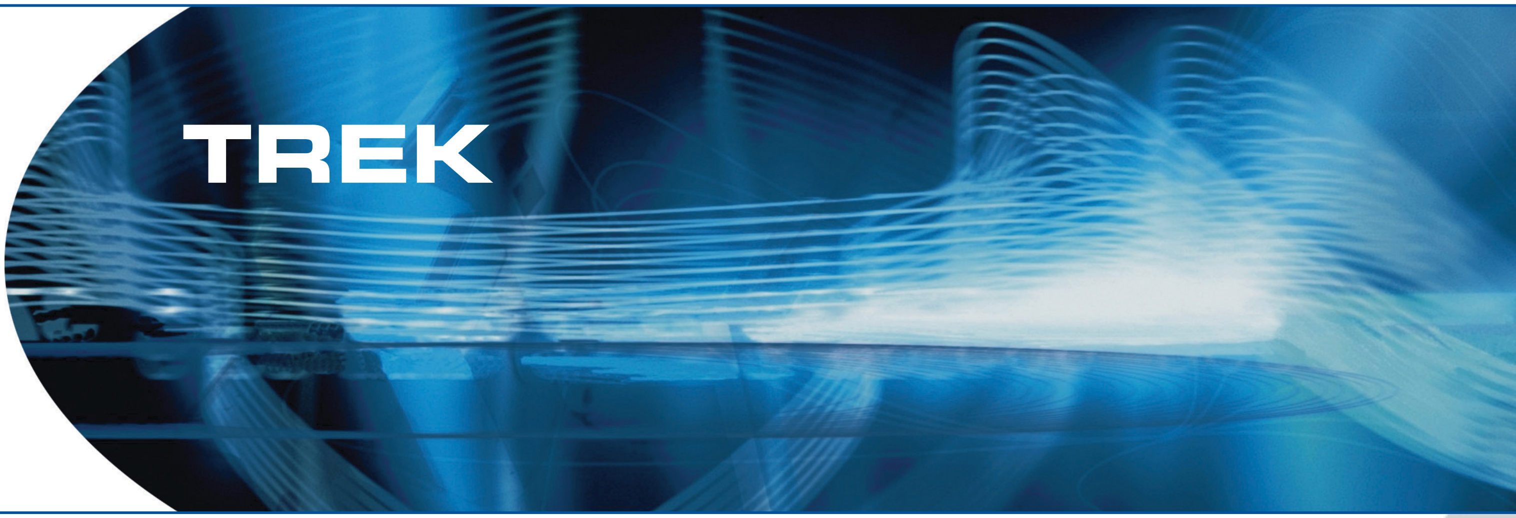
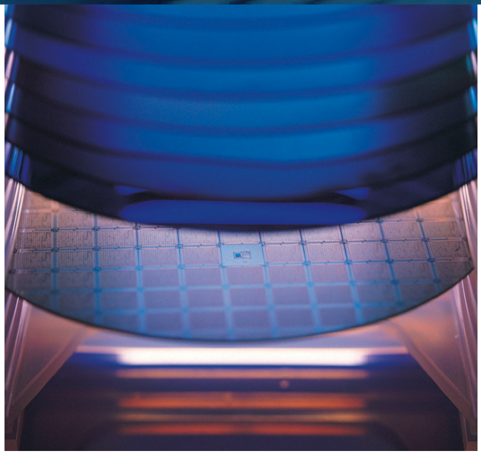


Measurement and Power Solutions™

Products and Systems Catalog

An Advanced Energy Company



For over 50 years, TREK, INC. has been providing innovative electrostatic measurement and high-voltage amplifier/supply solutions to customers worldwide. Trek's superior engineering design capability allows us to provide high quality, cost-effective products and services to meet market needs and customer-specific applications. Our proprietary technology and technical expertise, coupled with our long-term relationships, set us apart from our competitors and make us the leader in the markets we serve. Trek's commitment to develop new technologies will enable us to continue to provide current and future customers with innovative solutions.

TABLE OF CONTENTS

In early 2018 Advanced Energy Industries, Inc. acquired Trek. Later in 2018, AE acquired Monroe Electronics' Electrostatic and ESD product line and relocated production and sales to AE's Trek facilities in Lockport, NY.

www.trekinc.com • www.trekinc.com/monroe/ • www.advancedenergy.com

APPLICATIONS

CUSTOM OEM

Trek works closely with OEMs to expedite the transition of concepts into designs which are then commercialized into manufactured products to meet the OEM's performance requirements. Trek products are utilized in multi-million dollar equipment to assure precise performance is attained regularly and reliably. Our OEM relationships extend to decades, not just months or years, assuring continuity and constancy. Please contact us for assistance with your next project and experience the excellence which only Trek can provide.

ELECTROSTATIC IMAGING

Trek's products are used in various stages of electrostatic image-forming processes in connection with laser printers, copiers and many other printing devices. We also provide products for precise charge-to-mass ratio measurements of toner or other particulates.

ENVIRONMENTAL

Trek's products are being utilized to study the effects of plasma on emissions and exhaust with the potential of effecting a significant reduction in noxious components.

GOVERNMENT / MILITARY

Trek supplies products which are utilized in government programs and projects, in research at the national laboratories, and to subcontractors involved in government contracts. Trek is ITAR certified.

INDUSTRY / ACADEMIA R&D

Researchers around the world depend on Trek's products to help them in their scientific endeavors. This research is typically done within the field of physics but additional disciplines include engineering, biology, chemistry and many others.

MATERIALS SCIENCE

Evaluation of materials and surfaces is critical to the effective implementation of technology in many industries. Trek's products assist in studies of dielectrics, electroactive polymers, electrostatic coatings, insulators/conductors, pyroelectrics, and smart materials.

PHOTOVOLTAIC / SOLAR

Trek's electrostatic measurement products assist with management of processes where charge levels must be monitored. Other Trek products enable electrostatic handling and chucking of materials (i.e. glass) which may be preferred to avoid problems related to mechanical handling.

PIEZOELECTRONICS

High voltage amplifiers from Trek are used to drive piezoelectric elements and for poling of piezoelectric materials in connection with positioning, active vibration dampening, and micro-applications including MEMs.

SEMICONDUCTOR

Trek's amplifiers enable precise control in ion beam and electron beam deflection/steering processes in semiconductor wafer processing. Trek also provides electrostatic chuck (ESC) supplies which deliver improvements in wafer handling efficiency through waveform versatility. Other products measure surface potential of the wafers.

SPACE / AVIATION

Trek has supplied products which were included in the payload on space shuttle missions to enable performance of zero gravity scientific experiments. Material charging evaluations are enabled by Trek products in connection with space radiation studies.

AMPLIFIERS

THEORY OF OPERATION - TREK'S HIGH-VOLTAGE POWER AMPLIFIERS

Trek high-voltage power amplifiers employ unique and proprietary circuitry to produce a closed-loop amplifier system which features exceptional DC stability and excellent wideband performance characteristics.

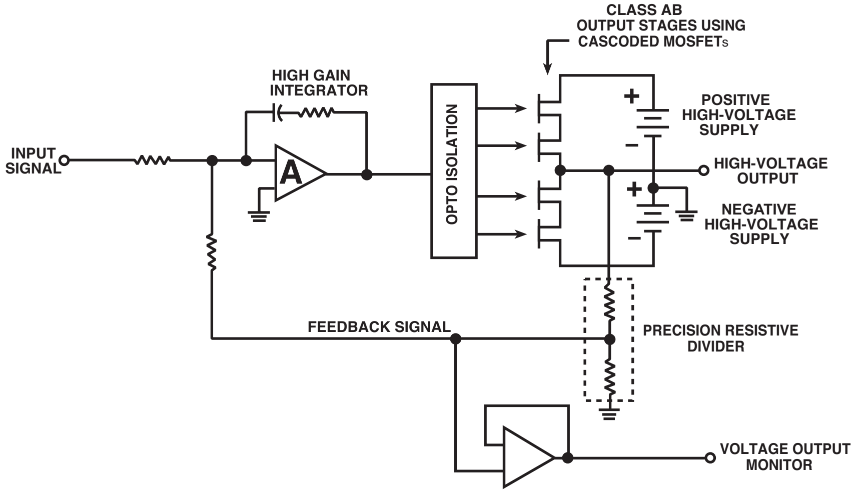
Featuring all-solid-state construction, Trek amplifiers are fully protected against arc-over and operation into short circuits. Please refer to the simplified block diagram. Trek power amplifiers employ a unique four-quadrant class AB high-voltage output stage which is constructed using MOS power transistor devices in a proprietary multidevice cascode connection. This cascode connection provides tight voltage and power sharing across all devices in the cascode array to yield exceptional MTBF reliability performance.

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.

Typical capabilities of Trek's DC high-voltage power amplifiers include:

- Voltage ranges to 120 kV peak-to-peak
- Current ranges to ±25 A
- Small signal bandwidth to 2.6 MHz
- Slew rates to 2000 V/μs
- Gain stability to ±10 ppm/°C
- Full 4-quadrant, class AB, all-solid-state output stages
- Short circuit protection
- Noise less than 0.005% of full scale
- All-solid-state for high reliability, low maintenance
- Transconductance mode to precisely control output current

HV Power Amplifiers Theory of Operation



In applications which involve driving capacitive loads, the useful bandwidth of the amplifier is often limited by the peak output current capability of the amplifier rather than the amplifier's AC gain bandwidth characteristics.

Engineers at Trek have designed many amplifiers with various voltage and current levels which can be used to drive capacitive loads. The tables on pages 4-7 list many of the Trek amplifiers with their voltage and current ranges. To determine which Trek model amplifier is most suitable for your application:

- Substitute the peak-to-peak voltage ($V_{peak\text{-}to\text{-}peak}$) in Volts that will be applied to your load into the appropriate equation for driving capacitive loads with sine, triangle or square waves (see below).
- Use the tables on pages 4-7 to make an initial selection of a Trek amplifier with the appropriate voltage characteristics. Substitute the internal capacitance value in Farads of the selected Trek amplifier* into the appropriate variable (C_{int}) of the equation.
- Substitute the capacitive value in Farads of your load (C_{load}) into the equation.
- Substitute the desired frequency (f) in Hertz or square wave slope (dV/dt) of the output waveform into the equation.
- Solve for the peak current (I_{peak}) in Amps needed from the amplifier.

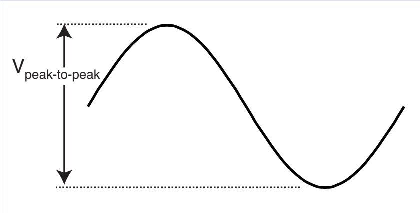
Note: If the calculated peak current is equal to or less than the peak current range of the amplifier, the Trek amplifier will not be bandwidth limited due to output current limitations. For example, if the calculated peak current is equal to or less than 20 mA, the Model 20/20C will not be bandwidth limited due to output current limitations.

Please refer to the following diagrams and formulas for assistance, or contact Trek for technical guidance.

Driving Capacitive Loads with Sine Waves

$I_{peak} = (C_{load} + C_{int}) \cdot \pi \cdot f \cdot V_{peak\text{-}to\text{-}peak}$

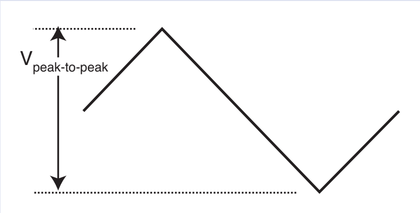
where: I_{peak} = the peak current needed from the amplifier
C_{load} = the load capacitance (including cable capacitance)
C_{int} = the internal output capacitance of the amplifier*
f = the output frequency
$V_{peak\text{-}to\text{-}peak}$ = the peak-to-peak voltage applied to the capacitive load



Driving Capacitive Loads with Triangle Waves

$I_{peak} = (C_{load} + C_{int}) \cdot 2 \cdot f \cdot V_{peak\text{-}to\text{-}peak}$

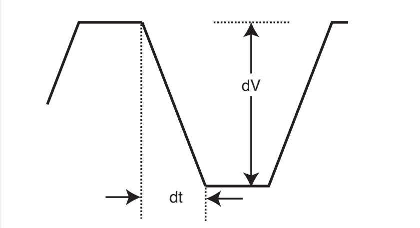
where: I_{peak} = the peak current needed from the amplifier
C_{load} = the load capacitance (including cable capacitance)
C_{int} = the internal output capacitance of the amplifier*
f = the output frequency
$V_{peak\text{-}to\text{-}peak}$ = the peak-to-peak voltage applied to the capacitive load



Driving Capacitive Loads with Square Waves

$I_{peak} = (C_{load} + C_{int}) \cdot dV/dt$

where: I_{peak} = the peak current needed from the amplifier
C_{load} = the load capacitance (including cable capacitance)
C_{int} = the internal output capacitance of the amplifier*
dV = the peak value of the square wave
dt = the rise time required
dV/dt = the slope of the rise/fall time



*Trek amplifiers represent a broad range of internal capacitance values as demonstrated by a sampling of Trek's models at right. Please contact Trek for the internal capacitance value of an amplifier that interests you, if it is not listed here.

Trek Model	C_{int} (pF)
30/20A	50
10/10B-HS	55
20/20C	60
5/80	70
601C	400

HIGH-VOLTAGE POWER AMPLIFIERS
POWER SUPPLIES
HV FUNCTION GENERATORS
TRANSCONDUCTANCE AMPLIFIERS















Amplifier Model*	Output Voltage Range (DC or peak AC)	Output Current (DC or peak AC)	Slew Rate (greater than)
50/12	0 to ±50 kV	0 to ±12 mA	350 V/μs
40/15^	0 to ±40 kV	0 to ±15 mA	350 V/μs
30/20A^	0 to ±30 kV	0 to ±20 mA	750 V/μs
P0621P or N	P: 0 to +30 kV; N: 0 to -30 kV	0 to ±20 mA	350 V/μs
20/20C-HS	0 to ±20 kV	0 to ±20 mA DC ±60 mA peak for 1 ms	800 V/μs
20/20C		0 to ±20 mA	450 V/μs
PD07016	0 to ±10 kV	0 to ±60 mA DC ±300 mA peak AC for 20 μs	1000 V/μs
10/40A-HS	0 to ±10 kV	0 to ±40 mA DC ±120 mA peak for 1 ms	900 V/μs
10/40A		0 to ±40 mA	750 V/μs
10/10B-HS	0 to ±10 kV	0 to ±10 mA DC ±40 mA peak AC for 1 ms	700 V/μs
609B-3	0 to ±10 kV	0 to ±2 mA	30 V/μs
610E	0 to ±1 kV or 0 to ±10 kV	0 to ±200 μA or 0 to ±2000 μA	20 V/μs
PD05034	0 to ±7.5 kV	0 to ±50 mA DC ±160 mA peak AC for 60 μs	1000 V/μs
615-10	0 to 20 kV peak-to-peak AC 0 to ±10 kV DC bias	0 to ±10 mA DC 0 to ±35 mA peak AC	500 V/μs
615-3	0 to 10 kV peak-to-peak AC 0 to ±5 kV DC bias	0 to 5 mA average AC	80 V/μs
5/80	0 to ±5 kV	0 to ±80 mA	1000 V/μs
609E-6	0 to ±4 kV	0 to ±20 mA	150 V/μs
623B	0 to ±2 kV	0 to ±40 mA	300 V/μs
677B	0 to ±2 kV	0 to ±5 mA	15 V/μs

^ *Also available as unipolar unit*

**Please see page 6-7 for additional amplifiers*

Most models have all of the following controls and adjustments: Remote High-Voltage ON/OFF Control, Dynamic Adjustments for Waveforms, Current Limit/Trip Options, Output Voltage and Current Monitors

Large Signal Bandwidth (DC to greater than)	Small Signal Bandwidth (DC to greater than)	Special Features	Typical Applications
1.4 kHz (2% distortion)	20 kHz (-3 dB)	Precise high-voltage control with DC offset	Dielectric studies, electrostatic deflection
1.4 kHz (2% distortion)	20 kHz (-3 dB)	Precise high-voltage control with DC offset	Dielectric studies, electrostatic deflection
5 kHz (2% distortion)	30 kHz (-3 dB)	Precise high-voltage control	Electrostatic deflection
3.5 kHz (1% distortion)	25 kHz (-3 dB)	Positive / negative unipolar voltage control	Positive: electrostatic deflection Negative: poling of materials
5.2 kHz (1% distortion)	20 kHz (-3 dB)	High peak current, improved bandwidth and slew rate	Atmospheric plasma, electrostatic deflection
7.5 kHz (-3 dB) 3.75 kHz (1% distortion)		Precise high-voltage control, adjustable current limit or current trip	Dielectric studies, electrostatic deflection, ferroelectrics
7.5 kHz (2% distortion)	20 kHz (-3 dB)	Precise high-voltage control	Electrostatic deflection, electroactive polymers
23 kHz (-3 dB) 9 kHz (1% distortion)	25 kHz (-3 dB)	High peak current, improved bandwidth and slew rate	Dielectric barrier discharge, mass spectrometers, particle accelerators
23 kHz (-3 dB) 7.5 kHz (1% distortion)		Precise high-voltage control, adjustable current limit or current trip	Electrophoresis, electrostatic deflection
19.5 kHz (-3 dB) 9.5 kHz (1% distortion)	60 kHz (-3 dB)	Adjustable current limit or current trip, slew rate, high speed, improved bandwidth	Precision voltage and current monitors
400 Hz (1% distortion)	10 kHz (-3 dB)	Inverting, noninverting & differential input configurations, low noise	Ferroelectric characterization
1.2 kHz (-3 dB) 600 Hz (1% distortion)	10 kHz (-3 dB)	Amplifier, DC supply & transconductance controller	R&D, electrophotography
15 kHz (1% distortion)	75 kHz (-3 dB)	High current, slew rate, speed	Piezoelectric driving, dielectric studies
7.5 kHz (2% distortion)	20 kHz (-3 dB)	Four-quadrant high-voltage stage design, sine, square or triangle wave output	Waveform generation
5 kHz (-3 dB) 3 kHz (1% distortion)	10 kHz (-3 dB)	Amplifier, DC supply & waveform generator	R&D, electrophotography, charger roller supply
60 kHz (-3 dB) 50 kHz (1% distortion)	75 kHz (-3 dB)	Precise high-voltage control with high current	Polymer & ceramic corona charging, plasma chemistry
13 kHz (-3 dB) 6 kHz (1% distortion)	35 kHz (-3 dB)	Inverting, noninverting & differential input configurations	AC and DC biasing, electrorheological fluids
10 kHz (1% distortion)	40 kHz (-3 dB)	Inverting, noninverting & differential input configurations, low noise	Precise voltage control
1.2 kHz (1% distortion)	5 kHz (-3 dB)	Amplifier & power supply, digital display	Piezoelectric driving, electrophoresis fluids

AMPLIFIERS

HIGH-VOLTAGE POWER AMPLIFIERS
POWER SUPPLIES
HV FUNCTION GENERATORS
TRANSCONDUCTANCE AMPLIFIERS

PIEZO DRIVERS

	Amplifier Model*	Output Voltage Range (DC or peak AC)	Output Current (DC or peak AC)	Slew Rate (greater than)
	PZD2000A	0 to ±2 kV	0 to ±200 mA DC, ±400 mA peak AC for 2ms	750 V/μs
	2220	0 to ±2 kV	0 to ±10 mA DC, ±20 mA peak AC for 5ms	100 V/μs
	2210	0 to ±1 kV	0 to ±20 mA DC, ±40 mA peak AC for 5ms	150 V/μs
	PZD700A, -1 and -2	0 to ±700 V (bipolar) 0 to +1.4 kV or 0 to -1.4 kV (unipolar)	0 to ±100 mA (bipolar) 0 to ±50 mA (unipolar)	380 V/μs (bipolar) 370 V/μs (unipolar)
	PZD700A M/S		0 to ±200 mA (bipolar) 0 to ±100 mA (unipolar)	
	2205	0 to ±500 V	0 to ±40 mA DC, ±80 mA peak AC for 5ms	150 V/μs
	601C -1 and -2	0 to ±500 V, 0 to +1 kV, 0 to -1 kV	0 to ±10 mA DC, ±20 mA peak AC	50 V/μs
	PZD350A -1 and -2	0 to ±350 V (bipolar) 0 to +700 V or 0 to -700 V (unipolar)	0 to ±200 mA (bipolar) 0 to ±100 mA (unipolar)	550 V/μs (bipolar) 440 V/μs (unipolar)
	PZD350A M/S		0 to ±400 mA (bipolar) 0 to ±200 mA (unipolar)	500 V/μs (bipolar) 400 V/μs (unipolar)
	2100HF	0 to ±150 V	0 to ±300 mA	2000 V/μs (typical)
	603 -1 and -2	0 to ±125 V or 0 to +250 V or 0 to -250 V	0 to ±40 mA DC, ±80 mA peak AC	100 V/μs

E-CHUCK SUPPLIES

	Amplifier Model*	Output Voltage Range (DC or peak AC)	Output Current (DC or peak AC)	Slew Rate (greater than)
	640	0 to ±2 kV	0 to ±5 mA	15 V/μs
	645	0 to ±2 kV DC	0 to ±6.5 mA DC, 10 mA peak	
	646	0 to ±3 kV DC	0 to ±6.5 mA DC, 10 mA peak	

REFERENCE & POWER SUPPLIES

	Amplifier Model*	Output Voltage Range (DC or peak AC)	Output Current (DC or peak AC)	Slew Rate (greater than)
	605A	0 to +1 kV or 0 to -1 kV DC	0 to ±1 mA DC	*Note: This unit is adjustable*
	668B	0 to +3 kV or 0 to -3 kV DC	0 to ±5 mA DC	*Note: This unit is adjustable*

*** Refer to datasheet for individual model specifications*

**Please see page 4-5 for additional amplifiers*

Most models have all of the following controls and adjustments: Remote High-Voltage ON/OFF Control, Dynamic Adjustments for Waveforms, Current Limit/Trip Options, Output Voltage and Current Monitors

Large Signal Bandwidth (DC to greater than)	Small Signal Bandwidth (DC to greater than)	Special Features	Typical Applications
60 kHz (3% distortion)	100 kHz (-3 dB)	High current	Dielectric material characterization
7.5 kHz (-3 dB)	50 kHz (-3 dB)	DC stability, wide bandwidth, full four-quadrant class AB all-solid-state output stages	Piezoelectric driving, electrophoresis research
40 kHz (-3 dB)	100 kHz (-3 dB)	DC stability, wide bandwidth, full four-quadrant class AB all-solid-state output stages	Piezoelectric driving
125 kHz (-3 dB) (bipolar) 120 kHz (-3 dB) (unipolar)	200 kHz (-3 dB)	High current	Semiconductor research, piezoelectric driving
150 kHz (-3 dB) (bipolar) 125 kHz (-3 dB) (unipolar)			
75 kHz (-3 dB)	100 kHz (-3 dB)	DC stability, wide bandwidth, full four-quadrant class AB all-solid-state output stages	Piezoelectric driving
8 kHz (1% distortion)	30 kHz (-3 dB)	Dual channel units available, low noise	Modulating electro-optics, piezoelectric driving
250 kHz (-3 dB) (bipolar) 200 kHz (-3 dB) (unipolar)	350 kHz (-3 dB) (bipolar) 250 kHz (-3dB) (unipolar)	Dual channel units available, improved slew rate, large signal bandwidth	Semiconductor research, piezoelectric driving
		High current	Ion beam control, piezoelectric driving
2.6 MHz (-3dB)	3 MHz (-3 dB)	Slew rate, large signal bandwidth	Piezoelectric driving, MEMS, electro-optic modulation, ultrasonics, dielectric material characterization
150 kHz (5% distortion)		Dual channel units available	Piezoelectric driver, MEMS
1.2 kHz (1% distortion)	5 kHz (-3 dB)	Computer interface, USB connector, current limiter indicator, HV ON indicator, integrated electrostatic voltmeter	Waveform tests, one or two phase ESC systems, process optimization
		Software driven, amplifier-powered, wafer detection	Electrostatic bipolar semiconductor wafer chucking (E-chuck) systems
		Software driven, amplifier-powered, wafer-detection	Electrostatic-driven clamping, holding, chucking of materials
in 1 volt increments by a precision dial or fixed at +1 kV or -1 kV Output accuracy better than 0.1% of full scale		Reference supply, low noise, remote on/off	DC reference supply
in 1 volt increments by a precision dial or fixed at +3 kV or -3 kV Output accuracy better than 0.015% of full scale		Precision DC reference supply, programmable memory	DC reference / power supply

ELECTROSTATIC VOLTMETERS

THEORY OF OPERATION - TREK'S ELECTROSTATIC VOLTMETER SYSTEMS

Many very high impedance voltage measurements cannot be made using conventional contacting voltmeters because they require charge transfer to the voltmeter, thus causing loading and modification of the source voltage. For example, when measuring voltage distribution on a dielectric surface, any measurement technique that requires charge transfer, no matter how small, will modify or destroy the actual data. In these types of applications a different approach to voltage measurement is required.

An instrument that measures voltage without charge transfer is called an electrostatic voltmeter. A primary characteristic of an electrostatic voltmeter is that it accurately measures surface potential (voltage) on any kind of material without physical contact and therefore, no charge transfer and loading of the measured source can occur.

In practice, an electrostatic probe is placed in close proximity (1 mm to 5 mm) to the surface to be measured. The electrostatic voltmeter functions to drive the potential of the probe body to the same potential as the measured unknown. This achieves a high accuracy measurement that is virtually insensitive to variations in probe-to-surface distances, and prevents arc-over between the probe and measured surface.

Scientific, industrial, or research applications for Trek electrostatic voltmeter systems include:

- Research and development of electrophotographic processes
- Light decay measurements of photoreceptors
- High-speed measurements of photoreceptor characteristics
- Contact potential measurements
- Materials evaluation
- Charge accumulation monitoring of LCD production processes
- Monitoring surface potentials in electrostatic painting processes
- Measuring electrostatic potential on polymers, rubber, fabrics, and paper
- Charge accumulation monitoring in clean rooms
- Radiation effect studies
- Measuring electrostatic potential on moving objects or surfaces

Trek is known in the marketplace for its novel noncontacting electrostatic voltmeter design (described on pages 8 and 9). This design was first introduced in 1968 to address charge transfer issues associated with contacting voltmeter designs at the time. Trek's noncontacting instruments, which measure voltage without charge transfer, continue to find extensive use in environments where surface contact must be avoided.

Trek's ultra-high impedance Infinitron™ voltmeter technology advances the state of the art, enabling precision and accuracy when an application requires surface contact measurements with virtually zero charge exchange upon probe contact. This need for site-specific contacting measurement is taking on greater importance as electronics are miniaturized, and other critical surface phenomena are being scrutinized. Recent advances in the technology enable Trek's Infinitron instruments (800 Series) to be used in both contacting and noncontacting modes. See pages 10 and 11 for more information.

To measure an unknown voltage on a test surface, the electrostatic probe is positioned in close proximity to the test surface at a spacing of approximately 1 mm to 5 mm. The sensitive electrode, having a small surface area, "views" the test surface through an aperture in the body of the probe. The use of a small area electrode and aperture serves to increase the spatial resolution of the probe to a relatively small area on the test surface. For the present explanation, we consider the surface under test to be a large conductive surface with a uniform potential. (Refer to block diagram below.)

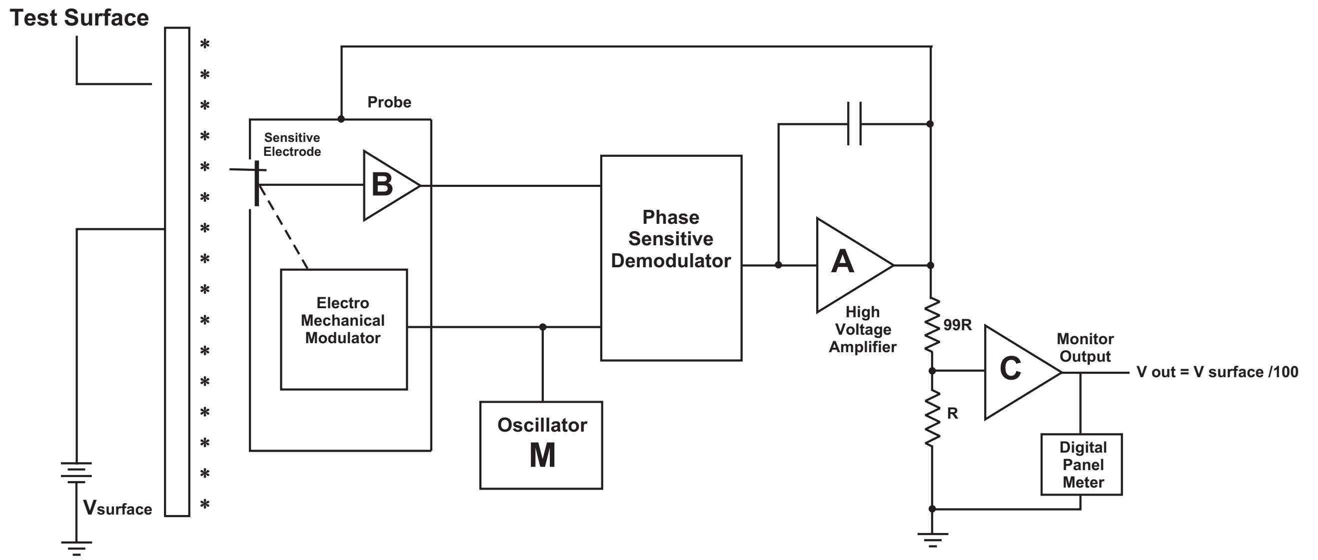
The probe housing is constructed of a conductive material which serves as a reference surface and is connected to the output of the high-voltage amplifier (A), which adjusts the voltage applied to the probe reference surface.

The sensitive electrode is electromechanically vibrated to produce capacitive modulation between the electrode and the test surface. If the voltage of the test surface is different than the voltage of the reference surface (probe housing), the difference in voltage induces an AC signal on the electrode due to the modulating of the capacitance there between. The amplitude and phase (either 0° or 180°) of the AC signal are related to the magnitude and polarity of the voltage difference.

The signal induced on the electrode is then fed to a preamplifier (B) in the probe.

The amplified electrode signal and the output voltage of the oscillator (M) which drives the electromechanical modulator are connected to a phase sensitive demodulator whose output is a DC voltage whose magnitude and polarity are related to the voltage difference.

ESVM Theory of Operation



The signal from the phase sensitive demodulator is connected to the input of an integrating DC high-voltage amplifier (A), the output of which is the probe housing reference potential, which is thus driven toward the potential of the test surface.

This process quickly drives the probe housing potential to the same potential as the potential on the test surface. At this point, the electrostatic field between test surface and probe will be nulled to zero.

With the electric field nulled, the signal induced upon the electrode is reduced to zero, thereby reducing the demodulated signal to the integrating DC amplifier to zero. Thus the high-voltage amplifier (A) output and the probe housing are maintained at the potential of the test surface.

The output of the high-voltage amplifier (A) is precisely divided down to a low voltage level to drive buffer amplifier (C) for accurate monitoring and display of the measured electrostatic potential on the test surface.

ELECTROSTATIC VOLTMETERS

	Electrostatic Voltmeter Model*	Output Voltage Range (DC or peak AC)	Speed of Response (10-90%) (less than)	Voltage Monitor Output Accuracy (better than)
	341B	0 to ±20 kV	200 μs for a 1 kV step	±0.1% of full scale
	P0865	0 to ±10 kV		
	370	0 to ±3 kV	50 μs for a 1 kV step	±0.05% of full scale
	370TR	0 to ±3 kV	200 μs for a 1 kV step	±0.05% of full scale
	347	0 to ±3 kV	3 ms for a 1 kV step	±0.05% of full scale
	344	0 to ±2 kV	3 ms for a 1 kV step	±0.05% of full scale
	368A	0 to ±2 kV	200 μs for a 1 kV step	±0.1% of full scale
	706B	0 to +1 kV or 0 to -1 kV (switch selectable)	DPM Sampling Rate: 3 readings/second	±0.5% of full scale
	323	0 to ±100 V	300 ms for a 100 V step	±0.05% of full scale
	320C	0 to ±100 V	300 ms for a 100 V step	±0.05% of full scale
	325	0 to ±40 V	3 ms for a 10 V step	±0.05% of full scale

The electrostatic voltmeters listed above utilize Trek's noncontacting technology.

	800	0 to ±100 V	3.5 ms for a 100 V step	±0.1% of full scale
	820	0 to ±2 kV	500 μs for a 1 kV step	±0.1% of full scale
	821HH	0 to ±2 kV	500 μs for a 1 kV step	±1% of full scale

**Contact Trek for additional products. Please refer to www.trekinc.com/monroe/ for additional electrostatic voltmeter products.*

Probe Models (order separately unless otherwise noted)	Special Features	Typical Applications
3450 Standard 3453/3455 High-Temperature, High-Vacuum	High voltage, high speed	Electrostatic research & development, charge accumulation monitoring of LCD production processes, monitoring surface potentials in electrostatic painting processes, electrostatic potential measurement on polymers, rubber, fabrics & paper
3800 Miniature 3870 Elevated-Temperature 7000 Standard	Optional data acquisition module	Electrophotographic research & development, research & development of photoreceptors, charge accumulation monitoring in semiconductor production, measuring electrostatic potential on moving objects or surfaces, radiation effect studies
3629A Transparent 3627 Standard	Transparent probe option	Photosensitive surface studies research & development
6000B Standard/High Res 555P Miniature 6300 High-Temperature	Wide variety of probe options	Photoconductor/dielectric surface voltage measurement, charge accumulation monitoring in semiconductor production, electrostatic potential measurement on film, polymers & paper
6000B Standard/High Res 555P Miniature 6300 High-Temperature	Wide variety of probe options	Electrophotographic research & development, charge accumulation monitoring in semiconductor production, electrostatic potential measurement on film, polymers & paper
3800 Miniature 3870 Elevated-Temperature	Multichannel enclosure	Research & development applications, electrostatic potential measurement on film, polymers & paper, electrophotographic research & development
Side Viewing Probe (included)	Portable, durable, battery operated	Photoreceptor evaluations, materials testing, static charge measurement for LCD, semiconductor, MR heads & IC processes
6000B Standard/High Res 555P Miniature 6300 High-Temperature	High sensitivity (5 mV), response speed control, noise/speed adjustments	Semiconductor wafer surface voltage measurement, contact potential measurement, disk drive charge accumulation measurements
3250 High-Sensitivity	High sensitivity (1 mV), noise/speed adjustments	Materials evaluation, electret studies, contact potential measurement
PD1216P High-Sensitivity	Low voltage, high sensitivity (1 mV), noise/speed adjustments	Materials evaluation, electret studies, contact potential measurement

Trek's new Infinitron® technology permits contacting (and noncontacting) measurements with virtually zero charger transfer; Refer to models below.

800P Contacting/ Noncontacting Probe (included)	Infinitron® ultra-high impedance voltmeter: Resistance greater than 10^{16} Ω Capacitance less than 10^{-15} F	Measurement of ESD-sensitive components and circuitry where virtually zero charge transfer is required
820P Contacting/ Noncontacting Probe (included)	Infinitron® ultra-high impedance voltmeter: Resistance greater than 10^{15} Ω Capacitance less than 10^{-15} F	Measurement of ESD-sensitive components and circuitry where virtually zero charge transfer is required
821P Contacting/ Noncontacting Probe (included)	Infinitron® ultra-high impedance voltmeter: Resistance greater than 10^{14} Ω Capacitance less than 10^{-14} F	Hand-held unit for versatile measurement of ESD-sensitive components and circuitry where virtually zero charge transfer is required

NONCONTACTING ELECTROSTATIC PROBE SELECTION TABLE

Electrostatic Voltmeter Model	Probe Model	Dimensions	Body Shape / Aperature Location / Aperature Size	Special Feature	Speed of Response (less than)	Noise (rms) (less than)
Model 320C 0 to ±100 V DC or peak AC	3250	30.5 mm H 28.7 mm W 57.2 mm L	square / side / 6.35 mm dia.	high-sensitivity	300 ms	5 mV (1:1 ratio)
Model 323 0 to ±100 V DC or peak AC	6000B-8	9.5 mm dia. 68.6 mm L	round / side / 1.32 mm dia.	high-sensitivity	300 ms	20 mV (1:1 ratio)
	6000B-16	10.2 mm sq. 68.6 mm L	square / side / 1.32 mm dia.	high-sensitivity	300 ms	20 mV (1:1 ratio)
Model 325 0 to ±40 V DC or peak AC	PD1216P	10 mm dia. 56 mm L	round / side / 4.6 mm dia.	high-sensitivity	3 ms	1 mV (1:1 ratio)
Model 344 0 to ±2 kV DC or peak AC and Model 347 0 to ±3 kV DC or peak AC	555P-1	5.6 mm sq. 49.8 mm L	square / side / 2.56 mm dia.	miniature	3 ms	3 mV
	555P-4	5.6 mm sq. 49.8 mm L	square / end / 1.17 mm dia.	miniature	4.5 ms	4 mV
	6000B-5C	11.2 mm dia. 65.7 mm L	round / end / 0.79 mm dia.	high-resolution	4.5 ms	4 mV
	6000B-6	10.3 mm dia. 69.7 mm L	round / side / 0.79 mm dia.	high-resolution	3 ms	3 mV
	6000B-7C	11.2 mm dia. 65.7 mm L	round / end / 1.32 mm dia.		4.5 ms	4 mV
	6000B-8	9.5 mm dia. 68.6 mm L	round / side / 1.32 mm dia.		3 ms	2 mV
	6000B-13C	10.2 mm sq. 63.7 mm L	square / end / 0.79 mm dia.	high-resolution	4.5 ms	4 mV
	6000B-14	10.2 mm sq. 68.6 mm L	square / side / 0.79 mm dia.	high-resolution	3 ms	3 mV
	6000B-15C	10.2 mm sq. 63.7 mm L	square / end / 1.32 mm dia.		4.5 ms	4 mV
	6000B-16	10.2 mm sq. 68.6 mm L	square / side / 1.32 mm dia.		3 ms	3 mV
	6300-7	11.8 mm H 11.1 mm W 76.2 mm L	square / end / 1.32 mm dia.	high-temperature (to 100°C)	6 ms	10 mV
	6300-8	11.8 mm H 11.1 mm W 76.2 mm L	square / side / 1.32 mm dia.	high-temperature (to 100°C)	4 ms	10 mV
Model 341B 0 to ±20 kV DC or peak AC and Model P0865 0 to ±10 kV DC or peak AC	3450	11.8 mm H 11.1 mm W 76 mm L	square / side / 3.05 mm x 1.52 mm		200 μs	20 mV
	3453ST	11.8 mm H 11.1 mm W 76.2 mm L	square / side / 3.05 mm x 1.52 mm	high-temperature (to 100°C) high-vacuum	200 μs	20 mV
	3455ET	11.8 mm H 11.1 mm W 76.2 mm L	square / end / 1.52 mm dia.	high-temperature (to 100°C) high-vacuum	200 μs	20 mV
Model 368A 0 to ±2 kV DC or peak AC and Model 370 0 to ±3 kV DC or peak AC	3800E-2	5.6 mm sq. 50 mm L	square / end / 1.85 mm dia.	miniature	Model 368A is less than 200 μs Model 370 is less than 50 μs	Model 368A is less than 25 mV Model 370 is less than 20 mV
	3800S-2	5.6 mm sq. 50 mm L	square / side / 2.35 mm dia.	miniature		
	3870ET-2	5.6 mm sq. 50 mm L	square / end / 1.85 mm dia.	elevated-temperature (to 60°C)		
	3870ST-2	5.6 mm sq. 50 mm L	square / side / 2.35 mm dia.	elevated-temperature (to 60°C)		
Model 370 0 to ±3 kV DC or peak AC	7000ER	8.7 mm dia. 69.8 mm L	round / end / 1.60 mm dia.		50 μs	20 mV
Model 370TR 0 to ±3 kV DC or peak AC	3627	11.8 mm sq. 76.2 mm L	square / side / 1.5 mm x 3.0 mm		200 μs	20 mV
	3629A	11.8 mm sq. 65.6 mm L	square / side / 5.3 mm dia.	nonfringing transparent	200 μs	20 mV

PROBES FOR ELECTROSTATIC VOLTMETERS

Please use the table on p.12 as a guide. Selected models which depict the breadth of Trek's offerings are shown here. Standard probe cable length is 3m but other lengths are available.

High Resolution Probes

Available with side/end view options and round/square body options.

High Sensitivity Probes

Side view available with round/square body options.

High Temperature Probes (100°C)

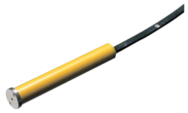
Square body available with side/end view options.

Miniature Probes

Square body available with side/end view options.

Standard Resolution Probes

Available with side/end view options and round/square body options.



Transparent Probes

These special probes are designed for applications such as photosensitive voltage measurement; square body, side view.

CHARGE-TO-MASS RATIO TEST SYSTEM

Model 212HS is a new charge-to-mass ratio (Q/m) test system which utilizes the "draw-off" transfer method to provide repeatable, highly accurate charge measurements on toner or other powders. The unit includes a multi-functional display. Data can be stored temporarily to on-board system memory and then transferred to a personal computer via the USB terminal.

ACCESSORIES

AC Adapters

Trek offers AC adapters for its models that require an AC adapter. The adapters can also be used to charge the internal rechargeable battery of Trek units containing such batteries.

Carrying Cases

Please contact Trek if you are interested in obtaining a carrying case for your portable Trek unit. Our standard case is provided with the appropriate internal cushioning to address most situations (to accommodate probes and other accessories as needed).

Rack Mount Adapters

Trek offers a variety of rack adapters for its amplifiers and electrostatic voltmeters. Contact Trek for details.

ELECTROSTATIC FORCE MICROSCOPE

Trek's Model 1100TN enables voltage distribution measurements with a very high spatial resolution – better than 10µm – well beyond the capability of typical electrostatic voltmeters. Trek's EFM can also measure voltage distribution across a much larger surface area as compared to a scanning probe microscope when operated under atmospheric conditions.

ESD PRODUCTS

Trek offers a variety of products for management of electrostatic discharge (ESD) including electrostatic detectors/sensors, electrostatic voltmeters, ESD Audit Kit, charged plate monitors, field meters, ionizers and surface/volume resistance meters. Please refer to our ESD Measurement & Control Instruments Catalog for additional information.

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TREK, INC. supports the initiatives of both the "Restriction on the use of certain Hazardous Substances" (RoHS) in electrical and electronic equipment and the European Union on "Waste Electrical and Electronic Equipment" (WEEE).

Trek product photos in this brochure are not necessarily shown at the same scale.

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

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