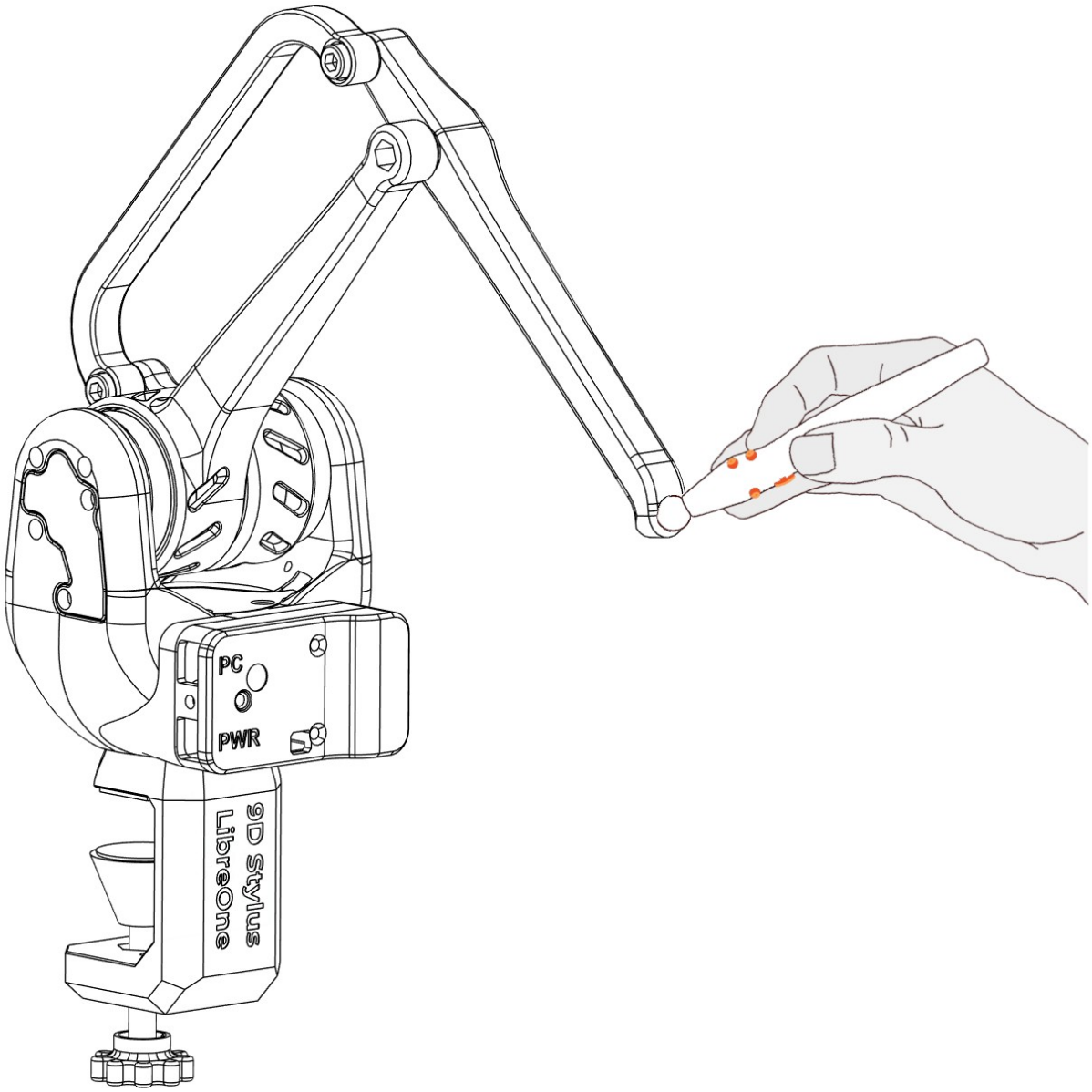
SENMAG ROBOTICS

9D Stylus LibreOne User Manual



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What's in the box?

9D Stylus Libre One Main Unit

V2 Stylus

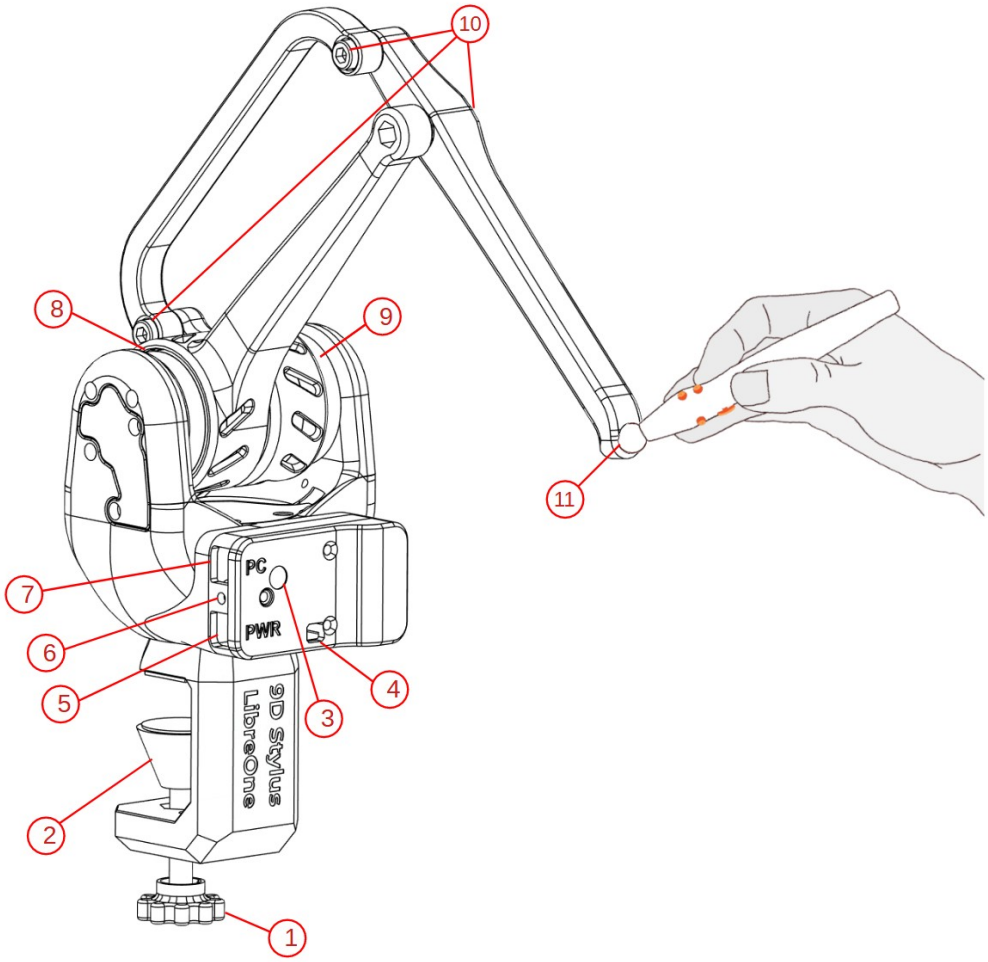
65W USB-C power supply

Short & Long clamp feet (x2 of each)

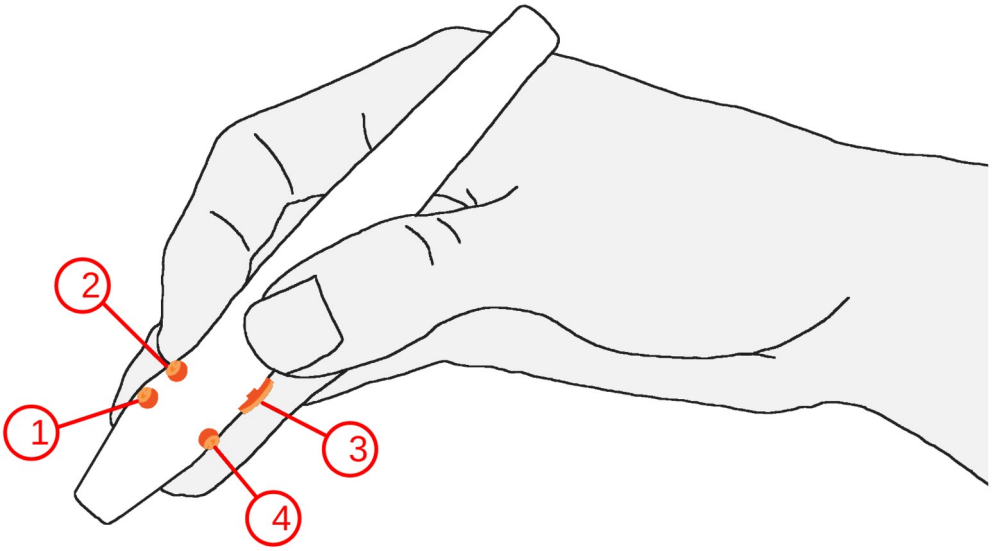
USBC – USBC Power Cable

USBA – USBC Data cable

Getting to know your Libre One



1	Table clamp screw
2	Table Grip pad
3	Status LED
4	Stylus cable connector
5	USB Power connector - connect to USBC power supply (65W+)
6	Bootloader button
7	USB data connector - connect to PC / laptop
8	Shoulder motor
9	Elbow motor
10	Linkage Screws
11	Stylus magnetic interface



1 Front button

2 Rear button

3 Scroll (half/full forward, click, half/full backwards)

4 Side button

Guidelines for safe use:

Always remember: *your 9D stylus is a robotic device and must be treated with appropriate care. Improper use can lead to malfunction, damage to property or injury to users. It is the user's / owner's responsibility to ensure that the device is used safely and properly, and that any third parties receive appropriate supervision and instruction on safe use. Get in touch with the Senmag team if you are ever unsure about how to properly / safely use your 9D stylus.*

The following list presents some generic guidelines for safe use, however is not intended to be exhaustive. It is the user's responsibility to identify any additional considerations appropriate to their specific use cases.

- **Always** 'park' the device when not actively using it (push it backwards so the elbow joint rests above the desk)
- **Always** securely attach your 9D stylus, using the included grip pads, to an appropriate surface. **Never** connect or power the 9D stylus without appropriately mounting it first.
- **Always** keep any objects / obstructions / hazards (e.g. laptops, computer monitors or coffee mugs) out of reach of the device – we suggest moving the un-powered device around by hand to ensure its workspace is clear.
- **Never** put your hands near the robotic components / linkage while the device is powered. You should only touch the stylus
- **Always** switch off the device when not in use. **Never** leave the device unattended while powered.
- **Regularly** inspect the device for any damaged parts / cables. **Never** power / use the device if it is damaged.
- **Always** consider reducing the force limits in the device settings when undertaking experimental work.
- **Always be sure to use appropriate power supply cables:** Not all USB-C cables are suitable for high power delivery. Using unsutable cabling can lead to thermal buildup or even fires. It is the operators responsibility to ensure that any USBC power cables used are rated to the (default) 60W required by LibreOne (the cables provided by Senmag are suitably rated).

Setup

Securing the device:

Select an appropriate surface to mount your 9D stylus:

Remember Newton's 3rd law – every action has an equal and opposite reaction. The surface must be able to withstand any forces your 9D stylus will create.

The surface should be between 10mm – 40mm thick, and be sufficiently weighted or otherwise anchored to the floor / walls.

Depending on the thickness of the surface, attach either the short or long grip pads:

Lifting the device by the elbow joint, slide it onto the surface and adjust the table clamp screw until it is firmly gripping the surface. *Warning: Do not over-tighten the clamp screws – finger-tight is enough.*

Check the device is firmly attached: hold the base of the device with one or both hands and try to slide it sideways. You should not be able to move the device. If it slides, tighten the table clamp screws slightly, and try again.

Attach a stylus to the device – it should magnetically snap into the socket.

Connection:

Your LibreOne uses 2 USB-C connections (check the image in the "Getting to know your Libre One" section):

- The lower USB-C connector is used for the power supply. Connect via a suitable (65W +) USB-C cable to a suitable (65W +) USB-C power supply.
- The upper USB-C connector is used for data transfer to a PC / Laptop. Connect via a suitable usb data cable.

Calibration:

The orientation tracking uses an IMU inside the stylus – this relies on magnetic fields to track orientation, and will need to be recalibrated (the 'full' stylus calibration option in the LibreOne Companion software) whenever the device is moved significantly (e.g. to a new desk / room / building).

Connecting to a PC:

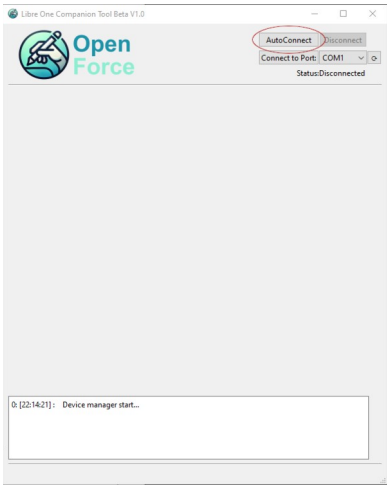
Remember: *only connect and/or power the device while it is securely attached to a suitable surface!*

Alongside the 9D Stylus LibreOne, we maintain an open source Companion Tool program that is used to perform calibrations. The companion tool is made using QT, and is pre-available pre-compiled for Windows as an installer or portable application (download link: https://github.com/senmag-robotics/LibreOneCompanion).

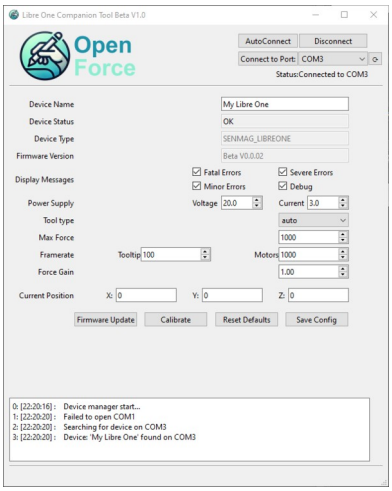
Connect the LibreOne's data cable to your PC / Laptop.

(Note: If it is the first time you are connecting, you may need to wait a few seconds for windows to set up the device).

Start the LibreOne Companion tool, and click the auto-connect button.



The tool will scan all COM ports and should detect your LibreOne. (if you see messages such as "unable to open COM" at the bottom, make sure no other programs might be trying to access the device (e.g. UnityEngine).



The companion tool allows you to configure and debug your LibreOne. *Note: You must click the "Save Config" button for new settings to be applied!* Settings include:

- **Device Name:** this name will be used in UnityEngine when generating the haptic cursor – especially useful if you wish to use multiple devices at once!
- **Device Status:** Gives you more detailed information about the state of your LibreOne
- **Device Type & Firmware Version:** For diagnostic purposes
- **Display Messages:** For firmware debugging – the firmware can be programmed to print messages to this console
- **Power Supply:** The target voltage and current settings for the USB-C power supply – only adjust these if you are having issues with your supply.
- **Max Force:** A limit built into the device's firmware – can be useful to reduce this setting while trying experimental software applications!
- **Framerate (tooltip & Motors):** The target framerates for the Libre-one's internal control-loops. (Note: this does not affect the main haptic framerate – here the LibreOne will attempt to automatically match the software application)
- **Force Gain:** an internal gain setting – can adjust this if your device is experiencing stability issues.
- **Current Position:** Shows the current XYZ location for debug purposes.
- **Firmware Update:** Launches a tool to update/recover the firmware of your LibreOne.
- **Calibrate:** Launches a wizard to assist you in calibrating your LibreOne.
- **Reset Defaults:** Reset your LibreOne to default settings. (not implemented yet!)
- **Save Config:** Save the current settings to your LibreOne.

When you are finished in the companion tool, be sure to click disconnect! (Other software will not be able to access your LibreOne while the companion tool is connected!)

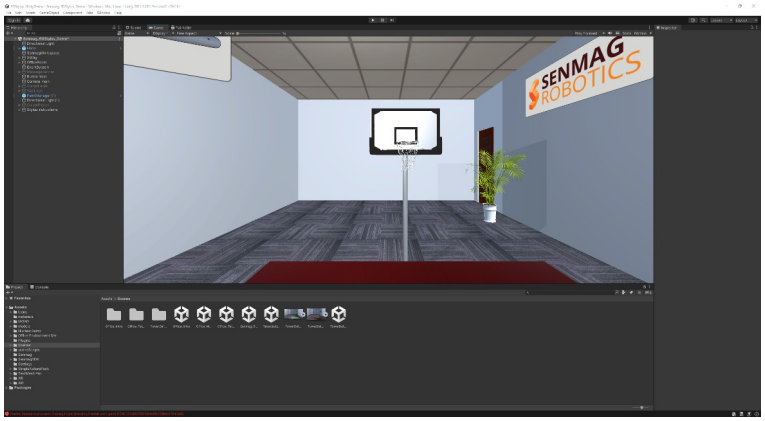
Running the demo application:

Alongside the 9D stylus's, we maintain a plugin and SDK for Unity Engine. The 9D stylus demonstration application is created using this plugin.

Note: The Unity SDK resource and demo projects are open source – you are free to use it and anything within it as you like. We only ask that you contribute your feedback, ideas, and creations to help us improve and further build this resource for everyone!

To run the demo application:

- Install the UnityEngine application from https://unity.com/
- Get the Demo application from our GitHub and copy the files to your computer: https://github.com/senmag-robotics/9DStylus_UnityDemo
- Open the demo application folder in the UnityHub program, and follow UnityHub prompts to install the appropriate version of Unity Engine (we recommend against upgrading the project to newer versions of UnityEngine)
- Once the project is open, in the Unity Editor, navigate to Assets/Scenes and double click to open the Senmag_9DStylus_Demo scene. You should see something like the following:



- With your 9D stylus connected, run the Unity program by clicking the 'Play' button at the top of the editor window. You should see a small orange ball appear near the centre of the room – this is the 9D cursor.
- Moving your 9D stylus should move the 9D cursor. Clicking the 'rear button' on the stylus will open the menu, and allow you to access elements of the demo!

Tips for use / development:

- **Idle Position:** The 9D stylus will switch to an idle / low power mode when pushed backwards (the elbow resting on the desk).
- **Set the maximum force target:** You can control the maximum force your 9D stylus will attempt to render – we recommend reducing this setting if doing any experimental work!
- **Two's company!** The Unity SDK supports use of multiple 9D Stylus devices simultaneously!

Troubleshooting:

We have compiled this section that may help you diagnose and fix issues with your LibreOne. You are always welcome to contact our team via the OpenForce discord or via our website if you experience any issues with your LibreOne.

LibreOne reports its own power status via the status LED and gives more detailed debug info through the Companion Tool software.

Issue:

The Stylus Doesn't track correctly:

Try performing a full calibration of the IMU using the LibreOne Companion software. (the full calibration needs to be done whenever your LibreOne is moved significantly, e.g. to another room / building)

The Linkage feels stiff or sticky:

Try adjusting the tension of the three linkage screws (labelled in the image in the "Getting to know your Libre One" section)

Try applying a small amount of lubricant to the linkage screws.

The status LED shows red, or yellow / orange:
This indicates an issue with the USB-C supply:

- Check your USB-C supply is capable of 65W,
- Try another USB-C cable,
- Try another USB-C supply,
- Try adjusting the power supply settings in the Companion Tool software.

The status LED shows blue:

This means you LibreOne is in bootloader / startup mode. It should automatically exit startup mode after two seconds. If it remains in this state, first try restarting the device (disconnect & reconnect the power cable). If it continues to be stuck in Blue, it likely means the firmware has become corrupted. Connect using the LibreOne Companion tool, and perform a firmware update.

The companion software / unity cannot detect the device:

Check the windows device manager – your LibreOne should appear as a “COM” port in windows - you should see a COM port that disappears if you disconnect the USB data cable from your device.

If you don’t see a COM port:

- Try another USB-C data cable (some do not support data communication)
- Try another USB port on your PC / Laptop
- Try restarting your PC / Laptop

If you do see a COM port:

- Try restarting your LibreOne (disconnect & reconnect the power)
- Try starting your LibreOne in recovery mode (connect the power while pressing the bootloader button)

Device Status is “ Encoders Disconnected”:

Indicates the LibreOne cannot communicate with the position encoders (the chips that measure the angles of each joint)

- Remove the electronics and coloured covers to check for any encoder connectors that have become unplugged, or for any damaged wires. If cables have become damaged, you can contact our team to ask for replacements.

Device Status is “Excessive Encoder Noise”:

Indicates the LibreOne has detected abnormal motion from its position encoders. Likely that an encoder / encoder magnet has come loose inside. Remove the coloured covers and check for any visible signs of damage.

Device Status is “Calibration Error”:

The LibreOne was unable to load it’s calibration profile.

- Use the LibreOne Companion Software to perform a full re-calibration

Device Status is “Tool Disconnected”:

The LibreOne was unable to communicate with the stylus / tool.

- Check the tool type is set correctly in the LibreOne Companion Software,
- Check the connectors / wires to the stylus tool. Replace if needed.

Downloads and Useful links

Find the latest version of this manual here:
https://senmag-robotics.com/9DStylusLibreOne/resources/UserManual.pdf

Download the LibreOne Companion Tool here:
https://senmag-robotics.com/software/LibreOneCompanion/downloadLatest/

Find the latest version of LibreOne Firmware here:
https://senmag-robotics.com/9DStylusLibreOne/firmware/latest/

Download the UnityEngine Demo application here:
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