



- 100 Volt
- 200 Amp



**7794MRL  
GRADIENT  
AMPLIFIER**

**7794MRL Pulsed Output - Current Mode**

|                        | PULSE DURATION / OFF TIME (mS) |           |           |         |            |           |         |
|------------------------|--------------------------------|-----------|-----------|---------|------------|-----------|---------|
|                        | DC*                            | 500 / 500 | 100 / 100 | 10 / 20 | 170 / 1000 | 25 / 1000 | 4 / 100 |
| Output ( $\pm$ A Peak) | 160                            | 200       | 200       | 200     | 200        | 200       | 200     |

\*DC 0.15 $\Omega$

The AE Techron 7794MRL gradient amplifier provides a solution for the unique requirements of Low-Field and Ultra-Low-Field MRI.

AE Techron is an industry pioneer in MRI. Our engineers developed some of the first commercially available gradient amplifiers ever made. We bring this experience to the design of every new gradient amplifier in our product line.

One key differentiation of AE Techron Gradient amplifiers compared to typical gradient amplifiers from other suppliers is the 7794MRL's very-low-noise linear topology. A key benefit of this approach is the elimination of switching noises, which makes it possible to achieve good image quality with magnetic fields down to 100 mT.

Never satisfied with the performance of our products, we were excited when we were approached by leaders in the low-field MRI community and asked to work with them to develop an improved Low-Field Gradient amplifier that would allow them to achieve faster rise times and better images at ever lower field strengths.

The 7794MRL is the result of this cooperative development effort. By further reducing the already low system non-linearities found in our 2100 series MRI systems, the AE Techron 7794MRL is able to be used successfully in research systems with field strengths as low as an amazing 6 mT.

The 7794MRL also possesses a number of important physical attributes. It combines a small footprint, integrated power supply/amplifier design, rugged construction and modest weight, to make it a great choice for field-deployable, low-field or small-bore MRI systems.

**Features**

- Output of up to 200 amperes peak, at up to 100 volts.
- 4-quadrant linear design.
- Blanking feature lowers the noise floor on the amplifier by shutting down the output stage. This action occurs in less than 10  $\mu$ s.
- Current mode response: DC-5 kHz (compensation dependent); Voltage mode response: DC-20 kHz at rated power.
- Robust, linear power supply results in extremely low noise; bi-level switch design limits heat dissipation to output devices.
- Provides precision control of output offset, DC drift and gain linearity.
- Protection circuitry guards against input overloads, improper output connection (including shorted and improper loads), over-temperature, over-current, and supply voltages that are too high or low.
- Shipped ready to operate from 208-volt ( $\pm$ 10%) 3-phase AC mains; 400-volt model available on request.

Contact us directly or contact your local AE Techron sales partner to see if we can support your latest project with its special requirements in ways other suppliers can't or simply choose not to.

## Performance

Specification typical at 25°C ambient. Unless otherwise noted; testing was done in Current mode with a load = 140  $\mu$ H + 100 m $\Omega$ .

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| <b>Peak Current Limit</b>                                     | 200 A  |
| <b>Gain Linearity*</b>  | <b>DC:</b> 0.0125% (over input signal, from 0.2V to 5V)<br><b>AC:</b> 0.030%   |
| <b>Output Offset (adjustable to zero)</b>                     | <b>Voltage Mode:</b> Less than $\pm$ 400 $\mu$ V<br><b>Current Mode:</b> $\pm$ 5 mA  |
| <b>Input Characteristics</b>                                  | <b>Three-Terminal Barrier Block Connector:</b><br>Balanced with ground; 20 k $\Omega$ differential<br><b>BNC Connector:</b> Unbalanced; 10 k $\Omega$ single ended<br><b>Max Input Voltage:</b> $\pm$ 10 V balanced or unbalanced<br><b>Common Mode Rejection:</b> –58 dB with 5 V input |
| <b>Output Impedance</b>                                       | <b>Current Mode (effective):</b> 2000 $\Omega$<br><b>Voltage Mode (typical):</b> 3 m $\Omega$ in Series with 2.23 $\mu$ H  |
| <b>Load</b>   | <b>Current Mode:</b> 100 $\mu$ H + 100 m $\Omega$<br><b>Adaptable Range:</b> 5 $\mu$ H to 2.5 H, 0.01 $\Omega$ to 20 $\Omega$  |
| <b>Current Mode Response</b>                                  | –3 dB at 5 kHz (compensation dependent)  |
| <b>Current Settling Time</b>                                  | <b>Ramp 0 A to <math>\pm</math>50 A or <math>\pm</math>50 to 0 A:</b><br>100 $\mu$ s to within 1.0 A or 1%<br>175 $\mu$ s to within 200 mA, 0.2%   |
| <b>Total Harmonic Distortion</b>                              | <b>Current Mode:</b> Less than 0.05%<br><b>Load:</b> 140 $\mu$ H + 100 m $\Omega$  |
| <b>Noise Floor</b>  | 200 $\mu$ A or less<br>5 $\mu$ A or less (when Blanking circuit is enabled)  |
| <b>DC Drift</b>   | <b>Self Heating Drift, 0 to <math>\pm</math>60 A:</b><br>5 mA/10 minutes maximum   |
| <b>Noise Output</b>   | <b>10 Hz to 1 kHz:</b> 0.2 mA<br><b>1 kHz to 60 kHz:</b> 0.05 mA   |
| <b>Signal-to-Noise Ratio</b>                                  | -110 dBA   |
| <b>Ripple Noise Output</b>                                    | None   |
| <b>Slew Rate, Voltage Mode:</b>                               | 4.5 V/ $\mu$ s   |
| <b>Remote Control and Monitoring (back-panel D connector)</b> | <b>Current Monitor:</b> $\pm$ 1 V / 20 A $\pm$ 1%<br><b>Reporting:</b> System Fault, Over Temp, Over Voltage, Over Load<br><b>Control:</b> Force to Standby, Remove from Standby, Reset after a Fault  |

\*Gain Linearity Accuracy was measured in Voltage mode with the amplifier driven into a 10 $\Omega$  load with between 0.1VDC and 6VDC or between 0.2VAC and 5VAC presented at its inputs.

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| <b>Amplifier Protection</b>            | <p><b>Over Load/Distortion (IOC):</b> Shutdown or clipped output</p> <p><b>Current vs Time (ODEP):</b> Clipped output</p> <p><b>Each heat sink temperature:</b> Shutdown 105°C</p> <p><b>Overvoltage Shutdown:</b> 229 VAC / 440 VAC</p> <p><b>Undervoltage Shutdown:</b> 187 VAC / 360 VAC</p>  |
| <b>LCD Display (front panel)</b>       | <p>Can be configured for up to four simultaneous displays reporting one, two, or all four of the following: <math>V_p</math>, <math>V_{RMS}</math>, <math>A_p</math>, <math>A_{RMS}</math>. Also reports any fault conditions that occur and suggests corrective action.</p>   |
| <b>Status Indicators (front panel)</b> | <p>LEDs indicate a status of Run, Ready or Standby, and Fault conditions.</p>  |
| <b>Controls (front panel)</b>          | <p><b>Soft Touch Switches:</b> Run (Enable), Stop and Reset functions.</p>   |
| <b>Controls (back panel)</b>           | <p><b>AC Mains Switch and Circuit Breaker:</b> Dual-function power switch and circuit breaker; rating: 30A for 208 volts or 15A for 400 volts. Turn off and then back on to reset.</p>   |
| <b>Connectors (back panel)</b>         | <p><b>Power Connection:</b> NEMA-style locking receptacle; matching AC connector also included.</p> <p><b>Signal Output:</b> 4-position terminal barrier block (OUTPUT/Common/ SAMPLED COMMON/CHASSIS GROUND); resistor between SAMPLED COMMON and CHASSIS GROUND terminals is a 2.7-ohm, 2W, 5%, metal-oxide resistor.</p> <p><b>Signal Input:</b> User-selectable unbalanced BNC or balanced Barrier Strip</p> <p><b>Interlock I/O Connection:</b> 25-pin D connector provides for remote monitoring and control functions</p> |
| <b>Power Requirements</b>              | <p>Three-phase, 208 VAC <math>\pm 10\%</math>, 47-60 Hz, 30 Amp AC service; (400 VAC <math>\pm 10\%</math>, 15 Amp service model available).</p>   |
| <b>Thermal Requirements</b>            | <p><b>Operating Temperature:</b> +10°C to +50°C (+50°F to +122°F). Maximum output power de-rated above 30° C (86°F).</p> <p><b>Storage:</b> -30°C to +85°C (-22°F to +185°F).</p> <p><b>Humidity:</b> 70% or less, non-condensing.</p>   |
| <b>Physical Characteristics</b>        | <p><b>Dimensions:</b> 19" L x 12.25" H x 22.8" D (48.3 cm L x 31.1 cm H x 57.9 cm D).</p> <p><b>Cooling:</b> Forced air cooling from front to back through removable filters via six 100 CFM fans. No space is required between rack-mounted amplifiers. Air filters are removable from the rear via one fastener per side and may be eliminated if cabinet filtration is provided.</p> <p><b>Airflow:</b> 600CFM.</p> <p><b>Weight:</b> 153 lbs (69 kg).</p> <p><b>Shipping Weight:</b> 158 lbs (71.7 kg).</p>                  |

