



# Echomac<sup>®</sup> FD-6

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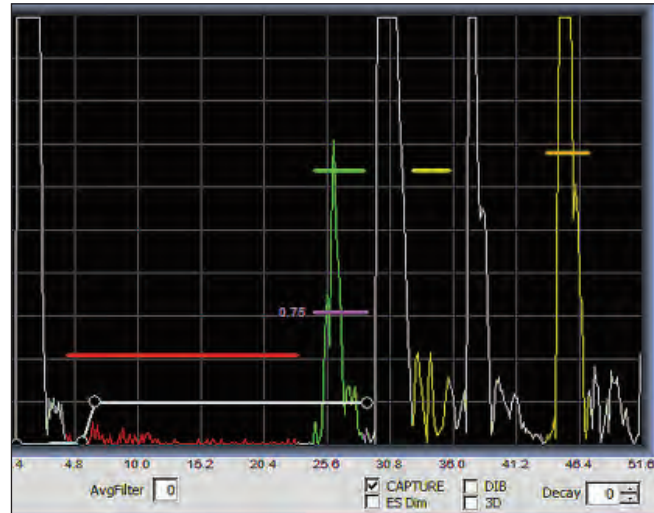
Ultrasonic Instrument for Flaw Detection, Thickness, and Dimensional Measurement in Tube & Bar



# Inspection Features

## Superior Performance

- Vivid, real time, flicker free full color display of test signals, thresholds and settings.
- Improved Signal-to-Noise.
- Improved repeatability of test results.
- Up to 32 Channels in one Instrument.
- 16 step damping adjustment for better resolution.
- Additional high and low pass filter.
- Negative square wave pulse echo or pitch-catch through transmission optimize transducer efficiency.
- Meets API, ASTM & EN standards.



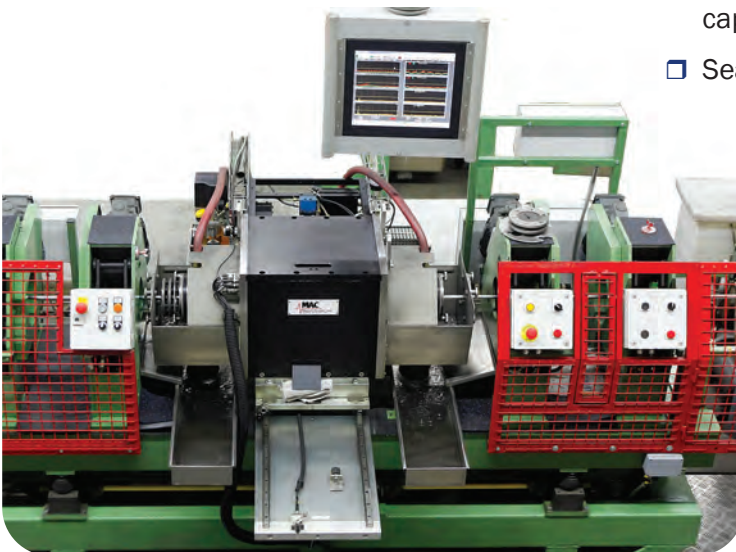
A-Scan display in the UT Screen shows the setup for Channel 1 with a gate interface and 4 gate thresholds.

Gate	? A	? B	? C	? D
Gate	<input checked="" type="checkbox"/> Gate A	<input checked="" type="checkbox"/> Gate B	<input checked="" type="checkbox"/> Gate C	<input checked="" type="checkbox"/> Gate D
Sync	IP	IP	IF	IF
Start	77.48	92.04	44.90	58.94
Width	8.32	9.10	8.06	10.14
Thresh	35	21	30	25
Gain	0.00	0.00	0.00	0.00
Pol.	POS	POS	POS	NEG
Count	1	1	1	1

Gate Dialog Box in the UT Screen

## Versatile, Intuitive Operation

- Set up and control all key test parameters on one screen with a click of the mouse or keyboard.
- Move thresholds by selecting and dragging on screen.
- Adjust parameters for several channels at once with the "Global" key. Or easily copy a group of test parameters from one channel to another.
- Follow up test results and supervise operators remotely.
- Versatile, robust recorder functions and comprehensive logging of results for tracking setups and recordings.
- Full tracking of end suppression, defect marking capability, and customizable data retention.
- Seamless Integration with existing mill operations.



Echomac® electronics installed with an Echomac rotary transducer unit to test stainless steel and titanium alloys in heat exchanger tubing

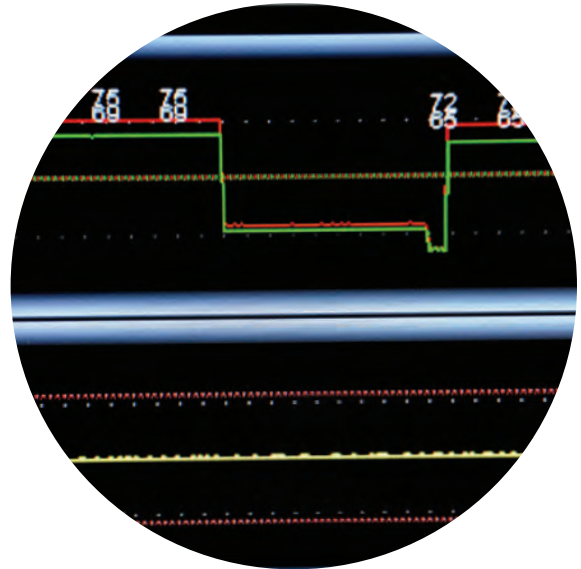
# Echomac Operation and Control

## Ultrasonic Control Panel - UT Screen

Provides full access and display of ALL ultrasonic test parameters. A-scan captures infrequent flaw echoes of short duration. Up to 4 measurement gates can be employed for each channel with graphic adjustment, live peak and other relevant test results are displayed real time. A Strip Chart provides an elapsed time linear display. All parameter settings from one channel can be easily copied to additional channels or adjust globally.

## Multi Channel View - Multi Screen

Displays A-scan and Strip Chart of up to 32 individual channels or functional groups\*, simultaneously. The strip chart shows the peak captured signal levels in color highlighted outlines, along with the numerical peak measurement within each gate. Graphic editing of visual devices such as gate, DAC, and scope position provide convenient adjustment.



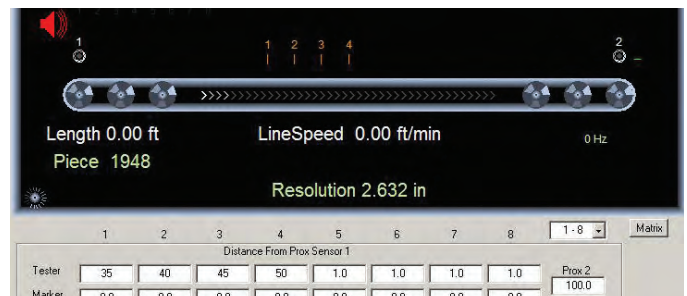
Multi Screen Strip Chart view of peak signal levels & numerical value

## Production Recorder - Chart & Batch Screen

Strip charting and defect logging of all events for up to 32 individual channels or functional groups\*, in both live or replay mode. Each chart clearly indicates Accept/Reject status. It also displays piece number and length, start time, date, line speed, and number of sample points taken. Batch screen manages record folders and production information input.

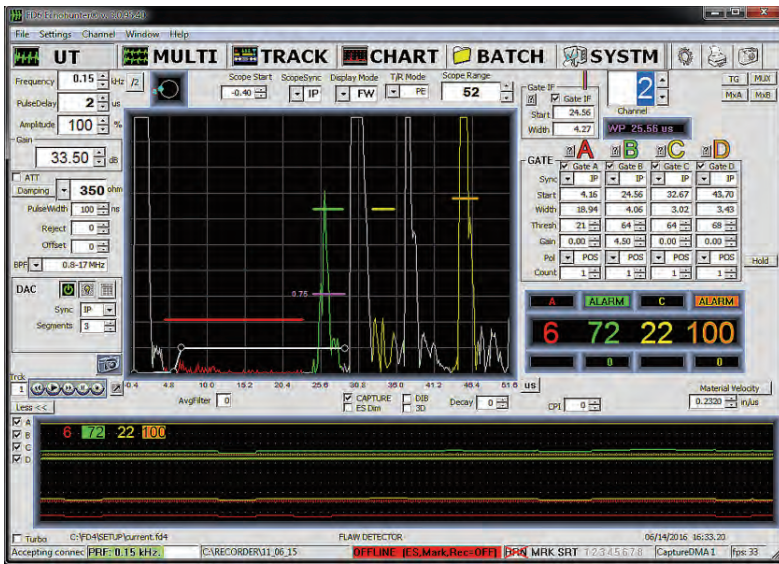
## Tracking System - Track Screen

Accurately track product through FD6 test channels so each channel can be properly set for end suppression and flaw tracking through an encoder or simulated timer clock. Track screen provides control for all the parameters relating to the production line, alarm matrix routing, output control and sorting criteria. Complex arrangement and multiple line speed calibration are employed.



\* A Functional group consists of channels with similar test functions such as channels for detecting longitudinal defects. These related channels are mapped into one chart for easy viewing, adjusting, or copying..

# Features of Echomac Electronics

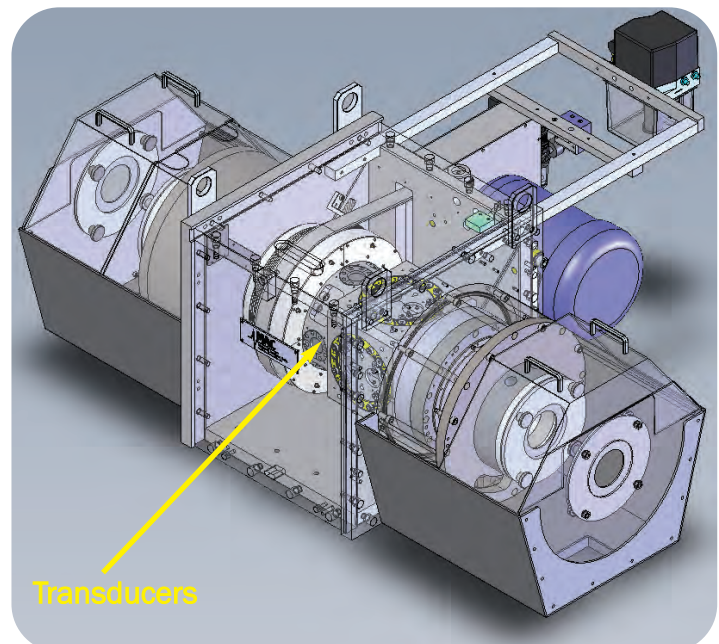


- ☑ Includes up to 32 independent test channels in a single computer.
- ☑ Increased Gain Range with fine resolution and improved linearity.
- ☑ User configurable criteria for flaw, lamination and thickness gauging, independently for each channel.
- ☑ Adjustable pulse firing sequence to avoid crosstalk in multi-channel applications.
- ☑ Four independent flaw gates for each channel with improved resolution.
- ☑ 15 segments distance amplitude correction (DAC).
- ☑ Improved DAC interface and resolution.
- ☑ Very high resolution thickness measurement for each channel.
- ☑ Programmable for Pulse Echo or Through Transmission.

## Echomac FD-6 Applications

- ☑ Inspect carbon, duplex, or stainless steels, aluminum, titanium, copper and other metals and alloys.
- ☑ Detect flaws and measure dimensions and wall thickness.
- ☑ Test tube & bar for internal defects and inclusions.
- ☑ Inspect for tube ovality and eccentricity.
- ☑ Inspect strip before welding.
- ☑ Upgrade and/or replace older ultrasonic testers & systems.
- ☑ Use with rotary, spin-the-tube, squirter, bubbler installations.

*Echomac® Rotaries rotate up to 32 transducers around the tube or bar, as it is moved through the test. Water is continuously circulated in the transducer housing to maintain the couplant for the UT signals.*





## Echomac® FD-6 Instrument Technical Data

### **PULSER**

<b>TYPE OF PULSER</b>	Negative Square
<b>PULSER VOLTAGE</b>	225 Vp, max @50 Ohms damping (adjustable from 0 to 100% in 1% steps)
<b>PULSE WIDTH</b>	30 to 500 ns (adjustable in 5 ns steps)
<b>DAMPING</b>	50 to 350 Ohms (adjustable in 20 Ohms steps)
<b>RISE TIME</b>	10 ns or less
<b>PULSE REPETITION FREQUENCY (PRF)</b>	10Hz To 15 kHz (adjustable in 10Hz steps)
<b>PULSE DELAY</b>	1 to 1000 $\mu$ s (adjustable in 1 $\mu$ s steps)
<b>MODES OF OPERATION</b>	Pulse-Echo or Through Transmission (Pitch-Catch)

### **RECEIVER**

<b>GAIN RANGE</b>	0 to 100 dB (adjustable in 0.1 dB steps)
<b>DIFFERENTIAL GAIN</b>	Adjustable in the full gain range for each gate interval
<b>FREQUENCY RANGE (-3dB)</b>	0.6 Hz to 27 MHz
<b>BAND PASS FILTER (-3dB)</b>	0.6-2.0 MHz, 0.8-17.0 MHz, 1.1-5.0 MHz, 2.0-10.0 MHz, 5.0-15 MHz, and 12-27 MHz
<b>INPUT IMPEDANCE</b>	1 k Ohms
<b>OSCILLOSCOPE DISPLAY</b>	FE, PHE, NHE and RF
<b>LINEAR REJECT</b>	Digital (adjustable from 0 to 40% in 1% steps)

### **GATE**

<b>NUMBER OF GATES</b>	4 x Measurement Gates and 1 x Interface Gate
<b>GATE SYNCHRONIZATION</b>	Internal Pulse (IP or Main Bang) or Interface (IF)
<b>DELAY AFTER INTERFACE</b>	None, Pre-trigger available
<b>GATE START RANGE</b>	20ns to 1000 $\mu$ s (adjustable in 10ns steps)
<b>GATE WIDTH</b>	20ns to 1000 $\mu$ s (adjustable in 10ns steps)
<b>DEFECT EVALUATION</b>	Alarm threshold (adjustable from 0 to 100% of FSH in 1% steps)
<b>ALARM LOGIC</b>	Positive or negative (independent on each gate)
<b>PEAK &amp; VALLEY DETECTION</b>	For positive alarm mode, the largest signal within the gate is held until it is recorded on strip chart In negative alarm mode, the smallest signal is held in a similar manner. Peak value is processed by hardware

### **DISTANCE - AMPLITUDE CORRECTION (DAC)**

<b>DAC CURVE</b>	15 segments, limited to 16k points per channel, with easy setup by dragging with mouse or operator entry in table
<b>DAC DYNAMIC RANGE</b>	0 to 80dB (Max. DAC Gain + Gate Gain + Main Gain = 100dB)
<b>DAC RESOLUTION</b>	10ns
<b>DAC UPDATE</b>	40dB/ $\mu$ s
<b>DAC TRIGGER</b>	Main Bang or Interface (with Pre-trigger)

### **THICKNESS CIRCUIT**

<b>THICKNESS RESOLUTION</b>	1ns approximately 0.00012" (~3 µm) for steel 1020 in PR mode (higher resolution for OD measurement)
<b>THICKNESS MODES</b>	Average and min/max capture for rotary
<b>ERROR DETECTION CIRCUIT</b>	An adjustable measuring gate limits thickness measurement to a specific location, prohibiting false readings from missing echoes. Slew rate control restricts measurements from rapidly changing from previous measurement in order to minimize false signals.
<b>ALARM THRESHOLDS</b>	Independently settable for minimum and maximum deviations from nominal values

### **A-SCAN DISPLAY**

<b>DIGITIZATION</b>	100 MHz, 8 bit, independent for each channel
<b>DEPTH</b>	500 points
<b>RANGE</b>	1 µs or greater
<b>SYNC</b>	IP or IF with delay
<b>PROCESSING</b>	Each channel has a dedicated ADC processor, and DMA engine for capturing and displaying consecutive traces. Specialized peak capture mode of operation is implemented in both hardware and software.
<b>PERSISTENCE/DECAY</b>	Previous traces can be shown in fading intensities to hold infrequent events. DIB processing mode allows much longer and infinite hold.

### **DIMENSIONAL MEASUREMENT**

<b>DIMENSIONAL MEASUREMENT</b>	Three-Transducer mode of operation for simultaneous measurement of OD, ID and wall thickness of tubes. Two transducers are located on opposite sides of the tubes; the third transducer has a fixed artificial target for water velocity compensation due to temperature variation. Eccentricity mode is available
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### **STRIP-CHART PRESENTATION & RECORDING**

<b>GENERAL</b>	Strip-charts are displayed on the monitor with the A-scan and setup parameters, or separately.
<b>NUMBER OF TRACES</b>	Any and all gates up to 32 channels
<b>RECORDING</b>	There are 32 recording channels and 4 gates
<b>REPORTING</b>	Summary reports containing number of pieces or length tested, number of rejects, date of test, material and customer information, are given at the end of a production run

### **TUBE & BAR TRACKING**

<b>TUBE &amp; BAR TRACKING</b>	Implemented in hardware. End suppression and defect marking are fast and high precision. Alarms Matrix fully configurable. Marking distance programmable up to 10k encoder pulses.
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### **COMPUTER**

<b>COMPUTER</b>	Industry standard IBM compatible, standard rack mount computer with Windows® platform
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### **NETWORK**

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

<b>AC POWER</b>	Under 800 VA from a 115 V or 230 V, 50 or 60 Hz line for an 8 channel installation
<b>ENCLOSURE</b>	Standard 19" rack-mount computer enclosure and rack mount monitor, typically housed in air conditioned cabinets. CE approved.
<b>WEIGHT</b>	55 lbs. (24.75 kg)
<b>OPERATING TEMPERATURE</b>	0 to 50 degrees C (32 to 122 degrees F)

*Specifications subject to change without notice. Echomac®, Echo-Hunter® and MAC® are registered trademarks of Magnetic Analysis Corporation, Elmsford, NY. Windows® is a registered trademark of Microsoft Corporation.*

Magnetic Analysis Corporation ~ 103 Fairview Park Drive- Elmsford, New York 10523-1544 USA ~ Tel: +1.914.530.2000 ~ info@mac-ndt.com

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

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