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Focus Tunable Lens EL-16-40-TC

Handling Instructions

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Contents

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1. General

1.1. Safety

The EL-16-40-TC is intrinsically safe and does not expose the user and operators to significant harm, even if powered and in operation.

1.2. Do's and Don'ts

Use gloves when touching the EL-16-40-TC.
Do not touch the glass of the EL-16-40-TC.

Always use ESD protection.

Do not use aggressive agents such as acetone or acids to clean the EL-16-40-TC.

The EL-16-40-TC contains strong magnets. Use non-magnetic tools only and remove magnetic parts (ferritic steel, permanent magnets) from the assembly area.

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2. Manual Handling

2.1. Unboxing and storage

- When possible, open the packaging in a cleanroom environment, or under a laminar flow hood. Always use gloves when handling the lens.
- Do not touch the glass or connector area. Do not place the glass on hard surfaces.
- Store the lens in its original packaging until integration and keep it away from dust, magnetic parts, and sources of mechanical shock.

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

Figure 2: TL-16-40-TC with adapter in single-unit protective packaging.

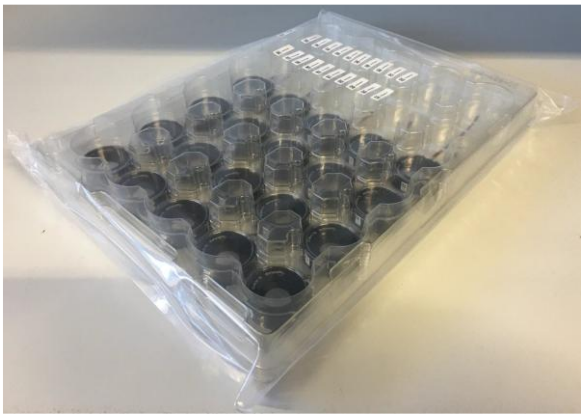

Figure 3: TL-16-40-TC OEM version packaged in trays of 30 units.

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3. Cleaning

3.1. Dust and particles

In most applications, particles of up to 0.15 mm size on the EL-16-40-TC 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.

Make sure not to expose the EL-16-40-TC to strong pulses of pressurized air, since this can damage the device (pressure should be less than 2 bar).

Figure 4: Dust-Cleaning of the EL-16-40-TC with adapter.

3.2. Stains and fingerprints

In case of contamination that cannot be removed with the air gun, the EL-16-40-TC glass can be wet cleaned as described below.

Wet cleaning is not simple and may end up contaminating the EL-16-40-TC 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.

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4. Mounting

4.1. Mounting layout

The EL-16-40-TC is available as a base version or with common thread adapters for optical integration. Available with adapters for M25.5, M26, M27, M30.5, C-mount, and M42 interfaces. Refer to the corresponding mechanical drawing for dimensions, interface details, and adapter geometry.

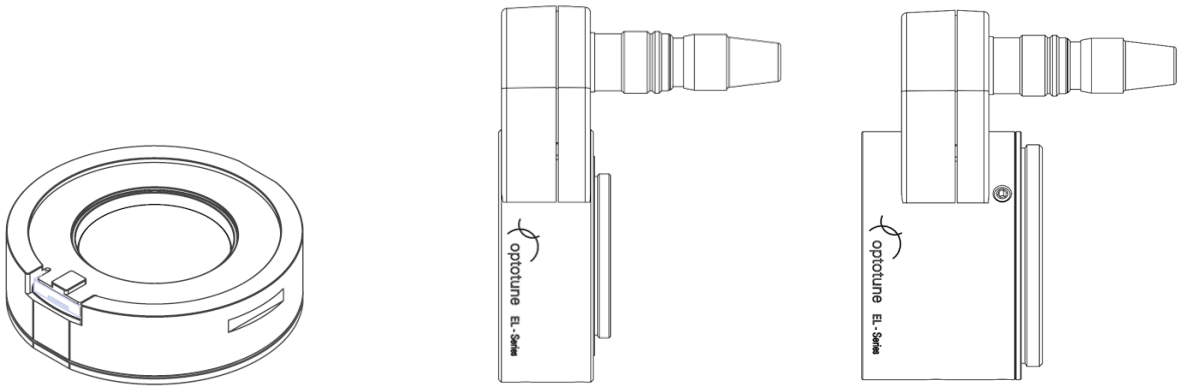

Figure 7: EL-16-40-TC base lens with adapter options for M25.5/M26/M27/M30.5/C and M42 interfaces.

4.2. Thermal management

Keep the lens within datasheet limits and ensure adequate heat dissipation in the surrounding assembly.

4.3. Magnetic considerations

Keep significant ferromagnetic material and magnets out of the EL-16-40-TC magnetic near field. Small screws are acceptable.

4.4. Mounting process

Mount the EL-16-40-TC on a compatible interface without tilt or mechanical load on the housing, connector, flex cable, or glass.

Only use non-magnetic tools in the vicinity of the EL-16-40-TC and do not place the device on magnetic parts or surfaces. The strong magnetic forces can damage the EL-16-40-TC.

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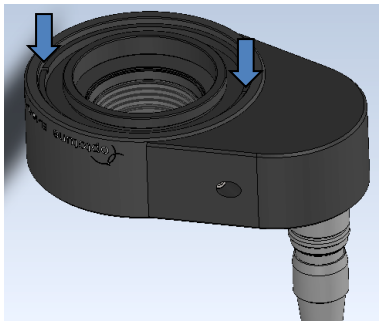
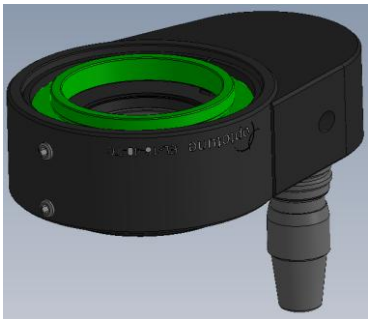
4.4.1. Thread adapter exchange

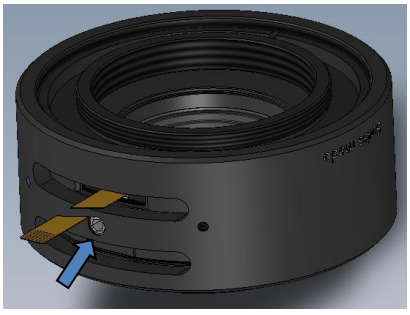
Loosen the fixation screws. Remove the retainer ring by alternating opposite sides. If present, remove the bottom thread adapter.

Remove the torx screws and lift off the housing part without the Hirose connector.

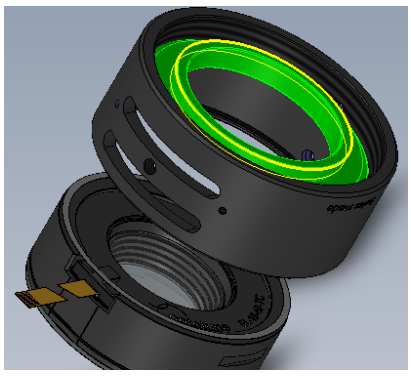

Remove the two black screws with the Allen key. Open the Molex latch, pull out the flex cable with tweezers, and loosen the fixation screw below the cable.





Tilt the assembly and push only on the thread adapter until the lens can be removed by hand. Remove the thread adapter only after the flex cable is fully out. Pushing the adapter too far may damage the flex cable.

To reassemble, repeat steps in reverse order.



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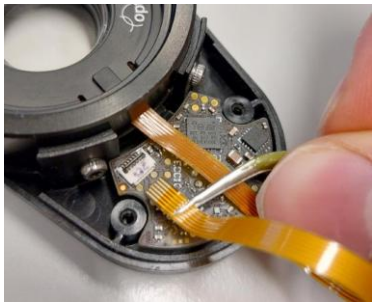
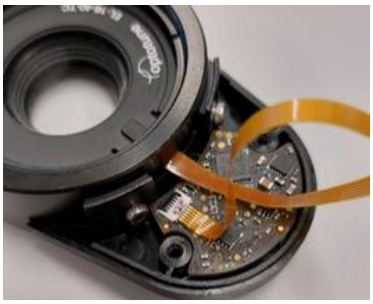
4.4.2. Installing ECC-1C adapter kit

Please note that after installing the ECC-1C adapter, the Hirose connector changes from male to female. After pulling out the flex cable (see Thread Adapter Exchange Procedure above), screw the bottom adapter part containing the ECC-1C. Then insert the flex cable into the Molex adapter with the latch lifted in an upright position and secure it by closing the latch to the horizontal position.



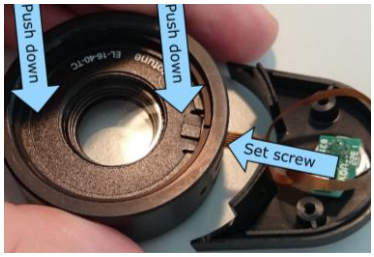


Place the adapter by sliding it down from the side, then tighten the two screws on the back of the adapter. Ensure the holes are not covered by the flex cable; otherwise, the cable may be damaged by the screws.


4.4.3. Tightening of loose assemblies

- If the assembly is loose, align the EL-16-40-TC in the tube so that the FPC cable is centered in the slits. Press the lens firmly into the tube, tighten the set screw from the side, and then tighten the retainer ring gradually. Finally, tighten the two-side set M3 screws with only little force.



Each M3 screw can be tightened with a maximum torque of 0.1 Nm. Maximum retainer ring torque: 0.4 Nm.

Exceeding these torque specifications can introduce hysteresis or permanently damage the lens.

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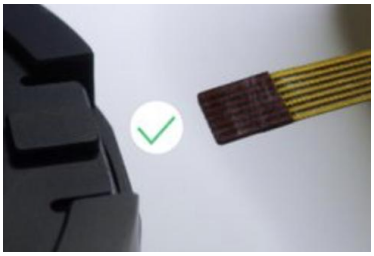
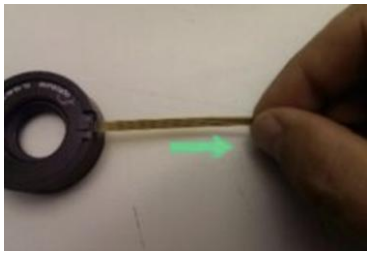
4.4.4. Connecting the FPC to the lens

- Open the FPC connector carefully with tweezers, insert the flex cable fully with the contact pads facing downwards, and close the locking tab. Finally, pull the cable slightly to verify that it is securely inserted.

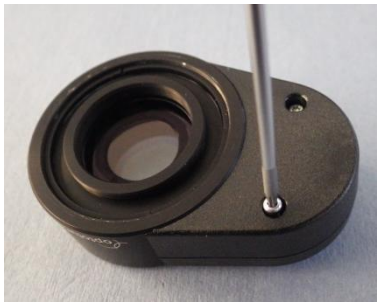


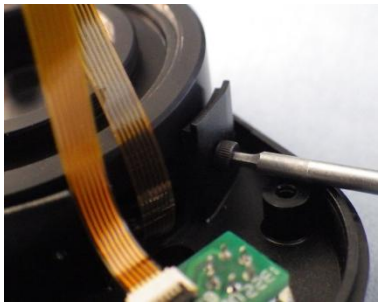


Do not perform this process while the lens is powered, as this can cause EEPROM damage.

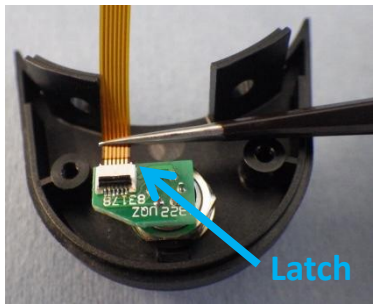
4.4.5. Hirose adapter handling

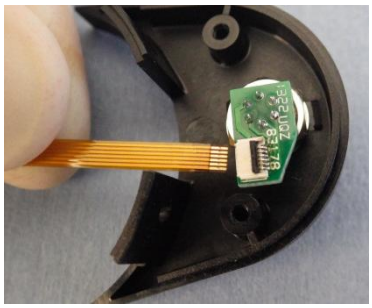
To flip the Hirose housing, remove the cover and unscrew the bottom adapter part. Rotate the housing as needed and reassemble it without pinching the flex cable.





To remove the housing, lift the black Molex latch to the upright position and gently pull out the flex cable.





When reassembling the Hirose adapter or flipping the housing, avoid routing the flex cable over screw holes. Inserting screws while the FPC covers a hole can puncture or shear the cable, leading to irreversible electrical damage.

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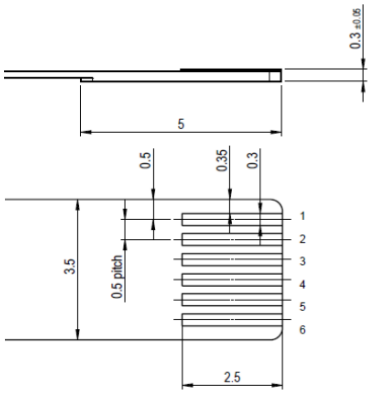
5. Electronics

Operate the EL-16-40-TC only within the datasheet limits. Overcurrent, overvoltage, or incorrect digital supply can permanently damage the lens.

5.1. Interface and connection

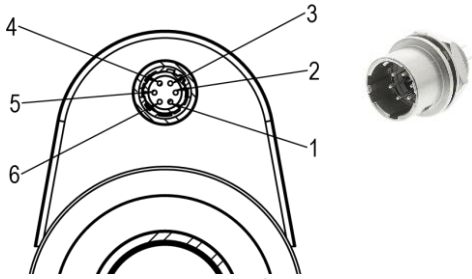
The EL-16-40-TC without adapter uses a 6-pin FPC flex cable for electrical connection. Two pins are assigned to the lens coil, and four pins are used for the I²C interface. See Figure 8 for pinout.



Pin out: EL-16-40-TC		
Position	**Function**	**Value**
1	GND	-
2	Max. control current -	-500 to 500 mA
3	Max. control current +	-500 to 500 mA
4	I²C SDA	Digital signal
5	I²C SCL	Digital signal
6	Vcc	3.3 V

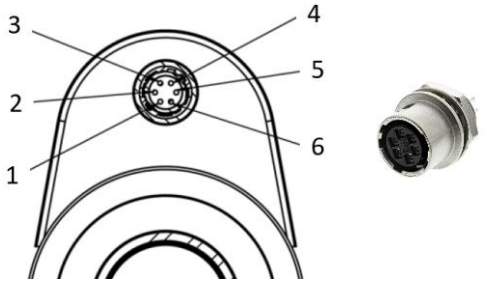
Figure 8: Left: EL-16-40-TC connector. Right: pin assignment and current limits.

Figures 9 and 10 illustrate electrical interfaces using Hirose connectors for lenses without and with integrated controllers (ECC-1C), respectively.



Pin out Hirose connector HR10G-7R-6PB(73)		
Position	**Function**	**Sensor pins**
1	Max. control current +	-
2	Max. control current -	-
3	GND	1-4
4	Vcc	8
5	I²C SCL	6
6	I²C SDA	5

Figure 9: Electrical connections of lens models without embedded controller featuring (male) Hirose connector.



Pin out Hirose connector HR10G-7R-6SB(73)		
Position	**Function**	**Value**
1	GPIO Trigger	-
2	Analog In	0-10V
3	UART Tx / I²C SCL	TTL
4	UART Rx / I²C SDA	TTL
5	GND	-
6	Vcc	5-24V

Figure 10: Electrical connections of lens models with embedded controller ECC-1C featuring (female) Hirose connector.

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Exceeding the maximum supply current can destroy the lens.

Make sure that the cable is put straight into the connector prior to power ON. Tilted cable can lead to short circuits and destruction of EEPROM and/or temperature sensor.

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6. FAQ and troubleshooting

Lens Not Working

Explanation & Possible Causes:

Common causes include:

- Corrupted EEPROM (e.g., due to interrupted write or hot plugging)
- Incorrect controller configuration or firmware mismatch
- Damaged or loose FPC (flex) cable
- Hardware fault in the actuator

Recommended Diagnostic Actions:

1. Check Device Detection in Cockpit
    - Connect lens to controller and open Optotune Cockpit.
    - If shown as “Unknown Device”, this indicates possible EEPROM corruption or firmware mismatch.
2. Read EEPROM Data
    - Attempt EEPROM readout in Cockpit:
        - If fields are empty or read fails → EEPROM corruption suspected.
        - See section EEPROM Corruption for recovery.
3. Test Operation in Current Mode
    - Set controller to Current Mode.
    - Slowly ramp up current within specifications (up to ±250 mA).
        - If optical response occurs → actuator is functional; issue likely in control parameters.
        - If no response → actuator or flex cable is damaged.
4. Inspect the FPC Cable
    - Always power OFF before disconnecting/reconnecting.
    - Check for:
        - Visible damage or kinks
        - Proper insertion: contacts facing down, latch fully closed
5. If Issue Persists
    - Contact Optotune Support.

EEPROM Corruption

Explanation & Cause:

EEPROM corruption may occur if power is cut during write or improper shutdown, causing calibration loss.

In Cockpit: Lens appears as “Unknown Device”, and EEPROM readout returns empty or error.

Quick check: Switch to Current Mode and apply a small current (within specs). If the lens responds, only EEPROM is affected.

Recommended Fix:

- Contact Optotune Support to obtain the EEPROM file and restore it via Cockpit or return lens for reprogramming.

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Firmware Update Requirement

Explanation & Cause:

Older firmware versions may contain known issues such as hysteresis inconsistencies or unstable thermal management.

Recommended Fix:

- Refer to the controller manual and update to the latest firmware using official Optotune tools.

Incorrect Driver or Software

Explanation & Cause:

Communication errors and feature limitations often result from driver/SDK mismatches with firmware.

Recommended Fix:

- Always use the latest driver package compatible with your firmware version.
- Confirm configurations (I^2C address, baud rate) against release notes.

Focus Jumps or Hysteresis

Explanation & Cause:

Triggered by rapid large-step movements or vertical mounting, amplifying magnetic and gravitational effects.

Recommended Fix:

- Inspect the set screw and loosen if required.
- Drive lens in smaller increments with appropriate settling times.

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