Blood flow imaging
Product highlights

Moor are proud to offer a choice of six advanced imaging systems for assessment of microvascular blood flow. Featured products include:

- **Clinical Burn Assessment**
  A choice of two clinically proven systems with the release of the rapid moorLDLS-BI.

- **Laser Speckle - moorFLPI-2**
  Fast full-field imaging based on the laser speckle technique - now with image resolution of 1M pixels/cm² and full area imaging at 25 frames/sec.

- **Laser Doppler - moorLDI2-HIR**
  Fully optimised for hind limb ischemia and angiogenesis modelling with 785nm laser and focussed optics to enable clear imaging of subsurface collateral vessels.

This catalogue is intended to provide an overview. Please contact us for further details or to arrange a no obligation on site visit. Visit [www.moor.co.uk](http://www.moor.co.uk) for full details of our imaging and moorVMS family for blood flow and oxygen monitoring. Clinical users can visit [www.moorclinical.com](http://www.moorclinical.com) for all burn assessment information.

Moor Instruments

Moor Instruments, established in 1987, is a world leader in the design and manufacture of laser Doppler systems.

Our systems are used for the measurement of skin blood flow and microvascular blood flow in other organs for a broad range of clinical and research applications such as wound management, plastic surgery, dermatology and dentistry.

**Quality**

Moor Instruments is an ISO 13485 registered company and has been for at least a decade. By working to strict quality procedures we ensure product safety, reliability and effectiveness.

**Customer support**

First hand experience of laser Doppler research and development within Moor dates back to 1978 and with this we have the breadth of knowledge to help with your application and the enthusiasm to try to find answers to any of your questions.

By giving priority to performance, quality and service we strive to be our customers number one choice.

The future

Our aim will always be to offer technical excellence within each product we manufacture.

Our experienced and highly skilled design team are also involved with a number of development projects for other partners and manufacturers. Whatever your needs, as a researcher, clinician or manufacturer, Moor will work harder for you.
Choosing the right package

START HERE

Clinical Burn Assessment or Research

- Burn assessment systems approved for clinical diagnosis

Speckle Contrast Imaging or Laser Doppler Imaging

- Speckle contrast enables video frame rate imaging of superficial tissues at high resolution

Fast LD line scanner or high resolution / large area with moorLDI2 imagers

- Fast LD line scanner is the fastest medium area laser Doppler imager available - from 4 seconds per scan

High resolution, small area or standard resolution, medium to large area

- High resolution laser Doppler for pre-clinical imaging - best resolution of 100 microns per pixel

Near Infra-Red imager is our most versatile system for clinical research and pre-clinical applications

- moorLDI2-BI
  - SEE PAGE 4
- moorLDLS-BI
  - SEE PAGE 5
- moorFLPI-2
  - SEE PAGE 6
- moorLDLS2
  - SEE PAGE 7
- moorLDI2-HIR
  - SEE PAGE 8
- moorLDI2-IR
  - SEE PAGE 9
Large area imaging is a key feature of the moorLDI2-BI. Areas up to 50cm x 50cm can be mapped in one scan (rather than a sequence that needs to be “stitched” together), with scan times ranging from 40 seconds up to 2 minutes.

Numerous studies using moor laser Doppler consistently show accuracies achieved in excess of 96% accuracy enabling early and effective planning of surgery or conservative management.

The complete package includes the moorLDI2-BI imager, clinical stand, isolation transformer, touchscreen panel PC, printer and burns imaging software. An integral part of the system is the installation, competence based training and a service contract ensuring support when needed.

Clinical Assessment Day 3
Lund and Browder chart records initial clinical opinion for surgical treatment of abdomen and both thighs. The regions appear deep 2nd degree and full thickness.

moorLDI2-BI Assessment Day 3
moorLDI2-BI shows high flow (HP14) on the abdomen and right thigh (except for a few regions of slightly lower flow, HP14-21) indicating a good healing potential. The left thigh shows low flow (HP>21) within the burn area indicating no healing within 21 days. The clinical decision was to treat the left thigh surgically and the remainder of the other burn areas conservatively.

Outcome Day 23
All areas treated conservatively healed well by day 23 - as shown in the photograph. The need for surgery of the upper left thigh was indicated by the moorLDI2-BI. This was confirmed by biopsy, the results of which showed full thickness burn within this area.
Rapid imaging is an essential feature of moorLDLS-BI which is most useful when scanning patients who are unable to keep still for long. With scan times of around 4 seconds for areas up to 15cm x 20cm the system is ideal for paediatric cases and can also be used for adults with easy to use repeat imaging to cover separate wounds or adjacent areas of large burns.

Numerous studies using moor laser Doppler consistently show accuracies achieved in excess of 96% accuracy enabling early and effective planning of surgery or conservative management.

The complete package includes the moorLDLS-BI imager, clinical stand, isolation transformer, touchscreen, panel PC, printer and burns imaging software. An integral part of the system is the installation, competence based training and a service contract ensuring support when needed.

**Key Features**
- Scan times from 4 seconds
- Areas up to 15cm x 20cm
- Multi-scan mode for multiple burn sites
mooFLPI-2 High resolution, video frame rate blood flow imaging

The mooFLPI-2 blood flow imager uses the laser speckle contrast technique to deliver real-time, high-resolution blood flow images, providing outstanding performance in a wide range of pre-clinical and clinical research applications, such as stroke modelling, spreading cortical depression, inflammation and irritancy.

User-friendly features promote smooth workflow and enable the high through-put required to scan cohorts quickly and accurately. Advanced analysis functions help you to draw sound conclusions from your blood flow images.

The system is ideally suited to any application where rapid changes are occurring – where conventional laser Doppler imaging could not provide data with sufficient time or spatial resolution. It is possible to image cardiac pulsations, fast changes during reactive hyperaemia and spatial variations due to axon reflex and drug stimulations. The mooFLPI-2 is ideal for very high resolution imaging, visualising blood flow in structures as small as 10 microns.

Key Features
- Frame rates up to 25 images per second
- CCD camera – motorised zoom and auto focus
- Scan areas from 5mm x 7mm to 15cm x 20cm
- Colour photo image matches blood flow images precisely

Forearm blood flow flare response to intradermal histamine. The images enable different areas to be analysed with high spatial and temporal resolution.

Images courtesy of Dr Geraldine Clough and Prof. Martin Church, Southampton, UK.
The moorLDLS2 line scanning system images at rates 4 to 5 times faster than the standard moorLDI2 imagers. The system employs a laser line to sweep across the tissue recording data from 64 points simultaneously.

The penetration properties of the laser line are similar to the moorLDI2 systems but the imaging times are much shorter e.g. 64 x 64 pixels in just 4 seconds.

The system is ideally suited to any application where the dynamic changes are too rapid to be captured by conventional single collimated beam laser Doppler imaging. It is ideal where the work volume is such that time/cost savings can be attained by using fast line scanning and where it is necessary in a clinical/surgical environment to minimise the scan time.

**moorLDLS2 Rapid laser Doppler blood flow imaging**

**Key Features**

- Scan time 4 seconds for 64 x 64 pixels
- Scan areas up to 20cm x 15cm
The moorLDI2-HIR is suitable for a wide range of pre-clinical research investigations, more typically where smaller areas are under investigation. The system features unique focused optics to provide 100 micron pixel size and 256 x 256 pixel resolution for high resolution blood flow images. The scan areas range from just 2.5cm x 2.5cm up to 25cm x 25cm with scan times typically less than 5 minutes. Use of 785nm wavelength laser provides a deeper measurement depth, optimal for angiogenesis studies such as hind limb ischemia and tumour modelling and pre-clinical cerebral blood flow imaging. Highly refined image measurement and analysis software allows for flexibility in measurement set up and comprehensive analysis functions. The moorLDI2-HIR features a colour photo image of the scanned area and automatic distance measurement, making the positioning and comparison of images easier.

The system is in routine use in numerous laboratories and clinics globally and employs unique, optical design and signal processing in order to generate the highest resolution and clearest images of its class. LDI is often compared to laser speckle imaging and whilst there are some similarities, both techniques offer unique advantages. LDI (and moorLDI2-HIR in particular) generally offers deeper penetration enabling enhanced visualisation of small vessels below the tissue surface, perfect for pre-clinical studies. For certain applications these features are critical.

Angiogenesis modeling in hind limb ischemia model, where average perfusion in a ligated limb is compared with the control limb. Multiple scans over days can identify the time course of collateral vessel development.
Image courtesy of James Faber, UNC, USA.
moorLDI2-IR Near Infra-Red imager

The moorLDI2 laser Doppler blood flow imager offers a well proven, high specification solution to your blood flow application for clinical or research application. The system is in routine use in numerous laboratories and clinics globally and employs unique, optical design and signal processing in order to generate the highest resolution and clearest images of its class.

LDI is often compared to laser speckle imaging and whilst there are some similarities, both techniques offer unique advantages. LDI generally offers deeper penetration enabling enhanced visualisation of small vessels below the tissue surface, perfect for angiogenesis modelling or through skull pre clinical cerebral blood flow imaging.

A full range of accessories are available, including stands for clinical or bench top use. Dedicated software and hardware is available to enable control of iontophoresis, pressure and skin heating protocols (please refer to the MIC2 brochure for iontophoresis control, moorVMS-PRES brochure for pressure control and the moorVMS-HEAT brochure for skin heating).

This sequence shows an ischemic ulcer on the heel of a foot. The region of deepest wound was slowest to heal and demonstrated increased blood flow during healing period (12 week assessment).

Images reproduced with kind permission of Dr Faisel Khan and Dr David Newton, Ninewells Hospital, Dundee.

A full range of accessories are available, including stands for clinical or bench top use. Dedicated software and hardware is available to enable control of iontophoresis, pressure and skin heating protocols (please refer to the MIC2 brochure for iontophoresis control, moorVMS-PRES brochure for pressure control and the moorVMS-HEAT brochure for skin heating).

Key Features
- Highest sensitivity of moorLDI2 range
- Suitable for wide range of research applications
- Maximum resolution of 2,600 pixels per cm²
- Scan areas from 5cm x 5cm to 50cm x 50cm

moorLDI2-IR with optional MS2 mobile stand and touchscreen panel PC
### Summary chart  Moor Instruments blood flow imaging product range

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>moorLDI2 RANGE</th>
<th>moorLDLS2</th>
<th>moorFLPI-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>moorLDI2-BI</td>
<td>moorLDLS-BI</td>
<td>moorLDI2-IR</td>
</tr>
<tr>
<td>MEASUREMENT PRINCIPLE</td>
<td>Single beam Laser Doppler</td>
<td>Laser Doppler Line</td>
<td>Single beam Laser Doppler</td>
</tr>
<tr>
<td>APPLICATION</td>
<td>Blood Flow Imaging</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td></td>
<td>Burn Assessment</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SCAN AREA AT FULL RESOLUTION</td>
<td>cm x cm</td>
<td>5 x 5 to 50 x 50</td>
<td>3.7 x 10 to 20 x 15</td>
</tr>
<tr>
<td>WORKING DISTANCE</td>
<td>cm</td>
<td>30 - 100</td>
<td>10 - 20</td>
</tr>
<tr>
<td>MAXIMUM SCAN RESOLUTION</td>
<td>Pixels</td>
<td>256 x 256</td>
<td>256 x 64</td>
</tr>
<tr>
<td>MAXIMUM PIXEL DENSITY</td>
<td>Per cm²</td>
<td>2,600</td>
<td>440</td>
</tr>
<tr>
<td>MAXIMUM PIXEL RESOLUTION</td>
<td>µm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MONITORING MODE</td>
<td>Number of Points</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FASTEST SCAN TIME</td>
<td>Seconds, 64 x 64 pixels</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>MEASUREMENT DEPTH</td>
<td>Superficial/Nutritive</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>VIDEO IMAGE</td>
<td>Colour</td>
<td>Colour</td>
<td>Colour</td>
</tr>
<tr>
<td>LASER CLASSIFICATION</td>
<td>3R</td>
<td>3R</td>
<td>3R</td>
</tr>
</tbody>
</table>

**Please consult with Moor Instruments for further information.**

Moor Instruments reserves the right to change specifications without notice.

*Research software can be supplied with burn assessment system on request.*