From: John Monteith
To: mark@whiteboxsolar.com
Cc: JShen
Subject: RE: FW: FW: GP21/22 Gain error correction
Date: Wednesday, January 16, 2013 9:02:42 AM
Attachments: image001.png
GP22_MinFLow.pdf

Hi Mark,

Please see the answers below. Please let me know if you have additional questions.

Best Regards,
John

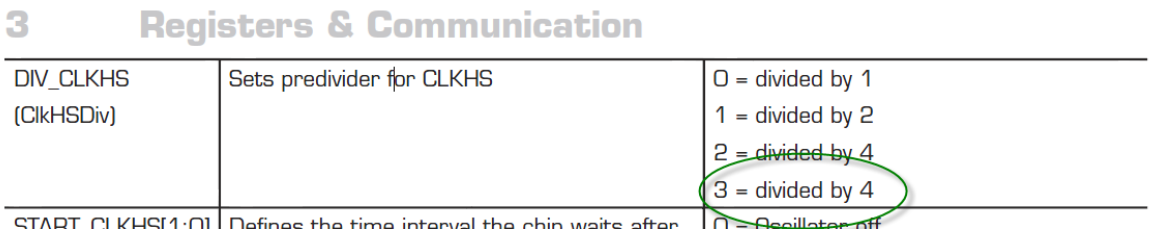
From: Mark Richards [mailto:mark@whiteboxsolar.com]
Sent: Tuesday, January 15, 2013 1:00 PM
To: John Monteith
Cc: JShen
Subject: Re: FW: FW: GP21/22 Gain error correction

John,

Thank you very much. I am copying John Shen, as the second question below came up in our testing.

Two more questions:

1. from the GP22 data sheet, page 3-5. Please confirm that a setting of 2 or 3 is correctly documented:
1. ACAM confirmed the datasheet is correct. The settings 2 and 3 are redundant as they are in the GP2 and GP21.



3 Registers & Communication

DIV_CLKHS (ClkHSDiv)	Sets predivider for CLKHS	0 = divided by 1 1 = divided by 2 2 = divided by 4 3 = divided by 4
START_CLKHS[1:0]	Defines the time interval the chip waits after	0 = Oscillator off

2. In our testing so far we are finding that an existing meter design (which uses a GP2) works fine despite a reflected signal strength of only 80mv peak to peak.

The specifications seem unclear as to the minimum signal strength that the GP22 is able to read. Both the Analog Front End and the Converter specifications in section 2.2 do not list a minimum signal strength (into the STOP1 and STOP2 pins).

Section 4.3 says "The ultrasonic signals will be packages of 50 to 200 sinusoidal oscillations with a several 100 mV amplitude." which is not particularly helpful.

What is the minimum peak to peak amplitude of the reflected signal that the GP22 can resolve?

Norbert (who you talked with before) answered this one: When I discussed the minimum amplitude with Mark I mentioned that with 400mV to 600mV peak-to-peak we get a signal-to-noise ratio that is good enough to measure low flow with high precision. The comparator does not have a minimum peak-to-peak. The limit given by the comparator is that the offset or zero offset can be set with a precision of 1mV. Of course, we can measure signals with only 80mV amplitude, but at such small signals the time variation induced by the 1mV variation of the offset limits the maximum possible resolution (detection of low flow). It will be good for industrial flow meters, but critical for legal for trade meters. For higher amplitudes, the effect will be smaller and therefore the resolution at low flow will be better.

Note: Of course, it is not only the comparator but also the hydrodynamics and the transducers stability that limit the lowest possible flow measurement. This is typically evaluated by optimization of all components of the flow meter. We can just say that there are devices in the field with 600 mV peak-to-peak and 2% resolution at minimum flow. I attached a diagram of a measurement with a real flow meter, that shows the noise at minimum flow. The noise is 0.1l at 25l/h, while the nominal flow of this meter is 2500l/h. This is a meter with 600mV p-p signal strength.

Thank you,

/mark

On 01/09/2013 10:32, John Monteith wrote:

> Hi Mark,
>
> Sorry for the slow response, but I was out sick yesterday. Here is the response from Germany:
>
> Answer for question 1:
> When speaking of supply voltage in this specification, it means VCC.
>
> Answer for question 2:
> Your program should scale the gain factor between 3.0V and 2.5V and you can you 0.00032 for every 0.1V step (3.0V - 2.5V).
> If he select a factor he is taking a deviation error. In his case, the error is very small. The excel file is for the illustrating.
>
> He didn't get my additional information that you were only going from 2.9 to 3.0 volts, but it really doesn't make a difference in this case.
>
> I hope this helps,
> John