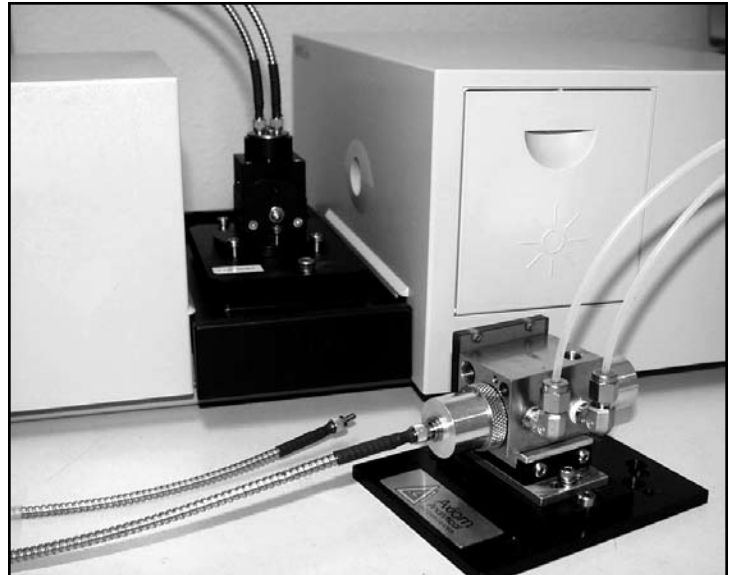


FNL Series

UV-Visible ATR Cells

Accurate spectroscopic analysis of chromophores and other strongly absorbing liquids.



Many dyes, aromatics, and other chromophores have absorptions in the UV and visible regions of the spectrum that are orders of magnitude too strong to allow transmission analysis without substantial dilution. However,

these substances can often be analyzed by means of attenuated total reflectance (ATR). Previous UV-Visible ATR devices have generally been in the form of probes employing sapphire prisms as ATR elements. While these probes work well for many applications, they are quite inflexible, being restricted to the use of sapphire with three reflections and a fixed angle of incidence. FNL Series ATR cells overcome this limitation by allowing the user to specify the element material (fused silica or sapphire) as well as the number of reflections (1 through 6) and the resultant angle of incidence.

FNL Series ATR Cells are closely related to Axiom Analytical's TNL Series mid-infrared Tunnel Cells. However, the FNL Series cells are modified for use with UV-Visible radiation and with ATR materials having relatively low indices of refraction. In particular, the optical geometry has been modified to allow near-grazing incidence at the element/analyte interface. By varying the incidence angle and the resultant number of

reflections, the sensitivity of a cell can be optimized for a given measurement task.

Optical Design

Figure 1 shows a cross section of model FNL-120H. The mechanical structure is similar to the TNL-120H mid-IR Tunnel Cell with the addition of a pair of fiber-optic collimators. However, in contrast to the mid-IR cell, the optical path within the ATR rod is determined by refraction at the ends of the rod rather than by reflection at the surface of a metallic cone. This enables the number of reflections and angle of incidence to be determined by specifying the appropriate cone angle on the rod ends.

Standard FNL Cells

Table 1, provides a list of standard models. These are specified by a combination of a three digit model number (120, 130, 131, or 132) and a group



Features

- Fiber-optic coupling to most UV-Visible spectrometers
- Response down to 200 nm
- Sensitivity set by interchangeable ATR elements
- Compatible with lab and process applications
- Rapid sample cleanout

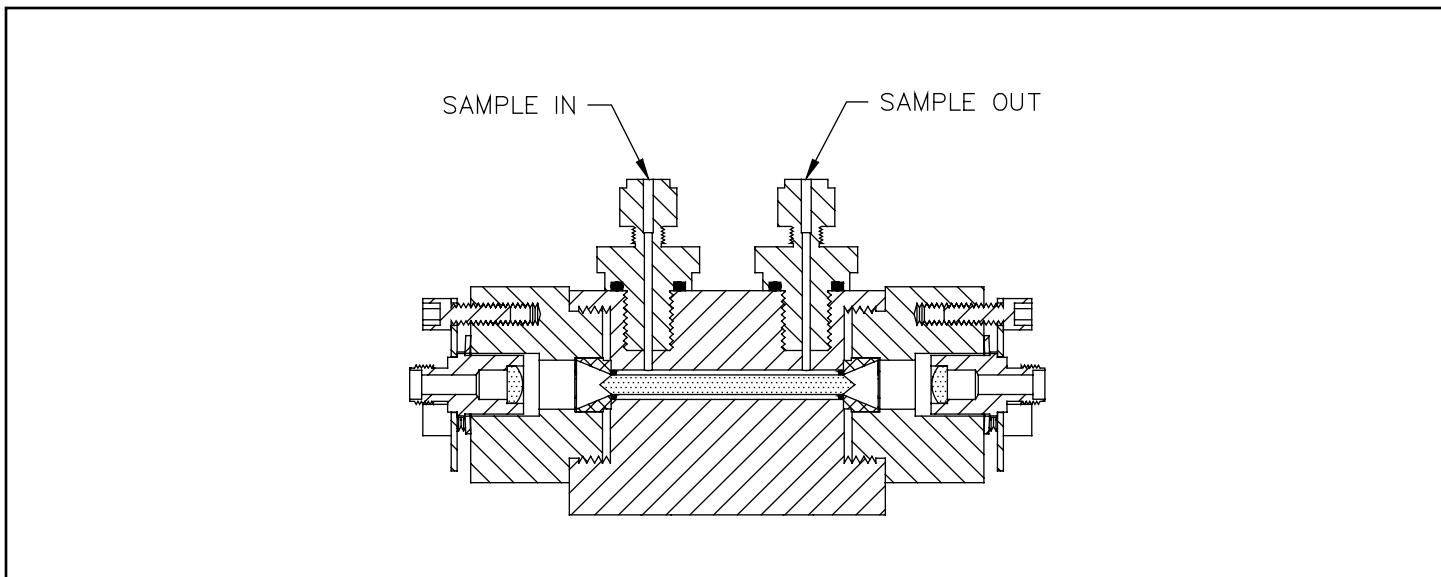


Figure 1: Cross-section drawing of a model FNL-130H UV-Visible ATR cell.

of suffixes in the following form: XY-N. The basic model number gives an indication of the element size and approximate sample volume. Letter suffix “X” indicates structural options such as standard helical flow housing, open boat, or high temperature. The number suffix “Y” is used to indicate the internal reflectance element material (Y = 7 for sapphire and 23 for fused silica). Finally, “N” indicates the number of reflections for the element selected.

Selecting the Best ATR Element For Your Application

The performance of an FNL Cell in a given application will depend on the number of reflections employed and on the relationship between the refractive index of the material being analyzed and the critical index listed in Table 1.

First, the refractive index of the analyte must be below the critical index. Otherwise, the light will not be “totally” reflected

at the interface and little or no signal will be obtained. Some non-polar solvents have refractive indices in the range of 1.5. Such substances will require the use of a sapphire element.

In cases where either element can be used, it is generally preferable to choose fused silica due to its generally better optical quality and better transmission past 250 nm. In either case, the absorbance sensitivity can be optimized for a given task by choosing the rod with the appropriate number of reflections. As the number of reflections is increased, the absorbance sensitivity will increase due both to the greater number of reflections and to the fact that the penetration depth of the light into the sample increases rapidly as the critical index approaches the analyte index.

For more information, or to discuss your specific application,

please do not hesitate to contact us at 1-800-goaxiom or visit us on the web at www.goaxiom.com.

References

Please see Technical Note AN-915 for a further discussion and typical applications examples (download from the Axiom website or call for a copy).

Table 1: Standard FNL Cell Models

	Element Dimensions (diameter x length)	Flow Volume	Liquid Fittings	Housing Options "X"
FNL-120XY-N	3.2 mm x 40 mm	40 μ L	10-32 HPLC	A, B, & H
FNL-130XY-N	6.4 mm x 82 mm	2 mL	$\frac{1}{8}$ " NPT Swagelok®	A, B, & H
FNL-131XY-N	6.4 mm x 82 mm	20 mL	$\frac{1}{8}$ " NPT Swagelok®	H
FNL-132XY-N	6.4 mm x 82 mm	75 mL	$\frac{1}{2}$ " NPT	H

Notes

- The model designations above include a suffix (XY), where "X" indicates the housing option and "Y" indicates the ATR element material.

Housing Options

X = A Standard helical flow geometry

X = B Open boat

X = H Cartridge heater and thermocouple (for use with **user supplied** commercial temperature controller)**Element Materials**

Refer to Table 2

- Tunnel Cells are delivered with mounting stands to match the sample compartments of individual spectrometers. **Please specify make and model when ordering.**

Table 2: Available FNL ATR Element Configurations*UV-Grade Sapphire Elements ($n_o = 1.80 @ 240 \text{ nm}$)*

"Y-N"	Cone Half Angle	Angle of Incidence	Number of Reflections	Critical Index (n_c)
7-5	38.5°	64.3°	5	1.62
7-6	32.0°	60.3°	6	1.56

UV-Grade Fused Silica Elements ($n_o = 1.48 @ 310 \text{ nm}$)

"Y-N"	Cone Half Angle	Angle of Incidence	Number of Reflections	Critical Index (n_c)
23-1	67.50°	82.5°	1	1.467
23-2	54.75°	77.7°	2	1.446
23-3	43.70°	72.9°	3	1.415
23-4	34.70°	68.5°	4	1.377