Motic®

MORE THAN MICROSCOPY

Enhancing Quality Control: Inspecting Flat Panel Electronics with Optical Microscopes

Introduction

In today's rapidly advancing technological landscape, flat panel electronics have become an integral part of our daily lives. These sleek, space-saving devices, including smartphones, tablets, television screens, and computer monitors, demand impeccable quality control during their manufacturing process. Quality control ensures that these electronic wonders meet the highest standards of performance and reliability. Optical microscopes play a pivotal role in this endeavor, enabling meticulous examinations of the intricate components and the detection of common defects.

The Importance of Quality Control

Quality control is pivotal in modern manufacturing, systematically verifying adherence to standards and regulations. In the realm of flat panel electronics, it's crucial for several reasons. These devices are now integral to daily life, serving as communication hubs, entertainment sources, and work tools. Any defect in a flat panel screen can lead to frustrating user experiences, from distorted video calls to safety concerns. Quality control is vital for maintaining consumer trust and brand reputation.

The intricate production of flat panel electronics involves multiple components that must harmonize flawlessly. Any defect in this complex process can result in usability issues and safety hazards. With components resembling instruments in an orchestra, precision is paramount. A robust quality control system is essential to ensure seamless integration and defect-free final products, preventing manufacturing inconsistencies and widespread defects.

Overview of Flat Panel Electronics Components

A comprehensive grasp of the intricate components that constitute flat panel electronics is fundamental for the effective execution of quality control measures. These components collectively mold the performance and visual quality of these ubiquitous devices, playing a pivotal role in the user experience.

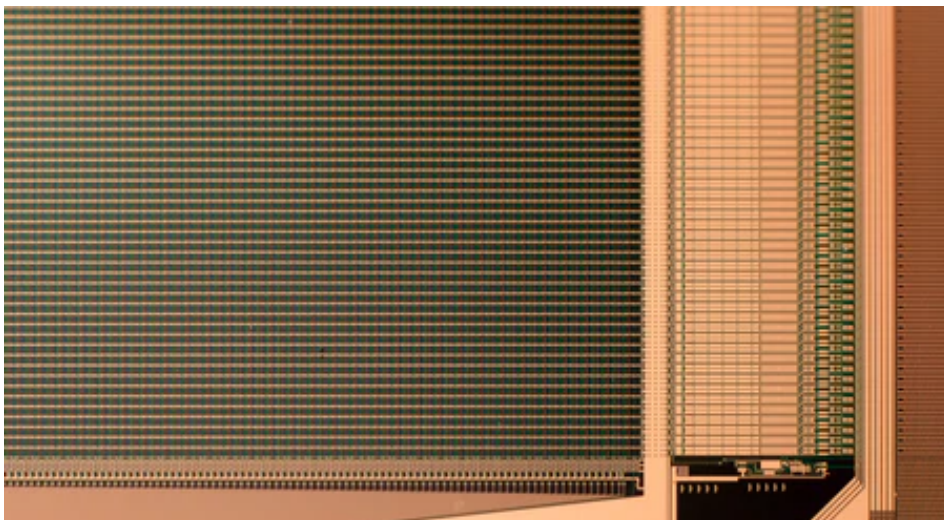


Figure 1. IPS Liquid Crystal Panel

Overview of Flat Panel Electronics Components

The most ubiquitous category of flat panel screens is the Liquid Crystal Displays (LCDs), known for their versatility and wide application. These screens comprise a multifaceted architecture, involving multiple layers working in unison. Beneath the surface, there exists a backlight source, usually in the form of LEDs, which illuminates the display. The backlight's uniformity and luminosity are of utmost importance as they directly impact the overall screen quality. Concurrently, liquid crystal molecules, the core of the LCD technology, regulate the passage of light, essentially serving as microscopic "shutters" to control pixel illumination. The alignment and condition of these liquid crystal molecules are meticulously monitored during quality control procedures. Any deviation from the prescribed alignment can result in visual artifacts, impacting the screen's overall performance. Moreover, color filters, essential for rendering accurate and vibrant colors, are meticulously examined for uniformity. Finally, a glass substrate housing thin-film transistors (TFTs) is instrumental in driving pixel activation. Ensuring the integrity and functionality of these TFTs is critical for the reliable operation of LCD screens. In essence, the quality control process for LCDs delves into the microscopic realms of liquid crystals and the intricate interplay of multiple components to guarantee optimal performance and visual fidelity.

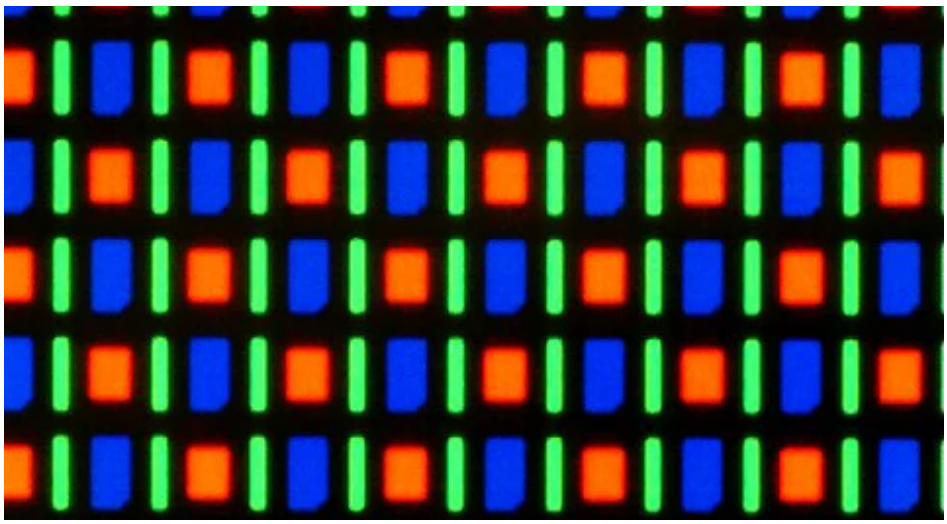


Figure 2. Example OLED screen from Google's Nexus One

Overview of Flat Panel Electronics Components

Organic Light Emitting Diodes (OLEDs) represent another prominent technology within the flat panel electronics landscape. Celebrated for their vivid colors and flexibility, OLEDs are often featured in high-end displays. These screens boast a distinctive structure where organic layers emit light when subjected to an electric current. Quality control for OLED screens involves a meticulous inspection of these organic layers. The uniformity of these layers is a paramount concern. Any irregularity in organic layer thickness or composition can lead to variations in brightness and color across the screen. Pixel condition is another focal point of examination, ensuring that each pixel emits light uniformly and accurately. Additionally, quality control technicians pay close attention to the presence of any contaminants in the organic layers. Even minuscule impurities can mar the visual quality and longevity of OLED displays. Thus, the scrutiny involved in the quality control of OLED screens extends from the molecular composition of organic layers to the final pixel's luminance.

While less prevalent in modern times, Plasma Displays employ a different technology altogether. These displays employ tiny cells filled with ionized gases to generate images. Quality control for plasma displays takes a unique path, concentrating on the physical integrity of the individual cells and the uniform distribution of gases within the screen. Plasma displays can be vulnerable to gas leaks, which can lead to irregularities in image formation and luminance. Thus, quality control measures for plasma displays include a rigorous assessment of gas containment and the presence of any leaks. This aspect of quality control safeguards against potential defects that may emerge during the manufacturing process, ensuring that the final product delivers a uniform and high-quality visual experience.

In essence, the thorough understanding of the distinct components within flat panel electronics is the bedrock upon which effective quality control stands. It necessitates a meticulous examination of not only the macroscopic aspects but also the microscopic intricacies that define the performance and visual quality of these devices.

Common Defects in Flat Panel Electronics

Despite the remarkable strides in manufacturing technology, the production of flat panel electronics is not immune to occasional imperfections. These defects can take various forms, spanning the spectrum from subtle disruptions to glaring issues that severely impact both visual quality and overall functionality.

One of the most frequently encountered defects is the presence of dead pixels. These are individual screen pixels that stubbornly remain locked in a single color or, in more severe cases, are entirely non-responsive, leaving conspicuous dark spots on the display. These dead pixels are often more pronounced and disruptive in bright images or during the playback of videos, where their presence can be particularly irksome, diminishing the overall visual experience.

Common Defects in Flat Panel Electronics

Figure 3. Example of dying pixels on a LED display.

Beyond dead pixels, another prevalent defect manifests as color inconsistencies. This can take the form of color bleeding, where colors appear to bleed into one another, creating a smudged or unclear image. Similarly, inconsistent color temperatures across the screen can cause certain areas to appear warmer or cooler than others, disrupting the faithful reproduction of images and undermining the visual fidelity that users expect.

Backlight bleeding is a common issue, especially in Liquid Crystal Display (LCD) screens. It occurs when light escapes from the edges of the screen, resulting in uneven illumination across the display. This defect is particularly noticeable when viewing dark or black scenes, as the uneven illumination creates unsightly splotches of light where there should be darkness. This not only detracts from the overall visual experience but can also lead to frustration among users.

Non-uniformity in brightness or color across the screen represents yet another potential defect. These inconsistencies can significantly diminish the viewing experience, making it difficult to enjoy content as intended. Such issues are particularly detrimental when color accuracy is paramount, such as in professional design or video editing.

Using Optical Microscopes for Inspection

Optical microscopes and their advanced techniques play a crucial role in inspecting flat panel displays for defects during the quality control process. These microscopes provide a magnified and highly detailed view of the intricate components of flat panel screens, allowing technicians to detect even the smallest imperfections. Here, we will delve into the ways in which optical microscopes and their techniques are employed in the inspection of flat panel displays:

1. High Magnification Inspection

Optical microscopes are capable of providing high levels of magnification, allowing technicians to closely examine the microscopic components of flat panel displays. This is particularly important when inspecting components like liquid crystal molecules in LCD screens or organic layers in OLED displays. By zooming in on these components, quality control personnel can identify any deviations from the prescribed alignment, thickness, or composition that might result in visual artifacts or color variations.

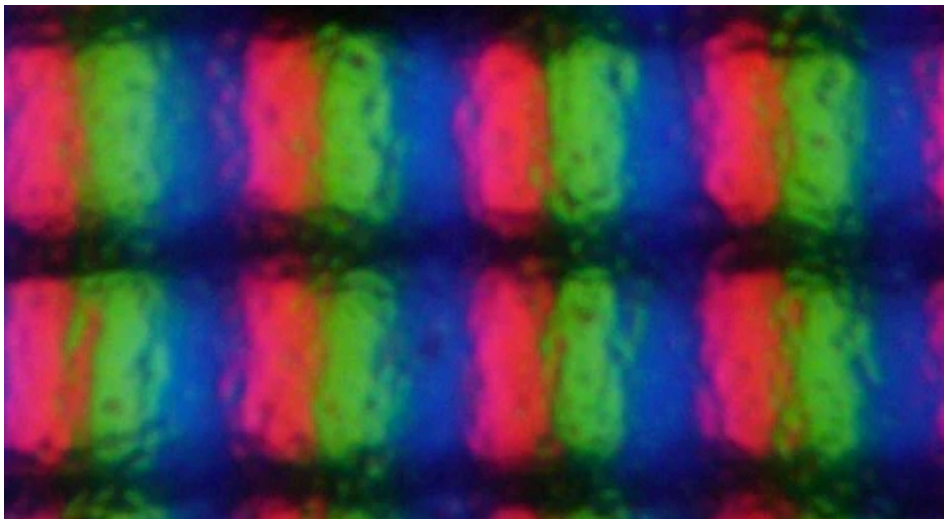


Figure 4: Magnified image of subpixels of an LCD screen. The dead pixel is very clear.

2. Uniformity Assessment

One of the critical aspects of flat panel displays is the uniformity of various elements such as backlighting and color filters. Optical microscopes are employed to assess the uniformity of these components across the entire screen. For instance, when inspecting LCD screens, technicians can use optical microscopes to ensure that the backlighting is uniform, as any unevenness can lead to backlight bleeding, causing irregular illumination across the display.

3. Pixel-Level Inspection

Detecting dead pixels or pixel-related defects is crucial for ensuring the visual quality of flat panel displays. Optical microscopes enable technicians to scrutinize individual pixels at a microscopic level. This level of detail is essential because dead pixels can be challenging to identify with the naked eye, especially on high-resolution screens. Microscope techniques allow for the precise identification of non-responsive or misaligned pixels.

Using Optical Microscopes for Inspection

4. Color and Luminance Evaluation

Optical microscopes can be equipped with colorimeters and spectrophotometers to measure color accuracy and luminance. This is vital for verifying that colors are reproduced faithfully across the screen and that there are no inconsistencies in color temperature. In professional applications like design and video editing, where color accuracy is paramount, these measurements ensure that the display meets industry standards.

5. Contaminant Detection

In OLED displays, any contaminants in the organic layers can severely impact visual quality and longevity. Optical microscopes equipped with imaging capabilities are used to inspect the organic layers for the presence of impurities or contaminants. Even minuscule particles can be identified, preventing potential defects that could affect the display's performance.

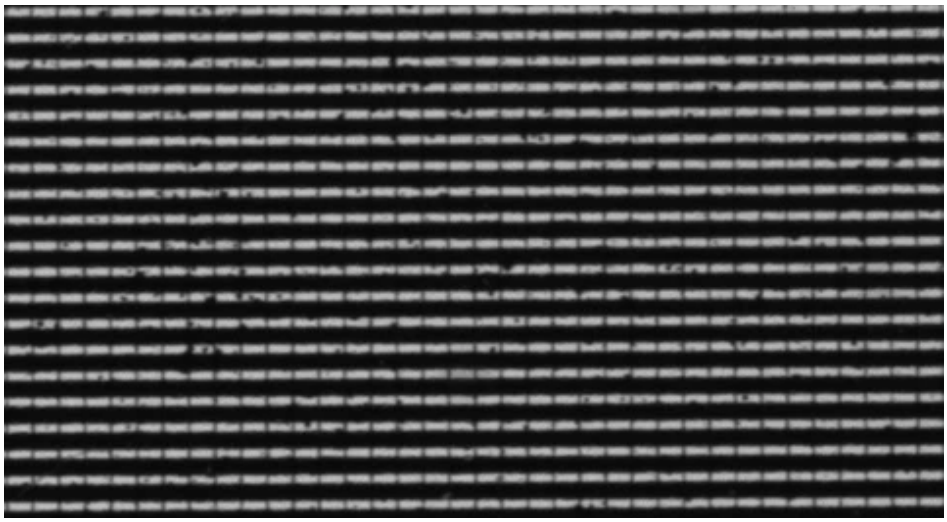


Figure 5: Example of dark spots forming in a OLED display, often formed from oxygen or moisture intake or old age.

6. Evaluation of Gas Containment

In the case of plasma displays, the presence of gas leaks can lead to irregularities in image formation and luminance. Optical microscopes can be employed to inspect the physical integrity of individual cells and check for any signs of gas leakage. This helps ensure that the final product delivers a uniform and high-quality visual experience.

7. Defect Documentation

Optical microscopes also aid in documenting defects. Technicians can capture high-resolution images and videos of defects for further analysis and record-keeping. This documentation is valuable for quality control records, analysis of manufacturing processes, and ensuring that defects are properly addressed and corrected.

Ideal Microscope for Flat Panel Inspection

In addition to these features, the SM7 microscope is also equipped with a number of other features that make it ideal for inspecting flat panels, such as:

- A large field of view: The SM7 microscope has a large field of view, which allows for large areas of the sample to be inspected at once. This is important for inspecting flat panels, as they are often large and need to be inspected quickly and efficiently.

- A variety of accessories: The SM7 microscope is available with a variety of accessories, such as a camera adapter and a stage micrometer. These accessories can be helpful for inspecting flat panels, as they can be used to document defects and to measure the size of defects.

Figure 6: SM7 PLAN Apochromat microscope.

In the context of flat panel inspections, the SM7 Microscope line is useful in that it can inspect defects:

- In the substrate: The SM7 microscope can be used to inspect the substrate of a flat panel for defects such as scratches, bubbles, and inclusions. These defects can cause problems with the performance and reliability of the flat panel.

- In the electrodes: The SM7 microscope can be used to inspect the electrodes of a flat panel for defects such as breaks, shorts, and misalignments. These defects can cause problems with the electrical performance of the flat panel.

- In the encapsulation: The SM7 microscope can be used to inspect the encapsulation of a flat panel for defects such as cracks, voids, and delamination. These defects can allow moisture and contaminants to enter the flat panel, which can damage the internal components.

Conclusion

In today's tech-driven world, flat panel electronics like smartphones and computer monitors have become indispensable. Quality control during their manufacturing process is essential to ensure top-tier performance and user satisfaction. Optical microscopes are vital tools in this quality control process, allowing for detailed inspections of intricate components and the detection of common defects. These devices have evolved beyond gadgets, becoming integral to communication, entertainment, and work, making the need for flawless screens paramount. Quality control ensures that these screens are free from issues like dead pixels, color inconsistencies, backlight bleeding, and more, ultimately safeguarding consumer trust and brand reputation.

Flat panel electronics, whether LCDs, OLEDs, or plasma displays, rely on the meticulous examination of their unique components. LCDs involve backlight sources, liquid crystal molecules, color filters, and thin-film transistors, all scrutinized for alignment, uniformity, and functionality. OLEDs, renowned for vibrant colors, require careful inspection of organic layers, pixel condition, and the absence of contaminants. Even less common technologies like plasma displays undergo quality control to check individual cell integrity and gas distribution. In essence, quality control in flat panel electronics delves into microscopic intricacies, ensuring optimal performance and visual quality for end-users, making optical microscopes indispensable tools in the process.

SM7 Series

The First Motic Stereo Plan-Apochromat: Enjoy and Be Surprised.

Power in any Aspect

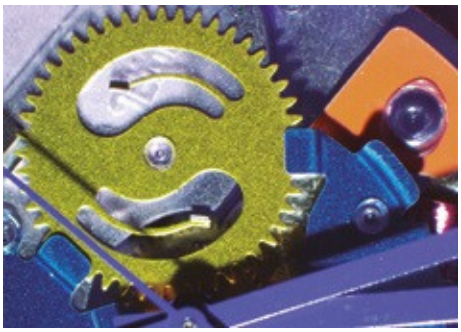
The SM7 features an optical performance with true colour reproduction, high resolution and low distortion. A stand with Incident/Transmitted LED light supplies variable illumination.

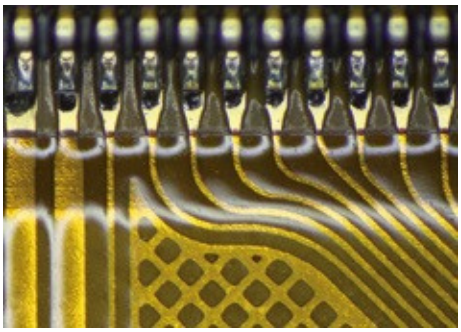
Stand Design

Ultra-flat stand bases for a relaxed positioning of hands and forearms facilitate lengthy preparation work. Pick your C. Elegans nema- todes from the petri dish, mount your gearwheel into the clockwork. The advanced ergonomic design maximizes efficient usage and minimizes fatigue.

Flexibility for Individual Demands

A variety of objectives and eyepieces allow tailoring a personal SM7. Upgrade your workplace with ergonomic stands and powerful optics, whether Apochromatic colour fidelity is in focus or improved resolution power.





SM7 Series

Motic SM7: High-Precision Galilean Optics

Galilean Optical System

The Galilean Optics of the SM7 show a 7:1 Zoom system, resulting in a standard magnification range of 8X-56X. A 10-Position Click-Stop helps to set precise magnifications in case repeatable measurements are required. The standard optical setup can be varied by exchanging objectives and/or eyepieces.

Superior Optics

For the best possible image results, a 1X Plan-Apochromatic objective with a Working Distance of 81mm is available. True-colour reproduction combined with improved Field Flatness and minimized image defects: both the world of living beings and technical samples are covered by our SM7 stereomicroscope.

Resolution Power for Tiny Details

Besides minimized chromatic and spherical aberrations, it is the resolution of the 1X Apochromatic objective which makes the SM7 especially interesting for technical applications. 36% more resolution power, an increase worth mentioning.

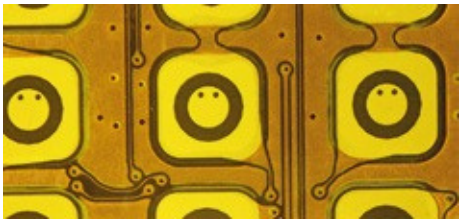
Powerful vizualisation for both eyes and camera

Eyepieces

The High eyepoint eyepieces 10X/22 suit spectacle wearers and offer a diopter adjustment range within +5/-8 dpt. Easy use of reticles is Motic's top model standard.

Observation Tubes

Our Trinocular head is supplied with a 100:0/20:80 2-position beam split, providing sufficient light to the camera port even under lowlight conditions. C-Mount cameras are adapted to the respective camera sensors. Besides the standard Binocular tube, a 60° inclination tube is available to meet special OEM demands.



SM7 Series

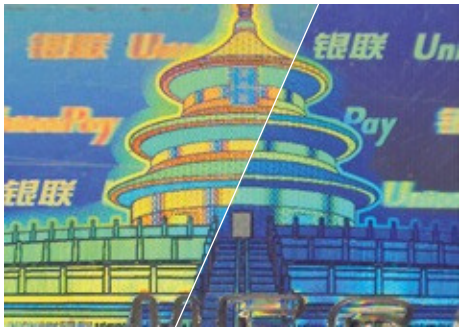
Illumination is the Second Key for the Safe of Information

Illumination

For years LEDs are replacing Halogen light sources in business and private life. A low energy consumption, a long lifetime and, especially for living samples, a low heat production are the main arguments.

Transmitted / Incident Light Stands

The SM7 Stand for transparent and opaque specimen incorporates 3W LEDs for both types of illumination, with separate controls for mixed samples. An optional 4-segment ring illuminator is meant for the standard stand. Herewith surface topographies can be visualized by activating different illumination angles. The SM7 features signifi- cantly flat stand bases for ergonomic positioning of hands and forearms. Long preparation work can be done without early fatigue. For ESD sensible work, Motic's ESD and surge protection system complies with both UL and CL standards and regulations. An essential feature for electronic and electric quality control environments.



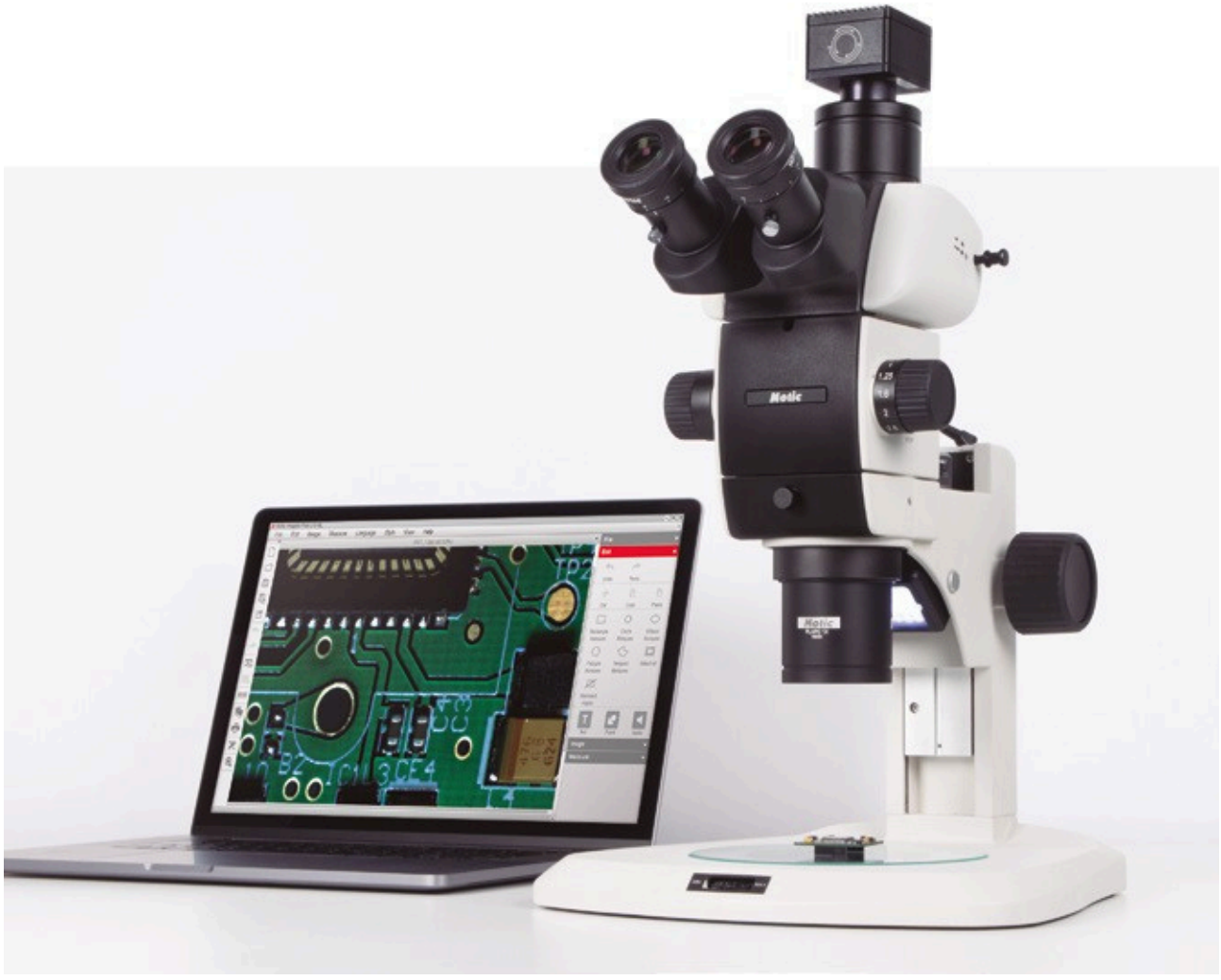
Moticam S-Line

Scientific-Grade Microscope Cameras

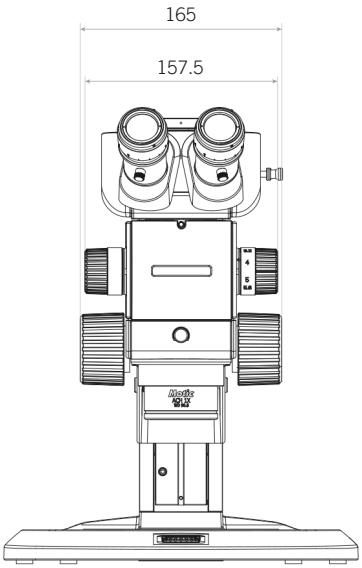
The new Moticam S-line marks a further step in Motic's digital microscopy. By utilizing the latest sCMOS sensors coupled with our own PCB design and on-board image management, each Moticam S series promises professional digital results at an affordable price. This MoticamS-line is designed and manufactured completely in-house under strict German quality guidelines. Whether for Clinical, Research or Industrial, this new generation of Moticams has got the answer for every demand. At Motic, we believe in making High-level Digital Microscopy affordable for everyone. You surely will enjoy this camera line.

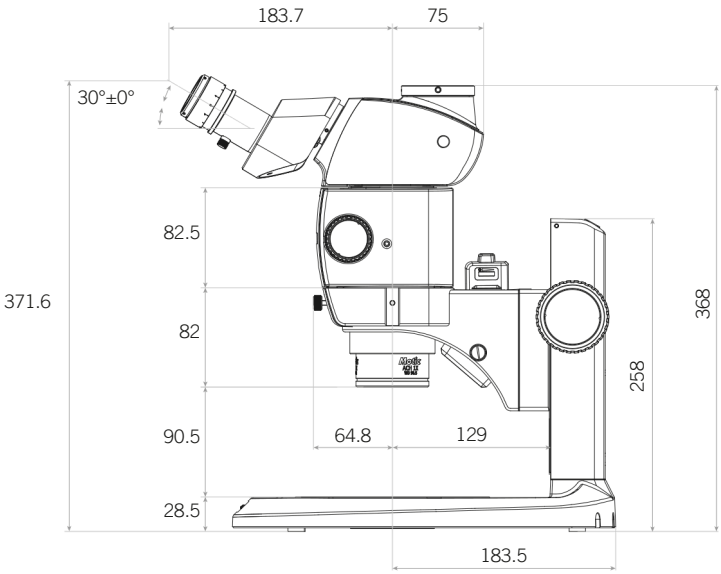
Key features

- FPS — Super-Fast Frame Rates
- USB3.1 — USB 3.1 Data Transfer
- True color reproduction
- sCMOS Sensor
- 20 MP — Up to 20MP Resolution
- Rolling and Global shutter models

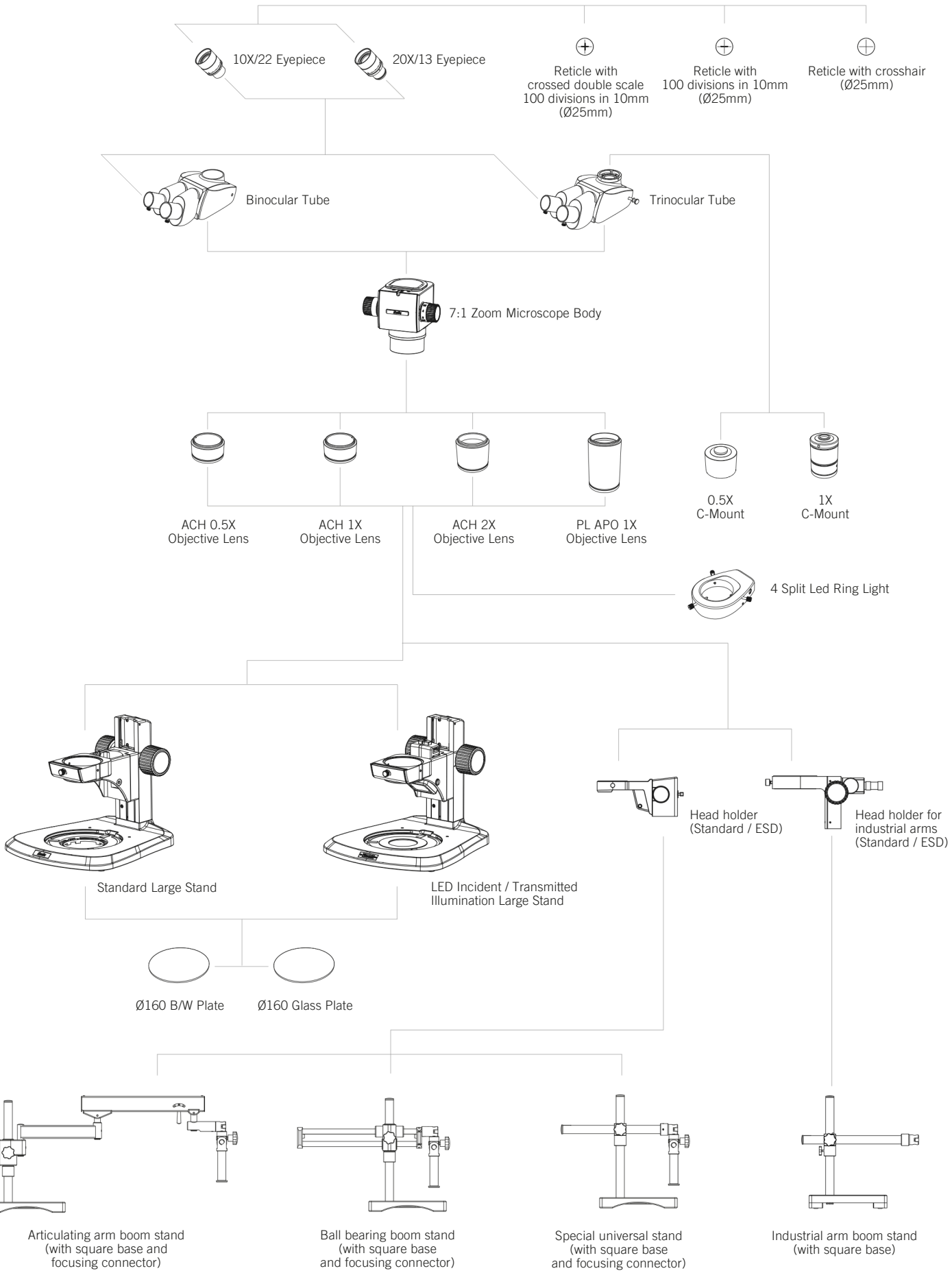


SM7 Series Dimensions





SM7 Series System Overview



SM7 Series Technical Specifications

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●	Name	**SM7-P A1X**	**SM7TR-P A1X**	**SM7-P APO1X**	**SM7TR-P APO1X**
	Optical system	Galilean infinity optical design. Common Main Objective (CMO)			
●	Observation tube	Binocular head	Trinocular head	Binocular head	Trinocular head
	Inclination	30º inclined			
	Trinocular light split	-	100:0/20:80	-	100:0/20:80
	Interpupillary distance	55-75mm			
	Diopter adjustment	On both eyepieces, +5/-8 diopter			
	Eyepieces	Widefield WF10X/22mm with diopter adjustment			
	Objectives system	Zoom, ratio 7:1			
●	Objectives classification	Plan Achromat		Plan Apochromat	
	Objectives	0.8X~5.6X (10-step)			
●	Working distance	90mm		81mm	
	Stand type	Fixed-arm stand			
	Head holder	For Ø76mm head			
	Focus mechanism	Coarse focusing system with tension adjustment			
	Focusing stroke	120mm			
●	Incident illumination	-			
●	Transmitted illumination	-			
●	Transformer	-			
●	Power supply	-			
	Accessories included	Dust cover, Black/White plate Ø160mm			
	Dimensions LxWxH	367x290x372mm			
	Base	310x290mm			
	Column/Arm	254mm			
	Net weight	6.9 Kg	7 Kg	7 Kg	7.1 Kg
	CONTRAST TECHNIQUES				
	Brightfield	Brightfield			




1100201800081	1100201800041	1100201800091	1100201800051	Sku
SM7-TLED A1X	**SM7TR-TLED A1X**	**SM7-TLED APO1X**	**SM7TR-TLED APO1X**	Name
Galilean infinity optical design. Common Main Objective (CMO)				Optical system
Binocular head	Trinocular head	Binocular head	Trinocular head	Observation tube
30º inclined				Inclination
-	100:0/20:80	-	100:0/20:80	Trinocular light split
55-75mm				Interpupillary distance
On both eyepieces, +5/-8 diopter				Diopter adjustment
Widefield WF10X/22mm with diopter adjustment				Eyepieces
Zoom, ratio 7:1				Objectives system
Plan Achromat		Plan Apochromat		Objectives classification
0.8X~5.6X (10-step)				Objectives
90mm		81mm		Working distance
Fixed-arm stand with incident & transmitted illumination				Stand type
For Ø76mm head				Head holder
Coarse focusing system with tension adjustment				Focus mechanism
120mm				Focusing stroke
LED 3W with intensity control				Incident illumination
LED 3W with reflector and intensity control				Transmitted illumination
External				Transformer
110-240V (CE)				Power supply
Dust cover, Glass plate Ø160mm				Accessories included
367x290x372mm				Dimensions LxWxH
310x290mm				Base
254mm				Column/Arm
7.3 Kg	7.4 Kg	7.4 Kg	7.5 Kg	Net weight
				CONTRAST TECHNIQUES
Brightfield				Brightfield

Motic®

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See the SM7 in action

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B.C., V6V 2K9, Canada

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