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Equipment for cellular & electrophysiology research

cFlow drop sensors

To work properly the drop sensors (**cF-4SEN**) on the **cFlow** have to be set up properly. Four things have to be set up properly.
1. The location of the sensor in relation to the dripper in the dripset is important for reliable operation.
2. The maximum flow rate has to be limited
3. The dripset has to be vertical.
4. The **cFlow** has to be reset to read the background IR level.

1. Location of sensor
Refer to the positioning for the dripset that you are using (usually Abbott type [http://www.cellmc.com/ref/m_cFIV.pdf]). If the sensor is too low then there is a significant delay between the drop leaving the dripper in the dripset and the detection of the drop by the **cFlow**. The **cFlow** scans all the drip sensors once every ms so there is little delay here but if you have the sensor say 0.5cm below the dripper there will be many milliseconds of delay and this extra time matters because depending on the resistance flow (ie. max flow rate) another drop may have partially formed.

2. Maximul flow rate
The maximum flow rate flow rate (to <3ml/min for a 60dpm dripset and <10ml/min for 15 or 20dpm dripset). Why? If the flow rate is not limited then you will get a continuous stream of fluid coming out of the dripset dripper. The drop sensor uses an infra-red beam to detect the drop and water is pretty much transparent to infra-red light. So the drop sensor will not see anything since there is no interruption of the signal. The sensor requires a drop to be formed to pick up the IR light scattered from the drop. This means that at the maximum flow rate you should still be able to see discrete drops being formed from the dripper. If there is a continuous stream or the drops are partly connected the sensor won't work. To reduce the flow rate you can increase either the upstream (of the dripset) or downstream resistance to flow. This means inserting either a narrower bore of tubing or a short length of very fine tubing to limit the flow. For example changing some of the tubing from 1/32" diameter to 1/50" diameter silicon tubing will significantly decrease the flow rate. In our testing you can use a length of about 7cm of 1/50" ID silicon tubing upstream of the dripset to reduce the max flow rate to 3ml/min. If you have small diameter tubing on the downstream side this will also reduce the flow rate so you will have to take this into account as well and may need to reduce the length of tubing upstream.

3. Vertical dripset
If the dripset is not vertical the drop can fall off the dripper and not pass properly through the area of the sensor. There is some lattitude in the sensing since the drop has a significant size the IR beam also covers a significant area. However if the dripsets are out of vertical then the sensor signal will be degraded by introducing changes in the size of the signal and also increasing the delay in the drop detection.

4. cFlow reset
In the current firmware the **cFlow** only measures the background IR level when it is powered up. This means that significant changes in the background IR light level can affect the drop detection. For example if you are in a lab where there is a lot of light at senset the IR light may increase significantly. Normally this isn't a problem since most light is from overhead lights and these are mostly fluorescent lights which have low levels of IR light. The other situation where the background light matters is if you

adjust the position of the sensor or change the dripset when the cFlow is turned on. The **cFlow** will then have an inaccurate measure of the background IR level and since the drop detector uses this level to set the threshold for each drop sensor the drops may not be detected properly (either not detected or be too sensitive).