

- 1 a with I-DOT printed array (drop distance = 500µm)
- 2 Function diagram of the I-DOT stamp on a 96 microtiter plate
- 3 Prototype of I-DOT

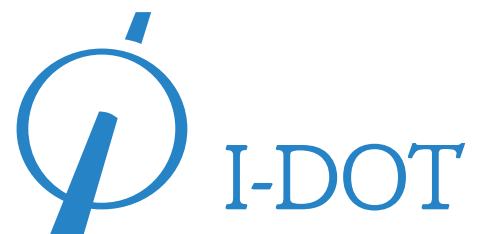
## I-DOT: IMMEDIATE DROP ON DEMAND TECHNOLOGY

The term I-DOT refers to an automated high-throughput system for handling liquid samples

Direct, fast and contamination-free sampling from a microtiter plate without the need for disposable pipette tips!

One of the most common handling steps in bioprocess technology is the handling of liquids. With standard devices, processing those media and cleaning the dispensing systems not only costs time and money but is also associated with quality losses. At the Fraunhofer Institute for Manufacturing Engineering and Automation IPA, a process has been developed which enables most pipetting steps to be carried out fully automated in a compact device and therefore quick, cost-effective and flexible. I-DOT uses a contact free technique to dispense volumes from one microtiter plate to another, to glass slides, fleece or components with complex surface structures.

A microtiter plate (MTP) in SBS format is used as the source plate. The utilized MTP differs marginally from standard plates in that it has a small centered borehole in the base of each well (so-called »nozzle«). As the diameter of the borehole is small, capillary pressure inside it is many times higher than pressure from liquid in a well. In consequence, the corrugation remains watertight despite the presence of the borehole and functions as a threshold valve. If pressure in the well is significantly increased for a short time, liquid is passed through the nozzle.



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### Cost-effective

Process equipment above the source MTP moves the dispensing head into the source position. The target plate is then placed below it. This permits creating different mixtures or dilution series in the target plate without staining a single pipette tip.

### Volume accuracy

The special quick-acting valve emitting extremely short compressed air pulses enables generating single drops with volumes as low as one nanoliter. With I-DOT, a coefficient of variation (CV) of less than 3% is achieved on dispensing samples in the lower nanoliter range. The duration of the pressure pulse is in the microsecond range. This enables pressure frequencies of up to 700 Hz to be generated and thus larger volumes to be dispensed within an extremely short time frame while maintaining very high volume accuracy and precision.

### Automation and standardization

The process is of great interest to the high throughput market. Instead of using a single dispensing head, sets of 4, 8, 96 or any other number of dispensing heads can be arranged in parallel. For example, this would allow mother-daughter plates to be generated from one 384 plate to another within a few seconds.

### Flexibility

Due to its simple construction, I-DOT can be integrated into just about any existing system and be used for a wide range of liquid-handling tasks. The system has a high viscosity range, enabling both aqueous solutions and highly viscous media up to approx. 800 mPas (equal to oil) to be dispensed by a single device. Cells and particles of solid matter in suspension can also be dispensed.

4 Top: dilution series in a 384 MTP; Bottom: drop being dispensed from a nozzle

5 Example of an MTP filled using I-DOT

### The advantages of I-DOT at a glance:

- No cross-contamination
- Fewer disposables, lower costs
- Reliable liquid handling even in the lower nanoliter range
- Source plates made of almost any type of thermoformable plastic
- High viscosity range
- No complex cleaning steps necessary
- Compact, easy-to-operate device

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Dispensing 55nl water onto a 384 MTP; CV = 3%

