Keysight Technologies
5530 Dynamic Calibrator

Data Sheet

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Introduction

5530 Dynamic Calibrator Requirements

Power Requirements

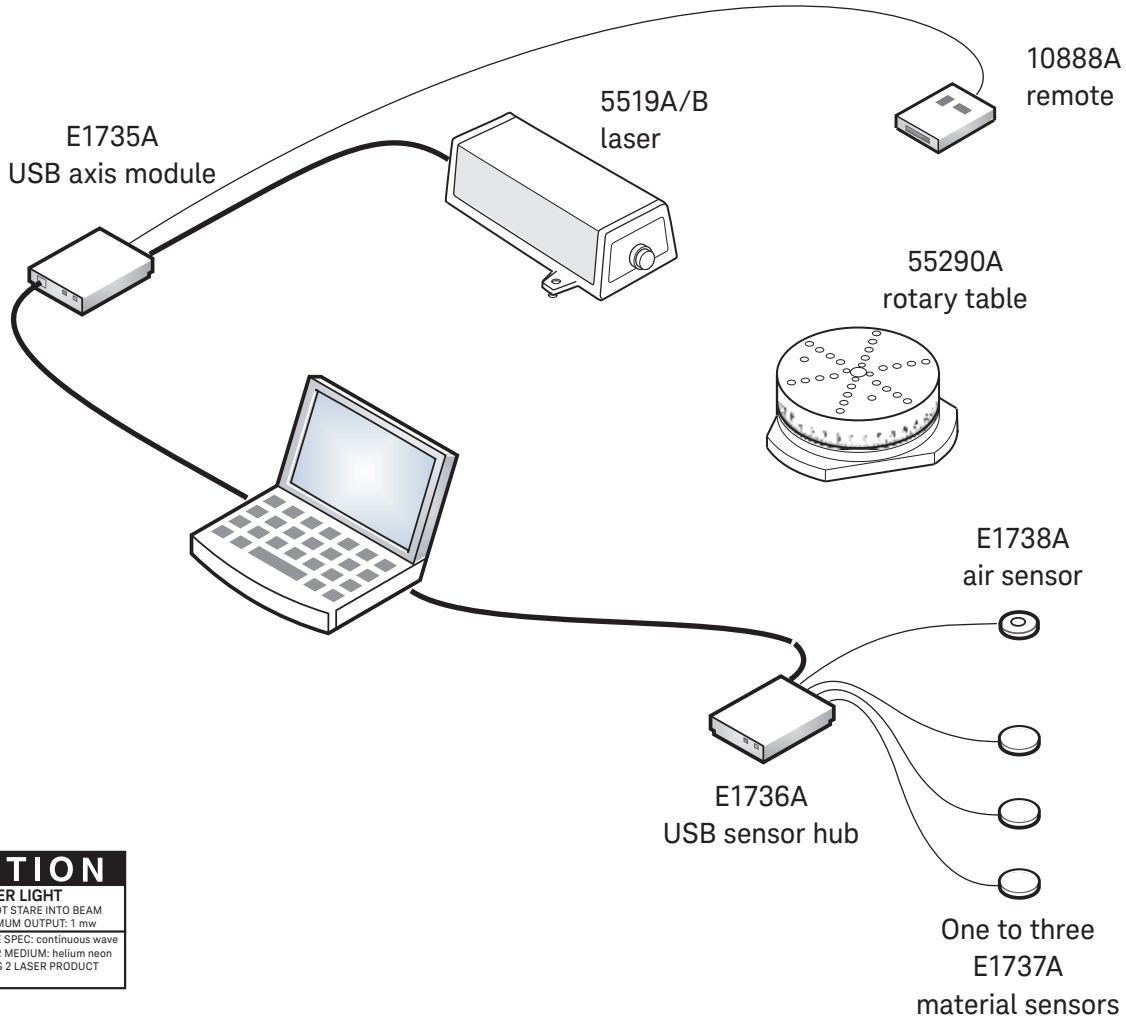
Laser Head:
100 – 240 Vac, 50/60 Hz
50W (during warmup), 33W (after warmup)

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 ± 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



Specifications

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

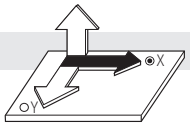
Wavelength Accuracy: ± 0.1 ppm
(± 0.02 ppm of measured wavelength wavelength with factory calibration, Option A6J)

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

Velocity Measurement Accuracy

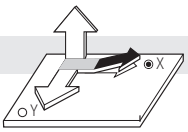
$$\left[\frac{2\ \text{mm/s}}{\text{Velocity}} + 0.01\right] \%\ \text{of displayed value}$$

Linear Distance and Diagonal Measurement Performance

OPTICS	RESOLUTION	MAXIMUM AXIS VELOCITY 5519A	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.

Angular Measurement Specifications



Angle Measurement Accuracy
± 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)

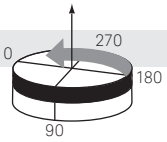
Angle Measurement Resolution
0.005 arc-seconds

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

Measurement Type
Pitch and yaw

Specifications

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)

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)

Flatness and Way Straightness Measurement Specifications[1]

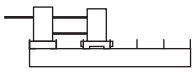
1. Values do not include effects of surface cleanliness or operator positioning repeatability.

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)

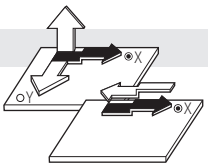
Reference Plane Accuracy
The uncertainty of a surface plate flatness measurement is bounded by two parallel planes separated by the values below:

Metric Units Mode: 0.03 $(M)^2$ µm
English Units Mode: 0.12 $(F)^2$ µin
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 ± 1.0 mm from the beam path in any direction.

Specifications

Straightness and Parallelism Measurement Specifications



Straightness Measurement Accuracy[1]
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: ± 0.15 $(M)^2$ µm
English units mode: ± 0.5 $(F)^2$ µin

Long Range Optics:
Metric units mode: ±0.015 $(M)^2$ µm
English units mode: ±0.05 $(F)^2$ µin
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)

Measurement Accuracy[2]

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 - 4000 µin)	100 - 1,500 µm (4000 - 60,000 µin)
0 – 40 °C	± 5%	± 2.5% ± 2.5 µm (100 µin)

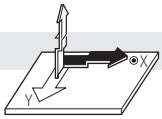
2. Measurement Accuracy specifications are not applicable to Timebase Straightness Measurements.

Straightness[3] 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:
Metric Units Mode:
± (1.0 + 0.1 M) arc-seconds ± 0.01 θ
English Unit Mode:
± (1.0 + 0.03 F) arc-seconds ± 0.01 θ

Long Range Optics:
Metric Units Mode:
± (1.0 + 0.01 M) arc-seconds ± 0.025 θ
English Units Mode:
± (1.0 + 0.003 F) arc-seconds ± 0.025 θ

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

Specifications

Environmental Compensation[1] and A-quad-B Input

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

E1738A Air Sensor[2]

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[4]

Temperature:	± 0.1°C (± 0.2°F)
Relative Humidity:	± 5%
Absolute Pressure:	± 50 Pa (± 0.008 psi)
Heat Dissipation:	1 mW typical Time

4. 12 month calibration interval

E1737A Material Temperature Sensor[3]

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.
Constant:	60s typical

Accuracy[4]

Temperature:	± 0.1 °C (± 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

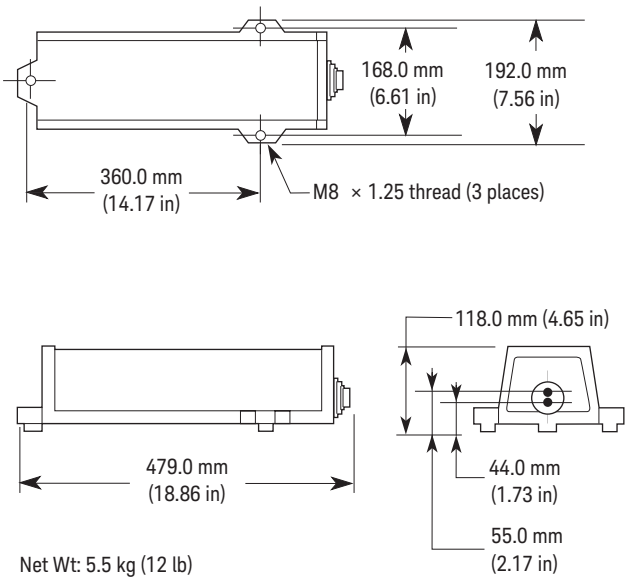
Differential Input Threshold
± 0.5V minimum, ± 7.0V maximum

Differential Input Impedance
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.

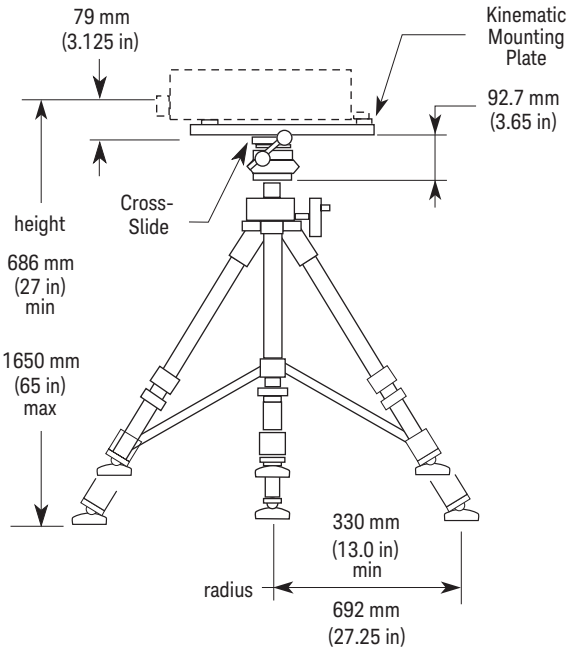
System Component Dimension and Weights

Keysight 5519A/B Laser Head



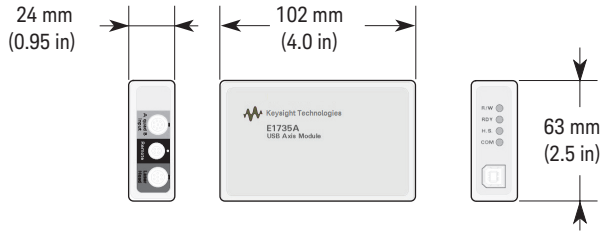
Net Wt: 5.5 kg (12 lb)

Keysight 10753B Laser Tripod



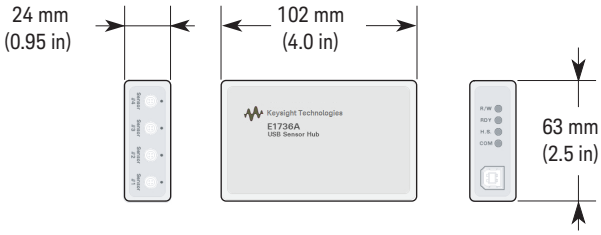
Net Wt: 8.0 kg (17.6 lbs)

E1735A USB Axis Module



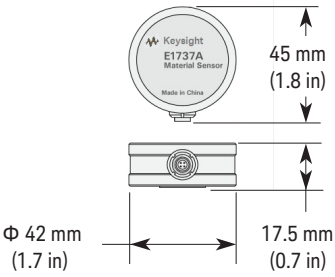
Net Wt: 0.20 kg (0.44 lb)

E1736A USB Sensor Hub



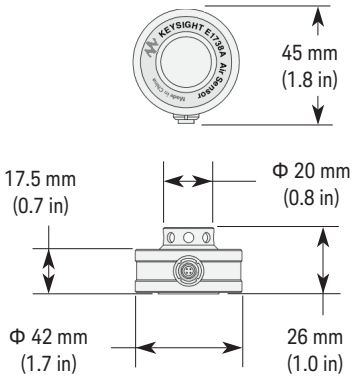
Net Wt: 0.20 kg (0.44 lb)

E1737A Material Sensor



Net Wt: 0.03 kg (0.063 lb)

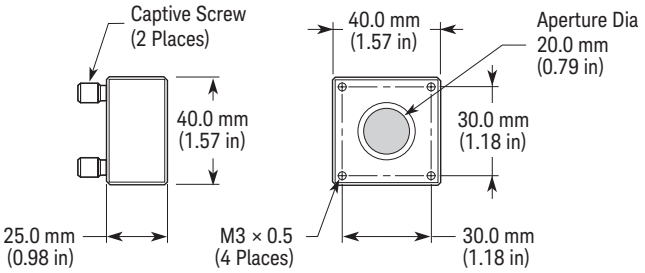
E1738A Air Sensor



Net Wt: 0.06 kg (0.125 lb)

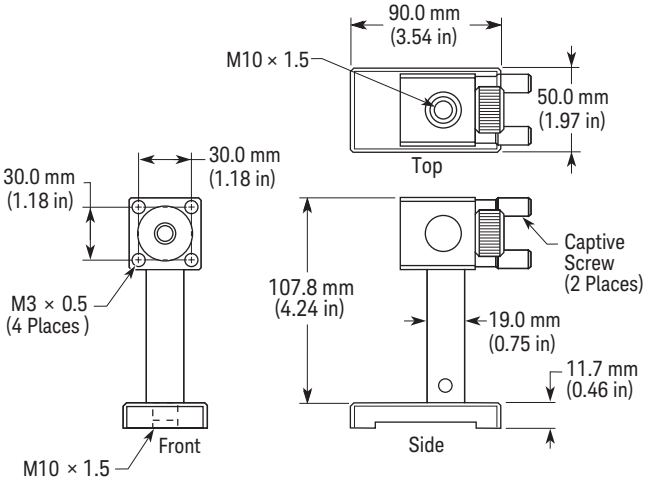
Optics and Accessories

Linear Optics

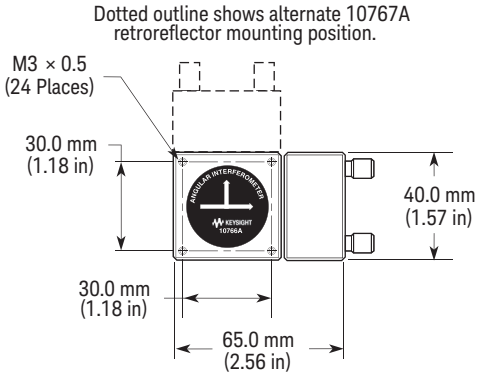


Keysight 10767A Linear Retroreflector

Net Wt: 224g (0.5 lb)



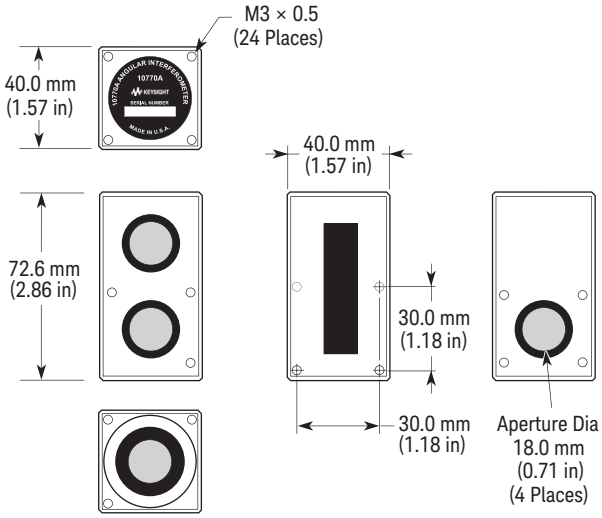
Keysight 10785A Height Adjuster/Post, 10784A Base



Keysight 10766A/10767A Interferometer Combination

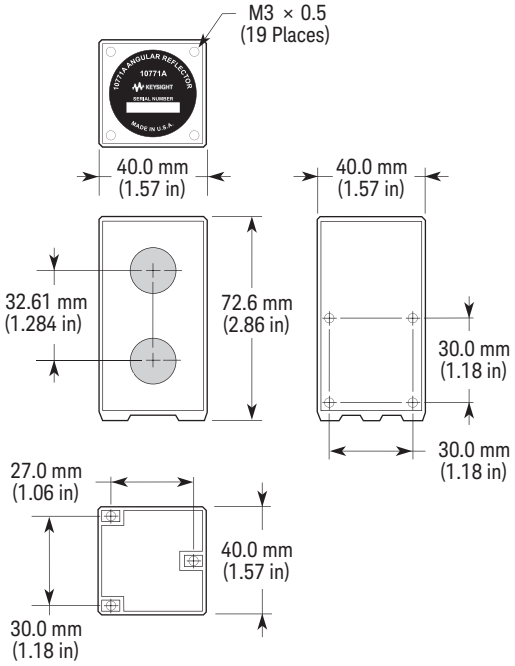
Net Wt: 5.36g (1.2 lb)

Angular Optics



Keysight 10770A Angular Interferometer

Net Wt: 553g (1.3 lb)

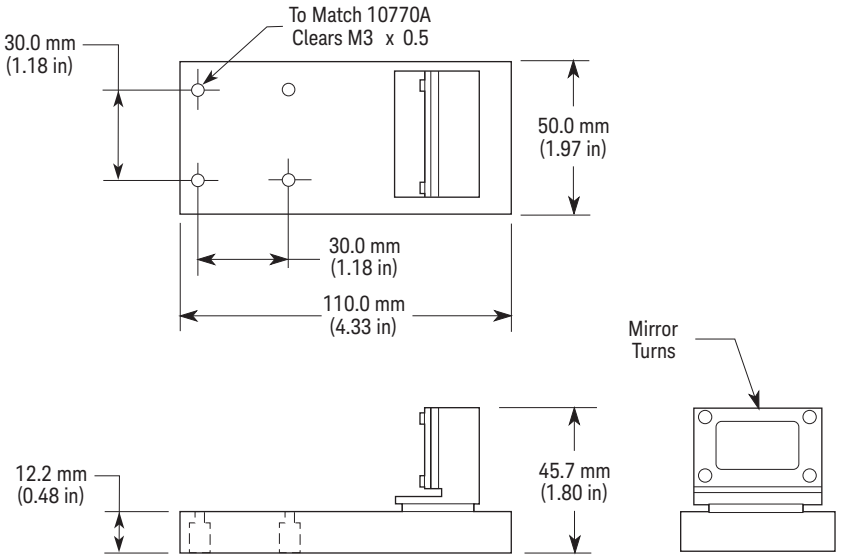


Keysight 10771A Angular Reflector

Net Wt: 650g (1.5 lb)

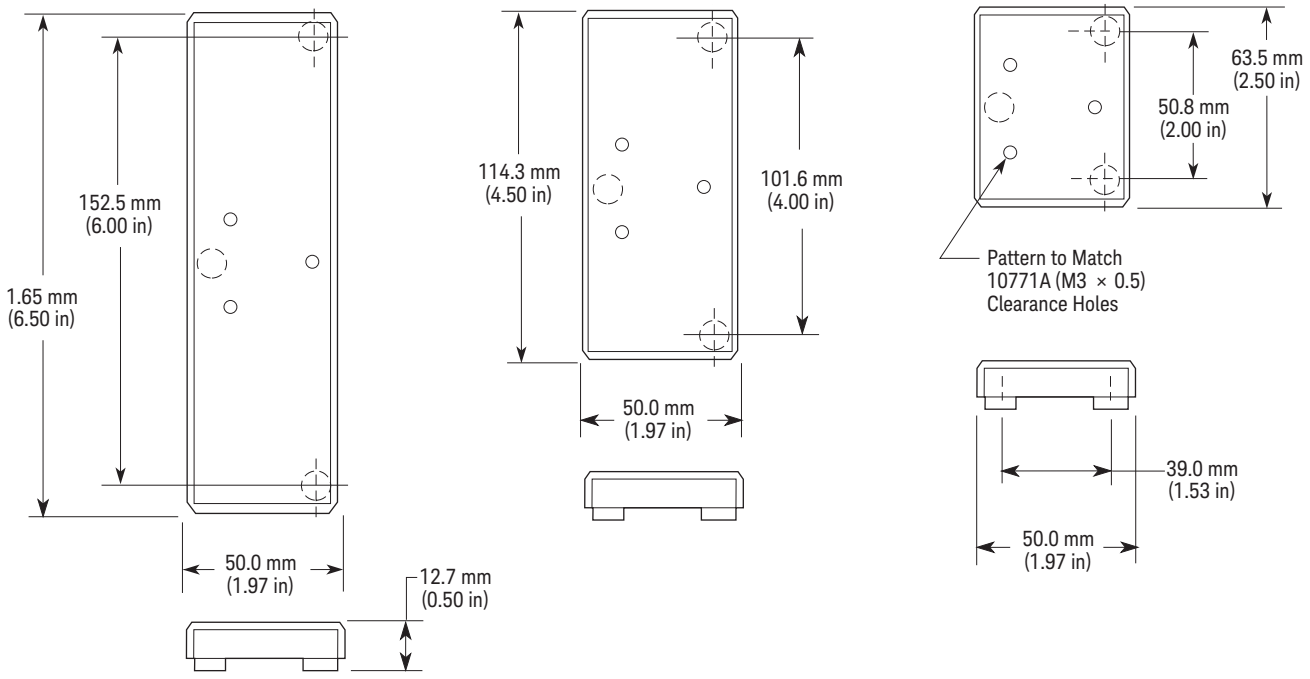
Optics and Accessories

Flatness Accessories



Keysight 10773A Flatness Mirror

Net Wt: 661g (1.5 lb)

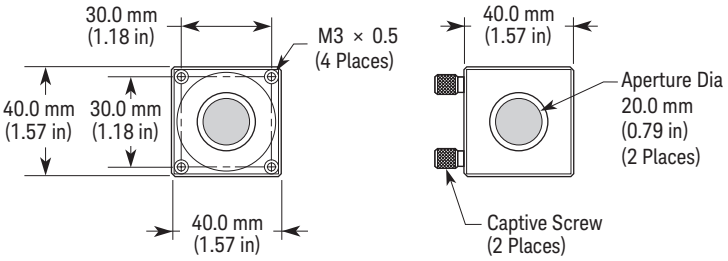


Keysight 10759A Foot Spacing Kit

Net Wt: 661g (1.5 lb)

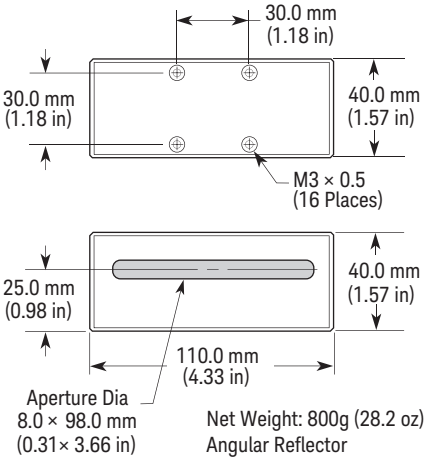
Optics and Accessories

Straightness / Squareness Optics

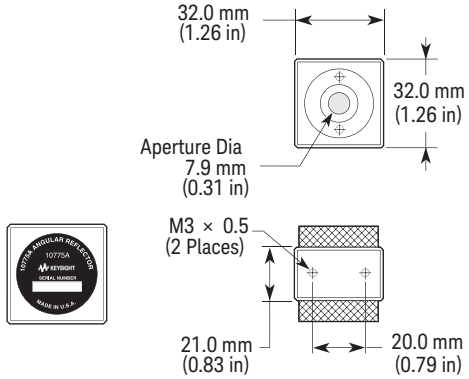


Keysight 10772A Tuning Mirror

Net Wt: 510g (1.2 lb) w/Mount

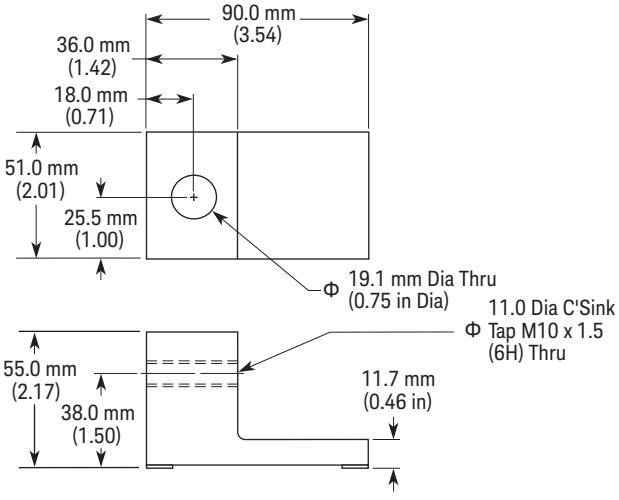


Net Weight: 800g (28.2 oz)
Angular Reflector

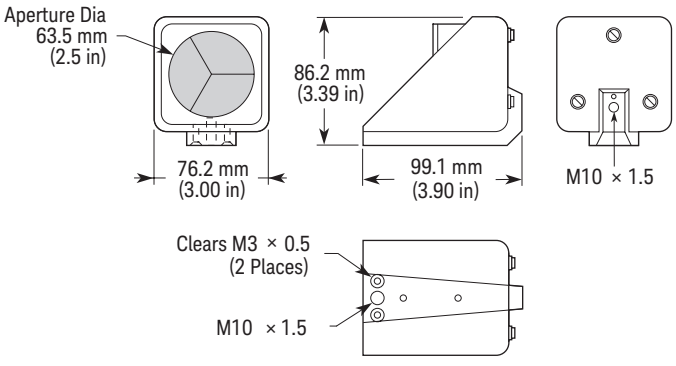


Net Weight: 164g (5.8 oz)
Straightness Interferometer

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



Keysight 10776A Straightness Mount

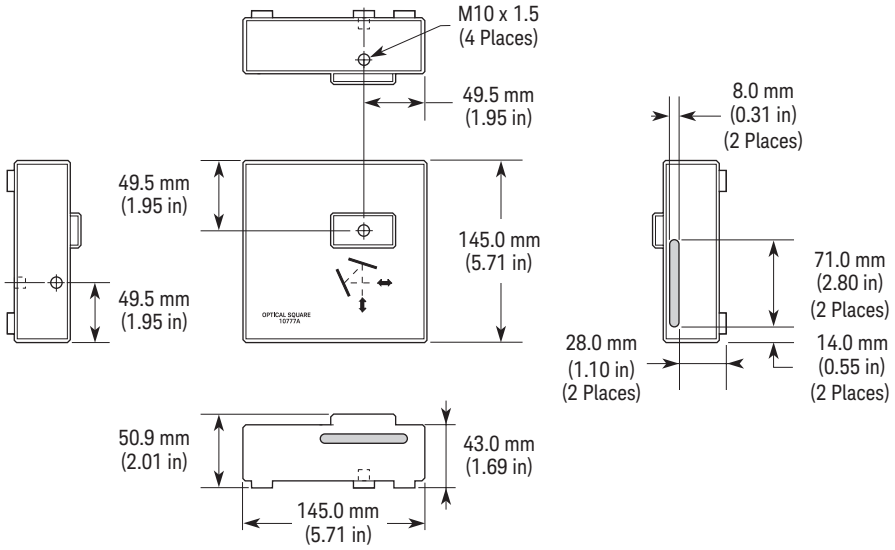


Keysight 10776-67001 Straightness Retroreflector

Net Wt: 374g (0.82 lb)

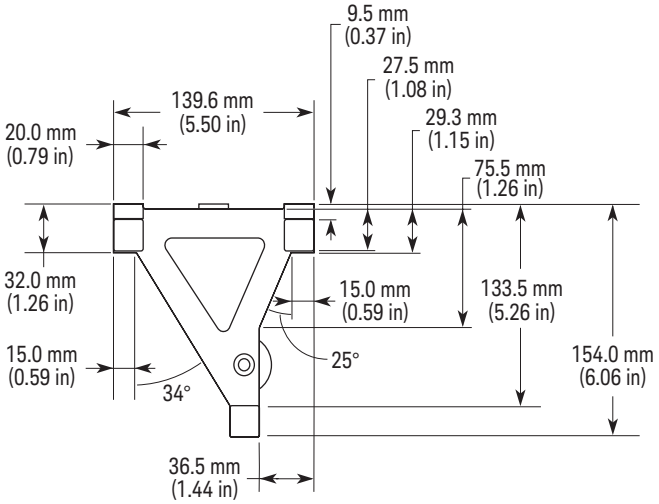
Optics and Accessories

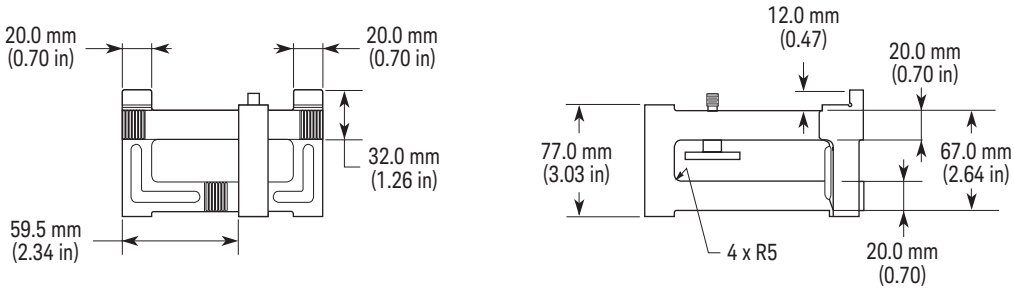
Straightness / Squareness Optics



Keysight 10777A Optical Square

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

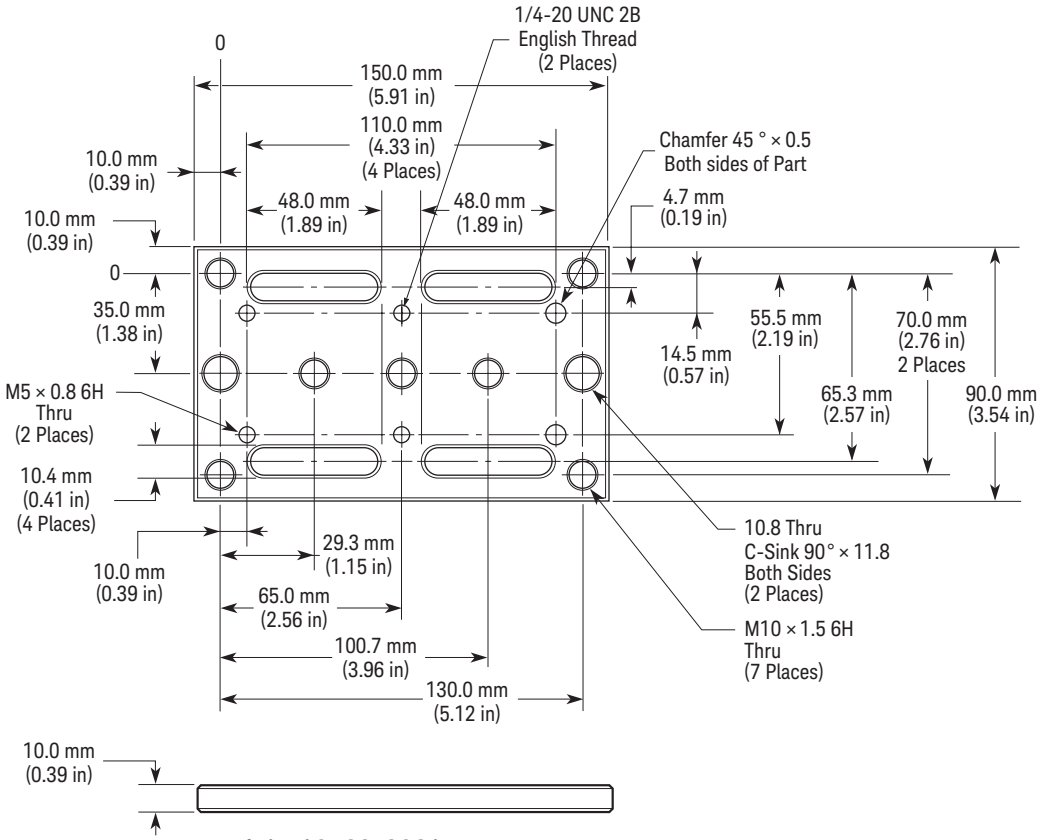




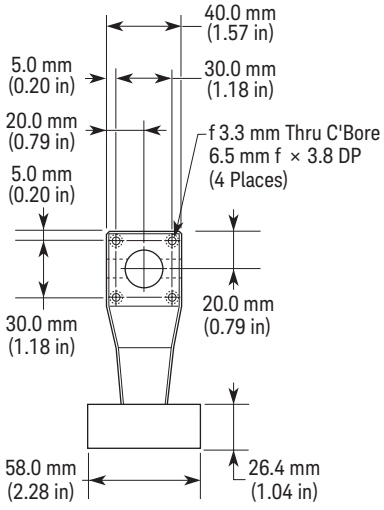
Keysight 10777-20007 Optical Square Base

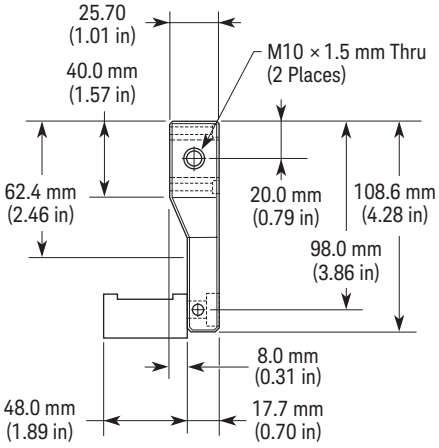
Optics and Accessories

Straightness / Squareness Optics

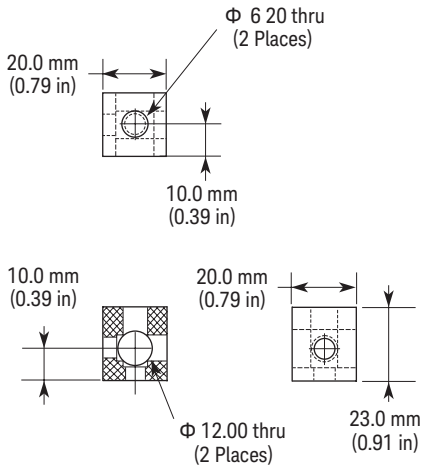


Keysight 10768-20214 Base - Large



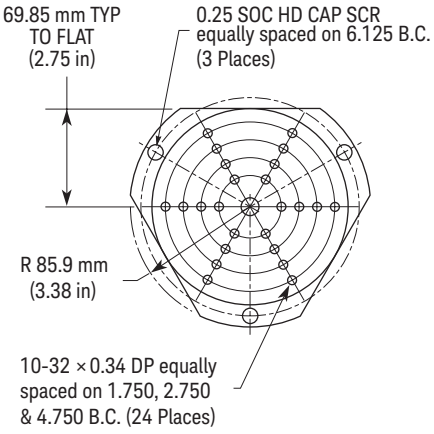


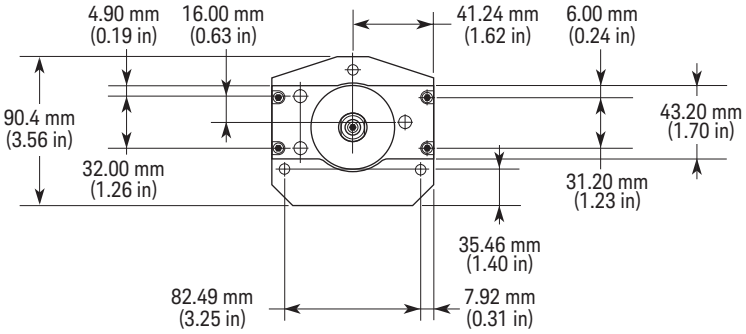
from Keysight 10768A/10769A Measurement Kit

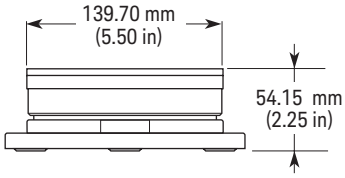


Keysight 10769B Turning Mirror
(Base Block Only)

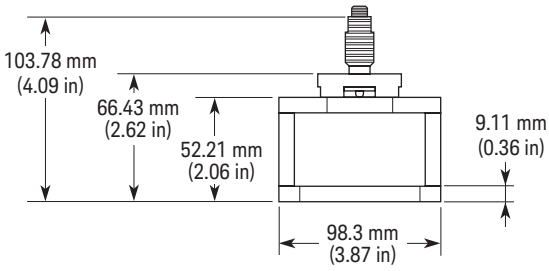
Keysight 55290A Angular Position Measurement Kit



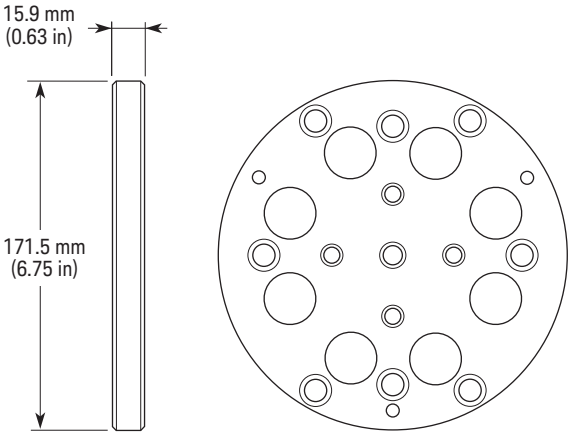




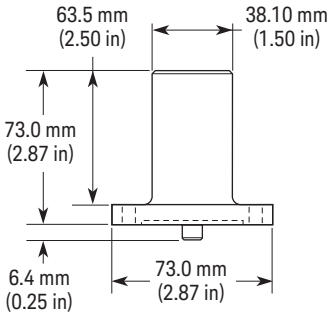
Rotary Indexing Table

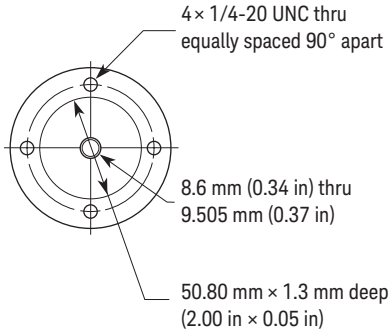


Fixture, Angle Position Measurement



Adapter Plate

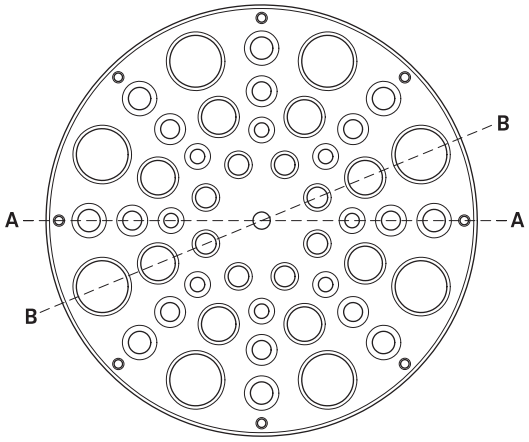




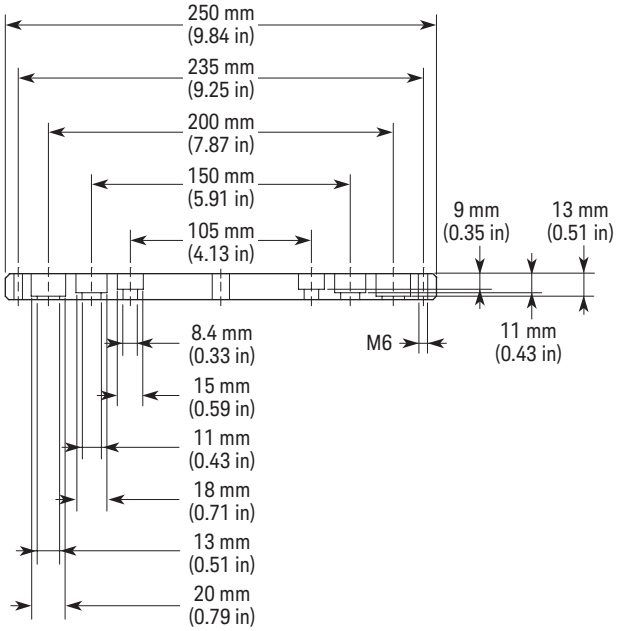
Flanged Shaft

Keysight 55290A Angular Position Measurement Kit

Adapter Plate



A - A



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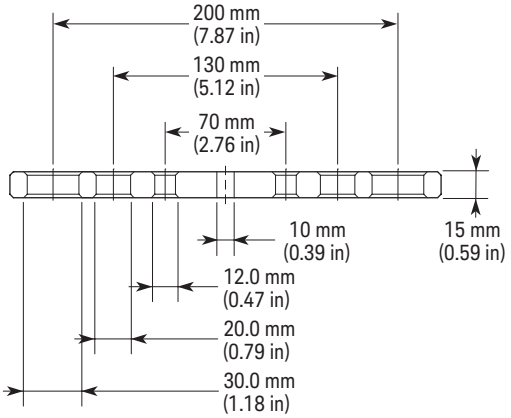
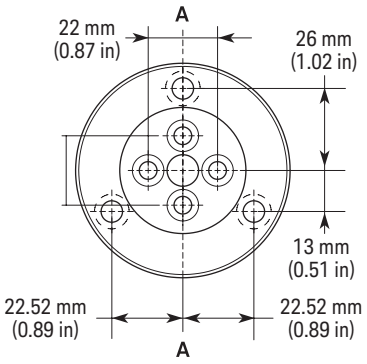
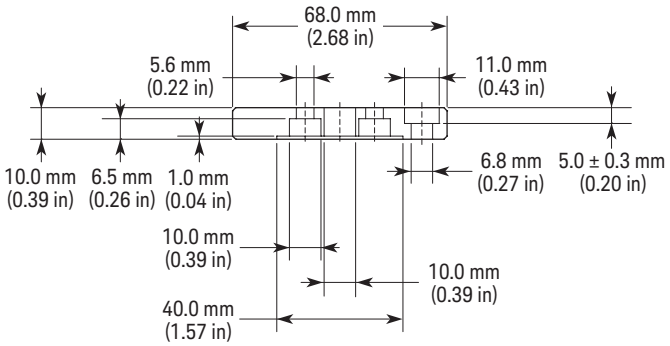
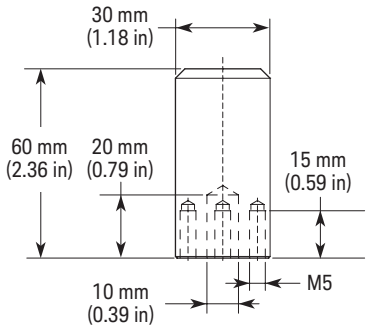


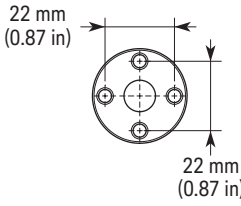
Flanged Shaft

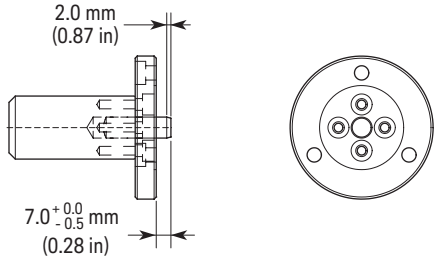


A - A









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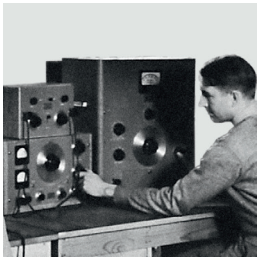
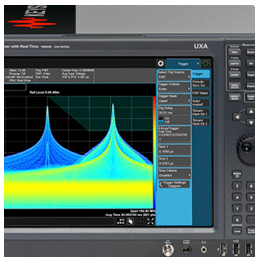


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