CHAPTER XXI

RELAY AND ELECTRONIC INTERLOCKING

B. ELECTRONIC INTERLOCKING (EI)

21.19 GENERAL REQUIREMENTS

21.19.01 Electronic Interlocking System shall be approved type and shall conform to latest approved specification.

21.19.02 Electronic Interlocking System shall have the highest safety integrity.

21.19.03 Electronic Interlocking System shall be suitable for working on Electrified and Non- Electrified sections.

21.19.03 Electronic Interlocking System Installation shall be of Route setting type using Entry/Exit control with a facility for individual operation of points.

21.19.04 Signalling and interlocking arrangements for the yard shall be in accordance with the approved Signal Interlocking Plan (SIP) and Selection Table (ST) or Route Control Chart (RCC).

21.19.05 Electronic interlocking system shall be capable of working with Control cum Indication Panel (CCIP) or/and Control Terminal with Video Display Unit (VDU).

21.19.06 Electronic Interlocking system shall have adequate built-in redundancy as per approved specification.

21.20 Section 'A' Para 21.2 to 21.18, under Relay Interlocking are generally applicable for Electronic Interlocking also.

21.21 CONTROL CUM INDICATION PANEL (CCIP) & CONTROL TERMINAL WITH VIDEO DISPLAY UNIT (VDU)

21.21.01 For CCIP, requirements of SEM Para 21.2 shall apply.

21.21.02 VDU shall be of appropriate size to display layout of the yard in well-proportioned dimensions and shall display all functions clearly distinguishable.

21.21.03 Display indications on VDU shall conform to Control Panel indications as covered in Para 21.2 or other approved type.

21.21.04 Operation of Signals, Points and other Controls such as Gate, Crankhandle, Siding, Slot etc., shall be carried out through appropriate dropdown menus or other approved means.

21.21.05 VDU shall have suitable protection facility against unauthorised operation.

21.21.06 All Emergency operations shall be two-step process protected against unintended operations.

21.21.07 Only non-resettable counters shall be provided while working with CCIP or VDU.

21.21.08 VDU shall have provision for Line Block Collars equivalent of CCIP.

21.21.09 Where CCIP and VDU are provided, it shall be possible to switchover the controls from CCIP to VDU and vice-versa, and where two VDUs are provided, it shall be possible to switch the controls from one VDU to other VDU.

21.21.10 Indication that **EI** system is healthy shall be displayed on the CCIP using a blinking green LED or blinking green indicator on VDU.

21.22 INTERFACE

21.22.01 Interface between Control Terminal, Video Display Unit, Control Panel, Panel Processor and Electronic Interlocking system shall be of approved type.

21.22.02 Interface of Points, Signals, Track Circuits and Controls such as Crank Handle, LC Gate, Siding, Slot etc., with Electronic Interlocking System shall be through Relays of approved type or through any Electronic Modules of approved type conforming to approved specification.

21.22.03 Interface between external data logging equipment and Electronic Interlocking system shall conform to approved specification.

21.22.04 Electronic Interlocking Systems shall be capable of being controlled and monitored from a centralized location.

21.22.05 It shall be possible to network the Electronic Interlocking Systems for diagnostic function to a centralized location.

21.22.06 Electronic Interlocking System may be capable of being networked with other systems for the purpose of centralized control and monitoring.

21.23 INTERLOCKING AND CIRCUIT REQUIREMENTS

21.23.01 Interlocking application logic (site specific data) requirements for the EI system shall be as per interlocking principles stipulated for Relay Interlocking.

21.23.02 It shall be possible to modify application logic for yard remodelling or change in interlocking using approved type of user interface.

21.24 POWER UP & SHUTDOWN

21.24.01 Electronic Interlocking system shall drive all the relevant signals to the most restrictive aspects whenever internal failure of any nature arises or when Electronic Interlocking system is powered up or during shutdown.

21.24.02 After powering up of Electronic Interlocking, the system shall block all signals and other operations. After verification of safety functions by Electronic Interlocking system, this blocking shall be released after a delay of at least 120 seconds.

21.25 CONFIGURATION

21.25.01 Electronic Interlocking system shall have hot-standby arrangement and changeover from one system to other systems shall not interrupt status of signalling.

21.25.01 Electronic Interlocking system shall be of either centralized or distributed type as per approved specification.

21.25.02 In case of distributed configurations, redundancy in communication media shall be provided for linking the subsystems.

21.25.03 Electronic Interlocking System in any configuration shall have time synchronisation.

21.26 VERSION CONTROL

21.26.01 Version of the Generic System software and hardware shall be approved and controlled by authority competent to approve the Electronic Interlocking system and its specifications.

21.26.02 Version of the Application logic (station specific logic) shall be unique for the installation and shall be approved by the authority competent to approve the circuit diagrams. Corresponding Checksum shall be recorded and controlled by the same authority.

21.26.03 Version number and Checksum shall change whenever any modifications are carried out to the Application logic (site specific logic).

21.26.04 A proper record of Checksums shall be maintained at Station, Divisional Headquarters and Zonal Headquarters as a part of completion wiring diagram as per format given below:

Version Control Certificate

1	Name of Station	:
2	Description of Work	:
3	CRS or CSTE Sanction no & date	:
4	Date of Commissioning	:
5	Approved Signalling Plan no.	:

6	Approved Panel Diagram no.	:
7	Approved Selection Table Diagram	:
8	EI Wiring Diagram Version no.	: (a) Existing - (b) New -
9	EI Wiring Diagram Checksum no.	: (a) Existing - (b) New -
		(Signature)
		Officer-In-Charge of Site (ASTE or DSTE)
	(Signature)	
	(SrDSTE or Dy CSTE)	
	Copy to: CSTE	

21.27 INSTALLATION

21.27.01 Installation of Electronic Interlocking system shall be done as per approved guidelines and technical advisory notes issued from time to time.

21.27.02 Application logic (site specific logic) shall be verified for safety and functionality by carrying out exhaustive safety and functionality tests by officers authorised by CSTE.

21.27.03 Only approved application logic with specified checksum shall be used in the EI system and this data and checksum shall be version controlled and preserved by the Railways.

21.27.04 Electronic Interlocking is required to be provided in dust proof cabinets of approved type having transparent front door.

21.27.05 Interface Relays, where provided, shall be of approved type and contacts should be paralleled as far as possible for better reliability.

21.27.06 Electronic Interlocking system shall be installed closer to Operator Room, preferably adjacent room. Track crossing should be avoided between main **EI** system and operator room.

21.27.07 The Electronic Interlocking room shall be provided with tiles or similar arrangements on floor and walls to avoid periodic painting of walls and resultant dust.

21.27.08 FRP or insulated ladders arrangement shall be used to carry wires from rack to rack or from other equipment.

21.27.0.9 All entries to Electronic Interlocking room shall be suitably sealed to prevent entry of rodents, *lizards*, *insects* etc.

21.27.10 Electrostatic Floor Pads and Hand bands shall be provided near electronic equipment to prevent damages to electronic equipment due to electrostatic discharges.

21.27.11 The room where Electronic Interlocking is installed, *shall* be provided with Air-conditioning in areas which are prone to dust or in vicinity of chemical factories releasing injurious fumes or in areas with extreme temperature.

21.27.12 Surge and lightning protection devices of appropriate class and rating shall be provided for the regulated power lines before extending them to Electronic Equipment Room. All equipment in Electronic Equipment Room shall derive power from these regulated and protected power lines (clean), but not from electrical service lines (dirty) used for room lighting, air-conditioning or fans.

21.27.13 Clean and dirty wiring shall be clearly segregated and routed in different enclosures/ladders, and where this is not feasible, a minimum distance of 150mm between clean and dirty wiring shall be maintained.

21.27.14 If clean and dirty wiring need to cross at any place, then wiring should be arranged at perpendicular to each other.

21.27.15 Indicative type surge protection devices of appropriate class and rating shall be installed for all copper based external interface ports (power, communication, maintenance terminal, panel interface etc).

21.27.16 Earth wire from Surge protection device to main earth terminal inside the room should be as straight and short as possible to provide a low impedance path for discharge of surge energies.

21.27.17 Earthing wires from electronic interlocking subsystems to main earth terminal shall be of distinctive color. Green or Green Yellow (GNYE) color is recommended for quick identification of a loose or disconnected earth wire.

21.27.16 All earth wires shall be as straight as possible and shall never be coiled. All Earth wires should be of adequate current carrying capacity and should never be less than 4 Square mm copper cross section.

21.27.17 Usage of mobile and radio-frequency devices inside electronic interlocking room shall be prohibited.

21.28 TESTING

21.28.01 System testing of EI system shall be carried out as per chapter XIII Para 13.38 at the time of initial installation and during subsequent modifications in interlocking.

21.29 POWER SUPPLY

21.29.01 Adequate redundancy in power supply arrangements for EI systems including VDUs shall be provided as per approved specifications and guidelines.

21.29.02 Wires connecting equipment shall be of adequate size so that there is not more than 0.5% loss in voltage.

21.30 EARTHING

21.30.01 Earthing shall be provided as per approved specifications, drawings and code of practice.

21.30.02 To the extent possible, perimeter earth shall be provided around the Electronic Interlocking room.

21.30.03 Earth value shall be less than ten ohms and shall be measured annually during dry season.

21.31 MAINTENANCE

21.31.01 Maintenance of Electronic Interlocking system shall be done as per approved system maintenance manuals. A general maintenance schedule for Electronic interlocking is provided for guidance at Annexure-34.

At stations having dense traffic and high speeds, the Railways may prescribe more frequent inspections, if considered necessary (IRSEM Para 19.48).

21.31.02 Maintenance Terminal of Electronic Interlocking system shall be provided in the Signal Technician Duty room.

21.31.03 Periodic testing of redundant systems shall be carried out. Checksums shall be verified during periodic inspections.

21.32 FURTHER READING

21.32.01 Following International Standards with latest revisions are applicable to development and implementation of safety related railway signalling systems and projects including Electronic Interlocking. IEC stands for "International Electrotechnical Commission" and CENELEC stands for "European Committee for Electrotechnical Standardization" .Both CENELEC and IEC have equivalent standards on each of the subjects as given below:

CENELEC	IEC	Subject
EN 50126	IEC 62278	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

EN 50128	IEC 62279	Railway applications - Communications, signalling and processing systems - software for Railway Control and Protection systems
EN 50129	IEC 62425	Railway applications - Communication, Signalling and processing systems - Safety related electronic systems for signalling
EN 50159	IEC 62280	Railway applications - Communication, Signalling and processing systems - Safety related communication (Part 1 & 2)

21.32.2 RDSO Specifications with latest amendments are applicable for design, installation ,testing and maintenance of Electronic Systems.

ANNEXURE-34

General Maintenance Schedule for E.I

Sno	Maintenance work to be done	Paragraph reference	Periodicity		
			Technician (Signal)	JE/SE-Signal (Incharge of Section)	SE/SSE-Signal (Overall incharge
1	2	3	4	5	6
1	Voltages shall be checked at check points	21.31.1	M	M	Q
2	Cooling arrangements like fans, dust filters		M	M	Q
3	Checksums to be verified	21.31.4	..	..	Q
4	Visual checks of indications on EI and subsystems		M	M	Q
5	System changeover	21.31.3	...	M	Q
6	Tightness of all terminals and cables, Earth wires etc.		...	...	Q
7	Panel to video, video to video changeovers etc.		...	M	Q
8	Surge protection devices including A, B, C,D class		....	M	Q
9	Redundancy in communication, DC-Dc converters etc.	21.31.3	....	M	Q
10	Cleanliness of room and equipment		M	M	Q
11	Emergency crank handle		.....	.....	Q
12	Checking of error logs		....	M	Q

M = Monthly, Q = Quarterly