



Workshop handout

INTRODUCTION TO THE METAL LAB

Instructor
Nicholas Perillo
Slack @**Nick Perillo**



www.motionlab.berlin



INTRODUCTION

- [Welcome to the course](#)
- [Objectives](#)

AT THE LAB

- [The space](#)
- [Machinery and Equipment](#)

BASICS OF METAL WORK

- [Creating your project](#)

USING THE MACHINERY

- [Checklist before using the lab](#)
- [Step-by-step instructions - drill press](#)
- [Step-by-step instructions - belt sander / grinding wheels](#)
- [Step-by-step instructions - band saw](#)
- [Step-by-step instructions - sheet metal bending brake](#)
- [Step-by-step instructions - bar bender](#)
- [Step-by-step instructions - sheet metal shears](#)
- [Step-by-step instructions - arbour press](#)
- [Step-by-step instructions - manual mill/drill](#)
- [Cleaning after finishing](#)

SAFETY

- [Risks and safety instructions](#)
- [Dos and Don'ts](#)

CONCLUSION

- [Practical exercise](#)
- [Additional resources](#)

HELLO!

In this 1.5 hour workshop you will learn how to safely use the basic manual tools and machines in the metal lab. In the metal lab you can create and modify parts in steel and aluminium when you need high strength.

This handout compiles the most relevant information about the metal lab, as well as some practical instructions on how to use the basic machines at MotionLab.Berlin. This guide will not cover advanced machines (CNC/Lathe) or welding. We encourage you to always come back to this material in case you have any questions regarding the use of the technology and the machinery.

YOUR LEARNING OUTCOME

During this workshop you will learn how to:

- Work in the metal lab safely.
- Use hand tools and operate machines.
- Create a basic object to try your new skills.



THE SPACE

2

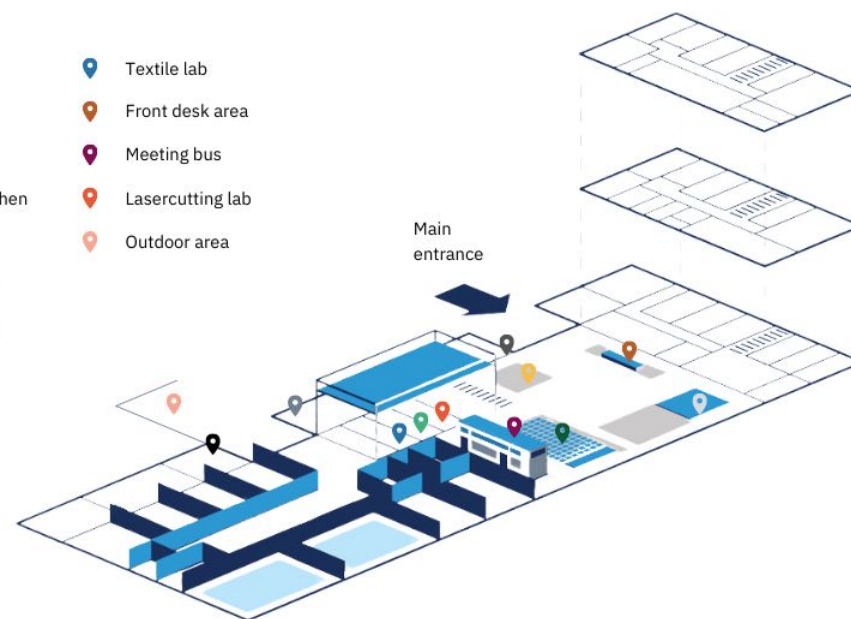
AT THE LAB

The metal lab is located through the blue door to the left of gate 2.

It is equipped with a range of hand and power tools suitable for metal fabrication and prototyping.

The maximum room capacity (including the welding area) is 5.

- 📍 CNC lab
- 📍 Metal lab
- 📍 Wood lab
- 📍 Community kitchen
- 📍 Event space
- 📍 Electronics lab
- 📍 3D printing lab
- 📍 Textile lab
- 📍 Front desk area
- 📍 Meeting bus
- 📍 Lasercutting lab
- 📍 Outdoor area



This workshop
is powered by



MACHINERY & EQUIPMENT

[Visit Knuth webpage](#)



Drill Press

Drilling capacity steel
(S235JR): 15.5 mm

**Distance spindle -
drilling table**
325 mm

Speed range
680 - 2700rpm



Belt sander/ grinding wheel

Belt width
100mm



Band saw

Cutting capacity 0° (round)
225mm

Cutting capacity 0° (rectangular)
(length x width)
245mm x 190mm

Belt speeds
40 / 90 m/min

MACHINERY & EQUIPMENT



**Folding Brake
SBS 170/**

Max sheet thickness

2mm

Working length

1270mm



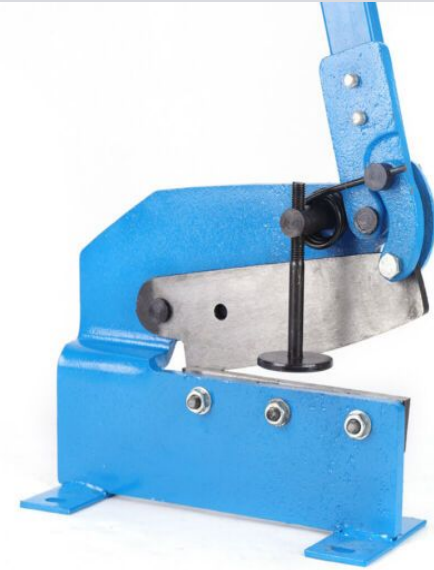
Bar Bender

Max bar thickness

5mm

Max bending angle

120 degrees



Sheet metal shears

Max cutting thickness

6mm

Max round bar thickness

12mm

MACHINERY & EQUIPMENT



Mill/Drill SBF 40 TV 1000

Working area

X axis travel 500mm

Y axis travel 190mm

Travel Z1 / Z2 axis
530mm

Spindle speed

75 rpm - 3200 rpm



Arbour Press

Working area

Max workpiece thickness
400 mm

Pressing force

20 kN (2t)

CREATING YOUR PROJECT

In order to successfully create your project in the metal lab, you need to consider these four steps:

HAVE A PROJECT AND A MATERIAL

Decide what would you like to make, and chose a suitable material to make it from.

Consider that the fabrication capabilities are limited in this lab and you should design your parts accordingly.

CREATE 2D DRAWINGS

Either hand drawn or with your preferred CAD software. Print it to have as a reference

The metal lab is a dirty and dangerous place for sensitive electronics. Printed or drawn references are preferable to bringing a laptop inside.

MEASURE TWICE, CUT ONCE

Carefully layout and mark your materials before committing to and cutting or drilling.

Slow down! You can save a lot of time and material by carefully considering each step. (it's safer too!)

SELECT THE RIGHT TOOL

Choose the right machine for your job

Some tasks don't require much precision and can be quickly completed on the drill press or with an angle grinder. For more precise operations, opt for the mill/drill or band saw for example.

CHECKLIST BEFORE USING THE MACHINERY

Before starting a job in the metal lab, ask yourself the following questions:

1

Can I operate this machine safely and confidently?

If in doubt, please ask! The metal lab is a very dangerous place. Sometimes all you need are some tips and a refresher.

2

Do I have any loose clothing or long hair that needs to be tied up?

Almost all of these machines spin fast and do lots of damage if you are not careful! Don't risk anything getting tangled in the machines.

3

In an emergency, do I know where the E-stop button is?

Take a moment to familiar yourself with the most important button!

4

Is there anyone else around me?

Be aware of your surroundings. Do you need to warn anyone nearby to wear hearing or eye protection?

USING THE **DRILL PRESS:** STEP-BY-STEP INSTRUCTIONS

For most holes this is the fastest and easiest machine to use when high precision or repeatability isn't required

- 1 Insert drill bit into the chuck. Tighten by hand by gripping the top and bottom and twisting in opposite directions.
- 2 Set the height of the platform by loosening the post clamp and winding up or down. Don't forget to re clamp for stability.
- 3 Position and clamp your workpiece to the platform
- 4 Press the green button to start the machine
- 5 Pull the lever on the right hand side to plunge the drill into the workpiece. Slowly apply pressure and retract the drill periodically to clear chips from the hole.
- 6 Press the red button to turn off. **Don't forget to clean up!**



USING THE **BELT SANDER:** STEP-BY-STEP INSTRUCTIONS

Great for deburring or refining your final metal part.

Don't use this to remove lots of material. Instead use a grinder (flex).

- 1 Turn on with the green button
- 2 Check that the belt is balanced. Adjust with the knob on the top right until it is centred and stable.
- 3 Place your workpiece on the platform and press into the belt. You may need to use pliers for small pieces as they will get hot. Don't use gloves
- 4 Turn off with red button
- 5 If you need a different belt, release the belt tensioner lever, replace the belt and re-balance.
- 6 The same process applies to the grinding wheel. Only grind steel on the grinding wheels. Aluminium clogges them up.



USING THE **BAND SAW:** STEP-BY-STEP INSTRUCTIONS

For cutting straight profiles with either a square or mitred edge.

- 1 Unlock the machine main switch. Code :2501
- 2 Set your material into the clamp. Adjust with the hand wheel until the clamp just touches.
- 3 Tighten with the lever behind the hand wheel.
- 4 Select coolant/no coolant and set the speed (fast for aluminium, slow for steel). Turn on with the Green button.
- 5 To lower the saw, turn the blue lever and adjust the speed with the small thumb screw.
- 6 When the cut finishes, the saw will automatically stop. Push the saw back up and turn the blue lever to hold it in place.
- 7 To change the cut angle. Loosen the lever below the hand wheel. Then push the saw head to the desired angle and re-lock with the same lever.
- 8 Clean up the machine and re-lock the main switch.



USING THE **SHEET METAL BRAKE**: STEP-BY-STEP INSTRUCTIONS

For precisely folding long edges on flat sheets. Great for folding net shapes cut with the metal laser!

Use **SHEET** metal only. Flat sheets up to **1270mm** wide and **2mm** thick

- 1 Push down on the foot pedal lock to open the clamp.
- 2 Place your material against the top of the bending bar and adjust the bottom knobs evenly for the correct bend thickness.
- 3 Press the foot pedal back down and adjust both top knobs until the clamp secures the material evenly and it is parallel.
- 4 Adjust the bend angle stop with a hex key.
- 5 Clamp with the foot pedal, make a test bend, measure and adjust the angle stop to account for springback
- 6 Clamping segments can be removed to allow for previously folded edges to pass through.
- 7 Press the foot pedal lock to release. Return machine to original configuration.



USING THE **BAR BENDER**: STEP-BY-STEP INSTRUCTIONS

Great for shaping bar stock. With practice this can be very accurate and consistent.

- 1 Only for metal bar stock up to 5mm thick.
- 2 Place bar stock into the bender as shown. Rotate the clamping block to suit the material thickness.
- 3 Clamp the material.
- 4 Adjust the bending surface with the thumb screws behind until it touches the material.
- 5 Bend to the desired angle.
- 6 There are a variety of clamping blocks and plates that can be used for different bend radii and for round stock.



USING THE **METAL SHEARS**: STEP-BY-STEP INSTRUCTIONS

Like a big pair of scissors for metal. Use this to cut sheet metal or bar stock to size.

- 1 Place material in the shears - Use the main blade for flat stock and the round hole for round bar up to 12mm.
- 2 Pull the lever down to make a cut, keeping fingers clear.
- 3 To cut sheet material, advance the material through the sheers and make multiple cuts (like a big pair of scissors).
- 4 Return the handle back to the upright position.



USING THE **ARBOUR PRESS**: STEP-BY-STEP INSTRUCTIONS

Great for pressing parts for close or interference fits (for example bearings) It could also be used with metal forming tools

- 1 Raise the ram with the lever on the right. Be careful not to let it fall and crush your hands!
- 2 Position the plate below to suit your application.
- 3 Lower the ram and press away!



USING THE **MILL/DRILL**: STEP-BY-STEP INSTRUCTIONS

This machine is complex and powerful. Please ask if you have any doubts. These instructions should only serve as a reminder and do not replace a comprehensive introduction to the machine.

- 1 Unlock and turn on the main switch code: 4010
- 2 Adjust the table height by loosening the levers and turning the crank. Make sure to re-tighten the levers!
- 3 Choose your spindle speed according to the table on the machine
- 4 Choose milling/drilling and cutting fluid if required.
- 5 Push the top left button to enable the machine
- 6 Enable the automatic x-axis feed via the “FEED RESET” button if needed. Every time you open the protective shield, “FEED RESET” needs to be pressed again.
- 7 Control the x-axis speed and direction with the knob and lever on the left side of the table.



USING THE **MILL/DRILL**: STEP-BY-STEP INSTRUCTIONS

- 8 Press and hold the yellow button for rapid movements
- 9 For fine positioning of the Z-axis pull the quill feed lever to the right until you feel it engage. You can now use the Z-axis handwheel.
- 10 For milling, lock the quill with the small lever
- 11 Select an appropriate head. (drill chuck, collet chuck or carbide face mill. **DO NOT ATTEMPT TO MILL WITH THE DRILL CHUCK.**

If you do not remember how to install each type, please ask.
It is important to install and remove each one correctly!
- 12 Turn off and lock the machine when finished and **CLEAN UP!**



CLEANING AFTER FINISHING

The metal lab gets extremely dirty and dusty very fast. **Please always clean up metal chips and grinding dust after every use.** Even if you have only created a small mess or the mess isn't all yours.

There are brooms, dust pans and a vacuum provided. Make use of them and make the space nicer for everyone.

Scrap material can be placed in the scrap bins or the scrap trolley (free to use).

When disposing of scrap metal please separate steel and aluminium for recycling.

In case of fire

- Shut off the tool you are using
- Stand clear and locate the nearest fire extinguisher.
- Carefully, and keeping some distance, bring the fire extinguisher next to the fire.
- Use a quick fire extinguisher burst to suffocate the flames.

Fire extinguishers



You will find multiple extinguishers placed around the metal lab.



RISKS AND SAFETY INSTRUCTIONS

The metal lab is the most dangerous place in MotionLab.Berlin

Most tools here can cause severe and even life threatening injuries.

Always be acutely aware of this! Take as many precautions as possible to keep yourself and others safe.

Before using any machine, locate and familiarise yourself with any safety features like emergency stop buttons and fire extinguisher locations.

Some tools generate lots of dust and fumes. Please open doors if possible and use the overhead extraction unit when welding and wear a dust mask when grinding.



DO'S AND DON'TS

DO

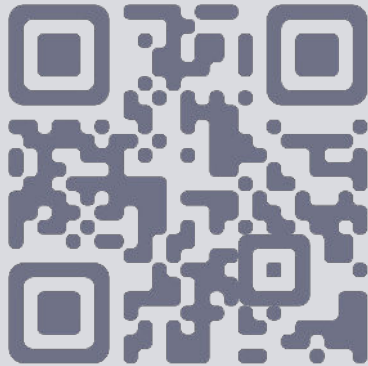
- Pay attention to what you are doing and to the people working around you
- When in doubt, ask. We are happy to help
- Keep the area around the machines clear from obstructions.
- **Always wear ear and eye protection**
- Turn off and lock (where provided) the machines when you finish working with it
- Report any faulty equipment to the staff
- Wear closed shoes (preferably steel toe)
- **Clean after yourself!** The metal lab gets extremely dirty and dusty very fast. Please always clean up metal chips and grinding dust after every use. Even if you have only created a small mess.

DO NOT

- Do not wear gloves when using machines (they can get caught and pull you into the machine)
- Leave any machine unattended while running under any circumstance.
- Attempt to to defeat guards or any other safety feature of the machine
- Use paint, glue, resin silicone or aerosol in the Lab space. Also no wood. Metal only!
- Disassemble or repair the machines



ADDITIONAL RESOURCES



MotionLab.Berlin Slack channel - [11_Metal](#) 

Join our metal lab slack channel and the community of experts!

Experience projects from coworkers, ask questions and help others and stay up to date about news and changes at the lab.

Also, let us know what exciting things you developed at the lab. Simply, post it in the slack channel and tag @Geri

Where can you order materials

[ProKilo](#) / Alboinstraße 26-34, 12103 Berlin

[Gemmel Metal](#) / Bessemerstraße 76B, 12103 Berlin





ALMOST THERE!

NOW, PARTICIPATE FROM
THE LIVE WORKSHOP AND START
WORKING ON YOUR PROJECTS!

DID YOU LIKE THE CONTENT OF THIS WORKSHOP
AND YOU ARE STILL NOT A MEMBER?

Join our ecosystem and make your ideas come to life!

Reach out to our colleague [Matthew](#)

Or sign up for our [newsletter](#) to learn about the upcoming
workshops and events.

Note:

This is a living document, which
may experience changes as our
labs evolve.

If any of the links don't work,
please report it to

info@motionlab.berlin