

GPR CONSORTIUM

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GSSI

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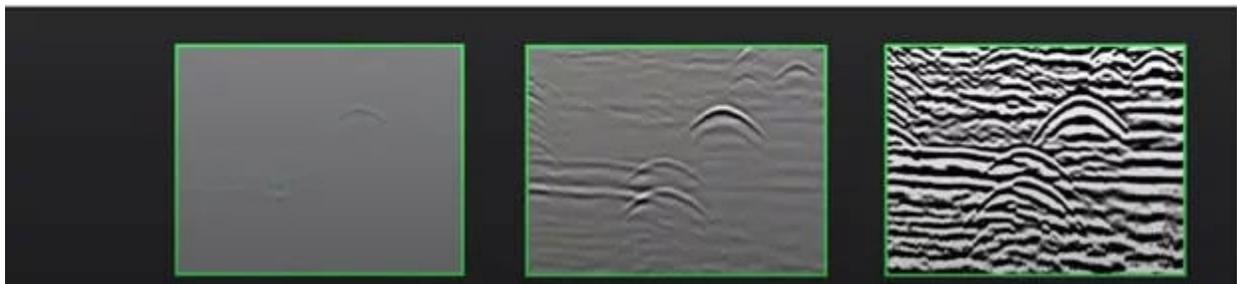
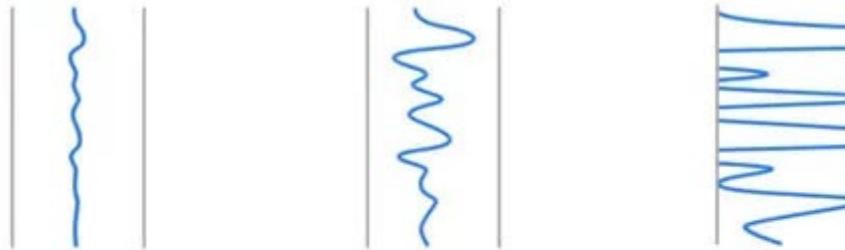
HOW TO BRING OUT GPR TARGETS MORE CLEARLY USING GAIN

When a GPR unit transmits a radar wave into the ground, it gets progressively weaker as the signal is absorbed, or attenuated, by the ground material. The transmitted signal starts off with a given strength, or amplitude, and that amplitude diminishes as it gets deeper into the ground because the signal is getting absorbed by ground elements, reflecting off of other elements, or is otherwise attenuated by the conductive material it's traveling through. The signal is still intact, but this attenuation can make it difficult to see targets on GPR displays or data files. GPR users can counteract that attenuation by adding, in effect, additional screen contrast; that added screen contrast is called gain. Gain will act similar to the brightness setting on any monitor or TV: when GPR users add more gain, whether before or after collection, they can make targets clearer and easier to see. In reality, though, gain adjustments account for signal strength loss and adjust the visual readout accordingly.

ADJUSTING GAIN ON A CONTROL UNIT

The fastest method to add gain is a simple one, known as display gain, which is a manipulation of the overall brightness setting of a GPR unit's screen. If, while collecting data, objects are under- or over-gained, users can adjust the display gain to make a quick change and make the screen a little easier to comprehend.

Display Gain



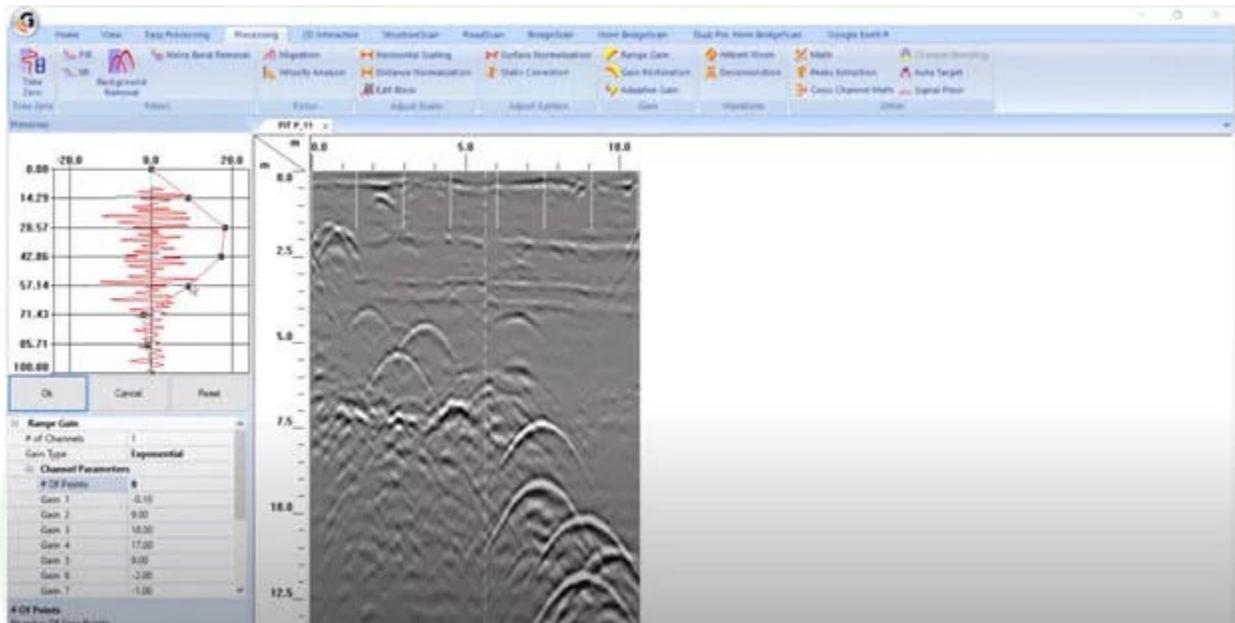
Data displayed is the same data set shown at three different gain levels. Left, the data is "under gained." Right, the data is "over gained." The center image best represents a properly gained signal.

Time variable gain is a more sophisticated method of adding gain on a GPR control unit in which users can apply a specific amount of gain to a specific part of the oscilloscope view. This method counteracts signal weakening by adding screen contrast in varying amounts across different depths of the scan. This ensures that targets at the bottom of the screen are as bright and easy to see as targets at the top; time variable gain evens out signal attenuation so that everything on the screen shows up with a similar brightness. Users can decide how many points of depth to adjust, with the maximum defined by each different GPR control unit.

A final control unit-based gain adjustment process is called adaptive gain. Adaptive gain creates a time variable gain curve made up of five points that moves through the file and adapts to actual attenuation conditions. This is especially beneficial when moving from one ground surface to another; instead of the screen being very bright over some targets and very faint over others, adaptive gain adjusts the gain curve during collection to create a more uniformly clear scan image.

ADJUSTING GAIN THROUGH POST PROCESSING

Users can not only adjust gain curve settings while using a GPR control unit, but can also make retroactive changes to the file's gain once opened in a post-processing software. The more sophisticated gain adjustment option in post-processing software is called exponential gain, which gives users the opportunity to choose how many points of adjustment to place on the gain curve. While this can work with as few as three or four points, somewhere between seven and 10 gives the right level of control for most gain adjustment needs. Some post-processing software allows users to add many more points to their gain curve, for extremely fine-tuned gain adjustments. The example below utilizes RADAN 7 by GSSI.



Data represents a RADAR file processed in RADAN 7. Eight gain points have been added to the data set to adjust exponential gain feature.

As with most gain curve processes, the goal of exponential gain is to make sure that every area of the scan is at about the same signal strength so that all targets are bright and easy to see. Once users have a gain curve that achieves this goal, it can be applied to the file, and then opened up as a newly processed file.