MAIDEN'S WELL

Benchtop pumping unit with digital speed control and timer

Operating Manual

Models:

PPS200166A

PPS200326A

An electronic version of this Operating Manual can be downloaded at www.maidenswell.com/support

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1 Introduction

1.1 Application and Usage

The product has been developed for the continuous and accurate transfer of liquids in laboratory, research and development, hydroponic, and horticultural applications.

The product is not to be used for clinical trials or to transfer liquids intended for human consumption.

1.2 Safe Operation

	**Risk of danger to health and the environment**

Please observe the following cautions and recommendations:

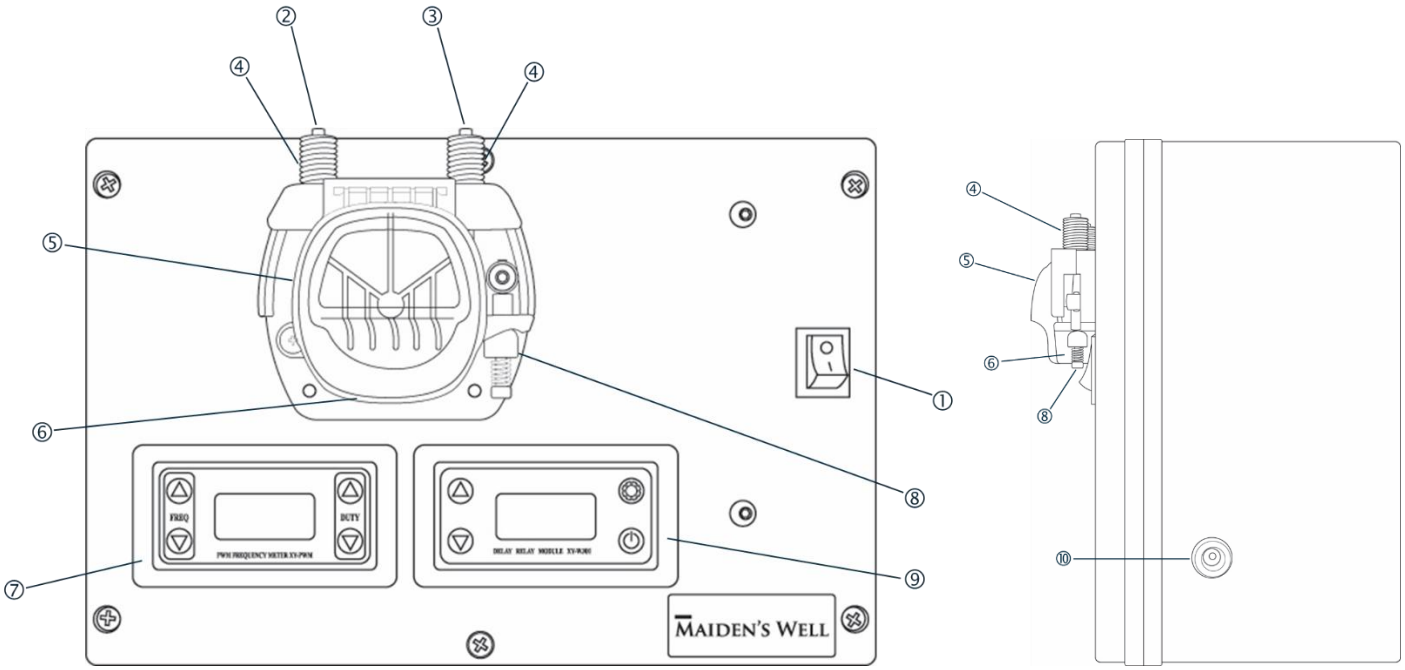
- Do not operate the product in a manner which exceeds the operating and environmental conditions specified in this document.
- It is the user's responsibility to ensure all liquids and chemicals are handled in accordance with their corresponding Safety Data Sheet and applicable rules and regulations, including wearing the correct personal protective equipment.
- It is the user's responsibility to ensure liquids are compatible with the internal BPT tubing.
- The internal tube may burst during operation. It is the responsibility of the user to take the necessary precautions to prevent injury to personnel or equipment.
- Do not use the product as a medical device.
- Do not use the product in the presence of explosive gases or fumes.
- Do not insert a finger or other body part into the roller housing while the unit is connected to a power source.
- Maiden's Well shall not be responsible for any modifications or repairs performed by the customer or any third party.

1.3 Package Contents

- 1 x Pumping unit
- 1 x 24V DC power adaptor
- 2 x inlet/outlet tubing connection adaptors
- 1 x internal tube replacement kit

2 Basic Setup and Operation

2.1 Overview



① On/off switch
② Inlet
③ Outlet
④ Threaded tube attachments
⑤ Pump head
⑥ Bottom guide
⑦ Flow rate/speed controller
⑧ Tensioning arm
⑨ Timer module
⑩ 24V power connection

2.2 Attaching the Inlet/Outlet Tubing

1. Ensure the tubing has the correct internal diameter for the pump model.

Model	Tube Internal Diameter
PPS100166A	1.5 - 1.6 mm

PPS100326A	3.0 - 3.2 mm

Using the wrong size tubing may result in leakage, restricted flow, or air bubbles in the outlet tubing.

2. Thread the inlet and outlet tubes through the tubing connection adaptors.
3. Push the end of each tube over the nozzle on the threaded tube attachments.
4. Screw the adaptors onto the threaded tube attachments.

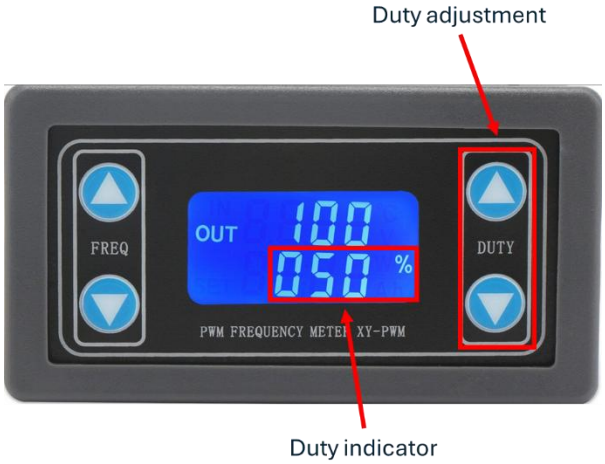
2.3 Before Switching On

1. Ensure the pumping unit is placed on a stable, level surface
2. Connect the 24V power supply
3. Ensure the inlet/outlet tubes are attached (see previous section)
4. Ensure the inlet/outlet tubes are placed into the reservoir and receiving vessel respectively

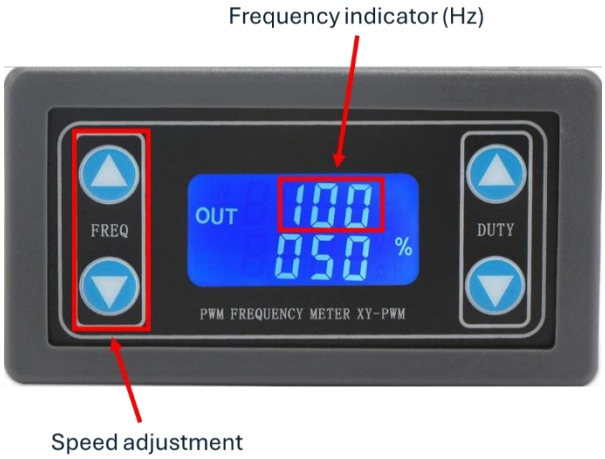
2.4 Adjusting the Pump Speed and Liquid Transfer Rate

The liquid transfer rate, or flow rate, is a function of the rotational speed of the pump which is controlled using a square wave signal. The pump speed is directly proportional to the signal frequency.

The duty as indicated below represents the on/off ratio of the signal for one cycle. It should be set to 50% for all operations.



The signal frequency, and therefore pump speed and flow rate, is adjusted using the arrows as shown below.

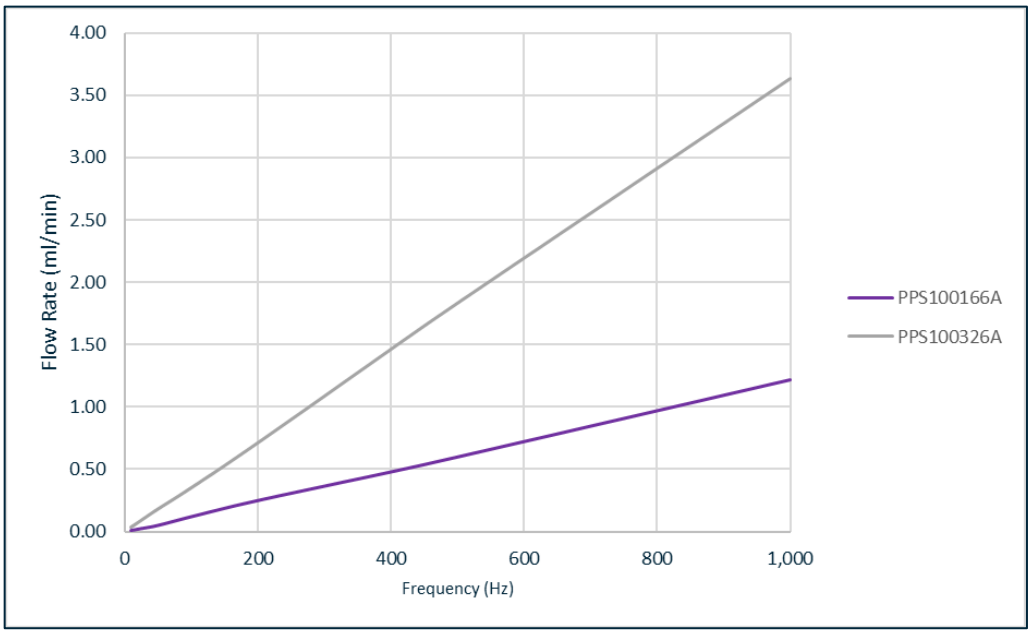


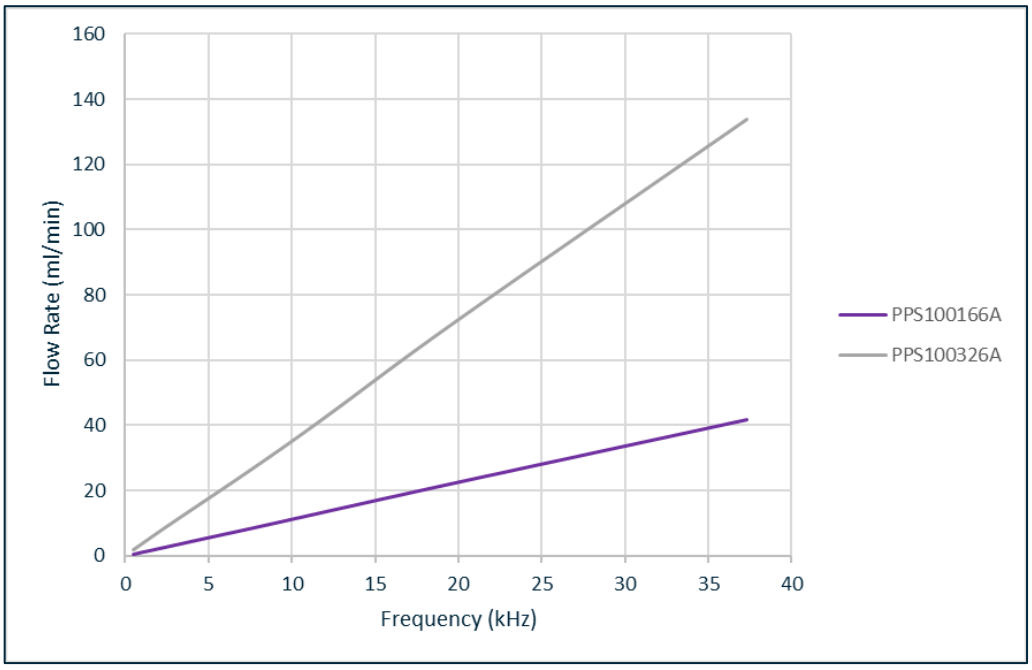
A frequency of 37.3kHz delivers the maximum pump speed of 350rpm.

Warning: damage may occur to the pump if a frequency higher than 37.3kHz is selected.

The relationship between pump speed and flow rate is dependent on the fluid characteristics and environmental conditions, but is approximately linear.

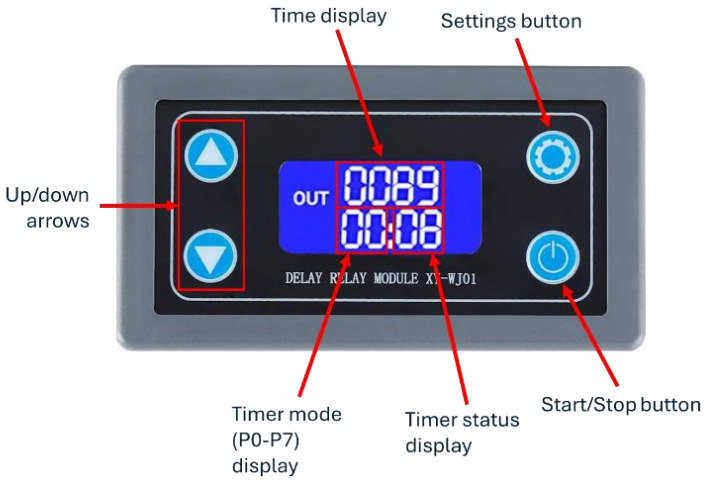
The following graphs show the approximate relationship between frequency and flow rate using water at 20°C under atmospheric pressure and inlet/outlet tubing of ID 1.6mm, 2.0mm, and 3.0mm.





Note: Actual flow rates will vary depending on the liquid being transferred, the size of the inlet/outlet tubing, the environmental conditions, and the condition of the internal tube. For optimal results the user should calibrate the pumping unit (see next section) before each operation to ensure the desired flow rate is achieved.

2.5 Operating the Timer



2.5.1 Timer Modes and Pump Operation

The pump timer has 8 modes as follows:

Mode	Description
P0/P1/P2	When the Start/Stop button is pressed the pump runs for a set time. Operation can be paused and restarted by pressing the Start/Stop button.
P3	Pump runs continuously when the unit is switched on at the On/Off switch. When Start/Stop button is pressed the pump stops for a set time before restarting.
P4	When the Start/Stop button is pressed the pump runs for a set time, then stops for a set time. The cycle is repeated for a set number of cycles after which the pump stops. Sequence can be paused at any time and restarted by pressing the Start/Stop button. Sequence can be repeated when complete by pressing the Start/Stop button.
P5	When Start/Stop button is pressed the pump runs for a set time after a set delay. The cycle is repeated for a set number of cycles after which the pump runs continuously. Sequence can be paused at any time and restarted by pressing the Start/Stop button. Sequence can be repeated when complete by pressing the Start/Stop button.
P6	When the unit is switched on at the On/Off switch, the pump runs for a set time, then stops for a set time. The cycle is repeated for a set number of cycles after which the pump stops. Sequence can be paused at any time and restarted by pressing the Start/Stop button. Sequence can be repeated when complete by pressing the Start/Stop button.
P7	When the unit is switched on at the On/Off switch, the pump runs for a set time after a set delay. The cycle is repeated for a set number of cycles after which the pump runs continuously. Sequence can be paused at any time and restarted by pressing the Start/Stop button. Sequence can be repeated when complete by pressing the Start/Stop button.

Notes:

- Timings are retained when the pump unit is switched off.
- Adjusting the timings in one mode alters the timings in the other modes.
- The timer module has two additional modes P8 and P9. These should not be used with the pumping unit.

2.5.2 Setting the Timing Range

1. Press and hold the Settings button until the timer mode display starts flashing
2. Press the Settings button again. The time and timer status display will start flashing
3. Press the Start/Stop button to move the decimal point in the time display

Time Display	Timing Range
0000	1 to 9999 seconds
000.0	0.1 to 999.9 seconds
00.00	0.01 to 99.99 seconds
0.0.0.0	1 to 9999 minutes

For example, if you want to set the timer to 3.2 seconds, move the decimal point to the 000.0 position, and the display will read 003.2

2.5.3 Selecting the Timer Mode

1. Press and hold the Settings button until the timer mode display starts flashing
2. Press the up or down arrow until the desired timer mode (P0-P7) is displayed
3. Press and hold the Settings button until the timer mode display stops flashing

2.5.4 Setting the Timer

1. Press and hold the Settings button until the timer mode display starts flashing
2. Press the Settings button again. The time and timer status display will start flashing
3. Press the up or down arrow until the desired time is displayed.

   In Timer Modes P0/P1/P2 and P3 hold the Settings button until the timer displays stop flashing.

   In Timer Modes P4, P5, P6 and P7 press the Settings button. The timer status display will change from OP to CL. Press the up or down arrow until the desired time is displayed. Press the Settings button again. The time status display will change from CL to LP. Press the up and down arrow to select the desired number of on/off cycles (1 = 1 set of on and off cycles). Hold the Settings button until the timer display stops flashing.

2.5.5 Additional Features

Auto Sleep Function

The backlight automatically turns off after approximately 5 minutes of no activity.

To switch on this feature, press and hold the Start/Stop button in any of the timer modes until ON L-P appears flashing in the display and then release.

To switch off the feature, press and hold the Start/Stop button in any of the timer modes until OFF L-P appears flashing in the display and then release.

View Settings

In Timing Modes P4, P5, P6 and P7 view the current timing settings by press the Settings button. The settings will cycle through once with a few seconds in between.

Display Parameter

In Timing Modes P4, P5, P6 and P7 switch between displaying the timing and the cycle count by pressing the up or down arrow.

2.6 Calibrating the Pumping Unit

The pumping unit should be calibrated using the same liquid which will be used for the application and at the same atmospheric temperature and pressure.

The pumping unit should be calibrated before each operation as physical changes in the internal tubing can cause minor variations.

Calibration is particularly important for flow rates < 1 ml/min.

Either of the following two methods can be used to calibrate the pumping unit for a specific flow rate.

Volume Method

1. Identify the desired flow rate
2. Place the pump inlet tube into the liquid reservoir and the outlet tube into a volume measuring apparatus, e.g. a measuring cylinder
3. Set the timer so the pump runs for a fixed time, e.g. 1 min, and run the pump
4. Note the volume of liquid transferred

5. Adjust the frequency setting until the desired flow rate is achieved

Density Method

1. Measure a set volume of the liquid to be transferred
2. Using a balance or scale, determine the mass of the measured liquid volume
3. Identify the desired flow rate
4. Place the pump inlet tube into the liquid reservoir and the outlet tube into a vessel placed on the scale
5. Tare the scale
6. Set the timer so the pump runs for a fixed time, e.g. 1 min, and run the pump
7. Note the mass of liquid transferred and divide by the density to obtain the volume
8. Adjust the frequency setting until the desired flow rate is achieved

The pumping unit should be calibrated before each operation as physical changes in the internal tubing can cause minor variations.

3 Replacing the Internal Tube

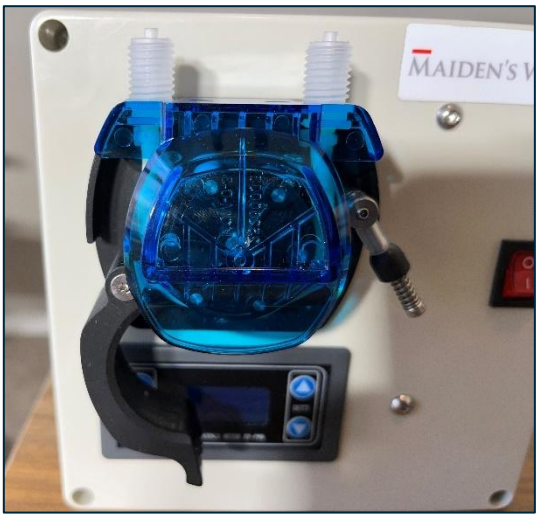
3.1 Preparation and Required Equipment

The following items are required to replace the internal tube:

- Replacement tube
- 2 x 100mm (4") cable ties
- Small Phillips head screwdriver
- Small tube of white lithium grease
- Small wire cutters or scissors

3.2 Directions

1. Disconnect the 24V power supply and switch the on/off switch to the off position
2. Release the tensioning arm and let the bottom guide swing down



3. Undo the two screws on the top of the pump and remove the front face

4. Slide the two threaded tube attachments out of their slots in the pump body and remove the internal tube.

5. Using the wire cutters or scissors, remove the cable ties holding the internal tube to the threaded tube attachments and disconnect the tube.
6. Connect the replacement internal tube to the threaded tube attachments and fix in place with the new cable ties. Use the wire cutters or scissors to remove the excess tie material.
7. Apply a little lithium grease to the side of the internal tube which will be in contact with the rollers.
8. Reverse steps 1-3 to install the new internal tube, ensuring the tube is aligned with the center of the rollers.

4 Troubleshooting

Problem	Cause	Recommended Action
On/off switch does not light up when switched to on position	Power not reaching pumping unit	Verify 24V power supply is connected

Pump does not turn when on/off switch is switched to on position	Selected frequency is outside the pump's operating range	Adjust the frequency to between 1Hz and 37.3kHz
Pump does not turn and makes a squealing sound	Frequency setting is too high	Reduce the frequency to below 37.3kHz
Fluid transfer rate changes over a short time (< 1 hour) at the same pump speed	Leaking internal tube	Replace internal tube
	Air ingress into inlet/outlet tubing	Ensure correct size inlet/outlet tubing is used
Leakage at connection between inlet/outlet tubing and threaded tube attachments	Wrong size inlet/outlet tubing used	Attach correctly sized inlet/outlet tubing
Fluid transfer rate changes over an extended period (> 24 hours) at the same pump speed	Physical changes in internal tube or inlet/outlet tubing	Calibrate the pumping unit

5 Specifications

Model	PPS200166A	PPS200326A
Minimum flow rate*	0.001 ml/min	0.1 ml/min
Maximum flow rate*	42.0 ml/min	134.0 ml/min
Internal tube ID	1.6 mm 1/16”	3.2mm 1/8”
Inlet/outlet tubing (recommended size)	ID 1.5 – 1.6 mm	ID 3.0 – 3.2 mm
Timer ranges	0.01 to 99.99 seconds 0.1 to 999.9 seconds 1 to 9999 seconds 1 to 9999 minutes	
Timer modes	P0/P1/P2: When Start/Stop button is pressed pump runs for a set time. P3: When unit is switched on pump runs continuously. When Start/Stop button is pressed the pump stops for a set time before restarting. P4: When Start/Stop button is pressed pump runs for a set time, then stops for a set time. Cycle is repeated for a set number of cycles after which the pump stops. P5: When Start/Stop button is pressed pump runs for a set time after a set delay. Cycle is repeated for a set number of cycles after which the pump runs continuously. P6: When unit is switched on pump runs for a set time, then stops for a set time. Cycle is repeated for a set number of cycles after which the pump stops. P7: When unit is switched on pump runs for a set time after a set delay. Cycle is repeated for a set number of cycles after which the pump runs continuously.	
No. of rollers	6	
Pump speed	0-350 rpm	
Pump driver	Stepper motor	
Speed control accuracy	0.1%	
Flow accuracy	1-5%	

Pump rotation		Counterclockwise, non-reversible
Dimensions (L x W x H)		243 mm x 134 mm x 160 mm 9.6" x 5.3" x 6.3"
Weight		1.17 kg 2.58 lbs.
Motor power		36W
Power supply		24V DC 3A, 5.5 mm x 2.5 mm, center positive
Materials	**Housing**	ABS plastic
	Internal tube	BPT
	Rollers	PET plastic
Operating temperature		0-45 °C 32-113 °F
Humidity		< 70% non-condensing
Noise rating		52dB at 0.5m
IP rating		IP 22 as per IEC 60529

*Measured using water at 20°C at atmospheric pressure and inlet/outlet tubing of ID 1.6mm, 2.0mm, and 3.0mm. Actual flow rates will vary depending on liquid being transferred, size of inlet/outlet tubing, environmental conditions, and condition of internal tube. Minimum flow rates are applicable to a period of at least 30 minutes.

6 Technical Support

For technical support please send an email to support@maidenswell.com

7 Product Return

If you wish to return the product, please send an email to support@maidenswell.com stating the reason.

8 Warranty

6 months (excluding replaceable internal tube).