



## 7224RLY

### Four-Quadrant Power Amplifier for Protection Relay Production Testing and Commissioning

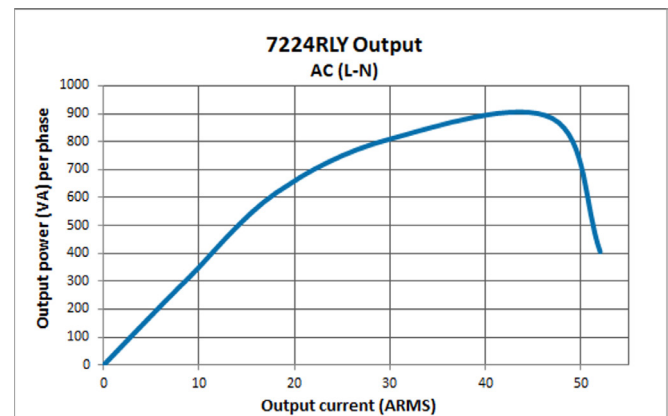
#### Performance Overview:

Maximum Current Output (0.5Ω):	50 Ap (35 ARMS)
Maximum Output Voltage:	158 Vp
Controlled-Current Bandwidth (0.25Ω load):	DC to 10 kHz
Standard Transconductance (from short to 1Ω load):	20 ±0.2%
Unit to Unit Phase Error (60 Hz):	±0.1°
Residual Noise (40 Hz to 600 Hz):	<2.5 mAp

#### Features

- High compliance voltage allows the 7224RLY to drive electromechanical relays directly
- Maintains phase accuracy for any load from a dead short to 2 ohms
- Front panel indicators for rapid assessment of amplifier status
- Installs in just 2U of a standard 19-inch rack; or stands alone for bench-top operation.
- Shipped ready to operate from single-phase, 120VAC (±10%) 60 Hz, 20A service. 220/240VAC, 50/60Hz, 10A model available on request.
- Protection circuitry protects from input overloads, improper output connection (including shorted and improper loads), over-temperature, over-current, and supply voltages that are too high or low.
- Backed by AE Techron's comprehensive, 3-year, no-fault warranty.

AE Techron's **7224RLY** is a four-quadrant, DC-enabled power amplifier that was created to meet the exacting requirements of the power utility industry. Capable of outputting a 40 mSec pulse with up to 52 amperes peak current, the 7224RLY is powerful enough to put protection relays, fuses and other critical components through a full range of tests. The low noise floor, low distortion and minimal phase error of the 7224RLY make it the ideal amplifier for power grid modeling.



#### Specifications

##### Performance

- Controlled-Current Bandwidth (0.25Ω load): DC to 10 kHz
- Maximum Output Current (0.5Ω load): 35A RMS (50 Ap)
- Maximum Output Voltage: 158 Vp
- Maximum Output Power: Dependent on load and frequency
- Load Constraint for Maximum Output: 0.5Ω + 200 mH\*

\*All loads from 8-ohm to short are stable with 2 mH in series.

**Output Offset Current:** Less than 10.0 mA DC peak  
**Standard Transconductance** (from short to 1Ω load): 20 ±0.2%  
**Common Mode Rejection Ratio** (40 to 600 Hz):  
 -58 dB minimum

**Unit-to-Unit Phase Error** (60 Hz): ±0.1 degrees  
**Residual Noise** (40 to 600 Hz): Less than 2.5 mA peak  
**Input-to-Output Phase Delay:** -0.2 degrees

**Out Accuracy:** Less than ±1%

**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

**Max Input Voltage:** ±10V, balanced or unbalanced

**Common Mode Rejection:** -58 dB with 5V input

**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 ± 1%; 2.5A/V ± 1% (differential configuration)

**Reporting:**

System Fault, Over Temp, Over Voltage, Over Load

**Remote Control via Interlock Connector:**

Force to Standby, Reset after a Fault

**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

**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 de-rated above 30°C (86°F).

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

**Cooling:** 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)

**Accuracy**

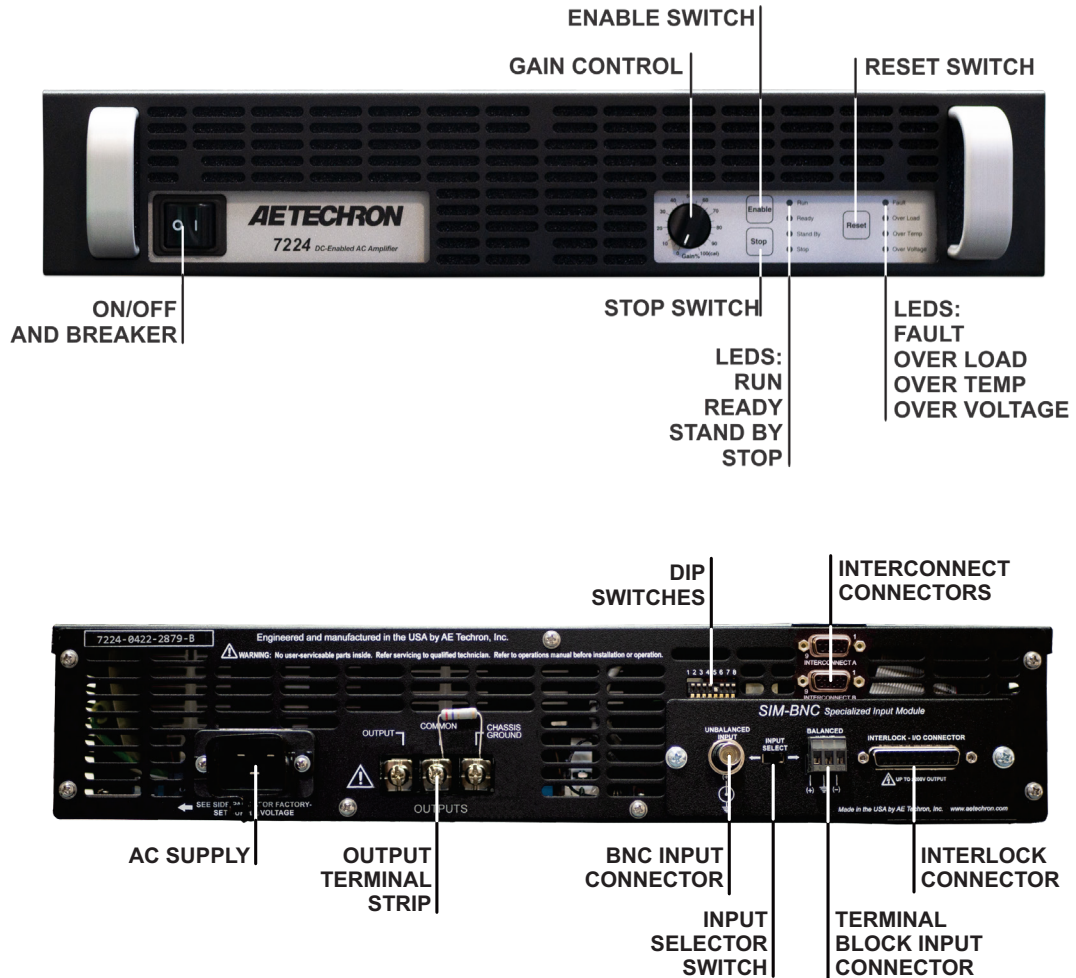
Amplitude vs. Frequency at 1V input, 20A output, amplifier transconductance set to 20:			
Load	Input Signal	Transconductance	
		1 kHz	100 Hz
2 ohms	Sine	19.9	20
1 ohm	Sine	20	20
0.5 ohm	Sine	20	20
Short*	Sine	20	20

\*Unimpeded wire.

## Pulse/Burst Specifications

TOTAL LOAD	DURATION	WAVEFORM	OUTPUT POWER
1.0 ohms	5 minutes	60 Hz Sine	28A RMS / 40A peak
		DC	20A peak
	20 seconds	60 Hz Sine	30A RMS / 43A peak
		DC	20A peak
	0.2 seconds	60 Hz Sine	33A RMS / 47A peak
		DC	30A peak

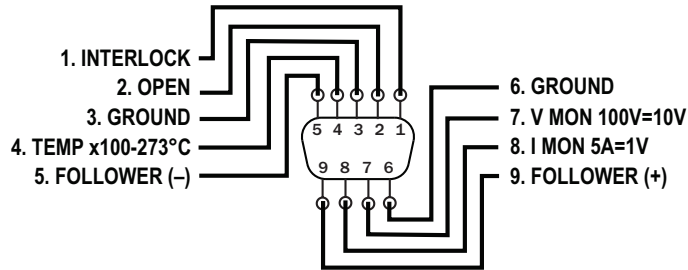
NOTE: Testing performed in mid-level mode using 40 ms pulses with a 30% duty cycle..



## CONFIGURATION SETTINGS

### PINOUTS FOR INTERCONNECT PORTS (A & B)

Models 7224 and 7234



### DIP SWITCH SETTINGS

Models 7224 and 7234



DEFAULT DIP SWITCH  
SETTINGS SHOWN

#### DIP SWITCH SETTINGS

- 1 OPERATION (CV / CC)
- 2 COMPENSATION (CC1 / CC2)
- 3 LOW PASS FILTER
- 4 GAIN (20 / 6)
- 5 ELECTRONIC GAIN MATCHING
- 6 MASTER / FOLLOWER
- 7 VOLTAGE INPUT (LOW / HIGH)
- 8 DC / AC COUPLING

#### UP

- CV**
- CC1**
- OFF**
- 20**
- ON
- MASTER**
- LOW**
- DC**

#### DOWN

- CC
- CC2
- ON
- 6
- OFF**
- FOLLOWER
- HIGH
- AC

- Controlled-voltage or controlled-current operation
- Compensation network (for controlled-current operation)
- Enable 50 kHz low-pass filter
- Gain selection (20 / 6)
- Enable electronic gain matching (for parallel multi-amp operation)
- Multi-amp configuration
- Low (line-level) input or high input (up to 180V)
- DC enable or DC block

RED = FACTORY DEFAULT

**CE** 230V versions of this product bear the CE mark

*AE Techron Sales Representative*



## 7548RLY

Four Quadrant Power Amplifier  
for Protection Relay Production  
Testing and Commissioning

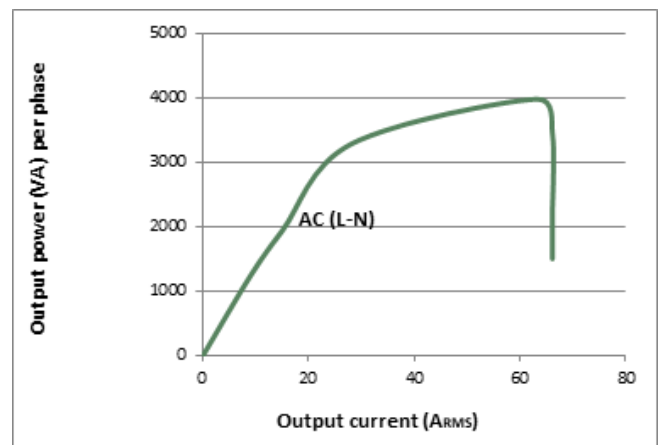
### Performance Overview:

Maximum Current Output (0.5Ω):	100 A <sub>p</sub> (70 A <sub>RMS</sub> )
Maximum Output Voltage:	195 V <sub>p</sub>
Controlled-Current Bandwidth (0.25Ω load):	DC - 10 kHz
Standard Transconductance (from short to 1Ω load):	20 ±0.2%
Unit to Unit Phase Error (60 Hz):	±0.1°
Residual Noise (40 Hz - 600 Hz):	<2.5 mAp

AE Techron's **7548RLY** amplifier was created to meet the demanding requirements of the power utility industry. With an output capability of 100 A<sub>p</sub>, the 7548RLY is powerful enough to put protection relays, fuses and other critical components through a full range of tests. It is capable of a controlled voltage bandwidth of DC - 100 kHz, and a controlled current bandwidth of DC - 10 kHz. The low noise floor, low distortion and minimal phase error of the 7548RLY make it the ideal amplifier for power grid modeling.

### Features

- High compliance voltage allows the 7548RLY to drive electromechanical relays directly.
- Maintains phase accuracy for any load from a dead short to 0.25 ohms.
- Front panel indicators for rapid assessment of amplifier status.
- Installs in a standard 19-inch rack; or stands alone for bench-top operation.
- Shipped ready to operate from three-phase, 208VAC (±10%), 47-60 Hz, 30A service. 400VAC (±5%) 15A model available on request.
- Protection circuitry protects from input overloads, improper output connection (including shorted and improper loads), over-temperature, over-current, and supply voltages that are too high or low.
- Backed by AE Techron's comprehensive, 3-year, no-fault warranty.



## Specifications

### Performance

Controlled-Current Bandwidth (0.25-ohm load): DC - 10 kHz

Maximum Output Current (0.5-ohm load): 70 A<sub>RMS</sub> (100 Ap)

**Maximum Output Voltage:** 195 V<sub>p</sub>

**Maximum Output Power:** Dependent on load and frequency

**Load Constraint for Maximum Output:** 0.5Ω + 200 mH\*

**Output Offset Current:** Less than 10.0 mA DC peak

**Standard Transconductance (from short to 1-ohm load):** 20 ±0.2%

**Unit to Unit Phase Error (60 Hz):** ±0.1 degrees

**Residual Noise (40 Hz to 600 Hz):** Less than 2.5 mAp

**Out Accuracy:** Less than ±1%

### Input Characteristics

**Balanced with ground:** Three terminal barrier-block connector, 20 kΩ differential

**Unbalanced:** BNC connector, 10 kΩ single-ended

**Max Input Voltage:** ±10V, balanced or unbalanced

**Common Mode Rejection Ratio (40 Hz - 600 Hz):** -58 dB minimum

### Status Display, Control, I/O

**Front Panel LED Displays indicate:** Ready, Standby, Fault

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

**LCD Display:** Can be configured for up to four simultaneous displays reporting one, two, or all four of the following: V<sub>p</sub>, V<sub>RMS</sub>, A<sub>p</sub>, A<sub>RMS</sub>. Also reports any fault conditions that occur and suggests corrective action.

**Back Panel Power Connection:** NEMA-style locking receptacle; matching AC connector also included

**Signal Output:** 4-position terminal barrier block (OUTPUT / COMMON / SAMPLED COMMON / CHASSIS GROUND); resistor installed between SAMPLED COMMON AND CHASSIS GROUND is a 2.7-ohm, 2W, 5%, metal-oxide resistor

**Signal Input:** User-selectable BNC or Barrier Strip, Balanced or Unbalanced

**Interlock Connector:** 25-pin D-sub connector used for amplifier control and status applications; also used in multi-amplifier applications

### Communication Capabilities

**Current Monitor:** 20A/V ± 1%; 10A/V ± 1% (differential configuration)

**Reporting:** System Fault, Over Temp, Over Voltage, Over Load

**Remote Control via Interlock Connector:** Force to Standby, Reset after a Fault

### Protection

**Over/Under Voltage:** ±10% (±5% for 400VAC version) 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

### Physical Characteristics

**Chassis:** The amplifier is designed for stand-alone or rack-mounted operation. The chassis is aluminum with a black powder-coat finish. The unit occupies seven EIA 19-inch-wide units.

**Weight:** 110 lbs (50 kg), Shipping 122 lbs (55.3kg)

**AC Power:** Three-phase, 208V AC (±10%), 47-60 Hz, 30A AC service; (400V AC (±10%), 15A model available)

**Operating Temperature:** 10°C to 50°C (50°F to 122°F), maximum output power de-rated above 30°C (86°F.)

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

**Cooling:** Forced air cooling from front to back through removable filters via six 100ft<sup>3</sup>/min. 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.

**Dimensions (HxWxD):** 8.75" x 19" x 22.8" (22.2 cm x 48.3 cm x 57.8 cm)

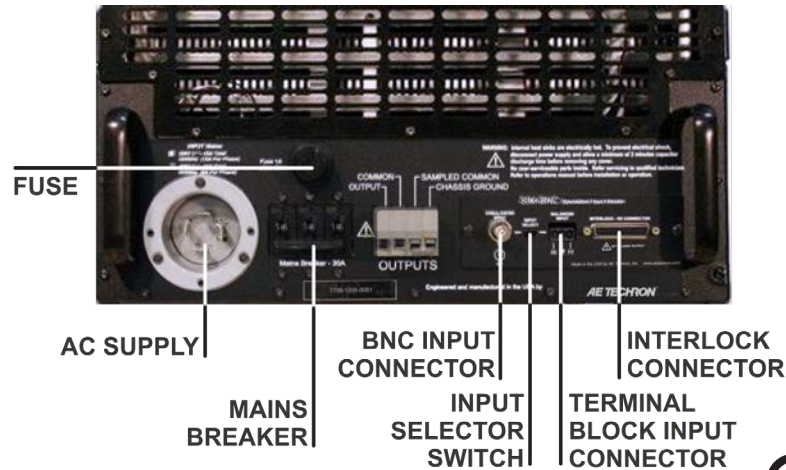
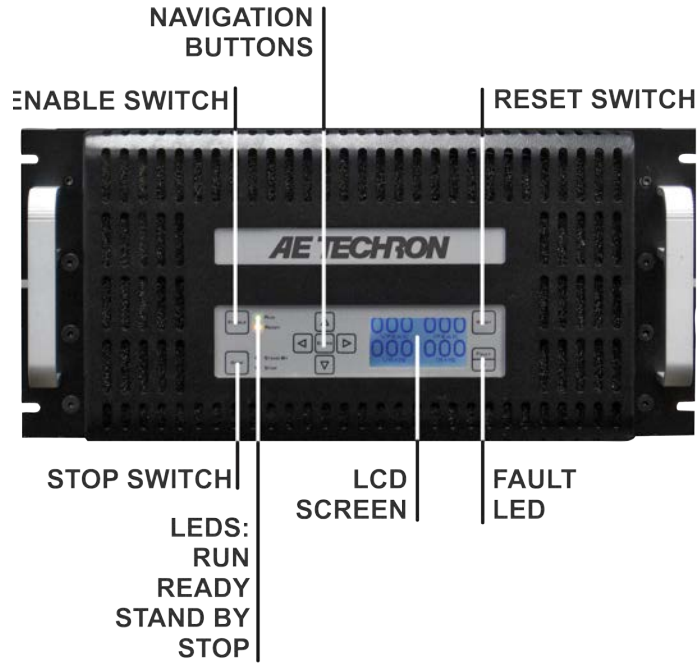
\*All loads from 8-ohm to short are stable with 2 mH in series.

## Accuracy

Amplitude vs. Frequency at 1V input, 20A output, amplifier transconductance set to 20			
Load	Input Signal	Transconductance	
		1 kHz	100 Hz
2 ohms	Sine	19.9	20
1 ohm	Sine	20	20
½ ohm	Sine	20	20
Short (unimpeded wire)	Sine	20	20

## Pulse/Burst Specifications

Load	Duration	Waveform	Output Power
0.5 ohms	20 seconds	60 Hz Sine	57 Arms / 80.6 Apeak
		DC	25 Apeak
	0.5 second	60 Hz Sine	66 Arms / 93 Apeak
		DC	70 Apeak
	0.2 second	60 Hz Sine	66 Arms / 93 Apeak
		DC	70 Apeak



**CE** 400V versions of this product bear the CE mark

*AE Techron Sales Representative*



## 7796RLY

### Four Quadrant Power Amplifier for Protection Relay Production Testing and Commissioning

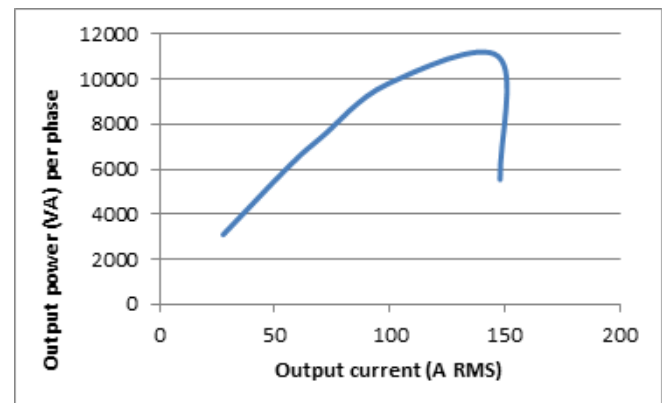
#### Performance Overview:

Maximum Current Output (0.5Ω):	200 Ap (141 A <sub>RMS</sub> )
Maximum Output Voltage:	183 Vp
Controlled-Current Bandwidth (0.25Ω load):	DC - 10 kHz
Standard Transconductance (from short to 1Ω load):	20 ±0.2%
Unit to Unit Phase Error (60 Hz):	±0.1°
Residual Noise (40 Hz - 600 Hz):	<2.5 mAp
THD+Noise (600 Hz at full output power):	<0.10%

AE Techron's **7796RLY** amplifier was created to meet the demanding requirements of the power utility industry. With an output capability of 200 Ap, the 7796RLY is powerful enough to put protection relays, fuses and other critical components through a full range of tests. It is capable of a controlled voltage bandwidth of DC - 100 kHz, and a controlled current bandwidth of DC - 10 kHz. The low noise floor, low distortion and minimal phase error of the 7796RLY make it the ideal amplifier for power grid modeling.

#### Features

- High compliance voltage allows the 7796RLY to drive electromechanical relays directly.
- Maintains phase accuracy for any load from a dead short to 0.25 ohms.
- Front panel indicators for rapid assessment of amplifier status.
- Installs in a standard 19-inch rack; or stands alone for bench-top operation.
- Shipped ready to operate from three-phase, 208VAC (±10%), 47-60 Hz, 30A service. 400VAC (±5%) 15A model available on request.
- Protection circuitry protects from input overloads, improper output connection (including shorted and improper loads), over-temperature, over-current, and supply voltages that are too high or low.
- Backed by AE Techron's comprehensive, 3-year, no-fault warranty.



#### Specifications

##### Performance

Controlled-Current Bandwidth (0.25-ohm load): DC - 10 kHz  
Maximum Output Current (0.19-ohm load): 141 A<sub>RMS</sub> (200 Ap)  
Maximum Output Voltage: 183 Vp  
Maximum Output Power: Dependent on load and frequency

**Load Constraint for Maximum Output:**  $0.19\Omega + 200 \text{ mH}$   
**Output Offset Current:** Less than 10.0 mA DC peak  
**Standard Transconductance (from short to 1-ohm load):** 20  $\pm 0.2\%$   
**Unit to Unit Phase Error (60 Hz):**  $\pm 0.1$  degrees  
**Residual Noise (40 Hz to 600 Hz):** Less than 2.5 mAp  
**THD+Noise (600 Hz at full output power):** Less than 0.10%

**Input Characteristics, Input Characteristics**

**Balanced with ground:** Three terminal barrier-block connector, 20 k $\Omega$  differential  
**Unbalanced:** BNC connector, 10 k $\Omega$  single-ended  
**Max Input Voltage:**  $\pm 10\text{V}$ , balanced or unbalanced  
**Common Mode Rejection Ratio (40 Hz - 600 Hz):** -58 dB minimum

**Status Display, Control, I/O**

**Front Panel LED Displays indicate:** Ready, Standby, Fault  
**Soft Touch Switches for:** Run, Stop, Reset  
**LCD Display:** Can be configured for up to four simultaneous displays reporting one, two, or all four of the following:  $V_p$ ,  $V_{RMS}$ ,  $A_p$ ,  $A_{RMS}$ . Also reports any fault conditions that occur and suggests corrective action.  
**Back Panel Power Connection:** NEMA-style locking receptacle; matching AC connector also included  
**Signal Output:** 4-position terminal barrier block (OUTPUT / COMMON / SAMPLED COMMON / CHASSIS GROUND); resistor installed between SAMPLED COMMON AND CHASSIS GROUND is a 2.7-ohm, 2W, 5%, metal-oxide resistor  
**Signal Input:** User-selectable BNC or Barrier Strip, Balanced or Unbalanced  
**Interlock Connector:** 25-pin D-sub connector used for amplifier control and status applications; also used in multi-amplifier applications

### Communication Capabilities

**Current Monitor:** 20A/V  $\pm 1\%$ ; 10A/V  $\pm 1\%$  (differential configuration)  
**Reporting:** System Fault, Over Temp, Over Voltage, Over Load  
**Remote Control via Interlock Connector:** Force to Standby, Reset after a Fault

### Protection

**Over/Under Voltage:**  $\pm 10\%$  ( $\pm 5\%$  for 400VAC version) 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

### Physical Characteristics

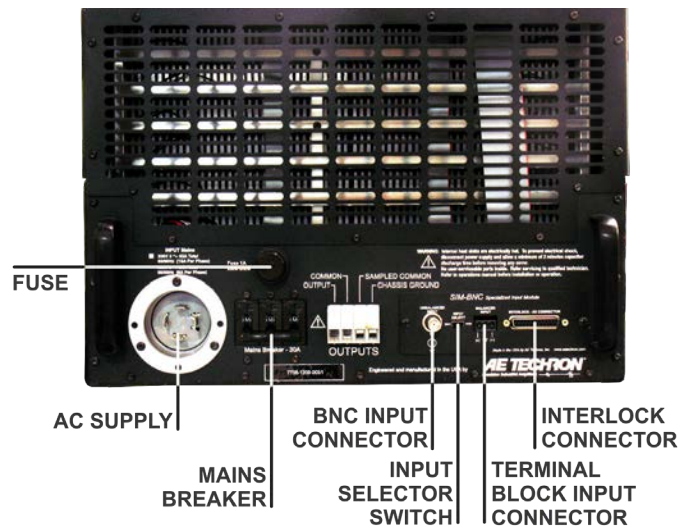
**Chassis:** The amplifier is designed for stand-alone or rack-mounted operation. The chassis is aluminum with a black powder-coat finish. The unit occupies seven EIA 19-inch-wide units.  
**Weight:** 160 lbs (72.5 kg), Shipping 175 lbs (79.4kg)  
**AC Power:** Three-phase, 208VAC ( $\pm 10\%$ ), 47-60 Hz, 30A AC service; (400VAC ( $\pm 10\%$ ), 15A model available)  
**Operating Temperature:** 10°C to 50°C (50°F to 122°F), maximum output power de-rated above 30°C (86°F).  
**Humidity:** 70% or less, non-condensing  
**Cooling:** Forced air cooling from front to back through removable filters via six 100ft<sup>3</sup>/min. 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.  
**Dimensions (HxWxD):** 12.25" x 19" x 22.8" (31.1 cm x 48.3 cm x 57.9 cm)

### Accuracy

Amplitude vs. Frequency at 1V input, 20A output, amplifier transconductance set to 20			
Load	Input Signal	Transconductance	
		1 kHz	100 Hz
2 ohms	Sine	19.9	20
1 ohm	Sine	20	20
½ ohm	Sine	20	20
Short (unimpeded wire)	Sine	20	20

## Pulse/Burst Specifications

Load	Duration	Waveform	Output Power
0.19 ohm	1 minute	60 Hz Sine	125 Arms / 176 Apeak
		DC	60 Apeak
	0.5 second	60 Hz Sine	141 Arms / 200 Apeak
		DC	188 Apeak
	0.2 second	60 Hz Sine	141 Arms / 200 Apeak
		DC	188 Apeak
0.53 ohm	1 minute	60 Hz Sine	91 Arms / 128 Apeak
		DC	100 Apeak
	0.5 second	60 Hz Sine	137 Arms / 193 Apeak
		DC	181 Apeak
	0.2 second	60 Hz Sine	139 Arms / 196 Apeak
		DC	164 Apeak
1.07 ohm	1 minute	60 Hz Sine	75 Arms / 107 Apeak
		DC	66 Apeak
	0.5 second	60 Hz Sine	93 Arms / 118 Apeak
		DC	108 Apeak
	0.2 second	60 Hz Sine	85 Arms / 120 Apeak
		DC	108 Apeak



**CE** 400V versions of this product bear the CE mark

*AE Techron Sales Representative*