

PCX-7420 B

Pulsed Current Source

Operation Manual



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Safety

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 electrical 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.

- Do not open the cover of PCX-7420 B. There are no user-serviceable parts inside. Opening the cover exposes you to lethal shock and voids the factory warranty.
- Do not install, handle, or remove the output cable or laser diode while the PCX-7420 B is operating.
- The PCX-7420 B can be triggered randomly by spurious transients. Always assume it is possible to get an unexpected pulse at the output.
- Allow at least 10 minutes after power-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 front of the chassis and exits the back of the chassis.
- Take normal precautions to protect this device against liquid entry or corrosive environments.
- Clean this device by wiping with a dry or damp cloth.

Introduction

• Description

The PCX-7420 B is a pulsed current source designed to drive laser diodes, bars, and arrays. It delivers current pulses from 3 A to 21.5 A with up to 250 W of total output power. An internal trigger source provides pulse repetition frequencies from 40 Hz to 100 kHz. The external trigger function allows operation at frequencies from single-shot to 1 MHz.

The bias current amplitude, main output current amplitude, bias pulse width, main pulse width, trigger source, and trigger frequency are adjustable from the front panel OLED screen or by computer control via RS-232 or USB interface.

The bias feature allows the PCX-7420 B to deliver a current pulse in two steps. The first step—the bias pulse—starts before the intended trigger time. Current is set just below the lasing point, minimizing the diode's response time to the main pulse. The bias pulse current is adjustable from 0 A to 5.8 A and the pulse width is adjustable from 0 ms to 25 ms.

The main pulse current adds to the bias current and energizes the diode at the intended time. The main pulse current is adjustable from 3 A to 15.7 A and the pulse width is adjustable from 50 ns to 5 ms.

Note: The total current output pulse is always the sum of the bias pulse current and the main pulse current, even if the bias pulse width is set to zero. Consider both the bias output current and the main output current when planning the total output current.

The PCX-7420 B can be triggered internally or externally. The input termination impedance for both the external gate and the external bias gate is selectable for either 50 Ω or 10000 Ω . The Sync output signal on the front panel allows the PCX-7420 B to be synchronized with other devices. The Sync signal logic levels are 0 V and +5 V, and its rising edge corresponds to the rising edge of the main output current pulse. The delay between the Sync output signal and the main output current pulse is 5 ns to 15 ns.

• Panel Layout

All features of the front and rear panel are labeled. Their functions are covered in the next section.



• Front Panel Features

HOME Button

Returns the PCX-7420 B front-panel display to the HOME screen. (The HOME screen contains the Main Current, Bias Current, Rear Enable status, and Key Switch status.)

ENABLE Button

Toggles the PCX-7420 B between enabled and disabled. The button illuminates green when the unit is enabled and red when disabled.

OLED Screen

Provides a user interface to the PCX-7420 B.

Encoder Knob

Changes screens on the front panel and changes the values of parameters. Rotate to change a value; push to cycle through the resolutions (increments of value change). When finished changing the parameter, press HOME to exit the parameter screen.

Keyswitch

Allows the PCX-7420 B to be enabled when ON. Disables the PCX-7420 B and prevents the system from being enabled when OFF.

External Bias Input

Accepts bias trigger pulses from an external source via a BNC connector.

External Gate Input

Accepts trigger pulses from an external source via a BNC connector.

Note: The impedance of the External Bias input and the External Gate input are selectable to either 50 Ω or 10 k Ω simultaneously.

Sync Output

Provides synchronizing output pulses to an external device via a BNC connector. The sync pulse is coincident with the leading edge of the output current pulse.

• Rear Panel Features

Output

Accepts the factory-supplied output cable and provides the generated current pulses. DO NOT TOUCH any part of this cable while the PCX-7420 B is powered up. Please review the Safety section above.

Rear Enable

Accepts either an external dry-contact closure or the factory-supplied shorting BNC plug. Closing the contacts, or installing the shorting plug, enables the output. Opening the contacts, or removing the shorting plug, disables the output and creates a rear enable fault.

IMON Output

Provides a voltage signal to an oscilloscope via a BNC connector that is proportional to the output current. Scaling is 36 mV / 1 A into 50 Ω .

NOTE: NEVER connect an oscilloscope directly to the output of the system.

USB Cable Connector

Provides communication with an external computer via USB.

RS-232 Cable Connector

Provides communication with an external computer via an RS-232 null cable.

Power Cable Connector

Accepts a standard grounding equipment power cable.

Fuse Holder

Houses two AC power fuses.

On-Off Switch

Powers the PCX-7420 B ON and OFF.

• Accessories Included

AC Power Cable

Factory-supplied standard computer-style power cord with NEMA C14 and NEMA 5-15R connectors.

Shorting BNC Plug

Attaches to the Rear Enable BNC connector. Enables the output when a closed-contact system is not used.

Keyswitch Keys

Keys for the front-panel keyswitch that allows the output to be enabled.

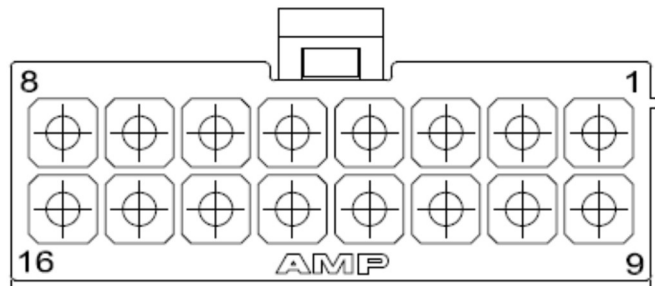
Output Cable

Two (2) factory-supplied cables that provide high current pulses to the external device.

Output Cable Pinout Information

The two male Amp connectors interface with the instrument and have the following pinout on each connector:

- Pins 1 through 8: negative (–) output
- Pins 9 through 16: positive (+) output



Rear view of Amp 770583-1 connector showing pinout

Laser Output PCBA

A factory-supplied laser output circuit board that provide a simple method to interface a laser or other external device.



Operation

• Setup

1. Make sure the PCX-7420 B has been OFF for at least ten minutes.
2. Make sure the polarity of the diode connection is correct. If necessary, review the output cable pinout in the Specifications section.
3. Connect the output cable from the PCX-7420 B to the output device.
4. Make the other connections (not required): External Trigger, External Bias, Sync, IMON, and a connection to the computer.
5. Connect the Rear Enable BNC and power cable.

• Power Up

1. Turn the power switch ON (I).
 - The unit displays the system information, serial number and firmware revisions as the unit initializes.
 - The Home screen displays Main Current, Bias Current, Rear Enable, and Key Switch when the system has finished initializing.
2. Turn the keyswitch ON when ready to turn on the output pulse.

PCX-7420 B

Serial # 110-001
Firmware D03-P05

Main Current 11.23 A
Bias Current 1.234 A
Rear Enable On
Key Switch Off

• Set the Main Output Current

MAIN:CURRENT:SETPOINT?
MAIN:CURRENT:SETPOINT n

1. Rotate the encoder knob until **Main Current** is displayed on the screen.
2. Press the encoder knob to update the main output current.

Main Current

11.234 A
Press KNOB to update

3. Rotate the encoder knob to change the value. The range is 3 A to 15.7 A.
4. Press the encoder knob to change the multiplier to x0.001, x0.010, x0.100, x1.000, or x10.000 indicated by the asterisk (*).
5. When the correct value is displayed, press the **Home** button.

Main Current

11.234 A
*

• Set the Bias Output Current

BIAS:CURRENT:SETPOINT?
BIAS:CURRENT:SETPOINT n

1. Rotate the encoder knob until **Bias Current** is displayed on the screen.
2. Press the encoder knob to update the bias current.
3. Rotate the encoder knob to change the value. The range is 0 A to 5.8 A.
4. Press the encoder knob to change the multiplier value to x0.001, x0.010, x0.100, or x1.000 indicated by the asterisk (*).
5. When the correct value is displayed, press the **Home** button.

Bias Current

1.234 A
Press KNOB to update

Bias Current

1.234 A
*

• Set the Main Pulsewidth

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

1. Rotate the encoder knob to the **Main Pulsewidth** screen.
2. Press the encoder knob to update the pulse width.
3. Rotate the encoder knob to change the value. The range is 0.100 μ s to 5000 μ s.
4. Press the encoder knob to change the multiplier value to x25 ns, x100 ns, x1.000 μ s, x10.000 μ s, or x100.000 μ s.
5. When the correct value is displayed, press the **Home** button to return to the **Home** screen.

Main Pulsewidth

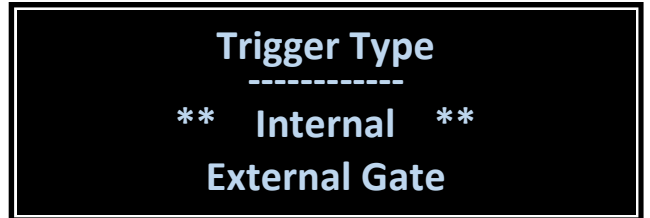
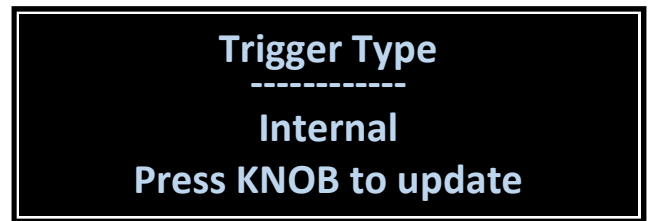
0.009,500 ms
Press KNOB to update

Main Pulsewidth

0.009,500 ms
x100.000 μ s

Gate information. It is recommended to disable the system prior to switching between internal and external triggering.

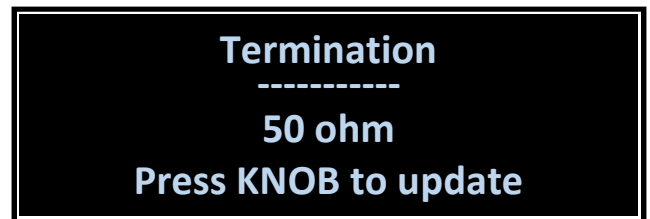
1. Rotate the encoder knob to the **Trigger Type** screen.
2. Press the encoder knob to select the Trigger Type.
3. Rotate the encoder knob between Internal and External Gate.
4. When the correct **Trigger Type** has been selected, press the **Home** button to return to the **Home** screen.



• Set the Termination

TRIG:EXT:TERM?
TRIG:EXT:TERM n

1. If you selected External Trigger, the correct termination must be set.
2. Rotate the encoder knob to the Trigger Termination screen.
3. Press the encoder knob to select the termination value.
4. Rotate the encoder knob between 50 Ω and 10 k Ω .
5. Press the **Home** button to return to the **Home** screen.



- **Set the Frequency**

TRIG:INT:FREQ?

TRIG:INT:FREQ n

When changing the frequency, the PCX-7121 maintains the duty cycle. It is recommended to change the frequency and then the pulse width.

For internal settings:

1. Rotate the encoder knob to the **Frequency** screen.
2. Press the encoder knob to change the frequency.
3. Rotate the encoder knob to select a value between 40 Hz and 100000 Hz.
4. Press the encoder knob to change the multiplier value to x1, x10 x100, x1000, or x10000, indicated by the asterisk (*).
5. When the correct value is displayed, press the **Home** button to return to the **Home** screen.

Frequency

100,000 Hz
Press KNOB to update

Frequency

100,000 Hz
*

Pulse width resolution, internal	40 Hz to 300 Hz:	1 Hz
	300 Hz to 5000 Hz:	100 Hz
	5 kHz to 100 kHz:	1000 Hz

For external settings:

1. Set the Frequency on the external signal generator.

- **View Information About the PCX-7420 B**

*IDN?

1. On the **Home** screen, rotate the encoder knob counter-clockwise 1 screen.
2. The **About** screen appears. View the model number, serial number, and firmware revision level.
3. Press the **Home** button to return to the **Home** screen.

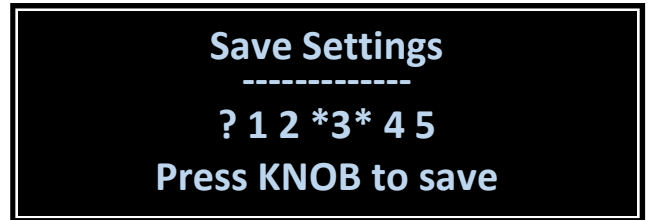
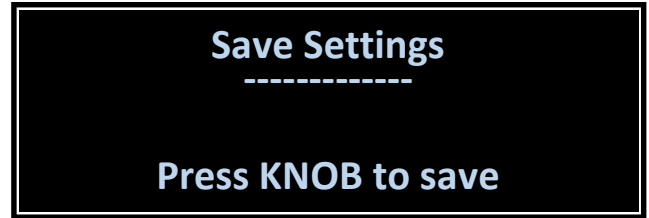
PCX-7420 B

Serial # 110-001
Firmware D03-P05

• Save Settings

*SAVE n

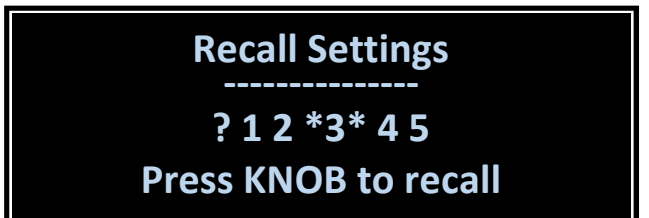
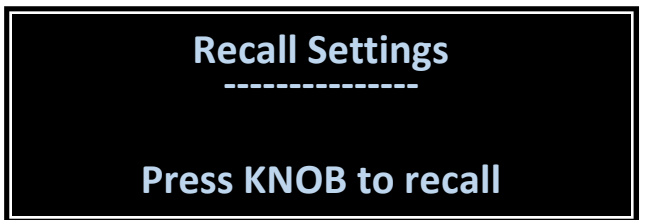
1. Rotate the encoder knob to the **Save Settings** screen.
2. Press the encoder knob to enter the save menu.
3. Rotate the encoder knob to choose a memory location from 1 to 5. During power up, the system defaults to memory location 1 parameters.
4. Press the encoder knob to save the values in the chosen memory location. The screen will display "Saving to location # n", indicating the data is being saved.
5. After the parameters have been saved to memory, press the **Home** button to return to the **Home** screen.



• Recall Settings

*RECALL n

1. Rotate the encoder knob to the **Recall Settings** screen.
2. Press the encoder knob to enter the Recall Settings menu.
3. Rotate the encoder knob to choose the memory location, 1 to 5. During power up the system defaults to memory location 1 parameters.
4. Press the encoder knob to restore the values from the chosen memory location. The screen will display "Loading data from location # n", indicating the data is being restored.
5. When finished restoring the parameters from memory, press the **Home** button to return to the **Home** screen.



• Warnings and Faults

All faults disable the PCX-7420 B. To continue after clearing a fault, you must send an "OUTPUT:ENABLE" command from the computer or press the ENABLE button on the front panel.

Keyswitch Status

STATUS:KEYSWITCH?

- The keyswitch was OFF at power-up, or it was turned OFF during operation, which disables the system.
- Turn the keyswitch ON to continue.

```
*****
* KEYSWITCH FAULT *
* System Disabled *
*****
```

Rear Enable Status

STATUS:REAR:ENABLE?

- The rear enable was disabled at power-up, or it was disabled during operation.
- This fault is caused by open dry contacts in the rear enable circuit or the removal of the shorting BNC plug.
- Connect the dry contacts or install the shorted BNC plug on the rear of the system.

```
*****
* REAR ENABLE FAULT*
* System Disabled *
*****
```

Over Temperature Fault

TEMP:IN?

TEMP:EXHAUST?

1. Allow cool, free air to flow from front to rear.
2. If there is a fault, either the ambient temperature or the exhaust air temperature exceeded the safe temperature operating range.
3. To view the temperature on the last screen, turn the encoder knob fully clockwise.
4. The first temperature is the intake and the second temperature is the exhaust.

```
Factory Information
-----
23°C->25°C 27.808V
100002000030000♥0000
```

• View the Communication Settings

1. Rotate the encoder knob until the RS-232 / USB communication information is displayed.
2. RS-232 and USB use the same settings. The parameters are 115200 baud, 8 data bits, no parity, 1 stop bit, and no flow control. The end-of-data packet character is the ASCII new line character ('\n').
3. RS-232 is selected by default; there cannot be a USB cable connected to a computer for RS-232 to be enabled.
4. If the USB port is connected to a computer, RS-232 is disabled automatically.
5. The USB driver can be found at <https://directedenergy.com>
6. During computer communication to the PCX-7420 B, the screen will change and report the Baud rate, the number of data bits and stop bits, and the parity.

RS232 / USB

115200, 8, 1, N
End line = char 10

• Power Down

WARNING

Risk of fatal electric shock. Wait at least 10 minutes after powering down the PCX-7420 B before handling the output cable or laser diode.

1. Disable the unit by pressing the ENABLE BUTTON on the front panel or by sending the computer command "OUTPUT:DISABLE".
2. Turn the keyswitch OFF.
3. Turn the unit OFF at the power switch on the rear of the system.

Command Set

A host PC can remotely control the configuration and operation of the PCX-7420 B through its RS-232 or USB interfaces. This feature allows the user to create system-level control software to run standardized test procedures for research, test, and manufacturing validation environments.

Any external communication from the RS-232 or USB port automatically updates the values on the **Home** screen of the front panel.

A cable connected from a computer to the USB port will disable the RS-232 port automatically. The RS-232 port will be disabled until the USB cable is disconnected from the PCX-7420 B.

The PCX-7420 B serial communication parameters are displayed when the user rotates the encoder knob to the **RS232/USB** settings screen. The parameters are 115200 baud, 8 data bits, no parity, 1 stop bit, and no flow control. The end-of-data packet character is the ASCII new line character ('\n'). Upon seeing the termination character, the unit assumes the entire data packet is received and processes the command.

The command set is based upon the SCPI (Standard Commands for Programmable Instruments) protocol. It has been optimized for use in DEI's equipment for application ease and device efficiency. Each command includes a string of words, and if necessary, data or a keyword. 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.

For every command sent to the PCX-7420 B, a response will be sent back to the user from the PCX-7420 B. The user's software must wait for a response before sending another command to avoid an overflow of the PCX-7420 B receive buffer.

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

When changing the frequency, the duty cycle will be maintained. The system will display the new pulse width on the second home screen. It is recommended to change the frequency and then the pulse width, unless the duty cycle is a priority to the user.

The commands are in alphabetical order except *LIST?. 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-7420 B. Example:

***LIST?**

**IDN?*

**SAVE*

**RECALL*

OUTPUT?

OUTPUT:ENABLE

OUTPUT:DISABLE

TRIG?

TRIG:INTERNAL

TRIG:EXTERNAL

TRIG:EXT:TERM?

TRIG:EXT:TERM

TRIG:INT:FREQ?

TRIG:INT:FREQ

TRIG:INT:MAIN:PULSEWIDTH?

TRIG:INT:MAIN:PULSEWIDTH

TRIG:INT:BIAS:PULSEWIDTH?

TRIG:INT:BIAS:PULSEWIDTH

MAIN:CURRENT:SETPOINT?

MAIN:CURRENT:SETPOINT

BIAS:CURRENT:SETPOINT?

BIAS:CURRENT:SETPOINT

STATUS:KEYSWITCH?

STATUS:REAR:ENABLE?

TEMP:IN?

TEMP:EXHAUST?

BIAS:CURRENT:SETPOINT?

Returns the setpoint of bias current in mA. Example:

BIAS:CURRENT:SETPOINT?

1500 mAmps

BIAS:CURRENT:SETPOINT n

Sets the amount of bias current in mA. The value of n must be between 0 and 5800. Example:

BIAS:CURRENT:SETPOINT 1500

BIAS:CURRENT:SETPOINT 1500

***IDN?**

Short for Identity; returns the manufacturer's name, unit model number, serial number, firmware revisions, and manufacture date. Example:

*IDN?

DEI Scientific, PCX-7420 B, 110-081, D03 M04, 00

MAIN:CURRENT:SETPOINT?

Returns the setpoint of main current in mA. Example:

MAIN:CURRENT:SETPOINT?

15000 mAmps

MAIN:CURRENT:SETPOINT n

Sets the amount of main current in mA. The value of n must be between 3000 and 15700. Example:

MAIN:CURRENT:SETPOINT 15000

MAIN:CURRENT:SETPOINT 15000

OUTPUT?

Returns whether the output is enabled or disabled. Example:

OUTPUT?

Disabled

OUTPUT:DISABLE

Disables the output; the same as pressing the front-panel ENABLE button until the Enable LED is unlit. Example:

OUTPUT:DISABLE
OUTPUT:DISABLE

OUTPUT:ENABLE

Enables the output; the same as pressing the front-panel ENABLE button until the enable LED lights green. Example:

OUTPUT:ENABLE
OUTPUT:ENABLE
(if successful)

If a fault is preventing the PCX-7420 B from enabling, clear the fault by pressing the HOME button. If the keyswitch is not ON or the rear enable connection is not made fix the system by turning on the keyswitch or connecting the rear enable BNC.

***RECALL n**

Loads saved configurations and sets the PCX-7420 B to use them. The value of n must be between 1 and 5. Example:

*RECALL 2
**RECALL 2*

***SAVE n**

Saves the current configuration to non-volatile memory. The value of n must be between 1 and 4. Example:

*SAVE 3
**SAVE 3*

STATUS:KEYSWITCH?

Returns whether the keyswitch is enabled or disabled. Example:

STATUS:KEYSWITCH?
Disabled

STATUS:REAR:ENABLE?

Returns whether the rear enable is enabled or disabled. Example:

STATUS:REAR:ENABLE?
Disabled

TEMP:IN?

Returns the temperature of the intake air in degrees Celsius. Example:

TEMP:IN?

27 °C

TEMP:EXHAUST?

Returns the temperature of the exhaust air in degrees Celsius. Example:

TEMP:EXHAUST?

38 °C

TRIG?

Returns the whether the trigger is internal or external. Example:

TRIG?

INTERNAL

TRIG:EXTERNAL

Sets the trigger to External. Example:

TRIG:EXTERNAL

TRIG:EXTERNAL

TRIG:EXT:TERM?

Returns the termination impedance of the external trigger input in ohms.

Example:

TRIG:EXT:TERM?

50 Ohms

TRIG:EXT:TERM n

Sets the termination impedance of the external trigger input in ohms. The value of n must be 50 or 10k. Example:

TRIG:EXT:TERM 10k

TRIG:EXT:TERM 10k

TRIG:INTERNAL

Sets the trigger to internal. Example:

TRIG:INTERNAL

TRIG:INTERNAL

TRIG:INT:FREQ?

Returns the internal trigger frequency in hertz. Example:

TRIG:INT:FREQ?

2400 Hz

TRIG:INT:FREQ n

Sets the internal trigger frequency in hertz. The value of n must be from 40 to 100000. Example:

TRIG:INT:FREQ 2400

TRIG:INT:FREQ 2400

TRIG:INT:MAIN:PULSEWIDTH?

Returns the pulse width of the main current pulse, in nanoseconds.

Example:

TRIG:INT:MAIN:PULSEWIDTH?

280000 nsec

TRIG:INT:MAIN:PULSEWIDTH n

Sets the pulse width of the main current pulse in nanoseconds. The value of n must be from 50 to 5000000. Example:

TRIG:INT:MAIN:PULSEWIDTH 280000

TRIG:INT:MAIN:PULSEWIDTH 280000

TRIG:INT:BIAS:PULSEWIDTH?

Returns the pulse width of the bias current pulse, in nanoseconds.

Example:

TRIG:INT:BIAS:PULSEWIDTH?

12000 nsec

TRIG:INT:BIAS:PULSEWIDTH n

Sets the pulse width of the main current pulse. The value of n must be in nanoseconds from 0 to 25000000. Example:

TRIG:INT:BIAS:PULSEWIDTH 12000

TRIG:INT:BIAS:PULSEWIDTH 12000

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 Drive, Suite 100
Fort Collins, Colorado 80525

Telephone: (970) 493-1901

sales@directedenergy.com
support@directedenergy.com
<https://directedenergy.com/>

CE Declaration

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: **20 A Current Source**
Equipment Model Designation: **PCX-7420**

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 2014/108/EC, FCC Part 15 and ICES-003 on the approximation of the laws related to Member States relating to electromagnetic compatibility.

Referenced Safety Standards:

IEC 61010-1
EN 61010-1

Referenced EMC Standards:

EN 61326-1

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**

