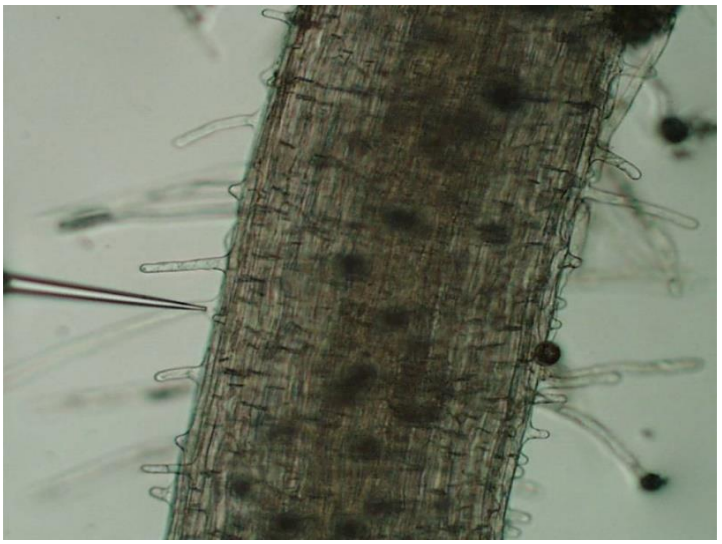
Annex No. 1 – Technical Specification of Product

MIFE™ Overview

Membrane-transport processes underlie many essential cell biological processes and are central to perception and signalling in response to virtually every known environmental factor. The MIFE™ system for non-invasive ion flux measurements is a unique tool enabling *in situ* characterisation of the activity of major membrane transporters in a wide range of living systems. See Newman IA (2001) *Plant, Cell & Environment* 24, 1-14.

The principle of the MIFE™ system is to measure the electrochemical potential gradient in solution near the tissue specimen (see the figure). This is done by moving an ion-selective micro-electrode probe between two positions near the specimen, and then converting the measured potential difference into net flux of the ion. The user-friendly interface allows convenient display, storage, and analysis of the recorded data.

The key features of the MIFE™ system are:



- **Non-invasiveness.** Net ion fluxes can be recorded from the specimen for many hours or even days.
- **High temporal resolution.** Net fluxes are measured every few seconds, making the MIFE™ an ideal tool to resolve rapid kinetics of cellular responses to external stimuli.
- **High spatial resolution (several µm)** allowing fine mapping of net flux profiles from small specimens (e.g. single cells).
- **Ability to measure neutral molecule flux.** Amperometric probes for oxygen, CO_2 and other molecules can be used.
- **Simultaneous measurements of several ions or neutrals.** By assessing stoichiometry ratios between various ions, valuable information can be gained about the membrane transporters involved.

MIFE3 Technical

The MIFE™ system was developed from 1987 and is made in Tasmania, Australia. From 2015, the new MIFE3 system comprises electronic hardware (main amplifier/controller, two 4-channel preamplifiers and Motor Drive), with stepper motor-driven micromanipulators and suitable mountings for the manipulators. A suitable microscope can also be incorporated, designed for horizontal measuring chamber (Inverted microscope), or for vertical measuring chamber (replacing the stage of a microscope lying on its back).

The main amplifier is the lower enclosure in the following picture. Cables from the two preamplifiers are shown at the front. The white USB cable to the computer is at the back right. Input sockets for low-impedance inputs are also provided alongside. The motor-drive control electronics is in the upper enclosure.

Low voltage AC power input connects into the rear of the enclosure, but is hidden in the picture. The system requires 10-12 VAC, 0.5 A, from a mains power pack (user supplied).

Amplifier electrical characteristics

Each of two pre-amplifiers has 4 inputs. The input leads are shielded and insulated. The shields are not grounded but are driven at the same voltage as the input signal.

Input resistance:	$>10^{12}$ Ω, with physical 1MΩ in series
Maximum safe input voltage range:	+/- 5 V
Signal input voltage range:	+/- 500 mV
Signal input "window" range:	+/- 50 mV
Offset range to adjust the signal "window":	+/- 500 mV
Preamplifier gain:	+ 9 (or unity, selected by a jumper)
Input sensitivity:	1.5 µV for one LSB of D/A converter
Source resistance measurable range:	1 MΩ to 10 GΩ
Main amplifier gain:	- 10

Manipulators and their control

Custom-mounted, Narishige-sourced manipulators are provided with the MIFE3 system. These are driven by a custom-mounted stepper motor that is controlled by the MIFE3 Motor Drive box (on top in the above picture).

For Horizontal Chamber configuration, the manipulators are supplied mounted together, ready for placement in the experimental cage.

For Vertical Chamber configuration, the manipulators are supplied mounted on the microscope that is also supplied. Some users may prefer to supply their own microscope.

Motor Drive enclosure

Power source: User supplied mains plug pack, 15-16 VAC or 22-24 VDC, 1.25 A

Power switch and indicator light on front panel

Motor Enable switch on front panel

Output to motor is from a socket on back panel to a connector on the mounted stepper motor. Its black cord is seen in the picture above.

Control input from computer: USB connector on back panel.

Computer (PC)

The computer may be provided by the user. Minimum requirements are as follows:

Processor:	Duo core processor. Minimum: 1.0 GHz. 2.0 GHz or faster recommended
Operating system:	Windows 7 SP1 or above.
Memory:	Minimum 1GB for MIFE3. 2GB or more recommended
Hard drive:	Minimum 12GB free disk space for MIFE3
3 USB ports:	1 for data acquisition 1 for motor drive 1 for data transfer

MIFE3 Software

The MIFE3 software and its installation instructions are supplied directly to the end user.

The MIFE3 software provides interfaces for easy configuring and controlling the MIFE3 hardware, for data capture, display and analysis. A MIFE3 User Guide is provided as a file in the program folder after the MIFE3 program is installed.

The MIFE3 system is sold by IMBROS, in arrangement with the University of Tasmania.

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MIFE3 Technical Specifications, requirements

October 2016

Introduction

The MIFE system was developed from 1987 and is made within the School of Mathematics and Physics in the University of Tasmania. It is used for the measurement of net fluxes of ions and neutral molecules near tissues in solution. From 2015, the new MIFE3 system comprises electronic hardware (main amplifier/controller, two 4-channel preamplifiers and Motor Drive), with stepper motor-driven micromanipulators and suitable mountings for the manipulators. The MIFE3 software is used for system control, data acquisition and analysis. The user provides the microscope of choice, designed for horizontal measuring chamber (Inverted microscope), or for vertical measuring chamber (replacing the stage of a microscope lying on its back).

Hardware

Main amplifier physical characteristics and connectors

The metal case (Green terminal on the rear panel) is the system and shielding earth. It should be connected to a good earth point.

AC power input, 10 to 12 V_{RMS}, 0.5 A, from a mains power pack (user supplied).

Back panel USB connector for the computer.

On front panel: -

Power switch and indicator light.

Two D15P connectors for inputs from preamplifiers. The left one is for the "A" channels 1 – 4, the right one for the "B" channels 5 – 8. Total gain for each channel, with preamplifier (9) and main amplifier (-10) is about - 90.

Two DB9S connectors for direct, low impedance, input to the 8 channels. With gain of - 10, the signals sum with the signals from the preamplifiers. Pin Connections: Pins 1, 2, 3: Analog ground. Pin 4: +6V. Pin 5: -6V. Pin 6: Chan 1(5). Pin 7: Ch 2(6). Pin 8: Ch 3(7). Pin 9: Ch 4(8).

Preamplifier (each of two) physical characteristics

4 inputs. The input leads are shielded and insulated; the shields are not grounded but are driven at the same voltage as the input signal.

Signal reference (analog common), referred to as "ground", at green terminal and four small sockets on the back. For safety, when any input lead is not in use, it should be plugged into a small socket.

Cable to main amplifier (channels 1-4 or 5-8).

The case is connected, via the cable shielding, to main amplifier chassis and thence to system earth.

Signal input characteristics and specifications (each of 8 channels)

Input resistance	$>10^{12}$ Ω , with physical 1 M Ω in series.
Maximum safe input voltage range	+/- 5 volt
Signal input voltage range	+/- 500 mV
Signal input "window" range	+/- 50 mV
Offset range to adjust the signal "window"	+/- 500 mV
Preamplifier gain:	+ 9 (OR unity, selected by a jumper).

Input sensitivity	1.5 μV for one LSB of D/A converter
Source resistance measurable range	1 MΩ to 10 GΩ
Main amplifier gain	- 10
Signal bandwidth	10 Hz (Set by an R-C filter roll-off)
Data sampling rate (typical)	<0.1 Hz to 20 Hz
Low impedance inputs to the main amplifier	sum with preamplifier output signals
Output	Digital via USB to the computer
and	Analog is available internally if requested.

Computer - this is provided by the user. The following are minimum requirements.
Processor: Duo core processor or faster. Minimum: 1.0 GHz. Recommended: 2.0 GHz or faster.
Operating system: Windows 7 SP1 and above.
Memory: Minimum: 1GB for MIFE3. Recommended: 2GB or more
Hard drive: Minimum: 12GB free disk space for MIFE3.
2 USB ports for data acquisition (the main amplifier, and motor drive)
1 USB port for data transfer

Manipulators and their control

Custom-mounted, Narishige-sourced manipulators are provided with the MIFE system.
These are driven by a custom-mounted stepper motor that is driven by the MIFE Motor Drive box.
For Horizontal Chamber configuration: MX-2; MHW-4-1 & SM-17. These are supplied mounted.
It is possible to use MHW-4 (5:1 movement) or the three axis MHW-103 in place of MHW-4-1.
For Vertical Chamber configuration: MMT-5 & MWS-1A. Both these are to be mounted by the user.
The three axis MHW-103 may be chosen in place of the MWS-1A. Both are 1:1 movement.
Motor Drive box electrical characteristics: -
Power source: User supplied mains plug pack, AC 15-16 V or DC 22-24 V, 1.25 A
Power switch and indicator light on front panel
Motor Enable switch on front panel
Output to motor: D25P socket on back panel
Control input from computer: USB connector on back panel.

Grounding

System and shielding earth

This is the large green terminal at the back of the MIFE3 amplifier, which is connected to the amplifier and preamplifier cases and to the shielding of the cables to the preamplifiers. This green terminal must be connected to a good earth point to fulfil the basic grounding and shielding requirements.
The electrometer bench, shielding, motor base and also the computer chassis should all be earthed by connecting them to the same earth point or to this green terminal.

Analog common

This is the "ground" reference for the analog signals in the analog amplifier circuitry. It is connected to the green terminal on each preamplifier. The "bath" reference electrode connection should be made to this terminal and kept isolated from the shielding or cage. This will minimise digital or pickup noise currents in the analog common line that produce false "signals". In good locations it may not cause noise if the analog common is in contact with the chassis or shielding earth, but it is best practice to keep the signal ground separate from the system earth.

Software

The MIFE3 software and installation instructions are supplied to the purchaser on a DVD.

MIFE3 software provides interfaces for easy configuring and controlling the MIFE3 hardware, for data capture, display and analysis. A MIFE3 User Guide is provided as a file on the DVD and in the program folder after the MIFE3 program is installed.

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Primo Vert

The new standard for quick assessment and inspection of living cells

The new inverted microscope Primo Vert is focused on the essentials: good optical quality, choice of quality materials with high durability, ease of use and an appealing industrial design: And all this is available for an affordable price.

Primo Vert addresses a wide range of applications: From routine laboratories for life cell inspection to cutting edge research laboratories which require - in addition to research microscopes - some compact and reliable routine microscopes for a quick and efficient check of living cells. Typical applications include e. g. cancer and HIV research, human, animal and plant genetics and cell biology in general.

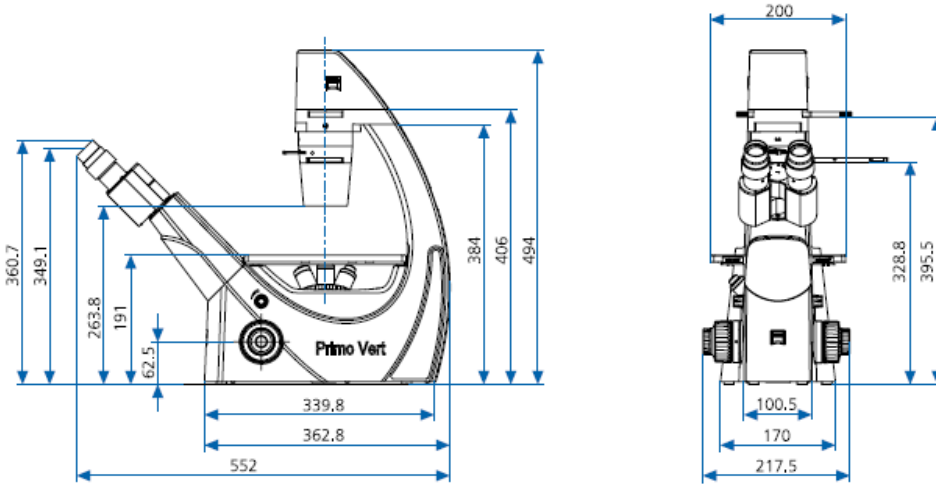
A number of attractive details are designed to guarantee a quick and reliable handling:

- Automatic light turn-off (in addition to manual on/off-function): Primo Vert switches off the light automatically after 15 minutes – saving energy and protecting the stand.
- Modular illumination: HAL or long lasting LEDs.
- High quality material: The stage is made of cast aluminum and all operating elements are coated with a special skin-friendly rubber mix.
- Universal phase slider for all objectives: For the ease of use there is one phase ring (Ph 1) available for 10x, 20x and 40x – this means no changing phase slider when changing objectives. In short: time-saving and economical.
- Increased working distance through easy removal of the condensor, e. g. for roller-bottles.
- Objective-indicators for fast identification of magnification.
- Carrying handle on the back.
- Attractive industrial design.

Efficient, reliable and affordable:
Primo Vert from Carl Zeiss

ZEISS

We make it visible.



Optical/Mechanical Data

Objective change	manual via quadruple objective nosepiece
Objectives	infinity-corrected objective range with W 0.8 mounting thread Plan-Achromat: 4x/0.1, 4x/0.1 Ph0, 10x/0.25 Ph1 LD-Plan-Achromat: 20x/0.3 Ph1, 40x/0.5 Ph1, 20x/0.3 Ph2, 40x/0.5 Ph 2
Phase-Slider	Universal Phase slider for the objectives Ph1: convenient and economical Phase slider for Ph2: more resolution
Eyepieces with field-of-view number 20	30 mm tube diameter WF 10x/20 Br. foc.
Specimen stage Dimensions (width x depth) Specimen guide Verniers with numerical and alphabetic scale Coaxial drive	fixed 200 x 239 mm right side X direction: numerical scale, readable from right to left Y direction: alphabetic scale, readable in the mirror right side
LD condenser 0.3	for V_{obj} 4x to 40x, a = 72 mm
LD condenser 0.4	for V_{obj} 4x to 40x, a = 55 mm
Binocular tube 45°/20 Maximum field-of-view number Interpupillary distance Tube angle Viewing height Viewing port	 20 adjustable from 48 to 75 mm 45° 360 to 397 mm tube factor 1x
Trinocular (photo)tube 45°/20 Maximum field-of-view number Interpupillary distance Tube angle Viewing height Viewing port Photo/video port Fixed beam splitting	 20 adjustable from 48 to 75 mm 45° 360 to 397 mm tube factor 1x tube factor 1x, 60 mm C-mount 50 % vis / 50 % doc
Light source	HAL: 6 V, 30 W LED: White light LED

- All optics in Primo Vert are anti-fungus treated
- Norms and standards met: CE, UL, CSA, IvD, DIN EN 61010-1 (IEC 61010-1), ISO 9001
- Available accessories (as option): Object guide and several mounting frames for Petri dishes etc., stage inserts (metal or glass), stage enlargements, several camera adapters, eyepiece micrometer and eyepiece pointer, neutral density and green interference filters, AxioVision LE microscope software

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