

# In Vivo and In Vitro Flow Measurement

## PowerLab® Data Acquisition Systems and Transonic Systems® Flowmeters



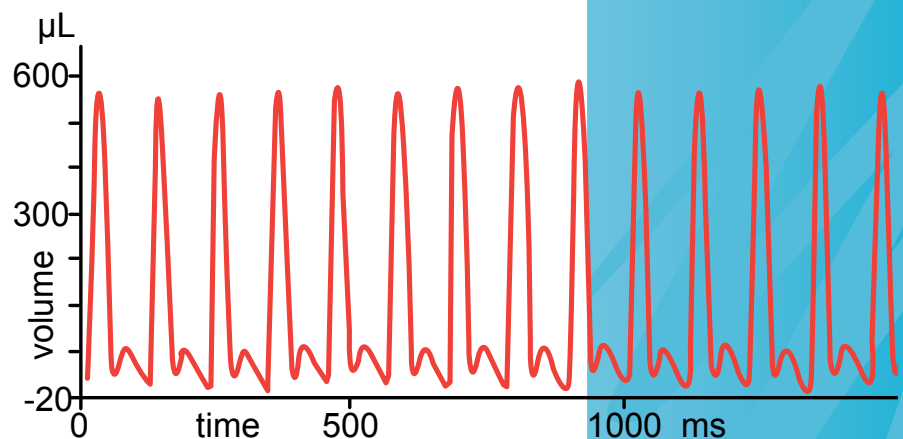
ADInstruments PowerLab data acquisition systems and Transonic Systems flowmeters provide researchers with the tools to accurately measure, record, display and analyze flow *in vivo* and *in vitro*.

Transonic Systems flowmeters use the transit-time method of ultrasonic illumination that has been the gold standard in volume blood flow measurement for the past two decades. A major advantage of the ultrasound transit-time technique is that the signal is unaffected by experimental perturbations or changes in vessel diameter. The technology offers unprecedented volume flow resolution with the flowprobes and flowsensors precalibrated and ready for immediate use.

Transonic Systems flowmeters connect directly to PowerLab data acquisition units using standard BNC inputs. PowerLab systems, with LabChart® software, easily acquire flow data and provide numerous online (real-time) and offline (post-acquisition) analysis features to derive parameters of interest. The flexible hardware and software allow the user to record and analyze up to 32 channels of data simultaneously at suitable sampling rates with high signal resolution.

### *In vivo* applications include:

- Myocardial Function
- Coronary Circulation
- Pulmonary Function
- Renal Hypertension
- Thrombosis Models
- Nutrient Metabolism
- MRI Studies
- Fetal/Pregnancy Hemodynamics



### Features & Benefits

- Complete flow analysis and acquisition systems
- Highly accurate volume flow measurement
- Ultrasound transit-time technology – the gold standard
- Perivascular probes suitable for chronic and acute *in vivo* measurements
- In-line tubing flow-sensors for *in vitro* applications
- Analog outputs for direct connection to PowerLab
- Typical parameters measured include:
  - Vascular Blood Flow
  - Cardiac Output
  - Stroke Volume
  - Renal Blood Flow
  - Fluid Flow in Tubing Application

# Data Acquisition & Analysis

ADInstruments PowerLab data acquisition systems (consisting of a PowerLab recording unit and LabChart software) are ideal for recording and analyzing cardiovascular parameters. ADInstruments systems have been cited in more than 7000 research papers to date and published in over 700 scientific journals.

ADInstruments software allows the user to continuously record and display up to 32 channels of data, perform online and offline calculations, display numerous analysis windows and automatically extract data to a spreadsheet. ADInstruments hardware is software controlled and the configuration of recording parameters such as range and filters takes seconds. All the information, including experimental settings, calibrations, raw data and computed values are saved in a single file.

## LabChart advantages:

- Software selectable sampling rates, range and filter settings
- Different sampling rates on separate channels
- Easy calibration (using Units Conversion)
- Automated online and offline data extraction to Data Pad
- OLE to applications such as Excel allows values to be updated in an external spreadsheet application in real time
- Comment annotation within the file during or after recording
- Automation of experimental procedures
- Editable macros

## PowerLab advantages:

- Four, eight and sixteen channel inputs
- Online sampling and computation speeds of up to 200 kHz per channel (400 kHz aggregate)
- Wide range of hardware and software filters
- Digital inputs and outputs for external instrument control and triggering
- High-speed USB 2.0 for connection to Windows® and Mac® OS computers
- Integrated Pod ports for greater choice of amplifiers and transducers
- Easy connection to Transonic Systems flowmeters

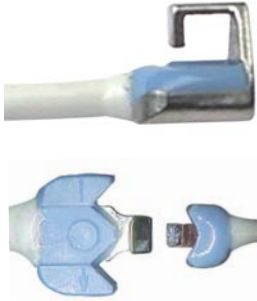
## Perivascular Application - Rat Carotid Arteries



Recording of normal and thrombolytic induced occlusion of blood flow in rat carotid arteries using Transonic Systems flowmeter and probes with an ADInstruments PowerLab data acquisition unit and LabChart software. Data courtesy of Assoc. Prof. Christine Wright, University of Melbourne, Australia.

# Perivascular Probes & Tubing Sensors

Patented in 1983, the innovative ultrasonic transit-time technology by Transonic Systems has been the gold standard for volume flow measurement for more than two decades. Measurements with Transonic flowmeters have been independently validated in many applications and referenced in over 3000 publications.



## Perivascular Flowprobes

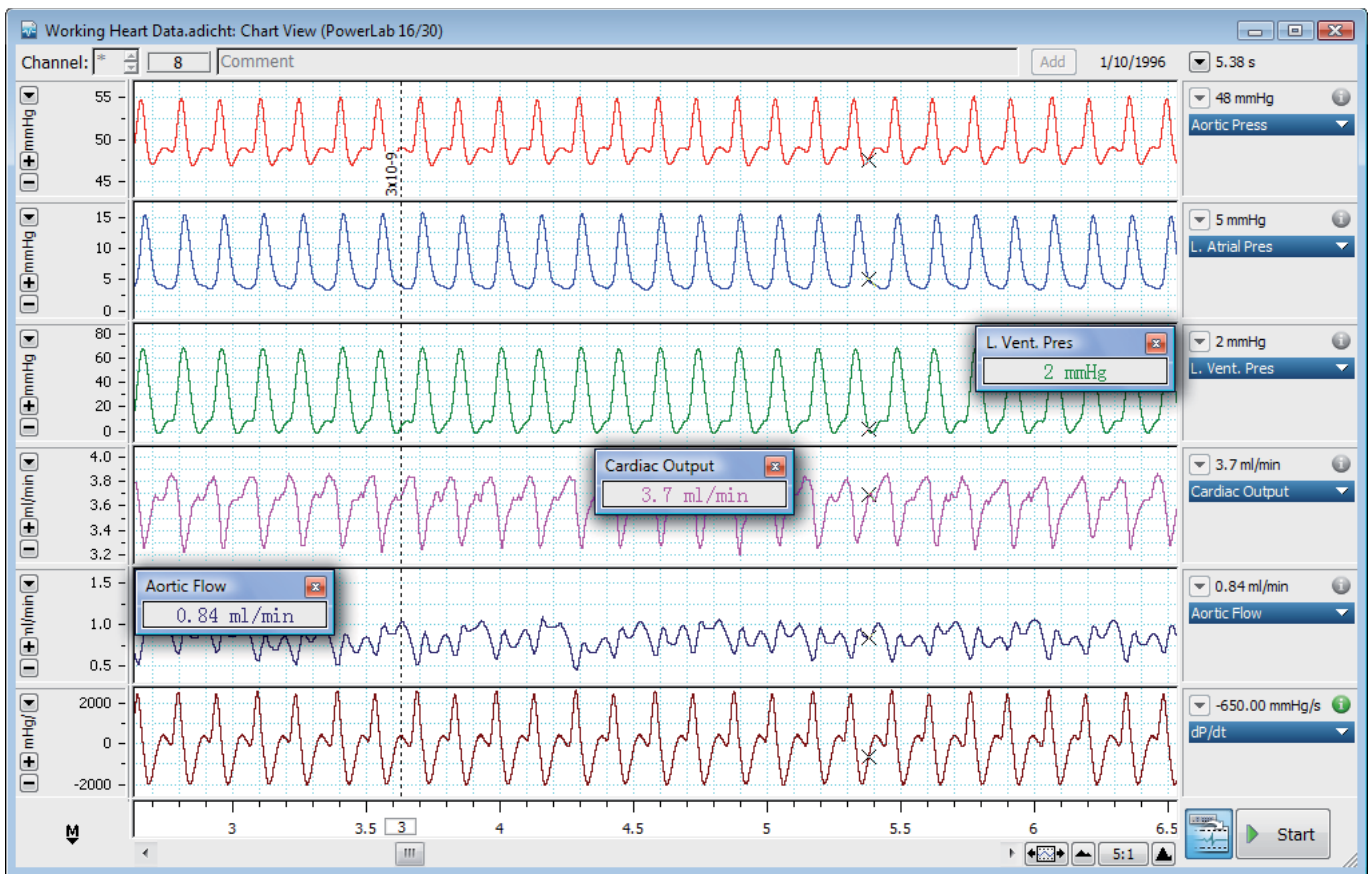
Perivascular flowprobes are available for acute and chronic measurements of flow in animal blood vessels. The probes are placed external to the vessel and do not interfere with flow to the target tissues. Available in a wide range of sizes (0.5 to 35 mm) and configurations, the probes are suitable for recording flow in small and large vessels in a variety of species, ranging from mice through to sheep and cows. Probes suitable for measuring cardiac output are also available.

## Tubing Flowsensors

Tubing flowsensors are used for volume flow measurements in tubing applications such as isolated perfused organ studies. The in-line flowsensors can be easily spliced into laboratory tubing and are calibrated to measure volume flow of water, saline, buffer solutions, blood and other fluids. The four-transducer sensor design offers precision accuracy for flows of less than 1 mL/minute up to 100 L/minute. Sterile Tubing Flowsensors (PXL) clip on the outside of flexible laboratory tubing to measure most non-aerated liquids including saline and buffer solutions, blood, water and other organic fluids. No physical contact is made with the fluid media. Flowsensors can be calibrated and programmed for up to 4 different fluid/temperature/tubing combinations with sensors available to suit tubing with OD dimensions of 3-32 mm.



## Tubing Application - Cardiac Output in Mouse Working Heart



Recording of a mouse isolated working heart with aortic, left atrial and left ventricular pressures, cardiac output, aortic flow and dP/dt. Data were recorded using an ADInstruments PowerLab system with LabChart software. Cardiac output and aortic flow were measured using Transonic Systems flowmeters. Data courtesy of Assoc. Prof. John Headrick, Heart Foundation Research Centre, Griffith University, Australia.

# Ordering Information

## Blood and Fluid Flow Systems

ML870B11 One Channel Perivascular System*	ML870B12 One Channel Tubing Flow System*	ML870B13 Two Channel Perivascular System*
1 x ML870/P PowerLab 8/30 includes LabChart Pro software	1 x ML870/P PowerLab 8/30 includes LabChart Pro software	1 x ML870/P PowerLab 8/30 includes LabChart Pro software
1 x T402-PB One Channel Perivascular Flowmeter	1 x T402-TB One Channel Tubing Flowmeter	1 x T402-PP Two Channel Perivascular Flowmeter
1 x MLAC01 BNC to BNC Cable	1 x MLAC01 BNC to BNC Cable	2 x MLAC01 BNC to BNC Cable
ML870B14 Two Channel Tubing Flow System*	ML870B15 Two Channel Perivascular/Tubing Flow System*	*Probe Selection
1 x ML870/P PowerLab 8/30 includes LabChart Pro software	1 x ML870/P PowerLab 8/30 includes LabChart Pro software	Due to the variety of applications and species used, probes must be ordered separately. Please see the separate selection sheet for guidance, or contact your ADInstruments representative for assistance or more information.
1 x T402-TT Two Channel Tubing Flowmeter	1 x T402-PT Two Channel Perivascular/Tubing Flowmeter	
2 x MLAC01 BNC to BNC Cable	2 x MLAC01 BNC to BNC Cable	

### Software

MLS060/7 LabChart	MLS330/7 GLP Client and MLS335 GLP Server
MLS260/7 LabChart Pro (Includes the modules listed below. Modules are also available for individual purchase.)	
MLS390/7 Dose Response (Win)	MLS310/7 Heart Rate Variability (Win and Mac)
MLS065/7 DMT Normalization (Win and Mac)	MLS240/7 Metabolic (Win and Mac)
MLS370/7 Blood Pressure (Win)	MLS062/7 Spike Histogram (Win and Mac)
MLS360/7 ECG Analysis (Win)	MLS380/7 Peak Analysis (Win)
	MLS340/7 Cardiac Output (Win)
	MLS320/7 Video Capture (Win and Mac)
	MLS395/7 Circadian Analysis (Win)

## LabChart Pro

Data analysis modules are available separately or as a complete software package in LabChart Pro\*.

**Dose Response** – generate dose response curves, EC<sub>50</sub> values and additional parameters

**Blood Pressure** – automatically detects, analyzes and reports parameters from arterial or ventricular pressure recordings

**ECG Analysis** – detects and reports the onset, amplitude and interval times of PQRST from human and animal ECG signals

**Heart Rate Variability** – displays and analyzes variation in the interval between heartbeats in human and animal ECG

**Peak Analysis** – automatic detection and analysis of multiple, but not overlapping, signal waveforms from recordings

**Circadian Analysis** – analyze and generate graphical and tabular views for daily and averaged circadian data

**Metabolic** – provides real-time measurements of parameters such as:  $\dot{V}CO_2$ ,  $\dot{V}O_2$ ,  $\dot{V}E$  and RER

**Spike Histogram** – detects, discriminates and analyzes extracellular spike activity generating a range of plots and statistics

**Cardiac Output** – calculates cardiac output from a LabChart recording of a thermodilution curve measured in animals

**Video Capture** – allows the synchronized recording and playback of a QuickTime movie and LabChart data file

**DMT Normalization** – calculates and standardizes optimal vessel pretension conditions using the wire myograph

\*LabChart Pro does not include GLP Client and GLP Server software.

 Share your data with colleagues. Free LabChart Reader – download to view and analyze LabChart data.

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PowerLab systems and signal conditioners meet the European EMC directive. ADInstruments signal conditioners for human use are approved to the IEC60601-1 patient safety standard and meet the CSA C22.2 No. 601.1-M90 and UL Std No. 2601-1 safety of medical electrical equipment standards.



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