

Industrial robotics, Machine vision, Quality control applications, Group viewing, Electronics fabrication of printed circuit boards, Wire bonders, Computer related production and testing techniques and Three Coordinate Measuring Machines all require the Micro-Video-Zoom-Objective Lens offering a broad magnification range for video use. To function properly in such varied applications, the lens system must have excellent resolution and stay in focus over its entire zoom range. Realizing these needs, Titan Tool has computer designed the **Micro-Video-Zoom-Objective System**. The Titan System is not a stereo microscope lens reappplied, but rather is designed especially for video applications. Using this approach, we are able to offer more features that broaden the System's application range, make it easier to use and lower the retail price.



A) The Zoom Lens is available with a choice of **6 different sub lenses**, magnifications .35X, .5X, .75X, 1X, 1.5X and 2X. They allow for a broad range of magnification, fields of view and working distances. The Micro-Video-Zoom-Objective is not furnished with a standard front sub lens. You order what you need together with the Zoom Objective. This allows for a flatter field, brighter and sharper image and better resolution.

B) In addition, Titan offers the choice of **.67X, 1X or 2X Video Adapters** to further expand the range of magnifications, Each video adapter is compatible with any of the six available sub lenses allowing total magnification of the Zoom System to be as low as .17X or as high as 18X at the camera focal plane. Fields of View go from a minimum of 0.02" using the 2X sub lens and 2X video adapter to a maximum of 1.79" with the .35X sub lens and .67X adapter. The choice of video adapter does not affect working distance of the system.

C) The Optical Path Bender bends the optical path of the Zoom Lens, TZOVA to the Video Adapter VATZ67 or VATZ1 or VATZ2 at 90° and considerably shortens the Optical Path to 5.75".

D) All threads used on the lens system are standard. The back thread of the Micro-Video-Zoom-Objective is the Royal Microscope Society mount and the Video Adapter screws directly into it. The Video Adapter has a standard 1-32 thread C-mount that fits directly into an industrial video camera.

E) 2X lens Attachment is available which remagnifies the basic image from the .67X, 1X or 2X Video adapters and Zoom Objective, two times or double basic magnification. This 2X lens attachment is also available with Reticle Order #RARP-3.

F) We have available as an extra option a **POLARIZING FILTER**. This is desirable as it eliminates glare back into the optical system which shows up as "HOT SPOTS" on the Video Monitor. These HOT SPOTS are caused by highly reflective materials such as circuits on Printed Circuit Boards, many polished metals, mirrors, micro circuit chips and etc. This filter fastens onto the front of the Sub Lens and behind the Fibre Optic Ring Illuminator.

G) In the Electronics Industry and other applications, there has been a demand for even larger **Fields of View for the Micro Video Zoom Objective**. We have resolved this problem by having available on **Optional .5X convertor** that can be used in conjunction with the zoom system to increase the Field of View. The Field of View is then doubled or increased by 15% depending on the Adapter and Sub Lens combination. The adjustable .5X convertor has 3 adjustable positions: Plus(+), Zero(0) and Minus(-). The Total Magnifications, Working Distances, Fields of View and N/A for the adapter, plus the convertor, can be purchased as an optional extra and is not necessary for the unit to function properly. If purchased, it screws directly into the bottom of the Zoom Objective between the Zoom Objective and the Sub Lens.

H) Alignment with the Zoom System is an ever present desire. We have solved this situation by having available 2 Reticle Patterns that can be incorporated directly into the Zoom System. These reticles are available in 3 different forms. Reticle RARP-1 is a simple broken cross hair where Reticle RARP-2 is composed of lines on the Vertical and Horizontal Axis incorporated in the Reticle Adapters RARP-1 or RARP-2 that have to be factory installed and so ordered prior to shipment. Reticle Adapter RARP-3 is identical to Reticle RARP-2 except the image is remagnified 2 times. Whatever the Magnification shown in Table I or II, it is doubled with the Reticle. RARP-3 Reticle Adapter shows many more circles and lines (90 Circles and 90 Lines) on the Vertical and Horizontal Axis as the Reticle Pattern itself is reduced. This Reticle Adapter can be purchased separately and added at any time to the System; as it screws directly in between the Video Camera and top of the Video Adapter. Reticle RARP-3 is recommended if the ultimate in Resolution and Accuracy is desired. It is possible to rotate all three reticles in their Adapters 90° to align with a workpiece or stage movement, by a simple screw adjustment.

VIDEO APPLICATIONS OPTICAL DATA TABLE I FOR AVAILABLE SUB LENS/ADAPTER COMBINATIONS OF TZOVA ZOOM OBJECTIVE, 6.5 : 1 RATIO FOR 2/3 VIDICON STANDARD USAGE

Magnification Of Sub Lens	N.A.	Working Distance	Magnification & Field Of View	Magnification Of Video Adapters		
				.67X Video Adapter	1X Video Adapter	2X Video Adapter
0.35X	.008 to .027	200MM or 7.874"	Total Mag. at Camera	.17X - 1.1X	.25X - 1.6X	.5X - 3.2X
			***Field Of View	46.0 - 7.7 MM 1.79" - 0.30"	30.70 - 5.11 MM 1.20" - 0.20"	15.3 - 2.6 MM 0.60" - 0.10"
			Depth Of Field	2.00" - .350"	1.900" - .300"	1.400" - .200"
			*Resolution	7.13 - 28.5 L/MM	10.1 - 40.3L/MM	16 - 57 L/MM
			**Res. with 2XL Adapter	14.3 - 32 L/MM	11.3 - 64 L/MM	22.62 - 80.6 L/MM
0.5X	.011 to .039	141MM or 5.551"	Total Mag. at Camera	.24X - 1.5X	.35X - 2.2X	.70X - 4.4X
			***Field Of View	34.2- 5.4 MM 1.33" - 0.21"	23.0 - 3.6 MM 0.90" - 0.14"	11.5 - 1.8 MM 0.45" - 0.07"
			Depth Of Field	1.30" - .300"	1.20" - .200"	.600" - .080"
			*Resolution	10.1 - 40.3 L/MM	14.3 - 50.8 L/MM	32 - 90.5 L/MM
			**Res. with 2XL Adapter	20.16 - 71.8 L/MM	16 - 80.6 L/MM	36 - 114 L/MM
0.75X	.017 to .059	93MM or 3.661"	Total Mag. at Camera	.35X - 2.2X	.52X - 3.3X	1.40X - 6.6X
			***Field Of View	23.0 - 3.6 MM 0.90" - 0.14"	15.3 - 2.4 MM 0.60" - 0.10"	7.7 - 1.2MM 0.30" - 0.50"
			Depth Of Field	.700" - .100"	.600" - .090"	.400" - .060"
			*Resolution	17.95 - 57L/MM	32 - 90.5 L/MM	45.3 - 128 L/MM
			**Res. with 2XL Adapter	28.51 - 102 L/MM	36- 128 L/MM	57 - 161L/MM
1.0X	.022 to .079	70MM or 2.745"	Total Mag. at Camera	.47X - 3.0X	.7X - 4.5X	1.4X - 9.0X
			***Field Of View	17.4 - 2.7 MM 0.68" - 0.11"	11.5 - 1.8 MM 0.45" - 0.07"	5.6 - 0.8 MM 0.22" - 0.03"
			Depth Of Field	.500" - .070"	.450" - .060"	.300" - .050"
			*Resolution	22.62 - 64 L/MM	32 - 90.5 L/MM	57 - 128 L/MM
			**Res. with 2XL Adapter	32 - 102 L/MM	40.3 - 128 L/MM	57 - 161 L/MM
1.5X	.034 to .075	45MM or 1.772"	Total Mag. at Camera	.70X - 4.5X	1.05X - 6.8X	2.10X - 13.5X
			***Field Of View	11.4 - 1.7 MM 0.44" - 0.07"	7.7 - 1.2 MM 0.30" - 0.05"	3.8 - 0.6 MM 0.15" - 0.02"
			Depth Of Field	.290" - .060"	.270" - .050"	.250" - .030"
			*Resolution	36 - 114 L/MM	57 - 128 L/MM	64 - 144 L/MM
			**Res. with 2XL Adapter	57 - 161 L/MM	71.8 - 181 L/MM	71.8 - 203 L/MM
2.0X	.043 to .096	34.5MM or 1.318"	Total Mag. at Camera	.94X - 6.0X	1.4X - 9.0X	2.8X - 18X
			***Field Of View	8.7 - 1.3 MM 0.34" - 0.50"	5.8 - 0.9 MM 0.22" - 0.04"	3.0 - 0.4 MM 0.12" - 0.02"
			Depth Of Field	.200" - .050"	.190" - .022"	.180" - .015"
			*Resolution	45.3 - 144 L/MM	64 - 161 L/MM	90.5 - 181 L/MM
			**Res. with 2XL Adapter	64 - 203 L/MM	90.5 - 203 L/MM	128 - 228+ L/MM

*Resolution in line pairs per millimeter **Resolution with 2XL Adapter or RARP-3 Adapter is used. *** All values for Field of View in above table were figured for a 2/3" Format Camera. For 1/2" Format, multiply values by .72 and for 1/3" Format, multiply by .54.

TOTAL MAGNIFICATION OF ZOOM SYSTEM = Mag. of Zoom Lens (Total Mag. at Camera) as per Table I & II X Electronic Magnification Table III. EX. 2X Sub Lens & 2X Video Adapter Mag. Range of 2.8X to 18X times 20.8X(9" Monitor & 2/3" Format Camera) gives a Magnification Range of 58.25X to 374X. A 1/3" Format Camera & 15" Monitor of 177.8X to 1143X & these Magnifications can be doubled as shown in table I with the 2XL Adapter.

DIMENSIONS FOR ZOOM OBJECTIVE:

- A) .67X, 1X or 2X Adapter 1.25" Diameter by 4.75" Long.
- B) Sub Adapter - Used between Zoom Objective and Video Adapter .67X, 1X or 2X is 1" Diameter.
- C) Zoom Objective - Maximum Diameter 1.50", overall length 3.80".
- D) Sub Lens .35X or .5X etc. - .35" Wide, .90" Diameter.
- E) Overall Length of Assembled Unit without Reticle Adapter -10.5"
- F) Overall Length of assembled with Reticle Adapter 14.25".
- G) Overall Length with .5X but without Reticle Adapter - 12.75".
- H) Overall Length with .5X Converter and Reticle Adapter and Zoom Lens - 15.875".
- I) 2XL or RARP-3 add 3.5" to overall length.
- J) Overall Length of TZOVA Zoom, SD Sub Lens & LB-90 is 5.75" at 90°.

ELECTRONIC MAGNIFICATION TABLE III			
CAMERA FORMAT CHOICES			
Monitor Size	1/3" (6mm)	1/2" (8mm)	2/3" (11mm)
9" (229mm)	38.2X	28.6X	20.8X
15" (381mm)	63.5X	47.6X	34.6X
19" (483mm)	80.5X	60.4X	43.9X
24" (610mm)	101.6X	76.3X	55.5X

www.TitanToolSupply.com • Phone: 716-873-9907

THE LB-90 RIGHT ANGLE OPTICAL BEAM BENDER

LB-90 Beam Bender was designed for those occasions where it is necessary to bend the optical path and shorten the overall length between the camera and workpiece.

Technically, it can become necessary to minimize the length of the optical system between the Video Camera and the workpiece. If this is essential, we have designed a 90° Optical Path system that uses an optical Square to bend the optical path at a 90° right angle. In front of the Optical Square, we have only the TZOVA ZOOM LENS AND THE SUB LENS with a total length of the square plus the Zoom Lens plus the Sub Lens of only 5.75". The Optical Tube and Video Adapter as well as the Video Camera are at right angles to the workpiece.

The RARP-1 or RARP-2 or VATZ67, VATZ1 or VATZ2 project to the side. If it becomes necessary, the Ring Illuminator, .5x Converter or the Polarizing Filter can be added between the Zoom Lens and Workpiece, in the front part of the Optical System. The 90° Optical Square is 1.470" Square with a .195" mounting plate on two sides for the Zoom Objective and Video C-Mount adapters. For mounting the system to a machine, it has four 10-32 drilled and tapped holes on a 1.096" center line .187" in from the edge. These drilled and tapped holes are located on the top and back side of the unit.

This allows for Vertical or Horizontal mounting of the Optical System. Having this unit in place considerably shortens the optical path.



THE .5X CONVERTOR ORDER #CVN-1

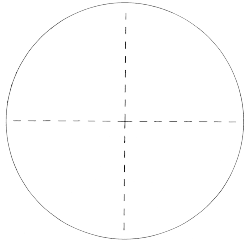


The CVN-1 .5X convertor is a valuable addition to the TZOVA Zoom Objective where **LARGER FIELDS OF VIEW** are desirable. All optical Calculations shown in Table II above which accounts for the Sublens, .5X Converter, Zoom Objective and Video Adapter. For TOTAL MAGNIFICATION including VIDEO CAMERA, use Table III for multipliers of Video Magnification.

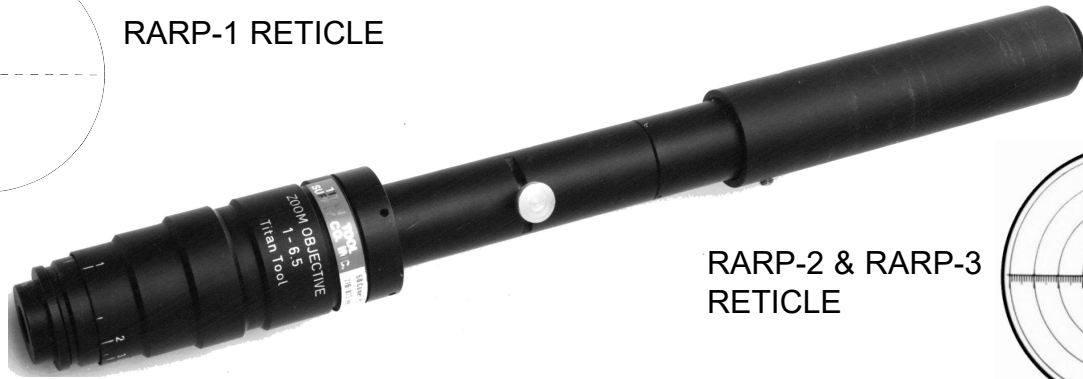
This .5X Converter is easily installed between the Zoom Lens and the Sublens. The Converter has an adjustment built into it that allows for Three Positions; Plus (+), Zero (0) or Minus (-) each with its own Field of Views and Working Distance. The Highest Magnifications are found with the Plus Position, the Largest Field of View with the Minus Position. This unit when used with the .67X adapter will not fill the Monitor Screen. This pertains strictly when used with the Low Magnification of the Zoom Lens. A round Image appears on the Monitor. An excellent image fully filling the Video Monitor Screen appears with 1X and 2X adapters and at High Magnification with the .67X Adapter.

OPTICAL DATA TABLE II SHOWING POSITIONS +, 0, - OF .5X CONVERTOR						
Mag. Of Sub Lens	N.A.	Working Distance	Mag. & FOV of 3 Positions on .5X Converter	Magnification Of Video Adapters		
				.67X Video Adapter	1X Video Adapter	2X Video Adapter
0.35X	.004" to .013"	Plus + 162MM or 6.38"	Magnification	.11X - .68X	.16X - 1.02X	.32X - 2.04X
			Field Of View	*70MM - 13MM 2.76" - .51"	53MM - 9.5MM 2.09" - .37"	26MM - 5MM 1.02" - .197"
	Zero 0 180MM or 7.09"	Magnification	.8x - .54X	.12X - .80X	.24X - 1.55X	
		Field Of View	*73MM - 14MM 2.87" - .55"	62MM - 9.5MM 2.44" - .374"	28MM - 6MM 1.10" - .24"	
	Minus - 250MM or 9.84"	Magnification	.06X - .58X	.09X - .58X	.18X - 1.16 X	
		Field Of View	*100MM - 18MM 3.94" - .71"	76MM - 12.5MM 2.99" - .49"	38MM - 6MM 1.50" - .24"	
0.5X	.006" to .020"	Plus + 120MM or 4.72"	Magnification	.16X - 1.01X	.24X - 1.50X	.48X - 3.0X
			Field Of View	*52MM - 10MM 2.05" - .40"	40MM - 6.5MM 1.58" - .26"	19MM - 3.5MM 1.50" - .14"
	Zero 0 132MM or 5.20"	Magnification	.12X - .75X	.18X - 1.12X	.36X - 2.24X	
		Field Of View	*57MM - 10MM 2.2" - .413"	44MM - 8MM 1.73" - .32"	21MM - 3.5MM .83" - .14"	
	Minus - 163MM or 6.42"	Magnification	.08X - .58X	.13X - .86X	.27X - 1.72X	
		Field Of View	*63MM - 12.5MM 2.48" - .49"	52MM - 8MM 2.05" - .32"	24MM - 4MM .95" - .16"	
0.75X	.009" to .030"	Plus + 83MM or 3.27"	Magnification	.24X - 1.48X	.35X - 2.2X	.70X - 4.4X
			Field Of View	*36MM - 6.5MM 1.42" - .28"	27MM - 4.2MM 1.06" - .17"	15MM - 2.1MM .59" - .08"
	Zero 0 88MM or 3.47"	Magnification	.17X - 1.11X	.26X - 1.66X	.52X - 3.3X	
		Field Of View	*38MM - 6.5MM 1.50y - .26y	29MM - 4.5MM 1.14y - .18y	15MM - 2.2MM .59y - .09y	
	Minus - 98MM or 3.86"	Magnification	.13X - .84X	.20X - 1.25X	.40X - 2.5X	
		Field Of View	*44MM - 7.5MM .157" - .30"	30.5MM - 5.1MM 1.20" - .20"	16MM - 2.5MM .62" - .098"	
1X	.011" to .040"	Plus + 62MM or 2.44"	Magnification	.32X - 2.01X	.47X - 3.0X	.94X - 6.0X
			Field Of View	*30MM - 5.2MM 1.18" - .21"	21MM - 3.25MM .83y - .13"	10.5MM - 1.7MM .41" - .07"
	Zero 0 64MM or 2.52"	Magnification	.25X - 1.49X	.35X - 2.2X	.70X - 4.4X	
		Field Of View	*29MM - 5.5MM 1.14" - .22"	22MM - 3.2MM .87" - .13"	11MM - 1.7MM .43" - .07"	
	Minus - 72MM or 2.84"	Magnification	.17X - 1.11X	.26X - 1.66X	.52X - 3.3X	
		Field Of View	*29MM - 5.2MM 1.14" - .20"	23MM - 4MM .91" - .16"	11.5MM - 2MM .45" - .08"	
1.5X	.017" to .038"	Plus + 42MM or 1.65"	Magnification	.48X - 3.02X	.71X - 4.5X	1.4X - 9.0X
			Field Of View	*14MM - 3.5MM .55" - .14"	*15MM - 2.2MM .59" - .09"	7MM - 2.5MM .28" - .098"
	Zero 0 42MM or 1.65"	Magnification	.36X - 2.28X	.53X - 3.4X	1.06X - 6.8X	
		Field Of View	*14MM - 3.2MM .55" - .13"	*14MM - 2.2MM .55" - .09"	7MM - 1.5MM .28" - .06"	
	Minus - 43MM or 1.69"	Magnification	.27X - 1.68X	.40X - 2.5X	.80X - 5X	
		Field Of View	*15MM - 3.2MM .59" - .13"	*14MM - 2.3MM .55" - .09"	7.5MM - 1.5MM .30" - .06"	
2X	.022" to .048"	Plus + 33MM or 1.30"	Magnification	.62X - 4.02X	.93X - 6X	1.8X - 12X
			Field Of View	*9.3MM - 3MM .37" - .118"	9MM - 2MM .35" - .08"	5.6MM - 1.0MM .22" - .04"
	Zero 0 35MM or 1.38"	Magnification	.47X - 3.01X	.70X - 4.5X	1.4X - 9X	
		Field Of View	*9.3MM - 3MM .37" - .118"	*9MM - 2MM .35" - .08"	5.6MM - 2MM .22" - .08"	
	Minus - 35MM or 1.38"	Magnification	.35X - 2.28X	.52X - 3.4X	1.06X - 6.4X	
		Field Of View	*10MM - 2.6MM .39" - .10"	9MM - 2MM .35" - .08"	5.5MM - 1MM 2.2" - .04"	

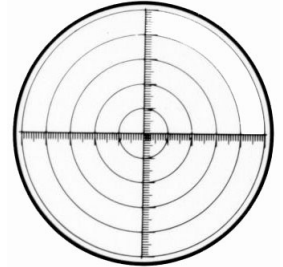
* Is used when a round image is received that does not fill the screen due to lens and chip limitations. This is only found on the high end of the magnification range, principally only with the .67X Adapter.



RARP-1 RETICLE



RARP-2 & RARP-3
RETICLE



Titan Tool has accomplished a unique breakthrough in optical design. In our computer designed **ZOOM OBJECTIVE**, we have added an **OPTICAL RETICLE** for Video Applications.

This State of the Art accomplishment has **several advantages over the previous method as used by the rest of the Industry.**

- (A) It is considerably cheaper than using a Cross Hair Generator.
- (B) The lines stay in the same location no matter how often the camera and monitor are turned Off and On.
- (C) The sharpness of the Reticle Pattern is not dependent on the number of Pixels in the Video Monitor and is precise in an absolute sense.
- (D) The Reticle Pattern can be rotated on it's Center Line up to 90° to align with a workpiece.
- (E) The Broken Line Pattern of both Titan Reticles allows you to align with very thin edges and lines, as thinner lines can be split on the width of the thicker lines.
- (F) On the Reticle Pattern RARP-2, the lines can be calibrated at various magnifications and measuring values can be assigned to them.
- (G) The Reticle Patterns work well even with cheaper Video Cameras and Monitors.
- (H) It can be used equally well with Black and White or Color.
- (I) The image is optically correct.

There are many **Applications** for the Titan **RETICLE PATTERNS** since they allow for 18 or 54 Magnifications which in turn allow for 18 or 54 different Fields of View and many different Working Distances. (See Table I or II on pages for more details.)

- (1) Quality assurance functions, as Alignment on X-Y-Z Three Coordinate Measuring Machines where Mechanical Alignment is impossible.
 - (2) Robot Guidance and Precise Alignment.
 - (3) Precise Automatic Alignment on Welding Alignment.
 - (4) Alignment on Printing Presses or Plates, Punch Presses, Drilling and Boring Machines.
 - (5) Testing and Calibration.
 - (6) Optical Gaging.
 - (7) Testing combined with Calibration.
 - (8) It can be combined in an inexpensive Measuring System when combined with an Illuminated Base. Video Adapter holder, X-Y Stage, Digital Micrometers, and Illuminating Systems with our FOI-150 Halogen Light Source and RI-23 Fibre Optic Ring Illuminator.
- RETICLE PATTERN RARP-1** consists of broken lines to line up in the X & Y Axis rather than on the center lines. This Pattern is used in both X & Y Axis. It is ideal when aligning a thin line or a very fine edge.

RETICLE PATTERN RARP-2 consists of a line on the X & Y Axis broken near the center with evenly spaced divisions that can be calibrated on the X & Y Axis.

RETICLE PATTERN RARP-3 This Reticle is identical to Reticle Pattern RARP-2, except it shows many more circles and 90° divisions on the Vertical and Horizontal Axis. **The image is re-magnified two times** with this Reticle adapter as it has an additional **2X Lens**. We recommended this Reticle Pattern; if the ultimate in Resolution is desired. It is also easily installed as it screws directly on top of the Video Adapter .67X, 1X or 2X and between the Video Camera. Since it remagnifies the image it eliminates the problems found with the .5X Convertor and the .67X Adapter. Using this unit, the image does fill the Monitor Screen, you receive a full image and Cross Hair is centered.

When ordering a Zoom Objective with a Reticle Pattern, you still have to order:

- (1) The Zoom Objective - TZOVA
- (2) At least one of the Sub Lenses - SD-.35X, SD-.5X, SD-.75X, SD-1X, SD-1.5X or SD-2X
- (3) At least one of the Video Adapter - VATZ-.67X, VATZ-1X or VATZ-2X
- (4) Special Reticle Adapter Order # RARP-1
or
Special Reticle Adapter Order # RARP-2
or
Supplemental 2X Reticle Adapter Order # RARP-3
- (5) The Fibre Optic Illuminator and one of the Light Sources, although not necessary, is strongly recommended.
- (6) Polarizing Filter - Order # PF-1 Optional, is highly desirable when working with the Reticle and reflective materials as it will not wash out the Reticle.



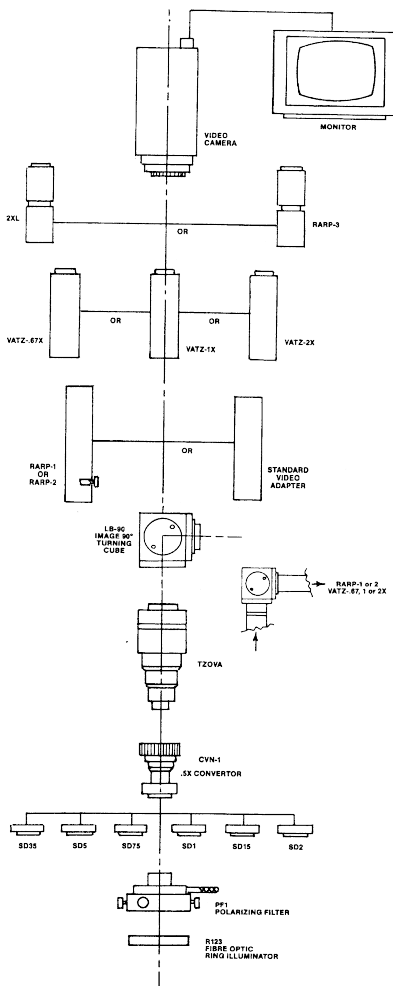
UPS-TSZM Universal Pillar Stand



SM-A-1 Special Mounting Bracket



MTSM-BS Sub Stage Base



Ordering Information

Model Number

TZOVA	Micro Video Zoom Objective
VATZ-.67X	Video Adapter
VATZ-1X	Video Adapter
VATZ-2X	Video Adapter
2XL	2X "C" Mount Adapter
RARP-1	Simple Cross Hair
RARP-2	Concentric Circle Adapter
RARP-2	2X "C" Mount Reticle Adapter
SD.35X to SD2X	Each Sub Lens
CVN-1	0.5X Converter
PF-1	Polarizing Filter
LB-90	90 Degree Image Cube
SM-A-1	Special Focusing Mounting Bracket
RI-23	Fibre Optic Ring Illuminator
FOI-150	Fibre Optic Light Source
UPS-TSZM	Universal Pillar Stand
MTSM-BS	Sub Stage Base