

**STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
TRENTON, NEW JERSEY 08625**

METRIC SPECIFICATIONS FOR LOOP DETECTOR UNIT

N. J. Specification No. EBM-LD-3

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New Jersey Department of Transportation Specifications for Loop Detector Unit.

The purpose of these specifications is to describe minimum acceptable design and operating requirements for a shelf mounted completely solid state four channel inductive loop detector unit, capable of detecting all licensed motor vehicles when connected to specific loop configuration, with loop detectors leads up to 300 meters, without detecting vehicles in adjacent lanes.

GENERAL - I

- 1-1 All circuits shall be fully solid state electronic circuitry. No vacuum or gaseous tubes shall be used in any circuits.
- 1-2 All components shall be de-rated by a minimum of 25 percent with regard to heat dissipating capacity and rated voltage so that, with maximum applied voltage, material shortening of life or shift in values shall not occur.
- 1-3 Each component (transistor, resistor, capacitor, integrated circuit, etc.) shall be readily identified with the original component manufacturer's identification number. If the component is re-identified with a manufacturer's part number, a complete cross-reference list shall be supplied. This list shall specify the electrical characteristics of the components giving the standard part number of the industry. All components shall be readily available commercially from other sources than the manufacturers. Integrated circuit devices having 14 or more leads shall be socket-mounted to facilitate repair and maintenance of units. When integrated circuits are of such special design that they preclude the purchase of identical components from any wholesale electronics distributor or any component manufacturer, one exact duplicate integrated circuit shall be furnished with each twenty, or fraction thereof, under each contract or bid proposal unless otherwise specified.

ELECTRICAL REQUIREMENTS - II

- 2-1 The loop detector unit shall be designed to operate within the environmental and operating standards set forth in the current NEMA Standards Publication No. TS 1, Section 15 (except as otherwise specified herein) and the performance requirements of this specification.
- 2-2 Circuit voltage of the loop detector unit shall not exceed 24 volts.
- 2-3 All components and terminals shall be readily accessible for servicing.

- 2-4 The output shall be a mechanical relay rated for 120 volt AC with plug in type contacts rated at 3 amps. Optically isolated, solid state outputs with the passive ability to drive at least a 24 volt DC, 20 milliampere current shall be provided, when required to provide compatibility with equipment in the contract to which this specification applies.
- 2-5 The loop detector unit shall be adequately protected from damage from instantaneous voltage surges which may occur in the supply line or loop leads. Varistors between power line leads shall also be capable of withstanding the discharge of a two (2) microfarad capacitor charged to 1 000 volts across the loop terminals and from the loop terminals to earth ground.
- 2-6 An indicator light shall be provided for each channel on the front of the unit to verify the detection of a vehicle. The indicator light shall be a high brightness type LED, suitable for sunlight visibility.
- 2-7 The loop detector unit shall be designed so that in the event of a power failure of more than 20 milliseconds, the loop detector shall continue its operation upon resumption of power. The loop detector unit shall attain at least 90 percent of its selected sensitivity within 30 seconds after the main supply voltage recovers to a voltage within the specified limits.
- 2-8 DC supply voltages shall be adequately filtered and regulated against changes in input voltage and output load current variations.

OPERATIONS - III

- 3-1 The loop detector unit shall be capable of detecting all motor vehicles at speeds from 8 to 129 kilometers per hour. The sensitivity or distance from the loop that a vehicle will be detected shall be adjustable.
- 3-2 The loop detector unit shall be capable of operating loops of various size with a total inductance of 20 to 2 000 microhenries, with loop lead in up to 300 meters.
- 3-3 Two loops or more shall be able to be connected to a single channel, in either series or parallel or series/parallel.
- 3-4 All digital circuits of the loop detector unit shall be crystal, controlled and have MOS-LSI logic perform all counting, memory and detection recognition on two or four channels.
- 3-5 The loop detector unit shall be provided with channels operating on a sequential scanning basis. Each channel may receive inputs from one or more inductive loops and shall be capable of operating in either "pulse" mode, where the detector shall rephase two seconds after initiating an out-put pulse of approximately 100 millisecond duration, or "presence" mode with a minimum hold time of four minutes for smallest detectable vehicle and a hold time of 60 to 120 minutes for an automobile.
- 3-6 The sensitivity of each channel shall be selectable in 2:1 increments over a range of seven pulse levels, seven presence levels, and an "off" position from a readily accessible thumbwheel control, or by dip switch.

- 3-7 The loop detector unit shall be able to detect all licensed motor vehicles over a range of inductance of 20 - 2 000 microhenries and shall be capable of detecting inductance change as minimum as 0.02 percent at 300 microhenries.
- 3-8 The loop detector unit shall detect vehicles when the loop detector is installed at a maximum depth of 150 millimeters below the roadway surface.
- 3-9 The loop detector unit must adapt itself to an increase or decrease in inductance and/or capacitance due to environmental conditions and continue to operate satisfactorily without retuning. The loop detector unit must be self-adjusting or tracking to variations in loop parameters through its tuning range and be capable of continued satisfactory operation regardless of changes without need for manual retuning.
- 3-10 For directional operation, loops must be capable of being overlapped.
- 3-11 A "frequency" switch shall be provided on the front of the loop detector unit. This switch shall be used to minimize the "cross-talk" between loop detector units in the same cabinet.
- 3-12 The loop detector unit shall have circuit board programming capacity to modify performance for particular applications or environments as follows:
- Pulse mode output duration shall be 100 milliseconds nominal.
- 3-13 Operation of loop detector unit shall not terminate if loops are partially defective through either single point leakage or short to ground. The output response to a broken loop shall be a detect.

MECHANICAL - IV

- 4-1 The overall dimensions of the shelf mounted loop detector unit shall not be greater than 89 millimeters W by 178 millimeters H by 229 millimeters D.
- 4-2 All controls, connectors, and indicators shall be located on the face panel of the sensor. Adjusting mode and sensitivity shall be easily accomplished without the use of any tools. An area of identification shall be provided adjacent to each channel.
- 4-3 The loop detector unit shall be designed so that the presence of metal objects in the vicinity of the loop can be compensated for through sensitivity selection.
- 4-4 Each loop detector unit shall be furnished with one (1) 1.8 meter long connector cable. The cable shall have a PVC jacket and rated for 300 volts. The conductors shall be 22 AWG stranded annealed copper wire, with PVC insulation rated for 300 volts.
- 4-5 The loop input leads of each channel shall have as a minimum, 40 twists per meter.

- 4-6 All conductors of cable shall be color coded.
- 4-7 One end of the connector cable shall be connected to a 19-pin, MS3106A-2-14S MS connector. The opposite end of the connector cable shall terminate with vinyl insulated spade type terminals. Input-output connector pin terminations shall be as follows:

PIN	FUNCTION	COLOR
A	AC- (COMMON)	WHITE
B	OUTPUT, CH 4 (-)	WHITE/BLACK
C	AC+ (LINE SIDE)	BLACK
D	LOOP INPUT, CH 1	BROWN
E	LOOP INPUT, CH 1	WHITE/BROWN
F	LOOP INPUT, CH 2	RED
G	LOOP INPUT, CH 2	WHITE/RED
H	CHASSIS GROUND	GREEN
J	LOOP INPUT, CH 3	ORANGE
K	LOOP INPUT, CH 3	WHITE/ORANGE
L	LOOP INPUT, CH 4	YELLOW
M	LOOP INPUT, CH 4	WHITE/YELLOW
N	OUTPUT, CH 1 (+)	WHITE/BLUE
P	OUTPUT, CH 1 (-)	BLUE
R	OUTPUT, CH 2 (+)	VIOLET/WHITE
S	OUTPUT, CH 2 (-)	VIOLET
T	OUTPUT, CH 3 (+)	WHITE/GRAY
U	OUTPUT, CH 3 (-)	GRAY
V	OUTPUT, CH 4 (+)	WHITE/GREEN

- 4-8 All connectors shall be equipped with strain reliefs and boots.

INSTRUCTIONS AND GUARANTEE - V

- 5-1 One schematic wiring diagram and maintenance manual, including theory of operation, shall be provided with each loop detector unit.
- 5-2 No changes or substitutions in these requirements will be accepted unless authorized in writing. Inquiries regarding this specification shall be addressed to the Manager, Office of Traffic Signal and Safety Engineering, New Jersey Department of Transportation, 1035 Parkway Avenue, P.O. Box 613, Trenton, New Jersey 08625.
- 5-3 The complete loop detector unit shall carry a two year guarantee from the date of delivery against any imperfections in workmanship and material.
- 5-4 The company agrees upon the request of the Manager, Office of Traffic Signal and Safety Engineering to deliver to the Office, a sample of the loop detector unit to be supplied in compliance with these specifications for inspection and test before acceptance. After completion of the test, the sample shall be returned.