

## LISY300 Gyroscope Module (#27922)

The LISY300 Gyroscope Module is a single-axis yaw rate sensor providing up to 300°/s full scale rotation detection at up to 88 Hz. Useful in balancing robots or auto-pilot systems, the LISY300 Gyroscope Module can detect how many degrees it has turned on its planar axis allowing the host microcontroller to stabilize the platform and correct for drift.

### Features

- $\pm 300^\circ/\text{s}$  full scale
- Easy SPI interface
- Small DIP form factor module
- Compatible with most microcontrollers

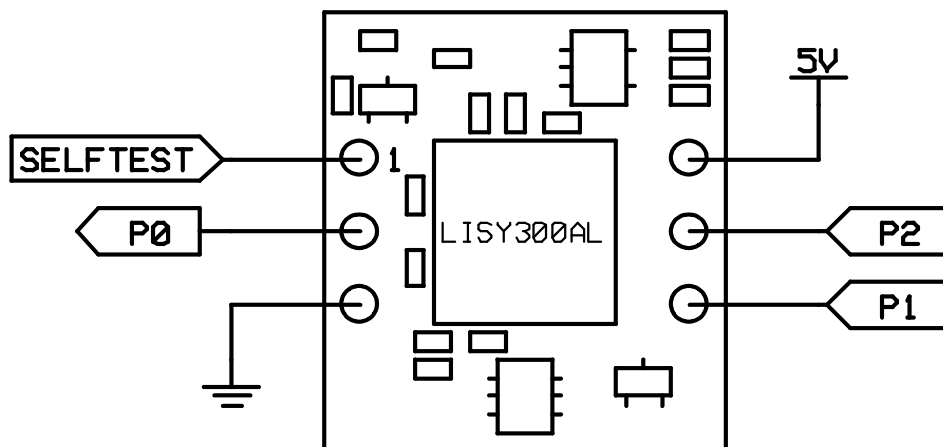
### Key Specifications

- Power requirements: 3.4 VDC to 6.5 VDC (5 VDC recommended) @ 5.25 mA
- Communication: SPI (4 MHz max)
- Operating temperature: 32°F to 158°F (0°C to 70°C)
- Dimensions: 0.75" L x 0.69" W x 0.47" H (19.18mm L x 17.56mm W x 11.95mm H)

### Application Ideas

- R/C Helicopter stabilization
- Auto-pilot system for R/C Planes
- Balancing Robot

### Quick Start Circuit



**Figure 1: Quick Start Circuit**

## Connecting and Testing

Using the Quick Start Circuit connect the LISY300 Gyroscope Module to your microcontroller. P0 will be connected to data out ( $D_{OUT}$ ), P1 will be connected to the synchronous clock input (SCLK) and P2 will be connected to the chip select ( $/CS$ ). You could optionally connect P3 to the self test (ST) pin. The code examples provided will make use of P0 through P2 on both the BASIC Stamp module and the Propeller chip.

## Pin Definitions and Ratings

Pin	Name	Function
1	ST	Self Test Input (Low = Normal, High = Self Test)
2	$D_{OUT}$	Serial Data Output
3	GND	Ground $\rightarrow$ 0V
4	SCLK	Synchronous Clock Input
5	$/CS$	Chip Select Input (Low = Select, High = Disable)
6	$V_{IN}$	Voltage Input $\rightarrow$ 3.4 VDC to 6.5 VDC

Symbol	Quantity	Minimum	Typical	Maximum	Units
$V_{IN}$	Supply Voltage	3.4	5.0	6.5	V
$I_{CC(Ave)}$	Average active supply current	—	5.2	—	mA
$V_{ST}$	Self Test Voltage Range*	3.0	3.3	5.0	V
$V_{OH}$	Signal High Output ( $D_{OUT}$ )	3.1	3.23	3.3	V
$V_{OL}$	Signal Low Output ( $D_{OUT}$ )	0	—	0.1	V
$V_{IH}$	Signal High Input ( $/CS$ , SCLK)	2.1	3.3	5.0	V
$V_{IL}$	Signal Low Input ( $/CS$ , SCLK)	0	—	0.8	V

\* MOSFET input, observe static precautions

## Theory of Operation

Internally the LISY300AL Gyroscope generates approximately 1.6V on its analog output when it is still. This value is affected very little by temperature so compensation is not required. The output of the LISY300AL is fed into a National Semiconductor ADC101S021 10-bit ADC. This ADC has a high-speed (4 MHz) SPI interface and the signal pins can operate at 3.3V and 5V. Both the gyroscope and the ADC are internally regulated to 3.3V.

As the gyroscope is rotated clockwise (looking down at the top of the IC) around its z-axis the analog output voltage falls. As the gyroscope is rotated counter-clockwise around the z-axis the analog output voltage rises. The amount of change in the voltage is relative to the speed in which the gyroscope is rotating. By measuring the output voltage the rate of rotation can be determined.

## Calibration

The static (non-moving) analog output of the gyroscope can be affected by the manufacturing process, therefore it is necessary to calibrate the gyroscope before use. This can be done at startup by making sure the gyroscope is still and sampling the ADC several times to get the average value. This value can be obtained each time at startup or could be stored after initial calibration. Please refer to the demo code for calibration examples.

## Sensitivity

The LISY300 Gyroscope has a sensitivity of 3.3 mV/°/s. The ADC is 10-bits providing approximately 3.22 mV per step. Each step is approximately 1 degree of change on the gyroscope.

## Communication Protocol

The communication with the Gyroscope actually takes place with the ADC, not the gyroscope chip itself. The ADC has an ADC capable of up to 4MHz communication speed, however the gyroscope will only update at a rate of 88 Hz. Communication with the ADC is initiated by bringing /CS low and clocking 16 bits via the SPI bus. Communication is terminated by bringing /CS high again. The data is sent MSB first and is preceded by 3 leading zero bits and trailed by 2 zero bits. Please see the datasheet for the ADC101S021 for more details on communication.

## Resources and Downloads

You may download free example programs, articles, schematic, etc. from the product page by typing 27922 into the search box on our website and clicking the GO button.

## Tech Support Resources

Parallax Inc. offers several options for obtaining technical support for your product:

- Email: [support@parallax.com](mailto:support@parallax.com)
- Fax: (916) 624-8003
- Phone: (916) 624-8333 or toll-free in the U.S. at (888) 99-STAMP. Phone support is available Monday through Friday from 7:00AM to 5:00PM Pacific time or you can leave a message and a tech support representative will return your call as soon as possible.
- Forums: <http://forums.parallax.com>. Our support forums are available 24 hours a day, 7 days a week and are frequented by both Parallax customers and employees. You can often find fast answers to questions by searching previous posts or posting your question to the Propeller chip forum.

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