SAFRAN Colibrys

TECHNICAL NOTE

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Differential to single output circuit

Product: VS1000

This document proposes an electronic circuit to convert the differential output to a single-ended output without performance losses.

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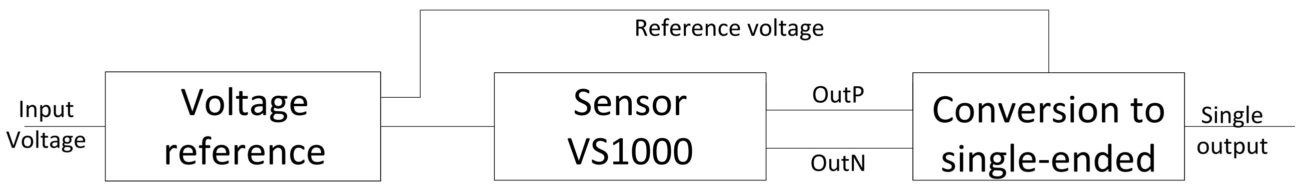
Document number	30N.SINGLE VS1000.A.09.15
Document revision	V1.0
Date of revision	09 Sept. 2015
Note	Colibrys reserves the right to change these data without notice

Recommended circuit

To use a single supply, the single output needs to be shifted by adding a DC voltage to the acceleration signal. Using an instrumentation amplifier having very high input impedance and a common mode voltage control could certainly be the best solution.

The proposed schematic consists into a voltage reference 3.3V, a VS1000.A accelerometer and one instrumentation amplifier.

The diagram representation is as following design, associated with specification requirement in way to conserve a maximum of the sensor performances:



Reference voltage requirement:

- To respect power supply stability and noise due to ratiometry:
  - Regulator needs noise in band <1 µV/√Hz
  - Temperature coefficient < 10 ppm/°C
- The reference output current requirement is >4mA for 1 sensor (12 mA for a triaxial).
- The regulator needs to be able to drive 10.5 uF of sensor decoupling capacitors.

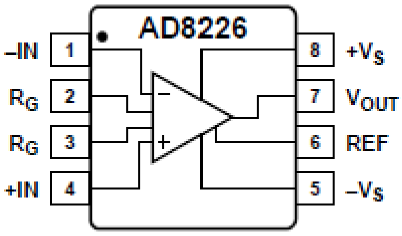
Voltage reference:
The voltage reference proposed is:
- MAX6043 for uniaxial.
- MAX6143 for triaxial.

Amplifier requirement

- Input impedance in bandwidth > 1MOhms
- Common mode rejection in bandwidth > 40dB
- Offset <0.9mV (10% of sensor max bias calibration)
- Temperature offset coefficient < 30uV/°C (10% of sensor bias temperature coefficient)
- Gain attenuation < 0.5% up to 1500Hz
- Stable with Gain=1
- Input voltage covering 0 to 3.3V
- Able to drive capacitive loads due to connection cable (~500pF)
- The power supply voltage needs to be compliant with customer requirement

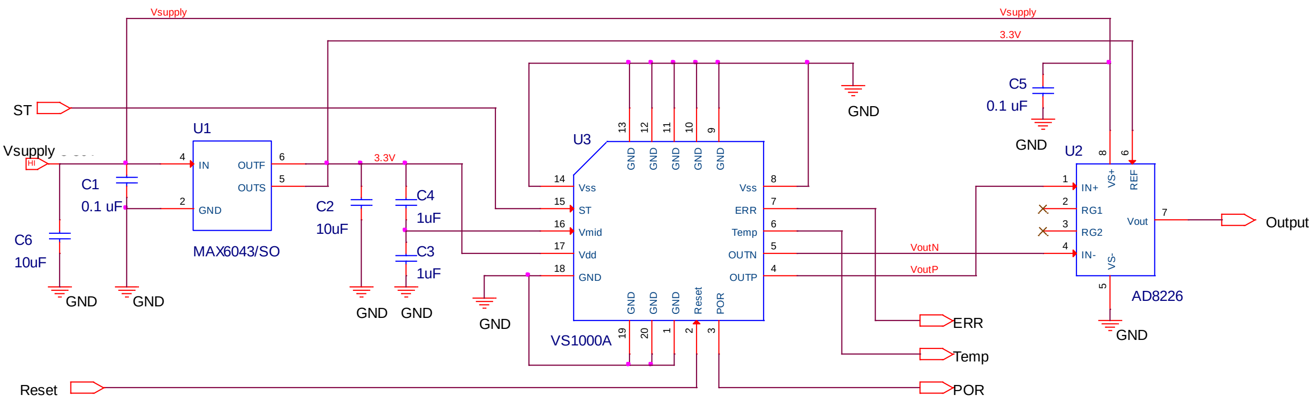
Instrumentation amplifier:
The output amplifier proposed is AD8226

Schematic design



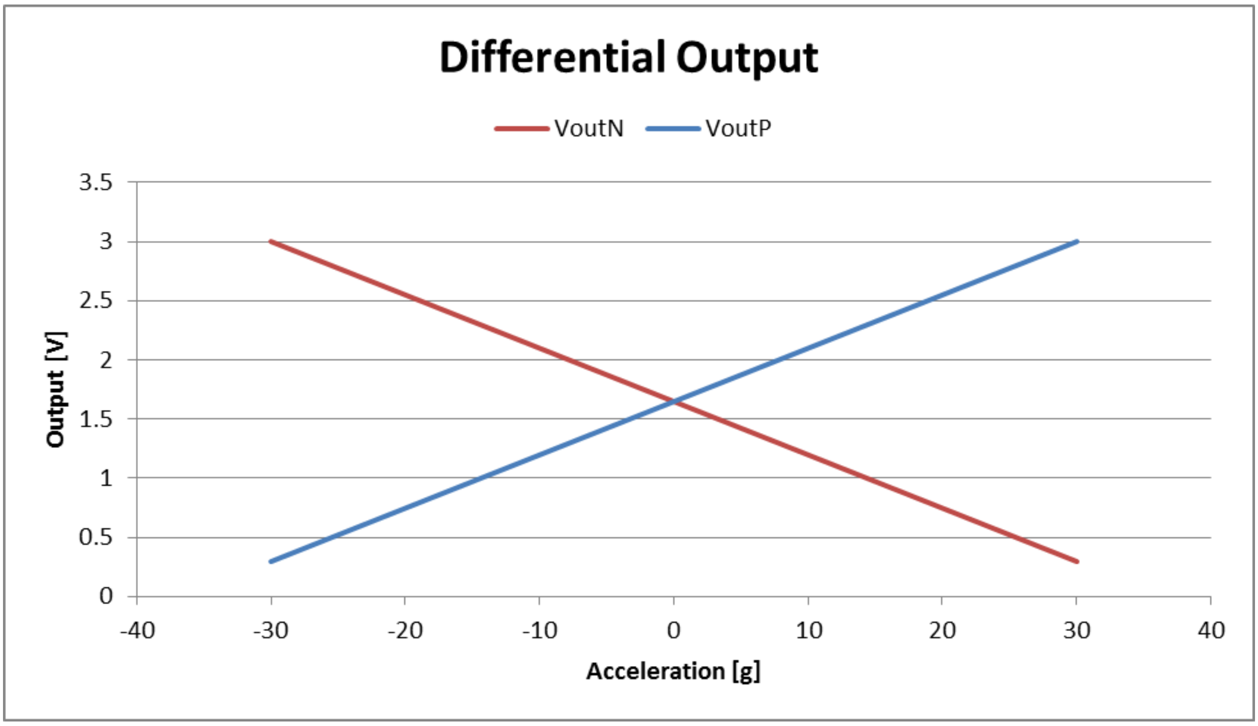
Notes

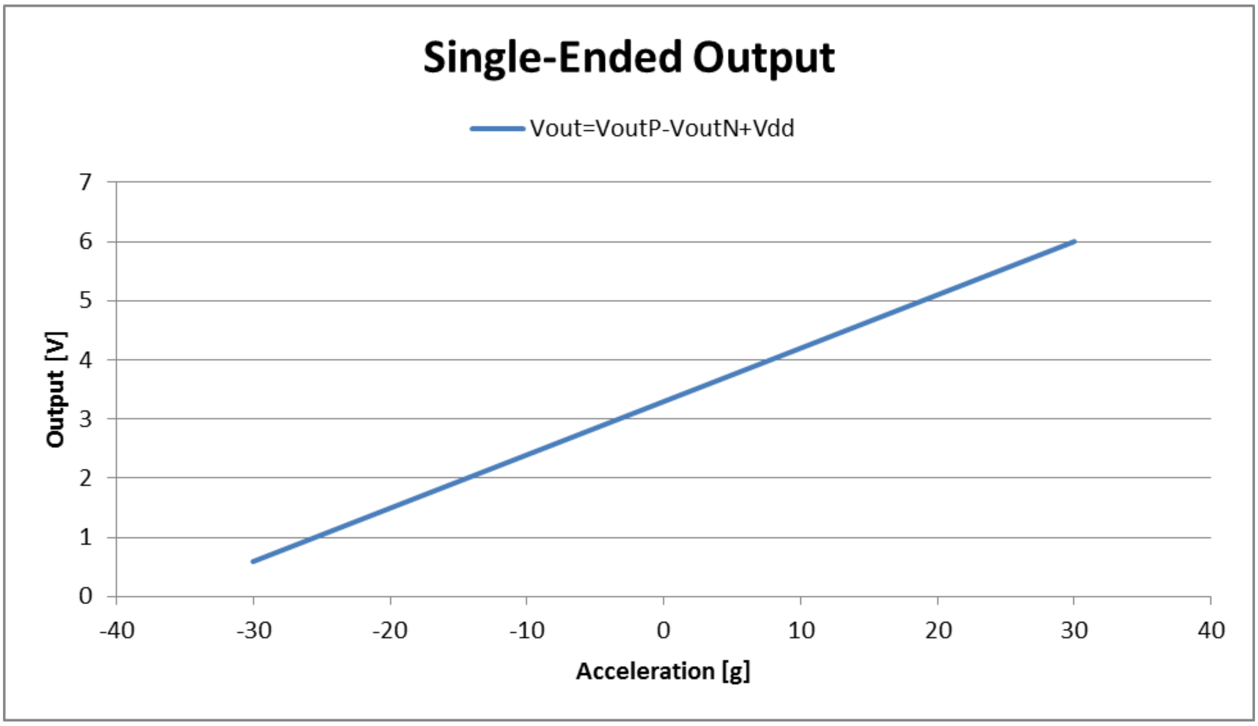
- This amplifier has a G=1 when no Rg is connected.
- The REF input will be the 3.3 Volts from power supply of the sensor.
- Using 3.3V ref and +/-2.7 Volts acceleration signal input, the single ended output signal range is 0.6 to 6 Volts
- This is inside input limit specified 0.3 to Vs-0.7, with Vs min = 8V.
- The specified temperature is -40°C to +125°C.



If input **ST** (Self-Test) is not used, it must be connected to **GND**.
If input **Reset** is not used, it must be connected to **Vdd**.

The next graphs present the output sensor signals VoutP and Vout N, and the single output resulting on output of the instrumentation amplifier. The representation is for 30g sensor VS1030.A.





The single output will follow the datasheet scale factor, with a bias at 3.3V.

Conclusion:

The proposed schematic is informative. It allows to converts the symmetrical outputs into single output. The sensor performances being maintained.