

PWM Port Aux 3

The FP1 Basic does not have a servo port (AUX 3).

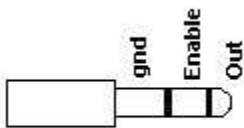
In mode 2, the PWM port (AUX 3) is activated. If a servo motor is connected to the PWM port, it will receive positioning pulses in response to pressure readings taken by the FP1 pressure sensor 1, in relation to a Hysterisis window determined by the user.

A servo motor can typically control an air bleed or restriction valve to control air pressure sensed by PS1. Controlling air pressure with valves is usually easier to do as opposed to controlling the power to the air source because changes to air valves create instant changes to air pressure, where changes to motor power involve delays while motors speed up or slow down. These delays can be confusing to the processor.

Servo motors are typically very small, but strong, motors that come with a selection of lever arms that will usually swing more than 180 degrees. They use very little power, operate on typically 5 volts, and have very precise movement. Their most common use is to control radio model airplanes, cars and boats. They can be very small (a few ounces) to very large (a pound or two). They also range in price from about \$10.00 to hundreds. They are easy to find in most hobby stores and are easy to mount and setup in fabricated systems. Mounting tape is also widely used as a means of mounting servos on model planes and cars.

Most servo motors position their lever arm in response to pulse width modulation (PWM). For most servos, this pulse width is a 5volt high level pulse that is typically 1000 to 2000 uS long in duration. Others may range from 500 to 2600 uS pulses.

The Servo Port is only active in Mode 2



Servo jack (AUX 3) connections. 1/8" or 3.5mm Stereo plug

The servo jack accepts a 1/8" or 3.5mm stereo phone plug.

The **Enable** connection is open when the FP1 is not in mode 2, and goes to +5 volts when mode 2 is entered. The enable signal can be used to turn on your servo circuit.

The servo jack **Out** connection is also open except when in mode 2.

Your servo will require a pullup resistor on the **Out** signal at the servo. The pullup resistor should not be connected to a voltage higher than +5.0 volts.

The servo jack **gnd** connection must be connected to the servo motor ground power lead.

The Sample Duration (s) automatically changes to 1 in mode 2 with early versions of the FP1. In latter versions, the sample duration is determined by (S). Since the FP1 cannot sample the pressure sensors and control the servo port at the same time, the sample duration can be shortened so that there will not be excessive lags in servo signals, and to speed the servo action. The normal Sample Duration (s), is restored when mode 2 is exited.

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Servo operation

The user establishes a test pressure window determined by **f**, the Depression Threshold Value, and **h**, the Hysterisis value. For example, if **f** is 10"wc, and **h**, is .05, then .05 is added and subtracted from 10, to establish a window of 9.95 to 10.05"wc. In mode 2, the FP1 will scroll readings down the screen only when the pressure on PS1 is within this window. The FP1 will also adjust the servo positioning pulses in response to the pressure readings on PS1 in an attempt to achieve the pressure window and maintain it. Simply put, the FP1 will signal the servo to turn one direction if the pressure applied to PS1 is less than the pressure window, and signal the servo to turn the other direction if the pressure applied to PS1 is greater than the pressure window.

Servo Positioning

The FP1 uses a 3 step system to search for the Test Pressure Window. This speeds up the search process without overshooting the window.

The user has several settings to help the servo respond to the positioning pulses from the servo port.

	Servo Step	Letter	Default uS	New Value	Servo Window	Letter	Default "wc	New Value
First Search	High	j	200		High	g	3	
Second Search	Medium	k	50		Medium	q	.5	
Third Search	Low	l	2		Low	h	.05	

Step One Pressure Window Search

Servo Step j is added to or subtracted from the servo positioning pulse width. Default value 200

Servo Window g is added to and subtracted from **f** to establish the pressure window size. Default value 3 makes a window size of 6"wc.

Notes: The first window search is done with a large pressure window and large steps of servo movement.

Step Two Pressure Window Search

Servo Step k is added to or subtracted from the servo positioning pulse width. Default value 50

Servo Window q is added to and subtracted from **f** to establish the pressure window size. Default value .5 makes a window size of 1"wc.

Notes: The second pressure window search is done with a smaller pressure window and smaller servo movements.

Step Three Pressure Window Search

Servo Step l is added to or subtracted from the servo positioning pulse width. Default value 50

Servo Window h is added to and subtracted from **f** to establish the pressure window size. Default value .05 makes a window size of .1"wc.

Notes: The final pressure window is small and the servo steps are also very small.

Servo Step is the size of steps, or the amount of movement the servo arm will make. A Step value of 200 will cause the arm to move many degrees of angle, while a Step value of 1 or 2 will cause the servo arm to just barely move.

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Servo Minimum and Maximum Position, n, x

A servo minimum and maximum position are established with **n** and **x** respectfully. These values set the positions that the servo will not exceed to prevent overdriving the servo beyond physical or operational limits.

Servo Stop, P Version 3.5.32 and later

This determines the position the servo will assume when not in mode 2. If Servo Stop is set to 1, the servo will assume the position of Servo Max, while a value of 0 will cause the servo to assume the position of Servo Min.

Servo Start, O Version 3.5.32 and later

This determines the default position the servo will assume when mode 2 is enabled. In earlier FP1 versions, a value of 1 will position the servo to Servo Max, while a value of 0 will cause the servo to assume the position of Servo Min.

Newer FP1 versions allows **O** to be set to any value between Servo Max and Servo Min. This allows the servo to rest at other positions other than Max and Min. This can help shorten search times by starting the servo position half way between Max and Min. Values entered above Max or below Min will be saved as Max or Min.

If Servo Start is set to 0 (zero) or a value less than Servo Min, the servo will assume the Servo Min position. If Servo Start is greater than Servo Max, the servo will assume the Servo Max position.

If Servo Start is between Servo Min and Servo Max, the servo will assume the position of Servo Start.

Servo Mode, N (FP1 software version 3.4.32 and later)

Servo Mode reverses the operation of the servo. The value is either 1 or 0 (zero). This is useful if the servo operates in the wrong direction you had intended.

Note: On FP1 versions 3.15.32 and earlier, N will change states if you look at the value but do not change it. It will still show as the original value, but will not actually be that value. If you look at the value of N, be sure to enter the desired value before pressing ENTER, even if the desired value is being displayed.

Mode 2 Sample Duration, S Determines the duration of sampling of PS1 and PS2. When mode 2 is entered, the sample duration is now determined by (**S**). Values are 1 - 20. Lower values speed up the servo operation but offer less stable and accurate flow rate readings. Larger values offer more stable flow rate readings and accuracy, but take more time. In all other modes of operation, the Sample Duration is determined by (**s**).

In General

Normally, when controlling a bleed valve, it is recommended that the valve be fully open or half open (later FP1 versions) when not regulating pressure, and to close the valve to obtain the correct pressure. Doing this keeps some types of air source motors and the air cooler by allowing them to move the maximum amount of air through the motors when air pressure regulation is not occurring, and helps prevent over pressurizing the system with too much initial pressure when the air source is turned on. Keeping the valve half open can also shorten search times in most cases.

Depending on the servo, the mechanical setup with the servo, and the air pressure that is being controlled, the user will need to make adjustments to establish proper servo values to facilitate a quick pressure window search without overshooting the pressure window, and to be able to maintain the pressure window. Poor settings result in either pressure window searches that take long periods of time, or cause the servo to swing back and forth as it continually overshoots the pressure window, or the servo has trouble maintaining a pressure window.

The combined features of mode 2, servo control and scrolling readings only when a pressure window is achieved, provide an accurate method of recording flow rates at a very specific reference pressure.

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When building an air valve use a high torque servo, as opposed to a standard or high speed servo. Your valve may not work well if there is any looseness in the linkage connecting the servo to the actual valve mechanism. Use as much of the servo travel as possible to increase the resolution and accuracy of the servo movement. For example, if the servo arm will travel 190 degrees lock - to - lock, try to use 180 degrees of travel to fully open and close your valve. Old throttle bodies and carburetors make good valve bodies to adapt a servo to.

Troubleshooting

Valve opens all the way and stays there.

If the valve is being used as a bleed valve, and your test pressure is higher than the desired pressure, the valve is not able to bleed off enough pressure. Reduce the pressure at your air source.

Valve closes all the way and stays there.

If your valve is being used as a bleed valve, and your test pressure is lower than desired, your air source is not able to supply enough pressure. Increase the capacity of your air source.

Valve is all the way open or closed and does nothing.

Try changing the value of N. This reverses the operation of the servo motor.

Note: On FP1 versions 3.15.32 and earlier, N will change states if you look at the value but do not change it. It will still show as the original value, but will not actually be that value. If you look at the value of N, be sure to enter the desired value before pressing ENTER, even if the desired value is being displayed.