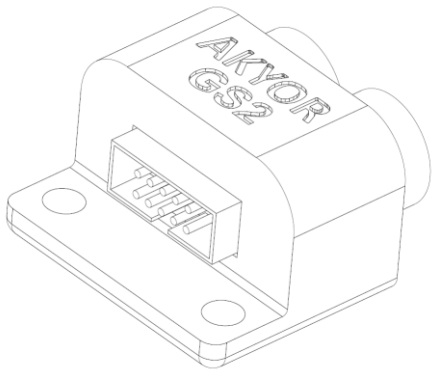
High-Precision Ultrasonic Motion/Distance/Vibration Sensor

FEATURES

- Non-Contact
- Analog/UART/PWM/LED Output
- High precision distance Sensor
- Only 8 grams (0.28 oz)
- Compatible with DVPGS2 Development Boards

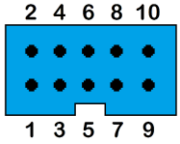


PRODUCT OVERVIEW

alignG-S2, is a cost-effective, low power, compact motion/distance/vibration measurement sensor with a Digital & Analog communication port. This 3.3V sensor consumes below 100mW of power. alignG-S2 is available in 3 packages: Type X, Y, and Z.

alignGS2X supports all features available for alignG-S2 sensor family. It employs Akyor's patented ultrasonic amplitude/phase measurement technology for displacement and distance measurement. In addition, it supports high speed ultrasonic Doppler measurement for vibration measurement and motion detection. alignGS2X is calibrated in the factory. **alignGS2Y** employs Akyor's patented ultrasonic amplitude/phase measurement technology for displacement and distance measurement. alignGS2Y is calibrated in the factory. **alignGS2Z** employs Akyor's patented high speed ultrasonic Doppler measurement for vibration measurement and motion detection. alignGS2Z is not calibrated in the factory.

PIN DEFINITION



I: Input O: Output P: Power Source X: No Connect

Pin	Symbol	Type	Function
1	VCC	P	+3.3 V
2	LED1	O	Vibration PWM
3	NC	X	No Connect
4	LED0	O	Motion Signal
5	NC	X	No Connect
6	TX	O	UART
7	AN	O	Analog
8	PWM	O	Distance PWM
9	GND	P	Ground / 0V
10	EN	I	Enable , Active H

Some pins are not available on Type Y and Z sensors.
Please refer to the Pin Description for details

ABSOLUTE MAXIMUM RATINGS*

VCC Voltage**	3.5 V
Voltage** on Input Pins	0 V to VCC
DC Current Per Output Pins	10 mA
Environment Temperature	-10°C to +60°C

*Exposure to absolute maximum ratings may permanently damage the sensor. Absolute maximum conditions are not the recommended conditions for storage or operating the sensor. Multiple or long-term exposure to proximity of absolute maximum conditions may degrade the performance of the sensor.

** Voltages with respect to GND pin

ELECTRICAL SPECIFICATIONS

VCC Voltage*	3.3V
Average Supply Current, Active**	30mA
Peak Supply Current, Active**	40mA
Average Supply Current, Sleep***	1mA

* Voltage with respect to GND pin ± 1%

** Current while No load on output pins ± 10%

*** Average Current ± 10%

DISTANCE MEASUREMENT PERFORMANCE[i]

alignGS2X

Precision[ii]	25 µm
Linear Error[iii]	50 µm
Accuracy[iv]	100 µm
Calibration Range[v]	4.6 mm
Refresh Time	0.75s±10%
Converging Time	8s±10%

alignGS2Y

Precision[ii]	50 µm
Linear Error[iii]	250 µm
Accuracy[iv]	250 µm
Calibration Range[v]	4.6 mm
Refresh Time	0.75s±10%
Converging Time	8s±10%

i. The sensor's performance depends on variety of parameters. These data are verified at 25°C (±2%), 50% (±5%) relative humidity, and pressure of 101325 Pa (±5%) for an object in about 10mm-15mm proximity of the sensor.

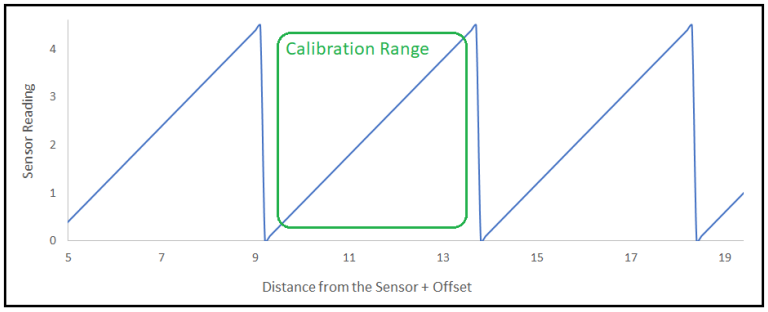
ii. Maximum Standard Deviation, calculated for 50 repeated measurements over 10 test points cross the calibration range.

iii. Maximum deviation from the best fitting average line, calculated for 50 repeated measurements over 10 test points cross the calibration range.

iv. Maximum deviation from the ideal position, calculated for 50 repeated measurements over 10 test points cross the calibration range.

v. At 10% edge of this range, the sensor does not meet the factory targeted performance specs.

alignG-S2X and alignG-S2Y can perform absolute distance measurement within 4.6mm range. As shown in the graph below, when the distance of the under-test surface from the sensor increases beyond the absolute measurement range, the sensor reading becomes zero and ramps toward 4.6mm again. It must be noted that the sensor is calibrated within the 4.6mm range in approximate 10-15mm distance from the surface. That's the recommended operational distance to install the sensor from the surface. The factory targeted calibration is not valid within 10% area of the calibration range's edges.



Sensor Output vs Distance (mm)

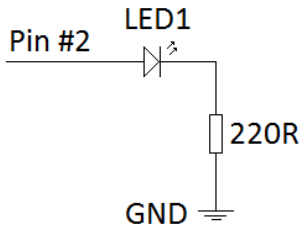
PIN DESCRIPTION

Pin #1: VCC

Power Supply must be connected to a regulated +3.3V (with ± 1% accuracy) source.

Pin #2: LED1 (available for alignG-S2X and alignG-S2Z sensors)

LED1 output is a PWM signal for vibration measurement output.



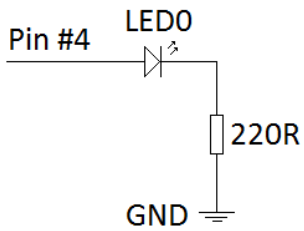
PWM vibration output is not calibrated in factory for alignG-S2X and alignG-S2Z sensors. For a special order of calibrated PWM output, please contact AKYOR.

Pin #3: NC

NC should not be connected to any power pin or electrical load. Applying any signal or load to the NC pin may permanently damage the sensor.

Pin #4: LED0

LED0 output is the micro-motion signal. When the under-test surface is stalled with no vibration and movement, this output is in Low logic state. If the level of vibration/motion in front of the sensor is higher than a pre-set internal threshold level, this pin goes to logic High state. The internal threshold level can be changed in factory upon customers' request. Please contact AKYOR for more information.



Pin #5: NC

NC should not be connected to any power pin or electrical load. Applying any signal or load to the NC pin may permanently damage the sensor.

Pin #6: TX (available for alignG-S2X and alignG-S2Y sensors)

This Output pin sends the sensor measurements via UART. This is the most accurate distance measurement output, calibrated in the factory. The table below shows the UART initial setting:

Parameter	Value
Baud Rate (bps)	9600
Data bits	8
Parity	None
Stop bits	1
Flow Control	None

Each UART data packet contains 4 Bytes starting with a header Byte, followed by data high Byte and data low Byte, and ending with tail check Byte.

Byte #	Description
1	Header check, always: AA-Hex = 170-Dec = 10101010-bin
2	data High byte
3	data low byte
4	Tail check = always: 55-Hex = 85-Dec = 01010101-bin

The calibrated distance can be calculated dividing the UART data by 800000.

Examples

Example1: the received data packet in HEX is: AA-0B-0F-55

0B0F-HEX = 2831-DEC; Distance = 2831/800000 = 0.00353875 m = 3.54 mm

Example2: the received data packet in HEX is: AA-02-F1-55

02F1-HEX = 753-DEC; Distance = 753/800000 = 0.00094125 m = 0.94 mm

Pin #7: AN (available for alignG-S2X and alignG-S2Y sensors)

Analog Output signal varies from 0 to 3.3V. The AN value can be converted to the distance by dividing the voltage value to 644.69

Examples

Example3: the AN voltage is 2.32V; Distance= 2.32/644.69 = 0.0035986 m = 3.60 mm

AN analog output is not calibrated in factory for alignG-S2X and alignG-S2Y sensors. For a special order of calibrated analog output, please contact AKYOR.

Pin #8: PWM Output (available for alignG-S2X and alignG-S2Y sensors)

The distance can be calculated dividing the duty cycle of the PWM signal by 195.36

Examples

Example4: the PWM signal has 50% duty cycle; Distance = 0.5/195.360195 = 0.0025594 m = 2.56 mm

PWM distance output is not calibrated in factory for alignG-S2X and alignG-S2Y sensors. For a special order of calibrated PWM output, please contact AKYOR.

Pin #9: GND

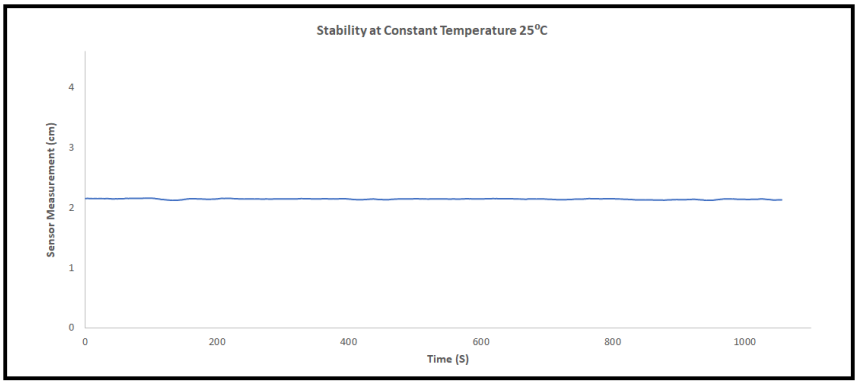
Ground

Pin #10: EN

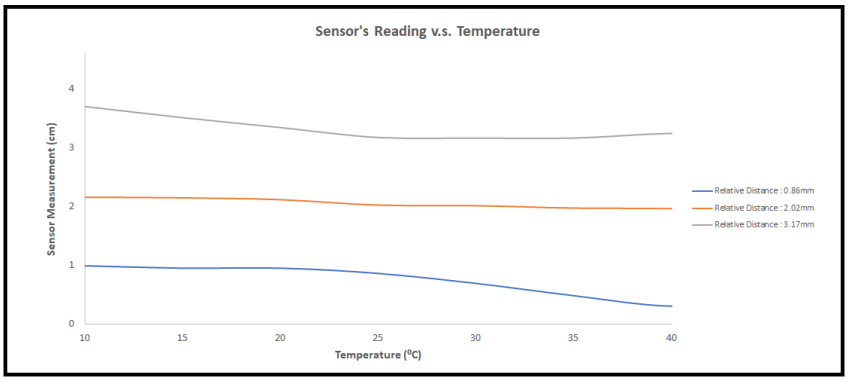
When EN is 0 (L), the sensor goes to sleep mode, reducing the power consumption of the system. The sensor wakes up setting EN to 1 (H).

TYPICAL PERFORMANCE CHARACTERISTICS

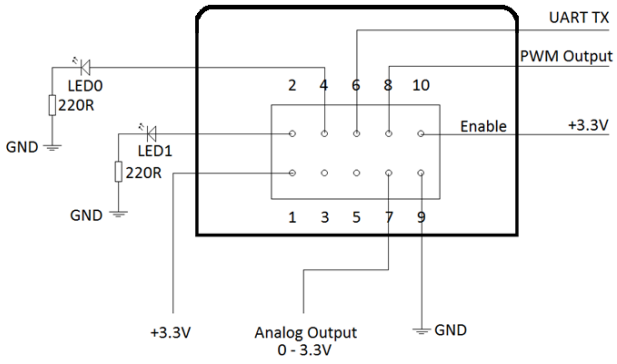
alignG-S measurement technology takes the advantage of a proprietary passive temperature compensation technique to minimize the environmental temperature influence. However, alignG-S series of sensors have no built-in active thermal compensation and calibration. Hence, their thermal response is not tested or calibrated in fabrication. For applications with a wider environmental temperature variation, please refer to alignG-T series that have built-in temperature compensation. In stable temperature conditions, alignG-S has the following typical stability over a long-term functionality.



A typical distance measurement response to the environmental temperature is shown below:



QUICK TEST CIRCUIT DIAGRAM



MECHANICAL SPECIFICATIONS (±500 µm)