



SALES PACK EG353 SERIES

THIS DOCUMENT SHALL NOT BE COPIED, REPRODUCED OR MADE AVAILABLE IN ANY FORM OR FOR ANY PURPOSE, OTHER THAN FOR WHICH IT IS SUPPLIED, WITHOUT THE PRIOR WRITTEN CONSENT OF HITEK POWER LTD.

HITEK POWER RESERVES THE RIGHT TO MAKE IMPROVEMENTS TO THE PRODUCT WITHOUT NOTICE.

CONTENT

1. HiTek Power EG353 Series Data Sheet
2. Specifications for EG353 Series
3. Equipment Handbook for EG353 Series
4. EG353 Block Diagram
5. EG353 HV Cable Options
6. Serial to Opto Interface
7. GUI Instruction Guide For EG353
8. Logging Software for EG353 Series
9. Certification



HITEK POWER EG353 SERIES DATA SHEET



HITEK POWER® EG353 SERIES
HIGH-STABILITY 35 KV HIGH VOLTAGE POWER SUPPLIES
FOR PRECISION SEM E-BEAM APPLICATIONS





High-stability
35 kV high
voltage power
supplies
**for precision
SEM e-beam
applications**



The high stability and reliability of EG353 high voltage power supplies elevate the performance and quality of your entire system. This series meets the demanding requirements of SEM (scanning electron microscope) applications, including inspection, material and biological sciences, and forensics. Based on proven design techniques and power-conversion technologies, EG353 power supplies deliver a dependable performance that helps maximize image quality and repeatability.

FEATURES

- › Low ripple (< 1.6 ppm, accelerator) and high stability (< 10 ppm, accelerator)
- › Small-volume or 19" rack-mounted versions
- › -35 kV accelerator, 200 μ A, 50 mV ripple
- › +10 kV extractor, 400 μ A, 20 mV ripple (floating)
- › -1 kV suppressor, 100 μ A, 30 mV ripple (floating)
- › 5 V at 3 A current-controlled low-ripple (LF < 1 mA, peak to peak) heater (floating)
- › Optional grounded outputs using expansion interface
- › Full digital control and monitoring (fiber-isolated RS-232)
- › RoHS compliant to EU Directive 2011/65/EU
- › CE marked for EU LV Directive 2006/95/EC

ASK US ABOUT DERIVATIVES AND SPECIAL PRODUCTS BUILT TO YOUR REQUIREMENTS.

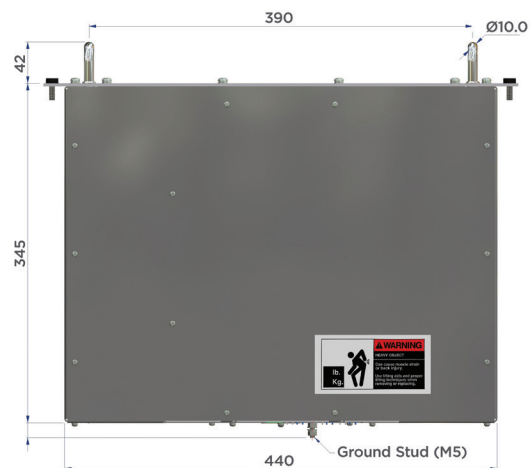


SPECIFICATIONS

ELECTRICAL INPUT				
Voltage	23 to 25 VDC, 24 VDC nominal			
Current	2.3 ADC max at 23 VDC input			
Protection	5 A time delay internal PCB-mounted fuse			
Electrical Output	Accelerator	Suppressor	Extractor	Filament
Line Regulation	< 0.3 V for a 1 VDC input voltage change	< 0.1 V for a 1 VDC input voltage change	< 0.5 V for a 1 VDC input voltage change	1 mA max for a 10% change in input voltage
Load Regulation	< 0.3 V for a 100 μ A load change	< 0.1 V for a 10 μ A load change	< 0.5 V for a 400 μ A load change	2 mA max from 0.4 to 1 Ω load change at 3 A
Output	-30 kV, 200 μ A, -35 kV for conditioning only (ground referenced)	-1 kV, 100 μ A (accelerator referenced)	+10 kV, 400 μ A (accelerator referenced)	3 A at 5 V max (accelerator referenced)
Accuracy	\pm 20 V	\pm 5 V	\pm 15 V	--
Voltage Ripple	LF: 50 mV peak to peak max under specified conditions	LF: 30 mV peak to peak max under specified conditions	LF: 20 mV peak to peak max under all conditions	LF: 1 mA peak to peak max under all conditions*
	HF: 25 mV peak to peak max under specified conditions	HF: 20 mV peak to peak max under specified conditions	HF: 15 mV peak to peak max under all conditions	HF: 5 mV peak to peak max under all conditions*
Voltage Monitor	0 to -35 kV, accuracy \pm 0.5%	0 to -1 kV, accuracy \pm 0.5%	0 to +10 kV, accuracy \pm 0.5%	0 to +6 V, 16 bit resolution, accuracy \pm 1%
Current Monitor	0 to 250 μ A 16-bit resolution \pm 0.5% accuracy	0 to 150 μ A 16-bit resolution \pm 0.5% accuracy	0 to 500 μ A 16-bit resolution \pm 0.5% accuracy	0 to 3 A 16-bit resolution \pm 2 mA accuracy for 2 to 3A \pm 20 mA accuracy for all other values
Stability	< 0.3 V over a 15 min period (after warmup period)	< 0.2 V over a 15 min period (after warmup period)	< 0.3 V over a 15 min period (after warmup period)	0.5 mA over a 1 hour period (after warmup period)
Thermal Drift	25 ppm max per $^{\circ}$ C over operating temperature	25 ppm max per $^{\circ}$ C over operating temperature	25 ppm max per $^{\circ}$ C over operating temperature	100 ppm max per $^{\circ}$ C over operating temperature
Environmental				
Operational Temperature	10 to 45 $^{\circ}$ C (50 to 113 $^{\circ}$ F)			
Storage/Transport temperature	-20 to +70 $^{\circ}$ C (-4 to 158 $^{\circ}$ F)			
Altitude	Sea level to 2000 m (6562')			
Humidity	80% max relative humidity up to 31 $^{\circ}$ C, reducing linearly to 50% at 40 $^{\circ}$ C (140 $^{\circ}$ F), non-condensing (ref. EN61010-1)			
Cooling	Free convection			
Physical	Module	19" Rack		
Dimensions (W x H x D)	See mechanical drawings, on page 5.			
Weight (Approx.)	10.2 kg (22.5 lb)	12 kg (26.5 lb)		
Construction	Steel and aluminum with protective treatment			
Remote Interface	RS-232; supplied by fully isolated fiber optics			
Remote Interface Connector	Hewlett Packard* versatile optical link: HP T-1521/HP R-2521			
Input Connector	2-way PTR/Phoenix STLZ950/2-G-5.08-H-green (pin 1 positive, pin 2 negative)			
RS-232 Fiber Connector	9-way, female, D-type			
Interlock Connector	Hewlett Packard* versatile optical link: HP T-1521/HP R-2521 (rear-panel mounted)			
HV Output Connectors	Heater: 2 wires of custom 4-way HV connector Suppressor: 1 wire of custom 4-way HV connector Extractor: 1 wire of custom 4-way HV connector			

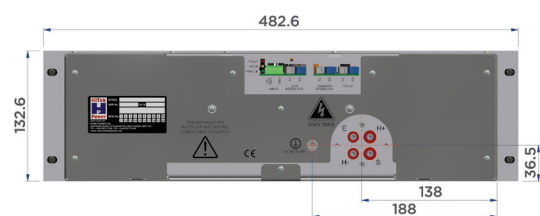
*Ripple measured with a 1 Ω load and 3 A

DIMENSIONAL DRAWINGS

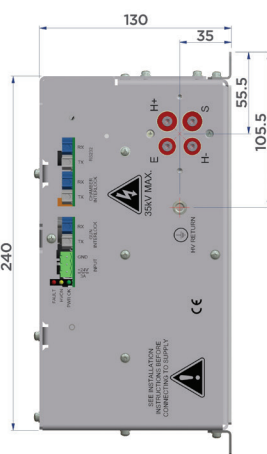
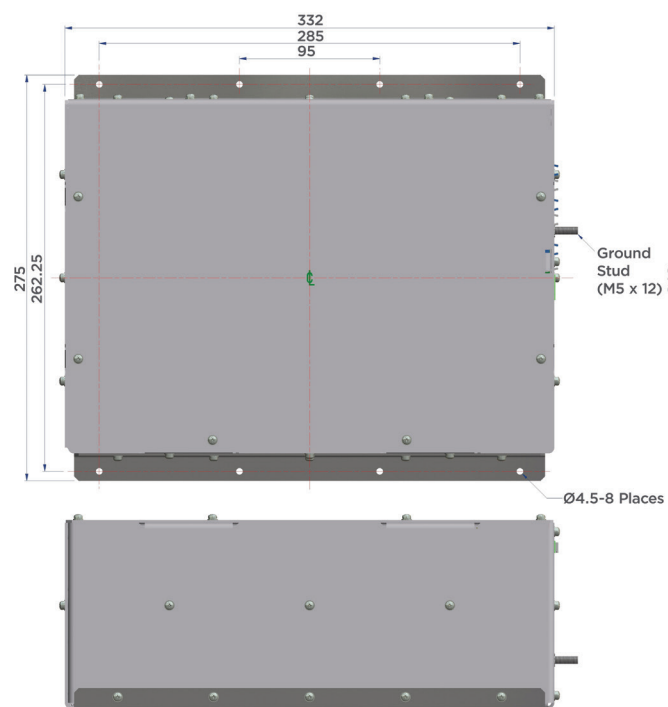


**PROVEN DESIGN TECHNIQUES AND
POWER-CONVERSION TECHNOLOGIES
FOR HIGH STABILITY, REPEATABILITY,
AND RELIABILITY**

All measurements are in millimeters.



Rack Unit



Module



For international contact information, visit
advanced-energy.com.



SPECIFICATIONS FOR EG353 SERIES

THIS DOCUMENT SHALL NOT BE COPIED, REPRODUCED OR MADE AVAILABLE IN ANY FORM OR FOR ANY PURPOSE, OTHER THAN FOR WHICH IT IS SUPPLIED, WITHOUT THE PRIOR WRITTEN CONSENT OF HITEK POWER LTD.

HITEK POWER RESERVES THE RIGHT TO MAKE IMPROVEMENTS TO THE PRODUCT WITHOUT NOTICE.

CONTENT

1.	Introduction	p.5
2.	Input Supply	p.5
3.	Output Performance	p.12
4.	Interlocks	p.12
5.	Remote Interface Connector	p.14
6.	ASCII Protocol	p.19
7.	Connections and Indicators	p.19
8.	Environmental Performance	p.20
9.	Safety and EMC	p.20
10.	Mechanical	p.21
11.	Module Outline	p.21
12.	19" Rack Mount Outline	p.22

1. INTRODUCTION

This document specifies the characteristics and performance of an electron gun power supply system to meet the requirements of an electron microscope application.

The power supply system will be based on HiTek Power's next generation high voltage modules that give some of the following benefits: better efficiency, more consistent operation, low variance to component change, greater reliability and easier testing.

Communications with the host computer are via multiple fibre optic connections.

The unit is supplied from a nominal 24V DC supply voltage which then drives the internal electronics.

The supplied outputs are:

Accelerator	-30kV 200uA, -35kV for conditioning only (Ground referenced)
Suppressor	-1kV 100uA (Accelerator Referenced)
Extractor	+10kV 400uA (Accelerator Referenced)
Filament	3A at 5V max (Accelerator Referenced)

2. INPUT SUPPLY

Input Voltage: 23 to 25V DC

Input Current: 2.3A DC max @ 23V DC input

Input Protection: 5A time delay Internal PCB mounted fuse

Input Connector: 3 Way PTR/Phoenix STLZ950/3-G-5.08-H-Green (Pin 1 positive, Pin 3 negative)

3. OUTPUT PERFORMANCE

All values and measurements should be made at constant temperature and after an initial 2 hour warm up period unless otherwise stated.

All values and measurements should be made with the unit operating within the limits specified within this document.

3.1 ACCELERATOR OUTPUT (REFERENCED TO GROUND)

Output Voltage: -100V to -30kV (-35kV for gun conditioning)

Accuracy: $\pm 20V$

Setting
Resolution: 16 bit resolution (50,000 steps used for full scale setting with remaining steps used for calibration and testing)

Slew rate: 1kV/s (1kV/s default, variable between 10V/s and 20000V/s in firmware)

Voltage Ripple: LF: 50mV pk to pk maximum under specified conditions
HF: 25mV pk to pk maximum under specified conditions

Voltage Monitor: 0 to -35kV, accuracy $\pm 0.5\%$ of full scale value

Wobbler Voltage: 0% to 100%

Wobbler
Frequency: 0.25 to 3Hz. Calibrated for 1Hz

Output Current: 0 to 200uA continuous

Current Monitor: 0 to 250uA, 16 bit resolution, accuracy $\pm 0.5\%$ of full scale value (50,000 steps used for full scale monitor with remaining steps used for calibration and testing)

Load Regulation: $<0.3V$ for a 100uA load change

Line Regulation: $<0.3V$ for a 1V DC input voltage change

Current trip threshold: 220uA (fixed value in software and 5 second delay before shutdown)

Hardware current limit: 240uA

Stability: $<0.3V$ over a 15 minute period (after warm up period)

Thermal Drift: 25ppm maximum per $^{\circ}C$ over operating temperature

Stored Energy: $<3.5J$

Output Decay Time: The output voltage will discharge to less than 60V without load in approx. 22 seconds

Output Arc Protection: Internal resistive limiting for arcs to ground

Feedback Resistance: 750M Ω

3.2 SUPPRESSOR OUTPUT (REFERENCED TO ACCELERATOR)

Output Voltage: -50V to -1kV (used lower will have less accuracy)

Accuracy: $\pm 5V$

Setting	
Resolution:	16 bit resolution (50,000 steps used for full scale setting with remaining steps used for calibration and testing)
Slew rate:	100V/s (100V/s default, variable between 0.3V/s and 20000V/s in firmware)
Voltage Ripple:	LF: 30mV pk to pk maximum under specified conditions HF: 20mV pk to pk maximum under specified conditions
Voltage Monitor:	0 to -1kV, accuracy $\pm 0.5\%$ of full scale value
Output Current:	0 to 100uA continuous
Current Monitor:	0 to 150uA, 16 bit resolution, accuracy $\pm\%$ of full scale value (50,000 steps used for full scale setting with remaining steps used for calibration and testing)
Load Regulation:	<0.1V for a 10uA load change
Line Regulation:	<0.1V for a 1V DC input voltage change
Current trip threshold:	100uA (fixed value in software with 5 second delay before shutdown)
Hardware current limit:	120uA
Stability:	<0.2V over a 15 minute period (after warm up period)
Thermal Drift:	25ppm maximum per $^{\circ}\text{C}$ over operating temperature
Output Arc Protection:	Internal resistive limiting and over voltage clamp, for arcs to cathode or extractor

Feedback
Resistance: 7.5M Ω

3.3 EXTRACTOR OUTPUT (REFERENCED TO ACCELERATOR)

Output Voltage: +100V to +10kV (used lower will have less accuracy)

Accuracy: $\pm 15V$

Setting
Resolution: 16 bit resolution (50,000 steps used for full scale setting with remaining steps used for calibration and testing)

Slew rate: 1000V/s (1000V/s default, variable between 3V/s and 20000V/s in firmware)

Voltage Ripple: LF: 20mV pk to pk maximum under all conditions
HF: 15mV pk to pk maximum under all conditions

Voltage Monitor: 0 to +10kV, accuracy $\pm 0.5\%$ of full scale value

Output Current: 0 to 400uA continuous

Current Monitor: 0 to 500uA, 16 bit resolution, accuracy $\pm 0.5\%$ of full scale value (50,000 steps used for full scale setting with remaining steps used for calibration and testing)

Load Regulation: <0.5V for a 400uA load change

Line Regulation: <0.5V for a 1V DC input voltage change

Current trip
threshold: 430uA (fixed value in software with 5 second delay before shutdown)

Hardware current limit:	460uA
Stability:	<0.3V over a 15 minute period (after warm up period)
Thermal Drift:	25ppm maximum per °C over operating temperature
Output Arc Protection:	Internal resistive limiting and over voltage clamp, for arcs to heater or ground
Feedback Resistance:	250MΩ

3.4 HEATER OUTPUT (REFERENCED TO ACCELERATOR)

Output Voltage:	0V to +5V (output voltage will be a function of the controlled filament current and the filament and cable resistance)
Output Current:	0 to 3A. Specification applies above 0.5A
Setting Resolution:	16 bit resolution (50,000 steps used for full scale setting with remaining steps used for calibration and testing)
Slew rate:	100mA/s (100mA/s default, variable between 1mA/s and 30A/s in firmware)
Accuracy:	±2mA for 2A to 3A, ±20mA for all other values
Voltage Monitor:	0 to +6V, 16 bit resolution, accuracy ±1% of full scale value (50,000 steps used for full scale setting with remaining steps used for calibration and testing)
Current Monitor:	0 to 4A, 16 bit resolution, accuracy ±2mA for 2A to 3A, ±20mA for all other values (50,000

steps used for full scale setting with remaining steps used for calibration and testing)

Stability: 0.5mA over a 1 hour period (after warm up)

Thermal Drift: 100ppm maximum per °C over operating temperature

Voltage Ripple: LF: 1mA pk to pk maximum under all conditions
HF: 5mV pk to pk maximum under all conditions
Ripple measured with a 1Ω load and 3A

Load regulation: 2mA max from 0.4Ω to 1Ω load change at 3A

Line regulation: 1mA maximum for a 10% change in input voltage

Output Arc Protection: Internal clamp diodes and controlled capacitance for arcs to ground

4. INTERLOCKS

Gun Interlock (Isolated fibre optic connections)

Operation: Opening disables all supplies and clears all Enables, Settings and updates

Connector: Avago HFBR-1521 (TX) and HFBR-2521Z (RX)
(Rear panel mounted)

Mating half: Avago HFBR-4516Z Duplex connector

Uplink Sense: Light off or disconnected, disables all supplies

Downlink Sense: Light on, all supplies disabled

Note: At power on the Host Controller should test the interlock operation.

5. REMOTE INTERFACE CONNECTOR

Isolated fibre optic serial connection with ACSII protocol

Connector: Avago HFBR-1521 (TX) and HFBR-2521Z (RX)
(Rear panel mounted)

Mating half: Avago HFBR-4516Z Duplex connector

Serial Port Configuration

Baud: 115200

Data: 8 bits

Stop: 1 bit

Parity: none

Handshake: none

Connector

Avago Versatile Link (VersaLink) latching duplex connector
Part Number HFBR-4516Z

**Cable Type:**

Industry standard 1.0 mm dual core plastic optical fibre 2.2 mm outside-diameter jacket

Note: Patch lead is called "VersaLink Purpose Duplex Straight-Through Patch Cord with Duplex Connectors"

Cable Length:

50 metres maximum

USB to Serial Converter (suggested):

USB-TTL(UART): USB-TTL 0.1" Socket (Part Number TTL-232R-3V3)

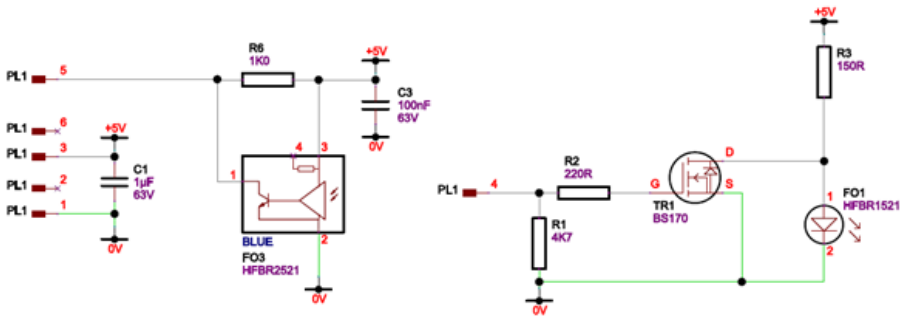
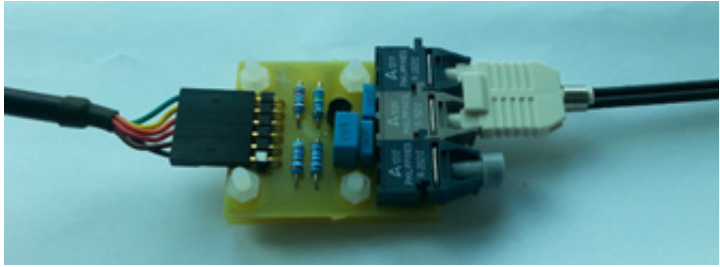
Manufactured by <http://www.ftdichip.com/>

(Drivers available here)

Stocked by <http://www.farnell.com/>



Serial to Optical adaptor (suggested):



6. ASCII PROTOCOL

This is simplified explanation of the protocol intended for customer use. For more information regarding protocol usage and engineering/calibration functions, refer to the separate document 'EG353 Protocol Vn.docx' for more details.

Commands are in the form or 'get', 'set' and 'operation':

<parameter>=<value><<cr>

<parameter>?<<cr>

<operation>!<<cr>

Example Commands:

B.VD=-10000 Set Beam VDEM (perhaps a voltage demand) to 10000, or 10kV.

B.VD =-10000.0	As previous, with a decimal fraction.
B.VD =-1e4	As previous, in exponent form.
B.VD =-1.0e+4	As previous, with signs.
B.VM?	Get the value of the named parameter.
CLEAR!	Carries out the requested operation.

System Parameters: (Read Only)

NAME	PARAMETER	VALUE
PROTOCOL	Protocol specification	1
SYSYTYPE	System type	Hitek.EG353xxxxxx
SYSVER	System specification	1
SWVER	Software version	String that represents the software version
SER	Serial number	32-bit integer.
STAT	Overall System State	See 'System Status Flags'

System Status Flags:

BIT	PURPOSE	DESCRIPTION
0	HV (beam voltage) enable	Corresponds to the B.EN parameter. Set by request 'B.EN=1', and cleared by 'B.EN=0' or 'RESET!' requests.
1	HV (beam voltage) on	Set if the beam voltage is switched on. This will be set if the beam is enabled, and there are no fault conditions
2	Filament enable	Corresponds to the F.EN parameter. Set by request 'F.EN=1', and cleared by 'F.EN=0' or 'RESET!' requests.
3	Filament on	Set if the filament output is active - that is, current is being driven into the filament
4	Extractor enable	Corresponds to the E.EN parameter. Set by request 'E.EN=1', and cleared by 'E.EN=0' or 'RESET!' requests.
5	Extractor on	Set if the extractor voltage is switched on. This will be set if the extractor is enabled, and there are no fault conditions.
6	Suppressor enable	Corresponds to the S.EN parameter. Set by request 'S.EN=1', and cleared by 'S.EN=0' or 'RESET!' requests.

7	Suppressor on	Set if the suppressor voltage is switched on. This will be set if the suppressor is enabled, and there are no fault conditions
10	Interlock input	Set if the interlock is open
12	Warning	Set if there are warning conditions present
13	Fault	Set if there are fault conditions present

Control Parameters: (Read/Write)

NAME	PARAMETER	UNITS	RANGE / NOTES
B.VD	Beam voltage demand	V	0 to 35000V, the desired voltage, in volts
B.VS	Beam voltage slew	V/s	10V/s to 20000V/s, desired slew rate
B.WD	Beam Wobbler Depth	Multiple	0=off, 0.5=50%, 1.0=maximum % of demand value, e.g. 1kV demand and B.WD = 0.02 (2%) gives 20Vpk/40Vpk-pk Maximum wobbler output = 200Vpk-pk
B.WF	Beam Wobbler Frequency	Hz	0.25 to 3Hz
B.EN	Beam enable	N/A	on/off control - 1 for on, 0 for off
F.EN	Filament enable	N/A	on/off control - 1 for on, 0 for off
F.ID	Filament current demand	A	0 to 3.5A, the desired current.
F.IS	Filament current slew	A/s	1mA/s to 30A/s, desired slew rate.
F.EN	Filament enable	N/A	on/off control - 1 for on, 0 for off.
E.VD	Extractor voltage demand	V	0 to 10000V, the desired voltage, in volts.
E.VS	Extractor voltage slew	V/s	3V/s to 20000V/s, desired slew rate.
E.EN	Extractor enable	N/A	on/off control - 1 for on, 0 for off.
S.VD	Suppressor voltage demand	V	0 to 10000V, the desired voltage, in volts.
S.VS	Suppressor voltage slew	V/s	3V/s to 20000V/s, desired slew rate.
S.EN	Suppressor enable	N/A	on/off control - 1 for on, 0 for off.

Information Parameters: (Read Only)

<i>NAME</i>	<i>PARAMETER</i>	<i>UNITS</i>	<i>NOTES</i>
B.VMAX	Maximum beam voltage	V	
F.IMAX	Maximum filament current	A	
E.VMAX	Maximum extractor voltage	V	
S.VMAX	Maximum suppressor voltage	V	

Monitor Parameters: (Read Only)

<i>NAME</i>	<i>PARAMETER</i>	<i>UNITS</i>	<i>RANGE / NOTES</i>
B.ST	Beam status	flags	See 'Output Status Flags'
B.FLT	Beam fault	flags	See 'Output Error Flags'
B.VA	Beam voltage actual	V	Actual demand with wobble and slew
B.VM	Beam voltage monitor	V	0 to 35000V
B.IM	Beam current monitor	A	0 to 200uA
F.ST	Filament status	flags	See 'Output Status Flags'
F.FLT	Filament fault	flags	See 'Output Error Flags'
F.IA	Filament current actual	A	Actual demand with slew
F.IM	Filament current monitor	A	0 to 3.5A
F.VM	Filament voltage monitor	V	0 to 6V
E.ST	Extractor status	flags	See 'Output Status Flags'
E.FLT	Extractor fault	flags	See 'Output Error Flags'
E.VA	Extractor voltage actual	V	Actual demand with slew
E.VM	Extractor voltage monitor	V	0 to 10000V
E.IM	Extractor current monitor	A	0 to 400uA
S.ST	Suppressor status	flags	See 'Output Status Flags'
S.FLT	Suppressor fault	flags	See 'Output Error Flags'

S.VA	Suppressor voltage actual	V	Actual demand with slew
S.VM	Suppressor voltage monitor	V	0 to 1000V, voltage monitor.
S.IM	Suppressor current monitor	A	0 to 100uA, current monitor

Output Status Flags: (Read Only)

<i>BIT</i>	<i>PURPOSE</i>	<i>DESCRIPTION</i>
0	Enable	Corresponds to the <output>.EN command. Cleared on power-up or RESET!
1	ON	Output is generating voltage (Active)
4	Ramp	Ramping in progress
5	Wobble	Wobble active
8	Frequency Lock	Converter frequency control system is locked at a fixed frequency
12	Warning	Warning is active on this output
13	Fault	Fault is active on this output

Output Error Flags: (Read Only)

<i>BIT</i>	<i>PURPOSE</i>	<i>DESCRIPTION</i>
0	Interlock	Set if the interlock is opened
4	Supply fault	Set if the input supply is outside 10% of the nominal 24V.
5	Internal	Software error / system communications error
8	Temperature	Set if the internal ambient exceeds 75°C
12	Over Current	Over current condition
13	Over Voltage	Over voltage condition

7. CONNECTIONS AND INDICATORS

7.1 REAR PANEL MAINS INPUT CONNECTIONS

7.2 REAR PANEL HV OUTPUT CONNECTIONS

Heater	2 wires of custom 4 way HV connector
Suppressor	1 wire of custom 4 way HV connector
Extractor	1 wire of custom 4 way HV connector

8. ENVIRONMENTAL PERFORMANCE

Temperature:	10 to 45°C (operational) -20 to 70°C (storage)
Humidity:	80% maximum relative humidity up to 31°C, reducing linearly to 50% at 40°C. Non condensing (ref. EN61010-1)
Altitude:	Sea level to 2000m
Vibration:	In accordance with ISTA 2A
Installation Category	II
Pollution Degree	2
Classification	Indoor use only

9. SAFETY AND EMC

EMC The unit is intended for installation as part of a system. Basic EMC filtering is provided. The EMC performance of the power supply can only be assessed when it is installed within and as part of the final system.

Safety Meets the requirements of the Low Voltage Directive (LVD), 2006/95/EC by complying with BS EN 61010-1:2010 when it is installed as a component part of other equipment. It is CE marked accordingly.

A protective earth terminal is provided at the rear of the unit. This shall be used to provide a safety ground.

10. MECHANICAL

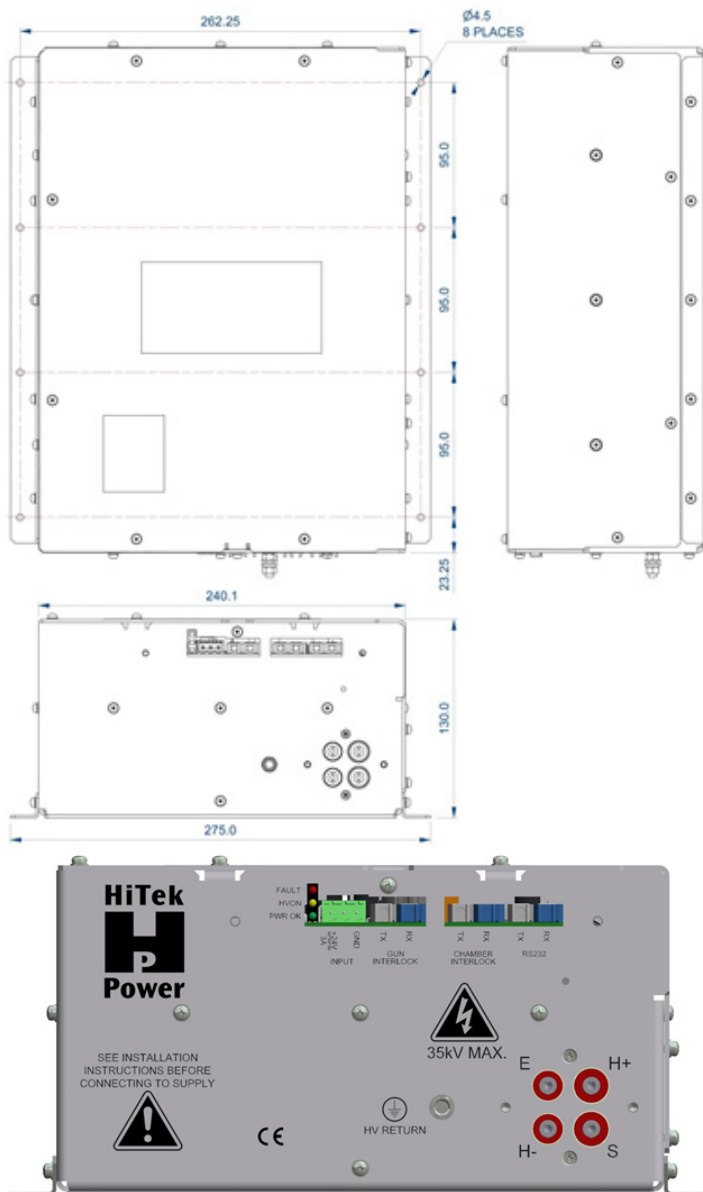
Module Size: 275mm x 348mm x 130mm

19" Rack size: 440mm x 405mm x 133mm

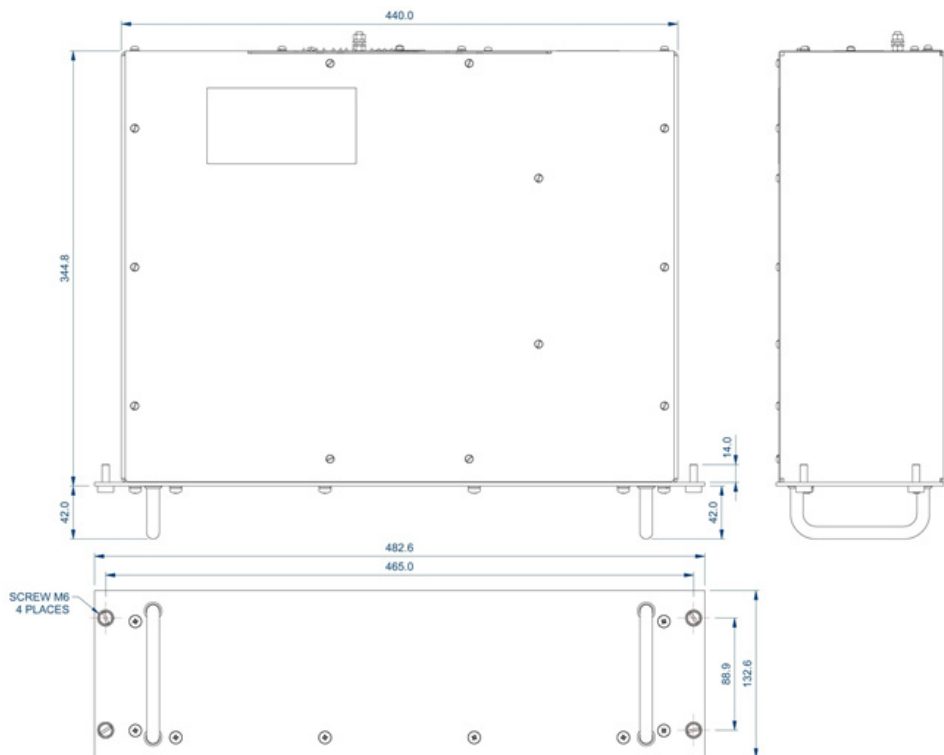
Module Weight: 12kg

19" Rack weight: 17kg

11. MODULE OUTLINE



12. 19" RACK MOUNT OUTLINE





For international contact information, visit
advanced-energy.com.

Specifications are subject to change without notice.

© 2017 Advanced Energy Industries, Inc. All rights reserved. Advanced Energy® is a trademarks of Advanced Energy Industries, Inc.



EQUIPMENT HANDBOOK FOR EG353 SERIES

THIS DOCUMENT SHALL NOT BE COPIED, REPRODUCED OR MADE AVAILABLE IN ANY FORM OR FOR ANY PURPOSE, OTHER THAN FOR WHICH IT IS SUPPLIED, WITHOUT THE PRIOR WRITTEN CONSENT OF HITEK POWER LTD.

HITEK POWER RESERVES THE RIGHT TO MAKE IMPROVEMENTS TO THE PRODUCT WITHOUT NOTICE.

CONTENT

1.	Introduction	p.5
2.	Safety Information	p.5
2.1	Safety Symbols	p.5
2.2	General	p.6
2.3	Safety Guidelines	p.6
3.	General Description	p.8
3.1	Remote Control	p.8
3.2	Safety	p.9
4.	Standards and Approvals	p.9
4.1	Safety	p.9
4.2	EMC	p.9
5.	Performance Specification	p.9
6.	Operation of the Power Supply	p.10
6.1	Unpacking and inspection	p.10
6.2	Mechanical installation	p.10
6.3	Electrical Installation and Operation	p.11
7.	Maintenance/Component Replacement	p.12
7.1	Replacement of components (including fuses)	p.12
7.2	Replacement of consumables, routine maintenance of parts	p.13
7.3	Cleaning	p.13
8.	Repairs	p.13
Fig. 1	Wiring of the Earth Terminal Assembly	p.15
Fig. 2	Mechanical Outline of 19 inch Rack	p.16
Fig. 3	Mechanical Outline of Module	p.17

1. INTRODUCTION

This document provides the information required to operate the EG353 tetrode electron gun power supply safely and within the limits of the specification. It must be read in full before any attempt is made to operate the power supply.

2. SAFETY INFORMATION

2.1 SAFETY SYMBOLS



Caution: Refer to equipment handbook



Danger: Risk of electric shock.
High voltage at power supply output



Earth terminal



Direct current



Protective Earth terminal

2.2 GENERAL

This power supply is intended for indoor professional use only in a non- explosive, non-corrosive and mainly non-conductive environment. It is capable of producing hazardous voltages and so must be treated with respect.

The product has been manufactured in an ISO9001 Quality Management approved facility to ensure continuity of the safety build standard. It leaves the factory in a safe condition.

Meets the requirements of the Low Voltage Directive LVD, 2006/95/EC by complying with BS EN61010-1:2010 when the Power Supply is installed as a component part of other equipment. When installing the power supply and making input, output and case connections, the relevant safety standards e.g. EN61010 and EN60950, shall be adhered to.

To maintain continued safety of the product and to the operator it is important that the entire handbook is read carefully, paying particular attention to the safety guidelines presented in this section. The handbook should be read before attempting installation or operation of the power supply.

If you do not fully understand the information given in the handbook do not use the power supply. Contact HiTek Power or an authorised agent for advice.

2.3 SAFETY GUIDELINES

1. This power supply is capable of producing hazardous voltages, which under some circumstances may be fatal.
2. It is recommended that the power supply is only operated by personnel who are familiar with high voltage and recognise the dangers it can pose.
3. Connection of the power supply input, output and fibre optic cables must be made in the following order:
 - a. Ensure the power supply is disconnected from the DC supply.

- b. Before touching the high voltage cables, ensure that the high voltage circuits and loads are discharged.
 - c. Connect the earth terminal (labelled HV return) on the unit to a protective earth.
 - d. Connect the fibre optic cables to the unit.
 - e. Connect the high voltage outputs to the load circuits. Connect the load return to the rear panel earth terminal.
 - f. Connect the DC input supply.
 - g. Energise the dc supply turn the enable ON and set demand signals as required.
4. Before removing or touching the high voltage output ensure that the DC input supply is de-energised and all high voltage parts are fully discharged.
 5. The external enable command is purely functional and must not be considered or used as a safety feature.
 6. The high voltage circuit and load must not be accessible to the user. Ensure the equipment enclosure housing the power supply has suitable interlocks to prevent contact with the high voltage. Ensure that the creepage and clearance distances between the high voltage output and the enclosure meet the requirements of a suitable safety standard e.g. EN60950 or EN61010.
 7. Ensure adequate ventilation of the power supply to ensure that possible ozone build up will be kept to a safe level.
 8. Operation with the cover removed exposes hazardous voltages. This should only be attempted by qualified service personnel authorised by HiTek Power.
 9. There are no user serviceable parts in the power supply.

If the power supply fails to operate, it must be returned to HiTek Power or to a HiTek Power authorised service centre for repair.

10. Do not use the power supply if it is damaged. Return to HiTek Power, or to a HiTek Power authorised service centre for examination.
11. The power supply should only be used for the purpose for which it is designed and manufactured. Failure to do this may impair the protection provided by the power supply.

3. GENERAL DESCRIPTION

The EG353 high voltage power supply is a high performance tetrode electron gun supply designed and manufactured by HiTek Power. It is a fully regulated closed-loop system to meet the requirements of an electron microscope application. Communications with the host system controller are via multiple fibre optics.

Reliability is of prime importance, and to this end numerous features are incorporated to ensure system integrity is maintained during adverse operating conditions. Such features include continuous primary current monitoring with fast pulse truncation and soft-start, extensive thermal monitoring and automatic shutdown on key components, passive output current limiting for instantaneous surge control and independent output overvoltage sensing.

The above features combine to give exceptional reliability even in an arduous operating environment.

3.1 REMOTE CONTROL

The power supply is operated by remote control via fibre optic cables. Full control and monitoring functions are available.

3.2 SAFETY

The power supplies described in this handbook generate voltages that are hazardous and can be fatal. They should only be installed and used by personnel who have received the appropriate training and who are fully aware of the hazards that exist.

4. STANDARDS AND APPROVALS

4.1 SAFETY

The EG353 tetrode power supply meets the requirements of the Low Voltage Directive, LVD, 2006/95/EC by complying with EN61010-1: 2010 when installed as a component part of other equipment. It is CE Marked accordingly.

4.2 EMC

The EG353 tetrode power supply is intended for installation as part of a system. Basic EMC filtering is provided.

5. PERFORMANCE SPECIFICATION

Refer to specification 55170029.

6. OPERATION OF THE POWER SUPPLY

6.1 UNPACKING AND INSPECTION

This product has been carefully packed to prevent damage during transit. When removing the product from the packaging, ensure that the power supply shows no evidence of rough handling and/or damage. Please note that the power supply is a heavy object. Appropriate lifting and handling procedures must be observed.

If evidence of damage is visible do not operate the power supply. Notify the carrier and keep the power supply and all packaging for warranty claims (see Repairs information, Section 8).

Accompanying the power supply should be:

- a. Handbook including the specification
- b. Copy of test results

There are no cables supplied.

If any of the above items are missing please contact HiTek Power. The power supply should only be installed into equipment by professional and competent personnel who are aware of the hazards that high voltage power supplies can produce and are familiar with the wiring and installation requirements of the countries where the product is to be used. All users should receive appropriate operational training in the use of the product.

6.2 MECHANICAL INSTALLATION

The power supply is designed to fit into a customer specified enclosure. There are no cooling/ventilation requirements to meet.

Front and rear panel handles are fitted to aid sliding the power supply in and out of the rack into which it is fitted within the host system. Neither the front panel nor the rear panel handles are intended to be used to support the entire weight of the power supply. Instead use appropriate lifting aids and lifting tech-

niques when removing, replacing or carrying the power supply.

The weight of the power supply is approximately:

Module Size 12kg (27lb)

19" Rack Size 17kg (38lb)

An outline drawing showing the mechanical dimensions of the power supply is shown in Fig 2.

6.3 ELECTRICAL INSTALLATION AND OPERATION

6.3.1 DC INPUT

The DC input (23V - 25V/3A) is applied to the power supply via the 3 way PTR/ phoenix STLZ950/3-G-5.08-H-Green input connector. Ensure that the power supply is wired up in accordance with local and national wiring regulations.

Ensure that the polarity of the DC supply is observed.

Always ensure the dc power source is off before connecting it to the power supply.

A 5A slow acting fuse is incorporated within the DC input in the unit to protect against excessive currents that may flow in the event of an abnormal fault.

The 24V DC supply to the equipment shall be capable of delivering a current of at least 10A to ensure that the internal protective fuse opens in a timely manner in the event of a fault.

The power supply is not fitted with a disconnect device (e.g. circuit breaker). Ensure that the host system provides a means to disconnect the power supply from the DC input supply. Also ensure that the disconnect device is suitably accessible for the operator.

It is recommended that the DC input supply is itself protected against output short circuit, either electronically (e.g. current fold-back) or electrically (e.g. fuse). Typically a fuse value greater than 10A is suggested, subject to suitability of application.

Ensure the dc power source provides reinforced (or double) isolation protection to the user if operated from a hazardous voltage (e.g. the mains).

6.3.2 EARTHING

Ensure the earth terminal on the power supply is connected to a reliable protective earth using heavy gauge multi-strand cable and M5 crimp terminal. Please note that the connections made to the earth terminal must be made in the order specified in Fig. 1.

6.3.3 HIGH VOLTAGE OUTPUT

The high voltage outputs are available on the rear of the 19" rack power supply and front of the module version. Ensure the HiTek Power HV connector assembly is properly fitted and secured to the rear panel.

6.3.4 FIBRE OPTIC CABLES

The fibre optic cables should be fitted to the appropriate connectors as follows: RS232, Gun, and Chamber interlocks. Note, the chamber interlock is not used on the O1 and O2 versions.

Note: For safety, any external circuits connected to the fibre optic cable circuitry must provide reinforced (or double) insulation from any hazardous voltages.

7. MAINTENANCE / COMPONENT REPLACEMENT

7.1 REPLACEMENT OF COMPONENTS (INCLUDING FUSES)

Any components that are believed to be faulty must be replaced by HiTek Power (see Repairs, Section 8.0).

It is not permissible for an operator to replace any fuses within the power supply. Instead the power supply must be returned to HiTek Power.

For reference the fuse fitted within the power supply is detailed as:

FS1 Input Fuse: Little-fuse 473 Series, 125V 5A MRT1L slow blow.

7.2 REPLACEMENT OF CONSUMABLES, ROUTINE MAINTENANCE OF PARTS

There are no consumables to replace, neither are there parts that require routine maintenance. If required, the power supply may be returned to HiTek Power for recalibration (see Section 8.0).

7.3 CLEANING

It is recommended that should the power supply require internal cleaning it should be returned to HiTek Power. The exterior of the equipment must only be cleaned with a dry lint free cloth.

8. REPAIRS

During the warranty periods, HiTek Power will repair all PSUs free of charge, providing the PSU has not been serviced/repaired by anyone other than HiTek Power personnel.

For repair or recalibration it is recommended that the complete power supply/instrument be returned.

Contact our service department who will issue you with a “returns material authorisation” (RMA) number and advise shipping instructions.

Please ensure adequate care is taken with packing and arrange insurance cover against transit damage or loss.

NB: failure to adhere to this procedure may cause unnecessary delays or incur extra cost.

EMEA

Phone +44 (0) 1903 712400
Fax +44 (0) 1903 712500
supportcentre@aei.com

HiTek Power Ltd.
Hawthorn Road
Littlehampton
West Sussex
BN17 7LT

AMERICAS

Phone +1 (978) 352-9100
Fax +1 (978) 352-9133
us.support@aei.com

Advance Energy Industries, Inc.
124 Jewett Street Unit 2
Georgetown, MA 01833-1868
USA

JAPAN

Phone +81 (6) 6271-8180
Fax +81 (6) 6271-8190
Info@hitekpowerjapan.co.jp

HiTek Power Japan.
1-5-13 Kyutaroumachi
Chuo-Ku
Osaka 541-0056
Japan

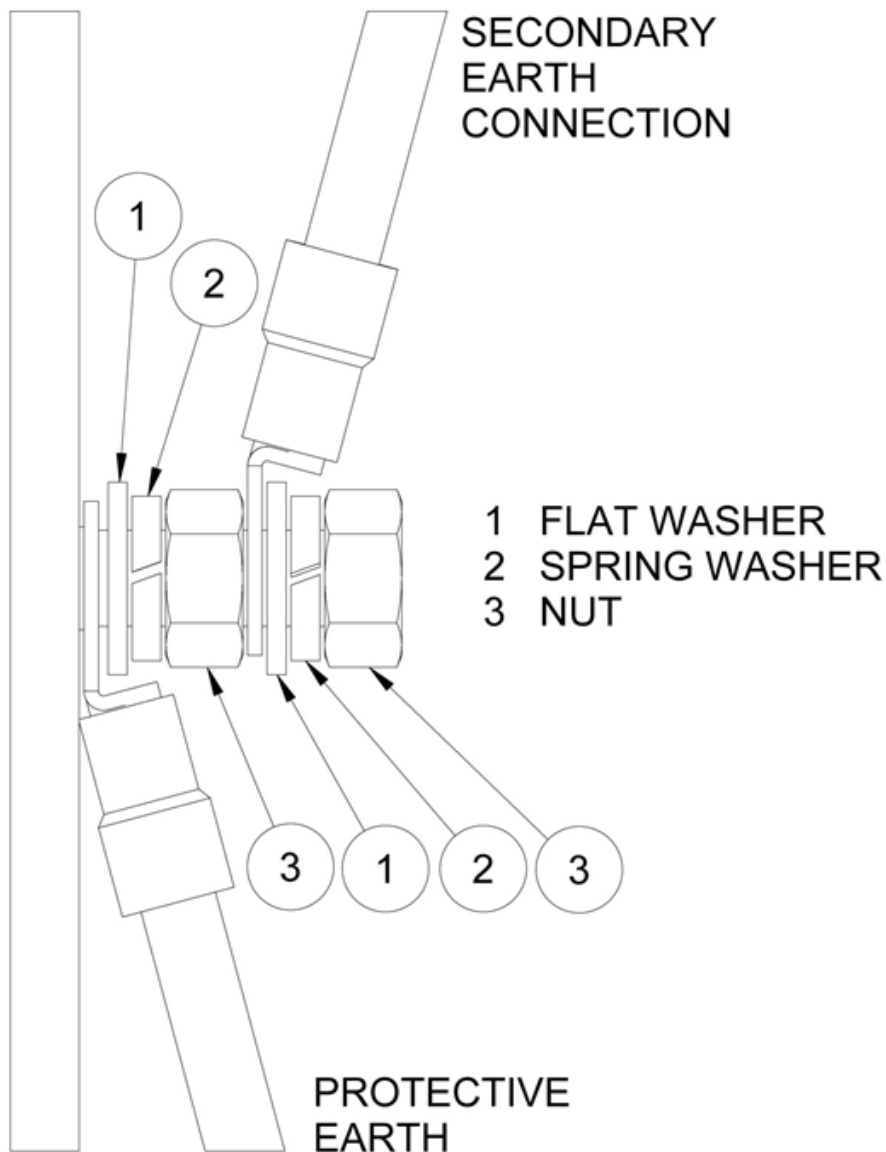
FIG. 1 WIRING OF THE EARTH TERMINAL ASSEMBLY

FIG. 2 MECHANICAL OUTLINE OF 19 INCH RACK

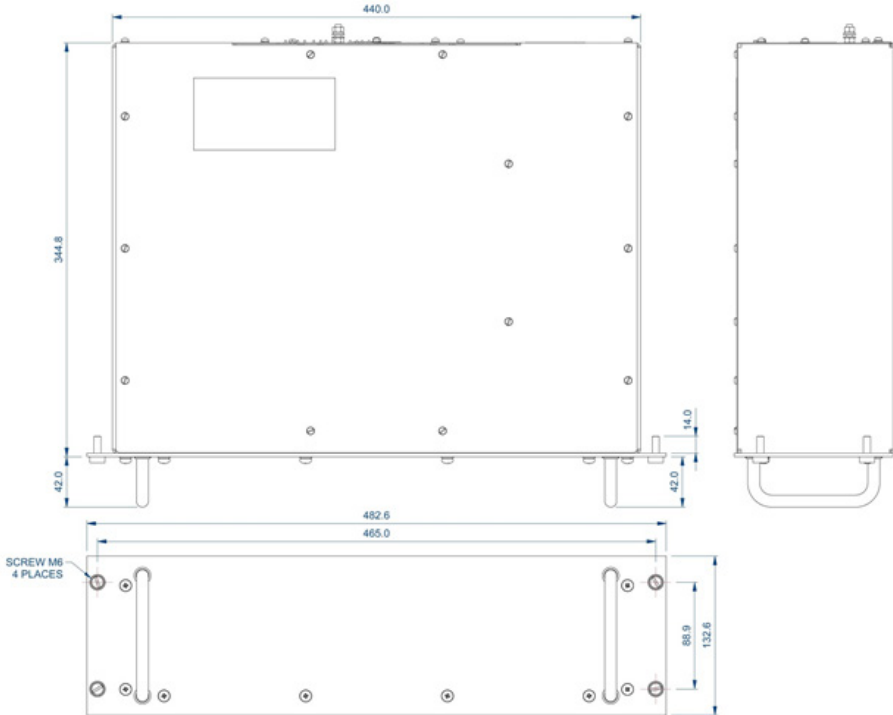
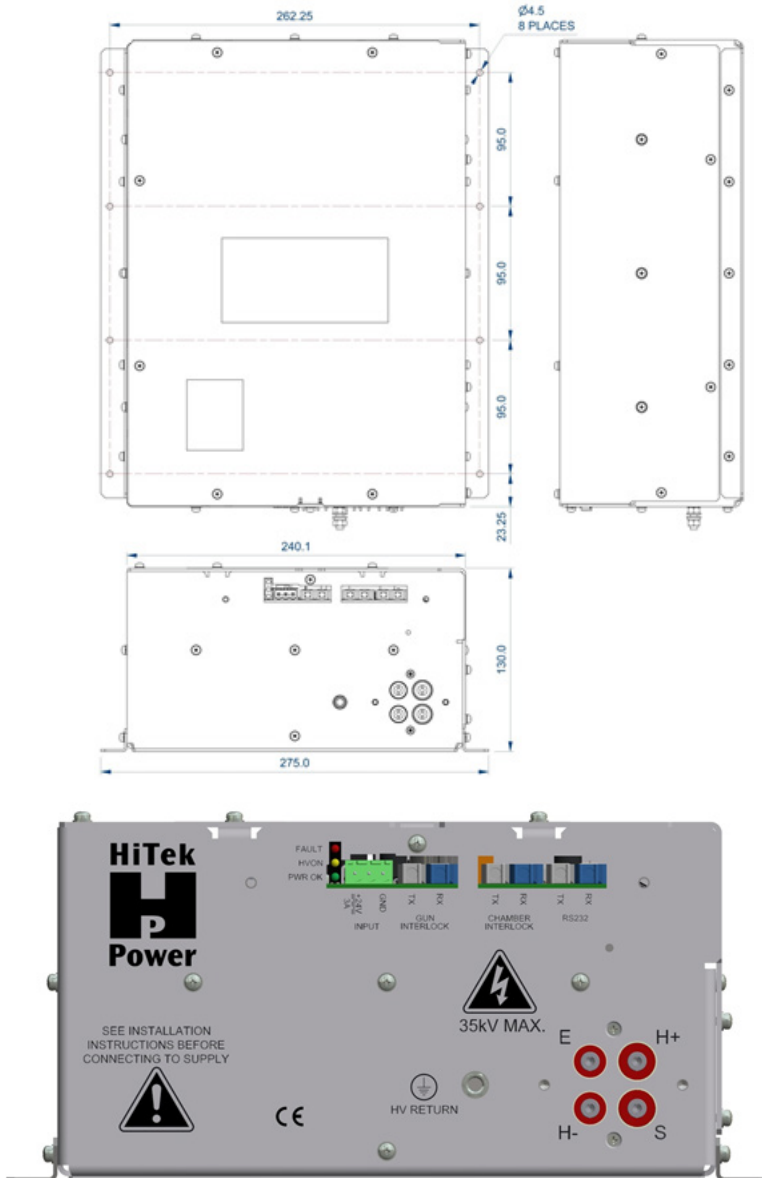


FIG. 3 MECHANICAL OUTLINE OF MODULE





For international contact information, visit
advanced-energy.com.

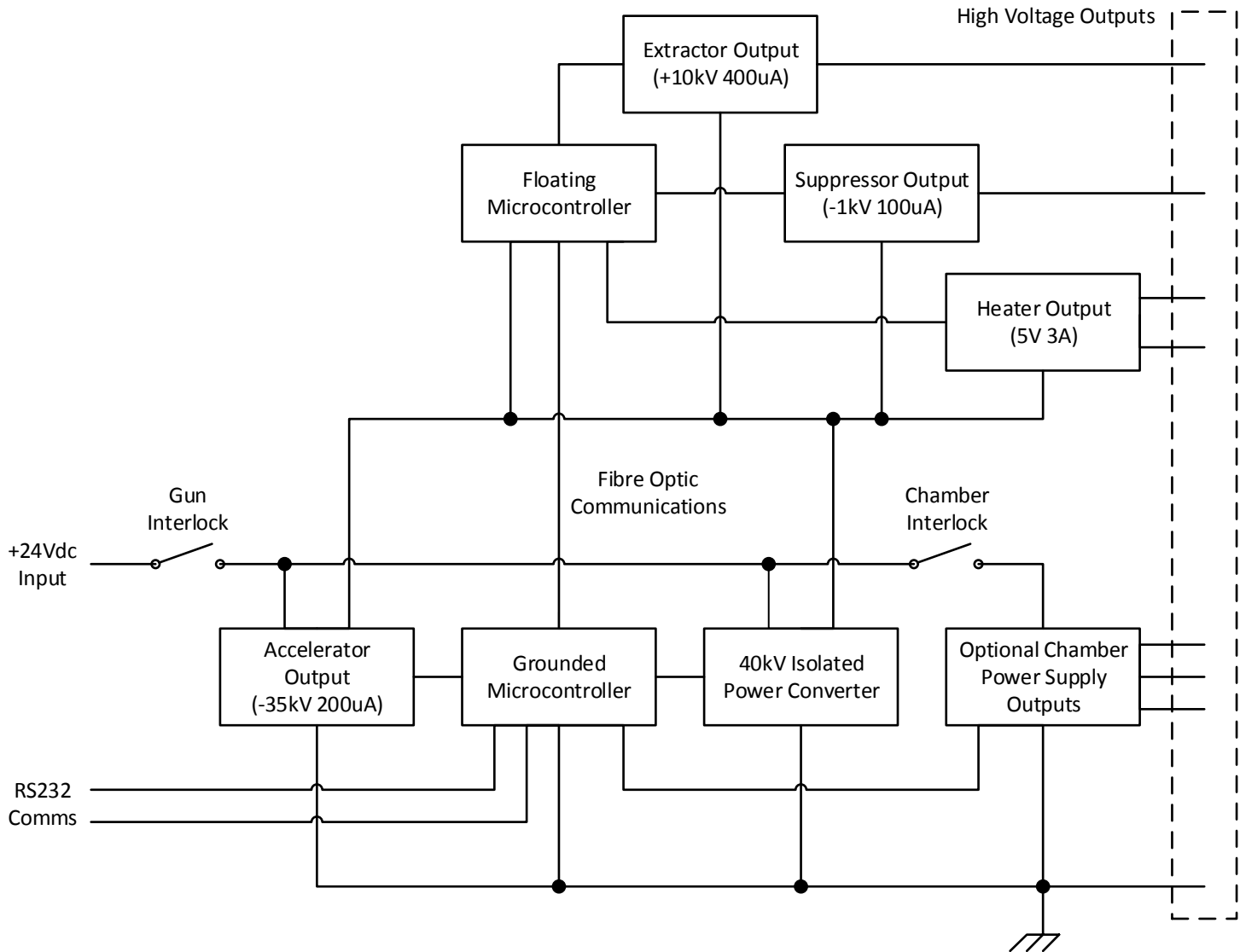
Specifications are subject to change without notice.

© 2017 Advanced Energy Industries, Inc. All rights reserved. Advanced Energy® is a trademarks of Advanced Energy Industries, Inc.



EG353 BLOCK DIAGRAM

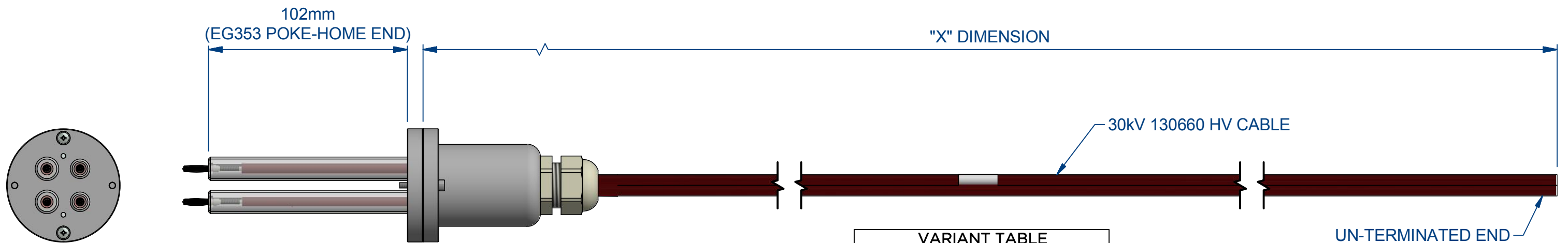
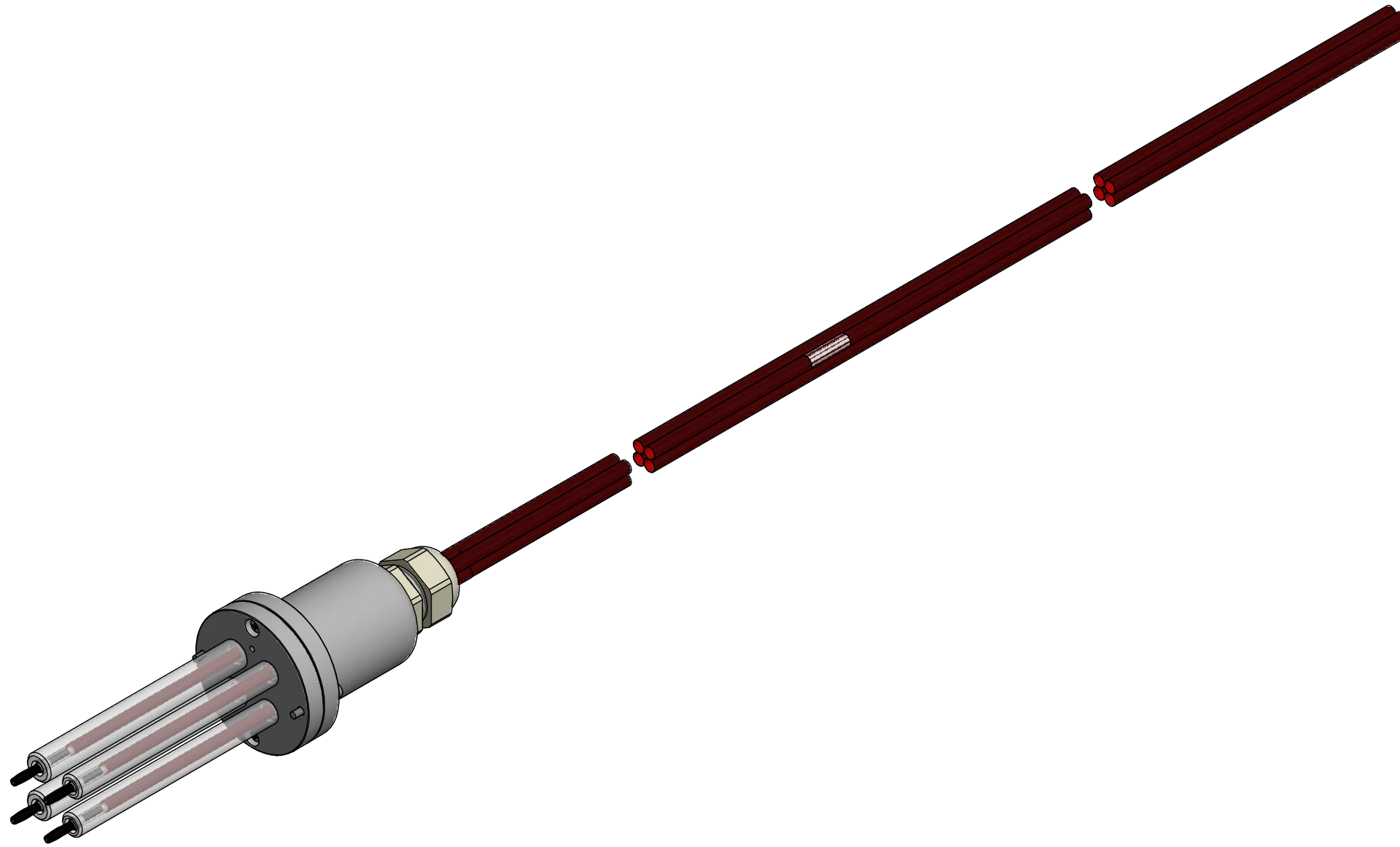
EG353 HV BLOCK DIAGRAM





EG353 HV CABLE OPTIONS

EG353 HV CABLE OPTIONS

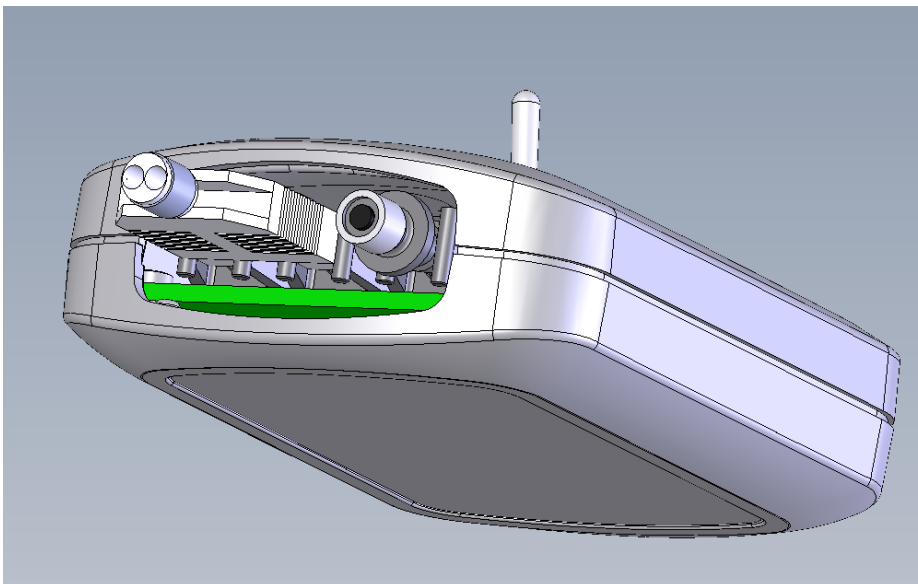
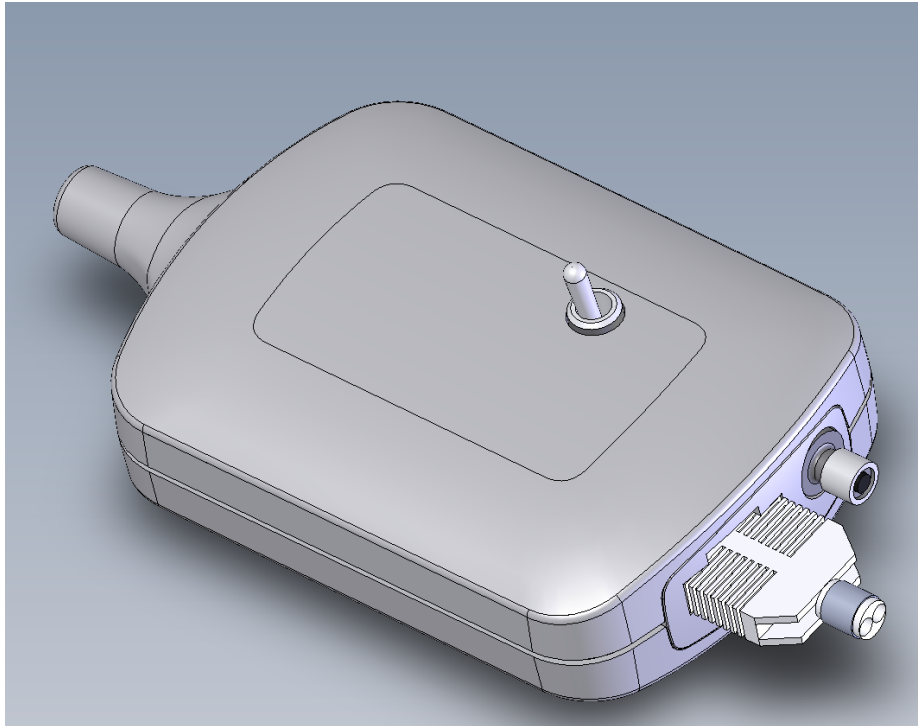


VARIANT TABLE	
VARIANT	"X" DIMENSION
A1053803-1M0	1000mm
A1053803-3M0	3000mm
A1053803-5M0	5000mm



SERIAL TO OPTO INTERFACE

Serial to Opto Interface



The Serial to Optical Interface is an optional extra that can be ordered, part number: 33400218-00.

This assembly is used to connect the controlling PC to the EG353 unit when used with our control software, please refer to the GUI chapter. It also provides a manual interlock switch.

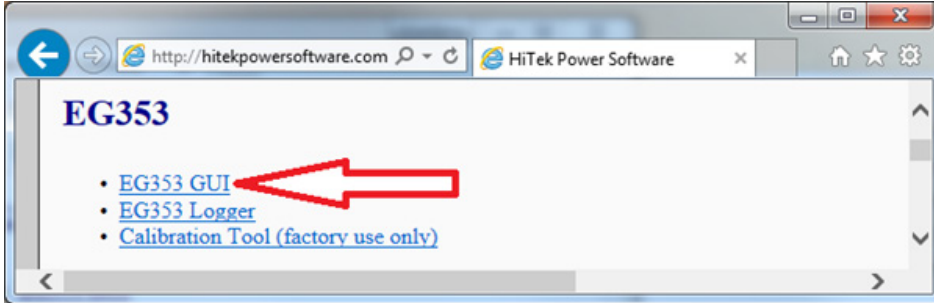


GUI INSTRUCTION GUIDE FOR EG353 SERIES

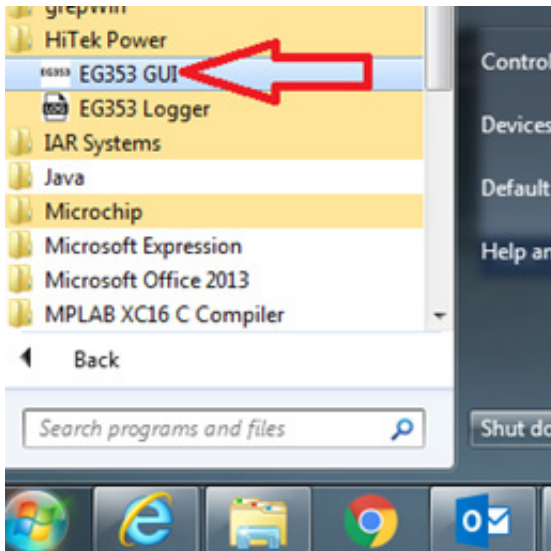
THIS DOCUMENT SHALL NOT BE COPIED, REPRODUCED OR MADE AVAILABLE IN ANY FORM OR FOR ANY PURPOSE, OTHER THAN FOR WHICH IT IS SUPPLIED, WITHOUT THE PRIOR WRITTEN CONSENT OF HITEK POWER LTD.

HITEK POWER RESERVES THE RIGHT TO MAKE IMPROVEMENTS TO THE PRODUCT WITHOUT NOTICE.

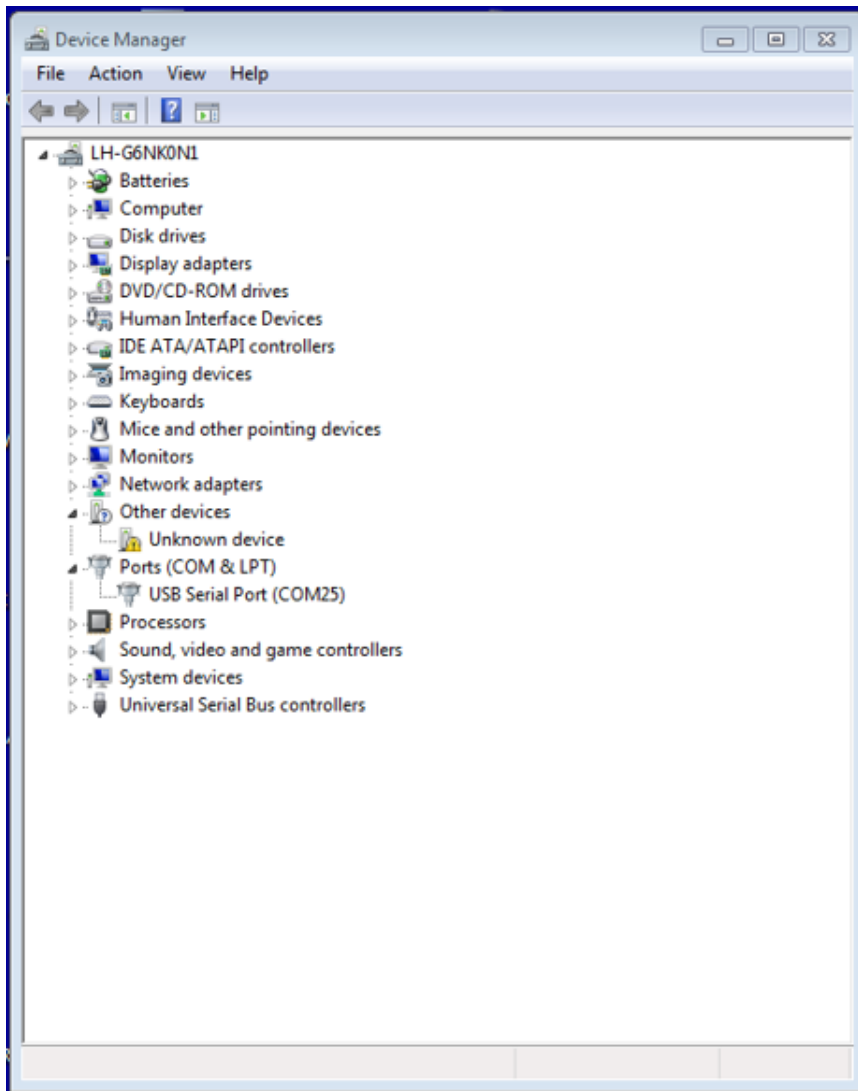
For detailed install instructions, follow this link to the EG353 GUI page
<http://www.hitekpowersoftware.com/>



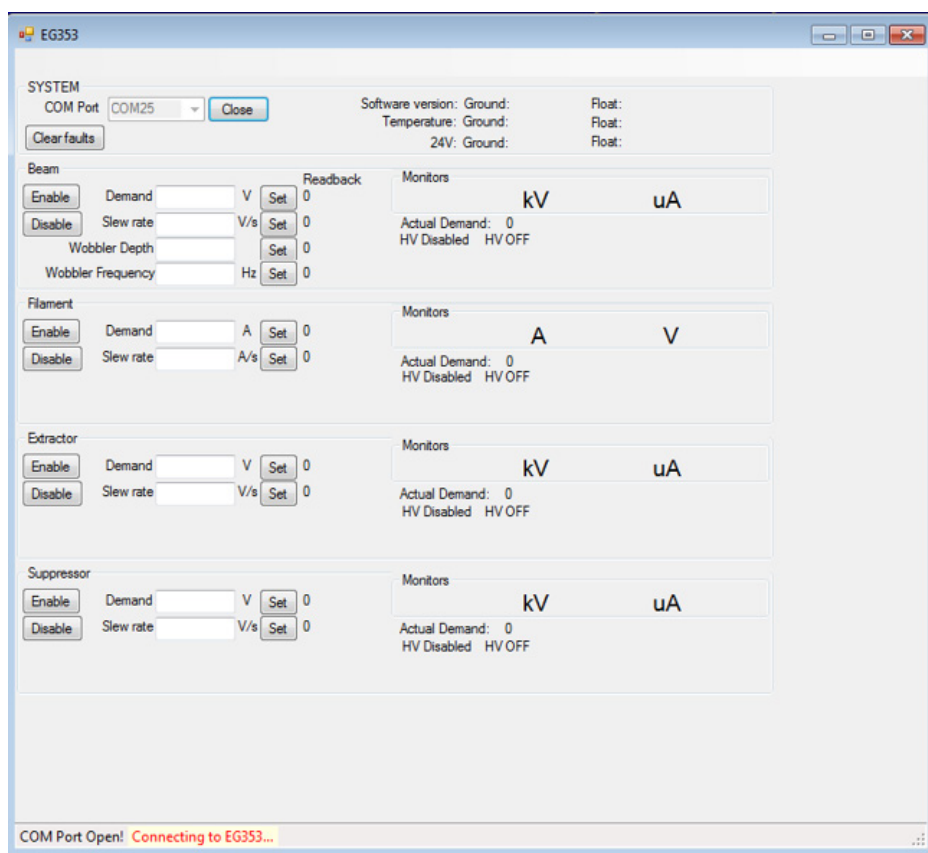
Detailed install instructions and addition help information are available from here
Once installed, launch the application from the 'start button'



Identify comm port using windows Device Manager.



Enter com port number in the GUI box titled “System Com Port”.



Ensure that the EG353 HV return and other output connections are connected and that the HV outputs are terminated properly.

Connect up the EG353 to the +24VDC, close the 'gun interlock', and RS232 link to the pc. With Gun interlock 'open' and the RS232 link connected to the PC, turn on the +24VDC supply, this should take around 200mA.

The GUI should connect and display the grounded software version, temperature, +24VDC supply, and interlock faults.

The screenshot shows the EG353 control interface. At the top, the 'SYSTEM' section includes a 'COM Port' dropdown set to 'COM25' and a 'Close' button. Below this is a 'Clear faults' button. The top right corner displays system information: 'Software version: Ground: r5419', 'Temperature: Ground: 32.55°C', and '24V: Ground: 24.01V'. The main interface is divided into several sections for different components, each with 'Enable' and 'Disable' buttons, 'Demand' and 'Slew rate' input fields, and 'Set' buttons. The 'Beam' section shows a 'Readback' of 0V and a 'Monitors' display showing 4.30V and -0.16uA. The 'Filament' section shows 'Monitors' for A and V. The 'Extractor' section shows 'Monitors' for kV and uA. The 'Suppressor' section shows 'Monitors' for kV and uA. Each section also displays 'Actual Demand' and 'HV Disabled' status, and a red 'Fault: Interlock;' message is visible in the monitor area of each section. At the bottom of the window, a status bar reads 'COM Port Open! EG353 Connected!'.

'close' the Gun interlock, the +24Vdc current should increase to approx 500mA
 Note the interlock fault has flagged up.

EG353

SYSTEM
 COM Port COM25 Software version: Ground: r5419 Float: r0
 Temperature: Ground: 30.49°C Float: 26.66°C
 24V: Ground: 23.97V Float: 23.45V

Beam
 Demand V Readback 0V
 Slew rate V/s 3.500V/s
 Wobbler Depth 0
 Wobbler Frequency Hz 1Hz
 Monitors
4.09V **-0.16uA**
 Actual Demand: 0V
 HV Disabled: HV OFF
Fault: Interlock;

Filament
 Demand A 0A
 Slew rate A/s 0.1A/s
 Monitors
0.00A **0.00V**
 Actual Demand: 0A
 Disabled: OFF

Extractor
 Demand V 0V
 Slew rate V/s 1.000V/s
 Monitors
-1.44V **0.09uA**
 Actual Demand: 0V
 HV Disabled: HV OFF

Suppressor
 Demand V 0V
 Slew rate V/s 100V/s
 Monitors
1.10V **0.06uA**
 Actual Demand: 0V
 HV Disabled: HV OFF

To clear interlock fault click on "Clear Faults" button.

EG353

SYSTEM
 COM Port COM25 Software version: Ground: r5419 Float: r5419
 Temperature: Ground: 30.67°C Float: 32.53°C
 24V: Ground: 23.97V Float: 23.45V

Beam
 Demand V Readback 0V
 Slew rate V/s 3.500V/s
 Wobbler Depth 0
 Wobbler Frequency Hz 1Hz
 Monitors
4.26V **-0.16uA**
 Actual Demand: 0V
 HV Disabled: HV OFF

Filament
 Demand A 0A
 Slew rate A/s 0.1A/s
 Monitors
0.00A **0.00V**
 Actual Demand: 0A
 Disabled: OFF

Extractor
 Demand V 0V
 Slew rate V/s 1.000V/s
 Monitors
-1.42V **0.09uA**
 Actual Demand: 0V
 HV Disabled: HV OFF

Suppressor
 Demand V 0V
 Slew rate V/s 100V/s
 Monitors
1.10V **0.06uA**
 Actual Demand: 0V
 HV Disabled: HV OFF

Disable then enable each output in turn.

Then set demand value- click "set" or press enter. (Note the - sign for Beam and Suppressor).

EG353 GUI

SYSTEM
COM Port: COM25 [Close] Software version: Ground: r5419 Float: r5419
Temperature: Ground: 37.28°C Float: 45.76°C
24V: Ground: 23.68V Float: 22.44V

Clear faults

Beam
[Enable] Demand: -30000 V [Set] -30.000V Monitors: -30,002.66V -182.50µA
[Disable] Slew rate: V/s [Set] 3.500V/s Actual Demand: -30.000V
Wobbler Depth: [Set] 0 HV Enabled HV ON
Wobbler Frequency: Hz [Set] 1Hz

Filament
[Enable] Demand: 3 A [Set] 3A Monitors: 3.00A 3.99V
[Disable] Slew rate: 1 A/s [Set] 1A/s Actual Demand: 3A
Enabled OFF

Extractor
[Enable] Demand: 8000 V [Set] 8,000V Monitors: 8,001.39V 322.63µA
[Disable] Slew rate: V/s [Set] 1,000V/s Actual Demand: 8,000V
HV Enabled HV ON

Suppressor
[Enable] Demand: -1000 V [Set] -1,000V Monitors: 1,000.03V -100.23µA
[Disable] Slew rate: V/s [Set] 100V/s Actual Demand: -1,000V
HV Enabled HV ON



For international contact information, visit
advanced-energy.com.

Specifications are subject to change without notice.

© 2017 Advanced Energy Industries, Inc. All rights reserved. Advanced Energy® is a trademarks of Advanced Energy Industries, Inc.



LOGGING SOFTWARE FOR EG353 SERIES

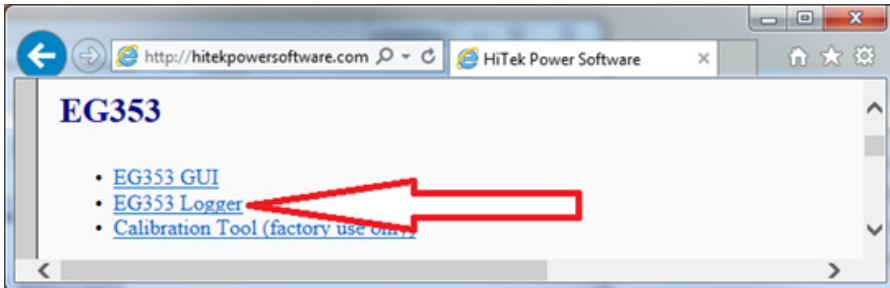
THIS DOCUMENT SHALL NOT BE COPIED, REPRODUCED OR MADE AVAILABLE IN ANY FORM OR FOR ANY PURPOSE, OTHER THAN FOR WHICH IT IS SUPPLIED, WITHOUT THE PRIOR WRITTEN CONSENT OF HITEK POWER LTD.

HITEK POWER RESERVES THE RIGHT TO MAKE IMPROVEMENTS TO THE PRODUCT WITHOUT NOTICE.

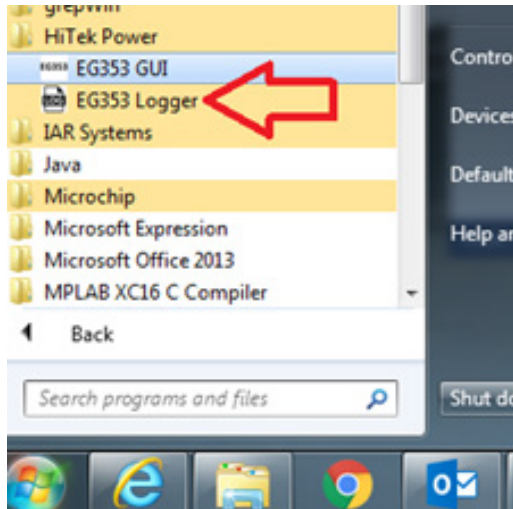
Use to collect performance data over a period of time. This includes temperature, output monitors and diagnostic data.

For detailed install instructions, follow this link to the 'EG353 Logger' page

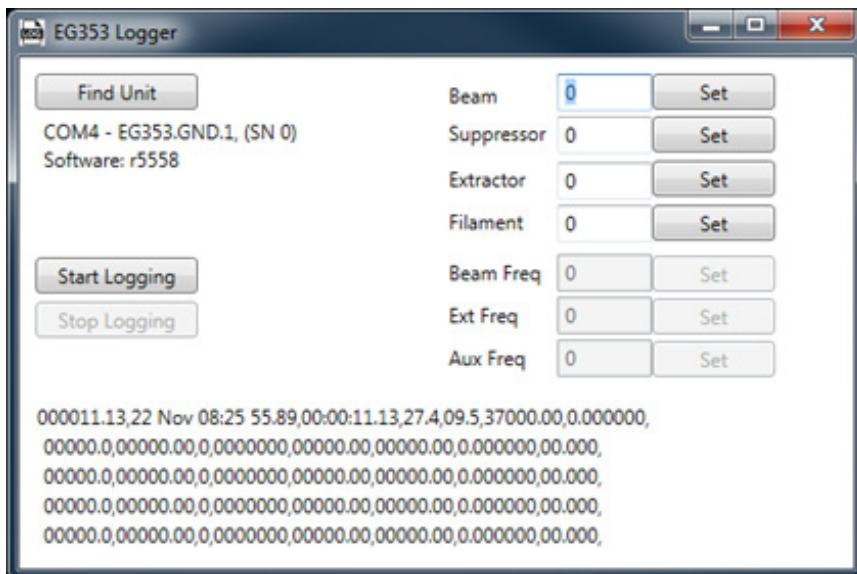
<http://www.hitekpowersoftware.com/>



Once installed, launch the application from the 'start button'



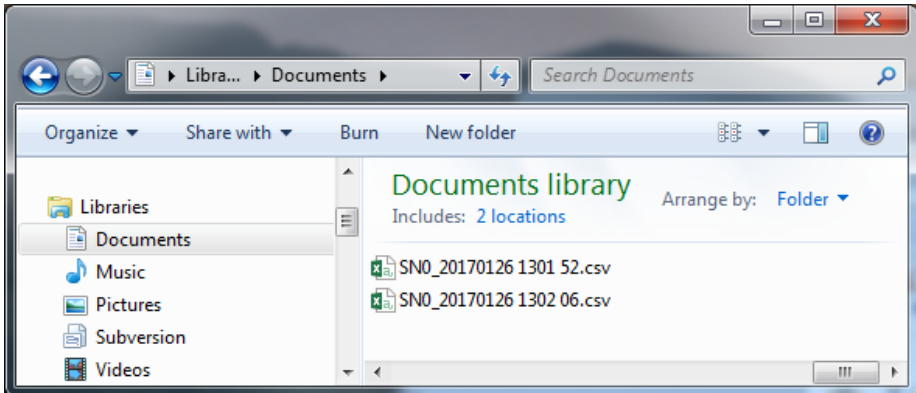
Screenshot:



INSTRUCTIONS

- › Application will AutoDetect the EG353 on start-up
- › Make sure the COM port is not in use
- › Set demands and wait for the output to settle
- › Click 'Start Logging' to collect data
- › Finish by clicking 'Stop Logging' button

All data is written to a timestamped CSV file in the 'Documents' directory under the users local profile. "C:\Users\<<username>>\Documents"



Description of CSV fields:

*_va = voltage actual

*_mv = voltage monitor

*_im = current monitor

For Engineering use only

*_fa = frequency actual

*_fm = frequency monitor (Stack PWM frequency. Beam and Extractor only)

*_ph = Phase difference (0.0 = Stack is working at optimal PWM frequency. Beam and Extractor only)

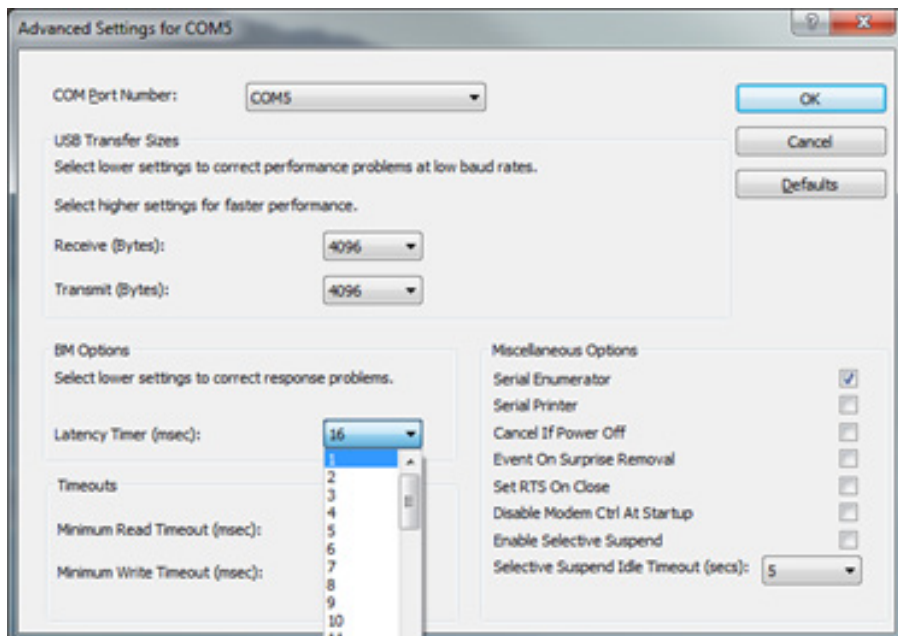
TIPS

For better graph visualisation, don't change demands while logging.

Datplot is recommended for graphing large datasets: <http://www.datplot.com/>

To greatly increase the poll rate, change the latency setting to 1ms from Device Manager:

Ports (COM & LTP) -> USB Serial Port (COM??) -> Right Click, Properties -> Port Settings -> Advanced -> Latency Timer (msec) -> 1ms





For international contact information, visit
advanced-energy.com.

Specifications are subject to change without notice.

© 2017 Advanced Energy Industries, Inc. All rights reserved. Advanced Energy® is a trademarks of Advanced Energy Industries, Inc.



CERTIFICATION



CERTIFICATE

No. U8 16 10 50060 020

Holder of Certificate: **HiTek Power Limited**
(an Advanced Energy company)

Hawthorn Rd, Littlehampton
West Sussex
BN17 7LT
UNITED KINGDOM

Production Facility(ies): 50060

Certification Mark:



C US

Product: **Power supply**
High Voltage Power Supply

Model(s): **EG353**
EG353R
EG353-01
EG353-02

Parameters:

Rated Voltage:	24Vdc
Rated Current:	3A
Protection Class:	Class I
Accelerator output:	-30kVdc, 200µA
Accelerator referenced outputs:	
Extractor output:	10kVdc, 400µA
Suppressor output:	-1kVdc, 100µA
Heater output:	3Adc at 5V max.

Tested according to: UL 61010-1:2012
CAN/CSA C22.2 No. 61010-1:2012

The product was voluntarily tested according to the relevant safety requirements noted above. It can be marked with the certification mark above. The mark must not be altered in anyway. This product certification system operated by TÜV SÜD America Inc. most closely resembles system 3 as defined in ISO/IEC 17067. Certification is based on the TÜV SÜD "Testing and Certification Regulations". TÜV SÜD America Inc. is an OSHA recognized NRTL and a Standards Council of Canada accredited certification body.

Test report no.: 071-75936535T-000

Date, 2016-11-23

Page 1 of 1

