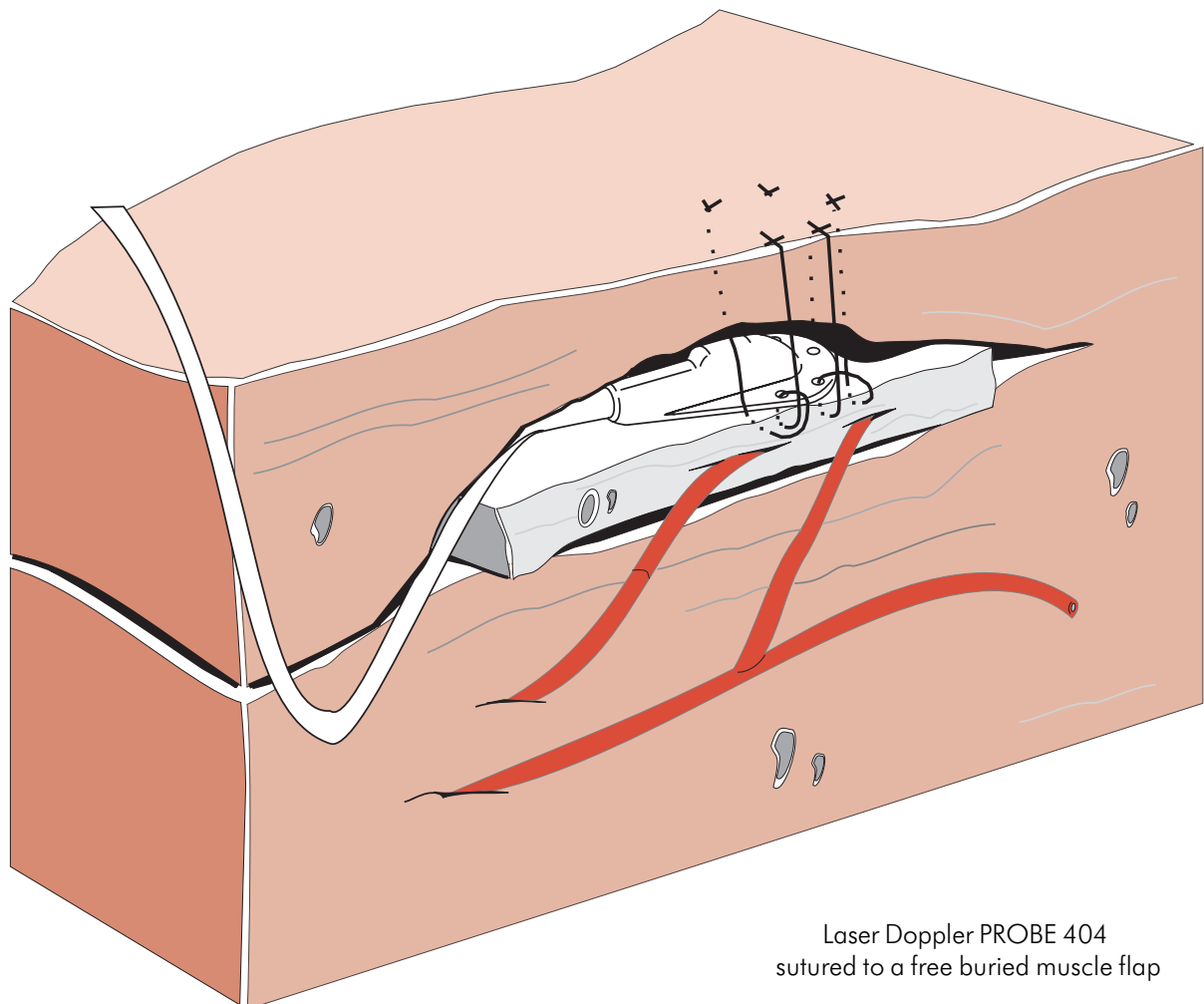




Laser Doppler Probes

Perimed - with 20 years of pioneering work in the Laser Doppler field, has developed a unique range of probes



Laser Doppler PROBE 404
sutured to a free buried muscle flap



PERIMED'S WIDE SELECTION OF PROBES

In line with our policy of continuous research and development, PERIMED offers a wide selection of probes for its PeriFlux instruments. A small selection of our probes is presented in this brochure. Please contact us if you can not find a probe that fits your particular need as we can custom-design probes of almost any shape and size.

The relative nature of laser Doppler measurements

Measurements obtained by laser Doppler instruments are in principle of a relative nature. A prerequisite for comparing results between instruments is a standardized calibration procedure. Provided that PeriFlux instruments are calibrated using the Perimed Motility Standard, and light source wavelength, probe configuration and tissue properties are the same, the results between instruments are comparable.

Factors influencing the measuring volume

The measuring volume (depth) is influenced by tissue properties, light source wavelength and probe configuration. A light source with wavelength 543 nm has less penetration depth than 633 nm which has less penetration depth than 780 nm. (Principles of laser Doppler flowmetry, Bonner & Nossal, in Laser Doppler Blood Flowmetry, pp. 17-45, eds. Shepherd & Öberg, Kluwer Academic Publishers, 1990.)

The fibre separation (distance between the transmitting and receiving fibres) also influences the penetration depth. The measuring volume increases with greater fibre separation.

Laser Doppler Light Sources available

Periflux PF 3 / PF 2B:

632.8 nm Helium-Neon laser tube.

PeriFlux System 4000:

780 nm and 635 nm laser diodes available. An external green 543 nm He-Ne laser can be connected to the system. In this case the transmitted light comes from the external laser, but the received signal is directed into the receiver of the PeriFlux System 4000.

PeriFlux System 5000:

780 nm laser diode.

Fibre data and fibre configurations

All probes use a silica fibre with a core diameter of 0.125 mm giving flexibility and a small bending radius. The probes are reinforced with Kevlar® for increased strength.

Probes are available with fibre separations from 0.15 to 1.2 mm. Standard separation is 0.25 mm.

Note. If fibres with a small separation distance are chosen for measurements on tissues with low perfusion, spatial variations will increase since there are fewer capillaries in the measuring volume. To reduce the effects of these spatial variations, an integrating probe PROBE 413 (313) has been designed to measure over large areas.

Multi-channel probes for simultaneous measurements at different depths

Probes can be designed with several different fibre separations in the same probe tip. If each pair of fibres is connected to a separate laser Doppler channel, microvascular perfusion from different vascular beds can be measured simultaneously.

To further extend the possibilities to reach different vascular beds, different wavelengths can be used simultaneously.

Sterilization - Disinfection

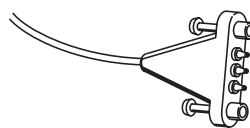
All probes and microtips can be sterilized using STERRAD® (Johnson & Johnson). They can also be sterilized by gas, by radiation or chemically disinfected using glutaraldehyde (Cidex® or similar).

Note. Temperature for probes and microtips must not exceed 65°C.

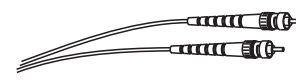
General Probe Information

The 300-series probes are designed to fit the PeriFlux PF 2B and PF 3. The 400-series probes are designed for the PeriFlux System 4000 and PeriFlux System 5000.

Probes have fibre optic cable lengths of 2.50 m (other lengths available) and are usually available from stock.



Connector for 300-series



Connector for 400-series

PF 1000 Calibration Device

Calibration device including Motility Standard and zeroing disc for PeriFlux instruments.



Probe Holders and Adhesive Tapes

The probe holders are fixed to the skin using Double-Sided Adhesive Tapes.

PH 08-1 Shaped probe holder (e.g. for digits) for PROBE 301, 308, 312, 401, 408, 412.

PH 14-1 Shaped probe holder (e.g. for digits) for angled probes PROBE 314, 414.

PH 08 Straight probe holder for PROBE 301, 308, 312, 401, 408, 412.

PH 13 Straight probe holder for integrating probes PROBE 313, 413.

PH 14 Probe holder for angled probes PROBE 314, 414.

PH 07, PH 07-4, PH 07-5, PH 07-6 see next page.

Double-sided Adhesive Tapes

PF 105-1 Adhesive rings diameter 32 mm.

PF 105-2 Adhesive rings diameter 22 mm.

PF 105-3 Adhesive strip 15 x 25 mm.



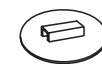
PH 08-1



PH 14-1



PH 08



PH 14

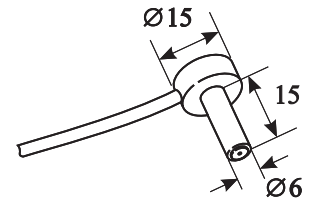


PH 13

Probe holder diameters are 34 mm

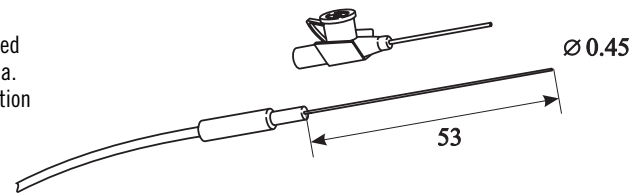
PROBE 401 (301) Angled Probe

Multi-purpose probe usually used for skin measurements. The angular cable arrangement simplifies fixation to the body.
 Probe holder PH 08, PH 08-1.
 See also PROBE 408.
Fibre separation: 0.25 mm.



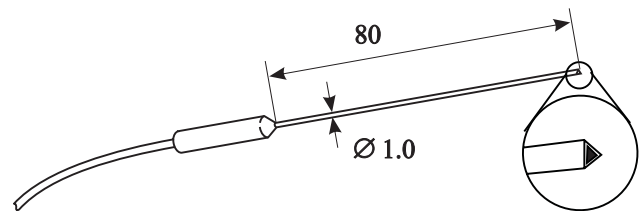
PROBE 402 (302) Needle Probe

Intended for acute invasive measurements. The tip (diam. 0.45 mm) may be introduced directly into the tissue to the desired depth or inserted through a 22 G/0.6 I.D. cannula.
 For human muscle measurements, the PROBE 418 with Microtips and the PH 18 Fixation device are preferable.
 See also PROBE 411 and PROBE 418 with Microtips.
Fibre separation: 0.15 mm.



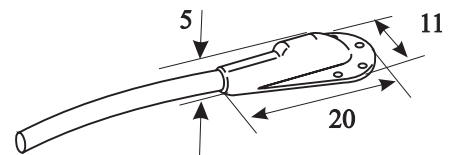
PROBE 403 (303) Stainless Steel Probe

The support is designed to fit in a micromanipulator or laboratory stand for exact positioning. Convenient for measurements on animal organs or in body cavities.
 See also PROBE 410.
Fibre separation: 0.25 mm.



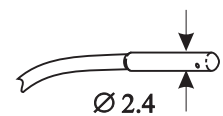
PROBE 404 (304) Suturable Angled Probe

The probe is designed to be sutured onto a flap. The low profile allows easy removal when used with buried flaps. The probe is made of epoxy to be rigid and flexible.
Fibre separation: 0.25 mm.



PROBE 406 (306) Angled Endoscopic Probe

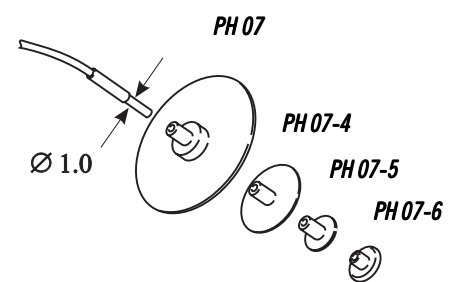
Can be inserted through the biopsy channel of an endoscope. Reads perpendicularly.
 See also PROBE 409.
Fibre separation: 0.25 mm.



PROBE 407 (307) Small Straight Probe with Miniholders

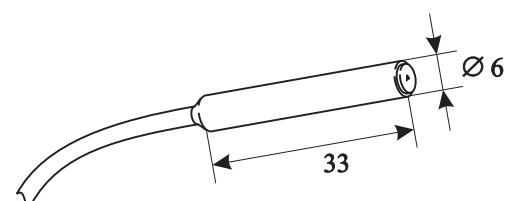
The soft, flexible design of the fibre line reduces the influence of artifacts from moving subjects. The probe fits into different types of small probe holders called Miniholders. The different types of Miniholders are suitable for different tissues.
Fibre separation: 0.25 mm.

- PH 07 The Miniholder has a thin latex sheet that adheres to wet surfaces. Intended for use on liver, kidney and intestine. Diameter 20 mm.
- PH 07-4 The probe holder is fixed to skin using double-sided adhesive strips (PF 105-3). Intended for measurements on skin, particularly small areas like toes and fingers. Diameter 10 mm.
- PH 07-5 Similar to PH 07-4, but the smaller diameter is suitable for use on small fingers and toes. Diameter 5 mm.
- PH 07-6 Glued to hard tissues like teeth and bone. The low, smooth profile allows the miniholder to be glued onto a tooth and left in place for extended periods, thus enabling repeated measurements on the same vascular bed. Diameter 4 mm, height 2.5 mm.



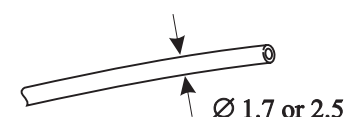
PROBE 408 (308) Standard Probe

Multi-purpose probe usually used for skin measurements.
 Probe holder PH 08, PH 08-1.
 See also PROBE 401.
Fibre separation: 0.25 mm.



PROBE 409 (309) Straight Endoscopic Probe

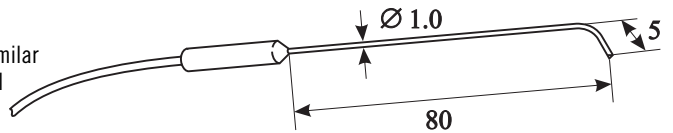
Intended for gastrointestinal measurements of mucosal blood perfusion. The probe can be inserted through the biopsy channel of an endoscope. Two diameters are available to fit different biopsy channels. See also PROBE 406.
Fibre separation: 0.25 mm.



PROBE 410 (310) Angled Stainless Steel Probe

The support is designed to fit in a micromanipulator or laboratory stand for exact positioning. Convenient for measurements on animal organs or in body cavities. Similar to PROBE 403 but the angled tip of the probe makes tissues such as nasal and oral mucosa more easily accessible.

Fibre separation: 0.25 mm.

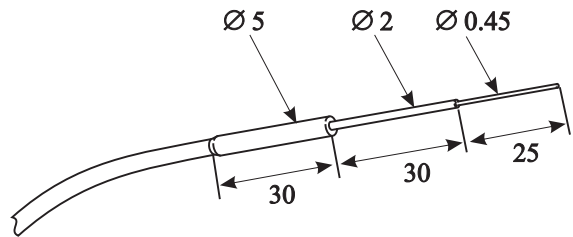


PROBE 411 (311) Needle Probe for Micromanipulator

Intended for acute invasive measurements. The support is designed to fit in a micromanipulator or laboratory stand for exact positioning. The tip is thin (0.45 mm) for easy penetration of tissue, for example animal brain.

See also PROBE 402.

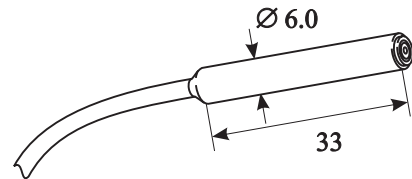
Fibre separation: 0.15 mm.



PROBE 412 (312) Deep Measurement Probe

(Previously called Multireceiver Probe.) The probe has a 1.2 mm separation of fibres to allow a wider and deeper measurement range (larger volume) than a standard probe. Probe holders PH 08, PH 08-1.

Fibre separation: 1.2 mm.

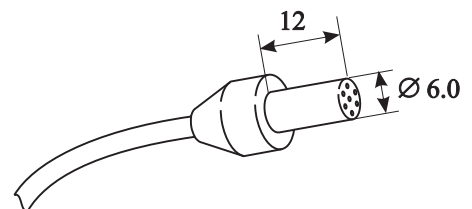


PROBE 413 (313) Integrating Probe

Intended for areas with large spatial variation, for example forearm. The measuring area of the probe has seven "probe tips". Each of the "probe tips" has a transmitting fibre and a receiving fibre. The values from each "probe tip" are optically integrated into one value. This method allows measurement over a larger area and thereby improves reproducibility in tissues with spatial variations in blood perfusion.

Probe holder PH 13.

Fibre separation: 0.25 mm.

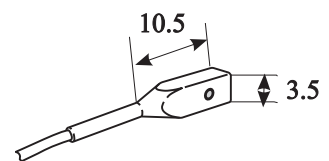


PROBE 414 (314) Angled Small Probe

Suitable for skin measurements as well as in cavities.

Probe holder PH 14, PH 14-1.

Fibre separation: 0.25 mm.

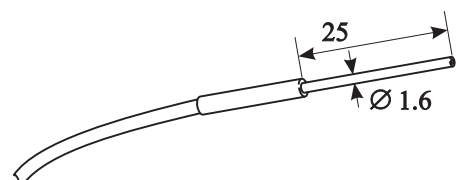


PROBE 416 (316) Dental Probe

Designed for measurements on teeth. For this application, the probe is fixed by drilling a hole in a "splint" about 1.5 mm from the gingiva.

See also PROBE 407 together with PH 07-6.

Fibre separation: 0.25 mm.



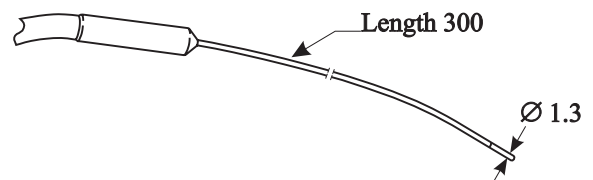
PROBE 418 (318) Master Probe

See information about disposable microtips on the next page.

PROBE 420 (320) Flexible Straight Probe

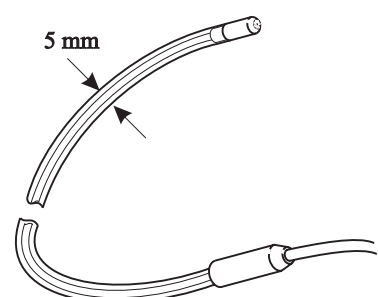
Suitable for measurements in parenchyma. It fits into commercially available skull screws. The probe can also be introduced into muscle or other tissues using a cannula.

Fibre separation: 0.25 mm.



PROBE 424 (324) Gastric Probe

The probe is intended for gastric mucosal perfusion measurement. The probe is introduced through the nose or orally. A metal wire allows positioning of the probe using X-rays. Introduction length 800 mm.



PROBES WITH DISPOSABLE MICROTIPS FOR MINIMAL INVASIVE MEASUREMENTS

To enable disposable probes, and for chronic measurements, Perimed has developed a laser Doppler probe system with disconnectable flexible plastic microtips. After the microtip is placed in the correct position, measurements are performed by connecting the microtip to the PeriFlux via a PROBE 418 (318) Master Probe. After measurements, the microtip can be disconnected from the Master Probe and left in the measuring site. Reconnection can easily be made.

The microtips have a 0.5 mm polymethylmethacrylate (PMMA) core and fluorine polymer cladding.

Ordering information

The standard microtip lengths are 80, 120 and 240 mm. Other lengths are available.

The tips can be supplied with a black polyethylene jacket (1 mm) for protection. When ordering jacketed tips, add a "J" to the appropriate ordering number e.g. MTB 500-0L120J.

PROBE 418-x (318-x) Master Probe

The probe is designed for simple connection and disconnection of the microtip.

Two different versions are available depending on tissue property and fibre length.

PROBE 418-1 (318-1) Used for normal tissue.

PROBE 418-2 (318-2) Used for very dark tissue (e.g. kidney). Also used with extra long microtips.

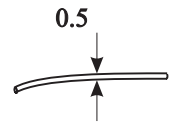


MT B500-0 Straight Microtip

Intended for measurements in tissues. The 0.5 mm flexible microtip can be inserted into the tissue with a 22 G/0.6 I.D. cannula.

The tips are available with lengths of 80, 120 and 240 mm. Other lengths are available.

Maximum lengths: wavelength 633 nm: 3000 mm, wavelength 780 nm: 1000 mm.

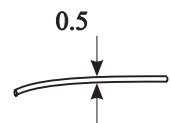


MT A500-0 Straight Microtip with Slanted Tip

Intended for measurements in tissues. The distal end of the tip has been polished with a slight angle to improve the optical properties. This results in a higher signal-to-noise ratio than ordinary straight microtips. The 0.5 mm flexible microtip can be inserted into the tissue with a 22 G/0.6 I.D. cannula.

The tips are available with lengths of 80, 120 and 240 mm. Other lengths are available.

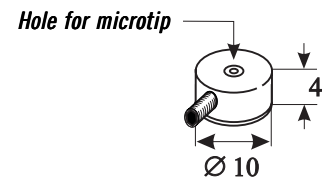
Maximum lengths: wavelength 633 nm: 1200 mm, wavelength 780 nm: 300 mm.



PH 18 Fixation Device for Microtip

The fixation device is secured onto skin using adhesive tape or glued to a skull. The microtip is inserted into the tissue with a 22 G/0.6 I.D. cannula and secured with the locking screw.

Using this device, the microtip will remain in its original position and artefacts and unnecessary trauma to the tissue are avoided.



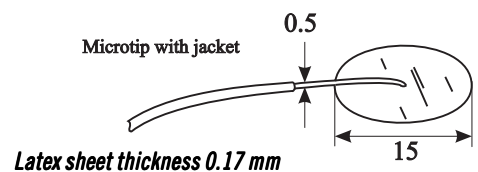
EXAMPLES OF SPECIAL MICROTIPS

MT B500-2 Angled Microtip with Adhesive Properties

Intended for surface measurements. The small latex sheet adheres to a moist surface and keeps the probe in place.

As an alternative, probe 407 (307) with miniholder can be used.

Maximum lengths: wavelength 633 nm: 1200 mm, wavelength 780 nm: 300 mm.



MT B500-3x EEG Probe and LD Microtip

Intended for surface measurements. An EEG probe (provided by the customer) can be modified to contain one or more microtips for laser Doppler measurements. The combined probe can be positioned on the cortex during a craniotomy, or pushed into position through a burr hole.

Maximum lengths: wavelength 633 nm: 1200 mm, wavelength 780 nm: 300 mm.

Probe identification:

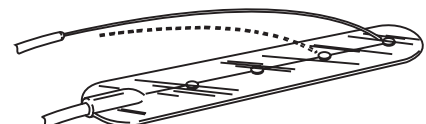
MT B500-31 EEG probe combined with one microtip

MT B500-32 EEG probe combined with two microtips

MT B500-33 EEG probe combined with three microtips

MT B500-34 EEG probe combined with four microtips

Other combinations can be supplied

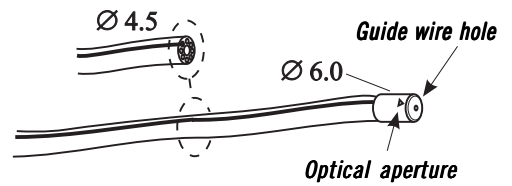


EXAMPLES OF CUSTOM-MADE PROBES

PROBE 415-135 Two-channel Flexible Angular Intestinal Probe

Intended for gastric and intestinal mucosal perfusion measurements. The probe is introduced through the nose. A blue radiopaque line follows the lumen and simplify the positioning of the probe using x-rays. A central lumen allows introduction of a guidewire. The two probes read perpendicularly. The probe also contains several empty channels that can be used for instance for pressure measurements.

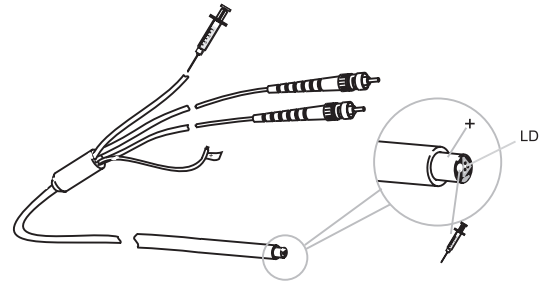
Fibre separation: 0.25 mm.



PROBE 423 (323) with Electrical Stimulation and Drug Delivery

Intended for endoscopic measurements, for example in the lungs. Electrical pulsation and/or drug delivery are used for stimulation of the tissue perfusion.

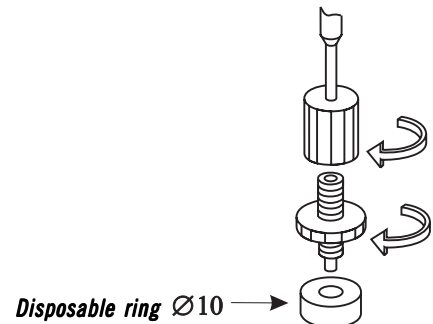
Fibre separation: 0.25 mm.



PROBE 425 (325) Rotating Probe

Intended for measurements on rat brain, the rotating probe allows measurements while the animal is conscious. The animal can move with the probe in place. The disposable ring is cemented or screwed onto the skull. The probe has one rotating part that rests on a non-rotating glass rod. The glass rod is available in different lengths to allow invasive or cortical measurements.

Other Rotating Probes are available.

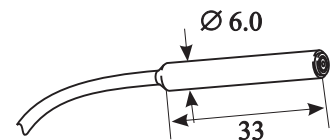


PROBE 415-7 Multichannel Probe for skin Measurements

Intended for measurements on skin. Probes are made with 2 or 3 different fibre separations and can simultaneously use different wavelengths. With this probe, the perfusion at different depths can be measured simultaneously. (See page 2, "Multi-channel Probes".)

Probe holder PH 08, PH 08-1.

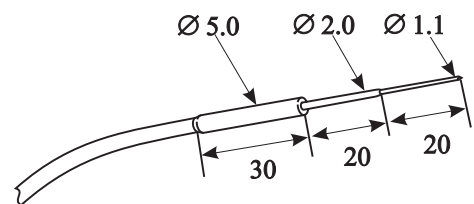
Information on fibre separation on request.



PROBE 415-49 Multichannel Probe for Micromanipulator

Specifications as above, but the support is designed to fit into a micromanipulator or a laboratory stand for exact positioning, e.g. on a rat brain.

Information on fibre separation on request.

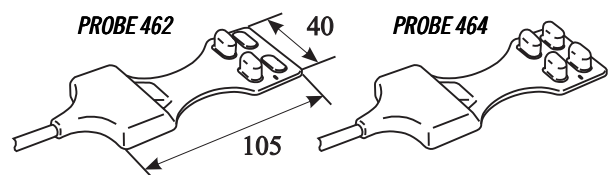


PROBE 462 Two-channel Flexible Throstatic Laser Doppler Probe

PROBE 464 Four-channel Flexible Throstatic Laser Doppler Probe

The probes are designed to be placed directly on a burn wound. They have two or four laser Doppler channels for perfusion monitoring. Heating elements surround each optical aperture. These elements are heated equally by the PF 4005 PeriTemp. The probes are flexible to adapt to the measuring site.

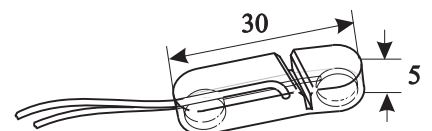
Fibre separation: 0.25 mm.



PROBE 415-127 Wet Surface Probe

The probe is designed to be fixed to a tissue using a small vacuum. Examples of tissues are kidney, liver and intestine (serosa). The two vacuum chambers are evacuated using a pump.

Fibre separation: 0.25 mm.



HEATED PROBES

Skin perfusion is strongly dependent on skin temperature. For reproducible skin perfusion measurements, it is important to control and to monitor the skin temperature. A convenient method to make perfusion measurements under temperature-controlled conditions is to use Perimed's laser Doppler Systems and Perimed's range of heat-controlled units, PF 5020 Temp Unit (PeriFlux System 5000), PF 4005 PeriTemp Tissue Heater (PeriFlux System 4000) and the built-in heater system in PeriFlux PF 3 and PF 2B. The Perimed heater units are used together with the Thermostatic probes and probe holders described below.

For PeriFlux PF 3 and PF 2B, only PF 350 Thermostatic Probe holder, PROBE 355 and PROBE 357 can be used. (When ordering always state instrument serial number.)

Heat provocation

Local heating can be used for heat provocation. The reactive hyperaemia following heat provocation is monitored by the PeriFlux laser Doppler. Typical temperature setting is 42-44°C. The microcirculatory response to the heat indicates the vascular capacity of the tissue. Such measurements can be used to determine the viability of tissues with impaired microcirculation.

Temperature stabilization

For reproducible skin perfusion measurements without temperature provocation, it is important to maintain a constant skin temperature. Using Perimed's heat controlled units is an easy way to stabilize the local skin temperature when a temperature-controlled room is not available. Typical temperature setting is 32-33°C.

Typical applications

By using local heat provocation and measuring the vascular capacity of the tissue with laser Doppler, it is possible to evaluate the degree of microcirculatory impairment in patients with conditions such as Lower Limb Ischaemia, PAOD, Atherosclerosis or Diabetic microangiopathy. These types of measurement are also used to differentiate between superficial and deep dermal burns as well as defining the need for and level of amputation.

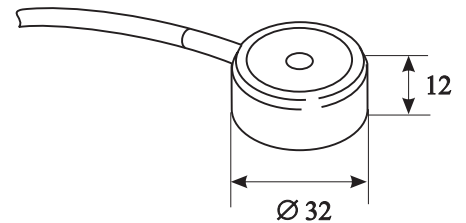
PF 450 (350) Thermostatic Probe Holder

The thermostatic probe holder is used together with several different laser Doppler Probes. The probes listed below will fit in the centre hole of the thermostatic probe holder. The thermostatic probe holder is fixed to the skin using double-sided adhesive rings.

PROBE 401, 408, 412, 413 -fits into thermostatic probe holder PF 450.

PROBE 301, 308, 312, 313 -fits into thermostatic probe holder PF 350.

Key feature: The PF 450 (350) Thermostatic Probe Holder can host several different types of Probes.

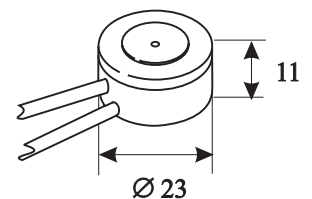


PROBE 455 (355) Angled Thermostatic Laser Doppler Probe

A combined laser Doppler and thermostatic probe used for local heat provocation while blood perfusion is measured. Double-sided adhesive rings (PF 105-2) are used for fixation. The probe is water-resistant. Similar to PROBE 457 (357) but intended for use on larger areas, e.g. dorsum of foot or forearm.

Fibre separation 0.25 mm.

Key feature: The optical fibres are integrated in the heated area and thus the whole tissue area under the probe will be heated.

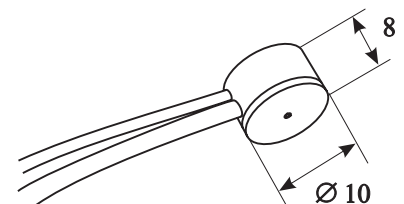


PROBE 457 (357) Angled Small Thermostatic Laser Doppler Probe

A combined laser Doppler and thermostatic probe used for local heat provocation while blood perfusion is measured. Double-sided adhesive strips (PF 105-3) are used for fixation. The probe is water-resistant. Similar to PROBE 455 (355) but intended for use on small areas, e.g. toes and fingers, but can also be used elsewhere.

Fibre separation 0.25 mm.

Key feature: The optical fibres are integrated in the heated area and thus the whole tissue area under the probe will be heated.

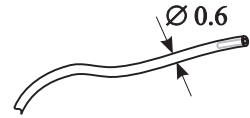


TEMPERATURE MEASUREMENT SENSORS

For the PF 4005-3 PeriTemp Tissue Heater and PeriFlux System 5000 with PF 5020 Temp Unit, one or two separate temperature sensors can be connected. The sensors are non-heated and can measure skin temperature. For technical specifications, see brochures for **Perimed PF 4005 Tissue Heater** and **Periflux System 5000**.

SENSOR 442 Skin Spot Sensor

Measures temperature in an area with a diameter of about 0.6 mm.
The sensor is fixed to the skin using tape.
Typical time constant: 3 sec.



Please contact us if you can not find a probe that fits
your particular need as we can custom-design probes of almost any shape and size.

HEADQUARTERS

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