

ORIEL

CORPORATION

250 Long Beach Boulevard
Stratford, CT 06497-0872
Phone: (203) 377-8282
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BEAM PROBE

MODEL 77651

Please read these instructions completely before
operating this equipment.

If there are any questions or problems regarding
the use of this equipment, please contact:

ORIEL CORPORATION

- or -

ORIEL S.A.R.L.
9 Avenue De Laponie
Z.A. De Courtaboeuf
91951 Les Ulis Cedex
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Fax: 01-69-07-23-57

ORIEL SCIENTIFIC, LTD.
1 Mole Business Park
P.O. Box 31
Leatherhead
Surrey KT22 7AU
England
Phone: 0372-378822
Fax: 0372-375-353

- or -

The representative from whom this equipment was purchased.

BEAM PROBE, MODEL 77651

This imaging Beam Probe collects the wide angle radiation which emerges from the glass fiber optic bundles. The Glass Imaging Beam Probe, Model 77651, uses a three element lens to gather all of the light and re-image the end of the fiber bundle. Two output lenses are available from Oriel.

With the 40230 lens, it is possible to re-image 1:1 at 2mm from the end of the probe, or form a larger image at greater distances. At a distance of 100mm from the Beam Probe, the magnification is 12.5x and the individual fibers can be seen clearly. Refer to the table below for the selection of the output lens (which is referred to as lens 2 in our catalog).

Lens Model No.	Focal Length (mm)	Working Distance (mm)	Magnification*	Output Beam** (F/#)
40230	38	9	1.4	1.12
40250	75	12	1.7	1.4

* By moving the fiber bundle you can change magnification and working distance.

** Assumes Lens 1 is filled by the beam from the fiber bundle.

Refer to Figure 1 for a diagram of the 77651, as it is shipped without the front lens.

Refer to Figure 2 for a diagram of the Beam Probe 77651 which shows the output lens (referred to lens 2 in our catalog) installed.

For the assembly of the Beam Probe with the front lens 40230 and 40250, follow the instructions listed below.

1. Remove the forward retaining ring and set the front lens into place as shown in Figure 2.
2. Replace the forward retaining ring.

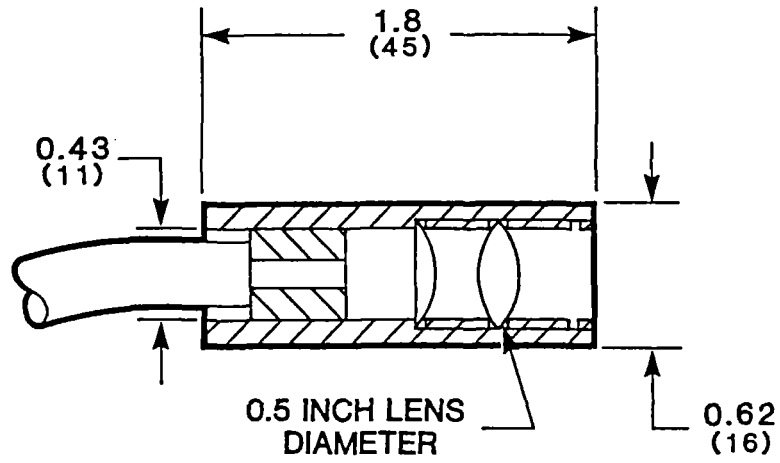


Figure 1

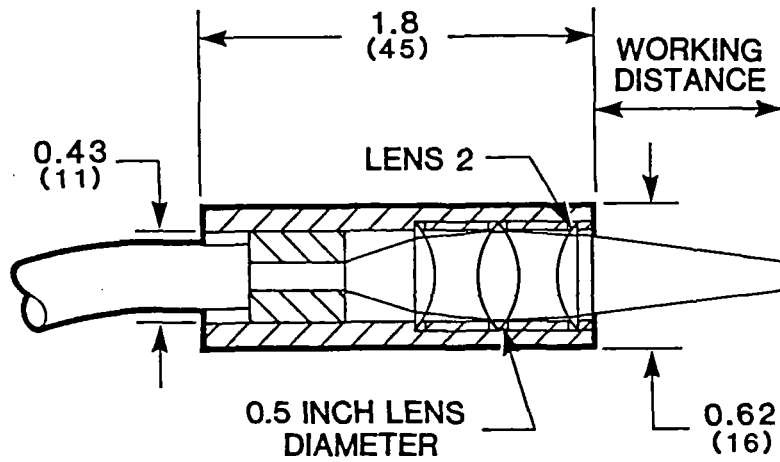


Figure 2

Note: All dimensions in inches and (mm)

WARRANTY

Oriel Corporation warrants that all goods described in this manual (except consumables such as lamps, bulbs, filters, ellipses, etc.) shall be free from defects in material and workmanship. Such defects must become apparent within the following period:

1. All products described here, except spare parts: one (1) year or 3000 hours of operation, whichever comes first, after delivery of the goods to buyer.
2. Spare parts: ninety (90) days after delivery of goods to buyer.

Oriel Corporation's liability under this warranty is limited to the adjustment, repair and/or replacement of the defective part(s). During the above listed warranty period, Oriel Corporation shall provide all materials to accomplish the repaired adjustment, repair or replacement. Oriel Corporation shall provide the labor required during the above listed warranty period to adjust, repair and/or replace the defective goods at no cost to the buyer ONLY IF the defective goods are returned, freight prepaid, to an Oriel Corporation designated facility. If goods are not returned to Oriel Corporation, and user chooses to have repairs made at their premises, Oriel Corporation shall provide labor for field adjustment, repair and/or replacement at prevailing rates for field service, on a portal-to-portal basis.

Oriel Corporation shall be relieved of all obligations and liability under this warranty if:

1. The user operates the device with any accessory, equipment or part not specifically approved or manufactured or specified by Oriel Corporation unless buyer furnishes reasonable evidence that such installations were not a cause of the defect. This provision shall not apply to any accessory, equipment or part which does not affect the safe operation of the device.
2. The goods are not operated or maintained in accordance with Oriel's instructions and specifications.
3. The goods have been repaired, altered or modified by other than Oriel authorized personnel.
4. Buyer does not return the defective goods, freight prepaid, to Oriel repair facility within the applicable warranty period.

IT IS EXPRESSLY AGREED THAT THIS WARRANTY SHALL REPLACE ALL WARRANTIES OF FITNESS AND MERCHANTABILITY. BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTIES, CONDITIONS OR LIABILITIES, EXPRESSED OR IMPLIED, ARISING BY LAW OR OTHERWISE, WHETHER OR NOT OCCASIONED BY ORIEL'S NEGLIGENCE.

This warranty shall not be extended, altered or varied except by a written document signed by both parties. If any portion of this agreement is invalidated, the remainder of the agreement shall remain in full force and effect.

CONSEQUENTIAL DAMAGES -

Oriel Corporation shall not be responsible for consequential damages resulting from misfunctions or malfunctions of the goods described in this manual. Oriel's total responsibility is limited to repairing or replacing the malfunctioning or malfunctioning goods under the terms and conditions of the above described warranty.

INSURANCE -

Persons receiving goods for demonstrations, demo loan, temporary use or in any manner in which title is not transferred from Oriel, shall assume full responsibility for any and all damage while in their care, custody and control. If damage occurs, unrelated to the proper and warranted use and performance of the goods, recipient of the goods accepts full responsibility for restoring the goods to their condition upon original delivery, and for assuming all costs and charges.

RETURNS

Before returning equipment to Oriel for repair, please call the Customer Service Department at (203) 377-8282. Have your purchase order number available before calling Oriel. The Customer Service Representative will give you a Return Material Authorization number (RMA). Having an RMA will shorten the time required for the repair, because it ensures that your equipment will be properly processed. Write the RMA on the returned equipment's box. Equipment returned without a RMA may be rejected by the Oriel Receiving Department. Equipment returned under warranty will be returned with no charge for the repair or shipping. Oriel will notify you of repairs not covered by warranty, with the cost of the repair, before starting the work.

Please return equipment in the original (or equivalent) packaging. You will be responsible for damage incurred from inadequate packaging, if the original packaging is not used.

Include the cables, connector caps and antistatic materials sent and/or used with the equipment, so that Oriel can verify correct operation of these accessories.

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ORIEL

Pinhole and Lens System

INSTRUCTION MANUAL

INSTRUCTION MANUAL
PINHOLE AND LENS SYSTEM
OPERATING INSTRUCTIONS

Please read these instructions completely before
operating this equipment.

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SECTION I - 15380 ADJUSTABLE PINHOLE MOUNT

OPERATION

Inserting the Pinhole -

The pinhole is permanently mounted in a pull out adapter which is slid into a receptacle inside the mount. To provide for repeatable positioning the adapter contains a vee groove, which should fit over a pin in the back of the receptacle. To aid in lining up the vee groove and pin while sliding the adapter in place, rotate the adapter so that the spot on the adapter handle lines up with index mark on the face of the housing. You then will feel the adapter fall in place. Note that the adapter is spring loaded against two line contacts in the receptacle. For more permanent mounting tighten the set screw in the side of the receptacle ring through access hole in the side of the housing between the two micrometers.

TIGHTEN THIS PINHOLE ADAPTER SET SCREW
UNTIL SNUG ONLY. DO NOT OVERTIGHTEN
AS IT IS POSSIBLE TO DAMAGE THE ADAPTER.

Adjustment of Pinhole Position -

X-Y orthogonal adjustments are provided by two metric micrometers. The movable pinhole adapter receptacle is spring loaded against the faces of these micrometers.

One inch (25 mm) diameter handles are installed on the micrometers to improve the setability. These can be removed if desired.

If the pinhole receptacle ring does not appear to spring back properly toward either of the micrometers check that nothing external, such as an objective lens, is binding against the pinhole or the adapter.

The pinhole mount provides smooth precision micrometer adjustments about two orthogonal axis perpendicular to the optical axis. The range of travel is 3/16 inch. Various sized pinholes from 1 to 100 microns are available. These are permanently mounted in separate pullout adapters designed for rapid interchange.

These pinhole mounts are useful to build a spatial filter of laser beam expander. They can also be used to create a precision adjustable "artificial star" or be used to scan images in front of the detector.

This pinhole mount can be mounted by:

1. an optical bench rod
2. to a face plate with the three holes provided - or
3. directly to a 15720 Precision Lens Translator to form a Spatial Filter.

SECTION II - 15720 PRECISION LENS TRANSLATOR

OPERATION

Inserting Lenses -

Three standard lens adapters are available:

with standard microscope objective threads.

inch (23.2 mm) diameter eyepieces by means of a set screw.

25 mm diameter lenses by means of two spring loaded rings.

These lens adapters are slid into the lens mount. Coarse positioning is done by hand. (Additional coarse positioning is possible by sliding the lens within the adapter).

After the lens is coarse positioned, it is held in place by two set screws. Access to these set screws is obtained through the small hole on the side of the large knurled ring. Rotate that knurled ring so the hole is vertical (opposite from the optical bench rod mount) to find one of the set screws, then rotate 90 degrees counter-clockwise to find the other.

Fine Positioning of the Lens -

A total of 3/16 inch (4-1/2 mm) motion is provided by the large knurled knob. For best results with very high magnifications (very short focal lengths) always approach the focus point from one direction only. This will eliminate any very small residual play in the lens.

Oriel Lens Microtranslator -

This is a very high precision focussing lens mount which allows very fine focussing in one direction with negligible wobble, rotation or play. It is particularly useful for short focal length lenses such as microscopic objectives where small amounts of rotation or wobble cause erratic image movements.

The lenses are mounted from a slide in adapter which can be coarsely positioned then held with a set screw. 3/16 inch (4.8mm) fine focussing travel is then driven by a large 2 inch (51mm) diameter knurled ring.

This Lens Translator can be mounted to

- a) an optical bench rod,
- b) a 15380 Pinhole Mount with three tapped holes,
- c) an optional 15820 Flange,
- d) a carrier or table base by a 15850 Mounting Base.

SECTION III - 15220 SPATIAL FILTER ASSEMBLY

OPERATION

Read first the pages describing the 15380 Adjustable Pinhole Mount and the 15720 Precision Lens Translator.

Alignment of Spatial Filter with Laser -

General Method:

First the laser is aligned with the Spatial Filter. Then the lens is positioned far away from the focus point to provide a large spot of light on the pinhole which is relatively easy to find by scanning.

As soon as the large spot is found by the pinhole the lens is moved toward the focus point. As the lens approaches the focus, the apparent size of the spot at the pinhole plane becomes smaller. If the pinhole is centered in the spot the output beam becomes brighter. The positioning of the pinhole however becomes more critical as the focus is approached.

The final positioning involves translating the lens then peaking the brightness of the output beam with the pinhole micrometers then translating the lens again then the micrometers until the focus is reached. When the focus is reached the output beam should be at its largest, brightest and most uniform.

Alignment Procedure -

The following are suggestions only to be employed at first. Each user will find his own technique for speeding the process.

1. Remove Pinhole and Lens. Approximately center the pinhole receptacle ring with the two micrometers. Align with laser beam so that spatial filter is approximately centered on axis.
2. Coarse Lens Positioning: Remove laser beam. Rotate large knurled knob clockwise (tightening) until it reaches the end of its travel. DO NOT TIGHTEN AS DAMAGE TO THE THREADS MAY OCCUR. Insert pinhole but do not tighten set screw. Insert lens until lens just contacts the pinhole and begins to push pinhole out. The 5X, 10X and probably the 20X objective will not reach the pinhole. These should be inserted as far as they will go. Tighten both lens set screws until snug. DO NOT OVERTIGHTEN.
3. Laser Beam Alignment: Remove pinhole. Place paper or screen a few inches from output end of filter. Align and center laser beam on lens. This centering can be determined best by centering the diverging output beam from lens as seen on the paper or screen.
4. Rotate lens knob counter-clockwise until approximately at far end of its travel. Insert pinhole and, if desired, lock in place with pinhole set screw. (If the

pinhole will be removed or changed frequently do not lock in place.)

5. Hold paper screen against output end of filter. A faint glow should be visible. (This should be done in the dark). It will be faint because the focal point of the lens should be far from the pinhole. Rotate lens knob clockwise toward the proper focus. The glow should get brighter. Continue approaching focus point with lens until image starts to shift to side or image abruptly gets dimmer. Adjust vertical micrometer back and forth for maximum brightness; then the horizontal micrometers several times to obtain maximum brightness.
6. Readjust lens toward focus again and repeat step 5 several times until focus is reached. When lens is slightly out of focus a series of diffraction rings may be visible. These will become larger in size as focus is approached and usually will disappear at the focus point leaving a large uniform diverging beam. In the final stages the rings are useful for centering the pinhole.

For best results always approach the focus point with the lens from the same direction. This will minimize the effects of any small residual lens wobble. Also after the lens has been positioned make a final touch up adjustment of the pinhole.

If with a 20X, 60X or 5X objective it appears that the focus point is located further away from the pinhole than the fine adjust will allow, loosen the two lens set screws and manually reposition the lens.

Spatial Filter Assembly -

The Oriel Spatial Filter Assembly is a stable, precise optical instrument comprising an adjustable pinhole and a short focal length adjustable focus lens. The Spatial Filter Assembly filters laser beams by eliminating off-axis modes and spurious interference fringes leading to spatial noise for various laser/holographic and optical data processing applications. With an input laser beam entering the lens, the output is a well-filtered uniform diverging beam suitable for holographic illumination or for recollimating in an expanded form by a large diameter objective lens. The f/na . of the diverging cone can be calculated by dividing the focal length of the lens by the diameter of the entering laser beam down to the minimum f/no . of the lens.

The 15220 Spatial Filter Assembly consists of the following parts:

- 15380 Adjustable Pinhole Mount
- 15520 Pinhole in Adapter - 10 micron diameter
- 15720 Precision Lens Translator
- 15750 Microscope Objective Adapter
- 13590 Microscope Objective - Focal length 9mm (20X)

Pinholes and Adjustments -

The pinhole is adjusted along the X and Y axis by two precision anti-backlash metric micrometer screws with 1" diameter handles. The pinhole is held in a completely spring-loaded mounting. The X-Y motions are smooth, orthogonal and without play. Available pinhole diameters are 1, 5, 10, 25, 50 and 100 microns. The pinholes are mounted in a quick pullout adapter which is easily interchanged.

Lens and Lens Focusing -

The lens position is adjusted along the optical (Z) axis by means of a 2 inch (51 mm) diameter outer ring (40 turns per inch). The lens has a spring-loaded, precision, non-rotating mounting assuring a smooth focusing with negligible wobble. Available lenses include Achromatic Microscope Objectives with effective focal lengths of 3.5, 9, 16 and 30 mm (i.e., 60X, 40X, 20X, and 5X respectively).

The achromatic design of these lenses compensates for spherical aberration and allows operation of several laser wavelengths without refocusing. The lenses are placed in the mount with a pullout adapter which is easily interchanged.

Mount the Spatial Filter Assembly in three ways:

- 1) By an optical bench rod with a 1/4-20 tapped hole in the precision lens translator.
- 2) To a flat vertical face plate by an optional 15820 Mounting Flange attached to the adjustable pinhole mount. The flange is 3.50 inches (89mm) O.D. with three 0.166 inch (4mm) diameter through-holes on a 3 inch circle.
- 3) To a flat base or carrier by a mounting base. This is a 2 x 3 inch (51 x 76 mm) by 0.5 inch (12.7 mm) thick block with four 5/32 inch (4 mm) clear holes at the corners of a 1-1/4 x 2-1/4 inch (31.8 x 57.2 mm) rectangle. The short dimension is parallel with the optical axis. The optical axis height is 2-1/2" (63.5 mm).

SECTION IV - 15260 AND 15280 LASER BEAM EXPANDER
AND COLLIMATOR

OPERATION

Read first the pages describing the 15380 Adjustable Pinhole Mount, the 15720 Precision Lens Translator and the 15220 Spatial Filter.

Preliminary Assembly and Adjustment -

1. Remove output 1 inch diameter lens by removing top set screw.
2. Follow the entire alignment procedure described under the Operation section of the 15220 Spatial Filter Instructions. Lock Pinhole Adapter in place before final alignment. Hand tighten lock nuts on micrometer screws.
3. Install output lens holder.
4. Watching the output beam on a target, position the output lens near the desired point and tighten lens set screws. Note that this lens can be used to create a collimated output beam (infinity focus), or an image of the pinhole can be created at any distance down to 1 foot.

Laser Beam Expanders -

These beam expanders consist of a 15220 Spatial Filter Assembly with an output focusing lens assembly to recollimate the beam. The input positive lenses are the achromatic microscope objective lenses. Two output lens assemblies are available. A 22 mm aperture, 80 mm focal length output lens will provide expansion of 2.7 to 27X with the input lenses listed below. A 46 mm aperture, 160 mm focal length output lens will provide expansions of 5 to 50X. The output lenses are focussed with a smooth, low motion.

These expanders can be used to create an expanded collimated beam or to produce an image of the illuminated pinhole at a distance. The diameter of this image can be estimated as follows:

$$\frac{\text{Image Diameter}}{\text{Pinhole Diameter}} = \frac{D-F}{F}$$

Where D = distance from the exit lens and F = the focal length of the exit lens.

Output Lenses -

The output lnses are cemented doublets corrected for negligible spherical aberration in third order. They are fabricated to a very high degree of sphericity thus assuring an extremely well

collimated beam. In addition, they are corrected for chromatic aberration so that many laser wavelengths can be used without refocussing. They are anti-reflection coated for the 4000-7000 A region.

Standard Components -

The beam expanders listed below include the output lenses, a pinhole mount with 10 micron pinhole and a precision lens translator with microscope objective input lens. This will produce 9X beam expansion with the 22 mm aperture lens and 18X beam expansion with the 46 mm aperture lens.

Alignment and Adjustment for Subsequent Use (after the preliminary adjustment is made):

1. Align and center laser beam onto the beam expander. This can best be done by placing a paper or screen target a few inches from the output beam and aligning the beam for approximately maximum brightness. NOTE: If this alignment cannot be accomplished because there is no apparent output beam, remove output lens assembly and follow preliminary assembly and adjustment steps described above.
2. With the beam thus approximately aligned, final alignment is done by minor re-adjustments in the pinhole position by the two micrometers, adjusting each alternately to obtain maximum brightness. At this time

SECTION V - WARRANTY

Oriel Corporation warrants that all goods listed in this acknowledgement (except consumables such as lamps, bulbs, filters, ellipses, etc.) shall be free from defects in materials and workmanship. In cases of defects in materials and/or workmanship, such defects must become apparent within the following period:

- a. All covered products, except spare parts: one (1) year or 3000 hours of operation, whichever comes first, after delivery of the goods to buyer.
- b. Spare parts: ninety (90) days after delivery of goods to buyer.

The extent of Oriel Corporation's liability under this warranty is limited to the adjustment, repair and/or replacement of the defective part(s). During the above listed warranty period, Oriel Corporation shall provide all materials to accomplish the repaired adjustment, repair or replacement. Oriel Corporation shall provide the labor required during the above listed warranty period to adjust, repair and/or replace the defective goods at no cost to the Buyer ONLY on condition that the defective goods are returned freight prepaid to an Oriel Corporation designated facility. Oriel Corporation shall provide labor for field adjustment, repair and/or replacement at prevailing rates for such field service.

Oriel Corporation shall be relieved of all obligations and liability under this warranty if:

1. The goods are operated with any accessory, equipment or part not specifically approved or manufactured or specified by Oriel Corporation unless buyer furnishes reasonable evidence that such installations were not a cause of the defect, provided that this provision shall not apply to any accessory, equipment or part, the use of which does not affect the safety of the machine.
2. The goods are not operated or maintained in accordance with Oriel's instructions and specifications.
3. The goods have been repaired, altered or modified by other than Oriel authorized personnel.
4. Buyer does not return the defective goods, freight prepaid, to Oriel repair facility within the applicable warranty period.

WARRANTY (continued)

IT IS EXPRESSLY AGREED THAT THIS WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS OR MERCHANTABILITY, AND BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTEES, CONDITIONS OR LIABILITIES, EXPRESS OR IMPLIED ARISING BY LAW OR OTHERWISE AND WHETHER OR NOT OCCASIONED BY ORIEL'S NEGLIGENCE. This warranty shall not be extended, altered or varied except by a written instrument signed by both parties; provided, that in the event the provision relieving Oriel from liability for its negligence should for any reason be held ineffective the remainder of the paragraph shall remain in full force and effect.

CONSEQUENTIAL DAMAGES

Oriel Corporation shall not be responsible for consequential damages as a result of misfunctions or malfunctions of the goods listed on this acknowledgement. Oriel's total responsibility shall be limited to repairing or replacing the malfunctioning or malfunctioning goods under the terms and conditions of the above described warranty.

INSURANCE

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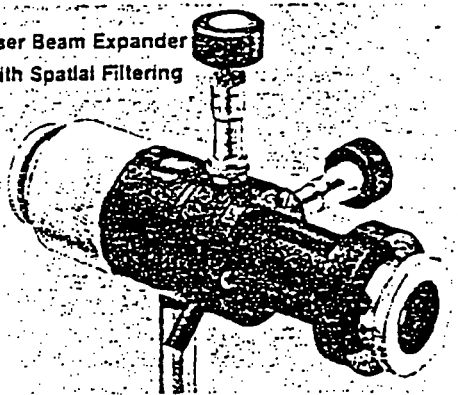
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SECTION VI - DRAWINGS

See the following pages.

Oriel LASER BEAM EXPANDERS — with Spatial Filtering

15260 Laser Beam Expander
with Spatial Filtering



These Oriel Beam Expanders consist of a 15220 Spatial Filter Assembly (description on the previous page) with an output focusing lens assembly to recollimate the beam. The input positive lenses are the Achromatic Microscope Objective lenses listed on the previous page. Two output lens assemblies are available. A 22 mm aperture, 80 mm focal length output lens will provide expansion of 2.7 to 27X with the input lenses listed (see table below). A 46 mm aperture, 160 mm focal length output lens will provide expansions of 5 to 50X. The output lenses are focussed with a smooth, low stiction motion.

These expanders can be used to create an expanded collimated beam or to produce an image of the illuminated pinhole at a distance. The diameter of this image can be estimated as follows:

$$\frac{\text{Image Diameter}}{\text{Pinhole Diameter}} = \frac{D-F}{F}$$

where D = distance from the exit lens and F = focal length of the exit lens.

OUTPUT LENSES

The output lenses are cemented doublets corrected for negligible spherical aberration to third order. They are fabricated to a very high degree of sphericity thus assuring an extremely well collimated beam. In addition, they are corrected for chromatic aberration so that many laser wavelengths can be used without refocussing. They are antireflection coated for the 400-700 nm range.

INPUT LENSES

A series of interchangeable achromatic microscope objective input lenses are listed on the previous page.

PINHOLES

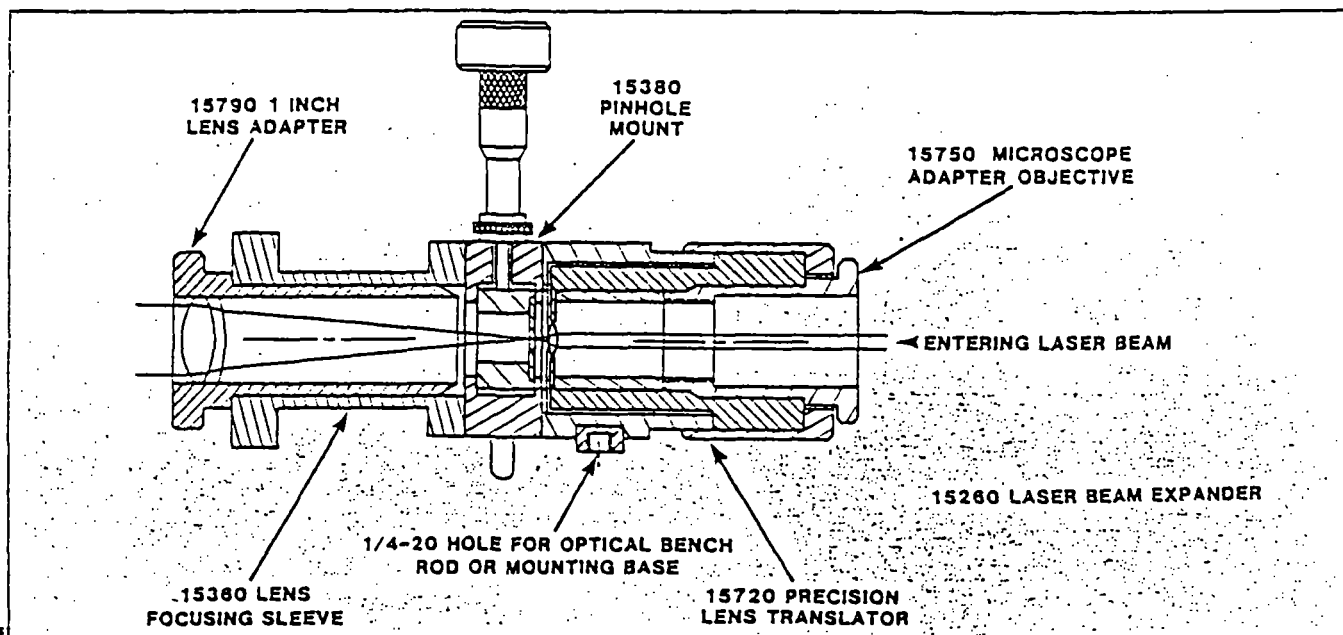
A series of interchangeable pinholes are also listed on the previous pages.

STANDARD COMPONENTS

The Beam Expanders listed on this page include the output lenses shown above, a Pinhole Mount with 10 micron pinhole and a Precision Lens Translator with a Microscope Objective Input Lens. This will produce 9X beam expansion with the 22 mm aperture lens and 18X beam expansion with the 46 mm aperture lens.

BEAM EXPANSION POWERS

Input Lenses	Beam Expansion	
	with 15280 80mm focal length 22mm aperture output lens	with 15280 160mm focal length 46mm aperture output lens
13570 (30 mm F.L.)	5 X	2.7 X
13580 (16 mm F.L.)	10 X	5 X
13590 (9 mm F.L.)	18 X	9 X
13600 (5 mm F.L.)	32 X	16 X
13610 (3 mm F.L.)	53 X	27 X

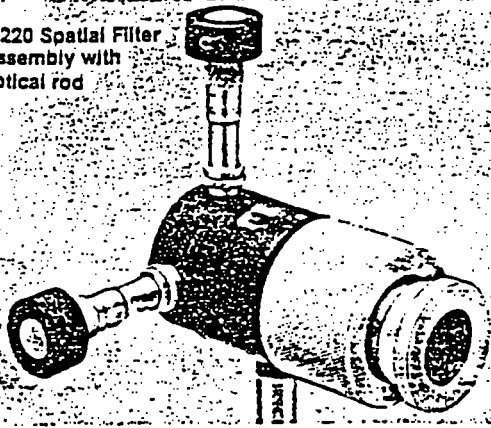


- 15260 Laser Beam Expander
with Spatial Filtering 22 mm Aperture
- 15280 Laser Beam Expander
with Spatial Filtering 46 mm Aperture

- 11891 Inch Base Mounting Kit
- 11892 Metric Base Mounting Kit

ORIEL SPATIAL FILTER ASSEMBLY

15220 Spatial Filter Assembly with optical rod



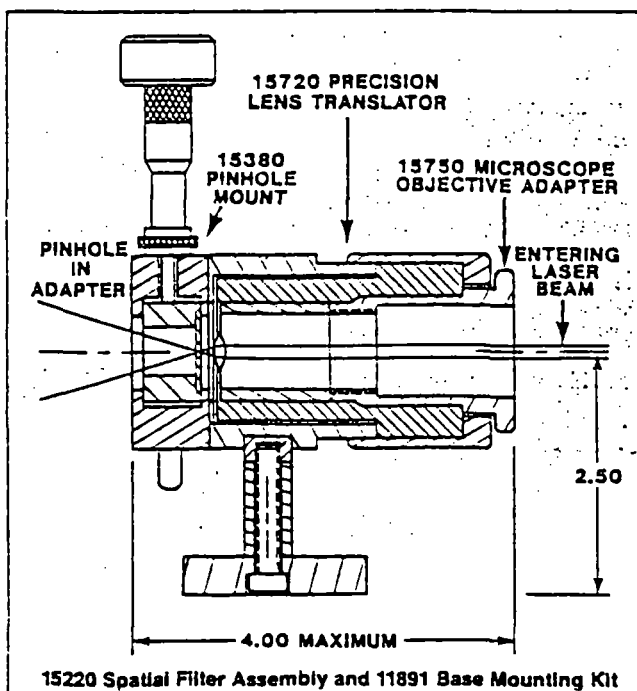
The Oriel Spatial Filter Assembly is a stable, precise optical instrument that consists of an adjustable pinhole and a short focal length lens with adjustable focus.

The Spatial Filter Assembly filters laser beams by eliminating off-axis modes and their resultant spurious interference fringes leading to spatial noise for various laser/holographic and optical data processing applications. With an input laser beam entering the lens, the output is a well-filtered uniform diverging beam suitable for holographic illumination or for recollimating in an expanded form by a large diameter objective lens. The f /no. of the diverging cone can be calculated by dividing the focal length of the lens by the diameter of the entering laser beam down to the minimum f /no. of the lens (see ordering information below).

COMPONENTS

The 15220 Spatial Filter Assembly consist of the following parts:

- 15380 Adjustable Pinhole Mount
- 15520 Pinhole in Adapter — 10 micron diameter
- 15720 Precision Lens Translator
- 15750 Microscope Objective Adapter
- 13590 Microscope Objective Focal length — 9 mm (20 X)



PINHOLES and ADJUSTMENT

The pinhole is adjusted along the X and Y axis by two precision anti-backlash metric micrometer screws with 1 inch diameter handles. The pinhole is held in a completely spring-loaded mounting. The X-Y motions are smooth, orthogonal and without play. Available pinhole diameters are 1, 5, 10, 25, 50 and 100 microns. The pinholes are mounted in a quick pullout adapter which is easily interchanged.

LENSES AND LENS FOCUSING

The lens position is adjusted along the optical (Z) axis by means of a 2 inch (51 mm) diameter outer ring (40 turns per inch). The lens has a spring-loaded, precision, non-rotating, mounting assuring a smooth focusing with negligible wobble. Available lenses include Achromatic Microscope Objectives with effective focal lengths of 3, 5, 9, 16, and 30 mm (i.e. 60X, 40X, 20X 10X and 5X respectively).

The achromatic design of these lenses compensates for spherical aberration and allows operation of several laser wavelengths without refocusing. The lenses are placed in the mount with a pullout adapter which is easily interchanged.

MOUNTING: You can mount the Oriel Spatial Filter Assembly in three ways:

- (1) by an optical bench rod with a 1/4-20 tapped hole in the Precision Lens Translator or
- (2) to a flat vertical face plate by an optional 15820 Mounting Flange attached to the Adjustable Pinhole Mount. This flange is 3.50 inches (89 mm) O.D. with three 0.166 inch (4 mm) diameter through-holes on a 3 inch circle.
- (3) to a table, carrier, translator or magnetic platform with a 11891 or 11892 Base Mounting Kit, containing a 1/2 inch (12.7 mm) thick base plate, 4 precision spacers — 1, 1/2, 1/4 and 1/8 inch (25.4, 12.7, 6.4, 3.2 mm) with appropriate screws to fix the centerline in 1/8 inch (3.2 mm) increments. The 11891 base has slots for 1/4 inch screws on 2 inch centers, the 11892 has slots for 6 mm screws on 50 mm centers. Both have original #6 holes.

15220 Spatial Filter Assembly as described*

- 15820 Mounting Flange
- 11891 Inch Base Mounting Kit
- 11892 Metric Base Mounting Kit

*Note: Other lenses or pinholes may be substituted with corresponding price adjustments.

PRECISION PINHOLES (In Pullout Adapters)

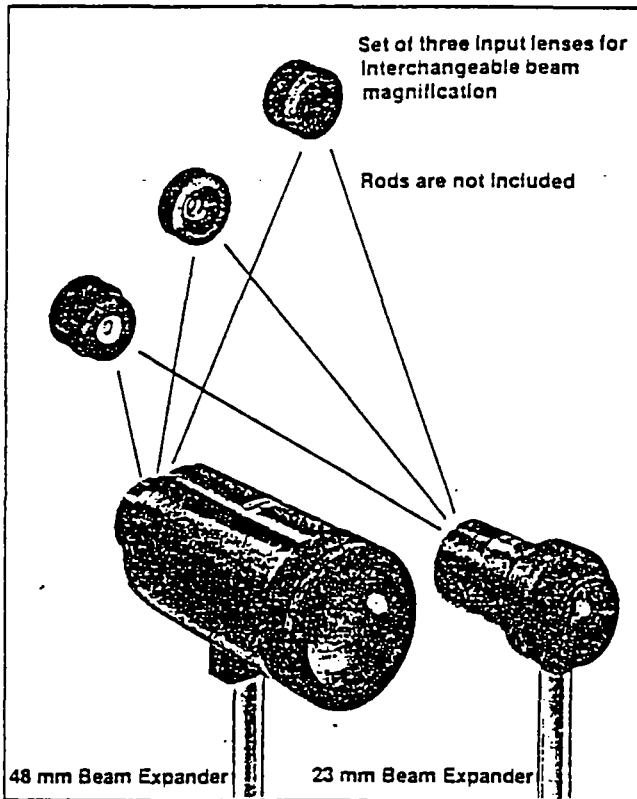
- 15460 Pinhole in Adapter-100 Micron dia.
 - 15480 Pinhole in Adapter- 50 Micron dia.
 - 15500 Pinhole in Adapter- 25 Micron dia.
 - 15520 Pinhole in Adapter- 10 Micron dia.
 - 15540 Pinhole in Adapter- 5 Micron dia.
 - 15560 Pinhole in Adapter- 1 Micron dia.
- Other sized pinholes on request

ACHROMATIC MICROSCOPE OBJECTIVE LENSES

Part No.		Power	Focal Length	f/no.	Price
13570	Lens	5X	30mm	10	
13580	Lens	10X	16mm	3	
13590	Lens	20X	9mm	2	
13600	Lens (S.M.)	40X	5mm	1.5	
13610	Lens (S.M.)	60X	3mm	1.2	

ORIEL IR LASER BEAM EXPANDER/COLLIMATOR

For 10.6 μ CO₂ Lasers or Other Lasers From 3 to 14 μ



- Diffraction limited performance at infinity focus.
- Up to 100 Watts power throughput
- Zinc selenide lenses
- Visible transmission—for alignment
- Interchangeable input lenses—for selectable magnification
- Low wavefront distortion—less than 1/4 wave at 10.6 μ
- Output lens focussing for collimated or focussed beam
- Easy mounting to existing lasers or to optical bench rods

These Oriel infrared laser beam expanders use a Galilean telescope design with a diverging input lens and converging output lens. The beam magnification is the ratio of the two focal lengths.

The zinc selenide lenses used in these expanders provide low absorption at 10.6 microns and transmission in the visible to allow for prealignment of a system with visible lasers. They are useful with lasers up to 100 watts beam power.

These lenses are a meniscus shape designed for minimum spherical aberration then precision ground and polished to produce minimum wavefront distortion. On the standard units these lenses are antireflection coated for the 9 to 11 micron region. On special order coatings for other wavelength regions can be obtained.

Two models are available with output apertures of 23 mm and 48 mm respectively. Interchangeable input lenses allow for a choice of beam magnification factors.

- 16020 IR Beam Expander (2.5, 5 and 10X) with antireflection coated zinc selenide lens of 23 mm aperture, 80 mm focal length; input lens not included. Order from below.
- 16040 IR Beam Expander (5, 10 or 20 X) with antireflection coated zinc selenide lens of 48 mm aperture, 160 mm focal length. Input lens not included. Order from below.
- 16110 IR Laser Beam Expansion Set includes 16020 and 16040 expanders and all three input lenses to provide 2.5, 5, 10 or 20X expansion.

DIVERGING INPUT LENSES FOR THE ABOVE coated zinc selenide lenses mounted in 1 inch (25.4 mm) diameter holders.

Focal Length mm	Total Aperture mm	Beam Magnification		
		with 16020	with 16040	Model No.
-32	12	2.5X	5X	16060
-16	6	5X	10X	16080
- 8	4	10X	20X	16100

OTHER ANTIREFLECTION COATINGS

The standard expanders are antireflection coated for the 9-11 micron region. Coatings on other regions can be supplied on request. Send for Vol. III of the Oriel Catalogs.

NEAR INFRARED SENSOR CARDS: SENSIRS

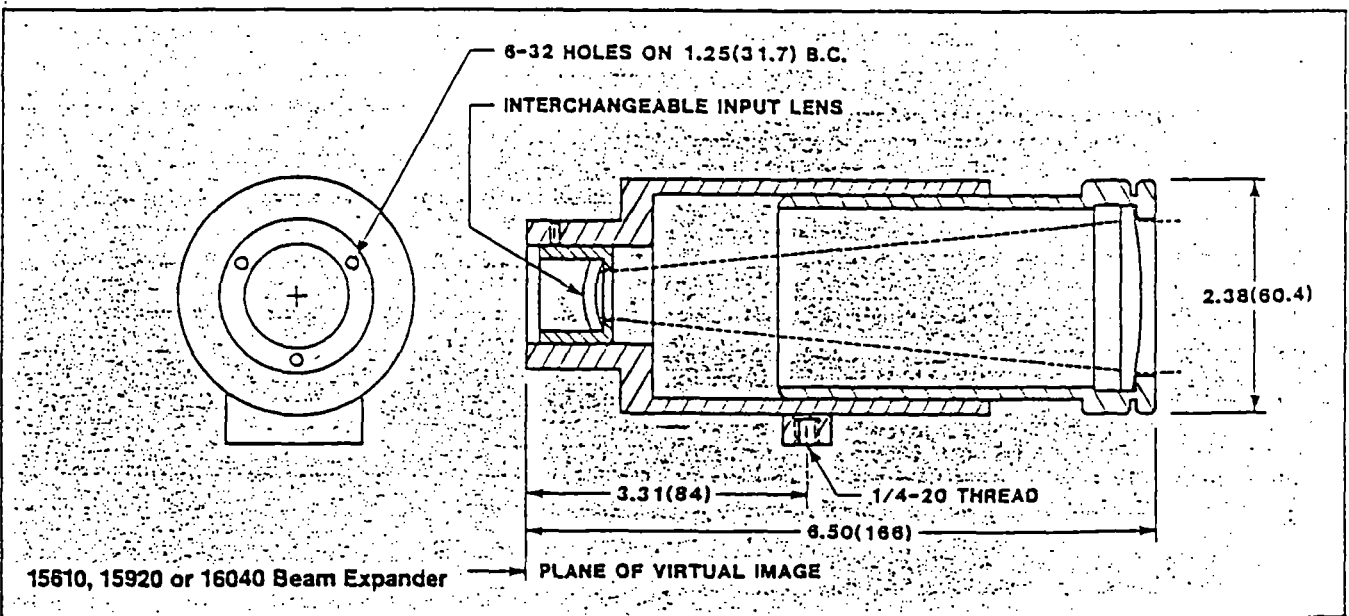
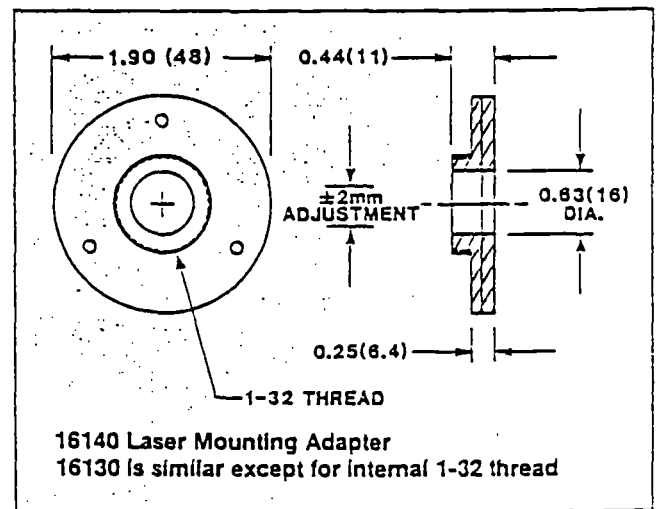
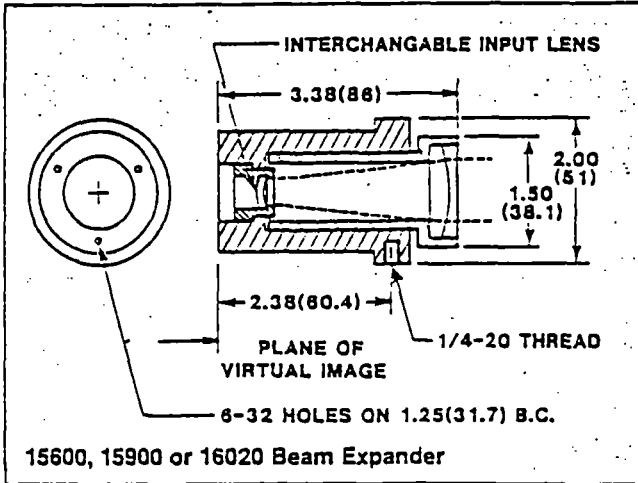
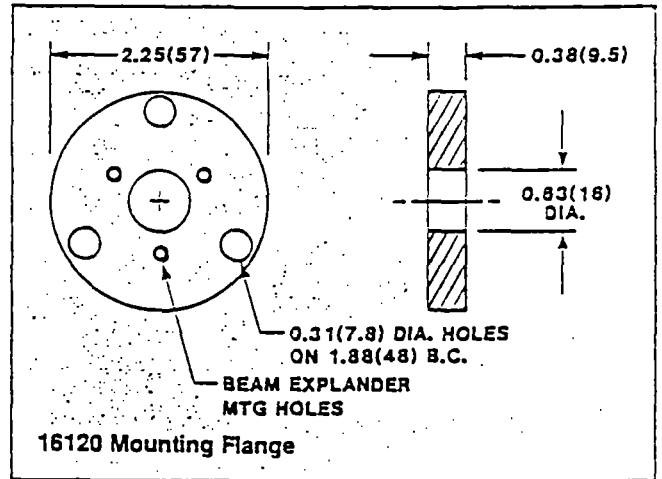
For Detection and Alignment of Lasers, Leds, Fiber Optics and Blackbodies and other NIR Sources from 750 nm to 1.55 μ .

The SENSIRS card contains a re-useable near infrared sensitive material that emits visible light when illuminated by near infrared radiation. The SENSIRS emitted visible light not only allows detection but provides information on spatial distribution of the beam as well. Normal daylight or room light "charges" the sensor material in less than a minute. Insertion of the SENSIRS card into the beam will produce an orange or blue green "spot" indicating the beam. The card is 2.5 x 4 inches (65 x 110 mm) with the active area 2 x 2 inches (50 x 50 mm).

Model #	Form	Emission Color	Wavelength Range (1) nm
15981	Reflective	Orange	(1.0 μ) 750 to 1300
15982	Transmissive	Orange	(1.0 μ) 750 to 1300
15983	Reflective	Blue-Green	(1.0 μ) 750 to 1300
15984	Transmissive	Blue-Green	(1.0 μ) 750 to 1300
15985 ²	Reflective	Blue-Green	(1.3 μ) 950 to 1600

- 1) Peak response is at the center of the wavelength range with a "bell" shaped within ± 150 nm of the peak. For viewing outside of this region, the room must be dark.
- 2) Emission from 15985 can be viewed only in darkened room.
- 3) Minimum sensitivity is approximately 0.5 mW/cm² for all models except 15985. The 15985 requires approximately 15 mW/cm² for emission to occur.

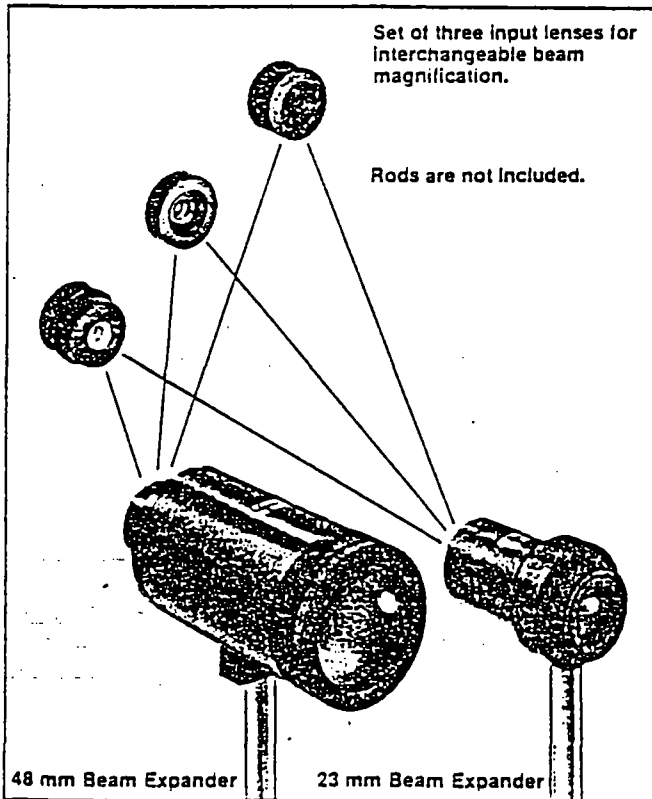
Oriel BEAM EXPANDER DRAWINGS



NOTE TO OEM'S AND OTHER VOLUME USERS
We have manufactured thousands of beam expanders for laser beam scanning or long distance laser alignment systems. These can be pre-focussed and hermetically sealed for field use if required. Contact us for a quotation!

Oriel LASER BEAM EXPANDER/COLLIMATOR

For Ultraviolet—Visible—Near IR Lasers



- Usable from 190 nm to 1.5 μ — with fused silica lenses
- High power throughput
- Selectable beam magnification — with interchangeable input lenses
- Output lens focussing — for collimated focussed beam
- Easy mounting — to existing lasers or to optical bench rods

These Oriel laser beam expanders use a Galilean telescope design with diverging input lens and converging output lens. The beam magnification is the ratio of the two focal lengths.

These expanders with fused silica lenses are useful from 190 nm in the ultraviolet to 1.5 microns in the near infrared. The lenses are singlets designed for minimum spherical aberration then precision ground and polished.* The standard lenses are uncoated. Broad band or narrow band anti-reflection coatings can be supplied on request. See Vol. III of the Oriel Catalogs for information on coatings.

The output lenses can be focussed with a smooth, low stiction motion and locked in place with a set screw. Two models are available with output lenses of 23 mm aperture and 80 mm focal length and 48 mm aperture and 160 mm focal length. Interchangeable input lenses allow for a choice of beam magnification factors.

*NOTE: If operation in the ultraviolet is necessary order the expanders with fused silica lenses listed on this page. For visible use only the expanders on the following page with doublet glass lenses have improved aberration and collimation characteristics.

- 15600 UV Near IR Beam Expander (5, 10 or 20X) with Fused Silica Output lens of 23 mm aperture, 80 mm focal length. Input lens not included. Order from below.
- 15610 UV-Near IR Beam Expander (10, 20, or 40X) with Fused Silica Output lens of 48 mm aperture, 160 mm focal length. Input lens not included. Order from below.

DIVERGING INPUT LENS FOR THE ABOVE
Fused Silica lenses mounted in 1 in. (25.4 mm) diameter holders.

Focal Length mm	Total Aperture mm	Beam Magnification		
		with 15600	with 15610	Model No.
-16 mm f.l.	6	5X	10X	15620
- 8 mm f.l.	4	10X	20X	15630
- 4 mm f.l.	2.5	20X	40X	15640

- 15650 UV Near IR Laser Beam Expander Set includes 15600 and 15610 expanders and all three input lenses to provide 5, 10, 20 or 40X expansion

16120 Input Mounting Flange

*16140 Laser Mounting Adapter with 1 inch — 32 external thread for Oriel Lasers.

*16130 Laser Mounting Adapter with 1 inch — 32 internal thread

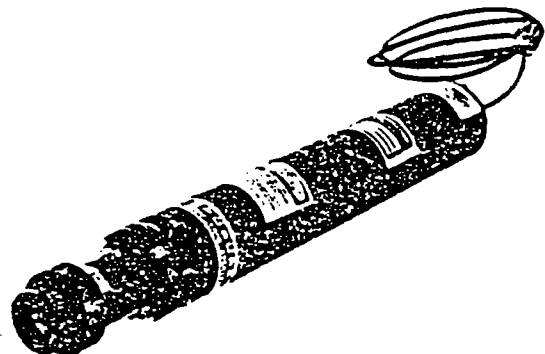
*16150 Laser Mounting Adapter with 3/4 inch — 32 external thread

*These adapters provide a ± 2 mm lateral adjustment.

ANTIREFLECTION COATINGS

Broad Band Antireflection Coating The reflectivity from about 4% to 1.5-2% per surface over a wavelength region of $\pm 20\%$ of the center wavelength. Specify wavelength region.

Narrow Band Antireflection Coating provides about 1/4% per surface reflectivity over a narrow wavelength band. Specify wavelength.



SPECIFICATIONS

Lens Diameter	Aperture	*Maximum Lens Thickness at edge of aperture	Range of Travel a circle whose diameter is:	Resolution
2 inch (50 mm)	1.75 inch (44 mm)	0.5 inch (13 mm)	1/2 inch (6 mm)	20 μ inch (0.5 μ m)
4 inch (100 mm)	3.75 inch (95 mm)	1.0 inch (25 mm)	3/4 inch (13 mm)	20 μ inch (0.5 μ m)
6 inch (150 mm)	5.75 inch (146 mm)	1.5 inch (38 mm)	1 inch (19 mm)	20 μ inch (0.5 μ m)

PRECISION CENTERING MOUNT—2 INCH AND ACCESSORIES

- 17371** Lens Centering Mount — 2 inch
Base mounted for use on surfaces with 1/4-20 holes on 2 inch centers
- 17372** Lens Centering Mount—2 inch
Base mounted for use on surfaces with M6 holes on 50 mm centers
- 17330** Lens Centering Mount — 2 inch
with out base for bench rod mounting with 1/4-20 tapped hole.
- 14520** Special Adapter Set: Two plate adapter
for any diameter optic up to 0.44 inch (11 mm) thick. Specify diameter of optic.

SINGLE FIBER OPTIC MOUNTS

- 18910** Single Fiber Vacuum Chuck
for 2.0 in. (50.8 mm) mounts This vacuum chuck holds single fibers from 125 to 500 microns (.005-.020 in.) An external vacuum pump is required.
- 18915** Single Fiber Collet Chuck
For 2.0 in. (50.8 mm) mounts. The single fiber is held on a collet whose jaws are adjustable from 125 to 760 microns (.005-.030 in.)
- 18916** Precision Single Fiber Chuck
for 2.0 in. (50.8 mm) mounts.
Holds fibers from 10 to 500 microns (.0004-.020 in.)

LENS ADAPTERS FOR 2 INCH MOUNTS

- 14540** 1 inch Self-Contained Adapter with threaded retaining ring for 1 inch (25 mm) dia. optics up to 0.38 inch (9.5 mm) thick. Aperture is 0.75 inch (19 mm)
- 14550** 1.5 inch Self-Contained Adapter with threaded retaining ring for 1.5 inch (or 37.5 mm) dia. optics up to 0.5 inches (13 mm) thick. Aperture is 1.25 inch (32 mm)
- 14350** 15 mm Adapter Set: Two plate adapter
for 15 mm optics up to 0.38 inches (9.5 mm) thick. Aperture is 13 mm.
- 18900** Microscope Objective Holder
Standard microscope objective threads are located in the center of this 2.0 in. (50.8 mm) diameter plate.

PRECISION PINHOLES MOUNTED IN 2.0 IN. (50.8 MM) DIAMETER DISCS

- 18890** 100 Micron Pinhole
- 18892** 50 Micron Pinhole
- 18894** 25 Micron Pinhole
- 18895** 10 Micron Pinhole
- 18896** 5 Micron Pinhole
- 18897** 1 Micron Pinhole

PRECISION CENTERING MOUNT—4 INCH AND ACCESSORIES

- 17381** Lens Centering Mount — 4 inch
Base Mounted for use on surfaces with 1/4-20 holes on 2 inch centers
- 17382** Lens Centering Mount — 4 inch
Base Mounted for use on surfaces with M6 holes on 50 mm centers
- 17340** Lens Centering Mount — 4 inch
without base for Optical Bench Rod Mounting with 1/4-20 tapped hole.

LENS ADAPTERS FOR 4 INCH MOUNTS

- 14680** 3 inch (or 75 mm) Adapter Set:
Two plate set to mount 3 inch (or 75 mm) optics up to 0.875 inches (22 mm) thick
- 14690** Special Adapter Set
Two plate set for any diameter optics up to 0.875 inches (22 mm) thick. Specify diameter of optic.

PRECISION CENTERING MOUNT—6 INCH AND ACCESSORIES

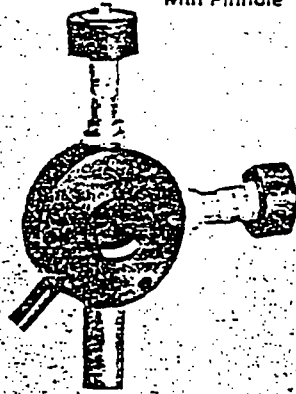
- 17391** Lens Centering Mount — 6 inch
Base mounted for use on surfaces with 1/4 inch tapped holes on 2 inch centers
- 17392** Lens Centering Mount — 6 inch
Base Mounted for use on surfaces with M6 holes on 50 mm centers
- 17350** Lens Centering Mount
without base for optical bench rod mounting with 1/4-20 tapped hole

LENS ADAPTERS FOR 6 INCH MOUNTS

- 17820** 5 inch (or 125 mm) Adapter
Two plate set to mount 5 inch (or 125 mm) optics up to 1.375 inches (35 mm) thick
- 17380** Special Adapter Set
Two plate set to mount any diameter optics up to 1.375 inches (35 mm) thick. Specify diameter of optic.

ORIEL LENS MICROTRANSLATOR AND PINHOLE MOUNT

15380 Adjustable Pinhole Mount with Pinhole



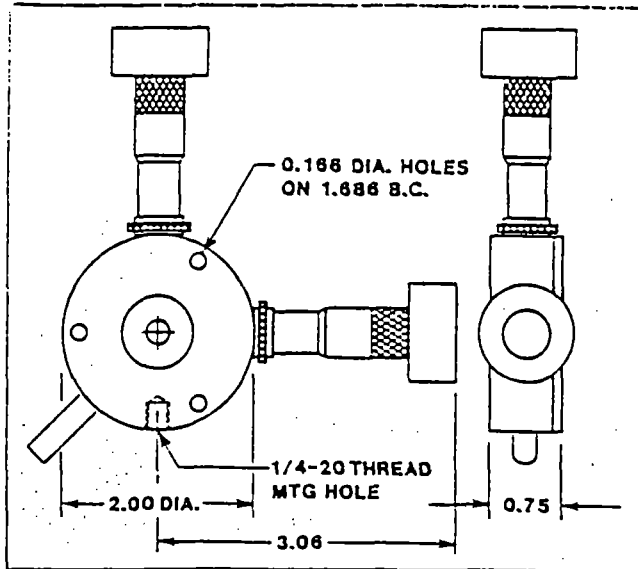
ADJUSTABLE PINHOLE MOUNT

This pinhole mount provides smooth precision micrometer adjustments about two orthogonal axes perpendicular to the optical axis. The range of travel is 3/16 inch. Various size pinholes from 1 to 100 microns are available. These are permanently mounted in separate pullout adapters designed for rapid interchange.

These pinhole mounts are useful to build a spatial filter or laser beam expander. They can also be used to create a precision adjustable "artificial star" or in front of a detector or they can be used to scan small images.

This pinhole mount can be mounted by:

- 1) An optical bench rod as shown
- 2) To a face plate with the three holes provided
- 3) Directly to a 15720 Precision Lens Translator to form a Spatial Filter.

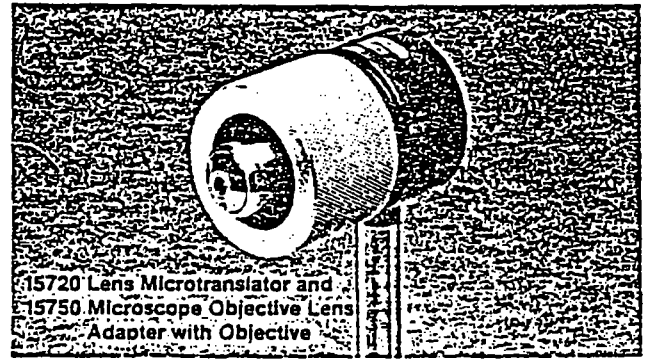


15380 Adjustable Pinhole Mount without pinhole

Pinhole (in adapter) for the Pinhole Mount

- 15460 100 micron pinhole
- 15480 50 micron pinhole
- 15500 25 micron pinhole
- 15520 10 micron pinhole
- 15540 5 micron pinhole
- 15560 1 micron pinhole

For motorized versions see page 216



LENS MICROTRANSLATOR

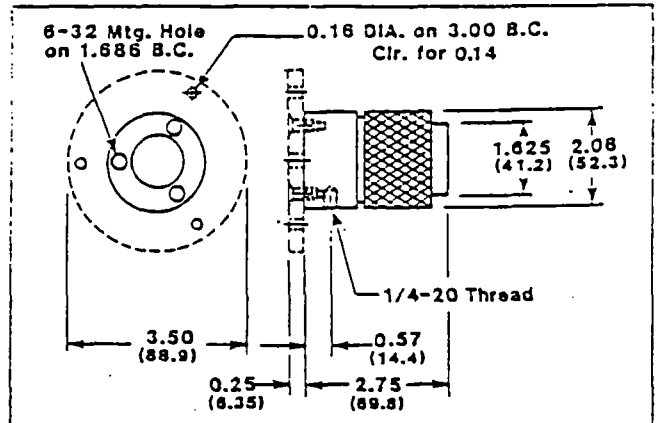
This is a high precision focussing lens mount allows very fine focussing in one direction with negligible wobble, rotation or play. It is particularly useful for short focal length lenses such as microscope objectives where small amounts of rotation or wobble cause erratic image movements.

The lenses are mounted from a slide in adapter which can be coarsely positioned then held with a set screw. 3/16 inch (4.8 mm) fine focussing travel is then driven by a large 2 inch (51 mm) diameter knurling ring.

This Lens Translator can be mounted:

- 1) to an optical bench rod as shown
- 2) To a 15380 Pinhole Mount with 3 tapped holes
- 3) By (3) 6-32 holes on end
- 4) By optional 15820 mounting flange

Choose a lens adapter and lenses below:



15720 Lens Microtranslator without lens adapter

15750 Microscope Objective Lens Adapter for standard objectives

15820 Mounting Flange

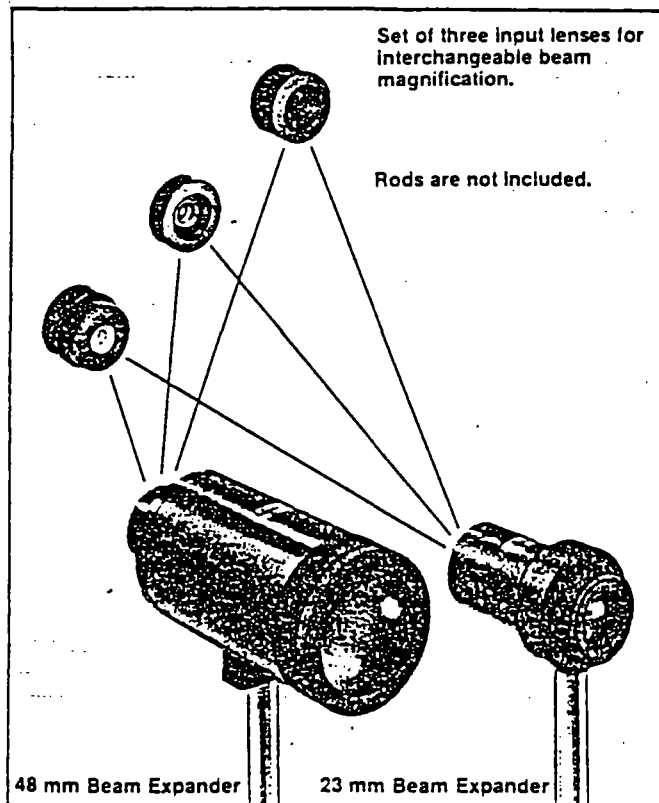
MICROSCOPE OBJECTIVES

This series of achromatic objective provides 5X to 60X magnification. The numerical aperture and power are inscribed on each objective

Model No.	Power	Effective Focal Length (mm)	N.A.
13570	5x	30	0.1
13580	10x	16	0.33
13590	20x	9	0.5
13600	40x	5	0.67
13610	60x	3	0.8

ORIEL LASER BEAM EXPANDER/COLLIMATOR

For Ultraviolet—Visible—Near IR Lasers



- Usable from 190 nm to 1.5 μ — with fused silica lenses
- High power throughput
- Selectable beam magnification — with interchangeable input lenses
- Output lens focussing — for collimated focussed beam
- Easy mounting — to existing lasers or to optical bench rods

These Oriel laser beam expanders use a Galilean telescope design with diverging input lens and converging output lens. The beam magnification is the ratio of the two focal lengths.

These expanders with fused silica lenses are useful from 190 nm in the ultraviolet to 1.5 microns in the near infrared. The lenses are singlets designed for minimum spherical aberration then precision ground and polished.* The standard lenses are uncoated. Broad band or narrow band anti-reflection coatings can be supplied on request. See Vol. III of the Oriel Catalogs for information on coatings.

The output lenses can be focussed with a smooth, low stiction motion and locked in place with a set screw. Two models are available with output lenses of 23 mm aperture and 80 mm focal length and 48 mm aperture and 160 mm focal length. Interchangeable input lenses allow for a choice of beam magnification factors.

***NOTE:** If operation in the ultraviolet is necessary order the expanders with fused silica lenses listed on this page. For visible use only the expanders on the following page with doublet glass lenses have improved aberration and collimation characteristics.

- 15600 UV Near IR Beam Expander (5, 10 or 20X) with Fused Silica Output lens of 23 mm aperture, 80 mm focal length. Input lens not included. Order from below.
- 15610 UV-Near IR Beam Expander (10, 20, or 40X) with Fused Silica Output lens of 48 mm aperture, 160 mm focal length. Input lens not included. Order from below.

DIVERGING INPUT LENS FOR THE ABOVE
Fused Silica lenses mounted in 1 in. (25.4 mm) diameter holders.

Focal Length mm	Total Aperture mm	Beam Magnification		
		with 15600	with 15610	Model No.
-16 mm f.l.	6	5X	10X	15620
- 8 mm f.l.	4	10X	20X	15630
- 4 mm f.l.	2.5	20X	40X	15640

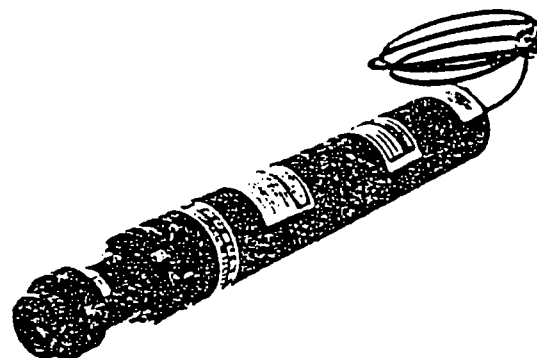
- 15650 UV Near IR Laser Beam Expander Set includes 15600 and 15610 expanders and all three input lenses to provide 5, 10, 20 or 40X expansion
- 16120 Input Mounting Flange
- *16140 Laser Mounting Adapter with 1 inch — 32 external thread for Oriel Lasers.
- *16130 Laser Mounting Adapter with 1 inch — 32 internal thread
- *16150 Laser Mounting Adapter with 3/4 inch — 32 external thread

*These adapters provide a ± 2 mm lateral adjustment.

ANTIREFLECTION COATINGS

Broad Band Antireflection Coating The reflectivity from about 4% to 1.5-2% per surface over a wavelength region of $\pm 20\%$ of the center wavelength. Specify wavelength region.

Narrow Band Antireflection Coating provides about 1/4% per surface reflectivity over a narrow wavelength band. Specify wavelength.



71130-M

O R I E L

THERMOPILE DETECTOR HEAD

MODELS 71130 and 71140

INSTRUCTION MANUAL

900516:ch
WPNO.2

Please read these instructions completely before
operating this equipment.

If there are any questions or problems regarding
the use of this equipment, please contact:

ORIEL CORPORATION
250 Long Beach Boulevard
Stratford, CT 06497-0872
Phone: (203) 377-8282
Fax: (203) 378-2457

- or -

ORIEL S.A.R.L.
9 Avenue De Laponie
Z.A. De Courtaboeuf
91940 Les Ulis
France
Phone: 01-69-07-20-20
Fax: 01-69-07-23-57

ORIEL SCIENTIFIC, LTD.
1 Mole Business Park
P.O. Box 31
Leatherhead
Surrey KT22 7AU
England
Phone: 0372-378822
Fax: 0372-375-353

- or -

The representative from whom this equipment was purchased.

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SECTION II	DETECTOR INSTALLAION	5
SECTION III	OPERATION	8
SECTION IV	WARRANTY	10
SECTION V	RETURNS	12
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I. INTRODUCTION

Models 71130 and 71140 Thermopile Detector Heads hold, respectively, thermopiles mounted in TO-5 cans or TO-8 cans. Each thermopile detector sits in a socket so that its sensitive surface can be irradiated through a threaded opening in the front of the detector head. This opening may have a window to protect windowless detectors from air currents and atmospheric contamination.

The BNC connector on the back plate carries the signal produced by the thermopile.

The front of the detector head has a 1-1/2" flange that will hold a wide range of accessories, such as filter holders, and shutters. A 1/4-20 tapped hole allows rod mounting.

II. DETECTOR INSTALLATION

If the thermopile detector is not already installed in the head, install the detector as follows (see Figure 1):

1. Remove the three screws (8) holding the rear plate in place and slide the socket board assembly out of the housing.
2. Remove the two long screws (9), on the rear plate, which hold the assembly together. (These pass through the pairs of spacers to the front plate.)
3. Plug the detector into the sockets as shown in Figure 2. (Use the diagram which applies to the model used.)
4. Place the front cover plate (3,10) over the detector and see if it contacts the front spacers (7). If not, note how far it is from the spacers. Remove the detector and cut this amount off each of the detector pins.
5. Replace the detector in the socket and reassemble the inner assembly. Tighten the two long screws securely through the circuit board and spacers to the front panel.
6. Place the inner assembly back in the housing and fasten it in place with the three screws.
7. If applicable, place a 10mm diameter window in the opening of the front plate, ahead of the detector. Hold it in place with the retainer ring. (13).

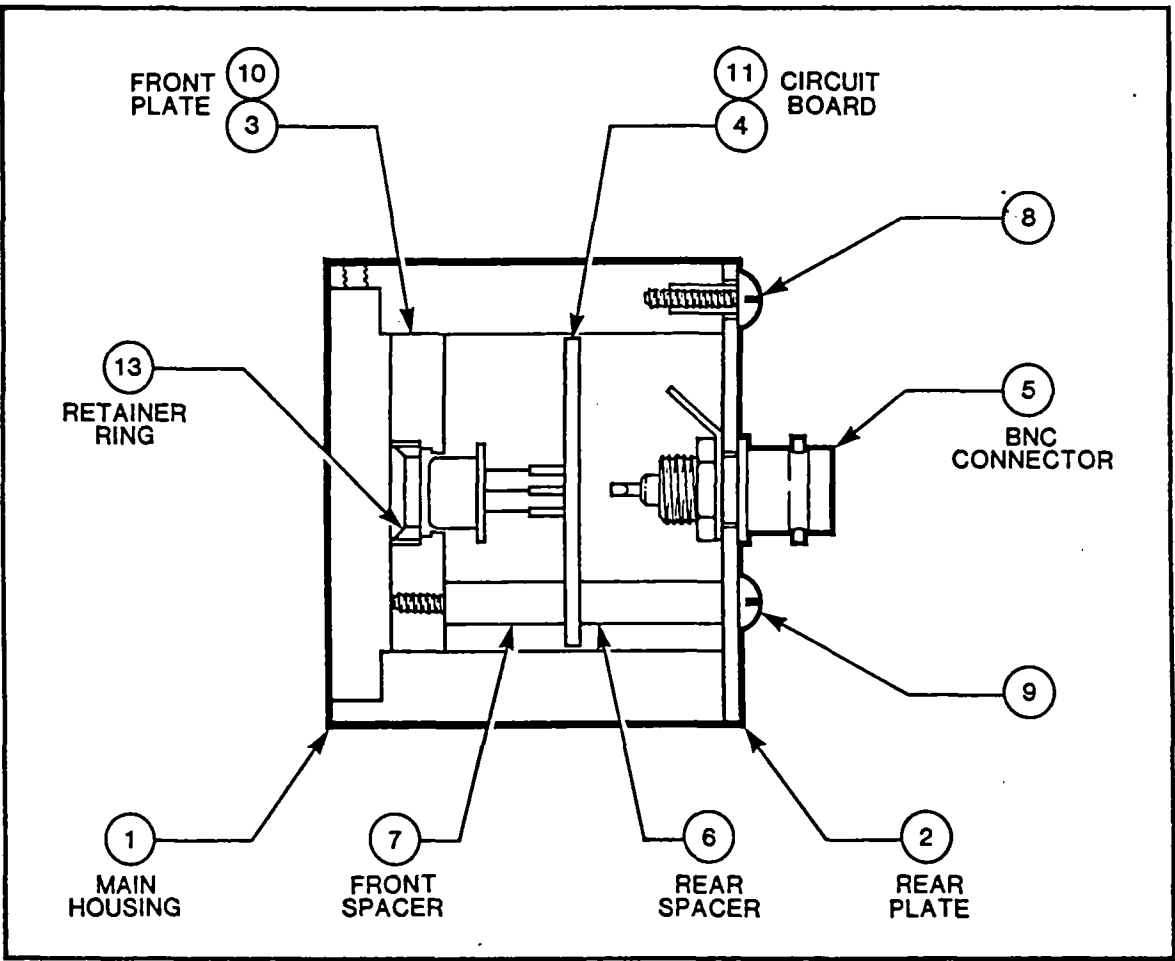


FIGURE 1 MODEL 71130/71140 HOUSING

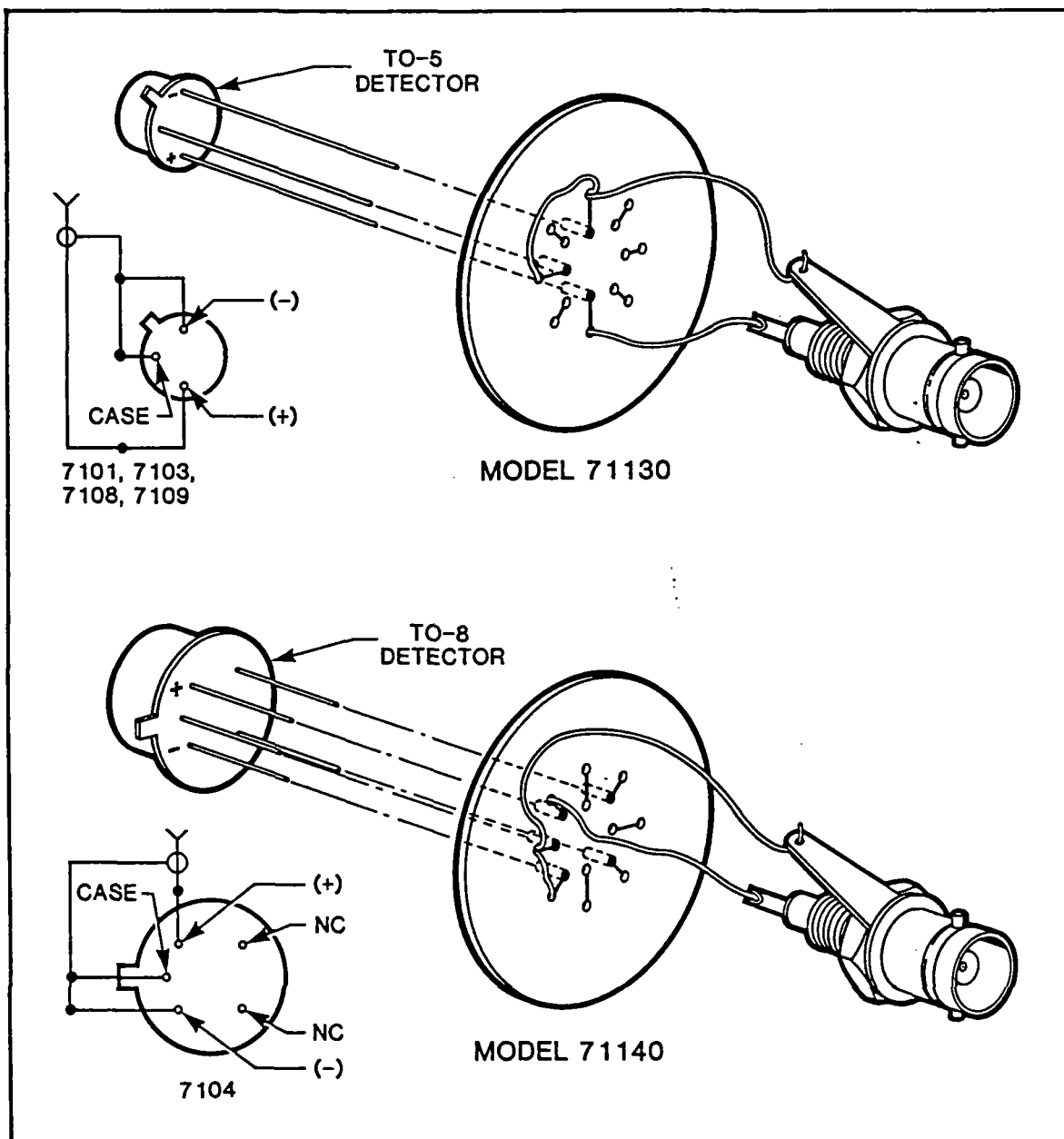


FIGURE 2 DETECTOR/HEAD PIN-SOCKET MATING

III. OPERATION

The thermopile's output is a low voltage, self-generated dc voltage. Therefore, you will need a sensitive voltmeter or multimeter (sensitivity of 10 microvolts or less) to measure the voltage. Because the voltages are so small, the best way to get accurate measurements is to take a series of measurements with the radiation blocked and unblocked and then compute the average.

To set up the thermopile detector head:

1. Connect the voltmeter or multimeter to the BNC connector on the detector head.
2. Place the detector head so that radiation from the source falls on the detector head.
3. Arrange the source and the detector head so that you can interrupt the radiation, using either a sheet of opaque material or Oriol's model 71430 shutter. The shutter is convenient if the detector head is solidly coupled to the experimental setup, or if you are making many measurements.

To take voltage measurements:

1. Close the shutter; i.e., block the radiation.
2. Wait about 30-60 seconds and check the voltage after the voltmeter has reached its minimum reading.
3. Open the shutter; i.e., unblock the radiation.
4. Wait about 30-60 seconds again and check the voltage after the voltmeter has reached its maximum reading.
5. Repeat steps 1-4 three to five times.
6. Average the readings for closed shutter voltage.
7. Average the readings for open shutter voltage.

8. Compute the difference of the two averages. This is the voltage signal which is proportional to the radiant power falling on the detector, V_s .
9. To compute the radiant power in watts, divide the result of step 8 by the detector's responsivity in volt/watt, R_v .
$$W = V_s / R_v$$
10. To compute the irradiance on the detector, divide the result of step 8 by the detector area (in square centimeters), A_d .
$$H = W / A_d$$

NOTE: Since the figures for responsivity are approximate, the radiation values will also be approximate. These measurements will be satisfactory if you need only relative values. If you need more accurate results, calibrate the thermopile against a detector with known responsivity.

SECTION IV - WARRANTY

Oriel Corporation warrants that all goods described in this manual (except consumables such as lamps, bulbs, filters, ellipses, etc.) shall be free from defects in material and workmanship. Such defects must become apparent within the following period:

1. All products described here, except spare parts: one (1) year or 3000 hours of operation, whichever comes first, after delivery of the goods to buyer.
2. Spare parts: ninety (90) days after delivery of goods to buyer.

Oriel Corporation's liability under this warranty is limited to the adjustment, repair and/or replacement of the defective part(s). During the above listed warranty period, Oriel Corporation shall provide all materials to accomplish the repaired adjustment, repair or replacement. Oriel Corporation shall provide the labor required during the above listed warranty period to adjust, repair and/or replace the defective goods at no cost to the buyer ONLY IF the defective goods are returned, freight prepaid, to an Oriel Corporation designated facility. If goods are not returned to Oriel Corporation, and user chooses to have repairs made at their premises, Oriel Corporation shall provide labor for field adjustment, repair and/or replacement at prevailing rates for field service, on a portal-to-portal basis.

Oriel Corporation shall be relieved of all obligations and liability under this warranty if:

1. The user operates the device with any accessory, equipment or part not specifically approved or manufactured or specified by Oriel Corporation unless buyer furnishes reasonable evidence that such installations were not a cause of the defect. This provision shall not apply to any accessory, equipment or part which does not affect the safe operation of the device.
2. The goods are not operated or maintained in accordance with Oriel's instructions and specifications.

WARRANTY (continued)

3. The goods have been repaired, altered or modified by other than Oriel authorized personnel.
4. Buyer does not return the defective goods, freight prepaid, to Oriel repair facility within the applicable warranty period.

IT IS EXPRESSLY AGREED THAT THIS WARRANTY SHALL REPLACE ALL WARRANTIES OF FITNESS AND MERCHANTABILITY. BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTIES, CONDITIONS OR LIABILITIES, EXPRESSED OR IMPLIED, ARISING BY LAW OR OTHERWISE, WHETHER OR NOT OCCASIONED BY ORIEL'S NEGLIGENCE.

This warranty shall not be extended, altered or varied except by a written document signed by both parties. If any position of this agreement is invalidated, the remainder of the agreement shall remain in full force and effect.

CONSEQUENTIAL DAMAGES -

Oriel Corporation shall not be responsible for consequential damages resulting from misfunctions or malfunctions of the goods described in this manual. Oriel's total responsibility is limited to repairing or replacing the malfunctioning or malfunctioning goods under the terms and conditions of the above described warranty.

INSURANCE -

Persons receiving goods for demonstrations, demo loan, temporary use or in any manner in which title is not transferred from Oriel, shall assume full responsibility for any and all damage while in their care, custody and control. If damage occurs, unrelated to the proper and warranted use and performance of the goods, recipient of the goods accepts full responsibility for restoring the goods to their condition upon original delivery, and for assuming all costs and charges.

SECTION V - RETURNS

Before returning equipment to Oriel for repair, please call the Customer Service Department at (203) 377-8282. Have your purchase order number available before calling Oriel. The Customer Service Representative will give you a Return Material Authorization number (RMA). Having an RMA will shorten the time required for the repair, because it ensures that your equipment will be properly processed. Write the RMA on the returned equipment's box. Equipment returned without a RMA may be rejected by the Oriel Receiving Department. Equipment returned under warranty will be returned with no charge for the repair or shipping. Oriel will notify you of repairs not covered by warranty of the cost of the repair before starting the work.

Please return equipment in the original (or equivalent) packaging. You will be responsible for damage incurred from inadequate packaging, if the original packaging is not used.

Include the cables, connector caps and antistatic materials sent and/or used with the equipment, so that Oriel can verify correct operation of these accessories.

SECTION VI PARTS LIST/DRAWINGS

See pocket on back cover for parts list and catalog information.

ORIEL CORPORATION ASSEMBLY PARTS LIST

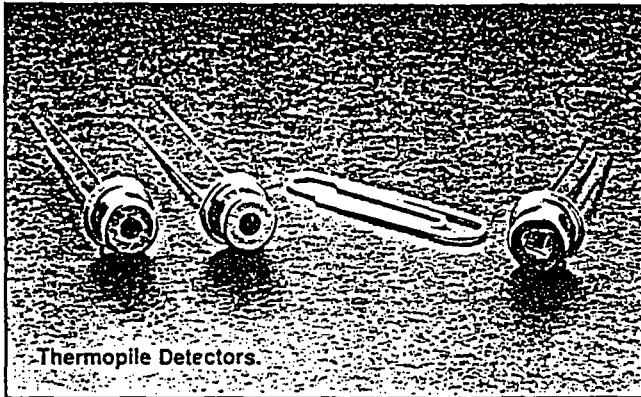
ASSEMBLY PART NO. 7113 & 7114 NAME DETECTOR HOUSING		-1=7113 -2=7114		DWG/SCHEM NO. 7113-3-1000	P/L REV C	REV DATE 9-19-80	REL FOR PROD	IPO NUMBER				
ITEM NO.	SCHEM DES	DWG SZ	ORIEL PART NO. OR DWG. NO.	DESCRIPTION	QTY/ASS'Y				VENDOR	P.O. NO	VENDOR/MATL UNIT COST	+ MACHIN UNIT COST
					-1	-2	-3	-4				
1		B	7113-2-1005	MAIN HOUSING	1	1						
2		B	7113-2-1006	REAR PLATE	1	1						
3		B	7113-2-1007	FRONT PLATE	1	0						
4		A	7113-1-1100-1	P.C. CARD ASSY	1	0						
5			10-10-010	B.N.C. CONN'R	1	1						
6			20-50-033	SPACER, 3/4	2	2						
7			20-50-032	SPACER, 5/8	2	2						
8				SCREW #6-32 x 1/2 LG. B.H	3	3						
9				SCREW #4-40 x 1 5/8 LG B.H	2	2						
10		B	7114-2-1007	FRONT PLATE	0	1						
11		A	7113-1-1100-2	PC CARD ASSY	0	1						
12				(A) SOCKET SET SCREW, 6-32x3/16"	3	3						
13		B	7111-2-1007	RING RETAINER	1	1						
14	Ⓢ		60-30-030	LUG	1							

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ORIEL CORPORATION ASSEMBLY PARTS LIST

ASSEMBLY PART NO. 7113-1-1100 NAME THERMOPILE CIRCUIT BOARD			DWG/SCHEM NO. 7113-1-1100	P/L REV	REV DATE A	REL FOR PROD 8-29-79	IPO NUMBER					
ITEM NO.	SCHEM DES	DWG SZ	ORIEL PART NO. OR DWG. NO.	DESCRIPTION	QTY/ASS 'Y				VENDOR	P.O. NO	VENDOR/MATL UNIT COST	MACH/ASSY UNIT COST
					-1	-2	-3	-4				
1			7113-1-1102	PC CARD	1	1						
2	*		10-50-024	LEAD SOCKET PINS (A)	3	0						
3			10-50-043	SOCKET PINS (A)	0	5						
				* ONLY INDIVIDUAL PINS REQUIRED, REMOVE FROM LEAD CARRIER TO INSTALL.								
				ENGINEERING PRINT FOR REFERENCE ONLY <u>DO NOT REMOVE</u>								

For Radiation Measurements From the UV to FAR IR



- ☑ Broad spectral response: 0.2 to 50 microns
- ☑ Rugged thin film construction for high reliability
- ☑ Excellent long term stability
- ☑ Interchangeable windows
- ☑ Room temperature operation
- ☑ Self-generating voltage - no bias required
- ☑ Noise behavior ideal for DC or low frequency operation
- ☑ Complete detector housing available

OPERATION

The classic thermopile is an array of junctions of dissimilar metals connected in series. Alternate (hot) junctions are blackened and/or attached to plates to increase their effective area; the remainder are cold junctions maintained at ambient temperature. Radiation absorbed by the hot junctions increases their temperature relative to the cold junctions and an emf is produced. Since the conversion process is strictly thermal, only the absorption characteristics of the blackening material affects the wavelength response.

- In the past, thermopiles were hand made from very fine unsupported wires. Rugged models were insensitive and slow, while the sensitive models were delicate and expensive. Oriel Thermopiles use thin film technology to produce the junctions. More junctions can be packed into the active area, and the devices are rugged and reliable. The proprietary black coating is spectrally neutral from the UV through the IR. These thermopiles operate at room temperature, and can be used for measuring steady or slowly varying signals.

CHOOSING THE PROPER DETECTOR

Detector Size

- The 2 x 2 mm detectors are for most general purpose applications.
- The 0.8 x 2 mm detectors are for imaging an elongated source such as a monochromator slit.
- The 6 mm diameter detectors have a uniform response over the central 5 mm diameter. This is particularly useful for measuring the total power of a laser or focused beam.

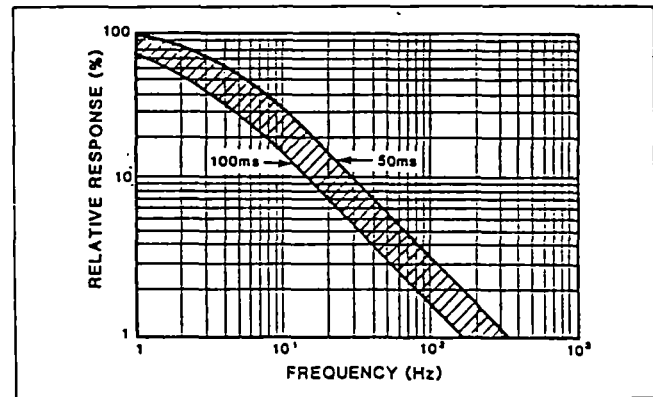


Fig. 1 Typical Responsivity of Thermopile Detectors with fast response coating.

SPECIFICATIONS/ORDERING INFORMATION

Interchangeable Windows

10 mm diameter by 1 mm thick for use in the Detector Mounts or Housings. (See page 328.)

3810 Fused Silica Window	3813 KRS-5 Window
3811 Calcium Fluoride Window	3814 Irtran 2 Window
3812 Potassium Bromide Window	3815 Silicon Window

Detectors

Detector Area (mm x mm)	Surface Type	Window	Number of hot Junctions	Maximum Irradiance (W cm ⁻²)	DC Responsivity (V/W)	D* (cm Hz ^{1/2} W ⁻¹)	NEP (W Hz ^{-1/2})
2 x 2	Black	None	48	0.1	9-16	2 x 10 ⁸	10 ⁻⁹
2 x 2	Fast	KBr	48	0.1	9-16	2 x 10 ⁸	10 ⁻⁹
2 x 2	Fast	KRS-5	48	0.1	9-16	2 x 10 ⁸	10 ⁻⁹
0.8 x 2.4	Black*	Black ¹	20	0.1	6-10	1.7 x 10 ⁸	10 ⁻⁹
6 mm diameter	Black*	Black ¹	75	0.1	3-5	1 x 10 ⁸	5 x 10 ⁻⁹

¹For faster response in these sizes contact Oriel Applications Engineers.

Detector Black Coating

Two types of black coatings can be applied to the active element:

- The **Stable Black Coating** is an organic paint which is absorptive from 0.2 to beyond 50 μm , but with slightly reduced absorptivity from 1 to 15 μm . (Fig 2.) Thermopiles with this coating can be used without windows or with interchangeable windows to reduce the effects of air currents. Our housings have holders for our 10 mm diameter 1 mm thick windows. The window transmission may influence the spectral response.
- The **Metal Oxide Coating** also has a uniform and broadband response. A thermopile with this thin coating has a response time which is 2 to 3 times faster than a similar thermopile with the paint coating. Since the metal oxide is attacked by the atmosphere, detectors with this coating have permanently sealed windows.

See page 445 for window transmittance.

TO READ OUT THESE DETECTORS

The output signal is a self-generated voltage.

For D.C. operation, use a microvoltmeter. You can estimate the sensitivity required of the microvoltmeter from the power incident on the thermopile and the tabulated responsivity. The readings will drift if the temperature of the detector casing and cold junction change. You should shutter the beam to prevent it from warming the detector. Only open the shutter to read the signal level.

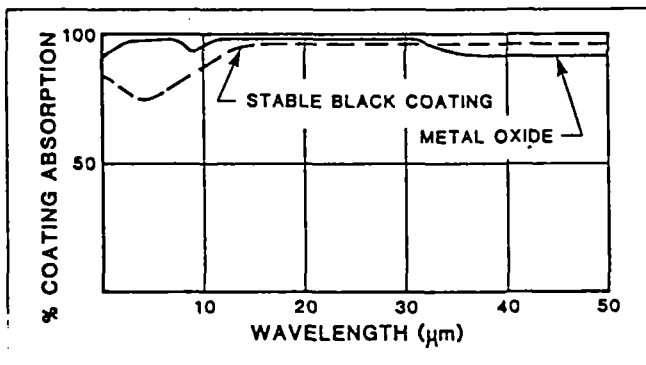


Fig. 2 Absorptivity of our Thermopile coatings.

WINDOW CHARACTERISTICS (1 mm thick)

Material	Usable Spectral Range (μm)	Approx. Transmittance in Range (%)	Water Solubility (g/100 g)	Affected by Humidity
IR Fused Silica	0.20-3.5	93	0	No
Calcium Fluoride (CaF_2)	0.13-11	94	0.0017	No
Potassium Bromide (KBr)	0.25-26	93	53.5	Yes
KRS-5	0.60-40	74	0.05	No
Intran 2 (ZnS)	2.00-13	73	0	No

See page 445 for transmittance curves for these materials.

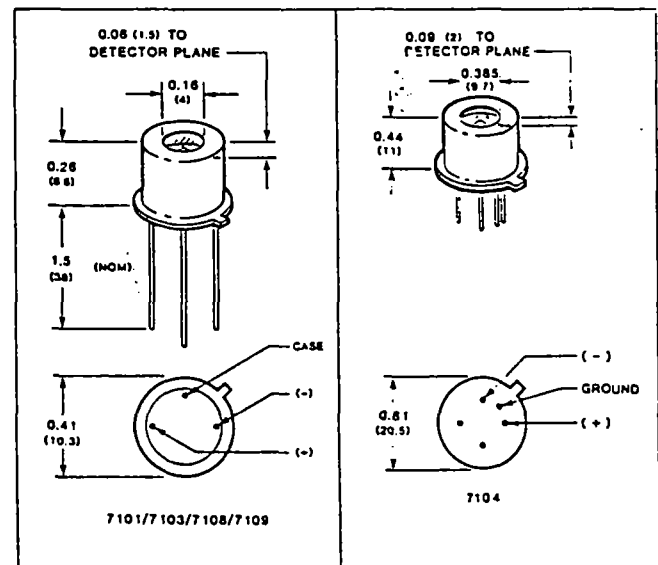


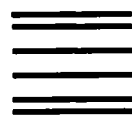
Fig. 3 Thermopile Detectors. See page 328 for Thermopile Detector Housings.

Resistance (k Ω)	Time Constant (ms)	Case Type	Detector Only		Detector in Housing	
			Model No.	Price	Model No.	Price
6-15	100-250	TO-5	7101		71775**	
6-15	50-100	TO-5	7108		71776**	
6-15	50-100	TO-5	7109		71777**	
1-5	300	TO-5	7103		71778**	
18-35	800-1400	TO-8	7104		71779***	

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- 32 Laser system development
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- 41 Photochemistry
- 44 Solar simulation
- 47 Microscopy
- 50 Machine vision/robotics

- 53 Development or manufacture of semiconductor, thin/thick film circuitry microwave devices
- 56 UV curing
- 59 Graphic Arts
- 60 Other: _____

I work at these wavelengths:

- 86 100-190 nm
- 89 190-320 nm
- 92 320-400 nm
- 95 400-700 nm
- 98 0.7-1.2 μ
- 101 1.2-3 μ
- 104 3-15 μ
- 107 over 15 μ

I use or may use:

- 59 Optical tables/benches
- 61 Optical mounts
- 62 Micropositioners
- 68 Precision motorized drives
- 71 Lasers
- 74 Arc lamp sources
- 77 Monochromators/Spectroscopy
- 78 Detectors
- 80 Fiber optics—bundles
- 83 Fiber optics—single fibers
- 84 Filters, lenses, mirrors

My application is: IMMEDIATE WITHIN 90 DAYS FUTURE

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