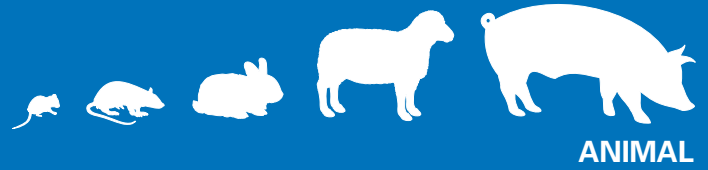
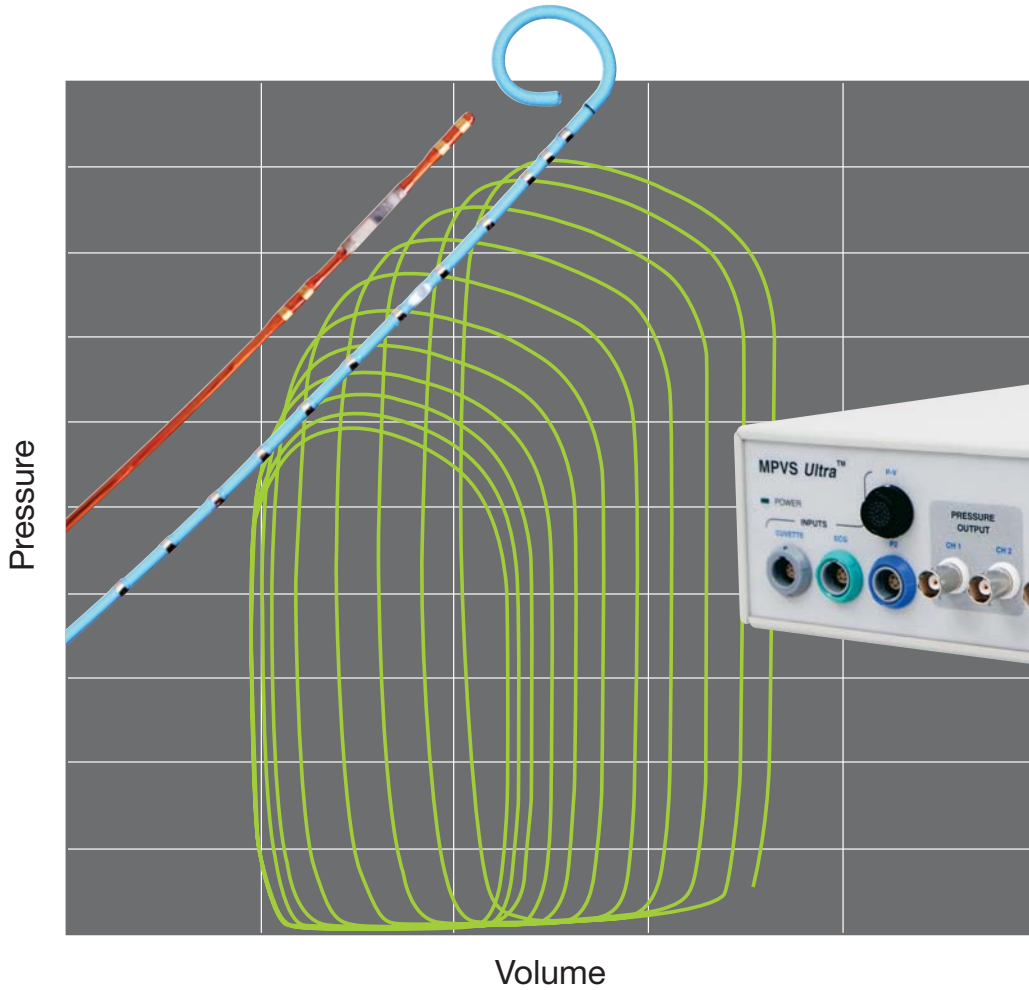


# MPVS Ultra



## Complete Solution for Measuring Cardiovascular Pressure and Volume in Small and Large Animal Models

*Animal Use Only*



Sensors.Systems.Solutions.®

The Millar Pressure-Volume System, the MPVS *Ultra*,™ simultaneously and continuously measures high-fidelity left ventricular pressure and volume from the intact beating hearts of animals ranging in size from transgenic mice to domestic livestock.

Using the MPVS *Ultra*, cardiovascular pressure and volume signals can be plotted against each other in real time, generating the characteristic pressure-volume (P-V) loops that are an excellent illustration of the cardiac cycle in normal or diseased conditions of the living heart. With the MPVS *Ultra*, P-V loops may be captured during pharmacological, therapeutic, and hemodynamic interventions, allowing comprehensive evaluation of the fundamental mechanical properties of the heart.

MPVS *Ultra* is the only complete solution for measuring real-time cardiovascular pressure and volume in small and large animal models with an industry-leading seven volume segments.

### MPVS *Ultra* Components

- Millar Mikro-Tip® P-V catheters
- P-V signal conditioning hardware with innovative software-controlled user interface
- PVAN *Ultra*™ data analysis software
- Rho cuvette for volume calibration
- Data acquisition system (Compatible with commercially available DAQ systems. Millar provides ADInstruments PowerLab® solutions.)
- Connection cables
- Computer (not included)

### Applications

- Baseline P-V loop analysis
- Occlusion P-V loop analysis
- Phenotyping gene manipulations
- Cardiac hypertrophy
- Cardiac failure
- Cardiovascular remodeling
- Toxicology
- Pharmacology (rapid drug screening)
- Cardiac resynchronization therapy
- Surgical interventions
- Ischemia/reperfusion studies

### Mikro-Tip P-V Catheters



Millar Mikro-Tip P-V catheters combine pressure sensors and electrodes for simultaneous high-fidelity pressure-volume measurements from a single instrument. Millar is proud to manufacture the world's smallest (1 French) sensor tip pressure-volume catheter.

### P-V Catheter Features




- Real-time pressure-volume measurement at the source
- High-frequency response
- No motion artifact or damping of pressure signal
- Minimally invasive
- Size range from 1 to 7 French in single-field or dual-field configurations
- Custom electrode spacing available
- Technology backed by 20 years of conductance measurement experience and 35 years of pressure sensor innovation



## Small Animal Catheter Models

Features/Model	PVR-1045	PVR-1030 	SPR-839	SPR-869	SPR-838 
Part Number	842-0001	842-0002	840-8111	840-8136	840-8110
Animal Type	Mouse	Mouse	Mouse	Small rat	Normal/large rat
Catheter Material	Polyimide	Polyimide	Polyimide	Polyimide	Polyimide
Segment	Single	Single	Single	Single	Single
Effective Length	3.25 cm	3.25 cm	3.5 cm	12.5 cm	12.5 cm
French Size (Sensor)	1	1	1.4	2	2
French Size (Catheter Body)	0.8	0.8	0.8	1.1	1.1
Number of Pressure Sensors	1	1	1	1	1
Sensor Location from Tip	Centered in electrode segment	Centered in electrode segment	Centered in electrode segment	Centered in electrode segment	Centered in electrode segment
Electrodes	4	4	4	4	4
Electrode Spacing	4.5 mm segment	3.0 mm segment	4.5 mm segment	6.0 mm segment	9.0 mm segment
Electrode Connector Type	Redel	Redel	Redel	Redel	Redel
Pressure Sensor Connector Type	Low profile	Low profile	Low profile	Low profile	Low profile
Reusable	Yes	Yes	Yes	Yes	Yes
Repairable	No	No	Yes	Yes	Yes

## Large Animal Catheter Models

Features/Model	SPR-923-1 	SPR-923-3	SPR-550-5	SPR-550-8	SPR-554-5 	SPR-554-11 	SPR-562-1	SPR-570-9
Part Number	840-8206-1	840-8206-3	840-8176-5	840-8176-8	840-8202-5	840-8202-11	840-8178-1	820-0009-9
Animal Type	Rabbit	Rabbit	Large Animal	Large Animal	Large Animal	Large Animal	Large Animal	Large Animal
Catheter Material	Nylon	Nylon	Nylon	Nylon	Nylon	Nylon	Polyurethane	Polyurethane
Segment	Multi	Multi	Multi	Multi	Multi	Multi	Multi	Multi
Effective Length	105 cm	105 cm	125 cm	125 cm	125 cm	125 cm	125 cm	125 cm
French Size	3	3	5	5	5	5	6	7
Number of Pressure Sensors	1	1	1	1	1	1	2	1
Sensor Location from Tip	Between 3rd and 4th electrode	Between 3rd and 4th electrode	Between 5th and 6th electrode	Between 4th and 5th electrode	Between 5th and 6th electrode	Between 4th and 5th electrode	Between 4th and 5th electrode and 5 cm proximal to 12th electrode	Between 4th and 5th electrode
Tip Characteristics	Straight	Straight	Straight	Straight	Straight	Straight	Straight	Straight
Pigtail	No	No	Yes	Yes	No	No	Yes	Yes
Electrodes	10	10	12	8	12	10	12	8
Electrode Spacing	3 mm	4.5 mm	7 mm	7 mm	7 mm	7mm	7 mm	8.5 mm
Electrode Connector Type	Redel	Redel	Redel	Redel	Redel	Redel	Redel	Redel
Field Configuration	Single	Single	Dual	Single	Dual	Single	Dual	Single
Pressure Sensor Connector Type	Low profile	Low profile	Low profile	Low profile	Low profile	Low profile	Low profile	Low profile
Reusable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Repairable	No	No	No	No	No	No	No	No

Refer to [www.millarinstruments.com](http://www.millarinstruments.com) or contact Millar Instruments for a complete listing of Mikro-Tip P-V catheters.

## MPVS *Ultra* Signal Conditioning Hardware

The MPVS *Ultra* signal conditioning hardware provides analog outputs of time-varying left ventricular pressure and volume signals for data acquisition. The combined pressure and volume signals generate real-time pressure-volume loops that allow calculation and analysis of a wide variety of hemodynamic parameters in both small and large animals.

### Hardware Features

- State of the art technology
- Small and large animal capabilities in one system
- Seven volume segments plus composite volume
- Dynamic electrode configuration for optimization of volume signal
- Innovative software-controlled user interface
- Built-in volume calibration technique using Rho cuvette and Baan's equation
- Adjustable gain settings to allow both *in vivo* and *in vitro* studies
- Intracardiac electrograms measured across electrodes on P-V catheter
- Dual pressure inputs
- Thermodilution capability
- Compatibility with commercially available data acquisition systems
- Compatibility with all Millar Mikro-Tip P-V catheters



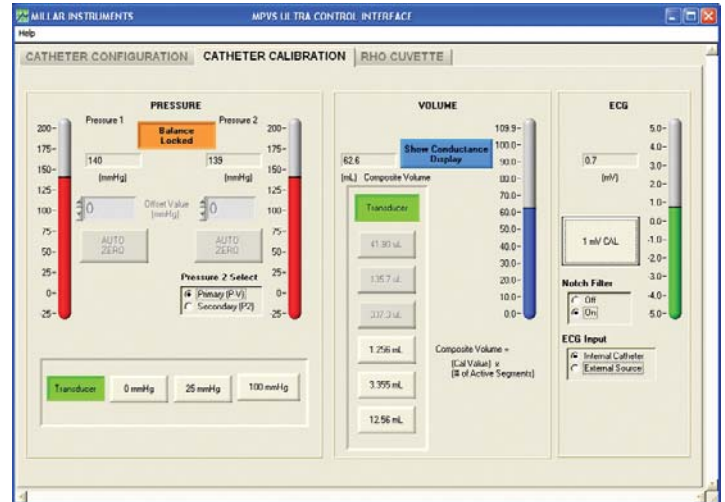
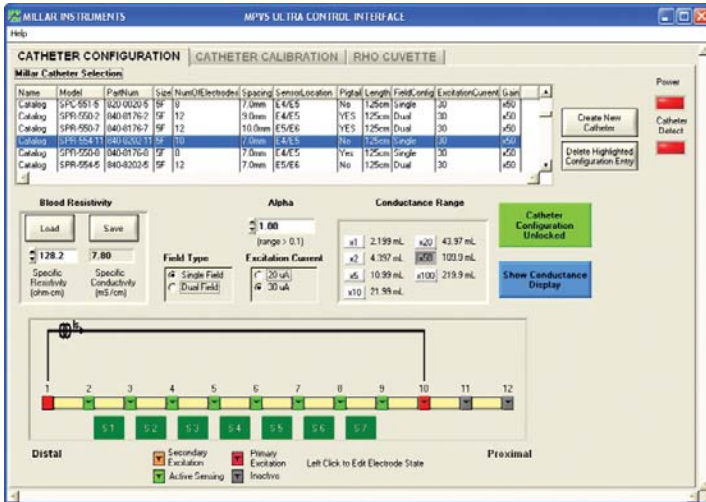
Refer to [www.millarinstruments.com](http://www.millarinstruments.com) for technical specifications.

## MPVS Ultra Control Interface Software

The MPVS *Ultra* is the first and only pressure-volume system to be software-controlled. With the graphical user interface, the user can manage catheter configuration, calibrate all signals, and measure conductivity and resistivity.

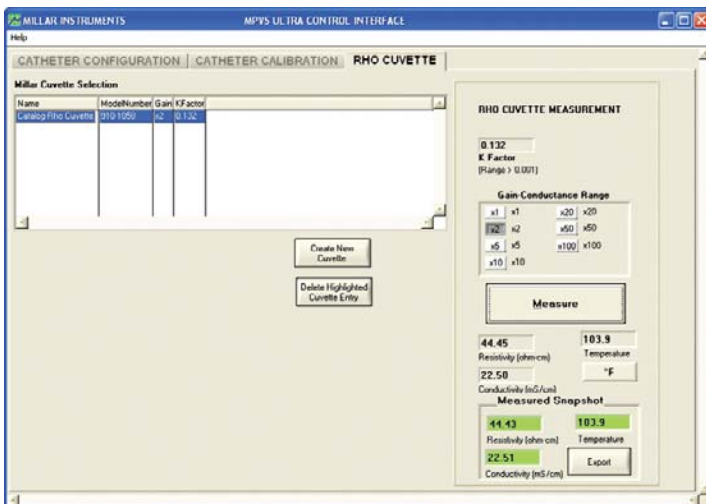
To streamline studies, the user can select the appropriate catheter model from a preloaded list of catalog catheters or quickly create an entry for a custom model. Configurations can be saved and easily loaded for future studies. Dynamic adjustment of the number of active segments allows for an optimal volume signal in each procedure.

Conductivity, resistivity, and the temperature of a blood sample are measured with one click.



## Rho Cuvette

The Rho cuvette measures the resistivity and conductivity of a blood sample. The resistivity is incorporated into Baan's equation, the accepted method of volume conversion from conductance to true volume units.



## Data Acquisition System

MPVS *Ultra* is compatible with any commercially available data acquisition system that meets these requirements:

- Accepts analog inputs of  $\pm 10$  V.
- Has a minimal sample rate of 1,000 Hz for small animals.
- Able to display real-time X-Y plots.

## PVAN *Ultra* Data Analysis Software

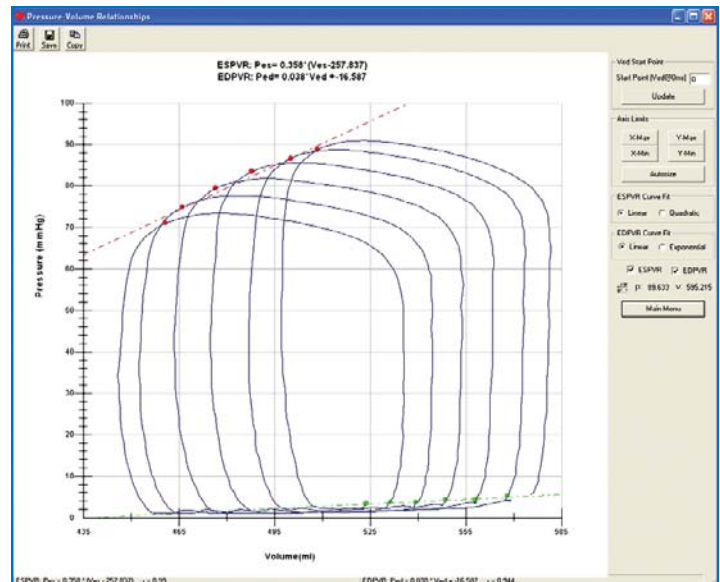
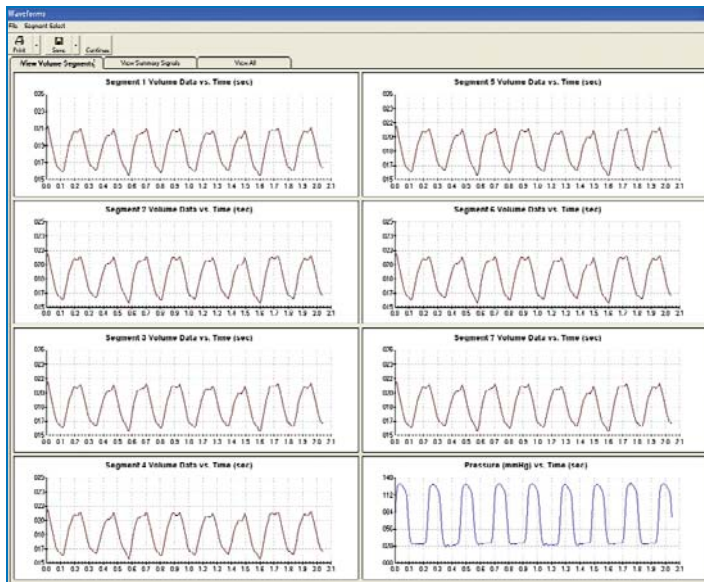
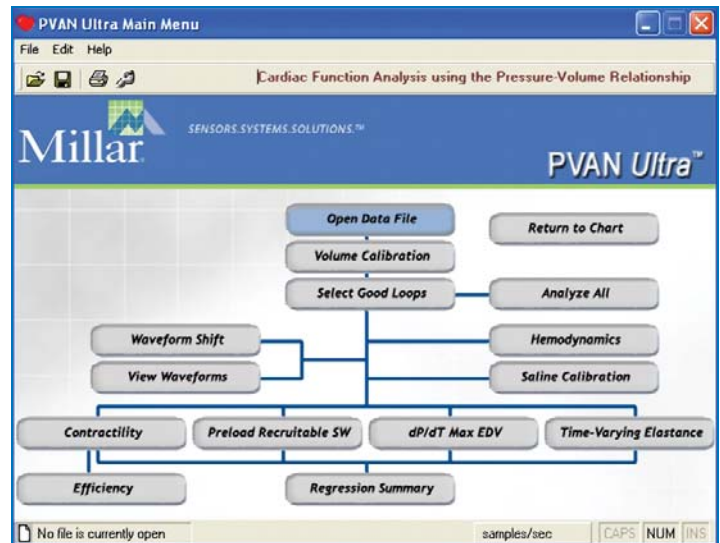
Millar's PVAN *Ultra* software provides a powerful, easy-to-use method for investigators to calculate the hemodynamic parameters of the P-V data generated by the MPVS *Ultra* hardware.

PVAN *Ultra* opens the text files generated by the data acquisition software and applies a variety of algorithms to the P-V data to calculate over thirty different hemodynamic parameters.

The calculated hemodynamic parameters serve as indicators of cardiovascular performance in response to different interventions (genetic mutations, drugs, occlusions, etc.).

PVAN *Ultra* contains an intuitive user menu that offers easy access to a variety of displays and calculation tables for several cardiovascular parameters. A saline calibration feature allows the user to obtain a value for the parallel conductance volume contribution of the myocardium.

Data may be easily exported to spreadsheets or text files, and graphical information can be placed into presentations or papers for publication.



## Parameters Calculated by PVAN *Ultra* Software

Parameter	Description	Parameter	Description	Parameter	Description
HR	Heart Rate	Ea	Arterial Elastance	dP/dt min	Minimum dP/dt
Vmax	Maximum Volume	CO	Cardiac Output	dV/dt max	Maximum dV/dt
Vmin	Minimum Volume	SW	Stroke Work	dV/dt min	Minimum dV/dt
Ves	End-Systolic Volume	SV	Stroke Volume	P@dP/dt max	Pressure at dP/dt Max
Ved	End-Diastolic Volume	EF	Ejection Fraction	P@dV/dt max	Pressure at dV/dt Max
Pmax	Maximum Pressure	PRSW	Preload Recrutable SW	V@dP/dt max	Volume at dP/dt Max
Pmin	Minimum Pressure	ESPVR	End-Systolic P-V Relationship	V@dP/dt min	Volume at dP/dt Min
Pes	End-Systolic Pressure	EDPVR	End-Diastolic P-V Relationship	Tau (Weiss)	Tau-Weiss Method
Ped	End-Diastolic Pressure	E(t)	Time-Varying Maximum Elastance	Tau (Glantz)	Tau-Glantz Method
Ees	End-Systolic Elastance	dP/dt max	Maximum dP/dt	Tau (Logistic)	Tau-Logistic Method

## Standard MPVS *Ultra* System

A standard MPVS *Ultra* system includes all the following.

Hardware		
MPVS <i>Ultra</i> Kit (includes signal conditioning hardware and control interface software)		880-0168
Rho Cuvette Kit		910-1060
Software		
PVAN <i>Ultra</i> Analysis Software		001-1056
Two Cable Packs		
<i>Ultra</i> Cable Pack, 10 ft		880-0169
or <i>Ultra</i> Cable Pack, 4 ft		880-0170
BNC Cable Pack, PowerLab		880-0172
or BNC Cable Pack, 3 ft		880-0171
Catheters		
Refer to tables of catheter models, or contact Millar.		
Data Acquisition System		
PowerLab 16/30 or other system that meets minimum requirements		



## Why Choose a 'Millar'?

We are honored that many of our customers refer to our Mikro-Tip catheters as 'Millars.®' Clinical users worldwide have testified to their precision, reliability, and fine workmanship. The high-quality characteristics of our clinical products are manifest in our research catheters, whether standard catalog models or one-of-a-kind special orders.

Your research is validated by its accuracy, and accuracy begins with the selection of instrumentation for the research project. Millar understands this crucial decision and is the only manufacturer of research catheters built in an ISO13485:2003 quality environment. Millar is ISO13485:2003 Medical Device Quality Management Standard certified and FDA registered and compliant. Our precision instrumentation has been noted in over 2,000 published peer-reviewed papers. We are proud that 'Millars' are the research scientists' catheter of choice, and we will continue to offer exceptional quality to enable you to:

- validate your data with the gold standard.
- make decisions based on accurate data obtained by the most reliable devices available.
- publish your important research with confidence.

Thank you for continuing to choose a 'Millar.'

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## Millar Worldwide Distribution

Millar Instruments, Inc. has a network of Authorized Distributors in most countries around the world. For information on the Millar distributor in your country, please contact the Millar Customer Service Department at our headquarters in Houston.

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M.I. P/N 005-1060 Rev. --