TrainSHIELD™

Collision Avoidance System for Trains (CAST)

Empowering safety in rail transportation

TrainSHIELD (TM) is a Collision Avoidance System for Trains (CAST) designed to restrict train speeds and prevent signal passing at danger (SPAD) to avoid train collisions. In normal operation, CAST works on the principle of providing to the train a maximum distance that it can travel, the speed profile of the track ahead and other track information about the route that has been set. The train then permits the driver to drive the train, but should the distance or speed limit be exceeded, or be in danger of being exceeded, then the CAST onboard equipment intervenes to control the train, bringing it to stand still, if necessary. CAST mainly comprises of equipment fitted on-board locomotive (LOCO UNIT) along with Braking Interface Unit, Driver Machine Interface and Station UNIT fitted at railway stations, IBS, IBH and level crossing UNITS. It also comprises of RF Tags or Balises mounted on the tracks and redundant Data Radio network for communication among various TCAS Units.

When a route has been set, locked and detected in the interlocking and is safe to use, the CAST trackside equipment provides a Movement Authority (MA) to the CAST onboard equipment of a train that is able to enter that route. This MA consists of the maximum distance that the train has permission to travel, the line speed and track gradients within this distance. The CAST onboard equipment combines this information with any onboard speed limits (for example, train speed) and then calculates a speed profile that the driver is not permitted to exceed.

The speed profile is calculated down to zero speed at the end of its MA taking into account the train's braking characteristics. This information is provided to the driver through the DMI. At all times, the driver is responsible for the movement of the train. CAST provides a supervision function. Should the driver attempt to exceed the distance or speed for which permission to move has been granted, CAST warns the driver and then intervenes to either slow down the train or bring it to a stop.

Information is transmitted to the train through a combination of tag groups and via the data radio network. Using the radio network, the train is also able to transmit information to the trackside equipment, such as position reports and onboard status.

Collision prevention

- Prevention of Signal Passing at Danger (SPAD)
- Speed Limit imposition based on preset conditions.
- Detection and Prevention of Head-on Collisions
- Detection and Prevention of Rear-end Collisions
- Detection and Prevention of Side Collision
- Detection and Prevention of Collision due to fouling.
- Manual SOS functionality to bring all trains in the vicinity to a stop, in emergencies.

Technical Features

- Vital Computer system based on dual redundant processors; SIL 4 compliant as per CENELEC standards
- CAST is suitable for all types of rail road signals. e.g. Stations equipped with relay interlocking, electronic interlocking, Multi-aspect color light signaling, mechanical signaling, and automatic signaling.
- CAST uses RFID technology / Balises to determine location and direction information.
- CAST is suitable for all types of rail road section such as Suburban, Multi Line, Intermediate block signaling sections; turnouts of all types having different speed potentials.
- CAST has a braking Interface Unit (BUI) that is suitable for Air/vacuum Brake/Dual/Electro-pneumatic systems of diesel and electric locomotives as well as other self propelled vehicles treated as trains.
- CAST units are cable of working in electrified as well as non-electrified territories. They are suitable for use on AC/DC EMUs/DMUs/MEMUs single or multiheaded electric/diesel locomotives/banking locomotives.
- CAST offers multilevel braking for smoother train speed regulation operations i.e. Normal, Full service braking (FSB) and emergency braking.
- Built-in data logger to record important operational and health status events.
- Real time health status monitoring via GSM/GSMR of the Loco CAST and station CAST units with information fed directly into the CAST-MIS server
- Bluetooth Wireless connectivity for downloading of recorded events for analysis.

Specifications

- ARM7 - 32bit Micro-Processor, 16/32 MB RAM
- Operating frequency 441.8 TX -446.8 RX MHz, UHF Band, tunable
- Tx Power - 10 Watts (max), programmable
- Communication Range 12 to 15 km., line of sight
- Digital Inputs up to 72, Optically isolated, expandable
- Digital Outputs 48, Solid State Relays
- Operating Voltage: 110V DC / 72V DC / 24V DC
- Average Power Consumption: 100W(max) of Loco and Station Units, 50W for other Units
- Ingress Protection Class : IP54
- Operating Temperature Range : – 10°C to +70°C
- Relative Humidity: 95% @ 40°C (w/o Condensation)
- Mechanical Shock : 40G in packed conditions and 3G in unpacked operating condition
- Vibration: 5 – 150 Hz @3g
- Comply with General Standards: IEC 571 IEC 1000 – 4 and ISO 9001:2000

Design specifications

- CAST has an open architecture design for future expansion and technology advancements. It is scalable and upgradable.
- Modular architecture for both Hardware and Software
- SIL 4 Compliant

Central Monitoring System (Optional)

- CAST-MIS is a web based online diagnostic and performance monitoring tool for effective monitoring and efficient maintenance of CAST.

Comprehensive Project Support Services

• Technical feasibility study	• Manufacturing and supply with accessories
• Time and cost estimation	• Installation & Commissioning
• Positional survey	• Configuration & Customization during incubation
• Radio communication survey	• Training of Personnel
• Point survey at stations	• Warranty Maintenance
• Route Design and assessment	• Post warranty annual maintenance(optional)
• Pilot project execution	

KERNEX
Delivering Railway Safety

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