Newport SR-160-CF

Fiber Adapted Super Cavity Optical Spectrum Analyzer

Limited Availability
Used and in Excellent Condition

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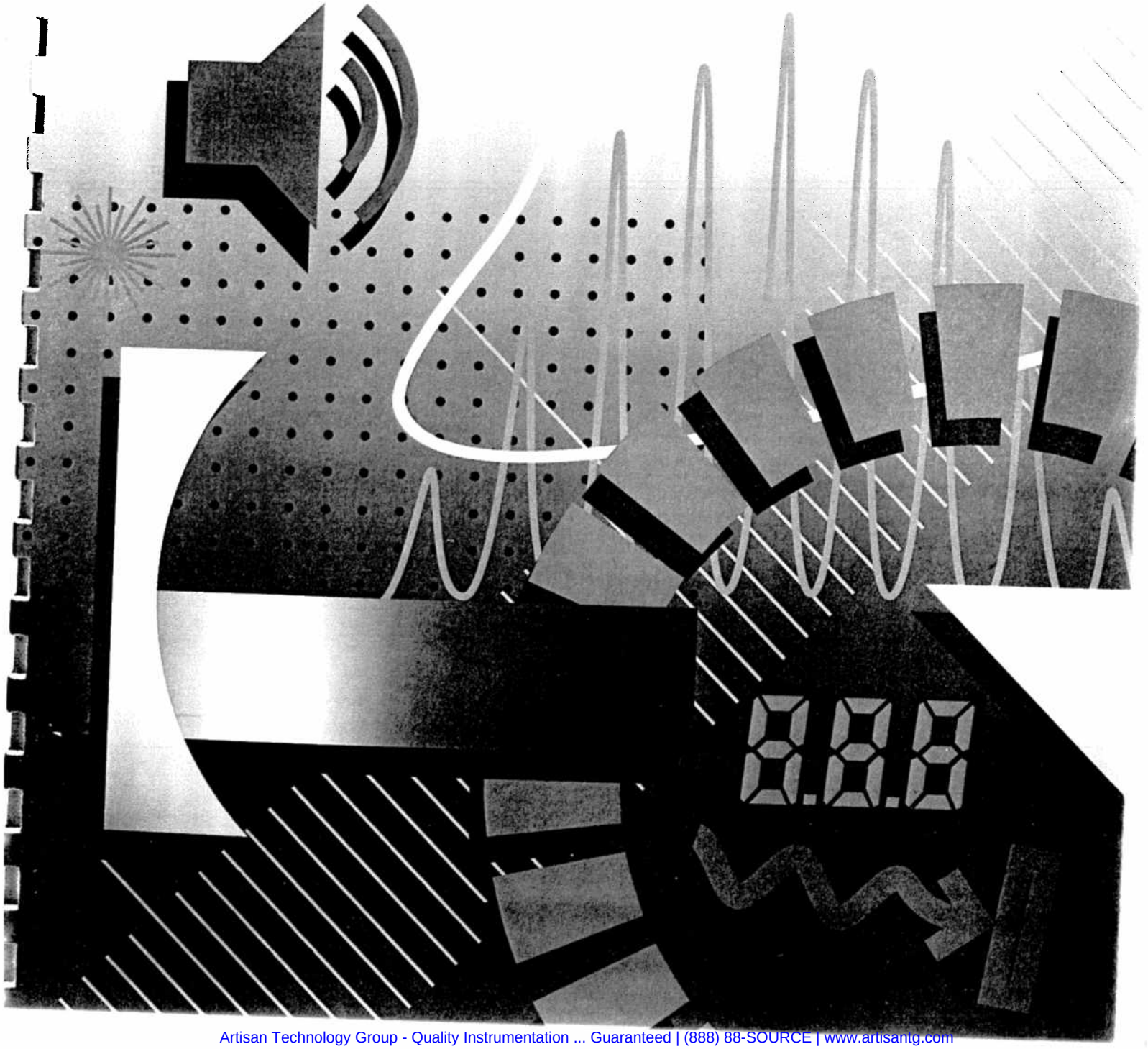
Newport

SuperCavity™ Fiber Input Adapter Instruction Manual



Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of one year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport representative or contact Newport headquarters in Irvine, California, U.S.A. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid.

Repaired products are warranted for the balance of the original warranty period or 90 days, whichever is longer.

This warranty does not apply to defects resulting from modification or misuse of any product or part. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

Irvine, California U.S.A.
Part No. 17421 Rev. B
IN-03902 (8-92)

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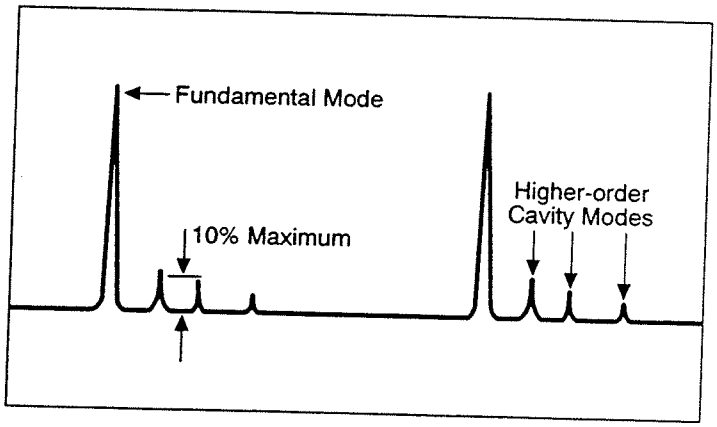
Specifications

SuperCavity™ Fiber Input Adapter :

Insertion Loss	3db (>50% throughput) with FiberMate, 0.5 db max. (>89% throughput) with connector
Maximum Sideband Amplitude	-10db (see Figure below)
Operating Temperature	0° to 70° Centigrade
Operating Relative Humidity	10% to 90%, Noncondensing
Shipping Weight	5 lbs.
Fiber Input Adapter Dimensions	1.5" dia. × 3.0" (38mm dia. × 76mm)
Fiber Cable length	117" (3 meters) standard, other lengths available



Amplitudes of higher-order cavity modes are guaranteed to be less than 10% of the fundamental mode amplitude.

Definitions

TEM_{00} The lowest order free-space propagating mode of a laser. This mode has a Gaussian intensity distribution.

dB decibels

SuperCavity™ Optical Spectrum Analyzer

Ordering Information[1]

Wavelength Range (nm)	Center Wavelength λ_c (nm)	Free Spectral Range[1] (nominal)	SuperCavity (including controller, mount)	SuperCavity (Head only)	Fiber Adapted SuperCavity System (including Fiber Input Adapter, controller, mount)	Fiber Adapted SuperCavity (with Fiber Input Adapter)	Retrofit SuperCavity[2] (with Fiber Input Adapter)
High Finesse SuperCavity™:							
580 - 660	620	6 GHz	SR-130	SR-130-C	SR-130-OPT 02 XX	SR-130-OPT 01 XX	SR-130R-OPT XX
465 - 525	495	6 GHz	SR-110	SR-110-C	N/A	N/A	N/A
515 - 585	550	6 GHz	SR-120	SR-120-C	N/A	N/A	N/A
580 - 660	620	6 GHz	SR-130	SR-130-C	SR-130-OPT 02 XX	SR-130-OPT 01 XX	SR-130R-OPT XX
755 - 845	810	6 GHz	SR-140	SR-140-C	SR-140-OPT 02 XX	SR-140-OPT 01 XX	SR-140R-OPT XX
1000 - 1120	1060	6 GHz	SR-150	SR-150-C	SR-150-OPT 02 XX	SR-150-OPT 01 XX	SR-150R-OPT XX
465 - 525	495	8,000 GHz	SR-210	SR-210-C	N/A	N/A	N/A
515 - 585	550	8,000 GHz	SR-220	SR-220-C	N/A	N/A	N/A
580 - 660	620	8,000 GHz	SR-230	SR-230-C	SR-230-OPT 02 XX	SR-230-OPT 01 XX	SR-230R-OPT XX
755 - 845	810	8,000 GHz	SR-240	SR-240-C	SR-240-OPT 02 XX	SR-240-OPT 01 XX	SR-240R-OPT XX
1000 - 1120	1060	8,000 GHz	SR-250	SR-250-C	SR-250-OPT 02 XX	SR-250-OPT 01 XX	SR-250R-OPT XX
High Transmission SuperCavity™:							
1300 - 1350	1325	6 GHz	SR-160	SR-160-C	SR-160-OPT 02 XX	SR-160-OPT 01 XX	SR-160R-OPT XX
1520 - 1580	1550	6 GHz	SR-170	SR-170-C	SR-170-OPT 02 XX	SR-170-OPT 01 XX	SR-170R-OPT XX
1300 - 1350	1325	8,000 GHz	SR-260	SR-260-C	SR-260-OPT 02 XX	SR-260-OPT 01 XX	SR-260R-OPT XX
1520 - 1580	1550	8,000 GHz	SR-270	SR-270-C	SR-270-OPT 02 XX	SR-270-OPT 01 XX	SR-270R-OPT XX
HiRez™ OSA:							
615 - 650	633	6 GHz	SR-135	SR-135-C	SR-135-OPT 02 XX	SR-135-OPT 01 XX	SR-135R-OPT XX
775 - 815	790	6 GHz	SR-145	SR-145-C	SR-145-OPT 02 XX	SR-145-OPT 01 XX	SR-145R-OPT XX
1030 - 1090	1064	6 GHz	SR-155	SR-155-C	SR-155-OPT 02 XX	SR-155-OPT 01 XX	SR-155R-OPT XX
615 - 650	633	8,000 GHz	SR-235	SR-235-C	SR-235-OPT 02 XX	SR-235-OPT 01 XX	SR-235R-OPT XX
775 - 815	790	8,000 GHz	SR-245	SR-245-C	SR-245-OPT 02 XX	SR-245-OPT 01 XX	SR-245R-OPT XX
1030 - 1090	1064	8,000 GHz	SR-255	SR-255-C	SR-255-OPT 02 XX	SR-255-OPT 01 XX	SR-255R-OPT XX

N/A: not available

Fiber Input Adaptor
Choose Fiber Termination XX = 01 Bare Fiber
03 FC (NTT) Connector

1. Custom free spectral ranges are available. Controllers may be purchased separately. Call Newport for price and availability.
2. You will be asked to send us your SuperCavity at the time you place the order.

Certificate of Performance

Newport

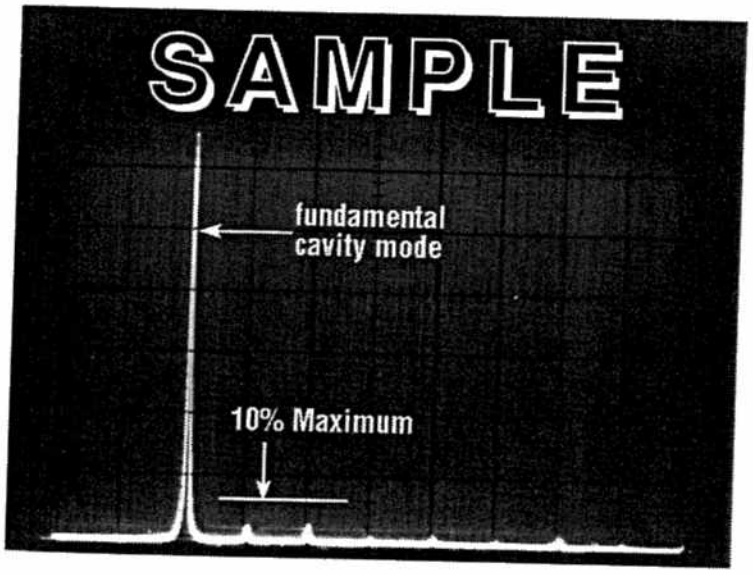
Product SuperCavity™ Fiber Input Adapter

System Model Number _____ ***System Serial Number*** _____

Controller Model Number _____ ***Controller Serial Number*** _____

Options _____

Transverse Mode Amplitude:



Quality Control _____

Quality Control Check Date _____ ***Quality Control Stamp*** _____

Newport Order No. C_____ ***Customer's Purchase Order No.*** _____

User Name _____ ***Organization Name*** _____

Address _____

City _____ ***State*** _____ ***Zip*** _____

Section 1
General Information

1.1 Introduction

This instruction manual contains the necessary information for operation and maintenance of the Newport SuperCavity™ Fiber Input Adapter as well as information for troubleshooting and obtaining service if necessary. This information is divided into the following sections:

- Section 1 provides general information about this manual and the SuperCavity™ Fiber Input Adapter. It contains a product description, discusses safety, and gives the features and options that are available.
- Section 2 explains the principles of operation of the Fiber Input Adapter.
- Section 3 contains system operation procedures for the Fiber Input Adapter and accessories.
- Section 4 provides for Maintenance and Adjustment of the Fiber Input Adapter.
- Section 5 provides instructions for obtaining factory service.
- Section 6 contains reference drawing.

1.2 Manual Addenda

Information concerning changes or improvements to this instrument which occur after the printing of this manual will be found on the addendum sheet(s) included with this manual.

Note

Please review the addendum sheet(s) in this manual before attempting to operate or service this instrument.

1.3 Product Description

The SuperCavity Fiber Input Adapter is a precision single mode fiber input coupler-to-SuperCavity adapter. It provides a simple method of obtaining spectral data on the optical characteristics of the light in either a fiber system or free space beam using the Newport SuperCavity Series of optical spectrum analyzers. **Figure 1** illustrates a typical Fiber Input Adapter/ SuperCavity system.

The Fiber Input Adapter is matched to a particular SuperCavity head at the factory and is **not** in general interchangeable with other SuperCavity heads. The adapter consists of a small cylindrical body with a wavelength-specific single mode fiber connected to it. The head itself is attached via a threaded kinematic mount to the SuperCavity head. The adapter may be detached and re-attached without disturbing its alignment with the beam waist of the SuperCavity.

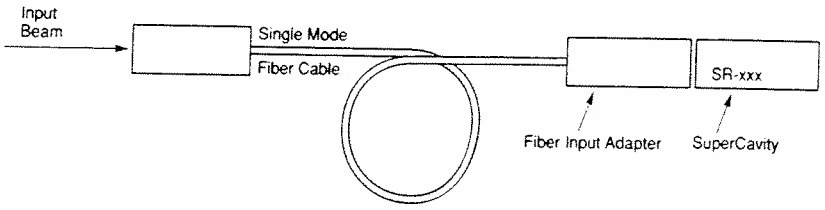


Figure 1a — Block Diagram of Fiber Adapted Supercavity.

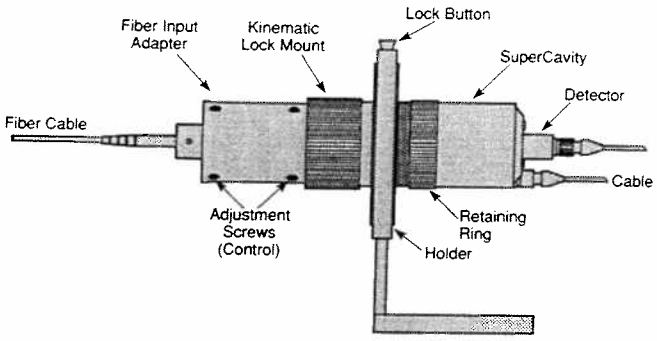


Figure 1b — SuperCavity Fiber Input Adapter External View

The main features of the FiberMate are:

- high coupling efficiency into single mode fibers
- easy to align using a convenient front retroreflecting mirror
- stable optical coupling
- wide range of wavelength availability
- compact
- adaptable to many Newport standard mounts

1.4 Getting Started

Please carefully read and understand this instruction manual before using the SuperCavity Fiber Input Adapter. Alignment of this device requires care and patience for optimum performance. Be especially careful in observing the warnings and cautions throughout this manual (see Section 1.8). If any operating instructions are not clear, contact Newport Corporation before beginning to use the Fiber Input Adapter.

1.5 Unpacking and Inspection

All SuperCavity Fiber Input Adapters are carefully aligned and inspected mechanically and optically before shipment. Upon receiving this instrument, check for any obvious signs of physical damage that might have occurred during shipment. Report any such damage to the shipping agent immediately. Retain the original packing materials in case reshipment becomes necessary. The following items are included with every SuperCavity Fiber Input Adapter:

- Fiber Input Adapter Head with 3 meters of single-mode, wavelength-specific fiber cable
- Replacement kinematic mount for the SuperCavity front plate (installed)
- Instruction manual

Options available for this instrument are described in Section 1.9, a schematic showing the wooden delivery box and its contents is shown below.

1.6 Specifications

Detailed specifications of the SuperCavity Fiber Input Adapter may be found immediately preceding this section of the instruction manual.

1.7 Warranty Information

Warranty information may be found on the page preceding the Table of Contents in this manual. Should it be necessary to exercise the warranty, contact your Newport representative or the factory to determine the correct course of action. Newport Corporation maintains offices worldwide; these offices are listed in our General Catalog and on the back cover of this manual. Information concerning the application, operation, or service of this instrument may be directed to any of these locations.

1.8 Safety Terms

The following safety terms are used in this manual:

The **WARNING** heading in this manual explains dangers that could result in personal injury or death.

The **CAUTION** heading in this manual explains hazards that could damage the instrument.

In addition, a **NOTES** heading gives information to the user that may be beneficial in the use of this instrument.

1.9 Option Accessories and Services

The standard fiber cable length is 3 meters; special lengths are available as an option. The termination of the input end of the adapter is either a bare fiber end or a connectorize end.

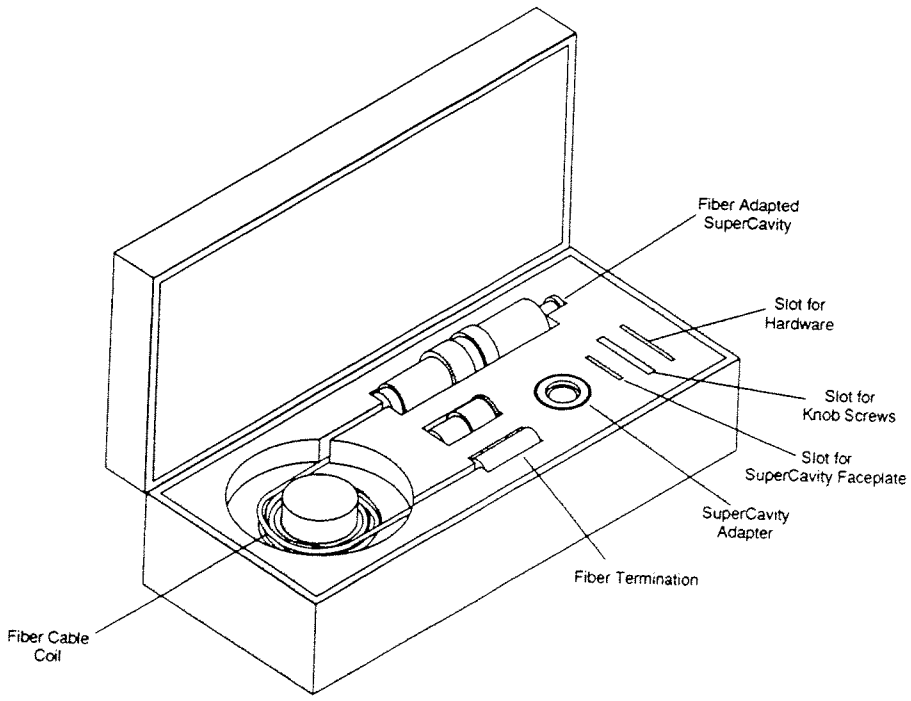


Figure 2 — The SuperCavity and Fiber Input Adapter as received after shipment.

Section 2
Principles of Operation

2.1 SuperCavity Fiber Input Adapter

The Fiber Input Adapter is used for coupling light from a coherent source (such as a laser or fiber-optic system) into the Newport SuperCavity Series Optical Spectrum Analyzers. Physically, the adapter has a cylindrical body about 1.5 inches in diameter and 3 inches long (excluding the fiber cable — see Section 6 for dimensional outline drawings). It comes with a kinematic adapter which allows the unit to be detached from, and re-attached to, the SuperCavity head without loss of alignment. (The kinematic mount allows the SuperCavity head to also be used normally with mode-matching optics and free-space beams.)

2.1.1 Head Characteristics

The SuperCavity Fiber Input Adapter head as cross- sectioned in Figure 3 consists of:

- a kinematic front mounting plate to replace the original front plate of the matched SuperCavity,
- a knurled ring to hold head firmly against the front mounting plate,
- a machined outer aluminum body with adjusting screws,
- and a subassembly containing the coupling optics.

The Fiber Input Adapter uses a basic lens-fiber combination, as illustrated in the cross-sectional schematic of Figure 3. Coherent light (such as that from a laser) is coupled into the fiber by using either a free space beam coupler or a fiber-to-fiber connector. The output beam from the adapter exits in a collimated TEM_{00} mode and is factory-aligned to a matching SuperCavity head.

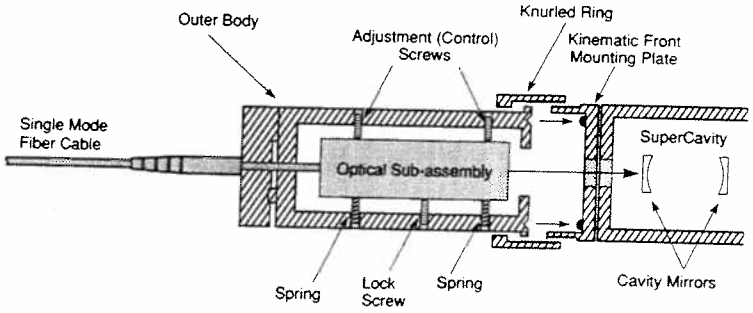


Figure 3 — Schematic Cross Section of the Fiber Input Adapter.

The Fiber Input Adapter's beam waist must be positioned at the SuperCavity beam waist to maximize energy transfer from the TEM_{00} free space mode to the lowest order (i.e., the zeroth or fundamental) mode in the SuperCavity. This lowest order mode may be identified in two ways; first, it is the first peak in the series of transverse modes, and second, it is a single, degenerate peak. This may be confirmed by changing the centering and decreasing the sweep on the SuperCavity Controller so as to examine each mode present. The zeroth mode shows a single peak, while higher order modes appear as multiple peaks that are closely grouped due to non-degeneracy.

A retro-reflecting mirror is installed on the adapter's front kinematic mounting plate as a standard feature. The normal to the surface of this retro-reflecting mirror is aligned parallel to the optical axis of the matched SuperCavity head. This mirror performs the same function as the retro-reflecting mirror in the SuperCavity's original front plate and is provided to assist in the initial alignment of the input beam when the SuperCavity is used in its mode-matched free-space configuration (without the head attached). A detailed description of how to use this mirror for alignment is found in the Newport SuperCavity Optical Spectrum Analyzer manual.

2.1.2 Single Mode Fibers

The adapter is specific to a particular wavelength range, i.e. the alignment of the input optics and the single-mode fiber cable used are optimum for a particular range of wavelengths only. Each wavelength range is identified by the cable coloring as follows:

Cable Color	Wavelength Range	For Use With SuperCavity
Green	465-550 nm	N/A
Red	580-660 nm	SR-130/230, SR-135/235
Maroon	755-845 nm	SR-140/240, SR-145/245
Brown	1000-1120 nm	SR-150/250, SR-155/255
Blue	1300-1550 nm	SR-160/260, SR-170/270

NOTE

Each SuperCavity Fiber Input Adapter is matched to a particular SuperCavity head. The adapters are not in general interchangeable.

CAUTION

The fiber cables used are not armored to withstand excessive applied force or abuse. Alignment of the adapter at the factory may be disturbed or lost if the cable is stretched or subjected to other unusual stresses or strains in the field. Handle the area of the cable's input into the adapter with normal precautions and special care to prevent misalignment.

The single-mode fiber used here is a matched clad design, with a uniform refractive index profile, and a mechanically strippable UV acrylate coating. The outer diameter of the cladding and numerical aperture of the fiber are nominally 125 microns and 0.11, respectively.

The fiber cable is a general purpose, tight buffer design. The minimum recommended bend radius is 2 inches (5 cm). Its outer diameter is 0.098 inches (2.5 mm).

2.1.3 Sample Spectra

Careful alignment of the Fiber Input Adapter is necessary to maximize the amount of energy injected into the lowest order mode in the SuperCavity head. Figure 4 illustrates the spectra to be expected both when the fiber adapter output is well aligned with the optical axis of the cavity (as in Figure 4a, illustrating one Free Spectral Range and well-aligned mode structures) and when the fiber adapter output is misaligned with the cavity axis (Figure 4b and 4c).

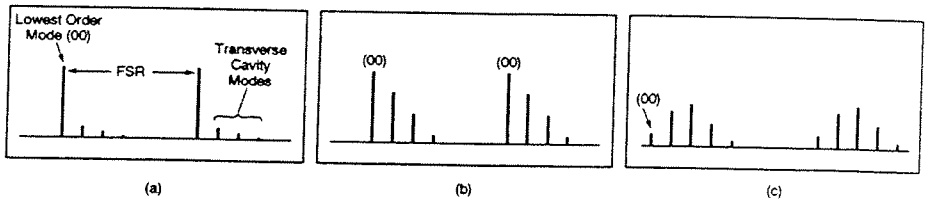


Figure 4 — Optical Mode Spectrum of SuperCavity (a) well aligned, (b,c) misaligned

The Fiber Input Adapter is matched to a given cavity head at the factory for the greatest throughput in the lowest order cavity mode. Higher order modes are almost always excited as well. These modes are specified to be at least 10dB below the main peak maximum — and preferably even further down. Over time, drift may occur that causes the higher order mode intensities to rise (as in Figure 4b). While alignment of the cavity with the fiber adapter output in the field may be difficult, the user can "tweak" the adjustment screws in the head of the Fiber Input Adapter to maximize the zeroth order mode. This procedure is presented in Section 4, Maintenance and Troubleshooting.

Section 3
System Operation

3.1 Introduction

The SuperCavity Fiber Input Adapter is a precision single mode fiber input coupler-to-SuperCavity adapter. It provides a simple method of obtaining spectral data on the optical characteristics of the light in a fiber system or free space beam using the Newport SuperCavity Series of optical spectrum analyzers.

WARNING

Wear laser eye protection when aligning and using this adapter. Even stray reflections can cause eye damage!

3.2 Preparations for use

The Fiber Input Adapter is matched to a particular SuperCavity head at the factory and is not in general interchangeable with other SuperCavity heads. The adapter consists of a small cylindrical body with a wavelength-specific single mode fiber connected to it. The head itself is attached via a threaded kinematic mount to the SuperCavity head. The adapter may be detached and re-attached without disturbing its alignment with the beam waist of the SuperCavity.

NOTE

Each SuperCavity Fiber Input Adapter is matched to a particular SuperCavity head. The adapters are not in general interchangeable.

3.2.1 Kinematic Mount Installation

It may be necessary to install the kinematic mount on the matched SuperCavity if, for some reason, the mount has been removed. The following steps should be followed:

1. Remove the original faceplate (with the SuperCavity Model identification on it) and store it in a safe place. The plate is held on with three 4-40 Allen head button screws, which should be saved with the faceplate.

NOTE

The SuperCavity head front plate mounting holes are drilled in a non-symmetric pattern. Only one orientation of the kinematic mounting plate is allowed with the three Allen head screws installed.

2. Install the new kinematic mount with the proper orientation using the 4-40 Allen head screws supplied.

CAUTION

Do not overtighten these Allen head socket screws. A snug fit is sufficient to hold the mounting plate.

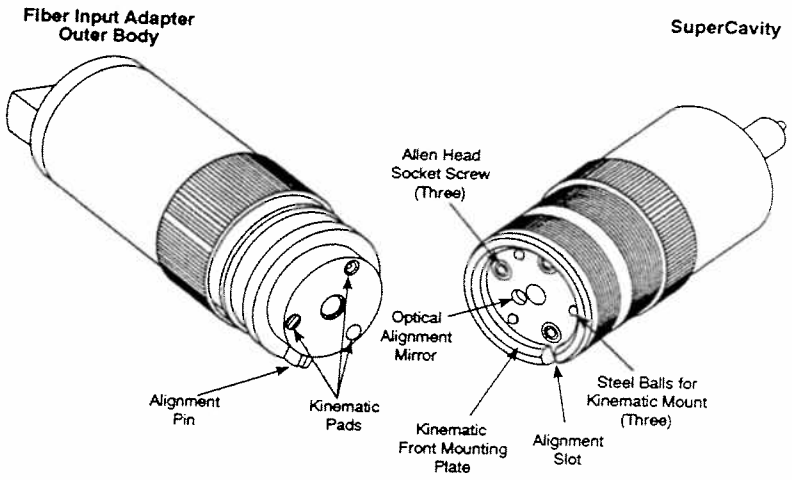


Figure 5 — External view of the SuperCavity and the Fiber Input Adapter showing the details of the kinematic mount.

3.2.2 Head Attachment

After attaching the adapter kinematic mounting plate (or if it is already installed), align the alignment pin on the Fiber Input Adapter to the corresponding alignment slot on the front mounting plate of the SuperCavity. Holding the two parts together, slide the knurled ring onto the kinematic plate threads and tighten.

The Fiber Input Adapter is aligned at the factory such that after the attachment of the adapter head to the kinematic front plate of the SuperCavity, the frequency spectrum of the source is displayed on the oscilloscope. This spectrum can be obtained provided that the SuperCavity controller is ON and connected to the oscilloscope and that the SuperCavity is aligned and coupled to a laser source.

Overtightening the knurled ring causes slight deformation of the mounting parts which in turn alters the mode alignment of the beam. This causes alteration of the displayed pattern of frequency spectra. To obtain identical mode patterns after each kinematic attachment, it may be necessary to return the knurled knob to the same position each time.

CAUTION

Do not overtighten this knurled ring. Overtightening may damage the mounting parts. A snug fit is sufficient to locate the adapter beam waist in the cavity.

3.2.3 Fiber Input Adapter Setup

After installation of the kinematic mount to the front of the SuperCavity and attachment of the Fiber Input Adapter to the SuperCavity head, the assembled unit should be placed away from electrical and mechanical disturbances. The standard length of fiber supplied with the adapter allows the user to remotely locate the head away from such disturbances, preferably also in an area of low air circulation (e.g. — out of the air conditioning paths) to enhance thermal stability. Longer lengths of fiber are optionally available if the standard length is insufficient to accomplish this for any reason.

NOTE

The SuperCavity assembly must have free air circulation around it for proper thermal stabilization. Air currents, however, should be avoided or minimized near the cavity head to enhance thermal stability.

A mount like the Newport Model LP-1B (which is part of the SuperCavity System) is convenient for supporting the SuperCavity head assembly since it secures the cavity head using the standard mounting threads already available.

Also available for mounting the SuperCavity system is an adapter ring found in the wooden delivery box. This adapter may be threaded onto the SuperCavity and held either on a standard SP support post, or on an LM-2 lens mount. The adapter has two holes, one has an English 8-32 thread, and the other a metric M4 thread for standard mounting on SP posts. A V-groove is also cut into the edge for special holding requirements.

The input end of the fiber may be terminated in a number of different ways, depending both upon the application and upon the customer's availability of equipment:

1. Free-space beams may also be coupled into the bare fiber end by using a Newport F-915 or 1015 Series Fiber Coupler. For specific information on the correct objective and component to match a particular application, please contact a Newport Applications Engineer.

NOTE

If the bare fiber input is to be connectorized by the user, handling of the SuperCavity assembly during the process may disturb the alignment. As a result, the user may choose to tweak the alignment to restore the optimum output mode pattern. This process is detailed in Section 4.

2. Light in fiber networks may be coupled directly to the Fiber Input Adapter by utilizing an unused port in the network. This method of coupling light into the SuperCavity provides both the lowest coupling losses and the fastest way to acquire output spectra from the SuperCavity controller.

3.2.4 Typical Operating Conditions

Typical operation of the SuperCavity Fiber Adapted system includes connecting the SuperCavity to the controller, which in turn is connected to an oscilloscope, as shown schematically in Figure 6.

Note that it may be necessary for proper system operation to use an optical isolator between the laser and the input end of the fiber. The degree of isolation needed depends upon the type of laser used. For most lasers, an acousto-optic modulator or deflector or a 30dB isolator is sufficient to provide the necessary degree of optical isolation. However, some lasers, and in particular laser diodes, may require more than 60dB of optical isolation for proper operation.

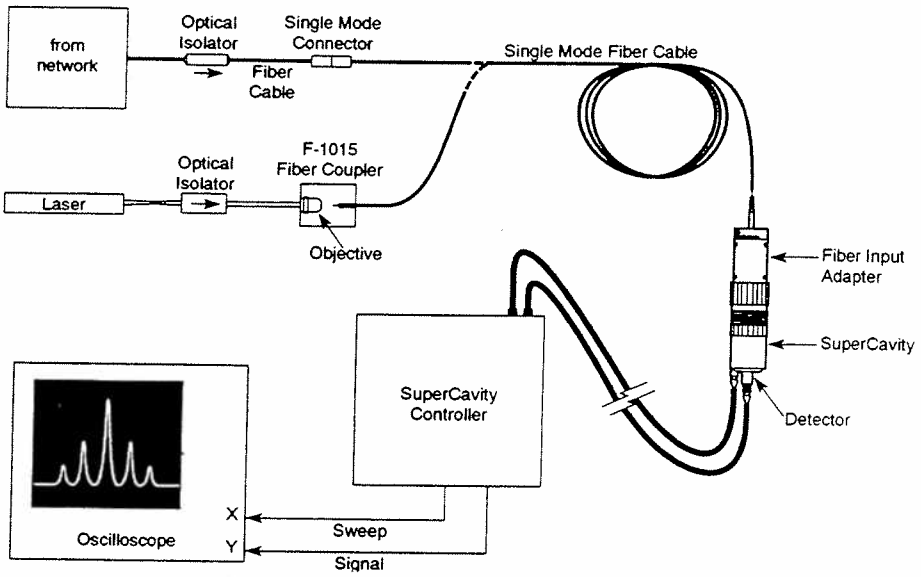


Figure 6 — SuperCavity Fiber Input Adapter System. Schematic for a typical set up showing the different schemes for coupling light into the single mode fiber. For proper SuperCavity system operation an optical isolator is necessary.

3.3 Remote Operation

Because attenuation in most optical fibers is negligible over lengths on the order of tens of meters, the use of the Fiber Input Adapter allows the SuperCavity system (and, in particular, the head) to be remotely located away from sources of electrical and mechanical noise. Of even greater significance, however, is that the head can also be located away from sources of heat that greatly affect the stability of the SuperCavity system due to thermal fluctuations in the local environment. This isolation of the SuperCavity in a remote, temperature-stable environment is, therefore, highly recommended to increase the stability of the system.

NOTE

Where possible, in addition to remotely locating the SuperCavity head, additional thermal isolation using a plexiglass box (or similar thermal isolation) to reduce air currents may also be helpful. The cavity head, however, must still be allowed free air circulation in order to thermally stabilize.

Section 4
Maintenance and Troubleshooting

4.1 Maintenance Proceedures

In cleaning the body of this instrument, use only a soft cloth and methyl alcohol. The optics should be cleaned only with lens paper and reagent grade acetone or alcohol that leaves no residue.

Re-alignment of the Fiber Input Adapter is discussed below.

4.1.1 Re-alignment Theory

In general, the Fiber Input Adapter is aligned at the factory to the specifications listed in the Specifications Section of this manual and should require no user re-alignment. However, accidentally jarring or dropping the unit by shipping or through frequent handling, or over periods of prolonged thermal cycling, re- alignment in the field may be necessary. The adapter is designed, however, such that only minor adjustment may be necessary after receiving the instrument.

Coupling light from the fiber to the cavity is accomplished by mode matching optics. While the alignment of the waist of the focused beam with the waist of the cavity — i.e. mode matching into the fundamental cavity mode — is of great importance if most of the energy of the incoming beam is to be coupled into the lowest order cavity mode, mode matching issues are fully addressed by the optical design and need not be of concern to the user.

The design also allows for the pigtailing head to be removed so as to allow the cavity to be used in a normal free-space beam configuration. The pigtailing head may be re-attached without loss of the initial alignment. Repositioning of the pigtailing head is accomplished via an alignment slot and a kinematic mount on the SuperCavity front face (see Section 3.2.1 for installation of the kinematic mount). Only minor adjustment of the back screws should be necessary for "tweaking" the alignment.

4.1.2 Re-Alignment Procedures

Re-alignment of the optical assembly to the SuperCavity head is accomplished by four control screws and one lock screw. These screws are hidden under the outside body cover. They are easily accessed by locating and removing the button head Allen screw near the back end of the Fiber Adapter and removing the cover, see Figure 7.

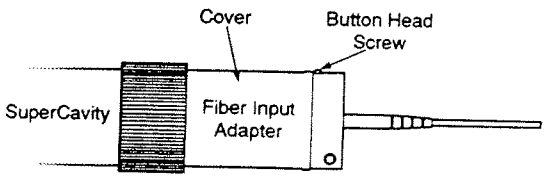


Figure 7 — Outside view showing the location of the button-head screw which holds the outside cover of the Fiber Input Adapter in place. The four alignment control screws and one lock screw are hidden under this outside cover.

Re-alignment of the focusing optics is achieved by a combination of angle and translation adjustment of the optical sub-assembly shown in Figure 2. This is accomplished by iterating the adjustment of the front screws and back screws. Adjusting any one of these screws leads to both angular and translation motion of the beam direction with respect to the SuperCavity head's optical axis, as in Figure 8.

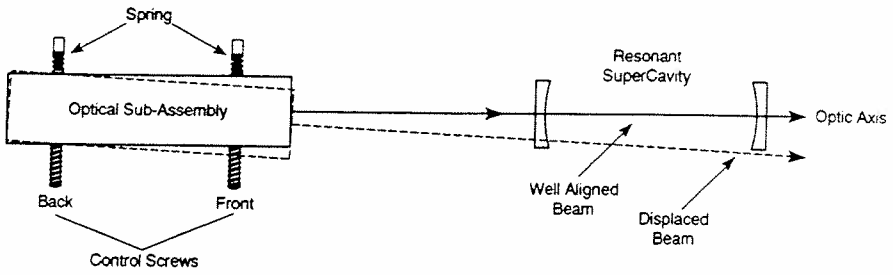


Figure 8 — Schematic showing the effect of adjusting only one control screw (front, in this case). The optical beam acquires both an angular and a translation displacement error with respect to the SuperCavity optical axis.

NOTE

Each SuperCavity Fiber Input Adapter is provided with four knob screws located in a slot inside the wooden delivery box (see the Figure below). These are provided for those customers that prefer knob control screws instead of the slotted screw/screwdriver combination. Screw replacement is straight-forward: With a mode pattern showing on the oscilloscope, remove one slotted screw and replace with a knob screw. Turn that knob until the signal is regained. Repeat this procedure ONE SCREW AT A TIME until all four control screws are replaced with knob screws. Save the slotted screws in the wooden delivery box for future use. These screws are precision high pitch screws. When they are inserted in the Fiber Input Adapter care, should be taken to align the mechanical axis of the screw to that of the tapped hole.

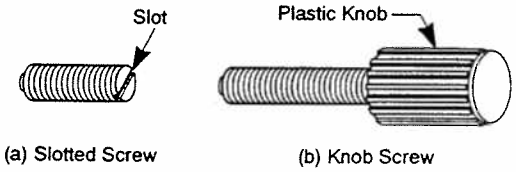


Figure 9 — Control screws provided with the Fiber Input Adapter.

Re-alignment of the Fiber Input Adapter is accomplished as follows:

1. Turn ON the SuperCavity and adjust the controller to display one Free Spectral Range of modes on the oscilloscope (see Figures 4a, 4b, and 4c).

NOTE

Re-alignment is most easily accomplished when the signal into the matched SuperCavity is still present and identification of the lowest order (fundamental) mode is possible. If the signal is absent or the fundamental mode cannot be identified, the user may choose to return the unit to Newport. Newport will re-align the adapter with the SuperCavity for a nominal charge (see Section 5).

2. Locate the three linear holes on the side of the body. The lock screw is the middle screw. Loosen the lock screw one turn while observing the oscilloscope to monitor signal amplitude and to locate the position and direction of the zeroth order (fundamental) transverse mode of the family. Any adjustment of the control screws is directed at maximizing the amplitude of this mode.

3. There are four control screws, two in the front and two in the back. The two front and two back screws are positioned at 90 degrees to each other so as to decouple motion in the horizontal axis from that in the vertical. Choose either the horizontal or the vertical axis. Place two screw drivers on the control screws for that axis, one on the front and one on the back control screw.

CAUTION

Do not attempt to adjust each screw independently to maximize the zeroth order mode. This may provide only a local maximum. To obtain a global maximum, turn one screw a few degrees and search for the maximum by adjusting the other screw, turning it a few degrees to either the left or to the right. Repeat this step until the mode peaks.

Repeat with the other axis. Iterate this procedure to ensure that all axes are peaked. This motion is necessary since the object of the alignment is to point the focused beam to the center of the resonant cavity where the waist is located.

4. After alignment is complete, lock the position in place by using the center lock screw. Tighten gently —overtightening may slightly misalign the optical sub-assembly . If this occurs, it may only be necessary to adjust the back control screws to peak the original signal. Note that the position of the optical sub-assembly for optimum coupling to the SuperCavity may not be at the center, as is shown in Figure 10.

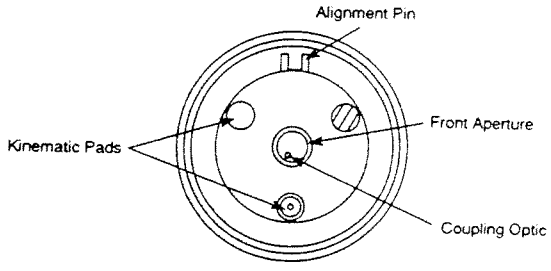


Figure 10 — Front view of the Fiber Input Adapter. The position of coupling optics and the optical axis may be off-center from the mechanical axis without affecting performance.

5. If, in the process of this alignment procedure, the signal disappears completely from the oscilloscope, it will be necessary to realign the optics using the following steps:

NOTE

Ensure the controller is "ON" with the sweep position in the middle of its range, and all cables are connected to the SuperCavity head. If an invisible wavelength is involved, then an infrared vidicon camera or viewer will be needed for rough alignment.

5a. Remove the detector from the back of the SuperCavity.

WARNING

When using visible or near-IR lasers, do not look directly into the detector port on the SuperCavity head. SuperCavity outputs retain the coherence of the original laser beam.

5b. When viewing the mode structure inside the cavity through the detector port with the appropriate device (camera, viewer, etc.), a small bow-tie pattern or a rectangular pattern should appear in the middle of the clear aperture. The pattern, which indicates the light distribution inside the cavity, is the superposition of all transverse modes that are excited by the input beam. In general, the larger the pattern is, the greater misalignment of the beam waists. Perfect alignment is achieved when this pattern is reduced to a single spot.

5c. If this pattern is not present, an attempt should be made to locate two faint spots which represent the first two round trips that the light makes inside the cavity. Once these spots are located, move the optical focusing assembly so that these spots approach each other. If these spots are absent, a random search may be necessary to locate a position where a bow tie or a rectangular shape is in view.

5d. After the above alignment procedure is complete, remount the detector. A mode family should then appear on the oscilloscope. Repeat steps 2-5 for fine tuning of the coupler while observing the zeroth order mode to ensure that correction of the alignment proceeding to conclusion.

4.2 Troubleshooting Guide

The following troubleshooting guide is intended to allow the user to isolate and solve problems with the adapter so that, to the greatest extent possible, the return of the adapter/SuperCavity system to Newport becomes unnecessary. For the problems that cannot be easily resolved, or for other situations that are not covered in this section, please see Section 5 for details on returning the entire system to Newport for service.

Symptom	Possible Fault/Corrective Action
Total system failure	Ensure power plug is connected to the SuperCavity controller. Ensure controller power switch is "on". Check controller fuse for continuity, replace if defective. Ensure AC Voltage jumpers are set properly — change if necessary, check fuse as above.

	Check cables to the SuperCavity head for connectivity and replace if defective. If none of the above, return the adapter and SuperCavity system to Newport for service.
Low or Missing Output in the Fundamental Mode	Check that the adapter is properly mated to the SuperCavity head. The kinematic mount is keyed and fits only one way. With the adapter removed, the optical power emitted from the adapter head may also be measured. Re-align the input end of the fiber if low power is measured (see Section 4.1). If no power is detected regardless of input manipulation, the cable may be broken. Return the adapter and SuperCavity system to Newport for service. Otherwise, re-alignment may be necessary (see Section 4.1). Re-install the adapter on the SuperCavity head with the correct alignment of the kinematic mount.
Confusing Spectra Output	Re-align the input if a confusing spectra is present in the output or if the lowest order fundamental mode cannot be found. See Section 4.1 or return the adapter and SuperCavity system to Newport for service.

Section 5
Factory Service

5.1 Introduction

This section contains information regarding obtaining factory service for the SuperCavity Fiber Input Adapter. The user should not attempt any maintenance or service of this instrument and/or accessories beyond the procedures given is Section 4: Maintenance and Troubleshooting. Any problems which cannot be resolved using the guidelines listed in Section 4 should be referred to Newport Corporation factory service personnel. Contact Newport Corporation or your Newport representative for assistance.

5.2 Obtaining Service

To obtain information concerning factory service, contact Newport Corporation or your Newport representative. Please have the following information available:

1. Instrument model number
2. Instrument serial number (if any)
3. Description of the problem.

If the instrument is to be returned to Newport Corporation, you will be given a Return Authorization Number, which you should reference in your shipping documents.

Please fill out the service form, located on the following page, and have the information ready when contacting Newport Corporation. Return the completed service form with the instrument.

5.3 Packaging Instructions

If your Fiber Input Adapter needs to be returned to Newport for any reason, the following packaging instructions should be followed to ensure safe arrival and processing of the returned unit:

1. If possible, return the unit in its original packaging.
2. If the original packaging is damaged or otherwise unusable, duplicate that packaging to the greatest extent possible. Err on the side of safety where the padding and other protection is concerned. Figure 11 will be of assistance in this process.
3. Remember to include the Newport Return Authorization Number on the outside of the shipping carton and our Service Form inside the container to assist us in returning your unit to you as soon as possible.

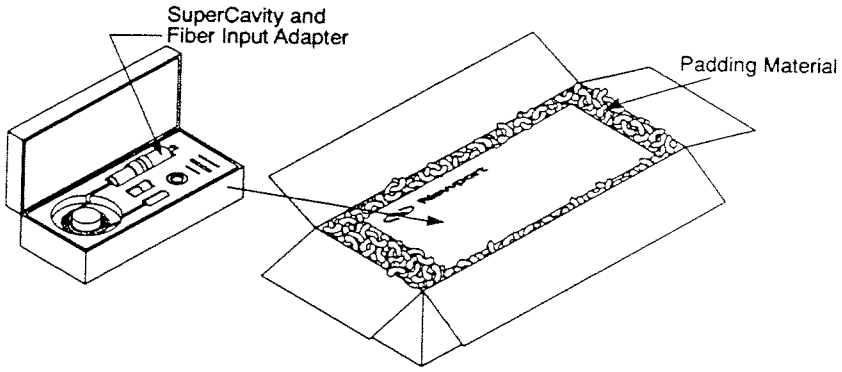


Figure 11 — Schematic for Packaging of SuperCavity and Fiber Input Adapter.

5.4 Service Form

Newport Corporation
U.S.A. Office: 714/863-3144
FAX: 714/253-1800

Name _____ RETURN AUTHORIZATION # _____

Company _____ (Please obtain prior to return of item)

Address _____

Country _____ Date _____

P.O. Number _____ Phone Number _____

Item(s) Being Returned:

Model # _____ Serial # _____

Description: _____

Reason for return of goods (please list any specific problems) _____

_____

Please complete the below, as appropriate.

List all control settings and describe problem: _____

_____

_____

_____ (Attach additional sheets as necessary).

Show a block diagram of your measurement system including all instruments connected (whether power is turned on or not). Describe signal source. If source is a laser, describe output mode, peak power, pulse width, repetition rate and energy density.

Where is the measurement being performed?

(factory, controlled laboratory, out-of-doors, etc.) _____

What power line voltage is used? _____ Variation? _____

Frequency? _____ Ambient Temperature? _____

Variation? _____ °F. Rel. Humidity? _____ Other? _____

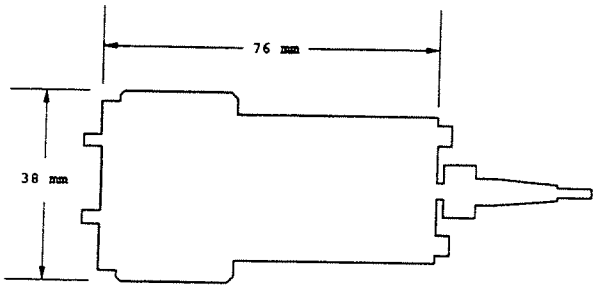
Any additional information. (If special modifications have been made by the user, please describe below).

_____

_____

Section 6
Reference Drawing

Fiber Input Adapter



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