SECTION 684

LAYER 2 FIELD-HARDENED ETHERNET SWITCH

DESCRIPTION

684.01.01 GENERAL

A. This specification describes the functional, performance, environmental, submittal, documentation, and warranty requirements, as well as the method of measurement and basis of payment, for a Layer 2 Field-Hardened Ethernet Switch, herein called the field switch.

B. The Field Switch shall comply with this specification to operate within the Freeway and Arterial System of Transportation (FAST) Arterial Management System and Freeway Management System.

C. This specification is for equipment only, no installation, to be delivered to the FAST Traffic Management Center (TMC) for testing and approval prior to final acceptance.

1. The Engineer shall be notified prior to the delivery to the TMC.
2. No partial shipments will be accepted.
3. All equipment supplied on this project shall be delivered during a single delivery, and shall be labeled clearly with the project and location designation.

D. All equipment shall be approved prior to purchase by the FAST Director or designee.

MATERIALS/EQUIPMENT

684.02.01 FUNCTIONAL REQUIREMENTS

A. The field switch shall comply with the following standards:

1. Institute of Electrical and Electronic Engineers (IEEE) 802.IQ: Local and Metropolitan Area Networks, Virtual Bridged Local Area Networks.
2. IEEE 802.1P: Traffic Class Expediting and Dynamic Multicast Filtering, Draft 8.
3. IEEE 802.3X: IEEE Standards for Local and Metropolitan Area Networks; Specifications for 802.3 Full Duplex Operation.
4. IEEE 802.1W: IEEE Standards for Local and Metropolitan Area Networks, Common Specifications, Part 3; Media Access Control (MAC) Bridges, Amendment 2, Rapid Configuration.
5. Federal Communications Commission Rules and Regulations, Vol. II: Part 15 for Class A Equipment Electronic Compatibility and Susceptibility (product electromagnetic compatibility is required).
6. National Electronics Manufacturers Association (NEMA) TS-1: Section 2, Traffic Control System. The following clauses apply:
   a. 2.1.2: Voltage.
   b. 2.1.3: Frequency Range.
   c. 2.1.4: Power Interruption.
   d. 2.1.5: Temperature and Humidity, as modified herein.

e. 2.1.6: Transients, Power Service.

f. 2.1.7: Transients, Input-Output terminals.

g. 2.1.8: Non-Destruct Transient Immunity.

h. 2.1.12: Vibration.

i. 2.1.13: Shock.

7. Underwriters Laboratories, Inc. 60950: Safety Requirements for Information Technology (IT) Equipment (applicable to equipment safety).

8. Military Handbook MIL-HDBK-217F-2: Reliability Prediction of Electronic Equipment, Notice 2.

B. Detailed Requirements:

1. The field switch shall:

a. Be 6-port (minimum) 10/100 Base TX RJ-45.

b. Have a minimum of two 100 Base FX fiber optical ports.

c. Operate non-blocking, at full wire speed.

d. Support remote reset and remote management.

e. Support IGMP snooping.

f. Support IP Multicast filtering.

g. Support remote turn on/off Base TX ports.

2. The field switch shall also meet the following functionality and performance requirements:

a. Each 10/100 Base TX port shall connect via RJ-45 connector.

1) The ports shall operate as half-duplex or full-duplex (IEEE 802.3x) over 100 m segment lengths.

2) The ports shall provide auto-negotiation and Medium Dependent Interface/ Medium Dependent Interface, Crossover (MDI/MDIX) capability.

b. Each 100 Base FX (Fiber Transmission) port shall connect via fiber connectors and 9/125 µm single-mode fiber.

1) Fiber connectors shall be available as Straight Tip (ST).

2) The ports shall operate as full-duplex (IEEE 802.3x) over 15 km segment lengths.

3) The minimum link loss budget (OPB = RX (min) – LED aging) shall be greater than or equal to 15 dB.

c. The field switch shall provide the following advanced Layer 2 functions:

1) IEEE 802.1Q VLAN with support for a minimum of 128 Virtual Local Area Networks (VLAN).

2) IEEE 802.1P priority queuing.

3) IEEE 802.1W rapid spanning tree (required).

4) IEEE 802.3X flow control greater than or equal to 1,028.

5) Support automatic address learning of a minimum 4,096 Medium Access Control (MAC) addresses and greater than or equal to 1,028 static MAC address.

d. The field switch shall provide the following port security functions:

1) Ability to configure static MAC addresses.

2) Ability to disable automatic address learning per ports; known hereafter as secure port.

3) Secure ports only forward statically configured MAC addresses.

4) Trap and alarm upon any unauthorized MAC address and shutdown for programmable duration.

5) Port shutdown requires administrator to manually reset the port before communications are allowed.

6) All the above activities are done remotely.

e. The field switch shall provide the following network management functions:

1) SNMPv3 (RFC 2273).

2) RMON (RFC 1757).

3) Port Mirroring (RFC 1757).

4) Spanning Tree (IEEE 802.1D).

5) Rapid Spanning Tree (IEEE 802.1W).

f. The field switch shall support:

1) Telnet.

2) Trivial File Transfer Protocol (TFTP) or File Transfer Protocol (FTP).

3) Command Line Interface.

4) Simple Network Management Protocol (SNMP).

3. The field switch shall have an integrated web interface.

a. Reset/Reboot and firmware shall be supported via all methods listed above.

b. All parameters and settings (network management, security, Layer 2 features, and so forth) shall be user configurable through the maintenance port, web interface, Telnet, and all other supported remote management tools.

4. The field switch shall allow for stand-alone shelf mounting unit and DIN rail mounting.

5. The field switch shall have the following characteristics:

a. Power: Nominal 120 VAC, 60 Hz.

b. The unit shall be provided with all power conversion and regulation necessary to support electronics operation.

c. The power input circuitry shall be designed to protect the electronics from damage by a power surge or under-voltage condition.

d. Power consumption shall not exceed 20 watts.

6. The field switch shall include a power status indicator.
7. Physical Characteristics:
    a. 6-Port.
    b. The field switch shall not exceed 3 inches high by 17.25 inches wide by 10 inches.
    c. The weight shall not exceed 6 pounds.
8. Environmental: The field switch shall conform to functional and performance specifications as defined herein when operated in the following environment.
    a. Temperature: -4 degrees F to 165 degrees F.
    b. Humidity: 5 to 95 percent relative humidity, non-condensing.
9. Cooling shall be by convection with case acting as heat sink. No cooling fan shall be used.
10. The field switch shall have the following minimum indicators:
    a. Power: On, Off.
    b. Network status per port: Transmit, receive, link, speed.
11. Status indicators shall be light emitting diode (LED).
12. All connectors, indicators and replaceable components shall be permanently marked and traceable to the supplied documentation, including schematics and parts list. The external markings shall include the product function name, model number, serial number and manufacturer's name.
13. The field switch shall have a minimum Mean Time Between Failures (MTBF) of 40,000 hours.
14. Each unit shall have a unique MAC address. MAC address shall be derived from an address space of 10,000 sequential addresses.
15. Documentation: Upon delivery, the following minimum documentation shall be provided by the vendor with each field switch provided:
    a. Initial configuration: This document shall provide both hardware and software settings.
    b. Setup and configuration manual.
    c. Users manual.
16. Warranty:
    a. The field switch shall be warranted for a minimum of 3 years.
    b. The warranty shall guarantee the field switch to be free from defects from assembly, fabrication and materials.
    c. The warranty shall begin upon acceptance by the Contracting Agency.

CONSTRUCTION

684.03.01 BLANK

METHOD OF MEASUREMENT

684.04.01 MEASUREMENT

A. The Layer 2 Field-Hardened Ethernet Switch shall be measured per each. The mounting hardware and cabling and network management software are considered incidental to the unit and will not be measured or paid for separately.

BASIS OF PAYMENT

684.05.01 PAYMENT

A. The accepted quantity of Layer 2 Field-Hardened Ethernet Switch will be paid for at the contract unit price per each, which shall be full compensation for furnishing and configuring the unit and for all labor, material, and equipment required to facilitate an operational field switch.

B. Payment will be made under:

PAY ITEM	PAY UNIT
Layer 2 Field-Hardened Ethernet Switch	Each