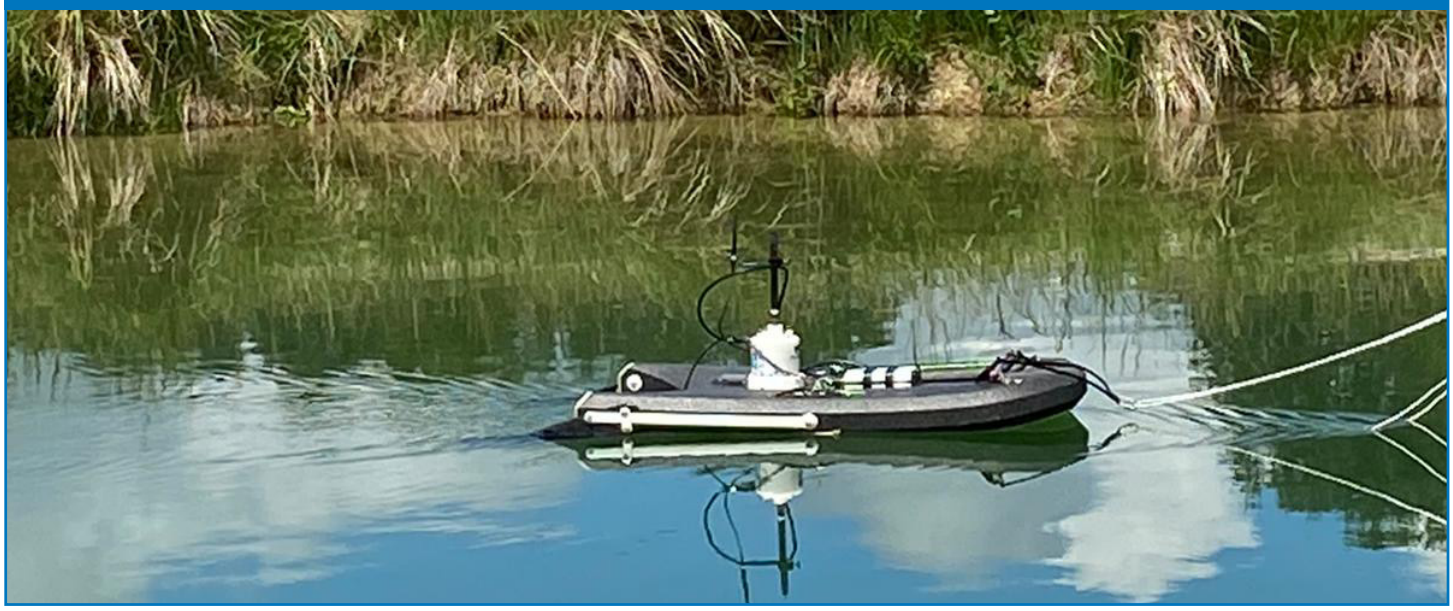
xylem
Let's Solve Water

Technical Paper
SonTek, a Xylem brand • XA00194

Blanking Distance vs Screening Distance

UNDERSTANDING THE DIFFERENCES BETWEEN THE TWO CONCEPTS

DISCHARGE DATA COLLECTION BASICS



There are two parameters for the RiverSurveyor M9 and RS5 which define where the first velocity cell closest to the instrument begins: Blanking Distance and Screening Distance. This technical note will discuss the differences between the two settings.

Blanking Distance

With all acoustic Doppler profiling systems (ADCP, ADP, etc.) there is a region immediately in front of the instrument where a measurement cannot be made, because the transducers need some time to recover electronically from the transmit pulse and prepare to receive the return signal. This region is typically defined as the "blanking distance" or "minimum blanking distance". The size of this 'near-field' region is dependent on the acoustic frequency (1.0MHz, 3.0MHz, etc.), profiling technique (Incoherent (IC, also referred to as Narrowband), Pulse-Coherent (PC), or Broadband (BB)), and the pulse length of the transmitted acoustic signal (the lower the acoustic frequency, the longer the transmitted acoustic pulse length). With the RiverSurveyor M9, the blanking distance setting defaults to the minimum value of 0.05m but can be increased by the user.

The RS5 has a more complex blanking distance default, as it modifies this parameter depending on the water depth and pulse type. For the RS5, the blanking distance can range from 0.04-0.106m, and cannot be modified by the user.

SonTek
a xylem brand

The instrument housing shape and diameter may also impact how close to the instrument a measurement can start, due to inherent flow disturbance surrounding the housing. The nature of the flow disturbance may vary depending on the velocity, surface roughness, instrument depth below the surface, etc.

Screening Distance

In order to provide their field technicians with a consistent set of setup parameters for their range of ADCPs and to help eliminate potential flow disturbance issues, the United States Geological Survey (USGS) requested that instrument manufacturers either increase the minimum blanking distance or provide a 'screening distance' setting that is applied on the collected data. To simplify the implementation of a standard setting for screening distance, during the installation of the RiverSurveyor Live software, the user can choose to include the USGS default screening distance in every measurement. It can also be applied manually before each measurement, if desired.

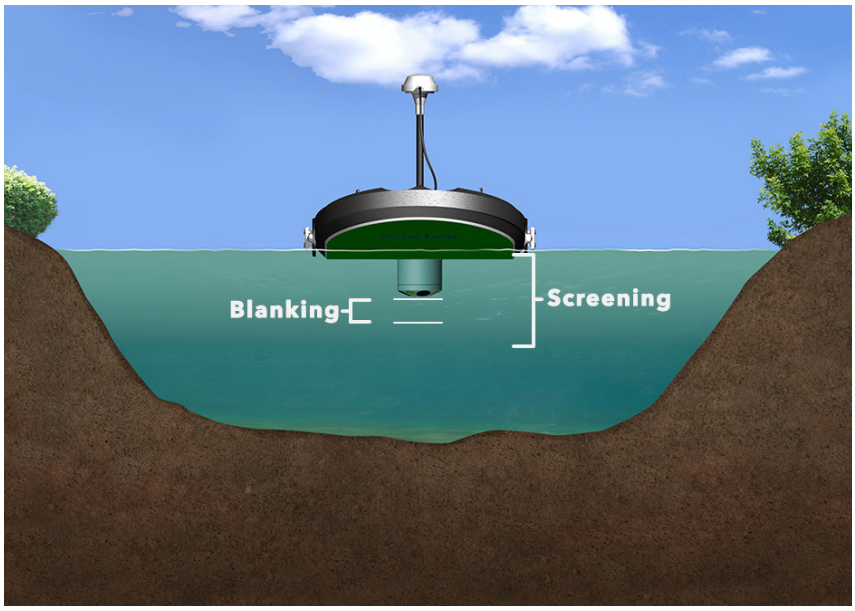


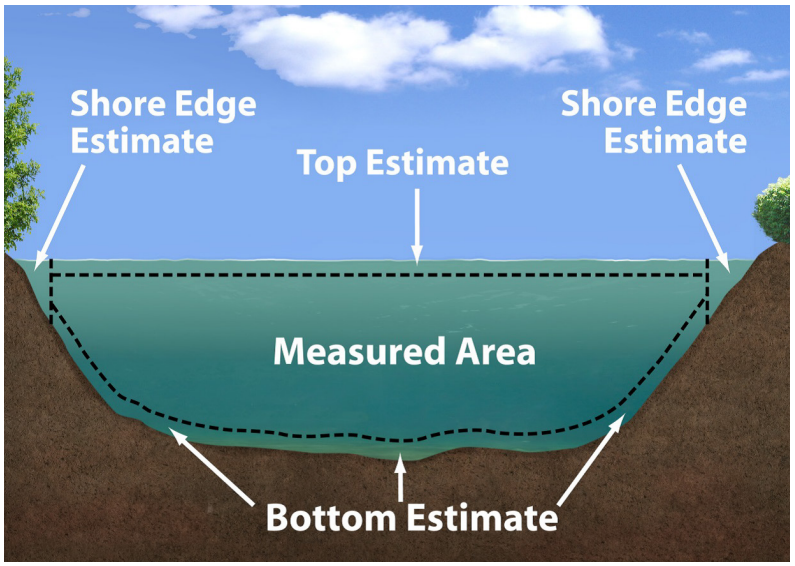
Illustration depicting blanking versus screening distances.

The screening distance setting programs the instrument to begin processing data below a certain distance referenced from the surface. This is an important point of difference between the two parameters; "screening distance" is referenced from the water surface, while "blanking distance" is referenced from the vertical beam transducer of the ADCP. Screening distance is essentially a filter that can override the blanking distance parameter to increase the minimum distance from the system at which the velocity data will processed for the discharge calculation, rather than using the blanking distance setting of the instrument.


Amazon River and side-mounted M9 ADCP.

An important point to note is that the M9 still measures the velocity profile starting at the Blanking Distance parameter; the screening distance indicates where to start processing the velocity data, and the user has the ability in post-processing to change or remove the Screening Distance parameter. As for the RS5, there is no screening distance default currently required by any agency. Due to its much smaller size and footprint in the water, it does not currently require an additional screening distance due to the reasons highlighted in the USGS studies referenced at the end of this paper. However, the user can choose to apply a screening distance to an RS5 measurement through the RSQ software, if desired.

A primary use for the screening distance parameter is boat-mounted applications where the setting can be set to filter out the flow disturbance from the hull of the boat. As an example, for measurements on the Amazon River using a RiverSurveyor M9 mounted over the side of a large boat, the screening distance parameter was used to begin the measurements below the region of flow disturbance generated by the hull of the boat.

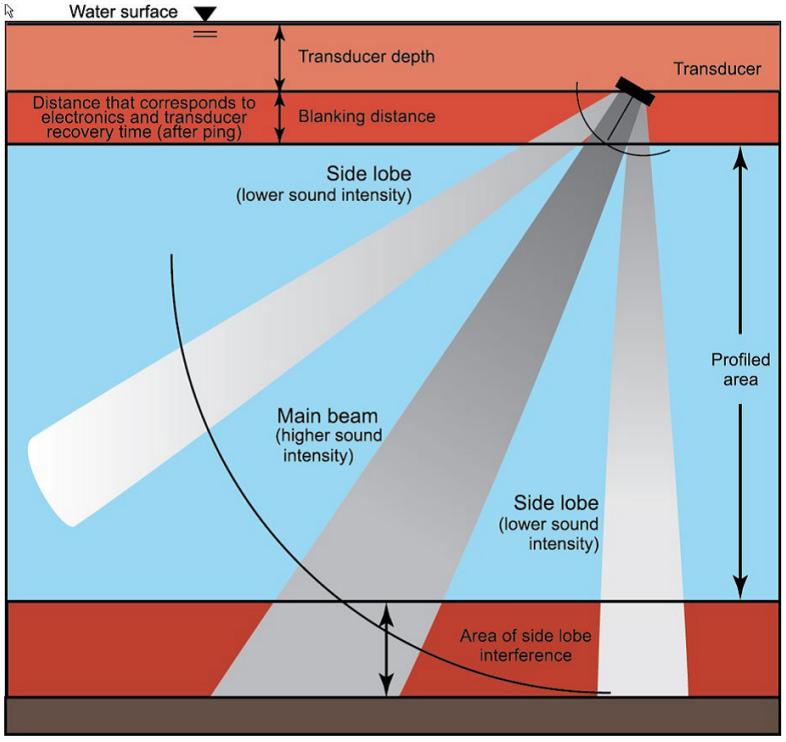


An important consideration is than an accurate Transducer Depth is required to calculate the appropriate screening distance:

Screening Distance = Transducer Depth + depth to screen below the instrument

Other Unmeasured Areas

With an ADCP there will always be areas near the surface 'above' the instrument and including the blanking distance, as well as at the bottom and edges of the channel due to acoustic interference or depths too shallow. In these unmeasured areas the velocity is estimated using extrapolation. Utilizing a screening distance to begin a measurement further below the surface will increase the unmeasured area near the surface.



If you are interested in further details on flow disturbance effects, please see:

Mueller, D. S., Abad, J. D., García, C. M., Gartner, J. W., García, M. H., and Oberg, K. A. 2007. "Errors in acoustic Doppler profiler velocity measurements caused by flow disturbance. Journal of Hydraulic Engineering Vol 133 Issue 12 December 2007"

Gartner, J. W., and Ganju, N. K. 2002. "A preliminary evaluation of near-transducer velocities collected with low-blank acoustic Doppler current profiler." Proc., Hydraulic Measurements and Experimental Methods"

Muste, M., Kim, D., and González-Castro, J. A. 2010. "Near-Transducer Errors in ADCP Measurements: Experimental Findings" Journal of Hydraulic Engineering Vol 136 Issue 5 May 2010.

SonTek, a Xylem brand
9940 Summers Ridge Rd.
San Diego, CA 92121

+1.858.546.8327
inquiry@sontek.com
SonTek.com

Sound Principles.
Good Advice.

SonTek.com