

Underwater Fiber-Optic Plane Irradiance Collector

User's Manual

Revision F, October 2018



Hōbi Instrument Services

www.hobiservices.com

Revisions

F—October 2018, improved illustrations, table of immersion factors.

E—July, 2015: New formatting and illustrations, notes about immersion correction.

D—May 1, 2008: Correct o-ring label on drawing

C—June 16, 2004: Change o-ring from 5-102 to 3mm x 1mm

B—June 16, 2004: Add explanation of air-optimized version, discussion of cable waterproofing.

A—June 13, 2003: First release

Introduction

The Hobi fiber-optic plane irradiance collector attaches to an SMA-terminated fiber optic cable to provide a cosine-weighted angular response to light under water.

When properly assembled, the collector protects the sensitive end of the fiber optic from water. Note that the fiber optic cable itself, supplied by the user, must also be constructed so as to prevent water from entering its own outer jacket. See below for an explanation of this.

For the most robust water seals, such as those used in the underwater cables built into HOBI Labs instruments, the collector includes mounting holes and an o-ring gland to allow mounting onto a larger watertight structure. Contact Hobi Instrument Services for assistance if you need further details about these features.

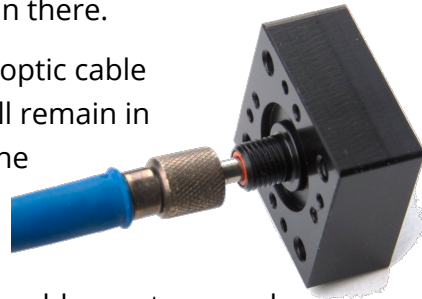
Attaching the collector to a fiber-optic cable

Water-tight connection to the collector requires an o-ring with internal diameter of 3 mm and thickness of 1 mm. Hobi recommends and supplies silicone o-rings that have an orange-red color, to make them more visible.



1. Place the o-ring in the groove of the connector. When properly placed, it will remain there.

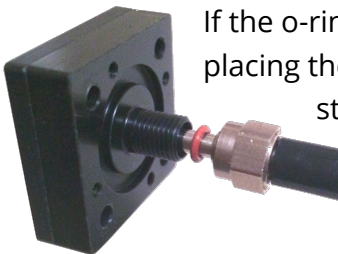
2. Gently insert the fiber-optic cable ferrule. Ideally, the o-ring will remain in place while you fully insert the ferrule, as shown at right.*



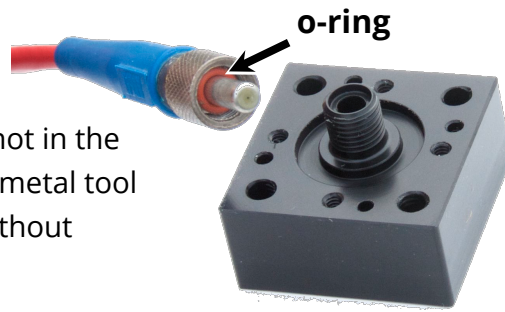
3. Tighten the threaded coupling nut on the connector **only with your fingers**. Other tools could overstress and damage the plastic threads on the collector.

* In some cases, the o-ring may jump out of the groove when you insert the ferrule.

If the o-ring will not stay in place, use this alternate method: start by placing the o-ring on the ferrule, then hold the threaded nut stationary while **rotating the collector**. That will ease the o-ring into the correct position.



When disconnecting a fiber cable from the collector, note that the o-ring will usually stay on the fiber ferrule (as shown at right), not in the collector. You may need to use a sharp, non-metal tool (such as a toothpick) to remove the o-ring without damaging it.



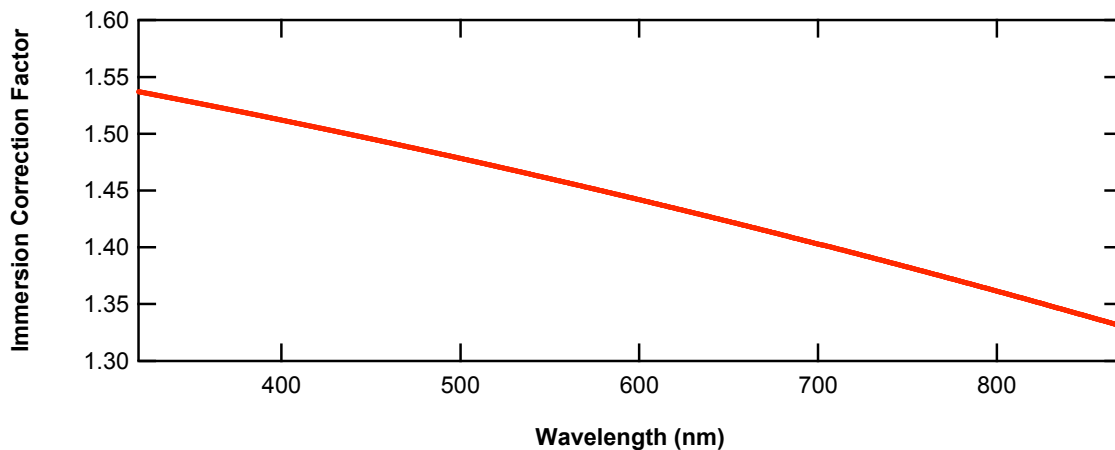
Precautions and Maintenance

- Cover the SMA fitting whenever the fiber optic cable is detached, both to keep it dry and to protect the threads.
- Use only fingers to tighten the connector.
- Clean with soapy water. Do not use acetone or other harsh solvents.
- After use in salt water, rinse thoroughly with fresh water, before removing fiber-optic cables.

Immersion Correction

When the light collector is immersed, the change in index of refraction from air to water decreases its transmission efficiency. If you have calibrated your system in air to indicate spectral irradiance, the immersion effect will cause the reported irradiance to be too low. You must multiply the indicated irradiance by a correction factor, which depends on wavelength.

Wavelength:	300	400	500	600	700	800	850
Immersion Factor:	1.54	1.51	1.48	1.44	1.40	1.36	1.33



Fiber Optic Cable Construction and Waterproofing

Most off-the-shelf cables are constructed with a waterproof outer jacket, but this alone does not guarantee the assembly is watertight. The SMA connector on the end of the cable must also be properly sealed at the time of manufacture. Most high-quality cables are sealed in this way. Further, water entry into a cable will not necessarily cause problems. Nevertheless it is best avoided, and users should be aware of the following considerations.

The most likely entry point for water is where the cable's outer jacket enters the fiber optic connector. This is normally covered by a strain-relief "boot" as shown below. This boot may or may not form a seal by itself.



SMA termination with boot



SMA termination with boot removed

The lower picture shows the blue jacket entering the metal part of the connector. At some point inside the connector the jacket ends, and if it is not sealed at that point, water may enter the cable. In high-quality commercial cables the connector is often filled with epoxy, encapsulating the jacket and providing an waterproof seal. However since the seal is internal the only way to be sure is to consult the manufacturer.

If in doubt, you can provide extra protection by sealing the ends of the boot, or even encapsulating it entirely, with a waterproof adhesive such as the silicone caulking that is used for sealing aquarium tanks.