

GAI-TRONICS CORPORATION

SMARTSERIES

**INTELLIGENT INTRA-PLANT
COMMUNICATION AND EMERGENCY
NOTIFICATION SYSTEM**

GUIDE SPECIFICATION

**for
NEC Standards**

PART 1 GENERAL

1.1. Scope of Work..... 2

1.2. Work Included..... 2

1.3. Seller Warranties 2

1.4. Workmanship 2

1.5. Material and Construction 2

1.6. Work Not Covered In This Specification..... 3

1.7. References 3

1.8. Operation and Maintenance Instructions 3

1.9. Quality Assurance 3

1.10. System Description..... 4

1.11. System Operation 4

PART 2 PRODUCTS AND MATERIALS

2.1. General 6

2.2. ADVANCE Control Unit 6

2.3. Field Devices 9

2.4. Cable..... 21

2.5. Loudspeakers..... 25

2.6. Terminal Boxes **Error! Bookmark not defined.**

2.7. Auxiliary Headset..... 31

2.8. Options 32

PART 3 EXECUTION

3. Installation 33

**EQUIPMENT SPECIFICATION FOR
INTELLIGENT INTRA-PLANT COMMUNICATION
SYSTEM**

Note: Items in brackets [] are requirements associated with the option for emergency notification in addition to the standard intelligent Page/Party® operation, and may be omitted if not required. Also note that the emergency notification requirements stated herein are written primarily for fire alarm systems, however, requirements specific to other systems, such as gas detection, security, or process control equipment may be substituted.

PART 1 GENERAL

1.1. Scope of Work

Furnish all labor, materials, equipment, and services necessary and required for a complete and operating intelligent (addressable and supervised) communication [and emergency notification] system. Any material not specifically mentioned in this specification or shown on the applicable drawings, but required for proper performance and operation shall be provided.

1.2. Work Included

Intelligent Page/Party® system, including controls (central and remote), software, handset stations, amplifiers, loudspeakers and horns, wiring and all specified and/or required accessories.

1.3. Seller Warranties

The Seller warrants the satisfactory and successful operation of all equipment furnished under this specification at the ratings, under the conditions, and for the type of service specified herein. Goods manufactured by the seller are warranted to be free from defects in material and workmanship until one year after the date of shipment.

1.4. Workmanship

All work shall be performed in accordance with the best practice in design, manufacture, and fabrication of all material and apparatus by this specification, notwithstanding any omission from the specifications or drawings.

1.5. Material and Construction

All materials used in the construction of the apparatus shall be new and selected as the best available for the intended purpose, considering long life and best engineering practices. Factors of safety shall be used throughout the design. Only heavy-duty industrial components rated to operate within the temperature ranges and other environmental conditions specified in section 1.10.1 shall be used.

1.6. Work Not Covered In This Specification

- [A. Fire alarm system, including control panel and alarm initiating devices (detectors, pull stations, flow switches, etc.).]
- [B. Fire alarm system visual indicating devices (strobes).]

1.7. References

1.7.1 National Fire Protection Association (NFPA)

1.7.1.1 NFPA 70 National Electric Code

1.7.1.2 Occupational Safety And Health Act (OSHA)

1.7.2 Underwriters Laboratory (UL)

1.7.2.1 UL 464 Audible Signal Appliances

1.7.2.2 UL 1604 Electrical Equipment For Use In Class I and II, Division 2 and Class III Hazardous Locations

1.7.2.3 UL 1638 Visual Signaling Appliances

1.8. Operation and Maintenance Instructions

1.8.1 After award of contract, and at the buyer's request, the seller shall furnish two (2) sets of the following:

1.8.1.1 Installation, Operation and Maintenance literature complete with mounting details and dimensions, installation and connection instructions, operating and maintenance instructions, a list of replacement parts and equipment specifications.

1.8.1.2 Submit outline and connection drawings.

1.9 Quality Assurance

1.9.1 All work shall be performed in accordance with this specification, applicable drawings and the best practices in design, manufacture and fabrication.

1.9.2 The system equipment manufacturer shall be ISO 9001 registered for the design, manufacture, contract installation management and service of industrial intelligent communication [and emergency notification] systems. The system manufacturer shall have at least 10 years documented experience in the manufacture of similar systems currently demonstrating proven satisfactory service.

1.9.3 The system installer shall be a company having the approval of the manufacturer and having at least 5 years documented experience in the installation of similar systems currently demonstrating satisfactory service.

1.10 System Description

1.10.1 Environmental Conditions

1.10.1.1 Field devices shall be suitable for installation in the following general types of surroundings:

- Extremely noisy locations, up to 115 dB sound pressure level.
- Ambient temperatures ranging from -30° C to +70° C (-22° F to +158° F).
- Humid and oily locations.
- Dusty and smoky locations, including dirt and flyash.
- Hazardous areas (Classes I, II and III, and Divisions 1 and 2).
- Outdoors (where indicated)
- Areas having constant vibration.

1.11 System Operation

1.11.1 General

1.11.1.1 The intelligent communication system shall include microprocessor based controls, software, handset stations, amplifiers, loudspeakers and horns, cable, wiring, conduit and all specified and/or required appurtenances and accessories. The system shall be capable of supervising and monitoring all system circuits and devices to acquire trouble information and to establish that the devices can respond. The system shall also conduct periodic self-diagnostics on the various subsystems and report failures.

1.11.1.2 Basic system functions shall be as follows:

- Paging -- The capability to support alarm message and operator prioritized, directed one-way audio broadcast within and between zones.
- Partying -- The capability to support full duplex two-way audio communications within and between zones for two or more operators concurrent with, but not interfering with paging.
- Status Monitoring -- The capability to log change of state occurrences and execute diagnostics for alarm events, trouble conditions and operational state.
- Emergency Notification -- The capability to generate prioritized alarm responses to real world events.

1.11.1.3 The system shall be capable of being expanded at any time up to the maximum capacity of the system as stated within this document.

1.11.1.4 System software shall be capable of being re-programmed in the field by a manufacturer's authorized technician via a portable computer. All programmed information shall be stored in non-volatile memory.

1.11.1.5 The system shall be zoned as indicated on the supplied drawings and customized to operate as specified within this document.

1.11.2 Page/Party® Operation

- 1.11.2.1 The system shall provide both page and party line operation utilizing handset stations located at multiple locations throughout the facility in accordance with the drawings.
- 1.11.2.2 Each Page/Party[®] handset station shall be capable of switching between the page line and up to five (5) party lines. Each station shall also be capable of being configured to limit the amount of time allotted for the station's handset to be off-hook. After reaching this configured time limit, the station shall be placed electrically on-hook, the page or party connection disconnected and a signal enunciated at the ADVANCE Control Unit.
- 1.11.2.3 Paging

The paging channel shall broadcast speech over the system loudspeakers. Where necessary to prevent acoustic coupling, the loudspeaker adjacent to the handset station shall be automatically muted when the handset is removed from its cradle and the page channel is selected.

Page priority levels and associated destination loudspeakers shall be configured per the following schedule:

1.11.2.4 Insert Project Specific Requirements

- 1.11.2.5 Party

Party line channels shall provide two-way conversation capability without interference or crosstalk between channels. Party line conversations shall not be heard over the system loudspeakers.

1.11.3 Emergency Notification Operation

- 1.11.3.1 The system shall be capable of receiving and supervising inputs from miscellaneous remote contact closure type devices (emergency shower/eyewash stations, etc.) and activating the appropriate alarm indicating circuits (loudspeakers, horns, strobes, etc.) in accordance with the following schedule:

1.11.3.2 Insert Project Specific Requirements

- 1.11.3.3 The system shall be capable of receiving one or more inputs from a central fire alarm control panel and then activating the appropriate audible and visual indicating appliances (loudspeakers, horns, strobes, etc.) and/or report these to the ADVANCE Control Unit. The audible and visual alarms shall operate continuously until manually stopped at the ADVANCE Control Unit. The system shall be capable of supporting up to 124 unique user-defined alarms, consisting of voice messages, tones, or a combination of both. Fire alarms shall have priority over all paging. The emergency notification system shall receive inputs from the fire alarm panel and provide audible and visual alarm annunciation in accordance with the following schedule:

1.11.3.4 Insert Project Specific Requirements

- 1.11.3.5 Based on the number of inputs required to achieve the system specified, the manufacturer shall determine and provide the optimum interface between the emergency notification system and the fire alarm panel. This interface shall be relay

contact output based. It shall be the responsibility of the system manufacturer to evaluate and select the system interface and to provide all engineering and input signals to interface with the fire alarm panel. The system manufacturer shall be responsible for guaranteeing the correct interface and intended operational philosophy of the overall system.

2. PART 2 PRODUCTS AND MATERIALS

2.1 General

2.1.1 Where practical, equipment shall be the standard cataloged products of a single manufacturer.

2.2 ADVANCE Control Unit

2.2.1 General

The ADVANCE Control Unit shall provide annunciation, supervision and control for the system. The ADVANCE Control Unit shall be modular in construction, and contain all modules or printed circuit board cards as necessary to operate according to this specification and applicable drawings.

2.2.2 Enclosure

The ADVANCE Control Unit shall consist of components installed in either a free standing or wall mounted metallic enclosure. The enclosure shall have either front and rear doors or a front door and swing-frame for operational and maintenance access. The front access door shall be translucent to provide unobstructed view of all ADVANCE Control Unit visual indicators. The enclosure shall support mounting of 19 inch rack equipment with vertical mounting rails for attachment of system cable termination modules, in accordance with DIN standards. The enclosure shall accommodate entry and termination of all system cabling. The enclosure shall be adequately sized by the system manufacturer to accommodate all system components required to provide operation as described herein.

2.2.3 Card Rack Assembly

The Card Rack Assembly shall be the central ADVANCE Control Unit assembly. The assembly shall include a universal AC power supply with an input range of 85 - 264 VAC at a frequency range of 47 - 440 HZ, a VME type backplane, the Master Control Unit (MCU) and up to eighteen (18) removable cards. The following cards shall control the operation and topology of the system and shall be installed in the Card Rack (actual quantity as required):

- External Audio Interface Card (1 max)
- Dual Page/Party® Interface Card (14 max)
- Amplifier Zone Interface Card (4 max)
- Access Panel Interface Card (2 max)
- Voice Network Adapter Card (1 max)

2.2.4 Master Control Unit

The Master Control Unit (MCU) shall be the central component of the system and shall be installed in the Card Rack Assembly. All system functions shall be coordinated by the microprocessor based MCU and its associated software. The MCU shall maintain constant

communication links with the cards and shall supervise all field devices. The MCU shall contain a bootable disk which maintains the system program software and the system configuration program. The system configuration may be pre-programmed at the factory or may be loaded during system installation. The MCU shall incorporate, as a minimum, a X86/200 MHz microprocessor, with 64 MB of read/write solid state memory.

2.2.5 Audio Messenger Interface

The Audio Messenger Interface (AMI) shall generate the audio messages (tones, digitally pre-recorded speech or a combination of both) that will be broadcast over the system loudspeakers during emergency conditions. The AMI shall generate frequency-modulated (FM) tones, including steady, alternating, swept and siren. Each tone type shall have the following programmable parameters - tone frequency, play time and time segment duration.

The unit shall include an onboard real-time clock. The clock shall allow the Audio Messenger to play scheduled events at specific times or intervals such as daily, weekly, monthly or specific days or dates. The user shall be able to program up to 29 scheduled events.

The LCD shall display current time and indicate current message playing.

The Audio Messenger shall include a supervisory output. This output shall remain active (closed) when the unit's processor is healthy. The contact shall be opened if the processor fails.

The AMI can support two modes of operation: Day and Night Mode. Day and night modes may be independently configured.

A Telephone Interface shall be included to allow users to access the system via a telephone network. The Audio Messenger shall auto-answer and may either provide a live audio path to the system or be programmed by the user for record and playback. With telephone paging, acoustical feedback, or howling, is a common problem. To prevent acoustic feedback, the AMI shall include a built-in feedback eliminator. If the system is configured to use the feedback eliminator, incoming telephone pages are recorded and stored until the telephone connection is terminated. After the telephone connection is terminated, the AMI will broadcast the page. The delay between the recording and the playback of the page eliminates any possibility of feedback.

The AMI can provide secure telephone access to the system by being configured to allow telephone access only if a remote access security code is entered. The remote access code is used to prevent unwanted callers from directly accessing the system. Day and Night modes can have different security codes.

The AMI shall be user programmable by means of a PC-based configuration tool allowing the user to configure messages and alarm tones.

The AMI shall use a removable media card to hold configurations and alarm tones and messages.

2.2.6 External Audio Interface Card

The External Audio Interface (EAI) shall allow multiple audio paths to be interfaced to the system. It is installed within the card rack assembly and is controlled by the Master Control Unit (MCU) installed in that same card rack. The EAI provides a fail-safe contact when the MCU is not responding.

2.2.7 Dual Page/Party[®] Interface Card

The Dual Page/Party[®] Interface (DPPI) shall provide the interface between the ADVANCE Control Unit, Page/Party[®], and SmartSeries field devices. One DPPI shall be required for every two Page/Party[®] paging zone. The DPPI shall include the following features and capabilities:

- Interface ADVANCE Control Unit to intelligent Page/Party[®] (SmartSeries) devices through data/voice page line and two party lines.
- Interface ADVANCE Control Unit to non-intelligent Page/Party[®] stations through page line and two party lines.
- Support party line 1 and party line 2 on/off hook detection.
- Provide ground fault detection on page line and party line 1.
- Implements self-check path diagnostics.
- Provide external relay output (driver output) to indicate page audio routing to PPI area.
- Accepts contact closure input to request page audio routing to other system areas.

2.2.8 Amplifier Zone Interface Card

The Amplifier Zone Interface (AZI) shall provide the interface between the ADVANCE Control Unit and up to 12 power amplifiers/loudspeaker loops. The AZI shall execute the following functions:

- Perform audio switching of the page resources to the power amplifiers. There shall be two page resources or buses available in the card rack.
- Perform audio switching from the tone resources to the power amplifiers.
- Provide RS485 communication to field devices.

2.2.9 Access Panel Interface Card

The Access Panel Interface (API) shall be responsible for interfacing Access Panels (if required) to the system for public address, intercommunication, and alarm control. The API shall include the following features:

- Support data communication to Access Panels – allowing data transmission over a single twisted pair of wires.
- Digital to analog audio converter – allows Access Panels to communicate with analog equipment such as Page/Party® stations.
- Provide a digital audio/data interface to the Access Panels.
- Provide an analog interface to the page resources.

Constant communication shall occur between the API and MCU. The MCU shall supervise this communication link. Each interface card shall accommodate up to eight (8) access panels.

2.2.10 Audio Distribution/Monitoring Module

The Audio Distribution/Monitoring Module (ADM) shall be used to distribute up to six (6) loudspeaker loop outputs from the AZI card and supervise the integrity of these loops. The module shall monitor for loop integrity and ground fault detection. The ADM shall be mounted in an equipment rack. The ADM shall communicate with the MCU via an RS485 interface.

2.3 Field Devices

2.3.1 Access Panels

An Access Panel shall be an electronic assembly that is typically mounted in the ADVANCE Control Unit or remotely, as required. The unit shall be capable of initiating paging, public address announcements and audio messages as well as controlling and/or monitoring the system. The Access Panel shall consist of a painted metal front panel and shall include the following:

- Switches – for audio (page or alarm) message initiation and destination selection. Momentary, illuminated push-button switches shall be used. Switch functions shall be configurable with one switch to be dedicated to “Lamp Test”.
- Light Emitting Display LEDs (integrated into pushbuttons) – for operation or status indication. LEDs shall be configurable.
- Optional Handset Pressbar and Cradle – provides additional input such as paging and live voice messages and party line communication.
- Optional Microphone with panel mounted integral page initiate switch – provides additional input such as paging and live voice messages.
- Optional Display – allows the user to view text messages indicating the system status. Types of displayed messages shall include Alarm Receipt, Alarm Activation, Initiating Device Circuit (IDC) Activation, IDC Restore, Page Status, Trouble Warning, Trouble Restore, and Acknowledge Message.
- Buzzer – provides an audible signal to alert control room personnel of any change in system status that is displayed in the VFD.
- Integral low-power audio output for direct loudspeaker connection.

2.3.2 Monitored Input Module

The Monitored Input Module (MIM) shall be a microprocessor based module that monitors remote devices, such as fire alarm panels, process equipment control panels, emergency eyewash/shower stations, etc., for contact closure. The MIM shall be suitable for mounting in an equipment rack. The MIM shall communicate with the MCU via either an RS485 or an FSK interface.

The MIM shall be capable of supervising eight inputs, each configured independently to supervise single, multiple or deactivated devices as follows:

- Deactivated – Input is not monitored
- Line Supervision Multiple Switch – Detects open circuit, ground faults and switch actuation from one or more normally-open dry contact closures.
- Single N.O. Switch – Detects open circuit, wire-to-wire short circuit, ground faults and switch actuation from a single normally-open dry contact closure.
- Single N.C. Switch – Detects open circuit, wire-to-wire short circuit, ground faults and switch actuation from a single normally-closed dry contact closure.
- Non-supervised N.O. Dry Switch – Detects switch actuation from one or more normally-open dry contact closures.
- Non-supervised Wet Switch – Detects the presence or absence of 24 VDC voltages.

2.3.3 Monitored Relay Module

The Monitored Relay Module (MRM) shall be used to supervise up to eight (8) Notification Appliance circuits (NACs) and route power to the particular AC or DC signaling devices, such as high intensity strobe indicators. The MRM shall be suitable for mounting in an equipment rack. The MRM shall communicate with the MCU via either an RS485 or an FSK interface.

The MRM shall be capable of supervising eight circuits. These circuits shall be used for input (IDC) or output (NAC) operations. Each line shall be configured independently to supervise single, multiple or deactivated devices as follows:

- Deactivated – Input is not monitored
- Line Supervision Multiple Switch – Detects open circuit, ground faults and switch actuation from one or more normally-open dry contact closures.
- Single N.O. Switch – Detects open circuit, wire-to-wire short circuit, ground faults and switch actuation from a single normally-open dry contact closure.
- Single N.C. Switch – Detects open circuit, wire-to-wire short circuit, ground faults and switch actuation from a single normally-closed dry contact closure.
- Relay Circuit (NAC) – Detects open circuit, short circuit, and ground faults while the relay is not energized.
- Non-supervised N.O. Dry Switch – Detects switch actuation from one or more normally-open dry contact closures.
- Non-supervised Wet Switch – Detects the presence or absence of 24 VDC voltages.

2.3.4 SmartSeries Indoor Handset/Speaker Station, **Model 7005-802**

2.3.4.1 Handset/Speaker Amplifier

The smart handset station shall consist of a handset and speaker amplifier. The unit shall be capable of operation at 90 - 140 VAC, 50/60 HZ, and ambient temperatures ranging from -30° C to +70° C (-22° F to +158° F). The unit shall be used to:

- Support user one-way page announcements over system loudspeakers.
- Support user party-line communications with other system users.
- Serve as an amplifier to receive and broadcast page announcements over a loudspeaker.
- Monitor station off-hook status.
- Automatically adjust the station loudspeaker volume to maintain 6-10dB above ambient background noise.
- Provide self-diagnostics and report problems with the loudspeaker, amplifier, cable and handset amplifier.

The handset section shall have an output level of 1.5 Vrms (nominal) into a 33 ohm load. There shall be a 55 dB nominal voltage gain, an automatic gain control circuit and a frequency response of 350-6500 HZ, +/- 3 dB. Distortion shall be no greater than 1.5% maximum THD at 1000 HZ. The input impedance shall be 100 ohms at 1000 HZ. The handset shall be gray ABS and include a 10 ohm, pressure differential, noise canceling dynamic transmitter, a 130 ohm, high efficiency dynamic receiver, and a pressbar page switch for one-hand operation. The transmitter gain, receiver volume, and sidetone controls shall all be adjustable through access on the rear surface of the unit.

The speaker amplifier section shall have a push-pull, Class B, 12 watt minimum output at 120 VAC nominal input and have taps for 8 or 16 ohm loudspeaker loads. There shall be 25 dB maximum voltage gain, adjustable into an 8 ohm load, and a frequency response of 350-6500 HZ +0, -3 dB reference to 1kHz. The distortion shall be no greater than 1% maximum THD at 12 watts and 1000 HZ, with a full load to no load regulation of a 1.5 dB maximum rise, and an input impedance of 16,000 ohms (nominal). The speaker amplifier section shall also contain a feature, which allows the system to monitor ambient noise during periods of no page activity and then automatically adjust the loudspeaker volume to compensate for that noise. The output shall automatically adjust to limit distortion. The volume level offset (above ambient) shall be adjustable from 0 to 25 dB. The volume level offset shall be concealed and adjusted through an access hole behind the nameplate on the front of the unit.

2.3.4.2 Enclosure Indoor

Multi-Party Enclosures shall consist of a steel box approximately 13.8" (350mm) H x 8.1" (206mm) W x 5.1" (129mm) D with a switch for selection of up to five (5) party lines, a receptacle to mate with plug-in handset/speaker amplifier, and terminal strips for connection of field wiring. The unit shall be built to NEMA Type 1 standards. Drill template shall be included for field installation. The shipping weight shall not exceed 7.5 lbs (3.4 kg).

The amplifier (2.3.4.1) and enclosure (2.3.4.2) shall be listed for Class I, Division 2, Group A, B, C and D locations.

2.3.5 SmartSeries Indoor Handset/Speaker Station with Auxiliary Jack, **Model 7005-803**

2.3.5.1 Handset/Speaker Amplifier (same as 2.3.4.1) with auxiliary jack for use with a headset and 30' extension cable (2.7).

2.3.5.2 Multi-Party Enclosure (same as 2.3.4.2)

2.3.6 SmartSeries Indoor Handset/Speaker/RTU Station, **Model 7005-821**

2.3.6.1 Handset/Speaker Amplifier (same as 2.3.4.1)

2.3.6.2 Multi-Party Enclosure (same as 2.3.4.2) with Remote Terminal Unit. The RTU allows connection of NAC and IDC devices to the SmartSeries station providing:

- 1 supervised input circuit and 1 supervised relay output (factory setting)
- 2 supervised input circuits and no relay output
- 2 supervised input circuits and 1 non-supervised relay output

2.3.7 SmartSeries Indoor Handset/Speaker/RTU Station with Auxiliary Jack, **Model 7005-822**

2.3.7.1 Handset/Speaker Amplifier (same as 2.3.4.1) with auxiliary jack for use with a headset and 30' extension cable (2.7).

2.3.7.2 Multi-Party Enclosure (same as 2.3.4.2)

2.3.8 SmartSeries Weatherproof Handset/Speaker Station (Metallic), **Model 7305-803**

2.3.8.1 Handset/Speaker Amplifier (same as 2.3.4.1)

2.3.8.2 Enclosure, Outdoor Metallic

Multi-Party Metallic Enclosure shall be cast aluminum, approximately 14.9" (378mm) H x 10.6" (270mm) W x 9.6" (244mm) D overall, shall have a hinged door with a cam-style latch, and built to NEMA standards. It shall contain a switch for selection of up to five (5) party lines, a receptacle to mate with plug of plug-in handset/speaker amplifier, and double row terminal strips for connection of field wiring. 1-1/4" (31.8mm) conduit hub plates shall be provided on both top and bottom.

The amplifier (2.3.8.1) and enclosure (2.3.8.2) shall be listed for Class I, Division 2, Groups A, B, C and D; Class II, Division 2, Groups E, F and G; and Class III, Division 2 locations.

2.3.9 SmartSeries Weatherproof Handset/Speaker Station (Metallic) with Aux. Jack, **Model 7305-806**

2.3.9.1 Handset/Speaker Amplifier (same as 2.3.4.1) with auxiliary jack for use with a headset and 30' extension cable (2.7).

2.3.9.2 Multi-Party Enclosure (same as 2.3.8.2)

2.3.10 SmartSeries Weatherproof Handset/Speaker/RTU Station (Metallic), **Model 7305-821**

2.3.10.1 Handset/Speaker Amplifier (same as 2.3.4.1)

2.3.10.2 Multi-Party Enclosure (same as 2.3.8.2) with Remote Terminal Unit. The RTU allows connection of NAC and IDC devices to the SmartSeries station providing:

- 1 supervised input circuit and 1 supervised relay output (factory setting)
- 2 supervised input circuits and no relay output
- 2 supervised input circuits and 1 non-supervised relay output

2.3.11 SmartSeries Weatherproof Handset/Speaker/RTU Station (Metallic) with Aux. Jack, **Model 7305-823**

2.3.11.1 Handset/Speaker Amplifier (same as 2.3.4.1) with auxiliary jack for use with a headset and 30' extension cable (2.7).

2.3.11.2 Multi-Party Enclosure (same as 2.3.10.2)

2.3.12 SmartSeries Weatherproof Handset/Speaker Station (Non-metallic), **Model 7305-804**

2.3.12.1 Handset/Speaker Amplifier (same as 2.3.4.1)

2.3.12.2 Enclosure, Outdoor Non-metallic

Multi-Party Non-Metallic Enclosure shall be made from glass-reinforced polyester approximately 14.6" (371mm) H x 10.9" (276mm) W x 10.5" (267mm) D overall, shall have a hinged door with cam-style latch, and built to NEMA 4X standards. It shall contain a switch for selection of up to five (5) party lines, a receptacle to mate with plug-in handset/speaker amplifier, and double-row terminal strips for connection of field wiring. Hubs for conduit entrance shall not be supplied, because field installation is simple and conduit entrance/exit can be made in the most convenient location. A template is provided to simplify installation.

The amplifier (2.3.12.1) and enclosure (2.3.12.2) shall be listed for Class I, Division 2, Groups A, B, C and D; Class II, Division 2, Groups E, F and G; and Class III, Division 2 locations.

2.3.13 SmartSeries Weatherproof Handset/Spkr. Stn. (Non-metallic) with Aux. Jack, **Model 7305-807**

2.3.13.1 Handset/Speaker Amplifier (same as 2.3.4.1) with auxiliary jack for use with a headset and 30' extension cable (2.7).

2.3.13.2 Multi-Party Enclosure (same as 2.3.12.2)

2.3.14 SmartSeries Weatherproof Handset/Speaker/RTU Station (Non-metallic), **Model 7305-822**

2.3.14.1 Handset/Speaker Amplifier (same as 2.3.4.1)

2.3.14.2 Multi-Party Enclosure (same as 2.3.12.2) with Remote Terminal Unit. The RTU allows connection of NAC and IDC devices to the SmartSeries station providing:

- 1 supervised input circuit and 1 supervised relay output (factory setting)
- 2 supervised input circuits and no relay output
- 2 supervised input circuits and 1 non-supervised relay output

2.3.15 SmartSeries Weatherproof Handset/Speaker/RTU Station (Non-metallic) with Aux. Jack, **Model 7305-824**

2.3.15.1 Handset/Speaker Amplifier (same as 2.3.4.1) with auxiliary jack for use with a headset and 30' extension cable (2.7).

2.3.15.2 Multi-Party Enclosure (same as 2.3.14.2)

2.3.16 SmartSeries Division 1 Handset/Speaker Station, **Model 825-141C201**

The unit shall be capable of operation at 90 - 230 VAC, 50/60 HZ, and ambient temperatures ranging from -20° C to +66° C (-4° F to +151° F). The unit shall be used to:

- Support user one-way page announcements over system loudspeakers.
- Support user party-line communications with other system users.
- Serve as an amplifier to receive and broadcast page announcements over a loudspeaker.
- Monitor station off-hook status.
- Automatically adjust the station's loudspeaker volume to maintain 6-10dB above ambient background noise.
- Provide self-diagnostics and report problems with the loudspeaker, amplifier, cable and handset amplifier.

The handset section shall have an output level of 1.5 Vrms (nominal) into a 33 ohm load. There shall be a 55 dB nominal voltage gain, an automatic gain control circuit and a frequency response of 250-6500 HZ, +/- 3 dB. Distortion shall be no greater than 1.5% maximum THD at 1000 HZ. The input impedance shall be 100 ohms at 1000 HZ. The handset shall be gray, carbon-loaded ABS and include a 10 ohm, pressure differential, noise canceling dynamic transmitter, and a 130 ohm, high efficiency dynamic receiver. The transmitter gain, receiver volume, and sidetone controls shall all be adjustable inside the unit.

The speaker amplifier section shall have a Class D, 30 watt minimum output at 120 VAC nominal input. There shall be a frequency response of 250-6500 HZ +0, -3 dB reference to 1kHz. The distortion shall be no greater than 1% maximum THD at 24 watts and 1000 HZ, and 3% maximum THD at 30 watts and 1000 HZ with an input impedance of 16,000 ohms (nominal). The speaker amplifier section shall also contain a feature, which allows the system to monitor ambient noise during periods of no page activity and then automatically adjust the loudspeaker volume to compensate for that noise. The output shall automatically adjust to limit distortion. The volume level offset (above ambient) shall be adjustable from 0 to 25 dB. The volume level offset shall be concealed and adjusted inside the unit.

The enclosure shall be metallic and shall include a switch for selection of up to five (5) party lines, a pushbutton page switch, and terminal strips for connection of field wiring.

Equipment shall be listed/approved for use in Class I, Division 1, Group B, C, and D; Class II, Division 1, Groups E, F, G and Class III locations

2.3.17 SmartSeries Division 1 Handset/Speaker/RTU Station, **Model 825-151C201**

Same as 2.3.16

The enclosure shall also include a Remote Terminal Unit (RTU). The RTU allows connection of NAC and IDC devices to the SmartSeries station providing:

- 1 supervised input circuit and 1 supervised relay output (factory setting)
- 2 supervised input circuits and no relay output
- 2 supervised input circuits and 1 non-supervised relay output.

2.3.18 SmartSeries Division 1 Handset/Speaker/Alt. Page Station, **Model 825-161C201**

Same as 2.3.16

The enclosure shall also include an Auxiliary Page Destination rotary switch.

2.3.19 SmartSeries Indoor Speaker Station, **Model 750-801**

2.3.19.1 Speaker Amplifier

The smart speaker amplifier shall be capable of operation from 90-140 VAC and 50/60 HZ and shall be capable of operating in ambient temperatures ranging from -30° C to +70° C (-22° F to +158° F). The unit shall be used to serve as an amplifier to receive and broadcast page announcements over a loudspeaker.

The smart speaker amplifier shall automatically adjust the stations loudspeaker volume to maintain 6-10dB above ambient background noise.

The smart speaker amplifier shall also provide self-diagnostics and report problems with the loudspeaker, amplifier, cable and handset amplifier.

The amplifier shall have a push-pull, Class B, 12 watt minimum output at 120 VAC nominal voltage input and have taps for 8 or 16 ohm voice coils. There shall be 25 dB maximum voltage gain, adjustable into an 8 ohm load, and a frequency response of 350 to 6500 HZ +0, -3 dB reference to 1kHz. The distortion shall be no greater than 1% maximum THD at 12 watts and 1000 HZ, with a full load to no load regulation of a 1.5 dB maximum rise, and an input impedance of 16,000 ohms (nominal). The volume level offset shall be concealed and adjusted through an access hole behind the nameplate on the front of the unit. The unit shall also contain a feature which allows the system to monitor ambient noise during periods of no page activity and then automatically adjust the loudspeaker volume to compensate for that noise. The output shall automatically adjust to limit distortion. The volume level offset (above ambient) shall be adjustable from 0 to 25 dB.

2.3.19.2 Enclosure, Indoor

Enclosure shall consist of a steel box approximately 8.1"(206mm) H x 8.1" (206mm) W x 5.1"(129mm), with a receptacle to mate with the plug of a speaker amplifier, and double-row terminal strip for connection of field wiring. All field wiring connections for external power, page lines, party lines, and loudspeaker circuits shall terminate on this strip. A drill template shall be included for field installation.

The unit shall be approved by listed/approved non-incendive for use in Class 1, Division 2, Groups A, B, C, and D locations and for Canada for Class I, Division 2, Group A, B, C, and D locations.

2.3.20 SmartSeries Indoor Speaker/RTU Station, **Model 750-821**

2.3.20.1 Amplifier (same as 2.3.19.1)

2.3.20.2 Enclosure, Indoor (same as 2.3.6.2).

2.3.21 SmartSeries Weatherproof Speaker Station (Metallic), **Model 760-801**

2.3.21.1 Amplifier (same as 2.3.19.1)

2.3.21.2 Enclosure

Metallic Enclosure shall be cast aluminum, approximately 11.6" (294mm) H x 9.6" (243mm) W x 5.2" (133mm) D overall, with a neoprene-gasketed cover attached with four (4) stainless steel screws. It shall contain a receptacle to mate with plug-in speaker amplifier, and double-row terminal strip for connection of field wiring. Also furnished shall be a hubplate for 1.25" (31.8mm) conduit entrances (top) and a dual hubplate for 2, 1.25" 31.8mm conduit entrances (bottom).

Station shall be listed/approved for use in Class I, Division 2, Group A,B,C, and D; suitable for Class II, III, Division 2, Group G locations, and for Canada Class I, Division 2, Groups A,B,C, and D; Class II, Division 2, Group F, and G; Class III locations.

2.3.22 SmartSeries Weatherproof Speaker/RTU Station (Metallic), **Model 760-821**

2.3.22.1 Amplifier (same as 2.3.19.1)

2.3.22.2 Enclosure, Weatherproof Metallic (same as 2.3.10.2)

2.3.23 SmartSeries Weatherproof Speaker Station (Non-metallic), **Model 760-803**

2.3.23.1 Amplifier (same as 2.3.19.1)

2.3.23.2 Enclosure, Weatherproof Non-metallic

Non-Metallic Enclosure shall be made of glass-reinforced polyester resin, approximately 14.6" (371mm) H x 10.9" (276mm) W x 10.5" (257mm) D overall, shall have a hinged door with cam-style latch, and be built to NEMA 4X standards. It shall contain a receptacle to mate with plug-in speaker amplifier, and terminal strips for connection of field wiring. Hubs for conduit entrance shall not be supplied. All field wiring connections for external power, page lines, party lines, and loudspeaker circuits shall terminate on this strip.

Station shall be listed/approved for use in Class I, Division 2, Groups A, B, C, and D; suitable for Class II, III Division 2, Group G locations, and for Canada for Class I, Div. 2, Groups A, B, C & D; Class II, Div. 2, Groups F & G; Class III locations.

2.3.24 SmartSeries Weatherproof Speaker/RTU Station (Non-metallic), **Model 760-822**

2.3.24.1 Amplifier (same as 2.3.19.1)

2.3.24.2 Enclosure, Weatherproof Non-metallic (same as 2.3.14.2) with Remote Terminal Unit. The RTU allows connection of NAC and IDC devices to the SmartSeries station providing:

- 1 supervised input circuit and 1 supervised relay output (factory setting)
- 2 supervised input circuits and no relay output
- 2 supervised input circuits and 1 non-supervised relay output

2.3.25 SmartSeries Division 1 Speaker Station, **Model 820-140C201**

The unit shall be capable of operation at 90 - 230 VAC, 50/60 HZ, and ambient temperatures ranging from -20° C to +66° C (-4° F to +151° F). The unit shall be used to:

- Serve as an amplifier to receive and broadcast page announcements over a loudspeaker.
- Automatically adjust the station's loudspeaker volume to maintain 6-10dB above ambient background noise.
- Provide self-diagnostics and report problems with the loudspeaker, amplifier and cable.

The speaker amplifier section shall have a Class D, 30 watt minimum output at 120 VAC nominal input. There shall be a frequency response of 250-6500 HZ +0, -3 dB reference to 1kHz. The distortion shall be no greater than 1% maximum THD at 24 watts and 1000 HZ, and 3% maximum THD at 30 watts and 1000 HZ with an input impedance of 16,000 ohms (nominal).

The speaker amplifier section shall also contain a feature, which allows the system to monitor ambient noise during periods of no page activity and then automatically adjust the loudspeaker volume to compensate for that noise. The output shall automatically adjust to limit distortion. The volume level offset (above ambient) shall be adjustable from 0 to 25 dB. The volume level offset shall be concealed and adjusted inside the unit.

The enclosure shall be metallic and shall include terminal strips for connection of field wiring.

Equipment shall be listed/approved for use in Class I, Division 1, Group B, C, and D; Class II, Division 1, Groups E, F, G and Class III locations

2.3.26 SmartSeries Desk-Edge Handset/Speaker Station, **Model 7105-804**

2.3.26.1 Multi-Party Desk-Edge Subset

Multi-Party Desk-Edge Subset shall be approximately 6" (155mm) H x 3" (79mm) W x 9" (239mm) D overall and shall secure to either side of a desk through sets of 13/64" (5.16mm) diameter holes in the mounting bracket. It shall also include a gray ABS handset with a 10 ohm, pressure differential, noise-canceling dynamic transmitter, a 130 ohm, high efficiency dynamic receiver, a pressbar page switch for one-hand operation, and a switch for selection of up to five (5) party lines. All connections to the subset are to be made through an eight-foot (8') multi-conductor cable terminated by a connector, which plugs into the bottom of the associated remote amplifier enclosure. The hookswitch mechanism shall be of an electronic proximity detection circuit utilizing a sealed relay in the amplifier to eliminate exposed contacts.

2.3.26.2 Remote Amplifier

The handset section shall have an output level of 1.5 Vrms (nominal) into a 33 ohm load. There shall be a 55 dB nominal voltage gain, an automatic gain control circuit and a frequency response of 350-6500 HZ, +/- 3 dB. Distortion shall be no greater than 1.5% maximum THD at 1000 HZ. The input impedance shall be 100 ohms at 1000 HZ. The handset shall be gray ABS and include a 10 ohm, pressure differential, noise canceling dynamic transmitter, a 130 ohm, high efficiency dynamic receiver, and a pressbar page switch for one-hand operation. The transmitter gain, receiver volume, and sidetone controls shall all be adjustable through access on the rear surface of the unit.

The speaker amplifier section shall have a push-pull, Class B, 12 watt minimum output at 120 VAC nominal input and have taps for 8 or 16 ohm loudspeaker loads. There shall be 25 dB maximum voltage gain, adjustable into an 8 ohm load, and a frequency response of 350-6500 HZ +0, -3 dB reference to 1kHz. The distortion shall be no greater than 1% maximum THD at 12 watts and 1000 HZ, with a full load to no load regulation of a 1.5 dB maximum rise, and an input impedance of 16,000 ohms (nominal). The speaker amplifier section shall also contain a feature, which allows the system to monitor ambient noise during periods of no page activity and then automatically adjust the loudspeaker volume to compensate for that noise. The output shall automatically adjust to limit distortion. The volume level offset (above ambient) shall be adjustable from 0 to 25 dB. The volume level offset shall be concealed and adjusted through an access hole behind the nameplate on the front of the unit.

2.3.26.3 Remote Amplifier Enclosure

Remote amplifier enclosure for multi-party operations shall consist of a steel gray polyurethane enclosure approximately 8.1" (206mm) H x 8.1" (206mm) W x 5.1" (129mm) D with a receptacle to mate with plug of remote handset/speaker amplifier, double-row terminal strips for connection of field wiring and receptacle to mate with subset plug.

The Subset, Amplifier, and Enclosure shall be listed/approved for use in Class I, Div 2, Groups A, B, C, D.

2.3.27 SmartSeries Flush-Panel Handset/Speaker Station, **Model 7155-804**

2.3.27.1 Multi-Party Flush Panel Subset

Multi-Party Flush Panel Subset shall be approximately 6" (153mm) H x 6" (153mm) W x 2.5" (64mm) D behind panel and be mounted through four (4) .25" diameter holes in the subset panel. Panel cutout shall be 5" (127mm) W x 4.88" (124.0mm) H x 2.5" (63.5)D. It shall also include a gray ABS handset with a 10 ohm, pressure differential, noise-cancelling dynamic transmitter, a 130 ohm, high efficiency dynamic receiver, and a pressbar page switch for one handed operation. All connections to the subset are to be made through an eight foot (8') multi-conductor into the bottom of the associated remotely mounted amplifier enclosure. The hookswitch mechanism shall be an electronic proximity detection circuit utilizing a sealed relay in the amplifier to eliminate exposed contacts.

2.3.27.2 Remote Handset/Speaker Amplifier (same as 2.3.26.2)

2.3.27.3 Remote Amplifier Enclosure (same as 2.3.26.3)

The Subset, Amplifier, and Enclosure shall be listed/approved for use in Class I, Div 2, Groups A, B, C, D.

2.3.28 SmartSeries Desktop Handset/Speaker Station, Model 7265-802

2.3.28.1 Multi-Party Desktop Subset

Multi-Party Desktop Subset shall be approximately 4.81" (122.2mm) H x 10.46" (265.7mm) W x 9.35" (237.5mm) D overall. It shall also include a gray ABS handset with a 10 ohm, pressure differential, noise-canceling dynamic transmitter, a 130 ohm, high efficiency dynamic receiver, a pressbar page switch for one-hand operation, and a switch for selection of up to five (5) party lines. All connections to the subset are to be made through an eight foot (8') multi-conductor cable terminated by a connector which plugs into the bottom of the associated remote amplifier enclosure. A loudspeaker and volume control shall be located on the front panel. The hookswitch mechanism shall be an electronic proximity detection circuit utilizing a sealed relay to eliminate exposed contacts.

2.3.28.2 Remote Handset/Speaker Amplifier (same as 2.3.26.2)

2.3.28.3 Remote Amplifier Enclosure (same as 2.3.26.3)

The Subset, Amplifier, and Enclosure shall be listed/approved for use in Class I, Div 2, Groups A, B, C, D.

2.4 Cable

- 2.4.1 Two (2) conductor cable, Model 60021-301, shall be a twisted pair (generally for loudspeaker connection to amplifier enclosures) with 2.0" (50.8mm) (maximum) left hand lay, each conductor No. 18 AWG (16 /30), bare copper with TFFN PVC insulation. Twisted conductors are assembled with non-wicking, 600V PVC nylon filler, wrapped with a uniformly round jacket. Overall jacket of hard service, flame retardant, moisture and sun resistant, black 90° polyvinyl chloride compounded to provide protection against oil, heat, chemical and mechanical abuse. Maximum O.D. shall be .285" (7.24mm). Cable shall be Underwriter's Laboratories Inc. - listed UL1277 Power and Control Cable, and shall meet or exceed the requirements of IEEE-45 Marine Shipboard Cable, CSA C22.2, No 239 Control and Instrumentation Cable and NEC Article 501.
- 2.4.2 Two (2) conductor cable, Model 60021-303, (same as 60021-301) with bronze braid and PVC jacket. Maximum O.D. shall be .450" (11.43mm).
- 2.4.3 Two (2) conductor cable, Model 60021-305, (same as 60021-301) with aluminum braid and PVC jacket. Maximum O.D. shall be .450" (11.43mm).
- 2.4.4 Two (2) conductor cable, Model 60021-307, (same as 22.1) with corrugated aluminum sheath and PVC jacket. Maximum O.D. shall be .498" (12.65 mm).

- 2.4.5 Two (2) conductor marine cable, Model **60021-308**, shall be a twisted pair (generally for loudspeaker connection to amplifier enclosures) with drain wire and shielding tape rated for 600/1000 volt service, each conductor shall be No. 18 AWG (19 x .0100”) 19W tin-coated flexible copper. Drain wire shall be No. 20 AWG (19 x .0080”) 19W tin-coated flexible copper. Shielding tapes shall be poly/aluminum tape helically applied and lapped and a rubber backed tape helically applied and lapped. Insulation shall be mica tape helically applied and lapped plus 30 mils of non-halogen 110° C low-smoke/halogen-free crosslinked polyolefin. The jacket and sheath shall be 60 mils of black low-smoke halogen-free crosslinked (thermoset) polyolefin. The armor shall be braided bronze and Nominal O.D. shall be .620”. Cable shall be designed and constructed for Marine Shipboard installation in offshore marine environments including Class 1, Division 1 and Zone 1 applications. Cable shall be Underwriter’s Laboratories Inc. – listed (UL Listing #E111461) and ABS 99-BT5905-X and fire resistant rated per IEC 60331, flame rated per IEC 332-2 Cat. A and IEC 331.
- 2.4.6 Two (2) conductor marine cable, Model **60021-309**, shall be a twisted pair (generally for loudspeaker connection to amplifier enclosures) with drain wire and shielding tape rated for 600/1000 volt service, each conductor shall be No. 16 AWG (19 x .0117”) 19W tin-coated flexible copper. Drain wire shall be No. 20 AWG (19 x .0080”) 19W tin-coated flexible copper. Shielding tapes shall be poly/aluminum tape helically applied and lapped and a rubber backed tape helically applied and lapped. Insulation shall be mica tape helically applied and lapped plus 30 mils of non-halogen 110° C low-smoke/halogen-free crosslinked polyolefin. The jacket and sheath shall be 60 mils of black low-smoke halogen-free crosslinked (thermoset) polyolefin. The armor shall be braided bronze and Nominal O.D. shall be .620” (15.75 mm). Cable shall be designed and constructed for Marine Shipboard installation in offshore marine environments including Class 1, Division 1 and Zone 1 applications. Cable shall be Underwriter’s Laboratories Inc. – listed (UL Listing #E111461) and ABS 99-BT5905-X and fire resistant rated per IEC 60331, flame rated per IEC 332-2 Cat. A and IEC 331.
- 2.4.7 Three (3) conductor cable, **Model 60028-101**, shall be one twisted triplet (generally for loudspeaker connection to amplifier enclosures) with 2.0" (50.8mm) (maximum) left hand lay, each conductor No. 18 AWG (16 / 30), bare copper with TFFN PVC insulation. Triplet conductors are assembled with non-wicking, 600V PVC nylon filler, wrapped with a uniformly round jacket. Overall jacket of hard service, flame retardant, moisture and sun resistant, black 90° polyvinyl chloride compounded to provide protection against oil, heat, chemical and mechanical abuse. Maximum O.D. shall be .303" (7.69mm). Cable shall be Underwriter's Laboratories Inc. - listed UL1277 Power and Control Cable, and shall meet or exceed the requirements of IEEE-45, CSA C22.2, No 239 Control and Instrumentation Cable and NEC Article 501.
- 2.4.8 Three (3) conductor cable, **Model 60028-003**, (same as 60028-101) with bronze wire braid and PVC jacket. Maximum O.D. shall be .390 (9.906 mm).
- 2.4.9 Three (3) conductor cable, **Model 60028-005**, (same as 60028-101) with aluminum braid and PVC jacket. Maximum O.D. shall be .390 (9.906 mm).

- 2.4.10 Sixteen (16) conductor cable, **Model 60029-101**, shall contain power and ground, page and party conductors. Power conductors shall be a twisted pair with 4.75" (120.65mm) maximum left hand lay, each shall be 14 AWG (19 / 27), bare copper with THHN / THWN PVC insulation. Ground conductor shall be one (1) conductor with 14 AWG (19 / .0147) bare copper, maximum O.D. is .115" (2.92mm) and with THHN / THWN PVS insulation. Party and page conductors shall be six (6) twisted pairs with 2.0" (50.8mm) maximum left hand lay, each conductor shall be 18 AWG (16 / 30) bare copper with TFFN PVC insulation. Control conductor shall be one (1) conductor 18 AWG (16 / 30) bare copper, maximum O.D. is .088" (2.92 mm) with THHN/THWN PVC insulation. The cable shall be assembled with all pairs twisted with systematically varying lays to minimize crosstalk, with non-wicking, non-hygroscopic nylon filler, wrapped with polyester binding tape for uniformly round cable. The overall jacket shall be a flame-retardant, moisture and sun-resistant, black 90°C polyvinyl chloride compounded to protect against oil, heat, chemical, and mechanical abuse. Maximum O.D. shall be 0.675" (17.15mm). Cable shall be Underwriter's Laboratories Inc. - listed (Subject 1277), and shall meet or exceed the requirements of IEEE-45, CSA C22.2, No 239 Control and Instrumentation Cable and NEC Article 501.
- 2.4.11 Sixteen (16) conductor cable, **Model 60029-103**, (same as 60029-101) with bronze wire braid and PVC jacket. Maximum O.D. shall be .860" (21.84mm).
- 2.4.12 Sixteen (16) conductor cable, **Model 60029-105**, (same as 60029-101) with aluminum braid and PVC jacket. Maximum O.D. shall be .860" (21.84mm).
- 2.4.13 Sixteen (16) conductor cable, **Model 60029-107**, (same as 60029-101) with corrugated aluminum sheath and PVC jacket. Cable stranding on 14 AWG conductors may also be (7 / .0242 strand) and on 18 AWG conductors may use (7 / 26 strand). Maximum O.D. is .999" (25.37mm).
- 2.4.14 Sixteen (16) conductor marine cable, **Model 60029-108**, shall contain power and ground, page and party conductors. Power conductors shall be a twisted pair with 4.75" (120.7mm) maximum left hand lay, each shall be 14 AWG (19 x .0100") 19W tin-coated flexible copper. Ground conductor shall be one (1) conductor with 14 AWG (19 / .0147") 19W Tin-coated flexible bare copper. Party and page conductors shall be five (5) twisted pairs with 2.0" (50.8mm) maximum left hand lay, each conductor shall be 18 AWG (19 / .0100") 19W Tin-coated flexible copper. Control conductor shall be one (1) conductor 18 AWG (19 / .0100") 19W Tin-coated flexible copper. The cable shall be assembled with all pairs twisted with systematically varying lays to minimize crosstalk. Insulation shall be mica tape helically applied and lapped plus 30 mils of non-halogen 100° C low-smoke/halogen-free crosslinked polyolefin. The jacket and sheath shall be 80 mils of black low-smoke halogen-free crosslinked (thermoset) polyolefin. The armor shall be braided bronze and Nominal O.D. shall be 1.218" (30.94mm) Cable shall be designed and constructed for Marine Shipboard installation in offshore marine environments including Class 1, Division 1 and Zone 1 applications. Cable shall be Underwriter's Laboratories Inc. – listed (UL Listing #E111461) and ABS 99-BT5905-X and fire resistant rated per IEC 60331, flame rated per IEC 332-2 Cat. A and IEC 331.

- 2.4.15 Sixteen (16) conductor marine cable, **Model 60029-109**, shall contain power and ground, page and party conductors. Power conductors shall be a twisted pair with 4.95" (125.7mm) maximum left hand lay, each shall be 12 AWG (19 x .0185") 19W tin-coated flexible copper. Ground conductor shall be one (1) conductor with 12 AWG (19 / .0185") 19W Tin-coated flexible bare copper. Party and page conductors shall be five (5) twisted pairs with 2.0" (50.8mm) maximum left hand lay, each conductor shall be 18 AWG (19 / .0100") 19W Tin-coated flexible copper. Control conductor shall be one (1) conductor 18 AWG (19 / .0100") 19W Tin-coated flexible copper. The cable shall be assembled with all pairs twisted with systematically varying lays to minimize crosstalk. Insulation shall be mica tape helically applied and lapped plus 30 mils of non-halogen 100° C low-smoke/halogen-free crosslinked polyolefin. The jacket and sheath shall be 80 mils of black low-smoke halogen-free crosslinked (thermoset) polyolefin. The armor shall be braided bronze and Nominal O.D. shall be 1.265" (32.13mm). Cable shall be designed and constructed for Marine Shipboard installation in offshore marine environments including Class 1, Division 1 and Zone 1 applications. Cable shall be Underwriter's Laboratories Inc. – listed (UL Listing #E111461) and ABS 99-BT5905-X and fire resistant rated per IEC 60331, flame rated per IEC 332-2 Cat. A and IEC 331.
- 2.4.16 Sixteen (16) conductor crush and impact resistant marine shipboard and Type TC cable, **Model 60029-110**, shall contain power and ground, page and party conductors. Power conductors shall be a twisted pair with 4.95" (125.7mm) maximum left hand lay, each shall be 12 AWG (19 x .0185") 19W tin-coated flexible copper. Ground conductor shall be one (1) conductor with 12 AWG (19 / .0185") 19W Tin-coated flexible bare copper. Party and page conductors shall be five (5) twisted pairs with 2.0" (50.8mm) maximum left hand lay, each conductor shall be 18 AWG (19 / .0100") 19W Tin-coated flexible copper. Control conductor shall be one (1) conductor 18 AWG (19 / .0100") 19W Tin-coated flexible copper. The cable shall be assembled with all pairs twisted with systematically varying lays to minimize crosstalk. Insulation shall be crosslinked polyolefin. The jacket shall be 120 mils of Americable CIR™ (Thermoplastic) and nominal O.D. shall be 9.35" (23.75mm). Cable shall be designed and constructed for Marine Shipboard installation in offshore marine environments including Class 1, Division 2 and Zone 2 applications. Cable shall be Underwriter's Laboratories Inc. Crush-Impact Rating UL 2225 (1500 lbf crush; 25 ft-lbs impact) and flame rated per IEC 332-2 Cat. A and IEC 331 (1000oC for 3 hours) and IEEE 1202/FT-4 (Vertical Tray) And UL Marine shipboard cable and Type TC w/open wiring approved.

2.4.17 Sixteen (16) conductor marine cable, **Model 60029-111**, shall contain power and ground, page and party conductors. Power conductors shall be a twisted triplet with 4.75" (120.7mm) maximum left hand lay, each shall be 14 AWG (19 x .0100") 19W tin-coated flexible copper with conductors colors of brown, blue, green/yellow banded or striped blue. Party and page conductors shall be five (5) twisted pairs with 2.0" (50.8mm) maximum left hand lay, each conductor shall be 18 AWG (19 / .0100") 19W Tin-coated flexible copper. Control conductor shall be one (1) conductor 18 AWG (19 / .0100") 19W Tin-coated flexible copper. The cable shall be assembled with all pairs twisted with systematically varying lays to minimize crosstalk. Insulation shall be mica tape helically applied and lapped plus 30 mils of non-halogen 100° C low-smoke/halogen-free crosslinked polyolefin. The jacket and sheath shall be 80 mils of black low-smoke halogen-free crosslinked (thermoset) polyolefin. The armor shall be braided bronze and Nominal O.D. shall be 1.218" (30.94mm). Cable shall be designed and constructed for Marine Shipboard installation in offshore marine environments including Class 1, Division 1 and Zone 1 applications. Cable shall be Underwriter's Laboratories Inc. – listed (UL Listing #E111461) and ABS 99-BT5905-X and fire resistant rated per IEC 60331, flame rated per IEC 332-2 Cat. A and IEC 331.

2.5 Loudspeakers

2.5.1 Compact Paging Loudspeakers with Built-in Driver

- 2.5.1.1 Loudspeaker shall be **Model 13350** direct radiating horn with an asymmetrical shape for efficient sound dispersion and equipped with built-in driver. Unit shall be approved as raintight by Underwriters Laboratories, Inc. Frequency response shall be 450 - 3000 Hz \pm 5 dB and dispersion shall be 90° nominal. Horn assembly shall be constructed of U.V. resistant, weatherproof, high-impact, glass-reinforced polyester finish shall be black. Sound pressure level shall average 117 dB at 1 meter on axis at 12 watt rated power. Voice coil impedance shall be 8 ohms. Power handling capacity shall be 16 watts rms. Horn shall be equipped with two integral 0.75" (19.05mm) conduit entries and a terminal block for wire termination. Dimensions of horn shall not exceed 9.52" (241.8mm) H X 8.02" (203.7mm)W x 8.12" (206.2mm) D. Shipping weight shall not exceed 6.6 lbs. (3.5 kg).
- 2.5.1.2 Loudspeaker shall be **Model HP15-8** re-entrant horn equipped with built-in driver. Frequency response shall be 330-8000 Hz and dispersion shall be 130° nominal. Horn assembly shall be constructed of ABS and equipped with a stainless steel mounting bracket. Sound pressure level shall average 118 dB at 15 watt rated power. Voice coil impedance shall be 8 ohms. Power handling capacity shall be 20 watts. Dimensions of horn shall not exceed 7.8" (198.1mm) diameter and 9.7" (246.4mm). Finish shall be RAL7035. Shipping weight shall not exceed 3.8 lbs. (1.7 kg).
- 2.5.1.3 Loudspeaker shall be **Model HP30-8** re-entrant horn equipped with built-in driver. Frequency response shall be 310-8000 Hz and dispersion shall be 115° nominal. Horn assembly shall be constructed of ABS and equipped with a stainless steel mounting bracket. Sound pressure level shall average 124 dB at 1 watt rated power. Voice coil impedance shall be 8 ohms. Power handling capacity shall be 30 watts. Dimensions of horn shall not exceed 9.33" (237mm) diameter and 11.26" (286mm). Finish shall be RAL7035. Shipping weight shall not exceed 5.07 lbs. (2.3 kg).
- 2.5.1.4 Loudspeaker shall be **Model 13328-001** re-entrant horn equipped with built-in driver. Frequency response shall be 600-6000 Hz and dispersion shall be 95°. Horn assembly

shall be constructed of acrylic with metal mounting bracket. Sound pressure level shall average 114 dB at 1 watt 1 meter at 15 watts rated power. Voice coil impedance shall be 8 ohms. Power handling capacity shall be 15 watts. Dimensions of horn shall not exceed 6.25" (159mm) and 6.93" (176mm). Finish shall be light beige. Shipping weight shall not exceed 2.5 lbs (1.13 kg).

2.5.2 Reflex Horns

- 2.5.2.1 The re-entrant horn shall be **Model 13340** and possess constant directivity characteristics across the voice frequency band. The horn body shall be of high-impact, glass-reinforced polyester and shall have an air column length of 2.8' (.85m). A hot-dipped galvanized zinc "U" mounting bracket shall be affixed with stainless steel hardware to the horn body. Threaded throat area to accommodate screw-in driver shall have standard 1 3/8 - 18 UNEF thread. Dimension shall not exceed 15.63" (397mm) H X 27" (686mm) W X 14" (355.6mm) D. Dispersion angle shall be 120° horizontal, 60° vertical, maximum and nominal. The acoustical frequency response is 450-8,000 Hz when used with driver model 13314 or driver model 13310. The low frequency cutoff is -10 dB (350 Hz) and the high frequency cutoff is -10 dB (12 KHz). The dB level is 108 dBspl 1 watt at 1 meter with driver model 13314, and 102 dBspl 1 watt at 1 meter with the driver model 13310. Shipping weight shall not exceed 12 lbs (5.44 kg).
- 2.5.2.2 The re-entrant horn, **Model 13302-002**, shall be reflexed, with reflector and bell of spun aluminum with epoxy coating and shall have an air column length of 3.5 feet (1.1m). Overall trumpet length shall not exceed 16" (406mm), less mounting bracket and driver unit. Bell mouth diameter shall not exceed 21" (533mm). Dispersion angle is 85° nominal and efficient frequency range, 440-3400 Hz. Sound pressure level shall be 118 dB at 12 watts rated power when used with driver Model 13314. Threaded throat area to accommodate screw-in driver shall have standard 1 3/8 - 18 UNEF thread. Shipping weight shall not exceed 13.0 lbs. (5.9 kg). "U-type" steel-mounting bracket shall be provided for mounting and be affixed to the bell with fully serrated, adjustable joints and bracket position secured by self-locking nuts. The mounting bracket shall have three holes at the base for mounting to a pipe fixture. All parts other than hardware, but including the mounting bracket, shall be epoxy coated. Finish shall be gray epoxy.

- 2.5.2.3 The re-entrant horn, **Model 13304-002**, shall be reflexed, with reflector and bell of spun aluminum with epoxy coating and shall have an air column length of 2.5' (762mm). Overall trumpet length shall not exceed 12.5" (319mm), less mounting bracket and driver unit. Bell mouth diameter shall not exceed 16.5" (419mm). Dispersion angle is 95° nominal and efficient frequency range, 450-3500 Hz. Sound pressure level shall be 116 dB at 12 watts rated power when used with driver Model 13314. Threaded throat area to accommodate screw-in driver shall have standard 1 3/8 - 18 UNEF thread. Shipping weight shall not exceed 11 lbs (4.9 kg). "U-type" steel-mounting bracket shall be provided for mounting and be affixed to the bell with fully serrated, adjustable joints and bracket position secured by self-locking nuts. The mounting bracket shall have three holes at the base for mounting to a pipe fixture. All parts other than hardware, but including the mounting bracket, shall be epoxy coated. Finish shall be gray epoxy.
- 2.5.2.4 The re-entrant horn, **Model 13306-101**, shall be reflexed, with reflector and bell of spun aluminum, with epoxy coating, and shall have an air column length of 1.5 ft (457.2mm). All parts shall be finished with epoxy coating. Threaded throat area to accommodate screw-in driver shall have standard 1 3/8 - 18 UNEF thread. Overall trumpet length shall not exceed 6.13" (155.6mm), less mounting bracket and driver unit. Bell mouth diameter shall not exceed 9.75" (247.7mm). Dispersion angle shall be 110° nominal and efficient frequency range shall be 460-4000 Hz. Sound pressure level shall be 116 dB at 12 watts rated power when used with driver Model 13314. Shipping weight shall not exceed 2.8 lbs (1.3 kg).
- 2.5.2.5 Two-way horn, **Model 13305-101**, shall have two double-reflexed horns, bells of spun aluminum with epoxy coating and tone arms of die-cast aluminum. The horns shall face in opposite directions and be joined by a cast-aluminum "Y" acoustic coupler. Threaded throat area to accommodate screw-in driver shall have standard 1 3/8 - 18 UNEF thread screwed directly into the acoustic coupler. Each bell mouth diameter shall not exceed 9.75" (247.7mm) and shall have a dispersion angle of 2 @ 80° nominal. Sound pressure level shall be 109 dB at 12 watts rated power when used with driver Model 13314. Shipping weight shall not exceed 4.5 lbs (2.0 kg).

2.5.3 Heavy Duty Drivers

- 2.5.3.1 Driver shall be **Model 13314-001**, have a weatherproof rating of NEMA 4X and approved by Underwriters Laboratories for use in Division 2 areas. Driver power handling capacity shall be 30 watts with a frequency response of 300 to 4,500 Hz \pm 6 dB. Voice coil shall have an impedance of 8 ohms. Sound pressure level shall be 111 dB at 1 watt, 1 meter (swept sine average) with reflex horn Model 13304-002, a 2.5 ft. (762 mm) air column re-entrant type horn. Complete housing assembly shall be weatherproof molded VALOX equipped with standard 1 3/8 - 18 UNEF threads for screw-in connection to horn. An electro-formed metal mesh screen shall be integral in the throat of unit to prevent the entrance of foreign particles. Color shall be black. Electrical connections shall be made to a 3 ft. 1 cable preconnected to the driver. Dimensions of unit shall not exceed 5" (127mm) in diameter and 5.5" (139.7mm) in length. Shipping weight shall be 3.1 lbs (1.41 kg).
- 2.5.3.2 Driver shall be **Model 13314-002** have a weatherproof rating of NEMA 4X and approved by Underwriters Laboratories for use in Division 2 areas. Driver power handling capacity shall be 30 watts with a frequency response of 300 to 4,500 Hz \pm 6 dB. Voice coil shall have an impedance of 16 ohms. Sound pressure level shall be 111

dB at 1 watt, 1 meter (swept sine average) with reflex horn Model 13304-002, a 2.5 ft. (762 mm) air column re-entrant type horn. Complete housing assembly shall be weatherproof molded VALOX equipped standard 1 3/8 - 18 UNEF threads for screw-in connection to horn. An electro-formed metal mesh screen shall be integral in the throat of unit to prevent the entrance of foreign particles. Color shall be black. Electrical connections shall be made to a 3 ft. 1 cable preconnected to the driver. Dimensions of unit shall not exceed 5" (127mm) in diameter and 5.5" (139.7mm) in length. Shipping weight shall be 3.1 lbs. (1.41 kg).

2.5.3.3 Explosionproof driver shall be **Model 13310-201** and approved by Underwriters Laboratories (#E71922) for use in hazardous areas specifically designated as Division 1, Class I, Groups B, C, and D. Driver shall have a full range power capacity of 30 watts continuous power. Frequency response shall be 320-3580 Hz (± 6 dB). Voice coil shall have an impedance of 16 ohms. Sound Pressure level shall be 110 dB at 1 watt, 1 meter (swept sine average) with reflex horn 13304-002. Case shall be heavy die-cast aluminum, epoxy coated with dimensions not exceeding 7.9" (200.7mm) in diameter and 8.875" (255mm) in length. Rear of case shall be made removable to facilitate wiring by incorporation of eight .375" (9.5mm) diameter bolts and provisions made for connection of standard .5" pipe conduit. Coupling diameter shall be standard 1 3/8 - 18 UNEF threads for screw-in attachment to horn. Weight of unit shall not exceed 12.8 lbs. (5.8 kg).

2.5.3.4 Explosionproof driver shall be **Model 13310-205** and approved by CSA International for use in hazardous areas specifically designated as Division 1, Class I, Groups C, and D and Class II, Groups E, F, and G. Driver shall have a full range power capacity of 60 watts continuous power. Frequency response shall be 250-12000 Hz (± 6 dB). Voice coil shall have an impedance of 16 ohms. Sound Pressure level shall be 109 dB at 1 watt, 1 meter (swept sine average) with reflex horn 13304-002. Case shall be heavy die-cast aluminum, epoxy coated with dimensions not exceeding 7.9" (200.7mm) in diameter and 8.875" (255mm) in length. Rear of case shall be made removable to facilitate wiring by incorporation of eight .375" (9.5mm) diameter bolts and provisions made for connection of standard .5" pipe conduit. Coupling diameter shall be standard 1 3/8 - 18 UNEF threads for screw-in attachment to horn. Weight of unit shall not exceed 12.8 lbs. (5.8 kg).

2.5.4 Cone Loudspeaker Assemblies

2.5.4.1 Wall loudspeaker assembly, **Model B406-8-W**, shall be ABS / RAL 9002 finish. Mounting shall be accomplished by a metal bracket. Dimensions shall be 8.3" (210mm) H x 8.3" (210mm) W x 2.6" (66mm) D. The loudspeaker shall be have a frequency response of 180-14,000 Hz with a power handling capacity of 6 watts. The voice coil impedance shall be 8 ohms. The assembly weight shall be 2.7 lbs (1.2 kg).

- 2.5.4.2 Wall loudspeaker assembly, **Model 801A**, shall be furnished in simulated walnut finish with a sloping front. Mounting shall be accomplished by a metal bracket, which will easily attach to a standard electrical switch box. Dimensions shall be 10.5" (266mm) H x 9.5" (241mm) W x 5.5" (140mm) D. The loudspeaker shall be 8" (203.2mm) in diameter with a frequency response of 45-18,000 Hz with a power handling capacity of 15 watts. The voice coil impedance shall be 8 ohms. The unit shall have a built-in volume control. The assembly weight shall be 8 lbs. (3.6 kg).
- 2.5.4.3 Bi-directional loudspeaker, **Model CAR4-8**, shall be aluminum / RAL 9010 finish. Mounting shall be a foot bracket to allow easy wall mounting. Dimensions shall be 6" (152mm) H x 7" (178mm) x 3.5" (90mm) D. The loudspeaker shall have a frequency response of 150-16000 Hz with a power handling capacity of 4 watts. The voice coil impedance shall be 8 ohms. Electrical connections shall be made to a 3.28' (1M) cable pre-connected to the loudspeaker. The assembly weight shall be 3.3 lbs. (1.5 kg).
- 2.5.4.4 Ceiling loudspeaker assembly shall be **Model B650-8** and consist of an ABS grill, polystyrene dust box, and 6" cone loudspeaker and related mounting hardware. The unit shall be factory assembled and wired, ready for installation. The enclosure shall measure 9.1" (232mm) diameter x 4.7" (107.9mm) deep. The baffle shall be a white ABS. The frequency response shall be 140-18,000 Hz with a power handling capacity of 6 watts. The voice coil impedance shall be 8 ohms. The assembly weight shall be 2.7 lbs. (1.2 kg).
- 2.5.4.5 Ceiling loudspeaker assembly shall be **Model 1204-001** and consist of an enclosure, baffle, a 12" (304.8mm) cone loudspeaker and related mounting hardware. The unit shall be factory assembly and wired, ready for installation. The enclosure shall measure 12.75" (323.9mm) diameter x 7.25" (184.2mm) deep. It shall be constructed of heavy gauge steel and be heavily undercoated. The baffle shall be an aluminum trim ring 17" (431.8mm) in diameter. The frequency response shall be 140-7,000 Hz with a power handling capacity of 10 watts. The voice coil impedance shall be 8 ohms. The unit shall have a remote volume control arranged to mount in a standard electrical switch box. The assembly weight shall be 10 lbs (4.6 kg).

2.5.5 Optional Mounting Assemblies

GAI-Tronics strongly recommends the use of mounting brackets primarily as a means of terminating conduit and cable connection to the loudspeaker. Secondly, they are recommended where loudspeaker orientation is a factor in high noise environments. Although every horn or loudspeaker is provided with a bracket that can bolt to any secure structure, conduit cannot be terminated without a junction box. In addition, loudspeakers can only be aligned through one range of motion. By using our mounting brackets, the loudspeaker can be positioned through a full range of motion to allow for best orientation during or after installation. This allows precise direction of sound toward the most critical listening area. Please reference the following chart for a specification of model numbers of the optional Mounting Assemblies.

Loudspeaker Number	411A	412B	413A	414-002	415A	Driver Number
13328-001				*		Integral Driver
HP15-8		*				
HP30-8		*				
13350						
13340	*					13314-xxx
13340					*	13310-101
13306-101	*					13310-101 or 13314-xxx for bottom mounting
13306-101					*	13310-101 or 13314-xxx for suspended mounting
13305-101			*			Any driver
13304-002	*					13314-xxx
13304-002					*	13310-101
13302-002	*					13314-xxx
13302-002					*	13310-101

2.6 Terminal Boxes

- 2.6.1 Indoor Terminal Box, **Model 10434-002**, shall be constructed of 16 ga. steel with gray polyurethane, approximately 8.12" (206.2mm) H x 8.12" (206.2mm) W x 5.25" (133.4mm) D overall, with a neoprene gasketed cover attached with four screws. It shall have two (2) 11 point terminal strips for field wiring connections. Shipping weight shall be approximately 6 lbs (2.7 kg).
- 2.6.2 Indoor/Outdoor Terminal Box, **Model 9974**, shall be high-impact, glass-reinforced polyester, approximately 9.5" (241mm) H X 8" (201mm) W X 3.8" (97mm) D overall, a modular assembly that allows the front panel to be separated from the rear enclosure. The front panel shall be secured to the rear enclosure using four captive screws. It shall have two 11-point terminal strips for field wiring connections. It shall have two drill spots on the top and two drill spots on the bottom for locating conduit entry. The shipping weight shall not exceed 5 lbs (2.27 kg).

Equipment shall be listed/approved for Class I, Div. 2, Groups A, B, C & D; Class II, Div. 2, Groups F & G; Class III locations

2.6.3 Weatherproof Terminal Box

- 2.6.3.1 Weatherproof Metallic Terminal Box, **Model 10436-002**, shall be cast aluminum alloy with gray baked enamel finish, approximately 11.56" (293.6mm) H x 9.55" (242.6mm) W x 5.3" (134.6mm) D overall, with a neoprene gasketed cover attached with four stainless steel screws. It shall have two (2) 11 point terminal strips for field wiring connections. Also furnished shall be a hubplate for 1.25" (31.8mm) conduit entrances (top and bottom). Shipping weight shall be approximately 10 lbs (4.5 kg).
- 2.6.3.2 Weatherproof Non-Metallic Terminal Box, **Model 10499-001**, shall be injection molded thermoplastic (PVC), approximately 12" (304.8mm) H x 10" (254mm) W x 6.88" (174.6mm) D overall, meeting NEMA 1, 2, 3, 3R, 3S, 3R, 12, 13. Components are UL-listed and CSA-certified. It shall have two (2) 19 pt. terminal strips for field wiring connections. Shipping weight shall be approximately 6 lbs (2.7 kg).

2.7 Auxiliary Headset and cable

- 2.7.1 Headset/Microphone assembly, **Model 10401-201** for use with or without a hardhat, shall have liquid filled earcups, a gooseneck noise-cancelling boom microphone, a Noise Reduction Rating of 24db and permit intelligible communications in areas up to 110dBspl ambient noise. Male connectors shall be included to mate with extension cable (Reference Paragraph 31). The shipping weight shall not exceed 2 lbs (.9 kg).
- 2.7.2 Extension Cable, **Model 10416-103**, shall be provided with a female connector to mate with headset/microphone (Reference Paragraph 28), and the male connector to mate with amplifier. The thirty foot (30') straight cord shall include a belt clip to act as strain relief for headset and a push-to-page switch. Shipping weight shall not exceed 2 lbs (.9 kg).

2.8 Options

2.8.1 Epoxy Coating – **EP**

Epoxy coating shall protect equipment exposed to corrosive environmental conditions. Epoxy coating shall preserve the finish of metal components by resisting the harsh effects of extreme temperature, humidity, and wind-blown sand particles. Epoxy shall not chip, peel, or rust.

2.8.2 Tropicalization – **TR**

Tropicalization process shall protect vulnerable circuitry with a preparation that combats the effects of humidity and high temperatures. The tropicalization process shall deter corrosion and fungus growth, ensuring operational reliability.

2.8.3 Hytrel Handset Cord – **H1 / H2 / H6**

HY Thermoplastic elastomer cords (Hytrel[®]) shall offer superior performance via "memory" to retain coil and shall provide excellent performance in extreme temperatures. Bushings shall be molded to coil cord to protect internal wires. Hytrel cords are available in the following lengths:

- 6 foot length – H6
- 15 foot length – H1
- 25 foot length – H2

2.8.4 15 foot PVC Handset Cord - **15**

2.8.5 25 foot PVC Handset Cord - **25**

2.8.6 Spring Kit for Weatherproof Non-metallic Enclosure - **SK**

Spring Kit shall ensure closure for door to protect Handset/Speaker Amplifier from rain and dust in addition to damage to enclosure door. Spring kit shall be installed by the manufacturer of the enclosure.

PART 3 EXECUTION

3. Installation

Locate and install components as indicated on the applicable drawings and in accordance with the manufacturer's recommendations. Control and access panels shall be mounted with sufficient clearance for observation and testing. All junction boxes shall be clearly marked for easy identification. All wiring shall be in conduit or other approved means. All devices, conduit, junction boxes, etc., shall be securely hung and fastened with appropriate fittings to ensure positive grounding throughout the entire system.

No wiring other than that associated with the intelligent communication [and emergency notification] system shall be permitted in system conduits. Wiring splices are to be avoided to the maximum extent possible, and if needed, they shall only be made in junction boxes and shall be crimp connected. Transposing or changing the color-coding of wires is not permitted. Wire nut-type connections are not acceptable. All conductors in conduit containing more than one wire shall be labeled on each end with "E-Z markers" or equal. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded.

All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.

The equipment manufacturer shall provide technical guidance during and/or following construction to perform a check-out of the system. At such time, a factory trained technician shall apply system power and make all necessary adjustments and instruct operating and maintenance personnel on the proper use and care of the system. Charges for the service are to be on a per diem basis (including travel time), plus all expenses at actual cost.

The manufacturer shall offer an annual test and maintenance agreement, consisting of the following:

- Regularly and systematically examine, test and adjust all system components.
- Submit test reports, which certify that all components have been tested and that the system is in proper working order and functions in accordance with this specification.