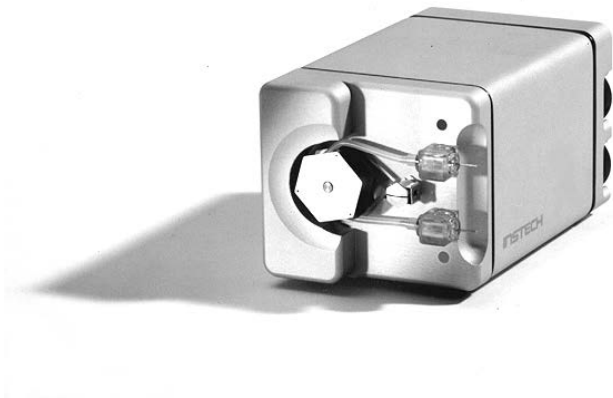


INSTECH

Model P720 Peristaltic Pump

Operation Manual



NOTE: This pump is a laboratory device. It is **not** intended for use on humans.
Instech Laboratories, Inc. cannot assume liability from improper use of its products.

Instech's Model P720 pump is a full-featured, miniature peristaltic pump designed specifically for low flow laboratory applications. Instech's wide variety of pump tube sets let you configure this pump to run at flow rates from 0.2 to 180 ml/hr,* to work with a variety of solutions, and to pump in single or dual channel mode.

The Model P720 can operate as a stand-alone pump or as an element in closed loop control applications using the external speed control input. The pump has an internal battery that will operate the pump continuously for up to 30 hours if the power should fail or if you just want to move the pump around your lab without turning it off.

This pump's circuitry has been designed to minimize electromagnetic radiation, making it ideal for use near sensitive microelectrodes. For quietest operation, run the pump using the internal battery.

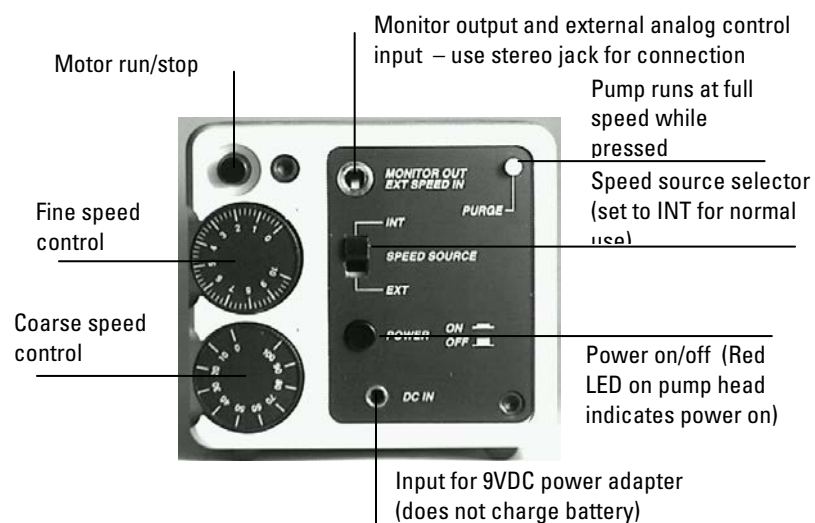
* For the base model with a 900:1 motor gear ratio. Other motors are available for other flow rate ranges.

Set-up

Check for signs of shipping damage. You should have received:

- 1....Model P720 pump
- 1....Wall mounted 15V DC power adapter
- 1....9V lithium battery
- 1....3.5mm stereo jack (for external speed control)

Order tube sets separately.



Model P720 pump controls

Battery Installation

1. Place POWER switch in off position (out).
2. Remove screw holding access cover on underside of pump and remove plate.
3. Withdraw connector and attach to battery terminals. A lithium U9VL is preferred due to its long shelf life and higher capacity (about twice the operating time as an alkaline) although an alkaline will suffice.

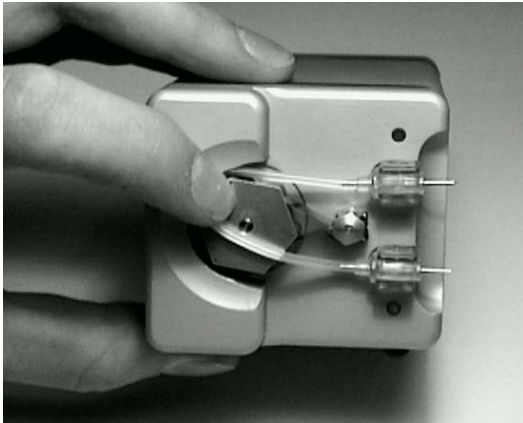
4. Make sure that the removal ribbon is below the battery.
5. Place the battery into the compartment and replace access plate.

Testing Battery Backup Operation

1. Place speed source selector in INTERNAL position.
2. With no external adapter attached, turn on POWER switch and check pump end for illumination of red LED.
3. Press PURGE. The rotor should turn at full speed.
4. Set speed to some value other than zero and turn on motor by pressing the RUN/STOP button.
5. While motor is running, check that the amber LOW BATTERY LED has not come on (battery voltage below 7.5V); if so, replace battery.

Pump Tube Installation

1. Slip the tubular portions extending from the bottom of the connector blocks into the mounting holes with the silicone tube just above the rotor.
2. Actuate the rotor, using the PURGE button, while guiding the tubing down and around the rotor with your finger (see figure below).
3. Press in both connectors so that they align with the square depressions in the pump.
4. Again press PURGE button to check that the tube has been correctly installed and that the amber Kapton tape has not been displaced. There will be slack in the tape as the rotor turns; this is normal.



Pump tube installation

Pump Tube Removal

1. Press the purge button.
2. Lift the input side of the tube out of the holder.
3. As the rotor turns, lift the input side until the entire tube has disengaged.
4. Remove the output side from its holder.

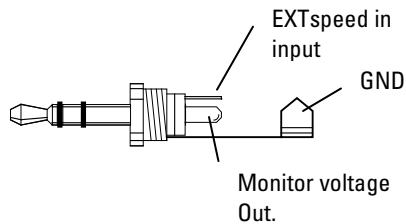
Operation

Stand Alone Operation

1. Insert the power jack into the pump *first*, then plug the 9V DC wall mount supply into an AC outlet.
2. Press in the pump POWER switch.
3. Attach inlet and outlet lines as required. Due to the low flow rates, it is usually best to attach the lines to the pump tube connector, fill the system, clear any air bubbles, pinch off the line to stop any flow and then install the pump tube into the pump as described above. The rotor will prevent flow when it is not turning. Pump tube installation may be performed without the external supply if it is more convenient.
4. Set desired flow rate using the two setting control knobs in conjunction with previously obtained calibration plot of flow vs. Dial Settings or MONITOR Voltage (see Calibration).
5. Check that SPEED SOURCE is in the INTernal position. If this switch has inadvertently been moved to the EXTernal position without an external input the pump will not run or respond to dial settings.
6. Press MOTOR RUN/STOP button to start pumping. Use this button to start and stop the pump rather than the POWER; it provides more rapid starts and stops.

External Speed Control

In this mode you will be supplying an analog voltage to control the speed of the pump. Bi-directional control is possible using this mode. The MOTOR RUN/STOP behaves normally. Set the SPEED SOURCE to EXTernal and apply the voltage via the center ring of the 3.5 mm stereo phono jack input at the top of the control panel.



Stereo jack connections for EXternal speed control

The control voltage passes through the speed control potentiometers and can be attenuated via the knob settings. This is a useful feature when operating more than one pump from a common control line since it allows individual speed adjustment for each pump. It is also useful when a digital level is used as a control voltage.

The input parameters are as follows:

Ensure that maximum MONITOR VOLTAGE (after knob attenuation) does not exceed ± 1.75 volts. An input of $+1.5V$ will produce a MONITOR voltage of about $-1.75V$ when the dials are at 100 and 10.

Zero volts = Zero flow rate (actively controlled). *Note:* TTL 0 state may not be 0 volts. CMOS is usually close enough to work directly.

Positive Control voltage will cause the rotor to rotate clockwise (outflow will be on the top).

Negative control voltage will cause the rotor to rotate counter-clockwise (outflow on the bottom).

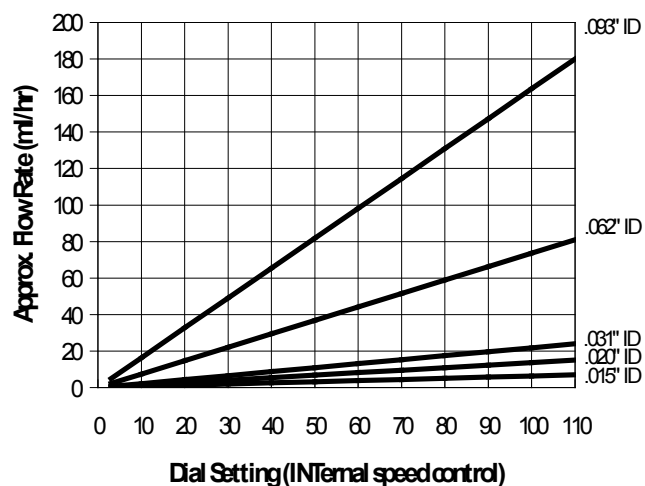
To establish the maximum dial setting (assuming you desire full motor speed at your full speed signal):

1. Set Speed Source to EXT.
2. Apply power and press Power Switch IN.
3. Turn dials to 0.
4. Apply the maximum control signal that your system will deliver. Increase the dials until the MONITOR voltage reaches a maximum of $1.75V$.

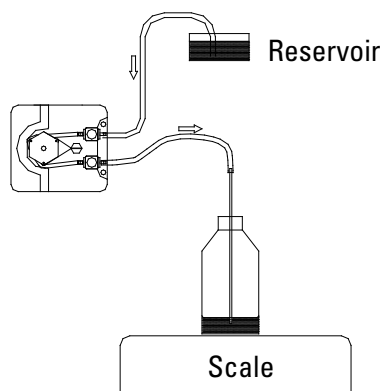
5. You may now perform a calibration of Flow vs. Monitor voltage as detailed below by either varying the incoming signal or with a constant input and varying the dials. Remember not to exceed the values determined in step 4 above.
6. Turn on the MOTOR RUN/STOP switch. You may leave the switch in this position and stop the pump by applying zero volts to the control input.

Calibration

Instech's P720 peristaltic pumps use tube sets of different sizes to cover the range of flow rates. The base model P720, with a motor that has a 900:1 gear ratio, will have flows from approximately 0.2 to 180 ml/hr (see chart below). Other models, such as the P720/66, /10K or /37K will have different ranges as shown in the spec sheet posted on the Instech website. To determine the flow rate at a given rotor speed you will need to calibrate your pump. We have designed our pumps so that the relationship between the rate setting on the controller and the rotor's speed is linear; therefore, in most cases you only need to perform a single-point calibration. For highest accuracy, we recommend that you calibrate each pump tube that you use, since tubing ID can vary from lot to lot.



1. Attach either the inflow or the outflow tube to a container on a balance, or one whose weight is precisely known. Ensure that all the air has been removed from the lines.
2. Set the pump dials to 110 to run the motor at maximum speed (coarse speed control: 100, fine speed control: 10), and turn on the pump motor. (Alternatively, when using the external speed control, or when you need more precision, you may calibrate vs. Monitor Voltage instead of dial settings. To read the Monitor Voltage connect a digital voltmeter between ground and the tip of the 3mm stereo jack plugged into the monitor jack.)
3. Collect or withdraw a timed sample, typically for 10 minutes. The total delivered volume upon which the calibration is based should exceed 0.5 ml (approximately 6 minutes when using the smallest tubing), assuming that the sample is being weighed with a resolution of 1 mg.
4. Weigh the sample and calculate the actual flow rate. Flow rates should be linear with dial settings between 3 and 110.



Tips for Most Accurate Calibration

- Calibrating the pump by measuring the sample in a graduated pipette is usually less accurate than weighing the sample as described above.

- When using new tube sets, run the pump at full speed for 20 to 30 minutes to allow the pump tube to stretch into its final shape.
- Use the same liquid that you will be using under actual operating conditions.
- When calibrating at very low flow rates, beware of evaporation. Use a covered container or one with a small surface area.
- If possible, simulate the pressure differences across the pump tube that will be experienced under actual operating conditions. Increased back pressure on the outflow side will cause a slight increase in delivery rate due to tubing dilation, though this effect is usually less than 1%.

Replacement Parts

Kapton Strips

This amber strip can reduce tube wear and minimize the tendency for the peristaltic action to walk the tube through the pump, which can stretch the tube and alter the flow rate calibration. The strip should never be tight around the rotor. Replacement strips are available—specify part number KSK. In many cases the kapton strips may not be necessary.

Tube Sets

Tube sets will typically last about one month under continuous operation. Dual tube sets place greater stress on the pump motor than do single tube sets, and thus they may shorten the life of the motor.

To specify a tube set, first choose the size of tube you need based on your expected flow rates. Next choose the tube material and inlet and outlet connectors using the table below. When ordering, give Instech a part number that specifies: inlet connector–tubing–outlet connector. For example, LL-020S-22 specifies a single channel .020” silicone tube with a male Luer lock inlet connector and a 22 gauge hypodermic tubing outlet connector. Note that

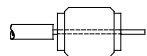
you can have different inlet and outlet connectors on the same tube set. Call for current prices.

DUAL TUBE SET WARNING: Dual channel tube sets, particularly the 062 size, place more stress on the pump motor than do single channel tube sets, which will shorten the life of the pump. Pumps with spur gearheads (P720/37K, P720/10K and P720) are more susceptible to this stress than are pumps with planetary gearheads (P720/66). In addition, dual 062 tube sets make contact with the sides of the pump rotor, which will cause those tube sets to wear faster than other sizes.

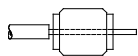
Available tube set materials, sizes and connectors

Material	Infusate	Tube size (ID)				
		.015"	.020"	.031"	.062"	.093"
Silicone	Saline, most drugs	015S	020S	031S	062S	093S
C-FLEX®	IV diets with fats	-	020C	031C	062C	093C
VITON®	Petroleum-based fluids	-	020V	-	062V	-
Channel s	Inlet and outlet connectors	.015"	.020"	.031"	.062"	.093"
Single	22 gauge tubing	22		-	-	-
Single	20 gauge tubing	20		-	-	-
Single	.062" ID barb (soft plastic)	BS				
Single	Male Luer lock	LL				
Single	Female Luer lock	FL				
Single	.093" ID barb (soft plastic)	93				
Dual	22 gauge tubing	D22		-	-	-
Dual	20 gauge tubing	D20		-	-	-
Dual	.062" ID barb (soft plastic)	DBS	-			-

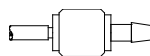
VITON is a registered trademark of DuPont Dow Elastomers LLC. C-FLEX is a registered trademark of Consolidated Polymer Technologies, Inc. Tygon is a registered trademark of Norton Performance Plastics Corporation.



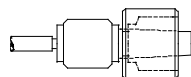
22 22 gauge tubing
Fits PE50, .020" Tygon®



20 20 gauge tubing
Fits PE100, .030" Tygon®



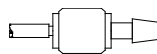
BS .062" ID barb
Fits .062" Tygon®



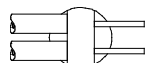
LL Male Luer lock
Fits female Luer, .093" Tygon®



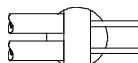
FL Female Luer lock
Fits male Luer lock



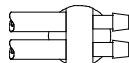
93 .093" ID barb
Fits .093" Tygon®



D22 Dual 22 gauge tubing
Fits PE50, .020" Tygon®



D20 Dual 20 gauge tubing
Fits PE100, .030" Tygon®



DBS Dual .062" ID barb
Fits .062" Tygon®

Tube Set Connectors

Accessories

Instech also offers a range of accessories and replacement parts for its peristaltic pumps. Call for current prices.

Part Number	Description
P720/RMC	Rod mounting clamp. Attaches P720 and P820 pumps and controllers to standard rod mounting systems (including Instech's UNIMOUNT).
P720/KSK	Kapton strip replacement kit. 20 protective strips, 5 retaining clips and 1 installation tool.
P720/BATT	9V lithium battery for P720 pump.

Specifications

Rotor type	3 roller
Rotor speed	.4 – 14 RPM
Power supply voltage	+8 to 15 V DC
RPM supply sensitivity	-.08 %/Volt
Typical operating current – single tube	25 mA
Typical operating current – dual tube	30 mA
Typical idle current	14 mA
Monitor voltage (INT)	0 to ± 1.46 VDC
Nominal external voltage (EXT)	± 1.5 to ± 10 VDC
Recommended battery	Lithium U9VL
Alternative battery	Standard 9V alkaline
Battery voltage triggering amber Lo Bat LED	~7.5 V
Size (WxHxD)	2.5"x2.25"x4"
Weight	1 lb
Typical repeatability	$\pm 3\%$
Linearity vs. dial setting	$\pm 3\%$
Accuracy	$\pm 5\%$
Maximum pressure – .015"-.020" ID tube	20 PSI
Maximum pressure – .031"-.093" ID tube	5 PSI

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Instech Laboratories, Inc.

Instech has been a leading provider of instruments for medical and biological research for over 40 years. Our reputation for quality and reliability is recognized by research facilities, universities and a wide range of companies throughout the world.

Our design and manufacturing capabilities include:

- Small fluid pumps
- Continuous animal infusion systems
- Automated blood sampling systems
- Dissolved oxygen measurement systems
- Motor controllers

For more information on the complete line of Instech systems and custom products, call us at 800-443-4227 or visit our website at www.instechlabs.com.

INSTECH

The equipment behind the science.

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