

# Echomac<sup>®</sup> VM

## Velocity Measurement to Assess Nodularity in Ductile Iron Cast Automotive Components



As the use of nodular graphite iron material has expanded in recent years for automotive safety parts, ultrasonic velocity measurement provides an industry accepted, reliable means of verifying the material integrity of the part. Unacceptable degrees or variations in Nodularity, a type of graphite structure that can develop during the production process, can attenuate the velocity of sound waves passing through the material. The Echomac<sup>®</sup> VM measures the sound velocity and, using known limits, reports whether the part is acceptable.

# Simple, Effective Instrument to Test Velocity

## Echomac<sup>®</sup> VM Features

- ❑ Operates with either full immersion or bubbler couplant technology.
- ❑ Test two parts simultaneously in separate test stations using one instrument.
- ❑ Evaluate Velocity, Thickness or Flaw detection.
- ❑ Standard configuration has 2 Velocity channels and 2 Flaw channels with an option for 4 additional Flaw channels.
- ❑ Industrial hardened I/O connections are protected from the environment.
- ❑ Enclosure includes a closed loop heat exchanger to ensure proper operating temperature and protection from the outside environment.
- ❑ Dual Screen view displays test results for two parts.
- ❑ Easy to read Velocity Application screen.
- ❑ Trend Chart display and built in Data Logger.
- ❑ Automatic or manual testing.
- ❑ Less than 2 second evaluation time.



Live A-scan during test

The new Echomac<sup>®</sup> VM Velocity Measurer is designed and manufactured by Magnetic Analysis Corp., a US based leader in supplying NDT instruments, systems and service for more than 85 years.

[www.mac-ndt.com](http://www.mac-ndt.com)

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## Echomac<sup>®</sup> VM Instrument Technical Data

### **PULSER**

<b>SPIKE VOLTAGE</b>	500 Volts into 50 $\Omega$ , adjustable 0 to 100% in 1% steps
<b>RISE TIME</b>	10 ns or less
<b>DAMPING</b>	50 $\Omega$ OR 200 $\Omega$
<b>REPETITION RATE</b>	0.8 TO 15 kHz per channel, adjustable in 0.1 kHz steps
<b>PULSE DELAY</b>	1 to 1000 $\mu$ s steps, adjustable in 1 $\mu$ s steps
<b>PROBE TYPE</b>	Through Transmission

### **RECEIVER/AMPLIFIER**

<b>BAND WIDTH</b>	0.4 to 30.0 MHz
<b>GAIN</b>	0 to 60 dB, adjustable in 0.25 dB steps
<b>DIFFERENTIAL GAIN</b>	Adjustable in the full gain range for each gate interval
<b>HIGH PASS FILTER</b>	0.4 MHz cutoff frequency
<b>LINEAR REJECT</b>	Digital (adjustable from 0 to 40% in 1% steps)

### **EVALUATION**

<b>DIGITIZER</b>	100 MHz base sampling rate 400 MHz TOF resolution
<b>RECTIFICATION MODES</b>	RF Gating
<b>VELOCITY RESOLUTION</b>	0.0003 inches/ $\mu$ s 0.007 km/s
<b>VELOCITY RANGE</b>	500 to 20,000 m/s
<b>THICKNESS RESOLUTION</b>	0.0025 $\mu$ s 0.0003 inches in steel 0.0076 mm
<b>MEASUREMENT TECHNIQUES</b>	Flank
<b>MEASURING RANGE</b>	2.5 to 500mm (in steel)

### **A-SCAN DISPLAY**

<b>MODES</b>	FW, PHW, NHW and RF display
<b>GATES</b>	Bar display
<b>DAC CURVE</b>	16 segment, no width limitations, any segment can be increasing or decreasing, mouse drag adjustment
<b>RANGE</b>	1 $\mu$ s or greater
<b>DEPTH</b>	500 points
<b>DELAY</b>	-10 to +499 $\mu$ s
<b>TRIGGER MODES</b>	Initial pulse (IP) or interface echo (IF) with delay
<b>TRACES</b>	1,2,4, or all (overlaid on baseline)

## **GATES**

<b>NUMBER</b>	1 interface and 4 measurement
<b>LIMITS</b>	Min velocity and max velocity Or Min thickness and max thickness
<b>SYNCHRONIZATION MODES</b>	Initial pulse (IF) or interface echo (IP)
<b>MEASUREMENTS</b>	Component velocity Min, max, and average velocity Component thickness Limits evaluation (alarms)
<b>RANGE</b>	0.1 to 500 µsec
<b>DELAY</b>	0.04 to 499 µsec

## **OUTPUTS**

<b>OPTO ISOLATED LOGIC &amp; SOLID STATE RELAYS</b>	Reject on Min/Max Velocity or Flaw Accept Load Part No Test
<b>ANALOG PART THICKNESS</b>	5 volts full scale (12 bit)
<b>VELOCITY TEST CYCLE TIME</b>	greater than 2 seconds for complete test cycle

## **NETWORK**

<b>NETWORK</b>	10/100 Ethernet. TCP/IP, Remote application can control test parameters and view signal waveforms.
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## **COMPUTER**

<b>COMPUTER</b>	Intel dual core process. Ethernet, 120 GB FD, keyboard, mouse, USB ports, Windows 7 Professional
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## **OPERATING CONDITIONS**

<b>AC POWER REQUIREMENT</b>	Under 500 VA from a 115 V or 230 V, 50 or 60 Hz line
<b>ENCLOSURE</b>	Standalone computer enclosure with integrated monitor. These units come with electric coolers
<b>WEIGHT</b>	46 lbs. (20.87 kg)
<b>DIMENSIONS</b>	24"L x 12"H x 12"D (61cm x 30.5cm x 30.5cm)
<b>OPERATING TEMPERATURE RANGE</b>	0 to 50 degrees C (32 to 122 degrees F)

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# Echomac<sup>®</sup> VM Automated Test System

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Velocity Measurement to Assess Nodularity in  
Ductile Iron Cast Automotive Components



# Echomac® VM Test Tank

The Magnetic Analysis Echomac® Velocity test tank and instrument is designed to provide high speed ultrasonic velocity testing for verifying the percentage of nodularity in ductile automotive safety parts. The system operates by manually loading the parts into the test fixture, the part is tested, stamped if good and automatically ejected into the appropriate area.

The Echomac® VM Test tank is constructed as an industrial hardened package for years of trouble free use in the demanding environment that foundries offer. The system is supplied with the Echomac® VM . computer based ultrasonic velocity instrument. The system consists of a heavy duty steel immersion tank, removable part fixture, automatic part ejection mechanism, air stamper for marking good parts and full PLC control for managing the system and ensuring operator safety.

## Features:

- ❑ Manual load with Sorted Automatic Ejection of the test parts
- ❑ Automated air stamping of all passed parts
- ❑ Fully contained water system allows filtered recirculation during testing, couplant can be transferred to lower storage tank for fixture changes and maintenance
- ❑ Heavy Duty industrial design with hardened steel outfeed chute
- ❑ Highly accurate part placement fixtures constructed from hardened steel for long life
- ❑ Part testing speed typically 3-5 seconds (800-1200 parts per hour)
- ❑ Multiple tests per part for verifying Velocity, Thickness or Flaw detection
- ❑ Operates on 110 volts 50 or 60 Hertz
- ❑ Air and Electrical supply with quick disconnect

## Safety:

- ❑ Integral light curtain or dual hand palm switches ensure operator safety
- ❑ Sorting gate is defaulted to the failed part location to ensure only good parts are accepted

## Dimensions:

48" x 36" x 72" (121.9 cm x 91.4 cm x 182.9 cm)  
600 Lbs (272.15 kg), Forklift transportable

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