MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
WIRELESS INTERCONNECT FOR SIGN MOUNTED FLASHER

a. Description. This work consists of installing, or removing a wireless interconnect, master, repeater, or remote to operate advance warning sign optical flashing beacons at location(s) shown on the plans.

b. Materials. Provide wireless interconnect, master, repeater, or remote in accordance with this special provision. Provide all hardware, and appurtenant materials in accordance with sections 918 and 921 of the Standard Specifications of Construction and this special provision.

1. Wireless Contact Closure Type Radio. Equipment must meet the following requirements:

A. Operate as a master, repeater, or remote unit, equivalent to the ENCOM, COMMPAK I/O 8 900 megahertz (MHz) type radio, as determined by the Engineer;

B. Operate in the license-free, spread spectrum band (902-928 MHz), utilizing frequency hopping technology;

C. Provide 139 user-selectable channels, with 62 available hopping sequences, two of which must be non-overlapping;

D. Be completely configurable via included ControlPak type software, or approved equal as determined by the Engineer.

E. Be compatible with units currently in the field (manufactured by ENCOM Inc.), as determined by the Engineer;

F. Have software features providing:

(1) Remote programming;

(2) Remote configuration;

(3) Spectrum analyzer; and

(4) Radio link diagnostics;

G. Provide bi-directional communications for confirmation;

H. Have software configurable input/output (I/O) data mapping;

I. Be programmable for radio frequency output levels of 1 milliwatt (mW), 10 mW, 100 mW, or 1 Watt;

J. Have 8 inputs which can be ground activated or “true” activated from 0 to 24 volts direct current (VDC);

K. Have 8 outputs (open collector) with the following capabilities:

(1) Outputs must have software programmable timers; and

(2) Outputs must be capable of providing flash functionality;

L. Provide a maximum of 8 milliseconds (ms) end-to-end latency.

M. Have the following light emitting diode (LED) indicators:

(1) Power (PWR);

(2) Radio Frequency (RF) Link Status;

(3) Input Channel Activity (8); and

(4) Output Channel Activity (8);

N. Operate in ambient temperatures ranging from -30 degrees Fahrenheit (F) to 165 degrees F;

O. Operate with voltages between 6VDC and 30VDC, with a typical current draw of less than 100 milli-amps;

P. Have a receiver sensitivity of better than 110 decibel milliwatts (dBm) at 10-6 Bit error rate (BER); and

Q. Have a maximum size of 1¾ inches (height) by 4¾ inches (depth) and 3¾ inches (width).

2. Equipment Box Enclosure.

A. Furnish an equipment box enclosure meeting the following fabrication requirements:

(1) Has nominal dimensions of 16 inches tall, 14 inches wide; and 12 inches deep;

(2) Fabricated from 1/8 inch thick aluminum, or approved equal;

(3) Has a nominal 1/2 inch lip formed around the opening to allow the door gasket to seal out dust and moisture; and

(4) Has four standoffs mounted on the inside to accommodate a back-panel.

B. Ensure the equipment box is painted as follows:

(1) Inside of the enclosure painted white;

(2) Exterior finished with a durable and weather-resistant protective coating having a total dry film thickness of not less than 1.5 mils; and

(3) Final coating aluminum in color having a total dry film thickness of not less than 0.75 mils.

C. Ensure the equipment box door meets the following requirements:

(1) Equipped with a weathertight neoprene sponge rubber gasket approximately 5/8 inches wide by 3/16 inches thick;

(2) Mounted with a heavy duty stainless steel continuous hinge;

(3) Includes lock cover to prevent dust and moisture from entering the lock assembly; and

(4) Provided with a lock and two Corbin Type Blank 04266 type keys, or approved equal.

D. Ensure the back panel mounted in the equipment box meets the following requirements:

(1) Fabricated from 1/8 inch thick aluminum;

(2) Has only four predrilled holes to attach the panel to the standoffs;

(3) Has nominal dimensions of 15 inches wide and 11½ inches wide; and

(4) Attached to the standoffs with four 1/2 inch, 10-32 stainless steel Allen head screws and four lock washers.

3. Master-Repeater-Remote Equipment Requirements (permanent power required). Where master-repeater-remote equipment requiring a permanent power source is specified, provide the following:

A. Master. Provide a permanent powered master unit including an equipment box enclosure equipped with the radio, pushbutton activation, confirmation lights, associated equipment and mounting hardware; and a 7 dB Omni antenna, or either one or two 10 dB minimum Yagi antennas (specified for the frequency range of the radio), as indicated on the plans.

(1) When the plans call for the master to be located inside a building (school or fire station applications), furnish a plug-in type equipment box enclosure with external pushbutton activation and confirmation lights, to be installed by appropriate local forces.

(2) When the plans call for the master to be located outside, furnish and install an equipment box enclosure with internal pushbutton activation and confirmation lights.

B. Repeater. Furnish a repeater unit including a 7 dB Omni Antenna (specified for the frequency range of the radio), an EL-240 type cabinet, or approved equal, equipped with the radio and associated equipment. Mount the repeater as indicated on the plans.

C. Remote. Furnish a remote unit including a 10 dB minimum Yagi antenna (specified for the frequency range of the radio), an EL-240 type cabinet, or approved equal, equipped with the radio and associated equipment. Mount the remote as indicated on the plans.

D. Connectors. Furnish TC-400-NMH Type N male connectors, or approved equal, fastened at the ends of the LMR 400 dB cable for connection to both polyphaser and antenna.

4. Master-Repeater-Remote Equipment Requirements (solar power). Where master-repeater-remote equipment requiring a solar power source is specified, provide the following:

A. General Solar Power Requirements.

(1) Rubberized plastic coated Omni antenna (specified for the frequency range of the radio)

(2) Solar assembly housing equipped with the radio and associated equipment;

(3) Solar engine/battery system including one 20-watt minimum solar panel (capable of being tilted and oriented south) no larger than the footprint of the housing including two field-replaceable, sealed lead acid batteries, and all required mounting hardware.

B. Master. In addition to the requirements in subsections b.4.A.(1) thru b.4.A.(3) above, provide a solar powered master unit including an equipment box enclosure equipped with the radio, external pushbutton activation, external confirmation lights, associated equipment, and mounting hardware.

C. Repeater. Comply with the requirements of subsections b.4.A.(1) thru b.4.A.(3) above.

D. Remote. Comply with the requirements of subsections b.4.A.(3) thru b.4.A.(3) above.

5. Documentation. Provide instructions for hardware installation, programming, and system operation to the Engineer at the time of installation.

6. Warranty. Provide a manufacturer's warranty, transferable to the MDOT, 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 819 and 820 of the Standard Specifications for Construction, the applicable typical signal construction detail(s), and this special provision.

1. Installation. When installing new equipment is specified, furnish and install the wireless interconnect master, repeater, or remote as shown on the plans.

2. Removal. When removal is specified, remove the wireless interconnect, as shown on the plans. Removal includes the wireless interconnect package, solar or non-solar power supply, surge protection, antennas, mounting brackets, hardware assembly, fittings, cable, connectors, grounding, and other appurtenances required for a complete removal.

3. Salvage and Disposal. Salvage and store, or dispose of, removed material as directed by the Engineer and in accordance with section 204 of the Standard Specifications for Construction. Store salvaged equipment to be re-installed on the project in a protected and clean environment.

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

Pay Item	**Pay Unit**
Wireless Intercn, Sign Mtd Flasher, Master	Each
Wireless Intercn, Sign Mtd Flasher, Repeater	Each
Wireless Intercn, Sign Mtd Flasher, Remote	Each
Wireless Intercn, Sign Mtd Flasher, Solar Power, Master	Each
Wireless Intercn, Sign Mtd Flasher, Solar Power, Repeater	Each
Wireless Intercn, Sign Mtd Flasher, Solar Power, Remote	Each
Wireless Intercn, Sign Mtd Flasher, Rem	Each