Infra-Red Interferometers
for performance testing of infra-red materials and optical systems

Specialist expertise in testing, analysis, design, development and manufacturing for Optical fabrication, Optical Assemblies, defense related engineering disciplines including sensors, systems, and electronics.

MANUFACTURING Solutions

A wealth of technical experience in electrical, mechanical, electro-mechanical and electro optical systems is available for the assembly and test of a variety of complex subsystems. Production operations and logistics expertise is supplemented by project management, manufacturing and process engineering skills in order to ensure cost effective delivery.

NextGenn Global Technologies Limited promotes a extensive range of specialist testing, analytical, design, manufacturing, and evaluation facilities to a wide market across the Optics, Optical Assemblies, Laser diagnostics, aerospace and defence industries. NextGenn has several programmes in the industry and offers unrivalled capability in key technologies that are relevant to the Optics fabrication, Testing of Optical Assemblies, Laser diagnostics, aerospace and defence and a host of commercial industries. NextGenn offers access to this wealth of expertise on a commercial, contract basis through three major disciplines: Testing, Imaging and Manufacturing Solutions.

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The INFRARED II dual waveband Twyman-Green unequal path Interferometer available with a choice of lasers operating at LWIR 10.6 microns wavelength, in the MWIR 3.39 micron wavelength range which allows fringes to be obtained quickly and easily with excellent signal-to-noise with the facility of a common interferometer system for both the wave bands. We offer two options for Co2 Laser: One option uses Co2 Laser with 12 tunable lines (10.3-10.8 microns), this can be fixed at 10.6 microns and Second Option uses Co2 Laser with 45 tunable lines(9.1-10.9 microns). The Base unit includes IR remote control and 633nm external laser alignment source.

INFRARED II dual waveband Twyman-Green interferometers have been designed to be rugged, easy-to-use instruments that can be used for development, test, production, quality control or research applications and are fully supported with a comprehensive range of optical and mechanical accessories and static and phase-measuring fringe analysis software options for the accurate measurement of wavefront aberration of thermal imaging lenses, optical homogeneity of infra red materials and flatness of optical surfaces.

The construction of this system combined with a fast warm-up time means that fringe images can be quickly and easily produced with no focus drift. All instruments feature a focal plane array camera which is much more sensitive than previous cameras and has significantly reduced noise, allowing high quality images of fringes to be acquired quickly, easily and with no focus drift. When used with phase shifting fringe analysis
software, the acquisition of fringes is much more reliable. The phase shifting technique used allows the highest degree of precision and enables full use of standard accessories.

The **INFRARED-II dual waveband system** operates at both 3-5 micron band using 3.39 micron HeNe laser source and at **10.6** using a stabilized CO2 waveguide laser source operating at 10.6 microns. Alternative lasers are available for different wavelengths. Both 3.39 micron and 10.6 micron Lasers along with alignment Laser is housed inside a single housing to make the system compact and easy to use.

The INFRARED-II dual IR using a factory-fitted phase shifting accessory employs a piezo-electric transducer which moves the reference mirror in the interferometer. Successive frames of video output can then be analyzed to provide the greatest possible accuracy in the measurement using our advanced PC and μShape™ Fringe Analysis Software.

As precision non-contact instruments, the **INFRARED II Dual IR** interferometers provide rapid and accurate measurement of wavefront distortion through IR systems and components. Their operating wavelengths allow for the evaluation of high specification IR lens assemblies, producing interference fringes that indicate the degree of aberrated performance. Their associated fringe analysis software enables detailed performance analysis of even the most complex of lenses.

It features a focal plane array camera which is much more sensitive than previous cameras and has significantly reduced noise, allowing high quality images of fringes to be acquired quickly, easily and with no focus drift. When used with phase shifting fringe analysis software, the acquisition of fringes is much more reliable. This is of particular importance in the 3-5 micron wavelength range where the lasers are generally of low power.

This technical excellence of the system allows optical design services, optical testing, diamond machining and sub-assembly manufacturing. Each instrument comes with a comprehensive operating manual and is backed by a one year guarantee plus a choice of technical field service and support packages.

The INFRARED II Dual IR interferometer systems is configured in a Twyman Green optical configuration and have an integral co-linear visible HeNe laser at 3.39 micron and a stabilised CO2 waveguide laser source operating at 10.6 microns included that provides the user with a rapid and accurate alignment system and are designed to provide versatile testing capabilities.

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KEY BENEFITS of INFRARED II Dual IR Interferometer:

- Portable and compact
- Easy to set up and operate
- Provide remote control operation
- Non-contact and precise
- Transmitted wavefront measurement for IR materials/systems
- Compatible with a wide range of standard accessories
- Practical, versatile and affordable

**Specifications**

<table>
<thead>
<tr>
<th>Configuration</th>
<th>INFRARED II Dual IR Interferometer</th>
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</thead>
<tbody>
<tr>
<td>Description</td>
<td>Dual waveband Twyman-Green Unequal Path Interferometer</td>
</tr>
<tr>
<td>Acquisition Mode</td>
<td>Temporal Phase Shifting</td>
</tr>
<tr>
<td>Alignment Mode</td>
<td>Integral co-linear visible HeNe laser</td>
</tr>
<tr>
<td>Wavelengths</td>
<td>3.39 um &amp; 10.6 microns (others available)</td>
</tr>
<tr>
<td>Maximum Output</td>
<td>Test Lasers: &lt;4mW at MWIR waveband and &lt;400mW at LWIR waveband both housed in single housing along with Alignment Laser: &lt; 45 mW at 633 nm</td>
</tr>
<tr>
<td>Clear Aperture</td>
<td>50 mm (Expandable with accessories)</td>
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<tr>
<td>Maximum Cavity Length</td>
<td>&gt;30 m</td>
</tr>
<tr>
<td>Polarization</td>
<td>Linear</td>
</tr>
<tr>
<td>Pupil Focus Range</td>
<td>+/- 10 mm (higher focus ranges are available as custom made)</td>
</tr>
<tr>
<td>Pupil Magnification</td>
<td>1Xto 3X</td>
</tr>
<tr>
<td>Camera</td>
<td>High Resolution dual waveband 320x240 uncooled ferroelectric focal plane array</td>
</tr>
<tr>
<td>Motorized Controls</td>
<td>System wavelength, Zoom, Focus, Tip-Tilt Reference Mirror</td>
</tr>
<tr>
<td>Additional Option</td>
<td>Beam Attenuation (manual) for low reflectivity test surfaces</td>
</tr>
<tr>
<td>Computer System</td>
<td>Minimum Dual Core 2 GHz processor, 1GB RAM, 160GB Hard drive, CDRW, DVDRW, 19 in LCD monitor, keyboard, mouse, frame grabber</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows-7 OR Windows XP</td>
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### System Software

<table>
<thead>
<tr>
<th>Function</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>µShape and FastFringe</td>
<td>µShape Phase Shifting data acquisition</td>
</tr>
<tr>
<td></td>
<td>FastFringe™ instantaneous data acquisition</td>
</tr>
<tr>
<td></td>
<td>Fringe contrast controlled via camera and frame grabber settings</td>
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<tr>
<td></td>
<td>Reference generation, subtraction, data averaging, masking</td>
</tr>
<tr>
<td></td>
<td>2D and 3D surface maps</td>
</tr>
<tr>
<td></td>
<td>Zernike / Seidel / Slope / Geometric / Fourier Analysis</td>
</tr>
<tr>
<td></td>
<td>Absolute sphere, aspheric analysis, prism &amp; corner cube analysis,</td>
</tr>
<tr>
<td></td>
<td>multiple aperture analysis</td>
</tr>
</tbody>
</table>

### Fringe detection

- Focal plane array with fringe contrast adjustments

### System Transmission

- >= 75%

### Display

- CCIR compatible or as specific user requirements

### System Performance Specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (PV)</td>
<td>wavefront&lt;λ/50 P-V with reference calibration and subtraction</td>
</tr>
<tr>
<td></td>
<td>surface deviation&lt;λ/100 P-V with reference calibration and subtraction</td>
</tr>
<tr>
<td>Repeatability (PV)</td>
<td>wavefront λ/100 P-V, λ/200 rms surface deviation λ/200 P-V, λ/400 rms</td>
</tr>
<tr>
<td>Precision</td>
<td>λ/1000 rms</td>
</tr>
<tr>
<td>Acquisition Rate</td>
<td>µShape™ 0.16secs to 1.33secs</td>
</tr>
<tr>
<td></td>
<td>FastFringe™ 20milliseconds</td>
</tr>
<tr>
<td>Dimensions</td>
<td>675mm (l) x 260mm (w) x 280 mm (h)</td>
</tr>
<tr>
<td>Weight</td>
<td>35 kg approx</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>720Watts</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>Operational : 10–30°C, stability +/-2°C, non-condensing</td>
</tr>
<tr>
<td></td>
<td>Storage: 5–45°C, non-condensing</td>
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**Phase shift software:**

Phase shift analysis can improve accuracy by capturing the fringes with several different phases of the reference beam. This permits calculation of absolute phase for every pixel within the pupil, which increases accuracy and repeatability of measurements to around lambda/100, and allows the sense of the fringe perturbation to be identified as a wavefront retardation or advance.

The technique involves using a piezo transducer to move the reference optic by around lambda/2 and utilizing dedicated phase shift analysis software to provide full analysis of circular, multiple, low contrast and nulled fringes.

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We can offer software which is extremely versatile, and features masking facilities which enables data to be acquired using a variety of transparent or opaque masks as user-adjustable circles, ellipses, rectangles and polygons.

This allows information to be obtained from different parts of the optical surface under test. These display formats can be extended to all measured data, such as aberration fields, MTF and slope field. Results can be displayed directly in terms of ISO and DIN standards.

Phase measuring interferometry is a more accurate technique than static fringe analysis since it offers higher density and uniform sampling of the interference pattern, and better phase resolution.

**Specification:**
- Piezo mirror control
- Phase shifting control
- Vision Fringe acquisition and interpretation software
- Frame grabber PC card & PC DAC card

**Key Features :**
- Software operates within Windows™
- Capability to evaluate both components and systems.
- Full analysis of circular, multiple, low-contrast and null fringes.
- Macro programming facility allows repetitive testing routines to be set up.
- Reference subtract.
Static Fringe Analysis:

A variety of static fringe analysis software packages is available. Static fringe analysis typically offers an accuracy of around lambda/20 and has the benefit that the software results can be verified manually for simple peak to valley measurements. Software offers far more sophisticated analysis including calculation of the rms wavefront deviation, and other derived functions such as the Strehl Ratio, MTF, Point Spread Function and Encircled Energy Function.

The wavefront shape is often approximated by fitting Zernike coefficients to the available data, enabling the calculation of Seidel Aberrations. The software can also flag pass/fail criteria based on irregularity, power, peak to valley wavefront value and rms wavefront aberration.

Key Features:

- Pass/fail criteria; irregularity, power, PV, rms.
- Low cost analysis of open or closed fringes.
- Full wavefront analysis including MTF, PSF, slope error.
- Zernike analysis up to 49 terms & Reference subtract.
INFRARED II Dual IR Standard Accessories:

- Aperture converters to increase the 35mm output beam diameter
- Reference flats ($\lambda/20$)
- Transmission spheres ($\lambda/10$)
- Reference spheres ($\lambda/20$)
- Collimating lenses
- Off-axis parabolas
- Attenuators
- Precision mounts
- Vertical configurations
- Upward/downward looking options
- Static/phase fringe analysis system
- Phase shifting accessory
- Refractive collimator (100mm aperture)
- Beam expander 150mm/200mm
- Beam expander 300mm
- Transmission sphere f/1
- Transmission sphere f/2
- Transmission sphere f/4
- Transmission sphere f/8
- Compact precision mount 2 axis (tilt)
- Compact precision mount 5 axis
- Large precision mount 2 axis (tilt)
- Large precision mount 3 axis (tilt)
- Large precision mount 5 axis (tilt xyz)

We encouraged you to discuss your application with us and we can then accordingly offer several custom made accessories to support your project.

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**Reflective Beam Expander**

The reflective beam expander accessory is designed for the analysis of large optics using the INFRARED range of infrared interferometers and can be used both in the 3-5 micron and 8-12 micron wavebands.

The unit is produced in collaboration with Optical Surfaces Ltd and features a Newtonian configuration not a Galilean configuration to provide an intermediate focused image for efficient relaying of optical pupils, which is essential at longer infrared wavelengths.

The reflective beam expander is a robust, standalone unit which can be bolted to an optical bench with height adjustment for fine alignment. It contains a matched pair of permanently aligned aluminum mirrors, complete with magnesium fluoride protective coatings.

It has a wave front accuracy of $\lambda/10$ in the 3-5 micron waveband, with output apertures of 150 mm and 200 mm as standard, although other sizes are available. The input aperture of 30 mm is matched to the INFRARED Interferometers output aperture.

For further information about Infra-red interferometers and their applications please contact our sales department.

**NextGenn Global Technologies Limited**

13/F, Culturecom Centre,  
47 Hung To Road, Kwun Tong, Kowloon, Hong Kong  
FAX: +852 8161 7033  
Email: sales@nextgenn.net  
Web: [www.nextgenn.net](http://www.nextgenn.net)