Dispensing

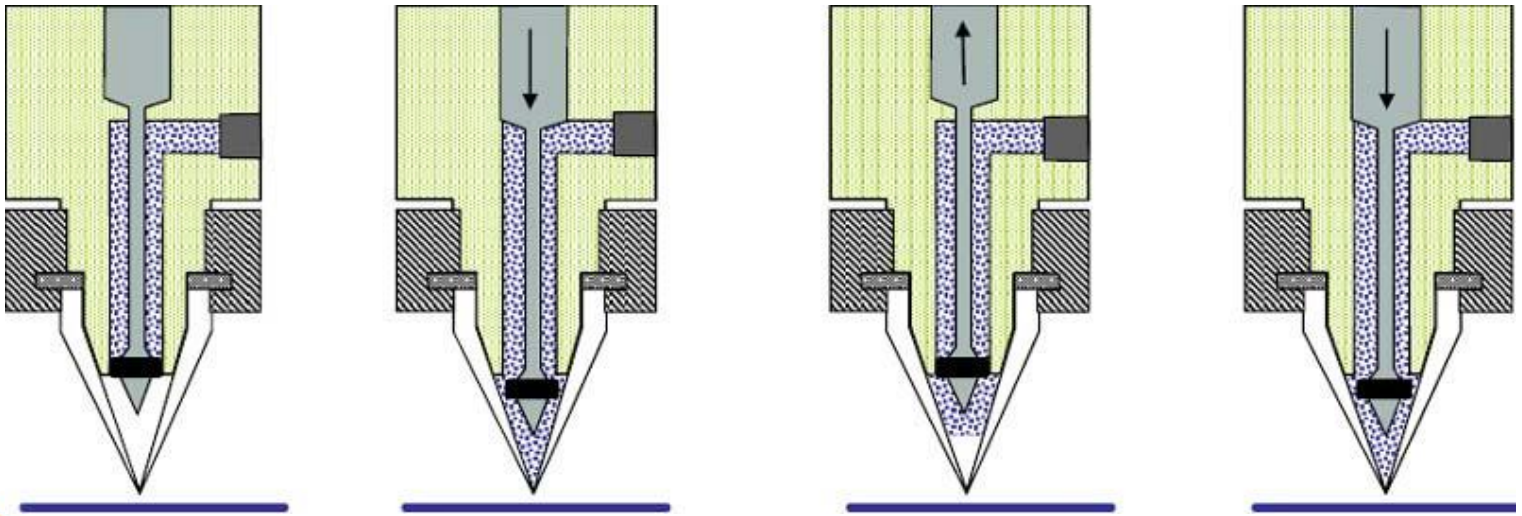
– Dispensing is digitally controlled printing technique which enables non-contact material deposition to substrate. Printed layout is designed with CAD program, which is then translated into script file.

  http://www.youtube.com/watch?v=xaHdLRQrJQU

  http://www.youtube.com/watch?v=VNbhOki8ZDA

Principle of Operation

- Material is placed on a reservoir from which its is being 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 being controlled together with valve opening. When closed, valve draws a little vacuum to the tip so that no dripping occurs.



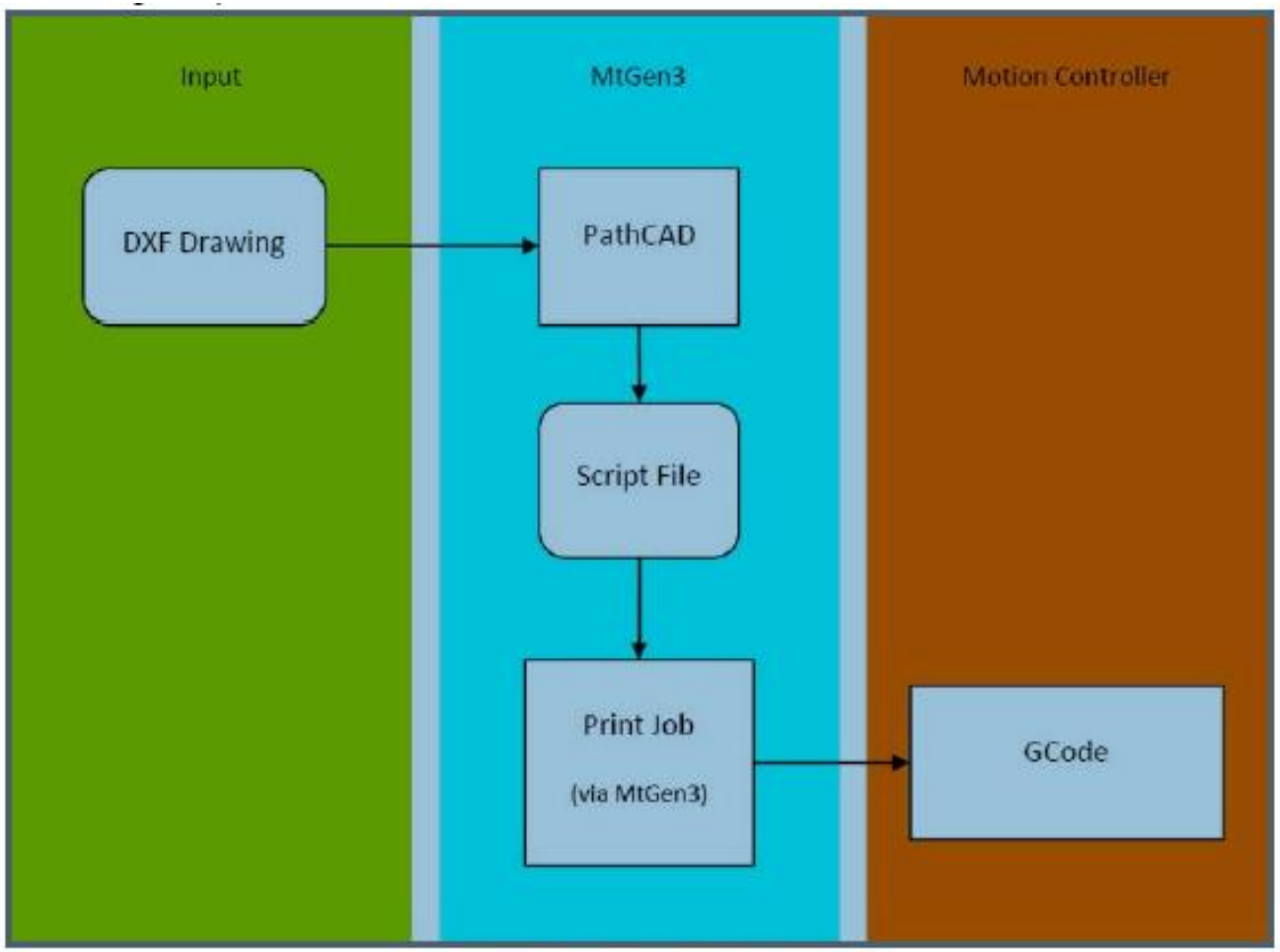
Parameters having effect on Quality

- Printing material rheology
- Particle size
- Tip nozzle diameter
- Pressure
- Tip – substrate distance (gap)
- Printing speed
- Valve open/close and speed

Effect of Nozzle

Nozzle	I. Diameter µm	O. Diameter µm	Solution line (min) µm	Suspension * line (min) µm	Solution Dot (min) µm	Suspension* 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

Printing File Creation



nScript MTGen3 Operation Manual

Example of a Printing File Script

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

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

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
move         0     -2    0        // Dispensing head movement (mm) in X Y Z
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
```

Dispensing, Pros and Cons

Advantages

- Extremely wide viscosity range (1 – 1000000 mPas)
- Non-contact
- Material deposition to curved substrates
- Accuracy
- Layer thickness/width adjustable
- Low material waste

Disadvantages

- Sheet based process
- Low speed process
- Indefinite material quantity on substrate

Dispensing Compared with other Methods