CompuFlow 1000 MR Physiological Flow Pump System for MRI

MRI Version

Product Description

The CompuFlow 1000 MR flow pump system is designed to generate realistic, accurate and repeatable physiological volume flow waveforms, including pre-programmed; carotid, femoral, sine, square and constant flow waveforms. The system includes an embedded industrial grade motherboard and proprietary *SimuFlow III Waveform Editing Software* for creating user-defined physiological flow waveforms. Users have the option of inputting their own waveform data points, reshaping the supplied pre-programmed waveforms (click and drag) or downloading waveforms onto the system.

The CompuFlow 1000 MR is accurate to with ± 3.0% over a flow range of 0.1 to 35 ml/s. Each system is calibrated and accompanied with a *certificate of calibration* specifying the calibration results at relevant flow rates, as well as being provided with a calibration constant to verify the pump systems accuracy.

The CompuFlow 1000 MR is two-unit design, a Control Unit and a Pump Unit with an internal reservoir. For MRI environments the Control Unit is positioned outside the MRI suite, the Pump Unit can be positioned in the scanning room. Shielded cables are supplied to connect the computerized motor control unit to the pump unit via the penetration panel or wave-guide.

Combine the CompuFlow 1000 MR with an appropriate vascular phantom and blood mimicking fluid, and the resulting closed flow loop ensures easy, accurate and reliable evaluation and validation of diagnostic imaging systems and techniques. The system is ideal for flow quantification in MRA, iMRI, DSA, CTA, Doppler ultrasound, optical coherence tomography (OCT) and endovascular simulation applications.

Applications

Research and new technology developments requiring accurate and repeatable pulsatile and constant flow waveforms (i.e. flow quantification, MRA, iMRI, DSA, CTA Doppler ultrasound, optical coherence tomography (OCT) and endovascular techniques.

Ability to control waveform shape.

Gated flow studies.

Calibration of clinical imaging systems.

Product Features

***REALISTIC** PHYSIOLOGICAL FLOW WAVEFORMS*
***PULSATILE** AND CONSTANT FLOW WAVEFORMS*
***ACCURATE** VOLUME FLOW WAVEFORMS*
***REPRODUCIBLE** WAVEFORMS*
***PROGRAMMABLE** USER DEFINED WAVEFORMS*
***CALIBRATION** CERTIFICATE*
***MULTIMODALITY** IDEAL FOR COMPARING IMAGING MODALITIES*

Accurate and reproducible physiological flow waveforms including those with reverse flow components such as the femoral waveform.

Pump unit can be in close proximity to a magnetic bore, resulting in clinical acquisition of realistic and accurate (± 3.0%) physiological waveforms.

SimuFlow III waveform editing software allows for the development of user-defined pulsatile and constant flow waveforms. Users can control the shape of the waveform.

Pre-programmed waveforms include; carotid, femoral, sine, rectangular and constant flow waveforms.

Control with user supplied keyboard, mouse and monitor to communicate with the embedded computer.

Calibration certificate is provided with each system verifying the systems accuracy. The system can be calibrated and certified traceably to a national standard for regulatory requirements. A re-calibration service is available.

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Fluid Flow Specifications

Volume range 0.1 – 35 ml/s
Accuracy of ± 3.0%
Sine waves up to 12 Hz
Physiological flow waveforms including reverse flow components

Mechanical Specifications

High-torque micro-stepping motor
450 ml pump cylinder
Adjustable over-pressure shut-off (7 to 50 psi)
Self-sealing1/4 inch inner diameter plastic connectors

Computer Control

On-board dedicated motor controller
Easily upgraded high level control software
Windows 10 Embedded Operating System

Interface Options

User supplied monitor, keyboard and mouse

Physical

Control Unit dimensions: 14.0" (L) x 11.0" (W) x 9.0" (H)
Control Unit Weight: 15.0 lbs. (6.8 kg)
Pump Unit dimensions: 19.6" (L) x 10.0" (W) x 9.25" (H)
Pump Unit Weight: 38 lbs. (17.2 kg)
Reservoir capacity: 1.5 litres
Circulating Fluid Volume: 2 litres

File Format

Waveform data is stored on embedded harddrive.
Files can contain up to 1,000 flow-rate values describing a waveform
User specified time-base ranging from 2 to 50 ms per point
Waveforms can be looped continuously
Variable frequency waveforms can be generated

Electrical

110/220 VAC 50/60 Hz, 4.0 amps @ 120V
EMI shielding
1 RS-232 serial communication port
1 remote controller port
1 ECG TTL trigger output (BNC)
Monitor port
Keyboard port
Mouse port
Two shielded cables between the Control Unit and a penetration panel (10 foot lengths).
Two shielded cables between the Pump Unit and a penetration panel (20 foot lengths).

Calibration Options

Standard calibration
Traceable calibration to a National Standard

Accessory Products

MR Finger for ECG gated flow studies
Multi+ Variable Waveform Software Option to mimic arrhythmia
MRI QA Flow Phantom Set
Anatomically correct vascular models
Blood mimicking fluid, BMF-MR

References:

Holdsworth DW, Rickey DW, Drangova M, Miller DJM, Fenster A, "Computer-controlled positive displacement pump for physiological flow simulation," Med. Biol. Eng. Comp., 29, 565-570 (1991)

Holdsworth, D.W., Norley, C.J.D., Frayne, R., Steinman, D.A., and Rutt, B.K., "Characterization of common carotid artery blood-flow waveforms in normal subjects," accepted for publication in Phys. Meas., (Dec 1998)

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