

SIGNALLING & COMMUNICATION DEPARTMENT

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BASIC SIGNALLING

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INTRODUCTION TO SIGNALLING

The essential purposes of a railway signalling system are:

- To maintain a safe distance between following trains on the same track.
- To safeguard the movement of trains at junctions and when crossing a path which could be taken by another.
- To regulate the passage of trains according to the service density and speed required.



TYPES OF SIGNALLING SYSTEM

1.Station Signalling

Control of train movements in the station limits

2.Block Signalling

Control of train movement in the block section



STATION SIGNALLING

Control of train movements within station limits which is located between outermost stop signal to outermost stop signal in the opposite direction

The train control method is in accordance with the provision of the signals. The provision of the given signals according to several stations types.



TYPES OF STATION SIGNALLING

Non Interlocked Station

- Partially Interlocked Station
 - High Point Indicator Station
 - Partially Interlocked Special Electrical
- Fully Interlocked Station
 - Fully Interlocked Mechanical
 - Fully Interlocked Electrical

Relay Route Interlocking (RRI)

Processer Based Interlocking (PBI)



NON INTERLOCKED STATION



- There is Outer Signal only and controlled through single lever which is located at facing points
- > Points and signals are operated by individually and separately
- Point in main line and loop line installed with List & Morse Key and operated using Tumbler
- There is no Home Signal
- Admission Indicator is provided in front of the station to communicate between Potter and Station Master
- The speed of trains through facing point:
 - 55 km/h entering main line
 - 25 km/h entering loop line



PARTIALLY INTERLOCKED STATION (SPECIAL ELECTRICAL)



- There is outer signal from colour light type which is known as offset signal. Its controlled by electrically from control panel station by Station Manager
- Points are controlled by electrically using point motor which is installed at point and operated by Station Manager using rotate switch located at panel station manager
- There is track circuit installed at the points only
- The speed through the facing point is 55 km/h and if the station is Through Switching, the speed of the trains is the maximum speed allowed for a train.



FULLY INTERLOCKED ELECTRICAL (RRI)



- Two types of system RRI Single Track & RRI Double Track
- The lever and Signal is the type of push button located at special panel within the station that can display the position of signal aspect and points.
- Provision of Signal :
 - Distance Signal
 - Inner Home Signal
 - Outer Home Signal
 - Starter Signal
 - Advanced Starter Signal



BRAKING DISTANCE



MINIMUM DISTANCE SIGHTING

HOME SIGNAL/ INNER HOME SIGNAL	300m
SHUNT LIMIT BOARD/	
STARTER SIGNAL/	
ADVANCED STARTER SIGNAL	100m
OUTER SIGNAL/OUTER HOME SIGNAL	300m
DISTANCE SIGNAL/ DISTANCE BOARD	300m
AUTOMATIC BLOCK SIGNAL	300m

BRAKING FULL DISTANCE (160 km/h)

DESCENDING SLOPE	(1 in 200 - 1 in 100)	1450m
DESCENDING SLOPE	(1 in 200 - Flat)	1325m
FLAT LEVEL		1200m
ASCENDING SLOPE	(Flat - 1 in 200)	1150m
ASCENDING SLOPE	(1 in 200 - 1 in 100)	1450m



COMPARISON BETWEEN NON INTERLOCKED, PARTIALLY INTERLOCKED & FULLY INTERLOCKED

Non Interlocked

- Signal aspect conflicts may occur
- North & south signal can be clear at both sides at the same time
- There are many delay during shunting the trains

Partially Interlocked (Special Electrical)

- The signal can still be clear even though there is a train on the incoming track at the station
- No indication to Station Manager which is can show the track have trains or obstruction

Still categorized as less secure

Fully Interlocked (RRI)

- Easy to operate (panel)
- The signal cannot be released on the route of the trains
- Status of the track whether clear or occupied can be confirmed through panel indication



BLOCK SIGNALLING

The Absolute Block System

Permits only One train to be in a Block Section at any one time, except

- Accidents and Emergencies
- Special Instructions

Block Section

➤The portion of line between two Blocks Stations on to which no train may enter without the authority to proceed under the system working.

Block Station

A station on single lines, or on Track Circuit Block double lines when a station panel is open at which the Driver must obtain authority to proceed.



BLOCK SECTION

Token Areas

- Begin at station block advanced starter signal or shunt limit board or home signal or outermost facing point
- Ending at next station advanced starter signal or shunt limit board or home signal station or outermost facing point in opposite direction

Tokenless Areas

- Begin at station block RAB starter signal whether the station is local or switched through
- Ending at next station RAB starter signal in opposite direction if station is local / RAB starter in incoming direction trains is switched through



BLOCK SECTION (CONT'D)

Track Circuit Block

- Begin at one multiple aspect signal
- Ending at next multiple aspect signal in the similar direction and track
- When the station is operated automatically work, block section begin last exit signal until next stop signal multiple aspect



AUTHORITY TO PROCEED

- Token Areas Sections of railway on the Single Line Where the authority to proceed is a token handed to the Driver
- Tokenless Areas Sections of railway on the Single Line where the authority to proceed is not by a token handed by to the Driver but by the clearance of Starting Signal to Green
- Track Circuit Block (TCB) Areas double line section of the railway where authority to proceed is by clearance of a multiple aspect signal



TYPES OF BLOCK SIGNALLING

Token

Key Token
Paper Line Clear Ticket
Train COTA & Ticket COTA
Paper Authority

Tokenless

Relay Auto Block (RAB)
Track Circuit Block (TCB)
Axle Counter



Token Equipment



Tokenless Equipment (RAB)



INTERLOCKING SYSTEMS

Interlocking Components

Train Detection

Point Machine

➢Signal





INTERLOCKING SYSTEMS

Working System





TRAIN DETECTION

Purposes:

- To detect the absence of the trains
- To detect the present incoming or outgoing of the train at the selected track
- To indicate the presence a train when failures occur



TYPES OF TRAIN DETECTION

DC Track Circuit

- DC Ganz
- AC Immune DC
- AC Track Circuit
 - AF UM 71
 - AF TI21
- Axle Counters









DC TRACK CIRCUIT (AC IMMUNE DC)

- Track circuits, usually DC type, has feed end and relay end components
- specially strengthened to avoid traction interference and damage (AC Immune)
- DC fed into rails via variable feed resistor, which limits amount of current which can be drawn from power supply and energises Track Relay
- Occupation by train provides low resistance shunt path through it's wheel set and voltage at relay reduced, relay de-energises



DC TRACK CIRCUIT (AC IMMUNE DC)



GKTM

DC TRACK CIRCUIT (AC IMMUNE DC) Ac Traction / Ac Immunity

- DC track circuits used in single rail mode, sharing common rail with traction return current
- 50Hz extraneous voltage appear across either feed or relay end
- To achieve AC Immunity
 - Place highly inductive choke in series with Track Feed Set
 - DC Relay mechanism inherently AC immune by use of copper slug placed between coil and armature
- Two types of AC immune relay 9 ohm and 20 ohm
- > 20 ohm used where greater distances required than 9 ohm



DC TRACK CIRCUIT (AC Immune DC)

Track Circuit Voltages

- Minimum of 0.5V and maximum of 6V is present across relay coil
- Minimum of 1.2V is present across outgoing links of feed set
- Residual voltage must not exceed 0.3V for 939 105 relay



- Generally terminated at each end by an electrical joint to a transmitter or receiver via a matching unit
- An insulating joint may also be used in place of the electrical joint at each end or at both ends of the track circuit
- The length of track included in the electrical joint is terminated at each end by a tuning unit
- A track air-core inductor connected to the midpoint of the electrical joint optimises performance and balances the return traction current between the two rails
- Use different frequencies to avoid crosstalk between adjacent sections of track



The continuity of the traction current return circuit is provided by:

- the mid-point of the track air-core inductor (up to a permanent load of 200 A) in the case of electrification
- a matched inductive connection in the case of DC electrification
- our types of track circuit are thus used:
 - 1700 Hz track circuits and 2300 Hz track circuits on one track
 - 2000 Hz track circuits and 2600 Hz track circuits on the parallel track.









Components

Transmitter

Matching unit

Tuning unit











Components

Track Relay



Air Core Inductor (ACI) 600



Air Core Inductor (ACI) 400





- They are used in lieu of track circuits for train detection in block sections
- Used for multiple track sections to count the axles, establish the track occupancy and provide the information to the interlocking equipment
- They are immune to Traction Return Current (both AC and DC type) and its harmonics
- Signalling bonding is not needed as the system is electrically isolated from the rails
- Not reliant on track conditions (ballast, rusty rail) or wheel conditions



Basic Arrangement





Components

- Detection Point (Zp30H) consist of two sub- unit
 - Electronic unit (E-E30H)
 - Rail Contact (Sk30H Tx/Rx Coils)
- Electronic Junction Box (EAK30H) which houses the Electronic Unit (E-E)
- > Axle Counter Evaluator (ACE) consist of
 - Power Supply (DC/DC Converters)
 - CPU
 - Serial I/O
 - Parallel I/O
- ISDN/V.24 Converter



AXLE COUNTER Components





Electronic Junction Box (EAK)



Electronic Unit



ISDN /V.24 Converter



Power

DC 110v from LSC - EAK30H and ISDN /V.24 Converter at LSC

DC 50V from SER - ISDN/V.24 Converter at the SER

DC 24V from SER - The ACE unit at the SER



POINT MACHINES

- Point Machines or can be also known as a point motor, switch machine or switch motor that can be defined as a device for operating of unlocking operating and locking a switch. They are widely used in signaling system for the following reasons:
 - They provide locking of the points in set position.
 - The locking is controlled by the signal system, and train occupancy.
 - They can provide detection that the points are in the correct position.
 - They provide the physical force to throw the points, only when directed by the signal system.



TYPES OF POINT MACHINES

- Mechanical Point Machine
 - Facing Point
 - Economical Facing Point
 - Facing Point Lock with Trap Point
- Electrical Point Machine
 - AC Point Machine (380 V)
 - DC Point Machine(110 V)







POINT MACHINES MOVEMENT





POINT MACHINES MOVEMENT



Switch position changed when the Points motor works and move the rod points

POINT MACHINE



Signals

Signals are used for controlling the movement of trains

Types of Signal

- Fixed Signals : consist of semaphore, colour light and position light signals. They control the movement of trains, prevent conflicting movements and when necessary, give an indication of route.
- Hand Signals : are used when the signal communicated between the staff who are performing shunting or do the trains. The method of using Hand Signals with the help of flags , lamps or hand only.
- Obstruction Signals: are used when emergency, possession, signals failures or anything that can be dangerous to the trains. For an examples rail breakage, signals defect etc.



SIGNAL CHART





TYPES OF SIGNAL







Electrical Signals





A Station panel from which an authorised person sets routes, operates points or signals for train movements



GKTM UBANG JAYA 11

Panel Station (RRI)

Video Display Unit (VDU) (PBI)























Signaling & Communication System - KTMB





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THANK YOU

