

Understanding and Selecting Blanking Modes for the CEESCOPE™ and CEE ECHO™

The CEESCOPE™ and CEE ECHO™ can operate in three different blanking distance setup modes, a traditional MANUAL mode and two shallow-water specific modes, MINDEPTH, and ADAPTIVE. The echogram (water column and bottom profile) traces from the three modes are compared over an identical survey track collected using the CEE-USV™ unmanned boat with a draft of only 0.5ft (15cm). The differing bottom tracking behaviors as described here should be understood to allow selection of the most appropriate blanking mode for the survey. While the ADAPTIVE mode may allow the shallowest measurements overall, MINDEPTH results in cleaner data in very shallow water.

Introduction

The blanking distance is the zone directly below the transducer where all incoming sonar ping energy is ignored by the echo sounder. As the MAX DEPTH setting on the echo sounder may be considered the maximum depth that can be surveyed, the BLANKING distance plus the draft of the transducer is the minimum depth measurable. The principal reason for blanking is transducer ringing. As the transducer emits a sonar ping, the ceramic element vibrates to generate the sound pulse. The same ceramic element is used to detect the returning reflected ping, and the dissipating vibration from the emitted ping causes noise in the sonar data of the return. The transducer is essentially listening to itself. The ringing noise very rapidly decreases with time as the transducer element relaxes, and that time may be expressed as a distance below the transducer. The time / distance needed to prevent this noise interfering with the “real” sonar return is the minimum required blanking distance.

If the blanking distance is too short, the depth record will show excessive spiking to near zero as the echo sounder interprets the transducer ringing as a bottom echo return. If the blanking is properly set, there will be little or no spiking.

If the blanking distance is much longer than required, no issues will arise unless surveying in shallow water where the bottom depths above the blanking distance plus vessel draft will not be measurable.

As the water depth, turbidity or sonar ping absorption increase, the echo sounder automatically increases its output power to maintain a bottom track. As the power increases, the ringing noise from the transducer increases proportionally. This generally requires longer blanking distances for deeper water surveying.

The default blanking mode is MANUAL. This mode will be familiar to anyone experienced with the CEESCOPE, CEE ECHO or other echosounders on the market. The MANUAL mode is recommended for all surveys when the maximum depth is 10m (33') or deeper.

MANUAL Mode (1m / 0.5m Blanking Distance Input)

The blanking distance and mode are entered on the CEESCOPE™ and CEE ECHO™ LCD keypad through the “ES” menu screen 2 (high frequency, HF) and screen 4 (low frequency, LF). The shallow water-specific ADAPTIVE and MINDEPTH modes are available on the HF channel only. Older echo sounders without the ADAPTIVE and MINDEPTH modes may be user-upgraded with 2020 year or later firmware to gain these modes.

With the blanking mode set to MANUAL, the unusually long blanking distance of 1m (3.3ft) was first selected simply to demonstrate what happens when the bottom rises into the blanking zone under the transducer, as shown on Figure 1. Typically, in very shallow water when using the CEE-USV™ blanking distances are 0.2 – 0.4m (0.6 – 1.2 ft). Here it is obvious when the bottom enters the blanked zone, noise is generated as the echo sounder is unable to “see” the bottom and usable data disappears. The bottom is quickly reacquired when it is again below the blanking zone, however some lag is inevitable and lower vessel speed is beneficial during transitions out of blanked depth areas.

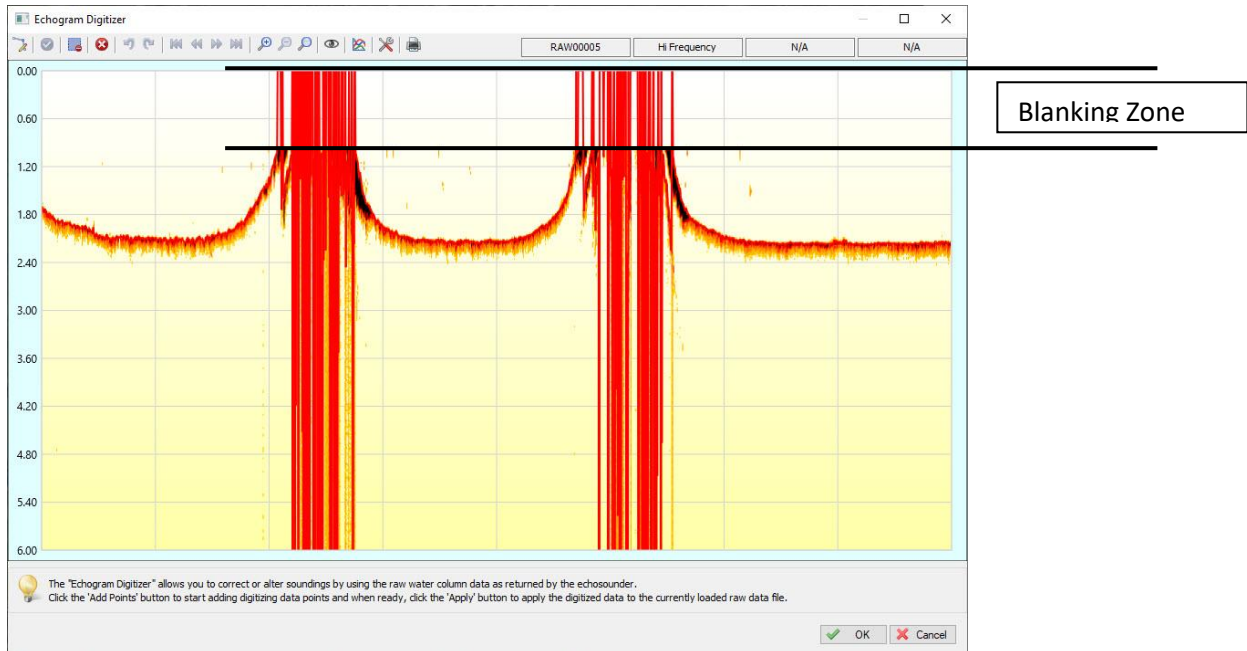


Figure 1. Water column echogram showing bottom tracking in MANUAL blanking mode (1m).



Figure 2. Map view of digitized depths in MANUAL blanking mode (1m).

Depending on the substrate type – hard versus soft bottom, there may be a double (or triple) echo present where the received sonar ping energy is reflected from the surface back down to the bottom and recorded after two transits through the water column. When the “real” bottom enters the blanked

zone, now all the echo sounder can see is the double echo return. While this double echo is below the blanking zone, often this will be tracked resulting in a consistent depth results at twice the real depth as shown on Figure 3. Note that the second echo can only be precisely double the actual depth when the transducer draft is zero.

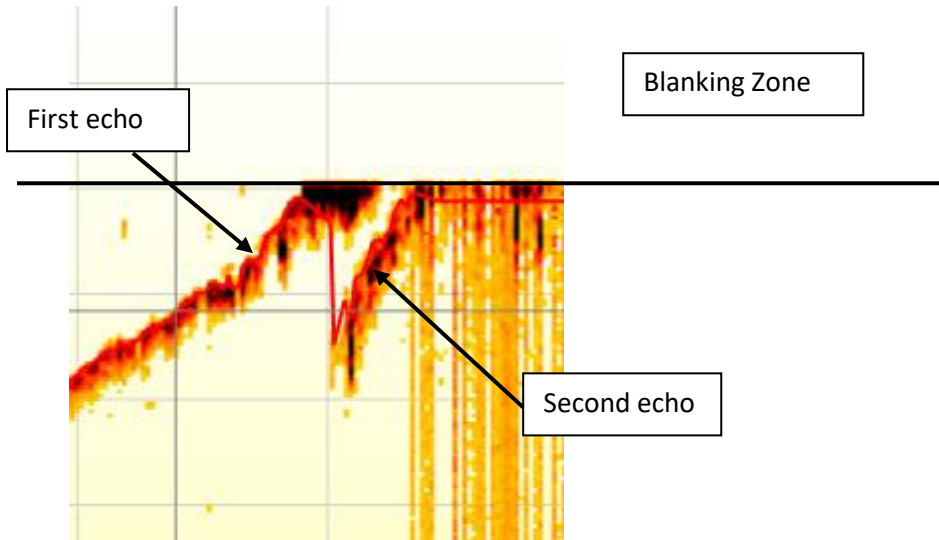


Figure 3. Water column echogram showing digitized depth return (red line) moving from the “real” bottom to a double echo return as the bottom enters the blanked zone.

Manual Mode (0.5m Blanking Distance Input)

Repeating the same track on MANUAL mode with a 50cm (1.6ft) blanking distance results in identical behavior but more of the bottom is accurately mapped as the 0.5 – 1m depth range may be “seen” by the echo sounder.

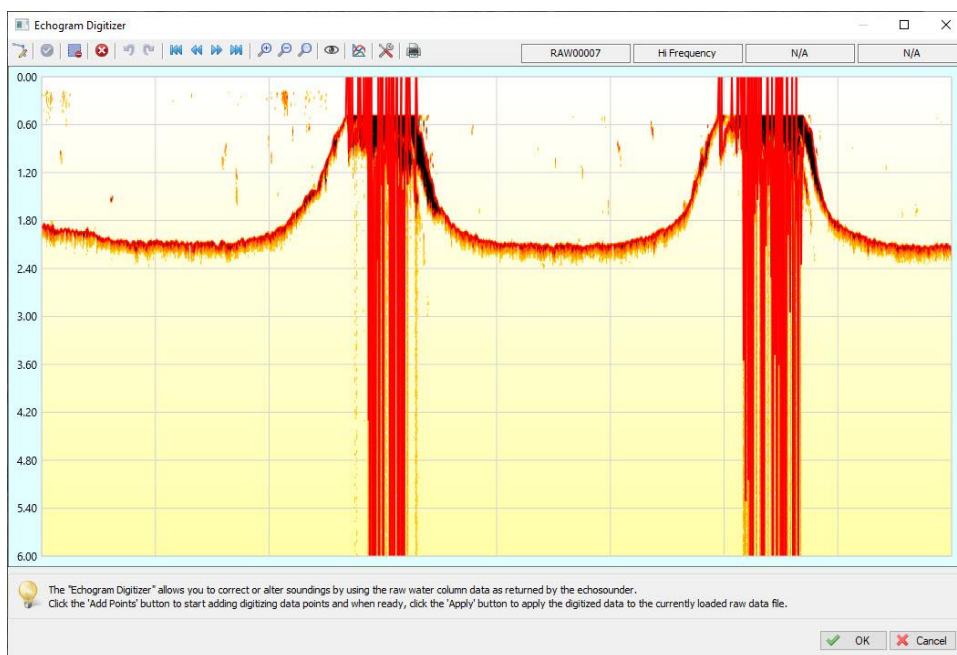


Figure 4. Water column echogram showing bottom tracking in MANUAL blanking mode (0.5m).



Figure 5. Map view of digitized depths in MANUAL blanking mode (0.5m).

MINIMUM DEPTH Mode (1m Blanking Distance Input)

The MINDEPTH mode requires a blanking distance input, however in this mode when the bottom is detected to move inside the blanking zone as set by the user, the depth output is reduced to zero. This eliminates the noisy data seen in the manual mode once the bottom depth is above the blanked distance. Editing of data in this mode is made easier as there is no despiking required, merely a removal of the zeroes.

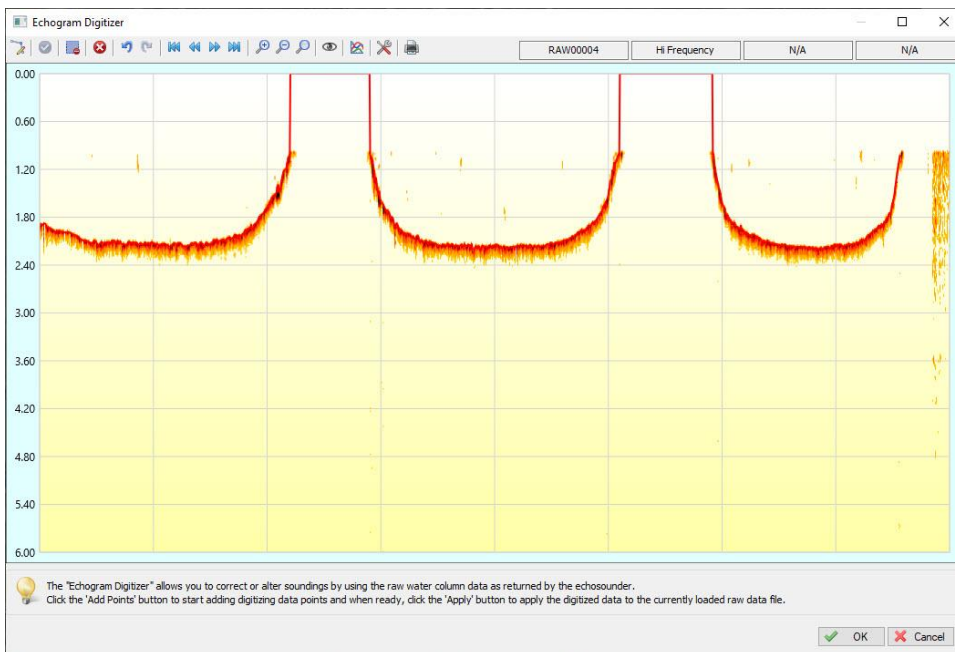


Figure 6. Water column echogram showing bottom tracking in MINDEPTH blanking mode (1m).



Figure 7. Map view of digitized depths in MINDEPTH blanking mode (1m).

Use of MINDEPTH with a short blanking distance will result in the cleanest data for very shallow water, obviously with the 1m blanking distance set in this example much of the survey data is lost! Often during USV surveys the boat will be working at the blanking zone limits and setting a short blanking distance – say 0.25m (0.8ft) with MINDEPTH mode will be an effective approach with clean data and maximum coverage.

ADAPTIVE Mode

When using ADAPTIVE mode there is no requirement for the user to set a blanking distance. The echo sounder automatically manipulates the blanking distance in accordance with the sonar ping characteristics. This allows the attainment of the minimum possible blanking distance according to the survey conditions. However, if the bottom depth enters the blanked zone, unlike the MINDEPTH mode there will be significant spiking until the bottom depth is reacquired.

On the example below, the boat was first driven so the bottom depth was always below the minimum measurable depth (A) in this case the bottom was tracked at around 25cm (0.8ft). On the second pass, the boat was deliberately beached (B) and then driven through water under 20cm (0.6ft) deep until the bottom was reacquired at about 40cm (1.3ft) depth.

The advantage of ADAPTIVE mode is the very minimum attainable depths can be measured.

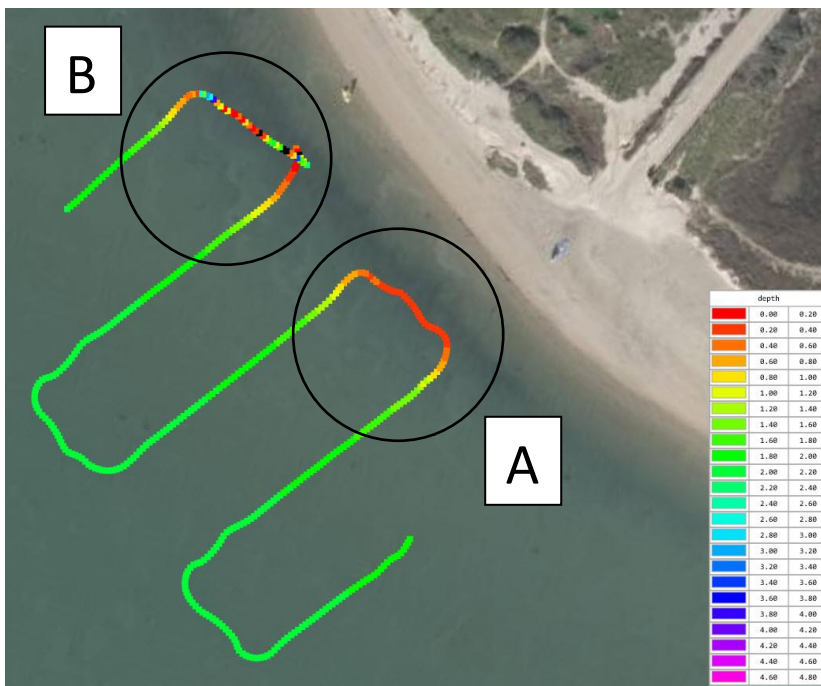
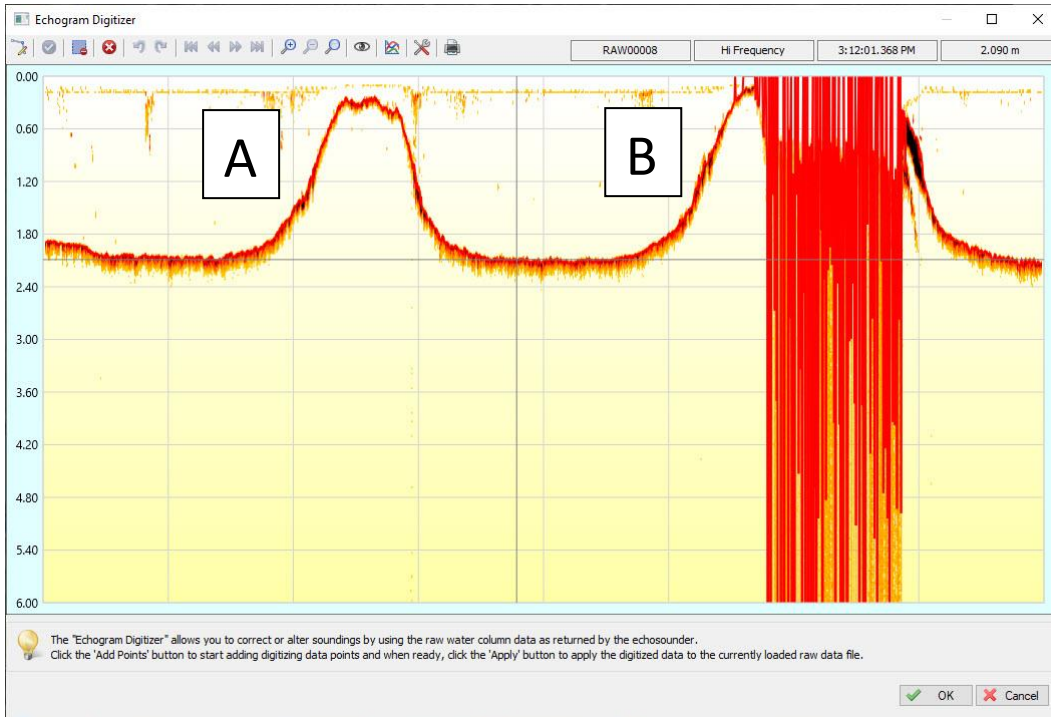


Figure 8. ADAPTIVE blanking mode with the bottom below blanked zone (A) and within blanked zone (B).