

# freeslate

## Process chemistry

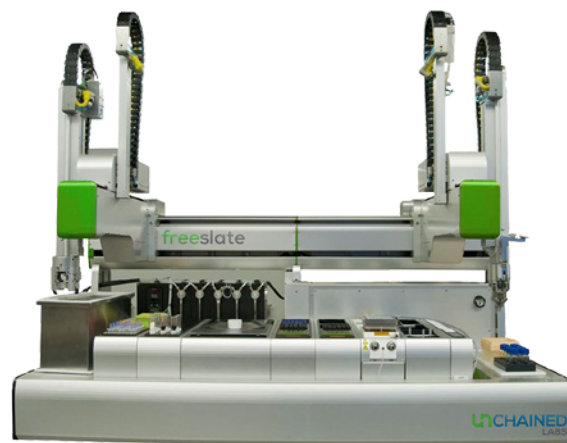
Freeslate lets you make additions and grab samples from your reactions while they're happening. You'll have a whole new level of insight into what your small process tweaks do in real time. Take it to the next level and screen both discrete variables like catalyst precursors and ligands and continuous variables like temperatures, pressures and time. Pinpoint key process variables, map out reaction profiles, identify high yield and selectivity conditions, and optimize synthetic routes – all on the same system.

### Applications

- Process optimization
  - Identify high yield conditions
  - Reaction screening and optimization
- Screen continuous variables such as equivalents, concentrations, temperatures, pressures and time
- Screen discrete variables such as catalyst precursors, ligands and solvents
- Optimize and screen new synthetic routes
- Improve yields and impurity profiles
- Optimize catalyst loading
- Map process robustness

### Key features

- Rapid, real-time reaction kinetics
- Process control of 8 individual reactions with independent pressure and temp control
- Fully automated *in-situ* reagent addition and slurry sampling under pressure
- Execute up to 96 pressurized reactions such as hydrogenation (with optional SPR or DSPR)
- Overhead stirring for complete reaction mixing
- Accurate and automated dosing of small quantities of solid, liquid or slurry reagents
- Control heating, stirring, and vortexing in vials or microtiter plates
- Provide an inert atmosphere for air-sensitive chemistries



freeslate configured for reaction screening



Optimization sampling reactor (OSR)



Example freeslate deck configured for reaction screening

- |                                  |                                |
|----------------------------------|--------------------------------|
| 1 Vial/plate gripper             | 5 Vortexing station            |
| 2 Waste bin                      | 6 Solid dispensing tool rack   |
| 3 Balance with integrated camera | 7 Heating/cooling/stir station |
| 4 PDT rack                       | 8 Capping/decapping station    |
|                                  | 9 1-tip liquid dispenser       |

## Available options

### Vial/plate gripper

Plate size: Standard microtiter  
Vial size: 1–125 mL  
Total mass: Up to 3 kg

### Heated 4-tip liquid dispenser – extended tip

Heated reservoir volume per tip: 1 mL  
Reservoir temperature: Up to 120 °C  
Temperature uniformity:  $\pm 2$  °C (across tips)  
Tip pitch: 9 mm  
Extendible tip: 1  
Syringe sizes: 50  $\mu$ L – 2.5 mL (standard supplied)

### 1-tip liquid dispenser

Dimensions (OD, ID, L): 2.03 mm x 0.76 mm (18–19 gauge) x 323 mm  
Syringe sizes: 50–10 mL

### Viscous liquid dispenser

Technology: Positive displacement tip (PDT)  
Disposable tips: 10–10,000  $\mu$ L, from Eppendorf and Rainin  
Viscosity: 1–1,000 cP

### Heating/cooling/stirring station

Temperature range: –20–180 °C  
Mixing: Up to 750 rpm  
Mixing type: Magnetic tumble stirring

### Vortexing station – 3 positions

Orbital: Up to 2000 rpm  
Maximum vortexing mass: 860 g

### pH measurement

Configuration: Single or 4-channel probe  
Measurement time per 96-well plate: ~34 minutes  
Range: pH 1–13  
Resolution: 0.01 pH units  
Repeatability:  $\pm 0.1$  pH units

### Heated single-tip liquid dispenser

Heated reservoir volume per tip: 1 mL  
Reservoir temperature: Up to 120 °C  
Syringe sizes: 1–2.5 mL (standard)  
Needle size: 16 gauge, non-piercing

### Deck screening pressure reactor (DSPR)

Max pressure rating: 200 psi @ 180 °C  
Pressure drop: <5 psi/hr

### Optimization sampling reactor and sampling arm

Temperature rating: –20–200 °C  
Reactors: 8 independent reactors  
Possible delta between adjacent reactors: >80 °C  
Heating and cooling rate: >10 °C/min  
Pressure rating: Ambient to 400 psi  
Maximum overhead stirring speed: 750 rpm  
Reactor total volume: 40 mL  
Reactor working volume: 25 mL

### Solid dispense

**Dispense technology:** Dispense algorithm dynamically controls the dispensing head to adjust for powders with different densities, particle sizes, particle shapes and static charges

- **Classic powder dispense:** Traditional stirrer dispense mechanism
  - Hopper volume range: 10–100 mL
- **Storage vial (SV) powder dispense:** Unique vibratory dispensing mechanism for highly precise dispensing of small amounts as low as 0.5 mg
  - Hopper volume: 4 mL

### Balance with integrated camera

Maximum weight:

- Standard: 1200 g
- High-sensitivity option: 220 g

Sensitivity:

- Standard: 0.1 mg
- High sensitivity option: 0.01 mg

Resolution:

- Standard: 0.1 mg
- High-sensitivity option:
  - 0.01 mg (0–110 g)
  - 0.1 mg (110–220 g)

Repeatability:

- Standard:
  - High weight (measured >200 g): 0.25 mg
  - Low weight (measured up to 200 g): 0.15 mg
- High-sensitivity option:
  - High weight (measured at 200 g): 0.15 mg
  - Low weight (measured at 10 g): 0.04 mg

Response time: <22s

Camera resolution: 1032 pixels (max wide) x 779 pixels (tall)

### Vial capping/de-capping station

Vial range: 2–125 mL

### Off-deck third-party instrument integration

- HPLC
- GC

Other systems available for virtual integration.  
Please contact Unchained Labs for a full list of systems.

## Facilities requirements

Physical:

**Without enclosure:**

156 cm W x 90.8 cm D x 140 cm H, ~300 kg

**With integrated enclosure:**

193 cm W x 152.4 cm D x 220 cm H, ~612 kg

Electrical:

**freeslate:**

208–220 V  $\pm 10$  %, 50–60 Hz, 20 A

**Computer:**

US: 115 V  $\pm 10$  %, 60 Hz

EU: 220 V  $\pm 10$  %, 50 Hz

**Compressed dry air:** 0.5–0.9 MPa (70 psi to 130 psi),  
4 L/min (8 mm hose)



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