is at 'ON' shall be given by a RED light and a permissive signal is at 'ON' shall be given by a yellow light on the corresponding signal symbols on the panel.

3.11.3.2 Indication that Stop/Permissive signal is 'OFF' shall be given normally by a green, Yellow or double yellow light as signal is seen in the field on the corresponding signal symbol on the panel. How ever in case of a Domino Panel any 'OFF' can be shown by Green along with the following flashing indications for the conditions as enumerated below.

(a) Failure of Green, Green only flashes, Red off.
(b) Failure of Yellow, Green flashes, red on and Steady
(c) Failure of double yellow, Both green and red flasher
(d) Failure of red, * green not lit, red on and flashing

* To be read as yellow for a permissive signal

3.11.3.3 Indication for 'OFF' aspect of a shunt signal on the same post as the running signal, is not required. In the case of shunt signal on independent post, the 'ON' indication shall be given by a white light strip or two miniature white lights in a horizontal position on the corresponding shunt signal symbol on the panel.

3.11.3.4 Signal indication for 'OFF' aspect of the shunt signal shall be given by a slanting white light strip or two miniature slanting white lights. Such indication of a shunt signal located on the same post as a running signal shall be given below the running signal indication.

3.11.3.5 A white light for 'A' / 'AG' Marker indication should be lit up on the panel below the symbol of the signal indication set for automatic working.

3.11.3.6 Indication that 'calling-on' signal is 'OFF' shall be given by a white light below the running signal indication of corresponding signal symbol.

3.11.3.7 Route indication shall be provided by a white strip light which should be lit when route indicator has displayed 'OFF' aspect by a white strip over the running signal symbol on the panel if required by the railways.

3.11.4 TRACK CIRCUIT INDICATIONS

3.11.4.1 Indication that the track circuit is occupied shall be given by a row of red lights (not less than two) on the each track circuit.

3.11.4.2 When the track circuit is not occupied, (ie, clear) the red lights shall be extinguished.

3.11.5 POWER SUPPLY INDICATIONS

3.11.5.1 A meter shall be provided on the control panel for indicating supply voltage, if required by the railways.

3.11.5.2 An introduction to indicate the availability of the supply from the Main/Diesel Generator/Catenary one or two should be indicated on the panel.

3.11.6 OTHER INDICATIONS

3.11.6.1 Approach track circuits where provided, for all directions shall be indicated on illuminated diagram. In continuous track circuit territory, the approach track circuits will cover all the track circuits in rear of the first stop signal upto the next signal in rear or upto the track circuit specified in the table of control for approach locking. An approach track circuit-controlling calling-on signal shall be indicated separately with a distinct mark.

3.11.6.2 Advance, approach warning of trains if required shall be indicated on the panel in the form of flashing lights or other type of indication as specified by the railways and audible bell warning to attract attention of panel operator. These visual and audible warnings shall be stop as soon as the approach track circuits mentioned in clause 3.11.6.1 above are occupied or signals are taken 'OFF' for the train. It shall be possible to silence the audible warning by pressing a push button. This cancellation shall not apply to train approaching subsequently for which the push button must be pressed again.

3.11.6.3 Where required by the railways failure of a signal lamp/route lamp shall light a red lamp on the panel and also will give an audible warning for the same. Such indication may cover group of signals. A common audible warning can also be provided for a group of signals. It shall be possible to silence the audible warning by pressing a push button. Such cancellation of audible warning shall not apply to subsequent failures for which the push button must be pressed again.

3.11.6.4 A white lamp indication showing that the crank handle is free and a red indication showing that the crank handle is in the locked position shall be provided on the control panel near the crank handle control transfer switch/button.

3.11.6.5 A white lamp indication shall be provided when an emergency route cancellation is initiated in approach lock conditions of route. This indication will be lit up after the schedule time – lapse and will go 'OFF' after the cancellation of the route.

3.11.6.6 If two position type push buttons are used on control panel a buzzer to indicate that push button/ push buttons has/have been left pressed may be provided.

3.11.6.7 Indications for slots. Gates control etc shall be provided as required by the railways.

3.11.6.8 Return wires from indication lamps and relays shall be suitably bifurcated so that excessive current does not damage it. Any break in return wire shall net fail the indication/relay or give a wrong indication or pick-up a wrong relay.

3.11.6.9 The panel indication lamps shall be operated by not more than 24v miniature bulbs or LED's.

3.11.6.10 When electronic flashes relay is provided, a flasher white indication shall be provided to indicate that it is working satisfactorily.

4.0 INTERLOCKING AND CIRCUIT REQUIREMENTS

4.1 General Circuits Requirements –

4.1.1 The wiring diagram shall be drawn using symbols either as per B.S. Specification No.376 or American/German symbols as required by the railways. The nomenclature of the symbols used shall be in accordance with British Specification and explanations of circuit if any, shall be given in English.

4.1.2 The circuit diagram, cable plans, control tables, equipment drawing etc shall be drawn up on A2 size polyester film for RRI's and A3 size polyester film for wayside PI's.

4.1.3 Before designing the detailed circuits, route and point control tables showing approach locks, back locking, releases overlaps, isolation, interlocking, dependence of signal aspect, grouping of crank handles and the condition for release of crank handles, etc shall be drawn up and approved by the railways.

4.1.4 If so specified, the internal circuits shall be suitably protected and electrically isolated from external circuits.

4.1.5 Signal circuits shall be so designed that the signal shall not change to a lesser restrictive aspect than intended one, and route shall not be released because of fluctuations in power supply voltage or when the supply resume following its failure.

4.1.6 Sequential operation of relay shall be proved in all cases when relays having metal to metal front contact (proved signalling relays) are used.

4.1.7 While designing signal circuits and equipment to be used in AC traction territory special precaution shall be taken and reference shall be made as per RE practices.

4.1.8 The battery or power supply for line circuits, shall be arranged at the end of the circuits farthest from the operated unit, Where it is not practicable, operate cable shall be provided for outgoing power supply.

4.1.9 Common Return – Common return shall not be provided in vital circuits.

4.1.10 All external safety circuits shall be in cables.

4.2 Route setting and interlocking circuits for installations provided with route setting system:-

4.2.1 The route setting and clearance of signal shall be achieved in following sequence :-

(a) Proving that interlocking is free.
(b) All points in the route, overlap and isolation are operated to the required position, locked and detected.
(c) The selected route, overlap and isolation is locked.
(d) Proving that the track circuits in the route upto the next signal and its overlap are clear.
(e) Proving that the crank handle for all the points in route, overlap and isolation are locked and their control is not released.
(f) That all interlocked level crossing gates are closed and locked against road traffic in the route and overlap, if any.
(g) Clearing of signals.

4.2.2 Route setting and interlocking in installations provided with non route setting system :-

Setting and locking of route and learning of signal shall include the following process:

(a) The points in the selected route and if required in overlap and isolation are operated to required position by individual operation of switches or push button in conjunction with group push button.
(b) Operation of entrance exit buttons/switches or one control switch clears the signal proving that

(i) The points in the required route including overlap and isolation if any set and detected.
(ii) That all the track circuits in route and overlap if any are clear.
(iii) That all interlocked level crossing gates are closed and locked against road traffic in the route and overlap if any are clear.
(iv) Proving that the crank handles for all the points in route, overlap and isolation are locked & their control is not released.
(v) Proving that the control key of the siding points, if any is locked & can not be released for shunting purposes etc.

Note: *For clearing calling-on signals proving of the track circuits in route and overlap is not needed, and the proving of points and L.C.gates in overlap is not needed. But the isolation points must be set, locked and detected in the required position. For clearing of shunt signals the proving of berthing track circuits, points & L.C. gates in overlap is not needed. This applies to both the systems having Route or non route setting facilities.*

4.2.3 The interlocking between conflicting routes shall be achieved through route interlocking circuits.

4.2.4 Pre-setting of conflicting routes shall not be possible under any circumstances.

4.2.5 Necessary approach and back lock of the signalled route shall become effective when all points concerned have taken up their final position but before the signal assumes `OFF' aspect or before the `A' marker is lit.

4.2.6 Approach locking or time locking (Dead approach Lock) shall be provided for all controlled signals and also for all electric locks provided on hand-operated points. Approach looking shall be continuously effective from the pre-determined point on approach of the signal. The distance from which the approach locking is effective depends upon speed, gradient, etc.

4.2.7 Where required, additional controls on level crossings, ground frames, cabins etc., shall be provided and these shall be suitably interlocked with the other conflicting routes in accordance with details given by the railways.

4.2.8 A white indication for block control on the last stop signal should be provided on control panel, where section ahead is worked on Absolute Block System.

4.3 Route Release Circuits :

4.3.1 Complete route release including overlap shall be effective only after the signal governing the route is put back to `ON' and corresponding route switch/button has been operated to normalize the route; unless automatic route release by the passage of train is specially asked for. Complete release of route through sectional route release may be provided if asked for by the railways.

4.3.2 Where a route has got number of route sections, the circuit shall be so designed that the route section does not release only by picking up of the concerned track relay. Same is released only after the next track circuit is also dropped and picked up, except in case when the last track is a berthing track. In cases where the route is controlled by single track circuit the route release shall be controlled after pre-determined time delay.

4.3.3 The route release circuit shall be so designed that it will release only when at least two track circuits drop and pick-up in sequence.

4.3.4 In installations provided with route setting system, sectional route release shall be provided where required. In such cases sub-route section already released shall permit setting up of other routes, if interlocking otherwise permits.

4.3.4.1 In case of installation provided with non route setting system, sectional route release need not be provided unless specifically asked for by the railways. The complete route release shall be effective only after the signal governing the route is put back to `ON' and corresponding route switch/(button) has been operated to normalize the route.

However, for panels provided with such push buttons only, when sequence proving relays are provided to prove the authorized passage of a train then and only then, automatic route release shall be provided.

4.3.5 It shall be possible to release a route in emergency after suitable time delay, with the approach track occupied, provided the train has not passed the signal during the time interval.

4.3.5.1 It shall be possible to release a route in emergency after a suitable time delay where approach track circuits have not been provided and after the signal has been put back to danger provided the train has not passed the signal during this time interval.

4.3.5.2 When the route is released by the passage of train the overlap points shall be released only after the lapse of two minutes of occupation and clearance of last point track circuit of the route. On cancellation, the overlap points may be released simultaneously along with the main route.

4.3.6 Facility of emergency route/sub-route cancellation in case of track circuit failure, shall be provided, if required by the railways. Emergency cancellation of route/ sub-route shall be possible by co-operation of two persons, one representative of Signal Department and other from Traffic Department and every such cancellation shall be recorded on a counter.

4.4 Signal Control Circuits:

4.4.1 It shall not be possible for a signal to assume `OFF' aspect in installations provided with route setting facility unless the route switches/buttons have been operated and relevant route has been correctly set and locked and relevant track circuits are clear. In installations provided with non route setting facility the signal shall not assume `OFF' aspect unless the route is set and locked, relevant track circuits are clear and signal switch/button has been operated. In case self restoring type of push buttons are used, signal shall not assume `OFF' aspect unless push button is pressed and released.

4.4.2.0 Circuits shall be so designed that the failure of any part of a circuit affecting the control of the signal shall not cause the signal to display to more favourable indication than intended.

4.4.2.1 The circuit shall be so designed that in case of failure of a signal lamp, the lamp of lower aspect is lit automatically and in case of failure of red lamp it shall not be possible to clear the signal in rear.

4.4.3 Signal control circuits shall be so designed that each signal will display its most restrictive aspect when any of the following conditions are obtained in the section over which the signal reads i.e., up to the next signal and the overlap, if any:

(i) Occupancy by a train, engine vehicle or track circuit failure.
(ii) Where a point switch, if any, in the section is not properly set or facing points not properly closed and locked including correct position.
(iii) An interlocked level crossing gate, if any, not properly closed and locked including overlap.
(iv) Where an independently operated point or trap provided for isolation is not in the correct position.
(v) When crank handle control is released or crank handle has been taken out.
(vi) When the signal ahead is displaying none of its aspects and is blank.
(vii) When control key of the siding points, if any is released for shunting purposes.

***Note** : For `calling-on signals' Para 4.4.3 (i) will not apply and for shunt signals berthing tracks will not be included in the purview of para 4.4.3 (i).*

4.4.4 Fouling protection, approach locking, time locking, route locking, crank handle locking, route holding and track locking shall be incorporated in the relevant control circuits.

4.4.5 Each aspect light of a signal may be proved where necessary and the aspect indication shall be provided as needed.

4.4.6 Wherever required, necessary control on the level crossing, ground frames, cabins, siding control key, crank handles etc shall be provided.

4.5 Interlocking of level crossing gates:

It shall not be possible for a signal to assume `OFF' unless all interlocked level crossings in its route are closed and locked against the road traffic. Similarly, it shall not be possible to release any such interlocked gate until the signal is replaced to `ON' position and the route is released.

4.6 Point interlocking and control circuits:

4.6.1 The points once set shall remain in the last operated position until these are operated by different route setting or by individual operation of points.

4.6.2 Normally individual operation of points shall be possible only when the interlocking is free and relevant point track circuit is clear. In case of emergency when point zone track circuit fails, it shall be possible to operate the concerned point, provided interlocking is free by releasing an emergency control. Each such operation shall be recorded on a counter.

4.6.3 Interlocking between points shall be possible only to the minimum extent necessary.

4.6.4 Point control circuits shall be so designed that a cross connection or a short circuit can not operate a point or give a false indication of the same.

4.6.5 The correspondence of the point control relays and point indication relays shall be proved in signal circuits before the signal displays an `OFF' aspect.

4.6.6 Cross-overs shall be operated by separate point machines, one at each end, unless specified otherwise. The detection of setting and locking of the points at the two ends shall be connected in series.

4.6.7 Interlocking of Crank Handle

4.6.7.1 Crank handle/point NX key provided for manual operation of the points worked by electric point machine must be interlocked with signals.

4.6.7.2 It must not be possible to release the crank handle/Point NX key unless the signals have been put back to `ON' position and concerned route is released.

4.6.7.3 In major yard where number of points are more these points, should be grouped in different zones. The crank handle/Point NX key for each group of point machines should be so arranged that they can not be interchanged.

4.6.7.4 Emergency Release of Crank Handle :

However, if the route remains locked due to what so ever reason, it shall be possible to release the Crank Handle/Point NX key after a time delay of 120 seconds from the time the signals have been put back to `ON' position, at a station where Crank Handle is kept in location near the concerned points. In case of stations having Crank Handle in SM's office it shall be possible to release the Crank Handle as soon as the signal is put back to `ON' and Crank Handle release command is given.

4.6.8 Siding control key for manual operation of siding points lying on running lines, shall be so interlocked that it may not be possible to clear the signal leading over that line when the key is released for operating siding points for shunting purposes.

4.7 Cross Protection

4.7.1 For purely internal circuits including vital circuits, no double cutting or cross protection need be provided unless specifically required.

4.7.2 All equipments in external circuits shall be suitably protected from cross connections and rendered immune to false operating by stray currents.

5.0 Relays

5.1 The various types of relays used in relays interlocking systems shall comply with IRS Specification No.834 * and the requirements of one of the following specifications as applicable.

IRS-846	DC Neutral Line relays (proved type) for Railway Signalling. (Tentative)
IRS-853	Tractive Armature shelf type direct current neutral line relay (non proved type for Railway Signalling (Tentative).
IRS-854	Tractive armature, shelf type direct current neutral track relay (non-proved type) for Railway Signalling.
IRS-861	Fail safe type of Electronic time delay device for Railway Signalling (Tentative)
BS: 519	Tractive armature direct current neutral polar line relay for Railway Signalling.
BS:1659	Tractive armature direct current neutral track and line relays for Railway Signalling.
BS: 1745	Alternating current relays for Railway signalling: track relays (double-element; 2-position), line relays (single-element, 2-position).
BRS: 930	Miniature tractive armature, D.C. Neutral Line Relay, plug-in type for Railway signalling purpose.
BRS: 931	Miniature tractive armature, A.C. immune DC Neutral line relay, plug-in type for Railway Signalling purposes.
BRS:932A1	Miniature Tractive Armature, AC Immune D.C. Biased Neutral Line Relay, Plug-in type for Railway Signalling Purposes.
BRS:933A	Miniature Tractive Armature, A.C. Immune D.C. Slow, pick-up Neutral Line Relay, Plug-in-type for Railway Signalling, purposes.
BRS:934	Miniature Tractive Armature A.C. Immune D.C. Slow release Neutral Line Relay, Plut-in type for Railway Signalling, purposes.
BRS:935	Miniature Tractive Armature D.C. Magneticaly latobed Neutral Line Relay Plug-in type for Railway Signalling purposes.
BRS:937	Ministure D.C Neutral thermal time element relay, plug-in type for Railway Signalling purposes.
BRS:938A	Miniature Tractive Armature D.C. Neutral Track Relay plug-in type for Railway Signalling purposes.
BRS: 939A	Miniature tractive armature A.C. Immune D.C. Neutral track relay plug-in type for Railway Signalling purposes.
BRS:940	Miniature Tractive Armature DC single wound lamp roving relay plug-in type for Railway Signalling.
BRS: 941	Miniature Tractive armature AC lamp proving Relay plug-in type for Railway Signalling.
AAR Signal Section Specification No. 180 Manual, Part 145.	Detachable type Neutral Direct Current Relay for non-vital circuits.

Testing Railway Signalling Relays (General) (Tentative)

5.2 If signalling relays of the type other than covered by the specification mentioned above to be used, they shall conform to relevant IRS, BS or BRS specifications or any other specifications as approved by the Railways.

5.3 Time element relays electronic type conforming to IRS / BS / BRS or of the specification approved by railways shall be used . When electronic time element relays are used these shall be two in numbers in parallel and their contacts should be in series with each other.

5.4 All Relays or relay groups in the control panel and relay room shall be of miniature plug-in type , unless otherwise specifically permitted by the railways.

5.5 The Relays , including track relays, located in the track side location boxes, shall be preferably of the plug-in type .

5.6 All plug – in relays and relay groups shall be fitted with non-interchangeable interlocking device to prevent the wrong relays/relay group being accidentally plugged in during replacements.

5.7 Removal or replacement of plug in relays /relay groups from the relay racks during operation shall not cause any unsafe conditions in the circuits.

5.8 As far as possible , all relays shall be housed in the relay room of the controlling cabin to achieve maximum centralisation.

5.9 Where feasible all relays except track relays , shall have 10% of working contacts as spare subject to a minimum of one front and one back to fecilitate addition and alteration to the circuits at a later date. Extra space to accommodate repeater relays as required shall be provided in the relays rack to cater for future expansion .

5.10 A reliable type flasher relay shall be used preferably a mercury flasher. In case electronic flasher relay used, the same shall not be used for giving flashing indications to the points while these are under operation , or for indication to route setting operation. However, an electronic flasher can be used for other indications.

6.0 SIGNALS

6.1 The main running signals shall be of colour light signal multi-unit type conforming to IRS Specification No. S26 *.

* Colour light Signal , Multi unit type (Tentative)

6.2 Shunt Signal shall be of position light type conforming to IRS Drawing No.SA-23840 - (Advance).

6.3 Route indicators shall be either or the Direction type conforming to IRS Specification no.S-66 or Multi-lamp unit type conforming to Drawing No.SA-23761 (Advance) or of stencil type to approved design.

6.4 ‘A’ Marker light for semi-automatic signals shall be of to Drawing No.SA-23461 (Advance) and ‘AG’ marker light for semi automatic gate signals shall be to Drawing No:SA 23490 (Advance).

6.5 Roundels, glasses and lenses used in the colour light signals shall conform to IRS Specification No : 57.Roundels , glasses and lenses.

6.6 The signal lamps used for the different types of signals shall be as indicated below : -

6.6.1 Colour light – Type SL 17 or SL 21 or SL 35 to IRS – S – 57. Electric lamps for Railway signalling.

6.6.2 Position light shunt signal – 110 v 25 w to IS : 418 tungsten filament general service electric lamps or 50 v 25 w as approved by the railways .

6.6.3 Direction type route Indicator – 110 v 25 w to IS 418 tungsten filament general service electric lamps.

6.6.4 Multi – lamp unit type Route Indicator – Type SL 5,12 v, 4 w to IRS – S – 57.Electric lamps for Railway signalling.

6.6.5 'A' & 'AG' Marker light - 110 v 25 W to IS : 418. tungsten filament general service electric lamps.

6.6.6 Calling-on signal – 110 v 25 w to IS : 418 . tungsten filament general service electric lamps.

7.0 POINTS

7.1 Unless other wise specified , the points shall be operated by Electric Point Machines. The Electric Point Machines of the non-trailable type with plunger type locking or rotary type internal locking or point clamp type locking shall be used for operation of points , double slips, diamonds etc. These shall conform to IRS Specification No S24 Non – Trailable Electric point Machine with Plunger type Locking (Tentative). The design and functional feature of the same shall be as given below :

7.1.1 Overall dimensions and dimensions of fixing centers shall be in accordance with Indian Railways Schedule of Dimensions.

7.1.2 Means shall be provided to cut off the motor feed in case of obstruction to the point movement after a predetermined time lag, based on the

7.1.3 The point operating control circuits shall gave Track Circuit Control, overload protection and cross-protection.

7.2 Hand worked point switches shall be equipped with circuit controllers that are operated by the switches when closed. Such switches shall be electrically locked by the approach track circuit so that it is not possible to work them on the face of an approaching train.

7.3 The crank handles, referred in Clause 8.1 of IRS Spec. No S-24 (Non Trailable Electric Machine with plunger type locking) shall be provided to facilitate operation of points in case of failure of point machines. For this purpose if necessary, the points in the yard may be divided in to convenient groups and to distinguish particular groups, crank handles with different wards may be used. The crank handles may be provided in a suitable place near the group of points to which they refer. The slots in the point machines provided to take the crank handles will applicable to the group. The crank handles shall, however, normally be locked. It shall be possible to release them for use in point machine by releasing a control from the main cabin. With the crank handle released it shall not be possible to set up any of the relevant routes, and clear the signal for the same. The interlocking of crank handle, can also be achieved by using NX key of different wards.

7.3.1 It shall be checked that when the crank handle is removed from its normal position from EKT or other approved relay interlocking arrangement, the signals leading over the concerned route / zone can not be taken 'OFF', nor the points could be operated from the cabin / panel.

7.4 In AC traction area the point machine shall be immune to the effects of Electro-magnetic induction. These should be installed with in the range to which these are immune to the effects of AC electrification.

8.0 Track Circuits

8.1 Only DC or AC 50 or 83-1/3 cycle track circuits or electronic track circuits of an approved design shall be used.

8.2 Axle counter of an approved design can be used in lieu of track circuit.

8.3 The track circuits shall be designed and installed that in the case of a failure of block joints, the adjacent track circuit feed shall not wrongly energize the next track circuit relay.

8.4 A DC track circuit shall be not be fed directly from AC supply using transformer and rectifier. A storage battery must be connected with battery charger and the connection so made if battery is disconnected the rectifier is also disconnected.

8.5 DC Track relays can be centralized in location/relay room only by using separtate 2 crore cable of adequate cross section and not through multi-core cables.

9.0 CABLES

9.1 Unless otherwise specified, the cables used in the RELAY INTERLOCKING SYSTEMS shall conform to one of the following specifications:

9.1.1 IRS Specification No. S35-Pvc Insulated Alluminium Screened cables for Railway Signalling.

9.1.2 IRS specification S63-PVC Insulated cable for Railway Signalling.

9.1.3 IS: 694 – PVC Insulated cables for working voltages upto and including 1100 volts.

9.1.4 IRS-TC-30 – Telecom quad cable for special purposes in RE-area. (Tentative).

9.1.5 IRS-TC - 31 – Telecom quad cable for special purposes in Non- RE Area (Tentative).

9.2 Adequate spare conductors to a minimum of 20% of the total conductors used shall be provided for in each main cable upto the farthest point zone beyond this there should be a minimum of 10% spare conductors of the total conductors used. No spare conductors are required if the total number of conductors used is three or less.

9.3 Suitable conductor sizes shall be used to ensure that the voltage drop on line is not more than 10%.

9.4 When cables are to be terminated or jointed underground in outside location boxes, these shall be brought up over the ground and terminated or jointed in water tight junction boxes.

9.5 At least two cores of cable shall be provided between two ends of the yard to cater for telephone communication for maintenance purposes in non RE areas. Where the yard is extending over a large area, the location boxes may be grouped and one socket may be provided in one of the location boxes in the group so that telephone communication are conveniently available for co-ordination with the cabin during maintenance or rectification of failures of various ground equipments. Where such groups are situated in different directions from the cabin a separate pair of conductors shall be used for each direction connected to the cabin. In RE areas provision shall be made for telephone communication through a telecommunication cable, if already available or a separate telecom cable shall be laid for the purpose.

9.6 Earth leakage detectors of multi- channel type conforming to RDSO's revised specification No. S-45 both AC and DC may be provided to detect any leakage to earth in cable conductors.

10.0 WIRING AND RELAY RACKS

10.1 The wiring used in various equipment shall comply with the requirements laid down in IRS specification no. S 23 *

10.2 All wiring in the cabin and locations shall be done in a neat manner so that the wiring does not in any way prevent the proper functioning over working parts and is easily accessible for maintenance.

10.3 All wiring in the cabin and location shall be terminated on suitable terminal blocks/tag blocks conforming to DRg. No. RDSO/S – 16040 having minimum insulation resistance of 500 M ohm at 500V D.C.

10.4 At all locations and cabins wire entrance of adequate size, conveniently located for ease of approach to terminals and other equipment so arranged as to protect the wires from mechanical injury, shall be provided. Such wire entrance shall be plugged and sealed with suitable compound after the wiring is completed.

10.5 a) Unless otherwise specified, the internal wiring of relay rack in locations and cabin shall be generally carried out with plain annealed copper conductors: PVC insulated unarmoured flame retarding type of 1100B grade. The size of the conductors can be as follows:-

(i) Single core size	-	1mm Dia.
(ii) Multi core each CORE of size	-	1mm Dia.
(iii) Multi core each CORE of size	-	0.6 mm Dia.
(iv) Flexible insulated wire size.	-	16/0.20 mm Dia.

b) Rack to rack wiring shall be generally carried out with multi core cable having plain annealed copper single core conductor size 1.6/1.5 Sq.mm PVC insulated unarmoured unsheathed 1100 Volts grade. Cables and insulated wires used for internal wiring shall satisfy relevant clauses of IS-694** and VDE- 0472/6.65.

10.5.1 Unless otherwise specified following practice shall be adopted for internal wiring; The connecting wires shall be terminated on eyelets/ lugs if required by railways.

a) For connecting shelf type and plug-in non-proved type relays (Q-Style) flexible wire of 16/0.20 mm shall be used.
b) All connections to proved typed relays (Siemens) shall be done with 0.6 mm single strand multi core cable.
c) For all connections from cable terminations to tag blocks and indicators etc. shall be done with the help of 1 mm single strand wires.
d) For all connections to circuit breakers lever locks, etc. Single strand wire of 1.5/1.6 Sq.mm size shall be used.

** PVC insulated cables for voltages upto including 1100V.
*** Recommendations for testing of insulated cables and flexible cards.

10.5.2 Relay to Relay wiring on the same rack should be as far as possible direct without intermediatries like tag blocks/terminals.

10.6 Identification Marker for identifying the terminals and tags shall be provided to each terminal to identify the circuits for which it is used.

10.7 Relay racks shall have sufficient capacity to take additional equipment to the extent of 15% of equipment provided to permit additions and alterations.

10.8 Charts showing the position of relays on relay racks and contact analysis of relays indicating the spare and used contacts shall be prepared and kept in the cabin/Relay room.

11.0 FUSES, TERMIANLS AND TERMINAL LINKS

11.1 Fuses shall preferable be of the screw-cap cartridge type with different colour codes for different current ratings and these shall be non-interchangeable.

11.2 The fuses, when blown off, shall preferably give a visible indication.

11.3 Each group of circuits shall be carefully protected by fuses in the cabins/relay rooms and in location to facilitate easy fault localization.

11.4 Fuses shall be so arranged that they can be easily replaced without causing interference or unsafe conditions to other circuits.

11.5 Cartridge fuse links shall conform to B.S. Specification No. 714.

11.6 The terminal block (small) when used shall conform to IRS Drawing No. RDSO/S 16040.

11.7 The terminal boards provided at the locations and other place shall be provided with suitable links to facilitate isolation of the two sides of the circuits which are connected through the terminal links.

12.0 POWER SUPPLY ARRANGEMENTS

12.1 The power supply scheme shall be designed taking into consideration the commercial power supply available. The capacity of the power supply arrangements shall be adequate to cater for load of all the equipments inside the cabin as well as outside equipments like track circuits signals and point machine along with a 20% spare capacity to cater future expansion.

12.2 The power supply arrangements shall include arrangement for stabilizing the AC supply voltage fluctuations in such a way that it gives 110V $\pm$ 2% volts AC in the secondary circuit. The voltage stabilization shall be achieved with the help of quick response voltage stabilizer.

12.2.1 The signal supply transformer should have 110-120-130 volts tappings for maintaining uniform voltages on the lamp at a distance.

12.2.2 All battery chargers used shall be to RDSO/SPN/60 (Draft) and inverters to IRS S-58/1982.

12.2.3 Signal light feeding circuits should have voltage stability of + 3%.

12.2.4 Where three phase track circuits are used the integrity of each phase voltage being available should be proved in route release circuits.

12.3 The design shall cater for no break power supply arrangements for all A.C. circuits with automatic and manual switching over facility to standby power supply in case of power failure/fluctuations beyond limits of voltage stabilization and frequency variations of $\pm$ 3%. The standby power supply shall have a continuously rated capacity equivalent to main power supply arrangement.

12.3.1 All DC supplies including for point machines shall be provided with a battery back up in both RE and Non RE areas.

12.4 The schematic diagram of the proposed power supply scheme shall specify clearly the capacity of various devices like transformers, battery chargers, batteries, switches, flasher relays, protective devices, etc.

12.5 In case power is to be fed to any outdoor equipment through common feeders from outside in different cable and on different route, so that the failure of a part of the feeder or a fuse blowing off shall not effect the feed to the outdoor equipment in the whole yard.

12.6 The supply and distribution of the power supply shall be governed by the Indian Electricity ACT and Rules framed where cartridge fuse links use in Railway Signalling circuits.

13. GENERAL

13.1 In case of big yards and busy junction stations where a large number of trains/shunting movements take place resulting in intensive relay operations; relay room shall be air conditioned.

At way side stations where the traffic density is less the provision of air conditioning is optional.

Relay rooms in areas which are prone to dust or in near vicinity of chemical factories releasing injurious fumes or areas with extreme temperature may be air conditioned.

13.2 Fire detector and Fire Alarm of a suitable and approved design shall be provided in all relay rooms of Route Setting type relay interlocking installation.

All installations shall be provided with suitable type of fire fighting arrangements.

13.3 Adequate number of spare signalling relays and other equipments shall be provided with each relay interlocking installation.

13.4 If required by railways a quartz clock shall be provided on the indication panel.

13.5 Suitable standard earthing shall be provided for all relay racks, operating panel, power supply, switch board, transformers, inverters, etc.

13.6 Incase of major Route Relay interlocking and solid state interlocking installation, data logger shall be provided. At way side panel interlocked installation provision of data logger is optional.

SEM - II - 21.18.5 Communication between SM,s panel room, relay room equipment room and locations must be provided

SEM – II - 21.18.6 Panel shall be operated by SM/Panel operator who shall possess a panel competency certificate issued jointly by Traffic Inspector and section engineer (Signal) of the section duly counter signed by Asst.Officers

OPTIONAL REQUIREMENTS

Para (1.1)	Installation may be either of route setting type or non route setting type.
Para (3.3)	Illuminated Panel diagram and operating control console can be combined in one or a separate illuminated diagram and console containing operating members can be provided.
Para (3.5.1)	Use of common signal switch for conflicting Signal in non route setting type installation.
Para (3.6)	Use of two/three position switch for point operation
Para (3.10.6)	Voltage control on Panel for variable supply voltage for panel indication.
Para (3.10.7)	Voltage control on panel for supply to signal lamp.
Para (3.10.10)	Option to provide SM's Lock key in route setting type installation.
Para (3.11.5.1)	Option to provide a voltmeter on panel for power supply
Para (3.11.6.1)	Option for the provision of advance approach warning.
Para (3.11.6.3)	Option for the provision of signal/route lamp failure indication
Para (4.1.4)	Isolation of internal circuits
Para (4.3.1)	Option to use sectional route release including overlap by the passage of train,.

Para (4.3.4) (4.3.4.1) (4.3.5) (4.3.5.1)	Option to use sectional route release.
Para (4.5.6)	Option in operation of cross overpoints with the help of common point machine
Para (4.7.1)	Option to use double cutting and cross protection in internal circuits
Para (13.1)	Option in air condition in the relay room
Para (13.6)	Option in provision of Data Logger

APPENDIX - A

INFORMATION TO BE SUPPLIED BY THE RAILWAYS:

1.1 Whether the installation is to be of: -

(i) Route setting type

Or

(ii) Non route setting type

A-2 whether the equipment and circuitry to be used shall conform to 25 KV AC electrification requirements depending upon the territory in which installation is desired (Para 1.3)

A-3 Signalling plan and selection (control) Tables showing the signalling arrangement for the yard (Para 2.1)

A-4 Local conditions to be taken into account for the design of a reliable operation (Para 2.3)

A-5 Whether a separate illustrated diagram and “Control Console” containing all the operating members shall be provided (Para 3.3)

A-6 In route setting system:-

(i) Whether each route shall be controlled means of two push buttons-one at the entrance and other at the exit of the route concerned.

Or

By means of one switch at the entrance and one push button at the exit of the route

Types of push buttons used to be used in entrance/exit system either two position or three position type (Para 3.5)

(ii) In non route setting type installations whether signal shall be cleared by individual push button in conjunction with group push button.

Or

Switch controlling each signal or a common switch for conflicting signals which are not required at the same time or one push button at the entrance and other at the exit end(Para 3.5.1)

A-7 Whether two positions or there position switches or individual push buttons and a common push buttons should be provided for individual operation of points (Para 3.6)

A-8 Details for the selection of alternate overlaps for different routes. Any special method of section of overlaps to be given(Para 3.7)

A-9 Details for the selection of alternate route for a route. Any special method of section of approach route to be given(Para 3.7.1)

A-10 Colour of the Switches/Push buttons that have not been specified in the specification to be given (3.8)

A-11 Details of approach locking and time release locking to be provided(para 3.10.2)

A-12 Route required to be switched from manual central to automatic working(para 3.10.4)

A-13 Requirements of additional control on level crossings, ground frames, goods cabins, crank handles etc(para 3.10.5, 3.10.5.1)

A-14 Provision of supply voltage control for panel indication circuits to adjust the intensity of illumination(para 3.10)

A-15 Provision of voltage control on signal lamps to be given(para 3.10.7)

A-16 Type of control required for selection of power supply (para 3.10.8)

A-17 Whether indication panel for maintenance staff required, if so, the place where required(para 3.10.10)

A-18 Type of indication for points, signals and route required on the control panel to be specified (para 3.11.1, 3.11.2,3.11.3.3, 3.11.3.7, 3.11.6.1, 3.11.6.3, 3.11.6.4, 3.11.6.5)

A-19 Whether meter to indicate supply voltage is to be provided on control panel(para 3.11.5.1)

A-20 Whether advance approach warning for trains is required and type of indication to be given (para 3.11.6.2)

A-21 Type of panel indication bulbs to be provided(para 3.11.7)

A-22 Type of symbols to be used for drawing of wiring diagrams(para 4.1.10

A-23 Whether internal circuits should be electrically isolated from external circuits(para 4.1.4)

A-24 If facility for pre-setting of route is required, its details shall be provided(para 4.2.4)

A-25 Details of additional controls on level crossings, ground frames and other cabins, etc(para 4.2.7)

A-26 Whether complete route release including overlap by operation of switches or sectional route release by passage of train is needed.(para 4.3.1)

A-27 If sectional route release is required, its details shall be provide.(paras 4.3.4, 4.3.4.1, 4.3.5)

A-28 Whether facility for emergency route/sub-route cancellation required.(para 4.3.6)

A-29 Details of signals for which aspect light is required to be proved be given(para 4.4.50

A-30 Details of controls on level crossings , ground frames,cabins,crank handles, siding points etc(para 4.4.6)

A-31 In case of a cross over whether each and shall be operated by a separate point machine or by one point machine and a rodding system.(para 4.6.6)

A-32 Details of grouping of point zones for crank handles (para 4.6.7.3)

A-33 Whether double cutting and cross protection is means for internal circuits including vital circuits (Para 4.7.10

A-34 Requirements of extra space on relay rack for future expansion to be given(para 5.9)

A-35 Type of route indicator to be provide (para 6.3)

A-36 Whether the point are to be operated by electric point machines or any other method (para 7.1)

A-37 Details of the type of the track circuits to be provided, whether AC or DC (if AC track circuit to be provided whether 50 cycles Ac or 83-1/3 cycle AC) or electronic track circuit or Axle counters of an approved design for track circuit (para 8.1.8.2)

A-38 Details of the wire to be used for wiring of the relay rack/cabin etc (para 10.5 and 10.5.1)

A-39 Whether relay room is to be air conditioned (para 13.1)

A-40 Requirements of train describer system and the specification thereof

A-41 Any other facility or requirement not covered by the above specification

A-42 Whether quartz clock is to be provided on Indication panel.

APPENDIX 'B'

INFORMATION TO BE SUPPLIED BY THE TENDERER (RAILWAYS)

B-1 Panel indication lamps proposed to be used (para 3.11.7)

B-2 Means proposed for cutting of power supply to the point motor in case of obstruction (para 7.1.2)

B-3 Specification of cable proposed to be used for distribution of power supply, for point operation and other external and internal circuits (para 9.1)

B-4 List and number of spare equipments to be supplied (para 13.3)

B-5 Power supply to be made available single phase/3 phase commercial supply/from Auxiliary transformer in RE area.

B-6 Any other additional facility offered which is not covered by the specification.

British Standard(BS), British Railway Standard(BRS),American Association of Railroads(AAR), British Post Office Engineering Department(BPO) specifications and VDE specifications as approved by the Railway, which shall also be compiled to the extent applicable:-

IRS: S7	Roundels, Glasses & Lenses
IRS: S23	Electrical signalling and Interlocking Equipment(Tentative)
IRS: S24	Non-trailable Electric point Machine with plunger type locking(Tentative)
IRS: S26	Colour Light Signal, Multi Unit Type(Tentative)
IRS: S34	Testing Railway Signalling Relays (Tentative)
IRS: S35	P V C insulated Aluminium Screened cables for Railway Signalling(Tentative)
IRS: S45	Earth Leakage Detector (Tentative)
IRS: S46	DC Neutral Line Relay (Proved type) for Railway Signalling(Tentative)
IRS: S54	Tractive Armature, Shelf type, direct current neutral track relay(non-proved type) for Railway Signalling(Tentative)
IRS: S57	Electric Lamps for Railway Signalling (Tentative)
IRS: S58	Inverters for Railway Signalling (Tentative)

IRS: S60	AC Immunisation characterstics of DC Neutral tractive armature Miniature Plug-in-type line relay for Railway Signalling (Tentative)
IRS: S61	Fail safe type of Electronic time delay device for Railway Signalling (Tentative)
IRS: S63	P V C Insulated cables for Railway Signalling (Tentative)
IRS: S66	Route Indicator Direction Type, 5 lamps Unit Arm (1 to 6 way) (Tentative)
IRS: TC 30	Underground Telecom. Quad cable for special purposes in RE Areas (Tentative)
IRS: TC 31	Underground Telecom. Quad cable for special purposes in Non-RE Areas (Tentative)
RDSO/SPN/ 60-83	Battery Charger
IS - 418	Tungsten Filament General Service electric lamps
IS - 694	P V C Insulated cables (for voltages upto and including 1100 Volts)
IS - 1554	Part 1: P V C Insulated heavy duty electric cables part I for working voltages upto and including 1100 Volts
BS : 376	Part I &part II Railway Signalling Symbols Part I schematic Symbols, Part II wiring Symbols and written circuits
BS : 442	Terminals for Electrical Apparatus for Railway signalling Purposes.
BS : 519	Tractive Armature Direct Current neutral polar line relays for Railway signalling.
BS : 714	Cartridge Fuse – links for use in Railway Signalling circuits
BS : 1659	Tractive Armature Direct Current neutral track and Line relays for Railway signalling.
BS : 1745	Alternating current relays for Railways Signalling: track relays (double-element, 2 position),line relays(single-element, 2 position)
BRS : 930	Miniature Tractive Armature, DC Neutral line relay, plug-in-type for Railway signalling Purposes.
BRS : 931	Miniature Tractive Armature, AC Immune DC Neutral line relay, plug-in-type for Railway signalling Purposes.
BRS : 932 A	Miniature Tractive Armature, AC Immune DC Biased Neutral line relay, plug-in-type for Railway signalling Purposes.
BRS : 933 A	Miniature Tractive Armature, AC Immune DC Slow pick-up Neutral line relay, plug-in-type for Railway signalling Purposes.
BRS : 934	Miniature Tractive Armature, AC Immune DC Slow release Neutral line relay, plug-in-type for Railway signalling Purposes.
BRS : 935	Miniature Tractive Armature, DC magnetically latched Neutral line relay, plug-in-type for Railway signalling Purposes.
BRS : 937	Miniature DC Neutral thermal time element relay, plug-in-type for Railway signalling Purposes.
BRS : 938 A	Miniature Tractive Armature, DC Neutral track relay, plug-in-type for Railway signalling Purposes.
BRS : 939 A	Miniature Tractive Armature, AC Immune DC Neutral track relay, plug-in-type for Railway signalling Purposes.
BRS : 940	Miniature Tractive Armature, DC Single wound lamp proving relay, plug-in-type for Railway signalling Purposes.
BRS : 941	Miniature Tractive Armature, AC Single wound lamp proving relay, plug-in-type for Railway signalling Purposes.
VDE – 0472/6.65	Recommendations for testing of insulated cables and flexible cords.
AAR Signal Section Specn.180 Manual Part 145	Detachable Type Neutral Direct Current Relays for non-vital circuits

This specification requires reference to the following Indian Railway Standard Drawings:-

SA: 23840 (Adv)	Shunt Signal, Position Light Type
SA: 23761 (Adv)	Route Indicator Multi-Lamp Unit type.
SA: 23741 (Adv)	Terminal Block Small (Small)
SA: 23461 (Adv)	'A' marker Illuminated
SA: 23490 (Adv)	'AG' marker Illuminated

The terminology used in the specifications are generally covered by the definition given in IRS Specs.No:S23.

Whenever any reference to any standard and/or drawings appears, it shall be taken as a reference to the latest version of that standard and/or drawing unless the year of issue is specially stated. The specifications are indented mainly to cover the technical provisions relating to the mechanical and electrical requirements of RI systems including the annually equipments.

3.2 Guide lines for provision of RI in S/L & D/L

(As per RB Lr No: 2002/Sig. / PI / 1 , Dt : 9.7.2002 , the following guide lines are to be observed for provision of PI/RRI in S/L & D/L.)

A. On Double Line Sections :

A1. At all big junction stations, Route Relay Interlocking (RRI) shall be provided. All the features mentioned in items (i) to (vi) under A.3 below will apply to RRIs. The number of operating staff in RRIs will, however, depend on the actual requirement as assessed by the Railway.

A2 . (i) At small junctions having only 3 directions or non-junction stations having more than *5* running lines with complex lay outs, where there is extensive and repeated shunting, there 'are *many* traffic gates, good sheds and sidings etc., Railways may provide either central panel or end panels after assessing the local complexities. The decision about provision of end panel or central panel at such stations will be made by COMs of the Railways in interest of smooth operations and safety However, if it is decided to provide central panels at such stations, all the features mentioned under P3 below will apply. In case end panels are provided, central slide frame with Station Master will be of push button type instead of mechanical frame.
(ii) Block proving by axle counters will be provided in a contiguous section even if, at few stations in between, end .panels have been provided.

A3. At all other stations, central panels will be provided with the following features:

(i) The station will be fully track circuited in the station section.

(ii) Block proving by axle counter (or block proving track circuits) will be provided as a pre-requisite of the central panel.

(iii) Central panel will be of route setting type and will be provided with solid state interlocking / relay interlocking as sanctioned.

(iv) It would be desirable that similar type of panels are installed on the whole of the section instead of getting a mixture of technology thereby creating problems in maintenance and consequent operations.

(v) The block instrument (block proving with axle counter) will be provided -with the ASM at the central location.

(vi) No manned traffic gates would be non-interlocked in the Station area. i.e all manned traffic gates in the station area would be interlocked.
Wherever at present Switchman/ Cabinman is operating the traffic gates within the station area, he may be replaced by traffic Gateman, who will operate the gate from a get-lodge, near the Level Crossing.

(vii) At all stations with central panels, an additional ASM or a qualified Group 'C' traffic staff will be provided in each shift' who will oversee and check through trains, exchange all right signals with the train crew, handle the job of shunting at the station, cranking of' points In can of points or signal failures, issue pilot memo, caution orders etc. He will also facilitate working between the station and traffic/ engineering level crossing gates.
In addition to these operating duties, he will also deal with public enquiries and commercial booking, provided the workload does not justify a separate booking/commercial clerk.

B. On single line sections

All guidelines as in case of double line section shall also be applicable on single line sections, except Para A3 (vii) which shall be modified as under:

"If the line capacity utilization has already reached a level of 85% (with maintenance block), an additional ASM / Group 'C' traffic staff will be provided in each shift for doing multifarious work as mentioned in Para P3 (vii)."

C. Wherever central panels have already been provided without block proving axle counters, immediate action be taken to provide the same on priority. 'I

D. Wherever end panels have been provided, the present SM slide frame should be converted into push button panels to reduce failures and ensure greater safety.

(This issues with the approval of Board (ML & MT).
The above policy directives must be followed by the Zonal Railways with immediate effect while executing works.)

3.3 Policy on Type of equipment to be provided for interlocking at Block Stations.

As per RB lr No : 2003/SIG/G/5/Pt. dt : 14th Sept 2006

Ref: Railway Board's letter No. ***2003ISigIGI5*** dt.14th sept. 2006

Policy With regard to the type of equipment / relays to be provided by interlocked stations was issued vide reference above. The policy has been reviewed in consultation with Traffic, Planning and Finance Directorates. Board has confirmed the policy issued earlier and the same is reiterated as under:

S.No	No of Routes	Line / type of interlocking required to be provided
1.	Up to 50 routes	Relay based interlocking of M-M or M-C
2.	50 to 200 routes	Electronic interlocking
3.	Above 200 routes	RRI with relay based interlocking of M-M or M-C

ANNEXURE – I

BRIEF DESCRIPTION OF RELAY FUNCTIONING

1. SMR(SMPR): Station Master relay

- It picks up when the SM's key is inserted on the panel
- Authorises the operation when key is in
- Prevents the unauthorized operation when key is out (Locking the panel)
- If required, more repeater relays can be used
- one contact of SMR can pick up three SMPR relays.
- If more than three repeater relays are used then another contact of SMR can pick up more three repeater relays and so on.

2. LVR/LPR: Low Voltage Monitoring Relay

- It picks up from main supply of State Electricity Board.
- It is critically adjusted and made to drop if I/C 230V AC falls down.
- To indicate the SM to start the DG set for signal supply and charge battery.
- LPR is picked up through LVR
- LPR is to provide Audio- Visual indication to SM.
- LPR is to provide to suppress Audio Buzzer by Acknowledging

3. NCR: Normal Control Relay

- NCR picks up when point control switch turned to normal
- To operate the point to normal
- Pick up through SMR/SMPR front contact
- Cross proving is ensured RCR back contact
- Progresses the circuit to WLR front contact point lock relay

4 RCR: Reverse Control relay

- RCR picks up when point control switch turned to Reverse
- To operate the point to reverse
- Pick up through SMR/SMPR front contact
- Cross proving is ensured NCR back contact
- Progresses the circuit to WLR front contact point lock relay

5 NJPR: Cancellation Progress Relay

- Pick up after 2 minutes of cancellation initiation.
- Can be common for 2 or more functions where simultaneous movement / cancellations is not possible.
- May release ASR of signal (Route Cancellation)
- May release Crank Handle (CHEKT) extraction of crank handle under route Locked condition feature.

- May release gate control Key(LX EKT) extraction of level crossing key under route locked condition feature.
- NJPR B/C is to be provided in cancellation initiation circuit i.e. JSLR cct. To have effective time delay (appropriate time required)

6 CHLR : Crank handle lock Relay

- It picks up when crank handle is inside the EKT equipment and the key is turned
- Its F/C is used in relevant signals UCR & HR circuit
- Crank handle can be extracted when all the relevant signals are in normal position.
- It will drop when the crank handle is initiated for extraction from the equipment .

7 CHFR : Crank handle free Relay

- It picks up through concerned signals normal position (ASR F/C)
- Its F/C is used in crank handle extraction circuit
- Its B/C is used in relevant signal HR circuit

8 LXRR : Level crossing gate control reverse relay

- Picks up when gate control is reversed
- It picks up LXYR for releasing gate control
- Its B/C is proved in LXPR circuit
- Its B/C is proved in concerned signal RR circuit

9 LXYR : Level crossing control releasing relay

- It picks up through LXRR F/C
- It picks up through LXFR F/C in route free condition
- It picks up through LXJSLR F/C in route locked condition (Gate control release under route locked condition)
- It picks up LXYPR in RE areas at gate locations
- Its B/C is proved in LXPR circuit

10 LXJSLR : Level crossing timer initiating relay

- It picks up when LC gate control to be released under route locked condition
- It further initiates NJPR for releasing Gate after pre- determined time delay
- Its B/C is used in other JSLR circuits in the group

11 RR/RPR: Signal Switch Reverse proving relay.

- Picks up when signal switch is reversed
- Picks up through SMR F/C
- Picks up through proving conflicting signal switches not operated (RR B/C) 1st stage I/L
- After picking stick circuit is held through SMR B/C to prevent RR from dropping even though the switch is disturbed.
- Its B/C is used across UCR coil as cross protection arrangement.

12 UCR: Route Checking relay

- One UCR for each signal
- Picks UP through RR Front contact (Signal switch 'R')
- Pick up to prove 2nd stage of I/L
- Proves conflicting route/Signals not operated
- Proves concerned crank handles are locked in the equipment
- Proves concerned points are set according to Route
- When picked up it drops ASR
- Its B/C used in HR circuit across HR coil as cross protection arrangement.

13 WLR: Point Lock Relay

- Picks when NCR / RCR picks up when the point switch is operated to 'N'/'R' respectively.
- Picks up through concerned ASR F/C & OVSR F/C proves not involved in route /Overlap
- Picks up through concerned point tracks F/C proving tack locking
- Proving crank handle in (preferable)
- B/C of WLR is proved in NWR/RWR cct. as cross protection.
- It switches the circuit of NWR/RWR according switches position N/R respectively.
- Its B/C is proved in NWKPR/RWKPR to prove indication Locking.

14 TR: Track Relay

- Connected for certain portion of Track
- Pickup when Track is clear from Train/vehicle
- Pick up contact is used to pick up TPR in relay room as well location (for point operation)
- B/C is used as cross protection

15 NWR: Normal Point Relay

- Picks up after WLR F/C through selection of NCR
- It further Picks up WJR for point operation to normal
- Its B/C to be proved in detection circuit duly proving point operation relays dropped condition after the operation.

16 RWR: For Reverse operation circuit

- Picks up after WLR F/C through selection of RCR
- It further Picks up WJR for point operation to Reverse
- Its B/C to be proved in detection circuit duly proving point operation relays dropped after the operation.

17 WJR: Point Time oriented relay

- Picks up when NWR/RWR picked up for normal/Reverse operation respectively.
- Picks up through B/C of WXR
- It further switches WXR
- It further switches. WCR (QBCA) heavy duty.
- Drops when the point is operated to required position/condenser discharged whichever is earlier
- Normal supply is cut OFF when WXR picks up
- WJR is continued to be pick up by charged condenser till such time condenser discharges.

18 WXR: Overload protection Relay

- It Picks up through WJR
- When Picked up, it cuts the normal supply to WJR
- It further switches. WCR (QBCA) heavy duty.
- Drops only when either the point is operated to required position or When the operator changes intention and operated to other position in case of obstruction.(Mid-stroke Reversal facility)
- Its drop contact has been proved in detection circuit to prove points operation stations is withdrawn and non the point is in detection mode.

19 WNKR: Point normal Indication Relay

- It is situated at location box near point location.
- It picks up when points are set locked at normal (through ND contacts in point machine)
- It picks up through B/C of WRKR as cross proving.
- It further switches to NWKR in relay room duly proving WCR,WXR,WJR,NWR,RWR are dropped.

20 WRKR: Point Reverse Indication Relay

- It is situated at location box near point location.
- It picks up when points are set locked at reverse (through RD contacts in point machine)
- It picks up through B/C of WNKR as cross proving.
- It further switches to RWKR in relay room duly proving WCR,WXR,WJR,NWR,RWR are dropped.

21 NWKR: Normal Point Indication Relay

- It is situated in the relay room
- It picks up through WNKR from point location
- It picks up through B/C of RWKR as cross proving

- It picks up through NCR F/C proving point control normal position
  - It holds through WLR B/C to prevent to drop when points are not favorable to operate even though the point control is disturbed.
- It further switches NWSR & NWKPR

22 RWKR: Normal Point Indication Relay

- It is situated in the relay room
- It picks up through WRKR from point location
- It picks up through B/C of NWKR as cross proving
- It picks up through NCR F/C proving point control normal position
  - It holds through WLR B/C to prevent to drop when points are not favorable to operate even though the point control is disturbed.
- It further switches RWSR & RWKPR

23 NWSR: Normal Point Stick Relay

- It is situated in relay room
- it picks up through NWKR F/C
- It picks up when WLR dropped
- It picks up through B/C of RWSR,RWKR,RWKPR as cross proving and also they were dropped after previous cycle of operation
- It sticks through own F/C and its F/C is used in UYR circuit and other circuits to prevent the failures due to loose packing of points
- It drops only when the point is initiated to operate from Normal to Reverse either from panel or through Crank handle

24 RWSR: Reverse Point Stick Relay

- It is situated in relay room
- it picks up through RWKR F/C
- it picks up when WLR dropped
- It picks up through B/C of NWSR,NWKR,NWKPR as cross proving anmd also they were dropped after previous cycle of operation
- It sticks through own F/C and its F/C is used in UYR circuit and other circuits to prevent the failures due to loose of packing points
- It drops only when the point is initiated to operate from Reverse to Normal either from panel or through Crank handle

25 NWKPR: Normal Point Indication Repeating Relay

- It picks up through NWKR F/C and NWSR F/C
- It picks up through WLR B/C proves indication locking and hence NWKPR F/C is used in UCR/HR circuits
- It picks up through B/C of RWKPR ,RWSR, RWKR as cross proving

26 RWKPR: ReversePoint Indication Repeating Relay

- It picks up through RWKR F/C and RWSR F/C
- It picks up through WLR B/C proves indication locking and hence RWKPR F/C is used in UCR/HR circuits
- It picks up through B/C of NWKPR ,NWSR, NWKR as cross proving

27 ASR: Approach stick relay

- This is associated with signal operation
- Each is signal is provided with one ASR
- A common ASR can be among two or more signals provided they are for the same direction and can be taken off only one at a time
- It is normally in picked up condition and it drops as and when the route is checked and initiated

28 UYR1: Route Releasing Relay1

- It picks up when the train is being received on signals
- It picks up through ASR/ASPR B/C (to actuate only when the route is locked)
- it picks up through TSR B/C proving train passed concerned signal
- it picks with two track circuits occupied and one track circuit not occupied as the first situation
- Its F/C is used in ASR pick up circuit
- It should be of slow to release till ASR / ASPR firmly picks up and makes its stick contact

29 UYR2: Route Releasing Relay2

- It picks up when the train is being received on signals
- It picks up through ASR/ASPR B/C (to actuate only when the route is locked)
- it picks up through TSR B/C proving train passed concerned signal
- it picks with two track circuits occupied and one track circuit not occupied as the second situation
- Its F/c is used in ASR pick up circuit
- It should be of slow to release till ASR / ASPR firmly picks up and makes its stick contact
- If the route is lengthier one more UYR may be used
- there can be common UYRs for the opposite signals in either of direction can be taken OFF one at a time to economize in such case selection should be made for which direction of movement the UYR should actuate

30 TSR : Track stick relay

- There will be one TSR for each signal
- A common TSR can also be provided among two or more signals for the same direction of traffic, which will not be taken OFF at the same time.

- This has the feature of "one signal one train"
- It picks up through controlling track circuit clear.
- It picks up through normal condition of signal (ASR F/C, RR B/C, Normal position of signal switch.
- Its pick up contact is used in signal HR circuit.
- Its B/C is used in UYR circuit to prove train movement beyond the signal.

31 JSLR: Timer initiating Relay

- It is used to cancel the set route, proves the route is locked before the train could move beyond the signal / after the train moved the signal and cleared the route (ASPR B/C)
- It is designated by prefixing with signal no.
- It picks up through station master's authorization (SMR F/C)
- It picks up through cancellation initiation by pressing push button
- It picks through concerned signal normal position (drop condition of HR/DR,RR UCR proved)
- It ensures the train is not within the route set (clear of the route)
- It initiates timer to activate which gives output after the desired time lapse.(60/120/240 seconds)
- If there is a common timer grouped among other signals, only one JSLR to pick up at a time so other JSLR B/C to proved alternately in JSLR pick up circuits
- JSLR, NJPR together will feed ASR after lapsing of the defined time lag
- COJSLR, NJPR together will feed to clear the calling on signal since calling on signal shall be taken to OFF after ensuring the stoppage of the train for the pre-determined time.
- CHJSLR, NJPR together will feed CHYR in case emergency crank handle extraction feature under locked condition feature where exists
- LXJSLR, NJPR together will feed LXYR in case emergency LC gate key extraction feature under locked condition feature where exists.

32 NJPR: Time- lag Proving Relay

- This picks after initiating timer as per the pre- set time lag according to selection in the group (generally 120 seconds for all signals, but some railways follow 60 sec. for shunt signals)
- Cancellation press button normally closed contact is used in the NJPR initial path circuit to prove its integrity
- Its pick up is used in the respective time lag proving circuits
- Its B/C is used in the in the JSLR initial pickup circuit to ensure that NJPR should pick up all the times with a fresh (regulated) time lag

- For calling on route cancellation the time lag is 240 sec. followed by most of the railways some railways may be following 120 sec. Whose designation is CONJPR .

33 HR : Caution Aspect Controlling relay

- It picks up through UCR F/C
- It picks up through concerned track repeating relay F/C in route ,berthing overlap
- All ASR/ASPRs B/C should be used in HR circuit for proving that all the concerned points are electrically locked
- ASR F/C of all conflicting signals must be used in HR circuit for proving that all the concerned conflicting signals are not operated / Normal
- Glowing of route aspect lamps shall be proved in the HR circuit for the diverging line
- Non glowing of route aspect lamps shall be proved in the HR circuit for the straight line
- HR B/C or ASR F/C will be used in crank handle / LC gate extraction / Siding control extraction circuit

34 HPR : Caution Aspect Controlling Repeating Relay

- It is used in RE areas generally
- It picks up through from relay room
- AC immunized relay should be used for this circuit
- Its F/C is used in signal lamp circuit along with HR F/C

35 COAR : Calling On acknowledgement Relay

- It picks up through calling on track occupation by the train
- it initiates audio visual indication to the SM
- its F/C is used in COHR circuit

36 COCAR: Calling on Cancellation Relay

- There is one COCAR for for each calling on signal
- This picks up on pressing co-cancel button
- It picks up through station master's authorization (SMR F/C)
- COCAR, CONJPR together will feed COASR after lapsing of the defined time lag (generally 240 sec).

37 SR1: Stickrelay (controlled by block working)

- Ensures one line clear one train
- picks up when the Block commutator turned to TOL position
- Drops as and when the train passes beyond LSS
- Its F/C is used in LSS DR circuit

38 SR2 : stickrelay (controlled by block working)

- Ensures one line clear one train
- picks up when the Block commutator turned to TOL position

- Drops as and when the train passes beyond LSS
- Its F/C is used in LSS DR circuit

39 LCPR: Line clear proving Relay

- Picks up when the Block commutator is turned to Line clear position
- Its F/C is used in LSS DR circuit

40 ZR1: Block clearance proving relay

- It picks up when the train is received on signals (Signal reverse position) for which the line clear was granted
- Fulfils the essentials of lock and block working
- It picks as the train actuates the track circuits in a sequential manner
- It registers the first situation of train movement.

41 ZR2: Block clearance proving relay

- It picks up when the train is received on signals (Signal reverse position) for which the line clear was granted
- Fulfils the essentials of lock and block working
- It picks as the train actuates the track circuits in a sequential manner
- It registers the second situation of train movement

42 ZR3: Block clearance proving relay

- It fulfills the requirement of Electric stick
- It picks up through ZR1 F/C & ZR2 F/C and sticks through TOL / LC of Block commutator to facilitate Block Forward operations
- It drops when the commutator is turned to line clear position

ANNEXURE - II

Details of Standardization Work Shop at IRISET: 25/05/09 To 29/05/09
Relay Interlocking (Metal -Carbon Type)

Sl. No.	Topic	Remarks on Discussion
1	Type of Panels – (Knob type **OR** Push Button type.)	• Both are currently in Use. • Only SR, SWR having Knob Type. Both Railways to changeover • Push Button to be preferred for future.
2	Whether Route Setting type **OR** Non-Route setting type.	Route Setting Type for all future installations
	RELAY ROOM /TRACK CIRCUIT	
3	Type of Relays – (Metal to Metal **OR** Metal to Carbon).	Metal to carbon to be standardized for adoption to EI logic.
4	What are the circuits being provided with Cross protection?	
	(a) Indoor Circuits	WLR, UCR, HR. - These also have double cutting .
	(b) Outdoor Circuits	Required in all external circuits Ex : NWR, RWR, TPR, ECPRs, HPRs, DPRs
5	Standardization of Tables of Control	• Signal Control table with 23 columns Developed during Workshop (See Annexure-I). • Proforma of Point Control, LC gate control, Siding Control tables of E.Rly. were agreed by all. (See Annexure-II).
6	Initiation circuits: LR or NNR/NRR	• Both can be kept • LR for Knob panel • NNR for push buttoned panels
7	Standardization of TSR / WLR / ASR circuits	TSR circuit to have only ASR and replacement TPR contacts
8	The necessity of back contact proving in Metal To Carbon type relays. (To avoid the relay permanently in picked up condition.)	Not required
9	Using of QLI Relay (Magnetic stick Relay) for the purpose of storing the information. (Similar to interlocked relays in Metal-to-Metal contact relays).	• SCR, SER, ECoR started using QL1. • As this is useful, others also may adopt.

Sl. No.	Topic	Remarks on Discussion
10	Method of Picking up Repeater Relays for purely internal circuits in Relay Room.	• When more back contacts are required, BPR may be picked up and it's front contact to be used in circuits. • Up to 3 Repeater relays may be picked up from main relay (both for Front / Back contact repeating).
11	Standardizing nomenclature of relays.	• Discussed separately. (Details in Annexure-IV). • Nomenclature for some relays is to be finalised
12	Method used to restrict the number of contacts to 45 in different circuits.	Intermediate Relay is used
	TIMER	
13	Provision of number of Timers in a Station	
	(a) Any Restriction to use the number of timers in Yard/Way side Stations.	• No restriction. Number of timers depend on need. • One per signal / Signal Group is adequate
	(b) Whether Electronic Timers used is single or two with contact in series to release the circuits.	Single with reliable ET
	(c) Method adopted to ensure voltage on Electronic timers not to exceed 28.8 Volts.	Manufacturer / Specs of ET should take care.
	INTERLOCKING	
14	Stages of Interlocking:	
	(a) Knob/ Button stage.	• All Railways agreed for providing interlocking in three stages. Viz. Button/Knob, UCR & HR. • Proving of Track Circuits in UCR stage also may be done.
	(b) UCR Stage	
	(c) HR Stage	
15	Proving of TPR contacts in two stages in Relay interlocking circuits.	• Presently being done in one stage. • To be proved in Two stages i.e at UCR and HR stages
16	Method of Interlocking of Crank Handles:	
	(a) By proving ASR Front Contact (Route Locking Relays)	• HR down, UCR down to be used instead of ASR up. • As per SEM, ASR is to be proved and whenever CH taken out, point operation from panel is not permitted. SEM amendment to be
	(b) By proving UCR and HR Back Contacts.	

Sl. No.	Topic	Remarks on Discussion
	(c) If ASR Front Contact is proved, the Method of extracting Crank Handle during Route locking cases (with time delay, etc.)	proposed to allow individual operation of points (for maintenance) from panel even after CH is taken out (point operation through route setting to be prevented when CH out). However signals should be locked.
	(d) Emergency CH extraction	• Required -if ASR pick up contact is proved. • Not required -if HR and UCR drop are proved in CHYR circuit
	ROUTE RELEASE	
17	Whether sectional route release feature is provided for all major/ medium yards or all stations including Wayside stations.	Sectional route release feature is required at all stations (Major, Medium & Wayside Stations) to maintain uniform route releasing circuits at all stations.
18	Whether the method of sequential proving of Track circuits in Sub-routes is as per Part-II SEM Para No.21.5.2.	SEM to be followed
19	Where Track Circuits are provided with Standby batteries, whether 'R' Relay contacts (Main Power supply monitoring Relay) are proved in Route Releasing circuits to avoid inadvertent Releasing of routes during resumption of Power supply.	Required. But nomenclature of Relay shall be POR instead of R.
20	When Calling-on Signal route is cancelled whether the route Locked by the Main signal (Home signal) will get released **OR** not.	• Separate ASRs for main signal and calling on signal required. • Main ASR & Co-ASR will pick up if calling on route is cancelled
21	RRBU cancellation for full route release bypassing back locking (after physical verification of track by ASM).	To be provided
	LC/SIDING	
22	Whether Electrical Emergency Release is given to open LC gates situated in Automatic signalling territory.	CR, WR, ER – Provided in Auto + Normal. SCR - Not existing anywhere. SR - Not in Auto Section. After detailed discussions, many Railways mentioned to have this facility to avoid hardship to gateman in the event of failures. Remark : Majority Agreed
23	Whether approach clearance of gate signals situated in automatic signalling is being adopted to avoid change of aspect in the phase of an approaching train.	Not required.

Sl. No.	Topic	Remarks on Discussion
24	The distance at which the approach warning and approach locking is effective for an LC gate situated in an automatic signalling territory.	A.W. = 5 km A.L. = 3 km
25	The method of Interlocking of LC gate in Station section situated in automatic signalling territory (whether knob/button control is extended from panel).	Push button controls are preferred as all future panels shall be with push buttons.
26	Road warning at Interlocked LC gates and its aspects	During operation: Red Flasher & Audio Alarm.
27	Whether Lever lock circuits controllers **OR** EKTs are provided for interlocking LC gates/ Siding.	EKT
	POINTS	
28	Whether points are operated through a Point contractor Relay provided at site **OR** directly operated from the Relay room.	• WR - Direct operation from Relay Room. • Consensus : Relay Room operation if within Range. • Local operation beyond Range
29	(a) The Point contactor Relay:	• Point contactor relays – separate for each end of a cross over to be provided
	(b) 24V/60V Siemens Point Group.	NR, SER are using this type
	(c) Using 'Q' Type Relays and QBCAI Relays.	SWR, SCR are using these relays.

Sl. No.	Topic	Remarks on Discussion
	(d) Detection	• Detection in series for Indication to Panel. • Separate Detection cable is to be provided. • Signal aspects may go to danger when a train passing over points disturbs the detection due to loose packing etc. To overcome this Stick relays are used (NWKSR or RWKSR) in SR, SCR and SWR. • Detailed discussions were held regarding provision of separate detection for 'A' and 'B' ends due to certain advantages (i.e. to avoid piloting etc. during loop line point failure).This will also enable degraded operation in signalling (from Std.III to I) in the event of non-availability of detection at other end of cross over. • Some Railways have agreed. Some have reservations. Remark : No consensus. To be discussed in next meeting.
	(e) Points Operation - Series / Parallel	• Both Serial & parallel operations are in use. • Preferred Option is serial operation. Remark : Majority Agreed
	(f) Point Circuit	• Point Operation & Detection, Circuit recommended by SAG officers was discussed but details of Circuit of RLBPR / NLBPR were required. • Remark : To be discussed in next meeting .
30	Emergency operation of points in all stations.	Required
	(a) Whether NKR is required at site/Loc.	No
	(b) Whether TR/TPR required at site /Loc	No
31	Whether WLR normally Up / Down	WLR normally drop in automatic route setting
32	Whether Point track circuits are proved at site in the Point Operation circuit.	Proved wherever local fed.
33	Special throw of points / swinging isolation to achieve more flexibility in the yard.	• Sample Layouts were shown by S.Rly. • Concepts Agreed
34	(a) Detection of Siding Trap Point (Open condition) Electrically for signalled movements when siding is operated locally and interlocked through EKTs.	Not required.

Sl. No.	Topic	Remarks on Discussion
	(b) Detection of Siding Trap Point (Closed condition) Electrically for signalled movements in the Trailing Direction when siding is operated locally and interlocked through EKTs.	• Rod operated - Detection is required. • Key lock - No detection is required
35	Whether 110 Volts DC is extended to point location only on initiation of Point operation using contactor relay (PCR).	110 Volts cable to be live only when needed i.e., for operation.
36	A motor operated point in the berthing portion of Track.	Provide Intermediate starter to hold the route
	SIGNAL	
37	Method of Lighting Signals in RE area.	
	(a) Locally fed	As per SEM
	(b) Remotely fed	As per SEM
38	The cutting in Arrangement provided for 4-aspect automatic signal provided with LED signals.	• In S.Rly - Due to faster LED response, momentary Red aspect during change over is observed by Driver, due to which Circuit has been modified to introduce delay through RC circuit was tried successfully. • No such problem has been reported from other Railways. • SCRly mentioned that their Circuit is found suitable without adding RC circuit to ECR's. • This issue may be monitored by Railways and necessary action taken. Remark : To be discussed in next meeting
39	Provision of Emergency putting back of signal to danger even if panel is locked. (SM's key out).	Required. EGGN to be provided.
40	Signal/Route/Cancellation procedure 2/3 Button	• Button type - 3 buttons (GN, UN, and ERRB). • Knob type - single button (along with Knob turned to Normal). • S.Rly to provide a button for ERRB operation This is to differentiate Emergency cancellation from normal route release.
	BLOCK	
41	Proving of Block overlap track circuit in the line clear circuit (180 metres Track Circuit ahead of Home signal).	Not required.

Sl. No.	Topic	Remarks on Discussion
42	Proving of overlap track circuit (120 metres track circuit) in Single Line Automatic signalling as per Board's letter issued in 1998.	To be done as per CRS recommendation. Being proved in all Railways.
43	Whether distant signal ECRs are proved in block circuit to prevent the block being closed or line clear being granted in the event of distant signal remaining blank.	Not required.
	BPAC	
44	Standardizing BPAC circuits and Reset circuits.	S.Rly. Circuit for reset was shown. This may be studied
	SSI	
45	In SSI whether to adopt distributed logic or single logic irrespective of size of the yard.	• Distributed for MLK - II for more than 5 lines and Jn.Stns. • Others centralised.
46	Provision for extracting Crank Handle during failure of Micro lock/logic.	Required
47	In SSI whether operation is through control panel/ VDU/ Touch Screen.	As per Operating Department's requirement.
	PANEL	
48	Types of illumination on panel (LED or other type)	LED type only to be used
	Indications	
	(a) Each aspect of signal is shown or only 'ON'/OFF for signals	All aspects to be given as per site
	(b) Point : N/ R, Lock Free	• Point normal and reverse setting and • separate lock indication to be given
	(c) Whether the point indication is available near the point knob or as a strip in the route.	Where knob exists, provide Indication there also
	(d) Crank handle: In Out Free Lock	In and Out indication
	(e) LC Gate - Open / Closed	• Provided at Panel. • Free / Locked indications are provided at LC gate
	(f) Colours for the above as per SEM or local practice	To be followed as per SEM
	(g) Whether locked indication (through a strip of while light) for overlap zone is given.	Required.

Sl. No.	Topic	Remarks on Discussion
	(h) Whether indication is given for overlap releasing (during the working of the Timer).	Required.
	(i) Flasher Relay working indication on Panel	To be provided
49	Maintainer's Panel - Compulsory / optional	• Compulsory for major yards & built-in feature for all EIs. • Optional for Wayside Stations for Panel
50	Type of locking & sealing arrangement for buttons / Switches used for emergency operations on panel	• Sealing practices depend on Knob / Push button. • Push Buttons for emergency operations to be sealed.
51	Panel voltage for indications 12V or 24V, AC or DC	24 Volts D.C only to be used for Future
(*Note :- The above information is furnished for Trainees to understand that Different practices exist in Zonal rlys. Pl note that on some of the issues discussed above, Final decision is yet to be taken*.)		

ANNEXURE - III

SIGNALLING MATERIALS/EQUIPMENTS REQUIRED FOR A 4 ROAD DOUBLE LINE STATION FOR RELAY INTERLOCKING USING METAL-CARBON CONTACT RELAYS.

S. NO	DESCRIPTION OF MATERIAL	QTY	UNIT
1	Control Panel Complete.	1	No
2	Colour Light Signal 2 aspect complete.	6	SET
3	Colour Light Signal 3 aspect complete.	6	SET
4	LED Lamp arrangements Complete.(D A).	1	Set
5	Route Indicator Junction type 2 way.	1	SET
6	Route Indicator Junction type 3 way.	1	SET
7	Calling-on signal.	2	NOS
8	Position light Shunt Signal Ground type.	2	NOS
9	Position light Shunt Signal Post type.	2	NOS
10	Track Circuit & Accessories (Pl. TC/RE)	18	SETS
11	Track Circuit & Accessories (Pt,TC/RE)	14	SETS
12	Electric Point Machine.	14	NO'S
13	Ground Connection for Point Machine.	14	SETS
14	Insulation Material for Point Machine.	14	SETS
15	Heavy duty relay for Point Machine./QBCA	14	NO'S
16	MS Termination Box.	14	No
17	Crank Handle Interlocking.	4	Set
18	Electric Key Transmitter.	2	NO'S
19	Wiring & Accessories (Det. Attached).	1	SET
20	Relays Wiring and Rack Fixing etc.,	384	SET
21	Relays QNA1.	320	NO'S
22	Relays QJ1 (Time Element).	4	NO'S
23	Relays ECR's	31	NO'S
24	Relay UECR	2	NO'S
25	Relays Flasher type.	1	NO'S
26	Relay LED (ECR).	26	NO'S
27	Solid state Buzzer.	4	NO'S
28	Cable & Accessories (Det.Attached).	1	SET
29	River Sand	4.0	KM
30	Bricks	2.0	KM
31	Power Supply arrangements.	1	Set
32	Apparatus Case Large	12	NO
33	Apparatus Case Medium	12	NO
34	Apparatus Case Small	8	NO
35	Sheet Iron Box	4	NO
36	'E' type locks With Keys	48	NO
37	Selective Calling-on Telephone.	8	NO
38	Earth Leakage detectors.	2	NO
39	Walkie Talkie Instrument.	2	No
40	Sighting Board complete,	4	NO
41	Boards For Calling-on/stop etc..	2	NO
42	Earthling arrangements.	20	NO
43	Cement Concrete. (Det. Att.)	#####	CU.M
44	Painting Materials	1	SET
45	Miscellaneous Stores	1	LS
46	Transport Arrangements During Line Block	1	LS
47	Temp. accommodation during line block	1	LS
48	Provision for Hiring of Vehicle.	2	months

S. NO	DESCRIPTION OF MATERIAL	QTY	UNIT
49	Testing & Commissioning	1	LS
50	Labour Charges(Dept) @ 0%		
51	Loading & Unloading @ 3%		
52	Carriage @ 2%		
53	Contingencies @ 1%		

DETAILS OF WIRING AND ACCESSORIES

SNO	DESCRIPTION	QTY	UNIT
1	Wiring coil 16/02mm	270	coil
2	Wire coil 10 sqmm copper	6	coil
3	Wire coil 3/20	6	coil
4	Terminal blocks PBT Arnite 6 way		Nos
5	Terminal blocks PBT Arnite 1 way		Nos
6	Non detertg. Type fuses with bases		Nos
7	Teak wood planks	0.25	Cu.m
8	Hard wood planks	0.25	Cu.m
9	Relay racks 2 way	5	Nos
10	Fixing and mounting relay rack.		Nos
11	Condensers and resistors	2	LS
12	Hylem / Decolam sheets 1mx2mx6mm		Nos
13	Rosin core	2	Kgs
14	Miscellaneous	1	LS

Details of Cement

S.NO	DESCRIPTION	QTY	UNIT
1	CLS signals	12	Cu.m
2	Gr.shunt sigs./compensator/lead out/SPI	2	Cu.m
3	Relay/power rack	5	Chum
4	CT box/'A' type bases	0	Cu.m
5	Apparatus case large	12	Cu.m
6	App. case small/medium/sht. iron box	24	Cu.m
7	Boards/Detectors base/cranks	10	Cu.m
8	Miscellaneous	1	Ls
	Total		

Labour Details of cables/river sand & bricks

SNO	DESCRIPTION	QTY	UNIT
1	Trenching soft soil	2000	Mtr
2	Trenching hard soil	1500	Mtr
3	Trenching rocky soil	500	Mtr
4	Mounting on wheels and laying of cable	34000	Mtr
5	Filling. sand above & below the cable	6000	Mtr
6	Laying of Bricks	2000	Mtr
7	Track/Bridge crossing	75	Mtr
8	Masonry of channel ramps	80	No
9	Laying of cable markers	300	Mtr
10	Termination of cable	2800	wire
11	Cable compound ceiling of locations	1	Ls
12	Miscellaneous	1	Ls
	Total		

Details of cables and accessories			
S.NO	**DESCRIPTION**	**QTY**	**UNIT**
1	Cables 2 core 2.5 sqmm	4	Km
2	Cable 2 core 25 sqmm	5	Km
3	Optic Fibre Cable (24 Fibre).	0	Km
4	Cable 12 core 1.5 sqmm	10	Km
5	Cable 24 core 1.5 sqmm	7	Km
6	Cable 30 core 1.5 sqmm	8	Km
7	Cable markers	300	No
8	Teak wood planks	0.5	Cu.m
9	Hard wood planks	0.5	Cu.m
10	Terminal blocks 1 way PBT Arnite		No
11	Terminal blocks 6 way PBT Arnite		No
12	TLJ boxes	16	No
13	RCC pipe of 150 MM Dia.	25	2M
14	G.I pipe of 100 MM Dia.	25	M
15	Cable compound	40	Kg
16	Miscellaneous	1	Ls

DETAILS OF CLS ASPECT LED LAMP ARRANGEMENTS.			
SNO	**DESCRIPTION**	**QTY**	**UNIT**
1	LED lamp RED		
2	LED lamp YELLOW.		
3	LED lamp GREEN.		
4	Shunt signal LED lamp.		
5	Calling-on signal LED lamp.		
6	Route indicator LED lamp.		

SNO	**DESCRIPTION**	**QTY**	**UNIT**
1	2 Aspect CLS LED LAMP (R+G).	6	No
2	3 Aspect CLS LED LAMP (R+Y+G).	6	No
3	4 Aspect CLS LED LAMP (R+Y+Y+G).	0	No
4	Shunt signal LED lamp.	4	No
5	Calling-on signal LED lamp.	2	No
6	Route indicator LED lamp.	2	No

Details of Power Supply arrangements			
SNO	**DESCRIPTION**	**QTY**	**UNIT**
1	Diesel Generator, 10 KVA .	1	No
2	Integrated power supply to suit in	1	Set
3	Miscellaneous.	1	No

Note :-

- Approximate Cost for Relay Interlocking for Signalling portion (Excluding Engineering and Electrical Requirement) = Rs 1.2 Crores in 2009.
- Details may vary as per Design & Local railways practices.

TYPICAL PLAN FOR A RELAY ROOM AND POWER SUPPLY ROOM

ENGINEERING DEPARTMENT

(a) The door of relay room should be flush type and opened inside all other rooms should be of ordinary double door type.
(b) Flooring in all rooms should be with tiles as an anti dust arrangement.
(c) Duct for laying cable to be provided in the rooms in consultation with ASTE/DSTE/CN.
(d) Opening (0.67mx0.67m) for cable entry to be provided at the basement level of relay room in consultation with ASTE/DSTE/CN.
(e) Window shutters should be of sliding type with glass/good quality acrylic panels and protective covering with expanded metal to be provided for all windows on the outer side.
(f) Height of windows should be 0.91 mtr. above floor level.
(g) Floor level should be at a height of 1m from rail level. (ie; higher than a high level platform whether existing at present or not to take care of future and to avoid flooding of water in rainy season.)
(h) Battery room should contain two tier battery stand with acid proof tiles up to a height of 2 mts. on the walls.
(i) Cement flooring to be provided in side the barbed fencing area.
(j) The shed of generator shall be covered by asbestos sheets.

ELECTRICAL DEPARTMENT

(FITTINGS TO BE PROVIDED IN CONSULTATION WITH S&T OFFICIAL.)

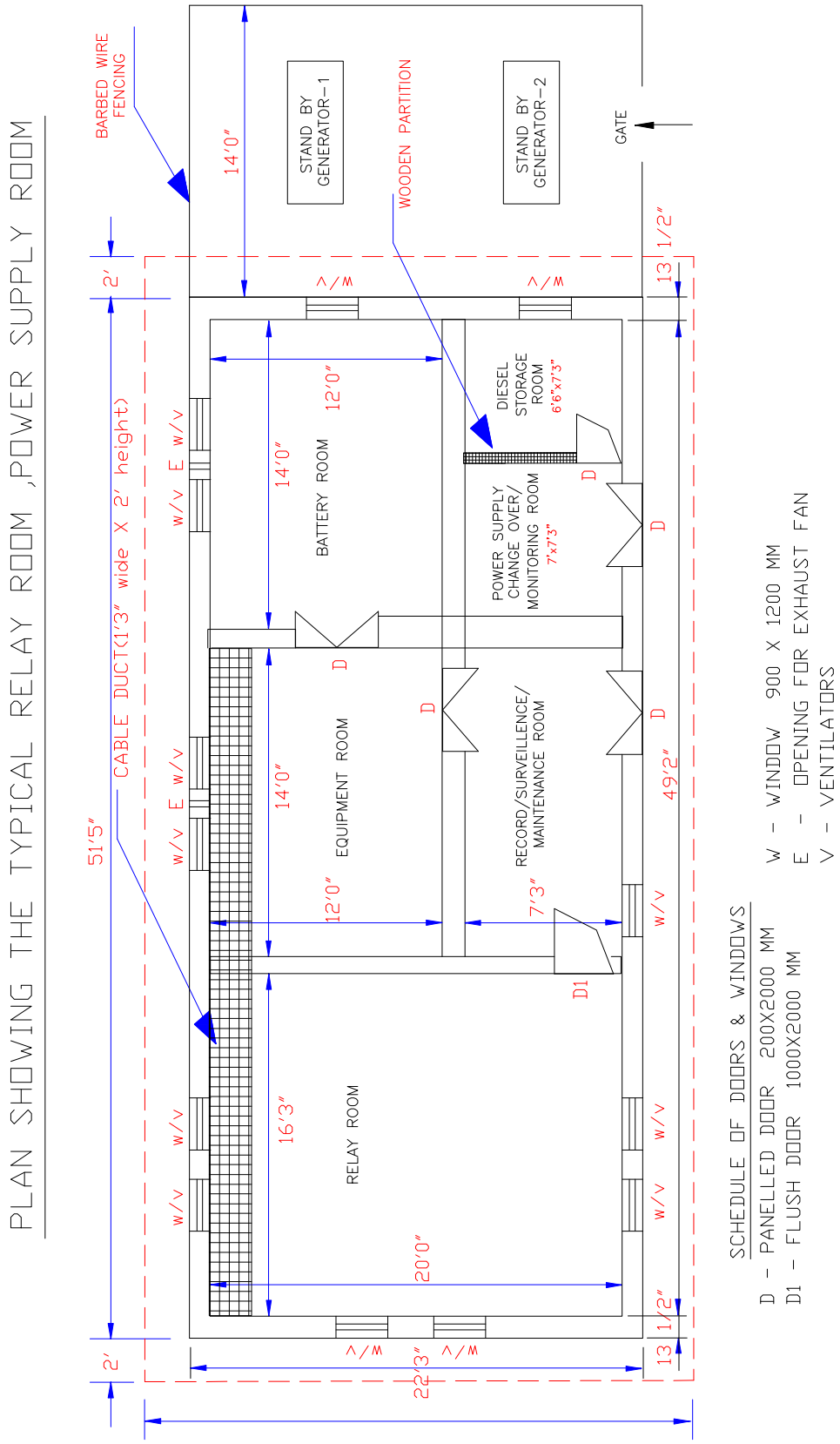
(a) Six tube lights should be fitted in relay room, four on the walls and two on the roof.
(b) In all the other rooms tube light each should be provided one on the roof and other on the wall.
(c) Relay room shall be provided with two ceiling fans. And all other rooms shall be provided with one ceiling fan each.
(d) All the lights and power plug points in relay room and one tube light each in the remaining rooms shall be wired separately with change over facility from main to generator supply.

(e) Two power plug switch boards (15/5Amp. Cap) should be provided in equipment, battery and power supply change over room and four plug boards (one 15/5Amp. on each wall)

(f) Three Nos. of 'ON' and 'OFF' heavy-duty switches should be provided in the power supply change over/monitoring room for change over.

(g) Wherever 3-phase power supply is available in the station the same shall be extended to the power supply change over/monitoring room with double pole 4 position phase selector switch for 3 phases.

(h) Exhaust fan should be provided one each in battery and equipment room walls at suitable height.


PLAN SHOWING THE TYPICAL RELAY ROOM ,POWER SUPPLY ROOM
BARBED WIRE FENCING
CABLE DUCT(1'3" wide X 2' height)
STAND BY GENERATOR-1
STAND BY GENERATOR-2
WOODEN PARTITION
GATE
BATTERY ROOM
DIESEL STORAGE ROOM 6'6"x7'3"
POWER SUPPLY CHANGE OVER/ MONITORING ROOM 7'x7'3"
EQUIPMENT ROOM
RECORD/SURVEILLENCE/ MAINTENANCE ROOM
RELAY ROOM
51'5"
49'2"
22'3"
14'0"
12'0"
16'3"
20'0"
7'3"
2'
1'2"
13
w/v
E
D
D1
SCHEDULE OF DOORS & WINDOWS
D - PANELLED DOOR 200X2000 MM
D1 - FLUSH DOOR 1000X2000 MM
W - WINDOW 900 X 1200 MM
E - OPENING FOR EXHAUST FAN
V - VENTILATORS

ANNEXURE – V

TYPICAL BUILDING PLAN FOR S&T REQUIREMENT

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

No.98/W1/Genl/0/30-Pt. **New Delhi, Dated 13.08.08.**

The General Managers,
All Indian Railways.

Joint Engineering & S&T Circular

Sub: Standardization of service buildings for S&T requirement.

1. In the estimates for new line, gauge conversion & doubling projects being submitted to Railway Board, area of service buildings proposed by Railways for S&T at a block section are varying. In order to standardize and keep it to bare minimum the requirement of buildings for S&T have been reviewed. Separate rooms for Axle counters, data loggers and telecom room for quad cable communication (except for OFC) are not considered necessary.

2. It has been decided that following rooms for S&T requirement be provided:-
   a) Stations having ASM room:-
      - Relay cum Axle counter room (7.1 x 4.6m).
      - IPS & Datalogger Equipment room (3.7x4.6m).
      - Battery room (3x4.6m).
      - DG cum solar room (3.7x4.6m).
      - Panel may be kept in the ASM room.

      Total area to be constructed is 79.7 sqm.
   b) In case ASM room does not exist (NL projects) or is not usable, a new ASM/Panel room (6.1x4.6m) may be constructed. Total area including ASM room is 107.6 sqm.
   c) In case the work involves provision of OFC system, an OFC room (3.6x 4.6m) may also be constructed for housing OFC equipments.

3. A typical building plan for S&T requirement at ¾ line stations is enclosed as annexure. It is also desirable that above buildings may be constructed away from PF area to ensure obstruction free movement of the passengers.

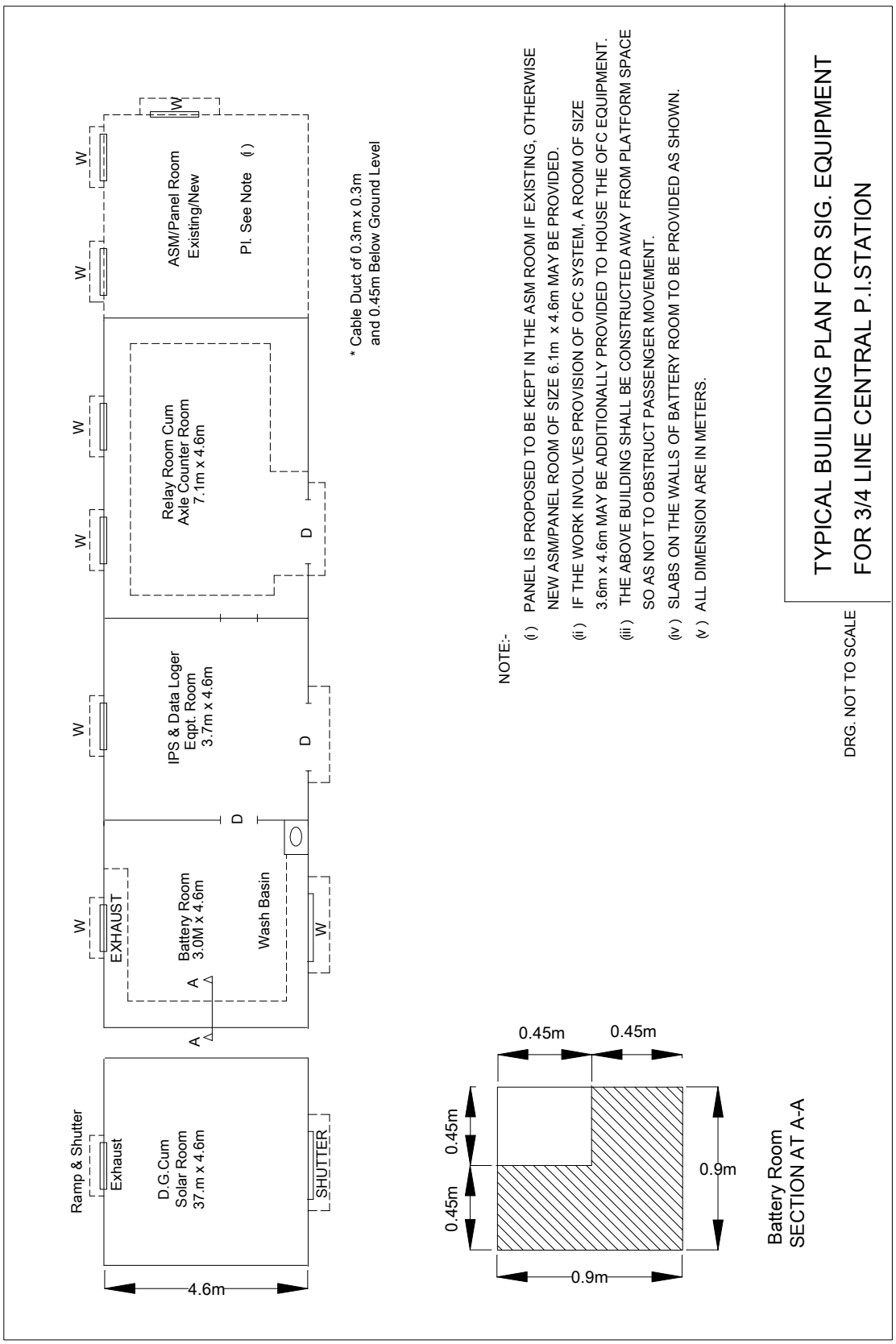
4. While framing estimates of Railways projects, above guidelines should be strictly followed.

This issues with the approval of Board (ME & ML).

13/8/08
(R.L. Gupta)
Executive Director/Signal

13/8/08
(P. K. Sanghi)
Executive Director/Works

DA: As above.
Copy to: CAO/Cs & CSTEs, PCEs All Indian Railways.


TYPICAL BUILDING PLAN FOR SIG. EQUIPMENT
FOR 3/4 LINE CENTRAL P.I.STATION
DRG. NOT TO SCALE
NOTE:-
(i) PANEL IS PROPOSED TO BE KEPT IN THE ASM ROOM IF EXISTING, OTHERWISE NEW ASM/PANEL ROOM OF SIZE 6.1m x 4.6m MAY BE PROVIDED.
(ii) IF THE WORK INVOLVES PROVISION OF OFC SYSTEM, A ROOM OF SIZE 3.6m x 4.6m MAY BE ADDITIONALLY PROVIDED TO HOUSE THE OFC EQUIPMENT.
(iii) THE ABOVE BUILDING SHALL BE CONSTRUCTED AWAY FROM PLATFORM SPACE SO AS NOT TO OBSTRUCT PASSENGER MOVEMENT.
(iv) SLABS ON THE WALLS OF BATTERY ROOM TO BE PROVIDED AS SHOWN.
(v) ALL DIMENSION ARE IN METERS.
* Cable Duct of 0.3m x 0.3m and 0.45m Below Ground Level
ASM/Panel Room Existing/New
PI. See Note (i)
Relay Room Cum Axle Counter Room 7.1m x 4.6m
IPS & Data Loger Eqpt. Room 3.7m x 4.6m
Battery Room 3.0M x 4.6m
EXHAUST
Wash Basin
Ramp & Shutter
Exhaust
D.G.Cum Solar Room 37.m x 4.6m
SHUTTER
4.6m
W
D
A
0.45m
0.9m
Battery Room
SECTION AT A-A