



## 7228

### 1 kVA, DC-enabled Linear Power Amplifier

#### Performance Overview:

AC Power (up to 20 kHz):	1000 watts RMS
Small Signal (8V p-p):	1 MHz
For High-Power Applications to:	200 kHz+
DC Power:	16A at 13.5 VDC
40 mS Pulse (0.5Ω):	60 A <sub>p</sub>
Slew Rate:	100 V/μs
Output Voltage:	±150 V <sub>p</sub>
Output Impedance:	5.3 mΩ in series with 0.95 μH

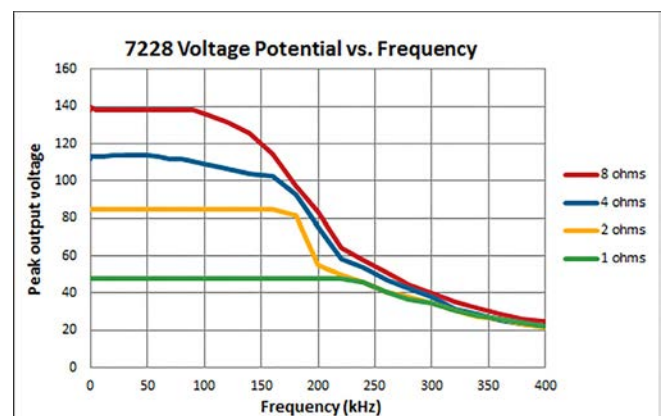
AE Techron's **7228** amplifier is a 1-kVA, DC-enabled unit that provides advanced protection and exceptional versatility. It features a DC to 1 MHz bandwidth and improved performance at frequencies above 100 kHz. In continuous operation, a 7228 can provide up to four times the output power of the 7224 at frequencies above 100 kHz. If more current or power is needed, amplifiers can be combined in series or parallel and operate as a single system.

Back-panel switches allow the 7228 be configured by the user for high-voltage/low-current, medium voltage and current, or low-voltage/high-current applications. Residual noise, slew rate, and gain linearity have all been improved over the 7224 model. It can safely drive a wide range of resistive, inductive loads.

The 7228 is typically used to create waveforms as required by a variety of EMC standards for DC powered electronics like FMC 1278, DO-160, and MIL STD 461. It can also be used as a gradient amplifier for very small bore, high-gain MRI and NMR systems.

#### Features

- Up to 4X the long-term power of the 7224 at frequencies above 100 kHz.
- Changes to protection, connection type and modes of operation are accomplished quickly by changing back-panel DIP switches or via remote contact closure.
- Provides user-selectable current limit, DC Blocking and DC Servo for transformer-based loads.
- Series or Parallel systems can be configured using back-panel DIP switches or remote contact closure. Ballast resistors are not required for connecting multiple amps in parallel.
- Monitors for excessive ground currents and moves to Standby when these conditions occur.
- Variable-speed, thermostatically controlled cooling fans minimize noise and reduce the fatigue of test personnel.
- Stable when driving highly capacitive loads.
- Four-quadrant operation.



## Specifications

### Performance

AC testing was done at 100 Hz. Continuous DC power levels are lower. See DC Specifications chart for test conditions.

7228 accuracy was measured when driven into a 10-ohm load with between 0.1 VDC and 6 VDC or between 0.2 VAC and 5 VAC presented at its inputs.

**Frequency Response, DC - 1 MHz (1 watt):**  $\pm 3$  dB

**Slew Rate:** 100 V/ $\mu$ Sec

**Residual Noise,**

**10 Hz to 500 kHz:** 900  $\mu$ V (0.90 mV)

**10 Hz to 80 kHz:** 450  $\mu$ V (0.45 mV)

**Signal-to-Noise Ratio,**

**10 Hz - 30 kHz:** -109.5 dB

**10 Hz - 80 kHz:** -106.3 dB

**10 Hz - 500 kHz:** -100.5 dB

**Unit to Unit Phase Error:**  $\pm 0.1$  degrees at 60 Hz

**THD (DC - 30 kHz):**  $< 0.1\%$

**Output Offset,**

**With DC Servo Off:** Less than  $\pm 5$  mVDC

**With DC Servo On:** Less than  $\pm 400$   $\mu$ V

**DC Drift (after 20 minutes of operation),**

**With DC Servo Off:** Less than  $\pm 1.5$  mVDC

**With DC Servo On:** Less than  $\pm 200$   $\mu$ V

**Output Impedance:** 5.3 mOhm in Series with 0.95  $\mu$ H

**Phase Response (10 Hz - 10 kHz):**

0 to -5 degrees plus 750 nsec propagation delay

### Input Characteristics

**Balanced with ground:** Three terminal barrier block connector, 20k ohm differential

**Unbalanced:** BNC connector, 10k ohm single ended

**Gain (variable or fixed):**

**Voltage Mode:** 20 volts/volt

**Current Mode:** 5 amperes/volt

**Gain Linearity (over input signal, from 0.2V to 5V),**

**DC:** 0.05%

**AC:** 0.15%

**Max Input Voltage:**  $\pm 10$ V, balanced or unbalanced

### Display, Control, Status, I/O

**Front Panel LED Displays indicate:**

Ready, Standby, Fault, Over Temp, Over Voltage, Overload

**Soft Touch Switches for:** Run, Stop, Reset

**Gain Control, when enabled:**

Voltage gain adjustable from 20 to 0

### On/Off Breaker

**Back Panel Power Connection:**

25 Amp IEC (with retention latch)

**Signal Output:**

Three-position terminal strip (OUTPUT/COM/CHASSIS GROUND); resistor between COM and CHASSIS GROUND terminals is a 2.7-ohm, 2W, 5%, metal-oxide resistor

**Signal Input:**

User-selectable BNC or Barrier Strip, Balanced or Unbalanced

### Communication Capabilities

**Current Monitor:**

5A/V  $\pm 1\%$ ; 2.5A/V  $\pm 1\%$  (differential configuration)

**Reporting:**

Run/Standby Status, System Fault, Over Temp, Over Voltage, Over Load

**Remote Control via Expansion Port:**

Blanking, Force to Standby, Reset after a Fault, DC Block, DC Servo, Control Mode, Bi-level Mode, Power Supply Rail Mode, Balanced/Unbalanced Input Signal, Series/Parallel Mode, 6X Gain, Signal Ground, Current Limit

### Physical Characteristics

**Chassis:**

The Amplifier is designed for stand-alone or rack-mounted operation. The Chassis is black aluminum with a powder coat finish. The unit occupies two EIA 19-inch-wide units.

**Weight:** 41 lbs (18.6 kg), Shipping 51 lbs (23.2 kg)

**AC Power:**

Single phase, 120 VAC, 60 Hz, 20A service;  
(220-240 VAC, 50-60 Hz, 10A service model available)

**Operating Temperature:**

10°C to 50°C (50°F to 122°F), maximum output Power derated above 30°C (86°F).

**Humidity:** 70% or less, non-condensing

**Cooling:**

Variable-speed, thermostatically controlled cooling fans provide forced air cooling from front to back through removable filters.

**Airflow:** 180CFM

**Dimensions:** 19 in. x 22.75 in. x 3.5 in.  
(48.3 cm x 57.8 cm x 8.9 cm)

### DC Specifications – High-Current Mode

VDC	OUTPUT (Amperes)	
	5 Minutes, 100% Duty Cycle	1 Hour, 100% Duty Cycle
48	21	16
24	25	25
13.5	20	16

### AC Specifications – High-Voltage Mode

Ohms	PEAK OUTPUT						RMS OUTPUT					
	40 mSec Pulse, 20% Duty Cycle		5 Minutes, 100% Duty Cycle		1 Hour, 100% Duty Cycle		5 Minutes, 100% Duty Cycle		1 Hour, 100% Duty Cycle			
	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Watts	
16	160	10	153	10	153	10	108	7	108	7	731	
8	148	18	136	16	126	15.8	96	12	89	11.2	1000**	
4	120	29	90	22	63	15.7	64	16	45	11.2	500	
2	92	45	47	23	47	23	33	16	33	16	550	

### AC Specifications – Mid-Level Mode

Ohms	PEAK OUTPUT						RMS OUTPUT					
	40 mSec Pulse, 20% Duty Cycle		5 Minutes, 100% Duty Cycle		1 Hour, 100% Duty Cycle		5 Minutes, 100% Duty Cycle		1 Hour, 100% Duty Cycle			
	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Watts	
8	84.5	10.5	80	10	80	10	57	7	57	7	400	
4	77	19	73	18	73	18	54	13	54	13	700	
2	67	33	61	30	56	27	43	21	39	19	769	
1	52	51	47	46	26	26	33	33	20	20	400	
0.5	30	60	13	26	10	20	9.8	18	7.3	14	100	

### AC Specifications – High-Current Mode

Ohms	PEAK OUTPUT						RMS OUTPUT					
	40 mSec Pulse, 20% Duty Cycle		5 Minutes, 100% Duty Cycle		1 Hour, 100% Duty Cycle		5 Minutes, 100% Duty Cycle		1 Hour, 100% Duty Cycle			
	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Watts	
2	33	16	33	16	33	16	24	12	24	12	273	
1	29	28	28	28	28	28	20	19	20	19	388	
0.75	26	34	26	34	26	34	18	24	18	24	452	
0.5	22	43	22	43	22	43	16	31	16	31	488	
0.25	14	53	11	45	11	45	8	32	8	32	256	

Testing performed with fans set to Auto, 1 kHz sinewave input signal, resistive load, 20°C ambient temperature.

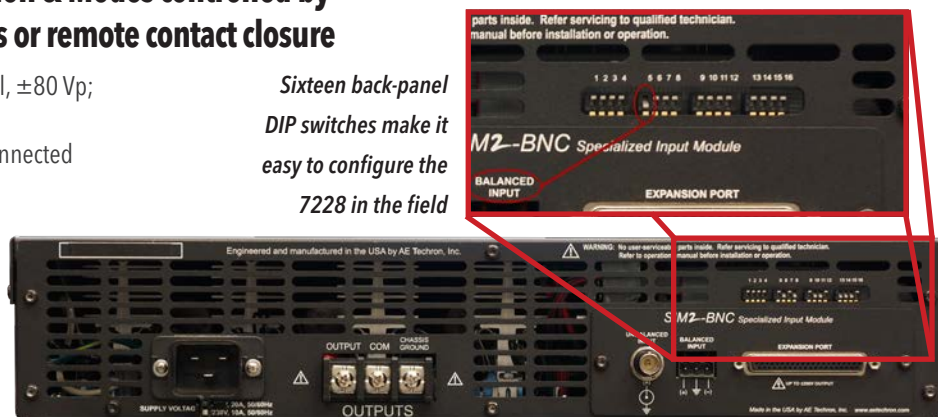
\*Testing performed with Bi-level setting set to Manual, Low.

\*\*Continuous operation for 45 minutes.

### Settings, Configuration & Modes controlled by external DIP switches or remote contact closure

- High-voltage,  $\pm 150$  Vp; Mid-level,  $\pm 80$  Vp; and High-current  $\pm 40$  Vp
- Stand-alone, Series, or Parallel connected
- DC blocked or enabled
- DC servo on or off
- Current limit on or off; level
- Input balanced or unbalanced
- Controlled Voltage or Controlled Current
- Input ground lift

Sixteen back-panel DIP switches make it easy to configure the 7228 in the field



**Protection**

**Over/Under Voltage:**

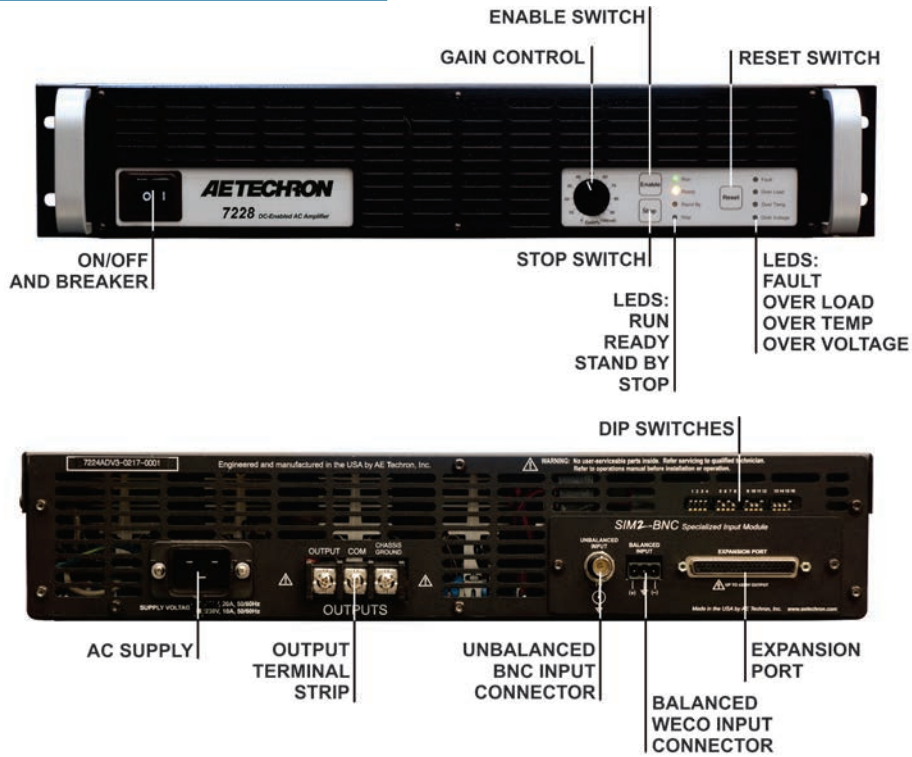
± 10% from specified supply voltage amplifier is forced to Standby

**Over Current:**

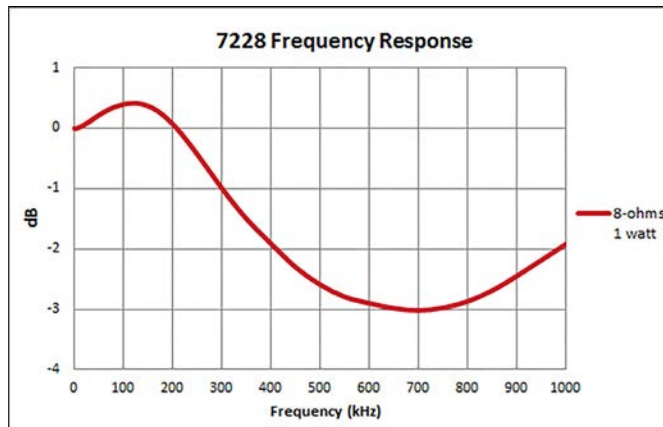
Breaker protection on both main power and low voltage supplies

**Over Temperature:**

Separate Output transistor, heat sink, and transformer temperature monitoring and protection



**FREQUENCY PERFORMANCE**



*AE Techron Sales Representative*