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THORLABS

WFS150-5C - JUL 20, 2018

Item # WFS150-5C was discontinued on July 20, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

SHACK-HARTMANN WAVEFRONT SENSORS, 1.3 MEGAPIXEL RESOLUTION

- CCD Sensor with 1.3 Megapixel Resolution
- Sensitivities up to λ/150
- Wavelength Ranges of 300 - 1100 nm or 400 - 900 nm
- Kits Available with Interchangable Microlens Arrays

WFS150-5C
Includes Post-Mounting Adapter

Application Idea
A WFS150-5C Mounted on the KM100WFS Kinematic Mount

OVERVIEW

Features

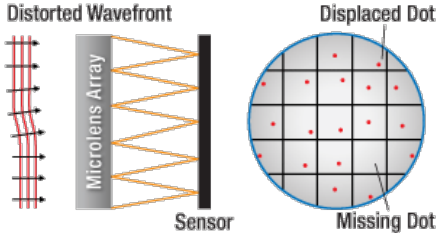
- CCD Camera Provides 1.3 Megapixel Resolution
- Real-Time Wavefront and Intensity Distribution Measurements
- Includes Interchangeable High-Quality Photolithographic Microlens Array
- Nearly Diffraction-Limited Spot Size
- Use with CW or Pulsed Light Sources
- USB Connection to PC
- Live Data Readout via TCP/IP
- Compact Housing: 45.5 mm x 32.0 mm x 40.4 mm with Baseplate
- Flexible Software Options
  - GUI Software
  - Instrument Driver Package for C Compilers
  - LabWindows™/CVI
  - LabVIEW™
  - DotNet
- Kinematic Mount Designed for Wavefront Sensors Available Separately (See Below)

Thorlabs' High-Resolution Shack-Hartmann Wavefront Sensors, which incorporate CCD cameras with 1.3 megapixel resolution, provide accurate measurements of the

Shack-Hartmann Wavefront Sensor Selection Guide			
	Max Speed[a]	Wavefront Accuracy[a]	Wavefront Sensitivity[a]
CCD Wavefront Sensor	Up to 15 Hz	Up to λ/50	Up to λ/150
High-Speed, CMOS Wavefront Sensor	Up to 1120 Hz	Up to λ/60	Up to λ/200

- Dependent on Microlens Array

Operation Principles



wavefront shape and intensity distribution of beams. These wavefront sensors are available with either a chrome-masked microlens array for use in the 300 - 1100 nm range or an AR-coated microlens array for use in the 400 - 900 nm range. The former has a lenslet pitch of 150 µm whereas the latter is available with a lenslet pitch of either 150 or 300 µm. These three offerings allow the end user to select a system that offers high spatial resolution, enhanced contrast, or high wavefront accuracy. Please note that calibration of the microlens-camera pair is required; to purchase a new lenslet array for a previously purchased Shack-Hartmann Wavefront Sensor, please contact Technical Support for a quotation on the microlens array and calibration service.

If your application would benefit from a fast wavefront sensor, please see our line of Shack-Hartmann wavefront sensors with frame rates up to 1120 Hz. For more information about choosing the appropriate Shack-Hartmann wavefront sensor for a particular application, see the *Selection Guide* tab above.

Schematic of a Mircrolens Array Focusing a Distorted Wavefront

The Shack-Hartmann sensor consists of a lenslet array and a camera. When a wavefront enters the lenslet array, a spotfield is created on the camera; each spot is then analyzed for intensity and location. Using this method, Shack-Hartmann wavefront sensors can dynamically measure the wavefronts of laser sources or characterize the wavefront distortion caused by optical components. In addition, they can provide real-time feedback for adaptive optics systems and are included for this reason in Thorlabs' Adaptive Optics Kits. For more details on the theory of Shack-Hartmann wavefront sensing, see the *SH Tutorial* tab above.

Shack-Hartmann Kits with Two Microlens Arrays

Thorlabs also offers wavefront sensor kits (Item # WFS-K1 and WFS-K2) that include two microlens arrays and the base CCD camera unit loaded with the appropriate calibration data for the two lenslet arrays. Switching lenses is easy using the provided pick-up tool; the patented magnetic holder (US Patent No: 8,289,504) precisely positions the array correctly every time. These kits are ideal for situations where more than one light source or optical setup needs to be analyzed.

Select wavefront sensors are available in our adaptive optics kits, shown above.

Accessories

Each Shack-Hartmann Wavefront Sensor and Kit comes in a convenient storage and carrying case. Mounting accessories include an SM1A9 C-Mount to internal SM1 (1.035"-40) thread adapter for mounting Ø1" lens tubes and mounted optics, such as Neutral Density Filters, and a base plate for attaching Ø1/2" posts.

GUI Software

The included software package offers a user-friendly graphical interface with tools for choosing camera setting, calibration, analysis, and display options. All sensors require a USB2.0 port to operate. The software also includes drivers for C compilers, LabVIEW™, LabWindows/CVI™, and DotNet for integration into custom system control and data collection software. For more information on the included software or to download the latest version, see the *Software* tab above.

Adaptive Optics Kits

In an effort to bring adaptive optics to even more research fields, Thorlabs has partnered with Boston Micromachines Corporation (BMC) to provide adaptive optics kits. These kits bundle the three primary components for any adaptive optics system: a Multi-DM MEMS deformable mirror system, a WFS150-5C Shack-Hartmann Wavefront Sensor, and real-time control software. In addition, the kits (shown in the photo to the right) also include a light source, all collimation/imaging optics, and all mounting hardware necessary (breadboard not included). These kits are specifically designed to provide an affordable, easy-to-use adaptive optics solution that can be integrated into a research system in hours instead of months.

SPECS

Camera Specifications

Item #	WFS150-5C	WFS150-7AR	WFS300-14AR
Detector Array Type	CCD		
Camera Resolution (Max)	1280 x 1024 Pixels, Selectable		
Pixel Size	4.65 µm x 4.65 µm		
Aperture Size (Max)	5.95 mm x 4.76 mm		
Frame Rate (Max)	15 Hz		
Exposure Range	79 µs - 65 ms		
Shutter	Global[a]		
Image Digitization	8 Bit		

- A global shutter exposes the entire detector at one time.

Microlens Array Specifications

Item #	WFS150-5C	WFS150-7AR	WFS300-14AR
Wavelength Range	300 nm - 1100 nm	400 nm - 900 nm	400 nm - 900 nm
Effective Focal Length (When Mounted in WFS)	3.7 mm	5.2 mm	14.2 mm
Nominal Focal Length	5.2 mm	6.7 mm	18.6 mm
Reflectivity	<25%	<1%	<1%
Number of Active Lenslets	Selectable by Software, Depending on Microlens Array		
Number of Active Lenslets (Max)	39 x 31		19 x 15
Substrate Material	Fused Silica (Quartz)		
Free Aperture	Ø9 mm		
Lenslet Grid Type	Square Grid		
Lenslet Pitch	150 µm		300 µm
Lens Shape[a]	Round, Plano-Convex Spherical		Square, Plano-Convex Parabolic
Fill Factor (Approximate)[b]	74.5%		100%
Lens Size	Ø146 µm		300 µm x 300 µm
Coating	Chrome Mask	Anti-Reflection	
Array Size	10 mm x 10 mm x 1.2 mm		

- The convex surfaces face the camera.
- The Fill Factor is a measure of the fraction of incident light reaching the detector. For the WFS150-5C and WFS150-7AR, the fill factor is less than 100% because the round lenses are arranged on a square grid.

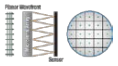
General Specifications

Item #	WFS150-5C	WFS150-7AR	WFS300-14AR
Wavefront Accuracy[a]	λ/15 rms @ 633 nm		λ/50 rms @ 633 nm
Wavefront Sensitivity[b]	λ/50 rms @ 633 nm		λ/150 rms @ 633 nm
Wavefront Dynamic Range[c]	>100λ @ 633 nm		>50λ @ 633 nm
Local Wavefront Curvature[d]	>7.4 mm	>10.0 mm	>40.0 mm
Optical Input Connector	C-Mount		
Physical Size (H x W x D)	40.4 mm x 32.0 mm x 45.5 mm		
Power Supply	<1.5 W via USB		
Operating Temperature	+5 to +35 °C (Non-condensing)		
Storage Temperature	-40 to +70 °C		
External Trigger Input Specifications			
Save Static Voltage Level	0 to 30 V DC		
Low Level	0 to 2.0 V		
High Level	5.0 V to 24 V		
Trigger Slope	Software Selectable: Low-High or High-Low		
Input Current (Max)	10 mA		
Pulse Width (Min)	100 µs		
Slew Rate (Min)	35 V / msec		

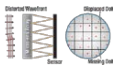
- Absolute accuracy using internal reference. Measured for spherical wavefronts with a known radius of curvature.
- Typical relative accuracy with respect to a reference wavefront (user calibration). Reference and each measurement values are averaged over 10 frames.
- Peak-to-valley wavefront deformation over entire aperture of wavefront sensor.
- Radius of wavefront curvature over single lenslet aperture.

All technical data are valid at 23 ± 5 °C and 45 ± 15% relative humidity (non-condensing).

How a Shack-Hartmann Wavefront Sensor Works



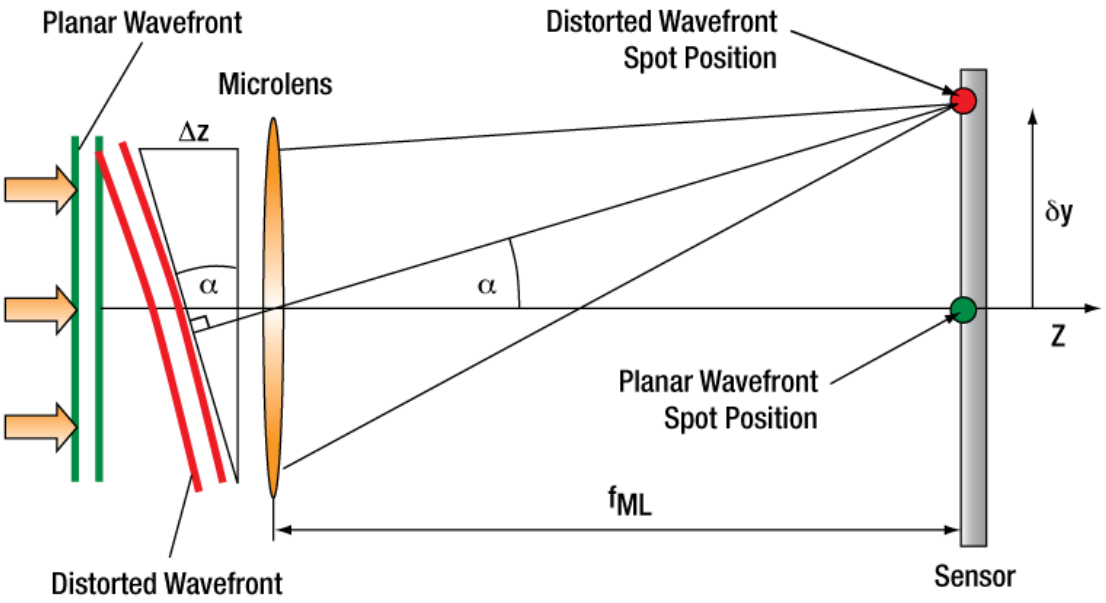
A Shack-Hartmann wavefront sensor uses a lenslet array to divide an incoming wavefront into an array of smaller beams. Each beam is focused onto a CMOS camera that is placed at the focal plane of the lenslet array, as shown in the figure to the left. If a uniform, planar wavefront is incident on the Shack-Hartmann sensor, each lenslet forms a spot along the optical axis of the lenslet. This yields a regularly spaced grid of spots on the detector.



A distorted wavefront, however, will cause some lenslets to focus with the spots displaced from the optical axis. Therefore, the light imaged on the sensor will consist of some regularly spaced spots mixed with displaced spots and missing spots. This information can be used to calculate the shape of the wavefront that was incident on the microlens array. Shack- Hartmann type wavefront sensors can be used to characterize the performance of optical systems. In addition, they are increasingly used in applications where real-time monitoring of the wavefront is used to control an adaptive optic with the intent of removing the wavefront distortion before creating an image.

Wavefront Distortion and Spot Displacement

As discussed above, each microlens of the lenslet array collects the light falling onto its aperture and generates a single spot at the detector plane. The figure below is a detail of a wavefront incident on a single microlens. The spot positions will be directly behind the lenses (shown in green) only if the incident wavefront is flat and parallel to the plane of the lenslets. For a wavefront which is distorted in the region of the microlens, the spot positions will be deviated in the X and Y direction (as shown by the red dot) so that every spot lies away from the optical axis z of its associated microlens by an angle θ. This angle θ is the same as the angle between the distorted wavefront and the planar wavefront, as shown in the figure.



Parameters Affecting Shack-Hartmann Performance

Four parameters that influence the performance of a Shack-Hartmann wavefront sensor are the number of lenslets that cover the detector active area, the dynamic range, the measurement sensitivity, and the lenslet focal length. The number of lenslets restricts the maximum number of Zernike coefficients that a reconstruction algorithm can reliably calculate. When selecting the number of lenslets required, consider the amount of distortion being modeled (i.e., how many Zernike coefficients are needed to effectively represent the true wave aberration).

Sensitivity (α_{min}) is a function of the minimum detectable spot displacement (δy_{min}), as described by the equation:

$$\alpha_{min} = \delta y_{min} / f$$

where f is the focal length of the microlens. Dynamic range, θ_{max}, is a measure of the maximum extent of phase that can be measured:

$\alpha_{max} = \delta y_{max} / f = (d / 2) / f$

where d is the diameter of the microlens. Both of these equations were derived using the small angle approximation. α_{min} is the minimum detectable wavefront slope that can be measured by the wavefront sensor. The minimum detectable spot displacement δy_{min} depends on the pixel size of the detector, the accuracy of the centroid algorithm, and the signal to noise ratio of the sensor. α_{max} is the maximum wavefront slope that can be measured by the wavefront sensor and corresponds to a spot displacement of δy_{max}, which is equal to the lenslet radius.

A Shack-Hartmann sensor's measurement accuracy (i.e., the minimum wavefront slope that can be measured reliably) depends on its ability to precisely measure the displacement of a focused spot with respect to a reference position. A conventional algorithm will fail to determine the correct centroid of a spot if it partially overlaps another spot or if the focal spot of a lenslet falls outside of the area of the sensor assigned to detect it (spot crossover). Special algorithms can be implemented to overcome these problems, but the limit the dynamic range of the sensor. The dynamic range of a system can be increased by using a lenslet with either a larger diameter or a shorter focal length. Increasing the dynamic range by increasing the lenslet diameter decreases the number of Zernike coefficients available to represent the wavefront. Conversely, increasing the dynamic range by shortening the focal length decreases the sensor's sensitivity. Ideally, a lenslet with the longest focal length that meets both the dynamic range and measurement sensitivity requirements should be used.

The Shack-Hartmann wavefront sensor is capable of providing information about the intensity profile as well as the calculated wavefront.

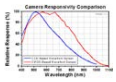
SELECTION GUIDE

Selecting a Shack-Hartmann Wavefront Sensor

Shack-Hartmann Wavefront Sensor Selection Guide			
	Max Speed[a]	Wavefront Accuracy[a]	Wavefront Sensitivity[a]
CCD Wavefront Sensor	Up to 15 Hz	Up to λ/50	Up to λ/150
High-Speed, CMOS Wavefront Sensor	Up to 1120 Hz	Up to λ/60	Up to λ/200

- Dependent on Microlens Array

Thorlabs offers two different cameras for a variety of wavefront sensing applications. The wavefront sensors on this page feature a high-speed CMOS camera capable of reaching frame rates up to 1120 Hz (microlens array dependent). Thorlabs also offers a line of Shack-Hartmann wavefront sensors with a CCD camera. Each camera type is available with one of three microlens arrays offering flexibility in wavelength range, spatial resolution, spot contrast, and wavefront accuracy.

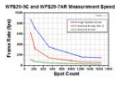


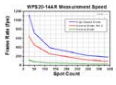
CCD sensors exhibit lower noise and higher image uniformity, but provide much slower frame rates compared to CMOS-based wavefront sensors. The high frame rate of the CMOS detector enables more wavefront measurements per second and thus can detect faster wavefront fluctuations, an important feature for sensors used in high-speed adaptive optics systems.

Measurement Speed

The CCD-based wavefront sensors have a measurement speed of 15 fps that is independent of the spot count (i.e. independent of the microlens array pitch). By contrast, the measurement speed of the wavefront sensors with CMOS cameras will decrease as the spot count increases. The plots below provide a comparison of performance of the CMOS sensor when used with the 150 µm and 300 µm pitch microlens arrays.

The WFS20 CMOS-based wavefront sensors support three different measurement modes. In the normal measurement mode, the entire spotfield image is transmitted to the PC. This mode can also be used with 2X binning, reducing the amount of data that needs to be transfered to the PC and increasing the measurement speed. In this mode, the spot location is still reported based on the real camera pixel array. Alternatively, the sensor can be used in a "High-Speed Mode" where the wavefront calculations are carried out in the control box and only the centroid locations are transmitted to the PC. This greatly decreases the amount of data that needs to be tranferred to the PC and provides the fastest measurement speeds. However, since the spotfield image is not transferred to the PC, it is harder to detect certain errors, such as those caused by camera saturation.





Choosing a Microlens Array

Each Shack-Hartmann Wavefront Sensor is available with 3 different microlens arrays. The table to the lower right details the features of the microlens included with each item.

MLA150M-5C Microlens Features

This microlens array includes a chrome mask that prevents light from passing between the microlenses. This leads to a higher contrast in the spot field but will considerably increase the amount of back reflections. This microlens array can be used over an extended wavelength range of 300 nm to 1100 nm. The array features a 150 µm lens pitch, which offers a larger number of spots and thus a higher spatial resolution of the wavefront, and a wider wavefront dynamic range because of their shorter focal length.

Features of WFS Microlens Arrays				
Microlens Array #	**High Spot Contrast**	**High Wavefront Accuracy**	**High Spatial Resolution**	**Low Back Reflection**
MLA150M-5C	✓		✓	
MLA150M-7AR			✓	✓
MLA300M-14AR		✓		✓

MLA150M-7AR and MLA300M-14AR Microlens Features

Both of these microlens arrays are AR coated for the 400 nm to 900 nm wavelength range, making them ideal for applications that are sensitive to back reflections. The MLA150M-7AR microlens array has a 150 µm lens pitch, which offers a larger number of spots and thus a higher spatial resolution of the wavefront, and a wider wavefront dynamic range because of their shorter focal length. The MLA300M-14AR has a 300 µm lens pitch that supports higher wavefront accuracy and sensitivity at the expense of dynamic range and spatial resolution.

Microlens Arrays			
Microlens Array #	**MLA150M-5C[a]**	**MLA150M-7AR[a]**	**MLA300M-14AR[a]**
Coating	Chrome Masked for 300 - 1100 nm	AR Coated for 400 - 900 nm	
Lenslet Pitch	150 µm		300 µm
Wavefront Sensor Item #			
WFS20-5C(/M) WFS150-5C	✓		
WFS20-7AR(/M) WFS150-7AR		✓	
WFS20-14AR(/M) WFS150-14AR			✓
WFS20-K1(/M) WFS150-K1	✓		✓
WFS20-K2(/M) WFS150-K2		✓	✓

- The microlens array # refers to the identifier printed on the front of the microlens array housing(s) and cannot be ordered independently of a WFS20 sensor.

SOFTWARE

Software

Download

Click on the Software button to the right for the latest version of Thorlabs' Shack-Hartmann Wavefront Sensor Software Package. The download includes the software package with a graphical user interface for operating the WFS in standard applications and support for developers who want to extend or adapt the functionality of the device to their special requirements.

Software

Version 4.6.0 (November 4, 2015)

The wavefront sensor software package for Windows™ Vista, 7, 8.1, or later (32 or 64 bit).

Software Update**

Version 4.6.3 (February 5, 2016)

This is the Advanced Beta Version of the wavefront sensor software package for Windows™ Vista, 7, 8.1, or later (32 or 64 bit).

- Ability to Save Spotfield Data to Various File Types

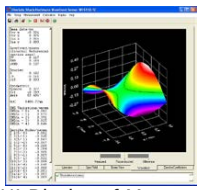
System Requirements:

- Windows™ Vista, 7, 8.1, or Later (32 or 64 Bit)
- USB 2.0 or 3.0* Port
- Graphic Resolution: 1024 x 768 Min

*When used with USB 3.0, the WFS150 and WFS300 wavefront sensors operate with reduced speed and increased minimum exposure times.

**This is the Advanced Beta Version, also known as a Release Candidate, of Thorlabs' Wavefront Sensor Software. It is provided as is for users who would benefit from the additional functionality. This software version has undergone preliminary bug testing. If it passes further tests without issue, it will eventually be released as the next official version of the wavefront sensor software.

Software and Graphical User Interface



GUI Display of Measured Wavefront

Display/Output Options

For screen images of the GUI display options, please click on the links:

- Raw Spotfield Image
- Zernike Coefficients
- Measured and Reconstructed 3D Wavefront
- Irradiance Distribution
- Lineview Intensity of Pixel Column
- Tabulated Output
- Flexible Export Option: Text or Excel File
- Live Data Readout via TCP/IP to a DataSocket Server

Calculated Parameters

- Beam Centroid and Diameter
- Modal and Zonal Reconstructed Wavefront
- Max Variance of Wavefront, Peak-to-Valley (PV), and RMS of Wavefront
- Zernike Representations of Tilt, Defocus, Astigmatism, Coma, Spherical, and Higher Order Aberrations
- Fourier and Optometric Parameters

Included Drivers

The software includes a driver package for constructing custom applications with the following software packages:

- C Compilers
- LabWindows™/CVI
- LabVIEW™
- DotNet

1.3 Megapixel Shack-Hartmann Wavefront Sensor

Item #	WFS150-5C	WFS150-7AR	WFS300-14AR
Wavelength Range	300 - 1100 nm	400 - 900 nm	400 - 900 nm
Effective Focal Length	3.7 mm	5.2 mm	14.0 mm
Lens Array Coating	Chrome Mask	AR Coated	
Lenslet Pitch	150 µm		300 µm
Wavefront Accuracy	λ/15 rms		λ/50 rms
Wavefront Sensitivity	λ/50 rms		λ/150 rms
Camera Sensor Type	CCD		
Frame Rate	15 Hz		
Camera Resolution	1280 x 1024 Pixels Max, Selectable		

Part Number	Description	Price	Availability
WFS150-5C	Shack-Hartmann WFS, 150 µm Pitch, Chrome Masked, 300 - 1100 nm	$4,089.18	Today
WFS150-7AR	Shack-Hartmann WFS, 150 µm Pitch, AR Coated: 400 - 900 nm	$4,089.18	Today
WFS300-14AR	Shack-Hartmann WFS, 300 µm Pitch, AR Coated: 400 - 900 nm	$4,089.18	Today

1.3 Megapixel Shack-Hartmann Wavefront Sensor Kits

The WFS kits combine the base camera unit and two interchangeable microlens arrays. The chart below contains the properties of the lens arrays included with each kit, for more details on the lens and camera properties please see the *Specs* tab above.

Item #	Lens Array 1	Lens Array 2
WFS-K1	Chrome Mask: 300 - 1100 nm, Pitch = 150 µm	AR Coated: 400 - 900 nm, Pitch = 300 µm
WFS-K2	AR Coated: 400 - 900 nm, Pitch = 150 µm	AR Coated: 400 - 900 nm, Pitch = 300 µm

How to Interchange Microlens Arrays

The microlens arrays are mounted with a precision patented magnetic holder. They can be easily interchanged and returned to the same position using the pickup tool that is included with the kit, as shown in the photo to the right.

Part Number	Description	Price	Availability
WFS-K1	Customer Inspired! High Sensitivity WFS Kit, 150 µm Pitch, Chrome Masked and 300 µm Pitch, AR Coated	$4,954.14	Today
WFS-K2	Customer Inspired! High Sensitivity WFS Kit, 150 µm Pitch, AR Coated and 300 µm Pitch, AR Coated	$4,954.14	Today

USB and Trigger Cables

The CAB-DCU-T2 cable is used to replace the USB to Micro Sub-D cable included with the 1.3 megapixel Shack-Hartmann sensors in applications where a trigger is required. For specifications for the trigger input, please see the *Specs* tab above.

Item #	Device Side Connector	Trigger Input Connector	PC Connector	Shielding	Length
CAB-DCU-T2		Bare Wire	USB 2.0, Male	Double Shielded, 80 °C, 30 V	3 m

Part Number	Description	Price	Availability
CAB-DCU-T2	Customer Inspired! USB and Trigger Cable (In Only) for DCU Series and DCC1240 Cameras, 3 m	$80.34	Today

Upgrade Service for Wavefront Sensors

Customers who purchased either a WFS150 or WFS150C wavefront sensor of our superseded earlier generation with fixed lens arrays can upgrade these SH sensors to one of the current WFS150-5C, WFS150-7AR, or WFS300-14AR models. If you order this upgrade service, your old WFS sensor must be sent back to Thorlabs. Please contact your local Tech Support Team for instructions, your choice for the updated model, and other details.

Part Number	Description	Price	Availability
WFS-EXP	**WFS Upgrade Service to Exchangeable Microlens Arrays**	**$857.82**	**Lead Time**

Kinematic Mount for Wavefront Sensors

Click to Enlarge
The KM200PM mount platform's larger size allows for flexible mounting options.

- Two 80 TPI Adjusters for ±4° of Fine Tip and Tilt Control
- 8 mrad Adjustment per Revolution
- Platform can be Removed and Secured to Either Arm Enabling Left- or Right-Handed Configuration
- Removable Knobs Expose Adjuster Screws with Hex Socket

Thorlabs' KM100WFS and KM200PM(/M) Kinematic Platform Mounts provide kinematic control for our CCD-Based and High-Speed CMOS-Based Shack-Hartmann Wavefront Sensors. Please note that the optical axis of the sensors will not be centered over the optical post. The animation to the right shows how to convert between the left- and right-handed orientations for the KM100WFS. This process is very similar for the KM200PM(/M)

Platform Specifications			
Item #	**Tapped Holes**	**Through Holes**	**Platform Depth[a]**
KM100WFS	-	#8 (x2) M3 (x2)	1.52" (38.6 mm)
KM200PM	6-32 (x16) 8-32 (x4)	#8 (x2)	2.10" (53.3 mm)
KM200PM/M	M4 (x21)	M4 (x2)	53.3 mm (2.10")

- The Distance between the Front and Back of the Platform

The KM100WFS can accommodate the WFS150 wavefront sensors, and features a similar design to our KM100PM platform. Two M3 through holes are also provided for mounting a WFS150 CCD-based wavefront sensor. Each CCD-based wavefront sensor is shipped with an adapter plate for post mounting; two lengths of M3 screws are included with the KM100WFS so that the wavefront sensor can be mounted with or without the adapter plate attached. The DCU CCD Cameras and the WFS300 and WFS20 sensors can also be mounted on the KM100WFS.

The KM200PM(/M) mount is larger than the KM100WFS(/M), and can mount the WFS150 sensors using one of the #8 (M4) through holes near the front edge of the plate. The larger profile and number of holes provides a variety of mounting options. The platform is secured to the front plate using two 4-40 screws with a 3/32" hex [the KM200PM/M uses M2.5 screws with a 2 mm (5/64") hex]. The two pieces of the mounting platform assembly are held together with two 3-48 screws [5/64" (2 mm) hex]. If desired, the mounting plate can also be removed and replaced with a user-supplied alternative, enabling custom mounting options.

Part Number	Description	Price	Availability
KM200PM/M	**Kinematic Prism Mount, 53.3 mm Deep, M4 Taps**	**$120.36**	**Today**
KM100WFS	**Kinematic Mount for Thorlabs' Wavefront Sensors**	**$83.39**	**Today**
KM200PM	**Kinematic Prism Mount, 2.10" Deep, 6-32 and 8-32 Taps**	**$120.36**	**Today**


Wavefront Sensor
THORLABS
LA150-5C