**\*\*\*\*\*\*\* [NOTES TO SPECIFIER] \*\*\*\*\*\*\***

**Bogen Nyquist E7000 Series Educational System VoIP Intercom**

* Any size campus – from two stations to unlimited capacity per facility
* Any size school district for an unlimited capacity
* Any number of bell schedules, with unlimited events for time, music playlist, and announcement scheduling
* Any combination of VoIP administrative phones (Admin Stations), VoIP staff phones (Staff Stations), VoIP speakers, call buttons, or analog speakers in the classrooms, office areas, staff areas, and workrooms
* Program and audio distribution via the Local Area Network (LAN)
* Configuration and administration via any web-enabled device

# **PART 1 – GENERAL**

## **1.01 GENERAL REQUIREMENTS**

1. The conditions of the General Contract (General, Supplementary, and other Conditions) and the General Requirements are hereby made a part of this Section.
2. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of the Bogen Nyquist E7000 Series Educational System. The specifying authority must approve any alternative system.
3. Contractors who wish to submit alternative equipment shall provide the specifying authority with the appropriate documentation at least 15 business days prior to bid opening. The submitted documentation must provide a feature-by-feature comparison identifying how the proposed equipment meets the operation and functionality of the system described in this specification. Prior to bid date, the contractor shall provide adequate and complete submittal information, which shall include but not be limited to specification sheets, working drawings, shop drawings, and system demonstration. The alternative supplier-contractor must also provide a list to include six installations identical to the proposed system.
4. The contractor shall provide the FCC registration number of the proposed system, where applicable.
5. Final approval of the alternative system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternative system at the contractor’s expense.
6. The contractor for this work shall have read all the bidding requirements, the general requirements of division xx, and the contract proposal forms, and shall be held to the execution of this work. The contractor shall be bound by all the conditions and requirements therein.
7. The contractor shall be responsible for providing a complete functional system, including all necessary components whether included in this specification or not.
8. In preparing the bid, the contractor should consider that no claim will be made against the owner for any costs incurred by the contractor for any equipment demonstrations requested by the owner.

## **SCOPE OF WORK**

The contractor shall furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating VoIP school communications system including but not limited to:

1. Nyquist NQ-E7030 Analog Station Bridge (ASB)
2. 24 station interface supporting analog speakers and call switches
3. Built-in 2x120W power amplifiers
4. Two speech links
5. Category wiring
6. 25/70-volt speaker(s), ceiling-mounted, wall-mounted, and paging horns
	1. Ceiling Mounted Speakers: CSD2X2U Drop-In Ceiling Speaker
	2. Ceiling Mounted Speakers: S810T725PG8U Ceiling Speaker
	3. Wall Baffle Speakers: MB8TSQ/SL Metal Box Speaker
7. Analog/Mechanical Call Switches capable of placing Normal, Urgent, or Emergency priority calls
	1. CA-15C rocker style momentary call button
8. CAN Bus 2.0 interface designed for future support of Nyquist Digital Call Switch (DCS) NQ-E7020 or NQ-E7020-G2 that can initiate Normal, Urgent, or Emergency priority calls, all with options for Privacy Mode
9. Nyquist NQ-P0100 Matrix Mixer Pre-Amplifier (MMPA)
10. Four Mic/Line inputs that are user-configurable
11. Line-Level/Monitor output
12. Digital AES/EBU (AES3) input
13. Nyquist NQ-E7010 Input/Output (I/O) Controller
14. Eight inputs to monitor third-party device events
15. Eight outputs to initiate third-party device actions
16. Power over Ethernet (PoE) Class-1 (IEEE 802.3af compliant)
17. Nyquist NQ-S1810WT-G2 Classroom VoIP Wall Baffle Speaker(s)
18. Adjustable volume via web browser, 100 steps minimum
19. Built-in 10W amplifier
20. MEMS digital microphone for full duplex talkback
21. PoE Class-3 (IEEE 802.3af compliant)
22. Connection to optional Nyquist DCS NQ-E7020/NQ-E7020-G2, which is capable of placing Normal, Urgent, or Emergency priority calls and can provide station status and the ability for the user to enable and disable Privacy Mode
23. Nyquist NQ-S1810CT-G2 Classroom VoIP Ceiling Speaker(s)
24. Adjustable volume (100 steps minimum) via web browser
25. Built-in 10W amplifier
26. MEMS digital microphone for full duplex talkback
27. PoE Class-3 (IEEE 802.3af compliant)
28. Connection to optional Nyquist DCS NQ-E7020/NQ-E7020-G2, which can place Normal, Urgent, or Emergency priority calls and can provide station status and the ability for the user to enable and disable Privacy Mode
29. Built-in Master Clock with the following minimum features:
30. Unlimited Events
31. Unlimited Concurrent Schedules
32. Unlimited Holidays
33. Nyquist E7000 Series Educational System Software shall be installed on a dealer or a customer-supplied server with the following minimum specifications:
	1. Web Server for full system configuration and operation
	2. Nyquist web-based Administrative User Interface (Admin Web UI) for programming and day-to-day system operation, including but not limited to:
		1. Station intercom two-way calling
		2. Zone Paging with software-adjustable volume per zone
		3. Emergency Paging
		4. Playing Emergency Tones
		5. Playing Tones
		6. Playing Announcement Files
		7. Managing Bell Schedules
		8. Weekly Bell Schedule Review at-a-glance
		9. Audio Distribution
		10. System muting
34. Teacher’s Dashboard web-based UI for teachers, including but not limited to:
35. Directory
36. Dial Pad
37. Voicemail
38. Call Forwarding
39. Single-click or touch Normal or Emergency Calling
40. Single-click or touch 911 calling
41. VoIP Admin Phone, PoE, 7" 800 x 480-pixel color touch screen with backlight
42. VoIP Staff Station, PoE, 132 x 64-pixel graphical LCD with backlight
43. Lightspeed Topcat (TCN) Instructional Audio System, including but not limited to
44. All-in-one ceiling audio system with integrated amplifier, speakers and DECT 2-way wireless audio communication
45. Integrated two-way hybrid speaker system with exciter technology sound panel and low frequency cone driver
46. Wireless transmission range: up to 200 ft (600m) open field
47. Up to 3 microphones for whole room instruction, team-teaching or student sharing
48. Pendant-style Flexmike® classroom microphone with audio input utilizing DECT Technology (1.9 GHz) for transmission. IR not acceptable.
49. Optional Sharemike™ handheld microphone student pass-around use.
50. Both microphones must contain Li-Ion battery with operation up to 8 hours.
51. Both microphones must be rechargeable via single cradle charger. Charger must be powered via 5V USB.
52. Wireless Media Connector with DECT (1.9 GHz) to integrate with and wirelessly transmit all classroom multimedia to be played through the ceiling audio system.
53. Owner Telephone System Connectivity
54. System shall be capable of connecting to the Public Switched Telephone Network (PSTN), analog Public Branch Exchange (PBX), or digital PBX/IP-PBX by connecting to an unlimited number of SIP trunks, analog FXO/FXS lines, or CO Trunks.
55. Telephone service with public utilities will be arranged by the owner in conjunction with the equipment supplier. Equipment supplier shall generate a one-page document that will provide the owner with the number of outside lines.

## **1.03 SUBMITTALS**

1. Spec Sheets on all items including cable types
2. Outline drawing of system control cabinet showing relative position of all major components
3. Shop drawings, detailing integrated electronic communications network system including, but not limited to, the following:
4. Station wiring arrangement
5. Equipment cabinet detail drawing
6. Wiring diagrams showing typical connections for all equipment
7. Numbered Certificate of Completion for installation, programming, and service training, which identifies the installing technician(s) as having successfully completed the Nyquist E7000 technical training course provided by the Bogen Communications LLC

## **1.04 QUALITY ASSURANCE**

1. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.
2. The contractor shall be an established communications and electronics contractor that maintains a locally run and operated business and has done so for at least 10 years. The contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.
3. The contractor shall show satisfactory evidence, upon request, that he or she maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The contractor shall maintain at his or her facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

## **1.05 SINGLE SOURCE RESPONSIBILITY**

1. Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and a minimum of 30 years of experience in the industry. The supplying contractor shall have attended the manufacturer's installation and service training classes. A certificate of this training shall be provided with the contractor's submittal.

## **1.06 SAFETY / COMPLIANCE TESTING**

The communications system and its components shall, where applicable, bear the label of a Nationally Recognized Testing Laboratory (NRTL), such as Environmental Technology Laboratory (ETL), and shall be listed by their re-examination service. All work must be completed in strict accordance with all applicable electrical codes, under direction of a qualified and factory-approved contractor, and to the approval of the owner.

## **1.07 IN-SERVICE TRAINING**

The contractor shall provide a minimum of eight hours of in-service training with this system. These sessions shall be broken into segments, which will facilitate the training of individuals in the operation of this system. User Guides shall be provided at the time of this training.

## **1.08 WIRING**

1. System wiring and equipment installation shall be in accordance with generally accepted engineering best practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical codes. All wiring shall be tested to be free from grounds and shorts.
2. All system wiring shall be labeled at both ends of the cable. All labeling shall be based on the room numbers as indicated in the architectural graphics package.
3. Wiring shall be done per manufacturer's recommendation (Cat 5 or West Penn #357) depending on speaker type. All terminal connections are to be on barrier strips.

## **1.09 PROTECTION**

1. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.
2. The contractor shall note on their system drawings, the type and location of these protection devices and all wiring information. Such devices are not to be installed above the ceiling.

## **1.10 SERVICE AND MAINTENANCE**

1. The contractor shall provide a five-year equipment hardware warranty of the installed system against defects in material and workmanship. All materials shall be provided at no expense to the owner during normal working hours. The warranty period shall begin on 1st of the month following the date of shipment.
2. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of this system after the initial hardware and software warranty periods.
3. System shall include software maintenance that includes bug fixes and new feature releases for a period of six years.
4. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

# **PART 2 - SYSTEM SPECIFICATION**

## **2.01 MANUFACTURERS**

1. Manufacturers, subject to compliance with requirements specifications, provide the following system:

Bogen Nyquist E7000 Series Educational System manufactured by Bogen Communications LLC

Lightspeed Topcat (TCN) Instructional Audio System manufactured by Lightspeed Technologies, Inc.

1. The specifying authority must approve any alternative system 14 days prior to bid day.
2. The intent is to establish a standard of quality, function, and features. It is the responsibility of the contractor to ensure that the proposed product meets or exceeds every standard set forth in these specifications.
3. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

## **2.02 EQUIPMENT**

### Nyquist NQ-E7030 Analog Station Bridge

1. 24 station support
2. 120W of total available power; max. 40W per any individual port
3. 25 Volt Speakers(s)
4. Analog Call Switch(s)
5. Software programmable configuration and operation
6. Rack mounted, wall mounted, or shelf mounted
7. CAN Bus 2.0 interface for future support for NQ-E7020/NQ-E7020-G2 DCS

### Nyquist NQ-P0100 Matrix Mixer Pre-amplifier

1. No less than four Line/Microphone Level Inputs used for:
	1. CD Player
	2. AM/FM Tuner
	3. Push-to-Talk Paging Microphone
	4. MP3 Player
	5. Digital AES/EBU (AES3) input
2. Line Level output to drive external amplifier
3. Software programmable configuration and operation
	1. Push-to-Talk Channel
	2. Push-to-Talk Type
	3. Push-to-Talk Zone
	4. Mixer Channels
4. Mixer Channels Wall or shelf mounted

### Nyquist NQ-E7010 Input/Output Controller

1. Eight Dry Contact Inputs
2. Eight Open Collector Outputs
3. Software programmable configuration and operation including:
	1. Contact Type
	2. Extension
	3. Name
	4. Close Interval
	5. Actions including:
		1. Audio
		2. Alarm
		3. Announcement
		4. Disable-Audio
		5. Other
		6. Tone
		7. Enable-Audio
	6. Action ID
	7. Zones
	8. Close Extension
	9. Dashboard Type
	10. Dashboard Title
	11. Dashboard Scope
	12. Dashboard Text
	13. Dashboard Style
	14. Email
4. Wall or shelf mounted

### Nyquist Station Equipment

1. NQ-T1100 VoIP Admin Phone – Color Touch Display (aka Admin Station)
2. NQ-T1000/NQ-T2000 VoIP Staff Phone – LCD Display (aka Staff Station)
3. NQ-S1810WT-G2 VoIP Wall Baffle Speakers with talkback
4. NQ-S1810CT-G2 VoIP Ceiling Speakers with talkback
5. NQ-E7020/NQ-E7020-G2 Digital Call Switch
6. CSD2X2U Drop-In Ceiling Speaker
7. CA15C or CA21B Analog Call Switch

### Lightspeed Topcat (TCN) Equipment

1. Topcat all-in-one ceiling audio system with integrated amplifier, speakers and DECT 2-way wireless audio communication
2. Flexmike (FMN) wireless pendant microphone
3. Optional Sharemike (SMN) wireless handheld microphone
4. FSC microphone cradle charger
5. Wireless DECT (1.9 GHz) Media Connector with 2-way audio interface.

### Optional Equipment

1. Telephony interface device(s) for FXO/FXS analog port connectivity

## **2.03 COMPONENTS AND DESCRIPTIONS**

The Nyquist E7000 Series Educational System is a software-based VoIP paging and intercom system.

The Nyquist E7000 Series Educational System must be capable of supporting existing Bogen Multicom 2000 and Bogen Quantum Multicom IP wiring, 25-volt speakers and analog call-switches, and equivalent competitive systems utilizing the existing architectural numbering scheme. The VoIP capabilities of the Nyquist system will enable the support of the features across the various Nyquist appliances within the facility. The following sections define how the system handles each of the features in the system. Systems that do not allow the reuse of existing wiring or numbering scheme shall not be deemed acceptable. Systems that do not allow appliances to be seamlessly integrated via the LAN are not considered equal.

### Nyquist E7000 Server Software

1. The Nyquist E7000 server software shall be installed on a dedicated dealer or customer supplied server. An unlimited number of facilities can be networked into a Nyquist-based District.
	1. Minimum Nyquist Server Requirements
* Debian Linux OS (AMD 64-bit version) release 8.4.x – 8.8.0
* Quad-core Intel-based processor running at 3.0 GHz or higher
* 8 GB RAM
* One 250 GB disk drive
	+ Redundant Array of Independent Disks (RAID) is recommended for redundancy and high availability.
	+ Consider using a larger drive if large amounts of audio (for example, voice mail, announcements, recordings, and music) are being stored on the system. Other factors that should be considered are:
* How often will backups be performed?
* Will the system be backed up locally or remotely on a detachable drive, SAN/NAS, or NFS?
* How many users will have voicemail ability?
* How long will voicemail messages be stored?
* Will voicemail messages be part of the local system backups?
* NIC 10/100/1000 MB Ethernet port
* One or more PCI/PCI Express (PCIe) slots if telephony network connectivity other than, or in addition to, SIP trunking
* One or more PCI/PCIe type third-party telephony interface cards (for example, FXO, FXS, etc.) if telephony network connectivity other than, or in addition to, SIP trunking
1. Audio shall be transmitted between the server and the Nyquist appliances using the customer supplied LAN/WAN using both G.722 and Opus 48k audio encoding and streaming technology to deliver High-Definition audio quality. Systems that do not use G.722 and Opus for audio encoding and streaming shall not be deemed equivalent.
2. The Nyquist server software and Nyquist appliances software shall be upgradeable via the Nyquist Web UI.
3. It shall be possible for a Nyquist facility to make “station-to-station” calls and “remote facility” All-Call pages to a single facility or to all Nyquist facilities in a district via the Nyquist Web UI or an Admin Station. Systems that require remote viewing software or other application software to be installed/loaded on to additional servers or PCs to make station-to-station calls and remote facility All-Call or district paging shall not be considered equivalent.
4. The Nyquist server software is designed to handle all facility and district-wide communications, including but not limited to, inter-facility intercom calling and paging, district-wide Emergency All-Call and local facility point-to-point calls. Via the Nyquist Web UI, every facility shall be configured with the IP addresses of all the other remote facilities within the district.
5. Nyquist can support an unlimited number of facilities; however, the maximum number of simultaneous remote facility intercom calls supported is based on the actual performance of the WAN and the Nyquist Server CPU load.
6. The voice quality of the facility calls may vary based on the WAN conditions. The maximum network bandwidth that All-Call and Zone Paging uses is 64 kbps (Multicast G.722), and intercom calls use 128 kbps (unicast, G.722).
7. The system shall facilitate the repetitive playing of Normal or Emergency audio tones or announcements directed to a Paging Zone until stopped by the Nyquist user via the Web UI, an Admin Station, or a dry contact closure connected to the Nyquist I/O Controller NQ-E7010.
8. A built-in Master Clock shall be included to automatically control class change bells or other time-based signals. The Master Clock shall have an unlimited number of Events that may be programmed into any of the unlimited number of Schedules, and unlimited number of Holidays. The schedules shall be nameable for easy selection when assigning schedules to days or overriding a schedule.
9. Network Time Synchronization. The system shall be capable of periodically updating/synchronizing the processor’s time with a Network Time Server running Network Time Protocol (NTP) via the school’s LAN network. Systems that do not provide Network Time Synchronization will not be deemed equivalent. The Nyquist server can be the NTP server for other devices on the LAN such as IP clocks and other IP devices.

### Nyquist Server Application

1. The Nyquist software is installed onto the server, and upon boot-up, users can log in to the Nyquist server application via a web browser that supports WebRTC. Systems that require Com Port redirect software, client PC application, software or serial-to-Ethernet adapters for user access are not deemed equal. Communications between the server and the Web UI(s) shall be via secure Hyper Text Transfer Protocol (HTTPS) connections (i.e., https://).
2. The Nyquist Web UI shall be configured with four different default user access levels, based on four unique user roles. Systems that do not provide unlimited access levels and unlimited user roles are not considered equal.
	1. The four default roles shall be: admin, optech, operator, and user. These roles provide a starting point/example for administrators to create additional roles.
3. Only a user assigned the admin role shall be able to provide access to users, giving them the ability to create, delete, edit, and view system parameters.
4. Only an Administrator shall have the ability to adjust roles and Class of Service (CoS) of users. The roles determine if users can view the definable data objects that can include configuration, alarms, and performance data and if users can perform certain operations based on the user’s role and station’s CoS. All changes to roles and CoS are effective immediately, without the need to restart the browser or reboot the server.
5. The Nyquist Web UI Dashboard shall provide full administrative capabilities to manage/operate the following system features:
	1. Calling/Paging – User can initiate a call by accessing the directory or by dial pad and can receive calls, make Zone Page and All-Call Page, make a Prepending Page, Emergency All-Call paging.
	2. Call Forwarding
	3. District Calling/Paging – Used for District Facility Page, District All-Call, and District Emergency All-Call.
	4. Tones/Announcements – Used to play Tones, Announcements, and Alarms.
	5. View This Week’s Schedule – Used to show the current interactive Bell Schedule.
	6. Audio Distribution – Used for entire facility or Audio Zones
	7. Enable or Disable Audio – Used to place the Nyquist system into Page Exclusion mode (i.e., ”mute” the system) when a contact closure is supplied from the fire alarm panel. Systems that do not provide this capability are deemed not equal.

Systems that require application software to be installed on a PC to manage the above features shall not be considered equivalent.

1. To facilitate installation and configuration of the system, additional Web UI menus are required. The menus shall only be visible to users with the correct roles and CoS. The navigation menus found on the Web UI shall be as follows:
	1. System Parameters – Allow installers to adjust core system parameters.
	2. Zones – Allow installers to create and modify Paging, Time, and Audio Zones.
	3. Schedules – Allow installers and administrators to create bell schedules for the facility, predefine alternative schedules to run, prevent the bells from ringing on a holiday, and schedule an announcement to play. The system shall allow an unlimited number of schedules to operate simultaneously within a facility.
	4. Admin Groups – Allow the installer to create, modify, and delete software groupings of admin phones that can ring when a station calls in with a call switch.
	5. CoS Configuration – Allow the installer to create, modify, and delete CoS groups that control station access to the following features: Call-in Level, Zone Paging, All-Call Paging, Emergency All-Call, Inter-Facility Call/Page, Audio Distribution, Remote Pickup, Join Conversation, Call Forwarding, Walking Class of Service, External Call Routing, Call Transfer/3-way Calling, Manually Activate Tone Signals, Call Any Station, Manage Recording, Monitor Calls, Monitor Locations, Conference Admin, Conference User, Voicemail, Record Calls, Activate Alarm Signals, Disable Audio, Enable Audio, Allow Callee Auto-answer, District Paging, and Inter-Facility Features.
	6. Stations – Allow the installer to set up, modify, and delete stations; set up Page Exclusion; view Station Status; and add New Stations.
	7. Bridge Devices – Allow the installer to configure the Nyquist ASBs.
	8. Audio – Allow the installer to upload and manage Announcements, Playlists, Songs, and Tones. The system must support the uploading of both MP3 and WAV files and make Audio file management simple for users. Systems that limit the size of Audio files shall not be considered equal.
	9. Users – Allow the installer to manage users by giving them the proper roles and assign extensions if needed.
	10. Roles – Allow the installer to grant users rights to Create, Delete, Edit, Restart Server, Sort Menu, Systems Update, Manage, Import/Export, Restore, Settings, or View.
	11. Facilities – Allow the installer to set up the district wide facilities for remote paging and calling.
	12. Outside Lines – Allow the installer to set up FXS and FXO ports for inbound and outbound system calling.
	13. SIP Trunks – Allow the installer to set up SIP trunks into the facility for inbound or outbound calling.
	14. Call Details – Allow the installer to review the historical system activities that can be used for incident investigation or system troubleshooting.
	15. System Backup/Restore – Allow the installer to preform system backups or restores and allow the backups to be schedule to run automatically.
	16. System Logs – Allow the installer to view and export Server, Nyquist-Intercom, and Web Server logs that can be used for troubleshooting and technical assistance.
	17. Paging Exclusions – Allow the installer to view and edit stations that are excluded from paging.
	18. Firmware – Update firmware for Nyquist speakers and appliances.
	19. Help – Provide information about the system, online help topics, and System Administrator Manual.

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Systems that do not provide these menus as a minimum shall not be considered equal.

### Nyquist NQ-E7030 Analog Station Bridge

* 1. The Nyquist NQ-E7030 ASB allows facilities with existing Multicom or Quantum or compatible intercom systems to upgrade to Nyquist. Each ASB supports up to 24 speakers and call switches with 120 Watts of embedded 25 Volt power. The ASB is designed to drive any combination of 25 Volt speakers and horns. Features Include:
		1. 10/100 Ethernet
		2. 24 station interface - Supports connections to as many as 24 individual 25 Volt speakers with one 25 Volt speaker connection per interface
		3. 24 dry contact closure-type analog Call Switch connections
		4. Half-duplex talkback using speaker as pickup
		5. CAN Bus 2.0 Interface for future NQ-E7020/NQ-E7020-G2 DCS support and other accessory devices
		6. 120W of available power across all 24 channels; maximum 40W per channel
		7. 2 x RGB full spectrum LED status indicators
		8. USB 2.0 host port, type A connector (future use)
		9. Universal mains supply (100VAC – 240VAC)
	2. The Nyquist NQ-E7030 ASB shall be rack, wall, or shelf mountable and shall include the required mounting bracket hardware.

### Nyquist NQ-P0100 Matrix Mixer Pre-Amplifier (MMPA)

* 1. The Nyquist NQ-P0100 MMPA is designed to bring external audio into the Nyquist system. The MMPA interfaces with a local sound system by accepting one or more local audio sources, mixing them, and outputting them to either, a) the network for Audio Distribution, or b) the MMPA’s line level output that can then be inserted into an external amplifier to drive local sound system in gyms, cafeterias, auditoriums, etc. The MMPA supports the following:
		1. Four software selectable MIC or Line Input channels via three XLR connectors and four sets of screw-terminals. Any single input channel shall be capable of being configured to support a Push-to-Talk microphone (for example, Bogen DDU-250). Channel-1 can be configured as a digital AES/EBU (AES3) input. Line/Monitor output – The MMPA becomes a station on the Nyquist system, allowing users to call it directly or to include it in any of the Page, Time, or Audio Zones.
		2. The MMPA shall support the following features: Line-Level output to drive input on a local amplifier; One USB 2.0 host port (Type-A connector) for future use; 2 x RGB full spectrum LED status indicators.
		3. The MMPA is powered by Universal mains supply (100VAC – 240VAC).
		4. The MMPA shall be wall or shelf mountable and shall include the required mounting bracket hardware.
	2. The dealer shall supply a minimum of one Nyquist MMPA that allows for up to four user-configurable audio inputs. The MMPA shall support Line, MIC, and digital AES/EBU (AES3) input sources. The system shall support an unlimited number of MMPAs.

### Nyquist NQ-E7010 Input/Output Controller

* 1. The Nyquist NQ-E7010 I/O Controller is designed to accept contact closure inputs and activate open-collector outputs to drive relay coils.
1. PoE Class-1; IEEE 802.3af compliant with Optional 48VDC 15W power supply
2. Eight Dry Contact Closure Inputs that can be used with Fire Alarm Override Relays, external event triggers (for example, Lockdown Buttons, etc.)
3. Eight Relay Driver Outputs (Open-Collector) for use with Clock Correction (Sync Pulse), response to contact closure inputs, etc.
4. USB 2.0 host port, Type-A connector (future use)
5. 2 x RGB full spectrum LED status indicators
	1. The Nyquist NQ-E7010 I/O Controller shall support wall or shelf-mounting options and shall include the required mounting bracket hardware.
	2. The Nyquist NQ-E7010 I/O Controller shall be designed for wall or shelf mounting.

### Nyquist VoIP Admin Phone – Color Touch Display (Admin Station)

1. The Nyquist Admin Station shall have the following features:
	1. 7” 800 x 480-pixel color display with backlight
	2. Touch screen display for one touch operation
	3. Full-duplex hands-free speakerphone with AEC
	4. Call hold, mute
	5. Redial, call return, auto answer
	6. PoE (802.3af) Class-3 support
	7. Headset with EHS support
	8. Dual Gigabit Ethernet ports
	9. Desk Mountable
	10. Optional Wall mount capable
2. The Nyquist Admin Station display panel shall show the time of day and day of week, the current bell schedule(s), and the station numbers and call-in priority of staff stations that are calling in. Depending upon the system programming, an Admin Station shall display menus to activate Zone Paging, All-Call Paging, Emergency All-Call Paging, District All-Call paging, alarm signals, and external functions.
3. The Admin Station shall be capable of calling either the loudspeaker or Staff Station at each classroom location.
	1. The Admin Station shall display the classroom number of any station that calls 911. This allows front-office administrators to direct emergency personnel to the correct physical location in the building when they arrive. If a system is not connected to outside phone lines, then 911 calls can be routed to a designated station within the facility. The system shall automatically record all 911 calls made from any station. The 911 call recording shall begin as soon as 911 is dialed and continue unit the call is terminated. Recorded calls shall be maintained on the system for later playback review and/or retrieval by authorized personnel and/or authorities. Systems that do not provide this feature will not be deemed equal.

### Nyquist NQ-T1000/NQ-T2000 Staff VoIP Phone – LCD Display (Staff Station)

* 1. Nyquist Staff Station shall have the following features:
1. 132 x 64-pixel graphical LCD with backlight
2. Two-port 10/100M Ethernet Switch
3. Full-duplex hands-free speakerphone with AEC
4. Call hold, mute
5. Redial, call return, auto answer
6. PoE (802.3af) Class-3 support
7. Dual color (red or green) illuminated LEDs for line status information
8. Two 10/100M Ethernet ports
9. Wall or desk mountable
	1. The classroom Staff Station shall be capable of the following features depending on how the station CoS is configured:
	2. Emergency intercom call – Staff Stations shall be capable of making an Emergency intercom call, which is then routed to the assigned Admin Station. This requires the display of the architectural number and call-in level on the Admin Station. Systems that do not provide this feature are not equivalent.
	3. Speed dial
	4. Toggle audio distribution on and off
	5. Call Forward activation and deactivation for All-Calls/Busy/No Answer/Busy or No Answer
	6. Conference Calling
	7. Transfer Call
	8. Dial Administrative station– Staff Stations can allow the user to dial the station number to call to the Admin phone or its associated speaker. The call shall be routed to the Admin Station showing the architectural number that is calling.
	9. Emergency All-Call – An emergency page shall be broadcasted to all the stations in the facility.
	10. Place Outside Call
	11. Remote Answer
	12. Single-Zone/All-Station Page
	13. Call Waiting Tone for Outside Calls – It shall be possible to feed the call waiting tone to the Administrative Phone during a conversation.
	14. Transfer call from VoIP speaker in classroom down to an associated Staff Station
	15. Transfer call from analog speaker in classroom down to an associated Staff Station
	16. Transfer call from VoIP Staff Station in classroom up to an associated VoIP speaker
	17. Transfer call from Staff Station in classroom up to an associated analog speaker

### Nyquist NQ-S1810CT-G2 VoIP Ceiling Speaker with Talkback and NQ-S1810WT-G2 VoIP Wall Baffle Speaker with Talkback

1. The VoIP speakers shall not require traditional intercom wiring or transformer taps to manually set or adjust volume. Simply connecting them via Cat 5 to a PoE Switch or PoE Injector on the system’s network should allow them to be ready to program into the system. Volume is controlled via the Nyquist Web UI. All Nyquist audio appliances shall use a wideband Opus codec for Audio Distribution. Use of the Opus codec, along with G.722, allows for High-Definition audio. Nyquist VoIP speakers shall be equipped with a digital MEMS microphone to achieve superior talkback audio. VoIP Speakers that utilize the speaker as the microphone shall not be considered equal.
2. The NQ-S1810WT-G2 VoIP Wall Baffle Speaker with Talkback design facilitates mounting the speaker up to four different ways:
	* 1. 2x2 Wall Mount
		2. Box Mount
		3. Corner Mount
		4. Tilted Mount
3. The VoIP Speakers provide CAN Bus 2.0 Interface support for the NQ-E7020/NQ-E7020-G2 DCS.
4. The VoIP Speakers shall be PoE IEEE 802.3af compliant. VoIP speakers may be placed up to 100 meters (328 Feet) from a PoE switch or PoE Injector.
5. Software provides adjustable audio output level.
6. DHCP with Option 66 is supported for easy network deployment.
7. The VoIP Speakers provide VLAN support.
8. The VoIP Speakers are pre-assembled for faster installation.
9. Each VoIP Speaker includes a10 Watt integrated power amplifier.
10. Each VoIP Speaker has a digital MEMS microphone to support talkback.

### Nyquist NQ-E7020/NQ-E7020-G2 Digital Call Switch

1. The Nyquist DCS has been exclusively designed for use with Nyquist appliances equipped with a CAN Bus 2.0 Interface. The CAN Bus 2.0 interface provides power and signal, and multiple DCSs can connect to each CAN Bus 2.0 interface. The DCS fits into a Single Gang/ Low Voltage installation using standard ‘decora-plate’ covers (supplied).
2. The DCS is a capacitive touch button design, so it doesn’t have any moving parts to wear out. The behavior of this switch is software definable. Systems that require membrane or mechanical rocker style call switches that can wear out over time shall not be acceptable.
3. Normal Call initiation involves touching the DCS one time. When a user touches the button on the DCS once, one of the three LED segments will light up green, a normal call will be placed, and the light will start blinking green. This is the indication that the Normal Call has been placed to the VoIP Admin Phone or to a group of VoIP Admin Phones and that the phone or phones are ringing.
4. Urgent Call initiation involves touching the DCS one time. When a user touches the button on the DCS once, one of the three LED segments will light up yellow, an Urgent Call will be placed, and the light will start blinking yellow. This is the indication that the Urgent Call has been placed to the VoIP Admin Phone or to a group of VoIP Admin Phones.
5. Emergency Call initiation involves touching the DCS one or three times depending on station programming. When a user touches the button on the DCS once or three times within three seconds, all three LED segments will light up red, an Emergency Call will be placed, and the light will start blinking red. This is the indication that the Emergency Call has been placed to the VoIP Admin Phone or to a group of VoIP Admin Phones.
6. Single Press Emergency Call, if programmed, involves touching the DCS one time. When a user touches the button once, all three LED segments will light up red on the DCS, an Emergency Call will be placed, and the light will start blinking red. This is the indication that the Emergency Call has been placed to the VoIP Admin Phone or to a group of VoIP Admin Phones.
7. Normal and Urgent Calls can easily be upgraded to an Emergency Call after the DCS is flashing by touching the button on the DCS one time. The Normal or Urgent Call will be canceled, and an Emergency Call will be placed.
8. Privacy Mode – Pressing and holding the button on the DCS for four seconds will place the speaker into Privacy Mode. As the user continually touches the DCS button, all LED segments will turn purple; when all three LED segments are lit purple, the speaker is in Privacy Mode. If a call comes into the classroom when the station is in Privacy Mode, the microphone will be disabled; the user in the classroom can touch the DCS once and it will allow talkback. Once the call ends, the classroom will need to manually return the speaker into Privacy Mode, if desired. The user can disable Privacy Mode without placing a call by pressing and holding the button on the DCS for four seconds. As the user continually touches the DCS, all LED segments will turn blue. When all three LED segments are lit blue, the speaker is no longer in Privacy Mode. Systems that require mechanical or membrane switches to achieve Privacy Mode shall not be considered equal.
9. The colors specified above are created by three RGB full spectrum LED segments to provide installers and users with visual status and feedback when installing and using the DCS. When the DCS is being installed and the power is connected before the signal, the LED will light red. It will also light red if the speaker in the classroom stops communicating with the Nyquist Server, indicating a problem with the station.
10. In addition to providing visual call status indications, a call confirmation audio file shall be played on the associated loudspeaker when a call is placed via a DCS. The three call-in levels shall have distinct audio confirmation messages:
	1. Call Placed
	2. Urgent Call Placed
	3. Emergency Call Placed
11. Emergency Link Transfer – If an Emergency Call is unanswered by the VoIP Admin Phone and the Emergency Link Transfer is active, the Emergency Call will be forwarded to the loudspeaker associated with the Emergency Link Station. Any station equipped with a loudspeaker can be programmed as the Emergency Link Station. Systems that do not provide Emergency Link Transfer shall not be considered equal.

### Bogen Analog Call Switch CA-15C

1. The momentary Call Switch shall be capable of placing a combination of Normal/Urgent/Emergency Calls based on the software configuration of the Call Switch.
2. Normal/Emergency Call configuration: Making a Normal Call in this mode involves pressing the button on the Call Switch once. A call is then placed to the designated Admin Station. An Emergency Call involves pressing the call switch at least four times. The Emergency Call is then routed to the designated Admin Station. In both scenarios, the calling station number and call-in level (Normal or Emergency) are displayed on the Admin Station or on a group of Admin Stations. Additionally, Emergency Calls can be routed to an alternative Admin Station or Emergency Link.
3. Urgent/Emergency Call configuration: Making an Urgent Call in this mode involves pressing the button on the Call Switch once. A call is then placed to the designated Admin Station. An Emergency Call involves pressing the button on the Call Switch at least four times. The Emergency Call is then routed to the designated Admin Station. In both scenarios, the calling station number and call-in level (Urgent or Emergency) are displayed on the Admin Station or on a group of Admin Stations. Additionally, Emergency Calls can be routed to an alternative Admin Station or Emergency Link.
	1. Emergency Only call configuration: Making an Emergency Call in this mode involves pressing the Emergency Call switch with Call Level Emergency one time. The call is then switched to the Admin Station. This requires the display of the station number and call-in level on the Admin Station or on a group of Admin Stations. Additionally, Emergency Calls can be routed to any Admin Station, including Emergency Link.
4. Emergency Link Transfer - If an Emergency Call goes unanswered by the Admin Station and the Emergency link transfer is active, the Emergency Call will be forwarded to the loudspeaker associated with the Emergency Link Station. Any station equipped with a loudspeaker can be programmed as the Emergency Link Transfer. Systems that do not provide Emergency Link Transfer shall not be considered equal.
5. In addition to the mechanical click of a Call Switch button press, a call confirmation audio file shall be played on the associated loudspeaker when a call is placed. The three call-in levels shall have distinct audio confirmation messages:
	1. Call Placed
	2. Urgent Call Placed
	3. Emergency Call Placed

### Additional Loudspeakers for use with the Nyquist ASB

1. Classroom Speakers shall be Bogen:
	1. Ceiling Mounted Speakers: CSD2X2U Drop-In Ceiling Speaker
	2. Ceiling Mounted Speakers: S810T725PG8U Ceiling Speaker
	3. Wall Baffle Speakers: MB8TSQ/SL Metal Box Speaker
2. Hallway Speakers shall be Bogen:
	1. Ceiling Mounted Speakers: CSD2X2U Drop-In Ceiling Speaker
	2. Ceiling Mounted Speakers: S810T725PG8U Ceiling Speaker
	3. Wall Baffle Speakers: MB8TSQ/SL Metal Box Speaker
3. Outdoor/Gym/Locker Room Speakers shall be Bogen:
	1. FMH15T mounted in BBSM6 surface-mounted vandal-resistant enclosure/BBFM6 flush-mounted vandal-resistant enclosure with FMHAR8 adapter ring and SGHD8 heavy duty grille
	2. KFLDS30T Wide Dispersion Re-entrant Horn Loudspeakers
4. Common Area Speakers shall be Bogen:
	1. OCS1 Orbit Ceiling Speakers
	2. OPS1 Orbit Pendant Speakers

### Instructional Audio System

1. All-in-one ceiling audio system with integrated amplifier, speakers and wireless receiver shall be Lightspeed Topcat:
2. Wireless communication: DECT Technology (1.9 GHz)
3. Wireless transmission range: up to 200 ft (60m) open field
4. Power output: 20 Watts RMS
5. Acoustic frequency response: 60 Hz to 18 kHz -10dB
6. AC Mains Power Input: 100-240V ~ 50/60Hz 1.5A
7. DC Power Input: 24V/2.5A
8. Signal-to-noise: >60 dB
9. Total Harmonic Distortion: <1% @ 40 Watts (20W / Channel)
10. Automatic power on when Flexmike is powered on and linked
11. Dimensions (W x D x H): 24” x 12” x 3.7” (595mm x 295mm x 94mm)
12. Weight: 13.5 oz. (6.1 kg)
13. Controls:
	1. (1) Volume control with source selection for audio input and tone
	2. Page mute (PageFirst™) sensitivity level control
14. Connections:
	1. (1) Direct AC mains power input
	2. (1) Optional DC Power Input
	3. (1) Audio input (Longer cable runs may require a ground loop isolator in order to prevent audio hum caused by a ground loop.)
	4. (1) S/PDIF Audio in from another Topcat
	5. (1) S/PDIF Audio out to another Topcat
	6. 6-pin euro-block system interface with:
		1. 24/70V page-sensing mute (PageFirst™)
		2. Contact closure input mute
		3. Contact closure output trigger
15. Device Pairing: Infrared receiving diode to receive signal from microphone to initiate new device pairing process.
16. Flexmike Pendant-style microphone / transmitter
17. Description: the pendant-style Flexmike transmitter shall contain microphone volume control on the unit allowing users to adjust volume level from anywhere in the classroom. The Flexmike shall be capable of being worn around a teacher’s neck as a hands-free microphone via the lavaliere cord or to be used as a handheld student pass-around microphone. The Flexmike must be rechargeable via cradle charger or USB power. It must have a user replaceable, snap-in rechargeable battery pack.
18. Lanyard: adjustable length with magnetic clasp
19. Wireless communication: DECT Technology (1.9 GHz)
20. Transmission range: up to 200 ft (60m)
21. Audio distortion: <1%
22. Integrated microphone type: unidirectional electret
23. Digital audio interface: USB-C 2-way digital audio interface
24. Earbud output: 3.5mm (for monitoring optional Activate Pods)
25. Push button volume control: +/- 6dB (total range = 12 dB)
26. Power: on/off/mute button
27. Battery Power: 3.7V Li-Ion battery pack
28. Battery run time: 8 hours (fully charged)
29. Charging: via cradle charger or USB-C cable
30. Cradle Charger: 2-slot drop-in cradle charger capable of charging 2 microphones
31. Cradle Charger Power: 5V USB-C, charging off AC power or computer USB
32. Pairing: IR emitter to enable one-button pairing with amplifier
33. Dimensions (L x W x H): 2.9” x 1.1” x 0.7” (74 x 28 x 18mm)
34. Weight: 1.2 oz (34g)
35. Optional Sharemike wireless handheld microphone
36. Description: handheld wireless microphone for student pass-around use
37. Wireless communication: DECT Technology (1.9 GHz)
38. Transmission range: up to 200 ft (60m)
39. Audio distortion: <1%
40. Integrated microphone type: unidirectional electret
41. Auxiliary Audio Input: 3.5mm
42. Digital audio interface: USB-C 2-way digital audio interface
43. Power: on/off/mute button
44. Battery Power: 3.7V Li-Ion battery pack
45. Battery run time: 8 hours (fully charged)
46. Charging: via cradle charger or USB-C cable
47. Cradle Charger: 2-slot drop-in cradle charger capable of charging 2 microphones
48. Cradle Charger Power: 5V USB-C, charging off AC power or computer USB
49. Pairing: IR emitter to enable one-button pairing with amplifier
50. Dimensions (L x W x D): 6.0” x 1.0” x 1.0” (153 x 25 x 25mm)
51. Weight (with batteries): 2.6 oz (73g)
52. Wireless Media Connector
53. Description: Wireless audio transmitter/receiver to integrate with classroom audio sources and send/receive the wireless to the Topcat system in the ceiling.
54. Wireless Communication: DECT Technology (1.9 GHz)
55. Analog Audio Inputs: (4) 3.5mm stereo jacks connect to classroom audio sources.
56. Analog Audio Outputs: (2) 3.5mm jack with volume control
57. Digital Audio Interface: 2-way digital audio via USB (USB-C)
58. (1) Audio input volume control
59. (1) Audio output volume control
60. (1) Power button with LED
61. (1) Tone control
62. Audio frequency response: 80 Hz to 7 kHz ±3 dB
63. Audio distortion: <1%
64. DC Power Input: USB 5V/0.2A (type USB-C)
65. Mounting: table-top or wall
66. Dimensions (W x D x H): 7.6”x 4.1”x 1.1” (193 x 104 x 28mm)

## **2.04 SYSTEM CAPABILITIES**

1. The communication system shall be a Bogen Nyquist E7000 Series Educational System and shall provide a comprehensive communications network between administrative areas and staff locations throughout the facility.

 The system shall provide no less than the following features and functions:

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1. Software-based, state-of-the-art, Voice over IP (VoIP) paging and intercom solution.
2. The system shall provide a Web User Interface (Web UI) that shall allow users to configure and control the system, in accordance with their assigned User Role, from any Web browser enabled PC, Mac, or Android tablet or mobile device.
3. Amplified-voice communication with analog loudspeakers shall use a shielded audio pair when connected to an ASB.
4. The system shall support any combination of the following VoIP phone station types: NQ-T1100 Administrative VoIP Phone – Color Touch Display (Admin Station) or NQ-T1000/NQ-T2000 Staff VoIP Phone – LCD Display (Staff Station).
	1. All VoIP phone station types shall utilize the same type of field wiring.
	2. There shall be no limit to the number of Admin Stations that can be connected to a facility. Systems that require different head-end equipment to make Admin Stations function, or systems that limit the number of Admin or Staff Stations shall not be deemed acceptable.
5. Future station alterations shall only require the Station Type to be changed in system programming. Alterations shall not require field wiring or system head-end alterations, unless an analog station device is being replaced by a VoIP station device or vice-versa.
6. The system shall be a global non-blocking system. The system shall be capable of unlimited amplified intercom paths per facility. Two amplified intercom paths shall be provided with each ASB for its complement of 24 stations. All hardware, etc., required to achieve the necessary number of amplified-voice intercom channels for this system shall be included in this submittal. ASB amplified-voice intercom channels shall provide voice-activated switching. Systems requiring the use of a push-to-talk switch on administrative telephones shall not be acceptable. There shall be an automatic level control for return speech during amplified-voice communications. The intercom amplifier shall also provide control over the voice switching sensitivity and delay times of the VOX circuitry on the ASB.
7. The system shall provide 911 Dial-Through via outside FXO/FXS lines or SIP trunks to ensure that one or more lines are always available for 911 calls. The 911 Dial-Through is available to any properly configured station (via CoS). When a station dials 911, the 911 call is processed as follows:
	1. Call routes to an Emergency Group where the call can be answered.
	2. The 911 CO lines can be pre-configured and reserved. If the 911 reserved lines are busy, the normal CO lines will be connected to route the 911 calls. If all the normal CO lines are busy, then one of the ongoing calls shall be disconnected and the 911 call shall be placed.
	3. When 911 is dialed from any station, its designated Admin Station or Admin Group will receive a message that the station has dialed 911.
	4. The system shall automatically record all 911 calls made from any station. The 911 call recording shall begin as soon as 911 is dialed and shall continue until the call is terminated. Recorded calls shall be maintained on the system for later playback review and/or retrieval by authorized personnel and/or authorities.
8. It is of highest importance that Emergency Calls from stations receive prompt attention. Therefore, it is important that there be an alternative destination in case the Emergency Call does not get answered at the primary location. Details are as follows:
	1. Staff-generated Emergency Calls shall be treated as the second highest system priority. Therefore, all Emergency Calls shall annunciate at the top of the call queue of their respective Admin Station or Admin Group. Should that Emergency Call go unanswered for 15 seconds, the call shall be re-routed to an alternative speaker station. Then, a tone will prompt the caller to make a verbal call for help and annunciates to the Emergency link station “Emergency.” During the transfer, the original administrative telephone shall continue to ring the distinctive Emergency Ring. Should the Emergency Transfer-to-Station have an associated Admin Station, it will also ring for the Emergency Call.
	2. The Emergency Transfer-to-Station shall be software configurable.
	3. Systems failing to transfer unanswered Emergency Calls or failing to immediately connect to the designated Admin Station shall not be deemed as equal.
9. There shall be a Facility Wide Emergency All-Call feature. The Emergency All-Call shall be accessed from designated Admin Stations or the Nyquist Dashboard or by the activation of an external contact closure that shall give a microphone input Emergency status. The Emergency All-Call function shall have the highest system priority and shall override all other loudspeaker-related functions including Time Tones, Normal All-Call or Zone Pages, or Audio Distribution.
	1. Considering that Emergency Calls are to be treated with the highest level of concern, systems that do not regard Emergency All-Call with the highest priority shall not be deemed as equal.
	2. Upon touching the Directory icon, a menu shall appear on the Admin Station display prompting the user to select the desired menu.
	3. The Emergency All-Call shall capture the highest-level system priority and shall be transmitted over all speakers in the facility. It shall also be capable of activating an external control output, which can be used to activate external relays to automatically override volume controls, local sound systems, or strobe circuits.
	4. Systems without Emergency All-Call or systems with All-Call that cannot be activated by external means or that do not capture complete system priority or activate an external relay, shall not be acceptable.
10. There shall be unlimited Alarm Tones (four by default). Each may be accessed by dialing \*91 and the two-digit tone number from any Admin Station, SIP Trunk, or FXO/FXS system interface. These Alarm Tones are separate from the Time Tones. Users shall be able to add an unlimited number of Alarm Tones to the system by uploading MP3 or WAV files. Systems that do not Systems that do not allow the user to upload MP3 and WAV files to customize the Alarm Tones or need to use external alarm/tone generators or special software or have less than four Emergency Alarm Tones shall not be acceptable.
11. Upon touching the Directory icon on an Admin Station, a menu shall appear on the display prompting the user to select from the sub-menus. The Alarms sub-menu is the first available. This precludes the user from having to memorize complicated key sequences to access Alarm Tones.
12. There shall be unlimited I/O Controller relay driver outputs accessible and controllable by properly authorized users via an Administrative Web UI. These outputs remain set until accessed and reset. Users shall have the ability to review the status of each relay driver output. Users shall be prompted through fields via a plain English menu, precluding users from having to remember any dialing sequences to control this feature. The system shall support an unlimited number of I/O Controllers, and each I/O Controller shall be able to interact with any and all other I/O Controllers on the system (i.e., an input on one I/O Controller can trigger an output on one or more different I/O Controllers). Systems that require the user to remember complicated dialing schemes or prompt the user via cryptic commands shall not be acceptable.
	1. The I/O Controller can create a contact closure when the following operations are performed in the system:
		1. 911 call placed
		2. Audio Distributed
		3. Alarm is played
		4. Announcement is played
		5. All-Call preformed
		6. District All-Call performed
		7. District-Emergency-All-Call
		8. Emergency-Call
		9. Emergency-All-Call
		10. Audio-Disabled
		11. Page
13. The system shall provide software controlled and programmable control outputs for external relay activation for use with strobe lights, magnetic locks, card access systems, motion detectors, cameras, or any low-voltage, dry contact creating device. Systems using dedicated security stations for control of external functions shall not be acceptable.
14. The system shall be capable of interfacing to PSTN/PBX/iPBX via both FXO/FXS line and SIP trunk connectivity.
15. The system shall be capable of providing each facility (i.e., (i.e., Nyquist location) an unlimited number of incoming FXO/FXS or SIP trunk lines that can be designated by the user to ring the designated Day Admin or Night Admin. Where an Admin Station is designated to receive outside line calls, the incoming call’s Caller ID information shall appear on the display. The system shall also provide the ability to make outside line calls from Admin Stations. This ability shall be programmable for each Admin Station and there shall be an unlimited number of CoSs available to assign to any station.

1. The system shall be capable of supporting DID, DISA, and Security DISA functions.
2. The system shall provide a password-protected Security DISA feature that shall only be accessible from authorized Police, Fire, Emergency personnel, or an off-premises security office that monitors the facility’s security system. The Security DISA feature shall function as follows: Upon dialing the Security DISA phone number, the caller will receive a dial tone from the system, after which he or she must enter the assigned Security DISA passcode on the dial pad. Upon confirmation, the system will present the dial tone again and will allow the authorized personnel to dial any station/classroom on the system and monitor the activity without any pre-announce tone or privacy beep. This will allow the authorized personnel to audibly assess the situation and determine what actions need to be taken.
3. All DISA and Security DISA calls shall be automatically recorded by the system for later playback review and/or retrieval by authorized personnel and/or authorities.
4. The system shall provide for field-programmable three-, four-, five-, or six-digit architectural station numbers.
5. There shall be an automatic level control for return speech during amplified-voice communications.
6. Each station loudspeaker shall be assignable to all or any combination of Paging, Time, and/or Audio Zones. Systems that do not provide unlimited Paging, Time, and/or Audio Zones shall not be acceptable.
7. There shall be unlimited schedules with unlimited programmable events per facility. Each event shall sound one user-selected tone or external audio source. It shall be possible to assign each schedule to a day of the week or to manually change schedules from an authorized user via a web-based UI. Systems that do not provide unlimited schedules, events, and tones, or that require software to be installed on a PC to perform these functions shall not be acceptable.
	1. The system shall provide multiple concurrent schedules per facility/location to accommodate split facilities (for example., combined Elementary and Middle School, combined Middle and High School, etc.).
	2. The system must be capable of providing Class Change Music to be played from an external audio source or audio files that are stored in playlists on the system during class change periods or whenever a facility wants music to be played in an area (i.e., (i.e., one or more Time Zones) on an automated schedule.
	3. Each event shall be able to be directed to any one or more of the unlimited Time Zones.
	4. Each of the unlimited Time Zones shall have a programmable, customizable Preannounce Tone and volume control that is unique unto itself.
	5. Each event shall play any of the Normal tones or external audio. Each event may utilize a different tone. For example, the system shall be capable of sending the gymnasium, shop classes, and pool a separate, unique time tone to indicate “clean up.” Minutes later, the entire facility can be sent a different time tone to indicate class change.
	6. Each of the unlimited Time Tones may be manually activated by selected VoIP Admin Phones or via an authorized user with access to the Web UI. These tones shall remain active as long as the telephone remains off-hook or until canceled from the keypad or the Nyquist Web UI.
		1. Systems that do not provide an unlimited number of schedules or do not provide automatic activation of schedules shall not be acceptable.
8. Internal Master Clock shall be included, allowing an unlimited number of events per facility. Systems that do not provide an internal master clock or that must supply an external master clock to meet these specifications shall not be acceptable.
9. The Nyquist E7000 is capable of synchronizing with an NTP server and automatically adjusting the Daylight Savings Time for any time zone in the world. The server that the Nyquist E7000 application is running on can also be used as an NTP server for other systems on the LAN (for example, IP Clocks and control systems).
10. There shall be a Zone Page/All-Call Page feature that is accessible by selected Admin Phones and FXO/FXS or SIP connection to the PSTN or PBX/iPBX.
11. There shall be an option to play a pre-announce tone at any loudspeaker selected for voice paging.
12. There shall be a voice-intercom feature that is accessible by CoS authorized staff phones, all Admin VoIP phones, and Admin Web UIs.
	1. There shall be a privacy beep played every 15 seconds at any selected loudspeaker to indicate that an intercom call is in progress.
	2. There shall be a pre-announce tone played at any selected loudspeaker for intercom call communication.
	3. For special applications, the privacy and pre-announce tone signals shall be capable of being disabled during system initialization.
	4. There shall be a switch over to private telephone communications should the person at the classroom loudspeaker pick up his or her Staff Station and dial \*3 to transfer the call down to the associated classroom Staff Station.
13. There shall be various levels of telephonic communication accessible by all Admin Stations and Staff Stations.
	1. Staff Stations must be capable of being programmed to ring one Admin Station during day hours and a different Admin Station during night hours. Day and Night start hours shall be configurable. Staff Stations shall be capable of being assigned to any Admin station. Systems that limit the number and assignment of staff call-ins to an Admin Station shall not be acceptable.
14. Each VoIP speaker or ASB speaker equipped with a call switch (analog or digital) shall be configurable as one of three call-in types, as follows:
	1. Normal/Emergency
	2. Urgent/Emergency
	3. Emergency
15. Call buttons programmed for access Normal / Emergency or Urgent / Emergency shall be able to initiate an Emergency Call by repeated flashing of the phone’s hook switch or repeated pressing of the DCS or the Call Switch. Systems that require additional switches and/or conductors to initiate an Emergency Call, shall not be acceptable.
16. Normal and Urgent Calls shall be placed into the queue for the designated Admin Station or Admin Web UI.
17. Each Admin Station call queue shall first be sorted per call priority (for example, Emergency, then Urgent, and then Normal). Calls are sorted within each priority level on a first-in, first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems that do not sort calls per priority and order received shall not be acceptable.
	1. The display shall simultaneously display a minimum of three intercom calls pending.
	2. Additional calls beyond three shall be indicated by a scrolling option on the right-hand side of the screen thus prompting the user that additional calls are waiting.
18. It shall be possible to answer any incoming call by picking up the handset while it is ringing. It shall not be necessary to press any buttons to answer a call unless the call has dropped into the queue.
19. Staff Stations
	1. Staff Stations shall receive a dial tone upon going off-hook. Outgoing calls are made by dialing the desired station. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be a switchover from loudspeaker to private telephone communication when a person picks up the handset, dials \*3, and presses Enter/OK.
	2. Staff Stations shall be programmable for any type of system access, provided by or restricted by the following CoS options:
		1. Call-in Level
		2. Zone Paging
		3. All-Call Paging
		4. Emergency All-Call
		5. Inter-Facility Call/Page
		6. Audio Distribution
		7. Remote Pickup
		8. Join Conversation
		9. Call Forwarding
		10. Walking Class of Service
		11. External Call Routing
		12. Call Transfer/3-way Calling
		13. Manually Activate Tone Signals
		14. Call Any Station
		15. Manage Recordings
		16. Monitor Calls
		17. Monitor Locations
		18. Conference Admin
		19. Conference User
		20. Voicemail
		21. Record Calls
		22. Activate Alarm Signals
		23. Disable Audio
		24. Enable Audio
		25. Allow Callee Auto-answer
		26. District Paging
		27. Inter-Facility Features
		28. Manage Output Contacts
	3. Staff Stations shall be able to make a Normal Call to any Admin Station by dialing the Admin Station’s extension number. Staff Stations shall also be able to initiate an Emergency Call by dialing \*\*\*\*. Emergency Calls shall ring the Designated Day/Night Admin Station. The system shall provide for each station to have a Personal Identification Number (PIN). By dialing the PIN at any system telephone, the administrator shall have access to Emergency paging regardless of the restrictions on the particular phone being used.
20. Admin Stations
	1. Admin Stations shall receive a dial tone upon going off-hook. Outgoing calls are made by dialing the desired stations. Incoming calls can be directed to the telephone or to the associated loudspeaker for a hands-free reply. There shall be an automatic switchover from loudspeaker to private telephone communication should the person pick up his or her handset.
	2. The display shall normally show the time of day and day of week, bell schedule name, and the numbers of a minimum of three stations calling-in, along with the call-in status of each station (Normal, Urgent, Emergency). The Admin Station’s display shall indicate the station number being dialed from the Admin Station.
	3. The display shall also provide user-friendly menu selections to assist the operator when using the Nyquist system. Displays shall be in English for maximum ease-of-use. Systems that require the operator to memorize long lists of operating symbols or control codes shall not be acceptable.
	4. Admin Stations shall be programmable for any type of system access, providing or restricting the following CoS options:
21. Call-in Level
22. Zone Paging
23. All-Call Paging
24. Emergency All-Call
25. Inter-Facility Call/Page
26. Audio Distribution
27. Remote Pickup
28. Join Conversation
29. Call Forwarding
30. Walking Class of Service
31. External Call Routing
32. Call Transfer/3-way Calling
33. Manually Activate Tone Signals
34. Call Any Station
35. Manage Recordings
36. Monitor Calls
37. Monitor Locations
38. Conference Admin
39. Conference User
40. Voicemail
41. Record Calls
42. Activate Alarm Signals
43. Disable Audio
44. Enable Audio
45. Allow Callee Auto-answer
46. District Paging
47. Inter-Facility Features
48. Manage Output Contacts
	1. Program selection and its distribution or cancellation shall be accomplished from a designated Admin Station with the assistance of the menu display system. Distribution and cancellation shall be to any one or combination of speakers, any Audio Zone or Audio Zones, or All Zones. It shall be possible to provide an unlimited number of program channels for the user to pick from.
	2. It shall be possible via an Admin Station to manually initiate any of the unlimited Normal Tones or Emergency Tones. The Tones shall be separate and distinctly different from the Alarm Tones. The Tone selected shall be capable of being played one time, continuously until it is canceled, or until the administrative display phone is placed back on-hook.
	3. Each Admin Station shall maintain a unique queue of all stations calling that Admin VoIP phone.
49. VoIP Wall Baffle and VoIP Ceiling Speakers shall be configurable as one of two station types: 1) VoIP Speaker Only, or 2) VoIP Speaker with DCS.
50. The Bogen Nyquist VoIP speakers are powered via PoE. Use an 802.3af compliant PoE network switch port or PoE Injector to power these speakers. One PoE network switch port or PoE Injector is required per VoIP speaker.
51. VoIP speakers can be equipped with a DCS that can be programmed as a Normal/Emergency, Urgent/Emergency, or Emergency Only and shall be able to initiate an Emergency Call by touching the DCS one, two, or three times depending on the CoS and current call state of the DCS. If the station is authorized for Privacy Mode, the users can touch and hold for 4 seconds to enable Privacy Mode or hold for four seconds to disable Privacy Mode. Systems that require mechanical, membrane, or an additional number of switches to initiate an Emergency Call, shall not be acceptable.
52. Emergency Calls from VoIP Speaker with DCS shall have priority over the Normal and Urgent Calls in the queue on the Admin Stations and will show up at the top of the list. Systems that do not provide priority for Emergency Call shall not be acceptable.
53. Normal and Urgent Calls shall be logged into queue for the designated Admin Stations.
54. Admin Stations shall ring for when they receive a call, and then the call will be removed from the queue when the call is answered or when the Admin Queue times out (default is 30 minutes).
55. Each queue call shall first be sorted by call priority (Emergency, then Urgent, and then Normal). Calls are sorted within each priority level on a first-in, first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems that do not sort calls by priority and order received, shall not be acceptable. The display shall simultaneously show a minimum of three staff calls pending. Additional staff calls beyond three shall be indicated by an arrow pointing down thus prompting the Admin user that additional calls are waiting.
56. It shall be possible to answer any incoming call simply by picking up the handset while it is ringing. It shall not be necessary to hit any buttons to answer a call unless the call has dropped into the queue.
57. System programming shall be from an authorized Nyquist Admin User via any web browser. A valid username and password shall be required to gain access to the following programmable functions:
	1. System Parameters – Allow installers to adjust core system parameters.
	2. Zones – Allow installers to create and modify Paging, Time, and Audio Zones.
	3. Schedules – Allow installers and administrators to create Bell Schedules for the facility, predefine alternative schedules to run. Holiday Events prevent the bells from ringing on a school holiday. The system shall allow an unlimited number of schedules to operate simultaneous within a facility.
	4. Admin Groups – Allow the installer to create, modify, and delete software groupings of admin phones that can ring when a station calls in with a call switch.
	5. CoS Configuration – Allow the installer to create, modify, and delete CoS groups that can have the following features defined: Call in Level, Zone Paging, All-Call Paging, Emergency All-Call, Inter-Facility Call/Page, Audio Distribution, Remote Pickup, Join Conversation, Call Forwarding, Walking Class of Service, External Call Routing, Call Transfer/3-way Calling, Manually Activate Tone Signals, Call any Station, Manage Recording, Monitor Calls, Monitor Locations, Conference Admin, Conference User, Voicemail, Record Calls, Activate Alarm Signals, Disable Audio, Enable Audio, Allow Callee Auto-answer, District Paging, and Inter-Facility Features.
	6. Stations – Allow the installer to set up, modify, delete stations, set up Page Exclusion, view stations’ status, and add a station.
	7. Bridge Devices – Allow the installer to install the Nyquist ASBs.
	8. Audio – Allow the installer to upload and manage Announcements, Playlists, Announcements, Songs, and Tones. The must support the uploading of both MP3 and WAV files making Audio file management simple for users. Systems that limit the size of Audio files shall not be considered equal.
	9. Users – Allow the installer to manage users by giving them the proper Role and assign an Extension if needed.
	10. Roles – Allow the installer to limit user to the following: create, delete, edit, restart server, sort menu, systems update, manage, import/export, restore, settings, or view.
	11. Facilities – Allow the installer to set up the district wide facilities for remote paging and calling.
	12. Outside Line – allow the installer to set up FXS and FXO ports for inbound and outbound system calling.
	13. SIP Trunks – allow the installer to set up SIP trunks into the facility for inbound or outbound calling.
	14. Call Details – allow the installer to review the historical system activities that can be used for incident investigation or system troubleshooting.
	15. System Backup/Restore – allow the installer to preform system backup or restores and allow the backups to be schedule to run automatically.
	16. System Logs – allow the installer to view and export Server, Nyquist-Intercom, and Web Server logs that can be used for trouble shooting and technical assistance.
	17. Paging Exclusions – allow the installer to view and edit station that are excluded from paging.
	18. Firmware – is used to update Nyquist appliances.
	19. Help –Provides information about the system, online help topics, and System Administrator Manual.
	20. Systems not capable of supporting web-based configuration and control, or require plugins or dedicated application software, shall not be deemed as equal.
	21. Systems that require a Serial-to-Ethernet converter, or require additional application software on a PC for configuration and/or control shall not be deemed as equal.
58. Admin Group
	1. Admin Stations can be placed into Admin Groups, which are used if incoming calls are not answered by the assigned Admin Station or the Day or Night Admin associated with the Admin Station. Admin Groups act as an always answer feature by providing an alternate list of Admin Stations. If an incoming call is not answered by the assigned Admin Station within 30 seconds for normal calls or 15 seconds for emergency calls, all Admin Stations in the Admin Group will ring.
	2. If Call Forwarding is enabled at the Admin Station, Nyquist tries the forwarded extension. If that station does not answer or is busy, the call timeout is reduced to 15 seconds. After 15 seconds, the call rolls over to the Admin Group.
	3. If an Emergency level call receives no answer, the Admin Group will ring if the Day Admin or Night Admin does not answer.
	4. Admin Stations can be assigned to multiple Admin Groups. A Day or Night Admin can also be assigned to one or more Admin Groups.
59. Call Detail Reporting
	1. The Call Details feature allows the viewing and/or printing of detail records of every call in a facility in a call log format. Calls include scheduled announcements, paging, and internally and externally made or received telephone calls.
60. System Backup/Restore
	1. The system backup feature allows users with access to back up the system database, voicemail, and recordings.
	2. The system restore allows users with access to perform a system restore of previously backed up database, voicemail, and/or recordings.
	3. The installer also can set up an automatic backup that can be performed daily, weekly, or monthly.
61. System Log Files
	1. A log file records either events or messages that occur when software runs and is used when troubleshooting the system. The following parts of the Nyquist system generate log files:
		1. Server (This provides access to the Debian Linux OS server log files.)
		2. Intercom (This provides access to the Intercom application server log files.)
		3. Web Server (This provides access to the web server log files.)
	2. From the web-based UI, system logs can be viewed directly or exported via download to a PC, Mac, or Android device and then copied to removable media or attached to an email to technical support.
62. Paging Exclusions
	1. For school testing and exams, the administrators shall be able to put stations into Page Exclusion mode. During this time, the stations will only receive Emergency All-Call pages – not music, tones, or All-Calls. Emergency pages will still be heard at the station even if that station is set to exclude paging.
63. The Classroom Audio System shall be a Lightspeed Topcat Instructional Audio System and shall provide even distribution of audio throughout the entire classroom. The system shall provide no less than the following features and functions:
64. All-in-one design that lays in the suspended ceiling system with integrated amplifier, speakers and DECT 2-way wireless audio communication.
65. Integrated two-way hybrid speaker system with exciter technology sound panel and low frequency cone driver. No additional speakers should be required to simplify installation and minimize ceiling clutter. No directional cone speaker solutions accepted.
66. System must include a wireless pendant-style microphone for the teacher with rechargeable and field-replaceable Lithium battery.
67. System must have separate, purpose-built speaker solutions for instructional audio and PA audio to ensure both applications operate independently and without compromise.
68. System must include wireless media connector with multiple digital and analog audio inputs for integration with other classroom multimedia to ensure even distribution of all audio in the classroom.
69. Wireless media connector must have 3.5mm audio output for interface with assistive listening devices or computers for audio recording applications.
70. Microphones must have 2-way USB audio interface for connection with classroom computers to enable 2-way audio for distance learning applications, amplifying remote students within the classroom, and sending microphone audio from the sound system to the remote learners.
71. The audio system must contain a 70V page mute function that passively detects the audio signal of a page coming through a 25/70V PA system without compromising system performance or voiding warranties. As an audio signal is sent to the PA speaker, page mute detects that signal and immediately mutes all local audio through 975 amplifier.
72. The audio system must contain a contact closure input connection to detect a signal from Fire Alarm, IP Paging System or other device and mutes all local amplifier audio to ensure emergency alerts from external systems can be heard clearly.
73. The audio system must contain a contact closure output to interface with integrated communication system, enabling an alert to be triggered by the teacher microphone with a button press.
74. The system must be compatible and expandable to operate with 2-way small group speaker Pods allowing interoperability between both small group and whole group instruction.
75. Systems utilizing Infrared (IR) or 2.4 GHz wireless transmission are unacceptable due to the possibility of interference with wireless networks and other classroom technologies.
76. The system shall carry a standard warranty equivalent to the Lightspeed 5-year Warranty.

# **PART 3 - EXECUTION**

## **3.01 EXAMINATION**

1. Examine conditions, with the installer present, for compliance with requirements and other conditions affecting the performance of the Nyquist E7000 Series Educational System.
2. Do not proceed until unsatisfactory conditions have been corrected.

## **3.02 EQUIPMENT MANUFACTURER'S REPRESENTATIVE**

1. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.
2. As further qualification for bidding and participating in the work under this specification, the manufacturer's representative shall hold a valid C-10 Contractor's License issued by the Contractor's State License Board of [your state]. The manufacturer's representative shall have completed at least 10 projects of equal scope, giving satisfactory performance, and shall have been in the business of furnishing and installing sound systems of this type for at least five years. The manufacturer's representative shall be capable of being bonded to ensure the owner of performance and satisfactory service during the guarantee period.
3. The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state that the manufacturer guarantees service performance for the life of the equipment and that there will always be an authorized distributor assigned to service the area in which the system has been installed.
4. The contractor shall furnish a letter from the manufacturer of the equipment. This letter shall certify that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible, and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written unconditional guarantee, guaranteeing all parts and all labor for a period of five years after final acceptance of the project by the owner.

## **3.03 DIVISION OF WORK**

1. While all work included under this specification is the complete responsibility of the contractor, the following division of actual work listed shall occur:
2. The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work, shall be furnished and installed completely by the electrical contractor.
3. The balance of the system, including installation of speakers and equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative. The entire responsibility of the system, its operation, function, testing and complete maintenance for one year after final acceptance of the project by the owner, shall also be the responsibility of the manufacturer's authorized representative.

## **3.04 INSTALLATION**

1. The installation, adjustment, testing, and final connection of all conduit, wiring, boxes, cabinets, etc., shall conform to local electrical requirements and shall be sized and installed in accordance with the manufacturer’s approved shop drawings.
2. Low-voltage wiring may be run exposed above ceiling areas where they are easily accessible.
3. The contractor shall install the new system at the location shown on the plans.
4. All Staff Stations and Call Switches shall be wall-mounted:
5. Mount at 54" AFF.
6. All wiring should be concealed.
7. Verify exact location with architect.
8. Avoid mounting near doors to prevent students from activating and running out of the rooms.
9. Admin Stations can be desk or wall mounted.
10. Speaker and telephone lines run above ceiling and not in conduit shall be tie-wrapped to a ceiling joist with a maximum spacing of 8' between supports. No wires shall be laid on top of ceiling tile.
11. Connect field cable to each Analog Speaker transformer using UL butt splices for #22 AWG wire.
12. Contractor shall provide a minimum of eight hours of configuration and operational instruction to school personnel.
13. Bogen Communications LLC, shall provide online “How To” videos for instructing the teaching staff on how to operate the Teacher Dashboard aspect of the system.
14. On the first school day following installation of the Nyquist System, the contractor shall provide a technician to stand by and assist in system operation.
15. Mark and label all demarks IDF and MDF points with destination point numbers. Rooms with more than one outlet shall be marked XXX-1, XXX-2, XXX-3, etc. where XXX is the room number.
16. No graphic room number shall exceed the sequence from 000001 through 899999.
17. All outside speakers shall be on a separate Page Zone and Time Zone.
18. All zones shall be laid out not to exceed 40 Watts (@25V) maximum per zone.
19. All hallway speakers shall be tapped at 1 Watt (@25V) maximum.
20. All outside horns shall be tapped at 3.75 Watts (@25V) maximum.
21. All classroom speakers shall be tapped at ½ Watt (@25V) maximum.
22. Large rooms, such as cafeterias, shall be tapped at 2 Watts (@25V) maximum.
23. Plug disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.
24. Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T and B wire-ties, or hook and loop cable management. Edge protection material shall be installed on edges of holes, lips of ducts, or any other point where cables or harnesses cross a metallic edge.
25. Cable identification: Cable conductors shall be color-coded and individual cables shall be individually identified. Each cable identification shall have a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings.
26. Shielding: Cable shielding shall be capable of being connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in the same manner as conductors.
27. Provide complete “in service" instructions of system operation to school personnel. Assist in programming of telephone system.

## **3.03 GROUNDING**

* 1. The contractor shall provide equipment grounding connections for Integrated Telecommunications/Time/Audio/Media System as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to ensure permanent and effective grounds.
	2. The contractor shall provide ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.
	3. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.
	4. The contractor shall note on their drawings the type and locations of these protection devices and all wiring information.
	5. The contractor shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

## **4.04 DOCUMENTATION**

Provide the following directly to the Supervisor of Technology Services.

1. One printed copy of all field programming for all components in system
2. One copy of all diagnostic software with a copy of field programming data for each unit
3. One copy of all field wiring runs, location, and end designation of system

END OF SECTION