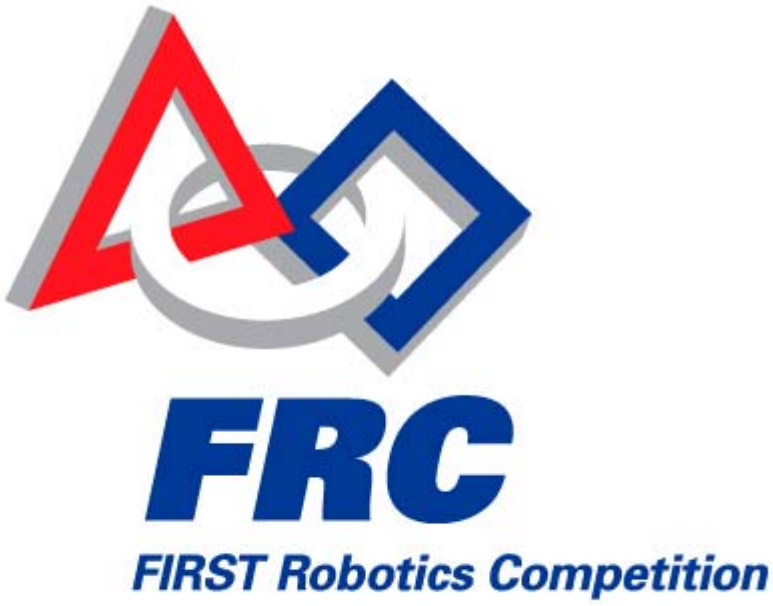
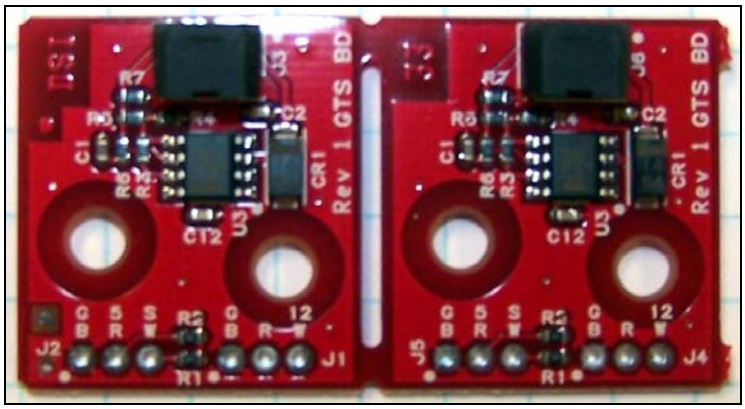


2008 *FIRST* Robotics

Sensor Manual

The 2008 *FIRST* Robotics Competition (FRC) sensors are outlined in this document. It is being provided as a courtesy, and therefore does not supersede any information or rules provided in the 2008 *FIRST* Robotics Competition Manual.

Differential Peak-Detecting Gear Tooth Sensor
Allegro Microsystems PN ATS642LSH



The ATS642LSH Hall-Effect IC is used for detecting and counting magnetic fields from ferrous gear teeth related to a robot's drive operations. For example, it can count teeth on a gear to measure and, through the RC, control robot speed.

A ferrous metal rotating gear (or sprocket, etc) will provide a pulse as each tooth passes. The duty cycle of the signal ranges from 41% to 61%. The pulse with is the same for clockwise and counterclockwise rotations.

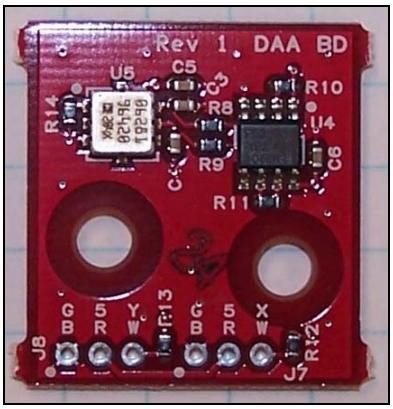
The device output is a PWM digital signal at a nominal 45µs pulse period for forward or reverse rotation out of the "S" port. This speed sensor is self-calibrating, adept at handling vibration, and is immune from air gap variations.

Two PWM cables are needed to interconnect the module. One cable is used to supply a 12Vdc operating voltage from the sensor distribution circuit breaker. The second PWM cable connects to an available digital input port on the robot controller to deliver sensed pulse counts from the "S" port and to receive +5V from the RC unit. "G" is always the ground connection. The current draw for these sensors is relatively low at 16mA.

Remember to periodically inspect for (and clean off) the Hall-Effect sensor for any ferrous debris, particularly following fabrication and mounting of the sensor and before competition.

For detailed operation of the Allegro MicroSystems ATS642LSH Differential Peak-Detecting Gear Tooth Sensor, refer to Allegro Microsystems' website at www.allegromicro.com.

Dual-Axis Accelerometer
Analog Devices PN ADXL204



The Dual-Axis Accelerometer (DAA) measures both dynamic motion (vibration) and static motion (gravity). It should be connected to two of the RC analog inputs to measure X-axis and Y-axis acceleration. Accelerometers are sensitive to rough handling. Please remember to handle with care.

The output varies by 1,000 mV/g, when given a 5.0-volt supply. The current draw is 3mA.

The sensitivity of the ADXL204 at 5V is more than three times higher than the sensitivity of the ADXL311 that has been provided in previous years.

For detailed operation of the Analog Devices ADXL311 DAA, refer to the Analog Devices website which can be found at www.analog.com.

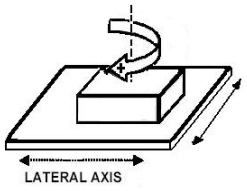
Board orientation	White dot by U5	X output (volts)	Y output (volts)
Horizontal	Don't care	2.5	2.5
Vertical	Upper left	1.5	2.5
Vertical	Lower left	2.5	3.5
Vertical	Lower right	3.5	2.5
Vertical	Upper right	2.5	1.5

All of the voltages assume the DAA is stationary.

Yaw Rate Gyro
Analog Devices PN AD22304

The Yaw Rate Gyro (YRG) senses angular changes about the top surface axis of the device and provides an output voltage proportional to the angular rate change. The output is useful for guidance, stability, and control of the robot platform.

One thing to remember as you locate your gyro sensor on your on the robot is that the lowest apparent drift on the gyro will occur when the module is mounted flat in or near the center axis of the robots rotation. The figure on the right indicates the rate change increase for clockwise rotation. Also, when mounting the YRG module, use nylon washers to isolate the PCB from the chassis.



RECOMMENDED MOUNTING
RATE GYRO MODULE

The Yaw Rate gyro receives 5V from the RC and connects to two of the robot controller's analog inputs. Please note that the output labeled "T" is for "Twist" or rotational velocity. The output labeled "R" is "Relative Temperature".

The actual Yaw Rate Gyro chip that was used in 2007 was the ADXRS150. The AD22304 has a guaranteed dynamic range of +/- 80 degrees per second vs. the +/- 150 degrees per second for the ADXRS150. Most other specifications are identical.

The "T" output varies by 12.5 millivolts per degrees per second of rotation. No rotation will give a 2.5-volt output. The current draw is 8mA. Accelerating clockwise will provide a voltage above 2.5 volts. The 3 dB bandwidth of the Yaw Rate Gyro is set at 40 Hz.

The "R" output varies by 8.4 millivolts per degree Kelvin. A temperature of 298 K (about 25 Celsius) will give an analog output of 2.5 volts. Higher temperatures will provide higher voltages. Cooler temperatures will provide lower voltages.

The datasheet is not available on the Analog Devices website, but is posted, for your reference only, on the *FIRST* website at www.usfirst.org/frc_gyro.