

Advanced printed electronics

Dispensing

Dispensing

Dispensing is digitally controlled printing technique which enables non-contact material deposition to substrate. Printed layout is designed with CAD program, which is then translated into script file.

Advantages:

Extremely wide viscosity range (1 – 1000000 mPas)

Non-contact

Material deposition to 3D substrates

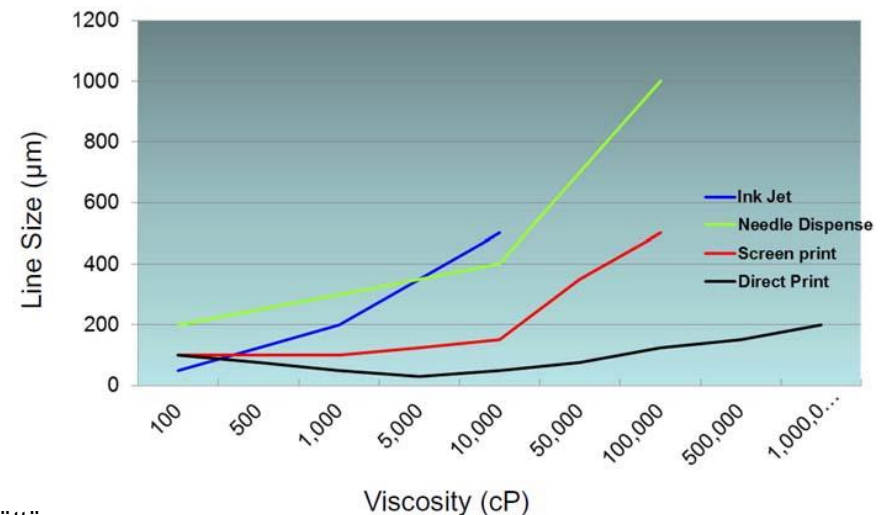
Accuracy

Layer thickness/width adjustable

Low material waste

Disadvantages :

Sheet type process -> overall speed low
Indefinite material quantity on substrate



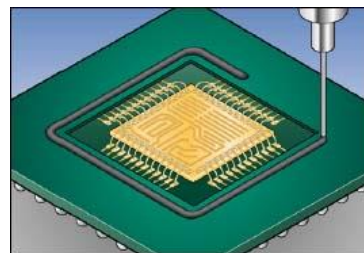
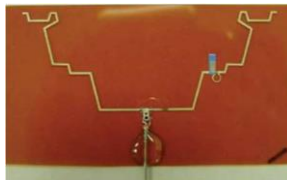
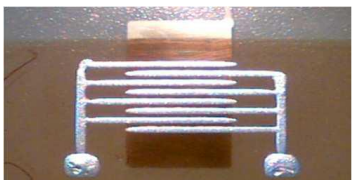
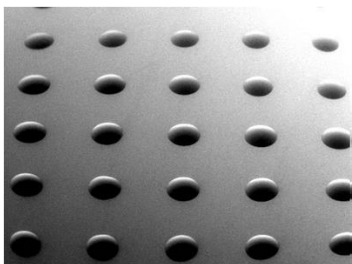
Typical use cases:

Printing conductors

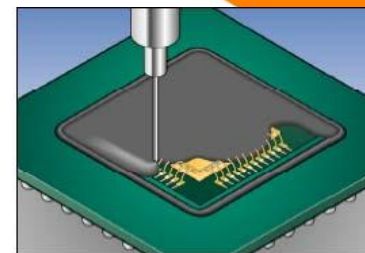
Application of glues, pastes

Printing on 3D structures

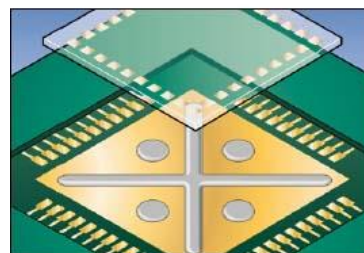
Biomaterial application



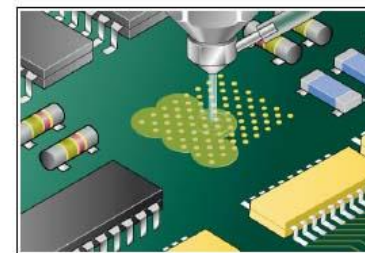
Dam and Fill (Dam)



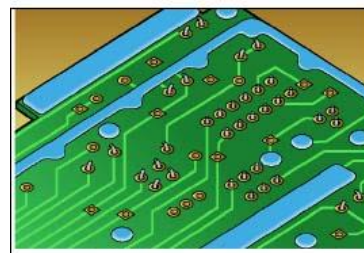
Dam and Fill (Fill)



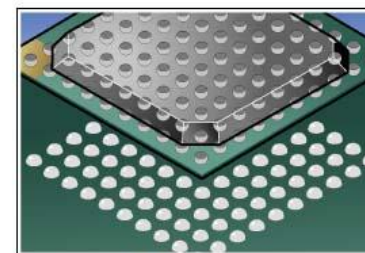
Die Attach



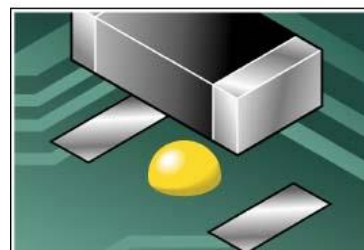
Selective Flux



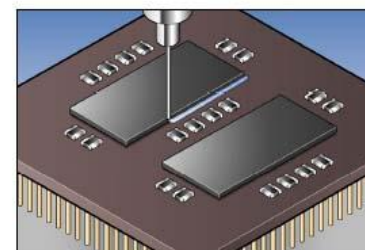
Solder Mask



Solder Paste



Surface Mount



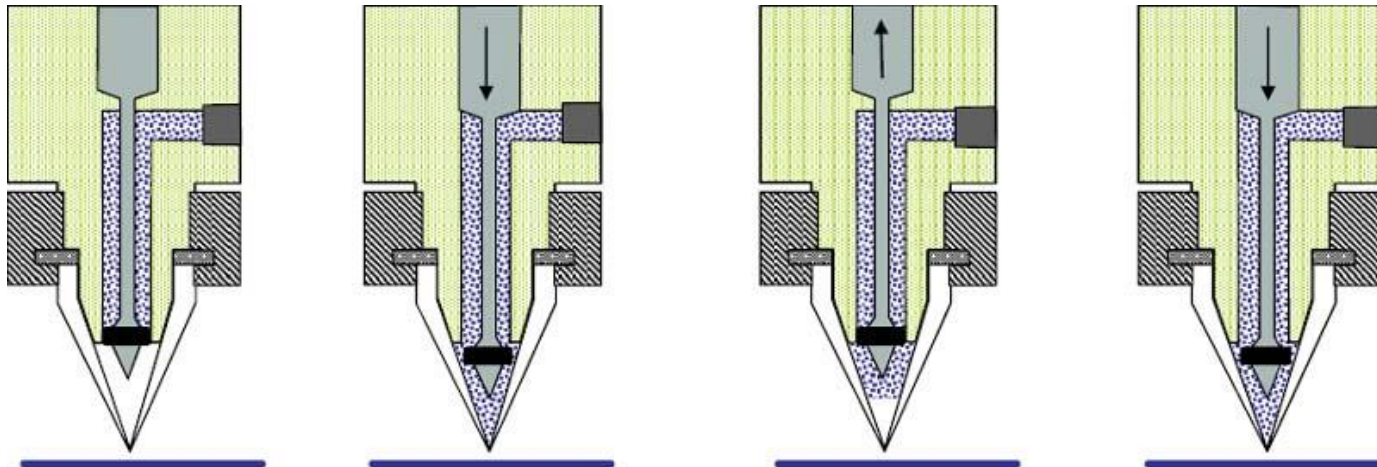
Underfill

The basic operating principle:

Material is placed on a reservoir from which it is pushed to valve body channel with air pressure.

Valve opens slightly to let material flow into the tip and then closes tightly → Dispenser is ready to use.

Dispensing is done by air pressure and the dispensing quantity is controlled together with valve opening. When closed, valve draws a little vacuum to the tip so that no dripping occurs.



Parameters affecting printing quality:

Printing material rheology

Material particle size

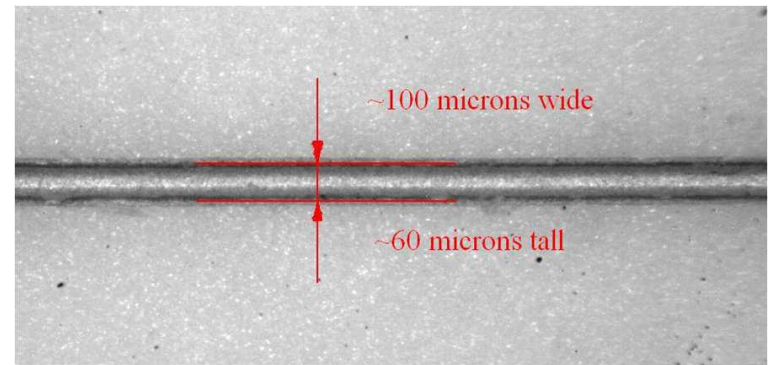
Tip nozzle inner/outer diameter

Printing pressure

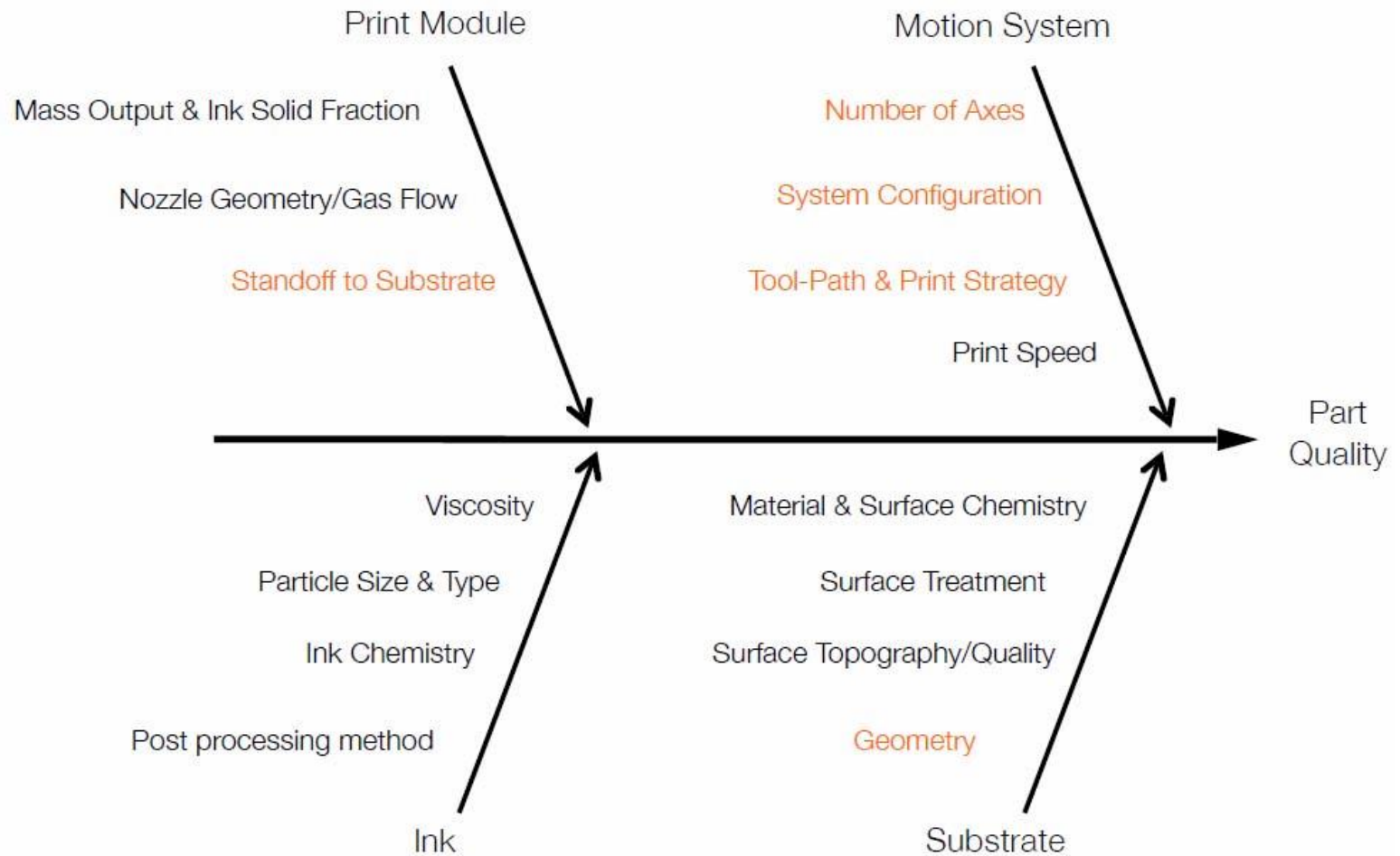
Tip – substrate distance (gap)

Printing speed

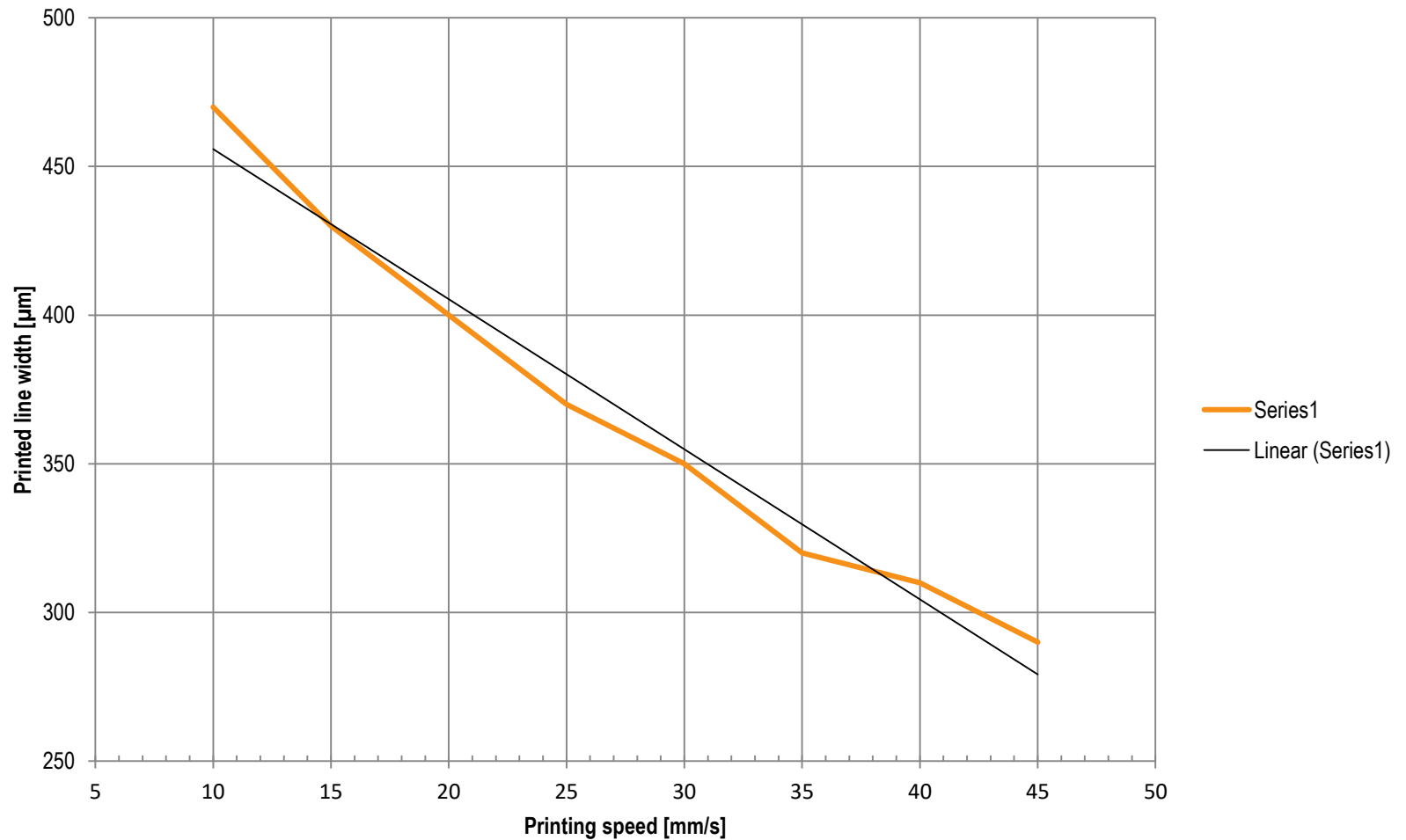
Valve open/close and speed



nScript inc., General interest presentation



Correlation between printing speed and printed line width



C2020522D1 Silver Ink, 175/125 µm ceramic nozzle

Ceramic tip sizes

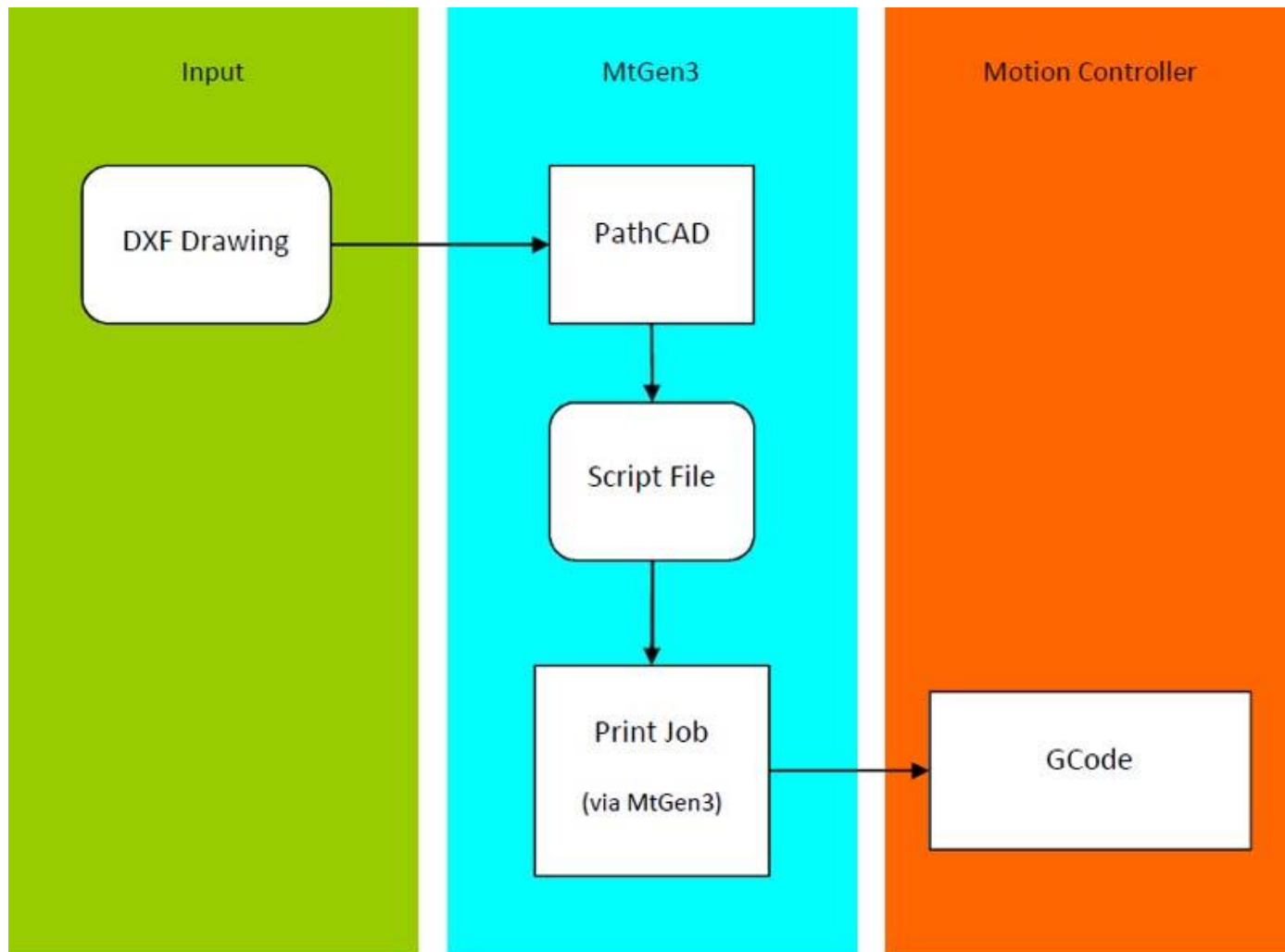
Nozzle	I. Diameter µm	O. Diameter µm	Solution line (min) µm	Suspension * line (min) µm	Solution Dot (min) µm	Suspensio n* Dot (min) µm
12.5/25	12.5	25	25	50-75	50	75
25/50	25	50	35	75-125	75	100
50/75	50	75	50	100-150	100	150
50/100	50	100	75	125-175	125	175
75/100	75	100	85	150-200	150	200
100/150	100	150	100	175-250	175	225
125/175	125	175	125	200-300	200	250
Custom	>125	175	>250	>250	>200	>250



Metallic tip sizes

Color	Gauge	I.D. (inch)	I.D. (mm)	O.D. (inch)	O.D. (mm)
Pink	18	0.041	1.041	0.049	1.254
Tan	19	0.034	0.864	0.042	1.067
Green	20	0.027	0.686	0.035	0.889
Lt. Blue	21	0.024	0.609	0.032	0.813
Purple	23	0.022	0.564	0.025	0.635
White	25	0.017	0.437	0.020	0.508
Red	27	0.013	0.335	0.016	0.406
Black	30	0.009	0.223	0.012	0.305
Blue	150um	0.006	0.16	0.010	0.24
Orange	100um	0.004	0.11	0.008	0.20
Yellow	50um	0.002	0.06	0.006	0.16

Printing file process :



Printing script file:

```

pen          SMARTPUMP_1          // defines dispensing pump
speed        5                    // printing speed

move         0      0      5       // safe move
move         0      0      -5      // safe move

trigvalverel 0.3    10            // valve open command (D.D SO); D.D opening, SO opening speed
trigwait     0.1                      // tip filling waiting time after valve open (delay x before starts next command)
move         0      -2      0       // Dispensing head movement (mm) in X Y Z axis
move         2      0      0
move         0      2      0
move         -2     0      0
valverel     0      1              // valve close (0 SC), SC closing speed
speed        10                    // after valverel, speed command defines move speed to next dispensing

move         0      0      1

```