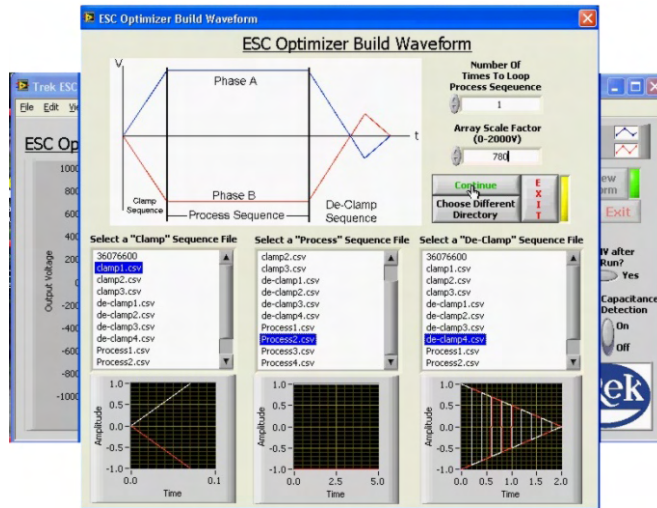


# Model 640 Electrostatic Chuck (ESC) Optimizer



Optimize the Waveforms and Voltages Required by Your Unique Electrostatic Chuck Processing Operation

Software Driven Computer-Controlled System for One or Two Phase ESC Systems

Graphically Displays and Records Data

Voltage Range:  
0 to  $\pm 2$  kV DC or peak AC

Output Current Range:  
0 to  $\pm 5$  mA DC or peak AC

Precision Voltage and Current Monitors Provide Low-Voltage Representations of the Output Voltage and Load Current

Electrostatic Voltmeter Measures Residual Voltage

The Trek Model 640 Electrostatic Chuck Optimizer system allows Scientists and Engineers the freedom to experiment and optimize the waveforms and voltages required by an electrostatic chuck/clamp. The Model 640 system can be used to research, facilitate, and discover the exact waveform to minimize the de-clamp time and the precise voltage amplitude to maximize clamp force and maintain optimum wafer processing for your particular ESC operation.

This software driven test system combines two amplifiers [for two-phase voltage combinations] and a waveform generator, which can be independently programmed and configured to investigate, research, and discover the perfect power supply and waveform recipe to efficiently drive your ESC application.

This software accepts parameters through arbitrary data input, pre-programmed waveforms, or imported from your own Microsoft Excel CSV files. This method of generating waveform files expedites this process by making the ability to customize waveforms simple, yet powerful enough to generate the most complex waveforms that can be envisioned by the user. The Model 640 ESC Optimizer enables the user to build the waveform process in three stages.

The individually programmed stages include: the Clamp Signal stage, the Processing Signal stage (with options to "loop" the process cycle), and the Declamp stage. All test data is recorded and presented in numerical and graphical format with a color coded display to visually cue successes or failures. The graphs can also be used to troubleshoot mechanical and electrical problems within your ESC operation.

An electrostatic voltmeter (ESVM) is contained in this system to optionally monitor any residual voltage from the clamping/de-clamping process.

These waveforms can then be used to specify operation parameters to build OEM amplifiers to meet the needs of your individual process. Once a finalized recipe is determined for optimizing your process, a permanent ESC power supply can be ordered for your system to ensure continuous, stable and consistent ESC processing.

[www.trekinc.com](http://www.trekinc.com)



# Model 640 Primary Specifications

All amplifier specifications are with no load unless otherwise specified. All electrostatic voltmeter specifications are at a probe-to-surface separation of 1 mm.

## Phase A & B Outputs

### Phase A Output Voltage Range

0 to  $\pm 2$  kV DC or peak AC (4 kV p-p).

### Phase A Output Current Range

0 to  $\pm 5$  mA DC or peak AC (10 mA p-p).

### Phase B Output Voltage Range

0 to  $\pm 2$  kV DC or peak AC (4 kV p-p).

### Phase B Output Current Range

0 to  $\pm 5$  mA DC or peak AC (10 mA p-p).

## Amplifier Performance [each phase]

### Large Signal Bandwidth (1% distortion)

DC to greater than 1.2 kHz.

### Small Signal Bandwidth (-3 dB)

DC to greater than 5 kHz.

### Slew Rate (10% to 90%, typical)

Greater than 15 V/ $\mu$ s.

### Settling Time (to 1%)

Less than 300  $\mu$ s for 0 to 2 kV step.

### DC Accuracy

Better than 0.1% of full scale.

### Offset Voltage

Less than 500 mV.

### Output Noise

Less than 100 mV rms (measured using the true rms feature of the Hewlett Packard Model 34401A digital multimeter).

### Drift with Time

Less than 100 ppm/hour, noncumulative.

### Drift with Temperature

Less than 350 ppm/ $^{\circ}$ C.

## Amplifier Features [each phase]

### Front Panel Display

A 3½ digit LED display.

#### Voltage Range

0 to  $\pm 1999$  V.

#### Voltage Resolution

1 V.

#### Zero Offset

$\pm 1$  count, referred to the voltage monitor.

## Amplifier Features [each phase]

### Voltage Monitor

A buffered output providing a low-voltage representation of the high voltage output.

#### Scale Factor

1 V/200 V.

#### DC Accuracy

Better than 0.1% of full scale. (May degrade to 0.6% in the presence of RF fields up to 3 V/m.)

#### Offset Voltage

Less than 5 mV.

#### Output Noise

Less than 10 mV rms (measured using the true rms feature of the Hewlett Packard Model 34401A digital multimeter).

#### Output Impedance

Less than 0.1  $\Omega$ .

### Current Monitor

A buffered output providing a low-voltage representation of the load current.

#### Scale Factor

1 V/mA.

#### DC Accuracy

Better than 1% of full scale.

#### Offset Voltage

Less than 5 mV.

#### Output Noise

Less than 10 mV rms (measured using the true rms feature of the Hewlett Packard Model 34401A digital multimeter).

#### Bandwidth (-3db)

DC to greater than 800 Hz.

#### Output Impedance

Less than 0.1  $\Omega$ .

## Waveform Generator

### Arbitrary Waveform Generator

Two (2) channels of Analog output.

#### Resolution

16 bits.

#### Samples/second

250 k.

## Electrostatic Voltmeter

### Measurement Range

0 to  $\pm 2$  kV DC or peak AC.

### Measurement Accuracy

**At the Voltage Monitor**  
Better than  $\pm 0.05\%$  of full scale.

### At the Voltage Display

Better than  $\pm 0.1\%$  of full scale  
 $\pm 1$  count, referred to the voltage monitor.

## Electrostatic Voltmeter (cont.)

### Speed of Response (10% to 90%)

Less than 100  $\mu$ s for a 1 kV step.

### ESVM Voltage Monitor Output

A buffered output providing a low-voltage replica of the measured voltage.

#### Scale Factor

1 V/200 V.

#### Offset Voltage

Less than 5 mV.

#### Output Noise

Less than 10 mV rms (measured with the true rms feature of the Hewlett Packard Model 34401A digital multimeter).

#### Output Current Limit

$\pm 10$  mA.

#### Output Impedance

Less than 0.1  $\Omega$ .

## Additional Features

### Computer Interface

A computer program is provided to take CSV files, containing waveform information, and outputting the waveforms to the High Voltage Amplifiers.

### USB Connector

Allows data transfer to and from a PC computer.

### Current Limit Indicator

#### (I for each phase)

A front panel indicator illuminates when the current exceeds  $\pm 5$  mA.

### HV ON Indicator

A front panel LED illuminates when the high-voltage is on.

## General

### Dimensions

193.2 mm H x 440.9 mm W x 447 mm D  
(7.6" H x 17.4" W x 17.6" D).

### Weight

11.3 kg (25 lb).

### High-Voltage Output Connector

Tyco high-voltage connector.

### AC Line Receptacle

Standard three-prong AC line connector.

### Line Voltage

Factory set for one of two ranges:  
90 to 127 V AC or 180 to 250 V AC.

