Warranty

LIMITED TWO YEAR CONSUMER WARRANTY:

Directed Electronics promises to the original purchaser, to replace this product should it prove to be defective in workmanship or material under normal use, for a period of two years from the date of purchase by the dealer as indicated by the date code marking of the product **PROVIDED** the product was installed by an authorized Directed dealer. During this two year period, there will be no charge for this replacement **PROVIDED** the unit is returned to Directed, shipping pre-paid. If the unit is installed by anyone other than an authorized Directed dealer, the warranty period will be 1 year from date of purchase by the dealer as indicated by the date code marking of the product. During this 1 year period, there will be no charge for this replacement **PROVIDED** the unit is returned to Directed, shipping pre-paid. This warranty is non-transferable and does not apply to any unit that has been modified or used in a manner contrary to its intended purpose, and does not cover damage to the unit caused by installation or removal of the unit. This warranty is void if the product has been damaged by accident or unreasonable use, neglect, improper service or other causes not arising out of defects in materials or construction. **ALL WARRANTIES INCLUDING BUT NOT LIMITED TO EXPRESS WARRANTY, IMPLIED WARRANTY, WARRANTY OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, AND WARRANTY OF NON-INFRINGEMENT OF INTELLECTUAL PROPERTY ARE EXPRESSLY EXCLUDED TO THE MAXIMUM EXTENT ALLOWED BY LAW, AND DIRECTED NEITHER ASSUMES NOR AUTHORIZES ANY PERSON TO ASSUME FOR IT ANY LIABILITY IN CONNECTION WITH THE SALE OF THE PRODUCT. DIRECTED HAS ABSOLUTELY NO LIABILITY FOR ANY AND ALL ACTS OF THIRD PARTIES INCLUDING ITS AUTHORIZED DEALERS OR INSTALLERS.** Unit must be returned to Directed, postage pre-paid, with: consumer's name, telephone number, and address, authorized dealer's name and address, and product description. **IN ORDER FOR THIS WARRANTY TO BE VALID, YOUR UNIT MUST BE SHIPPED WITH PROOF OF INSTALLATION BY AN AUTHORIZED DIRECTED DEALER. ALL UNITS RECEIVED BY DIRECTED FOR WARRANTY REPAIR WITHOUT PROOF OF DIRECTED DEALER INSTALLATION WILL BE COVERED BY THE LIMITED 1 YEAR PARTS AND LABOR WARRANTY.** Note: This warranty does not cover labor costs for the removal and reinstallation of the unit.

BY PURCHASING THIS PRODUCT, THE CONSUMER AGREES AND CONSENTS THAT ALL DISPUTES BETWEEN THE CONSUMER AND DIRECTED SHALL BE RESOLVED IN ACCORDANCE WITH CALIFORNIA LAWS IN SAN DIEGO COUNTY, CALIFORNIA.

DEI is a proud member of IASCA

Designed and Engineered in the USA by: Directed ELECTRONICS

ORION HIGH PERFORMANCE CAR AUDIO

amplifier owner's manual

HCCA-D1200
HCCA-D2400
HCCA-D5000

POWERED BY HARDCORE ATTITUDE

CONTENTS

INTRODUCTION

Thank you for your purchase of Orion's HCCA-D1200, HCCA-D2400, or HCCA-D5000 power amplifier. Each Orion amplifier is designed to be the leader in its class offering the most power, advanced features, and extreme ease of use. In high-end sound systems or high SPL systems, Orion amplifiers will give you years of trouble-free performance.

- **HCCA-D1200 -** 1200 Watt single-channel Class D amplifier with built-in infrasonic filter, with INTELLi-Q, ESP2, and remote bass. The HCCA-D1200 is capable of one-channel operation with a maximum power of 1200 Watts into 1Ω.
- **HCCA-D2400 -** 2400 Watt single-channel Class D amplifier with built-in infrasonic filter, with INTELLi-Q, ESP2, and remote bass. The HCCA-D1200 is capable of one-channel operation with a maximum power of 2400 Watts into 1Ω.
- **HCCA-D5000 -** 5000 Watt single-channel Class D amplifier with built-in infrasonic filter, with INTELLi-Q, ESP2, and remote bass. The HCCA-D5000 is capable of one-channel operation with a maximum power of 5000 Watts into 1Ω.

Each of these amplifiers has security and programmable features controlled via a ESP®-2 serial databus and Directed's proprietary Bitwriter® tool (998T). The Bitwriter® unit must have version 2.3 or above to access the amplifier features menu.

The installation of all Orion components will determine the overall performance result. Improper installation will not only limit the performance of your Orion system but also potentially compromise the reliability of this amplifier. To ensure proper sonic results and component reliability, please refer to your authorized Orion dealer for installation assistance or advice. If you decide to perform the installation yourself, be sure to read the entire manual before beginning the installation.

What's in the Box

- (1) Amplifier
- (1) Spare fuse(s)
- (1) Allen wrench 4mm
- (1) Allen wrench 3mm
- (8) #8 self-tapping black Phillips head pan head screws
- (4) flat washers with adhesive
- (1) 3' phono cable
- (1) 15' ESP cable (amplifier to security system cable)
- (1) Amplifier installation and operation manual
- (1) Window decal

IMPORTANT NOTE

Prior to servicing your vehicle ensure that the alarm system is disarmed. Due to the amplifier's anti-theft feature (if enabled), if the main power to the amplifier is removed while the security system is armed the amplifier operation is disabled. To reset the amplifier, refer to *Appendix—Programmable Features*.

PRACTICE SAFE SOUND™

Continuous exposure to sound pressure levels over 100dB may cause permanent hearing loss. High power automotive sound systems can generate sound pressure levels in excess of 130dB. When playing your system at high levels, please use hearing protection and avoid long term exposure.

RECORD YOUR SERIAL NUMBER AND DATE

To ensure your warranty (see back cover), please record the following information regarding your new amplifier.

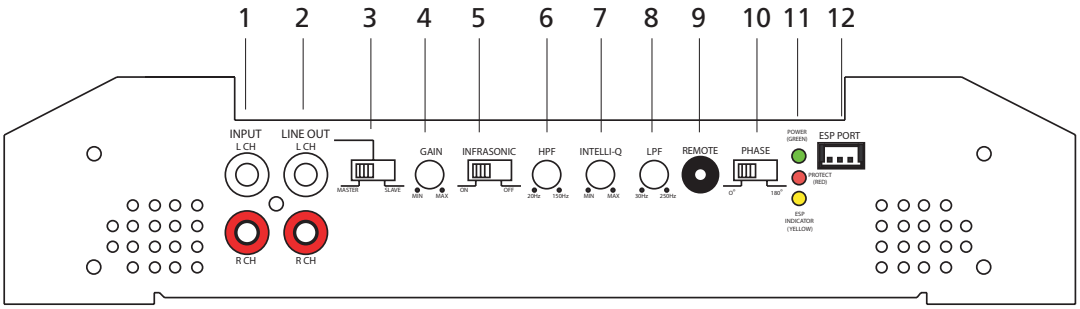
Model: _____

Serial Number: _____

Date of Purchase: _____

Purchased from: _____

END PANEL LAYOUTS



1. **RCA Input -** accepts RCA input from a head unit, preamplifier, or equalizer.
2. **RCA Line Output -** provides easy connection to additional amplifiers.
3. **Master/Slave Switch -** controls whether the amplifier is a slave or master when connected in combined amplifier configurations. (Refer to the Combined Amplifiers section of this guide.)
4. **Gain Control -** continuous adjustment for full power output.
5. **Infrasonic Switch -** when On cuts off extremely low bass frequencies (below the range of human hearing, that speakers cannot effectively reproduce). The high pass filter is engaged when the infrasonic switch is On. This improves efficiency of the amplifier's power supply, improves sound reproductive performance, and reduces chances of damaging the subwoofers.
6. **High-Pass Frequency Control -** adjusts the frequency of the high-pass crossover.
7. **INTELLi Q Control -** continuously adjusts the "Q" boost of the high-pass crossover from 0 to 10dB of boost.
8. **Low-Pass Frequency Control -** adjusts the upper crossover frequency of the amplifier.
9. **Remote Bass Input -** connects optional HP-RB1 remote bass control to control the bass level from the driver's seat.

10. **Phase Control Switch** - provides either 0 or 180 degree phase shift of the amplified output (speaker) with respect to the input signal to facilitate bridging of amplifiers.

11. **Power LED -** when illuminated (green) indicates that the amplifier is on.

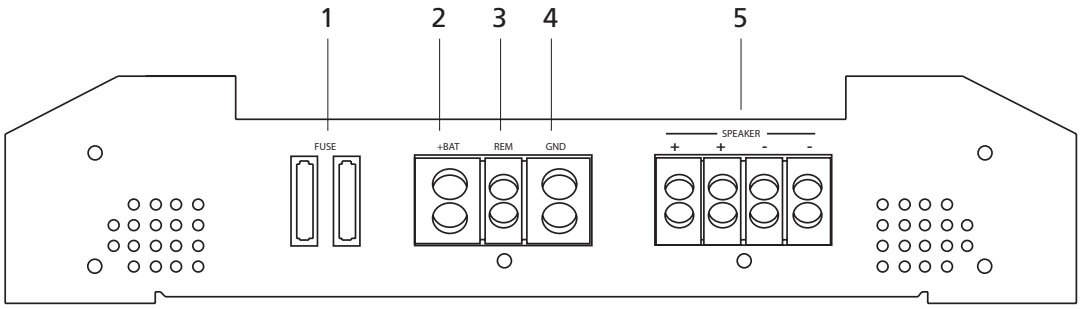
    Protect LED - when illuminated (red) indicates that the amplifier protective circuitry has been activated due to thermal, output short, supply undervoltage or supply overvoltage.

    ESP® Indicator LED - when illuminated (yellow) indicates ESP® functionality and is used to diagnose ESP® features. The LED flash characteristics will assists in diagnosing the type of fault (see *Appendix)*.

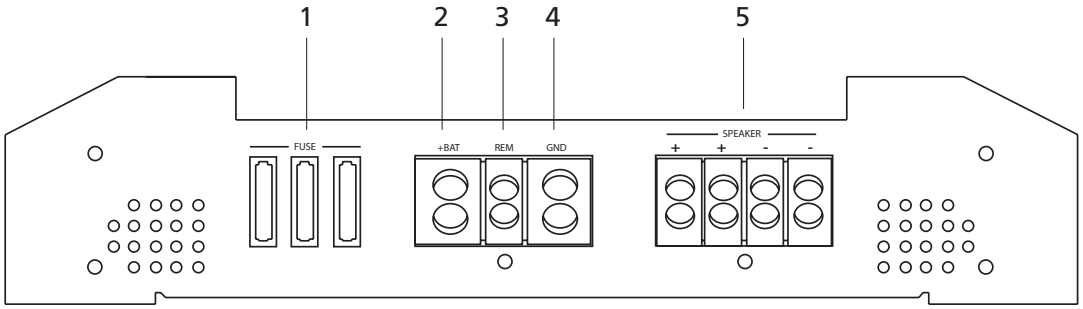
NOTE: The LED on top of the amplifier may also illuminate and flash with the ESP® LED indicator, if this option has been enabled by your installer (requires Bitwriter®).

12. **ESP® Port -** connection port for Bitwriter® or ESP2 security system.

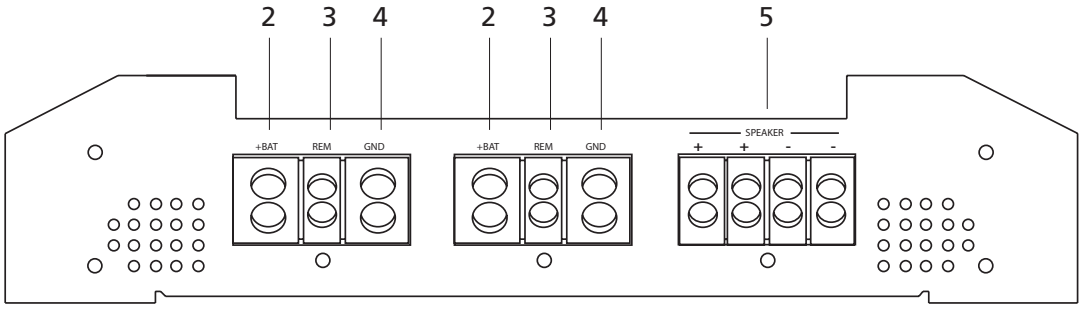
HCCA-D1200



HCCA-D2400



HCCA-D5000



1. **ATC Fuse -** this fuse(s) protects the amplifier against internal electrical damage and is meant to protect the amplifier only. All other power connections should be fused at the source. The HCCA-D1200 has two 30-amp fuses. The HCCA-D2400 has three 40-amp fuses. The HCCA-D5000 has one inline 250-amp fuse.

2. **+BAT -** connect this terminal through a FUSE or CIRCUIT BREAKER to the positive terminal of the vehicle battery or the positive terminal of an isolated audio system battery.

WARNING: Always protect this power wire by installing a fuse or circuit breaker of the appropriate size within 12 inches of the battery terminal connection.

3. **REM -** this terminal turns on the amplifier when (+) 12 volt is applied. Connect it to the remote turn on lead of the head unit or signal source. If a (+) 12 volt remote turn lead is not available, a Remote Power Adapter (P/N #55000) can be used to supply a remote turn on signal. DO NOT connect this terminal to constant (+) 12 volt.
4. **GND -** power return connection. Connect this terminal directly to the sheet metal chassis of the vehicle, using the shortest wire necessary to make this connection. Always use wire of the same gauge or larger than the (+) 12 volt power wire. The chassis connection point should be scraped free of paint and dirt. Use only quality crimped and/or soldered connectors at both ends of this wire. DO NOT connect this terminal directly to the vehicle battery ground terminal or any other factory ground points.
5. **Speaker -** connect the speakers to these terminals. (refer to the Speaker Connection section of this guide.)

NOTE: Make all connections to power, ground, speakers, and remote terminals before final positioning and installation of the amplifier in the vehicle.

NOTE: the HCCA-D5000 has two terminal strips for power connections. The +BAT and GND connections can be made to either of these terminals.

CEA SPECIFICATIONS

HCCA-D1200

Power Output: 250 Watts RMS x 1 at 4 ohms and ≤ 1% THD+N
Signal to Noise Ratio: -60 dBA (reference 1 Watt into 4 ohms)

Additional Power Output: 600 Watts RMS x 1 at 1 ohm at 14.4 Supply≤1% THD+N

HCCA-D2400

Power Output: 450 Watts RMS x 1 at 4 ohms and ≤ 1% THD+N
Signal to Noise Ratio: -60 dBA (reference 1 Watt into 4 ohms)

Additional Power Output: 1200 Watts RMS x 1 at 1 ohm at 14.4 Supply≤1% THD+N

HCCA-D5000

Power Output: 1000 Watts RMS x 1 at 4 ohms and ≤ 1% THD+N
Signal to Noise Ratio: -60 dBA (reference 1 Watt into 4 ohms)

Additional Power Output: 2500 Watts RMS x 1 at 1 ohm at 14.4 Supply≤1% THD+N

SPECIFICATIONS

Amplifier Section	HCCA-D1200	HCCA-D2400	HCCA-D5000
Power Output 4Ω (Watts)note 1	250 x 1	450 x 1	1000 x 1
Power Output 2Ω (Watts)note 2	400 x 1	800 x 1	1600 x 1
Power Output 1Ω (Watts)	600 x 1	1200 x 1	2500 x 1
Amplifier Efficiency	> 70% into 1Ω load at max. power	> 70% into 1Ω load at max. power	> 70% into 1Ω load at max. power
Externally Bridgeable	yes	yes	yes
Remote Bass Function	yes (HP-RB1 supplied)	yes (HP-RB1 supplied)	yes (HP-RB1 supplied)
Distortion at Rated Power	< 1.0% THD+N	< 1.0% THD+N	< 1.0% THD+N
Frequency Response	20Hz to 250Hz ±2.5dB	20Hz to 250Hz ±2.5dB	20Hz to 250Hz ±2.5dB
Linear Bandwidth	10Hz to 500Hz ±3dB	10Hz to 500Hz ±3dB	10Hz to 500Hz ±3dB
Damping Factor	> 200	> 200	> 200
Input Sensitivity	150mV to 5V rms	150mV to 5V rms	150mV to 5V rms
Supply Voltage Range	9 to 16V	9 to 16V	9 to 16V
Protection	thermal, DC offset, reverse polarity, short protection, under-voltage, over-voltage	thermal, DC offset, reverse polarity, short protection, under-voltage, over-voltage	thermal, DC offset, reverse polarity, short protection, under-voltage, over-voltage
Terminal Wire Gauge	Power 0/1 AWG, Remote 12 AWG, Ground 0/1AWG, Speaker 12 AWG	Power 0/1 AWG, Remote 12 AWG, Ground 0/1AWG, Speaker 12 AWG	Power 0/1 AWG, Remote 12 AWG, Ground 0/1AWG, Speaker 12 AWG
Input Impedance	20kΩ	20kΩ	20kΩ
Fuse Type	(2) 30 Amp	(3) 40 Amp	In-line 250 Amp
Dimensions	13"x10.5"x2.3"	13"x10.5"x2.3"	13"x10.5"x2.3"
Weight	8 lbs.	8 lbs.	8 lbs.
Crossover Section			
High Pass Crossover	Continuously variable (20-150Hz)	Continuously variable (20-150Hz)	Continuously variable (20-150Hz)
Low Pass Crossover	Continuously variable (30-250Hz)	Continuously variable (30-250Hz)	Continuously variable (30-250Hz)
Infrasonic Filter	Selectable On/Off 24dB/Octave -6dB at 20Hz	Selectable On/Off 24dB/Octave -6dB at 20Hz	Selectable On/Off 24dB/Octave -6dB at 20Hz
Intelli-Q	0–10dB boost	0–10dB boost	0–10dB boost

1. Continuous 4Ω load 20Hz to 200Hz, < 1% THD, with input voltage at 14.4VDC.
2. Continuous 2Ω load 20Hz to 200Hz, < 1% THD, with input voltage at 14.4VDC.

AMPLIFIER SETTINGS

Signal Input and Output Configurations

The input section of the amplifier consists of a phase switch that sets the output configuration, infrasonic switch, gain controls, high pass and low pass crossovers controls, Intelli-Q control, and RCA inputs. The input section makes it easy to adapt this amplifier to most system configurations.

Input Gain

These Orion amplifiers have level adjustments to allow for easy integration with any source unit. The input sensitivity can be adjusted from 150mV to 5V. Refer to *Testing the System* and *Adjusting the Sound of the System* sections of this guide for detailed instructions on setting the gain.

Phase Switches

- **0° -** leaves output unaffected. The output signal is in phase with the input signal.
- **180° -** inverts the output. The channel is 180° output of phase. This configuration is useful for inverting the phase of subwoofers to improve staging in a vehicle. This is also used when bridging two amplifiers into one speaker.

Line Output Configurations (System Expansion)

NOTE: When expanding your system by adding additional Orion amplifiers in the signal chain use only the same model(s) as the first amplier in the chain.

The line outputs on Orion amplifiers offer easy, unlimited system expansion. Routing signal from a source unit, pre-amplifier, or equalizer is a matter of connecting RCAs to the RCA Inputs of the first Orion amplifier and then the RCA line outputs to the next Orion amplifier's RCA line inputs in the signal chain. Then the Master/Slave switch on each of the amplifiers is set as follows:

The first amplifier in the signal chain will have its Master/Slave switch set to the MASTER position. In effect this first amplifier will set the gain for the remainder of the amplifiers in the signal chain.

The remaining amplifiers following in the signal chain will have their Master/Slave switch set to the SLAVE position. This allows the signal to be input directly, bypassing the subsequent amplifiers gain control. The audio level is set and supplied by the output of the master amplifier at its gain setting.

Internal Crossover Configurations

The crossover section of the Orion HCCA-D1200, HCCA-D2400, and HCCA-D5000 amplifiers is continuously variable and extremely flexible. In addition to the variable built-in low-pass filters, the high-pass crossover incorporates the INTELLi Q feature. This circuit is designed to optimize the performance of Orion subwoofers in all types of enclosures.

When using Orion loudspeakers, minor deviations from the recommended frequency ranges can provide superior results depending on your speaker locations and your vehicle acoustics. Setting crossover frequencies higher than recommended will not cause damage and may provide superior sonic results depending on your system's performance goals. Refer to your loudspeaker owner's manual for assistance in choosing the proper crossover frequencies for your system.

WARNING! DO NOT set crossover frequencies lower than the speakers recommended operating range. This can cause driver failure that is not covered by the manufacturer's warranty.

Low-Pass Crossover

When the switch is to the left (OFF position), the low-pass crossover is bypassed. When the switch is in the middle (12 position), the low-pass crossover is active with a 2nd order (12dB per octave) slope. When the switch is to the right (24 position), the low-pass crossover is active with a 4th order (24dB per octave) slope. The low-pass crossover is continuously variable from 30Hz to 250Hz.

High-Pass Crossover

When the switch is to the left (OFF position), the high-pass crossover is bypassed. When the switch is to the right (ON position), the high-pass crossover is active with a 2nd order (12dB per octave) slope. The high-pass crossover is continuously variable from 20Hz to 150Hz and is optimized for use as a subsonic filter. Additionally, boost can be added at the high-pass crossover frequency for improved bass output while still protecting the woofer from excessive excursion. The INTELLi Q adjustment allows up to 10 dB of boost at the selected crossover frequency.

WARNING! Exercise caution when setting INTELLi Q. Maximum boost can potentially cause woofer damage due to over-excursion.

Fine Tuning the Crossovers

The low-pass and high-pass crossover sections are each marked at four frequency points for ease of system adjustment. The low-pass crossover section is marked at 30Hz, 50Hz, 150Hz, and 250Hz. The high-pass crossover section is marked at 20Hz, 33Hz, 90Hz and 150Hz. Specific crossover points can be chosen based on the recommended operational bandwidth of your speakers.

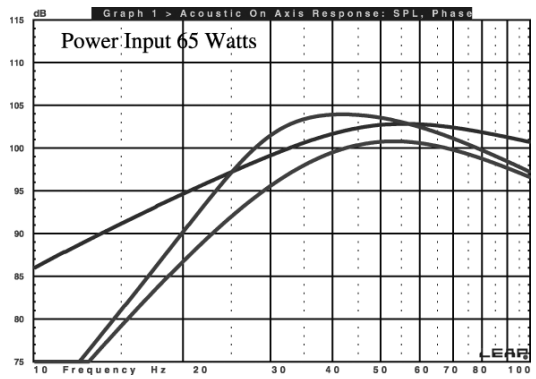
Adjusting INTELLi Q

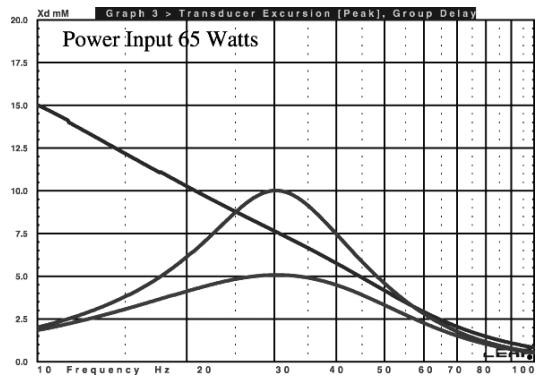
Incorporated in the high-pass crossover, INTELLi Q maximizes the performance of a subwoofer. The high-pass subsonic filter removes unwanted bass output from the woofer, increasing the output of a subwoofer by as much as 3 dB due to the increased mechanical power handling. Depending on the enclosure, using INTELLi Q can increase the low frequency response by an additional 10dB! The type of enclosure used and the woofer's excursion capability determine acceptable boost levels. Listed below are recommended boost levels for different enclosure designs.

Enclosure Type	Boost Levels			
	0dB	+3dB	+6dB	+10dB
Infinite Baffle	Tune above Fs of woofer	High X-Max Drivers--Tune above Fs of woofer	Not Recommended	Not Recommended
Sealed	Tune above Fs of woofer	Tune above Fs of woofer	High X-Max Drivers--Tune above Fs of woofer	Not Recommended
Vented	Tune to port frequency	Tune to port frequency	Tune to port frequency	High X-Max Drivers--Tune to port frequency
Sealed Band-pass	Tune above Fs of woofer	Tune above Fs of woofer	High X-Max Drivers--Tune above Fs of woofer	Not Recommended
Vented Band-pass	Tune to port frequency	Tune to port frequency	Tune to port frequency	High X-Max Drivers--Tune to port frequency
Aperiodic	Set crossover to Fs of woofer	Set crossover to Fs of woofer	Set crossover to Fs of woofer	Not Recommended

Infinite Baffle Example High-Pass Set at 30Hz

By removing low frequency signal that the woofer cannot produce, the woofer can play its capable range louder. The first example is an infinite baffle situation. The left graph displays the frequency response of a 12-inch woofer in an infinite baffle application without the high-pass filter, with the filter and with the filter and the INTELLi Q set to +3dB. As you can see, with +3dB of boost and the high pass filter set to 30Hz, the woofer has more output down to 25Hz and less overall excursion when compared to the non-high-pass response. Maximum physical excursion capability of the woofer is 15mm.

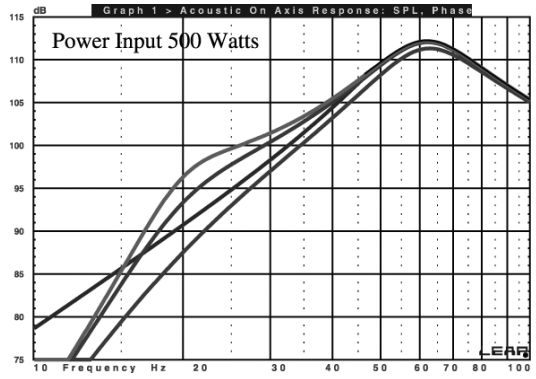


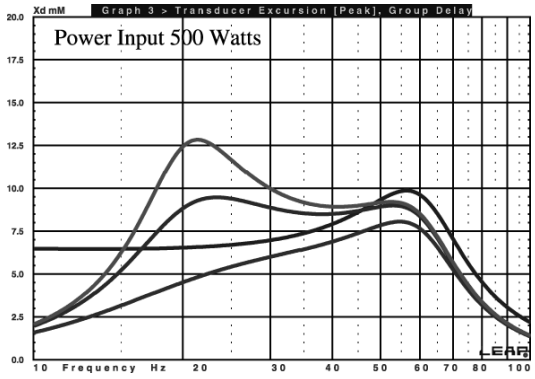


NOTE: The left graph is the response; the right graph is the driver excursion. These designations apply to the following graphs as well.

Sealed Example High-Pass Set at 20Hz

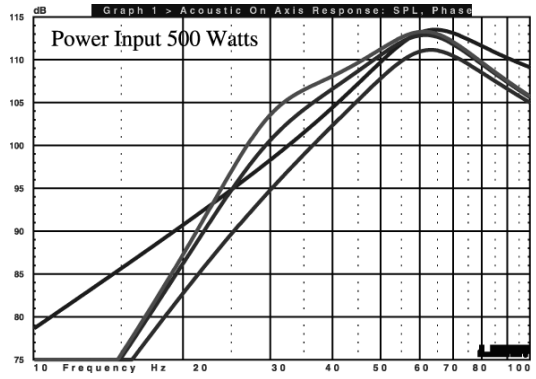
This sealed example is the same 12-inch woofer in the recommended sealed enclosure. Up to 6 dB of boost is capable if 20 Hz was used. With +6dB of boost, the woofer has more output down to 15 Hz.

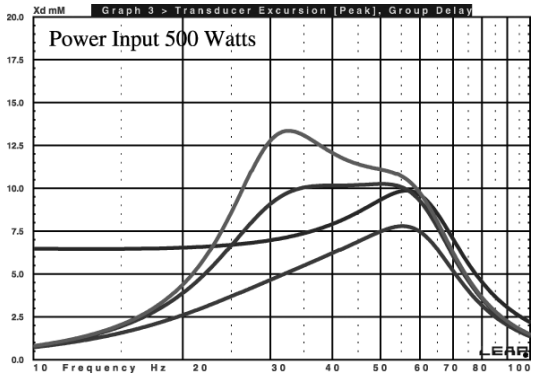




Sealed Example High-Pass Set at 30Hz

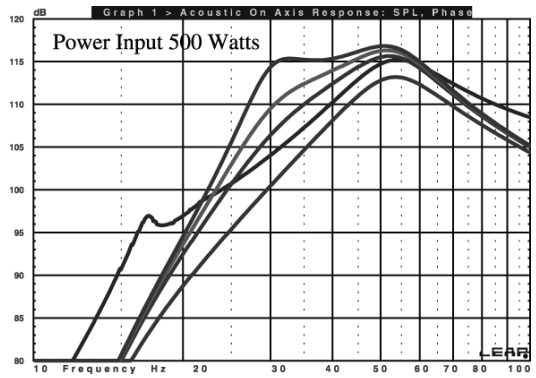
In this example, the frequency has been increased to 30 Hz. Up to 6 dB of boost is capable at this frequency. With +6dB of boost, the woofer has more output down to 23 Hz. The overall usable output is increased.

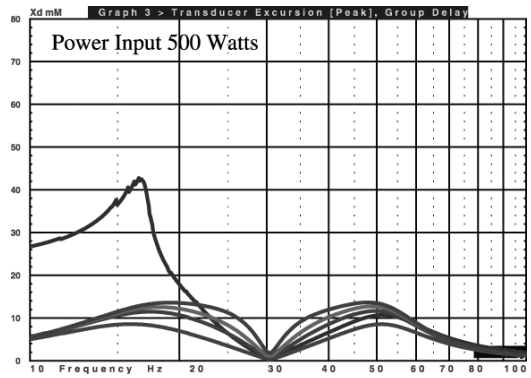




Vented Example High-Pass Set at 30Hz

Vented enclosures benefit most from the INTELLi Q. Up to 10 dB of boost is capable at the box tuning frequency of 30 Hz. With +10dB of boost, the woofer has more output down to 22 Hz. The excursion below the tuning frequency has been greatly reduced.





Remote Gain Operation

NOTE: Do not use the Remote Gain control when you have an expanded system installed (see *Line Ouput Configurations*). The Slave amplifier(s) gain will not be controlled.

The remote gain port provides easy remote access to the internal gain structure of the HCCA power amplifier. The HP-RB1 plugs into the amplifier via the 1/8" mini jack plug. The HP-RB1 can be installed in the front of the vehicle to control the amplifier gain level. The HP-RB1 can be used as a bass level control when used on an amplifier dedicated to subwoofers.

AMPLIFIER WIRING

Power Connections for the HCCA-D1200, and HCCA-D2400

- Orion HCCA-D1200 Fuse Size: 2 x 30 AMP ATC.
- Orion HCCA-D2400 Fuse Size: 3 x 40 AMP ATC.
- Power connections accept up to 4 AWG wire.
- 4 AWG power and ground wire recommended for optimal performance.
- Connect 12V+ to the battery through fuse holder. This connection provides +12V main power to the amplifier.
- Power wire must be fused no more than 18" from battery.
- Ground amplifier to a good chassis ground as close as possible to the amplifier.
- Connect REM terminal to remote turn-on lead from source unit. This connection provides +12V power to turn-on the amplifier.
- Add extra ground wire between the negative terminal of the battery and the chassis.

Power Connections for the HCCA-D5000

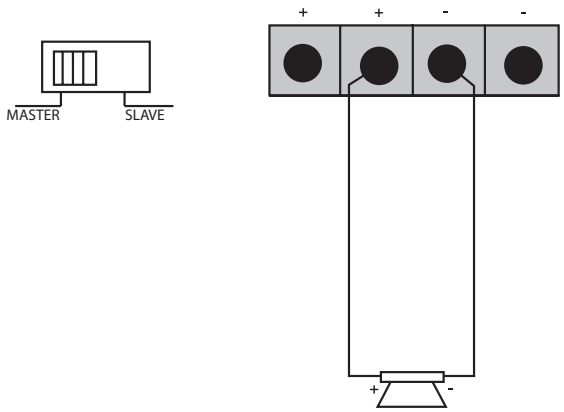
- Orion HCCA-D5000 Fuse Size: inline 250 AMP.
- Power connections accept up to 4 AWG wire.
- Dual 4 AWG power and ground wire required for proper performance.
- Connect 12V+ to the battery through power distribution and fuse holder. This connection provides +12V main power to the amplifier.
- Power wires must be fused no more than 18" from battery.
- Terminate both grounds of the amplifier to a good chassis ground as close as possible to the amplifier.
- Connect REM terminal to remote turn-on lead from source unit. This connection provides +12V power to turn-on the amplifier.
- Add an extra ground wire between the negative terminal of the battery and the chassis. Either dual 4 AWG or single 1/0 AWG is recommended.

NOTE: The addition of a ground wire from the battery to the chassis of the vehicle improves the ability of the battery to supply power to the amplifier. This is recommended because the current delivery of the factory electrical system was designed only to accommodate electronics supplied by the auto manufacturer.

WARNING! The Orion HCCA-D5000 has two separate four-gauge power and ground inputs. Both pairs of connections must use 4 AWG power wire for proper operation. Failure to do this may damage the amplifier and is not covered under warranty. The HCCA-D5000 cannot be operated in a bridge or strapped configuration, attempting to do so will damage the amplifier.

Speaker Connections

The Orion HCCA-D1200, HCCA-D2400, and HCCA-D5000 amplifiers offer two positive and two negative output terminals for ease of connecting the speakers to the amplifier. Since these are mono amplifiers, the speaker connectors are paralleled internally. Each amplifier is stable to 1Ω. See diagrams below.



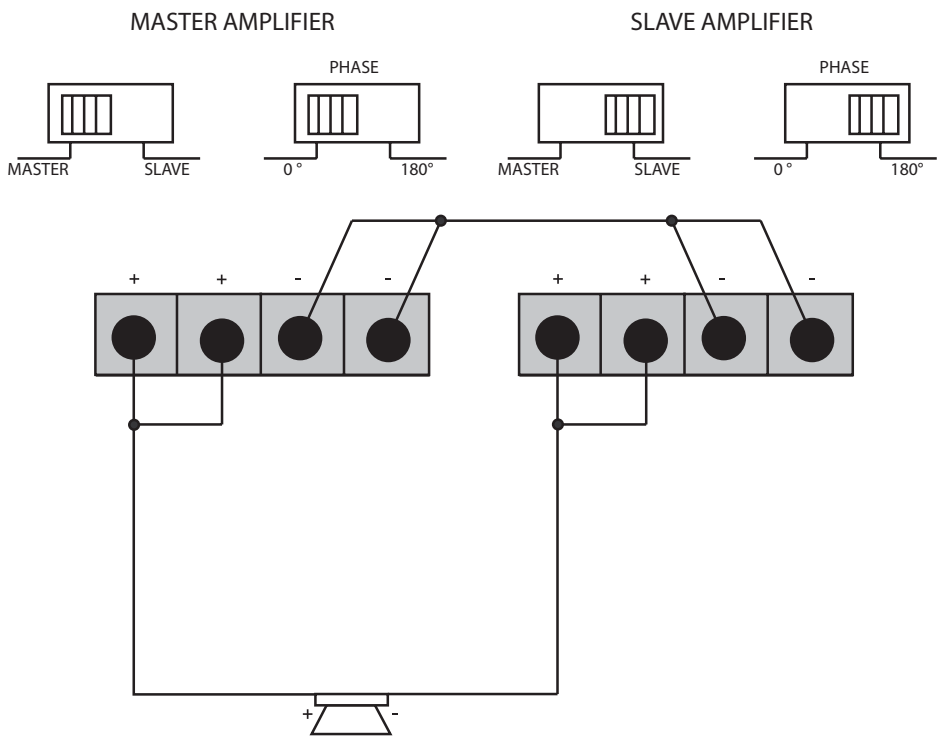
Bridging (strapping)

For bridging into a single speaker load, the Orion HCCA-D1200 and HCCA-D2400 have the ability to be bridged with another amplifier of the same model. To do this you must utilize the MASTER/SLAVE switch settings. For the MASTER amplifier, set the switch setting to MASTER. This will route the signal through RCA to the other (slave) amplifier. On the Slave amplifier set this switch to the SLAVE position. Refer to *Auxiliary Output Configuration* section of this guide. Set the PHASE switch on the slave amp, move the phase switch from 0 to 180, exactly opposite of the master amp. Refer to the *Phase Switches* section of this guide.

On the slave amplifier be sure to turn off all crossovers. For the speaker connections, connect the positive (+) speaker lead from the speaker to the positive (+) speaker terminal of the master amplifier. On the negative (-) speaker connection, take the negative (-) speaker terminal of the master amplifier and connect it directly to the negative (-) speaker terminal of the slave amplifier. The remaining positive (+) speaker terminal of the slave amplifier must be connected to the negative (-) speaker lead from the speaker. The impedance of the speaker must not exceed 2Ω. See diagram below.

NOTE: For best results, connect both negative speaker terminals on the master amp to both negative terminals on the slave amp using at least 12 AWG cable.

WARNING! The Orion 2500D is not designed to work in a bridged or strapped configuration. Attempting to apply these configurations will damage the amplifier and will not be covered under warranty.



AMPLIFIER INSTALLATION

Choosing Mounting Locations

The location of your amplifier will depend on several important issues. Due to the low profile size of the Orion amplifiers, there are many possible installation locations that will yield satisfactory amplifier performance. Always mount the amplifier in a place that protects the amplifier from the elements. In addition, mount the amplifier on a stable, flat surface.

NOTE: Mounting amplifiers upside down is not recommended and may cause premature thermal shutdown.

WARNING! Do not mount any amplifier in the engine compartment. Amplifiers are not designed to endure the harsh environment of the exterior elements.

Passenger Compartment

If you are going to mount the amplifier in the passenger compartment, make sure you have adequate room for ventilation. The amplifiers have been designed to make under-seat mounting possible. When mounting your amplifier under a seat or similar area, keep a minimum of 1" of clearance around the amplifier for adequate cooling.

Trunk Compartment

Mounting your amplifier in the trunk provides excellent performance as long as you do not restrict the airflow around the heatsink of the amplifier. For optimal results, mount the amplifier with as much clearance as possible. This type of mounting will yield the best cooling due to the convection effect of the amplifier chassis.

General Precautions and Installation Tips

WARNING! Be careful not to cut or drill into gas tanks, fuel lines, brake lines, hydraulic lines, vacuum lines, or electrical wiring when working on your vehicle.

Disconnect the vehicle's ground wire at the battery before making or breaking connections to the audio system's power supply terminals.

Do not use this amplifier unmounted. Failing to securely mount the amplifier can result in damage or injury, particularly in the event of an accident. An unmounted amplifier becomes a dangerous projectile in the event of a crash. Never mount the amplifier where it might get wet. Mount the amplifier so the wire connections will not be pulled. Route the wires where they will not be scraped, pinched or damaged in any fashion.

The +12V power supply wire must be fused as close as possible to the battery terminal, ideally within 12". Use the recommended fuse size or circuit breaker listed in the *Power Connections* section of this manual.

If you need to replace the fuse plugged into the side of the amplifier, replace the fuse with the same size and type fuse that came with the amplifier. If you are not sure as to the correct value, refer to the *Power Connections* section of this manual for details. Using a higher current fuse may result in damage to the amplifier that is not covered under warranty.

NOTE: Make sure all the equipment in the system is turned off when making or breaking connections to the input RCAs or speaker terminals. Turn on the system and slowly turn up the volume control only after double checking all wire connections.

Power for systems with a single amplifier can be supplied by most automotive electrical systems. Systems with multiple amplifiers may require a higher capacity battery, alternator or the use of a storage capacitor. We strongly recommend the use of a Directed Audio Essentials power capacitor with an extra battery in larger stereo systems.

Orion amplifiers generate a certain amount of heat as part of normal operation. Be sure the area around the amplifier is unobstructed to allow adequate air circulation. Remember, beach blankets, last week's laundry, school books and homework papers located on top of the amplifier do not improve air flow and may become damaged.

Tools of the Trade

Listed below are the majority of the tools required to perform an installation. Having the proper tools will make the installation that much easier. Some of these tools are necessities; some will just make the job easier.

- Allen Wrenches (2.5mm and 3mm)
- DMM or VOM
- Electric drill with assorted drill bits
- Grommets
- Heat shrink tubing
- Marking pen
- Nylon tie straps
- Phillips and flat blade screw drivers
- Pliers (standard and needle nose)
- Reference CD with 1 kHz Sine Wave at 0dB level (all bits high)

- RTA (real time analyzer)
- Soldering iron and solder
- Utility knife
- Wire brush or sandpaper for chassis grounding
- Wire crimper
- Wire cutters
- Wire strippers

Step By Step Installation

Step 1 Determine the location for the amplifier. Refer to the *Choosing Mounting Locations* section of this guide for detailed information.

Step 2 Decide on the system configuration for your amplifier. For system suggestions, refer to the *Speaker Connections* section of this guide.

Step 3 Run all the wires from the amplifier location to the speakers, source unit, and battery. Do not connect the battery at this time. Be sure to run RCAs and power and speaker wires away from factory electrical wires and system as they pose a great potential for induced system noise.

Step 4 Pre-drill amplifier mounting holes. Be sure to "think before you drill". Gas tanks, fuel lines, and other obstructions have a nasty way of hiding themselves. For best results use a marking pen to mark the mounting holes and pre-drill these holes with a standard 1/8" drill bit.

Step 5 Mount the amplifier. Make sure the amplifier is mounted on a flat surface. If this is not possible, do not over tighten the screws so that the chassis of the amplifier is twisted or bent.

Step 6 Turn the vehicle's key switch to the off position.

Step 7 Disconnect the vehicle's battery ground terminal.

Step 8 Connect power wires to the amplifier (ground first, then 12 V(+) and REM).

Step 9 Connect the RCA and speaker wires to the amplifier. Check the quality of your speakers and signal connections. This will determine the ultimate performance of your Orion amplifier. Refer to the *Signal Input and Output Level Controls* and *Speaker Connections* sections of this guide for correct wiring instructions.

Connect the ESP®-2 cable that came with the amplifier from the amplifier's ESP port to the security system's ESP port.

Step 10 Reconnect the ground terminal to the battery after power, speaker, and RCA connections are completed.

Step 11 Set crossovers. Refer to the *Internal Crossover Configuration* section of this manual for detailed instructions.

Step 12 Once satisfied that all connections and settings are correct, install the fuse located near the vehicle's battery and proceed to the *Testing the System* section of this manual.

WARNING! Never exceed the recommended fuse size of this amplifier. Failure to do so will result in the voiding of your warranty and possible damage to the amplifier.

SET UP AND TROUBLESHOOTING

Testing the System

After you have completed the installation, you need to test the system. This will help ensure years of trouble-free operation. Please refer to the listed steps below when testing the sound of your Orion system.

Step 1 Check all the wiring connections to be sure they are correct and secure.

Step 2 Turn the signal source volume control all the way down. Set any tone controls to their flat or defeated positions. This includes the loudness control.

Step 3 Turn the level controls of the amplifier to their minimum positions.

Step 4 Turn the source unit on. Check to see if the power LED located on the connection side of the amplifier is on. If not, please refer to the *Power Connections* and the *Troubleshooting Tips* sections of this manual for instructions.

Step 5 If using an aftermarket source unit, turn the level controls of the amplifier about one quarter of a turn. Slowly increase the volume level of the source unit to so that you can hear the output of the system. If no sound is heard or if the output is distorted, turn the system off immediately. Refer to the *Power Connections* and the *Troubleshooting Tips* sections of this manual to solve your installation problems.

Step 6 Check to make sure the output for each channel is correct. If the active crossovers are used, check to make sure that each output is correct from the amplifier. When using active crossovers on midrange and tweeters, do not use crossover frequencies lower than recommended. If the system is not configured properly, refer to the *Internal Crossover Configuration* section of this manual and take corrective action.

Step 7 If the output is clear and undistorted, continue to the *Adjusting the Sound of the System* section of this manual.

Adjusting the Sound of the System

Once you have checked the system's operation, adjust the sound of the system. Adjusting the sound of the system is accomplished by setting the level controls and adjusting the internal crossovers.

Step 1 Turn the signal source volume control all the way down. Set any tone controls to their flat or defeated positions. This includes the loudness control.

Step 2 Turn the level controls of the amplifier to their minimum positions.

Step 3 Choose music with high dynamic content that you like, with which you are familiar, and will be used most often in the system.

Step 4 Turn the source unit's volume control up to its highest undistorted output level. If you lack test equipment, this point occurs between 3/4 to full volume depending on the quality of your source unit. Listen for any audible distortion. If any distortion is audible, reduce the volume of the source unit until you have an undistorted output. Leave the volume control at this position during your system tuning.

Step 5 While listening to your chosen dynamic music, turn up the level control corresponding to the midrange output until you hear slight distortion and turn the level control back slightly for an undistorted output. Depending on your system, the midrange and tweeter output may be on the same output channels.

Step 6 Turn up the level control corresponding to the tweeter output until you hear slight distortion and turn back the level control slightly for an undistorted output. Depending on your system the midrange and tweeter output may be on the same output channels.

Step 7 Fine-tune the output level between midrange and tweeters. Refer to the *Internal Crossover Configuration* section of this manual for detailed instructions.

Step 8 Repeat Steps 5-7 for the rear speakers. If you do not have rear speakers continue to Step 10.

Step 9 Set levels between the front and rear midrange and tweeters for optimum front/rear balance.

Step 10 Turn up the level control corresponding to the woofer output until you hear slight distortion and turn back the level control slightly for an undistorted output.

Step 11 Fine-tune the output level between satellite speakers and the woofers. Refer to the *Internal Crossover Configuration* section of this manual for detailed instructions. If using an HP-RB1, adjust the level to the output of the woofer to match the sonic requirements of the system.

Step 12 Enjoy your awesome Orion sound system.

Troubleshooting Tips

Symptom	Probable Cause	Action To Take
No output		
	Low or no remote turn-on	Check remote turn-on voltage at voltage amplifier and repair as needed.
	Fuse blown	Check power wire's integrity and check for speaker shorts. Fix as needed and replace fuse.
	Power wires not connected	Check power wire and ground connections and repair or replace as needed.
	Audio input not connected	Check RCA connections and repair or replace as needed.
	Speaker wires not connected	Check speaker wires and repair or replace as needed.
	Speakers are blown	Check system with known work ing speaker and repair or replace speakers as needed.
Audio cycles on and off		
	Thermal protection engages when amplifier heat sink temperature exceeds 90°C (190°F)	Make sure there is proper venti lation for amplifier and improve ventilation as needed.
	Loose or poor audio input	Check RCA connections and repair or replace as needed.
	Loose power connections	Check power wire and ground connections and repair or replace as needed.
Distorted output		
	Amplifier level sensitivity set too high exceeding maximum capability of amplifier	Readjust gain. Refer to the *Adjusting the Sound of the System* section of this manual for detailed instructions.
	Impedance load to amplifier too low	Check speaker impedance load, if below 1Ω, rewire the speakers to achieve higher impedance.
	Shorted speaker wires	Check speaker wire connections and fix or replace as needed.
	Speaker not connected to amplifier properly	Check speaker wiring and repair or replace as needed. Refer to the *Speaker Connections* section of this guide for detailed instructions.

Symptom	Probable Cause	Action To Take
Distorted output		
	Internal crossover not set properly for speakers	Readjust crossovers. Refer to the *Internal Crossover Configuration* section of this guide for detailed instructions.
	Speakers are blown	Check system with known work ing speakers and fix or replace as needed.
Poor bass response		
	Speakers wired with wrong polarity causing cancellation at low frequencies	Check speaker polarity and fix as needed.
	Crossover set incorrectly	Reset crossovers. Refer to the *Internal Crossover Configuration* section of this guide for detailed instructions.
	Impedance load at amplifier is too low	Check speaker impedance load, if below 1Ω, rewire speakers to achieve higher impedance.
Battery fuse blowing		
	Short in power wire or incorrect wiring	Check power and ground con- nections and replace or repair as needed.
	Fuse used is smaller than recommended	Replace with proper fuse size.
	Actual current exceeds fuse rating	Check speaker impedance load. If below 1Ω, rewire speakers to achieve higher impedance.
Amplifier fuse blowing		
	Fuse used is smaller than recommended	Replace with proper fuse size.
	Impedance load at amplifier too low	Check speaker impedance load. If below 1Ω, rewire speakers to achieve higher impedance.
	Speaker is blown with shorted outputs	Check system with known work ing speakers and fix or replace as needed.
	Actual current exceeds fuse rating	Check speaker impedance load. If below 1Ω, rewire speakers to achieve higher impedance.

APPENDIX—PROGRAMMABLE FEATURES

The following listing are ESP®-2 features that can be programmed or accessed by your installer to customize or troubleshoot your system. Factory default settings are shown in bold.

NOTE: The Bitwriter® must have software version 2.3 or above to access the amplifier features menu.

NOTE: A setting marked "Reserved" is for future development.

Turn On Delay - 2.0, **2.5**, 3.0, 3.5, 4.0 seconds. Delays the amplifier turn-on when the head or source unit is turned on. This eliminates any annoying pops or noise during power up from the head or source unit from feeding through to the amplifier.

Service Code Display - **OFF**, Flash Code on LED, Reserved, Clear Last Fault.

When set to "Off" the service code display will not be displayed on top of the amplifier (see Top Light Options feature below) and the amplifier operates normally.

When set to "Flash Code on LED", the LED on top of the amplifier will be enabled to flash the diagnostic code (see table below).

The "Clear Last Fault" setting is used by your installer to clear the last fault event detected by the amplifier.

NOTE: When the Clear Last Fault setting is used, execute a "read" cycle from the Bitwriter® prior to attempting further writes. This resynchronizes the Bitwriter®.

ESP®-2 Status Indicator	Mode
Solid Illumination	Normal Operation
Flashing	Turn On delay or TX learn
Flashing Slowly	Thermal shutdown
Flashing Rapidly	Overcurrent
Slow Flash (50% duty cycle)	Overvoltage
Slow Flash (mostly off)	Under-voltage
Off	Amplifier Off
Flashing	Arm/Valet received
Flashing Rapidly	Amplifier in Anti-theft/Valet
Flashing	Amplifier armed

Input Gain Range (Volts) - **Default**, 0.15–0.50 V, 0.50–1.00 V, 1.00–3.00 V, 3.00–5.00 V. This feature allows the input gain range to be limited. This feature is useful to prevent the amplifier from being overdriven. The "Default" setting turns the Input Gain Range feature off, the input gain adjustment is settable over the full range of the control.

NOTE: If the Input Gain Adjustment is set to Lock (see below), the Input Gain Range adjustment will not be altered until the Input Gain Adjustment is set to Unlock.

Input Gain Adjustment - **Unlock**, Lock. When set to "Lock", the input gain adjustment is disabled. This can be set to lock after the amplifier has been installed and set up to prevent accidental or unwarranted adjustment.

NOTE: Use caution when adjusting or unlocking gain as restricting the range or unlocking the range can result in sudden increases in gain.

The *Valet Monitoring* and *Anti Theft* options (below) require the ESP2 alarm to be "learned" into the amplifier. Prior to setting the valet or anti theft to Enable or On, execute the TXID routine. The ESP2 alarm must be the one installed in the vehicle.

Valet Monitoring - **Disable**, Enable. Used in conjunction with an ESP®-2 security system to prevent operation of the amplifier when the security system is in Valet mode. When Valet mode is Enabled, and the valet code is received from the alarm system, the amplifier will not power up the next time it goes through a remote line On cycle (using the head unit or other device that turns the amplifier on).

Anti Theft - **Off**, Reserved, On. When set to "On", and when the ESP®-2 security system is armed, the amplifier will not operate until the security system is disarmed (the remotes used by the security system must be learned by the amplifier—see "Learn TX IDs" below). If the security system is armed and then the amplifier is disconnected from 12V DC, the amplifier will be locked out from operation. You can reset the amplifier by disarming the security system (it must be one of the transmitter learned by the system), then cycling the remote power on/off.

Top Light Options - Light Off W/Service Code, **Light On W/Service Code**, Light Off W/O Service Code, Light On W/O Service Code. This feature allows the toplight to duplicate the function of the ESP status indicator. This is set by the W/Service Code. The toplight may also be turned off if desired (Light On/Light Off) independent of the Service Code (see table below).

1. Light Off W/Service Code	Top light is off, but service codes will be shown.
2. Light On W/Service Code	Top light is on, and service codes will be shown.
3. Light Off W/O Service Code	Top light is off, but service codes will not be shown.
4. Light On W/O Service Code	Top light is on, but service codes will not be shown.

Learn TX IDs - **Off**, On. When On learns the amplifier learns the remotes (press arm and then disarm on just one of the remotes) used by a Directed Electronics ESP®-2 security system. If any remotes are added or replaced in the system your vehicle must be returned to the dealer to have the amplifier learn the new/replaced remotes. The installer uses the following procedure to learn the security system's remotes:

1. Unplug the amplifier ESP®-2 port from the security system.
2. Connect the Bitwriter® to the amplifier ESP®-2 port using the cable that came with the Bitwriter®.
3. Turn on the Bitwriter® and read the file from the amplifier.
4. Scroll down to Learn TX IDs and select the On setting.
5. Unplug the Bitwriter® and reconnect the ESP®-2 cable from the security system.
6. Arm the security system (the amplifier ESP® LED will flash), then disarm the security system. The remotes used with the security system are now learned into the amplifier. After a short time frame (approximately 20-seconds) the Learn TX IDs feature will automatically revert back to the default Off setting.

NOTE: The next three features are read only. The amplifier will not permit them to be changed. If a change is attempted, an "Unable to Verify" error message will appear on the Bitwriter®.

Event 1 through 7 - Stores up to seven recent events that have occurred to aid in diagnostic troubleshooting. The events that are retained are: Undervoltage, Overvoltage, Reserved, No Fault, Thermal, Overcurrent. These events are read-only, they cannot be written to the amplifier by the installer. Event 1 is the most recent event, then Event 2, and so on. If event memory is full (Event 7 has a stored diagnostic message), then if another event occurs the 7th event will be pushed out of memory.

NOTE: That while the Bitwriter® can be used to read the amplifier during an event, the priority of the amplifier is given to continually checking its health. Attempts to Write to the amplifier during and immediately following an event may result in communication errors.

The Major and Minor Rev levels of the ESP2 software should be referenced should it be necessary to contact Directed Electronics or Orion.

Major Rev - Major revision level of the ESP2 software.

Minor Rev - Minor revision level of the ESP2 software.

NOTES