

VISO SYSTEMS

Guidelines

Sensor maintenance

Revision: August 2026

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1. Introduction

Accurate optical measurements are the foundation of reliable lighting characterization, product research, and regulatory compliance.

Over time, high-precision spectrometers are subject to subtle performance drifts caused by environmental cycling, components aging, and mechanical stress. Even microscopic shifts can compromise radiometric and spectral integrity, leading to errors in luminous flux, color rendering indexes, and correlated color temperature calculations.

This document provides comprehensive guidelines for the ongoing maintenance, verification, and calibration of Viso Systems spectrometer sensors. It outlines the specific roles of field verification tools such as the REF-800 Fast Check lamp and full recalibration packages like the CALI-T50 reference light source. By establishing a structured routine of frequent internal checks and periodic factory recalibrations, laboratories can safeguard measurement accuracy, eliminate operational downtime, and maintain full traceability to international standards (PTB and NIST).

Adherence to these maintenance procedures ensures that your Viso system continuously delivers the highest data fidelity, preventing costly product development errors and ensuring compliance during strict quality audits.

You will find an overview of all up to date Viso manuals here:

<https://www.visosystems.com/user-manuals/>

2. Sensor reliability

2.1. Factory Calibration Process at Viso Systems

When a spectrometer sensor undergoes calibration at the Viso Systems Headquarters in Copenhagen, Denmark, it is placed into a highly controlled, laboratory environment designed to eliminate stray light and ambient light.

Viso's standard sensors are built around high-precision, fixed-grating spectrometers. They incorporate top-tier components like the Ibsen Photonics FREEDOM spectrometer and Hamamatsu detector arrays.

Viso's factory recalibration focuses primarily on **absolute radiometric calibration**—ensuring the sensor converts the incoming light intensity into exact lumen, candela, and color metrics accurately. This is achieved this using certified master lamps, which are directly traceable to PTB or NIST standards.

2.2. Why Spectrometer Sensors Need Regular Calibration

Spectrometers rely on sensitive optical configurations, diffraction gratings, and complementary metal-oxide-semiconductor (CMOS) or charge-coupled device (CCD) sensor arrays. These components shift over time due to three core factors:

- **Optical Alignment Drift:** Microscopic shifts in the alignment of the internal entry slit, mirror path, or diffraction grating can cause a wavelength shift. This results in photons hitting the wrong pixels on the detector array.
- **Thermal and Environmental Cycling:** Constant heating and cooling cycles expand and contract the internal components. This alters the sensor matrix's electrical baseline sensitivity and dark current signature over time.
- **Detector and Lamp Aging:** The photodiode array degrades unevenly under light exposure. This alters its relative response to specific wavelengths, while reference calibration bulbs slowly thin out their tungsten filaments, subtly shifting their spectral output.

2.3. How Lack of Calibration Affects Accuracy

If a spectrometer system drifts away from its true calibration data, the raw measurement data collected by the Viso Light Inspector software becomes distorted:

- **Wavelength Shifting:** If the pixel-to-nanometer map drifts spectrum becomes incorrect. This causes distorted color metrics: Color metrics like CCT, CRI (Ra), CQS, and TM-30 rely on accurate spectral mathematical balances. A minor skew in spectral shape leads to highly inaccurate color fidelity scores.
- **Flux skewing:** Total flux calculations rely on the sensor's absolute radiometric sensitivity.

3. Recommendations to system owners

3.1. Check of the calibration status regularly

Once every three months check your calibration status.

A special Viso reference light source (REF-800) is included with all new systems. **See further descriptions of the REF-800 source in section 4.**

If the original reference lamp does not exist anymore, Viso Systems can dedicate a REF-800 to the sensor during a factory recalibration – please contact info@visosystems.com.

It is also possible to use CALI-T50 to make calibration status checks, however caution must be taken to avoid exceeding the 30-hour service life of this lamp.

3.2. Calibrate if needed

If your status check indicates unsatisfactory precision, it is time for calibration. This would normally be once every one or two years.

Viso LightSpion owners: Contact Viso Systems or your Viso local dealer to arrange for factory calibration in Copenhagen

Viso BaseSpion and LabSpion owners:

Custom calibrations

If you own a CALI-T50 or a CALI-DT300 custom calibration source, you have the option of making your own on-site calibration. The advantage is that you can maintain your calibration with almost no downtime and no cost.

Viso recommends that you just perform custom calibrations for about 7 years and then renew the factory calibration.

Factory calibrations

You may also send your sensor to Viso Systems HQ in Copenhagen for factory recalibration, which has the following advantages:

- You are sure that the calibration takes place in a controlled laboratory
- Your sensor gets a calibration against a standard source which is one step up in the hierarchy of standard sources linking working instruments up to fundamental SI international standards.
- You get a calibration certificate that may be necessary for internal procedures and ISO accreditations
- Just after calibration, we will use your sensor to recharacterize the reference lamps, so that they match up, and can be used to do custom calibration/check-ups going forward. In general, the way we handle both REF-800 and CALI-T50 lamps is that we characterize them as a part of sensor factory calibration to pair everything together.

3.3. Maintain other system parts

As for maintaining other goniometer parts, you will find a recommended maintenance plan in the system user manuals:

https://data.visosystems.com/content/manuals/labspion_user_manual.pdf
https://data.visosystems.com/content/manuals/basespion_user_manual.pdf

4. Reference lamps

The CALI-T50, CALI-DT300 and REF-800 are specialized lighting tools designed to maintain the measurement accuracy of Viso goniospectrometer systems (such as the LabSpion and BaseSpion). While they look like standard lamps, they serve entirely different roles in the quality control pipeline.

The primary difference is that the CALI-T50 and CALI-DT00 are full recalibration light sources, whereas the REF-800 is a rapid health-check tool.

Recharacterization – extending the service life

The characteristics of reference lamp will change in time and by use:

Light Source Type	Primary Degradation Driver	Most Impacted Spectral Region	Flux Trend
Gently driven white LED	Slow crystal degradation and phosphor yellowing	Slightly more blue over time	Extremely slow change
Incandescent / Halogen	Filament thinning & glass silvering	Short visible wavelengths (Blue / Near-UV)	Gradual, predictable decline
Deuterium Arc	Window solarization & cathode sputtering	Deep Ultraviolet (< 250 nm)	Accelerated decline with added arc flicker

The CALI lamps both have a recommended service life of 30 hours. After this, it is possible to recharacterize the lamps to extend the service life for another 30 hours. Recharacterization does not adjust anything in the lamps - just very accurately measures their outputs, so that these outputs can be used subsequently as spectral intensity distribution references for your particular sensor.

4.1. Recommendations

In general, the way we handle both REF-800 and CALI-T50/CALI-DT300 lamps is that we characterize them as a part of sensor factory calibration to pair everything together.

As part of a Viso factory recalibration, we will ask you to send both the sensor and the REF-800 and CALI lamps to us. Just after calibration, we will use your sensor to recharacterize the reference lamps, so that they match up, and can be used to do custom calibration/check-ups going forward. Pairing sensors and lamps also contributes to limiting uncertainty.

5. Viso REF-800: The Fast Check Verification Lamp



5.1. Purpose

The REF-800 Fast Check is a **verification tool** included with all new goniometer systems. Its role is to confirm that your system is still measuring accurately without putting unnecessary wear and tear on your expensive CALI-T50 lamp. Also, REF-800 is more stable over time than incandescent lamps, which makes ideal for regular check-ups.

5.2. Construction

It features a durable, stable LED light source. It is paired with its own unique, matching power supply. Both the lamp and the power supply are physically labeled with an identical calibration tracking number and date.

5.3. Usage

Users mount the REF-800 onto their goniometer frequently (e.g., every 3 months) to perform a "check-up". The software compares the real-time readings against the factory base values. If the total luminous flux (lumen), peak intensity (candela), or spectrum shapes match the original values, the system is verified. If the spectrum looks jagged or values drift, it signals that it is time to calibrate.

Meticulously follow the detailed check-up procedure described in this manual:
https://data.visosystems.com/content/manuals/ref800_user_manual.pdf.

5.4. Traceability & Calibration

The REF-800 is not an absolute standard on its own. Instead, it is measured by Viso (or by your lab) immediately after the spectrometer receives a fresh factory calibration. A unique verification certificate is generated for that specific lamp-sensor pairing. It provides localized traceability, proving your hardware has not drifted since its last true calibration.

6. Viso CALI-T50: Sensor Recalibration Lamp



6.1. Purpose

The CALI-T50 Reference Lamp is built to perform a complete **custom recalibration of your Viso VIS or VIS-NIR spectrophotometer sensor**. It allows labs to bypass the 1–2 weeks of downtime required to ship equipment back to Viso headquarters for servicing.

6.2. Construction

It utilizes a specialized tungsten-halogen light source that generates a perfectly smooth, predictable continuous visible light spectrum. The lamp comes protected in a rugged suitcase housing integrated soft-start electronics to maximize bulb lifespan. It includes a highly regulated, dedicated precise power supply to prevent voltage fluctuations during the critical calibration process.

6.3. Usage

It is deployed infrequently; typically once every year or two. It must be set up in a completely dark room with non-reflective surfaces. The operator runs the Viso Light Inspector software, which measures the lamp and overrides the sensor's baseline calibration metrics.

Meticulously follow the detailed custom calibration procedure described in this manual:

https://data.visosystems.com/content/manuals/cali-t50_user_manual.pdf.

6.4. Traceability and Calibration

The CALI-T50 is highly traceable. Every unit is directly traceable to Viso's master calibration lamp (an Oriel lamp characterized by the PTB—the German National Metrology Institute), making it fully compliant with internationally recognized NIST standards via ILAC membership agreements.

7. Viso CALI-DT300: Sensor Recalibration Lamp



7.1. Purpose

The CALI-DT300 Reference Lamp is built to perform a complete **custom recalibration of your UV-VIS or UV-VIS-NIR spectrophotometer sensor**. It allows labs to bypass the 1–2 weeks of downtime required to ship equipment back to Viso headquarters for servicing.

7.2. Construction

CALI-DT300 from Viso Systems which contains two lamps:

- A deuterium lamp
- A tungsten irradiance lamp.

The combined spectrum provides a predictable spectrum from 200-1100 nm, making it possible to calibration UV-VIS(-NIR) sensors. The combined spectrum of the calibration source is provided in a .Impx file (lamp file). All CALI-DT300 light sources are traceable to Viso's factory calibration lamps. It includes a highly regulated, dedicated precise power supply to prevent voltage fluctuations during the critical calibration process.

7.3. Usage

It is deployed infrequently; typically once every year or two. It must be set up in a completely dark room with non-reflective surfaces. The operator runs the Viso Light Inspector software, which measures the lamp and overrides the sensor's baseline calibration metrics.

Meticulously follow the detailed custom calibration procedure described in this manual:

https://data.visosystems.com/content/manuals/cali-t50_user_manual.pdf.

7.4. Traceability and Calibration

The CALI-DT300 is highly traceable. Every unit is directly traceable to Viso's master calibration lamp (an Oriel lamp characterized by the PTB—the German National Metrology Institute), making it fully compliant with internationally recognized NIST standards via ILAC membership agreements.

At Viso Systems we design, develop and manufacture OEM- and customer-specific goniophotometer solutions. Our mission is to support customers with powerful and yet easy to use control measurements solutions. Products are developed and manufactured in Copenhagen, Denmark.



Light measurement made easy