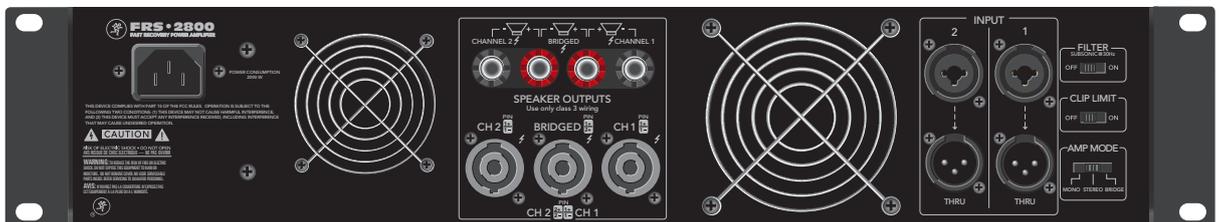


FRS Series

Two Channel Power Amplifiers
FRS•1700 and FRS•2800

OWNER'S MANUAL



Important Safety Instructions

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Use only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.



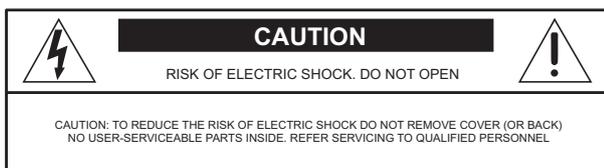
15. This apparatus shall not be exposed to dripping or splashing, and no object filled with liquids, such as vases or beer glasses, shall be placed on the apparatus.
16. Do not overload wall outlets and extension cords as this can result in a risk of fire or electric shock.
17. This apparatus has been designed with Class-I construction and must be connected to a mains socket outlet with a protective earthing connection (the third grounding prong).
18. This apparatus has been equipped with an all-pole, rocker-style AC mains power switch. This switch is located on the front panel and should remain readily accessible to the user.
19. NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Changes or modifications to this device not expressly approved by LOUD Technologies Inc. could void the user's authority to operate the equipment under FCC rules.

20. This apparatus does not exceed the Class A/Class B (whichever is applicable) limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

ATTENTION — *Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de class A/de class B (selon le cas) prescrites dans le règlement sur le brouillage radioélectrique édicté par les ministere des communications du Canada.*



The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure, that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

WARNING — To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.



Correct Disposal of this product: This symbol indicates that this product should not be disposed of with your household waste, according to the WEEE Directive (2002/96/EC) and your national law. This product should be handed over to an authorized collection site for recycling waste electrical and electronic equipment (EEE). Improper handling of this type of waste could have a possible negative impact on the environment and human health due to potentially hazardous substances that are generally associated with EEE. At the same time, your cooperation in the correct disposal of this product will contribute to the effective usage of natural resources. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, waste authority, or your household waste disposal service.

21. Exposure to extremely high noise levels may cause permanent hearing loss. Individuals vary considerably in susceptibility to noise-induced hearing loss, but nearly everyone will lose some hearing if exposed to sufficiently intense noise for a period of time. The U.S. Government's Occupational Safety and Health Administration (OSHA) has specified the permissible noise level exposures shown in the following chart.

According to OSHA, any exposure in excess of these permissible limits could result in some hearing loss. To ensure against potentially dangerous exposure to high sound pressure levels, it is recommended that all persons exposed to equipment capable of producing high sound pressure levels use hearing protectors while the equipment is in operation. Ear plugs or protectors in the ear canals or over the ears must be worn when operating the equipment in order to prevent permanent hearing loss if exposure is in excess of the limits set forth here:

Duration, per day in hours	Sound Level dBA, Slow Response	Typical Example
8	90	Duo in small club
6	92	
4	95	Subway Train
3	97	
2	100	Very loud classical music
1.5	102	
1	105	Greg screaming at Troy about deadlines
0.5	110	
0.25 or less	115	Loudest parts at a rock concert

Please write the serial number here for future reference (i.e., insurance claims, tech support, return authorization, etc.)

Purchased at:

Date of purchase:

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Introduction

Congratulations on the purchase of your new Mackie power amplifier. Please read these instructions to get the maximum performance from your amplifier, and to make the technical writer feel loved.

The FRS series amplifiers are designed for continuous duty in speech, music, and sound reinforcement applications in churches, schools, offices, arenas, hotel meeting rooms, convention centers, recreation facilities and other venues demanding high performance, flexible features, and rugged dependability.

The switching power supply allows for high efficiency and performance without the heavy weight of conventional AC transformers found in many amplifiers.

Rear panel low-cut and clip limiter switches provide extra protection for speakers.

The amplifier can operate in stereo, dual-mono, or bridged-mono. The output connections are NL4 and binding posts for left, right, and bridged mono.

The combination inputs are capable of accepting balanced XLR, 1/4" TRS, or unbalanced 1/4" TS connections from line-level sources. Two XLR thru-outputs allow sharing the balanced input signals with other amplifiers or powered speakers. Two front panel level controls allow adjustment of the input signals.

The front panel has a rocker-style power switch with a power LED, and each channel has a high-resolution six-segment LED meter.

The amplifier output stage is fully protected against permanent damage caused by overloading, shorts, extreme temperatures and silky boxers.

The front panel incorporates holes for rack mounting, where it will take up two rather lovely rack spaces. Two handles are fitted on the front panel for easy transporting.

Features

- Fast Recovery™ circuitry for clean, undistorted sound
- Ultra-lightweight switching power supply for maximum efficiency and minimal heat
- Available in two powerful models:
 - FRS•1700: 1660W continuous power at 4 ohms bridged
 - FRS•2800: 2800W continuous power at 4 ohms bridged
- Selectable mono/stereo/bridged operating modes
- High-resolution, 6-segment LED meter per channel
- Defeatable clip limiter plus short, under-impedance, over-current, and thermal protection
- 30 Hz subsonic filter maximizes amplifier efficiency and headroom
- Combo XLR / TRS input and TRS thru connectors per channel
- NL4 and binding post outputs per channel
- Third NL4 output for bridged mono applications, also provides both output channels on a single connector (mono / stereo modes)
- Multi-speed fans adjust to operating temperature for minimal acoustic noise
- Robust, impact-resistant, all-steel 2U rackmount chassis
- Lightweight and portable – Both models under 22 lb.

How to Use This Manual

After this introduction, a getting started guide will help you get things set up fast. The hook-up diagrams show some typical setups. The features section describes every detail and control, and you'll find illustrations with each feature numbered and described.



This icon marks information that is critically important or unique to the amplifier. For your own good, read and remember them.



This icon leads you to in-depth explanations of features and practical tips. They usually have some valuable nuggets of information.

Appendix A is a section on troubleshooting and repair. Appendix B is a section on connectors. Appendix C shows the technical specifications.

Getting Started



The following steps will help you set up the amplifier and get the levels just right.

Settings:

1. Be sure the amplifier's power switch is off.
2. Turn down both level controls.
3. On the rear panel, set the subsonic filter switch off and the clip limit switch on.
4. Determine which amp mode is best for your application:

Stereo mode is the typical setup for amplifying stereo signals. Input 1 is routed to the channel 1 output, and input 2 is routed to the channel 2 output.

Mono mode is used for sending a mono signal to both outputs with separately adjustable level controls. Input 1 is used in mono mode. (Leave input 2 disconnected).

Bridge mode uses both amplifier channels to power one speaker (or set of speakers). Input 1 is used in bridge mode. (Leave input 2 disconnected and its level control turned down).



Note: 4 ohms is the minimum speaker impedance you should connect to the amplifier in bridge mode.

5. Set the amp mode switch according to your application and delicate sensibilities.

Connections:

1. Using balanced cables, make connections from the mixer's (or other line-level signal source) main outs to the amplifier's inputs.
2. In stereo mode, connect the cables from the signal source to the amplifier's combo input jacks, either XLR or 1/4" TRS. The XLR and TRS inputs for each channel are wired in parallel.
 - The balanced XLR inputs are wired as follows:
 - Pin 1 = shield (ground)
 - Pin 2 = hot (+)
 - Pin 3 = cold (-)
 - The 1/4" TRS inputs are wired as follows:
 - Tip = hot (+)
 - Ring = cold (-)
 - Sleeve = shield (ground)
3. In mono mode and bridge mode, connect one cable from the input source to input 1, and connect nothing to input 2.
4. In stereo and mono modes, connect speaker cables to the speaker outputs, either the binding posts or the NL4 connectors.

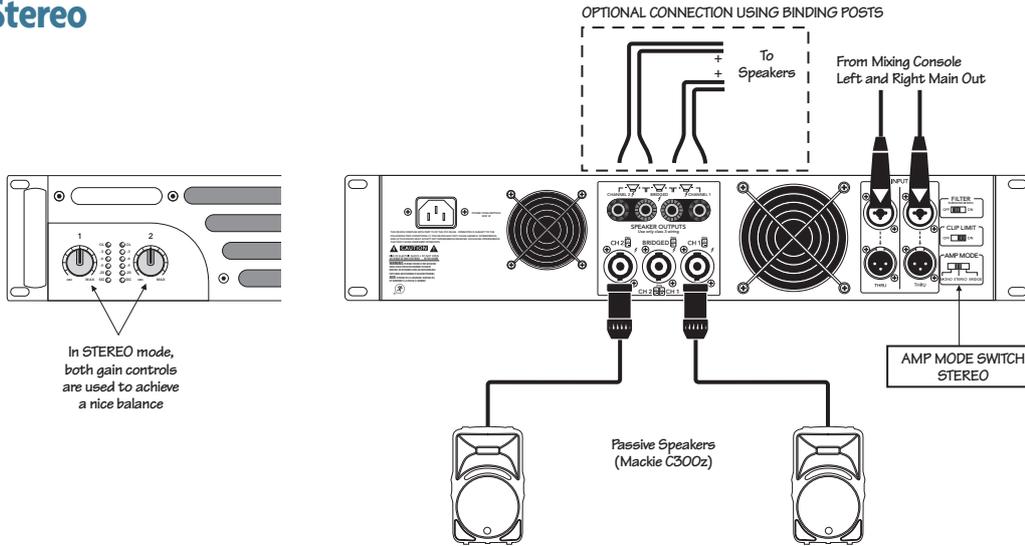
- The binding post connectors are wired as follows:
 - Red = hot (+ speaker terminal)
 - Black = cold (- speaker terminal)
 - The NL4 connectors are wired as follows:
 - 1+ = hot (+ speaker terminal)
 - 1- = cold (- speaker terminal).
5. In bridge mode, if using the binding post outputs:
 - Ch 1 red post = hot (+ speaker terminal)
 - Ch 2 red post = cold (- speaker terminal)
 - Do not use the black terminals.
 If using a NL4, connect it to the center bridged NL4 connector. This is wired as follows:
 - 1+ = hot (+ speaker terminal)
 - 2+ = cold (- speaker terminal)
 6. Plug all the sound system components into suitable AC outlets, properly grounded and capable of delivering adequate current.
 7. Make sure your signal source is powered up and delivering signal to the amplifier.
 8. Turn the amplifier's power switch on. Verify that the power LED lights.
 9. Slowly turn up both level controls on the amplifier. You should hear music and see the meters and sig LEDs flashing. If the OL (overload) LEDs are flashing, turn down either the level controls on the amp or the source signal's output level controls (i.e., master faders), until the OL LEDs either blink occasionally or not at all.
 10. For quieter listening, it is preferable to adjust the amp's level controls rather than the source signal's output level (unless you have the source's control all the way up!).

Things to remember:

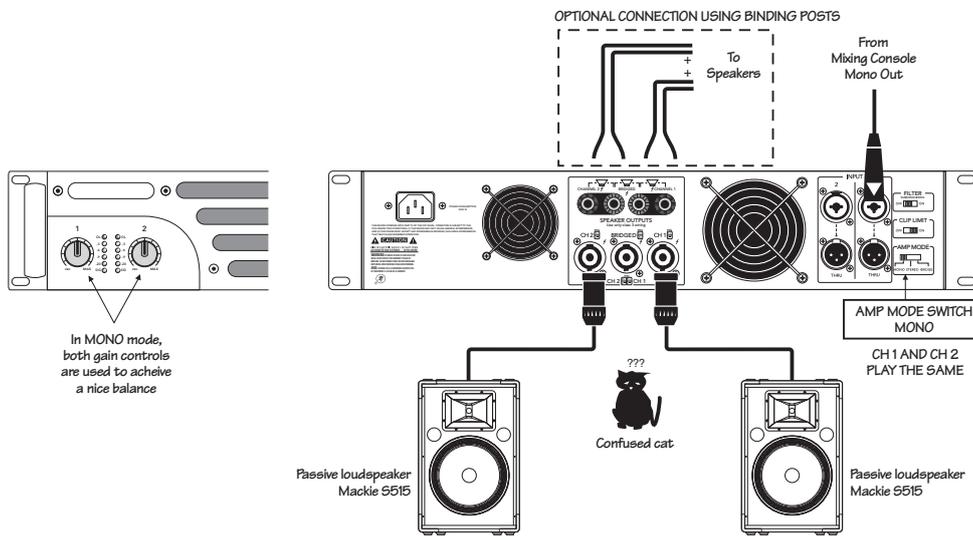
- Never plug amplifier outputs into anything except speakers (unless you have an outboard box specifically designed to handle speaker-level signals).
- Before making connections to an amp or reconfiguring an amp's routing, turn the amp's level controls down, turn the power off, make the changes, turn the power back on, and then turn the level controls back up.
- When shutting down the equipment, turn off the amplifiers first. When powering up, turn on the amplifiers last.

Hookup Diagrams

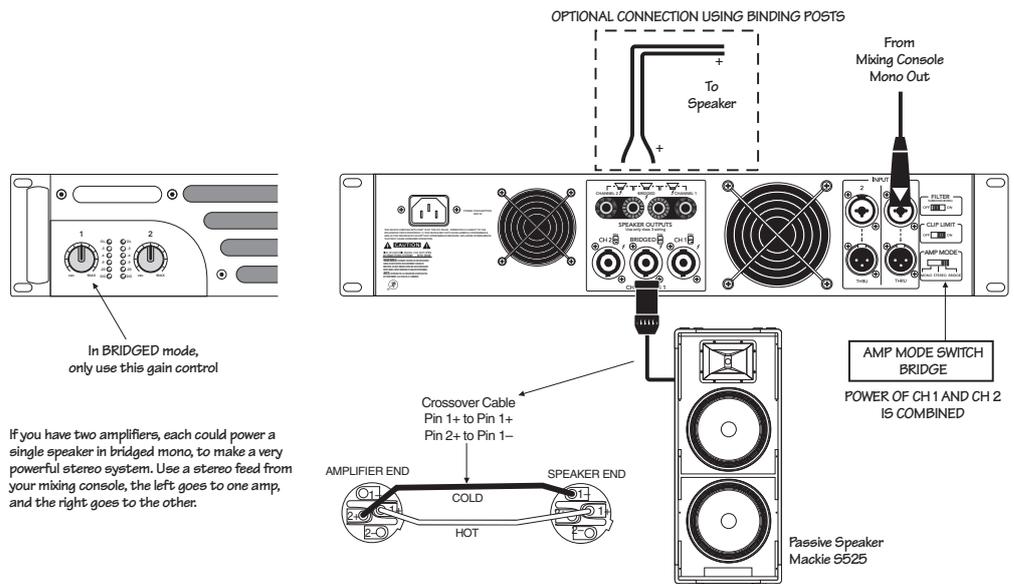
Stereo



Dual mono

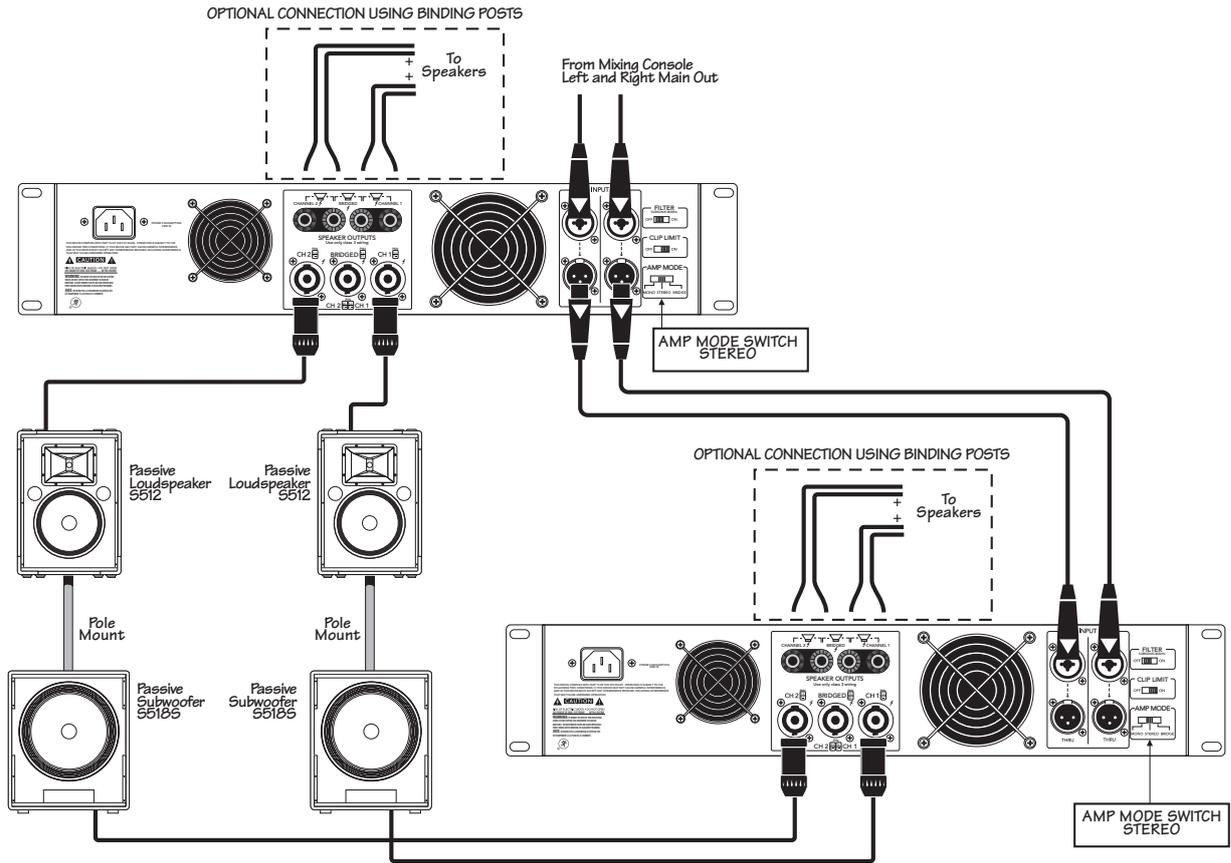


Bridged mono

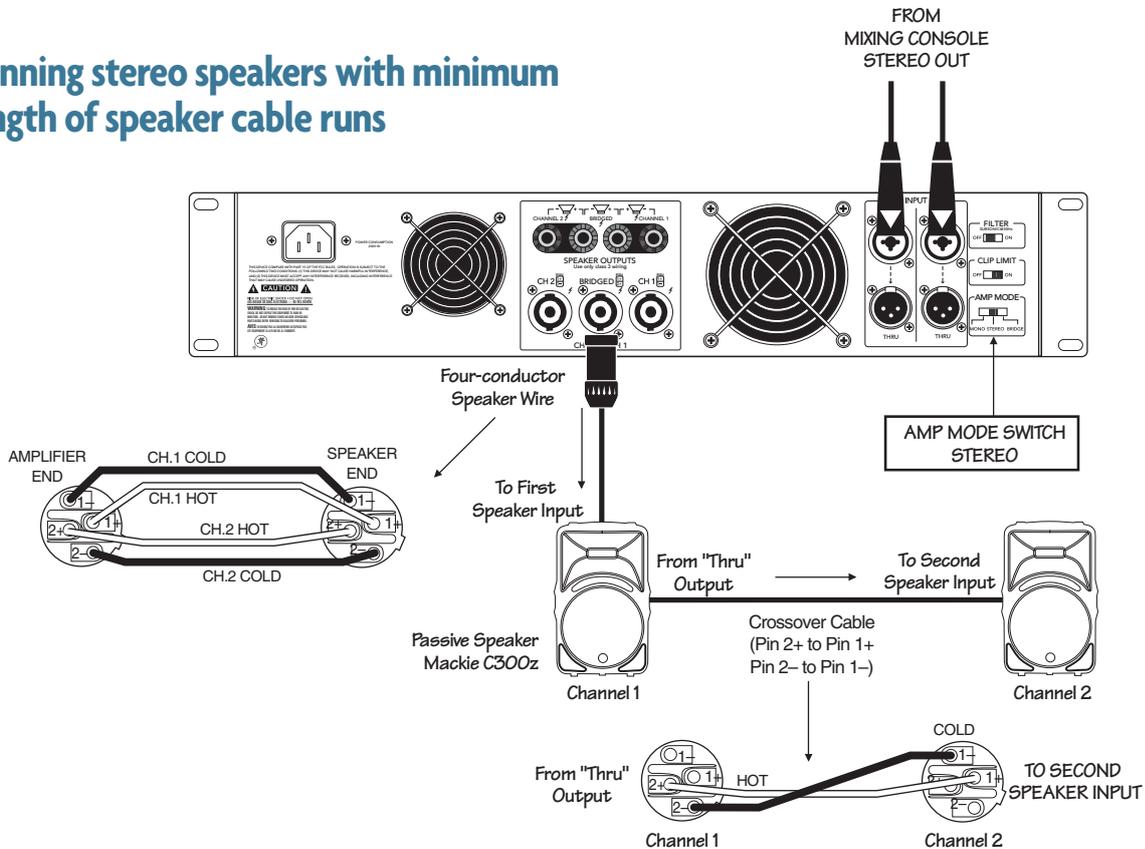


STEREO, DUAL MONO, AND BRIDGED MONO

Daisy-chaining two stereo amplifiers



Running stereo speakers with minimum length of speaker cable runs



DAISY CHAINING AND A SPECIAL CASE

Front Panel Features

1. Power

Use this rocker-style switch to turn the unit on or off. This connects / disconnects the AC power to the AC power transformer.

The amplifier is on when the top of the switch is pressed in. It is off when the bottom of the switch is pressed in.

The Power On LED at the top of the switch will light when the power switch is on.

2. Ventilation

Keep these ventilation slots free from any obstructions, so the air may flow freely and cool down the power transistors.

3. Meters

OL is short for “overload.” These indicate when the output of the amplifier has reached the maximum and is right on the edge of clipping. Clipping is very bad for speakers and should be avoided to prevent damage.

It is okay if the OL LEDs blink occasionally. It means that the transient peaks of the music are just hitting the full output of the amplifier. However, if the OL LED is blinking frequently or continuously, turn down the source signal (i.e., the mixer’s master faders) or the amplifier’s level controls.

The meters indicate the signals are below maximum output power by: -3 dB, -6 dB, -9 dB, and -20 dB.

SIG is short for “signal present.” These LEDs indicate when a signal is present after the level controls, at the output stage of the power amplifier. If the level controls are turned all the way down (fully counterclockwise), these indicators will not light.

4. Level Controls

These two knobs control the levels of channels 1 and 2. The knobs are detented to make it easy to set both controls to the same level. Usually, these are set all the way up.

You might turn them down slightly if you have high-efficiency speakers. Also, you could use them to control the level of line-level sources such as a CD player connected directly to the amplifier without a preamplifier or mixer.

The amplifiers are designed so that a $+3.4$ dBu (1.15 Vrms) input signal drives the amplifier to full power into 4 ohms:

FRS•1700 = 540 watts per channel into 4 ohms

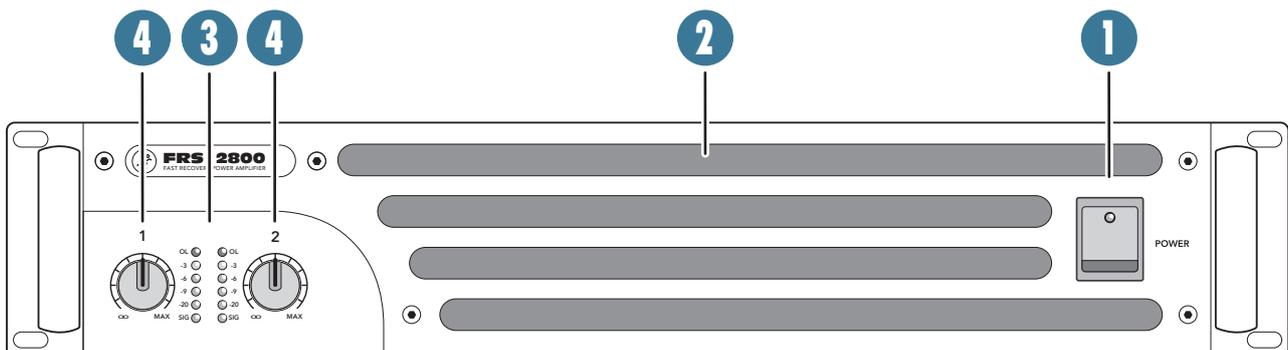
FRS•2800 = 850 watts per channel into 4 ohms

This equates to a gain of 33 dB and 35 dB respectively.

After you have set the levels for the mixer (or other signal source), adjust the level controls on the amplifier as the final adjustment to set the overall volume for the system.

In stereo and mono mode, use both level controls to control the levels going to each speaker.

In bridged mono mode, turn the channel 2 level control down, and just use the channel 1 control.



Rear Panel Features

5. Power Cord Socket

This is where you connect the detachable power cord included with your amplifier. Plug the other end of the power cord into an AC outlet properly configured with the voltage required for your particular model.

Be sure the AC outlet can supply enough current to allow full power operation of all the amplifiers plugged into it. The outlet should be a three-prong socket that matches the power cord.



WARNING: Bypassing the plug's safety ground pin can be dangerous. Don't do it!

6. Fan Vents



Do not obstruct the ventilation openings of the amplifier. Fans move air over the heatsinks to cool down the power transistors. If these vents are restricted then the amplifier may overheat and shut down.

7. Speaker Outputs

There are two options for connecting speakers: binding posts and NL4 connectors.

Since the connectors are wired in parallel (e.g., channel 1 binding post and NL4 are in parallel, and channel 2 binding post and NL4 are in parallel), you can connect a speaker to each connector, as long as the total impedance per channel is not less than two ohms.

- Two 8 ohm speakers in parallel equals 4 ohms.
- Two 4 ohm speakers in parallel equals 2 ohms.

When the amplifier is used in bridged-mono mode, use either the center NL4, or the two red binding posts to connect a single speaker.



In bridged-mono mode, do not use a speaker impedance less than 4 ohms. Be careful as both speaker wires are live. Do not connect the speaker wires to any external device that is grounded.

8. Combo Inputs

These combination inputs are for connecting balanced XLR plugs or 1/4" plugs.

The XLR inputs are wired conventionally, with pin 2 hot, pin 3 cold, and pin 1 ground.

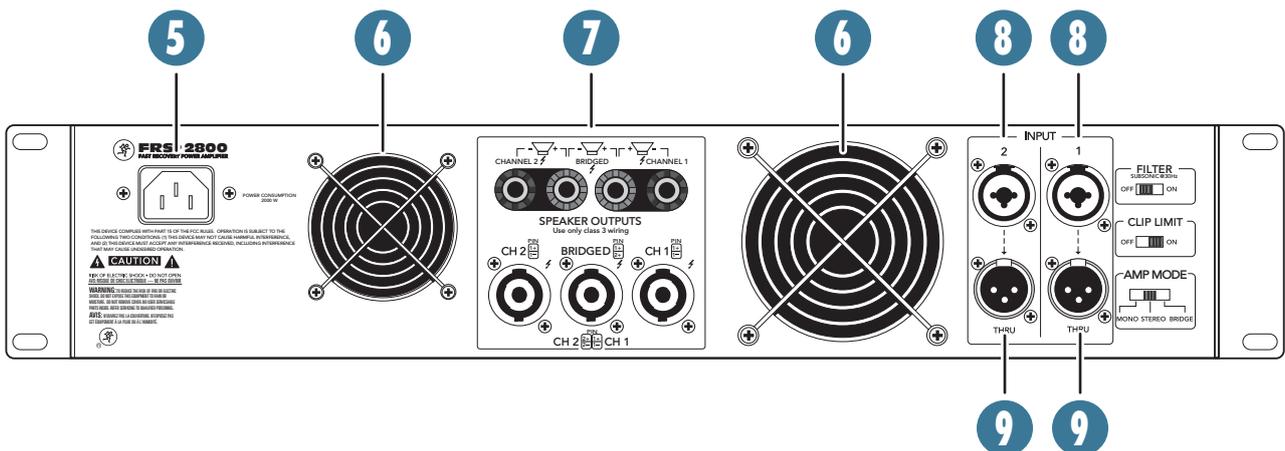
The 1/4" inputs are for connecting balanced 1/4" TRS or unbalanced TS plugs from line-level sources.

Use balanced connections where possible, as these offer better rejection of noise than unbalanced lines.

Use high-quality, three-conductor shielded cable for balanced connections. The better the shield, the better the audio signal is protected from induced EMI and RFI.

9. Thru Outputs

These male XLR connectors allow you to send the balanced input signals to other amplifiers, powered speakers, mixers, or recorders in the system. The line-level output is a straight copy of what goes in, and the amplifier level controls and switches have no effect.



10. Amp Mode

This switch determines the input signal routing within the amplifier. The stereo setting will be used in most applications. However, some applications might be better suited for using either the mono or the bridge setting.

Stereo: This is the normal position used when amplifying stereo signals. This mode accepts separate left and right inputs (1 and 2), and routes them to the channel 1 and channel 2 outputs. Each channel's level control adjusts the gain for its own channel, and each channel is independent.

Mono: This mode (also known as dual-mono) is used when you want to send a mono signal to both outputs. It accepts a single input (input 1), and routes it to both the channel 1 and channel 2 amplifiers. Each channel's level control adjusts the gain for its own channel.

Bridge: This mode (also known as bridged-mono) accepts a single input (input 1), and uses both amplifier outputs to power one speaker. Use the channel 1 level control to adjust the gain (turn the channel 2 level control all the way down). The hookup diagram at the bottom of page 6 shows how to connect a speaker in bridged mono.

VERY IMPORTANT  **WARNING:** In bridged mode, both connections to your speaker are live; that is, neither is grounded through the chassis (because the black binding posts are not used).

11. Clip Limit

When engaged, this switch helps to protect loudspeakers from the effects of clipping. It is designed to be virtually transparent, meaning you probably won't even notice any audible difference when the switch is turned on.

We recommend that you leave this switch on at all times. However, if you are working at quiet levels, or you have already placed a compressor / limiter in the signal path, you can leave this switch off.

The limiter senses when the amplifier is about to be overdriven and attenuates the overall level just enough to keep the signal from clipping. Clipping occurs when

the output voltage no longer linearly follows the input voltage. As the amplifier output voltage increases, it will eventually run into the internal DC power supplies and start to flatten out. The flat tops represent a DC voltage reaching the speakers, which interrupts the natural movement of the speaker's voice coil. High frequency harmonics are also produced which can play havoc with tweeters. Square waves sound awful, and could possibly damage the speakers and / or your reputation.



Speakers are designed to handle good clean continuous signals, but give them a clipped signal and even high-power speakers can be damaged. For example, a 100 watt amplifier that is clipping, can damage speakers that are rated at 400 watts.

The limiter is especially handy when working with loud output levels. Having the signal spikes (kick drum, for instance) attenuated a bit can actually increase the apparent loudness of the overall mix without diminishing the "power" behind the spikes. It is also a useful protection device for those unexpected moments, such as the lead singer actually hitting the right note, a mic stand or the drummer falling over, dropping the tone arm, or an attack of killer feedback.



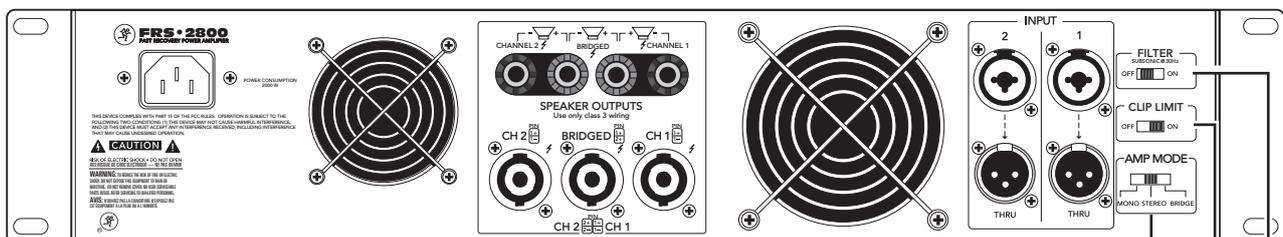
With the limiter engaged, the amplifier can still be overdriven into clipping and cause distortion. It just takes a stronger signal to do it. So even with the limiter turned on, still pay attention to the OL LEDs.

12. Subsonic Filter

Turn this switch on to engage a low-frequency cutoff (high-pass) filter at 30 Hz. The frequency range below 30 Hz is attenuated.

The amplifiers can amplify signals below 20 Hz, but most speakers can't reproduce frequencies that low. By engaging the subsonic filter, you allow the amplifier to power only the frequencies you can hear. In addition, this filter can reduce low-frequency stage noise (footsteps) and accidental microphone pops that could damage a loudspeaker.

Leave this off if the amplifier is powering a subwoofer, or if the speakers can reproduce low frequencies such as the kick drum range.



General Precautions

AC Power Requirements

The amplifier's power cord should be plugged into an AC outlet properly configured with the voltage required for your particular model.

Be sure the AC outlet can supply enough current to allow full power operation of all the amplifiers plugged into it. The outlet should be a three-prong socket that matches the power cord.



WARNING: Bypassing the plug's safety ground pin can be dangerous. Don't do it!

The AC current demand of an amplifier varies depending on several factors, including the load impedance, the crest factor, and the duty cycle of the program material. Under typical conditions reproducing rock music where musical peaks are just below clipping, the amplifiers require the following average currents:

$$\text{FRS} \bullet 1700 = 8 \text{ A}$$

$$\text{FRS} \bullet 2800 = 11 \text{ A}$$

It is recommended that a stiff supply of AC power be used because the amplifier places high current demands on the AC line. The more power that is available on the line, the louder the amplifier will play and the more peak output power will be available for cleaner, punchier bass.

If more than one amplifier is sharing an AC outlet, avoid turning them all on at the same time. Rather, sequence them on, one at a time, to prevent popping the circuit breaker (due to in-rush current).

Thermal Considerations

The power amplifier is fan cooled. Air is drawn through the rear panel vents to cool down the amplifier heatsinks and then expelled through the front panel vents.

When installing, be sure to allow sufficient air space around the front and rear of the amplifier for adequate cooling for the heatsinks. Leave at least one rack space above and below, and at least six inches behind and in front of the chassis to allow proper ventilation.

If the amplifier should overheat, a thermal switch turns off the power amplifier, allowing the heatsink to cool down. Once the amplifier has cooled to a safe operating temperature, the thermal switch resets and reactivates the amplifier. If this should occur, identify the cause of the problem and take corrective action. For example:

- Provide better ventilation
- Install a fan in the rack to move more air
- Make sure the amplifier is not overloaded with too low of a load impedance or by a short circuit on the speaker line

Rack Mounting

The FRS amplifiers are designed to be mounted in a standard 19 inch rack. They require two rack spaces (2U = 3.5"). They also require 14.7" depth inside the rack, including the rear support brackets. When designing the rack, put the heavier items at the bottom and the lighter items toward the top.

Secure the front panel of the amplifier to the front of the rack using four screws with soft washers to prevent scratching the panel. In addition, because of the weight of the amplifier, you must secure the rear support brackets of the amplifier to the back of the rack. You could use a support rail or shelf across the back of the rack, or angle brackets attached between the rear support rails and the rear rails of the rack. This is recommended for all components mounted in a rack that is going to be moved frequently.

Maintenance

Usually, the amplifier will not require regular maintenance for normal use. However, you can do several things to keep it in good operating and cosmetic condition.

- **Testing:** Periodically test the system for proper performance. A simple test is to play a CD through it using well-defined, articulate, wide-range program material. Listen to ensure all drivers are working properly and for any evidence of distortion or other extraneous sounds. Test at several volume levels: very low, normal, and high.
- **Cleaning:** Use only a clean dry cloth to dust off and clean the surface. Turn off the power to the amplifier while you do this.

Appendix A: Service Information

If you think your Mackie product has a problem, please check out the following troubleshooting tips and do your best to confirm the problem. Visit the Support section of our website (www.mackie.com/support) where you will find lots of useful information such as FAQs, documentation, and user forums. You may find the answer to the problem without having to send your Mackie product away.

Troubleshooting

No Power

- Our favorite question: Is it plugged in?
- Make sure the power cord is securely seated in the IEC socket and plugged all the way into the AC outlet.
- Make sure the AC outlet is live (check with a tester or lamp).
- Make sure the front panel power switch is in the on position.
- Is anything on the front panel illuminated? If not, make sure the AC outlet is live.
- Are all the lights out in your town? If so, contact your local power company to get power restored.
- If nothing is illuminated, and you are certain that the AC outlet is live, it will be necessary to have your amplifier serviced. *There are no user serviceable parts inside.* Refer to “Repair” on the next page to find out how to proceed.

No Sound or Low Output

- Loudspeaker cables or connectors are not wired correctly or they are faulty. Check all cabling, referring to these instructions for the correct connections. The best way to check a suspect cable is to swap it with a known good cable. Read the loudspeaker’s input panel to verify correct cable connections.
- Loudspeaker is not working. Connect the loudspeaker cable to a known good loudspeaker leaving all equipment set to the same levels. If the problem disappears, the loudspeaker is probably not working correctly.
- Are the channel level controls turned up? Slowly turn them up and see if you hear anything.

- Is the signal source turned up? Make sure the signal level from the mixing console (or whatever device immediately precedes the amplifier) is high enough to produce sound in the amplifier. The SIG LEDs should be blinking to indicate that signal is present.
- If the speakers are wired for bridge mode, make sure the amp mode switch is set to bridge.
- If the amplifier has become extremely hot, the thermal protection circuit may have activated. Allow the amplifier to cool down and normal operation should resume.
- Are there fuses in the speakers, or in-line fuses in the speaker wire? Check to see if they’re blown.

Distorted Sound

- The power amplifier is clipping. The signal level is exceeding the limits of the system and you must reduce the level from the mixer or signal source.
- The loudspeaker(s) are being overdriven. Turn down the volume to see if the distortion goes away. If not, review the owner’s manual for the loudspeakers to ensure that they are a proper match for the amplifiers.
- Ensure that no equipment in the signal chain is being overdriven. For example: input(s) or summing bus in the mixing console, equalizers, etc.
- Is the input connector plugged completely into the jack? Check the speaker connections and verify that all connections are tight and that there are no stray strands of wire shorting across the speaker terminals.
- If possible, listen to the signal source with headphones plugged into the console. If it sounds bad there, the problem is not in the amplifier.
- Loudspeakers not working properly.

Partial Sound (frequency band missing)

- Incorrect EQ settings in the electronic equipment. Ensure all EQ settings and filters on the mixing console or preamplifier and on other equipment are set for normal operation. Ensure level controls on electronic crossovers and associated amplifiers are correctly set and that all cables and connections for such equipment are connected and working properly.
- Loudspeaker not working properly. Swap with a good one.
- The fuses inside the amplifier may have blown. These are not a user-serviceable. See next page about service.

One side is louder than the other

- Are both level controls set to the same position?
- Check your source signal to make sure the left and right signals are balanced.
- Are the speaker impedances matched? Different speaker loads can cause different volume levels on each side.
- Try switching sides: Turn off the amp, swap the speaker cables at the amp and turn the amp back on. If the same side is still louder, the problem is with your speaker cabling or the loudspeakers. If the other side is louder now, the problem is with the mixer, the loudspeaker processor, the amp, or the line-level cabling.

Poor Bass response

- Check the polarity of the speaker cable connections. You may have your positive and negative reversed at one end of one speaker cable.

As the music gets loud, the amp shuts down

- Make sure the OL LEDs are not lighting continuously. If so, turn down the signal source or the amp level controls.
- Can the amp breathe? It needs plenty of fresh air to stay cool. **Do not block the ventilation holes.**

Noise/Hum

- Check the signal cable between the mixer and the amplifier. Make sure all connections are good and sound.
- Make sure the signal cable is not routed near AC cables, power transformers, or other EMI-inducing devices.
- Is there a light dimmer or other SCR-based device on the same AC circuit as the amplifier? Use an AC line filter, or plug the amplifier into a different AC circuit.
- If possible, listen to the signal source with headphones plugged into the console. If it sounds noisy there, the problem is not in the amplifier.
- Is there a cable-TV audio feed in your system? An incorrect ground may cause a "ground loop" hum.
- Sometimes it helps to plug all the audio equipment into the same AC circuit so they share a common ground.

Repair

For warranty repair or replacement, refer to the warranty information on page 19.

Non-warranty repair for Mackie products is available at a factory-authorized service center. To locate your nearest service center, visit www.mackie.com, click "Support" and select "Locate a Service Center." Service for Mackie products living outside the United States can be obtained through local dealers or distributors.

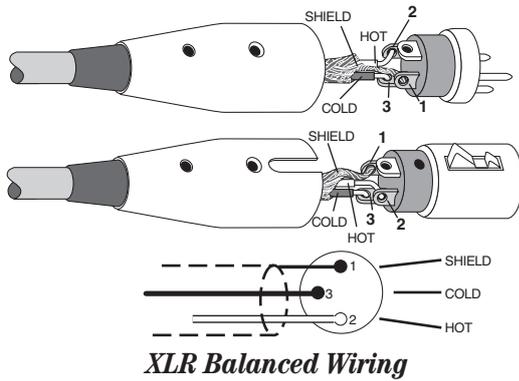
If you do not have access to our website, you can call our Tech Support department at 1-800-898-3211, Monday-Friday, during normal business hours, Pacific Time, to explain the problem. Tech Support will tell you where the nearest factory-authorized service center is located in your area.

Appendix B: Connections, math and stuff

Use a high-quality 3-conductor shielded cable to connect the signal between the signal source (mixing console, equalizer, etc.) and the balanced inputs to the amplifier. If you are using unbalanced inputs, use a high-quality 2-conductor shielded cable. Here are some common audio connectors and their internal wiring:

XLR Connectors

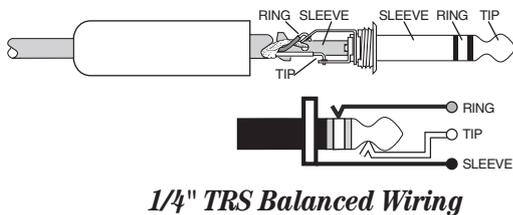
XLR connectors are commonly wired as follows (according to standards specified by the Audio Engineering Society):



- Pin 1 = Shield
- Pin 2 = Hot (+)
- Pin 3 = Cold (-)

1/4" TRS Phone Plugs and Jacks

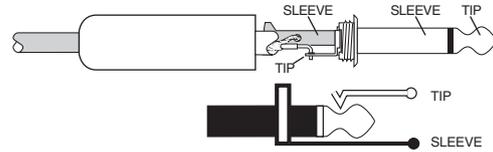
"TRS" stands for Tip-Ring-Sleeve, the three connections available on a stereo 1/4" or balanced phone jack or plug. TRS jacks and plugs are used for balanced signals and stereo headphones.



- Sleeve = Shield
- Tip = Hot (+)
- Ring = Cold (-)

1/4" TS Phone Plugs and Jacks

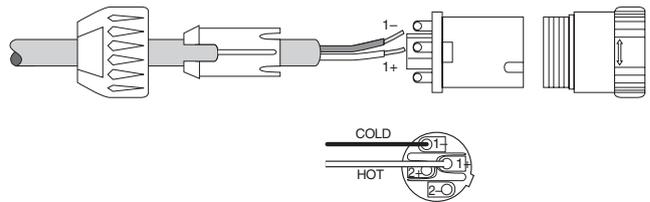
"TS" stands for Tip-Sleeve, the two connections available on a mono 1/4" phone jack or plug. They are used for unbalanced signals.



- Sleeve = Shield
- Tip = Hot (+)

NL4 Connectors

When using the NL4 outputs in stereo or mono modes, wire the NL4 connectors as shown below:



For other NL4 wiring configurations, see the hookup diagrams on pages 6 and 7.

Loudspeaker Cable

Note: Because of the high output capability of the amplifier, use only Class 3 (CL3) cable.

Use loudspeaker cables with a minimum conductor size for the length you need, as listed in these tables.

Minimum AWG	4 ohm	8 ohm
18	10 ft	25 ft
16	25	50
14	25	75
12	50	125
10	100	200

This will minimize power losses to less than 0.5 dB. The cable lengths listed are "up to" lengths. For in-between lengths, use the next larger conductor gauge. Using larger than the

Min Metric WG	4 ohm	8 ohm
12	3 m	8 m
14	8	15
16	8	25
20	15	40
25	30	60

recommended conductor size is always permissible. Using smaller than recommended conductor size will result in higher power losses.

The recommended conductor gauges are listed for AWG (American Wire Gauge) and Metric WG (Metric Wire Gauge). Note that smaller AWG numbers = larger conductors and smaller Metric WG numbers = smaller conductors. The Metric WG is equal to ten times the nominal conductor diameter in millimeters.

Longer Lengths

For cable lengths over 200 feet / 60 m at 8 ohms, and over 100 feet / 30 m at 4 ohms, the conductor sizes needed for less than 0.5 dB power losses are rarely practical for physical and cost reasons.

As a practical compromise for these situations the recommended conductor gauge is 10 AWG or 25 metric.

Speaker Impedances

A speaker's impedance varies with frequency. For example, it may be 4 ohms at 500 Hz, and 6 ohms at 120 Hz. What you need to know is the average (or nominal) impedance across the speaker's frequency range. This will be printed somewhere on the cabinet, or in the specification section of the missing manual.

If you're just dealing with one speaker per channel, then make sure that the average impedance is greater than or equal to 2 ohms.

In bridged-mono mode, make sure that your speaker impedance is greater than or equal to 4 ohms.

If you're driving an assortment of speakers, you have to make sure that the total impedance does not go below these same levels. There are two basic ways of linking multiple speakers: series and parallel. The following sections show how to make the connections and how to work out the total impedance:

Series

"Series" means that the positive amp output connects to the first speaker's positive terminal, the first speaker's negative terminal connects to the second speaker's positive terminal, the second speaker's negative terminal goes to the amp's negative output. Series connections are not normally used in PA applications because it ruins the amplifier's ability to damp (control) the speakers. The other snag: if one speaker goes out, they all do. The audience may not appreciate this, and things could get ugly fast.

Doing load calculations with series configurations is easy — just add the loads. For instance, two 4-ohm speakers in series, equals 8 ohms ($4 + 4 = 8$).

Parallel

"Parallel" means that the positive amp output connects to the positive terminals of all the speakers, and the negative amp output connects to the negative terminals of all the speakers. If one speaker opens in a parallel configuration, the others will still work, but the load will change. That lets you breathe a little easier (the show will go on), except that you may have a dead speaker and not even know it.

Calculating parallel loads is also easy, as long as each speaker has the same value — just divide the value by the number of speakers.

For example, four 8-ohm speakers, connected in parallel, will equal 2 ohms ($8 / 4 = 2$).

If the parallel loads aren't all the same, things gets a little more complicated, but nothing that you can't do with a simple calculator. The total impedance (Z_T) is given by the following formula, where Z_1 , Z_2 and Z_3 are the impedances of your speakers.

$$Z_T = \frac{1}{\frac{1}{Z_1} + \frac{1}{Z_2} + \frac{1}{Z_3} + \dots}$$

There are other, more complicated configurations, like series-parallel (using a combination of series and parallel links to arrive at a desired load) and parallel configurations of unmatched loads (usually not recommended). But rather than get too deep into this, let's just summarize the basics, as they apply to you and your amp:

- The lower the speaker impedance, the more power can be put out by the amplifier.
- Driving lower impedance speakers makes the amplifier work harder and heat up quicker.
- Do not connect a total impedance of under 2 ohms per channel in stereo and mono modes.
- Do not connect a total impedance of under 4 ohms in bridged mono mode.
- Connecting speakers in series or parallel can drastically alter their frequency response.
- Consider using multiple amplifiers rather than overloading one.
- Reduce the low-frequency output by engaging the low cut filter.
- Never plug the amplifier outputs into anything except speakers (unless you have an outboard box designed to accept speaker-level levels).
- Be careful in bridged mono mode, as both speaker wires are live. In this mode, do not connect the speaker wires to any external device which is grounded.

Appendix C: Technical Info

Specifications

Continuous Sine Wave Average Output Power, per channel, both channels driven, 20 Hz to 20 kHz

	FRS•1700	FRS•2800
2 ohms:	830 W	1300 W
4 ohms:	540 W	850 W
8 ohms:	310 W	500 W

Bridged Mono Operation, 20 Hz to 20 kHz

	FRS•1700	FRS•2800
4 ohms:	1660 W	2800 W
8 ohms:	1080 W	1700 W

Note: Power ratings are specified at 240 VAC line voltage.

Power Bandwidth

5 Hz to 50 kHz (+0, -3 dB)

Frequency Response

20 Hz to 25 kHz (+0, -1 dB)

Distortion

THD and SMPTE IMD; 20 Hz to 20 kHz
< 0.03 % @ 8 ohms

Signal-to-Noise Ratio

> 105 dB below rated power into 4 ohms

Channel Separation

> 68 dB @ 1 kHz

Damping Factor

> 300 @ 1 kHz and below, into 8 ohms

Input Impedance

20 k Ω balanced
10 k Ω unbalanced

Input Sensitivity

1.15 V (+3.4 dBu) for rated power into 4 ohms

Gain

FRS•1700:	33 dB
FRS•2800:	35 dB

Maximum Input Level

9.75 Vrms (+22 dBu)

Turn On Delay

2.5 seconds

Subsonic Filter

- 9 dB @ 30 Hz

Topology

FRS•1700:	Class AB
FRS•2800:	Class H

Cooling

Variable-speed fans with back-to-front airflow

Indicators

SIG (Signal Present) on each channel

OL (Overload) on each channel

Signal Meters -3 dB, -6 dB, -9 dB, -20 dB on each channel

Power LED on power switch

Current Consumption (measured at 240 VAC line voltage)

	FRS•1700	FRS•2800
Idle	0.5 A	0.6 A
Musical Program:		
@ 8 ohms	5.3 A	8.4 A
@ 4 ohms	7.4 A	10.8 A
@ 2 ohms	11.4 A	18.3 A

AC Power Requirements

U.S. model:	100–120 VAC, 50–60 Hz
European model:	200–240 VAC, 50–60 Hz

Physical Dimensions and Weight

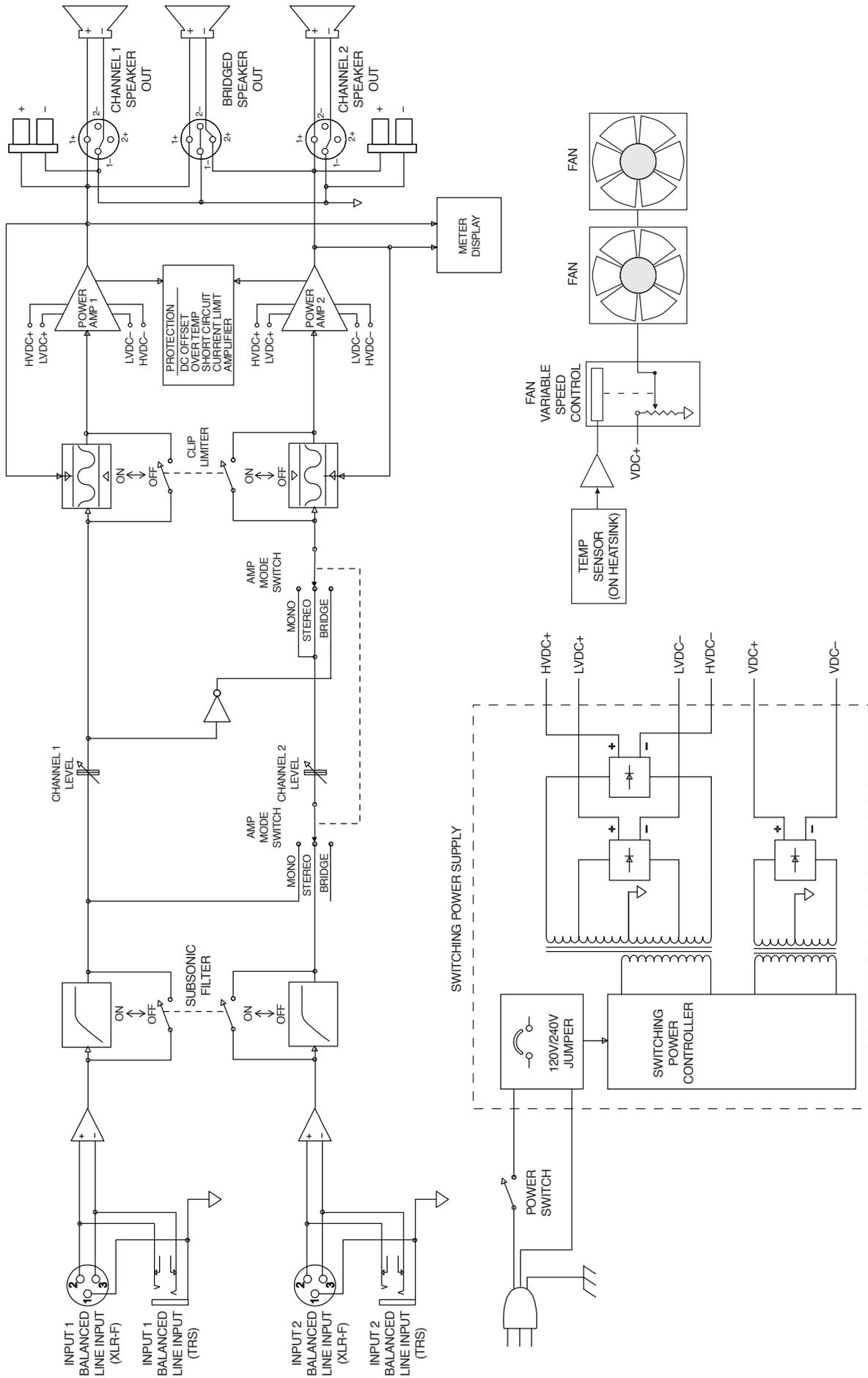
Height:	3.50 in / 89 mm
Width:	19.00 in / 483 mm
Depth:	14.7 in / 373 mm
Depth with Handles:	16.2 in / 411 mm
Weight:	
FRS•1700:	21.5 lb / 9.7 kg
FRS•2800:	22.0 lb / 10.0 kg
Flavor:	Slightly minty

LOUD Technologies Inc. is always boldly striving to improve our products by incorporating new and improved materials, components, and manufacturing methods. Therefore, we reserve the right to change these specifications at any time without notice.

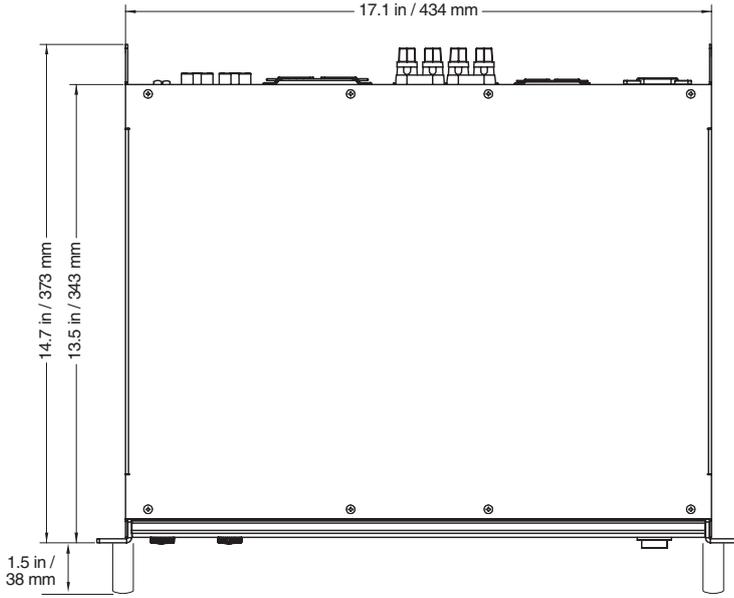
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Block Diagram



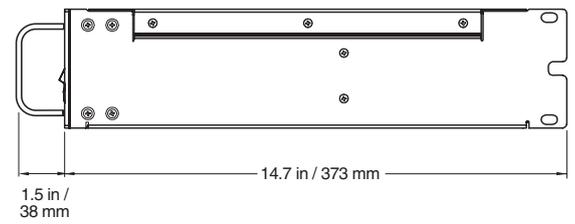
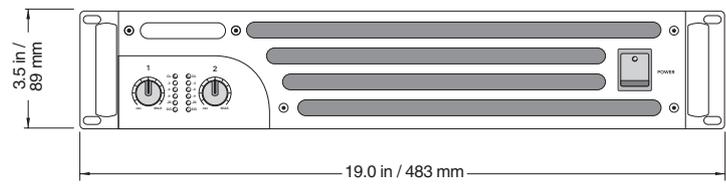
Dimensions



FRS-1700
WEIGHT
21.5 lbs.
(9.7 kg)



FRS-2800
WEIGHT
22 lbs.
(10 kg)



Mackie Limited Warranty

Please keep your sales receipt in a safe place.

This Limited Product Warranty ("Product Warranty") is provided by LOUD Technologies Inc. ("LOUD") and is applicable to products purchased in the United States or Canada through a LOUD-authorized reseller or dealer. The Product Warranty will not extend to anyone other than the original purchaser of the product (hereinafter, "Customer," "you" or "your").

For products purchased outside the U.S. or Canada, please visit www.mackie.com/warranty to find contact information for your local distributor, and information on any warranty coverage provided by the distributor in your local market.

LOUD warrants to Customer that the product will be free from defects in materials and workmanship under normal use during the Warranty Period. If the product fails to conform to the warranty then LOUD or its authorized service representative will at its option, either repair or replace any such nonconforming product, provided that Customer gives notice of the noncompliance within the Warranty Period to the Company at: www.mackie.com/support or by calling LOUD technical support at 1.800.898.3211 (toll-free in the U.S. and Canada) during normal business hours Pacific Time, excluding weekends or LOUD holidays. Please retain the original dated sales receipt as evidence of the date of purchase. You will need it to obtain any warranty service.

For full terms and conditions, as well as the specific duration of the Warranty for this product, please visit www.mackie.com/warranty.

The Product Warranty, together with your invoice or receipt, and the terms and conditions located at www.mackie.com/warranty constitutes the entire agreement, and supersedes any and all prior agreements between LOUD and Customer related to the subject matter hereof. No amendment, modification or waiver of any of the provisions of this Product Warranty will be valid unless set forth in a written instrument signed by the party to be bound thereby.

Need help with your amplifier?

- Visit www.mackie.com and click Support to find: FAQs, manuals, addendums, and other useful information.
- Email us at: techmail@mackie.com.
- Telephone 1-800-898-3211 to speak with one of our splendid technical support chaps (Monday through Friday, normal business hours, Pacific Time).



16220 Wood-Red Road NE
Woodinville, WA 98072 • USA
Phone: 425.487.4333
Toll-free: 800.898.3211
Fax: 425.487.4337
www.mackie.com
