



## Materials Printer & Cartridge DMP-2800 Series Printer & DMC-11600 Series Cartridge

### FAQs

1. What types of fluids can the Dimatix Materials Printer (DMP) jet?  
It is possible to jet a wide variety of fluids with the DMP, including aqueous and solvent-based fluids, solutions and particle suspensions. Ideal fluid characteristics are viscosity of 10 centipoise (0.01 Pa·sec) and surface tension of 30 dynes/cm. Particles should not aggregate or settle.
2. What fluid viscosity range is jettable?  
2 - 30 cps fluids
3. What material is the cartridge composed of, and what materials come in contact with my fluid?

<b>DMC-11610/DMC-11601</b>	<b>DMCLCP-11610/DMCLCP-11601</b>
Chemically resistant epoxy	Chemically resistant epoxy
Peroxide treated EPDM	Kalrez®
Polypropylene	LCP (Liquid Crystal Polymer)
Silicon	Silicon
Silicon dioxide	Silicon dioxide
4. Is the cartridge compatible with most organic solvents and acrylate materials?  
Yes, in general there is good compatibility with most solvents:
  - a) Aliphatic alcohols (high boiling point better than low in all cases)
  - b) Aromatic hydrocarbons such as anisole, trimethylbenzene
  - c) Aliphatic hydrocarbons such as hexane, dodecane,
  - d) Cellusolves
  - e) Glycols
  - f) Lactate esters
  - g) Aliphatic and aromatic ketones including tetrahydrofuran (evaporates quickly)
  - h) Polyethylene glycols, polypropylene glycols
5. How do I fill a cartridge?  
The fluid module is filled using a slip fit end syringe blunt end needle. You simply fill the syringe with fluid, insert the needle into the fill port on the fluid module and inject the fluid. A filter may be used between the syringe and the module if you are not sure that the fluid has been filtered.
6. What is the maximum and minimum volume that I can put in a cartridge?  
The maximum volume a cartridge can hold is 1.5 ml. The minimum volume is about 0.2 ml. Under-filling may not allow jet priming.
7. How long will a cartridge last?  
Excluding a small amount of fluid used in priming the printhead, 1 ml will provide  $1 \times 10^8$  10 picoliter drops.
8. The fluid volume in the cartridge is small.  
How much fluid is expressed with each purge?  
About 5 ul per second

How is it controlled or adjusted?

The purge time can be adjusted in the Cleaning Cycle editor in 0.1 second increments.

9. Could we increase the volume of the cartridge if needed?  
1.5 ml is the maximum volume the cartridge can hold.
10. What is the maximum temperature of the ink jet head cartridge heater?  
70°C
11. Can the cartridge (fluid supply) be sterilized in a conventional autoclave?  
We have not verified whether it is possible. That would be for the end user to try. However, it may be possible to use another chemical sterilization process, i.e., UV.
12. What is the drop size repeatability and accuracy?  
Drop size repeatability is within 3.5% untuned and about 0.5% tuned.
13. What is the smallest size spot or line that I can make?  
Spot size and line width are dependant on the fluid and substrate interaction. Generally, a 40 µm spot can be produced with a 10 pL drop.
14. What is the largest drop that I can make?  
Nominal drop size is 10 pL. But running in burst mode, you add about 10 pL per pulse. Eight pulse jetting is easily achieved with the Dimatix Model Fluid which produces approximately an 80 picoliter drop.
15. What is orifice size of the silicon nozzle?  
Approximately 21.5 µm
16. Can proteins jet out the silicon MEMS structure?  
Yes
17. How do I make a pattern to print?  
The DMP software has a few pre-loaded test patterns. It also has a user interface called the Pattern Generator in which you can create your own pattern. The Pattern Generator has a preview feature which allows you to see the pattern (down to the individual drops) before it is printed. DXF, Gerber, GDSII, OASIS and Bitmap files can also be imported for printing.
18. What drop placement accuracy can I achieve if I replace cartridges and want to jet a drop on a location that I already jetted on?  
To get the best accuracy you must use the DMP with the Fiducial Camera option, which will allow you to calibrate the position of the nozzle in your new cartridge and align to a spot that was previously deposited. The system repeatability is ± 25 microns.
19. What is the spacing between nozzles?  
Nozzle to nozzle spacing is 254 microns (100 dpi) in a single row.
20. What is the maximum resolution of the DMP?  
Patterns that are to be jetted are resolved into 5 micron pixels. This means that the smallest increment between one drop and the next can be 5 microns which is equivalent to 5080 dpi. At this spacing you will get drop overlap on your substrate because most spots will be at least 40 microns in diameter. The stages use 1µm encoders.
21. What is the controllable frequency range on the printheads?  
It depends on the fluid, but generally to 80 kHz for "ink jet tuned" fluids. These fluids are specifically formulated to maximize jetting performance. Other fluids have lower capabilities.

22. Does the liquid reservoir allow for heating AND cooling or other closed loop type thermal control?  
The cartridge has a built-in heater which is capable of heating the fluid to a maximum temperature of 70°C in the jetting structure. The reservoir of fluid is not heated. There is not a built-in cooling mechanism.
23. What is the maximum z-axis adjustment?  
25 mm
24. What is the temperature range for the heated platen?  
The platen heats to 60°C.
25. What is the minimum substrate size (will 50mm x 50 mm work)?  
A 50 mm substrate will be fine. There are vacuum holes on the platen to hold substrates in place. With small substrates, most of the platen's vacuum holes will be open and you may have to tape the substrate down or use a fixture.
26. Can you print on plastic (7 mil PET) with this platen?  
The platen is designed to handle a variety of substrates. Flexible films work fine because the vacuum system in the platen will hold the material securely.
27. Would the system be compatible with a dry box environment?  
Depending on the fluid you are jetting, in a dry box (0% relative humidity or RH) you may get excessive evaporation of the fluid at the nozzle which may cause problems with jetting.
28. Define "adjustable nozzle angle."  
This feature enables the user to set the drop spacing (resolution) in the y axis to adjust printing resolution or density. When creating a print pattern the user selects a desired drop spacing. Since the nozzles are in a single row, the cartridge can be set to various angles to adjust the effective spacing of the nozzles for printing. When they are perpendicular to the printing direction they are at their maximum spacing in the y axis of 254 microns nozzle to nozzle. When you adjust the cartridge to an angle lower than 90°, it decreases the y axis nozzle spacing for higher resolution printing.
29. Does the Drop Manager software allow you to control all adjustable parameters or is it possible for the user to program the components (macros, user defined programs, etc.)?  
The software allows you to generate print patterns and fully adjust the driving parameters as well as establish automatic cartridge cleaning cycles and other functions. It is not possible to have user-controlled macros.
30. How accurate can one set the temperature for the cartridge and platen?  
Cartridge temperature variability is  $\pm 1^\circ\text{C}$ . Platen temperature uniformity is approximately  $\pm 2^\circ\text{C}$ .
31. Would it be possible to have a more powerful heating system (up to 130°C) instead?  
The DMP does not have this capability due to product safety regulations.
32. Is it possible to print with a single nozzle?  
Yes
33. Stage:  
What are the specifications of the stage (precision, working area)?  
Working area is 8 in x 11 in (210 mm x 315 mm) with repeatability of  $\pm 25$  microns.
- What are the driving modes of the stage?  
The stage is scanned in X and Y to achieve raster-style printing.

34. Fiducial camera:  
What the purpose and function of the fiducial camera?  
This camera is mounted on the carriage of the DMP. When you make your first print in a series of prints (overprinting or printing a sequence of fluids), you can create two fiducial marks with your fluid. Then after you have replaced the substrate (if you moved it for measurements or testing, etc.) or inserted a new cartridge, you manually locate your fiducial marks. Software will then compensate for positional errors introduced by substrate location or cartridge alignment. You can also visually see the drops with the fiducial camera.
- Is it possible to watch the printed line while printing with the fiducial camera (live controlling)?  
No
- What is the theta platen?  
This is an alignment feature of the platen for precision substrate alignment along the x axis. This feature is used in conjunction with the fiducial camera for accurate substrate alignment.
35. When you print a small pattern, does the carriage have to travel the full length of the stages?  
No. The software recognizes the pattern size and moves the cartridge and stage just as far as it needs to optimize printing speed.
36. What is the maximum pressure that the cartridge fluid system is exposed to when purging?  
The maximum preset value for pressure is 5 psi. This value is nonadjustable.
37. Can a negative back pressure be used to unblock nozzles?  
No. Although the DMP has negative pressure capability to maintain the fluid meniscus in the jetting device, it cannot generate enough negative pressure to unclog nozzles. However, a normal purge cycle may relieve some clogs.
38. What is the printing distance from the cartridge to substrate?  
The preset height is 1 mm, but this height is adjustable in the "cartridge settings."
39. What is the magnification and resolution of the drop watcher?  
On the 19 in display that is shipped with the DMP, the Drop Watcher camera image is about 210 mm x 170 mm on the screen. This image area represents an actual area of about 1.4 mm x 1.1 mm on the cartridge. This magnification is 150x. The resolution as displayed on the monitor is about 2.25 microns per pixel.
40. What is the file format that drop watcher images are saved?  
Still images are saved as bitmap or .bmp files and video images are saved as .avi files.
41. Can air bubbles in the bag be avoided?  
Most air will go to the top of the bag after filling and attaching to the jetting module.
42. When using water-based fluids, is degassing needed?  
We have seen that degassing water-based fluids increases jetting performance.
43. How vapor tight is the bag? How long does it take before low molecular solvents diffuse through the bag?  
The polypropylene bag is 50 microns thick, and each solvent should be checked for compatibility. For more aggressive materials, an LCP (Liquid Crystal Polymer) bag may be used.
44. Can the fluid module be filled with nitrogen before filling?  
Yes, purging can be done in a nitrogen glove box.

45. Is it possible to set the temperature of the ink below 28°C? Can you switch off the heating element?  
You can set the cartridge to operate with no temperature which allows the cartridge to run at ambient temperature.
46. How can we keep the nozzles properly working while not jetting?  
A “tickle” profile (which is selectable) while not printing, which is a non-firing pulse, or we can run a variety of fire pulses or purges.
47. If nozzles are clogged, then can that be determined by the drop watch camera?  
Sometimes you can see if there is something in the nozzle or if it is not jetting with the camera.
48. Can the cartridge rotate? If yes, by how many degrees?  
Yes. It can rotate up to 90°. The cartridge can rotate between 0 and 90 degrees to facilitate 5080 to 100 dpi.
49. Can software be used to control the voltage of each nozzle?  
Yes. The software can be used to control the voltage of the individual nozzles.
50. Does the DMP have offline programming function?  
Yes, you can make patterns offline using the pattern generator or you can make Bitmap files and DXF, Gerber, GDSII and OASIS files offline.
51. If the DMP does not need air input, how does the vacuum plate work; is there any vacuum pump built in?  
There are two pumps built into the DMP. One is for the vacuum platen and one is to control purging and meniscus for the print cartridge.
52. What kind of working table is recommended for reducing printer vibration? Does the printer vibrate when printing?  
The printer does not vibrate significantly while printing, but it should be placed on a strong table.
53. How would I move from the DMP to a production system?  
The intent of the design of the DMP and its technology is such that it is very scalable to move into production environments. Further discussions with FUJIFILM Dimatix are needed to determine the best approach for your application.



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