



Innovation and Safety



COMPLETE SIGNALLING SYSTEMS & SOLUTIONS

SIGNALLING | EMBEDDED SYSTEMS | SOFTWARE | SYSTEM ASSURANCE

www.tsts.in

Conceptualize... Design... Deliver...

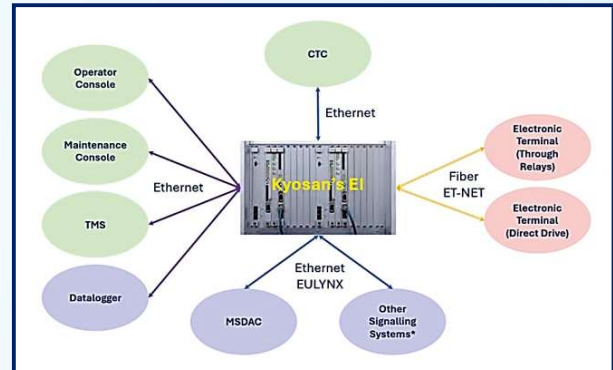
TVM Signalling and Transportation Systems Pvt. Ltd. (TSTS) is a Bengaluru, India based System Integrator for Rail Transportation and Smart City Projects, in its 18th year of operations, with 600+ strong professionals, having a total revenue of about Rs. 3,500+ Crores since inception, with 3,500+ person years of services provided to clients worldwide.

TSTS is a group company of 100+ year old Japanese major Kyosan Electric Manufacturing Co. Ltd.(Kyosan). TSTS is headquartered in Bengaluru, with 150+ site offices in India, and 1 branch office in Bangladesh and 1 Registered office in Australia.



ELECTRONIC INTERLOCKING

Kyosan's K5D is a SIL4 Vital Interlocking System to perform Fail-Safe interlocking logic and process control / Indication functions. It uses diversity and self checking architecture which is known as "Reactive Fail-Safe principle" in CENELEC terminology.

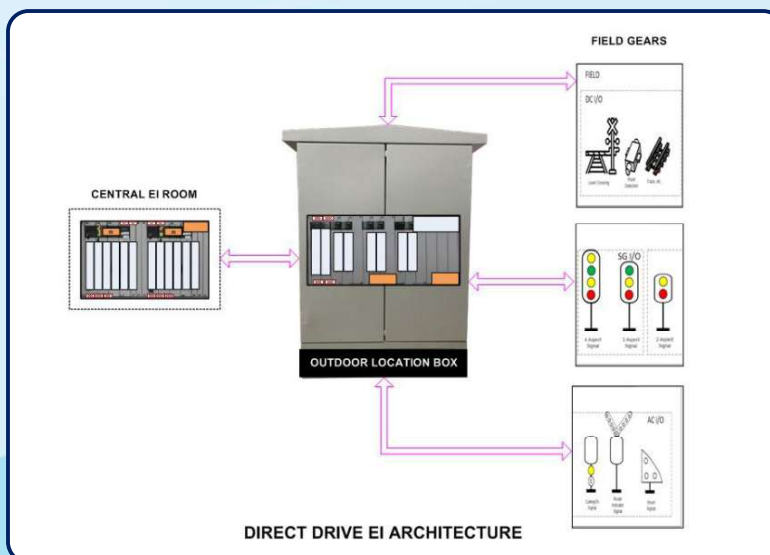


FEATURES

- Suitable for small, medium and big yards without external communication equipments.
- Suitable for Distributed architecture with Optical fiber connectivity and hence, effective for auto sections and IBH.
- No earthing is required for K5D Electronic Interlocking system.
- User friendly maintenance terminal (online hardware diagnostics, online relay and circuit status display, local and remote facility).
- Phase and modification works are simplified as the application software is loaded only in CPU and not required to be loaded in I/O gatherers.

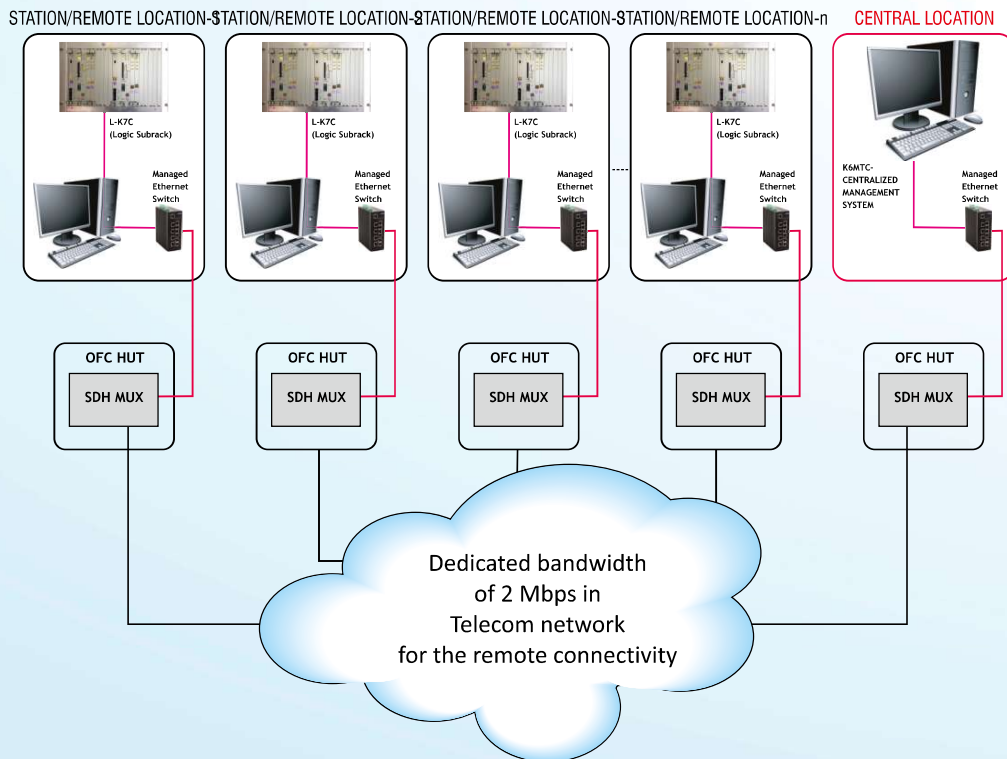
DIRECT DRIVE CAPABILITY

Kyosan make "K5D" EI system has been developed with the feature of relay less direct driving method to control signalling gears. This system is also having the facility to control signalling in conventional way as well. Upgraded K5D EI system enhances the capacity of the architecture and possibility of reducing usage of Relays and copper cables by controlling the gears directly without any intermediate relays.



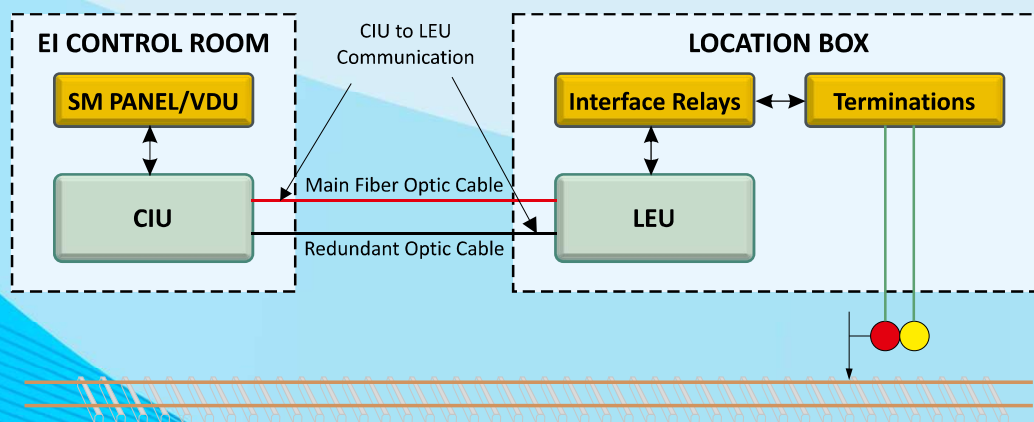
MTC NETWORKING FOR ELECTRONIC INTERLOCKING

Kyosan's MTC Network for K5D Electronic Interlocking system facilitates to display the Maintenance console of individual stations from the remote location i.e., central control room/divisional head office. This technology was implemented in 6 stations along with K5BMC namely, Pilol, Samlaya, Champaner road, Bikrol, Kharsaliya and Geratpur monitored from Central control room located at Vadodara division of Western Railway. Further, it has also been implemented in many Indian Railway Zones. The same technology can be applied for K5D as well.



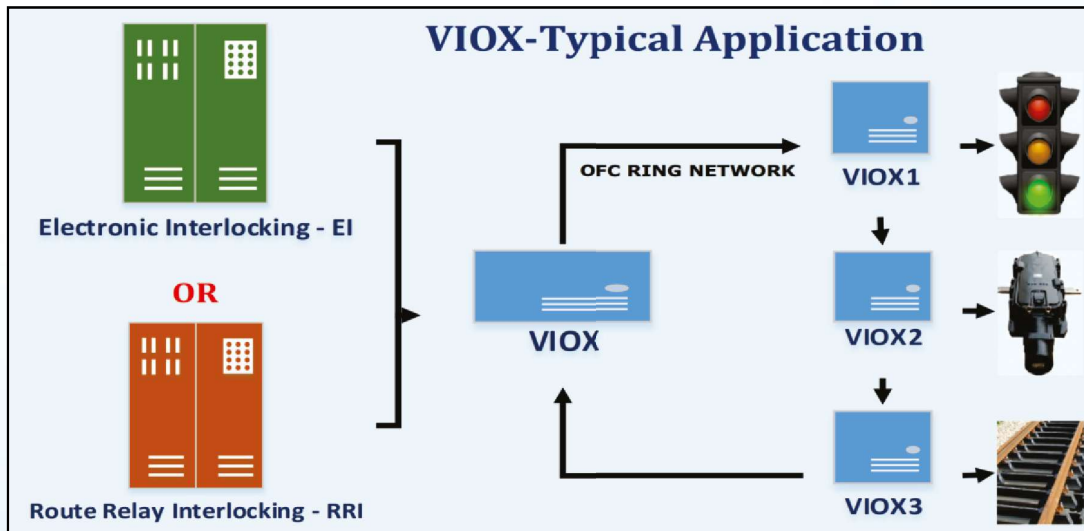
OUTDOOR MODERNISATION USING EI OBJECT CONTROLLERS

Kyosan based fiber linked signalling system reduces the need of copper cables and controls the outdoor signalling gears using Optical fibers laid between EI control rooms and location cases. The system is designed for fast and flexible installation with cost effectiveness.



VITAL I/O EXTENDER - VIOX

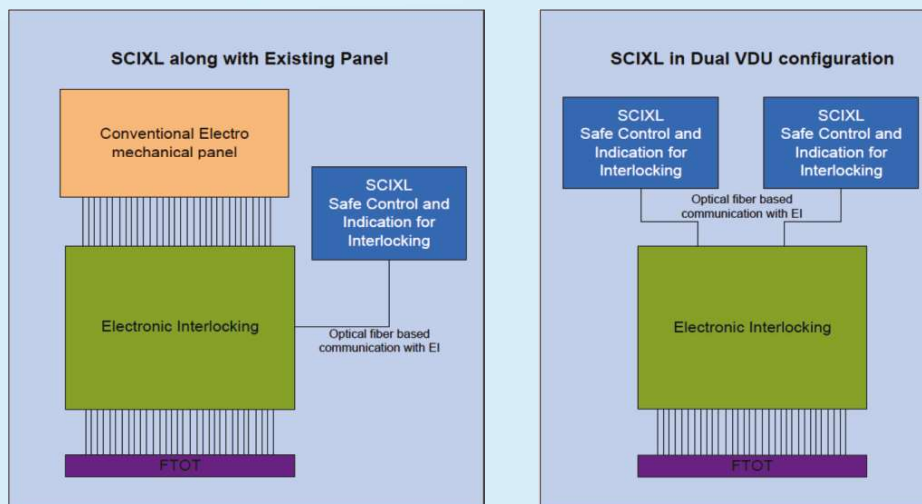
With the advent of industrial electronics and communication technology, it becomes possible to extend the vital inputs/outputs of EI/PI/RR1 from central relay room to location box through 'OFC ring network topology' without compromising safety. TSTS' VIOX is being designed according to RDSO FNMUX specification to suit SIL4 vital control applications.



SAFE CONTROL & INDICATION FOR INTERLOCKING - SCIXL

TSTS' SCIXL "Safe Control and Indication for Interlocking" is a SIL2 VDU (Visual Display Unit) software which acts as an interface between Station master and EI System. It displays the complete yard layout along with live indications of signal, point, track and other signalling information to the station master. It also displays various controls like pushbuttons, knobs and menus. Using this controls, the station master can instruct the EI to control the station yard.

It can be used along with existing panel as a redundant control cum indication panel. It can also replace the panel if installed in Dual VDU configuration. In dual VDU configuration two SCIXL will be connected to EI. Out of the two systems only one system will be online and through that system the station master can give commands to EI. SCIXL is connected to EI through Optical fiber.

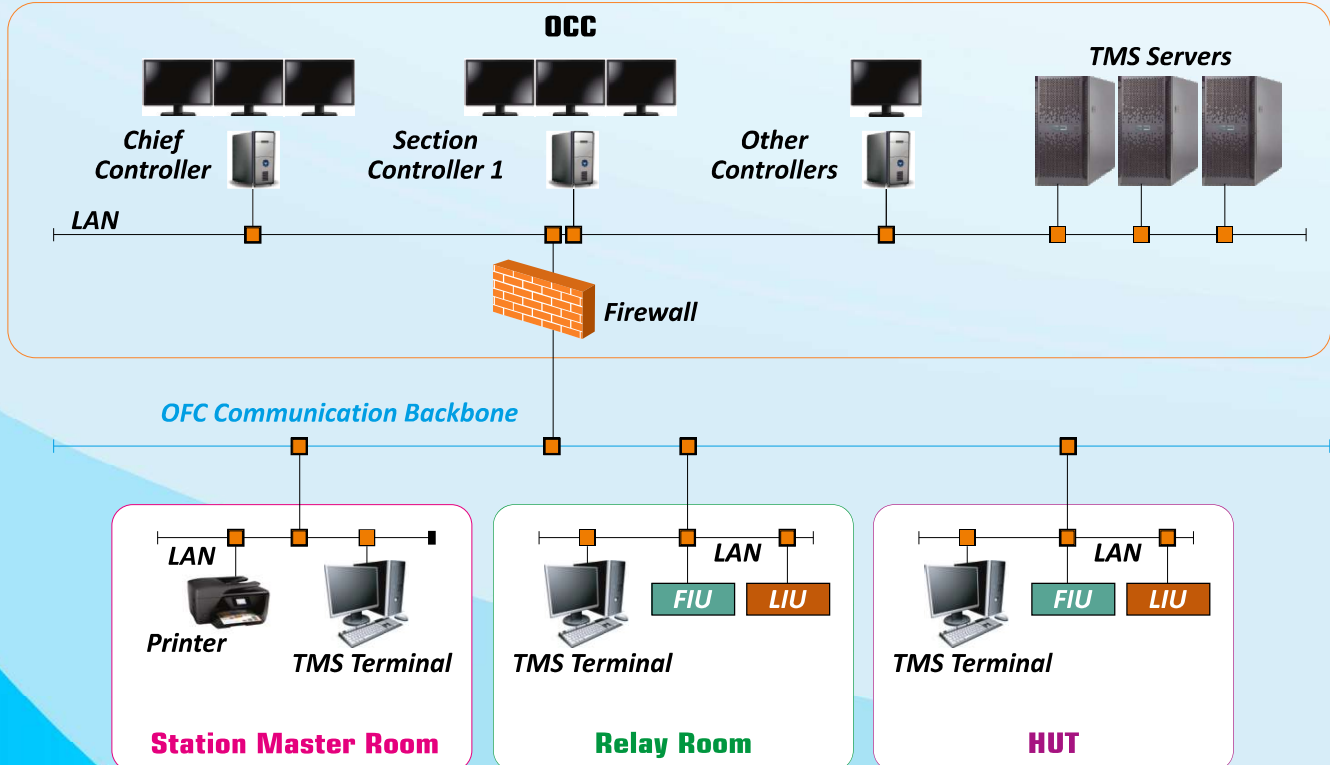


TRAIN MANAGEMENT / MONITORING SYSTEM - TMS

Kyosan's TMS – Train Management System is a management information system for monitoring train operations and assist in decision making for effective utilization of Railway infrastructure. The following are the subsystems of TMS installed at various locations.

1. Servers and Control terminals at Operation Control Center (OCC)
2. Field and EI interface equipment's at station relay room
3. TMS terminal at SM room

From the TMS terminal at OCC, the controllers can see the live indications of the yards from the centralized location. Controllers can view multiple stations under their operating area. The main feature of TMS, Timetable Management facilitates the user with various timetable types viz. Basic Timetable, Planned Timetable, Operation Timetable to manage the train operations efficiently. Various reports and graphs required for assisting decision making are generated live and stored for future reference.



MAJOR FUNCTIONALITIES OF TMS

Reports and Graphs

- ✓ Punctuality reports
- ✓ Bad runner report
- ✓ Train Composition report
- ✓ Punctuality analysis report
- ✓ Maintenance Block report
- ✓ Various reports as requested by Railways
- ✓ Train Graph

Live Indication

- ✓ Train ID
- ✓ Track Status
- ✓ Point Status
- ✓ Signal Aspects
- ✓ Crank Handle
- ✓ Route Set

Train Tracking

- ✓ Train ID assignment
 - Automatic
 - Manual
- ✓ Modify Train ID
- ✓ Delete Train ID
- ✓ Shift Train ID
 - Automatic
 - Manual

Timetable

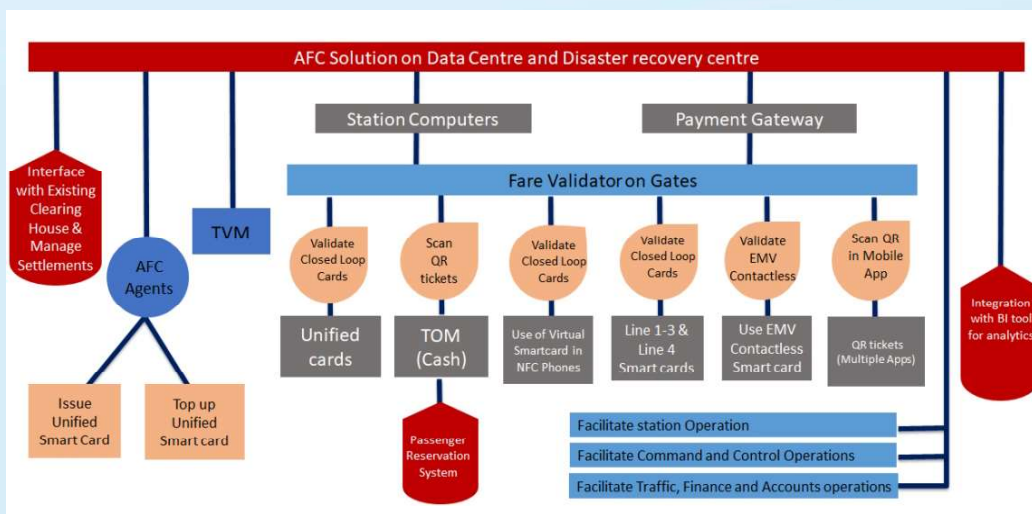
- ✓ Basic Timetable
- ✓ Planned Timetable
- ✓ Operational Timetable
- ✓ Actual Timetable

Others

- ✓ Messaging
- ✓ Alarms
- ✓ User Management

AUTOMATED FARE COLLECTION (AFC)

TSTS can offer and perform end-to-end System Integration services that include, supply of Access Gates and COTS products, Design, Installation, Testing and Commissioning, and Maintenance. TSTS has got into collaboration of OEMs for Access Gates, procuring kitsets from OEMs with the external casing fabricated, and getting the end product assembled locally by TSTS.

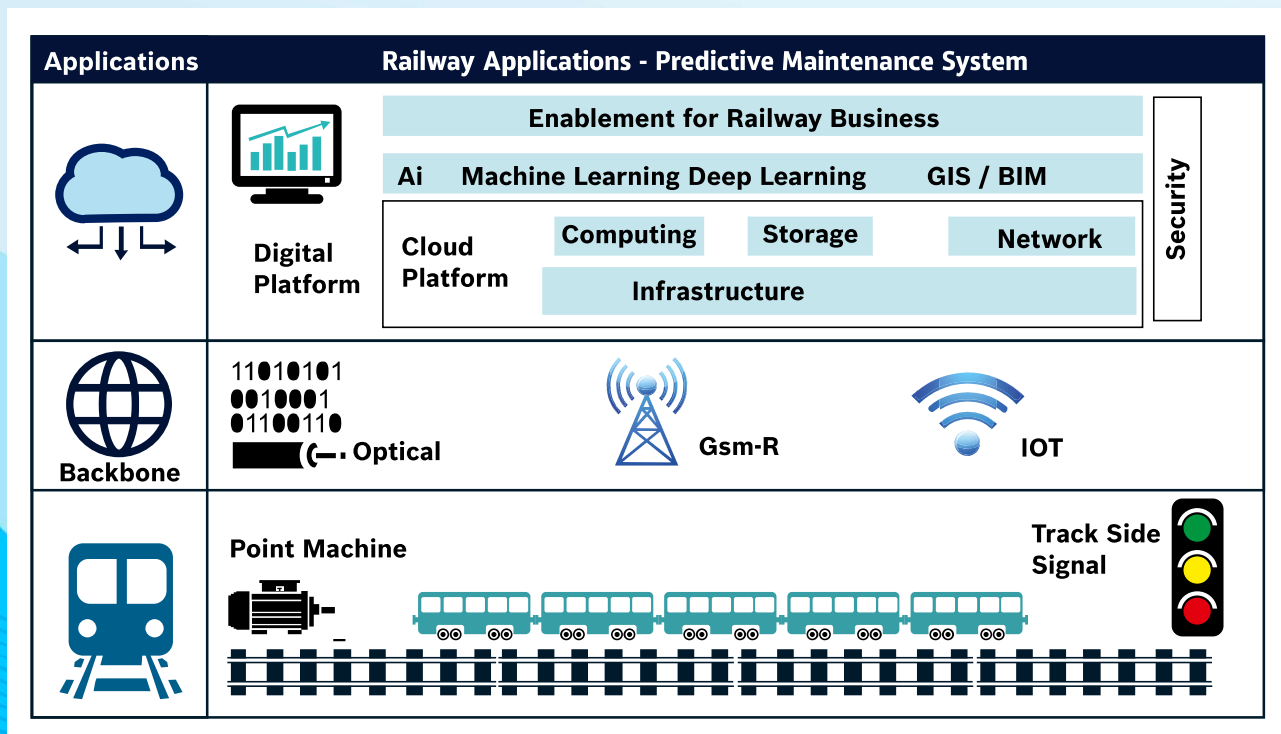


SIGNALLING PREDICTIVE AND DIAGNOSTIC INFORMATION MANAGEMENT SYSTEM (SPADIMS)

- SPADIMS is based on Internet of Things (IoT) and Artificial Intelligence technology to remotely monitor the Signalling assets and perform advanced Data Analytics to give Predictive Monitoring and Maintenance alerts
- To eliminate the highly time-consuming manual procedure to take signal measurements from signalling assets and perform inspection, by changing to real-time
- To create insights and knowledge from small and big data sources viz Interlocking, Signal Lamp, and Point machine
- To reduce the cost of asset mgmt., and to detect component issues in real-time and alert maint. teams
- To perform scheduled maintenance at the right time
- To optimize the timing of planned maintenance tasks and downtime
- To forecast component life and prioritize component replacement, using predictive algorithms

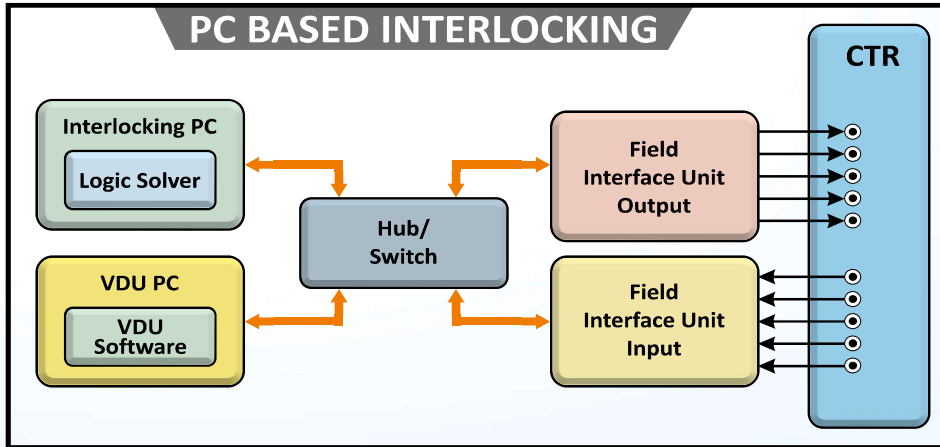
FEATURES

- Real-time data monitoring of Signalling assets
- Predictive Analytics & Alerts using Machine learning:
 - Predictive Maintenance Alerts
 - Configurable automatic events and alerts
- Display of Signalling assets on Geographic Information System (GIS):
 - Asset representation on GIS Map view
 - Tracking of assets



PC BASED INTERLOCKING - PCIXL

TSTS' PCIXL (PC based Interlocking system) is an Interlocking engine running from a normal desktop computer. It meets all the functional requirements of Electronic Interlocking. PCIXL along with its interface modules can work as standby when the main interlocking fails or during the commissioning of phase works.



Currently, PCIXL has been commissioned in following stations in Southern Railway - Pattukkottai, Peravurani, Ayingudi, Aranthangi, Periyakottai, Karaikkudi and Pattabiram Military Siding.

ADVISORY SERVICES

SERVICES

SYSTEM ASSURANCE, & CYBERSECURITY

- Provide end to end Support to clients in complying with standards and requirements related to RAMS and Cyber Security
- Provide end to end Support to Clients, towards getting their products certified for SIL (1 to 4) and Cyber Security
- Provide advisory services for System Assurance, including RAMS
- Provide advisory services for Cyber Security compliance for products and operations

SYSTEM SAFETY

- V&V support for software, hardware, and system development to ensure compliance to CENELEC 5012X (System, Software, and Hardware).
- Extended support in design, support, V&V for software, hardware, and system development to ensure compliance to CENELEC 5012X.
- RAMS assessment and safety case reporting support for systems.

CYBER SECURITY

- Support for product development to ensure compliance to IEC 62443.
- Security Assessment and Security Case support to comply with TS 50701, IEC 62443.



TSTS' LANDSCAPE OF OFFERINGS



Computer-based Interlocking

- System Integration
- OEM Supply, Selection & Supply of COTS Products
- Design, Testing
- Installation & Commissioning
- Maintenance, Support
- Mainline, Metro



Signalling Design Engg. Services

- Application Engineering
- Networking Diagram
- VDU, Interfaces
- Testing, Automation
- System Integration
- V&V, 3rd Party Review/Approval



Traffic Monitoring & Control

- Centralized Train Traffic Monitoring / Control (TMS / CTC)
- Rolling Stock Controller (RSC)
- Communication-Based Train Control (CBTC)
- Adaptive Traffic Control System (ATCS)

Domain Knowledge

Railways Stds., Principles, Practices, Safety	European Rail Traffic Mgmt. System (ERTMS)
Train Protection & Warning System (TPWS)	Communication-based Train Control (CBTC)
Railway Data & its Significance	Automatic Train Protection / Operation (ATP/O)

Product Design & Dev

Remote Diagnostics & Predictive Maintenance System (RDPMS)	Smoke & Fire Detection System
Metro AFC Gates	Signalling Design Automation (SDA)
Interlocking Simulation Station (ISS)	Real-time Interlocking Tester & Analyzer (RITA)



Embedded Hardware Products

- Mfg. & Supply of Metro AFC Gates
- Remote Diagnostics & Predictive Maintenance
- EEE's Addressable Fire Protection System
- Wayside Monitoring and Diagnostic System
- Driver-Machine Interface (DMI)



Software Services

- Product Development
- Turnkey Projects
- Customization
- Automation
- Simulation
- Cloud Hosting
- Testing



Advisory Services

- Cyber Security Solutions & Services
- System Assurance (RAMS)
- Independent Verification & Validation (IV&V)
- SIL Certification Support
- Project Management
- Project Consulting

Testing & Delivery

Internal / Client Factory Acceptance Testing (I/c-FAT)	System Acceptance Testing (SAT)
Independent Verification & Validation (IV&V)	Quality Check of COTS Products
Dual-shore/site Offshore/site Client-proximity	Turnkey / Fixed Cost / T&M, Indoor / Outdoor

Innovation & R&D

Collaboration with IITs for Innovation	In-house R&D
Office at Research Park, IITM	Office in Techno Park, IITK
Kaizen	IPR

DESIGN SUITE ON CLOUD



1. Station Info Design Executor (SIDx)

An exclusive software application used to generate baseline design like Bitchart, Relay Disposition, EI Rack Details, Simulation Diagram, Lamp board Diagram and other signalling details which will be used for further design deliverables like TOC, Interface Circuit, Application Logic, VDU etc.

2. Interface circuit Design Executor (ICDx)

A software application to generate the interface circuits for EI which includes system level Communication Drawings, Relay installation wiring, EI rack details with Terminal details, Contact analysis and Fuse chart. It can also generate the circuits in different colors to facilitate stage / phase work.

3. Control Table Design Executor (CTDx)

An application having excellent capability of generating Table of Control automatically from the simplified CAD Input of Signalling Plan.

4. Operating Layout Design Executor (OLDx)

A software tool which generates VDU Layout with Control and Indication database from the source file given as input.

5. Maintenance Info Design Executor (MIDx)

It generates the Maintenance Terminal Layout, database for Critical failure analysis of system functions from output of Signalling input Automation Tool.

6. Interlocking Logic Design Executor (ILDx)

Logic Data Generator (LDG) is a software application that automates the generation of application logic file(s) for a station based on the simple input files.

7. Conventional Circuit Design Executor (CCDx)

Boolean to British Conversion tool converts application logic written in Boolean form to equivalent British circuits form in AutoCAD format adaptable to all Railway practices and automatic wrapping of circuits to fit into A3 size drawing. It can also generate the circuits in different colors to facilitate stage / phase work / comparison for modifications.

8. Field Simulation Design Executor (FSDx)

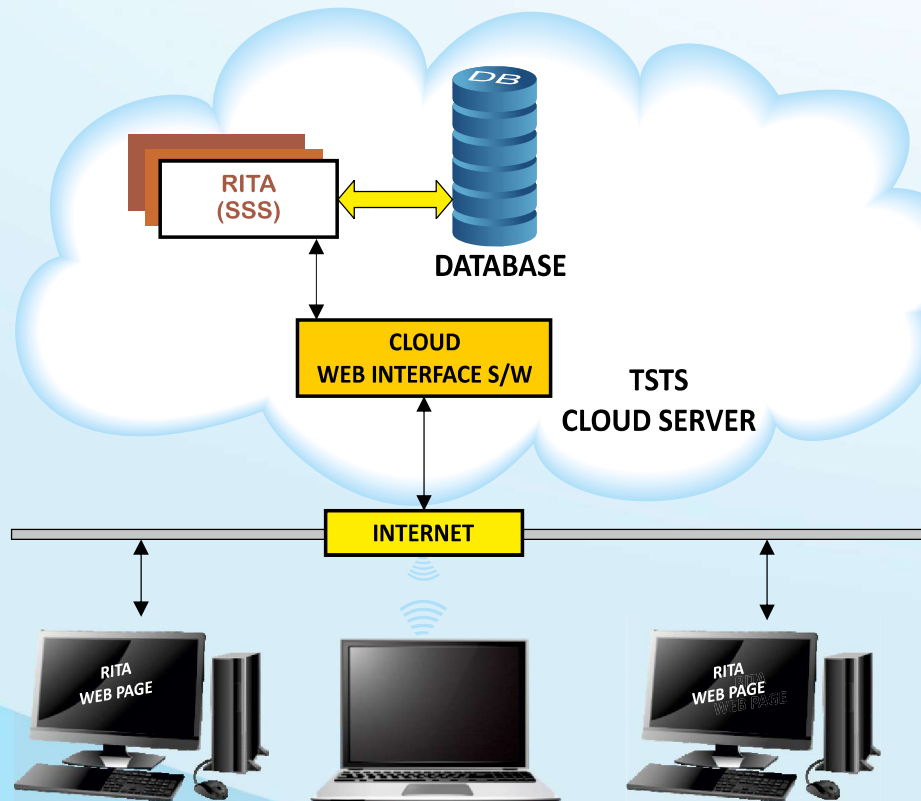
An exclusive software application used to generate Simulation Diagram and Lamp board Diagram based on station info output. User can customize the size of the FSDx output CADD files.

TSTS' TESTING SUITE ON CLOUD

• REAL TIME INTERLOCKING TESTING & ANALYZER (RITA) ON CLOUD

RITA on cloud is an automated testing environment on the internet cloud environment. RITA software is executed in a cloud environment with smart signalling simulator (SSS) interlocking simulator for performing automated testing. RITA along with its software tools on the cloud, completely automate the testing activity. With minimum user inputs, test scripts required for testing the "Table of control" and "Cross Table" can be automatically generated and tested as per Zonal/ Divisional Railway requirement. Test results are captured as detailed test reports in PDF format. Test results contain the sequence of commands given to the system, internal relay status during the execution of the command and corresponding outputs delivered by the system along with time stamp. All possible negative scenarios can be easily created and tested. Thus, RITA minimizes the time and manpower required for performing testing.

Multiple instance of same station can be tested simultaneously to reduce the testing time.

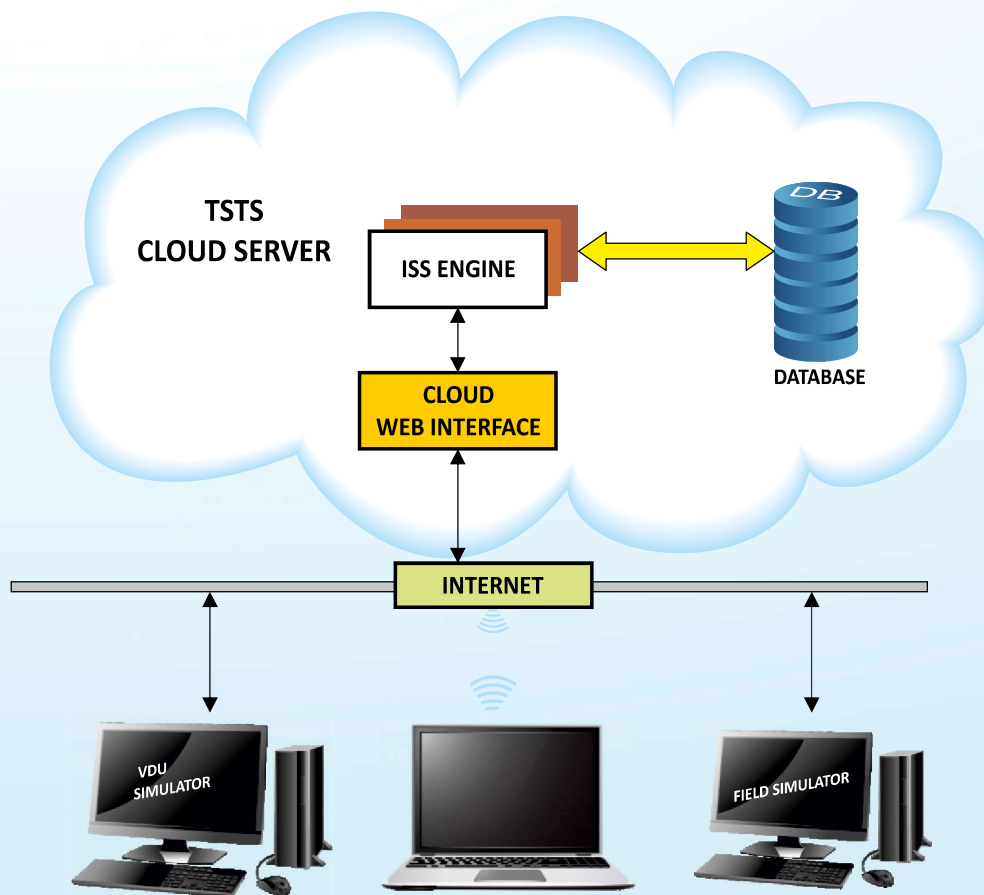


KEY FEATURES

- ❖ Automated testing of application logic without electronic interlocking
- ❖ Customized testing can be done as per Zonal/Divisional Railway requirement.
- ❖ Report generation in EXCEL format with time stamp.
- ❖ No separate test setup is required as desktops used by the engineers can be used for testing.
- ❖ No Logic change to suit automatic testing.

INTERLOCKING SIMULATION STATION (ISS) ON CLOUD

ISS on cloud is an application logic testing environment on the internet cloud environment. ISS on cloud is used for testing the correctness of Boolean Logic loaded into the Interlocking system. ISS virtually eliminates the elaborate requirements of EI hardware setup and manpower required for creating the test setup. ISS can also be used as a training tool to learn and analyze the functionality of application logic design. The VDU software used at site can be directly connected to ISS and correctness of VDU can also be tested along with the application logic.



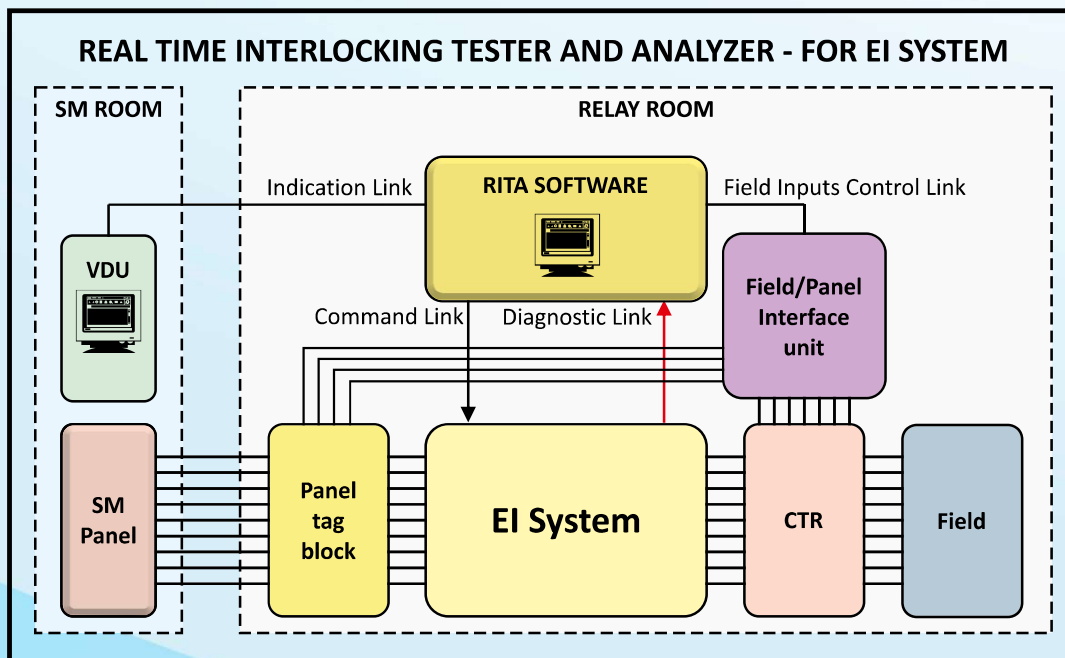
KEY FEATURES

- ❖ Testing of application logic without electronic interlocking for any size of station.
- ❖ No separate test setup is required as desktops used by the engineers can be used for testing.

AUTOMATIC SITE ACCEPTANCE TEST (ASAT)

REAL TIME INTERLOCKING TESTING & ANALYZER - RITA

Real time Interlocking Tester & Analyzer -RITA is an automated test equipment used for testing the correctness of interlocking system before and after commissioning. RITA is a desktop/laptop-based system with I/O interfaces. RITA along with its software tools automate the testing activity completely. With minimum user inputs, test scripts required for testing the “Table of control” and “Cross Table” can be automatically generated and tested as per Zonal/Divisional Railway requirement. After installation, interlocking system can be tested with actual field gears connected or using an automated field setup. Test results are captured as detailed test reports in PDF format. Test results contain the sequence of commands given to the system, internal relay status during the execution of the command and corresponding outputs delivered by the system along with time stamp. All possible negative scenarios can be easily created and tested. RITA minimizes the time and manpower required for performing SAT and integrity testing without compromising any test procedure/sequence.



KEY FEATURES

- ❖ Customized testing can be done as per zonal/Divisional Railway requirement.
- ❖ Reports in the PDF format with time stamp
- ❖ Can be used to test EI/RR/PI installations

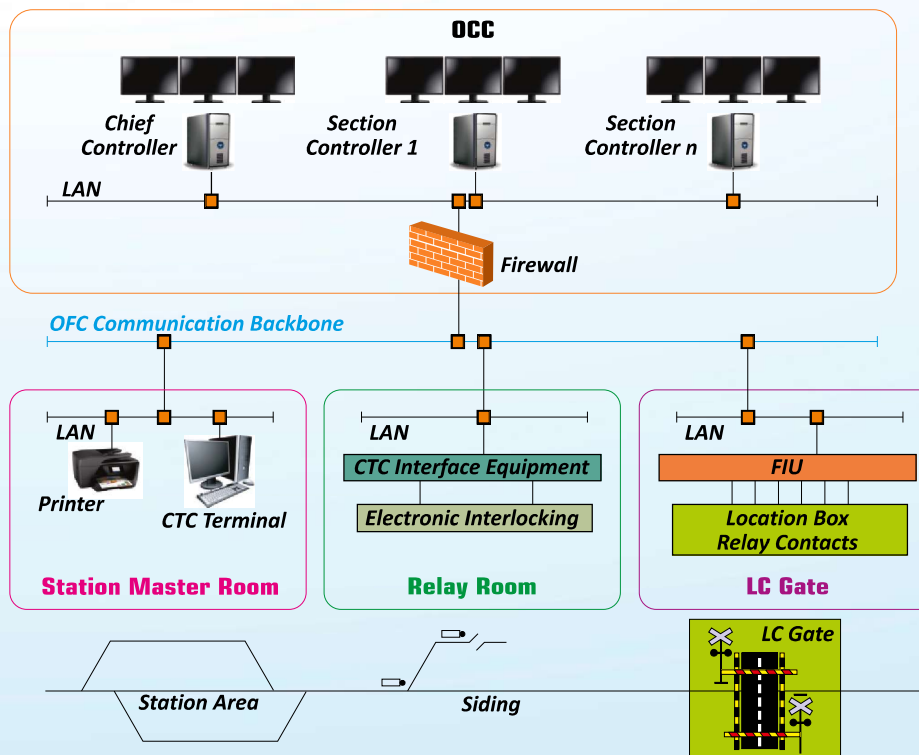
CENTRALIZED TRAFFIC CONTROL - CTC

Kyosan's Centralized Traffic Control (CTC) is a system for Control & Monitoring of multiple station yards and Block Operations from a centralized location. It acts as a remote terminal for controlling locally installed Interlocking system.

The following are the subsystems of CTC installed at various locations.

1. Control terminals at Operation Control Center (OCC)
2. EI interface equipment at station relay room
3. Station master terminal at SM room

Using CTC terminal, the controllers can directly give commands to the locally installed Interlocking system. With additional authentication from both the stations EI's, the CTC can handle block operations in the sections.



MAJOR FUNCTIONALITIES OF CTC

Control Operations

- ✓ SM command
- ✓ Route command
- ✓ Point command
- ✓ Crank handle
- ✓ Collar operation
- ✓ Block operation

Live Indication

- ✓ Track Status
- ✓ Point Status
- ✓ Signal Aspects
- ✓ Crank Handle
- ✓ Route Set
- ✓ Point Operation

Local remote changeover

Transfer of station operation control between OCC operator to station master.

User management

Various user management like user creation, addition and modifications.

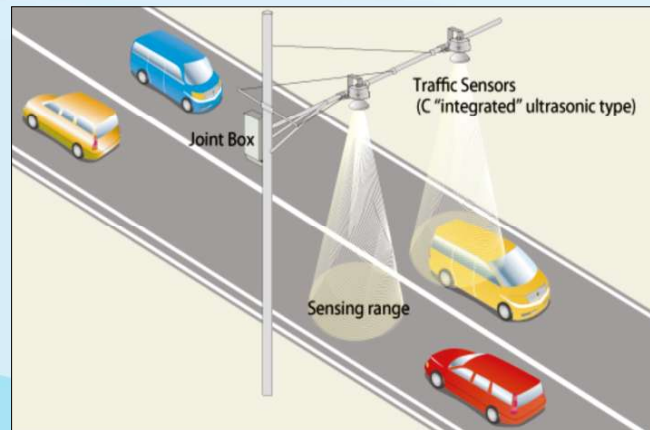
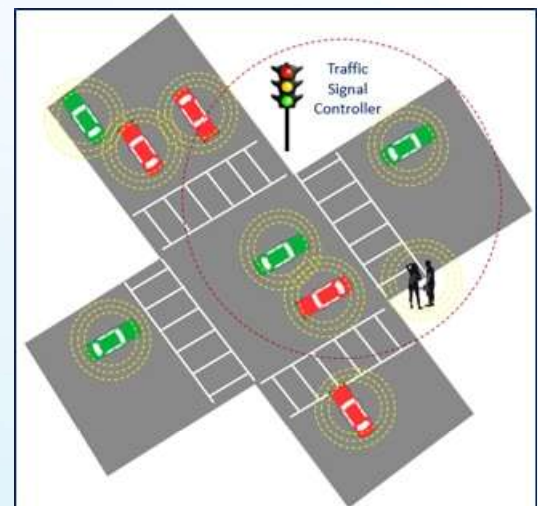
ADAPTIVE TRAFFIC CONTROL SYSTEM (ATCS)

Kyosan's Autonomous and Real Time signal control, based on estimated traffic demand at intersections, to minimize signal wait time, and to optimize the traffic flow, by dynamically changing the green split timings. This system can be installed in the individual traffic signal node or Monitoring multiple traffic signal nodes via Control Center. The real-time traffic flow will be updated in the supervisory system GUI/VDU/HMI, and supports two operating modes:

Auto, Manual

FEATURES

- Optimizes signalling by predicting traffic flow in real-time, including priority emergency vehicle pre-emption
- Device System operating parameters are configurable: Heavy traffic time plan on timely basis (Year/Date/Time), Weekly / Seasonal / Special Days
- Detection system based on Camera or Sensor
- Failure capturing feature at each hardware/module level
- Increased System availability, and improved travel time reliability, improved future infra requirements based on real-time traffic density



DELIVERY OPTIONS

TIME & MATERIALS (T&M)

Lower cost, Project / Resource Management with Client.

(E.g. Any activity onshore / offshore, with TSTS providing only the skilled resources and Client managing the resources and their activities.)

FIXED COST

A part of the work is taken on fixed cost, with complete project and resource management.

(E.g. Design Engineering Services executed from offshore, including milestone-based delivery.)

TURNKEY

Complete end-to-end activities from inception to commissioning, with the corresponding responsibilities and ownership.

(E.g. Onshore (site) and offshore activities, including design, supply, installation, testing, commissioning, maintenance and support.)

CERTIFICATION & AWARDS



CERTIFICATIONS / COMPLIANCE

- ISO 9001:2015: Quality Management
- CMMI Dev L3: CMMI Maturity Level 3
- ISO 45001 (Compliance): Occupational Health & Safety Management System
- ISO 27001: Information Security Management System
- ISO 27701 (In-progress): Privacy Information Management System
- GDPR (Compliance) : General Data Protection Regulation
- ISO 14001 (Compliance) : Environmental Management Systems



AWARDS & RECOGNITION SINCE INCEPTION

- Product of the Year
- Innovation Excellence
- Top SME 50 Index
- India SME 100
- Export Excellence
- Trade Excellence
- Business Excellence

MAP OF EI COMMISSIONING BY TSTS



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