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PS2-SMC-06 Servo Motor Controller Interface

PS2-SMC-06 Full Board Version

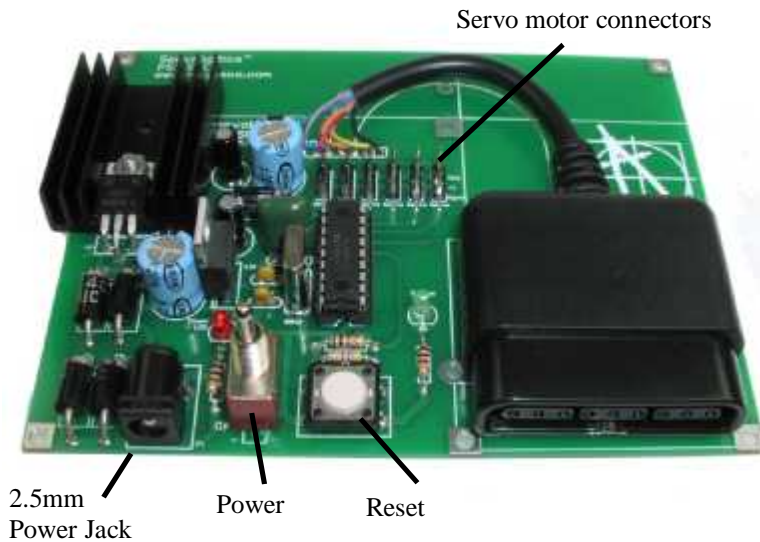**Servo motors and PS2 controller not included.**

PS2 (Playstation 2 Controller/ Dual Shock 2) Servo Motor Controller handles 6 servos. Connect 1 to 6 Servos to Servo Ports and control its movement by PS2. 4 Servos can be moved simultaneously.

 Basic **Operation:**

Wired / Wireless PS2 can be used with PS2 SMC board. Operation remains same for both Wired/ Wireless PS2. Connect the PS2 Controller Male Connector to the female connector present on PCB. In case you use Wireless PS2, connect wireless receiver to female connector on PCB. Power on the board. If PS2 is not connected or is faulty, status LED will blink slowly indicating that situation. Red LED on PS2 should go on immediately after board is powered. In case of Wireless PS2, user should press any of action buttons to establish a wireless link between PS2 and wireless receiver.

Analog Sticks control Servos. Each axis of analog stick controls one servo. X and Y axis of Left Analog Stick controls Servos 1 and 2 all the time. X and Y axis of Right Analog Stick controls Servos 3 and 4. **When Left 1 (shoulder button) is pressed, Right Analog Stick Controls Servos 5 and 6.**

Tilt of Analog Stick controls Servo speed. Tilt the stick slightly and servo will move at slowest speed. Tilt it more and it moves at higher speed. Tilting it all the way will result in servo moving at fastest speed. There are 3 speed slots.

The PS-SMC-06 monitors Servo Positions. Its stops Servos from moving beyond end points i,e prevent them from stalling. If user tries to move Servo beyond its limit on either side (CW or CCW), by tilting analog stick, Servo will stop moving and over limit indication will be given in terms of Rumble feature of DS2 (force feedback / vibration). This holds true for any of 6 servos.

Analog Sticks sometimes don't return to center position once they are released. There is a deadband (around center position of Sticks) kept in program to counter this, but if Stick doesn't return within deadband limits, corresponding Servo will keep moving. This may result in Rumble as well, once Servo reaches its limit.

Servo motor connectors

2.5mm
Power Jack

Power

Reset

The reset switch, 12mm Momentary Tactile Switch on board. resets the microcontroller. The interface may be powered by a variety of wall power transformer, see below. Images recommends power outputs that ranges from 7VAC or VDC to 9 VAC or VDC.

Power is supplied through 2.5mm power jack on board. PS2-SMC-06 is supplied with small power transformer. Our new IPS (Integrated Power Supply) line of servo motor controllers allows you to use a variety of inexpensive power supplies to run both your controller board and servomotors. Use available power supplies; transformers, batteries, wall transformers, etc. anything from 6V to 9V either AC or DC. The IPS system will regulate the power to run your servomotors efficiently. Power is supplied through 2.5mm power socket on board. You are in addition provided with a 2.5 mm plug to connect your own external power supply to the PS2-SMC-06 to take advantage of our IPS system.

Servo Connectors
There are six standard 3 pin Male Headers for connecting Hobby Servos, Servo1 to Servo6. Connect the servo-motor as shown in the picture above. The ground wire to the servo-motor (black) is facing the outside of the board. The signal wire (yellow) is facing the inside of the board

Power Up
Plug in DS2, supply the Power, connect the Servos and toggle the on/off switch to "on" position. Power LED will lit on indicating Power On. The Status LED will go on after couple of seconds indicating a communication link is established successfully with DS2 and Servos are ready to be controlled now. Status LED will stay on. At the same time RED LED on your DS2 will go on, indicating DS2 is in analog mode. All six Servos in Normal Independent / Unison Mode will move to center neutral position on power up. In CR mode, Continuous Rotation Servos won't move, remaining four Servos will move to center neutral position on power up.

A Slow Blinking Status LED indicates absence of DS2 / communication link error.
While using Cordless DS2, make sure communication link between DS2 and its wireless receiver is established. Pressing any of action buttons in DS2 will help establish the wireless link on power up. When a proper link between DS2 and its wireless receiver is established, pressing action button will result in blinking of LED on wireless receiver.

Controller Map

All 6 Servos are controlled by two Analog Sticks (thumb Sticks). Servo1 and Servo2 are controlled by Left Analog Stick. X axis of Left Analog Stick controls Servo1 and Y axis controls Servo2. Tilting Stick along any axis will result in motion of Servo associated with that axis. Tilting Stick in opposite direction along same axis will result in Servo motion in opposite direction.
Servo speed is proportional to Tilt Angle of Stick. Tilting Stick little will result in slowest Servo motion. Tilting Stick all the way will result in fastest Servo motion. There are 3 levels of Servo motion speed along one direction of axis.
Releasing Sticks will bring it to center position and Servo will stop at current position. Since Sticks may not always return to center neutral position, there is a dead band around the center of Stick, which results in no movement. This ensures Servo doesn't keep moving incase Stick has not returned to neutral position.

Servo3 and Servo4 are controlled by Right Analog Stick in same manner.

Pressing Left 1 (shoulder button) in front of DS2 will shift the control of Right Analog Stick from Servo3 – Servo4 to Servo5 – Servo6. Servo5 and Servo6 are controlled by Right Analog Stick, as long as Left 1 button is pressed. Releasing Left 1 button will shift back control of Right Analog Stick to Servo3 and Servo4.

Press Left Button for Servo's 5 & 6

Rumble

Servo has maximum limit in both direction and driving it beyond limits would cause damage to Servo and drain heavy current from Power Supply. To avoid this, Servos are not allowed to be driven beyond their limits. When any of the Servo has reached its limit and if user further tries to move it beyond the limit by tilting corresponding Analog Stick, Servo will not move and this condition will be indicated by a Rumble (Force Feedback) feature. Rumble will stay on as long as user keeps the Stick Tilted.
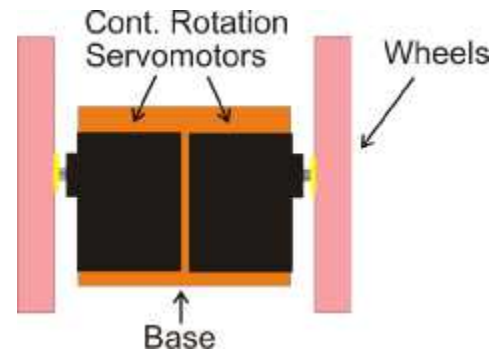
Programmable Configuration Modes

PS2 SMC can be configured in three different operating modes. These modes can be changed "on-the-fly" during normal operation. New mode selection is stored in non volatile memory of PIC and the stored Mode will automatically load next time PS2 SMC is turned on.

1.) Mobile Platform Mode –MPM - (Circle and Square Buttons)

In this mode Servomotor1 and Servomotor2 are configured as differential drive in a moving platform using two Continuous Rotation Servomotors. To activate the MPM press the Circle Button.
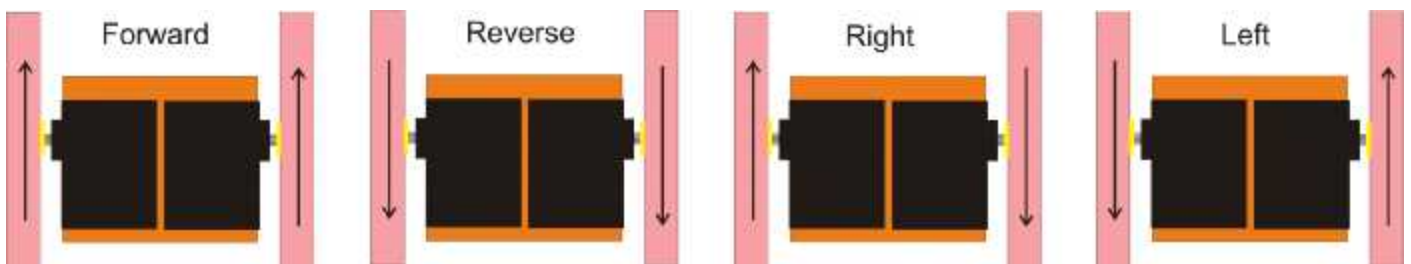

Pressing Square Button will select Normal Independent Mode (NIM) servomotor control mode. This mode is for standard servomotors, and not continuous rotation servomotors.

In MPM mode, Left Analog Stick will act as a navigation control with inbuilt speed control. Tilting Stick upwards will result in forward motion, downwards for reverse motion, left for left turn and right for right turn of your moving platform. Tilt angle of Stick will determine the speed of motion. 2 Level Speed Control is implemented.

Sometimes Stick doesn't return to neutral position on release, which may result in unwanted movements of Servomotors. Creating a small dead space or band around the center position of the Joystick eliminates this movement. Within this dead band the Servomotors aren't activated.

For mobile operations, or if you're just tight on space, the pcb can be cut down (before assembly) so its footprint is much smaller, see manual. The PS2 connector in secured to the bottom of the pc board.

2. Opposite Phase Mode – OPM-- (Cross and Triangle Buttons)

Servomotor3 and Servomotor4 can be configured either to be controlled as independent
Servomotors or in Opposite Phase Mode, (OPM). In OPM mode each servomotor shaft moves in the opposite direction from the other, 180 degrees out of phase. Pressing Cross
Button will select OPM Mode.

Pressing Triangle Button will select Normal Independent Mode.

The OPM mode can be helpful when 2 Servomotors are connected to a common load or using 2 Servomotors for increasing over-all relative speed of movement.
In OPM, the X axis of Right Analog Stick will control Servomotor3 and Servomotor4. Tilting Stick along X axis in one direction will result in simultaneous opposite movement of Servomotor3 and Servomotor4 at same speed.

Tilting Stick in opposite direction will result in simultaneous opposite movement
of Servomotor3 and Servomotor4, but in opposite direction to that of previous case. As
in MPM there is a dead band around the center of Stick and 3 Level Speed Control
proportional to Stick Tilt.

Servomotor5 and Servomotor6 always operate in independent normal mode.

3.) Normal Independent Mode –NIM - (Square and Circle Buttons)

Pressing Square Button will select Normal Independent Mode (NIM) servomotor control mode. This mode is for standard servo-motors, and not continuous rotation servomotors.
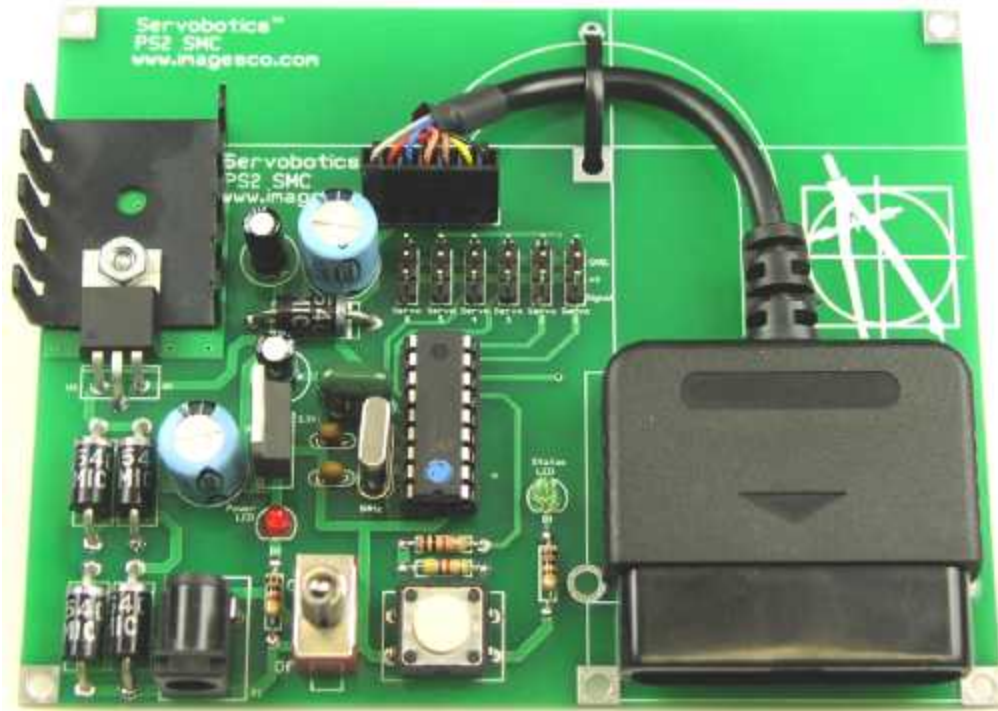
Handiness (Righties and Lefties)

Left – Right Hand (LRH) Mode for MPM (Right Arrow, Left Arrow Buttons)
MPM mode when selected by default places Left Analog Stick to control
Navigation. For Righties, they can switch Navigation control to Right Analog
Stick by pressing Right Arrow Button on Directional Pad would swap the controls
of Left and Right Analog Sticks. Pressing Left Arrow Button on Directional Pad
brings back the Stick Controls to their default mapping.   In Righty mode, Left
Analog Stick will control Servomotor3 and Servomotor4, Servomotor5 and Servomotor6 when Right1

Shoulder Button is pressed & Right Analog Stick will control Servomotor1 and
Servomotor2. Leftie – Righty mode is independent of other modes selected. It just
swaps the control between the two Sticks, irrespective of modes.
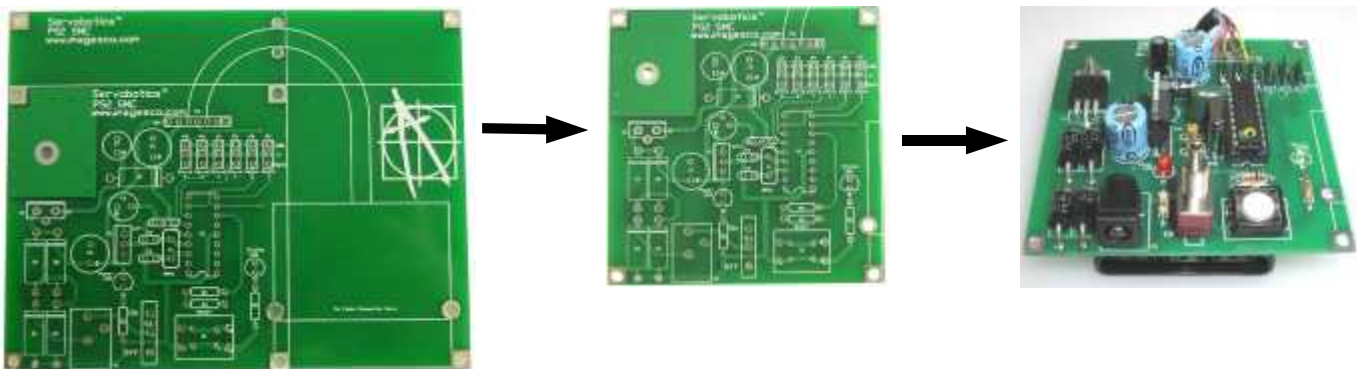
General Usage Notes
1. One should plug the PS2 controller and Servomotors before powering up on the interface board and removing them only after turning off the board.

2. While configuration modes can be changed anytime user wants in normal operation,
but since the associated mechanical hardware connected to motors for different
modes is so different, practically a need of changing from one mode to another won't arise during an operation. Mode change can be done when required, immediately on Power On, once Status LED goes On. This will ensure that servomotors are at center position when mode is changed and would not result in unwanted movement of Servomotors as a result of mode change. 3. Servo-motor control is inhibited when mode change buttons are pressed.
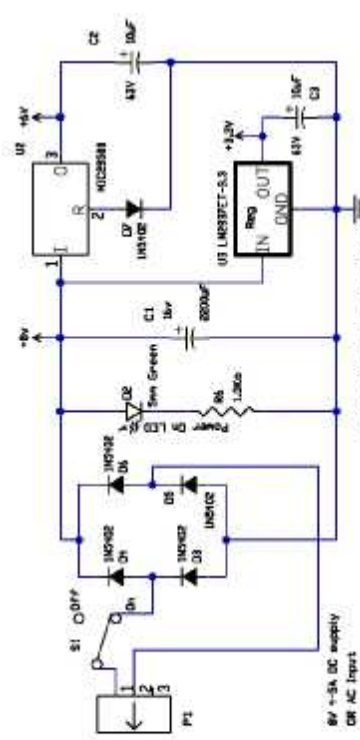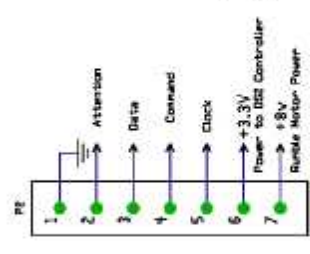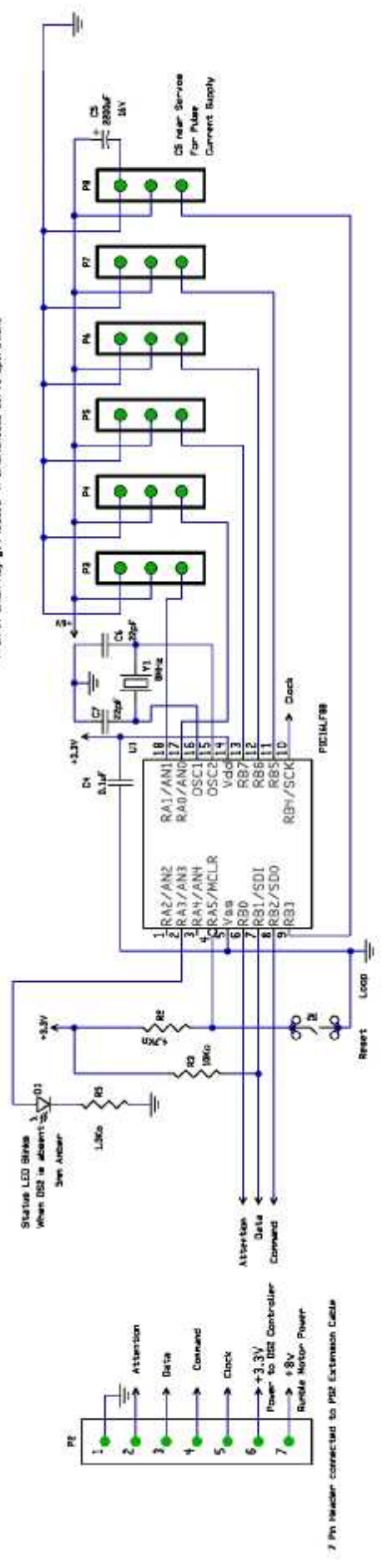
Construction

Construction:

The first step in construction is to decide which size PS2-SMC-06 you wish to build. The PC board has been designed so that the board size can be cut down and reduced in size for mobile robot applications. The photographs below illustrate. To the left is a photograph of the full sized PC board. Cutting lines on the top and side are provided on the full sized PC Board. In the middle the top and side sections have been cut away. In the far right photograph is the PS2-SMC-06 built on the smaller pc board. In this version the PS2 connector is mounted on the bottom of the PC board. All other construction details remain the same.
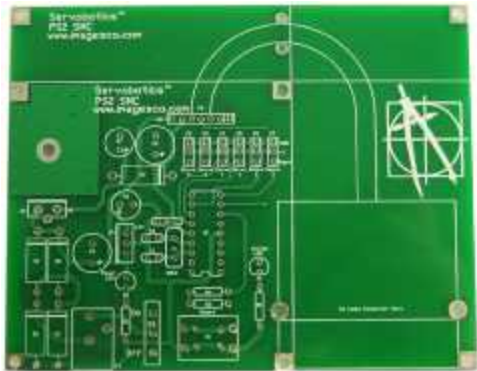

If you decide to cut down your board, here are a few suggestions. If you have a heavy duty guillotine style paper cutter , you could place the pc board in the paper cutter and trim the pc board. Other methods would involve cutting with a dremel or hack saw. In these cases remember that pc boards are, composed of glass-reinforced plastic. When you cut with a saw or dremel the dust created should not be breathed in. So make sure you wear a dust mask and gloves when cutting this material.
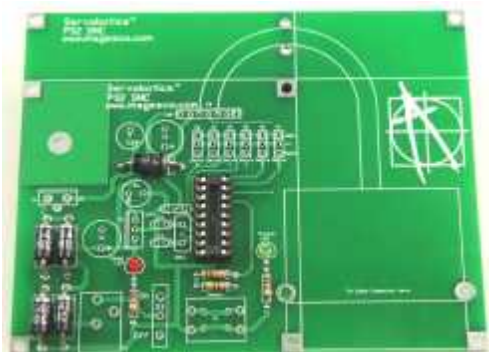
Construction Details for Kit Version:

Begin construction by mounting components and parts on the silkscreen side of the PCB.

Resistor R1 and R2 are 1K resistors (color bands, brown, black, red). R3 is a 4.7K resistors, (color bands yellow, purple, red). R4 is a 10K resistor, (color bands, brown, black, orange).

Next mount and solder the ICS-18 micro-controller socket labeled U2. Next mount and solder the 1N5402X diodes labeled D3 – D7. Keep the line on the diode orientated to the line of the silkscreen outline of the diode. Next mount the two colored LED's. The red LED is labeled Power LED. The green LED is labeled Status LED. Orientate the LED's properly. The longer lead of the LED is. This faces the round portion of the LED outline. The shorter lead of the LED is negative; it faces the flat side of the LED silkscreen outline.

Now mount and solder the round push-button switch and the toggle switch labeled S1. Mount and solder the power supply jack labeled P1. When mounting capacitors the longer lead is the positive lead. Capacitors C2 and C6 are 1000 uf. C5 and C7 are 10 uf capacitors. The following capacitors are non-polarized and may go in with the leads facing either way. Capacitor C4 is a 0.1 uf 100v. C1 and C3 are small 22 pf capacitors. Next, mount and solder the 8 MHz crystal, labeled Y1. Now, mount the SMH-03's labeled P2-P7, next mount the 7-pin header P8, and the LM2937 labeled U1. Before mounting the 7805* voltage regulator, first attach it to the heat-sink (heat sink included with the 3 and 5 amp versions only) and then mount it to the PCB in the position labeled U3.

When mounting voltage regulators LM2937 and 7805* to the PCB the flat side must be aligned with the small rectangle printed on the board.

*Depending upon which version of PS2 controller you purchased this regulator may be changed to the 3 amp or 5 amp version.

Plug the PS2 connector into the P8 connector . The black wire of the connector faces toward the right, with the PS2-SMC-06 facing you. Secure the PS2 connector to the top side of the PC board (if building full board version) or bottom side of PC board (reduced size version) using hot glue or epoxy.

Attach the servomotors to the P2 to P7 connectors as shown in the photograph to the left.

Connect a suitable power supply to the 2.5mm power jack on board.

Plug in your PS2 controller.

Use toggle switch to turn on power.

Use thumb joysticks to control your servo motors.

Parts List

- (1) PC Board
- (1) ICS-18
- (5) 1N5401-!N5402
- (1) Sub Min LED
- (1) Green LED
- (6) 3 Pin Straight Male Header
- (1) 7 Pin Straight Male Header
- (1) 8.0 MHz Crystal
- (1) 7805 (Voltage Regulator)
- (1) HeatSink-03
- (2) 1K Ohm ¼ Watt Resistor
- (2) 4.7K Ohm ¼ Watt Resistor
- (1) 10K Ohm ¼ Watt Resistor
- (1) 2.5mm PC Power Jack Connector (PJ-102B)
- (1) 12mm Mom Switch Tact (SW-25)
- (1) Toggle Switch SPDT On-On PCM (SW-07)
- (2) 10uF Capacitor, 16V
- (1) 0.1uF Capacitor, 100V
- (2) 22 pF Capacitor, 50V
- (2) 1000 uF Capacitor, 10V
- (1) LM2937
- (1) PIC16F88 Microcontroller
- (1) 7 Position Modular to CS Connector (Cable-PS2)
- (1) Jack-09

Reduced size PC board