

Multiple Echo Technique

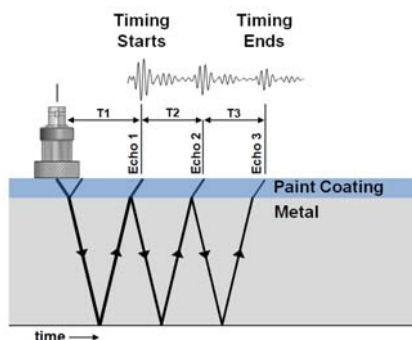
All Cygnus Thickness Gauges have the facility to use the Multiple Echo Measuring Technique with a single crystal probe. This provides, accurate, error-checked thickness measurements, ignoring coatings.

How it works:

A Thickness Gauge with a probe uses the time taken for echoes of sound to travel through a material and converts this into a thickness measurement. Multiple sound pulses are used hence the name "Multiple Echo Technique".

The first pulse of sound is sent into the material and the instrument then waits for this to return. The gauge sends a second echo and measures the time that has elapsed between the return of the first and second echoes. Simultaneously the gauge begins to time the third echo. The gauge then looks to match the timings between the second and third echoes. If these timings match exactly, the gauge will display a measurement. By matching the second and third timings, verification is made that the sound is coming from the same back-wall reflector.

The measurement displayed is an accurate thickness measurement. If the timings do not match, no measurement is displayed.



A single crystal probe (transducer) is used to measure in Multiple Echo. The crystal (element) both transmits and receives the sound

The 'multiple echo' beam travel is depicted in the diagram, spread out for time, to illustrate the timing method. The beam path is in fact straight, at 90° to the surface, and the ultrasonic energy reverberates up and down within the metal. Each time the echo is reflected back down, a small portion of the energy comes up through the coating, striking the probe which now acts as a receiver.

The delay between echoes at the probe face is exactly equal to the time taken to pass through the material (excluding the coating) twice, therefore coatings such as paint are ignored and the measurement displayed is of the metal thickness only.

Advantages of Multiple Echo:

The most obvious advantage is that coating and paint do not have to be removed and will not be included in the measurement displayed. Using Multiple Echo, Cygnus gauges can read through coatings up to approximately 6mm (0.24") thick. With the deep coat function this can be increased to 20mm (¾") of coating. A single crystal probe having a straight sound beam can be used to measure on curved surfaces. Changing the orientation of the probe doesn't affect the measurement.

As the timings between the second and third echoes have to match this ensures accurate, verified measurements. Ships surveys to classification standards usually specify Multiple Echo/Through Coating mode is required.

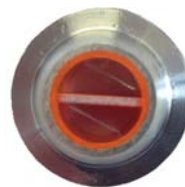
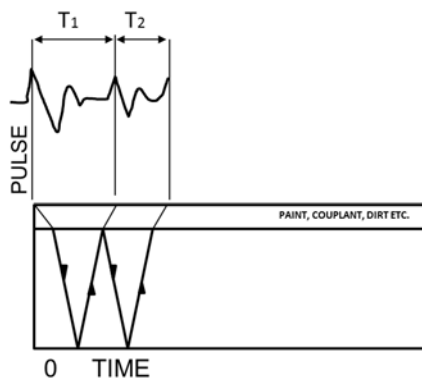


Echo-Echo Technique

The Cygnus + surface thickness gauge models and the Cygnus DIVE have the option to use them in Echo-Echo mode. This measuring technique is similar to Multiple Echo as it can be used to read through coatings without the need to remove them. The maximum thickness that can be measured through and ignored is 1mm. Unlike Multiple Echo though Echo-Echo uses a twin crystal probe.

How it works:

A Thickness Gauge with a probe uses the time taken for echoes of sound to travel through a material and converts this into a thickness measurement.



A twin crystal probe is divided into two semi-circular halves. One side transmits the sound pulse and the other receives. There is an acoustic barrier in the middle dividing the two halves.

The first pulse of sound is sent into the material from the transmitting side of the probe. The instrument then waits for this to return to the receiving side of the probe. The gauge sends a second echo and measures the time that has elapsed between the return of the first and second echoes.

As two echoes are used, a coating of paint up to 0.5mm thick can be ignored. The sound from a twin crystal probe travels at a slight angle creating a 'V-path'. This lengthens the distance travelled by the sound. The electronics in the gauge compensates for this with 'V-path correction' and so the thickness reading is unaffected.

MSI™ Measurement Stability Indicator

This feature helps ensure only stable measurements are displayed in Echo-Echo mode.

Advantages of Echo-Echo:

Echo-Echo can be used through coatings up to 0.5mm thick. Therefore these coatings do not need to be removed and reapplied. The focussed "V-path" helps to ensure a strong enough signal gets back the receiving side of the probe when used on painted metals with heavy back wall corrosion or pitting.

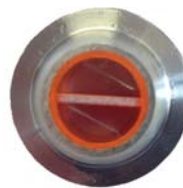
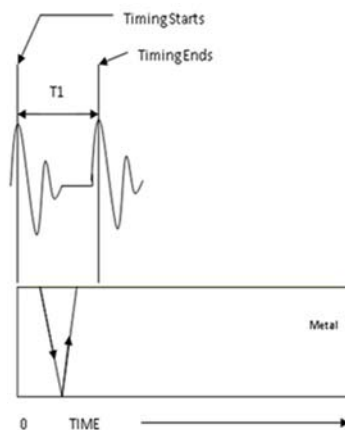


Single-Echo

The Cygnus + and the Cygnus DIVE Gauge thickness gauge models have the option to use them in Single-Echo mode using a twin-crystal probe. Using this measuring technique, any coatings or paint need to be removed before a thickness measurement is taken, otherwise their thickness is included.

How it works:

A Thickness Gauge with a probe uses the time taken for an echo of sound to travel through a material and converts this into a thickness measurement.



A twin crystal probe is divided into two semi-circular halves. One side transmits the sound pulse and the other receives. There is an acoustic barrier in the middle dividing the two halves.

A pulse of sound is sent into the material from the transmitting side of the probe. The instrument then waits for this to return to the receiving side of the probe.

As the sound from a twin crystal probe travels at a slight angle this creates a 'V-path'. This lengthens the distance travelled by the sound. The electronics in the gauge compensates for this with 'V-path correction' and so the thickness reading is unaffected by this.

MSI™ Measurement Stability Indicator

This feature helps ensure only stable measurements are displayed in Single-Echo mode.

Advantages of Single-Echo:

Single-Echo offers advantages when there is particularly heavy front and/or back wall corrosion. Ultrasound reverberates inside material being tested. Therefore using just one focussed beam, helps to keep this to a minimum. This is advantageous when used on:

- Irregular geometric shapes
- Highly attenuative materials e.g cast
- Plastic pipes, e.g. outfall & dredge pipes
- Applications with extremely heavy back wall pitting or corrosion

