How to use and enter the “Offset Trim Mode” of the Sensor Conditioning Electronics UZZ9000

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list of contents:

1. Introduction

The UZZ9000 is a signal conditioning electronics which converts two differential voltages (a sine and a cosine wave) into a linear output voltage. Typically these sine waves come from two sensor bridges (e.g. from the Magnetoresistive Sensor KMZ41 of Philips). To get a proper linear output characteristic it is necessary to adapt the offsets of the two input voltages to the input stage of the UZZ9000.

For this reason a special offset cancellation procedure was implemented. This document describes how to enter and use this so called offset trim mode.

2. Enter offset trim mode of UZZ9000

The mode can be enabled if the following protocol is sent to the input PIN9 and PIN10 of the UZZ9000. Each sensor input channel of the UZZ9000 (±VO1, ±VO2) has to be trimmed separately and can be selected by setting either bit number 3 or 4 to a high level (see fig. 1). The voltages at pin 9 and 10 need to have following characteristic:

low level [1)]:	GND .. 5 %VDD
high level [1)]:	VDD +/- 5 %VDD
rise and fall time of edges:	> 8 ns
frequency at PIN9:	< 1 MHz

[1)] related to supply terminals of UZZ9000, VDD: positive supply

Because of the asynchronous protocol following points have to be taken into account to ensure that a trim mode is entered properly:

1. initiate start condition:
during a high period at PIN9 a falling edge must appear at PIN10
2. choose channel for offset trimming:
All in all 5 rising edges at PIN9 are necessary to fulfill the protocol. During this 5 clock periodes a high level at PIN10 (while a rising edge appears at PIN9) decides whether the offset trim mode of channel 1 or 2 will be entered (see fig.1).

3. set stop condition (switch UZZ9000 to trim mode):
during the 5th high period of PIN9 a rising edge must appear at PIN10
and (!) afterwards PIN9 has to change one more time to low level

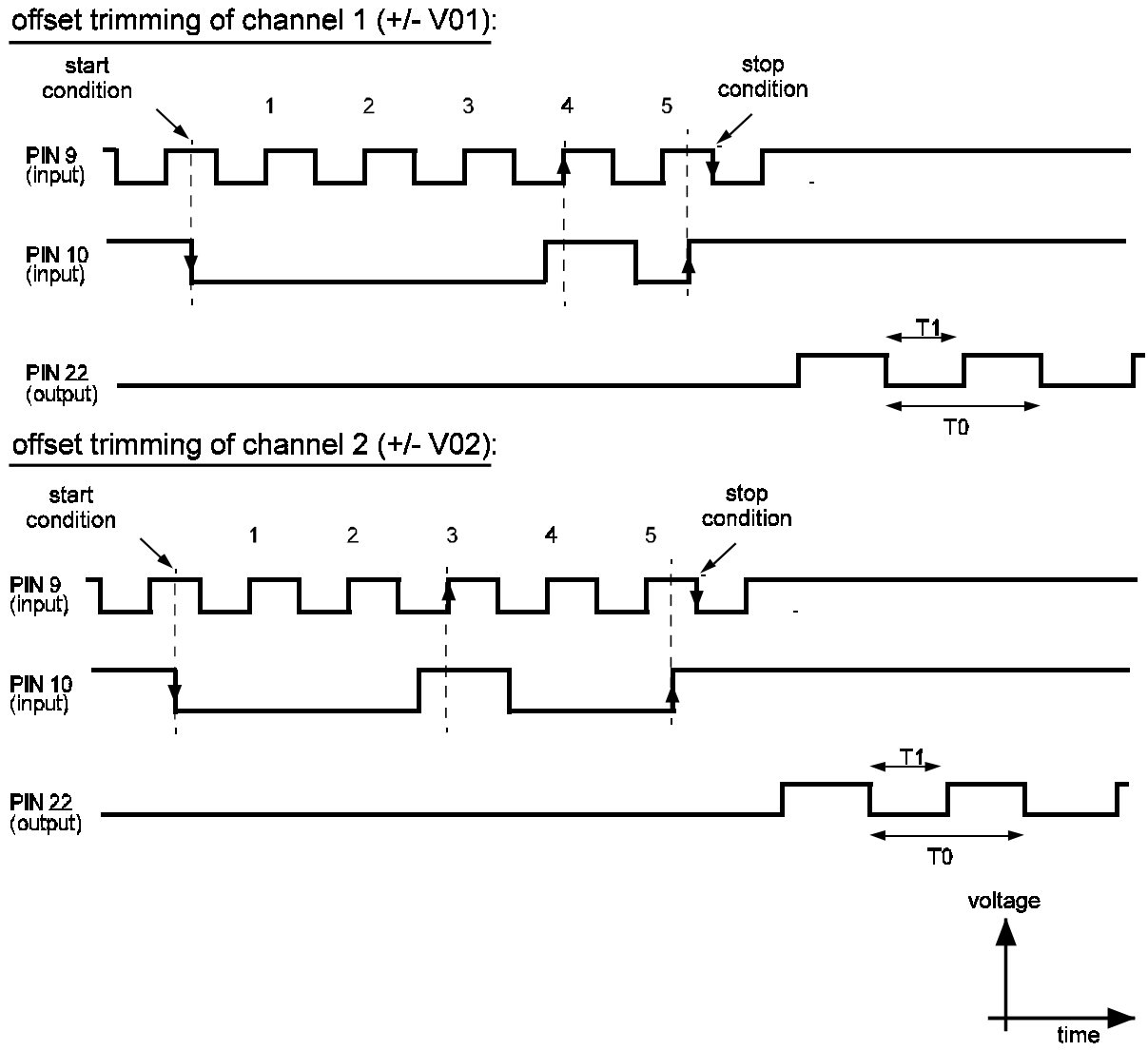

fig. 1: timing diagram

3. Trim procedure

To make use of the trimming procedure it is necessary to generate dynamic sensor signals. If the MR sensor KMZ41 is used this can easily be done by a rotating a magnet (rotational speed of magnet 20 Hz +/- 2.5 Hz) in front of the sensor, so that the outputs are AC voltages with a frequency of 40Hz +/- 5Hz. The absolute frequency is not that important, but the variation within one period should be less than 1 : 3000.

Immediately afterwards the UZZ9000 is switched to a trim mode and sinusoidal sensor voltages are applied to its inputs, PIN22 shows a square wave signal with the same frequency like the senor signal and a duty cycle DC of $\frac{T1}{T0}$. For a DC of 50% +/- 0,04% the offset for the selected channel is virtually eliminated. To change the DC to the correct value the voltage OFFS1 (PIN16, channel 1) or OFFS2 (PIN15, channel 2) has to be adjusted. These voltages must be ratiometric to the UZZ9000 supply and should not vary more than 0,1 %VDD (VDD: positive supply voltage of UZZ9000) over the temperature range. The allowed voltage range of OFFS1 and OFFS2 is 33,3 %VDD to 66,7 %VDD.

summarised data:

frequency of sensor signal:	40 Hz +/- 5 Hz	
stability of frequency per period:	1 : 3000	
measured duty cycle at PIN22 (target):	50% +/- 0.04%	
trim voltages OFFS1, OFFS2:	33,3 .. 66,7 %VDD	
temperature voltage drift of OFFS1, OFFS2:	0,1 %VDD	for the complete temperature range

A different possibility to cancel the offsets of the channels is:

1. measuring the high level voltage VH22 and the low level voltage VL22 at PIN22
2. calculate the average voltage VA22C = (VH22 - VL22)/2
3. apply dynamic sensor signals to UZZ9000 inputs (as described above)
4. measure the average voltage VA22M at PIN22
5. adjust voltage OFFS1 or OFFS2 until VA22M = VA22C +/- 0.04 %VA22C

4. Leave offset trim mode of UZZ9000

To leave the offset trim mode send a protocoll (which is similar to the one, used to enter the offest trim mode) to Pin9 and PIN10:

1. initiate start condition:
during a high period at PIN9 a falling edge must appear at PIN10
2. choose channel for offset trimming:
All in all 5 rising edges at PIN9 are necessary to fulfill the protocol.
During this 5 clock periodes **no** high level has to be send to PIN10.
3. set stop condition (switch UZZ9000 to normal operation mode):
during the 5th high period of PIN9 a rising edge must appear at PIN10
and (!) afterwards PIN9 has to change one more time to low level

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