

SECTION 272000 - NETWORK ELECTRONICS

Part 1 - GENERAL

1.1 Scope of Work

- A. This document describes the requirements for the contractors, products and installation relating to furnishing and installing Network Electronics.
- B. Contractor will provide a bid including all labor, materials, tools, and equipment required for the complete installation of work called for on the Construction Drawings and described in this Document. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the contractor feels that the system described is incomplete, they must address this in writing to the Owner/Owner's Representative before providing a bid.
- C. All Products described and Part Numbers given in this Specification are "or equivalent" unless otherwise noted.
- D. All questions concerning non specified product and services will be address to the Owner's Representative before Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.
- E. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities, Part Numbers and Material Descriptions will be provided as an attachment to this document.

1.2 Regulatory References

- A. Contractor will comply will all Federal, State, Local Codes/Regulations, and Industries Standards.
 1. Federal:
 - NFPA 70 - National Electric Code(NEC)
 - FCC
 - Part 15
 - Part 68
 2. State of Virginia:
 - International Building Code (IBC)
 - International Fire Code (IFC)
 - National Electrical Code (NEC)
 - Occupational Safety and Health Act (OSHA)
 3. Industry Standards:
 - Telecommunications Industry Associations/Electronics Industry Association (TIA/EIA)
 - Institute of Electrical and Electronic Engineers (IEEE)
 - 802.3 (Ethernet)
 - 802.3ab (Gigabit Ethernet over 4-pair Category 5 or higher)
 - 802.3ae 10 Gigabit Ethernet
 - 802.3Z (Gigabit Ethernet over optical fiber)
 - 802.1D Spanning Tree Protocol
 - 802.1d/802.1D-1998 (Ethernet Bridging)
 - 802.1q (VLAN tagging)
 - 802.1p (Prioritization)
 - 802.1w (Rapid Spanning Tree)
 - 802.1X (Port based Authentication)
 - 802.1ad (Link Aggregation)
 - 802.1s Multiple VLAN Instances of Spanning Tree
 - Underwriters Laboratories Inc. (UL)

- International Organization for Standardization/International Electromagnetic Commission (ISO/IEC) ISO 11801 Generic Cabling for Customer Premises
 - Building Industry Consulting Services International (BICSI) LAN Specialty Methods Manual (2009 or latest).
- B. If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- C. This document does not replace any code, either partially or wholly. The contractor must be aware of and comply with all local codes that may impact this project.

1.3 Contractor Qualifications/Quality Assurance

- A. Contractor Qualifications
Contractors will submit the following Qualification Documentation along with their bid proposal:
1. A List of References. Contractor shall have been in business for no less than five (5) years and provide a list of a minimum of three (3) projects of similar size and scope. List will include:
 - Project Name
 - Estimated Telecommunications Project Value
 - Brief Description of Work Performed
 - Contact Person
 - Contact Information, including Name of Business, and Phone Number.
 2. A photocopy of your Contractor License Certificate.
 3. A photocopy of your Cisco Partner Certificate.
 - Cisco Gold Partner or;
 - Cisco Premier Partner with Advanced Routing and Switching Specialization
 - Cisco Premier Partner with Advance Wireless LAN Specialization
 - After the winning Contractor has been selected, they will be required to provide proof that at least 50% of the installers that will work on this project have been certified by Cisco with a CCNA or CCDA certification.
- B. Quality Assurance
Contractors wishing to provide a proposal for this project are required to comply with the following without exception:
1. The winning Contractor will assign this project to a competent Project Manager who has demonstrated their ability to supervise a telecommunications project of the same size and scope.
 - The contractor will make this person available to the Owner/Owner's Representative before the start of this project for an interview. This person must be deemed acceptable by the Owner and/or their Representative before work can begin.
 - Project Manager will be required to be available for scheduled on site project meetings at no additional cost to the Owner.
 - Project Manager will be required to be available to meet on site with the Owner/Owner's representative with a minimum of 24 hours notice for non-emergency issues, and a minimum of 4 hours for emergency issues at no additional cost to the Owner.
 2. All material and equipment to be installed on this project will be "new". If the Owner/Owner's Representative discovers that "used" material or equipment has been installed on this project the Contractor will be required to replace said materials and/or equipment with "new" products at no additional cost to the Owner.

- “New” - Materials and products manufactured within one (1) year prior to installation, and meet or exceed the latest published specifications of the manufacture. Also, these materials and equipment may not have been in use before installation on this project unless directed otherwise in the project documents.
3. Contractor must warranty all materials, equipment, and labor for a minimum of one (1) year.
- Warranty will provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including Labor, drive time, shipping, taxes, etc.).
 - Contractor is required to be on site to repair/replace defective items no later than 24 hours after receiving trouble call.
 - Warranty will cover normal Business hours, 8am – 5pm, Monday thru Friday. All calls received on a Friday or the day before a holiday will be held until the following regular business day.

1.4 Submittal Documentation

- A. The successful contractor shall provide three (3) copies of their submittal package.
- B. The Submittal Package will include:
1. The successful contractor will provide their submittal package in accordance with the RFQ section “Project Management” sub section “Submittals”.

1.5 Equivalent Products

- A. All Products described and Part Numbers given in this Specification are those of Cisco Systems and Cisco Meraki or equivalent unless otherwise noted.
- B. Pre-Approved Equals;
1. Switching – None add to existing infrastructure
 2. Wireless – None, add to existing infrastructure
- C. Contractors wishing to approve a system other than those specified in this document will be required to perform the following:
3. Provide System specifications and cutsheets for all system components for the proposed new system(s).
 4. Provide an itemized comparison to each of the system functions as described in this specification. Include in that document how the proposed system compares to the specified system described in this document on a line by line basis, using one of the following three criteria: “exceeds”/“matches”/ “unequal”.
- D. All other products than those specifically address in the bid document that the Contractor is seeking approvals for must be **received** by the Owner’s Representative **no later than ten (10) days before the bid date**. All Approved Equals will be published in addendum form prior to the bid date.
- E. Failure to received written approval for product installed that deviates from the products called for in this specification and/or on the project drawings will result in the contractor having to replace the unapproved materials and equipment with the originally specified products at no additional cost to the Owner.
- F. All proposed system documentation must be sent to the Owner’s Representative via one of the following; mail, fax or email. The Contractor will include the project name, their contact information, and the specification section number that the proposed system is comparable to.

Infinity Communications and Consulting, Inc.
4909 Calloway Dr.
Bakersfield, Ca. 93312
(661) 716-1840 Phone
(661) 716-1841 Fax

p2bids@infinitycomm.com Email

1.6 Technology Clause

- A. As technology advances, it is understood that improved or enhanced products may supersede existing products in both price and performance and yet be essentially similar. This request for bids seeks to address the rapid advances in technology by allowing functionally similar or identical products that may be introduced in the future, during the term of this bid, to be included under the general umbrella of compatible product lines and are thus specifically included in this bid document.
- B. Discontinued or end of life products shall be replaced with an equal product to the original specified product at no additional costs to the owner.
- C. Some components listed below may not be 100% eligible for erate. Contractor shall cost allocate these components based on School's and Libraries' Eligible Services List.
- D. Erate Eligibility is based on School's and Libraries' Eligible Services List. It is the bidder's responsibility to verify with USAC the eligibility of all components in the project.

Part 2 - Products

2.1 WLAN – System Equipment

A. WLAN Equipment

1. Cloud Wireless Controller:

- Minimum Support for up to 500 access points and 7000 clients (licenses as necessary for project)
- IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX specification, 1000BASE-T, 1000BASE-SX, 1000-BASE-LH, IEEE 802.1Q Vtagging
- Ability to simultaneously configure and manage access points
- Allows access points to dynamically establish wireless connections without the need for a physical connection to the wired network
- Network tagging engine - search and sync settings by tag
- Automated network monitoring and alerts
- Highly available and secure (PCI / HIPAA compliant)
- Supports rogue access point detection and denial-of-service attacks.
- Support for adaptive power management to turn off access point radios during off-peak hours to reduce power consumption
- Configuration alerts
- Controller Data Center Support (Cloud Server Support)
 - Full redundancy through multiple locations
 - 24x7 automated failure recovery
 - Disaster recovery – including regularly scheduled failover drills
 - 24x7 automated intrusion detection
 - Protected via IP and port-based firewalls
 - Access restricted by IP address and verified by public key (RSA)
 - Systems are not accessible via password access
 - Administrators automatically alerted on configuration changes
 - High security card keys and biometric readers control facility access
 - All entries, exits, and cabinets are monitored by video surveillance
 - Security guards monitor all traffic into and out of the datacenters 24x7, ensuring that entry processes are followed
 - Only configuration and usage statistics are stored in the cloud
 - End user data does not traverse through the datacenter
 - All sensitive data (e.g., passwords) stored in encrypted format

- Service provider to provide one (1) license as necessary for the wireless access points included in this project.
- 2. The approved Cloud Wireless Access Controller shall be **Meraki # LIC-ENT-3YR**

Manufacture Pre-Configured Equipment List

Cloud Wireless Controller Equipment List			
Item	Part Number	Description	Quantity
1	LIC-ENT-3YR	Meraki MR Enterprise License, 3YR	213

This Material List has been configured by Cisco with the design information provided by the District and Consultant. The CONTRACTOR shall verify that this material is the correct material prior to bidding and prior to ordering. It is the CONTRACTORS responsibility for a complete system whether listed here or not.

- 2. Edge Wireless Device;
 - IEEE 802.11b/g/n/AC/AX access point.
 - 2.4GHz: 2 x 2 multiple input, multiple output (MIMO) with two spatial streams
 - 5GHz: 4 x 4 multiple input, multiple output (MIMO) with four spatial streams
 - 2.4 GHz 802.11b/g/n/ax client access radio
 - 5 GHz 802.11a/n/ac/ax client access radio
 - 100/1000/2.5G BASE-T Ethernet
 - Supports IEEE 802.3af Standard, 12.95 watts of power
 - Advanced Encryption Standard (AES)
 - Wi-Fi Protected Access 2 (WPA2) or WPA security
 - Service provider shall provide one access point for every WiFi outlet shown in contract drawings. Service provider shall provide all antennas, mounting hardware and POE injectors as required for a complete and operable WLAN.
 - The approved Edge Wireless Device shall be **Meraki MR56 # MR56-HW & Meraki MR46E # MR46E-HW**

Manufacture Pre-Configured Equipment List

Edge Wireless Device Equipment List			
Item	Part Number	Description	Quantity
1	MR56-HW	Meraki MR56 Wi-Fi 6 Indoor AP	194
2	MR46E-HW	Meraki MR46E Wi-Fi 6 Indoor AP w External Antenna Connectors	19
3	MA-ANT-3-E6	Meraki Indoor Dual-band Wide Patch Ant, 6port MR46E/MR53E	19

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2.2 Core, Edge LAN – System Equipment

- A. Core/Edge Switching
 - 1. 24-Port 10G Core Fiber Switch shall provide;

- 24 SFP+-based 10Gigabit Ethernet ports
- 800-Gbps switching capacity with 245 Mpps of throughput
- External USB and SD card support for flexible storage options; Type A (storage and boot) up-to 4 GB, Optional External Memory (SD Card) 2 GB
- 10/100/1000 RJ-45 console and management port
- IPv6 support in hardware, providing wired-network-rate forwarding for IPv6 networks and support for dual stack with innovative resource utilization
- Dynamic hardware forwarding-table allocations for ease of IPv4-to-IPv6 migration
- Scalable routing (IPv4, IPv6, and multicast) tables, Layer 2 tables, and ACL and quality of service (QoS) entries to make use of eight queues per port and comprehensive security policies per port
- Optional Module; 8 x10 GE SFP+/SFP - C4KX-NM-8SFP+
- CPU and Memory; Onboard Memory (SRAM DDR -II) 4 GB, Port Buffers 32-MB Shared Memory, CPU Dual Core 1.5 GHz
- Qos Policy Enforcement; Per Port or Per Vlan or Per Port, Per VLAN Granularity, Class of Service (CoS) Yes
- AC Power Max Rating 750W, System Power Consumption 330W nominal/400W max
- Total Output BTU 1122 BTU/hr (330 W) nominal/1365 BTU/hr (400 W) max
- The limited lifetime hardware warranty (LLW) includes 10-day advance hardware replacement for as long as the original end user owns the product.
- The approved Core Fiber Switch shall be the Cisco Catalyst 9500 24 Port 10GE (C9500-24Y4C-EDU)

Manufacture Pre-Configured Equipment List

Core Switching Equipment List			
Item	Part Number	Description	Quantity
1	C9500-24Y4C-EDU	Catalyst 9500 24x1/10/25G and 4-port 40/100G, K12	2
2	C9500-DNA-24Y4C-P	C9500 DNA Premier, 24Y4C Port, Term License	2
3	C9500-DNA-L-P-3Y	C9500 DNA Premier 12Q/16X / 24Y4C 3Year Term License	2
4	C9500-NW-A	C9500 Network Stack, Advantage	2
5	C9K-F1-SSD-240G	Cisco pluggable SSD storage	2
6	C9K-PWR-650WAC-R	650W AC Config 4 Power Supply front to back cooling	2
7	C9K-PWR-650WAC-R/2	650W AC Config 4 Power Supply front to back cooling	2
8	C9K-T1-FANTRAY	Catalyst 9500 Type 4 front to back cooling Fan	4
9	CAB-9K12A-NA	Power Cord, 125VAC 13A NEMA 5-15 Plug, North America	4
10	CAB-TA-NA	North America AC Type A Power Cable	51
11	ISE-BASE-T	ISE BASE Term License	100
12	ISE-BASE-TRK-3Y	ISE BASE Tracker Term 3Y	100
13	ISE-PLS-T	ISE PLS Term License	100
14	ISE-PLS-TRK-3Y	ISE PLS Tracker Term 3Y	100
15	NETWORK-PNP-LIC	Network Plug-n-Play Connect for zero-touch device deployment	53
16	PI-LFAS-AP-T-3Y	PI Dev Lic for Lifecycle & Assurance Term 3Y	6
17	PI-LFAS-T	Prime Infrastructure Lifecycle & Assurance Term - Smart Lic	6

18	PWR-C5-BLANK	Config 5 Power Supply Blank	51
19	SC9500HUK9-173	Cisco Catalyst 9500H XE.17.3 UNIVERSAL	2
20	SFP-10G-LR-S=	10GBASE-LR SFP Module, Enterprise-Class	4
21	SFP-10G-SR-S=	10GBASE-SR SFP Module, Enterprise-Class	36
22	STACK-T4-1M=	1M Type 4 Stacking Cable	1
23	STACK-T4-3M=	3M Type 4 Stacking Cable	12
24	STACK-T4-50CM	50CM Type 4 Stacking Cable	51
25	SWATCH-T	StealthWatch 1 FPS Term License	200
26	SWATCH-TRK-3Y	ISE BASE Tracker Term 3Y	200

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2. Edge POE Switches shall provide;

- 2 x 10 Gigabit Ethernet with SFP+
- 24 or 48 ports of Gigabit Ethernet desktop connectivity
- Cisco FlexStack stacking module support
- PoE+ with up to 30W per port that allows you to support the latest PoE+ capable devices
- Up to 40 Gb of wireless capacity per switch (48-port models)
- Power supply options, with 6400W fixed power supplies for PoE+ Limited lifetime hardware warranty, including next-business-day replacement with 90-day service and support
- The approved 48 Port Edge Switch shall be the Cisco Catalyst 9200 Series (C9200L-48P-4X-EDU)

It shall be the responsibility of the contractor to verify type and quantity of switches. See project drawings for reference. Each MC/HC shall have a minimum of 100% port density. Contractor shall verify POE power requirements and provide additional switches required to power all specified devices.

Manufacture Pre-Configured Equipment List

Edge Switching Equipment List			
Item	Part Number	Description	Quantity
1	C9200L-48P-4X-EDU	Catalyst 9200L 48-port PoE+ only, 4x10G uplinks, K12	51
2	C9200-STACK	Catalyst 9200 Stack Module	102
3	C9200L-DNA-E-48	C9200L Cisco DNA Essentials, 48-port Term license	51
4	C9200L-DNA-E-48-3Y	C9200L Cisco DNA Essentials, 48-port, 3 Year Term license	51
5	C9200L-NW-E-48	C9200L Network Essentials, 48-port license	51
6	C9200L-STACK-KIT	Cisco Catalyst 9200L Stack Module	51

This Material List has been configured by Cisco with the design information provided by the District and Consultant. The CONTRACTOR shall verify that this material is the correct material prior to bidding and prior to ordering. It is the CONTRACTORS responsibility for a complete system whether listed here or not.

- 2.3** Contractor's price shall include the cost to install, program and configure all of the above equipment.

Part 3 - Execution

3.1 General

- A. All Work described in this specifying document and on the Project drawings shall be performed in accordance with the acknowledged Professional and Industry standards and practices. All installed equipment shall meet and/or exceed the specified manufactures regulations.
- B. The Contractor shall maintain a competent supervisor and Manufacture Certified Technician assigned to this installation for the duration of the Project.
- C. Furnish and install all materials, devices, components and equipment required for a complete and operational system.
- D. It is the contractor's obligation to inform the Owner and/or the Owner's Representative of any and all conflict's, between the project documents and the onsite conditions.
- E. It is the Contractor's responsibility and obligation to coordinate with all necessary trades to ensure the integrity and compliance of the Manufacture and Industry standards are meet during the duration of the installation.

3.2 Programming

- A. Contractor shall provide all necessary programming to provide a complete operating Local Area Network.
- B. Contractor shall include in their bid one four hour planning meeting with the owner and their Representatives to outline all specific programming including, but limited to:
 - Notification to Contractor of the Approved IP Range.
 - All individual restrictions and permissions.
 - Contractor will address all concerns of the Owner and their Representatives.
- C. Each switch will include programming to support:
 - Account Login and Password for all management ports
 - Login Banner
 - Multiple IP Addresses
 - Radius or TACACS+ security
 - Server Time synchronization
 - Log Recording (Time stamped, sent to remote server)
 - SNMP recording
 - Multiple VLAN's
 - VLAN trunking
 - Multiple Quality of Service policies
 - HREAP

Contractor will provide all necessary programming to provide a complete operating Wireless Local Area Network, including software installation and site survey results before and after wireless installation.

Pre-installation survey will include:

- Proposed WAP locations
- Maps showing wireless coverage from proposed locations
- Suggested coverage enhancements or changes

Post-installation survey will include:

- Installed WAP locations with labels
- Maps showing actual wireless coverage with signal strength
- Throughput tests from each WAP

- D. Contractor will turn all system passwords and copies of management software over to the District at the completion of this project.
- E. Contractor will address all concerns of the Owner and their Representatives.
- F. After installation and programming, contractor will test and verify all programming configurations.

3.3 Testing

- A. After installation and programming, contractor will test and verify all programming configurations.
- B. LAN Testing
 - 1. After installation and programming, contractor will test and verify all programming configurations. Including but not limited to;
 - DHCP
 - VLAN
 - QOS
 - Multi-Protocol Label Switching (MPLS)
 - Multicast
 - IP Ping
- C. WLAN Testing
 - 1. The WLAN tester shall;
 - The Analyser should be capable to monitor the 802.11a/b/g and support for 802.11i
 - The Analyzer should be capable to monitor the performance of the WLAN network
 - It should be able to monitor the RF spectrum like SNR, C/N, etc.
 - The device should be capable of
 - a. Global Positioning System Device Logging
 - b. Record and Play Back WLAN Device Information
 - c. World Mode Operation – International Channel Scanning
 - d. Fifteen New WLAN Security Alarms
 - e. Four New WLAN Performance Alarms
 - f. Save and replay captured files in Wireless Sniffer in Ethereal file format
 - g. Configurable alarm threshold and audible alarm sound
 - h. Press-and-hold action supported on device icon for ease of navigation
 - i. Run-time static WEP decryption
 - j. Access control list (MAC addresses) import capability for rogue AP detection
 - k. Customizable vendor ID map for MAC address display.
 - The device should capture 802.11 frames to the device trace file, Device should record all WLAN device information at the end of a real time session into the trace file.
 - The device should be able to spot misconfigured WLAN devices operating in violation with regulatory rules.
 - The device should come with following security alarms:
 - Urgent AP with WEP disabled
 - Warning Client station with WEP disabled
 - Warning WEP initialization vector (IV) reused
 - Info Device using Open authentication
 - Warning Device probing network with NULL SSID
 - Urgent Authentication failures abnormally high
 - Urgent AP unconfigured
 - Urgent Rouge AP
 - Urgent Rouge client station

- Urgent Spoofed MAC address detected
 - Warning Crackable WEP initialization vector (IV) used
 - Info Device unprotected by VPN
 - Urgent Device unprotected by 802.1X
 - Warning AP broadcasting SSID
 - Warning Ad-hoc mode station detected
 - Urgent EAP rekey timeout too long
 - Urgent Denial-of-service attack association flood
 - Urgent Denial-of-service attack authentication flood
 - Urgent Denial-of-service attack EAPOL-logoff
 - Urgent Denial-of-service attack EAPOL-start
 - Urgent Denial-of-service attack EAPOL ID flood
 - Urgent Denial-of-service attack EAPOL spoofed success
 - Urgent Denial-of-service attack EAPOL spoofed failure
 - Urgent Denial-of-service attack De-authentication broadcast
 - Urgent Denial-of-service attack De-authentication FLOOD
 - Urgent Denial-of-service attack Dis-association broadcast
2. The contractor shall provide a complete system detail for all WLAN tests.
- D. Contractor will perform a witnessed testing for minimum of 10% of all new network devices installed as a part of this project.

3.4 System Documentation

- A. Upon completion of the installation, the electronics contractor shall provide four (4) full documentation sets to the Owner's Representative/Engineer for approval, one (1) to be a hardcopy and three (3) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This includes system single line drawings and maintenance and operation manuals, and all warranty information.
- C. The Device Information documents are to be in an Excel spreadsheet format. Each device installed will have individual information entered in the spreadsheet including:
- Manufacturer and Model of device
 - Physical Location (may include a digital picture), and mount type
 - Serial Number of device
 - IP Address(es) assigned to device
 - Firmware revision installed
 - Address and contact information of responsible staff
- D. Each Device Configuration document shall be provided in both an electronic and text document format. One (1) to be a hardcopy print and three (3) to be electronic copies. The Device Configuration documents are to be in a text file format. Each device installed will have the following configuration information included (if applicable):
- Manufacturer and Model of device
 - Current installed (running) configuration
 - Firmware revision installed
 - Installed modules, blades, or accessories
- E. Equipment documentation shall include the items listed below:
- Maintenance and Operations Manuals
 - All System Passwords and Management/Programming Software

END OF SECTION