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IECC Internal Subsystems Communications requirements (formerly RT/E/S/I7503)

This temporary front sheet facilitates change to the new Network Rail Standards referencing nomenclature.

The Ref above will be formally allocated to this standard when it is next changed in the meantime the contents, date and issue number of this Network Rail Standard are **UNCHANGED and with immediate effect it should be referred to as “(new ref) formerly (old ref)”.**

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RAILTRACK LINE SPECIFICATION

IECC INTERNAL SUBSYSTEMS COMMUNICATIONS REQUIREMENTS

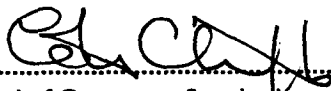
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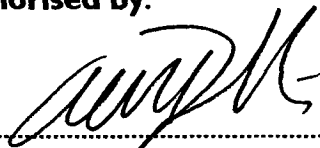
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Summary

This specification mandates the internal subsystems communications requirements for all new and existing IECC schemes.

Issue/Revision Record

This specification will be updated when necessary by distribution of a complete replacement. Amended or additional parts of revised pages will be marked by a vertical black line in the margin. The latest issue of this specification shall be implemented immediately upon receipt.

Issue	Date	Comments
1	June 1999	Initial Issue

Implementation

The provisions of this specification are mandatory and shall be enforced from 7 August 1999. The specification applies to all new and existing IECC schemes and supercedes the original Internal Subsystems Communications Requirements.

Superceded Document	Issue	Date
BR1631 : IECC Internal Subsystems Communications Requirements	3	August 1993

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CONTENTS

	Page
1 PURPOSE	5
2 SCOPE	5
3 GLOSSARY OF TERMS	5
4 INTRODUCTION	6
4.1 IECC System Architecture	6
4.2 The Signalling Network	6
4.3 The Information Network	7
4.4 The General Communications Network	8
4.5 Designation of SYSTEMS	8
4.6 Fault Logging	8
5 GENERAL	8
5.1 Definintions	8
5.2 Strategy	9
5.3 Communications Sequence	9
6 CHANNEL SELECTION STRATEGY	10
6.1 MASTER/MASTER : CHANNEL Selection Strategy	10
6.2 MASTER/SLAVE : CHANNEL Selection Strategy	10
7 CONNECTION STRATEGY	10
7.1 Message Restrictions	11
7.1.1 MASTER/MASTER	11
7.1.2 MASTER/SLAVE	11
7.2 Communications Requirements List	11
7.3 Use of the Communications Requirement List	12
8 COMMON COMMUNICATIONS REQUIREMENTS	13
8.1 Characters	13
8.2 Character Usage	13
8.2.1 Protocol	13
8.2.2 Text	13
8.3 SYSTEM Identity Characters	14
8.4 Message Format	14
8.5 Block Check Characters	14
8.6 Message Format Errors	15
8.7 CONNECTION Time Out	15
9 MASTER/MASTER PROTOCOL	15
9.1 Definitions	16
9.1.1 SENDER, RECEIVER	16
9.1.2 No Response (N/R)	16
9.2 Protocol Sequence	16
9.3 CHANNEL Status	17
9.3.1 Declaring a CHANNEL Up	18
9.3.1.1 Method 1	18
9.3.1.2 Method 2	18

9.3.2 Confirmation of CHANNEL Up	18
9.3.2.1 Normal Traffic Periods	19
9.3.2.2 Quiet Time	19
9.3.3 Declaring a CHANNEL Down	19
9.3.3.1 Failure to Transfer a Message	20
9.3.3.2 Failure to Transmit an Enquiry	20
9.3.4 Simultaneous Detection of CHANNEL Down	20
9.3.5 System Start Up Procedures	20
9.4 Tables	21
10 MASTER/SLAVE PROTOCOL	22
10.1 Ready State	22
10.2 Definition - No Response (N/R)	22
10.3 Protocol Sequence	23
10.4 CHANNEL Status	23
10.4.1 Declaring a CHANNEL Up	23
10.4.2 Conformation of CHANNEL Up	23
10.4.3 Declaring a CHANNEL Down	24
11 MESSAGE TEST FOR MASTER/SLAVE COMMUNICATIONS	25
11.1 Heading	25
11.2 Data	25
11.3 Data Field Types	26
11.4 Combination of Field Types	27
11.5 Data Field Errors Detected by the SLAVE	28
11.6 Data Field Errors Detected by the MASTER	28
11.7 Storage of Data Within the SLAVE	28
11.8 Acquisition of Data by a MASTER	28
11.8.1 Initialisation - Field Type I	28
11.8.2 Maintaining the Up to Date State	29
11.8.3 Change of State File Overflow	29
11.8.4 Change of State File Not Available	30
11.8.5 Re-transmission of Change of State Data	30
11.8.6 Usage of Field Types P, B and S	30
12 MESSAGE TEST FOR MASTER/MASTER COMMUNICATIONS	30
13 FAULT LOGGING REQUIREMENTS	30
14 APPENDIX A - IECC - TYPICAL SYSTEM CONFIGURATION	32

1 PURPOSE

This specification defines the mandatory communications requirements between the individual subsystems which form the Integrated Electronic Control Centre (IECC) when used on Railtrack infrastructure. It identifies the communications strategy to be applied, the protocols to be used and the data representations to be employed. Two types of communications are defined; between one IECC subsystem and another, and between an IECC subsystem and an interlocking.

2 SCOPE

The communications requirements defined herein are applicable where the IECC is used in relation to the signalling and operation of Railtrack infrastructure.

3 GLOSSARY OF TERMS

CHANNEL	A two-way communication path between a pair of SYSTEMS.
CONNECTION	The activation of a CHANNEL. The NETWORK ensures dedication of that CHANNEL for the duration of the activation.
LINK	A number of CHANNELS between a pair of SYSTEMS
NETWORK	A common communication mechanism shared by a group of SYSTEMS.
MASTER	A MASTER is a SYSTEM that is required to initiate communications and therefore has knowledge of the overall system. It can communicate with both MASTERS and SLAVES.
SLAVE	A SLAVE is a SYSTEM that is not required to initiate communications and therefore has no knowledge of the rest of the system.
SYSTEM	A processor(s) that perform(s) a set of defined tasks.
SENDER	Denotes the initiating and controlling SYSTEM during a MASTER/MASTER communication sequence.
RECEIVER	Denotes the responding SYSTEM during a MASTER/MASTER communications sequence.
LAN	Local Area Network.

4 INTRODUCTION

This specification details the overall IECC system architecture and the protocol for the communication between various SYSTEMS.

4.1 IECC System Architecture

- 4.1.1 With reference to Appendix A, the IECC shall consist of two independent networks, designated the signalling communication network and the information communication network intercommunicating with each other via a Gateway.
- 4.1.2 Each of the above networks shall be a general communications network of the LAN variety, duplicated for availability purposes, with both operational.
- 4.1.3 The strategies detailed in this standard monitor the operational state of the duplicated network, thus avoiding the requirement for any network-generated automatic changeover in the event of one failing.
- 4.1.4 Each SYSTEM connected to either of the networks shall consist of duplicated hardware and software. Detailed SYSTEM design shall be given in the relevant SYSTEM specification.

4.2 The Signalling Network

- 4.2.1 The types of SYSTEM on this network will be those associated with the direct control of the railway, namely :-
 - The Signalling Display Subsystem (DIS, SDS or RDF)
 - The Automatic Routesetting Subsystem (ARS)
 - The Gateway Subsystem (GWS)
 - The IECC System Monitor Subsystem (ISM)
 - The general communications network
 - The Signalling Interlockings (both SSI and RRI via an Route Relay Interlocking Interface (RII) or Interface Processor (IFP) or simulated through the Interlocking and Train Movements Simulator (SIM))

- 4.2.2 The numbers of each type of SYSTEM shall be given in the Project Specification or Design Specification.

4.3 The Information Network

- 4.3.1 The types of SYSTEM that will be connected to this network are those associated with the acquisition and dissemination of information for management, regulation and customer purposes.

As a guide, the SYSTEMS involved could be some or all of the following:

- Train describer links to adjacent and fringe signalboxes (directly [FB Subsystem] or via a communications system [ECS or PCS Subsystem])
- Track to Train Radio (via ECS or PCS Subsystem)
- The Information Generator Subsystem (IGS) providing train movement information, passenger information etc.
- The Gateway Subsystem (GWS)
- The Automatic Routesetting Subsystem (ARS)
- The Route Relay Interlocking Interface Subsystem (RII)
- The IECC System Monitor Subsystem (ISM)
- The Timetable Processor (TTP)
- The Interlocking and Train Movements Simulator Subsystem (SIM)

The Project Specification or Design Specification shall detail the requirements.

- 4.3.2 In general, this network will be connected to external systems via a communications system providing protocol and data converters, as in many cases, these systems will already be in existence.

The Project Specification or Design Specification will detail the requirements.

4.4 The General Communications Network

4.4.1 Details will depend on the type used for a particular application.

4.5 Designation of SYSTEMS

4.5.1 The only SYSTEMS designated as SLAVES shall be the Interlockings or their Interface Processors on the signalling network. All other SYSTEMS shall be designated MASTERS. Any variations will be detailed in the Project Specification.

4.6 Fault Logging

4.6.1 Fault logging requirements are given in Section 13. Details of actions to be taken when fault conditions occur, which are not covered by this standard, will be detailed in the relevant SYSTEM specification.

5 GENERAL

The protocol is designed to permit serial data communications between SYSTEMS when a common communications mechanism (NETWORK) is used. Details of the network requirements will depend on the type used for a particular application.

5.1 Definitions

5.1.1 The two way paths connecting any SYSTEM to any other SYSTEM, via the NETWORK, shall be known collectively as a LINK, with each individual two way path known as a CHANNEL.

5.1.2 In general, a LINK shall consist of two CHANNELS, but it shall be possible for communications to be handled by one of those CHANNELS.

5.1.3 The activation of a CHANNEL shall be known as a CONNECTION. The NETWORK will not allow switching of CHANNELS while a CHANNEL is active.

5.1.4 CHANNELS are divided into one logical INCOMING CHANNEL and one logical OUTGOING CHANNEL.

5.1.5 The logical INCOMING CHANNEL is reserved for those CONNECTIONS originated by other MASTERS.

5.1.6 The logical OUTGOING CHANNEL is used by a MASTER to originate a CONNECTION.

- 5.1.7 A SLAVE system only has incoming CONNECTIONS and therefore its CHANNEL maps entirely onto its logical INCOMING CHANNEL.

5.2 Strategy

In order that delays in the transfer of data, particularly at times of peak use, are shared evenly between SYSTEMS and not randomly distributed, the strategy of section 5.3 has been imposed on the frequency and duration of each CONNECTION.

5.3 Communications Sequence

The transfer of data between one SYSTEM and another shall be in accordance with the following sequence.

- 5.3.1 A MASTER will generate, and record, a communication requirement for another SYSTEM as detailed in section 7.
- 5.3.2 Having generated this requirement, the MASTER shall select the logical OUTGOING CHANNEL it will use for the data transfer according to the CHANNEL selection strategy detailed in section 6.
- 5.3.3 The MASTER shall then make a CONNECTION on the selected CHANNEL to the required SYSTEM, according to the CONNECTION strategy detailed in section 7.
- 5.3.4 Once a CONNECTION has been established, the MASTER shall transmit data under the control of one of the following :-
- 5.3.4.1 MASTER/MASTER protocol, where at most a single message shall be transmitted from the initiating MASTER to the other. The protocol shall be as detailed in sections 8 and 9.
- 5.3.4.2 MASTER/SLAVE protocol, where the MASTER shall send a request message and the SLAVE shall respond with a reply message. The protocol shall be as detailed in sections 8 and 10.
- 5.3.5 On completion of the data transfer, successfully or otherwise, the MASTER shall break the CONNECTION and delete that communication requirement from its record as detailed in section 7.

6 CHANNEL SELECTION STRATEGY

This strategy is a means of spreading the workload over more than one CHANNEL when more than one CHANNEL is available. It is NOT intended to be a method of increasing throughput.

The difference in the internal operations of MASTERS and SLAVES requires that the CHANNEL selection strategies are different for the MASTER/MASTER protocol and the MASTER/SLAVE protocol.

6.1 MASTER/MASTER : CHANNEL Selection Strategy

When only one CHANNEL is available, that CHANNEL shall be used for all communication. When both CHANNELS are available, CONNECTIONS shall be made on each CHANNEL alternately, except that retries shall be carried out on the same CHANNEL used for the original CONNECTION.

6.2 MASTER/SLAVE : CHANNEL Selection Strategy

When only one CHANNEL is available, that CHANNEL shall be used for all communications. When both CHANNELS are available the MASTER shall select, for all CONNECTIONS, only one of the CHANNELS to communicate with the SLAVE. This CHANNEL shall be used until it is declared down as detailed in section 10.

On CHANNEL changeover, the MASTER shall invoke the initialisation procedure of section 11.8.1 via the 'new' CHANNEL.

7 CONNECTION STRATEGY

The details of the NETWORK will be dependant on the particular application.

The NETWORK shall be such that while a CONNECTION is made between any two SYSTEMS, that CONNECTION shall not be broken by any other SYSTEM. The NETWORK, however, shall allow a number of CONNECTIONS between other SYSTEM pairs at the same time. To share out the time between SYSTEMS on a NETWORK, the following strategy shall be used.

7.1 Message Restrictions

The number and length of messages per CONNECTION shall be restricted to: