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## **SPECIFICATION ScR3**

# **MESSAGE HANDLING AND DATA TRANSMISSION FOR TRAIN DESCRIBERS**

**9th April 1996**

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## REVISIONS

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1	Transferral of typescript version of ScR3 specification (ref. SCR3/8/92) to a Word 6 document.	9th April 1996

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## 1. GENERAL

- 1.1 The specification describes the method to be used to link a Train Descriptor to a Driver Only Operation, TRUST, Passenger Train Information or similar system.

## 2. INTERFACE

- 2.1 The interface shall conform to CCITT recommendation V24/28 and EIA specification RS232.
- 2.2 Asynchronous data transmission shall be used at a baud rate of 1200 bits per second.
- 2.3 The data link is full duplex (4 wire).
- 2.4 The data link is intended to transfer data from the train descriptor and is primarily a single direction link apart from the acknowledge characters.

## 3. PROTOCOL

- 3.1 The protocol uses an eleven bit character made up of:-  
One start bit  
Eight data bits  
One parity bit  
One stop bit
- 3.2 The Block check character (BCC) shall be calculated by forming the Modulo 2 summation of all characters excluding STX. An example is given in Appendix A.
- 3.3 The characters ACK, NAK, STX, ETX and DLE will be used as defined below except when they follow directly on ETX when they will be assumed to be the BCC or, if they follow DLE, when they will be assumed to be a data character.
- 3.3.1 STX will have a hexadecimal code 02 will be used to denote the start of a message.
- 3.3.2 DLE will have a hexadecimal code 10 and will be used to denote that the next character is a data character and not a control character. Note when two successive DLE characters are received, the second is regarded as data.
- 3.3.3 ETX will have a hexadecimal code 03 and will be used to denote the end of a message. The next character is assumed to be the BCC.

- 3.3.4 ACK will have a hexadecimal code 06 and will be sent by the receiver to the transmitter to denote a complete message, with correct parity and BCC, has been received.
- 3.3.5 NAK will have a hexadecimal code 15 and will be sent by the receiver to the transmitter to denote a complete message has been received, but with either one or more parity errors or a BCC error.
- 3.4 A message will consist of a variable block of characters commencing with a STX and terminated with an ETX followed by a BCC.
- 3.5 Any message shall be variable in length, but shall not exceed 132 characters.
- 3.6 Each berth will be given a unique internal reference number (IRN) normally within the range 0 - 1000. This will be converted to two 8-bit binary bytes with the MSB becoming the Page Number starting from hexadecimal 00 upwards. A look up table of Berth Names against Berth IRN's will be required for each train describer.

### 3.7 Message Formats

Four types of message format are available:-

- Base Scan
- Change of State Scan
- Time Request
- Time Reply

#### 3.7.1 Base Scan Format

STX	Start of message.
Base Scan Marker & Page Number	1 byte with Bit 7 = 0 (Base Scan Marker) and the remaining 7 bits denoting the Page Number of the berth IRN.
Berth IRN	1 byte denoting the LSB of the berth IRN.
Berth Data	3 bytes denoting the TD packed as 4 x 6 bits (see Appendix B).
Berth IRN	Next Berth IRN if within same page.
Berth Data	1 byte denoting the LSB of the berth IRN.
ETX	End of message.
BCC	Block Check Character.

### 3.7.2 Change of State Scan Format

STX	Start of message.
Change of state Marker & Page Number	1 byte with Bit 7 = 0 (Base Scan Marker) and the remaining 7 bits denoting the Page Number of the berth IRN.
Berth IRN	As per Base Scan.
Berth Data	As per Base Scan.
Berth IRN	As per Base Scan.
Berth Data	As per Base Scan.
ETX	End of message.
BCC	Block Check Character.

### 3.7.3 Time Request Format

STX  
Time Request - hexadecimal code FF  
ETX  
BCC

### 3.7.4 Time Reply Format

STX  
Hours - 1 byte  
Minutes - 1 byte  
Seconds - 1 byte  
ETX  
BCC

### 3.8 Message Sequence

On start up the TD will send a Time Request until an ACK followed by a Time Reply is received. If no ACK is received after three attempts then a Time Request is sent at 10 second intervals with three attempts made each time.

Once an ACK and a Time Reply is received then the Base Scan is transmitted followed by the normal Change of State Scan.

The Base Scan itself consists of only the data for all the berths occupied within the train describer, the remaining berths are assumed to be empty. The first message in the scan will use the Base Scan Format and subsequent messages in the scan use the Change of State Scan format. The Base Scan marker bit is used to signal the receiver to clear all berths ready for a total update of data.

After the Base Scan is completed the Change of State Scan will consist of all berth data changes and, if empty, the hexadecimal code 20 will be used for each of the four spaces.

Each message will only contain berth IRN's within the same page number.

If the message is incomplete or corrupted at the receiver then no response will be made.

If the transmitter receives a NAK or no response (after a time delay) then the last message will be sent again. One message will be sent three times before the link is declared faulty. The time delay for no response will be 2000ms from the time of transmission of the BCC.

If the link is declared faulty the sequence will return to start up conditions.

If the TD receives a Time Reply message it will respond with an ACK followed by the Base Scan transmission.

### 3.9 Time Set

Arrangements will be made to reset the TD real time clock on receipt of the Time Reply message once every 24 hours. This will normally be at 04:00 hours and should be software selectable for each link as to whether it does or does not reset.

## APPENDIX A.

Example showing calculation of BCC

Character	Data Bits								Parity Bit
	LSB							MSB	
	0	1	2	3	4	5	6	7	
STX	0	1	0	0	0	0	0	0	1
Page No	0	0	0	0	0	0	0	1	1
Berth IRN	0	1	1	1	1	0	0	0	0
Data 1	1	0	0	0	0	0	1	0	0
Data 2	0	0	0	0	1	0	0	0	1
Data 3	0	0	1	0	0	0	0	0	1
ETX	1	1	0	0	0	0	0	0	0
BCC	0	0	0	1	0	0	1	1	0

Each data bit of the BCC shall be calculated to give an even number of ones in that column of the message.

In practice each byte is exclusive-or'd with the next up to and including ETX.

The BCC parity bit is the BCC character parity.

## APPENDIX B.

The four characters of the train description will be packed into three bytes.

Each alpha-numeric character is represented by the 6 least significant bits of their ASCII code.

Example - Berth G278 with an IRN of 533 containing a TD description of 1S27 is transmitted as a Change of State Scan.

<u>Marker &amp; Page No.</u>	<u>Berth IRN</u>	<u>Berth Data Bytes</u>		
10000010	00010101	11000101	00111100	10110111
<	<b>533</b>	>	< <b>1</b> >< <b>S</b> >< <b>2</b> >< <b>7</b> >	

Note: Bit 7 of the Marker & Page No. byte is set to 1 to indicate a Change of State message.