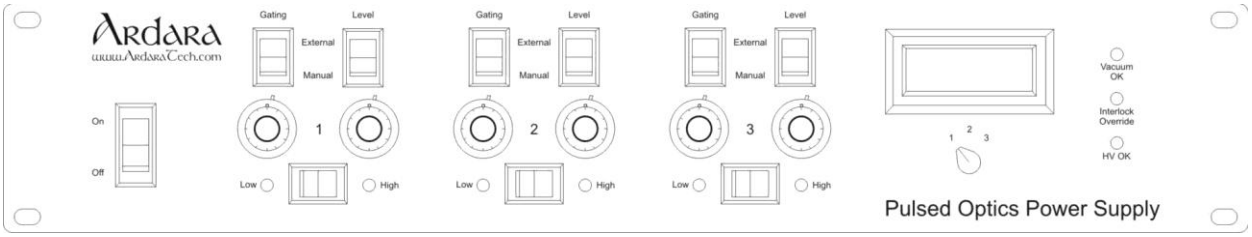
Pulsed Optics Power Supply (Model 115)



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1.0 Packing List

1.1 Packing List for Pulsed Optics Power Supply

The Pulsed Optics Power Supply is shipped with the following items:

Table 1. Pulsed Optics Power Supply

Quantity	Part Number	Description
1	PSDS_PLS_DC_01	Pulsed Optics Power Supply with 3 outputs
1	PSDS_PLS_DC_01_MAN	Pulsed Optics Power Supply Operator Manual
1	CABL_POW_110AC_10FT	Universal AC power cable for US use, 10 feet long

1.2 Optional Accessories for Pulsed Optics Power Supply

The following list of optional cables and components are compatible with the Pulsed Optics Power Supply. See Appendix A for more details.

Table 2. Optional Accessories for Pulsed Optics Power Supply

Part Number	Name	Description
801108	CABL_BNC_MXPIN_10FT_01	BNC to Molex plug cable, 12 inches long.
801112	CABL_MX_Y_FMF_121N_01	Two Molex sockets to Molex plug Y-cable.
801114	CABL_BNC_MXSOCK_10FT_01	BNC to Molex socket cable, 12 inches long.
801118	CABL_SHV_MXPIN_10FT_01	SHV to Molex socket cable, 10 feet long.
801138	CABL_RG58_120IN_BNC	BNC to BNC cable, 10 feet long.
801153	CABL_RG59_120IN_SHV	SHV to SHV cable, 10 feet long.
801156	CABL_RG62_36IN_SHV	SHV to SHV cable, 3 feet long.

2.0 Product Identification

In all communication with Ardara Technologies, please specify the Ardara Technologies part number for the power supply from your original purchase order, along with the serial number of the unit.

3.0 Scope of Manual

This manual applies to the Ardara Technologies Pulsed Optics Power Supplies Identified as PSDC_PLS_DC_01 in the upper left hand corner of the box's rear panel.

This document is valid as of the date of publication. We reserve the right to make technical changes to the design. As this design of the Pulsed Optics Power Supply is customizable, please refer to configuration document.

4.0 Intended Use

The Ardara Technologies Pulsed Optics Power Supply was designed to provide high speed switching high voltages suitable for up to three optics elements, including lenses, quadrupole deflectors, ion guide offset potentials, pre-filter offset potentials and other ion optics devices.

The system also features an available vacuum interlock input on its back panel, which is designed to disable the voltage output under conditions where the vacuum pressure is too high for safe operation.

5.0 Safety

This Pulsed Optics Power Supply is capable of generating lethal voltages. Care must be taken to ensure safety during use.

5.1 Input Power

This Pulsed Optics power supply is equipped with a universal input AC power connection, which requires that the power cord ground connection be connected to earth ground through a properly wired AC outlet to ensure safe operation. The use of a 'ground isolator' or similar device is prohibited for safe operation.

The AC power input is compatible with worldwide AC power, from 100 to 240 VAC, 50-60 Hz and 600 Watts.

5.2 Custom Output Connections

Use only approved high voltage cables and connectors, which are rated to the voltages in use.

It is often the case that this Pulsed Optics power supply is used to replace another in an existing application. Be sure to review the voltage ratings of the cables and vacuum feedthrus in use to verify compatibility with high voltages possible from this Optics supply.

Due to the possibility of high current on the output, care must be taken to not touch the output while the power supply is on.

5.3 Vacuum Pressure Considerations

The Ardara Pulsed Optics Power Supply is often used to power Ion optics at intermediate vacuum pressure. One challenge to operating high voltage devices is the impact of gas pressure on the voltage discharge limit.

At high vacuum (10^{-5} torr and below) and at atmospheric pressure and above, devices can tolerate quite high voltage gradients with very small electrode gaps.

However, for intermediate pressures (10^{-2} torr to 1 torr), the tolerance to high voltage gradients is dramatically reduced, resulting in discharges (i.e. glow discharge) which can damage the device as well as damage the power supplies

driving it. This phenomenon is described in the literature using the Paschen Curve.

The vacuum interlock feature of this Pulsed Optics Power Supply is designed to be utilized in conjunction with a vacuum gauge that features a contact closure output when the measured pressure is below a given set point. It is recommended that this feature of the Optics power supply be implemented to ensure safe operation.

6.0 Liability and Warranty

Ardara Technologies assumes no liability and the warranty becomes null and void if the end user or third parties:

- Disregard the information in this manual.
- Use the product in a non-conforming manner.
- Make any kind of changes (modifications, alterations, etc.) to the Pulsed Optics Power Supply.
- Use the product with accessories not listed in the corresponding product documentation.

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7.0 Product Overview

7.1 Summary

The Ardara Technologies Pulsed Optics Power Supply was developed to provide users with a high speed switchable high voltage source for various ion optics devices. Ardara's Pulsed Optics Power Supply is conveniently designed to install into a standard 19-inch (48.25 cm) instrument rack, allowing for adequate ventilation.

The design incorporates three independent fast response +/-200-volt outputs standard. With 200 volts per microsecond slew rate and a typical rise time of less than a microsecond, it is ideally suited for trapping and releasing ions in linear ion traps prior to injecting them into an orthogonal extraction TOF mass spectrometer. Each of the three pulsed optics circuits is effectively a broadband amplifier with a gain of 40, and can drive fairly high frequencies (hundreds of kilohertz) even into fairly high capacitive loads (performance was recently tested with a capacitive load of 3 nanofarads to ground). For those customers who have fast acting DAC's or waveform generators, there is a connector in the back to bring a command into each channel of the Pulsed Optics Power Supply, to use it simply as a broadband amplifier.

The front panel display switch allows direct measurement of each individual output voltage using the front panel digital voltmeter. The front panel also features 6 ten-turn potentiometers for fine control of each individual output's high and low state. Combined, these offer an easy, fast, and efficient voltage adjustment.

External command inputs can be implemented through the use of the DB15 connector and/or the three BNC connectors, featured on the back panel. A +/-5.00V command yields +/-200V output. Each output can be switched between front panel control and external command by switching the Internal/External switch. The external state control can be switched between the BNC inputs and three pins in the DB15 connector via jumpers inside the box.

Each channel of the Pulsed Optics Power Supply can be considered to have six modes of operation, depending upon how you configure the switches on the front panel, and depending on what kinds of voltages you connect to the back panel.

Mode 1: Front panel level control with front panel level state selector - useful for tuning the system up with manual selection of output level.

Mode 2: Front panel level control with external TTL state selection connected to the back panel. - For when you want to have manual control of the two output levels, but want to synchronize with an external device.

Mode 3: Back panel level control inputs with front panel level state selector. - Useful for manually verifying the exact voltages on front panel voltmeter for the two external level command inputs.

Mode 4: Back panel level control inputs with external TTL state selection connected to the back panel. - Complete external control of the two output levels as well as their states.

Mode 5: Same as mode 3, only with a dynamically programmed level (sine wave or arbitrary waveform) programmed into one of the external level inputs, with the front panel switch always selecting the programmed input.

Mode 6: Same as mode 4, but with external TTL state selection that allows you to quickly disable the arbitrary waveform, and substitute either a static or different arbitrary waveform.

Note that this power supply is not intended to be fast enough to be used as the high voltage pulser for a TOF system; rather it was designed to be synchronized with the high voltage pulser to gate ions into the pulsed extraction region from a linear ion trap prior to the high voltage TOF extraction pulse.

The unit has a vacuum interlock connector on the back panel, which allows an external contact closure to enable or disable the high voltage optics. This feature is compatible with ionization gauge pressure transducers with vacuum interlock contact closure outputs, and allows the Optics power supply to be put into a safe state if there is not adequate vacuum. This feature can also be used to turn voltages on and off remotely, by applying a 5-volt signal to pin 2 of this connector.

7.2 Front Panel Display

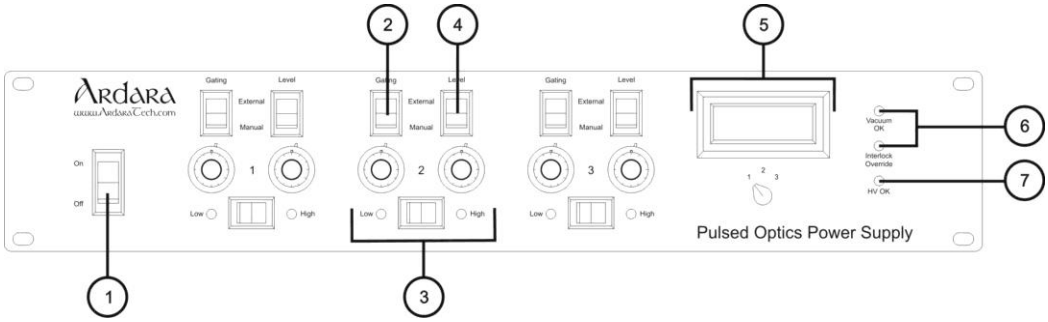

Figure 1. Front Panel Controls for Pulsed Optics Power Supply

Table 3. Pulsed Optics Power Supply Front Panel Controls

Balloon Number	Function	Description
1	On / Off Power Switch	Lighted power switch that enables AC power for the Optics power supply and also serves as a circuit breaker.
2	External/Manual Gating Switch	Selects between the Gating inputs; either externally through the DB15/BNC input (depending on the internal jumpers) or manually via the front panel switch.
3	Manual Voltage Adjustments and Switch for High/Low Commands	Ten turn potentiometers that control the optics voltages, with LED's below indicating which potentiometer are active during Manual Level control. The switch allows for manual gating control between the High and Low states.
4	External/Manual Level Switch	Selects between the Level inputs; either externally through the DB15 or manually via the front panel potentiometers.
5	Voltage Display and Selector Switch	Displays actual output voltage of the selected optics output. When gating, the value will not be able to accurately display the voltage. The switch selects the optics supply voltage (1 thru 3) that will be shown on the Display.
6	Vacuum OK and Interlock Override LED's	Vacuum OK LED lights when vacuum pressure of the system is OK. Interlock Override LED lights when the Override switch on the back panel has been activated.
7	HV OK LED	HV OK LED lights when the high voltage power supply inside the unit is working correctly.

7.3 Rear Panel Display

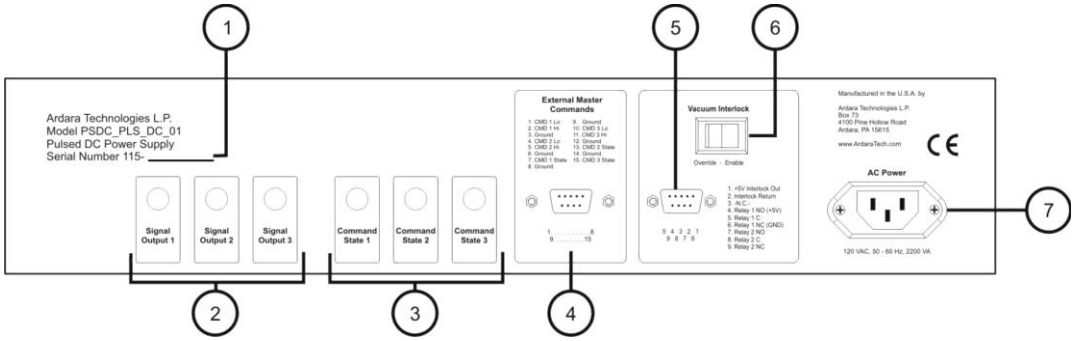

Figure 2. Rear Panel Controls for Pulsed Optics Power Supply

Table 4. Pulsed Optics Power Supply Front Panel Controls

Balloon Number	Function	Description
1	Serial Number	Ardara Technologies serial number of the Pulsed Optics Power Supply
2	Optics Output	3 SHV connectors
		Pin 1 is the output for Optics 1.
		Pin 2 is the output for Optics 2.
		Pin 3 is the output for Optics 3.
3	External State Command Input	BNC input for all three outputs to control the High / Low state of the output. 5 V for High and 0 V for Low
4	External Control Input	Female DB15 input that allows the control of optics voltages by applying a +/- 5.0V command, which is scaled to +/-200 volts and control of the state of the each optics by applying 0 volts for Low and 5 V for High.
		Pin 1 commands Optics 1 Low.
		Pin 2 commands Optics 1 High.
		Pin 4 commands Optics 2 Low.
		Pin 5 commands Optics 2 High.
		Pin 7 commands Optics 1 State.
		Pin 10 commands Optics 3 Low.
		Pin 11 commands Optics 3 High.
		Pin 13 commands Optics 2 State.
		Pin 15 commands Optics 3 State.
		Pins 3, 6, 8, 9, 12, and 14 are ground pins.

5	Vacuum Interlock Input/Output	Female DB9 input that allows external enabling and disabling of the high voltage output. Enables or disables the high voltage output depending on whether there is +5 volts presented to pin 2 from an outside source. For convenience, a +5 volt source is provided on pin 1, suitable for use with an ion gauge controller which has a contact closure output when a suitable pressure is established. A +5V signal present at pin 2 energizes two relays (#1, and #2) The Optics supply utilizes relay #1 internally, with pins 4, 5, and 6 available for diagnostics purposes. Relay #2 is available to echo the contact closure status, allowing the unit to daisy chain the vacuum interlock contact closure to other devices. The vacuum interlock relays used in this device support DC operation to 24 volts.
6	Vacuum Interlock Enable	Controls whether the vacuum interlock feature is enabled. When set to 'Override', the high voltage output is always enabled when AC power is turned on. When set to 'Enable', the high voltage output is enabled only when +5 interlock voltage is presented to pin 2 of the Vacuum Interlock Connector via contact closure on an ion gauge.
7	Universal AC Power Input	100 to 240 VAC, 60 Hz universal power input.

8.0 Installation

8.1 Installing the Pulsed Optics Power Supply

Installation of the Pulsed Optics Power Supply onto an optics system requires the following:

- Do not obstruct the airflow around the Pulsed Optics Power Supply.
- Do not operate the Pulsed Optics Power Supply in an environment that is subject to dust, high humidity, or mechanical vibrations.
- The Pulsed Optics Power Supply is designed to be mounting onto a 19-inch instrument rack, with adequate ventilation to the rear. The chassis of the controller must be properly connected to the mains ground, through mechanical fasteners.

8.2 Electrical Connections

8.2.1 AC Power Input

The Pulsed Optics Power Supply box is connected to ground via the ground connection in the three-pronged AC power cable.

- It is not safe to operate the Pulsed Optics Power Supply using a 'ground isolator' or three-prong to two-prong converter.
- Use only approved high voltage cables and connectors, which are rated to the maximum output voltage of the Pulsed Optics Power Supply.
- Make all connections with the Pulsed Optics Power Supply turned off

8.2.2 External Optics Output

Standard optics output is +/-200 volts. Ripple is less than 0.1% of maximum output voltage. *Care must be taken to **NOT** touch the output while the power supply is on due to the possibility of a high current.*

8.2.3 External Level Control Input

The three optics outputs can be controlled via external inputs through the DB15 connector. To be controlled externally the External/Manual Level switch must be set to External. *Reminder: Max/Min command is +/-5.0 V.*

8.2.5 External Gating Control Input

The three optics outputs can be gated/pulsed between the high and low states with TTL logic via two different external inputs, either through the BNC inputs or pins in the DB15. Only one input for each optic output is functional for a given setup. Jumpers on the interior PC board determine how the external gating functions. There are five sets of three jumper points (JP1 thru 5). JP1 is connected to the BNC inputs. JP2 and JP4 are connected to the rest of the circuit. JP3 is connected to the DB15 and JP5 is a bus connecting all three pins. Jumpers can be arranged to obtain the desired external gating control. For example, to obtain

individual control for each output from the BNC inputs, three jumpers are placed to connect JP1 to JP2. To have individual control via the DB15 the jumpers must connect JP2 and JP3. The addition of JP5 allows one input to gate more than one output. For instance, the BNC input of channel one can be the Master of all gating aspects with four jumpers placed between JP1-1 to JP2-1, JP4-1 to JP5-1, JP4-2 to JP5-2, and JP4-3 to JP5-3. The factory set jumpers will be identified in that particular unit's configuration document. *Reminder: Low state command is 0 V and High state command is +5 V.*

8.2.4 Vacuum Interlock Input

The vacuum interlock feature of this power supply should be implemented by constructing a cable that brings the +5 V command from pin 1 of the back panel female DB9 vacuum interlock connector out to the vacuum interlock contact closure from an ionization gauge controller, bringing the contact closure output back to pin 2 of the back panel vacuum interlock connector.

9.0 Commissioning

9.1 Initial Operation

- Set control to default to the front panel potentiometers by switching the External/Manual switches to Manual.
- Remove back panel optics output connectors, if present, so that the Pulsed Optics Power Supply is not connected to any other device.
- Set the back panel Vacuum Interlock switch to Override.
- Turn display selector knob to 1, the manual gate switch to low, and adjust potentiometer 1 Low between the low and high voltage limits. The front panel display should display -200V to 200V.
- Repeat for all other connectors.
- As the front panel command voltage is increased, verify that the resulting output voltage indicated on the front panel meter increases linearly.
- If using an external voltage source to control the unit, plug in the DB15 input in rear panel DB15 connection and switch the External/Manual Level switches to External. The front panel Level controls should now be disabled. Also adjusting the front panel potentiometer should have no affect on displayed voltage.
- Apply a range of voltages from -2.00V to 2.00V to individual optics and ensure voltage low and high limit reaches from -200V to 200V.
- If using external gating/pulsing to control the unit, plug in the appropriate input in the rear panel connector and switch the External/Manual Gating switches to External. The front panel gate switches should now have no

effect. Check the output with an oscilloscope to ensure that the desired pulse is obtained.

- Contact the Ardara Technologies Technical Support if the power supply fails to reach the appropriate maximum voltage.
- Note that there are current limiting resistors in series with each Optics Supply output. Attempts to measure the output voltage directly with a digital multimeter will result in erroneous readings which are proportionally lower than the values shown on the front panel display, due to a voltage divider configuration.
- If the displayed power supply output voltage appears erratic at higher voltage commands, then there may be some discharging happening external to the power supply, likely due to operation at too high a pressure, at too high a voltage for electrodes that are too close to each other or to ground. Verify that the Pulsed Optics Power Supply can reach its full voltage stably with no connection to the vacuum flange.

10.0 Maintenance and Care

Under normal operating conditions, the Pulsed Optics Power Supply does not require maintenance.

10.1 External Cleaning

Use a slightly moist cloth to clean the outside of the Pulsed Optics Power Supply. Aggressive scouring or cleaning agents might damage the painted surfaces.

10.2 Internal Cleaning

Under normal operating conditions, there should be no need to clean the inside of the Pulsed Optics Power Supply.

11.0 Dimensions

Table 5. PSDC_PLS_DC_01 Dimensions

Description	Dimension
Box dimensions (WxHxD)	Rack mount front panel 19 x 3.5 x 15 inches
Power Cable length	10 feet (removable)
Optics Cables (optional)	10 feet (removable)
Weight (with cables)	15.0 pounds
Shipping Weight	22.5 pounds

Appendix A: Cable and Connector Options

There are numerous options for providing cabling between the Pulsed Optics Power Supply and the user's hardware.

This Appendix provides an overview of various cable assemblies, which are compatible with the Pulsed Optics Power Supply.

A.1 Connector Drawings

Molex connectors are commonly used in break out cables to map out multiple devices or connectors. The following figures represent the pinouts for Molex connectors commonly used in Ardara Technologies cables.

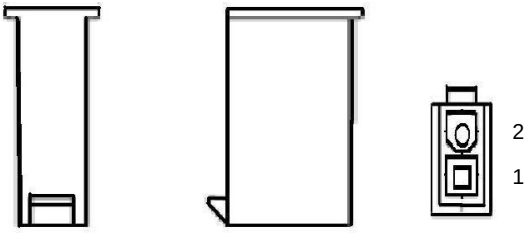

Figure A1. Pinout of 2 Pin Molex Plug.

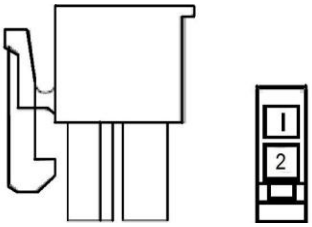

Figure A2. Pinout of 2 Socket Molex Socket.

A.2 Cable PN 801108 (CABL_ BNC_MXPIN_10FT_01)

This ten foot long coaxial output cable was designed to mate to a Molex two-socket connector on the female breakout cable (PN 801109), to bring Optics Power Supply voltages to BNC inputs such as the Ardara Technologies RF Power Supply pole bias offset inputs.

Table A6. CABL_BNC_MXPIN_10FT_01 – BNC to Molex cable. Extension for break out cable which allows connection to an external BNC input/output.

2 Pin Molex Pin Number	BNC with RG-58 Cable Connection
1	Center Conductor
2	Shield

A.3 Cable PN 801112 (CABL_MX_Y_FMF_12IN_01)

This Y-cable with two foot-long ends, replicates one of the Molex ends of a female breakout cable (PN 801109), allowing a single Optics Power Supply output to be mapped to two different elements.

A typical use for this kind of Y-cable is when there are more than one independently wired lens elements that need to be connected to a single optics supply.

Table A7. CABL_MX_Y_FMF_12IN_01 – Molex to Molex Y-cable. Extension for break out cable which allows monitoring of the voltage applied on each pin.

2 Pin Molex Pin Number	Color (20 Gauge)	2 Pin Molex Socket Number	Color (20 Gauge)	2 Pin Molex Socket Number
1	White	1	White	1
2		2		2

A.4 Cable PN 801114 (CABL_ BNC_MXSOCK_10FT_01)

This ten foot long coaxial output cable was designed to mate to a Molex two-socket connector on the male breakout cable (PN 801110), to bring external voltages from BNC outputs to the typical Ardara Technologies inputs.

Table A6. CABL_BNC_MXSOCK_10FT_01 – BNC to Molex cable. Extension for break out cable which allows connection to an external BNC input/output.

2 Pin Molex Pin Number	BNC with RG-58 Cable Connection
1	Center Conductor
2	Shield

A.5 Cable PN 801118 (CABL_SHV_MXPIN_10FT_01)

This ten foot long coaxial output cable was designed to mate to a Molex two-socket connector on the female breakout cable (PN 801109), to bring Optics Power Supply voltages to SHV inputs typically found on a flange face.

Table A6. CABL_SHV_MXPIN_10FT_01 – SHV to Molex cable. Extension for break out cable which allows connection to an external SHV input/output.

2 Pin Molex Pin Number	SHV with RG-58 Cable Connection
1	Center Conductor
2	Shield