

# TOPAS

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## Traffic Open Products and Specifications

### **TOPAS 2512B**

#### *Performance Specification for Below Ground Vehicle Detection Equipment*

<b>Revision</b>	<b>Date</b>	<b>Scope</b>	<b>Authorised by</b>
B	19/11/17	Final	Board

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## TOPAS 2512B

### PERFORMANCE SPECIFICATION FOR BELOW GROUND VEHICLE DETECTION EQUIPMENT

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## CHANGE LOG

The following outlines significant changes to this specification, from its previous issue which do not impact on currently Registered products:

- a. Document re-structured to focus technology bias into specific relevant sections where appropriate.
- b. Added new section to define specific requirements for non-loop based solutions.
- c. Removed old appendices E & F (which covered Highways England specific Motorway applications).
- d. Reference to Anti-locking facility (original section 2.19) removed.
- e. Specific mention of Haul Routes removed.

The following outlines significant changes to this specification, from its previous issue which may impact on currently Registered products:

- a. Products are now required to operate on both 24V AC and 24V DC supplies. (Section 2.3.22).
- b. Where products are not registered against all the appendices in this specification they are now required to clearly identify this on a product label. (Section 2.3.33).
- c. All lower speed thresholds reduced to 0 km/h (0 mph) to ensure correct operation of detection equipment in queues and stationary traffic. (Section 4 and Appendices).

The Requirements for re-registration of existing products are defined in section 1.8

# 1 INTRODUCTION

1.1 This specification covers the necessary requirements for localised 'below ground' vehicle detection equipment for use with permanently installed traffic systems on all roads except Motorways.

**Note:** The requirements for Motorway detectors are specifically defined by Highways England and are not included in this specification.

1.2 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.

1.3 Manufacturers may register products as being compliant with this specification, using the process defined in TOPAS 0600.

1.4 TOPAS registration requires Manufacturers 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.

1.5 Within this specification, "The Product" shall mean all components necessary to provide a complete operational detector unit or system meeting the requirements of this specification and the common requirements defined in TOPAS 0600.

1.6 Guidance to potential users of products compliant with this specification is given in Appendix F.

## **Implementation**

1.7 This specification will be immediately implemented from the date of issue for all new TOPAS Registrations.

1.8 For Products previously Registered against TOPAS 2512A, manufacturers are simply required to confirm in writing that the Products remain compliant with this amended specification. Once confirmed Product Registration information will be migrated on the TOPAS website.

## **Glossary of Terms**

1.9 A comprehensive glossary of terms may be found in Highways England document TA 84 Code of Practice for Traffic Control and Information Systems for All-Purpose Roads.

TOPAS Terms are defined in TOPAS 0600 and TOPAS 0601.

## 2 FUNCTIONAL REQUIREMENTS

### Scope

2.1 This Specification defines the requirements of Products to detect the localised passage or presence of a vehicle by means of the change in the output state of the detection equipment. Applications are specified in the appendices to this specification.

2.2 This Specification covers the performance requirements of vehicle detection equipment used for the following levels of integration with TOPAS Registered signal controllers:

- Parallel Interface; i.e. separate detector equipment connected via parallel outputs and a standard backplane, pinned as defined in Appendix E and mounted within the controller cabinet or in a remote housing.
- Serial Interface; i.e. separate detector equipment connected via serial outputs and a standard backplane, pinned as defined in Appendix E and mounted within the controller cabinet or in a remote housing.
- Detectors integrated within the controller functionality.

### General performance requirements

2.3 All detector Products, independent of technology and interface type, shall meet the requirements defined in this section.

2.3.1 For a multi-channel Product, the specified performance shall be achieved for each channel with all other channels operating normally.

#### Sensitivity

2.3.2 The Product shall be capable of detecting any of the vehicles defined in the appendices to this Specification.

2.3.3 The Product shall have a minimum of three selectable sensitivity settings for each detector channel as appropriate to the requirements of this specification and the various declared detection point configurations.

2.3.4 Where sensitivity settings and other detector parameters are selected in software the following provisions shall apply:

- The settings shall be retained in non-volatile storage for at least one year, in the event of any loss of power supply.
- When settings are being changed, the detector shall continue to operate correctly or output the 'detect' condition, and revert to normal operation within 5 seconds from the completion of the change.

#### Response Time

2.3.5 The response time of the Product shall not be greater than 64 milliseconds; this period is interpreted from the dynamic characteristics specified in 2.3.6.

2.3.6 The dynamic operating characteristics of the Product for any given vehicle type shall be such that the detection point on the road at which the vehicle is detected over the speed range of 40 km/h (25 mph) to 112 km/h (70 mph) shall not vary about a mean by more than  $\pm 0.5$  metres for any individual vehicle detector.

#### Presence Time

The Product shall maintain an unbroken vehicle detection signal for the periods specified in the appendices to this specification dependent on detector application. Presence Time(s) may be selectable.

#### Turnoff Time

2.3.7 The Product shall return to a non-detecting state in less than 50 milliseconds following the zone of detection being vacated.

### *Recovery from Sustained Actuation*

2.3.8 Following a sustained actuation the detector shall recover to normal operation within 100 milliseconds after the zone of detection is vacated.

### *Drift Compensation (Tracking)*

2.3.9 The Product shall incorporate automatic compensation to offset the effects of changes in the physical parameters being used to provide the detection caused by environmental changes.

### *Failure Modes*

2.3.10 Any fault condition which prevents the normal operation of the detector, shall after an interval not exceeding 5 seconds, produce a detect signal for as long as the fault persists.

2.3.11 An interruption of the power supply to the Product shall, after an interval not exceeding 5 seconds, automatically produce a detection signal (indicating the presence of a vehicle) from the Product for so long as the interruption persists.

2.3.12 The Product shall regain its specified operation within 5 seconds of the restoration of the power supply.

2.3.13 It shall not be possible for any vehicle, or combination of vehicles, to produce input conditions that either damage the Product or render it non-operational.

### *Detector Outputs*

2.3.14 Products which are not integrated into traffic signal controller systems and which provide a parallel interface shall comply with the Parallel Output Interface requirements of TOPAS 2523 and provide physical connections via a DIN 41612 type B connector as defined in Appendix E.

2.3.15 Products which are not integrated into traffic signal controller systems and which provide a serial interface, shall comply with the serial output interface requirements of appendix F.

*Note to purchasers:* The serial protocol used may be manufacturer specific and serial detectors from different manufacturers might not be compatible with current Traffic Signal controllers or each other.

2.3.16 For each channel of detection the Product shall provide a visual indication of the output. The indicator shall be clearly visible in all ambient light conditions.

2.3.17 For power conservation purposes the visual indication described in 2.3.16 may be normally off and only brought into operation via a readily accessible means.

2.3.18 Where a detection system provides more than 8 detection channels, physical indicators may be omitted, as long as the detection state of each channel can be observed by other means – for example by the connection of a handset or PC / Tablet based tool via a web browser.

2.3.19 Optional, secondary outputs for non-control applications may be provided, such as secondary vehicle counting equipment.

### *Fault Output (Optional)*

2.3.20 A separate fault output signal may be provided. In the quiescent (i.e. non-fault) condition the fault output shall be closed.

2.3.21 The Product may also provide an additional visual indication of fault conditions. The Indicator shall be illuminated when no fault is present. The indicator shall be clearly visible in all ambient light conditions

### Power Supplies

2.3.22 Products utilising the standard DIN 41612 type B connector as defined in Appendix E, shall be capable of being powered directly from both AC and DC power supplies as defined below.

#### Extra Low Voltage AC

The Product shall operate as required by this specification when the AC Voltage varies between +13% and -10% of its nominal voltage of 24V AC over the range  $\pm 4\%$  of its nominal 50Hz frequency.

#### Extra Low Voltage DC

The Product shall operate as required by this specification when the nominal 24V DC supply voltage varies over the range  $\pm 20\%$  of its nominal value.

### Physical Construction and Housing

2.3.23 The general design, construction and assembly of the Product shall be based on sound proven engineering principles.

2.3.24 The front panel of rack mounted Products shall be fitted with a means to assist easy removal and replacement of units.

2.3.25 Products used with traffic signal controllers shall preferably be mounted in the controller cabinet. Where this is not possible, remote detector housings may be used.

### Electrical Safety

2.3.26 Under no conditions shall the voltage produced by the Product, on any external outputs or between any outputs and earth, exceed 70 volts peak to peak.

2.3.27 All wiring, termination, earthing bonding and labelling shall be in accordance with BS 7671 (Latest edition).

### Test Requirements

2.3.28 The Product shall operate correctly, as required by this specification, when subjected to the EMC conditions, which may be met in use and shall meet the requirements of specification BS EN50293.

2.3.29 Where applicable (for example loop detectors), Products shall comply, with the current requirement of ETSI EN 300 330-1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz Part 2: Harmonized EN under article 3.2 of the R&TTE Directive.

For non-loop based solutions they shall be compliant with any additional relevant standards for electromagnetic compatibility (in addition to the EMC standards defined in 2.3.28), which apply to those technologies.

2.3.30 Adequate precautions shall be taken in the design of the equipment to prevent mutual interference between equipment of the same type when connected to adjacent detection locations. These precautions shall be at least sufficient to avoid any interaction between equipment monitoring a pair of detection zones each 2 metres square, with adjacent sides parallel to each other and spaced 0.5 metres apart throughout their length under all operating conditions at high sensitivity.

2.3.31 The Product shall operate as required by this specification when tested to the environmental requirements of TOPAS 2130.

2.3.32 Where the Product (or parts of the product) are mounted outside of the controller cabinet they may be protected by an additional enclosure and the complete assembly shall meet the additional environmental requirements as defined in TOPAS 2130

### Marking and Labelling

2.3.33 The Product shall be fitted with a label or other marking displaying the following:

- The unique Product Identity and serial number
- The specification Appendices against which the Product has been declared compliant. (If compliant with all appendices it is not necessary to specifically identify compliant appendices).
- The electrical supply requirements of the equipment.

### Long Term Performance

2.3.34 For each channel the product outputs shall be designed to deliver detection indications corresponding to 10,000,000 vehicles having been detected

2.3.35 The manufacturer shall specify the expected product life.

### Specific requirements for inductive loop based detection

2.4 The additional requirements in this section specifically apply to inductive loop based detection Products

#### Loop and Feeder Dimensions

2.4.1 Where loop technology is used, loops shall be able to be installed to comply with MCE 0108. Loop dimensions are to be in accordance with 7th Edition Specification for Highway Works, Volume 3 Highway Construction Details Section 1, G series drawings.

2.4.2 Other loop types may be used if recommended by the manufacture.

2.4.3 The general strategy for loop deployment is specified in MCE 0108 "Siting of Inductive Loops for Vehicle Detecting Equipments at Permanent Road Traffic Signal Installations"

2.4.4 Each detection channel shall be designed to accommodate loop inductive impedances from at least 50 $\mu$ H to at least 800 $\mu$ H.

2.4.5 The manufacturer shall specify the range of feeder lengths which can be accommodated.

#### Loop Auto-tune

2.4.6 The Product shall have an auto-tune facility that shall stabilise the operation of the detector within 5 seconds of power being applied;

2.4.7 The Product may have an auto-retune facility to re-stabilise the Product within 5 seconds after an inductance change of not less than +15% has been detected.

Note: This facility shall be capable of being inhibited if required.

#### Tolerance to Loop Faults

2.4.8 Any open or short circuit fault condition continuously presented to a loop input connection port of the detector for more than 30 milliseconds shall, after an interval not exceeding 5 seconds, produce a detect signal for as long as the fault persists.

2.4.9 The above faulty condition shall not damage the Product or, if it is a multi-channel design, affect the operation of the other channels.

2.4.10 The equipment shall not suffer damage if any loop and/or feeder is short circuited or disconnected.

2.4.11 As specified in section 2.3.26 under no conditions shall the voltage produced by the Product, on any external outputs or between any outputs and earth, exceed 70 volts peak to peak. This requirement specifically shall apply to the voltage across the feeder cables whether the loop is connected to or disconnected from the rest of the vehicle detection equipment.

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***Specific requirements for  
detection equipment using  
other technologies***

2.5 Where non-loop based solutions are to be Registered against this specification they must comply to all sections of this specification except section 2.4.

2.5.1 The manufacturer must specify (in the user documentation) the mounting conditions which, when used, will ensure the equipment is compliant with this specification.

## REFERENCES

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

### **British Standards**

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

BS 7671	Requirements for electrical installations (The IEE wiring regulations)
BS EN 50556	Road Traffic Signal Systems
ETSI EN 300 220-1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz Part 2: Harmonized EN under article 3.2 of the R&TTE Directive
BS EN 50293	Electromagnetic Compatibility - Road Traffic Signal Systems
BS EN 60529	Specifications for degrees of protection by enclosures (IP Code)

### **Specifications**

3.3 TOPAS Limited Specifications are available from [www.topasgroup.org.uk](http://www.topasgroup.org.uk)

MCE 0108	Siting of Inductive loops for Vehicle Detecting Equipments at Permanent Road Traffic Signal installations
MCH 1352	Technical Guide to SCOOT Loop Siting
MCH 1542	Installation Guide for MOVA
MCH 1932	Vehicle Detection Techniques
TR 2029	Inductive Loop Cable for Vehicle Detection Systems
TR 2031	Armoured Feeder Cable for Inductive Loops Systems
TOPAS 2130	Environmental Tests for Communications Equipment and Portable and Permanent Road Traffic Control Equipment
TOPAS 2500	Traffic Signal Controller
TOPAS 2523	Traffic Control Systems Interfacing Specification
TOPAS 0600	TOPAS Registration process

### **Other Publications**

3.4 Other publications can be obtained from the Stationary Office:

Specification for Highway Works	Department for Transport 7 <sup>th</sup> Edition of the Specification for Highway Works, Volumes 1 – Series 1200 & 1500, Volume 2 – Notes for Guidance NG1200 & NG1500 and Volume 3 – Highway Construction Details (HCD) G series drawings.
TSRGD:2016	The Traffic Signs Regulations and General Directions 2016

## 4. SUMMARY OF DETECTOR PARAMETERS

<b>Parameters</b> / <b>Appendices</b>	<b>A</b> <i>Standard VA applications (excl speed measurement)</i>	<b>B</b> <i>Speed Measuring</i>	<b>C</b> <i>UTC Counting Queue and Occupancy</i>	<b>D</b> <i>SCOOT and MOVA</i>
Lower entry speed into stable zone of detection			0 km/h	0 km/h
Higher entry speed into stable zone of detection			113 km/h	
Lower working Speed	0 km/h	40 km/h	0 km/h	0 km/h
Upper working Speed	129 km/h	129 km/h	129 km/h	129 km/h
Cycle lower working speed	0 km/h			
Cycle upper working speed	32 km/h			
Failure acceptance (multiple vehicle detection)	20%			
Single unbroken coverage with % covered			25%	
Detector must work with % of detection zone occupied	50%	50%	50%	50%

<b>Parameters</b>	<b>Appendices</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
		<i>Standard VA applications (excl speed measurement)</i>	<i>Speed Measuring</i>	<i>UTC Counting Queue and Occupancy</i>	<i>SCOOT and MOVA</i>
(a) Normal presence time		4 min	3.5 sec	4 min	4 min
Time variation + or - (a)		1 min	0.5 sec	1 min	1 min
(b) Alternative Presence time		3.5 sec	4 min	35 min	
Time variation + or - (b)		0.5 sec	1 min	5 min	
Variation of detection point at 40 km/h			0.2m		
Variation of detection point at 97 km/h			0.2m		
Zone of detection Max distance from detection zone edge				0.2m	

## APPENDIX A

# VEHICLE-ACTUATED TRAFFIC SIGNALS AT JUNCTIONS AND PEDESTRIAN CROSSINGS – OTHER THAN FOR SPEED MEASUREMENT

### ***Performance Requirements***

A1 Products used to provide vehicle demands and extensions, in accordance with equipment complying with Specification TOPAS 2500, shall comply with the following additional performance requirements.

A2 The Product shall respond to any vehicles, including pedal cycles, travelling at any speed between 0 km/h (0 mph) and 129 km/h (80 mph) (pedal cycles 4.8 km/h (3 mph) to 32 km/h (20 mph)), but is not precluded from detecting vehicles at speeds outside this range.

A3 The Product shall preferably give a single unbroken vehicle detection signal for all types of vehicles. If multiple vehicle detection signals are produced, then they shall not occur for more than 20% of all vehicles normally encountered on public roads with 3 or more road wheels.

A4 In the event of any type of motor driven vehicle with 3 or more road wheels coming to rest over a below ground detector, the presence time shall normally be 4 minutes  $\pm$  1 minute. An alternative presence time of 3.5 seconds  $\pm$  0.5 seconds may also be provided.

A5 The Product shall respond to any new vehicle after the presence time has expired.

A6 Note: A5 is required primarily in loop based applications where a single detector channel is connected to more than one loop in series. (Parallel configurations may not be used).

It is to ensure that if, during saturated traffic conditions, the detector presence time expires, then the movement of vehicles off and onto any of the loops, whilst the other loop is occupied, again produces a vehicle presence condition, (for example giving an extension to hold the green for that stage).

A7 The output signal to indicate the presence of a vehicle may be either high or low impedance condition.

## APPENDIX B

# SPEED MEASURING APPLICATIONS WITH PERMANENTLY INSTALLED AND TEMPORARY TRAFFIC SIGNALS

### *Performance Requirements*

B1 Products used to provide vehicle demands and extensions, in accordance with equipment complying with Specification TOPAS 2500, or other Registered equipment shall comply with the following additional performance requirements.

B2 The vehicle detection equipment shall respond to any vehicle with 3 or more road wheels, travelling at any speed between 40 km/h (25 mph) and 129 km/h (80 mph), but is not precluded from detecting such vehicles outside this speed range.

B3 In the event of any vehicle with 3 or more road wheels coming to rest after having entered the zone of, the presence time shall normally be 3.5 seconds  $\pm$  0.5 second. An alternative presence time of 4 minutes  $\pm$  1 minute shall also be provided.

B4 The detection point variation between the dynamic operating characteristic of any pair of vehicle detectors of the same type, or associated channel of a Product, shall be such that, the difference between the points at which they each detect the same vehicle at 40 km/h (25 mph) shall not exceed 0.2 metres, and the difference between the points at which they each detect the same vehicle at 97 km/h (60 mph) shall not exceed 0.2 metres.

The manufacturer shall specify the sensitivity or other product setting(s), which may be used for correct operation in this application.

**NOTE:** Tests for compliance with this clause shall be carried out with all detectors and feeders (if used) in an essentially identical environment.

B5 The vehicle detection signal to indicate the presence of a vehicle may be either the high or low impedance condition.

## APPENDIX C

# VEHICLE COUNTING, OCCUPANCY AND QUEUE APPLICATIONS IN UTC

### ***Performance Requirements***

C1 Vehicle detection equipment used for Vehicle Counting, Occupancy and Queue applications in UTC shall comply with the following additional performance requirements:

C2 The zone of detection of a vehicle detection equipment shall not be less than the physical area of the detection zone and not greater than an area whose sides are parallel to the physical sides of the detection zone and not further than 0.2m from these sides for any vehicle with 3 or more road wheels, travelling within the speed range 0 km/h (0 mph) to 113 km/h (70 mph). The manufacturer shall specify the sensitivity or other Product setting(s) that may be used for correct operation in this application.

C3 The vehicle detection equipment shall respond to any vehicle with 3 or more road wheels travelling at any speed between 0 km/h (0 mph) and 129 km/h (80 mph) but is not precluded from detecting vehicles at speeds outside this range.

If the associated equipment is a vehicle counter, the vehicle detection equipment shall give a single unbroken vehicle detection signal for all motor-driven vehicles with 3 or more road wheels. An exception can be made for special classes of vehicles such as those having a ground clearance greater than 0.5 metres.

For the purpose of the single unbroken vehicle detection signal, the vehicle shall traverse the detection zone in such a way that at least 25% of the detection zone area is covered by the vehicle.

C4 In the event of any type of motor vehicle with 3 or more road wheels coming to rest over a boundary of detection, such that it is positioned midway between the point at which it was first detected on entering the detection zone and the point at which it would just cease to be detected on leaving the detection zone, with the whole width of the vehicle within the detection zone, or with the vehicle occupying at least 50% of the detection zone area, whichever is the lesser, the presence time shall be switch selectable to 4 minutes  $\pm$  1 minute for counting and occupancy, and 35 minutes  $\pm$  5 minutes for counting and queue detection.

C5 The vehicle detection signal to indicate the presence of a vehicle may be either the high or low impedance condition.

## APPENDIX D

# SCOOT AND MOVA APPLICATIONS

### *Performance Requirements*

D1 Vehicle detection equipment used to provide occupancy information for UTC (e.g. SCOOT) and locally optimised (e.g. MOVA) traffic responsive strategy of traffic control, shall comply with the following performance requirements:

D2 The vehicle detection equipment shall respond to any vehicle with 3 or more road wheels, travelling at any speed between 4.8 km/h (3 mph) and 129 km/h (80 mph), but is not precluded from detecting vehicles at speeds outside this range. The equipment shall preferably give a single unbroken vehicle detection signal for all types of vehicles.

D3 In the event of any vehicle with 3 or more road wheels coming to rest over a below ground detector, the presence time shall be 4 minutes  $\pm$  1 minute for any vehicle. The value of the presence time shall preferably not be adjustable from the front panel.

D4 The 'presence' output signal shall be produced when a vehicle occupies the zone of detection, the output to hold as long as the occupation by the vehicle continues (subject to the limitations of D3).

D5 The vehicle detection signal duration shall be within 30 milliseconds of the time for which a vehicle is over its zone of detection.

D6 The value of input sensitivity or other product settings shall be set to accord with requirements of D2 with preferably no manual adjustment accessible from the front.

## APPENDIX E CIRCUIT DESIGNATIONS - EURO CONNECTOR

### E1 Euro Connector DIN 41612 type B (Appendices A, B, C & D)

PIN	Circuit Designation (Optional 8 Channel Connector)	1 Channel	2 Channel	4 Channel	8 Channel
1a	Output Channel 1 relay N/C or +ve solid state	√	√	√	√
2a	Detector Channel 5				√
3a	Output Channel 1 relay N/O or +ve solid state	√	√	√	√
*4a	Reserved see note 2				√
5a	Detector Channel 1	√	√	√	√
*6a	Reserved see note 2	√	√	√	√
7a	Master fault output relay N/O or +ve solid state	√	√	√	√
8a	Detector Channel 6				√
9a	Output Channel 2 relay common or -ve solid state		√	√	√
10a	Output Channel 5 relay N/C or +ve solid state				√
*11a	Master fault output relay common or -ve solid state	√	√	√	√
12a	Output Channel 5 relay N/O or +ve solid state				√
13a	Detector Channel 2		√	√	√
14a	Output Channel 6 relay common or -ve solid state				√
15a	Output Channel 3 relay N/C or +ve solid state			√	√
16a	Detector Channel 7				√
17a	Output Channel 3 relay N/O or +ve solid state			√	√
18a	Output Channel 7 relay N/C or +ve solid state				√
19a	Detector Channel 3			√	√
20a	Output Channel 7 relay N/O or +ve solid state				√
*21a	24V ac supply	√	√	√	√
22a	Detector Channel 8				√

PIN	Circuit Designation (Optional 8 Channel Connector)	1 Channel	2 Channel	4 Channel	8 Channel
23a	Output Channel 4 relay common or -ve solid state			√	√
24a	Output Channel 8 relay N/C or +ve solid state				√
*25a	Serial communications bus transmit data RS 232 TX (TXD+)	√	√	√	√
*26a	RS 232 RTS	√	√	√	√
27a	Detector Channel 4			√	√
*28a	RS 232 RS 232 DSR (RXD-)	√	√	√	√
*29a	Reset input	√	√	√	√
*30a	Reserved see note 3	√	√	√	√
31a	Output Channel 8 relay N/O or +ve solid state				√
*32a	Reserved see note 3	√	√	√	√
1b	Output Channel 8 relay N/O or -ve solid state				√
2b	Output Channel 1 relay common or -ve solid state	√	√	√	√
3b	Detector Channel 5				√
*4b	Master fault output relay N/C or +ve solid state	√	√	√	√
*5b	Reserved see note 2	√	√	√	√
6b	Detector Channel 1	√	√	√	√
*7b	Reserved see note 2	√	√	√	√
8b	Output Channel 2 relay N/C or +ve solid state		√	√	√
9b	Detector Channel 6				√
10b	Output Channel 2 relay N/O or +ve solid state		√	√	√
11b	Output Channel 5 relay common or -ve solid state				√
12b	Detector Channel 2		√	√	√
13b	Output Channel 6 relay N/O or +ve solid state				√
14b	Chassis ground	√	√	√	√
15b	Output Channel 6 relay N/C or +ve solid state				√



**NOTES:**

1. \* Indicates optional facility. Refer to Table F2 for communications connections. (RS 485 connections shown in brackets)
2. Reserved for loop frequency selection as defined below

PIN	Signal name	Function
*4a	Frequency selection bit 1	Least significant frequency selection bit
*5b	Frequency selection bit 2	
*6a	Frequency selection bit 3	
*7b	Frequency selection bit 4	Most significant frequency selection bit

**Table.E2  
 Frequency Selection (Option)**

These signals duplicate the functions of the frequency selection switches on the Product and shall affect all detection channels within the vehicle detector

Interface:

Logical '1' is defined as floating or connection to +ve rail.

Logical '0' is defined as connection to 0v common.

Signal Function:

The combined functions of these signals shall be:

'1111' Selects the highest available loop frequency

'1110' Selects the next highest available frequency

;;    ;;    ;;    ;;    ;;

'0001' Selects the next lowest available frequency

'0000' Selects the lowest available loop frequency

Where fewer than 16 available loop frequencies are available, these bits shall be implemented most significant first. Non-implemented combinations of bit patterns shall not cause the detector to malfunction and may be interpreted as either 'Detector off' or as operation at one of the valid frequencies.

3. Reserved for detector identification selection as defined below:

PIN	Signal Name	Function
*21b	Detector Identification selection bit 1	Least significant Detector Identification selection bit
*29b	Detector Identification selection bit 2	
*30a	Detector Identification selection bit 3	
*31b	Detector Identification selection bit 4	
*32a	Detector Identification selection bit 5	Most significant Detector Identification selection bit

**Table E3**  
**Detector Identification (Option)**

These signals set the Product identification for use within large serial bus connected detector systems.

Interface

Logical '1' is defined as floating or connection to +ve rail.

Logical '0' is defined as connection to 0v common.

Signal function:

The combined functions of these signals shall be

'11111' Selects the highest Detector Identification

'11110' Selects the next highest Identification

::    ::    ::    ::

'00001' Selects the next lowest Identification

'00000' Selects the lowest Detector Identification

## APPENDIX F INFORMATIVE GUIDE

### General

This Annex is an informative guide to Highway Authorities who wish to purchase / hire and use Below Ground Vehicle Detection Equipment, for use with Permanent Traffic Signal Controllers, which has been declared conformant to this specification. Prospective purchasers / hirers should ensure that the procurement contract address the following issues if they are required.

### Method of Connection

Where alternative interfaces are permitted in the appendices hereto, the following may optionally be complied with.

In order to be compatible with existing UK signal control equipment, the physical interfaces need to comply with the following connection types, tables & configurations.

*Note to purchasers:* The serial protocol used may be manufacturer specific and detectors from different manufacturers, implementing serial connectivity, might not be compatible each other.

#### 1. Connector Device RJ45 (Optional Front Panel Connector).

Pin	Signal	Input/Output
1	RTS	Output
2	DTR (TXD-)	Output (TX)
3	TX (TXD+)	Output (TX)
4	0V	Common
5	0V	Common
6	RX (RXD+)	Input (RX)
7	DSR (RXD-)	Input (RX)
8	CTS	Input

**Table F1**

RJ 45 Pin Connection

TERMINAL INTERFACE. The interface shall conform to RS 232 or RS 485. (RS 485 connections shown in brackets)

BAUD RATE. The Baud Rate must be capable at 9600 Bd or higher rates. Operation at 9600 Bd is recommended.

CHARACTER SET. The Character Set shall be ISO Alphabet No 5 (ASCII).

User Terminal. The manufacturer shall specify an appropriate terminal device and required software.

#### 2. Serial detector data Connection – Rear Terminations on Euro-Connector

Pin	Signal	Input/Output
26a	RTS	Output
25b	DTR (TXD-)	Output (TX)
25a	TX (TXD+)	Output (TX)
32b	0V	Common
28b	RX (RXD+)	Input (RX)
28a	DSR (RXD-)	Input (RX)
27b	CTS	Input

**Table F2**

**Connections to Euro-Connector**

TERMINAL INTERFACE. The interface shall conform to RS 232 or RS 485. (RS 485 connections shown in brackets).

BAUD RATE. The Baud Rate must be capable at 9600 bd or higher rates. Operation at 115.2 KBd is recommended.

CHARACTER SET. The Character Set shall be ISO Alphabet No 5 (ASCII).

The manufacturer shall define equipment with which this interface has proven compatibility.

### **3. Integrated Detector Link**

Where detector systems are integrated into a host controller, the detector/controller interface may be manufacturer specific.

#### ***Reset Input (Optional)***

Where required the product may provide a reset facility.

## 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 2512B.

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 certificate's, 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	Statement of compliance	A clause by clause statement of compliance against TOPAS 2512B confirming compliance and/or listing caveats or deviations.	✓
7	Test procedures and results	A reference to all test schedules and test result documents (by document part number and issue).	✓

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.	N/A
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.	N/A
13	Failure Mode Analysis	A reference to the product failure mode analysis requirements and results by document part number and issue.	N/A