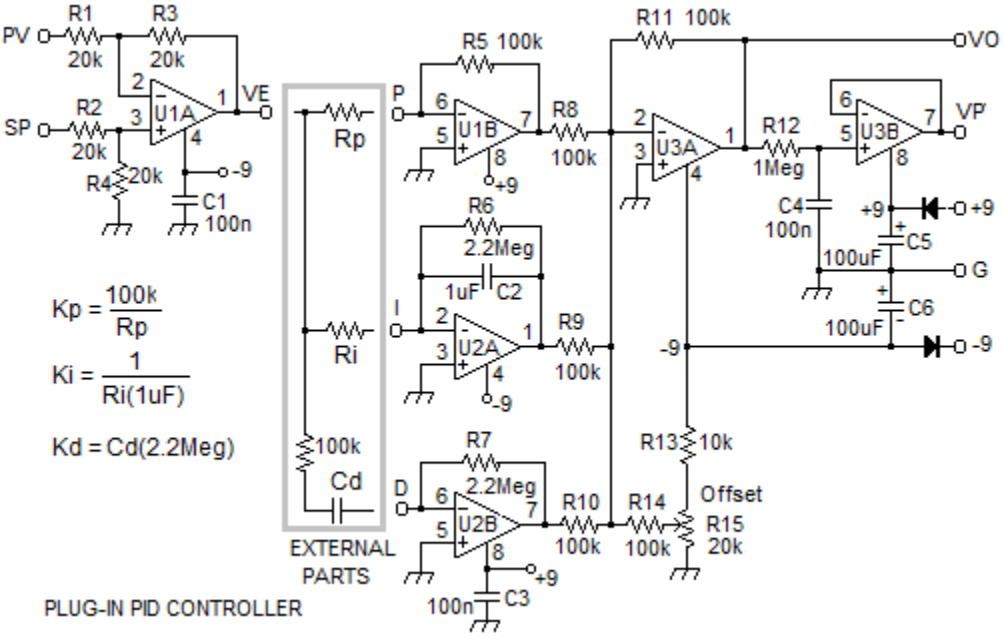
PID-X1 Controller Board Kit

The PID-X1 is a breadboard plug-in that is intended to simplify PID experiments. It allows students more time to experiment with PID parameters by reducing circuit construction time. It may be used for proportional, proportional plus integral, and proportional plus integral plus derivative mode experiments and applications.



U1A is a unity gain differential amplifier. Its output is the error voltage VE, which is the difference between the set point voltage, VSP, and the process variable voltage, VPV. U1B is a proportional amplifier whose gain is controlled by Rp.

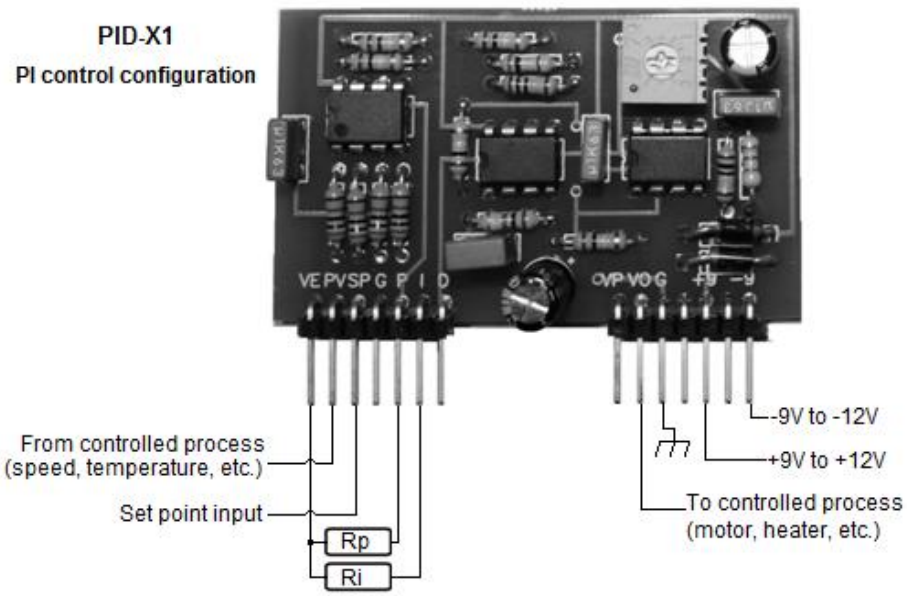
U2A is an integrator whose gain is controlled by Ri. U2B is a differentiator whose gain is controlled by Cd. U3A is a unity gain summer that sums the PID output voltages and the offset voltage. R15 controls the offset (equilibrium) voltage. The U3B circuit may be used to simulate a process with a time constant of tc = R12·C4 = 0.1 second.

Kp, Ki, and Kd Range:

Rp = 1k, Kp = 100
Rp = 100k, Kp = 1

Ri = 1k, Ki = 1000/S
Ri = 220k, Ki = 4.5/S

Cd = 10uF, Kd = 22S
Cd = 10nF, Kd = 22mS



Assembly and Application Information

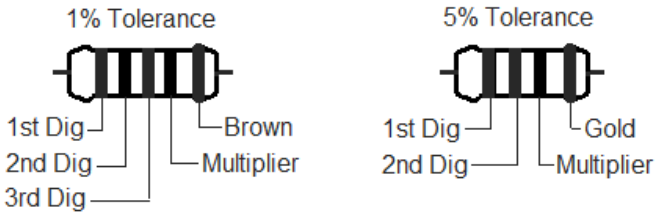
The part values provided with this kit are suitable for a wide range of applications, although other part values may chosen. It is assumed that the experimenter understands the functioning and application of the circuit. ZAP Studio does not warrant the PID-X1 suitable for any particular application. The PID-X1 has been used to perform some of the experiments in ZAP Studio's book: Electronic Control Systems: Simulations and Experiments, by Sid Antoch. It is also demonstrated on YouTube. (Click on the YouTube link at: www.zapstudio.com)

The PID-X1 has a "load simulator" so that PID (or P or PI) experiments may be performed without being connected to an actual process, such as a motor or heater. The load is simply a 0.1 second time constant (R12 and C4). The values of R12 and C4 may be changed to suit the application.

External "parameter setting" parts, Rp, Ri, and Cd are part of the of an application design, and are not provided.

Use the resistor color code to identify the resistors. Use the ohmmeter if in doubt.

1	Brown	6	Blue
2	Red	7	Violet
3	Orange	8	Grey
4	Yellow	9	White
5	Green		



Parts

R1, R2, R3, R4: 20K, ¼ Watt, 1%. R5, R8, R9, R10, R11, 14: 100K, ¼ Watt, 1%. R6, R7: 2.2Meg, ¼ Watt, 5%. R12: 1Meg, ¼ Watt, 5%. R13: 10K, ¼ Watt, 5%. R15: 20K Trimmer Pot.	C1, C3, C4: 100nF, 10%. C2: 1µF, 16VDC, 5%, Ceramic (non-polarized). C5, C6: 100µF, 16VDC, Electrolytic. D1, D2: 1N4001 Diodes. U1, U2, U3: LM358 Op-Amps. PC Board and two 7 pin headers.

Limited Warranty

ZAP Studio kit warranty is limited to the replacement of defective parts. The correct assembly and soldering of a kit is the responsibility of the assembler.

ZAP Studio will, without charge, replace missing or defective component parts for a period of 60 days after the date of purchase. Defective parts under warranty must be shipped to ZAP *Studio* with a copy of the original invoice or receipt, at the purchaser's expense. *ZAP Studio* will ship the replacement parts at its expense.

To report missing or defective parts, contact support: support@zapstudio.com

Exclusion: This warranty does not apply in the case of misuse or abuse of this kit product.

Address:

ZAP Studio
PO BOX 988
Philomath, OR 97370
