



VISHAY INTERTECHNOLOGY, INC.

## HIGH-VOLTAGE SYSTEMS

Vishay ESTA



HIGH-VOLTAGE SYSTEMS

MARKET SOLUTIONS

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# **High-Voltage Systems for Image Intensifier, Electrostatic Painting, Powder Coating, and Air Filtering Systems**

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### Customer-Specific High-Voltage Systems with the Highest Reliability for More Than 40 Years

This catalog presents various high-voltage systems for applications such as image intensifiers, electrostatic painting and coating systems for automotive and industrial applications, and air filtering systems. Vishay has been producing modular high-voltage systems such as these for more than 40 years.

#### Solution Examples

A high-voltage system for an **image intensifier** (Figure 1) comprises a transformer, cascade, and integrated electronic circuit based on a microcontroller, which carries out control and communication with an overlaying electronic control.

Automotive **electrostatic painting systems**, whether using liquid paint or heat-meltable powder, require a high voltage system with an output voltage 100 kV and output current of 100  $\mu$ A to 500  $\mu$ A. The high-voltage system provided by Vishay consists of a generator (Figure 2) and a control unit (Figure 3), which is installed in a control cabinet.

These two modules are integrated (Figure 4) and then installed in the painting robot arm, achieving a better accuracy of adjustment of the high-voltage amplitude or the load current depending on load resistance, which is given by the distance between the sprayer and the part being coated. Further advantages of the new high-voltage system include reduction of assembly and material costs. A microcontroller, which supports protocols such as CAN, PROFIBUS, and SERCOSIII, enables communication between the main control computer of the painting facility and the high-voltage system.

Microcontroller-based high voltage systems for **electrostatic air filtering applications** are designed for output voltages from 0 kV to  $\pm$  100 kV and current levels from  $\pm$  1 mA to  $\pm$  10 mA (Figure 5).

These high-voltage systems are compliant with the directive 94/9/EC (ATEX95) and designed and tested in compliance with EN 60079-15:2004, EN60079-11:2007, EN 50176:2005, EN 50177:2007, EN 50223:2001, and EN 50348:2008 for use in zone 2/22, device group II and device category 3G/2D.

#### Total Quality Management

Vishay's high-voltage products have been manufactured for the past two decades according to TQM guidelines for the following areas: control, assurance and improvement. Our certifications include DIN EN ISO 9001 from 1993 until 2008 and DIN ISO 14001:2004 from 2004.

Figure 1.

High voltage system for image intensifier



Figure 2.

High voltage generator for electrostatic painting



Figure 3.

Control unit for high voltage electrostatic painting



Figure 4.

Integrated high voltage system



Figure 5.

High voltage system for electrostatic air filtering



### High-Voltage System for Image Intensifier

This high-voltage image intensifier system for medical applications provides five different output voltages. All input and output connectors are protected against short circuit and overvoltage. The system complies with IEC 60601-1 for safe operation of electrical devices for medical applications. The control of all functions and communication is based on a 16-bit microcontroller.

#### Technical Data

Supply voltage	24 V $\pm$ 10 %
Max. current consumption	350 mA
Zoom control	Digital RS232
Output voltage range $V_{AD}$	29 kV to 31 kV
Current $I_{AD}$	0 to 5 $\mu$ A
Voltage tolerance $V_{AD}$	$< \pm 0.5$ %
Output voltage range $V_p$	2.5 kV to 3.0 kV
Current $I_p$	0 to 20 $\mu$ A
Display/Scan $I_p$	TP/RS232
Output voltage range $V_{E3}$	2 kV to 15 kV
Current $V_{E3}$	0 to 5 $\mu$ A
Voltage tolerance $V_{E3}$	$< \pm 0.5$ %
Number of level $V_{E3}$	8
Short-circuit-proof $V_{E3}$	Yes
Output voltage range $V_{E2}$	2 V to 930 V
Current $V_{E2}$	0 to 5 $\mu$ A
Voltage tolerance $V_{E2}$	$< \pm 0.5$ %
Number of level $V_{E2}$	8
Short-circuit-proof $V_{E2}$	Yes
Output voltage range $V_{E1}$	2 V to 600 V
Current $V_{E1}$	0 to 5 $\mu$ A
Voltage tolerance $V_{E1}$	$< \pm 0.5$ %
Number of level $V_{E1}$	8
Short-circuit-proof $V_{E1}$	Yes
Communication:	RS232
Dimensions:	140 mm x 140 mm x 50 mm
Weight:	0.8 kg
Operating temperature:	- 10 °C to + 60 °C max
Storage temperature:	- 25 °C to + 85 °C





### High-Voltage System for Electrostatic Surface Painting

This new integrated electronically controlled system for electrostatic painting in automotive and industrial applications consists of a high-voltage generator and a high-voltage control unit. By integrating these two modules and installing them in the painting robot arm, this system achieves more accurate high-voltage adjustments, since the load current depends on load resistance, which is given by the distance between the sprayer and the part being coated. The system also reduces assembly and material costs and allows use of a microcontroller for control and communication over such protocols as CAN, PROFI, or SERCOSIII-Bus with a facility's main computer.



This high-voltage system conforms with the directive 94/9/EC (ATEX95) and is designed and tested according to EN60079-15:2004, EN60079-11:2007, EN50176:2005, EN50177:2007, EN50223:2001, and EN50348:2008. The system is qualified for use in the zone 2/22, device group II with device category 3G/3D and IP65. Customer-specific high-voltage systems are available for output voltages from  $\pm 10$  kV to  $\pm 100$  kV and currents from  $\pm 30$   $\mu$ A to  $\pm 1000$   $\mu$ A.

#### Technical Data

Type	61xx	61xx	61xx
Supply voltage $V_{IN}$	28 V	28 V	28 V
Max. input current $I_{IN}$	3.2 A	2.7 A	1.7 A
Max. output voltage $V_{OUT}$	- 100 kV	- 100 kV	- 100 kV
Max. output current $I_{OUT}$	- 500 $\mu$ A	- 200 $\mu$ A	- 100 $\mu$ A
Output power $P_{OUT}$	50 W	20 W	10 W
Dimensions in mm	400 x $\varnothing$ 60	400 x $\varnothing$ 60	400 x $\varnothing$ 60
Weight	1.5 kg	1.5 kg	1.5 kg

Communication: Analog or digital  
Operating temperature: - 10 °C to + 60 °C max  
Storage temperature: -25 °C to + 85 °C

## High-Voltage Systems for Electrostatic Surface Painting in Automotive and Industrial Applications

These high-voltage generators consist of a high voltage transformer, capacitors, and diodes which build a high-voltage cascade and an integrated electronic circuit for converting DC voltage to AC voltage.

**Figure 6** shows the HVG-50 of the series 6122, which complies with ATEX95 and is qualified by the “Physikalisch-Technische Bundesanstalt” PTB-04 ATEX 5006 for the use in zone 2 and 22 and device category 2G and D.

**Figure 7** shows the HVG-100 with type 6124/-6, which is designed for electrostatic painting in automotive applications. This high-voltage generator complies with 94/9/EC (ATEX95) and is designed and tested according to EN 60079-15:2004, EN60079-11:2007, EN 50176:2005, EN 50177:2007, EN 50223:2001, and EN 50348:2008. The system is qualified for the use in zone 2/22, device group II with device category 3G/3D and IP65.

Customer-specific high-voltage systems are available for output voltages from  $\pm 10$  kV to  $\pm 100$  kV and currents from  $\pm 30$   $\mu$ A to  $\pm 1000$   $\mu$ A.

### Technical Data

Type	6122	6124	6126
Supply voltage $V_{IN}$	0 - 36 V	0 - 36 V	0 - 36 V
Max. input current $I_{IN}$	0.4 A	0.8 A	2.2 A
Max. output voltage $V_{OUT}$	- 80 kV	- 100 kV	- 100 kV
Max. output current $I_{OUT}$	- 50 $\mu$ A	- 100 $\mu$ A	- 500 $\mu$ A
Output power $P_{OUT}$	4 W	10 W	50 W
Dimensions in mm	130 x 40 x 40	400 x $\varnothing$ 65	400 x $\varnothing$ 65
Weight	0.4 kg	1.5 kg	1.5 kg

Operating temperature: - 10 °C to + 60 °C max

Storage temperature: - 25 °C to + 85 °C

**Figure 6.**

HVG-50 of the series 6122 is qualified by PTB 04 ATEX 5006



**Figure 7.**

HVG-100 of the series 6124/-6 is qualified as device group II with device category 3G/3D and IP65





### Control Unit for 6122/-4/-6 High-Voltage Systems

The CU-100 control unit consists of five printed circuit boards. Each PCB has a certain function as follows:

1. Switching power supply for other PCBs
2. Switching power supply for HVG 36 V DC
3. Control and monitoring of voltages and currents
4. Control and monitoring of voltages and currents
5. Reference values presetting



#### Technical Data

Supply voltage $V_{IN1}$	36 V AC + 5 % - 10 % 50/60 Hz
Max input current $I_{IN1}$	3.0 A
Supply voltage $V_{IN2}$	2 x 15 V AC $\pm$ 10 % 50/60 Hz
Max input current $I_{IN1}$	0.5 A

#### Reference values of the analog control inputs:

Output voltage 0 - 10 V	(- 2 kV to - 100 kV)
Output current 0 - 10 V	(0 to - 1 mA)
Shutdown threshold I 0 - 10 V	(0 to - 1 mA)
Shutdown threshold V 0 - 10 V	(0 to - 100 kV)
Shutdown threshold $I_{Dynamic}$ 0 - 10 V	(0 to - 100 $\mu$ A/s)
Shutdown threshold $V_{Dynamic}$ 0 - 10 V	(0 to - 200 kV/s)

#### Digital control inputs:

High voltage ON	+ 24 V
Commutate voltage-/current constant	+ 24 V
Shutdown dynamic threshold	+ 24 V
Failure acknowledgement (Reset)	+ 24 V
Paint release	+ 24 V
Advance warning	+ 24 V
Shutdown threshold current	0 V
Shutdown dynamic threshold current	0 V
Shutdown dynamic threshold voltage	0 V
Shutdown min. voltage	0 V

#### Analog actual value outputs:

Actual voltage outputs 0 - 10 V	(0 to - 100 kV)
Actual current outputs 0 - 10 V	(0 to - 1 mA)

#### Dimensions:

Plug-in cassette	3HE/42TE
Weight	2 kg
Operating temperature	- 10 °C to max. + 80 °C at heat sink
Storage temperature	- 25 °C bis + 85 °C



## High-Voltage Generators with DC and AC Supply Voltage for Powder Coating

Vishay's 5502-19726123000 /-010 high-voltage generators (Figures 8 and 9) feature a DC supply voltage of 0 V to 24 V and are designed for use in spray gun or stationary installed spraying cabins for powder coating.

### Technical Data

Type	610023000	6123010
Supply voltage $V_{IN}$	0 to 24 V DC	0 to 24 V DC
Max. input current $I_{IN}$	0.4 A	0.6 A
Output voltage $V_{OUT}$	- 60 kV	- 100 kV
Output current $I_{OUT}$	- 100 $\mu$ A	- 100 $\mu$ A
Output power $P_{OUT}$	6 W	10 W
Dimensions in mm	110 x $\varnothing$ 25	170 x $\varnothing$ 25
Weight	0.113 kg	0.163 kg

Operating temperature: - 10 °C to + 80 °C max  
 Storage temperature: - 25 °C to + 85 °C

The 5502-19726136012 high-voltage generator (Figure 10) features an AC supply voltage of 0 V to 18 V and is intended for use in spray gun or stationary installed spraying cabins for powder coating.

### Technical Data

Supply voltage $V_{IN}$	0 to 18 V AC
Operating frequency	40 kHz to 43 kHz
Max input current $I_{IN}$	< 1.5 A with $R_{load} = 1 \text{ G}\Omega$
Max input current $I_{IN}$	< 600 mA with $R_{load} = 10 \text{ G}\Omega$
Output voltage $V_{OUT}$	- 100 kV
Output current $I_{OUT}$	- 100 $\mu$ A
Output power $P_{OUT}$	10 W
Dimensions	144 mm x $\varnothing$ 27 mm
Weight	0.155 kg

Operating temperature: - 10 °C to max. + 60 °C  
 Storage temperature: - 25 °C to + 85

Figure 8.  
HVG 5502-19726123000



Figure 9.  
HVG 5502-19726123010



Figure 10.  
HVG 5502-19726136012





### Microcontroller-Based High-Voltage System for Electrostatic Air Filtering

This electronically controlled system for electrostatic air filtering in industrial environments consists of a high-voltage generator and a high-voltage control unit. The system can act as constant current source with voltage limiting or as a constant voltage source with a current limiting capability. Control of the high-voltage system in constant-current source mode or constant-voltage source mode, in dependence on the load, is done automatically. The system uses a microcontroller for control and communication with the main computer of the air filtering facility with the use of communication protocols such as RS485, CAN-bus, PROFI-bus or SERCOSIII-bus.



The system is qualified for the use in zone 2/22, device group II with device category 3G/3D and IP65. Customer-specific high-voltage systems are available for output voltages from  $\pm 10$  kV to  $\pm 100$  kV and current levels from  $\pm 1$  mA to  $\pm 10$  mA.

#### Technical Data

Supply voltage $V_{IN}$	110 V - 240 V AC
Max input current $I_{IN}$	6 A
Output voltage $V_{OUT}$	0 to - 100 kV
Max input current $I_{OUT}$	$\pm 1$ mA to $\pm 10$ mA

Shutdown dynamic threshold	Yes
Failure acknowledgement (Reset)	Yes
Advance warning	Yes
Shutdown threshold current	Yes
Shutdown dynamic threshold current	Yes
Shutdown dynamic threshold voltage	Yes
Shutdown min. voltage	Yes
Shutdown excess temperature	Yes
High voltage ON	Yes
Commutate voltage-/current constant	Yes
Shutdown dynamic threshold	Yes
Failure acknowledgement (Reset)	Yes

Operating temperature:	- 10 °C to max. + 80 °C at heat sink
Storage temperature:	- 25 °C bis + 85 °C



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