इरिसेट IRISET

S 24

INTERMEDIATE BLOCK SIGNALLING BLOCK PROVING AXLE COUNTER

Indian Railways Institute of
Signal Engineering and Telecommunications

SECUNDERABAD - 500 017

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INTERMEDIATE BLOCK SIGNALLING
BLOCK PROVING AXLE COUNTER

VISION :	TO MAKE IRISET AN INSTITUTE OF INTERNATIONAL REPUTE, SETTING ITS OWN STANDARDS AND BENCHMARKS
MISSION :	TO ENHANCE QUALITY AND INCREASE PRODUCTIVITY OF SIGNALLING & TELECOMMUNICATION PERSONNEL THROUGH TRAINING

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INDIAN RAILWAYS INSTITUTE OF

SIGNAL ENGINEERING & TELECOMMUNICATIONS

SECUNDERABAD - 500 017

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INTERMEDIATE BLOCK SIGNALLING
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CHAPTER 1: INTERMEDIATE BLOCK SIGNALLING

1.1 INTRODUCTION

1.1.1 Intermediate Block Signalling (IBS)

IBS is an arrangement made on a Double Line Section for increasing the Section Capacity by splitting of a long Block Section into two Sections namely 'Rear Section' and 'Advance Section' by installing an IB Signal at the point of bifurcation of that running Line with respect to the nominated direction of traffic.

The 'Rear Section' is signalled by operating the LSS which is monitored by Axle Counter or Track Circuits and the 'Advance Section' is signalled by operating the IB Signal which is interlocked with the Double Line Block Instrument at the Dispatching Station pertaining to the nominated running Line for nominated direction of traffic. For dealing the Trains in the opposite Direction, the other nominated running line is also equipped with the same system of Signalling at the other end of the Double Line Block Section.

It is a substitute for Class 'C' station. The IB Signalling is employed to avoid the expenditure on additional Block Instruments, Station Building and Operating Staff.

This can be achieved by providing Track Circuit or Axle counter with the Entrance point located at the LSS and the Exit point located at the IB Signal including IB Signal overlap of 400 metres for the purpose of controlling the LSS for 'Rear Section'. The IB Signal interlocked with the Double Line Block Instrument is provided for 'Advance Section' and is controlled by the Station Master at the Dispatching Station. Distant Signal is also provided to pre- warn the Loco Pilot regarding the aspect of the IB Signal. The same system is followed for the other running line for the opposite direction of traffic at the other end of the Double Line Block Section. IBS system minimises the detention to the closely following Trains and increases the frequency of the train movements. GR 1-02 (31), and 3.11 & 3.42 gives the requirements of IB signalling system.

1.2 FEATURES OF IBS

(a) IBS exists only on Double line section.

(b) The purpose of IBS is to increase the Section capacity.

(c) It is a replacement to Class 'C' station with the following advantages:

  (i) Block Instruments are not required.

  (ii) Station Master & Operating staff are not required.

  (iii) Station Building is not required.

  (iv) Section Capacity is increased.

(d) It splits Block Section into two sections namely,

  (i) Rear section (controlled by Axle counter/ Track circuits)

  (ii) Advance section (controlled by Block Instrument).

(e) Maximum two Trains can be dealt on a lengthy Double Line Block section on each nominated running line by adopting IBS system.

1.3 REQUIREMENTS

(a) Block Section is divided into two portions

(i) Rear Section

(ii) Advance Section

(b) Axle Counters with Resetting arrangement for each rear section.

(c) Axle counter used may be UAC or SSDAC.

(d) IBS Panel with various Indications & Push Buttons at each Block station.

(e) IB Signal, Distant and inner Distant signal (where applicable) for each direction.

(f) Conventional Double Line Block Instruments at each Block Station.

(g) Signal Post Telephone communication with station in rear from each IB Signal.

(a) REAR SECTION:

(i) Section between LSS and IB Signal (including 400 metres of overlap)

(ii) Entry of train into the “Rear Section” is controlled by LSS Signal.

(iii) LSS is controlled by clearance of the (rear section) Axle Counter

(iv) LSS is taken ‘OFF’ by station in rear.

(b) ADVANCE SECTION:

(i) Section between IBS and FSS of station in advance (Including Block overlap)

(ii) Entry of a train into the “Advance Section” is controlled by IB Signal.

(iii) And IB Signal is controlled by line clear issued from Block instrument at station in advance.

(iv) IBS is taken OFF by Station in rear.

(c) **AXLE COUNTERS:**

An Axle Counter with reset system for each rear section is kept at sending station. The axle counter may be of UAC or of SSDAC

(d) **SIGNAL POST TELEPHONE**:

Provided at the IB Signal post for Communication with the station in rear.

1.4 IBS LAYOUT

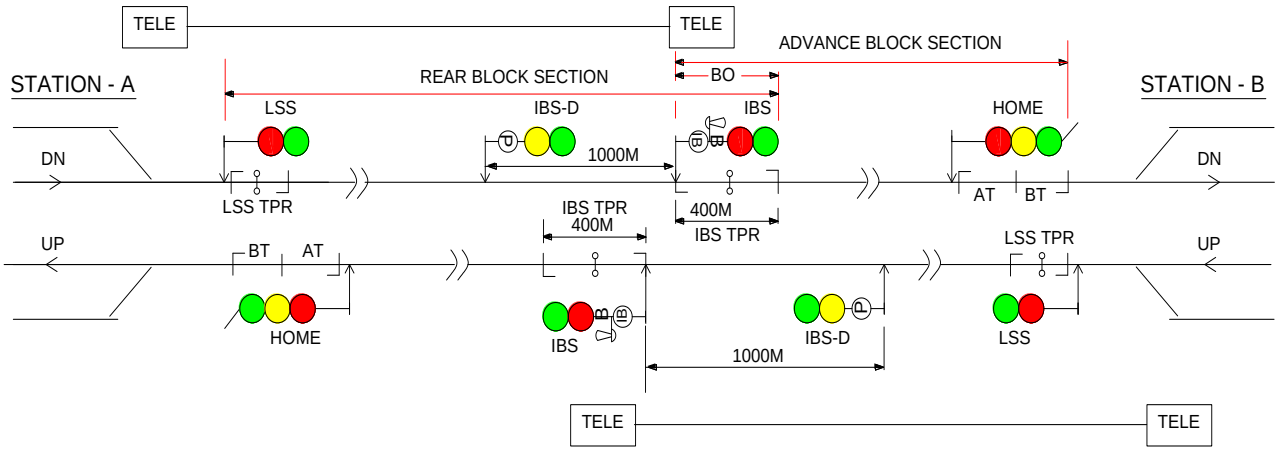


Fig No: 1.1

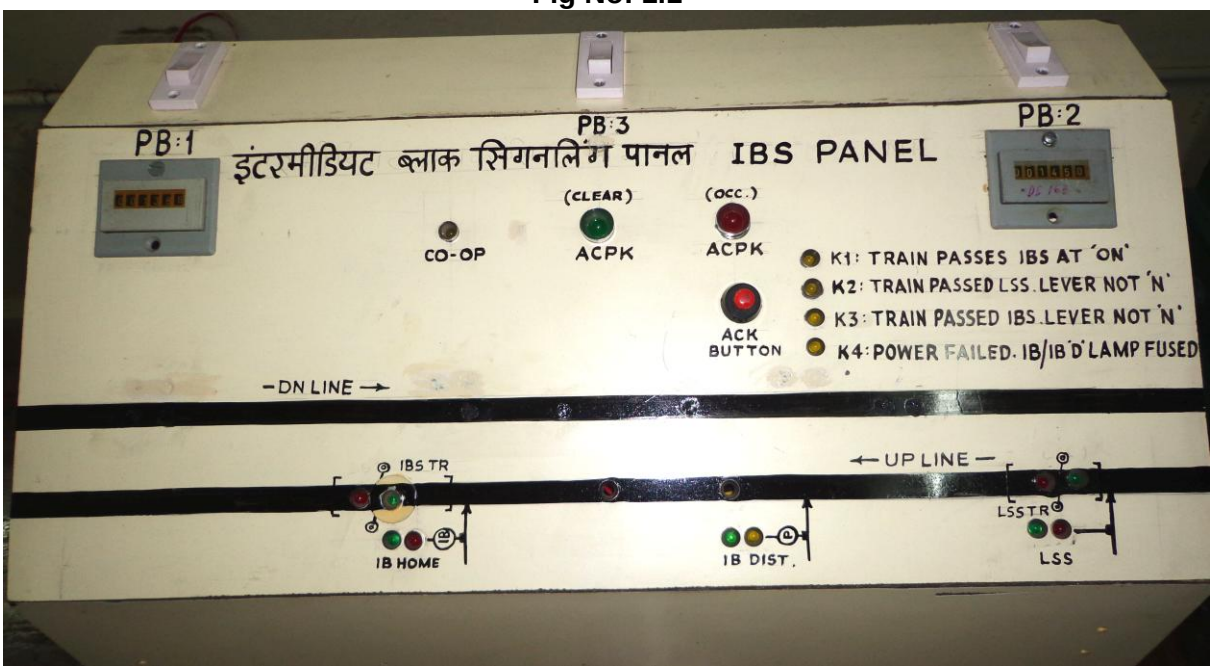


Fig No: 1.2

1.5 For each direction, an IB Signal is placed at the point where the section is divided into two portions and also a Distant signal at a minimum distance of 1 KM in rear of IB Signal is provided. A typical arrangement of IB Signalling is indicated in Figure No.1.1. The Axle Counter used in Rear section may be of Universal Axle Counter or of Single Section Digital Axle Counter. It is also possible to have IBS with two track circuits, one from LSS to IB signal and the other from IB-Signal upto the overlap of 400 meters. To the extent possible Up IB Signal and Down IB Signal shall be kept close together so that both can be controlled from the same IB-Equipment room located near the signals. This room accommodates the relays for controlling the IB signals and IB Distant Signals, Lamp Proving relays, Track proving relays and 110 V AC Power Supply for signals, 24 V DC Power supply Battery and Charger required for repeating IB relays at the corresponding signalling Station ‘A’ (Sending Station) and Station 'B'.

The IB Signal shall be so located that the running time of Rear Section will be equal to the running time of Advance Section in such a way that optimum headway can be maintained between the trains at maximum possible speeds. However, the gradient at the approach of IB signal and the existence of Neutral Section, visibility of signals etc., are also to be considered for locating the IB signal. If required, Up and Down IB signals may be staggered to suit the local conditions. Accordingly, the distant signals are also to be located.

1.6 IBS PANEL

It is made up of the following Indications & Push buttons Refer Fig. No.1.2.

(a) IB Signal indication

(b) IB Distant Signal indication

(c) IB track indication

(d) LSS Signal indication

(e) FVT track indication

(f) Axle counter Clear indication

(g) Axle counter Occupied indication

(h) Co-operation Indication: Appears at sending station only when PB3 is pressed at receiving station in case of IB Signal or Axle counter failure.

(i) K1: Appears at sending station when a train passes IBS at Danger.

(j) K2: Appears at sending station when a train passes LSS and LSS levers/switches still in reverse position.

(k) K3: Appears at sending station when a train passes IBS and IBS lever/switch is still in reverse position.

(l) K4: Appears at sending station when IB Signal or Distant becomes blank
(All indications are of white/Yellow in colour along with a Buzzer).

(m) PB3: Push button pressed at receiving station after receiving the train duly ensuring that the section is clear and the Block Instrument is normalised for extending the co-operation to sending station during IB Signal or Axle counter failure for Resetting.

(n) PB1: Push button pressed at sending station for resetting the system when train has passed IBS at Danger after getting co-operation indication from Advance Station.

(o) PB2: Push button pressed at sending station for resetting Axle counter failure after getting co-operation from the advance station. It is not required in case of SSDAC.

(p) Acknowledgement Push button for silencing the audible buzzer.

(q) Control for IB Signal

(r) Control for LSS Signal (optional)

(s) PB1 COUNTER

(t) PB2 COUNTER

The K1, K2, K3 & K4 visual indications are supported by audible buzzers. K1&K4 audible buzzers are stopped by pressing the Acknowledgement button while K2 & K3 audible buzzers are stopped by normalizing the LSS & IB Signal controls.

IBS Panel may be integrated with regular operating panel of the station.

1.7 SEQUENCE OF OPERATIONS FOR TRAIN MOVEMENT

The LSS of the Station 'A' (Sending Station) for down line can be cleared when the Rear Section (Axle Counter Section) is 'CLEAR'. In case of end cabin working, the platform SM's control is also required for the clearance of LSS by Switchman. When the LSS is taken OFF, the train passes the LSS and actuates the LSS track circuit (trolley suppression track circuit at Entrance end) and replaces the LSS to ON position.

The down IB signal is controlled by the cabin of station `A'(Sending station)and Line Clear is obtained from Station 'B' (Receiving Station) on Double Line Block Instrument. On obtaining Line Clear, the IB-Signal is cleared by the Switchman. When the IB signal is cleared, the Distant signal also displays Green aspect automatically. Then the train passes IB-signal and actuates the IBS track circuit (trolley suppression track circuit at Exit end) and the IB Signal is automatically replaced to ON replacing the Distant signal to normal aspect.

When the train passes the IB Signal and clears the section upto 400metres beyond IB Signal, the Rear Section (Axle Counter Section) becomes Free once again and is indicated by Axle counter section 'Clear'. Now the LSS of Station 'A' can be cleared for the second train to enter into the Rear Section. Similar arrangements shall be made for up Line also.

1.8 CONTROL OF IBS:

As soon as the first train goes beyond IB signal and actuates the IBS track circuit, "Train Entering Section" signal is to be given by Station 'A' (Sending Station) to Station 'B' (Receiving Station) and the block handle is to be turned to TOL at the receiving station. When the train reaches the block clearance point in advance of the Home Signal at Station 'B' and on getting train arrival Buzzer, the block handle is to be turned to Line Closed by Station 'B' after ensuring the complete arrival of the train.

After exchanging necessary information on telephone a fresh Line Clear is to be granted by Station 'B' for the second train which is now running between the LSS and IB signal. After obtaining Line Clear on Block Instrument, the IB Signal is cleared by the Station `A'. Thus, when the LSS controlled by the Axle Counter and the IB Signal controlled by Double Line Block Instrument for monitoring the second half of the Block Section (Advance Section) were working properly, the system permits one train between LSS and IB signal and another train between the IB overlap point and the Home Signal of the Station 'B' (Receiving Station),thereby increasing the section capacity.

1.9 RESETTING OPERATIONS

There are two types of resetting operations involved:

(a) When a Train passes IBS at 'ON':

(i) K1 indication appears with Buzzer at sending station. Pressing the acknowledgement push button stops the buzzer.

(ii) The receiving Station Master receives the above train and after ensuring the complete arrival of the said train normalises the Block Handle and after exchanging necessary information presses PB3 button.

(iii) The sending Station Master, after getting the co-operation indication on panel, presses PB1 and the system gets normalised.

(b) When Axle Counter fails:

(i) Axle Counter shows 'OCCUPIED' on IBS Panel at sending station even after train clears the section between LSS and IB Signal (including overlap).

(ii) The sending station informs receiving station.

(iii) The receiving Station Master receives the above train and after ensuring the complete arrival of the said train normalises the Block Instrument and after exchanging necessary information presses PB3 button.

(iv) The sending Station Master, after getting the co-operation indication on panel presses PB2 and the system gets normalised.

1.9.1 IBS FAILURE RESETTING

When the train has passed IB Signal at danger, the relay ACZR drops and is indicated by K1 visual indication and an audible buzzer sounds. Once this indication appears and buzzer sounds, the LSS cannot be re-cleared till such time the ACZR relay which has dropped due to train passed IB Signal at danger picks up. It will pick up only when Station Master of Station 'A' (Sending Station) and Station Master of Station 'B' (Receiving station) co-operate each other. For this Station Master of station 'B' presses the PB3 button after complete arrival of the train at station 'B' and Station Master of Station 'A' presses the PB1 button at the same time till the K1 indication disappears. This resetting operation is registered by a counter and the LSS can be a recleared only after this operation.

1.9.2 AXLE COUNTER FAILURE RESETTING

There are two types of resetting procedures to be carried out in case of axle counter failure depending upon the axle counters used in the Rear section.

(a) When Universal Axle Counter is used:

If the Axle Counters fails to show `clear indication' when the train has fully cleared the overlap in advance of IB signal, the resetting of Axle Counter can be done jointly by Station Master of Station 'A' (Sending Station) and Station Master of Station 'B' (Receiving Station) only after the train has arrived completely at the Station 'B'. This is verified by the Station Master of Station 'B'. When Axle Counter shows `occupied 'indication permanently, Station Master of Station 'B' (Receiving Station) has to press PB3 button and Station Master of Station 'A' (Sending Station) has to press PB2 button simultaneously, till such time the axle counter shows `clear' indication. This operation is registered by a counter at Station 'A'.

(b) When SSDAC is used:

At both receiving & sending end stations following operations are to be carried out.

(i) Insert SM's Key, turn key to right & keep pressed.

(ii) Press Reset button.

(iii) Release SM's key & remove, release reset button.

(iv) With above (i) to (iii) operations, 48 V DC from reset box is extended to SSDAC through relays PPR & VPR back contact and activates the reset circuit in modem card of SSDAC unit and generates reset command to Micro controllers in MLB1 & MLB2 cards.

(v) The SSDAC units gets reset & counts becomes zero and self test is carried out in both units, the SSDAC units attain the preparatory reset state & their LED indication also gets lit on the reset box in SM room.

(vi) The counter reading also increments by 1 count through preparatory reset command after a time delay of around 5 seconds which should be recorded.

(vii) A Pilot train should pass through the section to normalize the system & the vital relay of SSDAC picks up at both the stations.

From the above, it is seen that in both the cases, when the train passes IB signal at Danger or Axle Counter is not 'clear' even after the passage of the Train beyond the Axle Counter Section, the circuit will permit only one train in the entire Block Section of IBS System during the failure time. The normal working can be restored only after resetting the system by the co-operation of both the Station Masters. Station Masters are required to verify the complete arrival of the train at the receiving station and there are no trains in the entire Block Section of IB system before resorting to any type of resetting.

Similarly, for resetting IBS on Down direction, Station Master of Station 'A' (Receiving Station) has to press PB3 and Station Master of Station 'B' (Sending Station) has to press PB1 at a time.

For resetting Axle Counter failure on Down direction, Station Master of Station 'A' (Receiving Station) has to press PB3 and station master of station `B' (sending station) PB2 simultaneously.

1.10 PROCEDURE TO BE FOLLOWED BY DRIVERS IN CASE OF IB SIGNAL IS AT DANGER OR AT BLANK

As per GR 3.75 the Driver shall stop his train in rear of the signal & contact the SM of block station in rear on telephone provided on the signal post, then pass the defective IB signal if authorized by SM & if telephone is not provided or is out of order or communication is not possible with the Station 'A'(Sending Station), the train after waiting for 5 minutes can go beyond IB signal at a speed not more than 15 KMPH which should be reduced to 8 KMPH in case of inadequate visibility (like fog, night conditions, etc.); the Driver should proceed at restricted speed till he reaches Station 'B' and on arrival of the Train at Station 'B' (Receiving Station), the system should be reset by the joint co-operation of both the Station Masters and IB System can be normalised.

1.11 DESCRIPTION OF RELAYS AND CIRCUITRY

The detailed circuitry is shown in the Figure.No.1.5 to 1.24. The function performed by various relays and details of contacts included in their pick up circuit and holding circuit is given:

LCPR: This relay picks up at train dispatch end when the block handle is turned to Line Clear at the receiving end. It also requires ASR1 and ASR2 to be picked up before hand. When the IB signal is cleared or the control/lever is reversed, in order to hold LCPR in its pick up condition, there is a bye-pass path provided by LCPR front contact. This relay drops as soon as IBS TPR drops, or when the handle at the receiving end is turned prematurely from Line Clear position. See Figure No 1.5.

ASR1 and ASR2: These relays pick up when the handle is turned to TOL at the receiving end and after making sure that LCPR is down and the IB Signal is not showing Green aspect When ASR1 picks up ASR2 will also pick up. Once picked up, these relays will stick through their own front contacts and also through IBS TPR. The use of the two relays ensures that the handle is to be turned to TOL for a considerable period before the ASR2 picks up. Further, the two relays do not drop when the contacts of IBS TPR break momentarily, because the same is bye-passed by contacts of ASR1, ASR2, NSR and back contact of LCPR. See Figure No 1.5.

IBS DR: This relay will pick up after the picking up of LCPR and proves that ASR1 and ASR2 are in picked up condition and ACZR is in picked up condition and the IB lever is reversed. To ensure that the relay should not drop due to the dropping of LCPR due to premature turning of Block Handle from Line Clear to TOL at the receiving Station, the LCPR contact is bye-passed by DR front contact, NSR back contact and ACPR back contact. IBS DR controls the clearance of the IB Signal. See Figure No 1.5.

LSS YR: The relay LSS YR is a slot relay that picks up when SM gives the slot. It proves that the axle counter portion is clear, no train has passed IB Signal at danger and also ensures that the stick relay LSS SR is up, HSR is down (due to ACPR being up).It also proves that the track circuit ahead of LSS and ahead of IB signal are up and the slot is given by SM for clearing the LSS. See Figure No 1.6.

LSS DR: The contacts of LSS YR are used for picking LSS DR ensuring the LSS control/ lever is reversed. LSS-DR is actual relay which controls the feed to the LSS signal. See Figure No 1.6.

LSS SR: LSS SR is a stick relay which picks up through LSS TPR Up and also proving the other required conditions and sticks through its own front contact. This relay is de-energized by the actuation of LSS Track and picks up when LSS Track is clear after the passage of Train and the Axle Counter portion is occupied, which is proved by EVR Down, SUPR Down and LSS NSR in dropped condition. It is essential to keep the LSS SR in holding condition after the normalisation of LSS Lever after passage of a Train until the next Train strikes LSS Track after passing LSS. But, whenever the LSS TPR drops and picks up due to bobbing of the Track in normal duration, the LSS SR stick path will be disturbed and LSS SR will be de- energised. Hence LSS SR should be picked up again since the sequential Train operation is already ensured by the Normalisation of the LSS lever after the passage of LSS. Hence the LSS NSR front contact is used to pick up LSS SR in parallel path with the LSS SR stick path. LSS SR ensures One Signal-One Train feature. See Figure No1.7.

LSS NSR: This relay picks up through the LSS-SR & ACPR pick up contacts and it will stick through its own front contact along with the LSS lever Normal band. This relay enables the LSS SR to pick up again in case of bobbing of LSS TPR during normal condition as explained above. See Fig No 1.8.

ACPR: This relay picks up when the Axle Counter Section is free which is ensured through ACRSR down, EVR up and SUPR up. The SUPR front contact is bye-passed by LSS DR front contact to ensure that ACPR will not drop for a momentary drop of SUPR due to trolleys placed on track devices etc., thereby causing signal failure. It requires LSS SR up and LSS Slot not given and LSS lever in Normal position for initial energisation. Once picked up, it holds through its own front contact until the Train passes LSS and occupies the Axle Counter Section. See Fig No 1.7.

IBS HSR: IBS Holding Stick Relay normally remains in de-energised condition and picks up only when the Axle Counter Section is occupied and IB signal is cleared and showing OFF aspect. When the train passes the IB signal duly actuating the IB track circuit and replacing the Signal to 'ON', the HSR remains in picked up condition through IBS TPR drop contact and its own front contact. Once the train clears IBS Track, the HSR relay will be de-energised. The HSR relay keeps the ACZR relay in picked up condition while the train is passing the IB signal on a signal movement and negotiating on the IBS track circuit and it will not allow the ACZR to drop when the Train strikes the IBS TPR. See Fig No 1.9.

ACZR: The purpose of this relay is to detect whether a train has passed IB Signal at 'ON'. This relay will be normally in picked up condition and has three parallel holding paths namely LSS NSR, IBS HSR and IBS TPR pick up contacts. This relay drops only when all the three relays are in dropped condition. ACZR is controlled by the pickup contact of IBS TPR. Whenever IBS TPR bobs for any reason after completion of a Train movement, ACZR will be held through LSS NSR front contact.

When the train enters the Axle Counter Section, ACZR will be held through the HSR pick up contact during the passage of Train on IBS Track Circuit. Once the Train clears IB Track portion, HSR drops since the IBS TPR picks up and ACZR will continue to be in energised condition through the IBS TPR pick up contact. But, when a Train passes IB Signal at 'ON' due to some failure, HSR is not picked up since it is a non-signaled movement. Hence, when the IBS Track is actuated by the Train on passing IBS at 'ON', all the three holding paths of ACZR will not be available and hence it will be dropped positively thereby registering the Train Passing the IB Signal at 'ON'.

Once the ACZR relay drops, it requires the resetting of IB Signal by co-operation of both the Station Masters. The receiving end Station Master presses the PB3 button after ensuring the complete arrival of the Train. The relay CRR picks up at the sending station after being repeated at number of places where RE cutting is installed. As soon as the sending Station Master presses PB1, the relay ACZNR picks up duly proving ACZR in dropped condition and IBS TPR in picked up condition. With the picking up of CRR, the co-operation indication appears at Station 'A' and the relay ACZNPR picks up when CRR and ACZNR are in picked up condition. As soon as ACZNPR picks up, the relay ACZR picks up and sticks through its own front contact. The operation of ACZNR is registered by a special counter. See Fig. No. 1.9, 1.10 and 1.11, for CRR circuit in RE Area. Refer Fig No 1.12.

ACRSR: This relay is used for resetting Axle Counter failure. When the Axle Counter shows occupied after the Train has cleared the complete Axle Counter Section, the complete arrival of the Train is ensured by the Receiving Station Master and presses PB3 button at Receiving end & the Sending end Station Master has to press PB2 button for resetting. Then CRR picks up and PB2 being in pressed condition at Sending Station, the ACRSR will pick up proving that the ACPR is in dropped condition. Once ACRSR picks up, the resetting counter registers resetting number and the 'R' relay of the Axle Counter evaluator picks up which in turn resets EVR and SUPR relays and enables the ACPR to pick up. See Fig No 1.13 &1.7.

PBPR & XR: The PBPR relay picks up whenever the ACZR is in Dropped condition and it is used for silencing the buzzer. Similarly, when there is power failure or the IB signal is completely blank, the buzzer sounds and it is to be silenced by picking up of XR relay by pressing the acknowledgement button.

The audible bell in conjunction with the K2 & K3 indications is silenced whenever LSS lever or IBS lever is replaced to the normal position respectively. See Fig No 1.20

K1, K2, K3, K4: The indication circuits of K1, K2, K3, K4, Axle Counter Occupied & Clear indication, the 'ON' & 'OFF' aspect indication of LSS signal, IB signal & the LSS Slot indication etc., are shown in the Fig No 1.16, 1.17 & 1.18.

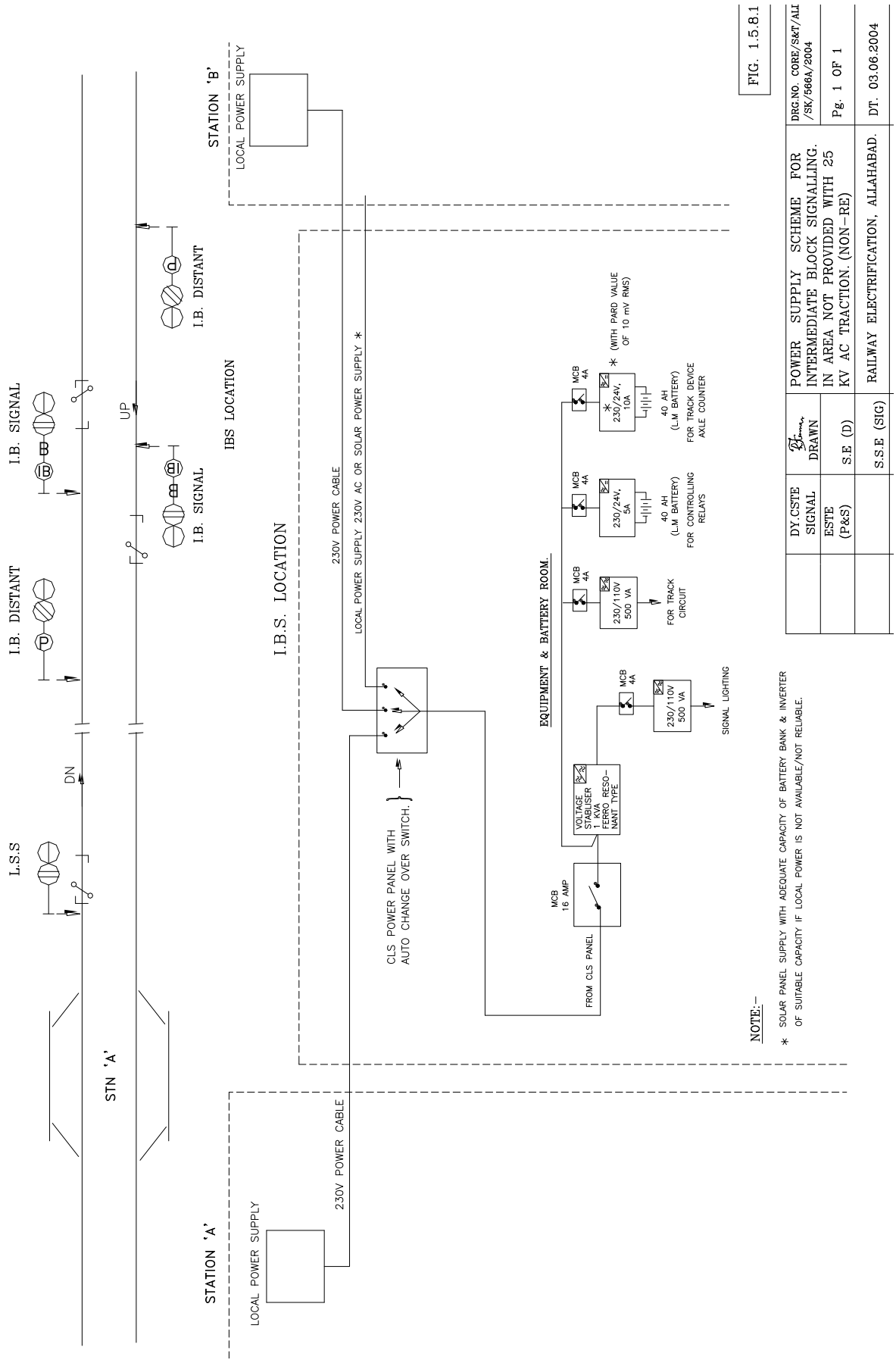
IBS DPR: There is only one relay IBS DPR for controlling the green aspect of the IB Signal located at IB Hut and this is a repeater of IBS DR which is located at sending end station and in RE section it is repeated at every RE cutting. As IBS DPR relay picks up, the IB Signal is cleared to 'OFF' and whenever the green lamp fuses or IBS DPR is down, the IB signal is replaced to 'ON' .The lamp proving relays IBS DECR & IBS RECR of IBS Signal works with the lamp circuit from IBS Relay Room for the Red and Green aspect of the IB Signal.

IBS-D DR: It is IBS Distant signal OFF aspect controlling relay, which in turn controlled by IB signal 'OFF' aspect and is held through its own front contact. This relay is at IB signal location and it is repeated at the IB Distant location as IBS-D DPR. The 110V feed to the bulbs of the IB Distant signal is taken from the IB location through the front contacts of IBS-D DR at IB Location and also proved in series with the front contacts of the IBS-D DPR located at the IB distant Location. The lamp proving relays ensure the working of IB Distant green and yellow aspects. Whenever IBS-D DR is down or the green aspect of the IB Distant is fused, the yellow aspect of IB Distant is lit automatically. See Fig No 1.22 and 1.23.

From the IB location to the Station 'A', the condition of the IBS Track circuit, condition of the lamp proving relays of the IB signal 'OFF' & 'ON' aspect are repeated. While proving the IB signal (Red or Green aspect) the corresponding bulbs of the IB Distant signal (Yellow or Green aspect) is also proved in series to ensure that there is correspondence in the aspect displayed by IB signal and IB Distant signals. The repeating relays IBS RECPR, IBS DECPR and IB TPR are again repeated at every RE cutting. See Fig No 1.24.

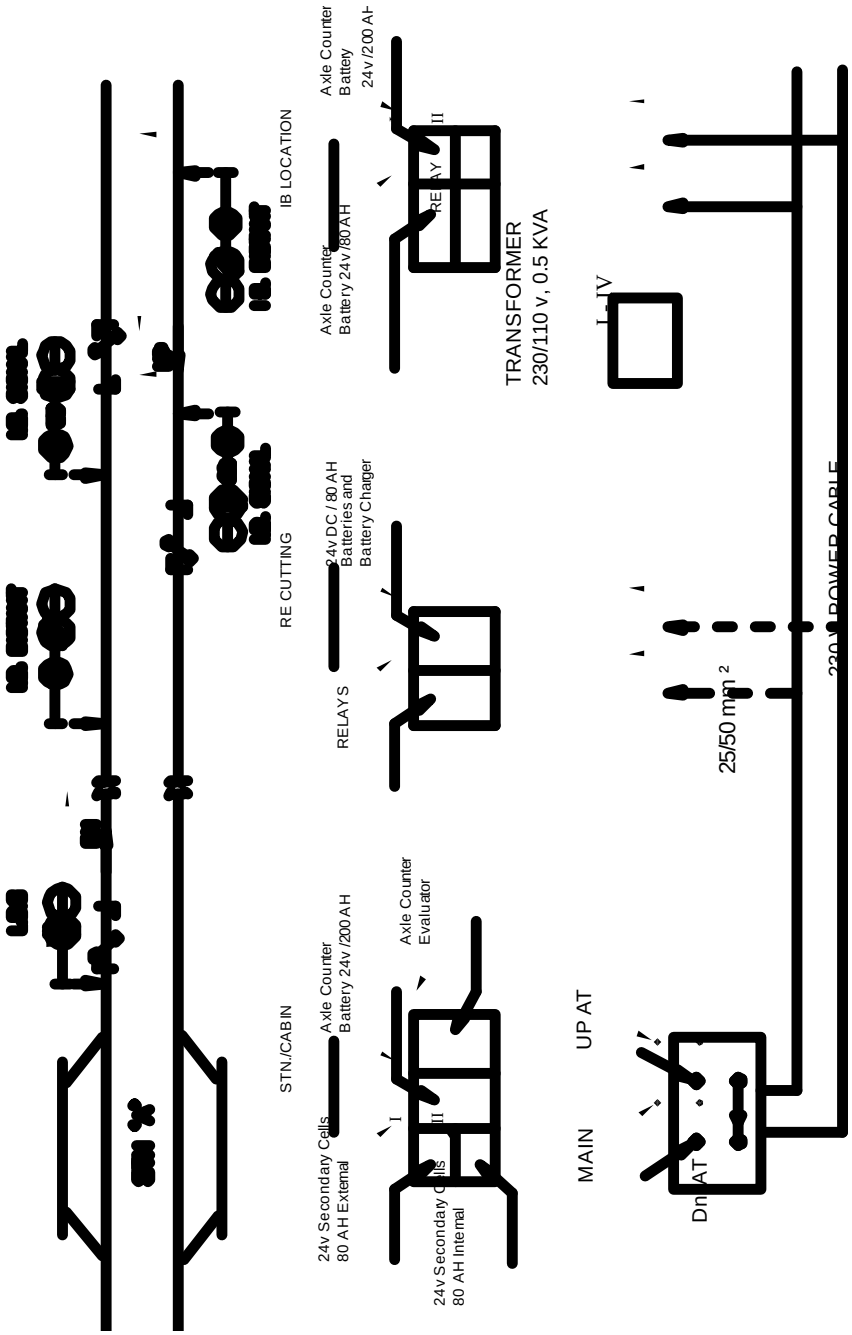
1.12 POWER SUPPLY ARRANGEMENTS

Power Supply required at IB location is 110 V AC for signal lighting and 12 V or 24 V DC for operating the various repeater relays from IB location to the Station 'A' (Sending Station) or Station 'B' (Receiving Station) as explained above. The details of Power Supply arrangements for IB location is shown below. 25 mm^2 aluminum power cable can be laid from the Cabin of Station 'A' (Sending Station) or Station 'B' (Receiving Station) to take 230 V AC to the IB location from where it can be stepped down to 110 V AC for signal lighting and also used for the battery chargers for charging the relay batteries. This 230 V AC is tapped from Auxiliary transformers of the traction supply at the cabin of Station 'A' (Sending Station) or at the cabin of Station 'B' (Receiving Station) and normally the supply is tapped from two Auxiliary transformers so that in case of failure of one of the AT supplies, the other can be manually selected. Alternatively as per the approved policy of the Railway Board, two AT supplies can also be provided at IB location itself for 230V AC, but this would require provision of reliable auto change over arrangements at the IB location itself change over from one AT supply to the other AT supply. See Figure 1.3 (a),(b) below.



POWER SUPPLY ARRNGEMENT FOR IBS (NON-RE)

Fig No: 1.3 (a)



POWER SUPPLY ARRNGEMENT FOR IBS (RE-AREA)

Fig No: 1.3 (b)

1.13 Cable Requirements

From the IB location to Station ‘A’ (Sending Station), apart from power cable, one PET Quad is required for carrying the Axle Counter track device at the overlap point of IB signal. In addition a 12 core cable is required, 2C for controlling the IB signal, 6C for the repeater relays and 2C for end to end cancellation circuit from Station ‘A’ (Sending Station) to Station ‘B’(Receiving Station) and a 2 core for testing telephone/spare

Between the IB distant and IB signal, additional 6 core cable is required for the RE cutting relays at the distant location and lighting circuits of distant signal. Similarly, cables will be required from IB location to the Station ‘B’ (Receiving Station). IB telephone can be provided on one of the paper quads of R.E. Telecom cable. As seen from the Fig No 1.12 for cancellation in Up direction as well as cancellation in down direction. Common two core cable is used between Station ‘A’ (Sending station) and Station ‘B’ (Receiving Station) and this will ensure that the

cancellation for only one direction can be done at a time with the co-operation of Station 'B'(Receiving Station) and Station 'A' by pressing PB3 and PB1/PB2 at the same time for Dn direction cancellation. The roles are reversed for cancellation in Up direction. For Up direction it is achieved by the relay CPBR at Station 'A' (Sending Station) which picks up when he presses PB3 button, but ensuring that DN CRR is de-energised at the same time. Through the contact of the CPBR, 12 V is applied on the cancellation circuit to which pick up for Up-direction cancellation relays at every RE cutting and finally it is repeated as Up CRR at Station 'B' (Receiving Station). Similarly, the co-operation is given by Station 'B' is repeated as down CRR at Station 'A' (Sending Station).

1.14 The above explanation is for only one direction namely from Station 'A' (Sending Station) to Station 'B'. Similar relays are located at Station 'B' for controlling IB signal in the Dn direction between Station 'B' (Receiving Station) and Station 'A' (Sending Station) and similarly relays will also be located at the IB location for controlling the Up IB Signal.

1.14.1 IBS LAYOUT

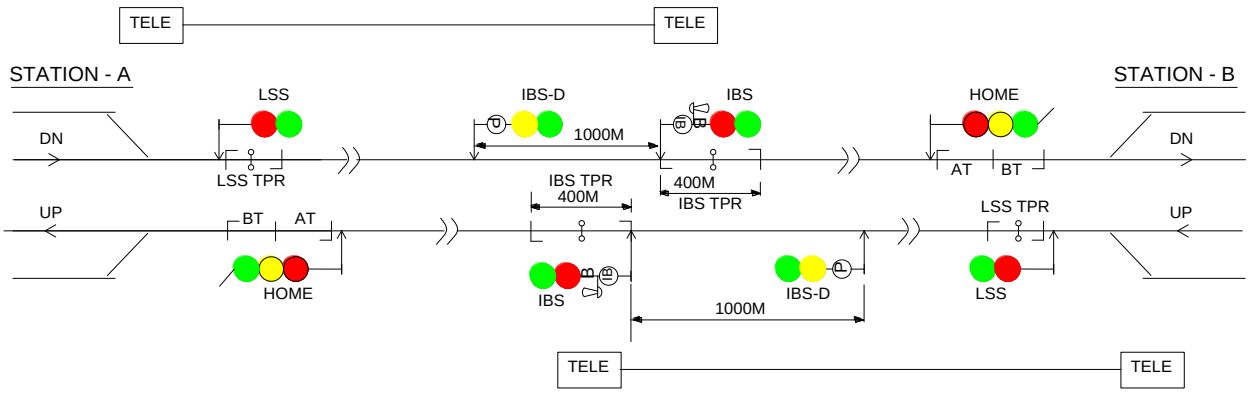
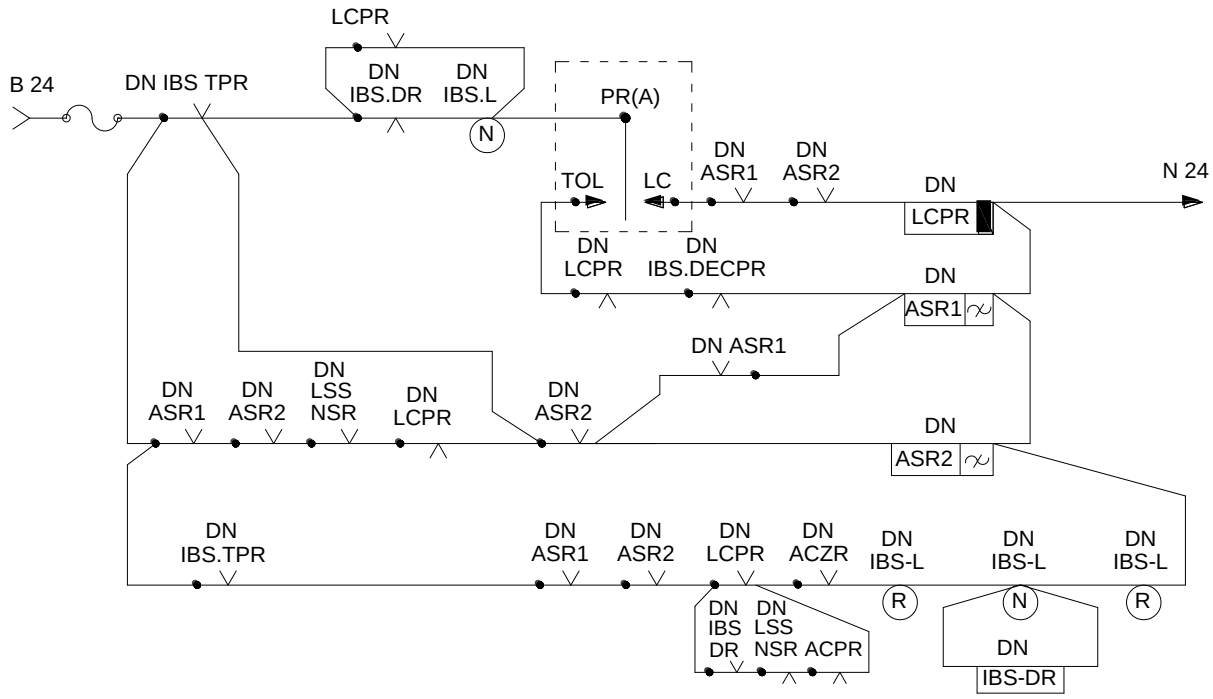


Fig No: 1.4

1.14.2 IBS CIRCUITS WITH UNIVERSAL AXLE COUNTER



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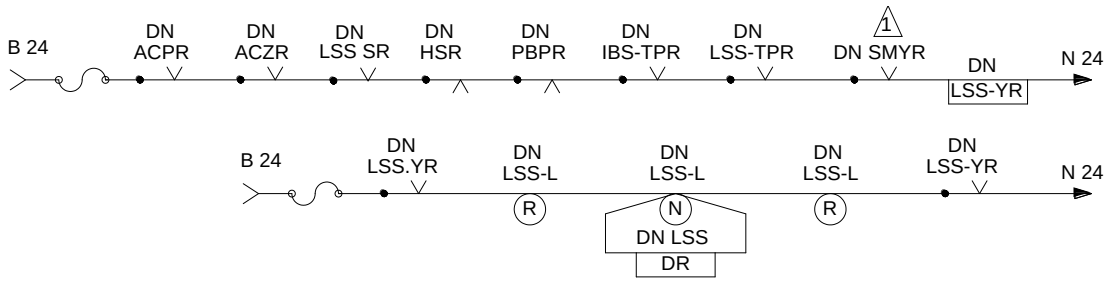

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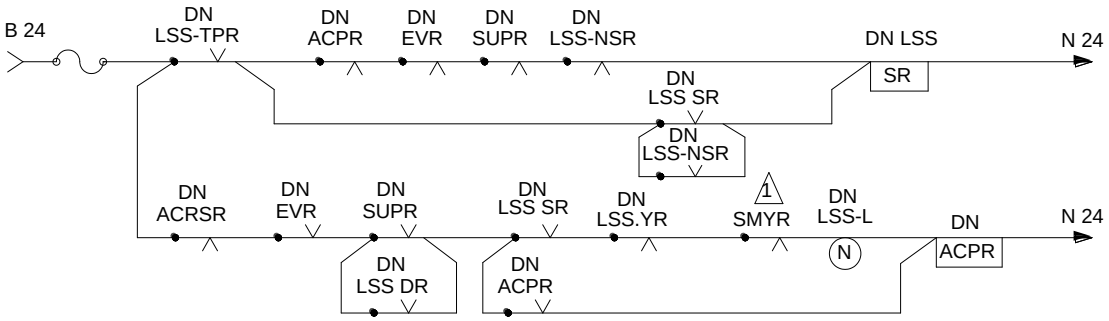

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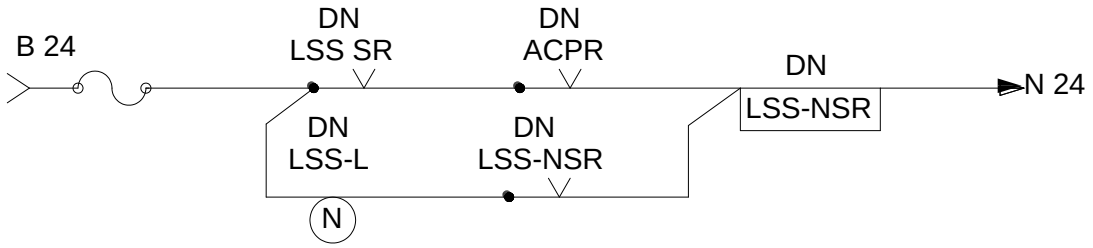

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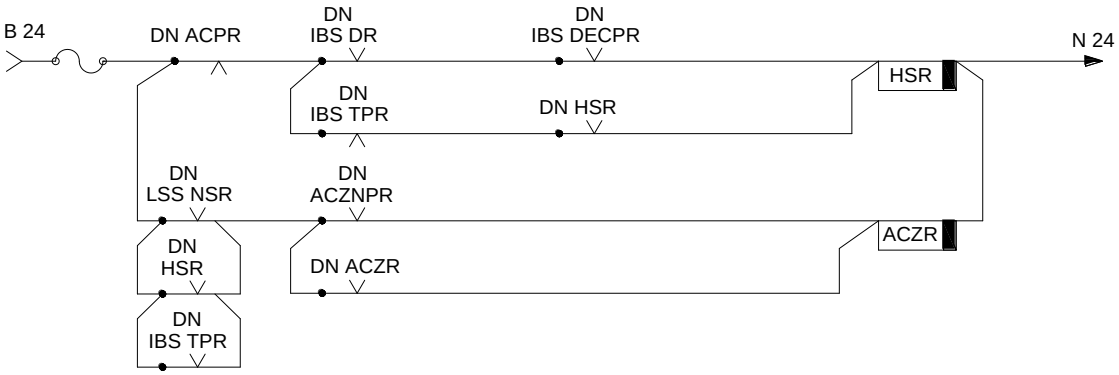

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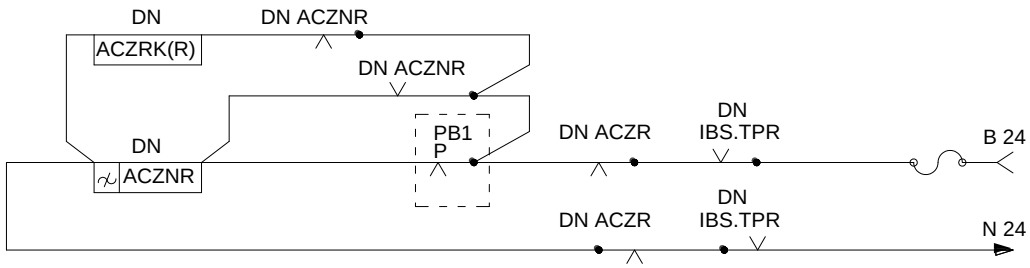

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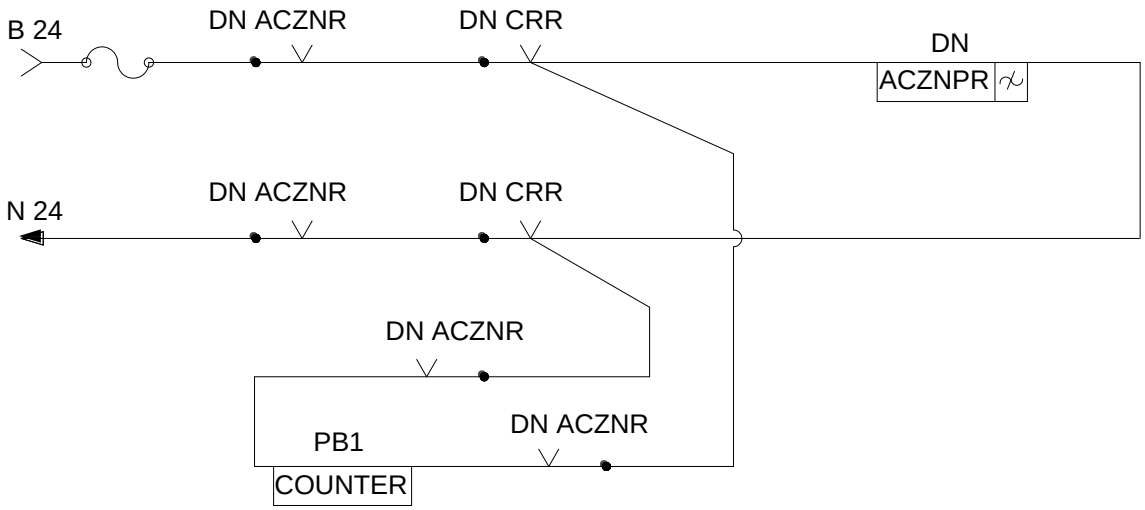

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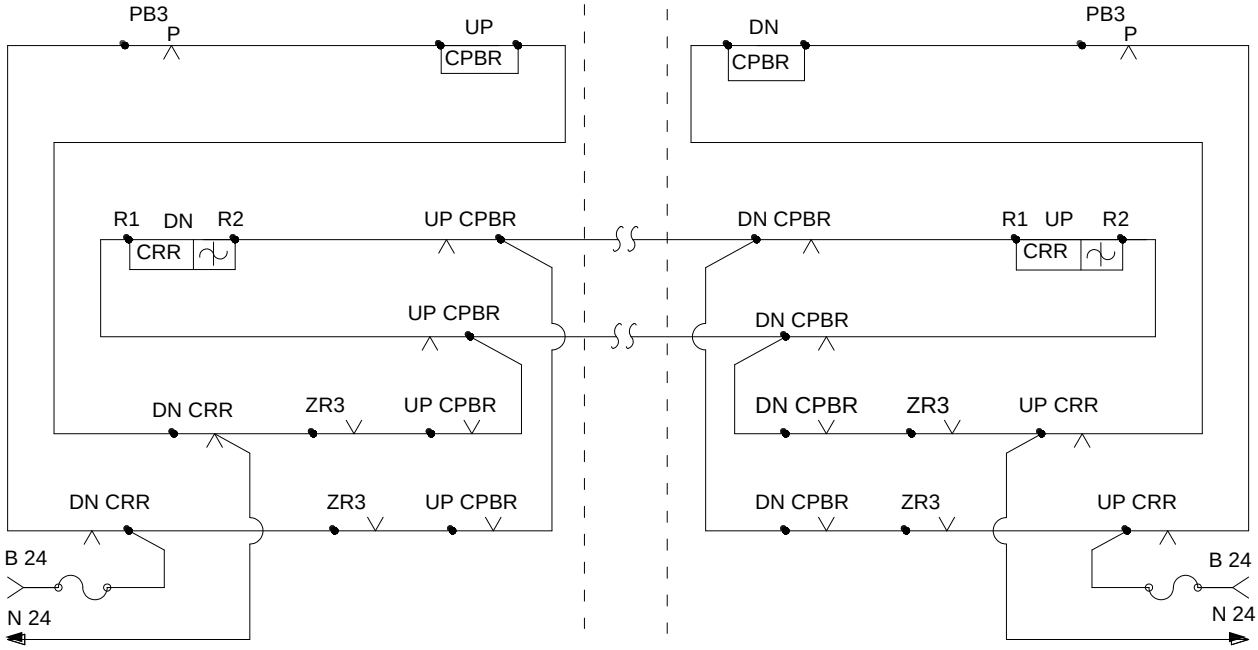

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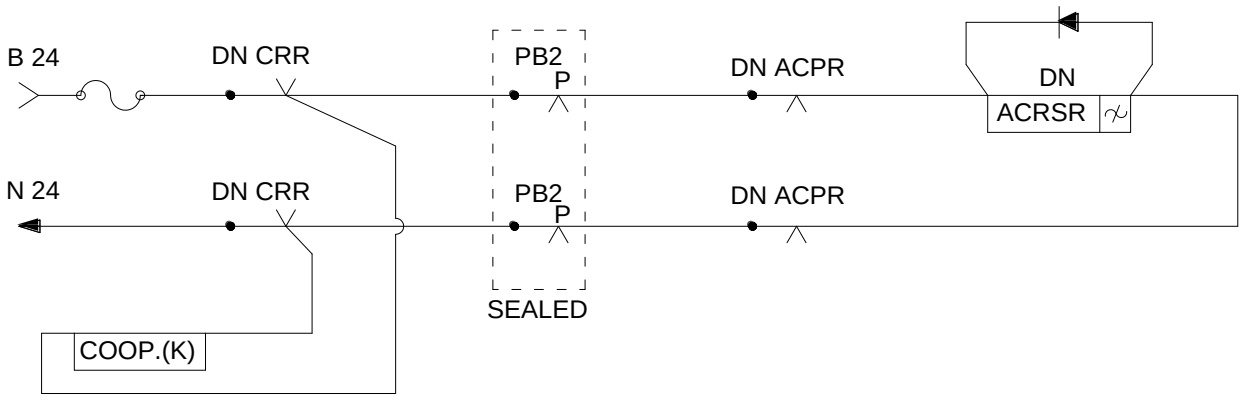

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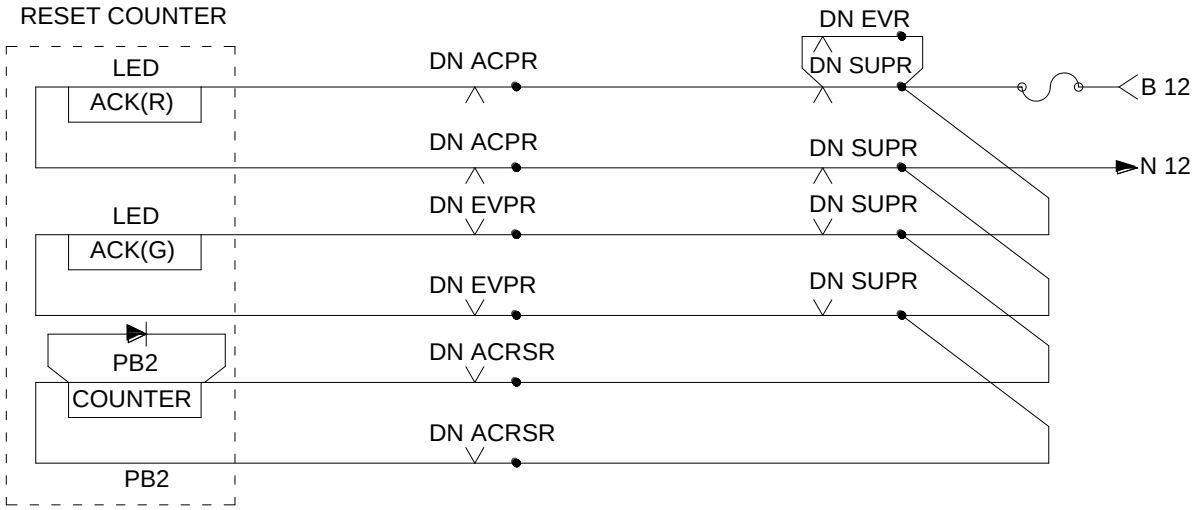

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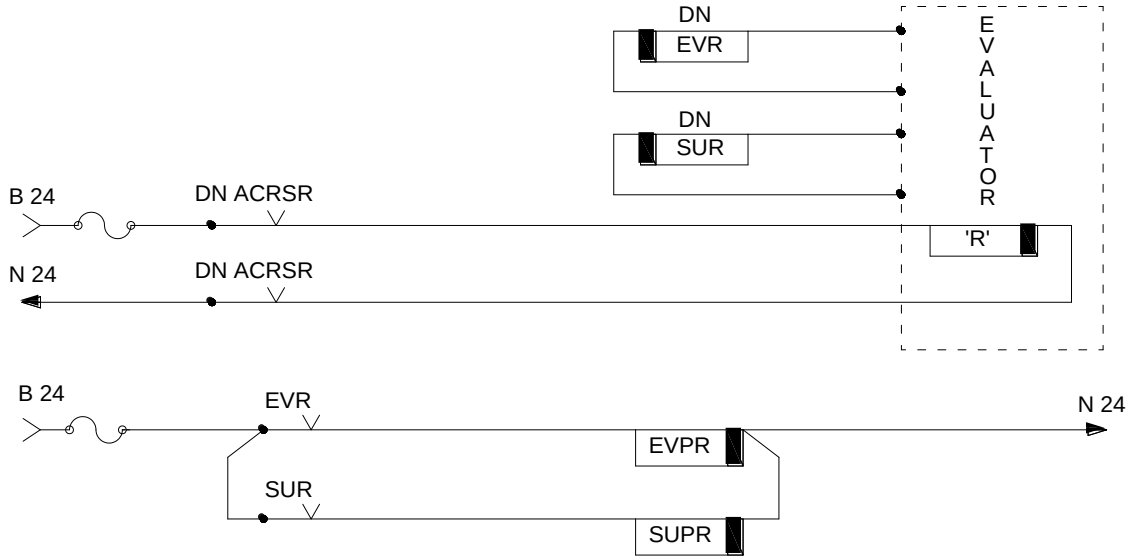


Fig No: 1.15

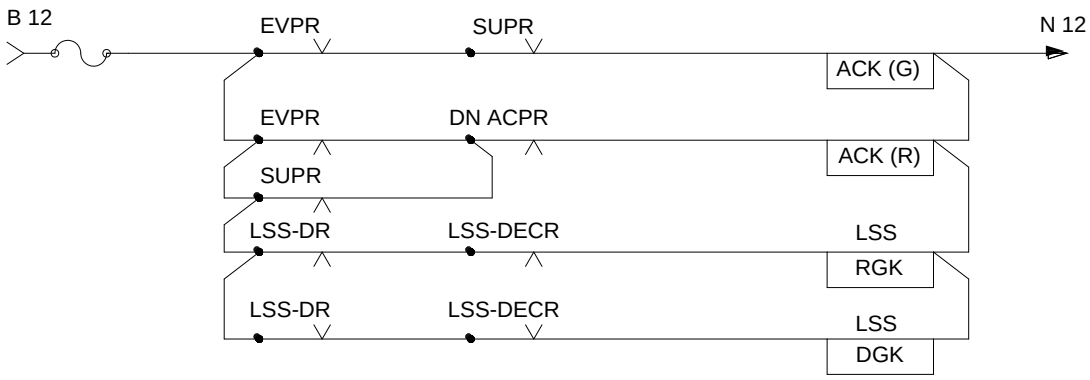
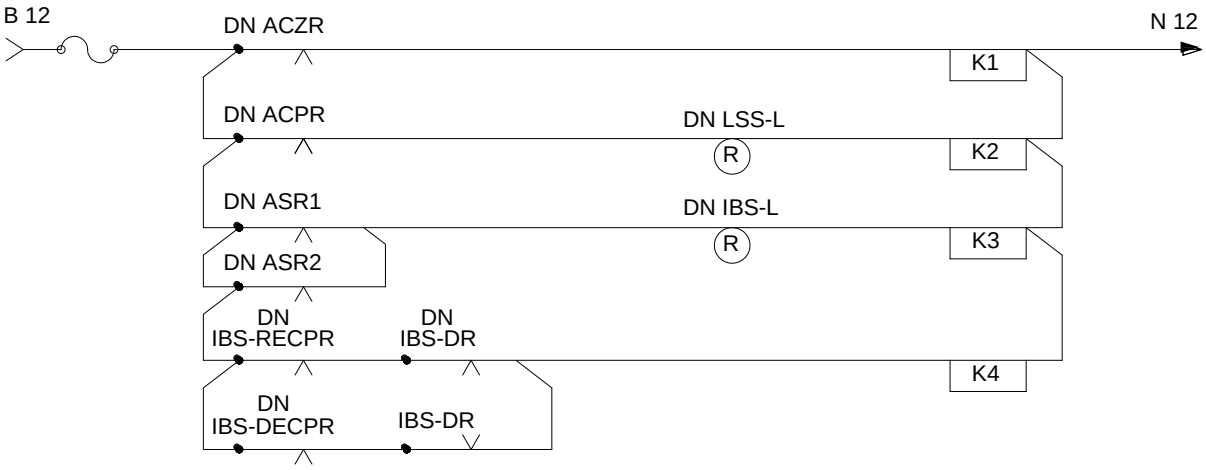


Fig No: 1.16

Fig No: 1.17



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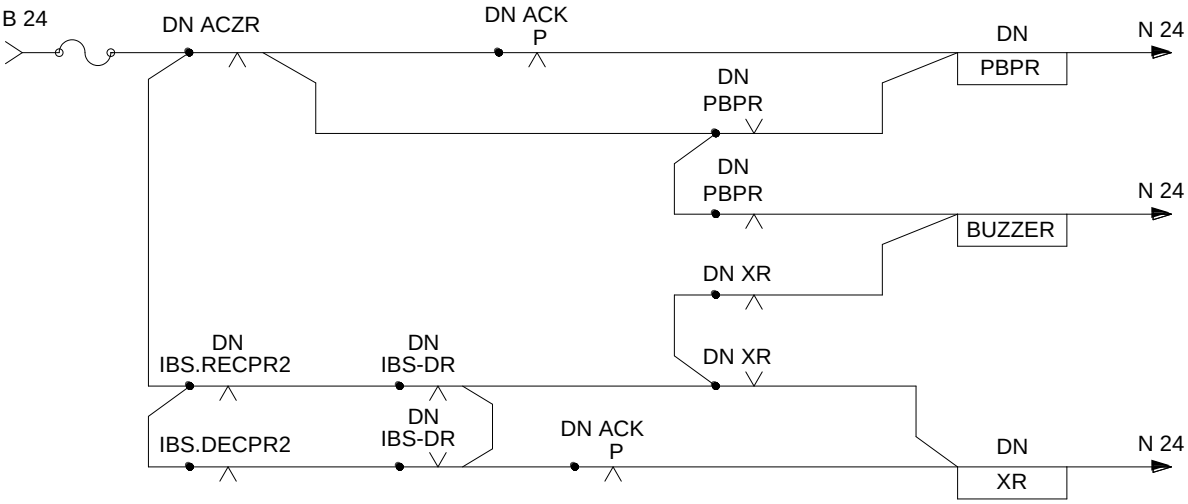

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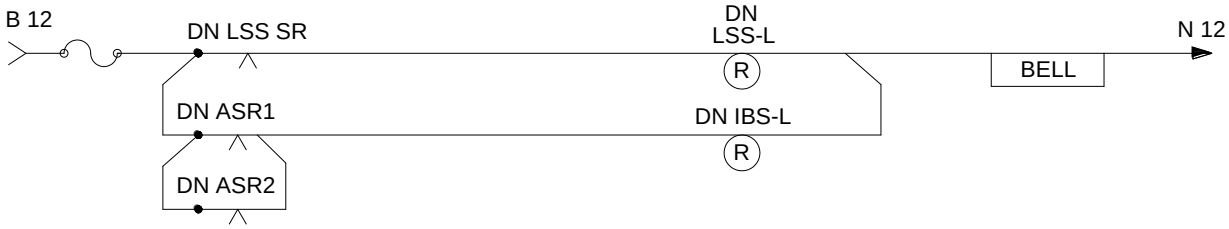

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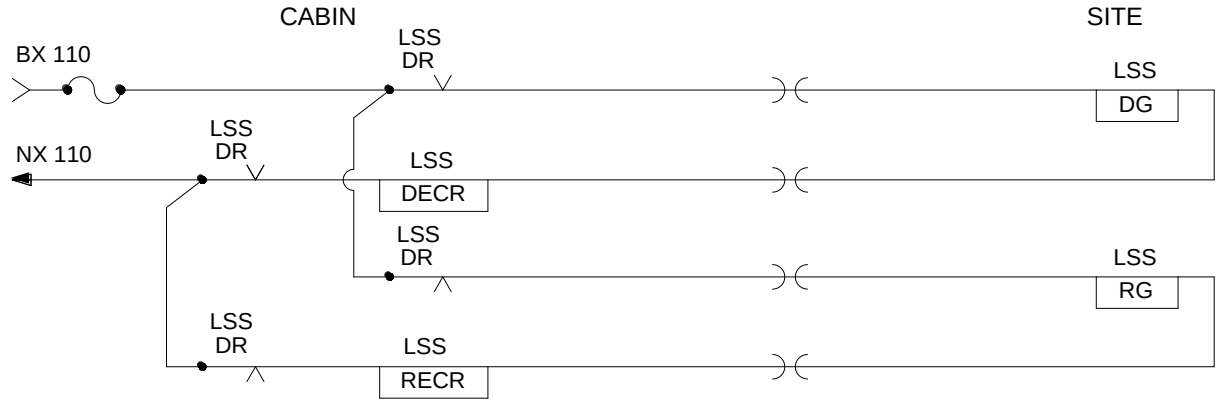

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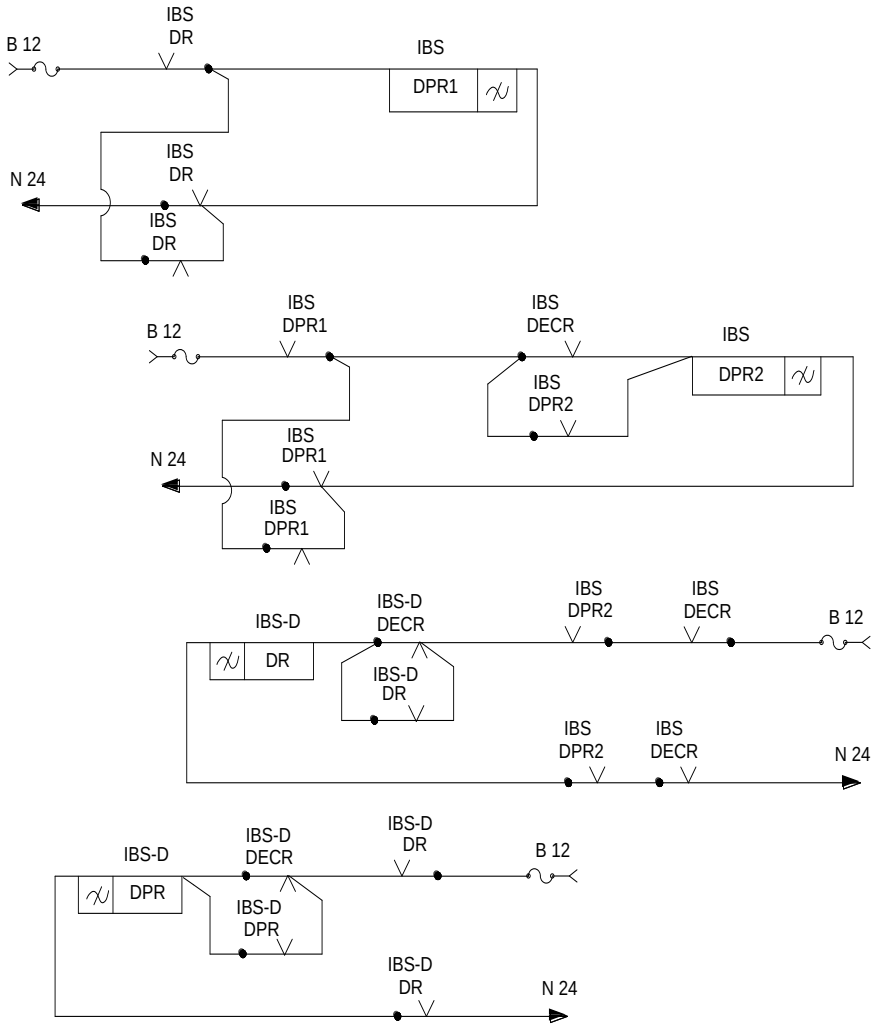

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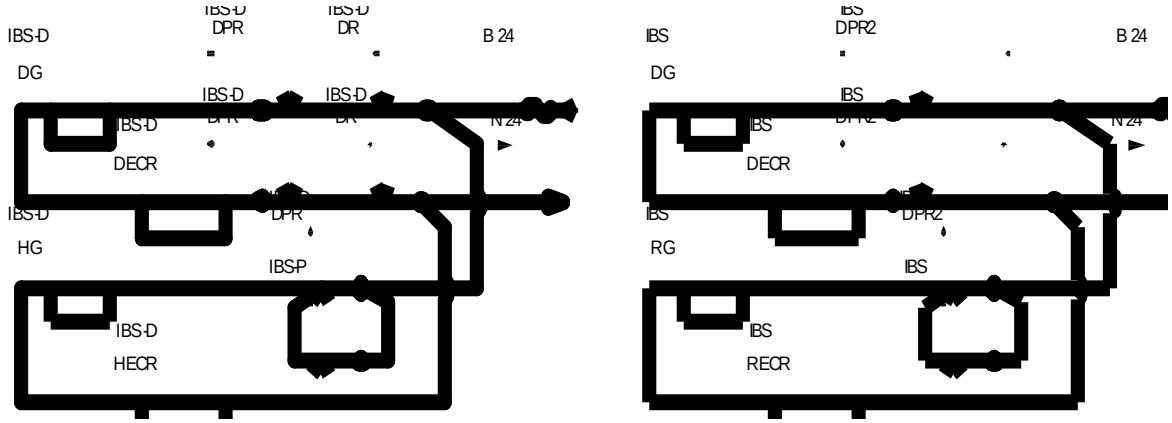

Fig No: 1.23

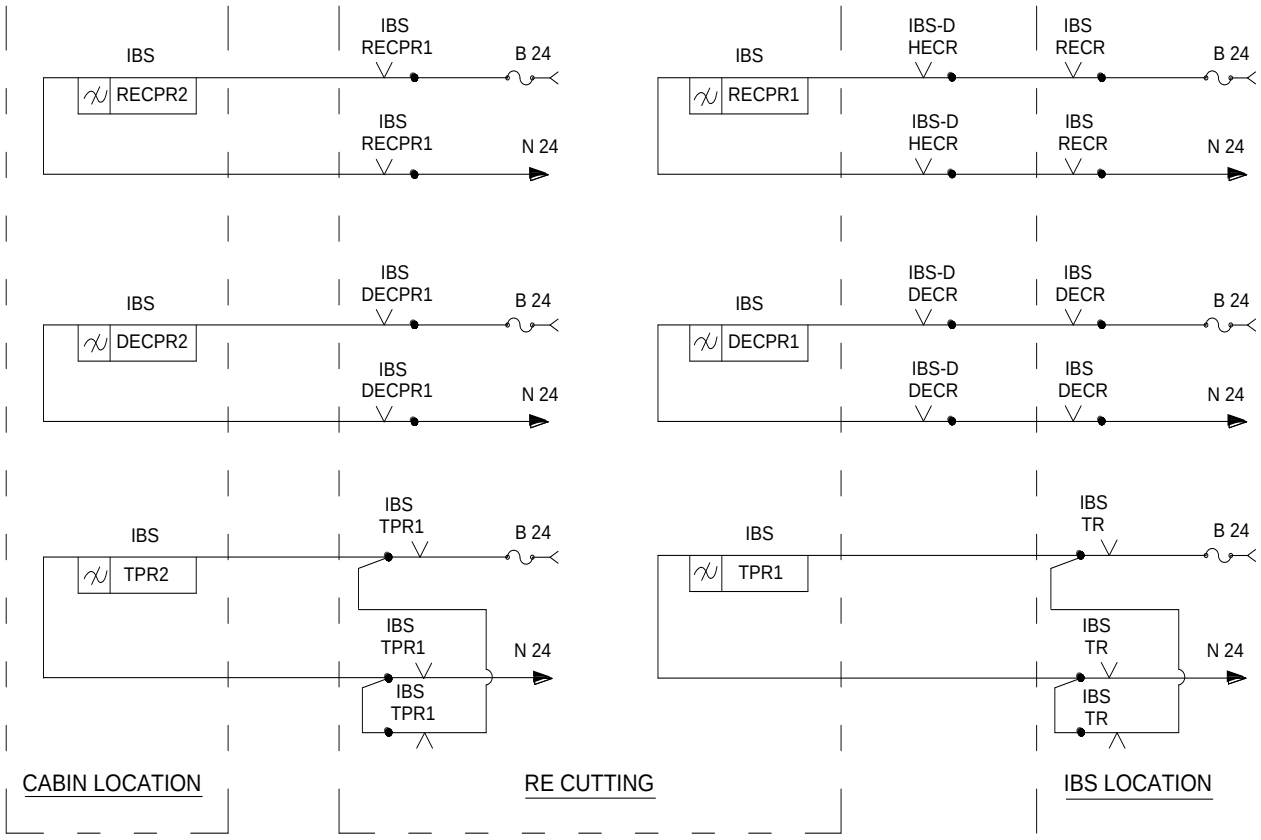

Fig No: 1.24

CHAPTER 2: AXLE COUNTER BLOCK WORKING (ACBW)

2.1 INTRODUCTION TO AXLE COUNTER BLOCK WORKING

Fig No: 2.1

Fig No.2.2

(a) With an increased demand for enhancing the section capacity and maximum allowed sectional speed, it necessitated to implement more safety devices with less operational time in Block working. The complete arrival of the train at the Block Station is ensured by human agency by verifying the Last Vehicle Board of the Train. This is time consuming in nature and may lead to unsafe conditions in case of Train partition. Hence, Axle Counter is provided for monitoring the entire Block Section for proper sequential operation of the Block working.

(b) The block panel concept was first used in push button instrument and non co-operative feature was available while sending station operating to take line clear.

(c) When block instrument is replaced with panel, a number of relays became necessary to prove block instrument status. Repeating of relays at the other end also became necessary to include in circuits.

(d) In the main RE telecom Cable only two PET quads were available, which was not sufficient for block and axle counter.

(e) Hence block multiplexer, CEL make was used with main RE cable, PET quads in Jhansi to Bina section in year 1994.

(f) With introduction of optic fibre it became necessary to use digital interface, initially Nokia–NKT-8808-single processor interface was used to work block on OFC in Durg-Nagpur section.

(g) Later indigenously, two firms- Deltron and Webfill conforming to CENELEC standards at SIL_4 level developed block interface.

(h) Meanwhile the digital axle counters came in a big way with the benefits of digital signal processing and communication. The single section digital axle counter having unique advantage of picking up vital relays at both ends, thus repeating of channel information unlike universal analog axle counter was not necessary. The digital axle counter communicating in duplex mode with 2W modem communication.

(i) In 2003-04 a number of sections in SCR, WR, and CR trunk routes on double line was commissioned by block instrument with digital axle counter.

(j) The quad requirement is only one and half.

(k) In the year 2005, the Block Panel with Digital Axle Counter and UFSBI of Deltron make was commissioned in Rajkharsuan-Dongaposhi Section.

(l) As policy decision, railway board decided to keep block instrument SGE in particular over trunk routes with a reliable single section digital axle counter.

(m) With OFC installed over most of the trunk routes the block proving and axle counter circuits were shifted to optic fibre channels using omnibus or 2W channels of primary Mux.

(n) Block proving with axle counter involves a combination of an axle counter, block instrument or block panel

(o) The normal double line block instrument is replaced with a block operating panel, associated relays and an axle counter at stations on either end of the block section on double line.

(p) The operating panel is used for obtaining line clear and cancellation.

(q) Axle counter is used to verify that the Block Section from LSS up to the block overlap beyond the first stop signal at the receiving end is clear of any train before the line clear can be obtained from the receiving station.

(r) Verifies that the train, which had left the dispatching station, had arrived complete at the receiving station before the block section can be once again closed.

(s) The line clear can be obtained by the sending Station Master without co-operation from the receiving Station Master (But if receiving station does not want to give line clear he has to take out the line clear blocking key)

(t) The section is closed automatically on arrival of the complete train at receiving station on home signal.

(u) Axle Counter Block Working can be done on both double line & Single line system.

(v) In Single line one axle counter and on double line two axle counters are used.

(w) The Mux system consists of relay logic circuit of combined converter units at both ends and relay status data is exchanged by using safe digital multiplexing which employs FSK coded signal.

(x) In main RE telecom Cable only two PET quads were available, which were not sufficient for transmitting all information of block and axle counter.

(y) A multiplexer working in time division mode was designed which combines status of six relays at station 'A' and reproduces them at station 'B' using only one pair of copper wires; similarly it can produce the status of six relays at station 'B' and at station 'A' also.

(z) By using multiplexer it has been possible to design a circuit using only two PET quads with one 1/2 quad for multiplexer information and axle counter information from station 'A' to station 'B', another 1/2quad for multiplexer information and axle counter information from station 'B' to station 'A' and a third 1/2 quad is used for the block bell and block telephone.

2.2 Axle Counter Block working with Multiplexer

2.2.1 Operating panel

(a) The arrangements on the Block Operating Panel are shown in the Figure No 2.2.

(b) It resembles conventional push button type token less block instrument with block telephone and a set of operating push buttons, indications and counters. In the bottom row there are TGT button and bell button.

(c) The bell button has to be pressed for exchanging bell code information between the two stations and for obtaining line clear at the dispatch station, the station master of the dispatch station can obtain the same without the co-operation of the station master of the receiving station by pressing TGT and bell code buttons till he gets TGT indication in the second row of indication lights.

2.3 Acknowledgement buttons:

(a) TGT acknowledgement and TCF acknowledgement buttons are provided with the yellow lights indicating as to which button is to be pressed for silencing the buzzer and for extinguishing the indications. When a train leaves Station 'A' and goes beyond LSS and is proceeding to Station 'B', the Station Master of the Station 'A' will get the TGT buzzer and yellow LED indication, he has to press TGT acknowledgement button and the Station Master of the station 'B' will get the TCF buzzer and indication, he has to press TCF acknowledgement button in order to silence the buzzer and thereby extinguishing the indication. The aspect of the last stop signal is also repeated on the operating panel by the side of the TGT button.

(b) There is a SM's key, which is to be inserted and turned for doing any operation on the block panel at the sending end. But even after the SM's key is taken out at the receiving end, the sending station can still obtain the line clear. By the side of SM's key, there is LCB key.

2.4 Line Clear Blocking key (LCB)

(a) Line Clear Blocking is a facility given to the receiving end Station Master to prevent the despatch of a train even after line clear is taken by sending end Station Master.

(b) When the receiving Station Master takes out the key, the sending Station Master can not take line clear.

(c) Even after obtaining Line Clear by the sending Station Master, the receiving Station Master can cancel the Line Clear by taking the Line Clear Blocking key out and pressing the bell code button. The line clear already obtained will be cancelled and the LSS at the sending station will go to danger provided the train has not passed the LSS at the time of cancellation.

(d) In the second row of indications, all the indications pertain to train going to Station-B and TGT is in Green Color, "line closed" is in Yellow Color and TOL is in Red Color and these appear depending upon the status of the block section. By the side of this, there is a free indication in green color and line occupied/block back/block forward in red color.

2.5 Line free indication

"Line Free" indication appears when the Axle Counter section is "Clear".
The line occupied indication appears when the Axle Counter section is occupied during normal movement of Train as well as during Block back and Block forward movement in the section.

The indications of the top row pertain to the other line of the Double Line Block Section for receiving the Train and indicate the status of the Block Section from Station 'B' to Station 'A'.

The indications of bottom row pertain to the line of the Double Line Block Section for sending the Train and indicate the status of the Block Section from Station 'A' to Station 'B'.

AXLE COUNTER BLOCK WITH MULTIPLEXER - YARD LAY OUT

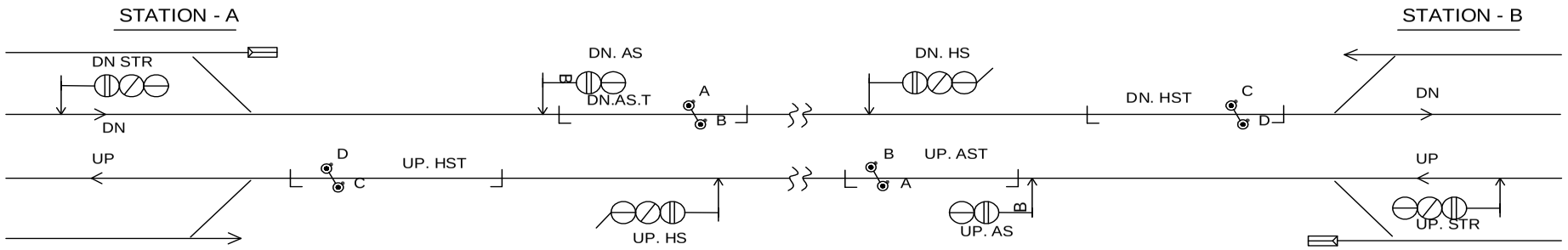

Fig No: 2.3

NOTE :

1. THE CIRCUITS ARE SHOWN FOR ONE STATION ONLY.
2. LEGEND : --

   TRANSMITTER / RECEIVER INPUT / OUT PUT TERMINALS SHOWN THUS : --

   RAILWAY SIGNALLING TERMINALS SHOWN THUS : --

   AXLE COUNTER TERMINALS SHOWN THUS : --

   RELAY RACK TERMINALS SHOWN THUS : --

   PANEL TERMINALS SHOWN THUS : --

3. ALL TERMINAL STRIPS SHALL BE 8W/10W OF DISCONNECTING LINE TYPE
   15 AMPS RATING FOR RLY. TERMINALS & NON DISCONNECTING TYPE
   5 AMPS RATING FOR TRANSMITTER / RECEIVER INPUT/OUTPUT TERMINATION

4. ALL RELAYS SHALL BE QNA1/QN1 UNLESS OTHERWISE SPECIFIED.
   (D) PREFIX TO A RELAY MEANS PERTAINING TO DISPATCH OF A TRAIN.
   (R) PREFIX TO A RELAY MEANS A RELAY PERTAINING TO RECEPTION OF
   ALL TRACK CCTS. SHALL BE OF THREE RAIL LENGTH.

2.6 NORMAL TRAIN WORKING

(a) For normal train working, the Station master at Station ‘A’ (sending station) can obtain a line clear by pressing bell code and TGT buttons till he gets TGT indication. After that he can take off LSS and as soon as train enters block section, the TGT buzzer with indication appears at Station ‘A’ and TCF Buzzer with indication will appear at Station ‘B’ along with TOL Indication on the block panel for the corresponding direction.

(b) Upon getting the buzzer and indication, the station master has to press relevant acknowledgement button to silence buzzer and indication.

(c) The station master at Station ’A’ is supposed to inform the details of the train to the station master at Station ’B’ before dispatching the train or while giving TOL beats.

(d) The station master at station ‘B’ receives the train by lowering the first stop signal and as soon as the train clears the block overlap the axle counter will show section clear provided all the axles of the train which have entered into the block section have cleared block section including block overlap

(e) Upon the axle counter showing the section clear the block instrument automatically reverts to the line closed status and both the TGT and TOL indications disappear and line closed and line free indications appear on the block panel for the corresponding direction.

(f) For dispatching a train the co-operation of the receiving station is not required and even for normalizing the block section on arrival of the train at the receiving station no operator intervention is necessary.

(g) This non co-operative feature is expected to result in considerable saving in the time associated with the granting of line clear and with the closing of the block section as compared to the conventional double line working.

(h) Similarly for dispatching a train from station ‘B’ to station ‘A’, line clear is obtained by station master at station ‘B’ without the co-operation of the station master at station ‘A‘ and block section is closed automatically on complete arrival of the train at station ‘A’ as verified by the axle counter.

(i) For the purpose of block back/block forward, as soon as the complete train comes back to the originating station, the axle counter will show section clear and the block section will be closed automatically.

(j) The location of the track device for the block working with axle counter for both the directions on double line section is indicated in Fig No 2.3 and details of the connections between the track device, multiplexer and axle counter evaluator are indicated in the Fig No 2.3 From this it may be seen that, for the down line, the axle counter is kept at station ‘B’ and it receives the information from the track device at the block overlap in station ‘B’ directly by a local cable.

(k) This axle counter also has to monitor the track device just beyond the LSS of Station ‘A’ for the down direction and this information comes through half quad of main telecom cable between the Station ‘A’ and Station ‘B’ along with the multiplexer information from Station ‘A’ to Station ‘B’ (both the multiplexer information and the axle counter track device information come on the same pair of cable since they are transmitted at different frequencies).

(l) Similarly the other half quad is used for transmitting the axle-counter track device information from Station ‘B’ that is required by the Up evaluator at station ‘A’ and also for transmitting the multiplexer information from station ‘B’ to Station ‘A’.

(m) Since there are two track devices associated with each detection point, normally 2 pairs of wires are required to carry 5 kHz up to the evaluator. To minimize the cable requirement a 4-wire converter unit is used.

2.7 Resetting

Whenever axle counter fails, the system can be reset by the co-operation of both Station Masters.

2.7.1 Resetting procedure

(a) The Station master at Station 'B' (receiving station) has to verify that all vehicles, which have left Station 'A', have arrived complete at Station 'B' and confirm the same to the station master at Station 'A' (on telephone).

(b) The SM at station 'A' then presses the reset cooperation button in the bottom row and as soon as the button is pressed at the sending station, the receiving station gets a reset cooperation indication in the top right hand corner. Upon getting this indication, the station master at receiving station can reset the axle counter by inserting and turning reset key. After reset operation is complete, the reset counter steps up by one digit and details of the reset operation are to be entered in the reset register.

4W/2W converter card:

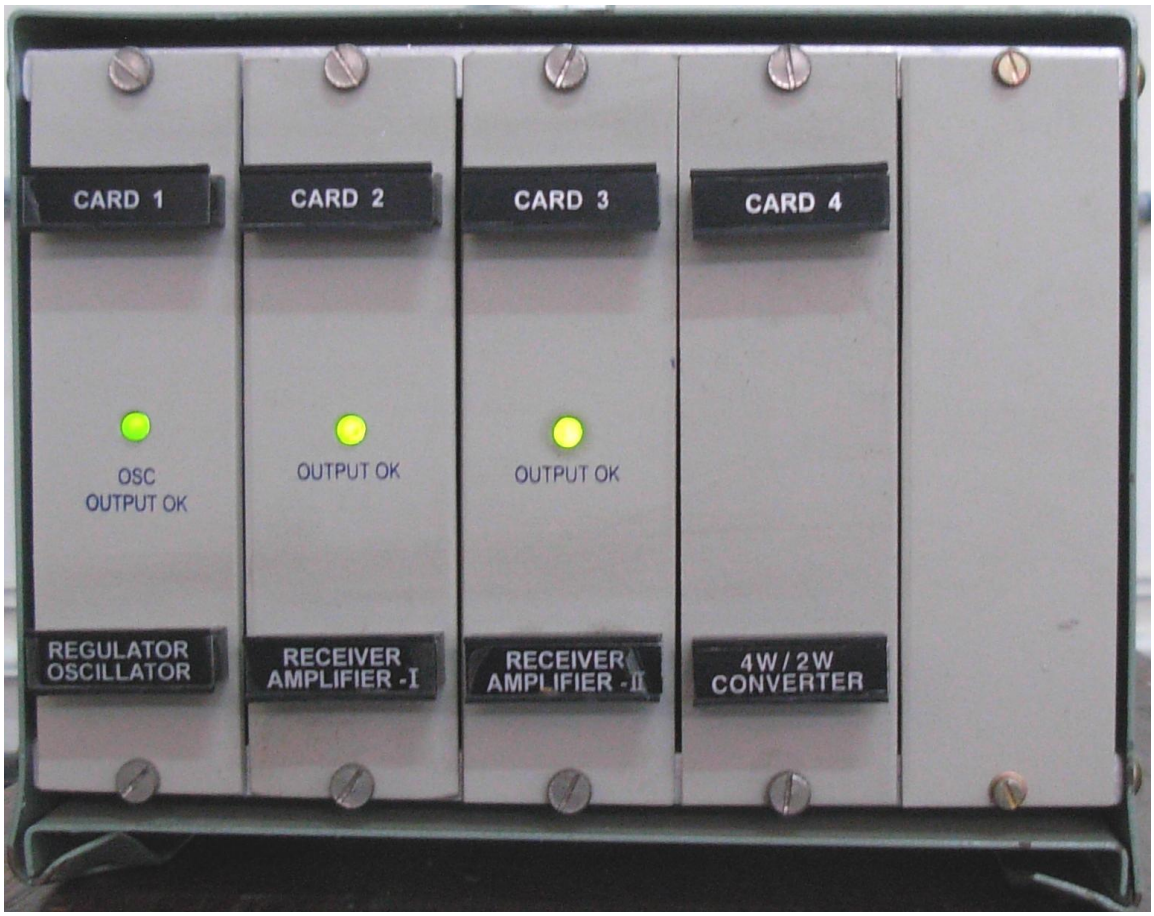

Fig No: 2.4

(c) This has an extra card to be fitted in the EJB and works on 24 V DC (it can therefore be used with 24 V EJB only). The 4 wire/2 wire converter converts one of the axle counter track device channel frequencies to 3.5 KHz by a suitable modulation process and therefore out of the two receiver outputs of channels A and B (for example) channel A is passed on as it is at 5 KHz and the output of channel B is converted to 3.5 KHz so that it does not interfere with the channel A.

(d) But since A & B outputs are at different frequencies, now it is possible to transmit the outputs of 2 receiver coils to the evaluator through one pair of cable (1/2 quad) only as against normal requirement of two pairs. The 4 wire / 2 wire converter has therefore been basically designed to economize the requirement of cable pairs in transmitting information from EJB to evaluator.

(e) This may be adopted in other axle counter applications also wherever there is a need to reduce the cable requirement. Similarly at the other end of the cable a 2 wire/4 wire equipment is used which again reproduces the original two receiver out-puts each of 5 KHz from the combined 5 KHz/3.5 KHz signal coming through the 2 wire circuit. The 4-wire output of the 2-wire/4-wire equipment at the receiving end is connected to the evaluator.

(f) The 2W/4W converter can be fitted as an extra card in the evaluator rack itself. The evaluators for each direction of Block working are kept at the receiving Stations.

2.8 MULTIPLEXER

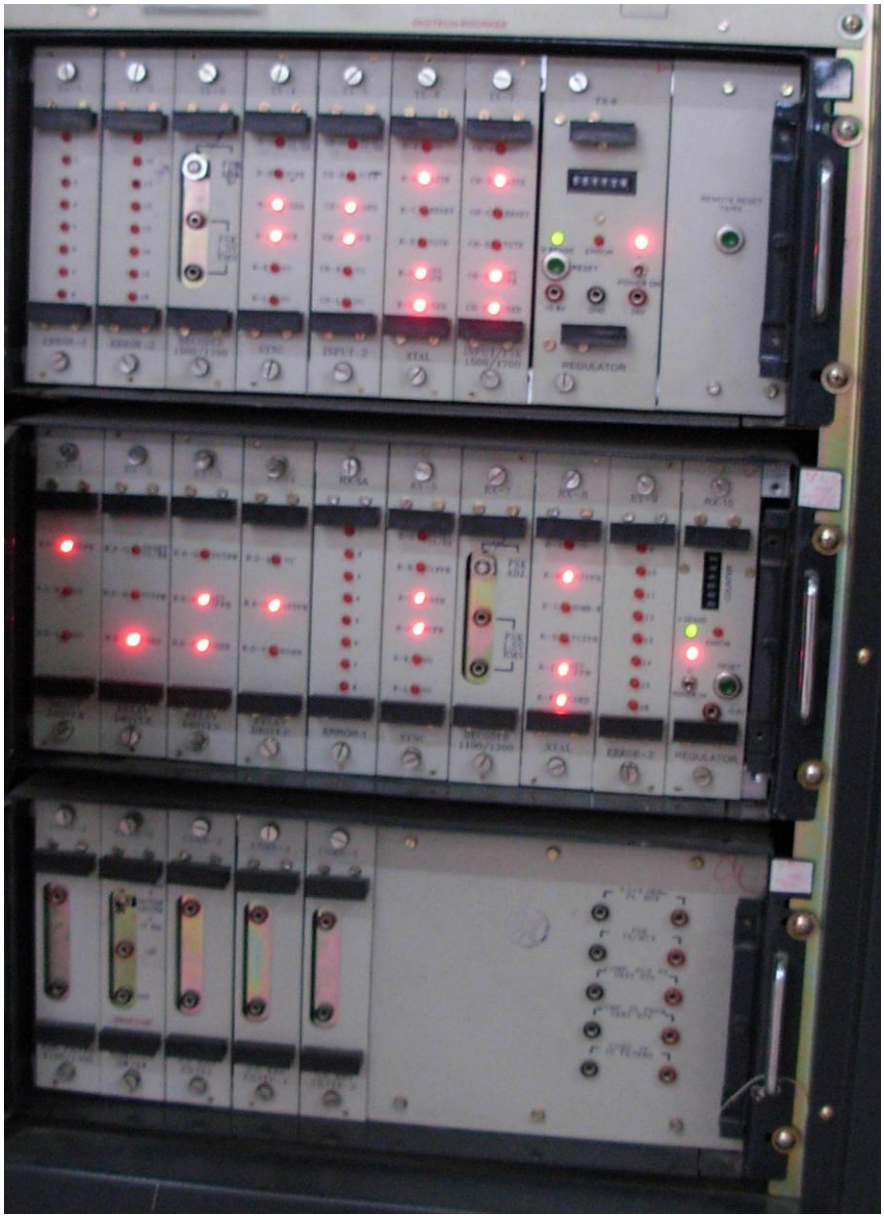

Fig No 2.5

(a) The purpose of the multiplexer is to obtain the status of relays at one station and re produce them at the other station. For example the multiplexer at Station 'A' would be combining the status of six relays for Down direction which are to be repeated from Station 'A' to Station 'B' and in addition will also transmit read back information in respect of six relays transmitted from station 'B' to Station 'A' in the Up direction.

(b) The read back information is used by the transmitting end to make sure that the relays at the other end are actually in agreement with the status of relays at the sending station. The multiplexer therefore has a total capacity for handling 12 relays inputs.

(c) The multiplexer works in TDM (time division multiplexing) mode and converts the relays status into digital bits 1 & 0. After that it transmits them through the cable after doing frequency shift key modulation using two frequencies of 1300 cycles and 2100 cycles for denoting digital 0 and digital 1. The data is transmitted through the cable at the speed of 1200 BPS.

(d) It will be seen that the two frequencies used for the multiplexer namely 1300 cycles and 2100 cycles are different from the frequency used for axle counters and therefore the multiplexer information as well as the axle counter track device (output of 4W/2W converter unit) information from Station 'A' to Station 'B' can go on one pair of main telecom pair on the PET quad and similarly the multiplexer information and axle counter track device information from Station 'B' to Station 'A' can go on another 1/2 PET quad of the main telecom Cable.

(e) Apart from six relays repeated from Station 'A' to Station 'B' plus six inputs for reading back the status of relays of station 'B' reproduced at Station 'A' for the up direction, the multiplexer has four more inputs for the station identification. In addition to the 16 bits of data the microprocessor based multiplexer also adds six check bits for error detection purpose.

(f) Thus the data consisting of 16 bits and in addition the six error check bits are converted into a telegram and then transmitted to the other station. The multiplexer has a duplicated microprocessor by way of hardware redundancy. Each packet of information is transmitted three times and at the receiving end at least two packets have to agree out of the three on both the duplicated hardware and then only it is acted upon.

(g) Apart from this there is the added safety feature of reading back the status of output relays at station 'B' by the transmitter of station 'A'. The read back status should correspond to the intended status of these relays. Similarly there is a read back of output relays of the multiplexer of Station 'A' by the transmitter at Station 'B'. The error detection system can detect single and double bit errors. In case of any mismatch between the duplicated hardware the system goes into a fail-safe shut down status.

(h) The microprocessor constantly executes self-checking routines to test the integrity of the hardware once in 1/100th of second. Multiplexers have been designed in such a way that they can be used through various transmission media like main telecom. Cable or microwave radio or optic fiber.

(i) The maximum cable attenuation between transmitter and receiver of the multiplexer could be 20 db and works on 24 V DC + 30% / - 10%.

(j) The current consumption is 4 Amps.

(k) The information multiplexed and sent from station 'A' is demultiplexed by a similar microprocessor based system at Station 'B'. Thus each multiplexer has got a transmitting portion and a receiving portion.

(l) The multiplexer output and the output of the 4 wire/2 wire converter are combined in the converter before being transmitted on 1/2 quad cable from station A to station ‘B’ and at station ‘B’ again split up and the 3.5 KHz and 5 KHz signals go to the 2 wire/4 wire converter equipment which in turn feeds the evaluator. The 1.3 KHz and 2.1 KHz signals go to the de-multiplexer.

2.9 Block bell and Oscillator

The oscillator transmits 150 cycles on the cable whenever bell code button is pressed. The relay XR picks up when bell push button is operated provided the telephone was not in use and through XR front contact. 150 cycles oscillator output is fed to the cable. At the other end, 150 cycles is rectified and operates the relay BXR and through the contact of the BXR a block buzzer operates.

2.10. RELAYS IN ACBW

Fig No: 2.6

(a) TELR: Whenever the "press to talk" is pressed, TELR picks up and this connects telephone circuits to the same pair of the wires used for transmitting the bell code. Thus either the bell code transmission or telephone transmission takes place on the same pair of the wire at a time. The circuit of the various controlling relays is given In the circuit diagram wherever prefix (D) is used, it indicates the train dispatch end and wherever prefix (R) is used it indicates the train receiving station relays.

(b) TGTR (D): picks up at the sending station whenever he is operating for line clear and this proves that the axle counter block section is clear as read by relay AZTPR (D) and it also proves that the relays AMR (D) and ASSR (D) are up. The relay TGTR (D) is repeated as TGTPR (R) at the receiving station.

(c) AMR (D): at the sending station ensures that whenever advanced starter track circuit is occupied and ASTPR is down, the instrument has gone to TOL when the advanced starter track picks up again and AZTPR (D) is down. This is to ensure proper sequence of operations of the block instrument whenever a train goes beyond the LSS.

(d) ASSR: is the advanced starter stick relay which ensures that whenever a train occupies the advanced starter track circuit the ASSR will be down and it will pick up when the ASDR is down, TCFPR (R) is down and AMR (D) is up apart from ASTPR up and advanced starter lever normal. This is to ensure one line clear and one train.

(e) ASDR: is the advanced starter-controlling relay.

(f) TCFR (**R):** is line clear granting relay, which picks up when TGTPR (R) is picked up. This proves that the conditions for giving Line clear are fulfilled at the receiving station namely, that the line clear blocking key is not taken out, home signal lever is normal, home signal controlling relays are down, axle counter is clear as read by **(**R) AZTR and also that the relay BCR is up. Once picked up the TCFR (R) will drop only when the axle counter monitored section is occupied. The status of TCFR(R) is repeated as TCFPR (D) at the sending station through the multiplexer.

(g) BCR (R): The relay BCR (R) proves that, after every line clear the home signal controlling relays are down, the instrument has gone to TOL and also that the axle counter is clear before the next line clear can be obtained. BCR (R) relay is normally up and drops as soon as the axle counter is occupied.

(h) TOLR (**R):** It picks up whenever axle counter is occupied after proving that TCFR (R) was up. This relay drops as soon as AZTR (R) picks up.

(i) AMR (**D):** The relay is normally up and drops when advanced starter track circuit at sending end is down after taking line clear. Once dropped it picks up only after making sure that the advanced starter track is picked up,

(j) AMR (**R):** relay ensures that whenever advanced starter track circuit is down, the proper sequence of train movement is followed and that the train has arrived inside the home signal block overlap point, as indicated by ZR picking up; it also ensures that the instrument was in TOL. AMR (R) relay is used for resetting the axle counter in such a way that unless AMR (R) picks up it will not be possible to reset the axle counter. This in turn ensures that resetting the axle counter is done only after concerned train has arrived beyond the block overlap.

(k) ZR (**R)**: The relay picks up at the receiving station on complete arrival of the train beyond the block overlap point provided the instrument is in TOL and after proving that home signal lever is reversed and the concerned track circuits are occupied.

(l) TOLR (**D):** at the sending station picks up whenever axle counter is occupied as indicated by AZTPR (D) and ensures that TCFPR (D) is up. TOLR (D) drops as soon as AZTPR (D) picks up.

(m) AZTR (R): at receiving end proves that the axle counter section is clear as indicated by BPR (R) up and advanced starter track circuit and home signal track circuit is clear.

(n) BPR (R) proves that EVR and SUPR are up and ASMR(R) is down and BSMR (R) is down the contact of BPR (R) in AZTR (R) circuit is bypassed by TCFR (R) and AZTR (R) front contacts so that once line clear is taken, momentary dropping of SUPR will not drop AZTR(R).

(o) ASMR (R): picks up when (R) BPR is down, (R) BSMR is up and (R) AMR is up. This relay is used for resetting of axle counter with the co-operation from the sending station.

(p) BSMR (R):

(i) Picking up it also proves that the train for which resetting is being done by co-operation has actually arrived beyond the home signal at the receiving station, relay.

(ii) Picks up at receiving station when sending station gives co-operation for resetting by pressing the reset co-operation button.

(q) AXPR (R): is the actual resetting relay and proves that EVR is down, SUPR is down and ASMR(R), BSMR (R) are up and also proves that home signal track circuit and advanced track circuit are clear. Once AXPR picks up, the reset voltage goes to the axle counter and reset relay (R relay) picks up inside the Evaluator, thereby resetting the entire system. AXPR drops when EVR and SUPR are up. Whenever AXPR is up the condenser is charged through BPR down and AXPR up and condenser discharges when AXPR is down and EVR is up, SUPR is up through the axle counter reset counter. This steps-up reset counter for every reset operation. ACHK is the cooperation indication at the receiving station, provided the train for which resetting is being done has arrived beyond the block overlap at receiving station.

AXLE COUNTER BLOCK WITH MULTIPLEXER - YARD LAY OUT

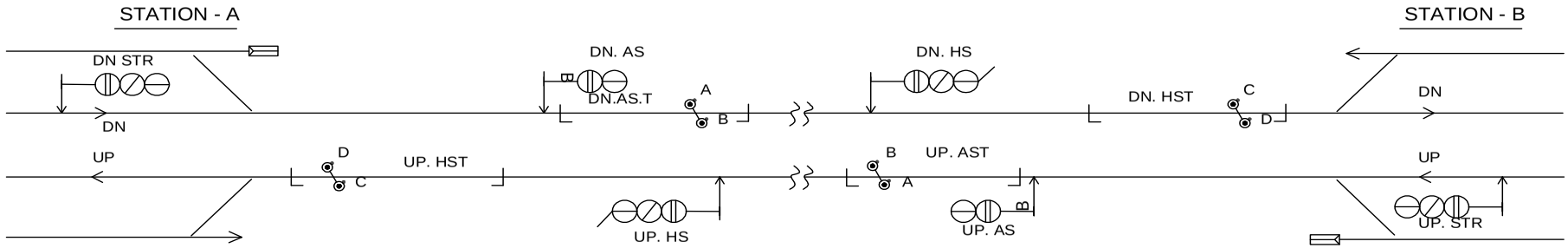

Fig No: 2.7

NOTE :

1. THE CIRCUITS ARE SHOWN FOR ONE STATION ONLY.
2. LEGEND : --

   TRANSMITTER / RECEIVER INPUT / OUT PUT TERMINALS SHOWN THUS : --

   RAILWAY SIGNALLING TERMINALS SHOWN THUS : --

   AXLE COUNTER TERMINALS SHOWN THUS : --

   RELAY RACK TERMINALS SHOWN THUS : --

   PANEL TERMINALS SHOWN THUS : --

3. ALL TERMINAL STRIPS SHALL BE 8W/10W OF DISCONNECTING LINE TYPE
   15 AMPS RATING FOR RLY. TERMINALS & NON DISCONNECTING TYPE
   5 AMPS RATING FOR TRANSMITTER / RECEIVER INPUT/OUTPUT TERMINATION

4. ALL RELAYS SHALL BE QNA1/QN1 UNLESS OTHERWISE SPECIFIED.
   (D) PREFIX TO A RELAY MEANS PERTAINING TO DISPATCH OF A TRAIN.
   (R) PREFIX TO A RELAY MEANS A RELAY PERTAINING TO RECEPTION OF A TRAIN.
   ALL TRACK CCTS. SHALL BE OF THREE RAIL LENGTH.

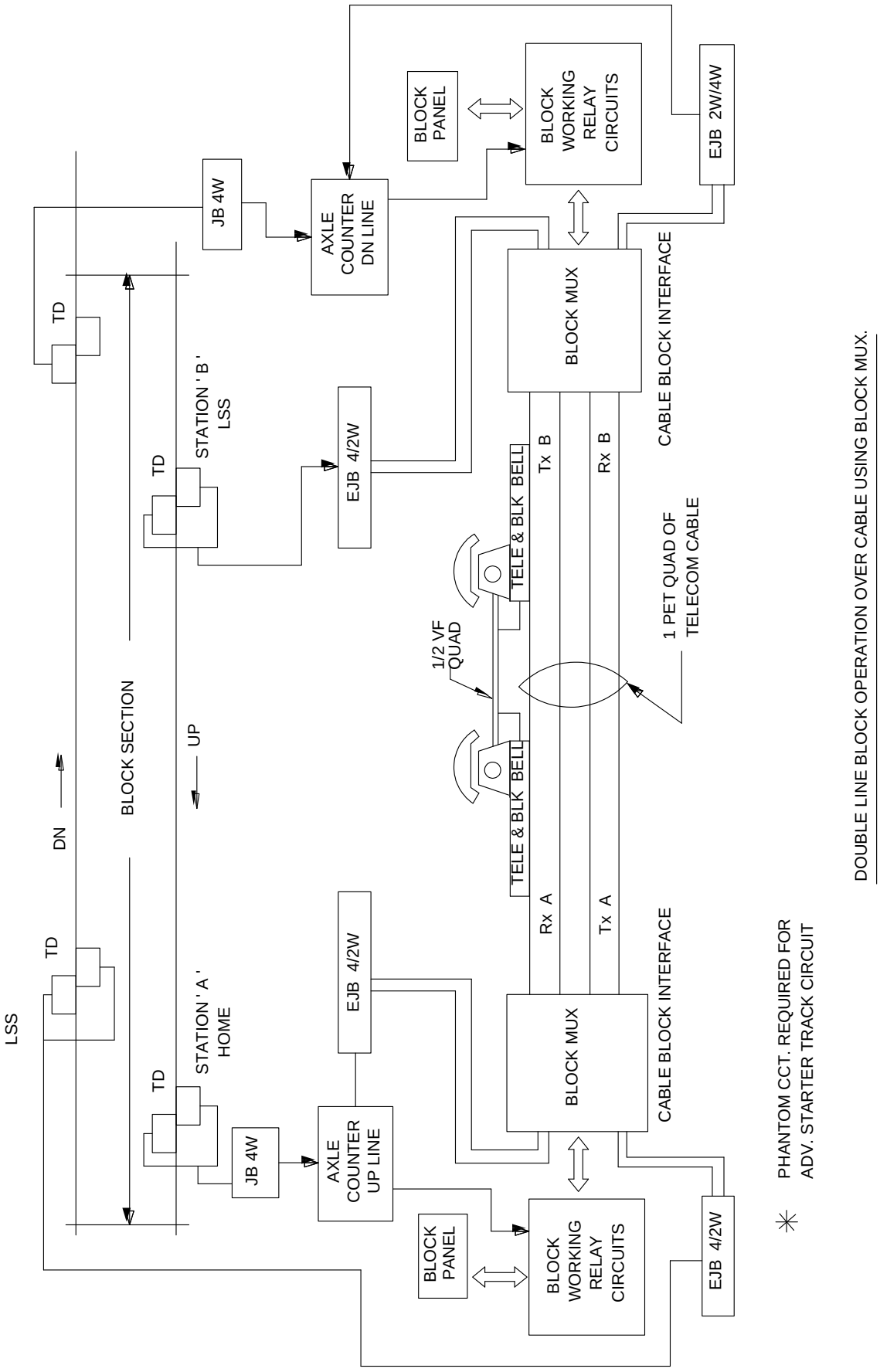
LSS
TD
DN
BLOCK SECTION
UP
TD
STATION ' A '
HOME
TD
STATION ' B '
LSS
TD
JB 4W
AXLE COUNTER UP LINE
JB 4W
AXLE COUNTER DN LINE
EJB 4/2W
EJB 4/2W
EJB 2W/4W
EJB 4/2W
BLOCK PANEL
BLOCK PANEL
BLOCK WORKING RELAY CIRCUITS
BLOCK WORKING RELAY CIRCUITS
BLOCK MUX
BLOCK MUX
CABLE BLOCK INTERFACE
CABLE BLOCK INTERFACE
Rx A
Tx A
Rx B
Tx B
TELE & BLK BELL
TELE & BLK BELL
1/2 VF QUAD
1 PET QUAD OF TELECOM CABLE
DOUBLE LINE BLOCK OPERATION OVER CABLE USING BLOCK MUX.
PHANTOM CCT. REQUIRED FOR ADV. STARTER TRACK CIRCUIT

Fig No: 2.8

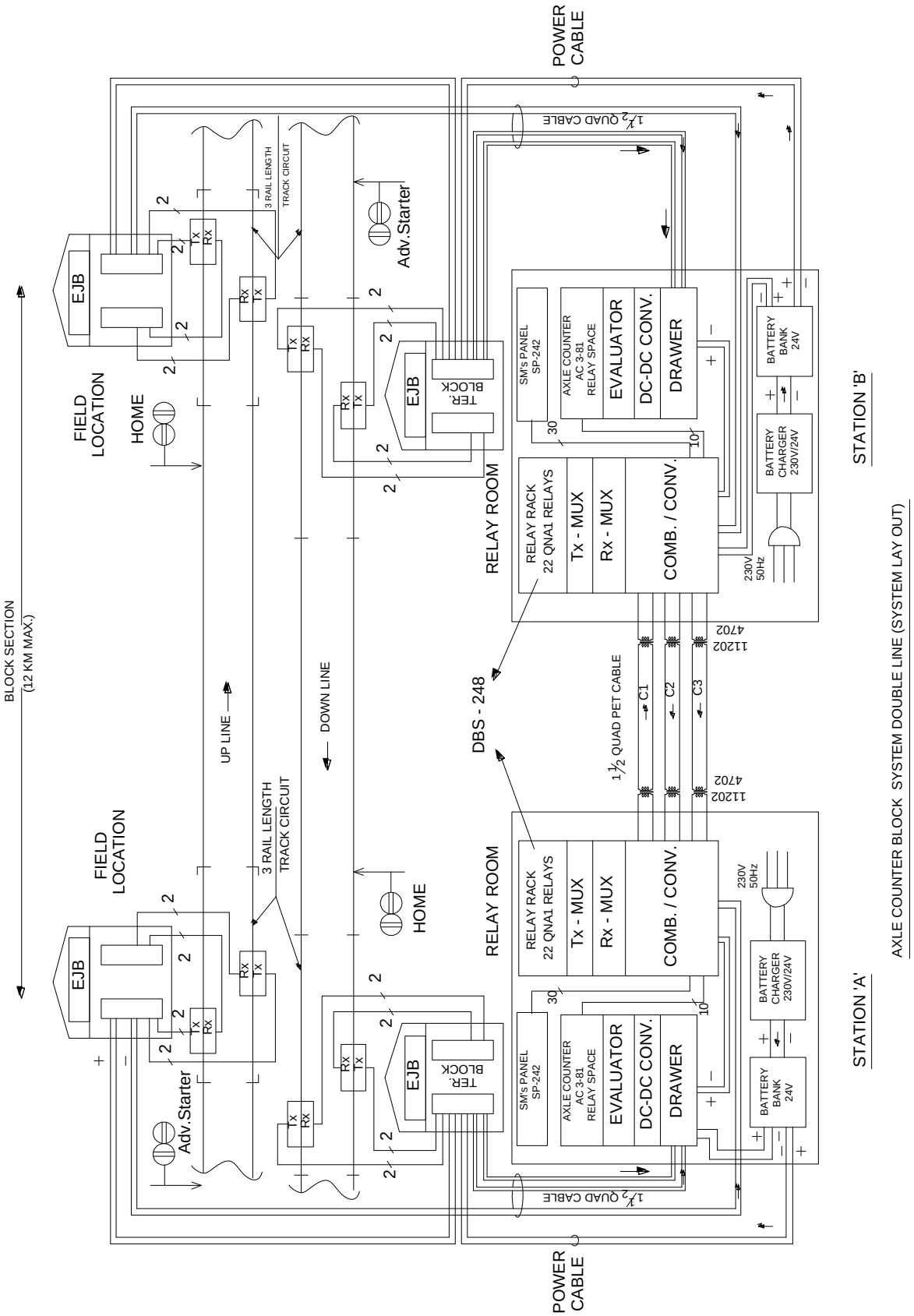
POWER CABLE
1½ QUAD CABLE
STATION 'B'
STATION 'A'
AXLE COUNTER BLOCK SYSTEM DOUBLE LINE (SYSTEM LAY OUT)
BLOCK SECTION (12 KM MAX.)
FIELD LOCATION
HOME
Adv.Starter
3 RAIL LENGTH TRACK CIRCUIT
UP LINE
DOWN LINE
DBS - 248
EJB
TER. BLOCK
RELAY ROOM
RELAY RACK 22 QNA1 RELAYS
Tx - MUX
Rx - MUX
COMB. / CONV.
SM's PANEL SP-242
AXLE COUNTER AC 3-81 RELAY SPACE
EVALUATOR
DC-DC CONV.
DRAWER
BATTERY BANK 24V
BATTERY CHARGER 230V/24V
230V 50Hz
1½ QUAD PET CABLE
C1
C2
C3
11202
4702

Fig No: 2.9

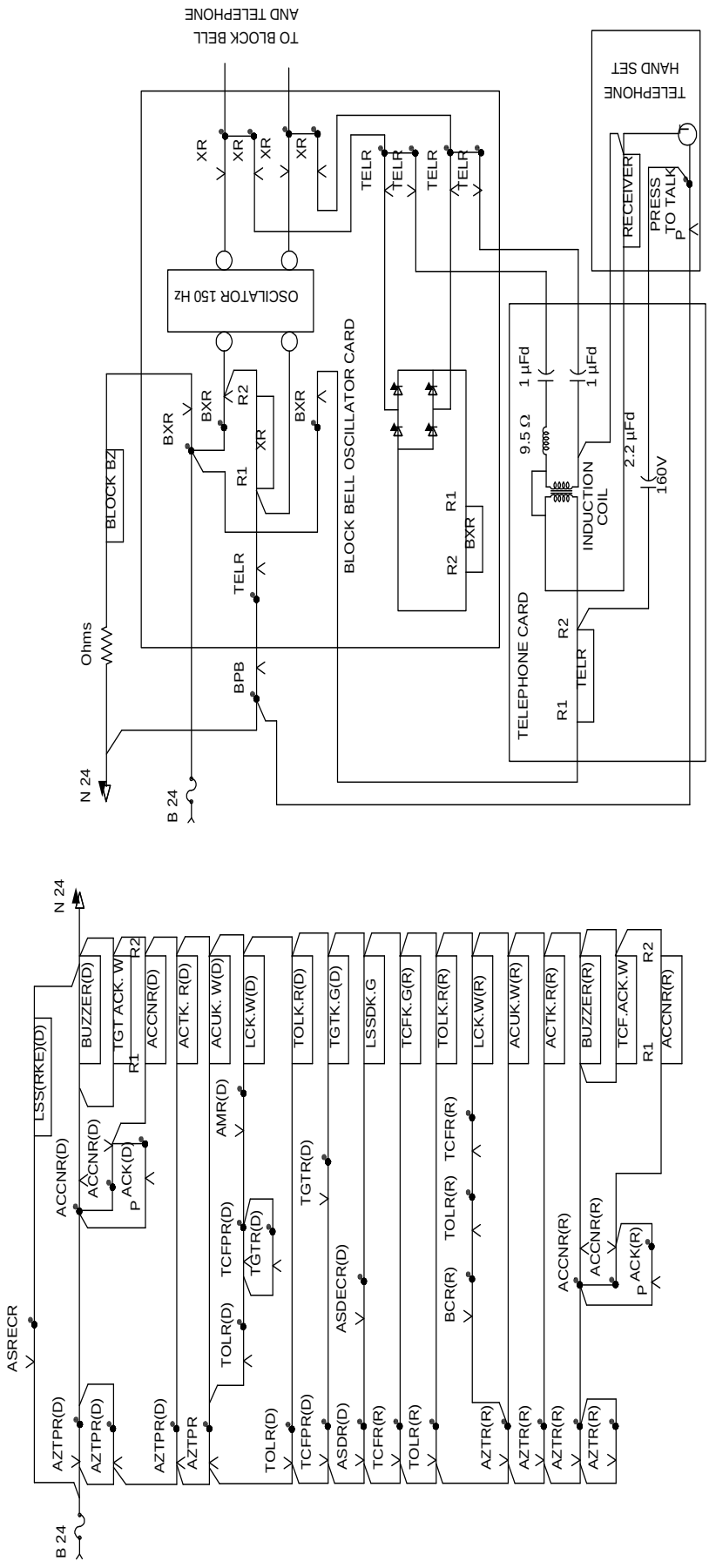
TO BLOCK BELL
AND TELEPHONE
TELEPHONE
HAND SET
RECEIVER
PRESS
TO TALK
P
XR
TELR
OSCILLATOR 150 Hz
BLOCK BELL OSCILLATOR CARD
BXR
R1
R2
BLOCK BZ
Ohms
BPB
N 24
B 24
TELEPHONE CARD
9.5 Ω
1 µFd
2.2 µFd
160V
INDUCTION
COIL
ASRECR
AZTPR(D)
AZTPR
TOLR(D)
TCFPR(D)
ASDR(D)
TCFR(R)
TOLR(R)
AZTR(R)
LSS(RKE)(D)
ACCNR(D)
ACK(D)
BUZZER(D)
TGT ACK. W
ACCNR(D)
ACTK. R(D)
ACUK. W(D)
AMR(D)
LCK.W(D)
TGTR(D)
TOLK.R(D)
TGTK.G(D)
ASDECR(D)
LSSDK.G
TCFK.G(R)
TOLK.R(R)
TCFR(R)
BCR(R)
LCK.W(R)
ACUK.W(R)
ACTK.R(R)
ACCNR(R)
BUZZER(R)
TCF.ACK.W
ACCNR(R)
ACK(R)

Fig.No.2.10

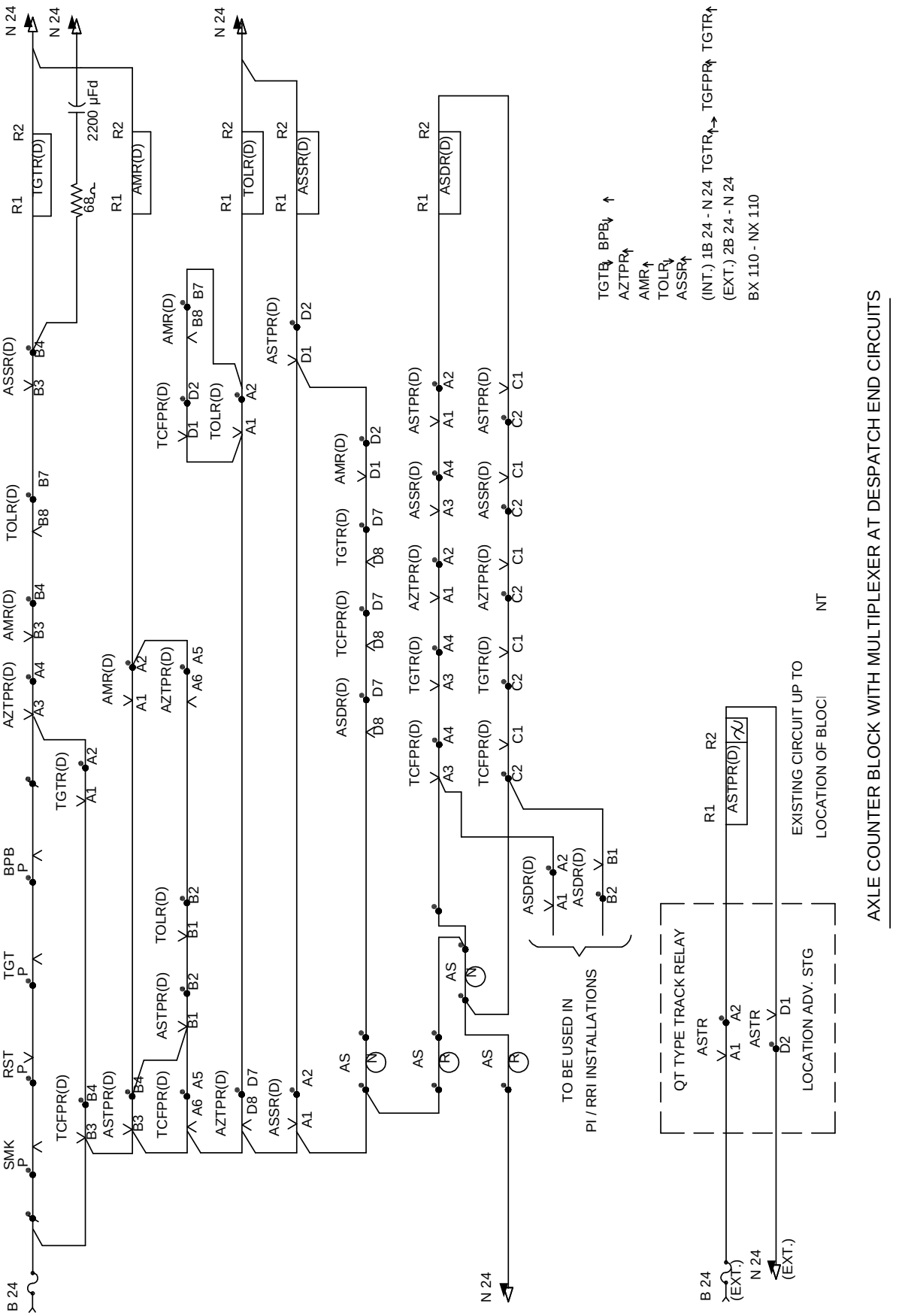
AXLE COUNTER BLOCK WITH MULTIPLEXER AT DESPATCH END CIRCUITS
N 24
B 24
SMK
RST
TGT
BPB
TCFPR(D)
ASTPR(D)
AZTPR(D)
TGTR(D)
AMR(D)
TOLR(D)
ASSR(D)
TGTR
2200 µFd
68Ω
R1
R2
AS
ASDR(D)
TCFPR(D)
TGTR(D)
AZTPR(D)
ASSR(D)
ASTPR(D)
TO BE USED IN
PI / RRI INSTALLATIONS
TGTR BPB
AZTPR
AMR
TOLR
ASSR
(INT.) 1B 24 - N 24 TGTR TGFPR TGTR
(EXT.) 2B 24 - N 24
BX 110 - NX 110
QT TYPE TRACK RELAY
ASTR
ASTPR(D)
EXISTING CIRCUIT UP TO
LOCATION OF BLOCI
LOCATION ADV. STG
NT
(EXT.)

Fig No: 2.11

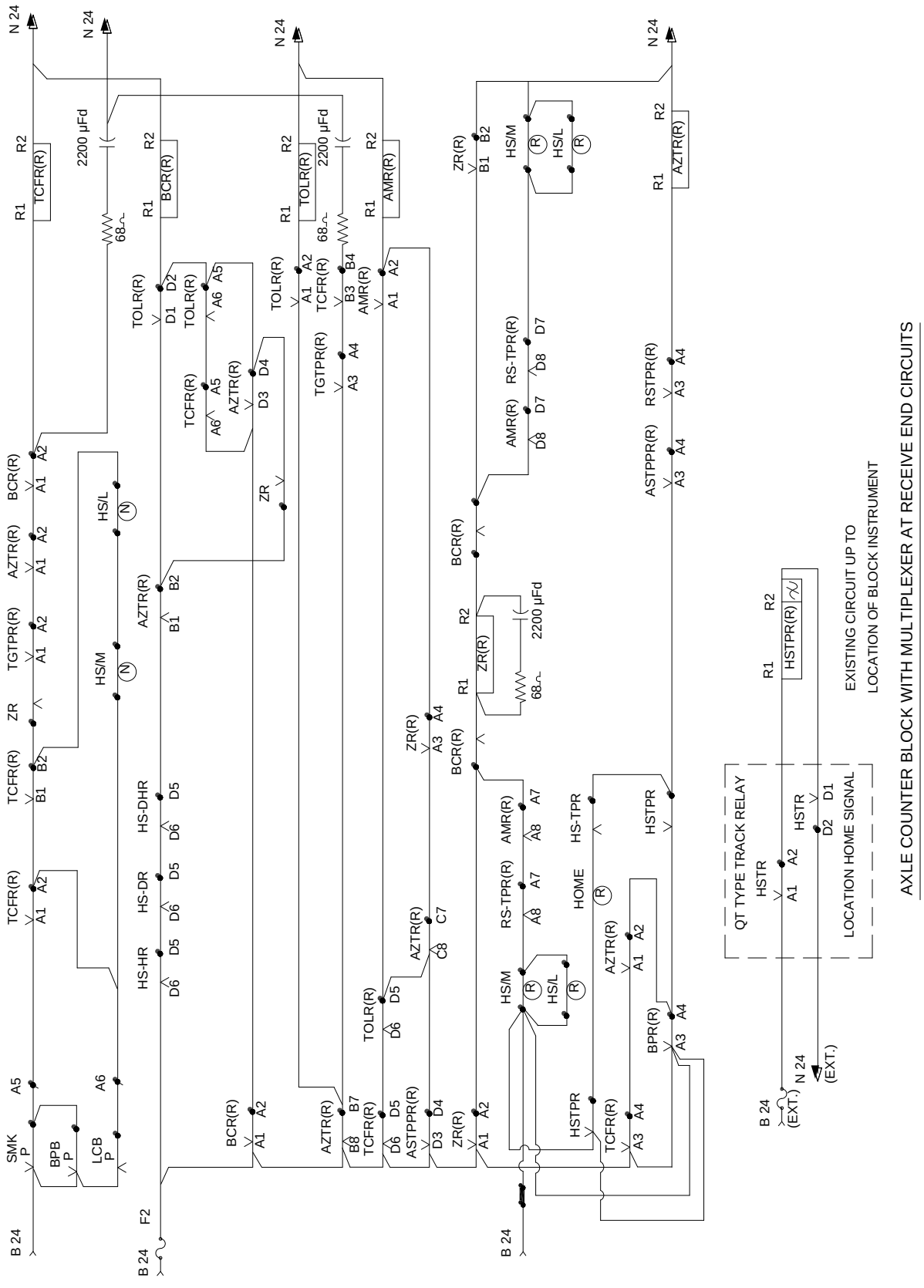
AXLE COUNTER BLOCK WITH MULTIPLEXER AT RECEIVE END CIRCUITS
EXISTING CIRCUIT UP TO
LOCATION OF BLOCK INSTRUMENT
LOCATION HOME SIGNAL
QT TYPE TRACK RELAY
N 24
B 24
F2
SMK
BPB
LCB
HS/L
HS/M
HS-HR
HS-DR
HS-DHR
HS-TPR
HOME
TCFR(R)
TOLR(R)
BCR(R)
AZTR(R)
TGTPR(R)
ZR
ZR(R)
AMR(R)
RS-TPR(R)
ASTPPR(R)
RSTPR(R)
BPR(R)
HSTPR
HSTR
HSTPR(R)
2200 µFd
68Ω
(EXT.)

Fig No: 2.12

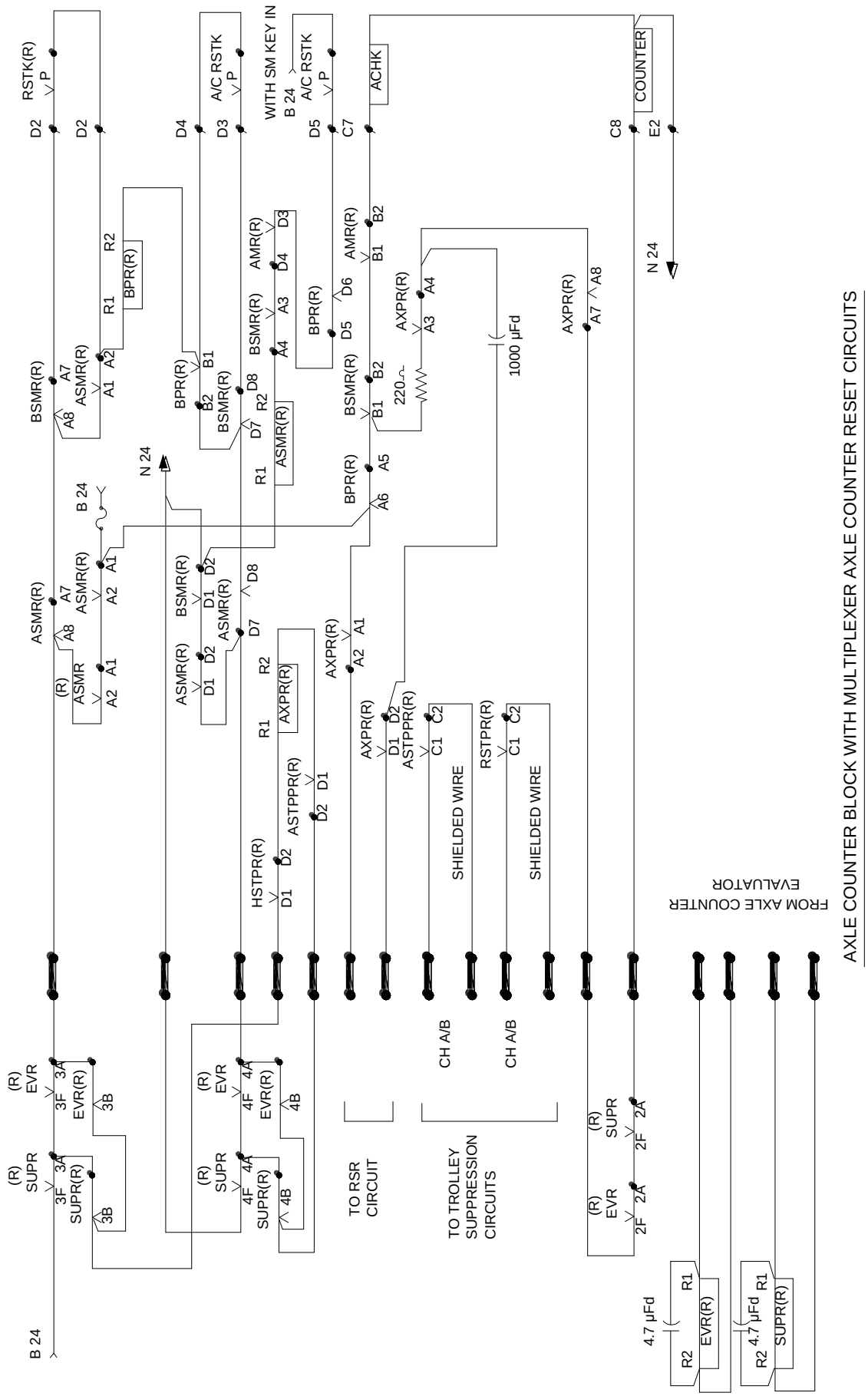
AXLE COUNTER BLOCK WITH MULTIPLEXER AXLE COUNTER RESET CIRCUITS
FROM AXLE COUNTER EVALUATOR
WITH SM KEY IN
RSTK(R)
A/C RSTK
ACHK
COUNTER
BSMR(R)
ASMR(R)
BPR(R)
AMR(R)
AXPR(R)
ASTPPR(R)
HSTPR(R)
RSTPR(R)
SHIELDED WIRE
1000 µFd
220Ω
4.7 µFd
EVR(R)
SUPR(R)
TO RSR CIRCUIT
TO TROLLEY SUPPRESSION CIRCUITS
CH A/B
N 24
B 24

Fig No: 2.13

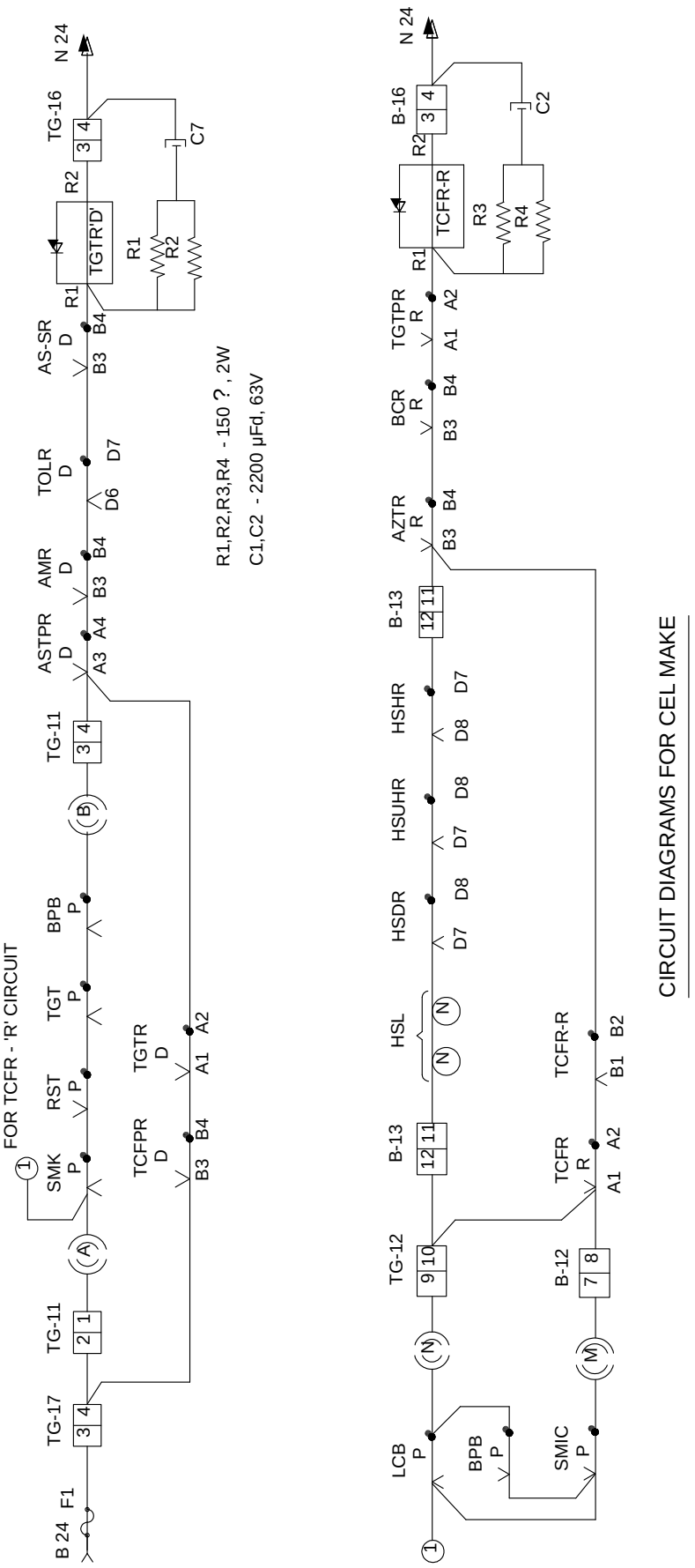
FOR TCFR - 'R' CIRCUIT
B 24 F1
TG-17
TG-11
TG-16
N 24
C7
C2
TGTR'D'
TCFR-R
R1
R2
R3
R4
AS-SR
TOLR
AMR
ASTPR
TGTPR
BCR
AZTR
B-13
B-16
B-12
TG-12
TCFPR
TGTR
TGT
RST
BPB
SMK
HSL
HSDR
HSUHR
HSHR
TCFR
LCB
SMIC
R1,R2,R3,R4 - 150 ? , 2W
C1,C2 - 2200 µFd, 63V
CIRCUIT DIAGRAMS FOR CEL MAKE

Fig No: 2.14

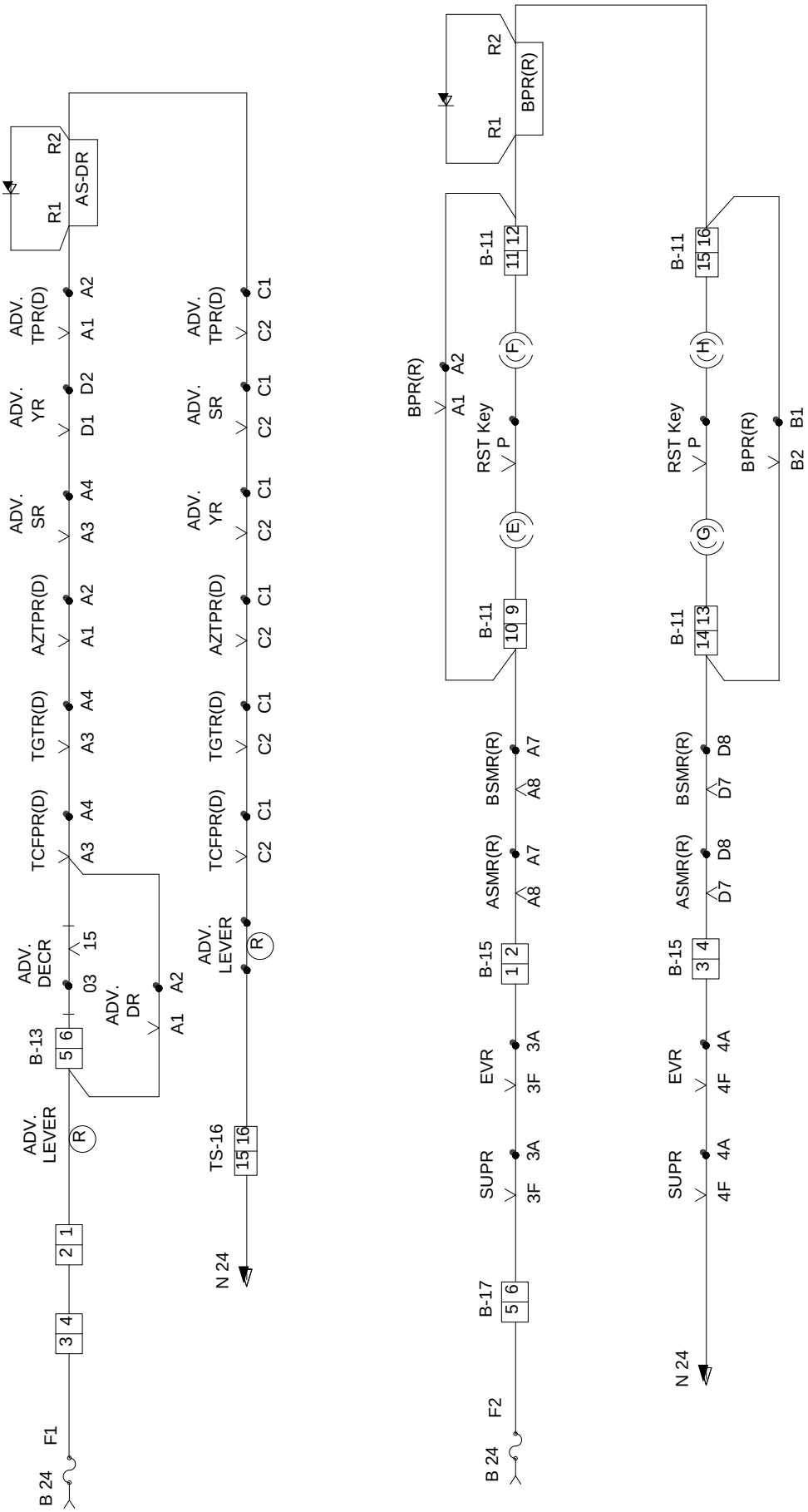
B 24
F1
3 4
2 1
ADV. LEVER
R
B-13
5 6
ADV. DECR
03
15
ADV. DR
A1
A2
TCFPR(D)
TGTR(D)
AZTPR(D)
ADV. SR
ADV. YR
ADV. TPR(D)
A3
A4
A1
A2
D1
D2
R1
R2
AS-DR
TS-16
15 16
N 24
C2
C1
ADV. LEVER
R
TCFPR(D)
TGTR(D)
AZTPR(D)
ADV. YR
ADV. SR
ADV. TPR(D)
C2
C1
B 24
F2
B-17
5 6
SUPR
EVR
3F
3A
B-15
1 2
ASMR(R)
BSMR(R)
A8
A7
B-11
10 9
RST Key
P
(E)
BPR(R)
A1
A2
B-11
11 12
(F)
R1
R2
BPR(R)
B-15
3 4
(G)
(H)
B-11
14 13
B-11
15 16
BPR(R)
B2
B1
N 24

Fig No: 2.15

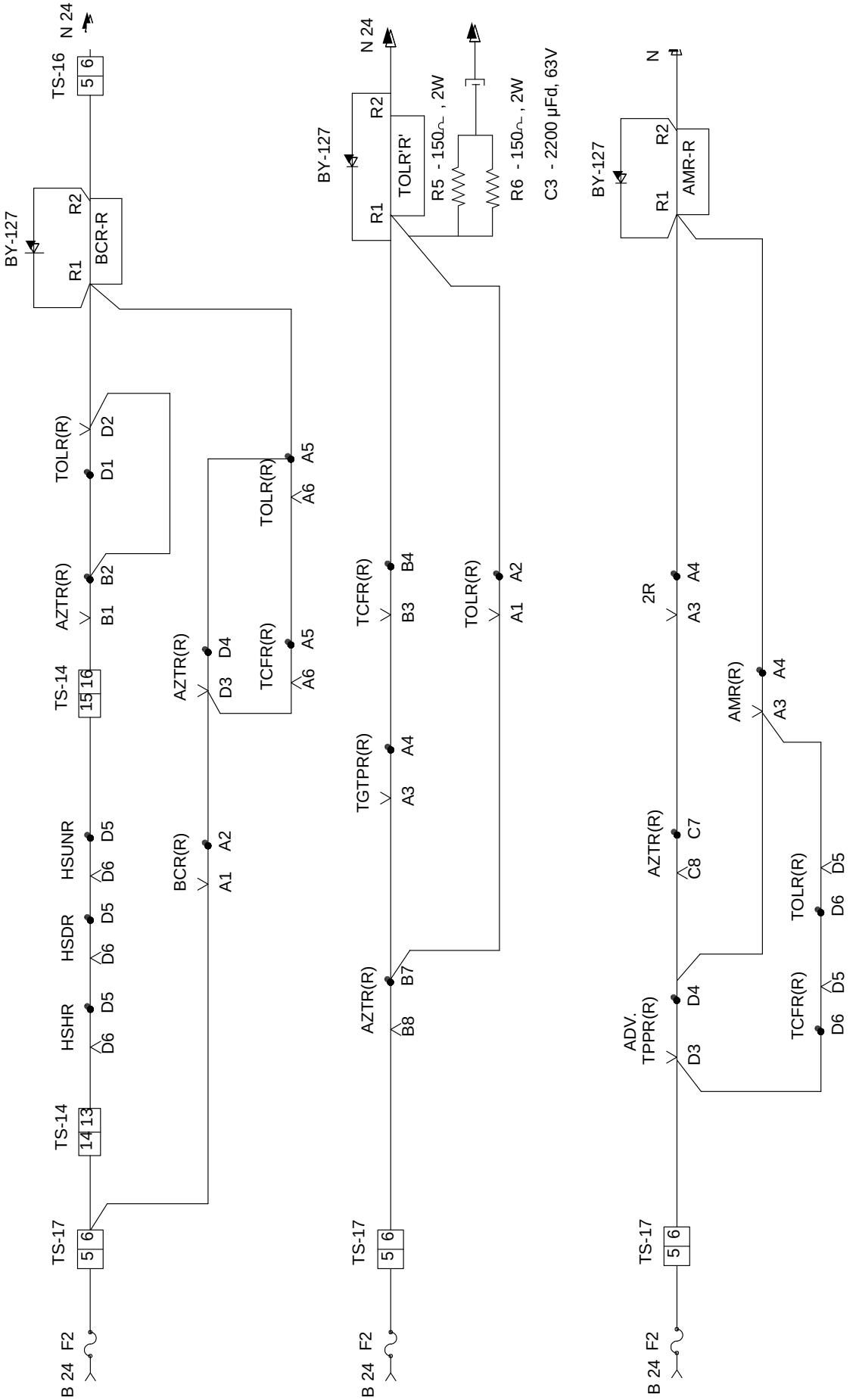
N 24
TS-16
5 6
BY-127
R2
R1
BCR-R
TOLR(R)
D2
D1
AZTR(R)
B2
B1
TS-14
15 16
HSUNR
D5
D6
HSDR
D5
D6
HSHR
D5
D6
TS-14
14 13
TS-17
5 6
B 24 F2
AZTR(R)
D4
D3
TOLR(R)
A5
A6
TCFR(R)
A5
A6
BCR(R)
A2
A1
BY-127
R2
R1
TOLR'R'
R5 - 150Ω , 2W
R6 - 150Ω , 2W
C3 - 2200 µFd, 63V
N 24
TCFR(R)
B4
B3
TOLR(R)
A2
A1
TGTPR(R)
A4
A3
AZTR(R)
B7
B8
TS-17
5 6
B 24 F2
BY-127
R2
R1
AMR-R
N
2R
A4
A3
AMR(R)
A4
A3
AZTR(R)
C7
C8
ADV.
TPPR(R)
D4
D3
TOLR(R)
D5
D6
TCFR(R)
D5
D6
TS-17
5 6
B 24 F2

Fig No: 2.16

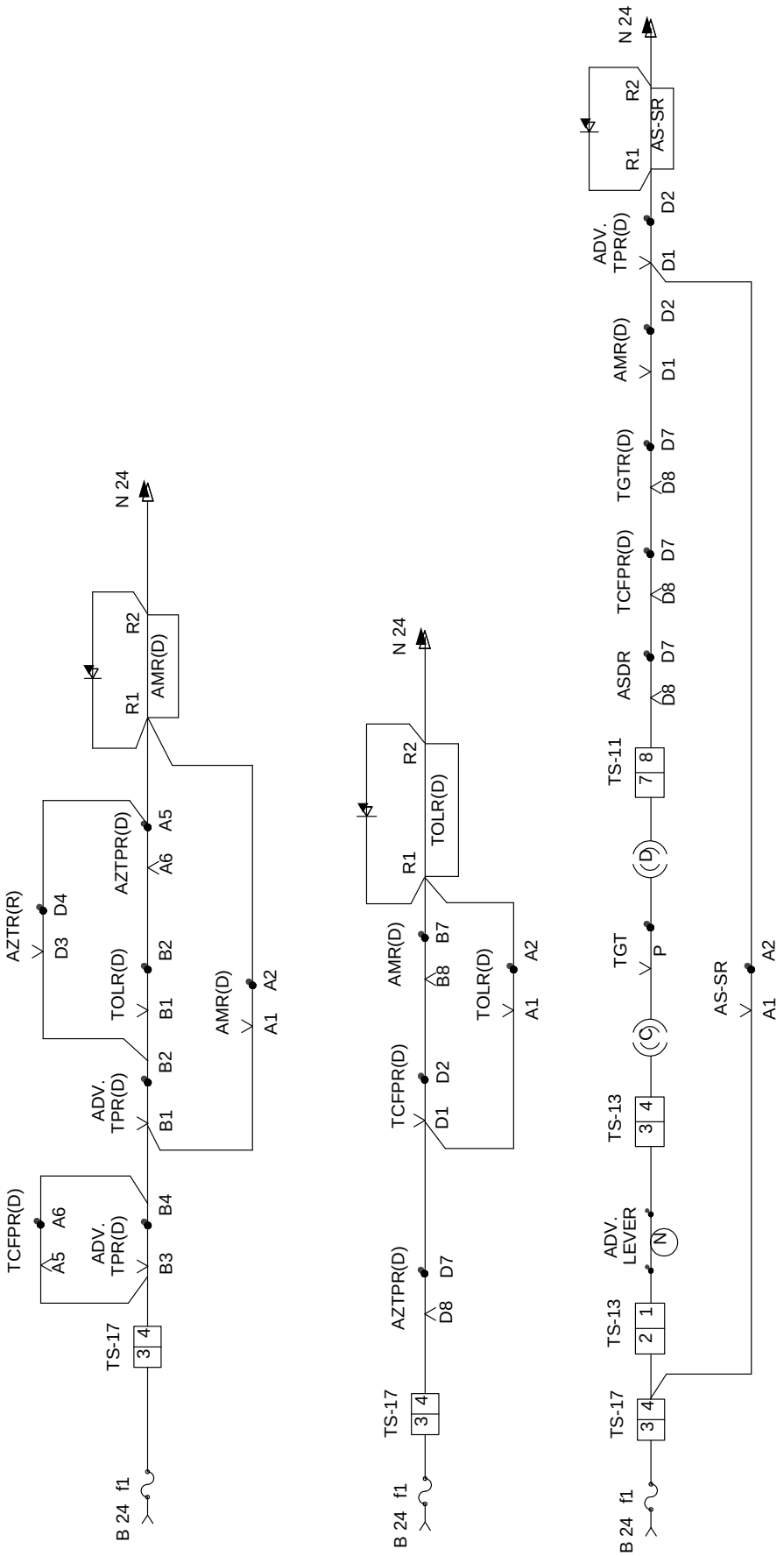
B 24 f1
TS-17
3 4
TCFPR(D)
A5 A6
ADV. TPR(D)
B3 B4
AZTR(R)
D3 D4
TOLR(D)
B1 B2
AZTPR(D)
A5 A6
AMR(D)
A1 A2
R1 R2
N 24
B 24 f1
TS-17
3 4
AZTPR(D)
D7 D8
TCFPR(D)
D1 D2
AMR(D)
B7 B8
TOLR(D)
A1 A2
R1 R2
N 24
B 24 f1
TS-17
3 4
TS-13
1 2
ADV. LEVER
N
TS-13
3 4
TGT
P
TS-11
7 8
ASDR
D7 D8
TCFPR(D)
D7 D8
TGTR(D)
D7 D8
AMR(D)
D1 D2
ADV. TPR(D)
D1 D2
AS-SR
A1 A2
R1 R2
N 24

Fig No: 2.17

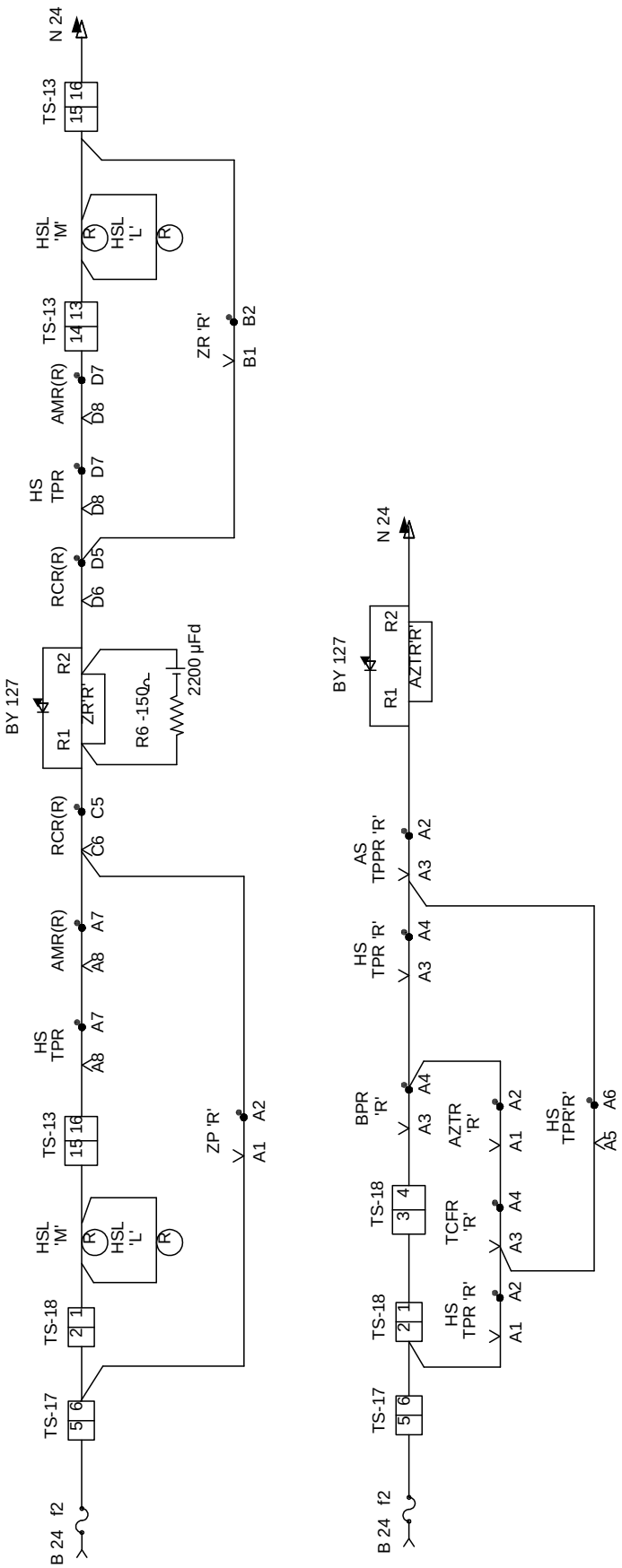
N 24
TS-13
15 16
HSL 'M'
HSL 'L'
TS-13
14 13
AMR(R)
D7
D8
HS TPR
D7
D8
RCR(R)
D5
D6
ZR 'R'
B2
B1
BY 127
R2
R1
ZR'R'
R6 -150Ω
2200 µFd
RCR(R)
C5
C6
AMR(R)
A7
A8
HS TPR
A7
A8
TS-13
15 16
ZP 'R'
A2
A1
HSL 'M'
HSL 'L'
TS-18
2 1
TS-17
5 6
B 24 f2
N 24
R2
R1
AZTR'R'
BY 127
AS TPPR 'R'
A2
A3
HS TPR 'R'
A4
A3
BPR 'R'
A4
A3
AZTR 'R'
A2
A1
HS TPR'R'
A6
A5
TS-18
3 4
TCFR 'R'
A4
A3
TS-18
2 1
HS TPR 'R'
A2
A1
TS-17
5 6
B 24 f2

Fig No: 2.18

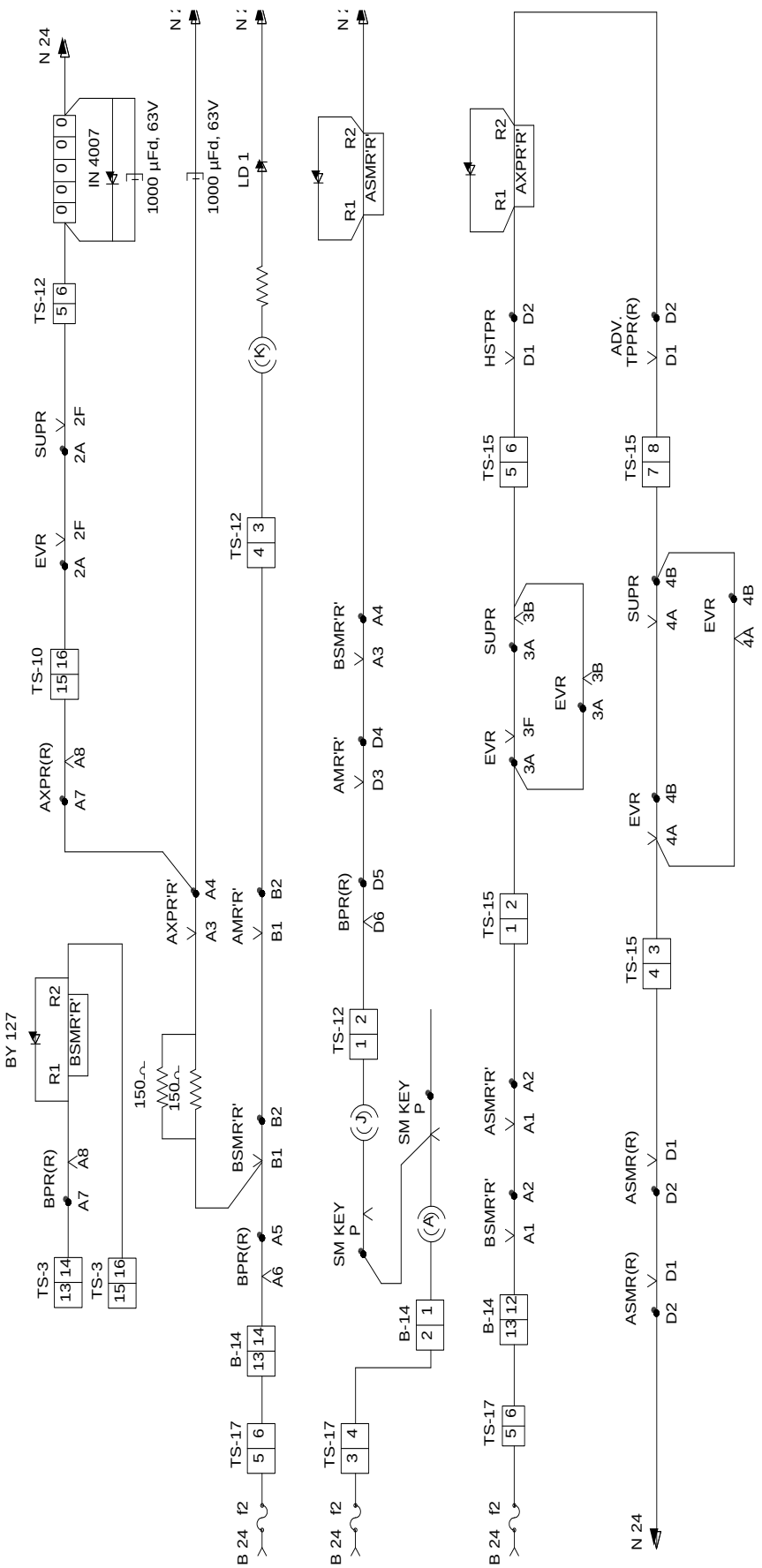
N 24
IN 4007
1000 µFd, 63V
LD 1
TS-12
TS-10
TS-3
TS-17
TS-15
B-14
SUPR
EVR
HSTPR
ADV. TPPR(R)
AXPR(R)
BPR(R)
AMR'R'
BSMR'R'
ASMR'R'
AXPR'R'
ASMR(R)
BY 127
150Ω
SM KEY
B 24 f2

Fig No: 2.19

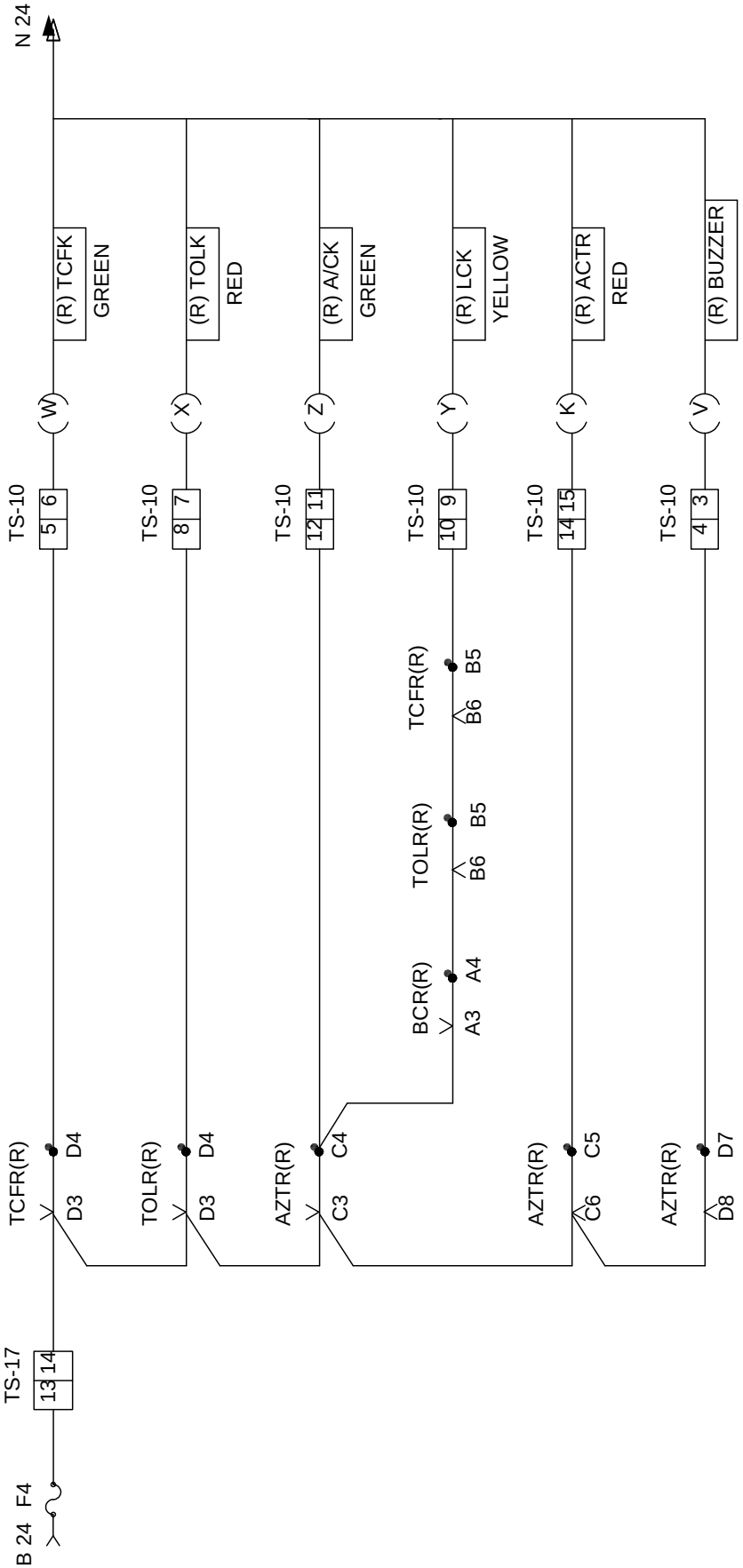
N 24
(R) TCFK
GREEN
(R) TOLK
RED
(R) A/CK
GREEN
(R) LCK
YELLOW
(R) ACTR
RED
(R) BUZZER
(W)
(X)
(Z)
(Y)
(K)
(V)
TS-10
5 6
8 7
12 11
10 9
14 15
4 3
TCFR(R)
TOLR(R)
AZTR(R)
BCR(R)
TCFR(R)
TOLR(R)
D4
D3
C4
C3
C5
C6
D7
D8
A4
A3
B5
B6
TS-17
13 14
B 24 F4

Fig No: 2.20

2.11 Remote reset:

This is a facility incorporated to enable the maintainer reset the Mux in a block working system in a real life situation single handedly from either end. Channel 'G' input of the Group II relays of the transmitter is kept reserved for the "remote re-set signal" There is another Push-button switch marked "Remote – Reset" on the front panel of the TX unit which when actuated sends the signal to the receiver at the other end. The decoded de-multiplexed pulsed output marked r-g of Channel 'C' at the remote end receiver available from the relevant The "Remote-Reset" Push button should be pressed for more than 0.6 Seconds. For it to be effective at the remote end. However if the switch is kept pressed for more than 1.8 sec. Multi reset action at the remote end will take place and the reset (attempt) registration counter may advance by a count of more than one.

2.12 Local reset

This is for resetting the unit either (TX or RX) by actuation of Push-button switch marked "Transmitter / Receiver Reset" mounted on the (facial-panel) of the "Regulator card" of the same unit front-plate. The unit is expected to resume normal working if error free. In case of a permanent fault however it will again revert back to the failed state. This reset facility is only available to maintainer and not to operating Staff. Every attempt to reset the unit is registered in Reset counter.

SM Panel to be installed at a distance not greater than 25 meters. from relay rack of axle counter block system.

2.13 4 WIRE JUNCTION BOX

The junction box, placed on trackside, feeds a continuous 5 KHz signal to the transmitter coils of the two track devices. In turn, it also receives the amplitude-modulated signals developed at the receiver coils of the track devices as two independent channels, each sent on two wires. After suitable filtration and amplification, the signal is sent to the axle counter evaluator as two channels on two wires each i.e. as a 4 wire output. In case of block working this equipment is used to interface the track devices placed at the receiving end i.e. Evaluator end.

2.14 2 WIRE JUNCTION BOX

This is a modification of the 4 wire junction box, used for saving the number of cable pairs i.e., from 2 to 1 pair where the track device signals have to be transmitted over several kilometers. It provides the output of the two track devices on a single pair of wires by shifting the frequency of one channel from 5 KHz to 3.5 KHz, and combining it with the 5 KHz of the other channel before transmitting it as a 2 wire output.

2.15 2 WIRE TO 4 WIRE CONVERTOR

Equipment complementary to the 2 wire junction box, it extracts the two signals sent on a single wire pair by the 2 wire junction box at the distant end. After suitable filtration and amplification, it provides the 5 KHz amplitude modulated signals over 4 wires to the two channels of the Axle Counter Evaluator.

2.16 TRACK DEVICES

These are special field sensors mounted on the rails, which serve to detect the presence of a passing wheel. A passing wheel is translated as a dip and the signal is sent to the junction box. They are staggered at 150 mm to 200 mm.

2.17 BLOCK MULTIPLEXER

It repeats the Block working relay information from one station to the other in a failsafe manner. This is achieved on a single line by using suitable multiplexing techniques. This relay information is digitally coded and sent as safety coded frequency shift keying signals. The frequencies used are 1100/1300 Hz. and 1500/1700 Hz. The baud rate is 1200 BPS.

2.18 VOLTAGE LEVELS ON AXLE COUNTER BLOCK SYSTEM WORKING

Description	Range	Rated
Junction box (a) 5 KHz Oscillator Output	54 V to 66 V	60 V Factory Set only.
Oscillator Frequency	4980 Hz to 5020 Hz	- - -
Rx.Coil output (with Jn.Box Connected)	i) Double Rail 700-1000 mV ii) Single Rail 900-1300 mV	800 mV Nominal 1100 mV depend on Setting.
Rx.Coil output under dip Condition	Up to 15% of 3 (c) above	- -
Receiver Amplifier output (at HOME location)	Double Rail 980-1400 mV ii) Single Rail 1260 –1820 mV	Double rail 1120 mV Single rail 1520 mV
4w/2w output at Advance Location only.	Double Rail 1370-1980 mV Single Rail 1760-2400 mV	Double rail 1568 mV Single rail 2017 mV
Axle Counter Channel levels incoming from track side for CH'A','B','C' & 'D' at Terminal Strip on back side of Rack	More than 200 mV Less than 150 mV rms input Clock-wise position. 105mv-110 mV rms Universal 10 V DC – 13 V DC Others: more than 8 V 5.2 V-5.4 V DC 9.8 V-10.2 V DC	Channel levels to be measured & recorded. Variation if any to be identified and problem to be solved. Must be selected initially once only.
(b) Attenuator pad setting Channel levels at Card to be set once only. EV Relay & SUP Relay output (across Relay Coils) DC-DC Converters output (test sockets)		105 mV rms Same as specification. 5.25 V DC 10.20 V DC.
Combiner/Converter (Test Sockets)		
(a) Tx./MUX output	900 mV – 1200 mV	As specified
(b) 5 KHz + 3.5 KHz output (4W/2W)	1.2 V to 2.2 V	As specified
(c) Composite output to next station	1.5 V	As specified
(d) Composite input from next station	More than 300 mV and less than 1200 mV	Signal mainly depend on Block section length and cable drop.

Transmitter/MUX (Test Sockets)		
(a) Battery input voltage	21.6 V DC – 28.8 V DC	24 V DC nominal
(b) Regulated output 10 VDC	10.6 V DC – 11.0 V DC	10.8 V DC
(c) Decoder output (local)	To be set at 1.5 V rms	As specified
Receiver/MUX (Test Sockets)		
(a) Regulated output 10 VDC	10.6 V DC – 11.0 V DC	10.8 V DC
(b) Decoder output	To be set at 1.5 V rms Not More than 2.1V	As specified
(c) Relay driver output for Adv. TPR , TGTR relays	- -	Depends mainly on Battery voltages.

2.19 The following points should be checked and ensured before commissioning of Block Proving by UAC after installation.

Note: Block Section length limit: Maximum 12 Kms.

Location (Out door):

(a) Station 'A'- Advance Starter and home signal Locations

Item	Required	Measured/ Observed		OK / Not OK	
		Adv. Str.	Home Signal	Adv. Str.	Home Signal
Placement of Cards	Should be in order				
Firmness of Cards	To be tightened with screw/clip properly				
MS Couplers on the EJB's	Installed and tightened properly				
MS coupler cables of the EJB's	Wired properly as per colour code (as per drg no. 1006002 of M/s CEL)				
Wiring of TX / Rx coils & MS coupler cables.	Wired on approved ARA/WAGO Series 260-261 terminal strips (as per drg no 1006002 of M/s CEL)				
Relay used at location of TR circuit.	Plug-in type				
Diode across every relay coil in reverse bias.	To be provided with IN 5408/ IN 4007				

Item	Required	Measured/ Observed		OK / Not OK	
		Adv. Str.	Home Signal	Adv. Str.	Home Signal
(a) Earthing of i. Location Box ii. Electronic Junction Box units iii. Screen of Track device cable. iv. Earthing of surge protection device.	Should be provided firmly with copper lugs. Value < 1 Ohms				
(b) Separate earth for Armour of quad cable.	Should be provided firmly with copper lugs. Value < 1 Ohms				
Fixing of Electronic Junction Box unit	Firmly fixed using nut and bolts on wooden shelf in location box.				
Fixing of TX coil	Outside the rail				
Fixing of Rx coil	Inside the rail				
Laying of track device cable	In corrugated/HDPE pipe				

Item	Required	Measured/ Observed		OK /Not OK	
		Adv.Str.	Home Signal	Adv.Str.	Home Signal
Fixing of deflector plates	As per clause 1.1.3 page 1-4 of installation manual of universal axle counter				
Deflector plates & TX/Rx coil	Should be tightly fixed.				
Cable for taking 24V DC from central location to location box	2 x 25 sq. mm Al.				
Cable for taking EJB signal to relay room from location box	Quad Cable				
Quad Cable insulation.	Standard pair to be used with IR >=10 M ohm				
Loss in quad cable at 2 KHz for QUAD.	< 20 Db				
Voice frequency isolation transformer	1120 ohm on equipment side and 470 ohm on cable side shall be used at both stations.				

Item	Required	Measured/ Observed		OK /Not OK	
		Adv.Str.	Home Signal	Adv.Str.	Home Signal
Training	It should be installed & commissioned by personnel trained by the manufacturer. Railway personnel shall be trained before commissioning.				
Fuse for EJB	2A				

(b) Station 'B'- Advance Starter and Home signal Locations:

Item	Required	Measured/ Observed		OK /Not OK	
		Adv.Str.	Home Signal	Adv.Str.	Home Signal
Placement of Cards	Should be in order				
Firmness of Cards	To be tightened with screw/clip properly				
MS Couplers on the EJB's	Installed and tightened properly				
MS coupler cables of the EJB's	Wired properly as per colour code (as per drg no. 1006002 of M/s CEL)				
Wiring of TX / Rx coils & MS coupler cables	Wired on approved ARA/WAGO Series 260-261 terminal strips (as per drg no 1006002 of M/s CEL)				
Diode across each relay coil in reverse bias.	To be provided with IN 5408/ IN 4007				
(a) Earthing of i. Location Box ii. Electronic Junction Box units iii. Screen of Track device cable. iv. Earthing of surge protection device.	Should be provided firmly with copper lugs. Value < 1 Ohms				
(b) Separate earth for armour of quad cable.	Should be provided firmly with copper lugs. Value < 1 Ohms				
Fixing of Electronic Junction Box unit	Firmly fixed using nut and bolts on wooden shelf in location box.				
Fixing of Tx coil	Outside the rail				
Fixing of Rx coil	Inside the rail				

Item	Required	Measured/ Observed		OK /Not OK	
		Adv.Str.	Home Signal	Adv.Str.	Home Sig-nal
Laying of Track de-vice cable	In corrugated/HDPE pipe as per drawing in manual (as per drawing no. 1006003A4 & 1007197A4 of M/s CEL)				
Fixing of deflector plates	As per clause 1.1.3 page 1-4 of installation manual of universal axle counter				
Deflector plates & TX/Rx coil	Should be tightly fixed.				
Cable for taking 24 V DC from central loca-tion to location box	2 x 25 sq. mm Al.				
Cable for taking EJB signal to relay room from location box	Quad Cable				
Quad cable insulation	Standard pair to be used with IR >=10 M ohm				
Loss in quad cable at 2 KHz for QUAD.	< 20 dB				
Voice frequency iso-lation transformer	1120 ohm on equipment side and 470 ohm on cable side shall be used at both stations.				
Fuse for EJB	2 A				

(a) ACS – 56 (3D) or ACS – 57 (4D) is to be converted to ACS – 55 (2D) before use in block section.

(b) DBS – 245A is the relay rack with terminal strips instead of wago terminal for con-nection to external circuits. (Supplied up to serial no. 573, dated July/Aug, ’05)

(c) Quad cable to be tested as per annexure-1of the manual

2.20 Readings at location

2.20.1 24V DC SUPPLY to Electronic Junction Box (JB-533, JB-534) UNIT

Measure the DC 24V input to the Electronic Junction Box.

Item	Required	Observed		OK /Not OK
		Station ’A’	Station ’B’	
DC Input to 4/2 wire EJB (JB-534) after charger ‘OFF’ for 15 minutes.	22 V to 28.8 V DC			
DC Input to 4/4 wire EJB (JB-533) after charger ‘OFF’ for 15 minutes	22 V to 28.8 V DC			

(a) OSCILLATOR OUTPUT (TX Coils)

Measure the oscillator output, frequency of Tx coil track device.

Item	Required	Observed		OK /Not OK
		EJB 534	EJB 533	
Station A, Tx1+Tx2 (OSC O/P)	54 V to 66 V (rms)			
Station A, Tx1+Tx2 (Frequency)	4900 to 5100 Hz			
Station B, Tx1+Tx2 (OSC O/P)	54 V to 66 V (rms)			
Station B Tx1+Tx2 (Frequency)	4900 to 5100 Hz			

(b) RECEIVER COIL OUTPUT

Measure the Rx coil signal output without any wheel and with dummy wheel.

Item	Rx coil output Without wheel			Rx coil output With dummy wheel			OK / Not OK
	Limit	Measured		Limit	Measured		
		EJB 534	EJB 533		EJB 534	EJB 533	
Station A Rx 1	>900 mV rms			<15% of Rx Coil Output			
Station A Rx 2	>900 mV rms			<15% of Rx Coil Output			
Station B Rx 1	>900 mV rms			<15% of Rx Coil Output			
Station B Rx 2	>900 mV rms			<15% of Rx Coil Output			

(c) ELECTRONIC JUNCTION BOX

Measure the AC Voltages Of Receiver Amp.1 & Receiver Amp. 2 at ARA Terminals in Location Box.

At ARA Terminal in Location Box	Rx Amplifier Output			OK /Not OK
	Limit	Measured		
		EJB 534	EJB 533	
Station A Rx Amp. 1	>1000 mV rms			
Station A Rx Amp. 2	>1000 mV rms			
Station B Rx Amp.1	>1000 mV rms			
Station B Rx Amp. 2	>1000 mV rms			
3.5 KHz + 5 KHz (4/2 wire) output at station A	>1200 mV rms			
3.5 KHz + 5 KHz (4/2 wire) output at station B	>1200 mV rms			

2.21 RELAY ROOM

Item	Required	Observed		OK / Not OK
		Station 'A'	Station 'B'	
Charger for Axle Counter	Power supply should be suitable for axle counter system. There should not be any other load on the power supply except BPAC system. Class "B" & "C" type surge protection must be provided on 230 V mains line. Voltage drop between battery terminal to system I/P should be < 1 V			
a) Earthing of i. Relay Rack ii. Evaluator Rack iii. SM Panel iv. Earthing of surge protection device.	Should be < 1 Ohm			
(b) Separate earth for Armour of quad cable.	Should be < 1 Ohm			
Battery bank	24 V, 40 AH or above for proper backup. (Rly to decide) or 24V, 5Amp module from IPS.			
Input voltage to system with charger ON	24 V to 28.8 V DC			

Item	Required	Observed		OK /Not OK
		Station 'A'	Station 'B'	
Input voltage to system with charger OFF (Keep charger OFF for 15 minutes before taking readings)	22 V to 28.8 V DC			
Voltage across ASTPR	>20 V			
Voltage across HSTPR	>20 V			
Retainer clip of relay	Should be properly tight			
DC-DC converter 24V to 24V	As per IRS: S 96/2000			
Fuses in Relay Rack	2 A (Type: HRC)			

(a) Universal Axle Counter: ACS-55 Sr.No. Station A_____ Station B_____

Test Point	Required	Observed		OK/ Not OK
		Station A	Station B	
Power supply (1 & 2 of TS-1)	22 V –28.8 V DC			
Signal level after Ch A pad adjusted with potentiometer maximum in card 1	Between 150 to 165 mV rms			
Signal level after Ch B pad adjusted with potentiometer maximum in card 1	Between 150 to 165 mV rms			
Signal level after Ch C pad adjusted with potentiometer maximum in card 1	Between 150 to 165 mV rms			
Signal level after Ch D pad adjusted with potentiometer maximum in card 1.	Between 150 to 165 mV rms			
DC-DC converter 5 V	4.50 to 5.50			
DC-DC converter 10 V	9.50 to 10.50			
DC-DC converter 10 V ISO	9.50 to 10.50			
Ch A, B, C, & D set by po-tentiometer to				
Channel A	105 mV ± 3 mV rms			
Channel B	105 mV± 3 mV rms			
Channel C	105 mV ± 3 mV rms			
Channel D	105 mV± 3 mV rms			
Relay Used for EV & SUP in axle counter	QS3, 1000 Ohm, 12 V			

(b) Relay Rack DBS-245B Sr. No. Station A_____ Station B_____

item	Required	Observed		OK/Not OK
		Station A	Station B	
Power supply	22 V-28.8 V DC			

(c) Transmitter Multiplexer: TM-237 Sr.No. Station A_____Station B_____

Item (Tx-8 module)	Required	Observed		OK/ Not OK
		Station A	Station B	
Power supply (Tx-8 module)	22 V to 28.8 V DC			
Output of DC-DC converter	24 V + 0.5 V			
DC-regulated voltage (Tx-8 Module)	10.8 V + 0.2 V			
FSK Signal (set on Tx-3 Module if req.)	1.5 V + 0.2 V rms			

(d) Receiver Multiplexer: RM-239 Sr. No. Station A_____ Station B_____

Item	Required	Observed		OK/Not OK
		Station A	Station B	
DC-regulated voltage (Rx-10 Module)	10.8 V + 0.2 V			
FSK Signal (Set on Rx-7 Module, if required)	1.5 V + 0.2 V rms			

(e) Combiner Converter: CC-240 Sr. No. Station A_____ Station B_____

Item	Required	Observed		OK/ Not OK
		Station A	Station B	
3.5 KHz + 5 KHz Jn. Box	1.2 V to 2.6 V rms			
FSK Tx-Mux	1.0 V to 1.2 V rms			
Composite out to next station	1.5 V to 2.6 V rms *			
Composite in from next station. (<12 Km section) (This decreases with increase in length and vice-versa)	200 mV to 1 V **			

**** Note:*** *The range shall be 1.8 V to 3.5 V with Combiner/Converter (2W/4W) version 360-7.*

***** Note:*** *The range shall be 200 mV to 2.4 V with Combiner/Converter (2W / 4W) version 360-7.*

Item		Required	Observed		OK/ Not OK
			Station A	Station B	
The switch position in Card 2 of combiner / converter should be positioned and set as per the length of block section		Downward (if length < 5 Km) Upward (if length > 5 Km)			
"Composite In" to filter	< 5 Km section	50% of point 4.6.4 above			
	> 5Km section	70% of point 4.6.4 above			

2.22 SM's Room

(a) SM Panel: SP-591 Sr. No. Station A_____ Station B_____

Item	Required	Observed		OK/ Not OK
		Station A	Station B	
SM Panel	Wired as per drg (006137A3) & fixed firmly			
SM Panel earthing	Connected to earth properly with lug			
Reset function	i. Reset not possible when Axle Counter section is clear and healthy. ii. Resetting normal working checked with cooperation from station A to station B and vice versa.			
Line Clear Function	Function should be normal			
Line clear Cancellation	As per G & SR			
Bell Operation	Should be normal			
Telephone Speech	Clear			

2.23 Test format for testing of QUAD cable between station (i.e. combiner to combiner) before commissioning of SSDAC/BPAC/SSBPAC (D)

Item	Expected	Measured/ Observed	OK/ Not OK
Communication Media Type of Cable	Only Quad cable to be used between— Combiner to combiner. EJB to combiner. EJB to Evaluator.		
Use of pair	Proper pair of wires to be used for connectivity. Annex-2 may be referred.		
Parallelism of Wires	No wires to be paralleled.		
Insulation resistance of Quad cable	Shall be greater than /equal to 10 M ohm.		
Loop resistance of designated pair	Not to exceed 56 ohm/Kms at 20^0 C. See Annexure – 3 for correction factor.		
Attenuation loss measured at 2 KHz	Shall not be greater than 20.0 dB for full length of the cable used.		
Near End Cross Talk (NEXT)	Shall be better than 55 dB.		
Far End Cross Talk (FEXT)	Shall be better than 55 dB.		
Continuity of cable Armour	Continuity shall be there.		
Separate Earth of quad cable Armour	Shall be less than 1 ohm.		
Cable allocation table	Shall be filled up and attached.		
Length of quad cable	<12 km		

2.24 Procedure for test

(a) Attenuation Loss: The output/Input impedance of signal generator/dB meter shall be 600 ohm.

(b) Near End Cross talk: Test tone of 150 KHz to be fed in the adjacent pair of the same quad & NEXT to be measured at the same end on the other pair of the same quad.

(c) Far End Cross talk: Test tone of 150 KHz to be fed in the adjacent pair of the same quad & FEXT to be measured at the far end on the other pair of the same quad.

(d) 1st pair = White & Quad colour i.e. A & B Wires

(e) 2nd pair= Red & Grey colour i.e. C & D Wires of designated colour of Quad.

(f) Each Quad is binded by the respective Quad colour binder

Color scheme of PE insulated Quads							
Quad Color	**Quad No.**	**Pair No.**	**A - Wire**	**B -Wire**	**Pair No.**	**C- Wire**	**D - Wire**
Orange	1	1A	White	Orange	1B	Red	Grey
Blue	2	2A	White	Blue	2B	Red	Grey
Brown	3	3A	White	Brown	3B	Red	Grey
Green	4	4A	White	Green	4B	Red	Grey
Yellow	5	5A	White	Yellow	5B	Red	Grey
Black	6	6A	White	Black	6B	Red	Grey

Precautions to be taken for using QUAD Cable:

i. Designated pair of wire of the same quad (mentioned in Table -1) should be used.

ii. Do not use one wire from one quad and another wire from some other quad.

iii. If any wire of a pair of the quad is broken /Non-functional, then use fresh pair of wire.

iv. Do not parallel wires of quad cable.

Item	Required	Observations
Loss in quad cable at 2 KHz for QUAD.	< 20 db	
Voice frequency isolation transformer	1120 ohm on equipment side and 470 ohm on cable side shall be used at both stations.	
Training	It should be installed & commissioned by personnel trained by the manufacturer. Railway personnel shall be trained before commissioning.	
Fuse for EJB	2 A	

2.25 Station 'B'- Home signal Locations

Item	Required	Observations
a) Earthing of i. Location Box ii. Electronic Junction Box units iii. Screen of Track device cable. iv. Earthing of surge protection device	Should be provided firmly with copper lugs. Value < 1 Ohms	
b) Separate earth for Armour of quad cable.	Should be provided firmly with copper lugs. Value < 1 Ohms	
Fixing of Electronic Junction Box unit	Firmly fixed using nut and bolts on wooden shelf in location box	
Cable for taking 24V DC from central location to location box	2 x 25 sq.mm Al	

Item	Required	Observations	
Cable for taking EJB signal to relay room from location box	Quad Cable		
Quad cable insulation	Standard pair to be used with IR >= 10 M ohm		
Loss in quad cable at 2 KHz for QUAD.	< 20 dB		
Voice frequency isolation transformer	1120 ohm on equipment side and 470 ohm on cable side shall be used at both stations.		
Training	A) It should be installed & commissioned by personnel trained by the manufacturer. B) Railway personnel shall be trained before commissioning.		
Fuse for EJB	2 A		

2.25.1 QUAD CABLE

24 V DC SUPPLY to Electronic Junction Box (JB-533, JB-534) UNIT.

Measure the 24 V DC input to the Electronic Junction Box.

Item	Required	Observed		OK /Not OK
		Station A	Station B	
DC Input to 4/2 wires EJB (JB-534) after charger 'OFF' for 15 minutes.	22 V to 30 V DC			
DC Input to 4/4 wire EJB (JB-533) after charger 'OFF' for 15 minutes	22 V to 30 V DC			

2.25.2 OSCILLATOR OUTPUT (Tx Coils)

Measure the oscillator output, frequency of Tx coil track device.

Item	Required	Observed		OK / Not OK
		EJB 534	EJB 533	
Station A, Tx1+Tx2 (OSC O/P)	54 V to 66 V (rms)			
Station A, Tx1+Tx2 (Frequency)	4900 to 5100 Hz			
Station B, Tx1+Tx2 (OSC O/P)	54 V to 66 V (rms)			
Station B, Tx1+Tx2 (Frequency)	4900 to 5100 Hz			

2.25.3 RECEIVER COIL OUTPUT

Measure the Rx coil signal output without any wheel and with dummy wheel.

Item	Rx coil output With-out wheel			Rx coil output With dummy wheel			OK / Not OK
	Limit	Measured		Limit	Measured		
		EJB 534	EJB 533		EJB 534	EJB 533	
Station A Rx 1	>900 mV rms		Not Used	<15% of Rx Coil Output		Not Used	
Station A Rx 2	>900 mV rms		Not Used	<15% of Rx Coil Output		Not Used	
Station B Rx 1	>900 mV rms			<15% of Rx Coil Output			
Station B Rx 2	>900 mV rms			<15% of Rx Coil Output			

2.25.4 ELECTRONIC JUNCTION BOX

Measure the AC Voltages Of Receiver Amp.1 & Receiver Amp. 2 at ARA Terminals in Location Box.

At ARA Terminal in Location Box	Rx Amplifier Output			OK / Not OK
	Limit	Measured		
		EJB 534	EJB 533	
Station A Rx Amp. 1	>1000 mV rms		Not Used	
Station A Rx Amp. 2	>1000 mV rms		Not Used	
Station B Rx Amp.1	>1000 mV rms	Not Used		
Station B Rx Amp. 2	>1000 mV rms	Not Used		
3.5 KHz + 5 KHz (4/2 wire) output at station A	>1200 mV rms		Not Used	

2.25.5 RELAY ROOM

General Points:

Item	Required	Observed		OK /Not OK
		Station A	Station B	
Charger for Axle Counter	Power supply should be suitable for axle counter system. There should not be any other load on the power supply except BPAC system. Class “B” & “C” type surge protection must be provided on 230 V mains line. Voltage drop between battery terminal to system I/P should be less than 1 V.			
a) Earthing of i. Relay Rack ii. Evaluator Rack iii. SM Panel iv. Earthing of surge protection device.	Should be < 1 Ohm			
b) Separate earth for Armour of quad cable.	Should be < 1 Ohm			
Battery bank	24 V, 40 AH or above for proper backup. (Rly to decide) or 24 V, 5 Amp module from IPS.			
Input voltage to system with charger ON	24 V to 28.8 V DC			
Input voltage to system with charger OFF (Keep charger OFF for 15 minutes before taking readings)	22 V to 28.8 V DC			
Voltage across ASTPR	>20 V			
Retainer clip of relay	Should be properly tight			
DC-DC converter 24V to 24V	As per IRS: S 96/2000			
Fuses in Relay Rack	2 A (Type: HRC)			

(a) **Universal Axle Counter** ACS-55 Sr.No. Station A_____Station B_____

Test Point	Required	Observed		OK/ Not OK
		Station A	Station B	
Power supply (1 & 2 of TS-1)	22V –30 V DC	Axle counter not installed		
Signal level after Ch A pad adjusted with potentiometer maximum in card 1	Between 150 mV to 165 mV rms			
Signal level after Ch B pad adjusted with potentiometer maximum in card 1	Between 150 mV to 165 mV rms			
Signal level after Ch C pad adjusted with potentiometer maximum in card 1	Between 150 mV to 165 mV rms			
Signal level after Ch D pad adjusted with potentiometer maximum in card 1.	Between 150 mV to 165 mV rms			
DC-DC converter 5 V	4.50 to 5.50			
DC-DC converter 10 V	9.50 to 10.50			
DC-DC converter 10 V ISO	9.50 to 10.50			
Ch A, B, C, & D set by potentiometer to				
Channel A	105 mv ± 3 mv rms			
Channel B	105 mv ± 3 mv rms			
Channel C	105 mv ± 3 mv rms			
Channel D	105 mv ± 3 mv rms			
Relay Used for EV & SUP in axle counter	QS3, 1000 Ohm, 12V			

(b) **Relay Rack** Sr. No. Station A SBS 247 NA_____ Station B SBS 247 A_____

Item	Required	Observed		OK/Not OK
		Station A	Station B	
Power supply	22V-30V DC			

(c) Transmitter Multiplexer: Sr. No. Station A TM 237 NA____. Station B TM 237 A ____
As per the manual of ACBWS DBS 245 B.

Item (Tx-8 module)	Required	Observed		OK/Not OK
		Station A	Station B	
Power supply (Tx-8 module)	22 V to 30 V DC			
Output of DC-DC converter	24 V + 0.5 V			
DC-regulated voltage (Tx-8 Module)	10.8 V + 0.2 V			
FSK Signal (set on Tx-3 Module if req.)	1.5 V + 0.2 V rms			

(d) Receiver Multiplexer Sr. No. Station A RM 239 NA_____. Station B RM 239 A _____

Item	Required	Observed		OK/ Not OK
		Station A	Station B	
DC-regulated voltage (Rx-10 Module)	10.8 V + 0.2 V			
FSK Signal (Set on Rx-7 Module, if required)	1.5 V + 0.2 V rms			

(e) Combiner Converter Sr. No. Station A CC 240 NA_____ Station B CC 240

Item	Required	Observed		OK/Not OK
		Station A	Station B	
3.5KHz + 5KHz Jn. Box	1.2 V to 2.6 V rms			
FSK Tx-Mux	1.0 V to 1.2 V rms			
Composite out to next station	1.5 V to 2.6 V rms *			
Comp. in from next station (<12Km section) (This decreases with increase in length and vice-versa)	200 mV to 1 V **			

The range shall be 1.8 V to 3.5 V with Combiner/Converter (2W/4W) version 360-7.

The range shall be 200 mV to 2.4 V with Combiner / Converter (2W / 4W) version 360-7

Item		Required	Observed		OK/ Not OK
			Station A	Station B	
The switch position in Card2 of combiner / converter should be positioned and set as per the length of block section		Downward (if length < 5 Km) Upward (if length > 5 Km)			
"Composite In" to filter	< 5 Km section	50% of point 4.6.4 above			
	> 5Km section	70% of point 4.6.4 above			

FAULT CHART FOR MUX TRANSMITTER - ERROR CARD-1

Sl. No.	Error Number	Normal Signal Level at landing	Error Signal Level at landing	Error due to	Cards to be re-placed in sequence until the error gets removed
1	2	3	4	5	6
1	E1	LOW	HIGH	(i) Inputs & local decoded output in group-1 not matching(i.e. Ch-A to Ch-F) (ii) Input-1 card not multiplexing the inputs correctly. (iii)Local decoding is not proper in decoder card. (iv) Decoding is O.K, but XTAL card is not giving proper matching output.	(1) Input-1 card (2) Decoder card (3) XTAL card (4) Error-1 card
2	E2	LOW	HIGH	All inputs in Group-1 i.e. Ch-A to Ch-F become zero level. All locally decod-ed received outputs become zero level.	(1) Input-1 card (2) Decoder card (3) XTAL card (4) Error-1 card
3	E3	LOW	HIGH	Clock circuits AQ clock, BQ clock not functioning or large mismatch in their timings.	(1) XTAL card (2) Error-1 card
4	E4	LOW	HIGH	Clock circuits AQ clock, BQ clock not functioning or large mismatch in their timings.	(1) XTAL card (2) Error-1 card
5	E5	LOW	HIGH	Parity generation bit is not according to inputs available to system i.e. Ch-A to Ch-F. Even inputs – parity bit(0) odd input – Parity bit(1)	(1) XTAL card (2) Input-1 card (3) Error-1 card
6	E6	LOW	HIGH	(i) Inputs & local decoded output in Group-2 not matching (i.e. Ch-G to Ch-L) (ii) Input-2 card not multiplexing the inputs correctly. (iii) Input-1 card not processing the multiplexed inputs correctly. (iv) Decoder card is not properly de-coding the locally received outputs. (v) Decoding is O.K, but sync card is not giving proper matching output.	(1) Input-2 card (2) Input-1 card (3) Decoder card (4) Sync card (5) Error-1 card
7	E7	HIGH	LOW	(i) All inputs in Group-1 Ch-A to Ch-E becomes zero level. (ii) All locally received outputs be-come zero only.	(1) Input-1 card (2) XTAL card (3) Error-1 card
8	E8	HIGH	LOW	Parity generated bit for Group-I is not according to inputs available to sys-tem.	(1) XTAL card (2) Decoder card (3) Input-1 card (4) Error – 1 card

Note: All the cards mentioned in column-6 should be checked for proper insertion in the mother board before replacement of new cards is done, since any loose fittings of these cards can also lead to error condition.

FAULT CHART FOR MUX TRANSMITTER - ERROR CARD-2

Sl. No.	Error Number	Normal Signal Level at landing	Error Signal Level at landing	Error due to	Cards to be re-placed in sequence until the error gets removed
1	2	3	4	5	6
1	E9	HIGH	LOW	All inputs in Group-I Ch-A to Ch-F become zero level.	(1) Input-1 card (2) Error-2 card
2	E10	HIGH	LOW	All inputs in Group-2 Ch-G to Ch-L become zero level..	(1) Input-1 card (2) Error-2 card
3	E11	HIGH	LOW	Parity generation bit for Group-2 is not according to inputs available to system.	(1) Sync card (2) Input-2 card (3) Error – 2 card (4) Decoder card
4	E12	HIGH	LOW	All inputs in Group-2 Ch-G to Ch-L become zero level.	(1) Input-2 card (2) Decoder card (3)Sync card (4)Error-2 card
5	E13	LOW	HIGH	Parity generation bit is not according to inputs available to system i.e. Ch-G to Ch-L. Even inputs – parity Bit(0) odd input – Parity Bit(1)	(1) Sync card (2) Input-2 card (3) Error- 2 card
6	E14	LOW	HIGH	(i)All inputs in group-2 Ch-G to Ch-L become zero level. (ii) All locally received outputs be-come zero only.	(1) Sync card (2) Decoder card (3)Input-2 card (4) Error- 2 card (5) Input-1 card
7	E15	HIGH	LOW	Clock circuits AGS, BQS not func-tioning or large mismatch in their timings.	(1) XTAL card (2) Sync card (3) Error – 2 card
8	E16	HIGH	LOW	Clock circuits AGS, BQS not func-tioning or large mismatch in their timings.	(1) XTAL card (2) Sync card (3)) Error – 2 card

Note: All the cards mentioned in column-6 should be checked for proper insertion in the mother board before replacement of new cards is done, since any loose fittings of these cards can also lead to error condition.

FAULT CHART FOR MUX RECEIVER – ERROR CARD – 1

Sl. No.	Error Number	Normal Signal Level at landing	Error Signal Level at landing	Error due to	Cards to be re-placed in sequence until the error gets removed
1	2	3	4	5	6
1	E1	LOW	HIGH	(i)Relay driver-1 card not inserted properly. (ii) Error-1 card going faulty.	(1) Insert Relay driver-1 card proper-ly. (2) Error-1 card.
2	E2	LOW	HIGH	All output in group-1 i.e. Ch-A to Ch-F become zero level..	(1) Decoder card (2)XTAL card (3)Error- 1 card
3	E3	LOW	HIGH	Clock circuits AQ clock, BQ clock not functioning or large mismatch in their timings.	(1) XTAL card (2) Error-1 card
4	E4	LOW	HIGH	Clock circuits AQ clock, BQ clock not functioning or large mismatch in their timings.	(1) XTAL card (2) Error-1 card
5	E5	LOW	HIGH	Parity generation bit is not according to inputs available to system i.e. Ch-A to Ch-F. Even inputs – parity Bit(0) odd input – Parity Bit(1)	(1) XTAL card (2) Input-1 card (3) Error- 1 card
6	E6	LOW	HIGH	(i) Relay driver -2 card not inserted properly. (ii) Error-1 card going faulty.	(1) Insert Relay driver-2 card proper-ly. (2) Error- 1 card
7	E7	HIGH	LOW	(i) All inputs in group-1 Ch-A to Ch-E become zero level. (ii) All locally decoded received out-put becomes zero level.	(1) Input-1 card (2) XTAL card (3) Error – 1 card
8	E8	HIGH	LOW	Parity generation bit for Group-1 is not according to Inputs available to system.	(1) XTAL card (2) Decoder card (3) Input-1 card (4) Error- 1 card

Note: All the cards mentioned in column-6 should be checked for proper insertion in the mother board before replacement of new cards is done, since any loose fittings of these cards can also lead to error condition.

FAULT CHART FOR MUX RECEIVER – ERROR CARD – 2

Sl. No.	Error Number	Normal Signal Level at landing	Error Signal Level at landing	Error due to	Cards to be replaced in sequence until the error gets removed
1	2	3	4	5	6
1	E9	HIGH	LOW	Relay driver-3 card not inserted properly.	(1) Insert Relay driver-3 card properly. (2) Relay Driver-3 card. (3)Error-2 card
2	E10	HIGH	LOW	Relay driver-4 card not inserted properly.	(1) Insert Relay driver-4 card properly. (2) Relay Driver-4 card. (3)Error -2 card
3	E11	HIGH	LOW	Parity generation bit for Group-2 is not according to inputs available to system.	(1) Sync card (2) Error-2 card (3) Decoder card
4	E12	HIGH	LOW	All inputs in group-2 Ch-G to Ch-L become zero level.	(1) Sync card (2) Error-2 card (3) Decoder card
5	E13	LOW	HIGH	Parity generation bit is not according to inputs available to system i.e. Ch-G to Ch-L. Even inputs – parity Bit(0) odd input – Parity Bit(1)	(1) Sync card (2) Error-2 card
6	E14	LOW	HIGH	(i) All inputs in Group- 2 Ch-G to Ch-L become zero level (ii) All decoded received outputs become zero level.	(1) Sync card (2) Decoder card (3) Error-2 card
7	E15	HIGH	LOW	Clock circuits AGS, BQS not functioning or large mismatch in their timings.	(1) XTAL card (2) Sync card (3) Error – 2 card
8	E16	HIGH	LOW	Clock circuits AGS, BQS not functioning or large mismatch in their timings.	(1) XTAL card (2) Sync card (3) Error – 2 card

Note: All the cards mentioned in column-6 should be checked for proper insertion in the mother board before replacement of new cards is done, since any loose fittings of these cards can also lead to error condition.

Precautions to be taken for using QUAD Cable:

(a) Designated pair of wire of the same quad (mentioned in Table -1) should be used.

(b) Do not use one wire from one quad and another wire from some other quad.

(c) If any wire of a pair of the quad is broken /Non-functional, Then use fresh pair of wire.

(d) Do not parallel wires of quad cable.

CHAPTER 3: BLOCK PROVING AXLE COUNTER WITH BLOCK INSTRUMENTS (BPAC)

3.1 Purpose

To prove the complete arrival of the train by the system & remove the dependency of human element in verifying the complete arrival of the train.

3.2 Introduction

In the conventional double line Block instrument all the operations are done by the receiving station master and this could result in detention to trains at the sending end in case of non-availability/pre-occupation of the receiving station Master. Moreover complete arrival of the train by checking up the LV board/Tail lamp is done manually by the receiving Station Master and in case of any failure to adhere to this procedure strictly, there is a possibility of Block being closed even if parting had occurred in the mid-section and the train had arrived incomplete. Axle Counter was thought of for use in Block working to overcome the twin problems of (1) dependence of human agency to verify the complete arrival of the train and (2) delays associated with the granting of Line Clear in conventional double line Block working.

3.2 Features of BPAC

(a) It verifies the complete arrival of the train.

(b) It enhances safety of train working.

3.3 Types

BPAC are of two types

(a) BPAC with Block Instruments

(b) BPAC without Block Instruments also called Axle Counter Block working.

(a) BPAC with Block Instruments:

According to block instruments used on Indian Railways BPAC with block instruments are further classified as follows

(i) BPAC with Double line Block Instruments

(ii) BPAC with F.M. Handle type tokenless Block Instruments on Single line.

(iii) BPAC with Push Button tokenless Block Instruments on Single line.

(i) BPAC with Double line Block Instruments

In this system conventional Double line Block Instruments are used at the either station of the block section with SSDAC/UAC for each block section on double line. The contacts of SSDAC/UAC Axle counter as VR/ACPR relay contacts are used in the Indication circuit, the LSS circuit, the Block clearance circuits, the other circuits like Bell circuit & also the Operations of Block Instrument remain as it is in the regular Double line block instrument working.

Layout:

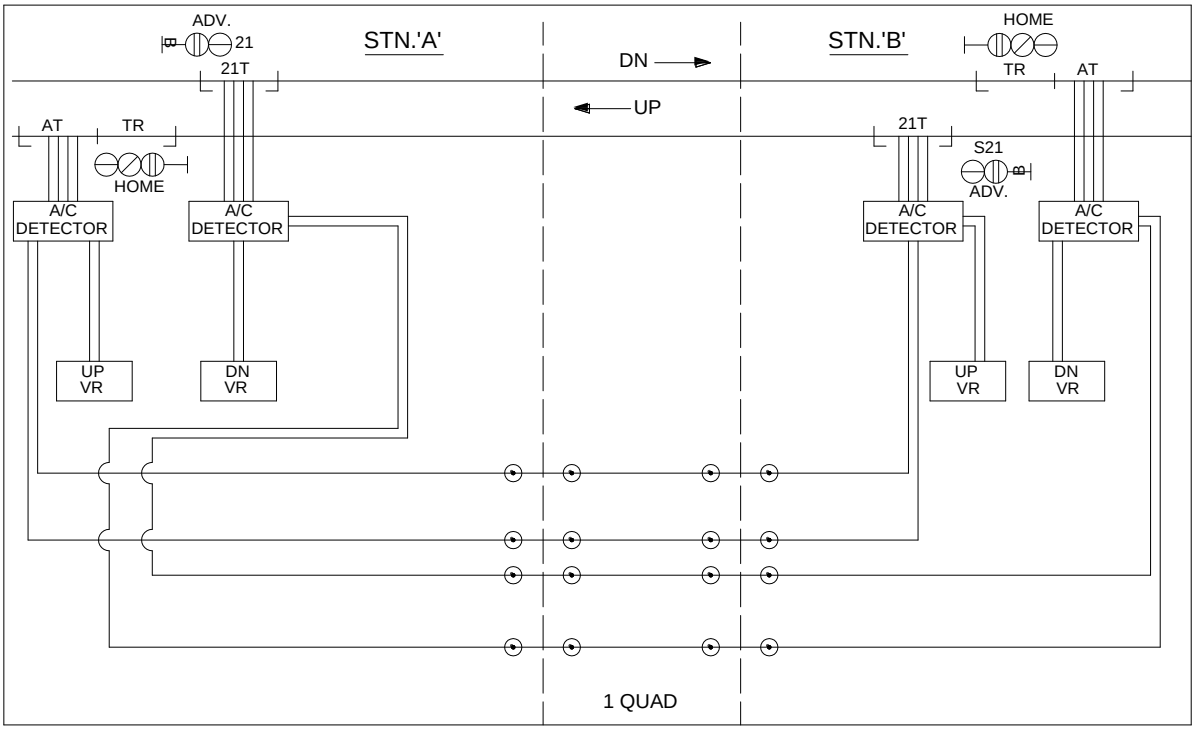

Fig No: 3.1

Indication Circuit:

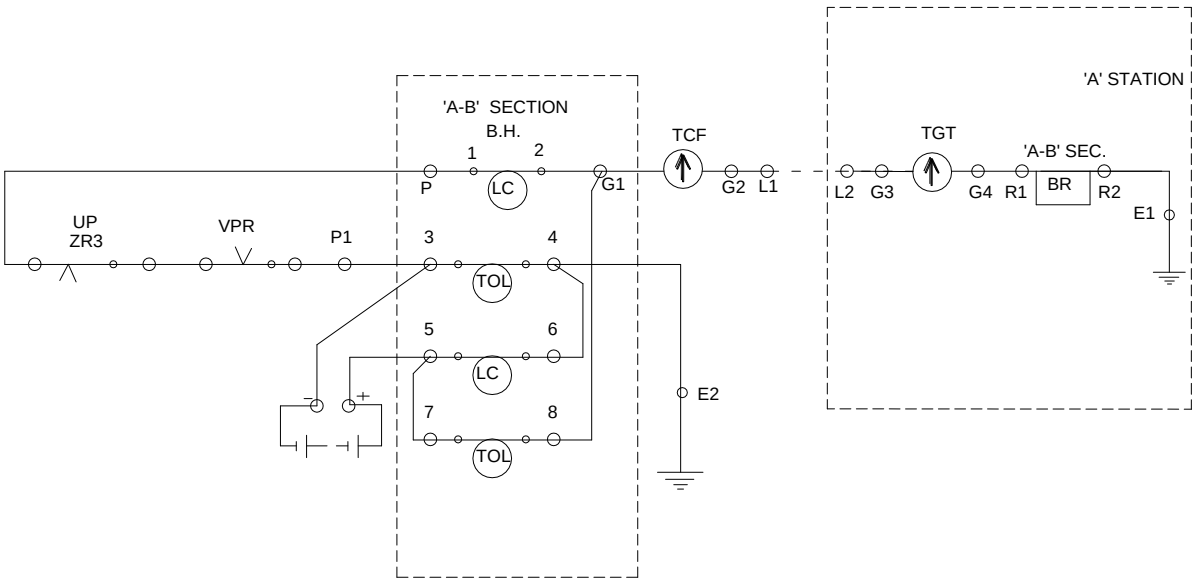

Fig No: 3.2

LSS CIRCUIT

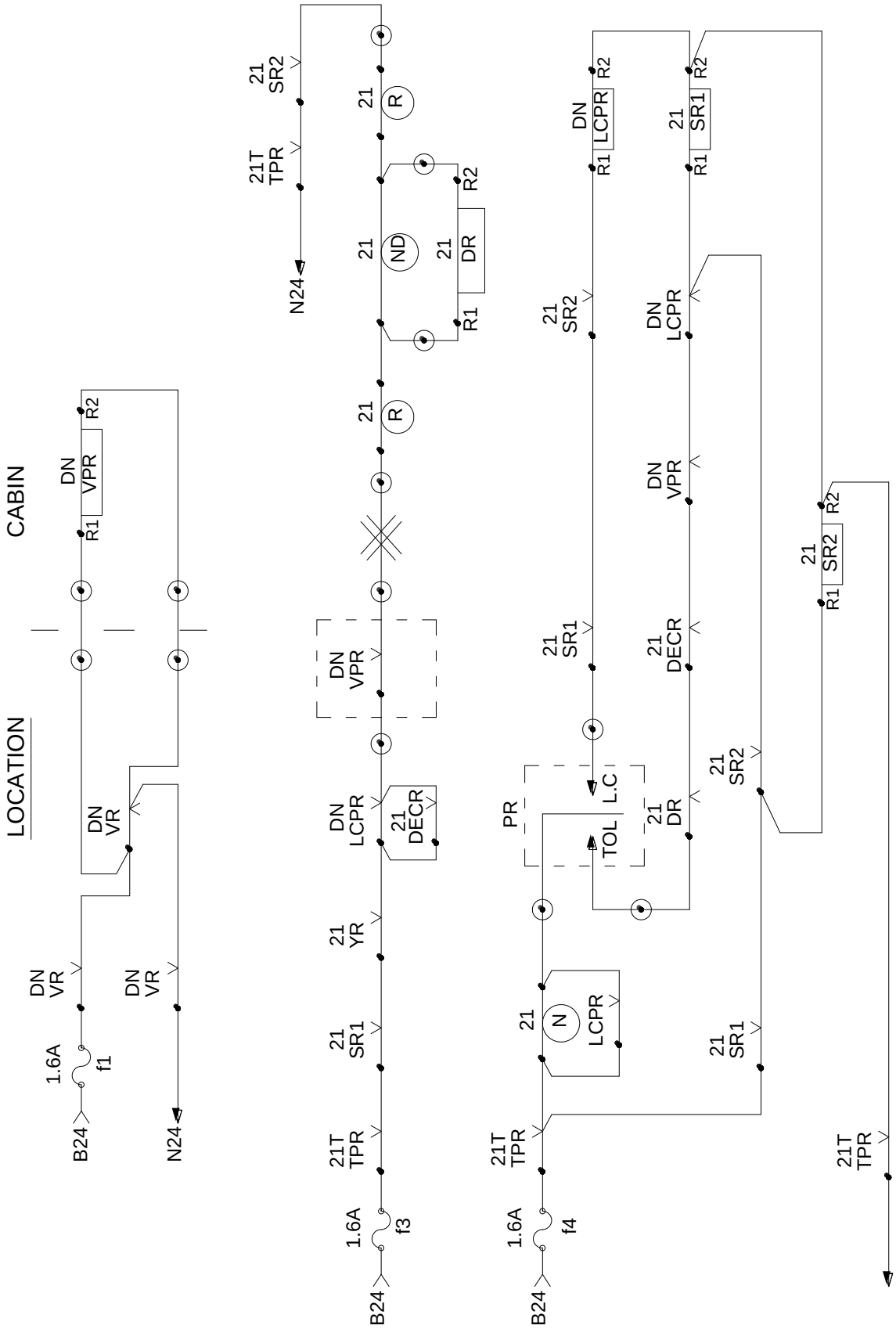

Fig No: 3.3

Block Clearance Circuit:

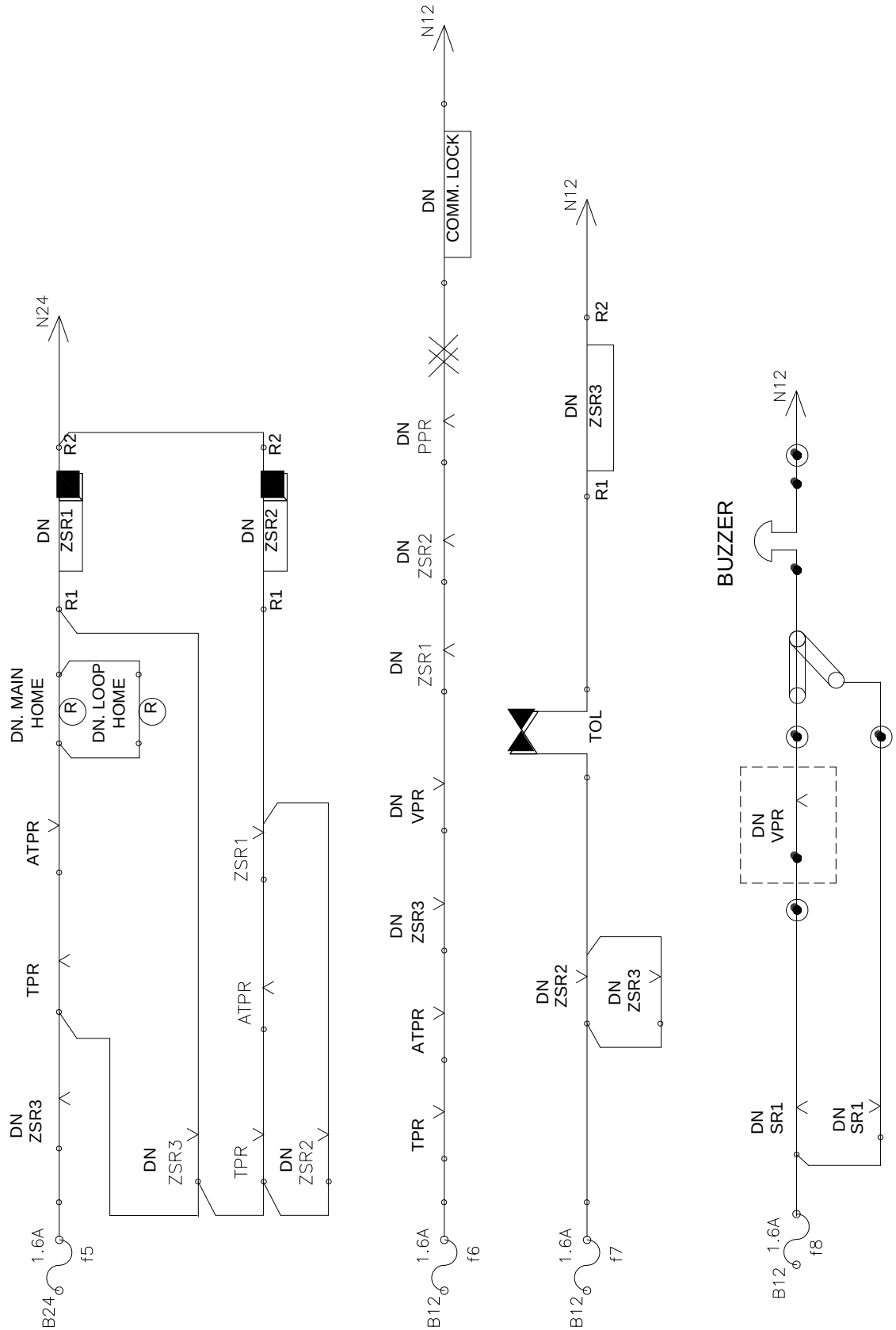

Fig No: 3.4

Reset Circuit:

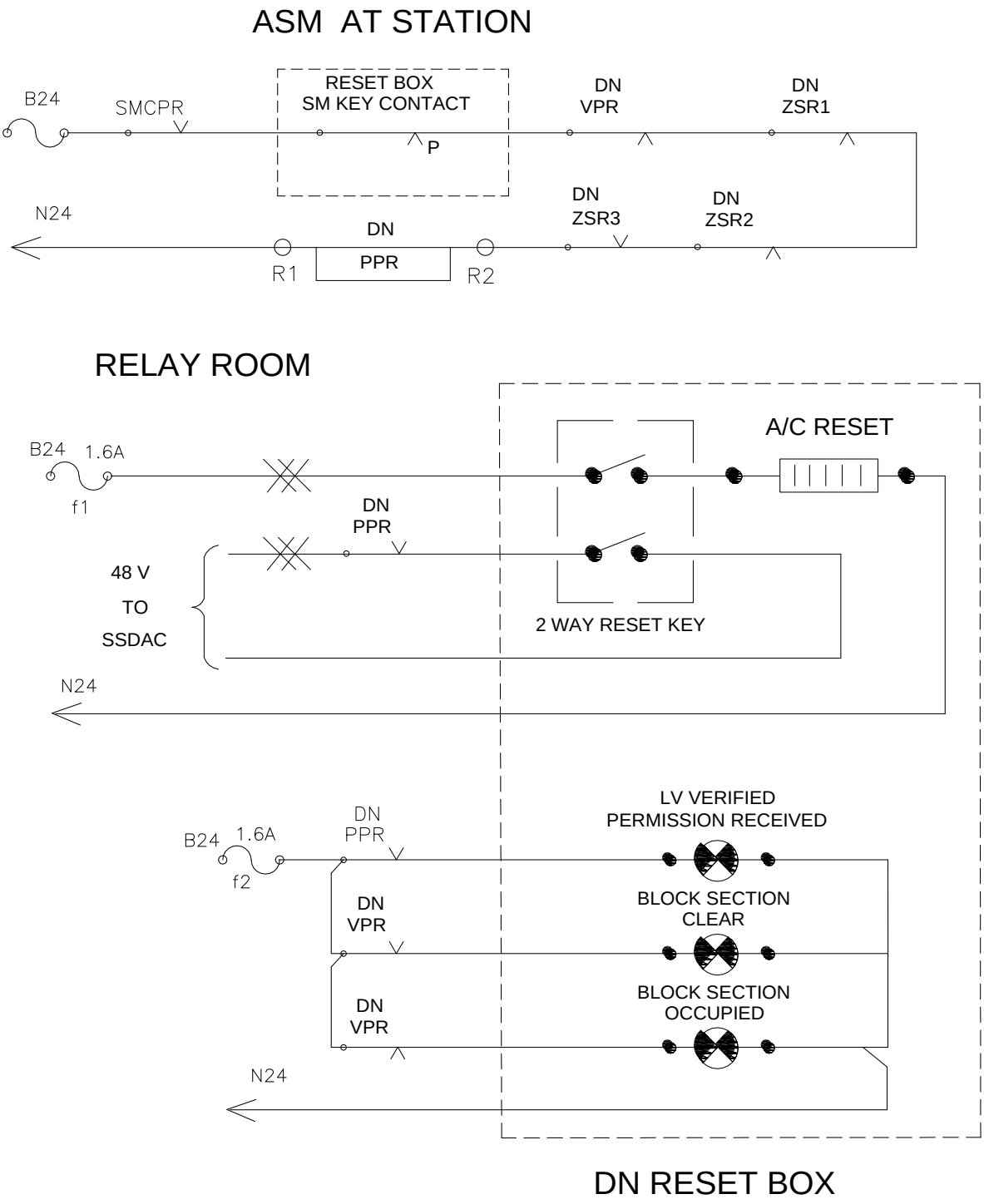

Fig No: 3.5

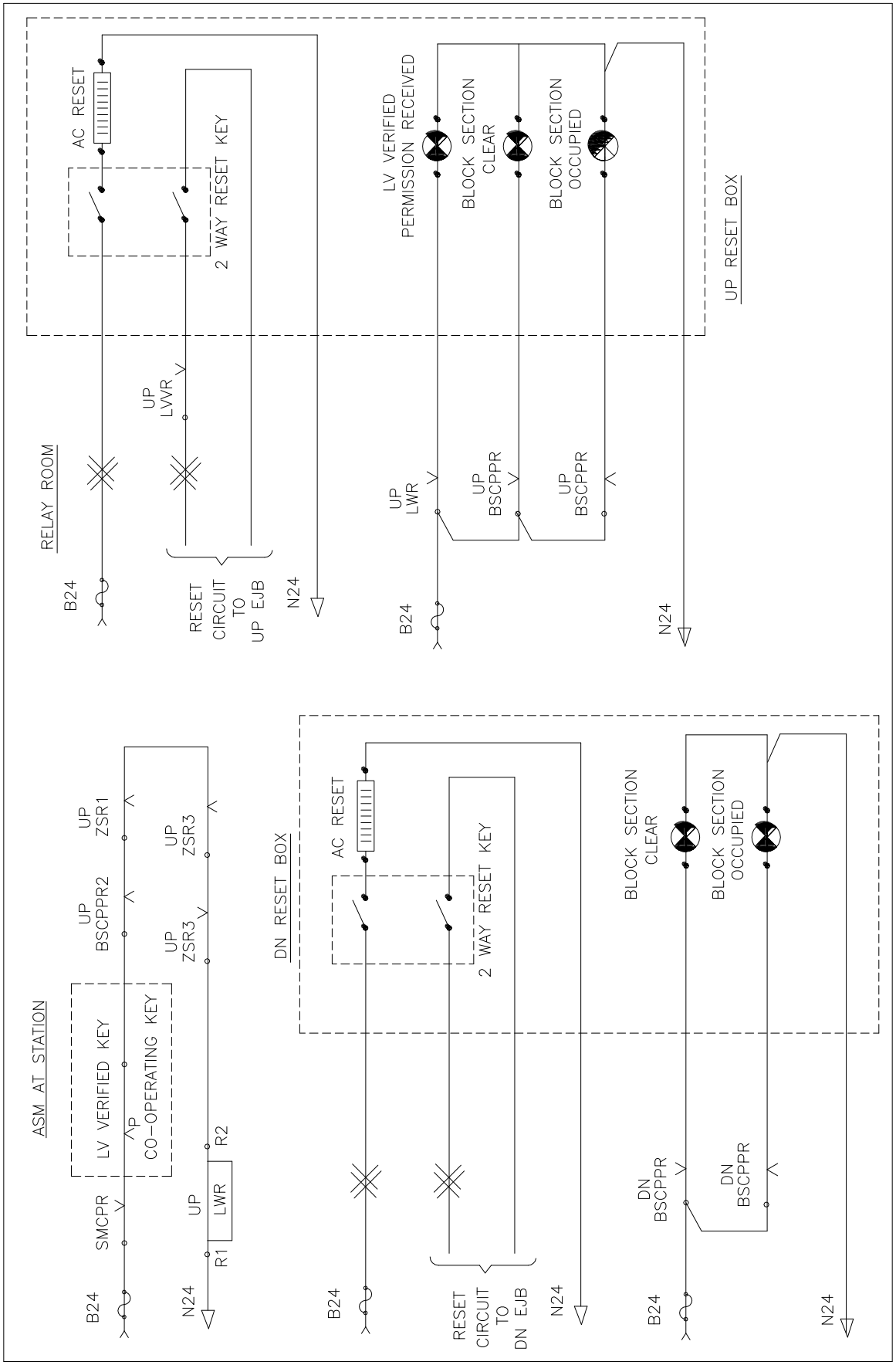
UP RESET BOX
AC RESET
2 WAY RESET KEY
LV VERIFIED PERMISSION RECEIVED
BLOCK SECTION CLEAR
BLOCK SECTION OCCUPIED
RELAY ROOM
UP LVVR
UP LWR
UP BSCPPR
UP BSCPPR
B24
N24
RESET CIRCUIT TO UP EJB
ASM AT STATION
LV VERIFIED KEY
CO-OPERATING KEY
SMCPR
UP BSCPPR2
UP ZSR1
UP ZSR3
UP ZSR3
UP LWR
R1
R2
DN RESET BOX
AC RESET
2 WAY RESET KEY
BLOCK SECTION CLEAR
BLOCK SECTION OCCUPIED
DN BSCPPR
DN BSCPPR
RESET CIRCUIT TO DN EJB

Fig No: 3.6

(ii) BPAC with F.M. Handle type Tokenless Block Instruments on Single line.

In this system, conventional F.M. Handle type Tokenless block instrument are used at the either station of the block section with SSDAC/UAC for block section on single line. The contacts of SSDAC/UAC Axle counter as VR/ACPR relay contacts are used in the PBPR circuit, TAR circuit & ASR circuit as shown below.

PBPR circuit:

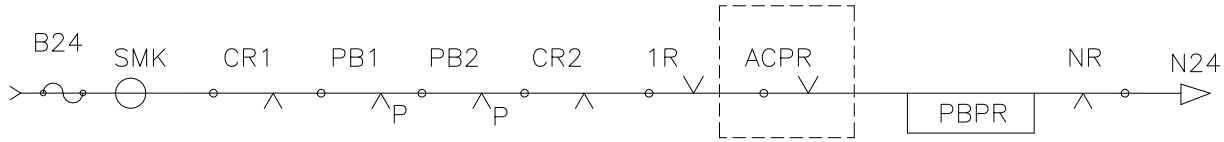

Fig No: 3.7

TAR circuit:

Fig No: 3.8

ASR circuit:

Fig No: 3.9

Axle counter indication circuit:

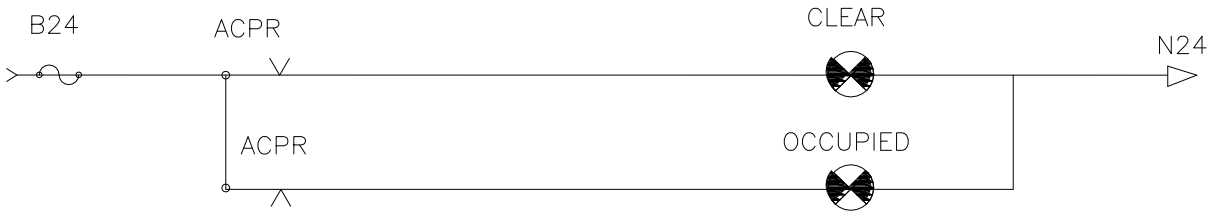

Fig No: 3.10

(iii) BPAC with Push Button Tokenless Block Instruments on Single line.

In this system conventional Push button Tokenless block instrument are used at the either station of the block section with SSDAC/UAC for block section on single line. The contacts of SSDAC/UAC Axle counter as VR/ACPR relay contacts are used in the SNR circuit, TAR circuit & ASCR circuit as shown below.

SNR Circuit:

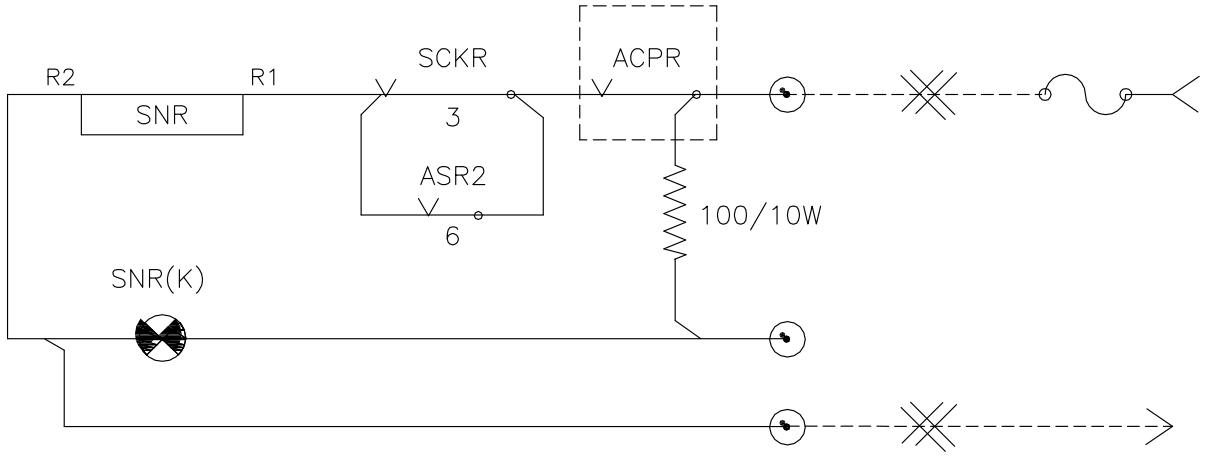

Fig No: 3.11

TAR Circuit:

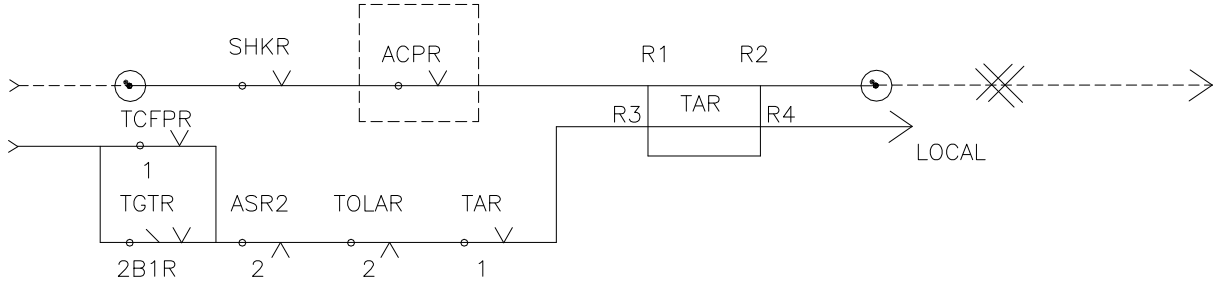

Fig No: 3.12

ASCR Circuit:

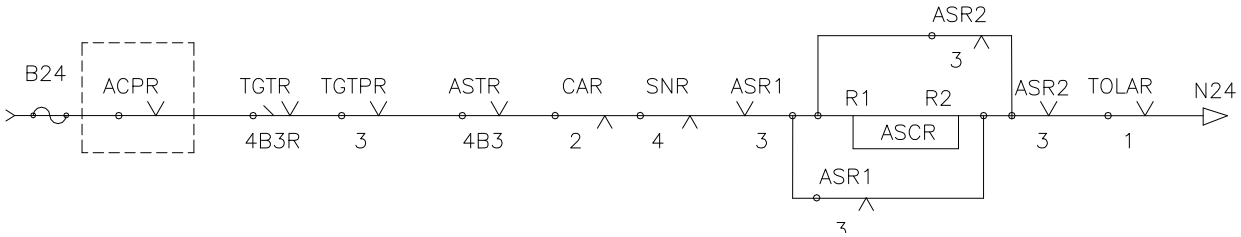

Fig No: 3.13

ANNEXURE - 1
AXLE COUNTER BLOCK WORKING WITH BLOCK PANEL AND UFSBI

A1.1 UNIVERSAL FAIL-SAFE BLOCK INTERFACE (UFSBI)

A1.1.1 System Description

The system requirement specification of the “Universal Fail-safe Block Interface(UFSBI)” equipment as per specification147/97.

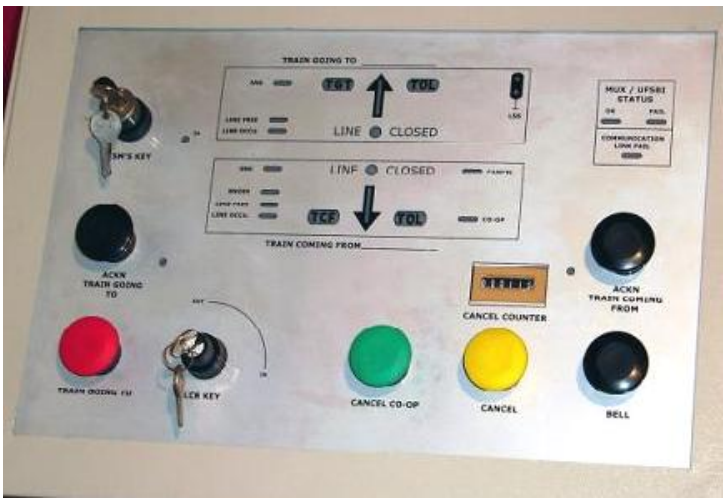

Fig No: A1.1

A1.1.2 General

(a) The UFSBI system acting as multiplexer for communicating the commands to one block panel to other in a fail safe manner to transfer block instrument signals (DC and analog FM signals converted to status) to the other end. The communication is full duplex. The medium of communication is digital channels of Optical fibre or copper cable.

(b) The Mux with its accessories, Interlocking relays and power supply are housed in a cubicle, called UFSBI-Cubicle.

A1.1.3 Technical Features

(a) The equipment is capable of driving safety signalling relays

(b) The equipment is capable of working on Telecom Cable as well as Voice/Data channel provided over Optical Fibre.

(c) The coding of signal transmission takes care of types of noise generally encountered in the transmission system and ensures safety of operation against these noises.

(d) Each equipment in the section has a unique address, which is settable through Back-panel jumpers “UFSBI Address Configuration Jumpers” given.

(e) The information exchanged between the pair of the interface equipment contains the source & destination address.

(f) Wrongly addressed information packets are promptly rejected by the system and frequent receipt of such packets is detected as link failure by the system.

(g) The bell of the Block Instrument work on voice channel i.e. block telephone.

(h) Alternatively, the bell may be worked through the Mux terminal. .

(i) The telephone is on a separate voice channel.

(j) The system works on 24V DC + 20% - 10%.

(k) A push button is provided for resetting UFSBI inside the cubicle on a reset box.

(l) The resetting system is provided with a veeder counter to count the number of reset action.

A1.2 Brief System Description & Working

The Block Panel work in Absolute Block system incorporating Block Proving by Axle Counter to control the movement of trains on double line block section from one block station to another in a fixed direction.

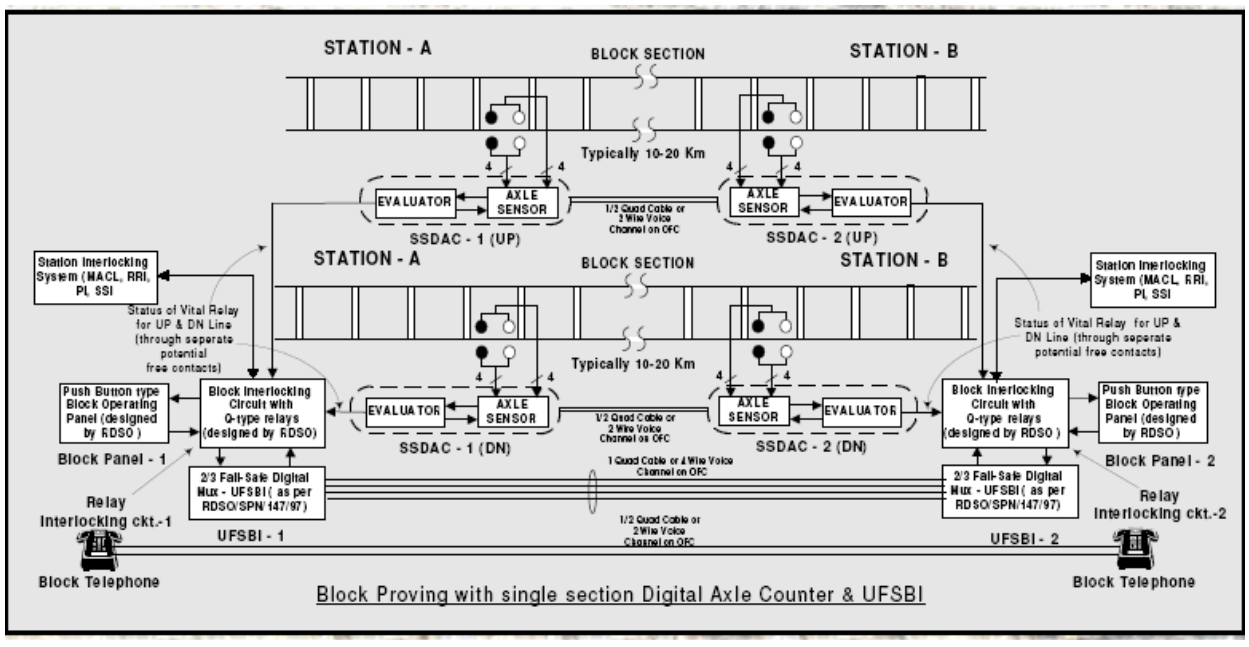

Fig No: A1.2

A1.3 Principle of working

(a) The trains are worked on Absolute Block system Each block section is provided with an Axle Counter to verify the occupation or clearance of block section and indicated on Block Panel

(b) It is not possible to clear Last Stop Signal to 'OFF' unless LINE CLEAR has been obtained from the station in advance, It is not possible to take LINE CLEAR unless block section and an adequate distance beyond first stop signal of station in advance is clear of trains

(c) The Last Stop Signal assumes 'ON' aspect automatically on entry of train into block section and when so replaced, is maintained in its 'ON' position, till a fresh LINE CLEAR is obtained on block panel Block section show automatically Train on Line on panel when train enters into the block section on line clear Train entry/exit buzzer, to/ from block section are provided and to be acknowledged Block section automatically closes on complete arrival of train at the receiving station

(d) A control to prevent the station in rear to take LINE CLEAR on its Block Panel without taking consent of receiving station. A control to cancel the LINE CLEAR, already taken by station in rear. It is possible to close the block section only, if no trains have entered the Block Section for at least 120 seconds after application of cancellation with co-operation from station in rear

A1.4 BLOCK PANEL

(a) Keys & Switches: The LCB key is L&T make (ESBEE brand) with catalog number HK85C3 for Key actuator & HC61A2 (1 NO) / HC61B2 (1 NC) for Elements. The SM's key is Siemens make.

(b) LED's used are of high intensity super bright water clear type of Agilent make and have 5 mm diameter with a viewing angle of 15^0.

(c) Electromagnetic Impulse Counter: Electro magnetic impulse counter is of 6 Digit, 10 impulses per second minimum, 24V DC non-resettable type, Keltron Make.

(d) Buzzers: Piezo make buzzers (Continuous and Intermittent) working at 24 Volts (+20% -10%) DC for audio alarm is provided to register the BELL CODE sent by other end SM & to register the occupation and clearance of each Block Section. The buzzer for receiving line is intermittent and for dispatch line it is continuous type. Provision to mute the audio alarm by pressing an Acknowledgement push button is provided. The Block buzzer works through block telephone line.

A1.5 Block Telephone

(a) This is provided for speech communication with SM at other end of Block section.

(b) Separate Block telephone is provided for separate block section.

(c) Block Panel has provision for hanging Block telephone as shown in Drawing. No. RDSO /S 32019 Sheet no 3 of 3.

A1.6 Quad Cable or Voice channel

(a) Provision for 2 quad or 3 voice channels (1 no. 4 wire & 2 nos. 2 wire) in OFC.

(b) As shown in drg. No. RDSO/S32019 sheet no 1/3 are to be provided by the Railways. Cables will be as per specification TC 30/97.

A1.7 The Block Proving with Axle Counter system comprising of Block Panel, Universal Fail Safe Block Interface and the relays

(a) Works on 24 V D.C. with a Maximum current consumption of 5A.Railways need to provide: Separate power supply for Block Panel, UFSBI & relays

(b) Separate power supply for Digital Axle Counter

(c) Separate power supply for Block Telephone

(d) Battery Charger / Module of IPS:

(e) The charger will be as per IRS S-86 / 2000 to cater 5 A/24 V DC load.

(f) The IPS module shall be as per RDSO SPN 165/ 2012 to cater 5 A/24 V DC load.

(g) Relay Rack & Signaling Relays:

(h) All the relays used as per the circuit diagram are of RDSO approved make.

(i) Relay rack is housed inside the same UFSBI cabinet. The Electronic Fail Safe timer (IRS: S 61/2000) is micro controller based. Relays are as per nomenclature of relays for double line with UFSBI as per drawing Number- RDSO/S-32018.

A1.8 Various relays in the relay rack

RELAY	RELAY TYPE	NORMAL DESCRIPTION	STATUS	FUNCTION
TGTR	QL1, 11F.4B	Train Going To Re-lay.	Drop	Operates to pick up on receipt of LINE CLEAR at Train sending station Normalizes, when station in advance sets to Line Closed after train arrival or OR cancellation of LINE Enquiry from train sending station.
TCFR	QL1, 11F.4B	Train Coming From Relay.	Drop	Operates to pick up on receipt of LINE CLEAR Normalizes after com-plete train arrival or Cancellation of LINE CLEAR.
ASCR	QN1, 8F.8B	Advance Starter Signal Control Re-lay	Drop	Picks up, when LINE CLEAR is available and Necessary controls are reversed by SM. Drops in any of the under-mentioned cases: a) Entry of train in Block Section. b) Withdrawal of any SM control.
TGTXR	QN1, 8F.8B	Train Going To code Relay	Drop	Station pressing of buttons Picks up at train sending for LINE CLEAR en-quiry. Drops when train sending sta-tion releases buttons for LINE CLEAR enquiry or Picking up of TGTR which ever is earlier.

RELAY	RELAY TYPE	NORMAL DESCRIPTION	STATUS	FUNCTION
TCFXR	QN1, 8F.8B	TRAIN COMING FROM code Re-ceive Relay	Drop	Picks up on receipt of LINE CLEAR enquiry from Train sending station Drops when station in rear releases buttons for LINECLEAR enquiry or TGTR pick up which ever is earlier
TGTYR	QN1, 8F.8B	Train Going To code Receive Re-lay	Drop	Picks up on receipt of LINE CLEAR at train sending Station Drops in any of the under-mentioned cases: a) Entry of train in Block Section. b) Cancellation of Line Clear.
120 JPR	QN1, 8F.8B	Timer mature re-peater Relay	Drop	Picks up on maturity of Timer for cancellation. Drops when block sta-tus set to Line Closed.
BPNR	QN1, 8F.8B	Bell Push button Relay.	Drop	Picks up on pressing of BELL push button with SM's Key IN, else drops.
TGTNR	QN1, 8F.8B	Train Going To but-ton Relay	Drop	Picks up on pressing of TRAIN GOING TO pushbutton else drops
CNR	QN1, 8F.8B	Cancel button Re-lay	Drop	Picks up on pressing of CANCEL push button else
FR1	QN1, 8F.8B	Flash controller Relay No. 1.	Drop	Toggles when Cancellation com-menced or any other abnormal condi-tion occur
FR2	QN1, 8F.8B	Flash controller Relay No. 2.	Drop	Toggles when Cancellation com-menced or any other abnormal condi-tion occur
TAR1	QNA1, 8F.8B	Train Arrival First Relay	Drop	Picks up when control on Reception Signal is Reverse and HS AT occu-pied by train and HS BT Clear. Drops when AT clear with a delay.
TAR2	QN1, 8F.8B	Train Arrival Se-cond Relay	Drop	Picks up when control on Reception Signal is Reverse and HS AT is clear and HS BT occupied by train. Drops when block status set to Line Closed
CAR	QN1, 8F.8B	Cancel relay	Drop	Picks up at Train receiving station on initiation of cancellation, provided all controls pertaining to Advance Starter and Reception Sig-nal/Signals and signals controlled by them are at Normal at both the sta-tions. Drops when cancellation ma-tures and system goes to Line Closed condition

RELAY	RELAY TYPE	NORMAL DESCRIPTION	STATUS	FUNCTION
BTSR	QN1, 8F.8B	Block Track Stick Relay	PICK UP	Picks up when Block status is LINE CLOSED and Block track is clear. Drops in any of the under-mentioned cases: a) Entry of train in Block Section. b) Cancellation of Line Clear.
AZTR	QNA1, 8F.8B	Block Section track Relay of dispatch line	PICK UP	Drops in the under mentioned cases: (a) Entry of train in block section, or (b) Axle Counter failure
TGTZR	QN1, 8F.8B	Advance starter signal normal checking repeater	PICK UP	Picks up to repeat Line Closed condition at train receiving station after arrival of train or after a Line Clear cancellation has been initiated, else drops
120 EJ Electronic		Timer unit for cancellation time of 120 seconds. Time delay	DROP	
HS ATPR	QNA1, 8F.8B	First track for direction proving repeater Relay	PICK UP	Picks up when HSAT track circuit is vacant else drops.
HS BTPR	QNA1, 8F.8B	Second track for direction proving repeater Relay	PICK UP	Picks up when HSBT track circuit is vacant else drops.
ASGNCR	QN1, 8F.8B	Advance Starter Signal Normal Checking Relay	PICK UP	Picks up when Advance Starter Signal and all its controls are at Normal, else drops.
HS GNCR	QN1, 8F.8B	Home Signal Normal Checking Relay	PICK UP	Picks up when Reception signal/signals and all its controls are at Normal, else drops
TCFCR	QN1, 8F.8B	Train Coming From Cancellation Relay	DROP	Picks up at receiving station when CANCEL CO OP Button is pressed at sending station else drops.
TCFZR	QN1, 8F.8B	Train Coming From Normal Proving Relay	DROP	Picks up at receiving station when TCFR drops, else drops
TGTPR	QN1, 8F.8B	Train Going To Normal Proving Relay	DROP	Picks up at train sending station when TGTR drops, else drops
SHKR	QN1, 8F.8B	Shunt Key Indicating Relay	PICK UP	Picks up when EKT is “IN” & Shunt Release Key is “OUT”, else drops

RELAY	RELAY TYPE	NORMAL DESCRIPTION	STATUS	FUNCTION
AS GNCPR	QN1, 8F.8B	Advance Starter Signal Normal checking repeating (for other station) Relay	PICK UP	Picks up when Advance Starter Signal and all its Controls are Normal at the other station, else drops.
BIPR1	QN1, 8F.8B	UFSBI health checks Relay	TOGGLE	
BIPR2	QN1, 8F.8B	UFSBI health checks Relay	TOGGLE	
BLR		Bell Relay	DROP	Picks Up When Other Station Presses the Bell Button

A1.9 Wiring of Relay Rack

(a) The relay rack is wired using 16 / 0.2 wire conforming to specification IRS: S- 76/ 89 (latest).

(b) Every wire is terminated properly. Termination of wires is done on non-disconnecting type terminals of Phoenix / Wago make with DIN rail mounting arrangements.

(c) Individual termination is marked with a unique number for easy identification.

(d) Wiring of relay rack is properly bunched.

A1.10 Internal Power Supply specifications

(a) DC-DC Converter is provided to derive the necessary voltages to operate the UFSBI from the external 24 V source. These internal power supplies are in hot Standby mode.

(b) The system operates with nominal 24 V DC input supply.

(c) DC-DC Converter derives

Input 24 V DC (+ 20% -10%)

(i) Output 24 V DC, 4 Amps

(ii) 5 V DC, 4 Amps

(iii) +12 V DC, 1.5 Amps

(iv) –12 V DC, 1 Amp

A1.11 Features of the power supply are

(a) Input-output isolation.

(b) Input over voltage and under voltage protection.

(c) Output short circuit and over load protection.

(d) 24 V DC output is isolated from other outputs.

(e) Ripple is less than 50 mV at rated value.

(f) Efficiency is more than 70%.

(g) Is capable to work in “HOT STAND-BY” mode.

A1.12 Modem Specifications

(a) Asynchronous 2400 bps, V.22 BIS, 4 wire,

(b) Leased line modem is used to interface

(c) UFSBI-MUX serial data to voice-channel provided by the Railway.

(d) Allowable Channel Loss: 25 dB (max.) between 2 modems

A1.13Hardware Architecture

The Block Proving with Axle Counter using UFSBI includes component.

Circuit for Surge Arrestor Module (SAM)

A1.14 UFSBI Address

(a) Configuration Jumpers

(b) The Address Configuration jumpers are set in the Connector side of the Mother-board. A pattern of this jumper setting is shown below:

(c) Left Center Right

(d) The TX Address of one unit should correspond with the RX Address of other unit. The Same type of settings should not be used in the adjacent pair of units.

(e) NOTE: 9 unique Address Configuration Jumpers are given in Annexure A of the manual.

A1.15 UFSBI installation guide

The following practices are to be observed in installing UFSBI at site:

(a) Battery.

(b) Battery Charger

(c) Earthing: Good earthing is to be provided

(d) Communication Channel:

(e) Allowable Channel Loss: 30 dB (max.) between 2 modems

(f) SNR: 20 dB (minimum)

(g) Transmit Power: -2 dBm (maximum at modem Tx pin)

(h) Receive Level: -32 dBm (minimum at modem Rx pin)

(i) The channel should be of good quality and must have steady performance

(j) for at least 72 hours before commissioning

NOTE: A list of commissioning pre-requisites in the form of a check sheet is provided in the manual

A1.16 Check during Installation

A1.16.1 Physical Examination: required for

(a) Connectors

(b) Relays and Relay-bases

(c) All the PCB modules

(d) Rack and the mainframe

(e) Card Guides

(f) Motherboard

(g) Interconnecting ribbon cables and wires

(h) Reset Box

(i) Modem

A1.16.2 Power Supply

(a) Battery Voltage should not exceed the range: 19.5 V to 28.8 V DC.

(b) Ensure that the above supply is not arbitrarily grounded.

(c) Before insertion of other modules, DC-DC converter is to be connected to the Battery Supply and its correct output levels should read as:

(i) 5 V [+/- 3%)

(ii) +12 V [+/- 2%]

(iii) –12 V [+/- 2%]

(iv) 24 V [+/- 5%]

A1.16.3 Starting the UFSBI

Installation of system is kept very simple; as such no elaborate procedure is required except those given as under:

(a) Plug in all the relays to the respective relay bases as per Relay disposition chart.

(b) Insert all the PCB's in the 6U Rack.

(c) Plug in all the connectors to their matched counter part as the length or wire groups corresponding to each counter part are optimally fixed.

(d) Probability of wrong connection is ruled out.

A1.16.4 WARNING

For removing and fitting PCB in the unit, please switch off the power Supply. Now switch 'ON' the power supply of the unit and check for:

(a) All the indications in DC-DC converter.

(b) Red indication in Reset Box and Buzzer sounds.

(c) Press the RESET switch and wait for 5 seconds.

(d) Press the BIPR ON switch. BIPR1 and BIPR2 relays will pick up.

(e) Buzzer stops and red indication in reset box changes to green.

(f) All CPU's will display **"00"** indicating UFSBI is normal.

(g) Now UFSBI starts functioning in loop.

Railways are to provide the following facilities for installation and commissioning of

(h) Block panel with UFSBI

(i) Battery & Battery Charger

(j) Terminal Block for field connections.

(k) Earthing: A good earthing for termination of the equipment

(l) A 4 wire full duplex OFC Voice Channel or Quad cable)

The block Operation through Block Proving with Axle Counter using UFSBI is to be kept under observation at least for three up and three down movements' of Trains. A close monitoring of the train movements through Block Proving With Axle Counter using UFSBI to be done at least for 48 Hrs after immediate installation and commissioning of the system.

A1.17 Maintenance

A1.17.1 Preventive Maintenance

Power supply: power supply unit of any type is the single Source responsible for most of the equipment faults and malfunctioning. A Regular check on power supply units such as battery banks, battery charger and DC-DC converters are mandatory.

Relays: UFSBI has used most reliable type of relays, but special care and testing is required for those to be used after long storage. No attempt is to be made to repair a relay.

A1.17.2 Maintenance of Communication Link

(a) Telecom cable is to be protected from injury during other kinds of installation if dis-connection of cable is required, the cable terminal is to be refitted firmly.

(b) The loss of signal due to lossy cable is to be kept under check.

(c) The display indication **"33"** indicates link failure. If the modem is found to be OK, next to be checked is the telecom cable.

(d) Maintenance of Equipment

(i) UFSBI unit will automatically trip-off if the Battery supply goes below 19.2 V & above 28.8 V DC. In case of repeated trip-off, both the DC supply level and the loading is to be checked. A healthy UFSBI should not draw more than 1.8 Amp DC.

(ii) No attempt of "resetting" is to be made in case of supply impairment or link fail-ure, If a faulty UFSBI system is not brought back to normal after "resetting" one must check:

– If there is any loosely fitted connector or improperly pressed PCB module.

– Connecting leads inserted in Terminal.

– The DC supply levels of the DC-DC converter.

(iii) For specific information on faults, refer "UFSBI Error Code List" of the manual.

(iv) Once a fault is found, the user should not attempt repairing at component level. The impaired module / PCB needs to be replaced by a spare one.

A1.18 Do's & Don'ts

(a) UFSBI system is to be operated or maintained only by trained persons. No attempt is to be made to operate the equipment at Battery Voltage ranging below 19.2 V and above 28.8 V DC.

(b) Connectors or PCBs is to be plugged in or out after switching off the Power Supply.

(c) "RESET" should not be applied in case of "Link Failure" or "Supply" Break Down.

(d) Replacement of components or modules is to be done with spares supplied/ prescribed by the manufacturer.

(e) While plugging in / out a PCB, care is to be taken to avoid application of Excessive force.

(f) Arbitrary grounding should not be done to any "common" terminal inside the equipment.

(g) Relay testing should not be performed involving forced 'pick-up' or 'drop' while the instrument is 'ON'.

(h) Standard restrictions against mishandling and opening of Block Instrument are applicable also to UFSBI.

A1.19 FAILURES

(a) Note the indication codes shown on the CPU and the LED on the Output cards and the Control & Communication card.

(b) It should also be recorded that under which condition the failure occurs, i.e. whether it occurs repeatedly during a certain operation or is it flitting in nature.

(c) Perform a Power-On-Reset following the steps given in the item 11.15 of Block Panel with UFSBI, Users Manual.

(d) In case the problem persists or recurs even after Power-On-Reset then follow the "Fault finding Procedure" as stated in Annexure C of the manual.

(e) During troubleshooting, whenever directed to check the effect of any change or replacement of card, please perform Power-On-Reset as stated in the item.

A1.19.1 REMEDIAL ACTIONS

(a) RESET BOX: consists of the following components. The functions of all the components are given below:

Counter keeps track of the number of Reset operations taking place. The Counter is non-resettable type i.e. the readings of this counter cannot be altered. RESET Button, sometimes the power-off and power-on sequence may not lead to Display **"0b"** (ready to press BI- ON button) on all CPUs. In that case Press the RESET button so that the CPUs again reset itself to show **"0b"** (ready to press BI-ON button) on all CPUs.

(b) BI-ON BUTTON: This button is required for starting the system. Whenever all the CPUs display **"0b"**, it indicates that it is ready for start. The user has to press this button for starting the system.

(c) BZ-ACK BUTTON: This button is required for acknowledging the buzzer whenever it sounds due to dropping of "Shut down relays" (BIPR1 & BIPR2).

(d) BI-OK IND.: This indication (green) glows when the Block Interface is in working condition. Normally on indication.

(e) BI-FAIL IND.: This indication (red) glows when the Block Interface is in failure mode. Normally off indication.

(f) LINK FAIL IND.: This indication (yellow) glows steadily when the modem fails to receive any data form remote station. In normal working condition, when the Modem receives data from remote station, this indication (yellow) will flicker continuously.

A1.19.2 The POWER-ON-RESET Operation

(a) The following steps are to be performed for carrying out the RESET operation of the UFSBI. Turn off the system power. Wait for 1 minute. Power-on the system. Check the display of the CPU. Wait till the display on all the CPUs display **"0b"**, if **"0b"** is not displayed, try by pressing the RESET button. If the problem persists, check corresponding codes in the error code list and take appropriate action as suggested in the remedial action column. If all the CPUs display **"0b"** then press the BI-ON button. Observe that both BIPR1 and BIPR2 pick up immediately after BI-ON is pressed. Once BIPR1 and BIPR2 pick up, BI fail (Red) indication goes off and BI OK (Green) indication comes on, the Link fail (Yellow) steady indication goes off & starts flickering as soon as the Modem starts communicating with remote station modem and all the CPU's display **"00"**.

A1.19.3 The RESET Operation

The following steps are to be performed for carrying out the RESET operation of the UFSBI:

(a) Press the Reset Button and see that the display in all 3 CPU's becomes **"0b"**

(a) Wait till the display on all the CPUs display **"0b"**, if **"0b"** is not displayed, try by pressing the RESET button. If the problem persists check corresponding codes in the error code list and take appropriate action as suggested in the remedial action column.

(b) If all the CPUs display **"0b"** then press the BI-ON button. Observe that both BIPR1 and BIPR2 pick up immediately after BI-ON is pressed.

(c) Once BIPR1 and BIPR2 pick up, BI fail (Red) indication goes off and BI OK (Green) indication comes on. Link fail (Yellow) steady indication goes off & starts flickering as soon as the modem starts communicating with remote station modem and all the CPU's display **"00"**.

A1.20 General Maintenance

(a) Power Supply should be periodically checked and ensured that the output voltage is well within the specified limit

(b) Battery should be periodically maintained.

(c) The BPAC system must have a separate Earthing, which should be maintained at regular interval and the Earth resistance must be kept below 2 ohms.

(d) The communication link dB loss and SNR should be periodically checked. In case of copper conductor cable, insulation resistance and loop resistance must also be periodically measured.

(e) In case any one of the CPU is showing an error code and the system is working in 2/3 mode, the fault must be attended immediately as directed in the error code list as preventive maintenance action.

(f) A Single CPU and Power supply failure detection/ alarm is provided.

(g) If a faulty UFSBI system is not restored after "resetting", we need to check the following:

(i) If there is any loosely fitted connector or improperly pressed PCB module.

(ii) Connecting leads inserted in Terminal.

(iii) The DC supply levels of the DC-DC converter output.

Environment: Spacious, Clean, Dry, well ventilated room preferably with a fan/exhaust fan.

Battery: 24 V DC / 120 AH

Battery Charger:

Good Quality low ripple battery charger (Axle Counter type) as per IRS: S-86/2000 or IPS module as per RDSO/SPN/165/2004 Nominal Voltage – 24 V/10 A (-10% to +20%)

Separate Power Supply provided for each of BPAC, SSDAC & Block Telephone as stated in RDSO/SPN/188/2004.

Earthing: Good lightning protection system with proper connection with earth provided.

A1.21 Communication Channel (on OFC or Microwave Radio)

(a) 4 wire Voice Channel on OFC (2400 bps, asynchronous)
S/N ratio: At least 20 dB

(b) Max. Tx Signal: -2 dBm to -5 dBm

(c) Min. Rx. Level: -32 dBm to -35dBm

(d) BER: Better than 10^{-5}

A1.21.1 Communication Cable

(a) Jelly filled Quad Cable as per specification: IRS: TC 30-05

(b) The cable insulation (must be better than10 MΩ /Km when tested with 500 V Megger)

(c) Loop resistance (should be less than 55 Ω/Km)

(d) Signal loss (should be less than 30 dB at 2.5 KHz)

(e) The armour of the cable must be properly earthed
Chanel Loss: 30 dB (max) line sections

(i) The Block Panel provided, offers audio-visual indications for all vital information.

(ii) The interlocking circuits and input/output through Q-series relays provide galvanic isolation, making the system suitable in both RE & Non- RE sections.

(iii) The system is media independent i.e. it works on Copper cable, OFC or microwave without hampering the fail-safety of the operation.

* * *

REVIEW QUESTIONS
CHAPTER-1

Objective questions:

1) IBS exists on (b)
   a) Single line b) Double line
   c) Multiple line d) None of the above.

2) In IBS section, the maximum number of trains possible on a running line is (b)
   a) One b) Two c) Three d) Four

3) In IBS the Block overlap shall be (b)
   a) 180 metres b) 400 metres c) 120 metres d) 25 metres

4) In IBS the LSS Signal is controlled by (b)
   a) Block instrument b) Axle counter
   c) IB signal d) None of the above

5) In IBS, the IB signal is controlled by the (a)
   a) Rear station Block instrument b) Advance station FSS
   c) Rear station LSS d) None of the above

6) In IBS the axle counter evaluator is at (a)
   a) At sending end b) At receiving end
   c) At both ends d) None of the above

7) In IBS the Telephone is connected to (a)
   a) Rear station b) Advance station
   c) Both station d) None of the above

8) In IBS when train passes IB signal at 'ON' (a)
   a) K1 indication appears b) K2 indication appears
   c) K3 indication appears d) K4 indication appears

9) In IBS when IB signal bulb fails (d)
   a) K1 indication appears at rear station b) K2 indication appears at rear station
   c) K3 indication appears at rear station d) K4 indication appears at rear station

10) The push buttons involved during axle counter failure resetting in IBS are (c)
   a) PB1, PB2 & PB3 b) PB1 & PB2
   c) PB2 & PB3 d) None of the above

Subjective questions:

1) Write features of Intermediate Block Signalling
2) Draw IBS Layout & explain in brief.
3) Write the sequence of operation for regular train movement in IBS
4) Write the resetting procedure for
   i) IBS signal failure resetting
   ii) Axle counter failure resetting
5) Draw the circuit for ACZR & HSR & explain in brief.

CHAPTER-2

Objective questions:

1) ACBW means (b)
   a) axle counter not working b) axle counter Block working
   c) block instrument not working d) all of the above.

2) Function of ACBW is also to (a)
   a) verify the complete arrival of train by the system
   b) verify the working of the block instrument.
   c) verify the complete arrival of train by station master.
   d) None of the above.

3) ACBW increases (b)
   a) the operating time
   b) the section capacity
   c) travel time of the train in the Block section
   d) all of the above

4) ACBW works (c)
   a) with Mux.
   b) Without Mux.
   c) Any of the above
   d) None of the above

5) ACBW with Mux requires Quad cable of diameter (c)
   a) 0.4 mm b) 0.6 mm c) 0.9 mm d) 1 mm.

6) ACBW with Mux requires (b)
   a) 1 Quad cable b) 1.5 Quad cable c) 2 Quad cable d) 2.5 Quad cable

7) In ACBW, resetting requires (b)
   a) No Co-operation b) Co-operation c) Both a & b d) None

8) ACBW is (b)
   a) Co-operative type system b) Non Co-operative type system
   c) any of the above d) None of the above

9) ACBW can work on (c)
   a) Telecom Copper cable b) Optic fibre cable
   c) any of the above d) None of the above

10) In ACBW the axle counter used shall be UAC or SSDAC (d)
   a) Only SSDAC
   b) Only UAC
   c) None of the above
   d) All of the above.

Subjective questions:

1) Draw the layout of ACBW & explain in brief
2) Write the various keys, buttons & indication of ACBW panel.
3) Write the normal train working in ACBW.
4) Write the resetting procedure in ACBW.
5) Explain in brief the working of 4W/2W Card in ACBW

CHAPTER-3

Objective questions:

1) BPAC means (c)
   a) Block proving analog counter b) Back Lock proving and counter
   c) Block Proving axle counter d) none of the above

2) BPAC system is (b)
   a) with only block instrument b) with block instrument and axle counter
   c) none of the above d) with only axle counter

3) Function of BPAC is to (a)
   a) Verify the complete arrival of train b) verify the arrival of train
   c) Verify train into block section d) none of the above

4) BPAC can be used (c)
   a) Double line BI b) Single line BI
   c) Both a & b d) None of the above

5) Working of BI in BPAC is (a)
   a) Same as earlier without BPAC b) Totally different
   c) BI not used d) None of the above

Subjective questions:

1) Write Features of BPAC
2) Write different types of BPAC
3) Draw the layout of BPAC on Double line
4) In BPAC on Double line which are the circuits to be modified
5) Write the circuits to be modified for BPAC in FM Handle type tokenless BI
6) Write the circuits to be modified for BPAC in Push Button tokenless type BI