

# Agilent 5530 Dyn<mark>amic</mark> Calibrator

Data Sheet



### **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 (plus 55290B if used) E1736A 120 mA (plus sensors) E1737A 6 mA maximum, 0.3 mA typical E1738A 6 mA maximum, 0.6 mA typical 55290B 250 mA maximum

### System Requirements

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

### PC Requirements

Compatible with any portable computer with Windows® XP or Windows Vista (32-bit) and two USB 2.0 ports and a CD drive "Windows" is a registed trademark of Microsoft, Inc.





### Laser Characteristics

询"5530"供应商 Helium-Neon with automatically tuned Tupe: 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 with factory calibration, Option UK6)

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

† Vacuum accuracy is ±0.02 ppm if the laser head is calibrated to MIL-STD 45662A.

#### **Velocity Measurement Accuracy**

 $\frac{2 \,\mu m/s}{Velocity}$  + 0.01 ] % of displayed value

# Angular Measurement Specifications



±0.2% of displayed value

±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 /	XIS VELOCITY
		5519A	5519B
Linear Optics	1 nm	±0.7 m/s	±1 m/s
(10766A)	(0.04 µin)	(±28 in/s)	(±40 in/s)
Plane Mirror	0.5 nm	±0.35 m/s	±0.5 m/s
Optics	(0.02 µin)	(±14 in/s)	(±20 in/s)
(10706A/B) *			
High Resolution	0.25 nm	±0.18 m/s	±0.25 m/s
Plane Mirror	(0.01 µin)	(±7 in/s)	(±10 in/s)
Optics (10716A) *‡			

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

±10° (rotated about base of optic) ±20° (rotated about center of optic)

**Measurement Type** 

### Angular Position Measurement Specifications 查询"5530"供应商

#### 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

#### Laser Measurement Mode

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

#### **Setup Requirements**

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

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



#### 55290B Rotary Axis Kit

Measurement Type Rotary and indexing tables or spindles

#### **Combined Mode (zero-reference measurement)**

Accuracy: ±1.0 arc-second Resolution: 0.036 arc-seconds Range: multiple rotations or partial arcs

#### Laser Measurement Mode

Accuracy: 0.2% of displayed reading. Accuracy can be improved to 1 sec by calibrating laser optics with the indexing table (55290B). Range: ±10°

#### **Setup Requirements**

Travel – none required Connects to 5530 system via E1735A Axis Module

#### Flatness and Way Straightness Measurement Specifications

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

#### **Flatness Measurement Accuracy**

±0.2% of displayed value ±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)	0.03 micron (1.0 µin)	
101.6 mm (4 in)	0.05 micron (2.0 µin)	
152.4 mm (6 in)	0.08 micron (3.0 µin)	

#### Way Straightness Accuracy



±0.2% of displayed value

±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)<sup>2</sup> µm English Units Mode:  $0.12 (F)^2 \mu in$ 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 查询"5530"供应商



#### Straightness Measurement Accuracy

Overall Accuracy = Optical Reference Accuracy

+ Measurement Accuracy

1. 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:  $\pm 0.015 \text{ (M)}^2 \mu \text{m}$ English units mode:  $\pm 0.05 \text{ (F)}^2 \mu \text{in}$ where: M = distance of travel of the moving optic in meters

#### 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)

### Measurement Accuracy

Short Range Optics:

	Displayed Value		
Temperature Range	0 – 10 µm (0 – 400 µin)	10 — 1,500 μm (400 — 60, 000 μin)	
0-40°C	±3.5%	±1% ±0.25 μm (10 μin)	

#### Long Range Optics:

	Displayed Value		
Temperature Range	0 — 100 µm (0 — 4,000 µin)	100 — 1,500 µm (4,000 — 60,000 µin)	
0-40°C	±5%	±2.5% ±2.5 μm (100 μin)	

### Straightness<sup>2</sup> Measurement Resolution

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

2. These specs are not applicable to Timebase Straightness Measurements.

#### **Squareness Measurement Accuracy**

Short Range Optics: Metric Units Mode:  $\pm(1.0 \pm 0.1 \text{ M})$  arc-seconds  $\pm 0.01 \theta$ English Unit Mode:  $\pm(1.0 \pm 0.03 \text{ F})$  arc-seconds  $\pm 0.01 \theta$ 

where:

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

 $\theta$  = 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

### En. 算視前 53 化 Horn Bunsation<sup>1</sup> and A-quad-B Input

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

#### E1738A Air Sensor<sup>2</sup>

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:* 0 – 40°C (32 – 104°F) *Relative Humidity:* 10% – 90% *Absolute Pressure:* 70 – 110 kPa (10 – 16 psia)

**Heat Dissipation**: 2 mW typical

Time Constant:5 min typical (temperature)

#### Accuracy<sup>4</sup>

Temperature:  $\pm 0.1$  °C ( $\pm 0.2$  °F)

Relative Humidity: ± 5%

Absolute Pressure: ± 50 Pa (± 0.008 psi)

4. 12 month calibration interval

#### E1737A Material Temperature Sensor <sup>3</sup>

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

Heat Dissipation: 1 mW typical

Time Constant: 60s typical

### Accuracy<sup>4</sup>

Temperature:  $\pm 0.1$  °C ( $\pm 0.2$  °F)

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)

#### A-quad-B Input

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

**Differential Input Impedance**  $100 \Omega$ 

#### **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 Dimensions and Weights

#### 查询"5530"供应商 Agilent 5519A/B Laser Head





(2.17 in)

Net Wt: 5.5 kg (12 lb)



#### E1736A USB Sensor Hub

Agilent 10753B Laser Tripod



Net Wt: 0.20 kg (0.44 lb)

### E1738A Air Sensor



Net Wt: 0.06 kg (0.125 lb)

#### E1735A USB Axis Module



Net Wt: 0.20 kg (0.44 lb)

#### E1737A Material Sensor



Net Wt: 0.03 kg (0.0625 lb)

#### **Linear Optics**







#### Agilent 10785A Height Adjuster/Post, 10784A Base



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

### **Angular Optics**



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





Net Wt: 650g (1.5 lb)

Flatness Accessories



Agilent 10773A Flatness Mirror

Net Wt: 661g (1.5 lb)



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

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**Agilent 10776A Straightness Mount** 

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

Straightness / Squareness Optics



#### Agilent 10777A Optical Square

Net Wt: 4.0 kg (8.9 lb) w/Mount







Agilent 10777-20007 Optical Square Base

Straightness / Squareness Optics



Agilent 10768-20214 Base - Large



from Agilent 10768A/10769A Measurement Kit



### Agilent 10769B Turning Mirror (Base Block Only)

### Agilent 55290A Angular Position Measurement Kit

### 查询"5530"供应商





\_ 50.80 mm × 1.3 mm deep (2.00 in × 0.05 in)

**Flanged Shaft** 

63.5 mm

38.10 mm

### Agilent 55290B Angular Position Measurement Kit

### 查询"5530"供应商 Adapter Plate



A - A



B - B



#### **Flanged Shaft**











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