SCRATCH AND DIG LENS INSPECTOR

SavvyInspector® SIL-4M

Introduction

The SavvyInspector® model SIL-4M is the motorized version of SIL-4, the world's first Army-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, "General specification governing the manufacture, assembly, and inspection of optical components for fire control instruments," 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.)

Product Description

SavvyInspector® SIL-4M 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 motorized 70 mm z-stage for focusing to different heights.
4. A joystick controlled motorized 100 mm x-y stage platform
5. 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.
6. A stand-alone computer with proprietary SavvyInspectior® 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 – Based on Army-Traceable Calibration Standards

The SavvyInspector® system comes from the factory with calibration files based on the most popular and respected comparison standards made by Brysen, Davidson, Jenoptik, Edmund and Thor Labs. It is the only scratch and dig measurement system capable of achieving calibrated scratch and dig measurements on curved surfaces.

Distribution in the UK & Ireland

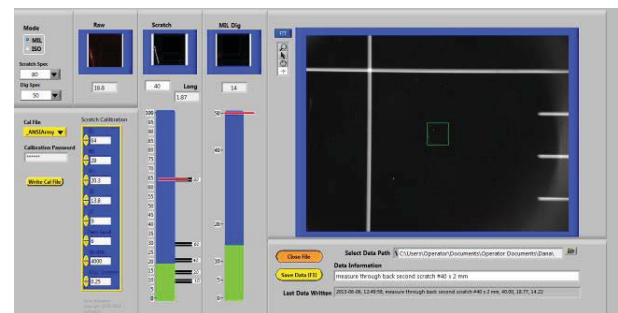## Version 6.4 Software

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 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 version 6.4 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 project or customer needs by the Quality Engineer as needed.

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	Five speed, motorized, joystick controlled x, y stage with >90mm travel Manual tip and tilt stage, ± 20 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	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 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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