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DEI SCIENTIFIC

PCX-7500

Pulsed Current Source

Operation Manual

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Contents

Safety

- Always refer to the safe operating section of the manual for your model of the PCX-7500 system.

- Do not open the cover of the PCX-7500. There are no user-serviceable parts inside. Opening the cover exposes you to shock and voids the factory warranty.

- Do not install, handle, or remove the output cables or laser diode while the PCX-7500 is operating. Allow at least 10 minutes after powering down before handling the output cable or laser diode.

- Do not use this device in a manner not specified by the manufacturer.

- Allow sufficient space around this device for air circulation. Cooling air enters the rear of the chassis and exits the front of the chassis.

- Do not use where liquids are present or in corrosive environments. Clean this instrument by wiping with a dry or damp cloth.

WARNING
Risk of lethal electric shock. Do not open the cabinet of this device. Do not touch the output or laser diode while it is operating. This device produces LETHAL levels of electric current, both inside its cabinet and at its output.

DO NOT OPERATE THIS DEVICE UNLESS ANOTHER PERSON, CAPABLE OF RENDERING FIRST AID OR RESUSCITATION, IS PRESENT.

SAFE AND PROPER OPERATION OF THIS DEVICE IS THE RESPONSIBILITY OF THE USER.

Directed Energy, Inc. (DEI) provides information on its products and associated hazards, but it assumes no responsibility for the after-sale operation and safety practices.

Safe Operating Area

This section contains Safe Operating Area (SOA) graphs for all PCX-7500 models. In each graph, the Safe Operating Area consists of the green and yellow shaded areas.

IMPORTANT: Do not operate the instrument outside of the Safe Operating Area!

Although the PCX-7500's internal and external triggering system allow it to operate outside the Safe Operating Area, such operation will result in permanent damage to the PCX-7500, the laser diode, or both.

The **green** region represents operating parameters for which the instrument functions safely and all pulse specifications are met. It is best to always operate in this region, but operation in the yellow region does not cause damage to the instrument or laser.

The **yellow** region represents operating parameters for which the instrument functions safely but pulse specifications may not be met. Operation in this area has not been characterized by DEI, is not guaranteed by specification, and may vary slightly from instrument to instrument. For example, rise and fall times may be slower and droop may be greater than specified.

Here is an example of how to use the SOA graph to calculate maximum pulse width:

Assume the laser is rated at 5 V 200 W, the pulser is a PCX-7500-5, and the desired pulse is 400 A at 500 Hz.

According to the PCX-7500-5 SOA graph, at 5 V the maximum output power is 100 W.
In this case the instrument (100 W), not the diode (200 W), is the limiting factor. If the diode was rated below 100 W, use the laser's maximum power and not the SOA value in the next step.

Find the maximum duty cycle:

power = voltage * current * duty_cycle
duty_cycle = 100 W *(SOA graph)* / [5 V *(laser forward voltage)* * 400 A] = 0.050

Find the period:

period = 1 / frequency = 1 / 500 Hz = 0.002 s

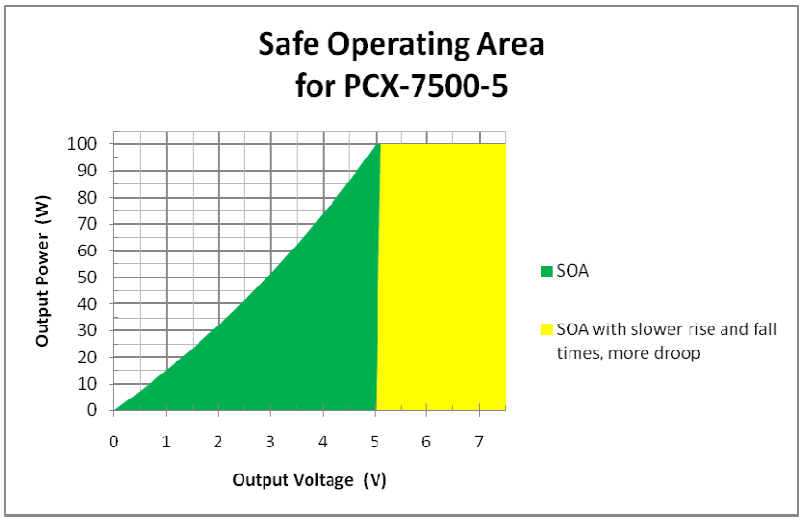
Find the maximum pulse width:

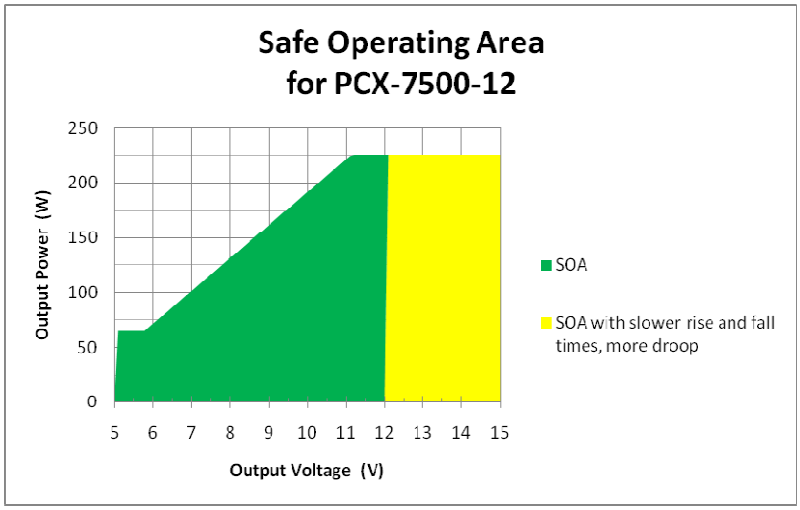
maximum pulse width* = period * duty_cycle = 0.002 s * 0.050 = 100 µs

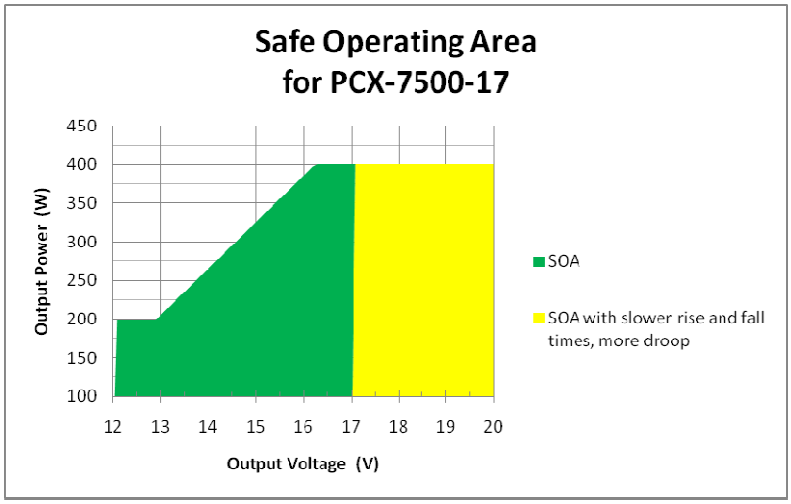
*The absolute maximum pulse width should never exceed 5 milliseconds, even in single shot operation.

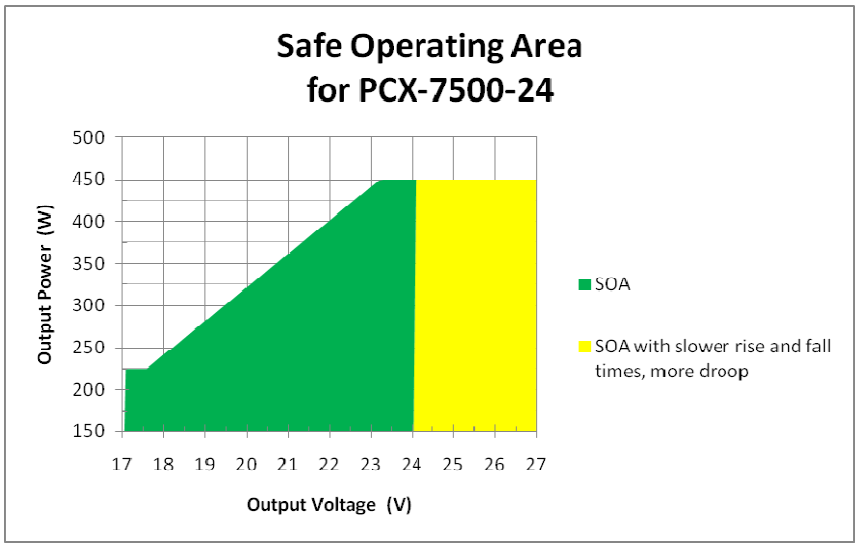
As long as the pulse width is 100 us or less, the instrument will be running in the SOA.

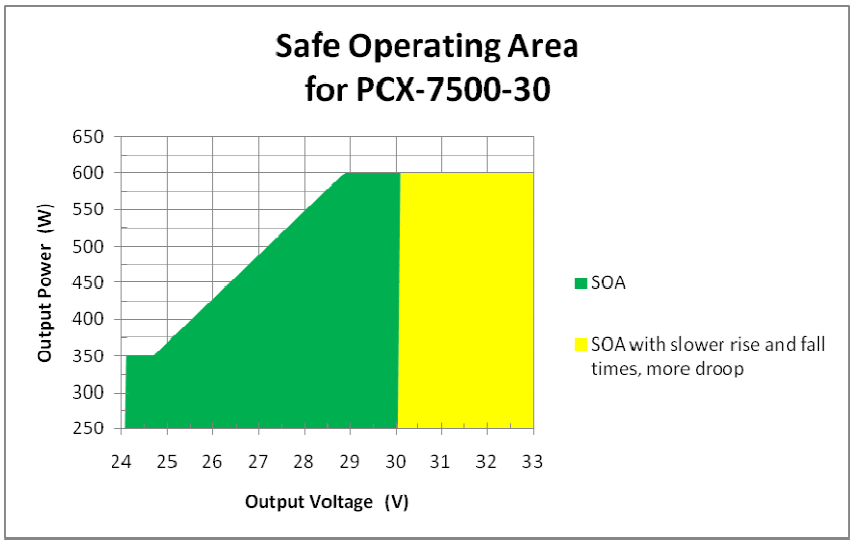
To calculate the maximum pulse width for a single-shot pulse (using external trigger), use 1 Hz as the pulse frequency. Remember, the output pulse width should never exceed 5 milliseconds.

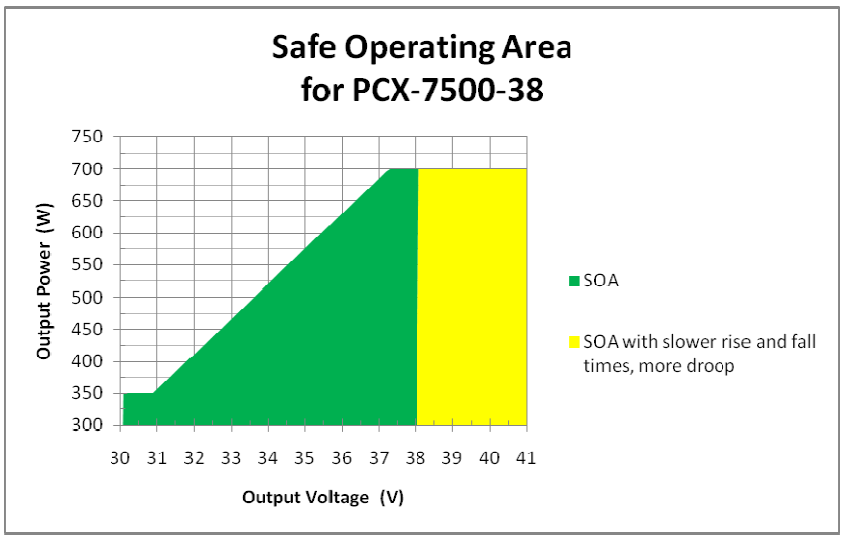

Safe Operating Area
for PCX-7500-5
Output Power (W)
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

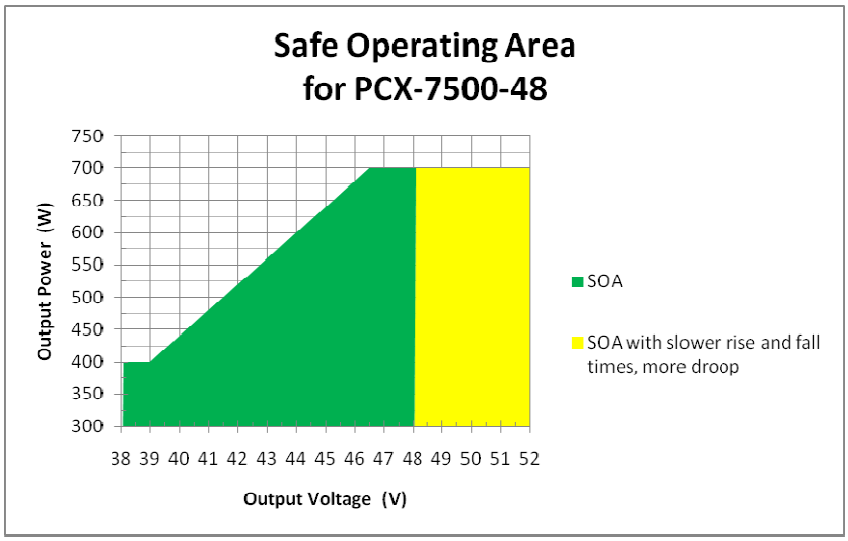

Safe Operating Area
for PCX-7500-12
Output Power (W)
250
200
150
100
50
0
5 6 7 8 9 10 11 12 13 14 15
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

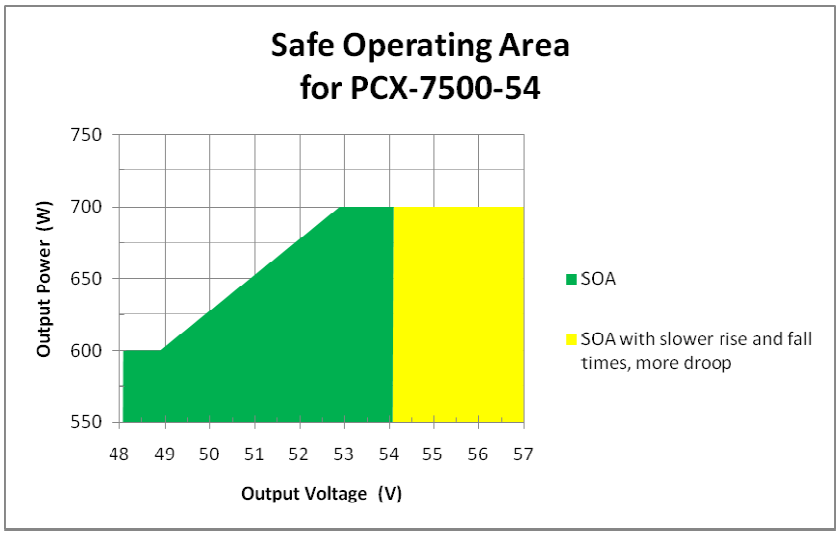

Safe Operating Area
for PCX-7500-17
Output Power (W)
450
400
350
300
250
200
150
100
12 13 14 15 16 17 18 19 20
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

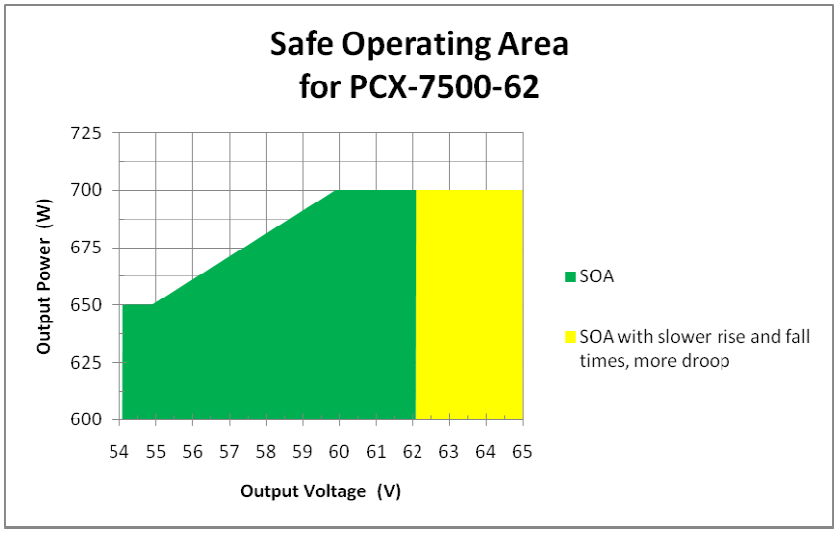

Safe Operating Area
for PCX-7500-24
Output Power (W)
500
450
400
350
300
250
200
150
17 18 19 20 21 22 23 24 25 26 27
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

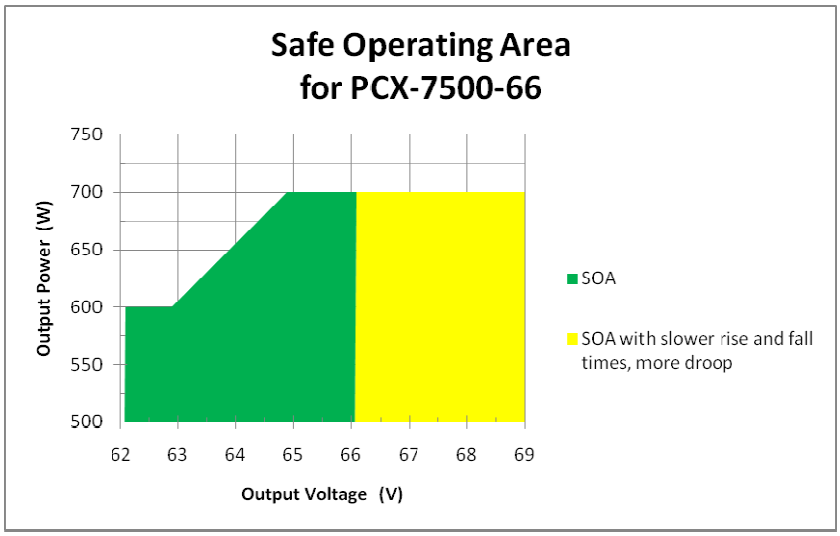

Safe Operating Area
for PCX-7500-30
Output Power (W)
650
600
550
500
450
400
350
300
250
24 25 26 27 28 29 30 31 32 33
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

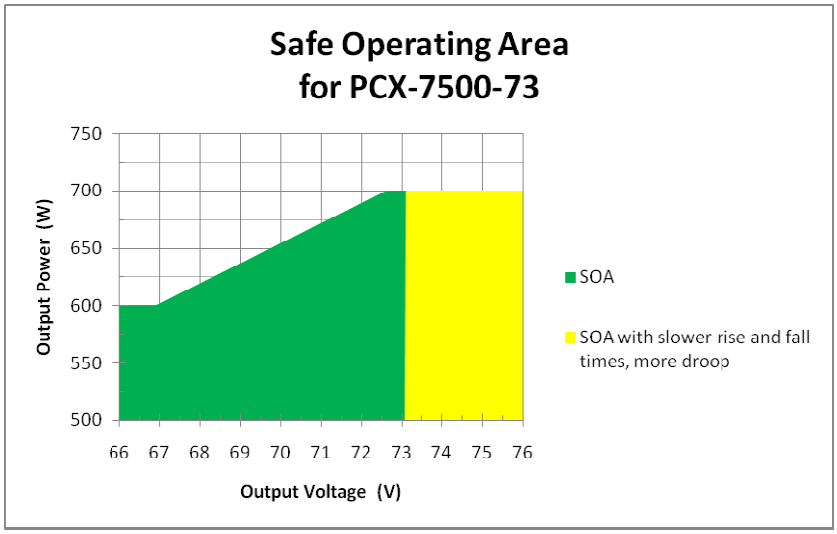

Safe Operating Area
for PCX-7500-38
Output Power (W)
750
700
650
600
550
500
450
400
350
300
30 31 32 33 34 35 36 37 38 39 40 41
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

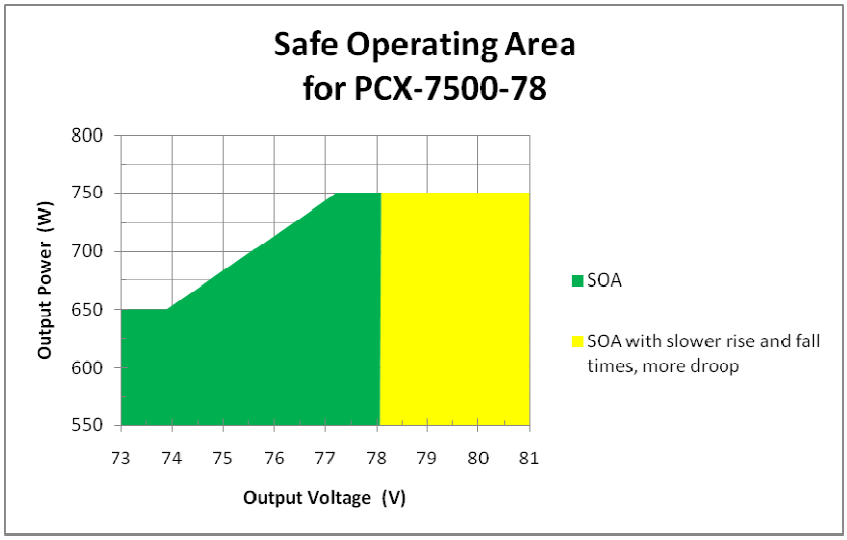

Safe Operating Area
for PCX-7500-48
Output Power (W)
750
700
650
600
550
500
450
400
350
300
38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

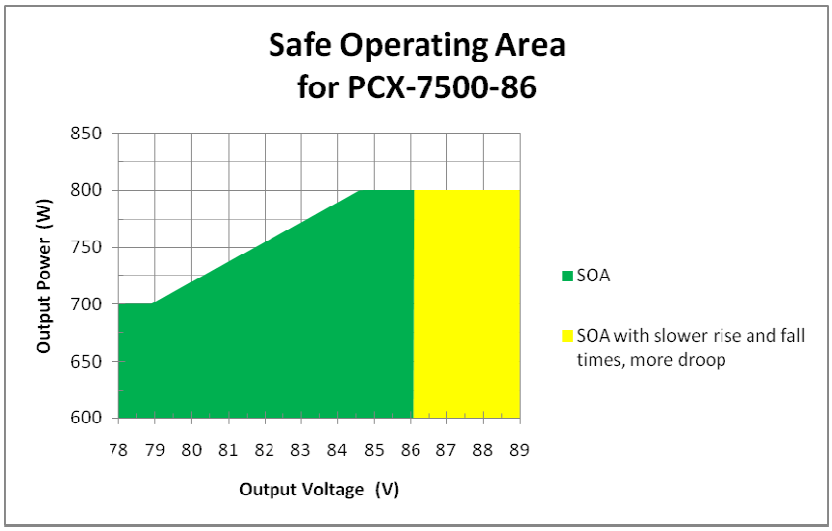

Safe Operating Area
for PCX-7500-54
Output Power (W)
750
700
650
600
550
48 49 50 51 52 53 54 55 56 57
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

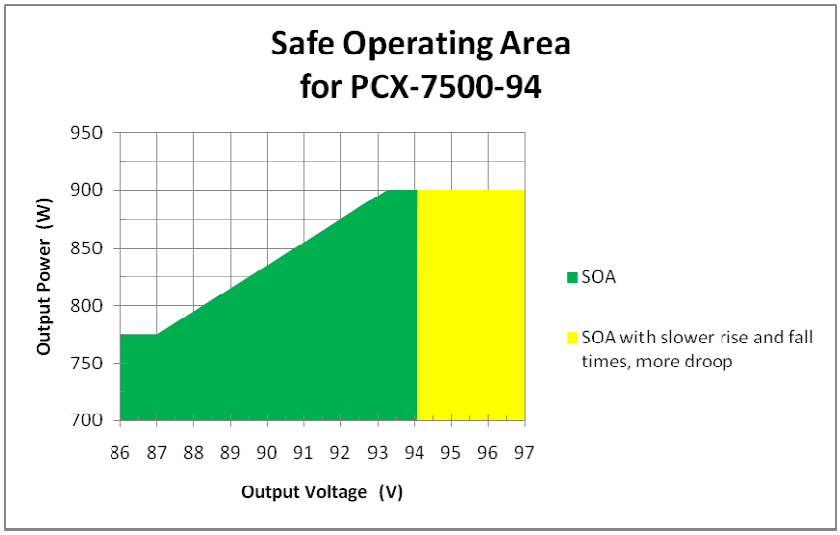

Safe Operating Area
for PCX-7500-62
Output Power (W)
725
700
675
650
625
600
54 55 56 57 58 59 60 61 62 63 64 65
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

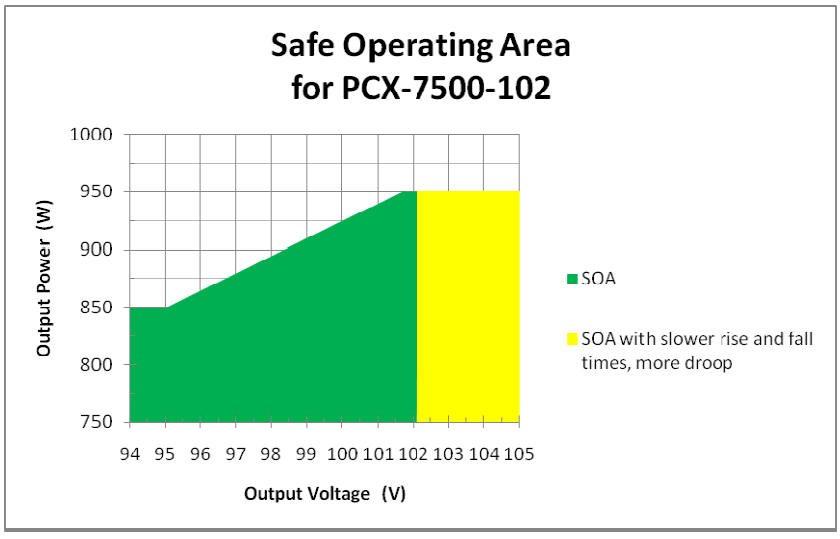

Safe Operating Area
for PCX-7500-66
Output Power (W)
750
700
650
600
550
500
62
63
64
65
66
67
68
69
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

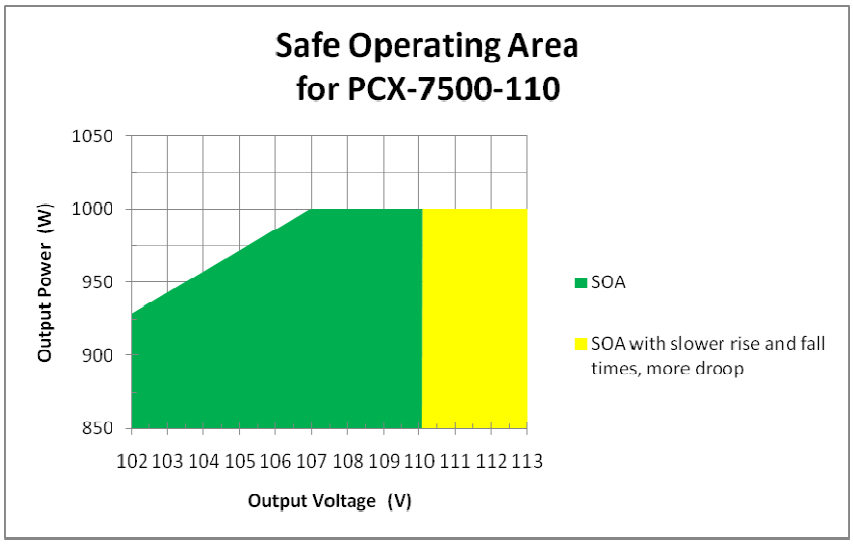

Safe Operating Area
for PCX-7500-73
Output Power (W)
750
700
650
600
550
500
66
67
68
69
70
71
72
73
74
75
76
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop


Safe Operating Area
for PCX-7500-78
Output Power (W)
800
750
700
650
600
550
73
74
75
76
77
78
79
80
81
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop


Safe Operating Area
for PCX-7500-86
Output Power (W)
850
800
750
700
650
600
78 79 80 81 82 83 84 85 86 87 88 89
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop


Safe Operating Area
for PCX-7500-94
Output Power (W)
950
900
850
800
750
700
86 87 88 89 90 91 92 93 94 95 96 97
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop


Safe Operating Area
for PCX-7500-102
Output Power (W)
1000
950
900
850
800
750
94 95 96 97 98 99 100 101 102 103 104 105
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop


Safe Operating Area
for PCX-7500-110
1050
1000
950
900
850
Output Power (W)
102 103 104 105 106 107 108 109 110 111 112 113
Output Voltage (V)
SOA
SOA with slower rise and fall times, more droop

Introduction

❖ Description

The PCX-7500 is an air-cooled, high-power current source designed to drive laser diodes, bars, and arrays. The output current can be set from 10 A to 450 A; the compliance voltage depends on the model. The pulse width is adjustable from 4 µs to 5,000 µs with a frequency range of 8 Hz to 10,000 Hz.

The PCX-7500 may be operated through its intuitive front panel controls. The color QVGA LCD provides immediate visual confirmation of all operating parameters, including pulsed current setpoints, internal trigger pulse width, internal trigger frequency, and error/fault messages.

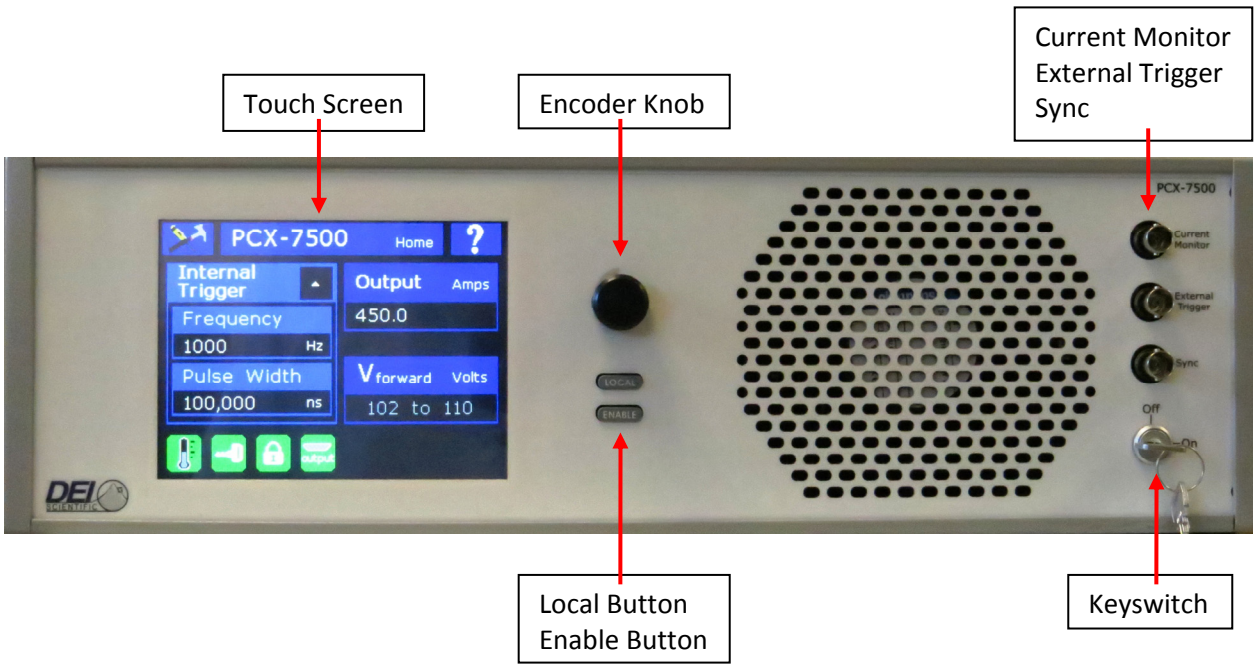
For automated applications, complete control of the instrument is provided through RS-232, USB, and Ethernet computer interfaces. Up to four system configurations may be stored in internal nonvolatile memory, providing instant recall of frequently-used configurations.

The laser diode is connected to the PCX-7500 through a low-impedance stripline cable designed to preserve the fidelity of high-speed current pulses. The output connector is interlocked such that the PCX-7500 is disabled when the connector is removed.

Conveniently-located front panel BNC connectors allow the PCX-7500 to be externally triggered and synchronized for specialized interconnected equipment applications. The impedance of the trigger input can be set to either 50 Ω or 10,000 Ω. The synchronization output pulse is synchronized to the leading edge of the output current pulse and is active with an internal or external trigger. The delay between the sync output signal and the main output current pulse is approximately 100 ns, measured from rising edge to rising edge.

The PCX-7500 has the ability to store four unique user settings, which include all system configurations for operation of the PCX-7500.

❖ Front Panel Features



Touch Screen
The touch screen provides a graphical user interface and touch control to adjust all functions of the PCX-7500.

Encoder Knob
Turn the encoder knob to change a value for functions of the PCX-7500. Push it to cycle through the resolutions (increments of value change).

Local Button Mode
Pressing the **LOCAL** button returns the PCX-7500 to front panel control from computer control. The LOCAL button is lit when the computer is in control.

Enable Button Mode
The **ENABLE** button selects whether the PCX-7500 output current is enabled or disabled. The ENABLE button is lit when the unit is enabled. The unit can only be enabled when the key switch is in the ON position.

Current Monitor (IMon)
This BNC connector provides a connection to an oscilloscope. The signal is a voltage representation of the output current at the output current connector, and ranges from 0 V to 1.5 V. At 100 A output current there will be approximately 330 mV on the IMon connector.

External Trigger
This BNC connector accepts trigger pulses from an external source. Its input impedance can be set to either 50 Ω or 10,000 Ω.

Sync Output
Synchronization pulses for external devices are available at the Sync Output BNC connector. The sync pulse corresponds to the leading edge of the output current pulse.

Keyswitch
The keyswitch ON position allows the PCX-7500 output current to be enabled. In the keyswitch OFF position, the PCX-7500 is disabled.

❖ Rear Panel Features

Current Output
This socket accepts the factory-supplied output cable and is the connection for the system-generated current pulses. DO NOT TOUCH any part of this cable while the PCX-7500 is powered up. Please review the Safety section.

Note: The absence of a properly installed output cable disables the output and creates an output enable fault.

Rear Enable
This connector accepts either an external dry contact closure or the factory-supplied shorting BNC plug. Closed contacts or the use of the shorting plug enables the output. Open contacts or removal of the shorting plug disables the output and creates a rear enable fault.

Voltage Monitor (VMon)
This BNC connector allows the user to monitor the voltage on the output cable. The VMon voltage voltage is linearly scaled to the output connector voltage and ranges from 0 V (0 V on the output connector) to approximately 1.392 V (120 V on the output connector).

USB Connector
Use this connector to communicate with an external computer with a USB cable.

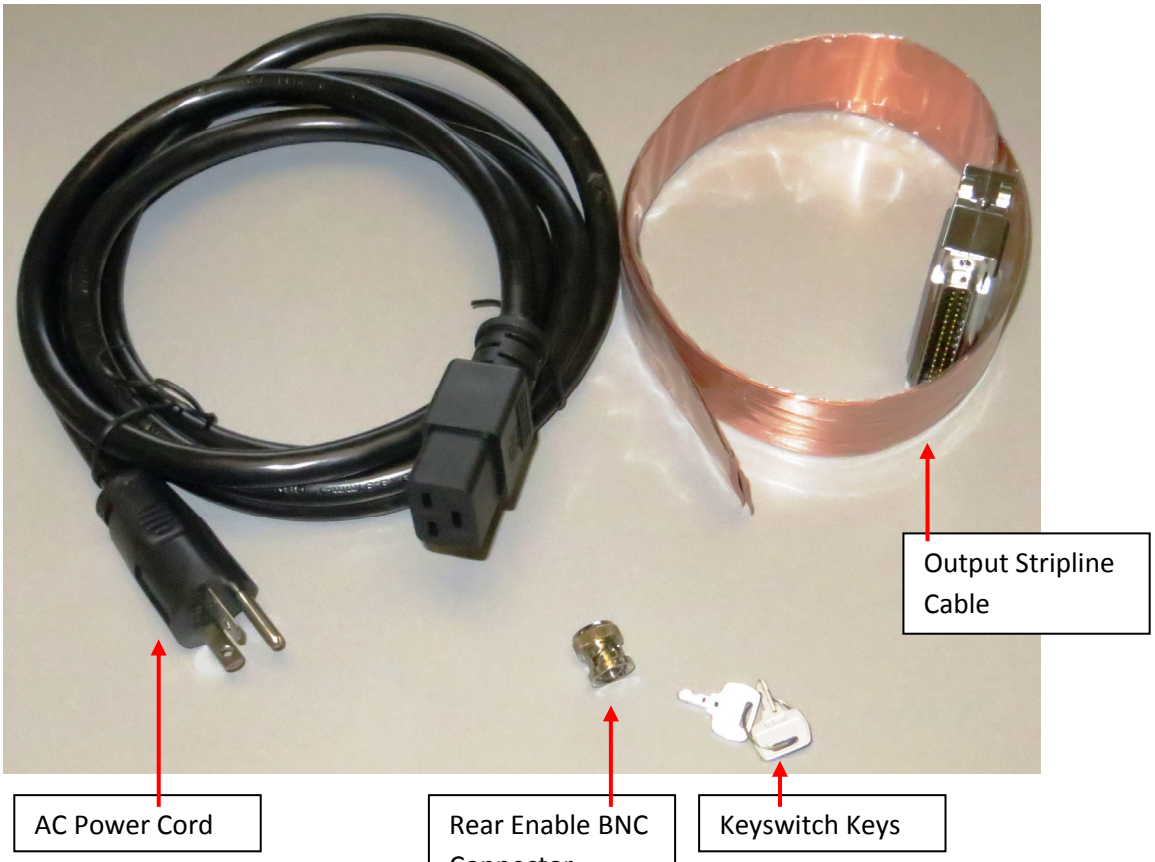
Ethernet Connector
Use this connector to communicate with an external computer through an Ethernet network.

RS232 Connector
Use this connector to communicate with an external computer via a RS-232 cable.

Power Cord Connector
The power cord connector accepts type IEC 320 C-19 to NEMA 5-20P grounding equipment power cord.

On-Off Power Switch
This switches powers the PCX-7500 on and off.

❖ Accessories Included



AC Power Cord
Factory-supplied power cord, type IEC 320 C-19 to NEMA 5-20P grounding equipment power cord.

Output Stripline Cable
This factory-supplied cable provides output current pulses to external devices. A DB-37 male connector fits the socket on the rear panel of the PCX-7500; a DB-37 female connector is on the user end.

Shorting BNC Plug
The shorting BNC plug attaches to the Rear Enable BNC connector on the rear panel. It takes the place of closed contacts and enables the output.

Keyswitch Keys
The keys access the front panel on-off keyswitch. The output is enabled when the keyswitch is in the ON position.

Interfacing Load to the Output Cable

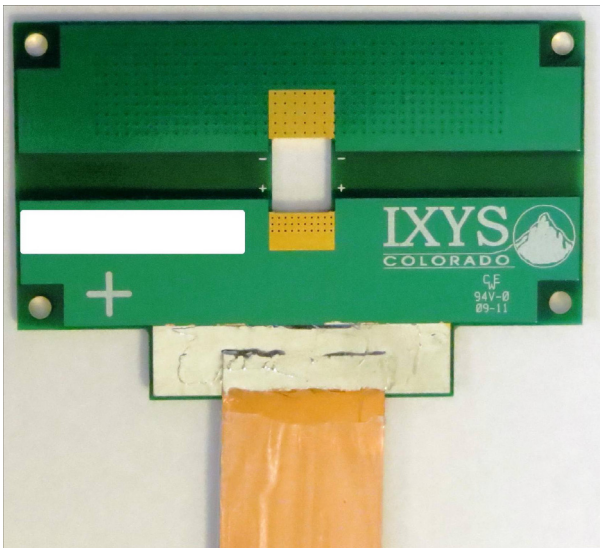
The output of the PCX-7500 uses a DB-37 connector that is connected to a stripline cable. One of these output cables is included with every system. The user may order additional output cables if there is a need for more than one cable.

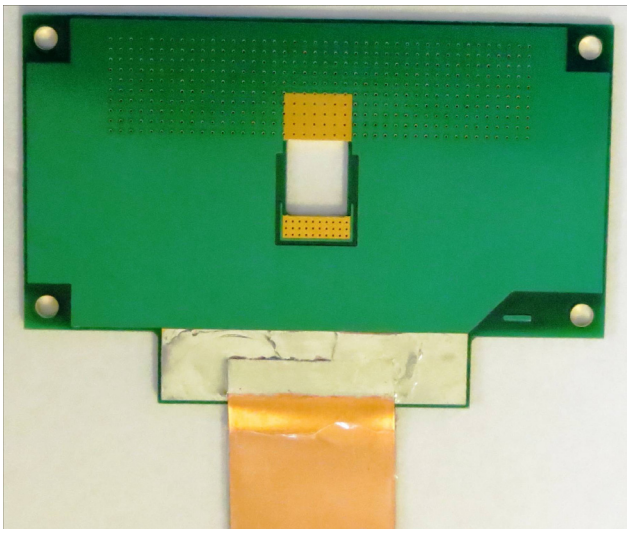
To interface to your load, you may solder the stripline directly to your load, or design a simple two-layer interface board (recommended). The interface board must have very low resistance, and more importantly, very low inductance in order to ensure that the droop and overshoot specifications are met. In order to reduce the inductance, there should be very wide copper planes on the top and bottom of the board and no copper inner planes. PCBs thinner than 0.070 inches perform best in reducing inductance. Copper thickness should be 2 ounces or more to reduce resistance.

DEI recommends soldering your laser directly to the interface PCB without any additional cables or wire. If wires are absolutely necessary, they should be as short as possible and twisted if longer than 3 cm. Wires and cabling from an interface board to the laser will increase inductance which increases overshoot. DEI can design a custom interface board for you at a nominal cost; please contact customer support for a quotation.

The two photos on the next page show an interface board created for a laser used in the DEI lab. The top of the interface board has solid copper from the stripline to the laser's positive terminal. The bottom of the interface board has solid copper plane everywhere the positive plane is, plus additional copper to connect to the negative side of the laser. The bottom copper is connected to the top of the board using as many vias as possible (over 400 in this case). Using multiple vias reduces both inductance and resistance. The laser is mounted in the center of the PCB, but it may be mounted anywhere on the board.

TOP **BOTTOM**





Why are we trying so hard to reduce resistance?

Resistance in the output path turns electrical energy into unnecessary heat. Designers spend a lot time and effort removing as much heat as possible from their systems, thus resistance is an unwanted parameter.

Why are we trying so hard to reduce inductance?

Inductance in the output path can cause voltage overshoot on the rising and falling edges of the output pulse. The overshoot voltage is defined by the following fundamental equation:

$$V = L * di / dt$$

Assume we wish to generate a 450 A pulse with a 1 μs rise time and a voltage overshoot of less than 10 volts. What is the maximum allowable inductance in the output path?

$$L = V / (di/dt) = 10\ V / (450\ A / 0.000001\ s) = 22\ nH$$

It is easily seen that with high currents and fast rise times, voltages can increase rapidly if inductance is not kept as low as possible. While we are more concerned about current overshoot than voltage overshoot, the overall result is that the current pulse can be affected by undesirable inductance in the output path.

Quick Start Guide

❖ Safety

Follow the safety guidelines. DO NOT PROCEED WITHOUT UNDERSTANDING AND OBSERVING THESE GUIDELINES.

❖ Requirements

Make sure the PCX-7500:

- Is connected with the proper cables and termination impedance
- Is powered up
- Has all faults cleared
- Has the rear enable and keyswitch enabled (the proper icons will be green when enabled)

❖ Controlling the PCX-7500 from the front panel

1. **Disable the PCX-7500**
   - The **Enable** button on the front panel glows green if the PCX-7500 is enabled. Press the button to disable. The green light goes out.

2. **Set the output current**
   - Press the **Output** button on the touch screen.
   - Press the encoder knob to set the resolution to x0.1, x1.0, or x10.0.
   - Turn the encoder knob to set the output current from 10.0 A to 450.0 A.
   - Press the **Done** button.

3. **Set the trigger to internal or external**
   - Press the **Trigger** button on the touch screen.
   - Press the **Internal** or **External** button to select the trigger.

4. **Set the internal pulse trigger frequency**
   - Press the **Frequency** icon on the touch screen.
   - Press the encoder knob to set the resolution to x1, x10, x100, x500, x1000, or x5000.
   - Turn the encoder knob to set the frequency from 8 Hz to 10,000 Hz.
   - Press the **Done** icon.

5. **Set the pulse width**
   - Press the **Pulse Width** icon on the touch screen.
   - Press the encoder knob to set the resolution.
   - Turn the encoder knob to set the pulse width from 4 µs to 5 ms.
   - Press the **Done** icon.

Pulse Width	Frequency
32 µs between	8 Hz to 30 Hz
8 µs between	31 Hz to 122 Hz
2 µs	123 Hz to 500 Hz
0.5 µs	500 Hz to 10000 Hz

6. **Enable the PCX-7500**
   - Press the **Enable** button on the front panel. The button lights green.

❖ Controlling the PCX-7500 from a computer

1. **Disable the PCX-7500**
   - Send the command “OUTPUT:DISABLE”.

2. **Set the trigger to internal or external**
   - Send the command “TRIG:INTERNAL” or “TRIG:EXTERNAL”.

3. **Set the internal pulse trigger frequency**
   - Send the command “TRIG:INT:FREQ n”, where n = [8 to 10000].
   - Units are hertz.

4. **Set the pulse width**
   - Send the command “TRIG:INT:PULSEWIDTH nnnn”, where n = [4000 to 5000000]. Pulse width is dependent on the frequency.
   - Units are nanoseconds.

5. **Set the output current**
   - Send the command “SETPOINT:CURRENT n”, where n = [10 to 450.0].
   - Units are amperes.

6. **Enable the PCX-7500**
   - Send the command “OUTPUT:ENABLE”.

Operation

❖ Setup

NOTE: Any change to a command adjustment typically requires less than 200 ms to complete.

1. Make sure the PCX-7500 has been OFF for at least ten minutes when connecting or disconnecting the current output connector.

2. Make sure the laser diode is connected with the correct polarity. If necessary, review the output cable for polarity specifications.

3. Make the other connections as necessary: External Trigger, Sync, Rear Enable, or the connection to the computer.

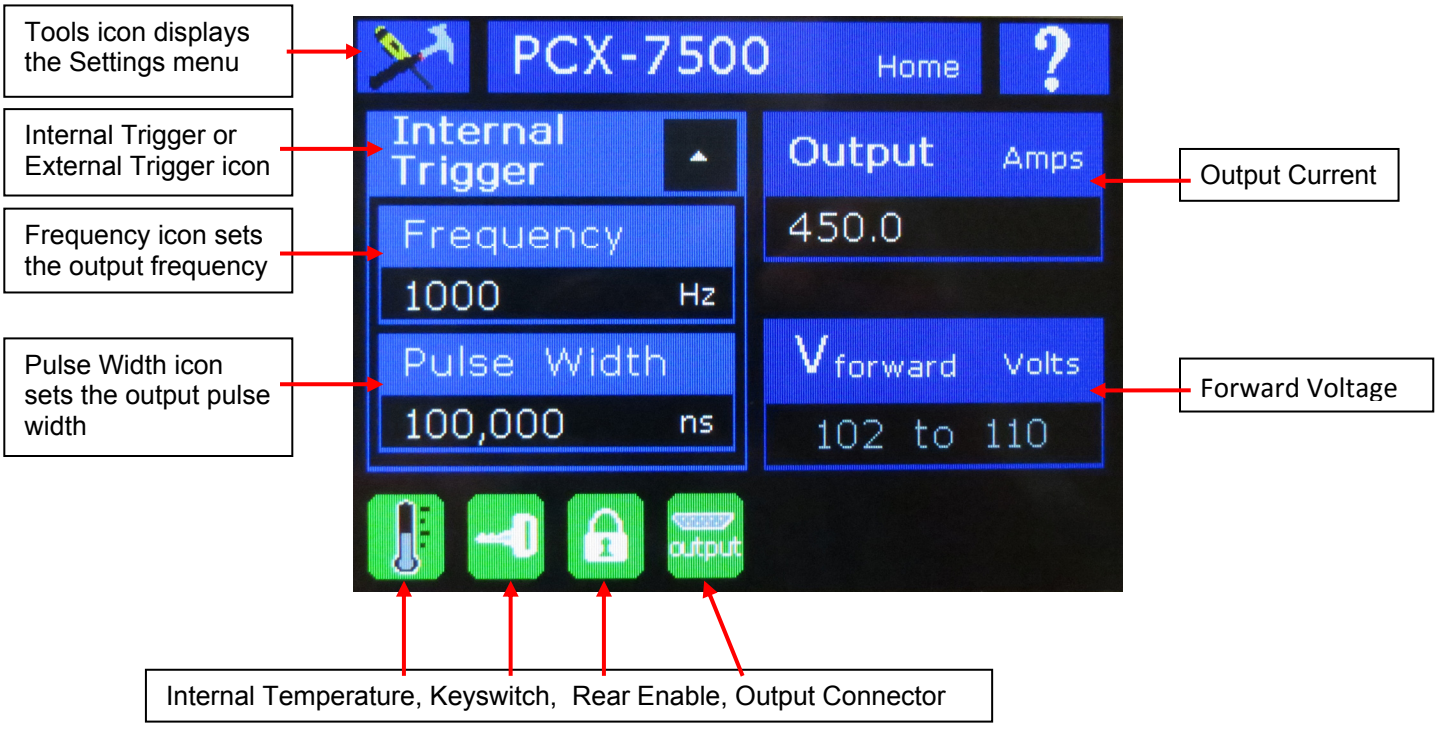
4. Connect the power cable.

❖ Power Up

1. Turn on the power switch. The instrument powers up in about 3 seconds.

2. The instrument plays a tune and displays DEI information.

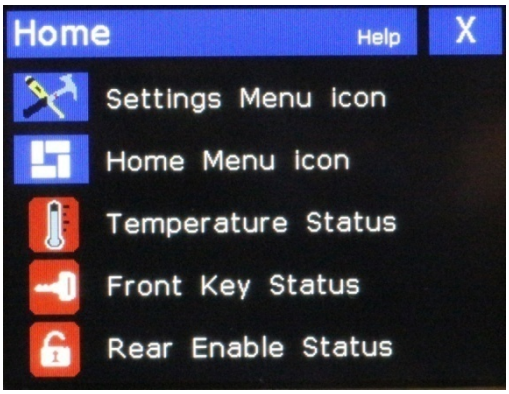
3. After a few seconds, the PCX-7500 displays the **Home** screen.



❖ Home Help Screen

1. On the Home screen, press the **"?"** (question mark) icon.

2. The **Help** screen appears. This screen describes the icons used in the PCX-7500.



❖ Set the Output Current

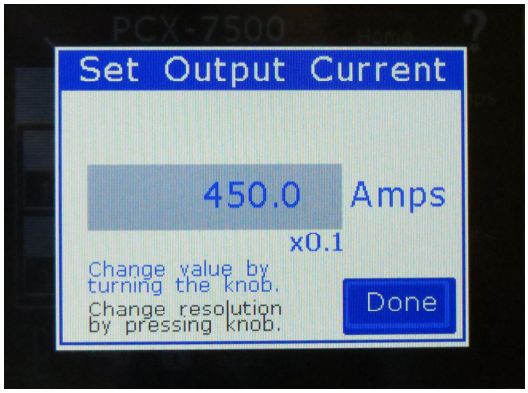
SETPOINT:CURRENT:?
SETPOINT:CURRENT: n (in A)

1. On the Home screen, press the **Output** button. The **Set Output Current** screen appears.

2. Press the encoder knob to select a resolution: x0.1, x1.0, or x10.0.

3. Turn the encoder knob to change the output current: 0.0 A to 450.0 A.

4. Press the **Done** button.



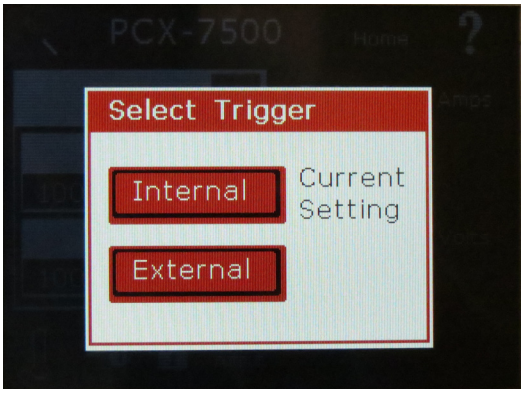
❖ Set the Trigger Source

TRIG:INTERNAL
TRIG:EXTERNAL

Note: The PCX-7500 will default to Internal Trigger mode during initial power up.

1. From the Home screen, press the **Trigger** icon. The **Select Trigger** screen appears.

2. Press the icon for the desired trigger mode.
   a. For **Internal Trigger** the **Home** screen appears. Set the frequency.

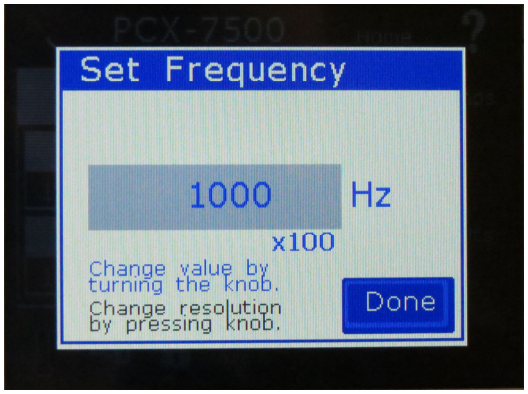


b. For **External Trigger** the **Set Termination** screen appears. Set the Termination if necessary.

❖ Set the Frequency

TRIG:INT:FREQ?
TRIG:INT:FREQ n

1. From the Home screen, press the **Frequency** icon. The **Set Frequency** screen appears.



2. Press the encoder knob to change the resolution to x1, x10, x100, x500, x1000, or x5000:

Frequency	Minimum Resolution
8 Hz to 299 Hz	1 Hz
300 Hz to 10000 Hz	100 Hz

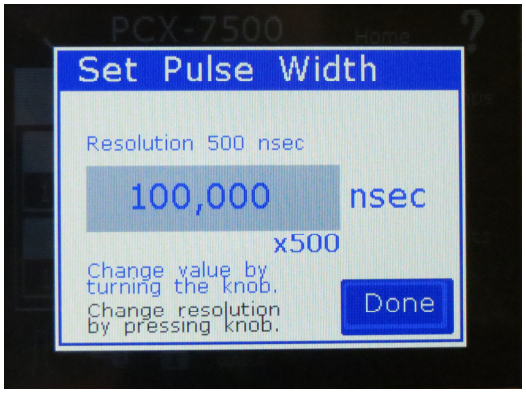
3. Turn the encoder knob to change the frequency from 8 Hz to 10000 Hz.

4. Press the **Done** icon. The **Home** screen reappears.

❖ Set the Pulse Width

TRIG:INT:PULSEWIDTH?
TRIG:INT:PULSEWIDTH n

1. On the **Home** screen, press the **Pulse Width** icon. The **Set Pulse Width** screen appears.



2. Press the encoder knob to select a resolution:

Pulse Width	Frequency
32 µs between	8 Hz to 30 Hz
8 µs between	31 Hz to 122 Hz
2 µs	123 Hz to 500 Hz
0.5 µs	500 Hz to 10000 Hz

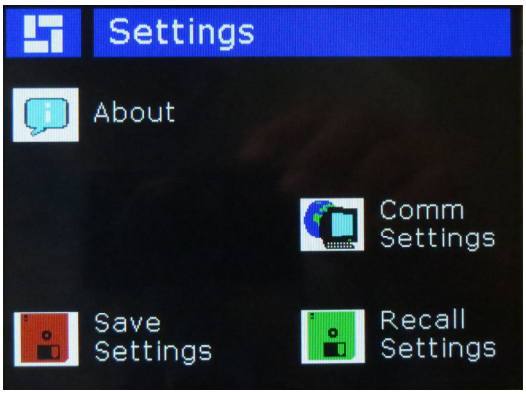
3. Turn the encoder knob to change the pulse width from 4 µs to 5 ms, dependent on frequency.

4. Press the **Done** icon.

❖ Settings Menu

1. On the Home screen, press the **Tools** icon.
2. The **Settings** screen appears.

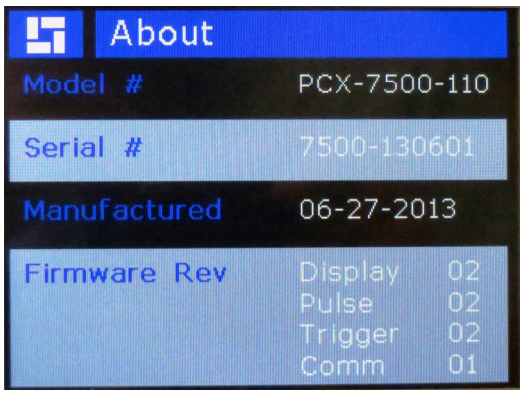
This screen allows the user to view the system settings and change settings as necessary.



❖ View Information About the PCX-7500

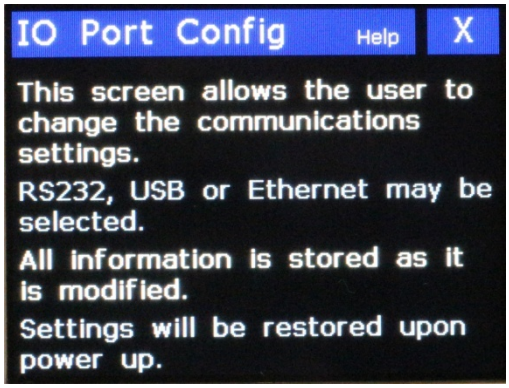
*IDN?

1. On the **Home** screen, press the **Tools** icon. The **Settings** screen appears.
2. Press the **About** icon. The **About** screen appears.
3. View the model number, serial number, calibration date, and firmware revision level.
4. Press the **Home** icon to return to the **Settings** screen.
5. Press the **Home** icon to return to the **Home** screen.



❖ View the Communication Settings

1. On the **Home** screen, press the **Tools** icon. The **Settings** screen appears.
2. Press the **COM Settings** icon. The **PCX-7500 COM** screen appears.

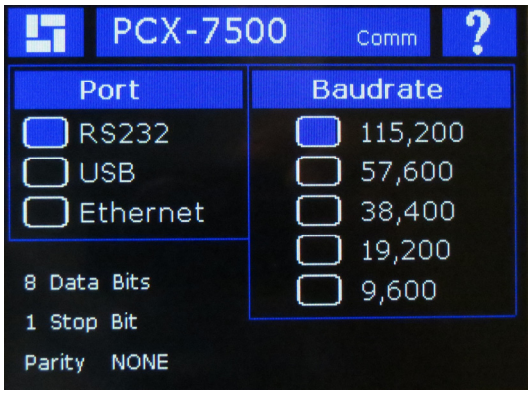


3. To view the communication help screen, press the **?** (question mark) icon.

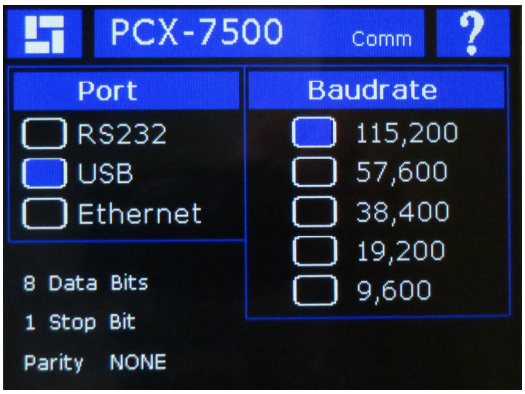
4. Press the **X** to return to the **PCX-7500 COM** screen.

5. Press the icon for the desired communication port.

   a. If **RS232** is selected, change the baud rate to appropriate setting.
   The screen reports the number of data bits, stop bits, and the parity.



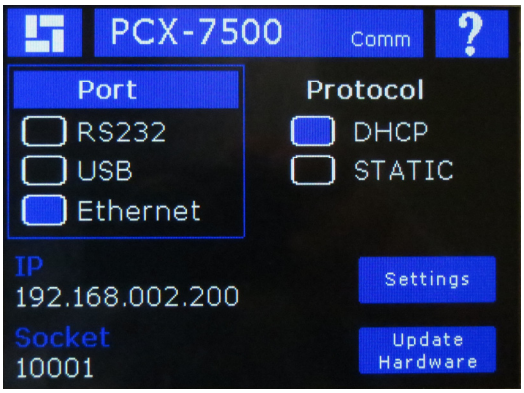
   b. If USB is selected, change the baud rate to appropriate setting.
   The screen reports the number of data bits, stop bit, and the parity.

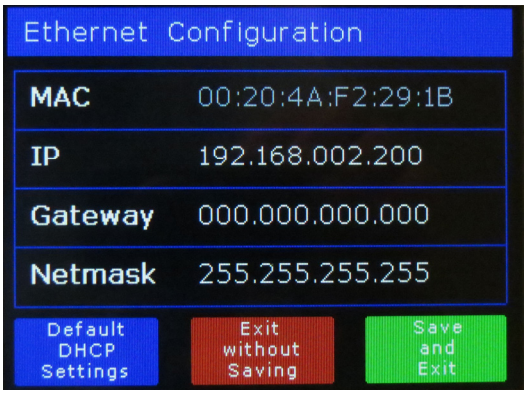


   c. If Ethernet is selected, choose DHCP or STATIC for IP address.

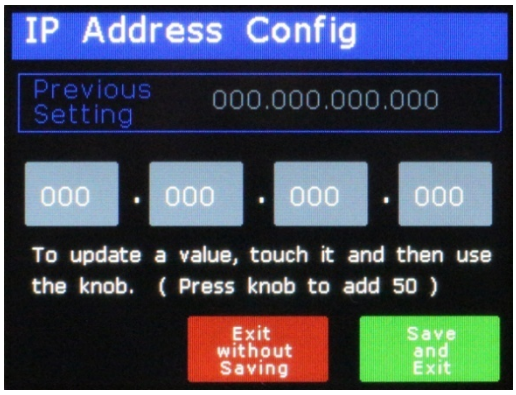
      - For DHCP, press **DHCP**, then press the **Update Hardware** icon.
      To reset the **DHCP** address, press the **Settings** icon. Press the **Default DHCP Settings**, then press the **Save and Exit** icon. Press the **Update Hardware** icon.

      - For Static, press **STATIC**, then press the **Settings** icon to make the desired entries for IP, Gateway, and Netmask fields.

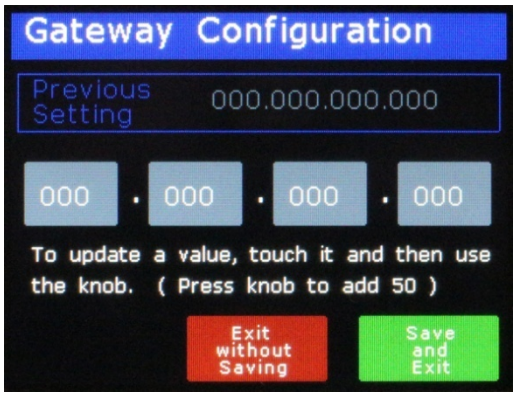




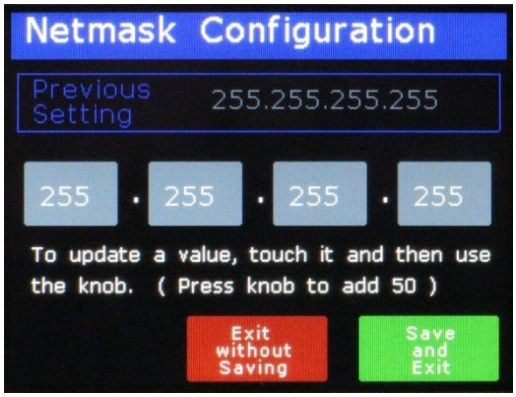
- Press the **IP** box to set the IP address, the **IP Address Config** screen appears. Press each field setting and use the encoder knob to change settings. Press the **Save and Exit** icon.



- Press the **Gateway** box to set the Gateway; the **Gateway Configuration** screen appears. Press each field setting and use the encoder knob to change settings. Press the **Save and Exit** icon.



- Press the **Netmask** box to set the Netmask; the **Netmask Configuration** screen appears. Press each field setting and use the encoder knob to change settings. Press the **Save and Exit** icon.

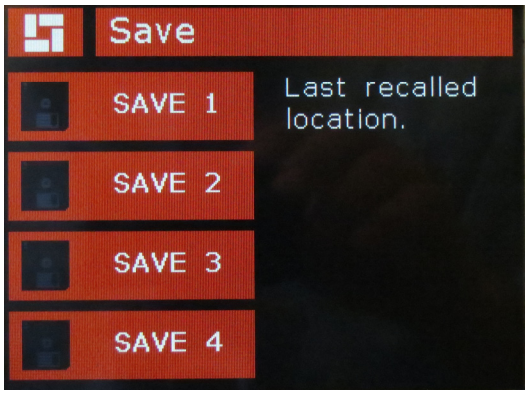


- Once all static settings are completed, press the **Save and Exit** icon. Then press the **Update Hardware** icon.

6. Press the Home icon to return to the **Home** screen.

❖ Save Settings

*SAVE n



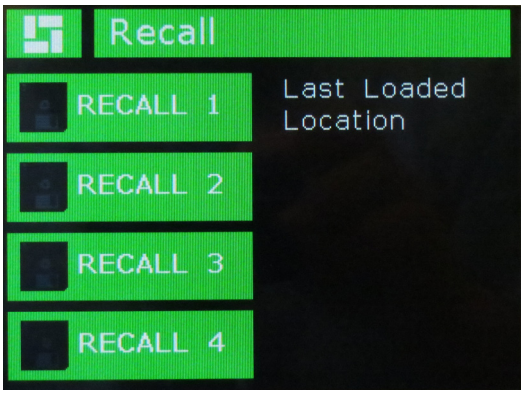
1. On the **Home** screen, press the **Tools** icon. The **Settings** screen appears.
2. Press the **Save Settings** icon. The **Save** screen appears.
3. Press the icon for one of the four locations to which you want to save the settings.

NOTE: Saving to a location overwrites any data at that location.

4. The save takes ~10 seconds. Press the **Home** icon to return to the **Home** screen.

❖ Recall Settings

*RECALL n



1. On the **Home** screen, press the **Tools** icon. The **Settings** screen appears.
2. Press the **Recall Settings** icon. The **Recall** screen appears.
3. Press the icon for one of the four locations from which you want to recall the settings.
4. The recall takes ~10 seconds. Press the **Home** icon to return to the **Home** screen.

❖ Power Down

OUTPUT:DISABLE

1. Disable the unit by pressing the **Enable** button.
2. Turn the **Keyswitch OFF**.
3. Turn the power **OFF** by using the power switch on the rear of the instrument.

Command Set

The Command Set consists of all the commands and queries that the PCX-7500 supports via remote computer control. Commands and queries must be in all capital letters. Commands and queries that require data, denoted as *n*, must have a space between the command and the data.

The PCX-7500 expects "\n" to be the end line character of commands and queries. The responses to the user's computer are also terminated with "\n". For every command sent to the PCX-7500, a response will be sent back to the user from the PCX-7500. The user's software must wait for a response before sending another command to avoid an overflow of the PCX-7500 receive buffer.

NOTE: Any change to a command adjustment typically requires less than 200 ms to complete.

In the examples, the command or query is in black; the response is in blue italics.

***LIST?**

Lists all commands and queries supported by the PCX-7500. Example:

*LIST?
**IDN?*
**SAVE n* :: *n=[1 … 4]*
**RECALL n* :: *n=[1 … 4]*
**LIST?*
OUTPUT?
OUTPUT:ENABLE
OUTPUT:DISABLE
TRIG?
TRIG:INTERNAL
TRIG:EXTERNAL
TRIG:INT:PULSEWIDTH?
TRIG:INT:PULSEWIDTH nnnn :: *n=[4000 … 5000000]*
TRIG:INT:FREQ?
TRIG:INT:FREQ n :: *n=[8 … 10,000] Hz*
TRIG:EXT:TERM?
TRIG:EXT:TERM
SETPOINT:CURRENT?
SETPOINT:CURRENT n :: *n=[10 … 450] Amp*
TEMP:EXHAUST?
FAULT?
FAULT:CLEAR:ALL
STATUS:KEYSWITCH?
STATUS:REAR:ENABLE?

***IDN?**

Abbreviation for identity; returns the manufacturer's name, unit model number, serial number, firmware revision, and manufacture date. Example:

*IDN?
DEI Scientific, PCX-7500-110, 7500-121131, Q01C01T01P01, 11-25-2012

***SAVE n**

Saves the current configuration to non-volatile memory. The value of n must be between 1 and 5. Example:

*SAVE 3
**SAVE 3*

***RECALL n**

Recalls saved configurations. The value of n must be between 1 and 5. Example:

*RECALL 2
**RECALL 2*

OUTPUT?

Returns the state of the output (Enabled or Disabled). Example:

OUTPUT?
Disabled

OUTPUT:ENABLE

Enables the output. Performs the same function as pressing the front-panel ENABLE icon. Example:

OUTPUT:ENABLE
OUTPUT:ENABLE

OUTPUT:DISABLE

Disables the output. Performs the same function as pressing the front-panel ENABLE icon. Example:

OUTPUT:DISABLE
OUTPUT:DISABLE

TRIG?

Returns the trigger type (Internal, or External). Example:

TRIG?
INTERNAL TRIGGER

TRIG:INTERNAL, or TRIG:EXTERNAL

Sets the trigger type. The trigger types are Internal, or External. Example:

TRIG:INTERNAL response is *TRIG:INTERNAL*
TRIG:EXTERNAL response is *TRIG:EXTERNAL*

TRIG:INT:PULSEWIDTH?

Returns the pulse width of the output pulse in nanoseconds. Example:

TRIG:INT:PULSEWIDTH?
4000 nsec

TRIG:INT:PULSEWIDTH nnnn

Sets the pulse width of the output pulse in nanoseconds. The value of nnnn must have two decimal places and be from 4µS to 5mS. Example:

TRIG:INT:PULSEWIDTH 5500
5500 nsec

Frequency	Resolution
8 Hz to 30 Hz	x32 µs, x320 µs
31 Hz to 122 Hz	x8 µs, x32 µs, x320 µs
123 Hz to 500 Hz	x2 µs, x8 µs, x32 µs, x320 µs
500 Hz to 10000 Hz	0.400 µs, x2 µs, x8 µs, x32 µs, x320 µs

TRIG:INT:FREQ?

Returns the trigger frequency in hertz. Example:

TRIG:INT:FREQ?
6000 Hz

TRIG:INT:FREQ n

Sets the trigger frequency in hertz. The value of n must be between 8 Hz and 10000 Hz. Example:

TRIG:INT:FREQ 2400
2400 Hz

Frequency	Minimum Resolution
8 Hz to 299 Hz	1 Hz
300 Hz to 10000 Hz	100 Hz

TRIG:EXT:TERM?

Returns the external trigger termination value. Example:

TRIG:EXT:TERM?
50 Ohm

TRIG:EXT:TERM n

Sets the external trigger termination of 50 ohms or 10k ohms, use n value of 50 or 10. Example:

TRIG:EXT:TERM 10
TRIG:EXT:TERM 10000

SETPOINT:CURRENT?

Returns the Output Current in amperes. Example:

SETPOINT:CURRENT?
100.2 Amps

SETPOINT:CURRENT n

Sets the Output Current in amperes. The value of n must be from 10.0 A to 450.0 A. Example:

SETPOINT:CURRENT 100
SETPOINT:CURRENT 100.0

TEMP:EXHAUST?

Returns the temperature of the internal heat-sink at the air flow exit, value in degrees centigrade. Example:

TEMP:EXHAUST?
35 `C

FAULT?

Returns the fault codes. Example:

FAULT?
(0, 0, 0, 0, 0, 0, 0, 0, 0, 0)

Each digit represents a failure or multiple failures (which are bitwise or'd together). The first digit is the failure that is the most recent failure and the last digit is the oldest failure. On power up, the default codes are 1,2,4,8,16,32,64,128,256,512.

The error codes are as follows:

Code	Error	Description
0:	no error	
1:	keyswitch error	keyswitch changed from on to off while pulses were enabled
2:	interlock error.	output cable was removed while pulses were enabled
4:	temperature error.	instrument's temperature exceeded expected range.
8:	open load	load is open or the required voltage exceeds instrument range
16:	24V error	internal 24V is outside of normal range
32:	Cap voltage error	< NOT USED >
64:	over current error	Either the PCX-7500 or the load failed. Contact DEI
128:	Under_Current_Error	< NOT USED >
256:	Power_Up_Error	< NOT USED >
512:	RS485_Error	< NOT USED >
1024:	HS_Error	Contact DEI, internal hardware issue.
2048:	CB_Error	Contact DEI, internal hardware issue.
4096:	LS_Error	Contact DEI, internal hardware issue.
8192:	Trigger_RS485_Error	Contact DEI, internal hardware issue.
16384:	Enable_Disable_Error	Contact DEI, internal hardware issue.

FAULT:CLEAR:ALL

Clears the fault codes. Example:

FAULT:CLEAR:ALL
FAULT:CLEAR:ALL

STATUS:KEYSWITCH?

Returns the state of the keyswitch (Enabled or Disabled). Example:

STATUS:KEYSWITCH?
ENABLED

STATUS:REAR:ENABLE?

Returns the state of the rear enable connector, (Enabled or Disabled). Example:

STATUS:REAR:ENABLE?
ENABLED

Warranty and Service

❖ Warranty

Directed Energy, Inc. (DEI) warrants equipment it manufactures to be free from defects in materials and factory workmanship under conditions of normal use, and agrees to repair or replace any standard product that fails to perform as specified within one year after date of shipment to the original owner. OEM, modified, and custom products are warranted, as stated above, for ninety (90) days from date of shipment to original owner. This Warranty shall not apply to any product that has been:

I. Repaired, worked on, or altered by persons unauthorized by DEI in such a manner as to injure, in DEI's sole judgment, the performance, stability, or reliability of the product;
II. Subjected the product to misuse, neglect, or accident; or
III. Connected, installed, adjusted, or used otherwise than in accordance with instructions furnished by DEI.

DEI reserves the right to make any changes in the design or construction of its products at any time, without incurring any obligation to make any change whatever in units previously delivered.

DEI's sole obligation, and buyer's sole remedies, under this agreement shall be limited to a refund of the purchase price, or at DEI's sole discretion, to the repair or replacement of products in kind that prove, to DEI's satisfaction, to be defective, when returned to the DEI factory, transportation prepaid by the buyer, within the warranty period. DEI shall in no way be liable for damages consequential or incidental to defects in its products, for failure of delivery in whole or in part, for injuries resulting from its use, or for any other cause.

Returns must be preauthorized and accompanied by a DEI return authorization number.

The foregoing states the entire warranty extended by DEI, and is given and accepted in lieu of 1) any and all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for any particular purpose and 2) any obligation, liability, right, claim or remedy in contract or tort.

❖ Factory Service and Support

For more information about your instrument or for an operation problem, please contact the factory:

Directed Energy, Inc.
1609 Oakridge Dr., Suite 100
Fort Collins, Colorado 80525
(970) 493-1901, ext. 24

sales@ixyscolorado.com
techsupport@ixyscolorado.com
http://ixyscolorado.com/

CE DECLARATION OF CONFORMITY

DECLARATION OF CONFORMITY

Manufacturer's Name: **Directed Energy Inc.**

Manufacturer's Address: **1609 Oakridge Drive, Suite 100; Fort Collins, CO 80525; USA**

Equipment Description: **450 Amp Current Source**

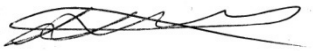
Equipment Model Designation: **PCX-7500**

Application of Council Directive: 73/23/EEC on the harmonization of the laws related to Member States relating to electrical equipment designed for use within certain voltage limits, as amended by: Council Directive 93/68/EEC and

Council Directive 2004/108/EC on the approximation of the laws related to Member States relating to electromagnetic compatibility.

Referenced Safety Standards:	**Referenced EMC Standards:**
EN 60335-2-82	EN61326-1
	EN 55011 Class A
	EN 61000-3-2
	EN 61000-3-3
	EN 61000-4-2
	EN 61000-4-3
	EN 61000-4-4
	EN 61000-4-5
	EN 61000-4-6
	EN 61000-4-8
	EN 61000-4-11

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Signature: 

Printed Name: **Stephen Krausse**

Title: **DEI General Manager**

Notes