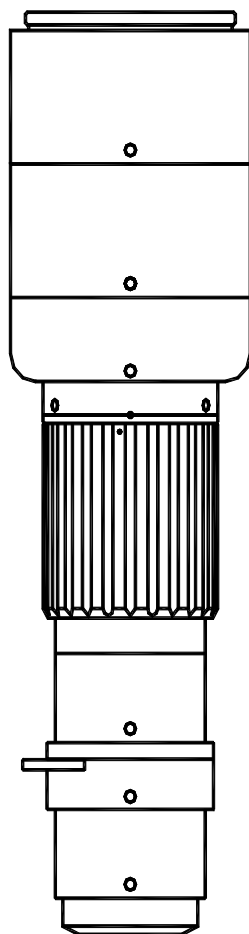


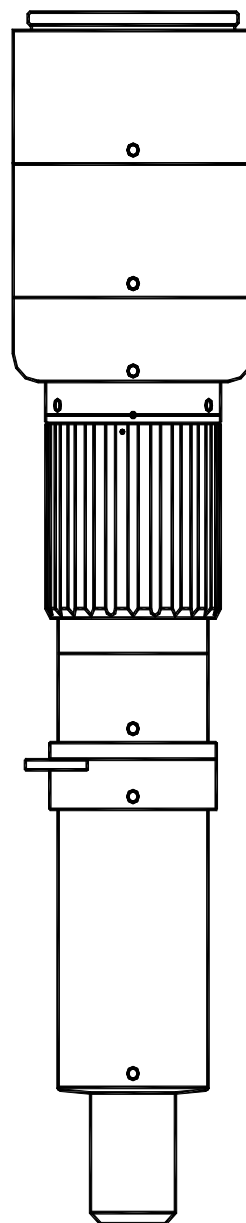
# INFINIPROBE™ TS-160 UNIVERSAL

## Macro/Micro Imaging System

MACRO



MICRO HM



## INFINIPROBE™ TS-160 UNIVERSAL INSTRUCTIONS FOR USE

**IMPORTANT:** As you read through the following instructions, please note the sections dealing with the use of the Variable Iris control. The TS-160 operates somewhat differently from traditional macro lenses and, particularly when the MICRO HM Objective is used, transitions into being a true microscope. At first, the use of the Variable Iris as detailed below may seem to be "counter-intuitive" but when properly set, the resulting images will be worth the effort.

**The TS-160 System.** The TS-160 consists of a Main Body which contains a patent-pending internally-focusable optical system, activated by a Focusing Ring which turns 360-degrees. Inside is a provision for 25mm diameter filters (for example, polarizers or fluorescence types). At its rear are two ganged T24mm tubes (*three ganged T24 tubes when the MICRO HM Objective is used in 35mm format—see below*) which allow access to accessories when one is temporarily removed—or permit one to be exchanged with a mount for use on a stereo microscope stand. A Clamp is available so that the TS-160 can be mounted on tripods or fixtures via 1/4-20 or two "outboard" M4 taps. A Variable Iris allows contrast control.

The InfiniProbe TS-160 is not a zoom lens. It is a continuously-focusable microscope. This means you can focus on any suitable object at a distance and move in to see it become a single frame at great magnification. Instead of being limited to a single working distance, you can choose whatever standoff you wish. You will never lose sight of your object as you focus closer and closer. As you focus, detail (resolution) increases and depth of field gets shallower. If you need more depth of field, just back up to get what you need. The depth of field and magnification are then balanced for best results.

**Formats.** What makes the TS-160 universal is its format compatibility. Depending on the adapter mounted behind the two ganged T24 tubes, the TS-160 can be used with all C-mount video cameras and DSLRs up to and including 24 x 36mm (35mm format) when used with the MACRO Objective (see below). When the MICRO HM Objective (see below) is used, the TS-160 can be used with two ganged T24 tubes up to and including the 4/3-in. format.

*When the (supplied) third T24 tube is added, the MICRO HM Objective can function with TS-160 to cover all sensors up to and including 24mm x 36mm (35mm) format. It then ranges magnification from 0 to 18x and may virtually be considered to be a "TS-180" in terms of its performance. (See the Table for magnification/working distances when three T24 tubes are ganged).*

**Objectives.** Two objective lenses interchange and attach to the Main Body: MACRO and MICRO HM:

1) The MACRO Objective is compact and can be focused from infinity (equivalent to a c.155mm F.L. 35mm camera lens) down to 18mm. When attached to the TS-160's Main Body, it provides a magnification range of 0-4x. Used with DSLRs or other viewing cameras the image is seen upright, as is typical of taking lenses.

2) The MICRO HM (Highest Magnification) Objective can be focused from infinity (equivalent to a c.60mm F.L. 35mm camera lens) down to 18mm. When attached to the TS-160's Main body, it provides a magnification range of 0-16x when two T24 tubes are ganged for use up to 4/3-in. formats and 0-18x when the third (supplied) T24 is added for 35mm format uses (see below). Used with DSLRs or other viewing cameras, the image is inverted, as is typical of microscopes.

Whichever objective you choose, the TS-160 is like taking a large lab-type zoom microscope with you *into the field*. Except, the InfiniProbe TS-160 can be picked up in your hand and carried wherever you go.

**Operation.** Using the TS-160 is as natural as stepping closer to get a better look. The best results are achieved by understanding the proper use of the Variable Iris incorporated in the Main Body.

Because the TS-160 is a microscope and not a "taking" or typical "macro lens," its Variable Iris is analogous to that of a regular laboratory compound microscope's iris in the condenser. Like lab scopes, there are no *f/stops* to be found—they are irrelevant. The Variable Iris' real purpose is not to control exposure—but to control *contrast and field flatness*. In the same way that lab scopes are *not supposed to be used* with the condenser full-open, the TS-160 is not supposed to be used full-open either. The proper use of the condenser on lab scopes is to stop-down until the first change in contrast "jumps" as the condenser's iris is closed-down—virtually an "automatic" characteristic. Consequently, the TS-160's Variable Iris is used to set the cross-over point where contrast and resolution are best-matched. This means that when the TS-160 is used correctly, all you have to do is: 1) Focus; 2) Set the contrast "jump;" 3) "Click." The camera or flash then sets the proper exposure. Perfect results from the TS-160 are as easy as that.

**Professionally Setting the Variable Iris.** The ultimate determination of the best position for the Variable Iris' setting can be ascertained by noting the contrast jump and then *slightly* stopping-down beyond it. Then, if it is possible to do so, focus up and down through the object. Note that the defocused light (Airy discs) can be set so that the blur above focus is equal to the blur below focus. This is actually the finest setting possible and produces the sharpest imagery that the TS-160 is capable of at the chosen working distance.

**MICRO HM Objective used with 35mm Formats.** The MICRO HM Objective requires the use of *all three* of the supplied T24 tubes when 35mm formats are utilized. At some working distances in this mode, stopping the Variable Iris down too much may show a slight vignette in the outer field. This is a characteristic that *only happens* when the Variable Iris is *misused*. If you observe a small vignette encroaching into the field, open the Variable Iris until it is gone. That point may well be the best setting in any case.

**Working Distance/Magnification/Field of View Tables.** The tables contained in these instructions are averaged between all factors. The cam action of the focus is made with great precision; nevertheless, *minute* tolerances can add up between the sum total of the parts. When the table refers to "4x" it is possible that the actual magnification of one TS-160 can be 4.02x and another 3.99x, etc.—just as no two automobile engines of 300hp have exactly 300hp each. The same holds true for possible *minute* differences for Working Distances and Fields of View. However, if exact Magnifications and Fields of View must be established between two or more TS-160 units, this can be done by using a ruling to set them precisely equal.

**Depth of Field Adjustment.** Although the Variable Iris can be used to some extent in the typical way of stopping-down the iris to gain depth of field, best results will come from simply moving the TS-160 a bit higher up to refocus. At a certain point, the exact balance of depth of field and resolution can be selected. This feature allows *you* to determine the best image to capture. You can digitally enlarge "just a bit" later, knowing that you have captured all the detail and depth of field.

**Illumination.** The TS-160 provides the best results when the light is intense and highly-directed. For modeling and fixed illumination, fiber optic or LED sources are recommended. Nevertheless, the best way to capture high-resolution images is by using flash.

**Mounting Options.** The TS-160 can be mounted on standard tripods or jigs by means of an optional Large Clamp with 1/4-20 and two "outboard" M4 taps. Alternatively, it can be mounted on many brands of stereo microscope stands by optional adapters. Infinity makes a line of such adapters that are all 24mm long. One of the two supplied T24 tubes can be removed and the selected Stereo Stand Adapter screwed on in place. Unlike many such adapters, Infinity's all become integral to the TS-160 itself.

**Filter Holder.** Removing the T24 tubes allows access to the Filter Holder Receptacle. Most 25mm diameter filters can be positioned there and locked in place by the optional Retaining Ring. In this way, the TS-160 can be equipped with polarizing, color, neutral density or fluorescence filters.

**Motor-drive Capability.** The InfiniProbe TS-160 can be supplied (special order) not only with its regular Fluted Focusing Ring, but with either of two others that can be used for motor drive applications. We offer a Grooved Ring for use with O-Rings and a Smooth Ring for use with custom gear attachments. Please see the appropriate drawing in this manual and contact us for further details.

**CentriTel® Compressor/C.** The TS-160 is designed primarily for large formats. However, if C-mount cameras up to 2/3-in. format are used, its magnification may be too high to match their pixel sizes. Projected image elements falling over several pixels can actually cause less resolution at the camera's sensor. The CentriTel Compressor/C answers this need and fits inside the TS-160 on top of the Filter Holder (see drawing). When configured with the CentriTel Compressor/C, the TS-160 is remarkably compact. A supplied T16 Tube parfocals both the MACRO and MICRO HM Objectives with their standard ranges, reducing their magnifications to 0-2x and 0-8.2x, respectively (overall, about a 50% reduction factor). The resolution of the TS-160 is then matched for C-mount cameras. Of course, the standard magnifications are still available if the CentriTel Compressor/C is removed and the unit brought back to its original configuration.

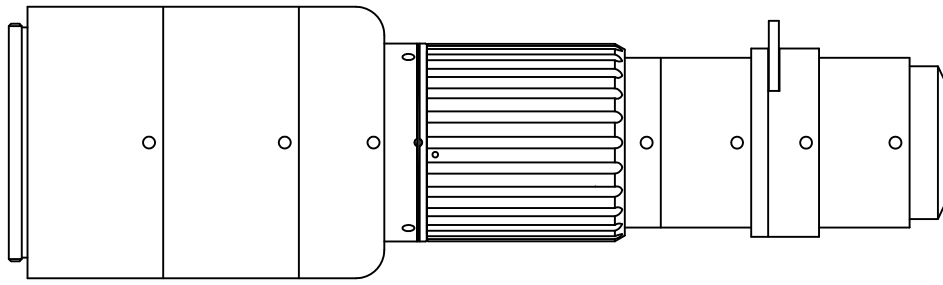
In addition, the CentriTel Compressor/C adds Infinity's unique CentriTel capability to the TS-160 when used with C-mount cameras. The magnification remains essentially constant during translation by the TS-160's internal focusing system. This makes the CentriTel Compressor/C ideal for digital stacking techniques from a fixed position.

**Care and Cleaning.** Your InfiniProbe TS-160 should be treated as the fine instrument that it is. Care should be taken to keep dust and dirt off the external lens surfaces. The unit can be cleaned (metal parts only) with a cloth moistened with alcohol. The external optical surfaces should be cleaned only when necessary, and then, only by a soft cotton swab moistened by an approved optical glass cleaner. If you have further questions, please contact Infinity Photo-Optical Company or your authorized dealer.

**Finally, Someone Is Bound to Ask:** "If the TS-160 can be used as if it were a 'TS-180', why not call it TS-180?" The answer is similar to the old adage that a "square is a rectangle but not all rectangles are squares."

The TS-160 works well even if used with two T24 spacers with the MICRO HM Objective—but not as well as it can be if an additional (supplied with each unit) T24 is added. (The MACRO always works with only two-ea. T24 spacers—not an issue). Essentially, if one is out in the field with the MACRO and wants to quickly switch to the MICRO HM Objective without taking apart the system—he can. 35mm can be covered but at a very slight compromise in outer field flatness. And, for C-mount use, the TS-160 is best with only two of the T24 spacers in-system. So, "160" (up to 16x) is always possible in all cases. "180" (18x) is only advantageously possible with 35mm format—and only really useful for 35mm. It is better to keep smaller formats less projected onto the sensor in view of their pixel sizes. Consequently, "160" (16x) is possible with two T24 tubes in all formats and "180" (18x) is optimized for only one. We decided to keep the product named for its most versatile configuration.

**Warranty.** Details of the Warranty are contained on the Warranty Page (attached).

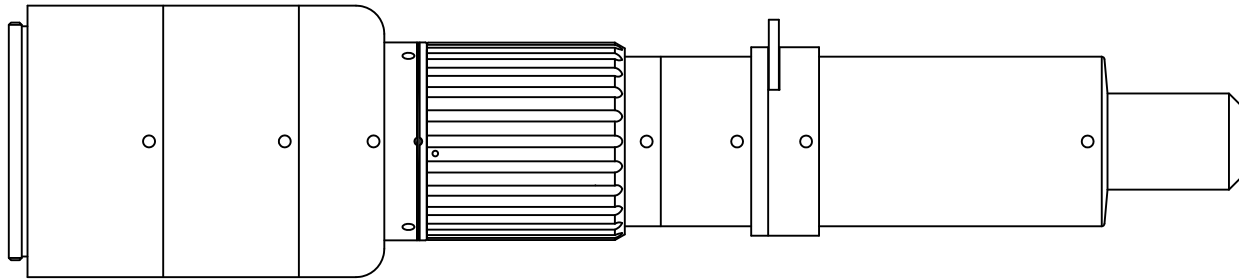


**LENGTH: 162.5mm [6.4"]**

**WEIGHT: 292g [10.3 oz.]**

## **MACRO**

Configured for use with up to 35mm Sensors.

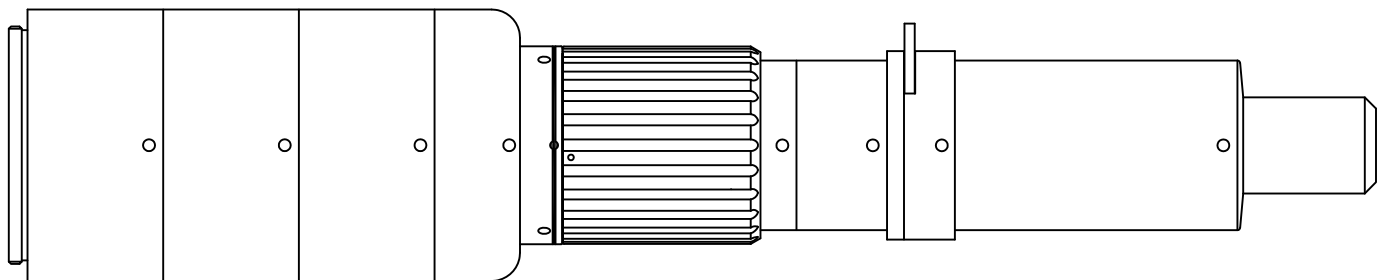


**LENGTH: 214.5mm [8.45"]**

**WEIGHT: 312g [11 oz.]**

## **MICRO HM**

Configured for use with up to APS.-C Sensors.



**LENGTH: 238.5mm [9.4"]**

**WEIGHT: 346g [12.2 oz.]**

## **MICRO HM**

Configured for use with up to 35mm Sensors.

# InfiniProbe™ TS-160 UNIVERSAL Macro/Micro Imaging System

## MACRO OBJECTIVE DATA

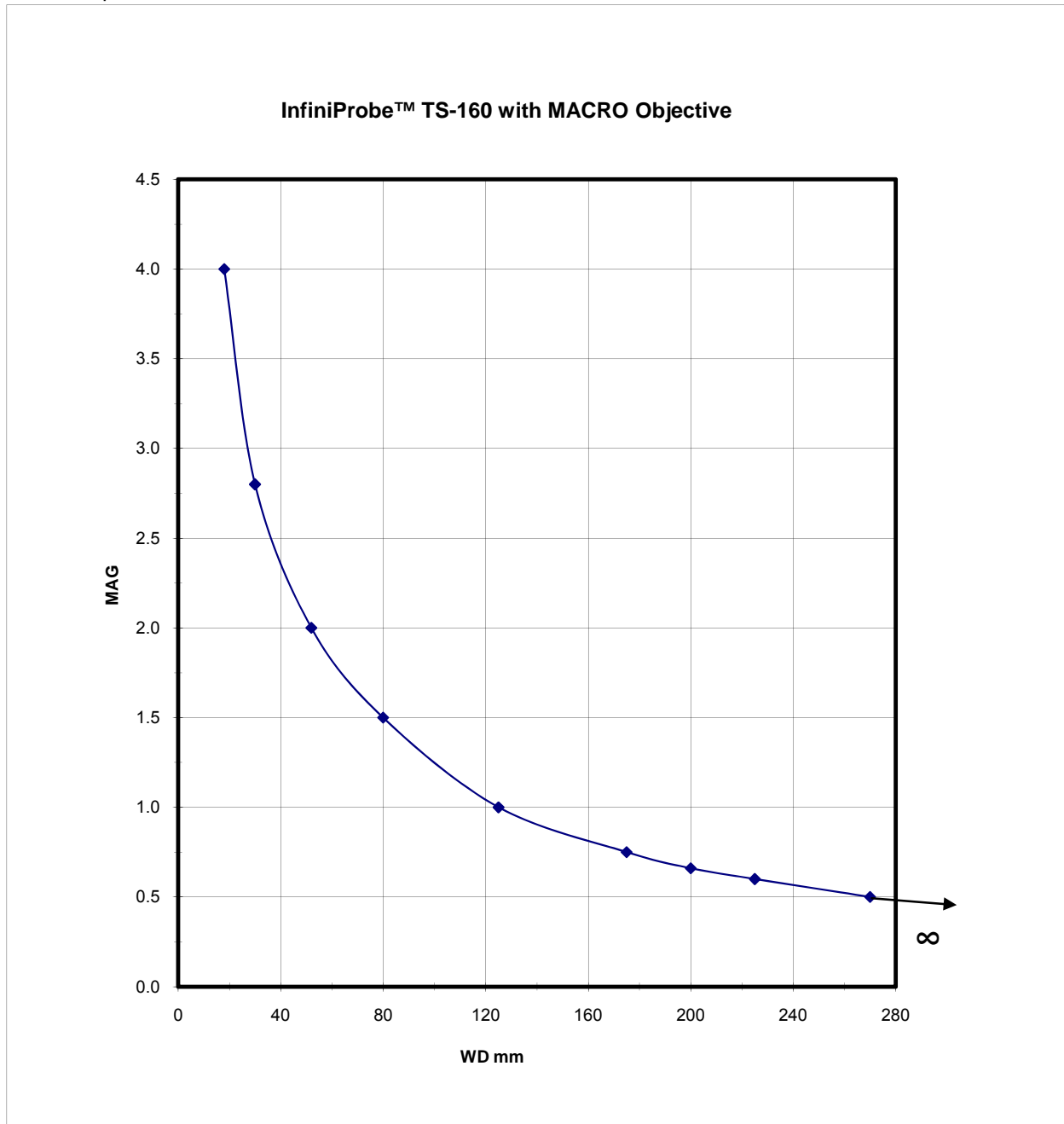
(Suitable for use with up to 35mm sensors)

<b>WD mm</b>	18	30	52	80	125	175	200	225	270
<b>Mag</b>	4.0	2.8	2.0	1.5	1.0	0.75	0.66	0.6	0.5
<b>FOV mm</b>	9.00	12.86	18.00	24.00	36.00	48.00	54.55	60.00	72.00

\*FOV based on 35mm video format (36mm horizontally). See Video Format Page for all conversions.

For formats other than 35mm: Divide magnification into the sensor's horizontal dimension.

For example, 1/2-in. C-mount = 6.4mm/4x = 1.6mm FOV.



# InfiniProbe™ TS-160 UNIVERSAL Macro/Micro Imaging System

## MICRO HM OBJECTIVE DATA

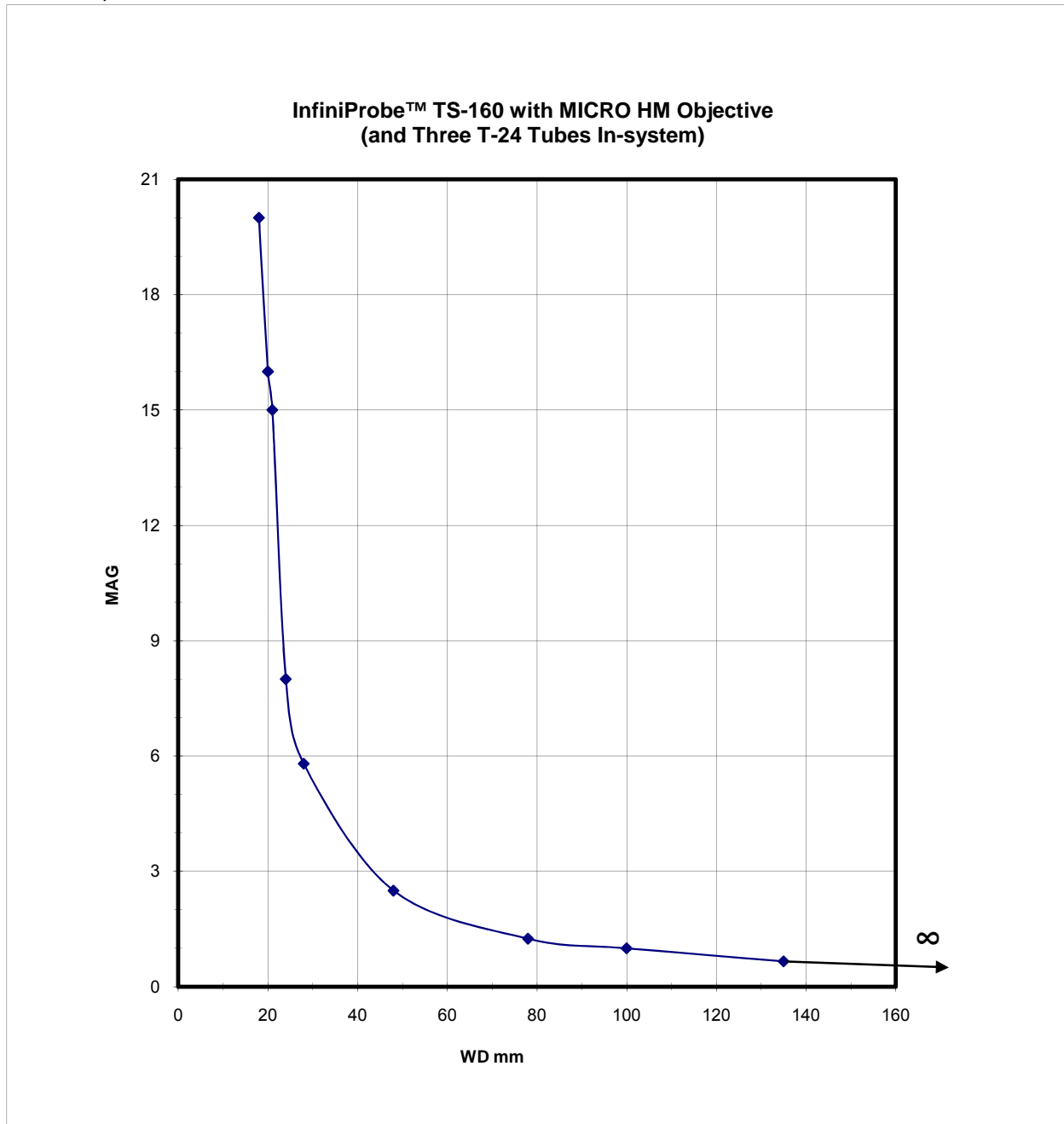
(and Three T-24 Tubes In-system)

<b>WD mm</b>	18	20	21	24	28	48	78	100	135
<b>Mag</b>	20	16	15	8	5.8	2.5	1.25	1	0.66
<b>FOV mm</b>	1.8	2.25	2.4	4.5	6.2	14.4	28.8	36	54.5

\*FOV based on 35mm video format (36mm horizontally). See Video Format Page for all conversions.

For formats other than 35mm: Divide magnification into the sensor's horizontal dimension.

For example, 1/2-in. C-mount = 6.4mm/4x = 1.6mm FOV.



# InfiniProbe™ TS-160 UNIVERSAL Macro/Micro Imaging System

## MICRO HM OBJECTIVE DATA

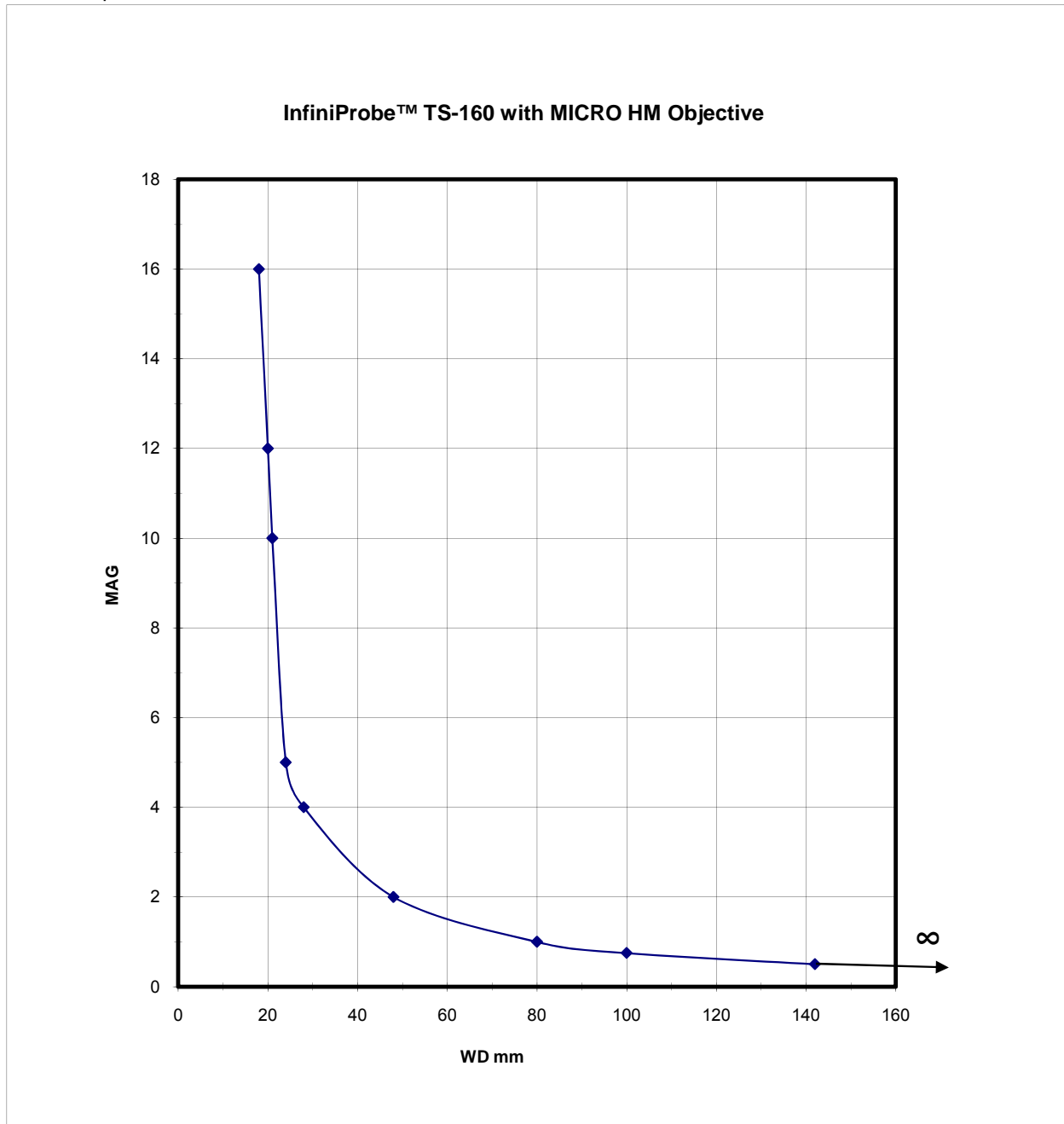
(Two T-24 Tubes and suitable for use with up to 4/3-in. sensors)

<b>WD mm</b>	18	20	21	24	28	48	80	100	142
<b>Mag</b>	16	12	10	5	4	2	1	0.75	0.50
<b>FOV mm</b>	0.98	1.3	1.6	3.1	3.9	7.8	15.6	20.8	31.2

\*FOV based on APS.-C (15.6mm x 23.4mm) video format. See Video Format Page for all conversions.

For formats other than APS.-C: Divide magnification into the sensor's horizontal dimension.

For example, 1/2-in. C-mount = 6.4mm/4x = 1.6mm FOV.



# InfiniProbe™ TS-160 UNIVERSAL Macro/Micro Imaging System

## MACRO OBJECTIVE with CentriTel® Compressor/C

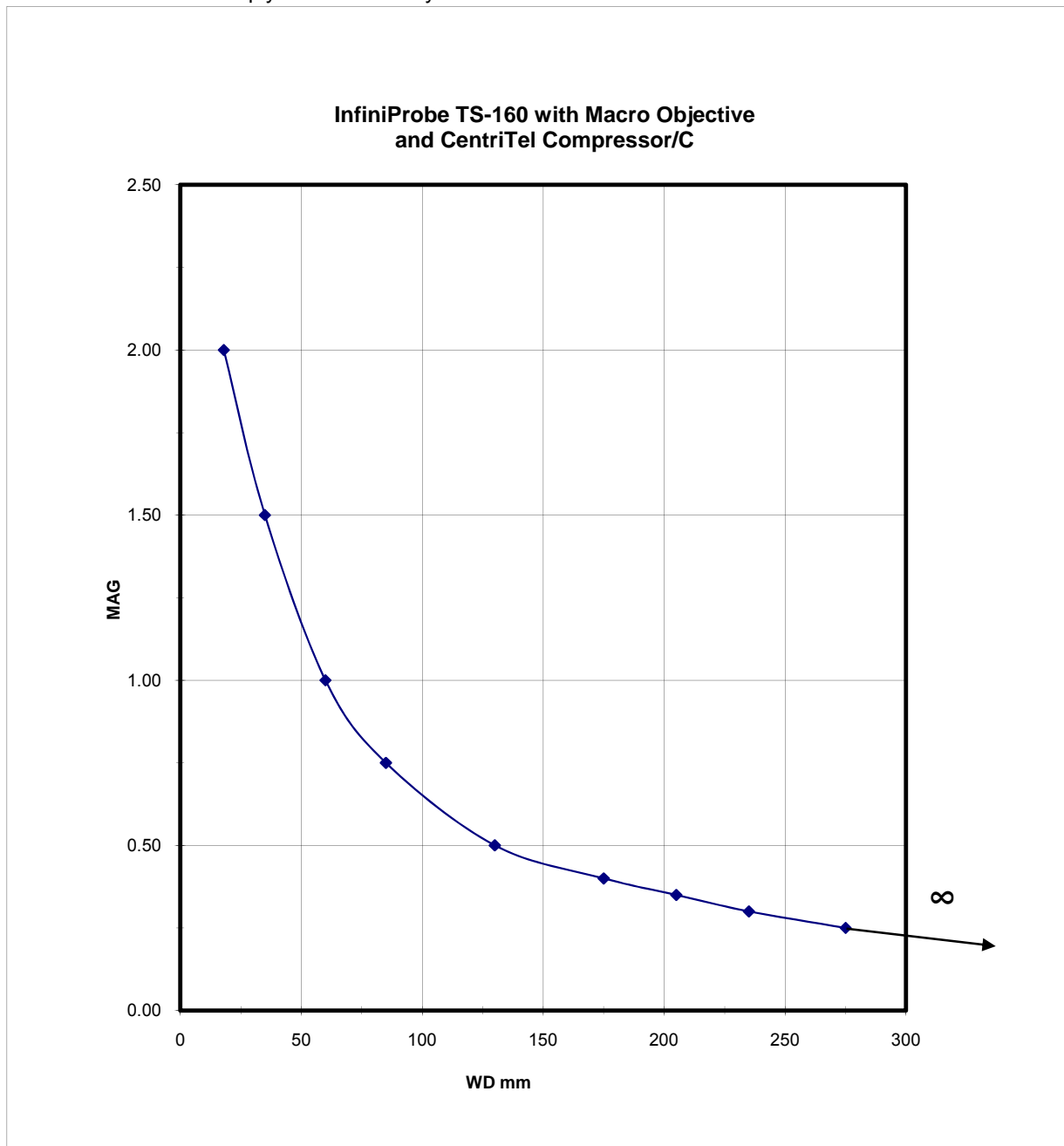
(Suitable for use with C-mount Sensors up to 2/3-in. Horizontal)

<b>WD mm</b>	18	35	60	85	130	175	205	235	275
<b>Mag</b>	2.00	1.50	1.00	0.75	0.50	0.40	0.35	0.30	0.25
<b>FOV mm</b>	3.2	4.3	6.4	8.5	12.8	16.0	18.3	21.3	25.6

\*FOV based on 1/2-in. video format (6.4mm horizontally). See Video Format Page for all conversions.

For 2/3-in. sensors multiply FOV in chart by 1.375 for new 2/3-in. FOV.

For 1/3-in. sensors multiply FOV in chart by 0.75 for new 1/3-in. FOV.



# InfiniProbe™ TS-160 UNIVERSAL Macro/Micro Imaging System

## MICRO OBJECTIVE with CentriTel® Compressor/C

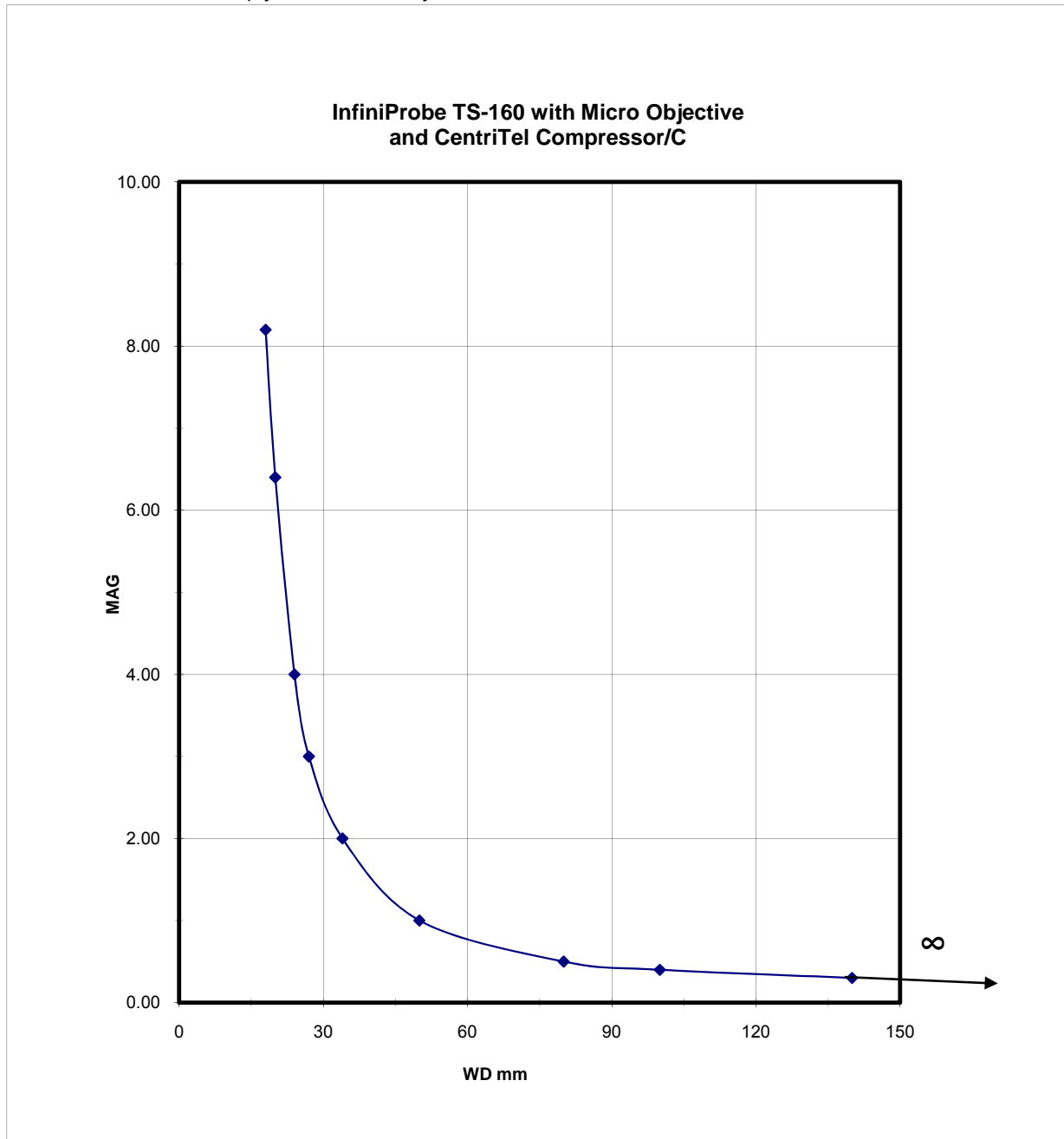
(Suitable for use with C-mount Sensors up to 2/3-in. Horizontal)

<b>WD mm</b>	18	20	24	27	34	50	80	100	140
<b>Mag</b>	8.20	6.40	4.00	3.00	2.00	1.00	0.50	0.40	0.30
<b>FOV mm</b>	0.78	1.00	1.60	2.13	3.20	6.40	12.80	16.00	21.33

\*FOV based on 1/2-in. video format (6.4mm horizontally). See Video Format Page for all conversions.

For 2/3-in. sensors multiply FOV in chart by 1.375 for new 2/3-in. FOV.

For 1/3-in. sensors multiply FOV in chart by 0.75 for new 1/3-in. FOV.



4

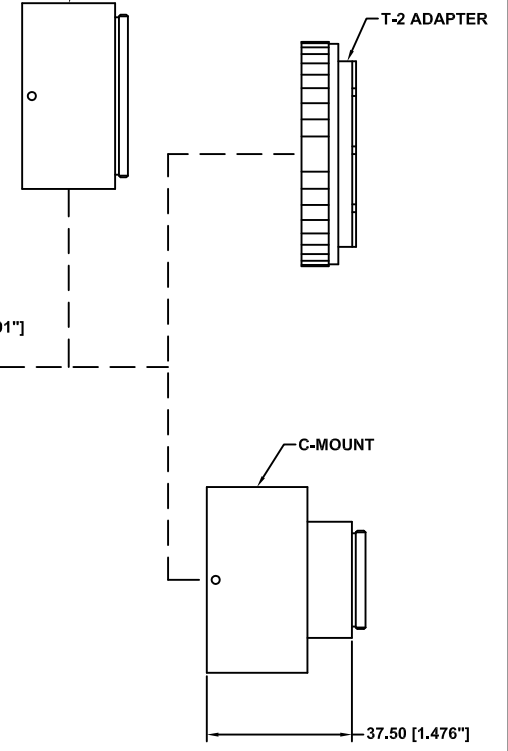
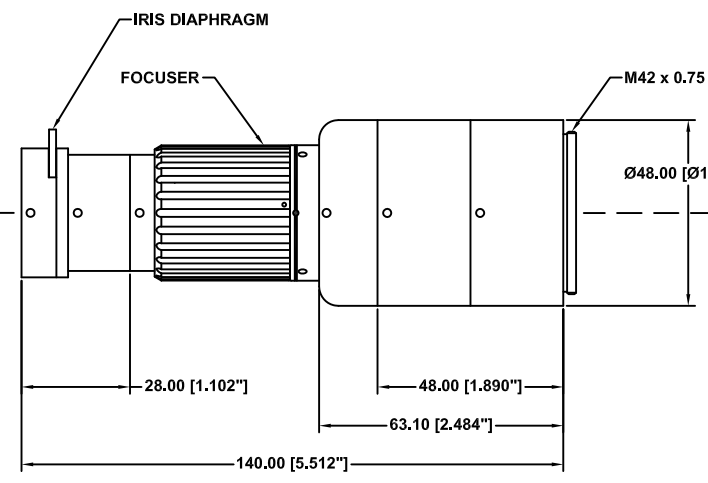
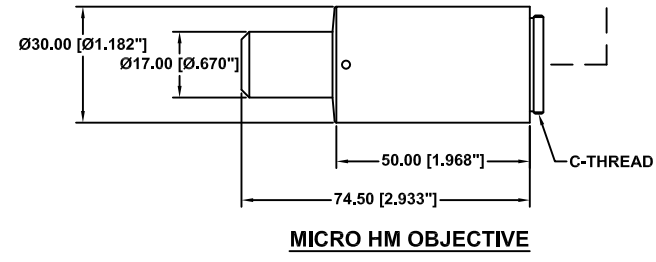
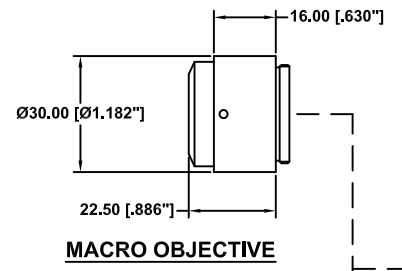
3

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1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

THIRD T-24 TUBE IS USED WITH 35mm FORMAT AND MICRO HM OBJECTIVE FOR GREATER DEPTH OF FIELD CONTROL VIA IRIS DIAPHRAGM.  
(NOT REQUIRED WITH MACRO OBJECTIVE)



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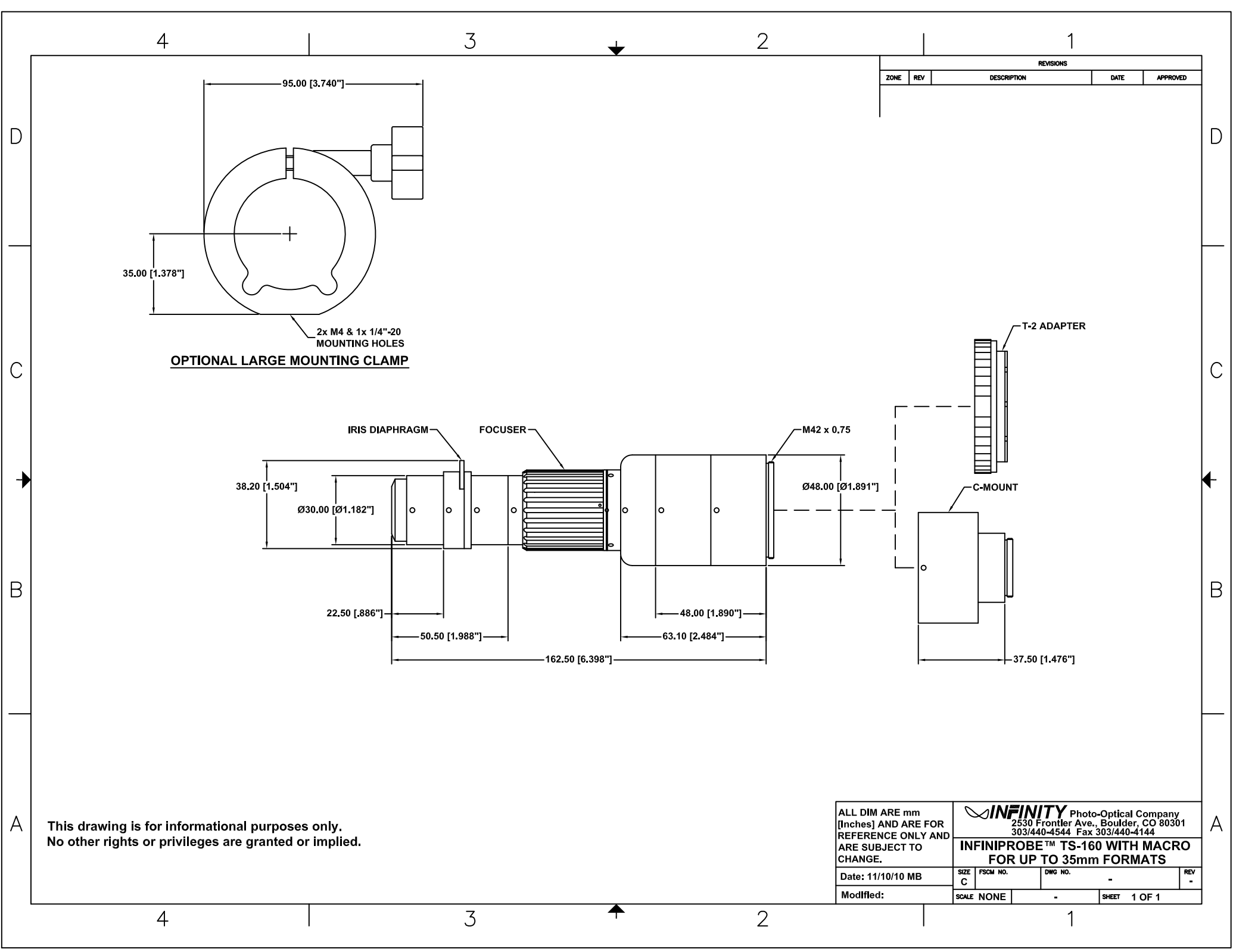
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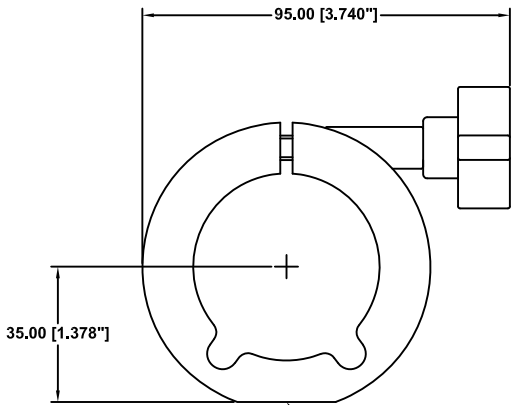
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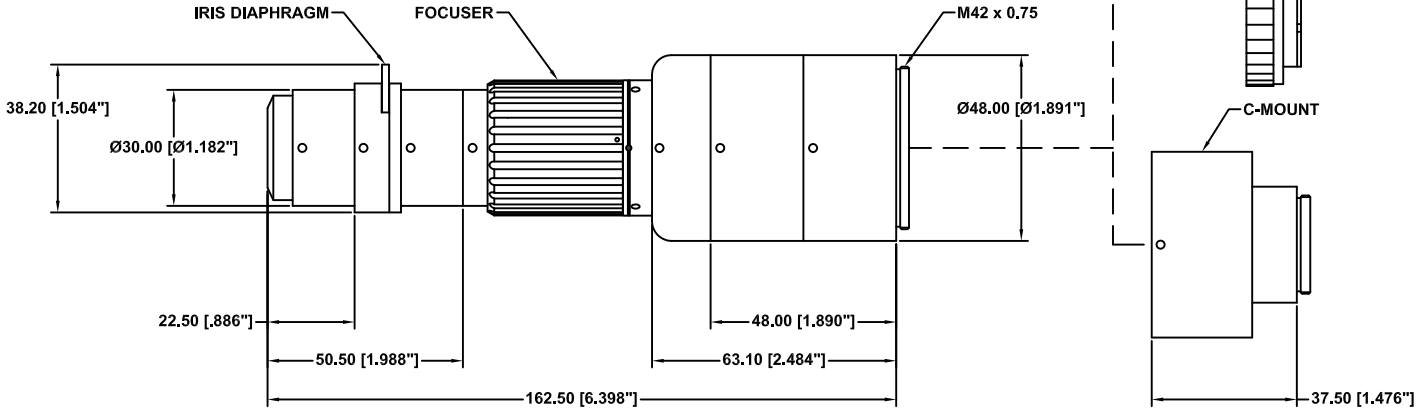
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REVISIONS				
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2x M4 & 1x 1/4"-20 MOUNTING HOLES  
**OPTIONAL LARGE MOUNTING CLAMP**



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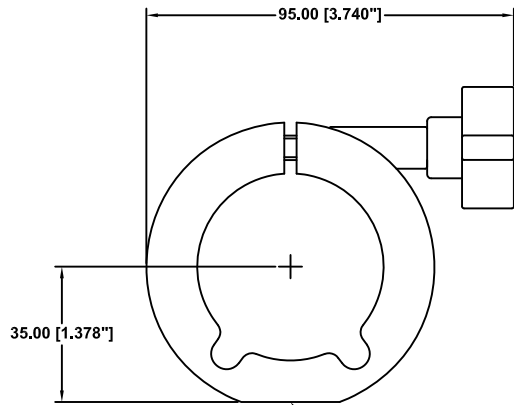
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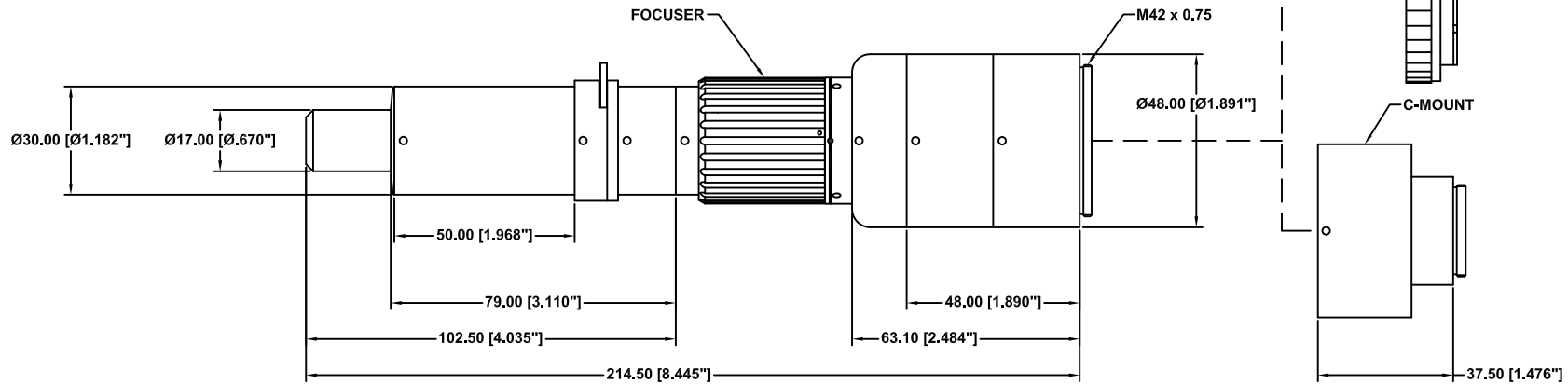
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2x M4 & 1x 1/4"-20 MOUNTING HOLES

**OPTIONAL LARGE MOUNTING CLAMP**



FOCUSER

M42 x 0.75

Ø48.00 [Ø1.891"]

T-2 ADAPTER

C-MOUNT

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**INFINIPROBE™ TS-160 WITH MICRO HM FOR UP TO 35mm FORMATS**

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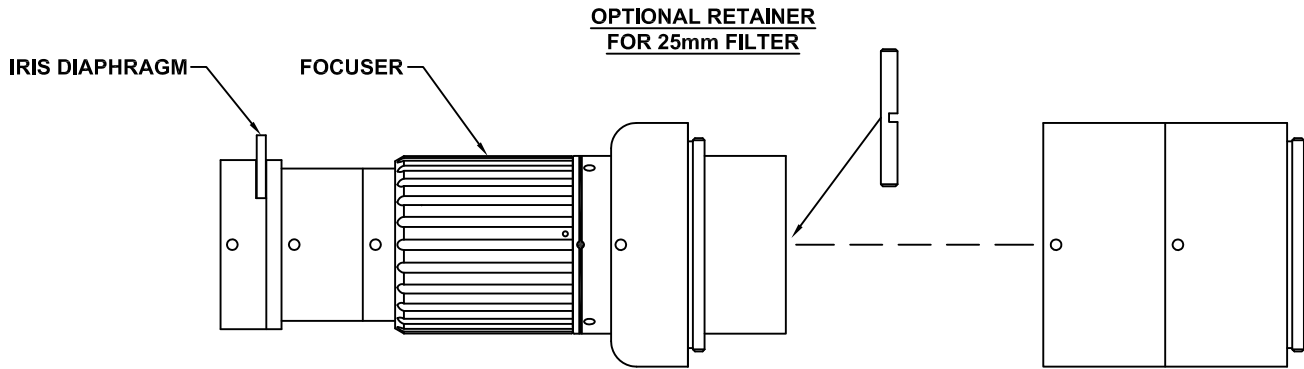
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REVISIONS				
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2530 Frontier Ave., Boulder, CO 80301  
303/440-4544 Fax 303/440-4144

**INFINIPROBE™ TS-160 MAIN BODY  
(FILTER INSERTION)**

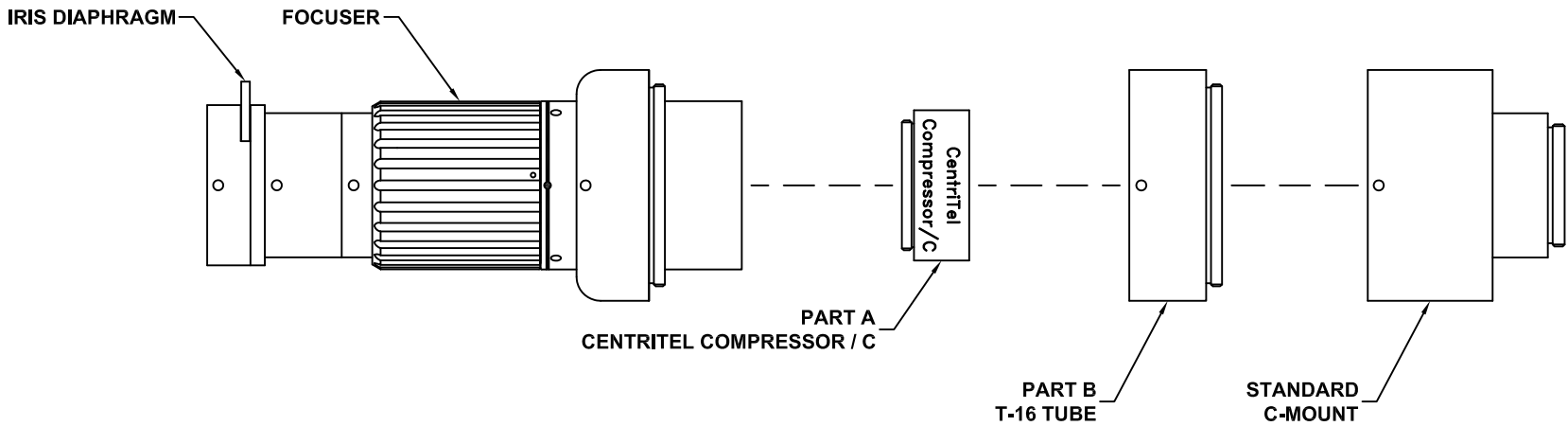
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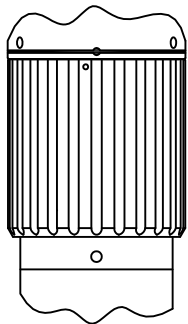
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REFERENCE ONLY AND  
ARE SUBJECT TO  
CHANGE.

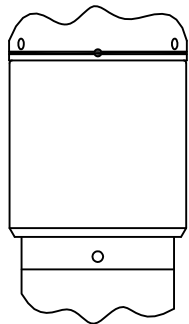
**INFINITY** Photo-Optical Company  
2530 Frontier Ave., Boulder, CO 80301  
303/440-4544 Fax 303/440-4144

**INFINIPROBE™ TS-160 MAIN BODY  
WITH CENTRITEL COMPRESSOR / C**

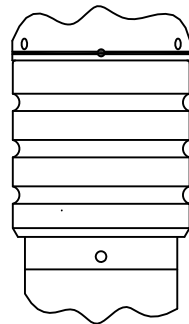
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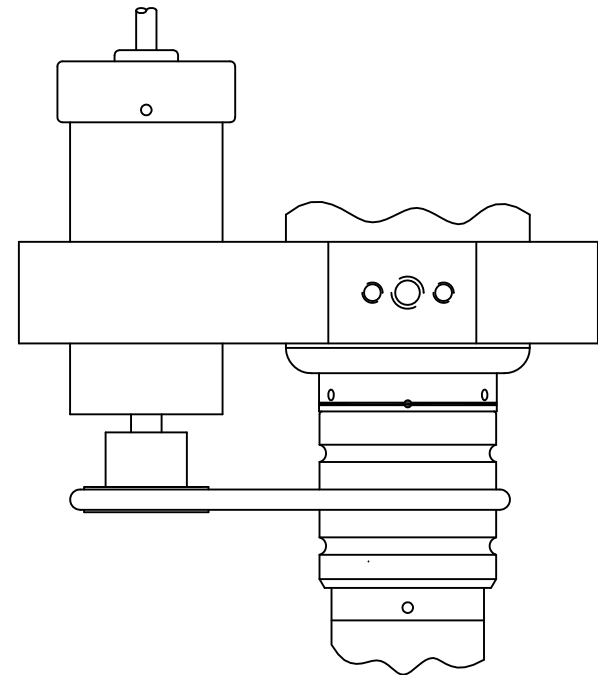
FOCUSER WITH  
FLUTED GRIP



FOCUSER WITH  
SMOOTH BARREL  
FOR GEAR DRIVES



FOCUSER WITH  
O-RING GROOVES



FOCUSER WITH  
MOTOR DRIVE

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

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[inches] AND ARE FOR  
REFERENCE ONLY AND  
ARE SUBJECT TO  
CHANGE.

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**FOCUSER CONFIGURATIONS**

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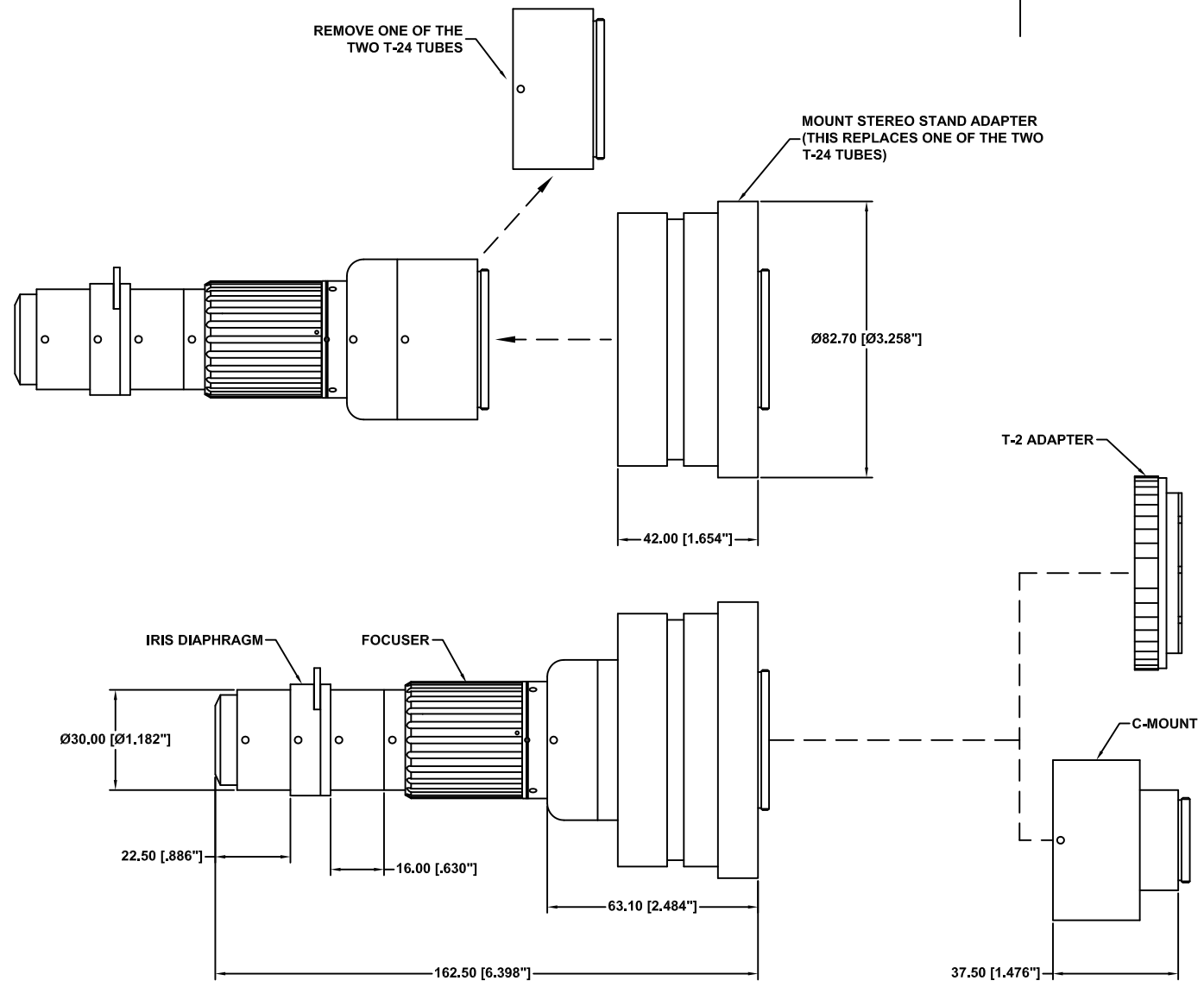
C

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B

A

A



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ALL DIM ARE mm [Inches] AND ARE FOR REFERENCE ONLY AND ARE SUBJECT TO CHANGE. <b>INFINITY</b> Photo-Optical Company 2530 Frontier Ave., Boulder, CO 80301 303/440-4544 Fax 303/440-4144				
<b>INFINIPROBE™ TS-160 WITH MACRO OBJ. AND STEREO STAND ADAPTER</b>				
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ZONE	REV	DESCRIPTION	DATE	APPROVED

D

D

C

C

B

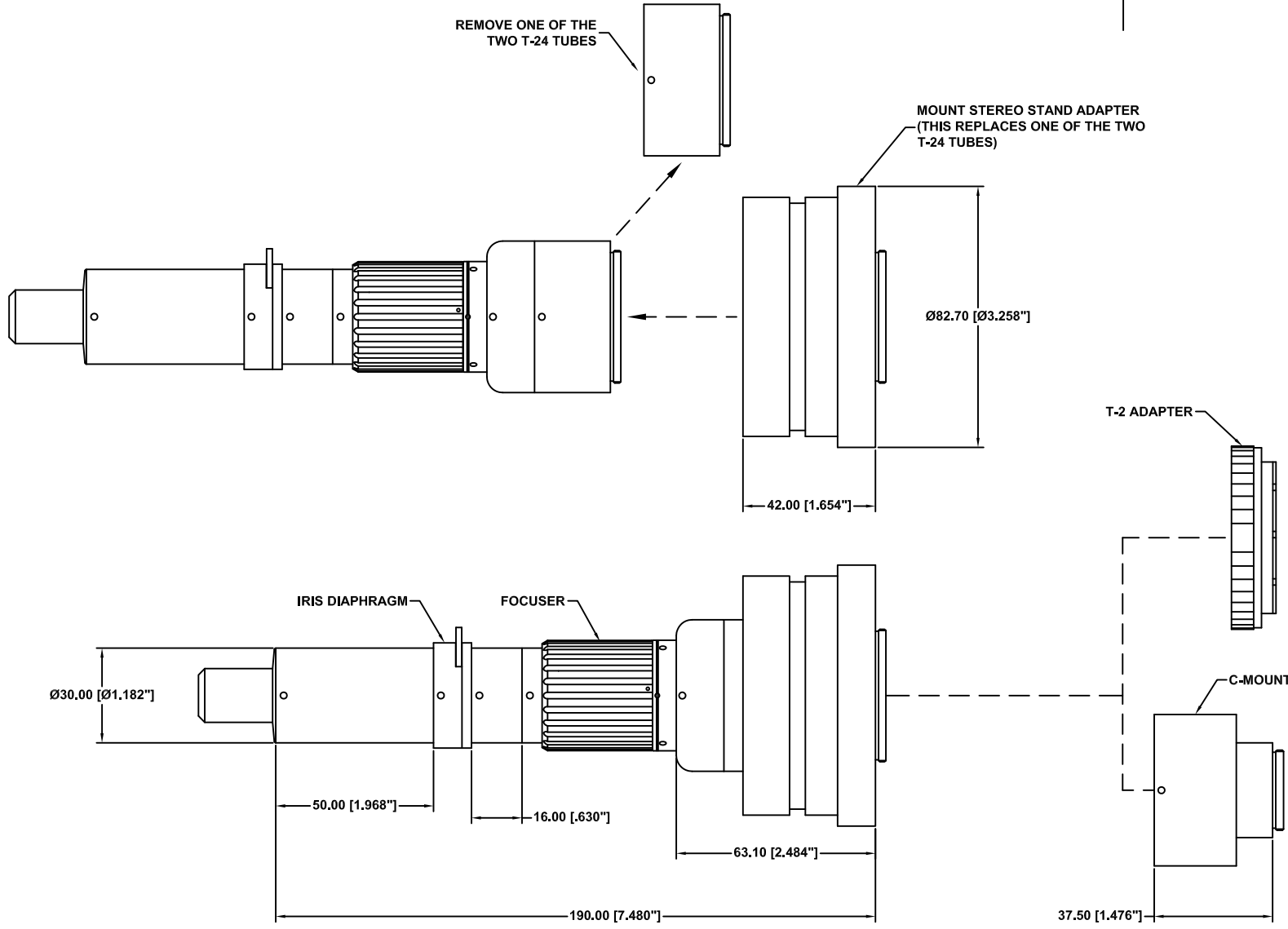
B

A

A

REMOVE ONE OF THE TWO T-24 TUBES

MOUNT STEREO STAND ADAPTER (THIS REPLACES ONE OF THE TWO T-24 TUBES)



This drawing is for informational purposes only. No other rights or privileges are granted or implied.

<b>INFINITY</b> Photo-Optical Company 2530 Frontier Ave., Boulder, CO 80301 303/440-4544 Fax 303/440-4144				
<b>INFINIPROBE™ TS-160 W/MICRO HM OBJ. AND STEREO STAND ADAPTER</b>				
Date: 12/14/10 MB	SIZE C	FSCM NO.	DWG NO. -	REV -
Modified:	SCALE NONE	-	SHEET 1 OF 1	

4

3

2

1

# Video Formats

Format	Factor	Diagram
1/4"	0.5	
1/3"	0.75	
1/2"	1.0	
2/3"	1.375	
1"	2.0	

Unless otherwise noted all data is given for 1/2" camera sensors. For FOV or magnification in other sensor sizes use the factors listed. For example, a FOV of 25mm listed for a 1/3" camera would be  $25 \times 0.75 = 18.75\text{mm}$ .

## **INFINITY PHOTO-OPTICAL COMPANY LIMITED WARRANTY**

INFINITY PHOTO-OPTICAL COMPANY hereby warrants its products to be free from defects in workmanship or materials for the warranty period set forth below. INFINITY PHOTO-OPTICAL COMPANY, at its option, shall repair or replace the defective product without cost to the purchaser, and such repair or replacement shall be the full extent of this express limited warranty. INFINITY PHOTO-OPTICAL COMPANY shall not be liable for any other damages either direct or consequential.

This warranty is made to the original purchaser, and is effective only on new equipment purchased from INFINITY PHOTO-OPTICAL COMPANY, or a dealer authorized by INFINITY PHOTO-OPTICAL COMPANY to sell the product.

This warranty is valid only when the product is returned to the authorized dealer from whom it was purchased, or returned directly to INFINITY PHOTO-OPTICAL COMPANY, freight prepaid, with proof of date of purchase.

This warranty does not extend to any defect, malfunction or failure caused by misuse, abuse or the use of the product with equipment for which it may not have been intended. Any unauthorized repair voids this warranty.

The warranty period for all products manufactured by INFINITY PHOTO-OPTICAL COMPANY is five (5) years from date of original purchase. Parts or components made or sourced from other manufacturers shall be solely covered by that manufacturer's warranty.

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