

# Applied BioPhysics Inc

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## ECIS p-FLOW Peristaltic Pump Manual, rev D.



### Pump Specifications

Maximum flow rate with 3.18mm ID tubing 24ml/min

Minimum flow rate with 3.18mm ID tubing: 70ul/min (1.2ul/sec)

Flow rate resolution with 3.18mm ID tubing: 70ul/min from -20ml/min to +20ml/min

Maximum ramp rate 0-20ml/min in 150msec (forward or reverse)

Full forward to full reverse: -24ml/min to +24ml/min: 400msec

Pump speed: -60 to +60 RPM stepper driven motor (10 kHz pulse)

Pump resolution: 0.1 RPM

Control input: USB

Manual controls: forward/reverse, run/stop, speed control (not linear)

Power: +15V DC, 1.2A, under 10W

## **Pump Tubing**

The recommended maximum tubing size to be used with this pump is PVC (Polyvinyl chloride) phthalate free ®Tygon, 3.18mm ID, 4.7mm OD. This is the standard tubing supplied with the pump. Smaller diameters can be used.

The tubing ID is 3.18mm (1/8", tubing OD is 4.7mm (3/16"), wall thickness 0.76mm (1/32"). The Applied BioPhysics part number is " P-flow 3.18 tubing". Tubing is supplied in packages of 12 455mm long tubes with the stops separated by 105 mm.

## **Pump Setup**

If installing the pump in the incubator, please preheat the pump to eliminate condensation by placing the pump in a sealed plastic bag in the incubator.

The pump generates between 5-10 watts of heat. Confirm the pump will not overheat your incubator by monitoring the incubator temperature with the pump running within the incubator space.

### **Flow Set-up Guide 25mL Kit**

**What you will need:**

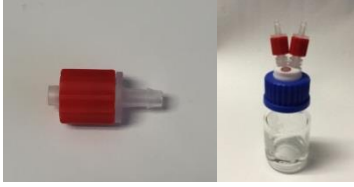
- 2 - 25mL glass bottles**
- 1 - two port Bottle Cap**
- 1 - three port Bottle Cap with filter**
- 1 - two- stop tubing**
- 2 - male-male tubing adaptors**
- 6 - red lock rings**
- 2 – Luer to Luer male adaptors**
- 2 - cut length of tubing (30cm/12inches)**
- 1 – ECIS Flow Array (1F8x1E or 1F8x10E)**

1) Locate two clear glass bottles with blue bottle caps.



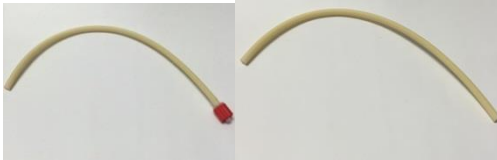
The three port cap should have a silver colored filter built in. Do not tamper with or try to remove this filter.

2) Locate the RED LOCK RING adaptors.



- a. Screw four red lock rings onto the Luer locks on both blue bottle caps.
- b. Make sure this connection is tight.

3) Locate tubing



- a. Cut some tubing into four pieces approximately 30 cm/12 inches long.
- b. You will need two red lock rings.
- c. Insert the prong end of the lock rings into one end of two of the four pieces of cut tubing.
- d. You should now have 2 pieces of tubing that have one end connected to a red lock ring and the other end empty and 2 pieces of tubing with nothing connected.

4) Locate the two stop tubing



- a. You will need 2 male-male tubing adaptors.
- b. Insert a Male – Male tubing adaptor into each end of the 2-stop tubing.

5) Connect the 2-stop tubing to the cut tubing



- a. You will need the 2 pieces of tubing with nothing connected
- b. Insert one end of each the 2 cut lengths of tubing into to one end of each of the 2 male-male adaptors connected to the 2-stop tubing
- c. Make sure the tubes are tightly connected to each adaptor.

6) Connect the tubing to the pump head

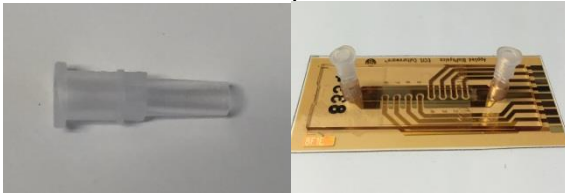
- a. Insert the middle portion of the two stop tubing into the pump head.
- b. Make sure the stops are not inside the pump head
- c. Push down the lever to lock it in place.

7) Place the two port bottle on the right and the three port bottle on the left of the pump.

8) Locate the two pieces of tubing each with one lock ring attached

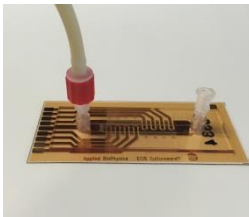


- a. Insert the empty end of one piece of the cut tubing onto a red lock ring on the three port bottle.
  - b. Insert the empty end of one piece of the cut tubing onto a red lock ring on the three port bottle.
- 9) Locate the two ends of tubing connected to the pump head
- a. Insert the empty end of the left piece of the cut tubing onto the red lock ring on the three port bottle.
  - b. Insert the empty end of the right piece of the cut tubing onto the red lock ring on the three port bottle.
- 10) Insert your prepared array into the array holder.  
Clamp the array in place
- 11) Find the Luer to Luer adaptors



Insert Luer to Luer adaptors into each of the two reservoirs.

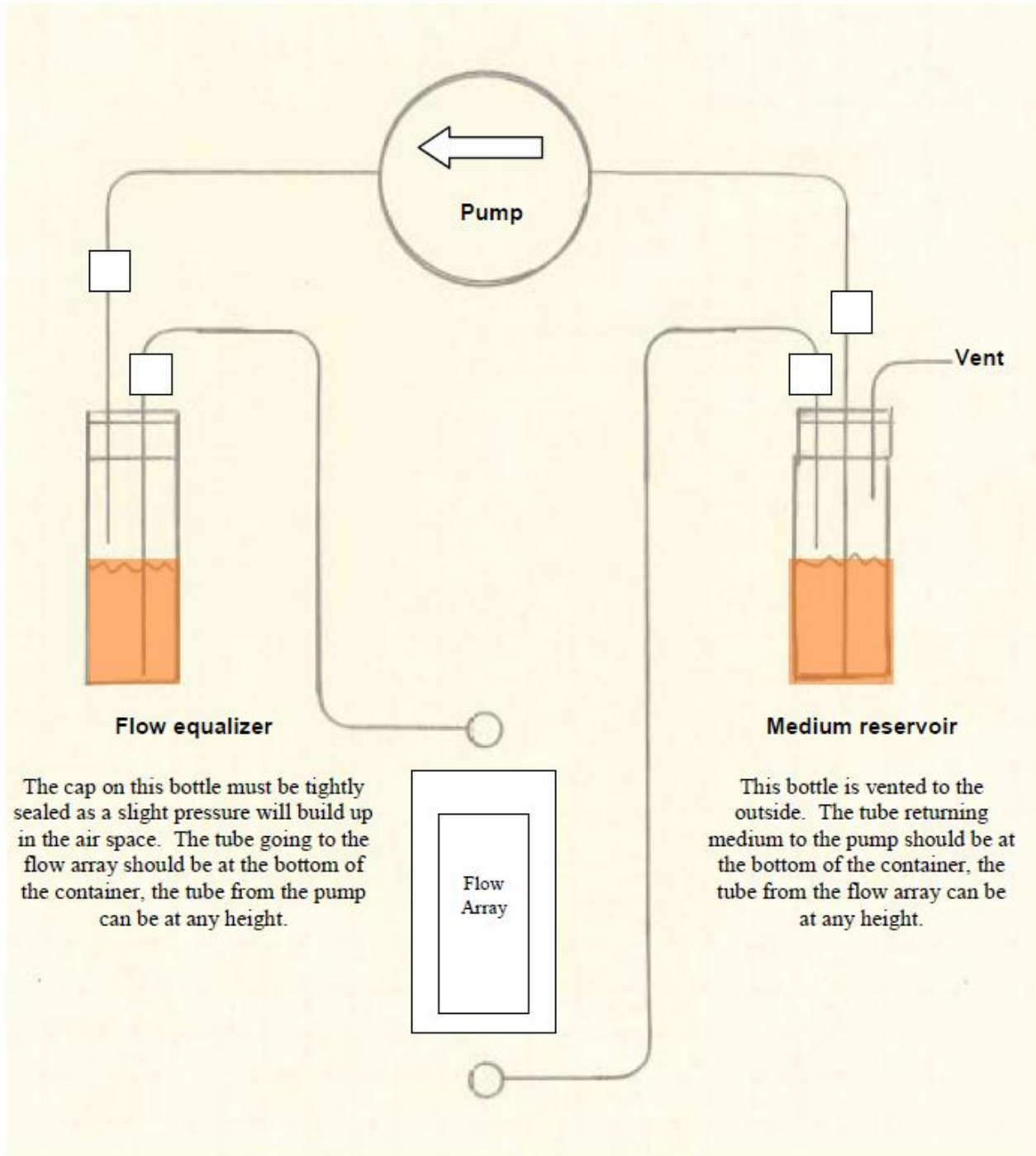
- 12) Connect the bottles and tubing to the array



- a. Insert the lock ring from the tubing on the three port bottle to the Luer lock closest to the array contact pads.
  - b. Insert the lock ring from the tubing on the two port bottle to the Luer lock farthest to away from the array contact pads.
- 13) Turn on the instrument and software.
- a. Set the pump to the proper settings (refer to Section B)
  - b. Turn on the pump and begin flow
- 14) Check to make sure the media in both bottles is staying at the same level.
- a. Media in the two port bottle will rise slightly and then stop
  - b. If the media continues to rise or fall steadily, turn off the pump and make sure everything is properly aligned and tightened. The rise and fall of media indicates an air leak at one of the connections.
- 15) Check for leaks around each lock ring

- a. If there is a visible leak, stop the pump and make sure everything is properly aligned and tightened
- b. Push down on the Luer locks if necessary.

16) If no leaks occur you are now ready to begin a Time Course Experiment with ECIS



## Modes of Operation

The pump can be run in four modes. Multiple pumps can be run from one PC.

### Pump indicator light (same front and back)

Green: on-power, ready

Red: constant RPM in manual or under PC control

Flashing Green: program is loaded from PC, ready to run

Flashing Red: program is running

To clear program, hold "run/stop" button on back of pump for 15 seconds.

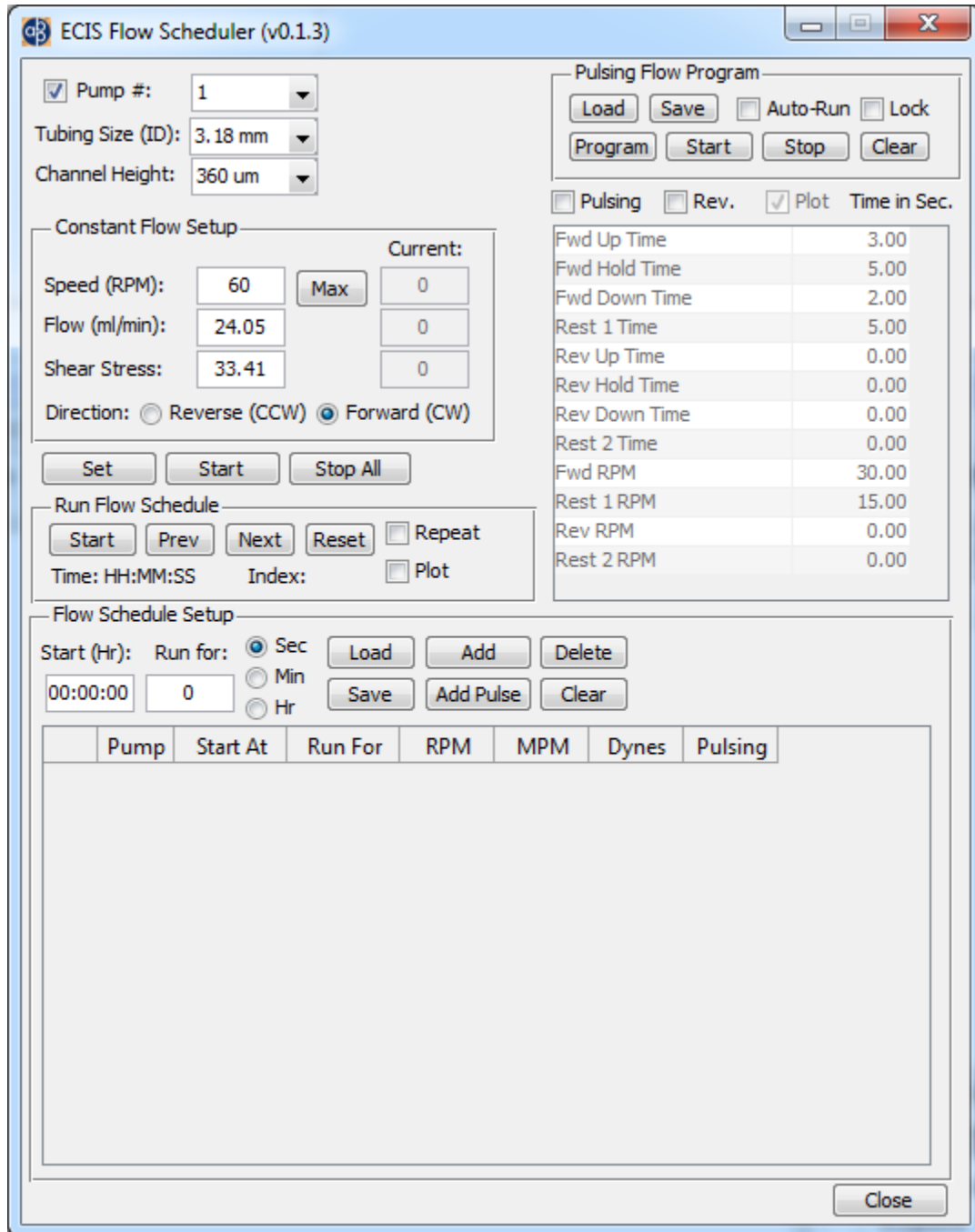
- 1) Manual. Plug in power supply and set toggle switch to run forward or reverse. Push run/stop button and set desired speed using rotary pot on back of pump. No connection to a PC is required to run in this mode.

Approximate pump RPM using rotary pot on back of pump.

Knob position	RPM
A	0.1
B	1.5
C	3.5
D	7
E	10.5
F	12.5
G	14
H	17
I	25
J	35
K	45
L	55
M	60

2) Computer control- single speed: Use ECIS software (version 1.2.215.0 or newer) .

[http://www.biophysics.com/software/ECIS\\_Software\\_v1\\_2\\_215.msi](http://www.biophysics.com/software/ECIS_Software_v1_2_215.msi)



Plug in USB cable. Open ECIS software.

- Go to "Acquire" dropdown, "Flow/pump" , "enable flow/pump module"
- "Set flow/pump COM port" (choose whatever port is indicated),
- "Enter tubing size if other than default (default is 3.18mm ID)"
- "Set channel height if other than default values (default values are 360um, 660um)"

- “Setup only flow/pump”, select “ECIS p-Flow” . Pump menu will appear in lower right corner of the ECIS main menu.
- Set “pump speed” or “flow rate”,
- “enter channel height”
- Click “Start” to run pump.
- Set “auto run” to have the pump start when an ECIS measurement starts.

### 3) Computer control- multi speed

Click “configure” in previous pump menu. This will open an expanded pump control window.

To program multi-timed speeds:

Set “speed” or “flow” under “constant flow setup”, set “fwd” or “rev”

Go to “Flow schedule setup” click “add” . This will be position “#1” in the sequence

Set “start time” and “run for” time (choose sec, min, hr above).

Add additional flow rates as needed

Choose “repeat” to continue sequence

Choose “plot” to review pump profile

“Prev” and “ Next” will cycle to the positions programmed.

### 4) Pulsing Flow Program

Click “pulsing flow” under “pulsing flow program” to program a pulse sequence.

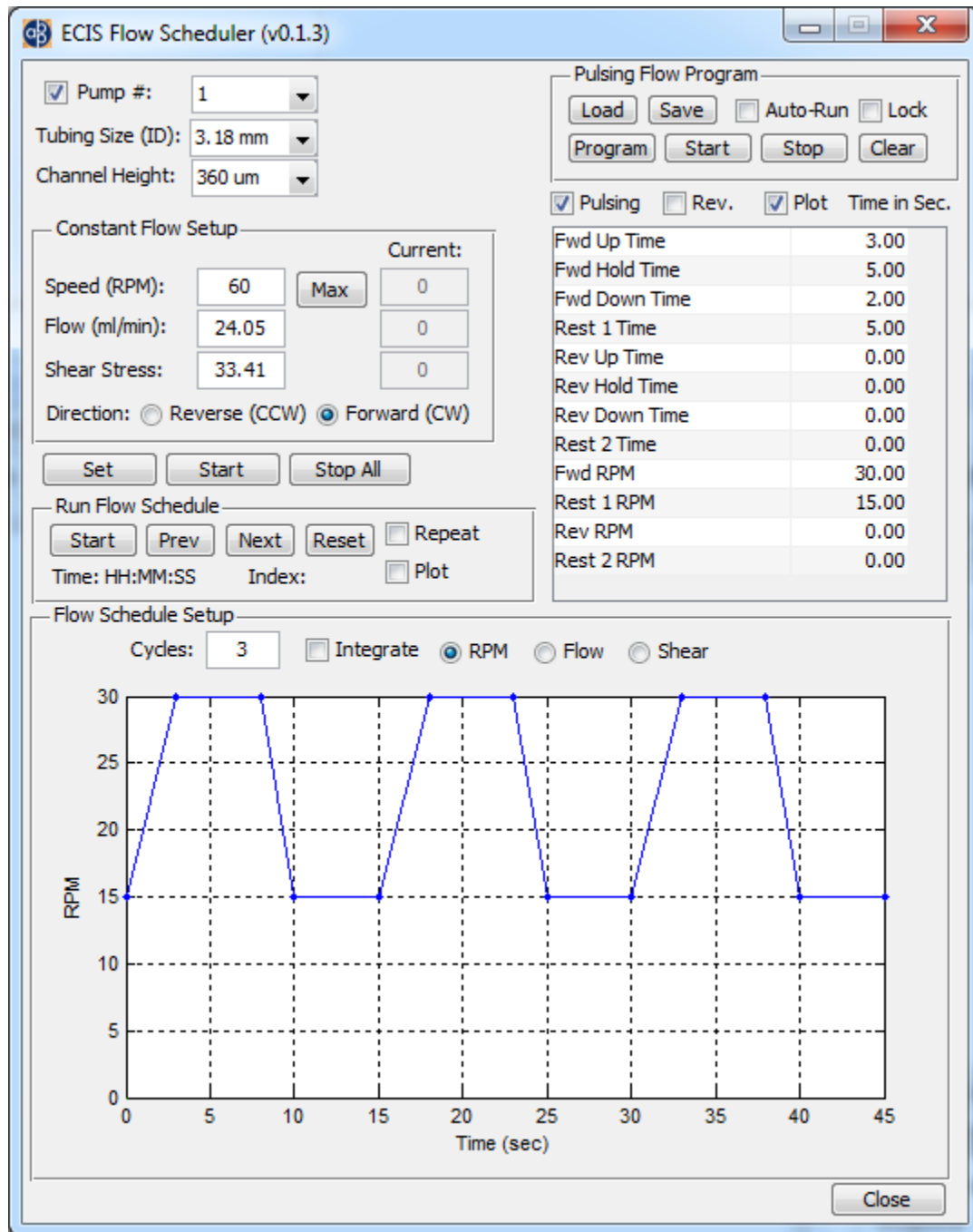
Click “plot” to view time line of the pulse sequence

There are 2 pulsing modes, either forward only, or forward and reverse. To select the forward/reverse mode, check the “Rev.” checkbox.



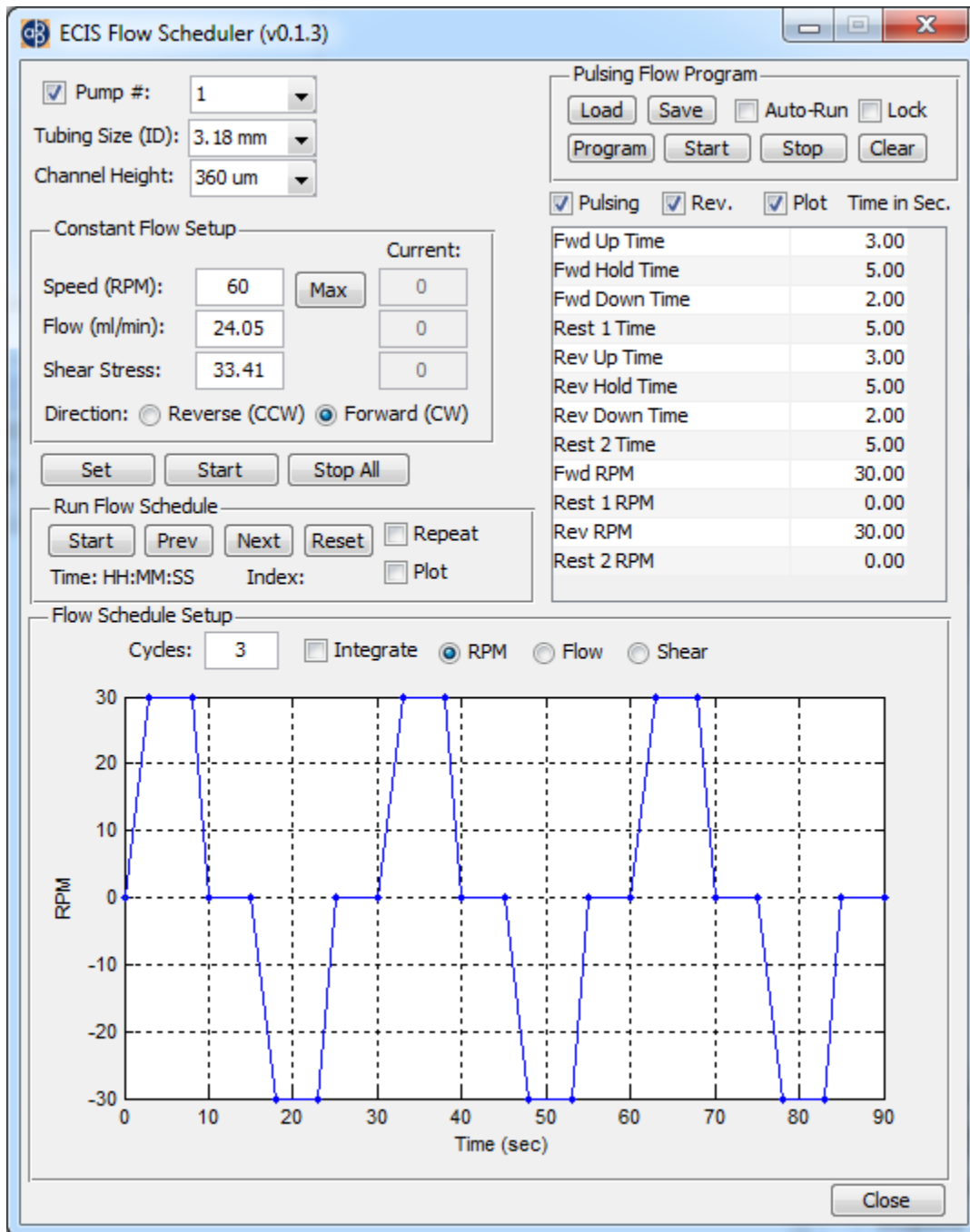
In forward only mode there is a high speed (Fwd RPM), and low speed (Rest 1 RPM). The n set the 4 times to define the pulse (in seconds):

- “Fwd up time”- time to ramp up to “Fwd RPM”
- “Fwd hold time” – time the pump will hold constant “Fwd RPM”
- “Fwd down time”- time to ramp down to “Rest 1 RPM”
- “Rest 1 time” – time pump will run at “Rest 1 RPM”



In Forward/Reverse mode there is a Forward speed (Fwd RPM) and Reverse speed (Rev RPM). The resting speed between pulses must always be zero (Rest 1 RPM, Rest 2 RPM). The following times are used to define the reverse pulse (in seconds):

- “Rev up time” - time to ramp up to “Rev RPM”
- “Rev hold time” –time pump will run at reverse RPM
- “Rest 2 time” - time to run pump at “ Rest 2 RPM”



Click "program" to load profile into the pump and start pump running