5530 Dynamic Calibrator





DATA SHEET

Introduction

5530 Dynamic Calibrator Requirements

Power Requirements

Laser Head: 100 – 240 Vac, 50/60 Hz 50W (during warmup), 33W (after warmup)

Calibrator Electronics (all +5V via USB): E1735A 280 mA max E1736A 120 mA (plus sensors) E1737A 6 mA maximum, 0.3 mA typical E1738A 6 mA maximum, 0.6 mA typical

System Requirements

Environmental Operating Temperature: 0 – 40 °C (32 – 104 °F) Optics temperature must be stabilized to \pm 2 °C to acheive accuracy specifications.

PC Requirements Compatible with any portable computer with Windows XP, Windows Vista (32-bit), Windows 7 (32-/64-bit) or Windows 8 (32-/64-bit) and two USB 2.0 ports and a CD drive



Laser Characteristics

Type: Helium-Neon with automatically tuned Zeeman-split two-frequency output

Output Power: ≥ 180 µW (< 1 mW per Class II Laser Product)

Safety Classification: Class II Laser Product conforming to U.S. National CDRH Regulations 21CFR 1040.10 and 1040.11.

Warm-up Time: Less than 10 minutes (4 minutes typical)

Vacuum Wavelength: 632.991354 nm

Wavelength Accuracy: ± 0.1 ppm (± 0.02 ppm of measured wavelength wavelength with factory calibration, Option A6J)

Wavelength Stability (typical): short term (1 hour): ± 0.002 ppm long term (lifetime): ± 0.02 ppm

Beam Diameter: 6 mm (0.24 in)

Beam Centerline Spacing: 11.0 mm (0.44 in) (input to output aperture)

Linear Distance, Diagonal, and Velocity Measurement Specifications

Measurement Range

Up to 40 m (130 ft) with Linear Optics; Up to 80 m (260 ft) with Long Range Option

Linear Distance and Diagonal Measurement Accuracy

| Temperature Range, °C [°F] | E1738A Air Sensor | In Vacuum [†] |
|-------------------------------|----------------------|------------------------|
| 0 – 40° [32° – 104°] | ± 0.4 ppm | ± 0.1 (± 0.02) ppm |

1. t Vacuum accuracy is \pm 0.02 ppm if the laser head is calibrated to MIL-STD 45662A.

Velocity Measurement Accuracy

 $\left[\frac{2 \text{ mm/s}}{\text{Velocity}} + 0.01\right]$ % of displayed value

Angular Measurement Specifications

Angle Measurement Accuracy

 \pm 0.2% of displayed value \pm 0.05 arc-seconds per meter of distance traveled by the linearly moving optic.

Maximum Distance Between Laser Head and Reflector Up to 15 m (50 ft)

Linear Distance and Diagonal Measurement Performance

| OPTICS | RESOLUTION | MAXIMUM AX 5519A | IS VELOCITY 5519B |
|--|-----------------------|---------------------------|---------------------------|
| Linear Optics (10766A) | 1 nm (0.04 μin) | ± 0.7 m/s (± 28 in/s) | ± 1 m/s (± 40 in/s) |
| Plane Mirror Optics (10706A/B)* | 0.5 nm (0.02 μin) | ± 0.35 m/s (± 14 in/s) | ± 0.5 m/s (± 20 in/s) |
| High Resolution Plane Mirror Optics (10716A)*† | 0.25 nm (0.01 μin) | ± 0.18 m/s (± 7 in/s) | ± 0.25 m/s (± 10 in/s) |

 Requires the 10724A Plane Mirror Reflector. Since alignment of these optics is much more sensitive than for linear optics, linear optics are recommended for general use.

+ Aperture distance of 10716A is 12.7 mm, whereas 5519A is 11 mm.

Angle Measurement Resolution 0.005 arc-seconds

Measurement Range

- \pm 10° (rotated about base of optic)
- \pm 20° (rotated about center of optic)

Measurement Type

Pitch and yaw



Angular Position Measurement Specifications (55290A Rotary Axis Kit)

Measurement Type Rotary and indexing tables or spindles

Indexing Mode (zero-reference measurement) Accuracy: 0.5 sec band +0.2% of displayed reading Index Step Size: 1° Range: multiple rotations or partial arcs

Indexing Mode (Interferometer in fixture) Maximum Lift: 15 mm (2 mm required for fixture)



Accuracy: 0.2% of displayed reading. Accuracy can be improved to 0.5 sec by calibrating laser optics with the indexing table (55290A). Range: \pm 10°

Setup Requirements

Travel (using +2 mm, -1 mm machine axis, or manual from zero reference)

Flatness and Way Straightness Measurement Specifications¹

1. Values do not include effects of surface cleanliness or operator positioning repeatability.

Flatness Measurement Accuracy

 \pm 0.2% of displayed value \pm 0.05 arc-seconds per meter of distance traveled by the moving optic

Flatness Measurement Resolution (per step)

Footspacing Dimension Resolution

| 50.8 mm (2 in) | |
|-----------------|--|
| 101.6 mm (4 in) | |
| 152.4 mm (6 in) | |

0.03 micron (1.0 μin) 0.05 micron (2.0 μin) 0.08 micron (3.0 μin)

Way Straightness Accuracy

± 0.2% of displayed value

 \pm 0.05 arc seconds per meter of distance traveled by the moving optics





Flatness and Way Straightness Maximum Range 15m (50 ft)

Reference Plane Accuracy

The uncertainty of a surface plate flatness measurement is bounded by two parallel planes separated by the values below:

Metric Units Mode: 0.03 (M)² μ m English Units Mode: 0.12 (F)² μ in where: M = length of the surface diagonal in meters F = length of the surface diagonal in feet

Lateral Offset and Flatness Range

The combination of lateral offset and maximum flatness deviation must not displace the reflector more than \pm 1.0 mm from the beam path in any direction.

Straightness and Parallelism Measurement Specifications



Measurement Accuracy²

Short Range Optics

Straightness Measurement Accuracy¹

Overall Accuracy = Optical Reference Accuracy

- + Measurement Accuracy
- This is analogous to the traditional straightedge and indicator method of measuring straightness, where Optical Reference Accuracy corresponds to the straightedge accuracy, and Measurement Accuracy corresponds to the indicator accuracy.

Optical Reference Accuracy

Optical reference inaccuracy can be eliminated by using straightedge (mirror) reversal techniques.

Short Range Optics:

Metric units mode: $\pm 0.15 (M)^2 \mu m$ English units mode: $\pm 0.5 (F)^2 \mu in$

Long Range Optics:

Metric units mode: $\pm 0.015 (M)^2 \mu m$ English units mode: $\pm 0.05 (F)^2 \mu in$ where: M = distance of travel of the moving optic in meters F = distance of travel of the moving optic in feet

Straightness Measurement Range (Orthogonal to Axial Travel)

± 1.5 mm (0.060 in)

Axial Separation (Travel)

(distance between the interferometer and the reflector, typical, with proper alignment, 15 - 25 °C): Short Range Optics: 0.1 - 3m (4 - 120 in) Long Range Optics: 1 - 30m (3 - 100 ft)

| | Displayed Value | |
|----------------------|----------------------------|-------------------------------------|
| Temperature Range | 0 - 10 μm (0 - 400 μin) | 10 - 1,500 μm (400 - 60,000 μin) |
| 0 - 40 °C | ± 3.5% | ±1% ±0.25μm |
| | | (10 µin) |
| Long Range Optics: | | |
| 0 0 1 | Display | ed Value |
| Temperature | 0 - 100 μm | 100 - 1,500 μm |
| Range | (0 - 4000 µin) | (4000 - 60,000 µin) |
| 0 – 40 °C | ± 5% | ± 2.5% ± 2.5 μm (100 μin) |

 Measurement Accuracy specifications are not applicable to Timebase Straightness Measurements.

Straightness³ Measurement Resolution

| Short Range | 0.01 μm (0.4 μin) |
|-------------|----------------------|
| Long Range | 0.1 μm (4 μin) |

3. Straightness Measurement Resolution specifications are not applicable to Timebase Straightness Measurements.

Squareness Measurement Accuracy

Short Range Optics:

 $\begin{array}{l} \mbox{Metric Units Mode:} \\ \pm (1.0 + 0.1 \mbox{ M}) \mbox{ arc-seconds } \pm 0.01 \qquad \theta \\ \mbox{English Unit Mode:} \\ \pm (1.0 + 0.03 \mbox{ F}) \mbox{ arc-seconds } \pm 0.01 \quad \theta \end{array}$

where:

- θ = calculated out-of-square angle in arc-seconds
- M = distance of travel of the moving optic in meters
- F = distance of travel of the moving optic in feet



Long Range Optics: Metric Units Mode: $\pm (1.0 + 0.01 \text{ M}) \text{ arc-seconds } \pm 0.025 \quad \Theta$ English Units Mode: $\pm (1.0 + 0.003 \text{ F}) \text{ arc-seconds } \pm 0.025 \quad \Theta$

Environmental Compensation¹ and A-quad-B Input

1. Compensation values may be manually entered by user via keyboard.

E1738A Air Sensor²

2. Refer to the E1738A Air Sensor Data Sheet, 5989-8456 for more specifications.

Wavelength of Light (WOL) in Air Compensation The E1738A Air Sensor provides for the automatic display of pressure, temperature, relative humidity, and computed WOL.

Operating Range

| Temperature: Relative Humidity: Absolute Pressure: | 0 – 40 °C (32 – 104 °F) 10% – 90% 70 – 110 kPa (10 – 16 psia) |
|--|---|
| Heat Dissipation: | 2 mW typical |
| Time Constant: | 5 min typical (temperature) |
| Temperature: Relative Humidity: Absolute Pressure: | ± 0.1°C (± 0.2°F) ± 5% ± 80 Pa (± 0.012 psi) |
| | |

Heat Dissipation: 1 mW typical Time

4. 12 month calibration interval

Shared Sensor Characteristics

Maximum Compensation Update Rate

per 15s (combined WOL and material temperature compensation)

Cable Lengths:

E1739A-5m (16 ft) E1739B-10m (33 ft) E1739C-15m (49 ft) E1739D-25m (82 ft)

E1737A Material Temperature Sensor³

Refer to the E1737A Material Sensor Data Sheet, 5989-8455 for more З. specifications.

Material Temperature Compensation

The E1737A Material Temperature Sensor provides for the automatic display of the temperature of the device under test. One to three sensors may be used.

Operating Range

| Temperature: | 0 – 40°C (32 – 104°F) |
|--------------------|------------------------------------|
| Material Expansion | Coefficient: |
| range: | –100.0 to +100.0 ppm per °C or °F, |
| | manually entered. |
| | |

Constant: 60s typical

Accuracy⁴

Temperature: ± 0.1 °C (± 0.2 °F)

4. 12 month calibration interval

A-quad-B Input

Differential Input Threshold ± 0.5V minimum, ± 7.0V maximum

Differential Input Impedance 100W

Input Rate > 2 ns edge-to-edge, or < 10 MHz information rate Example: at maximum speed, A and B both must be < 2.5 MHz.

System Component Dimension and Weights

Keysight 5519A/B Laser Head



Keysight 10753B Laser Tripod



E1735A USB Axis Module



Net Wt: 0.20 kg (0.44 lb)

E1736A USB Sensor Hub



Net Wt: 0.20 kg (0.44 lb)

E1737A Material Sensor



Net Wt: 0.03 kg (0.063 lb)

E1738A Air Sensor





Linear Optics



Keysight 10767A Linear Retroreflector Net Wt: 224g (0.5 lb)



Keysight 10785A Height Adjuster/Post, 10784A Base



Keysight 10766A/10767A Interferometer Combination Net Wt: 5.36g (1.2 lb)

Angular Optics



Keysight 10770A Angular Interferometer Net Wt: 553g (1.3 lb)





Flatness Accessories



Keysight 10773A Flatness Mirror Net Wt: 661g (1.5 lb)





Keysight 10759A Foot Spacing Kit Net Wt: 661g (1.5 lb)





Keysight 10774A Short Range Straightness Optics / 10775A Long Range Straightness Optics



Keysight 10776A Straightness Mount



Keysight 10776-67001 Straightness Retroreflector Net Wt: 374g (0.82 lb)

Straightness / Squareness Optics









Keysight 10777-20202 Optical Square Base

Straightness / Squareness Optics



from Keysight 10768A/10769A Measurement Kit

 \odot

23.0 mm

(0.91 in)

Keysight 55290A Angular Position Measurement Kit



Keysight 55290A Angular Position Measurement Kit



Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

