

Technical Specification

SCRATCH AND DIG LENS INSPECTOR

SavvyInspector® SIL-4

Introduction

The SavvyInspector® model SIL-4 is the world's first Army-traceable scratch and dig measurement system able to measure scratches and digs on curved or flat surfaces. The system is designed to reproduce the conditions of an in-reflection visual inspection described in ANSI/OEOSC OP1.002 "Appearance Imperfections" and Appendix C of MIL-PRF-13830B, "General specification governing the manufacture, assembly, and inspection of optical components for fire control instruments." The factory calibrated inspection head of the SavvyInspector® uses invariant illumination and detection optics and proprietary analysis software, allowing objective, repeatable, and recordable evaluation of scratch/dig surface quality on flat and curved surfaces with Radius of curvatures down to

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.

Product Description

SavvyInspector® SIL-4 is a complete inspection system consisting of:

1. A custom LED-based illumination assembly.
2. A detection assembly with a digital megapixel camera.
3. A manual z-stage for focusing to different part thicknesses.
4. A manual, encoded 100 mm x-y stage platform with rails for part holding and positioning.
5. A manual tip-tilt stage.
6. A stand-alone computer with proprietary SavvyInspector® analysis software.



Scratch/Dig Standards Supported

MIL-PRF-13830B

MIL-C-675C

ANSI/OEOSC OP1.002:2009 Visibility Method

ISO 10110/ISO 14997 visibility specification

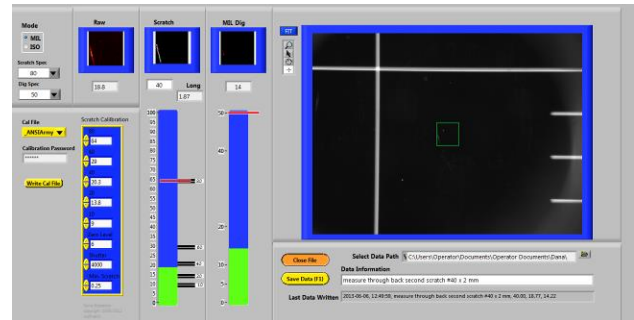
Instrument Calibration – Direct Traceability to the Army Calibration Standards

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 respected Brysen, Davidson, Edmund and Thor Labs comparison standards. It is the only Army traceable scratch and dig measurement system.

Version 7.0 Software

The SavvyInspector® operator interface is designed for easy factory-floor operation, while expanding its application in the role of “Master Inspector” for QA, QC and 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 software reports the scratch grade or dig value automatically. Curved surfaces can be evaluated using the included tip/tilt stage. 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. 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 version 7 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 project 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

| Feature | 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, MIL-C-675C and the visibility method described in ANSI/OEOSC OP1.002:2009 and in ISO10110-7:2017 and ISO14997:2017 |
| Camera Field of View | 9 x 12 mm, digitally zoomable | Allows rapid location of imperfections |
| Inspection Area | One mm square or circle in center FOV | Allows isolation of specific imperfection for evaluation |
| X-Y and tip/tilt Stages | Manual encoded x, y slide stage with >100mm travel Manual tip and tilt stage, ± 15 degrees | tip and tilt stage is required for up to 70 mm parts with surface slopes of up to 15 degrees. A large-aperture top plate is included for larger flat optics. |
| Focus | Manual 70 mm Z-stage for focus. Depth of focus > 1 mm | Easily accommodates thick parts |
| 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 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 |