



CORNING

Corning® Varioptic® Lenses

Step in Focus

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About Corning

Corning is one of the world's leading innovators in materials science. For more than 170 years, Corning has applied its unparalleled expertise in glass science, ceramic science, and optical physics to develop products that transform industries and enhance people's lives.

Corning succeeds through sustained investment in R&D, a unique combination of material and process innovation, and close collaboration with customers to solve tough technology challenges.

Corning's businesses and markets are constantly evolving. Today, Corning's products enable diverse markets such as mobile consumer electronics, display, optical communications, automotive, and life sciences vessels.

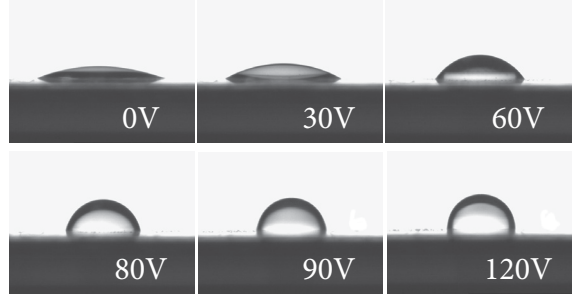
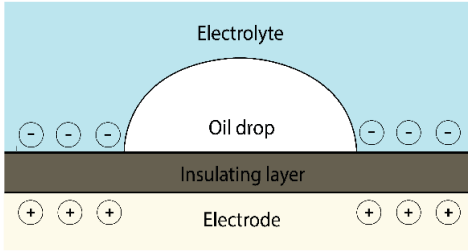
Corning® Varioptic® Lenses are optical devices that adjust voltage to change the shape of a liquid interface. This technology addresses demanding markets for industrial imaging applications. The technology was originally developed by Bruno Berge when he founded Varioptic in 2002, and Corning acquired the company in 2017.

Corning® Varioptic® Lenses is part of the Advanced Optics Division, a global leader in providing cutting-edge material and optical solutions that serve a variety of commercial markets including semiconductor manufacturing, microfabrication, consumer electronics, and more.



Electrowetting

Electrowetting occurs when a drop of insulating liquid (e.g. oil drop) is deposited on a flat surface, made of a conductive material covered with an insulating and hydrophobic layer, and then both the drop and surface are immersed in a conductive liquid (e.g. electrolyte). Voltage is then applied between the conductive substrate and the conductive liquid causing the liquid drop to change shape. This effect is known as electrowetting.



The shape of the drop then changes as voltage increases

Lens Structure

The design of the adjustable lens structure ensures:

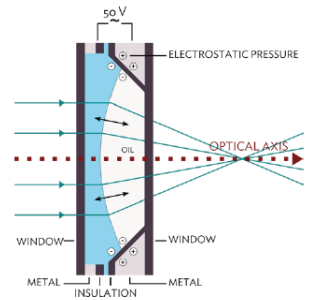
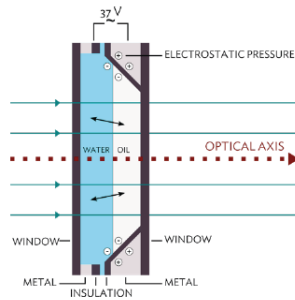
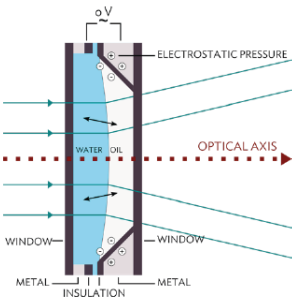
- Stable optical axis, by a conical centering of the drop
- Non sensitivity to orientation, by using two liquids of equal density
- High shock resistance, by a simple mechanical structure and equal density

Depending on the voltage applied, the lens can be a divergent lens, a flat lens, or a convergent lens.

Divergent Lens

Flat Lens

Convergent Lens



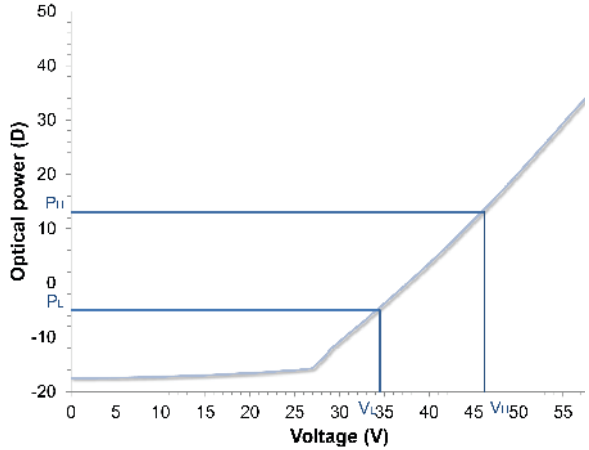
Key Performances

Optical Power vs. Voltage

The optical power of Corning® Varioptic® Lenses is a linear response versus voltage.

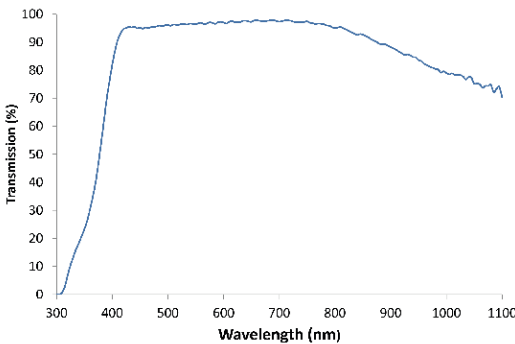
Optical Quality

The optical quality of each adjustable lens is specified by the Wave Front Error (WFE). The WFE characterizes the deviation of the actual shape of the lens compared to a perfectly spherical lens – and measured in nanometers rms. The typical WFE of the lens is in the range of 50 nm rms, which is the equivalent of a lambda/10 lens.

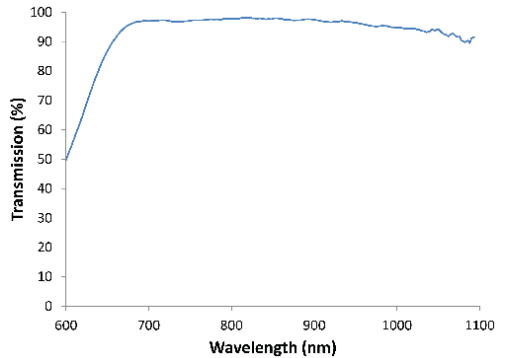


Transmission

The standard version of each lens comes with an anti-reflective (AR) coating which is optimized in the visible range. Therefore, the transmission drops slightly in the near infrared. The loss of transmission below 400nm is linked both to the anti-reflective coating and to the glass that is used in the lenses, which is a standard borosilicate glass.



A-25H0 – AR coating optimized in the visible range



A-25H1 – AR coating optimized in the near-infrared range

With an anti-reflective coating optimized in the near infrared, the transmission curve flattens from 700nm to 1100 nm.

System Integration

Corning® Varioptic® Lenses can be used in several types of systems:

- Manual focus: the user adjusts the focus manually, with a knob for example
- Closed-loop: this is the standard auto focus method, where a processor runs a contrast optimization loop to maximize the sharpness of the image
- Open-loop: this is a mode where the focus command is directly sent to the lens, from an external distance measurement for instance
- Mixed mode: a combination of open loop for coarse search, and closed loop for fine tuning of the focus
- Sweep mode: this mode performs a continuous sweep of the full range of the optical power of the liquid lens

Closed-loop Auto Focus

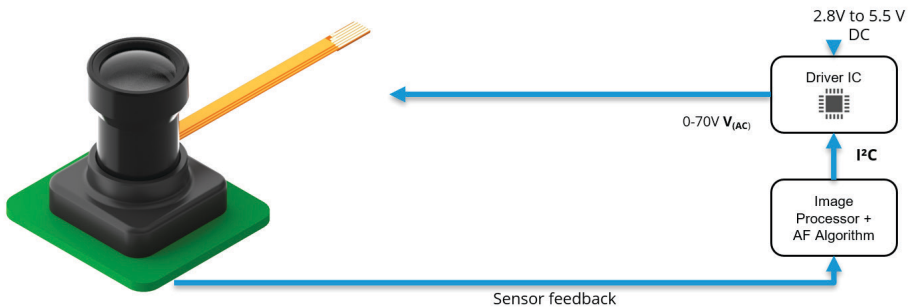
A closed-loop system consists of:

- An image sensor
- An optical lens consisting of fix-focus optics and an adjustable lens
- An adjustable lens driver IC
- A processor (ISP, FPGA...)

The processor performs the following tasks:

- Contrast measurement on the image output by the sensor
- Modification of the driver IC command to maximize this image contrast.

Corning Varioptic Lenses provides auto focus algorithms that have been optimized for the adjustable lens. The overall performance depends on many system parameters such as sensor frame rate and processing speed; typically, the complete auto focus loop can be completed in 8 to 12 frames.



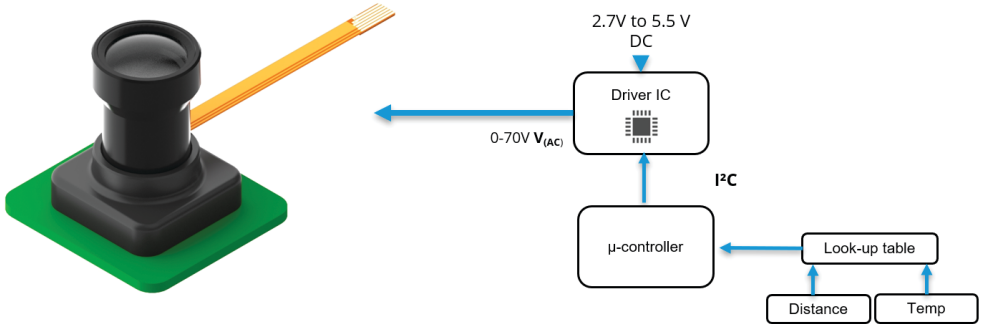
Open-loop Driving

Although the adjustable lens closed-loop is fast, there are situations where it is not possible to acquire several frames to perform a focusing loop. In this case, the solution is to use open-loop focusing, where the sensor feedback is not used.

Open-loop focusing is based on a look-up table where the desired focusing distance is linked to the driver IC command. This look-up table is initially calibrated. Focusing is then triggered through an external external device, for instance:

- A distance measurement device that measures object position.
- A predetermined set of distances, etc.

Through the addition of this extra device, open-loop driving enables ultra-fast focusing where focus can be achieved within one frame only.



Closed-loop vs. Open-loop

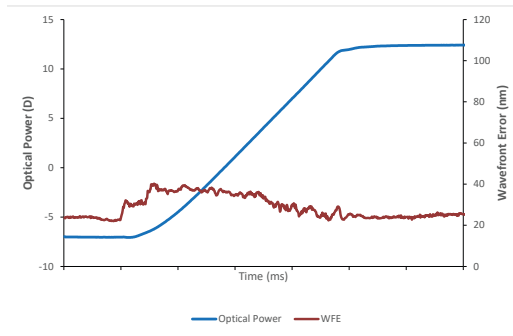
The main advantage of the closed-loop system is its simplicity of integration. Indeed, an open-loop system will need:

- A distance measurement device
- A temperature sensor
- A calibration of the device during production

Also, an open-loop system may be susceptible to any variation in the system. For optimum performances, open-loop and closed-loop should be combined: open-loop for coarse search and closed-loop for fine search.

Sweep mode

This mode is particularly suited for applications where the image does not need to remain in focus, typically like on the fly decoding applications. The focus ramp is a linear change of the optical power of the liquid lens with time, allowing the acquisition of images while the liquid lens is still moving, with virtually no settling time. The principle is to cover the full optical power range of the liquid lens such as having the focus moving between infinity and short distance making sure to have any targeted object focused at least on one image. The collected images can then be analyzed and decoded in parallel. This method can be extremely fast since it doesn't require any settling time between 2 focus positions relying on the unique property of the Liquid Lens which is, being able to provide high optical quality even while the optical power is being changed.



A-16F0 – Sweep example

Parameters can be tuned to meet application requirements (rise time, diopter range etc...).

Advantages of Corning® Varioptic® Lenses

The traditional way to perform the auto focus function is to mechanically move the lens module to adjust the back focal length (distance to the image sensor) depending on object distance. This method presents several drawbacks:

- Requires bulky and fragile motors
- Friction of small parts leading to damage and malfunction after a few hundreds of thousands of actuations
- Noise and high power consumption while moving the mass of the lens module

The unique characteristics of Corning Varioptic Lenses offer the following:

- No moving parts
- Hundreds of millions of cycles endurance
- Speed: much faster than mechanical actuators
- Robustness and unmatched mechanical shock resistance: tested at 4200g / 0.23ms / 100 times (x2 directions)
- Close focus ability: from infinity to below 5 cm
- Low power consumption: up to few mW at lens level
- Silent operation

Applications

- Barcode readers
- Consumer devices
- Lasers
- Augmented and Virtual Reality
- Biometrics
- Machine vision



Variable Focus Lenses (A-Series)

Corning® Varioptic® Lenses enable variable focus functionality when designed into imaging or beam shaping lenses. They offer a high degree of design freedom for mechanical, electrical, and optical integration.

A-16F

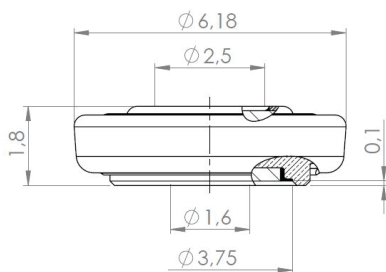
The smallest member of the A-Series family. It is specifically designed for ultra-compact cameras, such as barcode engines and industrial endoscopes, etc.

Key Features:

- 6.2 mm outer diameter
- 1.85 mm thickness
- 1.6 mm clear aperture
- Excellent optical quality and fast response time
- Focus range from 5 cm to ∞
- Easy to integrate

Ordering Information:

- A-16F0: with an anti-reflective coating optimized in the visible range
- A-16F1: with an anti-reflective coating optimized in the near infrared
- A-16F9: with no anti-reflective coating



Specifications:

Typical performance at 25°C

Useful aperture at 0° field of view	1.6 mm
Low optical power	-5 diopters (m ⁻¹)
High optical power	+15 diopters (m ⁻¹)
Wave Front Error on 1.6mm aperture	20 nm (rms)
Transmission at 587nm (or 850nm for F1)	97%
Storage temperature	from -40 to 85°C
Operating temperature	from -20 to 60°C

A-25H



Designed for compact optical systems such as: barcode readers, industrial cameras, biometrics. The A-25H small size, large dynamic range, and low wave front error delivers outstanding performance.

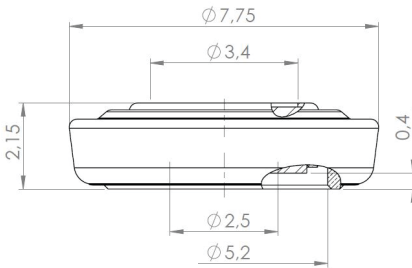
The A-25H lens is broadly suited for standard imaging applications. For very close distance imaging needs the A-25H-D0 is specially designed with a high dynamic range.

Key Features:

- 7.75 mm outer diameter
- 2.15 mm thickness
- 2.5 mm clear aperture
- Silent
- Focus range from 5.5 cm to ∞ (<3 cm to ∞ for A-25H-D0)
- Easy to integrate

Ordering Information:

- A-25H0 / A-25H0-D0 : with an anti-reflective coating optimized in the visible range
- A-25H1 / A-25H1-D0 : with an anti-reflective coating optimized in the near infrared
- A-25H9 / A-25H9-D0 : with no anti-reflective coating



Specifications:

Typical performance at 25°C

	A-25H	A-25H-D0
Useful aperture at 0° field of view	2.5 mm	
Low optical power	-5 diopters (m ⁻¹)	-35 diopters (m-1)
High optical power	+13 diopters (m ⁻¹)	+35 diopters (m-1)
Wave Front Error on 2.5mm aperture	30 nm (rms)	70 nm (rms)
Transmission at 587nm (or 850nm for H1)	97%	
Storage temperature	from -40 to 85°C	from -40 to 85°C
Operating temperature	from -30 to 85°C	from -20 to 60°C

A-39N



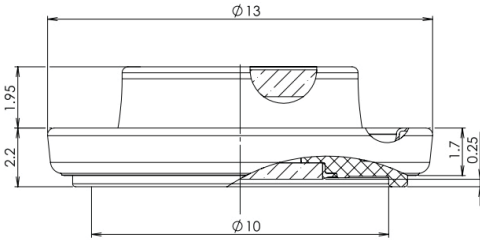
Designed specifically for variable focus products needing a large clear aperture: long focal objectives, large sensors, C-Mount objective lenses and laser beam shaping applications. The A-39N is perfectly suited for applications such as industrial vision, optical equipment, biometric devices, etc.

Key Features:

- 13 mm outer diameter
- 4.0 mm thickness
- 3.9 mm clear aperture
- Silent
- Focus range from 5 cm to ∞
- Easy to integrate

Ordering Information:

- A-39N0: with an anti-reflective coating optimized in the visible range
- A-39N1: with an anti-reflective coating optimized in the near infrared
- A-39N9: with no anti-reflective coating



Specifications:

Typical performance at 25°C

Useful aperture at 0° field of view	3.9 mm
Low optical power	-5 diopters (m ⁻¹)
High optical power	+15 diopters (m ⁻¹)
Wave Front Error on 3.5mm aperture	50 nm (rms)
Transmission at 587nm (or 850nm for N1)	97%
Storage temperature	from -40 to 85°C
Operating temperature	from -20 to 60°C

A-58N



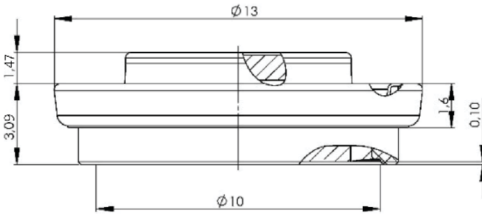
The A-58N lens is designed specifically for variable focus products needing a larger clear aperture than our A-39N and A-25H lenses. This lens is more specifically designed for optical instruments, scientific instrumentation, life sciences and microscopes.

Key Features:

- 13 mm outer diameter
- 4.3 mm thickness
- 5.8 mm clear aperture
- Compact & Low WFE
- Focus range from 7 cm to ∞
- Easy to integrate
- Without moving parts or internal heating

Ordering Information:

- A-58N0: with an anti-reflective coating optimized in the visible range
- A-58N1: with an anti-reflective coating optimized in the near infrared
- A-58N9: with no anti-reflective coating



Specifications:

Typical performance at 25°C

Useful aperture at 0° field of view	5.8 mm
Low optical power	-5 diopters (m ⁻¹)
High optical power	+10 diopters (m ⁻¹)
Wave Front Error on 5mm aperture	80 nm (rms)
Transmission at 587nm (or 850nm for N1)	97%
Storage temperature	from -40 to 85°C
Operating temperature	from -20 to 50°C

A-P Series

Packaged A-Series lenses are designed to make integration easier. By avoiding the hassle of mechanical and electrical integration of the lens, the variable focus capability can be integrated much faster into customer's system. The lens is built-in with an FPC cable, and can be connected to a standard FPC connector.

Ordering Information:

- A-P-16FX-31: Packaged A-16FX with straight Flex Cable with thermistor (FPC-A-31)
- A-P-25HX-33 : Packaged A-25HX with straight Flex Cable with thermistor (FPC-A-33)
- A-P-39NX-37: Packaged A-39NX with straight Flex Cable with thermistor (FPC-A-37)
- A-P-58NX-37: Packaged A-58NX with straight Flex Cable with thermistor (FPC-A-37)

(X=0, 1 or 9) contact us for more information on FPC specifications.

Specifications:

	A-P-16FX-31	A-P-25HX-33	A-P-39NX-37	A-P-58NX-37
External diameter	7.0 mm	8.8 mm	15.5 mm	15.5 mm
Thickness	3.0 mm	2.8 mm	5.2 mm	6.3 mm



From left to right : A-P-16FX-31 / A-P-25HX-33 / A-P-39NX-37 / A-P-58NX-37



A-PE-Series

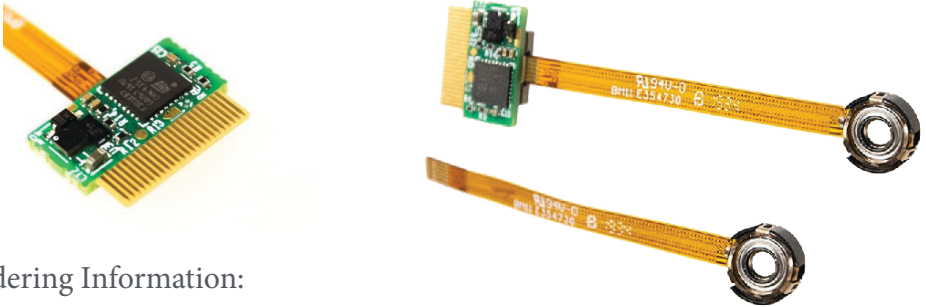


A-PE-Series is a higher degree of integration of the Corning® Varioptic® lens based on the combination of an A-P Series lens with a dedicated driving board. This product has been designed to reduce the integration and development effort on user side (comprehensive hardware, calibrated lens etc...) as well as to enhance the electro-optical performance of the lens embedding temperature compensation algorithm for better open loop operation and providing response time acceleration features to handle ever increasing sensor frame rates.

This platform will be rolled out across the A-Series portfolio, starting with the A-25H0 lens.

Key Features:

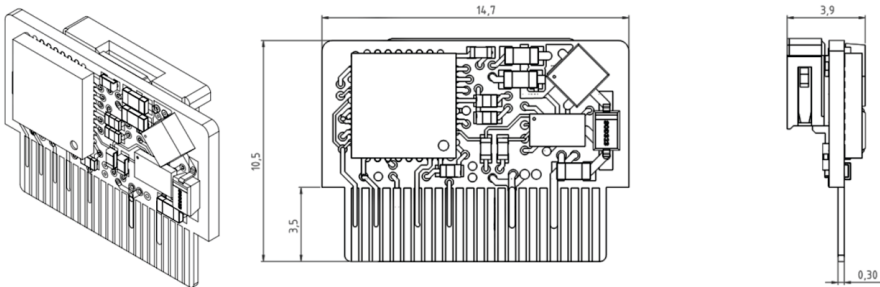
- A-P- Series lens & electronic board
- Multipoint calibration
- Thermal compensation (V-Temp), compensating both lens and driver related thermal variations
- Response time acceleration algorithm (V-Speed) - up to 5x faster
- Innovative driving mode (V-Sweep)



Ordering Information:

A-PE-25H0-33: Packaged A-25H0 with electronics and FPC-A-33

Electronic board mechanical dimension :



Auto Focus Modules (C-Series)

Corning® Varioptic® Lenses enable auto focus functionality when a fixed lens module and a variable focus lens are integrated into a Corning Varioptic receptacle mount. Corning provides auto focus algorithms that are optimized for Corning Varioptic Lenses.

C-S-Series

Integrates a fixed lens module and an A-Series variable focus lens in an M12 receptacle (S-mount). It can be easily mounted into a standard M12 sensor board and driven by the same drivers as the A-Series lenses.

Key Features:

- M12x0.5 thread
- Flex Cable compatible with 0.5 mm pitch connector
- Compatible FPC connectors:
 - 525590652 from Molex
 - 5034800600 from Molex
- Built in auto focus actuator
- Built in IR cut filter for -IR version

Ordering Information:

- C-S-25H0-026-43: includes A-25H0 and FPC-A-43, EFL = 2.6 mm
- C-S-25H0-036-43: includes A-25H0, and FPC-A-43, EFL = 3.6 mm
- C-S-25H0-047-43: includes A-25H0, and FPC-A-43, EFL = 4.7 mm
- C-S-25H0-075-43: includes A-25H0, and FPC-A-43, EFL = 7.5 mm
- C-S-25H0-096-43: includes A-25H0, and FPC-A-43, EFL = 9.6 mm
- C-S-39N0-158-47: includes A-39N0, and FPC-A-47, EFL = 15.8 mm
- C-S-39N0-250-47: includes A-39N0, and FPC-A-47, EFL = 25 mm

For module with IR cut filter (650 nm cut-off wavelength), please add I to one of the above reference when ordering



Corning® Varioptic® C-S-Series

C-H-Series

Integrates a fixed lens module and an A-16F variable focus lens in an M8 receptacle. It can be easily mounted into a standard M8 sensor board and driven by the same drivers as the A-Series lenses. It is the smallest formfactor auto focus lens module available among Corning® Varioptic® Lenses.

Key Features:

- M8x0.5 thread
- Flex Cable compatible with 1 mm pitch 4 pins connector
- Compatible FPC connectors:
 - SFW4S-2STE9LF from FCI
 - 04FMN-BTK-A (LF)(SN) from JST
- Built in auto focus actuator
- Built in IR cut filter for -IR version

Ordering Information:

- C-H-16F0-036-12: includes A-16F0 and straight Flex Cable without thermistor (4 pins)(FPC-A-12), EFL = 3.6 mm

For module with IR cut filter (650nm cut-off wavelength), please add I to one of the above reference when ordering



Specifications:

Typical performance at 25°C

	C-S- 25H0-026	C-H- 16F0-036	C-S- 25H0-036	C-S- 25H0-047	C-S- 25H0-075	C-S- 25H0-096	C-S- 39N0-158	C-S- 39N0-250
Effective Focal Length	2.6 mm	3.6 mm	3.6 mm	4.7 mm	7.5 mm	9.6 mm	15.8 mm	25 mm
Format	M12	M8	M12					
F-number	2.5	2.2	1.8	2	2.9	3.7	4	4 or 8
Chief Ray Angle (CRA)	17°	33.7°	33.7°	34.4°	16.5°	12.5°	5.5°	5°
Focusing range	4 mm to ∞	5 cm to ∞						15 cm to ∞

FOV vs. Sensor Format	C-S- 25H0-026	C-H- 16F0-036	C-S- 25H0-036	C-S- 25H0-047	C-S- 25H0-075	C-S- 25H0-096	C-S- 39N0-158	C-S- 39N0-250
1/4"	86°	63°	63°	46°	33°	26°	16°	9°
1/3"	134°	79°	79°	65°	44°	35°	22°	13°
1/2.7"	152°	-	-	71°	48°	39°	-	15°
1/2.5"	160°	-	-	75°	51°	41°	-	16°
1/2"	-	-	-	-	-	45°	-	18°
1/1.8"	-	-	-	-	-	50°	-	20°

	C-S- 25H0-026	C-H- 16F0-036	C-S- 25H0-036	C-S- 25H0-047	C-S- 25H0-075	C-S- 25H0-096	C-S- 39N0-158	C-S- 39N0-250
Back Focal (no IR)	5.26 mm	0.53 mm	0.53 mm	0.83 mm	4.07 mm	6.12 mm	6.02 mm	3.27 mm
Back Focal (IR filter)	5.36 mm	0.59 mm	0.59 mm	0.69 mm	4.26 mm	6.3 mm	6.2 mm	3.4 mm
Image circle diameter	7.2 mm	6 mm	6 mm	7.5 mm	7.2 mm	9 mm	6 mm	9 mm
Sensor compatibility	1/2.5"	1/3"	1/3"	1/2.4"	1/2.5"	1/1.8"	1/3"	1/1.8"

Setting Procedure

For optimum performance of the module, please refer to the setting procedure detailed in the Technical Data Sheets of the C-H and C-S-Modules.

C-u-Series

Combined with the use of specific adapters, either for C-Mount or M12, an inexpensive Auto Focus microscope can be built. It uses the same FPC cable as the C-S series, and therefore requires the same FPC connectors.

Ordering Information:

- C-u-25H0-075-43: inverted C-S-25H0-075



Specifications:

Typical performance at 25°C

	Extension Ring		
Magnification	X2	X4	X5
Working distance	7 mm	6 mm	5 mm
Focusing range	±0.85 mm	± 0.7 mm	± 0.65 mm

C-u Microscopy Set

Allows customers to achieve various magnifications, both for M12 and C-Mount cameras. This set is delivered with the C-Microscopy development kit.

- 1 microscope spacer
- 1 set of M12 and C-Mount adapters allowing X2, X3 and X5 magnifications
- 1 locking nut for M12 adapters



C-C-Series

Electronically focused, controllable C-mount module based on the A-39N0 variable focus lenses. The C-C-Series incorporates all necessary electronic components to drive the lenses and only requires a DC power supply.

Key Features:

- Integrated driving electronics
- Silent
- Supports I²C Analog, RS232, and SPI interfaces
- Supports closed-loop operations

Ordering Information:

20Mpx line :

- C-C-39N0-A1-XXX : supports I²C,SPI and RS232

5Mpx line :

- C-C-39N0-XXX-YYY : supports I²C,SPI and RS232

XXX = 160,250 or 350* (*20Mpx only) for 16mm, 25mm, 35mm EFL

YYY = I2C, R33, R12, SPI for I²C, RS232 3.3V, RS232 12V or SPI interface, YYY to be selected at order.

Specifications:

Typical performance at 25°C

	C-C-39N0-A1-160	C-C-39N0-A1-250	C-C-39N0-A1-350	C-C-39N0-160	C-C-39N0-250
Effective Focal Length	16 mm	25 mm	35 mm	16 mm	25 mm
Manual Iris	No	Yes	Yes	No	Yes
F-number	3.8	5 to 22	5.5 to 22	2.8	4 to 22
Focus range	15 cm to ∞	20 cm to ∞	20 cm to ∞	10 cm to ∞	10 cm to ∞
Image circle diameter	17,6 mm			11 mm	
Sensor compatibility	1.1"			2/3"	
Pixel size / Resolution	2.74µm/20MP			3.45µm/5MP	
DC power supply	3.3-24 VDC				
Current consumption	10 to 50 mA			25 to 100 mA	
Connector	6 pin jST SHR-06V-S-B				
Communication	32 bits			8 bits	



C-C-39N0-A1-160



C-C-39N0-160



C-C-39N0-250

C-T-Series

Electronically focused, controllable Telecentric module based on the A-39N0 variable focus lenses. The C-T-Series incorporates all necessary electronic components to drive lenses and only requires a DC power supply. The C-T-Series lenses can be mounted on C-mount cameras.

Key Features:

- Variable focus
- Silent
- Supports I²C and RS232 interfaces
- Supports closed-loop operations

Ordering Information:

- C-T-39N0-A1-XXX
XXX = 005 or 010 for 0.5 X or 1 X magnification

Specifications:

Typical performance at 25°C

	C-T-39N0-A1-005	C-T-39N0-A1-010
Mount	C-Mount	
Connector	Hirose 6-pin HR10A-7R-6SB	
Magnification	0.5 X	1 X
Image circle diameter	16mm	16mm
WD (mm)	116-128	102-118
TV Distortion	≤ 0.1%	≤ 0.1%
Resolution	8.8 μm	5.5 μm
Telecentricity	≤ 0.1°	≤ 0.1°



C-T-39N0-A1-005



C-T-39N0-A1-010

Introducing : The variable focus and astigmatism lens

The new V-80R0 liquid lens is built around a brand new 8 electrodes design and based on Corning Varioptic breakthrough technology.

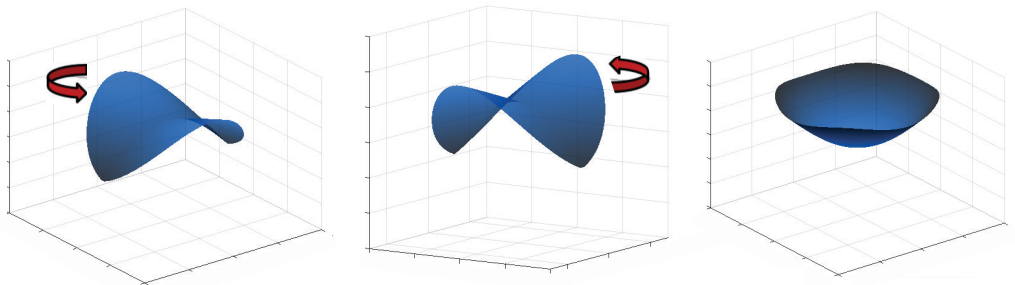
The extra electrodes provide new functionalities to this liquid lens in addition to the sphere variation : It is now possible to adjust astigmatism and axis by controlling the voltage with absolutely no moving parts.

Key Features:

- 8 mm clear aperture
- Up to 24 diopters of spherical power
- Up to 5 diopters of cylindrical power
- Combined sphere, cylinder, and axis variation
- Easy to integrate
- Silent
- Without moving parts or internal heating



Providing Sphere, Cylinder and Axis variation :





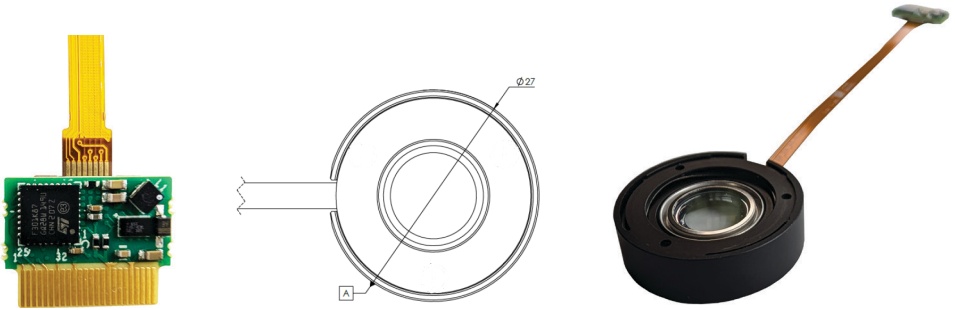
V-PE-Series benefits from a higher degree of integration similar as the A-PE Series.

This product has been designed to reduce the integration and development efforts providing a fully calibrated system ready to drive through its I²C / RS 232 interface.

The V-80R0 will only be available through this level of integration.

Key Features:

- Packaged V-80R0 multi electrodes lens & electronic board
- Multipoint calibration (Sphere ; Cylinder ; Axis)
- Thermal compensation (V-Temp), compensating both lens and driver related thermal variations



Ordering Information:

V-PE-80R0-07: Packaged V-80R0 with electronics and FPC-V-07

Specifications:

Typical performance at 25°C

Useful aperture at 0° field of view	8 mm
Sphere only optical power	-12 ... +12 diopters (m ⁻¹)
Sphere optical power range using cylinder	-6 ... +6 diopters (m ⁻¹)
Cylinder optical power range	-5 ... 0 diopters (m ⁻¹)
Transmission at 587nm	96%
Operating temperature	from 10 to 35°C

Maxim MAX14574

Corning has qualified the Maxim MAX14574 for the use with Corning® Varioptic® Lenses.

- Compatible with A-Series, C-S-Series and C-u-Series
- It is also possible to read the temperature of an external thermistor, through the I²C interface

Corning is the exclusive worldwide reseller of the Maxim MAX14574, to purchase, please contact Corning Varioptic Lenses at varioptic@corning.com or an approved Corning Varioptic Lenses distributor.



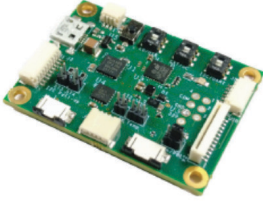
Performance Summary:

	MAX14574
Maximum Voltage	70 V
Resolution	10 bits
Interface	I ² C
Size (mm)	1.6 x 2.6
External Components	5
Output Waveform	PWM
Maximum Power Consumption	40 mW
Package	15 bump WLP
Temperature Reading	Yes
Input Voltage Range	+ 2.7 V to +5.5 V

Driver Boards



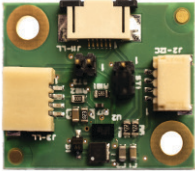
USB-M Universal



This board includes a Maxim driver and various FPC connectors for the A-P-Series, A-PE-Series, C-S-Series, C-H-Series and C-u-Series. Due to the FocusLab Software, it is easily driven through USB and delivered with the development kits. Its very small form factor enables the use of this board directly with any PC-driven application with no extra hardware development. This board is an evolution of our former “USB-M Flexiboard”. It also provides a compatibility with our C-C-39N0-A1 20Mpx product line.

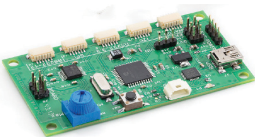
Board size : 48 x 35 x 8 mm.

Maxim Drivboard



This board includes a Maxim driver and the needed FPC connectors (4 and 6 pins) to accommodate the A-P-Series, C-S-Series and C-u-Series. It has a 4 pin JST connector for DC power supply and for I²C communication. It has been designed for fast driving of the adjustable lens directly from a microcontroller, an FPGA, a DSP, etc. A cabled JST connector is supplied with the board.

C-C Com Board



This board is a USB to RS232-12 V / RS232-3.3 V / I²C / SPI converter. Connected to a PC with a USB cable on one hand, and to the C-C module (C-C-39N0-A1 20Mpx product line excluded) on the other hand. It enables communication directly with any of the C-C versions using FocusLab. A potentiometer also allows direct control of the C-C voltage without a computer.

Board size : 42 x 75 x 16 mm.

Communication Devices

Flex Cables

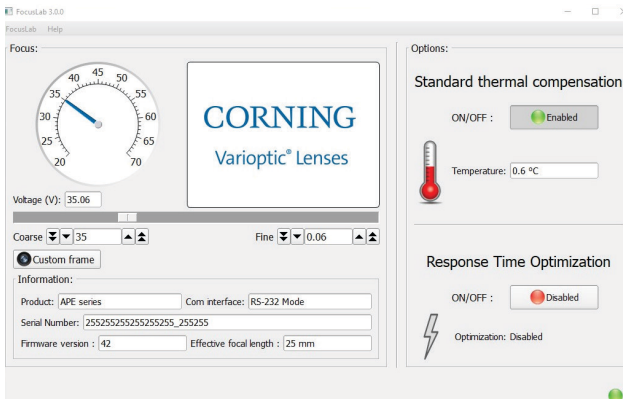
		Type				
	Compatibility	Pins	Pitch	Thermistor	Shape	Length(*)
FPC-A-31	A-P-16F series	6	0.5 mm	YES	Straight	46 mm
FPC-A-33	A-P-25H & A-PE-25H series	6	0.5 mm	YES	Straight	63 mm
FPC-A-37	A-P-39N & A-P-58N series	6	0.5 mm	YES	Straight	91 mm
FPC-A-12	C-H-16F0 series	4	1 mm	NO	Straight	71 mm
FPC-A-43	C-S-25H0 series	6	0.5 mm	YES	Bent	60 mm
FPC-A-47	C-S-39N0 series	6	0.5 mm	YES	Bent	61 mm

(*) : Longest dimension of the FPC

Softwares

FocusLab

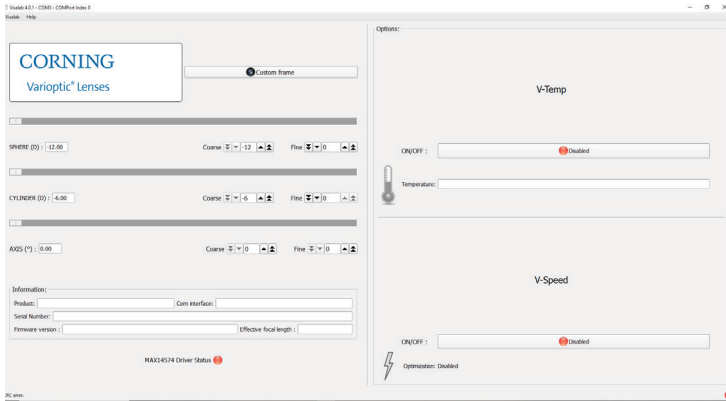
FocusLab allows customers to control the liquid lens through the USB Boards. The software controls the output voltage on the liquid lens. A specific dialog box allows for sending advanced commands to the liquid lens controller. A specific documented DLL integrates this in a C-code program.



FocusLab windows interface

VisaLab

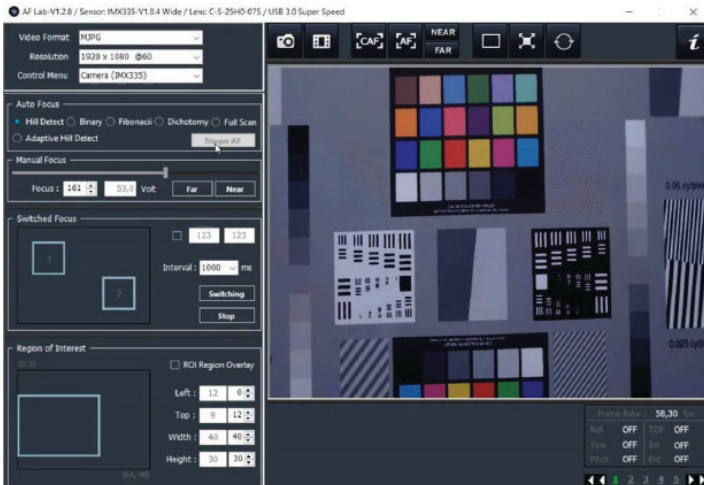
Visalab allows customers to control the new V-PE Series. The software controls the output voltage on the liquid lens electrodes to control the sphere, cylinder and angle. A specific documented DLL integrates this in a C-code program. Visalab also allows the control of the V-PE Series through the USB-M Universal.



VisaLab windows interface

AFLab

AFLab Software is provided together with the Corning® Varioptic® AF Explorer Development Kit, it allows to select the various AF modes & algorithms, change the basic sensor settings, as well as image & video acquisition among others.



Development Kits

Development Kits for various A-Series lenses and all C-Series modules are specially designed to speed up the evaluation and design process.

D-A-PE-25HX

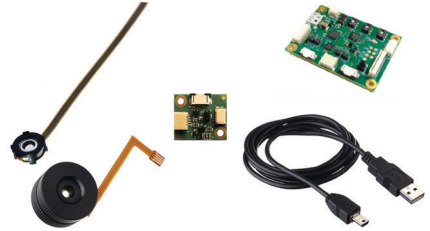
Ordering code: D-A-PE-25HX, X=0,1, or 9



- 1 A-PE-25HX-33
- 1 Maxim Drivboard
- 1 USB-M Universal, USB cable
- FocusLab Software
- Documentation Package

D-A-16F

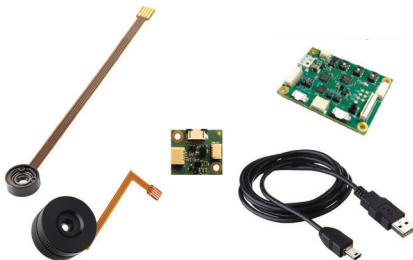
Ordering code: D-A-16FX, X=0,1, or 9



- 1 A-16FX
- 1 A-P-16FX-31
- 1 Maxim Drivboard
- 1 VHD-09
- 1 FPC-A-31
- 1 USB-M Universal, USB cable
- FocusLab Software
- Documentation Package

D-A-25H-D0

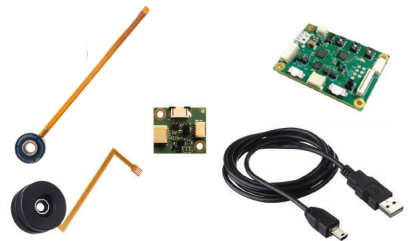
Ordering code: D-A-25HX-D0, X=0,1, or 9



- 1 A-25HX-D0
- 1 A-P-25HX-D0-33
- 1 Maxim Drivboard
- 1 VHD-07
- 1 FPC-A-33
- 1 USB-M Universal, USB cable
- FocusLab Software
- Documentation Package

D-A-39N

Ordering code: D-A-39NX, X=0,1, or 9



- 1 A-39NX
- 1 A-P-39NX-37
- 1 Maxim Drivboard
- 1 VHD-06
- 1 FPC-A-37
- 1 USB-M Universal, USB cable
- FocusLab Software
- Documentation Package

D-A-58N

Ordering code: D-A-58NX, X=0,1, or 9

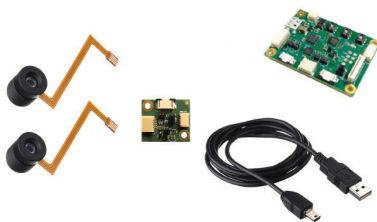


- 1 A-58NX
- 1 A-P-58NX-37
- 1 Maxim Drivboard
- 1 VHD-10
- 1 FPC-A-37
- 1 USB-M Universal, USB cable
- FocusLab Software
- Documentation Package

D-S/H Kits

Ordering code:

- D-S-25H0-XXX, XXX= 026/036/047/075/096, no filter
- D-S-25H0-XXXI, XXX= 026/036/047/075/096, with IR-Cut filter
- D-S-39N0-XXX, XXX=158/250 no filter
- D-S-39N0-XXXI, XXX=158/250 with IR-Cut filter
- D-H-16F0-036, no filter
- D-H-16F0-036I, with IR-Cut filter



- 2 C-S/H Modules
- 1 Maxim Drivboard
- 1 USB-M Universal, USB cable
- FocusLab Software
- Documentation Package

D-C Kits 5MP | 2/3"

Ordering code: D-C-39N0-XXX-YYY,
XXX=160 or 250, YYY= R12, R33, SPI, I²C



- 1 C-C-39N0-XXX-YYY
- 1 C-C Com board and cable
- FocusLab Software
- Documentation Package

D-C Kits 20MP | 1.1"

Ordering code: D-C-39N0-A1-XXX
XXX = 160,250 or 350



- 1 C-C-39N0-A1-XXX
- 1 USB-M Universal and cable
- FocusLab Software
- Documentation Package

RS232 12V requires dedicated shifter board

D-T Kits

Ordering code: D-T-39N0-A1-XXX
XXX = 005 or 010



- 1 C-T-39N0-A1-XXX
- 1 cable
- FocusLab Software
- Documentation Package

D-u-25H0-075

Ordering code: D-u-25H0-075



- 1 C-u-25H0-075
- 1 Maxim Drivboard
- 1 C-Series Microscopy Set
- 1 USB-M Universal, USB cable
- FocusLab Software
- Documentation Package

D-u-39N0-160

Ordering code: D-u-39N0-160-YYY
YYY= R12, R33, SPI, I²C



- 1 C-C-39N0-160-YYY
- 1 C-C Com board and cable
- 1 Adaptor ring
- 2 C-mount tubes (20 & 50 mm length)
- FocusLab Software
- Documentation Package

D-V-PE-80R0

Ordering code: D-V-PE-80R0



- 1 V-PE-80R0-07
- 1 USB-M Universal, USB cable
- VisaLab Software
- Documentation Package

Reference table Corning® Varioptic® Lenses

Series	Codes	Description	Page	
A-Series	A-16F0	1.6mm CA, A-Series, 20 dpt dynamic with VIS anti-reflective coating	10	
	A-16F1	1.6mm CA, A-Series, 20 diopters dynamic with NIR anti-reflective coating		
	A-16F9	1.6mm CA, A-Series, 20 diopters dynamic with no anti-reflective coating		
	A-Series	A-25H0-D0	2.5mm CA, A-Series, 70 diopters dynamic with VIS anti-reflective coating	11
		A-25H1-D0	2.5mm CA, A-Series, 70 diopters dynamic with NIR anti-reflective coating	
		A-25H9-D0	2.5mm CA, A-Series, 70 diopters dynamic with no anti-reflective coating	
	A-Series	A-39N0	3.9mm CA, A-Series, 20 diopters dynamic with VIS anti-reflective coating	12
		A-39N1	3.9mm CA, A-Series, 20 diopters dynamic with NIR anti-reflective coating	
		A-39N9	3.9mm CA, A-Series, 20 diopters dynamic with no anti-reflective coating	
	A-Series	A-58N0	5.8mm CA, A-Series, 15 diopters dynamic with VIS anti-reflective coating	13
		A-58N1	5.8mm CA, A-Series, 15 diopters dynamic with NIR anti-reflective coating	
		A-58N9	5.8mm CA, A-Series, 15 diopters dynamic with no anti-reflective coating	
A-P Series	A-P-16F0-31	1.6mm CA, Packaged A-Series (VIS), 6 pins FPC-A-31, 20 diopters dynamic	14	
	A-P-16F1-31	1.6mm CA, Packaged A-Series (NIR), 6 pins FPC-A-31, 20 diopters dynamic		
	A-P-16F9-31	1.6mm CA, Packaged A-Series, 6 pins FPC-A-31 20 diopters dynamic		
	A-P-25H0-33	2.5mm CA, Packaged A-Series (VIS), 6 pins FPC-A-33, 18 diopters dynamic		
	A-P-25H1-33	2.5mm CA, Packaged A-Series (NIR), 6 pins FPC-A-33, 18 diopters dynamic		
	A-P-25H9-33	2.5mm CA, Packaged A-Series, 6 pins FPC-A-33, 18 diopters dynamic		
	A-P-25H0-D0-33	2.5mm CA, Packaged A-Series (VIS), 6 pins FPC-A-33, 70 diopters dynamic		
	A-P-25H1-D0-33	2.5mm CA, Packaged A-Series (NIR), 6 pins FPC-A-33, 70 diopters dynamic		
	A-P-25H9-D0-33	2.5mm CA, Packaged A-Series, 6 pins FPC-A-33, 70 diopters dynamic		
	A-P-39N0-37	3.9mm CA, Packaged A-Series (VIS), 6 pins FPC-A-37, 20 diopters dynamic		
	A-P-39N1-37	3.9mm CA, Packaged A-Series (NIR), 6 pins FPC-A-37, 20 diopters dynamic		
	A-P-39N9-37	3.9mm CA, Packaged A-Series, 6 pins FPC-A-37, 20 diopters dynamic		
	A-P-58N0-37	5.8mm CA, Packaged A-Series (VIS), 6 pins FPC-A-37, 15 diopters dynamic		
	A-P-58N1-37	5.8mm CA, Packaged A-Series (NIR), 6 pins FPC-A-37, 15 diopters dynamic		
A-P-58N9-37	5.8mm CA, Packaged A-Series, 6 pins FPC-A-37, 15 diopters dynamic			
A-PE Series	A-PE-25H0-33	2.5mm CA, Packaged A-Series(VIS) with electronics, 6 pins FPC-A-33, 18 diopters dynamic	15	
	A-PE-25H1-33	2.5mm CA, Packaged A-Series (NIR) with electronics, 6 pins FPC-A-33, 18 diopters dynamic		
	A-PE-25H9-33	2.5mm CA, Packaged A-Series with electronics, 6 pins FPC-A-33, 18 diopters dynamic		

Series	Codes	Description	Page
C-S-Series	C-S-25H0-026-43	Imaging module (M12) includes A-25H0 and FPC-A-43, EFL = 2.6 mm	16
	C-S-25H0-036-43	Imaging module (M12) includes A-25H0, and FPC-A-43, EFL = 3.6 mm	
	C-S-25H0-047-43	Imaging module (M12) includes A-25H0, and FPC-A-43, EFL = 4.7 mm	
	C-S-25H0-075-43	Imaging module (M12) includes A-25H0, and FPC-A-43, EFL = 7.5 mm	
	C-S-25H0-096-43	Imaging module (M12) includes A-25H0, and FPC-A-43, EFL = 9.6 mm	
	C-S-39N0-158-47	Imaging module (M12) includes A-39N0, and FPC-A-47, EFL = 15.8 mm	
	C-S-39N0-250-47	Imaging module (M12) includes A-39N0, and FPC-A-47, EFL = 25 mm	
C-H-Series	C-H-16F0-036-12	Imaging module (M8) includes A-16F0, and FPC-A-12, EFL = 3.6mm	17
C-u-Series	C-u-25H0-075-43	Inverted C-S-25H0-075	19
C-C-Series	C-C-39N0-A1-160	Imaging module (C-mount) Based on A-39N0, 2.74 μ m/20MP, 1.1" EFL = 16 mm	20
	C-C-39N0-A1-250	Imaging module (C-mount) Based on A-39N0, 2.74 μ m/20MP, 1.1" EFL = 25 mm	
	C-C-39N0-A1-350	Imaging module (C-mount) Based on A-39N0, 2.74 μ m/20MP, 1.1" EFL = 35 mm	
	C-C-39N0-160-I2C	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 16 mm (I2C)	
	C-C-39N0-160-R33	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 16 mm (RS232 3.3V)	
	C-C-39N0-160-R12	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 16 mm (RS232 12V)	
	C-C-39N0-160-SPI	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 16 mm (SPI)	
	C-C-39N0-250-I2C	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 25 mm (I2C)	
	C-C-39N0-250-R33	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 25 mm (RS232 3.3V)	
	C-C-39N0-250-R12	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 25 mm (RS232 12V)	
	C-C-39N0-250-SPI	Imaging module (C-mount) Based on A-39N0, 3.45 μ m/5MP, 2/3" EFL = 25 mm (SPI)	
C-T-Series	C-T-39N0-A1-005	Telecentric lens (C-mount) Based on A-39N0, Supports I2C and RS232, 0.5X magnification	21
	C-T-39N0-A1-010	Telecentric lens (C-mount) Based on A-39N0, Supports I2C and RS232, 1X magnification	
V-PE Series	V-PE-80R0-07	Packaged V-80R0 with electronics and FPC-V-07	23
Driver Boards	71020301B (USB-M Universal)	This board includes a Maxim driver and various FPC connectors for the A-P-Series, A-PE-Series, C-S-Series, C-H-Series and C-u-Series.. It is driven through USB and delivered with the development kits. (compatible with our software FocusLab)	25
	71020132B (Maxim Drivboard)	This board includes a Maxim driver and the needed FPC connectors (4 and 6 pins). It has been designed for fast driving of the adjustable lens directly from a microcontroller, an FPGA, a DSP, etc.	
	71020330A (C-C Com Board)	It enables communication directly with any of the C-C versions using FocusLab. (C-C-39N0-A1 20Mpx product line excluded)	
AF Explorer	D-AF-EXP-STD-075	D-AF-EXP-STD-075 is the default configuration of the Corning Varioptic AF Explorer kit. It is based on the Sony IMX 335 sensor and Corning Varioptic C-S-25H0-075 Auto Focus lens module	33

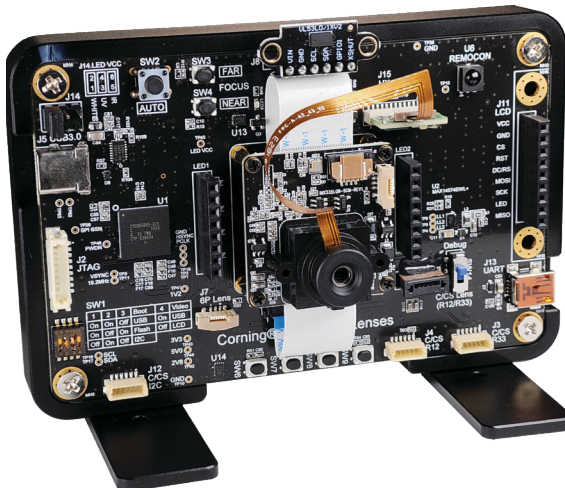
Corning® Varioptic® AF Explorer Development Kit

The Corning® Varioptic® AF Explorer is a comprehensive platform that produces fast and reliable auto focus based on Corning Varioptic liquid lens technology. The kit consists of several PCB boards with associated software and is provided in a ready-to-use format, including a USB camera system allowing straight-forward evaluation of Corning liquid lens products. The main structure is based on:

- an Image Signal Processor (ISP)
can be purchased separately for use in other designs
- a Cypress EZ-USB® CX3 USB 3.0 chip
- an image sensor board
- an integrated Time of Flight (TOF) sensor for distance measurement
- different lighting options
white, blue, and NIR LEDs (are included in the kit : White LEDs only)
- AF Lab Software that enables basic sensor settings, AF mode selection, AF algorithm, and more

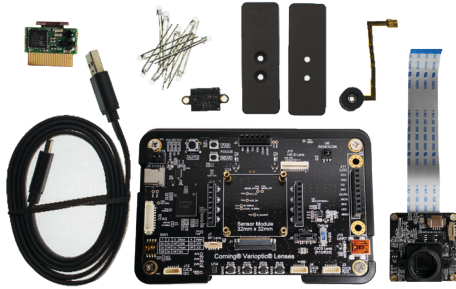
The kit is suited for camera developers wishing to study characteristics of the liquid lens. It offers various focus options, including manual focus, switched focus, closed-loop AF and open-loop AF - both triggered and continuous.

This kit can also be used as a reference design and a starting point for system designers, reducing time spent on development.



Default Configuration

D-AF-EXP-STD-075 is the default configuration of the Corning Varioptic AF Explorer kit. It is based on the Sony® IMX 335 sensor and Corning Varioptic C-S-25H0-075 Auto Focus Lens Module and includes:



- Main board
- Sensor board (Sony IMX 335 - 5MP 1/2.8")
- C-S-25H0-075 auto focus lens module
- A-PE series electronics (cf.p15)
- TOF sensor
- Dedicated software
- Several options available (added sensors, TFT LCD, ...)

Additional Options

The standard configuration of the Varioptic AF Explorer can be modified with these additional options:

- Sensor board with Sony IMX307 (2MP 1/2.8")
- Sensor board with Sony IMX335 (5MP 1/2.8")
- 2.8-inch LCD display to visualize live output of the camera system

These kit configurations can be used with C-C-series lenses and C-S- series lenses from Corning Varioptic Lenses. Select combinations are more compatible than others as listed in the chart below:

		Sensors	
		IMX307	IMX335
	Resolution	2 Mpx	5 Mpx
	Pixel Size	2.9 μm	2 μm
	Format	1/2.8"	1/2.8"
C-series modules	C-S-25H0-026	147°	
	C-S-25H0-036	85°	
	C-S-25H0-047	69°	
	C-S-25H0-075	47°	
	C-S-25H0-096	37°	
	C-S-39N0-158	24°	
	C-S-39N0-250	15°	
	C-C-39N0-160	23°	
	C-C-39N0-250	15°	

Compatibility	
Good	
Partial <i>(CRA mismatch, vignetting, ect.)</i>	

Documentation Package

With each Development Kit, Corning® Varioptic® Lenses deliver a complete set of application notes to assist the integration and development of the customer's product.

User Guides

- FocusLab user guide
- VHD user guide
- Board user guides (USB-M Universal, Maxim DrivBoard, C-Com board, AF Explorer)
- Microscopy user guide
- Tutorial videos

Integration

- Mechanical and opto-electrical integration guide
- Design and assembly rules
- Driver implementation guide
- Driver IC data sheets

Extended Details on Technology

- Marketing data sheet
- ZEMAX model: Focus configurations, $n(\lambda)$ specifications
- IGES/STEP models: 3D design and opto-mechanical integration

General

- Optical Wave Front Error
- Cosmetic specification
- Laser Applications

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