



Product Information
Version 1.1

ZEISS Correlative Particle Analysis

Quickly Characterize and Classify Particles Supporting
ISO 16232 by Light and Electron Microscopy



We make it visible.

Identify Process Critical Particles in the Shortest Possible Time

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- › The Advantages
- › The Applications
- › The System
- › Technology and Details
- › Service

Perform a particle analysis supporting ISO 16232 with your motorized ZEISS zoom or light microscope: Axio Zoom.V16 and Axio Imager.Z2m deliver information on the quantity, size distribution, morphology and color of particles. Polarization contrast allows you to differentiate between metallic and non-metallic objects. Identify suspect particles and relocate them in your ZEISS scanning electron microscope (SEM). Now you can automatically analyze their elemental composition with energy dispersive spectroscopy (EDS). One report consolidates all results from light and electron microscopy.

Capture more information in less time: by combining light and electron microscopy, you will release the full power of both.



▶ [Click here to view this video on YouTube](#)



Simpler. More intelligent. More integrated.

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Gain More Insights

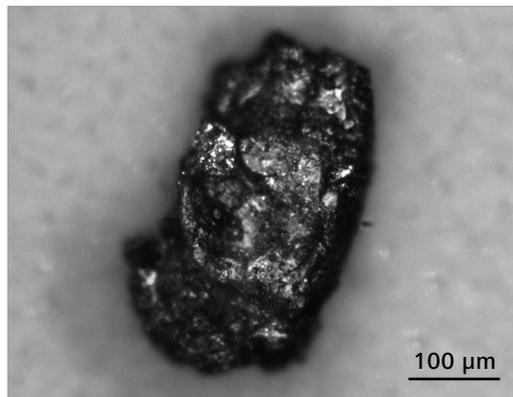
Characterize process-critical particles and identify killer particles. Correlative Particle Analysis (CAPA) combines your data from both light and electron microscopes. Detect particles with your light microscope. Now, you can relocate them automatically in your SEM from ZEISS and perform an EDS analysis to reveal information of their elemental composition. Use the gallery to pick out interesting particles and find out their origin.

Automated and Fast

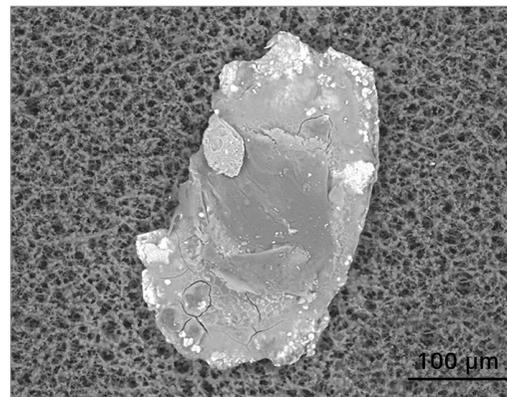
With CAPA you automatically get an integrated report with results from both light and electron microscopy. Additionally you can choose to combine your light and electron microscopy results in an interactive summary. With CAPA you get your results up to ten times faster than by consecutive individual analysis with light and electron microscopy.

Your Dedicated System

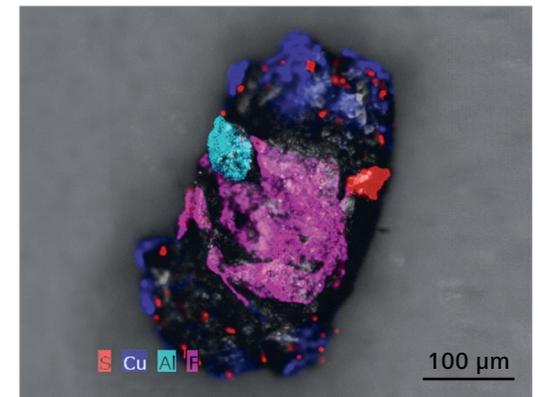
With only a few mouse clicks, edit project information, create reports, and archive your results. See all classifications and ISO codes at a glance. With the gallery and evaluation view, you gain a quick overview of the particle types: reflective, non-reflective, and fibrous. Relocate interesting particles at the touch of a button. Use the revision mode to reclassify or edit particles.



Light microscopy image of a metallic particle



Electron microscopy image of the same particle



Correlation of both images with EDX analysis

Your Insight into the Technology Behind It

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Workflow of Cleanliness Analysis



1 Components



2 Washing Plant



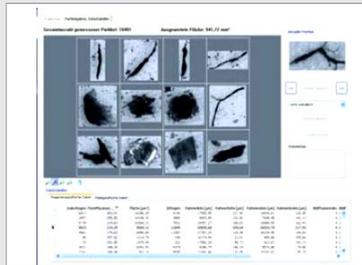
3 Cleaning Cabinet



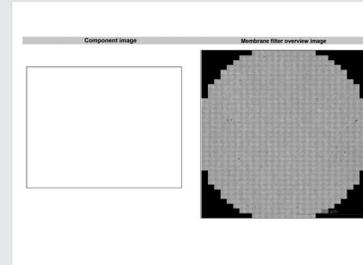
4 Membrane Filter



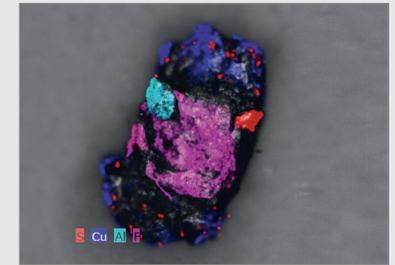
5 Screening in LM



6 Identification



7 Characterization LM



8 Characterization EM

Reporting acc. to ISO Standard 16232

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Your Correlative Workflow



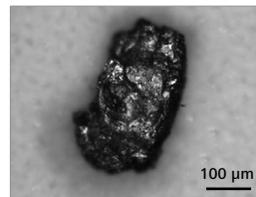
Correlative Holder

- Specimen holder for particle filter
47 mm or 50 mm
- Adapter plate
- Calibration marker



Light Microscopy

- Axio Zoom.V16
- Axio Imager.Z2m



Light Microscope

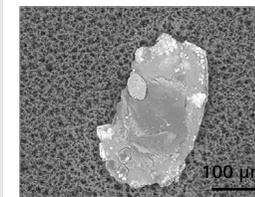


Select Particles of Interest



Electron Microscopy

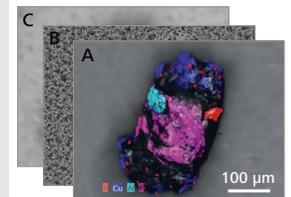
- EVO
- SIGMA
- MERLIN



Electron Microscope

Start EDS

- Correlation
- Image processing
- Consolidated report



A: EDX-Overlay
B: Electron Microscope
C: Light Microscope

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Documentation of Results

1. Cleanliness according ISO 16232 standard

Project data		Client data	
Project No.:	P00056	Date:	
Description:		Company:	
Operator:	vxvxcvxcvxcvxcv	Contact person:	
Test specification:	CAPA03092013 small Mosaix	Address:	
Comment:		Postal code:	
Component identification		Extraction conditions	
Name:		Procedure:	
Drawing-No.:		Environment:	
No. of components:		Solvent:	
Wetted area/component [cm2]:		Brand name:	
Wetted volume/component[cm3]:		Supplier:	
Pre-Treatment:		Type:	
		Misc.Type:	
		Amount [ml]:	
Microscope system for correlative analysis			
Supplier:	Carl Zeiss Microscopy GmbH	SEM supplier/type:	
Microscope type:	Axio Imager.Z2	EDS-detector supplier:	
Objective magnification:	5	Application type:	
Microscope camera:	AxioCamMR3	Application recipe:	
Exposure time [ms]:	528.8	Resolution EDS-detector [eV]:	
Resolution [Pixel]:	1368 x 1040	Chamber pressure [Pa]:	
Pixel scaling [µm/Pixel]:	44.09	Acceleration voltage [kV]:	
		Calibration Counter value [cps]:	
		SEM magnification [X-times]:	

2. Classification of metallic particles, Feret Max values ISO 16232 standard

Classes	>=	<	Absolute number of particles	Particles allowed	Status	Number %	Number sum	Number sum %	Parameter weight ed	Parameter weight ed %	Parameter weight ed sum	Parameter weight ed sum %	Cleanliness Level
B	5	15	0		OK	0.00	0	0.00	0.00	0.00	0.00	0.00	NO,A00,V00
C	15	25	0		OK	0.00	0	0.00	0.00	0.00	0.00	0.00	NO,A00,V00
D	25	50	0		OK	0.00	0	0.00	0.00	0.00	0.00	0.00	NO,A00,V00
E	50	100	0		OK	0.00	0	0.00	0.00	0.00	0.00	0.00	NO,A00,V00
F	100	150	0		OK	0.00	0	0.00	0.00	0.00	0.00	0.00	NO,A00,V00
G	150	200	2		OK	18.18	2	18.18	344.38	8.72	344.38	8.72	NO,A00,V00
H	200	400	5		OK	45.45	7	63.64	1463.01	37.06	1807.40	45.78	NO,A00,V00
I	400	600	3		OK	27.27	10	90.91	1500.87	38.01	3308.26	83.79	NO,A00,V00
J	600	1000	1		OK	9.09	11	100.00	639.89	16.21	3948.15	100.00	NO,A00,V00
K	#		0		OK	0.00	11	100.00	0.00	0.00	3948.15	100.00	NO,A00,V00

3. CCC Code and biggest particle

Largest object:	Particle types	ISO Code
Particle-ID: 377	all	CCC(N) = B222/C115/D93/E42/F21/G37/H90/I23/J19/K5
Feret Max [µm]: 4314.34	reflective	CCC(N) = B0/C1/D0/E1/F7/G9/H32/I11/J12/K2
Particle type: fibrous	non-reflective	CCC(N) = B222/C114/D93/E41/F14/G27/H56/I11/J7/K2
	fibrous	CCC(N) = B0/C0/D0/E0/F0/G1/H2/I1/J0/K1
Largest reflective particle		
Particle-ID: 371		
Feret Max [µm]: 1288.70		
Largest non-reflective particle		
Particle-ID: 451		
Feret Max [µm]: 1338.31		
Largest fibrous particle		
Particle-ID: 377		
Feret Max [µm]: 4314.34		

3. CCC Code and biggest particle

Classes	Class B: 5 - 15 (µm)	Class C: 15 - 25 (µm)	Class D: 25 - 50 (µm)	Class E: 50 - 100 (µm)	Class F: 100 - 150 (µm)	Class G: 150 - 200 (µm)	Class H: 200 - 400 (µm)	Class I: 400 - 600 (µm)	Class J: 600 - 1000 (µm)	Class K: x >= 1000 (µm)
Steel Non-alloy	0	0	0	11	6	1	0	0	0	0
Steel Alloy	0	0	0	11	0	0	0	0	0	0
Brass	0	0	0	0	1	0	0	0	0	0
Sustainable Si	0	0	0	1	0	0	0	0	0	0
Sustainable Al	0	0	0	6	3	2	0	0	0	0
Sustainable Zn	0	0	0	1	0	0	3	1	0	0

Tailored Precisely to Your Applications

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Typical Samples

- Diesel engines
- Cylinder blocks
- Crankshaft
- ABS systems
- Injector nozzle
- Gear

Task

Assure flawless functioning of parts and verify component cleanliness by cleanliness analysis supporting ISO 16232 and VDA 19

- Rinse parts with water and analyze and classify more than 25k particles on a filter starting from $>5 \mu\text{m}$.

Analyze particles within oils and brake fluids starting from $2 \mu\text{m}$ to avoid blocking of filters, nozzles and valves, oilaging, cracks and leakage or break down of pumps

- Analyze and classify more than 50k particles starting from $2 \mu\text{m}$.

Characterize process critical particles

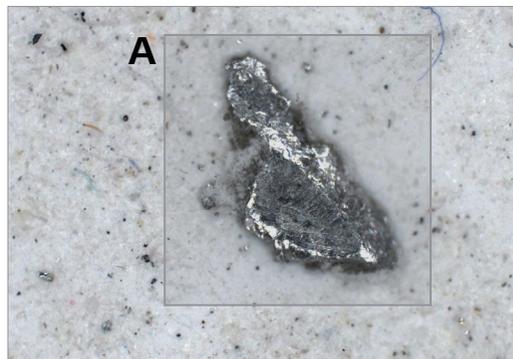
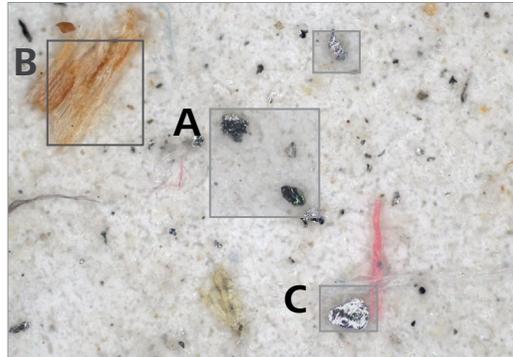
ZEISS CAPA offers

Brightfield and polarized light microscopy deliver information on number, shape, size and kind of particles on the filter. With the electron microscope you additionally analyze the particles with EDS. CAPA provides an automatic EDS measurement of the up to 200 biggest particles or 200 particles in a selected size range.

ZEISS CAPA at Work

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Typical Particles in the Light Microscope



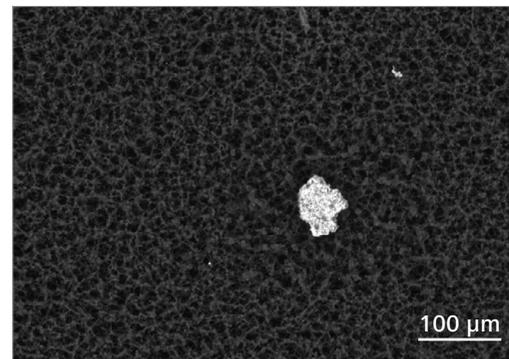
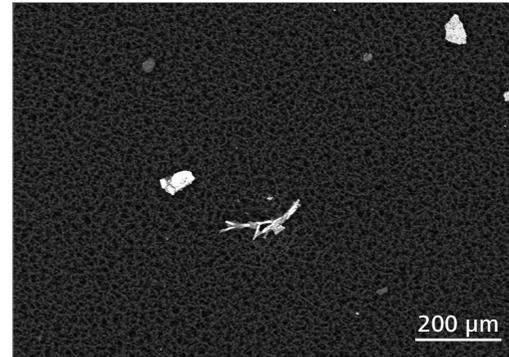
Filter membrane with different particle types

A: Metallic particles

B: Non-metallic particles

C: Fibers

Typical Particles in the Electron Microscope



ZEISS CAPA: Your Flexible Choice of Components

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1 Microscopes

Light Microscopes

- Axio Zoom.V16
- Axio Imager.Z2m

Electron Microscopes

- EVO
- SIGMA
- MERLIN Compact
- MERLIN

2 Software

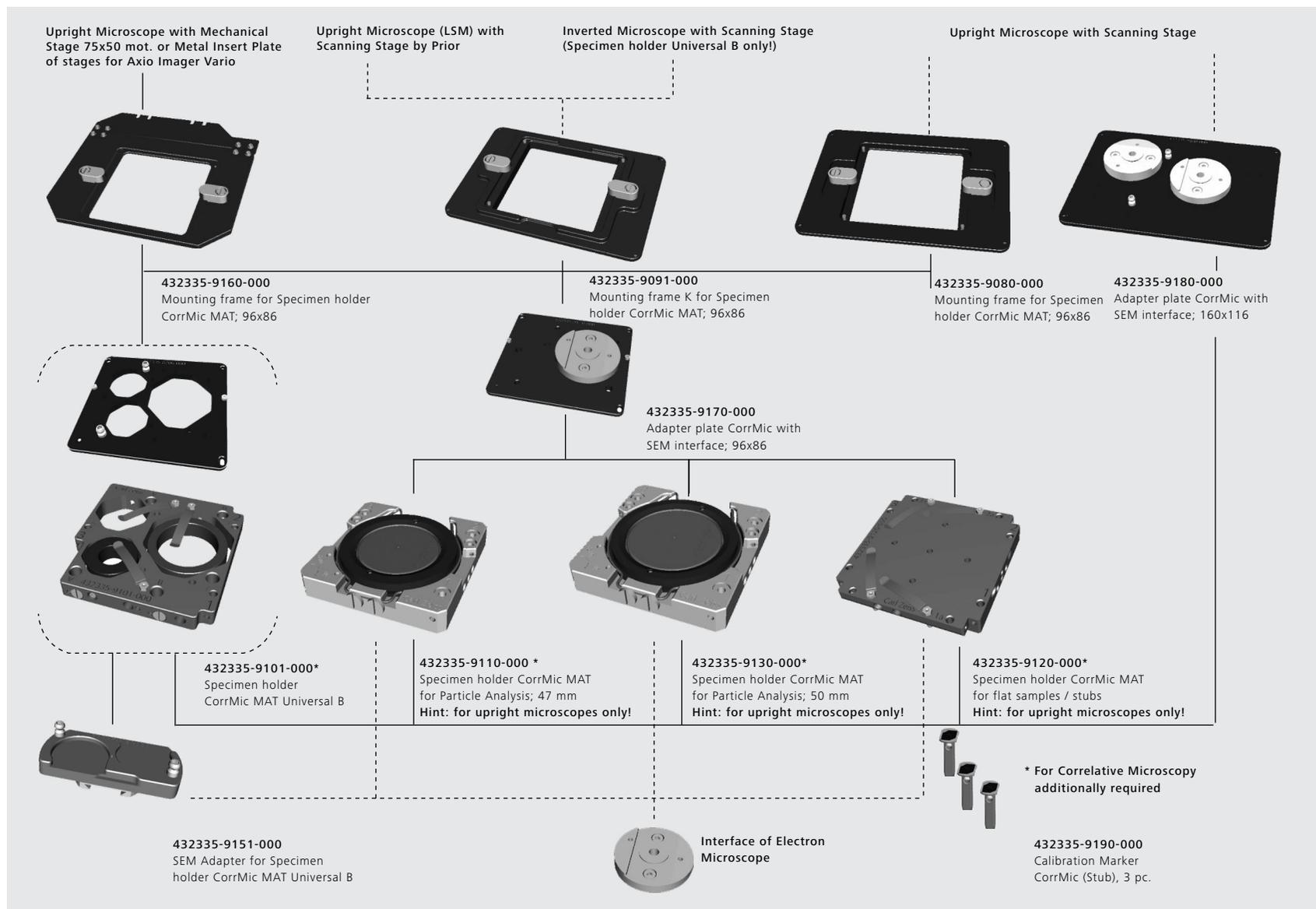
- AxioVision
- Software Module: ZEISS Correlative Particle Analyzer (CAPA) and MosaIX
- SmartSEM
- SmartPI

3 Accessoires

- Specimen holder for particle filter
47 mm or 50 mm
- Adapter plate
- Calibration marker
- Optionally adapter frame

ZEISS CAPA: System Overview

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Sample Holder Configuration Example

Microscope	Axio Imager.Z2m Upright microscope with mechanical stage 75x50 mot.	Axio Zoom.V16 Upright microscope with scanning stage S
Part 1	Specimen holder Particle Filter 47 mm 432335-9110-000 	Specimen holder Particle Filter 47 mm 432335-9110-000 
Part 2	432335-9190-000 Calibration marker CorrMic (Stub), 3 pc.	432335-9190-000 Calibration marker CorrMic (Stub), 3 pc.
Part 3	432335-9170-000 Adapter plate CorrMic with SEM interface; 96x86	432335-9180-000 Adapter plate CorrMic with SEM interface; 160x116
Part 4	432335-9160-000 Mounting frame for Specimen holder CorrMic MAT; 96x86	435465-9050-000 Adapter frame S 160x116 epi-illumination

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Configuration example for the automatic measurement:

To semiautomatic analyse nonreflective particles or particles smaller than 5 µm you additionally use the AxioVision software module Shuttle & Find.

Order Number	Description
354751-9759-000	19" color flat panel display monitor
354737-9425-000	Styled Dual Joystick Controller
352137-9194-000	Control panel with rotary controls and keyboard according to UK language kit
354800-9180-000	Basic Unit EVO MA 10. Tungsten emission system, air admittance to 400 Pa, 5-axis motorised stage with software joystick, SE-detector, and multilingual Win 7 LM 5SBSD-1 kV 16 mm low-kV diode
354850-9044-000	Chamber scope with IR illumination displayed to full screen (stage door mounted)
351450-6197-000	SmartPI Particle Analysis Package, including Bruker SDD Detector
410130-1600-000	AxioVision Rel. 4.8.2 Software Site Licence for EM (32 bit)
410132-1726-000	AxioVision 4 Modul Correlative Particle Analysis Site Licence for EM (32 bit)
495010-0013-000	Axio Zoom.V16 Documentation configuration (without eyepieces) with maximum motorization, particle sizes from 5 µm with objective 1.5x and from 50 µm with objective 0.5x

Technical Specifications

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Microscopes	
Light Microscopes	Axio Imager.Z2m, Axio Zoom.V16
Electron Microscopes	EVO, SIGMA, MERLIN
Essential Specifications	
Relocation Accuracy	≤ 25 µm (coarse); <10 µm (fine) – depending on stages
Compatibility	Detector software: Bruker: Esprit Software 1.9.4.3351, EdsMrg 1.4.0.38 SmartPI Version: V02.01 SP2 SmartSEM 5.6 Detector software: Oxford: INCA 5.03 EdsMrg 3.1.0.39 for W7 SmartSEM V5.05 SP5 SmartPI V02.01 SP1 Light microscope: AxioVision 4.9.1 Electron microscope: AxioVision 4.8.2
Calibration	Manual or semi automatic calibration of the holders with automatic software detection of markers
Additional Functionality	Image overlay
Speed	1h/200 Particle
Maximum number of particles	200

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Accessories

Specimen holder CorrMic MAT for Particle Analysis; 47 mm (D)

Clamping mechanism for filter diameter 47 mm

Max. scan diameter: 37 mm

Filter mount without cover glass

Mount for 3 calibration markers for Correlative Microscopy (available separately)

Stamping tool for marking filters for orientated filter installation

With SEM adapter

Compatible with airlock 80 mm

Specimen holder CorrMic MAT for Particle Analysis; 50 mm (D)

Clamping mechanism for filter diameter 50 mm

Max. scan diameter: 40 mm

Filter mount without cover glass

Mount for 3 calibration markers for Correlative Microscopy (available separately)

Stamping tool for marking filters for orientated filter installation

With SEM adapter

Compatible with airlock 80 mm

Count on Service in the True Sense of the Word

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Because the ZEISS microscope system is one of your most important tools, we make sure it is always ready to perform. What's more, we'll see to it that you are employing all the options that get the best from your microscope. You can choose from a range of service products, each delivered by highly qualified ZEISS specialists who will support you long beyond the purchase of your system. Our aim is to enable you to experience those special moments that inspire your work.

Repair. Maintain. Optimize.

Attain maximum uptime with your microscope. A ZEISS Protect Service Agreement lets you budget for operating costs, all the while reducing costly downtime and achieving the best results through the improved performance of your system. Choose from service agreements designed to give you a range of options and control levels. We'll work with you to select the service program that addresses your system needs and usage requirements, in line with your organization's standard practices.

Our service on-demand also brings you distinct advantages. ZEISS service staff will analyze issues at hand and resolve it – whether using remote maintenance software or working on site.

Enhance Your Microscope System.

Your ZEISS microscope system is designed for a variety of updates: open interfaces allow you to maintain a high technological level at all times. As a result you'll work more efficiently now, while extending the productive lifetime of your microscope as new update possibilities come on stream.

Please note that our service products are always being adjusted to meet market needs and maybe be subject to change.



Profit from the optimized performance of your microscope system with services from ZEISS – now and for years to come.

>> www.zeiss.com/microservice

The moment you have absolute confidence in your results.
This is the moment we work for.

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We make it visible.