There are a number of standard pressure protocols commonly used by clinicians. The moorVMS-PRES™ is pre-programmed to enable 7 of the most common protocols with full flexibility to customise and add your own variant. A simple ‘return to default’ option is available too. Once you have chosen your protocol, control the pressure cuff and apply to the patient, together with laser Doppler probe as appropriate. The protocol commences after your key stroke. An abort function is provided for any of your question.

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

First hand experience of laser Doppler research and flow in the microvasculature.


Kawanishi J. 2008  Clinical reliability and utility of skin perfusion pressure for routine microvascular testing with moorVMS-PRES™ automatic pressure cuff control for routine microvascular testing with moorVMS-PRES™

Not suitable for use in an oxygen rich atmosphere.

Protection against harmful ingress of water: IPX0 (not protected).

Degree of protection against electric shock: Type BF applied parts.

Medical devices directive 93/42/EEC: Class IIa, Active device for diagnosis.

Classification

Not suitable for use in the presence of flammable anaesthetics.

Specifcations:

Not suitable for use in an oxygen rich atmosphere.

Protection against harmful ingress of water: IPX0 (not protected).

Degree of protection against electric shock: Type BF applied parts.

Medical devices directive 93/42/EEC: Class IIa, Active device for diagnosis.
moorVMS-PRES™ - Vascular Testing

The moorVMS-PRES™ pressure cuff control system provides reproducible and fully automated pressure cuff control for routine vascular challenges. With the use of a moorVMS-LDF™ laser Doppler monitor, blood flow responses can be measured, providing a fully integrated and powerful solution for protocol management, analysis and reporting. The features include:

- Choice of 7 standard pressure protocols including ankle flow, brachial pressure, post-hemorrhage pressure, post occlusive reactive hyperaemia, pulse volume and ankle/toe brachial pressure index.
- Custom protocols for fully automated inflation. Hold Pressure and Deflation patterns, all from a single key press. Flexible and linear deflation settings.
- Rapid cuff inflation with built-in micropressure control for all cuff sizes.
- Highly accurate pressure sensing.
- Range of cuff sizes from 20 to 40"/High Tilt, sight pressure line connectors.
- Stand alone operation for use with any laser Doppler, imaging or other flow detection systems.
- moorVMS-PC software available with USB output for graphical display of pressure profile and integration with moorVMS-LDF™ blood flow traces.
- Connect ready to your data acquisition system. Analogue outputs of pressure and pulse volume recording. BNC connections.
- Medical grade design for both clinical and research applications.
- Multilingual training DVD for continual reference.
- Single operator control.
- Reliability measured by a 3 year basic warranty, extends to 5 years with annual servicing (in-built automatic reminder).
- Part of the moorVMS family: configure your ideal system with extra pressure, laser Doppler, regeneration and haemoglobin concentration, iontophoresis and skin heating modules.

Laser Doppler and Pressure Assessments

Combining automated pressure cuff control with laser Doppler monitoring of blood flow provides a highly sensitive and accurate tool for assessments of microvascular dysfunction and for vascular assessments of peripheral arterial disease (PAD).

Laser Doppler has become the gold standard for dynamic microvascular blood flow assessments as the laser Doppler technique is particularly sensitive for detecting flow changes.

A significant advantage of laser Doppler is that it does not require a pulsatile signal; pulsatility, essential to other techniques, is diminished or lost when peripheral blood flow is impaired. For example the use of laser Doppler in detecting low pressure normally avoids the false high results encountered from ankles with calcified arteries.

The moorVMS-PRES™ inflates the cuff to a target pressure below diastolic – typically 50mmHg. The small oscillatory pressure fluctuations within the cuff are monitored at this pressure. The fluctuation can be assessed to profile, amplitude and frequency.

The moorVMS-PRES™ – complete with pressure cuff, optic probes and moorVMS-LDF™ laser Doppler receiver.

5. Post Occlusive Reactive Hyperaemia (PORH)

Laser Doppler is used to follow the microvascular hyperaemic response from baseline, during occlusion and after release of occlusion. Important parameters detected automatically by moorVMS-PC™ software include time to first recovery, time to maximum hyperaemia, maximum hyperaemia and the area under the response curve.

Additional information is derived from the profile of the hyperaemic response.

moorVMS-PC PORH analysing screen shot – please refer to the moorVMS-PC software brochure for further details.

6. Ankle / Brachial Pressure Index (ABPI)

ABPI is the ratio of the systolic blood pressure in the lower leg to the systolic blood pressure in the arms. Compared to the ankle, laser Doppler gives much more information on peripheral arterial disease. ABPI is calculated by dividing the systolic blood pressure at the ankle by the higher of the two systolic blood pressures in the arms.

*Note, the arm rapid deflation cuff can be used in place of the standard arm cuff.

Postural Vasoconstriction

Oedema is common in venous insufficiency due to calf muscle pump failure and incompetent venous valves. Such insufficiency can lead to venous ulcers. Measurements of the percentage change in flow with the leg at heart level and their dependant provides an index of postural vasoconstriction. This test is performed using just the moorVMS-LDF™ laser Doppler system to detect the changes in flow associated with the test.

Custom protocols

Most of the pressure protocols follow the same pattern comprising of a resting baseline, cuff inflation to a target pressure, hold, then release (in various rates). The moorVMS-PRES™ allows complete control to change each parameter (within clinically safe limits).

Further customisation and inclusion of tissue heating and iontophoresis protocols is possible with the use of moorVMS-PC™ software.

7. Toe/Brachial Pressure Index (TBI)

As in the ABPI protocol, above, but toe pressure is used instead of ankle pressure. TBI is performed when ABPI is abnormally high (>1.3) for example due to arterial plaques or calcification commonly found in diabetic patients.

What equipment do I need?

<table>
<thead>
<tr>
<th>Equipment</th>
<th>moorVMS-PRES moorVMS-LDF1 or moorVMS-PC PC software</th>
<th>VP1T VP11sc ArmToe Arm RD* Thigh Pressure cuff</th>
</tr>
</thead>
<tbody>
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Note: the arm rapid deflation cuff can be used in place of the standard arm cuff.
Standard Pressure Assessments

There are a number of standard pressure protocols commonly used by clinicians. The moorVMS-PRES™ is pre-programmed to enable all of the most common protocols with full flexibility to customise and add your own variant. A simple ‘return to default’ option is available too. Once you have chosen your protocol, control the pressure cuff and apply to the patient, together with laser Doppler probe as appropriate. The protocol commences after your key entry. An alarm would be provoked safety to deflate the cuff on demand.

1. Toe Blood Pressure (TBP)

The toe blood pressure assessment (TBP) is used to determine the systolic pressure of a toe (or finger). The laser Doppler probe is placed distally to the cuff. The protocol commences after your key entry. An alarm would be provoked safety to deflate the cuff on demand.

2. Limb Blood Pressure

As for toe blood pressure, limb blood pressure is assessed with the cuff placed on a limb, rather than a digit and a laser Doppler probe.

3. Skin Perfusion Pressure (SPP)

SPP is used to assess tissue viability and is an aid to amputation level determination. In this case the laser Doppler probe is placed under the cuff to assess the tissue perfusion underneath the cuff itself (typically on the dorsum of the foot or lower limb). A flat laser Doppler probe is used to minimize any local artefact caused by tissue indentation.

About Moor Instruments

Moor Instruments, established in 1947, is a world leader in the design, manufacture and distribution of laser Doppler systems, used for the monitoring and imaging of blood flow in the microvasculature.

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.

Our dedicated design team are 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: Moor Instruments is certified to ISO 13485:2003.
- Compliance: Moor Instruments is certified to ISO 10993-1:2003, Medical devices directive 93/42/EEC and amended 2007/47/EC.

References:


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References:

moorVMS-PRES™ - Vascular Testing

The moorVMS-PRES™ pressure cuff control system provides reproducible and fully automated pressure cuff control for routine vascular challenges. With the use of a moorVMS-LDF™ laser Doppler monitor, blood flow responses can be measured providing a fully integrated and powerful solution for protocol management, analysis and reporting. The features include:

- **Choice of 5 standard pressure protocols** including limb foot blood pressure, skin perfusion pressure, post occlusive reactive hyperaemia, pulse volume and ankle brachial pressure index.
- **Custom protocols** for fully automated inflation, Hold Pressure and Deflation patterns, all from a single key press. Flexible and linear deflation and inflation rates can be varied.
- **Rapid cuff inflation** with built in microprocessor control for all cuff sizes.
- **Highly accurate pressure sensing.**
- **Range of cuff sizes** for digits to thigh. Quick fit, sight-press pressure line connectors.
- **Stand alone operation** for use with any laser Doppler, imaging or other flow detection systems.
- **moorVMS-PC software available** with USB output for graphical display of pressure profiles and integration with moorVMS-LDF™ blood flow traces.
- **Connectivity to** your data acquisition system. Analogue outputs of pressure and pulse volume recording. BNC connections.
- **Analogue outputs of pressure** and pulse volume recordings. BNC connections.
- **Medical grade design** for both clinical and research applications.
- **Multilingual training DVD** for continual reference.
- **Single operator control.**
- **Reliability ensured by a 3 year warranty, extends to 5 years with annual servicing (in-built automatic reminder).**
- **Part of the moorVMS family**; extends to 5 years with annual servicing (in-built automatic reminder).

**Laser Doppler and Pressure Assessments**

Combining automated pressure cuff control with laser Doppler monitoring of blood flow provides a highly sensitive and accurate tool for assessments of microvascular dysfunction and for vascular assessments of peripheral arterial disease (PAD).

Laser Doppler has become the gold standard for dynamic microvascular blood flow assessments as the laser Doppler technique is particularly sensitive for detecting flow changes.

A significant advantage of laser Doppler is that it does not require a pulsatile signal; pulsatility, essential to other techniques, is diminished or lost other peripheral blood flow is impaired. For example the use of laser Doppler in detecting low blood pressure normally avoids the false high results encountered from arteries with calcified arteries.

The moorVMS-PRES™ inflates the cuff to a target pressure below diastolic – typically 50mmHg. The small oscillatory pressure fluctuations within the cuff are monitored at this pressure. The fluctuation can be assessed to profile, amplitude and frequency.

**Post Occlusive Reactive Hyperaemia (PORH)**

Laser Doppler is used to follow the microvascular hyperaemic response from baseline, during occlusion and after release of occlusion. Important parameters detected automatically by moorVMS-PC™ software include time to first recovery, time to maximum hyperaemia, maximum hyperaemia and the area under the response curve.

Additional information is derived from the profile of the hyperaemic response.

**Ankle / Brachial Pressure Index (ABPI)**

ABPI is the ratio of the systolic blood pressure in the lower leg to the systolic blood pressure in the arms. Compared to the ankle, laser Doppler is more reliable in derivation of peripheral arterial disease. ABPI is calculated by dividing the systolic blood pressure at the ankle by the higher of the two systolic blood pressures in the arms.

Note, the arm rapid deflation cuff can be used instead of the standard arm cuff.

**Postural Vasoconstriction**

Oedema is common in venous insufficiency due to calf muscle pump failure and incompetent venous valves. Such insufficiency can lead to venous ulcers. Measurements of the percentage change in flux with the legs at heart level and then level are provided as an index of postural vasocstriction. This test is performed using just the moorVMS-LDF™ laser Doppler system to detect the changes in flow associated with the test.

**Custom protocols**

Most of the pressure protocols follow the same pattern comprising of a resting baseline, a cuff inflation to a target pressure, hold, then release (in various rates).

The moorVMS-PRES™ allows complete controllable target pressure, hold, then release (at various rates). The moorVMS-PRES™ allows complete controllable change each parameter (within clinically safe limits). The moorVMS-PRES™ allows complete controllable change each parameter (within clinically safe limits).

**7.Toe/Brachial Pressure Index (TBI)**

As in the ABPI protocol, above, but toe pressure is used instead of ankle pressure. TBI is performed when ABPI is abnormally high (>1.3) for example due to arterial plaques instead of ankle pressure. TBI is performed when ABPI is abnormally high (>1.3) for example due to arterial plaques instead of ankle pressure.

**Skin Perfusion Pressure**

Skin perfusion pressure is monitored with iontophoresis protocols is possible with the use of moorVMS-LDF™ laser Doppler system to detect the changes in flow associated with the test.

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABPI</td>
<td>Ankle / Brachial Pressure Index</td>
<td>mmHg/mmHg</td>
</tr>
<tr>
<td>TBI</td>
<td>Toe / Brachial Pressure Index</td>
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</table>

**What equipment do I need?**

- moorVMS-PRES™ complete with pressure cuff, skin probes and moorVMS-LDF™ laser Doppler monitor.
- moorVMS-PC™ software brochure for further details.
mooVMS-PREST™ - Vascular Testing

The mooVMS-PRES™ pressure cuff control system provides reproducible and fully automated pressure cuff control for routine vascular challenges. With the use of a mooVMS-LDF™ laser Doppler monitor, blood flow responses can be measured providing a fully integrated and powerful solution for protocol management, analysis and reporting. The features include;

- Choice of 7 standard pressure protocols including ankle brachial pressure, skin perfusion, post occlusive reactive hyperaemia, pulse volume and ankle brachial pressure index.
- Custom protocols for fully automated inflation, Hold Pressure and Deflation patterns, all from a single key press. Flexible and linear deflation within a broad range.
- Rapid cuff inflation with built in micropressure control for all cuff sizes.
- Highly accurate pressure sensing.
- Range of cuff sizes from dia 4 to 7. Quick fit, slight pressure loss connectors.
- Stand alone operation for use with any laser Doppler, imaging or other flow detection systems.
- mooVMS-PC software available with USB output for graphical display of pressure profiles and integration with mooVMS-LDF™ blood flow traces.
- Connect easily to your data acquisition system. Analogue outputs of pressure and pulse volume recording, BNC connections.
- Medical grade design for both clinical and research applications.
- Multi-branded training DVD for continual reference.
- Single operator control.
- Reliability ensured by a 3 year manufacturer’s warranty, extends to 5 years with annual servicing (in-built automatic reminder).
- Easy use with USB, for use with any laser Doppler, imaging or other flow detection systems.
- Premium quality and durability for both clinical and research applications.
- Custom protocols for fully automated inflation, Hold Pressure and Deflation patterns, all from a single key press. Flexible and linear deflation within a broad range.
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Combining automated pressure cuff control with laser Doppler monitoring of blood flow provides a highly sensitive and accurate tool for assessments of microvascular dysfunction and for vascular assessments of peripheral arterial disease (PAD).

Laser Doppler has the added advantage for dynamic microvascular blood flow assessments as the laser Doppler technique is particularly sensitive for detecting flow changes.

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The mooVMS-PRES™ inflates the cuff to a target pressure below diastolic – typically 50mmHg. The small occlusive pressure fluctuations within the cuff are monitored at this pressure. The fluctuation can be assessed to profile, amplitude and frequency.

4. Pulse Volume Recording (PVR)

Laser Doppler is used to follow the microvascular hyperaemic response from baseline, during occlusion and after release of occlusion. Important parameters detected automatically by mooVMS-PC™ software include time to first recovery, time to maximum hyperaemia, maximum hyperaemia and the area under the response curve.

Additional information is derived from the profile of the hyperaemic response.

The mooVMS-PRES™ - complete with pressure cuff, volt probes and mooVMS-LDF™ laser Doppler monitor.

5. Post Occlusive Reactive Hyperaemia (PORH)

Laser Doppler is used to follow the microvascular hyperaemic response from baseline, during occlusion and after release of occlusion. Important parameters detected automatically by mooVMS-PC™ software include time to first recovery, time to maximum hyperaemia, maximum hyperaemia and the area under the response curve.

Additional information is derived from the profile of the hyperaemic response.

The mooVMS-PRES™ - complete with pressure cuff, volt probes and mooVMS-LDF™ laser Doppler monitor.

6. Ankle / Brachial Pressure Index (ABPI)

ABPI is the ratio of the systolic blood pressure in the lower leg to the systolic blood pressure in the arms. Compared to the arm, lower blood pressure may result from insufficiency of peripheral arterial disease. ABPI is calculated by dividing the systolic blood pressure at the ankle by the higher of the two systolic blood pressures in the arms.

Note, the arm rapid deflation cuff can be used in place of the standard arm cuff.

7. Toe / Brachial Pressure Index (TBPI)

As in the ABPI protocol, above, but toe pressure is used instead of ankle pressure. TBPI is performed when ABPI is abnormally high (<1.4) for example due to arterial plaques or calcification commonly found in diabetic patients.
1. **Toe Blood Pressure (TBP)**

The toe blood pressure assessment (TBP) is used to determine the systolic pressure of a toe (or finger). The toe blood pressure (TBP) is used to determine the safety to deflate the cuff on demand.

2. **Limb Blood Pressure**

As for toe pressure, limb blood pressure is assessed with the cuff placed on a limb, rather than a digit and a distal laser Doppler probe.

3. **Skin Perfusion Pressure (SPP)**

SPP is used to assess tissue viability and is an aid to amputation level determination. In this case the laser Doppler probe is placed under the cuff to assess the tissue perfusion underneath the cuff itself (typically on the dorsum of the foot or lower limb). A flat laser Doppler probe is used to minimise any local artefact caused by the cuff.

**Specifications:**

- **Quality Control:** moorVMS-PRES™ is CE certified.
- **Moor Instruments is certified to ISO 13485:2003.**
- **Quality Control:** moorVMS-PRES™ modules.
- **Assured by our 3 year basic warranty or 5 year extended warranty for the moorVMS-PRES™.**

**Measurement Parameters:**

- **Pressure:** Linear, 1mmHg/s – 10mmHg/s from 250-40mmHg for all cuff sizes.
- **Deflation Rate:** less than 5s.
- **Inflation Rate:** Inflates a leg cuff to 200mmHg in less than 10s, arm cuff in less than 5s.
- **Inflation Range:** 20-250mmHg.
- **Pump:** Low volume, high flow, safety controlled. The pump is capable of maintaining transudates, providing transudate pressure, including intramuscular transudates, maintaining temperature at 37ºC.
- **Calibration:** Manual transudate delivery 500µl 600µl 1ml. Active device for delivery, device and pump.
- **Type of perfusion against static device:** Closed: Devices of perfusion against static device. Type A#B applied parts or in-line static parts. Fluctuation of perfusion against static device. Type B#A applied parts or in-line static parts.
- **Sensor:** Normal: 60mmHg, 120mmHg, 200mmHg, 280mmHg. Tapered: 50mmHg, 100mmHg, 150mmHg, 200mmHg. Sensitive: 225mmHg, 270mmHg, 300mmHg. Transducer: 0-5V, 0-10V, 4-20mA. Resistance: 1kΩ – 10kΩ. Resistance: 0-20mA, 0-50mA, 0-100mA. Accuracy: ±1% (full range).
- **Output:** Linear, 1mmHg/s – 10mmHg/s from 250-40mmHg for all cuff sizes.
- **Degree of protection against electric shock:** Type BF applied parts. Medical devices directive 93/42/EEC and amendment 2007/47/EC. Class IIa, Active device for diagnosis.
- **Operating Temperature:** 15-30ºC.
- **Operating Environment:** Clinic or laboratory, excluding domestic.
- **Dimensions:** W x H x D mm, Weight: kg. moorVMS-PRES: 235 x 80 x 200, 2kg.
- **Power Source:** Universal voltage, 100-230V AC, 30VA, 50 to 60Hz.
- **Analogue Outputs:** BNC sockets, 0-5V.
- **USB Interface for connection to PC.
- **Reliability:** Functioning over 3 year basic warranty or 5 year extended warranty for the moorVMS-PRES™ modules.

**References:**