

Remote Interlocking Interface ERSE Reference

For approval and authorisation of this document, please refer to the IECC Applications Manual Contents, RT/E/S/10040.

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**Published and issued by
Director, Asset Management
Railtrack plc
Railtrack House
Euston Square
LONDON
NW1 2EE**

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Amendment Record

Issue	Date	Description
3	29/10/99	Converted to Word format by AEA Technology Rail. Same as issue 2.1.
3.1	22/12/99	Section 3.12 amended for RII major cycle time check in MVME172 systems. Minor typographical errors corrected. Amendment record for issue 3, and sections 3.2, 3.3, 3.12 and 4.1.2.1 amended as a result of document review.
4	12/10/2000	Amendment to review SAO-ECML-RP-4 issue 1

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1 Introduction

1.1 PURPOSE

A Remote Interlocking Interface (formerly known as a Relay Interlocking Interface) subsystem (RII) is used to allow the incorporation of Route Relay Interlocking (RRI) signalled areas into the control area of an Integrated Electronic Control Centre (IECC). IECC communicates with interlockings using the Solid State Interlocking (SSI) protocol. RII uses the same protocol, but has access to the RRI indications and controls that were previously connected to the signaller's panel.

In most cases, the RRI will have been previously controlled directly by means of an entrance-exit (NX) panel and, hence, the controls and indications connected to RII will directly mirror the switches, lamps and buttons on the panel. Data for RII when used in this configuration is described in the SSI-Like Data Preparation Guide.

However in some instances, such as the Rock Ferry RRI forming part of the Merseyrail IECC area, the RRI may have been previously controlled by an NX panel via Electronic Route Selection Equipment (ERSE) and it may be decided to replace the ERSE with a TDM link to RII. The interface between RII and the RRI therefore closely resembles that between the ERSE and the RRI, and certain functions previously carried out by the ERSE must now be performed by means of RII data. This guide describes the preparation of the data for this configuration and outlines the principles to be adopted in implementing the RII-RRI interface

Although in theory this guide is equally applicable to the functionally similar Interface Processor (IFP), reference is only made to RII. The ERSE replacement has not been and will not be implemented with an IFP.

1.2 EVOLUTION

This guide supersedes an earlier provisional data preparation guide^[2]. This issue of the guide addresses changes in presentation of the data in line with the SSI Applications Manual^[3].

While it is likely that the principles described in the guide will be relevant to future applications, the nature of route-selection and relay interlocking equipment is such that future applications may differ in detail. Should this be the case, it may be necessary to investigate the differences and update this document to take account of them.

2 Definitions

2.1 AUTOMATIC ROUTESSETTING SUBSYSTEM (ARS)

The Automatic Routesetting Subsystem (ARS) is part of the IECC. ARS operates main signal running routes plus a limited set of shunting routes automatically in response to the approach of trains. It determines the optimum routing of trains in the area based on their current position, their importance and their destination, and automatically requests the required routes when the routes are free.

2.2 CONTROL

An item of information which passes along some or all of the information path from the IECC through the RII and RRI towards the trackside.

2.3 ELECTRONIC ROUTE SELECTION EQUIPMENT (ERSE)

ERSE is an electronic non-vital system, which is used to reduce the number of relays in an RRI, by carrying out many of the non-vital functions itself. Functions carried out by ERSE include the decoding of button sequences, the calling of the points to the positions required by the route and the calling of the route itself once points are correctly locked.

2.4 ENTRANCE-EXIT (NX) PANEL

A method of controlling signalling systems, where the state of the railway is displayed by lamps on a mimic diagram. A route is set by sequential operation of buttons placed near the entrance and exit signals of the route.

2.5 FLEXIBLE DISPLAY SUBSYSTEM (DIS)

The Flexible Display subsystem (DIS) is a replacement for the SDS (see section Signalling Display Subsystem (SDS)). In this document DIS is synonymous with SDS.

2.6 INDICATION

An item of information which passes over some or all of the information path from the trackside through the RRI and RII towards the IECC.

2.7 INTERFACE PROCESSOR (IFP)

IFP has been superseded by RII; it is still in use at the Yoker IECC scheme but is scheduled for replacement by an RII at Christmas 2000. The hardware is Motorola 6800-based and is constructed from purpose-built Eurocard processor boards. The hardware and software is not compatible with other IECC subsystems.

2.8 INTEGRATED ELECTRONIC CONTROL CENTRE (IECC)

A computerised railway control centre, intended to communicate mainly with SSIs.

2.9 REMOTE INTERLOCKING INTERFACE SUBSYSTEM (RII)

RII acts as a non-vital interface between the RRI and the IECC. To the IECC, it behaves in the same way as SSI. Instead of communicating with trackside equipment, it is connected to the RRI controls and indications. The data within the RII is closely related to SSI data.

The hardware is Motorola 68000-based and is constructed from commercially available VMEbus printed circuit boards. The hardware and software are compatible with other IECC subsystems.

2.10 ROUTE RELAY INTERLOCKING (RRI)

A relay logic circuit which accepts requests (usually from an operator's panel) and, if the safety conditions are satisfied, changes the state of trackside equipment to satisfy the request. The states of trackside equipment, as well as various RRI internal states, are available for display to the operator.

2.11 SIGNALLING DISPLAY SUBSYSTEM (SDS)

SDS provides the operating interface between the IECC system and the signaller.

2.12 SOLID STATE INTERLOCKING (SSI)

SSI performs the same function as RRI, but uses multiple-redundant microprocessors instead of relays. It also has the facility to interface with an Integrated Electronic Control Centre. The function of SSI, and in particular the data used to control its operation, is described in the SSI Applications Manual^[1].

2.13 TIME DIVISION MULTIPLEX (TDM)

A non-vital communications link which is used to connect the RII and the RRI.

2.14 TRAIN OPERATED ROUTE RELEASE

A process by which a route is freed after a train passes its entrance signal, with appropriate precautions to prevent false release while the train is still approaching. The route would otherwise have to be cancelled manually.

2.15 TRANSLATION AND NETWORK PROCESSOR (TNP)

TNP is a component of RII, including a pair of connections to the duplicated IECC Signalling Network. Each TNP contains one set of the data described in this document.

2.16 VITAL

A vital operation is part of the safety integrity of the railway and must be processed by a vital system (SSI or RRI).

3 RII Overview

3.1 GENERAL INFORMATION

The interface software and data is based on that used in SSI. The reader is assumed to be familiar with SSI data preparation and in particular the SSI Applications Manual^[3]. Familiarity with the interface between ERSE systems and RRI is also assumed.

RRI acts as an interface between RRI and IECC. The telegrams processed by the IPT data file are the indications received over the TDM link from the RRI. The telegrams generated by the OPT file are the controls which are sent over the TDM link to the RRI. The information exchange between RRI and IECC is functionally identical to that between SSI and IECC.

The data has three inter-related functions: transmitting the indications from the RRI to the IECC; transmitting the controls in the opposite direction; and providing certain functions which are required by IECC but may not have been implemented in the RRI. These functions include TORR, equipment reminder latches and the more restrictive sub-route release conditions required for by the Automatic Routesetting Subsystem (ARS).

A set of identities, with certain additions, is defined as for SSI. The indications from the RRI are used to deduce the state of these items (signals, points, routes etc.), which are then transmitted automatically to IECC. Under certain circumstances (usually when a request is received from IECC), RRI initiates one or more output changes which request the RRI to perform a desired action.

3.2 HARDWARE OVERVIEW

RRI is built from commercially available components, which are compatible with other IECC subsystems. On older IECCs the majority of the software runs on Motorola MVME101 processor boards whilst on later IECCs (or older systems that have been upgraded) the software runs on Motorola MVME172 boards. An RRI computer unit contains one such board for each connection to the duplicated IECC Signalling Network (known as a Translation and Network Processor or TNP), and one for each duplicated TDM field link. There is also a connection to the IECC Information Network, which allows faults on the field link to be reported to the IECC System Monitor subsystem (ISM).

Each TNP contains one set of the data described in this document, and from the point of view of the data behaves in a similar manner to a SSI. If more than one TNP is provided in the computer unit, they may communicate via an internal datalink. Otherwise the TNPs are independent of each other. However, several TNPs can communicate with the field on the same field link and one TNP can communicate with the field via several field links.

The RRI computer unit itself is duplicated for availability, with serial line switches to ensure that the IECC signalling network and field connections are always connected to the operational (master) computer unit. When a changeover occurs, RRI goes out of contact with the IECC Signalling Network for a short period while the new master computer unit updates itself from the field links.

3.3 BUTTON OPERATIONS

All button operations are implemented as RRI controls that are set or unset for a period of one RRI major cycle. The minimum major cycle time is specified by data^[4] and can be in the range 0.5s-1s.

Routes are set in the standard NX panel by the sequential operation of two (or occasionally more) buttons. These buttons are grouped in one or more “rings”, and only one button sequence can be in progress for each ring at any time.

The RII configuration in this document has no rings and few standard button operations because of the nature of the ERSE interface.

3.4 REMINDER DEVICES

IECC requires that reminder devices are provided to inhibit the operation of various items of equipment^[3]. These must be implemented in data. Reminder devices will generally be updated to the standby computer unit (see section 3.7).

3.5 SUB-ROUTE RELEASE

When ARS is provided, sub-routes must be released according to a more rigorous set of conditions than those normally used^[3]. For a SSI, these conditions are used as standard. However for an RII there are two sets of sub-routes. One set simply repeats the RRI indications and these are displayed to the signaller by IECC. The other set is released according to the more restrictive conditions, and RII must check these sub-routes when evaluating availability for ARS route requests. The data ensures that if an indication failure leaves a sub-route locked, the signaller can still set routes provided the RRI allows it. ARS however will be unable to operate for affected routes.

3.6 ARS ROUTE-AVAILABILITY DATA

The PFM and PRR files from the RII data can be used for generation of ARS route availability data, as is done with the equivalent SSI files.

3.7 MASTER-STANDBY UPDATE AND MEMORY PRESERVATION

RII is duplicated and the facility is provided for a small amount of flag information to be updated regularly from the master computer unit to the standby. However if changes of state take place less than 20 seconds before a changeover takes place then these may not have been updated to the standby. The ability to perform the master-standby update may also be affected by faults on the IECC networks. Hence, data is required to cause an alarm when computer unit startup or changeover occurs. If a master-standby update fails to take place, the standby computer unit puts all the flags affected into a restrictive state. There is also a facility to preserve certain flag information during a power failure that affects both computer units.

The information which may be updated is as follows:

- (1) Reminder device flags, which are transmitted to the standby and preserved during power failure. The restrictive state is “set”.
- (2) Flags, which are transmitted to the standby and also preserved during a power failure. The restrictive state is “unset”.
- (3) Flags, which are transmitted to the standby but not preserved during power failure. The restrictive state is “unset”.
- (4) Point keying bits, which are transmitted to the standby and also preserved during power failure. The restrictive state is “set”.

The flag identity file must be ordered in the manner described in section 5.3, in order to take advantage of these facilities.

3.8 STARTUP STATES

Apart from those items that are updated from the master computer unit or preserved during power failure, on startup or changeover the memory is initialised as for a mode 1 startup. However, there is no requirement for the technician to enable the equipment before it will operate fully. Data elsewhere in RII allows a timeout after