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Technical Note
SmartPulseHD®

SonTek.com

TECH NOTE: SonTek-SL (3G) SmartPulseHD®* Feature



SonTek's third generation of side-looking acoustic Doppler profilers—the SonTek-SL (3G)—now features SonTek's exclusive SmartPulseHD feature for dynamic selection and optimization of the acoustic pulsing scheme. The feature was first introduced in 2010 with the RiverSurveyor ADCP in down-looking configuration for instantaneous discharge measurements on moving platforms. In 2012, the feature was adapted and transferred to the SonTek-IQ series of velocity and flow meters for continuous measurements in vertical, fixed-mounted configurations in rivers, canals, and pipes. Continuing this trend, SmartPulseHD now benefits side-looking fixed-mounted systems for use in rivers, canals, and ports/harbors. Because the RiverSurveyor, SonTek-IQ, and SonTek-SL(3G) are each mounted, configured, and operated differently, SmartPulseHD will work differently in each instrument type.

SmartPulseHD in the SonTek-SL(3G) works as follows:

- The system continuously tracks water velocity and profiling range, depth, turbulence factors, and signal-to-noise-ratio (SNR). Based upon these values, it selects the optimum processing configuration.
- At any given time, the system is sending multiple ping types at one acoustic frequency, using different processing techniques to achieve the optimum system performance.
- For the SonTek-SL(3G), the acoustic frequency will be either 3000 or 1500 kHz.
- Multiple different ping types and processing techniques are utilized: water level detection and water velocity detection; and pulse-coherent, pulse-incoherent, and broadband. The exact technique being used will depend upon operating conditions and may change as conditions change.
- The system tracks velocity and depth on a second-by-second basis, and updates the processing technique accordingly.
- The best processing technique permitted by conditions will be used. While the selection criteria also depend on horizontal profiling range (frequency-specific criteria—see next section), the velocity criteria used are
 - o Pulse-coherent up to 0.7 m/s
 - o Broadband up to 1.7 m/s
 - o Pulse-incoherent up to 7 m/s
- Specific to side-looking configurations, the system accounts for changing water level and beam spreading effects, and adjusts the horizontal profile to avoid side-lobe contamination.
- Specific to side-looking configurations, unlike RiverSurveyor or SonTek-IQ systems, the cell size and number of cells reported in the horizontal profile are user-programmable parameters.

For the SonTek-SL3000(3G)

- When the water is sufficiently slow, the system can report data from pulse-coherent pings. If it can be used, pulse-coherent pings generally will offer the lowest standard deviations for a given condition. Maximum horizontal profiling range for pulse-coherent pings is 1.5 m.
- If conditions do not permit pulse-coherent pings, the system will select (using SmartPulseHD algorithms) either broadband or pulse-incoherent pings, within a horizontal profiling range up to 5 m.
- Cell sizes are user-defined from 0.04 to 0.5 m.

For the SonTek-SL1500(3G)

- When the water is sufficiently slow, the system can report data from pulse-coherent pings. If it can be used, pulse-coherent pings generally will offer the lowest standard deviations for a given condition. Maximum horizontal profiling range for pulse-coherent pings is 5.0 m.
- If conditions do not permit pulse-coherent pings, the system will select (using SmartPulseHD algorithms) either broadband or pulse-incoherent pings, within a horizontal profiling range up to 20 m.
- Cell sizes are user-defined from 0.16 to 2 m.

The SonTek-SL(3G) SmartPulseHD feature utilizes the system's powerful CPU with multi-thread parallel processing routines; some key advantages are listed below.

- The parallel processing capabilities allow the system to collect new acoustic pings while at the same time analyze data from the last set of pings. This continuous evaluation of the data allows the system to modify operation, on a second by second basis, to ensure it always uses the best ping types for the conditions at that moment.
- The high speed of the CPU means that the SonTek-SL(3G) has no limits in the type of pinging, processing or analysis that can be done. The final performance of the SonTek-SL(3G) is limited only by the physics of underwater sound.

SmartPulseHD processing should be able to adapt automatically to any operating condition without any user input. Despite this, the SonTek-SL(3G) software (called the "SonTek-SL: Intelligent Flow" software) includes an option to disable SmartPulseHD processing.

- When SmartPulseHD is disabled, the system will use pulse-incoherent pings only, exactly as done with previous-generation Argonaut-SL Doppler profilers, with the exception that the SonTek-SL(3G) will ping four times faster, even in pulse-incoherent mode.
- It is conceivable that users who use velocity data for velocity indexing purposes might want to control the system operation in order to control the variables that may affect a pre-existing velocity index.

**Patent pending.*

Founded in 1992 and advancing environmental science globally, SonTek manufactures acoustic Doppler instrumentation for water velocity measurement in oceans, rivers, lakes, harbors, canals, estuaries, industrial pipes and laboratories. SonTek's sophisticated and proprietary technology serves as the foundation for some of the industry's most trusted flow data collection systems. SonTek is headquartered in San Diego, California, and is a division of Xylem Inc.

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