TEXAS DEPARTMENT OF TRANSPORTATION
DEPARTMENTAL SPECIFICATION
TO-6043
DIGITAL LOOP VEHICLE DETECTOR UNIT

1.0 SCOPE

This specification is for use in the purchase of digital, solid state, self-tuning, inductive loop detector units with extend and delay features for use in traffic controllers and traffic counting systems.

2.0 GENERAL

2.1 Loop detector units supplied under this specification shall meet the requirements of NEMA TS 1, Section 15 (1986) unless otherwise specified in this specification or the Invitation to Bid.

2.2 The loop detector units provided shall be digital, solid state devices designed for 120 VAC operation and stand alone shelf mounting.

2.3 The loop detector units shall be either single or dual channel units as required in the Invitation to Bid.

2.4 The case of the loop detector unit may be of metal or an impact resistant plastic material, and shall be designed to permit easy access to internal components.

2.5 Each loop detector unit shall be provided with a unique permanent serial number on the outside of the main chassis.

3.0 DESIGN REQUIREMENTS

3.1 All circuit tracks shall have a conductivity equivalent to at least two ounces per square foot of copper.

3.2 Lightning protection shall be installed within the loop detector unit. The protection shall enable the amplifier to withstand the discharge of a 10 microfarad capacitor charged to plus or minus 1000 volts directly across the detector loop input pins with no load present. The protection shall enable the loop detector unit to withstand the discharge of a 10 microfarad capacitor charged to plus or minus 2000 volts directly across either the detector inputs or from either

side of the detector inputs to earth ground. For this test, the detector chassis shall be grounded and the detector inputs shall have dummy resistive load attached equal to 5.0 ohms.

3.3 An over current protection device shall be provided on all loop detector units. For shelf mounted vehicle loop detector units the fuse or circuit breaker shall be accessible from the front or back of the unit. Any other over current protection device may be mounted internally.

3.4 The output from the loop detector unit shall be solid state and optically isolated.

3.5 The loop detector unit shall be supplied with the delay and extend output features describes below:

1. Delay Output - A variable delay circuit shall be furnished to provide a delayed output. This circuit shall be variable from 0 to at least 20 seconds in one second increments. Detection of a vehicle shall be delayed for the amount of time selected, thereby providing no detector output until a vehicle has been present in the loop for this length of time. This timing shall reset each time the loop is vacated. The delay circuit shall be disabled immediately when 120 VAC is present on Pin J of the MS3106A-18 IP connector for this channel.

2. Extend Output - A variable extend circuit shall be furnished to provide a carryover output. This circuit shall be variable from 0 to at least 15 seconds in .25 second increments. Detector actuation shall be extended after the vehicle leaves the loop. The timing circuit shall reset after the extension has expired. The extend circuit shall not be disabled when 120 VAC is present at Pin HJ of the connector described herein. The timing shall be digital and all programming settings shall be accomplished by pins, thumbwheels, or dip-switches. The delay and extend features described above shall not be required to function simultaneously unless otherwise specified in the Invitation to Bid.

3.6 All programming (extend, delay, retention of presence, etc.) shall be external and located on the face of the unit.

3.7 The loop input shall be isolated from the detector circuitry by means of an isolated transformer.

4.0 FUNCTIONAL REQUIREMENTS

4.1 The loop configurations referred to in this specification shall consists of the following:

1. Four 6 x 6 foot, three turn loops connected in series/parallel

2. Two 6 x 30, two turn loops

3. On 6 x 80, foot I turn loop

4. One 6 x 30, quadrapole, 2-4-2 turn loop
5. Two high speed 6 x 6 foot, three turn loops

6. One high speed transverse 6 x 30 foot, two turn loop

4.2 The detector unit shall detect all vehicles that ordinarily traverse public streets and highways and which consist of sufficient conductive material, suitably located to permit recognition by the detector system. For this specification test vehicles shall be as follows:

1. Class I - A standard 10 speed, 26 inch bicycle

2. Class 2 - 50 cc motorcycle

3. Class 3 - Automobile ranging from 1700 to 2000 pounds

4. Class 4 - Standard C-50 tractor-trailer combination

4.3 When detecting test vehicles of the same class each channel of the detector unit shall include means to adjust sensitivity such that it shall include means to adjust sensitivity such that it shall not produce an output when the test vehicle is more than 36 inches from the perimeter of the loop. The detector unit shall have a minimum of three sensitivity selections for each channel.

4.4 The detector unit shall detect all traveling in the speed range of three miles per hour to 70 miles per hour.

4.5 Retention of presence detection shall be programmable from 0 to 900 seconds in two second increments or less. This feature shall be user selectable by a switch on the face of the unit. Upon termination of the time programmed for presence, the unit shall either retune to the environment immediately or upon the lost of green for that phase. This option shall also be user selectable by a switch on the face of each unit.

4.6 The detector, after being actuated continuously for any period, shall regain 100 percent sensitivity within 0.5 seconds after the loop is cleared of vehicles.

4.7 Each detector channel shall function in the following two from panel selectable modes:

1. Presence - When a Class 2 vehicle or larger occupies the center of any of the test loops (except for the Class 2 vehicle in the 6 X 80 foot loop), described in Figure 1, the detector shall maintain a detection output for the length of time the vehicle is in the loop and for the time period programmed for presence.

2. Pulse - A vehicle passing over a loop shall cause an actuation lasting between 75 milliseconds and 150 milliseconds. If a vehicle stops in the loop area, the loop detector unit shall, within five seconds, detect subsequent vehicles passing over the unoccupied area of the loop.

4.8 Upon restoration of electrical power after a power failure of any length, the detector shall automatically return to its normal state of operation within 15 seconds.

4.9 In addition to the requirements of NEMA TS -15.2.11, the detector shall continue to operate when the resistance between ground and either loop input is within the range of 100 megaohms to 50 ohms.

4.10 If a detector loop circuit becomes open, the detector shall produce an output that shall remain until the malfunction is corrected.

4.11 The connector shall be an MS-3106A-I 8- IP and shall have the following pin terminations:

Pin A Line Neutral (AC-)
Pin B Isolated Solid State Output (emitter)
Pin C Line, 115 VAC plus or minus 15% Hertz (AC+)
Pin D Loop Input
Pin E Loop Input
Pin F Spare
Pin G Spare
Pin H Chassis Ground
Pin I Isolated Solid State Output (collector)
Pin J 120 VAC Output from Green Load Switch for this phase

4.12 Two channel loop detector units shall be furnished with dual single channel connectors (MS3106A-18-IP) on the front panel of the units to insure field compatibility.

4.13 Indicator(s) shall be provided to distinguish between detection, detection delay, or detection extended.

5.0 FUNCTIONAL TESTS

Any or all of the following tests may be performed on equipment furnished under this specification.

5.1 In the presence mode, a Class 1, 2, 3, or 4 vehicle stopped over a 6 x 6 foot three turn loop with 100-foot lead-in shall be detected. Class 3 and 4 vehicles shall be continuously detected for a minimum of 15 minutes when so programmed or for a least one half-hour.

5.2 All classes of vehicles moving over a 6 x 6 foot three turn loop with 100 foot lead-in shall generate a single pulse output from the loop detector unit when in the pulse mode.

5.3 There shall be no crosstalk between adjacent loops connected to separate channels or loop detector in the presence mode shall detect a Class 3 vehicle for not less than 15 minutes and shall, upon departure of this vehicle from the zone of detection recover and, after one second, detect a Class 2 vehicle.

5.4 A 6 x 6 foot three turn loop connected to a detector in the presence mode shall detect a Class 3 vehicle for not less than 15 minutes and shall, upon departure of this vehicle form he zone of detection recover and, after one second, detect a Class 2 vehicle.

5.5 The 6 x 80 foot loop connected to a detector unit with 100 feet of lead-in shall detect Class 2, 3, and 4 vehicles. The vehicles shall enter the zone of detection at ten miles per hour and the Class 2 shall be detected for a minimum of three minutes. Class 3 and 4 vehicles shall be detected for the time programmed.

5.6 The 6 x 30 foot loop adjusted (sensitivity) for any one class of vehicles shall not detect a numerically equal class vehicle passing 36 inches outside any part of the loop's perimeter.

5.7 A Class I vehicle traveling at three miles per hour over either a 6 x 6 foot three turn loop or a 6 X 30 foot quadruple loop shall be detected.

5.8 A 6 x 6 foot loop with 100 foot lead-in connected to a detector unit shall continue to operate normally while resistance to ground on one of either loop lead is varied from 100 me-ohms to 50 ohms gradually in a 15 minute period. As loop integrity is restored gradually in the same time interval, the unit shall continue to operate normally.

5.9 When an open circuit induced in a loop circuit is restored, the detector unit shall automatically become operational within 15 seconds, or upon termination of the time programmed for the retention of presence feature.

5.10 A 1550 picofarad capacitor will be connected in parallel across a functioning 6 X 6 loop with 100 foot lead-in with a Class 3 vehicle over the loop. The loop detector unit shall continue to function normally.

5.11 A loop detector unit connected to a 6 X 6 three turn loop with 100 foot lead-in shall detect all classes of vehicles traveling from three miles per hour to 60 miles per hour

5.12 A loop detector unit connected to a 6 X 80 foot single turn loop shall detect Class 2, 3, and 4 vehicles moving at three miles per hour.

5.13 All of the above tests shall also be performed with 100 foot lead-in except Paragraphs 5.8 and 5.9.

5.14 Other NEMA environmental tests may be performed.

6.0 DOCUMENTATION REQUIREMENTS

Each loop detector unit shall be provided with one of each of the following documentation enclosed in each carton for each until supplied:

6.1 Complete and accurate schematic diagrams

6.2 Complete installation procedures

6.2 Complete performance specifications (both electrical and mechanical) on the unit

6.4 Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, or EIA

6.5 Pictorial of components layout on circuit board

6.6 Complete maintenance and troubleshooting procedures

6.7 Complete stage-by-stage explanation of circuit theory and operations

7.0 GUARANTY

The manufacturer shall furnish a one-year guarantee from date of final acceptance against any imperfection in workmanship or material.

8.0 MEASUREMENT

Measurement shall be made of each loop vehicle detector unit complete as specified in the Invitation to Bid.

9.0 PAYMENT

Payment will be made at the unit price bid for the item, delivery and approved at the place specified on the Invitation to Bid.