

Microwave Vehicle Detection Equipment for Portable Vehicle Actuated Traffic Signals

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Introduction

This specification describes the functional operating requirements and constructional details for equipment to detect road vehicles at portable traffic signals. Microwave vehicle detectors operate by directing a beam of microwave energy along a carriageway towards approaching vehicles and then detect the reflected signals from moving vehicles.

1. SCOPE

This specification gives the performance requirements for microwave vehicle detection equipment to be used to implement vehicle actuated control of Portable Traffic Signals.

2. EQUIVALENCE

2.1 Any requirement of the specification for goods or materials to comply with a specified standard shall be satisfied by compliance with

(i) a relevant standard or code of practice of a national standards body or equivalent body of any state of the European Economic Area

or (ii) any relevant international standard recognised for use in any state of the European Economic Area

or (iii) a technical regulation of any state of the European Economic Area

or (iv) traditional procedures of manufacture of a state of the European Economic Area where these are the subject of a written technical description sufficiently detailed to permit assessment of the goods or materials for the use specified

or (v) a specification sufficiently detailed to permit assessment for goods or materials of an innovative nature or subject to innovative processes of manufacture and fulfil the purpose provided for by the specified standard

or (vi) any method chosen by the manufacturer in accordance with UK legislation

provided that the proposed standard, code of practice, specification or technical description provides, in use, levels of safety, suitability and fitness for purpose equivalent to those required by the specified standard.

2.2 Any requirement of the specification to use material or an article which is defined by reference to a named supplier or manufacturer shall be satisfied by using an equivalent material or article of another manufacturer or supplier of any Member State of the European Economic Area provided that this material or article is, in use, as safe, suitable and fit for the relevant purpose as material or an article complying with the requirements set out in the specification.

2.3 Any requirement for any materials or articles to be designed, manufactured or supplied subject to a quality management scheme or product certification scheme or approval scheme shall be satisfied by compliance with any equivalent quality management scheme or product certification scheme or approval scheme acknowledged for use by a public authority of any state of the European Economic Area provided that the scheme ensures that the design, manufacture or supply offers, in use, equivalent levels of safety, suitability and fitness for purpose.

2.4 Where testing is carried out in a state of the European Economic Area such tests shall be carried out by an appropriate organisation offering suitable and satisfactory evidence of technical and professional competence and independence. This condition shall be satisfied if the organisation is accredited in a state of the European Economic Area in accordance with the relevant parts of the EN 45000 series of standards for the tests carried out.

3. DEFINITIONS

For the purpose of this specification the following definitions shall apply:

DETECTION ZONE: That area of the roadway within which a vehicle will be detected by a microwave vehicle detector.

OUTPUT: The specified condition between the output terminals of the MVD equipment, while a vehicle is being detected.

TURN-ON TIME: The time delay between the instant when a signal (the input signal), capable of causing an output, occurs, and the instant when an output occurs.

TURN-OFF TIME: The time delay between the instant when an input signal which has caused an output ceases, and the termination of the output signal.

VEHICLE DETECTION EQUIPMENT: Detection equipment provided at the installation by which the movement of vehicular traffic approaching or passing through the controlled area can be detected.

4. COMPLIANCE WITH STANDARDS

4.1 Unless specified to the contrary herein all equipment supplied to this specification shall comply, where appropriate, with the current requirements of :

- British Standard 2754 (Technically Equivalent to IEC 536) Memorandum. Construction of Electrical Equipment for Protection Against Electric Shock.
- British Standard 7671. Requirements for Electrical Installations (The IEE Wiring Regulations). The equipment shall be designed and constructed so as to permit both installation and use in accordance with the appropriate regulations regarding outdoor use of low voltage equipment.

4.2 This specification should be read in conjunction with the undermentioned Departmental Specifications as appropriate :

- TR 0111 - Traffic Signal Control Equipment For Use At Road Works.
- British Standard 505 - Road Traffic Signals (metric units)
- MCE 0137A - Traffic Signal Control Equipment for use at Haul Route Crossings 6/82.
- MCH 1478A - Guidelines for the testing of Microwave Vehicle Detection Equipment to TR 2147.
- TRG 0500 - Statutory Type Approval of Equipment and Systems for the control of vehicular and Pedestrian Traffic on Roads other than Motorways.

5. APPROVAL PROCEDURE

Equipment covered by this specification shall not be used on public roads unless it has been granted Statutory Type Approval. The procedure to be followed by a manufacturer to obtain such Approval is set out in Departmental Specification TRG 0500 'Statutory Approval of Equipments for the control of vehicular and Pedestrian Traffic on Roads'.

6. PERFORMANCE REQUIREMENTS

6.1 The equipment shall meet the following performance requirements. (All distances are measured horizontally from the detector):

6.1.1 The width of the detection zone shall be sufficient for a single Microwave Vehicle Detector to detect an approaching vehicle in either of two lanes as described in MCH1478.

6.1.2 The low speed threshold setting shall be within 2 to 2.5mph, (3.2 to 4kph) no detection shall occur below this threshold.

6.1.3 The equipment shall detect Bicycles, Mopeds, Motorcycles and Saloon Cars approaching at between the low speed threshold setting and 10mph (16kph) throughout the range 5 to 15m. Detection outside these ranges is not precluded.

6.1.4 Motorcycles and Saloon Cars approaching at 10mph (16kph) or greater shall be detected throughout the range 5 to 40m. Detection outside these ranges is not precluded.

6.1.5 Bicycles and mopeds approaching at 10 mph (16kph) or greater shall be detected throughout the ranges 5 to 25m. Detection outside these ranges is not precluded.

6.1.6 The equipment shall be capable of detecting a vehicle travelling at up to 60mph (96.5kph).

6.1.7 The equipment shall not produce an output signal for vehicles moving away from the detecting equipment.

6.1.8 The equipment shall be designed so as to minimise the possibility of false demands from extraneous objects.

6.1.9 The turn on time shall be less than or equal to 500ms.

6.1.10 The turn off delay time shall be 500ms \pm 20%.

6.2 A method of simulating the presence of an approaching vehicle if the MVD has not changed state after a specified time shall be provided. This shall be achieved by one of the following:

6.2.1 Automatically generating an output signal of 0.36 to 1.05 seconds duration to simulate the presence of an approaching vehicle. It shall be generated if the MVD has not changed state for a period of 2.5 minutes \pm 20%. The 2.5 minute timer shall be automatically reset to the start of a timing period, such that successive timings start from the time of loss of vehicle detection; or

6.2.2 Automatically generate a permanent output when the MVD has not changed state for a period of 2.5 minutes \pm 20%. The output shall automatically be removed when the MVD receives a vehicle detection signal. The 2.5 minute timer shall be reset from the time the vehicle detection signal is lost.

6.2.3 If both of these facilities are provided they may be selected by means of an internal link.

6.2.4 The output signal while a vehicle is being detected shall be as defined in Section 8.3.

7. POWER SUPPLIES

7.1 The equipment shall operate in accordance with this specification when powered from one of the following supplies:-

7.1.1 Low Voltage a.c.

Voltage: 110V +15% -20%: Frequency: 50Hz ±4%

The supply shall take the form of 55V-0v-55V with the OV terminal bonded to all externally accessible metal work.

7.1.2 Extra Low Voltage a.c./d.c.

Voltage: Nominal Voltage ±20% up to 50V max.
(Nominal voltage to be specified by the manufacturer.)

The equipment shall be protected against reverse polarity.

7.2 Maximum Power Consumption shall not exceed 25VA.

8. OUTPUT AND FAULT CONDITIONS

8.1 The output from the MVD equipment shall be isolated from earth and power supplies to the detection equipment. If the output is polarity conscious, a means shall be provided to protect the output device against an accidental reversal of current flow. The correct direction of current flow shall be clearly marked on the relevant output terminals, see Section 15 for cable core colour allocation.

8.2 In the non-detect state, the output shall continuously present a resistance of no more than 50 ohms.

8.3 In the detect state, the output shall continuously present a resistance of at least 100k ohms. The output must be able to withstand a continuous voltage across it of 50V dc or 110V ac and must not be damaged by transients of up to 650V peak amplitude for 1ms duration.

8.4 A visual indicator, which shall be red in colour, shall be fitted in the MVD as an output indicator. This shall illuminate for the duration of the output signal, and be positioned such that it is clearly visible to the user under normal operation.

8.5 Secondary output lines may be provided to drive a remote indicator which shall illuminate for the duration of the output signal.

8.6 An interruption of the power supply to the vehicle detection equipment shall, within ten seconds, automatically produce an output signal for so long as the interruption persists. The equipment shall regain its specified operation within twenty seconds of the restoration of the power supply.

9. OPERATING FREQUENCY AND TRANSMITTED POWER

The detection equipment shall operate at such a frequency and transmitted power as to comply in all respects with the Department of Trade and Industry, Radio Regulatory Division specification MPT1349 "Transmitters and Receivers for use in the Microwave Band allocated to Low Power Industrial Applications".

10. MUTUAL INTERFERENCE

MVD equipment manufactured to this specification shall not affect the operation of other MVD equipment of the same type when correctly mounted and operated in the following positions:

- back to back with the housings 25 ± 10 mm apart
- at right angles with the backs of the housings 25 ± 10 mm apart
- face to face 100m apart
- side by side 5m apart or greater, facing in the same direction.

11. ELECTROMAGNETIC COMPATIBILITY

The equipment shall be designed to avoid the production of undue electromagnetic interference and to have an immunity from external electromagnetic interference. Proof of conformity shall be demonstrated by compliance with a harmonised standard for the purposes of Directive 89/336/EEC in the area of motorway communications and traffic control applications. Until such time as a harmonised standard is in effect the UK Authorities will require compliance with TRG 1068.

12. ENVIRONMENTAL PERFORMANCE

The equipment shall meet the performance requirements specified in Department Specification TR 2130B in the following areas:

- Dry Heat (including solar radiation)
- Cold
- Damp Heat
- Immersion
- Shock
- Drop and Topple
- Bump

- Vibration transportation
- Vibration random

13. CONSTRUCTION

The equipment housing shall be constructed in such a manner and from materials which ensure it meets the environmental requirements detailed in Section 12 of this specification.

14. MOUNTING ARRANGEMENT

Three holes tapped M6 x 10 mm or M6 studs of length 15 to 30 mm, with fixing bolts or nuts, and shakeproof washers arranged in a triangle with the front pair of holes 51mm + 0.25mm apart, the rear hole being 38mm + 0.25mm from the line joining the front holes, shall normally be provided for fixing the housing.

15. INTERFACE REQUIREMENTS

CABLE AND CORE COLOUR - DESIGNATION (plugs may be fitted if required)

EXTRA LOW VOLTAGE DC VERSION			110V AC VERSION		
COLOUR	DESIGNATION		COLOUR	DESIGNATION	
Red Black Green	+VE OV Earth	POWER SUPPLY	Red Blue Green	LIVE LIVE EARTH	POWER SUPPLY
White Yellow	COMMON OPEN (DETECT) (+Ve)	OUTPUT SIGNAL	White Yellow	COMMON OPEN (DETECT) (+ Ve)	OUTPUT SIGNAL
Blue	Not Used		Black	Not Used	

15.1 Cable shall be to Def Stan 61-12 part 5, the minimum number of wires in each core shall be 16 and the nominal diameter of each wire shall be not less than 0.20 mm.

15.3 The external length of cable supplied shall be 1 metre ± 10%.

16. RELIABILITY

16.1 The equipment shall have an MTBF prediction figure of 20,000 hours.

16.2 The data contained in MIL-HDBK 217 shall be used for reliability prediction.

17. REFERENCES

- a. The Low Voltage Electrical Equipment (Safety) Regulations 1989 (Statutory Instrument 1989 No 728).
- b. British Standard 2754 (Technically Equivalent to IEC 536) Memorandum. Construction of Electrical Equipment for Protection Against Electric Shock.
- c. British Standard 7671 - Requirements for Electrical Installations (The IEE Wiring Regulations).
- d. MPT 1349 - DTI Performance Specification, Transmitters and Receivers for use in the Microwave Band Allocated to Low Power Industrial Applications.
- e. British Standard 505 - Road Traffic Signals
- f. TRG 1068 - Electromagnetic Compatibility Tests for Motorway Communications Equipment and Portable and Permanent Traffic Control Equipment
- g. TR 0111A - Traffic Signal Control Equipment for use at Roadworks.
- h. MCE 0137A - Traffic Signal Control Equipment for use at Haul Route Crossings 6/82.
- i. TRG 0500 - Statutory Approval of Equipment for the control of vehicular and Pedestrian Traffic on Roads.
- j. TR 2130 - Environmental Tests for Motorway Communication Equipments and Portable and Permanent Traffic Control Equipment.
- k. MCH 1478A - Guidelines for the testing of Microwave Vehicle Detection Equipment to TR 2147.
- m. MIL-HDBK 217F - US Military Standardisation Handbook; Reliability Prediction of Electronic Equipment
- n. Ministry of Defence - Defence Standard 61-12 (Part 5)

18. HISTORY

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A C Powell
Network Control Division
Highways Agency