

SavvyInspector[®] SIF-4, SIF-4M & SIF-8M

Scratch and dig lens inspection



SavvyInspector® SIF-4 & SIF-4M & SIF-8M

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The SavvyInspector® SIF instruments are a line of popular software assisted scratch-dig systems for flat optical surfaces. Introduced in 2009 there are now over 50 systems in the field measuring scratch and dig throughout the industry.

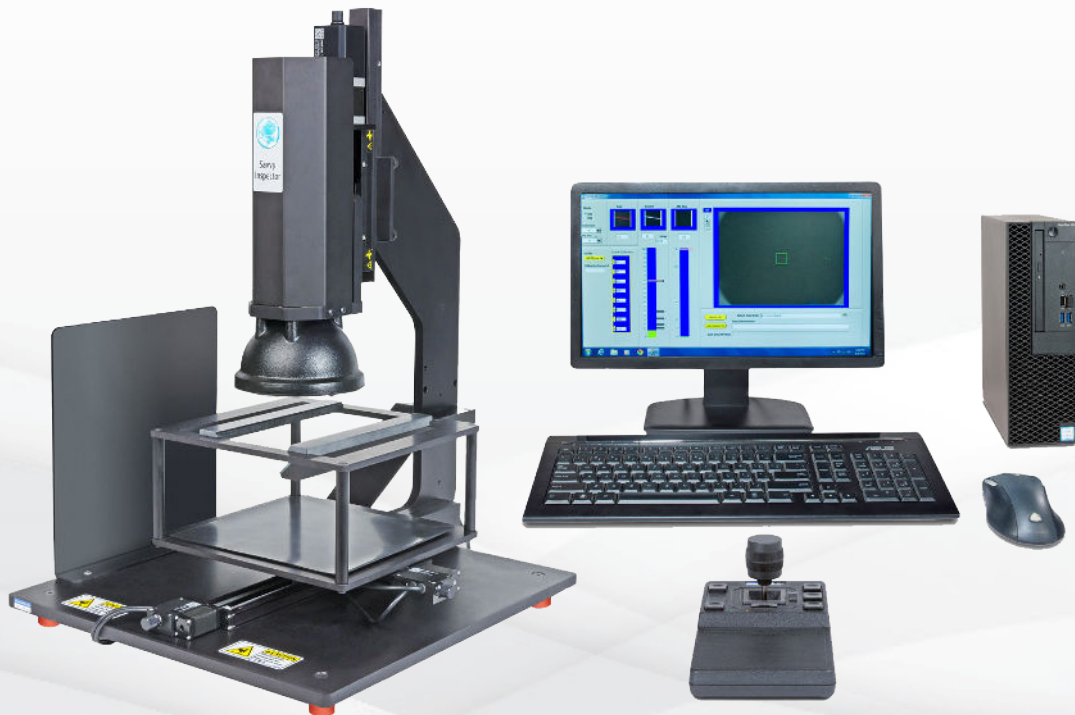
The SIF-4 uses a high-resolution 1.4 megapixel camera to perform precise measurements and grading on very small features and perform objective scratch and dig inspection.

The SIF-4M is the motorized version of our popular SIF-4 model. Joystick controlled motorized x, y and z stages make measurements fast and efficient for high volume parts.

The SIF-8M is a 200 mm motorized version of our popular SIF-4 software assisted scratch-dig system for larger flat optical surfaces. Joystick controlled motorized x, y and z stages make measurements fast and efficient for high volume parts as well as large, precise parts.

All instruments are designed specifically to reproduce the conditions of an in-reflection visual inspection as described in ANSI/OEOSC OP1.002 "Appearance Imperfections," Appendix C of MILPRF- 13830B, and in Annex A.3 of ISO 14997, the metrology standard for the new visibility notation of ISO 10110. The factory calibrated inspection head of the SavvyInspector® uses invariant illumination and detection optics and propriety analysis software, allowing objective, repeatable, and recordable evaluation of scratch-dig surface quality.

For the SIF-4M and SIF-8M models, full part mapping for inspection documentation and review is also supported, and the "autoscan" feature allows unmanned scanning and documentation of the entire optical surface in a composite map of tiled images of the entire surface inspected. Optional "autoinspect" and "autoreport" features allow automated inspection and documentation to your specified requirements.



SavvyInspector® SIF-8M system

Product Specifications

The SavvyInspector® SIF instruments are complete flat-optics inspection systems consisting of:

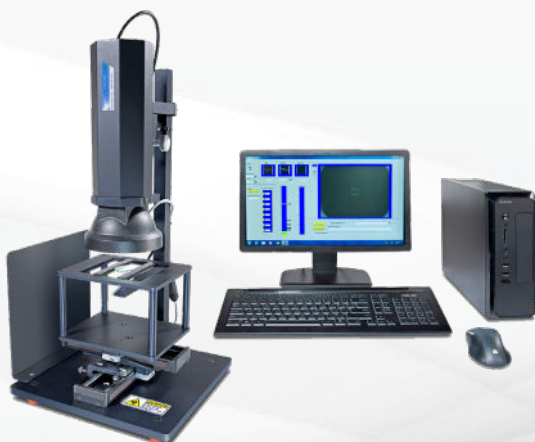
- A custom LED-based illumination assembly
- A detection assembly with a digital megapixel camera
- A manual or motorized z-stage for focusing to different part thicknesses
- SIF-4: a manual, encoded 100 mm x-y stage platform with rails for part holding and positioning
- SIF-4M: a joystick controlled, motorized 100 mm x-y stage platform
- SIF-8M: a joystick controlled, motorized 200 mm x-y stage platform
- Light baffles, base-stand assembly, and cabling
- A stand-alone computer with proprietary SavvyInspector® analysis software

Scratch/dig standards supported:

- MIL-PRF-13830B
- MIL-C-675C
- ANSI/OEOSC OP1.002:2017 Visibility Method
- ISO 10110/ISO 14997 Visibility Specification



SavvyInspector® SIF-8M system



SavvyInspector® SIF-4 system

Instrument calibration

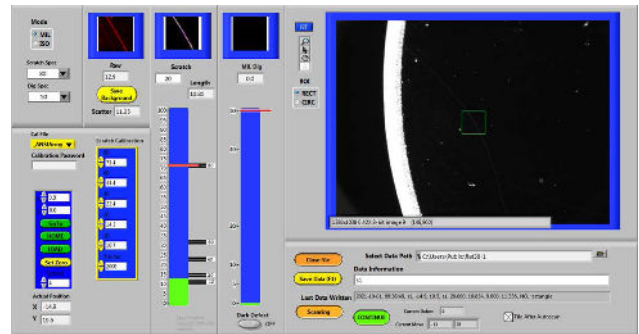
Direct traceability to the US Army calibration standards

The SavvyInspector® system comes from the factory with calibration files based on master scratch and dig limit standards at Picatinny Arsenal, as well as the US Army-traceable Davidson D-668 standards and other respected industry comparison standards. The SIF systems are the only MilSpec US Army traceable scratch and dig measurement systems.

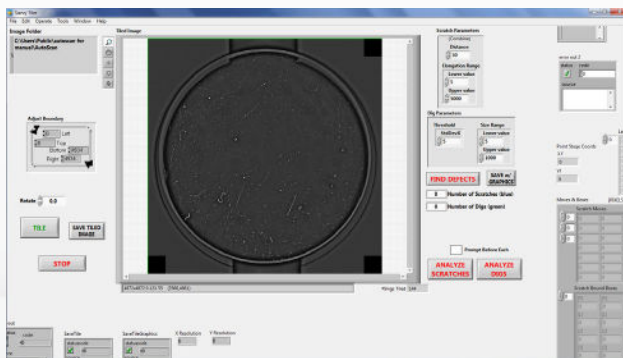
SavvyInspector® Software

The SavvyInspector® operator interface is designed for easy factory-floor operation, while expanding its application in the role of “Master Inspector” for Quality Assurance (QA), Quality Control (QC) and Material Review Board (MRB) decisions. The software reports the scratch grade or dig value automatically. There is no subjectivity; the grade is reported and the grade bar turns red if the imperfection is greater than the specification.

The operator enters the inspection level required, and then uses the manual x-y stage to locate the desired defect on the real-time viewing screen. The operator enters the inspection level required, and then uses the x-y stage to locate the desired defect on the viewing screen. Scratch lengths are measured with the click of the mouse. The “always on” inspection mode and programmable grade bars allow the operator to get real-time feedback on whether a selected imperfection is acceptable or not with a simple visual interface. When a careful review and documentation of a surface is required, the SavvyInspector® software provides data management tools to properly collect and file screen shots and inspection grades for each imperfection on a surface, including a summary log in CSV format for easy uploading into Excel or an inspection report. Accumulation rules can be applied using the SavvyAccumulator™ spreadsheet. Custom calibration files can be created for specific projects or customer needs by the Quality Engineer as needed. The calibration data can then be saved and accessed from the inspection mode.



Screen shot of inspection mode



Screen shot of tiled image

SIF-4M and SIF-8M are based on the same SavvyInspector® technology, but use motorized stages to assist in improved ease-of-use inspection and faster throughput. The operator enters the inspection level required, enters part geometry and size, and then uses the joystick to scan the surface for imperfections in the real-time viewing screen. The “auto scan” feature creates indexed image files for the entire surface, documenting the condition of the optic and allowing the operator to identify regions on the part which require further review. The coordinates can be entered and the system returns

to the desired location with the push of a button. Accumulation rules can be applied using the SavvyAccumulator™ spreadsheet, or the SavvyInspector® can do it for you. Optional automation software with customized inspection rules can be used to consistently and completely inspect and document entire components to your requirements.

Technical Specifications

SavvyInspector® SIL Features	Specification	Comment
Inspection head	1.4 Megapixel camera with fixed illumination and simulating reflection inspection for surface quality per MIL-PRF-13830B	Inspection setup is identical to that of MIL-PRF-13830B Annex C, and the visibility inspection method described in other MIL, ANSI and ISO standards
Viewing field	9 mm x 12 mm, digitally zoomable	Allows rapid location of imperfections
Inspection area	1 mm square or circle in the center of the viewing field	Allows isolation of specific imperfections for evaluation
X-Y stages	SIF-4: Manual encoded x, y slide stage with > 100 mm travel SIL-4M: Five speed, motorized, joystick SIF-8M: Motorized, joystick controlled 200 mm stages	Encoded stages read out distance moved since last mouse click allowing rapid evaluation of scratch length and precise positioning
Focus	SIF-4: Manual 70 mm z-stage for focus Depth of focus > 1 mm. SIF-4M & SIF-8M: Motorized, joystick controlled 70 mm Z-stage for focus. Depth of focus > 1 mm	Easily adjusts for thick parts
Test surface reflectivity	Plano or mild concave surface	Standard calibration files for metalized comparison standards are provided. Some custom calibrations or part fixturing may be required
Test surface shape	SIF-4M & SIF-8M: Motorized, joystick	Designed for flat parts, but long radius concave parts can also be inspected
Reported values	Scratch number - 10, 20, 40, 60, 80 Dig value - continuous from 5 to 70 ISO grade - 0.025 to 0.63	Per MIL-PRF-13830B and ANSI/OEOSC OP1.002, visibility method and ISO 10110-7/ISO 14997 visibility specifications
Comparison standards	Factory calibrated to FLIR/Brysen, Davidson comparison artifacts, as well as various plastic inspection paddles	Customer can generate and save calibration files for any artifact set
Instrument repeatability	> 95 % repeatability of reported scratch or dig grade	Presumes > 20 measurements of a clean surface in a proper environment of a stationary part
Instrument reproducibility	> 90 % reproducibility of reported scratch or dig value	Presumes the clean part is removed, replaced and repositioned to the same location > 20 times



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