MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
MICROWAVE VEHICLE DETECTOR

SIG:EMS 1 of 8 APPR:HLO:NJB:05-09-24
FHWA:APPR:06-04-24

a. Description. This work consists of completing one or more of the following work types at locations as shown on the plans:

1. Furnishing and installing a microwave vehicle traffic detector; and/or Ethernet extension and cast aluminum enclosure.

2. Removing and disposing of a microwave vehicle traffic detector; and/or Ethernet extension and cast aluminum enclosure as required.

3. Removing, storing, and reinstalling an existing microwave vehicle traffic detector; and/or Ethernet extension and cast aluminum enclosure as required.

As applicable, this work includes installation or removal of a detector, mounting brackets, hardware, cable, connectors, fittings, interface card, communication patch cords, lighting and surge protection, Ethernet extension and cast aluminum enclosure as required, grounding, and any other material required to ensure a complete installation or removal, as specified for a location.

b. Materials. Furnish materials in accordance with sections 918 and 921 of the Standard Specifications for Construction and this special provision or as directed by the Engineer, necessary to provide a complete and operating installation.

1. Microwave Vehicle Detector.

A. Furnish a microwave vehicle detector from the following list.

(1) MS Sedco TC-CK1-SBE Intersector.

(2) Approved equal (AE). Ensure the AE is evaluated, tested, and approved per the MDOT New Traffic Signal Device Product Review Guidelines. The review time is not justification to delay the project.

B. Furnish a microwave vehicle detector that consists of:

(1) A vehicle detector;

(2) An interface board and card for each detector;

(3) Four channel, two set interface card for creating and programming detection zones;

(4) An Ethernet interface and cable;

(5) Any associated cable, connectors as necessary to complete the work; and

(6) A Category (CAT)6-Power over Ethernet (PoE)-I surge protector with each detector.

C. Furnish a detector that:

(1) Is a microwave radar-based motion and presence detector used for intersection vehicle detection;

(2) Detects trucks, vehicles, motor cycles and bicycles by sending a signal representative of a loop type detector in a presence mode to a traffic signal controller device;

(3) Is easy to install, set up and program with minimum effort;

(4) Interfaces with a traffic signal controller and outputs signal when vehicles are present in user defined zones. Creates these zones by using an X-Y coordinate system and has the operation verified and optimized using a laptop with Internet Explorer type or greater as part of the installation process or resident on the personal computer (PC);

(5) Updates the X-Y coordinates 20 times per second;

(6) Allows the user to create and program up to eight independent zones and assign vehicle presence in each of these zones, and up to four independent optical isolated outputs to the control cabinet via one of three optional detector interface boards. Creates detection zones from 50 feet to 425 feet (minimum) from the detector location;

(7) Determines and displays the speed of each vehicle in the detection zones;

(8) Uses an interface in either English (standard) or metric units at the option of the user;

(9) Has a FCC certification, but non-site licensed, low-power microwave radar (digital wave radar) beam technology to provide vehicle detection;

(10) Weighs no more than 5½ pounds, is no more than 11 inches long, 8½ inches wide and 7 inches high and is immune to privacy issues; and

(11) Does not require the placement of hardware in or over the roadway;

D. Furnish a detector that operates:

(1) Within a temperature range from -40 °F to +185 °F (-40 °C to +85 °C) without degradation of operation;

(2) With 24 VDC supplied to the traffic control interface board interface card with no other power supplies required. With a total current of no more than 415 millampere (mA) at any time during the operation with no output active;

(3) Within 20 seconds from a cold start with full operation no greater than 2 minutes and provides a full automatic recovery from a power failure;

(4) Within a range from 50 feet to 425 feet (minimum) from the front of the detector;

(5) Under all-weather environments (i.e. rain, snow, and fog), day or night conditions including head light glare;

(6) Via an Ethernet interface with PoE connector;

(7) In the Frequency Shift Keying (FSK) mode and supports the five following selectable channels of microwave operation in Gigahertz (GHz):

(a) 24.075 GHz;

(b) 24.100 GHz;

(c) 24.125 GHz;

(d) 24.150 GHz; and

(e) 24.175 GHz.

(8) Optimally when mounted at a height from 16 to 20 feet; and

(9) Within a range of horizontal mounting angles (measured from direction of traffic) from zero to 20 degrees (minimum).

E. Furnish a detector that tracks:

(1) The presence of a vehicle in detection zone for a predetermined time and is user selectable from 0 to 960 seconds;

(2) Multiple moving and stationary vehicles simultaneously; and

(3) Each vehicle using its X-Y coordinates to determine the vehicle’s location.

F. Furnish a detector that includes:

(1) Grid tracking for the live interactive zones;

(2) A histogram to verify setup of the zones;

(3) User defined delay and/or extension times for each zone;

(4) A diagnostic and demonstration mode for various operations;

(5) A graphical representation of the vehicle track as it approaches the intersection using an Explorer type interface; and

(6) A CAT6-PoE-I surge protection device.

G. Mounting Hardware. Furnish a universal aluminum mounting bracket and AISI 300 Series stainless steel pole band, and hardware for mounting the detector as shown on the plans or as directed by the Engineer.

2. Interface Board. Furnish an interface board that:

A. Is available for each detector and is compatible with *NEMA TS-1* and *TS-2*, 170, 179 and 2070 controller cabinets;

B. Communicates with the controller cabinet and meets the requirements of CALTRANS 170/2070, 222 and 224 modules with respect to size and form;

C. Has a four output interface board that fits in a double input file slot;

D. Operates at 24 VDC and has a power supply for the detector over the Ethernet cable;

E. furnishes power and short circuit protection for each detector;

F. Has automatic recovery from a power failure and start up within 20 seconds of a cold start;

G. Is hot swappable and can be plugged in and out of the input file slot without adversely effecting its operation. Unplugging the interface board takes power off the interface board and off the detector;

H. Each output is optically isolated with a LED and status indicator;

I. Has an indication for a fault mode (no Ethernet connection) such that all LEDs and Opto-isolator are on which places a call on the traffic controller;

J. Has a recommended standard (RS)-232 port for diagnostics; and

K. Has up to four LEDs to indicate the activity of each zone. Has only two LEDs that are active on the two channel board.

3. Ethernet Cable.

A. Furnish an Ethernet cable that:

(1) Consists of an 8 conductor, 24 AWG per conductor solid or stranded cable, 600 volt. CAT5e or CAT6, outdoor-rated, shielded cable; and

(2) Is cut to length and terminated with registered jack (RJ)-45 male connectors.

B. Ensure the system client application(s) are network-deployable.

4. Surge Suppression.

A. Furnish one PoE surge protector for each microwave detector that:

(1) Exceeds CAT6 Transmission Values;

(2) Has DC over Ethernet on all pins;

(3) Has an operating current of 0.75 amperes (A) per pin continuous with a peak surge current of 10 Kilovolt-ampere (kVA);

(4) Supports transmission speeds of 10base T, 100base T and 1000base T;

(5) Incorporates Gas Discharge Tube (GDT), Positive Temperature Coefficient (PTC), and Silicon Avalanche Diode (SAD) technology; and

(6) Is *UL 487B* listed; tested to *International Electrotechnical Commission (IEC) 802.3af* and *802.3at* compliant, Restriction of Hazardous Substances (RoHS) compliant with restrictions on the use of hazardous substances.

B. Furnish a device that has nominal dimensions of 5.4 inches (length) by 1.6 inches (width) by 1.7 inches (height).

C. Furnishes an input and output RJ-45 connector.

D. Has an isolated 10-32 ground connection.

5. Ethernet and PoE Extension.

A. Furnish an Ethernet and PoE extender for Ethernet cable runs longer than 300 feet from the controller cabinet to the microwave detector and Ethernet and PoE extender that:

(1) Increases the maximum distance between the controller cabinet to the microwave detector from 300 feet to 600 feet;

(2) Requires no separate external power to operate the device;

(3) Is capable of forwarded PoE power up to 70 watts (W) with a maximum current of 0.7A on data pairs and a maximum current of 1.5A on spare pairs;

(4) Consumes no more than 1.3 W of power;

(5) Supports transmission speeds 10base T and 100base TX half/full duplex;

(6) Supports *IEEE 802af* PoE, *IEEE 802at* PoE Plus (2-event signature); and

(7) Furnishes steady and reliable communications for up to a maximum of 600 feet and is fully compatible with the microwave detector.

B. Furnish a device that has nominal dimensions of 4.13 inches (length) by 1.57

inches (width) by 0.87 inches (height).

C. Furnish a device that has only two RJ-45 connectors with power, network link/activity lights.

D. Furnish additional Ethernet cable for extension.

6. Enclosure.

A. Furnish a cast aluminum enclosure that:

(1) Is manufactured from cast aluminum, has top and bottom mounting hubs with set screws, and has an access door on side;

(2) Has hubs that are threaded and can accommodate 1½ inch steel pipe and includes a 1½ inch plastic cap fitting;

(3) Has a plastic terminal compartment door that includes a seamless 3/32 inch neoprene gasket formed around the opening to seal out dust and moisture;

(4) Has screws that are *AISI 300 Series* stainless steel;

(5) Has nominal dimensions of 10 inches (height) by 6 inches (width) by 4 inches (depth);

(6) Has a bonding provision on the enclosure body; and

(7) Is capable of housing the Ethernet and PoE Ethernet extension unit and all appurtenant materials.

B. Furnish an enclosure capable of being pole mounted that:

(1) Includes any necessary adapters, stainless steel banding, to permit mounting to a 4½ inches or larger steel pole. Ensure the adapter can accommodate lag bolts up to 3/8 inch (for wood pole installation) and stainless steel banding up to 1 inch (for steel pole installation); and

(2) Has mounting points furnished at or near the top and bottom of the enclosure.

C. Packing and Marking. Package each microwave vehicle detector individually in a manner acceptable to common carriers, and to ensure that the contents are not damaged or defaced during transportation to the final destination. Legibly mark each package with the content description, order number, and vendor's name.

D. Warranty. Furnish materials with a manufacturer’s warranty, transferable to the Department or the local agency responsible for the project, that the supplied materials will be free from all defects in materials and workmanship. Furnish the warranty and other applicable documents from the manufacturer, and a copy of the invoice showing date of shipment, to the Engineer prior to acceptance.

c. Construction. Complete this work in accordance with sections 818 and 820 of the

Standard Specifications for Construction, as shown on the plans, and as directed by the Engineer. Remove, store, and dispose of material in accordance with section 204 of the Standard Specifications for Construction.

Do not install the detector until all other signal equipment has been installed and inspected. Obtain the Engineer's approval prior to beginning detector installation. Correct detector installation, that was completed prior to the approval of the Engineer, and which is found to be non-optimal placement of the detectors, at no additional cost to the contract. The Engineer will not authorize extra payment or time extensions for work required to reorient or move the detector(s).

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price for the following pay items:

Pay Item	**Pay Unit**
Detector, Microwave Vehicle	Each
Detector, Microwave Vehicle, Rem	Each
Detector, Microwave Vehicle, Salv	Each
Ethernet Extension	Each
Ethernet Extension, Rem	Each
Ethernet Extension, Salv	Each
Enclosure	Each
Enclosure, Rem	Each
Enclosure, Salv	Each

1. **Detector, Microwave Vehicle** includes installing a microwave vehicle detector including the detector, mounting brackets, hardware, cable, connectors, fittings, interface card, communication patch cords, lighting and surge protection, grounding and all appurtenant material required to complete the work.

2. **Detector, Microwave Vehicle, Rem** includes:

A. Removing a microwave vehicle detector including the detector, and all appurtenant material required to complete the work.

B. Storage and or disposal of removed material.

3. **Detector, Microwave Vehicle, Salv** includes removing an existing microwave vehicle detector, storing, and reinstalling the microwave vehicle detector on the project, including the detector, and all appurtenant material required to complete the work.

4. **Ethernet Extension** includes installing an Ethernet and PoE extender, mounting brackets, hardware, cable, connectors, fittings, and all appurtenant material required to complete the work.

5. **Ethernet Extension, Rem** includes:

A. Removing an Ethernet and PoE extender including all appurtenant material required to complete the work.

B. Storage and or disposal of removed material.

6. **Ethernet Extension, Salv** includes removing an Ethernet extension, storing, and reinstalling the Ethernet extension on the project, including the Ethernet extension, PoE extension, and all appurtenant material required to complete the work.

7. **Enclosure** includes installing a cast aluminum enclosure, mounting brackets to wood or steel poles, hardware, connectors, fittings, grounding, and all appurtenant material required to complete the work.

8. **Enclosure, Rem** includes:

A. Removing a cast aluminum enclosure, mounting brackets, and all appurtenant material required to complete the work.

B. Storage and or disposal of removed material.

9. **Enclosure, Salv** includes removing a cast aluminum enclosure, storing, and reinstalling the enclosure on the project, including the enclosure, mounting brackets, and all appurtenant material required to complete the work.