

# Apo-Rodagon, Rodagon and Rogonar-S

Versatile Large-Format Lenses



# Apo-Rodagon-HR

## High-Resolution Lenses for Line- and Area-Scan Applications

The new Apo-Rodagon-HR is designed to close the gap between the high-resolution lenses of the inspec.x L Series, and the Apo-Rodagon-D lenses, both in terms of imaging quality and price.

The robust mechanics of this lens make it suitable for applications in the harshest environments. Thanks to the use of a fixed aperture there are no moving parts to shake out of adjustment due to vibrations in extreme applications. The standard aperture of 5.6 is the value at which the lens achieves the optimum performance. Other apertures are available on request.

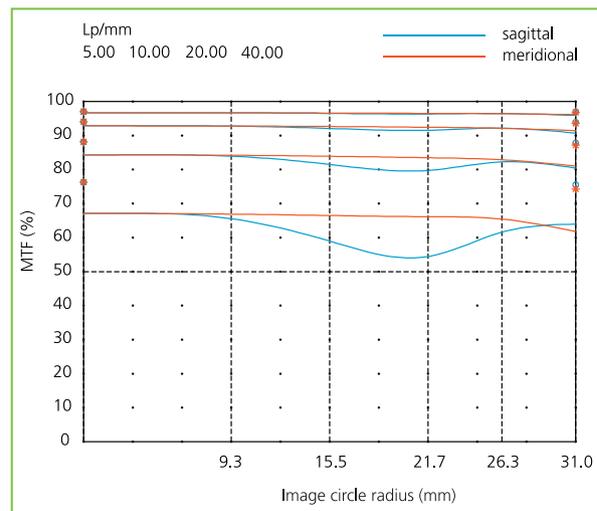
The high resolution of 80 lp/mm at the sensor side in combination with the large image circle of 62 mm makes the Apo-Rodagon-HR 0.5x a very good match with the popular 12k / 5  $\mu$ m line-scan cameras.

The Apo-Rodagon-HR 0.5x features the same focal length as the Apo-Rodagon-D 4.5/75 2x and can therefore replace this lens if higher resolution is needed.

- Ideal for 12 k / 5  $\mu$ m sensors
- Compact and robust mechanics
- High performance / price value
- Large image circle up to 62 mm



- Magnification range: -0.35 ... -0.65
- Camera mount: V-groove
- Iris diaphragm: fix
- Filter thread: M37x0.75
- Lens length: 47 mm
- Lens diameter: 46 mm



MTF of Apo-Rodagon-HR 5.6/75 0.5x @  $\beta' = -0.5$  and f-stop = 5.6

## Apo-Rodagon-HR

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
Apo-Rodagon-HR 5.6/75 0.5x	75	5.6	-0.65 ... -0.35	62	V-groove	0703-109-000-20

# APO-Rodagon-D

## High-Performance Lenses for Large Imaging Sensors

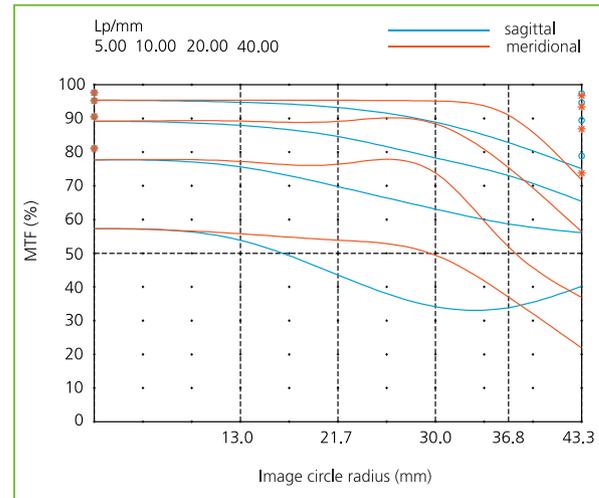
The high resolution of the Apo-Rodagon-D lenses makes them an optimum solution for cameras with a pixel size down to 7  $\mu\text{m}$ . The high resolution is accompanied by ultra-low distortions and negligible color fringing. The lenses are optimized for a magnification range from 1:2 to 2:1

The 6-element, apochromatically corrected lenses feature high contrast and sharpness right up to the picture corners with practically no color fringes.

Distortion is corrected to near zero and cannot be seen even in critical subjects with straight-lined structures. The optimum working aperture is between f/5.6 and f/8. This is important because the effective aperture of a lens focused for a scale of about 1:1 is approximately two f-stops smaller than the nominal aperture and therefore stopping down to smaller apertures than nominal f/8 would result in visible blur due to diffraction.

All models are fitted with click-stop aperture rings.

- Specially designed for scanning applications and large imaging sensors
- Optimized for 1:2 to 2:1 imaging
- Large image circle up to 102 mm



MTF of Apo-Rodagon-D 4.5/75 2x @  $\beta' = -0.5$  and f-stop = 5.6

- Focal length: 75, 120 mm
- Magnification range: -0.33 ... -3.0
- Spectral range: 400-750 nm
- Iris diaphragm: manual, click-stop
- Mount: M39x1/26" (Leica)
- Filter thread: M40.5x0.5
- Wide range of mechanical accessories

## Apo-Rodagon-D

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
Apo-Rodagon-D 4.0/75 1x	75	4.0	-1.2 ... -0.8	82	M39x1/26"	0703-005-000-40
Apo-Rodagon-D 4.5/75 2x	75	4.5	-0.8 ... -0.4	86.8	M39x1/26"	0703-028-000-21
Apo-Rodagon-D 5.6/120 2x	120	5.6	-0.8 ... -0.33	102	M39x1/26"	0703-043-000-20

# Apo-Rodagon-N

## Measuring Lenses for Large Imaging Sensors

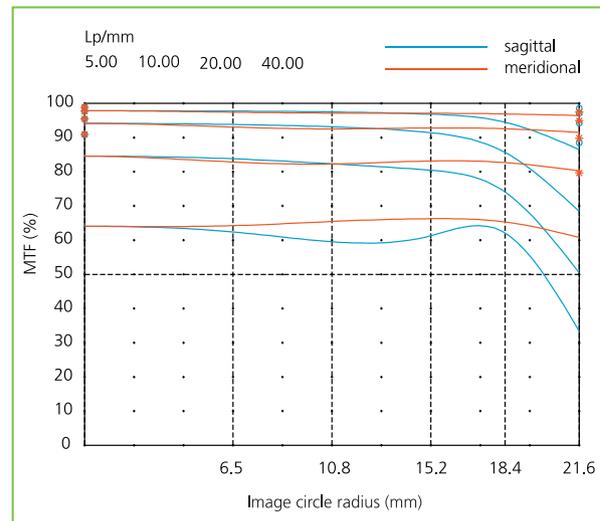
The Linos measuring lenses developed by Qioptiq feature the highest resolution, excellent contrast, minimum distortion and color neutrality. Apo-Rodagon-N Lenses produce crisp, sharp images to the extreme edges of the object.



### Apo-Rodagon-N

Apochromatically corrected lens designed to meet the highest requirements in an especially broad magnification range.

- Suitable for line-scan cameras and large imaging sensors
- Large image circle up to 100 mm
- High numerical aperture
- Adapter available for all common camera interfaces
- Focal length: 50 ... 105 mm
- Magnification range: -0.05 ... -0.5
- Spectral range: 400-750 nm
- Iris diaphragm: manual, click-stop
- Mount: M39x1/26" (Leica)
- Filter thread: M40.5x0.5
- Wide range of mechanical accessories



MTF curve of Apo-Rodagon-N 2.8/50 @  $\beta' = -0.1$  and f-stop = 2.8

### Apo-Rodagon-N

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
Apo-Rodagon-N 2.8/50	50	2.8	-0.5 ... -0.05	44	M39x1/26"	0701-349-000-40
Apo-Rodagon-N 4.0/80	80	4.0	-0.5 ... -0.067	86	M39x1/26"	0703-092-000-40
Apo-Rodagon-N 4.0/90	90	4.0	-0.5 ... -0.066	90	M39x1/26"	0703-094-000-20
Apo-Rodagon-N 4.0/105	105	4.0	-0.5 ... -0.06	100	M39x1/26"	0703-096-000-40

# Rodagon-F

## Precision Optics for F-Mounts

The Rodagon-F Series was developed by Qioptiq to adapt precision industrial-grade optics to an F-Mount camera, with a great price/performance ratio. Now, for the first time, users can integrate world renowned Rodenstock image quality in 40 - 60 mm focal lengths directly onto F-Mount cameras. A revolutionary design eliminates all moving parts to offer exceptionally robust performance. The smooth focusing is locked with a massive retaining ring that is fixed with additional screws.

The Rodagon-F lenses are available in different versions with fixed apertures. The fixed aperture prevents accidental misadjustment of the iris or slowly shifting aperture values due to vibrations. The image circle of these lenses is 44 mm and is therefore large enough for sensors with 35 mm format and the popular 41 mm line sensors.



- Suitable for line-scan cameras and large imaging sensors
- Large image circle up to 46 mm
- High numerical aperture
- Focal length: 40 ... 60 mm
- Magnification range: 0 ... -0.5
- Spectral range: 400-750 nm
- Iris diaphragm: fix
- Mount: F-Mount
- Filter thread: M40.5x0.5
- Wide range of mechanical accessories

## Rodagon-F

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
Rodagon-F 4/40	40	4	-0.5 ... 0	44	F-Mount	0703-090-000-25
Rodagon-F 5.6/40	40	5.6	-0.5 ... 0	44	F-Mount	0703-090-000-26
Rodagon-F 8/40	40	8	-0.5 ... 0	44	F-Mount	0703-090-000-27
Rodagon-F 2.8/50	50	2.8	-0.5 ... 0	46	F-Mount	0703-089-000-24
Rodagon-F 4/50	50	4	-0.5 ... 0	46	F-Mount	0703-089-000-25
Rodagon-F 5.6/50	50	5.6	-0.5 ... 0	46	F-Mount	0703-089-000-26
Rodagon-F 4/60	60	4	-0.5 ... 0	44	F-Mount	0703-087-000-25
Rodagon-F 5.6/60	60	5.6	-0.5 ... 0	44	F-Mount	0703-087-000-26
Rodagon-F 8/60	60	8	-0.5 ... 0	44	F-Mount	0703-087-000-27

# Rodagon, Rodagon-WA

## Measuring Lenses for Large Imaging Sensors

The Linos measuring lenses developed by Qioptiq feature the highest resolution, excellent contrast, minimum distortion and color neutrality. They sharply reproduce images all the way to the very edges of the object.



### Rodagon

High-performance lens featuring a highly consistent imaging quality and broad magnification range.

### Rodagon-WA

High-performance lens with extended-field viewing angle and a large resulting image circle.

- Suitable for line-scan cameras and large imaging sensors
- Large image circle up to 105 mm
- High numerical aperture
- Adapter available for all common camera interfaces
- Focal length: 35 ... 135 mm
- Magnification range: -0.03 ... -0.5
- Spectral range: 400-750 nm
- Iris diaphragm: manual, click-stop
- Mount: M39x1/26" (Leica)
- Wide range of mechanical accessories

### Rodagon

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
Rodagon 4.0/35	35	4.0	-0.2 ... -0.03	30	M39x1/26"	0701-357-000-20
Rodagon 2.8/50	50	2.8	-0.5 ... -0.07	44	M39x1/26"	0701-345-000-40
Rodagon 4.0/60	60	4.0	-0.5 ... -0.06	56	M39x1/26"	0701-393-000-40
Rodagon 4.0/80	80	4.0	-0.5 ... -0.06	62	M39x1/26"	0701-391-000-40
Rodagon 5.6/105	105	5.6	-0.5 ... -0.06	104	M39x1/26"	0701-394-000-40
Rodagon 5.6/135	135	5.6	-0.5 ... -0.1	105	M39x1/26"	0701-398-000-40

### Rodagon-WA

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
Rodagon-WA 4.0/40	40	4.0	-0.25 ... -0.066	46	M39x1/26"	0701-399-000-40
Rodagon-WA 4.0/60	60	4.0	-0.25 ... -0.066	82	M39x1/26"	0701-276-000-40

# Rogonar-S

## Measuring Lenses for Large Imaging Sensors

The Linos measuring lenses developed by Qioptiq feature the highest resolution, excellent contrast, minimum distortion and color neutrality. They sharply reproduce images all the way to the very edges of the object.



### Rogonar-S

Inexpensive lens with good imaging performance.  
Optimal price / performance ratio

- Suitable for line-scan cameras and large imaging sensors
- Large image circle up to 82 mm
- High numerical aperture
- Adapter available for all common camera interfaces
- Focal length: 50 ... 90 mm
- Magnification range: 0 ... -0.5
- Spectral range: 400-750 nm
- Iris diaphragm: manual, click-stop
- Mount: M39x1/26" (Leica)
- Filter thread: M40.5x0.5

### Rogonar-S

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
Rogonar-S 2.8/50	50	2.8	-0.4 ... -0.075	44	M39x1/26"	0801-397-000-40
Rogonar-S 4.5/60	60	4.5	-0.5 ... -0.1	56	M39x1/26"	0801-324-000-40
Rogonar-S 4.5/75	75	4.5	-0.5 ... -0.1	44	M39x1/26"	0801-325-000-40
Rogonar-S 4.5/90	90	4.5	-0.5 ... -0.125	82	M39x1/26"	0801-398-000-41

All Rodagon and Rogonar lenses also available in full metal housing.

# Mechanical Accessories

## Mechanical Adaptions

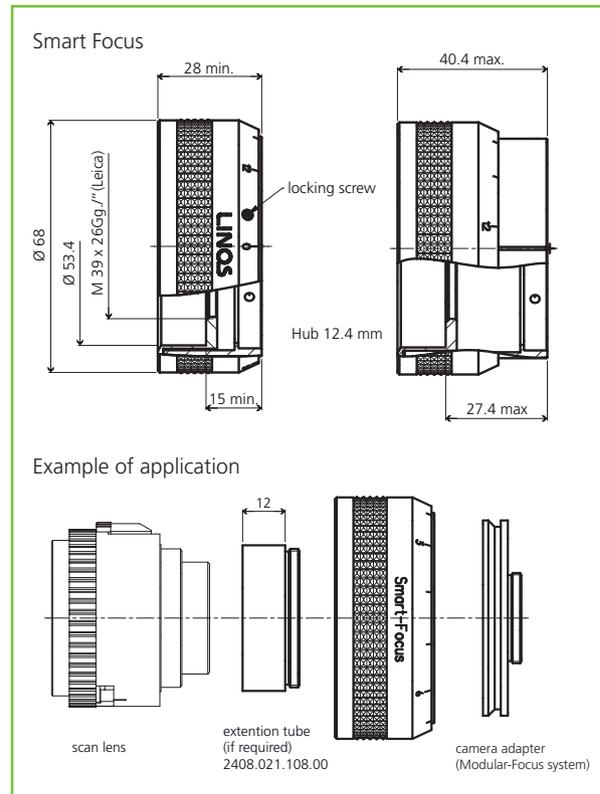
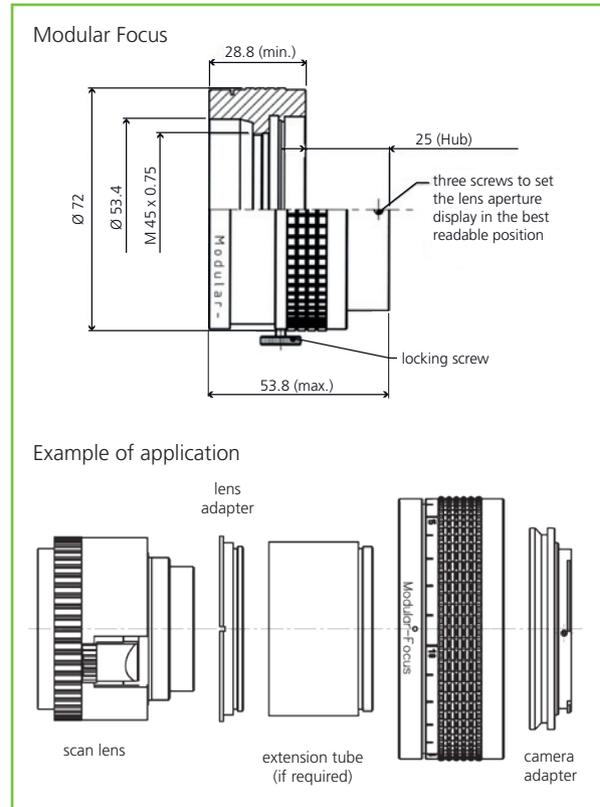
Qioptiq's LINOS Machine Vision Lenses have different threads and most have no focusing device. Therefore, we offer a complete range of mechanical accessories to adapt the lenses to all types of applications and camera systems.

### Modular Focus

A helical mount with locking screw and travel range of 25 mm. Lenses are mounted via an M45 thread using the various lens adapters and extension tubes that Qioptiq offers. A large variety of camera adapters is mounted directly with 3 set screws. The complete setup can be rotated freely for best azimuth or convenient access to aperture and locking screw. Smart mechanical design of the Modular Focus prevents the lens from rotating during focusing.

### Smart Focus

A low cost version of the Modular Focus with an M39x1/26" (Leica) lens thread. This enables direct mounting of the lens without lens adapter. A large variety of camera adapters is mounted directly with 3 set screws. The complete setup can be rotated freely for best azimuth or convenient access to aperture and locking screw. The travel range of the Smart Focus is 12.4 mm and the lens is rotating during focusing.



## Modular Focus

Product	Part No.
Modular Focus Helical mount	2408-009-000-40
Extension tube 24.5 mm M45x0.75	2408-009-113-00
Extension tube 60 mm M45x0.75	2408-009-123-00
Extension tube 87.5 mm M45x0.75	2408-009-122-00



Modular focus

## Smart Focus

Product	Part No.
Smart focus	2408-021-000-43
Extension tube 12 mm M39x1/26"	2408-021-108-00
Extension tube 24 mm M39x1/26"	2408-021-109-00
Extension tube 48 mm M39x1/26"	2408-021-110-00
Extension tube 120 mm M39x1/26"	2408-021-111-00



Smart focus

## Camera Adapter

Product	Part No.
Camera adapter C-Mount	2408-009-106-00
Camera adapter F-Mount	2408-009-142-00
Camera adapter M42x1	2408-009-119-00
Camera adapter M48x0.75	2408-009-148-00
Camera adapter M58x0.75	2408-009-132-00
Camera adapter M72x0.75	2408-009-134-00
Camera adapter M80x0.75	2408-009-159-00
Camera adapter M95x1.0	2408-009-155-00



Camera adapter M42

## Camera Extension Tubes

Product	Part No.
Extension tube M72x0.75-24mm	2408-009-135-00
Extension tube M95x1.0-24mm	2408-009-156-00



Extension tube M72

## Lens Adapter

Product	Part No.
Lens adapter M39x1/26"	2408-009-118-00
Lens adapter M39x1/26" *)	2408-009-112-00
Lens adapter M45-V-groove	2408-009-147-00

\*) To be used with Rodagon 5.6/135; Apo-Rodagon-D 4.5/75 2x; Apo-Rodagon-D 5.6/120 2x; Apo-Rodagon-N 4.0/105



Lens adapter

## Retro Rings

Product	Part No.
Retro ring M40.5x0.5 - M39x1/26"	2408-009-158-00
Retro ring M37x0.75 - M45x0.75	2408-009-152-00



Retro ring



# MachVis Workflow

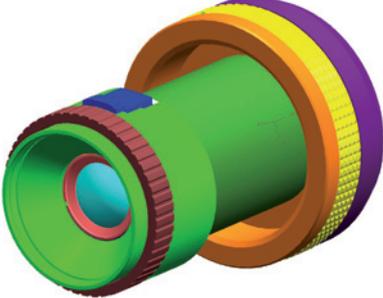
From the choice of lens...

The screenshot shows the MachVis CCD Lens selector 6.6.1 software interface. It features a table of optical lenses with columns for Optic Lens Name, Remark, Focus Device, Ext, Lens EFL, Total W.D., Free W.D., Object Size, Image Size, Mag Value, Scaled Mag Range, Lens to Camera, Flange F.D., Flange F.D. Range, and Depth of Field. A list of camera adapters is also visible on the left. Below the table, a 'Schematic System Drawing' shows a 3D exploded view of the lens and camera adapter assembly. A 'Component' table lists the parts used in the assembly.

Optic Lens Name	Remark	Focus Device	Ext	Lens EFL	Total W.D.	Free W.D.	Object Size	Image Size	Mag Value	Scaled Mag Range	Lens to Camera	Flange F.D.	Flange F.D. Range	Depth of Field
1	App-Rodagon HR D 2x	Modular Foc.	0	76.43mm	323.74mm	200.20mm	70.00mm	43.30mm	-0.619x	-1.3 to -0.175	102.64mm	102.14mm	83.0-108.0mm	0.37mm
2	App-Rodagon D 2x	Smart Focus	1	74.00mm	314.50mm	185.15mm	70.00mm	43.30mm	-0.619x	-1.6 to -0.2	102.47mm	118.57mm	110.2-122.6mm	0.27mm
3	App-Rodagon D 2x	Modular Foc.	2	74.00mm	314.50mm	185.15mm	70.00mm	43.30mm	-0.619x	-1.6 to -0.2	102.47mm	118.57mm	110.2-140.7mm	0.27mm
4	App-Rodagon D 1x	Mag	Modular Foc.	1	74.70mm	301.99mm	159.86mm	70.00mm	-0.619x	-2.4 to -0.4	95.63mm	107.83mm	91.2-118.2mm	0.24mm
5	App-Rodagon D 1x	Mag	Smart Focus	2	74.70mm	301.99mm	159.86mm	70.00mm	-0.619x	-2.4 to -0.4	95.63mm	107.83mm	90.2-110.6mm	0.24mm
6	App-Rodagon D 2x	Mag	Focus Adap.	8	74.00mm	214.50mm	160.59mm	70.00mm	-0.619x	-1.6 to -0.2	102.47mm	118.57mm	115.5-125.5mm	0.27mm
7	App-Rodagon D 1x	Mag	Focus Adap.	4	74.70mm	301.99mm	159.86mm	70.00mm	-0.619x	-2.4 to -0.4	95.63mm	107.83mm	104.5-109.5mm	0.24mm
8	Rogonair-S 75	Mag	Modular Foc.	1	74.00mm	314.23mm	172.56mm	70.00mm	-0.619x	-1.0 to -0.05	95.17mm	111.27mm	91.2-116.2mm	0.27mm
9	Rogonair-S 75	Mag	Smart Focus	1	74.00mm	314.23mm	172.56mm	70.00mm	-0.619x	-1.0 to -0.05	95.17mm	111.27mm	110.2-122.6mm	0.27mm
10	Rodagon 80	Mag	Modular Foc.	2	81.10mm	340.87mm	195.41mm	70.00mm	-0.619x	-1.0 to -0.03	109.97mm	124.67mm	115.7-140.7mm	0.24mm
11	Rodagon 80	Mag	Smart Focus	2	81.10mm	340.87mm	195.41mm	70.00mm	-0.619x	-1.0 to -0.03	109.97mm	124.67mm	122.2-134.6mm	0.24mm
12	App-Rodagon N 80	Mag	Modular Foc.	1	83.60mm	381.14mm	186.48mm	70.00mm	-0.619x	-1.0 to -0.034	116.15mm	129.65mm	126.7-161.7mm	0.24mm
13	App-Rodagon N 80	Mag	Smart Focus	2	83.60mm	381.14mm	186.48mm	70.00mm	-0.619x	-1.0 to -0.034	116.15mm	129.65mm	122.2-134.6mm	0.24mm
14	App-Rodagon N 80	Mag	Focus Adap.	6	83.60mm	381.14mm	186.48mm	70.00mm	-0.619x	-1.0 to -0.034	116.15mm	129.65mm	126.5-131.5mm	0.24mm
15	App-Rodagon N 90	Mag	Modular Foc.	1	90.10mm	378.39mm	206.56mm	70.00mm	-0.619x	-1.0 to -0.033	125.33mm	140.63mm	126.7-161.7mm	0.24mm
16	App-Rodagon N 90	Mag	Smart Focus	2	90.10mm	378.39mm	206.56mm	70.00mm	-0.619x	-1.0 to -0.033	125.33mm	140.63mm	134.2-148.6mm	0.24mm
17	Rogonair-S 90	Mag	Modular Foc.	1	80.40mm	300.88mm	217.11mm	70.00mm	-0.619x	-1.0 to -0.003	120.25mm	130.55mm	126.7-161.7mm	0.27mm
18	Rogonair-S 90	Mag	Smart Focus	2	80.40mm	300.88mm	217.11mm	70.00mm	-0.619x	-1.0 to -0.003	120.25mm	130.55mm	134.2-148.6mm	0.27mm
19	App-Rodagon N 90	Mag	Focus Adap.	7	90.10mm	378.39mm	206.56mm	70.00mm	-0.619x	-1.0 to -0.033	125.33mm	140.63mm	137.5-142.5mm	0.24mm
20	Rodagon 60	Mag	Modular Foc.	1	61.90mm	260.16mm	135.27mm	70.00mm	-0.619x	-1.0 to -0.03	78.39mm	94.29mm	91.2-118.2mm	0.24mm
21	Rodagon 60	Mag	Smart Focus	1	61.90mm	260.16mm	135.27mm	70.00mm	-0.619x	-1.0 to -0.03	78.39mm	94.29mm	86.2-86.6mm	0.24mm
22	Rodagon 60	Mag	Focus Adap.	3	61.90mm	260.16mm	135.27mm	70.00mm	-0.619x	-1.0 to -0.03	78.39mm	94.29mm	93.5-95.5mm	0.24mm

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to 3D modelling...



to the final system:





## Discover the Q!

Discover the capabilities, knowledge, equipment and technology of Qioptiq

The Vision Technology product area covers the whole range of industrial magnification tasks from Macro to Micro and Line-Scan to Area-Scan.

## Photonics for Innovation

Contact Qioptiq today:

[vision@qioptiq.com](mailto:vision@qioptiq.com)

**North America**

+1 (800) 429-0257

**Asia/Pacific**

+65 6499 7766

**Europe**

+49 (0) 89 255 458-0

[www.qioptiq.com](http://www.qioptiq.com)

