

Focus Tunable Lens EL-3.1-10.8

Handling Instructions



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1. General

1.1. Safety

The EL-3.1-10.8 is intrinsically safe and does not expose users or operators to significant harm, even when powered and in operation.

1.2. Dos and Don'ts



Use gloves when touching the EL-3.1-10.8.
Do not touch the glass of the EL-3.1-10.8.



Always use ESD protection.



Do not use aggressive agents such as acetone or acids to clean the EL-3.1-10.8.



The EL-3.1-10.8 contains a moving magnet. Use non-magnetic tools only and remove magnetic parts (ferritic steel, permanent magnets) from the assembly area to prevent damage to the device.

2. Manual handling

2.1. Unboxing

When possible, open the packaging in a cleanroom environment, or under a laminar flow hood. Always use gloves when handling the lens.



Figure 1: Ensure that lenses are handled in a clean environment.

The EL-3.1-10.8 is delivered in trays containing 77 OEM lenses. To avoid lenses accidentally being displaced or falling out of the tray due to magnetic attraction, we recommend using a steel tray holder plate below the lens tray when opening it. Figure 2 shows the tray holder plate used by Optotune, together with its dimensions and specifications.

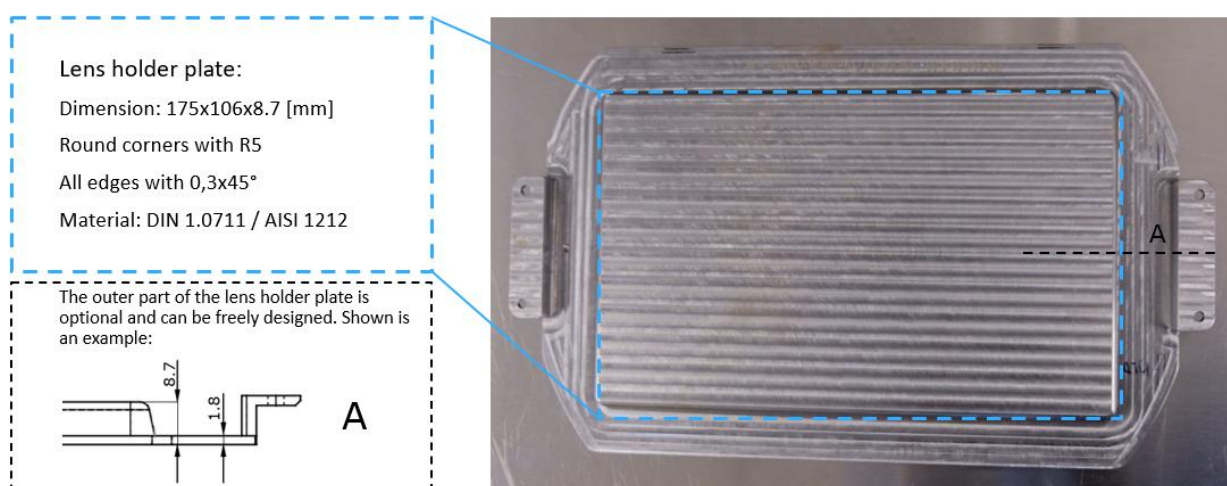


Figure 2: Lens holder plate.

The extraction of lenses from the tray using the steel plate is as follows:

1. Place the tray holder plate on a table

2. Remove the lens tray from its outer foil packaging. When holding the lens tray, make sure that the top and bottom cover stay together.



Figure 3: Correct way to handle the lens tray once removed from the outer packaging.

3. Place the tray with the lenses on top of the tray holder plate and make sure that the two fit well together. Note that the lens soldering pads should be facing downwards.

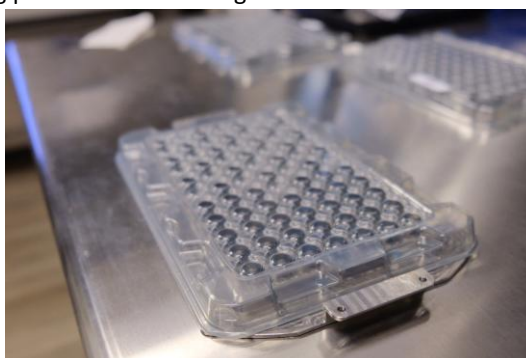


Figure 4: Lens tray on tray holder plate.

4. Separate the top cover of the tray from the bottom. Make sure that the bottom remains on the tray holder plate. The plate will keep the lenses from moving thanks to the magnetic attraction with the magnets inside the lenses.

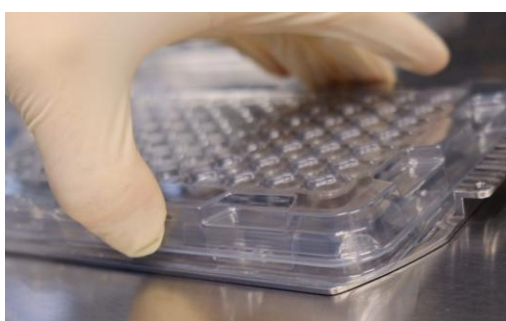


Figure 5: Removal of top tray cover.

5. Separate the top cover of the tray from the bottom around the full perimeter of the tray.

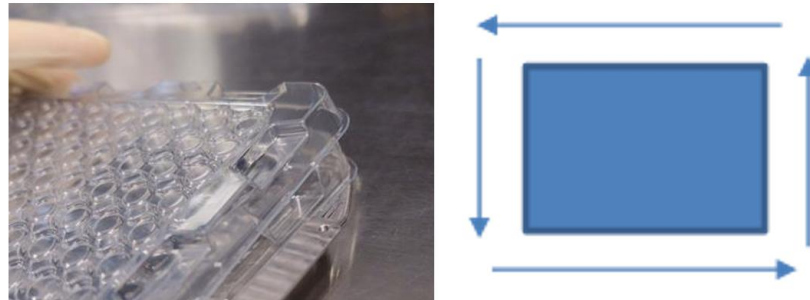


Figure 6: Separation procedure for top and bottom tray cover.

6. Slowly open the tray and put the top cover aside.
7. Now separate EL-3.1-10.8 lenses can be extracted from the tray. When handling individual lenses with tweezers, use non-magnetic ones. The lenses are best held on the flat sides of the lens housing.

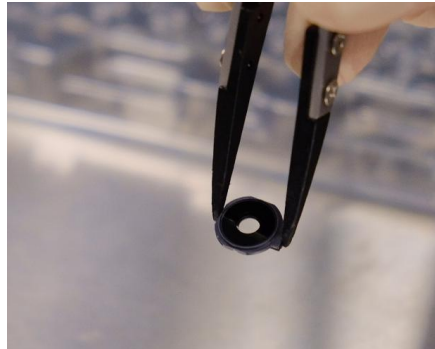


Figure 7: Lens held with tweezers.

2.2. Cleaning

Dust and particles

In most applications, particles of up to 0.15 mm size on the EL-3.1-10.8 are acceptable as the glass is several millimeters away from the image plane. In case there are particles >0.1 mm on the glass, we recommend cleaning it as follows:

- Use an air gun (filtered, oil-free, ideally ionized) to blow a **slow** air stream onto the glass.



Attention: Make sure not to expose the EL-3.1-10.8 to strong pulses of pressurized air, since this can damage the device (pressure should be <2 bar).

Stains and fingerprints

In case of contamination that cannot be removed with the air gun, the EL-3.1-10.8 glass can be wet cleaned as described below.



Wet cleaning is not simple and may end up contaminating the EL-3.1-10.8 more than cleaning it! Optotune recommends practicing first on a similar piece of glass.

- Use the following cleaning solution: 85% ethanol mixed with 15% diethyl ether.
- Soak a clean optical tissue with a small amount of liquid.
- Move the tissue slowly and continuously with very slight pressure over the glass. Always use a fresh edge of the tissue.
- Repeat with a different part of the clean tissue if required.

The cover glass on the PCB side of the lens is difficult to clean and contact with this area should be avoided. It is recessed, making access difficult, and can detach if too much pressure is applied.

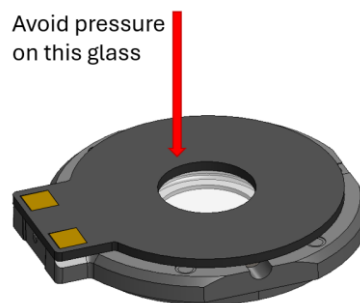


Figure 8: Cleaning of the cover glass of the EL-3.1-10.8 should be avoided as excessive pressure can lead to detachment of the PCB.

2.3. Soldering

The EL-3.1-10.8 is **not** suited for reflow soldering. For electrical connections, we recommend a conductive epoxy or low-temperature solder paste ($T < 150^{\circ}\text{C}$). For further information regarding the application of conductive epoxy, please contact sales@optotune.com.

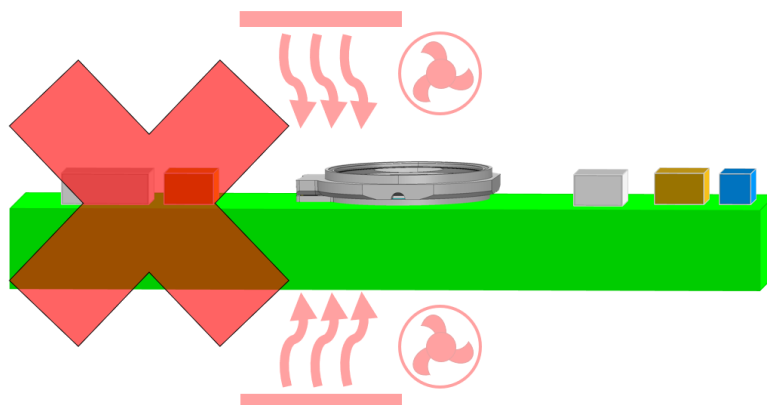


Figure 9: Reflow soldering should not be used for contacting EL-3.1-10.8.

3. Mounting

3.1. Mounting layout

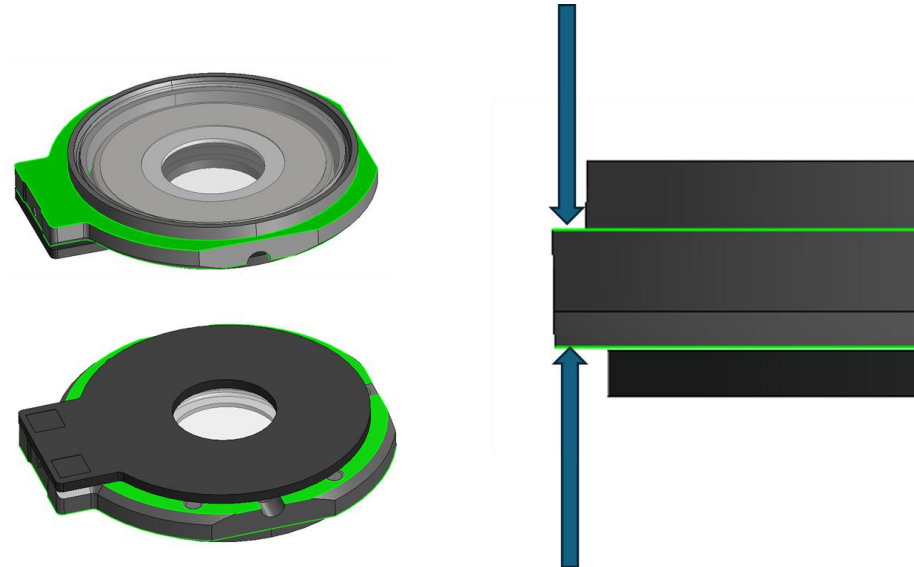


Figure 10: Clamping flange.

The EL-3.1-10.8 can be clamped using the flange indicated in green in Figure 10. During mounting, the force applied to EL-3.1-10.8 should be kept minimal to avoid damaging the lens.

We advise against mounting EL-3.1-10.8 with glue, as glue can enter the lens and hinder the moving parts of the lens. Depending on its components, glue can also produce volatiles which can adversely interact with the lens materials.

If glue is used for mounting the EL-3.1-10.8, we recommend using standard acrylates and UV-curable epoxies. Solvent-based adhesives, as well as room-temperature and thermosetting technologies such as silicone, polyurethane (PU) and polyvinyl chloride (PVC), should not be used for gluing the EL-3.1-10.8.



Only use non-magnetic tools in the vicinity of the EL-3.1-10.8 and do not place the device on magnetic parts or surfaces. The strong magnetic forces can alter lens behavior and in extreme cases damage the lens.

3.2. Thermal management

Optotune's electrically tunable lenses exhibit some degree of thermal drift. As the lens PCB can be a heat source at higher operating currents, we recommend heatsinking the PCB for best thermal performance.

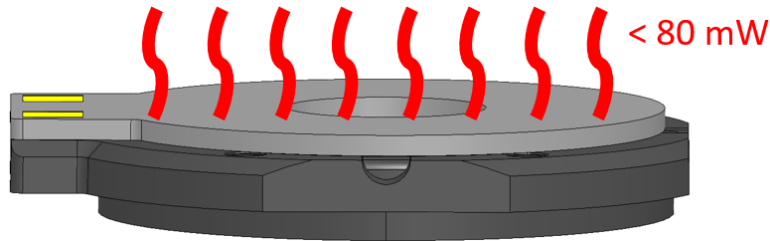


Figure 11: The PCB of the lens dissipates heat at higher operating currents (≈ 80 mW @ 100 mA).

3.3. Magnetic considerations

In the magnetic near field of the EL-3.1-10.8, as shown in Figure 12, there must NOT be a significant amount of ferromagnetic material or magnets. This explicitly includes stainless steel, which can have magnetic properties. Small parts, such as stainless-steel screws, are acceptable. A large steel component shifts the focal power of EL-3.1-10.8 by ≈ 0.1 dpt if it is placed within the indicated region. Please note that in most cases this corresponds to merely a shift in the focal power characteristics and generally leaves the lens functionality intact. In other words, the focal power will return to its initial value once the steel component has been removed again. If in doubt, please contact sales@optotune.com.

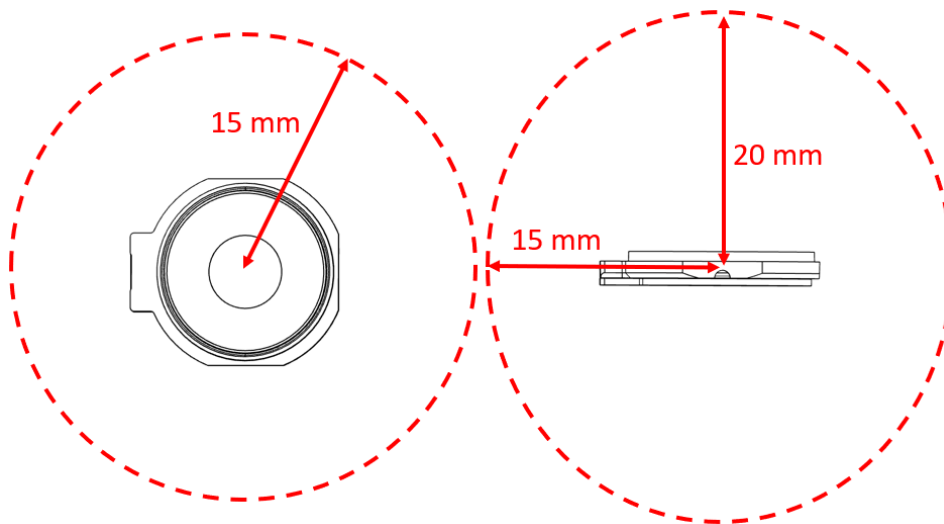


Figure 12: Magnetic near field zone of the EL-3.1-10.8.

4. Electrical connection and troubleshooting

The EL-3.1-10.8 is current-controlled. The current can be applied to the PCB of the lens either directly or by an attached flex cable.

4.1. Interface and connection

4.1.1 No-flex version

The electrical connection of the EL-3.1-10.8 consists of two contact pads on the PCB. Allowable control currents are in the range between -125 mA and +125 mA. A positive current will result in a positive focal power change of the lens, and vice versa. The pad material is Cu with a Ni/Pd/Au ($> 1.5/0.01/0.005 \mu\text{m}$) surface finish. The pinout is shown in Figure 13.

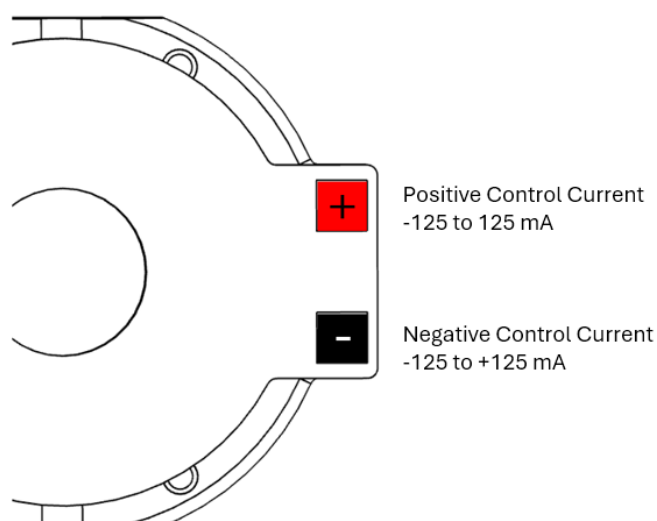


Figure 13: Positive and negative pad assignment.

Please refer to Section 2.3 for soldering instructions



Exceeding the maximum supply current can destroy the PCB.

4.1.2 Flex version

Pinout: EL-3.1-10.8			
Position	Function	Value	
1			
2	Max. control current -	-125 to 125 mA	
3	Max. control current +	-125 to 125 mA	
4			
5			
6			

Figure 14: Flex cable pin-out and current limits.

The EL-3.1-10.8 flex cable is a 6-pin type designed for a Hirose FH34-6S connector with thickness 0.31 mm. Four out of the six pins are unused.

4.2. Troubleshooting

If the lens is not tuning under an applied current, there are a few checks that can be made to identify the problem:

1. Measure the resistance between the two contact pads as indicated in section 4.1. The resistance value should be $8 \pm 1 \Omega$. If the resistance is too high or if the pads are shorted, it indicates that the lens motor is faulty. Please note that if a flex is attached to the PCB, additional resistance must be accounted for (e.g., a 40 mm flex adds 0.2Ω).
2. The magnet in the EL-3.1-10.8 can lose its magnetization at temperatures higher than 85°C . Use a ferromagnetic or magnetic item to test if the lens is still magnetized. The magnetization can also be partially lost, which will result in a smaller tuning range for the lens.



Attention: Turn off the coil signals during these tests!