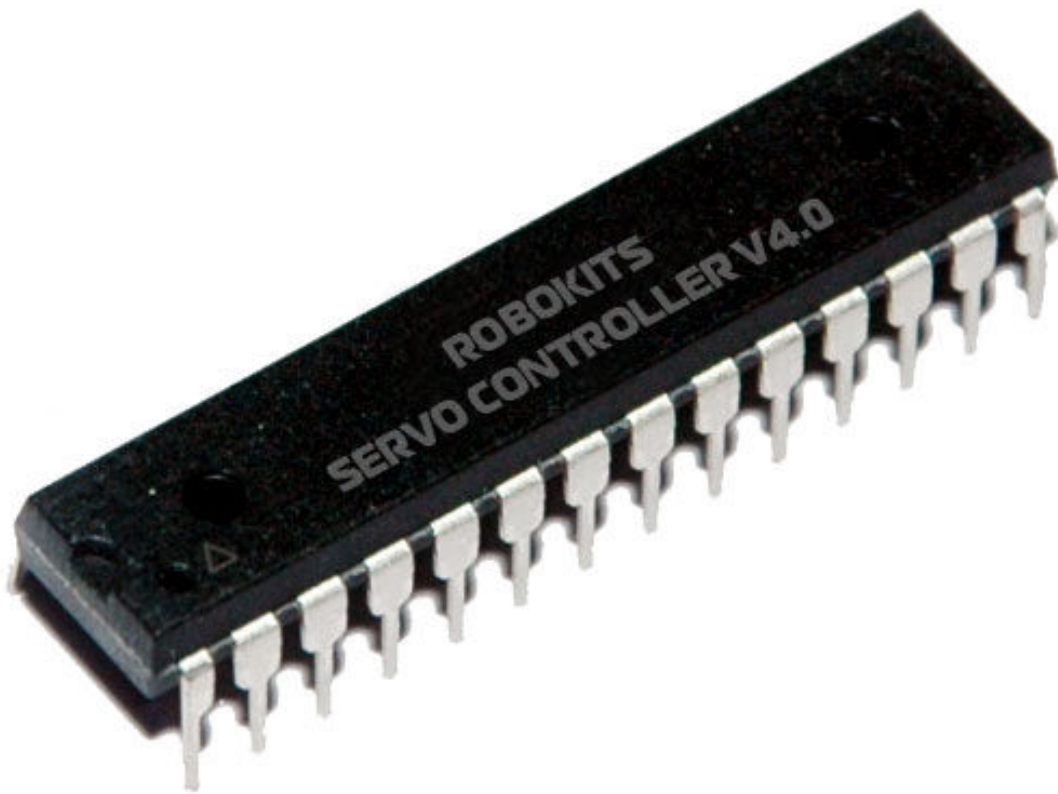


Robokits Serial 16 Servo Controller IC (RKI-1243)



Users Manual

<http://www.robokits.co.in>
<http://www.robokitsworld.com>

Serial 16 Servo Controller chip is ideal for making autonomous systems which run over Hobby servo motors. The software helps to develop the complex sequences in real time on the hardware like robotic arms, walkers, bipeds and any other servo controlled system. This chip provides asynchronous serial (UART) connectivity. Independent speed and range settings for each servo while delivering 0.5-microsecond resolution for smooth output across its broad output pulse range of 200 through 2400 microseconds. Visual Software for PC is available to make things very easy.

Features

- **Control 16 hobby servos from PC and Microcontroller**
- **UART interface**
- **Independent range setting for each servo**
- **0.5uS resolution**
- **50 Hz update rate**
- **28 Pin DIP Size chip**
- **Output pulse range of 200 through 2400 microseconds**
- **Simple hardware required to make it functional**
- **Easy to use software**
- **Servo sequencer with speed, delay, go to and many other features**
- **Home and neutral position setting**
- **Variable Baud rate – Works on 9600bps, 19200bps, 38400bps, 57600bps or 115200bps**
- **Auto-detection of Baud rate**

The basic idea of this chip is to control up to 16 servos for any of the project which uses servos. It works on serial commands and so once any command is sent through UART it holds or moves the servos to command position until the next command is received. This saves a lot of coding time at microcontroller or pc end. Additionally the timers and I/O pins of microcontroller are free to do some other work and interface with additional hardware and sensors. The hardware is very simple and can even be built easily on Bread board or General Purpose PCB in minutes. If the chip is connected to PC using RS-232 link on serial port or USB-UART link on USB port, our software for USB 16 Servo Controller can be used to generate complex sequences. These motion sequences can then be easily transferred to microcontroller code for generating serial commands.

Hardware Setup

Hardware requires following components with the Serial Servo Controller Chip

- 1 - 5V regulator / regulated power supply / +5V & GND lines from MCU Board
- 1 - 16 MHz crystal
- 2 - 22pf ceramic capacitors
- 1 - LED
- 1 - 100 Ω 1/4 watt Resistor
- 2 - 40X1 Male header strips

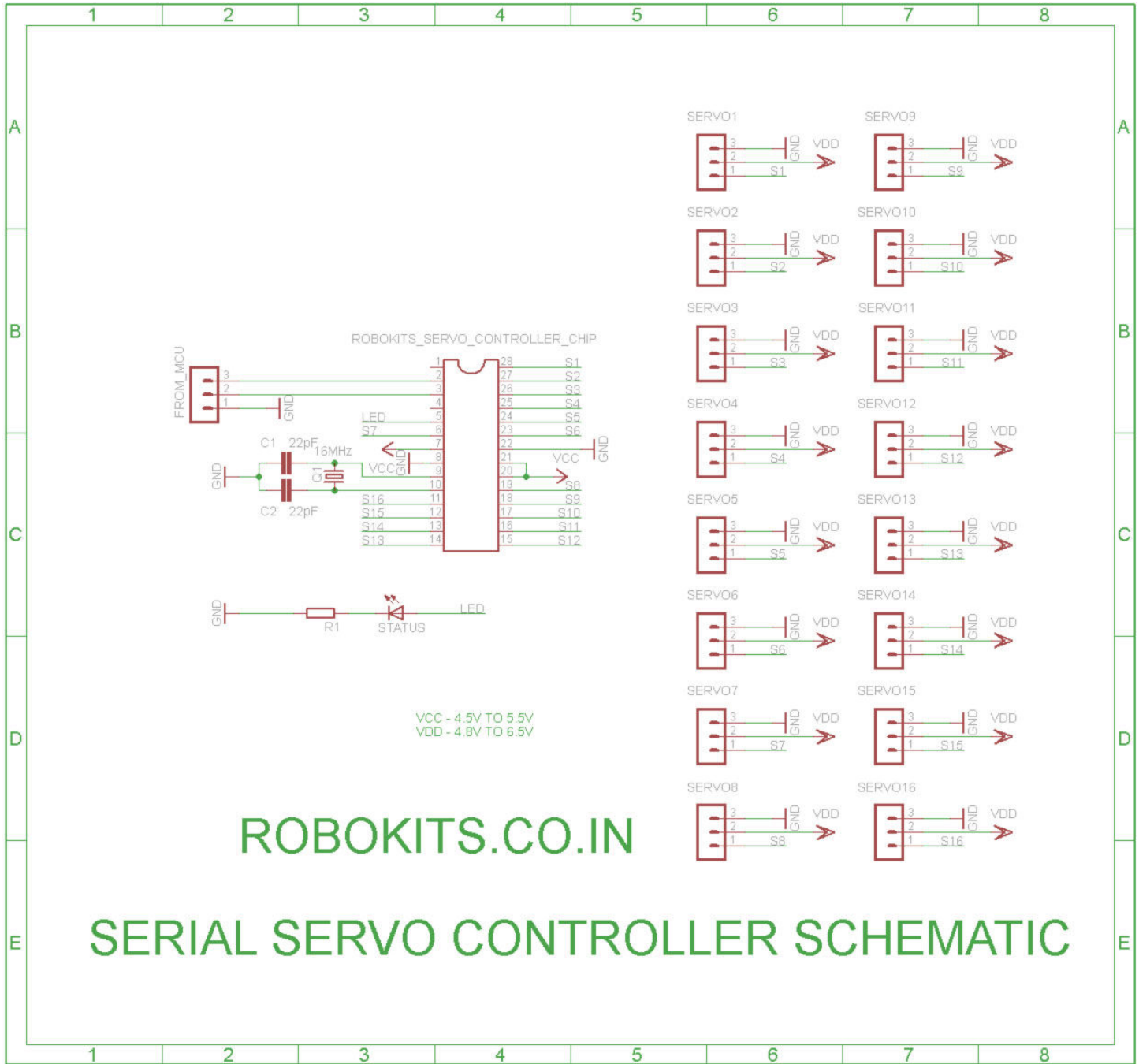
Additional hardware required to connect with PC

- PC-MCU Serial link or USB-UART link

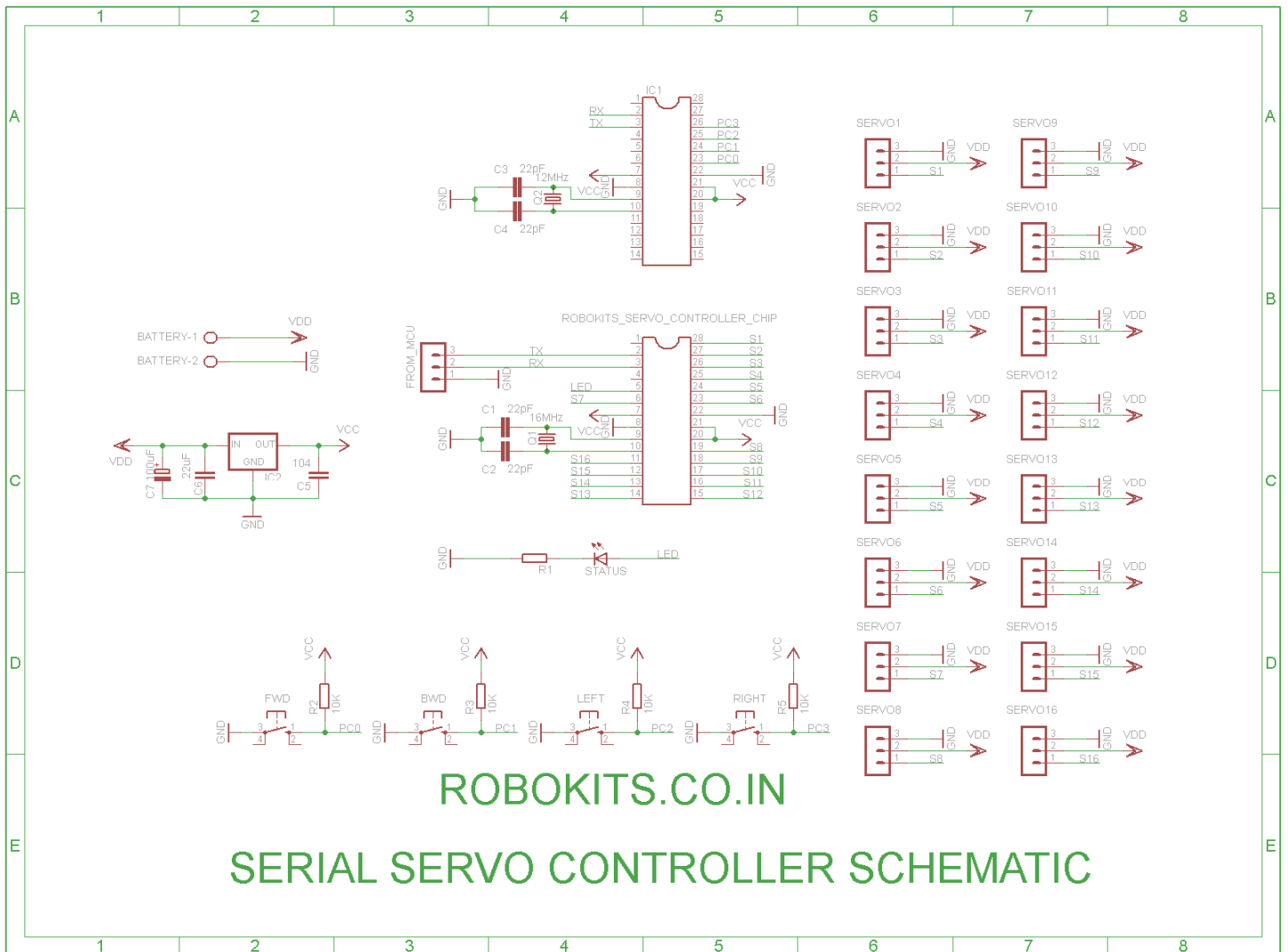
The circuit can be assembled on Breadboard, General purpose PCB or Special Purpose PCB as per requirements. We use the same chip on our USB 16 Servo controller. It takes the serial commands from PC through USB-UART Bridge.

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Schematic for microcontroller based system



Application circuit for servo based robot operated by switches and Atmel Atmega8 microcontroller.



- **4 Switches** are connected to base MCU for remote operation
- **RX & TX** lines of MCU are connected to TX and RX lines of Servo Controller IC respectively.

Pin connections

Pin Number	Connection	Description
1	RESET	
2	RXD	Connects to TX of MCU/PC UART
3	TXD	Connects to RX of MCU/PC UART
4	NC	
5	LED	Status LED, glows when ready
6	Servo 7	Pulse output for Servo # 7
7	VCC	+5V input
8	GND	Ground
9	Crystal 1	Pin 1 of 16MHz Crystal
10	Crystal 2	Pin 2 of 16MHz Crystal
11	Servo 16	Pulse output for Servo # 16
12	Servo 15	Pulse output for Servo # 15
13	Servo 14	Pulse output for Servo # 14
14	Servo 13	Pulse output for Servo # 13
15	Servo 12	Pulse output for Servo # 12
16	Servo 11	Pulse output for Servo # 11
17	Servo 10	Pulse output for Servo # 10
18	Servo 9	Pulse output for Servo # 9
19	Servo 8	Pulse output for Servo # 8
20	VCC	+5V input
21	VCC	+5V input
22	GND	Ground
23	Servo 6	Pulse output for Servo # 6
24	Servo 5	Pulse output for Servo # 5
25	Servo 4	Pulse output for Servo # 4
26	Servo 3	Pulse output for Servo # 3
27	Servo 2	Pulse output for Servo # 2
28	Servo 1	Pulse output for Servo # 1

Serial Commands

- **Auto-baudrate detection:**

- Send "CCCC"(Capital C 5 times) to UART for auto baud rate detection
- Allowed Baud Rates (9600, 19200, 38400, 57600, 115200 Baud)
- For example if you have configured your base MCU UART to 19200 baud and you send "CCCC" to servo controller chip, it will auto detect the baud rate and will be connected on 19200bps. After connection is established it will send acknowledgement "ROBOKITSV4.1" and will glow the LED. This confirms the connection is established and the chip is ready to receive commands.
- This step must be executed on startup. Without this step the controller will not start.
- Once connected Servo controller will accept following commands.

- **Basic Servo command structure:**

Start byte (S)	Command + Data byte (C)	Servo Byte (Servo)	Data Byte 1 (DB1)	Data Byte 2 (DB2)
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- Start byte is always 0XAA (Decimal 170).
- All other bytes must be less than 0X80 (Decimal 128).
- Servo byte will select servo number. 0X00 (Servo1) to 0X0F (Servo 16).
- Data byte 2 is not used in some of the commands and if not used do not send any extra characters.
- Short names are written in bracket in above line.

- Servo commands:**

Action	Start Byte (S)	Command +Data byte (C)	Servo Byte (Servo)	Data Byte1 (DB1)	Data Byte2 (DB2)	Comments
7bit Servo Position	0xAA	0x09	0x00 to 0x0f	Data & 0x7F	None	Set Servo Position (17uS Resolution) Data = DB1 200+(17*Data) uS Pulse Max Data=0X7F(Decimal 127)
8bit Servo Position Option 1	0xAA	0X20 (Data>>7) (0X20 or 0X21)	0x00 to 0x0f	Data & 0x7F	None	Set Servo Position (8.5uS Resolution) Data = ((C & 0X01)<<7) + DB1 200+(8.5*data) uS Pulse Max Data=0XFF(Decimal 255)
8bit Servo Position Option 2	0xAA	0x02	0x00 to 0x0f	Data & 0x7F	(Data>>7)	Set Servo Position (8.5uS Resolution) Data = ((DB2 & 0X01)<<7) + DB1 200+(8.5*data) uS Pulse Max Data=0XFF(Decimal 255)
13bit Position Option 1	0xAA	0X40 (Data>>7)	0x00 to 0x0f	Data & 0x7F	None	Set Servo Position (0.5uS Resolution) Data = ((C & 0X3F)<<7) + DB1 200+(0.5*data) uS Pulse Max Data=0X3FFF(Decimal 16383)
13bit Position Option 2	0xAA	0X03	0x00 to 0x0f	Data & 0x7F	(Data>>7)	Set Servo Position (0.5uS Resolution) Data = ((DB2 & 0X3F)<<7) + DB1 200+(0.5*Data) uS Pulse Max Data=0X3FFF(Decimal 16383)
Servo Speed Setting	0xAA	0X08	0x00 to 0x0f	Speed & 0x7f	None	Speed= DB1 Highest Speed - 0 Lowest Speed - 127 Max Speed=0X7F(Decimal 127)
Set Neutral Position	0xAA	0X04	0x00 to 0x0f	Data & 0x7F	(Data>>7)	Data = ((DB2 & 0X3F)<<7) + DB1 Neutral Position = 200+(0.5*data) uS
Set Home Position	0xAA	0X05	0x00 to 0x0f	Data & 0x7F	(Data>>7)	Data = ((DB2 & 0X3F)<<7) + DB1 Home Position = 200+(0.5*data) uS
Set Max Position	0xAA	0X06	0x00 to 0x0f	Data & 0x7F	(Data>>7)	Data = ((DB2 & 0X3F)<<7) + DB1 Max Position = 200+(0.5*data) uS
Set Min Position	0xAA	0X07	0x00 to 0x0f	Data & 0x7F	(Data>>7)	Data = ((DB2 & 0X3F)<<7) + DB1 Min Position = 200+(0.5*data) uS
Neutral Position	0xAA	0X00	0x00 to 0x0f	None	None	Set Servo to Neutral Position
Home Position	0xAA	0X01	0x00 to 0x0f	None	None	Set Servo to Neutral Position

- **Responses from Servo controller chip:**

- **`a': Command Accepted and Action will Start according to the command**
- **`e': Error in command**
- **`d': Data Error**
- **`s': Error in Servo Number**
- **`m': Minimum value greater than Maximum value.**

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Service and Support

Service and support for this product are available from Robokits India. The Robokits Web site (<http://www.robokits.co.in>) maintains current contact information for all Robokits products.

Limitations and Warrantees

The Robokits Serial 16 Servo Controller IC (RKI-1243) is intended for personal experimental and amusement use and in no case should be used where the health or safety of persons may depend on its proper operation. Robokits provides no warrantee of suitability or performance for any purpose for the product. Use of the product software and or hardware is with the understanding that any outcome whatsoever is at the users own risk. Robokits sole guarantee is that the software and hardware perform in compliance with this document at the time it was shipped to the best of our ability given reasonable care in manufacture and testing. All products are tested for their best performance before shipping, and no warranty or guarantee is provided on any of them. Of course the support is available on all of them for no cost.

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