GLOBALCOM® 5400 Series Voice Alarm Control and Indicating Equipment (VACIE)
User Manual

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02/xx/2014	0.1	Original	KAT	N/A
05/20/2014	0.5	First version for Jody/MediasPro	KAT	
05/23/2014	0.6	Updated Graphics & updated Designer chapter (16)	KAT	
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8/1/14	0.8	Update Designer GUI screens & descriptions Add firmware update info to DCT	KAT	
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10/21/14	0.A	Add Dante licensing and logos Update device details to show digital audio IP addresses	KAT	`
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2018	2.0	Incorporated many new products	KAT	

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1. GLOBALCOM EN 54-16 Product Overview

1.1 Introduction

The IED's GLOBALCOM® EN 54-16 Voice-Alarm Control Indicating Equipment (VACIE) Communication System is comprised of one or more of the following products integrated to suit the facilities specific needs for voice alarm and non-emergency paging:

- 5400ACS – VACIE system controller

- 5404DZM – Four channel digital zone manager for controlling and monitoring up to four amplifier channels and up to four speaker lines attached to them.

- 5432DZM – Four channel by 32 speaker digital zone manager for controlling and monitoring up to four amplifier channels, each with distribution to up to eight speaker lines (32 total).

- 5450CS – Touch screen paging station capable of acting as an emergency paging station.

- 5416CS – 16-button paging station capable of acting as an emergency paging station.

- 5414/5434/5454AMP – Four channel power amplifier capable of up to 100W/300W/500W per channel.

- 5410EOL/5411EOL – End of Line modules for speaker lines attached to the 5404/5432DZM

- 1516LI/1516LI-E – Logic input modules

- 1522LR – Logic input and relay output module

- DNA2404DH – Digital network amplifier

- 1544BAS – Backup amp switcher

- 1516ALI/1516BLI – A Loop/ B Loop Interface

- IPUSBD-8/IPUSBD-16 – Dante USB audio expansion devices

- 1100DAB-CD/1100DAB-DD – digital audio bridges

- BB-88DT/BB-816-DT/BB-168DT/BB-1616DT/B-EB1616DT – BlueBridge DSP devices

- 1544AIO-D – Dante audio input/output device

In addition, there can be equipment added for non-emergency functions such as:

- 5404/IED5401CS – non-emergency paging stations

- 540S – ambient noise sensor

- 1542NA-D/1581NA-D – PoE powered Dante small amplifiers

- 500VIS – Visual paging displays

These optional pieces of a system are not covered in this manual. The products listed in the first section above are covered in detail in Chapters 2 through 17. The block diagram in Figure 1-1 below shows how all these products interconnect via the network. Details on cabling and system architecture are covered in Chapters 100 and 101. Chapters 102 and 103 provide information on power consumption and cooling, and preventive maintenance procedures. System Configuration is covered in a separate document DOC1401D, *GLOBALCOM 5400 Series Designer User Manual*.
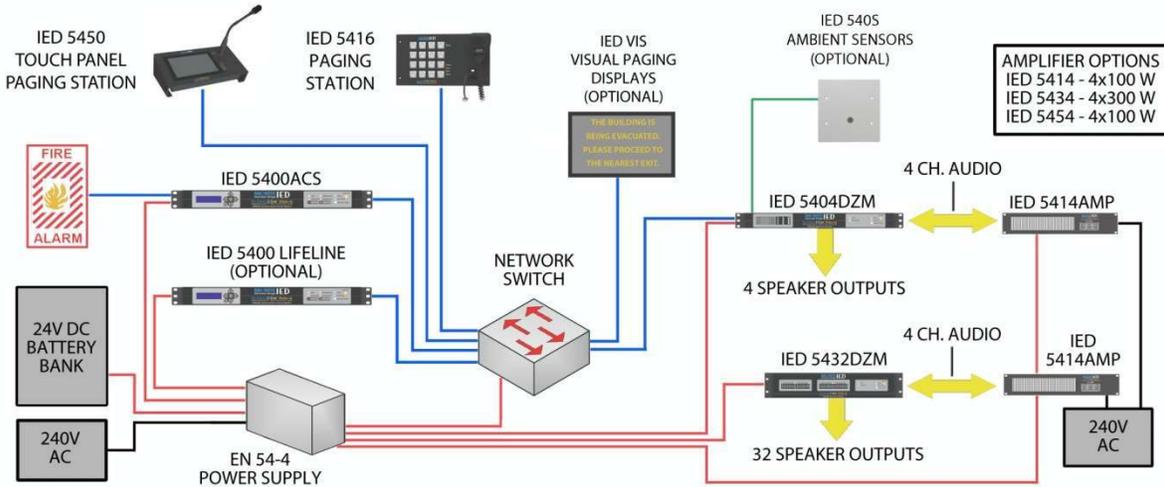
Figure 1-1:   Example GLOBALCOM-en Voice Alarm System

1.2   EN 54-16 Compliance

The EN 54-16 standard is a system level standard that depends on proper installation with listed components in order to fully comply with the standard. In addition to the IED supplied products, for a complete system it is also necessary to add third party components such as EN 54-4 listed power supplies, batteries and network equipment and cabling to build a complete system. The following third party equipment has been tested with the IED products:

- Vishay 595-275 Varistor

- Merawex ZDSO400-DR4 UL 54-4 24V power supply

- KTI KGS-1064-HP network switch

- Cosel SNR series power supply filters (specifically SNR-10-223-DT)

- TDK ZCAT2035-0930A ferrite cores for EMI reduction on DC signal lines

It is the responsibility of the installer to properly install, configure and calibrate the system so that it fully complies with EN 54-16.

> *Note: To not interfere with the integrity of the system operation, auxiliary Dante tools provided by the technology provider or others, such as Dante Controller, should not be used on change portions of the system involved in life safety.*

1.3   System Features

The GLOBALCOM-en system is a digital distributed networked system that can be sized to suit applications from only a few zones and no control stations to a system with hundreds of zones and 50 control stations. The GLOBALCOM-en implements all the required features of EN 54-16 and most of the optional features. For a complete listing of what features are implemented and in what manner, refer to Appendix A of this document. Table 1-1 below summarizes the features of the GLOBALCOM-en system at a high level, along with an indication of whether this is an EN 54-16 required feature, optional feature, or neither/extra (i.e., extra non-voice alarm feature such as for everyday use of the system).

Table 1-1:   GLOBALCOM-en System Feature Summary

Feature	Description	Required?
Background Music	Auxiliary audio inputs may be routed to selected zones for BGM	Extra
External Voice Alarm Audio Input	Auxiliary audio inputs – such as from a fire panel – may be used as audio source for voice alarms	Opt.
Multiple Priority Levels	Emergency and non-emergency priority levels available to manage situations with multiple pages/alarms	Yes
Alarm Messages (recordings)	Multiple alarm messages may be held on the solid state storage of the system. Up to two messages may play simultaneously.	Yes
Front Panel Control	May view or initiate alarm messages from controller front panel with proper access level.	Opt.
Other Messages	Large capacity for non-emergency messaging to suit the installation.	Extra
Live Alarm Paging	Live alarm paging may be initiated from any communication station with proper access (login or key switch)	Yes
Live Paging	Any number of non-emergency pages may be active simultaneously	Extra
Pre-Announce Tones	Live or Delay pages may have pre-announce chimes play prior to the live audio to help in getting attention or denoting type of page.	Extra
Message Repeats	Alarms and non-emergency messages can be configured to repeat multiple times or indefinitely at a defined repeat interval	Yes
Scheduled Messages	Launching of non-emergency messages can be scheduled by time of day and day of the week.	Extra
Mute Actions	Actions can be defined to mute some or all zones in the system to allow audio/signals from other systems to be heard	Extra
Delayed Zones	To allow phasing the notification of alarms, individual zones may be put into delay where they receive the alarm audio only after the delay has expired or the manual release button on the controller is pressed.	Opt.
Disabled Zones	If zones are in maintenance, they may be taken off-line by disabling them. This removes them from all alarms/pages as well as from any supervision, eliminating spurious faults.	Opt.
Fault Indicators	Present on all major products such as the 5404DZM, 5432DZM, 5400ACS, 5450CS and 5416CS. On the DZMs, they indicate faults for the device. On the other products, faults for the whole system.	Yes
Fault Beeper	Present on 5400ACS. Silence-able with button press on the front panel	Yes

Feature	Description	Required?
Fault Relays	Present on 5404DZM, 5432DZM and 5400ACS.	Opt.
Alarm Active Indicators	Present on all major products such as the 5404DZM, 5432DZM, 5400ACS, 5450CS and 5416CS. On the DZMs, they indicate alarms for the zones in the device only. On the other products, alarms for the whole system.	Yes
Fault List	Available on 5400ACS and 5450CS is a descriptive list of all faults in the system	Opt.
Alarm List	Available on 5400ACS and 5450CS is a descriptive list of all active alarms in the system	Extra
Zone Status List	Available on 5400ACS and 5450CS is a descriptive list of all zones with status of alarm, fault, disabled or delayed.	Opt/Extra
Backup Amplifiers	Available as one backup amp to many primary amps, with indicators on each DZM when a backup is active.	Opt.
Logic Inputs	Eight logic inputs available on the 5400ACS, with optional line supervision. Either16 or 32 additional logic inputs available with the 1516LI and optional 1516LI-E expansion. Two logic inputs available on the 1522LR. All logic inputs allow external systems or controls to be attached to a GLOBALCOM-en system for triggering alarms or non-emergency messages, and for certain reset actions like clearing all faults or silencing all alarms.	Opt.
Relay Outputs	Four form-C relay outputs available on the 5400ACS and two on the 1522LR, typically for signaling that system is in alarm, disabled or delayed zone states. May also be used with announcements such as to trigger strobe lights or local volume control over-rides.	Opt.
Amplifier Supervision	The 5404DZM and 5432DZM monitor the attached power amps and report fault conditions, loss of mains power, loss of 24VDC backup power or loss of audio through the amplifier	Yes
Speaker Line Supervision (Open or loss of speakers)	The 5404DZM and 5432DZM monitor the speaker line load and presence of 5410/5411EOL modules at the line ends and report any off-normal conditions as faults	Yes
Speaker Line Ground Fault Detection	Detect either side of a speaker line going to ground.	Yes
Speaker Line Short Detection	Detect low impedance on speaker line and disconnect from power amplifier to avoid harm to the amplifier.	Yes
Equalization on all amp channels	Perform frequency equalize of the audio to improve quality and intelligibility	Extra
Level Control on all amp channels	Levels may be adjusted (upward) for alarms vs. non-emergency paging and messages. On the 5404DZM, automatic level control based on ambient noise sensors placed in the spaces is available.	Extra

1.4   Announcements

There are four types of announcements – audio routings – that may be done by the GLOBALCOM-en system:

- BGM – Background music routed from an input source to designated zones. This is the lowest priority routing, pre-empted by any other announcement.

- Non-Emergency Paging/Messaging – These are everyday, non-alarm events such as might be used in a facility for locating a person or for reminding the public about facility policies.

- Alarms – These are emergency live or recorded message announcements that have the highest priority in the system.

- Mutes – These are "no audio" announcements which allow a GLOBALCOM-en system to "yield" to another system providing audio to a space (e.g., a local sound system in a stage or arena area).

The Digital Zone Manager units can be configured with different volume levels for each of the first three types of announcements, so for example BGM can be at a low level, non-emergency paging a little louder and alarms at the loudest level.

2. 5400ACS Announcement Control System

2.1　Introduction

The 5400ACS is an integrated announcement controller with built-in message server capability that is the core of an EN 54-16 compliance life/safety emergency notification system. These units contain all of the intelligence to manage an entire system of emergency communication stations, digital zone manager amplifier units, and other network peripherals. The 5400ACS manages the system in compliance with the EN 54-16 standard, performing overall supervision and reporting of equipment faults plus any ongoing alarm conditions.

The 5400ACS supports the following functions:

- Provides two channels of analog audio input for BGM (background music) or fire panel audio

- Provides two channels of analog audio output for local audio zones.

- Internal message server capable of recording 2 channels of delayed messages while providing 2 channels of message playback.

- Internal storage available for over 1000 minutes of message audio.

- Provides eight contact closures for initiating voice alarms, selecting zone groups for alarms, or non-emergency announcements actions. These closures may be configured to be supervised for shorts or opens.

- Provides an overall form-C fault relay, plus four configurable auxiliary relays.

- Provides status and alarm control via front panel display and indicators

The 5400ACS functional appears as in the block diagram in Figure 2-1. A system can have a second 5400ACS added to it to function as a lifeline (backup) controller, if so desired. Physically, the lifeline unit is identical to the primary controller, with all the same firmware. During system configuration, the user designates which one should act as the primary and which one as the lifeline. See Section 101.7 for more on wiring systems with lifeline controllers.
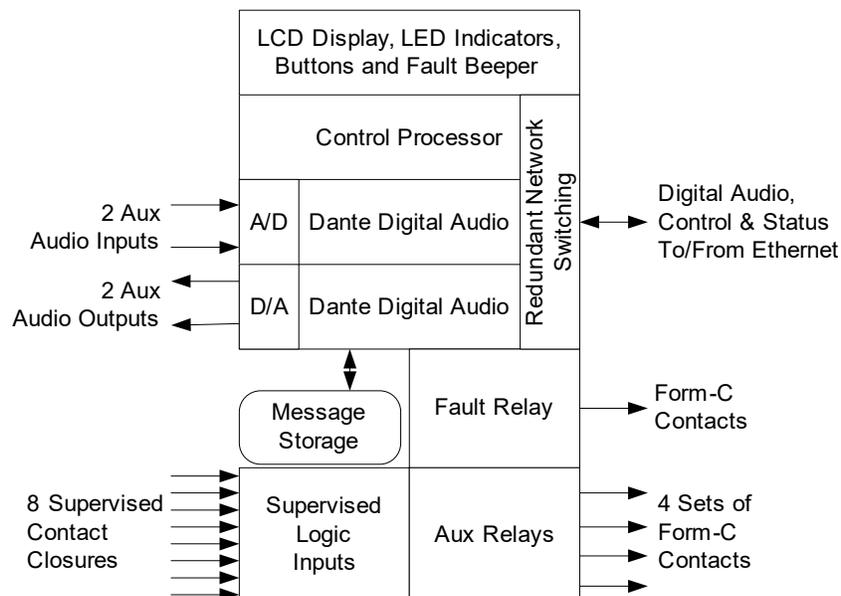
Figure 2-1:　Functional Block Diagram of 5400ACS

2.2   Controls, Connectors and Indicators

2.2.1   Front

The indicators and controls on the front of the 5400ACS are shown in Figure 2-2 and are described in the text which follows.

Figure 2-2:   5400ACS Front Controls and Indicators

(A) **LCD Display** – Used with navigation buttons to display status and control menu options.

(B) **Navigation Keys** – Used to navigate through the LCD menu and lists.

(C) **Overall Fault LED** – Illuminates when there is any fault in the system.

(D) **System Fault LED** – Illuminates when either of the controllers (microprocessors) in the 5400ACS are not running properly.

(E) **Disabled Zones LED** – Illuminates when there are disabled zones in the system.

(F) **Delayed Zones LED** – Illuminates when a voice alarm is active to one or more zones that are in delay.

(G) **Power LED** – Illuminates when the 5400ACS is powered on.

(H) **Power Fault LED** – Illuminates when there is an issue with power in the system, such

as loss of mains (running on batteries) or a problem with the batteries or charger.

(I) **Lamp Test Button** – Press to illuminate all the status LEDs on the front. LEDs will go back to their normal conditions when released.

(J) **Silence Alert Button** – Press to silences the fault alert beeper. Beeper will re-sound after a new fault or after a period of time has elapsed with the same fault conditions.

(K) **Release Delay Button** – Press to immediately release the delay on zones in alarm. The Delayed Zones LED should go off and the zones will be added to the voice alarm.

(L) **Announce/Alarm LED** – This illuminates yellow when there is a non-emergency announcement active in the system and red when there is a voice alarm active.

2.2.2   Rear

The connections on the rear of the 5400ACS are shown in Figure 2-3 and are described in the text which follows.
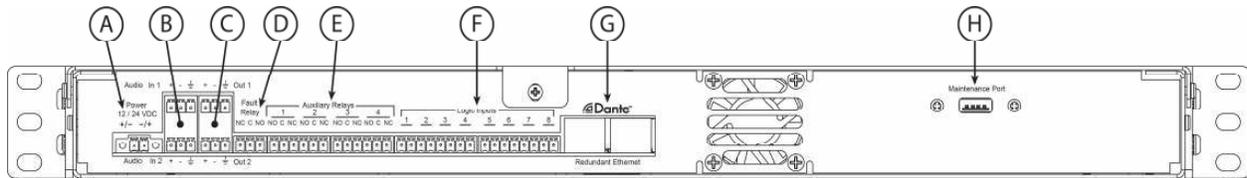
Figure 2-3:   5400ACS Rear Connections

(A) **Power Input** – 5400ACS power from EN 54-4 listed supply.

(B) **Aux Audio Inputs 1 & 2** – For input of BGM or fire panel audio.

(C) **Aux Audio Outputs 1 & 2** – For extra audio/zone outputs.

(D) **Fault Relay** – Form C relay that is triggered for any fault, i.e., whenever the general fault LED on the front is illuminated.

(E) **Aux Relays (4)** – Form C relays for indicating status of the system.

(F) **Logic Inputs (8)** – Logic inputs for triggering events in the system such as voice alarms. May be supervised for open and shorts or not.

(G) **Redundant Ethernet RJ-45's** – Ethernet connections for control and digital audio. If second port is used, should go to a separate (redundant network) switch.

(H) **Maintenance Port** – USB bus port for optional software maintenance.

2.3   Connections

2.3.1   Introduction

The following connections are possible to the 5400ACS, each of which is described in a section that follows:

- Frame Power

- Audio Inputs

- Audio Outputs

- Relays

- Contact Closures

- Ethernet

2.3.2   Frame Power Connection

Power may be connected to the two power terminals in either polarity. For EN 54-16 compliance, this should be wired to an EN 54-4 rated power supply. The unit is rated to run from either a 12V or 24V power supply. The 24VDC option is recommended. The gauge of the wire connecting to the power supply should be at least ___ AWG when connected to 12V and ___ AWG when connecting to 24V supply.

2.3.3   Audio Input Connections

The audio inputs are balanced with plus, minus and shield connections. When connecting to a balanced audio output, the connections should be made one-for-one. When connecting to an unbalanced output, one should connect the ground/shield from the output to both the shield and minus pins of the audio input on the 5400ACS as shown below.
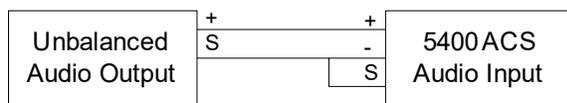
2.3.4   Audio Output Connections

The audio outputs are balanced with plus, minus and shield connections. When connecting to a balanced audio input, the connections should be made one-for-one. When connecting to an unbalanced input, one should connect the minus

pin of the 5400ACS output to the ground/shield of the audio input as shown below.
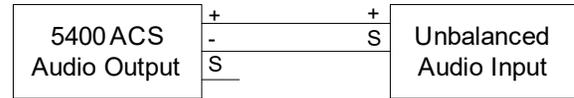
2.3.5   Relay Connections

The relays are form-C which means there are both NO (Normally Open) and NC (Normally Closed) connection in addition to the common (C) connection. Typically external devices are attached to the C and either the NO or NC connections depending on the desired signaling with the external system.

2.3.6   Contact Closure Connections

Connections to the logic inputs on the 5400ACS should be made via dry contact closures between the pair of pins for each input. There is an internal pull-up resistor of 10K Ohms providing a "wetting voltage" of 3.3V.

If connection is made from a remote equipment rack, then the logic input should be configured for supervision. This is done by adding 10K Ohm resistors in series and across the remote contacts in the configuration shown below. Note, these resistors should be added at the remote (signaling) end, not at the 5400ACS so that the whole communication path can be monitored for shorts and opens.
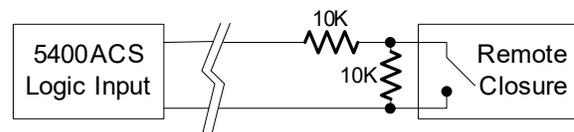
Note: The external resistors should have a tolerance of 1% or less for reliable operation.

2.3.7   Ethernet Connection(s)

The Ethernet connections are made via RJ-45 connectors and cabling appropriate for 100Base-TX. Only one connection is required, but both may be used for network cabling redundancy purposes.

2.4   Installation

2.4.1   Initial Installation

The steps to installing a 5400ACS are as follows:

- Attach any auxiliary audio connections to the Aux Input/Output connections on the back (items B and C in Figure 2-3)

- Connect Fault Relay (item D in Figure 2-3) either the NC or NO side to external system or other indicating equipment

- Connect Aux Relay (item E in Figure 2-3) to any external system or other indicating equipment for this installation

- Connect the Logic Inputs to any external system or activation switches for this installation

- Connect at least one Ethernet port to a switch in the same rack as the 5400ACS.

- If redundant network switches are available, connect the second Ethernet port to the redundant switch.

- Connect the EN 54-4 rated power supply, either 12V or 24V output, to the power jack and screw down the two holding screws on either side of the power connector.

Once all connections are made, one should bring up the System Management Center (SMC) software on a separate computer (e.g., laptop) connected into the same switch as the 5400ACS and proceed to download the system configuration to the 5400ACS.

2.4.2   Firmware Updates

Firmware can be updated via the separate 5400 Designer tool described in the user manual document 1401D.

2.5   Operation

2.5.1   Front Panel Buttons

There are three front panel buttons which are operated as follows:

- **Lamp Test Button** – Press to illuminate all the status LEDs on the front. LEDs will go back to their normal conditions when released. This button also tests that the I/O control microprocessor is running as it should. This button actually tells the microprocessor to turn on all the LEDs. So, if this works then even if a System Fault is indicated, the I/O microprocessor portion is functional.

- **Silence Alert Button** – Press to silences the fault alert beeper. Beeper will re-sound after a new fault occurs or after a period of time has elapsed with the same fault conditions.

- **Release Delay Button** – Press to immediately release the delay on zones in alarm. The Delayed Zones LED should go off and the zones will be added to the voice alarm.

Additionally, there is a special reset function that may be executed by holding down all three buttons for at least three seconds. This may be used when there is a System Fault and will reboot the main processor as an alternative to cycling power to the unit. Note, this will only work if the I/O microprocessor is functional, i.e., the Lamp Test button works as it should.

2.5.2   LCD Menu Operation

There is a 2 line by 16 character LCD display with navigation buttons on the left front of the 5400ACS, as shown by the highlight oval in Figure 2-4 below. The up and down arrow buttons are used to navigate through lists, such as menu options, faults and alarm list. The left and right arrow buttons are only used to move forward or backward in position when entering the level 2 password. The green check button is the select button. Typically pressing this button will select a menu item and if a sub-menu is available, move the user into that sub-menu. The red X button is used to go back one level/option (e.g., reverse of select).

Figure 2-4:   LCD Display & Navigation Buttons

Figure 2-5 summarizes the menu tree available on this display. Features in italics are only available to users who log in for higher level access. The summary screen is what is shown when the menu is in its quiescent state. Pressing the select button while the summary screen is displayed moves the display into the top-level menu as shown down the left side of Figure 2-5. Pressing the select button at any other level moves one over to the right another step, e.g., to sub-menus or setting options.

An item that shows up frequently in the menu tree is the [ACK Prompt]. This is an acknowledgement prompt. The top line of this prompt will be tailored to the operation that is being acknowledged. For example if clearing all faults, then the prompt may appear as at right. One acknowledges (confirms) the operation by pressing the green check select button or cancels out by pressing the red X button.

```
Ack Clear All
√-OK X-Cancel
```

The Summary Screen appears when the menu is not in use. After two minutes of no navigation button activity, the LCD display will automatically return to the Summary Screen. This screen lists the number of active alarms and active faults in the system, such as the example at right. Pressing the select button

```
Alarms: 0
Faults: 8T 0S
```

while the Summary Screen is displayed takes one to the Main Menu, described in the next section, followed by descriptions of the other menus that branch off of the Main Menu in the sections that follow.

> Note: When the Controller is booting up or when it is being updated from the Designer tool, the Summary Screen will change to show "Please wait…" on the top line and either "Starting" or "Updating" on the second line.

While navigating the menus, the top line always shows the current location in the menu tree (e.g., Main Menu), and the second line shows the current option that will be taken if the Select button is pressed.

Summary Screen
|
Main Menu
├── Faults
│   ├── Trouble
│   │   ├── View ——— [list of faults] ——— [ACK prompt]
│   │   └── *Clear All* ——— *[ACK Prompt]*
│   └── Supervisory
│   ├── View ——— [list of faults] ——— [ACK prompt]
│   └── *Clear All* ——— *[ACK Prompt]*
├── Alarms
│   ├── View *(Active)* ——— [list of alarms] ——┬── *Silence* ——— [ACK prompt]
│   │   └── View Alarm Zones — [zone status list]
│   ├── *Start* ——— *[list of alarms]* ——— *[ACK prompt]*
│   └── *Silence All* ——— *[ACK Prompt]*
├── Zones
│   ├── View ——— [list of zones] ——┬── *Enable/Disable [ACK prompt]*
│   │   └── *Delay On/Off   [ACK prompt]*
│   ├── *Delay On* ——— *[ACK Prompt]*
│   ├── *Delay Off* ——— *[ACK Prompt]*
│   ├── *Enable All* ——— *[ACK Prompt]*
│   └── *Disable All* ——— *[ACK Prompt]*
├── System
│   ├── *Reset* ——— *[ACK Prompt]*
│   ├── *Shutdown* ——— *[ACK Prompt]*
│   └── System Info ——— [List of information]
└── Login/out ———[Password Prompt] or [ACK Prompt to logout]

Figure 2-5:   LCD Menu Structure

2.5.2.1   Main Menu

On the Main Menu the following options are available to select:

- **Faults** – Selecting **Faults** will present the Faults Menu, which is divided into two menus for Trouble and Supervisory faults. A Level One user will only be able to view faults in each category. A Level Two user (entered the correct password) will be able to view and clear faults.

> *Trouble Faults are failures that impact the performance of the system, such as hardware malfunctions or loss of communications to devices.*
>
> *Supervisory Faults are off-normal conditions such as a contact closure to launch an alarm that remains after the alarm itself has been silenced.*

- **Alarms** – Selecting **Alarms** will present the Alarms Menu. A Level One user will only be able to view active alarms. A Level Two user will be able to also start alarms and silence all alarms.

- **Zones** – Selecting **Zones** will present the Zones Menu. A Level One user will only be able to view the status of zones (faulted, in alarm, disabled or in delay). A Level Two user will also be able to turn zone delays on or off, as well as disable/enable selected zones, disable all zones or re-enable all zones.

- **System** – Selecting **System** will present the System Menu. A Level One user will be able to view system information. A Level Two user will also be able to reset the system.

- **Login/out** – Selecting **Login/out** will either present the user with a login prompt (if not logged in yet) or with an acknowledge prompt to logout (if logged in currently). This is how access to the Level Two features is obtained.

Since the convention is to show the menu location on the top line and the current option on the second line of the LCD display, when first entering the Main Menu, the display will appear as at right. As one presses the down arrow button the second line will change to Alarms, Zones, System and Login/Out with successive presses.   Press the Select button (√) when the desired menu option is displayed on the second line.

```
Main Menu
Faults
```

2.5.2.2   Fault Menu

On the Fault Menu, one first is presented with the options for Trouble of Supervisory Faults. After selecting one of these, the following options are available to select to view/manage each fault list:

- **View** – View a list of current faults of this type (Trouble or Supervisory) in the system.

- **Clear All** – Clear all faults of this type in the system. For Trouble Faults, within 100 seconds, the system may re-discover the faults and re-post them to the fault list. The user must press the Select button (√) when the ACK prompt is displayed before the faults are actually cleared.

When **View** is selected, the user will see the first fault in the list displayed on the second line of the LCD display. The top line will say "View Faults n/m" where n is the index of the fault in the list and m is the total number of faults (length of the list). So in the example at right, the fault shown on the second line is the first of 20 faults. Fault descriptions that start with an asterisk (*) such as the one in the example are new faults that have not been acknowledge yet. These new faults will also be sorted to the top of the list. Faults can be acknowledged by pressing the Select button (√) while viewing the fault and then pressing the Select button again on the ACK prompt.
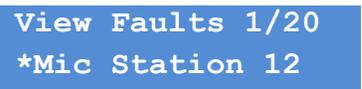
```
View Faults 1/20
*Mic Station 12
```

2.5.2.3   Alarms Menu

On the Alarms Menu, the following options are available to select:

- **View Active** – View a list of active alarms and their zones, and optionally with Level Two access, silence any active alarm.

- **Start** – [with Level Two access] View a list of all inactive alarms and start an alarm. Pressing the Select button (√) while on an alarm will present the ACK prompt to start this alarm. Pressing the Select button again will initiate the alarm.

- **Silence All** – [with Level Two access] Silence all active alarms. This presents an ACK prompt where the Select button (√) must be pressed again before the action is taken.

When viewing either the active alarms or inactive alarms to be started, the alarms will be shown one at a time on the second line of the LCD display, with a header such as "View Active n/m" appearing on the top line, where n is the list item number and m is the length of the list. In the example at right, the

```
View Active 2/20
Fire Evacuation
```

alarm shown is alarm 2 out of 20. If the alarm description is too long to fit on the second line, it will scroll across the display "marquee style". Use the down arrow button (▼) to see additional items in the list and the Exit button (X) to leave the View Active list and return to the Alarms Menu.

Pressing select button (√) while an alarm is displayed in the View Active window present a submenu with options:

- **Silence** – [with Level Two access] Silence this active alarm. This presents an ACK prompt where the Select button (√) must be pressed again before the alarm is actually silenced.

- **View Alarm Zones** – Select to view the zones involved in this alarm.

These alarm zones are displayed in a list similar to the alarm list, where the down arrow button (▼) can be used to view each zone.

2.5.2.4   Zones Menu

On the Zones Menu, the following options are available to select:

- **View** – View a list of Zones. With Level Two access a user may enable or disable, or delay or undelay individual zones in the system. Disabled zones are not supervised and are excluded from all announcements.

- **Delay On** – [with Level Two access] Put every zone in the system into delay. Individual zones may be taken out of delay after doing this function is done, say to test alarms to special test/monitor zones. This presents an ACK prompt where the Select button (√) must be pressed again before the action is taken.

- **Delay Off** – [with Level Two access] Turn off delay on every zone in the system. Individual zones can be put into delay after doing this function, as desired. This presents an ACK prompt where the Select button (√) must be pressed again before the action is taken.

- **Enable All** – [with Level Two access] Enable all zones in the system. This presents an ACK prompt where the Select button (√) must be pressed again before the action is taken.

- **Disable All** – [with Level Two access] Disable all zones in the system. Typically this will be used only as a pre-cursor step to going back into the View zones list and re-enabling selected zones. This presents an ACK prompt where the Select button (√) must be pressed again before the action is taken.

When the View option is selected, the LCD display will show a list of all zones in the system, one at a time on the second line of the display. The top line of the display will display "View Zones n/m" where n is

the list item number and m is the length of the list. In the example, at right, the zone displayed on the second line is zone 10 of 93. Each zone description may be prefaced by one of the following special characters:

```
View Zones 10/93
&!Hallway Northw
```

- Ampersand (**&**) if the zone is in the alarm state and is able to receive audio (not in delay)

- Percent sign (**%**) if the zone is in the alarm state, but is currently in delay at the start of the alarm.

- Grave accent (backwards apostrophe) (**`**) if the zone is currently configured to be delayed, but there is no alarm active to that zone.

- Asterisk (*****) if the zone is in the disabled state.

- Exclamation point (**!**) if the zone is in the faulted state.

If more than one condition co-exist, then multiple characters will be displayed. If the zone description is longer than the display, it will scroll right to left "marquee style.

With Level Two access (only), pressing the Select button (√) on a zone brings up the submenu options:

- **Disable (Enable)** – Disable (or re-enable) this zone. The menu shows either "Disable" if zone is currently enabled or "Enable" if currently disabled. This presents an ACK prompt where the Select button (√) must be pressed again before the action is taken.

- **Delay On (Delay Off)** – Turn alarm delay on/off for this zone. The menu shows either "Delay On" if zone is currently not in delay and "Delay Off" if currently in delay. This presents an ACK prompt where the Select button (√) must be pressed again before the action is taken.

2.5.2.5   System Menu

On the System Menu, the options that may be selected are:

- **Reset** – [with Level Two access] Reset the system, after pressing the Select button (√) again at the ACK prompt.

- **Shutdown** – [with Level Two access] Do an orderly shutdown of the system before powering it off.

- **System Information** – View system information such as firmware versions and IP addresses assigned. The information will cycle through automatically and includes the following:

  o   I/O Version – Firmware version on the I/O card microcontroller.

  o   CPU Version – Version of the controller software.

  o   CPU IP – IP Address of the controller

  o   CPU Subnet – Subnet mask of the controller

  o   Audio A IP – IP address of the first digital audio (Dante) chip

  o   Audio B IP – IP address of the second digital audio (Dante) chip

  o   CPU Date – Current date on the controller

  o   CPU Time – Current time on the controller

  o   Max Concurrent Recorded Msgs – Number of playback channels available on the controller (normally only two via the I/O board).

  o   Max Concurrent Delayed Pages – Number of record and playback channels available on the controller (normally only two via the I/O board).

2.5.2.6   Login/Out

This option is used to login for Level Two access or logout from this level, depending on whether the user is currently logged out or in.

> *The LCD menu indicates whether currently logged in or not by showing an asterisk (*) in the top right corner when logged in, e.g.,*
>
> ```
> Main Menu        *
> Faults
> ```
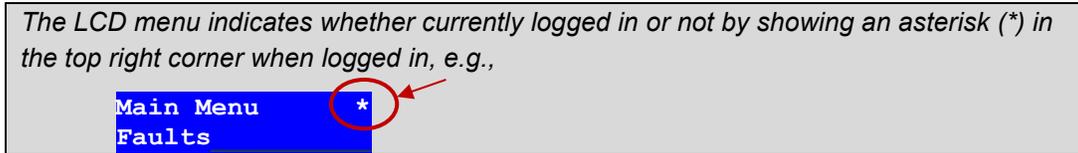
If logging in, the user will be presented with the **Enter Password** prompt such as shown at right. One selects the first digit of the password by pressing the up (▲) or down (▼) arrows until the correct value is shown. Then, one presses the right arrow button (►) once to move to the second password digit, and use the up and down arrows to select that digit, etc. until all digits required are filled in. The digit currently being entered will flash between _ or a number and a full box cursor (█). The example at right shows the first three digits of password entered, and the cursor on the fourth digit. Note, currently passwords are restricted to being four-digit numbers (PINs). When all digits are entered, the Select button (√) should be pressed to enter the password.

```
Enter Password

_ _ _ _
```

```
Enter Password
9 8 7 █
```
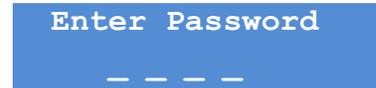
2.6   5400ACS Technical Specifications

2.6.1   Physical Characteristics

Height .... 1.75", 1 rack unit (4.4 cm)

Width (without rack mount ears) .... 17.2" (43.7 cm)

Depth .... 12.25" (31.1 cm)

Recommended Mounting Depth .... 18" (45.7 cm)

Weight .... 11.40 lbs (5.17 Kg)

2.6.2   Environmental Information

Operating Temperature Range ....
......................................32˚F - +104˚F(0˚C – +40˚C)

Storage Temperature Range..
....................................-4˚F – +158˚F(-20˚C – +70˚C)

2.6.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking
.... EN 54-16

2.6.4   Power

Supply Voltage ....12 or 24 VDC

Recommended Supply Voltage........................... 24 VDC

Supply Power (Max) .... 36 Watts

2.6.5   Audio Characteristics

Audio Input Sensitivity ....+14 dBu Max

Input Impedance ....10 kΩ

Audio Output Level ....+14 dBu Max (Balanced)

Power Output ....<1 Watt

Output Impedance .... 50 Ω

Total Harmonic Distortion ....<1% @ 1 kHz

Audio Bandwidth .... 20 Hz-20 kHz

2.6.6   Input/Output Characteristics

Form C Fault Relay ....2 Amps @ 110 VDC Max

Auxiliary Relays ....2 Amps @ 110 VDC Max

Logic Inputs (Isolated)

     LOGIC ACTIVE .... 0.08 VDC Max

     LOGIC IN-ACTIVE .... 2 VDC – 3 VDC Max or Open

2.6.7   Ethernet Connections

Medium.. Copper, 100Base-TX

Preferred Cable .... UTP cable Category 5

Maximum Length .... 100M from switch

Signal Levels ....According to IEEE 802.3

2.6.8   Other Connections

Power .... 2-pin Phoenix, 3.81 mm spacing
with locking screws

Maintenance Port (USB) .... 1 Rear

Redundant Ethernet (2) RJ-45

Audio In/Out (2x2) .... 3-pin Phoenix, 3.81 mm spacing

Logic Inputs (typical of 2) ....
.... 8-pin Phoenix, 3.81 mm spacing

Form C Auxiliary Relay Outputs (typical of 2) ....
.... 6-pin Phoenix, 3.81 mm spacing

Form C Fault Relay Output ....
.... 3-pin Phoenix, 3.81 mm spacing

3. 5404DZM Digital Zone Manager

3.1   Introduction

The 5404DZM Digital Zone Manager provides processing and management of four (4) paging zones assigned from an 5400ACS Announcement Control System. It also provides line level audio outputs to a paired four-channel amplifier unit. Digital Signal Processing (DSP) is provided on each of the four (4) output channels. This includes: input level controls, paging routing, automatic ducking of background music, equalization (high pass filters, low pass filters, up to 40 milliseconds of delay, plus up to 7 parametric bands per amplifier channel). IED's patented ambient analysis and control provides automatic level adjustment with two (2) Sensor Input Channels per amp channel.

The 5404DZM provides backup amplifier switching by switching up to four (4) loudspeaker loads from a primary power amplifier to a backup when a failure is detected. It also contains integrated supervision that monitors each signal path and reports any failures to the 5400ACS. The 5404DZM supports the following functions:

- Convert four channels of Dante digital audio to balanced analog amplifier channel inputs.

- Provide redundant Ethernet ports containing all control and digital audio.

- Route amplifier channel outputs to speaker lines via line supervision circuitry.

- Switch between primary and backup amplifier inputs.

- Supervise mains and backup power to the paired (main) amplifier

- Supervise paired amplifier channel status

- Control power of amplifier, so in Power Save Mode the amplifier is in standby, powering on periodically to test

- Provide an overall fault relay output

- Provide status LEDs on the front of fault conditions as well as paging, alarm and amp backup conditions

- Provide 8 ambient sensor inputs (2 per amp channel) and associated signal processor to automatically adjust level based on changes in noise in the spaces served.

These functions are shown diagrammatically in Figure 3-1.

Figure 3-1:   5404DZM Functional Block Diagram

3.2   Controls, Connectors and Indicators

3.2.1   Front

The indicators and controls on the front of the 5404DZM are shown in Figure 3-2 and are described in the text which follows.

Figure 3-2:   5404DZM Front Panel Indicators and Controls

(A) **Amplifier Status LED (4)** – Shows green when amplifier is powered on and not in alarm or faulted. Shows Yellow when amplifier is powered on and is faulted, but not in alarm. Shows red when amplifier is powered on and is in alarm. LED is off when amp is off, such as between testing or alarms when the unit is in Power Save Mode.

(B) **Speaker Line Fault LED (4)** – Shows yellow if there is a fault on the speaker line attached to this amp channel (open, short or ground fault, or speaker load off normal).

(C) **Amplifier Backup LED (4)** – Shows green when backup amp relay is engaged for this amp channel.

(D) **Overall Fault LED** – Shows yellow when there is any fault in the 5404DZM, associated power amplifier or speaker lines attached.

(E) **Ground Fault LED** – Shows yellow when there is a ground fault on any speaker line attached to this unit.

(F) **Power LED –** Shows green when the 5404DZM has power.

(G) **Power Save Mode LED** – Shows yellow when the 5404DZM is in Power Save Mode (e.g., when running on battery backup).

(H) **Announce/Alarm LED** – Shows red when an alarm is active to any zone (amp channel or speaker line) associated with this 5404DZM. Shows yellow when there is no alarm and there is a non-emergency announcement active to any zone associated with this 5404DZM.

(I) **Lamp Test Button** – Press to illuminate all the status LEDs on the front. LEDs will go back to their normal conditions when released.

3.2.2   Rear

The connections on the rear of the 5404DZM are shown in Figure 3-3 and are described in the text which follows.
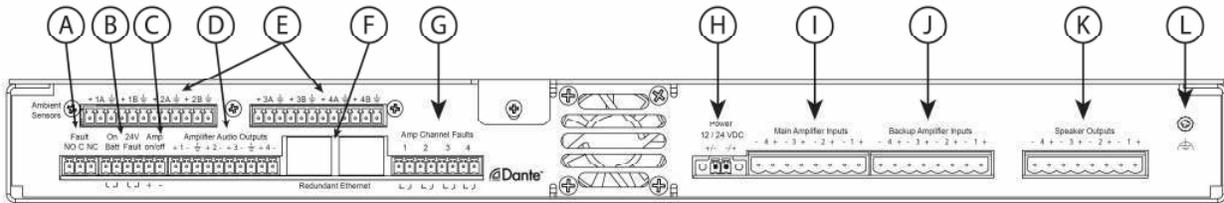
Figure 3-3:   5404DZM Rear Panel Connections

(A) **Fault Relay** - Form C relay that is triggered for any fault, i.e., whenever the general fault LED on the front is illuminated.

(B) **Power Status Logic Inputs** – On Battery (mains failure) and 24V Fault (backup power failure) indicated by dry contact closures from the associated power amp.

(C) **Amp Power Control** – Normally output voltage is around zero Volts. Goes to -12V to switch amplifier off (into standby) or +12V to switch amplifier on.

(D) **Amplifier Audio Outputs** – Balanced analog outputs that should go to associated amplifier channel inputs. Level is 0 dBu for full power out of the amplifiers.

(E) **Ambient Sensor Connections** – For connecting up to eight 540S ambient sensors.

(F) **Redundant Ethernet RJ-45's** – Ethernet connections for control and digital audio. If

second port is used, should go to a separate (redundant network) switch.

(G) **Amp Fault Logic Inputs** – Dry contact closures for amp channel faults from the amplifier (e.g., amp blew a fuse or went into protect mode).

(H) **Power Input** – 5404DZM power from an EN 54-4 listed power supply.

(I) **Main Amplifier Inputs** – Amplifier speaker outputs from the main amps.

(J) **Backup Amplifier Inputs** – Amplifier speaker outputs from the backup amps.

(K) **Speaker Outputs** – Connect to distributed speaker lines for each channel.

(L) **Earth Ground Reference** – Connect to earth ground in order to detect speaker line connections to ground (ground faults).

3.3   Connections

3.3.1   Introduction

The 5404DZM has the following connections which are described in the sections that follow:

- Frame Power

- Ethernet

- Amp Channel Audio

- Amp Channel Outputs (Main & Backup)

- Power Status Logic Inputs

- Amp Fault Logic Inputs

- Amp Power Control

- Speaker Line Outputs

- Fault Relay

- Earth Ground Reference

- Ambient Sensors

3.3.2   Frame Power Connection

Power may be connected to the two power terminals in either polarity. For EN 54-16 compliance, this should be wired to an EN 54-4 rated power supply. The unit is rated to run from either a 12V or 24V power supply. The 24VDC option is recommended. The gauge of the wire connecting to the power supply should be at least 18AWG and no larger than 16AWG.

3.3.3   Ethernet Connection

The Ethernet connections are made via RJ-45 connectors and cabling appropriate for 100Base-TX.

3.3.4   Amp Chan Audio Connection

The audio outputs are balanced with plus, minus and shield connections. When connecting to a balanced audio input, the connections should be made one-for-one. When connecting to an unbalanced input, one should connect the minus pin of the 5404DZM output to the ground/shield of the audio input as shown below.
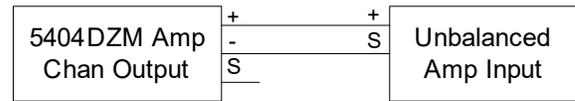
3.3.5   Connect Amp Chan Outputs

The outputs of the main amplifiers and if available the backup amplifiers should be wired to the inputs being careful to maintain the +/- polarity.

3.3.6   Power Status Inputs Connection

Dry contact closures for indicating loss of mains power (running on battery) and loss of 24V backup power should be made to the two logic input pairs provided.

3.3.7   Amp Fault Inputs Connection

Dry contact closures for indicating an internal amp fault for each amp channel should be connected to this. Due to their internal design the 5414AMP, 5434AMP and 5454AMP have one status output per pair of channels. Therefore, these logic outputs should be split out and connected to the 5404DZM logic inputs in the manner shown below.
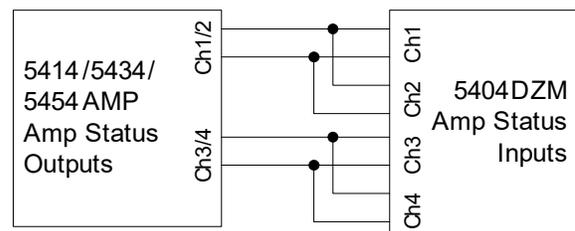
3.3.8   Amp Power Control Connection

This should be a one-to-one connection to the 5414/5434/5454AMP power control input being sure to observe the polarity (e.g., plus to plus and minus to minus).

3.3.9   Speaker Line Connections

The speaker outputs should be connected to the speaker line field wiring using a gauge of wire appropriate to the total load on that speaker run.

3.3.10   Fault Relay Connection

The relays are form-C which means there are both NO (Normally Open) and NC (Normally Closed) connection in addition to the common (C) connection. Typically external devices are attached to the C and either the NO or NC connections depending on the desired signaling with the external system.

3.3.11   Earth Ground Reference Connection

This should be connected to an earth ground point in order to allow the 5404DZM to properly detect speaker line ground faults.

3.3.12   Ambient Sensor Connections

Each ambient sensor has three connections: ground, power and sensor signal. The ground connection should go to the pin with the ground symbol. The power connection should go to the pin with the plus sign (+) and the sensor signal should go to the pin in between (labeled 1A, 1B, etc. up to 4B). The connections are labeled by amp channel 1 – 4 and A and B for the two possible sensors per channel. If only one sensor is available for a channel, then it should be connected to the A pins.

3.4   Technical Specifications

3.4.1   Physical Characteristics

Height .... 1.75", 1 rack unit (4.4 cm)

Width (without rack mount ears) .... 17.2" (43.7 cm)

Depth .... 12.25" (31.1 cm)

Recommended Mounting Depth .... 18" (45.7 cm)

Weight .... 10.15 lbs (4.60 Kg)

3.4.2   Environmental Information

Operating Temperature Range ....
....32˚F - +104˚F(0˚C – +40˚C)

Storage Temperature Range...
....................................-4˚F – +158˚F(-20˚C – +70˚C)

3.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking
.... EN 54-16

3.4.4   Power

Supply Voltage ....12 or 24 VDC

Recommended Supply Voltage .... 24 VDC

Supply Power (max) .... 15.7 Watts

Supply Power (min/Power Save) .... 12.3 Watts

3.4.5   Audio Characteristics

Audio Output Level .... 0 dBu Max (Balanced)

Output Impedance .... 50 Ω

Total Harmonic Distortion ....<1% @ 1 kHz

Audio Bandwidth .... 20 Hz-20 kHz

Main Amplifier Inputs .... 500 Watts Max/Channel

Backup Amplifier Inputs............ 500 Watts Max/Channel

Speaker Outputs .... 500 Watts Max/Channel

3.4.6   Input/Output Characteristics

Form C Fault Relay ....2 Amps @ 110 VDC Max

All Logic Inputs

LOGIC ACTIVE .... 0.08 VDC Max or Closed

LOGIC IN-ACTIVE............... 2 VDC – 3 VDC Max or Open

Amp On/Off Control

AMP OFF .... /-12 VDC @ 0.08 Amps for 0.02 sec

AMP ON .... +12 VDC @ 0.08 Amps for 0.02 sec

3.4.7   Ethernet Connections

Medium... Copper, 100Base-TX

Preferred Cable .... UTP cable Category 5

Maximum Length .... 100M from switch

Signal Levels ....According to IEEE 802.3

3.4.8   Other Connections

Power .... 2-pin Phoenix, 3.81 mm spacing
with locking screws

Redundant Ethernet (2) RJ-45

Amp Chan Out .... 10-pin Phoenix, 3.81 mm spacing

AC/DC Amp Power Status (2) & Amp On/Off Control 6-pin Phoenix, 3.81 mm

Amp Fault .... 8-pin Phoenix, 3.81 mm spacing

Form C Fault Relay Output ....
.... 3-pin Phoenix, 3.81 mm spacing

Ambient Sensors (typical of 2) ....
.... 12-pin Phoenix, 3.81 mm spacing

Main Amp Inputs ....
.... 8-pin Phoenix, 5.08mm spacing

Backup Amp Inputs ....
.... 8-pin Phoenix, 5.08mm spacing

Speaker Line Outputs (4)..
.... 2-pin Phoenix, 5.08mm spacing

4. 5432DZM Digital Zone Manager

4.1 Introduction

The 5432DZM Digital Zone Manager provides processing and management of thirty (32) paging zones derived from four (4) channels of amplification. It provides line level audio outputs to a paired four-channel amplifier unit. Digital Signal Processing (DSP) is provided on each of the four (4) output channels. This includes: input level controls, paging routing, automatic ducking of background music, equalization (high pass filters, low pass filters, up to 40 milliseconds of delay, plus up to 7 parametric bands per amplifier channel).

The 5432DZM provides backup amplifier switching for the four amplifier channels. It also contains integrated supervision that monitors each signal path and reports any failures to the 5400ACS. The 5432DZM supports the following functions:

- Convert four channels of Dante digital audio to balanced analog amplifier channel inputs.

- Provide redundant Ethernet ports containing all control and digital audio.

- Route amplifier channel outputs to up to eight (8) speaker lines per channel via line supervision circuitry.

- Switch between primary and backup amplifier inputs.

- Supervise mains and backup power to the paired (main) amplifier

- Supervise paired amplifier channel status

- Control power of amplifier, so in Power Save Mode the amplifier is in standby, powering on periodically to test

- Provide an overall fault relay output

- Provide status LEDs on the front of fault conditions as well as paging, alarm, amp backup conditions and whether each speaker line is active or in fault.

These functions are shown diagrammatically in Figure 4-1.
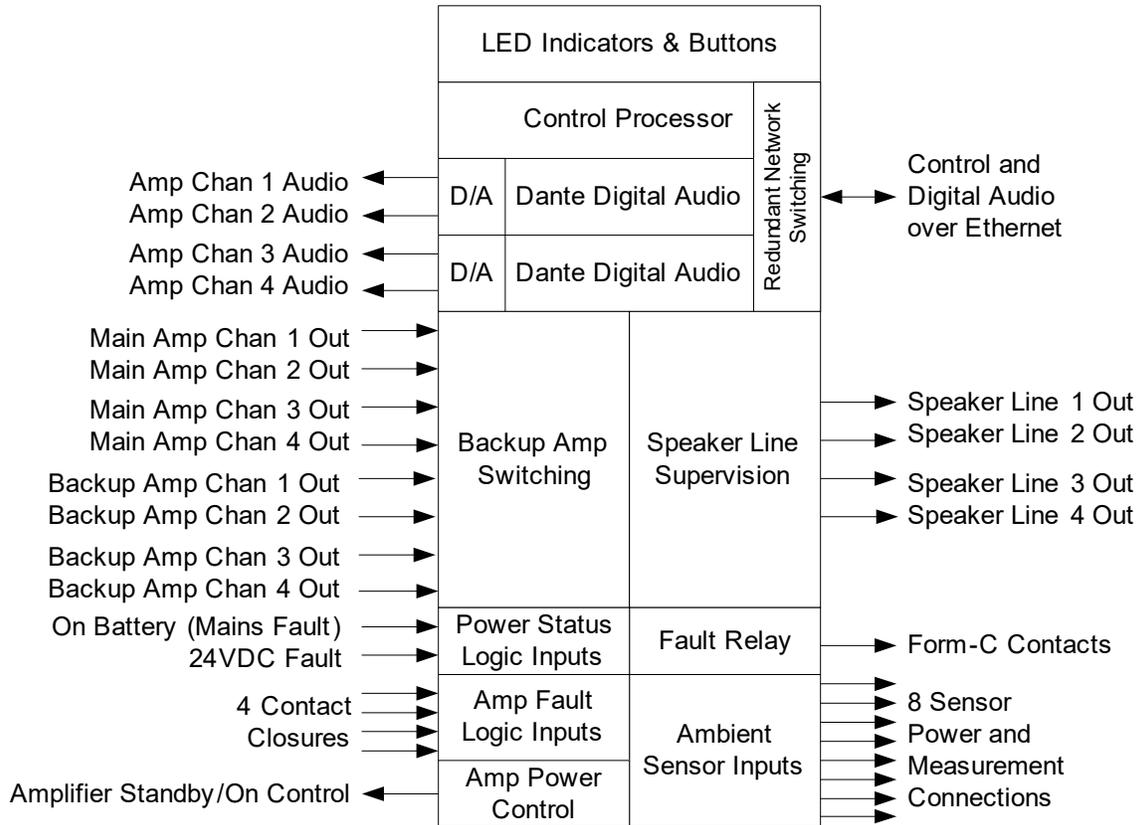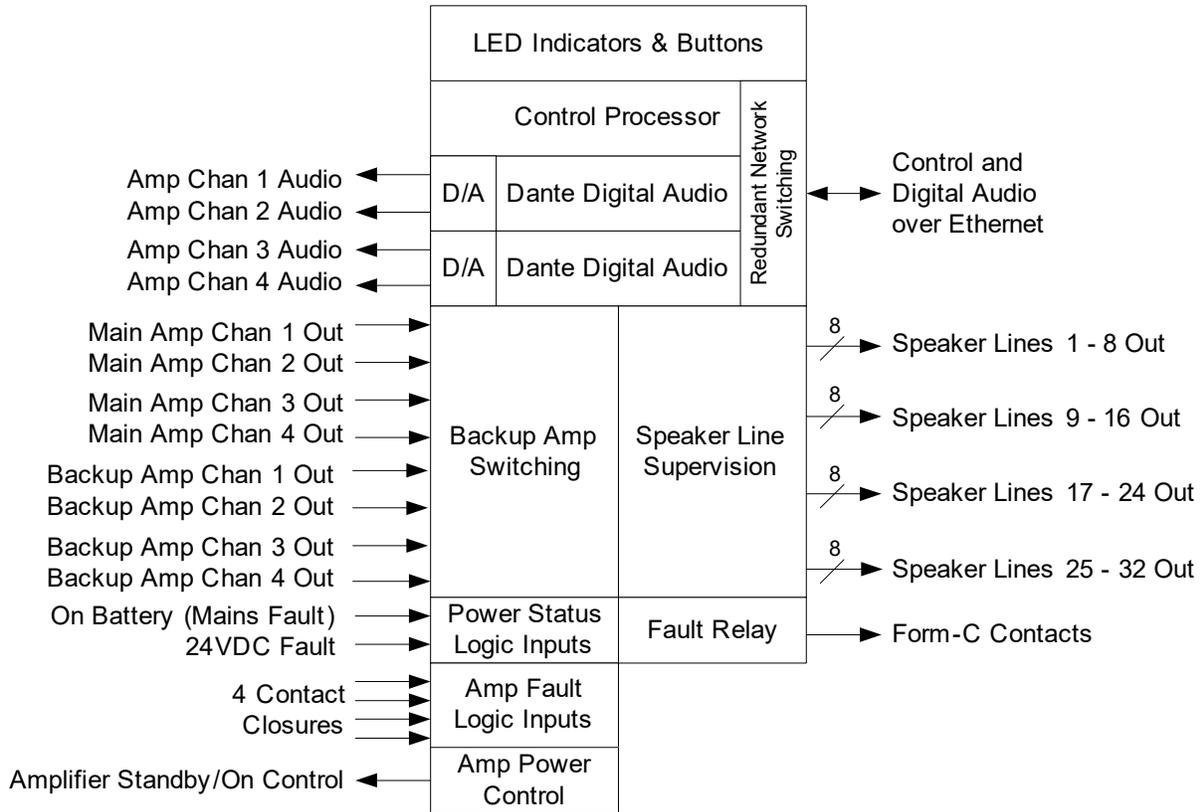
Figure 4-1:   5432DZM Functional Block Diagram

4.2   Controls, Connectors and Indicators

4.2.1   Front

The indicators and controls on the front of the 5432DZM are shown in Figure 4-2 and are described in the text which follows.


Figure 4-2:   5432DZM Front Panel Indicators and Controls

(A) **Amplifier Status LEDs** – Shows green when amplifier is powered on and not in alarm or faulted. Shows Yellow when amplifier is powered on and is faulted, but not in alarm. Shows red when amplifier is powered on and is in alarm. LED is off when amp is off, such as between testing or alarms when the unit is in Power Save Mode.

(B) **Amplifier Backup LEDs** – Shows green when backup amp relay is engaged for this amp channel.

(C) **Speaker Line Fault LEDs (8 per amp channel)** – Shows yellow if there is a fault on the speaker line attached to this amp channel (open, short or ground fault, or speaker load off normal).

(D) **Speaker Line In Use LEDs (8 per amp channel)** – Shows green when this speaker line is in use for BGM, announcement or alarm.

(E) **Overall Fault LED** – Shows yellow when there is any fault in the 5404DZM, associated power amplifier or speaker lines attached.

(F) **Ground Fault LED** – Shows yellow when there is a ground fault on any speaker line attached to this unit.

(G) **Power LED –** Shows green when the 5404DZM has power.

(H) **Power Save Mode LED** – Shows yellow when the 5404DZM is in Power Save Mode (e.g., when running on battery backup).

(I) **Announce/Alarm LED** – Shows red when an alarm is active to any zone (amp channel or speaker line) associated with this 5404DZM. Shows yellow when there is no alarm and there is a non-emergency announcement active to any zone associated with this 5404DZM.

(J) **Lamp Test Button** – Press to illuminate all the status LEDs on the front. LEDs will go back to their normal conditions when released.

4.2.2   Rear

The connections on the rear of the 5432DZM are shown in Figure 4-3 and are described in the text which follows.
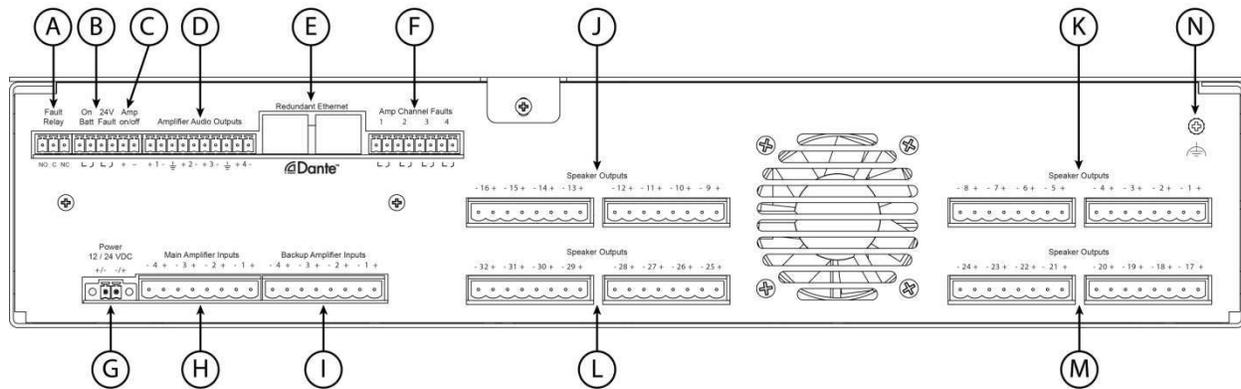
Figure 3-3:   5432DZM Rear Panel Connections

(A) **Fault Relay** - Form C relay that is triggered for any fault, i.e., whenever the general fault LED on the front is illuminated.

(B) **Power Status Logic Inputs** – On Battery (mains failure) and 24V Fault (backup power failure) indicated by dry contact closures from the associated power amp.

(C) **Amp Power Control** – Normally output voltage is around zero Volts. Goes to -12V to switch amplifier off (into standby) or +12V to switch amplifier on.

(D) **Amplifier Audio Outputs** – Balanced analog outputs that should go to associated amplifier channel inputs. Level is 0 dBu for full power out of the amplifiers.

(E) **Redundant Ethernet RJ-45's** – Ethernet connections for control and digital audio. If second port is used, should go to a separate (redundant network) switch.

(F) **Amp Fault Logic Inputs** – Dry contact closures for amp channel faults from the amplifier (e.g., amp blew a fuse or went into protect mode).

(G) **Power Input** – 5432DZM power from an EN 54-4 listed power supply.

(H) **Main Amplifier Inputs** – Amplifier speaker outputs from the main amps.

(I) **Backup Amplifier Inputs** – Amplifier speaker outputs from the backup amps.

(J) **Speaker Outputs 9 - 16** – Connect to distributed speaker lines for zones driven by amplifier channel 2.

(K) **Speaker Outputs 1 - 8** – Connect to distributed speaker lines for zones driven by amplifier channel 1.

(L) **Speaker Outputs 25 - 32** – Connect to distributed speaker lines for zones driven by amplifier channel 4.

(M) **Speaker Outputs 17-24** – Connect to distributed speaker lines for zones driven by amplifier channel 3.

(N) **Earth Ground Reference** – Connect to earth ground in order to detect speaker line connections to ground (ground faults).

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4.3   Connections

4.3.1   Introduction

The 5432DZM has the following connections which are described in the sections that follow:

- Frame Power

- Ethernet

- Amp Channel Audio

- Amp Channel Outputs (Main & Backup)

- Power Status Logic Inputs

- Amp Fault Logic Inputs

- Amp Power Control

- Speaker Line Outputs

- Fault Relay

- Earth Ground Reference

### 4.3.2   Connect Frame Power

Power may be connected to the two power terminals in either polarity. For EN 54-16 compliance, this should be wired to an EN 54-4 rated power supply. The unit is rated to run from either a 12V or 24V power supply. The 24VDC option is recommended. The gauge of the wire connecting to the power supply should be at least 18AWG and no larger than 16AWG.

4.3.3   Ethernet Connection

The Ethernet connections are made via RJ-45 connectors and cabling appropriate for 100Base-TX.

4.3.4   Amp Chan Audio Connection

The audio outputs are balanced with plus, minus and shield connections. When connecting to a balanced audio input, the connections should be made one-for-one. When connecting to an unbalanced input, one should connect the minus pin of the 5432DZM output to the ground/shield of the audio input as shown below.
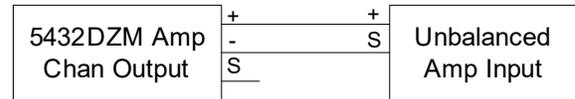

4.3.5   Amp Chan Output Connections

The outputs of the main amplifiers and if available the backup amplifiers should be wired to the inputs being careful to maintain the +/- polarity.

4.3.6   Power Status Input Connections

Dry contact closures for indicating loss of mains power (running on battery) and loss of 24V backup power should be made to the two logic input pairs provided.

4.3.7   Amp Fault Input Connections

Dry contact closures for indicating an internal amp fault for each amp channel should be connected to this. Due to their internal design the 5414AMP, 5434AMP and 5454AMP have one status output per pair of channels. Therefore, these logic outputs should be split out and connected to the 5404DZM logic inputs in the manner shown below.
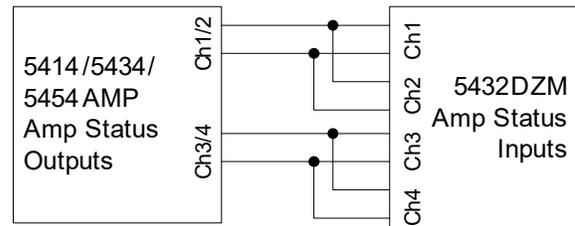
4.3.8   Amp Power Control Connection

This should be a one-to-one connection to the 5414/5434/5454AMP power control input being sure to observe the polarity (e.g., plus to plus and minus to minus).

4.3.9   Speaker Line Connections

The speaker outputs should be connected to the speaker line field wiring using a gauge of wire appropriate to the total load on that speaker run.

4.3.10   Fault Relay Connection

The relays are form-C which means there are both NO (Normally Open) and NC (Normally Closed) connection in addition to the common (C) connection. Typically external devices are attached to the C and either the NO or NC connections depending on the desired signaling with the external system.

4.3.11   Earth Ground Reference Connection

This should be connected to an earth ground point in order to allow the 5432DZM to properly detect speaker line ground faults.

4.4   Technical Specifications

4.4.1   Physical Characteristics

Height ....3.5", 2 rack units (8.8 cm)

Width (without rack mount ears) .... 17.2" (43.7 cm)

Depth .... 13.0" (31.1 cm)

Recommended Mounting Depth .... 18" (45.7 cm)

Weight .... 18.15 lbs (8.23 Kg)

4.4.2   Environmental Information

Operating Temperature Range ....
....32˚F - +104˚F(0˚C – +40˚C)

Storage Temperature Range...
.....................................-4˚F – +158˚F(-20˚C – +70˚C)

4.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking
.... EN 54-16

4.4.4   Power

Supply Voltage ....12 or 24 VDC

Recommended Supply Voltage .... 24 VDC

Supply Power (typical during test cycle) .... 54.2 Watts

Supply Power (idle) .... 32.4 Watts

Supply Power (min/Power Save) .... 19.32 Watts

4.4.5   Audio Characteristics

Audio Output Level .... 0 dBu Max (Balanced)

Output Impedance .... 50 Ω

Total Harmonic Distortion ....<1% @ 1 kHz

Audio Bandwidth .... 20 Hz-20 kHz

Main Amplifier Inputs .... 500 Watts Max/Channel

Backup Amplifier Inputs .... 500 Watts Max/Channel

Speaker Outputs .... 100 Watts Max/Channel

4.4.6   Input/Output Characteristics

Form C Fault Relay ....2 Amps @ 110 VDC Max

All Logic Inputs

LOGIC ACTIVE .... 0.08 VDC Max or Closed

LOGIC IN-ACTIVE.............. 2 VDC – 3 VDC Max or Open

Amp On/Off Control

AMP OFF .... /-12 VDC @ 0.08 Amps for 0.02 sec

AMP ON .... +12 VDC @ 0.08 Amps for 0.02 sec

4.4.7   Ethernet Connections

Medium... Copper, 100Base-TX

Preferred Cable .... UTP cable Category 5

Maximum Length .... 100M from switch

Signal Levels ....According to IEEE 802.3

4.4.8   Other Connections

Power .... 2-pin Phoenix, 3.81 mm spacing
with locking screws

Redundant Ethernet (2) RJ-45

Amp Chan Out .... 10-pin Phoenix, 3.81 mm spacing

AC/DC Amp Power Status (2) & Amp On/Off Control 6-pin Phoenix, 3.81 mm

Amp Fault .... 8-pin Phoenix, 3.81 mm spacing

Form C Fault Relay Output ....
.... 3-pin Phoenix, 3.81 mm spacing

Main Amp Inputs ....
.... 8-pin Phoenix, 5.08mm spacing

Backup Amp Inputs ....
.... 8-pin Phoenix, 5.08mm spacing

Speaker Line Outputs (32)..
.... 2-pin Phoenix, 5.08mm spacing

5. 5450CS Communication Station

5.1   Introduction

The 5450CS-H/-G digital communications station is a fully programmable touch screen user interface device for initiating audio/visual announcements with the 5400 Series Announcement Control Systems, and may also be used at an emergency position to fully supervise and control the system during alarm conditions. Each model utilizes an electret condenser cartridge that is positioned in the housing such that its frequency response is enhanced, maximizing good sound quality and intelligibility of live pages. The 7" diagonal screen provides information on zone, fault and alarm status in the system as well as numerous configurable controls for initiating alarms as well as non-emergency messages or live pages.

The 5450CS supports the following functions, which are also shown below in Figure 5-1.

- Touch screen user interface, supplemented with power, fault, alarm, ready and busy LEDs

- Microphone signal processing, including audio compression

- Auxiliary audio input such as for a local background music (BGM) source

- Auxiliary audio output such as for a local/monitor zone output

- Redundant Ethernet connection.
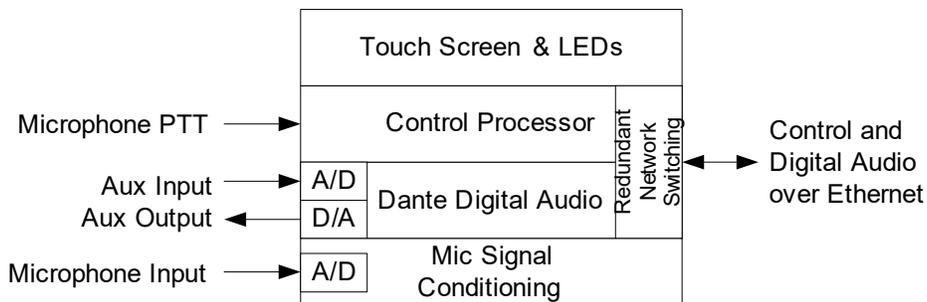
Figure 5-1:   Functional Block Diagram of the 5450CS

5.2　Controls, Connectors and Indicators

5.2.1　Front

The only indicators and connection on the front of the 5450CS is shown in Figure 5-2 and are described in the text which follows.
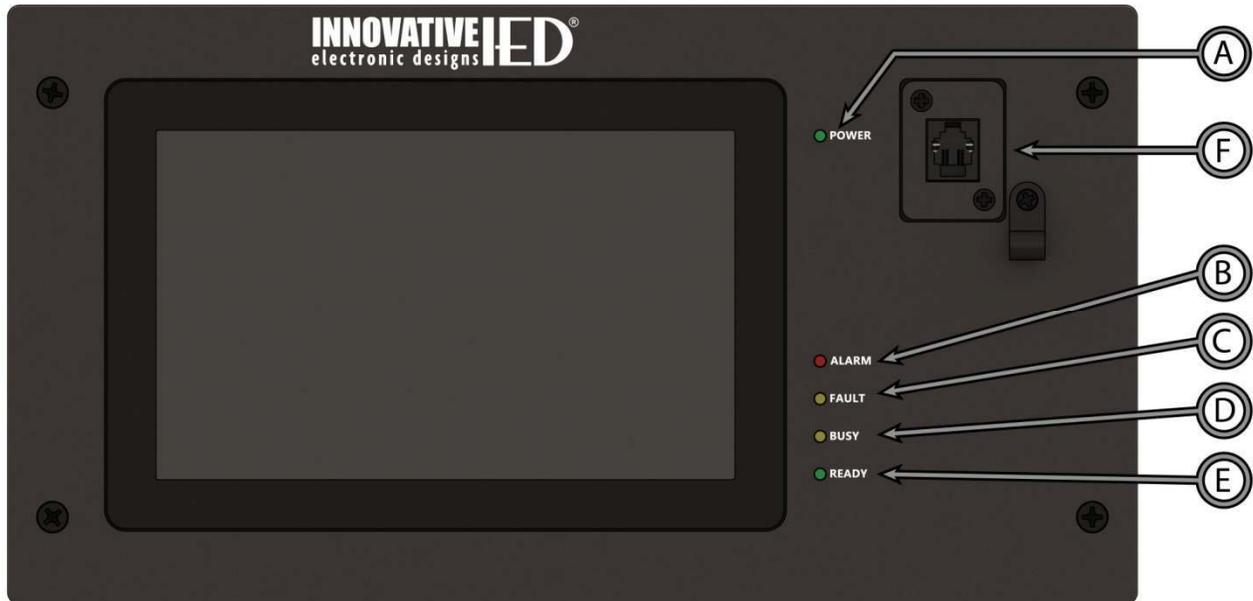

Figure 5-2:　5450CS Front Panel Indicators and Connections

(A) **Power LED** – Lights green when the station is powered up.

(B) **Alarm LED** – Lights red when there is an alarm active in the system.

(C) **Fault LED** – Lights yellow when there is a fault in the system.

(D) **Busy LED** – Lights yellow when the system is not ready to start a live page with the microphone, either due to higher priority alarms/announcements in the system or time to establish the audio routing with all endpoints required.

(E) **Ready LED** – Blinks green (fast double-blink in sync with the beeper) when the system is ready for a live page and is waiting on the user to push the PTT (Push-To-Talk) switch on the hand-held microphone or the Start button on the touch screen if the 5450CS has a gooseneck mic station. The LED goes solid when the live page is active. The LED will do a slow blink when the live page is nearing the time limit for the announcement.

(F) **Microphone Jack** – Jack to plug the microphone into. Shown in the figure is the jack for the hand-held. The gooseneck jack is a 5-pin XLR.

5.2.2 Rear

The connections on the rear of the 5450CS are shown in Figure 5-3 and are described in the text which follows.
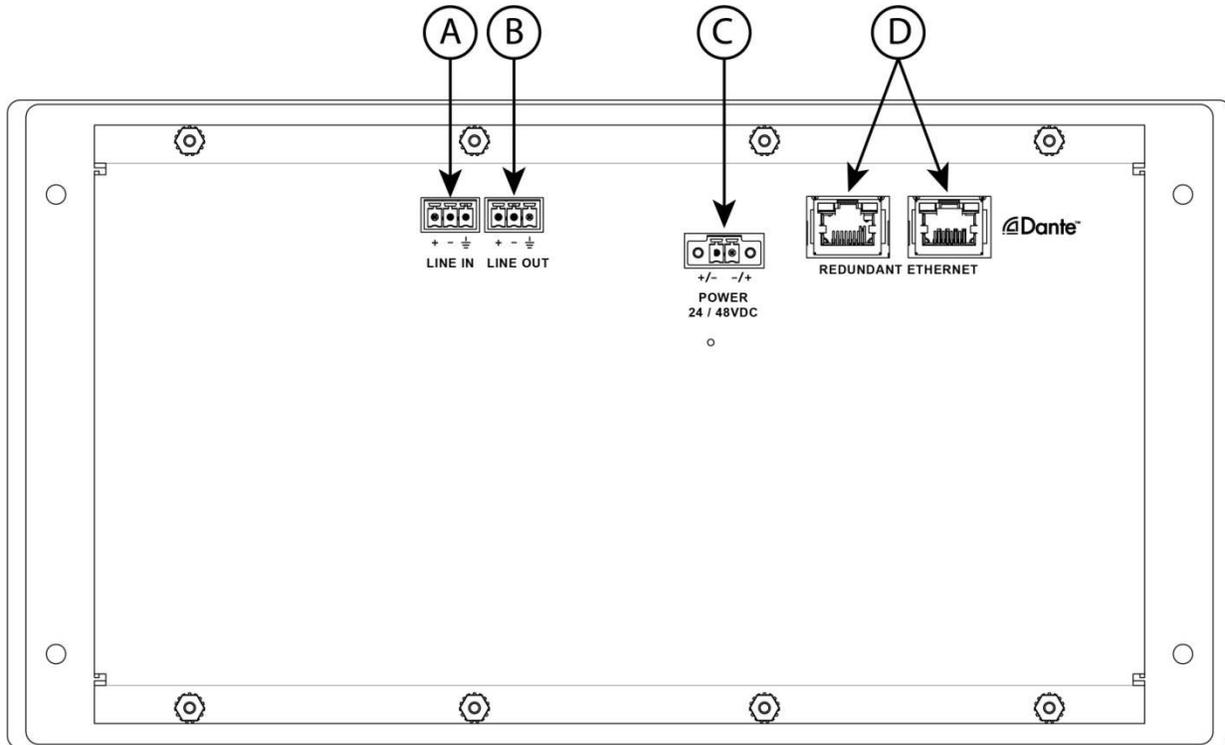
Figure 5-3:   5450CS Rear Connections

(A) **Auxiliary Audio Input** – Balanced line level input for special BGM (Background Music) or other function.

(B) **Auxiliary Audio Output** – Balanced line level audio output such as for a local zone.

(C) **Power Input** – As an alternative to PoE (Power over Ethernet), power can be supplied via this input.

(D) **Redundant Ethernet** – Dual redundant Ethernet RJ-45 jacks.

5.3   Connections

5.3.1   Introduction

The following connections are possible to the 5450CS, each of which is described in a section that follows:

- Power (opt.)
- Auxiliary Audio Input
- Auxiliary Audio Output
- Ethernet

5.3.2   (opt.) Power Connection

In lieu of Power of Ethernet (PoE) on the Ethernet connection, the unit may be powered from a 24 or 48VDC supply, connected to the power input on the rear of the unit. This connection is not required if PoE power is available on either of the Ethernet inputs.

5.3.3   Auxiliary Audio Input Connection

The audio input is balanced with plus, minus and shield connections. When connecting to a balanced audio output, the connections should be made one-for-one. When connecting to an unbalanced output, one should connect the

ground/shield from the output to both the shield and minus pin`` of the audio input on the 5450CS as shown below.

Unbalanced Audio Output	+	+	5450CS Aux Input
	S	-	
		S	
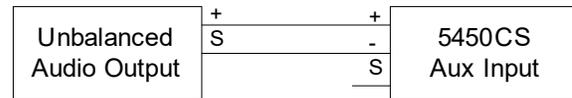
5.3.4   Auxiliary Audio Output Connection

The auxiliary audio output is balanced with plus, minus and shield connections. When connecting to a balanced audio input, the connections should be made one-for-one. When connecting to an unbalanced input, one should connect the minus pin of the 5450CS output to the ground/shield of the audio input as shown below.

5450CS Aux Output	+	+	Unbalanced Audio Input
	-	S	
	S		
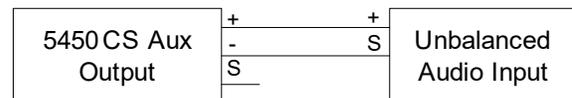
5.3.5   Ethernet Connection

The Ethernet connections are made via RJ-45 connectors and cabling appropriate for 100Base-TX.

5.4   Operation

The primary operation of the 5450CS is via the touch screen interface. The exact layout of on-screen "buttons" and other controls to launch messages are configurable for the particular installation, but are based on "template styles" provided by the configuration software. Any particular installation may not use all of these styles. The sections which follow describe the general controls and common status windows, including the icons always on the top of the screen. These general controls and common status windows are:

- Login window

- Screen top icons

- Alarm Status Window

- Zone Status Window

- Fault Status Window

- Station Settings Window

- Announcement/Station Status Windows (several)

Plus there are sections for the following template styles:

- Button pages

- Zone selection with four button pages

- Zone selection live page

- BGM Control Page

- Web link icon page

5.4.1   Login Window

The Login window is presented any time the communication station is locked. In many installations this will be the default condition for the mic station as well as the state it reverts back to after any period of idle time (how long this period is may be set by the system installer/configurator). The Login window appears as below in Figure 5.4-1.
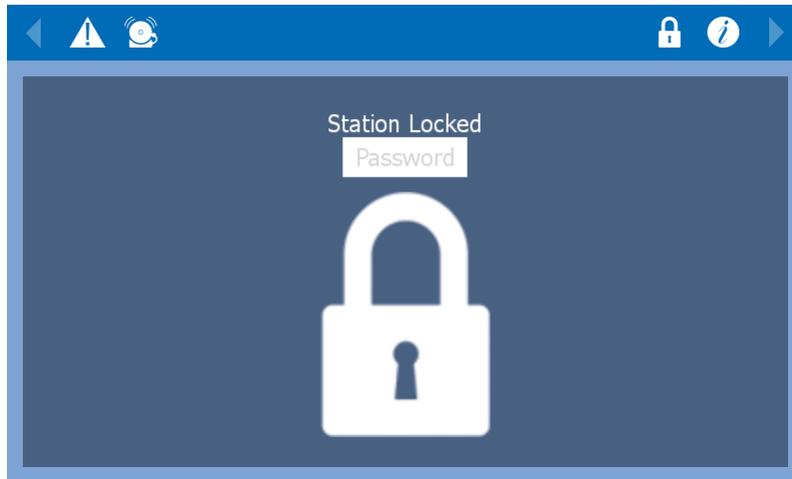
Figure 5.4-1:   The Login Window

The user logs in by touching the edit box that says "Password" in gray letters. This brings up a keypad such as shown below in Figure 5.4-2. One enters the numeric password on this keypad and then clicks on the "**enter**" button. As one types, the key entries will be shown as asterisks (*) in the edit box. The other keys on the left are backspace (delete the last digit entered) and clear (delete all digits entered).
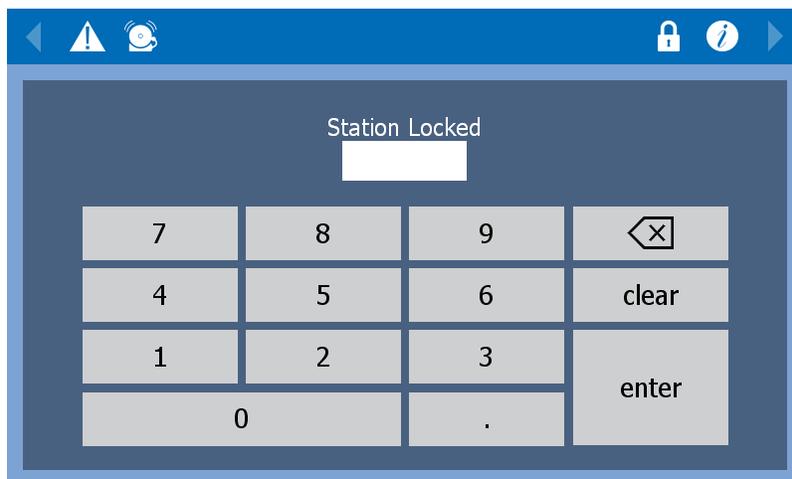
Figure 5.4-2:   The Login Window w/ Entry Keypad

5.4.2   Screen top icons

At the top of the 5450CS screen is a row of icons and a caption on a single bar. The items available here are shown in Figure 5.4-3 and are described below.
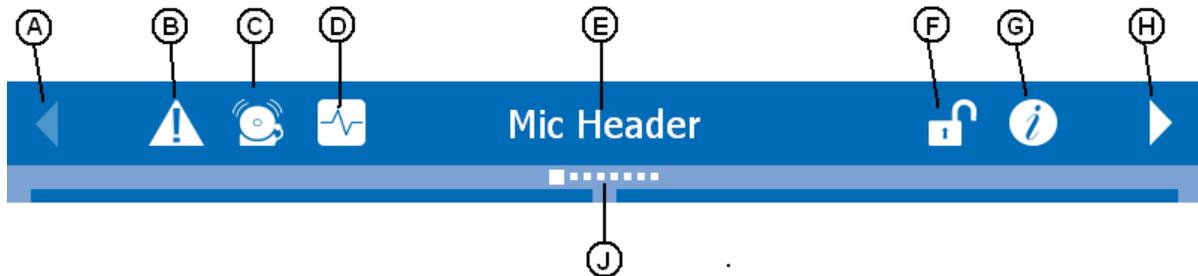
Figure 5.4-3:   Screen Top Icons

(A) **Page Left Control** – Touching this when enabled will move to the previous page or lower numbered page of controls.

(B) **Display Faults Icon** – If there are any current faults, a red counter number in a circle (e.g., ❶) will appear over top of this icon. Touching this icon will bring up the Fault Status window (section 5.4.3).

(C) **Display Alarms Icon** – If there are any currently active alarms, a red counter number in a circle will appear over top of this icon. Touching this icon will bring up the Alarm Status window (section 5.4.4).

(D) **Zone Status Icon** – Touching on this icon will bring up the Zone Status window (section 5.4.5)

(E) **Mic Station Caption** – If a user is logged in, the user name is displayed. Otherwise the mic station name is displayed.

(F) **Log out Control** – Touching this will lock the mic station by logging out (return to the

Log-in Window). This icon will only appear if station is lockable (requires a password to access).

(G) **Station Settings Icon** – Touching this icon brings up the Stations Settings window (section 5.4.6)

(H) **Page Right Control** – Touching this when enabled will move to the next page or higher numbered page of controls.

(J) **Page Location Indicator** – This area shows the user which page of announcement controls is currently displayed. In the figure, it is page 1 of 8 pages.

Note: Icons B, C and D may not be displayed for all users. Usually, these are enabled only for emergency personnel who log in.

5.4.3   Fault Status Window

The Fault Status window appears as in the example below in Figure 5.4-4. Features of the window are explained in the text below.
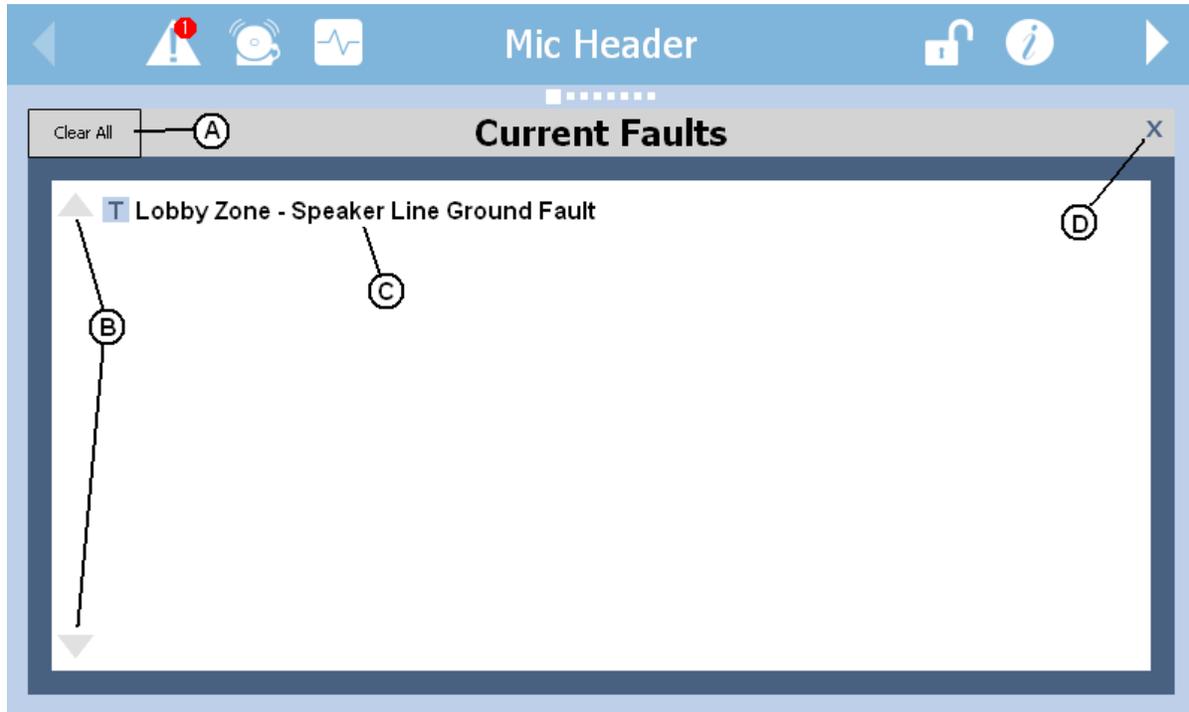
Figure 5.4-4:   Fault Status Window

(A) **Clear All Button** – Touching this will reset or clear all faults in the system, after confirmation by touching the green button in the Clear All Faults prompt (Figure 5.4-5). If the fault conditions still exist, they will re-appear after an appropriate interval of time.
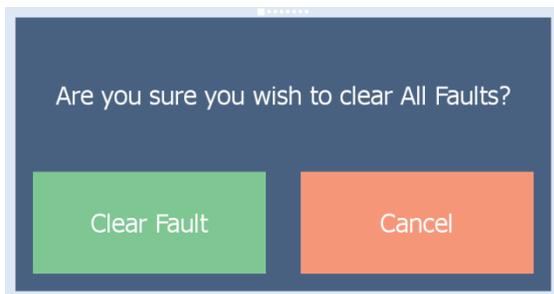
Figure 5.4-5:   Clear All Faults Prompt

(B) **Scroll Up/Down Buttons** – If the list of faults is more than one page long, these controls can be used to navigate up or down the list. Touch screen flicking gestures may also be used to scroll through the list.

(C) **Fault Description** – Descriptions of the faults appear in this list in plain text form. The type of fault is indicated by a letter in a light blue box in front of the description:

   T – Trouble Fault

   S – Supervisory Fault

(D) **Window Close Control** – Touch this X to close the Fault Status window. Alternately, touching anywhere on the icon bar above the window will close it.

5.4.4   Alarm Status Window

The Alarm Status window appears as in the example below in Figure 5.4-6. Features of the window are explained in the text below.
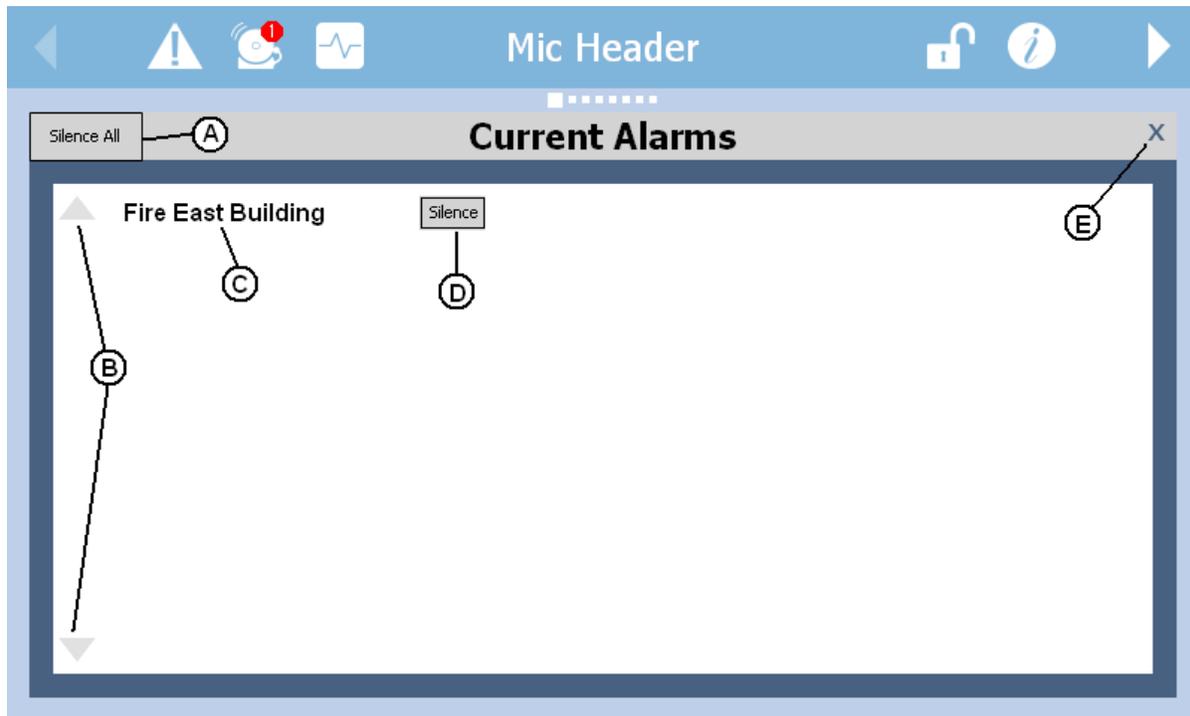
Figure 5.4-6:   Alarm Status Window

(A) **Silence All Button** – Touching this will clear or silence all alarms in the system, after confirmation by touching the green button in the Silence All Alarms prompt (Figure 5.4-7).
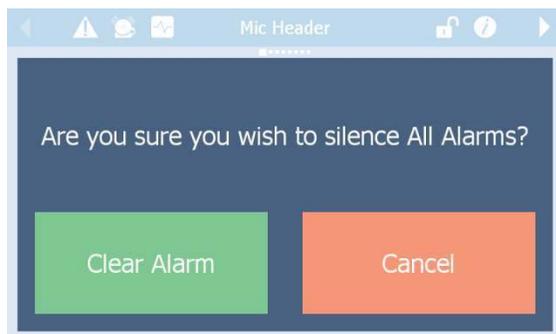
Figure 5.4-7:   Silence All Alarms Prompt

(B) **Scroll Up/Down Buttons** – If the list of alarms is more than one page long, these controls can be used to navigate up or down the list. Touch screen flicking gestures may also be used to scroll through the list.

(C) **Alarm Description** – Descriptions of the active alarms appear in this list in plain text form.

(D) **Silence Button** – Touch this to silence an individual alarm, after confirmation similar to prompt shown in Figure 5.4-7. If there are multiple alarms in the list, each will have its own silence button.

(E) **Window Close Control** – Touch this X to close the Alarm Status window. Alternately, touching anywhere on the icon bar above the window will close it.

5.4.5   Zone Status Window

The Zone Status window appears as in the example below in Figure 5.4-8. The features of this window are explained in the text which follows.
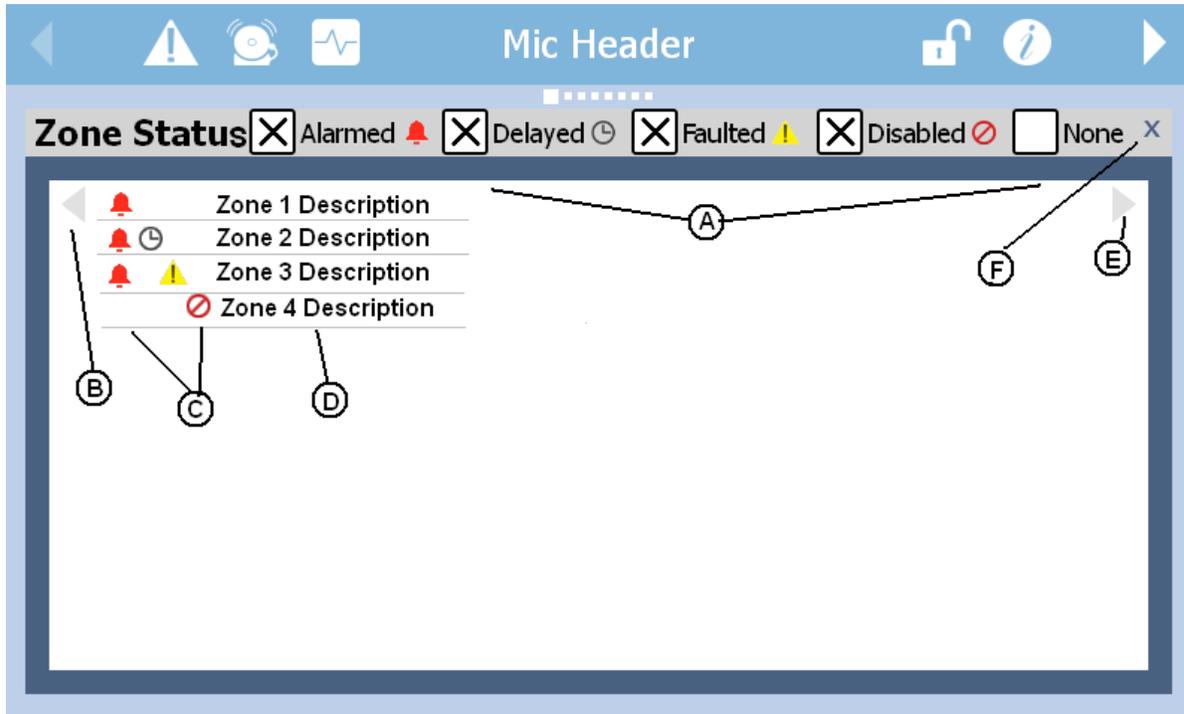
Figure 5.4-8:   Zone Status Window

(A) **Status Filter Choice Checkboxes** – Select to show zones with that status. For example, in the figure only zones with one of the four checked statuses will be displayed. Zones that are idle, don't have any faults and are not disabled do not appear. To see all zones in the system, the fifth checkbox would have to be checked.

(B) & (E)   **Scroll Left/Right Controls** – If there are more zones than will fit in the window, additional zones are viewable as columns. These controls can be used to view additional columns of zones. The touch screen flick gesture may also be used to move the view left or right.

(C) **Zone Status Icons** – These icons show the status for each zone as per the legend built into the filter checkboxes.

(D) **Zone Descriptions** – Descriptions for the zones displayed as entered when the system was configured.

(F) **Window Close Control** – Touch this X to close the Alarm Status window. Alternately, touching anywhere on the icon bar above the window will close it.

5.4.6   Station Settings Window

The Station Information window appears as in the example in Figure 5.4-9 below. The features identified by letter are described below in text.
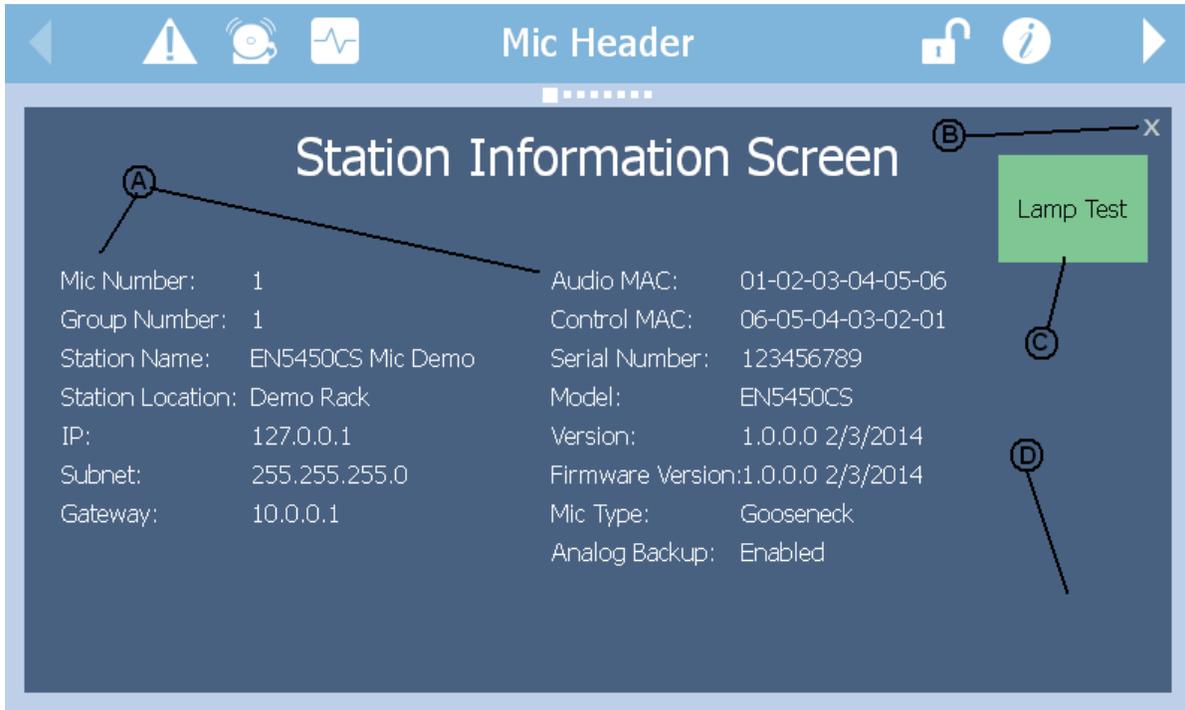
Figure 5.4-9:   Station Settings Window

(A) **Station Settings** – This is a list of properties that may be configured for the mic station or are useful to be reported, such as MAC addresses and version numbers.

(B) **Window Close Control** – Touch this X to close the Alarm Status window. Alternately, touching anywhere on the icon bar above the window will close it.

(C) **Lamp Test Button** – Touch this button to momentarily turn on all the station LEDs.

(D) **(hidden) Configuration Button** – Touch this area in the lower right corner to bring up a password entry screen such as the one shown in Figure 5.4-2 to log into the mic station. To get into the configuration mode, one must enter the password: 5022677436
Once in configuration mode, the Station Settings window appears as in Figure 5.4-

10. Editable settings have a button with [E] beside them.

Figure 5.4-10:   Station Settings w/ Edit Options

Pressing on one of the [E] buttons will bring up a keypad to edit, either a numeric-only one, identical to the one used for passwords, or the alpha-numeric one shown in Figure 5.4-11. The current value will be displayed in the edit box at the top. If one does not wish to change it, just touch the "enter" button.

Figure 5.4-11:   Full Keypad Window

If a property option is not alpha-numeric, but a matter of a choice, then a prompt such as the ones in Figure 5.4-12 will be presented. Simply touch the proper option button.
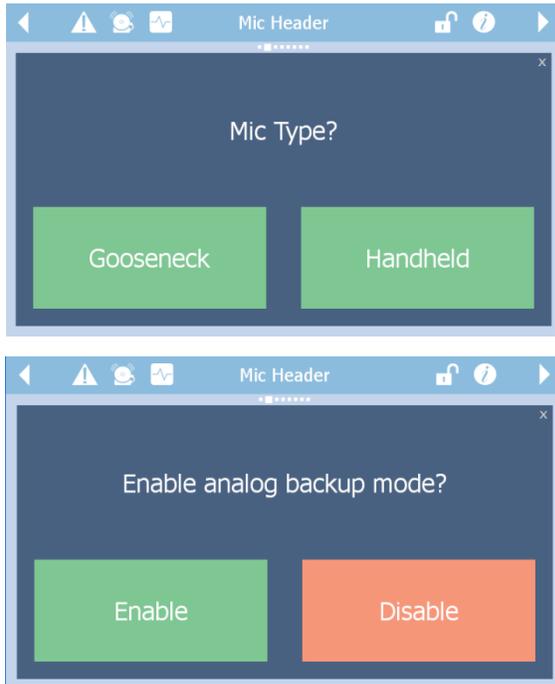
Figure 5.4-12:   Example Property Setting Prompts

If any of the settings are changed, then, the Station Settings window will display "Apply Changes" and "Discard Changes" buttons at the bottom of the window as shown in Figure 5.4-13. Note, that the changed setting(s) are highlighted in green.

Figure 5.4-13:   Apply Changes Prompt

If one clicks on the close X when in this state, then the window remains in this uncommitted property change state. Going back into the Station Settings window will show the changed setting(s) still highlighted. To apply or discard these changes, one needs to log back in to the edit mode as described above. This will bring the window back to the state shown in Figure 5.4-13 from which the "Apply Changes" or "Discard Changes" choice can be made.

5.4.7   Announcement/Station Status Windows

There are four windows that display announcement and control station status:

- Establishing Communications Status Window

- Announcement Ready Status Window

- Announcement Active Status Window

- Chime Active Status Window

- Busy Status Window

The Establishing Communication Status Window appears as in Figure 5.4-14. This window appears upon mic station boot up until communications with the controller are established and whenever the mic station has not heard from the voice alarm system controller in a certain period of time, or when the mic station has attempted to contact the controller and the communication attempt failed.

Figure 5.4-14:   Establishing Communications Status Window

The Announcement Ready Status Window appears as in Figure 5.4-15. This window appears whenever the announcement requires the use of the microphone. During this state, the green Ready LED on the mic station will double-blink along with the beeper. The window appears differently depending on whether the mic station has a gooseneck microphone or a hand-held microphone as shown in the figure.

Gooseneck Mic Configuration   Hand-Held Mic Configuration
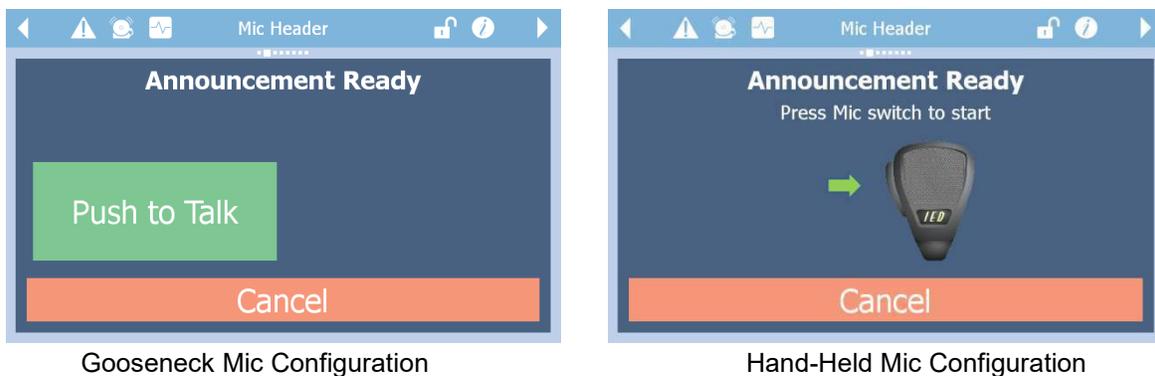
Figure 5.4-15:   Announcement Ready Status Windows

The user should touch the "Push to Talk" button or the squeeze the Push to Talk (PTT) switch on the hand-held mic to move the announcement into the active state. The user has five seconds to press the appropriate button or switch, or else the mic station will time out and return to the idle state. If the user doesn't wish to go active, instead of waiting the five seconds, the "Cancel" button may be touched.

Once an announcement has gone active, then beeper will be silenced, the Ready LED will come on solid, and the Announcement Active Status window appears as shown below in Figure 5.4-16, again in both gooseneck and hand-held versions. Pushing the "Push to End" button or releasing the PTT switch will terminate the announcement and return the mic station to the idle state. If an announcement has a time limit, the green Ready LED may start flashing slowly a few seconds before the time limit as a warning.

Gooseneck Mic Configuration   Hand-Held Mic Configuration
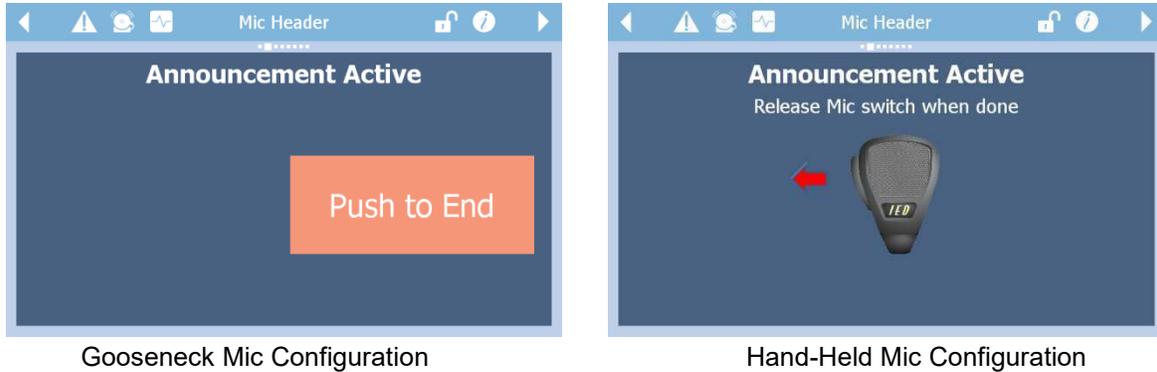
Figure 5.4-16:   Announcement Active Status Windows

If the announcement requires a pre-announcement chime, then before the active status window is displayed, the mic station displays the Chime Active Status window as shown in Figure 5.4-17. This window will go away and be replaced by the Active Status window after the chime has completed and it is now OK to talk into the microphone.
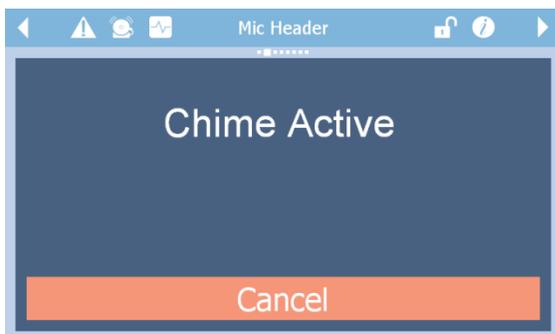
Figure 5.4-17:   Chime Active Status Window

It may be possible that some or all desired zones for an announcement are in use by an announcement of equal or higher priority at the time the user wishes to make an announcement. If this is the case, the yellow busy LED will illuminate and the user will see the Busy Status window as shown in Figure 5.4-18. When the zones become available, this window will go away and be replaced by the Ready Status window.

Figure 5.4-18:   Busy Status Window

If one doesn't not want to wait for the zones to become available, the announcement request may be canceled by touching the Cancel button.

5.4.8 Button pages

There are currently four styles of button pages available to the system installation/configuration person with two, four, eight and 16 buttons per page. Examples are shown below in Figure 5.4-19.
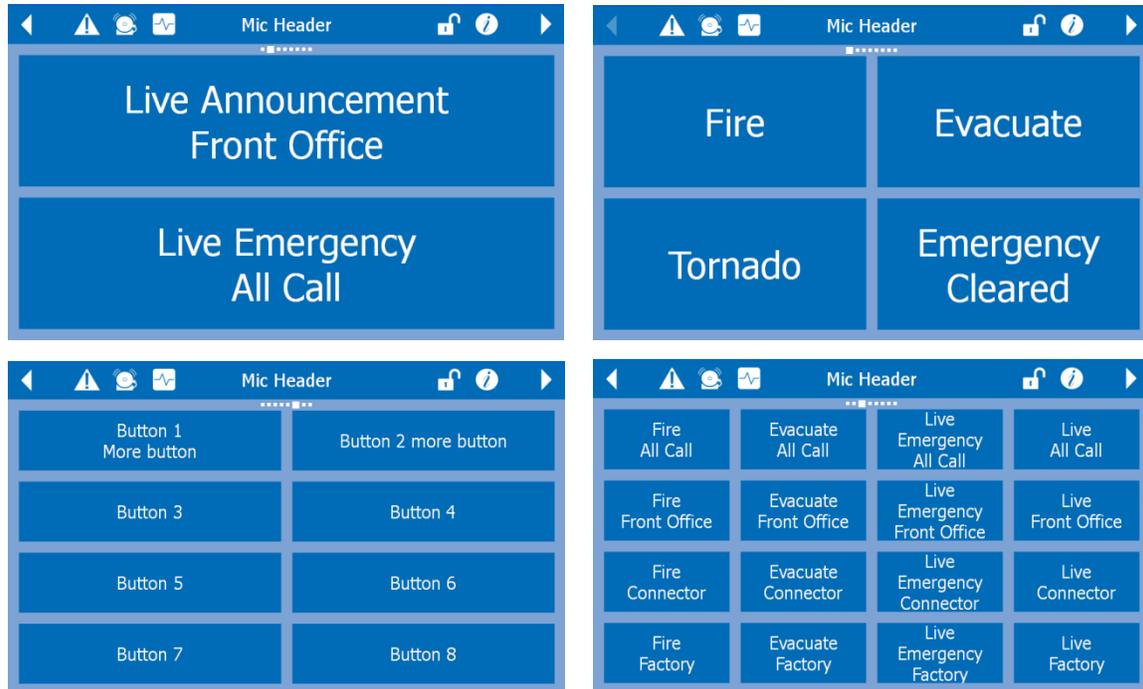
Figure 5.4-19: Button Page Options

All buttons have the same capabilities, which are also configurable at system installation time. These options include:

- Initiate (launch) an Alarm. An Alarm can be one or more actions started at the same time such as play an emergency message to an area (zone group) while muting neighboring zones to that area.

- Initiate a non-emergency message playback, optionally with repeats and time between plays

- Initiate a live page, either alarm/emergency level or non-emergency level.

In addition, there are two activation options that may be applied to a button:

- Get user confirmation before initiating

- Rather than only initiating a message, toggle a message on and off.

The confirmation is done via a Yes/No prompt window such as the one shown in Figure 5.4-20. The text after "Initiate:" comes from the button that was touched (in this case "Fire").

Figure 5.4-20:   Example Initiation Confirmation Prompt

While the announcement or alarm associated with a button is active, it will change to green from its normal green color. A button configured for toggle can be touched while it is green (active). When this is done, the user will be presented with a confirmation window such as in Figure 5.4-20, except with text asking to confirm ending the announcement. Once confirmed, the announcement will be terminated.

5.4.9   Zone Selection with Four Button Pages

Another option for configuring pages on the 5450CS is the zone selection with buttons type page as shown in the example in Figure 5.4-21.

Figure 5.4-21:   Example Zone Selection with Buttons Page

The list of available zones (which may actually be zone groups or collections of zones) is shown on the left. There are up/down navigation arrows on the extreme left. Zones can be toggled between selected (green background) and not (white background) by touching the line the zone is one. Alternately, all zones may be selected by touching the "All Zones" button, or all zones de-selected by touching the "Clear Zones" button.

The buttons on the right are defined during installation and configuration and can be actions like on the buttons described in the previous section, only instead of having fixed destinations they use the currently selected set of zones as their destination. These buttons have the same activation options as described above as well (e.g., confirmation and toggle). If no zones are currently selected, the buttons will be appear dimmed down and will be un-selectable.

5.4.10   BGM Control Page

Another option for configuring pages on the 5450CS is the Background Music Control page type as shown in the example in Figure 5.4-23.

Figure 5.4-23:   Example BGM Control Page

The list of available zones or zone groups for which BGM can be selected and controlled are shown in the list box in the center of this page. This operates just like the list on the Zone Selection with Four Buttons page. There are up/down navigation arrows on the extreme left. Zones can be toggled between selected (green background) and not (white background) by touching the line the zone is one. Alternately, all zones may be selected by touching the "All Zones" button, or all zones de-selected by touching the "Clear Zones" button.

The buttons are the left are volume control buttons. The buttons icons signify the following from top to bottom: volume up, volume down, mute BGM and un-mute BGM. These commands act upon the currently selected zones/groups in the list area in the center.

The buttons on the right are BGM sources where were configured in the 5400 Designer software for this mic station template. Pressing one of these buttons will route that audio source to the currently selected zones/groups in the list area, as its background music input (i.e., override-able by paging or alarms). The "None" button is the example, is not a fixed function, but is one of the options available to the user when defining the BGM source buttons. In addition to "None", there is an option in Designer to set the BGM to "Default" which means go back to the (original) project settings for those zones.

> Note: Adjusting BGM level (or mute) on one zone of a cluster of 8 in a group on the 5432DZM will adjust the level in all zones in that cluster receiving BGM, since they are all driving from the same amplifier channel.

5.4.11   Web Link Icon Page

Another option for configuring pages on the 5450CS is the Web Link Icon page type as shown in the example in Figure 5.4-24. What is shown in the figure is just an example with the maximum possible icons displayed. A page configured for an installation may have fewer icons or only some of the types of icons shown. Note, installers may be limited in the kinds of icons they can create on this page based on purchase or licensing options (e.g., whether the courtesy announcement system option was purchased for this system or not).

Figure 5.4-24:   Example Web Link Icon Page

Touching an icon on this page will display a web page hosted by the system server, a web camera or possibly a third-party server. The example shows some of the possibilities such as background music (BGM) control, courtesy announcements, flight announcements, zone level controls (real-time), security camera feeds and third party web pages.

Optionally, a security feed window may configured with an associated zone or zone group. If this is the case, a microphone icon such as the one at right will be displayed in the lower right corner of the camera feed window. Touching this icon will initiate a live page to the associated zone/group (move the mic station into the Ready and Active states).

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5.5   Technical Specifications

5.5.1   Physical Characteristics

Desktop Size .... 11.82" W x 6.19" H x 6.08"D
.... (30.02 cm W x 15.72 cm H x 15.44 cm D)

Wall Mount Size .... 11.82" W x 6.26" H x 2.01" D
.... (30.02 cm W x 15.90 cm H x 5.11 cm D)

5.5.2   Environmental Information

Operating Temperature Range ....
....32˚F - +104˚F(0˚C – +40˚C)

Storage Temperature Range..
....................................-4˚F – +158˚F(-20˚C – +70˚C)

5.5.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking
.... EN 54-16

5.5.4   Power

Auxiliary Supply Voltage .... 24 or 48 V DC

PoE Supply Voltage (IEEE 802.3af) .... 48 Volt

Supply Power (Max) .... 6.7 Watts

5.5.5   Audio Characteristics

Audio Output Level .... +4 dBu Max (Balanced)

Total Harmonic Distortion ....<1.5% @ 1 kHz

Audio Bandwidth .... 20 Hz-20 kHz $\pm$0.5 dB

Signal-to-Noise Ratio, S/N .... >85 dB

5.5.6   Ethernet Connections

Medium.. Copper, 100Base-TX

Preferred Cable .... UTP cable Category 5

Maximum Length .... 100M from switch

Signal Levels ....According to IEEE 802.3

5.5.7   Other Connections

Power .... 2-pin Phoenix, 3.81 mm spacing
with locking screws

Redundant Ethernet (2) RJ-45

Auxiliary Audio In/Out (typical of 2) ....
.... 3-pin Phoenix, 3.81 mm spacing

6. 5416CS Communication Station

6.1   Introduction

The 5416CS-H/-G digital communications station is a fully programmable 16-button device for initiating audio/visual announcements with the 5400 Series Announcement Control Systems. Each model utilizes an electret condenser cartridge that is positioned in the housing such that its frequency response is enhanced, maximizing good sound quality and intelligibility of live pages.

The 5416CS supports the following functions, which are also shown below in Figure 6-1.

- 16 buttons for selecting zone groups or alarms/announcements to launch

- LED Status indicators for power, fault, alarm, ready and busy conditions

- Microphone signal processing, including audio compression

- Auxiliary audio input such as for a local background music (BGM) source

- Auxiliary audio output such as for a local/monitor zone output

- Redundant Ethernet connection.
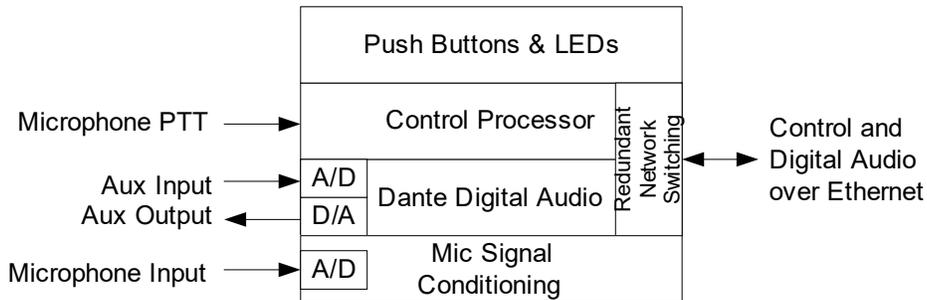
Figure 6-1:   Functional Block Diagram of the 5416CS

6.2 Controls, Connectors and Indicators

6.2.1 Front

The controls, indicators and connection on the front of the 5416CS is shown in Figure 6-2 and are described in the text which follows.
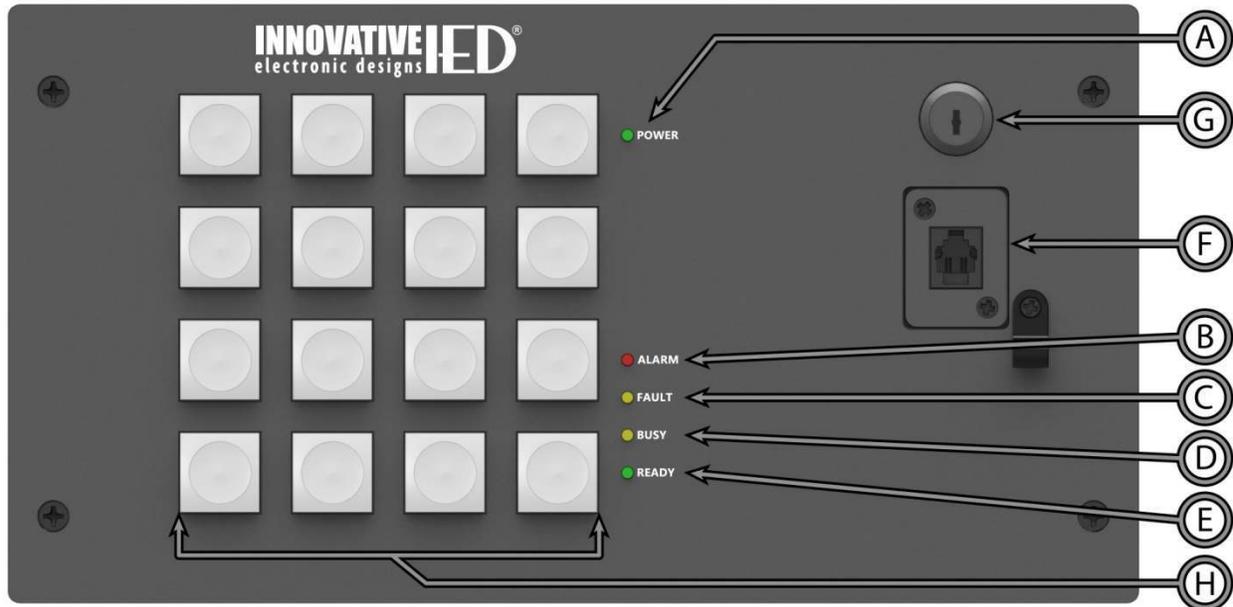
Figure 6-2:   5416CS Front Panel Indicators, Connections and Controls

(A) **Power LED** – Lights green when the station is powered up.

(B) **Alarm LED** – Lights red when there is an alarm active in the system.

(C) **Fault LED** – Lights yellow when there is a fault in the system.

(D) **Busy LED** – Lights yellow when the system is not ready to start a live page with the microphone, either due to higher priority alarms/announcements in the system or time to establish the audio routing with all endpoints required.

(E) **Ready LED** – Blinks green (fast double-blink in sync with the beeper) when the system is ready for a live page and is waiting on the user to push the PTT (Push-To-Talk) switch on the hand-held

microphone or the Start button on the touch screen if the 5450CS has a gooseneck mic station. The LED goes solid when the live page is active. The LED will do a slow blink when the live page is nearing the time limit for the announcement.

(F) **Microphone Jack** – Jack to plug the microphone into. Shown in the figure is the jack for the hand-held. The gooseneck jack is a 5-pin XLR.

(G) **Key Switch** – Used to lock or unlock the mic station. When in the locked position (blade horizontal), the mic station buttons may have limited *or no*, functionality.

(H) **Action Buttons** – Configurable for selecting zones or for launching alarms or non-emergency announcements.

6.2.2   Rear

The connections on the rear of the 5416CS are shown in Figure 6-3 and are described in the text which follows.
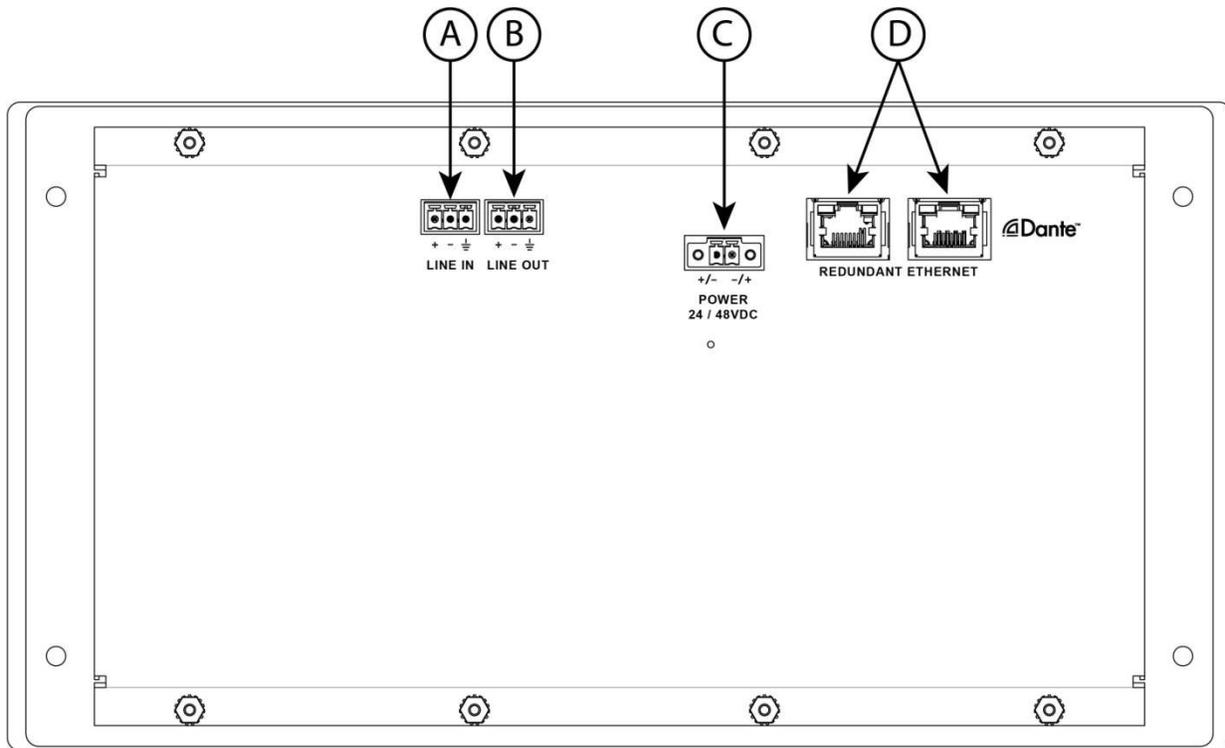
Figure 6-3:   5416CS Rear Connections

(A) **Auxiliary Audio Input** – Balanced line level input for special BGM (Background Music) or other function.

(B) **Auxiliary Audio Output** – Balanced line level audio output such as for a local zone.

(C) **Power Input** – As an alternative to PoE (Power over Ethernet), power can be supplied via this input.

(D) **Redundant Ethernet** – Dual redundant Ethernet RJ-45 jacks.

6.3   Connections

6.3.1   Introduction

The following connections are possible to the 5416CS, each of which is described in a section that follows:

- Unit Power (opt.)

- Auxiliary Audio Input

- Auxiliary Audio Output

- Ethernet

6.3.2   (opt.) Power Connection

In lieu of Power of Ethernet (PoE) on the Ethernet connection, the unit may be powered from a 24 or 48V supply, connected to the power input on the rear of the unit. This connection is not required if PoE power is available on either of the Ethernet inputs.

6.3.3   Auxiliary Audio Input Connection

The audio input is balanced with plus, minus and shield connections. When connecting to a balanced audio output, the connections should be made one-for-one. When connecting to an unbalanced output, one should connect the ground/shield from the output to both the shield and minus pins of the audio input on the 5416CS as shown below.
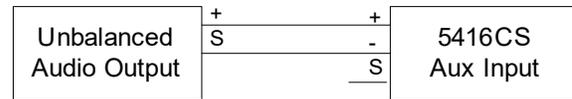
6.3.4   Auxiliary Audio Output Connection

The auxiliary audio output is balanced with plus, minus and shield connections. When connecting to a balanced audio input, the connections should be made one-for-one. When connecting to an unbalanced input, one should connect the minus pin of the 5416CS output to the ground/shield of the audio input as shown below.
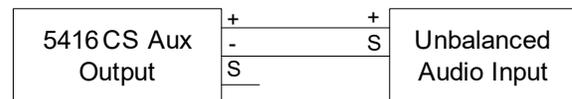
6.3.5   Ethernet Connection

The Ethernet connections are made via RJ-45 connectors and cabling appropriate for 100Base-TX.

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6.4 Installation

If desired, one may insert paper labels beneath the keycaps of the 16 buttons on the 5416CS. These labels should be no larger than 0.5" x 0.5" (12.7 x 12.7 mm). The GLOBALCOM-en Designer tool has a feature to print labels for you, if desired. These should be printed on standard weight laser printer or copier paper and cut out to size.

The keycap is composed of two pieces: a clear cap and a white insert that goes into the back of the clear cap. The paper label is inserted between these two pieces. To do this, it is necessary to first remove the clear cap and white insert assembly from the button base. Then pry these two pieces apart, insert the paper label and re-assemble. Specifically the steps to inserting labels are as follows:

1. Remove the front plate of the 5416CS to allow easier access to the buttons. The plate is attached via nuts around the edge on the back of the front plate.

> *Note, there will be a wire between the microphone jack and the main circuit board. When removing, lay the front panel aside so as to not pull on or damage this cable.*

2. Remove the keycap from a button by pulling upward on it.

3. Using a small flat bladed screwdriver (e.g., a watch repair size screwdriver), pry the clear cap and white insert apart.

4. Insert the new label into the clear cap and press the white insert back in to hold the label in place.

5. Re-attach the cap assembly to the button base.

6. Repeat for other buttons as desired.

7. Replace the front plate and attach with screws

> *Note, it is important to notice when re-assembling the clear keycap to the white insert and then attaching the cap assembly to the button base, that there are little tabs and indents where these tabs go on the mating pieces for each of the two assembly steps. Rotating parts 90 degrees out of this alignment before assembly will cause these tabs and indents to not mate up and the assembly to not hold together well under normal use. That is, if not aligned, the keycaps could be made to pop off the button base during use, or at least be more easily pried off should somebody be fiddling with the buttons on the front.*

Figure 6-4 below shows an exploded view of a button assembly for reference.

Paper Label
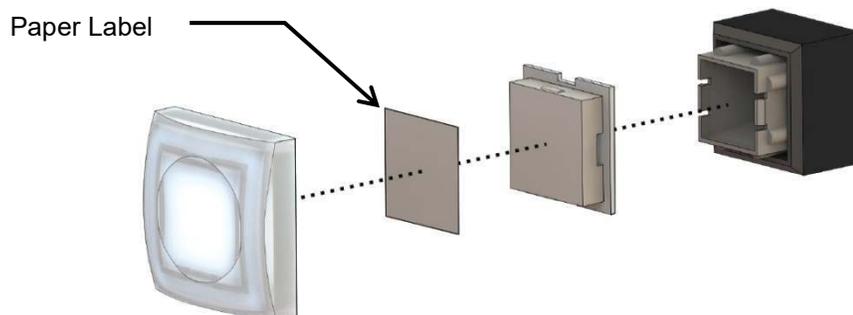
Figure 6-4: 5416CS Front Panel Button Exploded View

6.5   Operation

Operation of the mic station is via the action buttons on the front and the push-to-talk (PTT) switch on side of the hand-held microphone if the station is equipped with that style of microphone. The action buttons are configurable by the installer or system configurator and may have any of the following functions:

- Select a zone or group of zones for an alarm or announcement. These buttons will behave in a toggle manner. Alternate presses will select and de-select the zone(s) defined for the button.

- Launch an alarm, either to a pre-set zone group (e.g., all zones in the system) or to the currently selected zones. The alarm may be a pre-recorded message or a live page, optionally with a pre-announcement chime.

- Launch a non-emergency announcement, with the same options as an alarm for pre-set or user-selected zones, pre-recorded message or live page.

Operation of these buttons as well as use of the LED indicators is described in the sections which follow.

> *Note: If a button that is undefined is pressed, it will flash along with the Busy LED to indicate an error condition. Press the button a second time to clear this condition.*

6.5.1   Alarm/Announcement Operation

The steps involved in initiating an alarm or announcement vary slightly depending on the type, primarily whether for a pre-recorded message or live page. The steps for playing a pre-recorded message from the mic station is as follows:

1. If the alarm/announcement requires user-defined zones, then first select the desired zones or areas via the buttons configured for this. If an incorrect zone is selected, pressing the same button again will de-select it. Selected zones are indicated by the button illuminating green.

2. Press the action button to launch the alarm/announcement. When it goes active, the button that was pressed should illuminate to indicate it is active. If an alarm, the button will illuminate red. If non-emergency announcement the button will illuminate green.

3. Some alarms/announcements can only be initiated from the mic station and must run through the defined number of repeats before ending.

4. Other types of alarms/announcements can be configured as toggle action on the 5416CS. For these types, if the action button is illuminated, pressing the button a second time will stop the alarm/announcement and extinguish the button.

The steps for making a live page from the mic station are as follows:

1. If the alarm/announcement requires user-defined zones, then first select the desired zones or areas via the buttons configured for this. If an incorrect zone is selected, pressing the same button again will de-select it. Selected zones are indicated by the button illuminating green.

2. Press the action button to launch the live page alarm/announcement.

3. If the system can activate the announcement at this time (no zone conflicts with higher priority announcements), then the green Ready LED and beeper will flash in a double-pulse pattern. On stations with hand-held microphones, the user must now press the PTT switch on the side of the microphone to active the announcement. On stations with gooseneck microphones, the user must press and hold the same button as was used to launch the live page.

4. The live page now goes active. If there is no pre-announcement chime, the beeper will stop and the green Ready LED will illuminate solid. If there is a pre-announcement chime, then

both the yellow Busy LED and green Ready LED will illuminate while the chime is playing, revert to only the green Ready LED when it is OK to start talking into the microphone.

5. When the live page is complete, the user should release the PTT switch or the held action button to end the announcement.

6. If the announcement was defined with a time limit, within a few seconds of the end of the limit the green Ready LED will start doing a slow flash pattern as a warning to the user.

6.5.2   Key Switch and Special Operations

The mic station may have separate functionality when it is in the restricted or locked state as opposed to the unrestricted or unlocked state. The mic station may be configured with no functions in the locked state or perhaps with some non-emergency functions like local non-emergency paging only when locked. This is completely definable by the installer or system configurator. The key switch is in the locked state when the blade is vertical and the key is removable from the slot. When in the unlocked state (horizontal blade), the key cannot be removed from the key switch.

To test the LEDs on the mic station, one should simultaneously press and hold the buttons in the four corners of the mic station. This will illuminate all status LEDs, the beeper and all button LEDs. The buttons should appear amber when both LEDs inside are illuminated due to the combination of the red and green LEDs. If you see only red or only green on a button, that indicates the other color LED is not working.
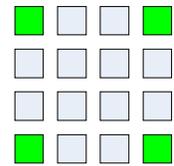
If the mic station is configured to activate its beeper to indicate new faults in the system, this alert beeper may be silenced by pressing the four inner most buttons on the keypad simultaneously.
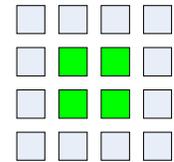
There are also two power-up special key combinations. These are activated by pressing and holding the keys while the mic station is powering up. The keys are recognized and you may release them when you see the LEDs on the keys light up for one second.

- Set IP Address to Dynamic (DHCP) – Pressing the bottom two corners during power-up.

- Set IP Address to Known Fixed – Pressing the top two corners during power-up will set the mic station's IP address to 192.168.1.150 .
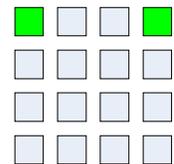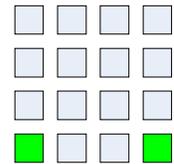
6.6 Technical Specifications

6.6.1 Physical Characteristics

Desktop Size .... 11.82" W x 6.19" H x 6.08"D .... (30.02 cm W x 15.72 cm H x 15.44 cm D)

Wall Mount Size .... 11.82" W x 6.26" H x 2.01" D .... (30.02 cm W x 15.90 cm H x 5.11 cm D)

6.6.2 Environmental Information

Operating Temperature Range ....32˚F - +104˚F(0˚C – +40˚C)

Storage Temperature Range... ....-4˚F – +158˚F(-20˚C – +70˚C)

6.6.3 EMC and Safety

Electromagnetic Compatibility .... EN 55022 .... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking .... EN 54-16

6.6.4 Power

Auxiliary Supply Voltage .... 24 or 48 V AC or DC

PoE Supply Voltage (IEEE 802.3af) .... 48 Volt

Supply Power (Max) .... 7.2 Watts

6.6.5 Audio Characteristics

Audio Output Level .... +4 dBu Max (Balanced)

Total Harmonic Distortion ....<1.5% @ 1 kHz

Audio Bandwidth .... 20 Hz-20 kHz $\pm$0.5 dB

Signal-to-Noise Ratio, S/N .... >85 dB

6.6.6 Ethernet Connections

Medium.. Copper, 100Base-TX

Preferred Cable .... UTP cable Category 5

Maximum Length .... 100M from switch

Signal Levels ....According to IEEE 802.3

6.6.7 Other Connections

Power .... 2-pin Phoenix, 3.81 mm spacing with locking screws

Redundant Ethernet (2) RJ-45

Auxiliary Audio In/Out (typical of 2) .... 3-pin Phoenix, 3.81 mm spacing

7. 5414/5434/5454AMP Power Amplifiers

7.1   Introduction

The 5400 series of amplifiers feature four channels of 100, 300 or 500 watt amplification in the 5414AMP, 5434AMP and 5454AMP, respectively. The amplifiers are Class D switching mode which provides benefits such as: higher efficiency, increased reliability, improved performance, and lower operating cost. The amplifiers are internally monitored and limited to prevent over-current and over-temperature conditions, also protecting the amplifiers from harm due to short circuits on the speaker lines.

In addition to mains power, a 24VDC power input is provided in the event of power loss when the amplifier will automatically switch to 24V battery power - without any loss of output power. The functions of the
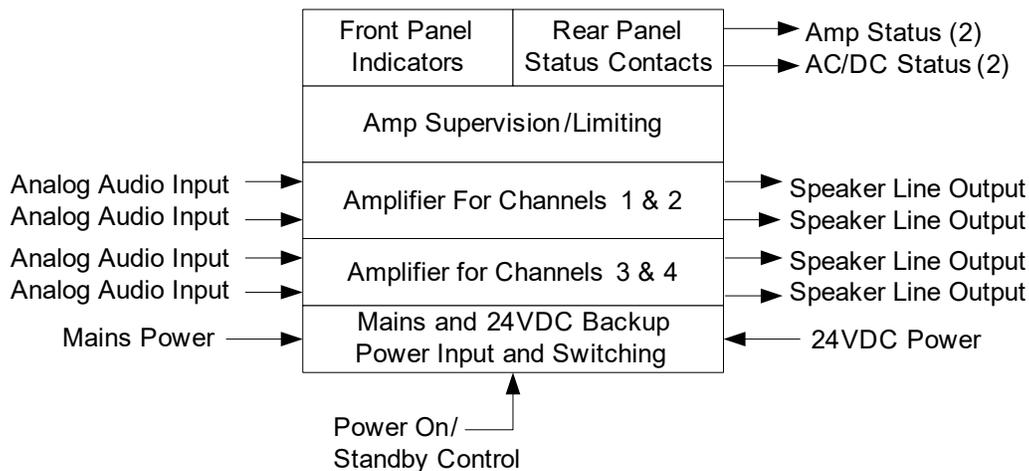
Figure 7-1:   Functional Block Diagram of the 54xxAMP

Please note: a 4-channel, full power operation with 24VDC Backup power will yield the following power output:

Mains			Backup	
230 VAC	4x500W	→	4x335W	24 VDC
230 VAC	4x300W	→	4x240W	24 VDC
230 VAC	4x100W	→	4x 95W	24 VDC

All values were measured with a 1 kHz sine wave. Please note that alarms, announcements and BGM require less than 1/3 of the nominal power of the amplifier

7.2   Controls, Connectors and Indicators

7.2.1   Front

The indicators on the front of the 5414/5434/5454AMP are shown in Figure 7-2 and are explained in the text below.
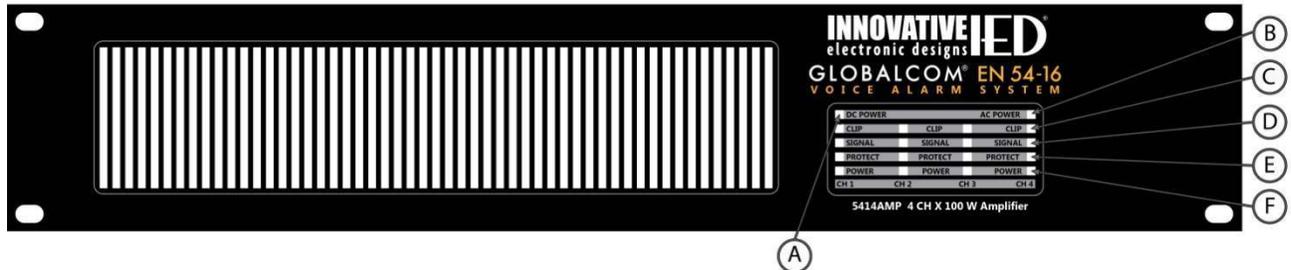
Figure 7-2:   5414/5434/5454AMP Front Panel Indicators

(A) **DC Power** – This LED illuminates when 24VDC backup power is available at the rear of the amplifier chassis.

(B) **AC Power** – This LED illuminates when mains power is available at the rear of the amplifier chassis.

(C) **Clip (4)** – This LED on each channel indicates when the audio input to that channel is causing the amplifier to reach clipping (maximum volume) level.

(D) **Signal (4)** – This LED on each channel indicates when there is audio present (above some minimum threshold) for the amplifier channel.

(E) **Protect (4)** – This LED on each channel indicates when the internal amplifier supervision/limiting circuitry has put that amp channel into protect mode. In this mode, signal input to the amp is limited or muted to protect the amplifier. The condition could be caused by such things as over-temperature condition, (near) shorts on the speaking line or over driving the audio input (e.g., well above clipping level). When the condition that caused the protect mode goes away, the amplifier will come out of protect mode automatically.

(F) **Power (4)** – This LED on each channel indicates that the amplifier channel is powered and operating.

7.2.2 Rear

The connections and controls on the rear of the 5414/5434/5454AMP are shown in Figure 7-3 and are described in the text which follows.
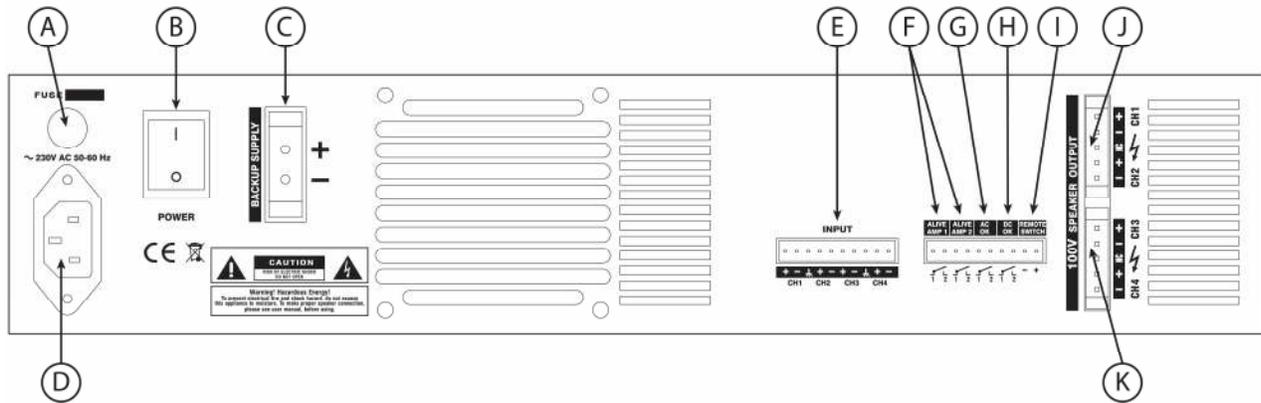
Figure 7-3: 5414/5434/5454AMP Rear Connections and Controls

(A) **Fuse** – Power input protection fuse. After correcting faulty condition replace with the same type and rating of fuse as was used originally. The amperage rating is written on the back just above the fuse holder.

(B) **Power Switch** – Used to turn the amplifier on/off manually.

(C) **Backup Power Input** – Connection to the 24V DC power for use when mains power fails.

(D) **Mains Power Input** – Connection for 230V AC line cord.

(E) **Analog Audio Inputs (4)** – Input for each channel of amplification.

(F) **Amplifier Status Contacts (2)** – Indication via dry contact closure for a fault on either of the internal two amplifiers (Amp 1 drives

channels 1 and 2, Amp 2 drives channels 3 and 4).

(G) **AC Status Contact** – Indication via dry contact closure when the AC mains power is not available.

(H) **DC Status Contact** – Indication via dry contact closure when the DC backup power is not available.

(I) **On/Standby Control** – A +12V pulse to these terminals turns the amplifier on (if in standby) and a -12V pulse turns it off (to standby).

(J) **Speaker Outputs for Channels 1 & 2** – Connections to 100V distributed speaker circuits.

(K) **Speaker Outputs for Channels 3 & 4** – Connections to 100V distributed speaker circuits.

7.3   Connections

7.3.1   Introduction

The connections available for the 5414/5434/5454AMP are:

- AC Mains Power
- DC Backup Power
- Audio Inputs
- Amp Status Contacts
- Power Status Contacts
- On/Standby Power Control
- Speaker Outputs

7.3.2   AC Mains Power Connection

Connection of the mains input should be made via the connector on the rear using a power cord such as a Belden 17850 or similar. It is important for electrical/shock safety that the earth/ground is used on this connection.

7.3.3   DC Backup Power Connection

The 24V DC backup power should be connected to the terminals using the Phoenix connector supplied with the amplifier. Be sure to secure the screws above and below the plug to prevent accidental pull-out of the plug.

7.3.4   Audio Input Connections

The audio inputs are balanced with shared ground pins for channels 1 &2, and for channels 3 and 4. Therefore when wiring, the shields from wires for pairs of channels need to both land in pin 3 or pin 8 of the 10-pin connector such as shown below (green is the shield wire).
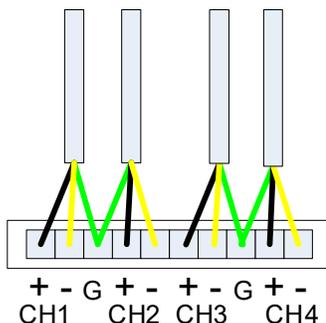
If connecting to a device with unbalanced audio outputs, one should connect the ground/shield from the output to both the shield and minus pins of the audio input as shown below.
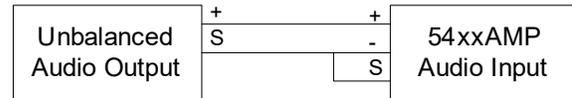
7.3.5   Amp Status Contacts

These outputs are dry contact closures that should be wired according to the logic input detection needs of the device these connect to. Note, that the contacts are closed when the amps are good and open to indicate a fault or protect mode condition in the amplifier.

7.3.6   Power Status Contacts

These outputs are dry contact closures that should be wired according to the logic input detection needs of the device these connect to. Note, that the contacts are closed when the power supply (AC or DC) is good and open to indicate a fault (loss of power at the chassis).

7.3.7   On/Standby Power Control

These inputs should be wired with the polarity indicated. The negative input would typically be the ground or reference voltage level for the other input. When the differential is around zero Volts no change to the amplifier power is made. When a pulse of +12 Volts is applied across the terminals, the amplifier will power on (go out of standby). When a pulse of -12 Volts is applied across the terminals, the amplifier will go into standby (power down to minimum power mode).

7.3.8   Speaker Output Connections

These outputs should be connected to a distributed 100V speaker line where the total of all the speaker taps do not exceed the power rating of the channel (100W for the 5414AMP, 300W for the 5434AMP or 500W for the 5454AMP) using an appropriate gauge cable for the speaker load.

7.4   Technical Specifications

7.4.1   Physical Characteristics

Height ....3.5", 2 rack units (8.8 cm)

Width (without rack mount ears) .... 17.2" (43.7 cm)

Depth .... 15.1" (38.4 cm)

Recommended Mounting Depth .... 18" (45.7 cm)

Weight .... 30.86 lbs (14 Kg)

7.4.2   Environmental Information

Operating Temperature Range
     32˚F - +122˚F(0˚C – +50˚C)

Storage Temperature Range
     -40˚F – +158˚F(-40˚C – +70˚C)

7.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking
.... EN 54-16

7.4.4   Power

Mains Voltage .... 210-240 VAC, 50-60 Hz

Recommended Mains Voltage .... 230 VAC

Backup Power Voltage .... 24 VDC

Max Output Power (per channel)
     5414AMP .... 100 Watts
     5434AMP .... 300 Watts
     5454AMP .... 500 Watts

Supply Power (max on mains)
     5414AMP .... 540 Watts
     5434AMP .... 1580 Watts
     5454AMP .... 2500 Watts

Supply Power (min/Power Save) .... 5 Watts

For complete breakdown of power under different conditions, see Table 7-1 below.

7.4.5   Audio Characteristics

Frequency Response at full power ± -0.5 dB
     20 Hz - 20 kHz

Power Bandwidth .... 20 Hz – 20 kHz, +/– 0.5 dB

Signal-to-Noise Ratio .... > 100 dB
     20 Hz – 20 kHz ref

Total Harmonic Distortion, THD .... < 0.3%

Output Clipping Level .... 100V RMS

Input Level for full power .... 0 dBu

Input Clipping .... 21 dBu

Input Impedance .... 12 kΩ

7.4.6   Input / Output Characteristics

Status Outputs .... dry contact closures

Amp On/Off Control

     AMP OFF ....-12 VDC @ 0.08 Amps for 0.01 sec min

     AMP ON .... +12 VDC @ 0.08 Amps for 0.01 sec min

7.4.7   Other Connections

Mains Power IED60320-13
     use Belden 17850 cord or similar

24 VDC Backup Supply .... 2-pin, Phoenix, 10.16mm

Audio Inputs .... 10-pin Phoenix, 3.81mm spacing

Speaker Outputs (Typical of 2) ....
.... 5-pin Phoenix, 5.08 mm spacing

Amp Alive Contacts (2) ....
.... Part of 10-pin Phoenix, 3.81mm spacing

AC OK .... Part of 10-pin Phoenix, 3.81mm spacing

DC OK .... Part of 10-pin Phoenix, 3.81mm spacing

Remote Switch (on/standby) ....
.... Part of 10-pin Phoenix, 3.81mm spacing

Table 7-1:   Input Current and Power for 54x4AMP

Model .	5454AMP		5434AMP		5414AMP	
Operating Mode	Mains 230V	Battery 24V	Mains 230V	Battery 24V	Mains 230V	Battery 24V
Off/Standby	0.12A/5W	0.1A	0,12A/5W	0.1A	0.12A/5W	0.1A
Idle	0.5A/72W	2.8A	0.5A/72W	2.8A	0.5A/70W	2.5A
1/8 Load (speech)	2.6A/430W	17.2A	2.0A/310W	12A	0.9A/145W	5.6A
Full Load	15.0A/2480W	83A	9.8A/1570W	58A	3.3A/540W	21A

8. 5410/5411EOL End of Line Modules

8.1   Introduction

The 5410EOL/5411EOL End-of-Line Modules are devices which augment automatic testing of 100 Volt constant voltage speaker lines. The devices allow testing continuity of speaker wiring all the way to the end of the line without the need and expense of a return wire from the line end. When used with the automated test function of the 5404DZM or 5432DZM, the devices enable testing the integrity of the speaker lines.

The 5410EOL model should be used with the 5432DZM paired with any amplifier (5414/5434/5454AMP) or with the 5404DZM when it is paired with the 100W per channel power amplifier (5414AMP). The 5411EOL should be used with the 5404DZM when it is paired with either the 300W or 500W per channel power amplifiers (5434AMP or 5454AMP).

While the 5410EOL or 5411EOL represents a significant load to the amplifier and speaker lines at 20 kHz, they have no significant effect on the audible frequency performance of the system. For proper/complete speaker line testing, speakers on a circuit must be wired as one continuous string without any paralleled off branches.

8.2   Connections and Installation

The only connections to the 5410/5411EOL are the two wires which should be placed across the distributed speaker line such as across the terminals of the transformer of the last speaker in a line.

8.3   Technical Specifications

8.3.1   Physical Characteristics

Size, overall

Length .... 1.96" (5 cm)

Width .... 0.956" (2.43 cm)

Thickness, not including leads .... 1.0" (2.54 cm)

Lead Length .... 6" (15.24 cm)
Measured from top surface

8.3.2   Environmental Information

Operating Temperature Range ....
.... (−40°F to +212°F) −40°C to +100°C

Storage Temperature Range ....
.... (−58°F to +221°F) −50°C to +105°C

8.3.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety ....EN 60950-1

Approvals .... CE marking

.... EN 54-16

8.3.4   Audio Characteristics

5410EOL .... ~100 Ω load at 20 kHz

5411EOL .... ~10 Ω load at 20 kHz

8.3.5   Connections

2 tinned wires

9. 1516ALI/1516BLI A/B Loop Interfaces

9.1   Introduction

The 1516ALI and 1516BLI are interfaces for class A or class B speaker wiring. In situations where an end-of-line module are not used, and instead the speaker line is looped back to the equipment rack, these interfaces can be used to supervise the speaker loops. Both devices provide supervision of up to 16 speaker loops each. The ALI version of the device will also drive both ends of the loop in the event there is a break in the line somewhere in the field. The BLI version is appropriate when small signal cabling was used to supply the speaker circuit return, rather than full gauge speaker wires.

The 1516ALI or 1516BLI may be paired with any of the amplifiers and Digital Zone Managers (DZM) covered in this user manual. The units may be powered via PoE from a network switch. The figure below shows the block diagram for the 1516BLI. The 1516ALI is essentially the same with output driving capability on the speaker line returns.
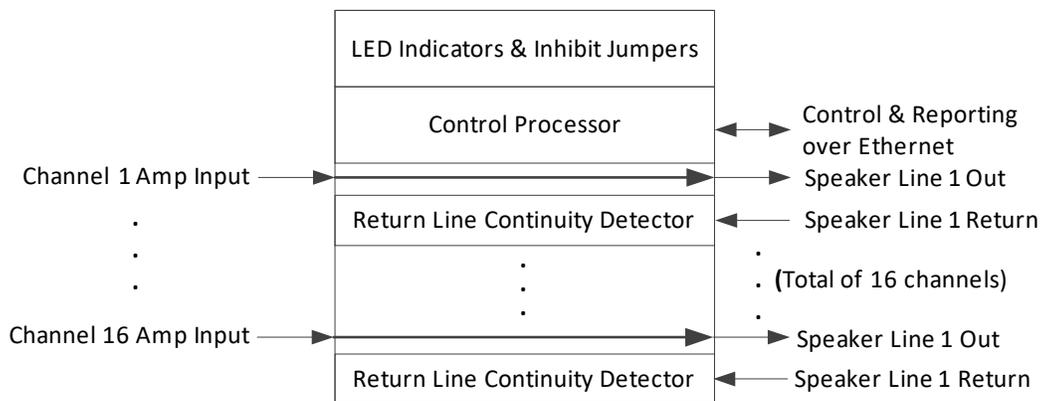
Figure 9-1:   1516BLI Block Diagram

9.2   Connections and Installation

The indicators, controls and connections on the front of the 1516ALI/BLI are shown in Figure 9-2 below.
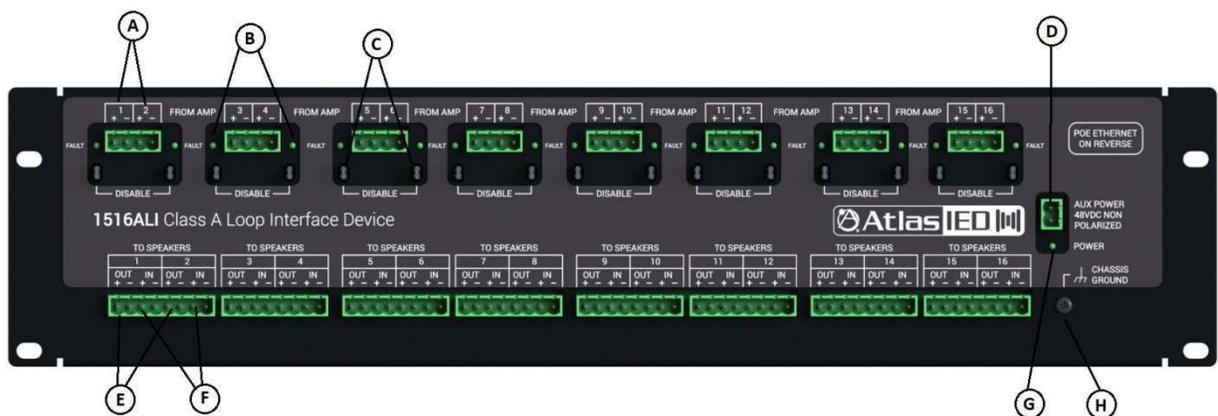
Figure 9-2:   1516ALI Front Indicators, Controls and Connections

(A) **Amp Out Connections** – Connections from the power amplifiers.

(B) **Fault Indicators** – LEDs which indicate a loop fault for this circuit.

(C) Fault Inhibit Jumpers – pins for shunts/jumpers to disable loop supervision for this circuit. Jumpers should be installed for all unused channels on the unit.

(D) Auxiliary Power Input – Optional 48VDC input for powering the unit.

(E) Speaker Out Connections – Connections out to the speaker field wiring.

(F) Speaker Return Connections – Connections back from the speaker field wiring.

(G) Power Indicator – LED to indicate that the unit has power from either PoE or auxiliary.

(H) Chassis Ground –connector to fully ground the unit's chassis to earth or same ground reference as the power amps or DZM units.

There is only one connection on the rear of the 1516ALI/BLI unit as shown in the figure below.

Figure 9-3:   1516ALI/BLI Rear Connection

(A) Ethernet Connection – RJ-45 connector for connection to a network switch.

9.3   Connectors and Installation

9.3.1   Introduction

There are several types of connection that can be made to the 1516ALI/BL:I.

- Ground Reference
- Amplifier Wiring
- (simple) Speaker Loops
- Multiple Speaker Loops to One Channel
- Ethernet Connection
- Auxiliary Power Connection

In addition, the follow installation steps should be performed as described in sections that follow.

- Install Bypass Jumpers
- Configure via Web Pages

9.3.2   Ground Reference Connection

If there is a solid connection to ground via the rack ears and screws, then this step is optional. For good measure, though, one should be sure to provide a solid ground connection to the ground connector on the 1516ALI/BLI case. This connection is necessary for the fault detection function.

> *Note: The amplifier/DZM outputs have a Voltage on them relative to ground. The detection circuitry requires a solid ground reference in order measure this voltage and properly function.*

9.3.3   Amplifier Wiring Connections

Connections should be made to the amplifier out terminals being sure to observe the polarity markings on the connections.

9.3.4   Speaker Loop Connections

Note: It is critical that speaker loop connections are made correctly to prevent serious damage to the amplifiers. Incorrectly connected loops can create SHORT CIRCUITS across the amplifier outputs. Please read and understand this section, and observe it in making the speaker loop connections, before applying power to the amplifiers connected to the 1516ALI.

It is important that a speaker loop strictly observes polarity all along its path so that the plus (+) connection going out is the same as the plus (+) connection coming back in, and the same on the minus side. This may be done simply by always connecting the same color wire all along the way, e.g., black-to-black and white-to-white. If one is unsure of how the field wiring was done, then the lines should be tested a cross-over in polarity.

Unfortunately, it is not possible to detect a cross-over in the wiring with a simple Ohmmeter. That is because these utilize DC Voltages, and at DC, both lines appear to be shorted together. This is because the coils in the speaker transformers appear as "just wire" to DC voltages, and these coils are connected across the speaker lines. So the testing must be done with an AC drive voltage.

The AC line test procedure one can employ is as follows:

- Disconnect both the + and – wires of the IN connection for a speaker loop, leaving only the OUT connection attached.

- If one has an impedance meter, which drives a line with an AC tone, this can be connected to the Amplifer Input for the loop being tested. Otherwise, power up the amplifier driving this loop and apply a test tone to it (e.g., using the Auto Test Details Screen n the 5400 Designer

- Attach a Voltmeter set for AC reading between the + OUTbound connection and the + INbound wire (not yet inserted into the 1516ALI).

- If the polarity is correct, one should observe NO VOLTAGE between these points. If incorrect, then one will see a voltage.

One should make the IN connections on the 1516ALI in accordance with the test, even if it does involve a "flip" in wiring color. This just means an odd number of such flips were made in the field wiring.

Figure 9-4:   Speaker Loop Cross-Over Test

9.3.5   Connecting Multiple Loops To One Amplifier Channel

If there are multiple speaker lines (loops) that "homerun" to the equipment room to be driven by one amplifier channel, these can be accommodated by the 1516ALI/BLI with proper wiring, so long as the total load presented is not over the amplifier's rating (e.g., two loops of 100 Watt load each on a 200 Watt amplifier channel). This is done, simply by daisy-chaining the amplifier input wiring on the Amp In connectors of the 1516ALI/BLI as shown in the figure below.
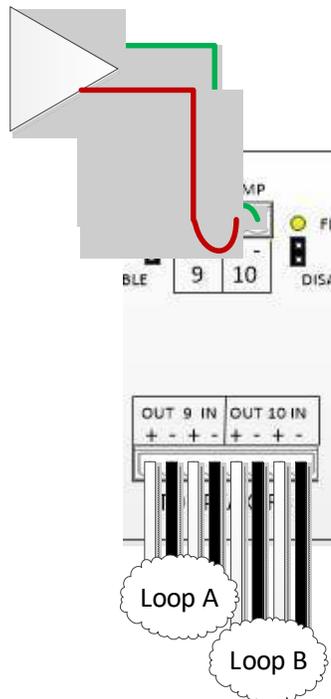
Figure 9-5: Connecting Multiple Loops to One Amplifier Channel

9.3.6   Ethernet Connect

Connect the 1516ALI/BLI to the network via the RJ-45 connector on the rear. If PoE power is available, the power LED, should illuminate after a couple of seconds.

9.3.7   (opt.) Auxiliary Power Connection

If the network does not supply PoE power, then the device should be powered from a separate

48V DC supply connected to the Auxiliary Power Input jack.

9.3.8   Install Bypass Jumpers

For any channels not connected to Class A or Class B loops, install a bypass jumper into the Fault Disable pins at that position.

9.3.9   1516ALI Initial Configuration

From the factory, the 1516ALI comes with a fixed address of 10.2.150.182. These settings can be changed as necessary via the built-in web pages. One accesses the web pages by typing the IP address into a browser address bar, e.g., "http://10.2.150.182".

> *Note, one will need to be on a computer configured to be on a compatible 10.x.y.z network in order to access the device at this address. This may require one to (temporarily) add a compatible network setting on their laptop or desktop computer used to access these web pages.*

The first page one encounters is the Status page. This shows the current state of all of the loops. One wants to click on the "Settings" label on the left (circled in red in the figure below) to go to the Settings page.
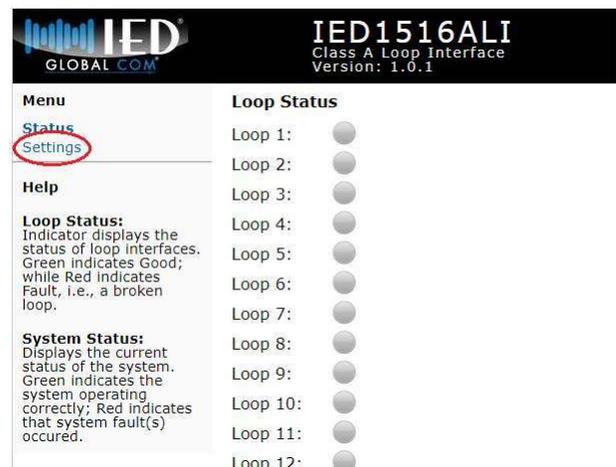
Figure 9-6: 1516ALI Status Web Page

Before accessing the Settings page, one must enter the current password in the edit box shown below. By default from the factory, the password

is "iednet" (without the quotes). This password can be changed on the Settings page, once accessed, if desired.

Figure 9-7: 1516ALI Settings Authorization

Once the correct password is entered and the Enter button pressed, one is taken to the Settings page as shown in the example below.
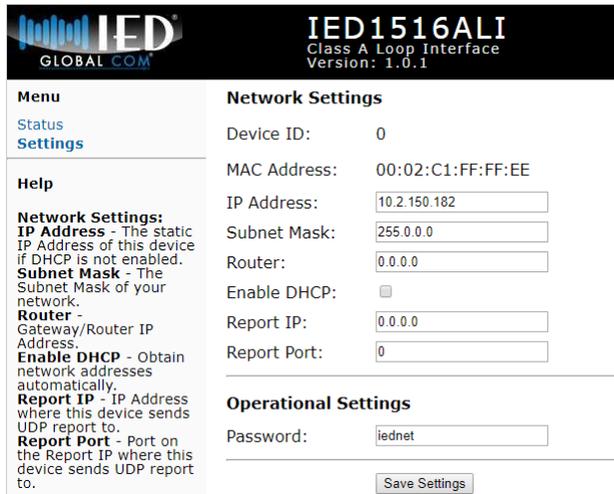
Figure 9-8: 1516ALI Settings Page

On this page, one can either enter the proper fixed address settings (IP address, subnet mask, and router or default gateway) or alternately enable DHCP (dynamic addressing) via the checkbox provided. This is also where one can optionally build in an address to always report faults to (e.g., a controller). The Password edit box is where one can change the password

used to access the Settings page. One must click on the "Save Settings" button in order for the changes to take effect.

Once all the changes are made, one presses the **Save Settings** button. After the settings are saved to flash, they will not take effect until the unit is rebooted or re-powered. When changes are made and saved, the web page will prompt to reset the device via the button and red notification shown in the figure below.
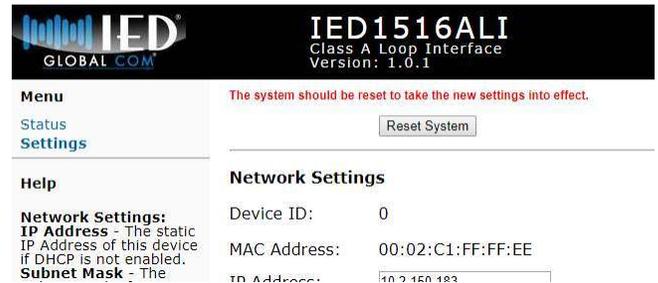
Figure 9-9: Prompt to Reset

After pressing the **Reset** button, one gets the web page shown below. Note, if the IP address is changed, the link to the web pages will break. The new IP address will have to be entered into the browser address bar.

Figure 9-10: Reset Notification

9.4   Technical Specifications

9.4.1   Physical Characteristics

Size, overall

    Height .... 2.5 RU or 4.375" (11.1 cm)

    Width .... 19" (48.3 cm)

    Depth .... 2.00" (5.08 cm)

Weight .... 4.95 lbs (2.25 Kg)

9.4.2   Environmental Information

Operating Temperature Range ....
.... +32°F – +122°F (0°C – +50°C)

Storage Temperature Range ....
.... -4˚F – +158˚F (-20˚C – +70˚C)

9.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety ....EN 60950-1

Approvals .... CE marking

.... EN 54-16

9.4.4   Connections

Ethernet RJ-45 (rear) .... 1 (w/ PoE)
Aux Power (48 VDC) .... 2-pin jack
Amplifier Channel Inputs (8 pair) .... 4-pin jack
Speaker Loop Outputs (8 pair)............................ 8-pin jack
      All connections except Ethernet via 0.2"
      (5.08mm) spacing lugless screw connectors.

10. 1516LI/1516LI-E Logic Input Modules

10.1 Introduction

The 1516LI is a network logic input device used to interface additional logic inputs with the 5400ACS controller. It provides 16 optically-isolated inputs that can be driven using dry contact closures or 0 to 50VDC logic signals. The functions for the logic inputs are configured using the GLOBALCOM-en Designer tool.

The 1516LI-E is a 16 input expansion module that connects directly to a 1516LI to bring its total input capacity up to 32 inputs. The functions of the 1516LI are shown diagrammatically in Figure 10-1.
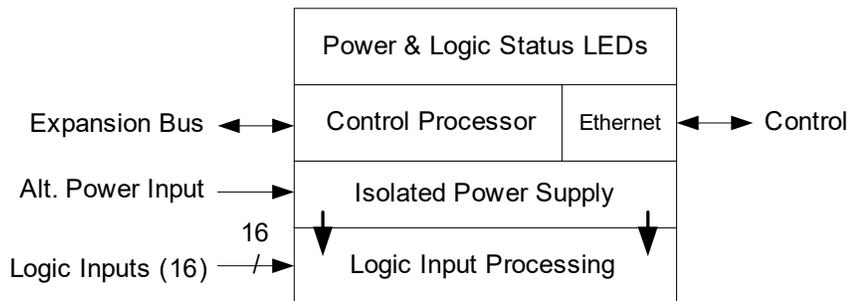
Figure 10-1: 1516LI Functions

The device receives its power over IEEE 802.3af PoE (Power over Ethernet) and communicates with other system devices over the Ethernet network. The maximum power consumption from the PoE switch is less than 3.5 watts. A secondary connection is provided for an external +48VDC power supply if PoE is not available. The 1516LI-E receives its power through its connection to the 1516LI.

The 1516LI and 1516LI-E are provided in an enclosure that either mounts to a DIN rail or is screwed down on a panel or wall to allow for convenient installation close to the signaling sources. The 1516LI-E connects to the 1516LI through the supplied 4-conductor expansion cable.

10.2   Controls, Connectors and Indicators

The connectors and Indicators on the 1516LI are shown in Figure 10-2 and are described in the text below.
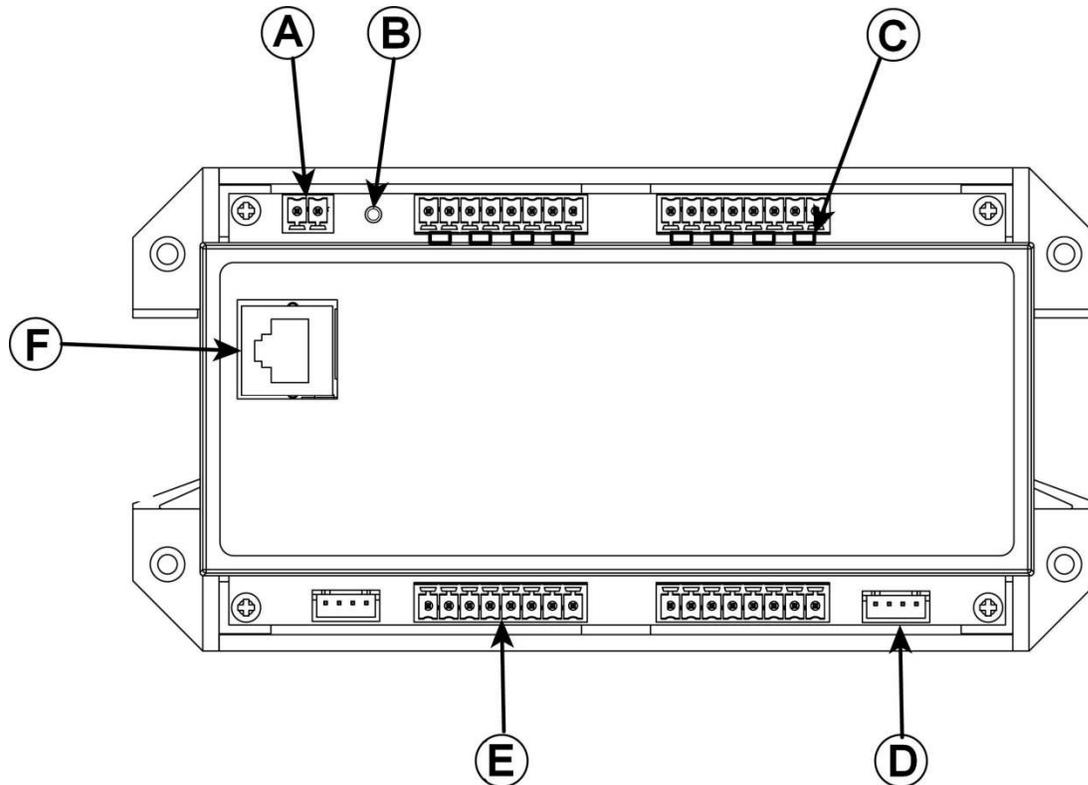
Figure 10-2:   1516LI Connectors and Indicators

The 1516LI-E expansion module only has items marked B, C, D and E.

(A) **Aux Power Input** – 48 VDC power input which may be used if power over Ethernet (PoE) is not available from the network switch.

(B) **Power Indicator** – Green LED that illuminates to show the unit has power.

(C) **Logic Closure Status LEDs** – 32 Yellow LEDs (one per input) that illuminate when the associated logic input detects a closure (zero voltage).

(D) **Expansion Bus Connector** - Attach expansion cable between 1516LI and 1516LI-E between to this connector.

(E) **Logic Input Connectors (typical of 4)** – Four banks of four logic input connections each for a total of 16 opto-isolated inputs.

(F) **Ethernet RJ-45** – For connection to network for network reporting of logic input states.

10.3   Connections and Installation

10.3.1   Introduction

There are four types of connection that can be made to the 1516LI. The 1516LI-E only allows for the first two connections.

- Logic Inputs
- Expansion Bus
- Aux Power
- Ethernet

10.3.2   Logic Input Connections

Each logic input connection is a pair of pins that are opto-isolated from the others. Each input supplies a "wetting voltage of 2.6V (3.3V minus a diode drop) via a 150 Ohm resistor. One may attach a relay contact to these inputs or alternately use an input voltage (zero for "closure" or "on" and 1.7V or higher, max 50V for "open" or "off").

10.3.3   Expansion Bus Connection

Connect the cable supplied with the 1516LI-E expansion module to this keyed connector on both the 1516LI and the 1516LI-E. There can be at most only one expansion module per 1516LI.

10.3.4   Aux Power Connection

If powering via a power supply rather than PoE, connect the power to this connector in either polarity. Note, if the 1516LI is used for functions covered by EN 54-16, a properly rated EN 54-4 power supply should be used for this purpose.

10.3.5   Ethernet Connection

The Ethernet connection is made via the RJ-45 connector and cabling appropriate for 100Base-TX.

10.3.6   Installation Notes

If the 1516LI-E expansion module is used, the 1516LI must be configured to "know" that it should have the expansion. See Appendix C on the Device Configuration Tool for specifics on doing this.

The 1516LI can be wall mounted or DIN rail mounted. It should be mounted in a clean, dry location where it is protected from the elements. Ventilation is recommended for installations where ambient air temperature is expected to be high.

Wall Mounting – Mount the 1516LI to a wall by using two to four #8 screws through the holes in the enclosure tabs or "feet".

DIN Rail Mounting – The 1516LI can be mounted to a standard (35mm by 7.5mm) DIN rail. Attach the unit to the DIN rail by hooking the spring tab side of the built-in clip to the DIN rail, compress the springs and slip the other side of the clip over the opposite side of the rail. Remove the unit from the DIN rail by compressing the spring tabs and lifting the opposite side off the DIN rail.

10.4   Technical Specifications

10.4.1   Physical Characteristics

Height .... 7.01" (17.81 cm)

Width .... 3.50" (8.90 cm)

Depth .... 2.00" (5.08 cm)

Weight .... 8 oz (227 g)

10.4.2   Environmental Information

Operating Temperature Range ......
.... −22˚F – +149˚F (−30˚C – +65˚C)

10.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking
.... EN 54-16

10.4.4   Power

Voltage (primary) .... 48VDC (PoE)

Power .... < 3.5 Watts

10.4.5   Input/Output Characteristics

Optically Isolated Inputs

Voltage Range ...... 0 – 1.6VDC (ON) / 1.7 – 50VDC (OFF)

Current .... 3 mA source / 160 mA sink

Minimum Hold Time (high or low) .... 250 ms

10.4.6   Connections

Inputs (typical of 4) ....
.... 8-pin Phoenix, 3.81 mm spacing

Network RJ-45

Aux Power .... 2-pin Phoenix, 5.08 mm spacing

Expansion Bus .... 5-pin Connector, 2.50 mm spacing

11. 1522LR Logic Input and Relay Output Module

11.1   Introduction

The 1522 Logic / Relay Module is a cost effective interface module that operates as an integral part of an GLOBALCOM-en system. It is a web-enabled, programmable relay device for a wide variety of remote control and automation applications. It has two electro-mechanical relays, two optically-isolated inputs, and a wealth of cutting- edge features. The logic inputs and relay outputs can be configured to have the same functions as the logic inputs and relay outputs on the 5400ACS. For example, the relays can be controlled remotely using actions configured in the 5400ACS controller or indicate status of the system to an external system. The optically-isolated inputs can be used trigger actions or as logic monitor points that will register faults in the system. The module receives its power over IEEE 802.3af PoE (Power over Ethernet) or if PoE is not available via the alternate power input connection.

The functions of the 1522LR are shown diagrammatically in Figure 11-1.
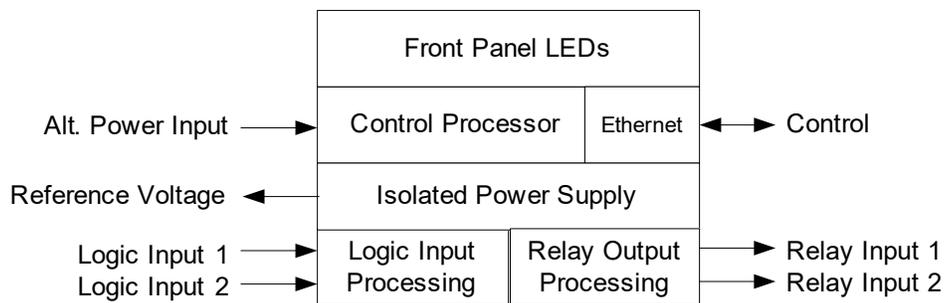
Figure 11-1:   1522LR Functions

11.2   Controls, Connectors and Indicators

The connectors and indicators for the 1522LR are shown in Figure 11-2 and are described in the text that follows.
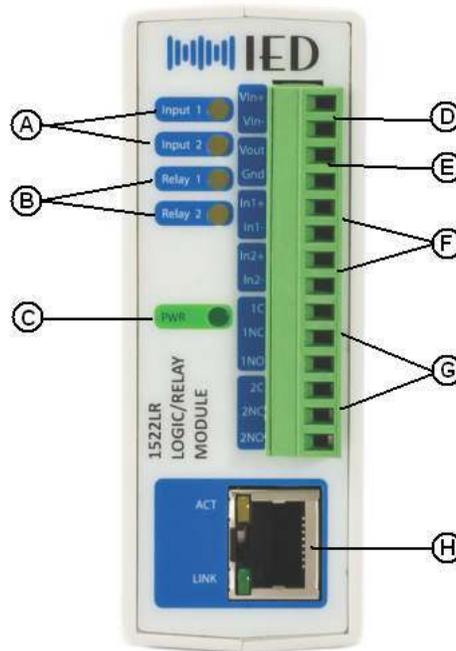
Figure 11-2:   1522LR Connectors and Indicators

(A)   **Logic Input Status LEDs** – Light when a closure (low voltage) condition is detected on the respective input contacts.

(B)   **Relay Active Status LEDs** – Light when respective relay is energized.

(C)   **Power LED** – Lights when the unit is powered up.

(D)   **Alt. Power Input** – As alternative to PoE power. If used, the input supply is 5VDC.

(E)   **Reference Voltage Output** – From an isolated power supply, so can be used if

needed to "wet" dry contacts wired to logic inputs.

(F)   **Logic Inputs** – Connect between pairs on input contacts.

(G)   **Relay Outputs** – Form C contacts (NO, C, NC).

(H)   **Ethernet Connection** – RJ-45 jack for 10Base-T or 100Base-TX Ethernet, Preferably the latter.

11.3   Connections and Installation

11.3.1   Introduction

There are four types of connections which may be made to the 1522LR, described in sections which follow:

- Logic Inputs

- Relay Outputs

- Alternate Power

- Ethernet

In addition, the last section covers some installation considerations.

11.3.2   Logic Input Connections

These inputs register "closed" or "on" condition with a voltage less than 3V applied to an input, and an "open" or "off" condition with greater than 3V applied (up to a max of 12V). If using dry contact closures, one can use the reference voltage available on Vout to "wet" the contacts as shown below.
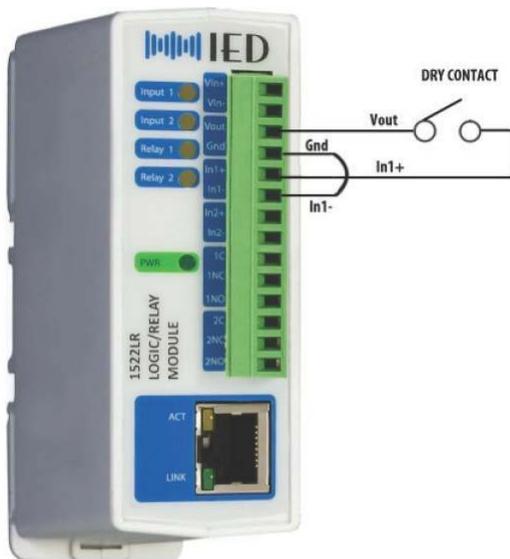
Figure 11-3:   Dry Contact Connection to Logic Input

Note, it is not necessary to use pull-up or current limiting resistors because there is a resistor internal to the unit on each input.

11.3.3   Relay Output Connections

Connections may be made to either or both the normally open (NO) and normally closed (NC) contacts of the relay outputs. If connecting to an inductive load like a motor, transformers or external (higher power) relay, it is possible to get arcing across the internal contacts in the 1522LR when the contacts open. To preserve the life of these contacts, one should use a protection diode for DC switching or appropriate RC filter for AC switching.
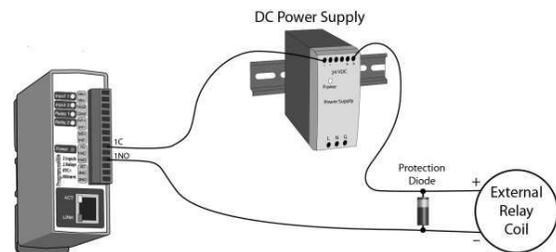
Figure 11-4:   DC Contact Protection
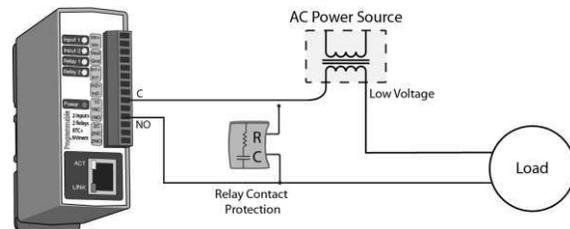
Figure 11-5:   AC Contact Protection

11.3.4   Alternate Power Connection

If powering via a power supply rather than PoE, connect 5VDC to this connector in the *polarity shown*. Note, if the 1522LR is used for functions covered by EN 54-16, a properly rated EN 54-4 power supply should be used for this purpose.

11.3.5   Ethernet Connection

The Ethernet connection is made via the RJ-45 connector and cabling appropriate for either 10Base-T or 100Base-TX (recommended).

11.3.6   Installation Considerations

Before first use in a system, the 1522LR should be configured with the Device Configuration Tool (Appendix C). This tool is used to set its network address (IP address, subnet mask, etc.) and whether it will be connected to a 10Base-T or 100Base-TX network.

The 1522LR can be wall mounted or DIN rail mounted. It should be mounted in a clean, dry location where it is protected from the elements. Ventilation is recommended for installations where ambient air temperature is expected to be high.

Wall Mounting – Mount the 1522LR to a wall by using two #8 screws. Attach the screws to the wall vertically spaced exactly 2.5 inches apart. The head of the screws should be about 1/10 inch away from the wall. The "keyhole slots" on the back of the 1522LR can then be slipped over the heads of the screws and down to secure.

DIN Rail Mounting – The 1522LR can be mounted to a standard (35mm by 7.5mm) DIN rail. Attach the unit to the DIN rail by hooking the top hook on the back of the enclosure to the DIN rail and then snap the bottom hook into place. Remove the unit from the DIN rail using a flat-head screwdriver. Insert the screwdriver into the notch in the release tab and pry against the enclosure to release the bottom hook.

11.4   Configuration for Use

11.4.1   Introduction

The 1522LR has a set of built-in web pages for configuring it. Use of these pages is described in the next section. The 1522LR comes from the factory with the default values shown below in Table 11-1. If the device's IP address has been changed, but forgotten there are techniques for recovering from this situation. These are described in the last section.

Table 11-1:   Factory Default Settings

Property	Value
IP Address:	10.2.150.175
Subnet Mask:	255.0.0.0
Control Web Address:	http://10.2.150.175
Setup Web Address:	http://10.2.150.175/setup.html
Setup Username:	admin
Setup Password:	iednet (all lower case)
Control Password:	no password set

11.4.2   Configuring the 1522LR

The 1522LR is configured by following these steps:

1. Connect the unit to power and network.

2. Set up a computer on the same network as the input module. To do this, set the IP address of the computer to 10.2.150.x (where "x" can be any unused address between 1 and 174) with a netmask of 255.0.0.0.

3. Configure the 1522LR using a web browser like Internet Explorer. Do this by pointing browser to the URL *http://10.2.150.175/setup.html*. The login username is admin and the password is iednet (all lower case). The initial screen one should see is shown in Figure 11-7.
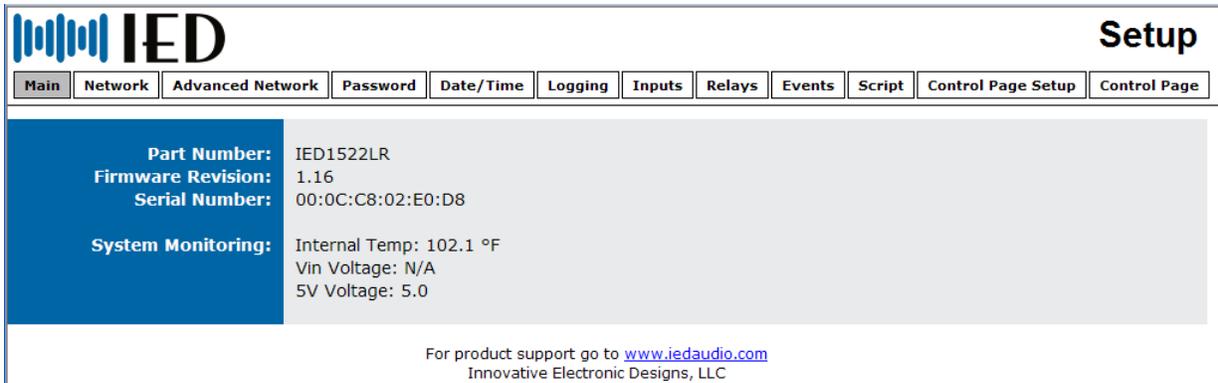
Figure 11-7:   Initial 1522LR Setup Screen

4. Set the permanent IP address, subnet mask and (optionally) the gateway address in the setup page under the Network tab.

5. Change the network Speed to 100 Mbps and the Mode to Full Duplex, also in the Network tab. The items one may change in steps 4 and 5 are shown in Figure 11-8 and are denoted by the red arrows.
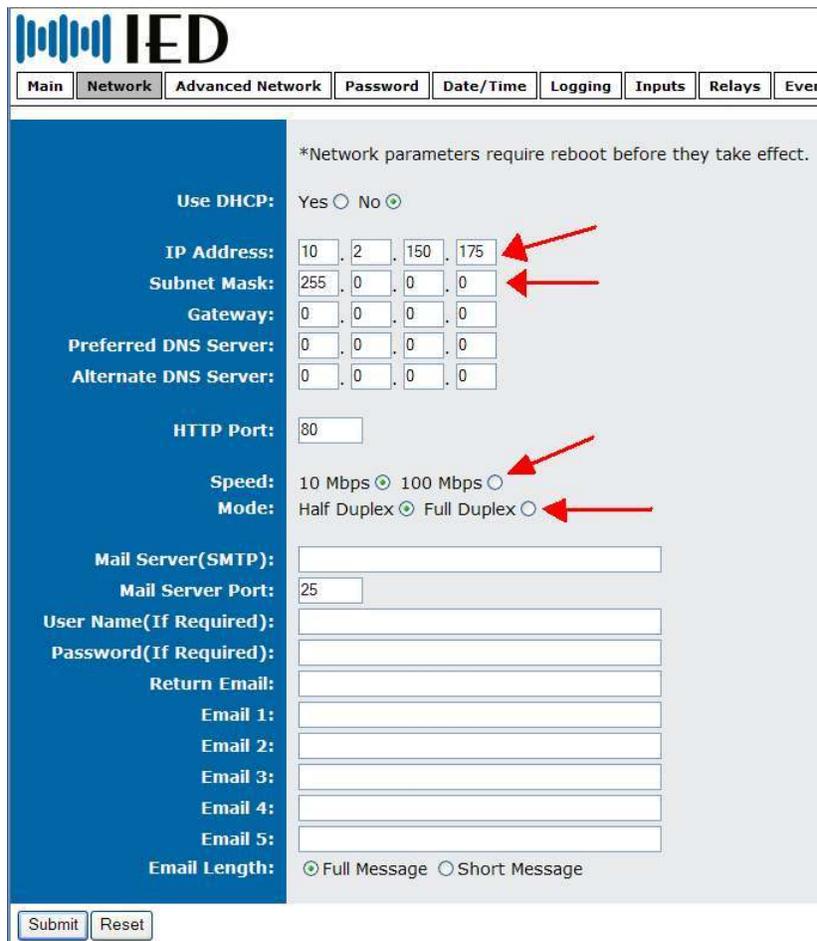
Figure 11-8:   1522LR Network Tab Properties to Change

6. Submit the changes via the Submit button on the web page.

7. Reset the 1522LR via either the Reset button on the web page or by removing and re-applying power to the unit.

8. Next, set the computer back to its original or desired network settings for the installation and verify that the 1522LR can be accessed at its new (permanent) IP address.

Note: After submitting a change to the IP address, communication will be lost to the unit until one changes the address in the web browser address bar to the new IP address.

11.4.3   Recovering from Lost IP Address

1522LR comes from the factory with the default IP address of 10.2.150.175. If the IP has been set to something else and one does not know the IP address of a 1522LR, one of two things can be done: (1) reset it to the factory default IP address or (2) assign it a temporary IP address.

Reset to Factory Defaults: In the event that the IP address or passwords are forgotten, the 1522LR may be restored to its original factory default settings. To do this, first remove the power from the unit. Next, carefully insert a thin object (such as a toothpick) through the small hole in the bottom of the unit to press the small button that is located inside the unit. When the object is inserted, a tactile feel can be detected as the button is depressed. While holding the button down, apply power and wait for about 10 seconds. After about 10 seconds, release the button. Now all settings will be back to the original factory defaults.

Warning: Do not use a metal object for this function.

Assigning a Temporary IP Address: The device will retain the temporary address until power is reset to it. How to set it depends on the host system you are working from. The procedure for doing this in Windows is described below.

Open a Command Prompt (select START, then RUN, then type "cmd"). Note: for Vista, the Command Prompt should be run as administrator (select Start, then type "cmd" and right click on "cmd" and select "Run as administrator").

In the Command window type the following:

```
arp -s {new IP address} {serial number of the 1522LR }
```

Note: IP address format is xxx.xxx.xxx.xxx
Serial number format is ss-ss-ss-ss-ss-ss (i.e., the MAC address)

For example, to set a IED1522LR (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

```
arp -s 10.10.10.40 00-0c-c8-01-00-01
```

Next, in the Command window type:

```
ping -l 102 {new IP address}
```

(The character after the dash is a lowercase "L".) For example, if the new IP address is 10.10.10.40, the following command would be used:

```
ping -l 102 10.10.10.40
```

The 1522LR should now have the temporary IP address until it is reset or reconfigured from the web pages.

11.5   Technical Specifications

11.5.1   Physical Characteristics

Height .... 3.88" (9.85 cm)

Width .... 1.41" (3.57 cm)

Depth .... 3.10" (7.80 cm)

Weight .... 5.5 oz (156 g)

11.5.2   Environmental Information

Operating Temperature Range ....
.... −22˚F − +149˚F(−30˚C − +65˚C)

11.5.3   Electrical

Relay Contacts (2)

Contact Form .... SPDT (form C)

Contact Material AgSnO2

Contact Resistance .... < 100 mΩ

Max Voltage 28VAC, 24VDC

Max Current 5A

Optically Isolated Inputs

Voltage Range .... 3 −11 VDC

Current .... 4.7–25 mA

11.5.4   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety ....EN 60950-1

Approvals .... CE marking
.... EN 54-16

11.5.5   Power

Voltage (primary) .... 48 VDC (PoE)

PoE Power .... < 3.84 W

Voltage (secondary/alt.) .... 5 VDC

Current (5 VDC) .... 474 mA max

11.5.6   Connections

Logic Inputs and Relay Outputs ....
.... 14-pin Phoenix,. 3.81 mm spacing

Network RJ45

12. IPUSBD-8/IPUSBD-16 Dante USB Audio Expansion Devices

12.1   Introduction

The IPUSBD-8 and IPUSBD-16 are products that provide 8 or 16 additional channels of record and playback capability for the 5400ACS system controller. For simplicity, in this section, the two products will generally referenced together as just the "IPUSBD". The devices are identical except for the number of digital audio channels available on each. The Ethernet connection is auto-negotiated 100/1000MB via redundant RJ-45 ports. The USB port is compatible with USB 1.0 and 2.0 standards, and will work in USB 3.0 ports. USB 2.0 or higher port is required for more than 8x8 channels simultaneously, due to bandwidth limitations of USB 1.0. The functions of the IPUSBD are shown diagrammatically in Figure 12-1.
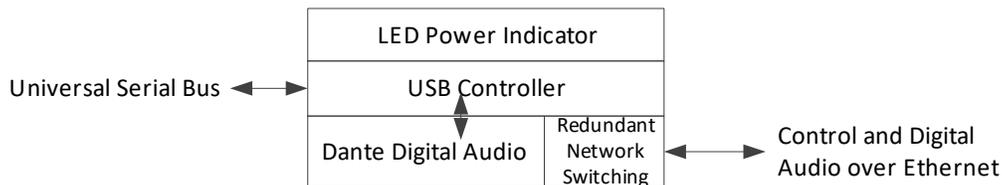
Figure 12-1:   IPUSBD Functions

The IPUSBD is provided in a half rack unit enclosure with "ears" for mounting into a 19" rack.

12.2 Controls, Connectors and Indicators

The connectors and Indicators on the IPUSBD are shown in Figure 12-2 and are described in the text below.
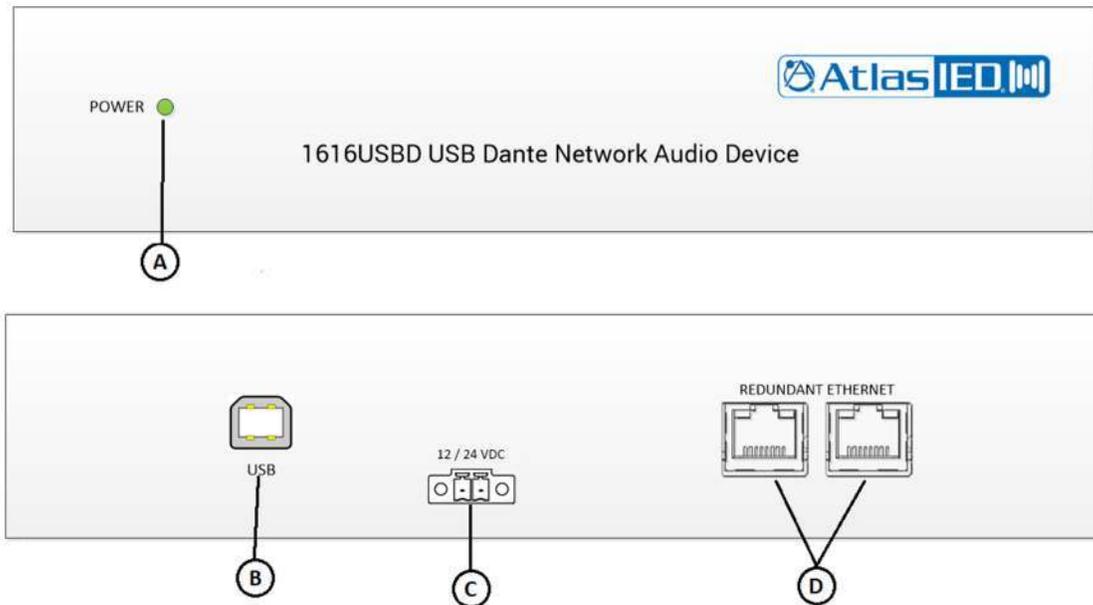
Figure 12-2:   IPUSBD Connectors and Indicators

The IPUSBD-E expansion module only has items marked B, C, D and E.

(A) **Power Indicator** – Green LED that illuminates to show the unit has power.

(B) **USB Bus Connector** – For attachment of suitable USB cable between IPUSBD and 5400ACS.

(C) **Power Input** – 12 or 24 VDC power input in either polarity

(D) **Ethernet RJ-45s** – For connection to network for control and Dante digital audio.

12.3 Connections and Installation

12.3.1   Introduction

There are three types of connection that can be made to the IPUSBD.

- USB Bus
- Ethernet
- Power

12.3.2   USB Bus Connection

Connect the IPUSBD to its 5400ACS system controller via a USB cable that goes from USB Type A to USB Type B connectors. For best performance, one should mount the IPUSBD as close as possible to the 5400ACS system controller and use as short of a USB cable as possible.

12.3.3   Ethernet Connection(s)

The Ethernet connection is made via the RJ-45 connectors and cabling appropriate for 100Base-TX or 1000Base-TX. Only one connection is required, but both may be used for network cabling redundancy purposes.

12.3.4   Power Connection

One should connect the IPUSBD to an EN 54-4 power supply using wire with sufficient capacity for the 3 Watts drawn by the IPUSBD.

12.4   Technical Specifications

12.4.1   Physical Characteristics

Size, Overall

   Height .... 1.75" (4.4 cm)

   Width .... 8.5" (21.6 cm)

   Depth .... 5" (12.7 cm)

    For proper operation add a minimum of 2" (5.1cm)
    clearance to the back for wiring to the unit.

Weight .... 3.125 lbs (1.42 Kg)

12.4.2   Environmental Information

Operating Temperature Range ....
.... +32°F – +122°F (0°C – +50°C)

Storage Temperature Range ....
.... -4°F – +158°F (-20°C – +70°C)

12.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety ....EN 60950-1

Approvals .... CE marking

.... EN 54-16

12.4.4   Power

Voltage (primary) .... 12 or 24 VDC

Power .... ~ 3.0 Watts

12.4.5   Connections

Power .... 2-pin Phoenix, 5.08 mm spacing

Network (2, redundant) RJ-45

USB Bus .... USB Type B female

13. 1100DAB-CD/1100DAB-DD Digital Audio Bridge Devices

13.1 Introduction

The 1100DAB-CD and 1100DAB-DD are products that provide a means to bridge digital audio between two networks or layer 2 VLANs. The two products differ in that the –CD product bridges CobraNet audio to Dante Audio and the –DD version bridges Dante to Dante. For this document, the simpler 1100DAB will be used to refer to both products. The –CD version can bridge 8 channels bi-directionally, while the –DD version can bridge 16 channels. The functions of the 1100DAB are shown diagrammatically in Figure 13-1.
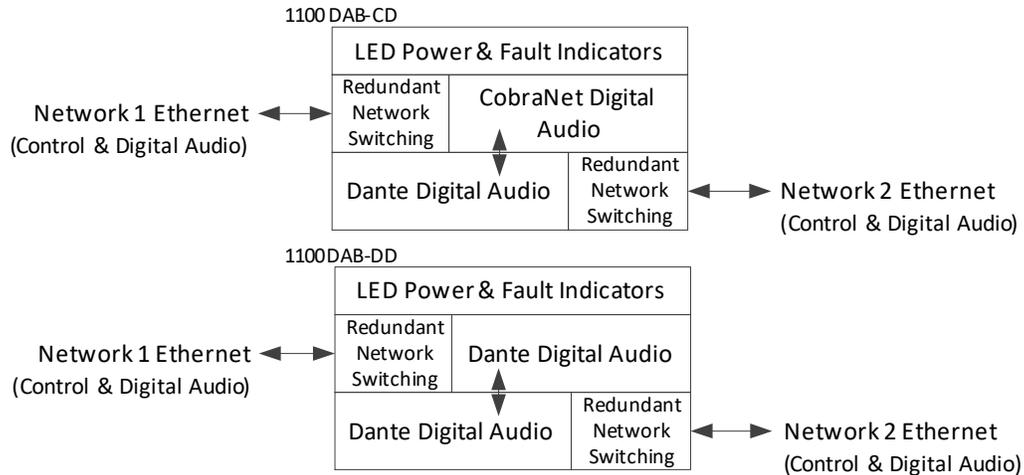
Figure 13-1:   1100DAB Functions

The 1100DAB is provided in a one rack unit enclosure suitable for mounting into a 19" rack.

13.2   Controls, Connectors and Indicators

The connectors and Indicators on the 1100DAB are shown in Figure 13-2 and are described in the text below.
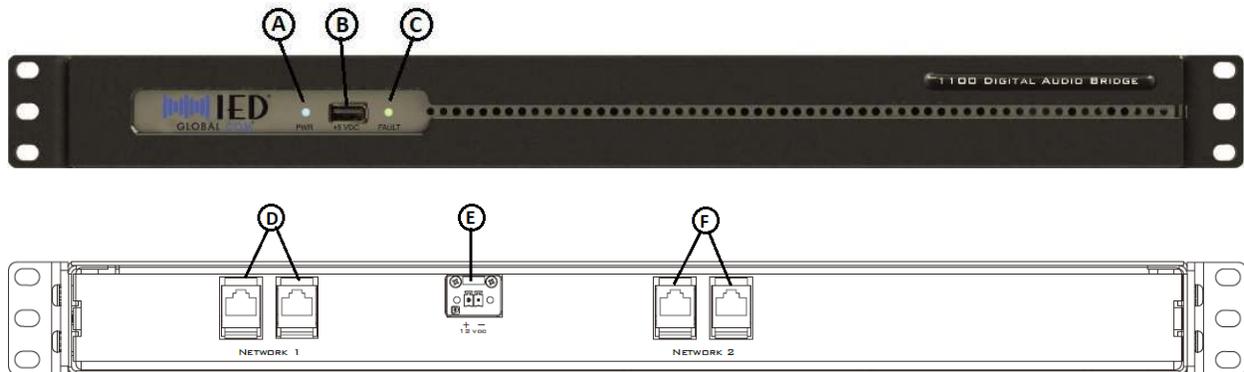
Figure 13-2:   1100DAB Connectors and Indicators

The 1100DAB-E expansion module only has items marked B, C, D and E.

(A) **Power Indicator** – Green LED that illuminates to show the unit has power.

(B) **USB Power Connector** – Supplies 5V power via USB connector (e.g., a charging port).

(C) **Fault Indicator** – Yellow LED that illuminates to show an internal fault.

(D) **Network 1 RJ-45s** – On the –CD product for connection to the CobraNet network.

On the –DD product for connection to one of the two Dante networks.

(E) **Power Input** – 12 VDC power input *in the polarity shown* below the connector.

(F) **Ethernet RJ-45s** – For connection to network 2 for control and Dante digital audio.

13.3   Connections and Installation

13.3.1   Introduction

There are three types of connection that can be made to the 1100DAB.

- Network 1 Ethernet
- Network 2 Ethernet
- Power

13.3.2   Network 1 Connection(s)

When bridging to a CobraNet audio system, this connection should be used for the CobraNet network connection, using cabling appropriate for 100Base-TX. When bridging two Dante systems/networks, this connection is to either of the two Dante network, using cabling

appropriate for 100Base-TX or 1000Base-TX. This can be either one connection or two if network cabling redundancy is desired.

13.3.3   Network 2 Connection(s)

This connects to the Dante network, using cabling appropriate for 100Base-TX or 1000Base-TX. Only one connection is required, but both may be used for network cabling redundancy purposes.

13.3.4   Power Connection

One should connect the 1100DAB to 12 VDC power supply using wire with sufficient capacity for the 6 Watts (max) drawn by the 1100DAB.

13.4   Technical Specifications

13.4.1   Physical Characteristics

Size, Overall

  Height .... 1.75" (4.4 cm)

  Width .... 17" (43.2 cm)

  Depth .... 12.25" (31.1 cm)

  For proper operation add a minimum of 2" (5.1cm) clearance to the back for wiring to the unit.

Weight .... 10.85 lb (4.92 kg)

13.4.2   Environmental Information

Operating Temperature Range ....
.... +32°F – +122°F (0°C – +50°C)

Storage Temperature Range ....
.... -4˚F – +158˚F (-20˚C – +70˚C)

13.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals .... CE marking
.... EN 54-16

13.4.4   Power

Voltage (primary) .... 12 VDC

Power

  1100DAB .... 4.8 Watts

  1100DAB-CD .... 7.0 Watts

  1100DAB-DD .... 9.2 Watts

13.4.5   Connections

Power .... 2-pin Phoenix, 5.08 mm spacing

Network 1 (2, redundant) RJ-45

Network 2 (2, redundant) RJ-45

USB Charging Port .... USB Type A female

14. 1544AIO-D Dante Audio Input/Output Device

14.1   Introduction

The 1544AIO-D provides analog-to-Dante and Dante-to-analog inputs and outputs. The device has four inputs and four outputs, but due to the way in which Dante channels are managed in the 5400 system, *only two inputs and two outputs may employed in a system design*. The audio inputs can be mic or line level. When one of the three mic levels is selected for an input, the device turns on 48V phantom power on the corresponding input connector. The Ethernet connection is auto-negotiated 100MB via an RJ-45 port. The 1544AIO-D is powered via the Ethernet connection using standard PoE (Power over Ethernet).

14.2   Controls, Connectors and Indicators

The connectors and Indicators on the 1544AIO-D are shown in Figure 14-1 and are described in the text below.
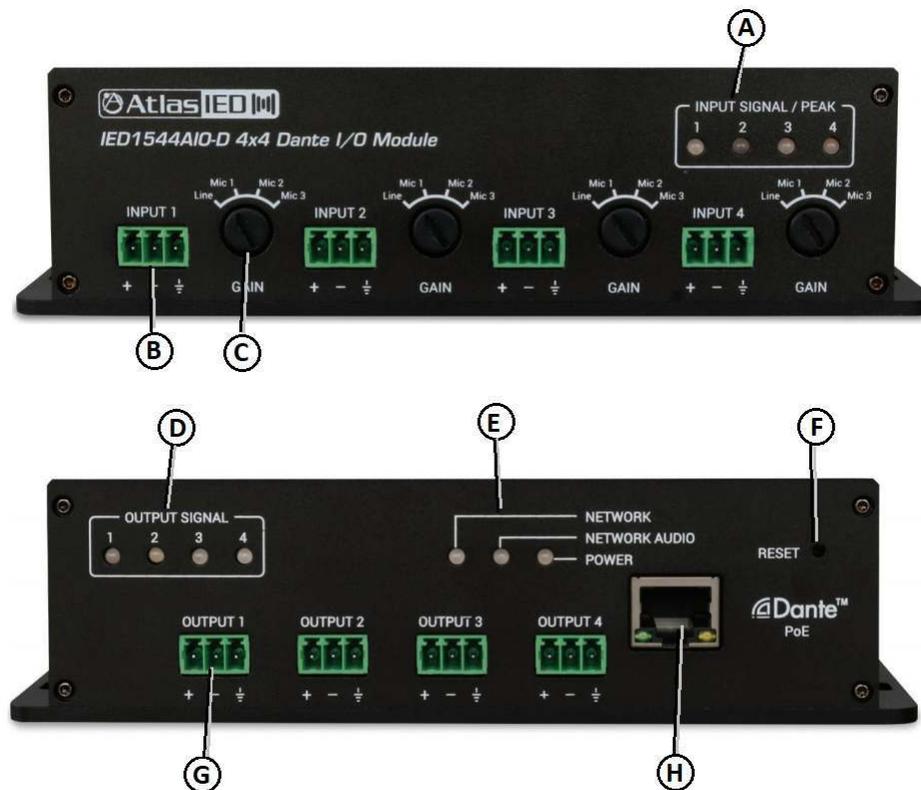
Figure 14-1:   1544AIO-D Connectors and Indicators

 (A) **Input Signal/Peak Indicators (4)** – Green LEDs illuminate to show signal presence, red LEDs illuminate to show signal is at peak (nearing clipping level) for each of the four inputs.

(B) **Input Connector (4)** – Balanced audio inputs.

(C) **Input Gain Selector (4)** – Set input to expect a signal at the nominal levels:

- Line = - 5 dBu
- Mic 1 = -15 dBu
- Mic 2 = -22 dBu
- Mic 3 = -30 dBu

In the Mic 1/Mic 2/Mic 3 positions, 48V phantom power is activated for that input.

(D) **Output Signal Indicators (4)** – Green LEDs illuminate to show signal presences on the outputs.

(E) **Device Status LEDs** – The Network and Network Audio LEDs illuminate green when there is a network connection and when there is network audio being received. The Power LED illuminates red when the unit is powered up.

(F) **Reset Button** – Press the recessed button inside the hole to reset the unit.

14.3   Connections and Installation

14.3.1   Introduction

There are three types of connection that can be made to the 1544AIO-D.

- Audio Inputs
- Audio Outputs
- Ethernet

14.3.2   Audio Input Connections

The audio input is balanced with plus, minus and shield connections. When connecting to a balanced audio output, the connections should be made one-for-one. When connecting to an unbalanced output, one should connect the ground/shield from the output to both the shield and minus pins of the audio input on the 1544AIO-D as shown below.

14.4   Technical Specifications

14.4.1   Physical Characteristics

Size, Overall

Height .... 1.75" (4.4 cm)

Width .... 3.27" (8.3 cm)

Depth .... 6.55" (16.6 cm)

For proper operation one should add a minimum of 2" (5.1cm) clearance to both front and back for wiring to the unit.

Weight .... 1.2 lbs (0.55 Kg)

14.4.2   Environmental Information

Operating Temperature Range ....
.... +32°F – +122°F (0°C – +50°C)
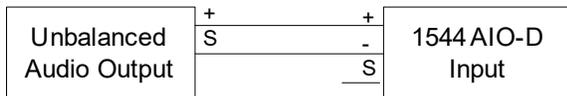
14.3.3   Audio Output Connections

Each audio output is balanced with plus, minus and shield connections. When connecting to a balanced audio input, the connections should be made one-for-one. When connecting to an unbalanced input, one should connect the minus pin of the 1544AIO-D output to the ground/shield of the audio input as shown below.

14.3.4   Ethernet Connection

The Ethernet connections are made via RJ-45 connectors and cabling appropriate for 100Base-TX.

.

Storage Temperature Range ....
.... -4°F – +158°F (-20°C – +70°C)

(G) **Output Connections (4)** – Balanced line level (max 14 dBu) connections.

(H) **Ethernet RJ-45** – For connection to network for control and Dante digital audio. This connector incorporates industry standard network connection and traffic indicator green/yellow LEDs.

14.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022

.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking

.... EN 54-16

14.4.4   Power

Voltage .... 48 V PoE

Power .... ~ 5.0 Watts

14.4.5   Connections

Inputs/Outputs (8)

.... 3-pin Phoenix, 3.5 mm spacing

Network RJ-45

15. BB-88DT/BB-816DT/BB-168DT/BB-1616DT/BB-EB1616DT Dante-Enabled Digital Signal Processors

15.1   Introduction

There are four models of Dante-enabled that may be incorporated into a system for additional audio inputs/outputs with digital signal processing (DSP) capabilities. The products mainly differ by the numbers of audio inputs/outputs they have:

- BB-88DT – 8 inputs x 8 outputs

- BB-816DT – 8 inputs x 16 outputs

- BB-168DT – 16 inputs x 8 outputs

- BB-1616DT – 16 inputs x 16 outputs

- BB-EB1616DT – 16 inputs x 16 outputs

All products have 16 Dante inputs x 16 Dante outputs. The difference between the last two products is that the EB model has fixed routing and fixed function DSP that can only do level controls on the inputs/outputs. The other models provide for user-define signal routing and DSP processing functions using the BlueBridge Designer tool. For simplicity, in this section, all the products will generally referenced together as just the "BB-xxxxDT". The BB-xxxxDT unit is one rack unit in height, suitable for mounting into a 19" rack.

15.2   Controls, Connectors and Indicators

The connectors and Indicators on the BB-xxxxDT are shown in Figure 15-1 and are described in the text below.
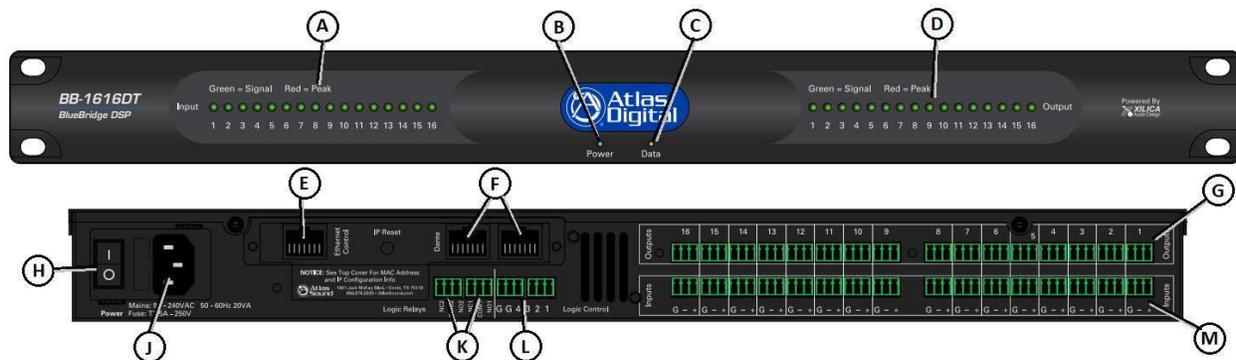
Figure 12-2:   BB-XXXDT Connectors and Indicators

(A) **Audio Input Signal/Peak Indicators** - Green LEDs illuminate to show signal presence, red LEDs illuminate to show signal is at peak (nearing clipping level).

(B) **Power Indicator** – Green LED that illuminates to show the unit has power.

(C) **Data Indicator** – Yellow LED that indicates when the unit is receiving data.

(D) **Audio Output Signal/Peak Indicators** - Green LEDs illuminate to show signal presence, red LEDs illuminate to show signal is at peak (nearing clipping level).

(E) **Network Control Port** – RJ-45 for connection to Ethernet for control. These connectors incorporate industry standard network connection and traffic indicator green/yellow LEDs.

(F) **Redundant Network Dante Ports (2)** – RJ-45s for connection to Ethernet for Dante digital audio.

(G) **Audio Outputs** – Balanced line level audio outputs.

(H) **Power Switch** – Switches on/off the mains power to the unit.

(J) **AC Power Connection** – Connect to a cord suitable for local connection to 120VAC or 230VAC mains power.

15.3   Connections and Installation

15.3.1   Introduction

There are six types of connection that can be made to the BB-xxxxDT.

- Audio Inputs
- Audio Outputs
- Ethernet
- Power
- Relays
- Logic Inputs

15.3.2   Audio Input Connections

The audio input is balanced with plus, minus and shield connections. When connecting to a balanced audio output, the connections should be made one-for-one. When connecting to an unbalanced output, one should connect the ground/shield from the output to both the shield and minus pins of the audio input on the BB-xxxxDT as shown below.

15.3.3   Audio Output Connections

Each audio output is balanced with plus, minus and shield connections. When connecting to a balanced audio input, the connections should be made one-for-one. When connecting to an unbalanced input, one should connect the minus

(K) **Relay Connections (2)** – Form C relay outputs.

(L) **Logic Input Connections (4)** – Dry contact closure detection for logic functions

(M) **Audio Inputs** – Balanced mic/line level audio inputs.

pin of the BB-xxxxDT output to the ground/shield of the audio input as shown below.
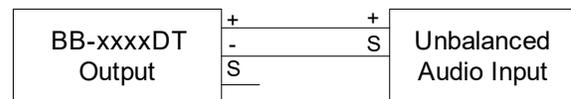
15.3.4   Ethernet Connection(s)

The Ethernet connections are made via the RJ-45 connectors and cabling appropriate for 100Base-TX or 1000Base-TX. At least the Control Network and one of the Dante Network connections has to be made. The second Dante connection may be used for network cabling redundancy purposes.

15.3.5   Power Connection

One should connect the mains power to an appropriate supply.

15.3.6   Relay Connections

These form C connections have three lines per relay: normally open (NO), normally closed (NC) and Common (C). One should connect to the common and either of the other two as appropriate for the interface/application.

15.3.7   Logic Input Connections

These inputs detect contact closures. Connections should be made between a numbered input 1, 2, 3 or 4 and one of the two ground (G) pins.

15.4   Technical Specifications

15.4.1   Physical Characteristics

Size, Overall

   Height .... 1.75" (4.4 cm)

   Width .... 19" (48.1 cm)

   Depth .... 9" (22.9 cm)

    For proper operation add a minimum of 2" (5.1cm) clearance to the back for wiring to the unit.

Weight .... 7.2 lbs (3.25 Kg)

15.4.2   Environmental Information

Operating Temperature Range ....
.... +32°F – +122°F (0°C – +50°C)

Storage Temperature Range ....
.... -4˚F – +158˚F (-20˚C – +70˚C)

15.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... UL 60005, EN 60950-1

Approvals ....CE marking
.... EN 54-16

15.4.4   Power

Voltage (primary) .... 90 – 240 vAC, 50-60 Hz

Power .... 18.5 W

Phantom Power on Inputs .... 48 V
   Software enabled

15.4.5   Audio Characteristics

Input Impedance .... >10 kΩ

Distortion ....0.002% (1 kHz@ 4 dBu)

Audio Bandwidth .... 20 Hz-20 kHz

15.4.6   Connections

Power .... Removable Standard IEC

Network (3) RJ-45

Audio Inputs (*)............... 3-pin Phoenix, 3.5 mm spacing

Audio Outputs (*)............ 3-pin Phoenix, 3.5 mm spacing

Relays (2)........................ 3-pin Phoenix, 3.5 mm spacing

Logic Inputs (**) .... 6-pin Phoenix, 3.5 mm spacing

_____

* Number of input or output connections depend upon the particular model

** One connector handles all four logic inputs

16. DNA2404DH Dante Digital Network Amplifier

16.1 Introduction

The DNA2404D provides four zones of amplification of incoming Dante audio, with built-in DSP functions including ambient analysis, and with speaker line supervision when end-of-line modules are employed on the speaker circuits. The functions of the DNA2404DH are shown diagrammatically in Figure 16-1.
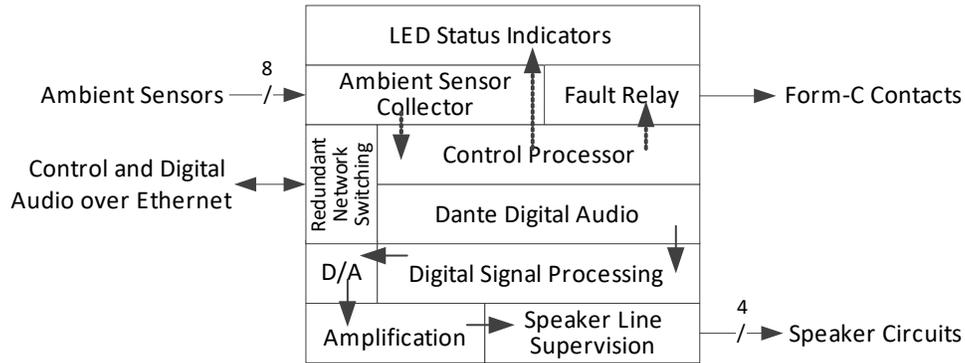
Figure 16-1:   DNA2404DH Functions

The DNA2404DH is provided in a two rack unit high enclosure with "ears" for mounting into a 19" rack.

16.2   Controls, Connectors and Indicators

The connectors and Indicators on the DNA2404DH are shown in Figure 16-2 and are described in the text below.
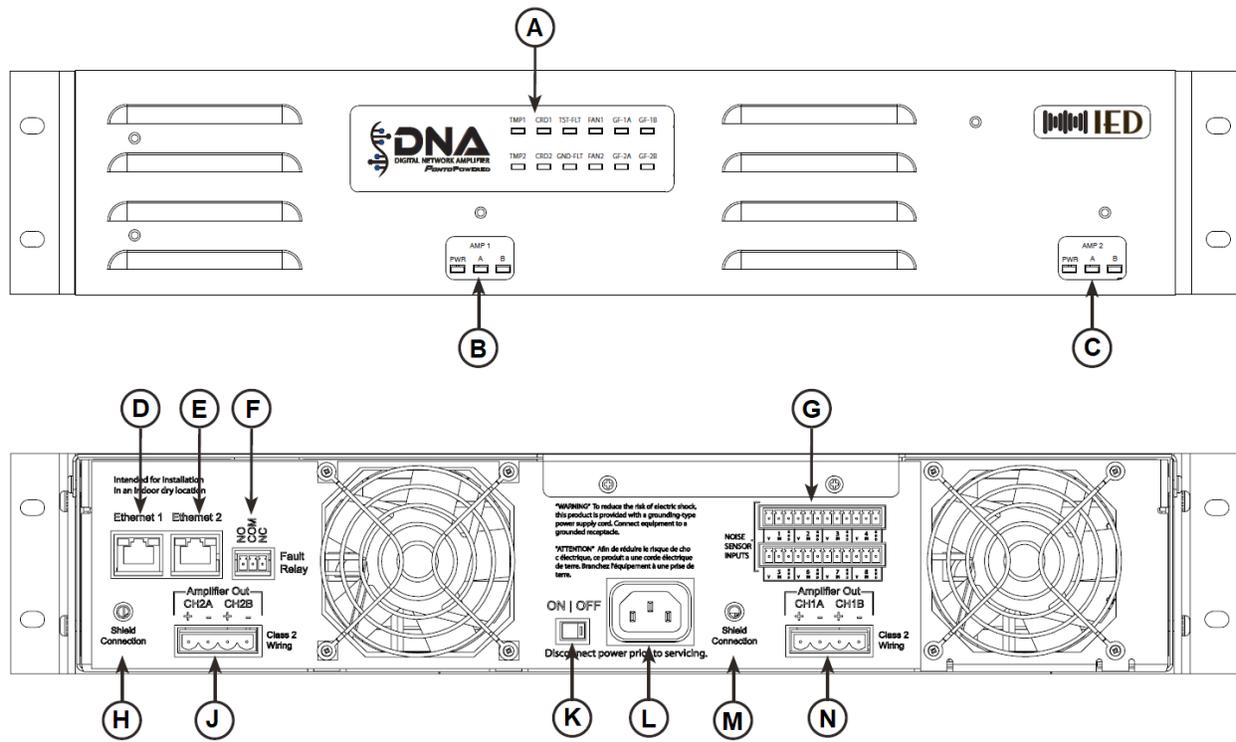
Figure 16-2:   DNA2404DH Connectors and Indicators

 (A) **Frame Status Indicators** – See below for descriptions of all these indicators.

(B)/(C)   **Amp Card 1/2 Indicators** – Green power LED and green/yellow signal/peak indicators for channels A and B.

(D)/(E)   **Redundant Ethernet RJ-45s** – For connection to network for control and Dante digital audio. These connectors incorporate industry standard network connection and traffic indicator green/yellow LEDs.

(F) **Fault Relay** – Form C connection.

(G) **Ambient Sensor Connections** – Up to two sensors per amp channel.

(H) **(opt.) Shield/Earth Connection** – If insufficient grounding for ground fault detection through the rack mounting.

(J)/(N)   **Speaker Circuit Connections**

(K) **Power Switch**

(L) **Power Input Connection.**
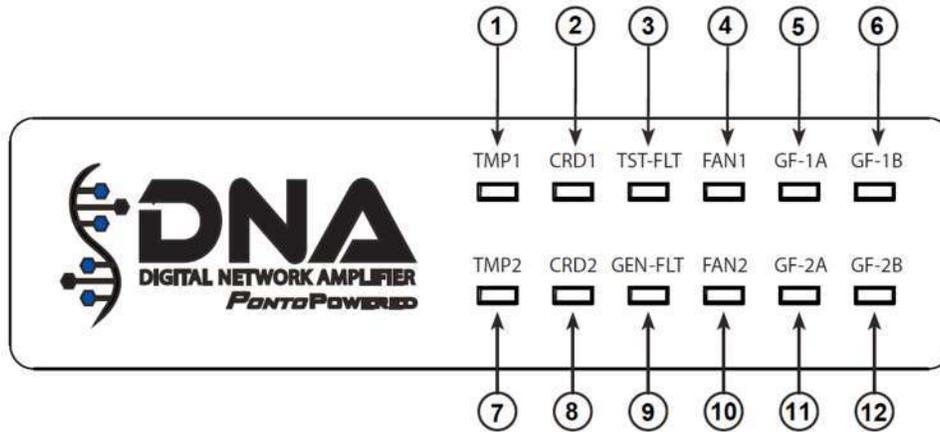
(1)/(7)   **Temperature Fault for Amp Card 1/2**

(2)/(8)   **Amp Card 1/2 Fault** – Such as blown fuse or power supply on the card.

(3)   **Test Fault** – Speaker line supervision test fault for some zone

(9)   **General Fault** – This LED will illuminate when any of the available fault conditions are present. It coincides with the activation of the fault relay on the back of the unit.

(4)/(10)   **Fan 1/2 Fault** – Fan speed low.

(5)/(6)/(11)/(12)   **Ground Fault for Speaker Lines 1A/1B/2A/2B**

16.3   Connections and Installation

16.3.1   Introduction

There are three types of connection that can be made to the DNA2404DH.

- Ethernet
- Fault Relay
- Earth Ground Reference
- Ambient Sensors
- Speaker Circuits
- Power

16.3.2   Ethernet Connection(s)

The Ethernet connection is made via the RJ-45 connectors and cabling appropriate for 100Base-TX. Only one connection is required, but both may be used for network cabling redundancy purposes.

16.3.3   Fault Relay Connection

The relays are form-C which means there are both NO (Normally Open) and NC (Normally Closed) connection in addition to the common (C) connection. Typically external devices are attached to the C and either the NO or NC connections depending on the desired signaling with the external system.

16.3.4   Earth Ground Reference Connection

This should be connected to an earth ground point in order to allow the 5404DZM to properly detect speaker line ground faults.

16.3.5   Ambient Sensor Connections

Each ambient sensor has three connections: ground, power and sensor signal. The ground connection should go to the pin with the ground symbol. The power connection should go to the pin with the plus sign (+) and the sensor signal should go to the pin in between (labeled 1A, 1B, etc. up to 4B). The connections are labeled by amp channel 1 – 4 and A and B for the two possible sensors per channel. If only one sensor is available for a channel, then it should be connected to the A pins.

16.3.6   Speaker Line Connections

The speaker outputs should be connected to the speaker line field wiring using a gauge of wire appropriate to the total load on that speaker run.

16.4   Technical Specifications

16.4.1   Physical Characteristics

Size, Overall

Height .... 2 RU or 3.5" (8.9 cm)

Width (with rack ears) .... 19" (48.3 cm)

Depth .... 17" (43.2 cm)

For proper operation add a minimum of 2" (5.1cm) clearance to the back for wiring to the unit.

Weight .... 19.2 lbs (9.7 Kg)

16.4.2   Environmental Information

Operating Temperature Range ....
.... +32°F – +104°F (0°C – +40°C)

Storage Temperature Range ....
.... -4˚F – +158˚F (-20˚C – +70˚C)

16.4.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4,
.... FCC part 15

Electrical Safety ....UL 60065, EN 60065, IEC 60065

Approvals ....CE marking
.... UL 1711
.... EN 54-16

16.4.4   Audio Characteristics

Power Bandwidth .... 20 Hz – 20 kHz, ± 3 dB

Signal-to-Noise Ratio .... >85 dB

16.3.7   Power Connection

One should connect the DNA2404DH to a suitable 240VAC power source.

Total Harmonic Distortion .... <0.2% @ 2 kHz

Output Impedance .... 0.6 Ω

Speaker Output Voltage .... 100 V RMS, Max

Power delivered to Speakers .... 600 W/Chan, burst
.... 200 W/Chan continuous

16.4.5   Fault Relay Characteristics

Nominal Switching Capacity .... 1.0 A @ 30 VDC
.... or 0.3 A @ 125 VAC (resistive load)

Max. Switching Power .... 30 W (DC), 37.5 VA (AC)

Max. Switching Voltage .... 110 VDC @ 0.27 A
.... or 125 VAC @ 0.3 A

16.4.6   Unit Power

Voltage (primary) .... 230 VAC, 50-60 Hz

Power Draw...

Quiscent .... 104 W

Full Power (all channels) .... 1000 W, Max

Speech (all channels) .... 530 W

Power Factor 0.70

16.4.7   Connections

Power .... 2-pin Phoenix, 5.08 mm spacing

Network (2, redundant) RJ-45

USB Bus .... USB Type B female

17. 1544BAS Backup Amplifier Switcher

17.1 Introduction

The 1544BAS is a device that provides backup amplifier switch capabilities for the DNA2404DH digital network amplifiers. The backup can be done as 1-to-1 or Many-to-1. See the Section 101.6.2 of this manual on System Architecture for examples of how to wire this device to DNA2404DH amplifier frames. The functions of the 1544BAS are shown diagrammatically in Figure 17-1.
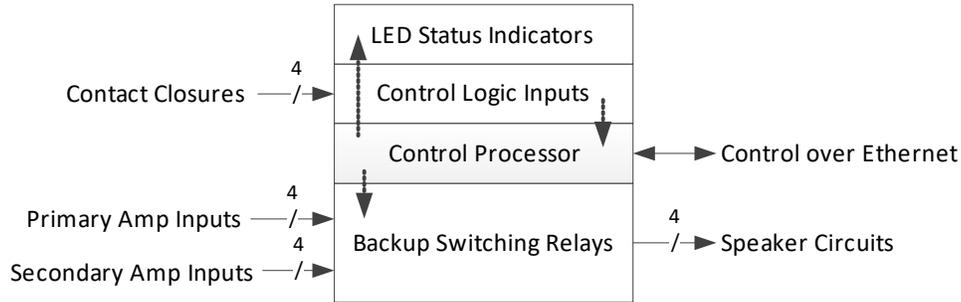
Figure 17-1:   1544BAS Functions

The 1544BAS is provided in a DIN rail mountable package, which also has options for mounting flush on other surfaces.

17.2   Controls, Connectors and Indicators

The connectors and Indicators on the 1544BAS are shown in Figure 17-2 and are described in the text below.
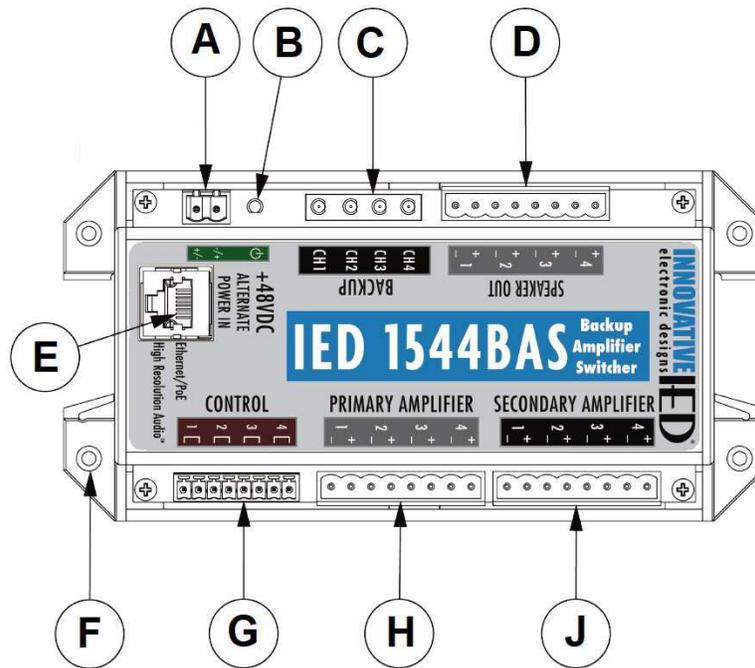
Figure 17-2:   1544BAS Connectors and Indicators

The 1544BAS-E expansion module only has items marked B, C, D and E.

(A) **(opt.) Aux Power Input –** As an alternative to Power over Ethernet, 48 VDC can be applied here in either polarity.

(B) **Power Indicator** – Green LED that illuminates to show the unit has power.

(C) **Backup Status LEDs** – Yellow LEDs to indicate when each channel is switched to backup.

(D) **Speaker Outputs** – Connect to speaker circuits for these zones.

(E) **Ethernet RJ-45** – For connection to network for control.

(F) **Mounting Holes (4)** – tabs with holes for alternate mounting to sliding unit onto DIN rail through middle.

(G) **Control Logic Inputs (4)** – Dry contact closure connections to switch amplifier channels to the backup amplifier. This control is an alternate to network control normally done by the system controller.

(H) **Primary Amplifier Inputs (4)** – Connections to the primary amplifier speaker out lines.

(J) **Secondary Amplifier Inputs (4)** – Connections to the backup amplifier speaker out lines.

17.3   Connections and Installation

17.3.1   Introduction

There are several types of connection that can be made to the 1544BAS.

- Amplifier Connections
- Speaker Line Connections
- Ethernet Connection
- (opt.) Control Line Input Connections
- (opt.) Power Connection

17.3.2   Amplifier Connections

Connect the 1544BAS primary and secondary amplifier inputs to the speaker outputs of two DNA2404DH amplifiers, using a gauge of wire suitable for speaker circuits of the intended load.

17.3.3   Speaker Line Connections

Connect these to the speaker circuits for each channel using a gauge of wire suitable for the intended speaker load.

17.3.4   Ethernet Connection

The Ethernet connection is made via the RJ-45 connector and cabling appropriate for 100Base-TX.

17.3.5   (opt.) Control Line Inputs

If not configuring the 5400ACS to do the backup amplifier switching control via the network, one may connect these inputs to the primary amplifier status lines, so that switching is performed on a bad amplifier status signal.

17.3.6   (opt.) Power Connection

As an alternative to Power over Ethernet, one may connect this input to 48 VDC.

17.4   1544BAS Initial Configuration

From the factory, the 1544BAS comes with a fixed address of 10.2.150.181. These settings can be changed as necessary via the built-in web pages. One accesses the web pages by typing the IP address into a browser address bar, e.g., "http://10.2.150.181".

Note, one will need to be on a computer configured to be on a compatible 10.x.y.z network in order to access the device at this address. This may require one to (temporarily) add a compatible network setting on their laptop or desktop computer used to access these web pages.

The first page one encounters is the Status page. This shows the current state of all of the relay outputs and logic inputs. One wants to click on the "Settings" label on the left (circled in red in the figure below) to go to the Settings page.
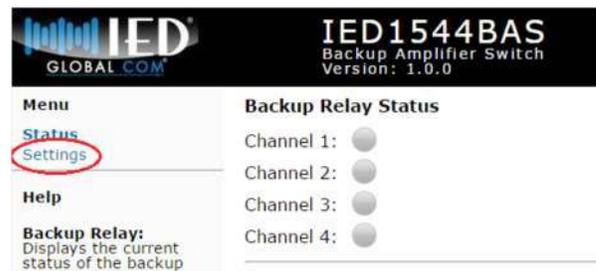
Figure 17-3: Access the Settings Page

Before accessing the Settings page, one must enter the current password in the edit box shown below. By default from the factory, the password is "iednet" (without the quotes). This password can be changed on the Settings page, once accessed.

Figure 17-4: Enter Password

Once the correct password is entered and the Enter button pressed, one is taken to the Settings page as shown in the example below.

On this page, one can either enter the proper fixed address settings (IP address, subnet mask, and router or default

gateway) or alternately enable DHCP (dynamic addressing) via the checkbox provided. The Password edit box is where one can change the password used to access the Settings page. There is also a checkbox to Disable Contact Closures. When checked, the 1544BAS can only be controlled via the network commands, as hardware control via the contacts is disabled.

Figure 17-5: Settings Page

Once all the changes are made, one presses the Save Settings button. After the settings are saved to flash, they will not take effect until the unit is rebooted or repowered. When changes are made and saved, the web page will prompt to reset the device via the button and red notification shown in the figure below.

Figure 17-6: Change Notification

17.5   Device Recovery

In the case somebody forgets the Settings password and not be able to properly access it, this can be reset by the Factory Reset option. This can be done by sending the command via HTTP from a browser, followed by a Reboot command. The form of these commands are:

> http://w.x.y.z/cmd?FactoryReset=A55A

> http://w.x.y.z/cmd?Reboot=A55A

where w.x.y.z is the current IP Address of the 1544BAS. (Note, the capitalization is important.) The device should respond to the first command with text in the browser that simply says:

> Command Accepted

Note, after the reboot, the device will be at the factory default IP address and so may not be addressable without changing the browser to point to that IP address.

17.6   Technical Specifications

17.6.1   Physical Characteristics

Size, Overall

    Height .... 7" (17.81 cm)

    Width .... 3.5" (8.90 cm)

    Depth .... 2" (5.08 cm)

Weight .... 9.6 Oz (272 g)

17.6.2   Environmental Information

Operating Temperature Range ....
.... -22°F – +149°F (-300°C – +65°C)

17.6.3   EMC and Safety

Electromagnetic Compatibility .... EN 55022
.... EN 61000-3-2, EN 61000-3-3, EN 5013-4

Electrical Safety .... EN 60950-1

Approvals ....CE marking
.... EN 54-16

17.6.4   Relay Ratings

Max Voltage .... 250 VAC

Max Current .... 8 A

Max Power Amplifier Rating (each channel)......... 500 W

17.6.5   Unit Power

Primary .... 48 VDC via PoE (802.af compliant)

Alternate/Optional ....40 - 50 VDC

Power Draw.. 4.0 Watts Max

17.6.6   Connections

Power .... 2-pin Phoenix, 5.08 mm spacing

Network RJ-45

Amplifier Inputs .... 8-pin Phoenix, 5.08 mm spacing

Speaker Outputs .... 8-pin Phoenix, 5.08 mm spacing

Control Inputs .... 8-pin Phoenix, 3.81 mm spacing

100.   Cabling

100.1 Introduction

The cabling required to connect the components of a complete voice alarm system consists of the following types:

- Line Level Audio Cables
- Speaker Cables
- Ethernet Cables
- Logic Cables
- 24V Power Supply Cables

The requirements for these different types of cabling are covered in the sections which follow.

> *Note: What is covered in these sections are general recommendations. It is the responsibility of the installer to use a cable that meets all local fire and electrical codes.*
>
> *Additionally, it is the installer's responsibility to abide by any special installation/wiring instructions or recommendations supplied with any third party equipment used in a system.*

100.2 Line Level Audio Cables

For balanced line level audio interconnections, generally shield twisted pair cabling should be used. If making individual connections, a cable with one pair and an overall shield, such as Belden 8451 or 8761 or equivalent may be used (e.g., 22 AWG gauge pair w/ foil shield). If making multiple connections, a multi-pair cable may be used, either with an overall shield or shields on individual pairs.

If the connection is being made a long distance, such as outside of the immediate equipment rack, the shield should only be connected at one end to avoid possible ground loops. Also, if cabling is running through conduit or in plenums, a special cable may be required.

100.3 Speaker Cables

Speaker cabling should be two conductor unshielded cable. The gauge should be selected to handle the current capacity for the distributed speaker line, which could vary from under one ampere for low power zones to as much as 5 Amps for a 500 Watt zone. One also has to be careful to select a cable that is rated for the type of installation, such as plenum rated cabling if installed in plenums.

100.4 Ethernet Cables

All Ethernet connections to GLOBALCOM equipment are 100Base-TX type connections using RJ-45 connectors, unless indicated otherwise in the individual device specifications (some *also* allow 1000Base-TX connections). The cabling used should be *minimum* Cat 5 UTP or shielded twisted pair (STP) wire, 22 or 24 AWG for the 100Base-TX connections and Cat 5e or Cat 6 UTP or STP for the 1000Base-TX connections.

The maximum length of this cable between any two connections in the system is limited to 100 meters (328 feet). For longer distances, the installer may employ media converters to convert to/from an appropriate fiber cable.

100.5 Logic Cables

Logic cables can be the same type cable used for line level audio, although the overall shield is not used or required. So, to save cost a cable without a shield may be used if desired.

For maximum EMI protection, any used Logic inputs on the back of the 5400ACS should include a ferrite core near the connector on the 5400ACS wired the same as shown below in Figure 100-1 for the DC supply outputs.

100.6 Power Supply Cables

Cabling between the 24V power supply and components such as the 5400ACS and 54xxDZM should be two-conductor, shielded wire sized to handle the current load of the attached device. In addition, since the IED equipment presents a high capacitance (up to 1000 uF) on these lines, it may be necessary with some third party products to include ferrite

cores attached close to the connector on the supply as shown below in Figure 100-1. (This is true for the power supplies that were used in the certification of the system, for example.)

Also it is a good practice to apply these same type of ferrite cores to the 230V input lines to reduce any conducted emissions back into the power lines of the facility.
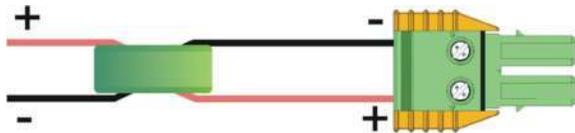
Toroid Type Ferrite Core

Clamp-on Type Ferrite Core

Figure 100-1:   Ferrite Core Placement

Additionally, to minimize electro-magnetic radiation from the system, one should include line filter modules between the 24VDC power supply and the IED components such as the Cosel SNR series (SNR-10-223-DT) power line filters. (see photo in Figure 100-2).

Figure 100-2:   Line Filter

100.7 Mains Cabling

To meet the requirements of the standards, it is necessary to install varistors on the mains cabling when it enters the rack, e.g., on the DIN rail connector blocks. This should be done according to the diagram in Figure 100-3.
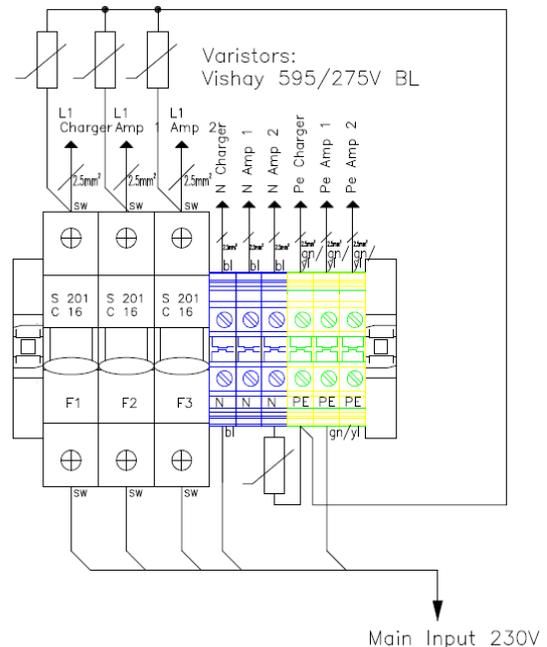

Figure 100-3:   Varistor Wiring on Mains

101.   System Architecture

101.1 Introduction

The sections which follow provide the fundamentals of configuring a system with the IED EN 54-16 system. It shows systems in their most simplified form. Actual systems would typically be more complicated than the examples shown, made up of compounding of units to meet the system requirements for number of control points (5416CS or 5450CS control stations) and number of zones. Topics covered in the following sections are: Basic System, Redundant Cabling, External Systems Connections (e.g., to fire panels), Backup Amplifiers and Lifeline Controller.

101.2 Basic System

The most basic system architecture is shown in Figure 101-1. This is a very simple system with one mic station and four zones. It could become a 32-zone system by substituting a 5432DZM for the 5404DZM and putting a larger power amp (5434AMP or 5454AMP) in place of the 5414AMP. For more options and flexibility in controlling the system, a 5450CS could be substituted for the 5416CS. As depicted, it is possible to insert Background music into either the 5400ACS or the Auxiliary Input on the 5416CS.

Figure 101-1:   Basic System Architecture

101.3 Redundant Cabling

The GLOBALCOM EN 54-16 system may be wired with redundant Ethernet using suitably configured redundant managed switches and cabling, such as in the simplified diagram in Figure 101-2. One connection from each of the switches should go to the redundant Ethernet ports on each GLOBALCOM device as shown in the figure. Note, if both switches have power over Ethernet (PoE), the communication station will properly draw power from either one. Otherwise, one may power the station with a local external EN 54-4 rated power supply.
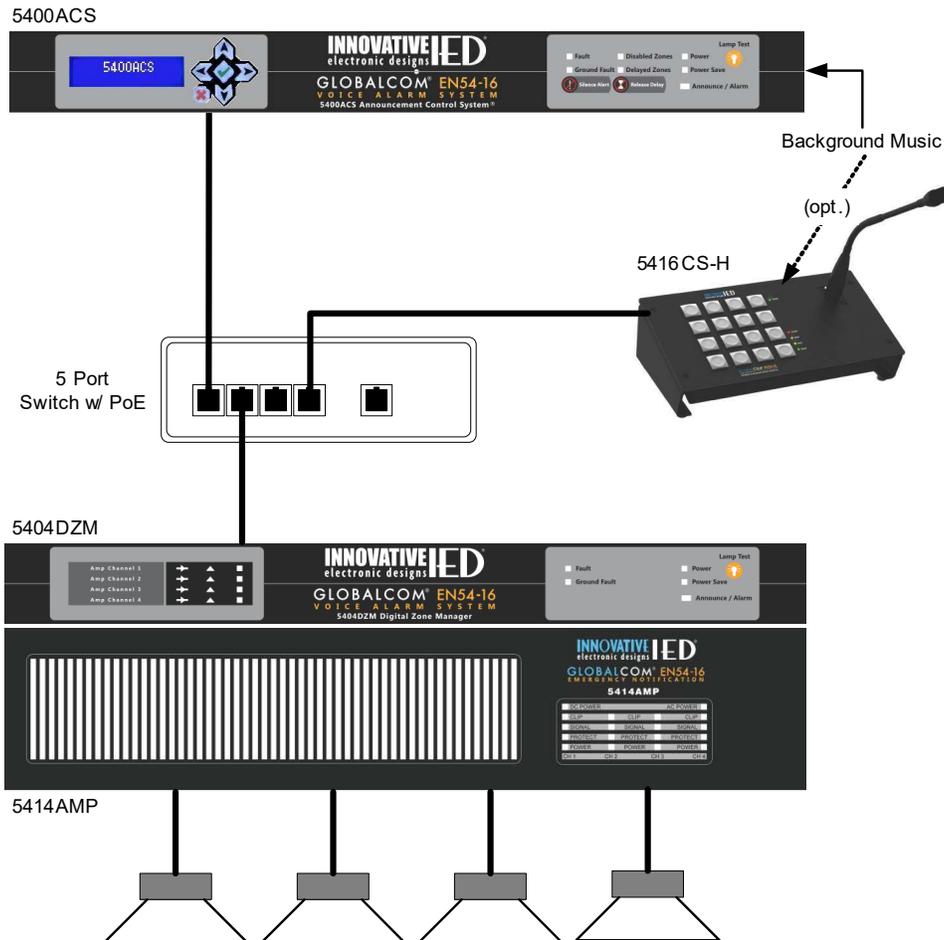


Figure 101-2: Redundant Ethernet Cabling Architecture

101.4 Interconnecting 54xxDZM and 54xxAMP Amplifiers

There are a number of interconnections between either a 5404DZM or 5432DZM and its companion 5414/5134/5454AMP power amplifier. Cable harnesses may be available from the distributor to make these interconnections easy to make in the field. If wiring is done by hand instead of using such harnesses, they should make all the connections described below. The general wiring between a 5404DZM or 5432DZM and any of the 54xxAMP models is shown schematically by wire pairs in Figure 101-3 and 13-4 respectively. The exact terminal-to-terminal connections are listed in Table 101-1.
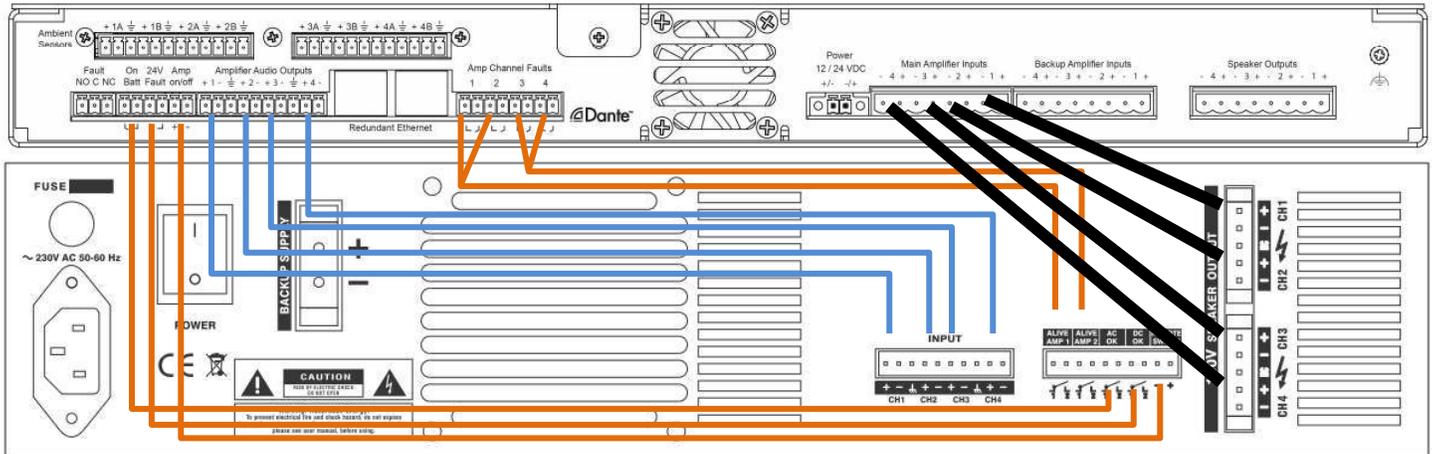
Figure 101-3: 5404DZM to 54xxAMP Wiring
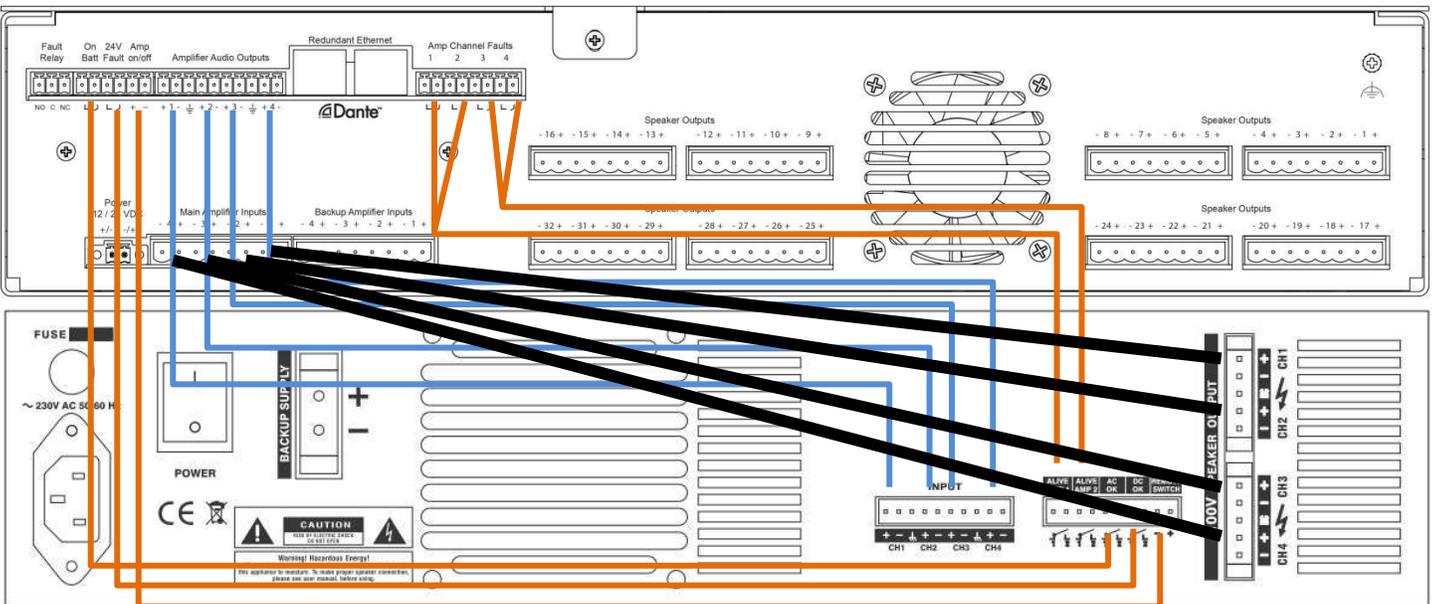
Figure 101-4: 5432DZM to 54xxAMP Wiring

The end-points are the proper Phoenix connectors with ends terminated according to best wiring practices (e.g., ferrules, shrink wrap). It is recommended that these units are always located right above/below each other as shown in the diagrams. The green lines are shielded twisted pair cable, with the grounds for pairs of channels 1/2 and 3/4 landed on the shared ground connection between the
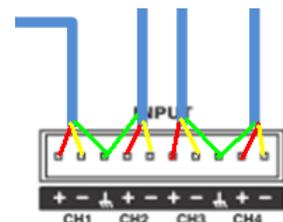
channels, such as in the close-up at right. All orange wires are low voltage logic lines that do not need to be shielded or twisted. The black cables should be speaker wire gauge twisted pair sized appropriately to handle the amplifier/speaker current load. The specific connections to be made are listed in Table 101-1. The ground or shield symbol is represented in this table by the down triangle (▼) character.

Table 101-1:   54xxDZM to 54xxAMP Wiring

Line Level Audio from DZM to AMP

54xxDZM Terminal	54xxAMP Terminal
Amplifier Audio Output 1+ _____	CH1 +
Amplifier Audio Output 1– _____	CH1 –
Amplifier Audio Output ▼_____	CH1/2 ▼
Amplifier Audio Output 2+ _____	CH2 +
Amplifier Audio Output 2– _____	CH2 –
Amplifier Audio Output 3+ _____	CH3 +
Amplifier Audio Output 3– _____	CH3 –
Amplifier Audio Output ▼_____	CH3/4 ▼
Amplifier Audio Output 4+ _____	CH4 +
Amplifier Audio Output 4– _____	CH4 –

Power Status and Control Connections

54xxDZM Terminal	54xxAMP Terminal
On Batt 1 _____	AC OK 1
On Batt 2 _____	AC OK 2
24V Fault 1_____	DC OK 1
24V Fault 2_____	DC OK 2
Amp On/Off 1 (+/-) _____	Remote Switch +
Amp On/Off 2 (▼) _____	Remote Switch –

Amplifier Status Connections

54xxDZM Terminal	54xxAMP Terminal
Amp Channel Faults 1-1 _____	Alive Amp 1-1
Amp Channel Faults 1-2 _____	Alive Amp 1-2
Amp Channel Faults 2-1 _____	Alive Amp 1-1
Amp Channel Faults 2-2 _____	Alive Amp 1-2
Amp Channel Faults 3-1 _____	Alive Amp 2-1
Amp Channel Faults 3-2 _____	Alive Amp 2-2
Amp Channel Faults 4-1 _____	Alive Amp 2-1
Amp Channel Faults 4-2 _____	Alive Amp 2-2

Amp Outputs to DZM

54xxDZM Terminal	54xxAMP Terminal
Main Amplifier Inputs 1 + _____	100V SPEAKER OUTPUT CH1 +
Main Amplifier Inputs 1 – _____	100V SPEAKER OUTPUT CH1 –
Main Amplifier Inputs 2 + _____	100V SPEAKER OUTPUT CH2 +
Main Amplifier Inputs 2 – _____	100V SPEAKER OUTPUT CH2 –
Main Amplifier Inputs 3 + _____	100V SPEAKER OUTPUT CH3 +
Main Amplifier Inputs 3 – _____	100V SPEAKER OUTPUT CH3 –
Main Amplifier Inputs 4 + _____	100V SPEAKER OUTPUT CH4 +
Main Amplifier Inputs 4 – _____	100V SPEAKER OUTPUT CH4 –

101.4.1   Dual-Amplifier 54xxDZM Wiring

When a 5404DZM or 5432DZM is configured to back up itself, it should be connected to two power amps as shown in the figure below. The main amplifier is wired to the 54xxDZM the same as it always does. In addition, the **Amplifier Audio Outputs** from the 54xxDZM should be wired to the inputs on the backup power amplifier (so it will be wired to *both* amplifiers) as shown by the blue lines in the figure below. Then, one connects the amplifier outputs from the backup amplifier to the **Backup Amplifier Inputs** of the 54xxDZM. If the system is configured to run on battery backup (i.e., EN 54-4 power supply) then the amplifier control lines should be run to the backup amplifier as well (dotted orange line in the figure).
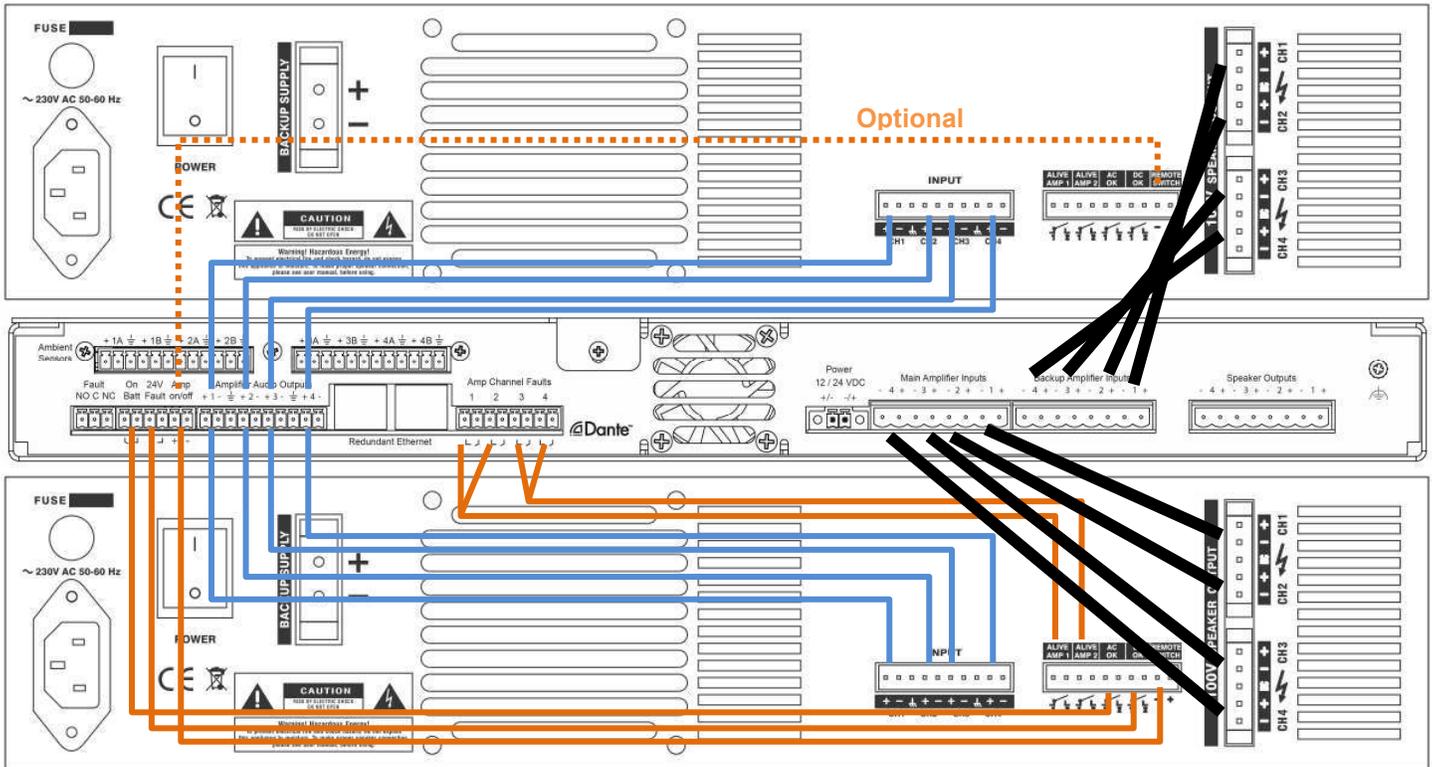

Figure 101-5:   5404DZM to Dual 54xxAMP (Self-Backup) Wiring (Backup on Top, Main on Bottom)

In this configuration, only the amplifier status (Alive) signals and AC/DC OK signals from the main amplifier are monitored (the orange lines in the figure). The backup amplifier is supervised too, but only by running the periodic test, which measures the response of the amplifier on the signals received at the Backup Amplifier Input terminals on the 54xxDZM.

> *Note: Supervision of the backup amplifier in this configuration requires an update to the 54xxDZM firmware to 2.0.10. Without the updated firmware version, this configuration will still function, only the backup amplifier will not be supervised.*

101.5 External Systems Connections

An external system such as a fire panel may be connected to the system using the logic inputs, relay outputs and auxiliary audio input connections on the 5400ACS such as the example shown in Figure 101-6. One or more alarm triggers from the external system could be connected to the logic inputs (max 8). These triggers could launch alarms (or non-emergency messages) in the GLOBALCOM system. As an alternative to pre-recorded message alarms, if the external system has an audio output from its playback unit or emergency microphone, this audio could be brought into one of the auxiliary audio inputs on the 5400ACS. This audio can be directed to the proper zones via the contact closure alarm triggers.
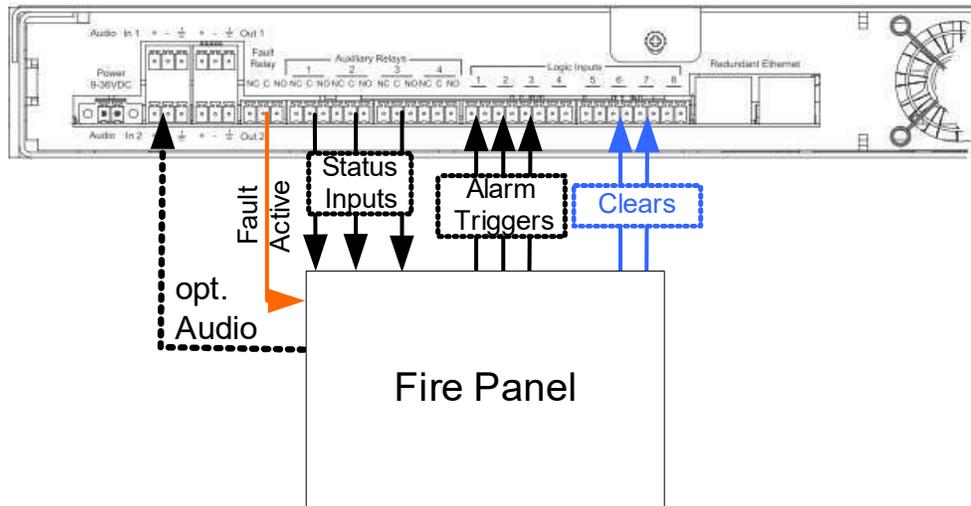
Figure 101-6:   Possible External System Connections

In addition to alarm triggers, it is possible to configure some of the logic inputs on the 5400ACS to perform one of two clear functions: Clear All Faults and Silence (Clear) All Alarms. These controls might be coupled with a reset of the fire panel, so that the voice alarm system is put into the same clear state. Additionally, logic inputs can be used to signal faults in external equipment to the 5400ACS.

For information back to the external system, the fault relay output could be sent to the external system. In addition, the auxiliary relays can be configured to indicate any of the following conditions (basically mirroring of any of the front panel status LEDs):

- System is in alarm (one or more alarms active)

- Zones are in delay (one or more zones are in alarms but not broadcasting until the delay expires or is manually released).

- Zones are disabled

- Announcement is Active (non-Alarm)

- Power Fault condition present

- Any Fault present (duplicate of the fault LED, e.g., for linking to second or third external devices/systems)

If this status information to an external system is not required, these relay outputs can be used instead for alarm/announcement related things such as triggering strobe lights or bypassing a local volume control during an alarm or announcement.
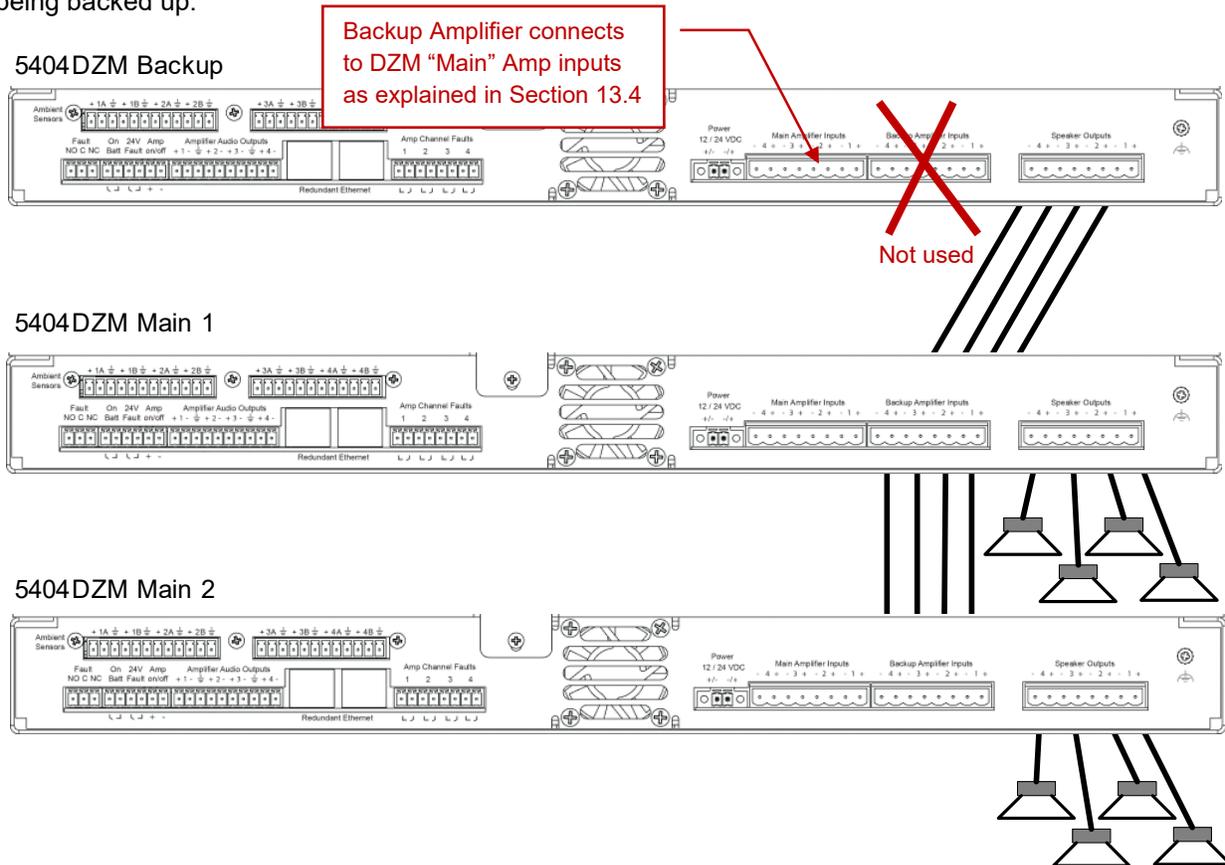
101.6 Backup Amplifiers

101.6.1   Backing up 54x4AMP units using 5404DZM

A backup amplifier may be added to the system as shown in Figure 101-7. The amplifier has a companion 5404DZM that receives re-routed digital audio for it from the network and supervises the backup amplifier. The backup amp and its 5404DZM are wiring together the same as for a main amp, as shown in Figure 101-4. The backup amplifier and its 5404DZM can backup either a 5404DZM or 5432DZM with amplifier.
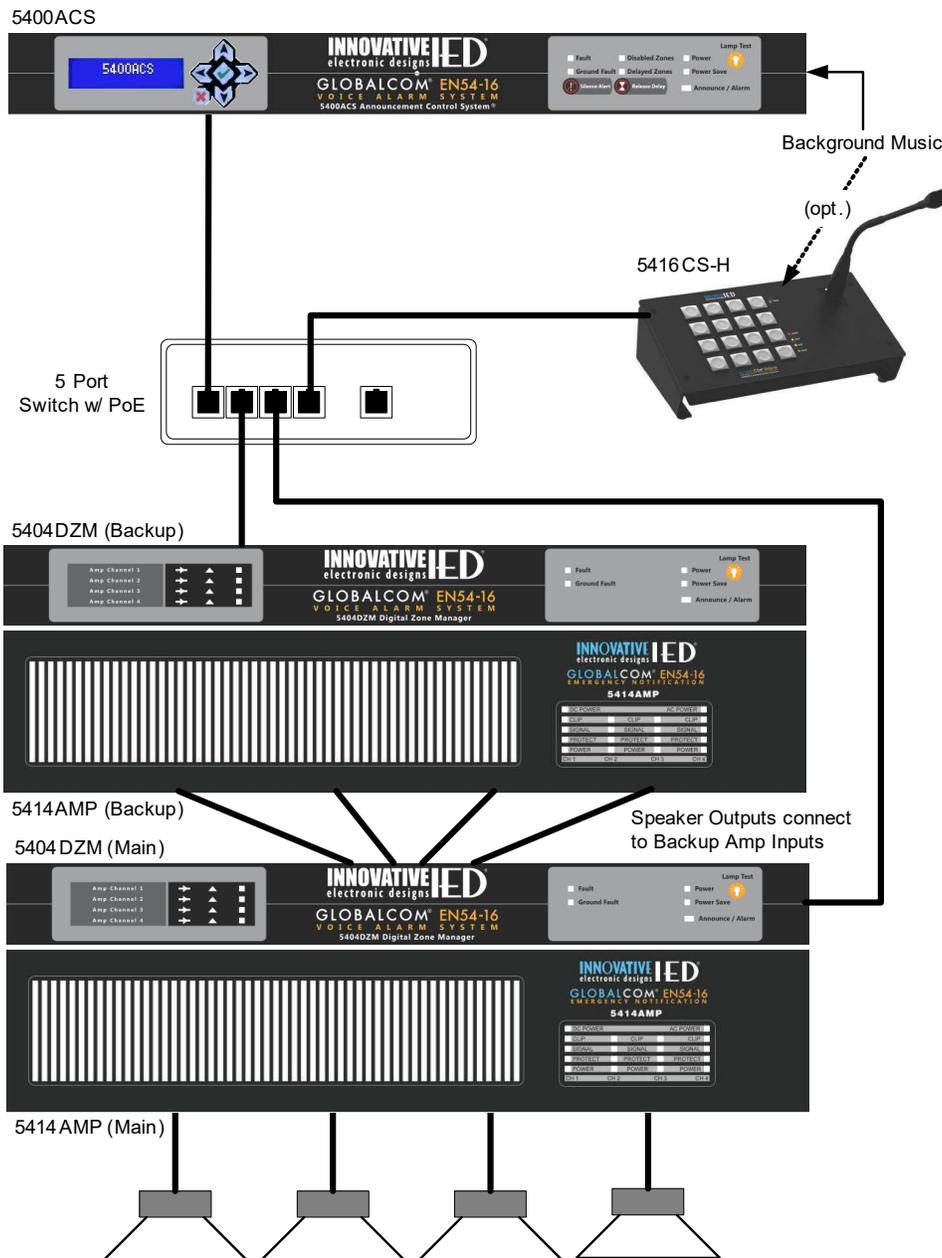
Figure 101-7:   Simple System with Backup Amplifier

Actually, the system may be configured to use one backup amplifier for multiple main amplifiers. Technically, there is no limit to the number of main amplifiers that may be backed up. Instead it may be a practical matter such as how many amps are in a rack or at a certain equipment room location. To wire a backup for multiple main DZM-amplifier combinations, one wires the speaker line outputs from the backup 5404DZM to the backup inputs on the main DZMs such as is shown in Figure 101-8. Note, the DZMs do not all have to be the same type since both the 5404DZM and 5432DZM process four amp channels. It is only a requirement that the backup amplifier have the same wattage rating as the largest of the amplifiers being backed up.


Figure 101-8:   Wiring One Backup for Multiple Main Amplifiers

Note: The real-time backup amp switching control in the GLOBALCOM EN 54-16 system assumes one-to-one wiring of backup to main channels. That is, backup channel 1 wires to main DZM channel 1, channel 2 to channel 2, etc.

101.6.2   Backing up DNA2404DH Units with 1544BAS

One can use a secondary (backup) DNA2404DH digital network amplifier to back up one or more primary DNA2404DH units. This is done by simply wiring the amplifier outputs to the primary and secondary amplifier inputs of the 1544BAS, and the speakers to the outputs of the 1544BAS as shown in the figure below. The switching control will be done via the network by the 5400ACS system controller.
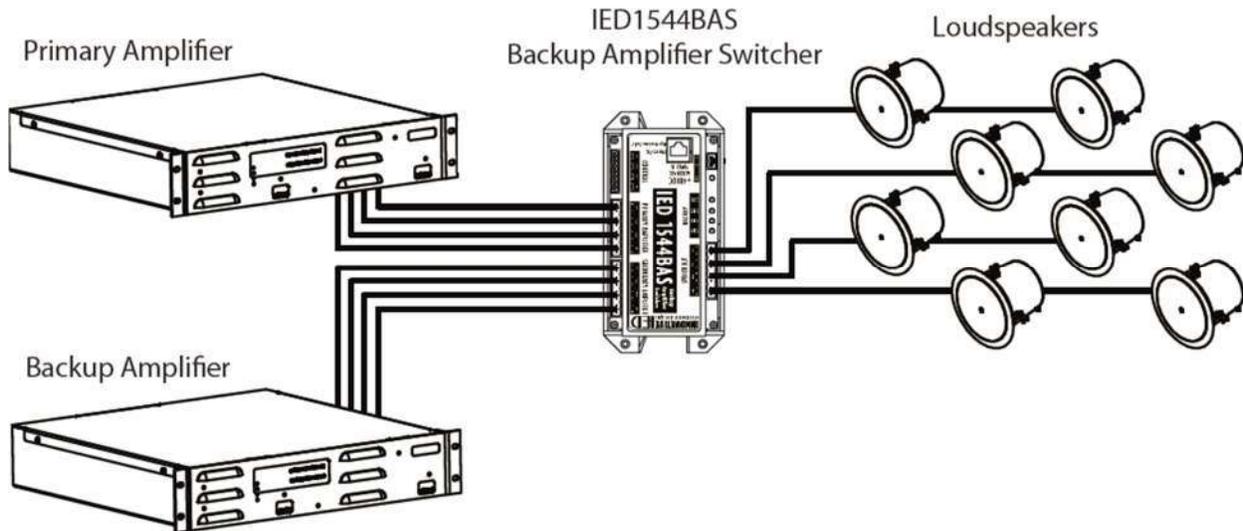
Figure 101-9:   One-to-One Backup of DNA2404DH Amplifiers

Below in Figure 101-10 is a diagram of extending this backup wiring scheme to allow one secondary amplifier to backup multiple primary amplifiers. What is shown is just an example, not a limit on the number of primary amplifiers than can be backed up from one secondary amplifier.
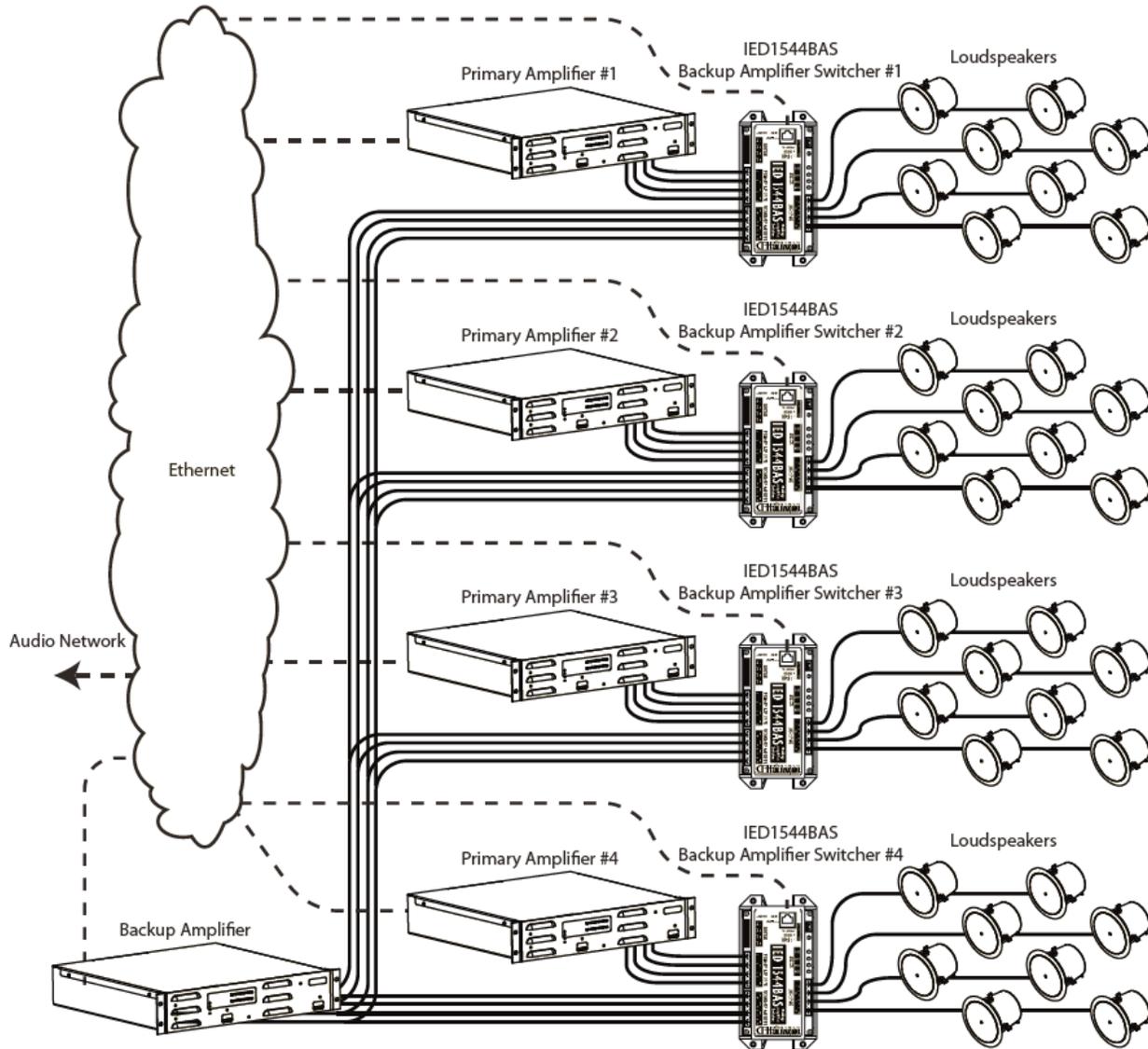
Figure 101-10:   Backing up Multiple Primary Amplifiers

101.7 Lifeline Controller

For additional redundancy, a backup announcement controller, called a Lifeline, may be added to the system as depicted in Figure 101-11. This device has to reside on the same Ethernet network (or redundant network, if redundancy employed), but could be physically located somewhere other than in the same rack or equipment room as the primary controller. Note, if remotely located, direct connections such as background music or external system connections may not be available unless wiring for these connections are also extended to the Lifeline's location.
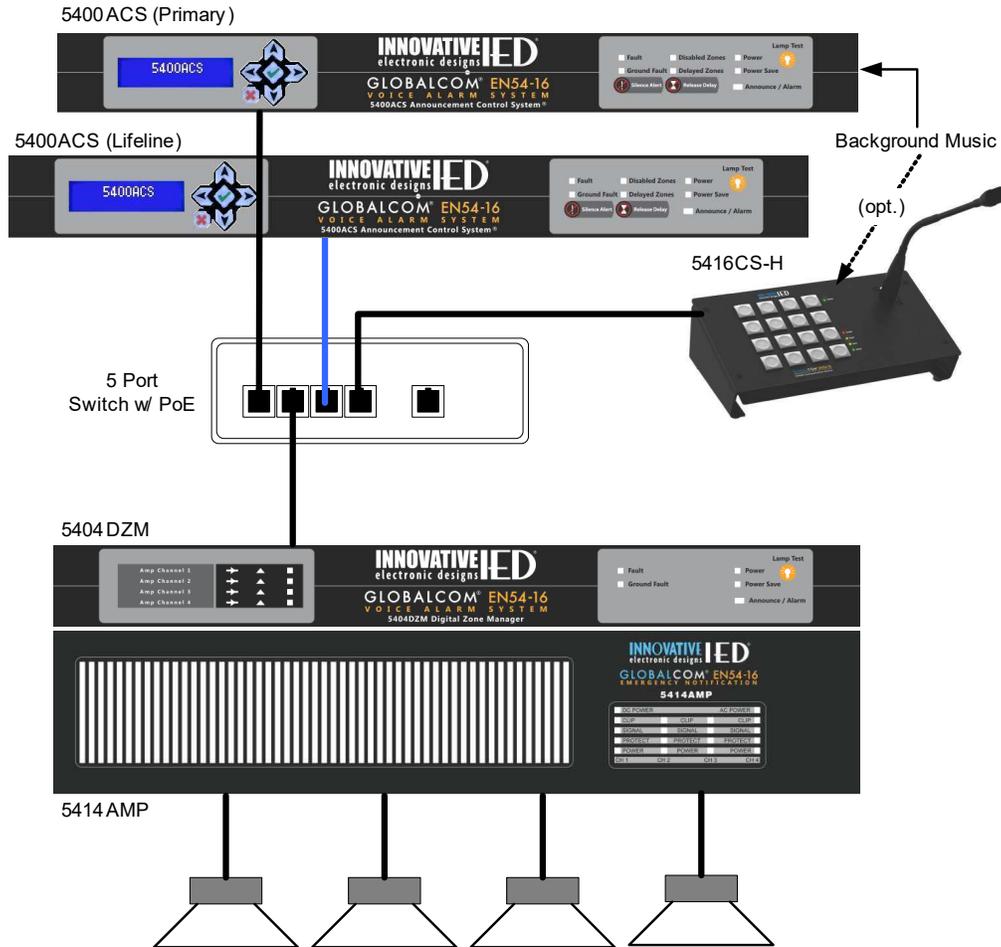

Figure 101-11:   System with Lifeline Controller

101.8 Typical Small Voice Alarm System

The core components of a typical small voice alarm system could be contained in one standard 19" rack using a combination of IED parts and third party components as described below. The primary components that would go into a 19" rack are as follows:

- IED5400ACS – Announcement Control System

- IED5432DZM – 32-zone Digital Zone Manager

- IED5434AMP or IED5454AMP – 300Wx4-channel or 500Wx4-channel Power Amplifier as required for speaker loads.

- IED5404DZM – 4-channel backup Digital Zone Manager

- Second IED5454AMP or IED5454AMP– backup Power Amplifier

- Merawex ZDS0400-DR4 EN 54-4 Power Supply

- KTI KGS-1064-HP 10-port Network Switch to interconnect components

The following ferrite cores and power line filters are used to interconnect the primary rack components:

- TDK # ZCAT2035-0930A clamp-on Ferrite Core Filters

- Cosel SNR-10-223-DT Line Filters

The clamp-on filters are used on the 30A outputs of the Merawex and on the same line just before each IED54x4AMP 24V input. The Cosel Line Filters are used on the Merawex 6A outputs between each power supply output and the 5400ACS, 5432DZM, 5404DZM and the network switches. These filters are to minimize any radiated and conducted EMI from the rack of equipment, keeping it below the required levels called out in the EMI standards.

In addition, the following components may be DIN rail mounted in the rack or may be located remotely and attached via a network connection back to the main rack:

- IED1516LI – 16-input Logic Input Module

- IED1516LI-E – 16-input Logic Expansion Module

- IED1522LR – 2 Logic Input plus 2 Relay Output Module

The following components are added in remote locations as required.

- IED5450CS-H – Touch Screen Communication Station with handheld microphone

- IED5450CS-G – Touch Screen Communication Station w/ goose neck microphone

- IED5416CS-H – 16-Button Communication Station with handheld microphone

- IED5416CS-G – 16-Button Communication Station with goose neck microphone

- IED5410EOL/IED5411EOL – Speaker End-Of-Line Modules

The interconnection drawing for the equipment rack might appear as in Figure 101-12 below. The Merawex power supply connections are shown in Figure 101-13.
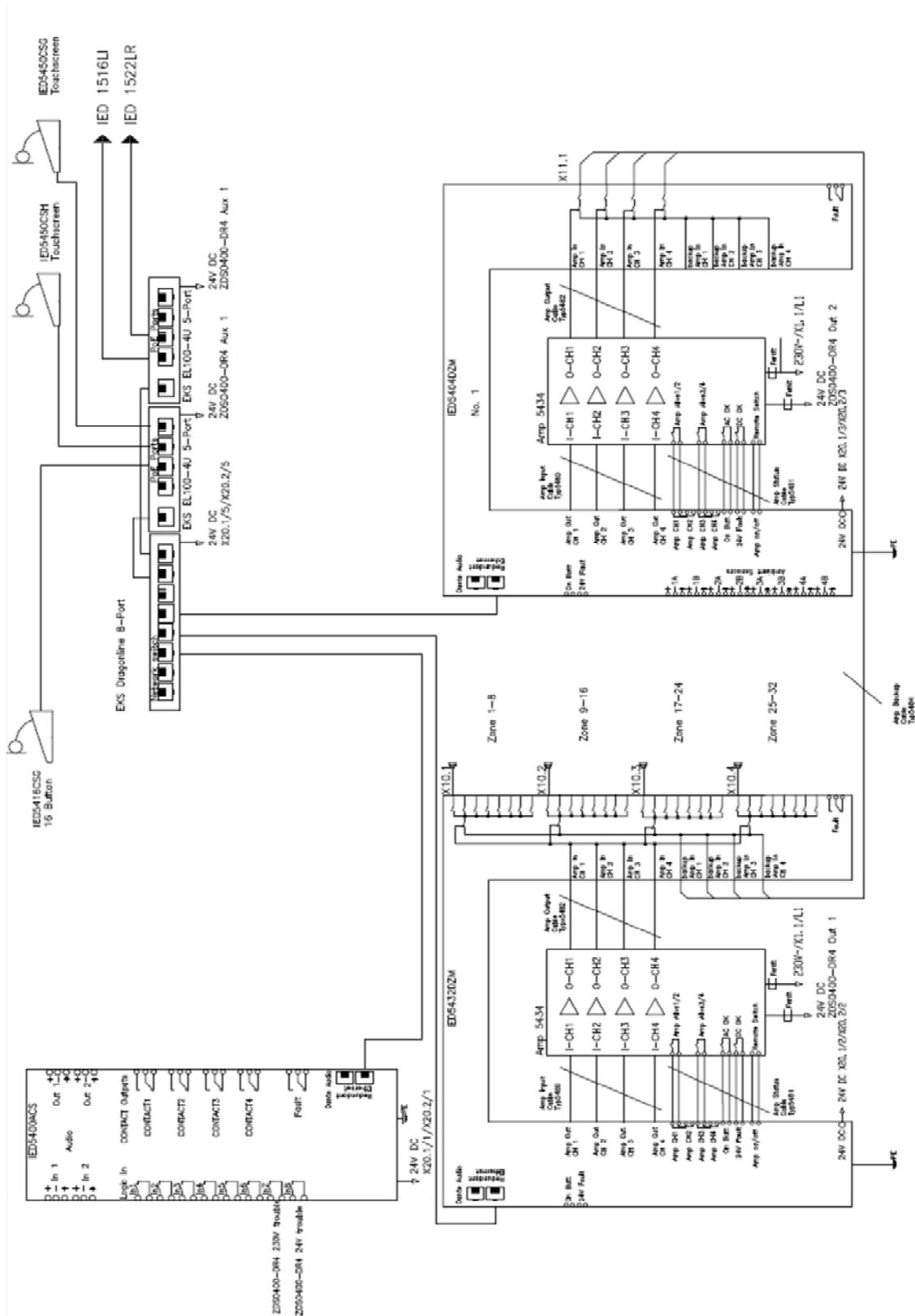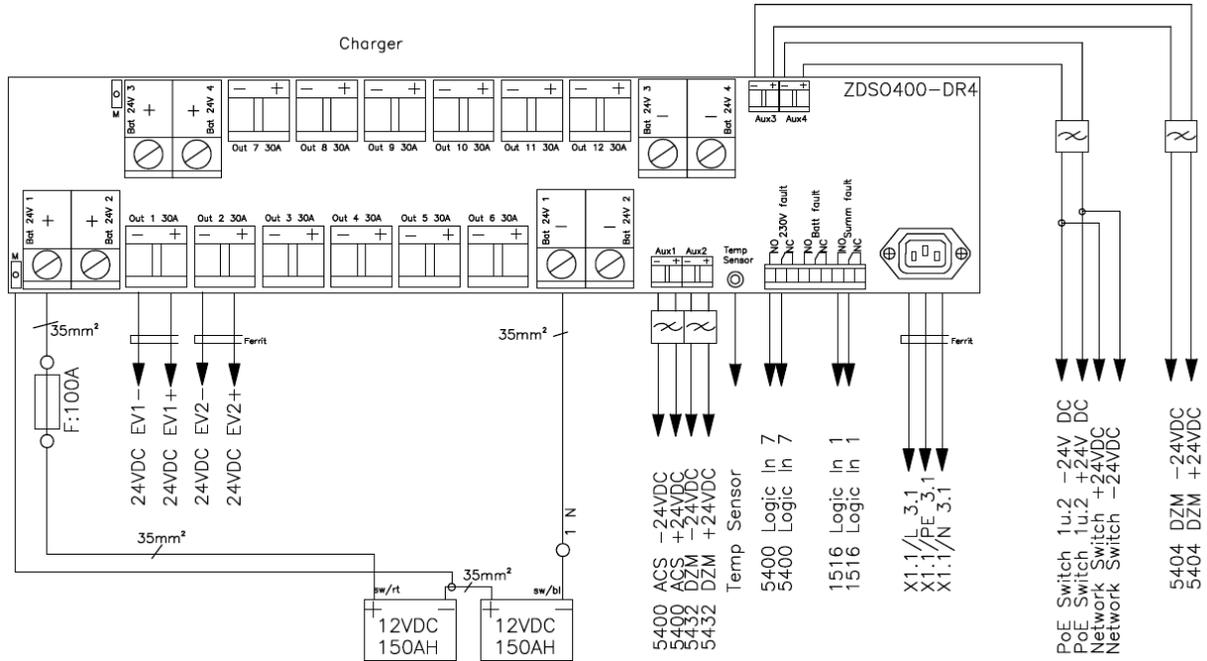
Figure 101-12:   Interconnection Drawing for Example VACIE System

Figure 101-13:   Power Supply Connections in Example VACIE System

In Figures 13-10 and 13-11, the locations of the TDK ferrite cores are indicated by the notation:

. The locations of the Cosel line filters are indicated by the notation: .

102.   Power Consumption

102.1 Introduction

To complete the installation and commissioning of a system, it is necessary to provide the system with adequate power and cooling, plus in many installations it is required that the system be available or operational for some period of time after mains power has been lost. The information in this section can be used to assist the system designer/installer in making the necessary calculations for power, cooling and battery capacity.

102.2 Power Consumption

The power consumption for the 5400ACS, 5404DZM, 5432DZM, 5416CS and 5450CS are listed in Table 102-1. The power consumption for the 54x4AMP models under various circumstances is listed in Table 102-2. In both tables the values are given in both Amperes (A) and Watts (W) Note, the 5416CS and 5450CS draw their power from either the PoE supplied on the network connection or via the auxiliary power input depending on how they are installed.

Table 102-1:   Non-Amplifier Power Consumption Values
All values are for 24V DC input to the units.

Model	Operating Mode	Power Consumption (max)
5400ACS	Quiescent/Standby/Alarm	1.5A / 36W
5404DZM	Quiescent Standby (Power Save) Running Amp Test	0.51A / 12.3W 0.51A / 12.3W 0.65A / 15.7W
5432DZM	Quiescent Standby (Power Save) Running Amp Test	1.35A / 32.4W 0.80A / 19.3W 54.2W
5416CS	Max on PoE Power	7.2W
5450CS	Max on PoE Power	6.7W

Table 102-2:   Amplifier Power Consumption Values

Model .	5454AMP		5434AMP		5414AMP	
Operating Mode	Mains 230V	Battery 24V	Mains 230V	Battery 24V	Mains 230V	Battery 24V
Off/Standby	0.12A/5W	0.1A	0,12A/5W	0.1A	0.12A/5W	0.1A
Idle	0.5A/72W	2.8A	0.5A/72W	2.8A	0.5A/70W	2.5A
1/8 Load (speech)	2.6A/430W	17.2A	2.0A/310W	12A	0.9A/145W	5.6A
Full Load	15.0A/2480W	83A	9.8A/1570W	58A	3.3A/540W	21A

102.3 Cooling Capacity

The primary cooling burden is for power from the amplifiers. Table 102-3 shows heat dissipation needs for the three amplifier models under various conditions.

Table 102-3:   Amplifier Heat Dissipation Needs

Operating Mode	5454AMP	5434AMP	5414AMP
Quiescent	75W	75W	75W
1/8 Power (Speech)	200W	140W	80W
1/3 Power (compressed music)	300W	200W	90W
Full Power	550W	340W	120W

Cooling capacity is an energy calculation which is the product of power and time as in Watt-hours. For example, 10 Watts for 1 hour is 10 Watt-hours, which is the same as 2 Watts for 5 hours. Cooling capacity is generally expressed in BTUs. To convert from Watt-hours to BTUs, one multiples by **3.412**.

Example: An equipment room has three 5434AMPs operating at 1/3 power for 24 hours. This equates to:

3 x 200W x 24 hours = 14,400 Watt-Hrs x 3.412 = 49,132 BTUs supplied in a day

102.4 Battery Capacity Calculation

To comply with regional or national fire safety codes, it may be necessary that the system be in standby or voice alarm mode for some period of time while drawing power from batteries. A typical standard would be 24 hours on standby followed by 30 minutes of voice alarm, for example. Some standards also address how quickly a battery charger can recharge the batteries after mains power is restored. A typical specification for this might be to recover 80% of the charge in 24 hours.

To calculate the power supply current capacity and battery size/capacity, one needs to add up all the equipment on one power supply and battery bank, e.g., typically one rack full of equipment using Tables 14-1 and 14-2 above. For the standby time (e.g., 24 hours) one should use the Standby power Amperage values from the table. For the operating in voice alarm mode time (e.g., 30 minutes) one should use the 1/8 power values from the tables.

Battery capacities are generally listed in Amp-hours (Ah), which is a simple product of Amperage and time expressed in hours. For example, a 100 Ah battery is capable of supplying 10A for 10 hours or 1A for 100 hours, or 4.17A for 24 hours.

In doing the recovery time calculation, it is important to note which devices run off the battery charger power supply all the time. In the GLOBALCOM EN 54-16 system, this may be all equipment other than the power amps. This current draw needs to be subtracted from the power supply/battery charger's maximum amperage to determine how much current is available to charge the batteries. Once subtracting this current from the total, refer to the battery charger manual for properly computing recovery time.

103.　　Preventive Maintenance

The system requires minimum maintenance to stay in good working order. The sections below cover some basic steps that should be followed.

103.1 Clean Air Intakes

All 19" rack equipment (5400ACS, 5404DZM, 5432DZM, 5414/5434/5454AMP) have cooling fans that draw air through the unit. Once a year vacuum the air intakes of these units and verify that the fans are functioning properly.

103.2 Change Batteries

The main processor board inside the 5400ACS has a battery on the real-time clock of type CR2032. This battery should be replaced every eight years. If it is carefully replaced without removing power to the unit, then date and time will not be lost. If power is off when the battery is replaced, then it will be necessary to reset the date and time as per instructions in section 13.x.y.

Appendix A: Acronyms and Abbreviations Used

The following acronyms and abbreviations are used in this document.

A	Amperes	kg	kilogram
AC	Alternating Current	kHz	kilo Hertz
Ah	Ampere-hours	LCD	Liquid Crystal Display
ACK	Acknowledge	LED	Light Emitting Diode
ACS	Announcement Control System	mm	millimeters
AWG	American Wire Gauge	NACK	Negative Acknowledgement
BGM	Background Music	NC	Normally Closed
BTU	British Thermal Units	NO	Normally Open
˚C	degrees Centigrade	PTT	Push to Talk
cm	centimeters	RU	Rack Units (1.75")
dB	decibels	TBD	To Be Determined
DC	Direct Current	URL	Uniform Resource Locator
DSP	Digital Signal Processing	UTP	Unshielded Twisted Pair
DZM	Digital Zone Manager	V	Volts
EMI	ElectroMagnetic Interference	VAC	Volts Alternating Current
EOL	End of Line	VACIE	Voice-Alarm Control Indicating Equipment
EQ	Equalization		
˚F	Degrees Fahrenheit	VDC	Volts Direct Current
Hz	Hertz	W	Watts
IED	Innovative Electronic Designs		

Appendix B: EN 54-16 Compliance Matrix

Below are the requirements for the EN 54-16 standard and how IED's GLOBALCOM® Voice-Alarm Control Indicating Equipment (VACIE) Communication System meets them.

Table B-1:   EN 54-16 Compliance Matrix

Clause #	Requirement	Compliance
4.0	**General**	
4.1	**General Requirements**	
4.1.1	If optional functions are included in the VACIE, (Voice Alarm Control Indicating Equipment), then all corresponding requirements need to be met.	The following optional functions, with requirements, are included in IED GLOBALCOM® EN 54-16: • Delays to entering the voice alarm condition (7.4) • Phased evacuation (7.5) • Manual silencing of the voice alarm condition (7.6.2) • Manual reset of the voice alarm condition (7.7.2) • Indication of fault related to voice alarm zones (8.4) • Voice alarm manual control (10) • Emergency microphone(s) (12) • Redundant power amplifiers (13.14) • Voice alarm condition output (7.9) • Indication of faults related to the transmission path to the CIE (8.3) • Interface to external control device(s)(11) The following optional functions are not included in IED GLOBLACOM®: • Audible warning (7.3) • Output to fire alarm devices (7.8)
4.1.2	If functions other than those specified are included they must not jeopardize any requirements of this standard.	IED GLOBALCOM® EN 54-16 provides the following additional functions that do not interfere with the requirements of this standard: • Ambient analysis and compensation for zone level control • Message playback scheduling
4.2	**Combined VACIE and CIE**	
	When VACIE and CIE (Fire Panel), are combined they may share common indications, manual controls and outputs. (See Annex F), Plus: a. A singe fault on CIE can not affect mandatory function of VACIE.	IED GLOBALCOM® EN 54-16 does not combine the VACIE and CIE. This requirement is not applicable.

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Clause #	Requirement	Compliance
	b. Indications and manual controls for voice alarm must be clearly identifiable.	
4.3	**Power Supply**	
	Power supply equipment external or internal in the VACIE shall comply with EN 54-4. Note: The PS may be shared with the Fire Alarm Equipment.	All amplifiers are supplied with a main supply and DC backup supply (24V) input. Switch over between the two takes place automatically, without any interruption or status change other than the power supply related indications. Control equipment, network switches and other equipment are supplied with DC power (24V) from an EN 54-4 certified power supply.
5.0	**General Requirements for Indications**	
	Display functional conditions – quiescent, voice alarm, fault warning & disablement conditions. (Test condition in ISO7240, Optional)	These conditions are indicated by front panel LEDs on the 5400ACS and DZM equipment.
	Must be capable of being in any combination of voice alarm, fault warning & disablement. (Test condition in ISC7240, Optional)	All IED GLOBALCOM® EN 54-16 equipment complies with this requirement.
	Mandatory identifications must be clearly identifiable. If alphanumeric display is used – multiple conditions may be displayed but each must be grouped into its own window.	On the IED 5400ACS portion of the system, the front panel of the system has indicators and controls such as those shown below The Fault indicators can only be yellow (or off/black), and the Power indicator can only be green. The Announce/Alarm indicator is either off, green or red depending on whether there is no announcement active, a non-emergency announcement active or an alarm announcement active, respectively. The Disabled Zones indicator is yellow. The Delayed Zones indicator is yellow. In addition, the front panel features a 2x16 character LCD alpha numeric readout and navigation buttons. On this panel, a list of all faults, one at a time may be read out. Also, all active and possible Alarms may be viewed, stopped or started.

Clause #	Requirement	Compliance
	Indication of supply power must be given by a separate discrete LED, and if system is distributed between separate cabinets, must be indicated in each cabinet.	The power indicator light is green. In addition, any problem with the mains power or the EN 54-4 power supply batteries or chargers are indicated by a separate yellow Power Fault LED on both the 5400ACS and the DZM units.
	Where indications are used in addition to mandatory indications, these shall not result in contradiction or confusion.	All indicators have both an LED and text indicating their meaning.
6.0	Quiescent Condition	
	Any system info may be displayed, but cannot be confused with alarm, fault or disablement condition.	In the IED GLOBALCOM® EN 54-16 system all alarm, fault and disablement conditions are clearly indicated.
7.0	Voice Alarm Condition	
7.1	Fire Alarm Signals	
7.1.1	Signal from CIE or manual control to VACIE must actuate within 3 seconds.	IED GLOBALCOM® EN 54-16 is compliant.
7.1.2	Mandatory indications may not be falsified by multiple alarms.	The IED GLOBALCOM® EN 54-16 system offers multiple alarm priorities. Correct configuration assures that mandatory indications and or outputs behave consistently when multiple alarm signals are received simultaneously from the CIE and/or manual controls.

Higher priorities overrule lower priorities in case of resource or destination conflicts. Calls with the same priority operate on first come first serve basis |
| 7.1.3 | Failure of transmission path between VACIE and CIE – no loss of control or change of state of the VACIE. Optional indication of the fault by means of LED or display. | The IED GLOBALCOM® EN 54-16 system is an autonomous subsystem that can operate without connection to the CIE. The effect of the failure of the transmission path between the CIE and the IED system is limited to fault |

Clause #	Requirement	Compliance
		reporting and losing interaction between the CIE and the IED system.
7.2	**Indication of Voice Alarm**	
7.2.1	The presence of a voice alarm condition shall be indicated on the VACIE, without prior manual intervention, by: a. A visible indication by means of a separate discrete light emitting indicator b. A visible indication for each activated alarm zone where manual controls are provided.	A voice alarm condition is indicated on the system by: • A red indicator on all call stations. • A red indicator on the 5400ACS and all affected DZMs • A textual indicator on the 5400ACS controller display • An output contact configured in the site specific data as voice alarm activated indicator (Emergency alarm indicator). A visible indication for each activated voice alarm zone is available on: • The detailed zone status display on the 5400ACS front panel alphanumeric readout • The Alarm view window of the 5450CS provides information on alarms and zones in alarm.
7.2.2.	Optional audible capable of silencing at Access Level 1 & 2	An alarm condition beeper is not provided in the IED GLOBALCOM® EN 54-16 system.
7.3	**Audible Indication (Optional)**	
	An audible warning of the voice alarm condition might be the same as that for the fault warning condition. If they are different, the voice alarm condition warning shall have priority.	An alarm beeper is not provided in the IED GLOBALCOM® EN 54-16 system.
7.4	**Delays to entering the voice alarm (Optional)**	
	The VACIE may be provided with a facility to introduce a delay before entering the voice alarm condition. In this case: a. The operation of the delay shall be selectable at access level 3 b. The operation of the delay shall be in increments not exceeding 1 min up to a maximum of 10 mins. c. The delay to one output signal shall not affect the delay to other outputs d. It shall be possible to override the delay by a manual operation at access level 1	The IED GLOBALCOM® EN 54-16 system is compliant with these requirements. Delayed zones may be configured from the external configuration software (level 3), but can be turned on/off via the front panel menu w/ password access (level 2). There is an indicator on the front panel that illuminates whenever there are active alarms to delayed zones (level 1). A button on the front panel may be used to immediately release any delayed zones

Clause #	Requirement	Compliance
	e. There shall be provision to switch on and switch off delays by means of a manual operation at access level 2 f. There may be provision to automatically switch on and/or switch off delays by means of a programmable timer which shall be configurable at access level 3 g. A separate discrete light emitting indicator and/or a field on the alphanumeric display shall be visible when a fire signal is received and the delay activated. This indication shall be suppressed when the VACIE enters the voice alarm condition.	(level 1).
7.5	**Phased Evacuation (Optional)**	
	The VACIE may have a provision to phase the warning signals to the emergency loudspeaker zones. The facility shall be configurable at access level 3. There may be provision to switch on and switch off the phases evacuation sequence by means of a manual operation at access level 2.	The IED GLOBALCOM® EN 54-16 system feature of delaying alarms by zone, rather than only on an all-alarm level allows for phased evacuation, by delaying the alarm to some zones differently than to others.
7.6	**Silencing of Voice Alarm Condition**	
7.6.1	If triggered from CIE, VACIE must respond to silence instruction from the CIE. May complete message in progress.	Voice alarm calls triggered from the CIE can also be stopped from the CIE by releasing the closure used to start the alarm, or providing another closure configured as a Silence All Alarms command.
7.6.2	Manual Silence (Optional) – Manually silence and re-activate from Access Level 2.	IED GLOBALCOM® EN 54-16 offers the possibility to stop voice alarm calls by de-activating the contact or key that started the call or by de-activating the alarm from the front panel menu (level 2 password). Voice alarms may also be initiated from the front panel menu with a level 2 password.
7.7	**Reset of Voice Alarm**	
7.7.1	If triggered from CIE, VACIE must respond to reset instruction from the CIE.	When the CIE releases a contact closure or if using a separate closure, indicates an alarm stop condition, the IED GLOBALCOM® EN 54-16 system resets the voice alarm condition.
7.7.2	**Manual Reset (Optional) –** Reset at Access	Both fault reset (Clear All) and VACIE system

Clause #	Requirement	Compliance
	Level 2 by separate manual control. Control shall only be used for reset, but can be the same used for fault reset. **Following Reset –** Indication of correct functional condition for received signals shall remain or be reestablished within 20 seconds.	reset are separate options available via the front panel menu with a level 2 password. After a reset operation, the IED GLOBALCOM® EN 54-16 system will immediately indicate the functional condition it is currently in. It will also immediately respond to received signals that will bring it into another functional condition.
7.8	**Output to Fire Alarm Devices**	
	In addition to voice alarm outputs the VACIE may have provision for the automatic transmission of the alarm signals to fire alarm devices such as beacons and vibrating devices.	This optional feature is not provided in the IED GLOBALCOM® EN 54-16 system as called out. However, auxiliary relay outputs can be configured to trigger alarm devices. They just cannot be de-activated or re-activated separately from the alarm they are associated with.
7.9	**Voice Alarm Condition Output (Optional)**	
	The VACIE may have provision for transmitting a signal that it is in the voice alarm condition.	Relay outputs may be configured to indicate that the system is in the voice alarm condition.
8.0	**Fault Warming Condition**	IED GLOBALCOM® is compliant.
8.1	**Reception and Processing of Fault Signals**	
8.1.1	The VACIE shall enter the fault warning condition when signals are received which, after any necessary processing, are interpreted as a fault.	On the IED 5400 ACS, the system reports faults via the front panel LEDs and a fault relay. In addition, a list of the active faults may be viewed on the front panel alphanumeric readout. Also, there is a power fault LED which illuminates when there is some issue with the system power (mains, backup batteries, etc.) and a System Fault indicator that illuminates whenever the controller itself ceases to function.
8.1.2	The VACIE shall be capable of simultaneously recognizing all of the faults specified in 8.2 and, if provided, in 8.3 unless this is prevented by: a. The presence of an alarm output signal on the same voice alarm zone, and/or b. The disablement of the corresponding voice alarm zone or function	All IED GLOBALCOM® EN 54-16 system faults are handled (acknowledged and reset) individually. Also, the IED GLOBALCOM® EN 54-16 system is capable of recognizing all of its system faults simultaneously. The IED GLOBALCOM® system is able to recognize faults in a voice alarm zone even when there is an alarm output signal on the zone. Zones which are disabled have their faults

Clause #	Requirement	Compliance
		suppressed by design.
8.1.3	VACIE shall enter the fault warning condition within 100 s of the occurrence of the fault, or the reception of the fault signal or within another time as specified in this European Standard or in other parts of EN 54.	The IED GLOBALCOM® system recognizes and reports all faults within 100 seconds.
8.2	**Indication of Faults in specified functions.**	
8.2.1	The presence of faults in specified functions shall be indicated on the VACIE without prior manual intervention. The fault warning condition is established when the following are present: a. A visible indication by means of a separate light emitting indicator (the general fault warning indicator) b. A visible indication for each recognized fault as specified in 8.2.3, 8.2.4, 8.4 (if provided) and 8.5 (if provided). c. An audible indication, as specified in 8.6	IED GLOBALCOM® EN 54-16 system provides a visible indication when it is in the fault warning condition via the fault LED, general fault relay, power problem LED and system (controller) fault LED. Some of these indicators are present on DZM devices as well as the 5400ACS controller. Additionally, every 5450CS and 5416CS paging station has a general fault IED on the front. In addition, a list of faults may be viewed on the 5400ACS front panel alphanumeric readout and on any 5450CS control station. The IED 5400ACS provides an audible fault indication on the 5400ACS controller when it is in the fault warning condition.
8.2.2	Alphanumeric display of faults – if display cannot simultaneously display all faults, presence of suppressed faults must be indicated and suppressed faults must be capable of display by manual method.	The IED GLOBALCOM® 5400ACS controller alphanumeric display is used to indicate the fault warning condition and all individual faults. The display indicates the number of faults present, and is not limited as to the number of faults it can display.

8.2.3	Faults requiring separate indication.
	 a. Power supply fault.
	    1. Short or break in transmission path
	    2. PS faults called out in 54-4
	 b. Ground fault <50K capable of affecting mandatory functions in fire alarm condition.
	 c. Blown fuse within VACIE capable of affecting mandatory functions in fire alarm condition.
	 d. Short or break of all transmission paths of the VACIE in more than one cabinet affecting mandatory functions not otherwise indicated.
		Faults of the supervised items are detected and reported through the general fault warning indication, the power fault LED and system fault LED, plus readouts on the front panel alphanumeric readout and on the 5450CS control stations.
		
		 All 100V lines of the IED GLOBALCOM® system can be supervised individually for earth faults (i.e. connections to earth with a leakage resistance of less than 50 k).
		
		 Every rupture of a fuse or the operation of a protected device that affects a mandatory

Clause #	Requirement	Compliance
	Troubles a, b, c, & d above may be suppressed during fire alarm condition.	function will result in a fault since the mandatory functions are supervised. In the GLOBALCOM EN 54-16 system, faults are not suppressed during fire alarm conditions.
8.2.4	Faults indicated by at least "General Fault Indicator:" a. Any short or break in voice alarm transmission path between parts contained in separate cabinets, even when fault does not affect a mandatory function. b. Any short or break in voice alarm transmission path to emergency microphone. c. Any short or break in voice alarm transmission path between VACIE and loudspeakers, even when fault does not affect the operation of the loudspeaker. d. Any short or break in the transmission path between the VACIE and any Fire Alarm devices – when used. e. Failure of any power amp.	The mains and backup power of all IED GLOBALCOM® EN 54-16 system elements are supervised individually. All network based transmission paths of the IED system are supervised using a keep-alive mechanism. The Dante audio transmission path of the IED system is supervised by means of clock availability.
8.3	**Indication of fault related to path to Fire Panel (Optional)**	
	The VACIE may have provision for an indication of faults related to the transmission path to the CIE. In this case, the short-circuit or interruption of the transmission path to the CIE shall be indicated by means of a separate light emitting indicator and/or an alphanumeric display.	All input contacts on the 5400ACS can be supervised for shorts and interruptions. Faults related to the transmission path to the CIE are therefore individually reported and can be inspected using the front panel alphanumeric readout of the 5400ACS controller. The faults are also reported through the general fault warning indication.
8.4	**Indication of faults related to voice alarm zones. (Optional)**	
	The VACIE may have provision for an indication of faults related to voice alarm zones. In this case the short-circuit or interruption of a voice alarm transmission path between the VACIE and the loudspeakers in that zone shall be indicated by means of a separate light emitting indicator per zone and/or an alphanumeric display.	Zone faults are indicated on each 5404DZM or 5432DZM via zone/amp station LEDs and additionally appear on the 5400ACS on the front panel alphanumeric display (summary fault count indication). On the 5400ACS alphanumeric display and on the 5450CS units, zone status is available that shows all zone conditions side-by-side such as in alarm, in fault, and in delay

Clause #	Requirement	Compliance
8.5	**System Fault (also see 14.4 & 14.6 software failure)**	
	A system fault is a fault as specified in 14.4 or 14.6. In the event of a system fault at least the following shall apply: a. Indicated by General Fault LED plus a separate LED b. Shall not be suppressed by any other functional condition c. Can only be cleared by manual reset or other manual operation at access Level 2 or 3. d. Also indicated by audible. (May be silenced)	The 5400ACS contains watchdog circuitry that will indicate a system fault should the embedded controller fail to function. The fault is indicated by a separate System Fault LED, as well as the general fault LED and general fault relay.
8.6	**Audible Indication**	
8.6.1	Capable of manual silence at Access Level 1 or 2. (May be same silence operation used to silence voice alarm)	In the GLOBALCOM EN 54-16 voice alarm system, the fault alert tone can be silenced via the front panel button (level 1).
8.6.2	Faults shall be silenced automatically if VACIE is automatically reset from fault condition.	In addition, if the fault condition is cleared, the tone will be silenced automatically.
8.6.3	If silenced, will re-sound for new fault condition.	Once silenced, if a new fault condition occurs, the alert tone will be re-activated.
8.7	**Reset of Fault Condition**	
8.7.1	The indications of faults as required in 8.2 shall be capable of being reset: (a) automatically when fault is no longer recognized, and/or (b)by manual operation at Access Level 2.	Once the fault condition is no longer occurring, the fault indications will be cleared within 100 seconds.
8.7.2	Following a reset, system returns to indicate correct functional condition corresponding to received signals within 20 sec.	If the user manually resets the fault condition (clear all faults operation on the front panel), any individual faults that are not actually resolved in the system are reported again within 20 seconds.
8.8	**Transmission of Fault Warning Condition**	
	The VACIE shall have provision to transmit at least a general fault warning, all faults in	There is a fault relay on the IED 5400ACS controller. This relay output contact indicates no fault when open (energized) and indicates

Clause #	Requirement	Compliance
	clause 8. This fault signal shall also be given if the VACIE is de-energized.	a fault when closed (de-energized). If the IED 5400ACS controller is de-energized this output contact is closed, therefore the fault signal will also be given.
9.0	**Disabled Conditions (Optional)**	
9.1	**General Requirements**	
9.1.1	Disablements of the VACIE in accordance with the requirements of 9.4 shall inhibit all corresponding mandatory indications and/or outputs but shall not prevent other mandatory indications and/or outputs.	The IED GLOBALCOM® EN 54-16 system allows for disabling individual zones in the system via the front panel menu (level 2 access). These disabled zones function independently and are not activated as part of a voice alarm nor are they supervised for faults while disabled. This function is independent of voice alarm condition or fault warning condition.
9.1.2	The VACIE shall have provision to independently disable and re-enable the function specified in 9.4 by means of manual operations at access level 2.	The front panel menu on the 5400ACS allows, at access level 2, the ability to disable and re-enable any zone or zones in the system.
9.1.3	The VACIE shall be in the disabled condition while a disablement in accordance with the requirements of 9.4 exists.	Disablement condition is indicated via and LED on the front of the 5400ACS.
9.1.4	Disablement and re-enablement shall not be affected by a reset from the voice alarm condition or from the fault warning condition.	Silencing all alarms or clearing all faults are independent operations available via the 5400ACS front panel menu, which do not affect the disablement condition.
9.2	**Indication of Disabled Condition**	
	The disabled condition shall be indicated visibly, by means of: a. A separate light emitting indicator (the general disablement indicator) and b. An indication for each disablement, as specified in 9.3 and 9.4	An LED on the front of the 5400ACS controller indicates that there are zones in the disabled condition. In addition, each zone disablement is indicated on the 5400ACS front panel alphanumeric display and on the zone status window available on the 5450CS paging stations.
9.3	**Indication of specific disablements**	
9.3.1	Disablements shall either be indicated within 2 s of the completion of the manual operation	The IED GLOBALCOM® EN 54-16 system is compliant.

Clause #	Requirement	Compliance
9.3.2	The same light emitting indicator may be used as that for the indication of the corresponding fault, if distinguishable.	The IED GLOBALCOM® EN54-16 system uses a separate indicator for the disablement condition.
9.3.3	If the indication is on an alphanumeric display, which cannot simultaneously indicate all of the disablements, etc.	The IED GLOBALCOM® EN54-16 system is capable of showing all disablements simultaneously on both the 5400ACS front panel alphanumeric readout and on the zone status windows on the 5450CS paging stations.
9.4	**Disablements and Their Indication**	
	Voice alarm zones may be capable of being independently disabled and re-enabled. In this case the disablements shall be indicated by means of separate light emitting indicators per zone and/or an alphanumeric display. The indications shall not be suppressed during the voice alarm condition.	The IED GLOBALCOM® EN 54-16 system is compliant.
9.5	**Transmission of the disablement condition**	
	The VACIE shall have provision for transmitting, by means of a general disablement signal, all disablement conditions specified in this clause.	Any auxiliary relay output may be configured to provide a general disablement signal for transmission to external systems.
10.0	**Voice Alarm Manual Control (Optional)**	
10.1	**General requirements**	
	The VACIE may have provision for manually activating the voice alarm output condition. If a voice alarm output control facility is provided the following shall apply: a. A manual control which causes a voice alarm condition to be given shall only be accessible at access level 2 and b. It shall be possible to activate each voice alarm zone individually and/or in one of several groups of voice alarm zones and c. The manual activation of a voice alarm zone shall not prevent the mandatory indications and outputs to other voice alarm zones.	The IED GLOBALCOM® EN 54-16 system allows for the manual starting or stopping of voice alarms from the front panel menu with level 2 password access. These actions are for predefined groups of zones. In addition, voice alarms may be manually activated from the 5450CS or 5416CS control stations as either predefine groups of zones or with manual selection of individual zones for the alarm. The IED system can have multiple simultaneous alarms active within interference with each other.
10.2	**Indication of the voice alarm zones in an**	

Clause #	Requirement	Compliance
	activated condition	
	The indication of the voice alarm condition in the voice alarm zone(s) associated with each manual control shall be available without any manual action and shall not be suppressed. This indication shall be by means of: a. A separate light emitting indicator (the General Voice Alarm Output activated indicator) and b. A separate light emitting indicator and/or alphanumeric display for each voice alarm zone and/or an indication for one or several groups of voice alarm zones.	The IED GLOBALCOM® EN 54-16 system has a general voice alarm IED on the front of the 5400ACS and on the 5450CS and 5416CS paging stations. On each 5404DZM or 5432DZM, zones that are in alarm may be read via LEDS on the front. Additional, a list of voice alarms and the status of all zones in voice alarm may be viewed on the 5400ACS front panel alphanumeric display and on windows available on the 5450CS paging station.
10.3	**Indication of the voice alarm zones in fault condition**	
	The indication of the fault condition of the VACIE, which would prevent the generation and transmission of the voice alarm signal to the voice alarm zone(s) associated with each manual control, shall be available without any manual action and shall not be suppressed. This indication shall be by: a. A separate light emitting indicator (the general fault indicator) and b. An indication for each voice alarm zone and/or an indication for one or several defined groups of zones.	The IED GLOBALCOM® EN 54-16 system provides general fault alarm indications via LEDs on the front of the 5400ACS and on the 5450CS and 5416CS paging stations. A list of zones with indications of both alarm and fault condition may be viewed on the 5400ACS front panel alphanumeric display and on a zone status window on the 5450CS paging station.
10.4	**Indication of the voice alarm zones in disablement condition**	
	The indication of the disablement condition in the voice alarm zone(s) associated with each manual control shall be available without any manual action and shall not be suppressed. This indication shall be by: a. A separate light emitting indicator (the general disablement indicator) and b. An indication for each voice alarm zone and/or an indication for one or several defined groups of zones.	The IED GLOBALCOM® EN 54-16 system provides a general disablement condition LED on the front of the 5400ACS. A list of zones with indications of both alarm and disablement may be viewed on the 5400ACS front panel alphanumeric display and on a zone status window on the 5450CS paging station.

Clause #	Requirement	Compliance
11.0	**Interface to external Control Devices (Optional)**	
	The VACIE shall have provision for interfacing to external control devices such as standardized user interfaces required by local regulations. In this case, the following shall apply: a. The interface shall only allow access level 1 and 2 functions. b. The mandatory functions of the VACS shall not be overridden; c. Any short circuit or earth fault in the transmission path to the external devices shall: (1) not prevent mandatory functions of the VACIE and (2) be indicated on the VACIE at least by means of the general fault warning.	The IED GLOBALCOM® EN 54-16 system is compliant. Basic functions for initiating alarms, silencing alarms, and resetting faults are configurable on logic inputs. Similarly status indications of the alarm condition, disablement condition, delay condition and fault condition are configurable on relay outputs. Logic inputs to the 5400ACS may be supervised for shorts and opens, and these conditions are indicated as faults and do not negatively impact the mandatory functions of the system.
12.0	**Emergency Microphone(s) (Optional)**	
	The VACIE may have provision for emergency microphone(s). In this case the emergency microphone(s) shall have: a. Priority over all inputs, including pre-recorded messages b. An emergency microphone control to open the microphone channel, at access level 2 c. Where a pre-announcement attention drawing signal is provided, an indicator adjacent to the microphone shall show when the signal has finished and live speech can commence. d. When the emergency microphone control is operated, any audible indication that might interfere with the use of the microphone shall be automatically muted. e. Where the VACIE has provision for the connection of more than one emergency microphone, they shall be configurable for priority at access level 3 or 4 and only one emergency microphone shall be active at any one time.	The IED GLOBALCOM® EN 54-16 system is compliant via the 5450CS and 5416CS paging station products. The 5450CS provides a touch screen for password entry, selections of zones and selection of actions, including both live and pre-recorded announcements. Operations initiated from the paging stations may be configured for higher priority than logic input initiations. Pre-announcement tone status is indicated via LEDs and via on-screen graphics/text on the paging stations. The IED system manages resources and priorities so that only one paging station has access to a zone at a time.
13.0	**Design Requirements**	The IED GLOBALCOM® EN 54-16 system is compliant.

Clause #	Requirement	Compliance
13.1	**General Requirements**	
13.1.1	Some verified by test, others by inspection of design.	The IED GLOBALCOM® EN 54-16 system is compliant.
13.1.2	Declare in writing that design has been carried out under guidance of quality management processes, (ISO), and that components have been selected for the intended purpose and expected to operate under an environment to comply with class 3K5 of EN 60721-3-3.	The IED GLOBALCOM® EN 54-16 system is compliant.
13.2	**Documentation**	

	a. General description of VACIE, for optional functions of this standard, functions relating to other parts of EN54 and ancillary functions not required by this standard.
	b. Technical Specifications:
	  1. Power Requirements.
	  2. Max # of voice zones.
	  3. Info on emergency mic's.
	  4. Min & Max electrical ratings for each input and output.
	  5. Info on communication parameters for each transmission path.
	  6. Recommended cable parameters for each transmission path.
	  7. Fuse ratings
	a. Specified means to limit consequences of fault (13.5.2)
	a. Configure and Commissioning Instructions
	b. Operating Instructions
	c. Maintenance Information
	d. Design Documentation
	  1. Drawings
	  2. Parts List (BOM)
	  3. Block Diagrams
	  4. Circuit Diagrams
	  5. Functional Description
	(To extent that compliance with the standard may be checked)
		The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.

13.3	**Mechanical Design**	
	a. Robust cabinet construction. b. Meets IP-30 of EN60529 (protects against solid objects ≥ 2.5mm, No water	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.

Clause #	Requirement	Compliance
	ingress protection). c. All interconnections inside cabinet shall be accessible @ Level 3. d. May be housed in more than one cabinet – if so, All controls must be in one cabinet or must specify mounting cabinets adjacent to each other. e. All manual controls and LED indicators shall be labeled and legible @ .8m distance. f. Terminations for transmission paths and fuses shall be labeled clearly.	
13.4	**Electrical and Other**	
	a. Processing of signals gives highest priority to voice alarm. b. Transition between main and standby power source has no affect on any indicators. c. Disconnect of main or standby power only through Access Level 3 or 4.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
13.5	**Integrity of Transmission Paths**	
	a. A fault in any transmission path between VACIE and any component of the VACIE shall not affect proper function of VACIE or any other path. b. A short or open in the transmission path to the loudspeaker (s) shall not affect more than one voice zone for longer than 100 sec. after occurrence. c. A single short or open in any voice alarm path between distributed cabinets shall not prevent activation of voice alarm to more than one zone for longer than 100 sec. after occurrence. d. If VACIE is used with a power supply housed in a separate cabinet, then an interface will be provided for at least two paths to power supply, so a short or open on one does not affect the other.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
13.6	**Accessibility of Indicators & Controls (Annex A)**	
	a. All Mandatory indicators and controls set for Level 1 shall have access with no intervention. b. Indicators and controls set for Level 1	The IED GLOBALCOM® EN 54-16 system products are compliant with this requirement.

Clause #	Requirement	Compliance
	will also be assessable at Level 2. c. Entry to Level 2 is by restricted process. d. Entry to Level 3 is by process different than Level 2. e. Entry to Level 4 is restricted by means that are not part of the VACIE.	
13.7	**Indications by LEDs**	
	a. Visible in ambient light at any angle up to 22.5˚. b. Visible 3 m. distance for general function and power indicator. c. Visible .8 m. distance for others. d. Flashing indicators – on and off period shall be greater than .25 sec. and frequency not less than – 1 Hz for alarm and .2 Hz for fault. e. If same LED is used for fault and disablement, then fault shall be steady and disable shall flash.	The IED GLOBALCOM® EN 54-16 system products are compliant with this requirement.
13.8	**Indications by Alphanumeric**	
	a. If consisting of elements or segments, loss of a segment shall not affect interpretation of the information. b. Mandatory indications shall be clear and unambiguous. c. Mandatory indications shall be legible for at least 1 hour following display & 5 min. for faults. d. Visible in ambient light @ .8 m. distance, 22.5˚ side to side and 15˚ above and below.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
13.9	**Indication Colors**	
	Red – Voice alarms Yellow – Faults and disablements Green – Power Colors not required for alphanumeric, but if in color requires this pattern.	The Announce/Alarm indicator is either off, green or red depending on whether there is no announcement active, a non-emergency announcement active or an alarm announcement active, respectively. The Fault indicators can only be yellow (or off/black), The Disabled Zones and Delayed Zones indicators are both yellow. The power indicator is green.
13.10	**Audible Indicator**	

Clause #	Requirement	Compliance

	a. Same device may be used for voice alarm and fault.
	b. Minimum sound pressure level in anechoic conditions, at 1 meter with any access doors closed:
	  1. 60 dBA for Alarm
	  2. 50 dBA for Fault
		The IED GLOBALCOM 5400ACS controller includes a fault alert tone that is compliant.

13.11	Indicator Test	
	All visible lamps and audible must test through a manual operation. (Lamp Test)	The IED GLOBALCOM® 5400ACS controller and the 5404DZM and 5432DZM has a lamp test button on the front panel. The 5450CS and 5416CS also have a lamp test function.
13.12	Audio Performance	
	a. Output Power – Declared by manufacturer. b. Signal to Noise – A-weighted 45 dB (IEC60268-1) c. Frequency Response – shall fit into non shaded area of Fig. 1.	The output power of the amplifier elements of the IED GLOBALCOM® EN 54-16 system (Power Amplifiers, Basic Amplifiers) are specified in the specification sections for these products.
NOTES:	A bandwidth of 400 Hz to 4 kHz is sufficient to achieve acceptable intelligibility in some acoustic environments. However, a wider frequency range can be necessary to achieve acceptable intelligibility in more difficult acoustic environments. The frequency response limits exclude loudspeakers.	The frequency response of all IED GLOBALCOM® EN 54-16 sound paths that include microphones is within the specified limits of this clause.
13.13	Message Store	
	Pre recorded messages shall be stored on non volatile memory that retains messages when all power is removed. Note: Tapes and optical / magnetic disks are not considered suitable. (See Annex C)	The pre-recorded messages of the IED GLOBALCOM® EN 54-16 system are digitally stored on a solid state storage drive in uncompressed format (linear PCM, 16-bit, 48kHz). This card retains the messages when all power sources are removed.
13.14	Redundant Amps (Optional)	
	a. May have provision for 1 spare amp. b. Must auto replace bad amp within 10 sec. c. Spare must have the same function and power out. d. Every amp fault must be indicated. (8.2) e. Supervision of spare must be	Each power amplifier channel of the IED GLOBALCOM® system managed via a 5404DZM or 5432DZM has an input for connecting a spare amplifier channel. It also contains a switch-over relay to switch the loudspeaker load from the original amplifier output to the spare amplifier output. A spare

Clause #	Requirement	Compliance
	maintained.	amplifier channel assignment is configurable to multiple main amplifier channels. After fault detection of an amplifier all loudspeaker lines are switched automatically to the spare amplifier (if connected and configured) within 10 seconds.
14.0	**Additional design requirements for software controlled VACIE**	The IED GLOBALCOM® EN 54-16 system is compliant.
14.1	**Additional design requirements for software-controlled VACIE**	
14.2	**General requirements and manufacturer's declarations**	
	The VACIE may contain elements that are controlled by software in order to fulfill the requirements of this part of EN 54. In this case, the VACIE shall comply with the requirements of Clauses 13 and 14, where relevant to the technology used.	
14.3	**Software Documentation**	
14.3.1	The manufacturer shall prepare documentation which gives an overview of the software design, which shall be submitted to the testing authority together with the VACIE. This documentation shall be of sufficient detail for the design to be inspected for compliance with this part of EN 54 and shall be comprised of at least the following:	The IED GLOBALCOM® system is compliant with this requirement.

	a. Functional description, using a clear methodology appropriate to the nature of the software, e.g. graphical representations of the system design, data flows and control flows and of the main program flow, including
	  1. A brief description of each module and the tasks it performs,
	  2. The way in which the modules interact,
	  3. The way in which the modules are called, including any interrupt processing, and
	  4. The overall hierarchy of the program;
		The IED GLOBALCOM® EN 54-16 system is compliant.

Clause #	Requirement	Compliance
	b. A description of which areas of memory are used for the various purposes (e.g. the program, site- specific data and running data); c. A description of how the software interacts with the hardware of the VACIE. d. Where dynamic memory management is employed, a separation shall be implemented between the program, site-specific data and running data and this shall be described in connection with the method of memory allocation.	
14.3.2	The manufacturer shall prepare and maintain detailed design documentation. It is not necessary that this be submitted to the testing authority, but it shall be available for inspection in a manner that respects the manufacturer's rights of confidentiality. This documentation shall be comprised of at least the following: a. Description of each module of the program as it is implemented in the source code of the program, containing b. The name of the module, and c. The identification of the author(s); d. Source code listing, including all global and local variables, constants and labels used, and sufficient comments for the program flow to be recognized; e. Details of any software tools used in the preparation of the program (e.g. high-level design tools, compilers, assemblers).	The IED GLOBALCOM® EN 54-16 system is compliant.
14.4	**Software Design**	
	In order to ensure the reliability of the VACIE, the following requirements for software design shall apply. The software shall have a modular structure. The design of the interfaces for manually and automatically generated data shall not permit invalid data to cause an error in the program execution. The software shall be designed to avoid the occurrence of a deadlock in the program flow.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
14.5	**Program Monitoring**	

Clause #	Requirement	Compliance
14.5.1	The execution of the program shall be monitored as in 14.4.2 or 14.4.3. If routines associated with the main functions of the program are no longer executed, either or both of the following shall apply. The VACIE shall indicate a system fault (as in 8.3). The VACIE shall enter the fault-warning condition and indicate faults of affected supervised functions (as in 8.2.3, 8.2.4, 8.3, 8.4 and 8.5), where only these functions are affected.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
14.5.2	If the program executes in one processor, the execution of the routines in 14.4.1 shall be monitored by a monitoring device as in 14.4.4.	The IED GLOBALCOM® 5400ACS controller is compliant with this requirement.
14.5.3	If the program executes in more than one processor, the execution of the routines in 14.4.1 shall be monitored in each processor. A monitoring device as in 14.4.4 shall be associated with one or more processors, and at least one such processor shall monitor the functioning of any processor not associated with such a monitoring device.	The IED GLOBALCOM® system is compliant with this requirement.
14.5.4	The monitoring devices of 14.4.2 and 14.4.3 shall have a time-base independent of that of the monitored system. The functioning of the monitoring device and the signaling of a fault warning shall not be prevented by a failure in the execution of the program of the monitored system.	Independent hardware circuitry in the 5400ACS is used to detect that a microprocessor has stopped executing properly.
14.5.5	In the event of a system fault as specified in 14.4.1 a) or 14.6, those parts of the VACIE affected shall enter a safe state not later than the indication of the system fault. This safe state shall not result in the false activation of mandatory outputs.	The IED GLOBALCOM® system is compliant with this requirement.
14.6	**Storage of Programs and Data**	
14.6.1	All executable codes and data necessary to comply with this part of EN 54 shall be held in a memory which is capable of continuous, unmaintained, reliable operation for a period of at least 10 years.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement. All information is stored in a solid state storage drive or flash card, depending on the product.
14.6.2	The program shall be held in a non-volatile	The IED GLOBALCOM® EN 54-16 system is

Clause #	Requirement	Compliance
	memory that can be written to only at access level 4. It shall be possible to identify the version reference or references of the program at access level 3. The version reference or references shall be in accordance with the documentation of 14.	compliant with this requirement.
14.6.3	For site-specific data, including emergency message(s), the following requirements shall apply. a. The alteration of site-specific data shall be possible only at access level 3 or 4. b. The alteration of site-specific data shall not affect the structure of the program. c. If stored in read-write memory, there shall be a mechanism that prevents the memory being written to during normal operation at access level 1 or 2, such that its contents are protected during a failure in program execution. d. It shall be possible to either read or interrogate the site-specific data at access level 2 or 3, or the site specific data shall be given a version reference that shall be updated when each set of alterations is carried out. e. If the site-specific data have a version reference, it shall be possible to identify this at access level 2 or 3.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
14.7	**Monitoring of Memory Contents**	
	The contents of the memories containing site-specific data shall be automatically checked at intervals not exceeding 1 h. The checking device shall signal a system fault if a corruption of the memory contents is detected.	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
15.0	**Marking**	
	The VACIE shall be marked with the following information, which shall be legible at access level 1:	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.
	a. The number of this European Standard b. The name or trademark of the manufacturer or supplier c. The type number or other designation of the VACIE. d. It shall be possible to identify a code or	a. The installer must mark the IED system with the number of this European standard (which is legible at access level 1), since the installer must install and configure the system properly in order to let the installation comply with this

Clause #	Requirement	Compliance
	number that identifies the production period of the VACIE at access level 1 or 2 or 3.	standard. b. The name "IED GLOBALCOM®"' is visible on each element of the system. The installer must ensure that this name is legible at access level 1 for all system elements. c. The type number of each unit of the system is present on the unit itself. The installer must ensure that this type number is legible at access level 1. d. The hardware version and production data are visible on the type number plate of each unit of the IED GLOBALCOM® system. The installer must ensure that this type number plate is identifiable at access level 1, 2 or 3.
16.0	**Tests**	
	a. Voice Alarm Condition b. Fault condition (14 conditions) c. Disablement d. Voice alarm manual control e. Interface external devices f. Emergency Microphone (s) g. Microphone priority h. Redundant Amps i. Audio Performance j. Output Power k. Signal to Noise l. Frequency Response (No Mic) m. Frequency Response (With Mic) n. Cold Operation -5˚c o. Damp Heat Operational (4 days) p. Damp Heat Endurance (21 days) q. Impact r. Vibration Operational s. Vibration Endurance t. Supply Voltage Variation u. EMC Compatibility	The IED GLOBALCOM® EN 54-16 system is compliant with this requirement.

Appendix C: 5400ACS Software Documentation

The heart of the GLOBALCOM EN54-16 Voice Alarm System is the 5400ACS Announcement Control System. The software that resides in the 5400ACS is documented below in terms of overall design, program monitoring, storage of programs and data, and monitoring of memory contents.

This documentation applies to all versions 1.x.y of the control software (i.e., version 1.0.0, 1.0.1, 1.1.0, 1.2.0, etc.). That is, any version that starts with 1 (one). The current version of software installed on a system can be determined at any time via the Device Configuration Tool, as shown in Figure C-1 in the right-most column of the device list.

C.1   Overall Design

The software is written in C# using the Microsoft .Net framework and is built in the Microsoft Visual Studio development environment. The software is designed using the latest object-oriented paradigms. For the purposes of this document, what the EN 54-16 standard calls a "module" will be a Windows service and what the standard calls a "routine" will be an object class. The four modules (services) in the 5400ACS software are:

- **Configuration Service** – This module is used to manage configuration data for the installation, both in the data store and in companion files such as configuration files that must be passed on to communication stations. When new configurations are received via the network, this service also performs functions such as stopping and restarting the Controller Service.

- **Controller Service** – This module is the heart of the 5400ACS controller. All of the significant run-time processing occurs in this module.

- **Communication Service** – This module implements interfaces to peripherals in the system, both those within the 5400ACS box and those accessed over the network.

- **Updater Service** – This module only handles EN54-16 Level 4 Access updating of the Configuration Service and does not run constantly like the other services mentioned.

The data and control flow interactions between these modules is shown below in Figure C-1. Subsections that follow describe each of these modules in more detail.
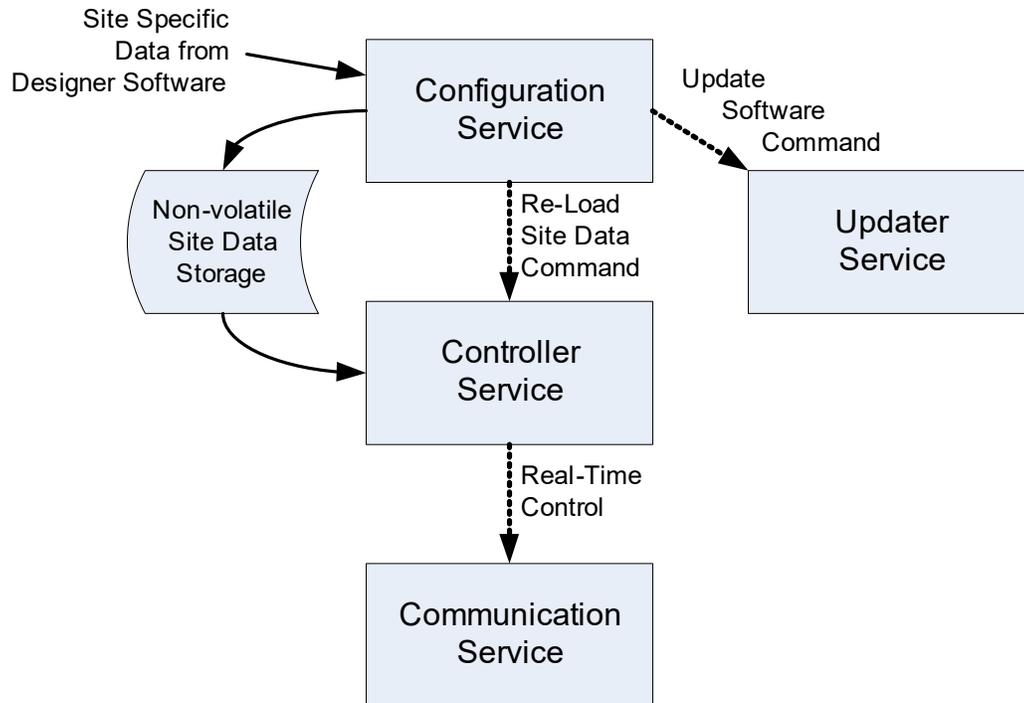
**Figure C-1:   Modules of the 5400ACS Software**

C.1.2 Controller Service

The controller module is the main service. It communicates to external devices (communication stations, 54xxDZMs, etc) as well as all components within the 5400ACS box, such as the SSD drive for message storage, sound devices, and front panel displays and indicators. This module manages announcements (alarms), detects and alerts to raises fault conditions, and handles functions like backup amp switching. Some specifics of what the module does are:

- Communicates directly to 5400 I/O Board via a serial port

- Communicates directly to LCD Display and buttons via USB serial port

- Communicates to DZM, communication stations and other devices via Ethernet

- Reads site specific data from a serialized xml file.

- Monitors the health of all portions of the system.

The Controller Service is designed in a layered fashion where each layer focuses on a specific type of function such as communication or audio routing. Individual layers are composed of numerous objects whose job is to encapsulate simple operations pertaining to the responsibilities of the layer. Object interaction within and across layers happen in a loosely coupled way via method calls and event notification (an innate facility of the C# language). Features and functionality are realized by the simple interaction of numerous objects across multiple layers. Key features of the 5400ACS detailing object interaction and control flow are shown in Figures C-2 to C-6.
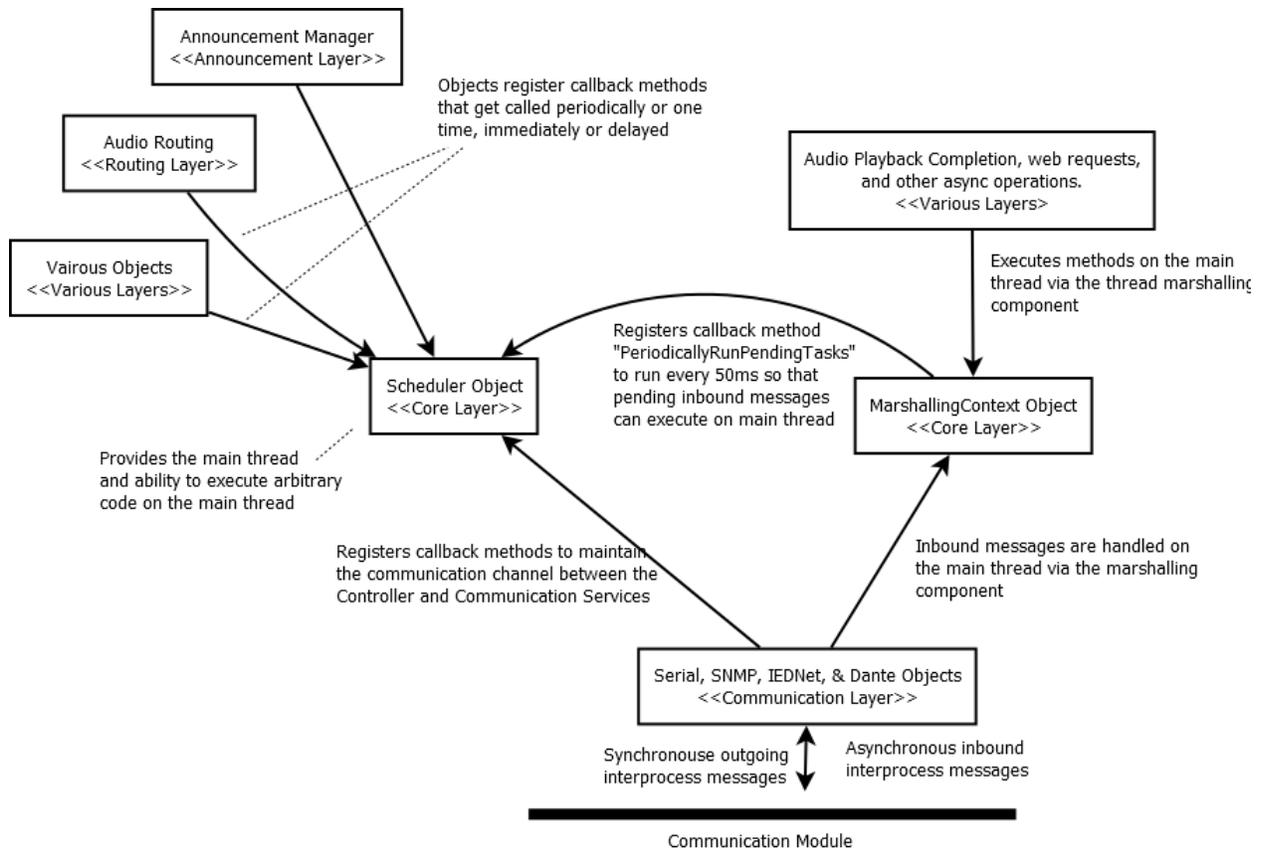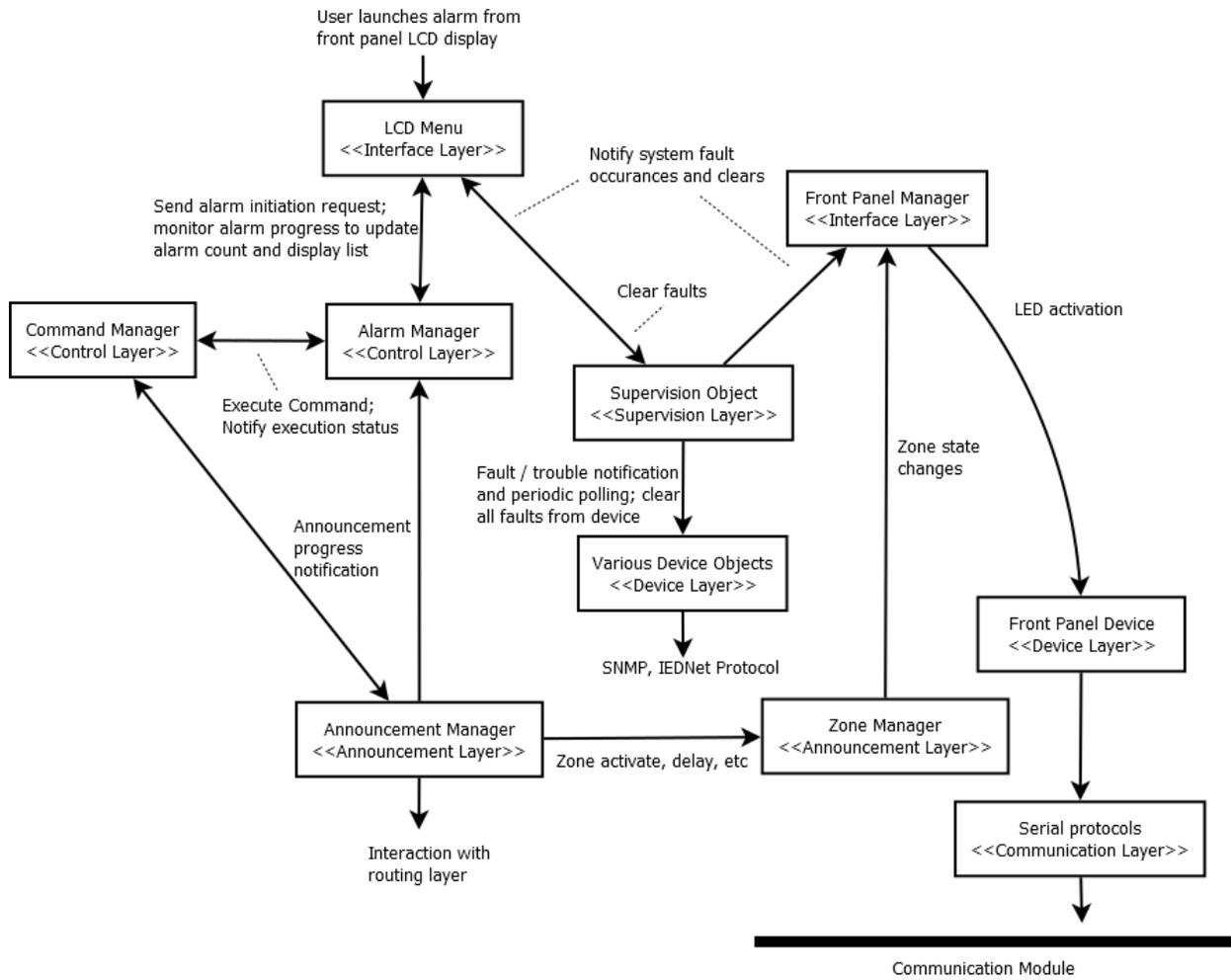
**Figure C-2:   The Main Thread and Driving Engine of the Controller
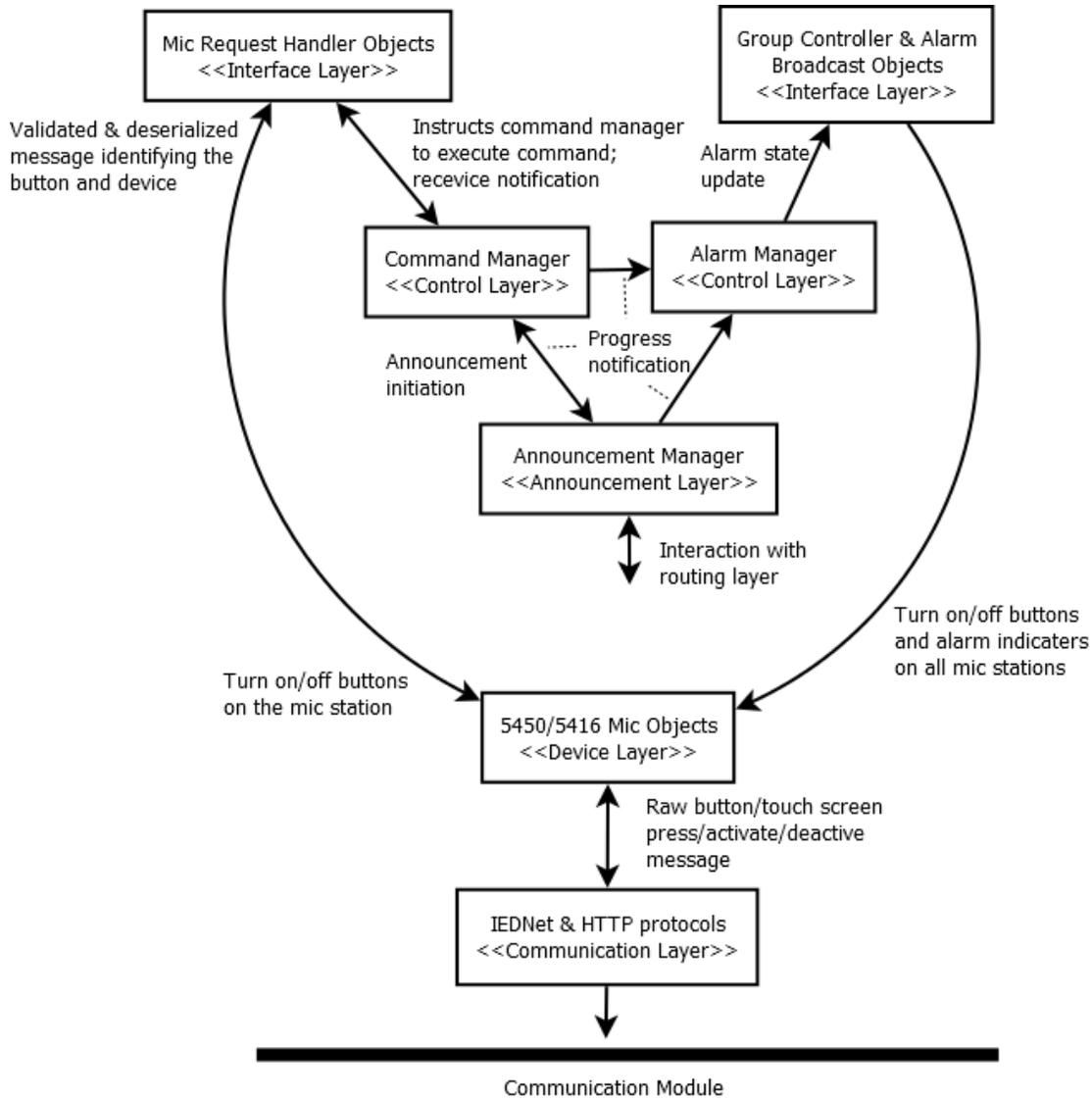Service**
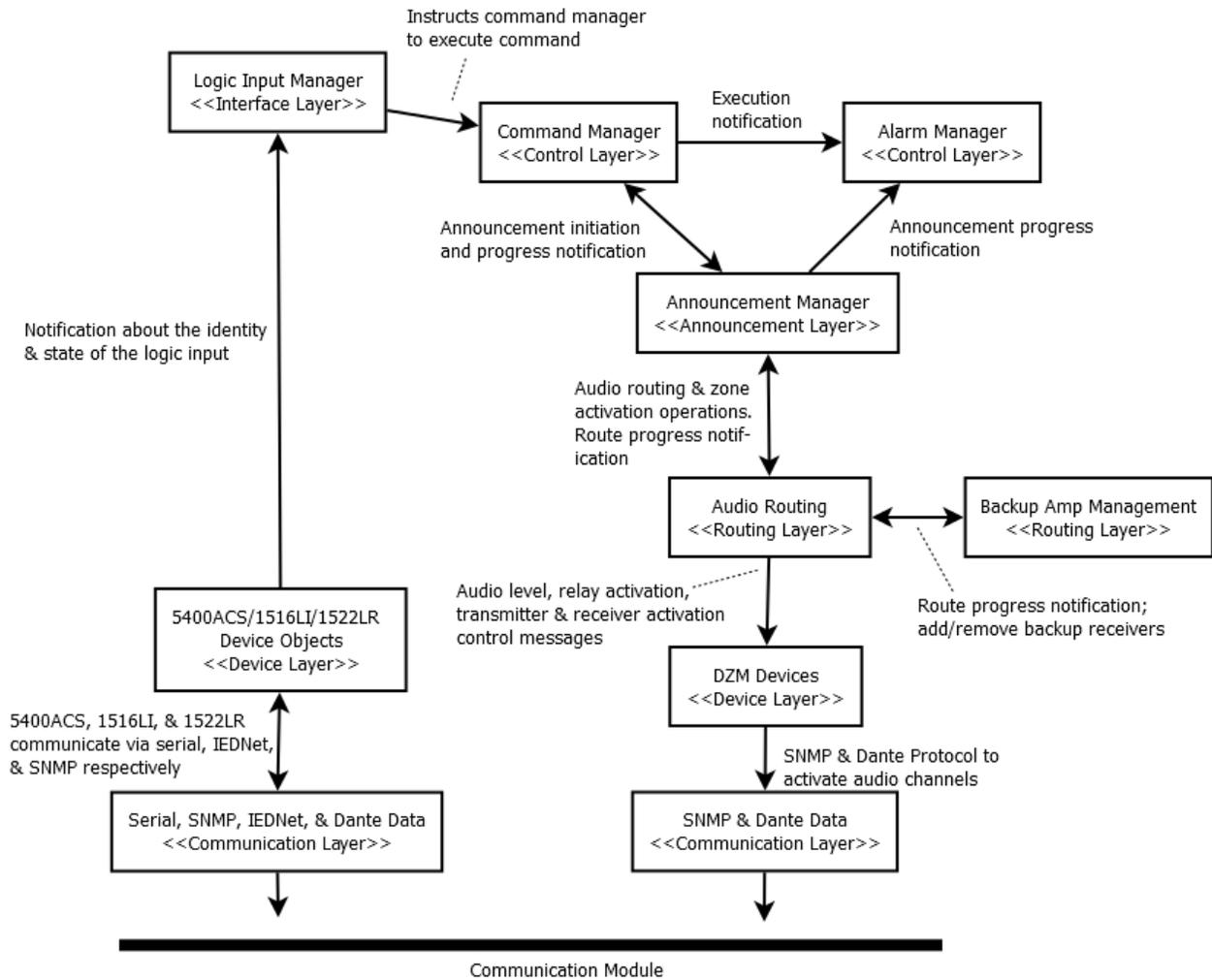
Figure C-3: Alarm Activation from Logic Inputs
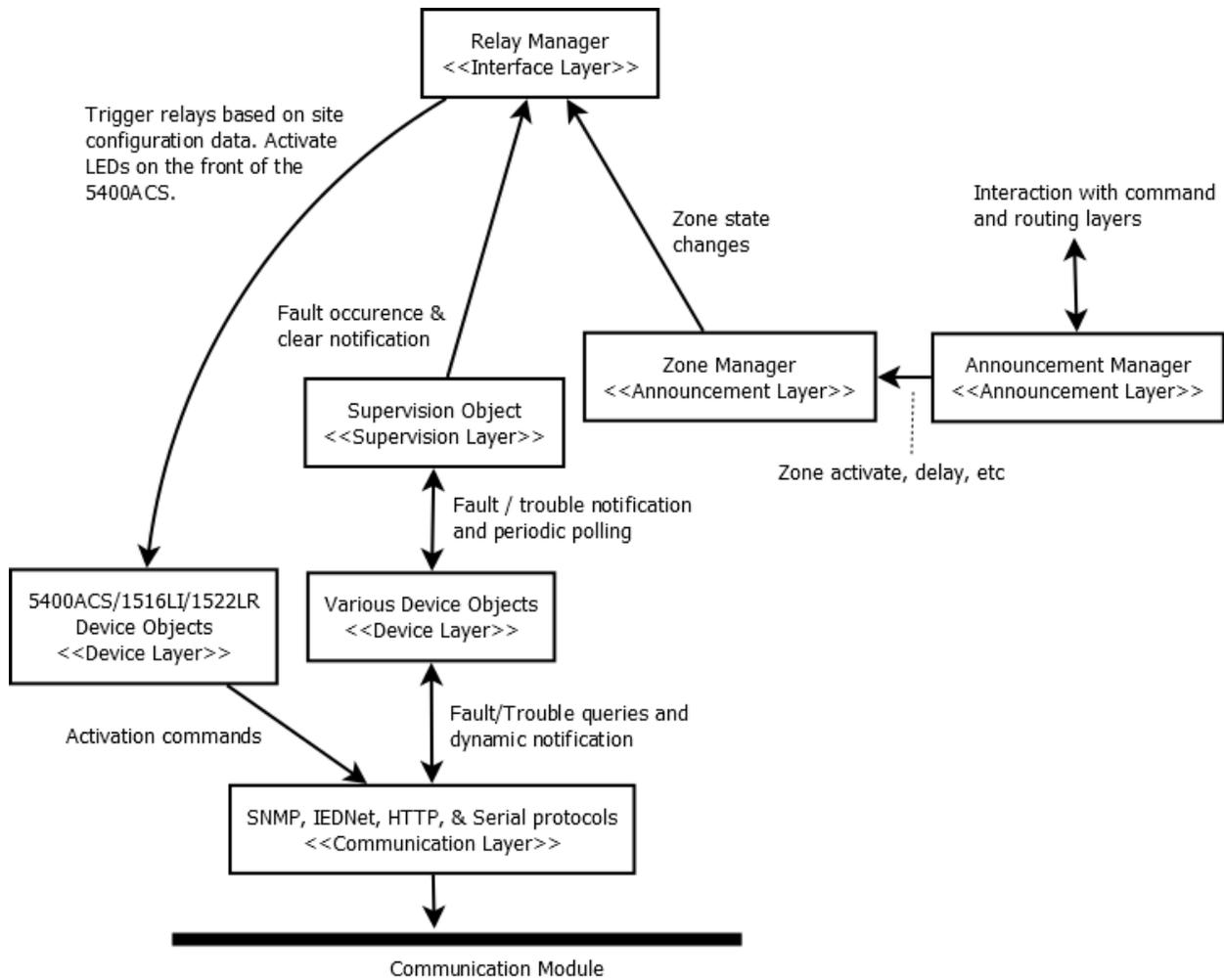
Figure C-4:   Interaction with Relay Hardware

Figure C-5:   Interaction with LCD Display and LED Indicators on 5400ACS

Figure C-6:   Interaction with Mic Station Hardware

C.1.2 Configuration Service

The configuration module acts as a configuration window to the outside world. The GLOBALCOM-en Designer communicates with the controller only through this module to obtain and update site specific data at Access Level 3 and firmware updates at Access Level 4.

Externally, the configuration module communicates over Layer 3 network with using JSON over HTTP REST. Internally, the configuration module performs its tasks by using Microsoft Windows .Net as well as lower level Microsoft Windows API functionality.

Responsibilities for the configuration module include:

- Obtaining and updating site specific information.

- Obtaining and updating kernel-level hardware configuration (network settings, date/time changes, etc.).

- Obtaining and updating an in-memory "configuration mode" which allows the GLOBALCOM-en Designer to suspend BGM routing while running a test calibration on a DZM.

- Obtaining and updating the analog auxiliary gain values in memory of the controller. This allows the GLOBALCOM-en Designer to evaluate audio gain values while the controller is running.

- Provides EN54-16 Level 4 access for updating either configuration, communication, controller, or updater modules.

Upon a site specific update (HTTP PUT) message to the configuration endpoint from the GLOBALCOM-en Designer, internally the configuration module acts as follows:

1. Validates user and password from GLOBALCOM-en Designer.

2. Marks current state as an "updating state" to reject other requests to update.

3. Validates the site-specific data for correctness. If invalid, rejects update and proceeds to step 8.

4. Determines if modules need to be reloaded based upon data being sent and stops them.

5. Determines where the site-specific data and/or firmware updates belong and transfers the data on disk.

6. Processes any kernel level requests.

7. Starts any modules that were stopped in step 4.

8. Marks current state as "updated" to allow another request to update.

Actions to stop and start or restart other services are handled via the Windows Service Controller (SC).

Upon a firmware update (HTTP PUT) message to the firmware endpoint from the GLOBALCOM-en Designer, internally the configuration module acts as follows:

1. Validates user and password from GLOBALCOM-en Designer.

2. Marks current state as an "updating state" to reject other requests to update.

3. Validates the firmware data for correctness. If invalid, rejects update and proceeds to step 8.

4. Examines the modules provided in the firmware update to be updated and stops the process(es).

5. Copies over any new modules provided in the update. If new modules provided include the configuration module itself, starts the updater module which will update the configuration module.

6. Updates internal firmware version number to version provided in the update.

7. Starts any modules stopped in the update.

8. Marks current state as "updated" to allow another request to update.

C.1.3 Communication Service

For times when the controller needs to communicate over the TCP/IP network with a device, there are four protocols needed not specific to any particular device, but still needed as a layer on top of the standard network layer included in Microsoft Windows.

The protocols included in the communication service include:

- Dante – Audinate's proprietary protocols for discovery and control of digital audio routing on a network.

- FTP – File Transfer Protocol for pushing files to other devices such as communication stations.

- IEDnet – IED's proprietary UDP-based control protocol and its upper level object-oriented layer, IED-24

- SNMP – Simple Network Management Protocol used for controlling 54xxDZM devices.

C.1.4 Updater Service

The updater module's has one responsibility, to update the configuration module. It does not run other than in the case of a firmware update.

C.2   Program Monitoring

Monitoring is handled by independently clocked hardware in the following tiers:

First Tier – A microprocessor running on the I/O board communicates with the control software via a serial port. If the control software fails to communicate for a period of time, the microprocessor turns on the System Fault indicator (LED) as well as the general fault LED, relay and beeper. Under user control, the microprocessor can also reset the processor board on which the software is running.

Second Tier – The above mentioned microprocessor has a built-in watchdog circuit.

Third Tier - Additionally, there is an independent circuit on the I/O board that also turns on the System Fault plus general fault indicators if the above mentioned microprocessor should fail.

In addition to the above hardware monitoring, there is the additional software monitoring in the processor:

Fourth Tier - The internal modules of the 5400ACS are setup to run as Windows Service Applications. The execution and monitoring of these modules are conducted by the Windows Service Control Manager component. The Service Control Manager provides facility to automatically restart a Service Application on abrupt termination, i.e., crash. The internal modules of the 5400ACS are configured in the Windows Service Control Manager to restart automatically on failure.

C.3   Storage of Programs and Data

The software modules, site specific configuration data, and audio messages for the 5400ACS are stored on a solid-state drive (SSD). Modification to the software modules (i.e., firmware update) is only allowed at Access Level 4 via the GLOBALCOM-en Designer software. Version information of the 5400ACS can be retrieved by navigating the menu on the 2-line LCD front panel display.

The Controller Service is responsible for building in-memory representation of the site-specific configuration data. It does so by first reading the entire contents of the site-specific configuration data into memory before constructing object models and their relationships with each other. These object models are used to query and control the various devices/components that make up the system. This operation is only performed after a new upload of the site specific configuration data or when the Controller Service starts (after powering up the 5400ACS).

Emergency messages/audio files are only accessed at the time of initiation of an emergency announcement. Such data files are opened via read-only access mode, read into memory buffers and streamed out over the network. The files are closed when the entire content have been streamed or when an announcement is cancelled prematurely.

The processes described above ensure that configuration data and messages are not altered in any way by the software modules of the 5400ACS. As mentioned elsewhere in this document, modification of data is only possible via the GLOBALCOM-en Designer software at Access Level 3. The program structure and flow remain unaffected by alterations of the site specific configuration data.

C.4   Monitoring of Memory Contents

The 5400ACS Software is a collection of Windows Services running on the Windows Operating System. Services and processes executing in the Windows environment do not have direct access to the underlying physical or hardware memory. Rather, each process is allocated virtual memory. Virtual memory is an operating system construct that separates a program's view of memory from the system's physical memory and allows the OS to isolate processes from one another, share the physical memory between multiple running processes, etc. It is not possible for any of the module of the 5400ACS Software to pinpoint their exact location in physical memory.

The operating system is responsible for memory management, corruption detection, and any remedial actions that can be taken to prevent data corruption. Failure to recover from a hardware error halts the OS and all processes controlled by the OS. This will trigger the fault indicators (LED), beeper, and relay as described in section C.2 (Program Monitoring).

The Controller Service reads from the solid-state drive (SSD) configuration data only when it is downloaded from the GLOBALCOM-en Designer software and when the 5400ACS is powered on. Failure to read configuration or emergency message data due from the SSD will terminate the Controller Service as it does not attempt to capture and (attempt to) handle low level errors. The fault indication mechanisms described in section C.2 (Program Monitoring) will activate when hardware errors are detected by the OS.

## Appendix D: Datasheets for Third Party Equipment

Deployment of a complete voice alarm system requires the use of several components not provided by IED. The following components have been tested and certified with the IED components. Their manufacturer data sheets are on the pages which follow:

- Vishay 595-275 Varistor

- Merawex ZDS0400-DR4 EN 54-4 Power Supply

- KTI KGS-1064-HP network switch

- Cosel SNR-10-223-DT Line Filter

- TDK # ZCAT2035-0930A clamp-on Ferrite Core Filter

595-275 VISHAY BC COMPONENTS

Varistor 17mm 275Vac 350Vdc 600mW RM7.5
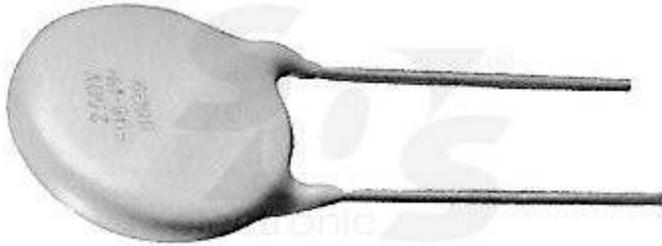
http://www.soselectronic.com/a_info/img_data/a/varistor.jpgA Varistor is a voltage dependent resistor with symmetrical voltage-current characteristics that is designed to protect all kinds of electronic devices or elements from switching and induced lightning surges. Its non linear exponent characteristics with broad using range and mass production is gradually being used by various level of electric engineering.

Features:

- Fast response time.

- Low leakage current.

- Excellent voltage ratio.

- Wide voltage & energy ratio.

- Low standby power and no follow on current

- High performance in surge current handling capability.

- High performance in clamping voltage characteristics.

Size	Disc 17mm
Pitch	7.5 mm
Peak Surge Current	4500 A
Maximum Energy	104 J
P Max.	0.6 W
Varistor Voltage	430 Uvar
Max. Voltage VDC	350 VDC
Max. Voltage VAC	275 VAC

MERAWEX

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USER MANUAL

Power supply units for sound alarm systems
type

ZDSO400-DR2, ZDSO400-DR4

20.12.2013

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Warnings

- **Read this User Manual thoroughly before using the device.**
- **Do not touch internal elements of an operating device – doing so poses a risk of an electric shock or burns.**
- **Protect the device from the possibility of any items or fluids entering in – doing so poses a risk of electric shock and device damage.**
- **Do not cover ventilation openings – doing so may result in device damage.**
- **Provide a free space of at least 8 cm at the sides of the device, enabling its proper ventilation.**
- **The device must be supplied from mains with a protective earthing terminal.**
- **The device may interfere with operation of sensible radio and television equipment located nearby.**

1. Technical description

1.1. Intended use

The power supplies are intended to be used as power supply of voice alarm systems (VAS), providing them with the backup battery power for acoustic amplifiers and controllers and other VAS modules separately:
1. ZDSO400-DR2 for up to maximum 6 power amplifiers, cooperating with one or two battery banks.
2. ZDSO400-DR4 for up to maximum 12 power amplifiers, cooperating with one to four battery banks.

The power supplies mentioned above can also be used for cooperation with the smoke and heat control systems (smoke and heat control systems) including systems located afar.

1.2. Construction and layout

Power supplies designed for installation in a typical 19" rack are assembled within a metal case:

1. ZSDO400-DR2 of the height of 1U,
2. ZSDO400-DR4 of the height of 2U.

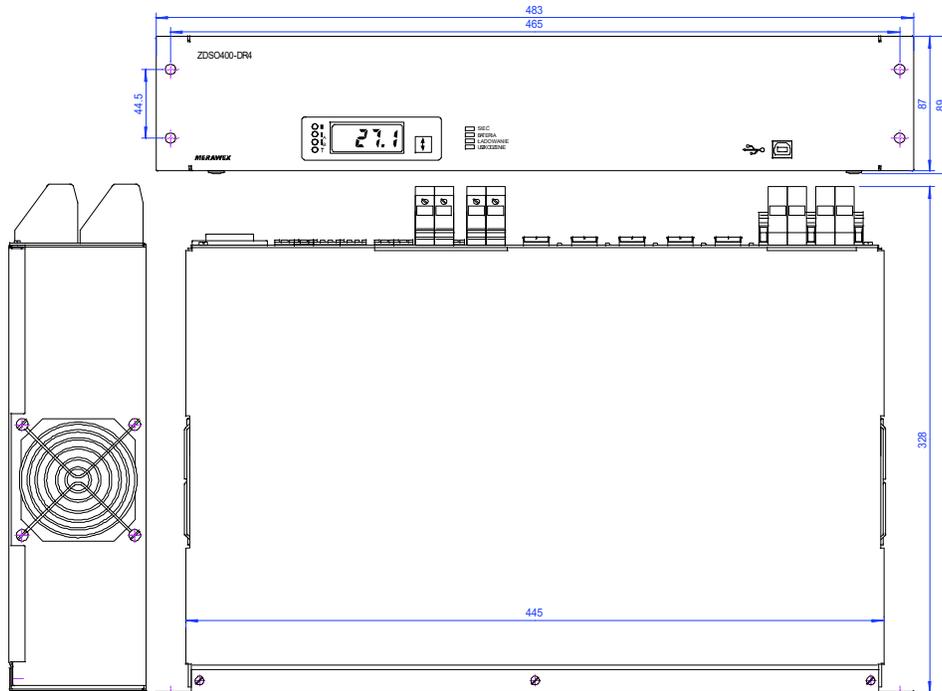Fig.1.   View and nominal dimensions of ZDSO400-DR2 power supplies.

Fig.2.   View and nominal dimensions of ZDSO400-DR4 power supplies.

ZDSO400-DR2 power supply

Note: The power supply unit is supplied together with:

1. The 230V mains cable equipped with the IEC plug;
2. A temperature sensor;
3. Set of plugs for connecting power supply of VAS amplifiers (6 pcs. of the PC 5/2-ST-1-7 plugs);
4. Set of plugs for connecting power supply of VAS controllers (2 pcs. of the MSTB2,5/2-ST plugs);
5. Set of plugs for connecting inputs and outputs of the indication system
   (5 pcs. of the MSTB2,5/2-ST plugs).
6. Ferrite core, toroidal, insulted, dimensions: 22x13.7x6.3 F830 (6 pcs.).
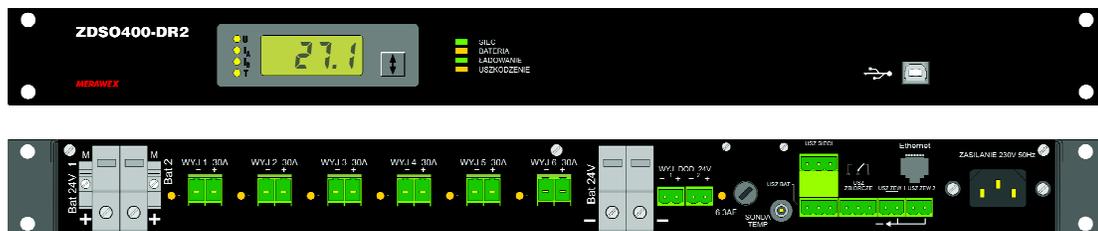
Fig.3. View of the front and back panel of the **ZDSO400-DR2** power supply unit**.**

A digital display panel, a USB port and 4 LED indication diodes are installed in the front panel of the power supply unit:

1. **MAINS** (green)
2. **BATTERY** (yellow)
3. **CHARGING** (green)
4. **FAULT** (yellow)

The back panel contains:

1. A male IEC socket for connecting the mains cable (**230Vac 50Hz.**)
2. Four screw connectors for connecting two 24 V battery banks (**BAT1, BAT2**) and two neighbouring connectors of the circuit equalizing voltages of the battery banks **M.**
3. A socket for connecting the temperature sensor (**TEMP SENSOR**).
4. Two input sockets for external fault indication (**EXT. FAULT 1 and EXT. FAULT 2**).
5. Three output sockets of relay indication system (**MAINS FAULT**, **BATTERY FAULT** and **GENERAL FAULT**).
6. 6 sockets for connecting VAS 24V amplifiers (from **OUT1** to **OUT6**). They can also be used for connecting the smoke and heat control system devices.
7. A double socket for connecting the network controller and other VAS modules designed for work with 24V power supply (**ADDITIONAL OUTPUT 24V**). They can also be used for connecting the smoke and heat control system devices.
8. **Ethernet** connector.

ZDSO400-DR4 power supply

<u>Note</u>: The power supply unit is supplied together with:

1. The 230V mains cable with the IEC plug;
2. A temperature sensor;
3. Set of plugs for connecting power supply of VAS amplifiers (12 pcs. of the PC 5/2-ST-1-7 plugs);
4. Set of plugs for connecting power supply of VAS controllers (4 pcs. of the MSTB2,5/2-ST plugs);
5. Set of plugs for connecting inputs and outputs of the indication system (5 pcs. of the MSTB2,5/2-ST plugs).
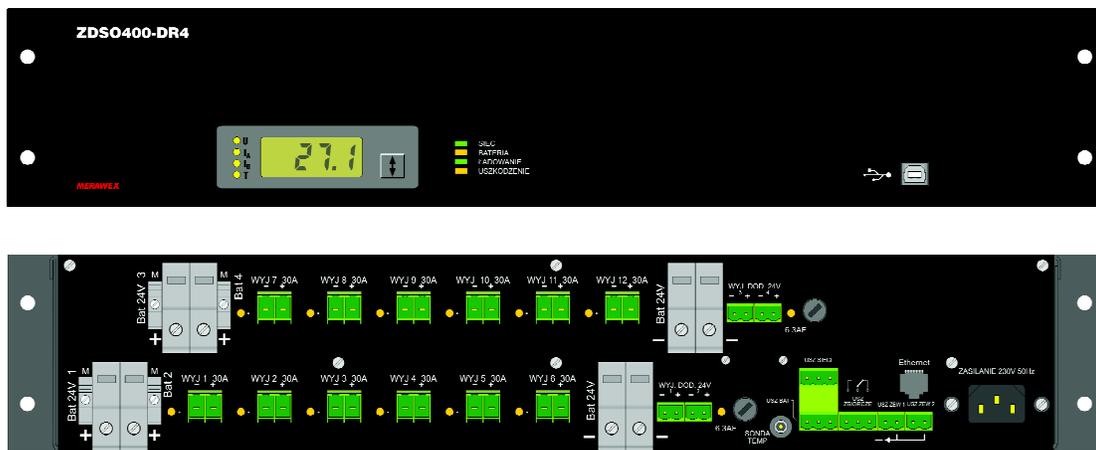6. Ferrite core, toroidal, insulted, dimensions: 22x13.7x6.3 F830 (12 pcs.).

Fig. 4. View of the front and back panel of the **ZDSO400-DR4** power supply unit

A digital display panel, a USB port and 4 LED indication diodes are installed in the front panel of the power supply unit:

1. **MAINS** (green)
2. **BATTERY** (yellow)
3. **CHARGING** (green)
4. **FAULT** (yellow)

The back panel contains:

1. A PC-type socket for connecting the mains cable (**230Vac 50Hz).**
2. Eight screw connectors for connecting four 24 V battery banks (**BAT1, BAT2, BAT3, BAT4**) and four neighbouring connectors of a circuit equalizing voltages of battery banks **M**.
3. A socket for connecting the temperature sensor (**TEMP SENSOR**).
4. Two input sockets for external fault indication (**EXT. FAULT 1 and EXT. FAULT 2**),
5. Three output sockets of relay indication system (**MAINS FAULT**, **BAT FAULT** and **GEN FAULT**).
6. 12 sockets for connecting VAS 24V amplifiers (from **OUT1** to **OUT12**). They can also be used for connecting the smoke and heat system devices.
7. Two double sockets for connecting the network controller and other VAS modules designed for work with 24V power supply (**ADDITIONAL OUTPUT 24V**). They can also be used for connecting the smoke and heat system devices.
8. **Ethernet** connector.

1.3. Basic electrical parameters

	ZDSO400-DR2	ZDSO400-DR4
Nominal mains voltage	230V +10% -15% 50Hz	
Power factor	0.94	
Efficiency (while charging the battery)	84%	
Output voltage stabilisation	0.5%	
Leakage current in the protective cable	<1.5mA	<3mA
Maximum power consumption from the mains	2.7A	5.4A
Nominal voltage of the external battery bank	24V	24V
Nominal voltage of the floating mode operation at 25°C	27.1V	27.1V
Nominal voltage of the bulk charging mode operation at 25°C	28.3V	28.3V
Temperature compensation factor of the floating mode operation and bulk charging	- 48mV/°C	- 48mV/°C
Maximum capacity of supplied battery banks	320Ah *2) *4)	640Ah *2) *4)
Maximum number of battery strings	2	4
Maximum charging current	16A	32A
Maximum resistance of battery circuit *1)	50mΩ	50mΩ
Load capacity of power supply outputs provided for VAS amplifiers	6 x 30A	12 x 30A
Load capacity of power supply output provided for network controller and other VAS modules	1x6A	2x6A
The quiescent current consumption from the battery	< 400mA	< 600mA
Current consumption from the batteries after LVD disconnection	< 3mA	< 6mA
Range of output voltage *3)	20.0…28.8V	20.0…28.8V
Maximum nominal output current which can be supplied continuously to the additional outputs of 24V Imax.a [A]	2A	4A
Maximum current which the power supply unit can take from a single battery when the main power supply is cut off or disconnected [A]	96A	96A
Maximum current consumed from all battery strings in the case of the fire alarm [A]	186A	372A

*1) *Guaranteed value of battery bank circuit resistance, at which the fault indication system is switched on for each battery string separately.*

*2) *The given capacities of the batteries include current consumption Imax.a from the additional 48V outputs for the VAS controller: 2A for ZDSO400-DR2, 4A for ZDSO400-DR4; when in need of consumption of higher current than the given ones, the battery capacity must be decreased by 25Ah for every 1A current over the given Imax.a values.*

*3) *The listed range includes voltage values between the voltage of a discharged battery bank (at the end of the floating mode cycle) and the value of the bulk charging mode voltage, including temperature compensation.*

*4) *The following User Manual does not include the description of the battery selection and calculating its capacity.*

1.4. Recommended working conditions

Relative humidity	max. 80%
Direct sunlight exposure	inadmissible
Strokes during operation	inadmissible
Ambient temperature	
▪ Limits of acceptable storage temperature	-40…+85°C
▪ Working temperature – class **3K5** according to **EN 60721-3-3**	-5…+45°C

2. Operation principle

The microprocessor controller checks the presence of the mains power, battery state, state of external alarms inputs and a number of internal parameters (e.g. acceptable time of the bulk charging). If an improper operation of the device is detected, a fault indication is generated. This operational state is signalled by corresponding diodes, lighting up in the front panel, and by three remote indication relays accessible in the back panel. The relays are activated, when no fault indications are being generated; it means that a fault indication causes deactivation of the relay.

The power supply circuit is based on a direct floating mode system. The power supply, supplied from the mains, is connected in parallel with an external battery bank.

The VAS amplifiers supplied with their own power supplies are required not to consume power from the 24V voltage. However, when power failure, they should automatically switch over to use the battery power supply.

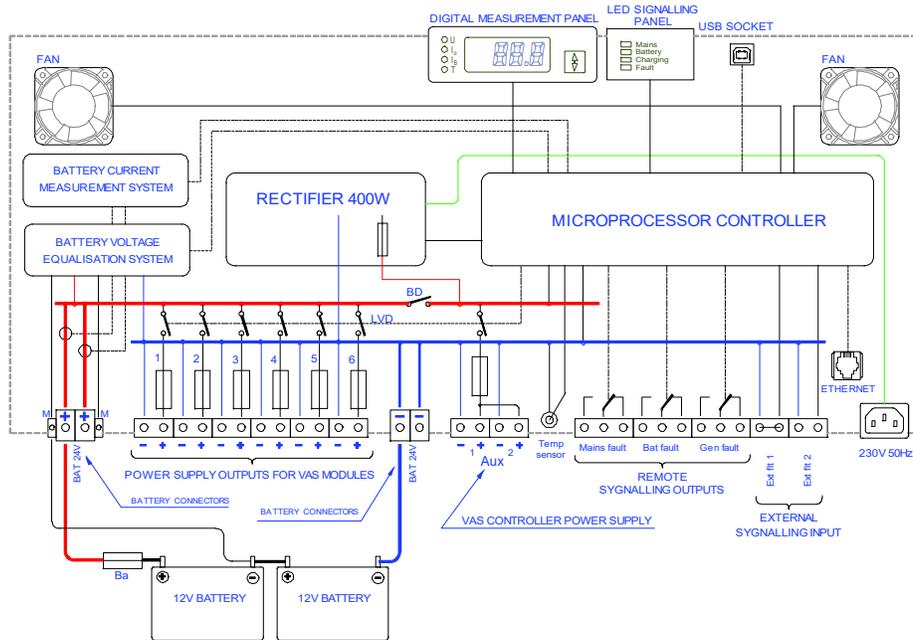Figs. 5a. and 5b. below present flowcharts of both power supplies.

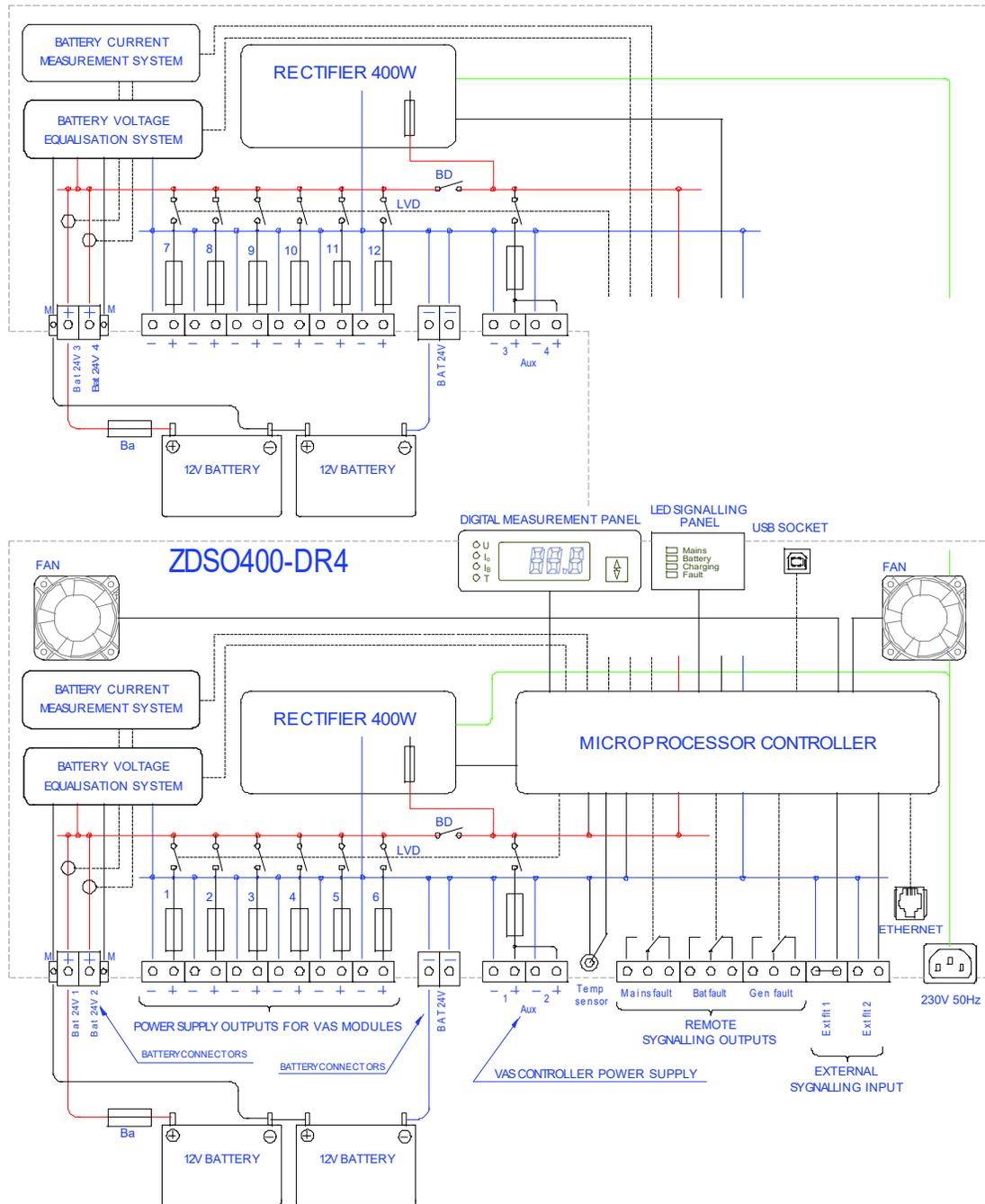Fig.5a Block diagram of ZDSO400-DR2 power supply.

Fig.5b Block diagram of ZDSO400-DR4 power supply.

When the mains present, the power supply maintains the external battery banks in their fully charged state. Power supply's operation is controlled by the microprocessor controller, which independently supervises the batteries, maintaining the floating mode voltage in them (depending on ambient temperature, if the external temperature sensor has been connected). This sensor should be located near the battery. If the sensor is absent, the controller maintains voltage corresponding to the ambient temperature of 25°C.

In case of power failure, the loads connected to the power supply are supplied directly from the battery bank – this is the battery mode. As the mains power supply returns, the battery bank charging current is above the set point, the power supply proceeds to the bulk charging mode.
This mode is characterised by charging using limited current at the increased voltage. The end of the bulk charging at a fully operational battery bank is defined by a significant drop of charging current after the preset charging voltage has been reached, after which the power supply decreases the voltage to the level of floating mode voltage, continuing charging at this voltage. If the battery bank is faulty, the bulk charging is interrupted in the fault mode after the maximum, preset charging time has been exceeded or when the permissible ambient temperature of the battery bank is exceeded.

The circuit of the ZDSO400-DR2 or ZDSO400-DR4 power supply is equipped with a LVD – an internal switch of deep discharge implemented in the relays in their output circuits (one relay in each circuit for powering amplifiers and one at each double outputs for powering the VAS controller). They disconnect the outputs from the battery banks when the battery reaches the minimum permissible discharge level, thus preventing it from further discharging and preventing it from being destroyed.
The second BD disconnector (Battery Disconnector) ensures powering continuity for additional outputs from the rectifier in the case of short circuit of the battery terminals of the charger.

Measurement of battery circuit resistance is an additional function of the controller. The resistance measurement takes place only in the floating mode operation. Detection of battery circuit resistance increase caused by an increase in internal resistance of the battery or by an increase of battery connection resistance, causes the indication for reaching high battery circuit resistance to be sent. If the battery bank gets disconnected, the controller detects a significant increase of battery circuit resistance and indicates a device configuration error.

The power supply is equipped with a function of voltage equalisation between batteries of each battery string. Voltage equalisation takes place as a result of loading the half of batteries which exhibit higher voltage, with a small current, of 100mA. This function is called for if the voltage difference exceeds 0.1V.
The use of voltage equalising circuit requires an additional connection to be introduced between the M terminal of a given battery string and the median point of the battery itself. This system is resistant to an incorrect connection of this connector (to an inappropriate terminal of any battery), indicating a fault in the such situations. The lack of this connection is automatically detected which results in switching off the voltage equalising system.

The circuit of the ZDSO400-DR2 or ZDSO400-DR4 power supply is continuously controlling the state of circuit breakers in the output circuits provided for amplifiers and of the circuit breaker (breakers) in the output circuit provided for the VAS controller. Fault to any of them results in a fault signal being generated (the signalling lights on the front panel of the power supply unit are switched on and the remote signalling to be put out), and in addition, switching on a yellow LED diode located near the faulted circuit breaker.

When the power supply unit is switched on, state of load at the outputs designed for VAS amplifiers is checked. Lack of current consumption from these outputs is required. If any of the amplifiers has e.g. its own power supply switched off (or faulty), which results in an attempt of switching it on using output voltage of the power supply unit, such the state shall be detected and the relay present at this output shall not switch on, and, in addition, fault indication shall be switched on. Relays present at the other outputs shall simply switch on, supplying voltage to operational amplifiers.

During the power supply start-up, the current consumption from the output designed for the VAS controller is permitted only. Its load present at this output, however, decreases the current provided for battery bank charging.

NOTES
1. If the system has already been switched on and any of the amplifiers starts current consumption using output voltage as a result of fault, malfunction or disconnection of its individual mains power, the power supply shall detect and indicate such the situation, if the current being consumed by the outputs exceeds 1A. Leaving the power supply system in this state may eventually result in an uncontrollable discharge of the battery, despite proper functioning of the power supply system itself.

3. Installation and connection

3.1. Installation

The power supply have been designed and manufactured as a cassette offering the IP20 protection rating, prepared for installation in a typical 19" rack using four mounting holes located in the front panel (Fig. 1, 2).

The rack dedicated to the Voice Alarm Systems must have IP30 protection rating.

Installation of power supply units in the rack requires guides to be used. Guides supporting the power supply cassette should be installed in such a way as not to impede the flow of air to the fans located on the both sides of the cassette. A 8 cm ventilation space is required on both sides of the case.

NOTES:
1. **The power supply is not equipped with its own mains switch, thus it is necessary to use a S301 C10A switch in the power supply circuits (outside the power supply unit).**
2. **The required electric installation should be provided as a permanent installation equipped with an overvoltage protection system.**

3.2. Connection

<u>Connecting to power supply network</u>

Connecting the mains to the power supply should be implemented by using a 3-wire YLY-type cable with the 1.5 mm^2 cross-section, equipped with the IEC plug.

<u>Load connection</u>

The ZDSO400-DR2 or ZDSO400-DR4 power supply has been designed for connecting the VAS amplifier modules supplied with the 24V voltage, and separately, the network controllers and other VAS modules supplied with the 24V voltage.

The sockets located in the back panel allow for connection of single amplifiers with power of up to 500W, using 2-pin connectors.

Amplifiers operating at higher power (maximum 1000W) should be simultaneously connected to two outputs of the power supply unit.

If the main amplifier is equipped with its spare amplifier present in the VAS system, it is possible to connect both amplifiers to the common power supply output (or two outputs for high power amplifiers). However, this connection should be made excluding connectors of the power supply units.

Plugs for output connection are supplied with the power supply unit. Maximum cross-section of the connected wires is 6 mm^2 in case of outputs provided for amplifiers and 2.5 mm^2 for the 24V power supply output providing power supply for the VAS controllers and other VAS modules[*].

If the used amplifiers, when mains power connected, yield the leading load higher than 47uF on their DC mains power input, it is required to use the separating ferrite cores mounted close to the output socket plugs according to the Fig. 6.
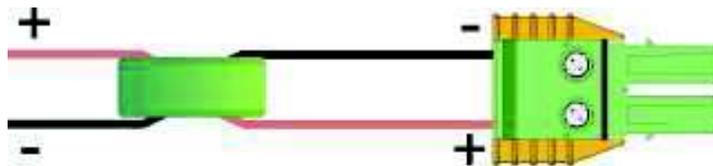

Fig. 6. Mounting the ferrite cores on the DC cables to the amplifiers

The ZDSO400-DR2 power supply is equipped with two power supply outputs for VAS controllers, while the ZDSO400-DR4 power supply unit is equipped with four such outputs. If the VAS system requires a higher number of controllers and cooperating devices to be used, corresponding splitting should be implemented outside the power supply unit.

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[*] The pairs of the output cables for powering the amplifiers should be passed through the ferrite core delivered with the power supply – according to the Fig. 6.

Connecting battery bank

Power supply units are designed to cooperate with VRLA-AGM battery banks.

Note: Because the power supply unit is not equipped with a battery bank circuit breaker, appropriate circuit breakers, separate for each of the battery banks, should be installed near each positive terminal of each battery.

Connection of a battery set should be made using wires with the cross-section of 16 mm^2 for terminals located in the back panel of the power supply unit, marked as **BAT** taking a proper care to provide them with a proper polarity. A reverse connection of a battery bank may result in severe fault to the power supply unit itself, as well as in connected, external devices.

Positive terminal poles, marked with numbers, enable distinguishing of battery banks as each of them is supervised separately. Negative poles are short-circuited together.

Note: The maximum resistance of the battery circuit cabling and fuse should not access 3mΩ.

The **M** outputs of the voltage compensation circuit should be connected with the center of the appropriate battery string by means of the cables of the cross section of 0.75mm2. The connection must be protected near the battery with its own fuse of 0.5 ... 2AF.

Connecting external fault indication system

The power supply is equipped with two inputs for connecting external fault indication systems, the sockets of which are located in the back panel. Corresponding plugs are supplied with the power supply unit. One of the plugs has a factory pre-installed jumper and it has to be placed in the alarm socket **EXT. FAULT 1**, even if this input is not used, since it is activated when its contacts become disconnected.

The second input **EXT. FAULT 2** is activated by short-circuiting its terminals.

External fault indication systems should be connected using the YnTKSY 1x2x0.8 type cables (the cross-section of 0.8 mm^2).

Output of remote indication

Outputs of remote relay indication are implemented as 3-pin sockets. The power supply unit is supplied with 2-pin plugs. You can use the normally connected (NC) or normally open (NO) contacts of the internal indication relays by placing them in the appropriate socket. Remote indication circuits should be connected by using the YnTKSY 1x2x0.8 type cables (of the cross-section of 0.8 mm^2).

Temperature sensor connection

The external temperature sensor supplied with the power supply unit should be connected to the appropriate socket (**Temp sensor**). The sensor should be placed in a direct proximity of the battery bank, **if possible, between the walls of two adjacent batteries.**

4. First Start

4.1. The initial information

The first start of the VAS system including the ZDSO400-DR2 or ZDSO400-DR4 and connected batteries should be done by the qualified service personnel of the Manufacturer or the authorized trained personnel.

The tests during the first start of the system are necessary to ensure the operation safety and reliability of the system operation – both from the mains and from the backup battery power.

Hence, the detailed description of the starting activities is not included in the User Manual.

At the first start you should check the system completeness and all VAS modules for their compliance with the electrical specifications of the object in which the system is to operate. The check should also include the correctness of connections as well as the battery connected and the indication circuits.

Remarks:
1. The values of the battery circuits' resistance ensuring the correct VAS system operation depend on two factors:
   a) battery capacity
   b) current during the fire alarm

2. The factory preset parameters of the battery circuits' resistance can be changed during the first start. Please, contact the Manufacturer to receive the computer software necessary for the purpose.

The power supply, at the start (after the earlier turning off), stores in its memory information on to which inputs the batteries have been connected. The check is carried out by automatic measurement of the resistance of each individual battery circuit. It is assumed the battery is connected if the measured resistance is lower than 2Ω. The resistance measurements of the battery circuits are conducted periodically and on such the basis the battery configuration change can be detected. The detected change is indicated by fault indication and corresponding error code. The configuration change can be accepted in the software or by the next start of the device.

If the power supply is started without the batteries connected, it will indicate the configuration fault for each of them. In this state, the outputs of the uninterruptible power supply for the amplifiers are not connected and the only output connected is the additional output for the VAS controller. In such the case, you need to connect a battery (one or several ones) and cancel the fault indication to have the configuration accepted by the device and start the normal operation.

At the start, the device restores the recently saved operation parameters. The change of these parameters is possible in the computer software through the USB or the Ethernet connection (if available) after connection to a computer network by means of any internet browser.

After the successful start of the system, please, perform the following tests of the devices' operation described below.

4.2. Maximum resistance of the battery bank circuit

As far as the indication of the impermissible increase of the battery bank circuits resistance is concerned, we can differentiate two types of resistance:

- initial resistance corresponding to the battery circuit resistance (including the battery itself) after making the connections (cables, terminals and fuses)
- permissible battery circuit resistance increase (e.g. due to aging process); its exceeding will trigger the fault circuit indication.

The sum of the initial resistance and the permissible battery circuit resistance increase is indicated in the power supply certificate and it cannot be higher than 50mΩ.

The resistance values have been listed in the table below.

resistance value / resistance categories	minimum value mΩ	default value mΩ	maximum value mΩ
Typical initial resistances	5	10	25
Permissible resistance increase	5	15	25
Total resistance	10	25	50

If the preset settings have not been changed during mounting the power supply, the default settings are valid.

The battery connections should be made in such the way to not to exceed the value indicated in the point 3.3. The initial resistance value set should not exceed the sum of the resistance of these connections and the resistance of the battery used. On the other hand, to prevent the appearance of unwanted fault indications, the permissible increase of the resistance should be set to the highest possible value.

Setting of suitable resistance values specific for a system is not easy due to the fact that the battery capacity (and consequently the battery resistance) depends on the required VAS system monitoring time and the current consumption at the moment. The permissible resistance increase depends on the VAS system current consumption during alarming. Please, contact the Manufacturer for making specific calculations including all power system parameters.

4.3. Checking the ability to maintain the output voltage

Please, disconnect the mains. The power supply should start operating in the battery operation mode supplying voltage on its all outputs for powering the VAS modules. The voltage presence and its value should be checked by means of a voltmeter.

In this state, the **MAINS** LED on the front panel of the ZDSO400-DR2 or ZDSO400-DR4 should be off and the **FLT** LED should be on.

The both relays of **MAINS FLT** and **GENERAL FLT** should come into the idle mode (the terminals' position should be according to the figure near the connector). The state of the relays can be checked by means of an ohmmeter connected between their appropriate terminals.

During the check, the connected VAS modules should function normally.

4.4. Checking the indication of high resistance of the battery circuits

When ZDSO400-DR2 or ZDSO400-DR4 powered from the mains, you should break the circuits of each of the battery strings one after another – by means of the respective breaker.

This is the simulation of an extreme growth of resistance of the battery circuit. The state should be detected during the next test. It can last from 5 do 100s, typically 30s (the default value of the measuring period). Similarly, after cancelling the break, the generated alarm will be cancelled automatically but after the next successful test – after the analogical period of time.

The state should be indicated by the ZDSO400-DR2 or ZDSO400-DR4 power supply by the **FLT** LED on and positioning of the relays of **BATTERY FLT** and **GENERAL FLT** in the idle mode (the relay position according to the figure close to the connector).

During the above test, the connected VAS modules should operate normally.

5. Operation

5.1. General information

Output voltages and signalling thresholds are preset as factory default values. Power supplies after installing require supervision by the service team as some emergency states may occur during the operation of the device.

NOTE: The power supply, in the battery backup system, should be given to periodical tests according to notices included in the User Manual of the system.

5.2. Operation safety

The power supply unit is a Class I device according to the standard EN 60950-1:2007/A1:2011 (IEC950), designed for connecting to a permanent, one-phase installation using an earthing cable, according to the HD 60364-4-41:2007 Standard *Electric installations at construction sites.*

The metal case of the power supply units is connected to a protective terminal (PE). The circuits used for connecting the battery, remote indication outputs and remote indication inputs are separated from power supply circuits and from the case.

Contacts of remote indication relays are completely separated from all other circuits (including output circuits).

Inputs of external fault indications are located on the potential of negative bus of the battery bank.

The interference filters used in the ZDSO400-DR2 and 3mA in ZDSO400-DR4 power supplies are equipped with the Y class capacitors causing the appearance of the leakage current in the protective conductor of maximum 1.5 mA.

5.3. Digital display

Power supply units allow for digital measurements of basic operation parameters of the system: current voltage of the supervised battery bank (**U**), its charging or discharging current (I_B), current consumed by the VAS controllers from the 24V power supply (I_A) and of the ambient temperature (**T**), if the temperature sensor has been connected. The current measurement type (selected by using the vertical arrow button) is distinguished by switching on a LED diode with the corresponding marking. In addition, one can read the error code detected by the power supply unit controller (all diodes indicating measurement type are switched off). This position is active only then, when an operation error has been detected in the system and the fault indication has been activated. A list of particular errors (many errors can be caused by a particular type of fault) is performed by using the vertical arrow button.

The long press of the arrow button allows basic operation parameters of the system to be measured, starting with **U**.

5.4. Digital communication

The front panel of the power supply unit is equipped with a **USB** communication socket used routinely for servicing. The servicing software allows for diagnostic works to be performed, enabling to check numerous operation parameters of the power supply and to modify its default settings. This output is galvanically insulated from all other circuits of the power supply unit.

Optionally, the power supply unit may be equipped with an Ethernet interface, enabling operation within a TCP/IP network. It has two simple service servers implemented:

- a http server for presentation of the current system state as web pages available for browsing using a web browser;
- ModbusTCP protocol server enabling device controlling and supervision.

Detailed information can be obtained from the manufacturer.

5.5. Operation state signalling

The power supply is equipped with LED, sound and remote indication systems. The LED indication is used in order to bring attention of the personnel to the operation state of the device and to inform about the reason of a potential malfunction. The sound indication system is activated together with the lighting signalling.

Fault indication is maintained as active until it is deactivated using the vertical arrow button located in the display panel. Short press of the button switches the sound indication system off, while keeping the LED and remote indication systems active. The remaining indication systems can be deactivated by pressing and holding the vertical arrow button for over 5 seconds. However, the use of the key is effective only when the reason triggering the event generation is no longer present. The indication systems are reset automatically only when the network power supply is restored and external signals at the **EXT. FAULT 1** and **EXT. FAULT 2** inputs are no longer detected. In the case of the power failure, instead of a continuous sound signal, a short, intermittent signal is generated every 15 seconds.

The LED indication system comprises four LED diodes located in the front panel of the power supply. Three diodes represent the current operation mode (**MAINS** - green, **BATTERY** - yellow, **CHARGING** - green), and the fourth - fault (**FAULT** - yellow**)**.

The remote indication system includes three sockets denoted **MAINS FAULT**, **BATTERY FAULT** and **GENERAL FAULT**. Each of the sockets has three plugs, switched between by using relays, completely separated from all other circuits. During normal, correct operation of the power supply unit, relay coils are active. It means that Mains Fault (power failure) indication, Battery Fault and General Fault indications are executed by **switching** the appropriate relay **off** (current loss in the relay coil).

The contact setting in this state (so called zero-voltage state) has been presented next to each corresponding socket.

List of states of the LED and remote indication systems is presented in the tables below.

LED indication system in the front panel.

DESCRIPTION	COLOUR	STATE	EVENT DESCRIPTION
MAINS	green	on	Normal operation state at the mains present.
		off	No mains or rectifier fault.
BATTERY	yellow	on	Battery operation (no mains or rectifier fault).
		off	Normal operation state at the mains present.
CHARGING	green	pulsating	Bulk charging.
		on	Charging during floating mode (after the bulk charging has finished).
		off	Charging has finished.
FAULT	yellow	on	Fault occurred within the power supply unit or external fault. Please read the error code from the display in order to determine the reason.
		pulsating	External fault indication at **EXT. FAULT 1** or **EXT. FAULT 2** input. ***).**

) If it is sent together with the external fault indication an internal fault occurs, the LED diode **FAULT will be on continuously.*

LED indication system in the back panel.

DESCRIPTION	COLOUR	STATE	EVENT DESCRIPTION
From **Out 1** to **Out 12**	yellow	on	Fault of output circuit breaker.
		pulsating	Current is consumed from the particular output (the indication is activated only before the outputs are switched on).
		off	Output switched on.
AUX	yellow	on	Fault of circuit breaker of additional outputs
		off	Output switched on.

Relay indication system.

DESCRIPTION	STATE	EVENT DESCRIPTION
MAINS FAULT	on	Normal operation state at the mains present.
	off	No mains or rectifier fault.
BATTERY FAULT	on	Correct battery operation.
	off	High resistance of battery circuit or battery voltage below a preset level (battery discharged).
GENERAL FAULT	on	No fault.
	off	Fault within the power supply or external fault.

5.6. Maintenance

The device does not require any specific maintenance operations to be performed. During normal operation of the unit care should be taken to maintain clean and tidy area around the power supply unit.

6. Servicing

6.1. Circuit breakers

Fuse type circuit breakers are easily accessible for the service team. Their parameters have been specified in the table below.

Protected circuit in the power supply	Fuse type and value of ZDSO400-DR2	Fuse type and value ZDSO400-DR4
Amplifiers output circuits – accessible after cover has been dismounted (Fig. 6 - #2)	6 x 30AF (6,3x32mm)	12 x 30AF (6,3x32mm)
Additional output 24V circuit (Fig. 6 - #1)	1 x 6.3AF (6.3x32mm)	2 x 6.3AF (6.3x32mm)

<u>**Caution**</u>**: If fuse replacement requires the cover to be removed, it can be done only after disconnected the mains and from the battery bank**.

The VAS system personnel can exchange the above mentioned breakers only. If other circuit breakers used within the power supply unit are faulty, a repair performed by qualified service personnel is required.

Fig. 7. below presents location of the circuit breakers inside the power supplies
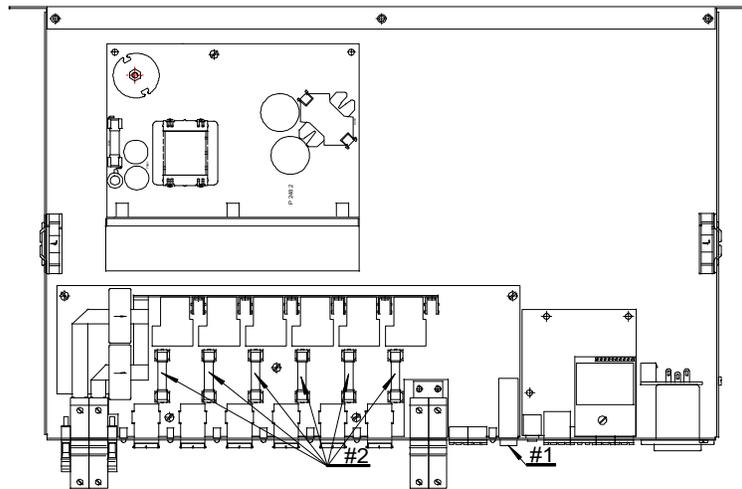
Fig. 7. Location of circuit breakers inside the power supply units

Note

The 2U height Fig. 8. power supply has two sets of sockets and fuses – the upper one and the lower one. To access the upper fuses set, the screws that fix the upper shield (A), should be unscrewed. In order to access the lower set of fuses, the screws (B) needs to be unscrewed and the upper set of fuses and sockets needs to be raised.
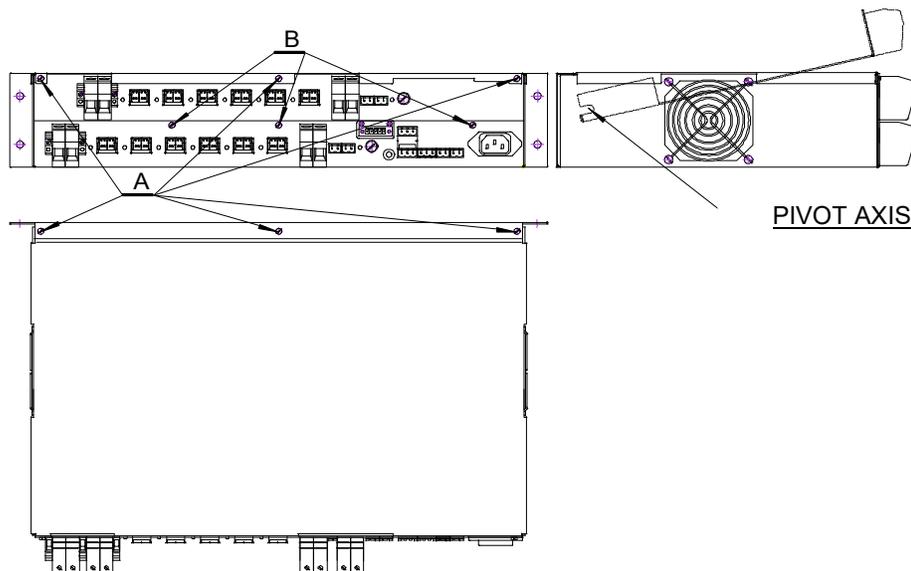

Fig.8. Access to the fuses in the 2U power supply version

6.2. Detecting faults and troubleshooting

Most cases of malfunctions which can occur during device operation is indicated and handled by the microprocessor installed in the device. The unit is equipped with 7 fuses (or 14 in the power supply of the 2U height), replacement of which may be undertaken by qualified service personnel. These are fuses of output circuits – amplifiers power supply and the VAS controller power supply or the smoke and heat control system devices.

Output fuses may be faulty as a result of short-circuit of device outputs. The VAS controller power output breakers are accessible directly on the rear panels of the power supplies. The VAS power output breakers replacement requires the access described in the point 5.1.

Warranty and after-warranty repairs are performed by service of the manufacturer or by an authorised service partner of the manufacturer.

7. Additional information

7.1. Remarks of the manufacturer

The manufacturer reserves the right to introduce construction and technology changes to the product, without diminishing its quality.

7.2. List of indicated error codes

Below, a list of codes accessible to the user is presented. It is possible to read the codes from the digital display. It is possible only then, when the system has detected a fault and the fault indication has been activated.

Codes denoted with the letter E indicate fault or error caused by an external factor. The letter P indicates an internal cause within the power supply.

Description	Code
Output(s) not disconnected	P01
Output(s) loaded	E02
Output(s) not connected	P03
Output circuit breaker(s) fault	E04
Network controller 1 circuit breaker fault	E05
Network controller 2 circuit breaker fault	E06
External fault 1 *)	E07
External fault 2 *)	E08
Package 1 rectifier fault	P09
Package 2 rectifier fault	P10
Power failure *)	E11
Battery loaded despite the mains present (overload)	E12
High battery voltage	E13
Low battery voltage	E14
Output disconnection voltage	E15
DC-DC converter fault	P16
Maximum bulk charging time exceeded	E17
Maximum bulk charging temperature exceeded	E18
Low battery temperature	E19
High battery temperature	E20
High device temperature (internal)	E21
Current detection at the outputs *OUT 1..12* despite the mains present	E22
	E23
Voltage regulation error	P24
Permissible resistance level for battery series 1 exceeded	E25
Permissible resistance level for battery series 2 exceeded	E26
Permissible resistance level for battery series 3 exceeded	E27
Permissible resistance level for battery series 4 exceeded	E28
Battery 1 configuration error **)	E29

Battery 2 configuration error **)	E30
Battery 3 configuration error **)	E31
Battery 4 configuration error **)	E32
No communication with the output package 1	P33
No communication with the output package 2	P34
Measurement/configuration error of the battery temperature sensor	E35
Internal temperature measurement error	P36
Battery 1 connector high current	E37
Battery 2 connector high current	E38
Battery 3 connector high current	E39
Battery 4 connector high current	E40
Battery 1 balancer system fault	P41
Battery 2 balancer system fault	P42
Battery 3 balancer system fault	P43
Battery 4 balancer system fault	P44
Battery 1 fault (or an improper balancer connection)	E45
Battery 2 fault (or an improper balancer connection)	E46
Battery 3 fault (or an improper balancer connection)	E47
Battery 4 fault (or an improper balancer connection)	E48

*) Fault without latched indication – disappears independently when the fault reason is ceased. Other faults require manual reset, which can be not efficient if the failure cause has not ceased.

**) Battery has been disconnected or connected during operation (after the system start-up)

7.3. Handling packagings and used products

Product packaging is made of non-hazardous materials (wood, paper, cardboard, plastics), which can be recycled. Packages which are no longer needed should be passed on to a waste collection station, after they had been sorted.

The used product is a non-hazardous waste which should not be disposed of in the general waste bin, but it has to be transferred to the local waste collection/recycling station accepting electric and electronic equipment.

Proper handling of used electric equipment contributes to avoiding harmful influences on people and environment resulting from improper warehouse storage and processing of such equipment.

KGS-1064-HP

Industrial Managed 10-Port L2 Gigabit Ethernet PoE+ Switches with 2 dual-speed SFP Slots

Product Highlights:

- Web, telnet, SNMP managed
- IPv6 support
- SFP dual speed support
- 8 PoE+ PSE ports
- RSTP, STP, MSTP support
- Multi redundant ring support
- IGMP & MLD snooping
- PoE PSE redundancy
- OPA function
- ALS function
- Typical industrial power DC12V-30V

KGS-1064-HP Ports

Key Features:
- Eight 10/100/1000Mbps RJ-45 and two dual-speed SFP slots
- All copper ports support auto-negotiation and auto-MDI/MDI-X detection
- All copper ports are equipped with 802.3at-compliant PoE PSE
- Two SFP slots support dual speed for 100BASE-FX and 1000BASE-X SFP transceivers
- Full wire speed forwarding
- Supports 802.3x flow control for full-duplex and backpressure for half-duplex
- Supports SFP with Digital Diagnostic Monitoring (DDM)
- Provides PoE PSE redundancy function
- Provides fiber optical power alarm function
- Provides Automatic Laser Shutdown function
- Powered via typical industrial power voltage DC 12V-30V

Management Features:
- Management:
  HTTP/HTTPS/SSHv2/CLI telnet/CLI console/SNMP v1/v2c/v3/RMON
  DHCP/DHCPv6 client, DNS client, NTPv4
  IPv6 support, System Syslog, Configuration down/upload, Software upload
  KTI's private MIB for DDM monitoring, Remote boot, TFTP firmware update via SNMP
- Security:
  NAS, 802.1X, MAC-based/Web/CLI authentication
  IP MAC binding, TACACS+, IP source guard
- Layer 2:
  QoS, 802.1Q/MAC-based/Protocol-based/Private/IP subnet VLAN, Port Isolation
  Storm control for UC/MC/BC packets
  Static MAC configuration
  IGMP v2/v3 snooping, MLD v1/v2 snooping, DHCP snooping
  Multiple Spanning Tree – MSTP, RSTP, STP
- KTI's Auto Multi-Ring (KAMR) Technology:
  Fast failover response time
  Auto recovery when failure is repaired
  Supports up to three redundant rings
  Works with RSTP network
  Supports ring member status monitoring for up to 100 units

160415

Specifications:

Standard	IEEE 802.3, 802.3ab, 802.3z, 802.3x, 802.3at, 802.1x, 802.1w, 802.1D, 802.1Q
Network Ports	8 10/100/1000Mbps Gigabit copper ports 2 1G/100Mbps SFP slots
Copper Port	Shielded RJ-45, 10/100/1000Mbps, auto-negotiation, auto-MDI/MDI-X support
Mini-GBIC SFP	SFP connector Interface: 1000BASE-X and 100BASE-FX support
Console	Connector: Shielded RJ-45 Interface: RS-232 with Galvanic isolation
Network Cables	10/100/1000Mbps copper: Cat.5 up to 100m 1000Base-X: 62.5/125µm, 50/125µm MM fiber, 9/125µm SM fiber
Power over Ethernet	IEEE 802.3at compliant (High power PoE) PSE PoE port output voltage 52V (±3%) 30W max. at port output for a Cat.5 distance of 100 meters 90W max. shared by all ports
MAC Addresses	Table with 8K entries
Buffer Memory	4Mbits
LED Indication	Per unit: Power, Management status Per port: Speed, link/activity/PoE status Per SFP: Speed/link/activity status
Relay Output	Alarm: power failure, specific port link fault Interface: 2 terminal contacts (30VDC/1A max. or 120VAC/0.5A max.)
DC Power Input	Flange terminal block: 2 pairs of +/- contacts Operating voltage range: +12 ~ +30VDC
Power Consumption	14W max.@24V (Full load with no PoE support) 113W max.@24V (with PoE function)
Housing	Enclosed metal with no fan
Dimension	60 x 106 x 140 mm (WxDxH)
Mounting Support	DIN-Rail, Panel Mounting (Optional)
Environment	Operating Temperature: -30ºC ~ 60ºC Storage Temperature: -40ºC ~ 85ºC Relative Humidity: 5% ~ 95% non-condensing
Approval	FCC Class A, VCCI Class A, CE mark Class A, EN60950-1 safety EN55022 emission, EN61000-3-2, EN61000-3-3, EN61000-6-2 Immunity for industrial environment, EN 50121-4 Railway environment IEC 60068-2-64 Vibration, IEC 60068-2-27 Shock 50G test

EMI EMS Safety Environmental Tests:

Test	Standard	Specifications
FCC/EMI	FCC Rule Part 15	Class A
CE/EMC/EMI	EN 61000-6-4	Class A
CE/EMC/EMS	EN 61000-6-2	
ESD Test	IEC 61000-4-2	Contact: +/-6KV
RS Test	IEC 61000-4-3	Strength: 20V/m
EFT/BURST	IEC 61000-4-4	DC IN: +/-2KV Signal: +/-2KV
Surge Immunity	IEC 61000-4-5	DC IN: +/-1KV Signal: +/-2KV
CS Test	IEC 61000-4-6	Level 3
Magnetic Field Imm.	IEC 61000-4-8	50/60Hz 300A/m
Safety	EN 60950-1	
Dielectric Voltage	IEEE 802.3	TP, 1500VAC/60sec.
Insulation Resistance	IEEE 802.3	TP, 500VDC/10Mohm
Cold Test	IEC 60068-2-1 Ad	-30˚C, 72hrs
Dry Heat Test	IEC 60068-2-2 Bd	+65˚C, 30%RH, 72hrs
Damp Heat Test	IEC 60068-2-3 Ca	+65˚C, 95%RH, 72hrs
Storage Test	IEC 60068-2-48	-40˚C, 96hrs +85˚C, 95%RH, 96hrs
Vibration Test	IEC 60068-2-64 Fh	10~200Hz, 0.1g^2/Hz 200~500Hz, 0.03g^2/Hz
Shock test	IEC 60068-2-27 Ea	50G
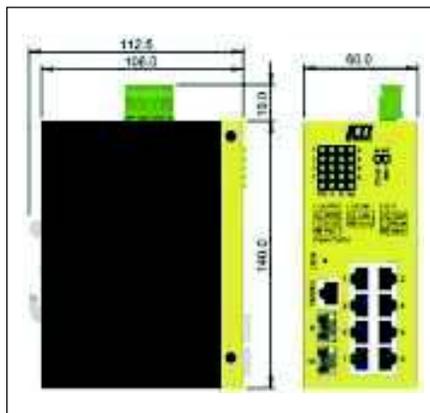
DIN-Rail Dimension   Panel Dimension

160415

SNR series (10A)

RoHS

DIN rail installation type

Terminal block type

DIN rail installation type and Terminal block type are option

Features of SNR series (10A)

Ripple noise attenuation type for switch mode power supplies(DC)

・50 VDC

・Best filter for switch mode power supplies of analog circuits

Specifications

No.	Items	SNR-10-223
		Interface:Connector
1	Rated Voltage DC[V]	50
2	Rated Current DC[A] ＊1	10 (Peak 20)
3	Test Voltage (Terminal-Mounting Plate)	500 VAC (Cutoff Current = 100mA), 1minute at room temperature and humidity
4	Isolation Resistance (Terminal-Mounting Plate)	500 VDC 50MΩ min at room temperature and humidity
5	D.C Resistance[mΩ]	20 max
6	Operating temperature	-40 to +71℃ (Refer to Derating Curve)
7	Operating humidity	20 to 95%RH (Non condensing)
8	Storage temperature/humidity	-40 to +75℃/20 to 95%RH (Non condensing)
9	Vibration	10 to 55Hz, 19.6m/s² (2G), 3min. Period, 1hour each X, Y and Z axis
10	Impact	196.1m/s² (20G), 11ms Once each X, Y and Z axis
11	Safety agency approvals	UL60950-1, C-UL (CSA60950-1), EN60950-1
12	Case size (without projection) /Weight	52×35×117 mm [2.05×1.38×4.61 inches] (W×H×D) /140g max (Option : -D, -T, -DT refer to external view)

＊1 Peak current for 10 sec. And Duty 35% max, refer to Instruction Manual 5. In detail.

Circuit Diagram

IN +Vin CY +Vout OUT
    -Vin CY + Co -Vout
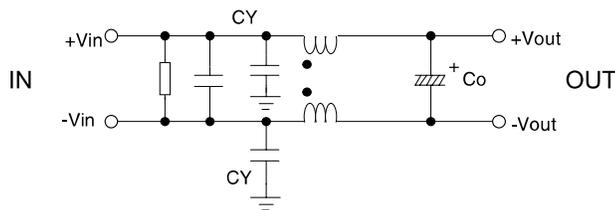
CY : Line to ground capacitor   Co : Electrolytic capacitor   ⏚ : Mounting Plate

■Expected life : 10 years

Derating Curve

Load Factor [%] vs Ambient Temperature [℃]
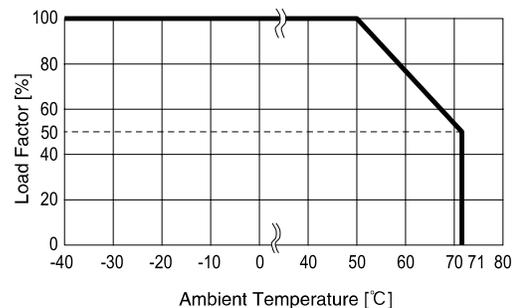
External view

Standard Type
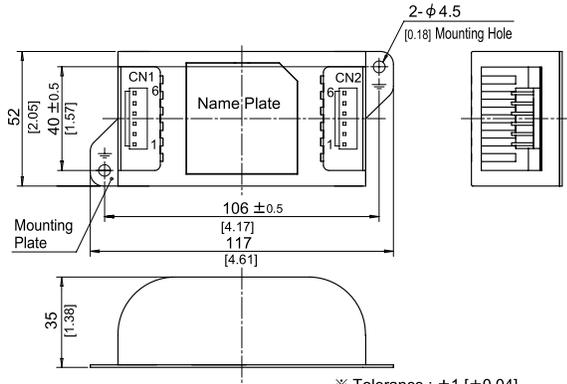
2-φ4.5
[0.18] Mounting Hole

CN1
6
Name Plate
CN2
6
1
1

52 [2.05]
40±0.5 [1.57]

106±0.5 [4.17]
117 [4.61]

35 [1.38]

Mounting Plate

CN1		CN2	
Pin No.	Function	Pin No.	Function
1,2,3	-Vin	1,2,3	-Vout
4,5,6	+Vin	4,5,6	+Vout

I/O Connector		Mating connector	Terminal
CN1,CN2	B6P-VH	VHR-6N	Reel:SVH-21T-P1.1
			Bulk:BVH-21T-P1.1

(Mfr:J.S.T)

Option harness : Refer to Instruction Manual 4

※ Tolerance : ±1 [±0.04]
※ Weight : 140g max
※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
※ Mounting plate : Iron (surface finishing : nickel plating) t=1.0 [0.04]
※ Case : PBT
※ Dimensions in mm, [ ]=inches
※ Keeping drawing current per pin below 5A (7A at peak current)
   for CN1 to CN2

Terminal block Type

8-M3

TB1   TB2
2-φ4.5
[0.18] Mounting Hole

+Vout
-Vout

+Vin
-Vin

Name Plate

52 [2.05]
40±0.5 [1.57]

6.2 [0.24]
7.6 [0.3]

106±0.5 [4.17]
117 [4.61]

35 [1.38]

Mounting Plate

Terminal cover
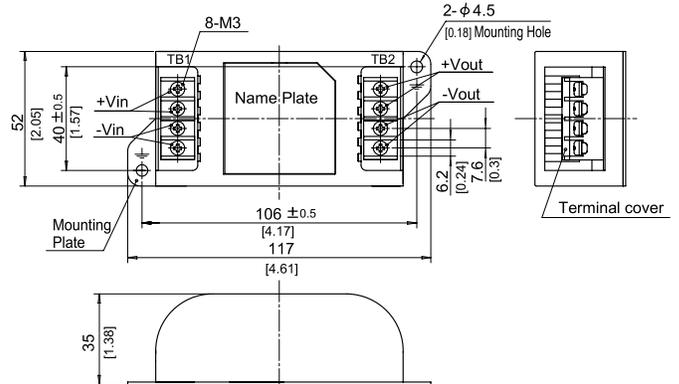
※ Tolerance : ±1 [±0.04]
※ Weight : 150g max
※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
※ Mounting plate : Iron (surface finishing : nickel plating) t=1.0 [0.04]
※ Case : PBT
※ Dimensions in mm, [ ]=inches
※ Terminal block screw tightening torque M3:0.8N・m (8.5kgf・cm) max
※ Keeping drawing current per pin below 8A (10A at peak current) for TB1 to TB2

DIN rail installation Type

IN
CN1
6
Name Plate
CN2
6
1
1
OUT

52 [2.05]

10 [0.39]

M4
FG

108.5 [4.27]
112 [4.41]

Mounting Plate

35 [1.38]
8 [0.31]
(9) [0.35]

DIN rail

CN1		CN2	
Pin No.	Function	Pin No.	Function
1,2,3	-Vin	1,2,3	-Vout
4,5,6	+Vin	4,5,6	+Vout

I/O Connector		Mating connector	Terminal
CN1,CN2	B6P-VH	VHR-6N	Reel:SVH-21T-P1.1
			Bulk:BVH-21T-P1.1

(Mfr:J.S.T)

Option harness : Refer to Instruction Manual 4

※ Tolerance : ±1 [±0.04]
※ Weight : 150g max
※ PCB Material /thickness : CEM3 / 1.6mm [0.06 inches]
※ Mounting plate : Iron (surface finishing : nickel plating) t=1.0 [0.04]
※ Case : PBT
※ Dimensions in mm, [ ]=inches
※ Keeping drawing current per pin below 5A (7A at peak current)
   for CN1 to CN2

Terminal block type+DIN rail installation Type

8-M3

IN
TB1   TB2
+Vout
-Vout

+Vin
-Vin

Name Plate

OUT

52 [2.05]

10 [0.39]

M4
FG

108.5 [4.27]
112 [4.41]

Mounting Plate

6.2 [0.24]
7.6 [0.3]

35 [1.38]
8 [0.31]
(9) [0.35]

DIN rail

Terminal cover

※ Tolerance : ±1 [±0.04]
※ Weight : 160g max
※ PCB Material /thickness : CEM3 /1.6mm [0.06 inches]
※ Mounting plate : Iron (surface finishing : nickel plating) t=1.0 [0.04]
※ Case : PBT
※ Dimensions in mm, [ ]=inches
※ Terminal block screw tightening torque M3:0.8N・m (8.5kgf・cm) max
※ Keeping drawing current per pin below 8A (10A at peak current) for TB1 to TB2

■Note when installing the EMI/EMC Filter on a DIN rail.

When the EMI/EMC Filter is grounded through the DIN rail, the proper noise attenuation may not be achieved.
Be sure to connect the FG terminal of the EMI/EMC Filter body to the earth.

IN
CN1
6
1

Name Plate

DIN rail

CN2
6
1
OUT

⚛TDK
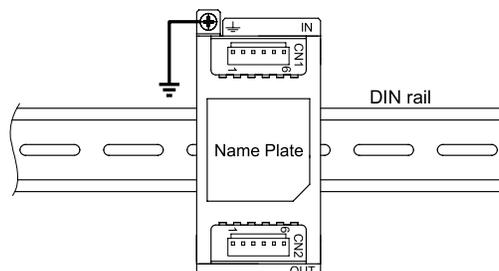
# Clamp Filters
For Cable

Conformity to RoHS Directive

ZCAT Series

FEATURES
• Unique plastic case ensures simple, convenient installation and includes a self-holding mechanism to prevent slippage on cables.
• Ferrite core provides excellent absorption of high-frequency EMC.
• Highly effective as countermeasure against common mode EMC without adverse effect on signal quality.
• Large core size prevents saturation during large signal surges.

INTERNAL CONSTRUCTION

Ferrite core

Plastic case
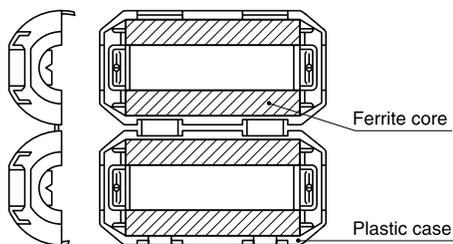
APPLICATIONS
Personal computers, word processors, monitors, hard disk drives, digital telephones, audio devices, electronic musical instruments, video games, copiers and facsimiles.

PRODUCT IDENTIFICATION

ZCAT	24	36	–	13	30	A	–	BK
(1)	(2)	(3)		(4)	(5)	(6)		(7)

(1) Series name
(2) Outer dimensions(mm)
(3) Length(mm)
(4) Inner dimensions(mm)
(5) Material code
(6) Fixed type code
   A: Cable fixed
     Hold the cable to secure it with the main body
   AP:Cable fixed
     (with lock mechanism)
   B: Clamp fixed
   C: Cable coil securing type
     (Coil the cable one time within the case to fix it/with lock mechanism.)
   D: Flat cable type
   DT: Flat cable type (Hold with adhesive pad.)
   Non code: Band fixed
     (Secure the cable and main body with the nylon belt.)
(7) Outer color code
   BK: Black
   Non code: Gray

ZCAT-C TYPE

PACKAGING STYLE AND QUANTITIES

Part No.	Quantity
ZCAT3035	200 pieces/box
ZCAT2017-B	350 pieces/box
ZCAT2235	400 pieces/box
ZCAT2436	400 pieces/box
ZCAT2032	420 pieces/box
ZCAT2035	480 pieces/box
ZCAT2132	480 pieces/box
ZCAT2749	400 pieces/box
ZCAT1730	840 pieces/box
ZCAT2017	640 pieces/box
ZCAT1325	1344 pieces/box
ZCAT1518	896 pieces/box
ZCAT1525	900 pieces/box
ZCAT3618-D	480 pieces/box
ZCAT4625-D	240 pieces/box
ZCAT6819-D	160 pieces/box

• Conformity to RoHS Directive: This means that, in conformity with EU Directive 2002/95/EC, lead, cadmium, mercury, hexavalent chromium, and specific bromine-based flame retardants, PBB and PBDE, have not been used, except for exempted applications.
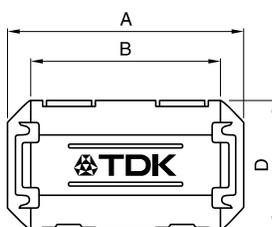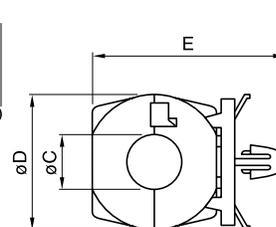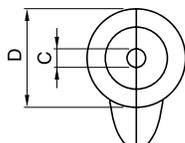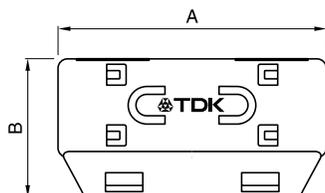
SHAPES AND DIMENSIONS

ZCAT TYPE
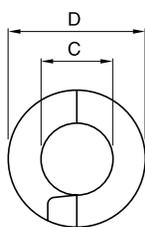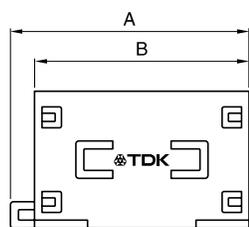
ZCAT-A, ZCAT-AP TYPE
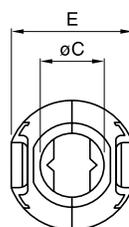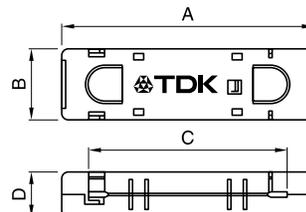
ZCAT-B TYPE
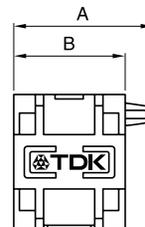
ZCAT-C TYPE

ZCAT-D TYPE

Applicable cable thickness: 1.3mm max.

Dimensions in mm

| Part No.	A	B	øC	øD	E	Applicable cable outer dia.	Weight(g)	Impedance freq. characteristics Fig.
ZCAT1518-0730(BK)[1]	22±1	18±1	7±1	15±1	–	7max.	6	1
ZCAT2017-0930(-BK)[1]	21±1	17±1	9±1	20±1	–	9max.	11	2
ZCAT2032-0930(-BK)[1]	36±1	32±1	9±1	19.5±1	–	9max.	22	3
ZCAT2132-1130(-BK)[1]	36±1	32±1	11±1	20.5±1	–	11max.	22	4
ZCAT3035-1330(-BK)[1]	39±1	34±1	13±1	30±1	–	13max.	63	5
ZCAT1525-0430AP(-BK)	25±1	20±1	4±1	15±1	11.5±1	2.5 to 4(USB)	7	4
ZCAT1325-0530A(-BK)	25±1	20±1	5±1	12.8±1	11.2±1	3 to 5(USB)	7	4
ZCAT1730-0730A(-BK)	30±1	23±1	7±1	16.5±1	15±1	4 to 7(USB/IEEE1394)	12	6
ZCAT2035-0930A(-BK)	35±1	28±1	9±1	19.5±1	17.4±1	6 to 9	22	3
ZCAT2235-1030A(-BK)	35±1	28±1	10±1	21.5±1	20±1	8 to 10	27	7
ZCAT2436-1330A(-BK)	36±1	29±1	13±1	23.5±1	22±1	10 to 13	29	8
ZCAT2017-0930B(-BK)	21±1	17±1	9±1	20±1	28.5±1	9max.	12	2
ZCAT2749-0430C(-BK)	49±1	27±1	4.5±1	19.5±1	–	4.5max.	26	9
ZCAT3618-2630D(-BK)	33.5±1	17.5±1	26±1	11.5±1	–	For 20 wires flat cable	15	10
ZCAT3618-2630DT(-BK)[2]	33.5±1	17.5±1	26±1	12.5±1	–	For 20 wires flat cable	15	10
ZCAT4625-3430D(-BK)	45.5±1	24.5±1	34±1	12±1	–	For 26 wires flat cable	32	11
ZCAT4625-3430DT(-BK)[2]	45.5±1	24.5±1	34±1	13±1	–	For 26 wires flat cable	32	11
ZCAT6819-5230D(-BK)	67.5±1	18.5±1	52±1	16±1	–	For 40 wires flat cable	58	11
ZCAT6819-5230DT(-BK)[2]	67.5±1	18.5±1	52±1	17±1	–	For 40 wires flat cable	58	11

[1] These products are delivered with fixed band.
[2] ZCAT-DT type: Adapted for flat cables and hold with adhesive pad.
• ZCAT-B type: Clamp fixed type installation hole diameter ø4.8 to 4.9mm, thickness of board 0.5 to 2mm.
• ZCAT-AP, ZCAT-C type: Once closed, the case will not be easily opened manually.

## STRUCTURE OF THE MOUNTING BAND
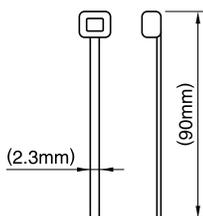
(2.3mm) (90mm) Material: 66-nylon(natural color)

• All specifications are subject to change without notice.

ELECTRICAL CHARACTERISTICS

Part No.	Impedance (Ω)min.[50 to 500MHz]
ZCAT1518-0730	35
ZCAT2017-0930	35
ZCAT2032-0930	80
ZCAT2132-1130	50
ZCAT3035-1330	100
ZCAT1525-0430AP	50
ZCAT1325-0530A	50
ZCAT1730-0730A	50
ZCAT2035-0930A	80
ZCAT2235-1030A	80
ZCAT2436-1330A	50
ZCAT2017-0930B	35
ZCAT2749-0430C	80
ZCAT3618-2603D(T)	30
ZCAT4625-3430D(T)	35
ZCAT6819-5230D(T)	35

• Test conditions: R-X meter at unloaded condition, ø1mm solder plated copper wire passes through.

TYPICAL EMC SUPPRESSION EFFECTS
RADIATION LEVEL vs. FREQUENCY CHARACTERISTICS

Without EMC filter

With EMC filter ZCAT2035-0930A
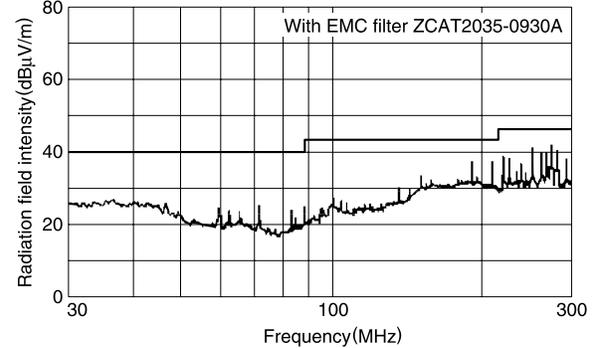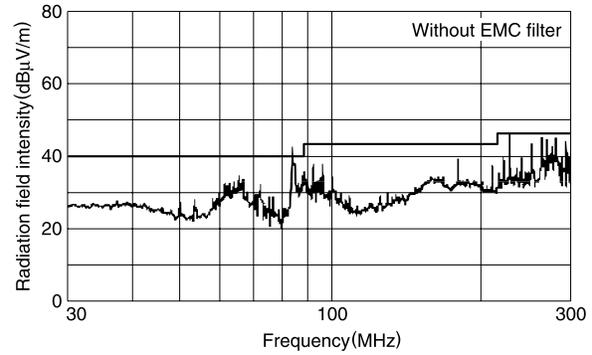
TYPICAL ELECTRICAL CHARACTERISTICS
IMPEDANCE vs. FREQUENCY CHARACTERISTICS

ZCAT1518-0730
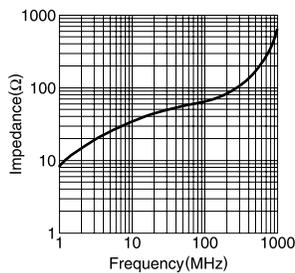
Fig.1

ZCAT2017-0930
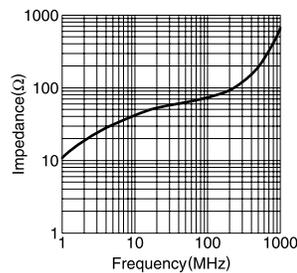
Fig.2

ZCAT2032-0930
ZCAT2035-0930A
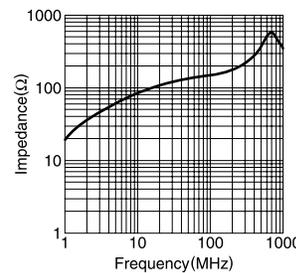
Fig.3

ZCAT1525-0430AP
ZCAT2132-1130
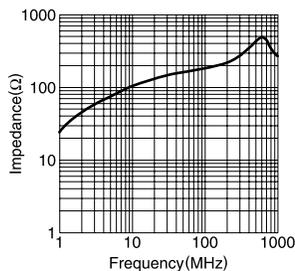**ZCAT1325-0530A**
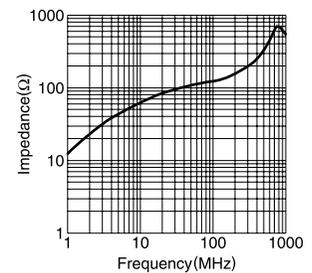
Fig.4

ZCAT3035-1330

Fig.5

ZCAT1730-0730A
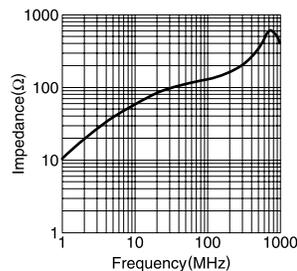
Fig.6

ZCAT2235-1030A
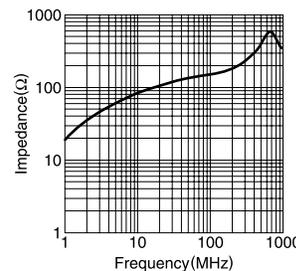

Fig.7

ZCAT2436-1330A
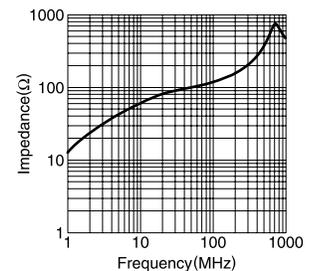

Fig.8

• All specifications are subject to change without notice.

TDK

TYPICAL ELECTRICAL CHARACTERISTICS
IMPEDANCE vs. FREQUENCY CHARACTERISTICS
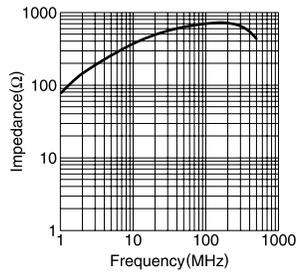
ZCAT2749-0430C   ZCAT3618-2630D   ZCAT4625-3430D
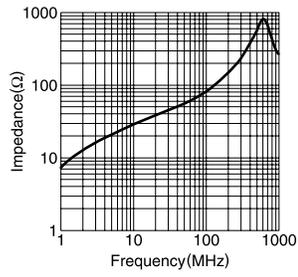   ZCAT6819-5230D

Fig.9   Fig.10   Fig.11