

# Doppler Ultrasound Flow Simulator

Model 069



## PERFORM SENSITIVITY & VELOCITY QA ON DOPPLER ULTRASOUND

The Doppler Ultrasound Flow Simulator is designed to simulate blood flow in a tissue mimicking phantom, and may be used to perform quality assurance testing of Doppler ultrasound devices. The two most common tests are sensitivity and velocity accuracy, but a number of other useful tests are also described in the literature (see references).

The simulator includes a tissue-mimicking flow phantom with a blood-vessel-simulating, ultrasound-compatible tube that enters the phantom at an angle. The phantom has both a top and bottom scanning surface that allows testing at varying depths and angles of orientation. This makes the phantom suitable for testing both peripheral flow and deeper abdominal vessels. The phantom is filled with Zerdine® tissue mimicking gel with a speed of sound of 1540 m/s, an attenuation of 0.7 dB/cm/MHz and a backscatter contrast designed to match that of the liver. It is housed in rugged ABS plastic for added durability. Customers who wish to combine B-mode quality assurance features with Doppler testing may request customization of the phantom to include wire, greyscale and anechoic targets.

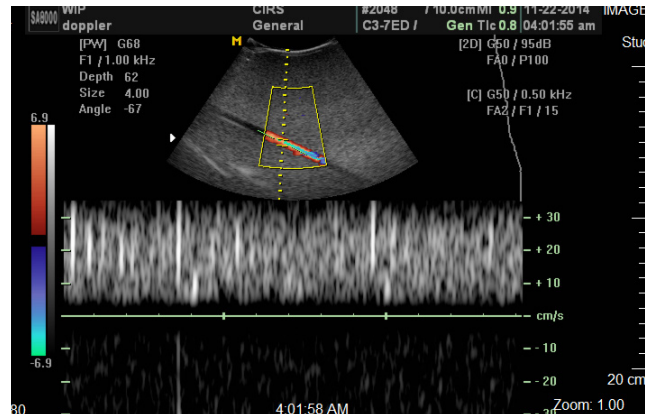
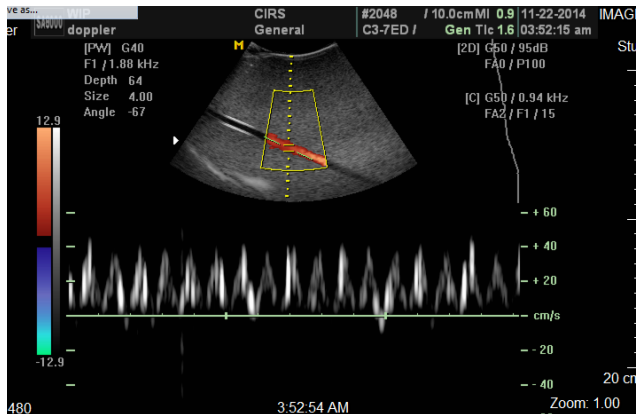
The simulator allows includes the following components:

1) A peristaltic pump capable of providing flow rates of 0.5 to 12.5 ml/s, which translates to an average flow velocity of 2-70 cm/s. (Peak flow velocities will be 2-4 times greater than the average flow velocity due to the effects of laminar and pulsatile flow.)

- 2) A fluid reservoir pre-filled with CIRS blood mimicking fluid. Replacement fluid may be ordered separately.
- 3) A pulse dampener that converts the pulsatile flow from the peristaltic pump into constant velocity flow.
- 4) Convenient color coded tubing with quick-disconnect fittings
- 5) Convenient hard-shell carry case designed so that the full system is pre-configured within the case.

### Features

- Max Flow Rate is 750 mL/ min
- Min Flow Rate is 0.04 mL/ min
- Pulsatile or Constant Velocity configurations available
- Tissue-Equivalent phantom
- Varying tube depths for peripheral and abdominal vessel simulation
- Blood Mimicking Fluid simulates acoustic and physical characteristics of blood
- All components stored in compact case for easy transport



Doppler ultrasound images with Doppler Ultrasound Flow Phantom showing pulsatile and continuous flow.

**SPECIFICATIONS**

**DOPPLER FLOW PUMP**

MOTOR TYPE	Step motor
MOTOR STEPS PER REVOLUTION	200
MICROSTEPPING	1/8 to 1/1 depending on motor speed
DC CONNECTOR	2.1mm, center positive
VOLTAGE AT DC CONNECTOR	24V DC at full load
AMPERAGE	900mA at full load
POWER SUPPLY TYPE	Unregulated linear external wall adapter, country and power source specific
POWER SUPPLY OUTPUT RATING	24V DC @ 1A
DIMENSIONS	7 3/4" x 5 1/4" x 5 3/4" High (19.685 cm x 13.335 cm x 14.605 cm)
WEIGHT	4.51 lbs. (2.05 kg)
MAXIMUM SPEED	372 rpm
MINIMUM SPEED	0.0168 rpm
MAXIMUM PUMPING RATE	775.2 mL/min with 3/16 ID tubing
MINIMUM PUMPING RATE	0.035 mL/min with 3/16 ID tubing

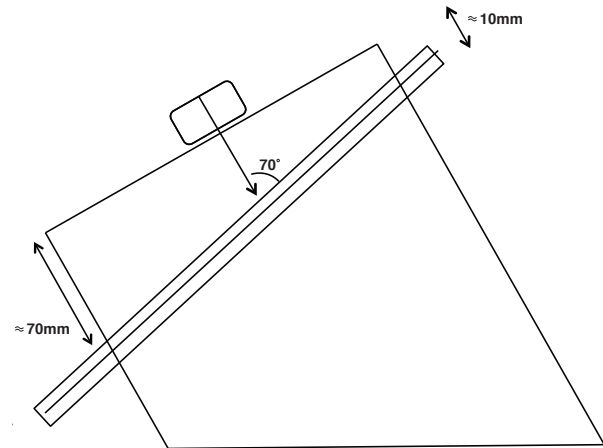
**BLOOD MIMICKING FLUID**

PROPERTY	HUMAN BLOOD (37°C)	BLOOD MIMICKING FLUID (22°C)
Viscosity (mPa)	3	4 ± 0.5
Velocity (m/s)	1583	1570 ± 30
Attenuation (dB/cm/MHz)	0.15	< 0.1
Backscatter (f <sup>4</sup> m <sup>-1</sup> sr <sup>-1</sup> )	4x10 <sup>-31</sup>	Not Measured
Fluid Properties	Non Newtonian	Newtonian

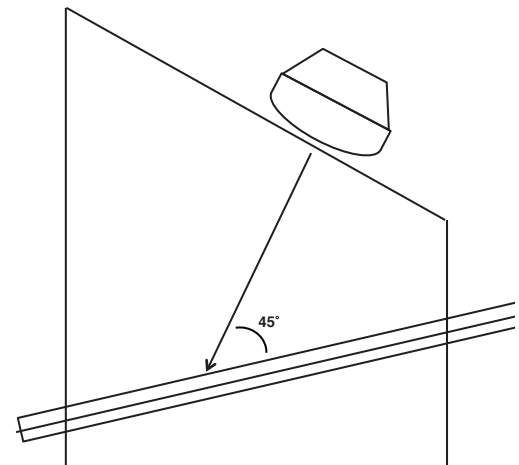
"Validation of a New Blood-Mimicking Fluid for Use in Doppler Flow Test Objects", K. Rammnarine, et. al., Ultrasound in Medicine & Biology, Vol. 24. No. 3, pp.454.

**TISSUE EQUIVALENT PHANTOM**

DIMENSIONS	20 cm x 12.5 cm x 27.5 cm
TUBING	Inside Dimensions: 3/16" Outside Dimensions: 1/4"
SCAN SURFACE	Saran laminate membrane; 12.5 cm x 17.5 cm
BACK-GROUND MATERIAL	Zerdine® SoS: 1540 m/s ± 10 m/s Attenuation: 0.7 dB/cm-MHz



Configuration 1: Peripheral Vessels



Configuration 2: Abdominal Vessels

**References:**

1. Performance Criteria and Measurements for Doppler Ultrasound Devices: Technical Discussion; Second Edition. AIUM Technical Standards Committee, 2002.
2. Testing of Doppler Ultrasound Equipment. Institute of Physical Sciences in Medicine, Report No. 79, ed. PR Hoskins, SB Sherriff and JA Evans, 1994.
3. IEC TS 61895: Ultrasonics – Pulsed Doppler diagnostic systems – Test procedures to determine performance. First edition, 1999-10.