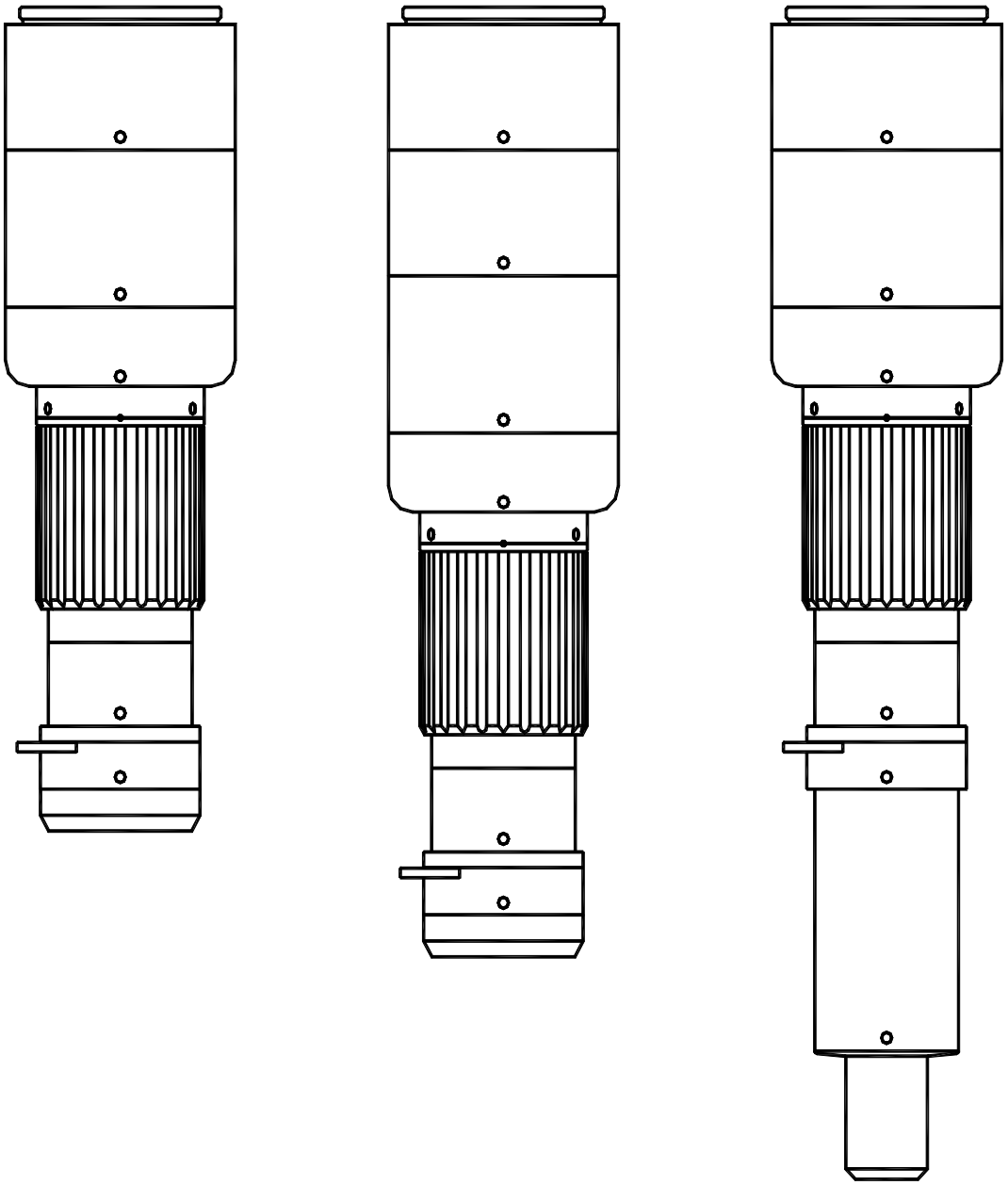
INFINIPROBE™ TS-160 UNIVERSAL

Macro/Micro Imaging System



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INFINIPROBE™ TS-160 UNIVERSAL INSTRUCTIONS FOR USE

You are about to experience a radically new approach to macro/micro imaging. It has a Variable Iris, but no f/stops and it focuses internally without any changes to its outer dimensions. It ranges magnification from 0 to as much as 16x. Almost any camera up to and including those with 35mm sensors can be used with it. It is so easy to use that it literally sets the best image for you every time you focus. It may be a "counter-intuitive" experience even to *experienced* photographers. It is the InfiniProbe TS-160 from Infinity Photo-Optical Company. Quality macro/micro imaging has become *simple and easy.*

QUICK-START CHECKLIST:

1) **Mount either the MACRO or MICRO HM Objective on the TS-160.**
2) **Mount the TS-160/camera on any suitable support—from a tripod to a boom stand—and use a suitable form of illumination.**
3) **Move the TS-160 up or down, closer or farther from an object to select a magnification.**
4) **Turn the Focusing Ring to focus on the object.**
5) **Close-down the Variable Iris until you see the *first* "jump" in contrast.**
6) ***Without moving the TS-160,* turn the Focusing Ring to focus *slightly* above and below your originally-chosen plane.**
7) **If you see blurring equal on both sides of focus, STOP and re-focus to the originally-chosen plane. If blurring is not *quite* equal on both sides of focus, *slightly* close-down a bit more until it is**.

Once you see blurring equal on both sides of focus, you will have set the *best possible image* from the TS-160*.*

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 is one at least T24mm tube which allows access to accessories when it is temporarily removed or 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 and aberrational 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, the TS-160 can be used with all cameras up to and including 24 x 36mm (35mm format).

continued

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

The MACRO Objective can be used in *three* "Power Range" Configurations. The TS-160 in MACRO mode is unique because it is able to be set for the exact characteristics you determine to be most important. Depending on the application and the options ordered, you can choose the results to be "weighted" for:

1) **Working Distance and Depth of Field (Direct).** Choose this configuration for compactness, economy (no accessory optics needed), general use and good depth of field. One T24 Tube is used with the T30 Tube.
2) **Highest Resolution and Magnification (Compressor Lens In-system).** This configuration emphasizes greater magnification occurring over a shorter working distance range. This increases the resolution but also increases the TS-160's length (by 24mm). Two T24 and one T30 Tubes are used.
3) **Highest Resolution with Low Magnification and Wide Field of View [Compressor Lens In-system combined with the LPI (Low Power Interface) Tube].** Interfacing the LPI between the MACRO Objective and the Range 2 configuration (Compressor in-system, etc.) creates a new configuration that emphasizes less magnification occurring over its (now closer) working distance range. The LPI is actually a second MACRO objective that gangs with the regular one. Equipped with the LPI, 1x is obtained at 55mm instead of 139mm at Range 1 and 107mm at Range 2.

Why is TS-160's ability to "weight" its MACRO characteristics so unique and important? It all has to do with the *angle* at which the imaged is captured. Certainly, other so-called "macro" lenses can provide a 1x magnification—but not generally *as close* as the TS-160 can (nor as far away, for that matter should you so choose). The angle at which the TS-160 can be used (known as the Numerical Aperture or NA) determines resolution. But as NA increases, it reciprocally limits depth of field. With the TS-160, you can manipulate the characteristics of the image to best advantage—within the laws of physics. Then, you can use the TS-160 up to 4x on-sensor at which time—if that is not enough—it can become a *microscope capturing images at up to 16x on-sensor by using the MICRO HM Objective.*

The Compressor Lens. The Compressor Lens acts to "move" the TS-160's operational curve so that even low magnifications are obtained at somewhat closer (but still significantly long) working distances. This means that the angular acceptance is higher in Numerical Aperture. The Compressor Lens was calculated so that at virtually every magnification provided by the MACRO Objective, the NA is correlative and comparable with that of compound laboratory microscope objectives of similar power.

Interestingly, the TS-160 uniquely converts from one operating principle with MACRO to another when the MICRO HM Objective is used. When the operating principle changes in favor of the MICRO HM Objective being used, care should be taken that the Compressor Lens is *removed* (as well as to *reduce* the number of T24 tubes from two to one) behind the T30 which should always remain up front. Please refer to the PDF Drawings for proper instructions on the Compressor Lens' installation.

The MICRO HM (Highest Magnification) Objective is designed to be used from 27mm down to 18mm (4-16x). Although it can be focused out to infinity, its optical correction is deliberately such that it begins its effective function precisely where the MACRO objective leaves off. Used with DSLRs or other viewing cameras, the image is inverted, as is typical of compound microscopes.

NOTE: When the MICRO HM Objective is utilized, the Compressor Lens must be removed and the total number of T24 Tubes reduced to only one.

Operation. Using the TS-160 is as natural as "stepping closer to get a better look." It is *essential* to understand that the Variable Iris must be used to monitor image quality.

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 microscope's in the condenser. *Like laboratory microscopes, there are no f/stops to be found—they are not relevant to using the TS-160.* The purpose of the Variable Iris is not to control exposure, but to control contrast, resolution and residual aberrations.

Setting the Variable Iris. The TS-160's internal focusing system allows it to be set for optimal imagery by means of the Variable Iris. Within a reasonable tolerance, microscopes have only *one theoretically proper point where contrast and resolution are optimized relative to aperture and working distance.* Fortunately, this point is easily seen when a sudden "jump" in contrast happens as the Iris is closed down.

To use the TS-160 properly, simply focus and then stop down the Iris until the contrast "jump" is seen. Then, the advantage of the TS-160's internal focusing allows a slight change to be made in focus above and below the originally-chosen plane *without physically moving it.* If the focus above and below the originally-chosen plane blurs equally at the Iris setting, *that is the optimal point.* Opening *or* closing the Iris from the optimal point will degrade the image. Still, it should be noted that it is possible—due to the coincidental characteristics of the object—that if equal blurring above and below focus does occur, *that* may indeed be the proper position even if the iris is not activated. In any case, it is always advisable to use several Iris positions for bracketing purposes.

HINT FOR MICRO HM OBJECTIVE USE: The Main Body *must* be set for use with the MICRO Objective by stopping the Iris down. Generally, this setting occurs between the second and third marks on the Iris' scale. A *slightly* smaller aperture may be chosen if the observed top and bottom blurs are not equal.

MICRO HM with 35mm Format. 35mm full-frame cameras may be used in the same configuration as for smaller formats (APS-C, for example). However, a slight vignetting can occur under some conditions. This is easily countered by using a second T24 tube in the system.

Depth of Field Adjustment. If there is only one point where the best image can be obtained, is closing the Iris to gain depth of field a proper thing to do? This is where the TS-160 is unique. While it is *possible* to close the Iris to increase depth of field, the image will inevitably be more or less degraded. The TS-160 can provide greater depth of field by moving it *up* or *away* from the object, refocusing and using the Iris to find the best image. In this way, every chosen depth can be taken at the optimal point. You can enlarge the images later, but they will be *captured* with the greatest fidelity.

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.

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 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 all the T-tubes allows access to the Filter Holder Receptacle. Most 25mm diameter filters can be positioned there and locked in place by a 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.

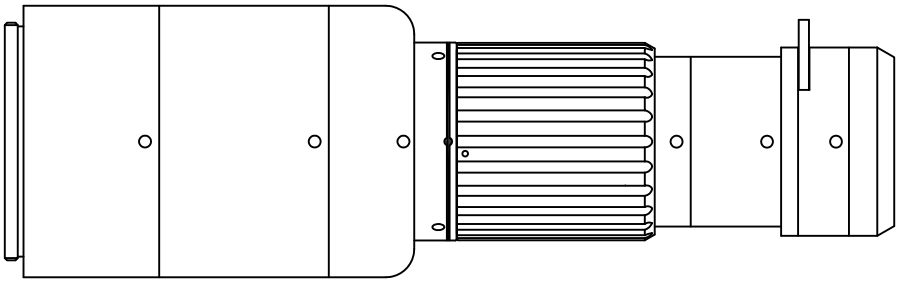
InfiniLight™ Adapter Tubes. Presently there are two InfiniLight Tubes with front flanges to fit Canon and Nikon flash units onto the TS-160 Main Body. The InfiniLight combines with the TS-160 to make a very compact yet efficacious macro system with self-contained flash illumination.

The InfiniLight consists of a flanged T tube part that is 12mm thick another 12mm T tube attached to it, thereby making it possible to exchange one of the supplied T24 tubes so that the InfiniLight becomes integral to the TS-160. This also permits custom spacings (we will advise) for use with various cameras whose otherwise obstructive designs *(e.g.,* those with thick built-in handles) to be utilized on the TS-160. As demands arise, we will consider producing other InfiniLight Tubes for makes other than Canon and Nikon.

C-mount Camera Use. The TS-160 lends its unique capabilities to high quality microscope cameras made by the major manufacturers. Most cameras used on laboratory-type microscopes are C-mount and usually have 2/3-in. sensors. These cameras often are supplied with useful software. Although the TS-160 is primarily designed to take advantage of formats as large as 35mm as provided by high-quality DSLRs, it can be used productively with microscope-type cameras as well. Please refer to the Infinity Photo-Optical website, www.infinity-usa.com for further details.

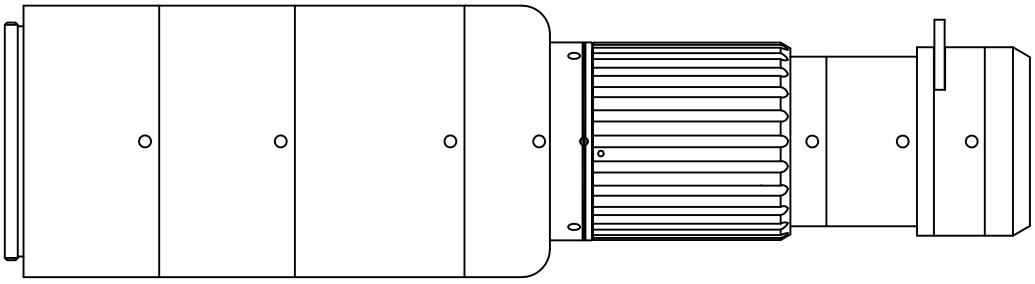
Care and Cleaning. Your InfiniProbe TS-160 should be treated as the fine instrument that it is. Care should be taken to keep dust and dirt off the external lens surfaces. The unit can be cleaned (metal parts only) with a cloth moistened with alcohol. The external optical surfaces should be cleaned only 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.

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



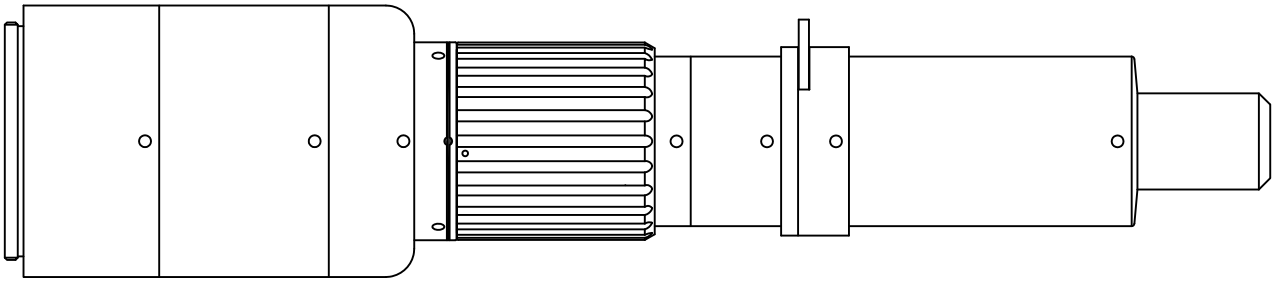
LENGTH: 154mm [6.06"] **MACRO**

WEIGHT: 294g [10.5 oz.]



LENGTH: 178.0mm [7.01"] **MACRO with Compressor Lens inside**

WEIGHT: 355.6g [12.7oz.]



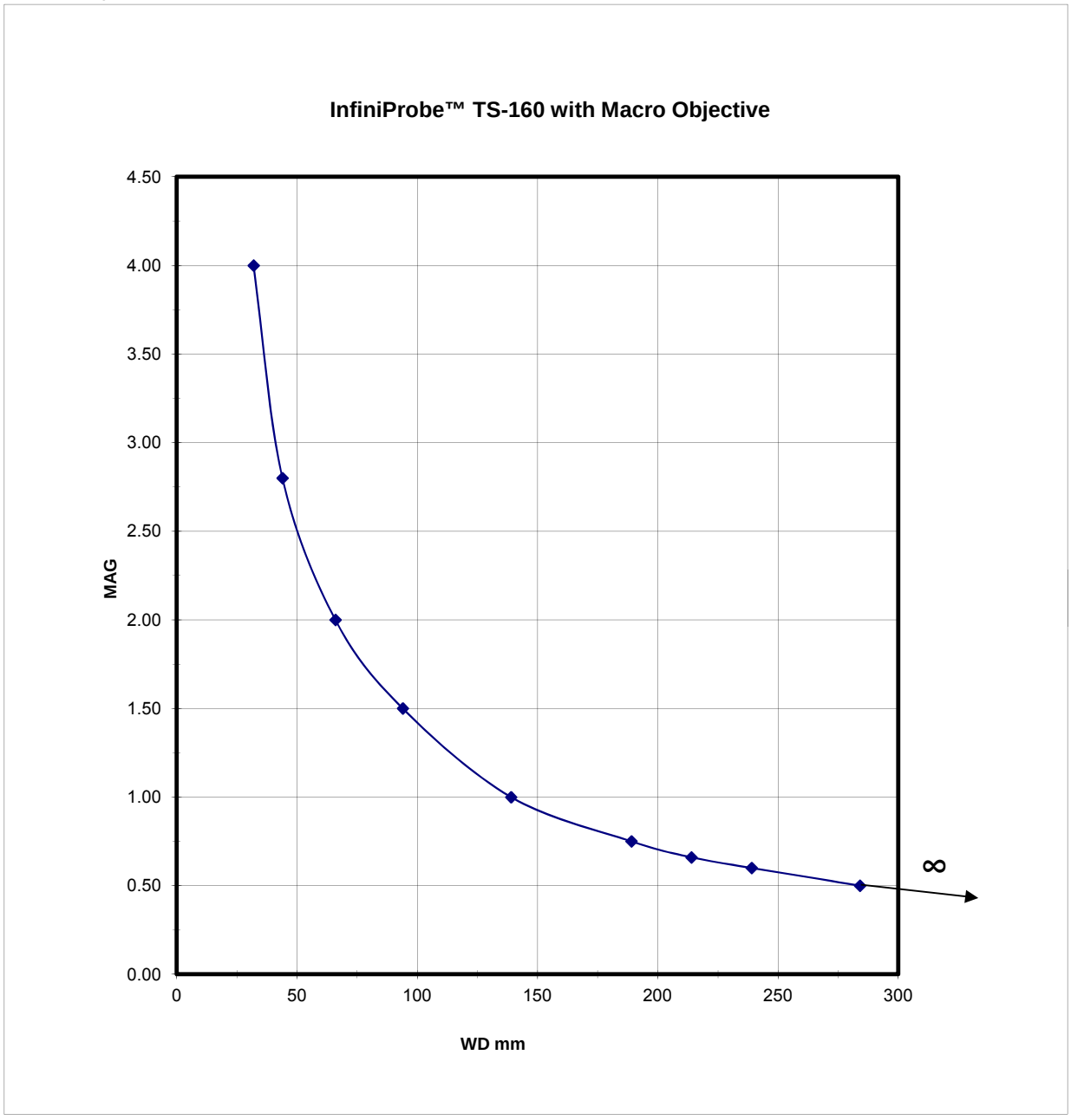
LENGTH: 220.5mm [8.68"] **MICRO HM**

WEIGHT: 327.6g [11.7 oz.]

InfiniProbe™ TS-160 Macro/Micro Imaging System
MACRO OBJECTIVE DATA

WD mm	32	44	66	94	139	189	214	239	284
Mag	4.00	2.80	2.00	1.50	1.00	0.75	0.66	0.60	0.50
FOV mm	9.0	12.9	18.0	24.0	36.0	48.0	54.5	60.0	72.0

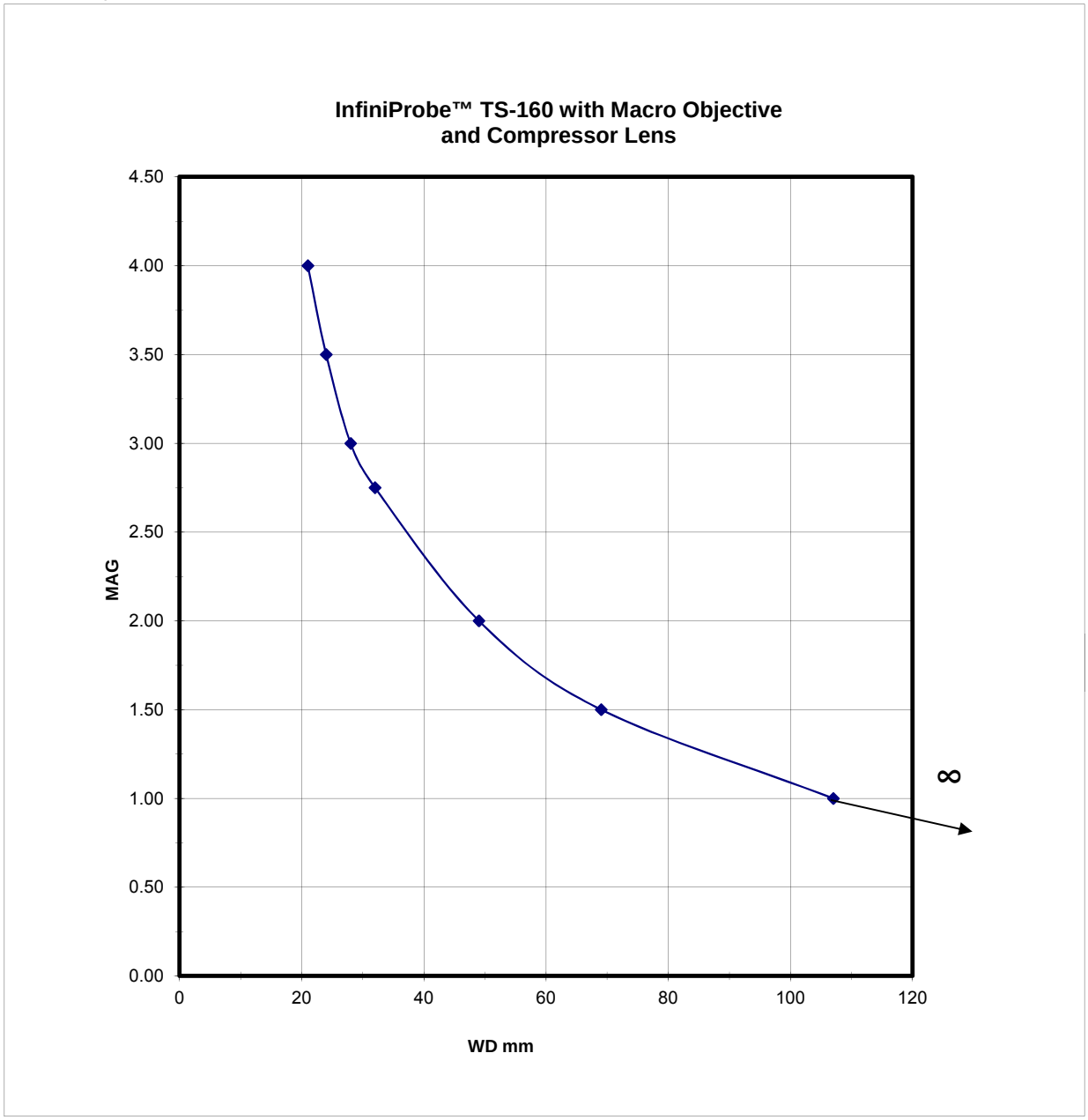
*FOV based on 35mm video format (36mm horizontally). See Video Format Page for all conversions.
For formats other than 35mm: Divide magnification into the sensor's horizontal dimension.
For example, 23x23mm Sensor: 23mm/4x = 5.75mm FOV.



InfiniProbe™ TS-160 Macro/Micro Imaging System
MACRO OBJECTIVE WITH COMPRESSOR LENS

WD mm	21	24	28	32	49	69	107
Mag	4.00	3.50	3.00	2.75	2.00	1.50	1.00
FOV mm	9.0	10.3	12.0	13.1	18.0	24.0	36.0

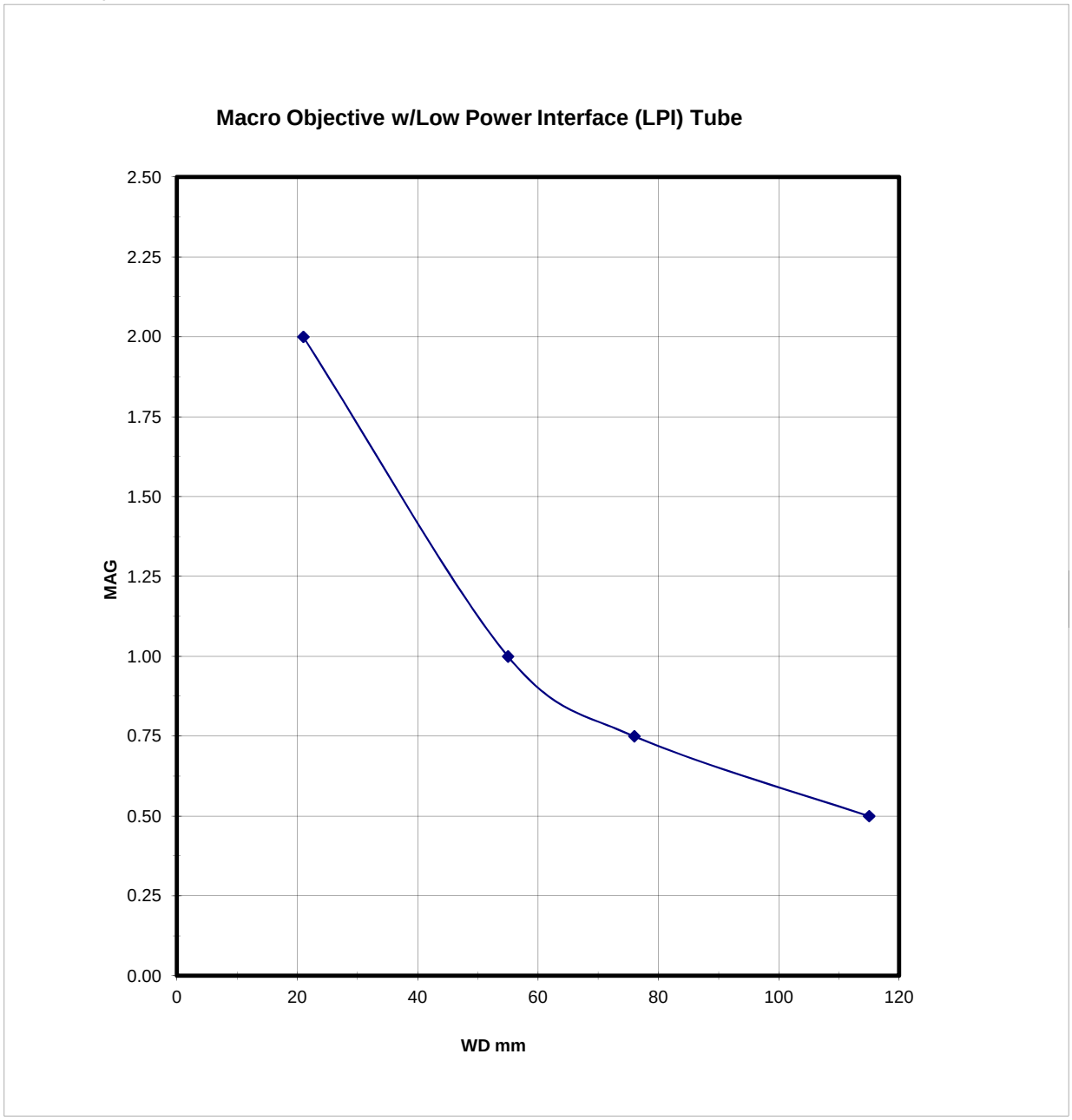
FOV based on 35mm format (36mm horizontally).
For formats other than 35mm: Divide magnification into the sensor's horizontal dimension.
For example, 23x23mm Sensor: 23mm/4x = 5.75mm FOV.



MACRO Objective w/Low Power Interface (LPI) Tube

WD mm	21	55	76	115
Mag	2.00	1.00	0.75	0.50
FOV mm	18.0	36.0	48.0	72.0

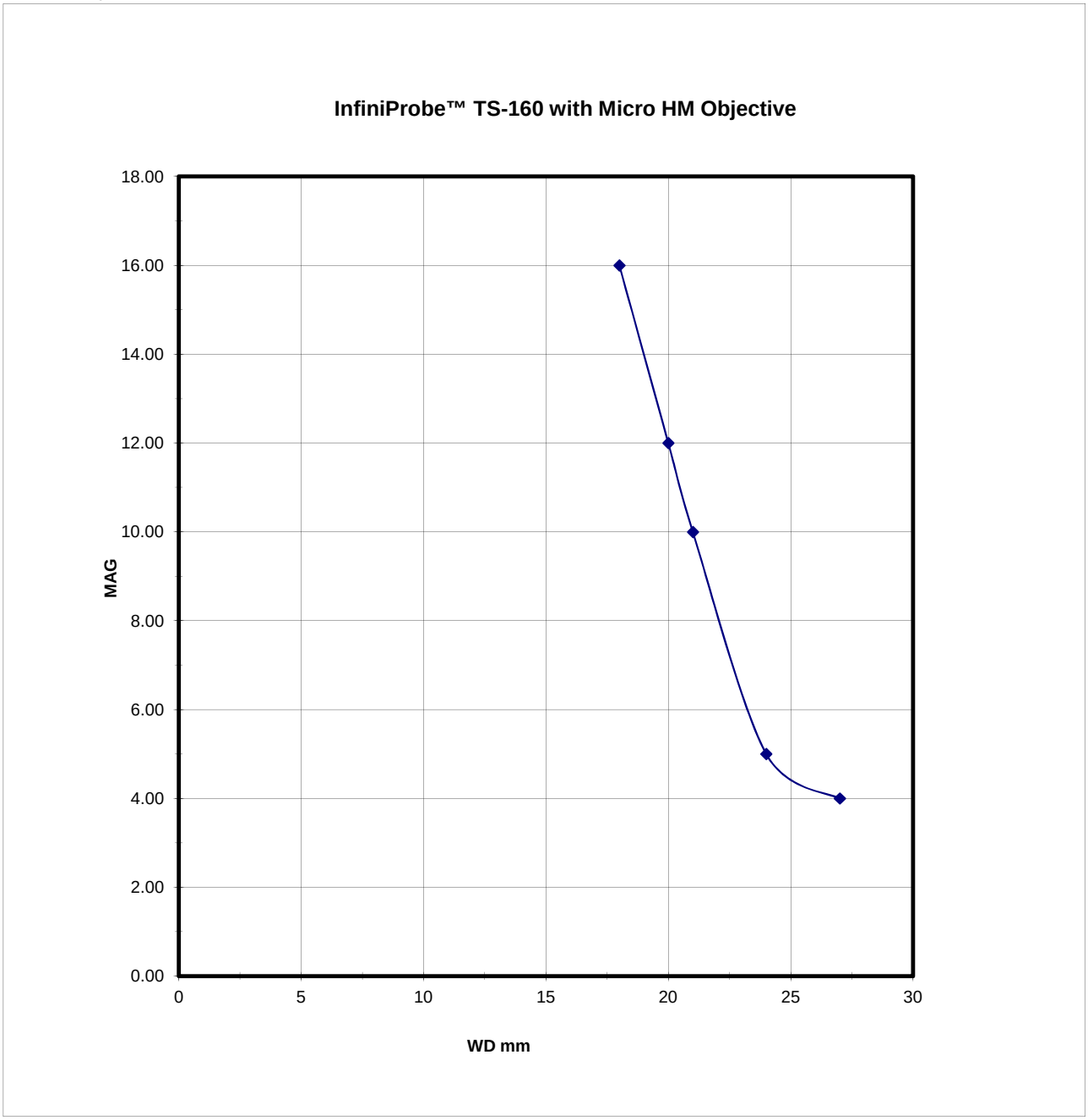
FOV based on 35mm format (36mm horizontally).
For formats other than 35mm: Divide magnification into the sensor's horizontal dimension.
For example, 23x23mm Sensor: 23mm/2x = 11.5mm FOV.



InfiniProbe™ TS-160 UNIVERSAL Macro/Micro Imaging System
MICRO HM OBJECTIVE DATA

WD mm	18	20	21	24	27
Mag	16.00	12.00	10.00	5.00	4.00
FOV mm	2.25	3.00	3.60	7.20	9.00

FOV based on 35mm format (36mm horizontally).
For formats other than 35mm: Divide magnification into the sensor's horizontal dimension.
For example, 23x23mm Sensor: 23mm/4x = 5.75mm FOV.



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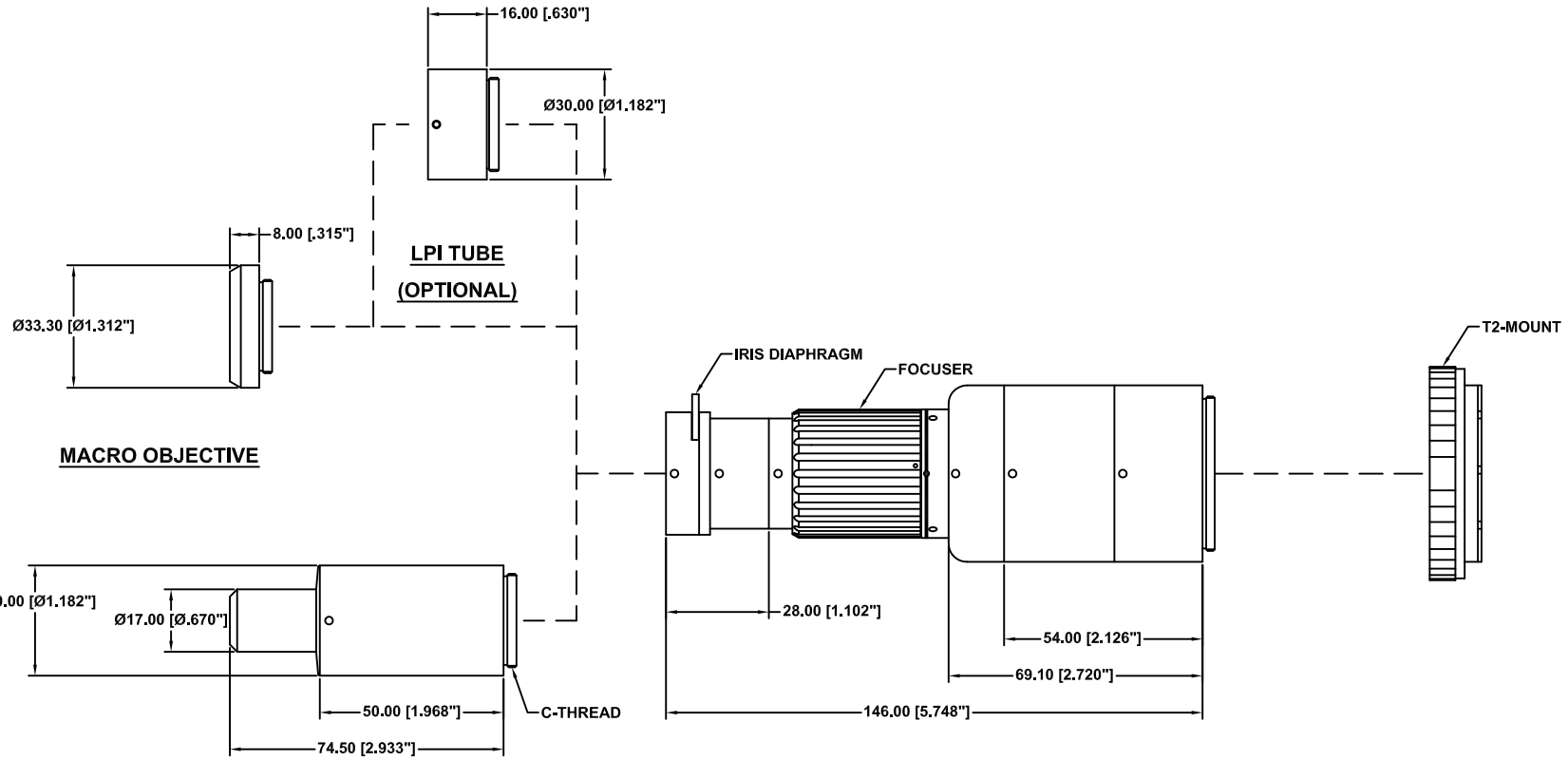

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Date: 06/26/13 MB

Modified: 12/17/13 MB

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

INFINIPROBE™ TS-160 MAIN BODY

SIZE	FSCM NO.	DWG NO.	REV
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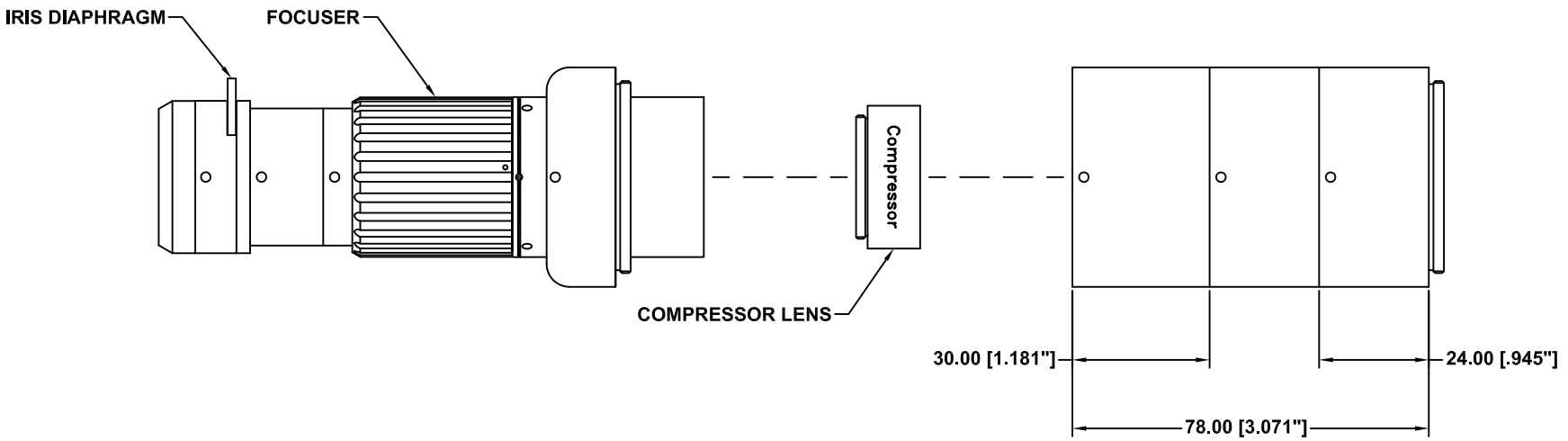

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	INFINIPROBE™ TS-160 MAIN BODY MACRO W/COMPRESSOR LENS
Date: 06/26/13 MB	SIZE B | FSCM NO. | DWG NO. - | REV A
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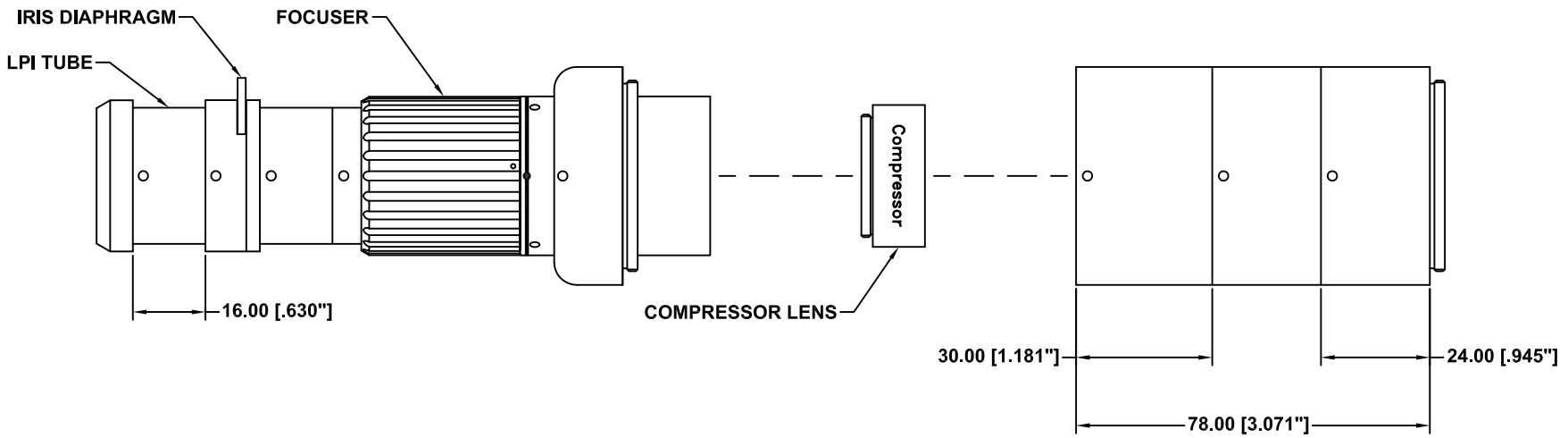

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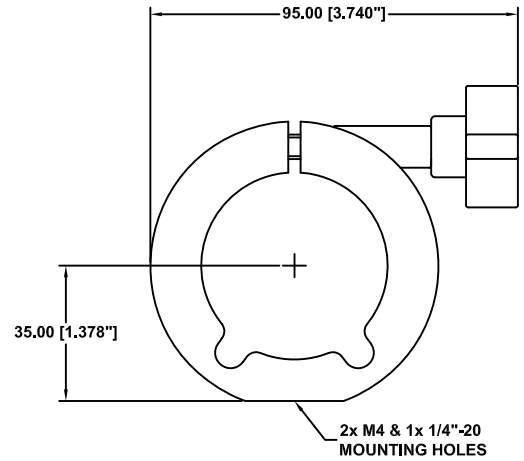

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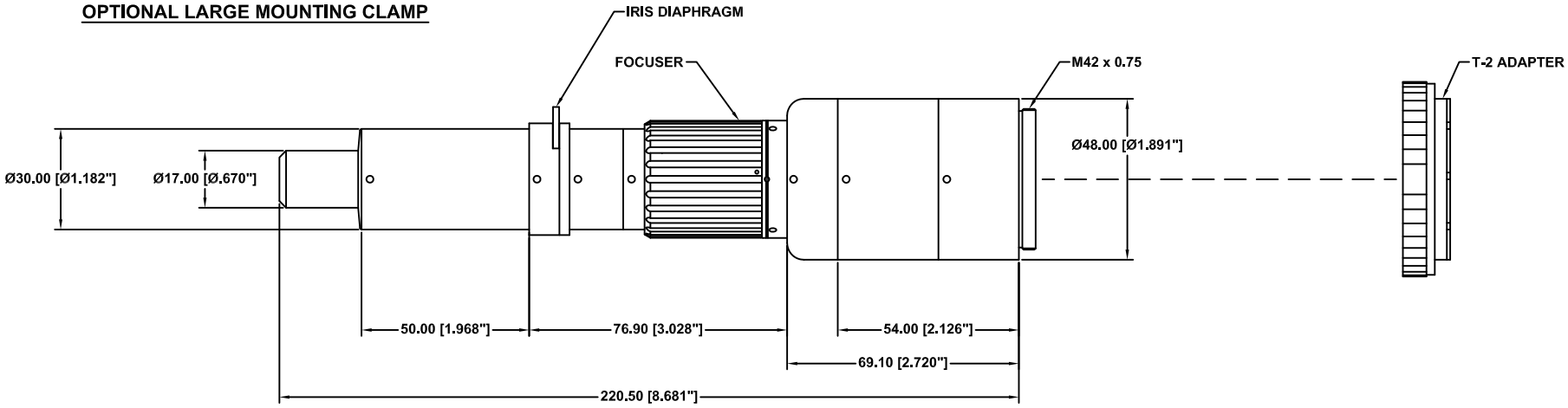

INFINIPROBE™ TS-160 MAIN BODY WITH MICRO HM OBJECTIVE

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

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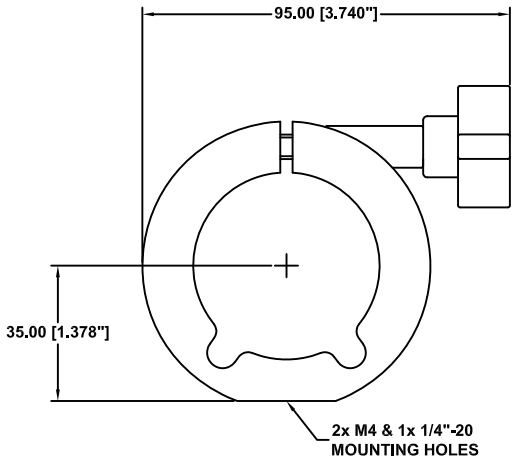

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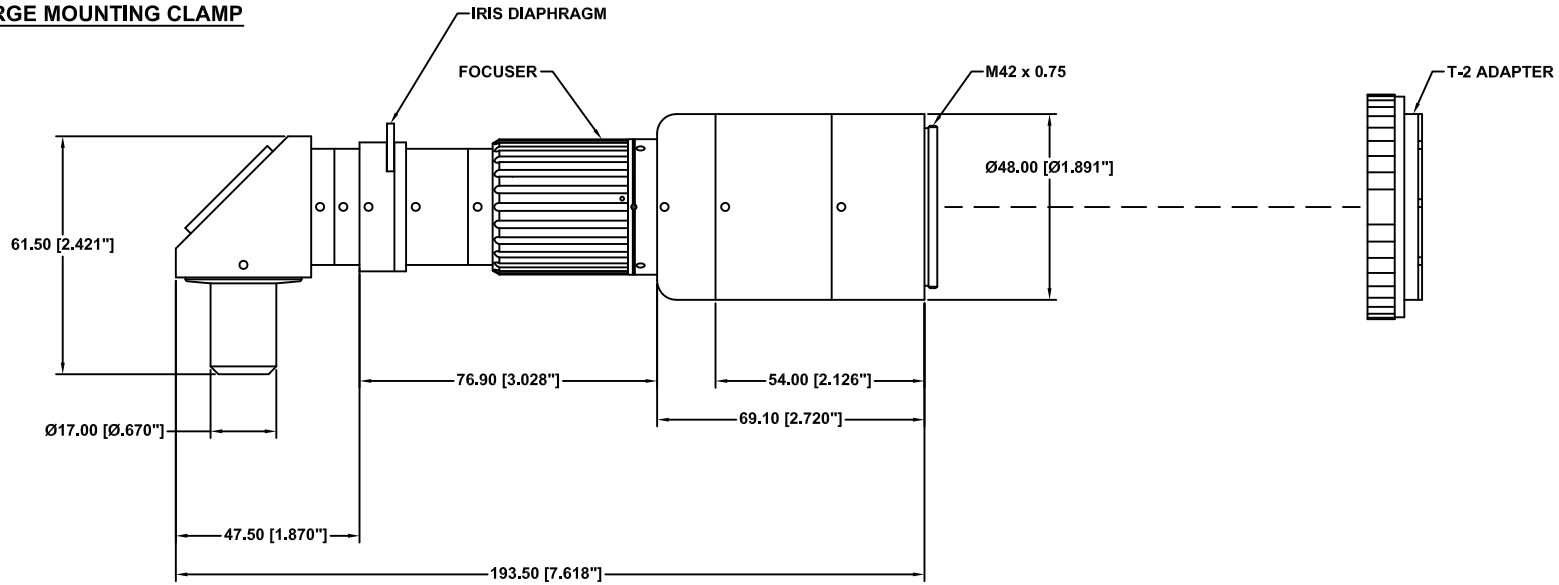

INFINIPROBE™ TS-160 MAIN BODY WITH MICRO HM-RA OBJECTIVE

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Date: 05/08/13 MB	INFINIPROBE™ TS-160 MAIN BODY with MICRO HM-RA OBJECTIVE
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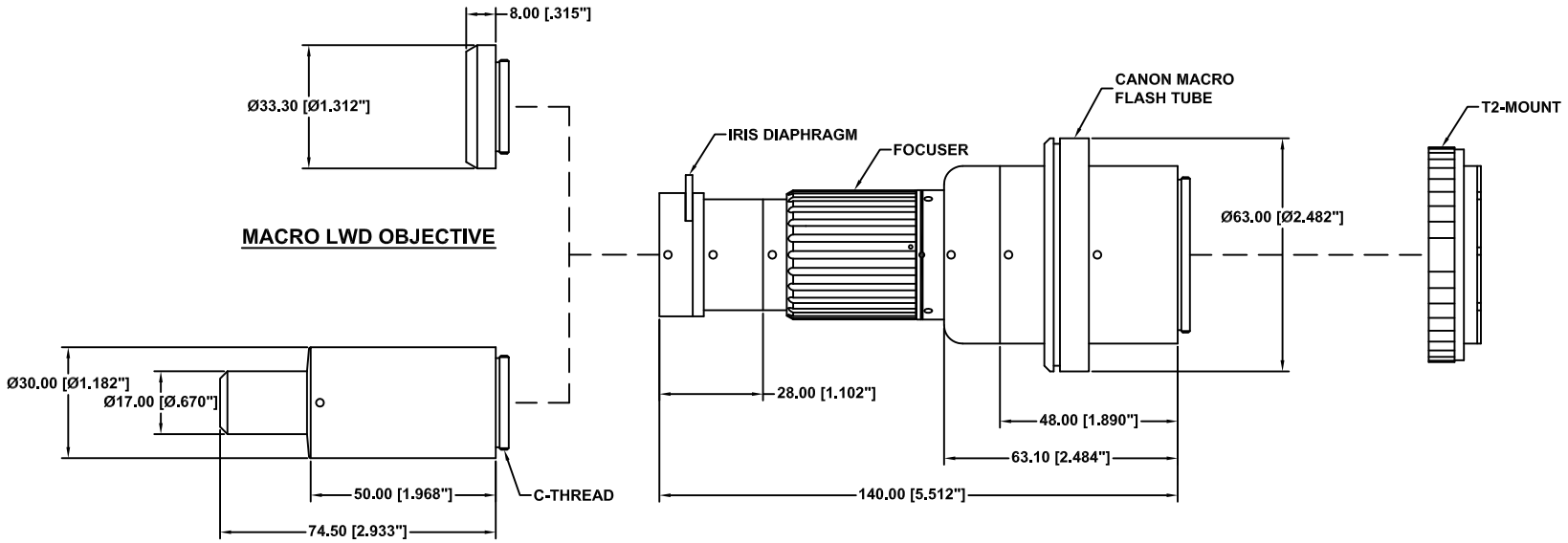

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Date: 07/17/13 MB

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INFINIPROBE™ TS-160 MAIN BODY w/CANON MACRO FLASH TUBE

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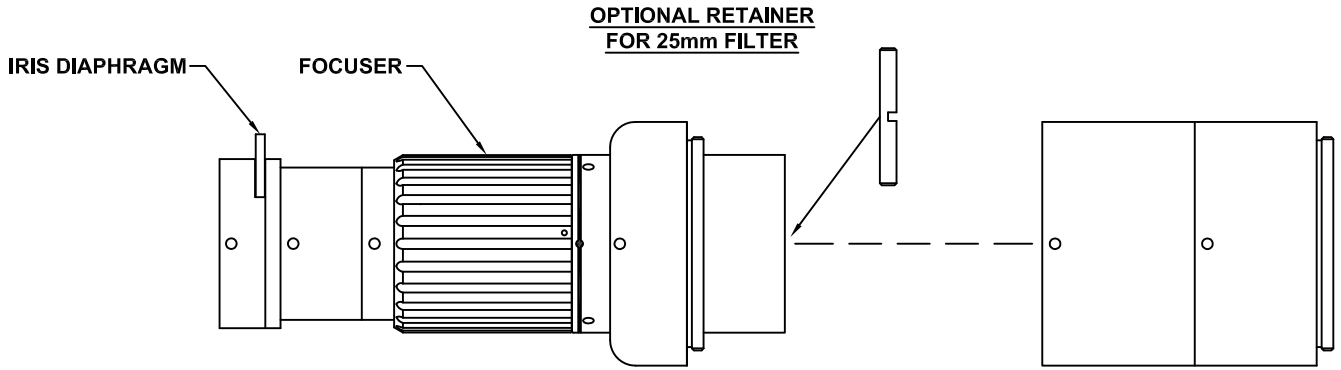

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Date: 12/01/10 MB	INFINIPROBE™ TS-160 MAIN BODY (FILTER INSERTION)
Modified: 08/14/13 MB	SIZE B | FSCM NO. | DWG NO. - | REV B
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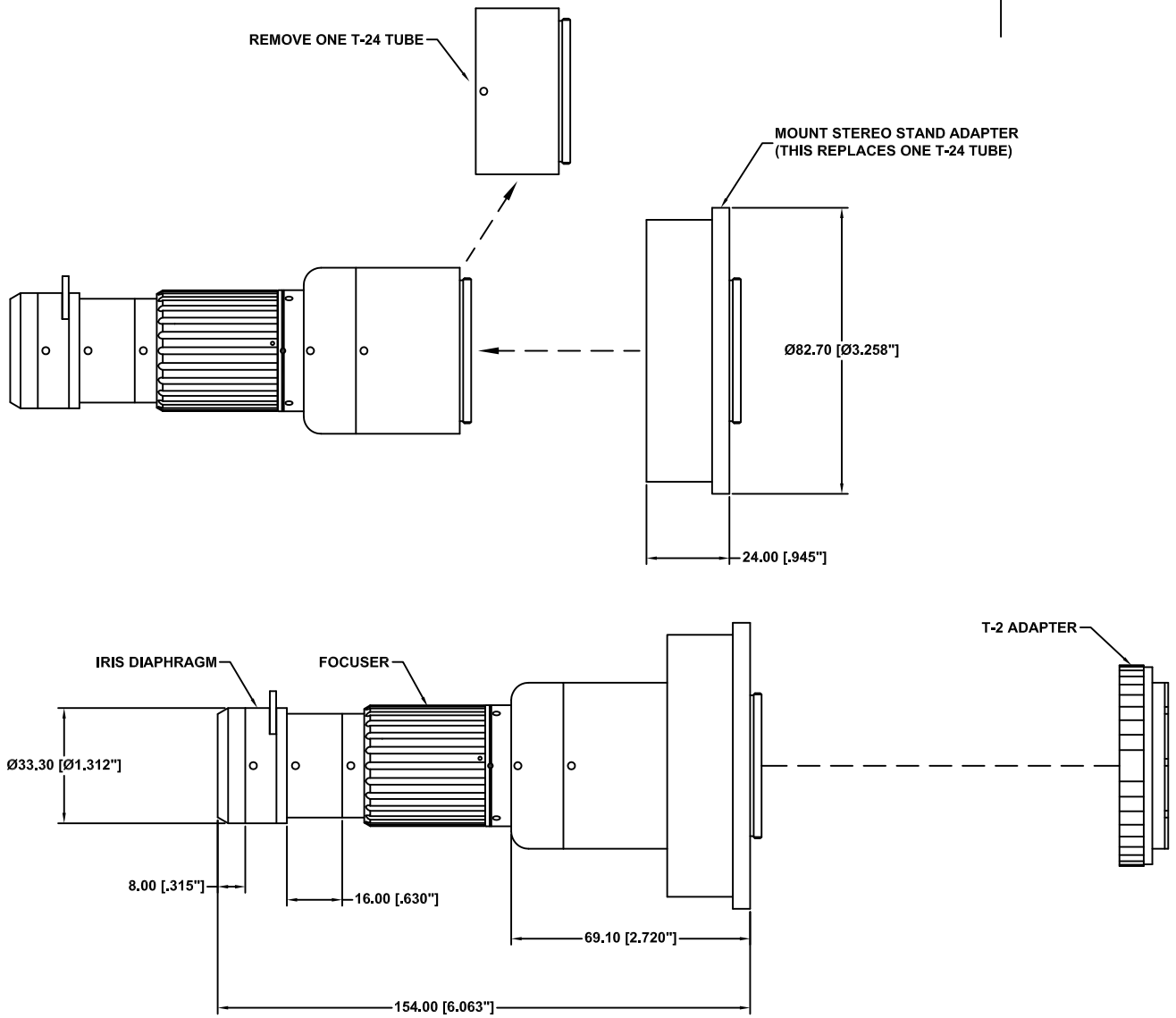

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Date: 06/26/13 MB	INFINIPROBE™ TS-160 WITH MACRO OBJ. AND STEREO STAND ADAPTER
Modified: 12/18/13 MB	SIZE C | FSCM NO. | DWG NO. - | REV B
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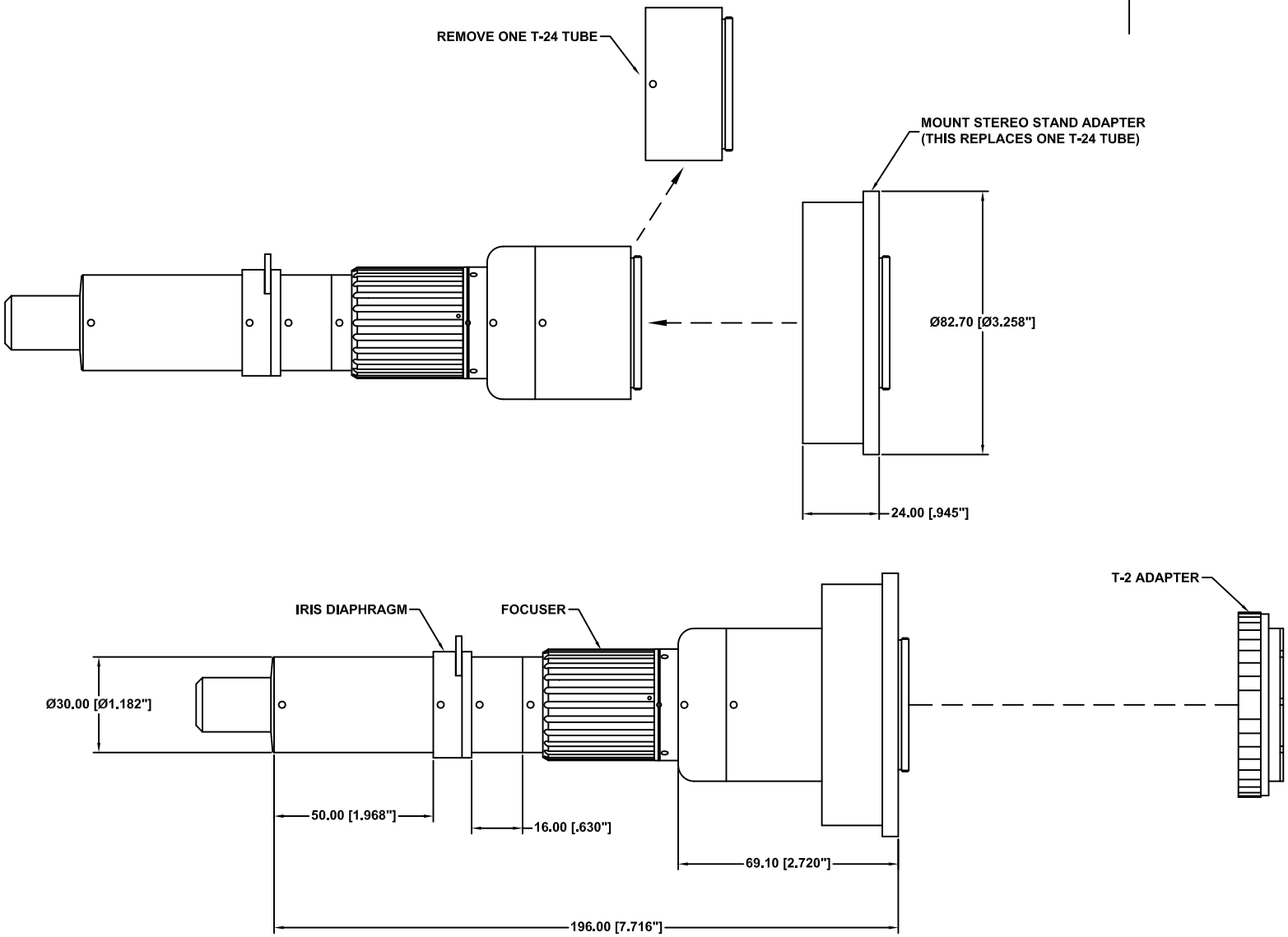

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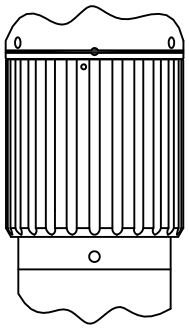
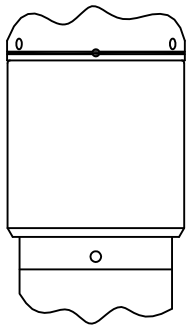
Date: 06/05/13 MB	INFINIPROBE™ TS-160 W/MICRO HM OBJ. AND STEREO STAND ADAPTER
Modified: 12/18/13 MB	SIZE C | FSCM NO. | DWG NO. - | REV B
	SCALE NONE | - | SHEET 1 OF 1

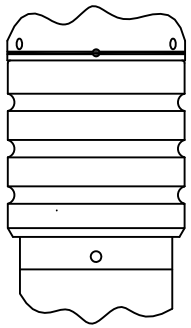
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



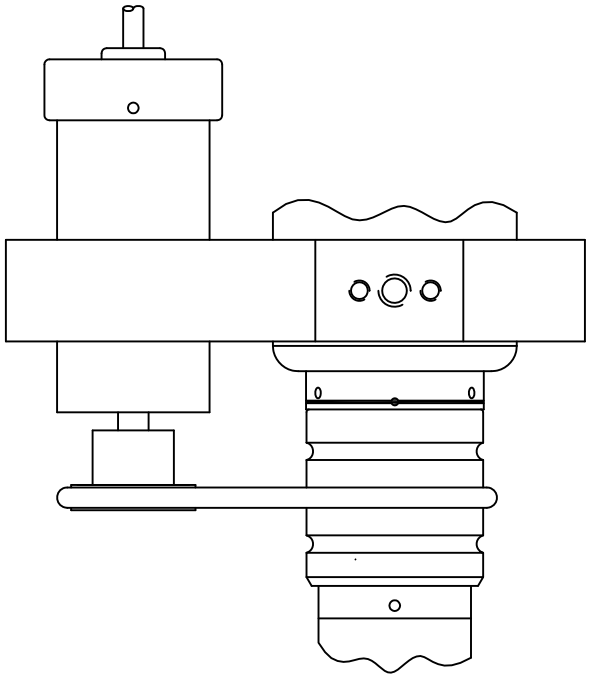
FOCUSER WITH
FLUTED GRIP



FOCUSER WITH
SMOOTH BARREL
FOR GEAR DRIVES



FOCUSER WITH
O-RING GROOVES



FOCUSER WITH
MOTOR DRIVE

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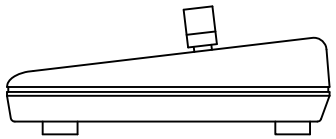
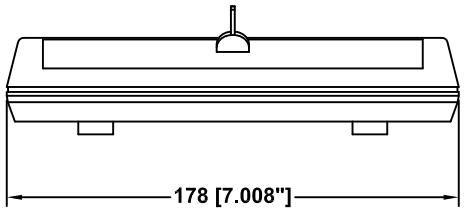
ALL DIM ARE mm [inches] AND ARE FOR REFERENCE ONLY AND ARE SUBJECT TO CHANGE.	INFINITY Photo-Optical Company 2530 Frontier Ave., Boulder, CO 80301 303/440-4544 Fax 303/440-4144			
	FOCUSER CONFIGURATIONS			
Date: 06/28/11 MB	SIZE B	FSCM NO.	DWG NO. -	REV -
Modified:	SCALE NONE	-	SHEET 1 OF 1	

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

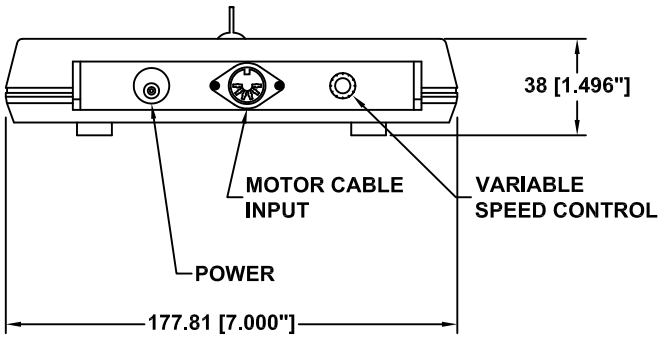
SIDE



FRONT

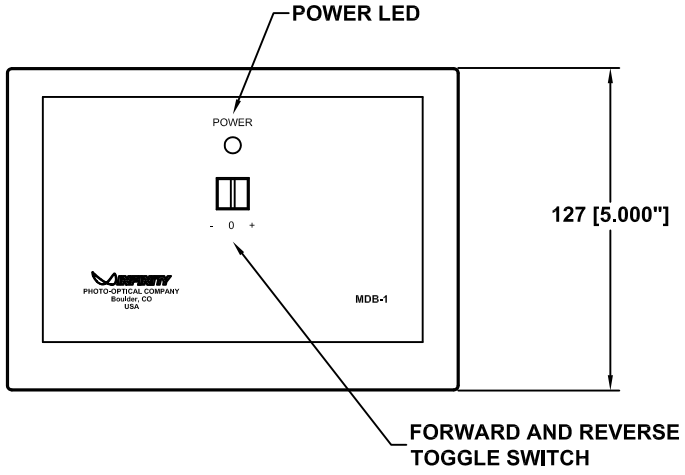


REAR



Cables are 3 meters long. Other lengths can be supplied.

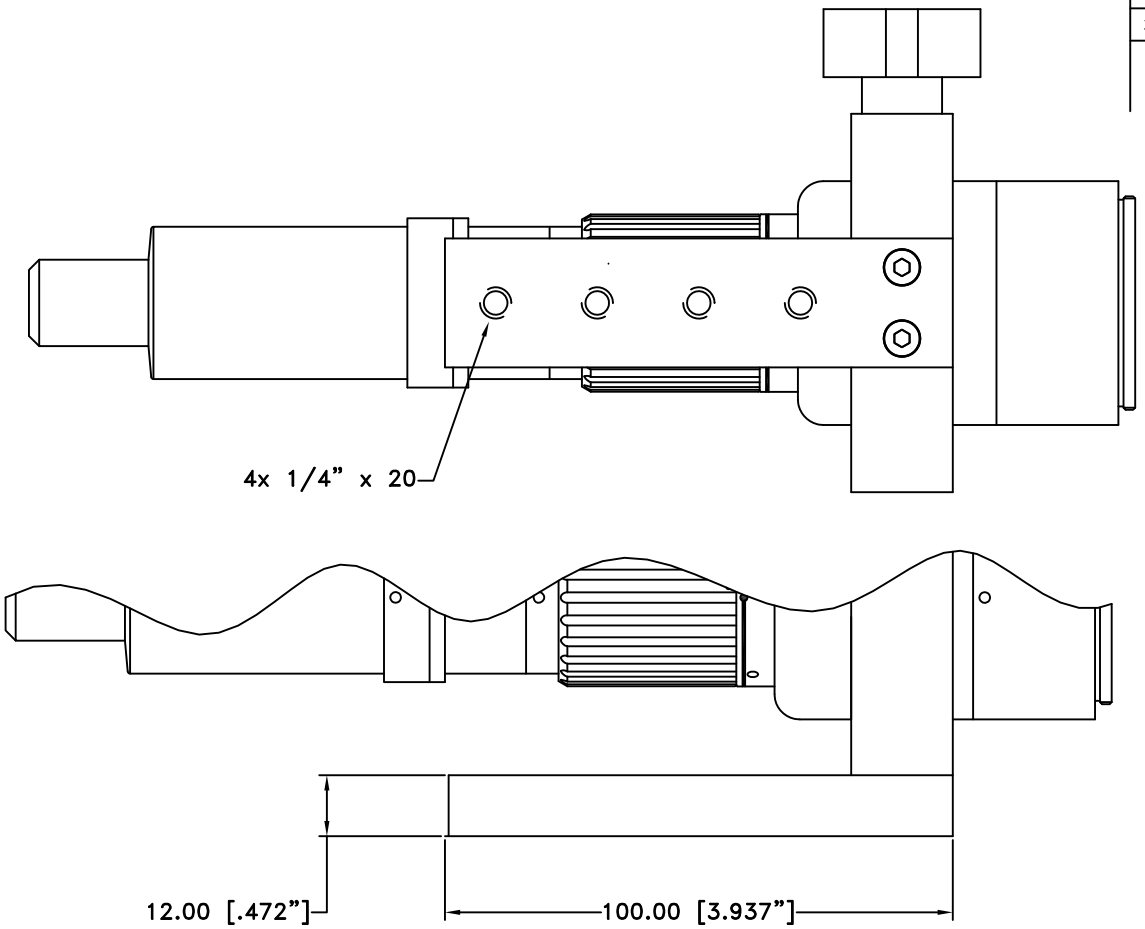
TO MOTOR



TOP

ALL DIM ARE mm [inches] AND ARE FOR REFERENCE ONLY AND ARE SUBJECT TO CHANGE.	INFINITY Photo-Optical Company 2530 Frontier Ave., Boulder, CO 80301 303/440-4544 Fax 303/440-4144			
	MDB-1 CONTROLLER			
Date: 06/20/12 MB	SIZE B	FSCM NO.	DWG NO.	REV -
Modified:	SCALE NONE	-	SHEET 1 OF 1	

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

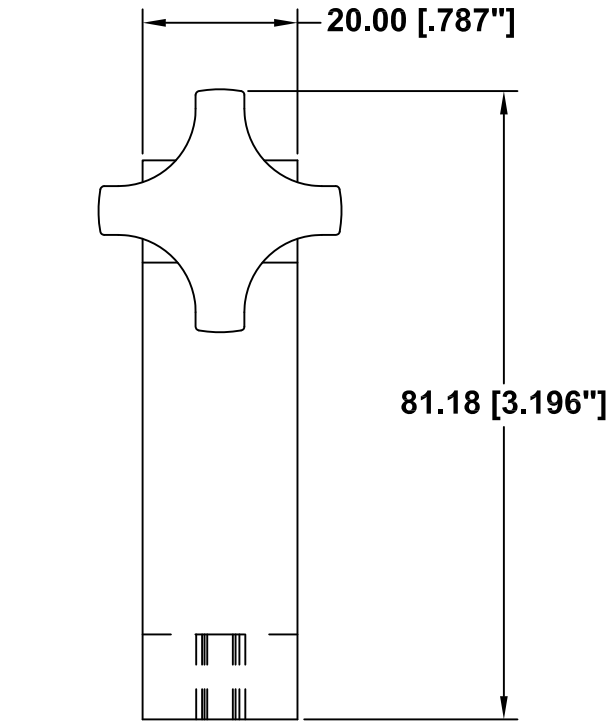


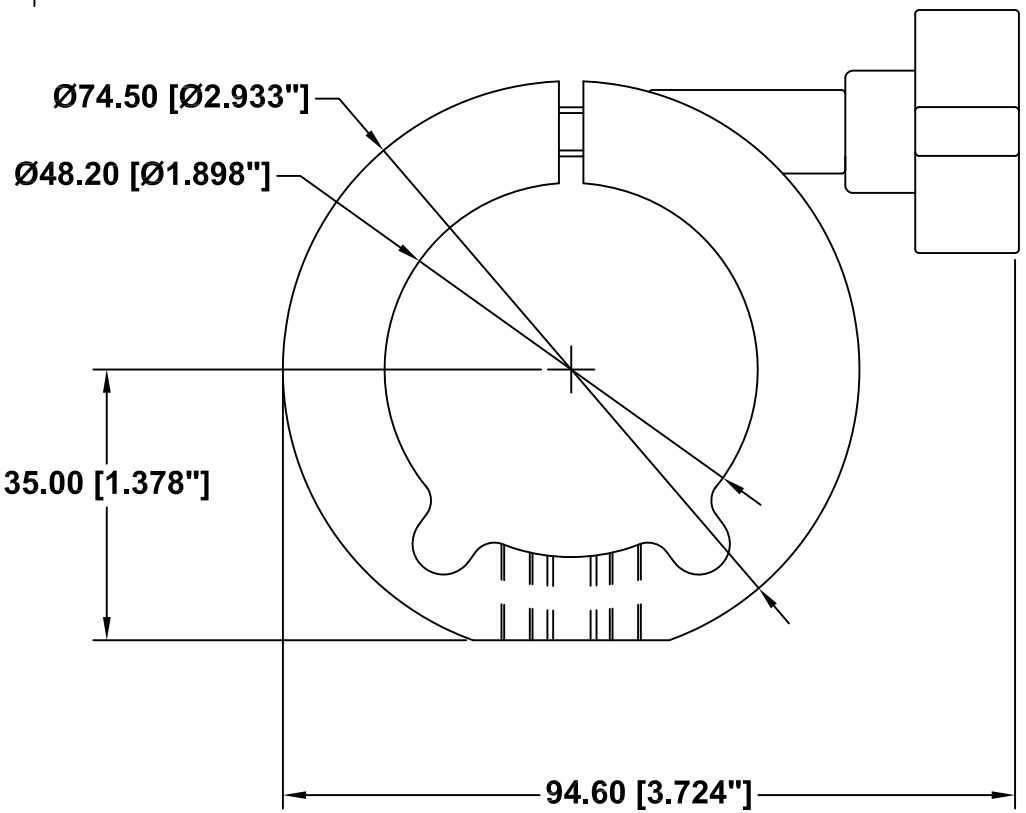
NOTE:

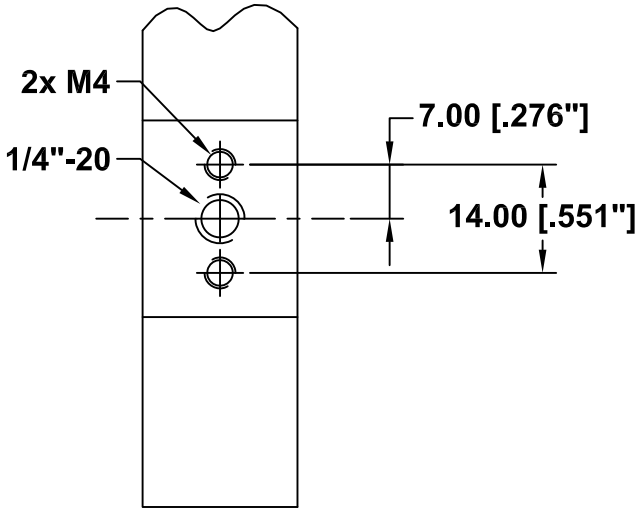
1. INFINIPROBE SHOWN WITH MICRO OBJECTIVE AND MOUTING BAR.

ALL DIM ARE mm [inches] AND ARE FOR 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 w/MOUNTING BAR
Date: 07/17/13 MB	SIZE B | FSCM NO. | DWG NO. - | REV -
Modified:	SCALE NONE | - | SHEET 1 OF 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED







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Date: 07/24/97 MS

Modified: 08/10/05 MB

INFINITY Photo-Optical Company
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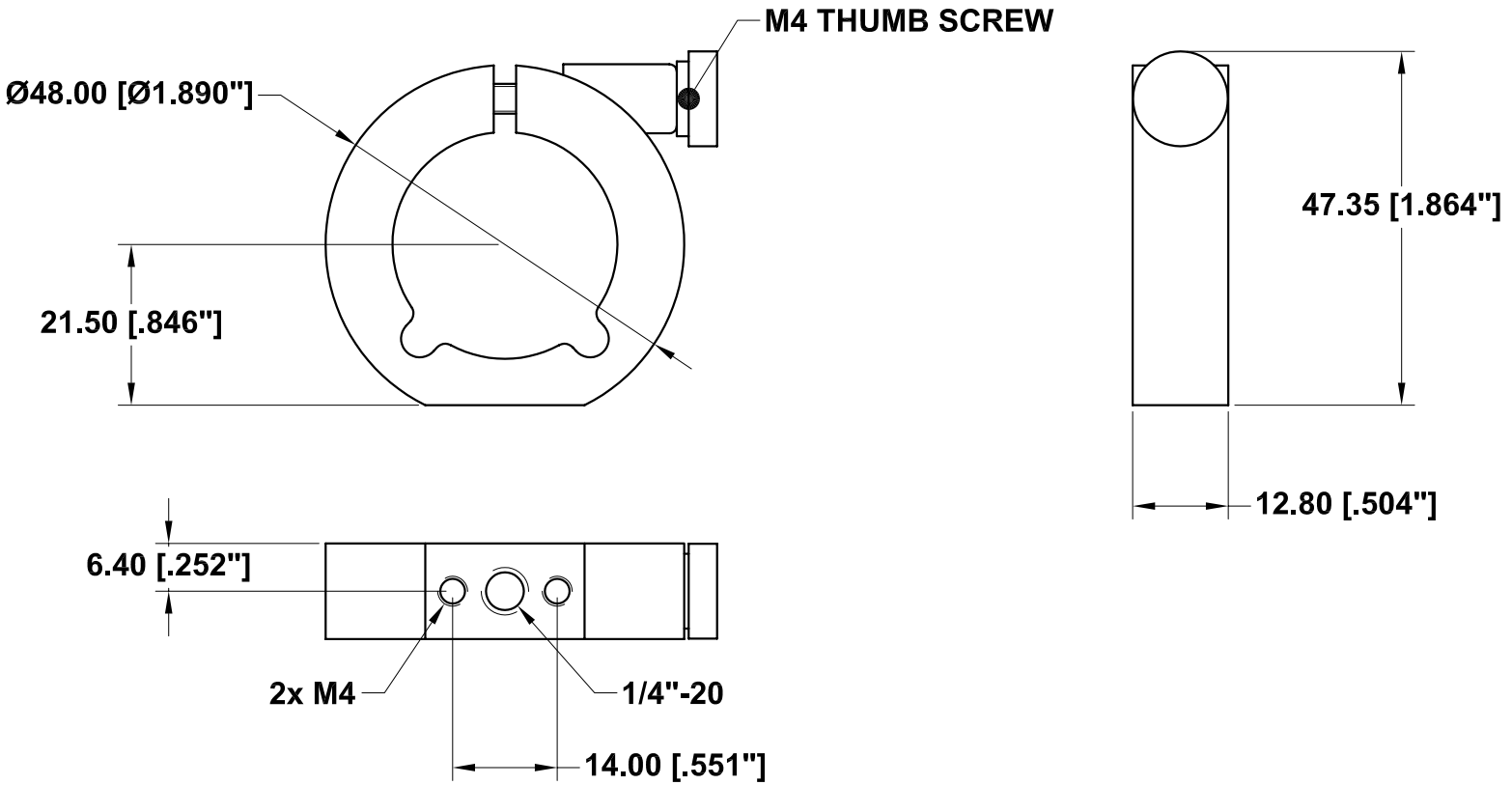
303/440-4544 Fax 303/440-4144

LARGE MOUNTING CLAMP

SIZE	FSCM NO.	DWG NO.	REV
A		770 170	-

SCALE		SHEET
NONE	-	1 OF 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



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Date: 03/19/01 MB

Modified: 04/06/01 MB

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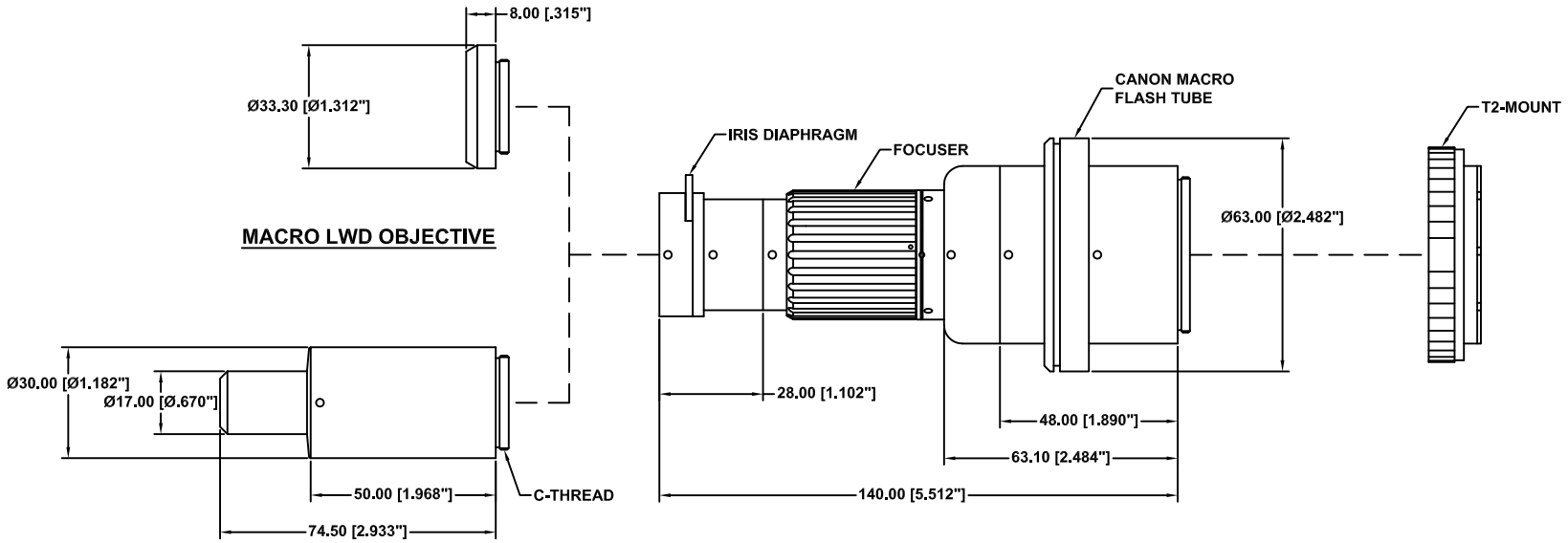
2530 Frontier Ave., Boulder, CO 80301
303/440-4544 Fax 303/440-4144

SMALL MOUNTING CLAMP

SIZE	FSCM NO.	DWG NO.	REV
A		990 170	A

SCALE NONE | SHEET 1 of 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



ALL DIM ARE mm [Inches] AND ARE FOR REFERENCE ONLY AND ARE SUBJECT TO CHANGE.

Date: 07/17/13 MB

Modified:

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

INFINIPROBE™ TS-160 MAIN BODY w/CANON MACRO FLASH TUBE

SIZE	FSCM NO.	DWG NO.	REV
C		-	-

SCALE NONE | - | SHEET 1 OF 1

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.

The warranty contained herein is the only warranty made by INFINITY PHOTO-OPTICAL COMPANY. Any implied warranty of merchantability and/or fitness for a particular purpose is expressly excluded from this warranty. INFINITY PHOTO-OPTICAL COMPANY shall not be liable for any expense, loss, incidental or consequential damages which may arise in connection with the use of this equipment. Recovery under this warranty is limited to repair or replacement of the equipment as provided above.

INFINITY PHOTO-OPTICAL COMPANY reserves the right to modify designs, equipment and accessories without notice.