



Interlocking System in Indian Railways

Why in News?

An investigation is underway to determine the cause of a [devastating train crash in Odisha's Balasore district](#). The incident has raised concerns about the electronic track management system used by the railways.

- The Indian Railway Minister has highlighted **a change in the electronic interlocking as the primary factor leading to the accident.**

What is an Interlocking System in Indian Railways?

▪ About:

- **Interlocking System** refers to a crucial safety mechanism used to control train movements and ensure safe operations at railway stations and junctions.
 - It is a **complex network of signals, points (switches), and track circuits** that work together to prevent conflicting movements and collisions.
- **Electronic Interlocking (EI): It employs computer-based systems** and electronic equipment to control **signals, points, and level-crossing gates.**
 - Unlike conventional relay interlocking systems, **EI utilises software and electronic components to manage the interlocking logic.**
 - **EI ensures the synchronisation of all elements** to facilitate uninterrupted train movement.
- As of 2022, **2,888 stations in India were equipped with an electronic interlocking system** — comprising **45.5% of the Indian Railways network.**

Indian Railways Network

- The Indian Railways is the **world's fourth-largest railway network**, carrying an average of eight billion passengers annually.
- The network spans over **68,000 km and encompasses more than 7,000 stations**, with a running track of 1,02,831 km.
- As of March 31, 2022, the total track length, **including sidings, yards, and crossings, stands at 1,28,305 km.**

▪ Components of Electronic Interlocking:

- **Signal:** Signals use **light indicators to direct trains** to stop (red), proceed (green), or exercise caution (yellow) based on the track's status ahead.
- **Point:** Points are **movable sections of tracks** that enable trains to change lines by guiding the wheels towards a straight or diverging path.
 - Electric point machines lock and unlock point switches in the desired position.
- **Track Circuit:** Electrical circuits installed on tracks **detect the presence of a train between two points**, determining the safety of train movement.
- **Additional Components:** Electronic systems, communication devices, and other equipment control signalling components and are housed in relay rooms with dual-lock access control.

- A data logger records all system activities, serving as a record similar to an aircraft's black box.

▪ **Functionality of the System:**

- **Command Reception and Route Setting:** The electronic interlocking system receives **commands from operators or automated control systems** following which information is collected from the yard and processed to set a safe route for trains to follow.
- **Alignment and Interlocking:** Once the route is determined, the **system aligns the necessary track switches (points) and interlocks signalling devices** at appropriate positions to establish the desired route.
- **Signal for Train Proceeding:** Trains are given **signals to proceed based on the track's direction and the absence of obstructions on diverging tracks.**
 - This ensures that trains can safely and smoothly navigate through the network.
- **Collision Prevention:** The system utilises track circuits to detect the presence of trains.
 - By monitoring these circuits, the **system prevents multiple trains from running on the same block or conflicting paths**, thus minimising the risk of collisions.
- **Point Locking:** Points (switches) remain locked in position until certain conditions are met, **such as the train crossing a specific section of the track or the signal to proceed being withdrawn.**
 - This ensures that the points are correctly aligned and secure for train movements.
- **Failure Indication:** In the event of a failure or malfunction, the system alerts operators or maintenance personnel.
 - One common method is the use of a **red light signal**, indicating that the system has detected an issue and the route ahead is not clear or safe.
 - This prompts appropriate actions to be taken to resolve the problem and ensure safe operation.

[Source: TH](#)

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