

Getting to the Bottom of CHIRP Technology

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Seminar Agenda

- Understanding CHIRP technology
- Learning the difference between CHIRP vs. NON-CHIRP transducers
- AIRMAR's CHIRP-ready transducer product line
- Getting the answers to your CHIRP questions



DEEPER.
BROADER.
CLEARER.

What is CHIRP?

- CHIRP has been used by the military, geologists and oceanographers since the 1950's
- This is the first time the technology has been available to the recreational, sport fishing and light commercial industry... and at an affordable price



CHIRP Starts with the Transducer

- AIRMAR transducers are the enabling technology for manufacturers designing CHIRP sounders.
- Only echosounders using AIRMAR CHIRP transducers can operate as a CHIRP system.
 - Furuno's DFF1-UHD
 - Garmin's GSD 26
 - Simrad's BSM-2
 - Raymarine's ClearPulse 450C

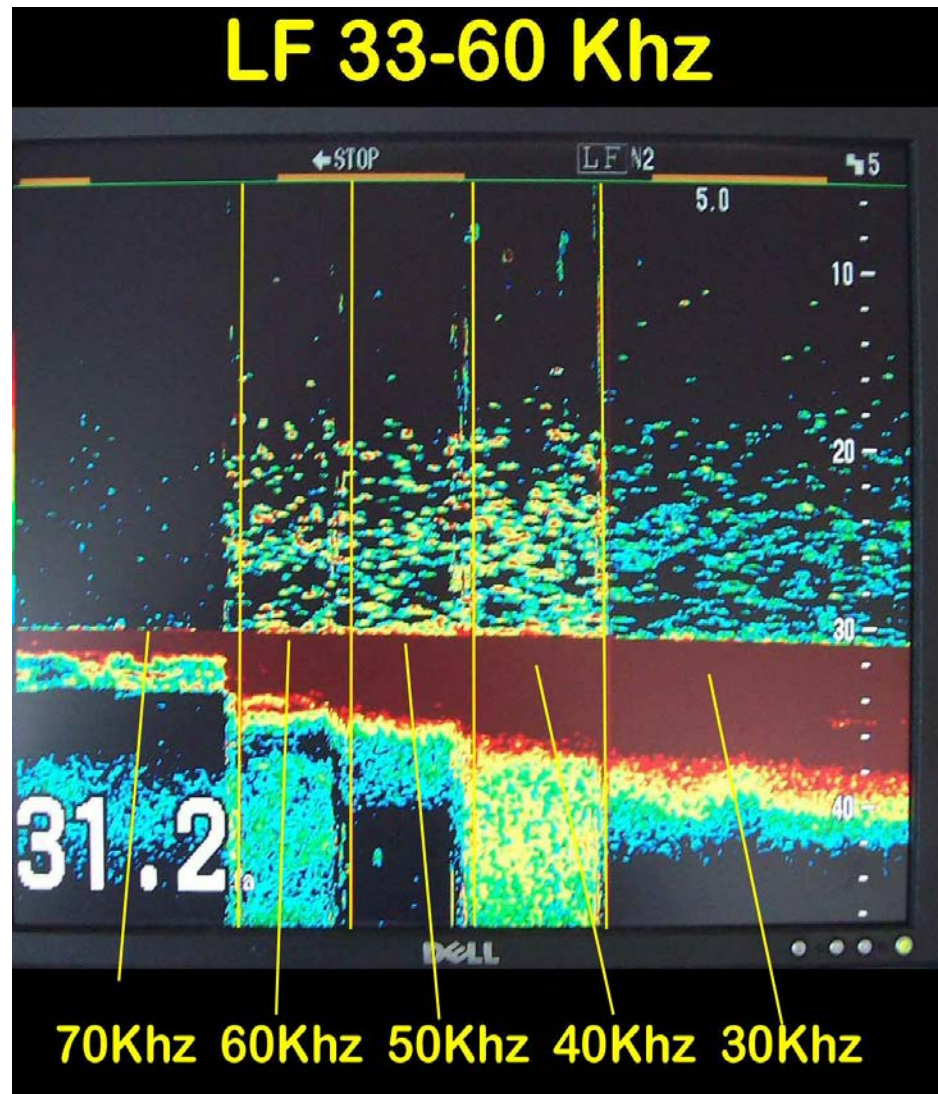


How Does CHIRP Work?

- CHIRP sounders transmit a long pulse across a wide frequency band
 - Traditional sounders operate at 50kHz and 200kHz. This limits what targets can be detected in the water column.
 - Any object(s) below the boat that are detected in the frequency band, will be seen on the display



Fish Imaging at different frequencies



CHIRP Starts with the Transducer

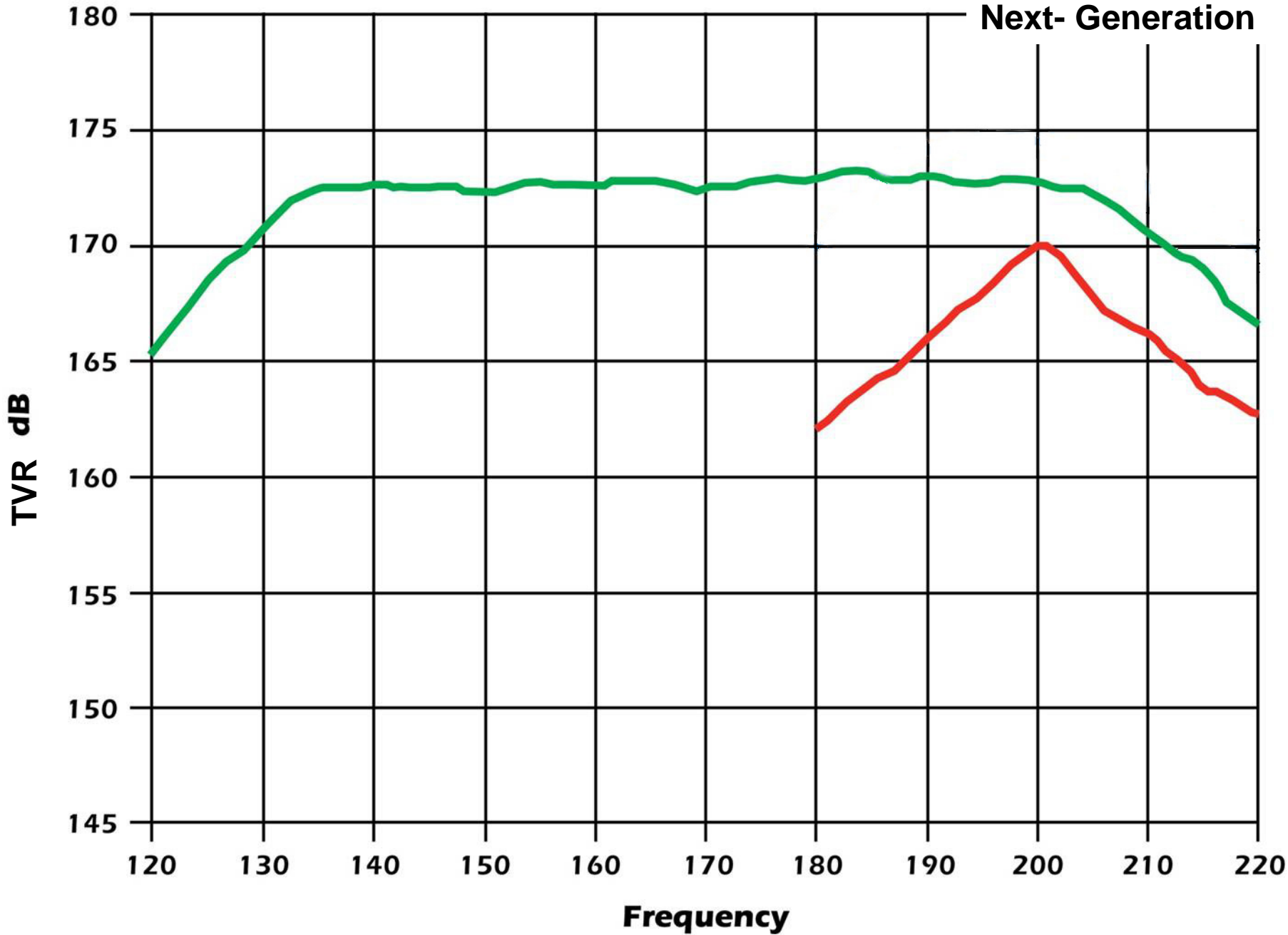
- AIRMAR's new CHIRP transducers are engineered with ceramics designed to operate over a broad range of frequencies (28kHz – 210kHz) with **no sensitivity loss.**



B260 Non-Broadband

B265LH FM & CHIRP

Next- Generation



CHIRP vs NON-CHIRP: What's the difference?

DEEPER.
BROADER.
CLEARER.

GAME CHANGING TECHNOLOGY.

CHIRP vs NON-CHIRP Fishfinders

- Non-CHIRP fishfinders operate at discrete frequencies of 50kHz and 200kHz
- Transmit pulse is only at a discrete frequency
- Typical Non-CHIRP fishfinders operate with a maximum duty cycle of 1% - meaning they transmit a voltage to the transducer no more than 1% of the time
- Consequently the transmit pulse can be high power but very short duration, limiting the total energy that is transmitted into the water column



CHIRP vs NON-CHIRP Fishfinders

- CHIRP sounders use a precise sweep pattern of many frequencies (28kHz – 210kHz) within a long-duration transmit pulse, sent to a CHIRP transducer.
- The equivalent sound energy transmitted into the water is 10 to 1,000 times greater than a conventional marine fishfinder. Resulting in **more energy on target**.
- Results are 5x greater resolution and depth capability than current fishfinders due to **the advanced signal processing of the return echo!**
- Key to the signal processing is knowing what they CHIRP signal looked like. “Pattern Matching”



CHIRP vs NON-CHIRP Fishfinders

- ONE transducer offers over 117 kHz of bandwidth, eliminating the purchase and installation of multiple transducers.
- Mix and match nomenclature:
 - B265LH/B265LM Thru-Hull: 42-65 kHz(L), 85-135 kHz (M), 130-210 kHz (H)
 - M265LH/M265LM In-Hull: 42-65 kHz(L), 85-135 kHz (M), 130-210 kHz (H)
 - TM265LH/TM265LM Transom-Mount: 42-65 kHz(L), 85-135 kHz (M), 130-210 kHz (H)
 - CM265LH/CM265LM Tank-Mount: 42-65 kHz(L), 85-135 kHz (M), 130-210 kHz (H)
 - PM265LH/PM265LM Pocket Mount: 42-65 kHz(L), 85-135 kHz (M), 130-210 kHz (H)

 - R509LH/R509LM Thru-Hull: 28-60 kHz(L), 80-130 kHz (M), 130-210 kHz (H)
 - R599LH/R599LM In-Hull: 28-60 kHz(L), 80-130 kHz (M), 130-210 kHz (H)
 - CM599LH/CM599LM Tank-Mount: 28-60 kHz(L), 80-130 kHz (M), 130-210 kHz (H)



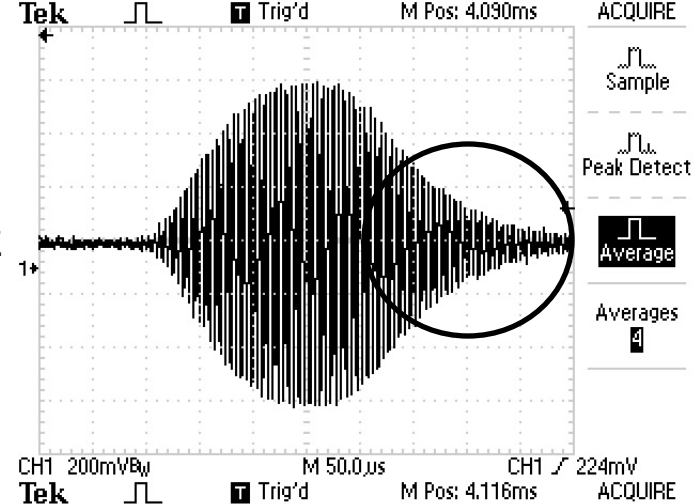
Understanding “Q”

- A transducer’s quality factor that describes the amount of bandwidth and the ringing of the ceramic element, or elements undergo when voltage is applied to the transducer.
 - Q is reported from a range of 1 to 35
 - The lower the Q, the better the performance.
 - A low Q transducer has more bandwidth.
 - Most competitors transducers have a Q ranging between 25-35.
 - AIRMAR transducers have a Q value ranging from 2 to 30.
 - **All of the transducers designed for use with CHIRP sounders have a Q of 3 or less.**

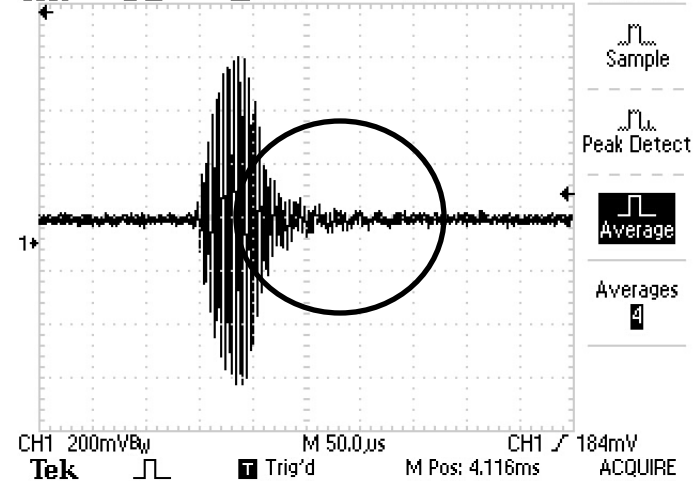


Real Data Echo Waveforms

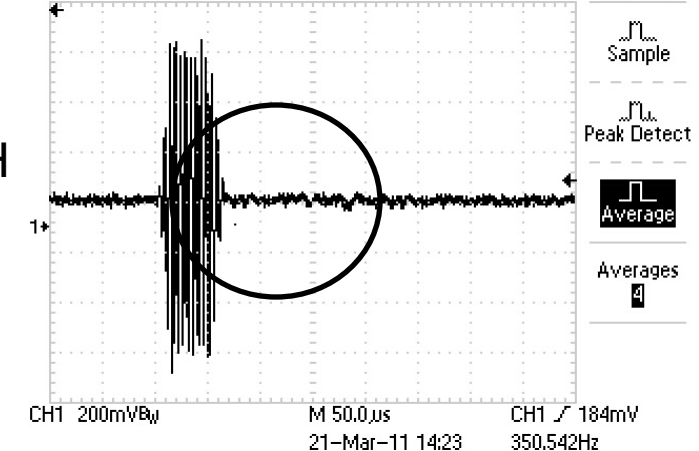
Transducer: P319
Frequency: 200 kHz
Q=31 Cycles: 35



Transducer: B260
Frequency: 200 kHz
Q=8 Cycles: 10



Transducer: R509LH
Frequency: 200 kHz
Q=2 Cycles: 10



Understanding “Q”

- A high Q means the transmitted acoustic pulse is extensively elongated
- A low Q means the acoustic pulse has minimal elongation, and closely resembles the drive waveform
- Q values range from 2 to 35
- With a high Q transducer, two close targets will blend together, and will not be displayed as individual targets

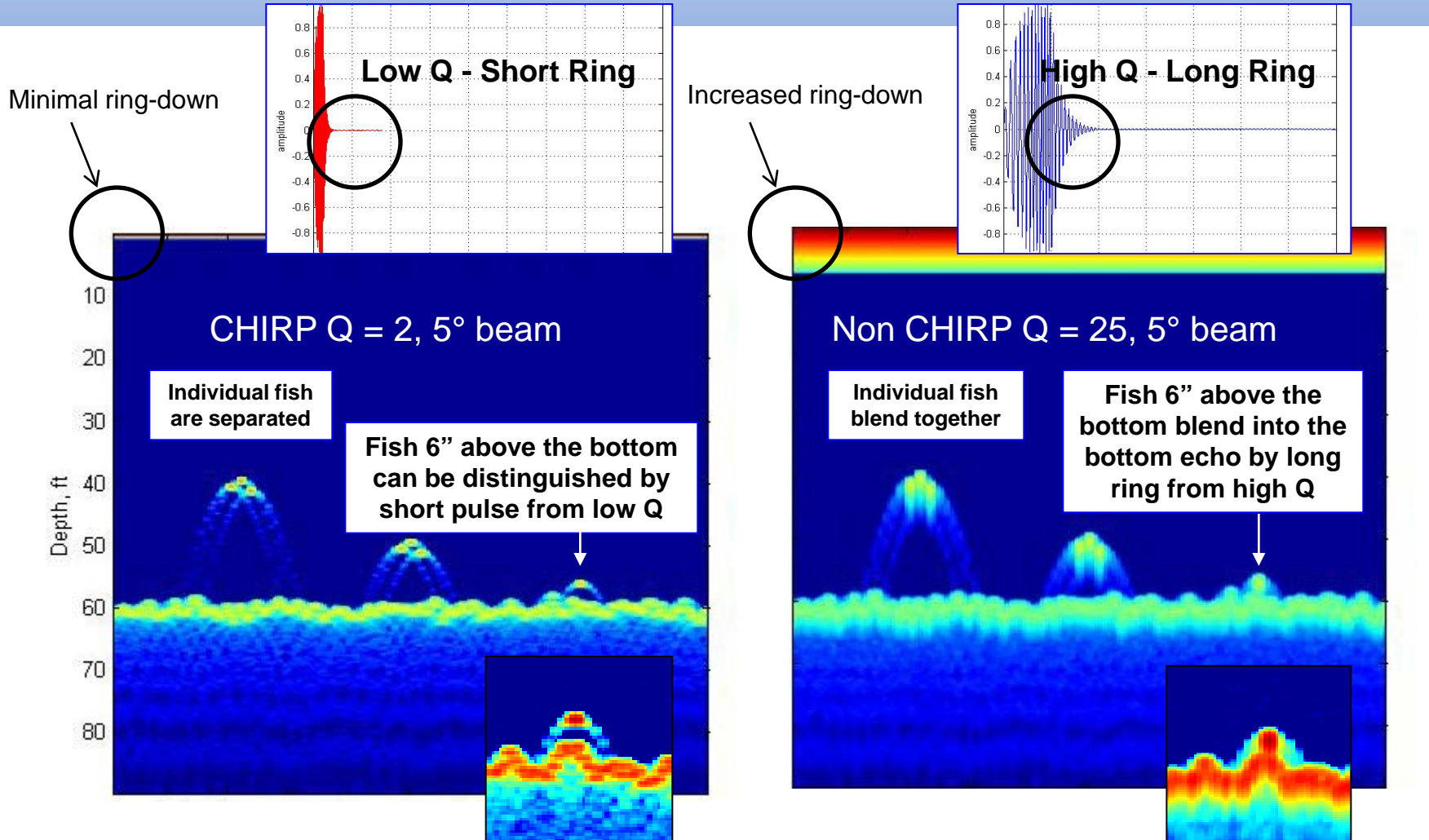


Understanding “Q” (Con’t.)

- With a low Q transducer, two close targets can be distinguished, and each target will be resolved on the display
- Transducers that are termed “Broadband” have Q’s of 2 or 3, and can also be used for CHIRP



Fishfinders with Low and High Q Transducers



Individual fish may be detected as close as 1" above the bottom

Echoes from fish 6" and less above the bottom blend in with echoes from bottom

Major Benefits of CHIRP Technology

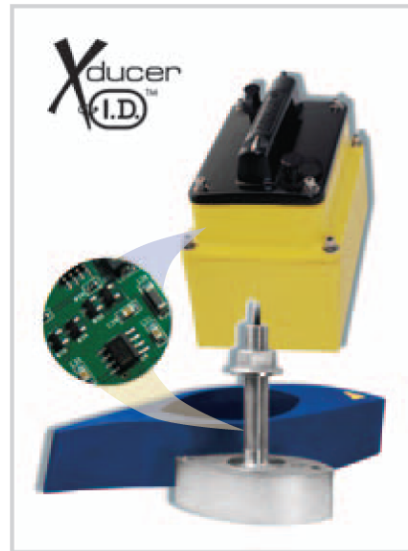
- 10 to 1,000 times more energy on targets
- 5 to 10 times greater detail and resolution
- Accuracy down to 3,000 m (10,000')
- Precise separation between bait fish and game fish
- Ability to pull targets from within the noise floor – better signal to noise ratio
- Improved bottom tracking at high boat speeds
- Low Q improve shallow water performance



Unique Transducer ID[®]

- All of AIRMAR's CHIRP transducers include a unique, patented Transducer ID[®]
 - measures and stores the operating parameters for each transducer

- Airmar part number
- Housing style
- Serial number
- Ceramic element configuration
- Date of manufacture
- Acoustic window
- Impedance matching configuration
- Nominal frequency(s)
- Best transmit frequency(s)
- Power rating
- Beam pattern



Unique Transducer ID[®]

- All of AIRMAR's CHIRP transducers include a unique, patented Transducer ID[®]
 - measures and stores the operating parameters for each transducer
 - enables the fishfinder to automatically configure itself to the transducer being used
 - minimal set up or customization is needed – transmitting across the bandwidth is done automatically by the sounder
- Stored data also assists with troubleshooting, warranty or required information about the transducer

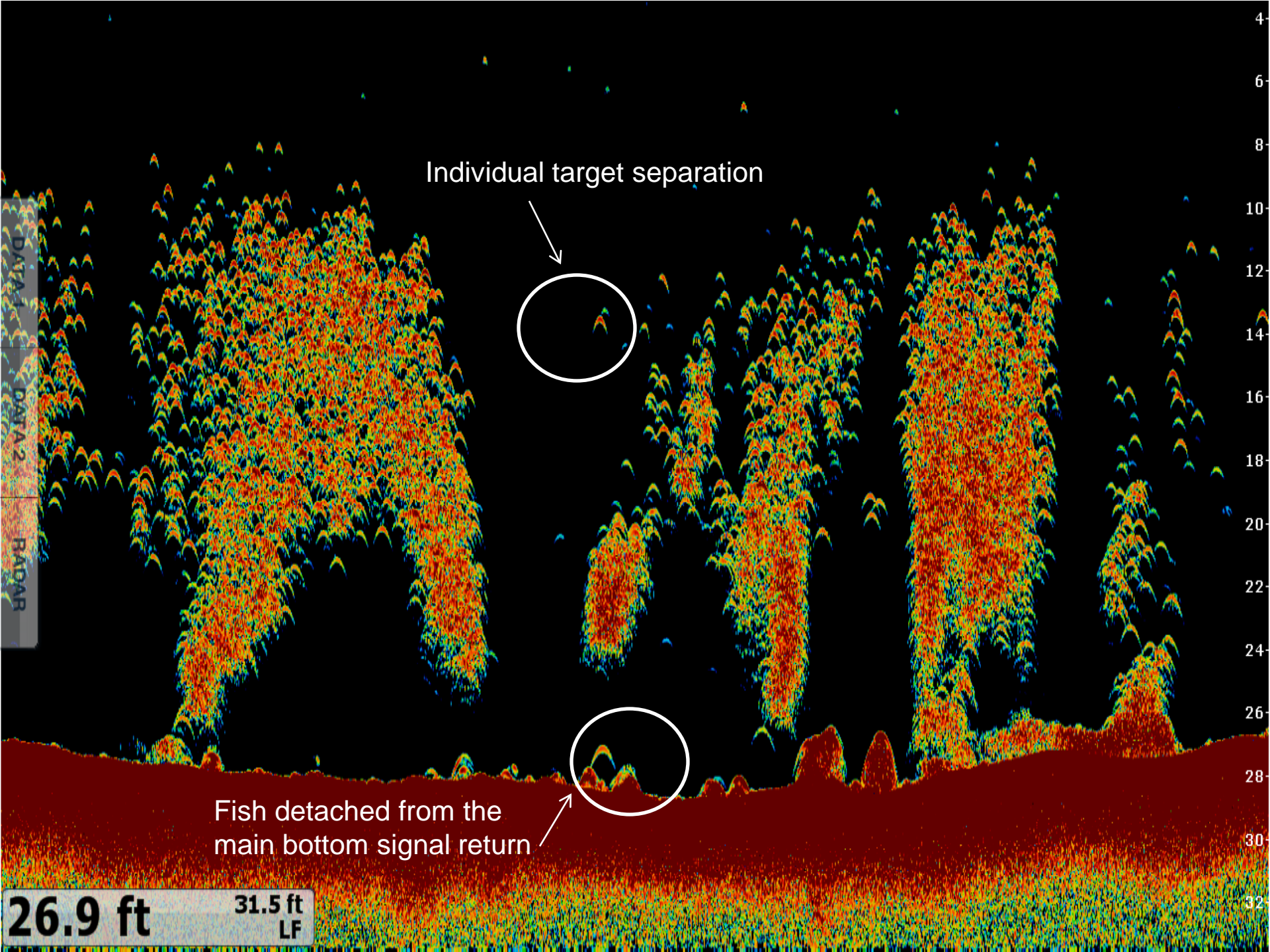


Example Screenshots:

Courtesy of Furuno, Garmin,
Raymarine & Simrad

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BROADER.
CLEARER.

GAME CHANGING TECHNOLOGY.



Individual target separation

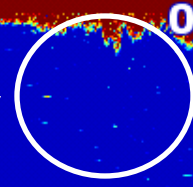
Fish detached from the main bottom signal return

26.9 ft 31.5 ft LF

DATA PART A 2 RADAR

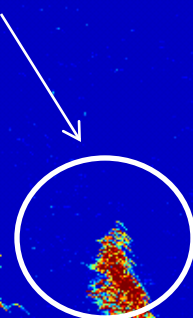
4
6
8
10
12
14
16
18
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22
24
26
28
30
32

233.1^f
64.38^{°F}
13.0_v

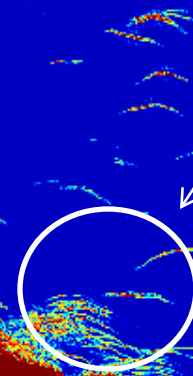


Minimal ring-down
resulting from a low Q

Incredibly sharp fish targets with
separation even in the dense shoals



Baitfish detached from the
main bottom signal return



GPS Speed
2.1^k_t
GPS Heading
168[°]_M

Auto Range
High Chirp

-/+ : Range | SELECT : Gain

50

100

150

200

250

288

Inicio

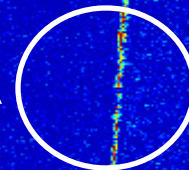
Mark

179.7 m

23.7 °C

12.8 v

Incredible resolution of such a small fish on the display in this depth



Veloc. GPS

0.0 ^k/_t

Rumbo GPS

334 °M

Rumbo

203 °M

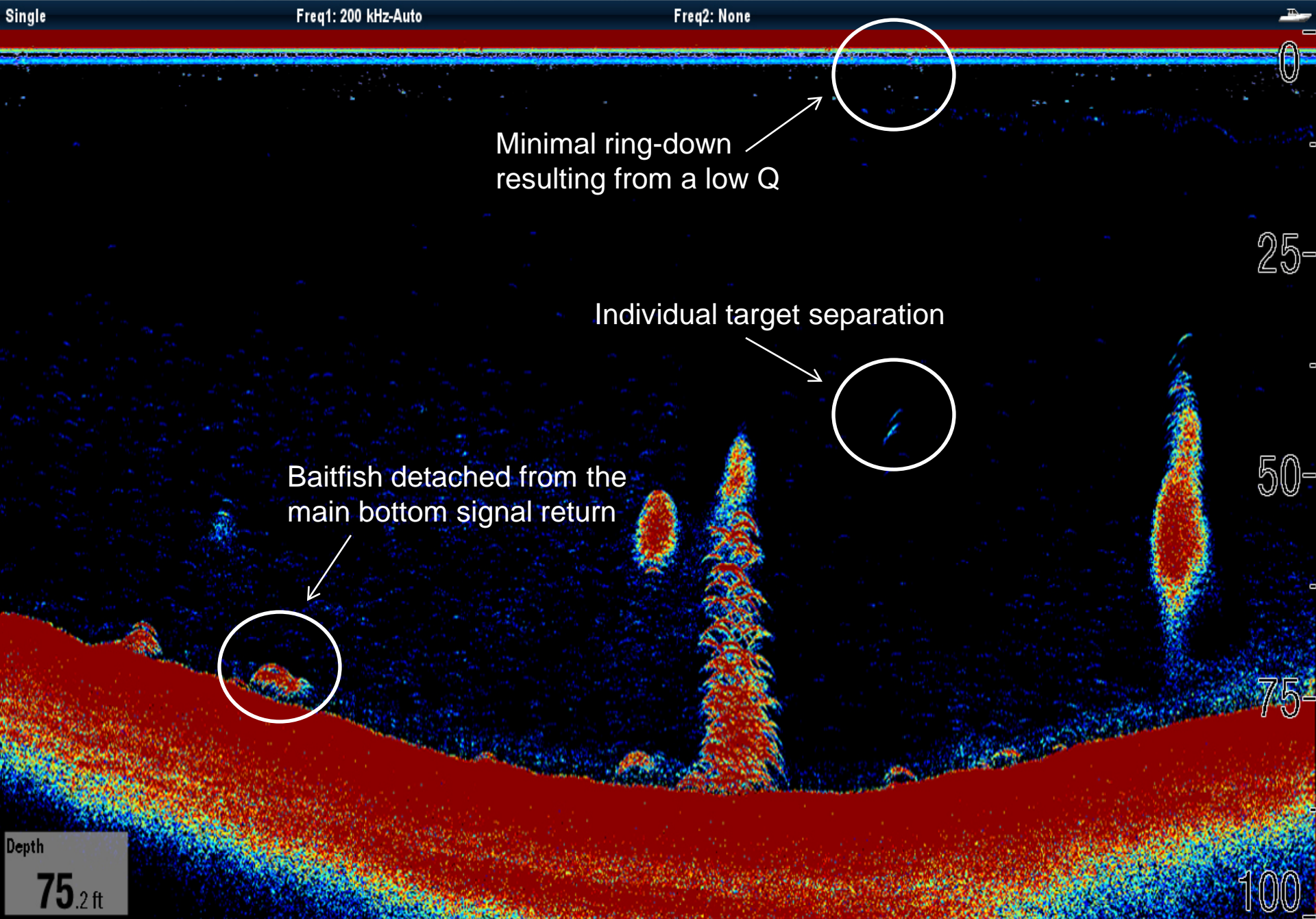
Desvío tray.

0.5 m

High Chirp



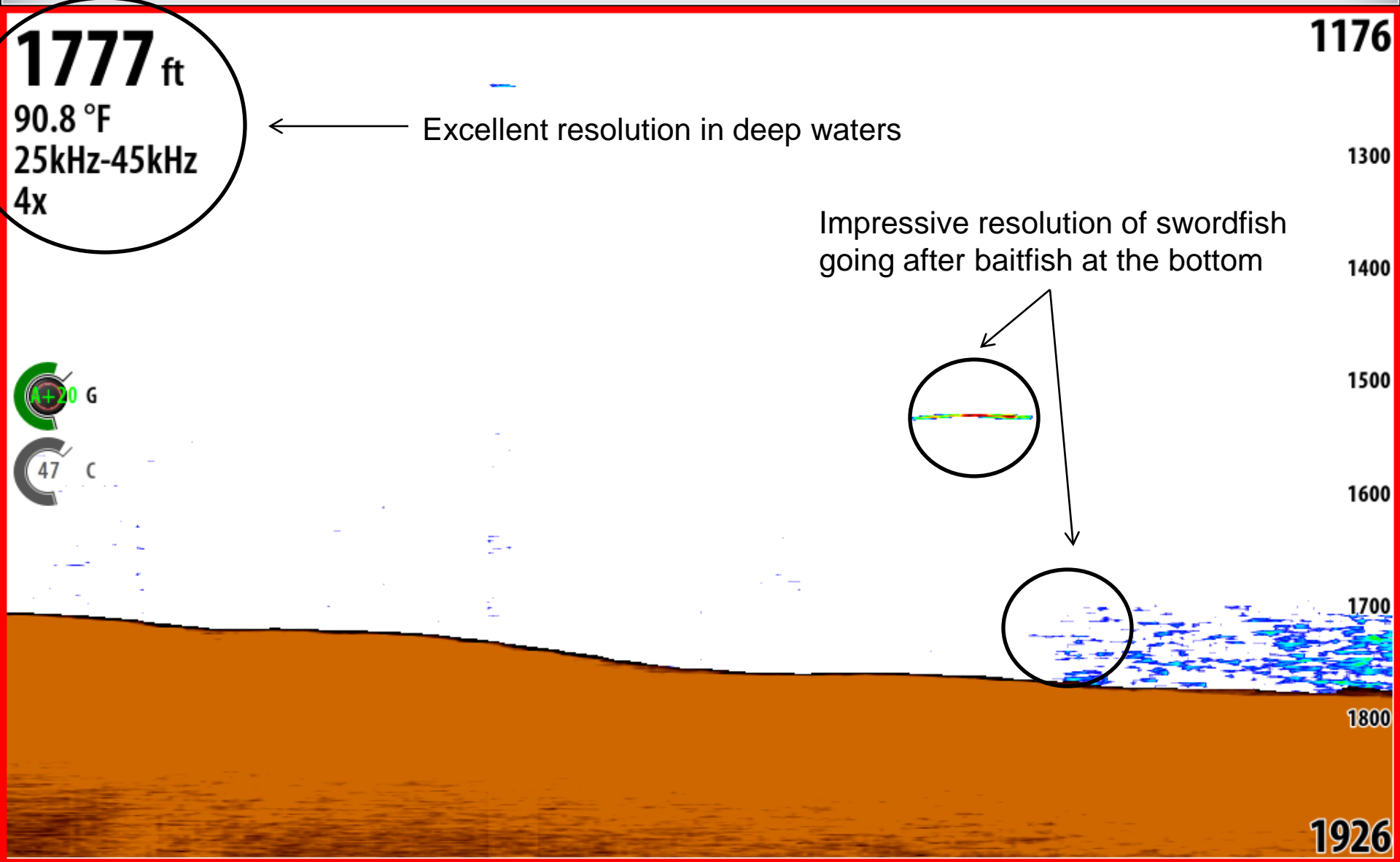
200



Minimal ring-down resulting from a low Q

Individual target separation

Baitfish detached from the main bottom signal return



1777 ft
90.8 °F
25kHz-45kHz
4x

← Excellent resolution in deep waters

Impressive resolution of swordfish going after baitfish at the bottom

+20 G
47 C



The CHIRP Product Line

DEEPER.
BROADER.
CLEARER.

GAME CHANGING TECHNOLOGY.

The Complete CHIRP Product Line

- CHIRP is available to ANY angler with ANY size boat
- Twenty-four (24) CHIRP transducers available in seven (7) different mounting options

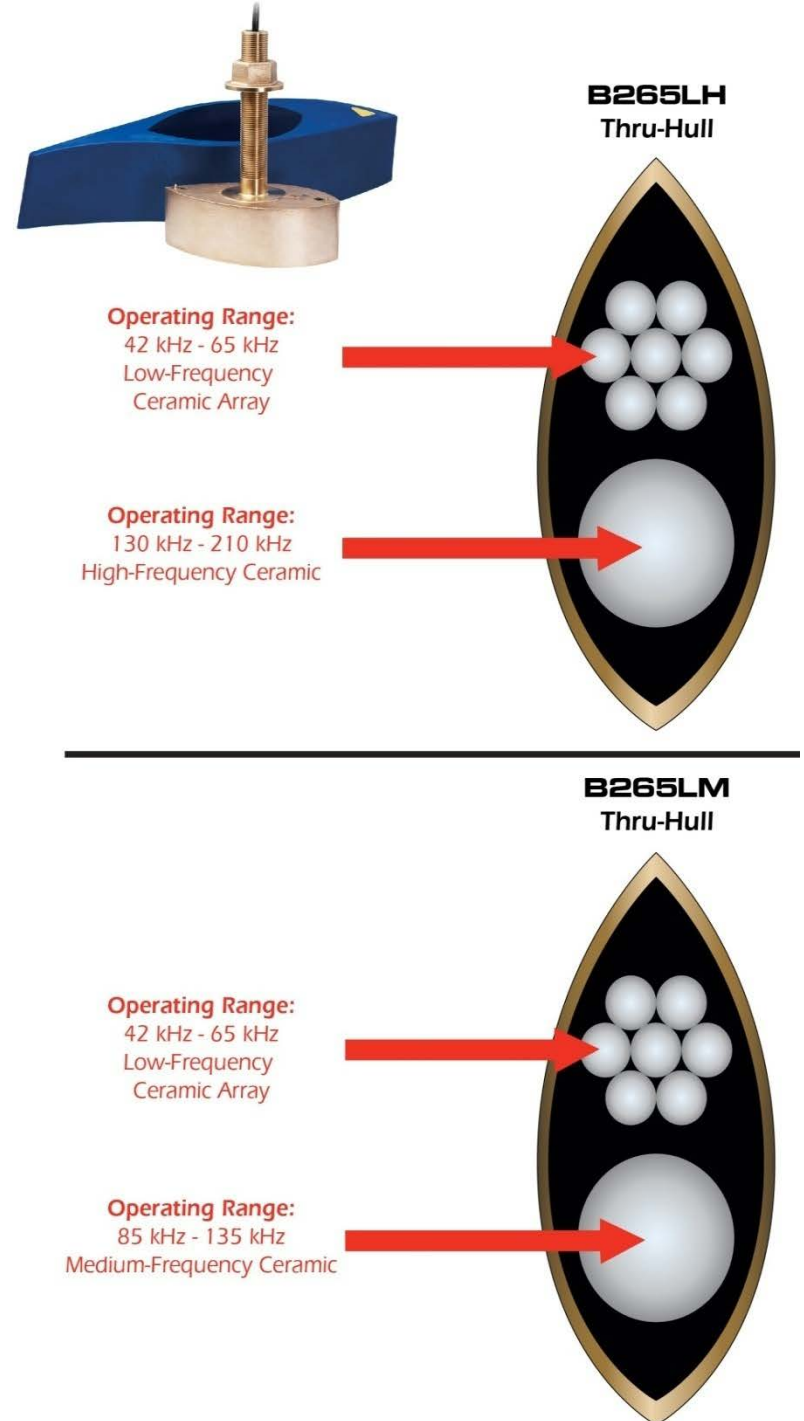


CORE

In hull, transom mount, tank mount, pocket and keel mount versions available.

LH model provides 103 kHz of bandwidth

LM model provides 73 kHz of bandwidth

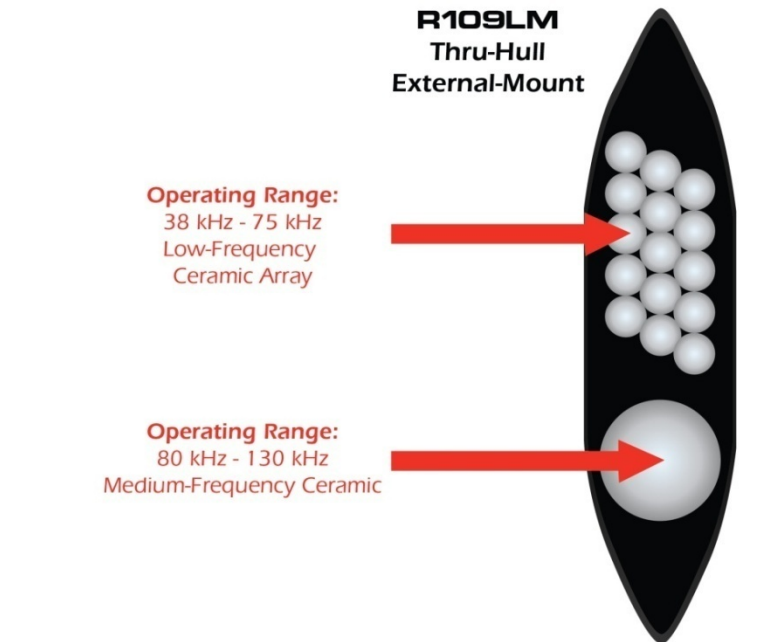
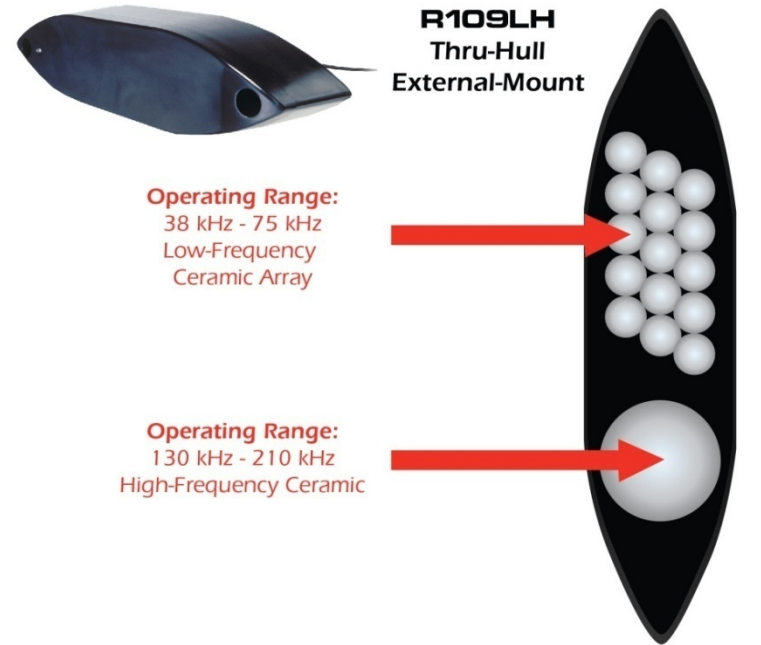


HARD CORE

In-hull and Keel/Pocket Mount options also are available

LH model provides 117 kHz of bandwidth

LM model provides 83 kHz of bandwidth

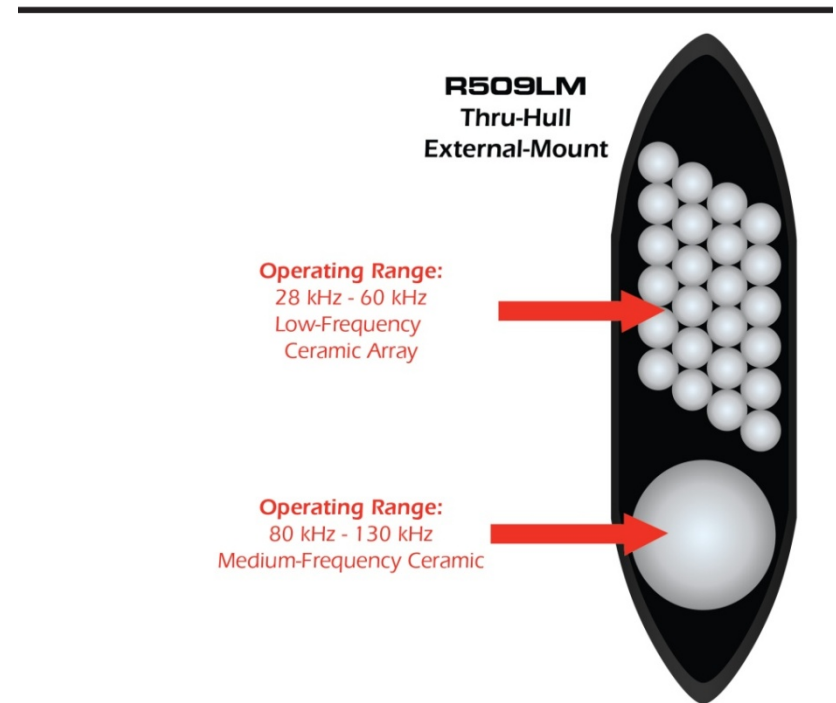
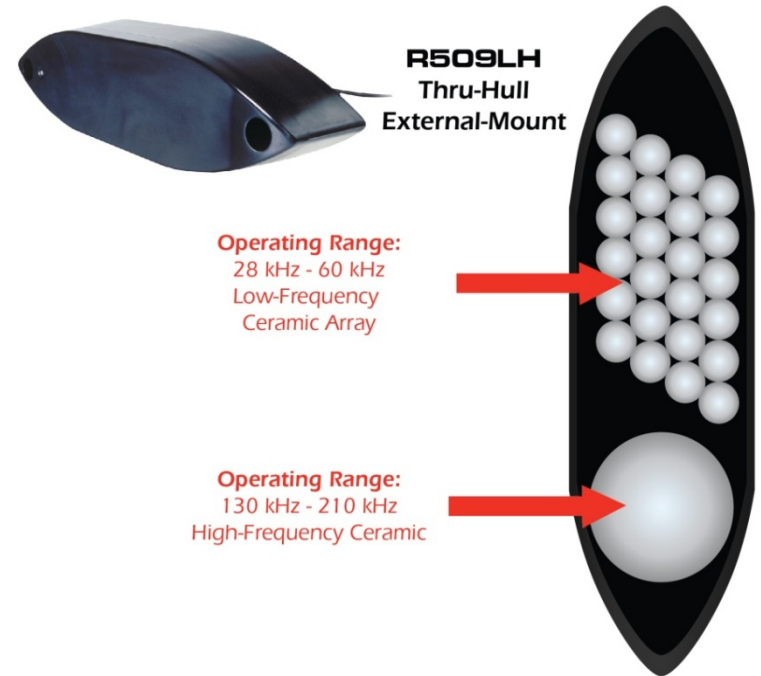


ELITE

In-hull and Keel/Pocket Mount options also are available

LH Model provides 112 kHz of bandwidth

LM model provides 83 kHz of bandwidth

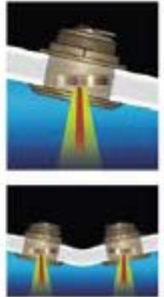
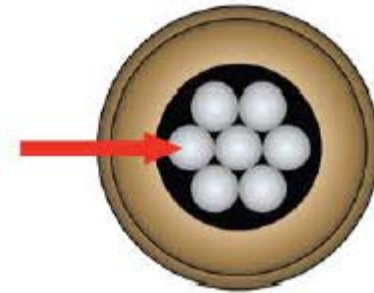


Core Products – Tilted Element



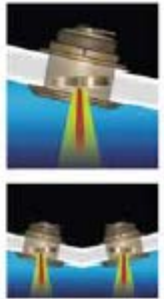
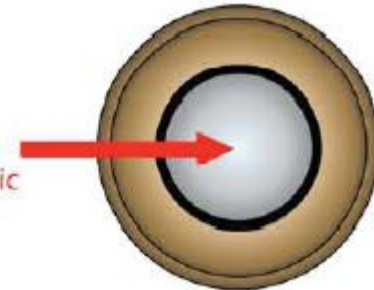
Operating Range:
40 kHz - 60 kHz
Low-Frequency
Ceramic Array

B175L
Tilted Element™



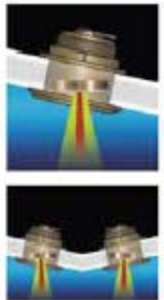
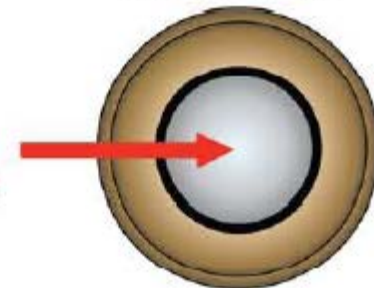
B175M
Tilted Element™

Operating Range:
85 kHz - 135 kHz
Medium-Frequency
Ceramic



B175H
Tilted Element™

Operating Range:
130 kHz - 210 kHz
High-Frequency
Ceramic



Price point Broadband

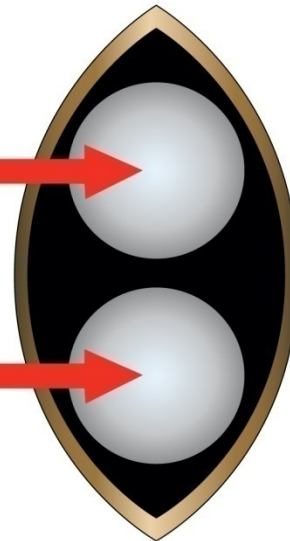


B765LH
Thru-Hull

Operating Range:
40 kHz - 80 kHz
Low-Frequency Ceramic



Operating Range:
140 kHz - 210 kHz
High-Frequency Ceramic

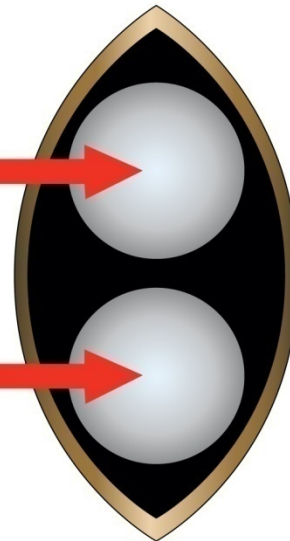


B765LM
Thru-Hull

Operating Range:
40 kHz - 80 kHz
Low-Frequency Ceramic



Operating Range:
80 kHz - 130 kHz
Medium-Frequency Ceramic



Advantages of the Middle Frequency

- 80 kHz – 130 kHz or 85 kHz – 135 kHz
- Better target resolution than low frequency band
- Ability to sound deeper than the high frequency band
- Covers popular fishing frequencies of 88 kHz & 107 kHz

Variations in Beamwidth

- **Low** – 28 kHz to 60 kHz provides 23° to 9° beamwidth
- **Low** – 38 kHz to 75 kHz provides 19° to 10° beamwidth
- **Low** – 40 kHz to 60 kHz provides 32° to 21° beamwidth
- **Low** – 40 kHz to 75 kHz provides 32° to 21° beamwidth
- **Low** – 42 kHz to 65 kHz provides 25° to 16° beamwidth



Variations in Beamwidth

- **Medium** – 80 kHz to 130 kHz provides 13° to 8° beamwidth
- **Medium** – 80 kHz to 130 kHz provides 24° to 16° beamwidth
- **Medium** – 85 kHz to 135 kHz provides 16° to 11° beamwidth
- **Medium** – 85 kHz to 135 kHz provides 24° to 16° beamwidth

- **High** - 130 kHz to 210 kHz provides 8° to 4° beamwidth
- **High** – 130 kHz to 210 kHz provides 10° to 6° beamwidth
- **High** – 130 kHz to 210 kHz provides 15° to 9° beamwidth



Summary

- CHIRP transmits across a wide frequency band
- The combination of a CHIRP sounder, a broadband transducer and the fishfinder's DSP can transmit over 10x's more energy in the water
 - Able to detect bottom >3000 meters and fish or objects in the water column in more difficult conditions that ever before
- Dramatically better signal to noise ratios resulting in better performance in noisy environments and tracking at high speeds
- One transducer covers all the popular fishing frequencies
- Transducer ID feature optimizes the system



Why Do They Cost More?

- Entire system is much more sophisticated
- New Transducer ID features
- Addition of heat sinks for thermal dissipation
- Common impedance requires transformers and inductors



Single vs Dual Transmission Line

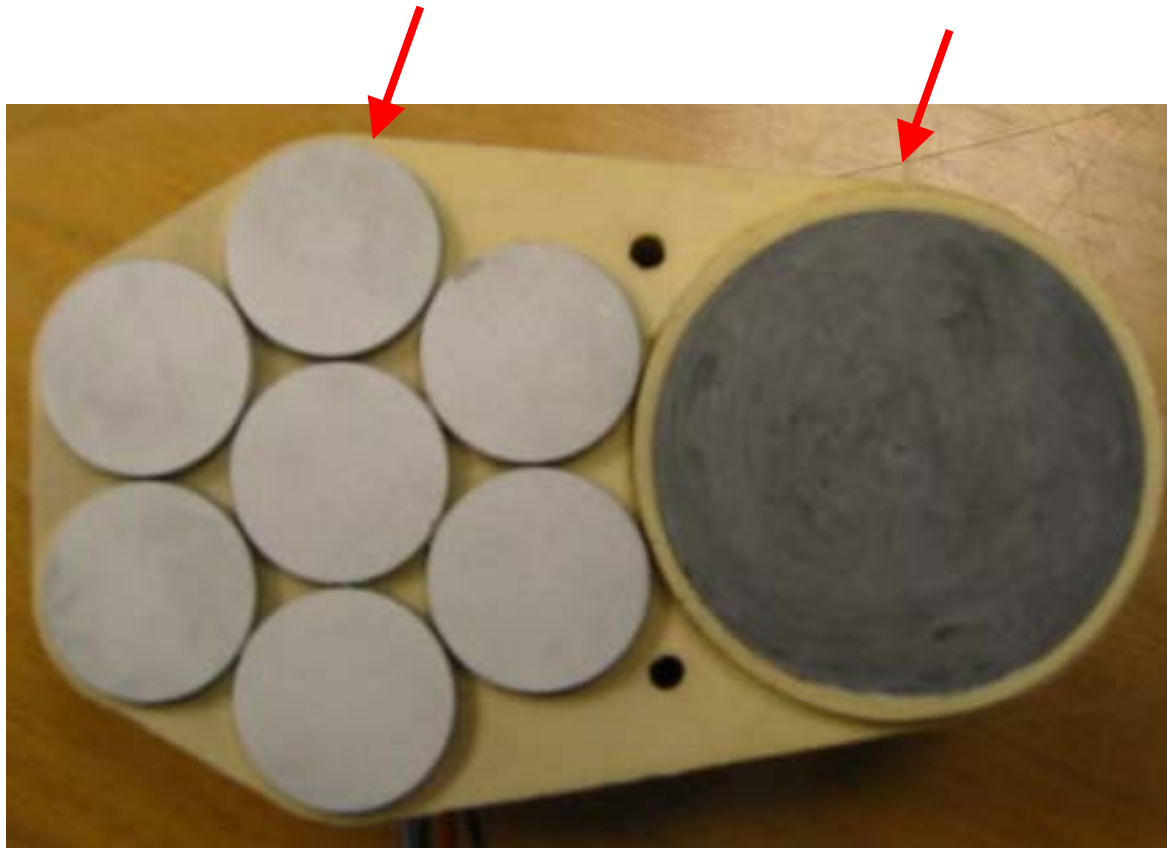
- A single transmission line sounder has one transceiver for both the high and low frequency signal
 - ie: BSM1, DSM300, GSD24, FCV585
- A dual transmission line sounder has two transceivers
 - ie: DSM400, FCV1100, FCV295

B260 Element Array

19° x 6°

50kHz Ceramic
Array

200kHz Broadband
Ceramic

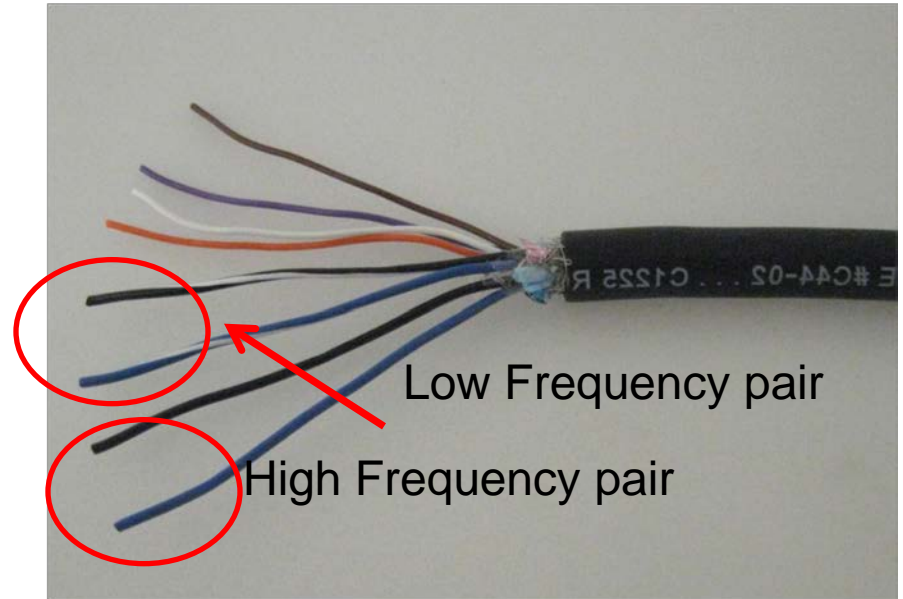


Diplexers

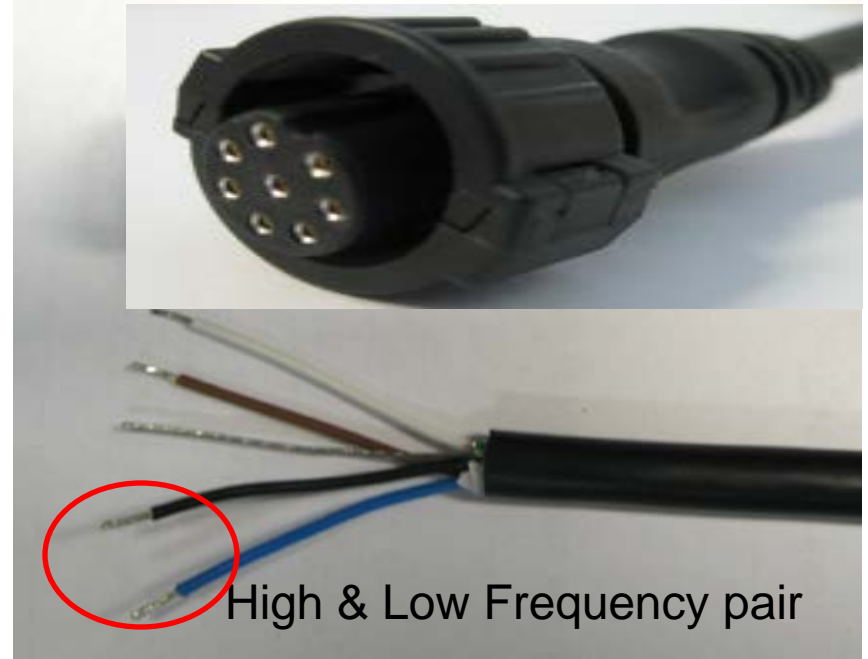
- Allows the ability to use transducers with separate elements for each frequency with a single transmission line echo sounder.
- Non-diplexed transducers have separate pairs of conductors for the high and low frequency. (Furuno's FCV sounders, DSM400)
- It is not possible to use a diplexed transducer with a dual transmission line sounder

Dual vs. Single Transmission Line Transducers

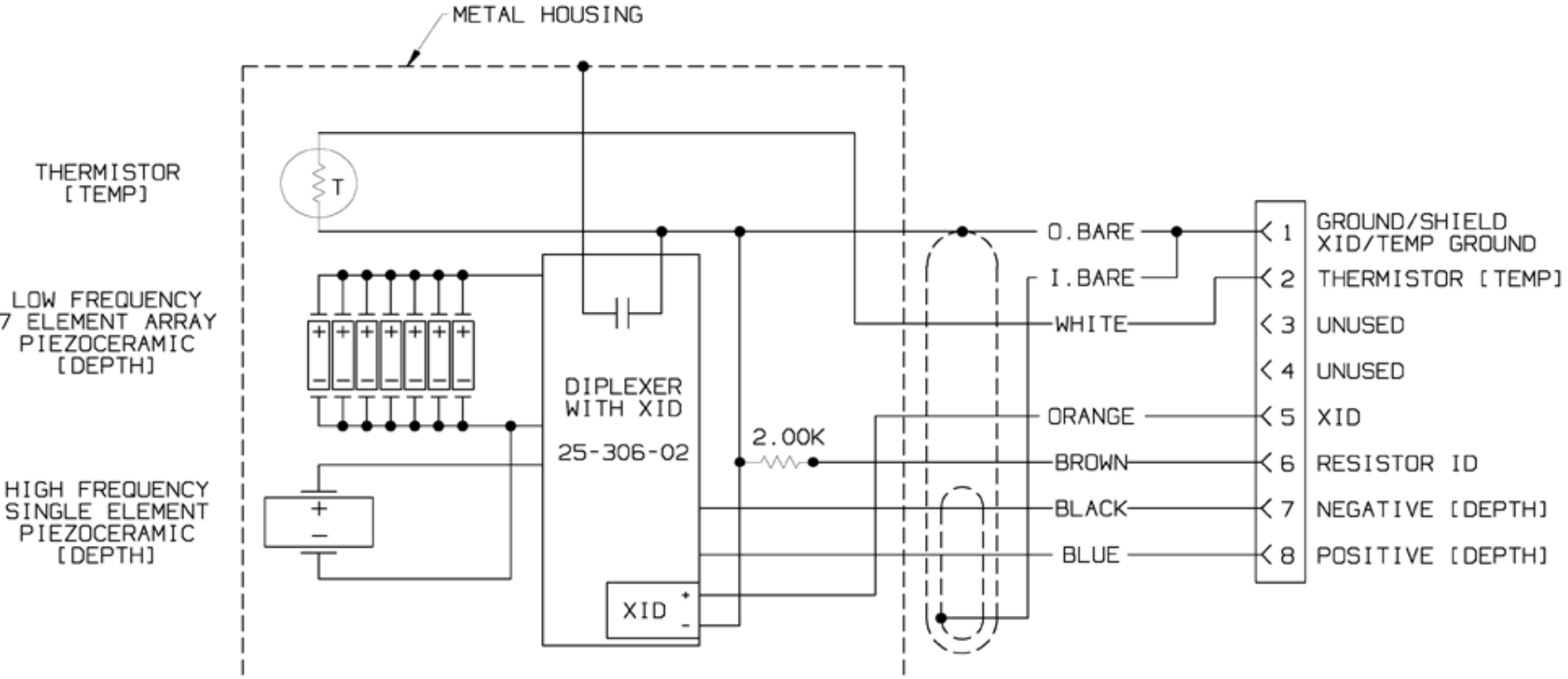
- Most CHIRP Transducers have NO connector and use 4 wires for depth
- 2 wires for High Frequency
- 2 wires for Low Frequency



- Most echosounders currently available use a single transmission line and require an internal diplexer
- These transducers use 2 wires for depth
- The HF and LF transmissions share these 2 wires



B260 Wiring with Diplexer



SOLDER LUG VIEW

CONTACT END VIEW



6/8 PIN FEMALE CONNECTOR #05-774-03

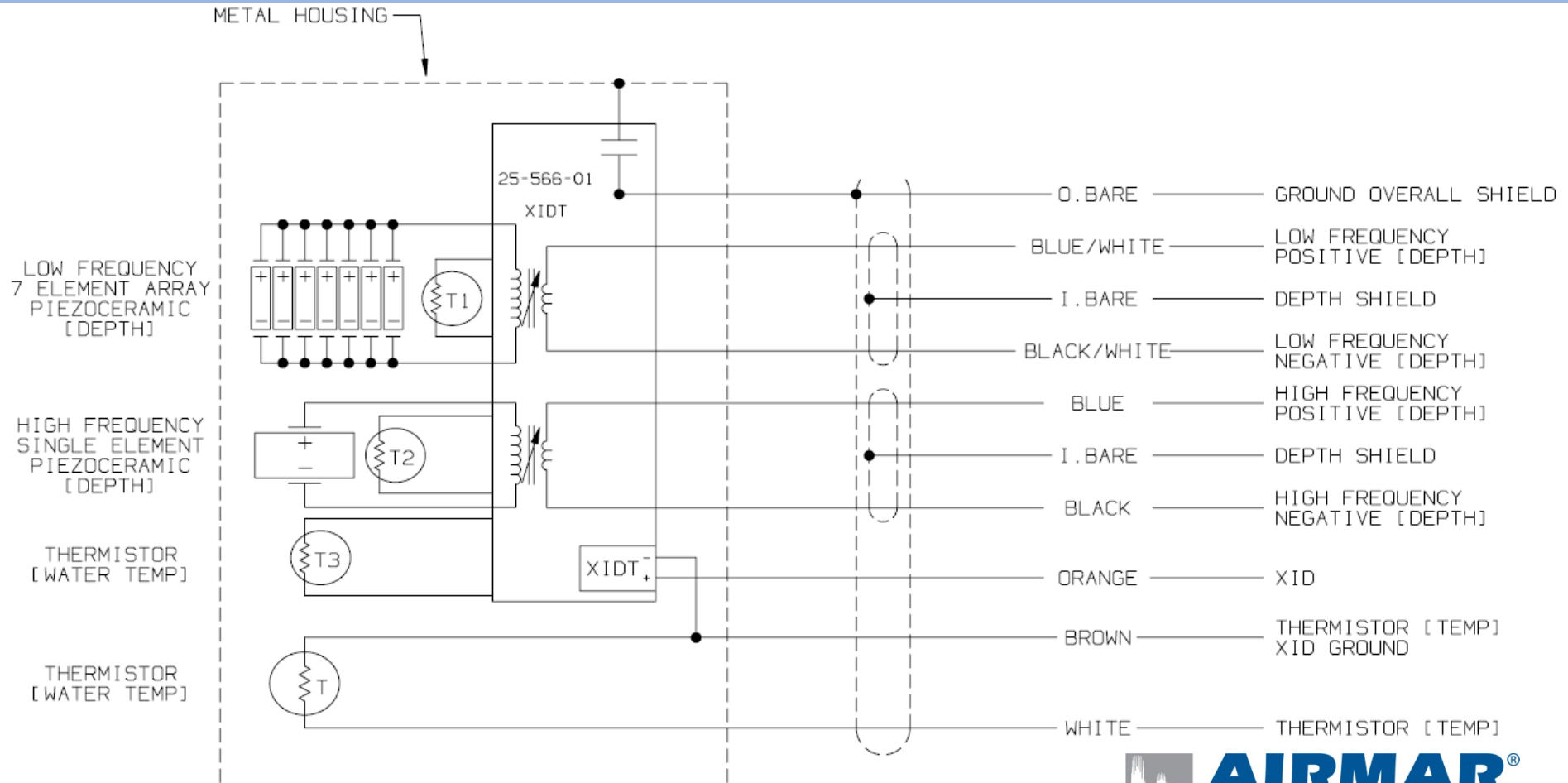
NOTES:

1. GREEN AND RED WIRES ARE CUT OFF ON BOTH ENDS.
2. INNER BARE WIRE IS CUT OFF INSIDE THE TRANSDUCER.



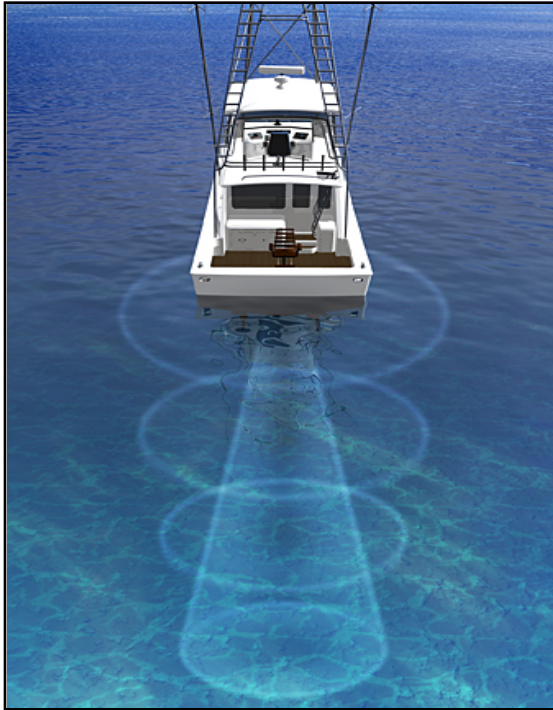
Sensing Technology

B265LH Wiring Diagram –

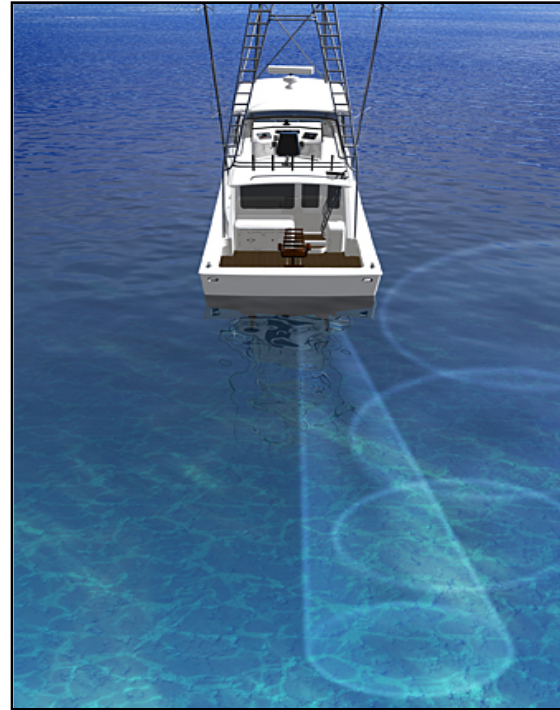


Transducer Installation & Placement

Importance of a Vertical Beam



Good



Bad

Regardless of mounting style, a properly installed transducer delivers a vertical beam that aims straight down toward the bottom, resulting in strong echo returns and accurate depth readings.

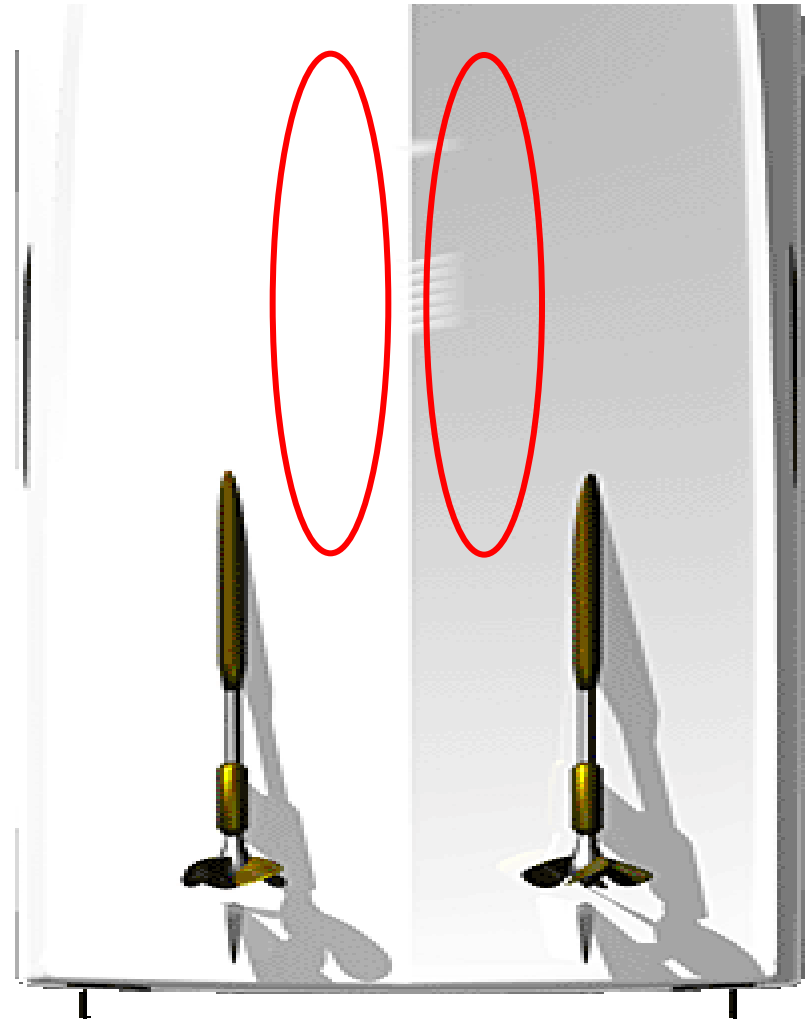
Optimum Fishfinder Performance...



...starts with optimum transducer placement.

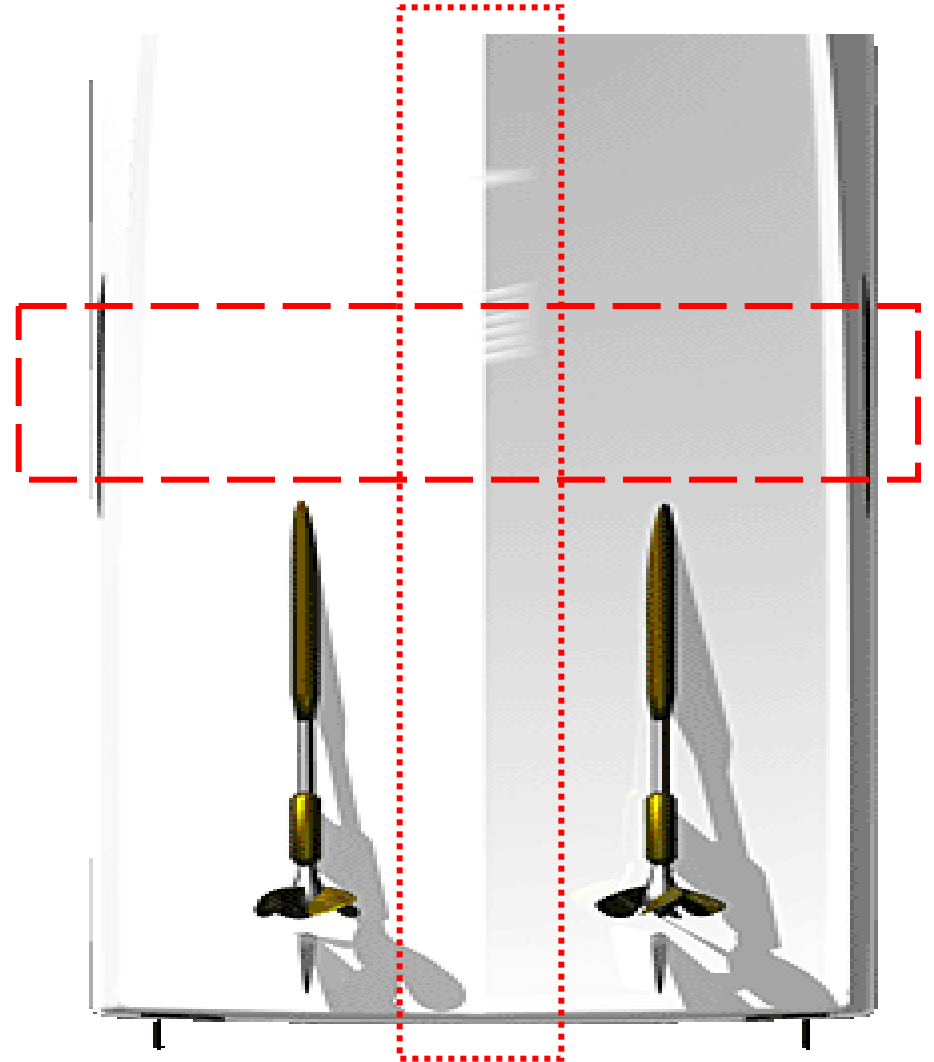
Location Selection

Transducer placement should be aft and close to the centerline. It needs to be located low enough that the transducer is in the water at all times.



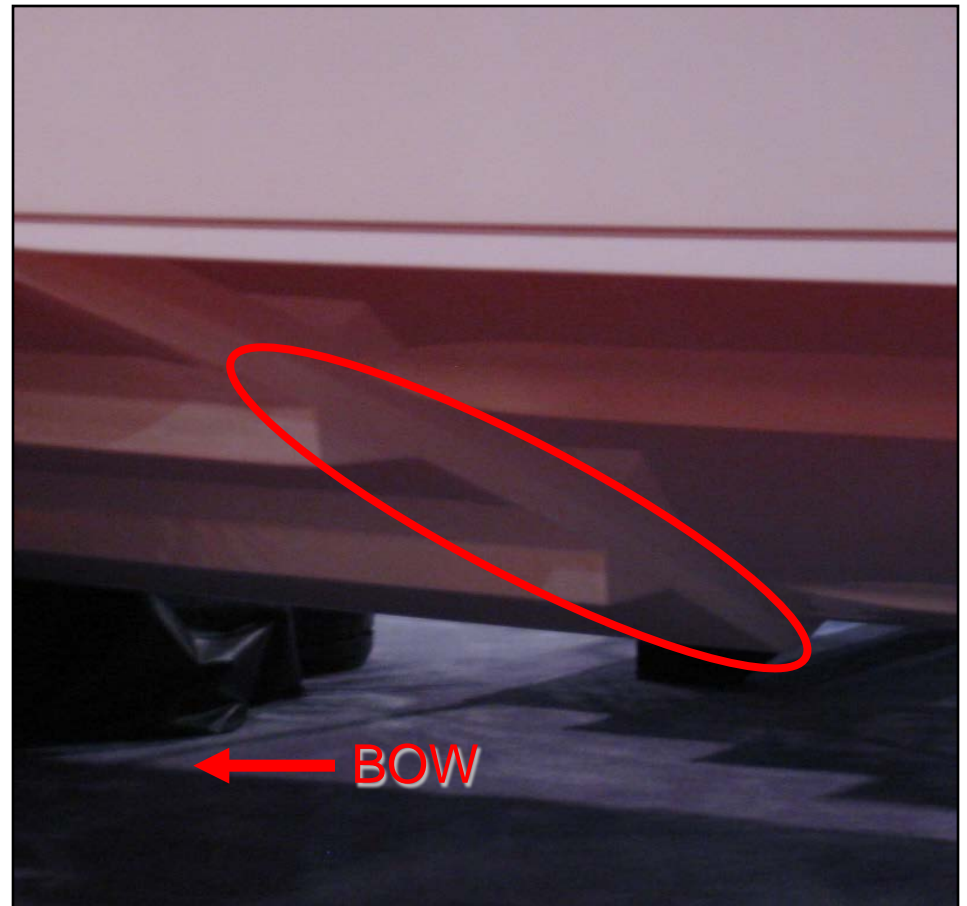
Location Selection

Consider items such as the lifting strap placement into the location as well as trailer bunks and rollers if it is a trailered vessel.



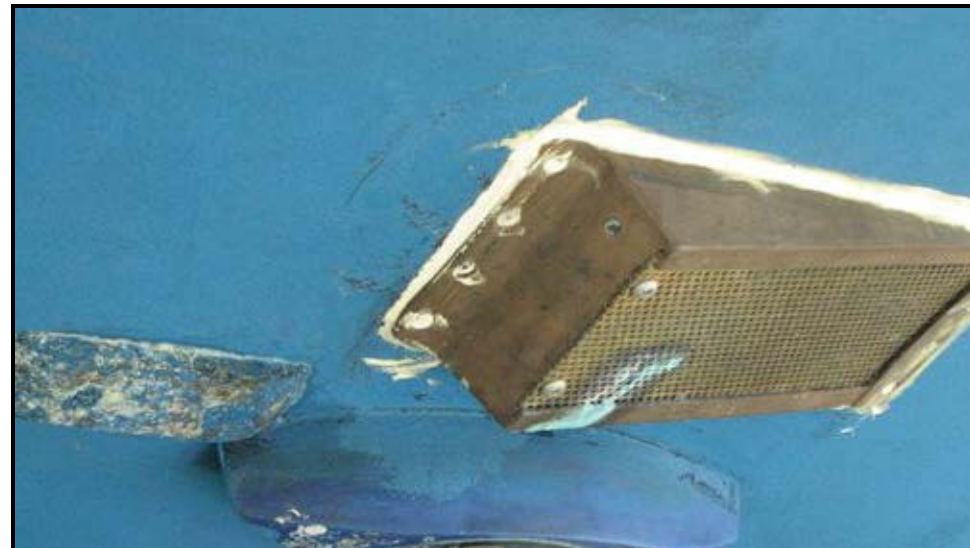
Stepped Hull Installations

Transducers used on stepped hull vessels **must** be located in front of the first step and low to the keel to operate properly.



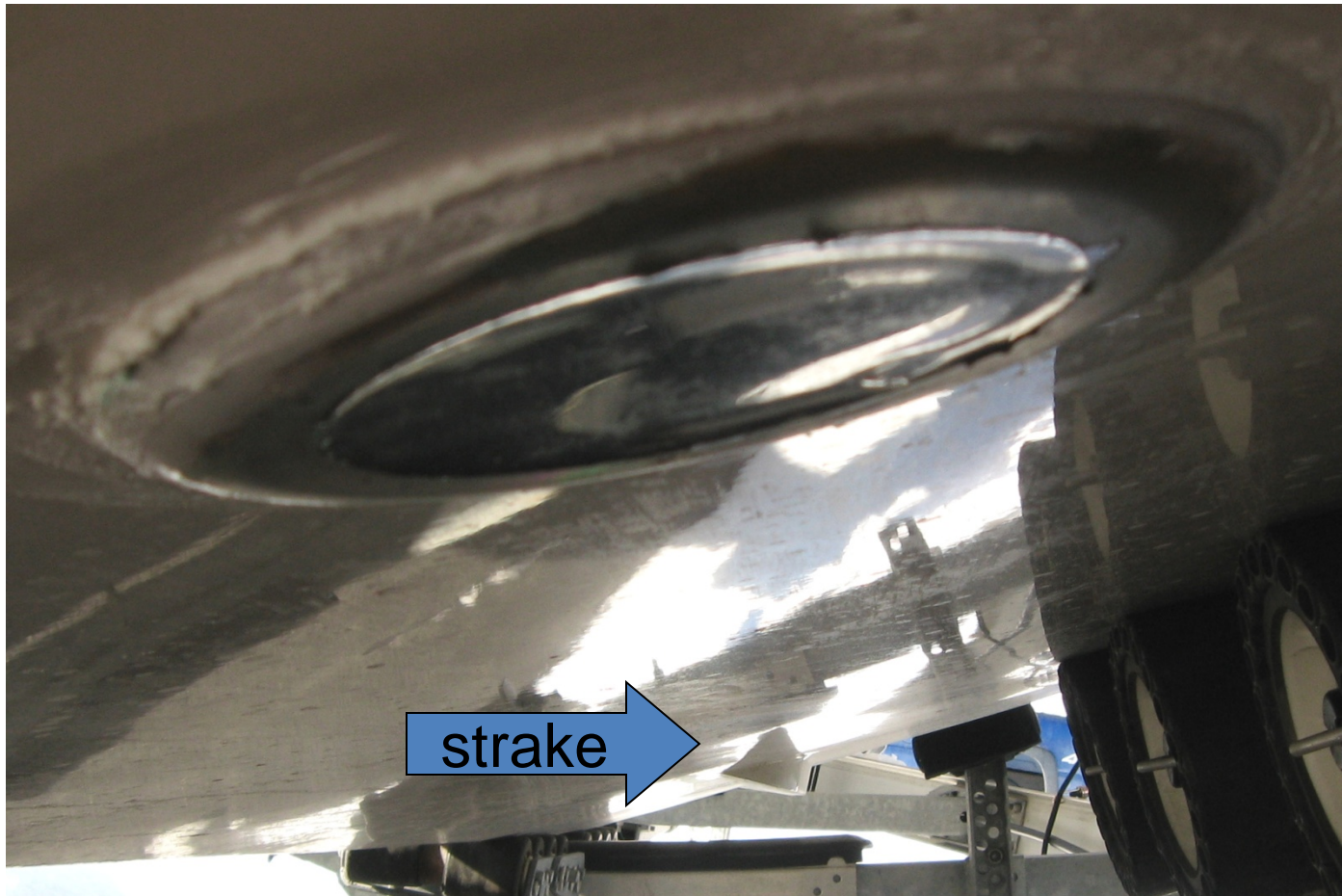
Installation Guidelines

- Bow thrusters, live well or cooling intakes as well as chines, steps and strakes can all introduce aerated water into the path of the transducer.
- Remember to always look forward all the way to the bow of the vessel to see if there will be any interference in front of the transducer's mounting location.
- If there is an intake 50 feet ahead, in line with the transducer, it will effect performance at high speeds.



Example of a Bad Installation

This installation of a B164 looks good, however notice the strake 10 feet directly in front of the transducer. This causes turbulence and air bubbles making the transducer stop reading bottom at 12 knots.



Example of a Bad Installation



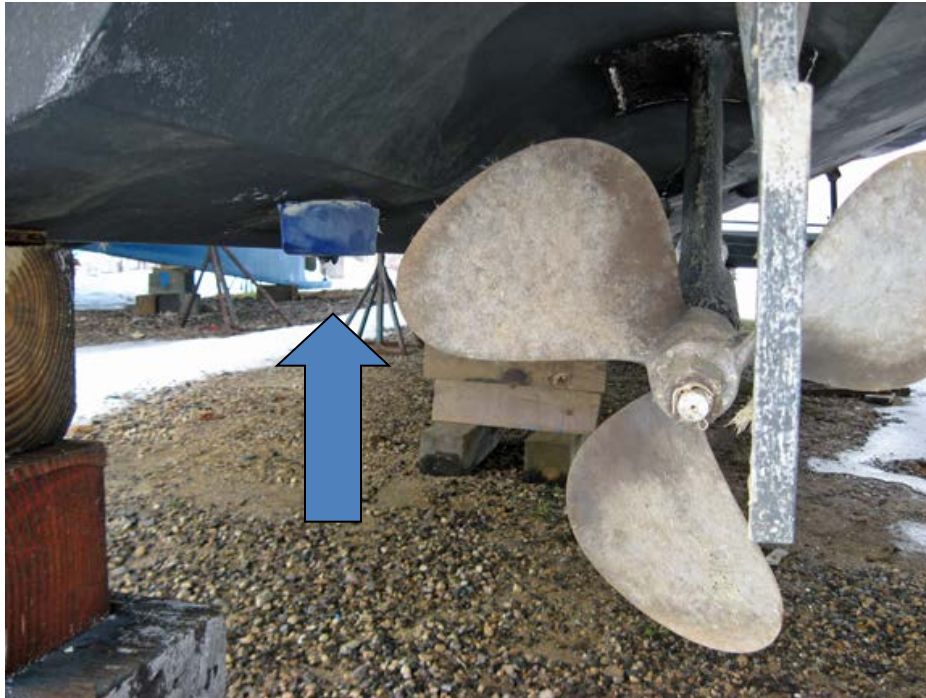
Side View



Aft View

This intake shown in the photos above will cause turbulence and send air bubbles over the transducer face as vessel speed increases. The transducer will work great when the vessel is drifting, but will not work well at speed.

Example of a Bad Installation



Forward View



Side View

This transducer is mounted too far aft and will be affected by the turbulent water that the starboard propeller will create at **ANY** speed.

Example of a Good B260 Installation



This is an excellent installation of a B260. There are no hull protrusions in front or alongside the transducer. The transducer is also installed away from the keel so that the beam is not shaded. An installation like this will give clear bottom readings up and above 30 knots.

Location Selection

Be sure that the transducer signal will not intersect the prop shaft(s), keel or any other hull projections, and that it is not directly in-line with the prop(s)



In-Hull Transducers for Fiberglass Hulls

Mounting:

Sand/grind the fiberglass until rough. Clean the fiberglass, then mount with:

1. Fiberglass Resin (best choice for long-term adhesion)
2. Fusor® 100EZ / T10.
3. 3M 5200,

Filling the tank:

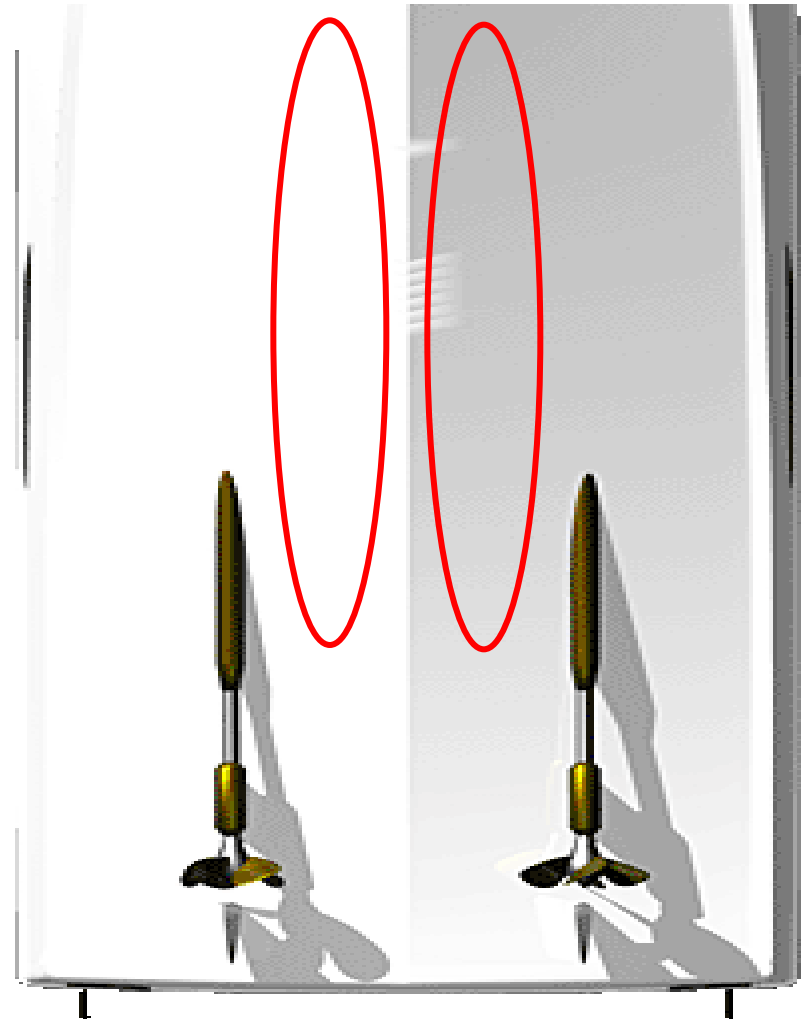
Use non-toxic Marine & RV red/pink anti-freeze



In-Hull Location Selection

The same installation placement guidelines for Thru-Hulls apply for In-Hulls.

The selected location should be aft and close to the centerline so that the transducer is in the water at all times.



Testing an In-Hull Mounting Location

Before installing the transducer tank, perform one of the 3 methods below in as deep of water as possible. Connect the transducer cable to the fishfinder to verify strong bottom readings.

- A. Flood the area with bilge water.
- B. Place the transducer in a garbage bag and fill with water
- C. Apply a water based lubricant to the transducer face and press against the hull

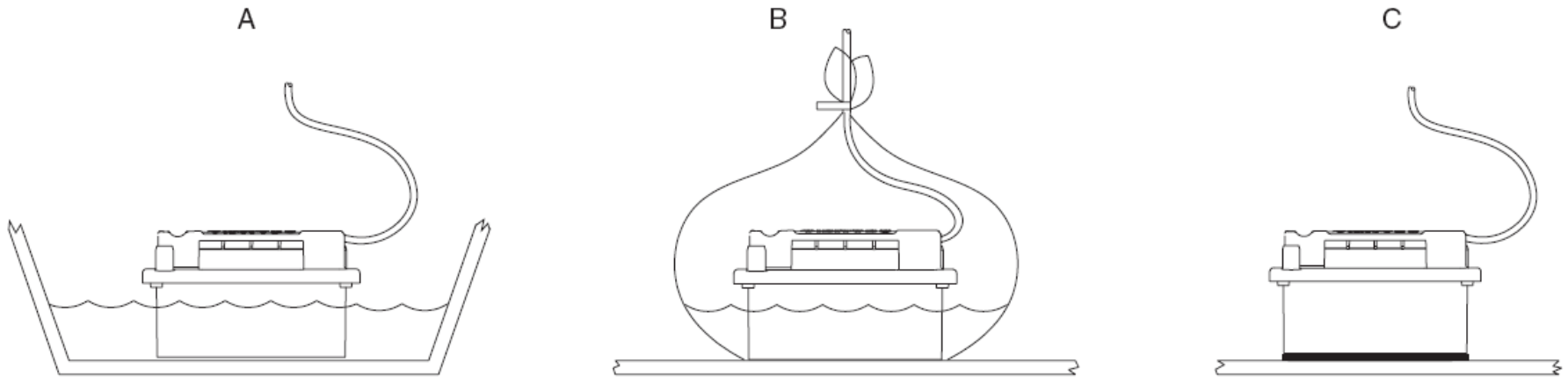


Figure 4. Testing the transducer at the selected location

Transom Mount Guidelines

Mount so that the bow of the sensor is slightly higher than the stern of the sensor and the sensor projects below the hull, otherwise aeration will occur.

Sea trial the vessel and adjust the transducer mounting height to achieve clear screen images at speed.



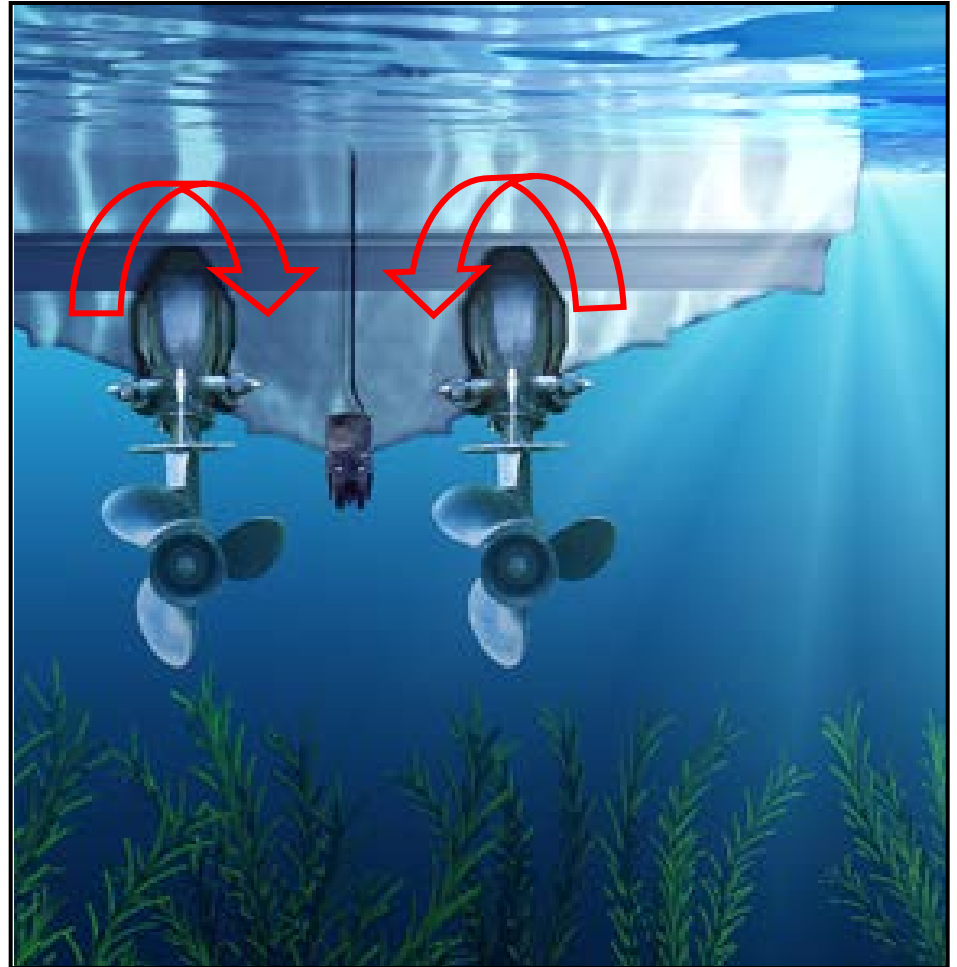
Transom Location Selection

Best results are achieved when the flow from the prop comes over the top of the transducer. Typically this is on the starboard side of the transom.



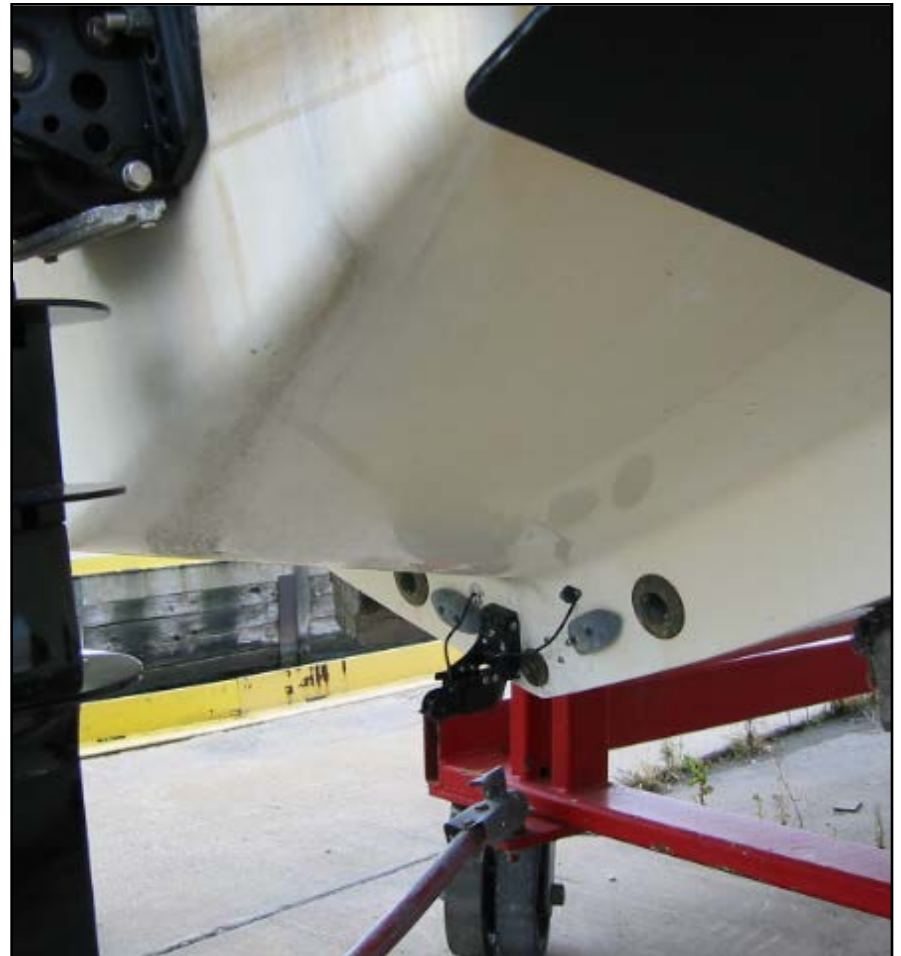
Transom Location Selection

For twin OB or I/O applications best results are achieved by mounting the transducer between the two drives, either on or just off of the centerline.



Transom Location Selection

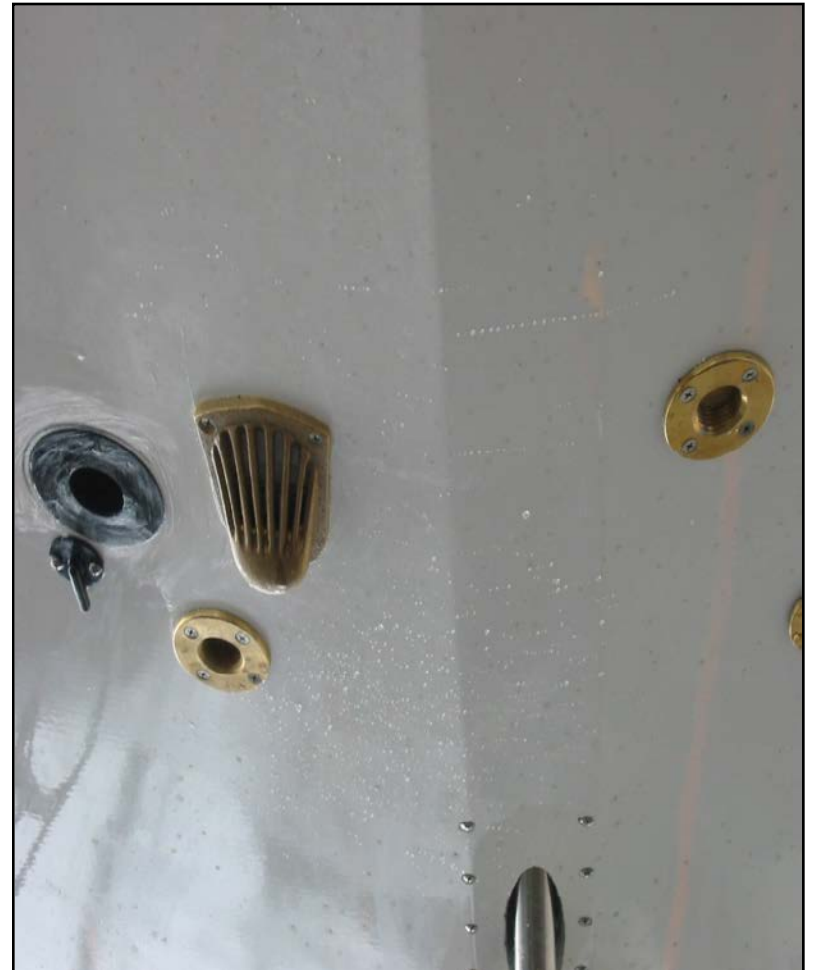
Transom models can be used on ***stepped transom*** boats that have sufficient headroom for release. They should be mounted on the lower surface.



Transom Location Selection

Select a mounting location that is not directly behind any strakes, hull fittings or sources of turbulence.

The water flowing over the face of the transducer must be turbulent free.



Transom Location Selection

Before installation, run the boat at speed and watch the water flow over the back of the transom. Locate the transducer in an area which you observed clean flow.



Transom Mount Flow Noise

- If experiencing interference with a transom mounted transducer you must test drive the vessel to determine what speed the image is lost at.
- Move the transducer to it's lowest position and retest.
- If screen image is improved repeat until you are satisfied with results.
- If screen image gets worse, move transducer up and re-test until improvement is seen.

Transom Mount Flow Noise

- Perform a slow but constant turn to the side of the hull that the transom transducer is mounted. Gradually increase rate of turn. If screen image improves the transducer needs to be mounted lower in the water.
- If screen image is worse when turning to the same side as the transducer try turning the opposite direction. This would indicate the transducer needs to be mounted higher in the water.