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## Temperature-Controlled Cuvette Holders for Spectroscopy

*We provide temperature-controlled single or multiple cuvette holders for almost any spectroscopic application. Choose from a wide assortment of models designed to stand alone or to fit your spectrometer.*

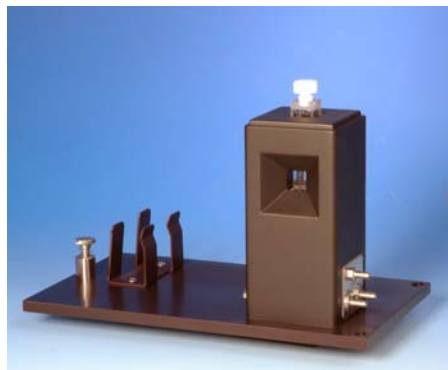
**Precision Peltier Temperature Control: -10.00 to +105.00 °C ( $\pm 0.02$  °C)**  
(with versions down to -55.00 °C or up to +150.00 °C)

### Features:

- Peltier control to make rapid, precise temperature changes.
- Rapidly ramp the temperature, slowing to give attention to important regions.
- Work at very low or very high temperature ranges.
- Use script control to automate temperature changes.
- Keep your sample homogeneous through vigorous magnetic stirring.
- Use a multi-cell holder and automate sample changing.
- Use a thermistor probe to record the internal sample temperature.

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### TLC 40 – Single Cuvette Holder for Absorbance

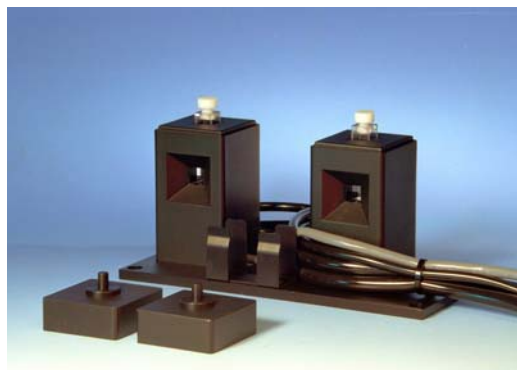


The TLC 40 is a single cuvette holder with a pair of optical ports on opposite sides of a square cuvette. It is used primarily for absorbance measurements.

- Variations are available to fit many different spectrophotometers.
- Variable speed magnetic stirring insures a homogeneous sample.
- Dry gas purge may be used to reduce condensation when working at low temperatures.
- An optional windowed cover is available for work at very low temperatures.

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### TLC 42 – Dual Cuvette Holder for Dual-Beam Spectrophotometers



The TLC 42 is a pair of cuvette holders identical to the TLC 40 driven independently by a single controller.

- The sample and reference may be maintained at the same or different temperatures.
- Each cuvette holder has magnetic stirring.
- Dry gas purge may be used to reduce condensation when working at low temperatures.
- Optional windowed covers are available for low temperatures.

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## TLC 50 – Single Cuvette Holder for Fluorescence



The TLC 50 is a single cuvette holder with optical ports on all four sides of the cuvette. It is used primarily for fluorescence measurements.

- Variations are available to fit many different fluorometers.
- A set of optical slits is included to limit excitation and emitted light.
- Variable speed magnetic stirring insures a homogeneous sample.
- Dry gas purge may be used to reduce condensation when working at low temperatures.

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## qpod™ – Sample Compartment for Fiber Optic Spectroscopy

The **qpod™** is a complete sample compartment for fiber optic spectroscopy, including a Peltier-controlled cuvette holder with magnetic stirring. The **qpod™** is constructed of a single molded housing. Components that deliver or collect light from the sample are provided with SMA fiber optic connectors enabling connection to light sources or spectrometers. The **qpod™** is available directly from us or from Ocean Optics ([www.oceanoptics.com](http://www.oceanoptics.com)), which can provide sources and miniature spectrographs that work very well with this sample compartment.

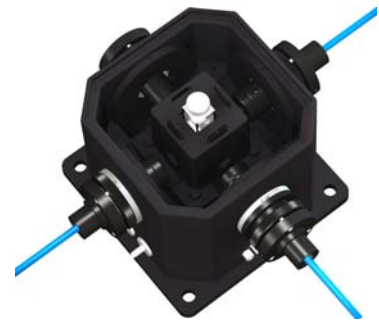
- High quality fused silica lenses, UV-enhanced front surface mirrors and plate polarizers
- Both focusing and position adjustments on all optical components
- Optical slits for limiting light access to the cuvette
- Filter holders for 12.5 mm diameter filters available for mounting on lens assemblies
- Variable speed magnetic stirring



**CUV-qpod-ABSKIT**  
absorbance



**CUV-qpod-FLKIT**  
fluorescence

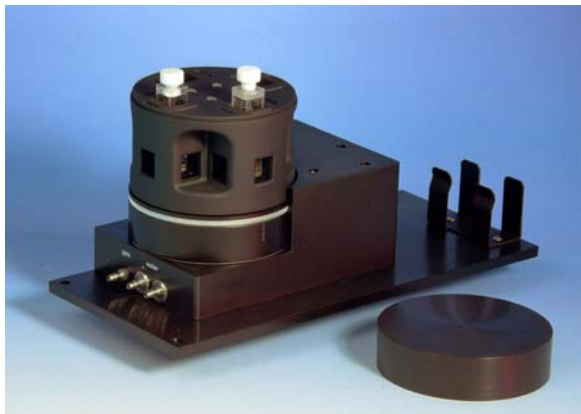


**CUV-qpod-MPKIT**  
multipurpose

The **qpod™** is available in three kit forms. The **CUV-qpod-ABSKIT** provides collimating optics to pass light straight through for absorbance, transmittance or turbidity measurements. The **CUV-qpod-FLKIT** provides imaging lens systems for excitation and detection of fluorescence emission at right angles. The **CUV-qpod-MPKIT** is a multipurpose kit with a combination of optics that may be used for either absorbance or fluorescence measurements. Additional filter holders and polarizers are also available.

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## TURRET 400 – Four Position Turret for Absorbance or Fluorescence



The TURRET 400 is a four-position rotating turret used for both absorbance and fluorescence measurements.

- Variations are available to fit many different UV/Vis spectrophotometers and fluorometers.
- A set of optical slits is included.
- Vigorous variable speed magnetic stirring under each cuvette insures homogeneous samples.
- Dry gas purge may be used to reduce condensation when working at low temperatures.
- The four positions are symmetrically identical leading to extremely uniform treatment of the four samples.

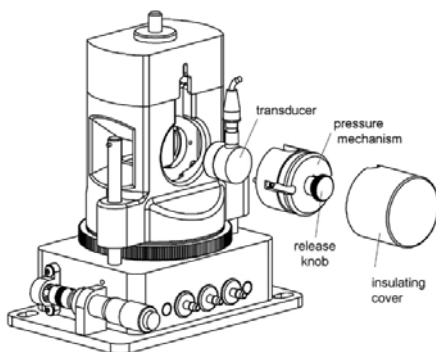
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## FLASH 300 – Cuvette Holder for Laser Spectroscopy



The FLASH 300 is a stand-alone instrument for laser spectroscopy. It is used for transient absorption, flash photolysis, fluorescence, and pulsed-laser photoacoustics. There are four optical ports, one on each side of the cuvette holder.

- Vertical adjustment can be used to match the height of the laser beam
- Micrometer-driven horizontal translation allows precise positioning of beams in the cuvette.
- An access plug can be removed for direct physical contact with the cuvette.
- Variable speed magnetic stirring is available.
- Dry gas purge may be used to reduce condensation when working at low temperatures.
- Optional windowed covers are available for work at very low temperatures.



The FLASH 300 with the photoacoustics option

Quantum Northwest specializes in instrumentation for pulsed-laser photoacoustics, and the FLASH 300 is frequently configured for this application. If you are interested in photoacoustics, please request special literature on this product line.

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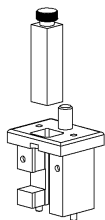
## CD 250 – Cuvette Holder for Circular Dichroism



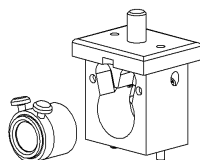
The CD 250 is a cuvette holder for circular dichroism.

- The cuvette holder body accepts a series of different cuvette carriages customized to different CD cuvettes.
- Variable speed magnetic stirring insures a homogeneous sample when using moderate volume cuvettes.
- Gas purge passes through a heat exchanger and may be used to isolate the cuvette from ambient air.
- Strain-free fused silica windows may be used to isolate the cuvette, leading to better temperature control, particularly for short path length cells.
- An optical port at 90° to the excitation beam may be used to measure fluorescence emission

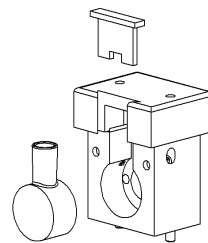
Three cuvette carriage options:



Carriage for a  
10 mm square  
cuvette



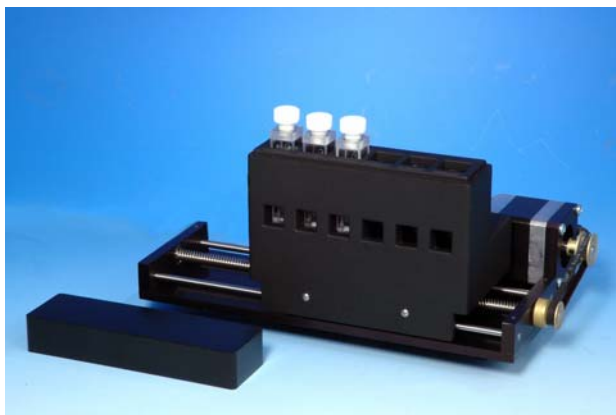
Carriage for a  
Hellma 121.000  
short path length  
cuvette



Carriage for  
a 10 mm  
cylindrical  
cuvette

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## LC 600 – Linear Cell Changer for Absorbance



Newest in the Quantum Northwest sample holder family, the LC 600 is a 6-position linear cell changer for use in absorbance instruments.

- Motor-driven horizontal translation chooses among six cuvettes.
- Optical slits may be inserted before each cuvette.
- Variable speed magnetic stirring is available under each cuvette.
- Dry gas purge may be used to reduce condensation when working at low temperatures.

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## Temperature Controllers

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### TC 125 – Single Temperature Controller

- Calibrated against a NIST-traceable thermometer
- Accepts a standard thermistor probe for monitoring the temperature of the sample
- Accepts serial instructions for remote control

A microcomputer-based temperature controller is included with each cuvette holder. The controller gain is set for a particular cuvette holder and the matched pair is calibrated against a NIST-traceable thermometer. Calibration data are provided.

Single cuvette holders such as the **TLC 40**, **TLC 50**, **FLASH 200** and **CD 250** are provided with a **TC 125** controller. The dual cell **TLC 42** cuvette holders use the **TC 225**, which independently controls the temperature of two cuvettes. The four-position **TURRET 400** uses the **TC 425** controller, which has four position buttons on its front panel to rotate the turret. The **LC 600** 6-cell linear changer is provided with a **TC 125** controller and cell changing requires external software control.

All controllers have provision for an external temperature probe that may be used to monitor the sample temperature. The controller accepts standard Series 400 and Series 500 thermistor probes.

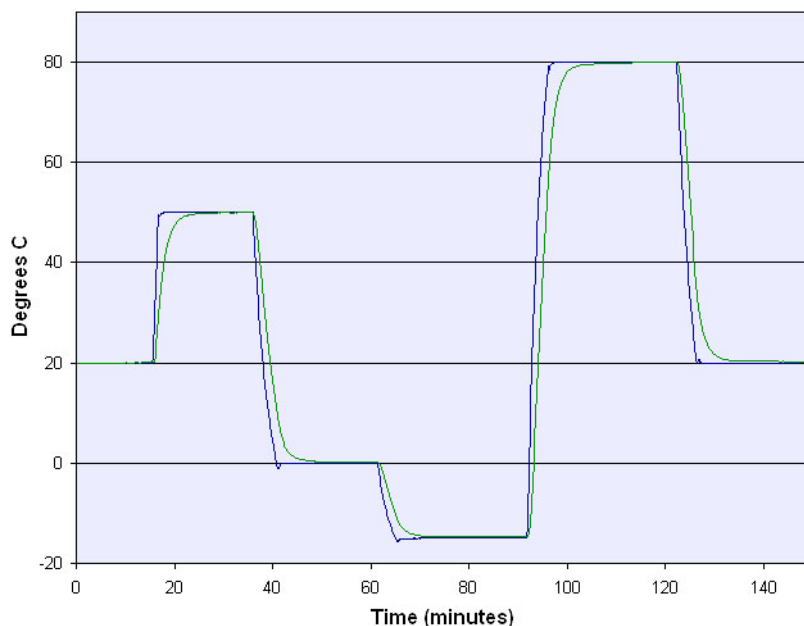
The temperature controllers may be connected to a computer using a USB cable. If you purchase the QNW Serial Control option, then you will be able to control the actions of the Controller remotely.

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## Performance

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Each cuvette holder is provided with a performance plot similar to that of Figure 1. Using the QNW Serial Control program, a script is run that sets and holds a series of temperatures. The blue line is the temperature of the body of the cuvette holder, a TLC 50. The green line is the temperature read on a probe placed in a cuvette in the TLC 50. Note the rapid temperature changes both ascending and descending.



**Figure 1** – TLC 50 performance

# Ramping Temperature

The Serial Control option may be used for complex temperature changes. For example, you may wish to ramp the temperature and record some spectroscopic property of your sample as a function of temperature. Since there may be regions of more interest than others, you may wish your programmed temperature changes to follow a complex pattern. For example, you might ramp up rapidly to a temperature below a critical transition, slow down during the transition to record more points of data and then speed up again.

The temperature controller understands a rich set of instructions. You may write a simple program that issues these commands, reads responses and gathers data from your spectrometer. Alternatively, you could purchase the QNW Serial Control program, which can communicate with the controller and plot sample holder and sample temperatures. The QNW Serial Control program runs in Windows. It has the capability to run pre-written series of commands called scripts.

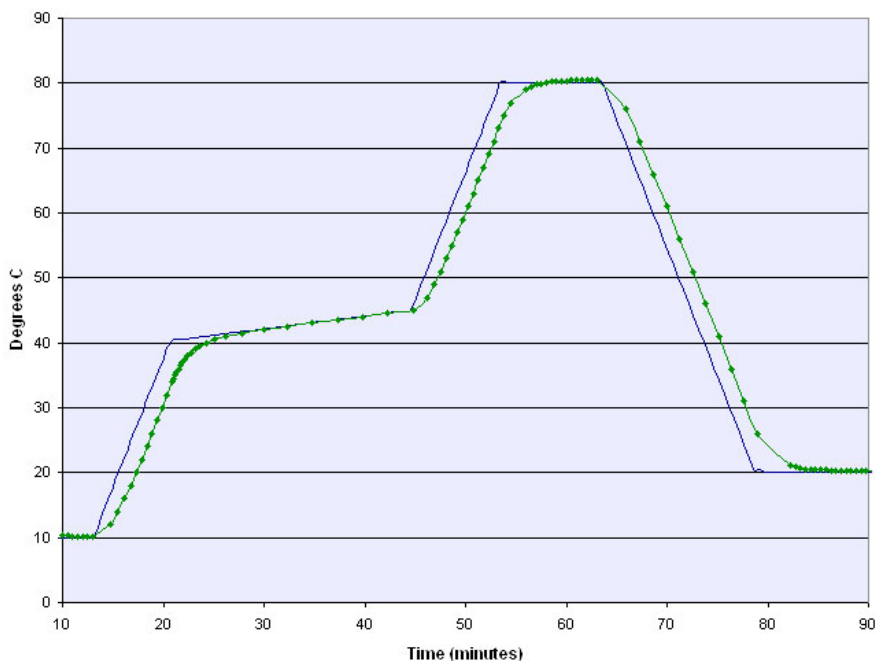


Figure 2 – temperature ramping with a TLC 50

Figure 2 shows the result of running a ramping script. The blue line represents the varying temperature of the sample holder body. The green line shows the temperature recorded by the controller from an external probe placed in the liquid sample. The points on the green line represent the times at which the controller has told

you or your spectrometer to record the spectroscopic property of interest. These points are every two degrees during the rapid ramps going up, every 0.5 degrees during the slow ramp and every 5 degrees coming down.

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•
•
•
•
[F1 PA S 2.0]    Set Automatic Probe temperature report to every 2.0
deg C.
[F1 PA +]       Turn on Automatic Probe temperature report
[*WTT>=40]     Wait until the target temperature reaches 40.00 deg C

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Second Ramp to 45:
[F1 RT S 4]     Set Ramping Temperature Interval to .40 deg C
[F1 RS S 12]    Set Ramping Time Interval to 12 seconds. Ramping rate
will be 0.5 deg C per minute.
[F1 TT S 45.00] Set Target Temperature to 45.00 deg C to start
ramping process.
[F1 PA S 0.5]   Set Automatic Probe temperature report to every 0.5
deg C.
[*WTT>=45]     Wait until the target temperature reaches 45 deg.

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Third Ramp to 80:
[F1 RT S 40]    Set Ramping Temperature Interval to .40 deg C
[F1 RS S 6]     Set Ramping Time Interval to 6 seconds. Ramping rate
will be 5 deg C per minute.
[F1 TT S 80.00] Set Target Temperature to 80.00 deg C to start
ramping process.
•
•
•
•

```

Figure 3 shows a section of the script that was run to generate figure 2. The commands themselves are enclosed in square brackets, while other text is used for documentation. The section of script that was used to generate the intervening slow ramp of Figure 2 is highlighted in red. Note how easy it would be to modify an existing script to generate a complex series of commands to automate your experiment.

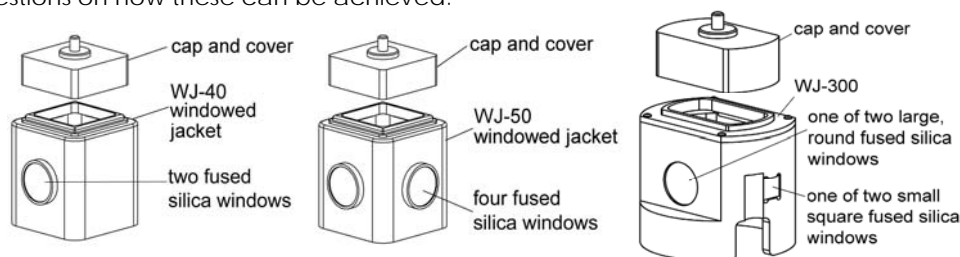
Figure 3 – a section out of the script used to generate Figure 2

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## Choices You Make on Ordering

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**Temperature Range** – The normal full control range for each of the temperature controllers is -55 °C to +105 °C  $\pm$  0.02 °C. Low temperatures achievable depend on the particular sample holder and how it is used. At any temperature below the dew point temperature, dry gas flow should be used to minimize condensation on cuvette windows. With dry gas flow and exposed to room air, the holders can generally be used down to about -10 °C. Within a spectrometer, where the moisture content of the environment can be controlled, they may be used to much lower temperatures down to about -25 °C. Below these temperatures it is necessary to provide additional insulation and optical windows to isolate the cuvette. We recommend the windowed jackets **WJ-40**, **WJ-50** and **WJ-300** on the **TLC 40**, **TLC 50** and **FLASH 300**, respectively for this purpose. Very low temperatures also require the use chilled cooling fluid to remove heat from the Peltier unit. Typically one uses methanol or methanol-water mixtures within about 25 °C of the temperature you wish to achieve. The single temperature holders have been tested down to -40 °C. If you require lower temperatures, contact us for suggestions on how these can be achieved.



Windowed Jackets for cold temperature operation of the **TLC 40**, **TLC 50** and **FLASH 300**

**High Temperature Operation** – Specify a /E after the model number if you would like to operate a **TLC 40** or **TLC 50** cuvette holder above 105 °C. This requires special firmware in the microcomputer of the temperature controller and special changes that replace or isolate heat sensitive components under the cuvette. Temperatures up to 150 °C may be obtained, although the upper range of temperatures should not be used for extended periods of time.

**External Serial Control** – The temperature controller may be controlled externally through a serial line to your computer. Unless otherwise specified, this will be through a standard USB connection. The controller responds to simple text instructions. External serial control can duplicate the functions provided by the controls on the front of the temperature controller. It also provides additional controls, including plotting, temperature ramping and scripting capabilities. **SER 2.2**, the serial control option, includes a cable, drivers and a Windows computer program, QNW Serial Control. QNW Serial Control will connect to the temperature controller and send instructions for its operation. It will monitor the temperature of the sample holder as well as a thermistor probe temperature of the sample, plot temperatures as a function of time and execute lists of text instructions called scripts. Modify one of the scripts provided, or write your own script to automate your measurements. Alternatively, you may write your own program to directly provide the text instructions to the controller. You might wish to do this if you want your program to also communicate with your spectrometer as well as the temperature controller.

**BATH 100** – The **BATH 100** is a submersible pump, plastic bucket and brass fitting that can be used as an inexpensive source of circulating water for the cuvette holders. Circulating water or other fluid is required to remove heat from the Peltier device when the temperature of the sample is lowered. For shipments overseas we provide the **BATH 100/OS** without the plastic bucket, because the bulk of the bucket increases shipping costs much more than the cost of a small plastic bucket purchased locally. As noted in the price list, the **Bath 100** or **BATH 100/OS** is already included in the price for sample holders for Varian and Ocean Optics.



**Beam Height** – The standard beam height for all of the cuvette holders (except the **CD 250**) is 8.5 mm above the bottom of the cuvette to match the dimension of a standard sized microcuvette. For a small additional cost, some of the versions of the **TLC 40**, **TLC 42**, **TLC 50** or **TURRET 400** may be made to accommodate a 15 mm beam height. Please inquire if you would like this modification.

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## Retrofitting Your Spectrometer

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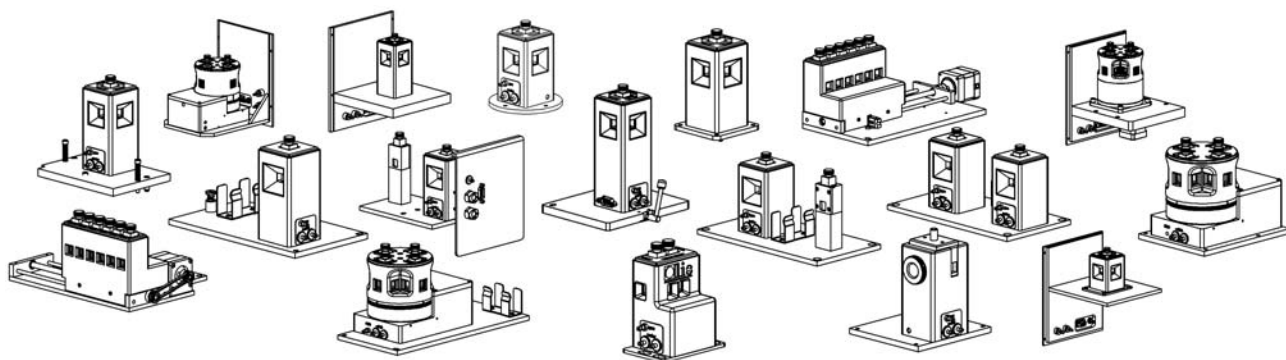
All sample holders are available in a basic, simple configuration. For a small addition cost, any of the holders may be also be purchased in a complete package that permits easy adaptation to a specific spectrometer.

Spectrometer adaptations typically include:

- preparation of the sample holder to the correct beam height
- a base plate of the correct size and hole pattern to mount in the spectrometer
- electrical connectors, cables, water and gas fittings and tubing to provide the utilities necessary to operate the Peltier unit

Many of the adaptations also include appropriate front panels and sample compartment floors for easy installation.

**Over 80 adaptations are currently available** (see the Spectrometer Price List). We will also be pleased to adapt a cuvette holder to your own special instrument at little additional cost.



**Two years parts and labor warranty on all equipment manufactured by Quantum Northwest**

(see web site for details)

Users of PTI fluorometers or the Varian Cary series spectrometers may visit the special sites describing temperature control options for these instruments (no www):

[pti.qnw.com](http://pti.qnw.com)

[varian.qnw.com](http://varian.qnw.com)



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[www.qnw.com](http://www.qnw.com)

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