

## Uncertainty of Measurement

Sources contributing to the uncertainty of measurement include equipment used, environmental conditions and the operator.

### EQUIPMENT



calibration  
certificate

For all measurements Pipette Clinic uses five decimal place balances, calibrated by NATA accredited facilities. That makes our measurements not only accurate but also traceable to the SI (International System of Units). Typical uncertainty of measurement of our balances is  $\pm 0.02$  mg.

### ENVIRONMENTAL CONDITIONS



calibration  
certificate

To monitor environmental conditions Pipette Clinic uses instruments that have been calibrated by NATA accredited facilities. Environmental conditions such as temperature, atmospheric pressure and humidity can influence the quality of the results. Temperature and pressure have influence on Z factor ( factor used to convert mass to volume ), while humidity affect the evaporation rate of water. Their influence has been estimated to be:

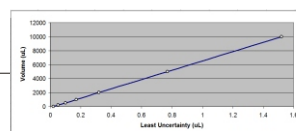
Temperature: Less than  $\pm 0.01\%$  ( For changes of  $\pm 0.5$  C )  
Pressure : Less than  $\pm 0.005\%$  ( For changes of  $\pm 3$  hPa )  
Humidity : 0% ( Due to the use of humidity trap )

### OPERATOR



To perform pipette calibrations Pipette Clinic employ only experienced and skilled technicians. Uncertainty of their measurements is estimated at 95% confidence level as:  $U = s$  ( standard deviation )  $\times k$  ( coverage factor = 2 )

Our least uncertainty of measurements is calculated using the following equation  $y = 0.0002x + 0.02$  where  $x$  is the measured volume. Assumption is made that the standard deviation is 0, meaning that all of the measurements are identical.




### CALIBRATION CERTIFICATE



calibration  
certificate

Comprehensive two page calibration certificate with estimated total uncertainty of measurement



**Calibration Certificate**

Client: Pipette Clinic Ltd  
 Date: 12.05.2016  
 Valid Until: 12.05.2016

Client: Pipette Clinic Ltd

**#862.2016**

**Calibration Data**

Volume (ml)	Volume (ml)	Volume (ml)
0.05	0.05	0.05
0.1	0.1	0.1
0.2	0.2	0.2
0.5	0.5	0.5
1	1	1
2	2	2
5	5	5
10	10	10
20	20	20
50	50	50
100	100	100

**10 ml Class A**

Volume (ml)	10
Temperature (°C)	20
Dispensed (ml)	10.0002

Uncertainty (ml)	0.0002
Repeatability (ml)	0.0002
Stability (ml)	0.0002

Stability (ml)	0.0002
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**Calibration Results (ml)**

Volume (ml)	100	50	20	10	5	2	1	0.5	0.2	0.1	0.05	0.02	0.01	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.00005	0.00002	0.00001	0.000005	0.000002	0.000001	0.0000005	0.0000002	0.0000001	0.00000005	0.00000002	0.00000001	0.000000005	0.000000002	0.000000001	0.0000000005	0.0000000002	0.0000000001	0.00000000005	0.00000000002	0.00000000001	0.000000000005	0.000000000002	0.000000000001	0.0000000000005	0.0000000000002	0.0000000000001	0.00000000000005	0.00000000000002	0.00000000000001	0.000000000000005	0.000000000000002	0.000000000000001	0.0000000000000005	0.0000000000000002	0.0000000000000001	0.00000000000000005	0.00000000000000002	0.00000000000000001	0.000000000000000005	0.000000000000000002	0.000000000000000001	0.0000000000000000005	0.0000000000000000002	0.0000000000000000001	0.00000000000000000005	0.00000000000000000002	0.00000000000000000001	0.000000000000000000005	0.000000000000000000002	0.000000000000000000001	0.0000000000000000000005	0.0000000000000000000002	0.0000000000000000000001	0.00000000000000000000005	0.00000000000000000000002	0.00000000000000000000001	0.000000000000000000000005	0.000000000000000000000002	0.000000000000000000000001	0.0000000000000000000000005	0.0000000000000000000000002	0.0000000000000000000000001	0.00000000000000000000000005	0.00000000000000000000000002	0.00000000000000000000000001	0.000000000000000000000000005	0.000000000000000000000000002	0.000000000000000000000000001	0.0000000000000000000000000005	0.0000000000000000000000000002	0.0000000000000000000000000001	0.00000000000000000000000000005	0.00000000000000000000000000002	0.00000000000000000000000000001	0.000000000000000000000000000005	0.000000000000000000000000000002	0.000000000000000000000000000001	0.0000000000000000000000000000005	0.0000000000000000000000000000002	0.0000000000000000000000000000001	0.00000000000000000000000000000005	0.00000000000000000000000000000002	0.00000000000000000000000000000001	0.000000000000000000000000000000005	0.000000000000000000000000000000002	0.000000000000000000000000000000001	0.0000000000000000000000000000000005	0.0000000000000000000000000000000002	0.0000000000000000000000000000000001	0.00000000000000000000000000000000005	0.00000000000000000000000000000000002	0.00000000000000000000000000000000001	0.000000000000000000000000000000000005	0.000000000000000000000000000000000002	0.000000000000000000000000000000000001	0.0000000000000000000000000000000000005	0.0000000000000000000000000000000000002	0.0000000000000000000000000000000000001	0.00000000000000000000000000000000000005	0.00000000000000000000000000000000000002	0.00000000000000000000000000000000000001	0.000000000000000000000000000000000000005	0.000000000000000000000000000000000000002	0.000000000000000000000000000000000000001	0.0000000000000000000000000000000000000005	0.0000000000000000000000000000000000000002	0.0000000000000000000000000000000000000001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.002	0.001	0.0005	0.0002	0.0001	0.005	0.000000000000000000000000000000000
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