

TOPAS

Traffic Open Products and Specifications

TOPAS 2502B

Performance Specification for Portable Traffic Control Equipment for use at Roadworks

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TOPAS 2502B

*Performance Specification for Portable Traffic Signal Control
Equipment for use at Roadworks*



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TOPAS 2502B

PERFORMANCE SPECIFICATION FOR PORTABLE TRAFFIC SIGNAL CONTROL EQUIPMENT FOR USE AT ROADWORKS

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1 INTRODUCTION

- 1.1 This specification covers the requirements for portable traffic signal control equipment for operation at road works on roads other than motorways.
- 1.2 In this specification “road works” are defined as any works or temporary restrictions which cause partial or total obstruction of any road or highway. Examples may include highway improvement schemes, excavations, structural or maintenance works of any kind, street works or any other work executed on or near the highway together with the necessary working space, safety zones, space required for the storage of any materials, the construction of any temporary structures and the operation of any constructional plant required for the execution of such work, including associated surveys and inspections.
- 1.3 “Road” in England and Wales is defined as ‘any highway and any other road to which the public has access and includes bridges over which a road passes’ (RTA 1988 sect 192(1)). In Scotland, the definition is extended to include any way over which the public have a right of passage (R(S)A 1984 sect 151(1)).
- 1.4 TOPAS specifications are explicitly purchasing specifications and compliance with them is not mandatory. However Local and other Purchasing Authorities may typically require that equipment purchased complies with TOPAS specifications and is TOPAS registered.
- 1.5 Manufacturers may register products as being compliant with this specification, using the process defined in TOPAS 0600.
- 1.6 TOPAS registration requires manufacturers to submit a Technical File to an appropriate Technical Assessor to aid compliance verification. The content requirement for the Technical File is defined in Appendix Z of this specification.
- 1.7 Guidance to potential users of this product is given in Appendix A.
- 1.8 Within this specification, “The product” shall mean all components necessary to provide a complete operational unit meeting the requirements of this specification and the common requirements defined in TOPAS 0600.

Implementation

- 1.9 This standard will be immediately implemented from the date of issue for all new TOPAS Registrations.
- 1.10 Approvals issued against previous standards for Portable Traffic Signal Control for use at Roadworks will remain valid. Retrospective action against this standard is not mandatory.

Glossary of Terms

- 1.11 A comprehensive glossary of terms is given in Highways Agency document TA84 Code of Practice for Traffic Control and Information Systems for All-Purpose Roads.

2 FUNCTIONAL REQUIREMENTS

Light Signals

- 2.1 The limits of output voltage and current of the signal switching circuits of the equipment for signal “ON” and signal “OFF” shall comply with class AF5 of BS 7987. The equipment must be used with signal heads which, when supplied with these voltages and currents, comply with the limits of luminous intensity for signal “ON” and signal “OFF” stated in BS EN 12368 (greater than 10 cd for “ON”; less than 0.05 cd for “OFF”).
- 2.2 The type of light signals to be used is defined in TSRGD regulation 35.
- 2.3 The displayed signal sequence shall comply with TSRGD regulation 33(3). The duration of the amber periods shall be:
- The amber vehicle signal following the green vehicle signal shall be of a fixed 3-second duration and;
 - The red/amber vehicle signal preceding the green vehicle signal shall be of a fixed 2-second duration.
- 2.4 The dimension and finish of the signal supports shall comply with TSRGD regulation 35 and direction 46.

Timing Accuracy

- 2.5 All timed periods shall be accurate to within ± 150 milliseconds.

Prevention of Hazardous Light Signal Displays

- 2.6 The Product shall have functionally independent supervisory control and monitoring processes.
- 2.7 The Product design shall prevent the display of simultaneous conflicting green vehicle signals and other abnormal signal displays during normal operation, under fault conditions or with permitted operator intervention. A simultaneous conflicting green signal is a Category 1 fault. Fault categories are detailed in Failure Modes.

System Communications Integrity

- 2.8 The Product shall be designed to provide reliable operation for up to 300 metres between any two “system components” under all normal conditions of deployment without any detectable loss of performance.
- 2.9 An independent monitoring facility shall be provided to verify the integrity of the communications system.
- 2.10 If the overall design of the Product divides the intelligence into separate discrete components and the interface between them is wireless, then the wireless communication shall be as follows:
- i) The Product shall provide a robust and reliable means of fail-safe communication and provide suitable levels of security, accuracy and reliability of all data being transmitted and received.

- ii) The Product shall maintain reliable operation in all reasonably expected conditions of use and shall be unaffected by other sources of radio transmission and by screening or reflections from vehicles or buildings.
- iii) An intermittent loss of communication between controller components shall follow the process for Category 2 fault.
- iv) An 'intermittent loss of communication' is defined as repeated unsuccessful attempts to complete a communications dialogue within 500 milliseconds.
- v) A permanent loss of communication to any system component shall cause a Category 1 fault.
- vi) A 'permanent loss of communication' is defined as an unsuccessful undertaking to complete a communications dialogue within a period of 2 seconds.
- vii) The Product shall meet the Electromagnetic Compatibility requirements of BS EN 50293
- viii) If the equipment uses wireless communication its operation shall be unaffected by similar equipment operating independently nearby. See also paragraph 2.1 of TOPAS 0600.

Light Signal Synchronisation

- 2.11 The illumination status of each light signal aspect shall be monitored such that each state of all signal units can be validated.

- 2.12 All light signal heads on the same phase shall have aspects synchronised to within 150 milliseconds.
- 2.13 An intermittent loss of synchronisation (repeated unsuccessful attempts to attain synchronisation within 500 milliseconds) shall follow the process for Category 2 fault.
- 2.14 A permanent loss of synchronisation (failure to synchronise within 2 seconds) shall cause a Category 1 fault.

Electrical Requirements

- 2.15 The Product shall operate using an Extra Low Voltage or Reduced Low Voltage power supply as defined in BS 7671 Requirements for Electrical Installations.
- 2.16 In the event of a power supply interruption to the controller equal to or less than 50 milliseconds the Product shall continue to function correctly.
- 2.17 In the event of a power supply interruption to the controller longer than 50 milliseconds the Product shall shut down in a safe manner. On restoration of the supply the Product shall follow the Start-up sequence in paragraph 2.20 to 2.25.
- 2.18 The Product shall be capable of operating for a minimum continuous period of 16 hours under full-load conditions without attention.
- 2.19 All wiring, termination, earthing and labelling shall be in accordance with BS 7671.

Start-up Sequence

- 2.20 When signals are switched on at start-up or restoration of power, the Product shall initially display a 3-second amber period followed by red on each stage, in cyclic order up to the selectable final stage which shall display a green vehicle signal after an all-red period equal to the longest all-red period pre-set in the controller
- 2.21 When 'Manual Control Mode' (see 2.39) is selected, the final stage shall not display green but move through a 3-second amber to red and await a manual command. The controller shall not move to a manually selected stage until the signals have been at all-red for at least the maximum pre-set all-red period.
- 2.22 Alternatively, all signal heads may display a red vehicular signal simultaneously without any other prior vehicular signal display. The controller shall not cause any green signal to be displayed until the signals have been at all-red for at least the maximum pre-set all-red period.

Initial set-up

- 2.23 On initial set-up, where the Product has independently powered signal heads relying on a communication system to provide instructions to change the signal display, in order to perform the start-up sequences defined in 2.20 to 2.22, it would be necessary for the communication system to be established and verified to all signal heads before any signals are illuminated. As an alternative, it shall be permissible for each signal head to show an immediate red signal display, or a three second amber display followed by red, when its related control unit is powered up, provided that it shall not be possible for any green signals to be displayed until all signal heads have been switched on, the communication system established and verified to all signal heads and the maximum pre-set all-red period has elapsed.
- 2.24 The controller shall not cycle from one stage to another until the preset all-red associated with the stage being left has expired.
- 2.25 On selection of Vehicle Actuated operation, demands shall be inserted on all stages. (see **Modes of Operation**)

Modes of Operation

General

- 2.26 The Product shall be capable of operating under:
- i) Vehicle Actuation (VA);
 - ii) Manual Control; and
 - iii) Fixed Time (FT)

- 2.27 A suitably marked facility for selecting the mode shall be provided. (see **Control Facilities and Indications**)
- 2.28 A minimum green vehicle signal period shall be associated with the start of every stage and no signal change shall be possible during the minimum green period. The minimum green running period for each stage shall be configurable to either 7 or 12 seconds.
- 2.29 An all-red period to follow each stage shall be user configurable between 1 and 50 seconds by 1 second increments. Different all red times may be set for different stages. On stage changes under all control modes the all red time shall not be violated. Under manual control the operator may call and hold all-red as a stage.

Vehicle Actuated (VA)

- 2.30 The Product shall employ a vehicle detection sub-system approved to TR 2147 or registered to TOPAS 2504
- 2.31 The Product shall operate each stage in cyclic order in accordance with vehicle demands and extensions.
- 2.32 The Product shall detect the passage of vehicles during a green signal period and extend this period in proportion to the amount of traffic detected without unduly penalising the traffic on opposing stages.
- 2.33 On the failure of a vehicle detector a permanent demand shall be registered for the appropriate stage.

- 2.34 The maximum period that a vehicular green signal may be held by vehicular extensions after a demand has been registered for an opposing stage shall be preset at a value in the range between 10 and 50 seconds, and adjustable in incremental steps no greater than 5 seconds.
- 2.35 In the event of a green period being terminated by the operation of the maximum green running period, provision shall be made to ensure that a demand is registered for a return to the interrupted stage as soon as possible.

Fixed Time (FT)

- 2.36 The Product shall continuously cycle through its stages sequentially with a fixed configurable maximum green period for each stage.

Manual Control (MC)

- 2.37 Manual selection of configured stages (including all-red) shall be possible.
- 2.38 It shall not be possible for the minimum green running period to be omitted or foreshortened by manual control.
- 2.39 When switching to Manual Control, from VA, or FT, any demand for a stage not running shall be cancelled.
- 2.40 If the change to Manual Control is made whilst the signals are in:
- i) amber or red/amber the signals shall continue to cycle through on the fixed, or selected timings until vehicular green is reached;
 - ii) all-red prior to a vehicular green selected the all-red shall continue, without interruption, as if it has been pre-selected;

- iii) all-red other than that prior to the green selected, an all-red period of at least that expected to follow the previous stage shall expire before the change.
- iv) vehicular green selected, the signals, after satisfying the minimum green period, shall continue until a different command is selected on Manual, or the operation returned to VA, or FT.
- v) on a different vehicular green to that selected, a change to the selected green shall take place following the expiry of the minimum green and the appropriate intergreen between the running green and that selected.

Signal Aspects On/Off

- 2.41 A facility to switch all signals, on and off, from an operator panel, shall be provided. This shall not switch power off to the Product, but allow all normal safety monitoring facilities to remain enabled.
- 2.42 When the signal aspects are switched on they shall start up in accordance with the sequence specified in 2.20 to 2.25.

Operator Facilities

- 2.43 A means shall be provided to configure the Product on set up; monitor operational values to confirm correct operation; and provide diagnostic information for maintenance and fault repair.

Red Signal Monitoring

- 2.44 The Product shall be capable of monitoring all red signals. (See Red Signal Monitoring in Informative Guide A5.)
- 2.45 In the event of all monitored red signals failing on an approach or a failure of the red signal monitor being detected, then the Product shall follow the procedure for a Category 3 fault. (See Red Signal Monitoring in A5.)

Dimming

- 2.46 Provision shall be made for dimming the signal aspects during periods of low ambient light. Dimming may be provided for the whole signal installation, or on an individual signal head basis.
- 2.47 The dimming facility shall automatically reduce the light output of the signals to between a quarter (1/4) and a twelfth (1/12) of their full on-axis intensity when the ambient light level is reduced to 55 lux and will automatically revert to the full intensity when the light level exceeds 110 lLux.
- 2.48 Signal aspects shall immediately switch to full brightness on failure of the dimming facility.

Equipment Housing

- 2.49 The Product in its housing shall meet the requirements of BS 7987 to the same environmental performance classes as defined in TR 2130C.
- 2.50 Any covers, doors, flaps, or similar allowing access to controls, circuits or live parts when opened shall meet the IP ratings of BS 7987.
- 2.51 Safety critical timing adjustments to the Product shall only be accessible via the main housing door (see Control Facilities and Indications).
- 2.52 An Operator's Panel may be provided which gives access to certain controls without the need to open the main housing door (see Control Facilities and Indications.) The Operator's Panel shall be provided with a means to prevent unauthorised operation.

Control Facilities and Indications

- 2.53 Control facilities which shall only be accessible via the main housing door shall include the selection of:
- i) the vehicular maximum green running period;
 - ii) the all-red period to follow each stage.
- 2.54 The following control facilities are also to be provided and may be used via an operator panel
- i) select mode of operation;
 - ii) switch all signals on and off with a single action (see 2.41).

- 2.55 The facilities referred to in paragraphs in 2.53 and 2.54 shall be devices that are capable of being readily identified by the operator and shall clearly indicate the selection made.
- 2.56 Indications shall also be provided to show each of the following:
- i) the presence of a stored demand on each stage;
 - ii) the operation of the detector when the stage is displaying the green signal;
 - iii) the current state of each signal on each stage;
 - iv) the occurrence of a hazardous light signal display (any non-permitted combination of signal displays)
 - v) conflicting green failure;
 - vi) the occurrence of a red lamp or red lamp monitor failure;
- 2.57 The indications in 2.56 shall be capable of being readily identified by the operator and shall clearly indicate the status.

Marking and Labelling

- 2.58 The Product shall be marked in accordance with BS 7987 and also with;
- i) the specification number against which it has been approved;
 - ii) any optional functionality that has been included in the self-declaration; and
 - iii) the signal load (number of heads) capacity of the Product.

Reliability

- 2.59 The Product, including any link to other parts of the complete system described in 1.5, shall have a Mean Time Between Faults (MTBF) prediction figure of greater than 12,000 hours continuous operation.

Failure Modes

Category 1

- 2.60 All signal heads shall revert to "OFF" within 500 milliseconds following the detection of a Category 1 failure. This will override any other requirement for a timing period to be maintained (e.g. minimum green, all-red, amber, red/amber)
- 2.61 Operation of the Product shall be inhibited until the fault has been cleared and the Product manually reset.

Category 2

- 2.62 The signals shall remain in their current display condition. This may result in some otherwise fixed times (e.g. amber, red/amber, all-red) being extended.

- 2.63 This shall be recoverable to normal operation, via the start-up sequence, when the intermittent fault has been absent for a period greater than 2 seconds.

Category 3

- 2.64 Within 500 milliseconds of failure of a red vehicle signal, any green vehicle signal(s) in conflict with that red signal failure approach shall be disabled. Each stage shall cycle with minimum green periods.

- 2.65 Where more than one approach has complete red signal failure, the Category 1 fault process shall be followed

3 REFERENCES

3.1 Where undated references are listed, the latest issue of the publication applies.

British Standards

3.2 British Standards are published by the British Standards Institution, London.

BS 7671	Requirements for Electrical Installations
BS 7987 :2001 +A1:2006	Road Traffic Signal Systems (a revision of this standard is expected to be published as BS EN 50556 in 2011)
BS EN 50293	Electromagnetic Compatibility Road Traffic Signal Systems Product Standard
BS EN 60529	Specification for Degrees of Protection Provided by Enclosures (IP Code)

Specifications

3.3 TOPAS Limited specifications are available at www.topasgroup.org.uk

TR 2130	Environmental Tests for Motorway Communications Equipment and Portable and Permanent Road Traffic Control Equipment
TOPAS 2504	Performance Specification for Vehicle Detection Equipment for Vehicle Actuated Traffic Signals
TOPAS 0600	Self-Certification Procedures for Statutory Approval of Traffic Control Equipment

Related Documents

BS EN 12368	Traffic Signal Heads (TSRGD requires signal heads for portable signals to comply with this specification)
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Legislation

The Traffic Signs Regulations and General Directions 2002 (SI 2002/3113) as amended by the Traffic Signs (Amendment) Regulations and General Directions 2011 (TSRGD)
Directive 2004/108/EC: The Electromagnetic Compatibility Regulations 2006 (SI 2006/3418)
Directive 2006/96/EC: The Electrical Equipment (Safety) Regulations 1994 (SI 1994/3260)

APPENDIX A - INFORMATIVE GUIDE

General

A1 This Appendix provides additional information regarding the use of portable traffic signals. It includes additional criteria which should be addressed by traffic authorities and other users in their procurement contracts.

Other equipment

A2 The equipment covered by this Specification is only part of the equipment required for a complete portable traffic signal installation. Additional equipment includes:

- Vehicle signal heads
- Vehicle detectors

This additional equipment is required to be type approved to the appropriate specifications.

Regulations

Use of this equipment is also subject to regulation, and attention is drawn to the TSRGD in general and the following sections of it in particular:

Regulations 35, 36

Directions 46, 53

Mounting of Traffic Signals

A3 The procurement contract should call for the mounting arrangement for the complete system (see 1.7) to withstand a wind speed of at least 26 m/s without toppling, rotating or bending.

Detectors

A4 Guidance on above ground vehicle detectors is given in Traffic Advisory Leaflet 16/99, The Use of Above Ground Vehicle Detectors.

Red Signal Monitoring

A5 The Product may have both monitored and unmonitored vehicular red signal aspects. The purpose of red signal monitoring is to allow operation of the crossing only when at least one red signal aspect is visible to drivers on each approach. It is for the body responsible for granting permission for the use of the equipment (usually the traffic authority) to determine which, if any, red aspects are unmonitored.

Electrical Power Source

A6 If the Product is required to operate for more than 16 hours under full-load conditions without attention (see 2.18) this must be stated in the procurement specification.

Application

A7 The equipment covered by this specification is for use in road works situations only (see the definition of "road works" in 1.2). It is not intended for use as a temporary replacement for permanent traffic signal equipment.

Security

A8 The controller door(s) are secured against unauthorised entry by means of suitable lock(s) or security device(s).

APPENDIX Z - TECHNICAL FILE CONTENT

This appendix defines the necessary content for a Technical File Pack (a collection of relevant documents) which must be reviewed by an appropriate Technical Assessor as part of the TOPAS Registration process (See TOPAS 0600).

Only the 'ticked' items are required to be present in a Technical File Pack used to support TOPAS Registration against TOPAS 2502B.

Ref	Item	Description	Required
1	Technical File overview document	A summary document outlining the product, specifying which TOPAS and other relevant specification(s) the product has been designed to comply with, together with a detailed table of contents for the Technical File Pack. Where copies of external certificates or documents are referred to these may be included within the Technical File overview document or supplied separately as part of the Technical File Pack.	✓
2	QA accreditation certificate(s)	A copy of the Quality Management Registration Certificates for the organisation applying for TOPAS Product Registration.	✓
3	Details of all CE markings that apply to the product	A list of all directives complied with and how achieved. Typically this would be references to explicit CE Technical Files and certificates, copies of which would be included in the Technical File Pack.	✓
4	A functional design description of the product	A reference to the overall System Design Documentation for the product (by document part number and issue).	✓
5	Product part numbers	A list of top level assembly part numbers and their issue states including all firmware / software part numbers and issues.	✓
6	Test procedures and results	A reference to all test schedules and test result documents (by document part number and issue).	✓

7	Statement of compliance	A clause by clause statement of compliance against TOPAS 2502B confirming compliance and/or listing caveats or deviations.	✓
8	EMC test results	A reference to EMC test performance requirements. Copies of the results of EMC testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	✓
9	Optical test results	A reference to Optical tests performance requirements. Copies of the results of Optical testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	✓
10	Environmental test results	A reference to Environmental tests performance requirements. Copies of the results of the Environmental testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	✓
11	Radio Agency test results	A reference to Radio Agency tests performance requirements. Copies of the results of Radio Agency testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	✓
12	Primary Safety Test results	For Traffic Control equipment specifically a reference to the Primary Safety Test schedule and test results by part number and issue. A copy of the test results should be included as part of the Technical File Pack.	✓
13	Failure Mode Analysis	A reference to the product failure mode analysis requirements and results by document part number and issue.	✓