

Manual of DX-200 X-Ray Crystal Orientation Machine



Specifications:

Power Supply / Power	Input AC 220V, 50Hz / 500W
X-ray Tube	Cu target, air cooling , Cu-K _a output
Max. Tube Current	35KV, 5mA
X-Ray Detector (Geiger)	Max. Voltage at 1050V
Measure Range	2 Theta = 10 ~ 140° ; Theta 10 ~ 70°
Reading Display	Digital display with resolution 5"
High Voltage Power Supply	Included in a separate unit which can be placed under desk
Dimension of X-Ray Part	500 L x 650 W x 400 H mm
Dimension of Power Supply Part	500 x 500 x 500 mm
Net Weight:	100 kg (220 lbs)



MTI Corporation

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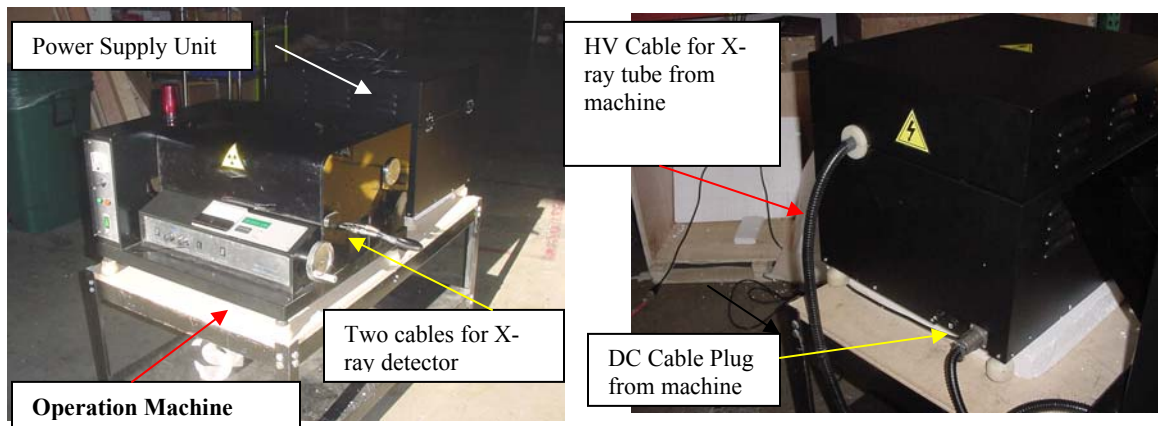
Quick Start for DX-200 X-Ray Crystal Orientation Machine

Once you receive shipment

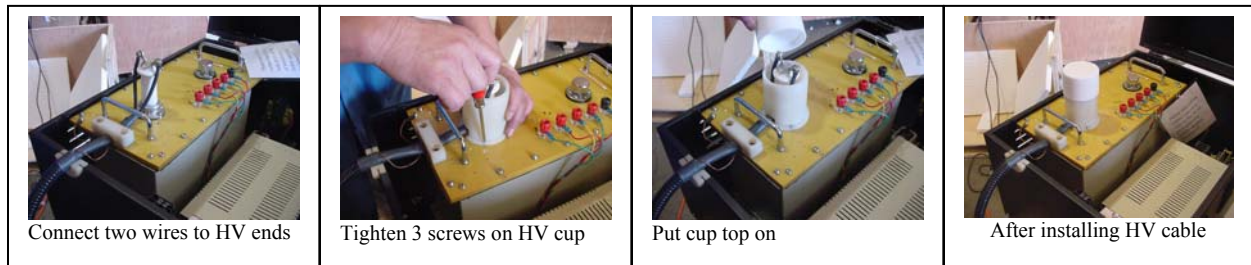
1. Please check all packing crates and boxes to see if any one gets damaged during shipping. Report any damage to shipping carrier, take picture for the damage as evidence, and inform MTI immediately. No later than 7 business days.
2. If no damage, please open box carefully. Please avoid any impact to the machine. X-ray tube inside DX-200 is very fragile
3. Counts all parts and accessories inside box to see if parts match the content in your purchase order and packing list. If found anything missing, please report MTI immediately.
4. Please read operation manual and quick start instruction before installation and operation

Installation

1. DX-200 consists of two units, e.g. Power Supply Unit and Operation Unit, which were packed in two boxes, separately.
2. You have to connect two units together as the follows:



Please connect HV cable from machine to Power Supply as the below pictures (lift top cover of power supply)



3. Take off seal rubber washer on the HV transformer.

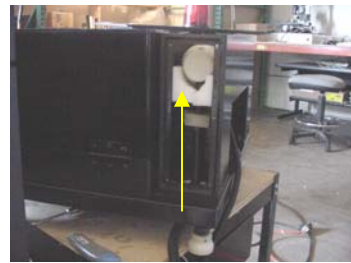
In order to keep oil inside HV transformer from leaking during shipping, we seal the open hole on the HV transformer (metal cover) by a rubber washer. Before operation please take off the washer by unscrew the metal cover as below picture:



4. Take off protection insert from underneath of X-ray tube, as shown below pictures



Open the back cover on X-Ray tube chamber from back of machine



Carefully take off the insert of plastic foam, and then put the cover back

5. Please install X-ray Indicator Light as the following picture



Open the top cover on X-Ray machine; tighten the Indication light from back of cover



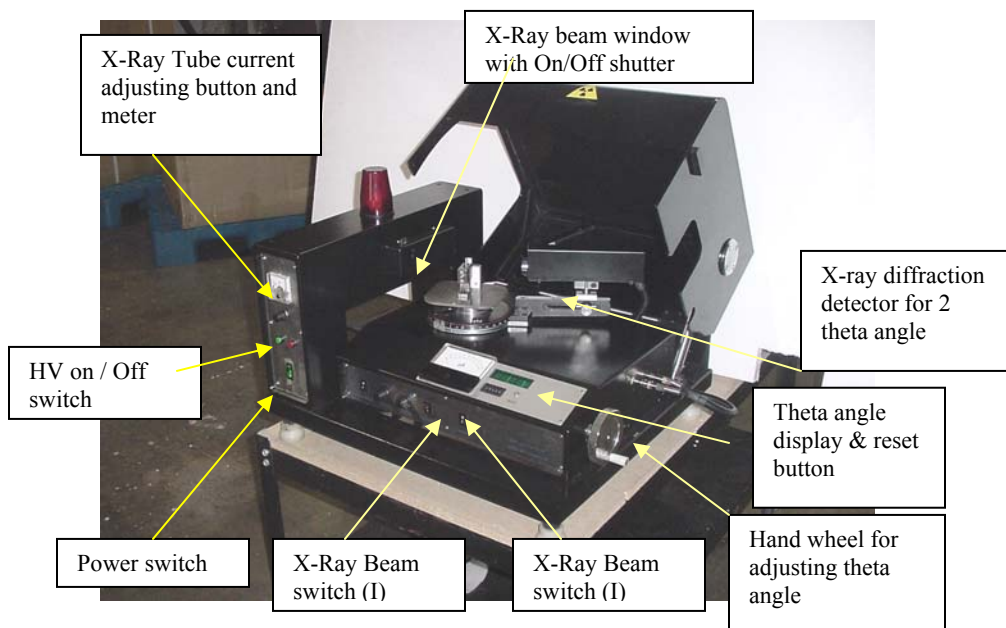
Plug in two wires from light into holder in



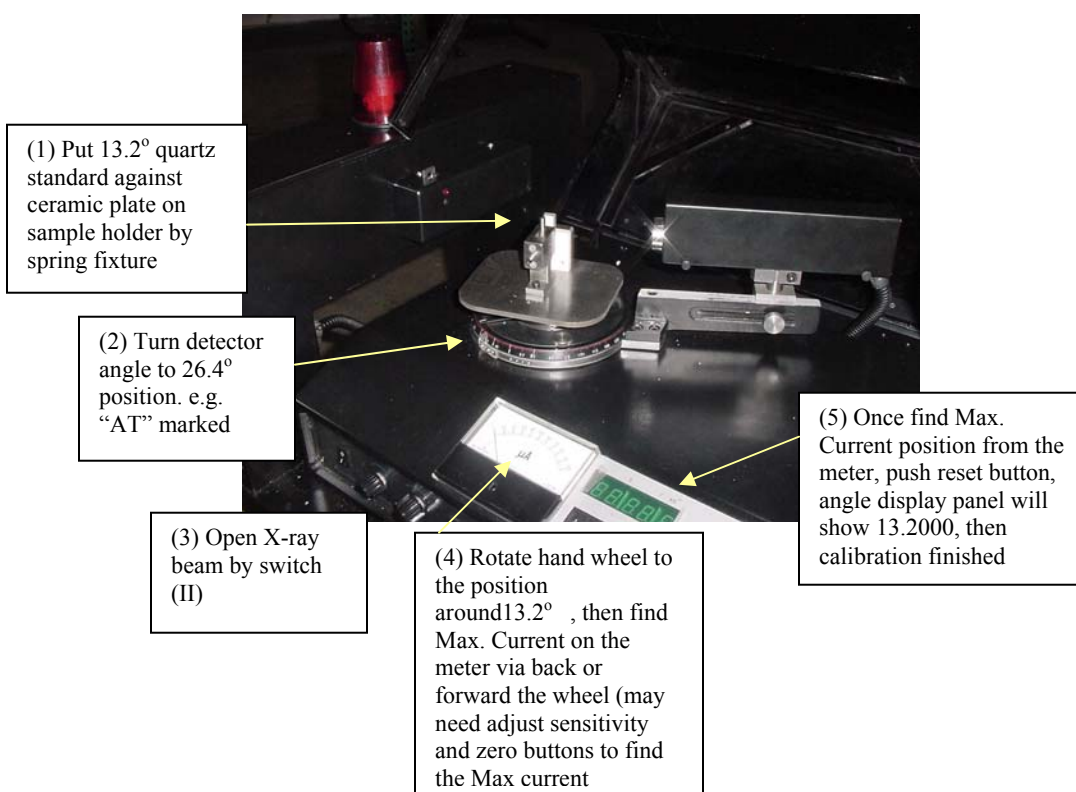
After installing the light, put cover back to top.

6. Plug power cable from power supply unit to a 220- 240V AC (single phase 50/60 Hz)
(If included AC plug does not fit your countries, please cut off the plug and replace a right one by yourselves)
7. Double check all wire connections before operation

Operation Test / Calibration



- Turn Power switch on (light on)
- Turn X-Ray tube current to minimum (1 mA)
- Push HV switch On (Red Indicator light on top will be ON)
- Adjust X-Ray tube current to 2 mA *(after HV-On for 30 minutes at first time use)
- Turn On X-Ray (I) switch at front panel left
- Turn On X-ray (II) switch on or off, X-ray shutter will open or close, and Red LED light at X-ray beam window will be On or off.
- You may check X-ray beam position by X-ray fluoresce pad under dark condition
- If everything is normal, put 13.2° quartz sample on the sample order to further test and calibrate the machine, as the follows:



Trouble Shooting Basic

Problems	What and how
No high voltage and X-ray indication light is not on	Top cover on X-ray chamber did not install properly. The limit switch is not pushed down. HV cable is not connected
X-ray tube current can not be adjusted	HV cable is not connected, Please check the cable and connect it
No any change in current meter of front panel (x-ray detector did not receive or deliver X-ray diffraction signal)	X-ray beam shutter is off --- please make sure switch (I) is on position, and switch (II) is on Or, Amplifier IC board inside machine may loose during shipping – --- open cover at right hand right , and make sure all electronic board insert firmly
If still can not operate	E-mail or call MTI Engineer

USER GUIDE OF DX-200 MACHINE.

To show you how to use the machine, we would like to give you an example how to measure SrTiO₃ single crystal substrate's orientation. Through this procedure, you will understand the principals and procedure of DX-200 machine. Before use DX-200 machine, we assume that you still remember Bragg's Law in Physics:

$$2d \sin\theta = n\lambda$$

For determining the orientation of SrTiO₃ <111>, 10x10x0.7mm crystal substrate

(I) Calibrate machine by standard sample (Always do this step for accurate measurement)

Switch on power (Fig.1) first, then after warm up 10 min, press green button of high voltage (Fig.2) to be sure high voltage indicator is on. Then adjust current to around 1 mA (Fig.3).



Figure 1

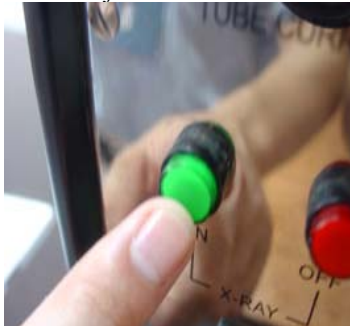


Figure 2



Figure 3

Open the plastic protecting cover, pull out the spring holder and place the standard sample (SiO₂ single crystal) in the center of sample stage. Release the holder to fix the standard sample to the flat surface of holder (Fig.4). Rotate **X-ray detector** to set 2θ angle at 26° and $40'$ (Fig 5). Adjust **θ angle hand wheel** (Fig. 6) to find the current at max.value (mA) (Fig.7)



Figure 4



Figure 5



Figure 6

Set θ value at $13^\circ 20' 00''$ from the counter on the machine, and press "RESET" button, then the value of digital display: $13^\circ 20' 00''$ is the θ value (Fig. 8). Then your machine has been calibrated.



Figure 7



Figure 8



Figure 9

II. Starting measurement of SrTiO₃ <111> substrate sample.

1. Take off the standard sample from the holder (Fig.9) and place the crystal sample in the center of the holder (Fig. 10). Then, rotate xxx to set 2 θ angle at 40° 02' (Fig. 11), which SrTiO₃ crystal <111> orientation's real 2 θ angle from ASTM card, or IDDD database.

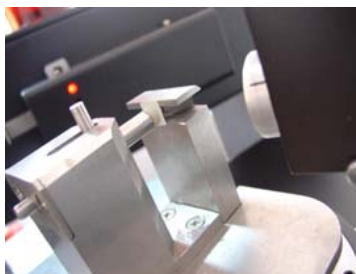


Figure 10



Figure 11



Figure 12

Close plastic protecting cover and rotate θ hand wheel to adjust angle around 10 -21 ° till the current value on Voltage meter reaches the max. value (mA). So the value in the digital display is 20° 02' 40" at the moment. (Fig.12).

Turn around SrTiO₃ substrate with 90° and read it three or four times, then you can determine the real orientation of this SrTiO₃ substrate is <111> if the values in digital display are always about $\theta=20^\circ 01'$. If the θ value is off 20° 01', said 20° 41', which means this substrate's orientation is off 40°, e. g. 0.67°. You need adjust substrate orientation by grinding, or return it you your supplier for replacement.

For crystal boule, you need a new sample holder set up as shown in Fig 13. Then rest procedure shall be same as the example of SrTiO₃.



Fig 13

Off course, we can attach a goniometry to DX-200 by yourselves according to your application, by taken off existing sample holder. DX-200 can measure crystal boule up 6" diameter after modifying sample holder.

Notice:

No installation necessary and free technique support through phone or online.



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