

TECHNICAL SPECIAL PROVISION

FOR

Local Hub Ethernet Switch (LHES)

FINANCIAL PROJECT NO.: 437493-1-52-01/437501-1-52-01

ORANGE AND LAKE COUNTY'S

The official record of this Technical Special Provision is the electronic file signed and sealed under rule 61G 15-23.004, F.A.C.

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Date: 1/12/2016

T684-1

LOCAL HUB ETHERNET SWITCH

T684-1-1 Description.

Furnish and install a Local Hub Ethernet switch (LHES) for intelligent transportation system (ITS) projects. Ensure that the LHES provides wire-speed fast Ethernet connectivity at transmission rates of 1 gigabits per second to and from adjacent LHES within the ITS network. Use only equipment and components that meet the requirements of these minimum specifications.

T684-1-2 Materials.

T684-1-2.1 General: Ensure that the ITS network administrator will be able to manage each LHES individually and as a group for switch configuration, performance monitoring, and troubleshooting. Ensure that the LHES includes Layer 2+ capabilities, including, QoS, IGMP, rate limiting, security filtering, and general management.

Ensure that the furnished LHES is fully compatible and interoperable with the ITS trunk Ethernet network interface, and that the LHES supports half and full duplex Ethernet communications.

Ensure that the LHES includes Layer 3+ capabilities, including, Open Shortest Path First (OSPF) routing protocol, Routing Information Protocol (RIP), Generic Routing Encapsulation (GRE), Virtual Router Redundancy Protocol (VRRP). Ensure all routing protocols are performed by way of hardware to ensure maximum line rates speed. Ensure the LHES includes any license(s) required to utilize all available layer 3 features.

Furnish all hot-swappable Gigabit Interface Converter (GBIC) fiber optical transceivers listed in Table 1 below for each LHES.

Table 1
Required Optical Transceivers

GBIC QUANTITY	PHYSICAL LAYER STANDARD	DATA TRANSFER RATE	MINIMUM TRANSCIVER DISTANCE
2	1GBASE-EX	1 Gbps	40 kilometers
2	1GBASE-LX10	1 Gbps	10 kilometers

Furnish an LHES that provides 99.999% error-free operation, and that complies with the Electronic Industries Alliance (EIA) Ethernet data communication requirements using single-mode fiber optic transmission medium and Category 5E copper transmission medium. Provide a switched Ethernet connection for each remote ITS field device.

Ensure that the LHES has a minimum mean time between failures (MTBF) of 10 years, or 87,600 hours, as calculated using the Bellcore/Telcordia SR-332 standard for reliability prediction.

Ensure all routing protocols are performed by way of hardware to ensure maximum line rates speed. Ensure the LHES includes any license(s) required to utilize all layer 3 features.

T684-1-2.2 Networking Standards. Ensure that the LHES complies with all applicable IEEE networking standards for Ethernet communications, including but not limited to:

1. IEEE 802.1D Standard for Media Access Control (MAC) Bridges used with the Rapid Spanning Tree Protocol (RSTP).
2. IEEE 802.1Q standard for port-based virtual local area networks (VLANs).
3. IEEE 802.1P standard for Quality of Service (QoS).
4. IEEE 802.3 standard for local area network (LAN) and metropolitan area network (MAN) access and physical layer specifications.
5. IEEE 802.3u supplement standard regarding 100 Base TX/100 Base FX.
6. IEEE 802.3x standard regarding flow control with full duplex operation.
7. IEEE 802.3z supplement standard regarding 1000 Base X.

T684-1-2.3 Optical Ports. Ensure that all fiber optic link ports operate at 1,310 or 1,550 nanometers in single mode. Ensure that the optical ports are Type ST, SC, LC, or FC only, as specified in the plans or by the Engineer. Do not use mechanical transfer registered jack (MTRJ) type connectors.

Provide an LHES having a minimum of two optical 1 Gigabit Ethernet ports capable of transmitting data at 1 gigabits per second unless otherwise shown in the plans. Ensure the LHES is configured with the number and type of ports detailed in the Contract Documents. Provide optical ports designed for use with a pair of fibers; one fiber will transmit (TX) data and one fiber will receive (RX) data. The optical ports will have an optical power budget of at least 15 dB, or as detailed in the Contract Documents.

T684-1-2.4 Copper Ports. Provide an LHES that includes a minimum of twelve gigabit Ethernet end user copper ports unless otherwise shown in the plans. All copper ports will be Type RJ-45 and will auto-negotiate speed (i.e., 10/100/1000 Base) and duplex (i.e., full or half). All 10/100/1000 Base TX ports will meet the specifications detailed in this section and will be compliant with the IEEE 802.3 standard pinouts.

T684-1-2.5 Management Capability. Ensure that the LHES supports all Layer 2 management features and certain Layer 3 features as defined by these specifications. These Layer 2 features will include, but not be limited to:

1. An LHES that is a port-based VLAN and supports VLAN tagging that meets or exceeds specifications as published in the IEEE 802.1Q standard, and has a minimum 4-kilobit VLAN address table.
2. A forwarding/filtering rate that is a minimum of 14,880 packets per second for 10 megabits per second, 148,800 packets per second for 100 megabits per second, and 1,488,000 packets per second for 1000 megabits per second.
3. A minimum 4 kilobit MAC address table.
4. Support of, at a minimum, Version 2 of the Internet Group Management Protocol (IGMP).
5. Support of remote and local setup and management via telnet and secure Web-based GUI.

6. Support of the Simple Network Management Protocol (SNMP). Verify that the LHES can be accessed using the resident EIA-232 management port, a telecommunication network, or the Trivial File Transfer Protocol (TFTP).

7. Port security through controlling access by the users. Ensure that the LHES has the capability to generate an alarm and shut down ports when an unauthorized user accesses the network.

8. Support of remote monitoring (RMON) of the Ethernet agent and the ability to be upgraded to switch monitoring (SMON), if necessary.

9. Support of TFTP and either Network Time Protocol (NTP) or the Simple Network Time Protocol (SNTP). Ensure that the LHES supports port mirroring for troubleshooting purposes when combined with a network analyzer.

10. Sampled Flow Network Monitoring export protocol capable of being turned on or off on individual Ethernet ports without affecting traffic.

These Layer 3 features will include, but not be limited to:

1. Open Shortest Path First (OSPF) routing protocol.
2. Routing Information Protocol (RIP).
3. Generic Routing Encapsulation (GRE).
4. Virtual Router Redundancy Protocol (VRRP).

T684-1-2.6 Mechanical Specifications. Ensure the LHES is no greater than 1-Rack Unit tall when mounted with the LHES front face facing the cabinet door. Ensure equipment is permanently marked with manufacturer name or trademark, part number, and serial number.

Ensure that every conductive contact surface or pin is gold-plated or made of a noncorrosive, nonrusting, conductive metal.

Do not use self-tapping screws on the exterior of the assembly.

All parts will be made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal.

T684-1-2.7 Electrical Specifications. LHES must be capable of operating on a nominal voltage of 120 volts alternating current (V_{AC}). Supply an appropriate voltage supply for each device to be powered from the UPS battery backup output.

Ensure that the LHES has diagnostic light emitting diodes (LEDs), including link, TX, RX, and power LEDs.

T684-1-2.8 Environmental Specifications. Ensure that the LHES has an operating temperature range of 0° Celsius to 45° Celsius. Ensure that the LHES has a storage temperature range of -40° Celsius to 70° Celsius. Ensure that the LHES has a non-condensing relative humidity range of 5% to 90% at 40° Celsius.

T684-1-3 Installation Requirements.

T684-3.1 General.

Mount the LHES inside a field site cabinet utilizing a compact switch 2-post rack mount kit that does not exceed 1-Rack Unit. Ensure that the LHES is resistant to all electromagnetic interference (EMI). Ensure that the LHES is mounted securely and is fully accessible by field technicians. Ensure that all unshielded twisted pair/shielded twisted pair Ethernet network cables are compliant with the EIA/TIA-568-B standard.

T684-1-3.2 Testing.

Subject the LHES to all tests as required by the project specifications and technical special provisions.

T684-1-4 Warranty.

Ensure that the manufacturer will furnish replacements for any part or equipment found to be defective during the warranty period at no cost to the Department or the maintaining agency within 10 calendar days of notification.

The manufacturer will warranty all components against defects in materials and workmanship for five years from the date of final acceptance by the Engineer. The warranty will cover all parts and onsite labor required for troubleshooting and repair.

Contractor hereby assigns to the Department any and all manufacturers' or other sellers' warranties that come with any products, material or supplies which are incorporated into or are consumed in the project in any way. To the extent that any such warranties do not extend to subsequent purchasers or owners or such warranties contain a limitation on assignment, Contractor agrees that Contractor purchased the products, materials and supplies on behalf of the Department with the intent that the Department be the intended recipient of any warranties. All documents associated with or describing any such warranties will be delivered to the Department along with the other project final acceptance documents and will be deemed to be a part of the required final acceptance documentation. Contractor will not take any action or fail to act in any way which voids any such warranties. All subcontracts will contain a similar provision which requires subcontractors to assign any such warranties to the Department.

T684-1-5 Method of Measurement.

The quantity to be paid for will be the number of LHES furnished, installed, and accepted.

T684-1-6 Basis of Payment.

Price and payment will be full compensation for all work specified in this Technical Special Provision.

Payment will be made under:

Item No. 684-1-1 Local Hub Ethernet Switch-each.