

# ***920C Cooled PMT Housing and Controller***

## ***OPERATION MANUAL***



**Photon Technology International**

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## **PTI Standard Instrument Warranty**

### **Warranty Period and Extent**

Photon Technology International (PTI) warrants that its instruments will be delivered in a functional state and free from defect, and will meet stated specifications for a period of one (1) year. The warranty period will start on the date of shipment by PTI. In case of systems that include installation by PTI, the warranty will start from the date of installation or thirty (30) days after the shipping date, whichever is earlier.

This warranty is in lieu of all other warranties, expressed or implied, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose, nor will PTI provide training on its use free of charge. PTI shall not be responsible for any liability, loss or damages, caused or alleged to be caused, by the system, as a result of use or operation including, without limitation, consequential damages and loss of profit.

### **Specific Exclusions and Limitations**

1. It is recognized that the performance of consumable items will diminish as a function of use, and that it may be necessary to replace such items to restore the stated specifications. Consumable items (arc lamps, filters, cuvettes, lenses, etc.) are not covered by the warranty.
2. The original manufacturer's warranty will be maintained for major system components not manufactured by PTI (e.g. computers, printers, microscopes, cameras and components thereof).
3. Fiber optic bundles are not covered by the warranty.
4. The use of arc lamps not supplied by PTI (or approved in writing by PTI) will void PTI's warranty on all illuminator subsystem components.
5. If there is any evidence of physical contact with coated optics (e.g. fingerprints), the warranty on that item will be voided.
6. If the optical components are realigned by the customer without specific permission from PTI, the warranty will be voided. Please note that the customer is responsible for changing lamps and aligning the lamp after installation. Aligning the lamp will not void the warranty unless other exclusions are applicable (nos. 4 and 5).
7. Instrument systems that are not authorized to be installed by anyone other than PTI service personnel will not be warranted.
8. In case of systems that include installation as part of the original purchase, unpacking the instrument by anyone other than PTI personnel will void the warranty.
9. Moving systems to another site within a facility or to another location, without specific permission from PTI, will void the warranty.
10. Damage or loss caused by shipping is not covered by the warranty.
11. Damage caused by improper operation of the instrument will void the warranty.
12. Damage caused by equipment not purchased from PTI that is attached to the instrument is not covered by the warranty.
13. Warranty is valid only in the state, province or country of the original purchase.
14. Warranty is valid only on systems having a computer supplied by PTI.
15. Software upgrades performed on the PTI computer workstation (e.g., adding word processors, image editors, etc.) not authorized by PTI will void the warranty.
16. Hardware upgrades performed on the PTI computer workstation (e.g., adding network boards, sound cards, etc.) not authorized by PTI will void the warranty.

### **Warranty Returns**

A Return Material Authorization (RMA) Number must be obtained from the PTI Service Department before any items can be shipped to the factory. Returned goods will not be accepted without an RMA Number. Customer will bear all shipping charges for warranty repairs. All goods returned to the factory for warranty repair should be properly packed to avoid damage and clearly marked with the RMA Number.

### **Warranty Repairs**

Warranty repairs will be done either at the customer's site or at the PTI plant, at our option. All service rendered by PTI will be performed in a professional manner by qualified personnel.

### **Software**

PTI makes no warranties regarding either the satisfactory performance of the software or the fitness of the software for any specific purpose. PTI shall not be responsible for any liability, loss or damages caused or alleged to be caused by our software as a result of its use, including, without limitation, consequential damages and loss of profit, nor will PTI provide training on its use free of charge.

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## Safety Symbols Used In This Manual

(NOTE: Not all may be present in this manual)



(DANGER)

This symbol indicates the potential for serious bodily harm. Extreme care should be taken when performing the task and all warnings should be strictly adhered to. All possible steps should be taken to ensure safety.



(WARNING)

This symbol represents the potential for electrical shock and/or other bodily harm. Care should be taken when performing the task. There is also the potential for damage to equipment if warnings are not taken seriously.



(CAUTION)

This symbol represents the potential for equipment damage. The user is expected to use care when performing the task.



(RADIATION)

This symbol represents the risk of UV radiation. User must take all appropriate steps to protect eyes and exposed areas of the skin.

# 1 Description

## 1.1 Introduction

The 920C Cooled PMT Housing consists of the housing with optics, the controller box, a Signal Interface Box and connecting cables. The controller box controls the temperature of the PMT chamber in the housing and the voltage applied to the PMT. The Signal Interface Box allows for the PMT signal to be used in Photon Counting and Analog Modes.

## 1.2 Specifications

<b>COOLED PMT CONTROLLER box</b>	
<b>Electrical</b>	
Line voltage	100 - 240 V, 50 or 60 Hz
Fuse	1.5 A, 250 V slow blow
<b>Controls</b>	
Front panel	
VOLTAGE ADJUSTMENT knob	10 turns, linear, -150 to -1427 V
Rear panel	
INTERNAL / EXTERNAL switch	Switches the PMT voltage control between the VOLTAGE ADJUSTMENT knob (front panel) or the EXTERNAL connector (rear panel)
<b>Connections</b>	
Rear panel	
TO PMT HOUSING	10-pin connector. Peltier cooling power and control
TO PMT SOCKET	6-pin connector. PMT High Voltage
EXTERNAL	BNC connection, 0 to +5 V (linearly corresponds to -150 to -1427 V at the PMT). When using FelixGX to control the PMT voltage, connect this to HV Control on the 920I interface box.
<b>Indicator Lights</b>	
OVERHEATING	Turns on red if the Peltier heat sink overheats to ~ 70 °C
TEMP IN RANGE	Turns on green when the PMT chamber temperature reaches -20 °C
<b>Physical</b>	
Controller box dimensions	115 (H) x 277 (W) x 305 (D) mm
	4.5 (H) x 10.875 (W) x 12 (D) inches
	Add a minimum of 2 inches (50 mm) at the back of the control box when attaching the heater cable and power (mains) cord.
Weight	2.3 kg
	5 lb

<b>Cooled Housing</b>	
PMTs supported	All 28 mm diameter side-on PMTs
Cooling	Double stage: thermo-electric cooling and air cooled heat sink
Cooling temperature	-20 °C in the PMT chamber
Settling time	Will reach desired temperature in less than 45 minutes
Window and lenses	UV-grade fused silica 185 nm to 2,200 nm, heated to prevent condensation
Focal length from slit	75 mm (2.95 inches)
Numerical aperture	0.35
Dimensions (including legs and lens tube)	290 mm (H) x 105 mm (W) x 240 mm (D)
	11.5 inch (H) x 4.1 inch (W) x 9.5 inch (D)
	Add 50 mm (2 inch) on the top for cables
	Add 90 mm (3.5 inch) at the front for the Peltier power cable
Air flow room	Leave 25 mm (1 inch) free around the Cooled PMT Housing for air flow.
Weight	3 kg (6 lb)
<b>Connections</b>	
front panel	10-pin connector from controller box. Peltier power and control.
-HV CONT (PMT socket)	6-pin connector. From controller TO PMT SOCKET
SIG (PMT socket)	BNC connector. To PMT In on 920I Interface Box.

<b>920I Interface Box</b>	
<b>Amplification</b>	5000 x
<b>Photon Counting (Digital) Mode Output</b>	TTL pulses that can go into a data acquisition module with a discriminator and counter
Maximum count rate	10 million counts per second
Absolute linear rate	3 million counts per second
Linear count rate (-5% deviation)	7 million counts per second
Pulse pair resolution	200 ns
Output pulses HV	TTL factory set
<b>Analog Mode bandwidth</b>	
Low	500 Hz
Medium (default)	200 kHz
<b>Connections</b>	
PMT In	BNC connector. From SIG connector on PMT socket.
Analog Out	BNC connector. To analog measuring device.
Digital Out	BNC connector. To digital measuring device.
Control	9-pin connector from ASOC-10.
HV Control	BNC connector. From controller box EXTERNAL connector.

### 3 Installation



To avoid possible damage to the sensitive photomultiplier tube, it is suggested that the new PMT be kept in darkness as much as possible until it is installed in its socket and the housing is closed.

Do not apply any voltage to the PMT when it is directly exposed to room light

Be careful not to touch the photocathode area of the PMT UV glass envelope. Finger oils may deposit on the surface and these may emit fluorescence when illuminated by incident light. If you do touch the PMT envelope wipe the glass clean with a lint-free tissue dampened with methanol and then with a clean dry tissue.

When installing or removing the PMT carefully grasp the base of the PMT with thumb and index finger and push down or pull up on the PMT while gently moving it side to side by small angles. Do not move the PMT through large angles as you can crack the ceramic insulator base of the PMT socket.

1. You will need 2.5 mm and 3/32 inch hex keys (Allen wrench; ball end preferred).
2. These steps assume the rest of the instrument has already been set up.
3. The Cooled PMT Controller box should be turned off and all cables should be disconnected from the socket.
4. Screw the legs onto the bottom of the Cooled PMT Housing.
5. Move the lens tube up to the exit slit on the emission monochromator and attach it with the screws provided using a 2.5 mm hex key (Allen wrench).
6. Using a 3/32 inch hex key (Allen wrench) unscrew and remove the 4 screws holding the socket in the top of the housing. Note that the three Teflon spacers and the star washer on the grounding bracket are held only by the screws and may fall off the housing when the socket is removed. Pull up on the socket and set it on a table top.



7. The O-ring B around the bottom of the base should already be in place. The smaller O-ring A needs to be placed around the edge of the base (hold it in place and pull on one side to stretch it to fit around the base) so that it stays on the socket base.
8. In dim light (to protect the PMT from excessive light shock), remove the PMT from its packaging.
9. The rib on the PMT indexing pin is on the same side of the PMT as the photocathode, so that when the rib inserts into the notch in the socket base, the photocathode faces the incident light from the monochromator. Lightly place the PMT into the socket so that the nib on the center shaft fits into the notch in the socket base. Using your thumb and index finger, grasp the base of the PMT and rock it slightly side to side while pushing the PMT into the socket. Make sure the PMT is fully seated in the socket.
10. Make sure the star washer is in place on top of the grounding bracket and the Teflon spacers are above the other three screw holes.
11. Place the PMT socket upright above the Cooled PMT Housing with the photocathode pointed toward the lens tube and monochromator. The BNC connector should be on the same side as the lens tube. See the picture on the front cover of this manual. Lower the PMT socket into the Cooled PMT Housing. Rotate the socket as necessary so the holes in the flange are aligned with the screw holes.
12. Insert the screws in the screw holes and tighten the screws. This will also compress the O-rings to create the seal around the PMT.
13. Connect the cables between the Cooled PMT Controller box (Controller box in the table below), the cooled housing, the 920I Interface Box and the ASOC-10 according to the following table.

FROM		TO		FUNCTION	CABLE	
DEVICE	LABEL	DEVICE	LABEL		TYPE	LABEL
Controller box	TO PMT HOUSING	Cooled Housing		Peltier power and control	10-pin	
Controller box	TO PMT SOCKET	Cooled Housing PMT socket	-HV CONT	PMT HV	6-pin	
Cooled Housing PMT socket	SIG	920I Interface Box	PMT In	PMT signal	BNC	
920I Interface Box	Analog Out or Digital Out	ASOC-10	Analog IN # or Digital A #	Photon Counting signal	BNC	
ASOC-10	Control #	920I Interface Box	Control	Analog or Digital OUT switch	9-pin	Control
920I Interface Box	HV Control	Controller box	EXTERNAL	External PMT voltage control (optional)	BNC (not supplied)	



## 4. Operation

### In use

- 1 Turn off the Cooled PMT Controller box.
- 2 On the Cooled PMT Controller box, turn the VOLTAGE ADJUSTMENT knob fully counterclockwise (minimum).
- 3 Turn on the Cooled PMT Controller box. The TEMP IN RANGE light on the front of the Controller should turn green when  $-20\text{ }^{\circ}\text{C}$  in the PMT chamber is reached, in about 45 minutes.
- 4 Move the INTERNAL / EXTERNAL switch on the back of the controller box to INTERNAL to be able to use the VOLTAGE ADJUSTMENT knob to set the voltage, or move the switch to EXTERNAL if an external control (EXTERNAL connector on the rear of the Controller box) is to be used.
- 5 Turn the VOLTAGE ADJUSTMENT knob clockwise to get the desired voltage, or adjust the external HV control.
  - a **Note for FelixGX with Saturation Alert:** If Saturation Alert warnings appear, then reduce the voltage applied to the PMT. Saturation Alert warnings can easily happen with a R928 because the 920I amplifies the signal by 5000x, whereas a 914 amplifies it by 100x.

### When finished

- 6 When you are finished using the 920C Cooled PMT Housing, turn off the Cooled PMT Controller box, and turn the VOLTAGE ADJUSTMENT knob fully counterclockwise (minimum).
- 7 If you want to remove the PMT from the housing, let the 920C Cooled PMT Housing stand for one hour, so that the interior comes to ambient temperature before removing the socket and the PMT. Otherwise moisture may condense on the cool interior.
- 8 If you want to remove the 920C Cooled PMT Housing from the monochromator:
  - a You do not need to wait for the housing to warm up to ambient temperature.
  - b Disconnect the cables from the 920C Cooled PMT Housing.
  - c Do NOT unbolt the lens tube from the 920C Cooled PMT Housing.
  - d Unbolt the square mounting bracket from the monochromator.

## 5 Maintenance

### 5.1 Troubleshooting

#### Signal = 0

Make sure the INTERNAL / EXTERNAL switch on the back of the Cooled PMT Controller box is set as desired. See Section 4 Operation, step 4.

Make sure that the desired voltage is applied to the PMT. See Section 4 Operation, step 5.

#### Overheating

If the OVERHEATING light on the front of the Cooled PMT Controller box turns red, the Peltier power is turned off and the TEMP IN RANGE light goes off, but the high voltage is still applied to the PMT. When the Peltier power goes off, the heat sink will gradually cool and then the Peltier power will automatically turn on again.

In the event of overheating, make sure the airflow in and out of the Cooled PMT Housing is not blocked.

If overheating still occurs, contact PTI Service.



Do not open the control box or the cooled housing case. There are no user-serviceable parts inside.

### 5.2 Replacing the fuses



Any fuse that fails repeatedly is potentially indicating a problem of a serious nature. In the event that a fuse fails upon, or shortly after replacement, contact PTI Service for assistance.

1. **Turn off the power** switch on front panel.  
Remove the lamp power supply AC cord from both the wall plug and the rear panel.
2. Push and rotate the plastic fuse cover counterclockwise about 1/8<sup>th</sup> of a turn and pull the fuse holder cap out.
3. Pull the fuse out of the fuse holder cap.
4. Replace with a 1.5 A, 250 V slow blow fuse.
5. Place the fuse into the fuse socket and rotate the fuse holder cap until fuse holder slides in most of the way and then push and rotate the fuse holder cap clockwise about 1/8<sup>th</sup> turn until the fuse holder cap locks into place.

## 6 Service Calls to PTI

Before calling for service, please review the **Troubleshooting** section. To aid our Service Department in discussing your questions, as well as to aid in the timely solution of any problems, please assemble as much as possible of the following information before calling PTI.

- Your system serial number, or as many other component serial numbers as possible
- The name of the purchaser or principal investigator, and the company or institution where the instrument is located.
- Your instrument type and hardware configuration
- Computer details, especially if the computer was not purchased from PTI:
  - Operating System and Operating System Service Packs installed (e.g., Windows XP Professional, year, Service Pack 3)
  - CPU – Intel or AMD
  - Hard drive size and amount of free space on the hard drive
  - RAM memory size
  - Video RAM size
  - Video card manufacturer and model number (if not on the computer motherboard)
  - An Ethernet port other than on the computer motherboard – manufacturer and model number
  - Any other peripherals attached to the computer
- The software name and version (in the program window, click on Help | About to find the software name and version information).
- The date on which your instrument was installed
- As much detail as possible on the particular chain of events or circumstances that led to the problem. This information should include the complete instrument status and data gathering protocol.
- If possible, be prepared to send sample data and hardware and acquisition setup files as e-mail attachments to PTI service personnel. Please send these files using the default format used by the PTI program. Screenshots of any error messages may be helpful.

Contact PTI Service at  
Toll Free: 877-784-4349 US/Canada  
Phone: 609 894-4420 Ext 115  
Fax: 609 894-1579  
Email: [PTIService@pti-nj.com](mailto:PTIService@pti-nj.com)

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