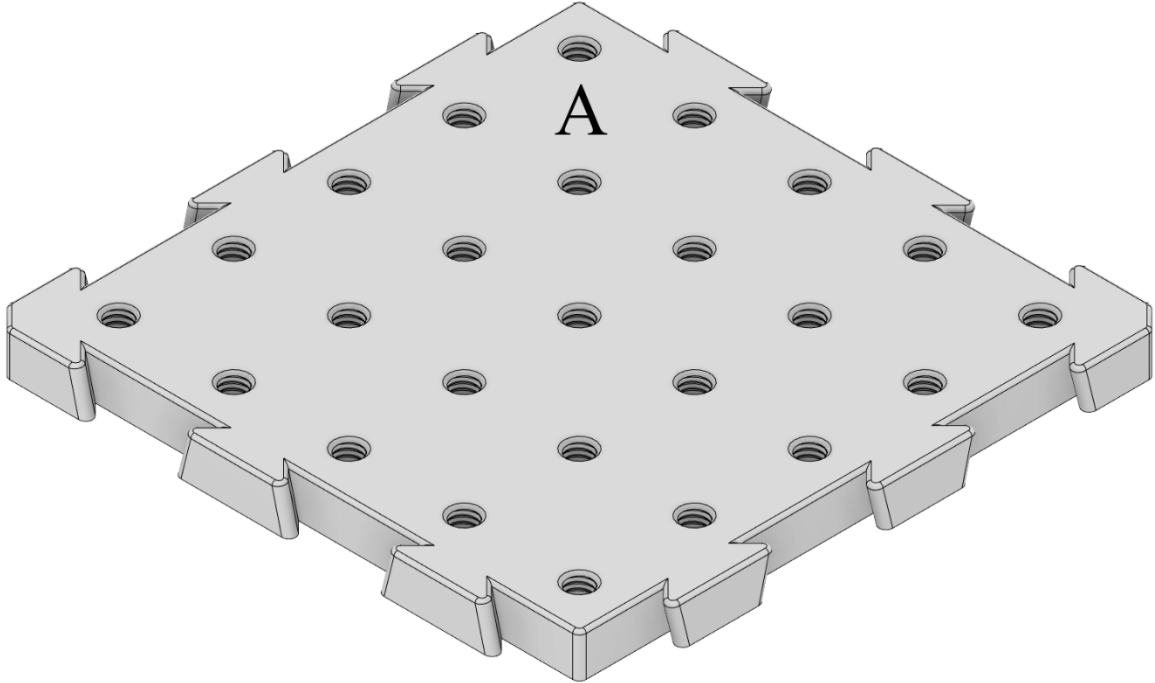


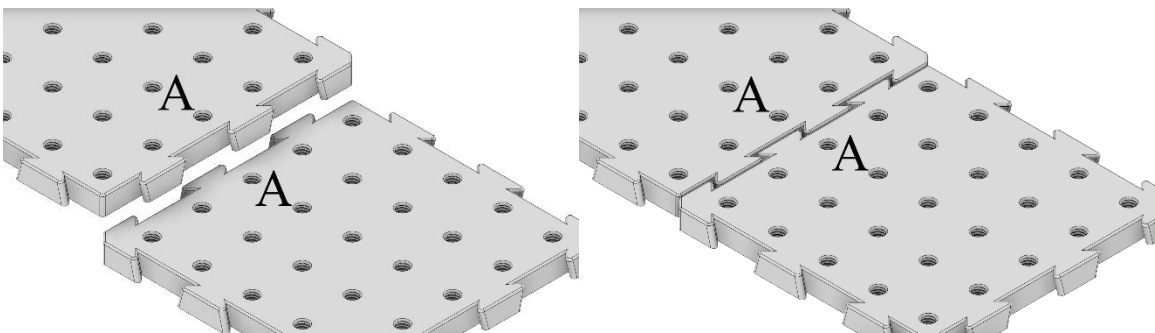
Kit Contents – 3D-Printed Opto-Mechanics <i>3D stereolithographic and STEP files, as well as a description of components with instructions on use within the kits and kit-build assignments, are available at <www.Github.com/MMantiaLU/3DP-EDUSPEC-Kit>. Bolded components indicate readily available metal hardware. Cost of printing filament (PLA) and metal hardware per kit approximated \$20.</i>			
ID	Components	Quantity	Function
A	Modular Optical Breadboard, 5x5-in	4	3-Axis Modularity for Opto-Mechanics
B	Post Holder w/ Clamping Fork	6	
C	Mounting Post	6	
D	1.25-in Sq. Mount	1	Webcam Mount
E	2-in Sq. Mount	2	Color Filter, Linear Polarizer, Diff. Grating Mount
F	Rotating Analyzer, 5° Grads, 2-in Sq.	1	Rotate Linear Polarizer 360°, Polarimetry
G	Ø0.5-in Optic Mount	2	Photodiode Mount
H	Ø1-in Optic Mount	2	Lens, Filter, Mirror Mount
I	Ø1.5-in Optic Mount	2	Lens Mount
J	FDS100 Photodiode Sleeve	1	Permits FDS100 Mounting into Ø0.5-in Mount
K	LED Flashlight Mount	1	Light Source Mount
L	Laser Pen Mount	1	Light Source Mount
M	Laser Pen On/Off Toggle	1	Toggles Laser Pen On/Off
N	1-cm Cuvette Mount	2	Sample Mount
O	1/4-20 Pan-Head Screw, 0.75-in	24	Fastening
P	1/4-20 Nut	12	Fastening
Q	1/4-20 Mount Screw	9	Fastening

Kit Contents – Optics & Electronics			
Components	Quantity	Function	Cost (\$)
1-MP USB CMOS Camera Module	1	Spectrometer Detector	29
1-cm Plastic Sample Cuvette	3	Liq. Sample Holding	1
Linear Polarizer, 2-in Square	3	Polarimetry	7
Linear Diffraction Grating, 500 Lines/mm	1	Diffraction	1
Linear Diffraction Grating, 1000 Lines/mm	1		1
2-Axis Diffraction Grating, 13,500 Lines/in	1		1
Ø1-in Mirror	3	Reflection	1
Color Filter Set, 2-in Sq.	1	Color Filter	1
Assorted Ø1-in & Ø1.5-in Lens Kit	1	Collimation & Focusing	20
LED Flashlight	1	Continuum Point Source	2
Laser Pointer, Green 532-nm	1	Collimated Line Source	3
AAA Batteries	2	For Laser Pointer	1
Arduino Uno Starter Kit	1	Electronics & Detector Signal Processing	37
FDS100 Silicon Photodiode	1	Light Detector	15

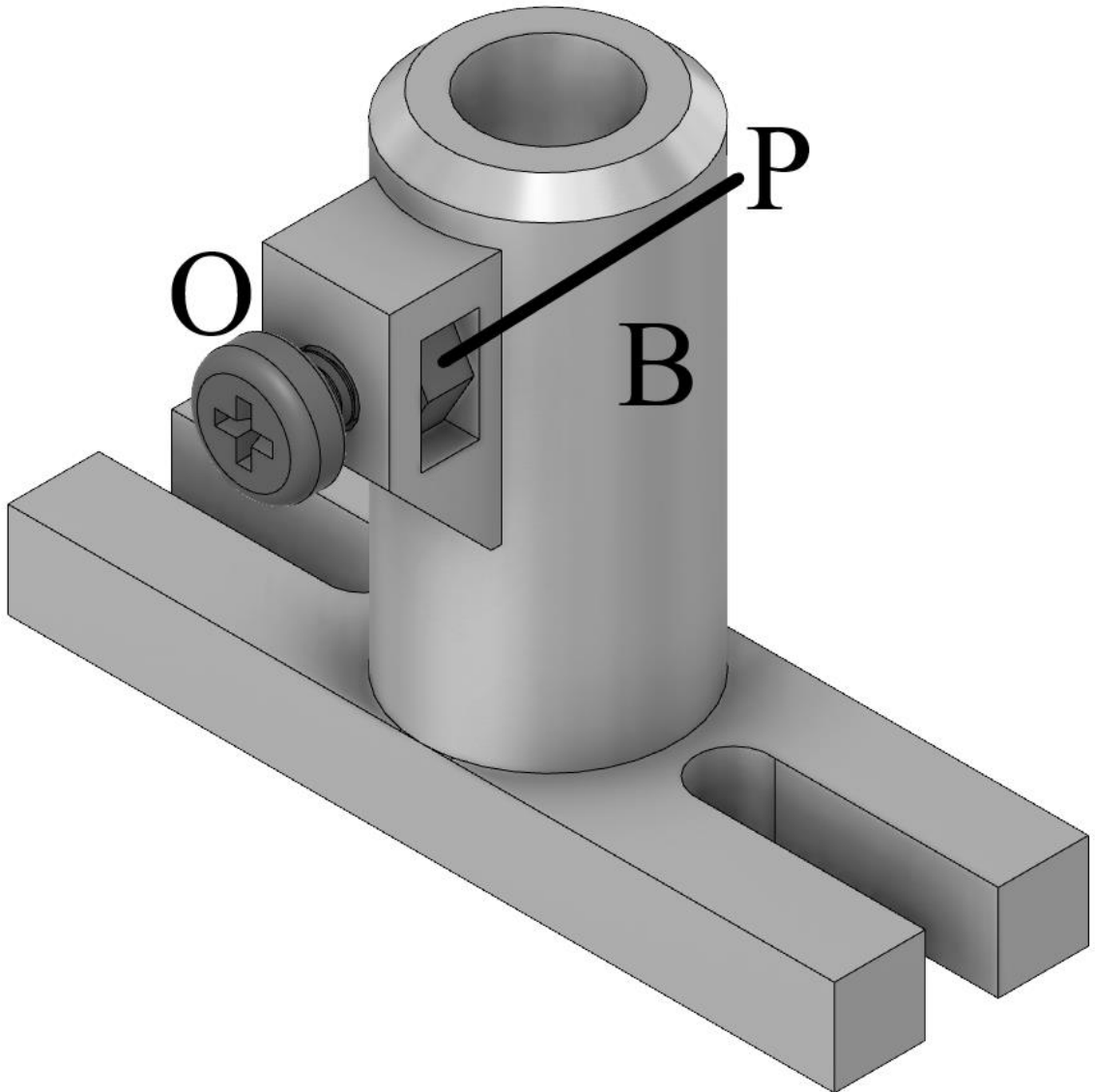
(A) Modular Optical Breadboard 5x5-in



The modular optical breadboard has a 5x5 array of 1/4-20 threaded holes on 1-in centers. Tapered connecting appendages along the edge allow for expansion to the desired breadboard size. The tapered connections require that inter-locking breadboards have one “correct” orientation, but greatly enhance overall rigidity.

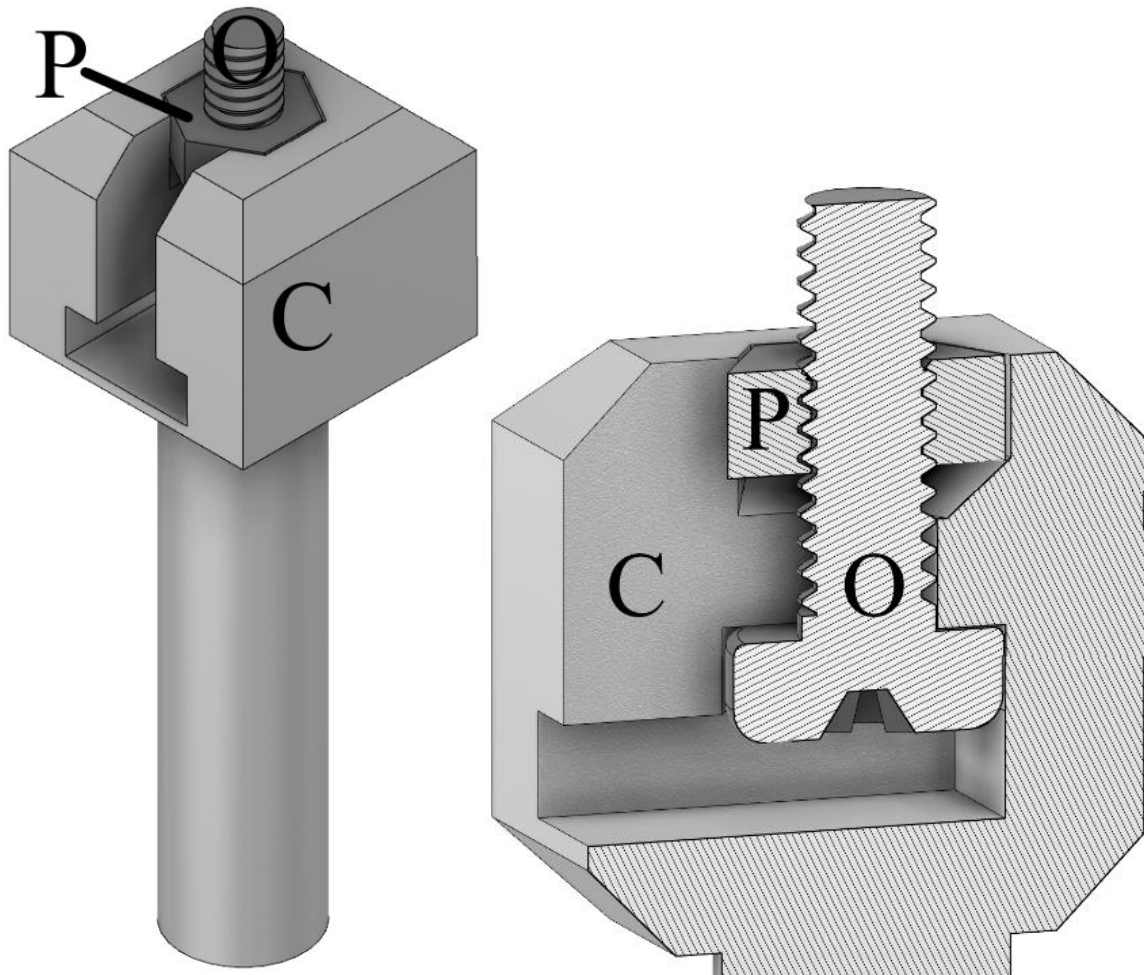


(B) Post Holder with Clamping Fork



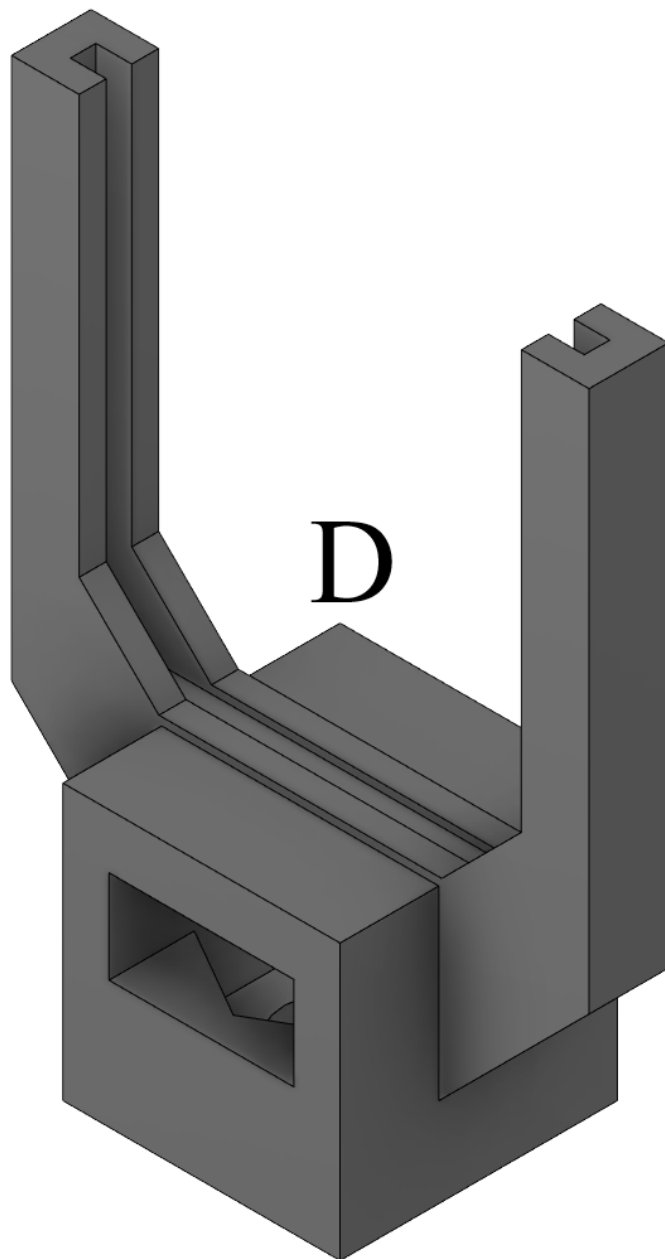
The post holder (B) requires a 0.75-in long 1/4-20 pan-head screw (O) and corresponding 1/4-20 nut (P). Tightening the screw by hand provides sufficient clamping force to fix a mounting post (C) at different points along the vertical axis. 1/4-20 screws (O) are used to fix the post holder (B) to the optical breadboard (A). The “forked” extensions of the post holder allow versatile placement in the horizontal plane on a breadboard.

(C) **Mounting Post**



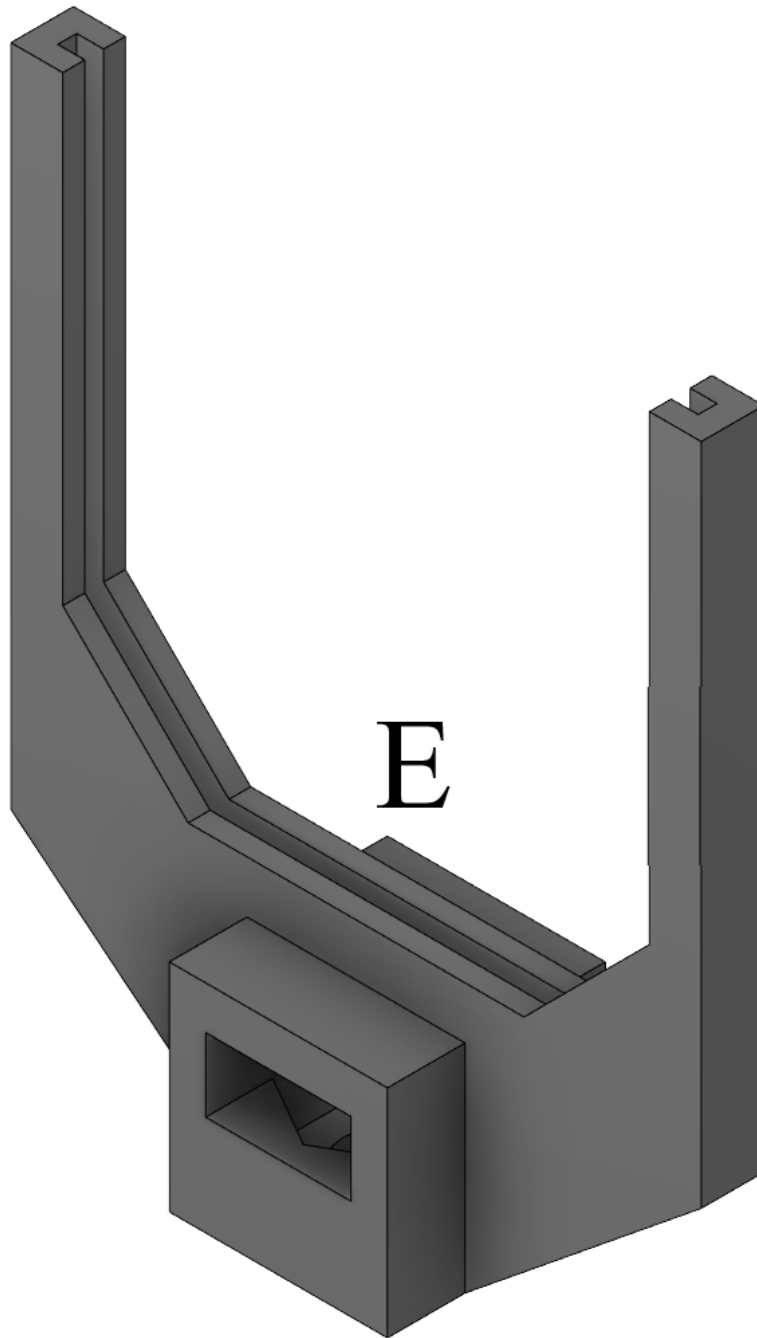
Mounting posts (C) are used in conjunction with post holders (B) to mount a variety of optical components. They are constructed by sliding a 0.75-in long 1/4-20 pan-head screw into the slot at the head of the post, pulling it up into a recessed hole, and then threading on a 1/4-20 nut (P). Pliers can be used to turn the screw until a very snug fit is achieved. Thread-locker can be used to make a permanent connection. The exposed thread of the screw are used to couple the mounting post to the optical mounts, which accept a 1/4-20 nut (P) dropped into their lower receiver.

(D) 1.25-in Square Mount



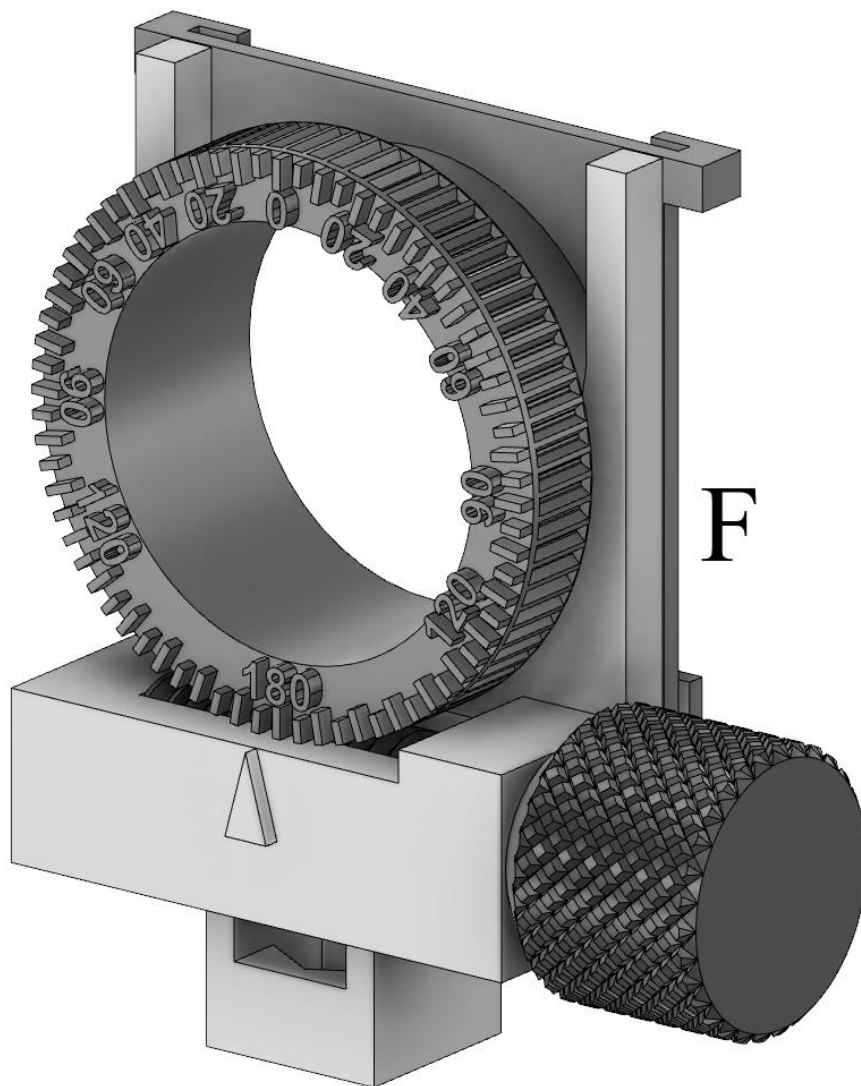
The 1.25-in Square Mount (D) is primarily used to mount a simple USB webcam PCB module for use with fixed-grating spectrometers.

(E) 2-in Square Mount



The 2-in square mount (E) is used to mount standard cardboard-enclosed optical films such as color filters, linear polarizers, and diffraction gratings.

(F) Rotating Analyzer



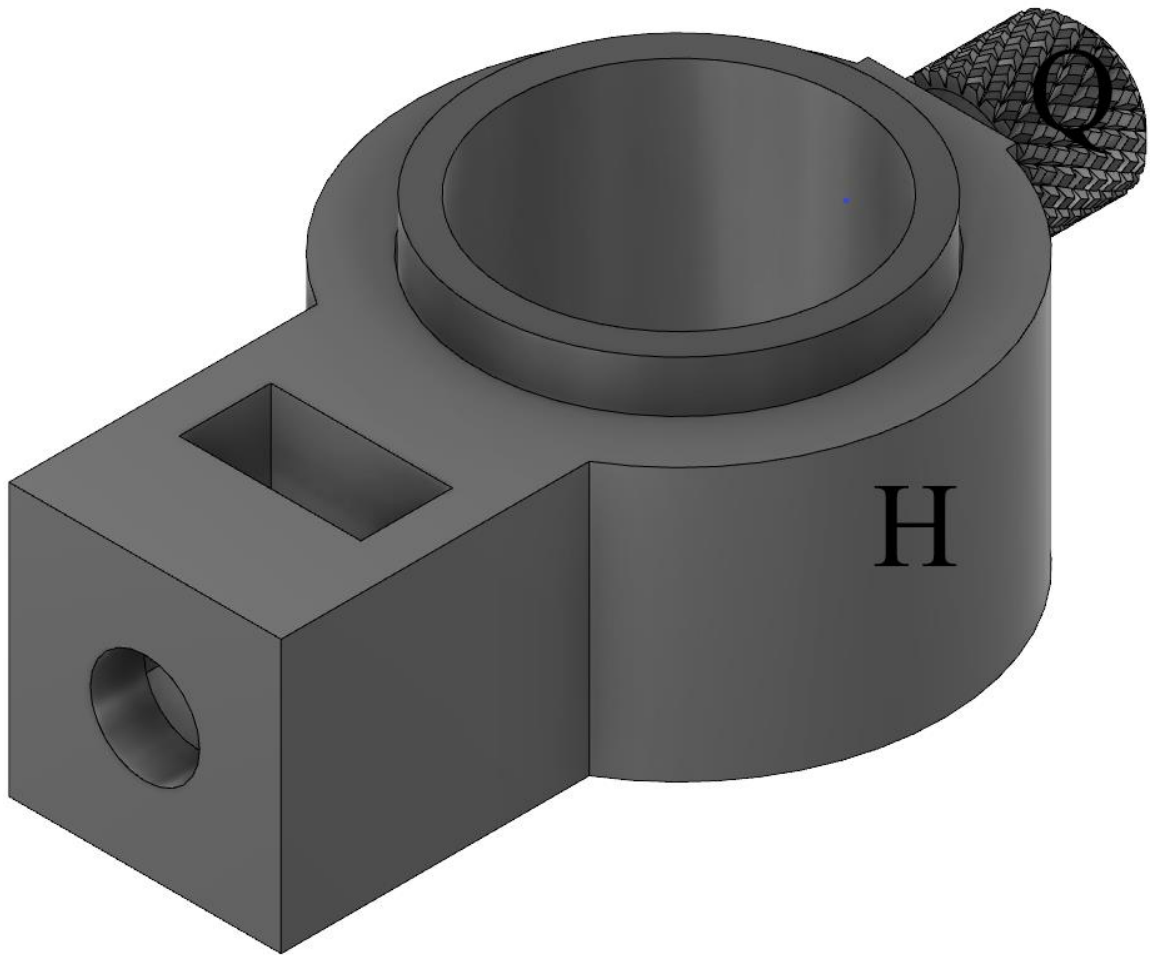
The rotating analyzer (F) consists of a main body, screw, and gear. The screw snaps into the body and acts as a manually operated worm drive for the graduated gear. The gear has a bracket on its backside to accept a standard 2-in square linear polarizing film. Rotating the screw will turn the gear and therefore the polarizer. This assembly can rotate a polarizer within the 5° graduations of the gear for polarimetry measurements.

(G) Ø0.5-in Optic Mount



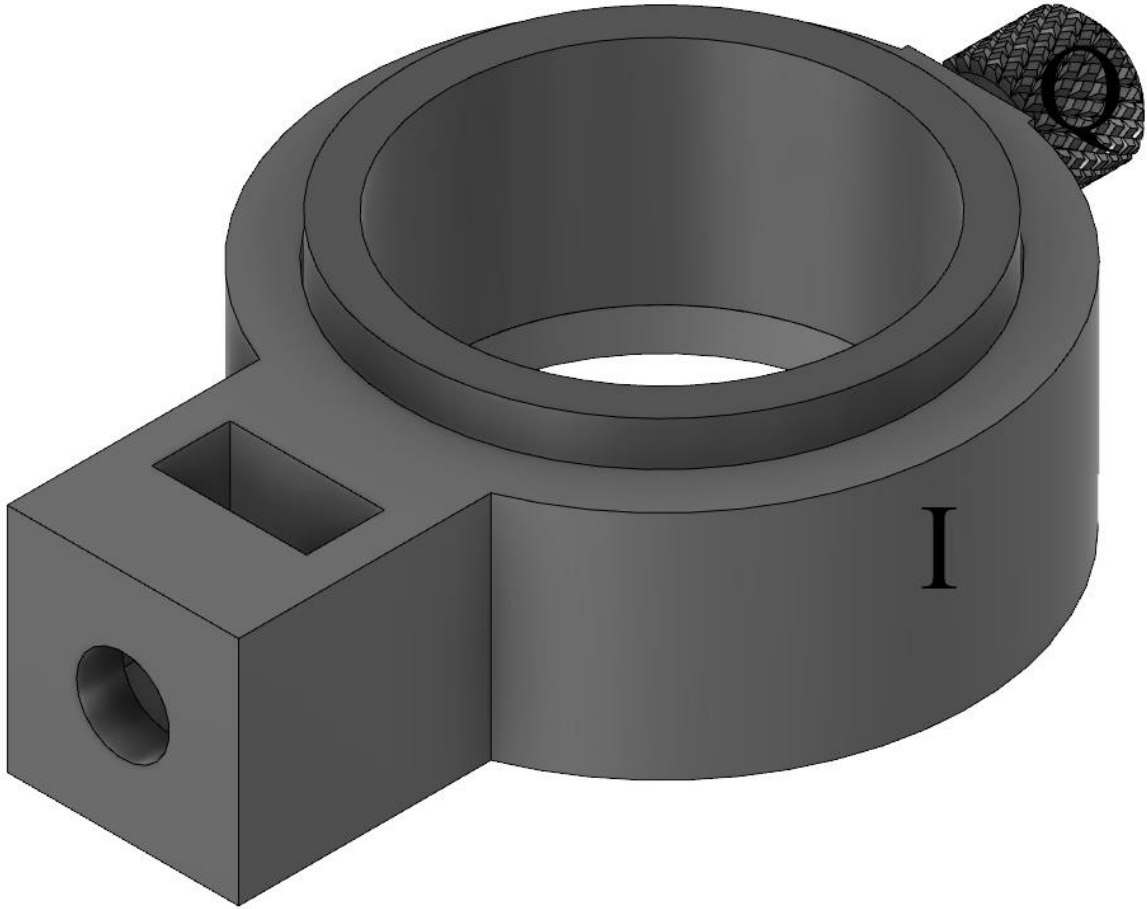
The Ø0.5-in Optic Mount (G) consists of a mount and insert. 0.5-in diameter optics of a variety of thicknesses can be mounted using the insert and a 1/4-20 Mount Screw (Q). Alternatively, an FDS100 photodiode can be mounted in this component by using the FDS100 Photodiode Sleeve (J).

(H) Ø1-in Optic Mount



The Ø1-in Optic Mount (H) is used to mount a variety of standard optical components such as filters, small lenses, and mirrors. 1-in diameter optics of a variety of thicknesses can be mounted using the insert and a 1/4-20 Mount Screw (Q).

(I) Ø1.5-in Optic Mount



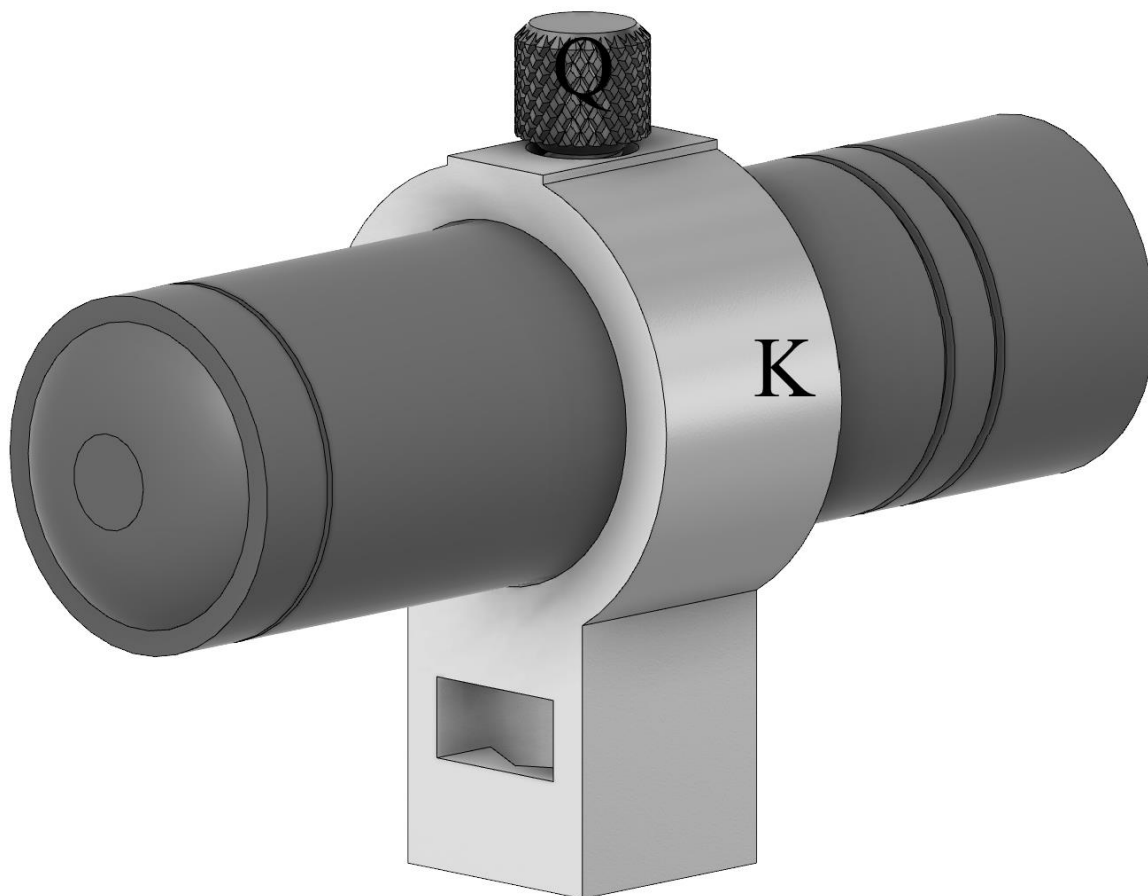
The Ø1.5-in Optic Mount (I) is primarily used to mount larger lenses or optical components. 1.5-in diameter optics of a variety of thicknesses can be mounted using the insert and a 1/4-20 Mount Screw (Q).

(J) FDS100 Photodiode Sleeve



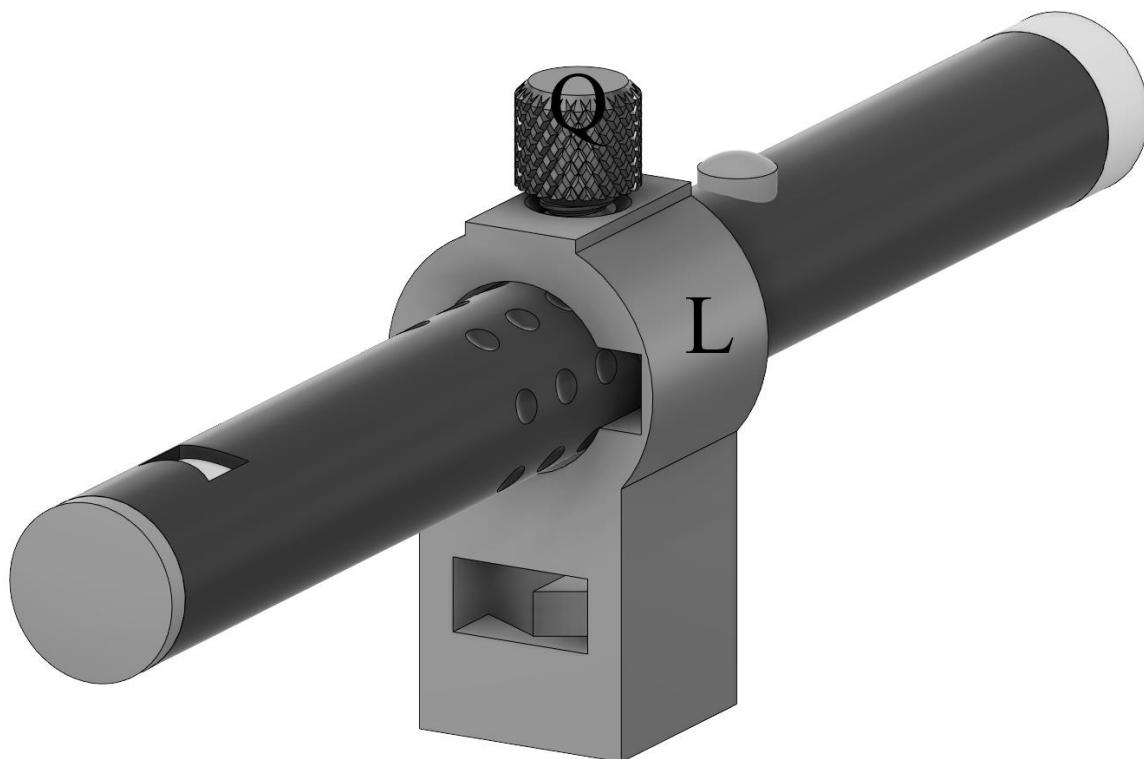
The FDS100 Photodiode Sleeve (J) is used in conjunction with the Ø0.5-in Optic Mount (G) to mount the FDS100 photodiode from www.Thorlabs.com/thorproduct.cfm?partnumber=FDS100. This photodiode is interfaced with Arduino using the example circuit from Figure 3-3 to produce analog measurements of light intensity for basic colorimetry, fluorimetry, and polarimetry experiments.

(K) LED Flashlight Mount



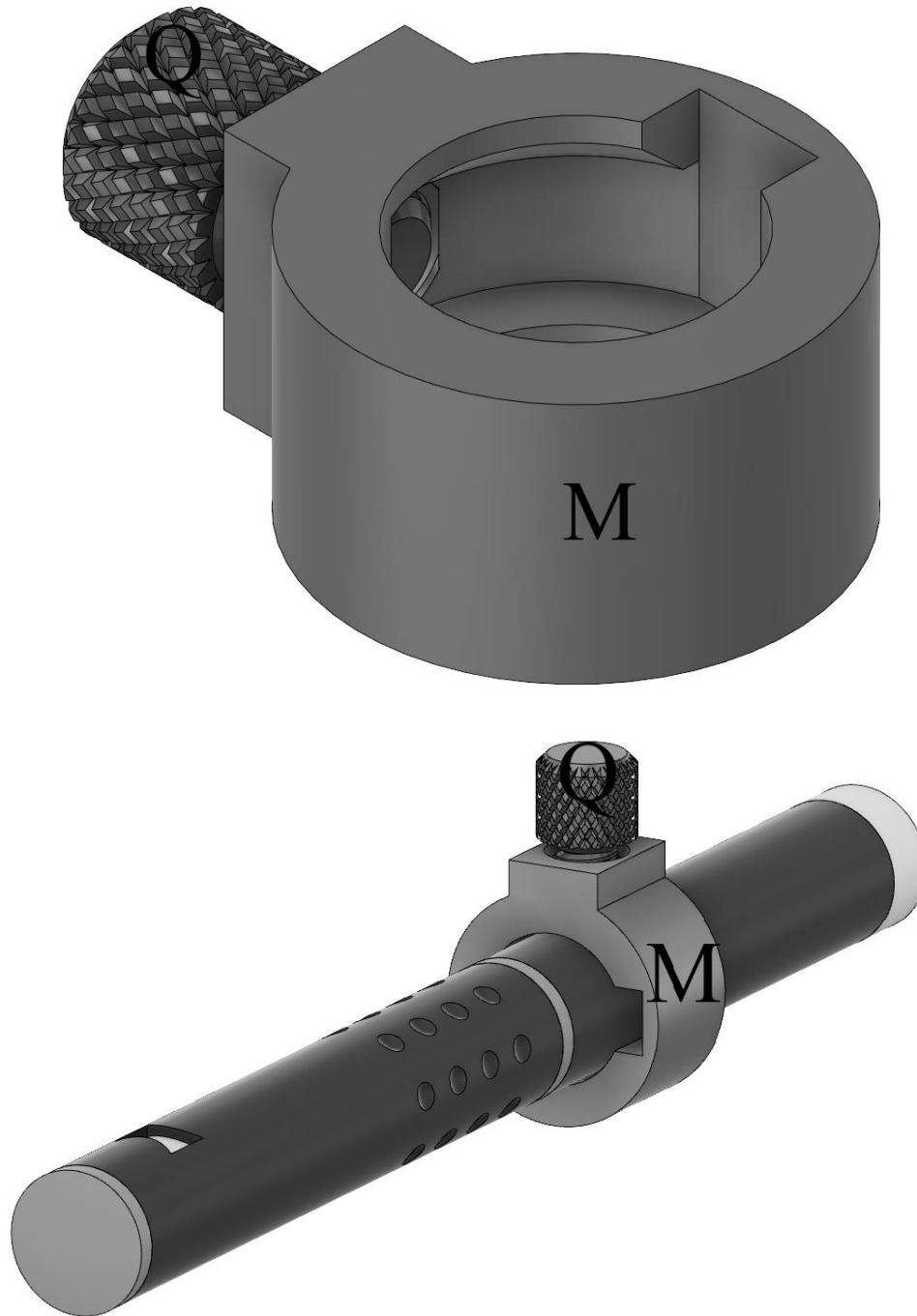
The LED Flashlight Mount (K) is used to mount a simple 25.5-mm diameter battery operated flashlight or device of similar dimensions. A 1/4-20 Mount Screw (Q) is used to clamp the flashlight in place. LED flashlights serve as broad spectrum point sources for spectroscopic experiments.

(L) Laser Pen Mount



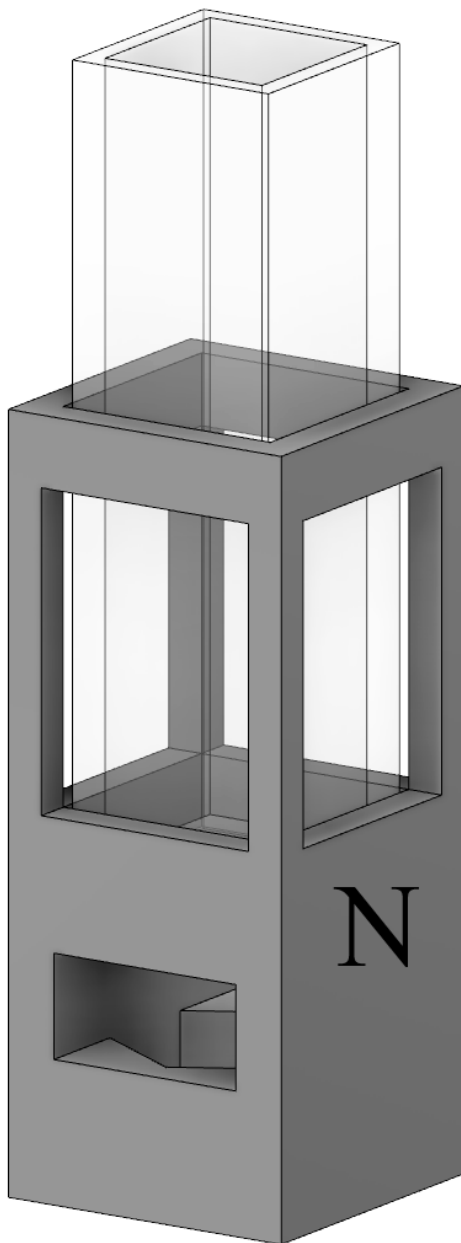
The Laser Pen Mount (L) is used to mount a 14.2-mm diameter battery-powered laser pen or device of similar dimensions. A 1/4-20 Mount Screw (Q) is used to clamp the laser pen in place. Laser pens serve as inexpensive monochromatic line sources for simple colorimetry, fluorometry, and polarimetry experiments.

(M) Laser Pen On/Off Toggle



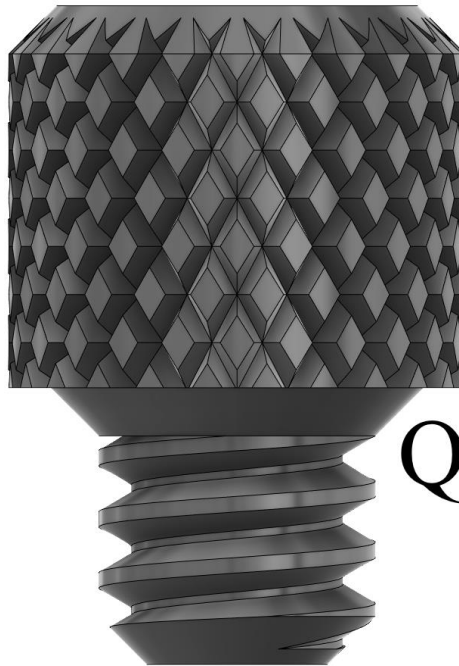
The Laser Pen On/Off Toggle (M) is used in conjunction with a laser pen and the Laser Pen Mount (L) to toggle the laser on and off. A 1/4-20 Mount Screw (Q) is used to depress the momentary switch on the laser pen.

(N) 1-cm Cuvette Mount



The 1-cm Cuvette Mount (N) is used to hold a standard plastic/quartz 1-cm sample cuvette. The open four-sided design is versatile and is used when analyzing liquid samples using colorimetry, fluorometry, polarimetry, and spectroscopy.

(Q) 1/4-20 Mount Screw



The 1/4-20 Mount Screw (Q) is used to directly fix the LED flashlight and laser pen light sources to their mounts, to clamp the backing insert of the (G), (H), and (I) optic mounts, and to depress the laser pen's momentary switch with the Laser Pen On/Off Toggle (M). This 3DP mount screw can be replaced by a similarly sized metal screw if available.