

Figure 1: 70kV 12W

## Introduction

The MagPro x-ray source is small, lightweight, and can be packaged into custom enclosures. The MagPro x-ray source includes an x-ray tube and a high voltage power supply that operates at up to a maximum of 12W at 70kV or 1000 $\mu$ A. The MagPro source is designed for bench top applications where higher flux reduces measurement times. The tube anode is grounded allowing placement close to the sample.

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## Initial Inspection:

Components	Quantity Required
TUB0015X-X- X-ray Source	1
Power Supply – 24VDC @ 1.7A 2.1 mm x 5.5 mm x 9.5 mm Barrel Connector	1
Cable – USB Type A-B 2.0	1

### *Please Inspect Contents*

When a MagPro tube is received, it should be unpacked and inspected as soon as possible. A standard MagPro tube is encased in a brass shield. This shield is connected directly to a high voltage power supply. Inspect the high voltage power supply and the tube shield assembly for any damage that may have occurred during shipping. If a tube has been damaged, please contact Moxtek immediately. The serial number is located on the high voltage power supply. Please do not touch the beryllium window.

## Source Handling

Care should be taken when handling the tube and the high voltage power supply. Do not drop or strike the tube on any surface. Care must be taken to not damage the beryllium window.

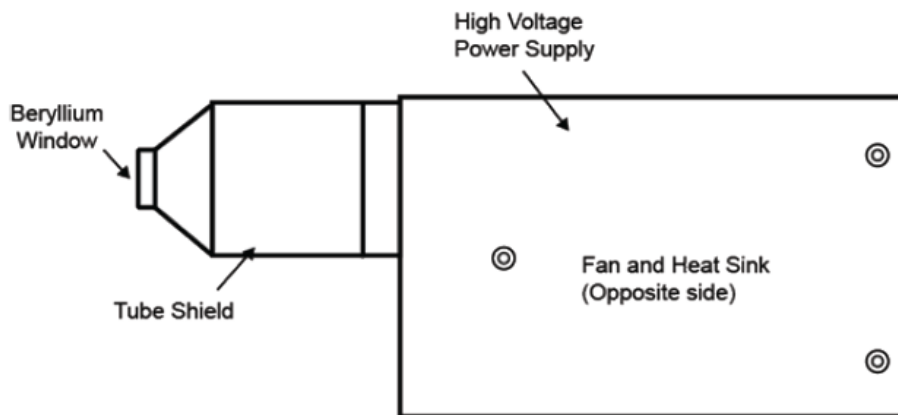
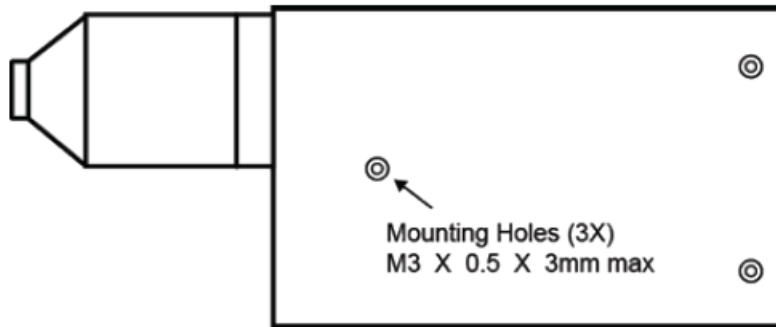


Figure 2: Part Locations

### Mechanical Mounting

The shielded MagPro source may be mounted with the exit collimator facing any direction. Care should be taken not to support the power supply by the shield alone. The high voltage power supply has three M3-0.5 threaded holes on both sides of the metal case. These holes may be used for mounting (see Physical Layout). Maximum screw thread insertion length is 3mm.



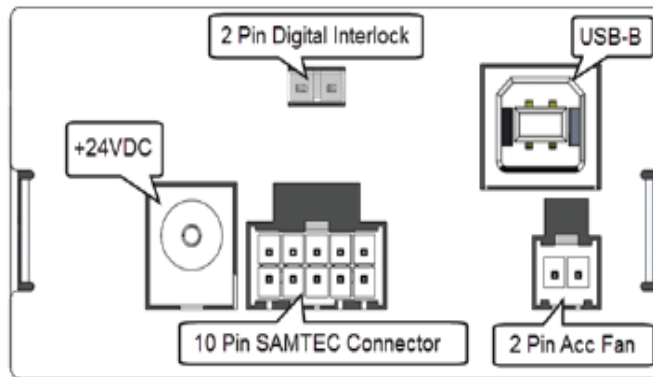
**Figure 3:** Mounting Holes

### Cooling

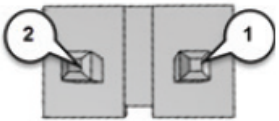
The MagPro tube utilizes a fan and heat sink for a combination of forced-air convection and conduction cooling. The tube should be operated in an environment that allows convection and conduction to secondary parts. Operating Temperature is  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . Maximum case temperature, as measured at the surface of the power supply enclosure, is to be  $\leq 65^{\circ}\text{C}$ .

## Electrical Connector Locations and Pinouts


**Figure 4:** X-ray Tube  
Electrical Connectors



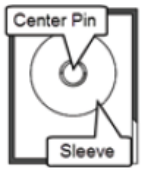
### 2-Pin Digital Interlock (SAMTEC TSM-102-01-L-SH)

Pin	Function	Connector
1	Interlock Send (GND)	
1	Interlock Receive (+5VDC Pull up)	

### 2-Pin Accessory Fan

Pin	Function	Connector
1	+12 VDC Power Red	
2	Ground Black	

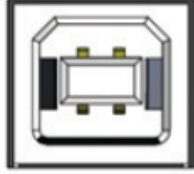
### +24 VDC

Power Jack	Function	Connector
Center Pin	+24 VDC $\pm$ 5% Input Power	
Sleeve	Ground	


### USB Type B Connector

The USB-B connector conforms to the USB standards for communication to a peripheral device. USB is master control; other connectors will be disabled when the USB is connected.

\*This should not be user accessed.

USB Connector	Connector
Standard USB Type B Connector. Device not powered by USB.	

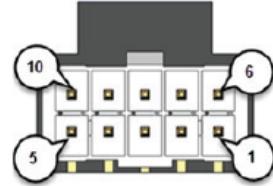
## 10-Pin SAMTEC Connector (IPL-105-01-L-D-RA-K)

Analog Control Pinouts				
Pin	Function	I/O Value	Response/Description	Connector
1	HV Enable	0.0 or +5.0 Volts (Input Z = 10k)	<1.0V = OFF, >4V = ON	
2	Filament Ready	0.0 or +5.0 Volts (Output Z = 1k)	<1.0 = Not ready, +5VDC = Ready	
3	HV Control	0.27 to +4.0 Volts (Input Z = 100k)	4 to 70kV	
4	HV Monitor	0.27 to +4.0 Volts (Output Z = 100Ω)	4 to 70kV	
5	Current Control	0.04 to +4.0 Volts (Input Z = 100k)	10 to 1000μA	
6	Current Monitor	0.0 to +4.0 Volts (Output Z = 100Ω)	0 to 1000μA	
7	Ground	Ground	Ground	
8	Ground	Ground	Ground	
9	Filament Enable	0.0 or +5.0 Volts (Input Z = 10k)	<1.0V = OFF, >4V = ON	
10	Input Power	+24 Volts DC ± 5%	Input Power	

Input impedance for the program signals is 100 kΩ to ground.

Output impedance of the monitor signals is 100 Ω series resistance from the error amplifier signals to the output of the monitors.

Recommend SAMTEC 10 pin connector IPD1-05-D-K-M as a mating connector

Analog Control Pinouts				
Pin	Function	I/O Value	Response/Description	Connector
1	HV Enable / Hard Disable	0.0 or +5.0 Volts (Output Z = 1k) 0.0 or +5.0 Volts (Input Z = 10k)	<1.0V = OFF, >4V = ON	
2	Filament Ready	0.0 or +5.0 Volts (Output Z = 1k)	<1.0 = Not ready, +5VDC = Ready	
3	I2C_SDA	0.0 or +5.0 Volts (Input Z = 100k)	<1.0V = LOW, >2V = HIGH	
4	HV Monitor	0.27 to +4.0 Volts (Output Z = 100Ω)	4 to 70kV	
5	I2C_SCL	0.0 or +5.0 Volts (Input Z = 100k)	<1.0V = LOW, >2V = HIGH	
6	Current Monitor	0.0 to +4.0 Volts (Output Z = 100Ω)	0 to 1000μA	
7	Ground	Ground	Ground	
8	Ground	Ground	Ground	
9	Filament Enable	0.0 or +5.0 Volts (Output Z = 1k)	<1.0V = OFF, >4V = ON	
10	Input Power	+24 Volts DC ± 5%	Input Power	

Input impedance for the digital signals is 100 kΩ to ground.

Output impedance of the monitor signals is 100 Ω series resistance from the error amplifier signals to the output of the monitors.

Recommend SAMTEC 10 pin connector IPD1-05-D-K-M as a mating connector.

### Safety

The MagPro comes with a digital interlock connection. The MagPro cannot emit x-rays if the two interlock pins are open; the x-ray source can emit x-rays if the two pins are shorted.

This does not apply under analog control, in which case the customer is responsible for designing and creating their own interlock. In practice, the two interlock pins should be connected to a normally open switch. This switch should be integrated into a radiation enclosure such that if the radiation enclosure is open, the switch is open and the x-ray source is turned off. The radiation enclosure design is a customer decision; customers are required to design their instrument to be “radiation” safe. The interlock circuit provides a means for the customer to achieve a radiation safe instrument.

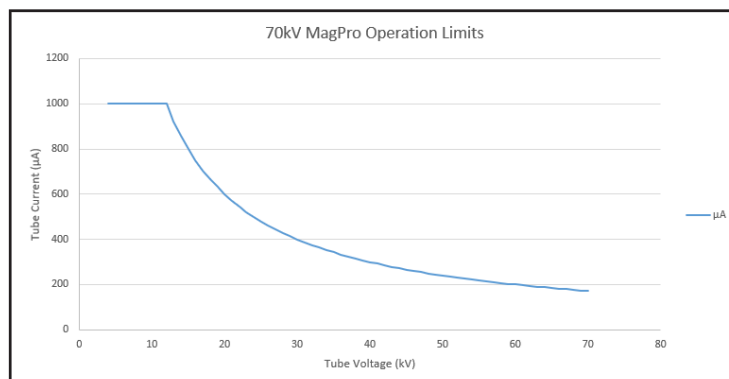
For CE Compliance, use the provided Ferrite Cable Filter (Steward Part Number 28A2024-0A2) with 3 wraps through the core and an AC/DC wall adapter (ETSA240170UDC-P5P-SZ or equivalent) with 20 AWG cable to provide the necessary filtration and shielding of input power..

### Operating Conditions






MagPro tube anodes are grounded to the brass metal shield. The shield is grounded to the power supply. Damage to the tube and/or power supply may result if a ground wire is not provided from the case ground to an appropriate equipment ground. Note that the Shield is potted directly to the HVPS should never be removed.

When operating the 70kV MagPro x-ray tube in analog mode, adhere to the maximum settings as shown in the plot below. Failure to adhere to these limits may cause damage to the x-ray tube and/or high voltage power supply. Failure to adhere to this parameter will void the tube warranty. Internal memory records operation outside established limits for failure analysis.

When operating the MagPro x-ray tube, wait 2 seconds after the tube has been powered off before powering the tube on again. Failure to wait 2 seconds may damage the filament. Failure to adhere to this parameter will void the tube warranty.



### Operating Precautions and Warnings

- Caution**  Verify that the tube and the high voltage power supply are properly grounded before plugging in the 24VDC supply cord connector.
- Caution**  MagPro X-ray sources contain Beryllium. If the Beryllium window is broken, a very small amount of dust might be generated. If this occurs follow the instructions on the MSDS for cleanup.
- Warning**  MagPro X-ray sources may become very hot during operation resulting in serious burns if touched. If so equipped confirm that the heat sink fan is operating correctly when source is powered on.
- Warning**  MagPro X-ray sources produce x-ray radiation. MagPro tubes are shielded with a metal shield and high-Z potting materials. Extra shielding may be required depending on the application. **ONLY OPERATE X-RAY SOURCE IN PROPERLY SHIELDED ENCLOSURES** preferably with the safety lockout switch preventing operation when shielding has been removed. It is the responsibility of the operator to ensure that all applicable safety precautions are taken and observed.
- Warning**  MagPro X-ray sources operate at high voltages. Do not operate HVPS if there is any damage to the case or a grounding wire is not securely attached.

## Software Installation

Download the “Magnum 12W Software.ZIP” file from attached [link](#): Also found at MOXTEK.COM\12WATT70kV. see image below:

1. locate and extract the zip file named “MoxtekSignedDrivers\_2.12.28.zip”
2. In the extracted file, locate and run the “install.bat” file.
3. extract and install the “12WattControllerVer040.zip” file.
4. Use the instructions in the “Operating Conditions” section.

IMAGE OF THE 12W page software download section for customer t

The screenshot shows the Moxtek website's product page for the Benchtop 12W x-ray source. The navigation bar at the top includes links for X-RAY PRODUCTS, OPTICAL PRODUCTS, COMPANY, CONTACT, and CAREERS, along with a search bar. The breadcrumb trail indicates the location: X-Ray Products > X-Ray Sources > Benchtop.

The main product image shows the Benchtop 12W x-ray source, a compact unit with a fan and a brass-colored tip. Below the image, the text reads: "Benchtop 12W".

The product description states: "The Moxtek® MAGPRO 70kV 12W x-ray source is designed for the portable XRF, XRD and Imaging instruments. Small spot size makes it a good choice for x-ray imaging applications."

The "Related Products" section displays two other models: MOX140G and Handheld, each with a "PRODUCT DETAILS" button.

The "Resources" sidebar on the right contains a search bar and several sections: "Related Downloads" (listing 70kV 12W MAGPRO Datasheet, High Voltage Calibration on MOXI™ Small, Compact X-ray Sources, and HPCI150W 60kV Datasheet), "Related FAQs" (with questions about calibration, photon emission, power supply, dimensions, spot sizes, and targets), and a "Software" section. The "Software" section is circled in red and shows a "Downloads" icon and a "ZIP 12W Software" link.

At the bottom of the sidebar, there is a newsletter subscription form with the text: "Subscribe to our newsletter to keep up with the latest news about x-ray products." and a "SUBSCRIBE" button.



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## Operating Conditions

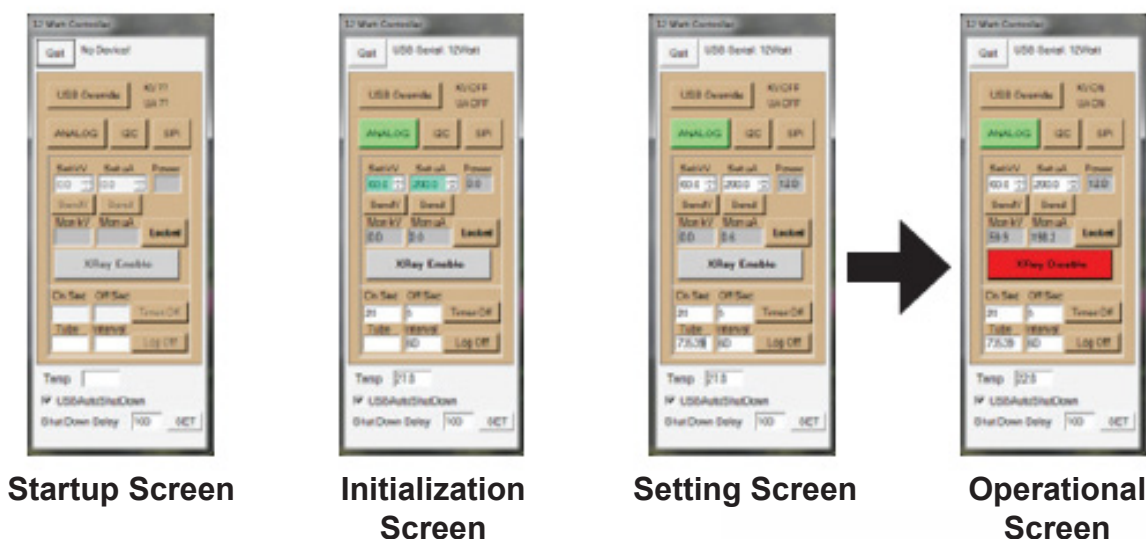
When installation is complete, locate the new “Moxtek” folder in your program directory, open the folder and double-click on the 12WControllerVer001 program to launch the application. Multiple instances of the program can be initiated, to control multiple sources simultaneously, by launching multiple interface panels.

### Panel Layout

On startup, the control panel will look similar to the “Startup Screen” shown below. Once a USB cable is plugged into the controlling computer, the program will recognize and display the controller version at the top of the panel as well as the MagPro source firmware (FW Vers:~) and USB Serial number.

Clicking on and entering the kV and emission current settings in the “Set kV” and “Set  $\mu$ A” windows respectively will turn the windows green, indicating that new values have been entered. Clicking on the “Send” button below the windows will transmit that value to the source, turning the window from green to white as shown in the “Setting Screen” panel. Source kV may be set between a minimum of 4 and maximum of 70kV.  $\mu$ A may be set between a minimum of 0 and maximum of 1000 $\mu$ A.

Figure 1: Power Window



Clicking on the Gray “XRay Enable” button will energize the tube to begin emitting X-Rays. The button will turn Red and display “XRay Disable” button indicating tube is operating normally. Clicking on “XRay Disable” button will toggle back to the Gray “XRay Enable” button de-energize the tube turning the x-rays off. This function is disabled if the “Locked” button is Red indicating that the mechanical safety interlock switch described in the Safety section is open due to an enclosure safety switch not being closed.

Selecting and setting the timer “On Sec” and “Off Sec” windows and then clicking on the “Timer ON” button will override the “XRay Enable” button turning the source on and off for the periods (Seconds) described in the windows respectively. When the timer is active the button will toggle from Brown to Green and then back to Brown when disabled.

Lastly, to record source life data, toggling the “Log ON” button will record a CSV operational text data file to a pre-set folder C:\lifetesting under a number entered in the “Tube” window on an interval (Seconds) set in the “Interval” window. Repeatedly starting and stopping this function will automatically increment the file name.

For warranty and ordering information, please visit [www.moxtek.com](http://www.moxtek.com)



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