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Laser Power Measurement EOS M280

Laser Power Measurement Overview



Within the subsystems incorporated in a PBF-LB machine, the laser (or lasers) is undoubtedly the most critical, as it is responsible for generating the energy that fuses the particulate material.

Checking the laser power is a verification to be carried out before each additive manufacturing job, to ensure that this aspect of the system has not suffered deterioration or alterations.

This check is carried out through a measurement process, assisted by an external device.



EOS M280 Power
Measurement Kit



Pocket Monitor



EOS M280 Power
Measurement Set up

Laser Power Measurement Personal Protective Equipment (PPE)



The measurement of laser power is a task that can be part of a general process of cleaning, maintenance, and checking between consecutive jobs. The F-theta lens must be cleaned using the appropriate procedure before carrying out the laser power measurement.

Assuming that the process chamber has to be clean and free of particulate material, the measurement of laser power presents a single main risk to people, which is the risk of burns from direct contact with the part of the measuring device exposed to the laser beam, which can reach temperatures higher than 100°C.

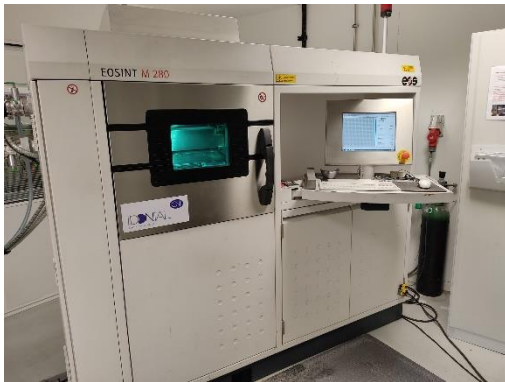


Use of basic PPE is sufficient for a laser power measurement operation. However, a special care must be taken when handling the measuring device once it has been exposed to the laser beam and heat resistant gloves should be worn.

Laser Power Measurement Working Area



The training scenario could begin by giving an overview of the machine and location of the build chamber, as well as an introduction to different components in the process chamber.



EOS M280



EOS M280 Build Chamber



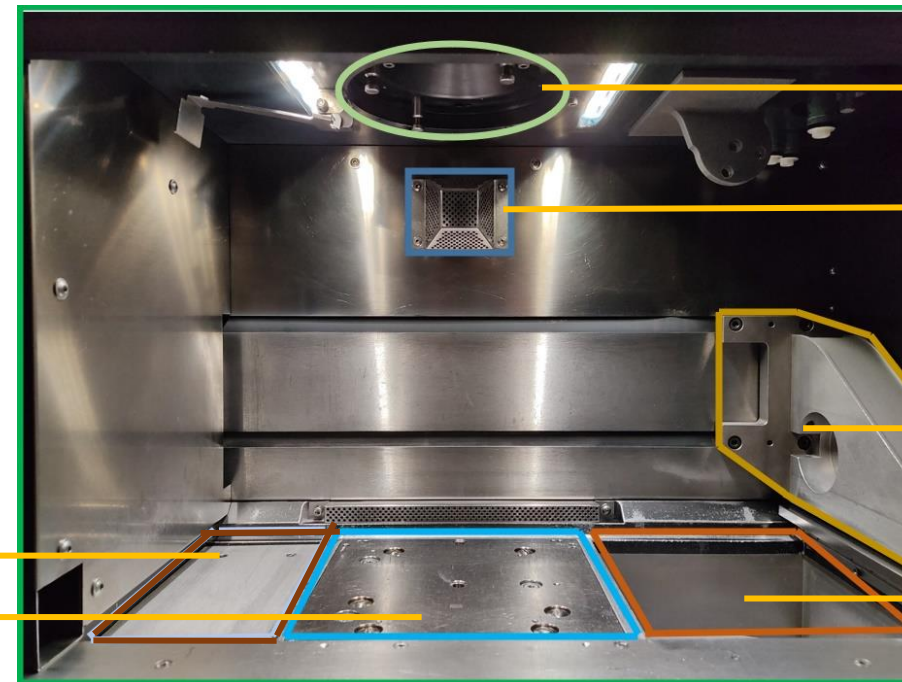
Inside of EOS M280
Build Chamber

Laser Power Measurement Working Area – Process Chamber



It could be important to highlight at this point that this case covers the general procedure for measuring the laser power for a specific, mono-laser machine (EOS M280), so different methodologies could be applied depending on the specific technology provider and machine. However, the general steps depicted in this experience are of application to any PBF-LB machine but the setting position of the measuring kit could vary slightly.

Collector Platform
Building Platform



F-Theta Lens
Protector Crystal

Lens Blowing
System

Recoater System

Dispenser Platform

EOS M280 Process Chamber

Laser Power Measurement

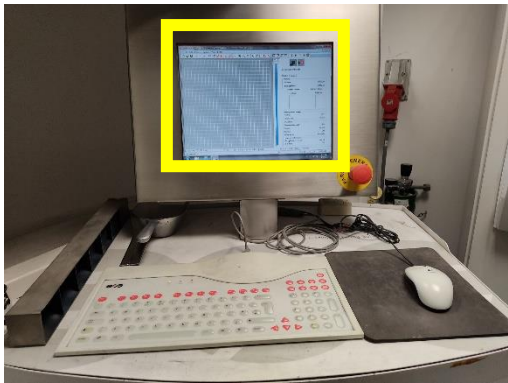
Step 1 – Software - Start the Measurement Tool



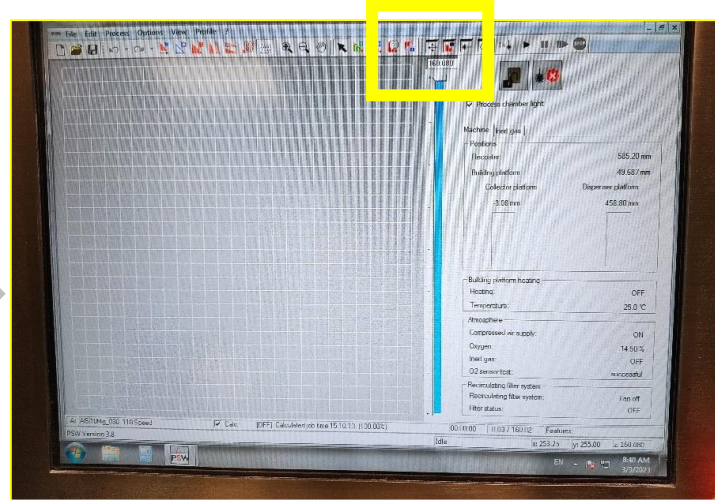
In order to measure the laser power, the first task is to place the recoater under the laser. This is done through machine's specific software options.

1. On PSW Main Screen Select "adjust" icon

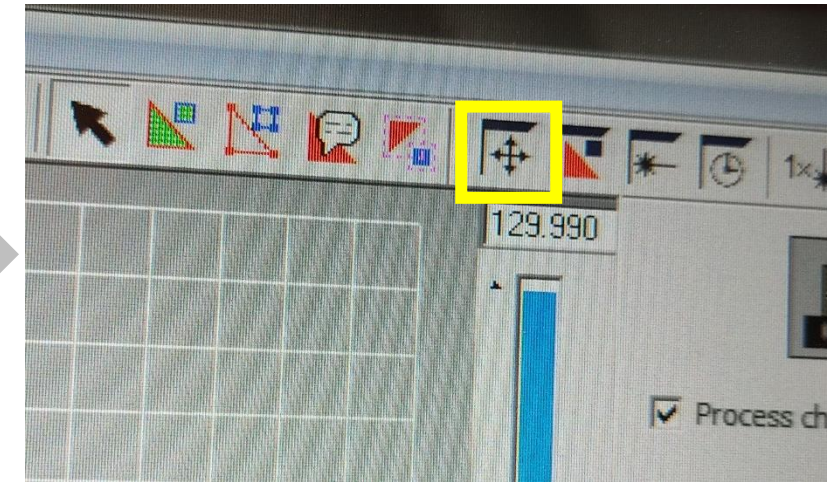
2. PSW Adjust Screen



EOS M280 HMI



EOS M280 HMI – Adjust Icon



EOS M280 HMI – Adjust Icon

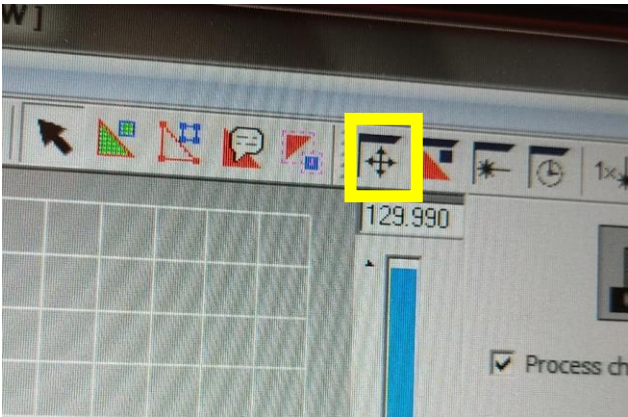
Laser Power Measurement

Step 2 – Software - Moving the Recoater Correct Position

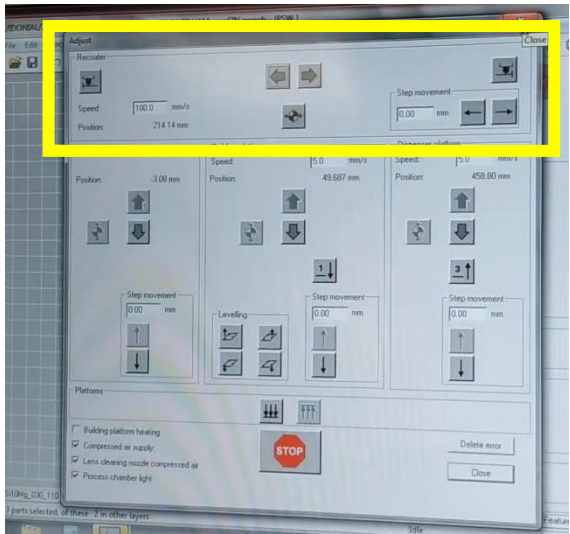


The adequate position of the recoater can vary between different machines, as well as the specific software options to achieve the correct position. The position indicated in this case is the correct for the example machine (EOS M280).

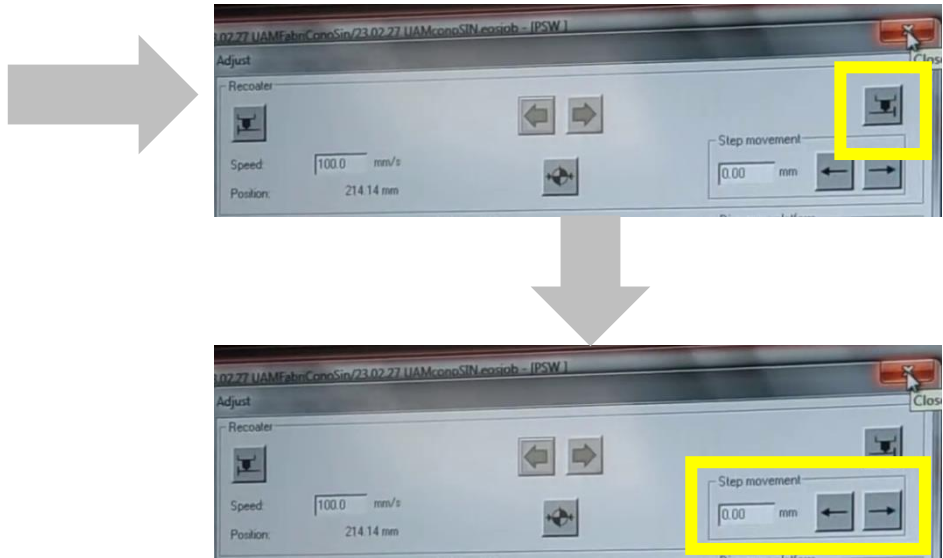
1. On the PSW Adjust Screen, move the recoater to its homing position, and then adjust its position 195 mm to the right



EOS M280 HMI – Adjust Icon



EOS M280 HMI



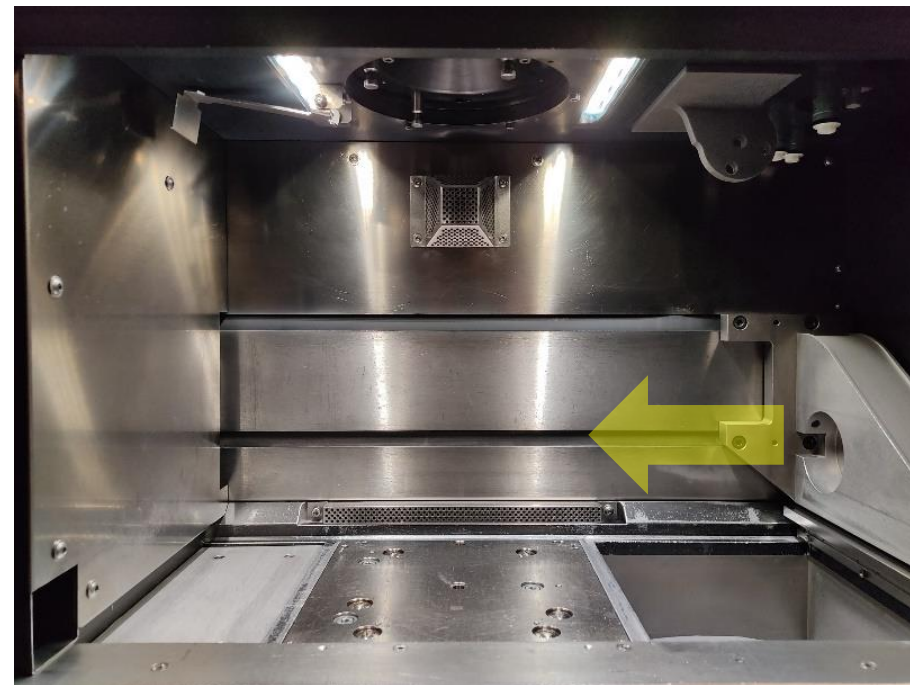


Laser Power Measurement

Step 2 – Software - Moving the Recoater Correct Position



After the software adjustment, the training scenario can highlight the movement of the recoater until it reaches its position under the laser.



EOS M280 Process Chamber

Laser Power Measurement

Step 3 – Mounting Holder on the Recoater



In this specific training scenario, the correct placement of the measuring device is achieved thanks to a plastic part, specially designed to adjust to the recoater geometry of the example machine. The holder is designed following Poka-Yoke principles, so a fine adjustment should be easily achieved.

1. Take the holder

2. Place the holder
on the recoater



EOS M280 Power Measurement Fixture



Laser Power Measurement

Step 4 – Check of the Measuring Device



In order for the measures to be accurate, the temperature of the measuring device must be under specifications (ambient temperature $\pm 0,5\text{ }^{\circ}\text{C}$). This is done through the own device, that counts with a temperature function.

1. Take the measuring device

2. Loosen the adjustment screw and open the device

3. Press the “TEMP” button.
Read the temperature value

¿Temp
Ok?

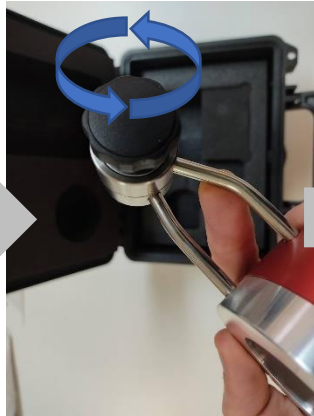
4. Compare recorded temperature value to one of a facility

Yes → Step 4

No → Wait until temp ok



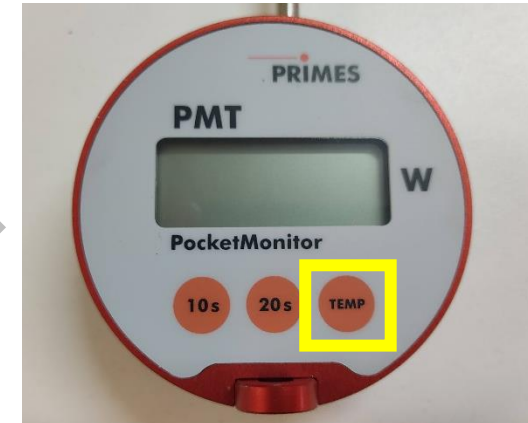
Measuring Kit



Measuring Device
Adjustment Screw



Measuring Device



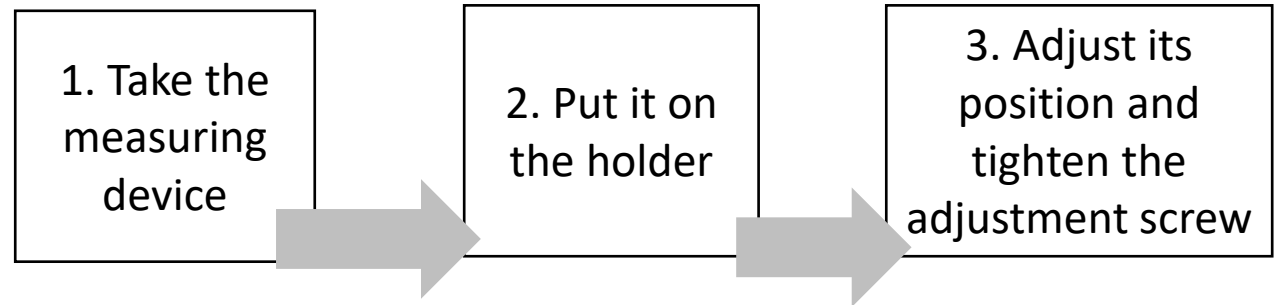
Measuring Device
Temp Button

Laser Power Measurement

Step 5 – Mount the Measuring Device on the Holder



On this specific training scenario, the measuring is done thanks to an articulated device, that can be adjusted to be placed on the previous holder.



Measuring Device



Measuring Device Holder



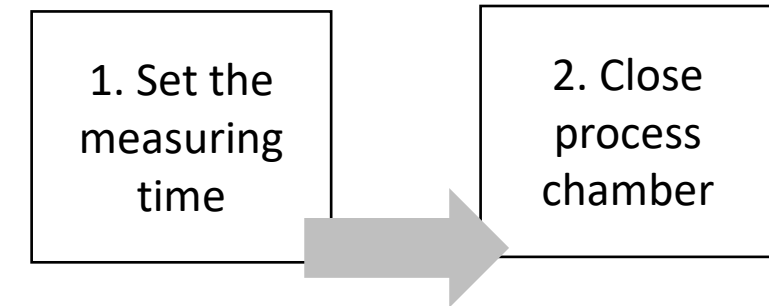
Adjustment Screw

Laser Power Measurement

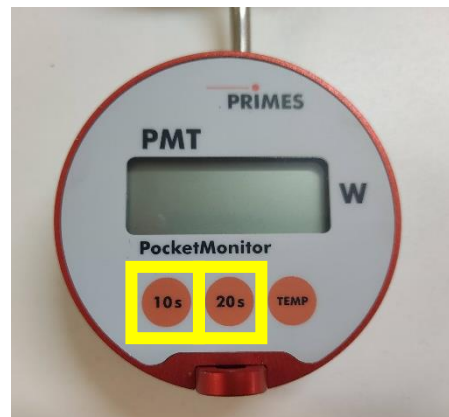
Step 6 – Activation of the Measuring Device



A measuring time is set on the laser power measuring device. In this specific case “20s” for nominal laser power below 200 watts and “10s” for nominal laser power greater than 200 watts. The process chamber is then closed. This specific device will be ready for doing a measure during the next 15 minutes (auto switch off time).



Measuring Device on the Holder



Timer on the Measuring Device



Closed Process Chamber



Laser Power Measurement

Step 7 – Software - Filling Process Chamber with Inert Gas

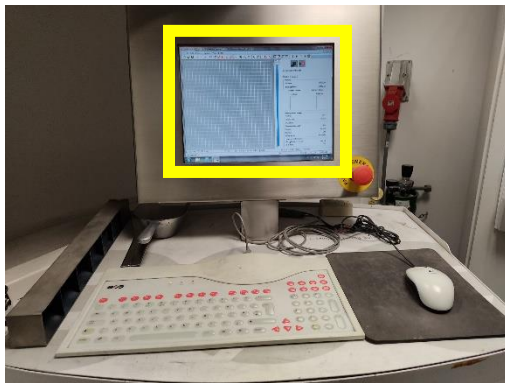


The laser shot to be measured has to be done under process conditions, so the process chamber has to be filled with inert gas (in the case of the example machine). This is done through the machine software.

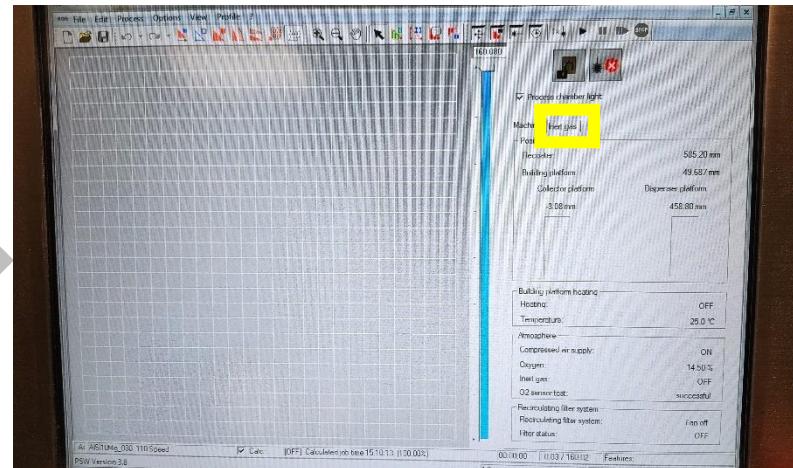
1. On PSW Main screen, select “inert gas” tab

2. Select boxes:
“Compressed air box”
“Process chamber pre-flooding”

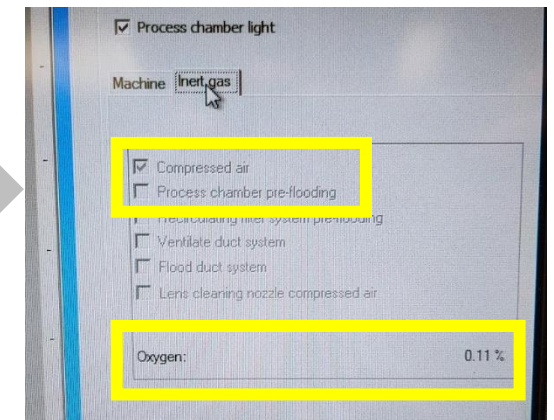
3. Wait until oxygen value is below 3%



EOS M280 HMI



EOS M280 HMI Inert Gas Tab



EOS M280 HMI Inert Gas Settings

Laser Power Measurement

Step 8 – Software - Setting Laser Shot



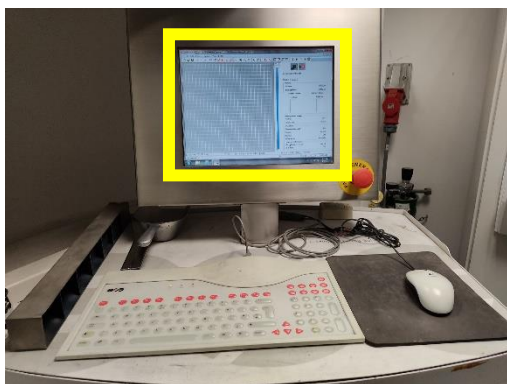
The appropriate parameters have to be set for the laser shot to be measured. This is done through the machine HMI software.

1. On PSW Main select the options menu, and then on Galvocon

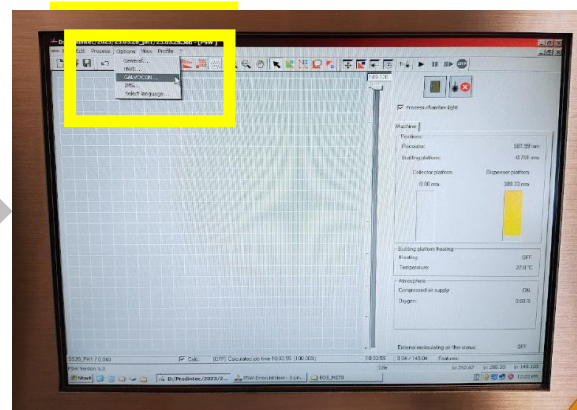
2. On the Galvocon GUI mode: Select "scanner test" tab

3. On the Scanner Test Tab: Set nominal laser power value. Enter value "0.00" for coordinates X and Y

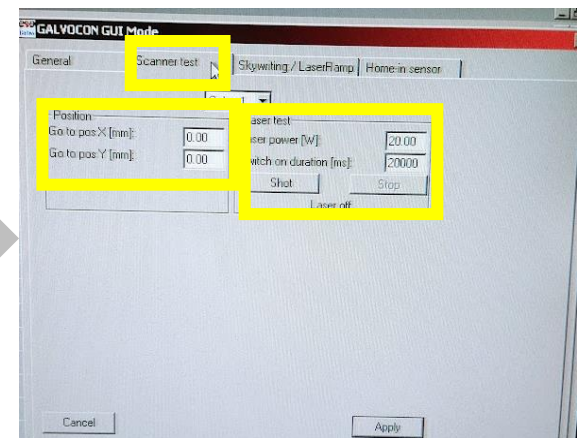
4. Establish laser shot duration (equal to time set previously on measuring device)



EOS M280 HMI



EOS M280 HMI – Galvocon Mode



Laser Power Measurement

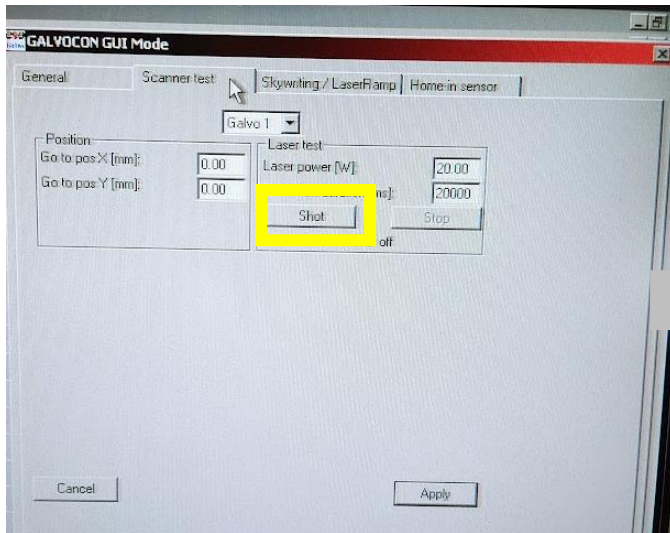
Step 9 – Software - Shotting Laser and Reading Laser Power Value



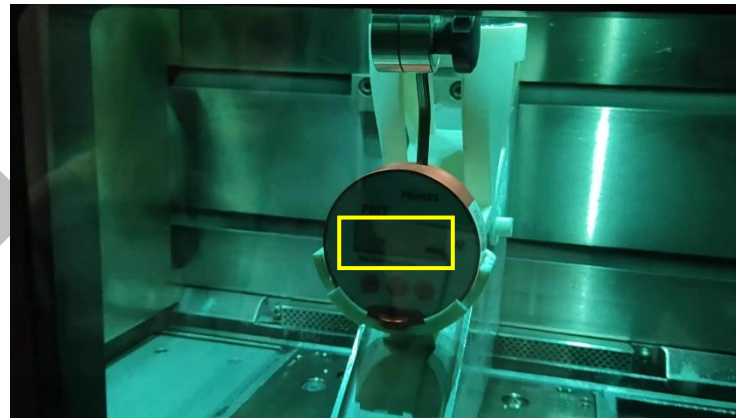
When all is set, the laser shot can be done. The laser shot will be registered in the measuring device.

1. On the Galvocon GUI mode: Scanner Test Tab select "Shot" button

2. On the measuring device wait until the shot is over and record the reading on the device



EOS M280 HMI – Galvocon Mode



Laser Power Measurement Results

Laser Power Measurement

Step 10 – Measuring Device Removal



The measuring device and the holder can be retired from the process chamber after reading is taken.



The surface receiving the laser shot can be very hot, don't touch it, manipulate it with care!

1. Cool down
the back body
receptor

2. Loosen the
adjustment screw
of the measuring
device

3. Retire the
measuring
device from
the holder

4. Retire the
holder

5. Close
process
chamber



Adjustment Screw and
Measuring Device



EOS M280 Power Measurement Holder



Closed Process Chamber



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