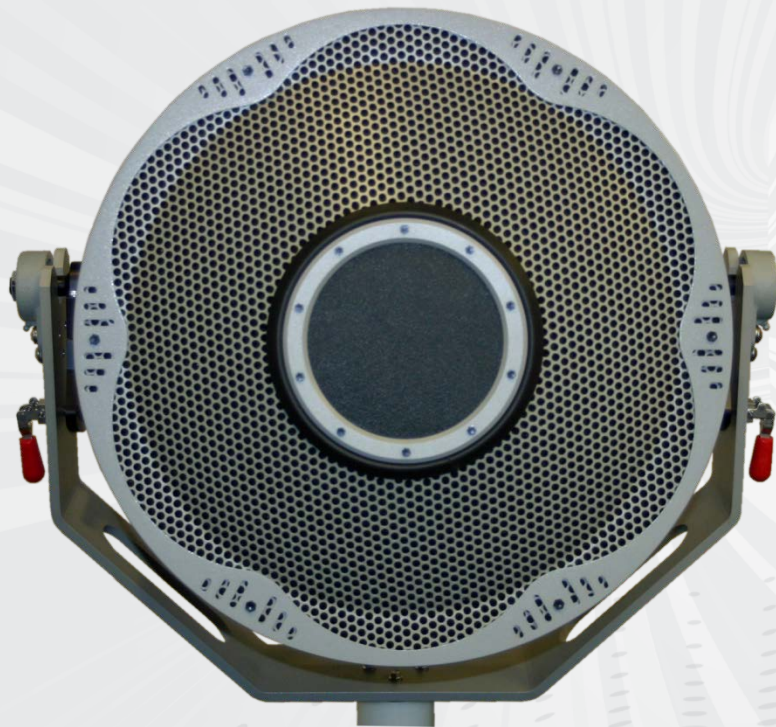


# OPERATION AND MAINTENANCE MANUAL

## HYPERSPIKE® MODEL HS-18



**Ultra**  
ELECTRONICS

  
**HYPERSPIKE**

*Sound that Moves*



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**This manual contains information that is proprietary to Ultra Electronics USSI. It is intended solely for the education and use of parties operating and maintaining the equipment described herein.**

## SAFETY PRECAUTIONS

The HyperSpike® HS-18 uses high operating voltages and sound levels. The primary safety risks are: 1) electrical shock and 2) hearing damage or loss. Only properly trained personnel should operate the HS-18. All operators should abide by the critical safety warnings identified in this manual to prevent injury or death during operation.

### **WARNING:**

#### **LIFE THREATENING ELECTRIC SHOCK OR DEATH BY ELECTROCUTION 100 - 250 VAC IS PRESENT WHEN ENERGIZED**

Always plug the unit into properly grounded electrical outlets.  
Never immerse the unit or power cable in water or allow it to sit in pooled water.  
Do not operate the device if the power cable is pinched, frayed, or cut.

### **WARNING:**

#### **TEMPORARY OR PERMANENT HEARING DAMAGE MAY OCCUR HIGH LEVELS OF SOUND CAN BE EMITTED**

Always wear hearing protection according to OSHA's hearing conservation program.  
Operators must remain behind the HS-18 during operation.

## Additional Electrical Safety Measures

Following these basic safety measures will prevent dangerous or potentially deadly situations from arising :

- Inspect the power cable for damage before each use.
- Keep the power cable away from heated surfaces.
- Never remove the power cable from an outlet by pulling on the cord.
- Never leave the unit plugged into an outlet when unattended.
- Never override any of the HS-18's electrical safety features.

## Sound Safety Measures

### **Threshold of Pain**

The National Institute for Occupational Safety and Health (NIOSH) recognizes 120 dB as the threshold of pain for unprotected hearing. Operators should wear hearing protection and ensure that personnel are not directly in front of the device, at close range, when the power is ON.

### **High/Low Switch**

The unit features a HIGH/LOW switch as pictured in Safety Figure 1. When the device is operated, the following output levels are present:

**LOW POWER:** Maximum output of the HS-18 is 130 dB at 1 meter from the front of the HS-18. In Low power mode, the approximate distance to where the device emits 120 dB (OSHA's defined threshold of pain) is 4 meters in front of the device.

**HIGH POWER:** Maximum output of the HS-18 is 156 dB at 1 meter from the front of the HS-18. In High power mode, the approximate distance to where the device emits 120 dB (OSHA's defined threshold of pain) is 50 meters in front of the device.



**Safety Figure 1.  
HIGH/LOW Power  
Switch**

### **Preventing Audio Feedback**

The HS-18 emits high levels of acoustic energy that can have a boomerang effect if the unit is transmitted at a solid object in close proximity (less than 25 meters). To prevent sound from reflecting back to the operator, ensure there is a clear path between the HS-18 and the intended target.

**CAUTION:**  
**Equipment damage may occur**  
**Audio feedback may occur when using a live microphone**  
  
Always operate the microphone directly behind the HS-18

### **Safe Handling**

Lifting the HS-18 improperly can lead to unnecessary physical strain and can result in personnel injury or equipment damage. When removing the HS-18 from its carrying case or lifting it, always remember to bend at the knees to maintain the optimum center of gravity.

**WARNING:**  
**PERSONNEL INJURY MAY OCCUR**  
**THE HS-18 MAY TIP OVER OR FALL FROM WIND GUSTS OR PLATFORM MOVEMENT**

Always secure the HS-18 to the intended mounting device  
Never leave the unit unattended without being secured



## 1.0 INTRODUCTION

This manual provides instructions on how to setup, operate, and maintain the HS-18, an advanced Acoustic Hailing Device (AHD) that can transmit both voice and tones at distances of more than 1500 meters.

### 1.1. Product Description

The HS-18 is intended for long-range hailing, warning, and notification. It projects sound energy into a focused beam that enables clear tones and voice transmissions to reach specific targets at long distances. Whether on foot, in vehicles, or inside structures; the HS-18 is used to identify and determine the intent of targeted subjects and modify behavior. At 90 pounds it is transportable by two men. The HS-18 can accept audio input from numerous devices such as a microphone, MP3/CD, Phraselator devices and laptop computers.

### 1.2. Standard Equipment and Accessories

The HS-18 is delivered with the following standard equipment shown in Figure 1.2-1:

- HS-18 Emitter Head
- Saddle Bracket
- CB Style Microphone
- Audio Input Cable
- COTS MP3 Player w/ Waterproof Case
- HS Audio Optimizer Software
- Banded & Disposable Earplugs
- Accessory Bag
- Power Cable

The following accessories are also available:

- Tripod
- Ship Rail Mount Kit
- Maritime Cover
- See the Parts List in Section 10 for a complete list of accessories and part numbers.

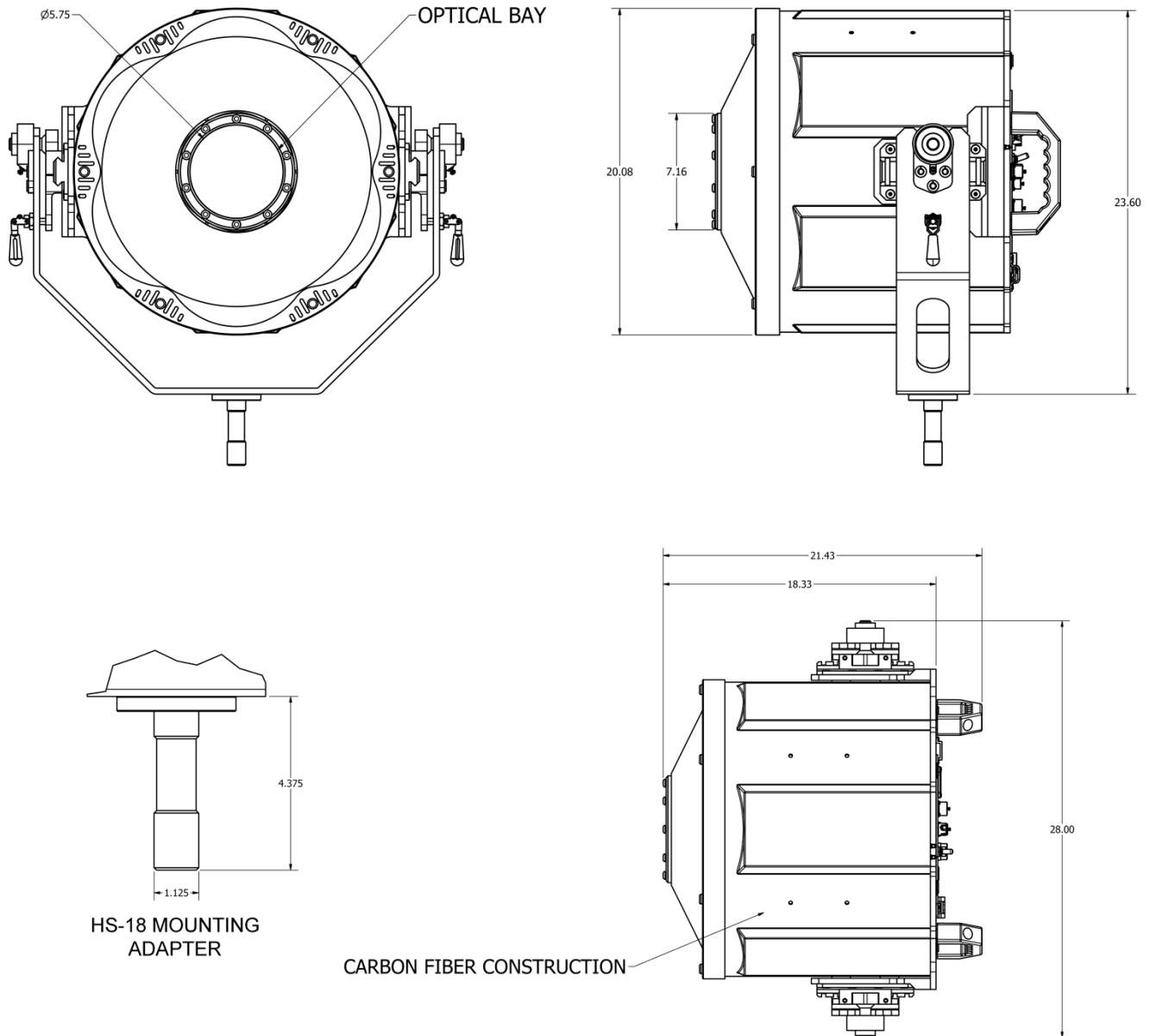


**Figure 1.2-1 Standard Equipment**



### 1.3. Physical Features

The HyperSpike® HS-18 is designed for easy assembly and maximum transportability by one or two users. The unit can go from disassembled to fully operational in just moments. The physical characteristics of the HS-18 are provided in Figure 1.3-1 and Figure 1.3-2.



**Figure 1.3-1 HS-18 Dimensions**

HS-18 WEIGHT	
Emitter Head	90 lbs (40.8 Kg)
HS-18 DIMENSIONS	
Emitter Configuration	Circular
Emitter Width	20.1 in (50.8 cm)
Emitter Height	20.1 in (50.8 cm)
Emitter Depth	18.3 in (46.5 cm)
Equipment Bay	5.8 in (14.6 cm)
Emitter Area (subject to wind load)	314 in <sup>2</sup> (2026 cm <sup>2</sup> )

Figure 1.3-2 HS-18 Physical Characteristics

#### 1.4. Acoustic Performance

The HS-18 delivers exceptional volume and sound quality at every operating range. See HS-18 Acoustic Specifications in Figure 1.4-1 and the Communication Range in Figure 1.4-2.

HS-18 ACOUSTIC PERFORMANCE	
Beam Width	+/- 5° at 2 kHz/-3 dB
Communication Range	Over 1500 meters* (see Figure 1.4-2)
Frequency Response	245 Hz – 10 kHz
Sound Pressure Level, Peak, A-Weighted	156 dB @ 1 meter
Speech Transmission Index (STI-Intelligibility)	0.96 out of 1.00
*At Maximum Rated Output, Dependent Upon Ambient Conditions	

Figure 1.4-1 HS-18 Acoustic Specifications

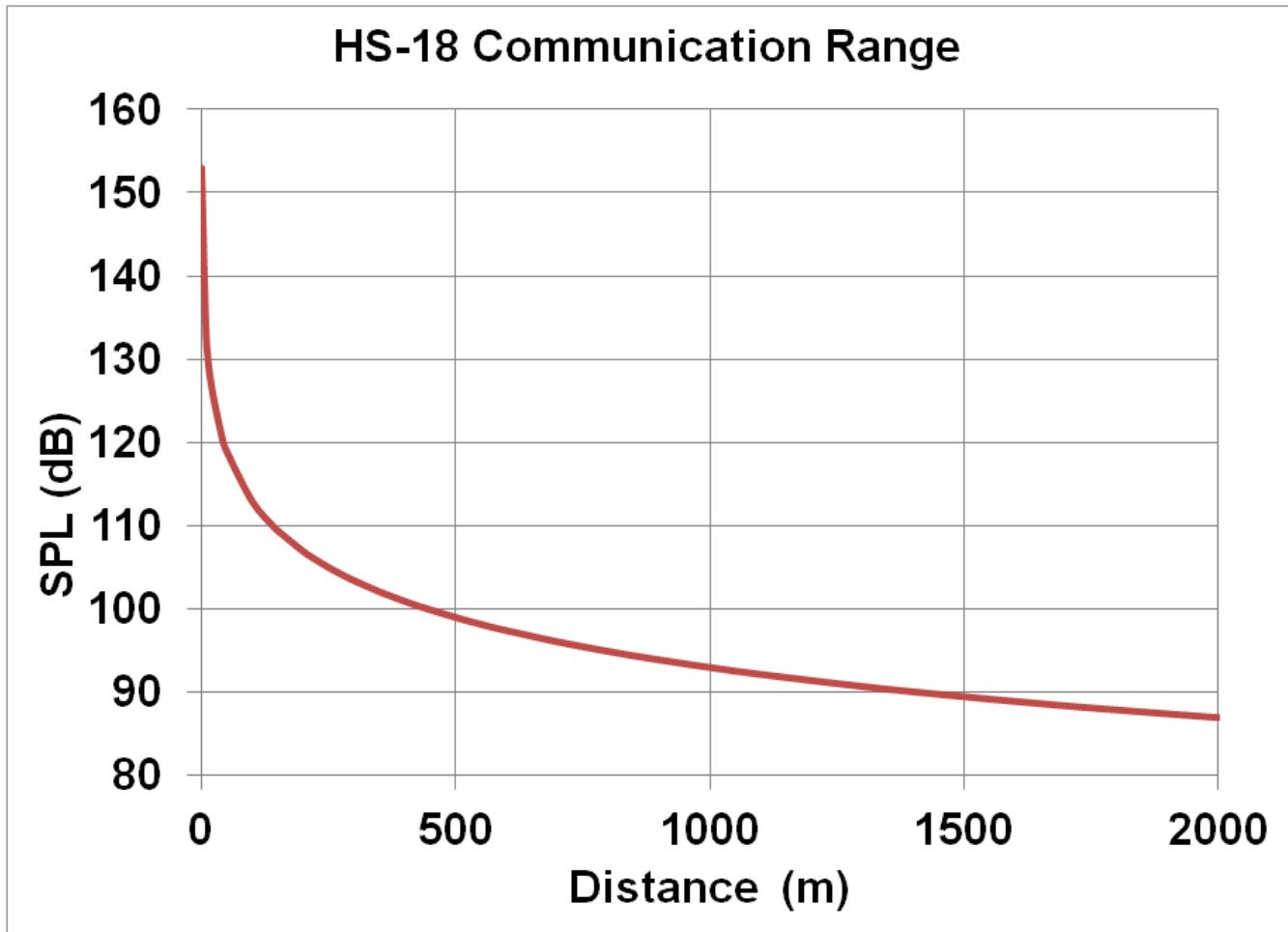


Figure 1.4-2 HS-18 Communication Range

### 1.5. Audio Inputs and Electrical Specifications

HS-18 INPUTS	
Dynamic Mic Level	600-1 k $\Omega$ , balanced twisted pair
Line Level Input	0 dBV (1.0 V <sub>RMS</sub> )
MP3 Player	Waterproof
Hi/Low Switch Limits	156 dB/130 dB
HS-18 ELECTRICAL SPECIFICATIONS	
Power Input	100-250 VAC
Frequency	50/60 Hz
Typical Current Draw, Normal Voice	2.4 Amps, 120 V
Typical Current Draw, Maximum Tone	6.0 Amps, 120 V

Figure 1.5-1 HS-18 Electrical Specifications

## 2.0 PREPARATION FOR USE

### 2.1. HS-18 Layout Overview

Before operating the HS-18, become familiar with the HS-18 control panel and review the unit and all included accessories, ensuring no damage has occurred during shipping. If parts are missing or damaged, or become damaged at a later date, refer to the warranty information in section 12.0 to obtain replacement parts or service.

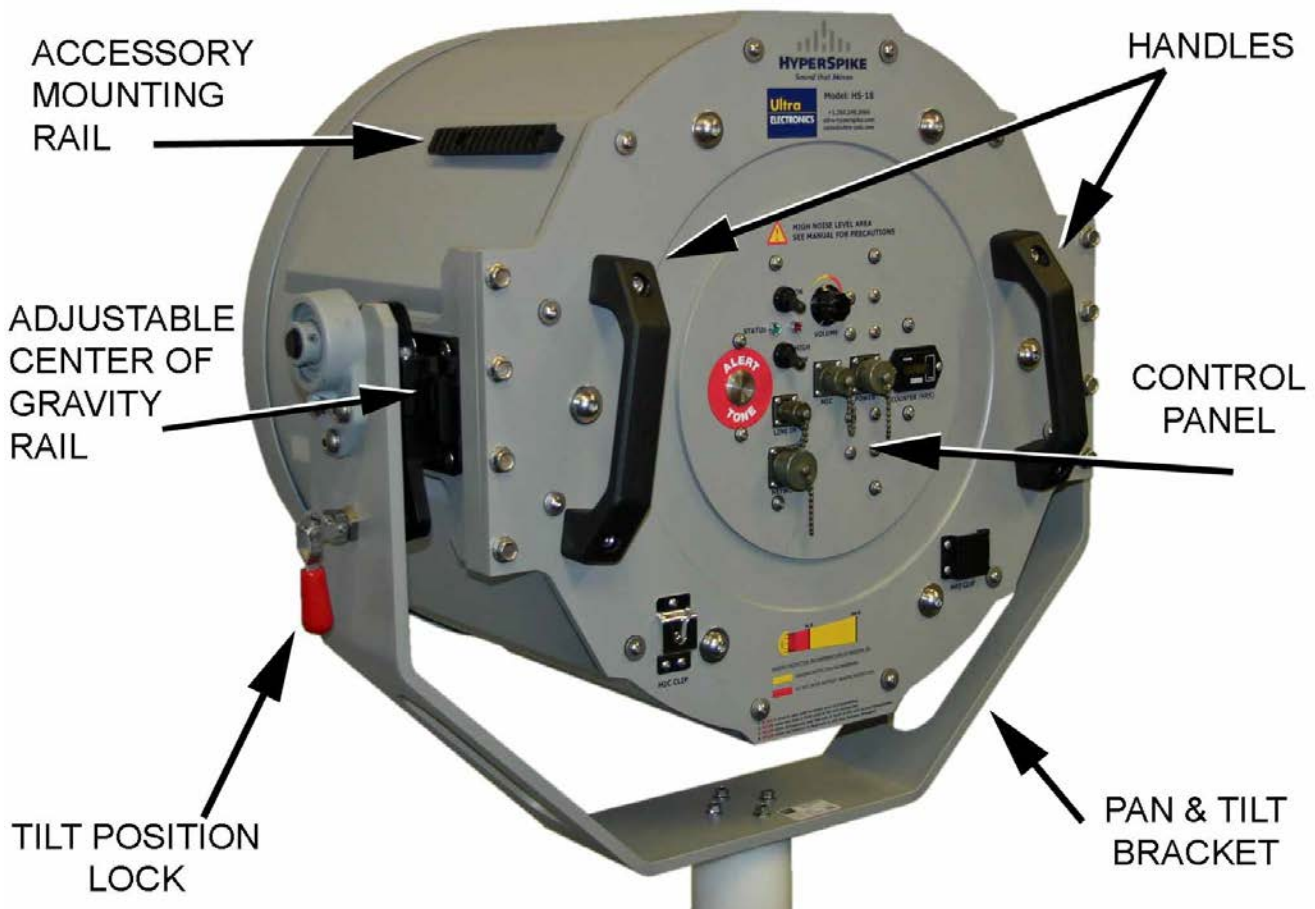
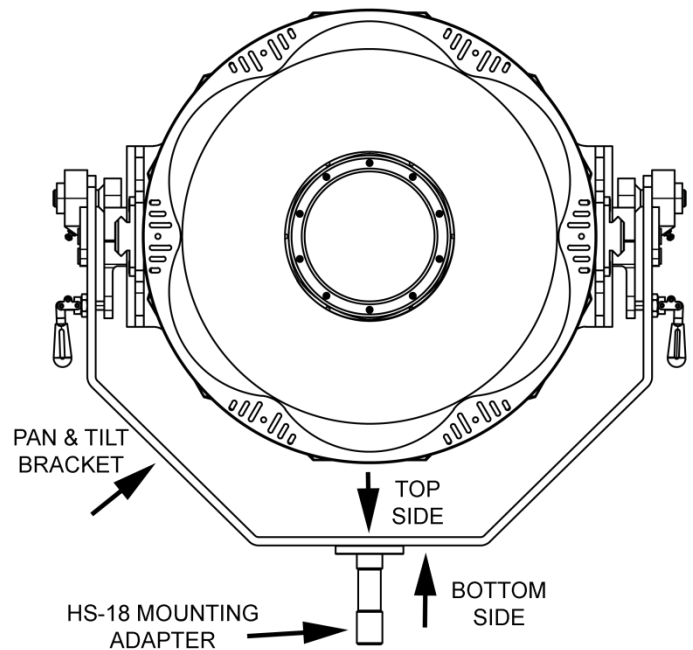


Figure 2.1-1 HS-18 Features

## 2.2. Installation of Mounting Adapter

The HS-18 is shipped with the Pan & Tilt bracket installed. In order to use the HS-18 with a tripod, ship rail clamp or other mounting platform, the HS-18 mounting adapter, which is provided, must be installed.

1. Tools needed are: one torque wrench and a 3/8" socket.
2. Locate mounting adapter and four 1/4"-20 flange head cap screws.
3. Position the mounting adapter on the bottom of Pan & Tilt bracket as shown in Figure 2.2-1 ensuring that the holes line up with the holes in the Pan & Tilt bracket.
4. Insert the screws into holes from top side of the Pan & Tilt bracket.
5. Tighten screws to a torque of 180 in-lbs.



**Figure 2.2-1 Mounting Adapter Installation**

## 2.3. Accessory Mounting Installation

Two Picatinny rails are located on the top of the HS-18 for easy mounting of accessories such as searchlights, lasers, range finders etc. Following the instructions from the accessory manufacturer, install desired accessories. Perform center of gravity adjustment in Section 2.4 if HS-18 is no longer parallel with the ground after accessories are installed.

## 2.4. Center of Gravity Adjustment

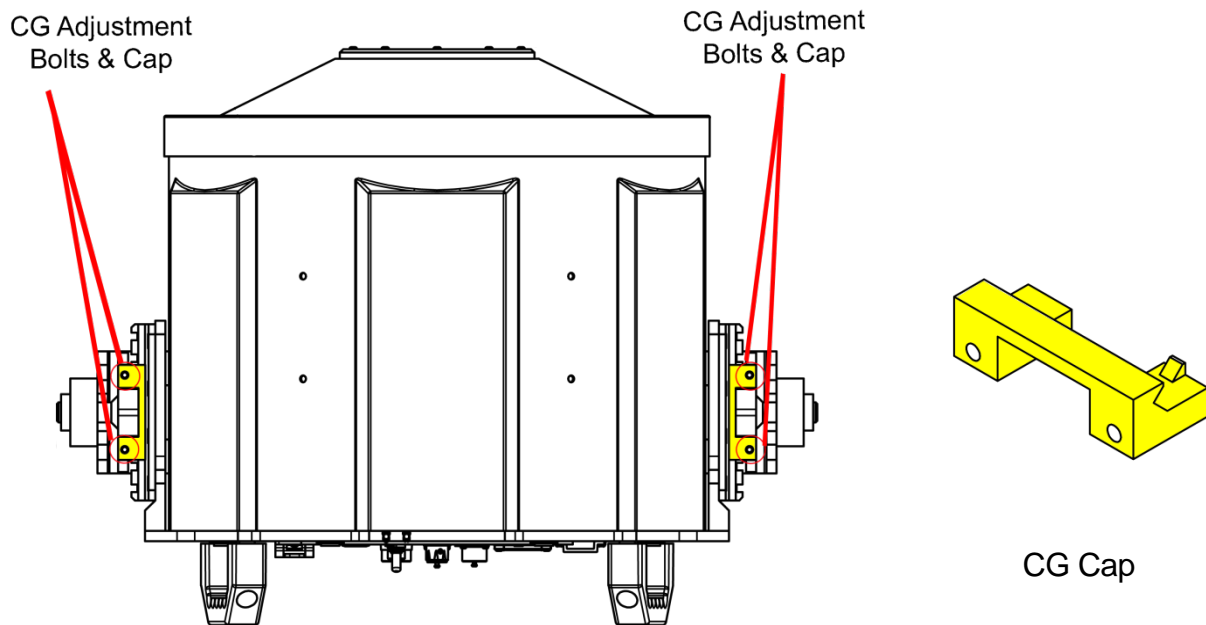
The HS-18 is equipped with a center of gravity or tilt adjustment. The HS-18 is shipped with its center of gravity adjusted so that the HS-18, without accessories, rests parallel to the ground. If the HS-18 is pointing up or down significantly, then the center of gravity should be adjusted to facilitate easy targeting and tracking movement.

To adjust the center of gravity, perform the following steps:

1. Tools needed are: 3/16" Allen wrench
2. Lock the HS-18 in place using the Tilt Position Lock so that the HS-18 is in a horizontal position.
3. Locate the four 1/4" socket head cap CG adjustment bolts as shown in the HS-18 top view of Figure 2.4-1.
4. Loosen and remove the four CG adjustment bolts using the Allen wrench.

**Note:** The HS-18 is now loose and is able to come off the CG rail.

**DO NOT remove the HS-18 from the rails.**



**Figure 2.4-1 Top View, CG Adjustment Bolts**

5. Remove the CG Caps.
6. Slide the HS-18 forward or backwards, on the rail, to balance the tilt so the HS-18 rests horizontally with ground or rests with minimal tilt.
7. Replace the CG Caps.
8. Insert CG adjustment bolts back into the holes and tighten. If the bolts do not easily slide into the holes, reposition the HS-18 until bolts slide into the hole.
9. Unlock the Tilt Position Lock.
10. Verify that the HS-18 is horizontal with the ground.
11. If necessary, repeat steps 2-8 if further adjustment is needed.

## 2.5. Installation with Tripod

1. Set the tripod up on a firm, level surface.
2. Ensure that the tripod cannot be knocked over by wind gusts or movement of vehicle for shipboard applications.
3. Lift the HS-18 onto the tripod and insert the mounting stud into tripod receiver.
4. Ensure the HS-18 and tripod is secure by tightening any locking levers.

### **WARNING:**

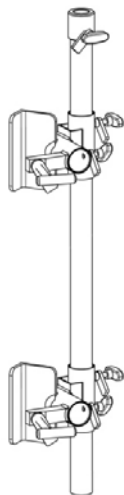
**PERSONNEL INJURY MAY OCCUR  
THE HS-18 MAY TIP OVER OR FALL FROM WIND GUSTS OR PLATFORM MOVEMENT**

Always secure the HS-18 to the intended mounting device  
Never leave the unit unattended without being secured

## 2.6. Installation with Ship Rail Mount

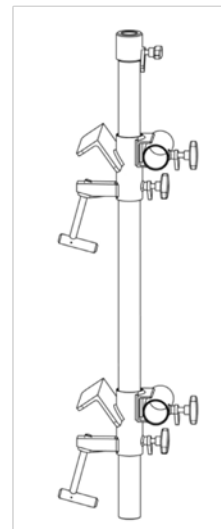
For installations on a rail:

1. Attach the Rail Mount vertically by loosening the Rail Mount flanges and placing the Rail Mount bars in a vertical position as shown in Figure 2.6-1.
2. Attach the Rail Mount horizontally by loosening the Rail Mount flanges and placing the Rail Mount bars in a horizontal position as shown in Figure 2.6-2.
3. Lift the HS-18 and insert the HS-18 mounting adapter into the Rail Mount receiver.
4. Ensure the HS-18 is secure by tightening the Rail Mount locking lever.



**Figure 2.6-1 Vertical Rail Mount**

**Note:** The rail mount can attach to any pipe rail or vertical stanchion that is a standard 2-inch (5 cm) or smaller.



**Figure 2.6-2 Horizontal Rail Mount**



## 2.7. Control Panel Connections

To prepare the unit for operation, perform the following:

1. Review the HS-18 control panel in Figure 2.7-1.

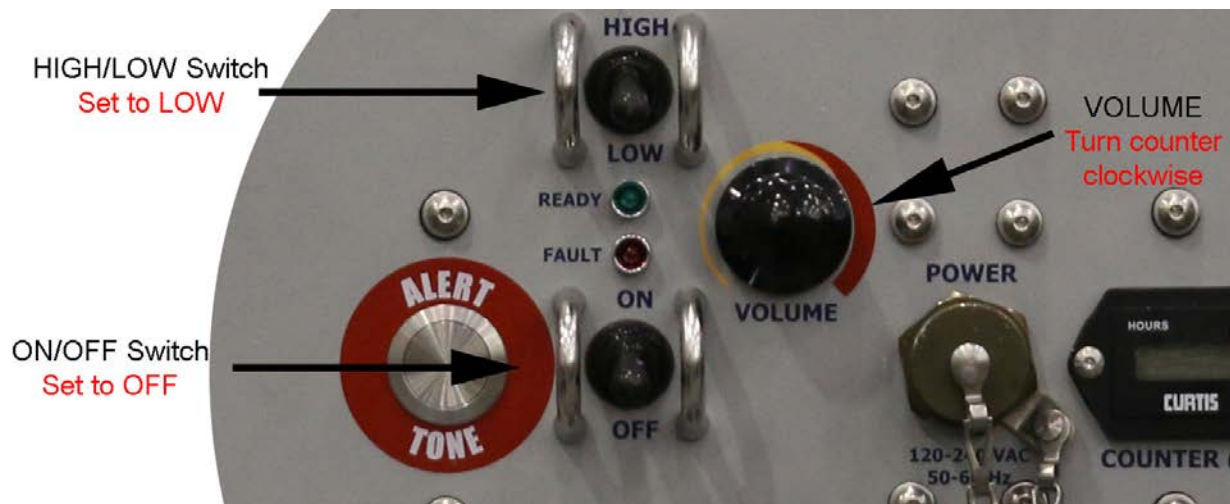


Figure 2.7-1 HS-18 Control Panel

2. Set the unit POWER switch to OFF.
3. Set the mode switch to LOW.
4. Set the VOLUME to zero.
5. Connect the AC power cable to a 100-250 VAC (50-60Hz) power source.
6. Connect the microphone cable to the Mic connector on the control panel.
7. If using pre-recorded messages, connect the MP3 player or other device to the Line In connector on the control panel.

**Note:** Each cable has a different size canon plug connector and will only connect to its respective connector on the unit.

### 3.0 PRINCIPLES OF OPERATION

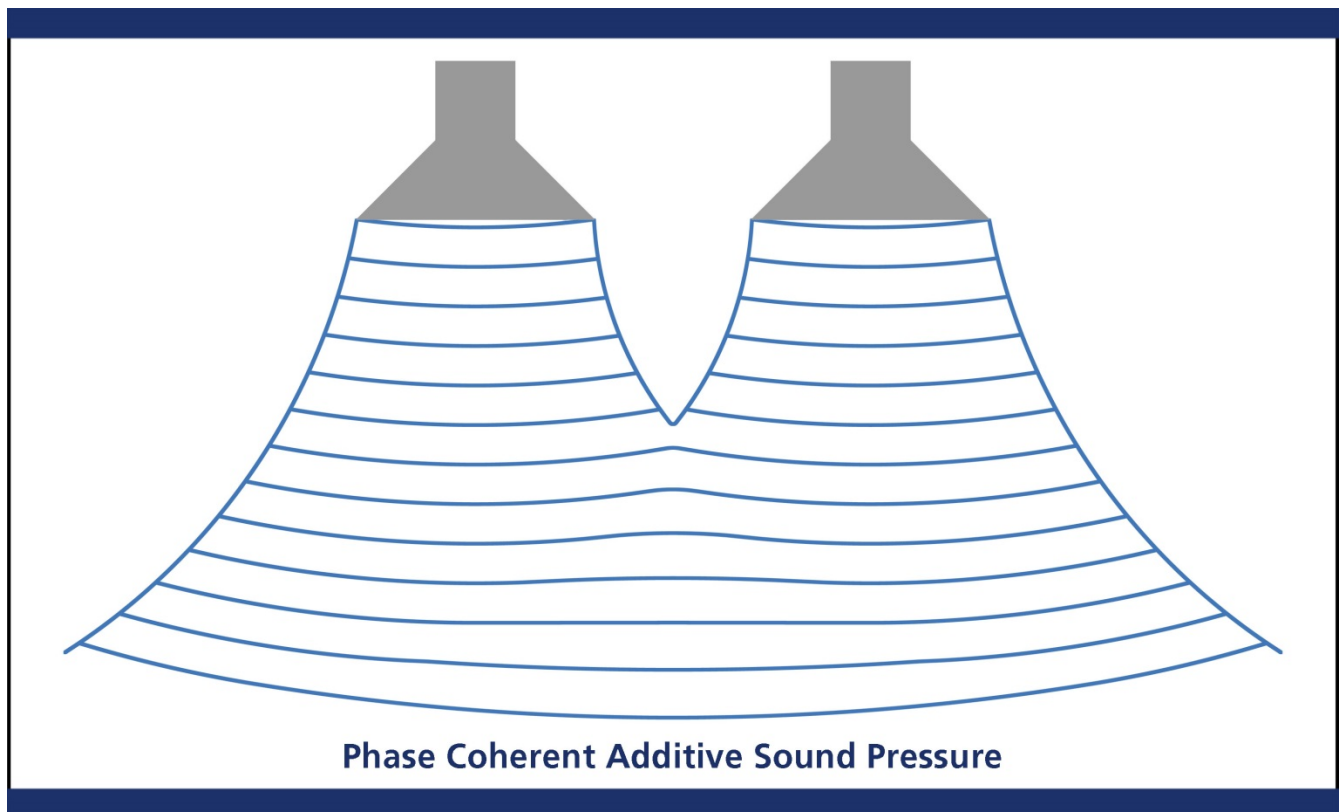
This section describes the HS-18's technology and theory of operation.

#### 3.1. Theory of Operation

The patented HS-18 acoustic hailing device projects focused audio energy at very high sound pressure levels with high intelligibility and clarity.

Utilizing a radial time-phased array of high-efficiency, wide band transducers, the HS-18 coherently sums all frequency bands of the transducers. The result is an acoustic beam that is perfectly in-phase; eliminating the usual destructive interference of adjacent device wave propagation and thus provides extremely low harmonic distortion levels, typically below 1%. Refer to Figure 3.1-1 for a depiction of the collimated sound beam as generated by the HS-18.

The result is that audio energy can be transmitted at even greater distances, with incredible clarity, far exceeding the performance of standard speaker systems.



**Figure 3.1-1 Coherently Summed Frequencies with Waveguide**

### 3.2. Sound Pressure Level (SPL)

Acoustic devices produce sound pressure levels (SPL) that are measured in units called Pascals. SPL is typically referenced to 20 micro Pascals ( $\mu\text{Pa}$ ). Therefore, an SPL measurement in dB is calculated by the following formula:

$$\text{SPL FORMULA: } \text{SPL (dB)} = 20 \times \log_{10} (\text{Sound Pressure Measured} / 20 \mu\text{Pa})$$

The HS-18 is capable of producing audio tones and messages at 156 dB SPL @ 1 meter. Referencing SPL levels @ 1 meter is simply a convention that is used so that it is easy to compare equipment from various manufacturers.

While atmospheric conditions can affect the outcome, determining the SPL at other distances can be performed by using the conventional “1 meter” reference typically found on data sheets and the following equation:

$$\text{SPL DISTANCE EQUATION: } \text{SPL @ Distance A meters} = \text{SPL @ 1 meter} - 20 \times \text{Log}_{10}(\text{Distance A})$$

As a reference, common sound pressure levels for various devices can be found in Figure 3.2-1.

Source of Sound	Sound Pressure Level	SPL Effect
Jet Engine at 50 meters	140 dB	Conversation inaudible
Threshold of Hearing Damage	130 dB	
Threshold of Pain	120 dB	
Siren, Chainsaw	110 dB	
Jackhammer	100 dB	Conversation barely audible
Thunder, Diesel Truck	90 dB	
Machine Shop	80 dB	Must speak loudly
Vacuum cleaner, Hair Dryer	70 dB	
Normal Talking	40 - 60 dB	Normal conversation
Quiet Library	40 dB	

Figure 3.2-1 Examples of Sound Pressure Level

### 3.3. Environmental Factors

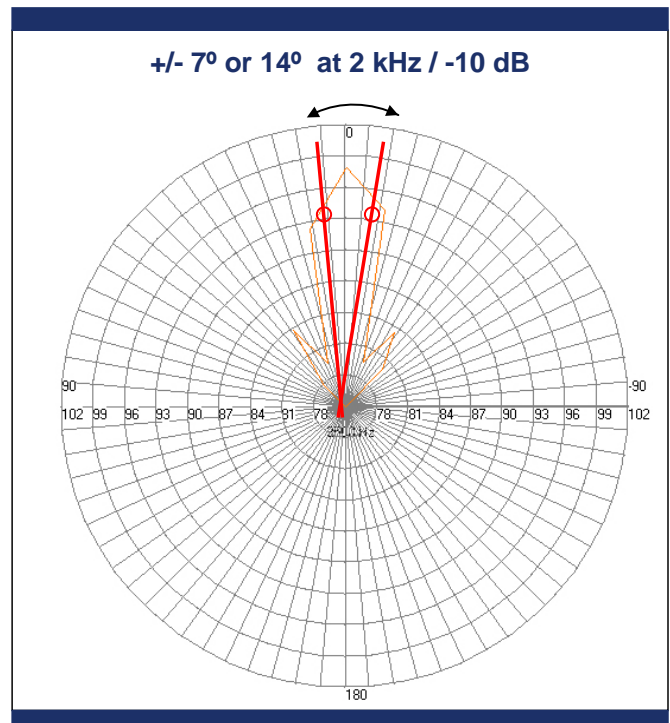
The environment can have a significant impact on SPL readings at the intended range. Refer to Figure 1.4-2 for the typical communication range of the HS-18 for ambient environmental conditions. Wind can easily add or subtract 3 to 6 dB of sound pressure, depending if the wind is a head wind or rear wind. Sound also bends with temperature gradients. Hot ground planes can bend sound upwards for example. Acoustically reflective surfaces can create multi-path conditions that can be either constructive (add SPL) or deconstructive (subtract SPL). These variables are very difficult to

predict in an ad hoc test set up, but can easily create up to 10 dB of variability in what may otherwise seem like fairly benign conditions. It is worth noting that high frequencies are more easily affected by environmental effects, however, lower frequencies, such as voice messages, are less affected.

### 3.4. Beam Width

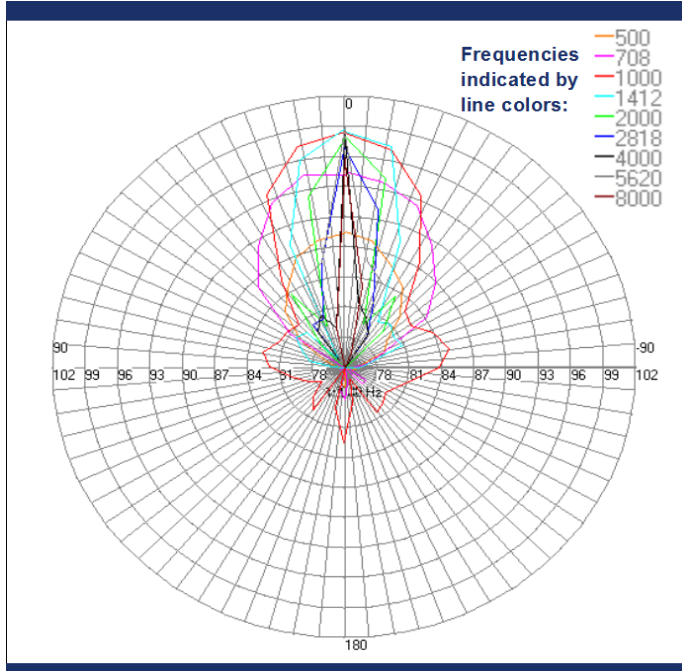
Unlike many public address systems, the HyperSpike® acoustic hailing devices have a narrow beam width. Polar plots (two dimensional) provide a basic understanding of the radiation pattern of an acoustic device and are common tools used to determine the beam width of an acoustic device. A polar plot describes the response of the speaker as it rotates around its axis. The most common polar plots are the horizontal and vertical responses.

A typical polar plot for a directional HyperSpike® product is found in Figure 3.4-1. It is important to note that any acoustic source will have varying polar responses depending upon the frequency measured. For this reason, the frequency being measured accompanies beam width specifications whenever they are provided.



**Figure 3.4-1 Typical Polar Plot**

Since the human voice is made up of many frequencies and harmonics, Figure 3.4-2 provides a more comprehensive view into how the HS-18 functions at varying frequencies. The polar plot in Figure 3.4-2 shows the radiation pattern of nine frequencies ranging from a low frequency of 500 Hz to the very high frequency of 8000 Hz.



**Figure 3.4-2 Multi-frequency Polar Plot**

## 4.0 NORMAL OPERATIONS

Once the HS-18 has been installed or positioned in place, use the following procedures to operate the HS-18.

### 4.1. Initial Testing

To confirm the unit is functioning properly, follow these basic steps:

1. Prepare the unit for use as described in Section 2.0.
2. Ensure the area in front of the HS-18 is clear and the operator is wearing ear protection.
3. Ensure the VOLUME control is set to the lowest volume by turning the knob counter clockwise.
4. Turn the POWER switch to ON.
5. Press and hold the ALERT TONE button.
6. Gradually turn the VOLUME control clockwise until alert tone is heard by operator.
7. If the alert tone is not heard, refer to troubleshooting in Section 5.0.

### 4.2. HS-18 Operating Instructions

Select the device to broadcast (MP3 player, Alert Tone, or Microphone). Depending upon the situation or protocol, you may want to initially broadcast in Low volume mode. Point the device toward the intended target and broadcast the desired message.

If you do not gain compliance or acknowledgement from your target, increase the volume by turning the knob clockwise and/or switch to “High” output mode.

If transmitting into a cross wind, direct your target to an up wind position. Winds from the left will blow the acoustic beam to the right as illustrated in Figure 4.2-1. Winds from the right will blow the acoustic beam to the left.

Winds that generate from the rear of the unit will enhance the acoustic range whereas winds that generate from the front of unit will reduce the HS-18’s acoustic range. Below are typical wind speeds and their likely effects:

- 0-3 mph: Wind hardly felt, but smoke drifts
- 3-5 mph: Wind felt lightly on the face
- 5-8 mph: Leaves are kept in constant movement
- 8-12 mph: Raises dust and loose paper
- 12-15 mph: Causes small trees to sway

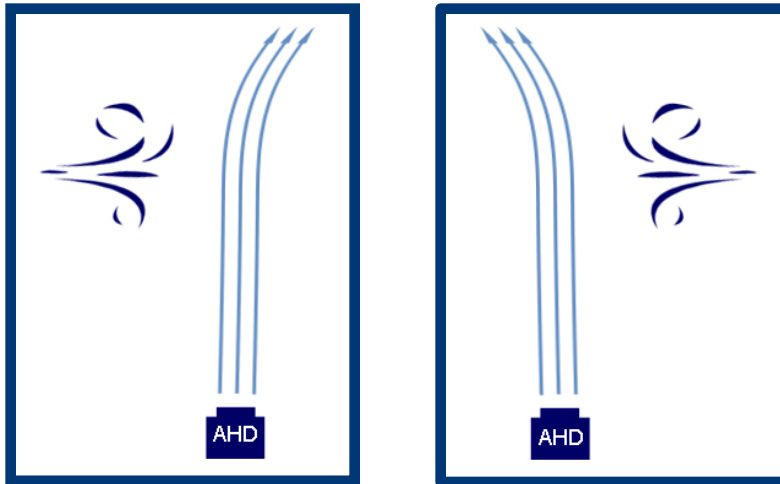


Figure 4.2-1 Impact of Wind on HS-18 Acoustic Beam

### 4.3. Alert Tone Feature

Used to quickly gain the attention of an intended target, the embedded alert tone can be initiated by pressing the button shown in Figure 4.3-1. The high frequency alert tone is emitted as long as the button is depressed.



Figure 4.3-1 Alert Tone Button

### 4.4. Microphone Operation

Place the microphone close to your mouth so that your top lip rests on the rubber bumper. Press and hold the transmit button to talk. For best results, speak loudly and clearly into the microphone.

**CAUTION:**  
Equipment damage may occur  
Audio feedback may occur when using a live microphone

Always operate the microphone directly behind the HS-18

### 4.5. MP3 Player Operations

To transmit pre-recorded voice messages and tones, select desired message from Menu and press the MP3 play button.

**NOTE:** Ensure the MP3 volume is set to maximum output. Failure to do so will result in less than maximum HS-18 volume output.



## 5.0 CORRECTIVE MAINTENANCE & TROUBLESHOOTING

### 5.1. Status Indicators

Status indicators built into the HS-18 guide the operator in troubleshooting the device. When power is initially applied to the HS-18, the red and green status indicators, shown in Figure 5.1-1 will momentarily flash while the HS-18 initializes. If the HS-18 is properly initialized and ready for use, the green indicator will remain lit while the red indicator will not. If there is a problem with the HS-18, the chart shown in Figure 5.1-2 can be used to determine the problem.



Figure 5.1-1 HS-18 Status Indicators

Green	Red	Action
On	Off	Ready for use
Off	Off	Check power to HS-18
On flashing	On flashing	Replace amplifier card or power supply
On	Stays On after power-up	Check for shorted transducers or replace DSP card
On	On during broadcast	Excessive heat. Turn off power. Wait 30 minutes to cool.

Figure 5.1-2 Troubleshooting Guide



## 5.2. Incoming Power (Green = Off, Red = Off)

Power is not present at the HS-18. Follow these steps:

1. Confirm that the AC power cable is plugged into a 100-250 VAC/50/60Hz power source.
2. Confirm VAC power is available at outlet.
3. Check power cord pins and HS-18 power connector for missing pins or damage.
4. Confirm power is available through the power cord.
5. Reconnect the power cable to the HS-18 connector. Turn on HS-18 to see if problem is solved.
6. If problem is not resolved, call for technical support or send unit back to manufacturer for repair. See Section 12.0 for warranty information and return instructions.

## 5.3. Amplifier/Power Supply Malfunction (Green = Flashing On, Red = Flashing On)

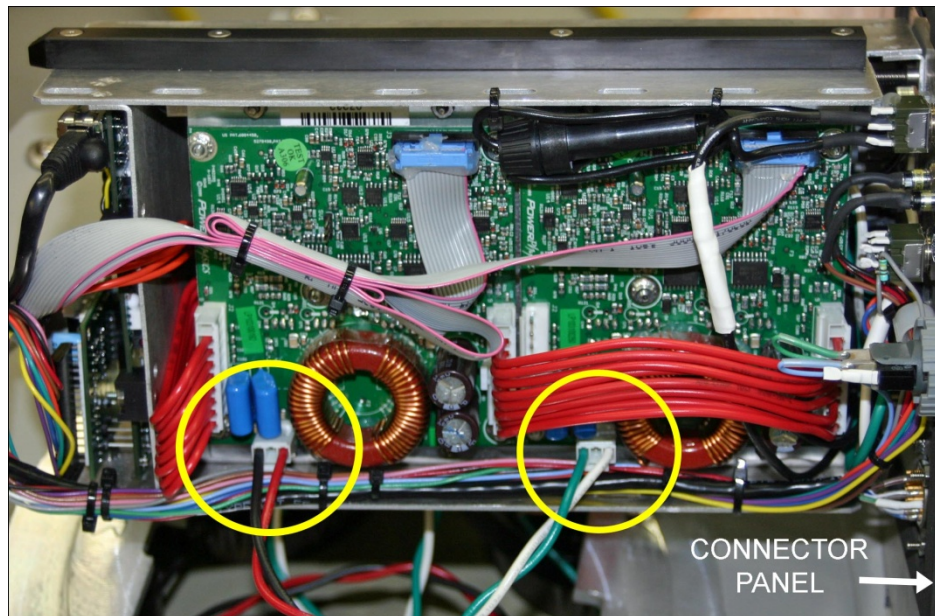
The amplifier or power supply has malfunctioned. If the lights flash once then only one of the two components has failed. If the lights flash twice then both components have failed. Troubleshooting should only be done by factory approved technicians. If one or both components have failed, then total replacement of the electronics assembly is recommended. To replace the electronics assembly, follow these steps below. Materials required are 1/8" wrench and a 1/4" socket drive.

1. Disconnect MP3, microphone and power cables from the back of the HS-18.
2. Remove the eight 8-32 button head screws from the connector panel on the back of HS-18 using the 1/8" Allen wrench, see Figure 5.3-1.



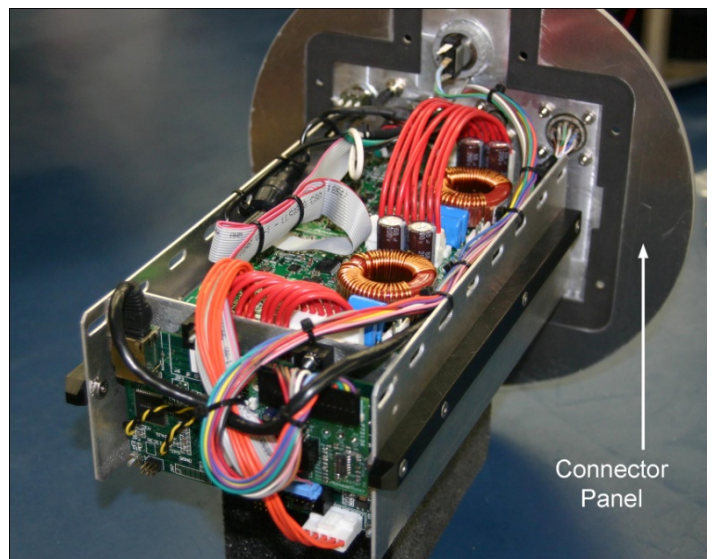
Figure 5.3-1 Button Head Screws

3. Slide the connector plate from the HS-18 to expose the HS-18 electronics module.
4. Disconnect the two header connectors shown in Figure 5.3-2.



**Figure 5.3-2 Header Connectors**

5. Completely remove the electronics module from the HS-18 unit as shown in Figure 5.3-3.
6. Using the replacement electronics module, reconnect the header connectors ensuring the connector with green and white wires are connected to the header closest to the connector panel.
7. Insert replacement electronics module by sliding back into HS-18.
8. Insert the eight 8-32 button head screws into the connector panel and torque to 25 in-lbs. using the 1/8" Allen wrench.
9. Connect the AC Power cable to the Power connector located on the back of the HS-18 and connect the AC Power cord plug to a 100-250 VAC/50/60Hz power source.



**Figure 5.3-3 HS-18 Electronics Module**

10. Power on the HS-18 and wait 15 seconds for the HS-18 to initialize. If the problem has been resolved, the green status indicator should be lit and the red status indicator should be off.
11. If the problem has not been resolved, call for technical support or send unit back to manufacturer for repair. See Section 12.0 for warranty information and return instructions.

#### 5.4. Shorted Transducers or DSP Malfunction (Green = On, Red = On)

Either one of the transducers is shorted to ground or the DSP card has malfunctioned. To verify if a transducer is shorted to ground follow steps 1 thru 5, then steps 17 thru 23 below. To replace the DSP card, follow steps 1 thru 16 below. Materials required are a digital multi-meter, 1/8" Allen wrench and ¼" socket.

1. Disconnect MP3, microphone and power cables from the back of the HS-18.
2. Remove the eight 8-32 button head screws from the connector panel on the back of HS-18 using the 1/8" wrench, see Figure 5.4-1 below.



Figure 5.4-1 Button Head Screws on Connector Panel

3. Slide the connector plate from the HS-18 to expose the HS-18 electronics module.



4. Disconnect the two header connectors shown in Figure 5.4-2.

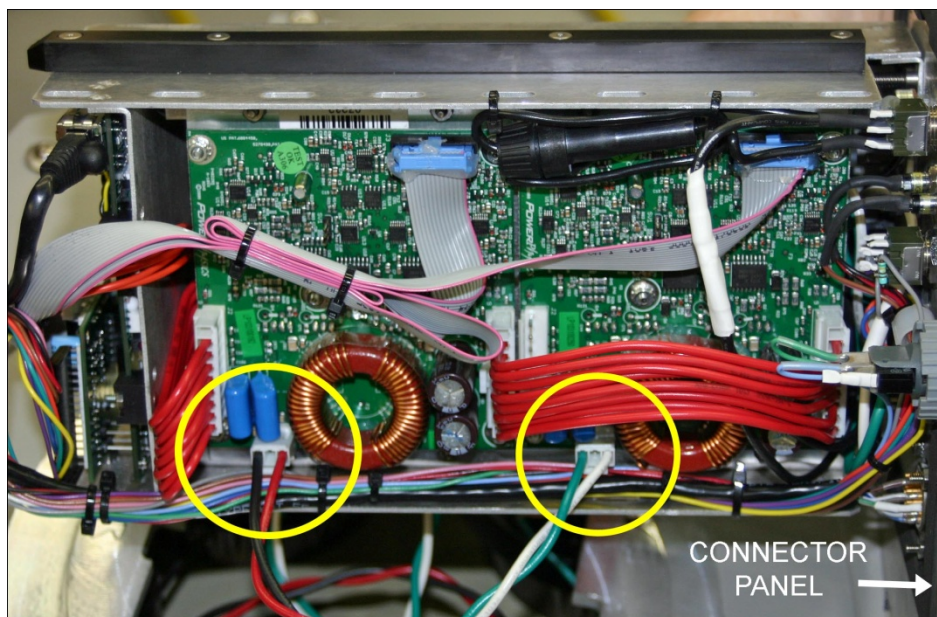


Figure 5.4-2 Header Connectors

5. Completely remove the electronics module from the HS-18 unit as shown in Figure 5.4-3.

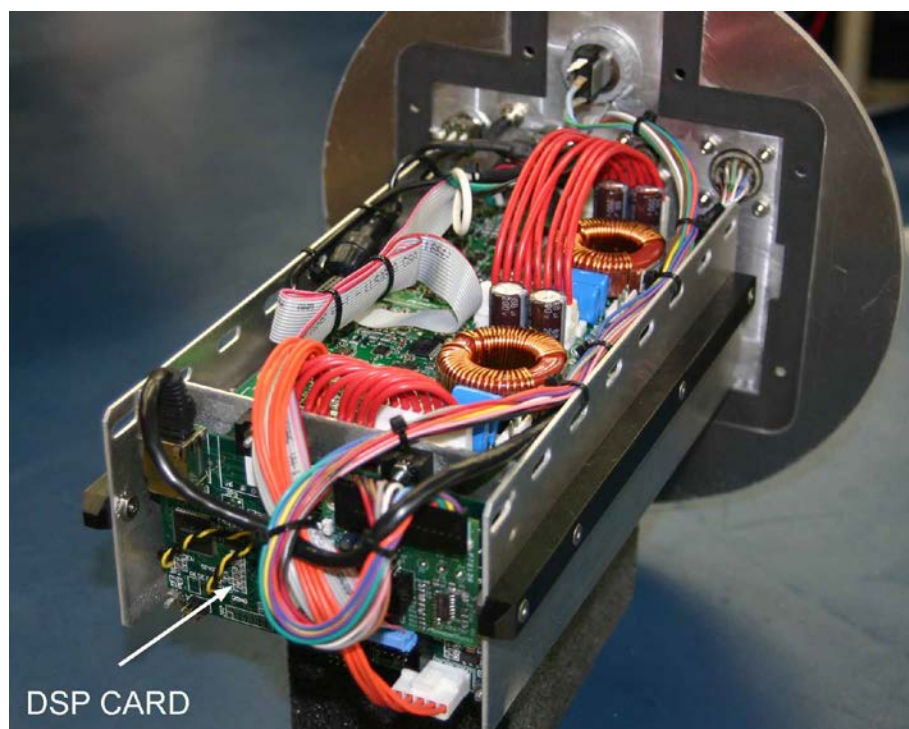
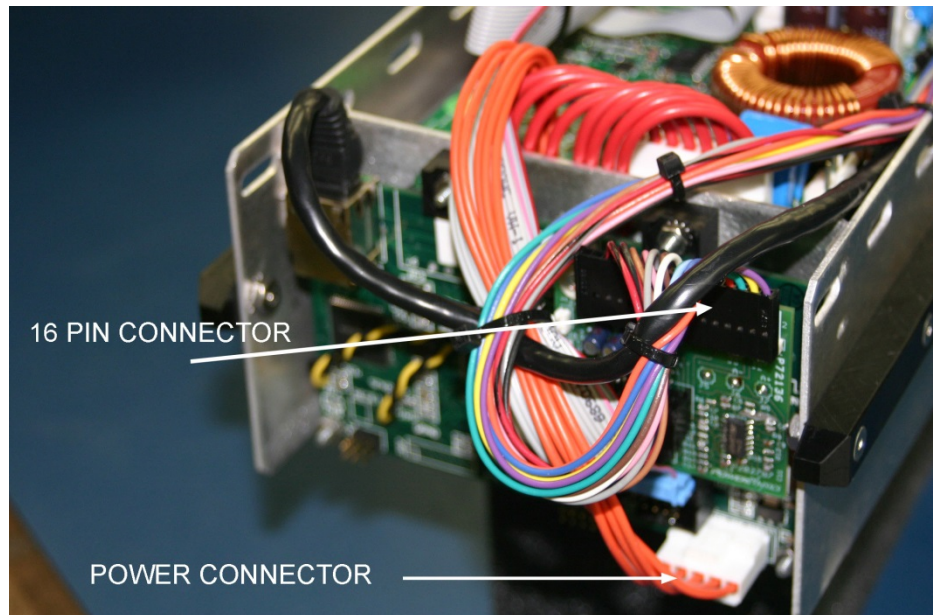


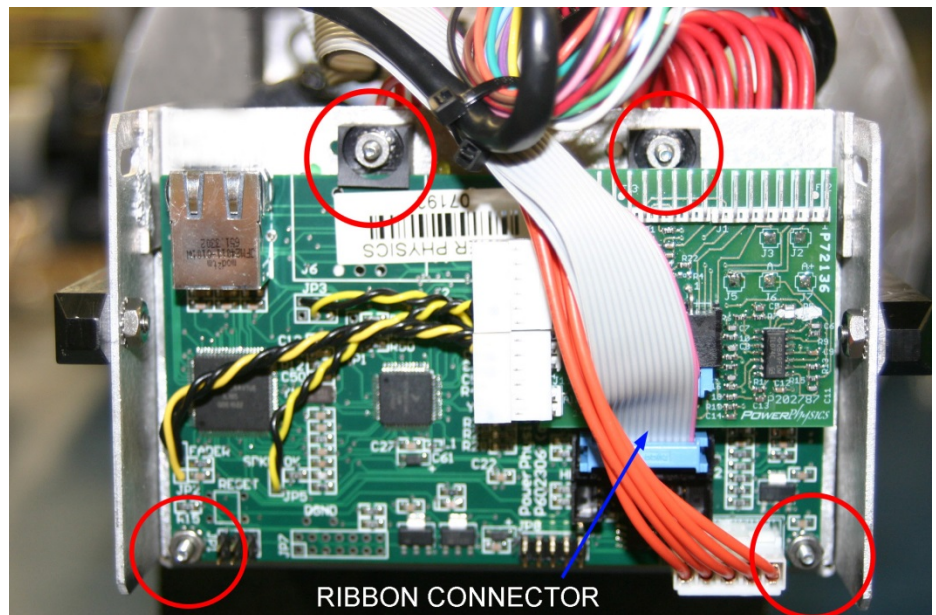
Figure 5.4-3 HS-18 Electronics Module

6. Referring to Figure 5.4-4 and Figure 5.4-5, disconnect the ribbon connectors (x 2), power connector and 16 pin connector; noting the orientation of the 16 pin connector.



**Figure 5.4-4 Remove Connectors from DSP Card**

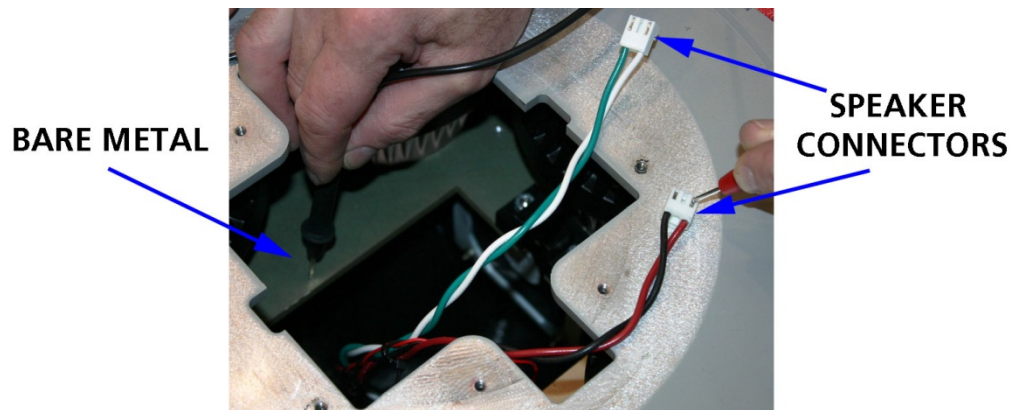
7. Using the ¼" socket drive, remove the four 4-40 lock nuts shown in Figure 5.4-5.
8. Remove the DSP card from the stand-off posts.
9. Insert the replacement DSP card as shown in Figure 5.4-5, reusing the black spacers from the previous DSP.
10. Place the four lock nuts on the stand-off posts and torque to 3.5 in-lbs.
11. Reconnect the ribbon connectors (x2), power connector, and 16 pin connector to the DSP card.
12. Reconnect the header connectors according to Figure 5.4-2 ensuring the connector with green and white wires is connected to the header closest to the connector panel.



**Figure 5.4-5 Remove Lock Nuts from Posts**



13. Slide electronics module back into HS-18.
14. Insert the eight 8-32 button head screws into the connector panel and torque to 25 in-lbs. using the 1/8" wrench.
15. Connect the AC Power cable to the Power connector located on the back of the HS-18 and connect the AC Power cord plug to a 100-250 VAC/50/60Hz power source.
16. Power on the HS-18 and wait 15 seconds for the HS-18 to initialize. If the problem has been resolved, the green status indicator should be lit and the red status indicator should be off.
17. To check whether a speaker is shorted to ground, with the electronics removed, use a digital multi-meter to check for continuity between each of the four speaker terminals to the bare metal of the speaker plate. (Figure 5.4-6) If a connection exists, follow the instructions below to identify the location of the short. If a connection does not exist, then proceed to replace DSP.



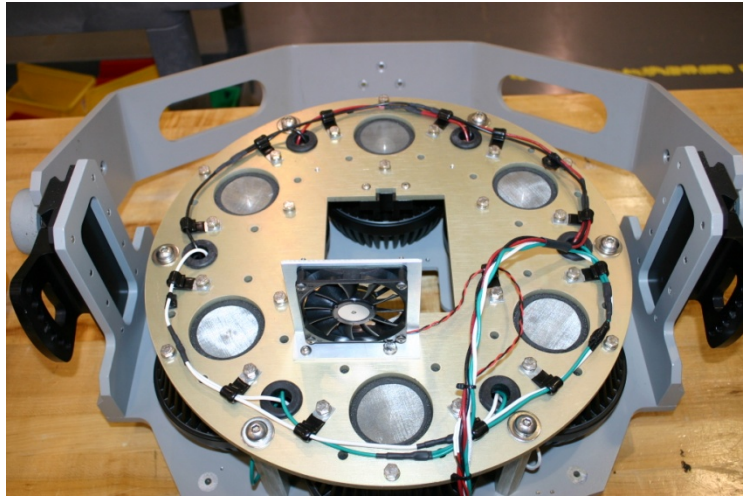
**Figure 5.4-6 Speaker Continuity Check**

18. If a connection does exist between the speaker plate and the speaker terminals, remove the screws that connect the housing to the back plate assembly (Figure 5.4-7), and then remove the back plate assembly from the housing.



**Figure 5.4-7 Backplate Screw Locations**

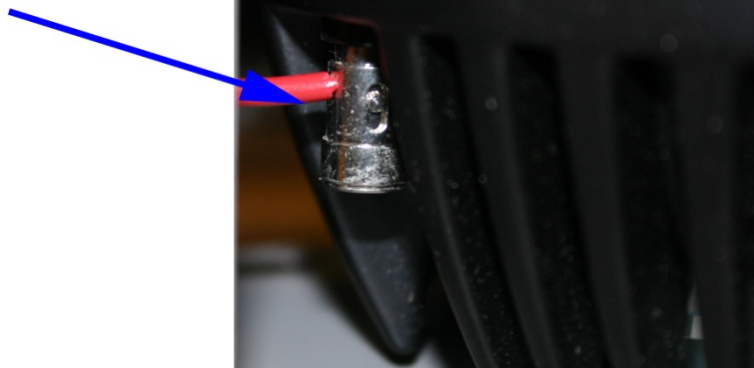
19. Place the back plate assembly on its handles on a table with the speaker openings facing up. (Figure 5.4-8)



**Figure 5.4-8 HS-18 Laying with Drivers Facing Up**

20. Identify the terminal that was shorted to ground and follow it to the first speaker, then unplug the wire from the speaker by pushing up on the terminal while pulling the wire out. (Figure 5.4-9)

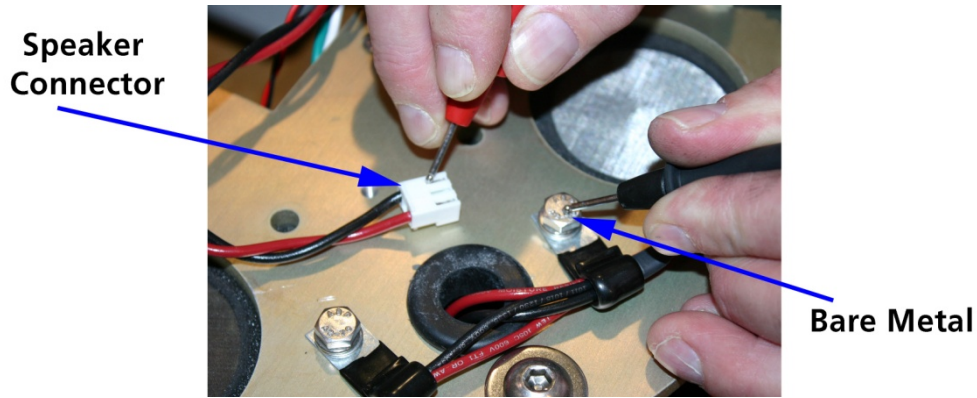
**Speaker Terminal**



**Figure 5.4-9 HS-18 Speaker Terminal**



21. Check continuity again from the connector to the speaker plate. (Figure 5.4-10) If the connection no longer exists, then follow instructions in Section 5.6 and replace the speaker. If the connection does still exist, then proceed to perform the same function on the next speaker in line, until all three speakers have been unplugged.



**Figure 5.4-10 Continuity Check**

22. If connection still exists when all speakers are unplugged, then check wiring for nicks or cuts and repair with heat shrink or electrical tape. If the damage is severe, contact the manufacturer for further repair instructions.
23. Repeat steps 20 thru 22 for other terminals that were shorted to ground.
24. If the problem has not been resolved, call for technical support or return to manufacturer for repair. See Section 12.0 for warranty information and return instructions.

### **5.5. Excessive Heat (Green = On, Red = On only During Broadcast of Message)**

Status indicators indicate that excessive heat is present in the HS-18 device. Perform the following steps to determine if the HS-18 has been damaged.

1. Power off the HS-18 and wait 30 minutes.
2. Turn the HS-18 power on and broadcast a message, at the same volume when the error occurred.
3. If the red indicator turns on during the broadcast, repeat steps 1-2.
4. If after several attempts and the red indicator still illuminates during a broadcast, replace the amplifier assembly. See section 5.3.

### **5.6. Low or No Audio Output**

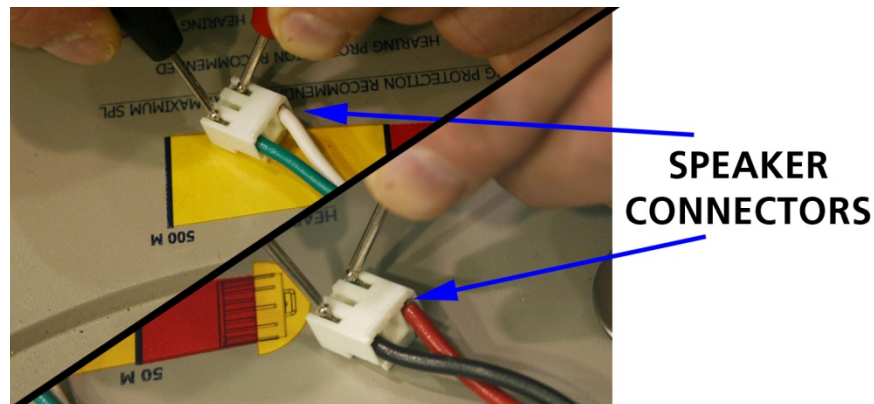
If audio messages are not being emitted, follow these steps:

1. Ensure that Power Switch is ON.
2. Ensure that 100 – 250 VAC is present at the outlet.
3. Ensure that Volume Level Control is above minimum.

4. If using a MP3 player, ensure the MP3 volume is set at maximum.
5. Ensure that the microphone is a dynamic microphone and not a condenser microphone.
6. If there is still no output, check all input cables for nicks, cuts, crimps or tears. Check all canon plugs for bent, missing or damaged pins.
7. If the problem has not been resolved, call for technical support or return to manufacturer for repair. See Section 12.0 for warranty information and return instructions.

If audio output is low, follow these steps:

1. Verify the High/Low switch is on High and the volume knob is all the way up.
2. If the output is still low, follow the instructions in Section 5.3 steps 1 thru 5 to remove the electronics from the speaker head.
3. Once electronics have been removed, check resistance of each speaker channel by placing the probes of a digital multi-meter on the back of the speaker terminals; resistance should be approximately 2.0 ohms. (Figure 5.6-1)



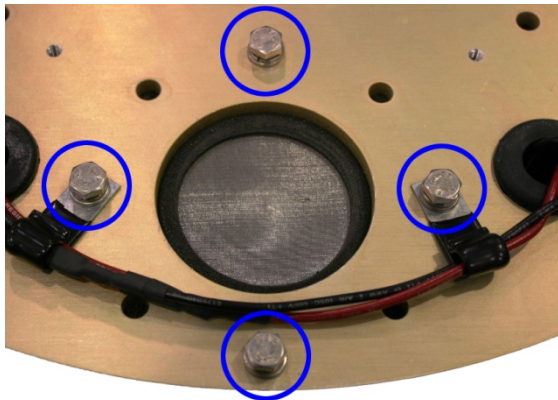
**Figure 5.6-1 HS-18 Resistance Check**

4. If resistance is more than 1.0 ohm higher or lower than 2.0 ohms, or if the channel is open or short, then follow the instructions below to trouble-shoot and replace speakers.
5. Remove the screws that attach the back plate assembly to the housing, (Figure 5.4-7) and then remove the back plate assembly from the housing.
6. Place the back plate assembly on its handles on a table, with the speaker openings facing up. (Figure 5.4-8)
7. To determine which transducers are bad, on the channel in question, remove the wires from the speaker terminals by pushing up on the terminal while pulling the wire out. (Figure 5.4-9)
8. Measure each speaker at the terminals to verify that it measures 5.8 to 6.0 ohms each. (Figure 5.6-2) If the speaker measures open or short, or measures more than 1.0 ohm different from 6.0 ohms, then the speaker should be replaced.

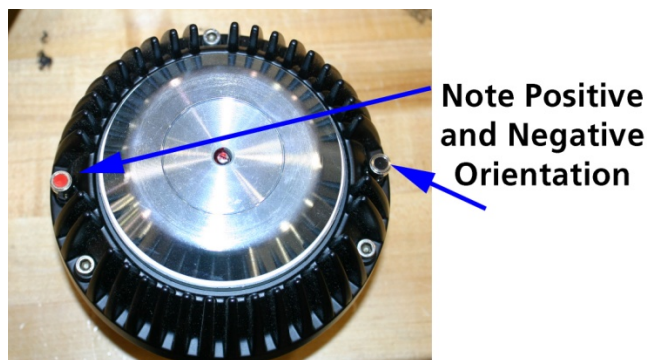


**Figure 5.6-2 HS-18 Speaker Resistance Test**

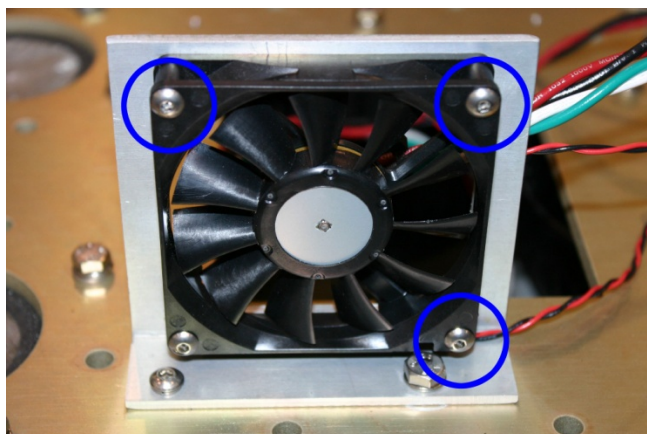
9. To replace a speaker, remove the four hex head bolts with a 10mm socket, noting the orientation of the speaker. (Figure 5.6-3 & Figure 5.6-4) If removing the speaker that is bolted through the fan assembly, remove the two top screws and the bottom right screw, then loosen the bottom left screw and rotate the fan out of the way. (Figure 5.6-5 & Figure 5.6-6)



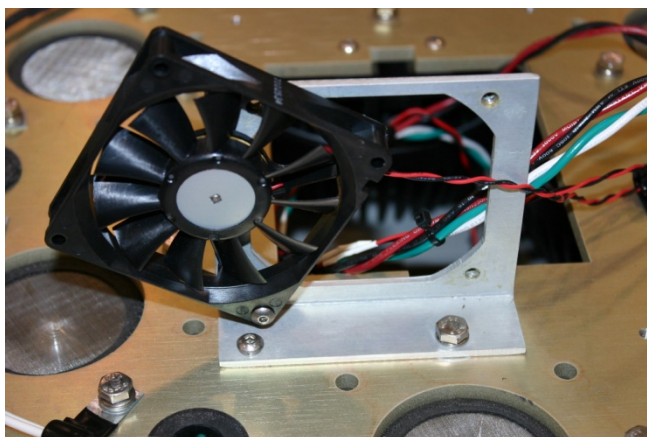
**Figure 5.6-3 HS-18 Speaker Bolt Locations**



**Figure 5.6-4 HS-18 Speaker Polarity**



**Figure 5.6-5 HS-18 Fan Screw Locations**



**Figure 5.6-6 HS-18 Fan Rotation**

10. Attach the red and black wires to the speaker terminals, and then slide the new speaker into position. (Figure 5.6-7)



**Figure 5.6-7 HS-18 Speaker Terminals**



11. Install the new speaker using the 10mm hex head bolts. Make sure that both washers are present on the bolt when reassembling. (Figure 5.6-8) Tighten to a torque of 50 in-lbs.



**Figure 5.6-8 HS-18 Speaker Bolt Components**

12. Once reassembled, repeat step 3 from above to verify that the channel in question measures the correct resistance.
13. With the nose of the housing facing down, carefully install the speaker assembly into the housing and secure with 12 screws to a torque of 35 in-lbs. (Figure 5.4-7)
14. Reconnect the header connectors according to Figure 5.4-2 ensuring the connector with green and white wires is connected to the header closest to the connector panel.
15. Slide electronics module back into HS-18.
16. Insert the eight 8-32 button head screws into the connector panel and torque to 25 in-lbs. using the 1/8" wrench.
17. Connect the AC Power cable to the Power connector located on the back of the HS-18 and connect the AC Power cord plug to a 100-250 VAC/50/60Hz power source.
18. Power on the HS-18 and wait 15 seconds for the HS-18 to initialize. If the problem has been resolved, the acoustic output of the HS-18 should be restored to full capacity.
19. If the problem has not been resolved, call for technical support or return to manufacturer for repair. See Section 12.0 for warranty information and return instructions.

If noise is being emitted instead of audio, the problem is most likely an individual device.

1. Individually unplug each device to see if the noise stops.
2. Speak into the microphone and play a message from the line level input devices separately to determine if a device is faulty.
3. The faulty device should be replaced.

## 5.7. Reference Pin-Outs

If there is a failure with the accessories, Figure 5.7-1, Figure 5.7-2 & Figure 5.7-3 provides pin outs for the HS-18 connectors.

**CAUTION:**

**Connector pins may be damaged  
Improper equipment storage may cause damage**

Always replace connector caps when storing the unit.  
Never force covers onto connectors.

	Amphenol Pins					
	Pin A	Pin B	Pin C	Pin D	Pin E	Pin F
<b>Power Cable</b>	Green	Black	White	-	-	-
<b>Microphone Cable</b>	Green	Yellow	Purple	Black	Lt Blue	-
<b>MP3 Cable Amphenol connector</b>	-	Red	Black	-	-	-

**Figure 5.7-1 Wire Color To Amphenol Pins**

<b>MP3 TRS connector</b>	Red to Tip	Black to Sleeve
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**Figure 5.7-2 MP3 TRS Connector Pin Out**



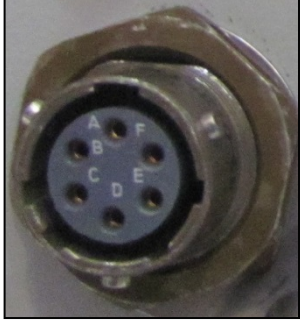
POWER	LINE IN	MIC
		
<p>A – common/shield B – hot C – neutral</p>	<p>0 dBv input (1.0 V<sub>RMS</sub>) A – not used B – hot C – neutral D – not used Any “mix” out type of signal, such as from a sound system, must go into this input, <b><u>NOT</u></b> the mic input</p>	<p>A – mic - B – mic + C – ground D – 5.0 V E – alert tone F – not used MIC is for a dynamic microphone (600-1,000 ohms) and the Record/Play microphone only.</p>

Figure 5.7-3 HS-18 Pin Outs



## 6.0 PREVENTATIVE MAINTENANCE & CLEANING

The HS-18 is a multi-environment device. As a result, maintenance should be performed based upon the conditions that exist where the unit is in use. The following preventive maintenance actions are the minimum methods needed to keep the unit functioning at optimal capacity.

**WARNING:**

**LIFE THREATENING ELECTRIC SHOCK OR DEATH DUE TO ELECTROCUTION  
100 - 250 VAC IS PRESENT WHEN SYSTEM IS ENERGIZED**

Ensure power is disconnected from device before performing maintenance.

Remember to always inspect the HS-18 before powering up the unit. Also, check all cables for frays, tears, and rips. If a cable is damaged, do not use it. If the unit or cables require service beyond the methods described in this section, refer to Section 12.0 for warranty information and return instructions.

### 6.1. Ground Operations and Sandy Environments

In some respects, using an AHD in a dusty environment may prove to be harsher than in maritime environments. The filter screen behind the front grill is intended to provide the transducers basic protection against the elements. For applications where the AHD is unmanned and exposed to the elements 24/7, it is highly recommended that an acoustic sock be used. This sock will provide an added layer of protection against the dust and rain, while providing an unobstructed path for the sound projection.

When the AHD is not in use, it is recommended that the unit is protected, at a minimum, with a storage or maritime cover to isolate it from the elements; transit cases are recommended for long term storage. The following are maintenance steps that should be performed periodically:

- 1) Point the AHD down with the front face pointing toward the ground.
- 2) Tap or shake the AHD to remove sand and dust. In environments where a significant amount of sand may have entered, or in an application where the unit may not have been serviced for a long interval of time, play the unit for a period of time to shake the dust loose from the inner workings of the transducers.
- 3) Wipe down all painted surfaces and canon plugs/connectors with a lint-free cloth soaked in clean/fresh water.

**CAUTION:**

**HS-18 can be damaged by pressurized air or pressurized water.**

Never use pressurized air or pressurized water to clean the HS-18.

## 6.2. Maritime Environments

Maritime environments can be a particularly severe place for any equipment due to rough seas, salt water, and inclement weather. Because of this, AHD's are sealed and weatherproof; designed for harsh environments. However it is important to remember that without proper care, it can be susceptible to failure.

When a deployed AHD is not in use, it is recommended that the unit is protected, at a minimum, with a storage or maritime cover to isolate it from the elements. If the AHD is not intended to remain installed then transit cases are recommended for long term storage.

The following steps should be carried out daily after use, especially after use in inclement weather. For unmanned applications where the AHD is permanently mounted on a vessel (Remote AHD or RAHD), these steps should be carried out when the ship returns to port:

- 1) Point the AHD down with the front face pointing toward the ground to allow water to drain from the unit.
- 2) Rinse the AHD with unpressurized fresh water.
- 3) Wipe down all painted surfaces and canon plugs/connectors with a lint-free cloth.

In either case, when the AHD or RAHD is not in use, it should be stored with the head locked at a downward angle to allow any additional moisture to drain out of the device.

**Note:** *These recommended preventive maintenance actions should be added to the shipboard equipment preventive maintenance schedule.*

## 6.3. Extreme Temperature Environments

The primary concern in extreme temperature conditions is storage, however, whether hot or cold, the parameters for dusty and maritime conditions should always be considered in conjunction with temperature. While AHD's are capable of being used in extreme temperature conditions, it is highly recommended that for extended storage, these devices be stored in a structure to shield them from the elements. Where possible this should be done with a transit case, or other protected storage container. This will protect the AHD's from being exposed to temperatures and conditions that may exceed their rated capability.

## 7.0 SOFTWARE

The HS-18 is shipped with the HS Audio Optimizer software to create custom messages. Please refer to the HS Audio Optimizer Software manual for detailed operating instructions.

## 8.0 PREPARATION FOR SHIPMENT

When shipping the HS-18:

1. Use a strong corrugated package or equivalent and pack the unit with a minimum of three inches of protective material on all sides to prevent damage during transit. At a weight of 90 pounds, it is recommended that the HS-18 package is palletized for shipment.

2. If shipping the unit in the custom Transit Case, be sure to secure all locks/fasteners on the case to prevent the case from opening during transit. Also, be sure to remove any installed casters from the transit case before shipping.
3. Finally, ensure the package is properly labeled to expedite the repair and return process if shipping the unit back to the manufacturer.

## **9.0 STORAGE**

To protect the HS-18 from damage, the unit should be stored in environments ranging in temperature from -40° to + 80°.

## 10.0 PARTS LIST

### 10.1. HS-18 Parts List

Figure 10.1-1 provides a list of HS-18 service kits and accessories that can be ordered or replaced.

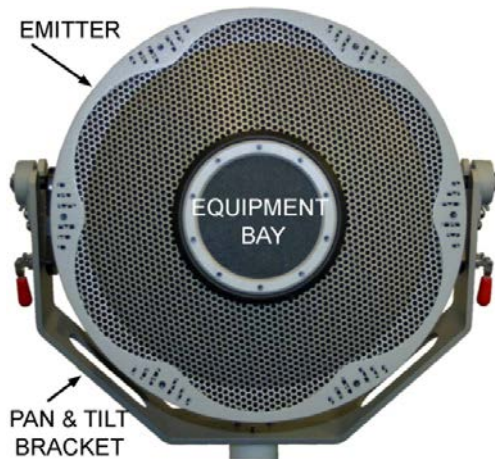
Description	Part Number(s)
CB Style Microphone	92012A-801
RP Microphone	90173A-HS18-801
Soft Cover	92042A-1
Maritime Cover	92040A-1
COTS MP3 Kit w/ Cable	72588A-802
MP3 Cable	42020A-801
HS-File Player (Including Accessories)	90146A-111
HS-File Player Input Cable	42117A-801
HS-File Player Charger	72955A-801
Owner's Manual	90096A-MAN-HS18
Power Cable (3 meter)	72590A-801
Power Cable (6 meter)	72591A-801
Xtend Remote Controller	90126A-801
Remote Operations Controller	72607A-801
Ship Rail Mount (stainless steel)	92011A-6
Transit Case	90096A-PKG-802
Tripod - Heavy Duty (with transit bag)	92010A-801
Search Light Installation Kit	72606A-802
Electronics Module	90096A-SK02
Transducer	90096A-SK03

**Figure 10.1-1 HS-18 Accessories and Service Kit Part Numbers**

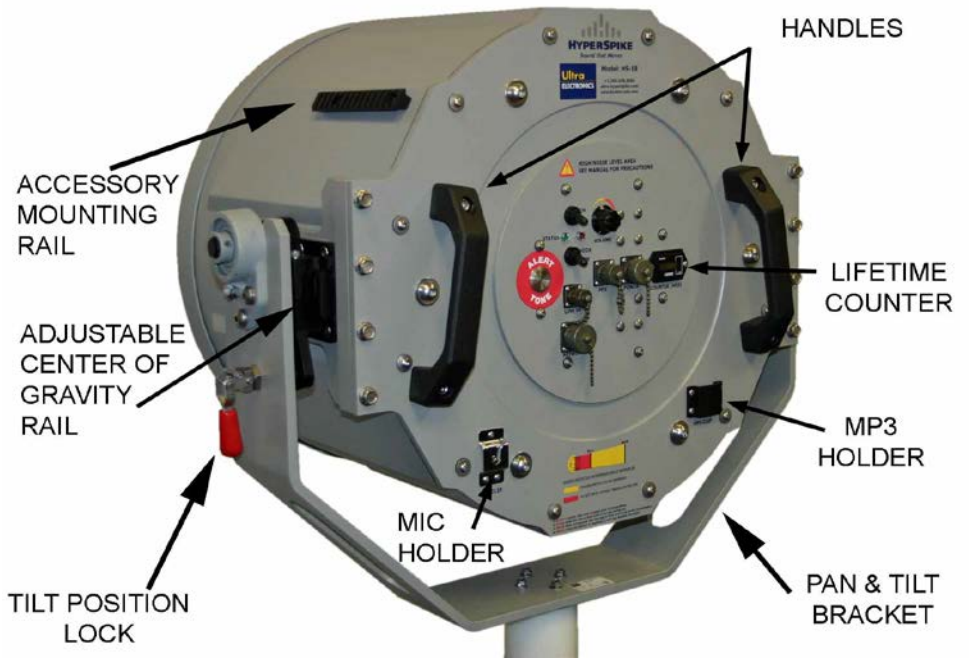
## 11.0 ILLUSTRATIONS AND DIAGRAMS

### 11.1. HS-18 Overview

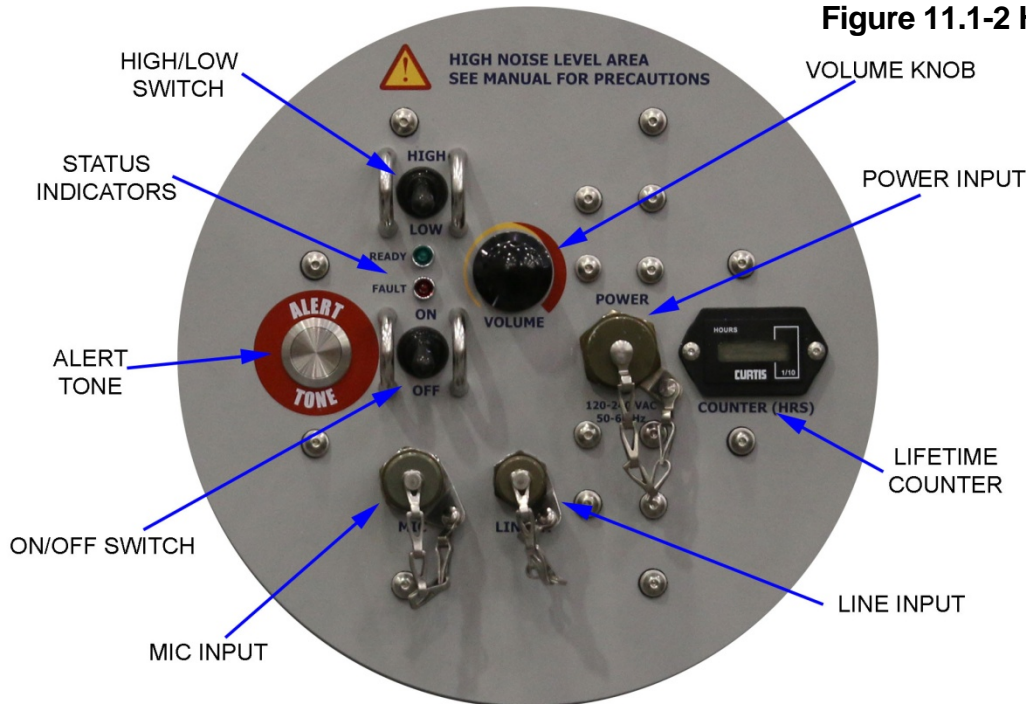
Figure 11.1-1, Figure 11.1-2 and Figure 11.1-3 illustrate the HS-18 component parts significant to operation and maintenance.



**Figure 11.1-1 HS-18 Front View**



**Figure 11.1-2 HS-18 Back View**



**Figure 11.1-3 HS-18 Control Panel View**

## 12.0 WARRANTY

Ultra Electronics USSI warrants its products to be free from defects in material and workmanship for a period of one (1) year from the date of shipment from USSI's facility. This warranty is extended to the original purchaser and all subsequent owners, provided a copy of the original dated bill of sale is presented when service is requested under warranty.

If your product should require service, write, phone, fax or e-mail Ultra Electronics USSI at:

**Ultra Electronics USSI**  
**4868 E Park 30 Drive**  
**Columbia City, IN 46725**  
**Phone: 260-248-3666**  
**Fax: 260-248-3510,**  
**E-mail: [APServiceDepartment@ultra-ussi.com](mailto:APServiceDepartment@ultra-ussi.com)**  
**URL: [www.ultra-HyperSpike.com](http://www.ultra-HyperSpike.com)**

We will either direct you to a local service agency or provide you with a Return Material Authorization (RMA) number so that you can ship the product to our factory. Do not ship the product to us without first obtaining an RMA number. Place the RMA number on all boxes returned to the factory to prevent equipment from being lost or mishandled. Merchandise returned to us for service under warranty must be accompanied by a copy of the original bill of sale, shipped prepaid, and packed per Section 8.0 of this manual. You are responsible for transporting your product to our factory. We will pay the return shipping charges on all products repaired under warranty.

### 12.1. Failures Not Covered by This Warranty

This warranty covers manufacturing defects. The warranty **DOES NOT** cover:

1. Damage caused by accident, misuse, abuse, product modification or neglect.
2. Damage incurred during shipment (you must claim these damages from the carrier).
3. Damage resulting from failure to operate the product in accordance with the instruction manual.
4. Damage resulting from attempted repairs by unauthorized personnel.
5. Claims based on any perceived agreement not explicitly stated in this warranty such as conversations with service personnel or sales representatives.

### 12.2. Limitation of Implied Warranties

All implied warranties, including warranties of merchantability, are limited in duration to a period of one (1) year from the date of shipment from Ultra Electronics USSI.

### 12.3. Exclusion of Certain Damages

Ultra's liability is limited to the repair or replacement, at our option, of any defective product, and shall in no event include incidental or consequential commercial damages of any kind. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the preceding limitation or exclusion may not apply to you.

For further information regarding this warranty, parts, or service, please contact Ultra Electronics USSI through one of the methods listed at the beginning of this warranty section.







Ultra Electronics USSI  
4868 East Park 30 Drive  
Columbia City, IN 46725 USA  
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