

## SavvyInspector<sup>®</sup> SIL-4 & SIL-4M

Scratch and dig lens inspection

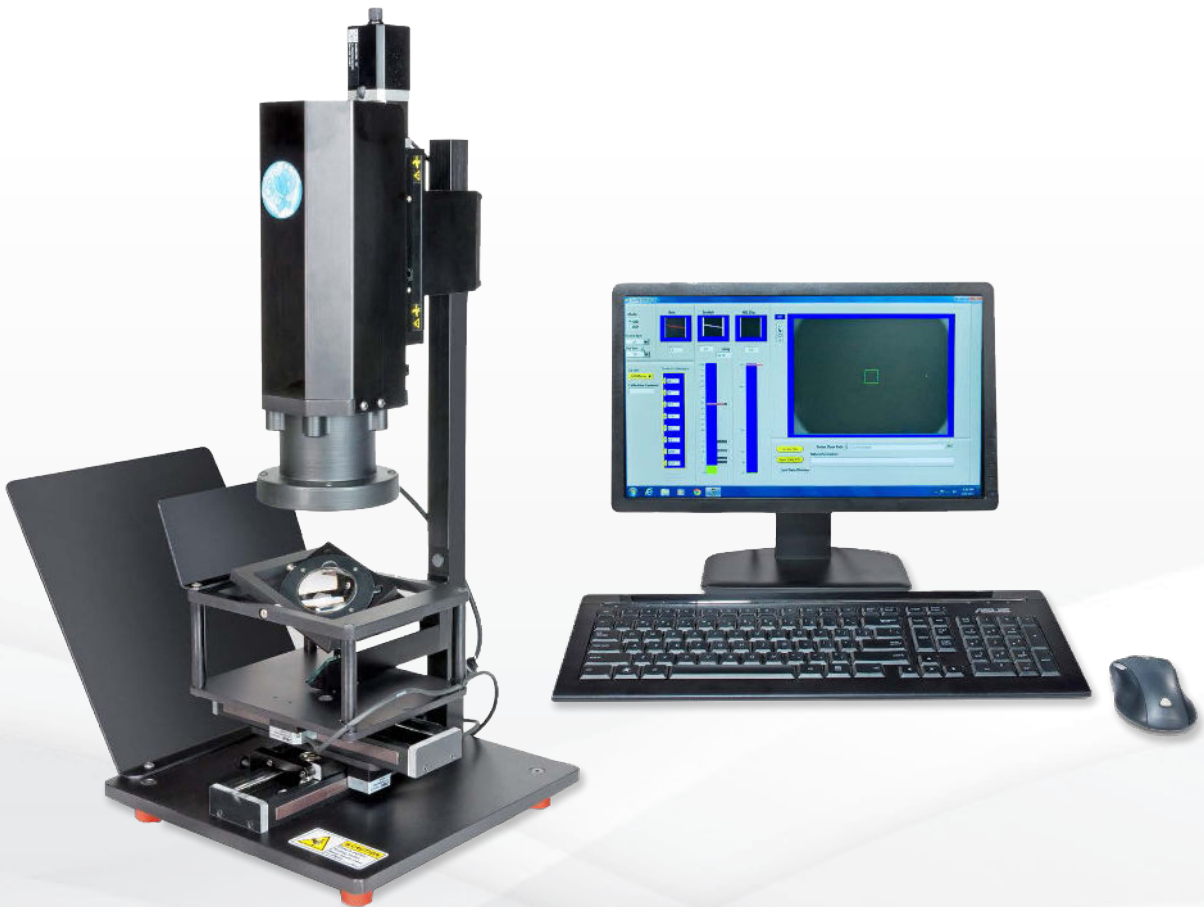


# SavvyInspector® SIL-4 & SIL-4M

## Scratch and dig lens inspection

The SavvyInspector® models SIL-4 and SIL-4M are the world's first US Army MilSpec-traceable scratch and dig measurement system designed to measure scratches and digs on curved surfaces. The system reproduces the conditions of an in-reflection visual inspection described in ANSI/OEOSC OP1.002 "Appearance Imperfections," Appendix C of MIL-PRF-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, a manual tip/tilt and rotation stage, and propriety analysis software, allowing objective, repeatable, and recordable evaluation of scratch-dig surface quality on curved surfaces.

The SIL-4 uses a 1.4 megapixel camera and is capable of evaluating lenses (e.g. plano-convex, 25 mm diameter  $R > 40$  mm or equivalent surface slopes) to specifications down to  $10^{-5}$ . The SIL-4M is recommended for measurements on small parts less than 10 mm diameter or parts with high slopes (up to  $f/2$ ).



SavvyInspector® SIL-4 system

# Product specifications

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The SavvyInspector® SIL-4 & SIL-4M are complete inspection systems consisting of:

- A custom LED-based illumination assembly
- A detection assembly with a digital megapixel camera
- A motorized, joystick controlled 70 mm z-stage for focusing to different heights
- SIL-4: a manual, 100 mm x-y stage
- SIL-4M: a joystick controlled, motorized 100 mm x-y stage platform
- A manual tip-tilt stage and three-jaw chuck to allow measurement of parts up to 45 mm in diameter. Additional tooling allows parts up to 70 mm diameter. A stand-alone computer with proprietary SavvyInspector® analysis software
- 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

## Instrument calibration

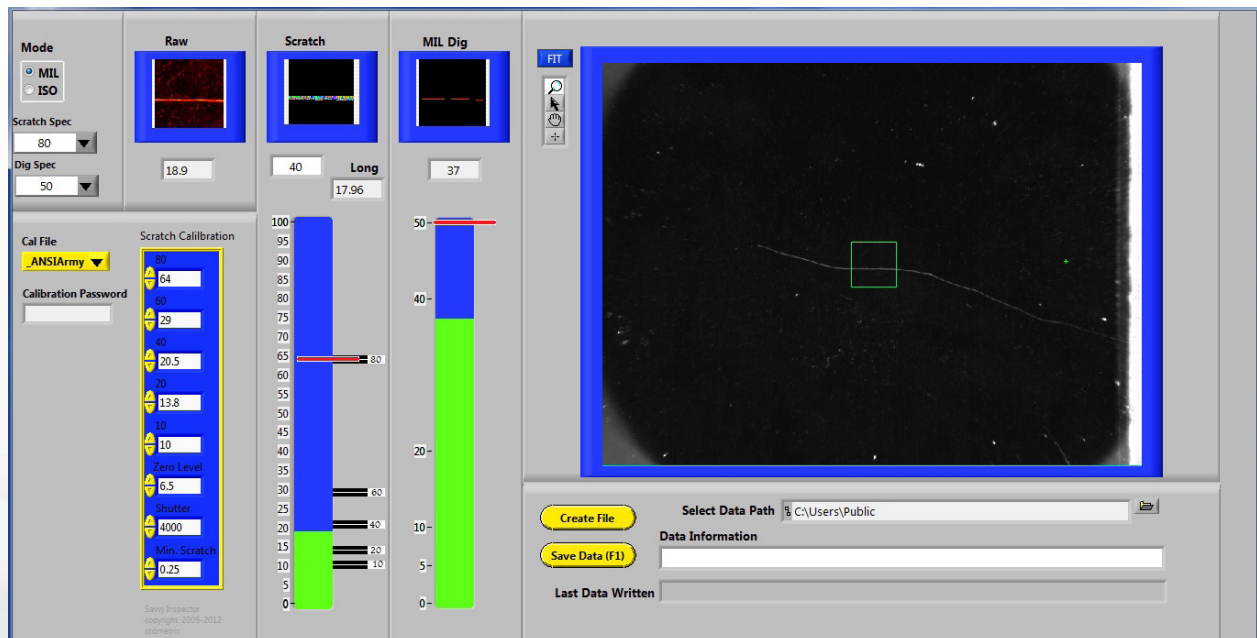
Scratch/dig standards supported:

The SavvyInspector® system comes from the factory with calibration files based on the US Army MilSpec traceable calibration standards as well as the US Army-traceable Davidson D-668 standards and other respected industry comparison standards. It is the only scratch and dig measurement system capable of achieving calibrated scratch and dig measurements on curved surfaces

# 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 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 curved part is then tilted with the manual tip-tilt stage to optimize the visibility of the imperfection of interest. Motorized focus controlled by the joystick allows easy measurement set up.

The software reports the scratch grade or dig value automatically. 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. There is no subjectivity; the grade is reported and the grade bar turns red if the imperfection is greater than the specification. 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. Custom calibration files can be created for specific projects or customer needs by the Quality Engineer as needed.



Screen shot of inspection mode

# Technical Specifications

| SavvyInspector® SIL Features | Specification   | Comment  |
|------------------------------|---|--|
| Inspection head              | 1.4 Megapixel camera and 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                   | <p>SIL-4: Manual encoded x, y slide stage with &gt; 100 mm travel. Manual tip and tilt stage, ±20 degrees</p> <p>SIL-4M: Five speed, motorized, joystick controlled x, y stage with &gt; 90 mm travel. Manual tip and tilt stage, ±20 degrees</p> | Tip and tilt stage is required for up to 70 mm parts with surface slopes of up to 15 degrees.  |
| Focus                        | Motorized 70 mm Z-stage for focus. Depth of focus > 1 mm  | Allows the operator to focus while translating and tilting the part  |
| Test surface reflectivity    | System can measure coated or uncoated parts, filters, windows, mirrors, lenses etc  | Standard calibration files for metalized comparison standards are provided. Some custom calibrations or part fixturing may be required               |
| Test surface shape           | Plano or concave/convex surfaces with less than 15 degrees of surface slope   | Designed for flat or curved surfaces   |
| Reported values              | Scratch number: 10, 20, 40, 60, 80<br>Dig value: Continuous from 5 to 70  | 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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