

EXPECTED IMPLEMENTATION JULY 2020

684 NETWORK DEVICES (REV 1-29-20) (FA 1-30-20) (7-20)

SECTION 684 is deleted and the following substituted:

684-1 Managed Field Ethernet Switch.

684-1.1 Description: Furnish and install a hardened, device-level managed field Ethernet switch (MFES) for intelligent transportation system (ITS) projects. Ensure that the MFES provides wire-speed fast Ethernet connectivity at transmission rates of 100 megabits per second from the remote ITS device installation location to the ITS network trunk interconnection point.

684-1.2 Materials: All equipment shall be permanently marked with manufacturer name or trademark, part number, and date of manufacture or serial number. Meet the requirements of Section 603. Use only equipment and components that meet the requirements of Section 996 and are listed on the Department's Approved Product List (APL).

Ensure that the ITS network administrator will be able to manage each MFES individually and as a group for switch configuration, performance monitoring, and troubleshooting.

Ensure that the furnished MFES is fully compatible and interoperable with the ITS trunk Ethernet network interface.

Provide a switched Ethernet connection for each remote ITS field device.

684-1.2.1 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 MFES having a minimum of two optical 100 Base FX ports capable of transmitting data at 100 megabits per second unless otherwise shown in the Plans. Ensure the MFES 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 must have an optical power budget of at least 15 dB, or as detailed in the Contract Documents.

684-1.2.2 Copper Ports: Provide an MFES that includes a minimum of four copper ports unless otherwise shown in the Plans.

Ethernet over very high speed digital subscriber line (EoVDSL) ports are permitted for use in applications where fiber optic cable is not available.

684-1.3 Installation: Mount the MFES inside a field site cabinet. Ensure that the MFES is resistant to all electromagnetic interference (EMI). Ensure that the MFES 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.

684-1.4 Field Acceptance Testing: Develop and submit a field acceptance test (FAT) plan to the Engineer for review and approval. The Engineer reserves the right to witness all FATs.

Once the MFES has been installed, conduct local FATs at the MFES field site according to the approved test plan. Perform the following:

EXPECTED IMPLEMENTATION JULY 2020

- D**
- in the Plans.
- connections.
- circuits.
- communication and power cables.
- addresses and subnetwork mask.
- telnet sessions from a remote personal computer (PC).
1. Verify that physical construction has been completed as detailed
 2. Inspect the quality and tightness of ground and surge protector connections.
 3. Verify proper voltages for all power supplies and related power circuits.
 4. Connect devices to the power sources.
 5. Verify all connections, including correct installation of communication and power cables.
 6. Verify configuration of the MFES Internet Protocol (IP) addresses and subnetwork mask.
 7. Verify the network connection to the MFES through ping and telnet sessions from a remote personal computer (PC).
 8. Perform testing on multicast routing functionality.

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684-2 Device Server.

684-2.1 Description: Furnish and install a device server as shown in the Plans.

684-2.2 Materials: All equipment must be permanently marked with manufacturer name or trademark, part number, and date of manufacture or serial number. Meet the requirements of Section 603. Use only equipment and components that meet the requirements of Section 996 and are listed on the APL.

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Verify that all wiring meets applicable NEC requirements and that the device server operates using a nominal input voltage of 120 V_{AC}. If the device requires nominal input voltage of less than 120 V_{AC}, furnish the appropriate voltage converter.

684-2.3 Installation: Mount the device server securely in a location in the equipment cabinet that allows the unit to be 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.

684-2.4 Field Acceptance Testing: Develop and submit a field acceptance test FAT plan to the Engineer for review and approval. The Engineer reserves the right to witness all FATs.

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Perform local field operational tests at device server field sites according to the test procedures stated herein.

- specified in the Plans.
- connections.
- circuits.
- communication and power cables.
- and telnet session from a remote PC.
1. Verify that physical construction has been completed as specified in the Plans.
 2. Verify the quality and tightness of ground and surge protector connections.
 3. Verify proper voltages for all power supplies and related power circuits.
 4. Connect devices to the power sources.
 5. Verify all connections, including correct installation of communication and power cables.
 6. Verify the network connection to the device server through ping and telnet session from a remote PC.
 7. Verify serial data transmission through the device server.

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EXPECTED IMPLEMENTATION JULY 2020

684-3 Digital Video Encoder and Decoder.

684-3.1 Description: Furnish and install digital video encoder (DVE) and digital video decoder (DVD) hardware and software to create a video-over-IP network system, as shown in the Plans.

684-3.2 Materials: All equipment shall be permanently marked with manufacturer name or trademark, part number, and date of manufacture or serial number. Meet the requirements of Section 603. Use only equipment and components that meet the requirements of Section 996, and are listed on the APL.

Ensure that the complete video and data transmission system, defined as the combination of DVE and DVD hardware together with the existing or planned network infrastructure, simultaneously transports video and data from multiple remote field locations to multiple monitoring locations for roadway surveillance and traffic management.

Provide a software decoding and control package that allows the viewing of any video source connected to the network through a DVE, and which allows the pan-tilt-zoom (PTZ) control of any PTZ camera on the network, the discovery of DVE and DVD devices on the network, and the control and adjustment of programmable parameters in the DVE and DVD equipment, including the network addresses of these devices, at no additional cost.

684-3.2.1 Digital Video Decoder: Provide a DVD that is either a hardware-based network device or a software application that resides on a workstation PC. Ensure that the software application provides PC desktop display of IP network video streams.

Provide all setup, control programs, and diagnostic software related to the DVE or DVD.

Provide all equipment licenses, where required for any software or hardware in the system.

Ensure that any software-based decoder applications do not interfere with SunGuide® software operating when installed and used together on a shared hardware platform. Ensure that the software-based decoder offers an open Application Programming Interface (API) and software development kit available to the Department at no cost for integration with third party software and systems.

684-3.2.2 Interoperability: Provide DVE and DVD devices and software that are interoperable and interchangeable with DVE and DVD devices and software from other manufacturers.

684-3.2.3 Network Interface: Ensure that fiber ports are single mode with a minimum link budget of 30 dB or the type and power detailed in the Contract Documents.

684-3.3 Installation: Ensure that front panel status indicators remain unobstructed and visible. Ensure that all unshielded twisted pair/shielded twisted pair network cables are compliant with the EIA/TIA-568-B standard.

684-3.4 Field Acceptance Testing: Develop and submit a field acceptance test FAT plan to the Engineer for review and approval. The Engineer reserves the right to witness all FATs.

EXPECTED IMPLEMENTATION JULY 2020

Perform local field operational tests at the device field site and end-to-end video streaming tests in order to demonstrate compliance with Department specifications. Testing will include, but not be limited to, the following:

1. Verify that physical construction has been completed as detailed in the Plans.
2. Inspect the quality and tightness of ground and surge protector connections.
3. Verify proper voltages for all power supplies and related power circuits.
4. Connect devices to the power sources.
5. Verify all connections, including correct installation of communication and power cables.
6. Verify video image is present and free from oversaturation and any other image defect in both color and monochrome mode.
7. Verify network connection to the DVE and DVD through ping and telnet session from a remote PC.
8. Verify serial data transmission through the DVE and DVD serial ports.
9. Verify support of unicast, multicast, and SAP.

684-4 Media Converter.

684-4.1 Description: Furnish and install a media converter as shown in the Plans.

684-4.2 Materials: All equipment shall be permanently marked with manufacturer name or trademark, part number, and date of manufacture or serial number. Meet the requirements of Section 603. Use only equipment and components that meet the requirements of Section 996 and are listed on the APL.

The media converter must allow transition between the transmission media shown in the Plans or required to construct a functional system, such as conversion from twisted pair to optical fiber or from twisted pair to coaxial cable.

Ensure that fiber ports are single mode with a minimum link budget of 30 dB or the type and power detailed in the Contract Documents.

Media converters must operate on a nominal voltage of 120 V_{AC} if POE is unavailable. Supply an appropriate voltage converter for devices that require operating voltages of less than 120 V_{AC}.

684-4.3 Installation: Ensure that status indicators remain unobstructed and visible. All parts must be made of corrosion-resistant materials, such as plastic, stainless steel, anodized or painted aluminum, brass, or gold-plated metal. Ensure that all unshielded twisted pair/shielded twisted pair Ethernet network cables are compliant with the EIA/TIA-568-B standard.

684-5 Warranty.

684-5.1 General: 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.

684-5.2 MFES: Ensure that the MFES has a manufacturer's warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

EXPECTED IMPLEMENTATION JULY 2020

D

684-5.3 Device Server: Ensure that the device server has a manufacturer's warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

684-5.4 Digital Video Encoder and Decoder: Ensure that the DVE or DVD has a manufacturer's warranty covering defects for two years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

684-5.5 Media Converter: Ensure that the media converter has a manufacturer's warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

684-6 Method of Measurement.

The Contract unit price for each MFES, device server, DVE, DVD, or media converter furnished and installed, will include furnishing, placement, and testing of all equipment and materials, and for all tools, labor, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, documentation, and incidentals necessary to complete the work.

Provide software-based decoders at no additional cost when furnished in conjunction with DVEs.

A software-based DVD provided individually must be paid under the pay item below.

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684-7 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

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| Item No. 684- 1- | Managed Field Ethernet Switch-each. |
| Item No. 684- 2- | Device Server-each. |
| Item No. 684- 3- | Digital Video Encoder with Software Decoder-each. |
| Item No. 684- 4- | Digital Video Decoder-each. |
| Item No. 684- 5- | Media Converter-each. |

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