



---

# External Interface Unit (EIU) Specification TS/005/BCV A2

## Infraco BCV Limited

# Instruction Manual (IM)

1.1	14-Mar-02	Update after ransmittal No. 84 15/02/2002	DC	FK	FK
1.0	10-DEC-01	Formal release - after Transmittal No. 38 : 07/12/200	DC	FK	FK
0.1	22-NOV-01	Pre-release - issue for approval	DC	FK	FK
<b>REV.</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>BY</b>	<b>CHK.</b>	<b>AUTH.</b>

Copyright © 2001-2 Tactical Controls Limited

This document contains proprietary information which is protected by copyright. All rights reserved. This document or parts thereof may not be reproduced in any form without written permission of the publishers.

The information in this document is subject to change without notice and should not be construed as a commitment by Tactical Controls Limited. Tactical Controls Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this material.

**Contents**

- 1. Introduction .....3
- 2. Block diagram .....3
- 3. Description .....3
- 4. Inputs .....4
- 5. Outputs .....4
- 6. Indicators .....5
- 7. Power supply .....6
- 8. Signal processing .....6
- 9. Installation .....7
- 10. Test and diagnostic .....8
- 11. System layout diagram .....9
- 12. Technical Specification .....10
- 13. Ordering information .....12
- 14. Supplier information .....12

## 1. Introduction

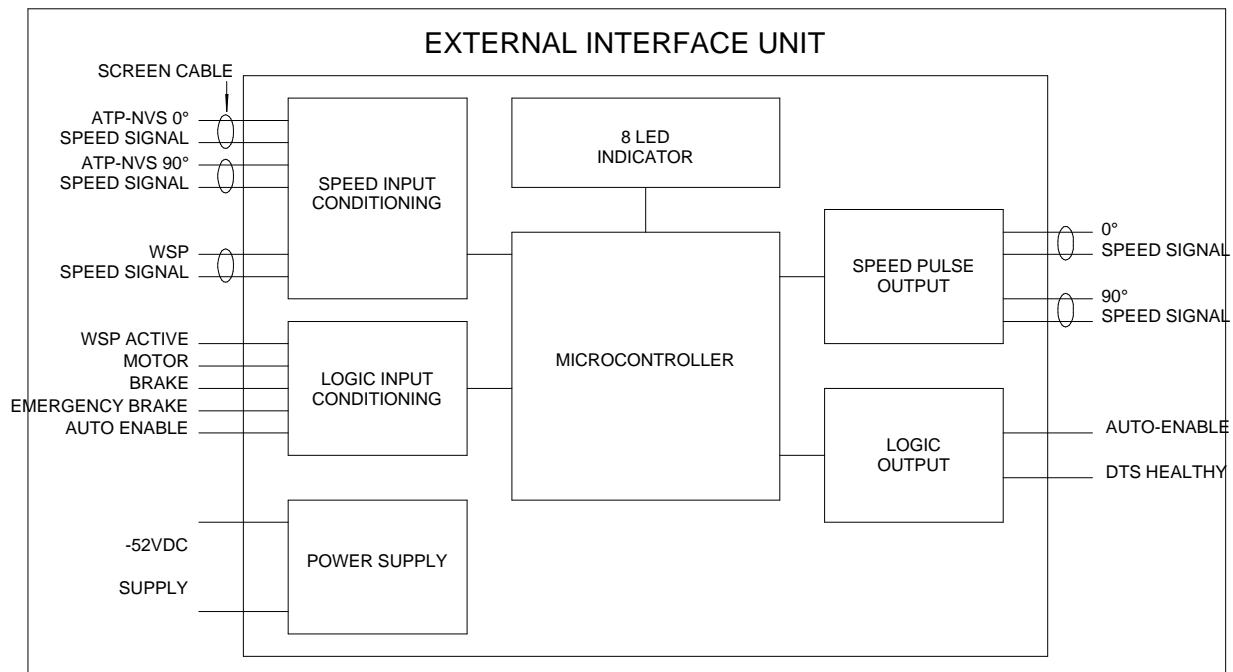
This instruction manual describes a microcontroller-based External Internal Unit (EIU) for Automatic Train Operation (ATO) Hardware Modification with application to 1992 Tube Stock - Performance Improvement Initiatives.

This design is based on the External Interface Unit Specification TS/005/BCV A2, from Infracore BCV Limited.

This EIU is designed to interface with the Automatic Train Protection non vital system (ATP-NVS or just ATP) and Wheelslide Protection (WSP) to provide more accurate speed information to the ATO.

The unit has environmental protection to IP65 and is made from aluminium sheet with Alocrom finish.

## 2. Block diagram



## 3. Description

At the heart of the system is the microcontroller which reads the speed signal from the ATP and WSP, and also the associated control logics.

All the signals are transient protected, hardware filtered and buffered before it is connected to the microcontroller inputs.

The operator interface of the EIU consists of: 8 Light Emitting Diode (LED) indicators.

The supply of the unit is derived from -52Vdc and is filtered and step-down via a switch-mode power supply to give a stable 5.0Vdc to the microcontroller.

The connections to the EIU are made via a 37 way bayonet connector.

## 4. Inputs

### Speed pulses

There are 2 sources of input speed pulses; one from the ATP, the other from the WSP.

All the speed pulses are of open collector transistor outputs with:

Logic 0: transistor ON; output LOW; 0.4Vdc at 16mA max.

Logic 1: transistor OFF; output HIGH; 30Vdc max.

The signal is a square waves of 194.286 pulses per wheel revolution.

For the ATP, two sets of signal with 90° phase shift between them are used to show direction.

For the WSP, there is only one set of signal hence no direction information is provided.

### Logics

There are five input logic signals:

WSP -52Vdc if WSP is active and 0Vdc if not.

Motor -52Vdc if motoring is demanded and 0Vdc if not.

Brake -52Vdc if service braking is demanded and 0Vdc if not.

Emergency brake -52Vdc if emergency brake is released and 0Vdc if not.

Auto Enable 0Vdc if enabled, +24Vdc if disabled.

## 5. Outputs

### Speed pulses

There is one set of output speed signal to the ATO. The characteristic is the same as the speed signal from the ATP.

All the speed pulses are of open collector transistor outputs with:

Logic 0: transistor ON; output LOW; 0.4Vdc at 16mA max.

Logic 1: transistor OFF; output HIGH; 30Vdc max.

ATO 0° phase speed signal

ATO 90° phase speed signal

### Logics

There is one output logic signal to the ATO. The characteristic is the same as the AutoEnable logic from the ATP, i.e. 0Vdc if enabled, +24Vdc if disabled.

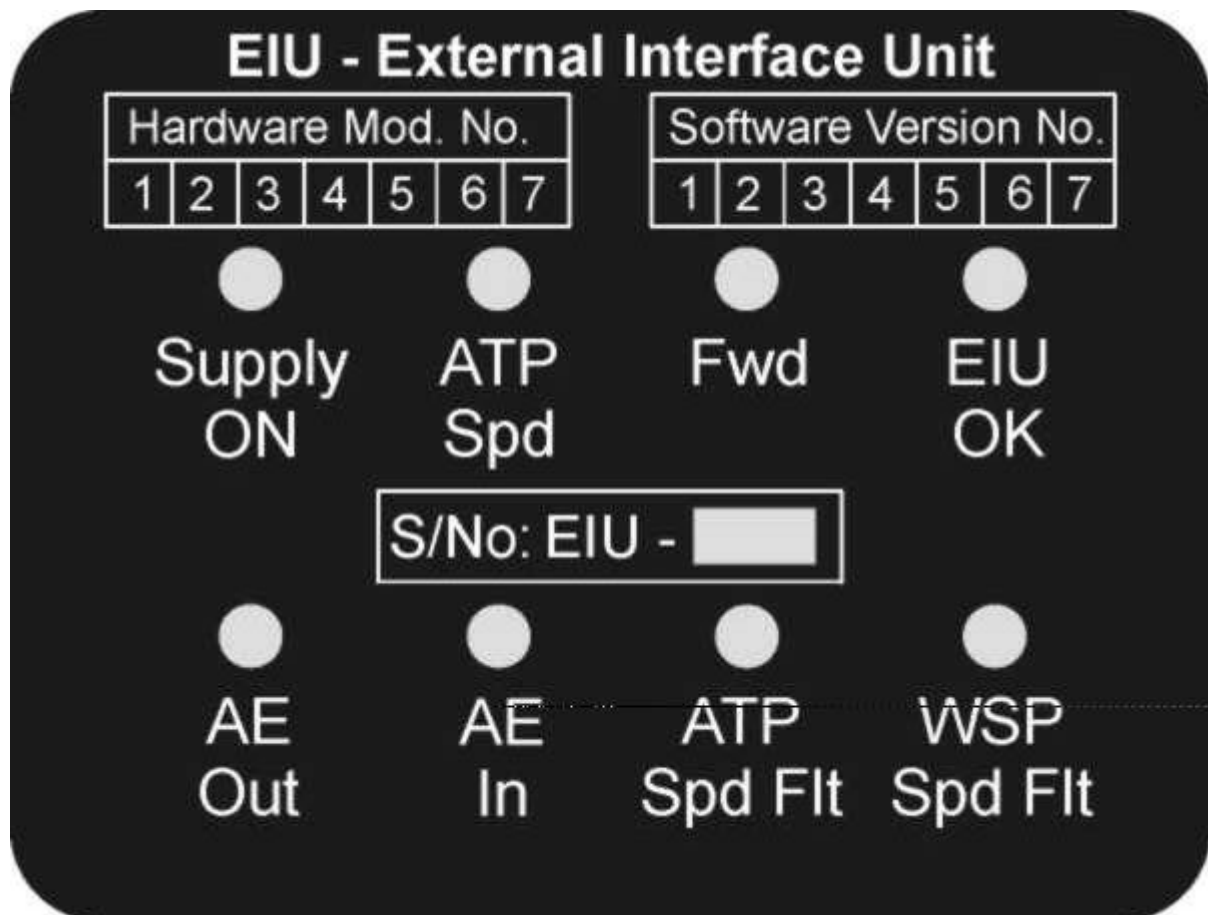
There is one output logic signal to the Data Transmission System (DTS) for fault logging. This logic signal is -52Vdc if EIU is healthy, 0Vdc if not.

## 6. Indicators

There are 8 indicators as shown on the EIU label below:

1. Supply ON - Green, On if power is healthy in the EIU.
2. ATP Spd - Green, On when ATP speed signal is being sent to the ATO; Off if WSP is used.
3. Fwd - Green, On if Forward direction is detected; Off if backward.
4. EIU OK - Green, On if EIU is working normally; Off if fault is detected.
5. AE Out - Green, On if AutoEnable signal is output to ATO; Off if not.
6. AE In - Green, On if AutoEnable signal is present from the ATP, Off if not.
7. ATP Spd Flt - Red, On if ATP speed fault is detected, Off if not.
8. WSP Spd Flt - Red, On if WSP speed fault is detected, Off if not.

### EIU Label



## **7. Power supply**

The EIU is powered by the Train's control supply which is nominally -52Vdc with the positive pole earthed. The design can accommodate a ripple of up to 5V peak to peak, at a nominal frequency of 850Hz and associated harmonics. EIU's supply input is designed to withstand the RIA12 Surge and Transient tests.

## **8. Signal processing**

### **Coasting**

The EIU uses the speed signal from the ATP.

### **Motoring**

Provided both the ATP and WSP speed signals are greater than zero, the EIU uses the speed signal from the WSP if the ATP speed signal is 10% greater than the WSP speed signal, otherwise the ATP speed signal is used.

Motoring has the lowest priority.

### **Braking**

With WSP active logic OFF, the EIU uses the speed signal from the WSP if the ATP is less than 90% of the WSP, otherwise the ATP speed signal is used.

With WSP active logic ON, the EIU uses the speed signal from the WSP if the ATP is less than 95% of the WSP, otherwise the ATP speed signal is used.

WSP active logic signal is latched by the EIU and only cleared when WSP is less than 10kph.

There is a speed threshold of 10kph, below which ATP is always used.

Braking has lower priority than Emergency braking

### **Emergency braking**

With WSP active logic OFF, the EIU uses the speed signal from the WSP if the ATP is less than 90% of the WSP, otherwise the ATP speed signal is used.

With WSP active logic ON, the EIU uses the speed signal from the WSP if the ATP is less than 95% of the WSP, otherwise the ATP speed signal is used.

WSP active logic signal is latched by the EIU and only cleared when WSP is less than 10kph.

There is a speed threshold of 10kph, below which ATP is always used.

Emergency braking has the highest priority.

**Speed fault**

If ATP is greater than 10kph and WSP is zero for more than 1 second, WSP speed fault is activated. The fault is cleared when WSP speed signal is detected again.

If WSP is greater than 10kph and ATP is zero for more than 1 second, ATP speed fault is activated. The fault is cleared when ATP speed signal is detected again.

This requirement shall not apply for the first 5 seconds of the Motor actuate signal nor once the train's speed has fallen below 10kph.

Any speed fault will cause the EIU OK LED to go out and the DTS healthy signal to change from -52V to 0V.

**Auto enable**

When the train is stationary, the EIU will output the Auto enable signal to the ATO if there is supply to the EIU and the Auto enable from the ATP is present.

When the train is moving, the EIU will not output the Auto enable signal to the ATO if there is an ATP speed fault.

**Auto enable fault**

If the AutoEnable output is detected without the AutoEnable input, the EIU will switch to Bypass mode where the speed signal from the ATP will go directly to ATO and the AutoEnable signal from the ATP will also go directly to the ATO. This fault is indicated by the EIU OK LED going out and the DTS healthy signal switching from -52V to 0V.

This fault can only be cleared by powering OFF the EIU once the fault condition is removed.

**9. Installation**

Installation of the EIU on the train is by means for 4 x M5 bolts through 4 slots on the base of the EIU unit. Please see System Layout Diagram for detail.

The EIU is supplied with a single 37 way bayonet connector fixed on the front of the unit. All electrical connections are made via this connector.

**Connector pin designation**

<b>EIU Pin connections table.</b>			
<b>Wire No.</b>	<b>Pin No.</b>	<b>Destination</b>	<b>Description</b>
A	13T	ATO PIN P	Auto Enable
B	20T	ATO PIN X	ATO Tacho 1
C	-	-	-
D	-	-	-
E	24T	ATO PIN s	ATO 0VE SCB
F	22T	ATO PIN Z	ATO Tacho 2
G	21T	ATO PIN k	ATO Tacho 1 0VE
H	-	-	-
J	-	-	-
K	13P	ATP PIN P	Auto Enable In
L	22P	ATP PIN Z	ATP Tacho 2
M	23T	ATO PIN m	ATO Tacho 2 0VE
N	X115	TB100	-
P	-	-	-
R	DT226A	TB100	DTS Monitor
S	24P	ATP PIN s	ATP 0VE SCB
T	20P	ATP PIN x	ATP Tacho 1
U	23P	ATP PIN m	ATP Tacho 2 0VE
V	-	-	-
W	-	-	-
X	-	-	-
Z	A0226A	TB77	-52 V Supply
a	LA1-BL	TB100	WSP Speed Output +
b	21P	ATP PIN k	ATP Tacho 1 0VE
c	-	-	-
d	X116	TB100	-
e	-	-	-
f	RW111C	TB100	0 V Return
g	LA1-BN	TB100	WSP Speed Output -
h	-	-	-
i	-	-	-
k	TB201S	TB78	Brake Actuate
m	TB201F	TB77	Em. Brake Status
n	-	-	-
p	-	-	-
r	TB201U	TB77	Traction Demand
s	LA1	TB100	WSP Active

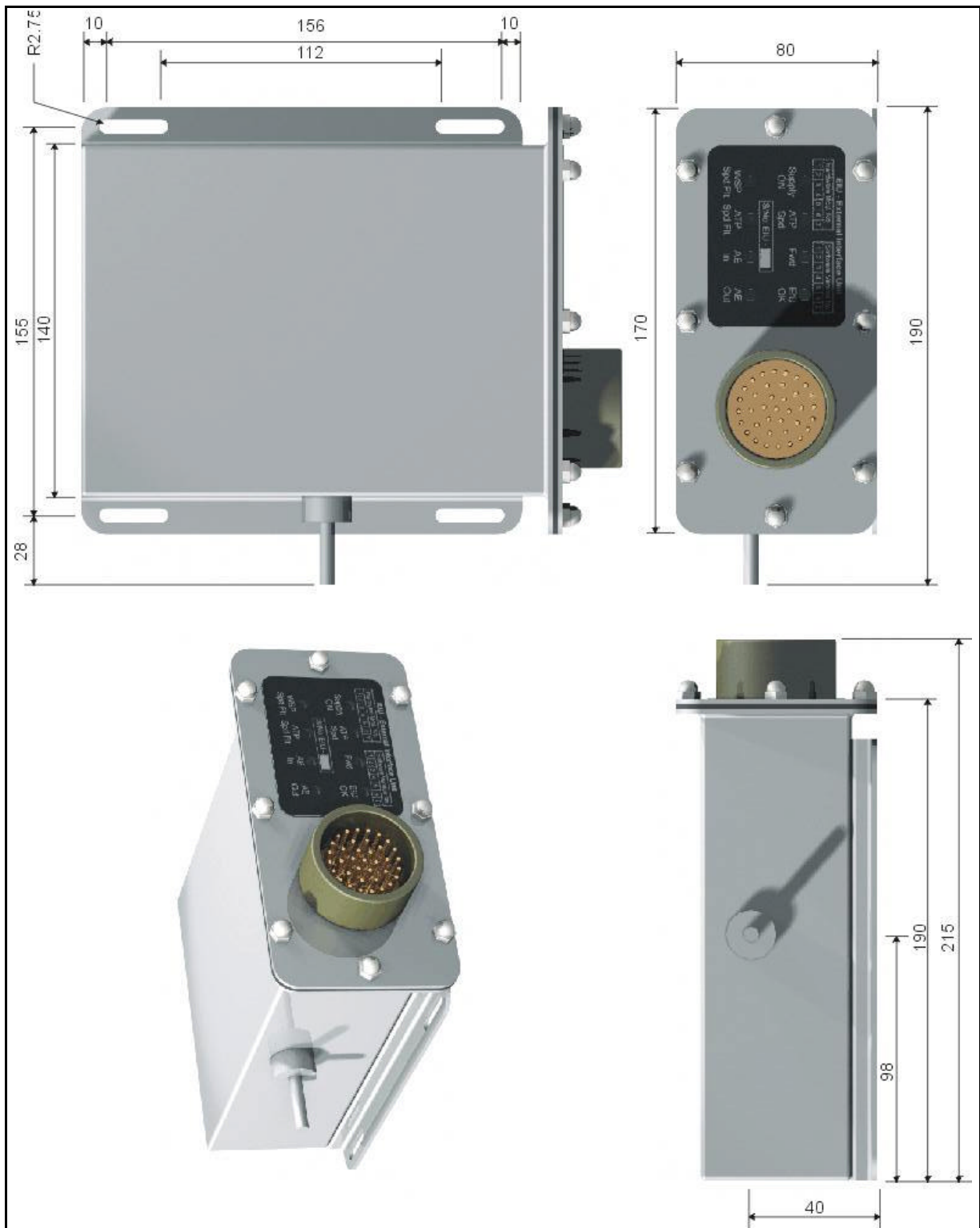
**10. Test and diagnostic**

The EIU can be monitored on the train using the EIU Train Test Box EIU-TTB. Please refer to EIU-TTB Instruction Manual for test and fault diagnostic procedure.

The EIU can be tested on the bench using the EIU Bench Test Box EIU-BTB. Please refer to the EIU-BTB Instruction Manual for test and fault diagnostic procedure.

**Warning: No user serviceable part inside the EIU. Opening the EIU can cause damage to the sealing gasket. This could void any warranty on the unit.**

### 11. System layout diagram



## 12. Technical Specification

### SUPPLY

<b>Voltage</b>	-32 to -63 Vdc; -52 Vdc nominal.
<b>Ripple</b>	Unaffected by 5 volt peak to peak.
<b>Input protection</b>	Reverse polarity protection. Surges and transients to BRB/RIA 12.
<b>Current consumption</b>	50mAdc maximum at -52Vdc

### INPUTS

<b>Speed pulses</b>	ATP-NVS - open collector outputs Logic 0: collector ON; output LOW; 0.4Vdc at 16mA max. Logic 1: collector OFF; output HIGH; 30Vdc max. square waves of 194.286 pulses per wheel revolution with an average wheel diameter of 0.675m. Two sets of signal with 90° phase shift to show direction. WSP same as ATP-NVS with 1 set of signal without phase shift.
<b>Logics</b>	WSP -52Vdc if WSP is active and 0Vdc if not. Motor -52Vdc if motoring is demanded and 0Vdc if not. Brake -52Vdc if service braking is demanded and 0Vdc if not. Emergency brake -52Vdc if emergency brake is released and 0Vdc if not. Auto Enable open collector enabled if condition is satisfied and disabled if not; i.e. 0Vdc auto enabled, +24Vdc auto disabled.

### OUTPUTS

<b>Speed pulses</b>	To ATO - transistor outputs Logic 0: transistor ON; output LOW; 0.4Vdc at 16mA max. Logic 1: transistor OFF; output HIGH; 30Vdc max. square waves of 194.286 pulses per wheel revolution. Two sets of signal with 90° phase shift to show direction.
<b>Logic</b>	Auto Enable transistor enabled if normal and disabled if not; 0Vdc if auto enabled, +24Vdc if auto disabled.  DTS -52Vdc if EIU is healthy and 0Vdc if not.

### INDICATORS

<b>LED</b>	Supply ON - Green ATP Spd - Green Fwd - Green EIU OK - Green AE Out - Green AE In - Green ATP Spd Flt - Red WSP Spd Flt - Red
------------	--

**ELECTRICAL INTERFACE**

**EIU** Litton/ABB bayonet type, 37 way rear panel mounted, male connector with pin contacts for the connection to the cable harness.  
Part no. ABCIRH-03T-28-21-PCW-F80-V0  
Mating Part no. ABB-H-08FM-28-21SCW-F80-P3

**ENVIRONMENT**

**Operating temperature** -15°C to +55°C.  
**Storage temperature** -30° to +85°C.  
**Relative humidity** 0 to 90%.  
**IP rating** IP65.

**MECHANICAL**

**Dimensions** 190 x 80 x 215 mm maximum.  
**Weight** 1.5Kg maximum.  
**Housing** Material: aluminium sheet, alocrom finish.

**STANDARDS** The EIU is designed to the following standards:

<b>BRB/LUL/RIA No.13: 1990</b>	General specification for electronic equipment
<b>BRB/LUL/RIA No.12:1984</b>	Surge and Transients testings
<b>BRB/LUL/RIA No.18:1990</b>	Interference testings
<b>BRB/LUL/RIA No.20:1988</b>	Vibration and shock testings.

Rolling stock electronic equipment specification G6621  
Rolling stock electrical supplies G6381

Electromagnetic compatibility - Rolling Stock Apparatus prEN50121-3-2  
BS EN 61373 (1999) Railway Applications - Rolling Stock equipment - Shock & Vibration Tests, Category 1A

**TEST EQUIPMENT**

**On Bench** Bench Test Box (EIU-BTB).  
**On Train** Train Test Box (EIU-TTB).

**Please refer to the relevant instruction manual for test and fault diagnostic procedure.**

### **13. Ordering information**

Ordering code: EIU

You are welcome to order the unit by code or by description - EIU External Interface Unit.

### **14. Supplier information**

**Tactical Controls Limited**  
Unit 4 Parkland Business Centre  
Chartwell Road, Lancing  
West Sussex BN15 8UE England  
Tel: (01903) 750800  
Fax: (01903) 750678  
Email@TacticalControls.co.uk