

Agilent 5530 Laser Calibration System

Data Sheet



Power Requirements

Laser Head

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



Electronics

(all +5 V 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

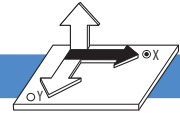
"Windows" is a registered trademark of Microsoft, Inc.



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.
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] 0 – 40 [32 – 104]	E1738A Air Sensor ± 0.4 ppm	In Vacuum † ± 0.1 (± 0.02) ppm
Velocity Measurement Accuracy	$\left[\frac{2 \mu\text{m/s}}{\text{Velocity}} + 0.01 \right] \% \text{ of displayed value}$		

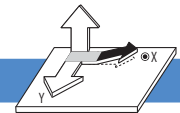
† Vacuum accuracy is ±0.02 ppm if the laser head is calibrated to MIL-STD 45662A.

Linear Distance and Diagonal Measurement Performance	Optics	Maximum Axis Velocity		Resolution
		5519A	5519B	
	Linear Optics (10766A)	± 0.7 m/s (± 28 in/s)	± 1 m/s (± 40 in/s)	1 nm (0.04 μin)
	Plane Mirror Optics (10706A/B) *	± 0.35 m/s (± 14 in/s)	± 0.5 m/s (± 20 in/s)	0.5 nm (0.02 μin)
	High Resolution Plane Mirror Optics (10716A) *‡	± 0.18 m/s (± 7 in/s)	± 0.25 m/s (± 10 in/s)	0.25 nm (0.01 μin)

* 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.

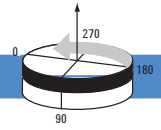
‡ Aperture distance of 10716A is 12.7 mm, whereas 5519A is 11 mm.

Angular Measurement Specifications



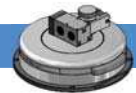
Angle Measurement Accuracy	± 0.2% of displayed value ± 0.05 arcsec per meter of distance traveled by the linearly moving optic.
Maximum Distance Between Laser Head and Reflector	Up to 15 m (50 ft)
Angle Measurement Resolution	0.006 arcsec
Measurement Range	± 10 ° (rotated about base of optic) ± 20 ° (rotated about center of optic)
Measurement Type	Pitch and yaw

55290A Angular Position Measurement Specifications



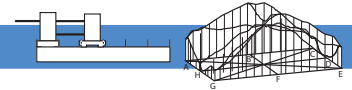
Measurement Type	Rotary and indexing tables or spindles
Indexing Mode (zero-reference measurement)	Accuracy: 0.5 sec band +0.2% of displayed reading Index Step Size: 1° Range: multiple rotations or partial arcs
Laser Measurement Mode	Accuracy: 0.2% of displayed reading. Accuracy can be improved to 0.5 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 Measurement Specifications



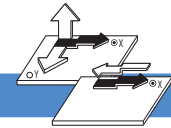
Measurement Type	Rotary and indexing tables or spindles
Combined Mode (zero-reference measurement)	Accuracy: ± 1.0 arcsec Resolution: 0.36 arcsec Range: multiple rotations or partial arcs
Laser Measurement Mode	Accuracy: 0.2% of displayed reading. Accuracy can be improved to 1 sec by calibrating laser optics with the indexing table (55290B). Range: ± 10°
Setup Requirements	Travel – none required Connects to 5530 system via E1735A USB Axis Module

Flatness and Way Straightness Measurement Specifications ¹



Accuracy	± 0.2% of displayed value ± 0.05 arcsec per meter of distance traveled by the moving optic	
Resolution (per step)	Footspacing Dimension	Resolution
	50.8 mm (2 in)	0.002 μm (0.06 μin)
	101.6 mm (4 in)	0.003 μm (0.12 μin)
	152.4 mm (6 in)	0.005 μm (0.18 μin)
Maximum Range	15 m (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.	

1. Values do not include effects of surface cleanliness or operator positioning repeatability. Assume the temperature of all optical components is stabilized in the range of 15 to 25 °C



Straightness and Parallelism Measurement Specifications

Straightness Measurement Accuracy ¹ Overall Accuracy = Optical Reference Accuracy + Measurement Accuracy

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

	Metric	English
Short Range Optics	$\pm 0.15 (M)^2 \mu\text{m}$	$\pm 0.5 (F)^2 \mu\text{in}$
Long Range Optics	$\pm 0.015 (M)^2 \mu\text{m}$	$\pm 0.05 (F)^2 \mu\text{in}$

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) $\pm 1.5 \text{ mm (0.060 in)}$

Axial Separation (Travel) Distance between the interferometer and the reflector, typical, with proper alignment, 15 – 25 °C

Short Range Optics	0.1 – 3 m (4 – 120 in)
Long Range Optics	1 – 30 m (3 – 100 ft)

Measurement Accuracy ² (0 – 40 °C)

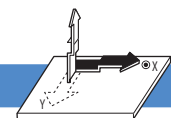
Short Range Optics	Displayed Value			
	<table border="1"> <tbody> <tr> <td>0 – 10 μm (0 – 400 μin)</td> <td>10 – 1,500 μm (400 – 60,000 μin)</td> </tr> <tr> <td>$\pm 3.5\%$</td> <td>$\pm 1\% \pm 0.25 \mu\text{m (10 } \mu\text{in)}$</td> </tr> </tbody> </table>	0 – 10 μm (0 – 400 μin)	10 – 1,500 μm (400 – 60,000 μin)	$\pm 3.5\%$
0 – 10 μm (0 – 400 μin)	10 – 1,500 μm (400 – 60,000 μin)			
$\pm 3.5\%$	$\pm 1\% \pm 0.25 \mu\text{m (10 } \mu\text{in)}$			

Long Range Optics	Displayed Value			
	<table border="1"> <tbody> <tr> <td>0 – 100 μm (0 – 4000 μin)</td> <td>10 – 1,500 μm (4000 – 60,000 μin)</td> </tr> <tr> <td>$\pm 5\%$</td> <td>$\pm 2.5\% \pm 2.5 \mu\text{m (100 } \mu\text{in)}$</td> </tr> </tbody> </table>	0 – 100 μm (0 – 4000 μin)	10 – 1,500 μm (4000 – 60,000 μin)	$\pm 5\%$
0 – 100 μm (0 – 4000 μin)	10 – 1,500 μm (4000 – 60,000 μin)			
$\pm 5\%$	$\pm 2.5\% \pm 2.5 \mu\text{m (100 } \mu\text{in)}$			

Straightness ² Measurement Resolution

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

Squareness Measurement Specifications



Measurement Accuracy

	Metric	English
Short Range Optics	$\pm (1.0 + 0.1 M) \text{ arcsec} \pm 0.01 \theta$	$\pm (1.0 + 0.03 F) \text{ arcsec} \pm 0.01 \theta$
Long Range Optics	$\pm (1.0 + 0.01 M) \text{ arcsec} \pm 0.025 \theta$	$\pm (1.0 + 0.003 F) \text{ arcsec} \pm 0.025 \theta$

where:

θ = calculated out-of-square angle in arcsec

M = distance of travel of the moving optics in meters

F = distance of travel of the moving optics in feet

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.

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

Environmental Compensation¹

E1738A Air Sensor

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 (10.2 – 16 psia)
Heat Dissipation	2 mW typical
Time Constant	5 min typical (temperature)
Accuracy ²	Temperature: ± 0.1 °C (± 0.2 °F) Relative Humidity: ± 5% Absolute Pressure: ± 80 Pa (± 0.012 psi)

E1737A Material Temperature Sensor

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	60 s typical
Accuracy ²	Temperature: ± 0.1 °C (± 0.2 °F)

Shared Sensor Characteristics

Maximum Compensation Update Rate	per 15 s (combined WOL and material temperature compensation)
Cable Lengths	E1739A – 5 m (16 ft) E1739B – 10 m (33 ft) E1739C – 15 m (49 ft) E1739D – 25 m (82 ft)

A-quad-B Input

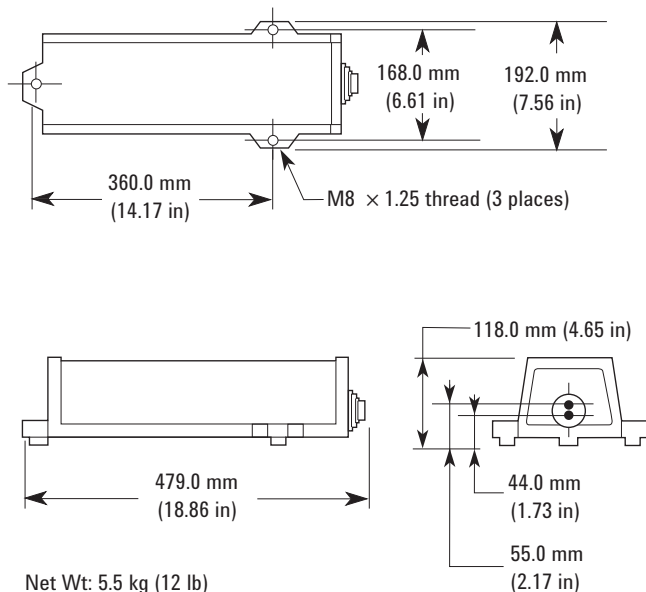
Differential Input Threshold	± 0.5 V minimum, ± 7.0 V maximum
Differential Input Impedance	100 Ω
Input Rate	>2 ns edge-to-edge, or <10 MHz information rate example: at maximum speed, A and B both must be <2.5 MHz.

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

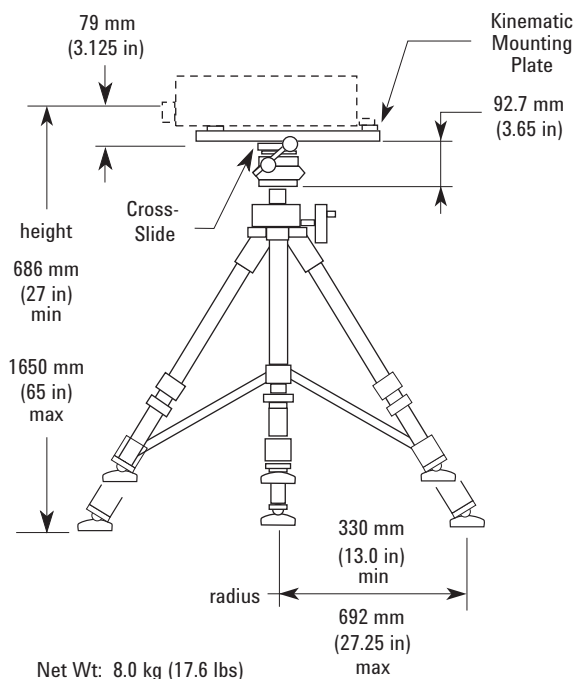
2. 12 month calibration interval

System Component Dimension and Weights

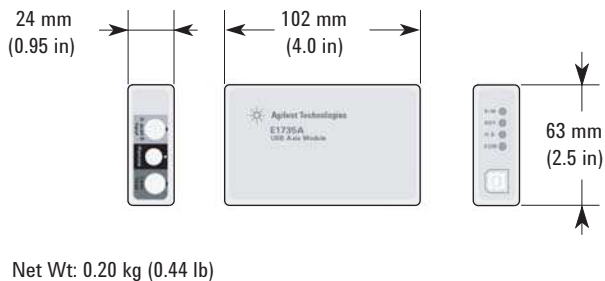
5519A/B Laser Head



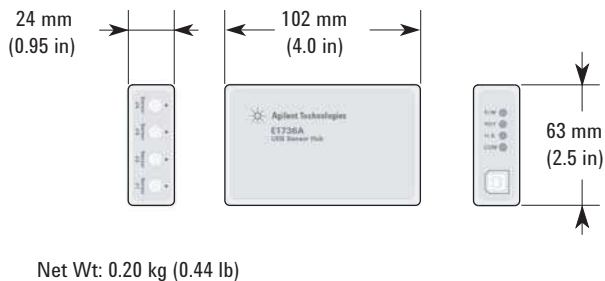
10753B Laser Tripod



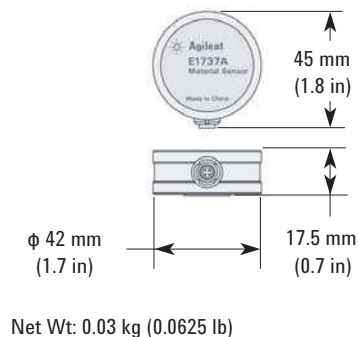
E1735A USB Axis Module



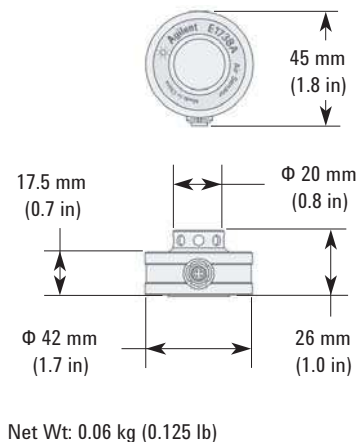
E1736A USB Sensor Hub

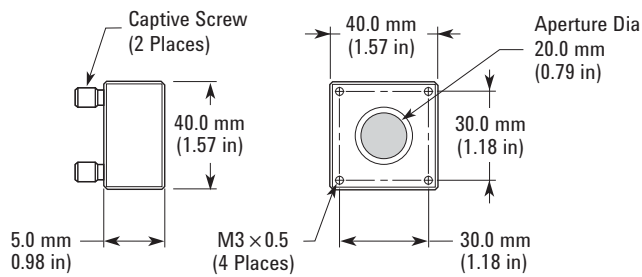


E1737A Material Sensor



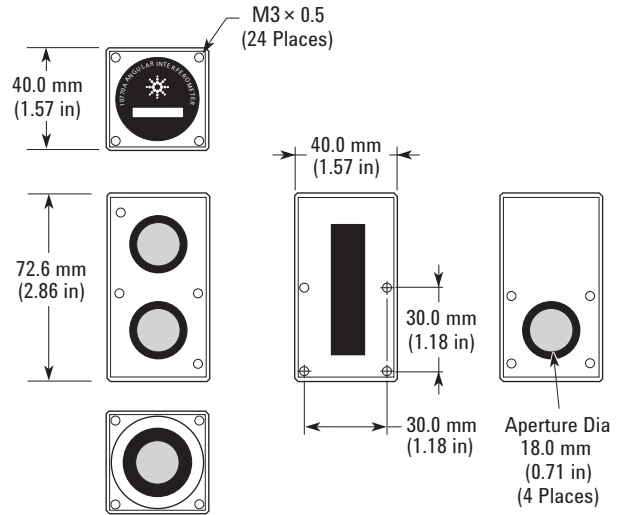
E1738A Air Sensor





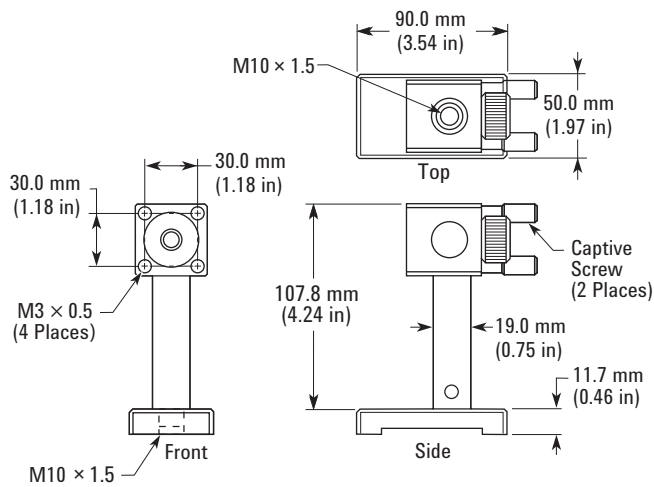
Agilent 10767A Linear Retroreflector

Net Wt: 224 g (0.5 lb)

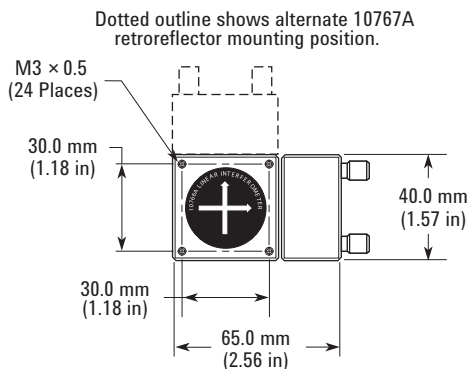


Agilent 10770A Angular Interferometer

Net Wt: 553 g (1.3 lb)

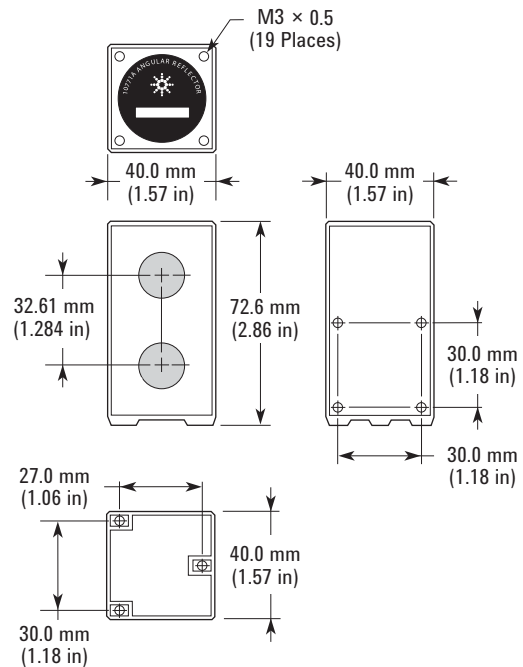


Agilent 10785A Height Adjuster/Post, 10784A Base



Agilent 10766A/10767A Interferometer Combination

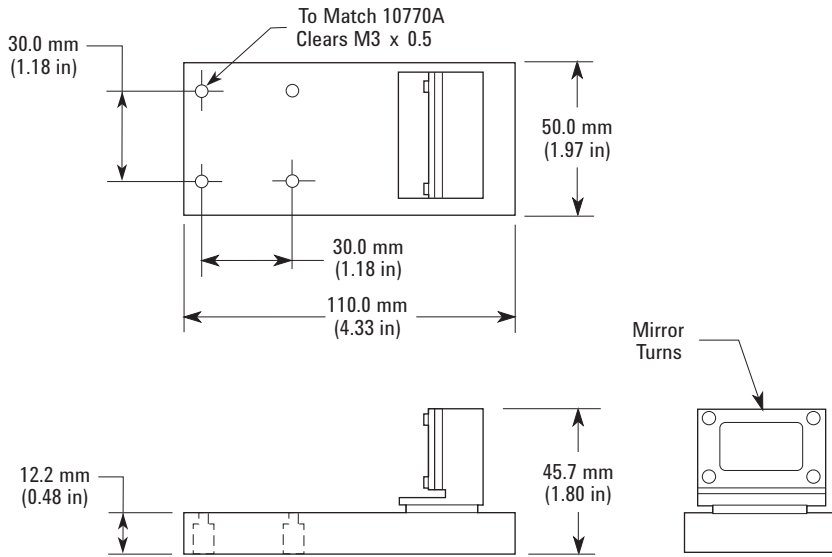
Net Wt: 536 g (1.2 lb)



Agilent 10771A Angular Reflector

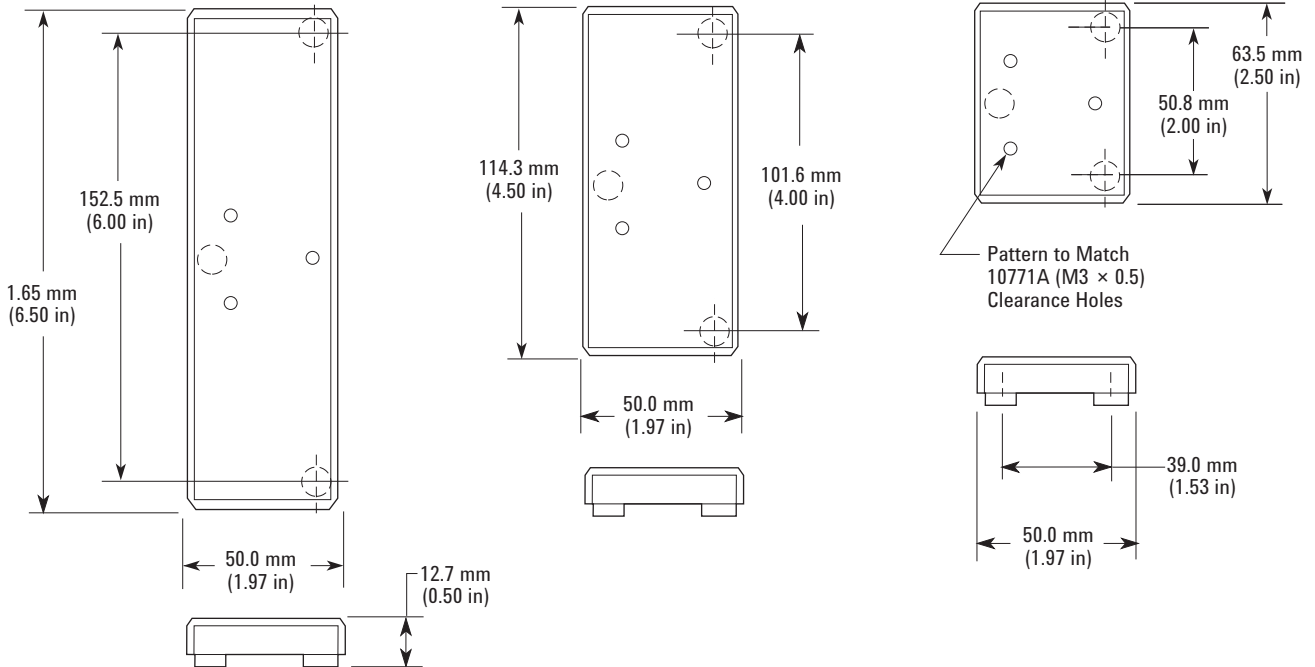
Net Wt: 650 g (1.5 lb)

Flatness Accessories



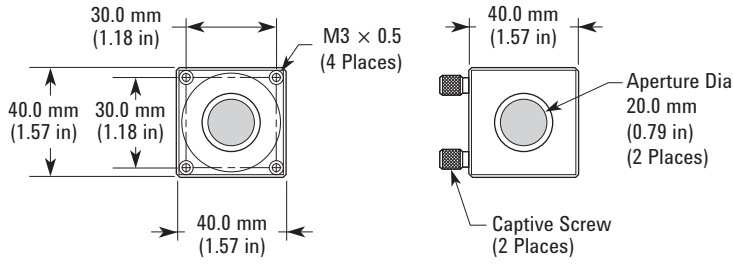
Agilent 10773A Flatness Mirror

Net Wt: 661 g (1.5 lb)



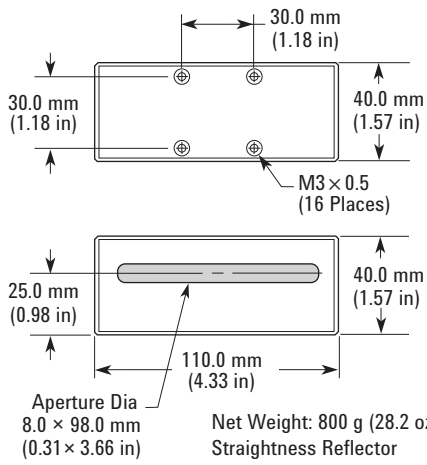
Agilent 10759A Foot Spacing Kit

Net Wt: 661 g (1.5 lb)



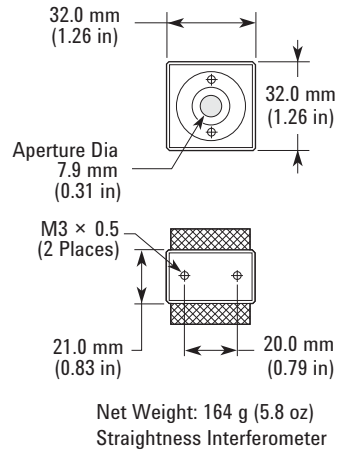
Agilent 10772A Tuning Mirror

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



Straightness Reflector

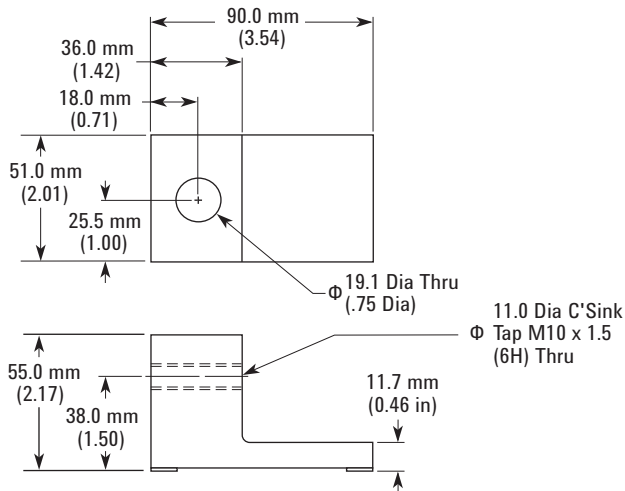
Net Weight: 800 g (28.2 oz)
Aperture Dia 8.0 x 98.0 mm (0.31 x 3.66 in)



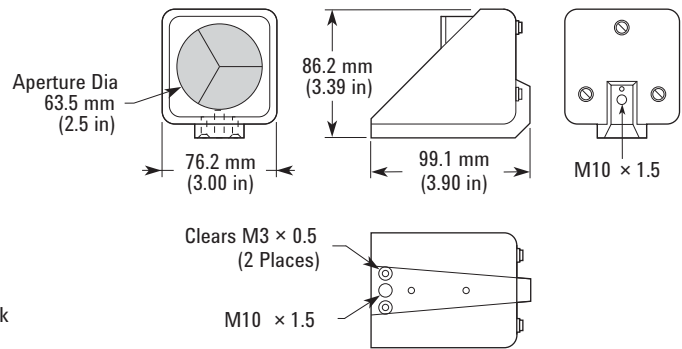
Straightness Interferometer

Net Weight: 164 g (5.8 oz)

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

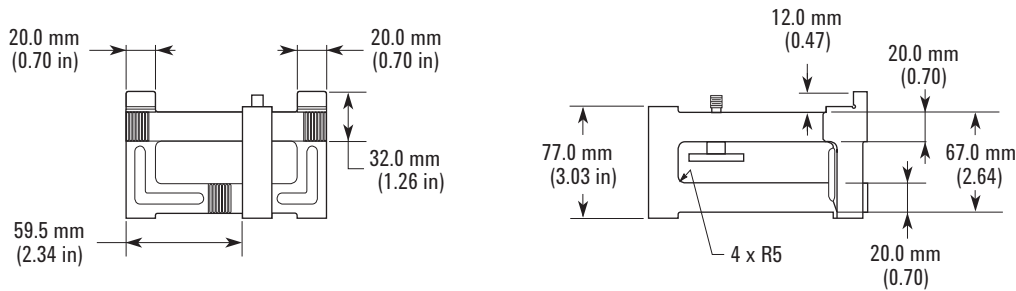
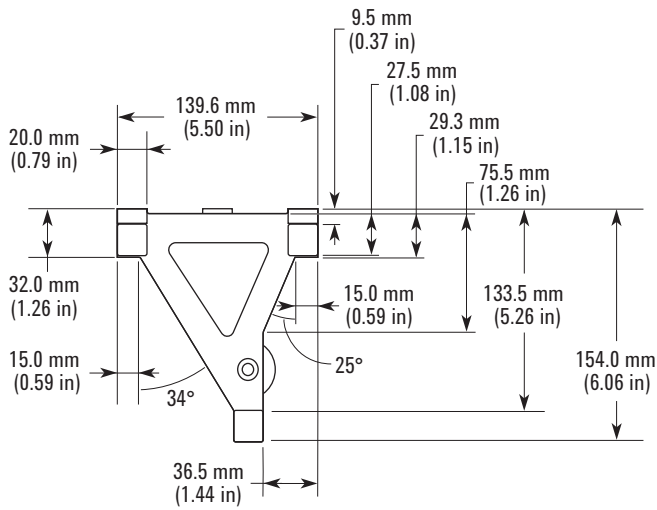


Agilent 10776A Straightness Mount

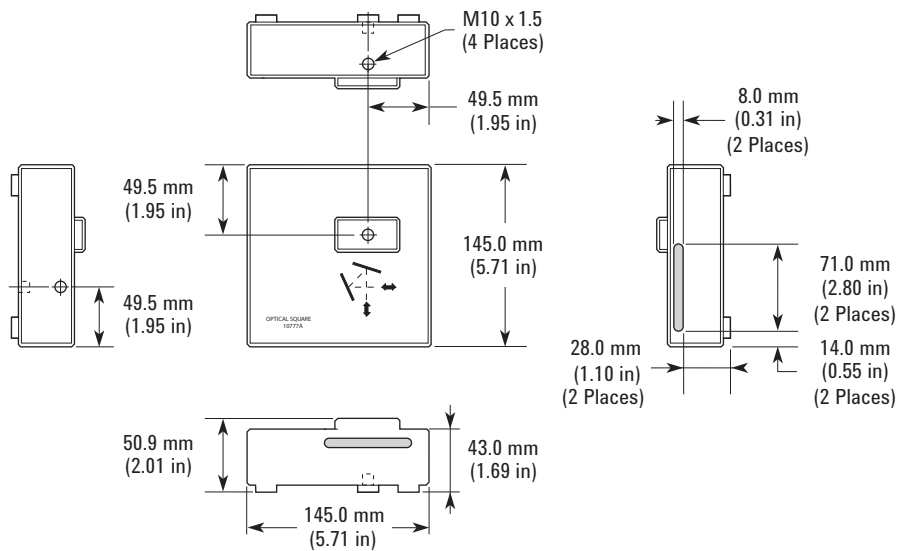


Agilent 10776-67001 Straightness Retroreflector

Net Wt: 374 g (0.82 lb)



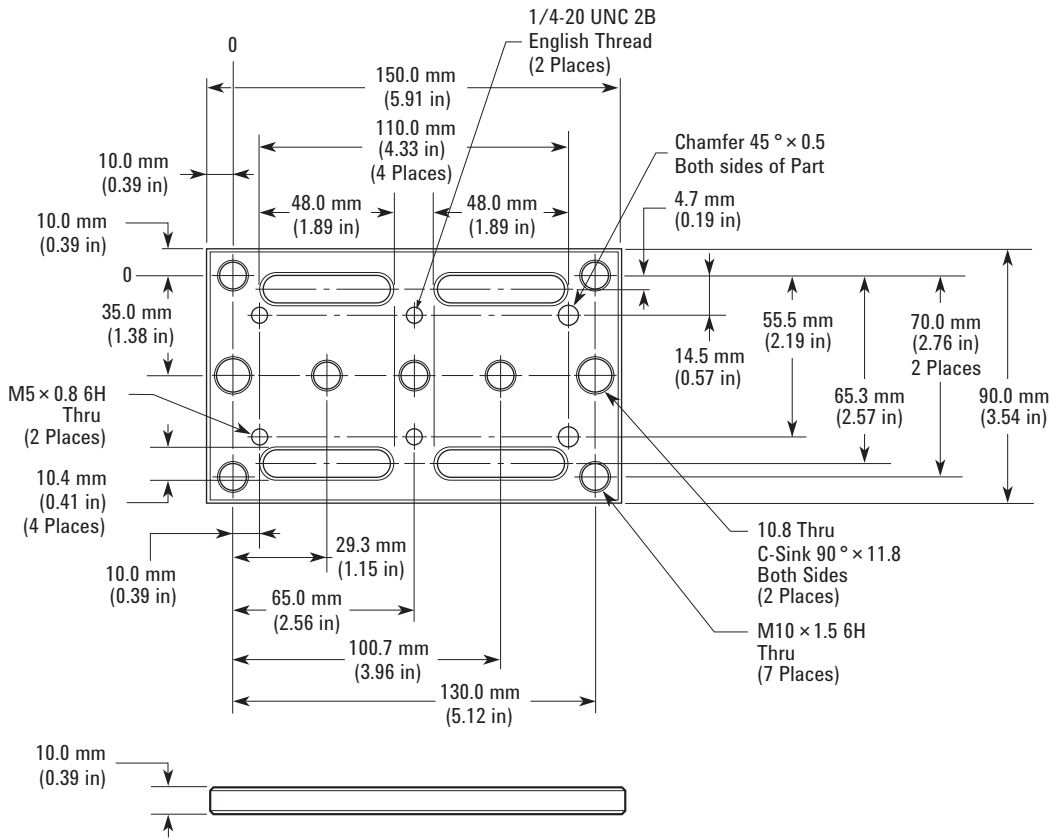
Agilent 10777-20007 Optical Square Base



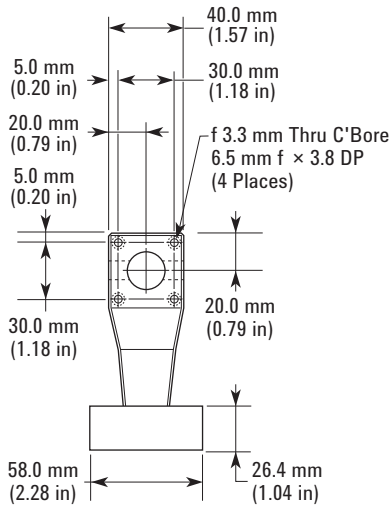
Agilent 10777A Optical Square

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

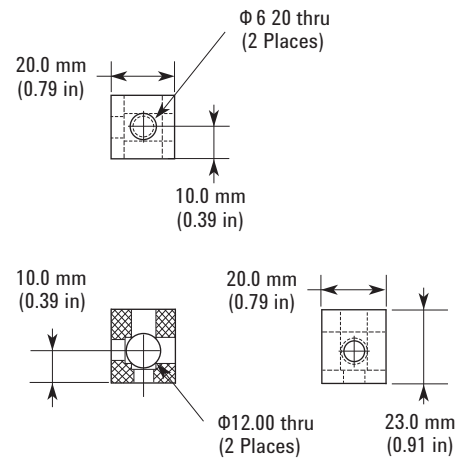
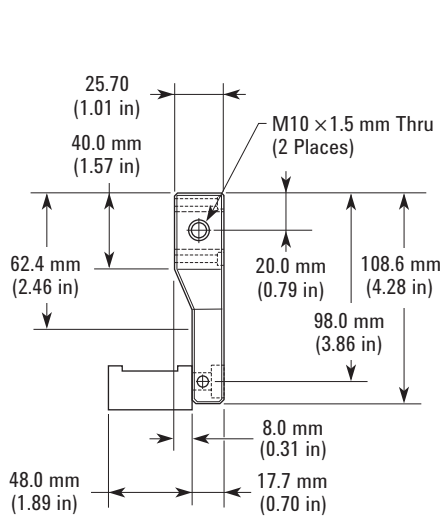
Diagonal Measurement Kit



Agilent 10768-20214 Base - Large

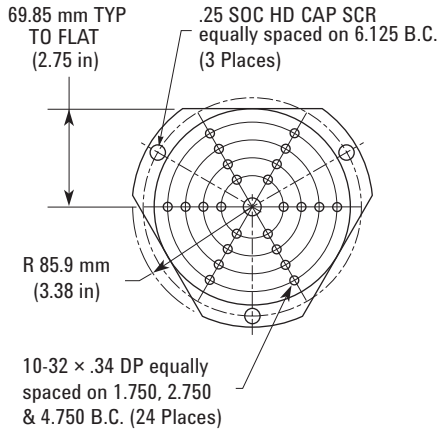


from Agilent 10768A/10769A Measurement Kit

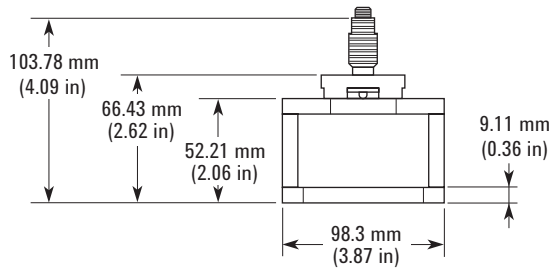
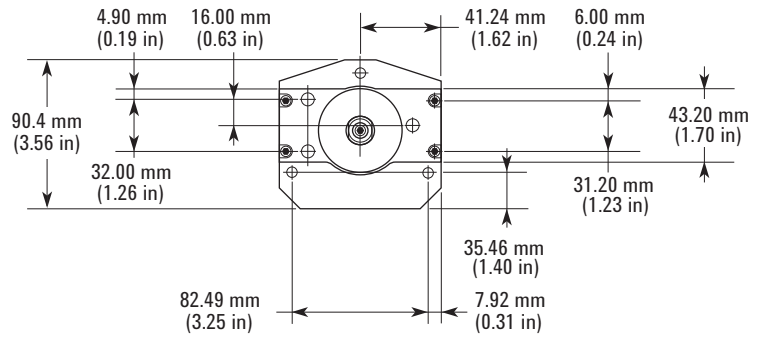


Agilent 10769B Turning Mirror (Base Block Only)

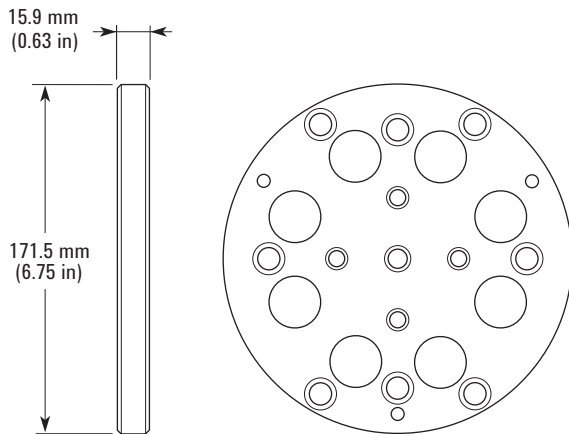
55290A Angular Position Measurement Kit



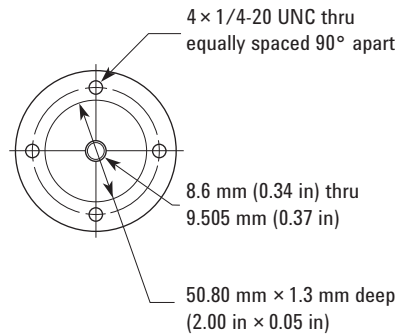
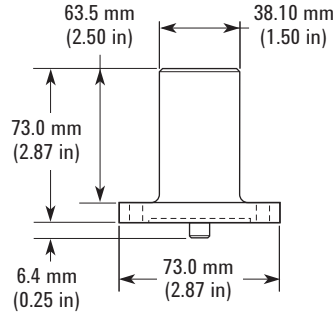
Rotary Indexing Table



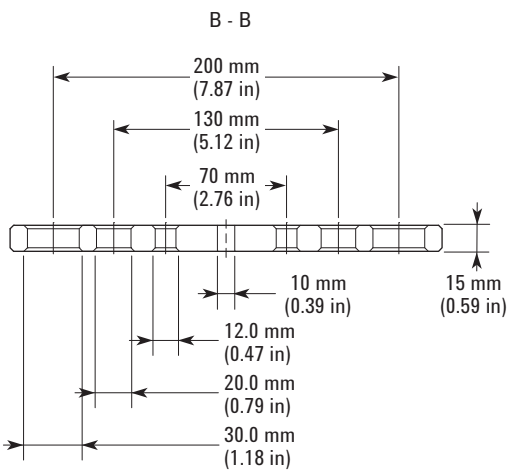
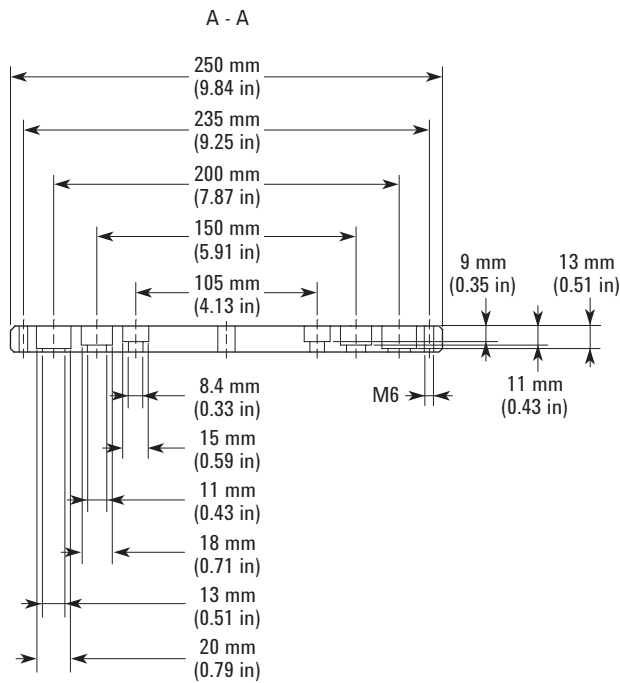
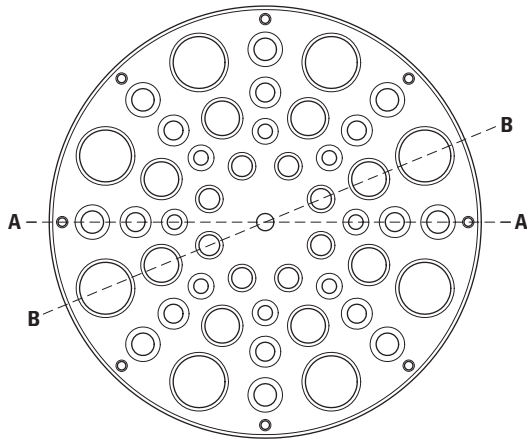
Fixture, Angle Position Measurement



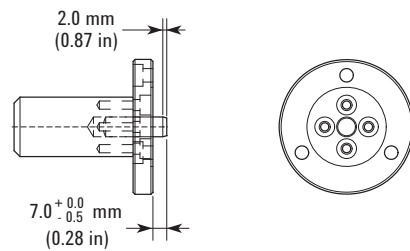
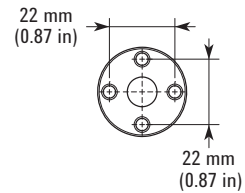
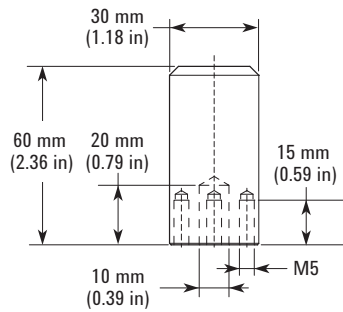
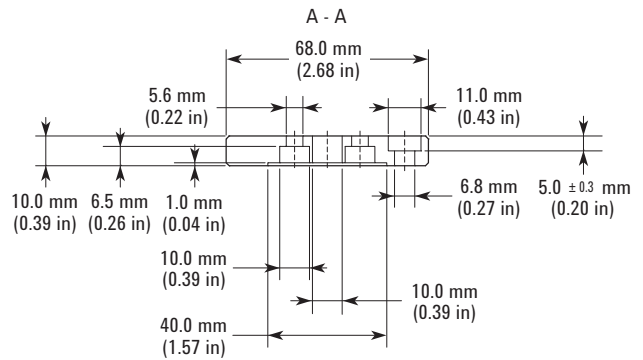
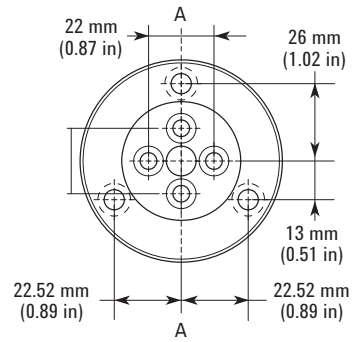
Adapter Plate



Flanged Shaft



Adapter Plate



Flanged Shaft



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Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	49 (0) 7031 464 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
United Kingdom	44 (0) 118 927 6201

For other unlisted countries:

www.agilent.com/find/contactus

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