TZM0745A Series Monocular Zoom Objective (MZO)

Contents

1 The Basic Characteristic of TZM0745A Series MZO

1.1 The Application of the TZM0745A Series MZO

TZM0745A series MZO is an ideal choice for most applications that requires multiple magnifications or for those that prohibits continual manual refocusing. The applications of the TZM0745A series MZO are: machine vision; small details inspection; industrial inspection especially electronic components; scientific research; medical industry; education industry.

Figure 1 TZM0745A with different configuration

1.2 The Modular Design of TZM0745A Series MZO

The modular design of TZM0745A series MZO is showed in Figure 2. The design is based on the bilateral parallel light path principle and consists of five basic modules plus. The five basic modules are: Middle Zoom Module, Auxiliary Lens Module, TV Lens Module, Bracket Adapter Module and Optional Module (not shown in Figure 2).
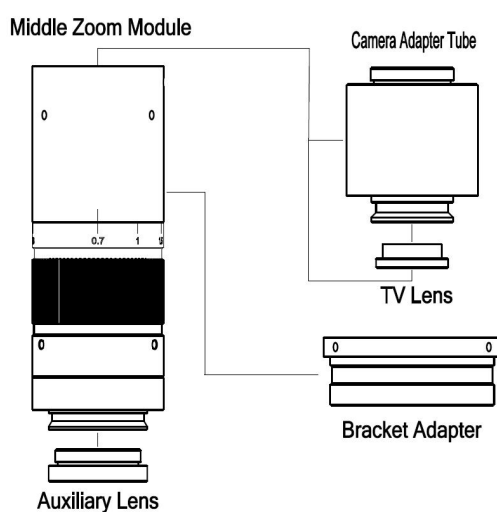

Figure 2 The four basic modules of TZM0745A series MZO. The Optional Module is not shown

1.3 The Nomenclature of the TZM0745A Series MZO

Because of ZM0745A series MZO's modular design, each module of TZM0745A series MZO is named respectively. The specific naming rules and corresponding parameters of each module are as follows:

1.3.1 Module One: The Middle Zoom Module

The Middle Zoom Module (code TZM0745Aaa), which is the main body of TZM0745A series MZO. TZM0745 represents the code of Middle Zoom Module and letter aa represents the auxiliary code of Middle Zoom Module.There are four types of Middle Zoom Modules, they are TZM0745A, TZM0745AT, TZM0745AD and TZM0745ATD. Details are listed in Table 1.

Table 1 The order number and function of the Middle Zoom Module

Order Number	Meaning	TZM0745A	Postfix meaning
TZM0745A	Ordinary Middle Zoom Module	ZM：Zoom 0745：0.7X~4.5X	NA
TZM0745AT	Middle Zoom Module with back focus trimmable(adjustable) function		T：Trim
TZM0745AD	Middle Zoom Module with detent to fix the magnification function		D：Detent
TZM0745ATD	Middle Zoom Module with back focus trimmable and magnification detent functions		TD：Trim & Detent

1.3.2 Module Two: Auxiliary Lens Module

The replaceable Auxiliary Lens, which can be threaded to the bottom of the Middle Zoom Module(code Wbbb), bbb represents the magnification of Auxiliary Lens. Different magnification of Auxiliary Lens defines the entire magnification of TZM0745A series MZO, resulting different working distance as well. For example, compared with the W100 Auxiliary Lens with 1.00x magnification reaches 80mm working distance, whilee W050 Auxiliary Lens will have a reduced magnification to half and the working distance will be extended to about 160mm. Auxiliary Lens and its corresponding optical parameters are shown in Table 2.

Table 2 The order number and optical parameters of Auxiliary Lens

Order number	Magnification	Working distance（mmm）	Field of view in the object side(TV050，1/3"sensor)	
			Lower magnification	Higher magnification
W050	0.5X	160	34.28mm	5.33mm
W075	0.75X	105	20.81mm	3.56mm
W100	1.00X	80	17.14mm	2.67mm
W150	1.50X	51.5	11.43mm	1.78mm
W200	2.00X	37.5	8.57mm	1.33mm

Note: The same Auxiliary Lens with different TV lens is just used to adapt to different image sensor, size which will not have much impact on the MZO field of view.

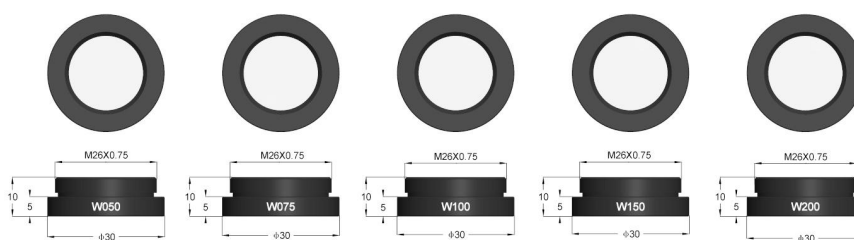Figure 3 The Auxiliary Lens for TZM0745A MZO

1.3.3 Module Three: The TV Lens

TV Lens (code TVccc), which can be threaded to the top of the Middle Zoom Module, ccc is the magnification of TV Lens. TV Lens with different magnification is used to adapt to sensors with different size. For example, the same field of view could be obtained when TV100 is used with a 2/3" size sensor and TV050 is used with a 1/3" size sensor. TV Lens and its corresponding optical parameters are shown in Table 3.

Table 3 The order number and optical parameters of TV Lens

Order number	The maximum compatible sensor size
TV050	1/3"
TV075	1/1.8"
TV100	2/3"
TV150	1"
TV200	4/3"

Note: Smaller image sensors can also be used for TV Lens with higher magnification, but in this way, the FOV of MZO will be reduced.
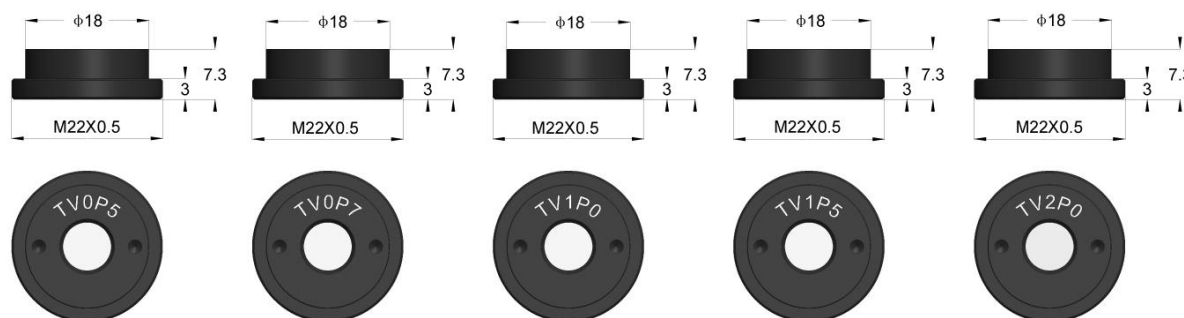
Figure 4 TV Lens with different magnification for TZM0745A

1.3.4 Module Four: Bracket Adapter

Bracket Adapter (code Add) used for brackets with different mounting apertures and is sheathed in the middle of MZO, dd is the diameter of the bracket . Current available Adds include A50 and A45. The installation method of the Bracket Adapter and bracket is shown in Figure 3.

Figure 3 TZM0745A series' Bracket Adapter

1.3.5 Module Five: The Optional Module

The Optional Modules include LED Direct Ring Light Module (including LED Direct Ring Light Module and LED Direct Ring Polarization Light Module) and Coaxial Light Module

(composed of Coaxial Light Adapter and LED Spot Light). The currently possible Optional Modules are shown in Table 4.

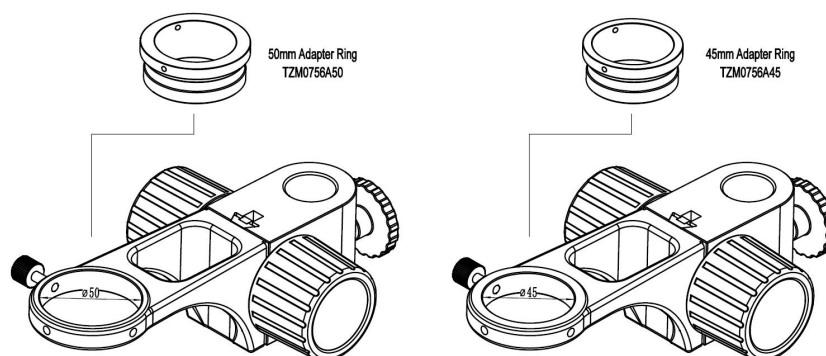Table 4 The Optional Module: Light source module for TZM0745A series MZO

Module	Order Number	Description
LED Direct Ring Light Module	TZM0756DRL	LED Direct Ring Light
LED Direct Ring Polarization Light Module	TZM0756DRPL	LED Direct Ring Polarization Light
Coaxial Light Module	TZM0756CL+TZM0756SL	Coaxial Light Adapter + LED Spot Light
Transmissive Light Module	TZM0756TL	LED Transmissive Light
Power of light source	40600014	US:POWER-U-12V1A(Power Adapter American Standard)
	40600015	DE: POWER-E-12V1A(Power Adapter European standard
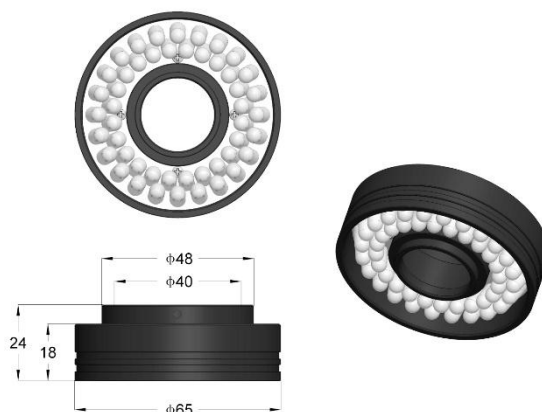
图 1 TZM0756DRL-65, the maximum diameter of LED reaches 65mm, and the diameter of 40mm in the center can be directly sleeved to the front end of the corresponding MZO to achieve uniform reflection lighting
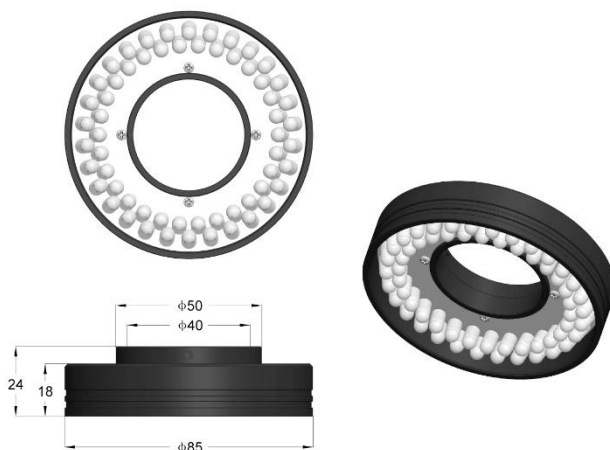
图 2 TZM0756DRL-85, the maximum diameter of LED reaches 85mm, and the diameter of 40mm in the center can be directly sleeved to the front end of the corresponding MZO to achieve uniform reflection lighting
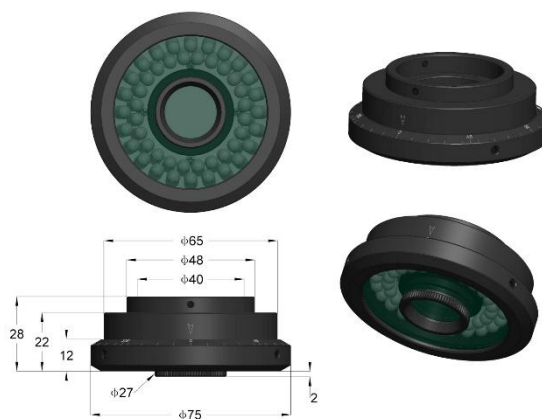
图 3 TZM0756DRPL-65，the maximum diameter of the LED reaches 65mm, and the small hole with a center diameter of 40mm can be directly sleeved on the front end of the corresponding MZO. By rotating the polarizing plate, uniform illumination of linear polarized light in different directions can be realized
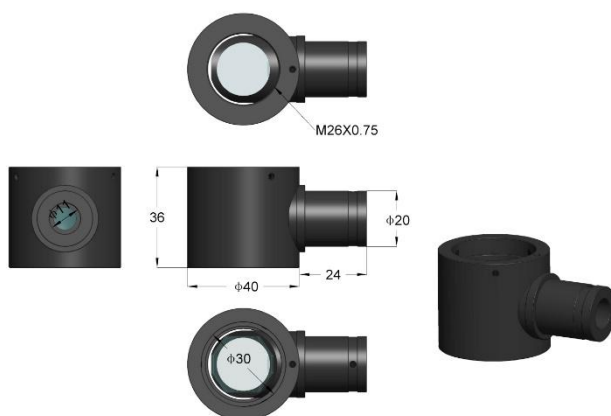
图 4 1.3.6   TZM0756CL Coaxial Light Adapter with 11mm hole for LED Spot Light
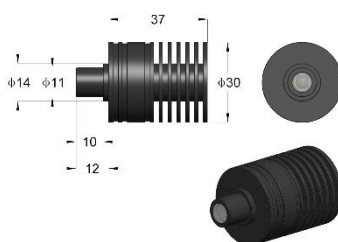
图 5 TZM0756SL, LED Spot Light can be directly connected with Coaxial Light adapter(TZM0756CL) to realize coaxial light illumination
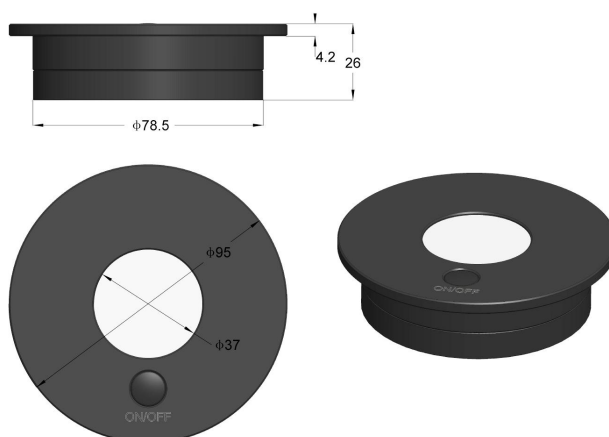
图 6 TZM0756TL LED Transmission Light source with illumination range of 37mm

1.3.6 The Naming of TZM0745A Series MZO

We have a special naming format for TZM0745A series MZO, we name TZM0745A series MZO products with a series module code, which is a combination of code of different modules and connected with crossbar "-" to form a comprehensive naming. With this paradigm, user can understand the meaning and function briefly. For example, if a MZO is composed of Middle Zoom Module TZM0745ATD, Auxiliary Lens W100(1.00x), TV Lens TV050(0.5x) and 50mm Bracket Adapter A50, the final MZO can be expressed as:

TZM0745ATD-W100-TV050-A50

Currently available TZM0745Aaa: TZM0745A, TZM0745AT, TZM0745AD, TZM0745ATD;

Currently available Wbbb: W100, W050, W075, W150 and W200;

Currently available TVccc: TV100, TV050, TV075, TV150 and TV200;

Currently available Add: A50 and A45;

Currently available Optional Modules are LED Direct Ring Light Module (including LED Direct Ring Light Module and LED Direct Ring Polarization Light Module) and Coaxial Light Module (composed of Coaxial Light Adapter and LED Spot Light).

The other Auxiliary Lens with b.bb magnification, TV Lens with c.cc magnification and Bracket Adapter with dd mm size can be customized according to the requirements.

1.3.7 The Configuration of TZM0745A with Five Modules
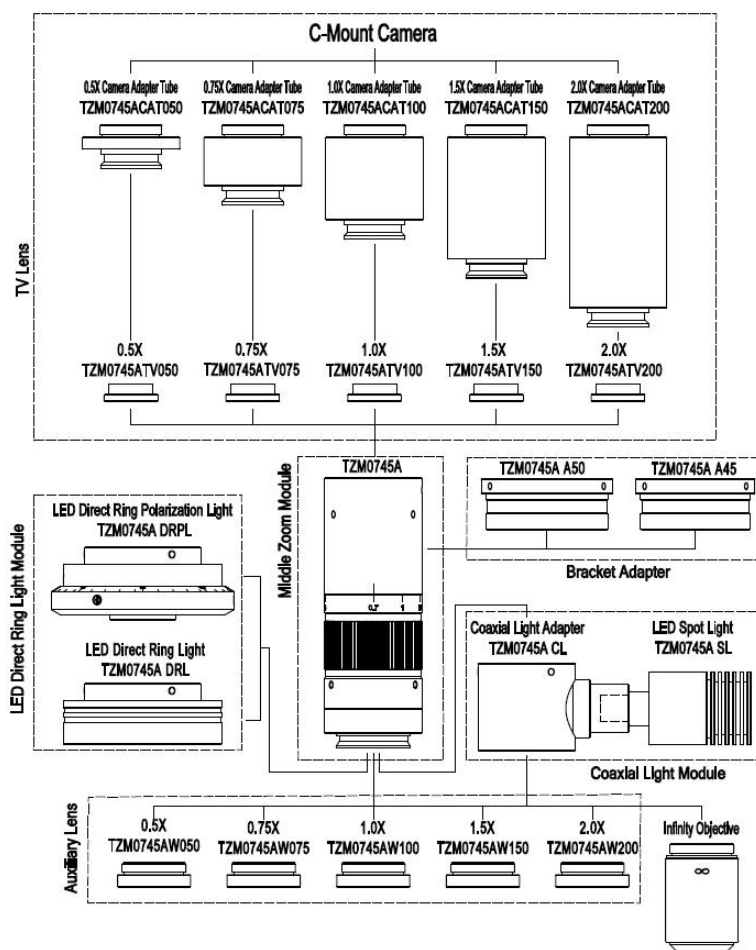
Figure 4 The five modules and the TZM0745A MZO

TZM0745A series MZO can be combined with Camera Module (optional) to form a digital monocular zoom microscope.

1.4 The Basic Characteristics of the TZM0745A Series MZO

The basic module of TZM0745A series monocular zoom object is TZM0745A-W100-TV100-A50, it has 0.7X to 4.5X zoom range and 6.5X zoom ratio. It is a high-quality precision MZO that provides high resolution and large depth of field. Its main features are shown below:

- With 0.7X~4.5X zoom range
- Large optical zoom ratio: 6.5X
- Larger NA: 0.018-0.078 (When using 1x Auxiliary Lens)
- Higher resolution: 18.6um-4.3um (When using 1.00x Auxiliary Lens)
- Larger field of view:1.25mm-34.28mm (Object plane)
- Larger sensor size: 2/3" (When using 1.00x TV Lens)
- Working distance range: 37.5mm-160mm
- Parfocal in zoom range
- Compatible with infinity objectives (both biological and metallographic)
- Compact size: 150 mm (length) × 40 mm (diameter)
- Auxiliary Lens with 0.50x, 0.75x, 1.00x, 1.50x and 2.00x magnification (Optional)

- TV Lens with 0.50x, 0.75x, 1.00x, 1.50x and 2.00x magnification (Optional)
- Brightness adjustable LED Direct Ring Light (Optional)
- Brightness adjustable LED Direct Ring Polarization Light (Optional)
- Brightness adjustable LED coaxial illumination (Optional)
- LED Transmissive Light (Optional)
- 45mm or 50mm Bracket Adapter (Optional)

1.5 The Optical Specifications of TZM0745A with Different Auxiliary Lens and TV Lens

The optical specifications of TZM0745A with different Auxiliary Lens and TV Lens are shown in Table 5. Auxiliary Lens and TV Lens with 1.00x are listed in the left-up cell. Its data is the basis of the other parameters in the whole table.

Table 5 TZM0745A-W100-TV100 and Its Extensions

Auxilary Lens	Specifications	TV Lens									
		1.0X(2/3") TV100		0.5X(1/3") TV050		0.75X(1/2") TV075		1.5X(1") TV150		2.0X(4/3") TV200	
		Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
1.0X (80mm WD) WD100	PMAG	0.70X-4.5X		0.35X-2.25X		0.525X-3.38X		1.05X-6.75X		1.40X-9.00X	
	DFOV(mm)	15.71	2.44	17.14	2.67	15.24	2.37	15.24	2.37	16.07	2.5
	NAO	0.018	0.078	0.018	0.078	0.018	0.078	0.018	0.078	0.018	0.078
0.5X （160mm WD） WD050	PMAG	0.35X-2.25X		0.18X-1.13X		0.263X-1.69X		0.525X-3.38X		0.70X-4.50X	
	DFOV(mm)	31.43	4.89	34.28	5.33	30.48	4.74	30.48	4.74	32.14	5
	NAO	0.009	0.039	0.009	0.039	0.009	0.039	0.009	0.039	0.009	0.039
0.75X (105mm WD) WD075	PMAG	0.53X-3.38X		0.263X-1.69X		0.394X-2.53X		0.79X-5.06X		1.05X-6.75X	
	DFOV(mm)	20.99	3.26	20.81	3.56	20.32	3.16	20.32	3.16	21.43	3.33
	NAO	0.013	0.059	0.013	0.059	0.013	0.059	0.013	0.059	0.013	0.059
1.5X (51.5mm WD) WD150	PMAG	1.05X-6.75X		0.525X-3.38X		0.788X-5.06X		1.58X-10.13X		2.10X-13.50X	
	DFOV(mm)	10.46	1.63	11.43	1.78	10.16	1.58	10.16	1.58	10.71	1.67
	NAO	0.026	0.117	0.026	0.117	0.026	0.117	0.026	0.117	0.026	0.117
2.0X (37.5mm WD) WD200	PMAG	1.40X-9.00X		0.70X-4.5X		1.05X-6.75X		2.10X-13.50X		2.80X-18.00X	
	DFOV(mm)	7.9	1.22	8.57	1.33	7.62	1.19	7.62	1.19	8.04	1.25
	NAO	0.035	0.155	0.035	0.182	0.035	0.155	0.035	0.155	0.035	0.155
Remarks	When using coaxial lighting, low magnification may produce vignetting. When using infinity objectives as Auxiliary Lens Module (adapter available), the PMAG、FOV and NA of the TZM0745A depends on the parameters of the objectives.										

WD: Working Distance;

PMAG: Primary Magnification;

FOV: Field of View in the object side;

NA: Numerical Aperture;

Note: Infinity corrected objectives limit system's usable zoom range due to uneven illumination. The maximum sensor size is 2/3".

1.6 The Dimension of TZM0745A Series MZO with Different Light Module

The dimensions of TZM0745A-W100-TV100-A50 with different light a) TZM0745A without light module; b) TZM0745A equipped with Direct Ring Light Module, c) TZM0745A equipped with Coaxial Light Module are showed in Figure 5.
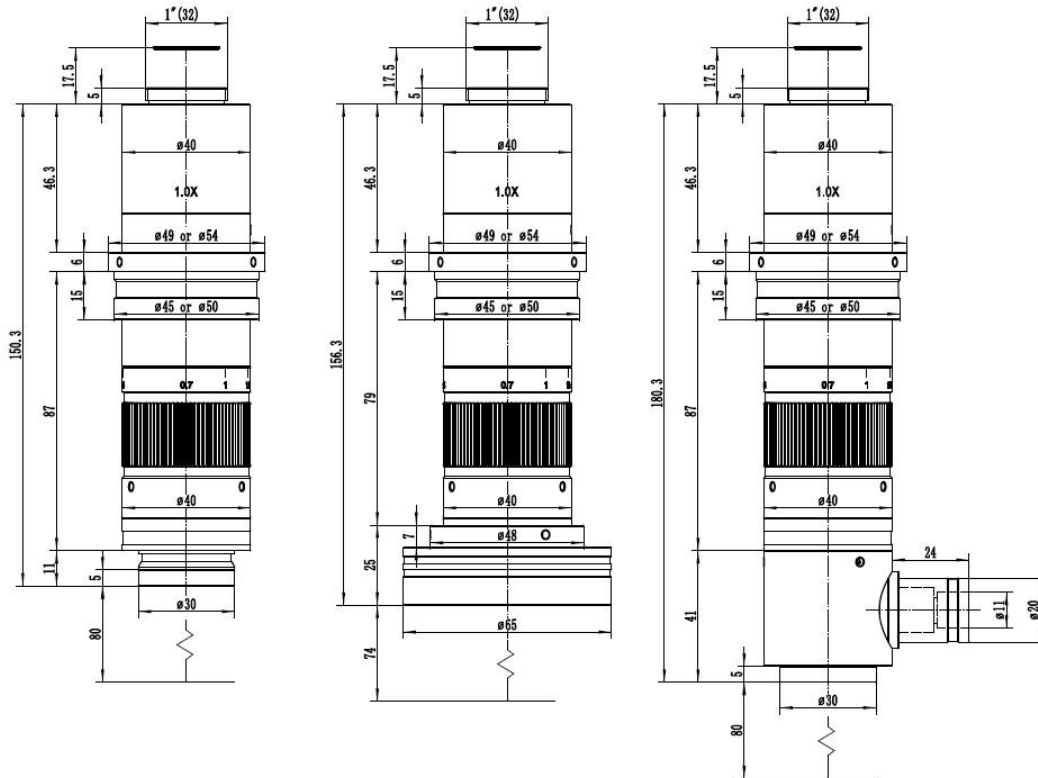
Figure 5 Dimensions of TZM0745A-W100-TV100-A50 with different light moudle

a) TZM0745A-W100-TV100-A50 without light module;

b) TZM0745A-W100-TV100-A50 equipped with Direct Ring Light Module,

c) TZM0745A-W100-TV100-A50 equipped with Coaxial Light Module)

The length of the MZO with different TV Lens will be slightly different. The length of TZM0745A-W100-TV100-A50 is 150.3mm, it is much shorter than most of the MZO in the market.

1.7 How to Configure the TZM0745A Series MZO

The corresponding parameters of TZM0745A series MZO are listed in Table 6. A specific combination can be determined according to the following steps.

1. Confirm the possible range of 1) FOV and 2) Working Distance in the object space to choose the Auxiliary Lens.
2. Choose the M26x0.705 to M20x0.705 Objective Adapter, if the M20x0.705 infinity objective is used.
3. Confirm the camera Image Area Size, it can be 1) Sensor Size (1/x in inch), 2) Image Diagonal Length, 3) Image Width or 4) Image Height to choose the right TV Lens.
4. Choose the 45mm or 50 mm adapter according to the diameter of the bracket hole diameter .

5. Choose the LED Direct Ring Light Module for the reflective illumination.
6. Choose the Coaxial Light Module if coaxial illumination is required.
7. Choose the Transmissive Light Module if transmissive illumination is required.
8. Choose the Camera Module.
9. We offer a variety of microscope cameras. Customers could get the detailed information of our cameras on the official website (http://www.touptek.com/) and choose the appropriate ones.

Table 6 The combinations of different the Auxiliary Lens, The Middle Zoom Module and the TV Lens. With this figure, user can configure Monocular Zoom Objective with different magnification to fit different sensor and different application

Camera	Main Zoom Module-Auxiliary-Lens-TV Lens	WD(mm)	PMAG	DFOV(mm)	NAO
1/3"	TZM0745A-W050-TV050	160	0.18X-1.13X	34.28-5.33	0.009-0.039
	TZM0745A-W075-TV050	105	0.26X-1.69X	22.86-3.56	0.013-0.059
	TZM0745A-W100-TV050	80	0.35X-2.25X	17.14-2.67	0.018-0.078
	TZM0745A-W150-TV050	52	0.53X-3.38X	11.43-1.78	0.026-0.117
	TZM0745A-W200-TV050	38	0.70X-4.50X	8.57-1.33	0.035-0.155
1/2"	TZM0745A-W050-TV075	160	0.26X-1.69X	30.48-4.74	0.009-0.039
	TZM0745A-W075-TV075	105	0.40X-2.53X	20.32-3.16	0.013-0.059
	TZM0745A-W100-TV075	80	0.53X-3.38X	15.24-2.37	0.018-0.078
	TZM0745A-W150-TV075	52	0.79X-5.06X	10.16-1.58	0.026-0.117
	TZM0745A-W200-TV075	38	1.05X-6.75X	7.62-1.19	0.035-0.155
2/3"	TZM0745A-W050-TV100	160	0.35X-2.25X	31.43-4.89	0.009-0.039
	TZM0745A-W075-TV100	105	0.53X-3.38X	20.95-3.26	0.013-0.059
	TZM0745A-W100-TV100	80	0.70X-4.5X	15.71-2.44	0.018-0.078
	TZM0745A-W150-TV100	52	1.05X-6.75X	10.46-1.63	0.026-0.117
	TZM0745A-W200-TV100	38	1.40X-9.00X	7.90-1.22	0.035-0.155
1"	TZM0745A-W050-TV150	160	0.53X-3.38X	30.48-4.74	0.009-0.039
	TZM0745A-W075-TV150	105	0.79X-5.06X	20.25-3.16	0.013-0.059
	TZM0745A-W100-TV150	80	1.05X-6.75X	15.24-2.37	0.018-0.078
	TZM0745A-W150-TV150	52	1.58X-10.13X	10.13-1.58	0.026-0.117
	TZM0745A-W200-TV150	38	2.10X-13.5X	7.62-1.19	0.035-0.155
4/3"	TZM0745A-W050-TV200	160	0.70X-4.50X	32.14-5.00	0.009-0.039
	TZM0745A-W075-TV200	105	1.05X-6.75X	21.43-3.33	0.013-0.059
	TZM0745A-W100-TV200	80	1.40X-9.00X	16.07-2.50	0.018-0.078
	TZM0745A-W150-TV200	52	2.10X-13.5X	10.71-1.67	0.026-0.117
	TZM0745A-W200-TV200	38	2.80X-18.00X	8.04-1.25	0.035-0.155

2 The Connection of the TZM0745A Series MZO and Camera

Figure 6 TZM0745A-W100- TV100+TZM0756DRL (LED Direct Ring Light Module)+
HDMI Camera XCAMLite1080P A(Circular)+TPS-10A+SCRN

Figure 7 TZM0745A-W100- TV100+TZM0756DRPL (LED Direct Ring Light Module) +
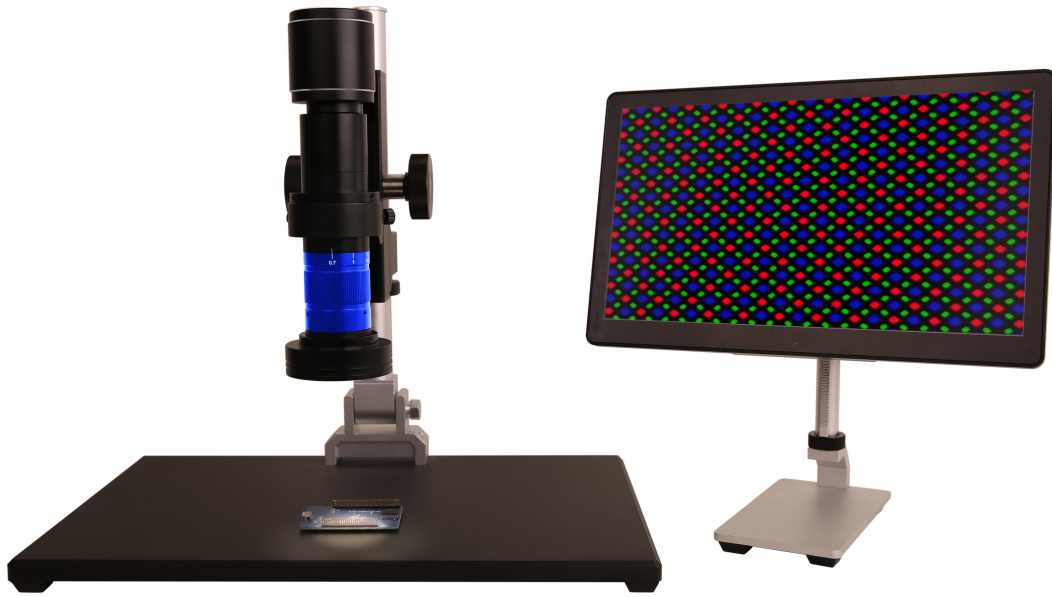HDMI Camera XCAMLite1080PA(Circular)+TPS-20A+SCRN

Figure 8 TZM0745A-W100- TV100+ TZM0756DRPL (LED Direct Ring Light Module) +
HDMI Camera XCAMLite1080PA(Circular)+TPS-200A+SCRN

3 Pictures Taken by TZM0745A Series MZO under Different Light Illuminations

Figure 9 are pictures of coins taken with TZM0745AW100-TV100 under left) LED Direct Ring Light illumination; middle) LED Direct Ring Polarization Light illumination; right) Coaxial Light illumination.

Figure 9 From left to right, there are three pictures of coins taken under left) LED Direct Ring Light illumination; middle) LED Direct Ring Polarization Light illumination; right) Coaxial Light illumination
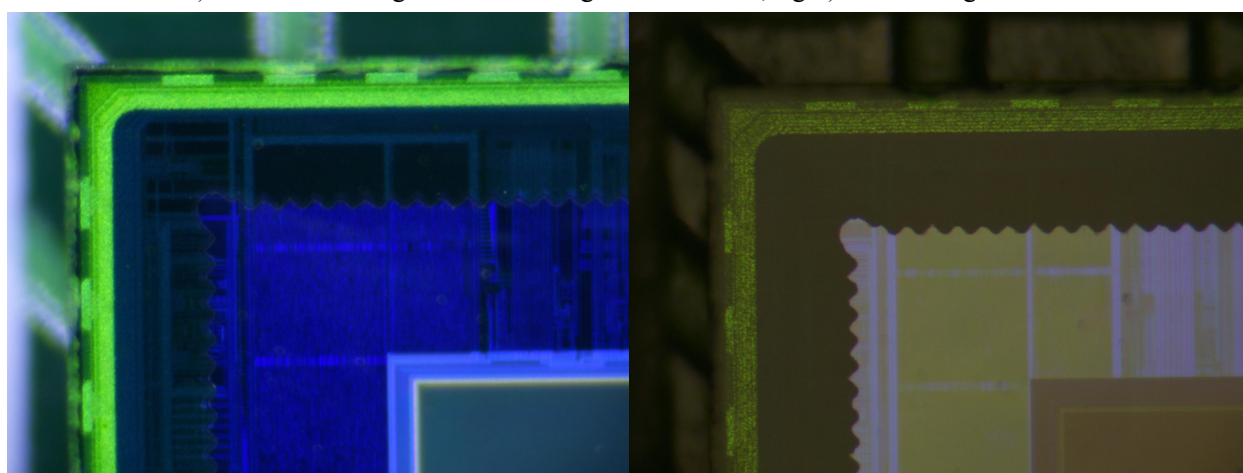
Figure 10 Pictures of CMOS image sensor taken with TZM0745A-W100-TV100 under LED Direct Ring Light illumination and Coaxial Light illumination (4.5X PMAG)
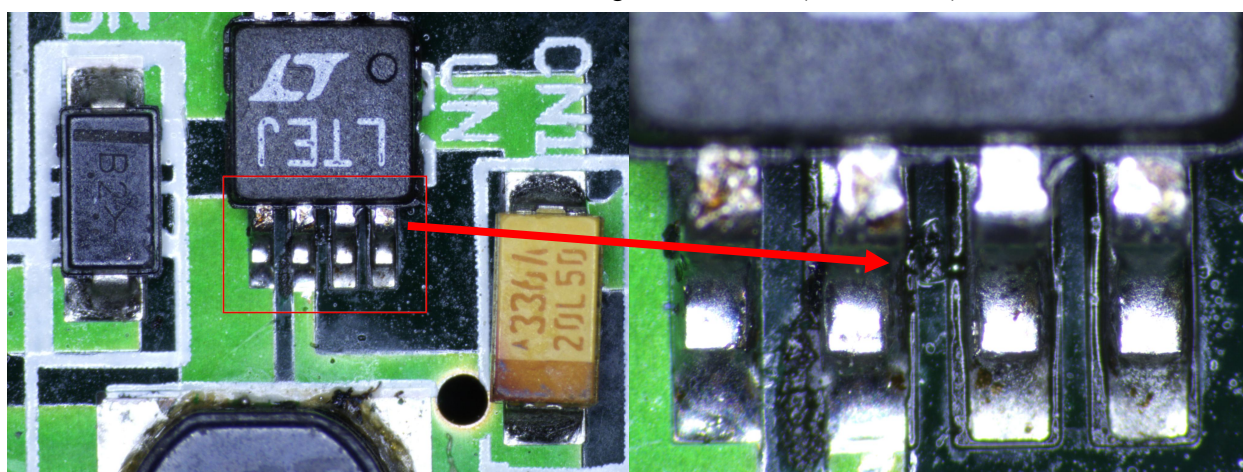

Figure 11 Picture of circuit board taken by TZM0745A-W100-TV100 under LED Direct Ring Light illumination, when shooting the left picture, the magnification of TZM0745A-W100-TV100 is 0.7X, and when shooting the right picture, the magnification of TZM0745A-W100-TV100 is 2.5X
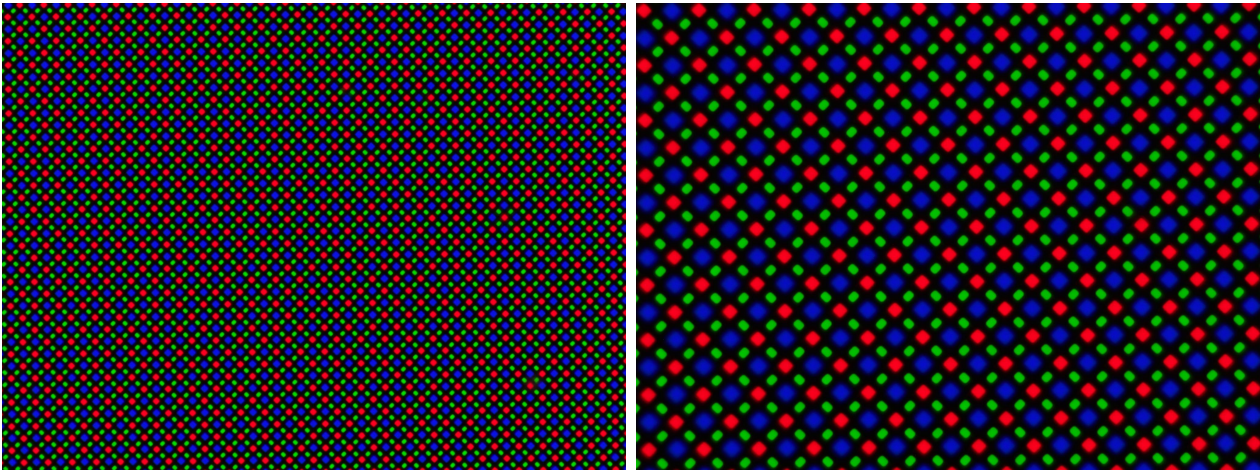
Figure 12 Mobile phone pixels taken by TZM0745A-W100-TV100, under 2.5X PMAG and 4.5X PMAG

4 TZM0745A Series MZO Packing List

The packing information of the TZM0745A series MZO is as follows:

Figure 13   The TZM0745A Main Body, including Auxiliary Lens Module, Middle Zoom Module, TV Lens, Camera Adapter Tube and Bracket Adapter

The packing information of TZM0756DRL is as follows:

Figure 14 TZM0756DRL, including LED Direct Ring Light and Power Adapter

The packing information of TZM0756DRPL is as follows:

Figure 15 TZM0756DRPL, including LED Direct Ring Polarization Light and Power Adapter

The packing information of Coaxial Light Module is as follows:

Figure 16 TZM0745A Coaxial Light Module, including TZM0756CL (Coaxial Light Adapter), TZM0756SL (LED Spot Light) and Power Adapter

5 Order List of TZM0745A Series MZO

TZM0745A Series Monocular Zoom Object Package Order List

Order number	Quantity	Remarks
Package Name TZM0745A◐ ◐-W●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●●-TV●●●-A●●		
TZM0745A◐ ◐-W●●●-TV●●●-A●●		
Remarks		

Remarks：Users or salesmen can directly write the corresponding module name, number of sets, and other special requirements in the remarks with their own professional knowledge.

TZM0745A Order List of Other Accessories

Module	Order number	Quantity	Remarks	Description
Auxiliary Lens Module	**W050**			0.50X Object Lens
	W075			0.75X Object Lens
	W100			1.0X Object Lens
	W150			1.5X Object Lens
	W200			2.0X Object Lens
	ON-XX			Biological Objective
	ON-YY			Metallographic Objective
	Objective Adapter			M26x0.706 to M20x0.706
TV Lens	**TV050**			For 1/3" Sensor
	TV075			For 1/1.8" Sensor
	TV100			For 2/3" Sensor
	TV150			For 1" Sensor
	TV200			For 4/3" Sensor
Bracket Adapter	**A45**			45mm Bracket Adapter
	A50			50mm Bracket Adapter
Coaxial Light Module	**TZM0756CL +TZM0756SL**			Coaxial Light Adapter + LED Spot Light
LED Direct Ring Light Module	**TZM0756DRL**			LED Direct Ring Light
	TZM0756DRPL			LED Direct Ring Polarization Light
Transmissive Light Module	**TZM0756TL**			LED Transmissive Light
Power of light source	**40600014**			POWER-U-12V1A(MSA-C1000IC12.0-12H-US), Power Adapter American Standard
	40600015			POWER-E-12V1A(MSA-C10001C12.0-12W-DE), Power Adapter European standard

TZM0745A Function Module Optional Order List

Module	Order number	Quantity	Remarks	Description
Middle Zoom Module	**TZM0745A**			Ordinary Middle Zoom Module
	TZM0745AT			Middle Zoom Module with adjustable back focus
	TZM0745AD			Middle Zoom Module with detent
	TZM0745ATD			Middle Zoom Module with adjustable back focus and detent
Auxiliary Lens Module	**W050**			0.50X Object Lens
	W075			0.75X Object Lens
	W100			1.0X Object Lens
	W150			1.5X Object Lens
	W200			2.0X Object Lens
	ON-XX			Biological Objective
	ON-YY			Metallographic Objective
	Objective Adapter			M26x0.706 to M20x0.706
TV Lens	**TV050**			For 1/3" Sensor
	TV075			For 1/1.8" Sensor
	TV100			For 2/3" Sensor
	TV150			For 1" Sensor
	TV200			For 4/3" Sensor
Bracket Adapter	**A45**			45mm Bracket Adapter
	A50			50mm Bracket Adapter
Coaxial Light Module	**TZM0756CL +TZM0756SL**			Coaxial Light Adapter + LED Spot Light
LED Direct Ring Light Module	**TZM0756DRL**			LED Direct Ring Light
	TZM0756DRPL			LED Direct Ring Polarization Light
Transmissive Light Module	**TZM0756TL**			LED Transmissive Light
Power of Light Source	**40600014**			POWER-U-12V1A(American Standard)
	40600015			POWER-E-12V1A(European standard)

6 Service

For customers who purchase the MZO from local dealer, please contact your dealer for more information.

For technical support, please contact e-mail address: tphz@touptek.com