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Level 3

Advanced SSI Go/No-Go Tester Specification

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Issue record

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1	26/08/2008	First issue

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 1 December 2008.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 4 to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Stage 4 was reached and not to comply with requirements contained herein, unless the designated Standard Owner has stipulated otherwise in the accompanying Briefing Note.

Reference documentation

UK Legislation

HSW Act: Health and Safety at Work etc. Act 1974

The Electricity at Work Regulations 1989

The Control of Substances Hazardous to Health Regulations (COSHH) 1999

The Manual Handling Operations Regulations 1992

British and European Standards

BS EN ISO 9001:2000	Quality Management Systems, Requirements
BS EN 61010-1:2001	Safety requirements for electrical equipment for measurement, control, and laboratory use
BS EN 61508-1:2002	Functional safety of electrical / electronic / programmable electronic safety-related systems
BS 5499-1:2002	Graphical symbols and signs. Safety signs, including fire safety signs. Specification for geometric shapes, colours and layout
BS 3858:1992	Specification for binding and identification sleeves for use on electrical cables and wires
BS EN 50121-1:2006	Railway Applications. Electromagnetic Compatibility, General
BS EN 50121-4:2006	Railway Applications – Electromagnetic Compatibility: Emission and immunity of the signalling and telecommunications apparatus
BS EN 50125-3:2003 Railway Applications	Environmental conditions for equipment, Signalling and Telecommunications
BS EN 50128:2001	Railway Applications. Communications, signalling and processing systems, Software for railway control and

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BS EN 50129:2003 Railway Applications. Communications, signalling and processing systems, Safety related electronic systems for signalling

[NR/CS/ACC/029](#) Product Acceptance

Company Standards

[NR/L3/SIG/11231](#) Signalling Maintenance Testing Handbook

[NR/L2/SIG/10071](#) Acceptance of Signalling Equipment

British Rail Specifications

BR1900 General Specification for Solid State Interlocking Equipment, June 1983

BR1901A Solid State Interlocking Lineside Points Module (MkII), Provisional Issue: April 1986

BR1901B Solid State Interlocking Lineside Points Module (MkIII), Provisional Issue

BR1902A Solid State Interlocking Lineside Signal Module (MkII), Provisional Issue: April 1986

BR1902B Solid State Interlocking Lineside Signal Module (MkIII), Provisional Issue

BR1904A Solid State Interlocking Data Link Module Mark III, Issue C: August 1989

BR1906 Solid State Interlocking Long Distance Terminal, September 1989

BR1926 Solid State Interlocking Trackside Functional Module Tester

Other Documents

Network Rail Invitation to Tender TSERV554 01/09/03 *SSI Go-No-Go Tester*

WS1901B Engineering Specification SSI Points Module MkIIIA, WRSL

WS1902B Engineering Specification SSI Signal Module MkIIIA, WRSL

WS1904B Engineering Specification SSI Data Link Module MkIIIA, WRSL

AL1902C Engineering Specification SSI Signal Module MkIV, ATIS

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1 Purpose

This document is the Network Rail Specification for a second-generation SSI (Solid State Interlocking) Go/No-Go Tester hereinafter referred to as the Advanced SSI Go/No-Go Tester.

1.1 Aim

This Specification identifies the detailed functionality of the Advanced SSI Go/No-Go Tester. It has been written in such manner that it can also form the basis of a test specification for the prototype and production versions of any tester built subsequently.

2 Scope

This Specification states the requirements for the design, manufacture, and testing of the Advanced SSI Go/No-Go Tester, together with the preparation and supply of associated documentation and manuals. Part-replacements of manufactured Advanced SSI Go/No-Go Tester units must also comply with the requirements of this Specification.

3 Definitions

Terms	
British Railways Specification	A standard published by the former British Railways Board at a time when the Director of S&T Engineering, BRB, had responsibility for technical standards applicable to railway signalling equipment.
British Standard	A standard published by the British Standards Institution. Its identity is prefixed by BS.
Contractor	Unless otherwise qualified, this refers to the organisation responsible for the design, assembly, and delivery to the end-user of the Advanced SSI Go/No-Go Tester equipment.
Equipment	All constituent parts and accessories of the Advanced SSI Go/No-Go Tester.
European Standard	A standard published by the European Committee for Standardisation, or by the European Committee for Electrotechnical Standardisation. Its identity is prefixed by EN.
International Standard	A standard published by the International Electrotechnical Commission. Its identity is prefixed by IEC.
Network Rail Company Standard	A standard, forming a Specification, Procedure, or Code of Practice, published by a Directorate of Network Rail.
Railway Group Standard	A high-level standard published by the Rail Safety and Standards Board. Its identity is prefixed by G, followed by a letter designating the subject category.
Signalling Control	The signalling centre equipped with the SSI system that

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Centre	requires testing by the Advanced SSI Go/No-Go Tester.
System	The System referred to in this Specification is the Advanced SSI Go/No-go Tester except where specifically stated otherwise.
Abbreviations	
ATIS	ALSTOM Transport Information Solutions
BRB	British Railways Board
CE	Committée European
CD-ROM	Compact Disc-Read Only Memory
COTS	Commercial Off-The-Shelf
DLM	Data Link Module
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test (in the context of this document, this means the SSI module being tested by the Advanced SSI Go/No-Go Tester)
GUI	Graphical User Interface
LDT	Long Distance Terminal
MTTR	Mean Time To Repair
O/C	Open Circuit
PC	Personal Computer
PM	Points Module
PRBS	Pseudo-Random Binary Sequence
RCM	Remote Condition Monitoring
RSSB	Rail Safety and Standards Board
Rx	Receiver
S&T	Signalling and Telecommunications
SCC	Signalling Control Centre
SIL	Safety Integrity Level
SM	Signal Module
SSI	Solid State Interlocking
Tx	Transmitter
TFM	Trackside Functional Module
WRSL	Westinghouse Rail Systems Limited

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4 Background

4.1

The SSI Go/No-Go tester units currently in service in the UK are based on BR1926, which specifies certain basic tests for MkII Signal Modules (SM) and Points Modules (PM) only. The tests that these units carry out are not documented, and it is considered that the testers do not test all aspects of module operation, particularly regarding MkIII modules and later; in consequence, some modules have entered service after passing a Go/No-Go test, only to fail shortly afterwards. Additionally, incompatibilities may exist between some existing Go/No-Go testers and TFMs such that suitable testing cannot always be completed and/or damage occurs.

4.2

The Advanced SSI Go/No-Go Tester, which is the subject of this specification, is intended to be a more sophisticated test facility than a basic tester. It can test more aspects of SM and PM operation, and in addition can test Mk III Data Link Modules (DLM) and Mk I Long Distance Terminals (LDT).

4.3

The Advanced SSI Go/No-Go Tester will perform a wide range of tests that can be undertaken from the external connector of the relevant module (i.e. without breaking the seal and gaining access to the interior of the unit). The Advanced SSI Go/No-Go Tester will also produce records of the testing carried out.

5 Conventions

Binary, decimal and hexadecimal numbers

Where there is possible doubt about whether a number is being expressed in binary, decimal or hexadecimal form, a subscript suffix "2", "10" or "16" is used to indicate these three forms respectively. For example:

101010₂ (binary)

42₁₀ (decimal)

2A₁₆ (hexadecimal)

6 General Requirements

6.1 Safety, Legislation, Regulations, and Recommendations

6.1.1

At all times, the Advanced SSI Go/No-Go Tester shall be safe. All appropriate measures shall be taken to ensure the safety of persons concerned in its construction, operation, maintenance, repair, and eventual disposal. All equipment necessary for the safe and satisfactory operation, control and protection of the Advanced SSI Go/No-Go Tester shall be chosen appropriately.

6.1.2

The Advanced SSI Go/No-Go Tester shall be adequately provided with facilities for earthing, insulating, screening and enclosing. Safe and appropriate access shall be provided for the operator, and for any necessary maintenance procedures.

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6.1.3

The Advanced SSI Go/No-Go Tester shall comply with the requirements of all relevant Statutory Instruments, Regulations and Orders, and take cognisance of relevant documents, including, but not limited to:

- a) The Health and Safety at Work etc. Act 1974;
- b) The Electricity at Work Regulations 1989;
- c) The low voltage directive 73/23/EEC (amended by CE marking Directive 93/68/EEC) specifically: checks in accordance with (but not limited to) BS EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use.
- d) Electromagnetic Compatibility (EMC) Directive
- e) The Control of Substances Hazardous to Health Regulations (COSHH) 1999;
- f) The Manual Handling Operations Regulations 1992;
- g) The Waste Electrical & Electronic Equipment Regulations (WEEE) 2006;
- h) The Restriction of the Use of Certain Hazardous Substances in Electrical & Electronic Equipment Regulations (RoHS) 2006.

This information is not necessarily exhaustive and does not modify the legal obligations of the contractor.

6.1.4

The contractor shall provide recommendations for training for all aspects associated with the operation and maintenance of the System.

6.1.5

For all materials used in the construction of the Advanced SSI Go/No-Go Tester, which are considered as falling within the scope of the COSHH Regulations 1999, the contractor shall provide a risk assessment report for these materials for the life of the equipment and its eventual disposal. Materials containing asbestos, chlorinated fluorocarbons (CFCs), and polychlorinated biphenyls (PCBs) shall not be used.

6.2 Design, Manufacture and Workmanship

6.2.1

The Advanced SSI Go/No-Go Tester shall be designed and manufactured in accordance with best available techniques not entailing excessive cost, and taking cognisance of the environment in which it will operate. Refer to referenced standards for quality control procedures etc.

6.2.2

All equipment shall be new, of current manufacture, and shall not have seen prior service except as required during testing, and be of the quality and type most suitable for working under the conditions specified for the service life of the Advanced SSI Go/No-Go Tester.

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6.2.3

The contractor shall provide a product safety case statement for equipment with novel or innovative features not previously accepted for use within the railway environment. The product safety case statement shall quantify any risks and indicate how these risks are controlled.

6.2.4

The operation of the System shall not be affected by the occurrence of any particular time or date.

6.2.5

The System shall comply with the requirements of relevant Network Rail, British and European Standards, and UK Statutory Instruments, Regulations and Orders (see previous listings).

6.3 Spares and Consumables

6.3.1

The contractor shall make recommendations for holdings of spare parts and consumable items, based on estimated replacement rates and delivery periods, to ensure that the Advanced SSI Go/No-Go Tester complies with the requirements of this Product Specification throughout its service life.

6.3.2

The contractor shall indicate, where possible, the extent of commonality with equipment previously developed or supplied to Network Rail. In particular, any consumable separately accepted for use on Network Rail infrastructure shall be identified by its PADS number in user documentation.

6.4 Documentation, Labels and Markings

6.4.1

The contractor shall prepare and supply Advanced SSI Go/No-Go Tester documentation, drawings, manuals and software code, in an agreed format. Documentation shall be as specified in Section 11.

6.4.2

Adequate safety and warning labels complying with BS 5499 shall be provided and shall be suitably secured to all relevant component parts for the service life of the Advanced SSI Go/No-Go Tester.

6.4.3

Where individual sub-units of the Advanced SSI Go/No-Go Tester cannot be lifted by one person in accordance with the Manual Handling Regulations, such units shall be clearly and indelibly marked with their gross weight in kilograms, centre of gravity, and handling and lifting points.

6.4.4

All labels and markings shall be in English.

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6.4.5

All individual components of the System, both software and hardware, that are not COTS items shall be uniquely identified and visibly marked with a name, part number and version (as appropriate). COTS items such as the PC and its standard hardware and operation system, shall be supplied to a minimum specification identified with a part number, with a managed supplier base.

6.5 Delivery

The sub-units that collectively comprise the Advanced SSI Go/No-Go Tester shall be suitably prepared to withstand without any damage or deterioration, handling, transit, storage and positioning.

7 Compliance With Standards

7.1 International, European and British Standards, and Reference Documents

7.1.1

All work associated with the Advanced SSI Go/No-Go Tester shall comply with all relevant parts of European Standards, whether reference is made to them or otherwise, within the text of this Specification.

7.1.2

In the absence of relevant European Standards, International or National Standards having currency within the European Community shall apply subject to the prior agreement of Network Rail.

7.2 Specific Equipment Standards

The Advanced SSI Go/No-Go Tester shall be designed, manufactured and tested in accordance with this Specification. Evidence shall be provided that such tests have been satisfactorily completed.

8 Mechanical, Electrical, and Performance Requirements

8.1 General

8.1.1

The Advanced SSI Go/No-Go Tester shall be fit for its intended purpose throughout its service life, when connected to components that could subsequently be used in the Network Rail Infrastructure.

8.1.2

The Advanced SSI Go/No-Go Tester scope of testing shall include a wide range of performance tests that can be carried out from the external connector of all SSI modules listed in 8.1.3 — that is, all possible tests that can be performed without breaking sealing devices and thereby gaining access to the interior of a unit.

8.1.3

The Advanced SSI Go/No-Go Tester shall be capable of testing SSI modules of the following functions, manufactures and marks:

- Signal Module (SM):
 - ~ ATIS or predecessor companies, marks II, 3 and 4;

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- ~ WRS� or predecessor companies, marks II, 3, IIIA;
- Points Module (PM):
 - ~ ATIS or predecessor companies, marks II and 3;
 - ~ WRS� or predecessor companies, marks II, 3, IIIA;
- Long Distance Terminal (LDT):
 - ~ ATIS or predecessor companies, mark I;
- Data Link Module (DLM):
 - ~ ATIS or predecessor companies, mark III;
 - ~ WRS� or predecessor companies, marks III and IIIA;

Within this range of modules, the Advanced SSI Go/No-Go Tester shall be capable of testing all models and modification states currently in service on the Network Rail Infrastructure, as supplied by either manufacturer:

- WRS�, and predecessor organisations;
- ATIS, and predecessor organisations;

Wherever practicable the System design shall provide for 'future proofing' such that the testing of new generations of backward compatible hardware can be tested on the tester by adding new tests or parameters (see also [Section 7](#)).

8.1.4

Control of the Advanced SSI Go/No-Go Tester shall be PC-based, and the user interface shall also be PC-based. During the testing process, the PC shall be controlled by a system program. After securing the module to be tested, and connecting it to the Advanced SSI Go/No-Go test equipment, it shall be necessary for the person performing the test to enter into the system, the details of the type, build and manufacture of the module to be tested. Subsequently, the execution of the necessary testing routines (from commencement through to the production of a final test report) shall be carried out automatically, with no human intervention normally necessary.

8.1.5

In addition to carrying out a single complete test on a module, an option shall be provided to carry out "soak testing". This shall be carried out by repeating the single test for a set period of time which shall be selectable. The number of "Passes" or "Failures" in this time shall be collated and presented as a result.

8.1.6

The System shall be capable of printing out test certificates for individual modules. This shall require the serial or identification number of the module entering into the computer prior to printing, together with the name of the operator. Details of the test date and time shall be included on the certificate.

8.1.7

Appropriate proprietary test equipment may be incorporated in the design of the Advanced SSI Go/No-Go Tester. Where such equipment is used within the System, full details of the operation, maintenance and calibration must be supplied. The

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equipment must be supported by either the original supplier or the contractor for at least ten years.

8.1.8

Custom-built modules may be incorporated in the design of the Advanced SSI Go/No-Go Tester as appropriate. Where custom-built modules are used, full details of the operation, maintenance and calibration must be supplied. The equipment must be supported by the contractor for at least ten years.

8.1.9

Where extra peripherals are added to the basic PC arrangements, the parts used shall be in easy supply from multiple sources. Where peripherals such as serial or digital output ports, extra memory or disk drives are added, which use variable address size, address type, or other parameters, they shall be capable of being set up either by the PC's basic set-up programmes, or via separate text files held on the PC and accessible by the operating programme. Thus, a simple failure of one small peripheral shall not necessitate a major change to the hardware or operating software.

8.2 Mechanical Requirements

8.2.1

The sub-units comprising the Advanced SSI Go/No-Go Tester shall be rack-mounted and contained within an enclosure. The method of support and enclosure shall use common standard practice for the mounting of S&T equipment. Ideally, a standard 19 inch cubicle shall be used for this purpose. To facilitate ease of mounting or ease of use by the operator, the control PC terminal and printer may be placed on a separate desk.

8.2.2

The construction of the supporting racking and enclosure shall conform to the requirements of the Health & Safety at Work Act 1974. It shall not contain any material that constitutes a health hazard.

8.2.3

The support racking and any enclosure shall be of robust construction. The materials used for the construction shall be corrosion-resistant, sufficient to last a minimum of 20 years in the expected environment.

8.2.4

The cubicle used to house the Advanced SSI Go/No-Go Tester (and, if provided, the operator's desk) shall be supported on castors, so that movement over short distances can be achieved without undue effort.

8.3 Electrical Requirements

8.3.1

The equipment shall be able to derive its power supply from both a 230 Va.c. 50 Hz 13 A domestic mains socket and a 110V a.c. 50Hz earth free supply. The total power taken by the System shall not be greater than 2 kVA.

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8.3.2

Only one power input shall be provided, which shall then split within the equipment to supply individual items. Power, as necessary, shall be distributed to the test equipment itself, the equipment under test, and any other power supplies or dummy load required by the testing operation.

8.3.3

Any devices used to derive appropriate voltages and currents from the mains supply to operate the test equipment, the EUT, and any dummy loads shall be deemed to be part of the equipment and supplied as part of the contract.

8.3.4

The equipment shall have provision for earthing, be insulated, and screened or enclosed as necessary, to ensure the protection of the equipment and safety of personnel, as outlined in the IEE Wiring Regulations, 16th edition.

8.3.5

Separate circuits, including power supplies, shall be electrically isolated from each other. Electrical insulation in excess of 4 MΩ measured at 250 Vd.c. shall exist between separate circuits.

8.4 Electromagnetic Compatibility

8.4.1

At all loads, the Total Harmonic Distortion measured on the input voltage terminals caused by the connection of the equipment, shall be less than 4%.

8.4.2

The equipment shall be immune to interference produced by all forms of electric traction in use on Network Rail.

8.4.3

The equipment shall be immune to interference produced by switching transients in signalling circuits in close proximity.

8.4.4

The equipment shall not interfere electrically or magnetically with any other equipment.

Compliance shall be demonstrated against EN 50121-4:2006 Railway Applications – Electromagnetic Compatibility: Emission and immunity of the signalling and telecommunications apparatus. Tests to demonstrate compliance shall be according to (but not limited to) the following standards:

- EN 61000-6-2:1999 Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments.
- EN 61000-4-2:1995 Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrostatic discharge immunity test. Basic EMC publication.

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- EN 61000-4-3:2002 Electromagnetic compatibility (EMC). Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test.
- EN 61000-4-4:1995 Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrical fast transient/burst immunity test. Basic EMC publication.
- EN 61000-4-5:1995 Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test.
- EN 61000-4-6:1996 Electromagnetic compatibility (EMC). Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields.
- EN 50081-2:1993 Electromagnetic Compatibility (EMC) – Generic Emission Standard – Part 2: Industrial Environment.
- ENV 50204:1996 Radiated electromagnetic field from digital radio telephones – immunity test.
- EN 61000-3-2:2001 Electromagnetic compatibility (EMC) Limits. Limits for harmonic current emissions (equipment input current up to and including 16 A per phase).
- EN 61000-4-11:1994 Electromagnetic compatibility (EMC). Testing and measurement techniques. Voltage dips, short interruptions and voltage variations immunity tests.

8.5 Cabling and Wiring

8.5.1

The interconnections between the sub-units comprising the Advanced SSI Go/No-Go Tester shall employ low-smoke, zero-halogen insulation materials.

8.5.2

Any cables shall be identified in compliance with BS 3858, shall be marked at both ends using appropriate means, and shall be appropriately identified on all relevant documentation and drawings.

8.6 Power Supplies and Protection

8.6.1

Adequate circuit breaker and fuse protection shall be provided in all parts of the Advanced SSI Go/No-Go Tester to mitigate the risks of damage or fire.

8.6.2

The System shall generate a controlled supply to the EUT that is both adjustable to the levels required in the testing and that remains within the necessary tolerances for those tests.

8.6.3

The System shall be equipped with isolation transformer(s) in the relevant parts of the circuitry such that the EUT shall be supplied using earth free supplies, as it would be on site, whatever power supply is connected.

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8.7 Software

8.7.1

The contractor shall adequately demonstrate that all necessary measures have been taken to ensure sufficient levels of the integrity of the software security. The software functions shall be developed in a manner appropriate to achieve Safety Integrity Level 0, as defined in BS EN 61508.

8.7.2

Where possible, the contractor shall make use of standard, commercially available software packages meeting the required Safety Integrity Level.

8.7.3

The step-by-step routine for each test shall be stored as a text file on the PC, and shall be accessed by the main operating programme.

8.7.4

Facilities shall be provided to edit or create new test routines. This functionality shall either be built into the operating programme, or it shall be possible to edit or create new routines externally using a word processor. A unique version number for each modified test routine shall be generated, and the user shall be able to apply a 25 character text name to it. There shall be a facility to store and manage modified test routines to permit recall and re-use as required. The process of editing or creating files shall be covered in detail in the System manual.

8.7.5

The System shall maintain a log on the computer hard disk, of any tests carried out, together with the results. This shall be in the form of a text delimited file, and shall include the following details:

- the module's stored identity (where appropriate);
- the module's diagnostic memory (where appropriate);
- details of the tests completed;
- dates and times of the tests;
- all hard "pass" or "fail" conditions;
- details of any analogue levels;
- operator's name;
- modified test name and version (where appropriate).

The facility to print a copy of the log data shall be provided. The printed log data and stored data shall incorporate the manually entered module identification as specified in 9.4.

8.7.6

The contractor shall make available to Network Rail, copies of all software developed in the course of system design. Network Rail shall have the right to copy this software for use internally and for use by other parties in connection with the operation and maintenance of the equipment.

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8.8 Environmental Conditions

The System shall be designed to operate satisfactorily under environmental conditions as described in BS EN 50125-3 for a heated building.

8.9 Maintainability

8.9.1

The Advanced SSI Go/No-Go Tester shall be designed for minimum routine maintenance requirements. Where routine maintenance activities are necessary, then the System design, together with the associated maintenance procedures, shall assure the safety of persons required to carry out any routine maintenance tasks.

8.9.2

The main sub-units comprising the Advanced SSI Go/No-Go Tester shall be safely and adequately maintainable as far as reasonably practicable.

8.9.3

The Advanced SSI Go/No-Go Tester shall not require routine maintenance or calibration to be performed at intervals of less than one year throughout its working life. The use of proprietary equipment, capable of being calibrated by its supplier or other test house, is desirable.

8.9.4

The Advanced SSI Go/No-Go Tester shall be constructed so that the MTTR shall be less than or equal to 4 hours.

8.9.5

The contractor shall provide Network Rail with recommendations for optimal preventive maintenance. The process of carrying out routine maintenance activities shall be covered in detail in the System manual.

8.10 Reliability and Availability

The System and operating procedures shall incorporate measures to ensure that performance does not degrade significantly within the period between calibration checks. Established methods by which this can be achieved are self-testing and/or testing with site-based standard equipment.

8.11 Interchangeability and Standardisation

As far as reasonably practicable, the Advanced SSI Go/No-Go Tester shall be of a standard product type. The design shall utilise sub-units and components that are supportable, through obsolescence management as necessary, for a minimum period of 15 years (see also Section 12).

8.12 Control Instrumentation and Alarms

Where self-testing is used to prove correct operation of the Advanced SSI Go/No-Go Tester, this shall occur on initialisation or as part of any testing completed. The control program shall stop further module testing, and suitably endorse testing results obtained since the self test was last carried out during that testing session, where a system problem is detected. The self-test that was failed shall be indicated

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and recorded. Resetting of the System shall be permitted except where an internal calibration fault has been detected.

Where standard equipment is used to determine continued operability, procedures, backed by system alarms, shall be put in place to enforce regular inter-calibration checks.

9 System Requirements

9.1 System Architecture

It is envisaged that the System will be formed from a number of subsystems remotely controlled by a master PC. Any such remote control interfaces shall be of an established standard such as RS485, GPIB, USB, CANBUS or I²C.

9.2 Identification, Data Logging Recording, and Data Hardcopy

All tests and results shall be recorded by the System, and linked to the EUT serial number. The file format of these records shall be such that they are readily accessible and available in hard or soft copy forms.

9.2.1

Some test criteria may be within the tolerance criteria specified by the manufacturer, being based on real world performance as described in section 9.5.2. If a test fails because it is outside such a real world criterion, the recording and hardcopy shall state the source of that criterion, and also state the relevant criterion from the manufacturers specification or state that the criterion is not present in the manufacturers specification. This information will be needed should a dispute arise between users of this tester and those using alternative equipment and test criteria.

9.3 Input, Output, and User-Interfaces

9.3.1

The design of the Advanced SSI Go/No-Go Tester shall be such that each of the SSI modules listed in section 8.1.3 may be connected to the test equipment using its 50-way or 75-way plug/socket connector. No other electrical connections to the module under test shall be made.

9.3.2

The System design shall incorporate a suitable means of detecting and registering the status of each of the front panel indications on the EUT.

9.3.3

As an intrinsic part of the test procedure, dummy loads shall be provided for all module outputs. Inputs to modules shall be simulated by voltage-free contacts on relays that are under the control of the system program, either directly or via the EUT.

9.3.4

After connecting the EUT to the test equipment, the user shall interact with the System using a standard PC interface. The System shall incorporate an intuitive Graphical User Interface (GUI). The user shall enter data and commands into the System using a standard keyboard and mouse. The System shall display in a clear

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and intuitive way, information regarding the health of the equipment, the progress of any tests, and any necessary prompts for the user.

9.4 Preparation and Initial Examination

Before connecting the EUT to the Advanced SSI Go/No-Go Tester and commencing functional testing, the control software shall prompt and guide the user in carrying out the preparatory actions listed in this subsection, which shall be performed in the order in which they appear. Where there might be some doubt as to the type of response, or action required of the user, then a sufficient level of help shall be embedded within the operating programme, and be readily available to resolve any dubiety.

9.4.1

As a pre-requisite to undertaking the testing of an SSI module, the user shall enter the following data concerning the module itself (generally available from the module labelling) into the System:

- Module Type (SM, PM, DLM,LDT)*;
- Manufacturer (WRSL/ATIS)*;
- Mark;
- BR Specification;
- Serial Number;
- Date of manufacture;
- Hardware modification state (as applicable);
- Software modification state(s) (as applicable).
- Test version number.

When details of a module for test are input into the Advanced SSI Go/No-Go Tester, a check shall be carried out on the serial number to determine whether the module has previously been tested on that particular test equipment. Where this is the case, the user shall be alerted, and the previous tests itemised, so that the findings of the previous testing may be recovered if required.

9.4.2

The fields listed in section 9.4.1 are mandatory and the System shall ensure that some form of entry is made. For those fields that have been identified with an asterisk (*), the control software shall present the user with a number of alternative choices, from which a selection must be made. The fields not identified with an asterisk shall require the input of information as text. Each of these text fields shall permit the entry of up to 25 characters.

Where the identification details are input as text, then the System software shall carry out checks on the validity of data, and shall block the entry of any data deemed to be invalid. As far as reasonably practicable, data shall be validated for:

- correct format;
- consistency against known, historic ranges of data (for example: manufacturers, serial numbers, build dates, and mod states).

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9.4.3

The user shall also be prompted to enter, where known, the following text details appertaining to the site where the SSI module was installed:

- Failure Location;
- Failure Date #;
- Failure Time #;
- Alleged Fault;
- Recording media received? (Has related logger data been received for analysis, or has the analysis been completed elsewhere?);
- Associated Equipment;
- Module Address (and base) # (applies to SM and PM only);
- Interlocking Identity (and base) # (applies to SM and PM only).
- Control Centre Identity (and base) # (applies to LDT only).

For the above fields that have been identified with a hash sign (#), the software shall validate the format of the text entered, and block the entry of data detected as invalid. For the remainder of the fields above, the software shall permit the entry of up to 40 characters.

9.4.4

Where the EUT is a Signal Module or a Points Module, the user shall also be prompted to enter into the System the allocation details of the following outputs and inputs, as recorded on the site diagrams:

Output No.7 §	Input No.7
Output No.6	Input No.6
Output No.5	Input No.5
Output No.4	Input No.4
Output No.3 §	Input No.3
Output No.2	Input No.2
Output No.1	Input No.1
Output No.0	Input No.0

In the case of a Signal Module it shall also be noted whether the outputs marked with a section sign (§) are Red Retained.

For each field listed in this section, the software shall permit the entry of up to 25 characters.

9.4.5

Where the EUT is a Long Distance Terminal, the user shall also be prompted to enter into the System, the allocation details of the following connections, as recorded on the site diagrams:

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Current Loop Connections

Data In Channel 1	Data Out Channel 1
Data In Channel 2	Data Out Channel 2
Data In Channel 3	Data Out Channel 3
Data In Channel 4	Data Out Channel 4
Data In Channel 5	Data Out Channel 5
Data In Channel 6	Data Out Channel 6

Interface Connections

Rx Data

Tx Data

Rx Clock

Tx Clock

For each field listed in this section, the software shall permit the entry of up to 25 characters.

9.4.6

Where the EUT is a Data Link Module, the user shall also be prompted to enter into the System, the allocation details of the following connections, as recorded on the site diagrams:

Current Loop Connections

Tx Data A	Rx Data A
Tx Data B	Rx Data B
Tx Data C	Rx Data C
Tx Data D	Rx Data D
Tx Data E	Rx Data E
Tx Data F	Rx Data F

Data Link Connections

Data Link 1

Data Link 2

Repeater

For each field listed in this section, the software shall permit the entry of up to 25 characters.

9.4.7

The user shall be prompted to inspect the seal of the EUT for intactness, and for the seal type and markings.

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The user shall be prompted to carry out a rotational test of the EUT, to determine whether or not there are any loose items within its casing.

The System shall provide the user with two text entry fields labelled “Module Sealed?” and “Rotation Test”; respectively, to be used for recording the results of the two tests described in this section. Each of these fields shall permit the entry of at least 50 characters.

9.4.8

The user shall be prompted to carry out a thorough visual examination of the EUT. Particular attention shall be paid to the 75-way connector (50-way connector in the case of a DLM); all connector polarisation pins, sockets and jackscrews shall be present and arranged as per Appendix A of this document. The connecting pins themselves shall be present, uniform, and correctly located in the assembly, as per Appendix A of this document.

All pins fitted shall be checked for security by attempting to push each back from its seating, from which it shall not move. There shall be only minimal side play in each case.

The controlling software shall provide the user with a text entry field labelled “Observations” for recording the results of this test, to permit the entry of at least 800 characters.

9.4.9

At the conclusion of the Preparation and Initial Examination stage, the controlling software shall direct the user to carry out the following steps:

- put the EUT onto the Advanced SSI Go/No-Go Tester;
- secure the EUT in place appropriately;
- affix an appropriate wiring loom to the front panel connector;
- apply any other necessary test equipment harnesses — for example, to the EUT front panel indication lamps.

9.5 Tests and Test Criteria

9.5.1

In the four following subsections of this document, detailed tests of the functionality of each type of module are specified.

As each test is carried out, the controlling software shall record any measurements obtained, and record any other relevant observations in the test log, referencing these against the relevant test reference number and title quoted in this specification. The Advanced SSI Go/No-Go Tester shall then determine whether or not the success criteria for the test in question (as quoted in this specification) have been achieved. The final result of each test shall be recorded appropriately in the test log as either “Pass” or “Fail”.

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9.5.2

As it is well established that most modules do not comply with specification in one or more respects, comparison would result in healthy modules failing the tests if they were purely based on specification values. Additionally, tests not found within the relevant specifications are stipulated.

Because of such considerations, the test success criteria quoted in this specification have been based upon typical real-world performance, in addition to pure specification data. Consequently, the test success criteria quoted herein have been drawn in the first instance from specifications, but where appropriate, the parameters have been modified to take account of real-world data.

Where test criteria have been established from practical data, the parameters are shown in *italic*. They are also distinguished by the presence of a range of values representing the upper and lower normal process limits such that failure due to special causes can be readily identified; the process limits have been set at the mean ± 3 standard deviations. Where insufficient practical data is available to allow calculation of process limits (less than two observations) any practical data value is marked with an asterisk.

Where no specification or practical data is available, only an asterisk (*) is shown.

9.5.3

Where there is reference to 110 Va.c. in a test procedure, or its upper and lower limits of 122Va.c. and 94Va.c., this shall be taken to mean the stated voltage $\pm 1\%$ unless otherwise stated. Where there is reference to 50 Hz in this section, this shall be taken to mean 50 ± 2 Hz unless otherwise stated. The System shall ensure that the test supply that it applies to the EUT conforms to these criteria, and shall provide a means of calibration.

9.6 Signal Module Testing Functionality

This section details the tests to be performed on SSI SMs, and the associated success criteria. Before any testing in this section is commenced 'Preparation and Initial Examination', as itemised in section 9.4 shall have been carried out.

For each of the Marks and manufactures of SM listed in section 8.1.3, the Advanced SSI Go/No-Go Tester shall be capable of performing the tests specified in this subsection. The tests shall be performed under the control of the operating software, in the order in which they appear in this document.

Unless otherwise specified, all straps between the EUT connecting pins, all inputs, and all output connections applied during one test shall be removed before commencing any other test. Similarly, unless otherwise specified, all disconnections made for the purposes of conducting a particular test shall be made good immediately after the end of that test.

Unless stated otherwise, the EUT shall receive identical data on both the Data Links A & B.

The System shall measure and record the ambient temperature of the surroundings in which testing is being carried out.