

## ImageMaster® Afocal

Telescope test bench







# Passion for optics

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TRIOPTICS develops and produces the world's largest range of optical measurement and manufacturing technology for the development, quality control and production of lenses, lens systems and camera modules.



# ImageMaster® Afocal

## Applications

### Image quality testing for telescopes, riflescopes, binoculars and spotting scopes

Afocal optics, such as those used in riflescopes, are often still tested today using purely visual test procedures. The results are therefore based on the subjective assessment of the tester and thus the repeatability of the measurement results is not guaranteed. Due to the multitude of determining factors, subjective quality testing often reaches its limits even

among the most experienced professionals. For image quality testing of optical afocal systems TRIOPTICS has developed the new ImageMaster® Afocal telescope test bench. The horizontal measurement system is well suited for typical afocal samples. With the ImageMaster® Afocal optical afocal systems like telescopes, riflescopes, binoculars and spotting scopes are tested in terms of functionality and image quality with a variety of specific optical parameters.



Especially for high-precision image quality measurement of riflescopes and telescopes, the ImageMaster® Afocal has established itself as a groundbreaking solution. The measurement of image quality based on MTF and numerous other parameters such as chromatic aberrations or the exact magnification is an

essential prerequisite for the accurate quality assessment and flawless functionality of these afocal optics. The ImageMaster® Afocal is suitable both for individual measurements in development and for automated end-of-line tests in production.

## Key features

- Horizontal measurement system for measuring image quality of optical afocal systems (e. g. riflescopes and binoculars)
- Measurement process: manual or fully automated
- Measurement at infinite and finite conjugates
- ImageMaster® MTF Lab Software

In its standard configuration a wide range of parameters such as MTF or magnification is easily measured with the ImageMaster® Afocal. With its focusable collimator also specific measurements like parallax can be performed in an easy and fast way.

In order to meet individual requirements, the test bench offers flexible configuration options

for measurement of different specific parameters of optical afocal systems, for instance the subjective as well as the objective field of view. Another important parameter, especially for riflescopes and spotting scopes is the eyerelief. It rounds up the versatile measurement functionality of the ImageMaster® Afocal.

# ImageMaster® Afocal

## Measurement of riflescopes, binoculars and spotting scopes

Are you looking for an automated measurement solution to determine the image quality of binoculars and spotting scopes? Sample holders make the difference!



Illustration 1: Measurement of riflescopes

Suitable sample holders for binoculars and spotting scopes enable precise and automated image quality measurement of these afocal optics.



Illustration 2: Sample mounting of binoculars

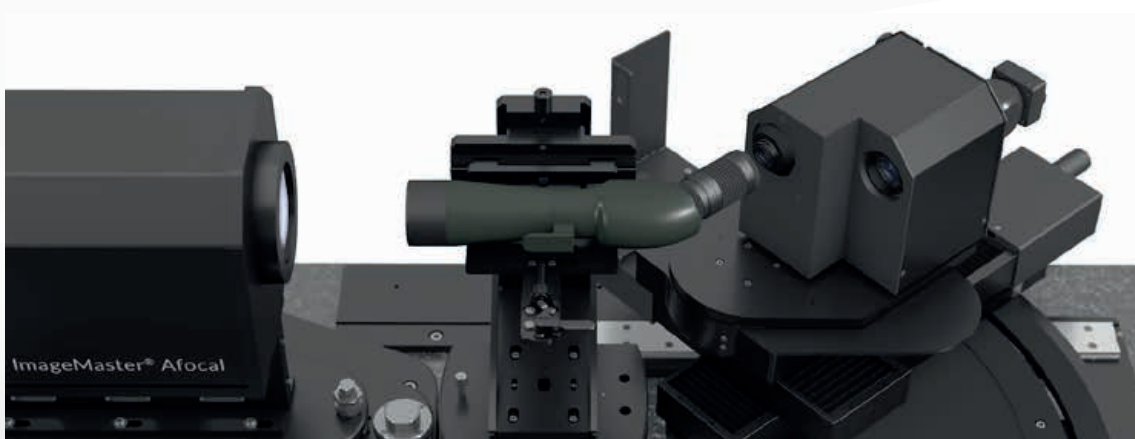
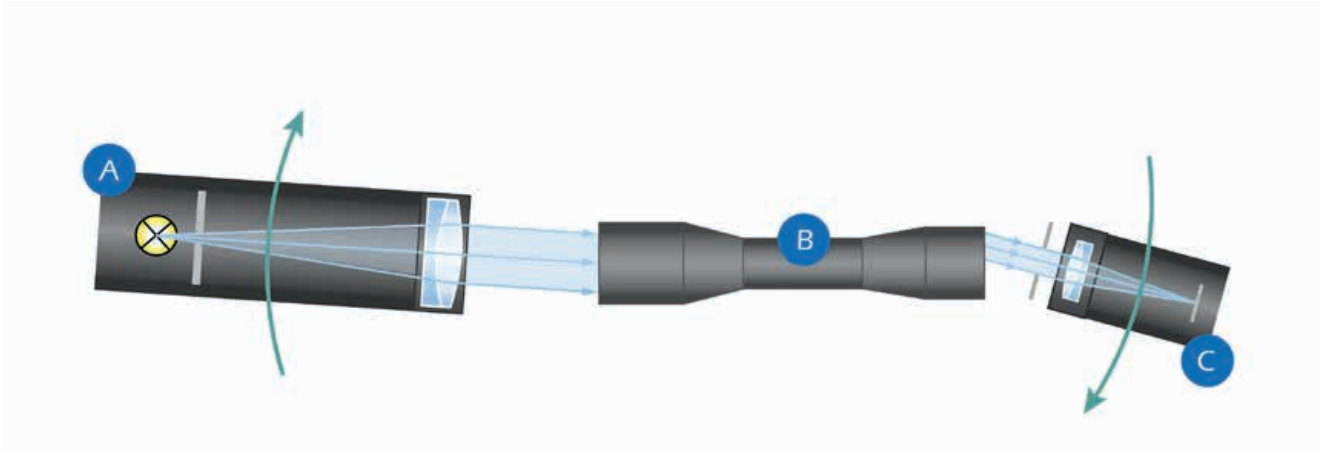


Illustration 3: Sample mounting of spotting scopes



# ImageMaster® Afocal

## Measurement principle and parameters



The ImageMaster® Afocal measures at infinite and finite conjugates. A collimator (A) simulates a distant object which may be located at infinity or some closer distance. A motorized video telescope (C) views the image created by the sample (B).

The measurement process with the ImageMaster® Afocal is manual or fully automated. The measurement is possible for finite and infinite object distances. A wide range of parameters such as the MTF or magnification are already measured in the standard configura-

tion. Customizable measurement sequences ensure operator independence in the measurement process and deliver objective measurement results. Specific measurements such as parallax can be easily performed with a focusable collimator. Measurements of other specific parameters, such as the eyerelief of riflescopes and spotting scopes or the subjective and objective field of view is also measured easily and precisely with the versatile system.

The ImageMaster® Afocal test bench measures the following parameters:

- MTF on-axis and off-axis
- Magnification
- Distortion
- Lateral chromatic aberration
- Longitudinal chromatic aberration
- Astigmatism
- Field curvature
- Parallax
- Field of view, objective and subjective
- Eyerelief

# ImageMaster® Afocal

## Advantages at a glance

- **Precision**

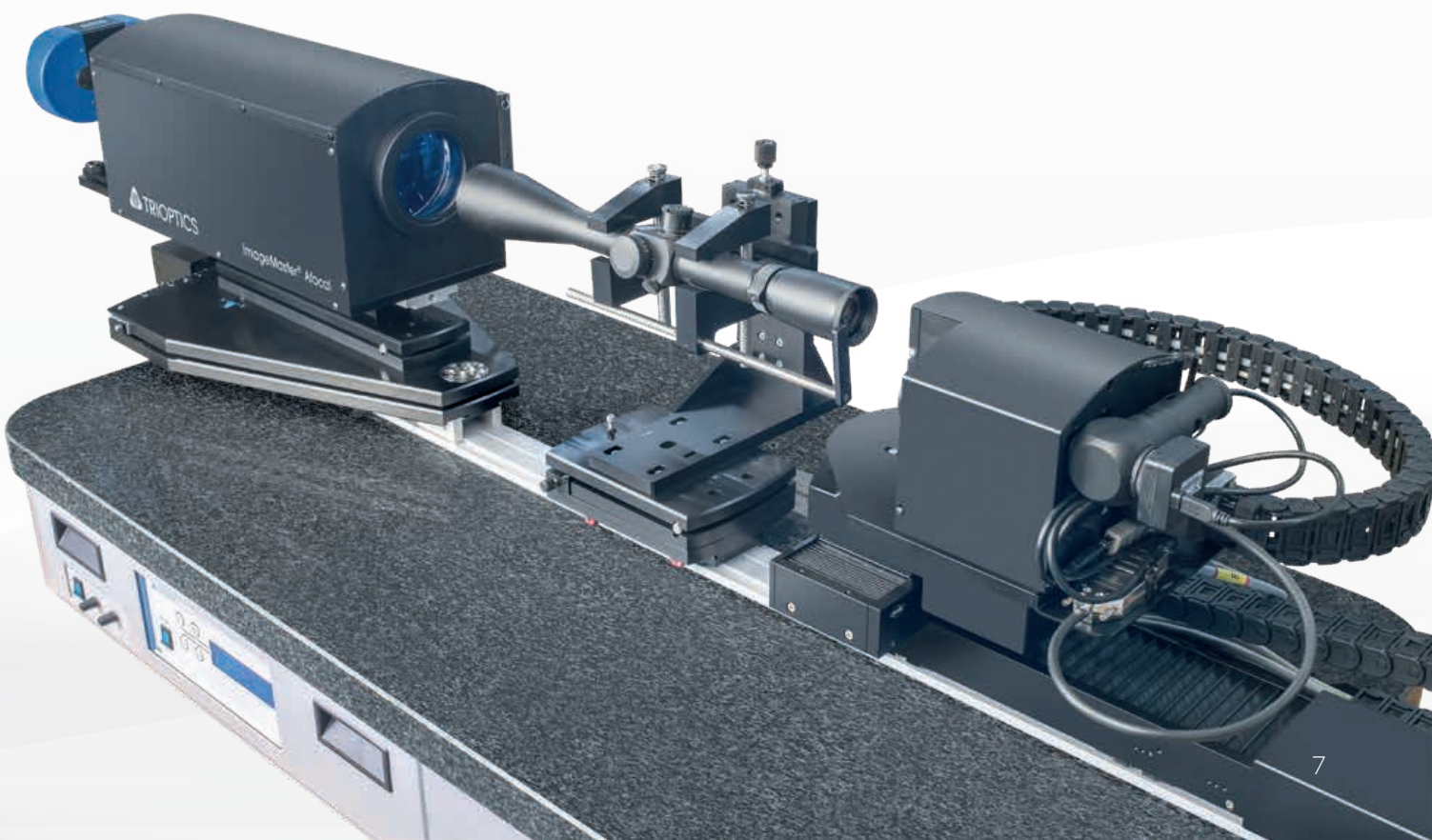
Does it really make sense to rely solely on subjective quality assessments in the field of afocal optics, where maximum precision is required? Numerous parameters such as chromatic aberrations or knowledge of the exact magnification are decisive factors for quality assessment. The precise measurement of these parameters is an essential precondition for perfect functionality.

- **Flexibility**

The ImageMaster® Afocal telescope test bench is designed for testing the image quality of afocal samples such as telescopes and riflescopes. Options and suitable sample holders allow the measurement of binoculars and spotting scopes.

- **Operator independent**

The horizontal measurement device has been specially developed for precise and automated measurement of the image quality (MTF and further parameters) of afocal optics. The image quality is determined objectively and thus operator-independently.



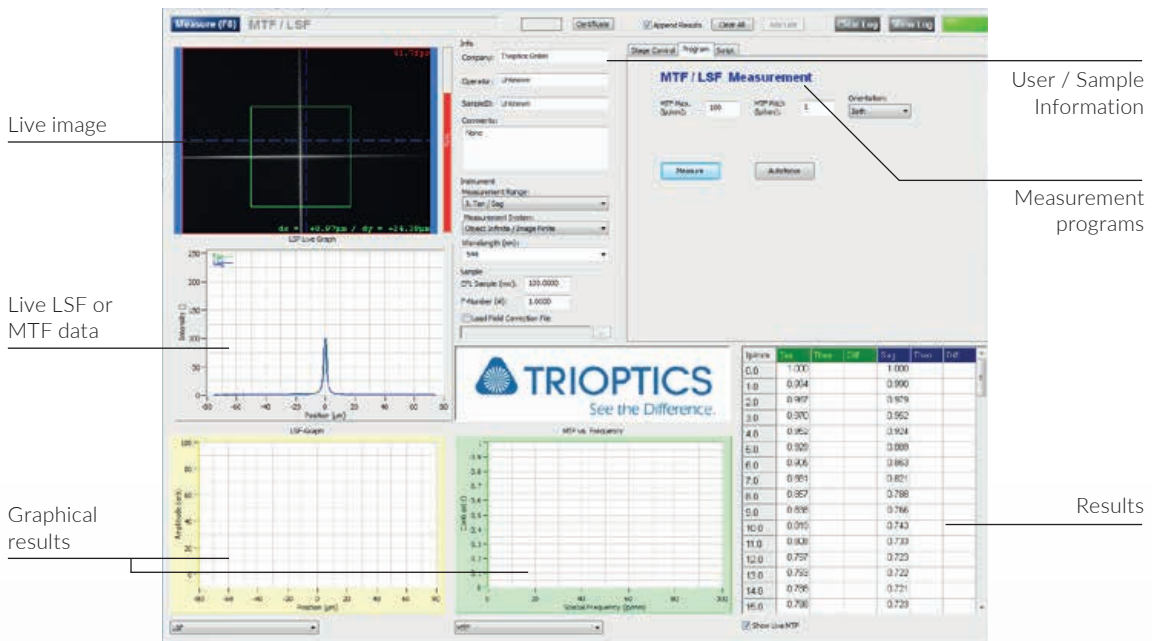
# ImageMaster® Afocal

## Software

### MTF Lab for ImageMaster® Afocal

The powerful ImageMaster® MTF Lab software package provides an easy-to-use graphical user interface and a complete functionality for fast

image quality measurements. It is the standard software for the ImageMaster® Afocal and other MTF measurement devices from the ImageMaster® HR range.



MTF Lab software for ImageMaster® Afocal

Its intuitive user interface shows a live image of the detector, a live LSF measurement and a live MTF calculation. An overview about the measurement results is given by graphical diagrams.

Information about the user and the sample under test as well as user comments can easily be entered and will be shown in the certificate. An intuitive menu enables the user to select different measurement programs and parameters to be measured. Standard MTF measurements as well as more complex measurements like MTF vs. field vs. focus are carried out easily without additional user

actions during the measurement process. The software has been developed for MTF measurement and many other parameters. It is suited for standard targets and filters, but also customized reticles and filters can be positioned with a reticle and filter changer and processed by the software. The software is able to completely automate the measurement using the easy but powerful scripting functionality. This means that after setting up the sample, the operator only has to start the script. From that moment on, he no longer has to keep an eye on the process the



whole time. Rather, he can perform measurements with several instruments at the same time or do other work in the meantime. Dedicated configuration files are available for different applications. For example, a set for measurement of riflescopes can be selected as well as different sets with different settings for

measuring binoculars or spotting scopes. Each sample-specific program contains a complete set of measurement parameters. The MTF Lab scripting tool is used to predefine individual measurement routines by writing short scripts for the sequence of measurement of different parameters in one run.

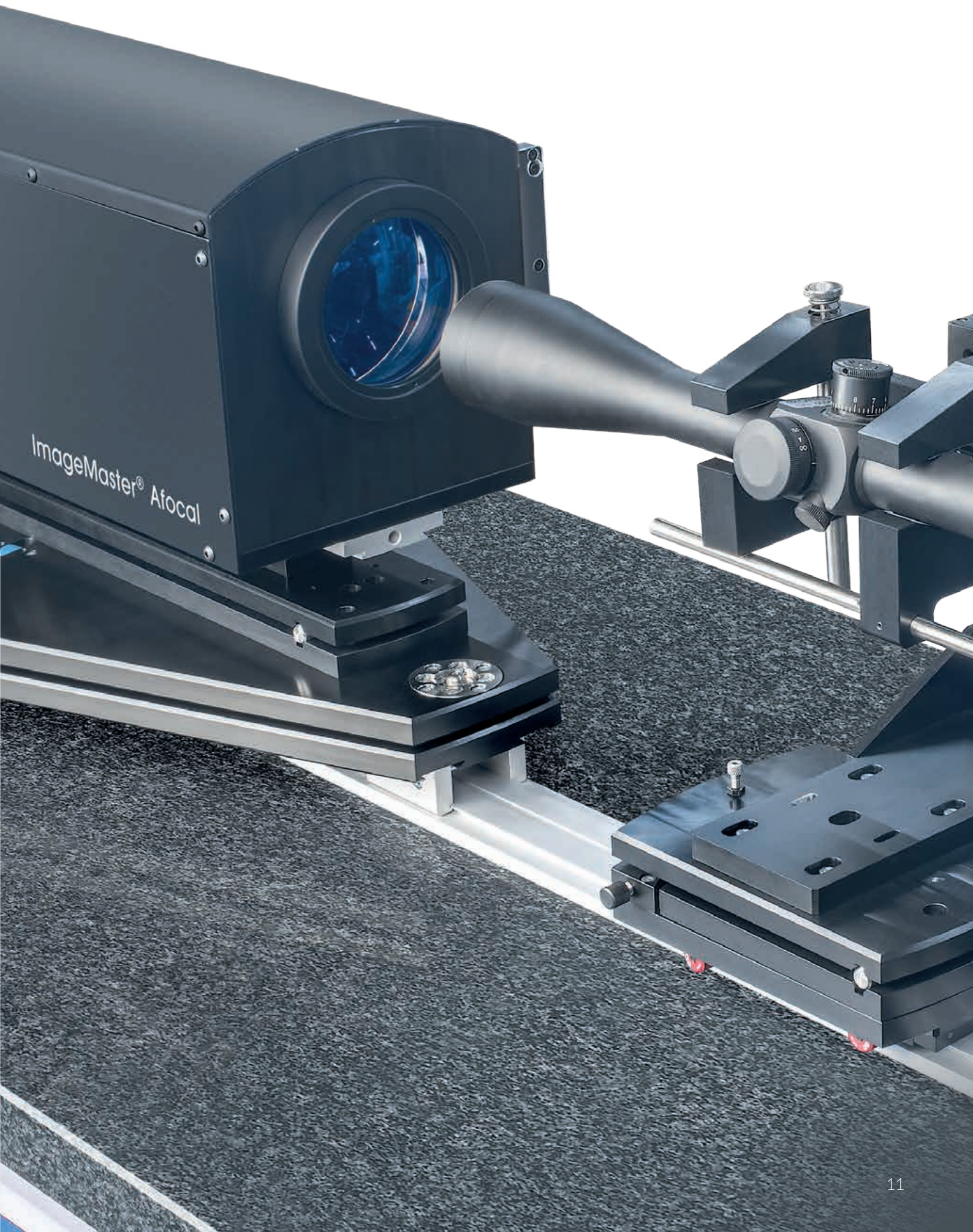
## Advantages of the ImageMaster® MTF Lab software at a glance:

- Measurements of MTF, magnification and a range of other parameters using special target patterns and dedicated software routines
- Intuitive user interface and time-saving lens test routines
- Functions for easy alignment of the sample under test
- Conventional MTF measurement using a single slit or a crosshair as a target
- Automated selection and positioning of the suitable reticle (target) and filter for the current application
- Configuration files with optimized process parameters and password protected access for operator and supervisor
- Scripting tools for customer specific programming and analysis

# ImageMaster® Afocal

## Technical data

Type	ImageMaster® Afocal
Spectral range	450 – 750 nm
Clear aperture	2 mm to 110 mm (depending on collimator)
Illumination sources	Halogen light source / LED panel
Max. off-axis object angle	±15°
Max. off-axis image angle	±90°
Magnification	0.5x to 60x
Accuracy (MTF on-axis and off-axis)	±2 pp on-axis / ±3 pp off-axis
Repeatability (MTF on-axis and off-axis)	±1 pp
Object distances	20 m - ∞ for parallax / 100 m - ∞ for MTF
Dimensions (h x w x d)	253 mm x 1,782 mm x 627 mm
Weight	approx. 185 kg
Type	Table-top unit







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