High Voltage Power Supply
Detector Series
(Release 033, 034, 035, 036, 037)

Manual

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User Manual for the High Voltage Power Supply Detector Series (Release 033, 034, 035, 036, 037)
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1 Table of Contents

2 Introduction

2.1 General Information

This manual is intended to assist users in the installation, operation and maintenance of Release Version 033, 034, 035, 036, 037 of the High Voltage Power Supply Detector Series (HVPS D). It is divided into 8 chapters.

2.2 Safety Instructions

Please read this manual carefully before performing any electrical or electronic operations and strictly follow the safety rules given within this manual.

The following symbols appear throughout the manual:

The "note symbol" marks text passages that contain important information/hints about the operation of the device. Follow this information to ensure a proper operation of the device.

The "caution symbol" marks warnings, which are given to prevent an accidentally damaging of the device. Do NOT ignore these warnings and follow them strictly. Otherwise no guarantee is given for arose damages.

The "high voltage symbol" marks warnings, given in context with the description of the operation/use of high voltage supplies and/or high voltage carrying parts.
Hazardous voltages are present that can cause serious or fatal injuries. Therefore only persons with the appropriate training are allowed to carry out the installation, adjustment and repair work.

2.3 General Overview

The Surface Concept HVPS D is a one channel (R034, 035, 036) or two channel (R033, R037) HV supply in a stand-alone housing especially laid out for the operation of Surface Concept MCP and Delayline Detectors. It holds three (R034), one (R035), four (R033, R037) or five (R036) HV connectors. Up to three of those are used for high voltage outputs to connect to the corresponding high voltage inputs of the MCP and Delayline Detectors and one high voltage input for an external reference voltage. Some devices hold additional HV outputs (R036). In the standard connection layout the HVPS D provides positive voltages for the supply of the MCP stack and the detector anode/phosphor screen, but the output polarity can also be negative (device dependend). Check the specification sheet of the HV Supply for detailed information on the output polarity. The output voltages are either referred to the ground potential (R035) or to an external reference potential, which can be connected in addition (R033, R034, R036, R037).
The maximum output voltage of the HVPS D is higher than the normal operation voltage of a MCP or delayline detector. Therefore please check the specification sheet of your MCP/Delayline Detector for the correct and the maximum operation voltage.

The device can produce lethal high voltages of up to several kV. Hazardous voltages are present, therefore only persons with the appropriate training are allowed to carry out the installation, adjustment and repair work.

Do not open the power supply, while it is in operation. Hazardous voltages are present. In case that the device must be opened, turn off the device first AND pull out the power plug.

3 Installation

3.1 Initial Inspection

Visual inspection of the system is required to ensure that no damage has occurred during shipping. If there are any signs of damage, please contact SURFACE CONCEPT immediately. Please check the delivery according to the packing list (**see Table 1-4**) for completeness.

- 1x High Voltage Power Supply Detector R033
- 1x BNC Termination Plug
- 1x SHV Termination Plug
- 3x SHV Cables (5m)/2x SHV Cables (5m) plus 1x 10kV HV Cable (5m)

Table1: Packing list for the HVPS D R033/R037

- 1x High Voltage Power Supply Detector R034
- 1x BNC Termination Plug
- 2x SHV Cables (5m)

Table2: Packing list for the HVPS D R034

- 1x High Voltage Power Supply Detector R035
- 1x BNC Termination Plug
- 1x SHV Termination Plug

Table3: Packing list for the HVPS D R035

- 1x High Voltage Power Supply Detector R036
- 1x BNC Termination Plug
- 2x SHV Termination Plug
- 3x SHV Cables (5m)

Table4: Packing list for the HVPS D R036

3.2 Installation

The general connection scheme of the HVPS D is shown in **Figure 1**.

The specific layout of the detector flange can vary to the image shown in Figure 1. Please check the manual of your delayline detector for the correct flange layout and feedthrough assignment.

Finish the complete cabling before switching on the HVPS D and switch off the device first before performing any changes to the cabling.

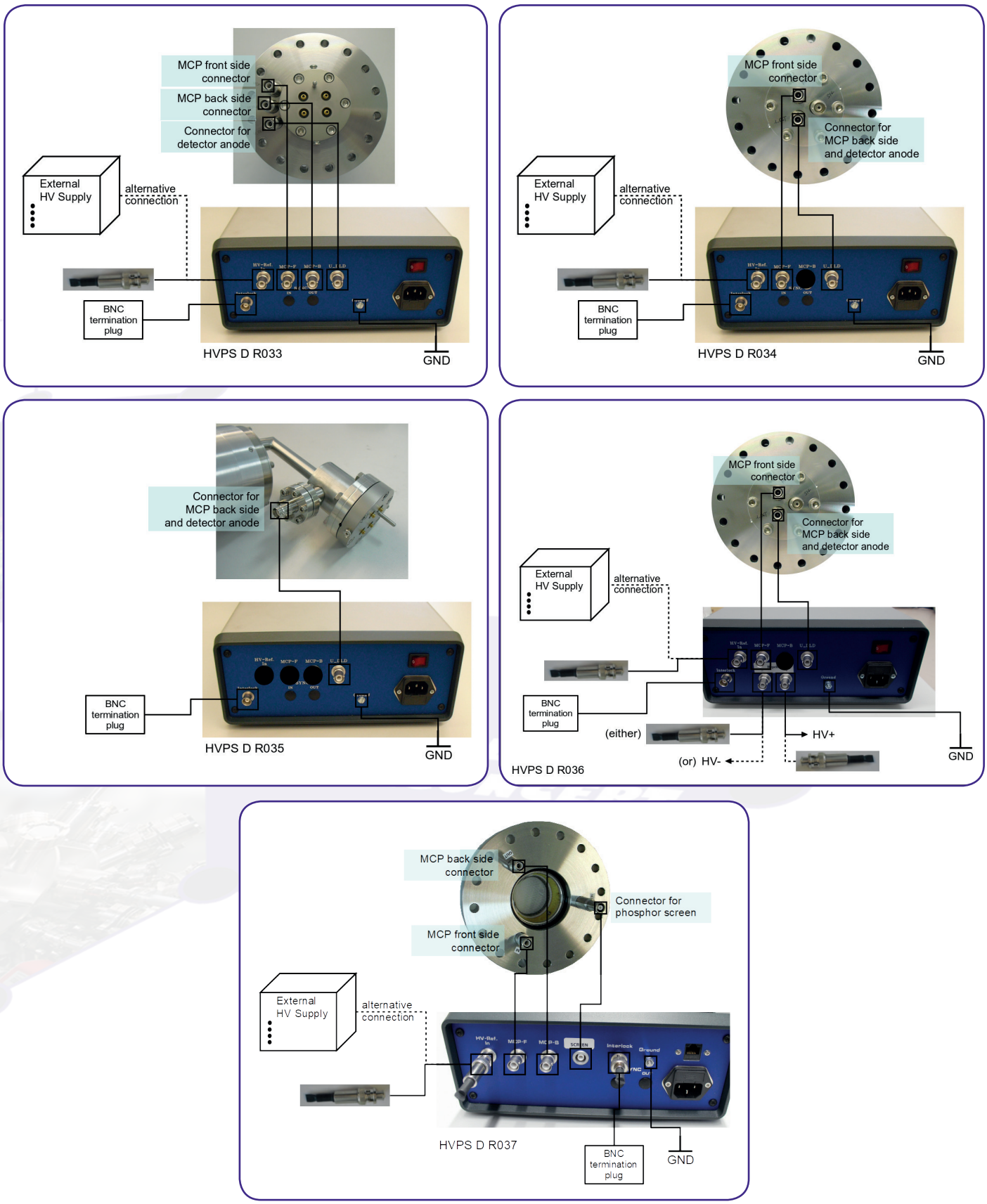


Figure 1: Connection scheme of the HVPS D R033, R034, R035, R036 and R037 to a MCP/Delayline Detector (the specific layout of the detector flange can vary to the shown image. Please check the manual of your Delayline Detector for the correct flange layout and feedthrough assignment).

- First, use the „Ground" connector (M4 screw) to ground the device.
- High voltage output is provided to the SHV sockets named "MCP-B" and "U_DLD" (where existing). For R037 high voltage output is provided to the SHV socket named"MCP-B" and to a LEMO 10,000V HV socket named "SCREEN".
- The socket named "MCP-F" connects the external reference voltage which is given to the device via the "HV Ref. In" input to the front side of the MCP stack (R033, R034, R036, R037).
- Use the HV cable/s to connect the output/s of the HVPS D to the corresponding HV input/s of the MCP/ delayline detector (see MCP/DLD manual for more details).
- Use the SHV termination plug to terminate the "HV Ref. In" input when not working with an external reference voltage (R033, R034, R036, R037).

Note

In cases that no reference voltage is applied to the device, the termination plug must be used to ground the reference input of the HVPS D. With a missing reference potential the HVPS D module is not providing any output voltage. For the HVPS D R035 the reference potential is connected to ground internally in the device itself.

- Connect the power cable to the main connector.
- Check if the Interlock-Plug (BNC termination plug) is connected.

4 Device Layout & Operation

4.1 Device Layout

The layout of the HVPS D is given below in **Figure 2**:

Figure 2: Layout of the HVPS D R034 (modified layout).

1. Hardware Reset Button
2. Status LEDs for Power (lightens up when device is switched on) and Ethernet Connection (lightens up only when a software is connected to the HV Supply)
3. Touch Display
4. Control Knob for High Voltage Adjustment
5. Control Knob for Channel Selection
6. BNC Connector for Hardware Interlock (Output of BNC Connector must be grounded to deactivate Interlock)
7. SHV Connector for Input of external Reference Potential (max. +/-1,000V for R033, R034 and R036; max. +100V/-1,000V and max. 7,000V overall output voltage for R037). Check with your MCP or DLD Manual for Details on maximum Reference Potential.
8. SHV Connector for Output of Reference Potential to Front Side of MCP Stack within a MCP or Delayline Detector. Only existing in R033, R034, R036 and R037
9. SHV Connector for Output of Operation Voltage for the MCP Stack within a MCP or Delayline Detector. Only existing in R033
10. SHV Connector for Output of Operation Voltage for the Detector Anode (R033, R034) and for the complete MCP/Delayline Detector (R035) respectively. R037 comes with a LEMO 10,000V HV Socket (type ERA.1S.405.CTL) for the Screen Supply of a Phosphor Screen Detector instead
11. SHV Connector for additional HV Output. Only existing in R036. See Specification Sheet for Details
12. SHV Connector for additional HV Output. Only existing in R036. See Specification Sheet for Details
13. Ethernet Socket
14. Power Switch, to turn ON/OFF the Device (lighted, when switched ON)
15. Ground Connector for Device Grounding
16. Power Socket

Caution

The HVPS D is specified for the operation with an external reference voltage of maximum +/-1,000V (device dependend, can be lower; see No. 7 in Figure 2).
Please also respect the corresponding specifications for the maximum voltage for the MCP front potential of your MCP/ delayline detector (see the manual and the specification sheet of your MCP/ delayline detector for further details).

4.2 General Device Operation

After switching on the device (14), the display (3) shows the "Surface Concept" animated logo, while the device is scanning for internal available HV modules and their specific settings. This can take up to several seconds. If the device is ready for operation, it switches into the standby mode and shows an empty mask for the voltage adjustment (**see Figure 3**).

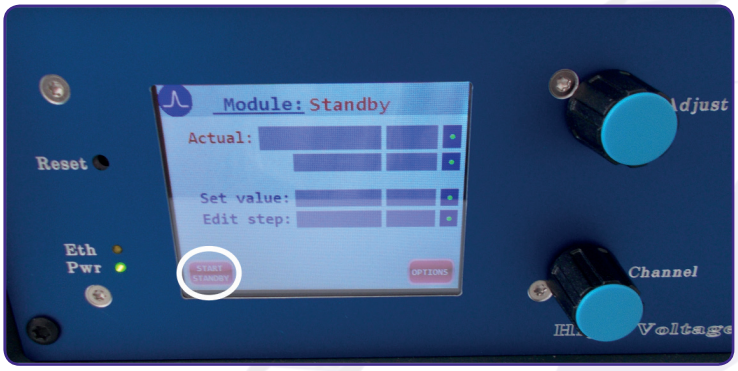


Figure 3: Standby mode.

Push the "Start/Standby" button in the lower left corner of the display to switch on the high voltage.
Alternatively one can press the "Channel" control knob.

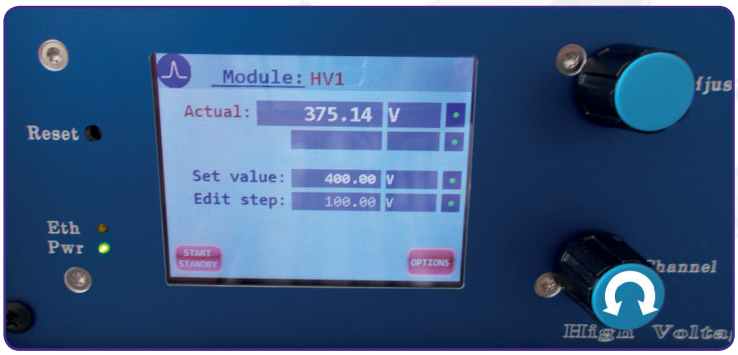


Figure 4: Operation mode.

After switching on the high voltage the device is in the so called operation mode. In operation mode the display shows the name of the selected channel in the top line (in this case "HV 1") as well as the output voltage of that channel.
The different HV channels can be selected by turning the "Channel" control knob (R033, R036 and R037 only).

Figure 5: Operation mode – voltage adjustment.

The "Adjust" control knob is used to adjust the output voltage.
Turn the "Adjust" control knob clockwise/ counterclockwise to increase/decrease the value of the output voltage in a step width as defined in the line "edit step".

The line "set value" displays the nominal value for the output voltage as adjusted by the user. Voltage adjustment can only be made in this line.

The line "actual" displays the actual value for the output voltage on the output connector as measured by the device.
The device always regulates the actual value of the output voltage to fit to the nominal value as set by the user.
Hereby the voltage measurement is always a relative measurement between the two HV outputs of one channel. Additional reference voltages (e.g. in floating operation) are not measured and therefore are also not displayed (**see Chapter 4.6** for further details)

Turn the "Adjust" control knob clockwise/counterclockwise while pushing it to increase/ decrease the step width in the line "edit step".
Turn the "Adjust" control knob clockwise/counterclockwise while pushing it to move the cursor position to the right/left.

Push the "Start/Standby"-button in the lower left corner of the display again to switch back to the "Standby" mode.

4.3 Operation of a Delayline Detector with the R033

The HVPS D R033 is specified for the operation with an external reference voltage of maximum +/-1,000V. Higher voltages can lead to internal HV sparking and to a damage of the device.
Please also respect the corresponding specifications for the maximum voltage for the MCP front potential of your MCP or delayline detector (see the manual and the specification sheet of your MCP/delayline detector for further details).

In some cases a delayline detector is operated with the front side of the MCP stack terminated to ground. But for many other applications it is necessary to apply some external reference voltage to the front side. In this case the floating capability of the HVPS D allows a more insusceptible supply of the correct detector operation voltage because the external reference voltage must not be taken into account for the DLD operation voltage. Additionally this wiring also saves the detector intrinsically from any over-voltage in case of a sudden drop of the external reference voltage.
In general there are three different application cases concerning reference potential to the front side of the detector's MCP stack.

For example: Assume an operation voltage of a detector of +1,900V.
Application case 1: The detector should be operated with the MCP front side connected to ground. In this case the SHV termination plug is connected to the "HV Ref. In" input. "MCP-B" is set to the detectors operation voltage. The display shows a value of MCP-B = 1,900V and U_DLD = 400V. The output voltage in respect to the ground potential is MCP-B = +1,900V and U_DLD = + 2,300V.

Application case 2: The detector should be operated with the MCP front side connected to +1,000V. In this case the external reference voltage is connected to the "HV Ref. In" input. First set the HVPS D to the detectors operation voltage. Then increase the external reference voltage to the +1,000V. The display shows a value of MCP-B = 1,900V and U_DLD = 400V, but the output voltage in respect to the ground potential is MCP-B = +2,900V and U_DLD = +3,300V.

Application case 3: The detector should be operated with the MCP front side connected to -500V. In this case the external reference voltage is connected to the "HV Ref. In" input. First set the HVPS D to the detectors operation voltage. Then increase the external reference voltage to the -500V. The display shows a value of MCP-B = 1,900V and U_DLD = 400V, but the output voltage in respect to the ground potential is MCP-B = +1,400V and U_DLD = +1,800V.

4.4 Operation of a MCP/Delayline Detector with the R034, R036

The HVPS D R034 and R036 is specified for the operation with an external reference voltage of maximum +/-1,000V. Higher voltages can lead to internal HV sparking and to a damage of the device.
Please also respect the corresponding specifications for the maximum voltage for the MCP front potential of your MCP or delayline detector (see the manual and the specification sheet of your MCP/delayline detector for further details).

In some cases a MCP detector is operated with the front side of the MCP stack terminated to ground. But for many other applications it is necessary to apply some external reference voltage to the front side. In this case the floating capability of the HVPS D allows a more insusceptible supply of the correct detector operation voltage because the external reference voltage must not be taken into account for the MCP operation voltage. Additionally this wiring also saves the detector intrinsically from any over-voltage in case of a sudden drop of the external reference voltage. In general there are three different application cases concerning reference potential to the front side of the detector's MCP stack.

For example: Assume an operation voltage of a detector of +1,900V.
Application case 1: The detector should be operated with the MCP front side connected to ground. In this case the SHV termination plug is connected to the "HV Ref. In" input. "U_DLD" is set to the detectors operation voltage. The display shows a value of U_DLD = 1,900V. The output voltage in respect to the ground potential is U_DLD = +1,900V.

Application case 2: The detector should be operated with the MCP front side connected to +1,000V. In this case the external reference voltage is connected to the "HV Ref. In" input. First set the HVPS D to the detectors operation voltage. Then increase the external reference voltage to the +1,000V. The display shows a value of U_DLD = 1,900V, but the output voltage in respect to the ground potential is U_DLD = +2,900V.

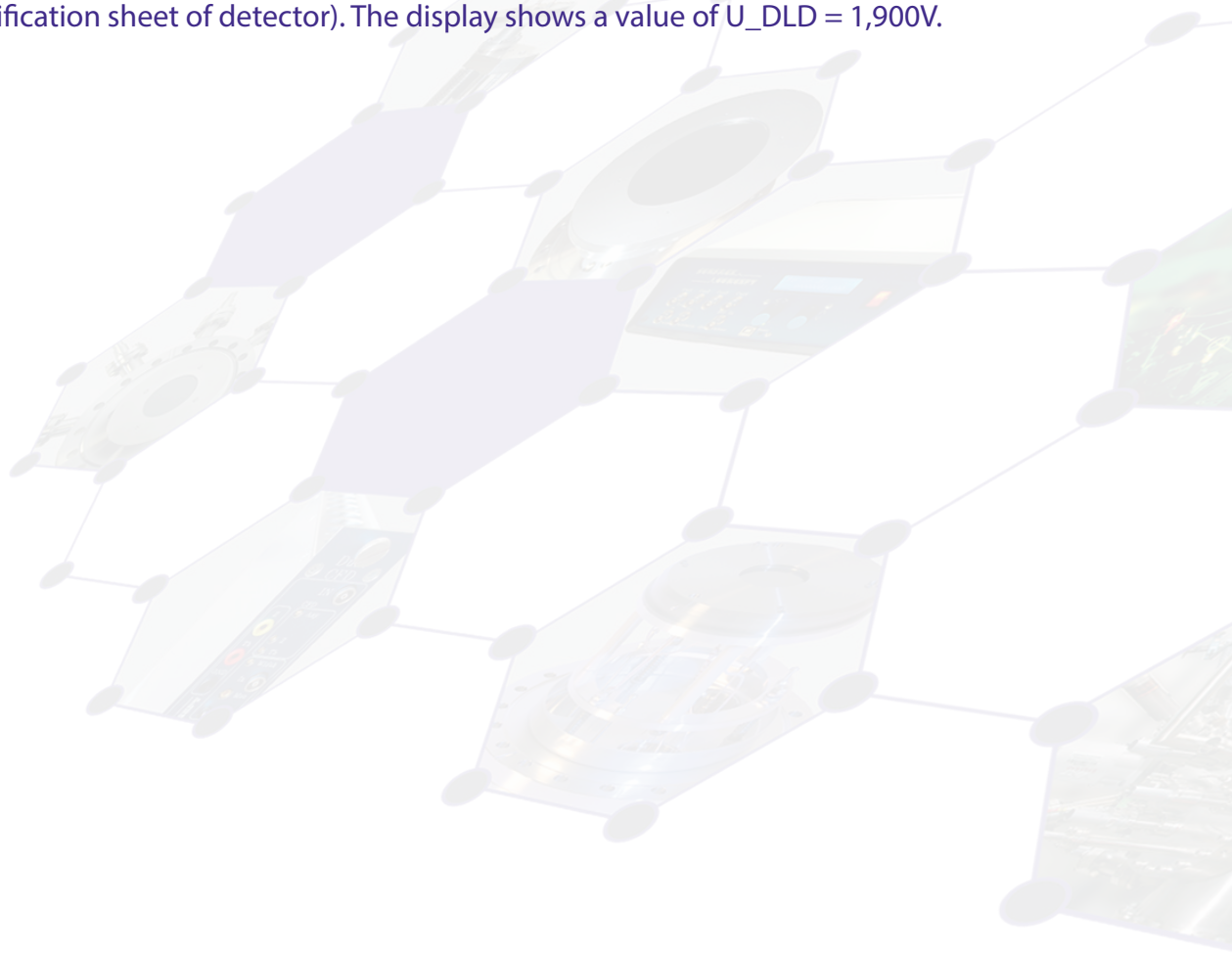
Application case 3: The detector should be operated with the MCP front side connected to -500V. In this case the external reference voltage is connected to the "HV Ref. In" input. First set the HVPS D to the detectors operation voltage. Then increase the external reference voltage to the -500V. The display shows a value of U_DLD = 1,900V, but the output voltage in respect to the ground potential is U_DLD = +1,400V.

For R036 only: The HVPS R036 has a second additional and independent HV output. The exact output voltage can be found in the specification sheet. The polarity of the output voltage can be defined by plugging a SHV termination plug to ground the opposite output of the additional output (terminate negative output to provide positive output voltage and terminate positive output to provide negative output voltage).

4.5 Operation of a MCP/ Delayline Detector with the R035

Certain MCP detectors and delayline detectors are designed for the operation with one single high voltage input. For those devices the HVPS D R035 is sufficient for providing the operation voltage.
In this case there is only one application case concerning reference potential to the front side of the detector's MCP stack.

For example: Assume an operation voltage of a detector of +1,900V (positive output polarity).
Application case: The MCP front side of the detector is connected to ground, while the MCP back side and the detector anode are connected to the operation voltage. "U_DLD" is set to the detectors operation voltage (see specification sheet of detector). The display shows a value of U_DLD = 1,900V.



4.6 Operation of a Phosphor Screen Detector with the R037

The HVPS D R037 is specified for the operation with an external reference voltage of maximum +100V/-1,000V and a maximum overall output voltage of 7,000V. Higher voltages can lead to internal HV sparking and to a damage of the device.
Please also respect the corresponding specifications for the maximum voltage for the MCP front potential of your MCP or delayline detector (see the manual and the specification sheet of your MCP/delayline detector for further details).

In some cases a phosphor screen detector is operated with the front side of the MCP stack terminated to ground. But for many other applications it is necessary to apply some external reference voltage to the front side. In this case the floating capability of the HVPS D allows a more insusceptible supply of the correct detector operation voltage because the external reference voltage must not be taken into account for the detector operation voltage. Additionally this wiring also saves the detector intrinsically from any over-voltage in case of a sudden drop of the external reference voltage.
In general there are three different application cases concerning reference potential to the front side of the detector's MCP stack.

For example: Assume an operation voltage of the MCP of +1,800V and screen of +3,000V.
Application case 1: The detector should be operated with the MCP front side connected to ground. In this case the SHV termination plug is connected to the "HV Ref. In" input. "MCP-B" is set to the detector operation voltages. The display shows a value of MCP-B = 1,800V and SCREEN = 3,000V. The output voltage in respect to the ground potential is MCP-B = +1,800V and SCREEN = +4,800V.

Application case 2: The detector should be operated with the MCP front side connected to +100V. In this case the external reference voltage is connected to the "HV Ref. In" input. First set the HVPS D to the detector operation voltages. Then increase the external reference voltage to the +100V. The display shows a value of MCP-B = 1,800V and SCREEN = 3,000V, but the output voltage in respect to the ground potential is MCP-B = +1,900V and SCREEN = +4,900V.

Application case 3: The detector should be operated with the MCP front side connected to -500V. In this case the external reference voltage is connected to the "HV Ref. In" input. First set the HVPS D to the detector operation voltages. Then increase the external reference voltage to the -500V. The display shows a value of MCP-B = 1,800V and SCREEN = 3,000V, but the output voltage in respect to the ground potential is MCP-B = +1,300V and SCREEN = +4,300V.

4.7 Schematic Layout of the HVPS D

Figure 6 shows the schematic layout of the HVPS D and especially the layout of the HV outputs. An internal controller measures the output voltage and regulates it to the nominal value entered by the user or set as default value within the device. Hereby the voltage measurement is always a relative measurement. The output polarity is defined by determine one of the outputs as reference potential (e.g. by termination to ground). Voltage measurement and regulating is also only respecting the relative output voltage of the single HV module in case of a floating operation. The absolute output voltage (as result of output voltage and reference voltage) is not determined by the device. Figure 6 also shows the internal load and measuring resistors.

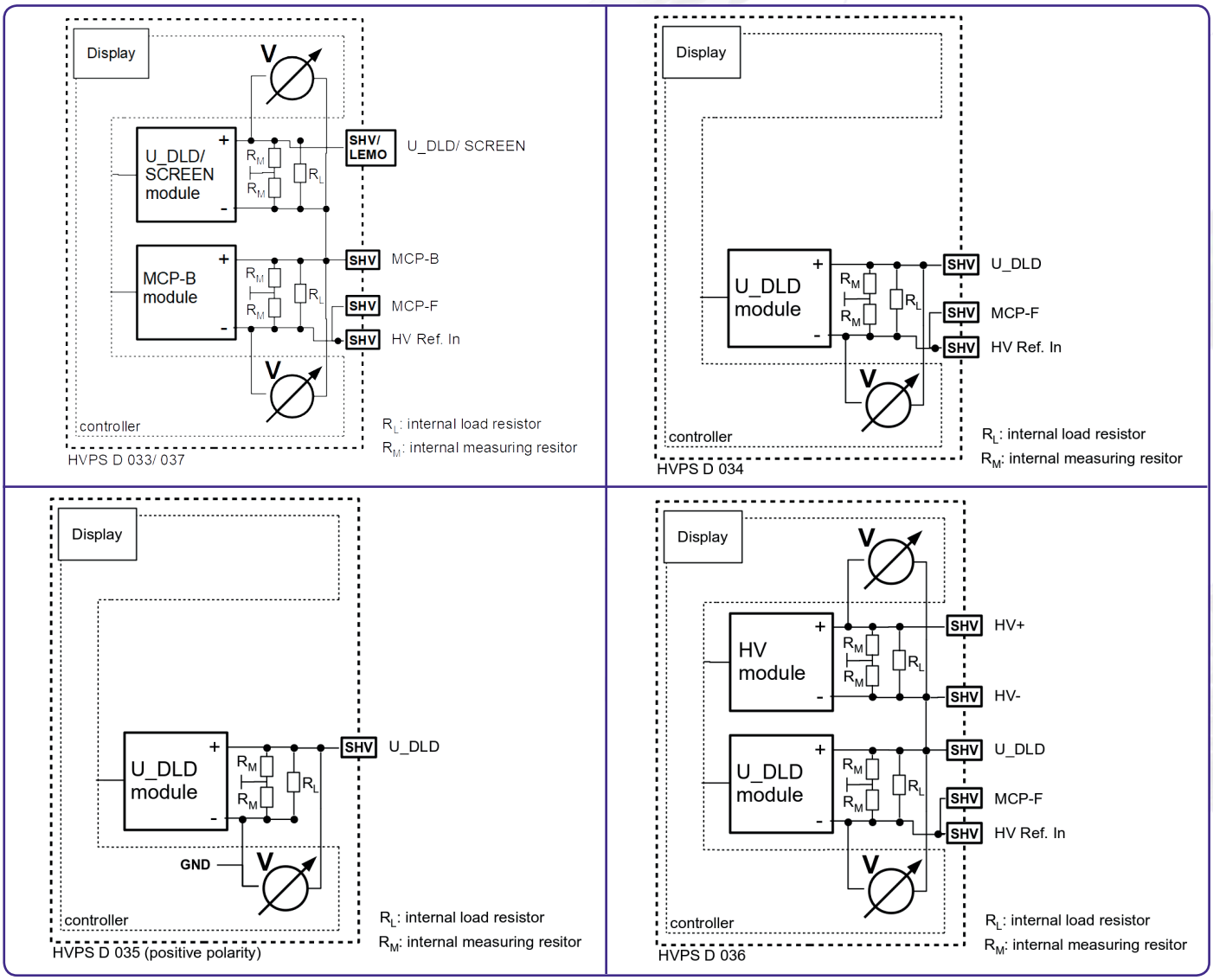


Figure 6: Schematic layout of the HVPS D R033, R034, R035, R037 (positive output polarity) and R036 showing also the internal load and measuring resistors.

Note

The HVPS D is not producing any output voltage if the reference input "HV Ref. In" is not terminated (either to ground or to an external HV potential), because the HV modules always need to be connected to a reference potential. A SHV termination plug is part of the delivery to terminate the "HV Ref. In" input to ground. For the HVPS D R035 the reference potential of the HV module is connected to ground internally in the device itself.

5 Additional Device Options

Pressing the "Option" button in the lower right corner of the device display, the device will switch to the overview display of the additional device options. The available options are device depending. Press the "Exit" button to switch back to the display of the operation voltages.

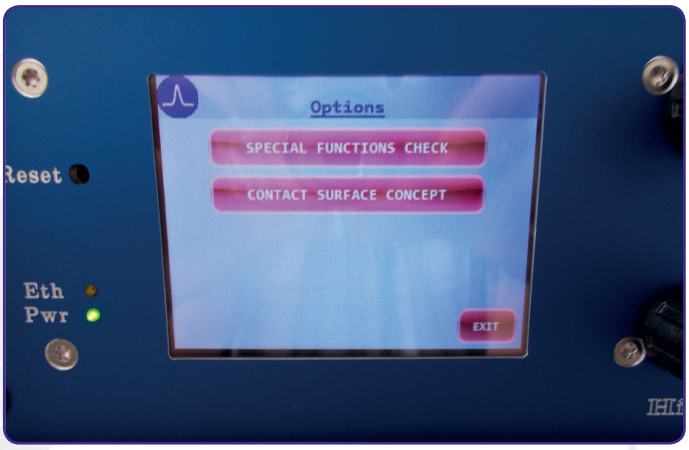


Figure 7: "Device Options" sub-menu

The overview of the device options show the different available options like the contact page for surface concept or special device specific functions. Open the specific sub-menu by pressing the corresponding button in the touch display.

5.1 Special Function Check

The sub-menu "Special Function Check" in the device options display the different special functions currently available for the Surface Concept HVPS D Series.
Not all listed functions are available for each single device layout.

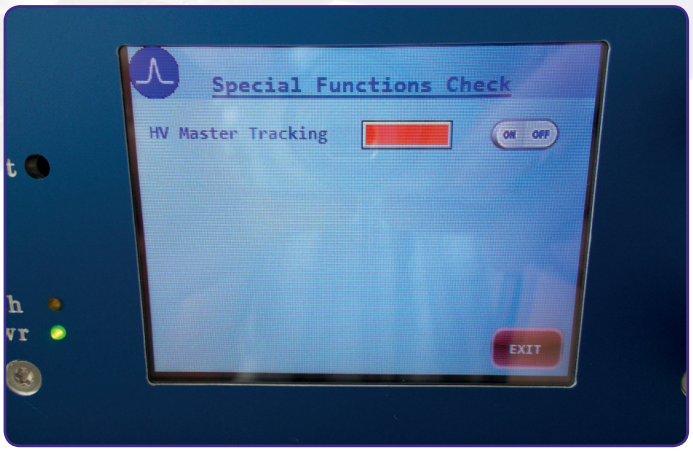


Figure 8: "Special Functions Check" sub-menu

The "HV Master Tracking" allows the HVPS to track an external reference voltage and to produce an output voltage which is in a fixed defined relation to the master voltage.
Please note: This function differs from the floating functionality, because the master voltage is "only" measured within the device and the HVPS is producing a corresponding output voltage.

The "HV Master Tracking" can be switched ON/ OFF by clicking on the corresponding button on the display (not available for the R033 – R036).

5.2 Contact Surface Concept

The sub-menu “Contact Surface Concept” in the device options displays the Surface Concept contact information. Press the “Exit” button to leave this sub-menu.

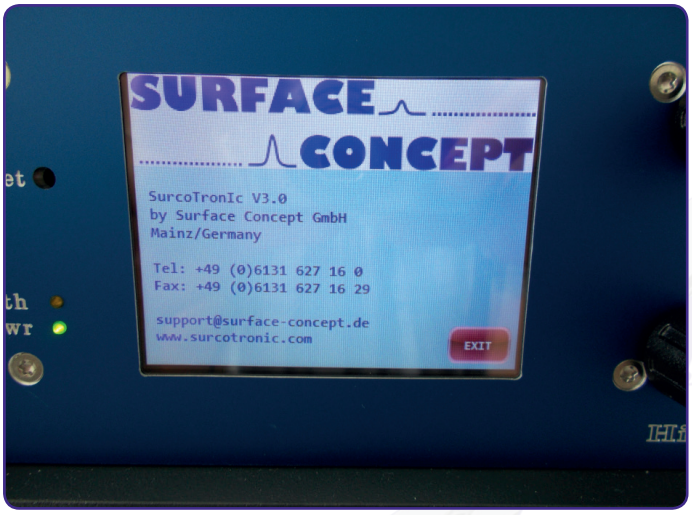


Figure 9: “Contact Surface Concept” sub-menu.

6 Error States

Error states of the device are indicated by error messages in the display.

Figure 10: Error code – Interlock

Err – Interlock

The device interlock is active and is blocking the HV output. Please terminate the interlock to ground using either the BNC termination plug (part of the delivery) or check the proper functionality of the use device which is providing the interlock.

7 Technical Data

High Voltage Power Supply D Series

	R033	R034
HV Output Channels:	2	1
HV Output Connector:	SHV5	SHV5
Output Voltage Range (channel U_DLD):	400V (fix)	see specification sheet
Output Voltage Range (channel MCP-B):	see specification sheet	N/A
Output Polarity:	see specification sheet	see specification sheet
Input Connector for Reference Input:	SHV5	SHV5
Maximum Voltage for external Reference Potential:	+/-1,000V	+/-1,000V
Additional HV Outputs	N/A	N/A

	R035	R036
HV Output Channels:	1	1
HV Output Connector:	SHV5	SHV5
Output Voltage Range (channel U_DLD):	see specification sheet	see specification sheet
Output Voltage Range (channel MCP-B):	N/A	N/A
Output Polarity:	see specification sheet	see specification sheet
Input Connector for Reference Input:	N/A	SHV5
Maximum Voltage for external Reference Potential:	N/A	+/-1,000V
Additional HV Outputs	N/A	see specification sheet

	R037
HV Output Channels:	2
HV Output Connector:	SHV5 and a LEMO type ERA.1S.405.CTL
Output Voltage Range (channel SCREEN):	see specification sheet
Output Voltage Range (channel MCP-B):	see specification sheet
Output Polarity:	see specification sheet
Input Connector for Reference Input:	SHV5
Maximum Voltage for external Reference Potential:	+100V/-1,000V (max. 7,000V overall output voltage)
Additional HV Outputs	N/A

Line Input

Electrical Input (LINE):	88 V - 264 V, 50/60 Hz
Power:	65 Watt (max.)
Fuse:	1x T 1.6 A

8 List of Figure

EC Declaration of Conformity

Manufacturer

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CE

Product: High Voltage Power Supply
Model: HVPS D

The above named products comply with the following European directive:

89/336/EEC	Electromagnetic Compability Directive, amended by 91/263/ EEC and 92/31/ EEC and 93/68/EEC
73/23/EEC	Low Voltage Equipment Directive, amended by 93/68/EEC

The compliance of the above named product to which this declaration relates is in conformity with the following standards or other normative documents where relevant:

EN 61000-6-2:2005+AC:2005	Electromagnetic compatibility (EMC): Generic standards - Immunity for industrial environments
EN 61000-6-4:2007+A1:2011	Electromagnetic compatibility (EMC): Generic standards - Emission standard for industrial environments
EN 61010-1: 2010	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

For and on behalf of **Surface Concept GmbH**

Mainz,……01.04.2013……. (Date)

Legal Signature…… (Dr. Andreas Oelsner)

This declaration does not represent a commitment to features or capabilities of the instrument. The safety notes and regulations given in the product related documentation must be observed at all times.