

CSI MasterFormat

Division 27.51.00

Distributed Audio-Video Communications Systems

27.51.13

Paging Systems

27.51.16

Public Address Systems

27.51.19

Sound Masking Systems

NOTE TO SPECIFIER

Lencore Spectra Emerald®, Tangent® - Networked Mass Notification, Audio and Sound Masking Systems

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Conditions and Requirements, Special Provisions of any larger body of specifications, of which this specification may be a part, are hereby made a part of this specification.

1.2 SUMMARY

- A. This specification includes all components required for a networked based MNEC, Audio and Sound Masking Systems including but not limited to digital signal processors, noise generators, paging interfaces, amplifiers, loudspeakers, servers and the associated wiring and controls and components to generate, amplify, distribute and reproduce voice pages, audio and stabilized background sound masking.

1.3 DEFINITIONS AND REFERENCES

- A. UL6500 – Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General Use
- B. UL 2043 – Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; 1996
- C. UL1480- Approved for use as speakers for use in a fire alarm, emergency and commercial/professional use.
- D. ASTM E 1374-02 – Standard Guide for Open Office Acoustics and Applicable ASTM Standards
- E. ASTM E 1573-02 – Standard Test Method for Evaluating Masking Sound in Open Office Using A-Weighted and One-Third Octave Band Sound Pressure Levels
- F. ASTM E 1130-02e1 – Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index

- G. FCC – EN 55103-1&2 – Audio, Video and Entertainment Lighting Control
- H. MNEC - Mass Notification Emergency Communication

1.4 APPLICABLE STANDARDS

- A. ANSI S1.4 American National Standard Specification for Sound Level Meters
- B. ANSI S1.6 American National Standard Specification for Preferred Frequencies and Band Numbers for Acoustical Measurements
- C. ANSI S1.11 American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters
- D. ASTM E 1130-02 Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index.
- E. ASTM E1573-02 Standard Test Method for Evaluating Masking Sound in Open Offices Using A-Weighted and One-Third Octave Band Sound Pressure Levels.
- F. ASTM E 1374-93 Standard Guide for Open Office Acoustics and Applicable ASTM Standards.
- G. ASTM E1041-85 – Standard Guide for Measurement of Masking Sound in Open Offices.
- H. NFPA 72- National Fire Protection Agency- specifies the application, installation, location, performance, inspection, testing, and maintenance of fire alarm systems, fire warning equipment and emergency warning equipment, and their components.

1.5. PERFORMANCE REQUIREMENTS

- A. The MNEC, Audio and Sound Masking systems must use one control unit for the entire system. Multiple control units are not acceptable.
- B. The MNEC, Audio and Sound Masking systems must be capable of separately and independently configuring zones for paging, audio and sound masking via the network empowered through its central control.
- C. The MNEC, Audio and Sound Masking systems must be able to reproduce and distribute audio from 65Hz through 16,000Hz.
- D. The MNEC, Audio and Sound Masking must provide automatic Adaptive Equalization to ensure a flat response for the entire building for paging and audio.
- E. The MNEC, Audio and Sound Masking must provide zone overlap where each speaker channel has a minimum of 10 programmable zones for paging, audio and masking separately.
- F. The Control System must meet ANSI 709.1 / ISO / IEC standards for open platform (i.e Lon, BACnet on Modbus).
- G. The Control System must meet the US Army Corp.'s Unified Facilities Guide Specifications, UFGS 25 10 10, "Utilities Monitoring and Control System" and UFGS 23 09 23, "Direct Digital Control for HVAC and Other Local Building Controls".
- H. The Network Nodes must have individual LCD identifiers.

- I. Plenum mounted network node equipment must have a lighted LED for visual inspection.
- J. The network system must be a multi-drop network system. Point to point systems are unacceptable.
- K. The MNEC, Audio and Sound Masking systems must be capable of reporting entire settings for each zone for paging, Audio and masking indicating at a minimum the volume, contour, 1/3rd band octave and 1/1 band octave equalization, parametric equalization, diagnostics, and groupings.
- L. The system must be capable of performing a complete diagnostics of its entire functions including diagnostics of the network, hubs, nodes, routers, dsp's, memory, circuitry, amplifiers and power
- M. The MNEC, Audio and Sound Masking systems must be capable of using diagnostics and remote administration via a standard web browser.
- N. The system must be capable of RS232, TCP/IP and contact closure for communicating with other systems.
- O. System must be capable of inputting a minimum of 6 audio sources.
- P. System must be capable of having a 1/1 octave band Eq for each individual Audio source.
- Q. Each speaker channel must be capable of source switching to any inputted source.
- R. System must be capable of producing a minimum volume level for Audio @ 83dB.
- S. The Sound Masking must be random and provide a minimum pattern of no LESS than 25 hours.

1.6 DESCRIPTION OF SYSTEM

- A. All audio/paging/masking Equipment installed in the ceiling must be UL Listed for use in a ceiling plenum.
- B. The system must be manufactured in the USA.
- C. All equipment and associated hardware shall be fabricated and installed in accordance with the manufacturer's specified recommendations.
- D. All wiring for power shall be a minimum of 16 gauge.
- E. All Wiring for Audio & Data shall be CAT 5 or better, 4 pair with RJ45 connectors.
- F. Location of grounding points shall be determined carefully to insure minimizing of system hum and elimination of ground loops. In addition, all connections of shields and conductors to equipment shall be in accordance with manufacturer's instructions and best professional practices.
- G. The sound generating units must have an adjustable sound spectrum shaping control in order to meet the varying spectral requirements of drywall ceilings; various types of ceiling tile, air return grills and openings around lighting fixtures, etc. The following is required:
 - The spectrum shaping ability shall be variable within the accepted industry range
 - Audio will be able to be shaped with a full (10 bands) 1/1 band octave equalizer.
 - Paging will be able to be shaped with a full (10 bands) 1/1 band octave equalizer.
 - Masking will be able to be shaped with a full (30 bands) 1/3 band octave equalizer.
 - All EQ's must be completely separate for each individual audio, paging and masking source
 - Masking Equalizers will be able to manipulate the entire audio spectrum from 20Hz to 20KHz

- H. Sound Quality: No audible hum or noise, should be heard from the systems audio speakers
- I. Each Speaker channel must be zone programmable and must carry a MINIMUM of 10 programmable zones per channel. Cross Zoning capabilities must be present in the system.
- J. Audio/Paging system must be able to prioritize either Audio or Paging inputs and zones

1.7. SUBMITTALS

- A. Product Data: Manufacturer's specifications and installation instructions.
- B. Product Data: For each component including nationally recognized testing laboratory listing data.
- C. Shop Drawings: Prepare and submit detailed dimensioned shop drawings for conduit runs (if required) and other distribution services including elevations showing minimum clearances and installed features and devices for system components. Show types and locations of masking speakers and their wiring connections. Channel assignments, and axis orientations. Show ducts, beams. And other significant sound reflecting and absorbing elements in ceiling space and show locations of partitions below ceiling. Include a diagram showing interconnection of major system components for each zone and channel and indicating grounding connections.
- D. Each shop drawing shall contain job title and reference(s) to the applicable drawing(s) and/or specification article(s).
- E. Product Certificates: Signed by manufacturers of system equipment and components certifying that products furnished comply with requirements.
- F. Record of Final Field Tests and Measurements: Include final adjustment of system.
- G. Maintenance Data: For system equipment and components (if needed) to include in maintenance manuals specified in Division 1. Include data for each type of product, including all features and operating sequences. Both automatic and manual.
- H. System Design: Schematics of the system showing quantity and location of system components and related cabling and accessories.
- I. Equipment operation and service maintenance manuals shall be provided for the equipment employed in the systems. This shall include wiring diagrams. The information in the manuals and on the drawings shall be sufficiently detailed to allow a technician of normal competence to understand, install, operate, maintain, calibrate and repair the equipment.
- J. Warranty Documents: Warranty documents covering the system components.

1.8. QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum of 10 years manufacturing Paging & Audio systems.
- B. System Design – Performed by an approved manufacturer representative.
- C. Installer Qualifications – Approved by manufacturer representative and are trained with the specified products or have demonstrated experience with the installation of similar products to those specified.
- D. System Adjustment – Done by an approved manufacturer representative or trained contractor
- E. Single Source Responsibility – For all End to End system and components.

1.9 CODES AND PERMITS

- A. Install all work in full accordance with the requirements of all local and governmental departments having jurisdiction over these matters, as well as with any requirements of the NFPA, NEC, MEA, BSA, UL, and other applicable Codes.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect from moisture during shipping, storage and handling.
- B. Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels intact.
- C. Inspect manufacturer's packages upon receipt.
- D. Handle packages carefully.
- E. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY

- A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.
- B. The MNEC, Audio and Sound Masking systems shall be warranted to be free from defects in materials, workmanship, and performance for a 10-year from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements. Provide products by the following:

Lencore Acoustics Corp.
1 Crossways Park Drive W
Woodbury, NY 11797
PH: 516-682-9292
Website: www.lencore.com
Email: drawings@lencore.com

2.2 SYSTEM COMPONENTS

- A. The enclosure for the Audio speakers shall consist of aluminum or electroplated steel, cylindrical housing.
- B. Speakers: 5 ¼ inch units mounted on metal baffles and arranged for optimum, multi-directional, angular sound distribution. Arrange units for suspension from the building structure above the ceiling.
- C. The system must be capable of being independently zoned on both a global and local level for all audio. All

zoning must be controlled from a network appliance.

D. CONTROL UNIT

- System control unit must be LON, Modbus or BACnet capable
- System control unit must have digital input/output relays
- System control unit must have TCP IP and serial port
- Control unit must be able to control entire building without any additional controls
- System control unit must be able to be browsed using off the shelf software
- System control unit must be capable of providing email reports
- System control unit must be capable of programming alarms, alarm triggers
- System control unit must be capable of creating data logs.

E. LOUDSPEAKER

- Size: 5 ¼ inch wide dispersion
- Power Rating: 10 Watts Root Mean Squared (RMS)
- Frequency Response: 50-12,000 Hz
- Pressure Sensitivity: SPL - at 1 Watt/m - 90 dB
- Impedance: 32 Ohms
- Magnet Weight: 10 oz. (283.5 grams)

F. NOISE GENERATOR: Octave bands from 20Hz to 20KHz

- Voltage: 48 Volts DC, 60 Hz
- Contour Adjustments
- Spectrum adjustment shall meet acoustical preferred curve

G. OUTPUT ADJUSTMENTS

- Central volume control, zone control and EQ control 1/1 octave bands for zones and units for paging and audio
- Parametric EQ for entire spectrum (20Hz – 20KHz)
- 1/3 band EQ for entire masking spectrum (25Hz – 20KHz). Meets ANSI specification for bands

H. WIRE:

- The power wiring shall be minimum 16 gauge, stranded, non-shielded, UL Listed, Plenum Rated
- The data wiring shall be CAT 5 or better, 4 pair with an RJ45 jack.
- The audio wiring shall be CAT 5 or better, 4 pair with an RJ45 jack.

I. POWER SUPPLY:

Output:

- DC VOLTAGE: 48v
- RATED CURRENT: 3.2A
- CURRENT RANGE: 0~3.2A
- RATED POWER: 153.6 W
- OUTPUT VOLTAGE ADJ. RANGE: 45.6~52.8V
- LINE REGULATION: ±0.5%
- LOAD REGULATION: ±0.5%
- SETUP, RISE TIME: 600ms, 30ms at full load
- HOLD UP TIME (Typ.): 20ms at full load

Input:

- VOLTAGE RANGE: 85~264VAC 120~370VDC
- FREQUENCY RANGE: 47~63Hz

- POWER FACTOR (Typ.): PF>0.93/230VAC PF>0.98/115VAC at full load
- AC CURRENT (Typ.): 2.5A/115VAC 1.2A/230VAC
- INRUSH CURRENT (Typ.): Cold Start 40A/230VAC

Safety: & EMC

- SAFETY STANDARDS: UL60950-1, TUV EN60950-1 and S-Mark J60950 Approved
- HARMONIC CURRENT: Compliance to EN61000-3-2,-3
- EMS IMMUNITY: Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN55024

Environment:

- WORKING HUMIDITY: 20 ~ 90% RH non-condensing
- WORKING TEMP: -10 ~ +60 (Refer to output load derating curve)
- STORAGE TEMP., HUMIDITY: -20 ~ +85 , 10 ~ 95% RH
- TEMP. COEFFICIENT: 0.05%/ (0 ~ 50°C)
- VIBRATION: 10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes

Others:

- MTBF: 191.2K hrs min. MIL-HDBK-217F (25°C)
- DIMENSION: 7 27/32" x 3 29/32" x 1 15/16"

Protection:

- OVERLOAD: 105 ~ 150% rated output power
- Protection type : Constant current limiting, recovers automatically after fault condition is removed
- OVER VOLTAGE: 52.8 ~ 64.8V
- OVER TEMPERATURE: 95°C±5°C (TSW1: Detect on Heat sink of Power Transistor)
- Protection type : Shut down o/p voltage, recovers automatically after temperature goes down

J. PROGRAMABLE AUDIO LEVEL CONTROL:

- Standard applications include scheduling, data logging, alarm detection & dispatch, meter reading, analog functions, and type translation. The scheduling application permits events and exceptions to be initiated based on time and date schedules configured by the user. An astronomical position calculator permits scheduling to be done based on the calculated position of the sun. The data logging application collects network activity for use by trending, reporting, and analysis applications. New DIME support enables data log upload to a Web services application to occur through a firewall. The alarming application provides a means to identify, announce, and log alarm conditions. The meter reading application supervises impulse meters and provides suitable conversion values for energy, gas, and water metering. Automatic Sound Power Level Changes: Two system channel changes, four times per day, and capable of different time settings for each day of the week:
- Program Memory: Nonvolatile for one year, minimum, without power. When re-energized after a power outage, control starts at zero level and automatically advances system sound level at same rate used for programmed level changes.

K. PAGING / AUDIO INTERFACE:

The Audio/Page Interface shall perform to the following requirements:

- The audio page interface should replace all bulky head end equipment. There should be no need for additional cable home-runs, amplifiers, separate equalizers, special switching equipment or matching vendors for compatible product interfaces.
- The audio page interface must be able to make zone additions, modifications, deletions and other changes to the paging, audio and EBS system without rewiring.

- The audio/page interface must be able to provide a minimum ability to program up to 100 zones for paging using DTMF tones through standard POTS telephone line. MPI must be able to be programmed for all call and emergency broadcast paging.
- Each zone and group must have a dedicated one band octave equalizer that is able to adjust either individual zones or groups.
- The audio page interface must be able to from one point manage up to 1.5 million square feet of space through a single interface.
- Volume and equalizer settings for paging and audio must be administered in no more than 1 dB steps.
- The audio page interface must automatically compensate and readjust for frequency line loss, broadcast and correct throughout the entire system at each node.
- Shall include telephone, audio and aux inputs.
- Momentary push button sequencer to sequentially initialize attached nodes
- Have a minimum of 6 Audio inputs.
- Have programmable input and output relay capability.
- Have an integrated speaker for listening to each individual source at the head-end.

PART 3 - EXECUTION

3.1. SYSTEM DESIGN

- A. Design system according to manufacturer's specifications.

3.2. EXAMINATION

- A. Ensure that facility build out is at a stage suitable for the system installation.
- B. Ensure that facility is constructed according to plans including wall locations, ceiling types and plenum barriers.
- C. Ensure that the plenum height is appropriate as per manufacturer's recommendations and as per plan.
- D. Ensure power requirements have been provided as per plan.
- E. Ensure sufficient space for centrally located components is available as per plan and manufacturer's specifications.
- F. Ensure any third-party components required to be interfaced with the system have been provided.

3.3. PERMITS

- A. Obtain necessary permits for installation work.

3.4. INSTALLATION

- A. Follow all applicable codes for the area
- B. Follow manufacturer's recommendations regarding installation as found in the MNEC, audio and Sound Masking systems installation manual.
- C. Follow the system design for location of loudspeakers and wiring.
- D. Record any necessary changes to the system design on the plan.

- E. Ensure that supplementary materials used meet applicable safety standards.
- F. Mountings and In-Plenum Loudspeakers shall be concealed above the acoustical ceiling. The loudspeakers shall be suspended from the slab above by chain. Where possible, the bottom, of each speaker shall be located a minimum of 6" to 8" (150 to 200mm) above the acoustical ceiling tile. It is most important that all units hang at a uniform height throughout to insure a uniformity of sound when the system is turned on. Follow all applicable codes for installation.
- G. Mounting of speakers directly into acoustical ceiling tiles. Cut appropriate hole in the ACT and mount ceiling speaker according to manufacturer's installation procedure. Ensure that the ceiling speaker obscures any visible cuts in the ceiling tile. Follow all applicable codes and either tie the speaker to the deck so that no weight of the speaker is carried by the ceiling tile or use appropriate ceiling tile bridge. Follow all applicable codes for installation.
- H. Wiring Method: Install wiring in accordance with all local electrical codes. Use only wire rated for plenum. Conceal cable in accessible ceilings, walls and floors where possible.
- I. Pulling Cable: Do not exceed manufacturers' recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between normal termination points. Remove and discard cable where damaged during installation and replace it with new cable.
- J. Exposed Cable: Install parallel to building lines, follow surface contours, and support as recommended by manufacturer.
- K. Grounding: As recommended by manufacturers, unless more stringent requirements are indicated. Ground equipment and conductors to eliminate shock hazard and to minimize ground loops. Common mode returns, noise pickup, cross talk and other impairments. Install 5-Ohm ground at main equipment location. Measure, record and report ground resistance.
- L. Impedance Matching: For systems components including connecting cable, provide end-to-end level and impedance matched signal paths. Use matching networks and balancing devices at connections where necessary to avoid mismatches.
- M. Splices, taps and terminations: Make splices, taps and terminations on numbered terminal strips in junction, pull and outlet boxes; and equipment closures.
- N. The speaker locations shown on the drawings are schematic only and may require field modification to avoid major ductwork, structures and other plenum barriers. Additional speakers may be required to provide uniform sound distribution because of these plenum obstructions.
- O. Identification: Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification" Use color coded conductors and apply wire and cable marking tape to designate wires and cables so media are identified in coordination with system wiring diagrams.
- P. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Basic Electrical Materials and Methods". Use color coded conductors and apply wire and cable marking tape to designate wires and cables so media are identified in coordination with system wiring diagrams.

3.5. FIELD QUALITY CONTROL

- A. Ensure that plenum heights meet the minimum recommended by the manufacturer for the loudspeakers.
- B. Ensure that distance between the top of the loudspeaker and the deck meets manufacturer's minimum specifications.

- C. Ensure that loudspeakers are suspended in a level manner.
- D. Ensure that loudspeakers are not obstructed as much as possible.
- E. Ensure cables are properly supported in the ceiling.
- F. Ensure cables are securely terminated

3.6. CLEANING

- A. Ensure that empty packaging and any material waste is removed from the site.
- B. Ensure the product is clean and presentable.

3.7. TESTING AND REPORTING

- A. At the completion of installation initial tests and adjustment are to be performed in accordance with specified spacing and orientation, tests be conducted in an open area of 35 ft. x 35 ft. minimum size. Tests shall indicate that all acoustical performance requirements described herein are satisfied.
- B. Verify that paging zoning and levels are appropriate and as per plan.
- C. All testing and adjusting of the system shall be accomplished in the absence of the eventual occupants whenever possible. These precautions are essential to insure that the attention of the occupants will not be unnecessarily drawn to the noise or to its source. Test area for consistency of masking volume and quality.

Tests and adjustments shall be include testing of:

- Hum and Noise Level
 - Loudspeaker Operation
 - Freedom from Buzzes, Rattles and Objectionable Distortion
 - Gain Control Settings
 - STIPA must meet .50 or better
- D. The manufacturers' agent with the support and cooperation of any Subcontractor installer shall perform the acceptance testing of the completed installation. These tests shall be performed to demonstrate that the equipment is fully furnished and installed in compliance with the terms of the Specifications in all Contract Documents. Except as otherwise specified, the Manufacturer or Subcontractor shall provide all instruments, equipment, labor and materials necessary to complete these tests.
 - E. Manufacturers Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation and connections. Report results in writing. Include the following.
 - Operational Test: Start system to confirm proper operation. Remove malfunctioning units, replace with new units and retest. Make initial sound spectrum and level adjustments for each zone.
 - Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - F. The Subcontractor shall project the completion date of tests and adjustments so that he can give a minimum of one week's notice to the active Project Manager.
 - G. Measurements of system performance shall be made using a calibrated ANSI precision sound level meter set for "slow" meter damping and 'A' scale filtering. The measurements shall be made at not less than twenty test positions at 4' height above the floor level, with gain adjusted to provide the system design level. All interior finishes and furnishings shall be in place. Tests shall be for each floor at times not occupied by personnel.
 - H. Final Acceptance Testing:

- Instrumentation: Use a professional quality sound level meter in accordance with ANSI S1.4
- Record test observations, readings and corrective actions.
- System Tests: Include the following for each zone:
 - Relative Sound Pressure Level

3.8. DEMONSTRATION AND TRAINING

- A. Demonstrate operational system to customer by walking the space.
- B. Demonstrate functionality of the system to the customer or customer's representative.
- C. Provide training to customer employee to maintain system as required.
- D. Occupancy Adjustments: When requested within 12 months of date of substantial completion manufacturer is to provide on site assistance in adjusting system to suit actual occupied conditions. Provide one visit to site outside normal occupancy hours for this purpose without additional cost to the owner.