ACQUITY UPLC I-Class

System Specifications

Revision A

Waters

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Introduction

The system specifications outlined in this document depend on the conditions in individual laboratories. Refer to the *ACQUITY UPLC I-Class System Site Preparation Guide*, or contact Waters® Technical Service for more information on specifications.

Notes:

- If your system includes a TUV detector, see the *ACQUITY UPLC TUV Detector Operator's Overview and Maintenance Information* for specifications.
- If your system includes a PDA detector, see the *ACQUITY UPLC Photodiode Array Detector Getting Started Guide* for specifications.
- If your system includes a PDA Extended λ detector, see the *ACQUITY UPLC Photodiode Array Extended λ Detector Getting Started Guide* for specifications.
- If your system includes a mass spectrometer, see the documentation included with it for specifications.
- If your system includes a sample organizer, see the *ACQUITY UPLC Sample Organizer Operator's Overview and Maintenance Information* document for specifications.

System features

ACQUITY UPLC I-Class system (SM-FTN)

The following table lists the features of an ACQUITY UPLC® I-Class system composed of a binary solvent manager (BSM), a sample manager with flow-through needle (SM-FTN), and one of the column management options.

ACQUITY UPLC I-Class system (SM-FTN) features:

Item	Specification
Total system bandspread, 5σ	6 to 9 µL Test conditions: • Mobile phase: 90:10 water/acetonitrile • Flow rate: 0.1 to 1.0 mL/min in 0.1 mL/min increments • Weak wash: 90:10 water/acetonitrile • Strong wash: 90:10 water/acetonitrile • Sample: 0.01 mg/mL caffeine (1-µl injection volume); 0.030 mg/mL caffeine (0.5-µl injection volume); 0.050 mg/mL caffeine (0.2-µl injection volume) • Column compartment: CH-A
Total system dwell volume	<100 µL, default configuration
Integrated leak management	Leak sensors, as standard, and safe leak handling. Drip trays direct all leaks to the front of the instrument, and then into waste line.
Operating flow rate range	0.010 to 2.000 mL/min, in 0.001 mL increments
Maximum operating pressure	• 124,106 kPa (1241 bar, 18,000 psi) up to 1 mL/min • 82,737 kPa (827 bar, 12,000 psi) up to 2 mL/min
pH range	pH 2 to 12

ACQUITY UPLC I-Class system (SM-FTN) features: (Continued)

Item	Specification
Gradient mixers	Binary solvent manager: • 50 µL mixer/filter (Standard) • 100 µL mixer/filter (Optional) • 380 µL mixer/filter (Optional)
Unattended operation	Leak sensors, full 96-hour diagnostic data display through ACQUITY UPLC console software
Injection cycle time	<15s Test conditions: • System: BSM, SM-FTN, ACQUITY TUV, CH-A • Solvent A: water/acetonitrile, 90:10 • Solvent B: 100% acetonitrile • Weak wash: water/acetonitrile, 90:10 • Strong wash: water/acetonitrile, 90:10 • Column: ACQUITY UPLC BEH C_{18} 1.7 µm, 2.1 × 50 mm • Sample: caffeine at 0.04 mg/mL in water/acetonitrile, 90:10 • Mobile phase: 100% solvent A • Isocratic chromatography • Flow rate: 0.4 mL/min • Injection volume: 1 µL • Load ahead mode: enabled • Run time: 2.0 min • Detection: UV at 273 nm

ACQUITY UPLC I-Class system (SM-FL)

The following table lists the features of an ACQUITY UPLC® I-Class system composed of a binary solvent manager (BSM), a sample manager with fixed-loop (SM-FL), and one of the column management options.

ACQUITY UPLC I-Class system (SM-FL) features:

Item	Specification
Total system bandspread, 5σ	4 to 7 µL Test conditions: • Mobile phase: 90:10 water/acetonitrile • Flow rate: 0.1 to 1.0 mL/min in 0.1 mL/min increments • Weak wash: 90:10 water/acetonitrile • Strong wash: 90:10 water/acetonitrile • Sample: 0.01 mg/mL caffeine (1-µl injection volume); 0.030 mg/mL caffeine (0.5-µl injection volume); 0.050 mg/mL caffeine (0.2-µl injection volume) • Sample loop: 10 µL • Injection mode: PLUNO • Column compartment: CH-A
Total system dwell volume	<95 µL, default configuration
Integrated leak management	Leak sensors, as standard, and safe leak handling. Drip trays direct all leaks to the front of the instrument, and then into waste line.
Operating flow rate range	0.010 to 2.000 mL/min, in 0.001 mL increments
Maximum operating pressure	• 124,106 kPa (1241 bar, 18,000 psi) up to 1 mL/min • 82,737 kPa (827 bar, 12,000 psi) up to 2 mL/min
pH range	pH 2 to 12
Gradient mixers	Binary solvent manager: • 50 µL mixer/filter • 100 µL mixer/filter • 380 µL mixer/filter
Unattended operation	Leak sensors, full 96-hour diagnostic data display through ACQUITY UPLC console software

ACQUITY UPLC I-Class system (SM-FL) features: (Continued)

Item	Specification
Injection cycle time	<15s inject to inject, with load ahead enabled Test conditions: • System: BSM, SM-FL, ACQUITY PDA, CH-A • Solvent A: water/acetonitrile, 90:10 • Solvent B: 100% acetonitrile • Weak Wash: water/acetonitrile, 90:10 • Strong Wash: water/acetonitrile, 90:10 • Column: ACQUITY UPLC BEH C_{18} 1.7 µm, 2.1 × 50 mm • Sample: caffeine at 0.04 mg/mL in water/acetonitrile, 90:10 • Mobile Phase: 100% solvent A • Isocratic chromatography • Flow rate: 0.4 mL/min • Injection volume: 1 µL • Load ahead mode: enabled • Run time: 2.0 min

Instrument control

The following table lists the mechanisms used to control ACQUITY UPLC I-Class system instruments.

Instrument control:

Item	Specification
External control	Empower™ software, MassLynx™ software, or standalone through ACQUITY UPLC console software
External communications	Ethernet interfacing via RJ45 connection to host PC

Instrument control: (Continued)

Item	Specification
Event inputs/outputs	Rear panel contact closure and/or TTL inputs/outputs
Connections INSIGHT®	Provides real-time monitoring and automatic notification of instrument performance and diagnostic information, allowing for quicker problem resolution
Local control	ACQUITY UPLC Local Console Controller (LCC)

Environmental specifications

The following table lists the environmental specifications for the ACQUITY UPLC I-Class instruments.

Environmental specifications:

Attribute	Specification
Acoustic noise	<65 dBA, system: binary solvent manager, sample manager (SM-FTN or SM-FL), CH-A
Operating temperature	4 to 40 °C (39.2 to 104 °F)
Operating humidity	20 to 80%, noncondensing
Shipping and storage temperature	–30 to 60 °C (–22 to 140 °F)
Shipping and storage humidity	20 to 80%, noncondensing

Electrical specifications

The following table lists the electrical specifications for the ACQUITY UPLC I-Class instruments.

Electrical specifications:

Attribute	Specification
Protection class[1]	Class I
Overvoltage category[2]	II
Pollution degree[3]	2
Moisture protection[4]	Normal (IPX0)
Line voltages, nominal	Grounded AC
Voltage range	100 to 240 Vac
Frequency	50/60 Hz
Maximum power draw	BSM: 360 VA SM-FTN: 400 VA SM-FL: 400 VA Column manager with active pre-heater (CM-A): 400 VA

1. **Protection Class I** — The insulating scheme used in the instrument to protect from electrical shock. Class I identifies a single level of insulation between live parts (wires) and exposed conductive parts (metal panels), in which the exposed conductive parts are connected to a grounding system. In turn, this grounding system is connected to the third pin (ground pin) on the electrical power cord plug.
2. **Overvoltage Category II** — Pertains to instruments that receive their electrical power from a local level such as an electrical wall outlet.
3. **Pollution Degree 2** — A measure of pollution on electrical circuits that can produce a reduction of dielectric strength or surface resistivity. Degree 2 refers only to normally nonconductive pollution. Occasionally, however, expect a temporary conductivity caused by condensation.
4. **Moisture Protection** – Normal (IPX0) – IPX0 means that no Ingress Protection against any type of dripping or sprayed water exists. The "X" is a placeholder that identifies protection against dust, if applicable.

Binary solvent manager input/output specifications

The following table lists the input/output specifications for the ACQUITY UPLC I-Class BSM.

Input/output specifications:

Attribute	Specification
Contact closure outputs (SW1 to SW3)	Maximum voltage: 30 VDC Maximum current: 0.5 A Maximum VA rating: 10 W Contact resistance (nominal): 0.2 ohms Screw terminal connector
Run stopped output	Maximum voltage: 30 VDC Maximum current: 0.5 A Maximum VA rating: 10 W Contact resistance (nominal): 0.2 ohms Screw terminal connector Behavior: If an error message exists, switch is closed and then opened when error is cleared
Stop flow input	TTL signal or contact closure: Input voltage range: ±30 VDC Logic High: ≥3.0 VDC Logic Low: ≤1.9 VDC Minimum pulse width: 100 msec Screw terminal connector
Start gradient input	TTL signal or contact closure: Input voltage range: ±30 VDC Logic High: ≥3.0 VDC Logic Low: ≤1.9 VDC Minimum pulse width: 100 msec Screw terminal connector

Input/output specifications: (Continued)

Attribute	Specification
Auxiliary input 1	TTL signal or contact closure: Input voltage range: ±30 VDC Logic High: ≥3.0 VDC Logic Low: ≤1.9 VDC Minimum pulse width: 100 msec Screw terminal connector
Auxiliary input 2	TTL signal or contact closure: Input voltage range: ±30 VDC Logic High: ≥3.0 VDC Logic Low: ≤1.9 VDC Minimum pulse width: 100 msec Screw terminal connector
Analog outputs (1 and 2)	0 to 2 volts full scale, screw terminal (digital to analog converter range is -0.1 to 2.1 to allow for offsets)

Sample manager - FTN input/output specifications

The following table lists the input/output specifications for the ACQUITY UPLC I-Class SM - FTN.

Input/output specifications:

Attribute	Specification
Event output relay (Inject Start Out)	Maximum voltage: 30 VDC Maximum current: 0.5 A Contact resistance (nominal): 0.2 ohms
Digital input signal (Inject Hold In)	Maximum input voltage: 30 VDC Logic High: ≥3.0 VDC Logic Low: ≤1.9 VDC

Sample manager - FL input/output specifications

The following table lists the input/output specifications for the ACQUITY UPLC I-Class SM - FL.

Input/output specifications:

Attribute	Specification
Event output relay (Inject Start Out)	Maximum voltage: 30 VDC Maximum current: 0.5 A Contact resistance (nominal):0.2 ohms
Digital input signal (Inject Hold In)	Maximum input voltage: 30 VDC Logic High: ≥3.0 VDC Logic Low: ≤1.9 VDC

Physical specifications

Binary solvent manager

The following table lists the physical specifications for the ACQUITY UPLC I-Class BSM.

Physical specifications:

Attribute	Specification
Height	22.9 cm (9.0 inches)
Width	34.3 cm (13.5 inches)
Depth	66.0 cm (26.0 inches)
Weight	26.3 kg (58.0 pounds)

Sample manager - FTN

The following table lists the physical specifications for the ACQUITY UPLC I-Class SM-FTN.

Physical specifications:

Attribute	Specification
Height	27.1 cm (10.7 inches)
Width	34.3 cm (13.5 inches)
Depth	71.2 cm (28.0 inches)
Weight	26.1 kg (57.5 pounds)

Sample manager - FL

The following table lists the physical specifications for the ACQUITY UPLC I-Class SM-FL.

Physical specifications:

Attribute	Specification
Height	27.1 cm (10.7 inches)
Width	34.3 cm (13.5 inches)
Depth	71.2 cm (28.0 inches)
Weight	25.9 kg (57.0 pounds)

Column heater

The following table lists the physical specifications for the ACQUITY UPLC I-Class CH-A.

Physical specifications:

Attribute	Specification
Height	7.6 cm (3.0 inches)
Width	34.3 cm (13.5 inches)
Depth	62.9 cm (24.8 inches)
Weight	5.7 kg (12.5 pounds)

30-cm column heater with active pre-heater

The following table lists the physical specifications for the ACQUITY UPLC I-Class System CH-30A.

Physical specifications:

Attribute	Specification
Height	50.8 cm (20.0 inches)
Width	12.1 cm (4.75 inches)
Depth	12.7 cm (5.0 inches)
Weight	4.5 kg (10.0 pounds)

Column manager - A

The following table lists the physical specifications for the ACQUITY UPLC I-Class System CM-A.

Physical specifications:

Attribute	Specification
Height	19.9 cm (7.8 inches)
Width	34.3 cm (13.5 inches)
Depth	61.0 cm (24.0 inches)
Weight	20.9 kg (46.0 pounds)

Performance specifications

Binary solvent manager

The following table lists the performance specifications for the ACQUITY UPLC I-Class BSM.

Performance specifications:

Item	Specification
Number of solvents	Up to four, in combination of two, A1 or A2 and B1 or B2
Solvent conditioning	Integrated vacuum degassing, six lines with two allocated for the injector needlewash/purge solvents
Gradient formation	High pressure mixing, binary gradient
Gradient profiles	11 gradient curves, including linear, step (2), concave (4), and convex (4)
Primary check valves	Intelligent Intake Valves (*i²Valve*)
Flow accuracy	±1.0% of set flow at 0.500 mL/min as per SystemsQT™
Flow precision	0.075% RSD or 0.01 min SD, (0.2 to 2.0 mL/min), whichever is greater using premixed solvent Test conditions: • Mobile phase: water/acetonitrile 60:40, premixed • Flow rate: 0.2 to 2 mL/min • Sample mix: alkylphenone mix (5-µL injection volume) • Column: ACQUITY BEH C_{18} 1.7 µm 2.1 × 50 mm (0.2 to 1.0 mL/min), XBridge™ C_{18} 3.5 µm 3.0 × 50 mm (1.0 to 2.0 mL/min) • Column temperature: 35 ± 1.0 °C • Wavelength: 254 nm UV

Performance specifications: (Continued)

Item	Specification
Composition ripple (baseline noise)	<1.0 mAu Test conditions: • Solvent A: water with 0.1% TFA • Solvent B: acetonitrile with 0.1% TFA • Weak wash: water with 0.1% TFA • Strong wash: water with 0.1% TFA • Flow rate: 0.5 mL/min • Gradient conditions: 1.0 to 99% B in 30 min with a 5 min hold, followed by an immediate return to baseline; time average window, 10 s. Noise range 1.6 to 3.6 min • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Detector: ACQUITY TUV, 214 nm wavelength, 40 points/sec sampling rate
Compositional precision	<0.2% RSD, or 0.02 min SD, whichever is greater (from 0.2 to 2.0 mL/min) Test conditions: • Mobile phase: 60:40 water/acetonitrile, dial-a-mix • Flow rate: 0.2 to 2 mL/min • Sample mix: alkylphenone mix (5.0-µL injection volume) • Column: ACQUITY BEH C_{18} 1.7 µm 2.1 × 50 mm (0.2 to 1.0 mL/min) and XBridge C_{18} 3.5 µm 3.0 × 50 mm (1.0 to 2.0 mL/min) • Detector: ACQUITY PDA, 254 nm UV • Column temperature: 35 °C ± 1.0 °C

Performance specifications: (Continued)

Item	Specification
Composition accuracy	±0.5% absolute from 5 to 95%, 0.2 to 2.0 mL/min (referenced to 100% Solvent B) Test conditions: • Solvent A: 90:10 water/acetonitrile • Solvent B: 90:10 water/acetonitrile with 5 mg/L caffeine • Wash solvents: 90:10 water/acetonitrile • Gradient conditions: step gradient from 5% to 95% Solvent B from 0.5 to 1.0 mL/min • Flow rate: 0.2 to 2.0 mL/min • Detector: ACQUITY TUV at 273 nm • Sampling rate: A minimum of 5 points/sec, with a filter time constant of 1.0 sec
Compressibility compensation	Automatic, no user intervention required
Priming	Wet priming runs at a flow rate of 4 mL/min per pump
Plunger seal wash	Equipped with a programmable active wash system, to flush the rear of the high pressure seals and plungers.
Flow ramping	Automatic
Mixing options	Standard: 50 µL Optional: 100 µL and 380 µL
Composition range	0.0 to 100.0% settable in 0.1% increments.

Sample manager - FTN

The following table lists the performance specifications for the ACQUITY UPLC I-Class SM-FTN.

Performance specifications:

Item	Specification
Injection volume range	• 0.1 to 10.0 µL as standard configuration • Up to1000.0 µL with optional extension loop
Injection accuracy	±0.2 µL, measured by fluid weight removed from vial with 10.0 µL injections averaged over 20 injections using standard 100- µL syringe

Performance specifications: (Continued)

Item	Specification
Injection linearity	R^2>0.999 Test conditions: • Solvent A: 90:10 water/acetonitrile • Solvent B: 100% acetonitrile • Wash solvent: 90:10 water/acetonitrile • Purge solvent: 90:10 water/acetonitrile • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Sample: caffeine, 0.03 mg/mL in 90:10 water/acetonitrile • Mobile phase: 100% Solvent A • Flow rate: 0.4 mL/min • Injection volume: 2.0 to 10.0 µl in 1.0-ml increments • Column Temperature: 40 °C • Detection: UV at 273 nm • Sampling rate: 10 points/sec or greater • Run time: 2 min • Data system: Empower

Performance specifications: (Continued)

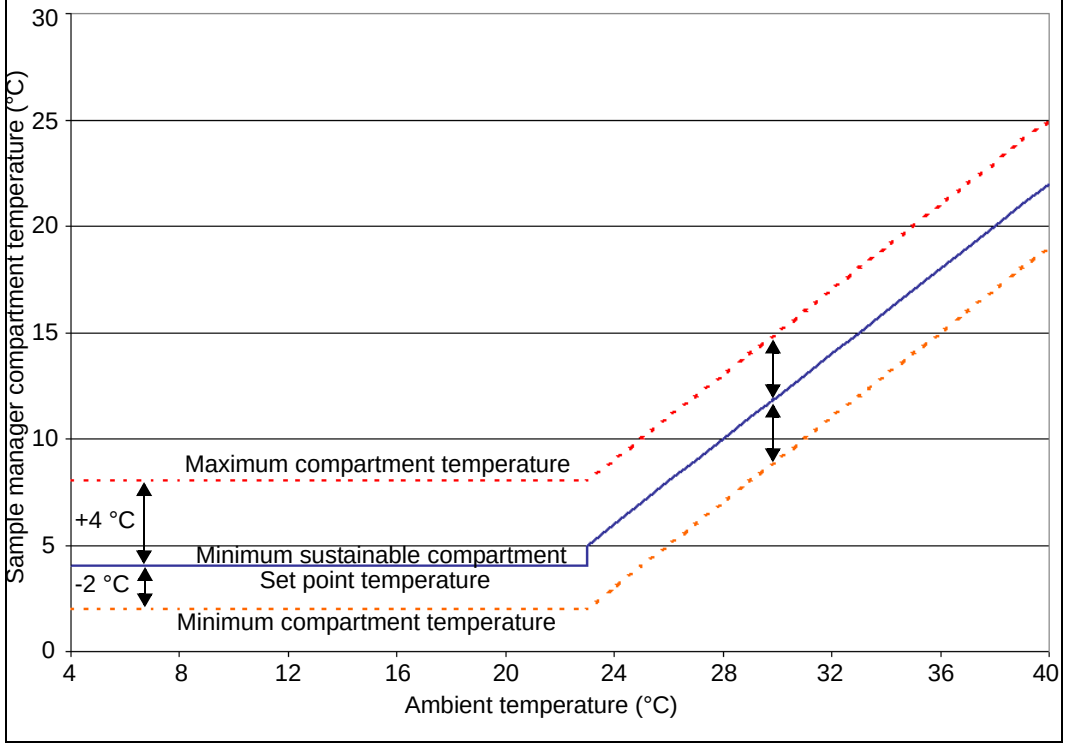
Item	Specification
Injection precision	<1% area RSD 0.2 to 1.9 µL injection <0.5% area RSD 2.0 to 10.0 µL injection Test conditions: • Replicates: 6 • Solvent A: 90:10 water/acetonitrile • Solvent B: 100% acetonitrile • Wash solvent: 90:10 water/acetonitrile • Purge solvent: 90:10 water/acetonitrile • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Sample: caffeine, 0.03 mg/mL in 90:10 water/acetonitrile • Mobile phase: 100% Solvent A • Flow rate: 0.4 mL/min • Column temperature: 40 °C • Detection: UV at 273 nm • Sampling rate: 10 points/sec or greater • Run Time: 2 min • Data System: Empower
Maximum sample capacity	Any two of the following: • 96 and 384 microtiter plates • 48-position 2.00-mL vial plates • 48-position 0.65-mL micro-centrifuge tube plates • 24-position 1.50-mL micro-centrifuge tube plates

Performance specifications: (Continued)

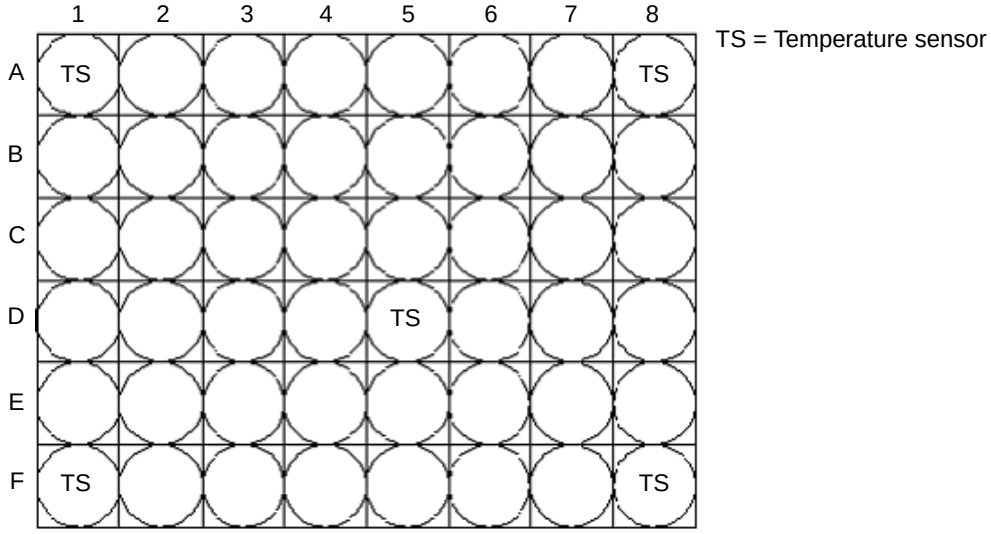
Item	Specification
Sample compartment temperature range	4.0 to 40.0 °C, settable in 0.1 °C increments with a tolerance range between –2 and +4 °C • At a setpoint of 4 °C with ambient temperature <23 °C and humidity <80%, maintains a sample temperature of 2 to 8 °C. • At ambient temperatures >23 °C and/or humidity >80%, the sample manager and sample organizer can maintain an average sample temperature of 18 °C below ambient, with a tolerance range between –2 and +4 °C.

Performance specifications: (Continued)

Item	Specification
Minimum sample compartment temperature specifications The graph shows achievable sample compartment temperature and expected variation at various sample temperatures.	



Performance specifications: (Continued)

Item	Specification
Recommended temperature sensor locations The following diagram shows the recommended temperature sensor locations on the sample tray when validating specifications. 	
Temperature accuracy	No more than a ±0.5 °C in temperature between a traceable external temperature measurement device and instrument temperature measurement device.
Temperature stability	±1.0 °C (at the sensor with sample compartment door closed)
Injection needle wash	Integrated, active, programmable
Minimum sample required	3 µL residual, using Waters' total recovery 2-mL vials (zero offset)

Performance specifications: (Continued)

Item	Specification
Sample carryover - UV	<0.001% Test conditions: • Solvent A: 90:10 water/acetonitrile • Solvent B: 100% acetonitrile • Wash solvent: 90:10 water/acetonitrile • Purge solvent: 90:10 water/acetonitrile • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Sample: caffeine 0.20 µg/mL in 90:10 water/acetonitrile (Standard); caffeine 4.0 mg/mL in 90:10 water/acetonitrile (Challenge); 90:10 water/acetonitrile (Blank) • Mobile phase: 100% Solvent A • Flow rate: 0.4 mL/min • Injection volume: 5 µL • Column temperature: 40 °C • Detection: UV at 273 nm • Sampling rate: 10 points /sec or greater • Data system: Empower

Performance specifications: (Continued)

Item	Specification
Sample carryover - MS	<0.001% Test conditions: • System: BSM, SM-FTN, CH-A, TQD • Solvent A: 0.1% NH_4OH in water • Solvent B: 0.1% NH_4OH in acetonitrile • Wash solvent: 50:50 water/acetonitrile + 0.2% NH_4OH • Purge solvent: 50:50 water/acetonitrile + 0.2% NH_4OH • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Sample: omeprazole 5 pg/µL in 85:15 water/acetonitrile + 0.1% NH_4OH (Standard); omeprazole 500 ng/µL in 85:15 water/acetonitrile + 0.1% NH_4OH (Challenge); 85:15 water/acetonitrile + 0.1% NH_4OH (Blank) • Mobile phase: gradient, 85:15 solvent A/solvent B to 65:35 solvent A/solvent B for 1.5 min • Flow rate: 500 µL/min • Injection volume: 1 µL • Column temperature: 50 °C • Transition: 346.08 Da to 198.07 Da • Cone voltage: 4 V • Data system: MassLynx
Advanced sample manager capabilities	Auto-dilution and auto-addition

Sample manager - FL

The following table lists the performance specifications for the ACQUITY UPLC I-Class SM-FL.

Performance specifications:

Item	Specification
Injection volume range	0.1 to 250.0 µL, in 0.1-µL increments. 10 µL loop standard with 1, 2, 5, 20, 50, 100, and 250 µL optional loops.
Injection linearity	R^2>0.999, (default needle) from 20 to 75% of loop, Partial Loop Uses Needle Overfill mode, (PLUNO), per SystemsQT protocol.
Injection mode	• Full Loop mode - used for optimal quantitation and dispersion • Partial Loop mode - used for fastest cycle time • Partial Loop Uses Needle Overfill Mode (default mode) - used for optimal quantitation using partial loop injection volumes

Performance specifications: (Continued)

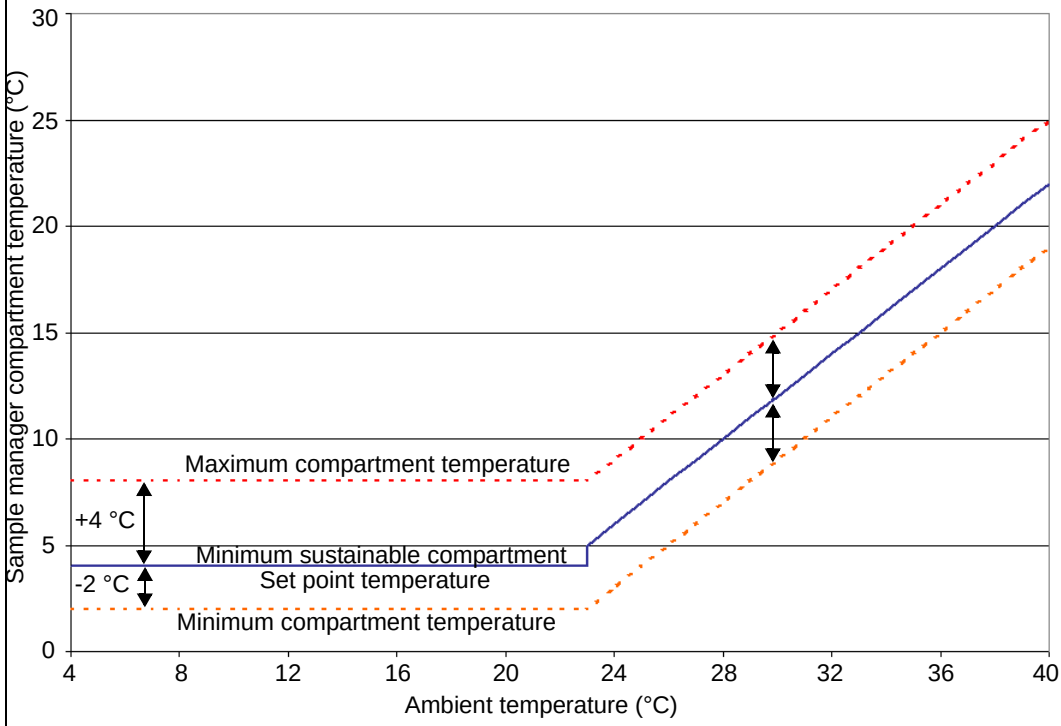
Item	Specification
Injection precision	<1% area RSD 0.2 to 1.9 µL injection (1, 2, and 5-µL loops) <0.5% area RSD 2.0 to 10.0 µL injection (5, 10, and 20-µL loops) Test conditions: • Solvent A: 90:10 water/acetonitrile • Solvent B: 100% acetonitrile • Weak wash: 90:10 water/acetonitrile • Strong wash: 90:10 water/acetonitrile • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Sample: caffeine 0.03 mg/mL in 90:10 water/acetonitrile • Mobile phase: 100% Solvent A • Flow rate: 0.4 mL/min • Injection volume: 20 to 75% of loop volume • Injection mode: PLUNO • Column temperature: 40 °C • Detection: UV at 273 nm • Sampling rate: 10 points/sec or greater • Run time: 2 min • Data system: Empower

Performance specifications: (Continued)

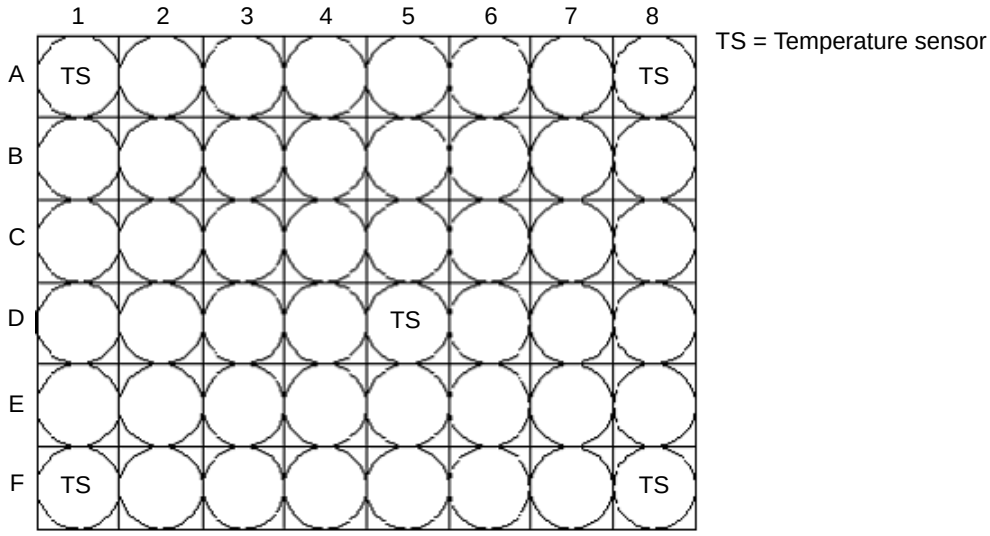
Item	Specification
Maximum sample capacity	Any two of the following: • 96 and 384 microtiter plates • 48-position 2.00-mL vial plates • 48-position 0.65-mL micro-centrifuge tube plates • 24-position 1.50-mL micro-centrifuge tube plates
Sample compartment temperature range	4.0 to 40.0 °C, settable in 0.1 °C increments with a tolerance range between –2 and +4 °C • At a setpoint of 4 °C with ambient temperature <23 °C and humidity <80%, maintains a sample temperature of 2 to 8 °C. • At ambient temperatures >23 °C and/or humidity >80%, the sample manager and sample organizer can maintain an average sample temperature of 18 °C below ambient, with a tolerance range between –2 and +4 °C.

Performance specifications: (Continued)

Item	Specification
Minimum sample compartment temperature specifications The graph shows achievable sample compartment temperature and expected variation at various sample temperatures.	



Performance specifications: (Continued)

Item	Specification
Recommended temperature sensor locations The following diagram shows the recommended temperature sensor locations on the sample tray when validating specifications.  	
Temperature accuracy	No more than a ±0.5 °C in temperature between a traceable external temperature measurement device and instrument temperature measurement device.
Temperature stability	±1.0 °C (at the sensor with sample compartment door closed)
Injection needle wash	Integrated, active, programmable dual wash
Minimum sample required	3-µL residual, using Waters' total recovery 2-mL vials (zero offset)

Performance specifications: (Continued)

Item	Specification
Sample carryover - UV	<0.001% with one additional injector valve cycle Test conditions: • Solvent A: 90:10 water/acetonitrile • Solvent B: 100% acetonitrile • Wash solvent: 90:10 water/acetonitrile • Purge solvent: 90:10 water/acetonitrile • Injection mode: PLUNO • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Sample: caffeine 0.20 µg/mL in 90:10 water/acetonitrile (Standard); caffeine 4.0 mg/mL in 90:10 water/acetonitrile (Challenge); 90:10 water/acetonitrile (Blank) • Mobile phase: 100% Solvent A • Flow rate: 0.4 mL/min • Injection volume: 5 µL • Column temperature: 40 °C • Detection: UV at 273 nm • Sampling rate: 10 points /sec or greater • Data system: Empower

Performance specifications: (Continued)

Item	Specification
Sample carryover - MS	<0.001% with one additional injector valve cycle Test conditions: • System: BSM, SM-FL, CH-A, TQD • Injection mode: PLUNO • Solvent A: 0.1% NH_4OH in water • Solvent B: 0.1% NH_4OH in acetonitrile • Wash solvent: 50:50 water/acetonitrile + 0.2% NH_4OH • Purge solvent: 50:50 water/acetonitrile + 0.2% NH_4OH • Column: ACQUITY UPLC BEH C_{18} 1.7 µm 2.1 × 50 mm • Sample: omeprazole 5 pg/µL in 85:15 water/acetonitrile + 0.1% NH_4OH (Standard); omeprazole 500 ng/µL in 85:15 water/acetonitrile + 0.1% NH_4OH (Challenge); 85:15 water/acetonitrile + 0.1% NH_4OH (Blank) • Mobile phase: gradient, 85:15 solvent A/solvent B to 65:35 solvent A/solvent B for 1.5 min • Flow rate: 500 µL/min • Injection volume: 1 µL • Column temperature: 50 °C • Transition: 346.08 Da to 198.07 Da • Cone voltage: 22 V • Data system: MassLynx
Advanced sample manager capabilities	Load Ahead and Loop Offline mode, valve cycle timed event

Column heater

The following table lists the performance specifications for the ACQUITY UPLC I-Class CH-A and 30-cm column heater with active pre-heater (CH-30A).

Performance specifications:

Item	Specification
Column capacity	CH-A: Single column, up to 4.6 mm internal diameter (ID), up to 150 mm in length with filter or guard column. Mounting extends out for use with MS-based detector. CH-30A: Single column, up to 4.6-mm internal diameter (ID), to 300-mm length, with filter or guard column. Maximum column, outside diameter (OD), is 5/8-inch.
Fittings	124,106 kPa (1241 bar, 18,000 psi), low dispersion, with reusable column inlet fittings
Column compartment temperature range	CH-A/CH-30A: • 20 to 90 °C, in increments of 0.1 °C (control requires a setpoint of greater than ambient temperature +5 °C)

Performance specifications: (Continued)

Item	Specification
Column compartment temperature accuracy	CH-A/CH-30A: Tested to ±0.5 °C Test conditions: • Door closed • No column installed • No flow • Measurement taken with traceable, external temperature measurement device • Measurement taken after 1 hour of thermal equilibration at set point • Measurement taken at column compartment sensor location Tested at 35 °C, 55 °C, and 85 °C
Column compartment temperature stability	CH-A/CH-30A: Tested to ±0.3 °C Test conditions: • Door closed • No column installed • No flow • Measurement taken with traceable, external temperature measurement device • Measurement taken after 1 hour of thermal equilibration at set point • Measurement taken at column compartment sensor location Tested at 35 °C, 55 °C, and 85 °C
Solvent conditioning	• Active pre-heating as standard • Passive pre-heating (also recommended in CH-A only for legacy method support)

Performance specifications: (Continued)

Item	Specification
Column tracking	eCord™ Technology column information management tracks and archives column usage history

Column manager

The following table lists the performance specifications for the ACQUITY UPLC I-Class CM-A.

Performance specifications:

Item	Specification
Columns capacity	Two columns, as standard (maximum length of 150 mm with filter or guard column) up to 4.6 mm internal diameter (ID)
Switching valves	Two nine-port, eight-position valves (CM-A only); provides programmable access switching; waste and bypass positions for rapid solvent changeover
Column compartment(s) temperature range	4.0 to 90.0 °C, settable in 0.1 °C increments; two independent heat/cool zones Derating: The minimum achievable column compartment temperature set point must not be greater than 25 °C below ambient temperature.

Performance specifications: (Continued)

Item	Specification
Time to temperature, from steady state, after door is open for 30 seconds.	12 minutes maximum Test conditions: • No column installed • No flow • Measurement taken with internal temperature sensor • Measurement taken after 1 hour of thermal equilibration at set point • Door is opened for 30 seconds • Tested at 35 °C, 55 °C, and 85 °C
Column compartment temperature accuracy	Tested to ±0.5 °C Test conditions: • Door closed • No column installed • No flow • Measurement taken with traceable, external temperature measurement device • Measurement taken after 1 hour of thermal equilibration at set point • Measurement taken at column compartment sensor location • Tested at 35 °C, 55 °C, and 90 °C
Solvent conditioning	Active pre-heating as standard
Fittings	124,106 kPa (1241 bar, 18,000 psi), low dispersion, with reusable column inlet fittings
Column tracking	eCord Technology column information management tracks and archives column usage history
2D support	Optional

Wetted materials of construction

Binary solvent manager

The following table lists the wetted materials of construction for the ACQUITY UPLC I-Class BSM.

Wetted materials of construction:

Description	Specification
Wetted materials	316L stainless steel, UHMWPE blend, MP35N, titanium alloy, gold, sapphire, ruby, zirconia, Nitronic 60, DLC, fluoropolymer, PEEK™ and PEEK blend

Sample manager - FTN

The following table lists the wetted materials of construction for the sample ACQUITY UPLC I-Class SM-FTN.

Wetted materials of construction:

Description	Specification
Wetted materials	316L stainless steel, polymide, PEEK blend, DLC, PPS

Sample manager - FL

The following table lists the wetted materials of construction for the sample ACQUITY UPLC I-Class SM-FL.

Wetted materials of construction:

Description	Specification
Wetted materials	316L stainless steel, UHMWPE blend, MP35N, titanium alloy, gold, sapphire, ruby, zirconia, Nitronic 60, DLC, fluoropolymer PEEK and PEEK blend