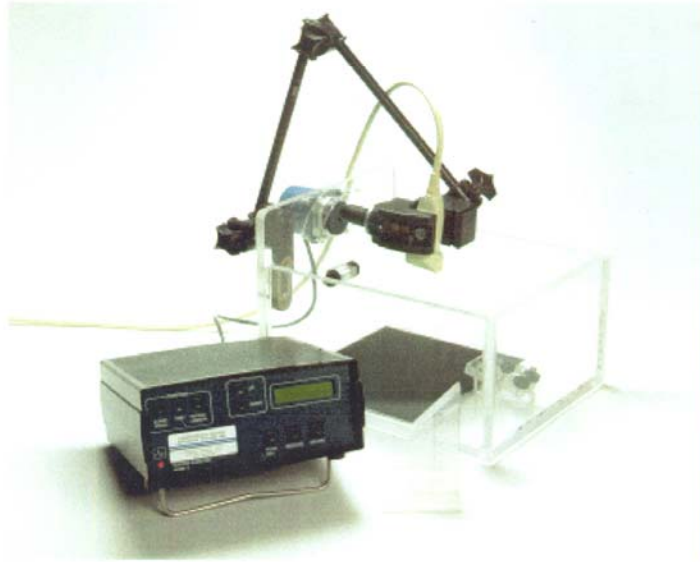


INSTRUCTIONS



Model 43 Doppler String Phantom



2428 Alameda Avenue • Suite 212 • Norfolk, Virginia 23513 • USA

(800) 617-1177 • (757) 855-2765 • FAX (757) 857-0523
www.cirsinc.com • admin@cirsinc.com

INTRODUCTION

Doppler ultrasound equipment is widely used to make critical diagnoses. There is a need to verify that ultrasound equipment is giving accurate, consistent results. The string phantom is a valuable tool for testing doppler equipment.

The Mark IV Doppler Phantom uses a moving string target to provide a good, consistent scatterer. Unlike phantoms that use fluids with suspended scatterers to simulate blood flow, the string's properties will not change in time. The velocity of the string is always known, and the angle between the transducer and the string can be measured accurately, making a variety of repeatable tests possible.

Ultrasound manufacturers and technologists can use the string phantom for a wide variety of purposes. Technologists can use the phantom to become familiar with their equipment, detect any angles or velocities that may be measured inaccurately, detect inaccuracies in sample volume location, and to check their equipment periodically to verify that it is functioning properly. In hospitals, where several different doppler units may be used, the string phantom makes it possible to compare them and verify that they are all giving similar results.

Ultrasound manufacturers can use the string phantom for quality assurance, to test new "cutting edge" technology, to train technicians, and to give demonstrations for sales purposes.

The Mark IV string phantom makes it possible to separate physiological data from effects caused by instrumentation.

FEATURES OF THE MARK IV DOPPLER STRING PHANTOM

The Mark IV Phantom uses a microprocessor to store 16 pre-programmed physiological and test waveforms. Each waveform has a period of either 1 or 1/2 second, and has 1000 data points. The string speeds have been checked and verified to be within +/- 1% of the stated velocity. Either tap water or a velocity-corrected fluid can be used in the tank. Since the speed of sound is slower in water than in the body and Doppler scanners are calibrated for use in the body, the string speed is adjusted for use either with water or velocity-corrected fluids.

The physiological waveforms in the phantom are adult common carotid, adult aortic, adult femoral, pediatric umbilical artery, adult stenotic common carotid artery, pediatric renal artery, pediatric ductus arteriosus, pediatric middle cerebral artery, and pediatric descending thoracic artery. The test waveforms include sine, triangle, and stepped ramp waves at a variety of speeds. The user can also run the string at any constant speed from 10 to 200 cm/sec in increments of 1 cm/sec. In addition, we can program custom waveforms into the Mark IV phantoms. The Mark IV Doppler Phantom is easy to use. It features a backlit liquid crystal display with help instructions. The universal transducer clamp will hold any transducer. The carrying case is durable and small enough to carry on an airplane.

SETTING UP THE MARK IV DOPPLER PHANTOM

The Doppler Phantom comes with two string loops made from 3-0 surgical suture. Take one of the strings out of the bag. Lay the loop over the motor pulley first, loop it around the pulley for a total of 0.5 revolutions, then run it down over the back of the two idler pulleys just below the motor, and then over to the remaining pair of pulleys. You will have to loosen the adjusting screw to give the loop some slack to get the string loop to go around the circuit. After it has been strung, adjust the tension by moving the adjustable pulley back and forth until there is enough tension for a string to be taut, but not enough to break it. The actual tension will not affect the data.

Before filling the tank, make sure it is on a firm surface. The tank may be filled with either cold tap water or velocity-corrected fluid. The speed of sound is 1480 meters/sec in water, and 1540 meters/sec in the human body. Since Doppler scanners are calibrated for 1540 meters/sec, the Phantom can be set for use with either water or velocity-corrected fluid (See "Operating the Mark IV"). When set for water the Phantom compensates for the different speed of sound, and the display indicates the speed that your scanner should be detecting. Fill the tank until the two small idler pulleys on the rear wall of the tank are just submerged. This depth works well, but it isn't critical. The depth may be changed to meet your needs. After filling the tank, there will be dissolved air bubbles in the water. For best results, wait an hour before using Doppler phantom so the water can de-gas itself.

Make sure the power is off on the rear panel, then plug the motor cable into the back of the control box and plug the main power cable into 120 volts AC. (See rear panel description) The Mark IV is fused for one amp so it will not need any special wiring. The Doppler phantom is ready for use now.

MOUNTING THE SCANHEAD ON THE TANK:

The universal scanhead clamp can be used to hold the scanhead at virtually any angle in the tank, but we have some suggestions for ease of use. There is a 15 degree tilt on the string target. This was done so that a scanhead looking straight down into the tank would have a known Doppler angle. You might want to use the 45 degree positioning jig provided to obtain a repeatable angle of 60 degrees. Also note depth of string using jig and be sure to position the probe at that depth during future measurements. Remember, the string speeds indicated on the Mark IV display or obtained from the velocity profiles in this manual are along the line of motion of the string. The velocity indicated on the ultrasound scanner will depend on the cosine correction factor. Also, the scan-plane of the scanhead should coincide with the string target or you will get only a partial view of the string.

There is a clamp on the end of the arm assembly for mounting the scanhead. Loosen up all of the arm joints and position the arm with its clamp to hold the scanhead at the desired angle in the water. Tighten each joint while watching the display screen to make sure the image has not moved. The idea is to immerse the scanhead into the water, but not so deep as to damage the scanhead. We find it convenient to have the string running when we align the scanhead with the string because with a color-flow machine, the string motion stands out strongly against any reverberations.

Jan 2001

Model 43 Doppler String Phantom

REVERBERATIONS IN THE TANK:

As with any water tank, there will be reverberations that can confuse the operator, so we have included a beam absorber. It is a rubber mat and is meant to be placed in the bottom of the tank, if desired, to absorb and scatter the beam. Water conducts ultrasound much more efficiently than the human body, so the power level on the ultrasound scanner will have to be reduced to minimum for best results.

STRING TARGET SPECIFICATIONS:

We have included some pre-cut strings for convenience, but it is simple to make more if they should break. The strings we include are made from 3-0 surgical suture.

While it is possible to lace the string around the pulleys and tie it. It is much easier to make a loop using two map tacks and a yardstick. Press the tacks into the yardstick 15 3/16" apart, loop the string around both tacks, and tie it using a square knot or modified square knot with one extra loop in the first half. Any knot that holds will work. You will see the knot go by when imaging the string. Add a small drop of Super-Glue or equivalent for additional security.

Smaller string targets will give a weaker return echo than larger strings. Also, surgical silk gives stronger echoes than fishing line because there are more scattering centers due to the fibers that protrude from the sides of the string.

REAR PANEL DESCRIPTION:

POWER ON/OFF: Applies 220 Volts AC to unit to turn it on.

AC RESPECTABLE: For insertion of power cord supplied.

DRIVE MOTOR: Plug the gray cord with the circular metallic connector that is attached to the motor and tank here.

COMMUNICATIONS: This is the computer interface port that can be used optionally for controlling all of the functions of the Doppler Phantom remotely. Its primary purpose is for automated testing of scanning equipment. This interface is not enabled at this time.

EGG OUTPUT: The Mark IV sends out a trigger pulse via this connector that could be used to synchronize a scanner if desired. It is not necessary to use this connector in most situations. The ECG Output specifications are:

Pulse width:	10 milliseconds
Start time:	Starts at the onset of systole or at time zero of test waves.
Compatibility:	Will drive one TTL LS gate.
Connector:	5 pin circular DIN pattern.
Pinout:	Looking at the rear panel from behind the unit, the index notch is at 12 o'clock, ground is at 11 o'clock, and the positive output is at 1 o'clock. Disregard the remaining 3 positions. They are reserved for future use.

OPERATING THE MARK IV DOPPLER PHANTOM

1. After the Doppler Phantom has been set up, turn on the power switch (located on the back of control box).
2. After a moment the display will prompt, "UP = H₂O DOWN = H₂O/GLYCOL". If the tank is filled with water, press UP. If the tank is filled with velocity - corrected fluid, press DOWN. (See set-up instructions for more details.)
3. When the display prompts "SELECT A FUNCTION", select either physiological wave forms, test waveforms, or constant speed by pressing the appropriate function button.
4. If you have selected physiological or test waveforms, you may select the desired wave form by pressing UP or DOWN. (See "Standard Waveforms" for graphs.) Press EXECUTE to start the motor.
5. If you have selected constant speed, press UP or DOWN to select the desired speed. Holding either button down causes the display to scroll faster. The motor starts automatically.
6. You may press FLOW REV. at any time to reverse the direction of simulated flow. An arrow in the bottom right corner of the display indicated the flow direction.
7. You may press UP or DOWN at any time to select a different waveform or speed. To change functions (e.g. to switch from physiological to test waveforms), you must press ESCAPE. ESCAPE brings back the "SELECT A FUNCTION" prompt.

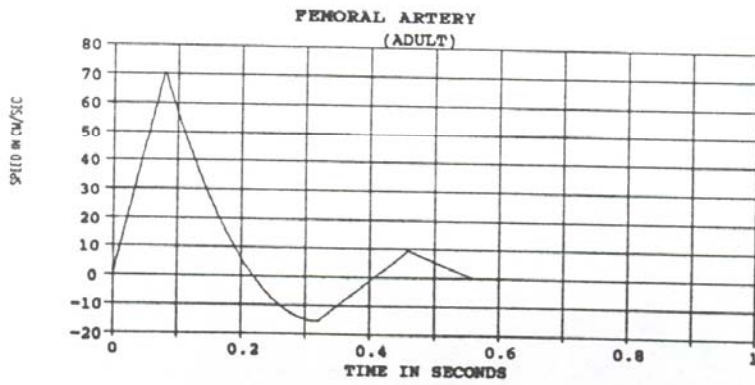
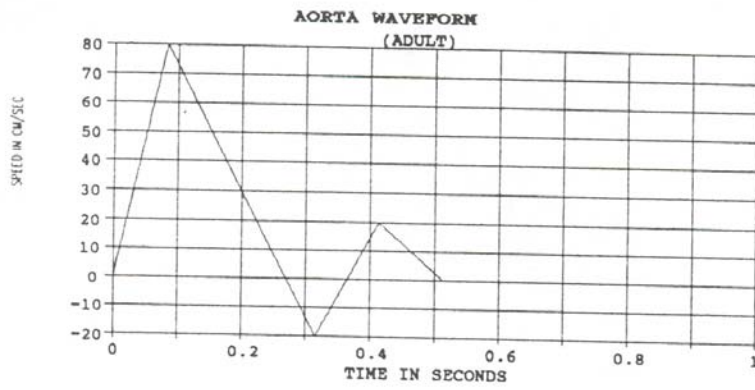
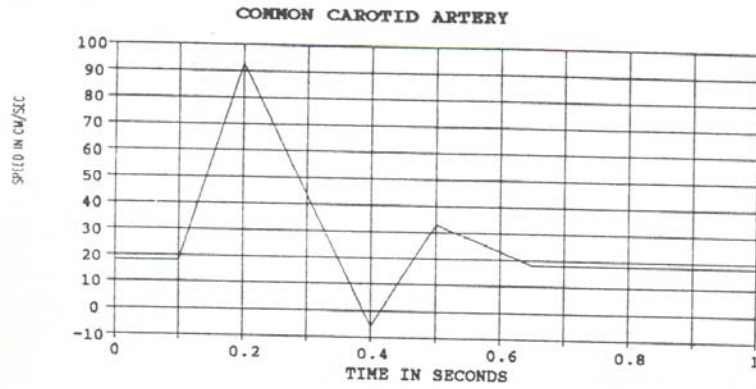
Maintenance Instructions

The Mark 4 phantom is designed to be virtually maintenance-free. There are also no adjustments that need to be made, but annual recalibration certification is recommended. CIRS offers that service. Contact us for additional information.

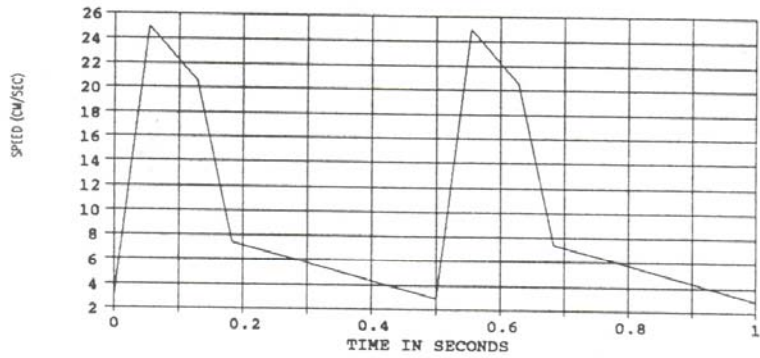
The electronic control box houses standard electronic components and requires no special care beyond what common sense would dictate. The user should never open the control box. If it is not functioning correctly, return it to CIRS for repair.

The water tank is made of clear acrylic plastic and is very tough. Other parts in the water tank are made of plastic or stainless steel. The user may operate the phantom with water or blood equivalent liquids without worrying about damaging the plastic tank or the components inside it. Avoid the use of any solvents, as they could weaken the tank.

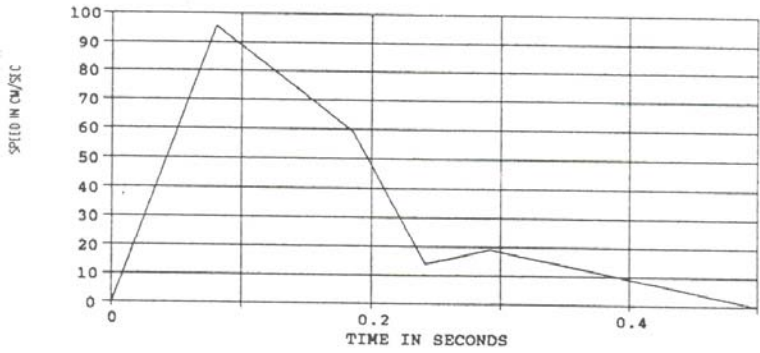
Standard Waveforms



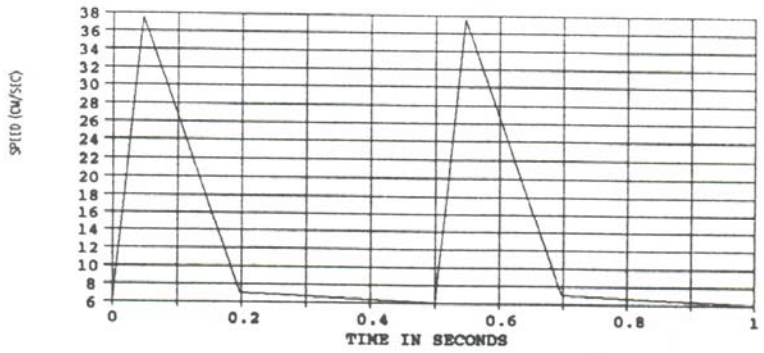
MIDDLE CEREBRAL ARTERY



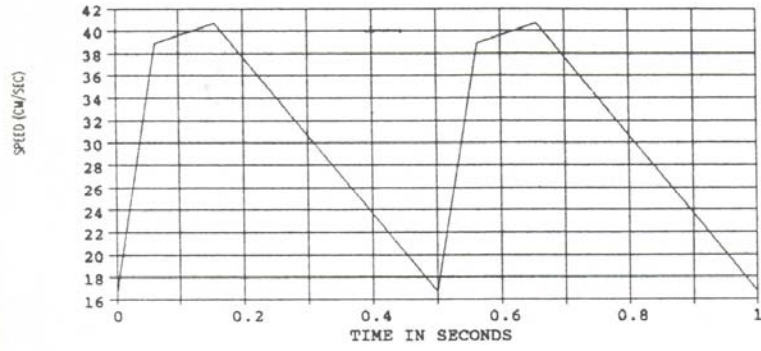
PEDIATRIC DUCTUS ARTERIOSIS



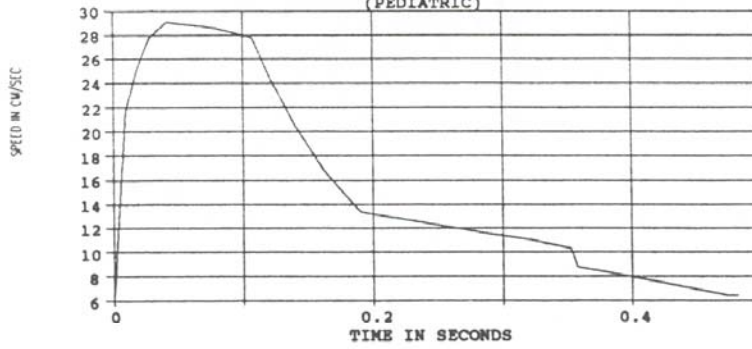
RENAL ARTERY

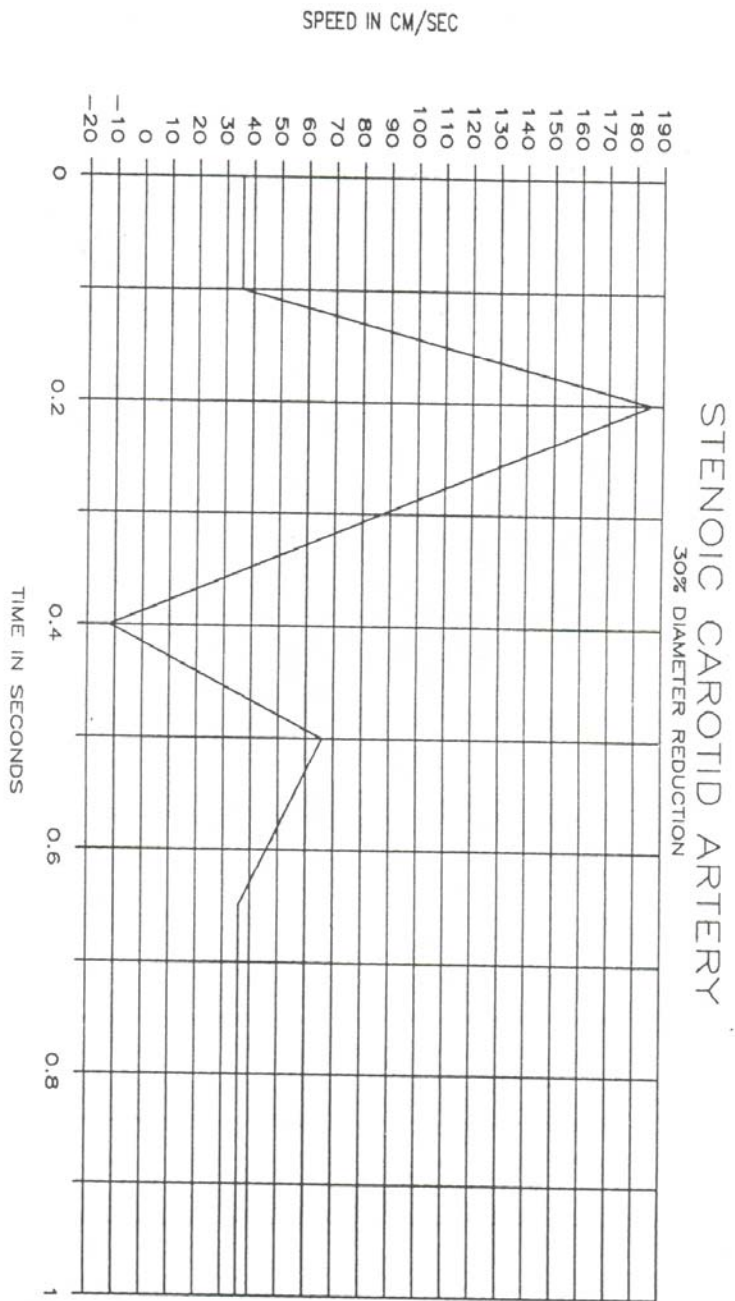


UMBILICAL ARTERY

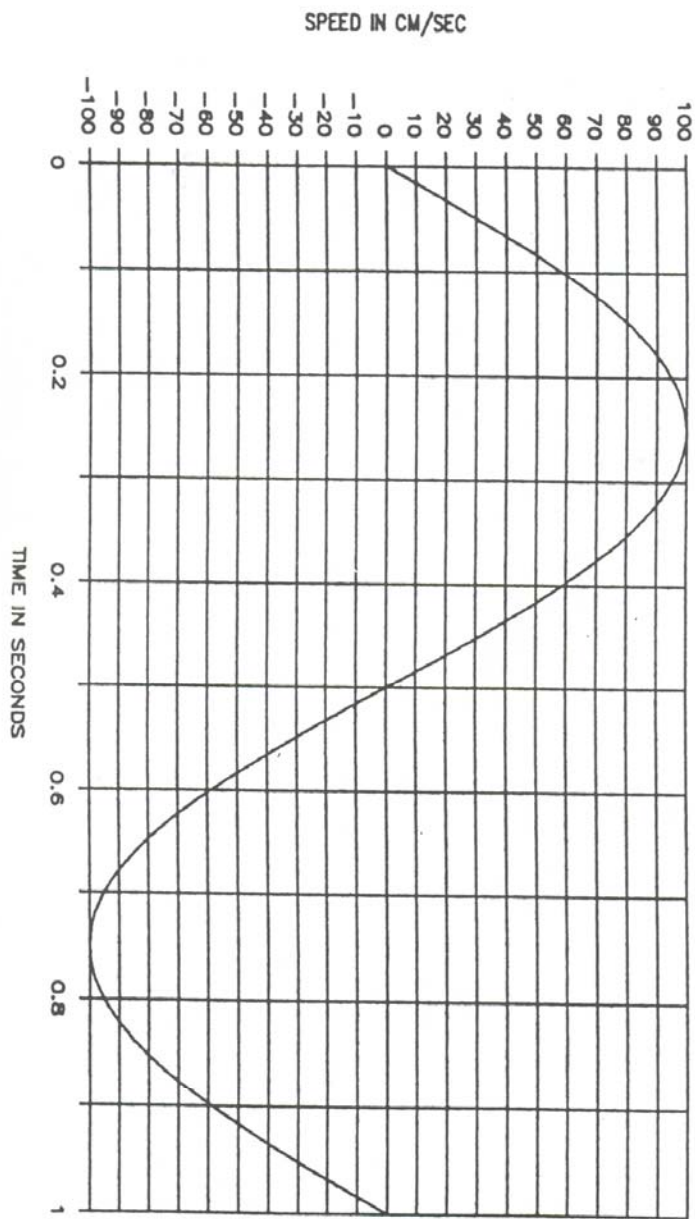


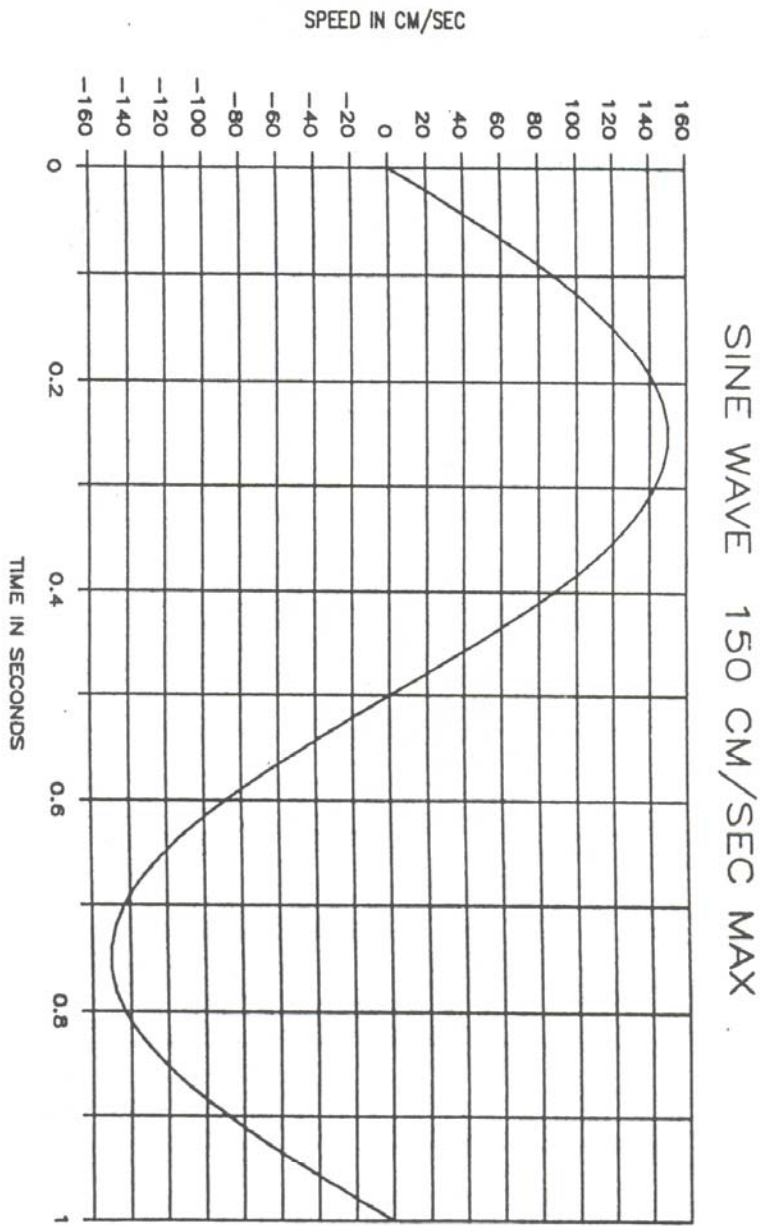
DESCENDING THORASCIC ARTERY
(PEDIATRIC)

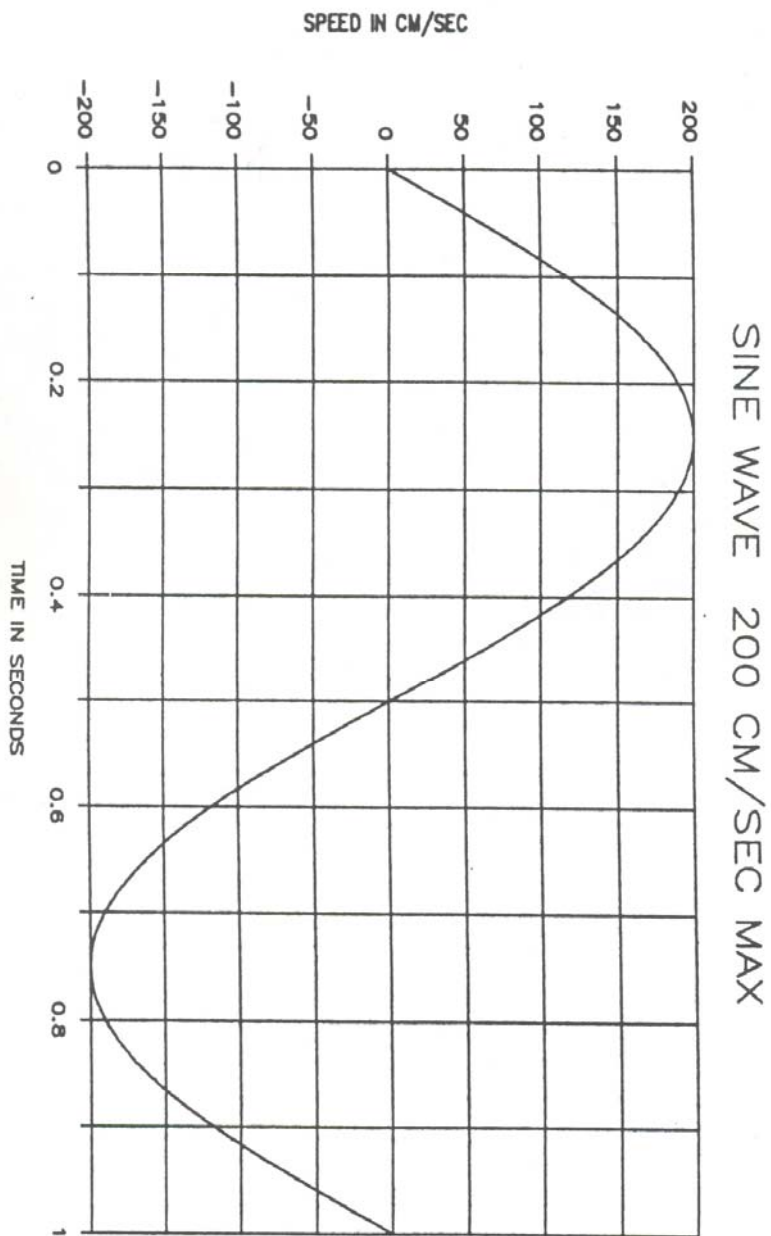




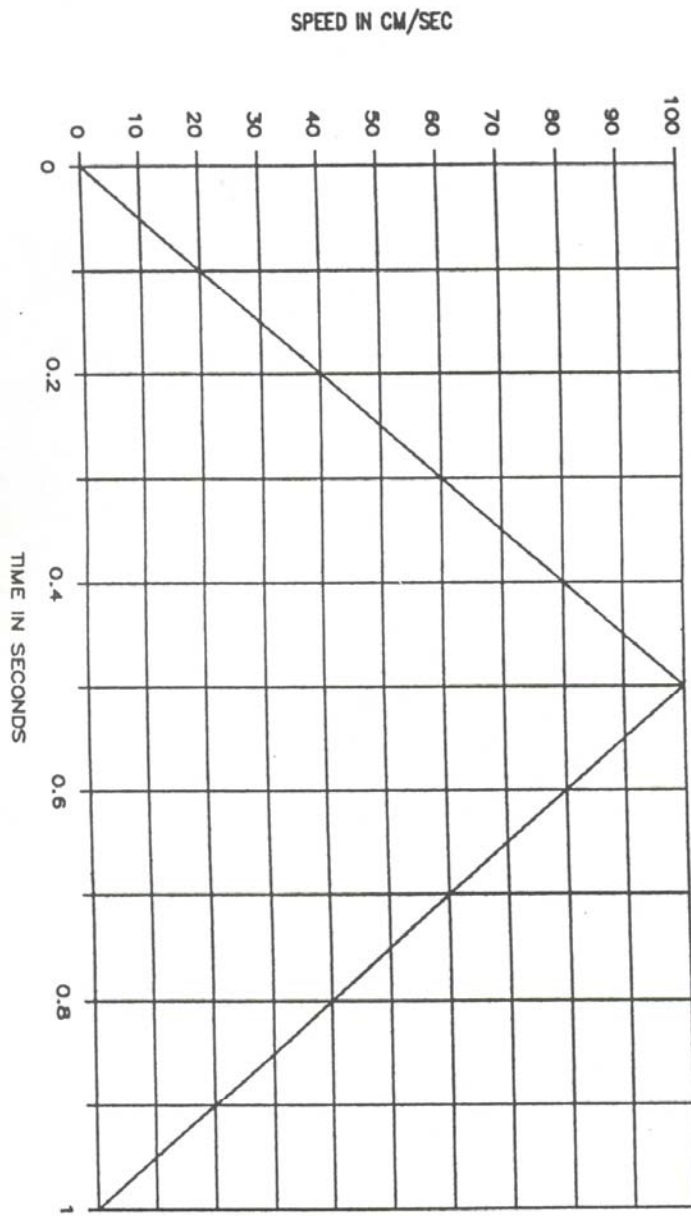
SINE WAVE 100 CM/SEC MAX

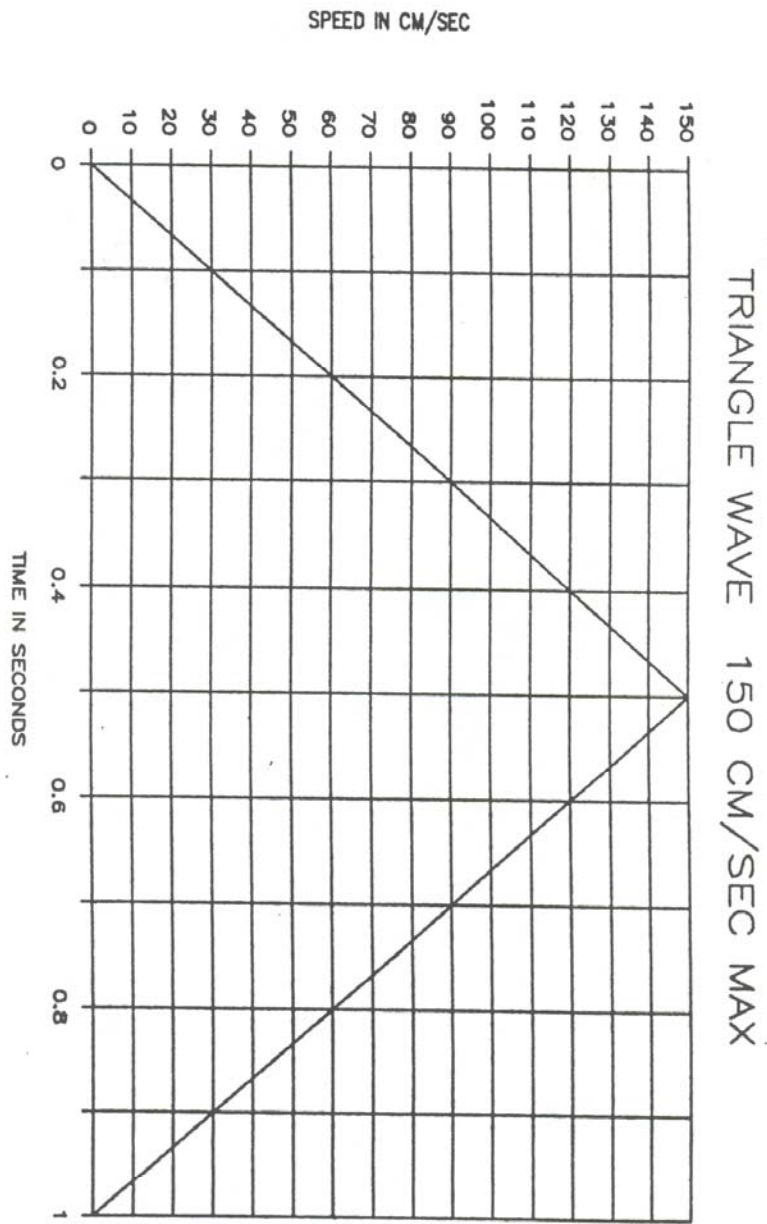


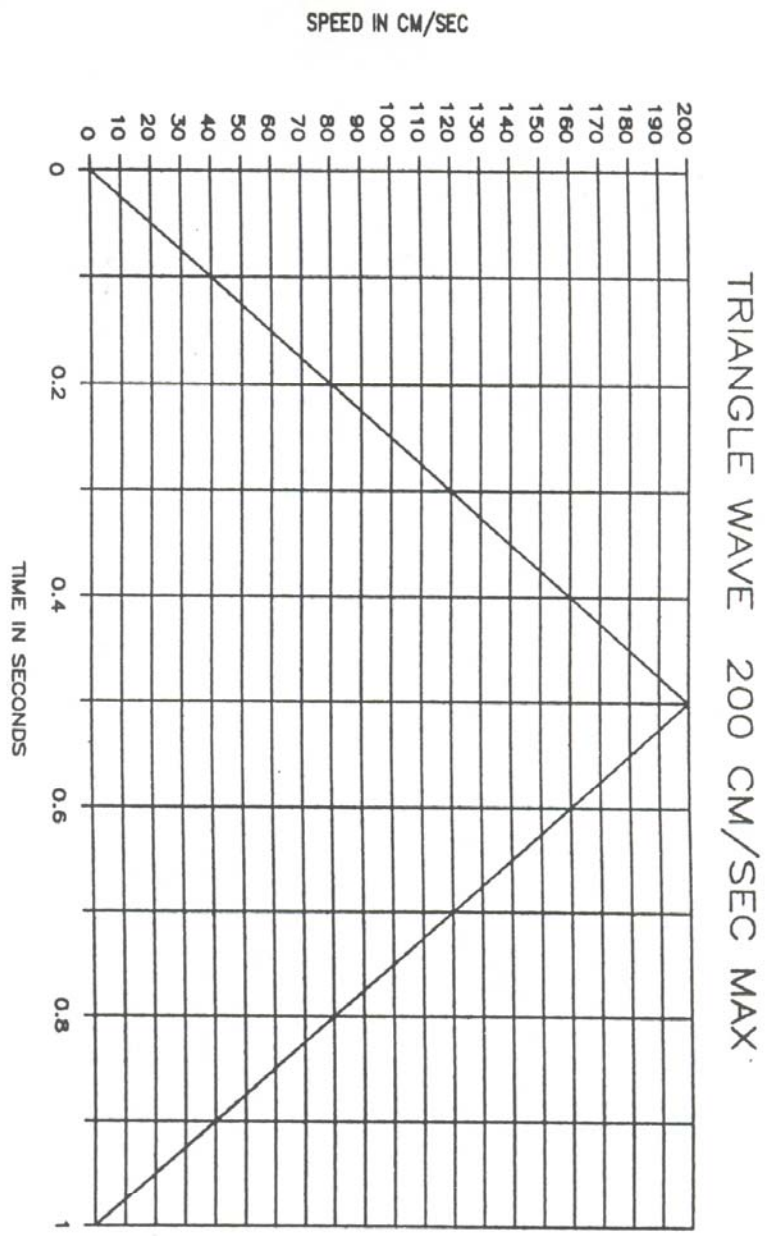


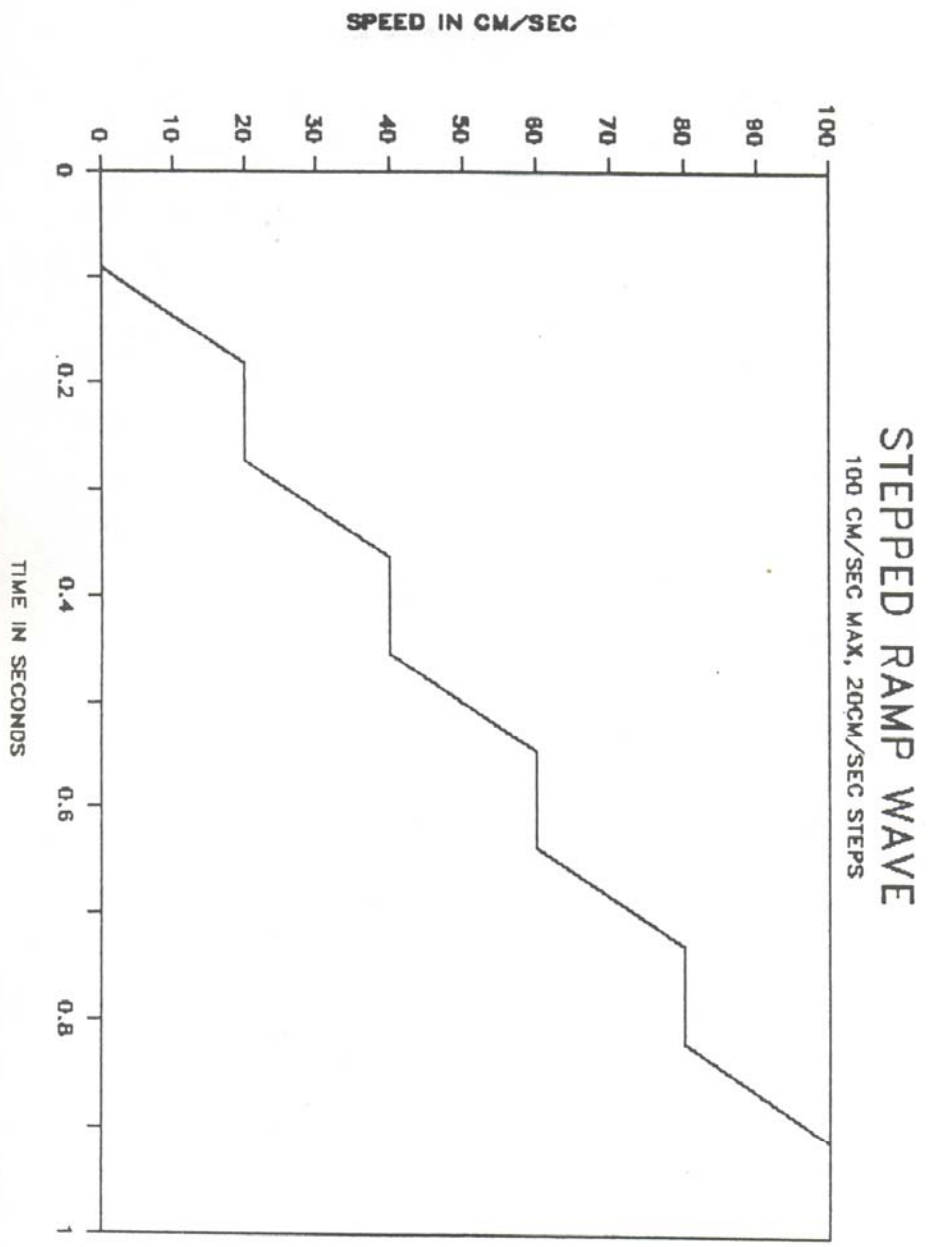


TRIANGLE WAVE 100 CM/SEC MAX









LIMITED WARRANTY

This product and its accessories, except as *noted below, are warranted by the manufacturer against defects in material and workmanship for a period of one year from the date of original shipment. During the warranty period, the manufacturer will repair or, at its option, replace, at no charge, a product containing such defect provided it is returned, transportation prepaid, to the manufacturer. Products repaired in warranty will be returned transportation prepaid.

There are no warranties, expressed or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description on the face hereof. This expressed warranty excludes coverage of, and does not provide relief for, incidental or consequential damages of any kind or nature, including but not limited to loss of use, loss of sales or inconvenience. The exclusive remedy of the purchaser is limited to repair, recalibration, or replacement of the product at manufacturer's option.

This warranty does not apply if the product, as determined by the manufacturer, is defective because of normal wear, accident, misuse, or modification.

** This warranty specifically excludes any items covered by their original manufacturer's warranty.*

NON-WARRANTY SERVICE

If repairs or replacement not covered by this warranty are required, a repair estimate will be submitted for approval before proceeding with the repair or replacement.

REPAIR SERVICE: Return the product, prepaid to:
COMPUTERIZED IMAGING REFERENCE SYSTEMS, INC.
2428 Alameda Avenue, Suite 212, Norfolk, Virginia, 23513
(757) 855-2765 Fax (757) 857-0523

IMPORTANT: To expedite your repair, please supply the following: (1) Complete detailed description of problem, (2) Purchase date, (3) Name of vendor, (4) Order number. Also indicate which, if any, accessory items are included in the return.

Doppler String Phantom

Accurately simulates 16 physiological and test waveforms

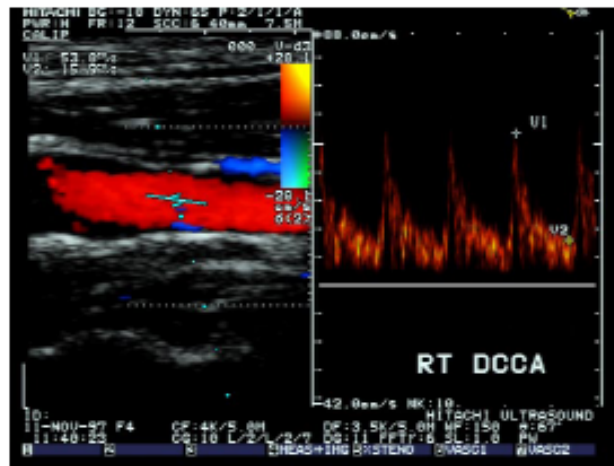
The CIRS Model 043 Doppler String Phantom is an essential tool for people who work with Doppler Ultrasound. The crystal controlled motor accurately generates sixteen pre-programmed waveforms using advanced string target technology. Since the speed is adjusted 1000 times every second, you know it's precise and repeatable.

The Model 043 can be set for use with water or velocity-corrected fluid. If you're using water, it adjusts the string speed accordingly so the different speed of sound in water won't affect your tests. And unlike fluid-flow phantoms, the target never changes; you know what your test results should be every time.

All CIRS Ultrasound phantoms, including the Model 043, are sold, with a user's manual, and a rugged carrying case. Additional options include a custom programming of special waveforms.



Model 043



Typical Doppler image of carotid blood flow in human.

*Tissue Simulation &
Phantom Technology*

CIRS

2428 Alameda Avenue • Suite 212 • Norfolk, Virginia 23513 • USA
(800) 617-1177 • (757) 856-2765 • FAX (757) 857-0523
www.cirsinc.com • admin@cirsinc.com

Model 043 Specifications

Digital Display:	Waveform readout, string speed, help statements and instructions, and computer host information.
Flow Simulation Speeds:	10 to 200 centimeters per second, bi-directional.
Speed Drift:	Crystal-locked to 20 parts per million (0.002%).
Accuracy:	+/- 1% of stated speed.
Pulsatile Waveforms:	16 pre-programmed and optional customer specified.
Waveforms Included:	Adult common carotid, stenotic carotid, femoral, aortic. Fetal middle cerebral artery, renal artery, umbilical artery. Pediatric descending thoracic artery, patent ductus arteriosus. Test waveforms: Sine waves with peak speeds of 100, 150, and 200 cm/second. Triangle waves with peak speeds of 100, 150, and 200 cm/second. Stepped ramp wave with stops at 0, 20, 40, 60, 80, and 100 cm/sec.
Waveform Resolution:	Each waveform simulation contains 1000 points of resolution, or speed adjustments, enabling extremely complex simulation.
Computer Interface:	Industry standard RS-232 interface built-in for future enhancements and remote control. Very useful for automated quality control in a manufacturing environment.
Fluids Used in Tank:	Plain tap water (velocity 1480 meters per second at 20 degrees C) or velocity corrected water/glycol solution giving 1540 meters per second at 20 degrees C. Phantom adjusts itself for either fluid.
Physical Specifications:	120 Volts AC, 50 Watts. Total weight in travel case: 22 lbs. (10Kg). Travel case dimensions: 17" x 17" x 10" (25 x 19.5 x 14 cm).
Tank dimensions:	10" x 12" x 9" deep (25 cm x 30 cm x 23 cm).