

# ES Series 300W, 500W, 1050W Operating Manual and User Guide



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PTEK™

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## This manual is for these Transmitters: FM300ES, FM500ES, and FM1050ES

### **Operating Voltage Requirements:**

FM300ES and FM500ES are Single Phase 110VAC Transmitters

\*\*\*The PTEK FM1050ES is a Dual Phase 110VAC device, more commonly referred to as 220VAC\*\*\*

## **Warranty Service**

The Limited Warranty covers parts and labor to the original purchaser as outlined on purchase invoice for use in the United States of America.

**---These transmitters are not recommended for use as a replacement IPA---**

Damage caused by misuse or shipping is excluded from the warranty. PTEK will not warranty the product due to misuse, accident, neglect, and improper installation or operation. Proper installation includes A/C line surge suppression, lightning protection and proper grounding of the entire transmitter, and any other recommendations designated in this Operating Manual.

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# Safety Instructions

To maximize user safety and ensure correct device operation, all instructions contained in this section should be read carefully.



Caution: It is important that the user observe all warnings and instructions that are on the unit and contained in this manual.

## Before Applying Power



Warning: DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Operation of the ES Series in the presence of flammable gases or fumes can endanger persons proximate to the site of operation.

Verify that the line voltage is 115VAC (**220VAC for the FM1050ES**).

## Ground the Exciter



Caution: DO NOT REMOVE THE EXCITER COVER

Removal of the exciter cover will invalidate the warranty. Component replacement and internal adjustments must be made only by PTEK qualified service personnel.

To minimize shock hazard, the exciter chassis must be connected to an electrical ground, the exciter must be connected to the AC power mains through a three-conductor power cable, with the third wire connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury. If the exciter is to be energized by any other source be certain that the chassis is connected to a separate safety ground.

## Fuses

Only fuses with the same required current, voltage rating, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

## Output Connector



Warning: The type-N output connector carries dangerously high RF voltages that present shock and burn hazards. Never operate the exciter without properly terminating the output connector in either an adequately rated load or antenna.

## Electrostatic Discharge (ESD)

A sudden discharge of electrostatic electricity can destroy static-sensitive devices or micro-circuitry. Proper packaging and grounding techniques are necessary precautions to prevent damage. Always take industry-standard precautions.

## Grounding Methods

The single point or star grounding system is recommended. There is one common or star point where all grounds join together at a single point. This point is often a selected point along a ground system that encircles the building using copper strap and multiple ground rods not closer than ten feet. Usually four ground rods connected with four inch copper strap spaced around the tower will be required. Wide flat copper strap should be used to reduce the ground conductor inductance.

The interior of the building should have a common ground system made up of 2 or 4 inch copper ground strap, which should be tied to the outside star point. The AC mains ground should also be connected to the star point. All coaxial cables should enter and exit the building at a single entry point and their shield(s) should be connected to the ground plate.

A single connection point to the station reference ground should be established, preferably where the AC power wiring and the RF feed coaxial cable enter the transmitter building. The purpose of this ground is to prevent ground loops and to ensure unwanted currents do not flow into the transmitter cabinet. The shield of the RF feed cable, the AC power, the ground return for the AC suppression system and the transmitter's reference ground point should all be individually connected to this point by insulated, low inductance, low impedance ground straps.

# General Safety Rules

- The device must be used in accordance with the instructions for use.
- Electrical installations in the room must correspond to the requirements of respective regulations.
- Take care that there are no cables, particularly mains cables, in areas where persons can trip over them.
- Do not use a mains connection in sockets shared by a number of other power consumers. Do not use an extension cable.
- Only use the mains cable supplied.
- The unit is completely disconnected from the power source only when the power cord is disconnected from the power source. Therefore, the power cord and its connectors must always remain easily accessible.
- Do not set up the device in the proximity of heat sources or in a damp location. Make sure the device has adequate ventilation.
- All plugs on the connection cables must be screwed or locked to the chassis housing.
- The device is designed to be used in horizontal position only.
- The device is no longer safe to operate when the device has visible damage or the device no longer functions.
- In case of system malfunction or visible damage to the ES Series, the device must be shut down and secured against unintentional operation.
- Repairs may only be carried out by authorized PTEK personnel.
- If extensions are made to the ES Series, the legal stipulations and the device specifications must be observed.
- The ES Series must be switched off and the line cord disconnected from the AC source when removing the top cover.

## Preface

This document, ES Series Operating Manual and User Guide, provides instructions on how to install, configure, power up, and perform diagnostics on the PTEK ES series Transmitter (see photo below), an easy-to-use and versatile system that can be used in either stand-alone or backup mode. The information contained within is intended for an experienced system operator with a knowledge of high-performance broadcast transmission systems. The 3RU-high (5.25”) FM300-1050ES transmitters are designed to fit a standard 19” rack.



ES Series PTEK Transmitter

Key features of the ES Series PTEK Transmitter include:

- Totally solid-state no-tune construction
- Wide input range from 88 to 264 VAC (200-264VAC for 1050W)
- **13-Month Warranty on all Parts and Labor**
- Built-in field-programmable FSK ID for translator use
- Remote-control interface
- Built-in stereo generator
- DDS for crystal clear audio and frequency stability
- Meets or exceeds all FCC and CCIR standards
- Designed and manufactured in the United States

Frequency stability for each unit is ensured by using Direct Digital Synthesis (DDS) with a highly stable crystal oscillator reference. All units incorporate over-temperature protection and VSWR foldback to automatically reduce power output to safe operating levels. Switch-mode power supplies provide consistent performance even when there are frequent power outages and voltage fluctuations that make stressful demands of power dependence. An overview and specifications of the ES Series PTEK Transmitter is given in Chapter 1 of this manual: “Overview and Specifications.”

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## Notes, Cautions, Warnings, and Sidebars

The following icons and formatted text are included in this document for the reasons described:



Note: A note provides additional information concerning the procedure or action being described.



Caution: A caution describes a procedure or action that may result in injury to the operator or equipment. This may involve—but is not restricted to—heavy equipment or sharp objects. To reduce the risk, follow the instructions accompanying this symbol.



Warning: A warning describes a procedure or action that may cause injury to the operator or equipment as a result of hazardous voltages. To reduce the risk of electrical shock and danger, follow the instructions accompanying this symbol.



## Overview and Specifications

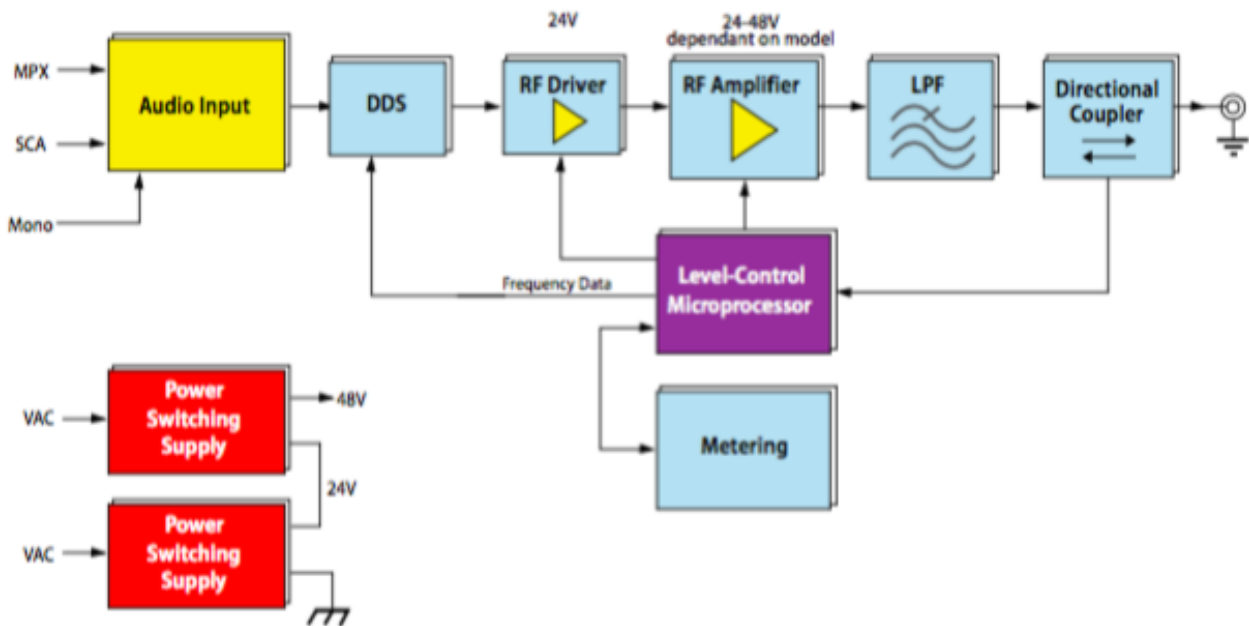
### 1.1 Overview

The 3RU-high (5.25”) ES Series PTEK Transmitter is designed to fit a standard 19” rack and is provided with rack-mount left and right tabs and handles. Optional rack-mount slides are available. The ES Series are rugged enough to withstand extreme shock (up to 5G), temperature (up to 50°C), and EMI such as that associated with broadcasting from remote rugged environments (see Figure 1-1; a block diagram is given in Figure 1-2 on page 10). The ES Series supports Mono, Wideband Stereo (left and right) and SCA inputs, ideal for a variety of commercial and dedicated stereo broadcast transmission applications.

**---Not recommended for use as a replacement IPA---**



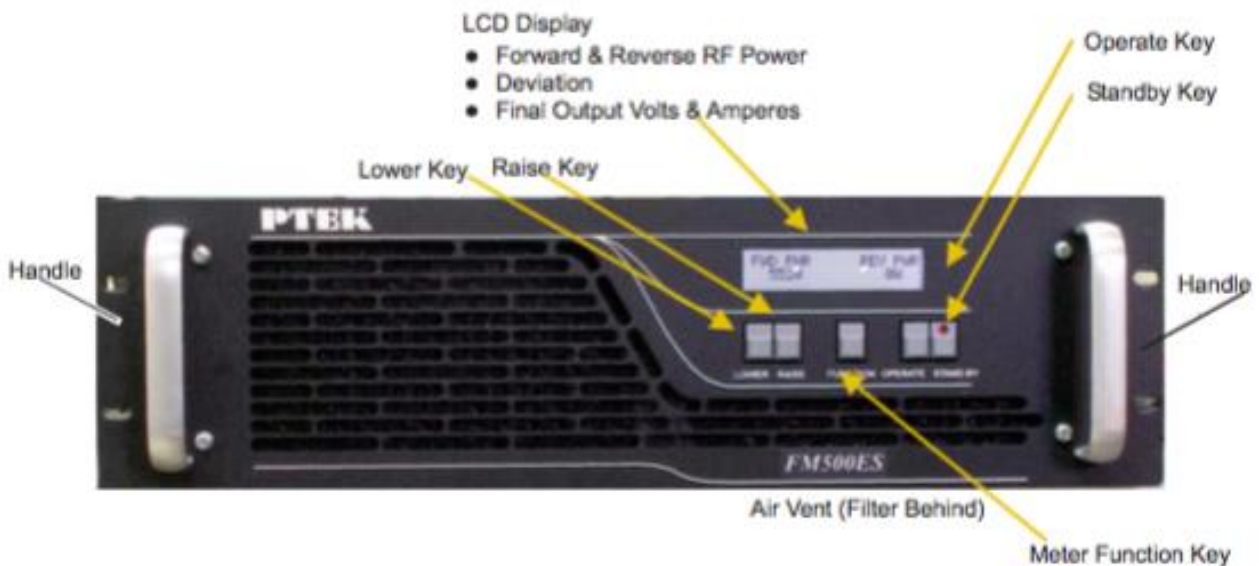
**Figure 1-1.** ES Series PTEK Transmitter



**Figure 1-2. ES Series System Block Diagram**

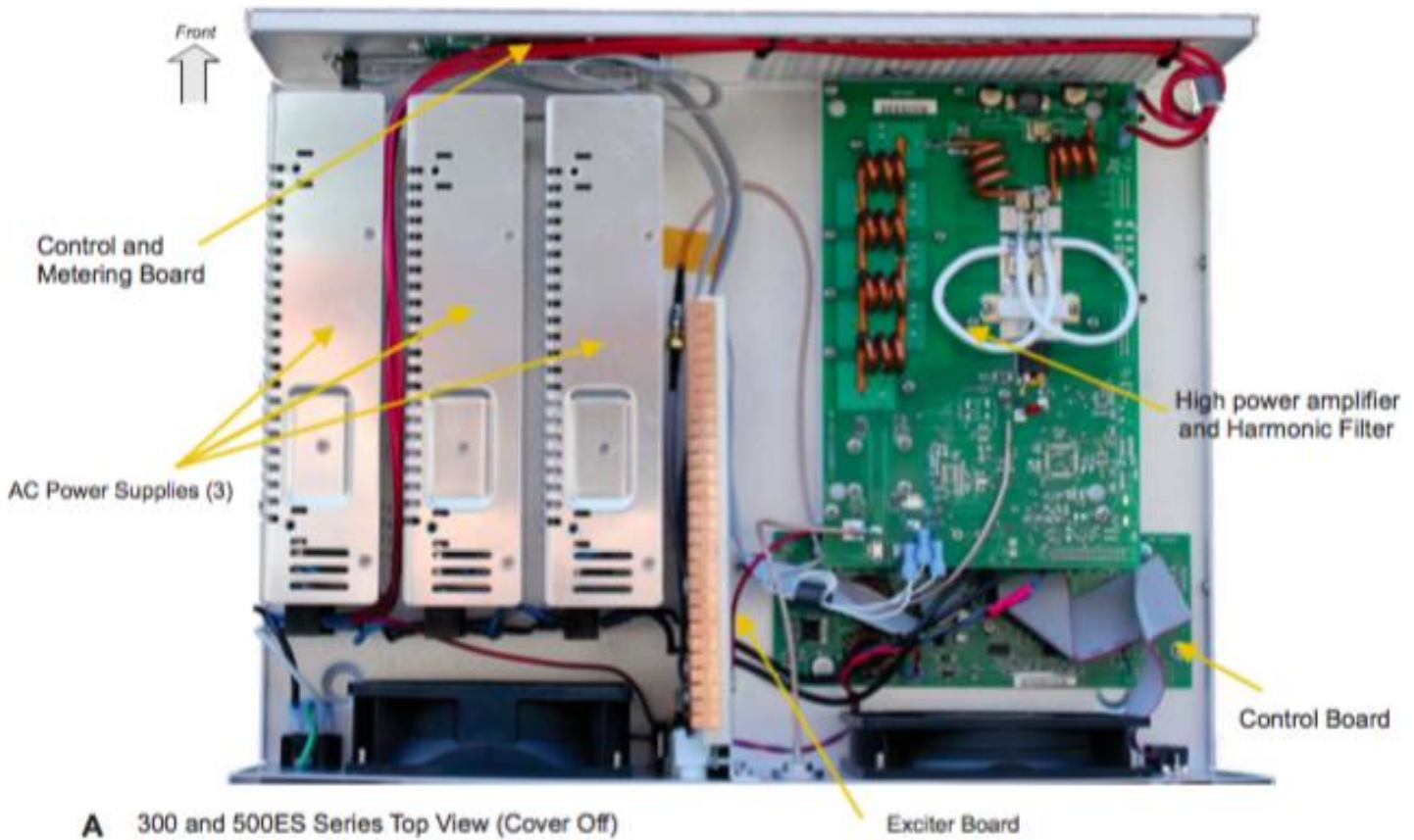
The ES Series is designed within a 3RU-high (5.25”) form-factor that is 13.75” (34.9 cm) deep (including the front panel and rear protective flanges; the chassis body itself is 13” deep) and 17” (43.2 cm) wide (19” including the front panel to fit a standard size rack.

Features on the ES Series front panel are shown in Figure 1-3.

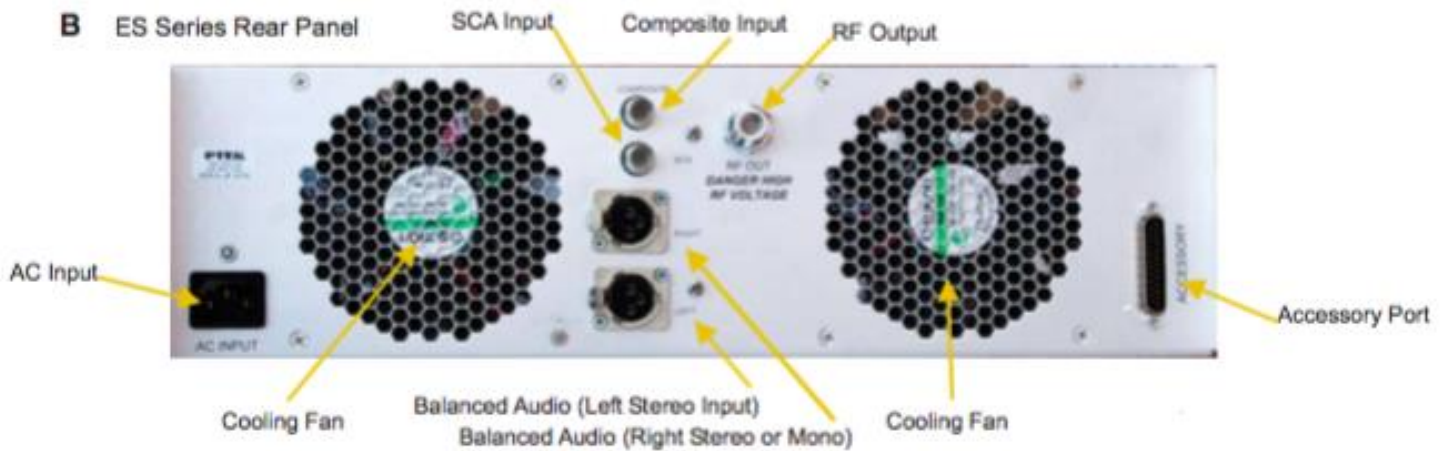


**Figure 1-3. ES Series Front Panel**

300 and 500ES Series Top View (Cover Off)



A 300 and 500ES Series Top View (Cover Off)



B ES Series Rear Panel

Figure 1-4. ES Series Open Top View (A) and Rear Panel (B)

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## 1.2 Specifications

### 1.2.1 General

Table 1-1 lists general specifications for the ES Series.

**Table 1-1. ES Series General Specifications**

Parameter	Description
Dimensions	<ul style="list-style-type: none"><li>• 5.25" (3RU) high</li><li>• 17" (43.2 cm) wide (19" including front panel)</li><li>• 13.75" (34.9 cm) deep (including the front panel and rear protective flanges; the chassis body itself is 13" deep)</li></ul>
Weight	Total shipping weight is 25 pounds
19" Rack-Mountable with Slide capability	<ul style="list-style-type: none"><li>• Left and right rack-mount tabs and handles are attached directly to the chassis.</li></ul>
Temperature Operating: Non-Operating:	<ul style="list-style-type: none"><li>• 0°C to +30°C (32°F to 86°F)</li><li>• 0°C to 50°C (32°F to 122°F)</li></ul>
Relative Humidity Operating: Non-Operating:	<ul style="list-style-type: none"><li>• 8% to 90% non-condensing</li><li>• 5% to 95% non-condensing</li></ul>
Maximum Wet Bulb Operating: Non-Operating:	<ul style="list-style-type: none"><li>• 27°C, non-condensing</li><li>• 35°C, non-condensing</li></ul>
Altitude Operating: Non-Operating:	<ul style="list-style-type: none"><li>• 0 to 10,000 feet above sea level</li><li>• 0 to 40,000 feet above sea level</li></ul>

## 1.2.2 Electrical

Table 1-2 lists the electrical specifications for the ES Series.

**Table 1-2. ES Series Electrical Specifications**

Parameter	Description
Frequency Range	• 87.7 MHz to 108 MHz
Audio Input Impedance	• 600 ohms
Audio Input Level (Composite)	• 1.25 volts RMS
Audio Input Level R & L Stereo Encoder ( <i>optional</i> )	
Frequency Response (Composite)	• 20 Hz to 15 (90) KHz
Pre-Emphasis	• 75 (or 50 uS to order)
Harmonic Distortion	• less than 0.1%
Signal-to-Noise Ratio	• >70 dB rms
RF Output Impedance	• 50 ohms
Output Connector	• N-type female
RF Power Output	• 1050W, 500W, 300W
Harmonic Attenuation	• Meets or exceeds FCC requirements
Power Requirements	• 88-264 VAC, internally fused
Fuse	• MDA 10 Amperes, 250 Volts AC

### 1.2.2.1 System Power

The ES Series FM500 uses three AC power supplies, and the FM300 uses two.

Each AC power supply is auto-ranging, single-phase AC input from 88 to 264 VAC (47 to 63 Hertz).

### 1.2.2.2 Noise Level

Typical noise levels emitted by the ES Series are outlined in Table 1-3. The chassis is installed with two 120-mm fans mounted side-by-side at the rear of the system. In addition, each AC power supply has its own cooling fan.

**Table 1-3.** Typical Noise Levels of the ES Series

Measured at:	1 Meter	2 Meters
Front	66.24 dB	57.57 dB
Rear	61.53 dB	57.93 dB

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## 1.3 Packaging and Shipping

The ES Series PTEK Transmitter is packaged in a reusable shipping container. Approximate weight of an empty container and one (1) AC power cord is 9 pounds (4 kg).

The approximate weight of an ES Series (installed with two power supplies) is under 15 pounds (6.8 kg).

The approximate weight of a manual and associated shipping paperwork is one (1) pound (0.5 kg).

Therefore, both the shipping container and a fully installed ES Series including power cord, manual, and associated paperwork weigh under 25 pounds (11.3 kg).

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## 2.1 Installation Procedures



Caution: Use industry-standard ESD grounding techniques when handling all components. Wear an antistatic wrist strap and use an ESD-protected mat. Store ESD-sensitive components in antistatic bags before placing them on any surface. Handle all IC cards by the front panel or edges only.

There are no operator serviceable parts inside the ES Series; therefore, replacement, inspection, or adjustment of internal components within the ES Series requires service by an authorized PTEK technician only. **DO NOT REMOVE THE TOP PROTECTIVE COVER OF THE ES Series CHASSIS** (see following warning).



Warning: Removal of the top protective cover of the ES Series by anyone other than an authorized PTEK technician will void the product warranty.

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## 2.2 Removing the Protective Top Cover

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Warning: Make sure that the AC power cord is removed from the AC input connector on the rear of the ES Series before removing the protective top cover.

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Open the ES Series Transmitter as follows:

1. Remove the protective top cover of the ES Series by loosening the two Phillips screws on each side of the chassis (see Figure 2-1).



**Figure 2-1.** ES Series Right-Side Top Cover Phillips Screws

2. Store the cover and screws in a safe place until replaced.

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## 2.3 Changing the Fuse

The ES Series PTEK Transmitter contains fuses mounted internally in the power supplies. Changing these fuses is not a normal service item and should only be necessary if a fault develops in the power supply.



## 2.4 Cleaning the Air Filter

Accessing the air filter requires removing the front panel of the ES Series.

1. Remove the four Phillips screws on the ES Series front panel (see Figure 2-2).



**Figure 2-2.** Remove the Front Panel Screws to Access the Air Filter

2. Remove the air filter (see Figure 2-3), then carefully wash it with mild soap and water.



**Figure 2-3.** Remove the Exposed Air Filter

3. Check that the exposed air vent holes are unobstructed.



**Figure 2-4.** Make sure the Air Vent holes are unobstructed

4. After the air filter has been dried, replace it and the front panel. Make sure the front panel screws are fully tightened.

---

## 2.5 Rack Mounts

Rack-mount tabs (or flanges) are built into the chassis and therefore are not removable. They are used to secure the ES Series chassis to a 19" rack.

Rack-mount slides are used to pull the ES Series away from the rack for easier access.

### 2.5.1 Mounting Brackets

Use the following steps to ensure an ES Series chassis to a 19" rack.

1. With the help of a second person, carefully insert the ES Series chassis into the 19" rack (see figure 2-5).



**Figure 2-5.** Left and Right Rack-Mount Brackets

2. Using four 10-32 screws with corresponding lock washers and nuts, attach the ES Series chassis to the 19" rack through the four mounting holes of the mounting brackets.



Caution: Make sure to tighten each mounting screw to assure that the ES Series chassis is firmly installed onto the 19" rack.

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## 2.5.1 Rack-Mount Slides

A set of two rack-mount slides (left side and right side) can be ordered from online vendors like [www.BSWusa.com](http://www.BSWusa.com). If desired, it is the customer's responsibility to purchase rack-mount slides from alternate sources prior to installation.

## Operation

This chapter describes:

- How to set up the ES Series system to begin operation
- How to turn the system on and off
- How to monitor and change the operational settings of the system

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### 3.1 Set Up the System

To successfully operate the ES Series PTEK Transmitter, an antenna (or power amplifier) and an audio source must first be connected to the system, as outlined in the following steps:

1. Connect the antenna or power amplifier input to the RF output connector on the rear panel of the ES Series (see Figure 3-1).
2. Connect the audio input to one of the following connectors on the rear panel:
  - Composite Input (ensure the Stereo encoder is disabled)
  - Balanced Mono Input
  - Balanced Stereo Left and Right (if equipped with stereo encoder)



**Figure 3-1. ES Series Rear-Panel Connectors**

## 3.2 Power Up the System

1. On the rear of the ES Series, plug an AC power cord (shipped with each unit) into the AC power socket (see Figure 3-2 on page 3-3).
2. Plug the other end of the AC power cord into a “live” AC outlet.
3. Make sure the STAND BY key on the front of the system has turned red (or the system has begun the startup sequence), thus assuring that the system has powered on (see Figure 3-3).

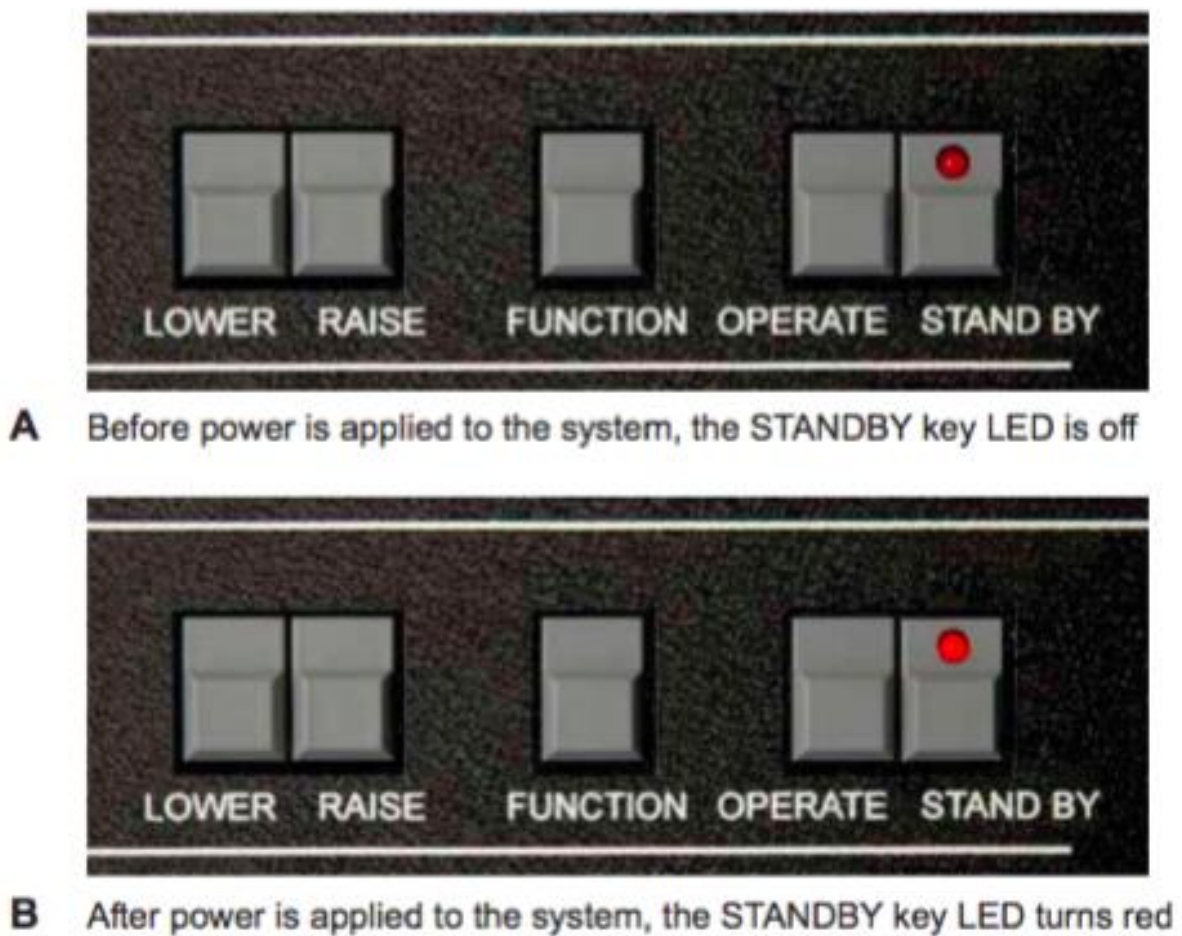


### POWER OUTAGE Note:

When power is reapplied, the system will power up in the mode it was in before the power outage. For example, if the system was in OPERATE mode, then it will power up in OPERATE mode. Similarly, if the system was in STAND BY mode before power outage, it will power up in STAND BY mode.



**Figure 3-2.** Plug the power chord into the transmitter AC Power Socket

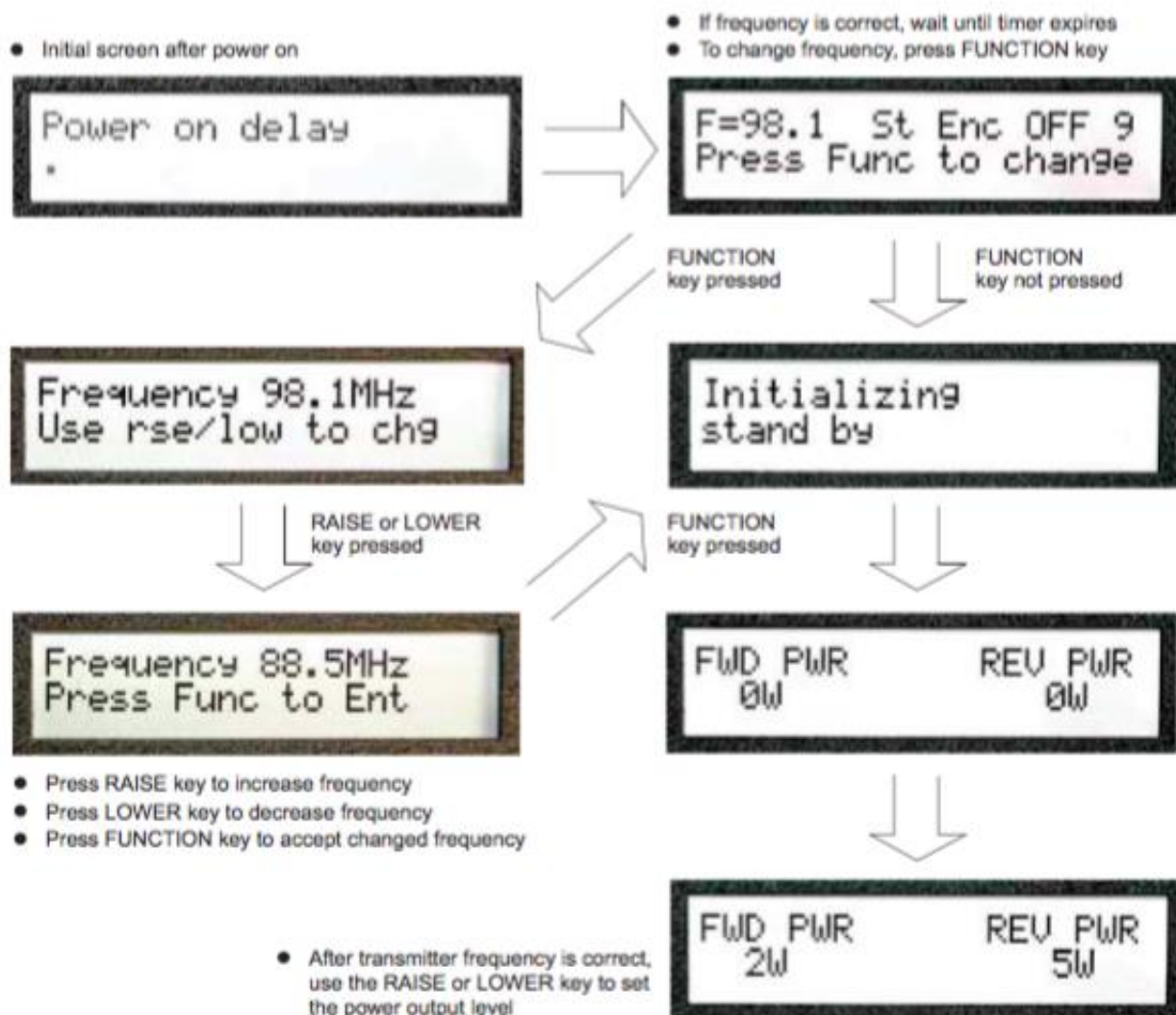


**Figure 3-3.** After power has been applied to the system, it enters STANDBY mode

## 3.3 Getting Started

### 3.3.1 Startup Sequence

1. Press the OPERATE key on the front of the ES Series.
2. After the OPERATE key is enabled, the LED display will show the initialization sequence and display the screens—in order—shown in Figure 3-4.

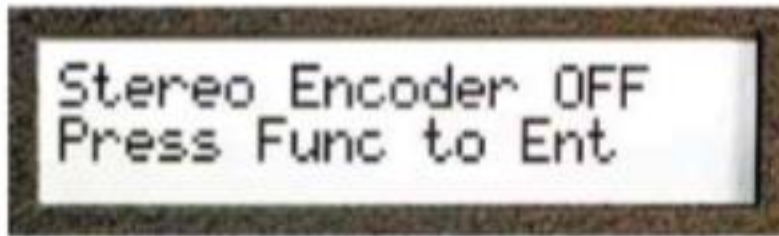


**Figure 3-4.** After the OPERATE key is pressed, the Startup Sequence Begins

### 3.3.2 Changing the Stereo Encoder

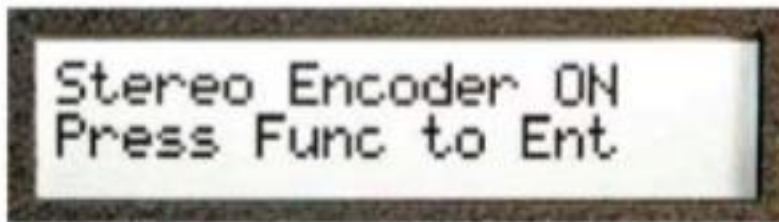
After changing the frequency in the startup sequence (see previous page), you have the option of changing the Stereo Encoder setting:

1. If the LCD screen displays the desired setting (Stereo Encoder OFF or ON), press the FUNCTION key to accept the setting (see Figure 3-5).



**Figure 3-5.** Stereo Encoder can be changed through the LCD Display

2. To change the Stereo Encoder setting, press the RAISE or LOWER key, which will result in the alternate setting (see Figure 3-6).



**Figure 3-6.** Press the RAISE or LOWER key to change the LCD Display



### 3.3.3 Audio

Audio levels for the ES Series have already been set and should not need to be changed. Deviation can be checked by pressing the FUNCTION key until the appropriate LCD screen is reached (see Figure 3-7).

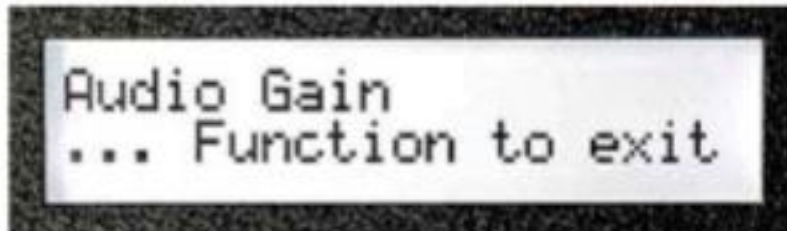


**Figure 3-7.**

When the LCD display is in DEVIATION mode, the maximum deviation should occasionally reach 100% (indicated by the thick bar). If the 100% level is never reached or exceeds 100%, the level needs to be adjusted.

The output level from the audio source should be adjusted to give a peak deviation of 75 kHz (as described above).

If the correct deviation cannot be obtained, the audio gain can be raised or lowered by pressing the FUNCTION key until the appropriate LCD screen is reached (see Figure 3-8).



**Figure 3-8.** Audio Gain can be adjusted through the LCD Display

When the AUDIO GAIN screen appears, the value may be raised by pressing the RAISE key or lowered by pressing the LOWER key until the desired deviation is reached. The Deviation Screen is displayed through the FUNCTION key.

### 3.3.4 Final Check

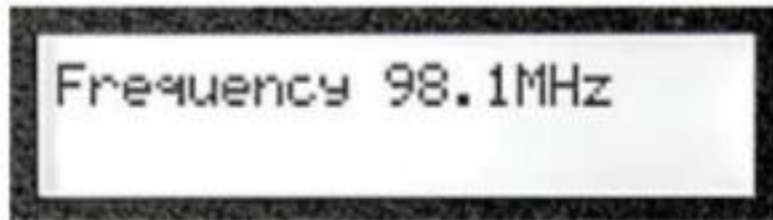
Pressing the FUNCTION key rotates the LCD display through the following screens:



Note: At each screen, pressing the LOWER or RAISE key changes the output power only. PA VOLTS and PA AMPS is another way of indicating the power output, accomplished by multiplying the voltage by the amperage (current), then multiplying the result by the efficiency.

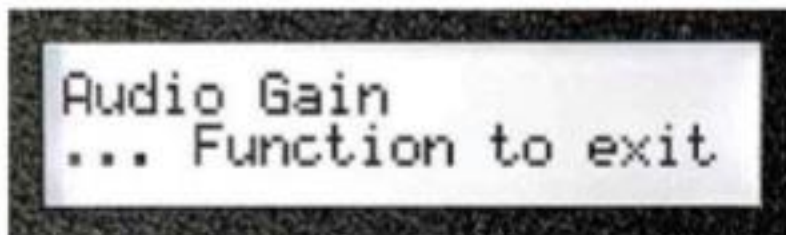
Readings should be recorded weekly to keep track of changes, which may indicate developing problems such as antenna or coax deterioration.

1. After pressing the FUNCTION key on the front of the unit, the operating frequency will appear on the LCD display (see Figure 3-9).



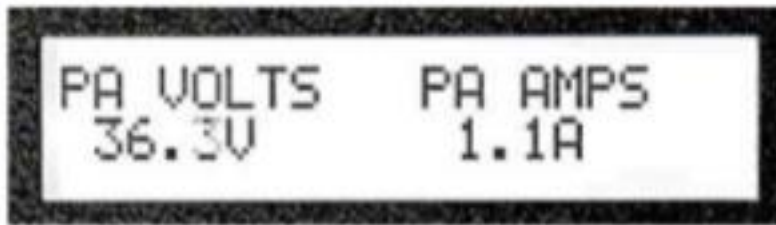
**Figure 3-9.** Press the FUNCTION Key to read Frequency

2. Pressing the FUNCTION key again will display the audio gain (see Figure 3-10).



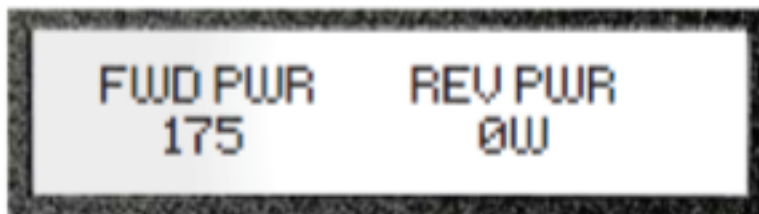
**Figure 3-10.** Press the FUNCTION Key to read Audio Gain

3. Pressing the FUNCTION key again will display the power output (volts multiplied by amps; see Figure 3-11).



**Figure 3-11.** Press the FUNCTION Key to read Volts & Amps

4. Pressing the FUNCTION key again results in a screen showing forward and reverse power (see Figure 3-12).



**Figure 3-12.** Press the FUNCTION Key to read Forward & Reverse Power

5. A final pressing of the FUNCTION key will produce a screen showing deviation (see Figure 3-13).



**Figure 3-13.** Press the FUNCTION Key to read Deviation

As already noted, further pressing of the FUNCTION key will rotate the LCD display through a queue of the same screens.

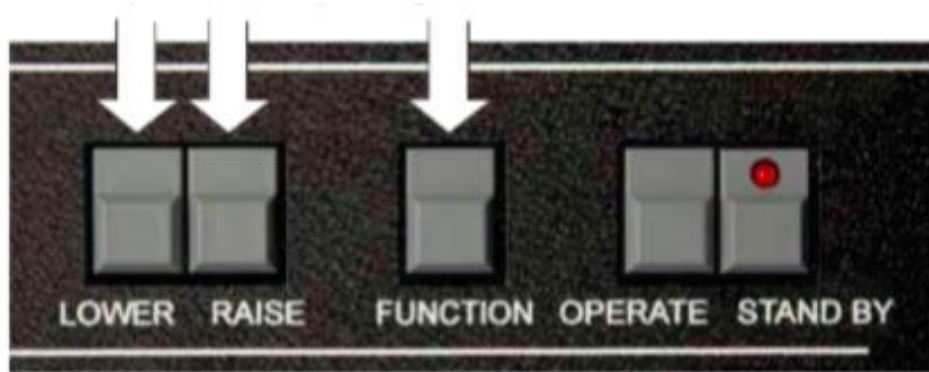
### 3.3.5 Efficiency Chart

	FM150ES	FM300ES	FM500ES			
	Supply Voltage					
	48V		30V		36V	
Power Output Watts	Supply Current A	Efficiency %	Supply Current A	Efficiency %	Supply Current A	Efficiency %
20	2.2	19%				
30	2.4	26%	5.5	18.2%		
50	2.8	37%	5.8	28.9%	5.5	25.3%
75	3.3	47%	7.1	35.0%	6.8	30.6%
100	3.6	58%	8.2	40.7%	7.8	35.6%
120	4.2	60%	9.0	44.3%	8.6	38.8%
150	4.8	65.1%	10.1	49.6%	9.6	43.4%
180			11.0	54.4%	10.5	47.6%
216			12.1	59.6%	11.5	52.2%
259			13.2	65.3%	12.6	57.1%
300			14.3	70.0%	13.6	61.3%
360					14.8	67.6%
432					16.3	73.6%
500					17.5	79.4%

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## 3.4 Additional Adjustments

The ES Series offers additional capabilities by pressing the LOWER, RAISE, and FUNCTION keys simultaneously (see Figure 3-14).



**Figure 3-14.** Press LOWER/RAISE/FUNCTION Keys Simultaneously



Note: When pressing LOWER, RAISE, and FUNCTION, the transmitter cannot be in STANDBY mode.

The resulting LCD screens will appear as follows:

1.



**Figure 3-15.**

After a few seconds, press the FUNCTION key to display the next LCD screen.

2.

---

Caution: Do not change any of these settings unless you have the proper test equipment and are able to make the appropriate measurements.

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**Figure 3-16.** Use the RAISE/LOWER Keys to adjust

3.



**Figure 3-17.** Use the RAISE/LOWER Keys to adjust

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## 3.5 Tune Up the Antenna

After the ES Series is transmitting on the desired frequency (refer to Section 3.3 on page 23), check the reverse power, which should be zero. Anything greater than 5 percent of the forward power (ie. 5W for a 100W output) requires attention.

Solid State transmitters have fast acting VSWR protection circuits that are intended to shut down RF power stages before damage can occur. They are intended for occasional trips. Repeated breakdowns will eventually damage a transmitter.

If reverse power is higher than 5 percent of the transmitters rated power, the transmitter's output power will be reduced to maintain the reverse power at a safe level. If the antenna match worsens (causing the reverse power to exceed 10% of the transmitter's rated power) the transmitter will trip and stop broadcasting. After 45 seconds the unit will attempt to transmit again. If the match is still high enough to generate greater than 10% of the rated transmitter power, the unit will trip again. This cycle will be repeated three times. If there is still no improvement in the antenna match, the transmitter will retry every 2 hours.



Note: The reflected power needs to be nullified to the smallest reading (1.1:1) by adjusting the antenna according to the manufacturer's instructions.

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## 3.6 Power Down the System

To power down (turn off) the transmitter, press the STAND BY key, then disconnect the AC power cord from the AC power socket on the rear panel of the chassis.

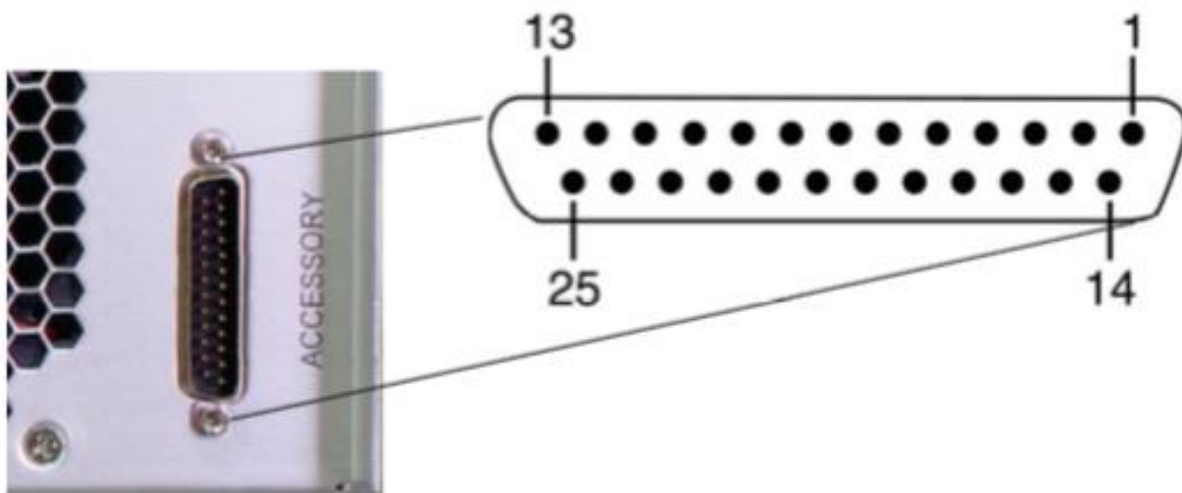
## Connector Pinouts

This appendix provides connector pinouts and signal descriptions for the user 1/10 connectors that are installed on the ES Series Transmitter rear 1/0 Panel (see Figure 1-4 on page 11).

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### A.1 Accessory Port

The transmitter rear 1/0 panel provides a 25-pin male DB25 connector as an accessory-port interface. Pinout is provided in Figure A-1; signal descriptions are defined in Table A-1.



**Figure A-1.** Accessory Port Pinout



**Table A-1.** Accessory Port Pinout Signal Descriptions

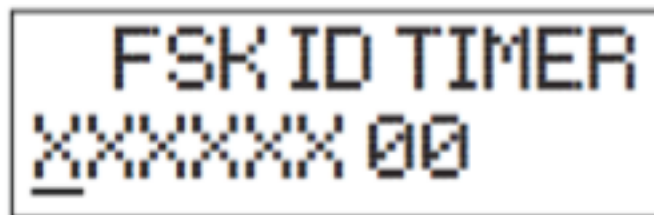
Pin	Signal Function
1	Forward power DC indication; 2.4V = 150W
2	Final voltage DC indication; $V = V/10$
3	Output power out of range Hi (10V)
4	<i>Not used</i>
5, 6, 18, 19	24V out (fan supply for combiners)
7	<i>Not used</i>
8	Raise; ground to raise the output power
9	<i>Not used</i>
10	<i>Not used</i>
11, 12, 23, 24	Ground
13	Remote on (ground to turn the unit on momentarily only)
14	Reverse power DC indication; 2.4V = 150W
15	Output power out of range Lo (10V)
16	<i>Not used</i>
17	<i>Not used</i>
20	Lower; ground to lower the output power
21	Final current DC indication; Full scale = 2.5V
22	<i>Not used</i>
25	Remote off (ground to turn the unit off momentarily only)

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## A.2 Setting the FSK ID



**Figure A-2.** With the unit in STANDBY mode, press and hold the RAISE Key; then switch the unit from STANDBY to OPERATE



**Figure A-3.** Release the key when this is displayed on the LCD Display

Pressing the FUNCTION key will increment the cursor; pressing RAISE/LOWER will change the character. When you are satisfied with both the CW 10 and the interval timer (which is in minutes), press the FUNCTION key to bring the cursor to the first character, then turn the unit to STAND BY.

To disable the CW 10 set the timer to 00.

After this is programmed the unit will send the set CW 10 at the programmed timer interval. With most FM receivers this ID will be inaudible.



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