

3el High Voltage Pneumatic Switch

HVPS01 24p 5kV 24V



Features:

- 24 spring loaded contact pins
- configurable pin groups
- high voltage insulation up to 5kV
- pneumatic driving
- integrated pneumatic valve
- sensor feedback on cylinder positions
- low current consumption
- DIN rail compatible mounting



Description:

HVPS01 24p 5kV 24V is a pneumatically actuated, multi-pole switch, featuring high voltage insulation between the adjacent contact pairs. An individual contact pair consists of a spring loaded, branded, brass pin on the static side and a branded brass pad on the moving side of the switch. There are in total 24 contact pairs. The contacts can be electrically grouped as preferred by adding high voltage rated SMD joint components (0Ohm resistors) on the switch PCB.

The switch integrates an electrically controllable pneumatic valve and control connectors on both sides. For operation the switch needs to be supplied with compressed air and 24VDC. Switching the electric valve on and off will let the compressed air to move the cylinder forward and backward establishing and breaking the electrical connection between the contact pins and pads. The pneumatic cylinder has two magnetic sensors on both directions of movement featuring visual and digital feedback on cylinder's position. The overall power consumption of the switch is 20mA with activated valve and one sensor.

In case of pneumatic hose puncture or sudden pressure loss the switch mechanism pushes the pylons apart using two helical compression springs to a safe insulation distance.

The guaranteed electrical insulation is 5kV for every face to face and adjacent switch pole confirmed by laboratory tests. The rated life time of the switch is 60.000 switch cycles without premature aging of the pins and pads. The rest of the mechanic parts are rated for more than 300k cycles.

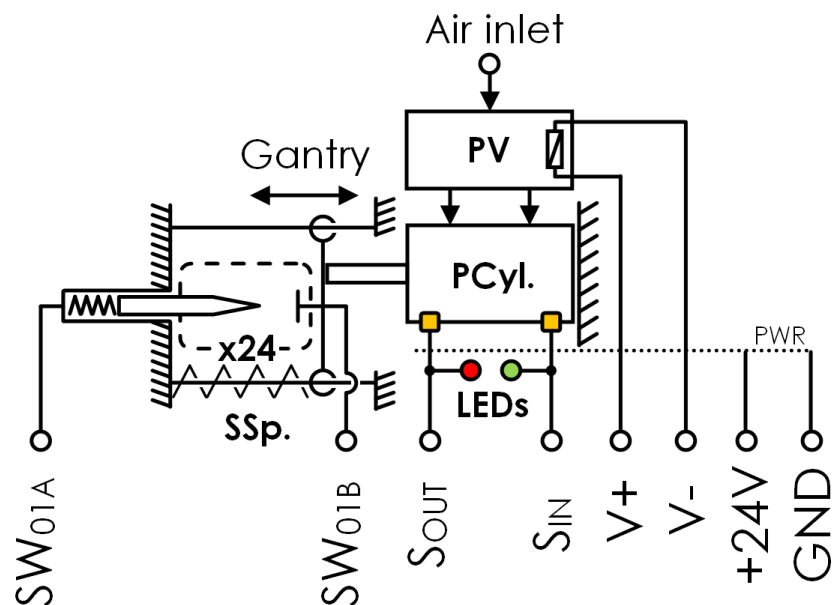
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Block schematic:

- The HVPS01245kV24V operates at $24V_{DC}$ and with compressed air
- The compressed air direction depends on the pneumatic valve (PV) state pushing forward or retracting the pneumatic cylinder's (PCyl.) piston
- The contact pads on the sliding gantry are moving forward and backward due to the movement of the piston making and breaking the electric contact between the corresponding pins and pads
- In case of sudden air loss the safety spring (SSp.) that the piston compresses against the fixed wall immediately pushes the contacts apart braking the electric circuit
- The HVPS01245kV24V integrates 24 pair of contacts formed by a fixed spring loaded pin and a moving contact pad
- The contact points are spatially positioned as far apart as required to insulate the 5kV potential across adjacent poles
- The contact pairs could be grouped in various combinations in different electric nodes using high voltage rated SMD shorting elements on the device's PCB (see further notes about in this document)



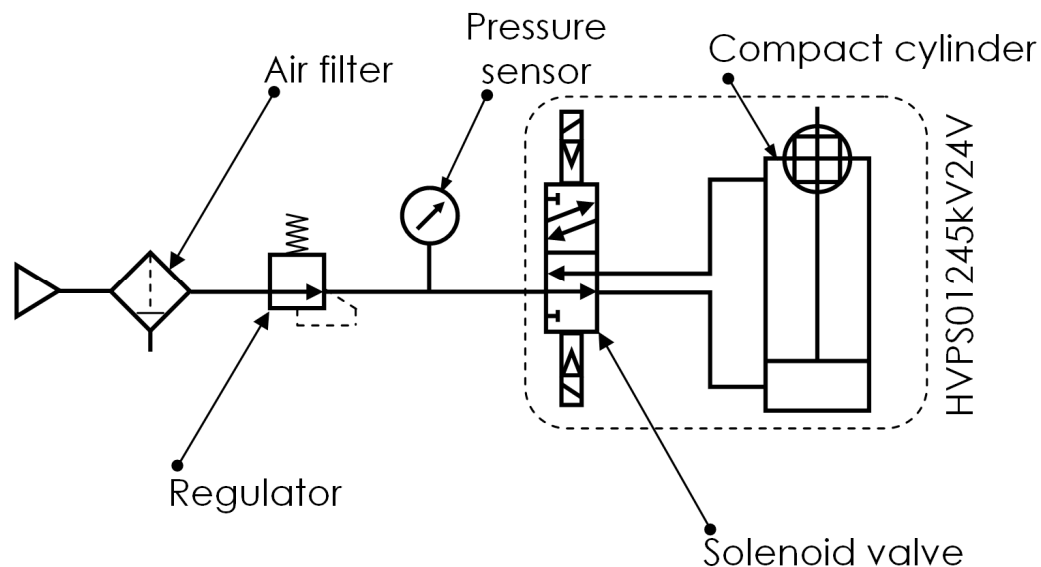
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Required pneumatic system schematic:

- The air filter should be capable to filter particles down to 5µm
- The regulator output should cover the working pressure range from 4 to 7bar
- The pressure sensor is optional, can be built in the regulator or used as separate, analogue output sensor
- The solenoid valve can be a normally closed (N.C.) or normally open (N.O.) 3-port port valve used with the exhaust ports kept open



Applications:

- Isolating low current analog signals between electronic circuits and high voltage power sources
- Isolating analog instruments and high voltage power sources for multipoint measurement schematics
- Switching between multiple voltage sources and external circuits
- Multiplexing non-differential, low or mid speed communication lines and high voltage power sources
- In most of the applications two HVPS01245kV24V units are needed with opposite control

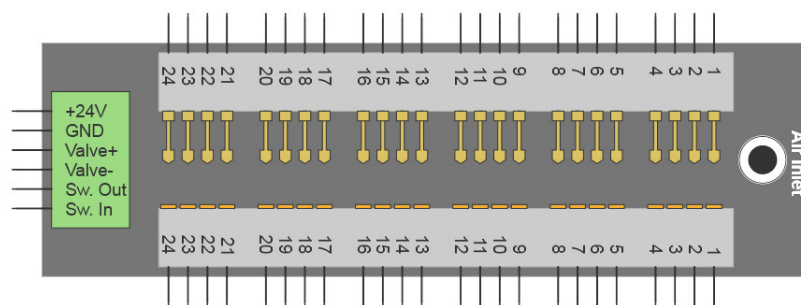
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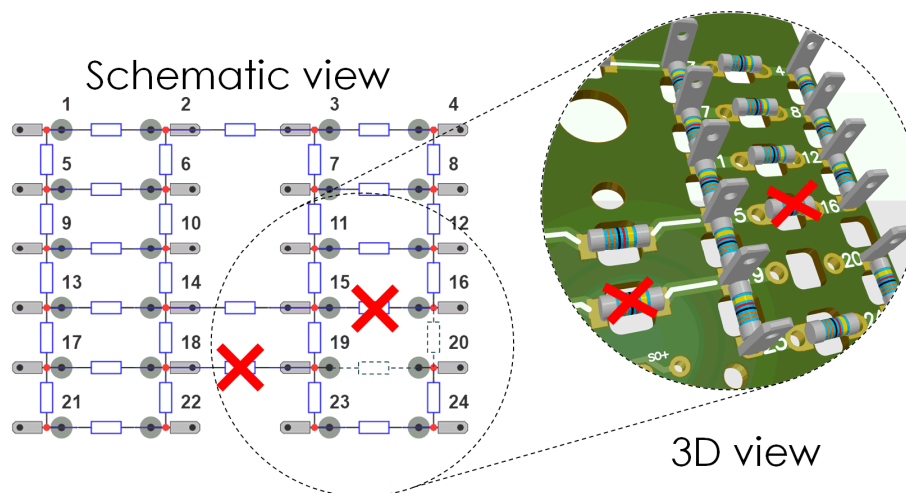
Board schematic symbol and pinout:

For CAD software integration the HVPS01245kV24V has a predefined schematic symbol containing with pinout following the physical connector arrangement of the real board. The pins and pads are grouped by four like the real pins and pads on the pylon blocks rows (the pads are on the moving pylon). The green control connectors are represented in only one instance for space saving (both having similar signals). The air inlet is also represented on the top of the symbol.



Configuring the poles:

For easy integration the HVPS01245kV24V has predefined schematic featuring different pole combinations. On the device's PCB there are solder pads attached to every contact point. Placing and soldering or removing high voltage rated SMD shorting elements (00hm resistors) on the device's PCB pads



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different electric nodes can be created between adjacent contact points.

This feature is helpful when the same two poles of a high voltage source should be distributed to numerous contact points of a DUT or any external circuit.

Basic requirements before use:

- The HVPS01245kV24V should be mounted on a standard 35mm DIN rail ensuring optimal distance from any conductive or electrically sensitive surface and the circuit PCB.
- The HVPS01245kV24V should be powered from an external, primary 24VDC power supply

Important note:

- Before executing any intervention on the HVPS01245kV24V it should be entirely disconnected from any external circuit

Electrical characteristics:

Nominal supply voltage:	24V
Operating temperature range:	-10°C ... 50°C
Current consumption:	1mA _[OFF] – 20mA _[ON]
Nominal insulation voltage:	5000V
Rated current of one switch:	150mA
Rated impedance of one switch:	0.8Ohm
Switch on time:	0.03s typical
Switch off time:	0.02s typical

Pneumatic characteristics:

Minimum air pressure:	4.0bar
Maximum air pressure:	7.0bar
Filtration degree (minimum):	5um
Piston speed:	50 – 500mm/s
Maximum force of piston @ 5bar [out]:	57N

Mechanical characteristics:

Rated life time of a switch pin:	60.000 cycles
Rated life time of mechanical parts:	300.000 cycles

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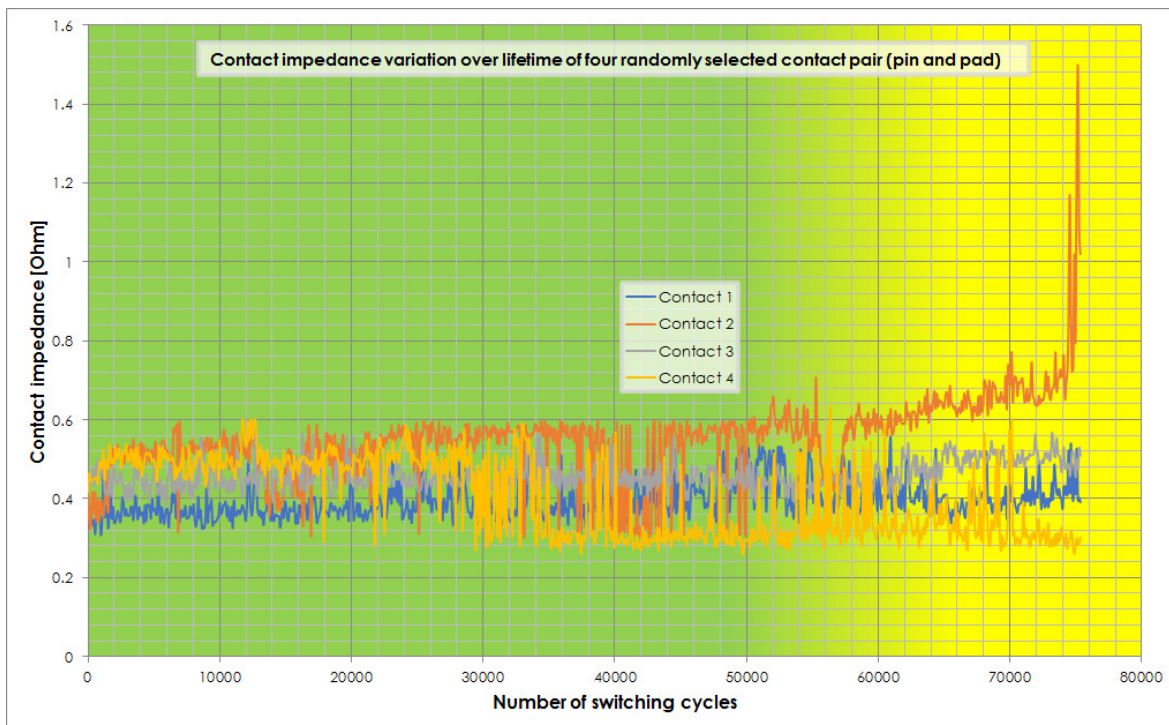
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Contact impedance variation over lifetime

The HVPS01245kV24V was tested during several hundred thousands ON-OFF cycles measuring and recording the variation of the contact impedance on every switch pair. In addition, the degree of wear on the other mechanical parts was monitored and recorded.

The below representation of the contact impedance shows recorded Ohmic values measured on four, randomly selected contact pairs during 74.000 ON-OFF cycles. The green area indicates the rated lifetime of the device of 60.000 switch cycles after which apparently one of the contacts impedance starts to grow beyond the expected limit. This is where the yellow area begins, where some contacts no longer work as expected.



The rest of the mechanic parts are rated for more than 300k cycles without significant wear.

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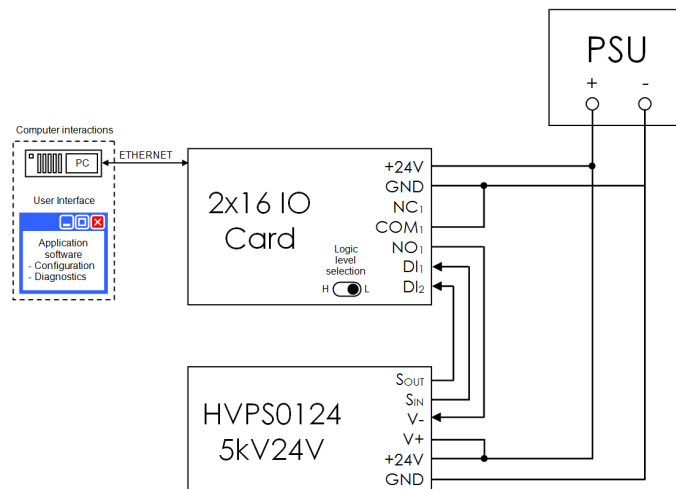
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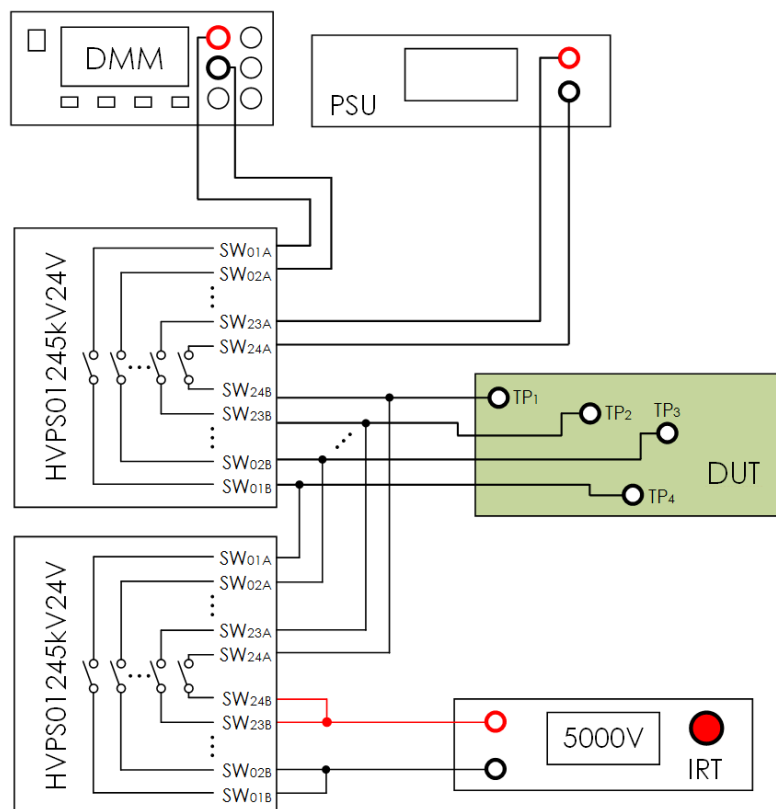
Schematic examples:

The electrical wiring diagram shows application example for typical use case.

- Recommended integration of HVPS01245kV24V in a fixture automation system using 3el's 2x16 IO Card



- DUT isolation for Insulation Resistance Test (IRT) using two HVPS01245kV24V units in series



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Mechanical drawings:

