



DPS3 –2P5P10P

Triple Output Digital High Voltage Power Supply



This document supersedes all previous specifications. Photek accept no responsibility for damage incurred if the customer does not follow the procedures outlined in this manual.

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1 Safety:-

The high voltage modules contained within the DPS3-2P5P10P have a maximum current capability as follows:-

- | | | | |
|------|-----------|---------------|---------|
| • V1 | Front MCP | (2kV module) | 1mA |
| • V2 | Rear MCP | (5kV module) | 0.5mA |
| • V3 | Screen | (10kV module) | 0.125mA |

The maximum output energy that can be delivered by any of these modules is limited to less than 4 joules for user safety,

Warning:- If a large capacitive load is connected across the output, the energy stored by this external capacitor may exceed this non-fatal limit.

Energy Stored By Capacitor = $\frac{1}{2} CV^2$ joules

In order to avoid any corona discharge: - Under no circumstances should a high voltage output be run at a voltage higher than 5kV in air without some insulation material encapsulating the high voltage connection.

2 High Voltage Connection Notes:-

All High Voltage connections must be made before applying power to this unit.

The connectors supplied with this unit are 12kV rated high voltage SHV BNC connectors. Care should be taken to ensure that correct connections have been made before power is applied to this unit.

User terminated connections must be carried out with adequate precautions to ensure safety of both user and equipment

The following precautions should be observed for connections made by the user: -

1. All wires must have an adequate voltage rating for the high voltage that they will carry.
2. All wires utilised in a vacuum chamber must be suitable for this application.
3. All wires should be continuous and connected to the main plug at one end and the Channel plate detector at the other end. These wires should not be 'wired inline', i.e. joined.
4. Mechanical strength of connections should be ensured with adequate strain relief to ensure reliable operation and extended life of the connections.
5. Connections should be insulated with suitable insulation material, such as heat-shrinkable insulation tubing, or a suitable silicon compound may be used to encapsulate the connections.

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3 DPS3-2P5P10P - Description

The DPS3-2P5P10P is a universal A.C. mains powered digital control unit designed to apply the high voltage required for a vacuum imaging or particle detector system.

The DPS3-2P5P10P unit incorporates three high voltage modules which allow for independent voltage control for a dual MCP device with a screen.

This unit may be used in conjunction with MCP gating modules such as Photeks GM-MCP. Exposure and Timing control may be supplied by units such as Photeks IGC3 low jitter Intensifier Gating Controller.

The DPS3-2P5P10P may be controlled from a PC using ASCII commands (detailed later in this manual). The only external requirement for computer control is an unused port on the computer and a simple communication suite.

The DPS3-2P5P10P may be incorporated into the users' software suite as all bi-directional control codes and protocols utilise ASCII characters. These codes and protocols are included later in this manual.

The DPS3-2P5P10P can be controlled from 6 push-button keys and a rotary encoder and information on the operating conditions is displayed on a 4 line x 40-character alphanumeric liquid crystal display located on the front panel of the unit.

The DPS3-2P5P10P has 3 High Voltage outputs via SHV connectors located on the rear panel of the unit. The high voltage modules contained in this unit are:-

1. V1 Front MCP 0 to 2000V
2. V2 Rear MCP 0 to 5000V
3. V3 Screen 0 to 10000V

The DPS3-2P5P10P outputs may be controlled either in output tracking mode or independent output adjustment mode.

The high voltage outputs may be displayed as either 'Absolute' voltages or 'Relative' voltages for each electrode of the VID module.

The DPS3-2P5P10P does not provide any image acquisition or image processing functions.

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4 DPS3-2P5P10P Features

The DPS3-2P5P10P has been designed to supply a dual MCP Vacuum Imaging Detector(VID) which is being operated in electron detection mode. The DPS3-2P5P10P offers the facility to vary the gain of the detector and may be incorporated into a synchronised exposure system.

The outputs from the DPS3-2P5P10P are all positive and supply the VID with 3 tracking electrode voltages in order to operate each MCP independantly while maintanin constant potential differences on the other electrodes.

This unit can be used in several modes of operation controlled by either computer control or manual editing via the front panel controls.

The features and possible operating modes for the DPS3-2P5P10P are detailed below.

4.1 'Tracking Disabled' or 'Tracking Enabled' Operating Modes.

The DPS3 incorporates a tracking function which may be enabled or disabled by the 'Track' key on the touchscreen or via the 'T1' or 'T0' commands from a computer.

4.1.1 Tracking Disabled

If Tracking is disabled any output may be controlled independantly within its pre-programmed limits. The other 2 outputs will remain at their absolute value, although their relative potentials may change.

In 'Tracking Disabled' mode the outputs may be adjusted to give negative potential differences and the unit will operate as a standard multiple output high voltage bench power supply. In this mode the DPS3 may be used for functions other than standard VID operation.

4.1.2 Tracking Enabled

With 'Tracking Enabled' adjustments made to Front MCP and Rear MCP electrode voltages will automatically track to maintain previously set potential differences on the other electrodes.

The tracking function operates as follows:

The voltage applied to the Front MCP is automatically added to the voltage on both the Rear MCP and the Screen of the VID, so that the Rear MCP maintains a constant gap voltage with the Screen, i.e. the Screen 'Gap' potential difference is maintained.

The voltage applied to the Rear MCP is automatically added to the voltage on the Screen of the VID, so that the Screen 'Gap' potential difference is maintained.

Adjustments to the voltage applied to the Screen will only adjust the Screen 'Gap' potential, it is not added to either the voltage on the Front MCP or Rear MCP.

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4.2 Manual Adjustment

Any electrode may be manually adjusted at any time by selecting the electrode and using the adjust control to either increase or decrease the voltage.

Each output may be adjusted with 1V resolution, i.e. each adjustment will increment or decrement by a minimum of 1V.

The speed that the output voltage may change in manual mode is limited to avoid excessive 'abrupt' changes to the potential differences on adjacent electrodes.

4.3 Saved Operating Conditions

The DPS3 automatically saves all of the operating conditions and the last set voltages for each output.

Once the desired operating voltages have been input they may be enabled/disabled just by pressing the 'Output is OFF Press to turn ON' key, this will ramp all voltages up over the preset 'Ramp-Up' time.

The DPS3 saves all of the control settings including Tracking and Interlock functions. If either or both interlocks have been enabled during the last operation of the DPS3 then they will automatically be enabled after power up.

If the unit is being operated via computer control then it is advisable that all desired setup conditions are transmitted to the DPS3 during initialisation.

4.4 Automatic 'Ramp-Up'.

As the DPS3 contains 3 independent high voltage power supplies an automatic 'Ramp-Up' feature has been incorporated to ensure that all voltages are applied to the intensifier in a safe and controlled way.

When the 'Output is OFF Press to turn ON' key is pressed or a 'P1' command is received from a computer the DPS3 will power up the HT power supplies and perform an automatic increment routine over the pre-programmed 'Ramp' time (minimum time = 1 second). The factory default 'Ramp' time is set to 5 seconds. This automatic increment raises the voltage in 1% steps.

When the 'Output is OFF Press to turn ON' key is pressed to power down the high voltage or a 'P0' command is received the DPS3 will 'Ramp-Down' the high voltage in 10% steps during 100 milliseconds. This is a controlled emergency off function so that electrode limit voltages are not exceeded during power down, but still allows the high voltage to be shutdown quickly.

If an electrode voltage adjustment command is received from a computer the DPS3 will perform an automatic increment/ decrement to the new set levels over the pre-programmed 'Ramp' time. This is not an emergency off function, so reduction of voltages ramps over the same time period as an increase.

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4.5 Interlock Functions to inhibit high voltage outputs

The DPS3 has 2 interlock inputs that may be enabled either independantly or together to provide a system safety high voltage over-ride. Both interlocks may be disabled if not required.

To enable the interlocks the Interlocks key may be pressed repeatedly until the desired interlocks have been enabled or the 'I' command may be used from a computer.

The interlocks are TTL inputs that must be grounded to allow the high voltage to turn on. If the input is open circuit the interlock will be active and the DPS3 will inhibit the high voltage function.

4.6 Audible Alarm with indicated alarm condition.

The interlock inputs are constantly monitored by the DPS3 firmware and if an interlock occurs the high voltage will be automatically powered down and an audible alarm will occur.

The DPS3 status display will indicate which Interlock function triggered the over-ride by displaying 'Tripped' next to the relevant interlock.

To cancel the alarm press any of the front panel keys. This will cancel the alarm but will not re-enable the high voltage. It is advised that the user investigate the interlock before re-enabling the high voltage.

Once the alarm has been cancelled the DPS3 will function normally, however if the interlock is still active and enabled the DPS3 will not allow the high voltage to be turned on. Any press of the 'Output is OFF Press to turn ON' key will emit an audible tone to indicate there is still an active interlock.

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5 Initial Setup

For the initial setup of a VID system manual control should be used. A safe procedure is outlined below: -

Ensure that all high voltage connections are terminated correctly prior to powering up the DPS3 unit.

After powering up the DPS3 the last operating conditions of the DPS3 will be indicated on the status display. The Ht Output will be Off and the 'Master' control will be set to 0.0%.

The last settings of the DPS3 may be enabled by setting the 'Master' control to 100% and then a press of the 'Output is OFF Press to turn ON' key will turn on the high voltages and ramp them up to the set values.

Ensure that Tracking is set to 'Tracking Enabled', this is the default condition and is indicated on the status display.

1. If tracking is 'Disabled' press the 'Tracking Disabled' key to switch it to 'Tracking Enabled'

If the Interlock functions are to be utilised ensure that the interlock conditions are satisfied and enable the interlocks as follows.

2. Press the Interlocks key to cycle through the interlocks to select the desired setting.

All of the voltages of the DPS3 should be zeroed prior to a controlled power up of the VID.

3. Press and hold the 'Reset' key, after 3-4 seconds an audible tone will be heard and all the high voltage outputs will be reset to 0V.
4. Press the 'Master' key and adjust this setting to 100.0%.
5. Press the 'Output is OFF Press to turn ON' key to power up the high voltage modules.

The screen is the first electrode to be adjusted so that the VID may be monitored and any excessive signal can be observed and acted upon. Without voltages on either MCP there should be no signal observed, any signal indicates a problem. Precise operating voltage may vary between devices so please refer to the documentation supplied with the VID.

6. Press the 'V3' touch area and adjust the Screen voltage to the desired level.

For a non-gated VID the static operating voltages for the MCP's will be between 650V and 1000V per MCP, if possible please refer to the test data supplied with the VID. It is advised that the user starts with the lower voltage until the signal level has been determined and only adjusts to the maximum if the input signal is low and more gain is required. Excessive signal will damage the MCP's.

For a gated VID the amplitude of the Gate unit pulse must be subtracted from the Rear MCP voltage, i.e. if the pulse amplitude = 400V then the Rear MCP should be set to $650V - 400V = 250V$.

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7. Press the 'V2' key and adjust the Rear MCP voltage to 650V(250V for Gated VID).

Adjusting the Front MCP voltage will raise the gain of the detector so that signal should be observed on the screen of the VID. It is advised that during first operation the screen is observed at all times and that the Front MCP voltage is raised slowly to avoid rapid gain changes until the required gain is determined.

8. Press the 'V1' key and adjust the Front MCP voltage. Precise voltage is determined by the signal observed.

Any electrode voltage may be adjusted at any time during operation of the DPS3.

8. To modify the Front MCP press 'V1' and adjust as desired.
To modify the Rear MCP press 'V2' and adjust as desired.
To modify the Screen press 'V3' and adjust as desired.

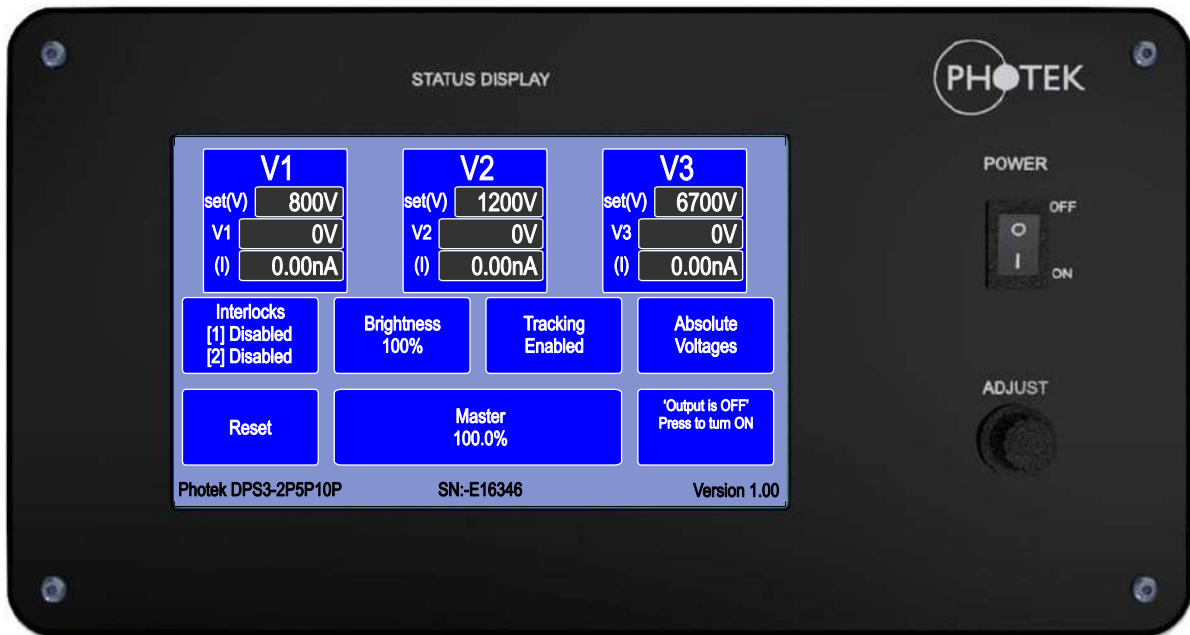
Once an acceptable level of signal has been determined the DPS3 may be operated without further adjustment. The High voltage settings will be remembered and may be safely powered up and down by successive presses of the 'Output is OFF Press to turn ON' key.

9. To power down the VID press the 'Output is ON Press to turn OFF' key.

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6 Front Panel Description

The front panel of the DPS3-2P5P10P is illustrated below: -



6.1 Power Switch

The power on/off switch is non illuminated so that the DPS3 may be used in a dark room. The DPS3 will be on when this switch is down or in '1' position.

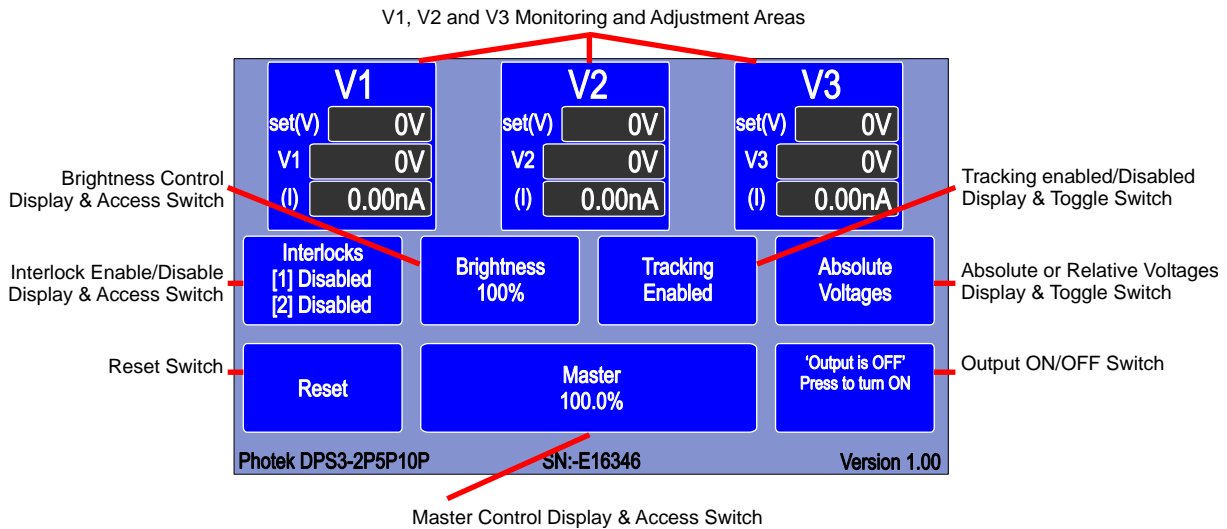
6.2 Adjust Control

The power on/off switch is non illuminated so that the DPS3 may be used in a dark room. The DPS3 will be on when this switch is down or in '1' position.

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6.3 Status Display

The status display is a touchscreen 7.2” liquid crystal display. The current operating conditions are displayed here. Manual modification of functions may be carried out using the touch sensitive areas and the ‘Adjust’ rotary control and by monitoring this display.



Functions downloaded from the PC will be displayed on the unit status display when they are implemented.

Under normal operating conditions the status display will indicate the current values of all relevant functions: Output ON/OFF, Tracking Enabled/Disabled, Absolute or Relative Voltages the current Interlock status and the 3 output voltages displayed as set and measured values and the measured output current.

6.4 Front Panel Controls

The DPS3-2P5P10P may be operated under manual control via the touch sensitive areas of the display utilising the adjust control for numerical adjustments. Each touch sensitive area is announced with its function and current status.

1. Tracking Enabled/Disabled - Touch Sensitive Area

This allows the user to enable/disable the high voltage tracking function.

When tracking is enabled any voltage adjustment on V1 will be applied to both the V2 and V3, and any adjustment of the V2 will be applied to the V3. This includes both increments and decrements. The DPS3-2P5P10P will not allow negative ‘gap voltages’ if tracking mode is enabled, i.e. V1 can never exceed the V2 potential and the V2 can never exceed the V3 potential. The software programmed limits will be active to limit the maximum voltages that may be set on each output.

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When tracking is disabled each output may be adjusted independantly. In this mode any output may be set to any value within its pre-programmed limits. Negative gap potentials are not possible in this mode of operation, i.e. V1 may not exceed the V2 potential and the V2 may not exceed the V3 potential.

2. V1/ V2/ V3 - Touch Sensitive Areas

These are edit functions which when pressed will allow for manual adjustment of the related electrode voltage utilising the ‘Adjust’ control.

V1– This allows the V1 voltage to be modified.

V2- This allows the V2 voltage to be modified.

V3 - This allows the V3 voltage to be modified.

3. Interlock - Touch Sensitive Area

This allows the user to select and monitor interlock status. There are 2 interlocks which may be enabled either to be ‘Seperately On’ or ‘Both On’ or ‘Both Off’.

Successive presses of this touch sensitive area will cycle through the interlocks in the sequence Interlocks Off, Interlock 1 On, Interlock 2 On, Both Interlocks On and then back to Interlocks Off

4. ‘Output is OFF’ Press to turn ON - Touch Sensitive Area

This key is a toggle function for the High Voltage On/Off control i.e. each time this key is pressed the high voltage power will be toggled to the opposite state.

5. Adjust

The ‘Adjust’ control is a rotary control for data editing.

When any of the voltage edit functions V1/V2/V3 is selected the ‘Adjust’ control may be used to increase or decrease the voltage on that electrode.

If the high voltage outputs are ‘On’ the adjustment of any electrode voltage is dynamic and occurs in real time as the user adjusts the control. This approximates to analogue control of the high voltage output selected.

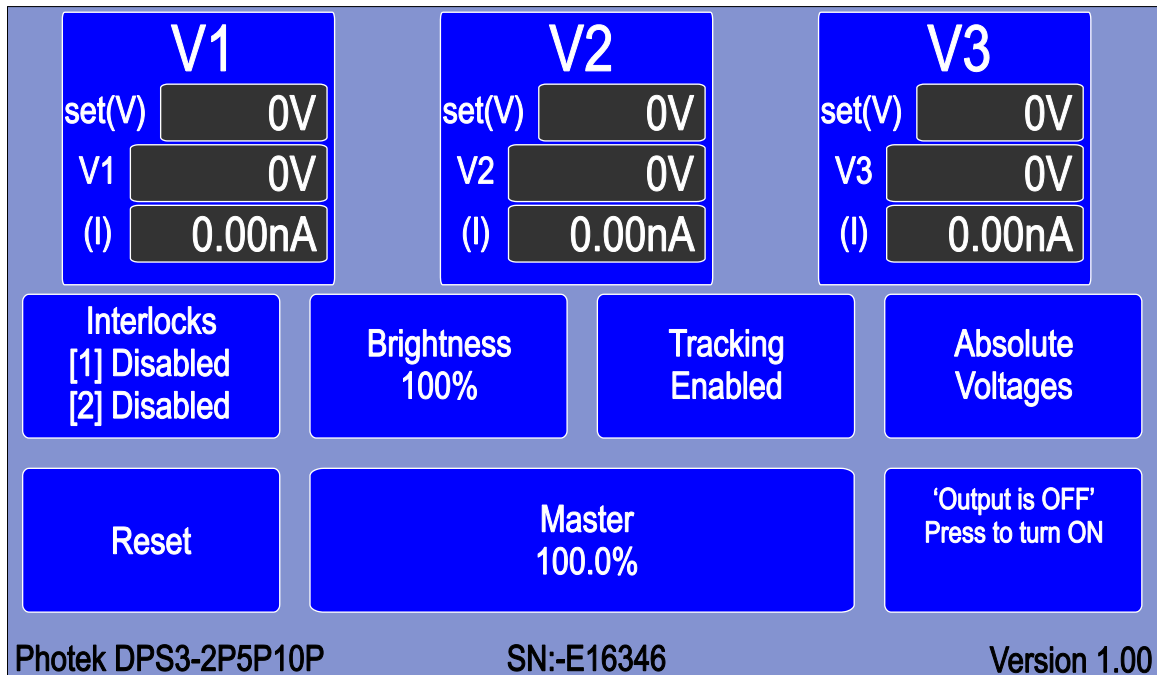
If the high voltage outputs are ‘Off’ when adjustments are made the DPS3 will use its pre-programmed ramp-up time when the the high voltage outputs are turned on.

If the Tracking function is set to ‘On’ any adjustment of V1 will be automatically added to both V2 and V3, likewise if V2 is adjusted this will automatically be added to V3. Any adjustment made to the V3 only adjusts V3. If at any time a limiting value is reached the DPS3 will emit an audible tone. The DPS3 will not allow its pre-programmed gap voltages to be exceeded.

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7 Status Display

After the power up sequence the DPS3 status will be displayed similar to the following: -



Each of the functions displayed is explained in the following sections.

7.1 Master Control

The Master control is displayed on the bottom center of the display.

This is a touch sensitive area and controls the output voltages as a percentage of the actual output.

This allows all outputs to be adjusted up or down by the same percentage. The output voltage will be a percentage of the 'set (V)' voltage as displayed in the voltage monitoring and adjustment area.

During power up this will be set to 100% as default and unless the DPS is being used for functions other than control of a VID device this area should not require adjustment.

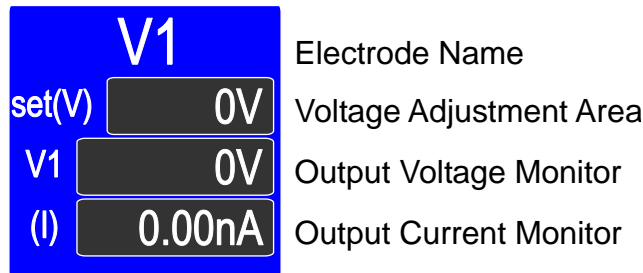


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7.2 Output Monitoring and Adjustment Areas

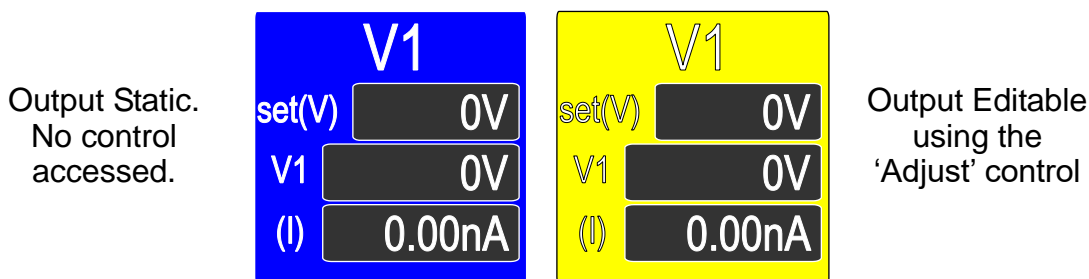
There are 3 touch sensitive areas which allow for adjustment and provide monitoring of the voltage and current for each output.

The 3 touch sensitive areas are V1, V2 and V3. These areas are located on the top line of the display and each area is independently activated and controlled within the functionality of the unit such as Tracking Enabled/Disabled and Absolute/Relative Voltage display. The output monitoring and adjustment area format is shown below: -



The Electrode name references the control and monitoring with the output connector name on the rear panel of the unit, i.e the V1 area controls and monitors the V1 output connector etc.

Set(V): The voltage adjustment is accessed by touching the area and using the Adjust control to increase or decrease the voltage. The output voltage may be set to 1V resolution within the limits of the high voltage module. Once accessed the V1 touch area will change to a yellow background which indicates that this electrode may be adjusted using the adjust control. This is shown below: -



Voltage Monitor V1/V2/V3: This is the feedback monitoring of the output voltage and is displayed with 1V resolution.

Note: the voltage monitor may be fractionally different from the set voltage.

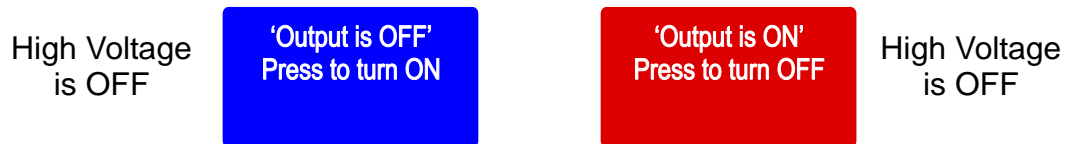
Output Current Monitor (I): The output current monitor displays the measured output current from the high voltage module. This has resolution of limiting resolution of 1uA for V1 and V2 and 10nA for V3. Accuracy is ± 1 Least Significant Digit.

The V3 measured current is calibrated at approximately 7kV with an error of $\pm 0.5\mu\text{A}$, this is a digital calibration of a non-linear current measurement and when the unit is operated at voltages significantly higher or lower than this, these errors will increase.

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7.3 High Voltage - On/Off

The status of the high voltage output is displayed on the bottom right of the display. This is a touch sensitive area and when pressed will toggle the high Voltage On and Off. When the high voltage is Off, the area will be blue, when the high voltage is On the area will change to be red as shown below: -



Immediately after power up the HT Output will always be 'Off'. The voltages displayed will be the last operating values, however no voltage will be present on the output connectors. The 'Output is OFF' Press to turn ON area must be touched in order to turn the High Voltage Outputs 'On'. All outputs will be toggled On or Off by this touch sensitive area.

The operating conditions of the DPS3 are saved when the High Voltage On/Off button is turned off. Any changes made to the DPS3 without being applied to the detector by enabling the high voltage will be discarded when the mains power is switched off and the last actual operating conditions will be remembered by the DPS3.

7.4 Tracking – On/Off

The Tracking function is displayed on the center right of the display. The two tracking modes are, tracking enabled and tracking disabled as indicated below: -



For operation of a VID Tracking should be enabled.

When Tracking mode is 'Enabled', the potential differences between adjacent higher voltage electrodes will be automatically maintained during adjustment of any one electrode voltage.

When Tracking is 'Disabled', each electrode voltage may be set to any value within its pre-programmed limits. The DPS3 will not allow the outputs to exceed the pre-programmed maximum values.

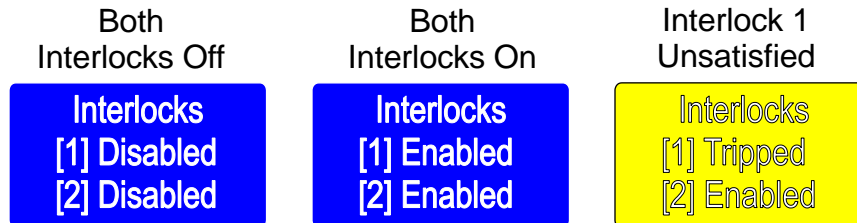
It is not possible to set the V1 higher than the V2 or V3 electrodes, and likewise it is not possible to set V2 higher than the V3 electrode. The DPS3 will not allow the outputs to exceed the pre-programmed maximum values.

The 'Tracking' area must be touched to toggle between 'Tracking Enabled' and 'Tracking Disabled' (Independent) control modes.

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7.5 Interlock Status

The interlock status is displayed on the center left of the display. There are 3 distinct states for each interlock; Disabled, Enabled and Tripped. These 3 states are indicated below: -



There are 2 interlocks which may be enabled individually, both together or, if they are not required, both may be disabled.

After power up the last used setting for the interlocks will be automatically enabled.

The interlock inputs are located on the 25-Way D Socket mounted on the rear panel of the DPS3.

To enable/disable the interlocks touch the interlock touch area repeatedly until the desired setting is displayed. Successive touches will cycle through the interlocks in the following order – Interlocks Off, Interlock 1 On, Interlock 2 On, Interlocks On (both 1 &2), then back to Interlocks Off.

Each interlock input must be connected to 0V to be satisfied. If an interlock is enabled and unsatisfied the high voltage outputs will be disabled.

If an interlock is ‘enabled’ and ‘unsatisfied’ the interlock status will change to indicate which interlock is active, ‘(1) Tripped’ – means Interlock 1 is enabled and unsatisfied..

If either interlock is enabled then it will be unsatisfied if the input is open circuit, this ensures that broken wires between the interlock driver and the DPS3 will not allow the DPS3 high voltage outputs to be turned on.

To enable the high voltage outputs, the Interlock conditions must be satisfied or the interlocks must be disabled. If the interlocks are disabled the VID has no protection.

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7.6 Absolute/Relative Voltages

The DPS3 may be enabled to display Absolute or Relative Voltages. The two possible states of the DPS3 are indicated below: -

Absolute: - All Voltages Referenced to 0V	<div style="background-color: #0000FF; color: white; padding: 10px; display: inline-block;"> Absolute Voltages </div>	<div style="background-color: #0000FF; color: white; padding: 10px; display: inline-block;"> Relative Voltages </div>	Relative: - $V1 = V1 - 0V$ $V2 = V2 - V1$ $V3 = V3 - V2$
---	--	--	---

If 'Absolute Voltages' is enabled then the voltage displayed will be the actual voltage that would be measured using a volt meter referenced to 0V.

If 'Relative Voltages' is enabled then the voltage displayed will be the current electrode voltage minus the voltage of the electrode immediately below.

For instance: -

1. V1 will display the voltage on V1 referenced to 0V.
2. V2 will display V2-V1
3. V3 will display V3-V2.

7.7 Screen Brightness

The DPS unit is designed so that it may be used in a dark room for testing of intensifiers. For that reason a brightness control has been incorporated in order that the user may operate the DPS unit in a dark environment without excessive light being emitted from the DPS unit. : -

Maximum Brightness	<div style="background-color: #0000FF; color: white; padding: 10px; display: inline-block;"> Brightness 100% </div>	<div style="background-color: #0000FF; color: white; padding: 10px; display: inline-block;"> Brightness 5% </div>	Minimum Brightness
-----------------------	--	--	-----------------------

The minimum Brightness that may be enabled is 5% and the maximum Brightness is 100%. To adjust the Brightness touch the 'Brightness' area and use the 'Adjust' control to modify the Brightness setting. The DPS unit remembers the last Brightness setting on power up and will re-enable this level.

7.8 Reset Function

The DPS unit has a Voltage Reset function in order that all voltages may be zeroed quickly.

Zero Voltages Function	<div style="background-color: #0000FF; color: white; padding: 10px; display: inline-block;"> Reset </div>
---------------------------	--

In order to reset all voltages to zero, the Reset area must be touched for approximately 4 seconds and then all voltages will be set to 0V.

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8 Rear Panel Description

The DPS3-2P5P10P rear panel is illustrated below: -



8.1 IEC Mains Inlet

The mains input for this unit is via a fused IEC inlet. This unit accepts any A.C. mains voltage between 90V and 250V, either 50Hz or 60Hz.

For voltages of 90V - 120V A.C. a 2.5A fuse should be fitted and for voltages of 220V - 240V A.C. or higher a 1.5A fuse should be fitted. The Fuse compartment has the capacity to store 1 spare fuse.

8.2 Fan Outlet

The fan outlet and the underside of the unit should be left uncovered to allow for air circulation within and around this unit.

The air intake is via slots located on the bottom of the unit and air is expelled from the Fan outlet mounted on the rear panel.

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8.3 V1, V2 & V3 Outputs

These are the 3 high voltage outputs from the DPS3 via 12kV rated high voltage SHV BNC connectors. The outputs correspond to the control functions as follows: -

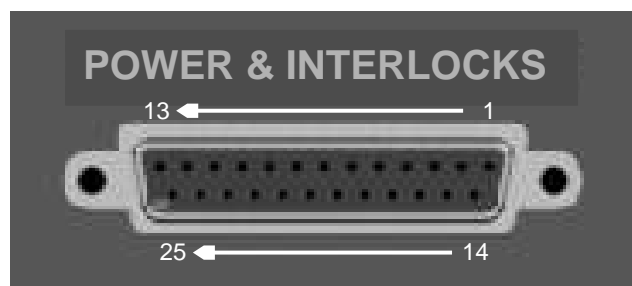
V1	Front MCP	0-2000V
V2	Rear MCP	0-5000V + V1
V3	Screen	0-5500V + V1 + V2

8.4 Interlock Connector

This 25-Way D-Type Socket contains both interlocks and 3 low voltage power supply outputs for the operation of peripheral interface units.

The interlock connections are TTL inputs that are pulled high. To use an interlock function a grounded connection must be supplied that indicates that the interlock is safe and allow the high voltage to be powered on. If an interlock is enabled and left open circuit it will disable the high voltage outputs from this unit and sound an alarm.

The Functions of this connector are indicated below: -



(View as seen looking at the DPS rear panel)

25-Way D-Type Socket	
Pin No.	Function
1, 14	+12V @ 1A Power Output <i>(See Note)</i>
2, 15	+5V @ 2A Power Output <i>(See Note)</i>
3, 16	-12V @ 0.25A Power Output <i>(See Note)</i>
5, 6, 7, 8, 9, 10, 18, 19, 20, 21, 22, 23, 24, 25	0V
11	Interlock 2 Input (0V = Satisfied)
12	Interlock 1 Input (0V = Satisfied)

Note: - Each power output is fitted with a fuse on the rear panel of the DPS3-2P5P10P unit, each fuse is a 5x20mm anti-surge (T) rated at the output current maximum.

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8.5 D.C Output Fuses

The DPS3 provide 3 output supply rails which may be used by the customer to power small quantities of peripheral electronics associated with the DPS3 system such as interlock drive electronics. In order to ensure that excessive current drawn from these supply rails does not affect the DPS3 primary function each output rail has been fitted with an accessible fuse located on the rear panel of the DPS3 unit. The output voltages and the fuse rating or maximum allowable currents are printed on the panel next to each fuse.

8.6 RS-232 Connector

This is an asynchronous serial communication port operating at a fixed baud rate of 19200. This enables the DPS3-2P5P10P to be controlled from a standard PC by means of ASCII control characters and codes.

The DPS3-2P5P10P RS-232 uses a 2 wire system (transmit and receive), handshaking is implemented in software for confirmation of valid control codes.

A full listing of codes and protocols are listed in the software interface section of this manual.

The RS-232 connector is a 9-Way D-Type Plug. Pin-out functions are listed below: -



(View as seen looking at the rear panel)

9 Way D-type plug	
Pin No.	Function
Pin 2	Transmit data
Pin 3	Receive data
Pin 5	Ground/ 0V

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9 RS-232 Serial Interface

9.1 Serial Link Configuration

The RS-232 utilised by the DPS3-2P5P10P is a 3-wire interface for asynchronous transmission and reception of data. The interface utilises TD (Transmit Data), RD (Receive Data) and Gnd from the RS-232 protocol.

The Baud rate for communication is fixed at 19200; this is programmed into the DPS3-2P5P10P and cannot be modified.

The Data format is No Parity, 8 Data bits and 1 stop bit.

All data transmitted to or from the DPS3-2P5P10P is in ASCII format. Commands take the form of letters and variables are ASCII numbers.

9.1.1 Configuration Summary:-

Baud Rate	=	57600
Parity	=	No
Data Bits	=	8
Stop Bits	=	1

9.1.2 Command Acknowledgement

When a serial command is received it may be acknowledged or the acknowledgement can be suppressed if the user wishes by enabling the “vb” or “verbose” command.

To suppress command acknowledgement send a “vb1” or “vb0” command and the DPS1 will accept commands but not acknowledge them. To re-enable command acknowledgement send a “vb2” command.

The following is a list of command acknowledgements and error codes that may be received by the user.

Response	Description Of Response
ok	command accepted and executed
err 1 command not recognised	characters entered are not a valid command
err 2 parameter missing	valid parameter required
err 301 number out of range	command not accepted as the value is out of the range of the function being updated

9.2 DPS Serial Commands

The commands for the DPS unit have been enabled in 2 ways, short commands for quick control by the user typing the commands and also as long commands (words) that may be used in software code to make it more readable/understandable. DPS user commands are listed below: -

Short Command	Long Command	Description
cmds	commands	Command Table Request
id	version	Unit Name & Software Version Request
gc	getchannel	Channel Selection and Voltage Reading
p	power	High Voltage Power Off, On
rf	relative	Relative/(Absolute) display mode
sc	setchannel	Channel Selection and Voltage Setting
si	setinterlock	Interlock Setting
sm	setmaster	Master Control Set Percentage
snr	serialnumber	Request Unit Serial Number
t	tracking	Tracking Enable/Disable
u	setramp	High Voltage Ramp-Up rate Setting
vb	verbose	Response Selection

Note: - Commands are not case sensitive.

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9.3 Command & Data Format

9.3.1 Command List Request

The command list request command allows the user to see a list of all user commands available for the DPS unit. The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	ASCII Integer Data String	Notes
Command List Request	cmds (commands)	-	

9.3.2 Unit Identification

The unit identification may be requested from the DPS1 by using the ‘id’ command. The returned data will be the unit type ‘DPS1’ and the firmware issue number i.e. ‘V1.00’. each data element will be de-limited by a comma, an ok will follow the returned data string. The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	ASCII Integer Data String	Returned Data
Request Unit Identification	id (version)	- (no data string)	DPS3,v1.00,ok

9.3.3 Get Channel

The getchannel command enables the user to request the operating conditions of the DPS1 unit. The getchannel command character/s must be followed by 2 ASCII variables, the first is the channel number, for a DPS1 this will always be 1, the second ASCII variable is the number indicating the variable that is to be requested. There are 10 variables that may be requested, these are listed below: -

1. Measured Voltage Value.
2. Set Voltage Value.
3. Measured Current Value.
4. Absolute Voltage Limit – High
5. Absolute Voltage Limit – Low
6. Relative Voltage Limit – High
7. Relative Voltage Limit – Low
8. Interlock Enable/Disable Status
9. Interlock Input Actual Status
10. Ramp Speed.

Data is returned in floating point notation, OK is returned on receipt of a valid command. The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	Valid ASCII Integer Data	Data Requested
Get Channel Data	gc (getchannel)	1,1	Measured Voltage
		1,2	Set Voltage
		1,3	Measured Current

For the interlock status request functions the data returned indicates the following: -

Data Returned	Interlock Enable/Disable Status	Interlock Input Actual Status
0	Both Interlocks Disabled	Both Interlocks Satisfied
1	Interlock 1 Enabled	Interlock 1 Unsatisfied
2	Interlock 2 Enabled	Interlock 2 Unsatisfied
3	Both Interlocks Enabled	Both Interlocks Unsatisfied

9.3.4 Power Command

The power command provides an on/off function for the High Voltage PSU.

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	Maximum/ Minimum ASCII Integer Data String	Command String Transmitted	Instruction Equivalence
High Voltage Power On/Off	p	1	p1	HV Power On
	(power)	0	p0	HV Power Off

9.3.5 Relative/(Absolute) Display Command

The Relative/(Absolute) command allows the display of the High Voltage outputs to be relative with respect to adjacent units or to be displayed as absolute voltages.

When displayed as relative the voltage is referenced to the next 'lower' output channel, i.e. V2 relative displays is referenced to V1 and V3 relative display is referenced to V2.

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	Maximum/ Minimum ASCII Integer Data String	Command String Transmitted	Instruction Equivalence
Relative (Absolute)	rf	1	rf1	Relative Display Mode
	(relative)	0	rf0	Absolute Display Mode

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9.3.6 Channel and Voltage Setting

The setchannel command character/s must be followed by 2 ASCII variables, the first is the channel number, for a DPS1 this will always be 1, the second variable is the actual voltage required, for negative power supplies a “-” sign is required for the output voltage to be accepted. The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	ASCII Integer Data String	Notes
Channel Select and Voltage Setting	sc (setchannel)	1,1000	Channel 1 Output set to 1000V

9.3.7 Set Interlock/s

The set interlocks command allows the required interlocks to be enabled/disabled. The setinterlock command character/s must be followed by one ASCII variable, this is the setting required for the interlocks. The interlocks are function variable is illustrated by the following table: -

Data Sent	Interlock Enable/Disable Status
0	Both Interlocks Disabled
1	Interlock 1 Enabled
2	Interlock 2 Enabled
3	Both Interlocks Enabled

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	ASCII Integer Data String	Notes
Set interlocks	si (setinterlock)	0	Both interlocks Disabled
Set interlocks	si (setinterlock)	1	Interlock 1 Enabled
Set interlocks	si (setinterlock)	2	Interlock 2 Enabled
Set interlocks	si (setinterlock)	3	Both interlocks Enabled

9.3.8 Master Command

The master command allows the user to set the outputs of all modules at a percentage of their respective set values.

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	Maximum/Minimum ASCII Integer Data String	Command String Transmitted	Instruction Equivalence
Master Control	sm (setmaster)	100 0	sm100 sm0	Master = 100% Master = 0%

9.3.9 Serial Number Request Command

The serial number request command allows the user to obtain the serial number of the DPS unit connected to the system.

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	Maximum/Minimum ASCII Integer Data String	Command String Transmitted	Instruction Equivalence
Serial Number Request	snr (serialnumber)	- -	snr	Serial Number Request

9.3.10 Tracking Command

The tracking command allows the user to select whether higher modules track increases on lower output modules or not.

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	Maximum/Minimum ASCII Integer Data String	Command String Transmitted	Instruction Equivalence
Tracking On/Off	t (tracking)	1 0	t1 t0	Tracking On Tracking Off

9.3.11 Set Ramp Rate

The speed that the high voltage rises from 0V to its set value is controlled by the “SetRamp” command. This is a command followed by an ASCII number variable which is equivalent to seconds equal or greater than 1. (i.e. minimum ramp rate = 1 second)

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	ASCII Integer Data String	Equivalent Ramp Speed
Set Ramp Rate	u	10	10 seconds
	(setramp)	3600	1 hour

9.3.12 Verbose

The verbose command allows the user to specify the level of command acknowledgement required from the DPS1 unit. The “vb” command is followed by either a 0, 1 or 2.

0 indicates no responses required, 1 enables just error responses, 2 enables all responses.

The default state for verbose is all acknowledgements are enabled.

The format of this command function is illustrated below: -

Command Function	ASCII Command Letter	ASCII Integer Data String	Notes
Set Command Acknowledgement	vb (verbose)	0	No Acknowledgements
		1	Only Errors are Acknowledged
		2	Enables all acknowledgements

10 DPS3-2P5P10P Specifications

10.1 Mechanical:

DPS3-2P5P10P Size:	Width 300 x Depth 350 x Height 160mm (Maximum Extents)
DPS3-2P5P10P Weight:	≈6.85Kg
Panel Colour:	Umbra Grey (RAL7022)
Case Colour:	Pebble Grey (RAL7032)

10.2 Electrical:

10.2.1 Mains Supply

Supply Voltage:	Universal 90-260V 50/60Hz
Fuse Rating Required:	110V/120V 2.5Amp 220V/240V 1.5Amp

10.2.2 High Voltage Outputs

The DPS3-2P5P10P is fitted with 3 High voltage modules. When the 'Output is OFF Press to Turn ON' switch is activated these high voltage D.C. output voltages will be present on the SHV BNC high voltage sockets on the rear of the unit.

	Maximum Output Voltage	Maximum Output Current	Full Load Ripple
V3 (Screen)	10kV	125uA	1.6V
V2 (Rear MCP)	5kV	250uA	800mV
V1 (Front MCP)	2kV	0.5mA	400mV

11 Items Supplied

The following Items are deliverable with the DPS3-2P5P10P system:-

Item No.	Description	Quantity
1	DPS3-2P5P10P Power Supply	1
2	ED573 - 2m SHV to SHV BNC Cable (Colour Coded Red)	1
3	ED574 - 2m SHV to SHV BNC Cable (Colour Coded Black)	1
4	ED575 - 2m SHV to SHV BNC Cable (Colour Coded Yellow)	1
5	ED375 - 2m USB to RS232 Lead – USB A to 9-Way D type Socket	1
6	2m IEC Mains Lead with a moulded plug (US, UK or European Plug)	1
7	DPS3-2P5P10P User Manual	1

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