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Mass Notification

IPS-400/800 SERIES SIREN SYSTEM

Installation, Operating & Troubleshooting Manual

Form No.13596E (050911)

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Introduction

Introduction to the IPS

Information on the operation, installation and maintenance of the Whelen Engineering Company's In-Plant Personnel Warning System (IPS) is provided in this technical manual. The IPS-400 and the IPS-800 are essentially the same. The IPS-400 has a single 400 watt amplifier, while the IPS-800 has two. This means that the IPS-800 can drive 800 watts of audio power, versus 400 watts for the IPS-400. The IPS-800 also has more battery capacity than the IPS-400. In the majority of cases throughout this manual, all IPS models will be referred to as an IPS.

The IPS is a complex system, capable of generating six standard warning signals and Public Address (PA). The IPS can operate with various combinations of speakers. The IPS may be linked to a central control point or points *via* radio frequency (RF) or landline (telephone circuit, dry contact or dual tone multi frequency (DTMF) *via* twisted pair), permitting multiplexed control and status feedback.

A typical In-Plant System consists of a cabinet with a controller board, 1 or 2 Power Amplifiers, a Speaker Output Board, a Battery Charger and Batteries. In addition, a system may include some number of various types of speakers.

Section I: Installation

The installation instructions are presented as follows:

- **Site Selection**
- **Receiving/Unpacking the IPS**
- **Installation of the IPS Cabinet**
- **AC Wiring**
- **Radio or Landline Board**
- **Speaker Wiring**
- **Batteries**

These steps are discussed in detail in this section. Once the installation steps are complete, the IPS is ready for an operational checkout.

a) Site Selection

Selecting the site for an IPS requires careful planning to achieve optimal use, range, and effect of the system. Consider maintenance and future expansion when selecting a cabinet mounting location.

Typically, a two conductor, 18 AWG cable is run from the speaker cabinet to the speakers.

The cabinet has a large mounting tab centered on the top, rear vertical cabinet wall for wall mounting. For outdoor applications, drain holes need to be drilled into the upper compartment of the IPS. Consult Whelen Engineering Company, Inc. for advice on outdoor applications.

NOTE: **As part of the site selection planning process, the local utility company should be consulted with respect to installation of AC service. The location of the IPS site should be checked for the quality of the AC service and to ensure there will be no electromagnetic interference at the site. Also, AC power sources subject to excessive power surges or transients are not acceptable. A site should also be appraised for antenna placement and for radio reception for systems equipped with RF link interfaces.**

b) Receiving/Unpacking the IPS

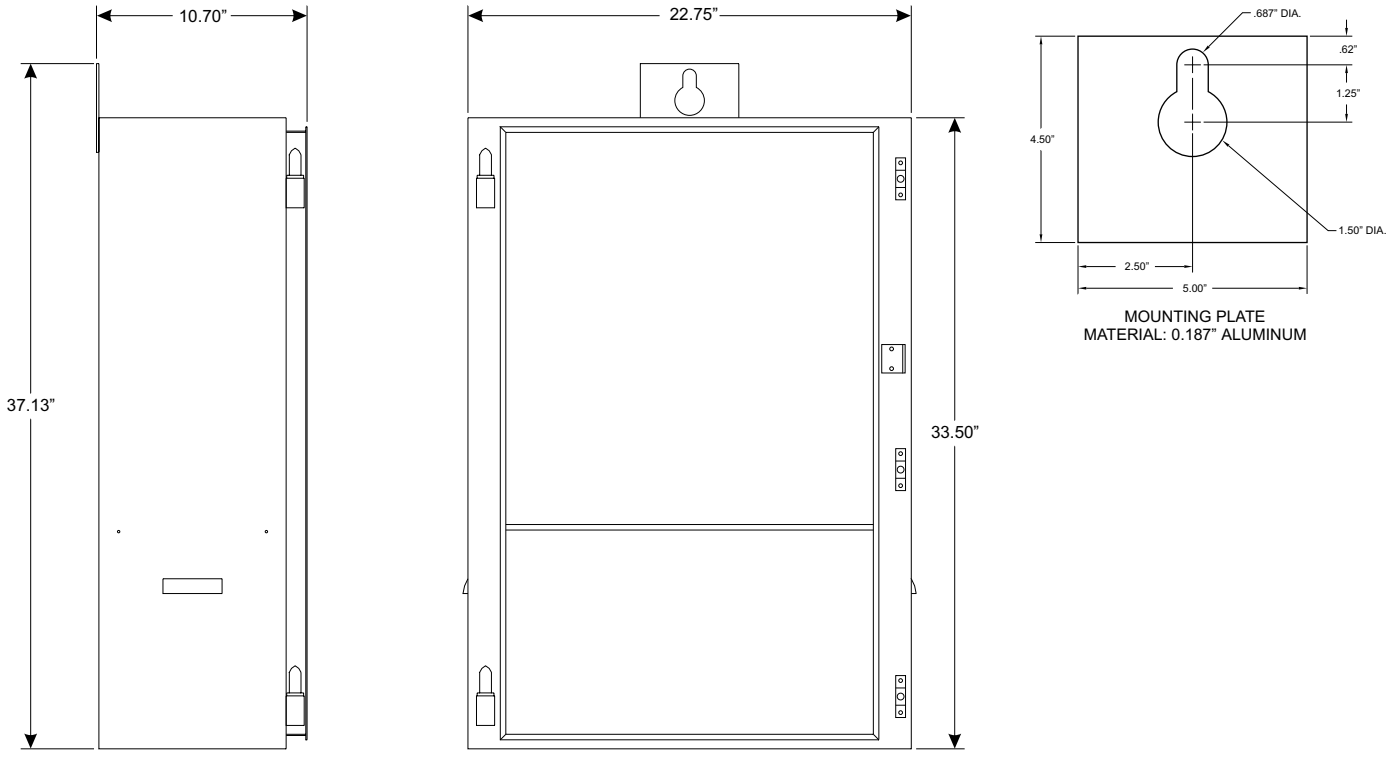
An IPS is typically shipped with the following items packed on a single shipping pallet: (a) two, 12 volt batteries and (b) the IPS cabinet with the appropriate electronics, as ordered. If a radio receiver/transceiver was ordered as part of the system, an antenna may be included on the pallet. For multiple-system purchases, pallets may be shipped carrying multiple IPS cabinets, for example, while other pallets may contain antennas and batteries. Speakers are commonly packaged together and sent simultaneously with the system. Before shipment, each IPS has been pre-assembled, wired, and tested at the factory. Each IPS is shipped in an upright fashion. The receiver of any shipment(s) should check each shipment against the purchase order to ensure that a complete system (as ordered) has been shipped.

c) Installation of the IPS Cabinet

The IPS cabinet is typically mounted to an inside wall of a building. The cabinet is equipped with a mounting plate located on the rear, cabinet top, as shown. Additionally, a second mounting hole has been pre-drilled through the rear cabinet wall of the battery compartment.

The IPS-400 and the IPS-800 are the same size, however, the IPS-400 weighs approximately 150 pounds and the IPS-800 weighs approximately 160 pounds. Make sure that both the mounting surface and the mounting hardware to be used are capable of supporting the weight of the IPS cabinet. Be sure to allow enough room to fully open the cabinet doors. Also, make sure there is room for conduit and wiring, typically on the left side of the cabinet.

Fig. 1: Type I Cabinet Dimensions



d) Installation of the Type I “C” Cabinet

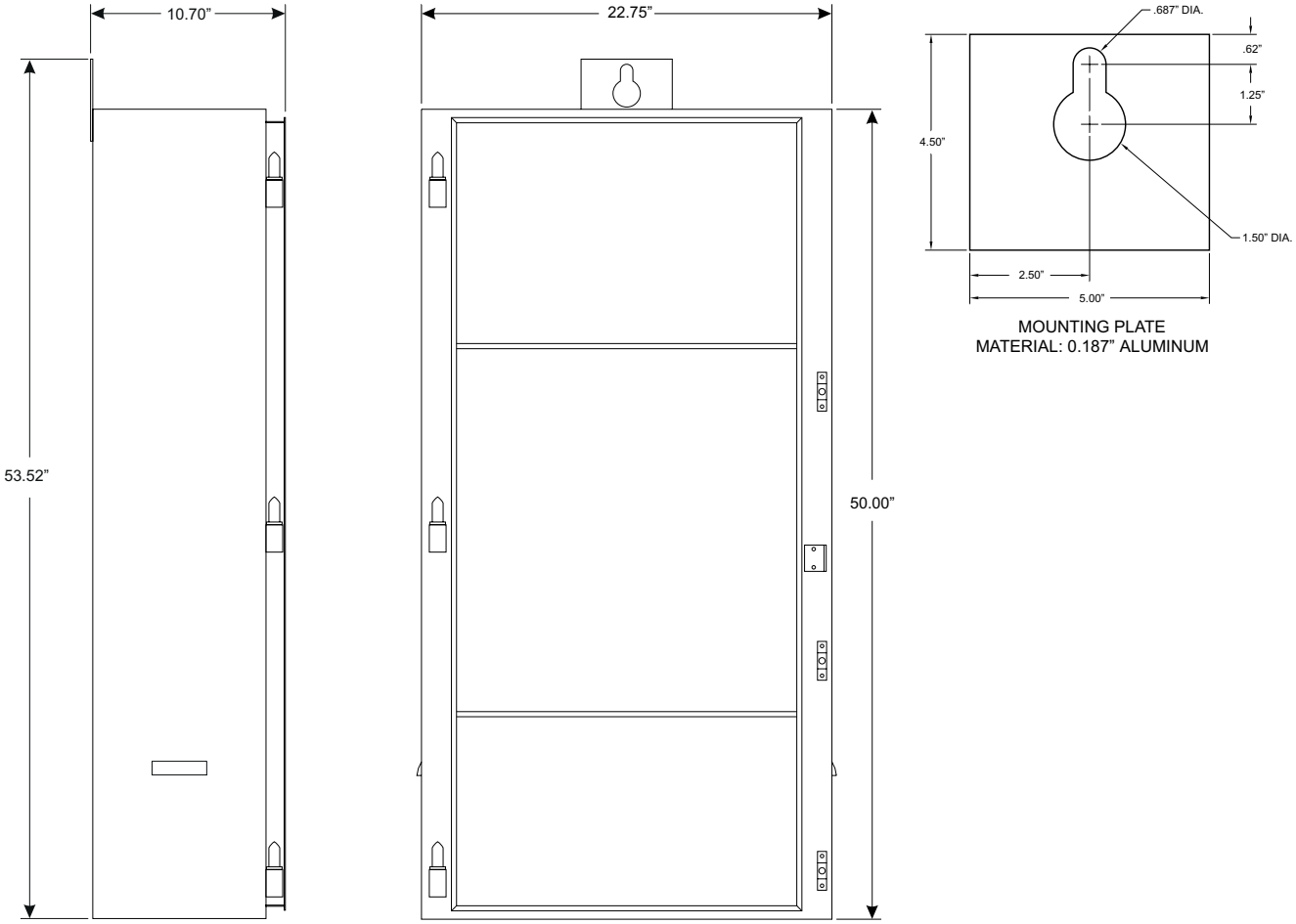
For Type I “C” cabinet installation only

The IPS cabinet is typically mounted to an inside wall of a building. The cabinet is equipped with a single mounting flange on the top, as shown in the drawing. This flange has two 7/16” holes and the bottom flanges have two 7/16” slots, in order to accommodate 3/8” hardware. The holes are on 14” centers.

The IPS-400 and the IPS-800 are the same size, however, with a Type I “C” cabinet the IPS-400 weighs approximately 150 pounds and the IPS-800 weighs approximately 190 pounds.

Be sure to allow enough room to fully open the cabinet doors. Also, make sure there is room for conduit and wiring, typically on the left side of the cabinet.

Fig. 2: Type I “C” Cabinet Dimensions



e) AC Wiring

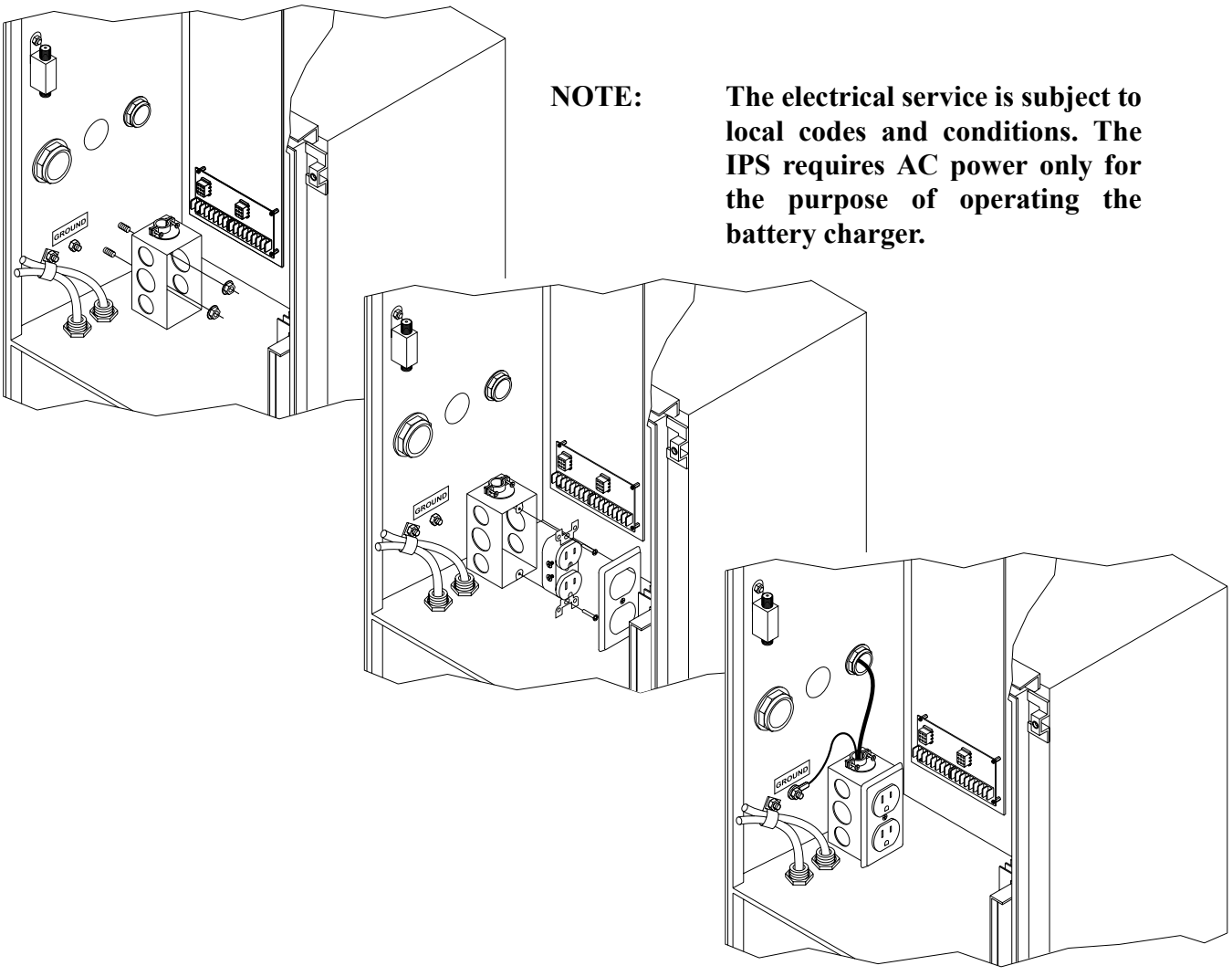
The IPS cabinet includes an AC duplex outlet, plate and housing that must be installed in the cabinet prior to wiring. There are two studs mounted on the left inner cabinet wall. Mount the AC housing onto the mounting studs. Secure the housing to the cabinet using the 10-24 wiz nuts included.

Route the AC service wire through the cable clamp on top of the box. Make the AC connections to the outlet, according to local electrical codes. Ground the outlet using the ground stud adjacent to the outlet housing.

Install a ground lug in the hole located in the bottom of the battery compartment. This hole can be found in the rear left section. Make a connection from this lug to earth ground using minimum of 4 AWG copper wire. An Aluminum-to-Copper (ALCO) connector must be used for ground connection to the cabinet. Always follow local codes.

Leave the battery charger unplugged.

Fig. 3: Cabinet View (AC Wiring)



NOTE: **The electrical service is subject to local codes and conditions. The IPS requires AC power only for the purpose of operating the battery charger.**

f) Radio Option

Locate the antenna so that it is clear of any obstructions. Ground the antenna bracket using a minimum of 4 AWG copper wire to a suitable earth ground.

If the unit is equipped with a transmitter, a coax protector has been provided. The protector is shipped pre-mounted in the electronics compartment and requires no installation other than connecting the antenna cables.

Loosely coil and secure any excessive antenna cable <u>inside</u> the cabinet. Be careful not to crimp the cable or create any sharp bends. After all of the radio connections are made, the antenna may be trimmed.

NOTE: When trimming the antenna, be sure to trim to the IPS cabinet transmit frequency. If the IPS is marked as having no transmit frequency, then the receive frequency may be used.

Fig. 4: Cabinet View (Antenna Wiring)

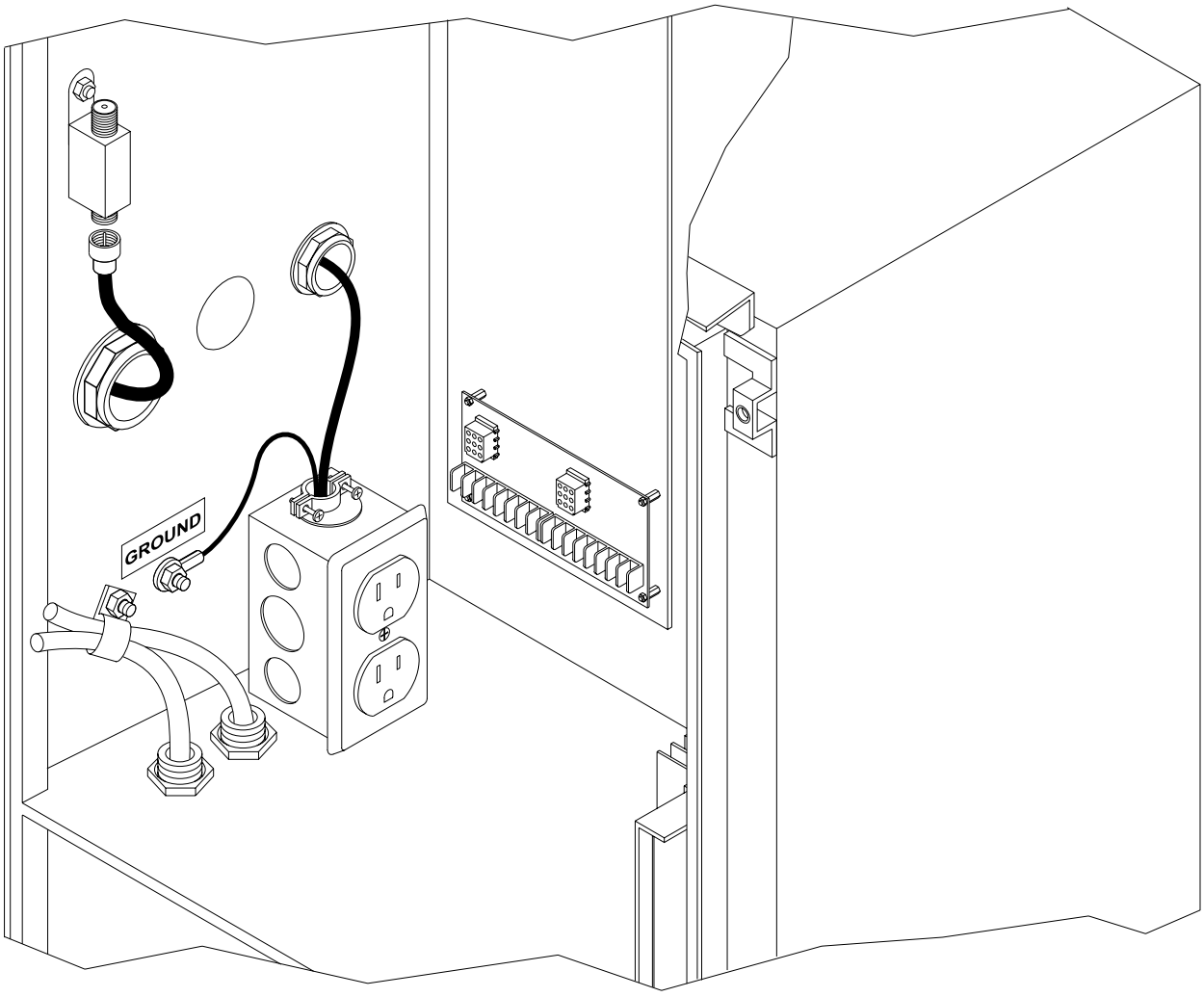
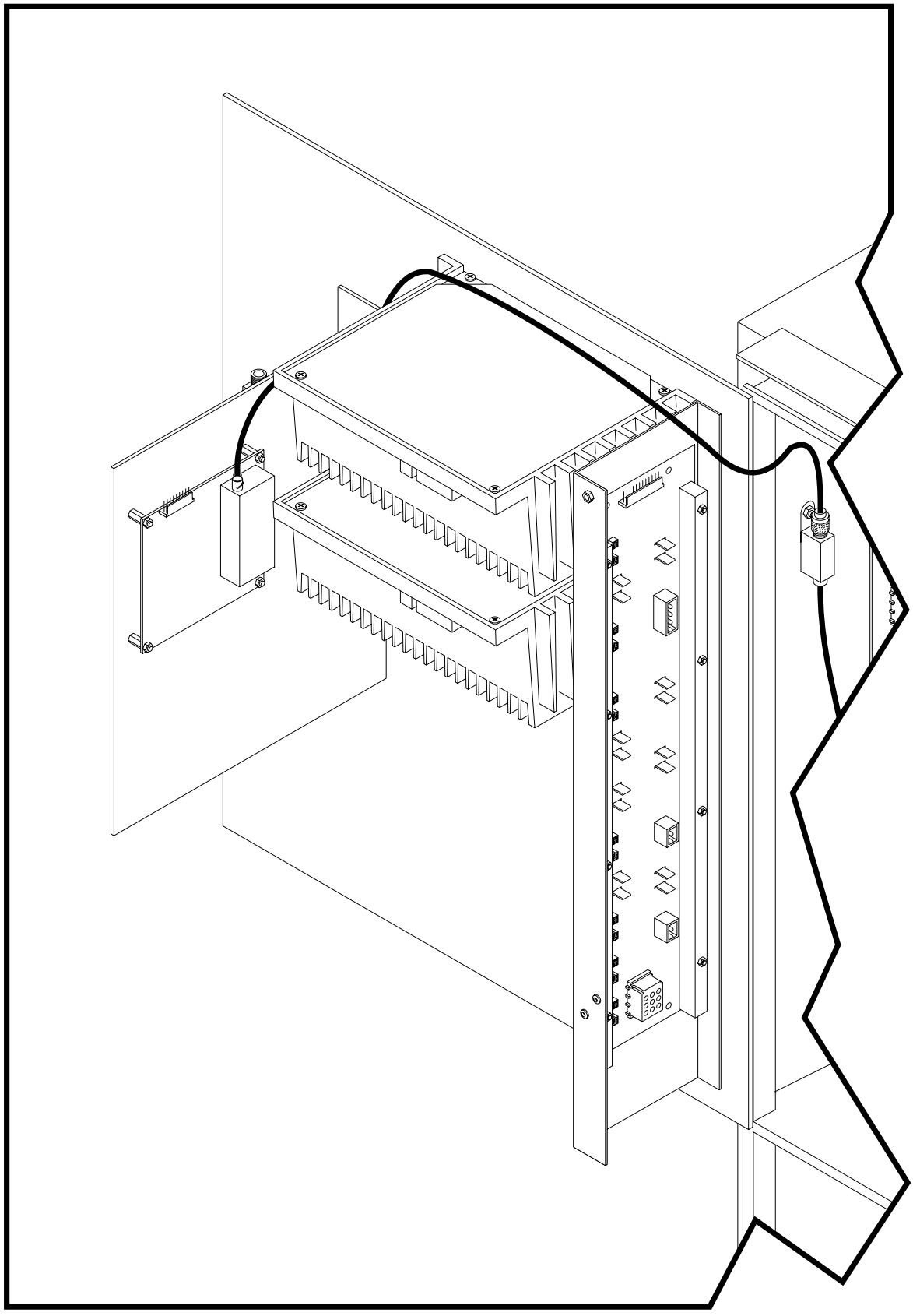


Fig. 5: Cabinet View (Radio Board)



g) Landline Option

As an option. the IPS may be remotely controlled by either landline or RF link. Either method communicates via a DTMF protocol. Remote control may be one-way or two-way. The one-way option simply controls the IPS, while the two-way option controls the IPS and reports IPS status back to an encoder located at a central control point (hereafter referred to as the "control center").

For landline systems with one-way communication, extend a pair of conditioned phone lines from your encoder to the landline board (refer to your encoder manual for information on connecting to the encoder). Connect these wires to positions 3 & 4 of the phoenix connector as shown below.

For landline systems with two-way communication, extend two pairs of conditioned phone lines from your encoder to the landline board (refer to your encoder manual for information on connecting to the encoder). Connect the "audio in" wires to positions 3 & 4 of the phoenix connector as shown below ("audio in" wires carry the signal from the encoder to the landline board). Connect the "audio out" wires to positions 7 & 8 of the phoenix connector as shown below ("audio out" wires carry the signal from the landline board to the encoder).

Fig. 6: Landline Board

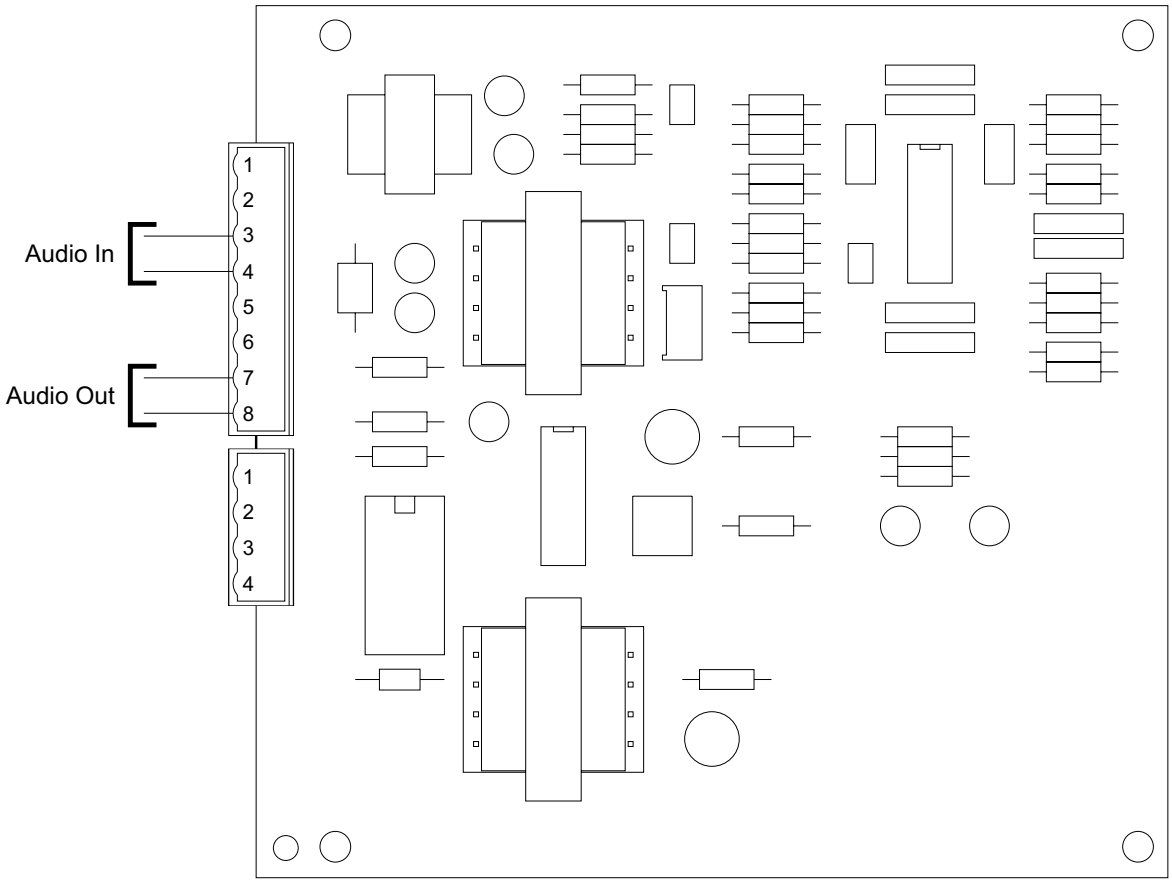
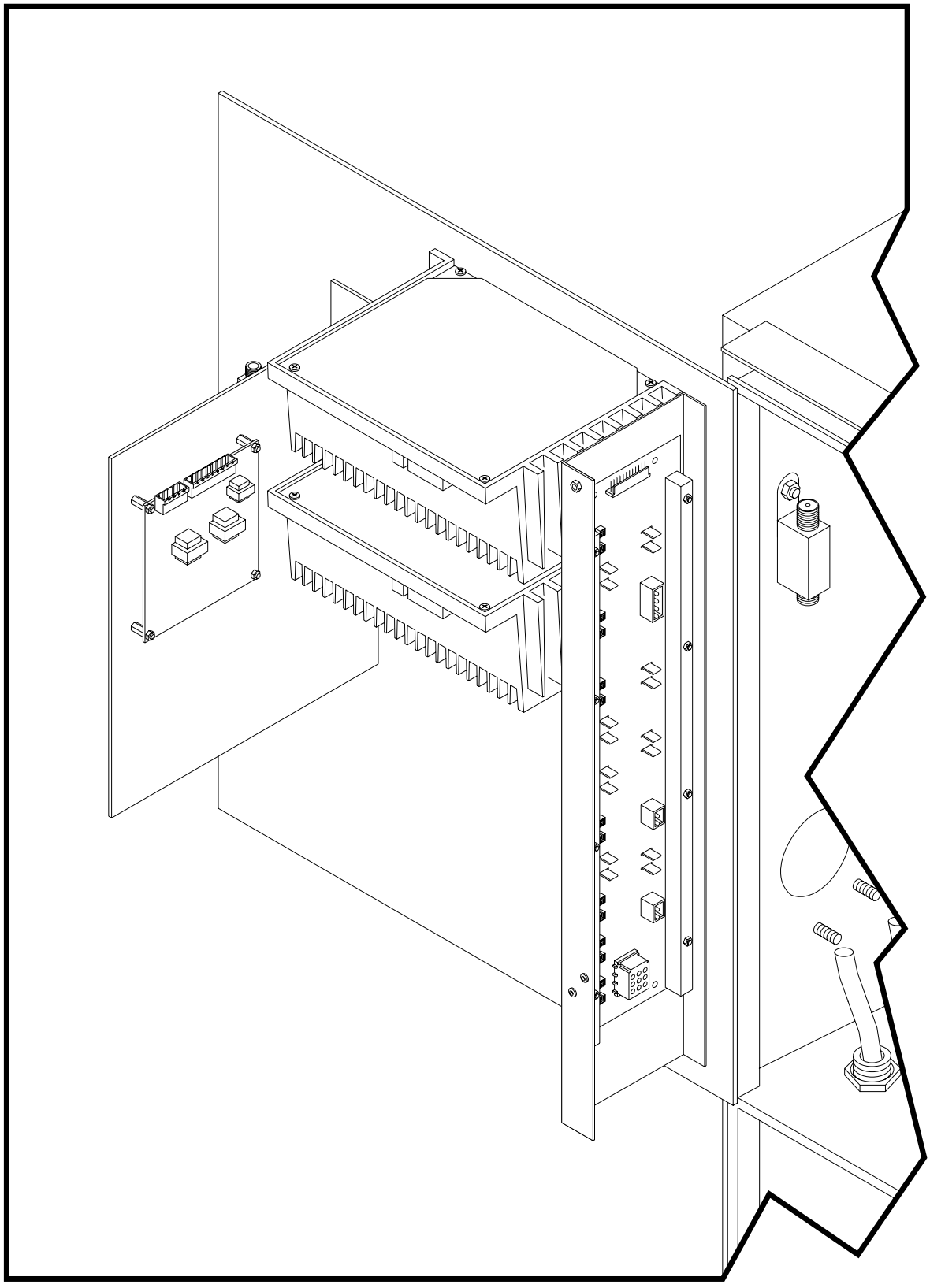


Fig. 7: Cabinet View (Landline Board)



h) Speaker Output Board

The speaker wires should enter the cabinet through the 1” (larger) knockout on the left cabinet wall. Dress the wires around to the Speaker Output Board on the left, inside cabinet wall (see Fig.12).

The speaker audio connections are made through the speaker output board. As shown below, the left terminal strip provides the audio connection points for the four outputs of the amplifier used in an IPS-400. The 8 terminals are arranged in pairs, a (-) and (+), for each of the four outputs beginning at the left with output 1 and progressing to the right to output 4. The second terminal strip is not used with the IPS-400.

If the system in question is an IPS-800, the first terminal strip connections are the same as in an IPS-400. However, the second terminal strip provides audio connection points for the 4 outputs of the second amplifier found in the IPS-800. This second terminal strip begins with output 5 and progresses to output 8.

Each output can drive up to 100 watts, therefore, speaker loads greater than 100 watts must be distributed across more than one output (see fig. 10 for example).

Fig. 8: Speaker Output Board

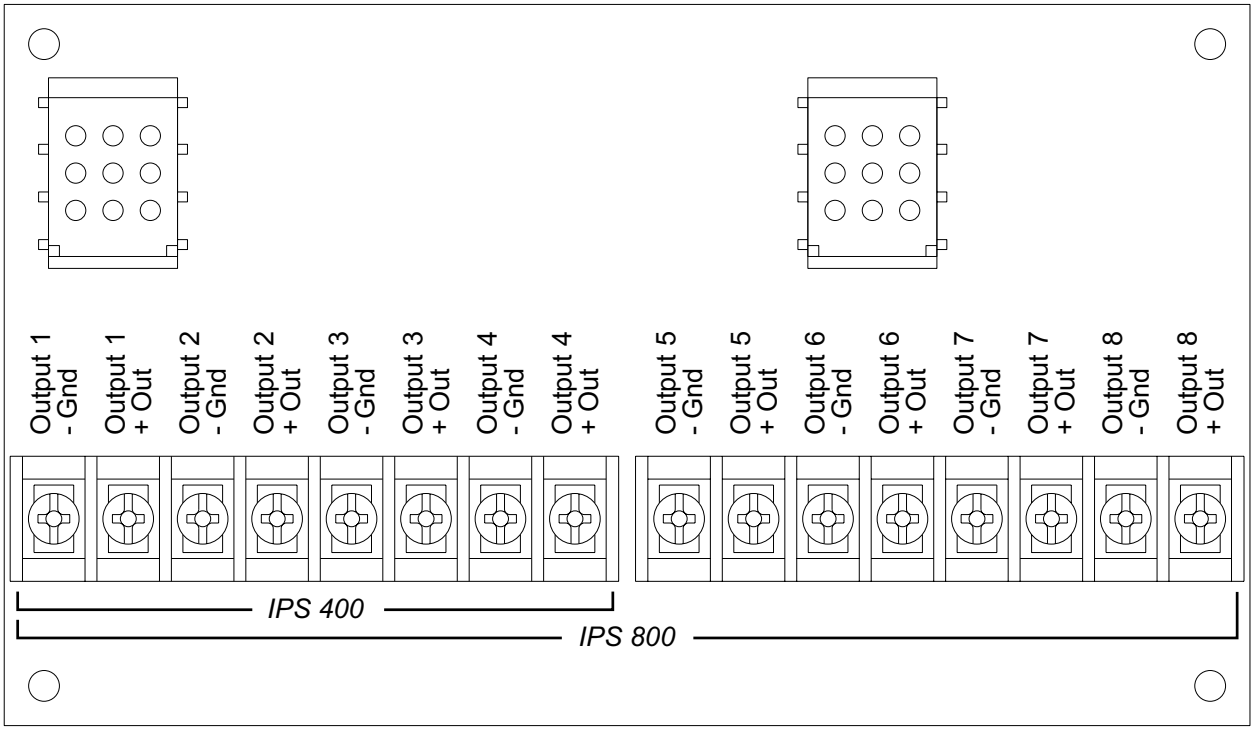
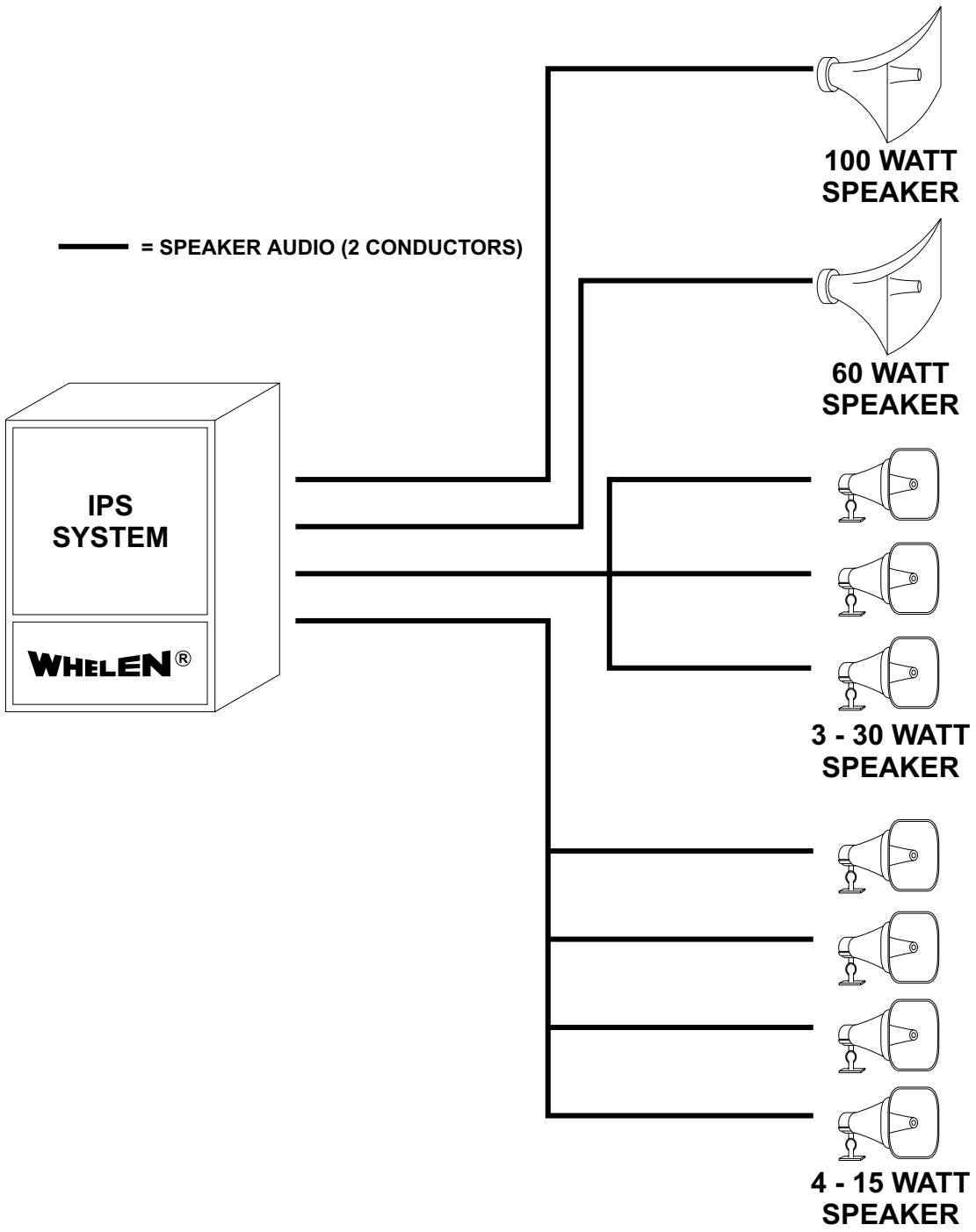


Fig. 9: Speaker Arrangement (sample)



CAUTION:In planning for speaker arrangement and placement, the use of hearing-protective devices should be considered for people working in close proximity to heavy-duty speakers connected to the IPS.

i) Batteries

Battery Installation

The batteries included with the IPS will be installed in the lower cabinet compartment as shown.

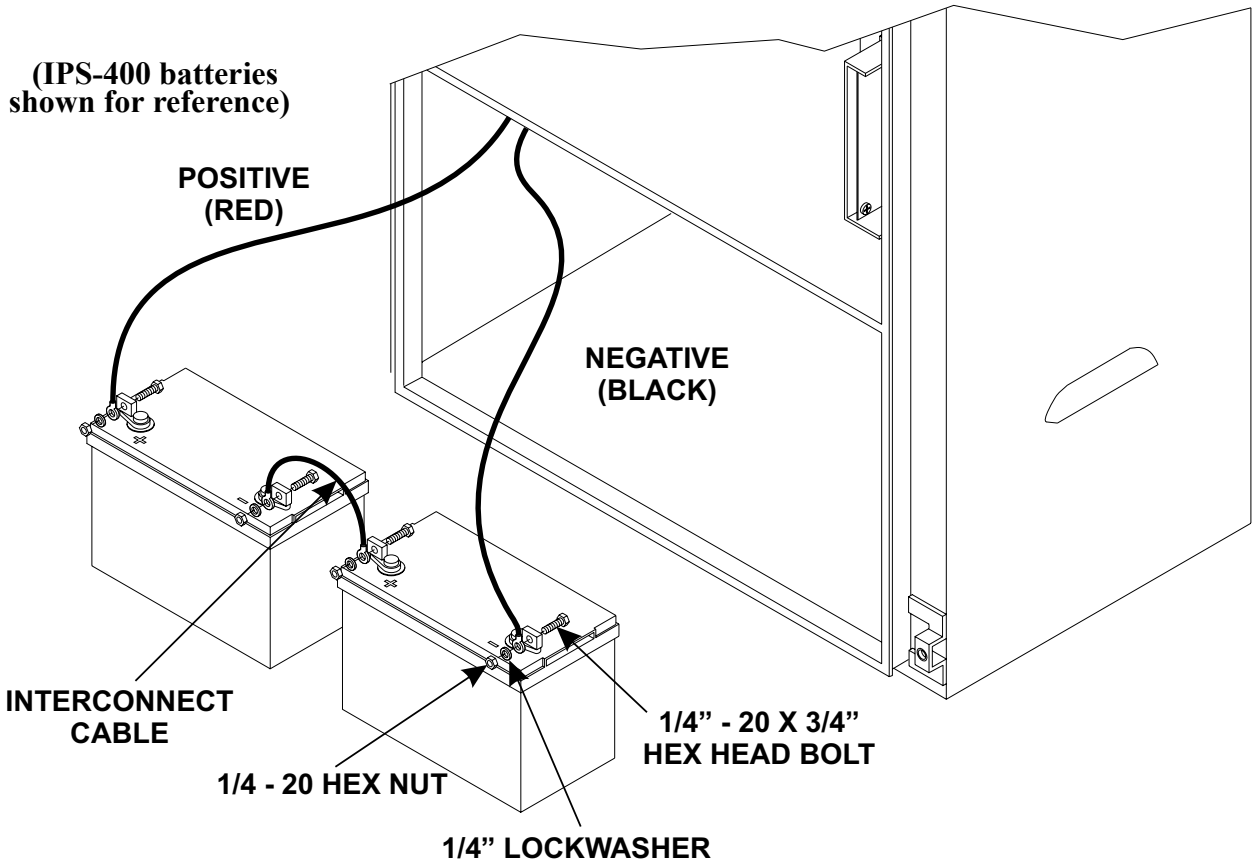
CAUTION:Do not allow battery terminals, cable terminals or uninsulated tools to make contact with the aluminum cabinet.

Battery Connections

Unplug the battery charger from the AC outlet. Connect the red cable to the (+) terminal of the left battery. Connect the black cable to the (-) terminal of the right battery. Finally, connect the interconnect cable to the (-) terminal of the left battery and then the (+) terminal of the right battery.

NOTE: A spark may occur when the last terminal connection is made.

Fig. 10: Cabinet View (Battery Connections)



Section II: Overview of System Components

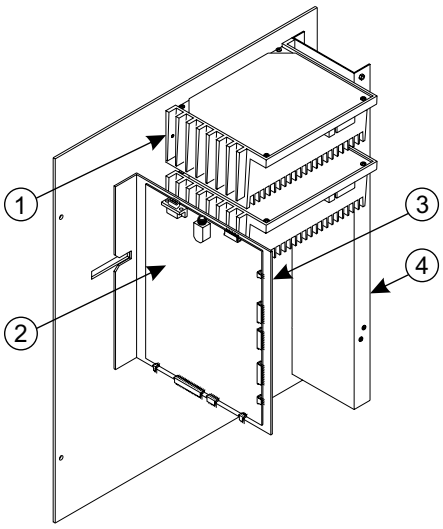
a) Station Component Locations

The IPS Siren System is comprised of 2 basic models:

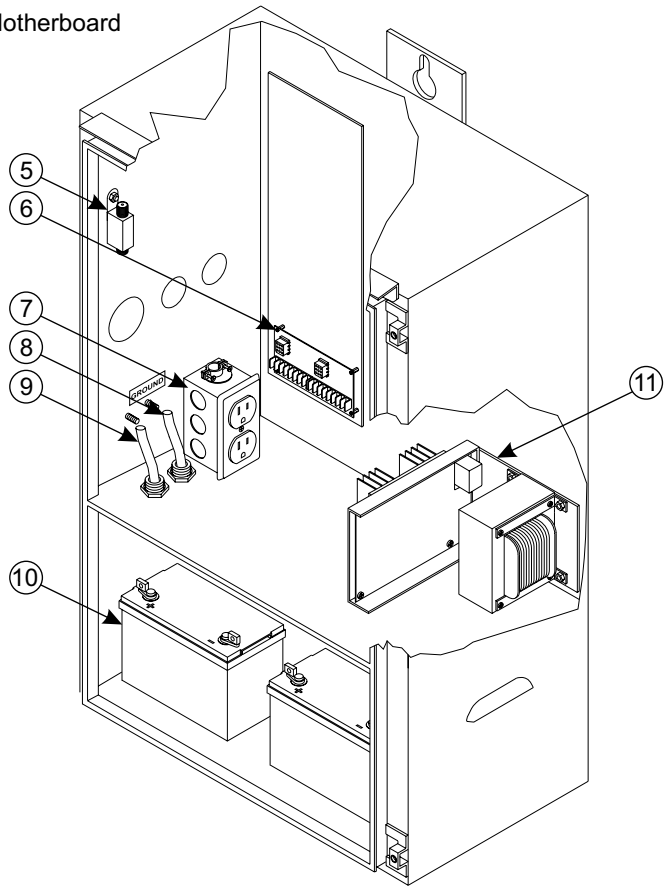
Model	Driver Info	Cabinet
IPS-400	One, 400 Watt Amplifier	Type I
IPS-800	Two, 400 Watt Amplifiers	Type I

Each system essentially functions in the same manner as does the other. This manual will provide the necessary information to properly operate, program and diagnose this system regardless of specific model. If information relevant to a specific model is required, it shall be presented and noted as such.

Fig. 11: Siren Cabinet Components



1. 400-Watt Siren Amplifier
2. Controller Board
3. Landline Board or Radio Board
4. Motherboard



5. Coax Protector
6. Speaker Output Board
7. AC Duplex Outlet Housing
8. POS Battery Cable
9. NEG Battery Cable
10. Battery
11. Battery Charger

b) Station Components Defined

Control Board **- This component (located on the inside of the upper compartment door) controls the key functions of the IPS400/800 system including:**

Tone Generation
Event Timing
Remote Station Status Reporting* (encoding)
Remote Activation
System Diagnostics

*** = optional**

The control board contains a microphone jack for public address and a serial port to allow connection of a palm computer (hereafter referred to as a PalmPC) to the remote station. The control board is also the location of the diagnostic LED's.

Siren Amps **- These components (located on the inside of the upper cabinet door) receive the desired tone or message generated by the control board, amplify it and deliver it to the siren driver.**

Radio Board or Landline Board (Optional) **- This component (located on the inside of the upper compartment door) receives signals from either the antenna or landline and delivers them to the control board for processing. These boards may be capable of either one- or two-way communication, depending upon how the system was ordered from the factory.**

Motherboard **- This component (located on the inside of the upper cabinet door) distributes Battery Voltage and signals to all system components that require this voltage. The motherboard is fused @10 Amps to protect all connected components EXCEPT for the siren amplifier(s) (they contain their own fuse). The Motherboard also distributes signals between the amplifiers and the control board.**

Speaker Output Board **- This component (located on the rear inside wall of the upper cabinet compartment) acts as the interface board for the Siren Amplifiers and the Siren Drivers.**

AC Battery Charger **- This component (located on the bottom of the upper compartment) uses 110 VAC (or 220 VAC) single-phase service to maintain the stations batteries at their proper voltages.**

Auxiliary Control Status Board (optional) **- This component (located on the right inside wall of the upper cabinet compartment) is wired to remote switches to facilitate remote operation of a specific siren station.**

Batteries **- These components (located on the inside of the lower cabinet compartment) provide the 28VDC necessary for the system to operate.**

Coax Protector (optional) **- This component (located on the left inside wall of the upper cabinet compartment) suppresses high-voltage (static) charges that could be present on the antenna.**

Antenna (optional) **- This component is capable of either receiving signals broadcast from the control center (one-way) or can both transmit and receive signals to and from the control center (two-way), depending how the system was ordered.**

Strobe Control Board (optional) **- This component (located on the rear inside wall of the upper cabinet) is a user-defined device that controls a pole-mounted strobe light. This light can be configured to activate during specific conditions (example: when any tone or message is generated).**

Intrusion Alarm (optional) **- This sensor (located on the door jam of the upper cabinet door) detects the opening of the cabinet door. If the station is equipped with this option, the alarm is configured to transmit a signal back to the control center.**

Section III: System Operations

a) Remote Operations

Remote operation of a IPS siren involves transmitting signals from the control center to the desired station. This is accomplished by using either an encoder and transmitter or, if the station is so equipped, using an auxiliary control status board that has been wired to switches/controls at the control center. Remote operation is beyond the scope of this document and will therefore not be addressed. If your system is equipped with an encoder, please refer to the encoder operating manual for information regarding remote operation. If your station has been wired to use the auxiliary control status board, refer to the reference materials provided by the electrical engineer or installer.

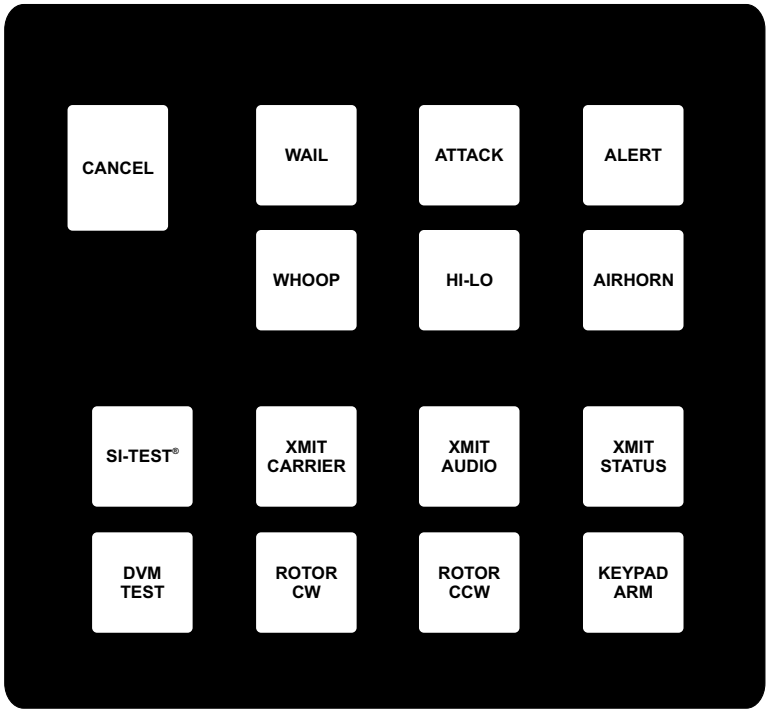
b) Local Operations

Local operation is accomplished through the control panel on the front of the station cabinet. The functions of these controls are as follows:

Cancel	**Abruptly stops siren tones without the normal "ramp down" found in several tones. Helpful in the event of an accidental tone activation.**
Wail	**Produces a slow rise and fall tone.**
Attack	**Produces a faster rise and fall tone.**
Alert	**A steady tone (Civil Defense alert).**
Whoop	**A repetitive rise-only tone.**
Hi-Low	**An alternating two-tone sound.**
Air Horn	**A pulsing air horn sound.**
SI TEST®	**Not used with IPS systems.**
Xmit Carrier	**Actuates remote station radio transmitter PTT circuit. When tone squelch is used with the transmitter, the transmit function is used when adjusting tone squelch modulation.**

Xmit Audio	**For use with remote station radio transceiver, causes transmission of DTMF tone via RF link for tone modulation adjustment.**
Xmit Status	**Transmits station status information and battery voltage to the control center.**
DVM Test	**Activates the Digital Voice Message (DVM) assigned to the DVM Test button in the configuration software.**
Rotor CW	**Not used with IPS systems.**
Rotor CCW	**Not used with IPS systems.**
Keyboard Arm	**Enables local station operation via keypad. Once pressed, the keypad remains active until either a) another keypad button is pressed, or b) 60 seconds have elapsed, whichever comes first. The Keypad Arm button must be pressed each time a keypad button is to be pressed. Note that the Cancel button is always enabled and does not require Keypad Arm to be pressed.**

Fig. 12: Station Control Panel



Section IV: Understanding Station Addressing

Every Siren Station in a given area code has its own, unique "Station Address". This address allows the user to select an individual or a group of stations. As stated elsewhere in this manual, a valid station address can be any number from 0000 to 9999. This allows for 10,000 unique addresses; a staggering number of stations to keep track of. Although it is logistically impossible to have that many stations in a single area code, it does illustrate the importance of a sensible, intuitive numbering convention for station addresses. This section will outline two types of conventions

a) Central Point Source: Quadrant, Sector, Radial & Station

Frequently, warning systems are used to notify the public of emergency situations that may occur from a single, centralized location. Typically, siren stations would be located throughout a 360° area surrounding this location for a specified distance from the source. In this scenario, the Central Point Source convention would be well suited.

For illustration purposes, assume the siren stations are installed within a 5 mile radius of the Central Point. As such, a Quadrant, Sector, Radial & Station numbering convention would allow the selection of any of the following:

- **any siren station**
- **all siren stations**
- **any one of four sectors**
- **any one of 5 radii within the sectors**

The area of coverage in this system, a circle, is divided into 4 quadrants. Each quadrant is then divided into 4 sectors. Each sector is further divided into 5 segments or radii emanating from the center of this siren system.

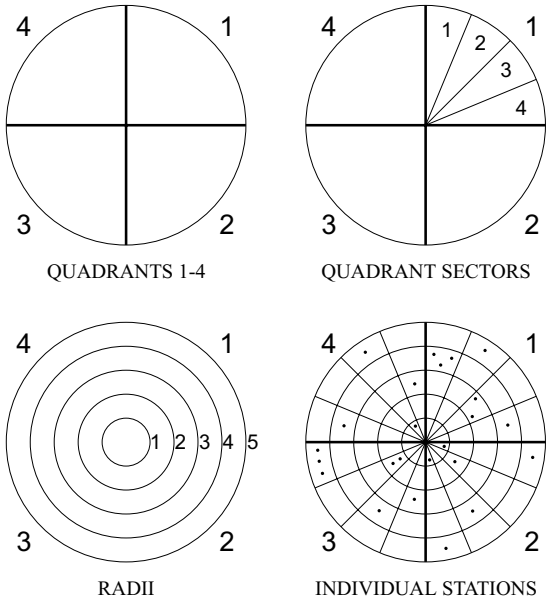


Fig. 13: Central Point (1)

In this system, a stations address is structured as follows:

Digit	Allocation
1	Quadrant (1 to 4)
2	Sector (1 to 4)
3	Radii (1 to 5)
4	Individual station within a radian

Here are some sample activations to further illustrate this concept.

Sample 1:

A station with address 1354 would be located in:

Quadrant: **1**

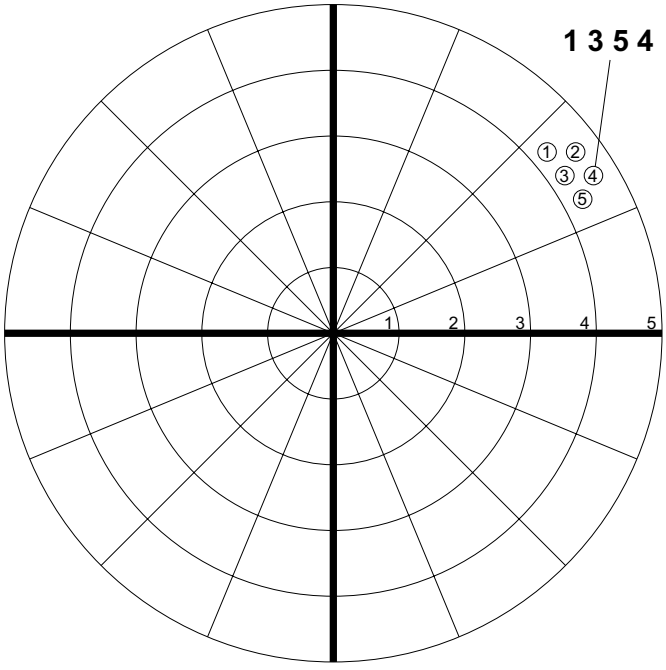
Sector: **3 of Quadrant 1**

Radial: **5**

Station: **4**

If an operator selects station 1-3-5-4, only that station will be selected, as shown.

Fig. 14: Central Point (2)



SINGLE STATION SELECTION
STATION 1354

Sample 2:

If the activation of a group of remote stations within a whole segment of a radius within a quadrant and sector is desired, the fourth digit address is substituted with a "Wild Card", the "#" pound sign.

An address selection of 1 - 3 - 4 - # would activate the system as follows:

Quadrant: **1**

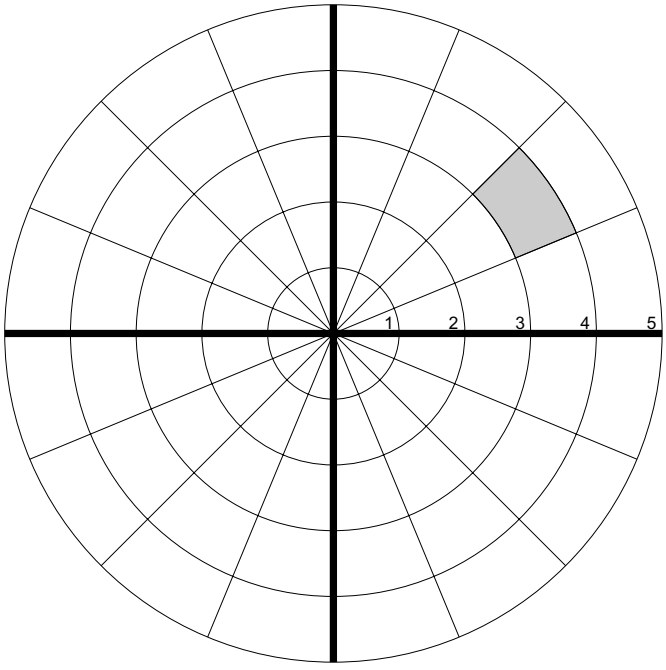
Sector: **3 of Quadrant 1**

Radial: **4**

Station: **# All stations defined by above**

This selection is shown below.

Fig. 15: Central Point (3)



GROUP SELECTION-RADIAL SECTOR
GROUP 134#

Sample 3:

Selection of an entire sector can be accomplished by using the following address:

Quadrant: **1**

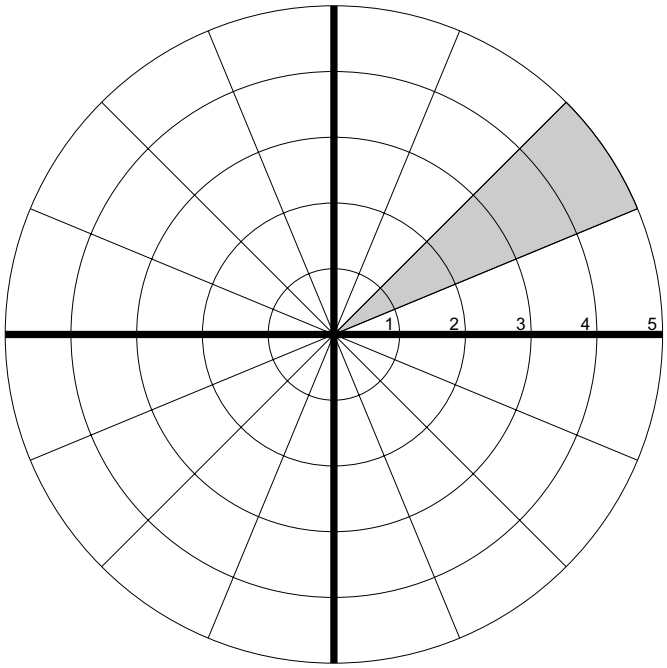
Sector: **3 of Quadrant 1**

Radial: **# All radial 1 - 5**

Station: **# All stations defined by above**

In selecting a sector, the first two digits of the address are set for the sector address, for example 1 - 3 (Quadrant 1 - Sector 3). The third and fourth digits are substituted with a # (Wild Card). Therefore, the address to select all stations in sector 1-3 is 1 - 3 - # - #. This selection is represented below.

Fig. 16: Central Point (4)



GROUP SELECTION-SUB-SECTOR
GROUP13##

Sample 4:

The selection of a complete quadrant can be achieved by using the following address:

Quadrant: **1**

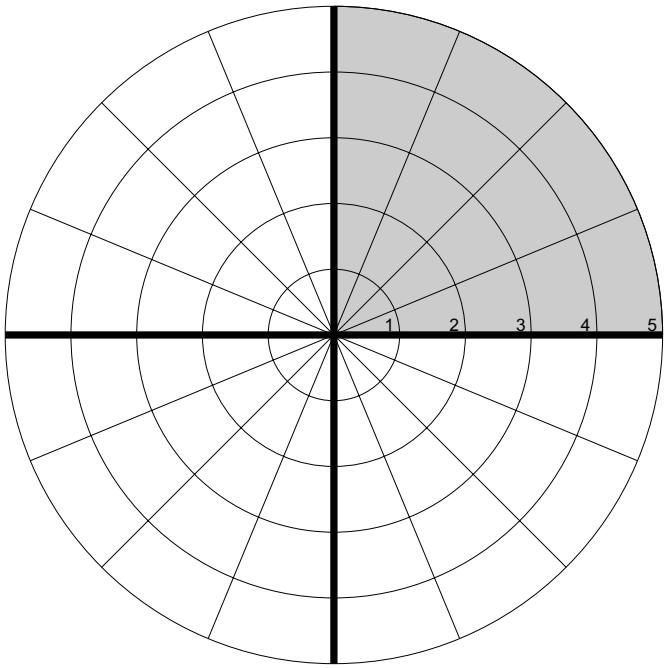
Sector: **# All sectors of Quadrant 1**

Radial: **# All radials in all sectors of Quadrant 1**

Station: **# All stations defined by above**

When selecting a quadrant, the first digit designates the Quadrant (1). the second, third and fourth digits are replaced with Wild Cards (#,#,#). Therefore, the address for selecting all stations in quadrant 1 is 1 - # - # - # as illustrated below.

Fig. 17: Central Point (5)



GROUP SELECTION-QUADRANT
GROUP###

Sample 5:

All stations in a system may be accessed by using the Wild Card (#) for all address numbers. The address would be # - # - # - #.

Quadrant: **# All Quadrants**

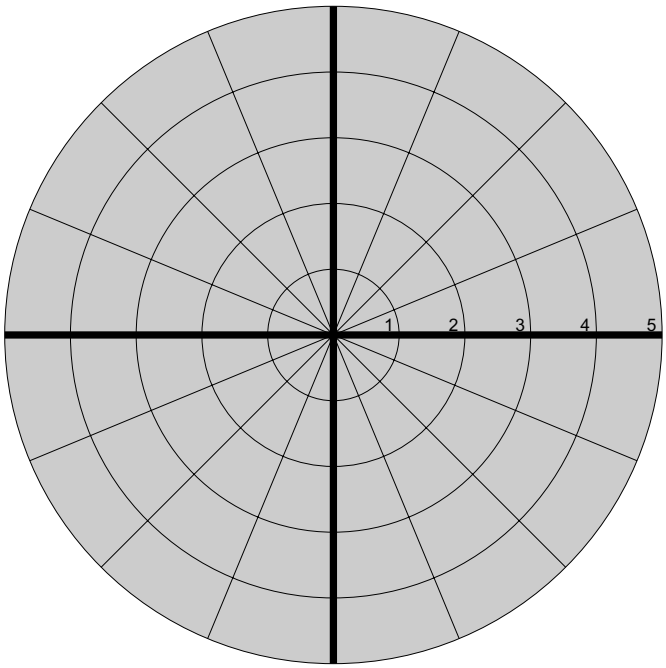
Sector: **# All sectors of all Quadrant**

Radial: **# All radials of all sectors of all Quadrants**

Station: **# All stations defined by above**

This "All Call" is illustrated as shown.

Fig. 18: Central Point (6)



GROUP SELECTION-"ALL-CALL"
GROUP ####

b) Zones

For this next type of address structure, assume that the siren system in question is used primarily for warnings throughout a large manufacturing complex. This complex is comprised of three regions with each region having no more than ten areas. Two areas contain more than 50 high-power voice and siren stations.

The following represents a Zoned System 4-digit address configuration, allowing activation by "All Call", regional group activations, area group activations and individual station activations:

```
X           X           X           X
:           :           :...........:.......... Individual Siren Station (0 - 99)
:           :
:           :..................................... Area (0 - 9)
:
:................................................ Region (0 - 9)
```

An address of 2 - 5 - 4 - 5 would indicate the following individual station:

Region 2, in Area 5, Siren Station 45.

The WIld Card (#) permits the use of several different types of group activations. Three samples follow:

Sample 1: Regional Activation (1 - # - # - #)
All Siren Stations in all Areas in Region 1 will be activated by this transmission.

Sample 2: Area Activation (1 - 5 - # - #)
All Siren Stations in Area 5 of Region 1 will be activated by this transmission.

Sample 3: System All Call (# - # - # - #)
All Siren Stations in all Area in all Regions will be activated by this transmission.

Section V: Troubleshooting

a) System Testing and Troubleshooting

In this section, operational checkout procedures and fault-isolation procedures are addressed. Successful completion of the operational checkout verifies proper operation of the IPS. Troubleshooting procedures are presented under the assumption that there is but one malfunction at a time. After all repairs are made, an operational checkout of that malfunctioning module should be repeated to make sure that any module replacement did not introduce a new malfunction.

Initial Operational Checklist

PROCEDURE NUMBER AND TOPIC	PROCEDURAL ACTIVITIES
1:Batteries	Check the series connection between the batteries in the IPS lower compartment
2:AC Service	Make sure there is a proper connection between the AC service and the AC workbox.
3:Power Check	If there is a dedicated AC disconnect switch, ensure that the switch is in the ON position.

b) System-level Faults and Troubleshooting Procedures

The system-level faults, isolation procedures and corrective actions are intended to assist in isolating the cause and location of a failure within the IPS cabinet, as well as any associated warning devices.

NOTE: In troubleshooting the IPS, the user is reminded that certain procedures and tests may cause the IPS to produce an audible signal. The user should use discretion regarding the production of warning signals. Most of the troubleshooting procedures may be performed without producing an audible signal.

System-level Faults and Troubleshooting Procedures

FAULT	ISOLATION PROCEDURE	CORRECTIVE ACTION
IPS will not activate via local controls	Determine whether battery voltage is less than 19 VDC	Perform battery system faults and troubleshooting procedures. If batteries do not attain and maintain 19 VDC, replace batteries.
Battery voltage is less than 19 VDC.	Verify 120 VAC present. Check the fuse on the battery charger.	Supply 120 VAC service. Replace the fuse.
IPS will not activate via local controls. PWR LED is ON	Observe all wiring and connections.	Repair or replace broken cabling/wiring between modules. If wiring or circuitry within a module appears damaged, contact manufacturer's service personnel.
IPS will produce tones which are audible near the cabinet, but fail to produce tones at designated sound levels.	Check the tone generator connector to the system driver board, including the cable leading to the controller board. Check the power amplifier cables and connections. Inspect power amplifier fuses. Observe speaker driver (i.e., wire) connections to terminal strip on the system driver board.	Refit the tone generator connector. Check cable/wiring path between tone generator and connection to the controller board. If damaged, have repaired or replaced. Check the cable/wiring path between the power amplifier connections on the power amplifier(s) and the associated connections on the system driver board. If loosened on the power amplifier(s), make proper connection. If loosened or damaged on the system driver board, have manufacturer's personnel repair or replace. Replace fuse(s) as required. Make proper connections. If damaged, have wires repaired or replaced. If problem not resolved, refer to speaker manual. If speakers check out properly, contact manufacturer service personnel.
IPS will not activate via remote controls (i.e., RF or landline).	Attempt local activation via the station control panel.	If local activation works, check RF paths and antenna connections. for systems with RF link. If problem is not resolved, refer to IPS Remote Activation Faults and Troubleshooting Procedures. If local activation works for systems with landline interfaces, clean and reconnect interfacing connections. If problem not resolved, replace line.

c) IPS Remote Activation Faults

Once it has been established that the IPS will activate via local controls, several conditions concerning remote controls or remote activation link faults may be examined.

Part A: Control Center

IPS will not activate via RF link	Localize the fault to either the control center or the remote (i.e., IPS cabinet) station/site. Determine the fault(s) within the control center side of the RF link.	Ensure that control center transmitter and encoder are ON. Verify that the control center transmitter and IPS station/site address code is selected on the control center encoder. Verify that the correct IPS station/site address code is selected on the control center encoder. If more than one IPS station/site exist in the communication system setup, determine that the encoder will address a IPS cabinet not in question. If the encoder will address more than one or more IPS cabinet stations, excluding the one cabinet station that will not activate, perform the troubleshooting steps concerning the IPS cabinet station side of the RF link (refer to Part B). Listen to the activation link transmission from a monitor or radio receiver on the activation link frequency. Send a CANCEL command. Verify that the DTMF tones are audible on the monitoring device. If the result of the above step is negative, inspect the audio connection between the encoder and transmitter and the encoder PTT circuit.
IPS will not activate vial RF link (cont'd).	Determine whether the encoder's DTMF tones are being modulated by the transmitter.	Obtain assistance from a radio service facility. Using an FM test set, ensure that the DTMF tone level modulation is set at 2.5 KC. If tone squelch is utilized, the modulation factor for the tone squelch should be added to the DTMF tone level set up.

Part B: IPS Cabinet Station Link

FAULT	ISOLATION PROCEDURE	CORRECTIVE ACTION
IPS will not activate via RF link.	Determine the fault(s) within the IPS cabinet/station side of the RF link. First determine whether the encoder's DTMF tones are audible at the IPS cabinet/station.	Using a monitoring device, have the control center dispatcher send a CLEAR command. If the DTMF tones are audible on the monitoring device, perform the following step. If the tones are not audible, skip to the following step. Have the DTMF tone transmitted again and observe the SQ (squelch) LED. If the SQ LED illuminates, this situation indicates that the IPS cabinet station is receiving the transmission. If the tone is not being received at the monitoring device or the IPS cabinet station, consider the RF link path and propagation.
	If the DTMF tones are audible or the monitoring device at the SQ LED illuminates, determine whether DTMF tones are being received and processed.	Have the central point dispatcher send another CLEAR command. If the DEC (decoder active) LED flashes, this situation indicates that DTMF tones are being received and processed.
IPS will not activate via RF link (cont'd).	If the SQ LED or DEC LED do not flash, verify radio connections.	Correct radio connections.
IPS will not activate via RF link (cont'd).		If the prior three steps do not determine the fault(s) or resolve the problem, contact manufacturer's service personnel.

d) Audio Loss

If after activating the siren there is no audio output, perform the following procedure step by step. This procedure will require a digital multimeter.

1. **Locate the Audio Presence LED on the controller board. When audio is present on the board, this LED will be on.**

2. **Activate the WAIL siren tone from the control panel on the siren cabinet. Confirm that the Audio Presence LED is on. If this LED is not on *or* if it turns off quickly, measure the battery voltage. The siren will not activate if battery voltage drops below 19 VDC. Be sure to measure the battery voltage <u>at the same time</u> you activate the siren. The batteries may show a good float voltage while they are not under load, but upon activation, the battery voltage may drop below 19 VDC if their capacity is low. Note that when the siren shuts down and the load is removed from the batteries, the voltage may rapidly return to 25 VDC or more. If this condition is occurring, the batteries will need to be replaced. If the voltages are in the normal range, proceed to step 3.**

3. **Locate connector J2 on the control board. With your multimeter set to AC volts, measure across pins 6 and 7 (White with Orange stripe and White with Brown stripe). With the siren tone running, 5 VAC should be present. *If no voltage is present, the controller board is probably at fault.***
   NOTE: Confirm that the audio presence LED is on while performing these measurements. It indicates that the siren controller is still activated. If the specified voltages are present, proceed to step 4.

4. **With the siren tone still active, measure across pin 1 (Blue wire) and pin 2 (Black w/ White trace) on each of the siren amplifiers. 5 VAC should be present at each amplifier. If so, proceed to step 5. If no voltage is measured, this is indicitive of a wiring problem between the controller board and the siren amplifiers. Check the wiring between these components**

5. **Unplug the siren amplifier wire harness from the Interconnect Board. Press "Cancel" on the control panel and then press "Wail". Measure across the output of each amplifier at the green Phoenix™ connector. NOTE: Be sure that the meter leads are measuring across the correct outputs, according to the label on the amplifier. Approximately 34 VAC should be measured. If this voltage level is measured, proceed to step 6. If this voltage level is not found and 5 VAC was measured at the input, proceed to step 7.**

6. **Set your meter to measure resistance at its lowest scale. Measure across each of the speaker drivers, making sure that at least one wire of each driver is removed from the power amplifier (or else the transformer in the amp is being measured as well). Each driver should have a DC resistance of approximately 3 Ohms +/-.3 Ohms. If a resistance value outside of this range is found, contact factory.**

1. **Set your meter to measure DC Volts. Connect the negative lead of your meter to ground (one of the solid black wires in the multi-position connector on the amplifier is a good ground source). With a siren tone activated, measure the following wires for the following voltages (approximately):**

Grey	**6 VDC**
Brown	**5 VDC**
Solid White (all)	**24 VDC**

e) AC Battery Charger

The battery charger has the primary function of maintaining the system battery supply to full capacity. The battery charger provides 5 Amps of charging current to the batteries. The operational status of the battery charger can be viewed by the DC LED during warning signal tone or when the system is powered up. In addition, a green LED on the charger indicates proper charging. To maintain optimum battery capacity, the IPS should be exercised on a frequent basis.

f) Digital Voice

1. **Remove all amplifier fuses.**
2. **Install an 8 ohm speaker at amplifier audio input connector pins 1 and 2 (Blue and Black w/White wires) in the 16 position connector.**
3. **Select a siren tone by pressing one of the controls on the front panel.**
4. **If the tone can be heard through the speaker, press the DVM-Test control to play the predesignated message.**

Section VI: Maintenance

Although The IPS400/800 is of a dependable, solid-state design, periodic activation, field inspection and preventive maintenance is recommended to insure the maximum performance of each station.

a) Frequency of Testing and Activation

A system of twice-monthly activation and confirmation, combined with a quarterly service and preventive maintenance is recommended to help insure the successful performance of a station. Increasing the frequency of testing will support and improve a station's test record.

Stations located in environmentally adverse locations will require inspection and preventive maintenance at more frequent intervals than just discussed. Stations should always be inspected following severe storms.

If a station is activated by remote control (landline or radio), the twice-monthly activation should be performed using the remote control link.

The twice-monthly activation of a station can be confirmed by several different methods, depending upon the options selected with each Whelen System.

Local Site Confirmation

For a basic station activated at the cabinet, or by landline or radio, have an observer confirm that the station activated audibly. The observer should report successful as well as failed station tests. Station Performance Logs should be maintained. It is important to understand that audible confirmation alone is not assurance that the station is operating at 100% power. This requires inspecting the station in greater detail.

Stations may be optionally equipped with counters that advance upon radio or tone generator activation. These counters do not confirm total operation or the final expected output of an outdoor warning device.

Remote Monitoring and Confirmation

Stations equipped with the optional Whelen COMM/STAT™ Command and Status Monitoring control, allow remote monitoring of status as well as confirmation of system activation. COMM/STAT™ returns the results of a remote station activation in a DTMF encoded format via radio link.

Remote monitoring by RF link eliminates the necessity of physically visiting a station to confirm an activation.

Following the activation of a station, a "Status Request" may be sent to that station by DTMF encoded radio command. Diagnostic information is then presented to the status encoder at the station, converted into DTMF code and transmitted back to the control center, where one of several COMM/STAT™ base station products will convert the DTMF code into meaningful information.

b) Quarterly Maintenance

Developing a quarterly inspection and preventive maintenance program for an IPS warning station requires a thorough understanding of all the elements and expectations of the system. The following section provides an overview and basic guideline for quarterly station inspection and preventive maintenance program for the sample station.

c) Replacement

IPS repair is performed at the module replacement level. Component level repair is not recommended. Speakers and strobe lights are replaced at the final assembly level.

Replacement information is presented for the following modules. The part number is provided for reference. Contact the sales office for replacement parts and current revision.

- **Controller Board**
- **Power Amplifier(s)**
- **Radio/Landline Board**
- **Battery Charger**
- **Batteries**

Controller Board Replacement

To replace this component remove all connectors from the board. Mark these connectors to ensure proper reinstalling. Remove all of the mounting nuts used to secure the board to its mounting panel. Reverse this procedure to install a new board.

Power Amplifier Replacement

Label and remove the connectors from the Power Amplifier. Using a Phillips screwdriver, remove the two amplifier mounting screws accessible from the front panel.

CAUTION! A Power Amplifier is heavy. Be sure to have a firm grip on it before removing the mounting hardware.

Radio/Landline Board Replacement

Label and remove any connectors from the board. Remove the antenna coaxial cable from the board. Remove the mounting hardware. Reverse the procedure to install the new board

Battery Charger Replacement

Make sure that the AC power cord is unplugged. Disconnect the cables. Remove the mounting nuts from the back wall of the charger. Reverse the procedure to install the charger.

d) Visual Siren Station Inspection

- **Observe the speaker, siren cabinet and AC Service for any signs of damage or loose mounting hardware.**
- **Check all conduit for watertight connection and entrance into the siren cabinet.**
- **Inspect the AC Service for damage, blown fuses, degraded (corroded) power connections and integrity of the lightning arrestor.**
- **Inspect the grounding system for the AC Service and the Siren Cabinet. Verify connections and acceptability of earth ground.**
- **Examine entire station for any signs of vandalism or forced entry.**

e) Siren Cabinet and Components

- **Inspect AC Outlet, fuse and surge suppression equipment. Examine system for infiltration of foreign material(s), rodents or other pests.**
- **Inspect battery terminal connections and clean if necessary. Re-apply silicone coating to battery terminals if necessary. Observe battery voltage with siren in inactive state.**
- **Examine all wiring harnesses for chafing. Verify wiring terminations for tightness and wiring connections for proper electrical connections. Replace and correct any corroded or marginal connections. Inspect antenna for proper connection.**

f) Speakers

- **Inspect speaker for blockage by rodents, pests or other foreign material. Clean if necessary. Inspect any wiring cables or harnesses for chafing. Clean if necessary. Confirm that the driver compartment will allow for water or moisture drainage. Inspect speaker wiring connections for any sign of corrosion.**
- **Verify tightness of all mounting hardware.**
- **Check all wiring terminations and connections.**

g) Station Performance Testing

NOTE: **Depending on local conditions and station options selected, the station may be tested on or off line. Off line testing of the station involves disconnecting the speaker drivers from the siren amplifiers, so as not to disturb personnel when verifying tone generator operation. A complete test must, however, include the testing of the siren amplifier operation.**

A basic routine, verifying the performance and operation of the sample station previously described, would be as follows:

1. Local and Remote Activation -

Activation of each remote station function by local control and remote control. With amplifiers on and off line as needed. An examination of each activation function will also facilitate a verification of related and subsequent system module activations and electrical connections that would be caused by an activation command. Also confirm function time outs (ex.: does the Alert signal time out at three minutes as per user specification?).

2. Response to Station Address and All Call address programming -

Control Center reception and activation for individual station address and All Call address selection.

3. Public Address -

With the station on line, activation of PA for both local and remote control, verifying PA Audio path and proper set up level of volume. Verify AC drop out on PA.

4. Siren Amplifiers -

Inspect for complete operation with proper tone quality.

5. Battery Charger Operation -

Observe for proper charging operation.
Verify AC drop out in PA.

6. Batteries -

Verify voltage stability under load.
Perform a load test.

1. Status Encoder -

Perform a siren tone test of the station.
Compare status information with observations made locally at the station.
Disable one speaker and verify that the "Full" LED indicator is off.
Disable AC and verify that the "AC" LED indicator is off.
Compare battery voltage return status with observed and measured battery voltage.

2. Transmitter -

Check status encoder DTMF tone level modulation with transmitter.
Check transmitter set up.
Verify power output and SWR.

NOTE: On concluding any examination of a station where connectors have been opened and closed, a final radio test should be performed and the results observed for a complete successful test. The PA audio path should also be audibly verified by sending PA and broadcast a voice message.

The following is a sample form that may be used for quarterly inspection and maintenance.

GENERIC SYSTEM MAINTENANCE CHECK LIST

Station #:_____ **Siren Address:**_____

Installation Date:____/____/____ **Inspection Date:**_____

Inspector:_____

PHYSICAL INSPECTION:

	OK	NOT OK	COMMENT
Mounting Hardware	___	_____	_____
Speaker Assembly	___	_____	_____
AC Service	___	_____	_____
Proper Grounding	___	_____	_____
Solar Panels*	___	_____	_____
Antenna*	___	_____	_____
Conduit Connections	___	_____	_____
Siren Case Assembly	___	_____	_____
Batteries	___	_____	_____
Components Secure	___	_____	_____
Harnesses	___	_____	_____

LOCAL OPERATIONAL TESTING

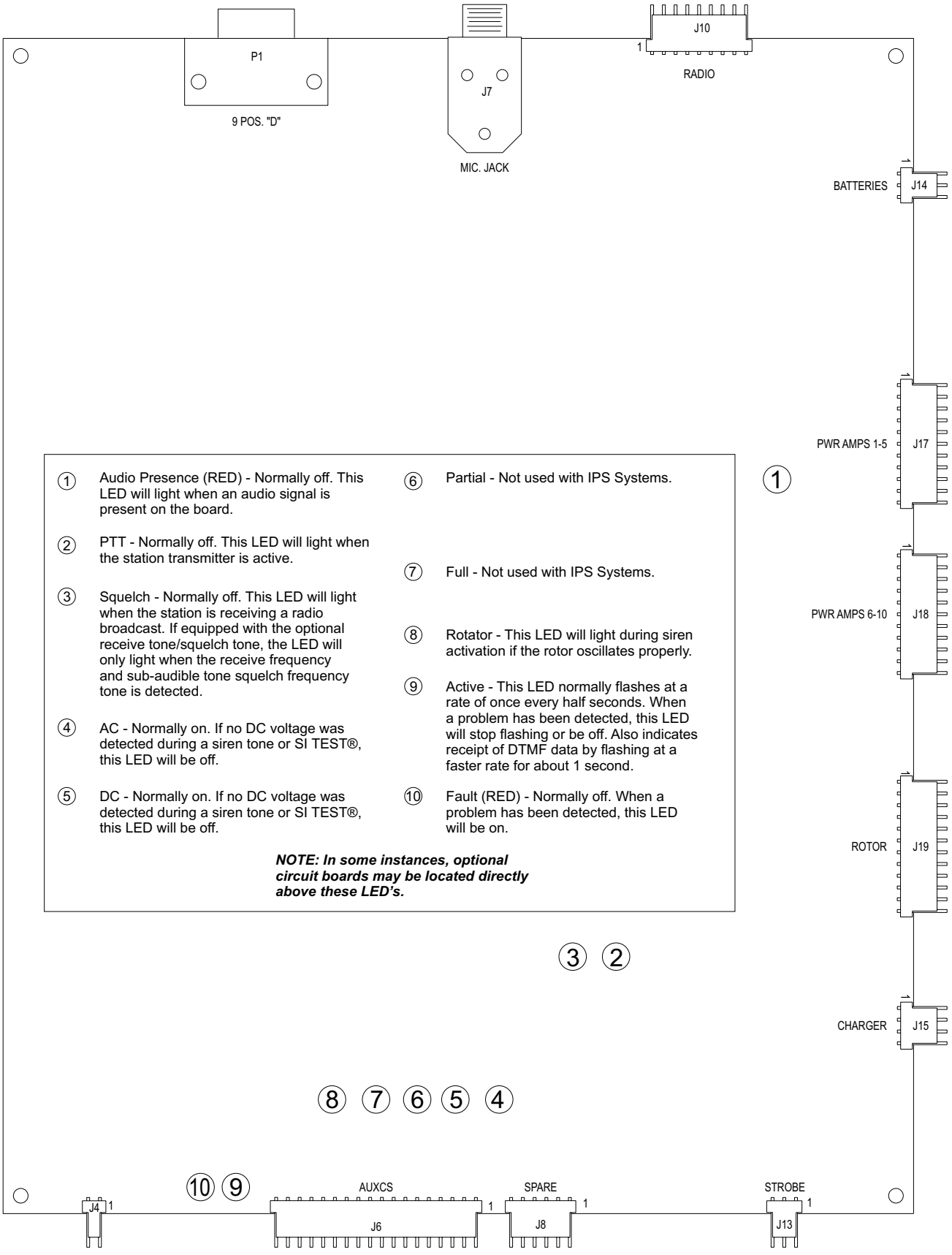
Battery Voltage	___	_____	_____
Manual Test:			
Clear	___	_____	_____
Wail	___	_____	_____
Attack	___	_____	_____
Alert	___	_____	_____
Airhorn	___	_____	_____
Hi-Lo	___	_____	_____
Whoop	___	_____	_____
Clockwise	___	_____	_____
Counter Clockwise	___	_____	_____
(SI TEST®):	___	_____	_____
AC LED	___	_____	_____
DC LED	___	_____	_____
Partial LED	___	_____	_____
Full LED	___	_____	_____
Rotor LED	___	_____	_____
Timer Set LED	___	_____	_____
Audio Present LED	___	_____	_____
Microphone	___	_____	_____
Mic Volume	___	_____	_____

GENERIC SYSTEM MAINTENANCE CHECK LIST
(continued)

	OK	NOT OK	COMMENT
Radio*:			
Squelch Control	___	_____	_____
Sensitivity	___	_____	_____
Antenna Tuned*	___	_____	_____
Transmit LED	___	_____	_____
Remote Activation:			
Clear	___	_____	_____
Wail	___	_____	_____
Attack	___	_____	_____
Alert	___	_____	_____
Public Address	___	_____	_____
Airhorn	___	_____	_____
Hi-Lo	___	_____	_____
Whoop	___	_____	_____
Wail / 5 Sec.	___	_____	_____
All Call	___	_____	_____
Speaker LEDs:			
1	___	_____	_____
2	___	_____	_____
3	___	_____	_____
4	___	_____	_____
5	___	_____	_____
6	___	_____	_____
7	___	_____	_____
8	___	_____	_____
9	___	_____	_____
10	___	_____	_____
SI TEST®:			
AC	___	_____	_____
DC	___	_____	_____
Partial	___	_____	_____
Full	___	_____	_____
Status Request	___	_____	_____
Intrusion*	___	_____	_____

***Optional**

Fig. 19: System LED Diagnostic Indicators



① Audio Presence (RED) - Normally off. This LED will light when an audio signal is present on the board.

② PTT - Normally off. This LED will light when the station transmitter is active.

③ Squelch - Normally off. This LED will light when the station is receiving a radio broadcast. If equipped with the optional receive tone/squelch tone, the LED will only light when the receive frequency and sub-audible tone squelch frequency tone is detected.

④ AC - Normally on. If no DC voltage was detected during a siren tone or SI TEST®, this LED will be off.

⑤ DC - Normally on. If no DC voltage was detected during a siren tone or SI TEST®, this LED will be off.

⑥ Partial - Not used with IPS Systems.

⑦ Full - Not used with IPS Systems.

⑧ Rotator - This LED will light during siren activation if the rotor oscillates properly.

⑨ Active - This LED normally flashes at a rate of once every half seconds. When a problem has been detected, this LED will stop flashing or be off. Also indicates receipt of DTMF data by flashing at a faster rate for about 1 second.

⑩ Fault (RED) - Normally off. When a problem has been detected, this LED will be on.

NOTE: In some instances, optional circuit boards may be located directly above these LED's.