MILFORD INSTRUMENTS Ltd

Rev1.2 18/4/02

SERIAL SERVO DRIVER BOARD-12, Part # 1-910

The SSBD-12 allows the control of up to 12 Hobby type servos from an RS232 input.
Main features are:
Baud rate configured at 9600 baud
Pulse resolution 8usecs –equivalent to an output pulse from 0.5msec to 2.5msec
Traverse speed of each servo may be set at the time of command
Incorporates provision for on-board Parallax BASIC Stamp BS2-IC.
Single 7.5-12V DC power supply
Supplied fully assembled and tested
May be used with existing software (though speed control feature and upper 4 servos not addressable)
Windows freeware is available from the admin section of our web site- www.milinst.com
Circuit board size 57x107mm

THEORY OF OPERATION
The SSBD-12 receives RS232 signals and generates 12 continuous pulse streams suitable for driving and holding in position, 12 hobby type servos.
RS232 signals must be at 9600 baud and must conform to the following 3 byte protocol:

Byte 1	255	(Synchronization byte)
Byte 2	Upper nibble-	(Traverse speed, 0 to 15)
	Lower nibble	(Servo address, 0 to 11)
Byte 3	Servo Position (0-254)	

The speed is expressed in units of 4usecs/frame change in the pulse width sent to the servo-
the servos are updated every 20msecs so 1 frame is equivalent to 20msecs,
the resolution of the driver is 8usecs so each unit change in position is equivalent to an 8usec change is position pulse width,
a speed value of 10 would imply a change per frame of 10x4usecs=40usecs pulse width change per frame,
moving 80 steps (ie from position 100 to 180) at a speed of 10 would take:
step change in pulse width= (180-100)*8usecs = 640usecs
change per frame= 10*4=40usecs
number of frames to complete the change= 640/40= 16 frames
time to complete change= 16*20msecs= 320msecs
Note that a speed value of 0 (ie upper nibble cleared) produces an immediate change in pulse width to maintain compatibility with the standard servo driver board.

The default movement range setting for the servos is 180 degrees thereby giving a resolution of 180/254= 0.72 degrees/unit signal change.
Note that not all servos can accommodate a full 180 degree range- many are nominally rated for a 90 degree swing though in practice will rotated through approximately 130 degrees.
Trying to exceed the servos internal limits may cause damage to the servo and overheat the driver board power supply.

SIGNAL SOURCE

At power up, the red LED will light. When a suitable serial signal is received, the LED will extinguish and thereafter only light momentarily when a valid synchronisation byte is received.

With the D-9/BS2 jumper switched to the D-9 position, the SSDB-12 may be driven directly from a PC using a standard 9 way serial cable.
With the jumper in the BS2 location, the input to the controller is transferred from the D-9 socket to pin11 of the BS2-IC socket. The Controller is then under the full control of any programme that you may wish to run from the BS2-IC. With the signal source jumper set to the BS2 position, the D-9 socket may be used to programme an on-board BS2-IC as per the standard BS2-IC project board.

POWER SUPPLY

The SSDB-12 uses a separate regulator for the Servos and one for the electronics. The Driver Board will accept DC voltages from 7.5 to 12v DC via the supplied power plug (2.1mm dia type, centre positive).
The servo regulator is rated at 1Amp and should be sufficient for most applications though, as servos may draw up to 200mA each when under load, high load applications involving a number of servos may need to be provided with a

separate power supply (4.8-6v DC). If the heatsink becomes too hot to touch then use a separate power supply and/or reduce the supply voltage.

HOOK-UP

Select the required signal source using the supplied jumpers.
Connect the servos to the 3 pin headers at the end of the board making sure the colour of the leads corresponds to those noted on the board- especially the red and black wires. Futaba servos use a white cable for the signal line; Hitec use yellow. Both will run equally well on the Driver Board.
Connect a suitable power supply to the power socket.
The red LED should light and the servos move to their mid positions. The servos should resist being changed by finger pressure.
If this is not the case then switch off immediately and check the polarity of the incoming power supply and the servo wire colours.
With the servos in their mid position run the control software either from the BS2 or from a PC using a serial cable connected to port 1 or 2.
Once a valid control signal is received, the LED will extinguish and will thereafter only light momentarily when a synchronization byte is received.
If this is not the case and/or the servos will not respond under software control then check the setting jumpers and the serial link.

PROGRAMMING EXAMPLES

The following code snippets illustrate how to run the SSDB-12 from the BS2-IC.

```
'Stamp2 /Servo Control Programme
'For testing 1-910 units (SSDB-12)
'This rev dated 25th May 2000
'Constants
rs232          con     $4054          '9600 baud, true data, no parity
ssc            con     11             'SSC on pin 11
min_travel     con     30             'Minimum travel for the servo
max_travel     con     220            'Maximum travel for the servo
sync           con     255            'ssc sync pulse

'Variables
byte2          var     byte           'the second transmitted byte
servo          var     byte2.lownib   'number of servos
speed          var     byte2.highnib  'servo traverse speed
position       var     byte           'servo position
'Programme
Start:
       for servo=0 to 11              'loop for all 12 servos
       speed= servo                    'move at varying speeds
       debug dec? byte2,cr
       serout ssc,rs232,[sync,byte2,max_travel]
       next
       pause 1000

       for servo=0 to 11
       speed=1                'slow return
       serout ssc,rs232,[sync,byte2,min_travel]
       next
       pause 1000
goto start
```

SERVOS

Most hobby type servos operate in a standard manner. Their movement is proportional to the pulse width of an incoming signal stream. These pulses are normally between 1 and 2 ms in duration and must be repeated every 20msecs or so. A pulse width of 1.5msecs will generally centre the servo, a pulse width of 2msec will cause the servo to move to the +45deg position and one of 1.0msecs will move the servo to the -45 deg position.
Hobby servos are generally rated for a total movement of 90 degrees though to allow for set-up, the actual range is often greater than 90 degrees. The SSDB-12 allows you to use this extra range but care should be taken to ensure the servo is not driven beyond its maximum physical range otherwise damage may occur.
It is recommended that the servo be moved a few degrees at a time until the end of its travel is detected (the servo stalls). Once the maximum travel limits have been established, these should be incorporated into the driving software to prevent servo damage.