

Primo Star iLED
Fast. Versatile. Reliable.



The Flexible, Complete Solution for Testing Tuberculosis
and Other Infectious Diseases Using LED-Fluorescence
and Brightfield



We make it visible.

The Fight Against Tuberculosis Has a Long and Successful Tradition.

Using a Carl Zeiss microscope, in 1882 Robert Koch discovered the bacterium that causes tuberculosis: *Mycobacterium tuberculosis*. Today, technology from Carl Zeiss is still making a valuable contribution in the fight against infectious diseases: Primo Star iLED, an LED-based fluorescence microscope, is fast, sensitive, robust, and easy to operate.

A successful collaboration: FIND and Carl Zeiss

Primo Star iLED is the result of a joint project between the Foundation for Innovative Diagnostics (FIND) and Carl Zeiss. Through the targeted promotion of diagnostic innovations, the Swiss foundation FIND has set itself the objective of combating the spread of dangerous infectious diseases. At Carl Zeiss, the battle against these diseases has a tradition dating back to Robert Koch's groundbreaking discovery. To this day, the company continues to set the standard with commitment and expertise

in the struggle against deadly infectious diseases. Its efforts in this area have enabled Carl Zeiss to come up with the LED-based fluorescence microscope Primo Star iLED, developed specifically for tuberculosis testing and based on the powerful routine microscope Primo Star. The success of this collaboration between FIND and Carl Zeiss is plain to see: Primo Star iLED will be offered at a particularly favorable price to public health services customers in the 22 high burden countries as defined by the WHO.

Primo Star iLED: the result of a successful collaboration between FIND and Carl Zeiss





Robert Koch's discovery was made possible by using the 100x objective with homogeneous oil immersion, calculated for the first time by Ernst Abbe



The LED-based fluorescence microscope Primo Star iLED simplifies the microscopic analysis of pathogens

Tuberculosis – still a deadly threat

Despite the fact that tuberculosis can be treated with antibiotics, cases of the disease are on the rise. In the statistical tables of deadly infectious diseases, it is ranked at the top alongside AIDS and malaria. Today, one in three people are already infected. The development of multi-resistant strains and co-infection with the HIV virus are giving rise to alarming prognoses: according to estimates by the World Health Organization (WHO), this situation will claim in the region of 30 million human lives around the world over the next ten years.

An important component for fast and reliable testing

The further spread of tuberculosis can only be prevented by means of efficient testing, followed by the appropriate treatment of those affected. For this reason, the WHO recommends that *Mycobacteria* should be examined using fluorescence microscopy. The LED-based Primo Star iLED fluorescence microscope combines the advantages of fluorescence microscopy and, thanks to a number of innovative elements, sets new standards in robustness, energy efficiency, and simple operability. Primo Star iLED – a further development of Primo Star – is impressive with its versatile performance features:

- Reflected-light fluorescence
- Rapid switching from fluorescence excitation to brightfield illumination
- Economical LED concept
- Battery pack for operation without a main power supply
- Special eyecups eliminate the need for a dark room

- Simple to operate
- Durable and robust
- Tried-and-tested Carl Zeiss optics made from high-quality glass
- High-quality materials
- Worldwide support from Carl Zeiss

In addition, Primo Star iLED offers all the advantages of Primo Star:

- Ergonomics: swiveling Siedentopf tube with comfortable viewing angle of 30°, adjustment for individual interpupillary distances from 48 mm to 75 mm
- Flexibility: modular and easy changeable illumination concept: halogen light (30 W), highly efficient, color-temperature stable LED, or tilting mirror (Fixed-Koehler)
- Convenience: external power supply unit with integrated storage position
- Form and function: attractive design combined with maximum functionality, intensity indicators on both sides of the microscope

Greater performance – wider range of applications

Primo Star iLED is also suited to test for other infectious diseases such as malaria and sleeping sickness. The ability to easily switch from fluorescence to brightfield also makes it possible to use the microscope for all simple laboratory and routine applications. All at a price-performance ratio that is unequalled in this segment.

Simply Better Performance with LED Fluorescence in Reflected-light: 10 % Increase in Sensitivity of Tuberculosis Testing.

Speed and sample throughput are essential success factors in the treatment of tuberculosis. After all, fast and reliable testing means early treatment.

Tried-and-tested standard: pathogen analysis in brightfield

The analysis of Mycobacteria using the transmitted-light brightfield technique is still common practice in the area of tuberculosis testing and it is possible to use this illumination technique with Primo Star iLED too. Due to the small size of the Ziehl-Neelsen-stained disease pathogens, in this case it is often necessary to work with 100x objectives. At such an objective magnification, however, the object field that the user is able to see is correspondingly small. The consequence of this is that it is comparatively time-consuming to examine the sample.

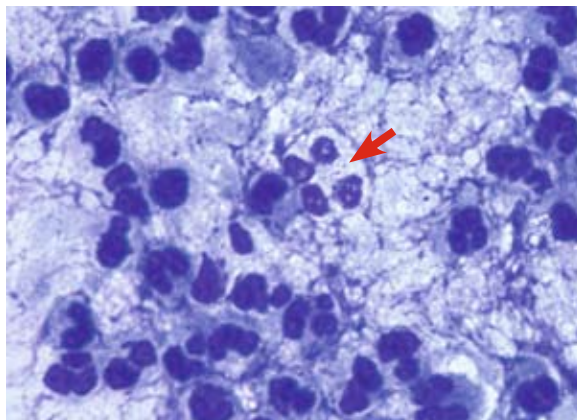
Better performance on every point: the LED-based fluorescence contrast of Primo Star iLED

Under the fluorescence excitation of Primo Star iLED, Mycobacteria appear yellowy green against a dark background. As a result, and by using a 40x objective with a larger object field, the pathogen can be detected up to

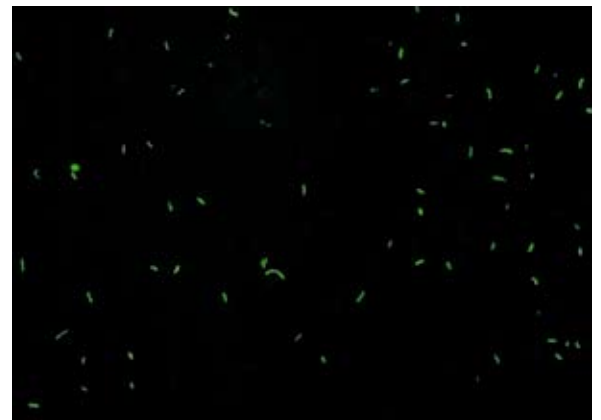
four times faster. In addition, the sensitivity of pathogen detection is also increased by 10 %. The fluorescence excitation takes place using Auramine O, which is excited by blue LED light (not UV light!) with a wavelength of 455 nm and emits from 500 nm to 650 nm. The excitation is perfect and produces excellent contrast with an outstanding signal-to-noise ratio.

Brightfield and fluorescence – with Primo Star iLED anything is possible

Simple switching from fluorescence to brightfield means that Primo Star iLED can be used with considerable versatility. Depending on your requirements, it is possible to employ brightfield transmitted-light techniques or fluorescence techniques. This makes Primo Star iLED the complete solution for LED-based tuberculosis testing using conventional methods or fluorescence. Flexible and powerful – true Carl Zeiss quality.



Mycobacterium tuberculosis. Analysis following Ziehl-Neelsen staining: the violet-stained mycobacteria can only be seen with difficulty in the microscopic image



Using the fluorescence contrast technique, the Mycobacteria can be identified easily, after being stained with Auramine O, as luminous yellowy green particles against a dark background



Dr. med. Harald Hoffmann
Head of the Institute for Microbiology and Laboratory Diagnostics, Asklepios Fachkliniken, Munich-Gauting, Germany

"Primo Star iLED is the much longed-for answer to the three most pressing problems faced by tuberculosis microscopy in our partner countries.

1. *The microscope offers fluorescence and transmitted-light brightfield microscopy in one, but does not require bulbs to be changed or adjusted nor Köhler illumination to be set up. The change between fluorescence and brightfield illumination is achieved with a simple flick of a switch. When a microscope can be operated as easily as this, training microscopists is made a great deal easier.*
2. *In addition to the favorable purchase price, Primo Star iLED also impresses by reducing the running costs of fluorescence microscopy from more than a dollar*

an hour to less than half a cent. This has been made possible by swapping the expensive mercury-vapor lamp for low-cost, long-life light-emitting diodes. Consequently, fluorescence microscopy, which is better suited for diagnostic purposes, is brought within everybody's reach in terms of affordability.

3. *Primo Star iLED needs hardly any electricity and can be run on batteries for many hours. This means that tuberculosis microscopy can also be offered in regions where a reliable power supply is not guaranteed.*

Primo Star iLED is a handy and robust all-rounder with an attractive design. It is sure to become a permanent feature of testing in our partner countries."

Carefully conceived details for use under the most difficult circumstances

A variety of innovative details have been developed to ensure that the microscope is easy to operate and can be used flexibly.

- With just a small number of manipulations the instrument can be used either as a brightfield microscope or fluorescence microscope.
- The use of LEDs is not only cost-effective: compared to mercury-vapor lamps as a light source for fluorescence, LEDs offer many application-oriented advantages.

- For use in the field and in regions with a fluctuating power supply a battery pack has been developed which allows the fluorescence microscope to be operated for several hours without main power.
- The special eyecups almost completely block out ambient light, rendering a dark room unnecessary.

Impressive in every detail – all in all, this is a carefully conceived solution equipped for the most difficult working conditions.



From fluorescence to brightfield contrast with the flick of a switch



The battery pack makes it possible to work without main power

A Wide Range of Applications Means Investment Security: Primo Star iLED Offers More Possibilities for Testing – and Makes Testing Faster.

Quick intervention is of the utmost importance – and what goes for tuberculosis testing goes for other infectious diseases too. According to the WHO, 300-500 million people are taken ill with malaria and sleeping sickness each year. For these diseases too, Primo Star iLED allows fast and reliable testing and, consequently, gives patients a good chance of recovery.

Malaria – a threat not only in tropical Africa

It is estimated that malaria, caused by plasmodia (single-cell parasites), claims the lives of 1 million people worldwide every year. If patients are tested in good time, all forms of malaria can in principle be cured. Microscope technology that is as fast as it is reliable is an important factor in making this possible.

Meaningful and reliable: microscopic analysis with Primo Star iLED

Malaria pathogens can be detected in brightfield with the help of Primo Star iLED, as this makes the various stages of maturity of the plasmodia visible. What is more, it is also possible in principle to perform fluorescence-based analysis using e. g. Acridine orange.

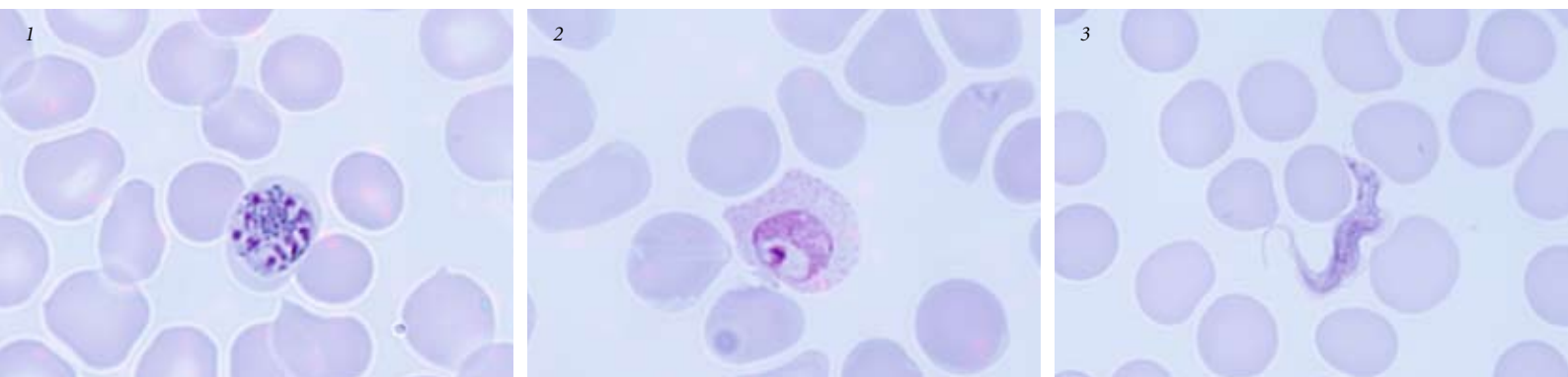
- Malaria tropica, the most serious form of the infection, is caused by *Plasmodium falciparum*
- Malaria tertiana is caused by *Plasmodium vivax* and *Plasmodium ovale*

- Malaria quartana results from *Plasmodium malariae*

The Primo Star iLED image, which is so rich in contrast, allows the characteristic structures of the individual malaria pathogens to be identified clearly. Any changes to the infected erythrocytes are made visible using objectives with magnifications of 40x to 100x. The various stages of maturity can also be detected. From the early stage of ring forms, via the daisy-head stage, through to rosette formation: the outstanding optics from Carl Zeiss deliver a brilliant image for hematology.

Testing for sleeping sickness

Primo Star iLED is also for carrying out tests for sleeping sickness (Human African Trypanosomiasis), an infectious disease caused by trypanosomes that mainly occurs in tropical Africa. According to estimates by the WHO, a total of more than 500,000 people are affected by it. The disease is transmitted by the tsetse fly, the bite of which



1) *Plasmodium malariae*, daisy-head stage, 2) *Plasmodium vivax* showing characteristic Schüffner's dots, 3) *Trypanosoma brucei gambiense* with undulating membrane
Andrea Michelsen, Managing Director of the Deutscher Verband Technischer Assistentinnen/Assistenten in der Medizin e.V., Head of the Central Laboratory of Ortenau Klinikum Lahr-Ettenheim, Germany



Primo Star iLED can be used universally anywhere in the world and is also suitable for routine analyses in medical practices



The worldwide spread of tuberculosis

allows flagellates to enter the human bloodstream. The pathogens are:

- *Trypanosoma brucei gambiense* in Western and Central Africa
- *Trypanosoma brucei rhodesiense*, primarily in Eastern Africa
- *Trypanosoma cruzi* (Chagas' disease) in South America

In this case too, the chances of recovery are increased by quick testing. Primo Star iLED allows the microscopic detection of pathogens, e.g. in a blood smear or in spinal fluid sediment: the spindle-like form of the trypanosomes, the long flagella and the undulating membrane can be identified clearly and with high contrast.

Other routine medical applications

Primo Star iLED is also extremely well-suited to other laboratory-based and routine medical applications involving fluorescence-based testing and brightfield illumination. You will also find it ideal for tests in the field of veterinary medicine.

Worldwide presence

The Carl Zeiss network – your guarantee of outstanding service. Besides a fast spare-parts and repair service, this also means that you will receive support from an experienced, international team of experts on all questions relating to microscopy. Whether you get in touch over the Internet, via the hotline or through your personal contact, you will obtain expert advice and help in finding the right solution for your specific application – whether in education or in the lab.



Somsak Rienthong

Senior Medical Scientist and chief of NTRL,
National TB Reference Laboratory,
Bureau of Tuberculosis, Bangkok, Thailand

"The new iLED excitation allows fluorescent tuberculosis pathogens to be made visible using an ordinary light microscope – compared with conventional fluorescence microscopes it is a very economical solution and offers high sensitivity. This is a huge advantage for tuberculosis control."



Prof. Dr. Dr. Knut Feldmann

President of the "Tuberculosis in the World" Foundation,
Advisor to the WHO and Secretary of the Bacteriology/Immunology Section of the International Union Against Tuberculosis and Lung Disease

"The WHO and other organizations fighting TB are extremely hopeful that a robust and powerful fluorescence microscope will make it possible to improve TB testing, especially in the case of HIV-infected patients."

Primo Star iLED: High-performance Technology in its Most Compact Form, Right Down to the Last Detail.

The Primo Star iLED complete solution and basic Primo Star stand consist of a whole range of sophisticated elements, ensuring reliable results for users world-wide.

An economical solution: the LED concept

The innovative LED concept for fluorescence excitation and illumination is particularly economical and energy efficient. With a lifespan of at least 10 years, the LEDs offer unrivaled durability: over the average life of a microscope, there will be most likely no need to change the LEDs. Operation is extremely simple for the user:

- No need for lamp changing and complex adjustment
- Primo Star iLED is ready to use immediately, without the warm-up and cool-down times required with mercury-vapor lamps
- No danger of being light-dazzled, because of reflected-light fluorescence
- LEDs are an energy-saving option: they consume one-tenth the power of a 50 W mercury-vapor lamp
- Hardly any heat is generated, samples are protected

Modular architecture: iLED as a retrofit package

If you already own a Primo Star, you can easily retrofit Primo Star iLED. The retrofit package is comprised of a fluorescence module, carrying handle, magnet insert, eyecups, and diaphragm slider. It can be assembled easily – without any need for time-consuming alterations to the microscope.

High-quality, well-protected Carl Zeiss optics

An antifungal treatment has been applied to all optical components. This coating ensures that they can be used optimally even under extreme climatic conditions and offers long-lasting protection. All the optics have been manufactured from high-quality glass that complies with the very highest quality requirements. Also, security has not been overlooked either: objectives and eyepieces are protected against theft both during use and transportation.

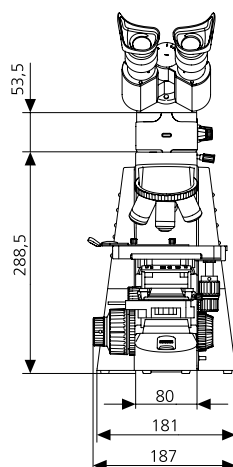
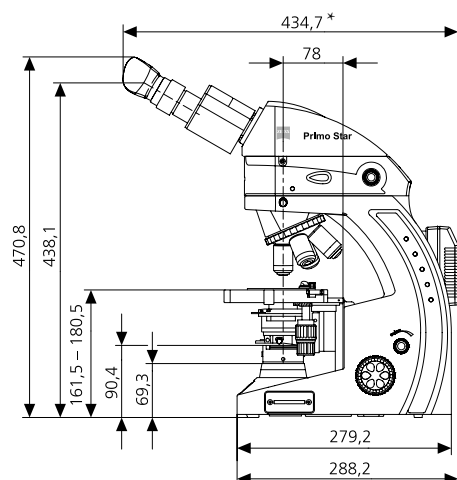


The impressive compact Primo Star iLED microscope with its various details



A retrofit package allows the basic Primo Star microscope to be converted into a Primo Star iLED

Technical Data: Primo Star iLED



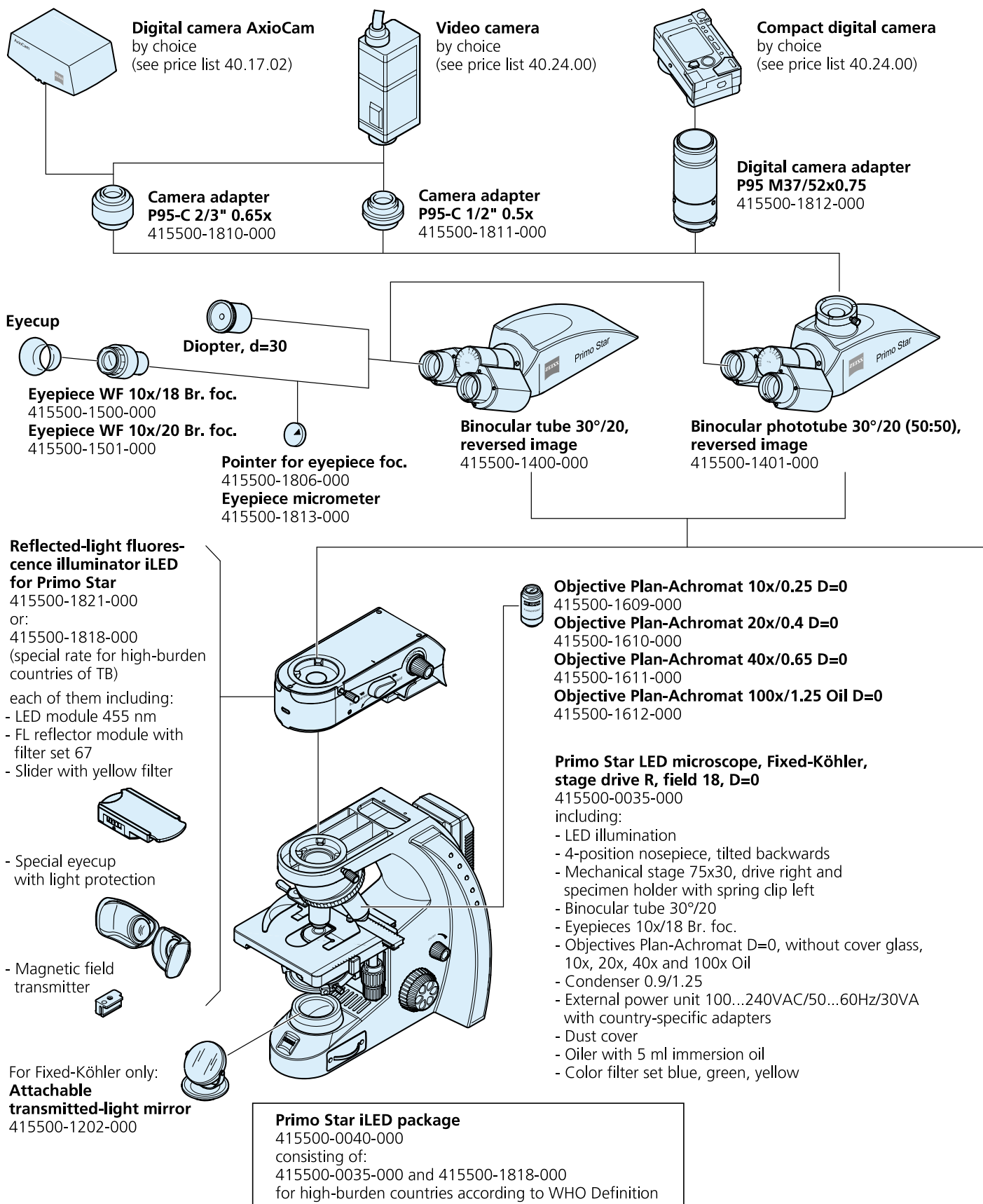
* only 359.3 mm in the rotated position

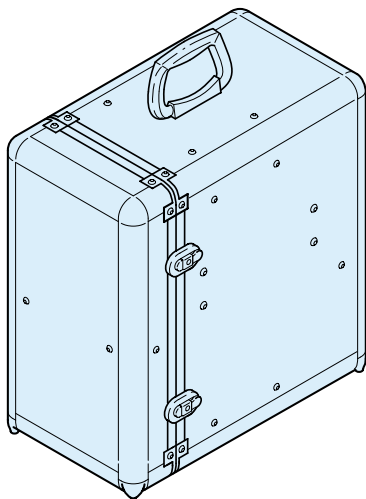
Technical data: Primo Star iLED complete package	
Optical system	Color-corrected infinity optics
Parfocal distance	45 mm
Tube length	180 mm
Magnifications	100x to 1000x for visual observation
Eyepiece tubes	Swiveling Siedentopf tube with upper and lower position: upper position offers approx. 40 mm extra viewing height; adjustable interpupillary distance: 48 mm to 75 mm; tube can be rotated 360°; 30° viewing angle (ergonomic angle); binocular tube
Eyepieces	WF 10x/18 Br. foc. with special eyecups
Nosepiece	4x, inclined backwards
Objectives	Plan-ACHROMAT 10x/0.25 D=0 WD: 4.51 mm; Plan-ACHROMAT 20x/0.4 D=0 WD: 1.00 mm; Plan-ACHROMAT 40x/0.65 D=0 WD: 0.45 mm; Plan-ACHROMAT 100x/1.25 D=0 WD: 0.30 mm
Condenser	Abbe condenser 0.9/1.25 (Fixed-Koehler)
Illumination	Modular illumination concept with drawer for transmitted-light illumination; white-light LED (3 W/6 V); blue-light LED (455 nm; 3 W/6 V); LED class 3B; reflected-light fluorescence
Stage	Stages with right-hand operation
Area of stage	w x d: 140 mm x 135 mm
Travel range	w x d: 75 mm x 30 mm
Z-drives	Fine drive: 0.5 mm/rot.; Coarse drive: 45 mm/rot.; Total travel range: 15 mm
Weight	Approx. 9.6 kg

Accessories	
Eyepiece pointer, battery pack, binocular phototube 50 % : 50 % (vis:doc)	
Tilting mirror (only for Fixed-Koehler stand variant)	
Phase contrast equipment: 10x/Ph1; 20x/Ph2; 40x/Ph2; 100x/Ph3; HAL (30 W/6 V), with phase sliders	
Darkfield equipment (DF slider 0.65)	
Camera adapters: C-mount adapter 1/2"; C-mount adapter 2/3"; digital camera adapter	
AxioVision LE with Canon camera driver	

European standards: CE for safety and for electromagnetic radiation, IVD 98/79/EG. International standard: CSA.
Quality Management: ISO 9001, ISO 13485. Environmental management: ISO 14001.

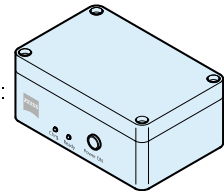
Antifungal guarantee
To provide an antifungal coating, Carl Zeiss treats all optical components with a special chemical from Bayer®.
Retrofit guarantee
The iLED module can be easily retrofitted onto all existing Primo Star instruments with just a few manipulations.





Case for transport and storage
415500-1805-000
(not suitable for Primo Star iLED)

For Primo Star microscopes
and Primo Star LED microscope:
Battery supply unit
415500-1814-000



Primo Star microscope stand, Fixed-Köhler, R
415500-1100-000
required:
Abbe condenser 0.9/1.25 field 18, Fixed-Köhler
415500-1701-000
Mechanical stage 75x30, drive right
415500-1300-000
Specimen holder left, for mechanical stage
415500-1302-0000

Primo Star microscope stand, Fixed-Köhler, L
415500-1102-000
required:
Abbe condenser 0.9/1.25 field 18, Fixed-Köhler
415500-1701-000
Mechanical stage 75x30, drive left
415500-1301-000
Specimen holder left, for mechanical stage
415500-1302-0000

Primo Star microscope stand, Full-Köhler, R
415500-1101-000
required:
Abbe condenser 0.9/1.25 field 20, Full-Köhler
415500-1700-000
Mechanical stage 75x30, drive right
415500-1300-000
Specimen holder left, for mechanical stage
415500-1302-000

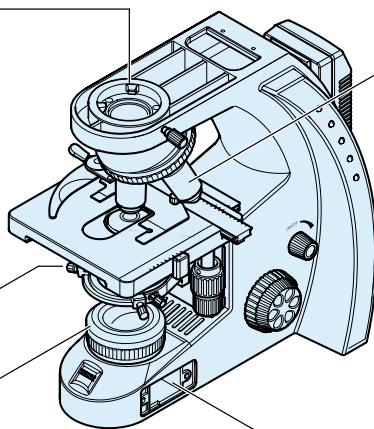
Primo Star microscope stand, Full-Köhler, L
415500-1103-000
required:
Abbe condenser 0.9/1.25 field 20, Full-Köhler
415500-1700-000
Mechanical stage 75x30, drive left
415500-1301-000
Specimen holder left, for mechanical stage
415500-1302-00

For Full-Köhler only:
Slider Ph 1, for Primo Star
415500-1815-000
Slider Ph 2, for Primo Star
415500-1803-000
Slider Ph 3, for Primo Star
415500-1817-000

Darkfield slider
0.40-0.65
415500-1802-000

For Full-Köhler only:
Slider Ph 1 / H / Ph 2
for Primo Star
415500-1816-000

Color filter set
blue, green, yellow d=45x1.5
415500-1804-000



Objective Plan-Achromat 4x/0.10
415500-1600-000
Objective Plan-Achromat 10x/0.25
415500-1601-000
Objective Plan-Achromat 10x/0.25 Ph 1
415500-1605-000
Objective Plan-Achromat 20x/0.4
415500-1606-000
Objective Plan-Achromat 20x/0.40 Ph 2
415500-1607-000
Objective Plan-Achromat 40x/0.65
415500-1602-000
Objective Plan-Achromat 40x/0.65 Ph 2
415500-1603-000
Objective Plan-Achromat 100x/1.25 Oil
415500-1604-000
Objective Plan-Achromat 100x/1.25 Ph 3
415500-1608-000

Transmitted-light illuminator
with LED
415500-1200-000

Transmitted-light illuminator with HAL
415500-1201-000
Halogen lamp 6 V 30 W
415500-1901-000



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