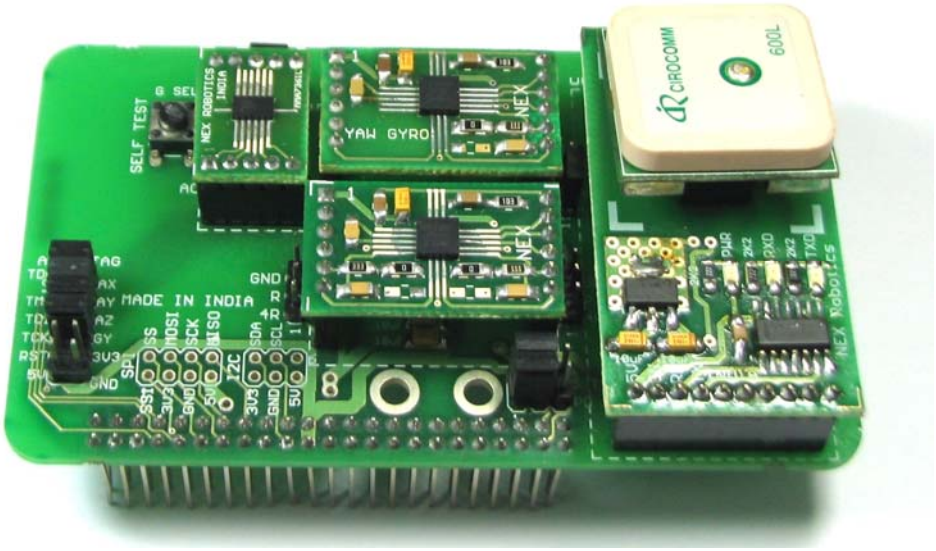
Sensor Adaptor Module for Fire Bird V ATMEGA2560 Robot



Sensor Adaptor Module is specifically designed for the Fire Bird V ATMEGA2560 series of robots for adding enhanced navigation capability. It has sockets for following sensor modules

1. 3 axis accelerometer
2. Yaw Gyroscope
3. Pitch and Role Gyroscope
4. GPS receiver
5. Expansion socket of SPI and I2C bus

Note: For More information on Gyroscope, Accelerometer and GPS Receiver module mounted on Sensor Adaptor Module Refer the respective manual from the NEX Robotics site www.nex-robotics.com or in the Fire Bird V ATMEGA2560 documentation CD.

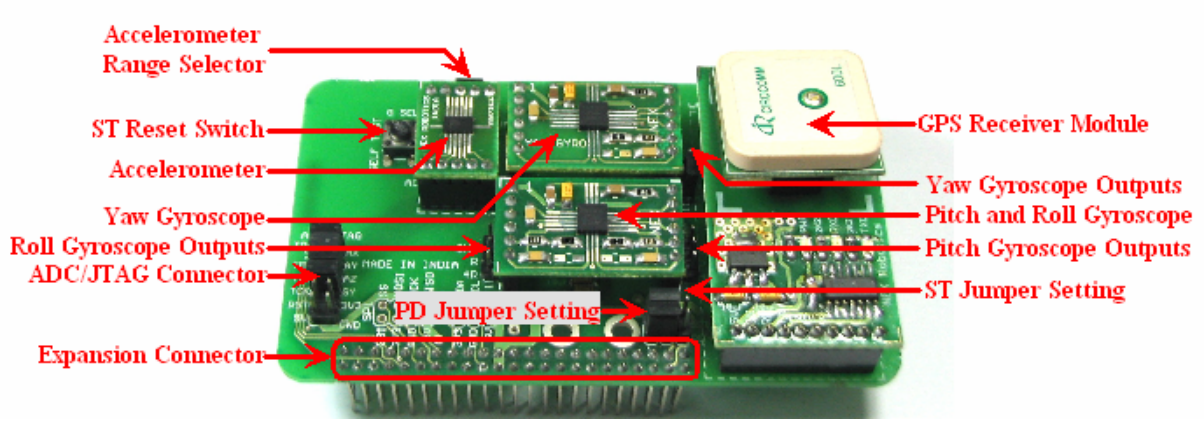


Figure 1: Sensor Adaptor Module Configuration

Board Version:

This adaptor module is version 1. You can check the version number just below the GPS module. It supports following sensor modules from NEX Robotics.

1. 3 axis accelerometer: MMA7361L
2. Yaw Gyroscope: LY510 and LY530
3. Pitch and Role Gyroscope: LPR510 and LPR530
4. GPS receiver: GPS Receiver MT3318 Module
5. Expansion socket of SPI and I2C bus

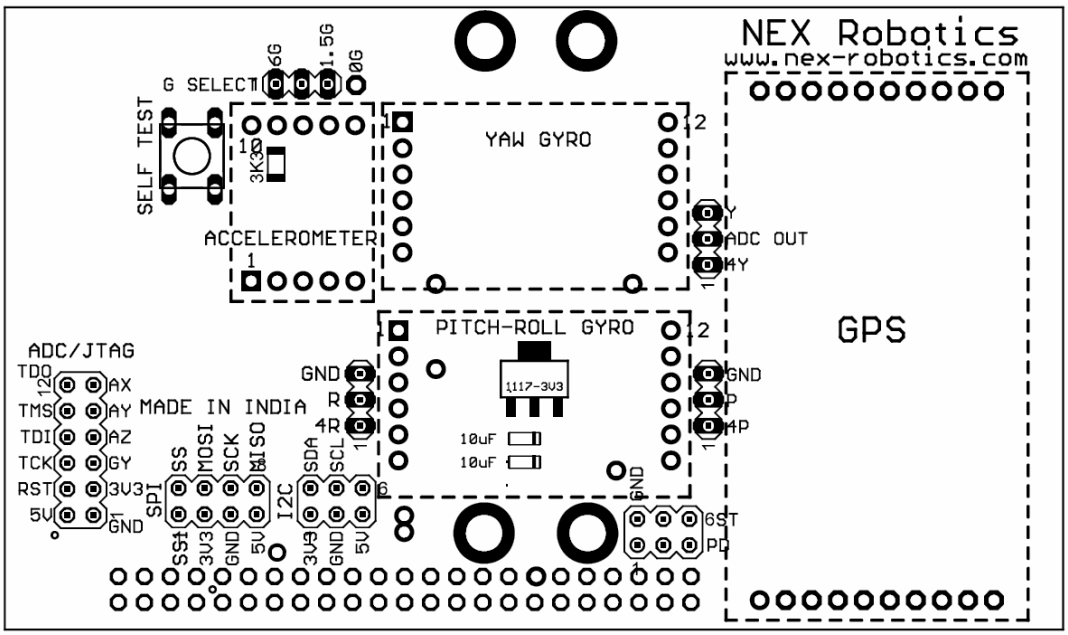


Figure 2: Board layout

Power:

Board operates on “5V uC supply”. It has onboard LM1117-3V3 low drop voltage regulator for supplying power to one accelerometer module and 2 gyroscope modules. GPS module runs on “5V uC supply”.

Accelerometer module

MMA7361L is a three axis low-g accelerometer module form NEX Robotics. It gives selectable acceleration range from ±1.5g or ±6g by putting the jumper on the G-SELECT jumper. With the acceleration range of ±1.5g it gives sensitivty 800 mV/g and with ±6g it gives sensitivty 206 mV/g. For more information on the accelerometer module, refer to its manual which is located in the "Accessories" folder in the documentation CD.

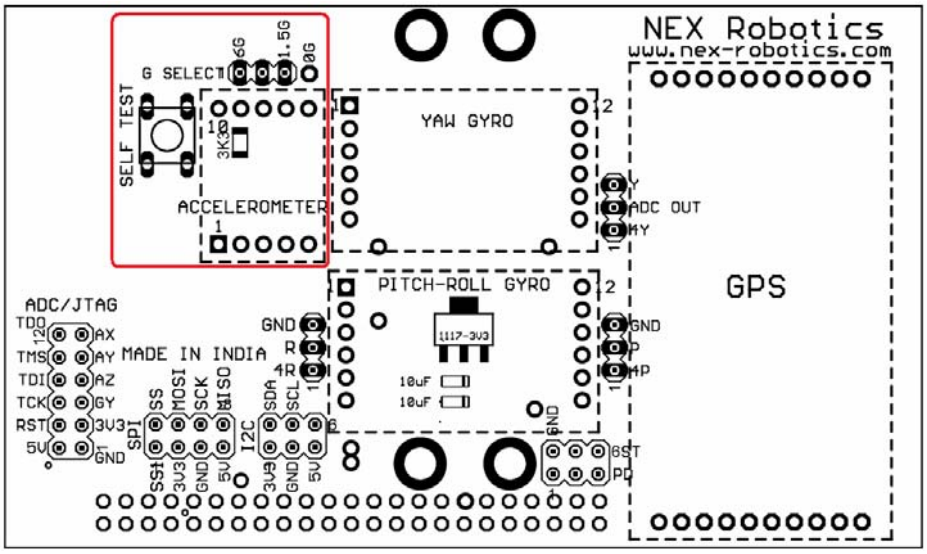


Figure 3: 3 Axis Accelerometer

Figure 3 shows the location of the accelerometer module. It is very important that you insert accelerometer with correct polarity. Pin 1 of the accelerometer is clearly marked near its socket.

Settings and connections:

G Select jumper: Sets G output of the accelerometer in 1.5G or 6Gs.

0G pad: gives output when 0G (free fall) is detected. It is left unconnected. It can be connected to any GPIO of the microcontroller (when it is configured as input).

Self Test Switch: It is used to test the functionality of the accelerometer.

Accelerometer X axis output: Connected to the ADC6 of the ATMEGA2560 microcontroller

Accelerometer Y axis output: Connected to the ADC5 of the ATMEGA2560 microcontroller

Accelerometer Z axis output: Connected to the ADC7 of the ATMEGA2560 microcontroller

Important:

ADC 5, 6 and 7 are also connected to the IR Proximity sensor 2, 3 and 4. In order to use these sensors you need to disconnect ADCs with the IR Proximity sensors. To do this remove all four jumpers of Jumper marked as J2 on the ATMEGA2560 microcontroller adaptor board. Figure 9 shows the location of the jumper. For more information on the ATMEGA2560 microcontroller board refer to chapter 3 of the Hardware Manual.

Yaw Gyroscope module

Board supports LY510 and LY530 yaw gyroscope modules from NEX Robotics. LY510 gives 400^0 per second and amplified 100^0 per second output while LY530 gives 1200^0 per second and amplified 300^0 per second output.

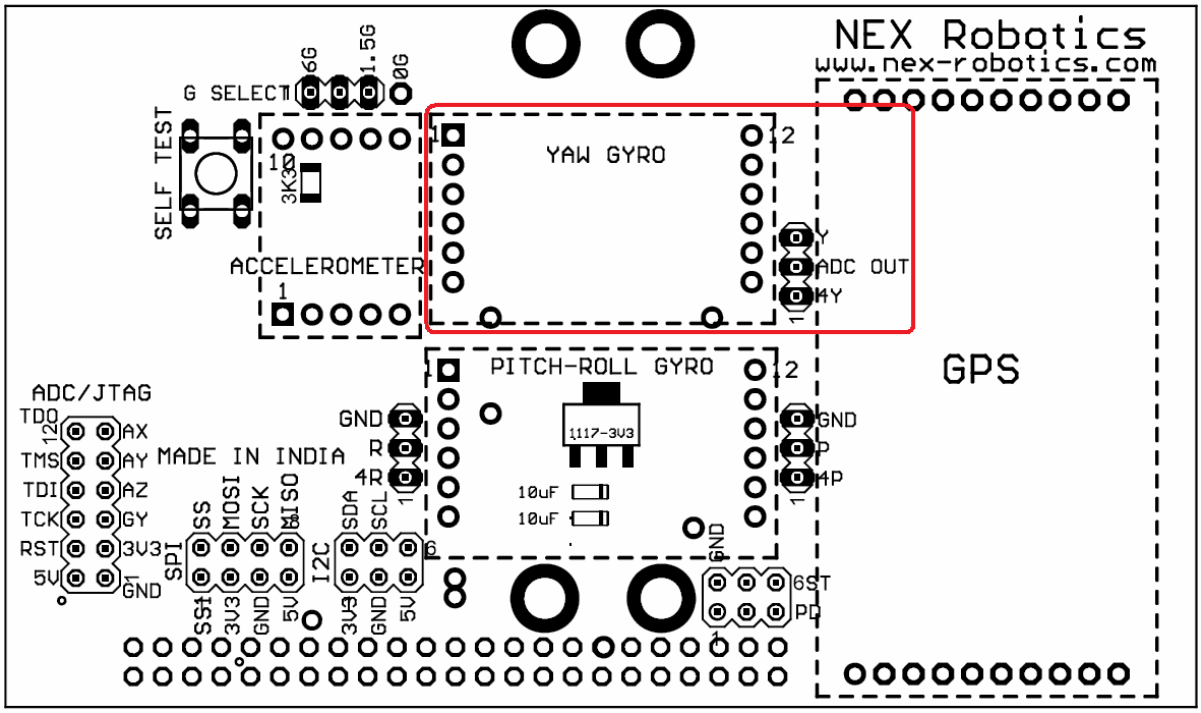


Figure 4: Yaw Gyroscope

Figure 4 shows the location of the yaw gyroscope module. It is very important that you insert gyroscope with correct polarity. Pin 1 of the yaw gyroscope is clearly marked near its socket. Just at the right side of the gyroscope module there is jumper for selecting 1X or 4X (amplified) output. Set jumper as per the required sensitivity. Yaw output of the gyroscope is connected via ADC OUT pin of the jumper to the ADC4 of the ATMEGA2560 microcontroller.

Important:
ADC 4 is also connected to the IR Proximity sensor 1. In order to use this sensor you need to disconnect ADC with the IR Proximity sensor. To do this remove all four jumpers of Jumper marked as J2 on the ATMEGA2560 microcontroller adaptor board. Figure 9 shows the location of the jumper J2. For more information on the ATMEGA2560 microcontroller board refer to chapter 3 of the Hardware Manual.

Pitch and Roll Gyroscope module

Board supports LPR510 and LPR530 Pitch and Roll gyroscope modules from NEX Robotics. LPR510 gives 400^0 per second and amplified 100^0 per second output while LPR530 gives 1200^0 per second and amplified 300^0 per second output.

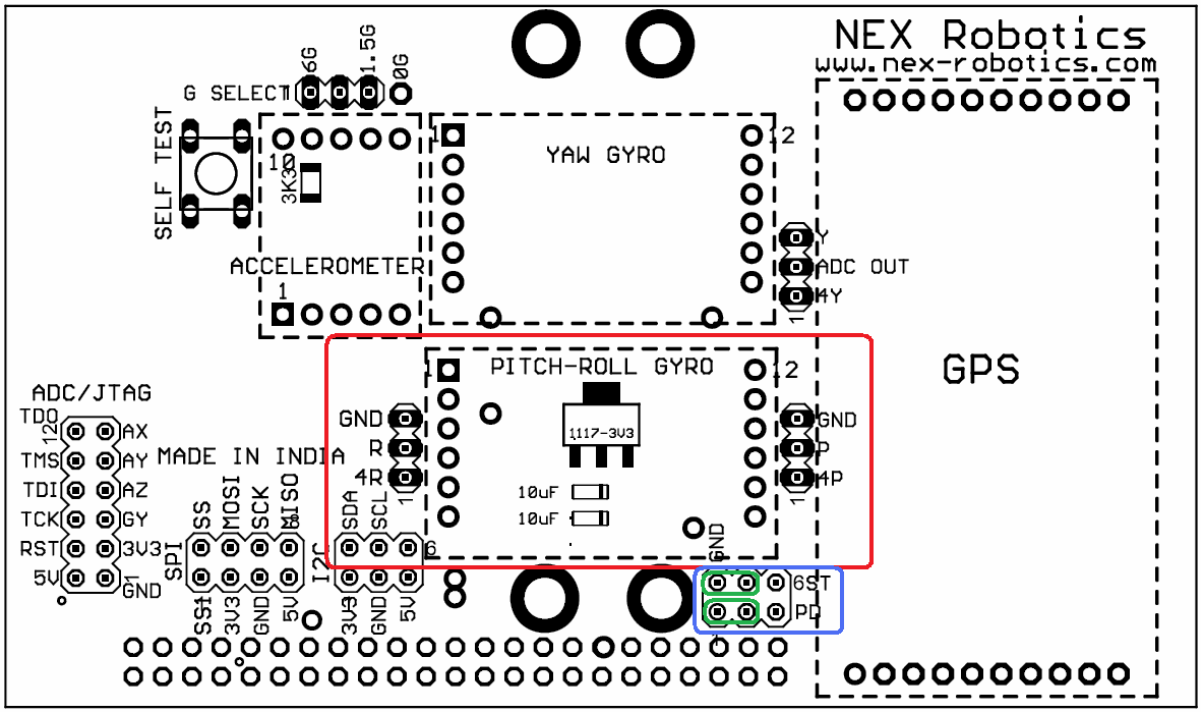


Figure 5: Pitch and Roll Gyroscope

Figure 5 shows the location of the pitch and roll gyroscope module. It is very important that you insert gyroscope with correct polarity. Pin 1 of the pitch and roll gyroscope is clearly marked near its socket. Roll and pitch outputs are available on the jumpers towards left and right side of the pitch and roll gyroscope module. P and R pins gives out un-amplified pitch and roll output while 4P and 4R gives out amplified output of the pitch and roll angles respectively.

Connections:

Pitch and roll outputs (amplified or un-amplified) are to be connected to the ADC pins of the ATMEGA2560 microcontroller, which are located in the “Servo Pod Connectr” of the ATMEGA2560 microcontroller adaptor board. For location of the connector, refer to figure 9. Section 3.19.5 describes the connections of the Servo Pod Connector. Figure 6 shows the pin numbers of the Servo Pod Connector.

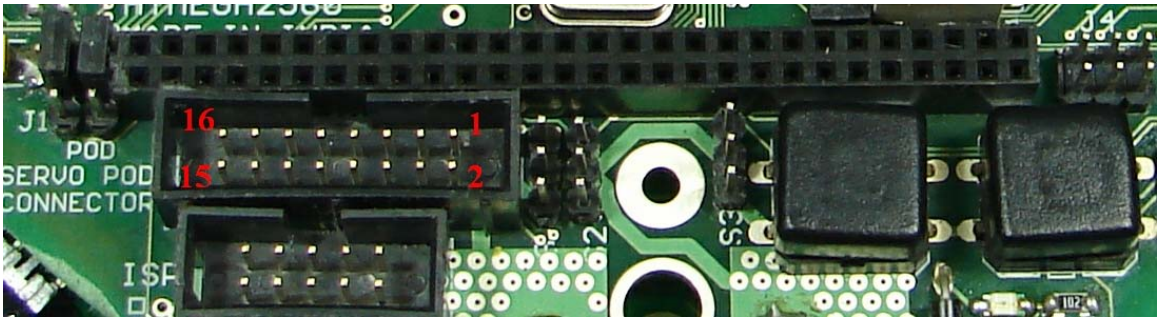


Figure 6: Servo Pod Connector

Pin No.	Pin Name	Description	Connections with the Pitch and Roll Gyroscope
1	Servo POD1	Connection with ATMEGA2560 ADC channel 14	Pitch (P or 4P) output of the pitch and roll gyroscope
2			
3	Servo POD2	Connection with ATMEGA2560 ADC channel 15	Roll (R or 4R) output of the pitch and roll gyroscope
4			
5	GPIO	Connection with ATMEGA2560 OC2A/PB4 pin (Pin no. 23)	
6			
7	Atmega8 ADC	Connection with ATMEGA8 ADC channel 1	
8			
9	Atmega8 ADC	Connection with ATMEGA8 ADC channel 3	
10			
11	Ground	Ground	
12			
13	V SYS	+ 5V (VCC)	
14			
15	V BATT	Battery Voltage(9V – 11V)	
16			

Table 1: Servo Pod Connector pin description

Connect pitch (P or 4P) output to the ADC 14 of the ATMEGA2560 microcontroller and roll (R or 4R) output to the ADC 15 of the ATMEGA2560 microcontroller. Refer to table 1 for the connections. Figure 7 shows the Pitch and Roll outputs connections with the Servo Pod Connector

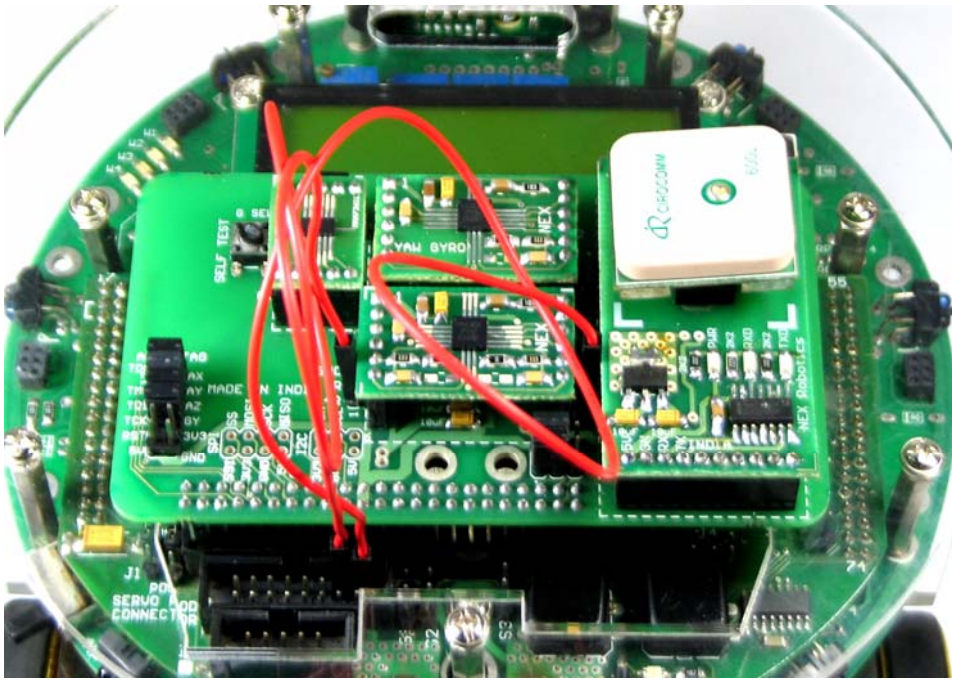


Figure 7: Pitch and Roll outputs interfaced with the Servo Pod Connector

ST and PD jumper settings for Yaw and Pitch-Roll gyroscopes
ST jumper is used for self testing of the both type of gyroscopes while PD jumper is used to put the gyroscopes in power down mode.

ST and PD jumpers are marked with blue border in the figure 5. Green marks within the blue border shows the default status of the jumpers. If jumpers are set in opposite direction then both gyroscopes will go in power down mode or self test mode. For more information on the settings refer to the gyroscope's documentation.

GPS module

Version 1 of the Sensor Adaptor Module supports MT3318 GPS Receiver Module from NEX Robotics. Insert the GPS Module with correct orientation as shown in the figure 1.

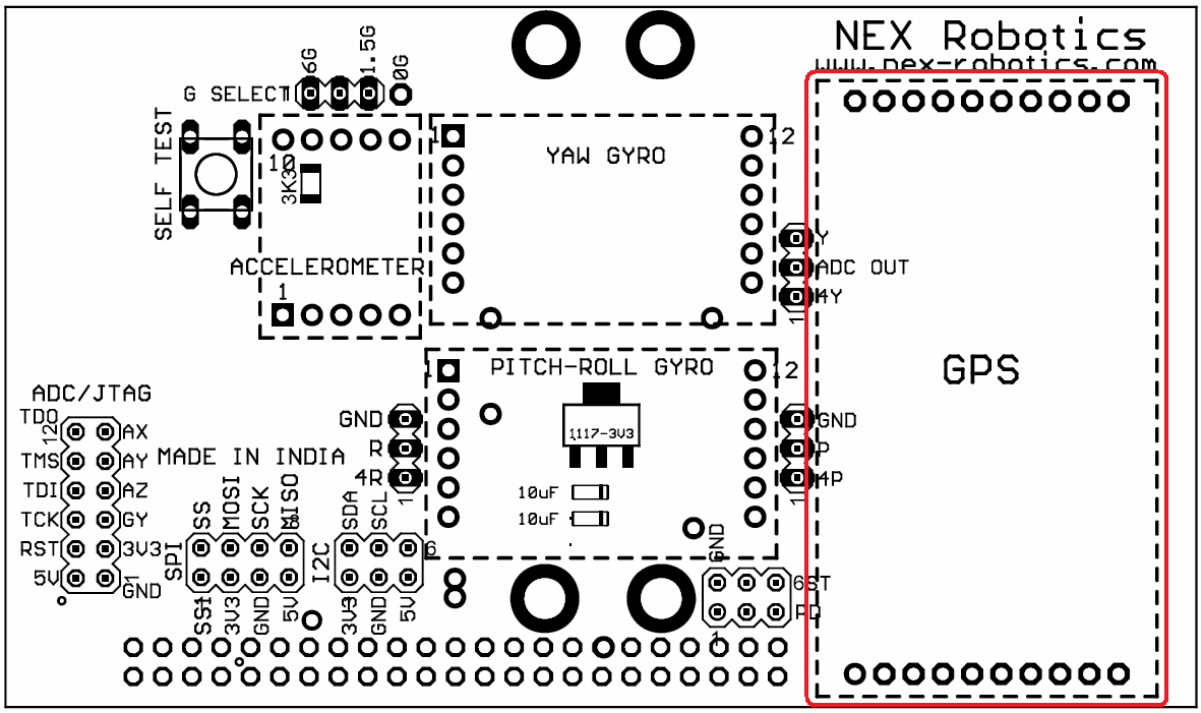


Figure 8: GPS Module

Important:
GPS module is connected to the UART 3 pins of the ATMEGA2560 microcontroller. These pins are also connected to the LED bargraph display on the ATMEGA2560 adaptor board. For correct operation you need to disable the bargraph display by removing jumper marked as J3. For location of the J3 refer to figure 9.

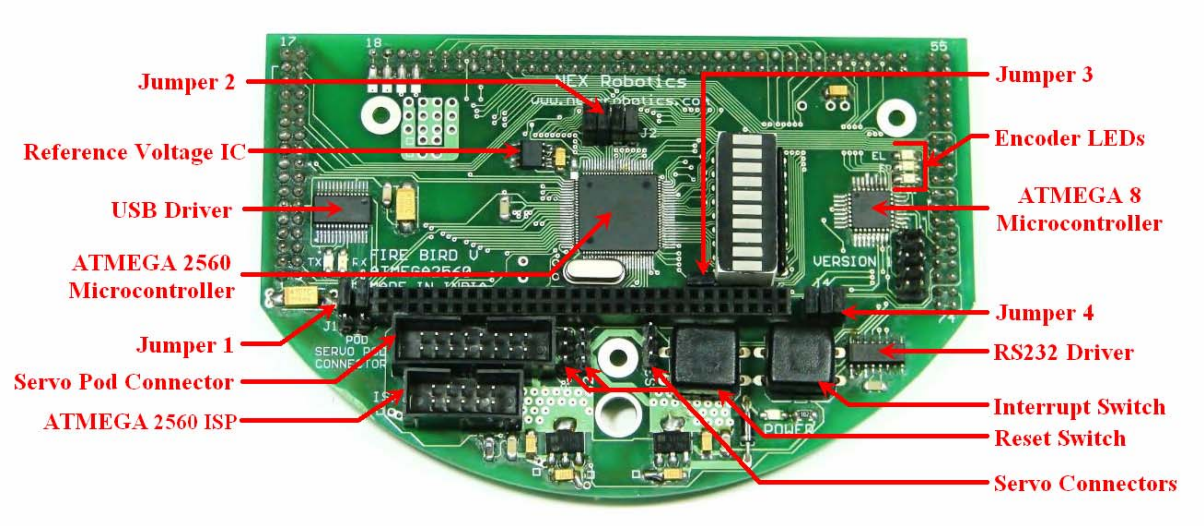


Figure 9 GPS Module

Pin configurations of Expansion Header on Microcontroller Board

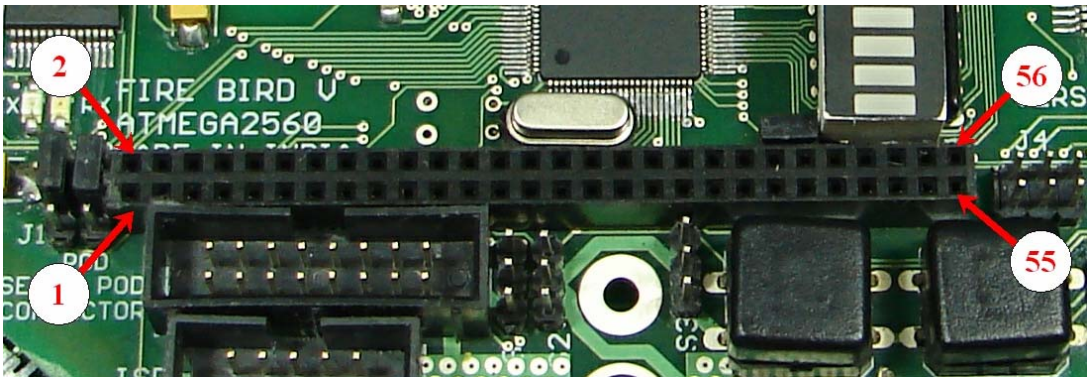


Figure 10: Expansion Header on Microcontroller Board

Pin No.	Function
1 to 6	No Connection
7	TDO (JTAG) / Accelerometer analog output X axis (AX)
8	TDI (JTAG) / Accelerometer analog output Y axis (AY)
9	TMS (JTAG) / Accelerometer analog output Z axis (AZ)
10	TCK (JTAG) / Yaw Gyroscope analog output (GY)
11	Slave Select of SPI communication (SS)*
12	No Connection
13	Master Out Slave In of SPI communication (MOSI)*
14	Clock of SPI communication (SCK) *
15	RESET
16	Master In Slave Out of SPI communication (MISO) *
17 & 18	No Connection
19	Data line for I2C communication(SDA) *
20	Clock signal of I2C communication (SCL)*
21 & 22	5V System Voltage. Current Limit: 400mA.

23 & 24	Ground
25 to 42	No Connection
43	Control signal for Self Test (ST) pin of Yaw, Pitch and Roll gyroscope modules
44	Control signal for Power Down (PD) pin of Yaw, Pitch and Roll gyroscope modules
45	TXD 3 of GPS Receiver Module
46	RXD 3 of GPS Receiver Module

Table 2: Pin configurations of Expansion Connector

* Not used pins

Expansion connector	Sensor Adaptor Module signals	ATMEGA2560 Microcontroller
7	Accelerometer analog output X axis (AX)	ADC6(uC pin 91)
8	Accelerometer analog output Y axis (AY)	ADC7(uC pin 90)
9	Accelerometer analog output Z axis (AZ)	ADC5(uC pin 93)
10	Yaw Gyroscope analog output (GY)	ADC4(uC pin 92)
21 & 22	5V System Voltage, Current Limit: 400mA.	5V from FBV Robot
23 & 24	Ground	Ground of FBV Robot
43	Control signal for Self Test (ST) pin of Yaw, Pitch and Roll gyroscope modules	PJ2 / GPIO (uC pin 65)
44	Control signal for Power Down (PD) pin of Yaw, Pitch and Roll gyroscope modules	PJ3 / GPIO (uC pin 66)
45	TXD 3 of GPS Receiver Module	RXD3 (uC pin 63)
46	RXD 3 of GPS Receiver Module	TXD3 (uC pin 64)

Table 3: Interfacing with ATMEGA2560

Application example

Application example “Sensor Adaptor Module Firmware” for Accelerometer and Gyroscope data display on the LCD is located in the “Accessories\Gyro Accelero Sensor Adaptor board” folder in the documentation CD. It displays data from 3 axis of the accelerometer and pitch, yaw and roll angels of the gyroscopes on the LCD. Figure 11 shows the data location on the LCD display. This application example displays the data in 8 bit from. User can modify this code to extract inertial data using various numerical methods.

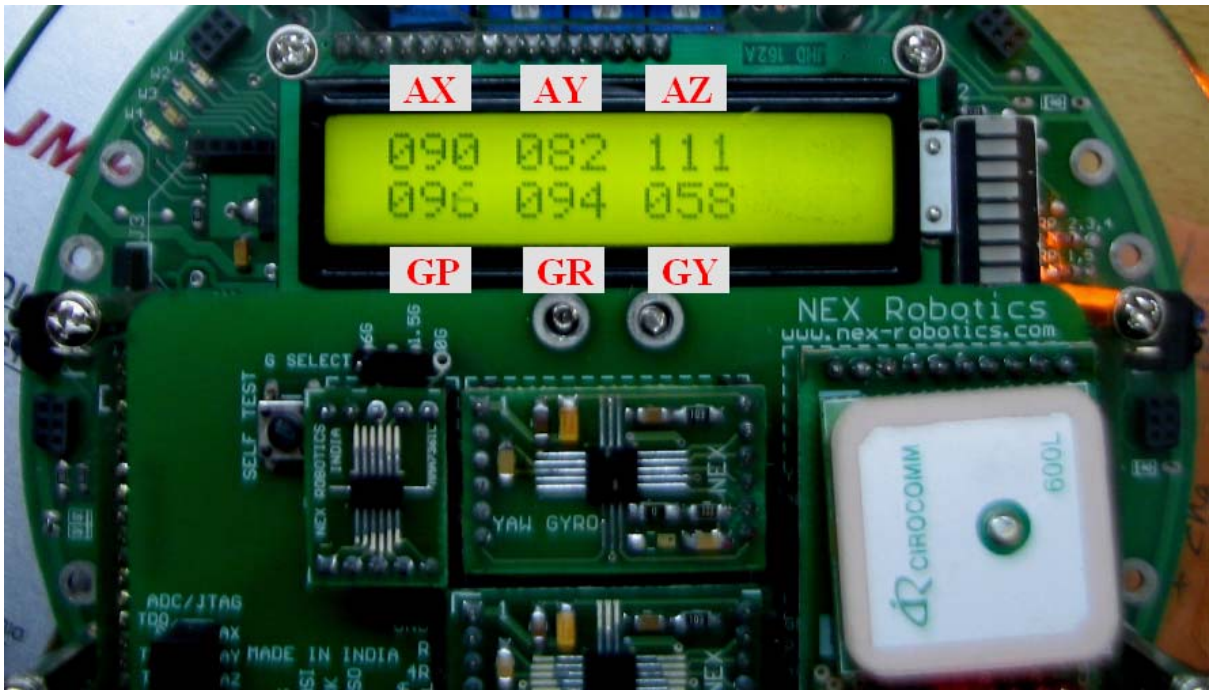


Figure 11: Sensor Value on LCD

Camera Pod Mounting on Fire Bird V ATMEGA 2560 Robot through Sensor Adaptor Module

The Camera Pod can be mounted on the Fire Bird V ATMEGA 2560 Robot through Sensor Adaptor Module. Following steps explains the camera pod mounting procedure.

You will need following things to do the mounting:

1. Metal studs with M3 threads; Qty. 4;
2. M3, 15mm nut; Qty. 4;
3. M3 Nylon nuts; Qty. 4;

Figure 12: Mounting Components

Step 1: Remove the acrylic top plate from the Robot. Mount nuts and bolts as shown in figure 13 on the top acrylic plate.

Figure 13: Nylon Nut and Bolt mounted on Acrylic plate

Step 2: Fit the acrylic top plate on the robot as shown below.

Figure 14: Acrylic plate fitted on FBV ATMEGA2560 Robot

Step 3: Insert the Sensor adaptor module in the expansion socket of Robot as shown in the figure 15.

Figure 15: Sensor Adaptor Module Mounted on Expansion Socket of FBV ATMEGA2560 Robot

Step 4: Tighten the 50mm metal Stud on the all 4 bolts.

Figure 16: Metal Studs on Sensor Adaptor Module

Step 5: Fit the camera pod on the metal stud and tighten with another 3mm star washer bolts as shown in the figure 17.

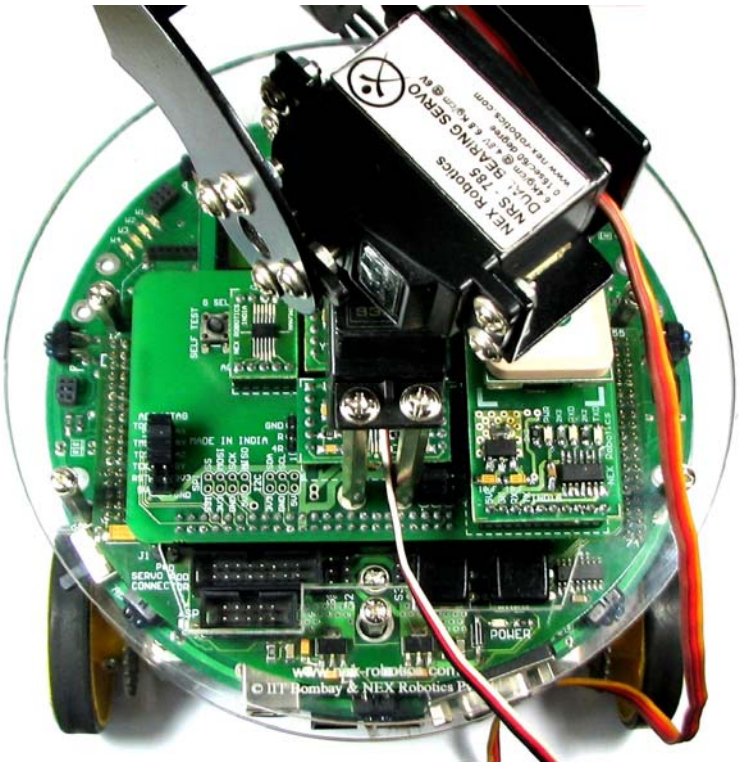


Figure 17: Camera Pod mounted on Metal Studs

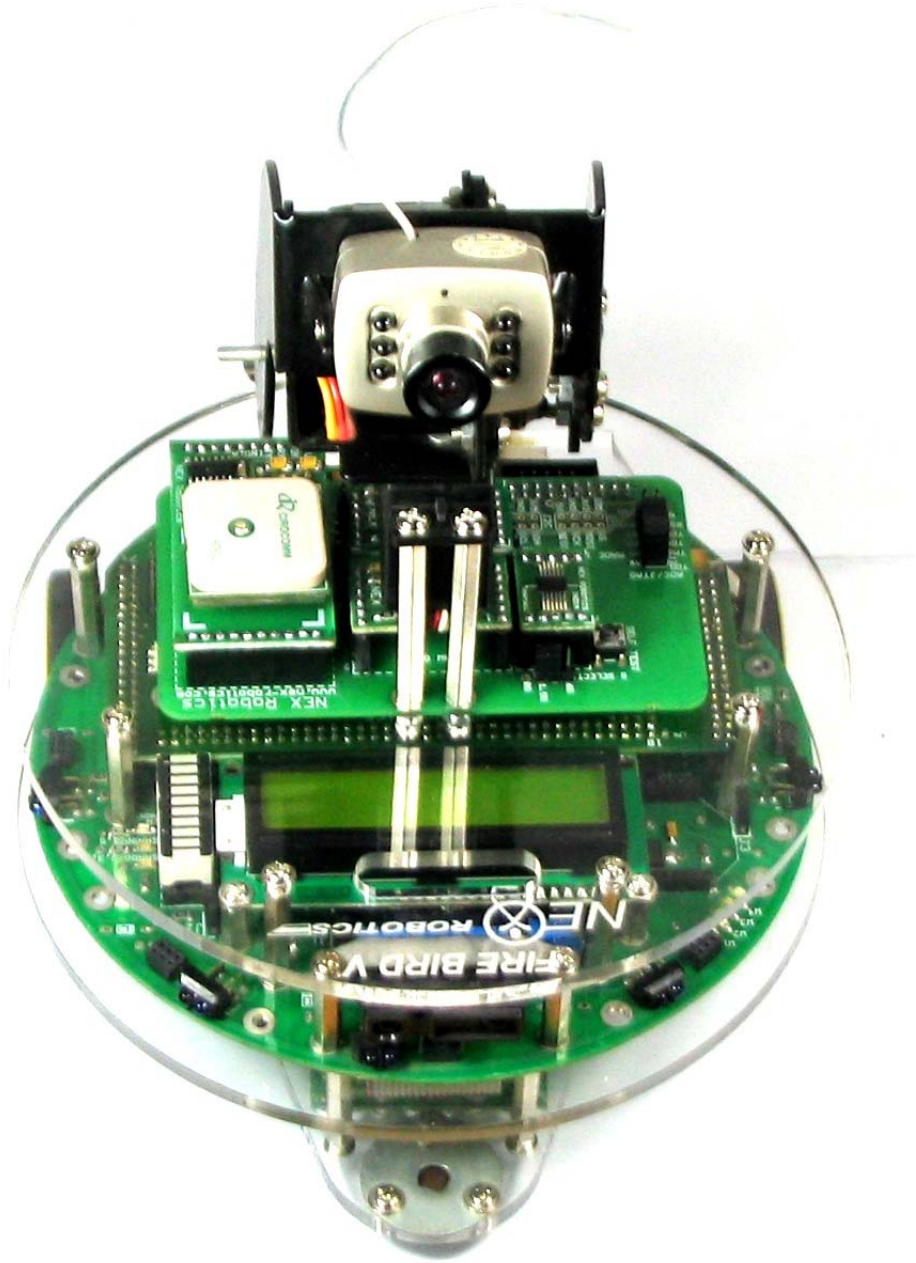


Figure 18: Camera pod mounted above the sensor adaptor module

Notice

The contents of this manual are subject to change without notice. All efforts have been made to ensure the accuracy of contents in this manual. However, should any errors be detected, NEX Robotics welcomes your corrections. You can send us your queries / suggestions at
info@nex-robotics.com

⚠ **Product's electronics is static sensitive. Use the product in static free environment.**
⚠ **Read the user manuals completely before start using this product**

Recycling:

Almost all the part of this product are recyclable. Please send this product to the recycling plant after its operational life. By recycling we can contribute to cleaner and healthier environment for the future generations.