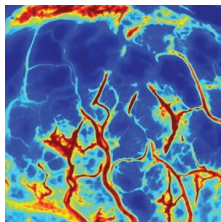
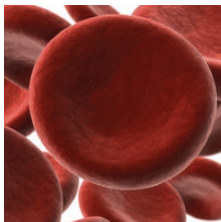
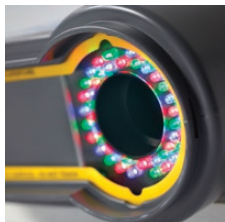
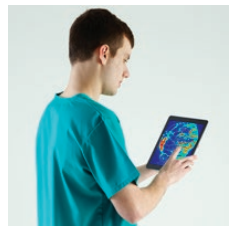
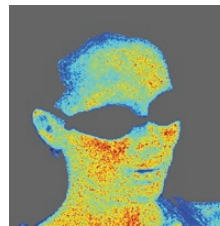


# Simultaneous tissue perfusion and oxygenation imaging with moorO<sub>2</sub>Flo



**moor instruments**  
innovation in microvascular assessment

# Simultaneous tissue perfusion and oxygenation imaging

The moorO<sub>2</sub>Flo is an imaging system designed to simultaneously image tissue perfusion and relative tissue oxyhaemoglobin and deoxyhaemoglobin concentration change.

The moorO<sub>2</sub>Flo combines Moor Instruments' existing laser speckle contrast technology for perfusion imaging with reflectance spectroscopy for oxygenation change imaging.

- **Non contact imaging** techniques.
- **Blood flow and oxygen videos** of any exposed tissue (skin or surgically exposed tissues).
- **Real-time video frame rates** to capture dynamic changes in flow and oxygen – up to 20 frames per second, with each frame containing 1 x blood flow image, 1 x oxyHb image, 1 x deoxyHB image and 1 x colour photograph.
- **Best spatial resolution of 10 microns per pixel** to reveal detailed morphology.
- **10 x optical zoom** to image areas from 15cm x 20cm to 5.6mm x 7.5mm with motorised zoom and autofocus.
- **Add multiple “regions of interest” to assess and quantify blood flow and oxygen changes** in real time and post measurement. Area of ROIs calculated automatically.
- **Colour photo image matches blood flow and oxygen images precisely** to aid identification of features.

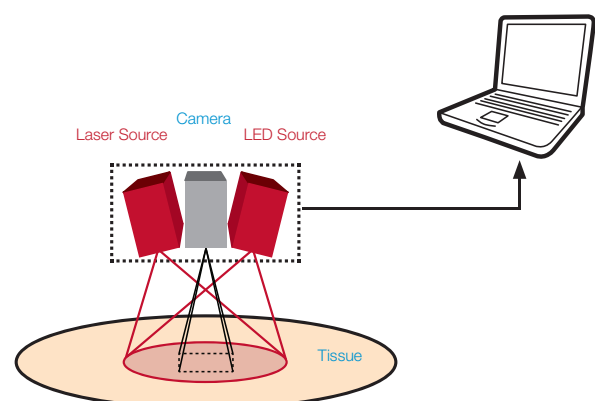
## moorO<sub>2</sub>Flo – how it works...

The moorO<sub>2</sub>Flo is the only commercially available system combining measurements of tissue perfusion and oxygenation changes. Two different techniques are provided within one physical package with measurement and analysis functions grouped into one software suite. The system uses a single video camera for both measurements so the data matches pixel for pixel and also combines a colour image of the scan site for records.

Tissue perfusion imaging is achieved with the laser speckle contrast analysis and oxygenation imaging achieved with reflectance spectroscopy. Simultaneous perfusion and oxygenation imaging is achieved by rapidly alternating between the two techniques.

**Perfusion Imaging – How it works:** Tissue is illuminated with a diverging infrared laser beam. The resulting random speckle pattern is imaged with the video camera. Movement, mainly of red blood cells within the tissue, causes the speckle pattern to blur, reducing contrast. Reduced contrast is associated with higher flow accordingly and these contrast variations are analysed to generate colour-coded maps of tissue perfusion.

**Oxygenation Imaging – How it works:** Tissue is illuminated sequentially with red, green and blue LEDs. The tissue is imaged with the video camera and illumination synchronised such that separate red, green and blue images are generated. These are subsequently analysed using the modified Beer-Lambert law to relate changes in the diffuse reflectance to generate colour coded maps of oxy-haemoglobin and deoxy-haemoglobin changes.





# Applications and Software

Dedicated software for measurement and analysis is provided to take advantage of the high acquisition speeds and spatial resolution provided by moorO<sub>2</sub>Flo. Our software is fully featured for setup, measurement, protocol control, analysis, reporting and exporting.

**Setup** offers full flexibility to choose scan size and temporal resolution, enabling you to collect data that is appropriate to your measurement, be it just a single image or a longer capture sequence. Zoom and auto focus is set conveniently using either the front panel control or via software control.

**Measurement** starts with a single click. Mark events and see changes in flow and oxygenation at predefined regions of interest (ROIs) that update graphically and histographically. Scan and ROI areas calculated automatically.

**Protocol Control equipment** (optional extra) enables precise and reproducible operation of Pressure Cuff, Skin Heating and Iontophoresis transdermal drug delivery equipment – reproducible stimulations/ challenges to flow and oxygenation.

**Analysis** post measurement includes the ability to replay and re-analyse data offline by re-positioning regions of interest. This allows maximum utilisation of the data set. Five different colour palettes, and optional functions such as smoothing, image XY shift (to counteract movement mid measurement) and variable speed sequence playback enables you to present your data clearly.

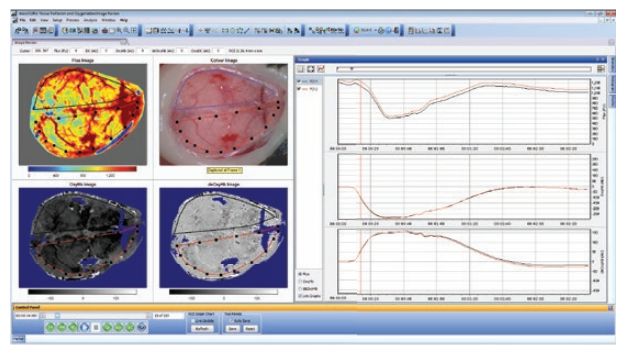
**Report templates** can be custom defined to produce the analysis and reporting that is needed from your studies from standard statistical to FFT / wavelet analysis. Export data to AVI, Matlab and graphical forms to extend the use of data for further analysis or presentations.



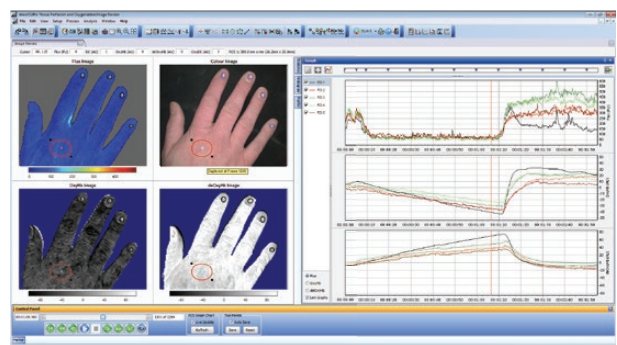
*moorO<sub>2</sub>Flo – Power, USB 3 and In / Out Trigger.*

## Your research

Please contact Moor or your nearest approved distributor to discuss your specific application. Ask to see the new system in action and evaluate it at your own facility. Current publications are updated online at [www.moor.co.uk](http://www.moor.co.uk).



*Cerebral Hypoxia protocol – illustrating changes in blood flow, oxy/ deoxy Hb and colour photo of imaging site*



*Post Occlusive Reactive Hyperaemia protocol (PORH) – illustrated during the ischemic phase of the recording.*

# About Moor Instruments

Moor Instruments, established in 1987, is a world leader in the design, manufacture and distribution of monitoring and imaging systems for micro-vascular assessments. We are proud now to include tissue oxygenation assessments within this portfolio.

Firsthand 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 and find answers to any of your questions.

By giving priority to performance, quality and service, we strive to ensure the highest levels of customer satisfaction.

Our dedicated design team is 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.

## Specifications:

### Quality Control

The moorO<sub>2</sub>Flo is CE marked.

### Measured Parameters

Tissue perfusion, in PU.  
Relative oxygenated and deoxygenated haemoglobin concentration change, in AU.

### Working Distance

100-380 mm (measured from front edge of enclosure).

### Imaging Area

5.6mm x 7.5mm (maximum zoom, minimum distance).  
150mm x 200mm (minimum zoom, maximum distance).

### Image Resolution

116 x 150 pixels for perfusion and haemoglobin images (low resolution).  
576 x 748 pixels for perfusion and haemoglobin images (high resolution).  
580 x 752 pixels for colour photo/video images.

### Combined Imaging Frame Rate

20 frames per second. 1 Frame consists of: 1x perfusion image, 1x oxyHb change image, 1x deoxyHb change image and 1x colour video image.

### Operating Environment

Indoor laboratory use.  
Temperature range: 15 – 30°C.  
Atmospheric pressure: 86-106 kPa.  
Humidity: 20-80%, non-condensing.  
Maximum altitude: 2000 m.  
Lighting conditions: Near-dark, controlled light environment or used inside a light proof enclosure.



moorO<sub>2</sub>Flo with LIGHTFRAME-SIZE1.

### Storage And Transportation Environment

Temperature range: 5 – 45°C.  
Atmospheric pressure: 50-106 kPa.  
Humidity: 20-80%, non-condensing.

### Power Source

AC mains, 100-230 V, 50-60 Hz.

### Dimensions

Scan head: 230x140x230 mm (WxHxD), 2.3 kg  
PSU: 105x55x170 mm (WxHxD), 0.7 kg

### Laser Classification

Class 1 (IEC 60825-1:2014).

### Measurement Laser

Emission pattern: Diverging circular beam.  
Wavelength: 785nm ± 10nm  
Maximum power: 100mW, Accessible power below IEC. 60825-1:2014 Class 1 limits.

### Aiming Lasers

Emission pattern: Collimated.  
Wavelength: 650nm  
Maximum power: 0.1mW per laser.

### Intended Use

The moorO<sub>2</sub>Flo is intended for use in research and educational life science applications only. The moorO<sub>2</sub>Flo is not intended to be used for medical diagnostic or therapeutic purposes.

**WARNING:** The moorO<sub>2</sub>Flo emits flashing light which may potentially trigger seizures for people with photosensitive epilepsy. Do not use the moorO<sub>2</sub>Flo in the presence of individuals with photosensitive epilepsy.

Moor Instruments reserves the right to change specifications without notice.

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innovation in microvascular assessment

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