Re: Help interfacing Current Transformers to ADC

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beananimal wrote:

> Here is what I gather my circuit is suposed to look like:
> http://tinyurl.com/f6et7
>
> Here is what I understand that needs to be done (In the event I have
> made no errors).
>
> 1) I am still unsure of the best choice for the CT (the 500:1 Triad, or
> the 1000:1 Avemco)

Best is not clear to me at this point, except for price. One of the problems created by the Triad is that the load current has to be connected through circuit board traces. This may produce some practical problems. The Amveco just has a hole that any wire can pass through. This allows a few connection options that do not include passing multi ampere current through traces. The connections may cost more than either transformer. The lower output current from the Amveco may also be better suited to be absorbed by an opamp output.

> 2) the choice of CT will dictate the size of R1
> 3) Once R1 is calculated, then R2 needs to be selected to provide the
> A/D with a suitable voltage range.

You still have not quite gotten your head around the concept of a current source. The opamp responds to the input current, by producing an output voltage that causes the input current to pass through R2, while holding the input at zero volts (because the input pin does not draw any significant current, so there is no other place for it to go). R1 has no effect on this process, since the current into it must also be the current out of it. It just adds extra voltage drop the transformer must supply, lowering its accuracy a little. The optimum value for R1 from the current transformer accuracy standpoint is zero. Jim added it to improve the stability of the opamp feedback process, to suppress any tendency to oscillate. That is its only purpose. So R2 is the only part that determines the output volts per amp sensed, and that calculation includes the transformer ratio.

> 4) The value of R2/R1 gives the Amplification ratio of the inverting
> amplifier that is formed by the OP−AMP. In this case it would be 7.87.
> So 1mv on the output of the Bridge will provide 7.87mV to the D/A
> through R3. 10mV would provide 78.7mV. and 100mV would provide 787mv?

Not when R1 is fed by a current source.

> 5) The inverting amp is being fed from the negative side of the bridge, so the output of the amp will be a positive voltage?

Right. This works as long as the transformer current can be sucked into the opamp output through R2, while balancing the inverting input at zero volts, to match the voltage applied to the non inverting input.

> 6) I think I have the diodes oriented correctly to protect the A/D input pin from the transients. The more I look at them the more I doubt myself. I thought I understood what was going on here.

I think you have them right. They prevent the output from swinging more than a diode drop more positive than Vcc or below ground. But I would add a second resistor after this clamp, since this is the same voltage that turns on diodes in the PIC inputs, sharing this clamping operation in an unknown way. The second resistor puts almost all the clamping current through your diodes. This is pretty important, since forward biasing, even a little bit, the internal clamping diodes, fouls up the accuracy of all the analog input channels. For this reason, a single current transformer that is producing an excessive output will ruin the accuracy of all the other channels, unless you take care of this detail. I normally use Schottky diodes (they conduct with half a diode drop), to keep the input clamping current very close to zero. This also applies to the overload clamp at the opamp input. If one of these comes on, it will affect the operation of the other 3 opamps in that package. So I would go with a Schottky, there, also.

> 7) From the datasheets I see that the recomended BAV99 package is faster and has a lower capacitance than the through hole 1n4148s I chose. I hope this is not an issue for the intended purpose, as I am not good with SOTs and certainly don't want to do 24 of them at 3 pins each!
>
> If I am totaly off base, please let me know and I will give this up and buy more electronics books before I waste anybody elses time.

This is not at all a waste of time. This is producing something worth archiving, that others can find with a search.

> Lastly: There will be 24 of these in my house running 24/7. After the numerous open secondary warnings, is there anything else that I need to do to ensure safety for myself and our home? Honestly, after all of the grave warnings, I actually feel like (in comparisson) that the act of poking around the grid voltage and gain stages of my tube amps is safe!

If the rectifier and burden (R1 and input clamp diode, in this case) are soldered together, then there is little risk of an open secondary.

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