

# XTB-ANR X10 Active Noise Reducer

## JV Digital Engineering

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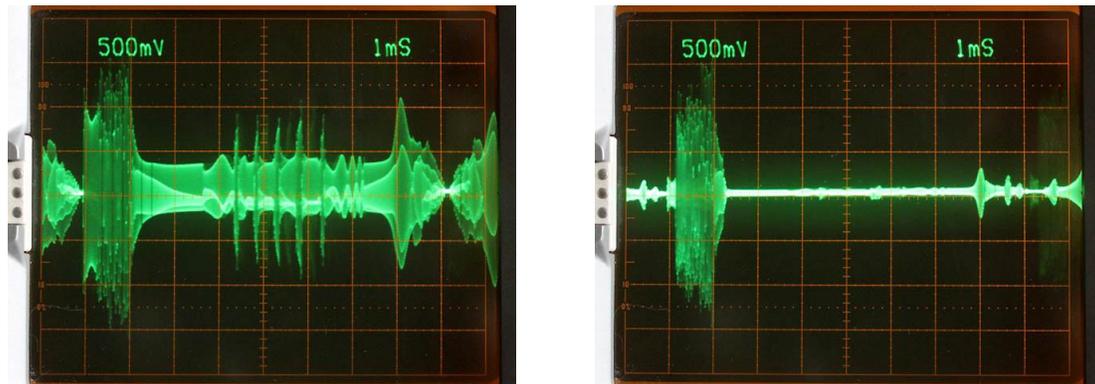
Our electrical systems have become vastly more complex since the 70's when the X10 protocol was developed. We now have to deal with all sorts of devices that load down X10 signal levels and generate electrical noise that prevents X10 modules from properly decoding commands. Many of us are using signal boosters to provide adequate signal levels, but the noise problem can be more difficult to solve.

X10 commands are sent as a series of signal bursts coupled to the powerline. Presence of a burst signifies a logic "1", and absence a logic "0". Noise near the X10 carrier frequency can fill in those blank frames, making it impossible for a receiving module to decode the command unless it includes AGC to raise its detection threshold above the background noise level. Unfortunately, many X10 devices do not incorporate AGC.

Until now, we were pretty much forced to isolate noise sources from the powerline with X10 filters, such as the X10 XPPF or our own XTB-F10. Like the XTBR and XTB-IIR do for signal levels, the XTB-ANR Active Noise Reducer provides an alternate way to deal with powerline noise.

The XTB-ANR is a small plug-in module that will significantly reduce powerline noise on the circuit or phase it is plugged into. When noise is on both phases, it is recommended that an XTB-ANR be plugged into a circuit on each phase near the distribution panel. That location will block noise generated on one circuit from being radiated out onto other circuits of that phase.

Below are two oscilloscope traces displaying what the XTB-ANR can do. The left photo shows an X10 signal combined with the horrendous noise generated by a Lumoform 4W LED light. The right photo with the XTB-ANR plugged into that circuit shows the X10 signal almost unchanged, but the background noise attenuated by about a factor of 10. For less powerful noise sources, the background noise is almost eliminated.



Zero crossings of the AC waveform are near the left and right of the traces where the noise drops to zero. In the right trace you can see the first portion of the X10 signal burst is attenuated until the XTB-ANR recognizes the valid X10 signal. At that point it switches off the attenuation, allowing the full X10 signal to come through. The variation in X10 signal burst amplitude is due to the noise and the X10 signal summing together. On the right side of the right trace you can see the faint shadow of a prior X10 burst due to the persistence of the oscilloscope CRT.

The difference between a logic "0" (no signal burst) and a logic "1" (with the burst) is about a factor of ten. An X10 module incorporating AGC should have no trouble detecting this signal. It might be marginal for a standard X10 module if the noise frequency is near the X10 120KHz passband. But this is the worst noise source we have found. Noise from a more typical noise source is usually reduced well below a standard X10 module's detection threshold.