

ViVitro Labs Dynamic Flow Measurement System

Redefining Cardiovascular Flow Measurement: Precise, low-noise physiological flow measurement with intelligent software integration and full-range performance using a single flow probe.



ViVitro Labs Dynamic Flow Measurement System with a 28 mm probe

The ViVitro Labs Dynamic Flow Measurement System (D-FMS) sets a new standard for dynamic cardiovascular flow measurement. With its proprietary electromagnetic design, the ViVitro Labs D-FMS redefines dynamic cardiovascular flow measurement by combining exceptional accuracy, broad flow range capability, and intelligent digital architecture into a single integrated platform.

Advanced signal processing, ultra-high internal sampling rates, and intrinsic noise immunity work together to produce clean and reliable high-resolution data. Combining with seamless integration into ViVitro Labs testing ecosystems, in-house* calibration capabilities and intelligent self-monitoring diagnostics, the D-FMS enables laboratories to simplify workflows, improve repeatability and reinforce results confidence.

Built for Dynamic Cardiovascular Testing

One Probe. Full Physiological Flow Range

Accurately measure flow from near-zero leakage to extreme cardiac outputs with a single probe eliminating complexity, reducing calibration burden and improving confidence across all cardiovascular test conditions.

True Dynamic Flow Insight for Advanced Cardiovascular Testing

Capture the full complexity of pulsatile cardiac waveforms with exceptional fidelity, enabling deeper understanding of valve dynamics, transient flow events and real physiological behavior.

High-Resolution Data to Capture What Other Systems Miss

Generate rich, high-density flow data that empowers users to detect subtle performance characteristics, improve waveform analysis and strengthen device validation with confidence.

Reliable Measurements Through Intelligent Noise Immunity

Deliver clean, stable and interference-resistant measurements through advanced digital signal architecture that protects data integrity regardless of laboratory environment or setup conditions.

Precise Real-Time Synchronization of Flow and Pressure

Correlate flow and pressure measurements with ultra-low latency and minimal phase shift enabling accurate analysis of valve closure, flow reversal and critical cardiac timing events.

Confidence-Building Accuracy for Leakage and Regurgitation Testing

Maintain highly stable zero-flow performance and repeatable measurements for precise regurgitation assessment while supporting compliance with stringent ISO 5840 requirements.

Engineered for Real-World Cardiovascular Flow Conditions

Accurately measures complex flows, reducing artifacts and improving repeatability in demanding test scenarios.

Smart Diagnostics That Protect Data Integrity

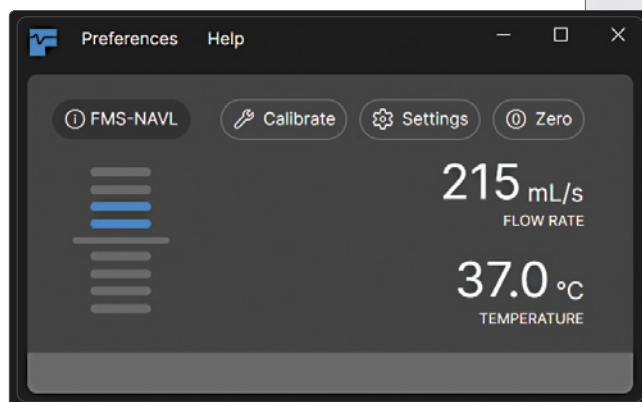
Integrated intelligence continuously monitors readiness, detects faults and prevents invalid measurements, while guiding users through calibration and operation ensuring reliable, traceable test results.

Simplified Operation with Seamless System Integration

Accelerate workflows and reduce user-errors with plug and-play operation and intuitive software tools. Provide seamless compatibility with Pulse Duplicator systems, ViVitest and existing laboratory systems.

Maximum Uptime with Flexible Calibration and Maintenance

Reduce downtime and eliminate dependency on external service providers through complete in-house* calibration, user-managed updates, robust maintenance-friendly design and configurable integration with virtually any acquisition platform.



D-FMS App (software)



D-FMS Processing Module

Advanced Flow Measurement Software Ecosystem Engineered for Physiological Flow Insight

The ViVitro Labs Flow Measurement System is supported by an advanced software ecosystem engineered specifically for cardiovascular testing workflows, combining intelligent automation, real-time diagnostics and seamless system integration to simplify every stage of testing. Automatic device recognition, guided workflows, synchronized data handling and configurable outputs enable users to move from setup to testing with minimal effort while maintaining exceptional consistency and reliability. Designed for both today's laboratory environments and next-generation digital workflows, the ViVitro Labs D-FMS software platform enhances productivity, reduces operator burden and strengthens confidence in every measurement and validation program.

Real-Time Monitoring and Visualization

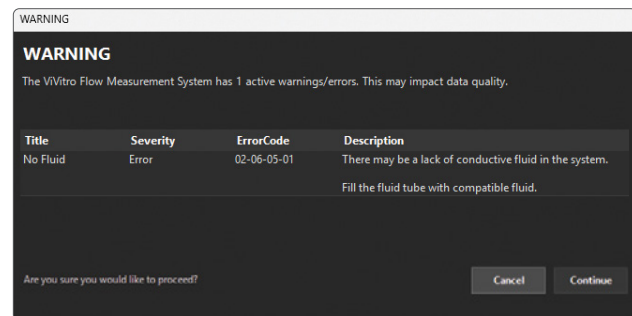
- Display live flow, temperature and system status information.
- Analog output for visualization and acquisition of high-resolution pulsatile flow waveforms in real time.
- Monitor readiness state and active diagnostic conditions.
- Track dynamic flow behavior with synchronized measurement outputs.

Guided Calibration and Verification

- Perform guided in-house calibration workflows.
- Verify flow accuracy using ISO 5840-aligned forward and reverse volume calculations.
- Optimize accuracy with in-house calibration using the study test fluid.
- Adjust gain and offsets with intuitive software controls.

Intelligent Diagnostics and Data Integrity

- Monitor signal integrity continuously during operation.
- Detect bubbles, no-fluid conditions and hardware faults automatically.
- Alert users to invalid measurement conditions in real time.
- Pause or block compromised data acquisition automatically.
- Maintain automated traceability logs of system activity and errors.



D-FMS App Intelligent Diagnostics capabilities

System Integration

- Integrate directly with new ViVitest v5.
- Support ViVitest v4 and QCTest v3 workflows and existing Pulse Duplicator.
- Operate with standard Windows 10 and 11 PCs via USB.
- Configure analog BNC output for third-party systems.
- Maintain backward compatibility with existing data acquisition systems.
- Simplify temperature measurement with an integrated in-lumen sensor.

Workflow Optimization

- Simplify setup with automatic device recognition.
- Reduce operator intervention through guided workflows.
- Access device information, diagnostics and system logs instantly.
- Configure filters, outputs and operating modes quickly.
- Minimize downtime with user-managed firmware and software updates.

Traceability and Confidence

- Automatically log calibration data and device information.
- Record fluid temperature and system activity continuously.
- Maintain historical records for troubleshooting and validation.
- Improve consistency across users and testing programs.
- Strengthen auditability and regulatory confidence.

Technical Specifications: Where Confidence Meets Measurement Fidelity

Maximum forward instantaneous flow:	100 L/min (1,667 mL/sec)
Maximum reverse instantaneous flow:	-100 L/min (-1,667 mL/sec)
Minimum flow:	0 L/min
Maximum cardiac output:	20 L/min
Flow accuracy:	0-50 ml/sec: ± 2.5 ml/sec 50-1700 ml/sec: $\pm 5\%$ of measurement
Accuracy of regurgitant volume per ISO-5840:2021:	2 ml for 20-200 BPM
Accuracy of regurgitant flow per ISO-5840:	10% of 1.5 L/min
Beat rate range:	20 to 200 BPM pulsatile
Measurement bandwidth:	30 Hz to 100 Hz, user-selectable
Typical flow signal noise level (30Hz filter):	1 ml/sec
Typical audible noise level:	35 dBa (Normal Working Condition), 45 dBa (During Warm-Up)
Flow zeroing interval:	Over 10 mins
Zeroing available on:	D-FMS processing module, D-FMS App, In ViVitest
Temperature sensor location:	Integrated - embedded in Flow Lumen
Probe construction:	Splash-resistant
Fluid temperature range:	18 °C to 45 °C
Fluid temperature accuracy:	± 0.5 °C
Typical fluid temperature reading noise floor:	0.1 °C
Maximum fluid pressure:	500 mmHg
Probe fluid compatibility:	Saline, PBS, Glycerin-Saline blood analog (3-4 cP), other conductive fluids (customization only).
Flow calibration:	Automated with SuperPump, Manual Gain Adjustment
Temperature calibration:	Manual Offset Adjustment
Probe warm up time:	<30 minutes
User-selectable voltage scaling:	Up to ± 10 V
Analog output update rate:	600 Hz
Analog output latency:	Less than 10 ms
Output connector:	BNC, cable is provided
Default mode to match ViVitest inputs:	± 5 V = ± 830 ml/s
Software compatibility	• Digital compatibility with D-FMS App v1 • Digital and analog compatible with ViVitest v5 • Analog flow compatible with ViVitest v4, QCTest v3 • Laptop requirements: Minimum 1 available USB port compatible, Windows 10 or 11, RAM 8 GB or greater, i5 processor or greater

28 mm D-FMS Probe for ViVitro Labs Pulse Duplicator



28 mm D-FMS Probe with barb fitting for Mock Circulatory Loop (MCL)



Probe:	• Inside Diameter (flow path): 28 mm (no visual obstruction through bore to facilitate imaging) • Thickness (flow direction): 22 mm • Total Width: 52 mm • Total Length: 111 mm • Weight: 150 g • Cable Length: 1.5 m
Barb fittings dimensions:	Tube ID: 25 mm, 30 mm and 35 mm
Processing module:	• Dimensions (H x W x D): 50 mm x 150 mm x 225 mm • System Weight: 2 kg
Voltage:	100-250 V~
Max power:	65 W
Input frequency:	50 or 60 Hz
C13 universal input plug, and regional power cords available.	



ViVitro Labs D-FMS - All parts

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