Owner's Manual

AR-1220

AC LINE VOLTAGE REGULATOR

FURMAN
VOLTAGE
REGULATORS

AR-1220 AC LINE VOLTAGE REGULATOR

Congratulations on your purchase of a Furman AR-1220 AC Line Voltage Regulator. 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 SERIES FEATURES

- **Nominal output voltages vs. "in Regulation" ranges:**
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Model	Output Voltage	In-Regulation Range	Output Accuracy
AR-1220	120	97 to 141	±5V
AR-1220J	120	97 to 141	±5V
AR-1220J	100	80 to 122	±4V

Usable range for most equipment is an additional 10% above and below the capture ranges shown in the table Ten LED bar graphs for Input Voltage and Output Current Extreme overvoltage or undervoltage causes instant shutdown, protecting equipment

- **Extreme Voltage Shutdown indicator LED**
- **Output In Regulation indicator**
- **14 regulated, conditioned outlets Twelve 20A outlets on the back panel, two 15A outlets on the front**
- **Fast acting user accessible circuit breaker protects against overload or shorts**
- **Output capacity 20 amps**
- **Very low stray magnetic field leakage**
- **On off breaker switch**
- **Output voltage selector switch (AR-1220J only)**
- **Rugged, two space rack unit weighs only 50 lbs. (23 kg.)**

AR 1220J NOTE: FIRST SELECT CORRECT VOLTAGE!

Before using your model AR 1220J Voltage Regulator, be sure that the output voltage switch on the rear panel is correctly set for the AC voltage required by your equipment Each item of equipment that you intend to power with the AR 1215J Voltage. Regulator should have its required voltage indicated on it, usually on the rear near the cord. If in doubt, consult your dealer.

GENERAL INFORMATION

Furman Voltage Regulators are intended to protect sensitive electronic equipment from problems caused by AC line voltage ir-regularities brownouts or overvoltages that can cause audio to-nal 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 (see table at left) and convert them to, and stabilize them at, the desired national voltage standard, ±5V. Voltages approximately ±10% beyond that range may be converted to usable levels, depending on the requirements of

the equipment, see figure 1.

The AR-1220 has twelve 20A outlets on the back, and two 15A outlets on the front. All are functionally interchangeable. The outlets are regulated, spike suppressed, and filtered against FIR with a 3 pole filter, making the unit a full function power conditioner. There are no controls except an on off breaker switch. (The AR-1220J also has an output voltage selector switch.)

Limitations: These Line Voltage Regul ators are for use with AC voltage only. DC voltages should never be applied to them. Also, they do not change or regulate line frequency. The output frequency will always be the same as the incoming line frequency.

MAXIMUM LOAD

The AR 1220 can handle loads totalling up to 20 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 .10 amperes per volt. See figure 2. As a practical matter, therefore, to cope successfully with worst case brownout condi-tions, you should plan your total load so that it does not exceed 16.5 amps, or 1980 watts. Please note that this refers to the aggre-gate power requirement of all equipment plugged into the Voltage Regulator, not to each individual item.

EXTREME VOLTAGE PROTEC-TION

The AR Series includes special circuitry to sense over and un-der voltages and positively shut down the output before possible damage is done. For the AR-1220, overvoltages are those over 150V (135V in 100V mode). When the input voltage exceeds that limit, the power will cut off. It will come back on automatically when the overvoltage is removed as long as the voltage has not exceeded 300V. The red LED labelled EXTREME VOLTAGE SHUT-DOWN indicates the shutdown condition. The output is also shut down for extremely low input voltages (those below 75V, or 65V in 100V mode).

To provide protection against a catastrophic error in AC mains wiring, dangerously high voltages (those over approximately 300V) will cause an internal fuse to blow, but equipment plugged into the Voltage Regulator will not be damaged.

FUSES AND CIRCUIT BREAKERS

There are one circuit breaker and 8 internal fuses in the AR-1220.

1. A fast blow 20 amp circuit breaker is used as the on/off switch. This breaker will trip if the unit's 20 amp capacity is exceed-ed at any time. If the circuit breaker is tripped, the on/off switch will switch off. To reset it, push the switch back to the on position.

2. A fast blow 1/4 amp fuse is located inside 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 (approximately 300V). To replace it, the unit must be completely disconnected from all power and removed from its rack. The six hex head screws and one Allen head screw holding the top cover must be removed.

NOTE: There are two different types of internal fuses. There are seven 30 amp fuses to protect the voltage switches against faults in the control circuits (see the section on Design), and the 1/4 amp fuse mentioned above, to protect the small transformer against line voltages greater than 300V. For continued protection, replace fuses only with the exact same type and rating. The internal fuses are lo-cated on the main circuit board.

INPUT VOLTAGE MONITORING

The row of ten LED's at the top 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 nomi-

nal 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.

The AR 1220J has switchable output voltages, and also has multiple scales on the Input Voltage meter corresponding to the selected voltage.

OUTPUT VOLTAGE MONITORING

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

If you wish to monitor your AR-1220's output voltage more pre-cisely, you may want to use a Furman Sound PL PLUS Power Conditioner and Light Module in conjunction with it. The PL-PLUS is the perfect complement to a Furman Voltage Regulator to assist in rack power distribution. It offers a 20 LED bar graph line voltage meter to monitor the incoming line (the Voltage Regulator output), twin slide out, swiveling lights with a dimmer control for equipment illumination, and eight additional outlets with their own spike and surge protection and RFI filtering.

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 117 120 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 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.

RF11EMI 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.

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 lo-cations would be either at the top or bottom. As with any rack-mount 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 1220 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 com-pact size for its rating. The Voltage Regulator's circuitry monitors the incoming line voltage with each cycle, comparing it to ar extremely precise voltage reference, accurate to ±0.15%. If a voltage e 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 of-ten 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. And 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.

ONE YEAR LIMITED WARRANTY

Furman Sound, Inc., having its principal place of business at 1997 South McDowell Blvd., Petaluma, CA 94954 ("Manufacturer") warrants its AR-1220 (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 one year from the 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.

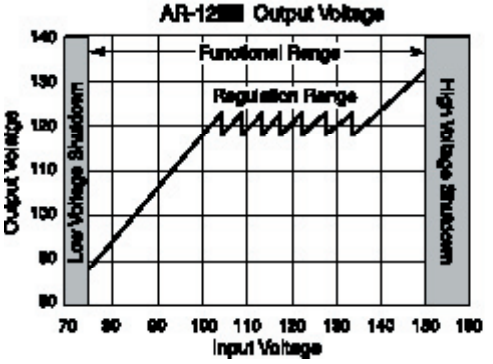
THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Manufacturer does not warrant against damages or defects arising out of improper or abnormal use of handling of the Product; 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 authorization 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.



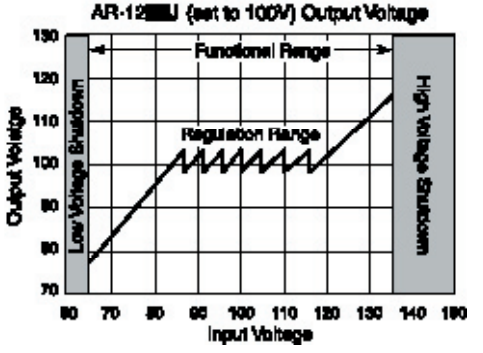
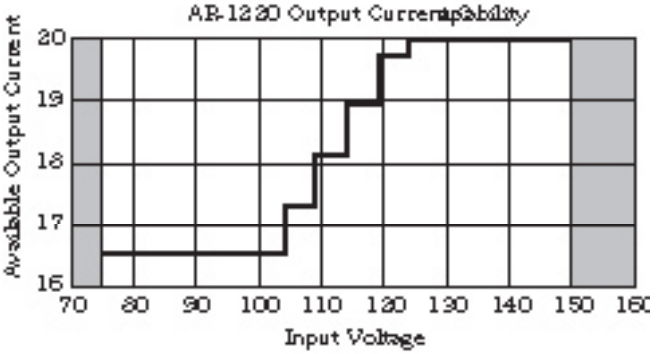
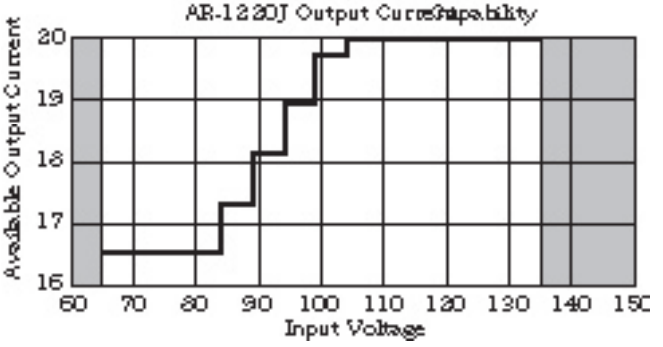


Figure 2 : Available output current vs. input voltage





AR-1220 SPECIFICATIONS

Current Rating:
20 amperes for input voltages of 104/124* or higher; derate at .15 A per volt to a minimum of 16.5A

"In Regulation" Ranges:
Provides regulation ±5V in 120V mode from 97 to 141V; (AR-1220J only: Provides regulation ±4V in 100V mode from 80 to 122V)

Shutdown Range:
120V mode: Below 75V or above 150V. (AR-1220J: 100V mode: Below 65V or above 135V)

Voltmeter Accuracy:
±5V

Spike Protection Modes:
Line to neutral, neutral to ground, line to ground

Spike Clamping Voltage:
Initial turn-on at 200V; TVSS rating of 400 volts peak at 500 A, L-N, N-G, L-G (tested to UL-1449)

Response Time:
1 nanosecond

Maximum Surge Current:
6,500 amps (8 x 20 µs pulse)

Maximum Spike Energy:
80 joules per node; 240 joules total

Noise Attenuation:
Differential mode: Greater than 40 dB

Transverse and common modes: Greater than 60 dB, 1-200 MHz

Dimensions:
3.5" H x 19" W x 17" D (8.9 x 48.3 x 43.2 cm)

Weight:
35 lbs. (16 kg)

FURMAN

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