AMETEK Drexelbrook

With Patented SmartGain™ Circuitry

Competitive Comparison:

Ignoring Non-Level Reflections With SmartGain™

USonic™ and **USonic-R™** with **SmartGain™** circuitry uses a method called Time Varied Gain (TVG) to ignore false (non-level) echoes or signal returns.

This approach causes the ultrasonic system to attenuate its gain (ability to hear the return echo) based upon a known correlation between the distance to the level and the return signal strength.

By attenuating the gain we have the ability to keep the return signals within a constant range in the patented TVG processing circuitry.

This means that when levels are close to the transducer, we use a maximum amount of attenuation and when the level is far from the transducer we use a minimum amount of attenuation, or no attenuation.

By keeping the bulk level signal in this programmed signal range, the smaller signal reflections from pipes, agitator blades, ladders or other similar obstructions are attenuated to the point that these signals are too weak to be processed and measured.

Facts:

- The bulk mass of liquid level being nearly perpendicular to the sensor face (maximum angle of reflection) will reflect the strongest signal levels.
- Other reflections that are not perpendicular to the sensor or smaller in mass will not reflect as much signal as the bulk mass of liquid level.

Benefits:

- There are no user routines or programs that need to be run. The USonic attenuates based on knowing the distance from the sensor face to the level.
- The vessel does not need to be emptied.
- The user can't misconfigure or null out the actual level because there is no user interaction through SmartGain.
- If any additional or future obstructions occur within the vessel, the system does not require any configuration changes or adjustments.

Our Competitive Advantages:

- The transmitted signal strength is at a constant power level. We do not increase our signal strength, which can cause an increase in the amplitude of "background noise" signals that can result in "hunting" and system performance issues.
- We do not vary our signal detection "threshold" level. Our detection threshold is not lowered to look for weak signals that would result in picking up background noise, and internal obstructions, which results in "hunting" and system performance issues.
- If the level signal is lost (due to foam or irregular shaped tank bottoms when the vessel is empty, etc.), the USonic will post a "lost echo" error signal (user defined at 3.7 mA or 22 mA), but the system will not lock-up on a non-level obstruction, or background noise.

Other Tank Mapping Routines (the Competition)
Many systems use a method called Time Varied Threshold (TVT).
This approach causes the system's threshold level (ability to recognize a valid echo) to be adjusted based on the echo levels of internal obstructions.

In areas of the vessel where non-level echoes are present, the system elevates the threshold to de-sensitize the receiver from any "base noise" generated by the non-level return echoes.

This mapping function works best when the vessel is empty or nearly empty because in order to correctly map the vessel obstructions, all of the obstructions must be exposed and above any liquid level. The mapping routine can only be used if there is a minimum distance of 2 m (6.5 ft.) from the sensor face to the bulk mass of level.

If the vessel has any moving obstacles such as an agitator, it must be running during this user programming routine to provide dynamic mapping results.

If the vessel is not completely empty, the user must program the routine with the actual bulk mass of level and then subtract 0.5 m (1.6 ft) from this distance; otherwise the system will ignore the signal reflection of the level.

The TVT program takes only a few seconds to run. During the "learn mode" the system looks at all reflections above the programmed level distance.

Requirements:
- Identified false level obstructions will not change in the future
- The signal level of identified false echoes will not get stronger

Problems:
- The customer will probably see a performance problem before the program is run, because…
    - The vessel must be emptied or nearly emptied
    - Agitators must be run unloaded during programming
    - The user must take action, and this action may not be completed correctly
    - During programming, the user may actually cancel out the level reading if the actual level in the vessel is not input correctly.

Disadvantages of TVT
- Under "normal" vessel operating conditions TVT should perform well, if configured correctly.
- If the signal is lost (Lost Echo, etc.), TVT will increase the transmitted power level in an effort to re-establish the level signal. For example: If the level is lost due to foam, or an empty tank with a coned or dished bottom (signal not reflected back to the transducer), then…
    - The TVT circuit will increase power, causing maximum reflections from non-level obstructions. This will cause the transmitter to "hunt" and lock on an element that is not the level, or background noise, and stay locked until reset (cycle power, or other) by the operator.

Conclusions
- With SmartGain there are **no** user actions needed to have this feature operate properly.
- With competitive mapping routines (such as TVT) the user must know when and how to implement this feature correctly. Incorrect configuration of TVT may cause more problems than it can solve.