Model 161 Optics Power Supply



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Table of Contents

Model 161 Optics Power Supply 1
Table of Contents 3
1.0 Packing List 5
1.1 Packing List for Optics Power Supply *5*
1.2 Optional Accessories for Optics Power Supply *5*
2.0 Product Identification 5
3.0 Scope of Manual 5
4.0 Intended Use 5
5.0 Safety 6
5.1 Input Power *6*
5.2 Custom Output Connections *6*
5.3 Vacuum Pressure Considerations *6*
6.0 Liability and Warranty 7
7.0 Product Overview 8
7.1 Summary *8*
7.2 Front Panel Display *8*
7.3 Rear Panel Display *9*
8.0 Installation 11
8.1 Installing the Optics Power Supply *11*
8.2 Electrical Connections *11*
8.2.1 AC Power Input 11
8.2.2 External DC Output 11
8.2.3 External Control Input 11
8.2.4 Vacuum Interlock Input 11
8.3 Tempus Data System *12*
8.3.1 Installation 12
8.3.2 Running the Software with RS232 Communication 12
8.3.3 Running the Software with USB Communication 13
8.3.4 Tune Dialog 13
9.0 Commissioning 18
9.1 Initial Operation *18*
10.0 Maintenance and Care 19
10.1 External Cleaning *19*
10.2 Internal Cleaning *19*
11.0 Dimensions 19
Appendix A: Cable and Connector Options 20
A.1 Connector Drawings *20*
A.2 Cable PN 801122 (CABL_OPTX_MS_MXPIN_10N0_10FT_01) *22*
A.3 Cable PN 801151 (CABL_OPTX_MXSOCK_4X_12IN_01) *23*
A.4 Cable PN 801152 (CABL_OPTX_MXPIN_4X_12IN_01) *24*
A.5 Cable PN 801153 (CABL_OPTX_MXSOCK_6X_12in_01) *25*
A.6 Cable PN 801154 (CABL_OPTX_MXPIN_6X_12in_01) *26*
A.7 Cable PN 801108 (CABL_ BNC_MXPIN_10FT_01) *27*
A.8 Cable PN 801114 (CABL_ BNC_MXSOCK_10FT_01) *27*
A.9 Cable PN 801112 (CABL_MX_Y_FMF_6IN_01) *28*
A.10 Cable PN 801118 (CABL_SHV_MXPIN_10FT_01) *28*
Appendix B: RS-232 Communications Protocol 29
B.1 RS-232 Communications Protocol Settings *29*
B.2 RS232 Command Syntax *29*
B.3 SET Command Syntax *29*
B.4 GET Command Syntax *31*

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1.0 Packing List

1.1 Packing List for Optics Power Supply

The Optics Power Supply is shipped with the following items:

Table 1. Optics Power Supply

Quantity	Part Number	Description
1	M161 Optics Power Supply	Optics Power Supply with 10 outputs
1	M161_Manual	Optics Power Supply Ten Output Operator Manual
1		
1	E_CABL_USB_TYPE_A-B_3.0M	USB cable for computer connection and Tempus Data System control
1	EA_CABL_INTERLOCK_1X	Vacuum interlock DB9 Y-cable
1	TEMPUS_DS_OPS_INSTALL_CD	Installation CD for the OPS version of Tempus Data System
1	CABL_POW_110AC_10FT	Universal AC power cable for US use, 10 feet long

1.2 Optional Accessories for Optics Power Supply

Ardara can provide numerous optional cables and components that are compatible with the Optics Power Supply. See Appendix A for more details.

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 Optics Power Supplies Identified as M161 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 Optics Power Supply is customizable, please refer to configuration document.

4.0 Intended Use

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

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

5.1 Input Power

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

5.3 Vacuum Pressure Considerations

The Ardara 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 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.

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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 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 Optics Power Supply was developed to provide users with a stable high voltage source for various ion optics devices. Ardara's 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 ten +/- 400-volt outputs standard.

The channels are controlled via a USB connection through the included Tempus Data System software. RS232 communications may also be used to communicate with the power supply, as outlined in Appendix B: of this manual. Tempus Data System provides full control of the output. The output can be turned on/off, incremented manually or by two set values, set to have a master command, and/or switched between multiple command states.

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

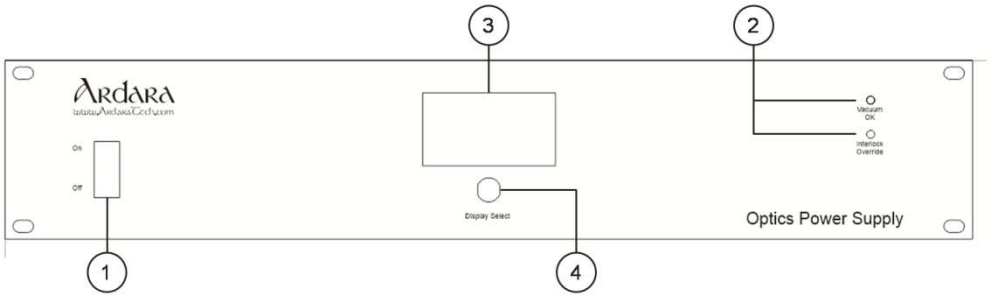


Figure 1. Front Panel Controls for Optics Power Supply

Table 3. 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	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.
3	LCD Display	LCD display shows readbacks for all 10 optics channels

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4	LCD Display State Button	Switchs the LCD display state; press to show additional decimal point, press again to switch back

7.3 Rear Panel Display

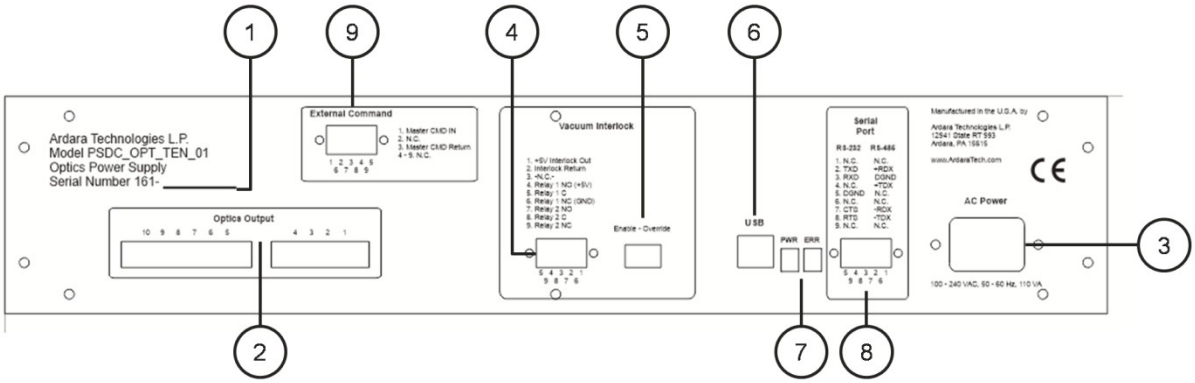


Figure 2. Rear Panel Controls for Optics Power Supply

Table 4. Optics Power Supply Rear Panel Controls

Balloon Number	Function	Description
1	Serial Number	Ardara Technologies serial number
2	Optics Output	6 and 4 pin Mate-N-Lok connectors Pin 1 of 4-pin is the output for Optics 1. Pin 2 of 4-pin is the output for Optics 2. Pin 3 of 4-pin is the output for Optics 3. Pin 4 of 4-pin is the output for Optics 4. Pin 1 of 6-pin is the output for Optics 5. Pin 2 of 6-pin is the output for Optics 6. Pin 3 of 6-pin is the output for Optics 7. Pin 4 of 6-pin is the output for Optics 8. Pin 5 of 6-pin is the output for Optics 9. Pin 6 of 6-pin is the output for Optics 10.
3	Universal AC Power Input	100 to 240 VAC, 60 Hz universal power input.

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5	Vacuum Interlock Connector	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.
4	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.
6	USB External Connection	USB Type B connector to be used to connect to a PC.
7	Power and Error LEDs	The Power LED should be Green any time power is present. The Error LED will be Red when and error has occurred.
8	RS232 Command Input	Female DB9 input/output RS232 connection which sends/receives the commands and readbacks to a connected computer.
9	External Command Input	Male DB9 input, takes an external command in on pin 1, with the common of the command on pin 3. External command is sent to the Master Bus, and the external signal can be added to the optics command by jumpering the master bus to the channel(s) meant to have the additive command.

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8.0 Installation

8.1 Installing the Optics Power Supply

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

- Do not obstruct the airflow around the Optics Power Supply.
- Do not operate the Optics Power Supply in an environment that is subject to dust, high humidity, or mechanical vibrations.
- The 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 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 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 Optics power supply.
- Make all Optics connections with the Optics power supply turned off

8.2.2 External DC Output

Standard DC output is +/-400 volts with 2 MΩ out impedance. Ripple is less than 0.1% of maximum output voltage.

8.2.3 External Control Input

Tempus communicates with the Optics Power Supply through the rear-panel RS232 connector or the USB port. Select the communication method in the Tempus configuration file as described below. Establishing a communications connection is separate from setting the optics output voltages or their on/off controls. Other control software may communicate with the supply using the RS232 protocol described in Appendix B.

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.

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8.3 Tempus Data System

8.3.1 Installation

Install the Tempus Data System application from the supplied installation media, following the Tempus manual. The listed prerequisites include .NET Framework 3.5 SP1 and .NET Framework 4.7.2. Keep the default installation directory, C:\Tempus. For a system containing PCI acquisition cards or a Tempus Data System controller box, install the specified National Instruments DAQmx 14.1 package before installing Tempus. After installation, launch Tempus using its desktop shortcut and load the configuration supplied for this Optics Power Supply. Refer to the Tempus manual for the complete installation procedure.

8.3.2 Running the Software with RS232 Communication

To use RS232 communication, load the configuration file supplied for this Optics Power Supply and open the Config editor from the main window (Figure 3). For each supply, locate “RS232 USB 1” under “PIC_Root” and select “RS232”; the final number changes for additional supplies. Set the corresponding “PIC_RS-232 Com Port 1” value to the COM port assigned to the serial connection or RS232/USB converter. Click Apply, then save the configuration file using the File menu on the main window. These changes take effect after the configuration is saved. Use the main-window “Optics” checkbox to establish communications before issuing tune commands or requesting readbacks.

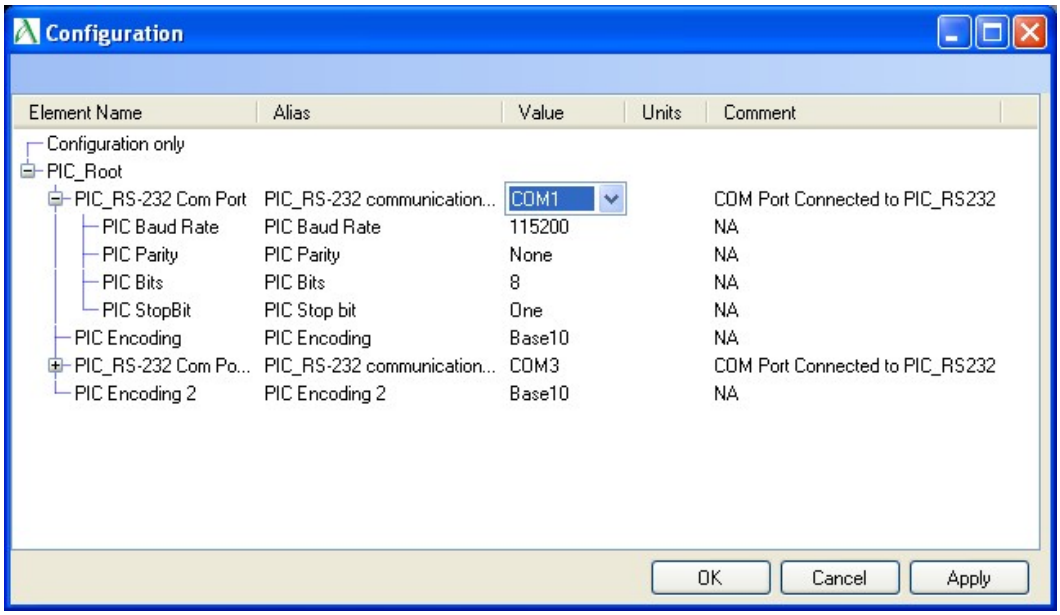


Figure 3: Tempus Data System Configuration Dialog

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*8.3.3 **Running the Software with USB Communication***

Start Tempus and power on the Optics Power Supply using the supplied configuration. When that configuration already matches the unit and selects USB, no additional communication setup is normally required. To change the communication method, open Config, locate “RS232 USB 1” under “PIC_Root” for each supply, select “USB”, click Apply, and save the configuration file. Check “Optics” on the main window to establish communications. If prompted to update the serial number, confirm that the correct configuration file is loaded and the intended supply is connected. The “Optics” checkbox controls the communications connection; output on/off and voltage settings are separate tune controls.

8.3.4 Tune Dialog

Open the Tune dialog by clicking Tune on the main-window toolbar (Figure 4). Before sending commands or requesting readbacks, establish communications using the main-window “Optics” checkbox. This checkbox controls the device connection, rather than the optics output on/off setting. When disconnected, editing a tune value changes the value held by Tempus only; readbacks fail and may be marked “F”. Once connected, use the appropriate optics tune elements to command the desired output state and voltages. The Tune dialog is a tree-based view; click +/- to the left of a parent branch to hide or show its child items.

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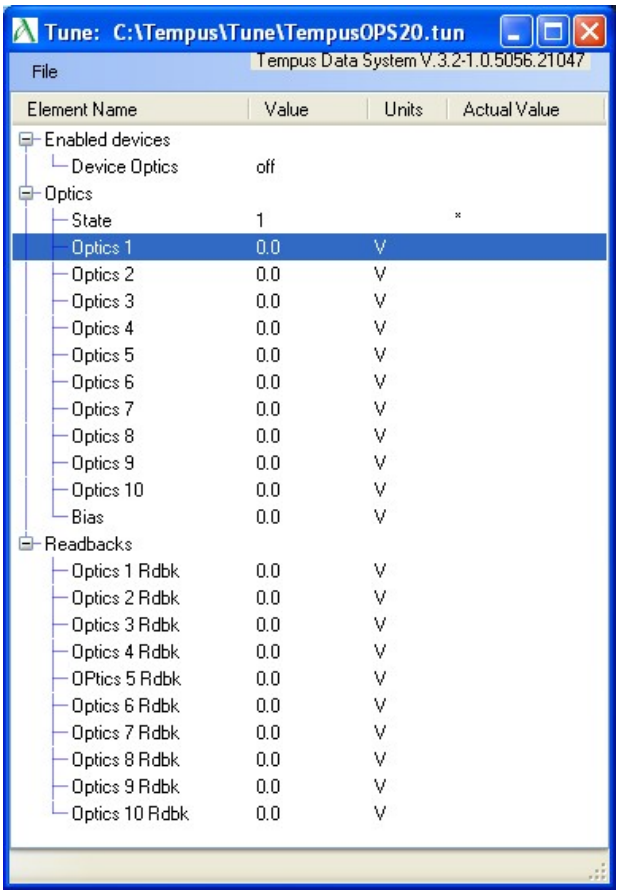


Figure 4: Tempus Data System Tune Dialog

The default configuration for the Tune dialog, when an Optics Power Supply is connected, is to display Optics and Readbacks.

The Optics branch contains a list of controllable optics outputs. A single left click on the value shown in the branch for a given element will modify the view to allow that tune value for that element to be adjusted, either by typing directly into an edit field, or using the smaller or bigger pair of Up/Down arrows. The smaller Up/Down arrows provide small incremental changes to the tune value, and the bigger Up/Down arrows provide ten times the increment as the smaller arrows. When editing the voltage field directly, the voltage will be applied when either the 'Enter' key is typed, or when the user clicks the mouse outside the edit field. While Tempus is connected to the supply, editing optics output voltages with either the Up/Down arrows or the edit field applies the newly selected voltage immediately to the electronics hardware, without a separate Apply action.

The Readbacks branch of the Tune dialog lists the measured output voltage for each optics element. With communications established, request an individual

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readback through that element's readback value, or request a group update through the Readbacks branch heading, as described in the Tempus manual supplied with the software. Use the update action supported by the installed Tempus release. Where the context menu provides "Update all analogs in readbacks", that command updates the group. Where "Periodically update…" is available on an individual readback, it opens a dialog for setting the update interval in seconds. These context-menu commands supplement the readback controls described in the Tempus manual.

A key feature of the Tempus Tune Dialog for the Optics Power Supply is the ability to force selected elements to track each other, allowing a single optics element to be the 'master' of one or more other optics elements, such that when the voltage on the 'master' element is changed, the voltages of selected 'slave' elements will follow that change, as if the master voltage is added to the slave voltage to yield the actual 'slave' voltage output. Elements that are 'slaved' to a 'master' will show a summed value in the fourth column of the Tune view, which is the actual commanded output voltage.

Another key feature of the Tempus Tune Dialog for the Optics Power Supply is the ability to maintain multiple sets of related tune values in a single tune file, allowing rapid switching between operational modes. One could tune for a given 'State' for the ion transfer optics, such as 'pass-through', and change the 'State' related to those specific ion transfer optics, allowing for a completely independent set of tune values to be entered for those elements, which will be saved with the tune file. Once these two 'States' have been tuned, the user can rapidly switch between these two sets of values by simply changing the value selected in the 'State' element.

Each element has a Edit Tune Configuration dialog (Figure 5) that is assessable via right-clicking the element and selecting 'Edit configuration of this tune…'. This dialog allows the user to change the alias of the element (name that shows up in the tune dialog), the displayed Unit, whether the element is visible in the tune dialog, where it should be displayed in the tune dialog, and some specifics about the element. For all elements with a value displayed the display precision will alter the number of decimal points that are shown. For a command control/analog out the value of the small arrows can be changed via the Increment, the element can be assigned a Master command, and it can be also assigned to a Master state. In contrast with the 'Immediate Mode' of the Tune dialog, any changes made will only be implemented once Apply or OK are clicked. "Restore Defaults from Config" restores the element attributes from the configuration file. "Update Config" updates the element attributes using the values in the tune configuration editor.

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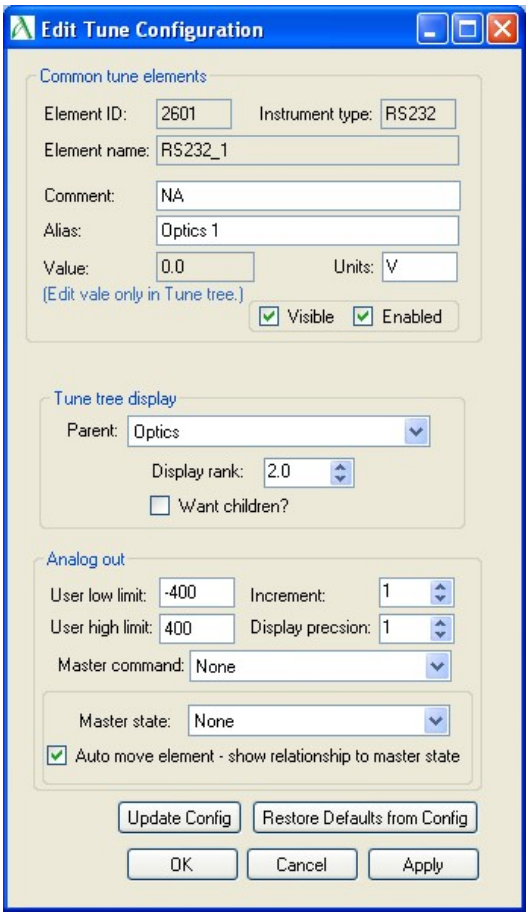


Figure 5: Tempus Data System Edit Tune Configuration Dialog

The Master command setting will set the output of a given element to be the sum of the master and the element. This summation will then be displayed in the last column of the Tune dialog. Each ten channel optics power supply is set up to have an extra virtual element labeled Bias that can be selected as the master of any of the other outputs, while not having a direct output voltage itself. The Master commands are listed by their Element name so the Bias will be listed as the 11th element of the power supply.

As identified above, the State capability allows each element to have multiple values according to which state is selected. To enable this functionality for a given element it must have a 'State' selected. To ease confusion a check box is provided that when checked and a State is selected, the element is automatically made a child of the State element. Also when an element is 'state-enabled' it will display an asterisk as the first character in the 'Actual Value' column on the right. For each element associated with a given State, each element will output the value that for that element which is associated with the current selected State. Selecting

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a different value for the State will change all of its slaves to their values associated with that state. Eight states are provided, labeled 1 through 8. The naming can only be changed by editing the names in the Tune XML file for that particular state element. Contact Ardara Technologies for specifics.

A tune file (.tun) contains the values and display information for a tune. Use the Tune dialog's File menu to save or load files from C:\Tempus\Tune. "Save Tune File" saves the current file; "Save Tune File As…" saves under a new name and makes that file the active tune. "Load Tune File…" loads the selected tune file. Device and communication settings belong to the configuration file (.cfg), normally kept in C:\Tempus\Config and saved from the main window's File menu. The Tune File menu can also show or hide the Main Application dialog (Figure 6). Once communications are configured and established, the main window may be hidden for optics-only operation; show it again to change communication settings or access other devices.

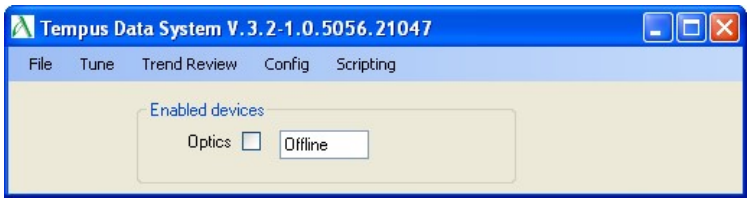


Figure 6: Tempus Data System Main Dialog

Lastly, to close the Tempus Data System software will depend on if the Main dialog is open. If it is open then closing it via the File menu or the 'X' will close the application. If the Main dialog is not open then the Tune dialog's File menu or 'X' will close the application.

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9.0 Commissioning

9.1 Initial Operation

- Connect the power supply to AC power, and connect the power supply to the control computer using the supplied USB cable.
- Start the Tempus Data System software, and power on the optics power supply. In the Tempus Data System software, use the main-screen “Optics” checkbox to establish communications, and confirm that Tempus recognizes the connected supply. This is the communications connection, not the optics output on/off control. If a prompt appears asking to update the serial number in the configuration file, ensure that the correct configuration file is loaded, and the correct optics power supply is connected to the computer.
- Remove back panel optics output connector, if present, so that the Optics Power Supply is not connected to any other device.
- Increment the first channel and check that the readback corresponds to the set voltage. Each channel should range from -400V to 400V.
- Repeat for all other channels.
- Contact the Ardara Technologies Technical Support if the power supply fails to reach the appropriate maximum voltage.
- Power off the Optics Power Supply, reconnect the optics outputs on the back panel.
- The Optics Power Supply is now ready to use.
- Note:

  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 Optics Power supply can reach its full voltage stably with no connection to the vacuum flange.

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10.0 Maintenance and Care

Under normal operating conditions, the Optical power supply does not require maintenance.

10.1 External Cleaning

Use a slightly moist cloth to clean the outside of the Optical power supply. Aggressive scouring or cleaning agents might damage the surfaces.

10.2 Internal Cleaning

Under normal operating conditions, there should be no need to clean the inside of the Optical power supply.

11.0 Dimensions

Table 5. PSDC_OPT_TEN_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	10 feet (removable)
Weight (with cables)	10 pounds
Shipping Weight	13 pounds

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Appendix A: Cable and Connector Options

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

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

A.1 Connector Drawings

The following two figures illustrate the pinout for the Mate-N-Lok connectors on the Optics Supply back panel, and the Fischer connector commonly used for bringing high voltages into a vacuum chamber.

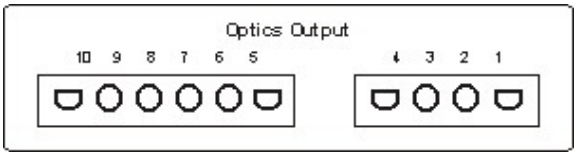


Figure A1. Pinout of the Mate-N-Lok Connectors on Back Panel of Optics Supply.

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.

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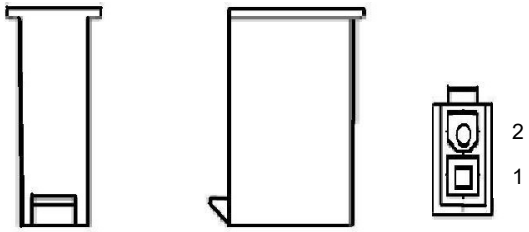


Figure A3. Pinout of 2 Pin Molex Plug.

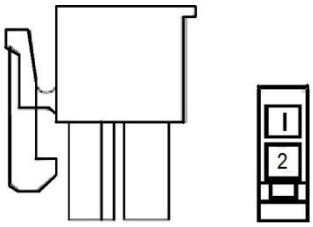


Figure A4. Pinout of 2 Socket Molex Socket.

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A.2 Cable PN 801122 (CABL_OPTX_MS_MXPIN_10N0_10FT_01)

The following table identifies the pinout for the standard cable that comes with the Optics Power Supply.

This cable is a ten-conductor cable that is ten feet long, using multi-colored, insulated twenty gauge wires. One end is terminated with a MS 10 connector to connect to a MS 10 feedthrough on a vacuum chamber. The other end is terminated with Molex Mini Fit Jr. connectors to allow the optics identities to be interchangeable.

Other optional cables such as the mxsock breakout cable (PN 801151) or the BNC to Molex cable (PN 801114) can be combined with the 10N0 cable to make a custom cable assembly.

Table A1. Cable Pinout for PN 801122, (CABL_OPTX_MS_MXPIN_10N0_10FT_01), Optics cable with ten Optics and no Filament connections.

Optics Power Supply Optics Amp Connector Socket Number	Wire Color (20 Gauge)	MS-10 Connector Socket
1	Red	E
2	Yellow	G
3	Orange	B
4	Brown	A
5	Blue	H
6	Green	F
7	Black	I
8	White	J
9	Gray	C
10	Purple	D

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A.3 Cable PN 801151 (CABL_OPTX_MXSOCK_4X_12IN_01)

This breakout cable can be used for those cases where the Optics Power Supply outputs are to be mapped to multiple devices or connectors.

The four-socket Mate-N-Lok connector side attaches to the Optics Power Supply output connector, with each output then available through an independent color-coded Molex two-socket connector.

Other optional cables such as the male breakout cable (PN 801152) or the BNC to Molex cable (PN 801108) can be combined with the female breakout cable to make a custom cable assembly.

Table A2. CABL_OPTX_MXSOCK_4X_12IN_01 – Optics cable with 4 pin optics input to Molex. Break out cable that connects to the Optics power supply.

AMP Connector Socket Number	Color (20 Gauge)	2 Pin Molex Socket Number
1	Red	1
2	Yellow	1
3	Orange	1
4	Blue	1

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A.4 Cable PN 801152 (CABL_OPTX_MXPIN_4X_12IN_01)

This male breakout cable can be used for those cases where the Optics Power Supply outputs are to be mapped to multiple devices or connectors.

The four-pin Mate-N-Lok connector side mimics the Optics Power Supply output connector, with each pin having its own independent color-coded Molex two-socket connector.

This four-pin Mate-N-Lok connector side of this cable was designed to be connected to the corresponding Mate-N-Lok female connector on a ten-foot cable assembly that connects to a twelve-pin vacuum feedthrough.

The two-pin Molex connectors are designed to connect to a mating connector on the female breakout cable (PN 801151).

Table A3. CABL_OPTX_MXPIN_4X_12IN_01 – Optics cable with Molex to 4 pin optics connector.

AMP Connector Pin Number	Color (20 Gauge)	2 Pin Molex Pin Number
1	Red	1
2	Yellow	1
3	Orange	1
4	Blue	1

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A.5 Cable PN 801153 (CABL_OPTX_MXSOCK_6X_12in_01)

This breakout cable can be used for those cases where the Optics Power Supply outputs are to be mapped to multiple devices or connectors.

The six-socket Mate-N-Lok connector side attaches to the Optics Power Supply output connector, with each output then available through an independent color-coded Molex two-socket connector.

Other optional cables such as the male breakout cable (PN 801154) or the BNC to Molex cable (PN 801108) can be combined with the female breakout cable to make a custom cable assembly.

Table A4. CABL_OPTX_MXSOCK_6X_12IN_01 – Optics cable with 6 pin optics input to Molex. Break out cable that connects to the Optics power supply.

AMP Connector Socket Number	Color (20 Gauge)	2 Pin Molex Socket Number
1	Blue	1
2	Green	1
3	Black	1
4	White	1
5	Gray	1
6	Purple	1

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A.6 Cable PN 801154 (CABL_OPTX_MXPIN_6X_12in_01)

This male breakout cable can be used for those cases where the Optics Power Supply outputs are to be mapped to multiple devices or connectors.

The six-pin Mate-N-Lok connector side mimics the Optics Power Supply output connector, with each pin having its own independent color-coded Molex two-socket connector.

This six-pin Mate-N-Lok connector side of this cable was designed to be connected to the corresponding Mate-N-Lok female connector on a ten-foot cable assembly that connects to a twelve-pin vacuum feedthrough.

The two-pin Molex connectors are designed to connect to a mating connector on the female breakout cable (PN 801153).

Table A5. CABL_OPTX_MXPIN_6X_12IN_01 – Optics cable with Molex to 6 pin optics connector.

AMP Connector Pin Number	Color (20 Gauge)	2 Pin Molex Pin Number
1	Blue	1
2	Green	1
3	Black	1
4	White	1
5	Gray	1
6	Purple	1

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A.7 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 801151), 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.8 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 801152), 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

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A.9 Cable PN 801112 (CABL_MX_Y_FMF_6IN_01)

This Y-cable with two foot-long ends, replicates one of the Molex ends of a female breakout cable (PN 801151), 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.10 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 801151), to bring Optics Power Supply voltages to SHV inputs typically found on a flange face.

Table A8. 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

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Appendix B: RS-232 Communications Protocol

The Ardara Technologies 10 Channel Optics Power Supply has no manual controls, but is controlled by a proprietary internal digital controller board with an RS232 communications interface, utilizing a simple ASCII text protocol.

The digital controller board is configured with sixteen analog outputs and sixteen analog inputs. The optics power supply high voltage output board uses ten of these analog outputs, and twelve of the analog inputs.

B.1 RS-232 Communications Protocol Settings

The 10 channel optics power communicates via RS232 with the following settings:

Baud rate: 9600 or 115200 (either will work)

PIC Parity: None

PIC Bits: 8

PIC Stop bit: One

PIC Encoding: Base10

B.2 RS232 Command Syntax

The 10 channel optics power supply has two basic commands: SET and GET. The SET command allows the user to set the output voltage for each of the sixteen outputs as a sixteen bit integer DAC value, and the GET command allows the user to either request the setpoint DAC value for each of the sixteen DAC outputs, or request the ADC readback value from each of the sixteen ADC readbacks.

B.3 SET Command Syntax

The SET command has the following syntax:

SET [Channel Number] [DAC Value] Z

The [Channel Number] represents the Optics Output channel (1 to 10).

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The [DAC Value] represents the integer decimal value for the DAC command (0 to 65535)

The letter Z is used as an end of line command.

The reply will be a simple 'OK', if the command was successfully received and changed.

An example of the input and reply for setting the commands for optics output channel 5:

input: SET 5 32768 Z

reply: OK

The DAC Values represent the integer base 10 sixteen bit (0 to 65535) DAC commands. The coarse calibration of the 400 volt optics power supplies has an output of approximately +408 volts for a DAC command of 65535 and approximately -408 volts for a DAC command of 0.

So if the command is set to 32767 then the output should be 0V. Another example would be to set a channel to 16384 and the output should be -204V.

Commands → Output

0 = -408V

32767 = 0V

65535 = +408V

It is recommended that the actual output values be calibrated to the DAC commands. A straight line calibration between the two endpoints (+400 and -400 volts) will generally yield a crossover at zero volts midpoint between the two endpoint commands.

A typical DAC Command calibration would be:

Commands → Output

642 = -400.0V

32767 = 0V

64892 = +400.0V

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B.4 GET Command Syntax

The GET command has the following syntax:

GET [Channel Number] Z

The [Channel Number] represents either the Optics Output Command channel (1 to 10), or the ADC Readback channel (17 to 32).

The letter Z is used as an end of line command.

The reply will be 'SR' followed by the [Channel Number], followed by an integer base 10 sixteen bit value, followed by 'OK'.

For Channel Numbers 1 through 10, the reply value will be an echo of the current commanded value, previously set by the SET command, as a base 10 sixteen bit number.

The reply values for channels Number 17 through 32 represent the 16 bit readbacks from the 14 bit ADC, with 17 through 26 representing the scaled readbacks of the high voltage outputs for channels 1 through 10, and the replies for channels 31 and 32 representing the scaled readbacks of the high voltage rail supplies.

An example of the input and reply for reading the readback for high voltage output channel 2 is as follows:

Commands → Output

input: GET 18 Z

reply: SR 18 32768 OK

The 14 bit ADC readbacks are scaled as if they are 16 bit numbers using only half the range to span the +/-408V range. (It is as if the readback is calibrated to -816 to +816 volts.)

If the readback value is 16384 then the readback is sensing about -400V on the output.

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Readback Value → Readback Voltage

16384 = -400V

32768 = 0V

49152 = +400V

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Table B1. GET Readback Response Table

Channel Number	Response
1	Digital command value for output1
2	Digital command value for output 2
3	Digital command value for output 3
4	Digital command value for output 4
5	Digital command value for output 5
6	Digital command value for output 6
7	Digital command value for output 7
8	Digital command value for output 8
9	Digital command value for output 9
10	Digital command value for output 10
17	Digital readback value of output 1
18	Digital readback value of output 2
19	Digital readback value of output 3
20	Digital readback value of output 4
21	Digital readback value of output 5
22	Digital readback value of output 6
23	Digital readback value of output 7
24	Digital readback value of output 8
25	Digital readback value of output 9
26	Digital readback value of output 10
31	Digital readback value of high voltage (+) rail
32	Digital readback value of high voltage (-) rail
35	Digital readback of the vacuum interlock
36	Digital readback of the optics enable

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