

# AR-15

## AC LINE VOLTAGE REGULATOR AND POWER CONDITIONER



**FURMAN**  
VOLTAGE  
REGULATORS

# AR-15 VOLTAGE REGULATOR / POWER CONDITIONER

*Congratulations on your purchase of a Furman AR-15 AC Line Voltage Regulator / Power Conditioner. The AR-Series regulators are designed specifically for any audio, video, or computer rackmount system requiring clean, filtered, and regulated AC power for optimum operation.*

## AR-15 FEATURES

- ***Provides nine regulated, conditioned AC outlets—eight on the rear panel and one on the front***
- ***Series mode protection plus (SMP+) with extreme voltage shutdown (E.V.S.)***
- ***LiFT (Linear Filtering Technology) with zero ground contamination***
- ***Eight rear panel outlets and one front panel outlet***
- ***BNC connector on the rear panel allows you to attach any standard (12VAC 0.5 amp) gooseneck lamp to illuminate the rear of your rack***
- ***Extreme Voltage Shutdown indicator LED***
- ***Output In Regulation indicator***
- ***Ten-LED bargraph input voltmeter***
- ***Fast-acting user-accessible circuit breaker protects against overload or shorts***
- ***Very low stray magnetic field leakage***
- ***Input capacity is 15 A; output capacity is 12 to 15 A***

## SAFETY INFORMATION

To obtain best results from your Furman AR-15 please be sure to read this manual carefully.

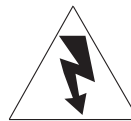
**WARNING:** To reduce the risk of electrical shock, do not expose this equipment to rain or moisture. Dangerous high voltages are present inside the enclosure. Do not remove the covers. There are no user serviceable parts inside. Refer servicing to qualified personnel only.

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.

## IMPORTANT SAFETY INSTRUCTIONS

### PLEASE READ PRIOR TO INSTALLATION

1. Please read and observe all of the safety and operating instructions before the AR-15 is operated. Retain these instructions for future reference.
2. The AR-15 should not be used near water — for example, near a bathtub, kitchen sink, in a wet basement, near a swimming pool, etc.
3. Do not place the AR-15 near heat sources such as radiators, heat registers, stoves, or other appliances that produce heat.
4. Route the power cord and other cables so that they are not likely to be walked on, tripped over, or stressed. Pay particular attention to condition of cords and cables at plugs, and the point where they exit from the AR-15. To prevent risk of fire or injury, damaged cords and cables should be replaced immediately.



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5. Clean the AR-15 with a damp cloth only. Do not use solvents or abrasive cleaners. Never pour any liquid on or into the unit.
6. When left unused for a long period of time, the power cord of the AR-15 should be unplugged from the outlet.
7. The AR-15 should be serviced by qualified service personnel when:
  - a. The power supply cord or the plug has been frayed, kinked, or cut.
  - b. Objects have fallen or liquid has spilled into the unit.
  - c. The AR-15 has been exposed to rain or other moisture.
  - d. The AR-15 does not appear to operate normally or exhibits a marked change in performance.
  - e. The AR-15 has been dropped, or the enclosure damaged.
8. The AR-15 requires that a safety ground be present for proper operation. Any attempt to operate the AR-15 without a safety ground is considered improper operation and could invalidate the warranty.
9. There are no user serviceable parts in the AR-15. Refer servicing to qualified service personnel only.

## Voltage Regulation

Furman Voltage Regulators are intended to protect sensitive electronic equipment from problems caused by AC line voltage irregularities—brownouts or overvoltages that can cause audio tonal changes, digital equipment malfunction (such as loss of MIDI programs or other data), or, in extreme cases, permanent damage. They accept input voltages over a wide AC voltage range and convert them to a steady, stable output at the desired standard

voltage, plus or minus five volts. Voltages approximately  $\pm 10\%$  beyond that range may be converted to usable levels, depending on the requirements of the equipment. This stable voltage protects equipment and allows optimal performance. See graphs on the back page.

The AR-15 has eight outlets on the rear panel, and one convenience outlet on the front panel. All are functionally interchangeable. The outlets are regulated, surge-suppressed, and linearly filtered, making the unit a full-function power conditioner. The AR-15 has no controls except an on-off switch and the switch for the optional rear rack light.

*Note: The AR-15 is for use with AC voltage only. DC voltages should never be applied to them. Also, it does not change or regulate line frequency. The output frequency will always be the same as the incoming frequency.*

## SMP+ (series mode protection plus)

Traditional surge suppression rely on circuits that “sacrifice” themselves when exposed to multiple transient voltage spikes, requiring the dismantling of your system, and repair of your surge suppressor. Not so with SMP+. With Furman’s SMP+, damaging transient voltages are safely absorbed, clamped, and dissipated. No sacrificed parts, no service calls, no down time.

Unique to Furman’s SMP+ is its unparalleled clamping voltage. While other designs offer clamping voltages that are well above 330 Vpk, Furman’s SMP+ clamps at 188 Vpk, (133 VAC RMS). This unprecedented level of protection is only available with Furman’s SMP+ technology. Additionally, Furman’s trusted over-voltage circuitry protects against all too frequent

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accidental connections to 208 or 240 VAC, by shutting off the incoming power until the over voltage condition is corrected.

## LiFT (Linear Filtering Technology)

Unfortunately, traditional AC filter - conditioners have been designed for unrealistic laboratory conditions. Prior technologies, whether multiple pole filter or conventional series mode, could actually harm audio and video performance more than they help, due to the resonant peaking of their antiquated, non-linear designs. Under certain conditions, these designs can actually add more than 10 dB of noise to the incoming AC line! Furman's SMP+ with LiFT takes another approach, ensuring optimal performance through linear filtering and no leakage to ground. With this exclusive filtration technology, all connected equipment will be free of noise and contamination and will operate at optimum performance levels.

## Extreme Voltage Shutdown Indicator

This LED is normally off. It monitors a hazard common in the entertainment industry: wiring faults – for example, accidental connection to 220VAC where 120VAC is expected, or an open neutral from a 208 or 240VAC feed. The Series II SMP+ circuit senses voltages that are so high that operation would be impossible and shuts the power down before damage can occur. Upon initially applying power to these units, the Extreme Voltage indicator LED will light if the input voltage is above the extreme voltage cutoff, and power will not be applied to the unit's outlets. If the unit has been operating with an acceptable input voltage and subsequently that voltage exceeds 145-150V, it will shut off power to the outlet and the Extreme Voltage LED will light.

**NOTE:** If the mains power is above the high cutoff voltage and has caused the unit to remove power from its outlets, it cannot restore power without the operator manually turning the unit off, then on again. Avoid turning the unit back on, without first checking the source of the problem, and perhaps changing the AC source.

## Protection OK Indicator

Although the Furman SMP+ circuit assures virtually protection from transient voltage spikes and surges, nature has a way of occasionally creating electrical forces that are beyond the capabilities of *any* TVSS device to absorb without some degree of damage. In the rare instance that this occurs, the green "Protection OK" LED indicator located on your front panel will dim. If this happens some level of protection from voltage surges will remain, but the Furman's clamping voltage rating will be compromised. The unit must be returned to Furman Sound, or an authorized Furman Service center for repair.

## FUSES AND CIRCUIT BREAKERS

There is one fuse and one circuit breaker in the AR-Series. In the event that the unit appears to be completely dead (neither the Power switch nor any LED's light up), unplug the power cord and the load and check the breaker. If the circuit breaker is tripped, a white button will pop up. Push it back in to reset it. The purposes of these circuit protection devices are:

1. A fast-blow 15 amp circuit breaker is accessible at the rear panel without removing the unit from the rack. This breaker will trip if the unit's 15 amp capacity is exceeded at any time.
2. A fast-blow 1/4 amp fuse is located inside

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the unit. This fuse will blow if the unit has been connected to a voltage that is above the range of the Extreme Voltage Shutdown circuitry. To replace it, the unit must be completely disconnected from all power and removed from its rack. The six hex head screws and two Phillips head screws holding the top cover must be removed. The internal fuse is located in a holder on the printed circuit board. Replace the fuse only with the exact same type (1/4 fast blow).

## INPUT VOLTAGE MONITORING

The row of ten LED's at the left of the front panel make up a meter that indicates INPUT VOLTAGE. Only one LED will light up at a time. There are two red LED's at the endpoints. When lit, they indicate that the input voltage may be above or below the point where it can be restored to the selected nominal output voltage (though it may still be restored to a usable level) but is not high or low enough to cause an extreme voltage shutdown.

## OUTPUT VOLTAGE MONITORING

A green LED labelled OUTPUT IN REGULATION indicates proper function (i.e., that the output voltage is within  $\pm 5V$  of the selected output voltage). Your equipment will always work normally when this light is on, and often will work satisfactorily even when it is off.

The AR-15 offers a 10-LED bargraph line voltage meter to monitor the incoming line (the Voltage Regulator output).

## INSTALLATION

Because of their toroidal transformer design, Furman Voltage Regulators may be positioned near most other equipment without fear

that the other equipment will be disrupted by leakage of a strong 50/60 Hz magnetic field. Nevertheless, suggested rack locations would be either at the top or bottom.

As with any rackmount equipment, be sure to use 10-32 machine screws for mounting in the rack's tapped holes (this is not a metric size). In particular, beware of 10-24 screws, which may fit if forced but which will strip the threads. To avoid marring the front panel finish, use plastic washers under the screw heads.

## DESIGN

The AR-Series uses a design based on an eight-tap toroidal autoformer. The toroidal design assures minimal leakage of stray magnetic fields, and, because of its high efficiency, a very compact size for its rating. The Voltage Regulator's circuitry monitors the incoming line voltage with each cycle, comparing it to an extremely precise voltage reference, accurate to  $\pm 0.15\%$ . If a voltage fluctuation requires that a different tap be selected, the new tap is electronically switched exactly at the zero-crossing, to avoid distorting the AC waveform. If necessary, it can switch taps as often as once each cycle. Most commercial voltage regulators using multiple-tapped transformers switch taps at uncontrolled times, thereby creating voltage spikes and clicks that can leak into the audio! Hysteresis in the switching circuits avoids "chatter" or unnecessary switching back and forth between adjacent taps. Unlike those voltage regulators that employ ferro-resonant transformers, Furman Voltage Regulators are not sensitive to small errors in line frequency, making them ideal for use with generators.

## MAXIMUM AND MINIMUM LOAD

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The AR-15 can handle loads totalling up to 15 amperes as long as the input voltage is equal to or above 124 volts. For voltages below that level, its capacity must be derated at approximately 113 milliamperes per volt. (See graphs on back page.) As a practical matter, therefore, to cope successfully with worst-case brown-out conditions, you should plan your total load so that it does not exceed 12 amps, or 1400 watts. Please note that this refers to the aggregate power requirement of all equipment plugged into the Voltage Regulator, not to each individual item.

*NOTE: While there is no minimum load requirement for the AR-15 you may experience an audible mechanical hum coming directly from the unit when the POWER switch is on with nothing plugged in. This effect will sometimes disappear as soon as you plug in any equipment drawing 40 to 50 watts total.*

## DEFINITIONS

**VOLTAGE REGULATION:** The AC line voltage is a number indicating the nominal electrical potential that has been adopted in a region for powering electrical equipment of all kinds. In most of North America it is 117 volts AC; in Japan, 100 volts; and in many other countries 220, 230, or 240 volts. The actual voltage can fall below or rise above this nominal level due to brownouts, power cutbacks, use of substandard wiring, and other causes. These deviations can cause poor performance or a malfunction. A regulator is a device which, through use of a transformer, corrects the voltage deviation by stepping it up or down so that it is as close as possible to the nominal level.

**SPIKE:** A pulse of energy on the power line. Spikes can have voltages as high as 6000

volts. Though they are usually of very short duration, the energy they contain can be considerable, enough to damage sensitive solid-state components in audio and computer equipment. Spikes can also foul switch contacts and degrade wiring insulation. They are an unavoidable component of electric power. They are caused unpredictably by electric motors switching on or off (on the premises or outside), utility company maintenance operations, nearby lightning strikes, and other factors. Spikes (also called surges or transients) are absorbed by special components called MOV's in the AR-series to provide safe voltage levels to protect your equipment.

**RFI/EMI INTERFERENCE:** Noise from RFI (Radio Frequency Interference) or EMI (Electro Magnetic Interference) involves lower voltages and less energy than is found in spikes, but it is continuous rather than transient in nature. It is not likely to cause physical damage, but it can certainly be annoying, producing static in audio circuits, "snow" on video screens, or garbled data in computers. Noise can be introduced into AC lines by nearby radio transmitters, certain kinds of lighting, electric motors, and others. Because noise occurs at higher frequencies than the 50 or 60 Hz AC line, it can be effectively reduced through use of low-pass filtering.

## THREE-YEAR LIMITED WARRANTY

Furman Sound, Inc., having its principal place of business at 1997 South McDowell Blvd., Petaluma, CA 94954 ("Manufacturer") warrants its AR-15 (the "Product") as follows:

Manufacturer warrants to the original Purchaser of the Product that the Product sold hereunder will be free from defects in material and workmanship for a period of three years from the

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date of purchase. The Purchaser of the product is allowed fifteen days from the date of purchase to complete warranty registration by mail or on-line at the Furman website. If the Product does not conform to this Limited Warranty during the warranty period (as herein above specified), Purchaser shall notify Manufacturer in writing of the claimed defects. If the defects are of such type and nature as to be covered by this warranty, Manufacturer shall authorize Purchaser to return the Product to the Furman factory or to an authorized Furman repair location. Warranty claims should be accompanied by a copy of the original purchase invoice showing the purchase date; this is not necessary if the Warranty Registration was completed either via the mailed in warranty card or on-line website registration. Shipping charges to the Furman factory or to an authorized repair location must be prepaid by the Purchaser of the product. Manufacturer shall, at its own expense, furnish a replacement Product or, at Manufacturer's option, repair the defective Product. Return shipping charges back to Purchaser will be paid by Manufacturer.

THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Manufacturer does not warrant against damages or defects arising out of improper or abnormal use of handling of the Product; against defects or damages arising from improper installation, against defects in products or components not manufactured by Manufacturer, or against damages resulting from such non-Manufacturer made products or components. This warranty shall be cancelable by Manufacturer at its sole discretion if the product is modified in any way without written authori-

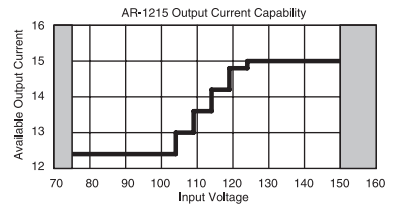
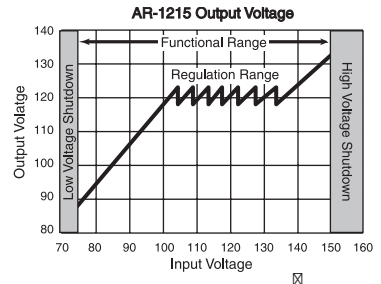
zation from Furman Sound. This warranty also does not apply to Products upon which repairs have been affected or attempted by persons other than pursuant to written authorization by Manufacturer.

THIS WARRANTY IS EXCLUSIVE. The sole and exclusive obligation of Manufacturer shall be to repair or replace the defective Product in the manner and for the period provided above. Manufacturer shall not have any other obligation with respect to the Products or any part thereof, whether based on contract, tort, strict liability or otherwise. Under no circumstances, whether based on this Limited Warranty or otherwise, shall Manufacturer be liable for incidental, special, or consequential damages. Manufacturer's employees or representatives' ORAL OR OTHER WRITTEN STATEMENTS DO NOT CONSTITUTE WARRANTIES, shall not be relied upon by Purchaser, and are not a part of the contract for sale or this limited warranty. This Limited Warranty states the entire obligation of Manufacturer with respect to the Product. If any part of this Limited Warranty is determined to be void or illegal, the remainder shall remain in full force and effect.

## SERVICE

Before returning any equipment for repair, please be sure that it is adequately packed and cushioned against damage in shipment, and that it is insured. We suggest that you save the original packaging and use it to ship the product for servicing. Also, please enclose a note giving your name, address, phone number and a description of the problem.

**NOTE:** All equipment being returned for repair must have a Return Authorization (RA) Number. To get an RA Number, please call the Furman Service Department, (707) 763-1010, ext. 120 or 121, between 8 a.m. and 5 p.m. U.S. Pacific Time, or fax to (707) 763-1310. Please display your RA Number prominently on the front of all packages.



## SPECIFICATIONS

### Spike Protection Modes:

Line to neutral, zero ground leakage

### Spike Clamping Voltage:

188 Vpk @ 3,000 amps, 133 VAC RMS  
(tested to UL-1449 6,000 Vpk @ 3,000 amps)

### Response time:

1 nanosecond

### Maximum surge current:

6,500 amps

### Voltmeter Accuracy:

±5V

### "In Regulation" Ranges:

AR-15 II: Provides regulation ±5V in 120V mode from 97 to 141V

### Noise attenuation:

10 dB @ 10 kHz  
40 dB @ 100 kHz  
100 dB @ 10 MHz

Linear attenuation curve from 0.05 - 100 ohms line impedance

### Shutdown Range:

Above 145 - 150VAC typically

### Dimensions:

19" W x 11.63" D x 1.75" H  
(48.26 x 29.54 x 4.45 cm)

### Weight:

14.5 lbs. (6.58 kg)

### Current Rating:

The AR-15 II is capable of 15 amps for input voltages of 124V (104V in 100V mode) or higher; derate at 113 mA per volt to a minimum of 12:3A

### Three Year Limited Warranty:

The AR-15 is protected by a limited three-year warranty covering defects in materials and workmanship.

# FURMAN

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