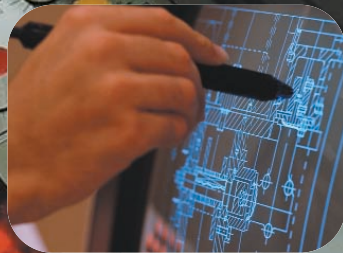


# POWER AMPLIFIER SOLUTIONS



**CONTROL WITHOUT COMPROMISE**

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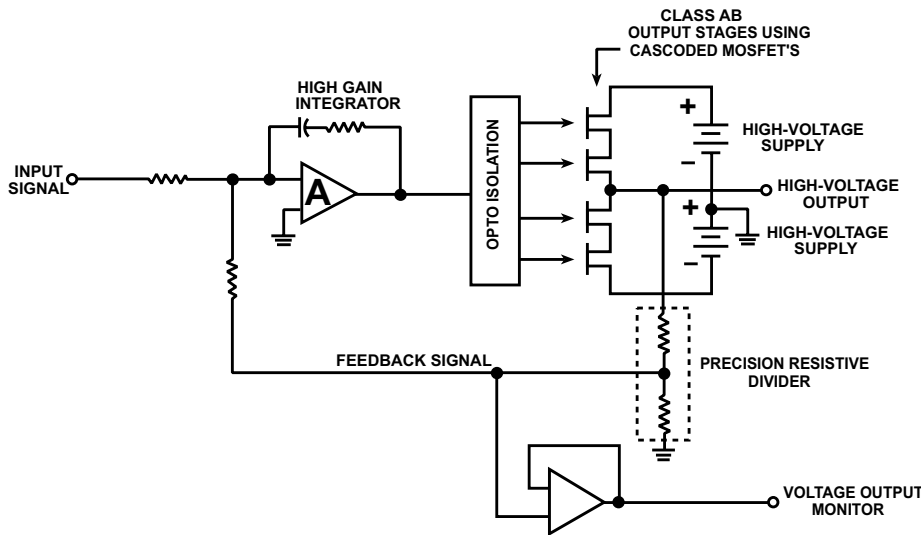
# The more demanding your high-voltage application, the more you should demand proven **TREK** performance and reliability.

In 1987, TREK, Inc., introduced the world's first all-solid-state, high-voltage linear power amplifier for medium current ion beam deflection applications. Since then, our world-class reputation has made us the high-voltage power amplifiers of choice for over 90% of the world's silicon wafer processing operations using medium-current ion beam implantation for precision ion beam sweeping and positioning. Little wonder that when failure was not an option, a TREK amplifier was chosen to fly on the Space Shuttle in 1996 to provide precise electrostatic fields for microgravity bubble drop experiments.

TREK high-voltage power amplifiers employ unique, proprietary circuitry to produce a closed-loop amplifier system, delivering exceptional DC stability and excellent wideband performance.

## *TREK advantages put you in greater control*

- Innovative designs using premium components deliver the truest amplified reproduction of the applied signal
- DC-stable operation with precision HV divider circuitry
- Extremely high slew rates permit rapid rise and fall times
- Four-quadrant operation to sink and source current anywhere within the output voltage range
- Effective management of power dissipation and energy from active loads
- Dynamic response of the active output stage makes TREK amplifiers a better choice than power supplies in many applications
- Advanced opto isolation circuitry for high linearity



*As the stability of the closed-loop amplifier system is dependent upon the feedback voltage divider stability over time, temperature and humidity, TREK employs an advanced thin film resistance technology in its feedback dividers. The signal from the feedback divider, being a precision divided representation of the amplifier output signal, is used to provide a low-level voltage monitor signal and to complete the feedback loop by comparing the divider output against the amplifier input signal in a high-gain integrating stage (A). The output of the integrating stage is used to drive optical couplers connected to the output stage cascode connected MOS device arrays, thus closing the feedback loop. To generate the high-voltage required by the output stages, high-voltage, high-frequency switching type power supplies are typically used.*



**Whether you're doing electrostatic force levitation, damping or piezoelectric positioning, you can settle for nothing less than total accuracy. Which is why you should settle for nothing less than TREK.**

**We're a recognized leader in both high-voltage and EOS/ESD solutions, certified to ISO 9001 international quality assurance system standards.**

**Our unsurpassed reputation for product innovation and engineering excellence is fueled by our unshakable commitment to technology research in response to customer needs.**

**All of which means that there's one simple, easy, proven way to meet your ever-evolving, ever-more demanding, application-specific high-voltage needs.**



**Simply make TREK your best resource, your partner of choice, for proven-reliable high-voltage power amplification solutions.**

# Any way you group them, TREK amplifiers are in a category by themselves.



## high-voltage amplifiers below 5 kV

Model	Voltage Range	Current Range	Large Signal Bandwidth	Small Signal Bandwidth	Slew Rate
609E-6	0 to $\pm$ 4 kV	0 to $\pm$ 20 mA	0 to 6 kHz	0 to 35 kHz	150 V/ $\mu$ s
PZD2000	0 to $\pm$ 2 kV	0 to $\pm$ 400 mA	0 to 60 kHz	0 to 90 kHz	500 V/ $\mu$ s
623B	0 to $\pm$ 2 kV	0 to $\pm$ 40 mA	0 to 10 kHz	0 to 40 kHz	300 V/ $\mu$ s
PZD700-1	0 to $\pm$ 700 V	0 to $\pm$ 100 mA	0 to 15 kHz	0 to 50 kHz	150 V/ $\mu$ s
PZD700-2	0 to + 1.4 kV	0 to $\pm$ 50 mA	0 to 12 kHz	0 to 50 kHz	100 V/ $\mu$ s
PZD700 M/S*	0 to - 1.4 kV	0 to $\pm$ 50 mA	0 to 12 kHz	0 to 50 kHz	100 V/ $\mu$ s
601C-1	0 to $\pm$ 500 V	0 to $\pm$ 20 mA	0 to 8 kHz	0 to 30 kHz	50 V/ $\mu$ s
601C-2	0 to + 1 kV				
	0 to - 1 kV				
PZD350-1	0 to $\pm$ 350 V	0 to $\pm$ 200 mA	0 to 40 kHz	0 to 100 kHz	500 V/ $\mu$ s
PZD350-2	0 to + 700 V	0 to $\pm$ 100 mA	0 to 14 kHz	0 to 100 kHz	350 V/ $\mu$ s
PZD350 M/S*	0 to - 700 V	0 to $\pm$ 100 mA	0 to 14 kHz	0 to 100 kHz	350 V/ $\mu$ s
603-1	0 to $\pm$ 125 V	0 to $\pm$ 80 mA	0 to 150 kHz	N/A	100 V/ $\mu$ s
603-2	0 to + 250 V				
	0 to - 250 V				
P1131	0 to + 100 V	0 to $\pm$ 8 A peak	0 to 1 kHz	0 to 15 kHz	1 V/ $\mu$ s

Visit [www.trekinc.com](http://www.trekinc.com), or contact us directly for more information.

\* PZD700 M/S and PZD350 M/S deliver twice the output current of the standard PZD700 and PZD350 respectively.

## high-voltage amplifiers 5 kV and above

Model	Voltage Range	Current Range	Large Signal Bandwidth	Small Signal Bandwidth	Slew Rate
30/20	0 to $\pm$ 30 kV	0 to $\pm$ 20 mA	0 to 2.5 kHz	0 to 20 kHz	350 V/ $\mu$ s
P0621P	0 to + 30 kV	0 to $\pm$ 20 mA	0 to 3.5 kHz	0 to 25 kHz	350 V/ $\mu$ s
P0621N	0 to - 30 kV	0 to $\pm$ 20 mA	0 to 3.5 kHz	0 to 25 kHz	350 V/ $\mu$ s
20/20C	0 to $\pm$ 20 kV	0 to $\pm$ 20 mA	0 to 3.75 kHz	0 to 20 kHz	350 V/ $\mu$ s
10/40A	0 to $\pm$ 10 kV	0 to $\pm$ 40 mA	0 to 7.5 kHz	0 to 25 kHz	700 V/ $\mu$ s
10/10B	0 to $\pm$ 10 kV	0 to $\pm$ 10 mA	0 to 4 kHz	0 to 20 kHz	250 V/ $\mu$ s
5/80	0 to $\pm$ 5 kV	0 to $\pm$ 80 mA	0 to 50 kHz	0 to 75 kHz	1000 V/ $\mu$ s

# Only a company obsessed with absolute control could create a piezo amplifier line so flexible, so precise.

## High-Voltage Amplifiers for Piezoelectric Actuation/Driving Applications



TREK's complete line of High- and Medium-Voltage Piezoelectric Actuation/Driving Amplifiers, providing up to 1 kilowatt power capability, with energy absorption, are all designed to provide the precise output voltage control you demand, whatever your application may be:

- High output power capability using 4 quadrant (class AB output stages)
- Fast rise/fall times into capacitive loads, very fast settling time
- High overstress handling capability
- High transient response with high bandwidth and fast settling time

### So many choices for total precision in:

- Microfluidics
- Piezoelectric Driving/Control & Vibration Damping
- Laser Modulation
- Semiconductor Research
- MEMS

### There's sure to be a TREK piezo amplifier model right for you

5/80	PZD2000	PZD700 Series	PZD350 Series	601C Series	603 Series	623B	609E-6	P1131
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For specifications, refer to charts on page 4.

# Make TREK high-voltage amplifiers the constant in your research.

## High-Voltage Amplifiers for Research Applications

The basic specifications for all TREK High-Voltage Amplifiers make any amplifier in the line an ideal choice for general purpose applications in laboratory or production environments where the application calls for high-voltage DC or AC signals. TREK standard specifications include:

- High speed, high accuracy, with exceptional stability and very fast settling time
- Bandwidths— 0 to 25 kHz nominal up to 150 kHz available
- Slew rates from 500 V/ $\mu$ s up to 1000 V/ $\mu$ s
- Internal power limiting for internal power protection
- Low output noise— to less than 10 mV RMS
- Bipolar or unipolar voltage ranges

### The perfect choice for any research need:

- Piezoelectric/Nonlinear Optic Material Poling
- Electrorheological Fluids
- Electroactive Polymers
- Plasma Chemistry
- Electrophoresis
- Dielectric Studies
- Electrooptic Modulation
- Partial Discharge
- Electrostatic Levitation
- Electrohydrodynamics
- Gyrotron

# You'll find the total reliability you demand across the spectrum of your mass spectroscopy solutions.

## High-Voltage Amplifiers for Mass Spectroscopy Applications

TREK High-Voltage Electrostatic Deflection Amplifiers are designed to deliver high reliability in the grueling continuous operation conditions today's mass spectroscopy applications demand, delivering:

- High programming speed with flat response into capacitive loading
- High stability over time, temperature
- Very high DC accuracy, very fast settling time
- Low output noise



### The ultra-reliable choice for:

- Electrostatic Deflection
- Accelerator Mass Spectrometer

### Models to choose for mass spectroscopy applications

30/20	20/20C	10/10B	10/40A	5/80	601C
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For specifications, refer to charts on page 4.

## For a world of reasons, we're the world's high-voltage choice for beam sweeping applications.

### High-Voltage Power Amplifiers for Beam Sweeping Applications

There's a reason that, today, over 90% of the world's medium current ion-implantation beam sweeping amplifier applications are implemented using TREK High-Voltage Electrostatic Beam Scanning Amplifiers. Because they are designed specifically for the high reliability continuous beam sweeping applications demand. Just a few of the reasons TREK amplifiers should be your only beam sweeping choice:

- Wide bandwidth at highly capacitive loading
- High linearity over entire output voltage range
- Low output noise
- Quick speed of response, very fast settling time
- Very accurate voltage and current monitoring

## Superior performance has made TREK high-voltage amplifiers a world industrial powerhouse.

### High-Voltage Amplifiers for Industrial Applications

No matter how demanding your industrial process, TREK High-Voltage Amplifiers are more than equal to the challenge, delivering highest reliability, even in the toughest of production environments. The key benefits that make them an excellent choice for your industrial need are:

- High programming speed with flat response into capacitive loading
- Very high DC accuracy
- Very fast settling time
- Low output noise
- High stability over time, temperature

## When it comes to controlling AC/DC current for all your electrophotographic applications, TREK performance can't be copied.

### High-Voltage Electrophotographic Amplifiers/ High-Voltage Function Generators/Reference Supplies

TREK High-Voltage Function Generators combine the performance of TREK High-Voltage Amplifiers with a low voltage function generator to create a high-voltage function generator in one simple convenient package. For added versatility, they offer a switch-selectable generator/amplifier mode to allow external signal input to override the generator function. General specifications include:

- Square, triangle, sine outputs with/without DC bias
- Frequency ranges up to 35 kHz
- High accuracy outputs
- High speed, highly accurate AC/DC current control
- Very fast settling time
- Low noise



#### The unquestioned leader for:

- Electrostatic Deflection
- Electrostatic Focusing

#### Models ideal for beam sweeping applications

30/20	20/20C	10/40A	10/10B	P0621P/N
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For specifications, refer to lower chart on page 4.



#### The ultra-reliable choice for:

- Electrostatic Abrasive Coating
- Corona Charging/Discharging
- Electrostatic Flocking
- Electrostatic Precipitator
- Ion Source Supplies

#### Models to choose for industrial process applications

30/20	20/20C	10/40A	10/10B	PZD2000
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For specifications, refer to chart on page 4.



#### The super fast, super accurate choice for AC/DC current control for:

- Corona Supplies
- Scoratron Grid Supplies
- Charge Roller Applications

Model	Voltage Range	Current Range	Frequency Range	Features
610E	0 to $\pm 10$ kV	0 to $\pm 200$ $\mu$ A 0 to $\pm 2000$ $\mu$ A	0 to 10 kHz	Transconductance amplifier/controller
615 Series	0 to $\pm 5$ kV	0 to $\pm 8$ mA	100 Hz to 10 kHz square, triangle & sine	Electrophotographic charge roller applications (R&D, production)
10/10B-FG	0 to $\pm 10$ kV	0 to $\pm 10$ mA	0.2 Hz to 10 kHz square, triangle & sine	Amplifier/signal generator
609E-6-FG	0 to $\pm 4$ kV	0 to $\pm 20$ mA	0.2 Hz to 10 kHz square, triangle & sine	Differential amplifier/signal generator
668B	0 to $\pm 3$ kV	0 to $\pm 5$ mA	N/A	Accuracy better than 0.015% of full scale
677B	0 to $\pm 2$ kV	0 to $\pm 5$ mA	0 to 5 kHz	Precise control of output voltage





## **There's a TREK amplifier for you, even if we have to build it from scratch.**

Whatever your application, settle for nothing less than the total accuracy and control only TREK high-voltage solutions deliver.

With so many powerful options, there's sure to be a cost-effective, precision TREK solution right for you. And if there isn't, simply give us your specifications and we'll custom design one just for your unique application.

TREK's engineering staff have designed many custom power amplifiers with various voltage and current ranges to custom fit the TREK solution to a wide variety of unique application requirements:

- High-voltage transconductance operation
- Precision output current monitoring to 0.1% of full scale current
- Precision output voltage monitoring to 0.02% of full scale voltage
- Output current profiling (current vs time) to provide ultra-fast slew rates
- Ultra-low noise output to less than 0.005% of full scale output
- Power dissipation monitoring and control
- Traceable reference quality high-voltage outputs from input reference sources
- Output high-voltage stage paralleling for increased current capability
- AC/DC high-voltage amplifiers for ionization generation and control
- AC/DC high-voltage amplifiers for electro static silicon wafer clamping systems
- AC/DC high-voltage amplifiers for electrophotographic charger roller control

## There's nothing like TREK laboratory-grade electrostatic voltmeters, either.

*Patented TREK technology makes us the only choice for accurate, noncontacting surface potential measurement.*

Because TREK Electrostatic Voltmeters deliver DC-stable voltage measurement without having to touch the test surface, it's possible to measure any surface, even moving surfaces, with no charge transfer from the surface. This translates to no modification of the measured voltage.

*Patented TREK technology makes us the only choice for accuracy over a wide range of probe-to-surface distances.*

TREK's patented probe delivers a large signal output that reduces noise and instability. Because the sensing electrode is located on a vibrating reed, it is in motion in the aperture, close to the surface for maximum possible sensitivity.

*Patented TREK technology makes us the only choice for accuracy/DC stability with varying probe-to-surface spacing.*

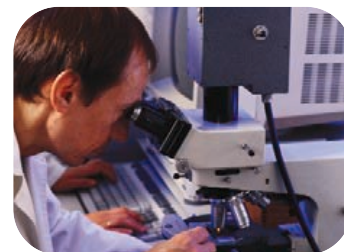
TREK's field-nulling technique for noncontacting measurement enables you to measure both stationary and moving surfaces with total accuracy without having to establish a fixed spacing. This also minimizes potential problems with arcing between the probe and test surface, even at very tight spacing.

*Patented TREK technology makes us the only choice for accuracy in high-contamination, high-humidity situations.*

TREK's patented probe design means close-tolerance components aren't needed. Noise and drift performance are significantly improved, even with contaminating particulates, high humidity and wide temperature ranges.

## TREK EOS/ESD solutions put you in total control.

Innovative, rock solid TREK technology delivers the information you need to make your invisible EOS/ESD problem visible. So you can make it go away. With total confidence for a change.



## The quality of TREK products is only exceeded by the quality of our service.

*Exceeding expectations around the world.*

Our extensive network of product service and application support personnel worldwide, all committed to delivering nothing less than first-class service, ensures that prompt, courteous help is always just a phone call away.

*Ready with answers for your toughest challenges.*

With application experience in a wide variety of industries and research fields, TREK Application Engineers are devoted to helping you solve your most challenging application questions. Before and after the sale.

**Represented by:**

Due to our continuous product quality improvement and customer satisfaction programs, TREK, Inc. reserves the right to change specifications listed in this brochure without notice.

CE compliant for most products



## CONTROL WITHOUT COMPROMISE

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