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SAMPLEMAX

Universal Sample Compartment

User Manual

Part Number 81036 Rev A

Revised March 26, 1999

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About the Manuals

You may have more than one manual, depending on your system configuration. To find the manual that has the information you need, these guidelines may help.

- Each manual generally covers a product and the features and accessories peculiar to and/or contained within that product.
- Accessories that can be applied to other products are normally covered by separate documentation.
- Software that is exclusively used with one instrument or system is covered in the manual for that product.
- Software that can be used with a number of other products is covered in its own manual.
- If you are reading about a product that interacts with other products, you will be referred to other documentation as necessary.

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Overview of the SampleMax:

The SampleMax is a universal sample compartment designed for a variety of sampling needs, including absorption, reflection, fluorescence, and photoluminescence measurements. Designed to hold thin films, liquids, and solid samples, the SampleMax easily attaches to ISA light sources, accessories, and spectrometers.

A diagram of the standard SampleMax as used in an absorption measurement is presented in Figure 1. Because of the versatility of the sample compartment, several other types of measurements are possible, many using other configurations. For example, reflection measurements would have the entrance and exit optical axes at a 90° angle, and the accompanying optical rails and lenses would reflect this option. The material (glass or quartz) and focal length of the lenses may also be selected to fit the application.

The SampleMax attaches directly to the entrance and exit slits of the TRIAX Series of spectrometers. The SampleMax also attaches to the M-series instruments, as well as to older ISA spectrometers, such as the 270M, 1680/81, 340, and HR460. Any of the standard ISA accessories and detectors, such as the 100F, 120F, PMT detectors, and the

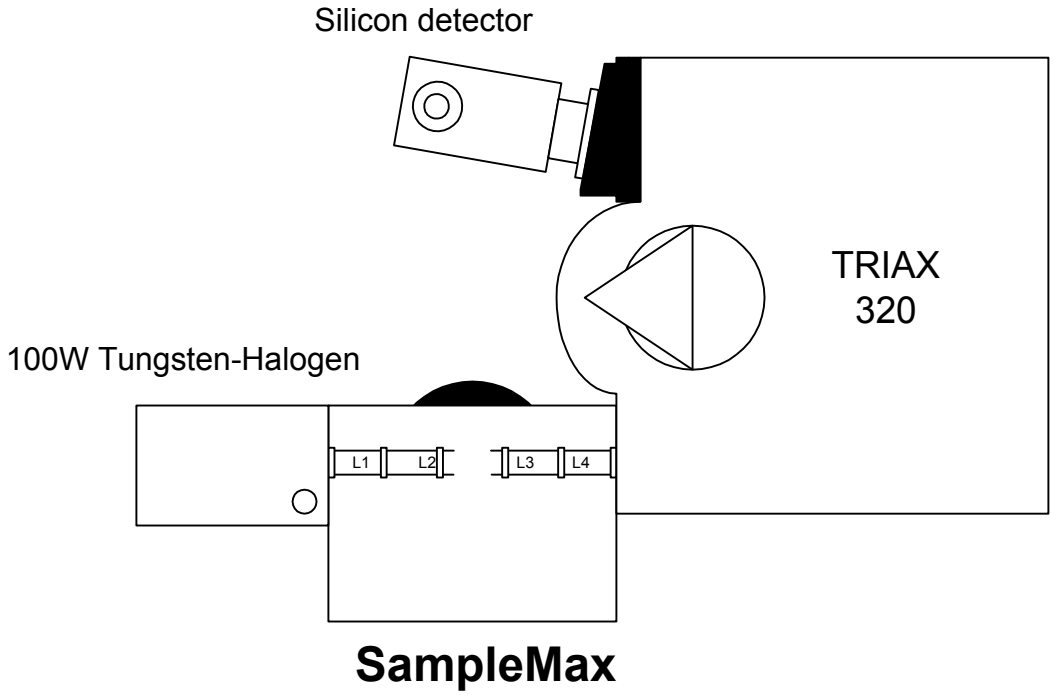


Figure 1. SampleMax in an absorption experiment

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220NSA slit adapter, will also mount directly to the ports of the sample compartment. For other adapters, see the **Appendix**. There are no electrical parts and few mechanical adjustments in its operation. The optical design allows for very little stray light.

Several options are available in addition to the basic system. The standard SampleMax includes a cuvette holder (Figure 2) for liquid samples, two optical rails of the user's choosing, and two lenses. Part numbers for options are listed below:

Part number	Description
ASC-VIS	SampleMax with glass lenses for measurements in the visible and near-IR regions of the spectrum
ASC-UV	SampleMax with quartz lenses for measurements in the ultraviolet, visible, and near-IR regions of the spectrum
ASC-SSOL	Solid sample holder (see Figure 3)
ASC-STUR	External turret wheel to allow for easy movement of the sample holder into the appropriate position for measurements
ASC-ORAIL	Rail mount assembly for third optical axis
ASC-SXZ	X-Z stage with micrometer control for the sample holder
ASC-VIS**xxx**	Additional glass lens, where **xxx** is the positive focal length (e.g., ASC-VIS40)
ASC-UV**xxx**	Additional quartz lens, where **xxx** is the positive focal length (e.g., ASC-UV60)
ASC-1679	External variable slit with height limiter
1920	Quartz cuvette
1925	Stoppered quartz cuvette

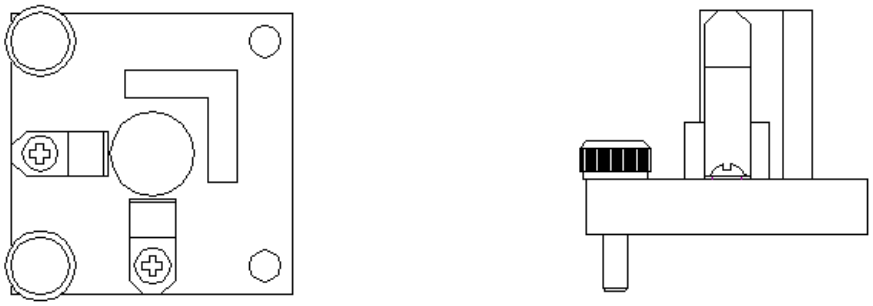


Figure 2. Cuvette holder

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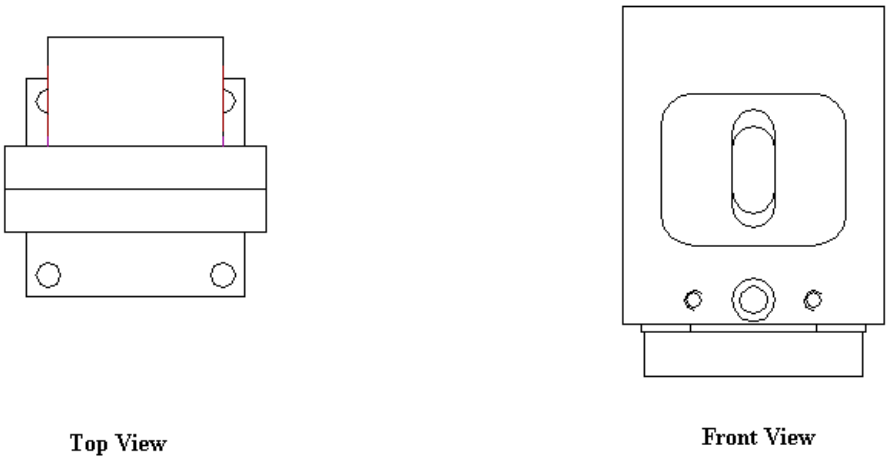


Figure 3. Solid sample holder

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Getting Started:

The first step in using your SampleMax is determining its location in the experiment. If unsure about how to fit the sample chamber among the other instruments, consult the **Experiments** section later in this manual for some examples. Because all ports may be used as either entrance or exit ports, you have some flexibility with regard to absorption and reflection experiments. For photoluminescence and fluorescence measurements using a laser, the front cover hole should be exposed to allow the beam to enter the sample chamber. If you have custom modifications made on your SampleMax, consult ISA for assistance in configuring your system.

Attach the feet included with the SampleMax and adjust them so that the chamber is level and that the height of the ports matches those of the attached instruments. From the top view, screw the feet clockwise to raise the height and counterclockwise to lower it. Place the mounted lenses in the optical rails at the approximately correct location (see the section on **Lens Configuration** later in the manual).

Instrument Mounting

TRIAX Series

- Remove the SampleMax cover to access the four screws that secure the Mounting Adapter to the wall of the SampleMax.
- Remove the Mounting Adapter.
- Using two 6/32" cap head screws, secure the Mounting Adapter to the TRIAX slits.
- Using the four screws previously removed, re-secure the Mounting Adapter to the SampleMax.

M-Series Instruments

- As with the TRIAX Series, remove the Mounting Adapter.
- Secure the ASC-1451 M-Series adapter to the M-Series entrance slit using the bolts provided.
- Using two 6/32" cap head screws, secure the Mounting Adapter to the ASC-1451.
- As with the TRIAX Series, using the four screws previously removed, re-secure the Mounting Adapter to the SampleMax.

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Sample Placement:

For all types of samples, it is important that the main sample stage be in the correct position. Normally, without the optional external turret rotator, this position will be set during the calibration of your system at ISA. For a SampleMax with the external turret rotator, ensure the proper position by rotating the turret wheel from the inside until the stage locks. Then, using the appropriate sample holder, mount the sample accordingly.

Cuvette

For liquid samples in a cuvette, it is important that the entrance and exit faces be clean and clear. The outer faces may be cleaned using methanol and lens tissue. By no means should there be fingerprints on any surface to be illuminated. To probe only the sample inside the cuvette, the walls must be transparent to the light. For this reason, UV measurements should include quartz cuvettes, as ordinary glass cuvettes will absorb ultraviolet radiation. If for some reason, the cuvette is not 100% transparent to the light and you are making transmission measurements of the sample, you may make a correction that takes this factor into account. This procedure is covered in the **Experiments** section later in the manual.

To place the cuvette into its sample holder, slide it gently between the two flexible metal clips and the solid retaining pieces on the stage until the bottom of the cuvette is flush with the stage. Be sure that the optical faces are in the proper location for the application (i.e., facing the light paths). For transmission measurements, the walls of the cuvette should be perpendicular to the optical axis and on opposite sides of the cuvette (Figure 4). For most fluorescence experiments, the optical walls should be adjacent at right angles to each other and also perpendicular to the optical axes (Figure 5). For laser-induced fluorescence experiments where absorption of the fluorescent light by the sample is a concern, the excitation and fluorescence light should be transmitted to the same single optical wall, which is 45° to each optical axis (Figure 6).

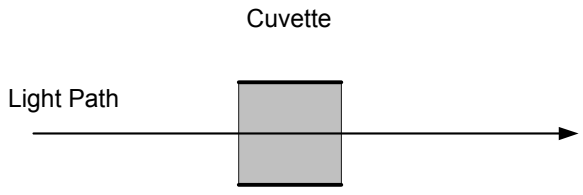


Figure 4. Transmission light path using cuvette

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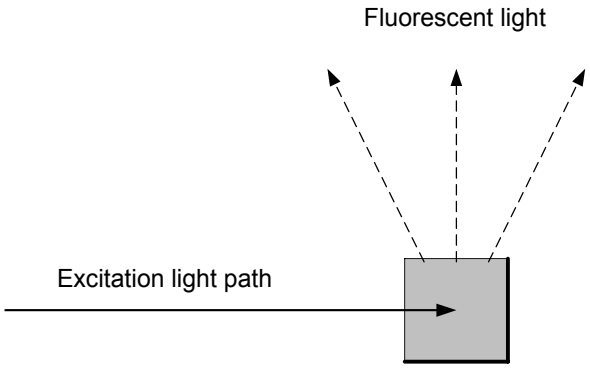


Figure 5. Fluorescence light paths using cuvette

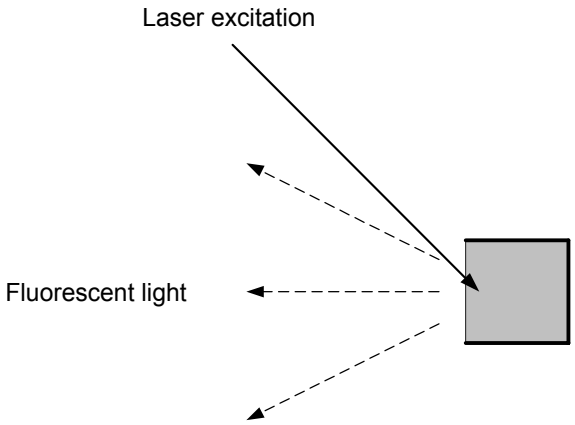


Figure 6. Single face cuvette laser-induced fluorescence light paths

Solid Sample Holder

The solid sample holder has an aluminum base with a spring-loaded metal piece to hold the sample in place. Simply place the solid sample between the plate and the holding piece so that the maximum amount of the sample is visible through the hole in the aluminum portion (refer to Figure 3).

Once the lenses are aligned and light provided to the system, one should check that the sample is in a position of maximum illumination. If you have the optional X-Z stage, you may change the micrometer position instead of moving the sample within the holder. Provided with the solid sample holder are two flexible metal clips. One of these pieces covers the hole on the aluminum piece and is better for holding the sample for reflectance and fluorescence measurements. The other piece allows for light transmission through

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the hole in the sample holder and is recommended for transmission measurements. Using the former, the sample holder should be placed so that the sample is 45° with respect to the optical axes (Figure 7). With the latter holder, the front of the sample holder (i.e., the end without the spring-loaded piece) should face the light source (Figure 8). If the metallic holding clip faces the entrance, you may get unwanted scattered light off of it. Tighten the sample holder to the SampleMax using a small 4/40 screw to ensure a stable position.

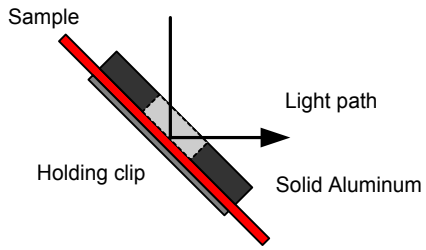


Figure 7. Reflection light path with solid sample holder

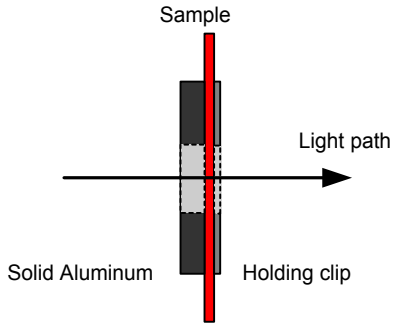


Figure 8. Absorption light path with solid sample holder

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Lens Configuration:

Single Lens Configuration

This configuration refers to a single lens both before and after the sample. Depending on the application, alignment using the standard SampleMax package typically involves moving two lenses, one before the sample and one afterward, along the optical axis. Once the sample is in place in the appropriate holder and the input light source has been introduced, proper adjustment of the lenses should provide the best possible throughput and sample illumination for this particular configuration. Figure 9 below provides a representation of a well-aligned SampleMax for an absorption experiment using a cuvette holder.

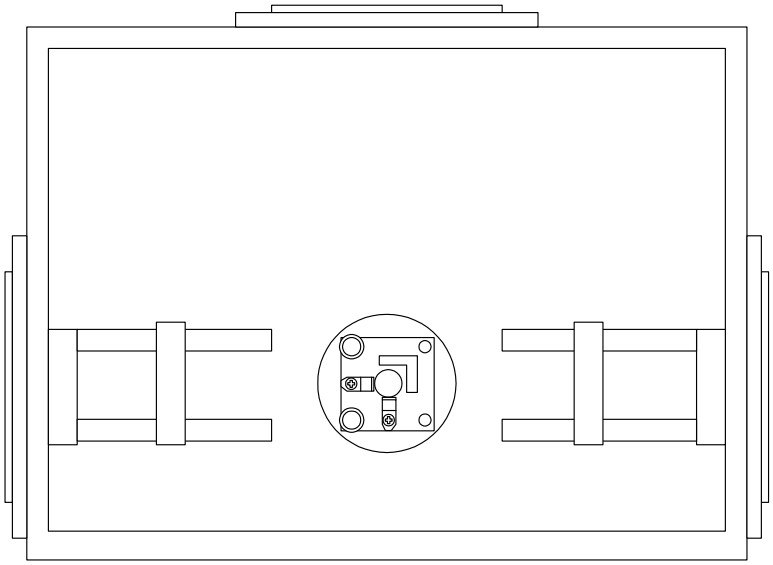


Figure 9. SampleMax single lens configuration

For many applications, the light at the sample should be focused so as to maximize the intensity of the light there and avoid clipping on the sample holder. If the input light is collimated, as in a laser source, this lens should be placed on the optical rail at a distance from the sample equal to its focal length. Using a business card to observe the beam size at the focus, move the lens until the beam is smallest at the location of the sample. It is probably helpful to remove the sample from the compartment for ease of alignment. Once the optimal location for this lens is found, tighten the set screw to the optical rail to lock its position.

If the input light is diverging, as in a point source, positioning of the lens to focus the light at the sample is a bit more complicated. See the section on **Optical Considerations** for a more detailed discussion of lens optics. The goal of minimum spot size at the

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sample remains the same, however. Without any further knowledge of optics, one may simply move the lens until this condition is met. Again, alignment generally works best without the sample in the sample compartment. For collimated light at the sample, place the lens at a distance from the point source equal to the lens' focal length.

After focusing at the sample, the beam begins to diverge, but most applications require focusing at the output of the sample compartment. Using the second lens at the appropriate distance from the sample, the collected light should be focused at the output port. As with focusing, it is not necessary to know the optical equations involved, but such information is presented in the **Optical Considerations** section. It is sufficient to move the lens along the optical rails until the focused light is visible at the output using a business card. For 180° configurations (i.e., as in transmission measurements), removing a relatively opaque sample should help in exit alignment. For 90° experiments (e.g., reflectance measurements), using a mirror or other relatively high reflector in place of the sample should similarly aid output alignment. For collimated light at the sample, simply place this second lens at a distance from the exit target (e.g., the entrance slit of the monochromator) equal to the lens' focal length.

Dual Lens Configuration

For the maximum throughput and f/# matching, one should use four lenses, two before the sample and two afterward. Figure 10 presents an optical diagram of the SampleMax used in a fluorescence measurement with a dual lens configuration. If the input light source is a point source or divergent in any way, it is generally recommended to collimate

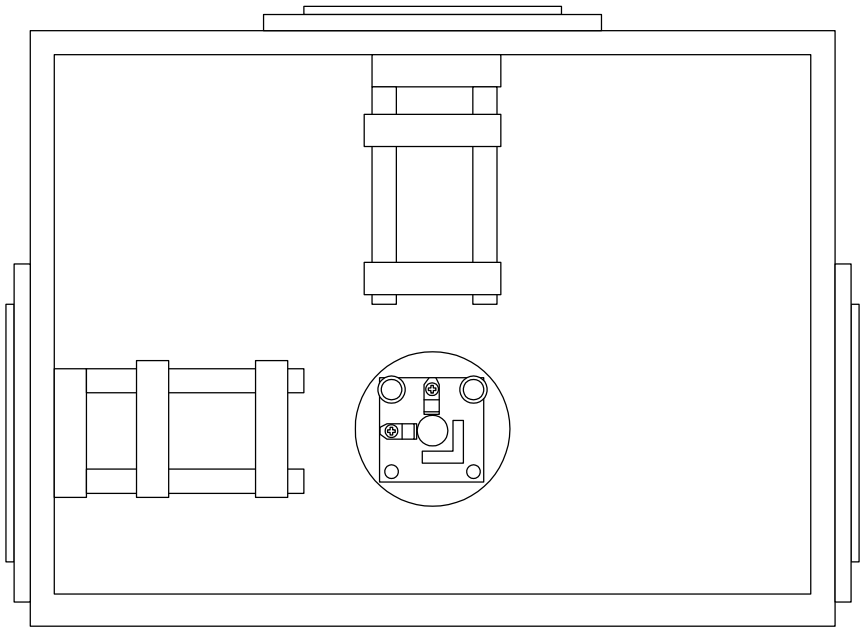


Figure 10. SampleMax with dual lens configuration

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this light. Collimated light neither diverges nor converges, but retains its diameter along the optical axis. Collimation involves putting the first lens closer to the sample than in the two-lens configuration, thereby collecting more light from the source. Using the plano-convex lens supplied with the SampleMax, this lens should be moved along the optical rails until the image is the same size at any distance after the lens. If necessary, remove any other lenses and the sample from the SampleMax and use a business card to observe the image over several centimeters. If the input light originates from a point source or diverges from a slit, the distance between this origin and the lens should be equal to the focal length of the lens (e.g., a +60 mm lens should be placed 60 mm away from the slit of a spectrometer before the SampleMax). Fine adjustments should be made for collimation. Once you have collimated the light, tighten the set screw and put the focusing lens into place. If the input light source is already collimated (e.g., as for a laser), this lens is unnecessary and should generally not be used.

As with a two-lens system, focusing requires a plano-convex or biconvex lens with a positive focal length (typically +40 mm plano-convex for those supplied with the SampleMax). If the light incident on this lens is collimated, place the lens on the optical rails at a distance equal to the focal length of the lens. Adjust for minimum spot size at the sample to ensure the tightest focusing there.

After the sample, the focused light will diverge and should be collimated again for maximum throughput of the output and/or f/# matching of a spectrometer at the output port. Place another plano-convex lens after the object at a distance equal to the focal length of the lens. Usually, this lens will be of the same focal length as the focusing lens. Check for collimation as with the input light source, and tighten the set screw on the mount to secure the lens position.

Finally, this collimated light may be focused to a position outside of the sample compartment, for example to a slit of a spectrometer. Again, the distance from the lens to the desired focused position should be equal to the focal length of the lens. More precise measurements may be made using a business card. For a more detailed discussion of optical considerations, please consult the following section.

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Optical Considerations:

For the sake of this discussion, there are two types of lenses: those of **positive focal length** and those of **negative focal length**. Positive focal length lenses can both focus collimated light and collimate diverging light (Figure 11). Negative lenses can collimate converging light and expand collimated light (Figure 12). The lenses in a SampleMax are generally of positive focal length.

Other than the material that comprises the lens, there are two important parameters associated with lenses – the **diameter** and the **focal length**. The diameter refers to the long diameter perpendicular to the optical axis. The focal length is a measure of how tightly a lens focuses. The focal length is given as the distance from the focal point the lens must be to collimate the light (for a diverging source) or focus the light (for a collimated source). A collimated laser incident on a lens with a +60 mm focal length lens will be focused 60 mm beyond the lens.

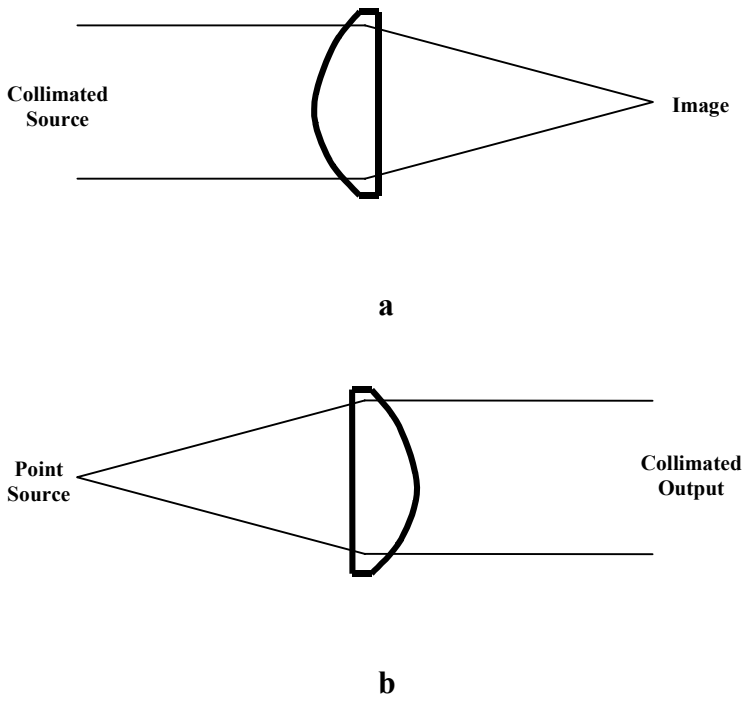


Figure 11. Positive focal length lenses.

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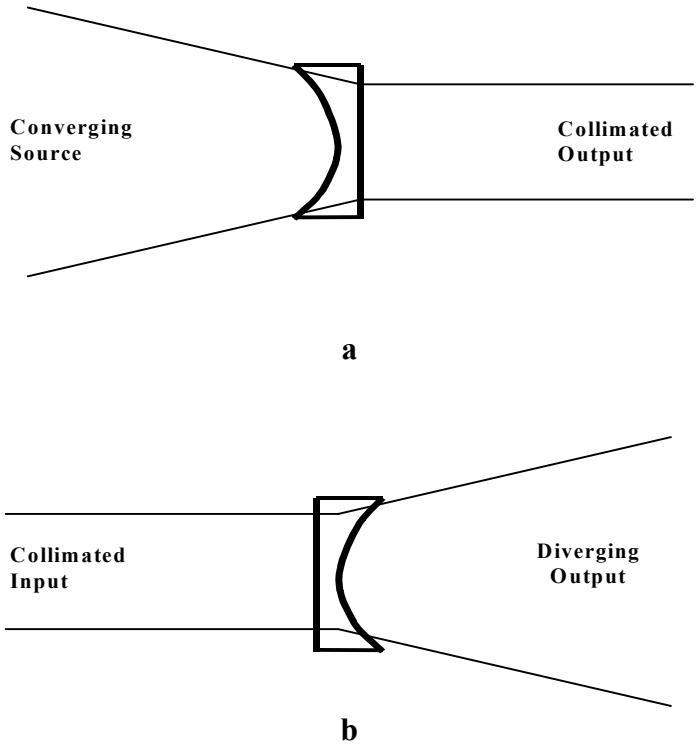


Figure 12. Negative focal length lenses.

Basic Lens Equations

Single Lens Configuration

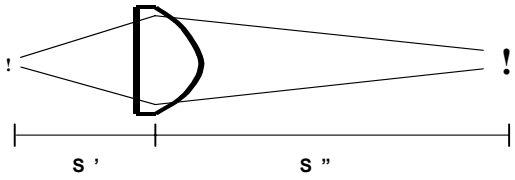


Figure 13. Single lens with light source.

Referring to Figure 13, the basic lens equation for focusing is as follows:

$$\frac{1}{f} = \frac{1}{s'} + \frac{1}{s''},$$

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where *f* is the focal length of the lens, *s'* is the distance between the object and the lens, and *s"* is the distance from the lens to the projected image. A divergent light source 60 mm away from a lens with a 40 mm focal length lens would focus 120 mm away from this lens. For a collimated source, *s'* is infinite and *f* = *s"*. Similarly, a lens placed at a distance *f* from a point source will collimate the light. If the lens is placed closer to the light source than the focal length of the lens, *s"* is negative, and the light will not focus.

Another factor to consider involves magnification of the image. In Figure 13, the image of the source is larger than the source itself because *s"* is longer than *s'*. The magnification ratio can be expressed simply as follows:

$$m = \frac{s''}{s'}$$

For a tighter focus, the magnification should be kept to a minimum and the single lens moved closer to the focal point. For greater collection of light from a diverging source, however, the lens should be placed closer to the source, thereby increasing the magnification at the focal point. Because of the compromises that are sometimes made using a two-lens system, one might consider a four-lens configuration as a superior alternative.

Note: For a given diameter, shorter focal length lenses present more spherical and spatial aberrations. Larger diameters help reduce these aberrations, but the cost is greater.

Dual Lens Configuration

With a single lens system, the lens collects a diverging light source and focuses or collimates. With a dual lens system, the first lens collects and collimates the light and the second focuses it. The advantages of such a system are better collection efficiency and throughput, tighter focusing, and added flexibility within a fixed distance between light source and focal point. Single lens principles apply to each lens when configuring a dual lens system. To collimate a divergent light source, place the first lens away from the source at a distance equal to its focal length. Then, focus the resulting beam by placing the second lens away from the focal point a distance equal to its focal length. The minimum distance between light source and focal point is equal to the sum of the focal lengths plus half the thickness of the lenses. With two *f* = +60 mm focal length lenses, one can focus light about 125 mm and up from the focal point. With a single *f* = +60 mm lens, this distance must be at least 240 mm.

Magnification with a dual lens configuration occurs when the focal lengths of the lenses are different. The equation that determines the magnification is as follows:

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$$m = \frac{f_1}{f_2}.$$

In this equation, f_1 is the focal length of the first lens and f_2 is the focal length of the second lens. If the second lens has a shorter focal length than the first lens, the spot size at the focus will be smaller than that of the original source.

F/# Matching

The f/# of a system can be given by the simple relation:

$$f/\# = \frac{d}{l}$$

Where d = the diameter of the optic and l = the distance from the focus to that optic. As Figure 14 shows, a larger f/# (with f/2 "larger" than f/4 because of the inverse relationship) has more divergence in the light beam and is considered "faster", signifying greater throughput. The angle θ is smaller for the f/4 instrument as well. The angle of approach to the focal point equals the angle of divergence from the focal point:

$$\frac{d_a}{l_a} = \frac{d_b}{l_b},$$

where a refers to the light path before the entrance slit and b refers to light after the slit. Light that enters the monochromator and diverges at an angle greater than θ "overfills" the optics and leads to scattered light in the monochromator. Light that enters at an angle less than θ underfills the optics and sacrifices throughput. For this reason, the light focused onto the entrance slit of a monochromator should have the same f/# as the

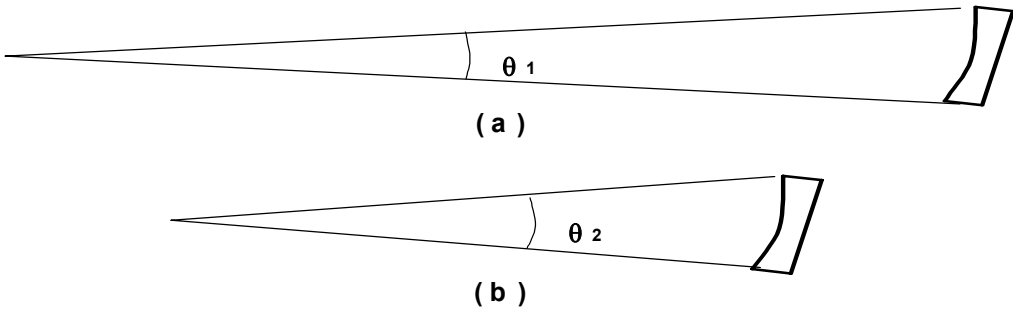


Figure 14. Comparison of (a) slower and (b) faster spectrometers from entrance slit to collimating mirror.

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monochromator itself. This is known as **f/# matching**. Collimated light filling a one inch (25 mm) diameter lens before the monochromator should have a focal length equal to 25 mm divided by the f/#. For example, the focal length would be 100 mm for an f/4 instrument. Note that it is the **distance from the optic, not the focal length of the lens** that determines the f/#. For a single lens system with an f = +40 mm lens 80 mm away from the entrance slit, the f/# will be 25/80 = f/3.2. For focused light sources, the same principles apply because it is the angle of focusing or defocusing that determines the f/#.

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Experiments:

Absorption/Transmission

Absorption measurements require a light source, SampleMax, spectrometer, detector, and data acquisition electronics and software. For these measurements, the incident light must pass through the sample chamber without deflection. The two short side ports must be used, with the long side port blocked off to prevent stray light. One port should be connected to the input light and the other connected to the output; it does not matter which port is connected to the input or output. A diagram of an absorption experiment is shown in Figure 1 on Page 1.

Because the intensity and wavelength dependence of the incident light is different for different configurations, each measurement should be referenced to a scan taken under the same conditions with no sample in place. The ratio of the output light intensity with the sample in place to the reference intensity is the transmission of the sample, which is frequently expressed as a percentage, %T. The absorption is simply the negative logarithm (base 10) of the transmission, or the negative logarithm of the percent transmission plus 2:

$$A = -\log T = 2 - \log (\%T)$$

For liquid measurements using a cuvette, the optical faces must be perpendicular to the incident and transmitted light. For best results, the spot size of the light should be smaller than the width of the cuvette to prevent light scattering. Reference scans should be taken with an empty cuvette in place in the SampleMax.

For solid and thin film measurements, the solid sample holder with the transmissive spring loading holding piece should be used to allow for maximum transmission. The sample face should be perpendicular to the light, and the spot size should be smaller than the sample holder hole to prevent light scattering. As with the cuvette, reference scans should be performed with and empty solid sample holder in the SampleMax.

Two possible orientations exist for absorption experiments. The first, illustrated in Figure 1, has the broadband light source pass through the sample into the spectrometer. The spectrometer, in turn, resolves the light into its wavelength components to be detected. The second method, illustrated in Figure 15, has the light source pass through the spectrometer, which serves as a monochromator. The monochromatic light passes through the sample and is then detected. Either method is valid and allows for transmission versus wavelength curves to be determined.

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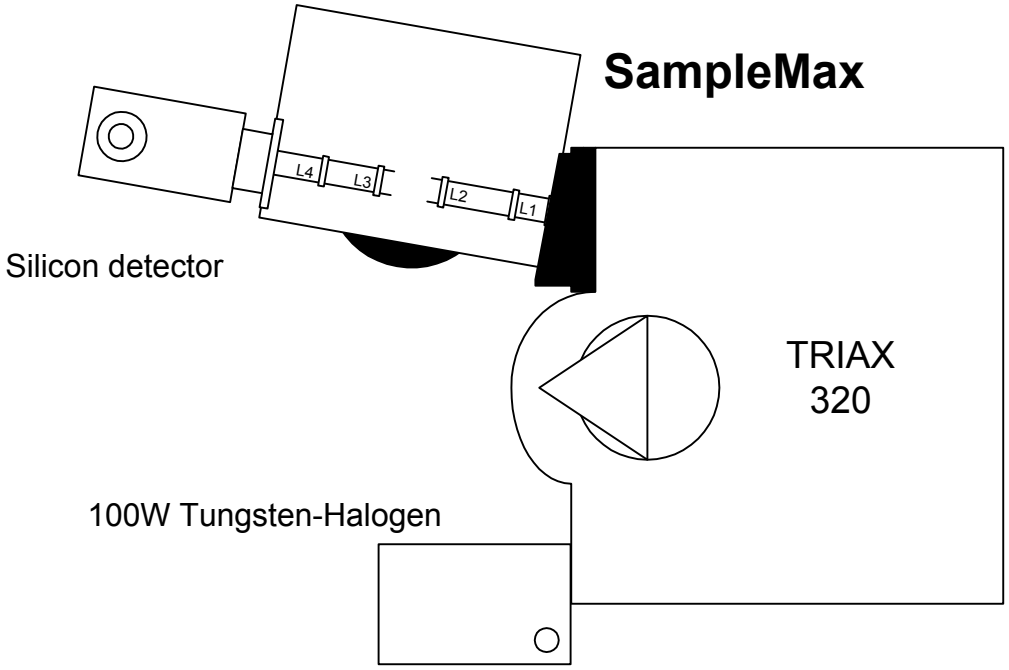


Figure 15. Alternate absorption experiment configuration using the SampleMax

Reflection and Fluorescence

Reflection and liquid fluorescence measurements require a 90◈ angle configuration in which the incident light is perpendicular to the detected light. To attain this configuration, use one short side port and the long side port; the specific ports are not important, but the remaining port should be blocked to prevent stray light. A diagram of a typical reflectance measurement configuration is provided in Figure 16.

For solid reflectance measurements, the sample should be at 45◈ to the incident and reflected light. Both the basic SampleMax and SampleMax with external turret rotator allow for this position. As with absorption experiments, the light beam spot size should be minimized to prevent scattering off the sample holder.

For fluorescence measurements using a cuvette, the optical faces must be perpendicular to the input and output light. The placement of the cuvette is therefore the same as with transmission measurements, but there must be adjacent optical faces for fluorescence experiments.

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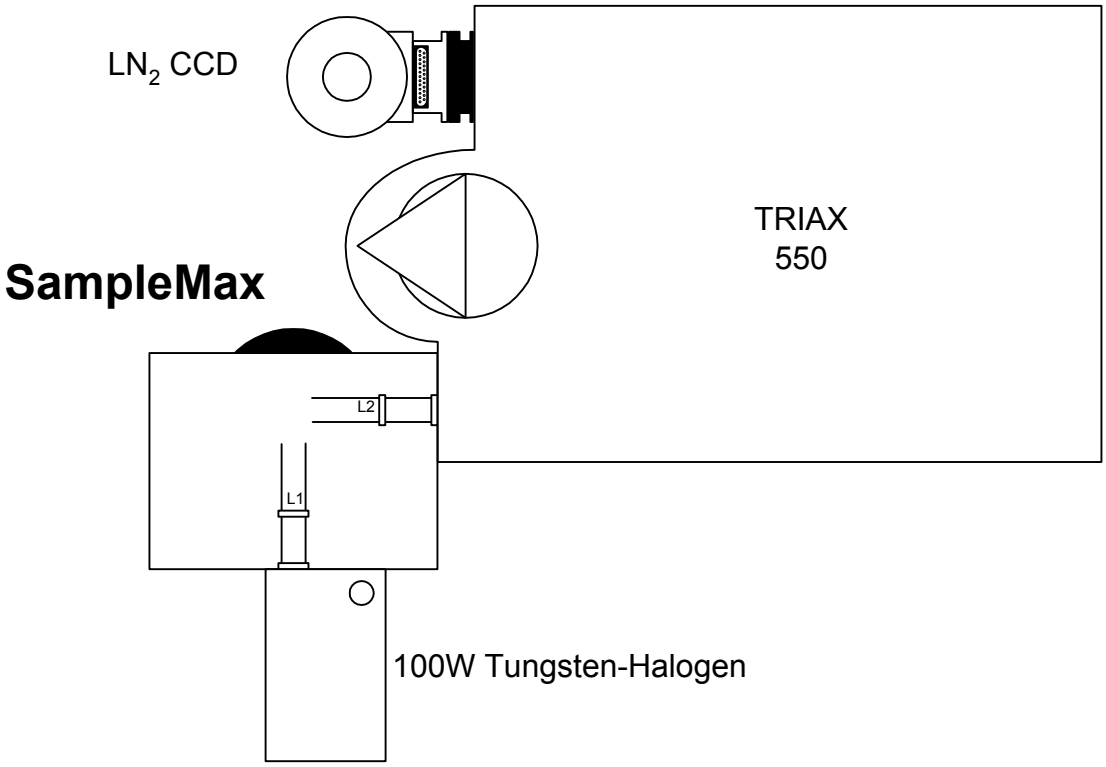


Figure 16. Reflection system using the SampleMax

Although as with absorption, reflection measurements can involve either of two configurations, fluorescence experiments require that the excitation light be monochromatic. Reflection and absorption experiments involve detecting light at the same frequency as the incident light, but fluorescence detection is of wavelengths longer than the source light. In order to attain a wavelength dependence of the fluorescence intensity, the incoming light must be monochromatic and variable in frequency. A second spectrometer placed at the exit port of the SampleMax allows for resolution of the fluorescence and enables determination of excitation/emission dependence.

As with absorption and transmission measurements, reflectance measurements should include a reference scan. In place of the sample should be a mirror which reflects the same percent of light regardless of the wavelength used in the measurement or a mirror whose reflectance is known. Unlike with absorption measurements, inclusion of the mirror involves determining a reference with an extra variable; knowledge of this variable makes for a more accurate determination of the measurement. The **reflectance** is simply the ratio of the reflected sample light to the reference light factored with the response of the reference mirror. To minimize the effect of the reference mirror, it should be spectrally flat with respect to the measurement light and virtually 100% reflective. Instruments SA can provide such a reference mirror mounted for use in the sample chamber. Contact an ISA Sales Engineer for details.

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Fluorescence measurement reference scans require that the cuvette be removed and a reference mirror put in its place. The reference measurement in this case serves to correct the observed fluorescence intensity for variations in the excitation source. Because detectors are usually wavelength-dependent in their response, accurate measurements should include a calibrated detector with known response. The reference mirror response must also be factored into the results.

Photoluminescence and Laser-Induced Fluorescence

Photoluminescence (PL) and Laser-Induced Fluorescence (LIF) experiments require a laser, SampleMax, spectrometer, and detector. A typical diagram of these experiments is provided in Figure 17. Usually, only one of the short side ports will be used to collect the luminescence from the sample. The laser and an optional focussing lens provide the input light. In addition to the collection lenses on the output rail, it is recommended that a notch filter be mounted to reject the input beam. To prevent distortion of the collected light, the output should be collimated at the notch filter. Therefore, a dual lens configuration with a notch filter between them is recommended. This light is resolved by a spectrometer and then detected.

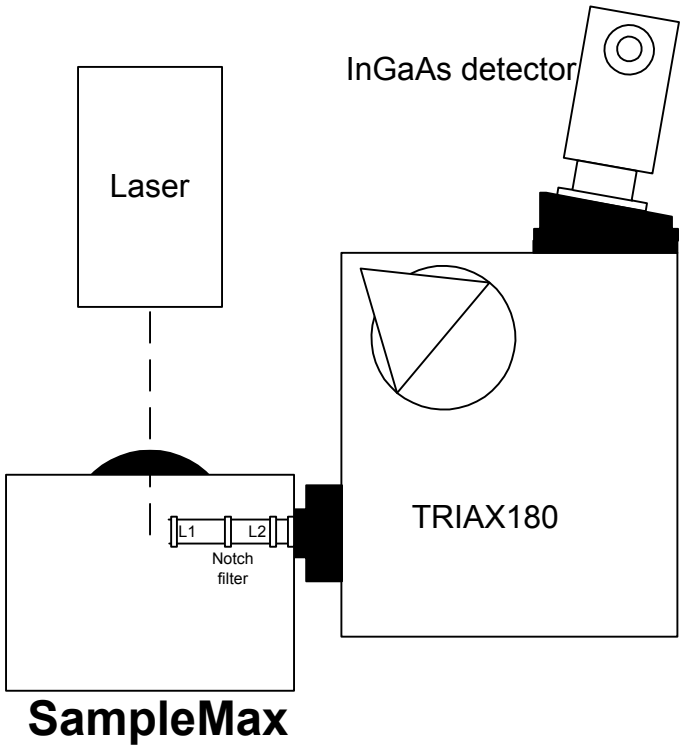


Figure 17. Photoluminescence experiment using the SampleMax

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For experiments in which the input is a laser beam, an entry port has been put on the cover of the SampleMax. When not in use, a plug is used to block the port and make the SampleMax light tight. For custom applications, ISA will place a laser entry port to your specifications on the SampleMax.

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Options:

External Turret Rotator (Part #ASC-STUR)

The primary advantage of the external rotator option is the ease with which the user may interchange experimental configurations. Without opening the SampleMax, one can switch from reflection to absorption experiments, for example. Grooves in the rotator serve to position the sample, as a metal pin snaps into place in the groove at a number of positions corresponding to potential experimental arrangements.

X-Z Stage (Part #ASC-SXZ)

Although the standard stage provides for centering so that the light input is incident on the sample, an optional X-Z stage (Figure 18) allows for far more precise positioning capability. A micrometer consisting of a fixed and rotating part controls each axis position. On the fixed part is a scale ranging from 0 to 5, with each unit representing 2 mm of motion. Tick marks represent 0.25 units, or 500 µm. The rotating part has a scale ranging from 0 to 25, with each unit ranging accounting for 0.01 units of the fixed scale, or 20 µm. One can measure the distance moved across the axis by noting the difference in micrometer settings. For example, if you begin with the fixed scale between 2.25 and 2.50 and the rotating part showing 13 when aligned with the axis on the fixed part of the micrometer, that would correspond to a setting of 2.38. If you finish when the setting is between 4.00 and 4.25 with 22 on the rotating part, your final position is 4.22. Therefore, you have moved 1.84 units, or 3.68 mm.

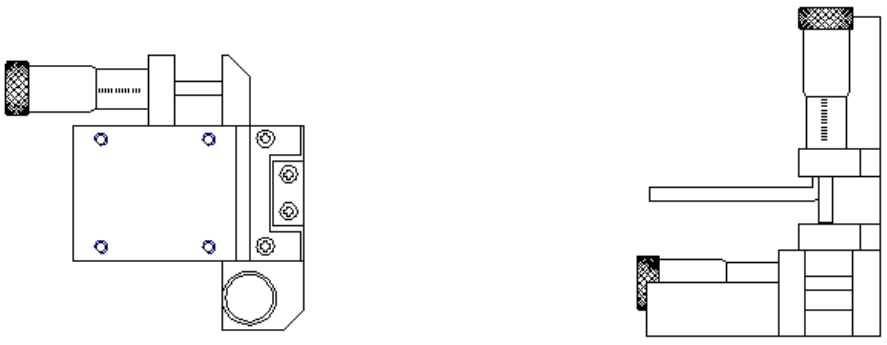


Figure 18. X-Z stage, ASC-SXZ

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The X-Z stage with precision micrometers enables the user to perform mapping measurements. If all other elements in the system remain fixed in position, the micrometers may be adjusted to change the position of the sample so that one can measure the variance in properties of the sample. This type of experiments is known as *mapping*, and is commonly used in photoluminescence of thin films and semiconductor wafers.

Variable Slit and Height Limiter (Part #ASC-1679)

The ASC-1679 adapter mounts directly to the SampleMax and places an adjustable slit flush with the port of the sample chamber. The slit may be adjusted from nearly closed to 8 mm wide with calibration marks every 100 μm. The height limiter allows for three options: fully closed, 1 mm height, and 15 mm height. Consult Figure 19 to attach the ASC-1679 to the SampleMax.

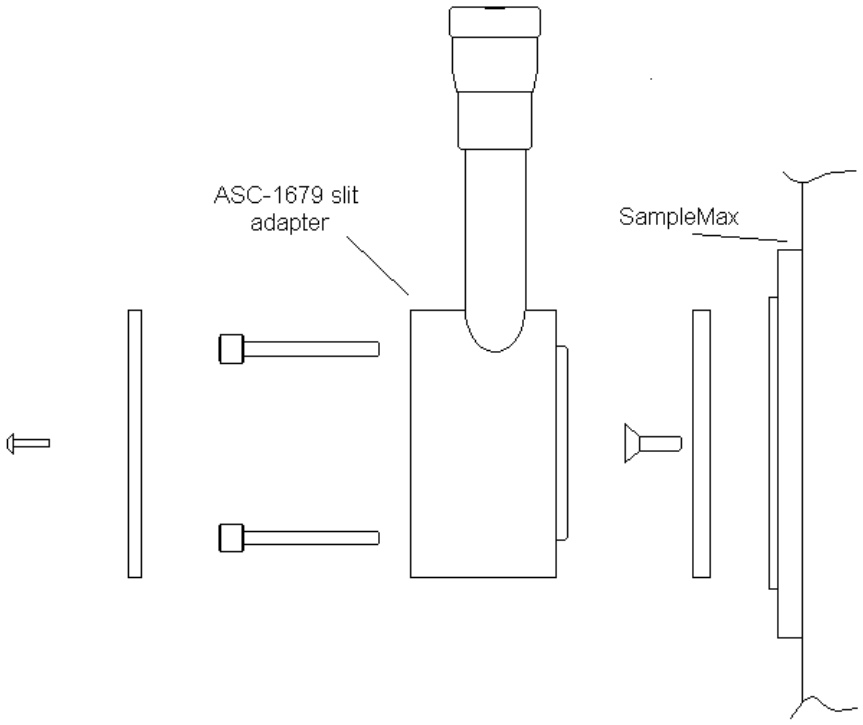


Figure 19. ASC-1679 slit adapter attachment diagram

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Service Policy:

If you need assistance in resolving a problem with your ISA instrument, contact us directly, or through our representative or affiliate in your area, if outside the United States.

Often it is possible to correct, reduce, or localize the problem to a replaceable component through discussion with our Customer Service Engineers.

All ISA instruments are covered by a warranty. The warranty statement is printed on the inside cover of this manual. Service for out-of-warranty instruments is also available, for a fee. Contact us for details and cost estimates.

If an instrument or component must be returned, The method described in this section should be followed to expedite servicing and reduce your downtime.

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A Return Authorization Number issued by our Customer Service Department must accompany all Instruments and Components returned to the factory. If in the United States, you may contact the Customer Service department directly at (732) 494-8660 ext. 185. The FAX number for Service is (732) 549-9309. Or, you may write to:

Instruments SA
Systems Service
3880 Park Avenue
Edison, NJ 08820

From other locations worldwide, contact the representative or affiliate for your area.

To issue a Return Authorization number, we require:

- The model and serial number of the instrument
- A list of items and/or components to be returned
- A description of the problem, including operating settings
- The instrument user's name, mailing address, telephone, and telefax numbers
- The shipping address for shipment of the instrument to you after service
- Your Purchase Order number and billing information for any non-warranty services
- The Original ISA Sales Order number is helpful to know
- Your Customer Account Number, if known, is also helpful
- Any special instructions

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Appendix – Part Numbers and Descriptions of Adapters:

Part number	Description
ASC-270	Adapter to mount to axial entrance of 270M
MSA-M28/1679A	Adapter to mount to slits with M28 threads
ASC-1451	Adapter to mount to 1451 slits (M-Series)
LSH-A270	Adapter for LSH-Series lamp housings
LSH-AXETRF	Adapter for FL-1007 Xe lamp housing
36540	Adapter for ACH-C chopper or AFO-FW filter wheel

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