# ACQUITY UPLC I-Class PLUS System with 2D Technology

The Waters™ ACQUITY™ UPLC™ I-Class PLUS System with 2D Technology allows chemists to increase sensitivity and selectivity, eliminate unwanted interferences, characterize the most complex samples, and perform separations that are normally incompatible with a mass spectrometer by adding a second reversed-phase separation to the experiment. The system is comprised of the following: Sample Manager with Flow-Through Needle (SM-FTN-I), Column Manager (CM-A), Binary Solvent Manager (Analytical Pump) and either a second Binary Solvent Manager or Quaternary Solvent Manager as the injection pump.

## ACQUITY UPLC I-CLASS PLUS WITH 2D TECHNOLOGY SYSTEM FEATURES

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| Integrated leak management | Leak sensors, as standard, and safe leak handling |
| System synchronization | Injection synchronization between both pumps and the sample manager enhances retention time reproducibility |
| pH range† | 1 to 12.5 |
| Unattended operation | Leak sensors, full 96-hour diagnostic data display through console software |

## ACQUITY UPLC I-CLASS PLUS BINARY SOLVENT MANAGERS

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| Number of solvents | Up to four, in any combination of two: A1 or A2 and B1 or B2 |
| Solvent conditioning | Integrated vacuum degassing, six lines with two allocated for the injector needle wash/purge solvents |
| Gradient formation | High pressure mixing, binary gradient |
| Gradient profiles | 11 gradient curves [including linear, step (2), concave (4), and convex (4)] |
| Operating flow rate range | 0.001 to 2.000 mL/min, in 0.001 mL increments (firmware version 1.71 and later) |
| Maximum operating pressure | 18,000 psi up to 1 mL/min, 12,000 psi up to 2 mL/min |
| Primary check valves | Intelligent Intake Valves ($i^2$Valve) |
| Flow accuracy† | ±1.0% of set flow rate 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 pre-mixed solvent |
| Composition ripple† (baseline noise) | ≤1.0 mAu |
| Compositional precision† | ≤0.15% RSD, or 0.01 min SD, whichever is greater |
| Compositional accuracy† | ±0.5% absolute from 5% to 95%, 0.2 to 2.0 mL/min |
| Pressure pulsation | ≤0.4% or 25 psi, whichever is greater |
| Compressibility compensation | Automatic, no user intervention required |
| Priming | Wet priming runs at a flow rate of 4 mL/min |
| Pump seal wash | Equipped with a programmable active wash system to flush the rear of the high pressure seals and the plungers |

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| Flow ramping | Automatic |
| Primary wetted materials | 316L stainless steel, UHMWPE blend, MP35N, titanium alloy, gold, sapphire, ruby, zirconia, Nitronic 60, DLC, fluoropolymer, PEEK and PEEK blend |
| Mixing options | Standard: 50 µL<br>Optional: 100 µL and 380 µL |

## QUATERNARY SOLVENT MANAGER (QSM)

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| Number of solvents | One to four, in any combination as standard.<br>Expanded solvent choices with optional six-port solvent select valve |
| Maximum operating pressure | 15,000 psi up to 1.0 mL/min, 9000 psi up to 2.0 mL/min (firmware version 1.5x and earlier)<br>15,000 psi up to 1.0 mL/min, 7800 psi up to 2.2 mL/min (firmware version 1.6x and later) |
| Solvent conditioning | Integrated vacuum degassing, four chambers.<br>One additional for the SM-FTN-I purge solvent |
| Solvent blending | Automated, on-line pH, ionic strength, and organic modifier blending from pure solvents with Auto▪Blend Plus™ Technology |
| Gradient formation | Low-pressure mixing, quaternary gradient |
| Gradient profiles | 11 gradient curves (including linear, step [2], concave [4], and convex [4]) |
| Settable flow rate range | 0.010 to 2.000 mL/min, in 0.001 mL increments (firmware version 1.5x and earlier)<br>0.010 to 2.200 mL/min, in 0.001 mL increments (firmware version 1.60)<br>0.001 to 2.200 mL/min in 0.001 mL increments (firmware version 1.65 and later) |
| Primary check valve | Intelligent Intake Valve (*i²Valve*) |
| Pressure pulsation† | ≤1.0% or 25 psi, whichever is greater |
| Flow accuracy† | ±1.0% at 0.5 to 2.0 mL/min using 100% A |
| Flow precision† | ≤0.075% RSD or ±0.01 min SD, whichever is greater, based on six replicates (with *i²Valve*) |
| Composition ripple† (baseline noise) | ≤1.0 mAu |
| Composition accuracy† | ±0.5% absolute (full scale) from 5% to 90% from 0.5 to 2.0 mL/min (with *i²Valve*) |
| Composition precision† | ≤0.15% RSD or ±0.02 min SD, whichever is greater, based on six replicate injections (with *i²Valve*) |
| Compressibility compensation | Automatic and continuous |
| Priming | Wet priming can run at flow rates up to 4 mL/min |
| Pump seal wash | Equipped with a wash system to flush the rear of the high pressure seal and the plunger |
| Flow ramping | Range: 0.01 to 30.00 min to reach 2.0 mL/min<br>Default: 0.45 min to reach 2.0 mL/min |
| Primary wetted materials | 316L stainless steel, PPS, fluoropolymer, fluoroelastomer, UHMWPE blend, sapphire, ruby, zirconia, Nitronic 60, DLC, PEEK and PEEK blend, titanium alloy |

## SAMPLE MANAGER (SM-FTN-I)

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| Injection volume range | 0.1 to 10.0 µL as standard configuration.<br>Up to 1000.0 µL with optional extension loop |
| Accuracy | ±0.2 µL, measured by fluid weight removed from vial with 10.0 µL injections averaged over 20 injections using standard 100.0-µL syringe |
| Linearity† | ≥0.999 |
| Precision† | ≤0.25%, 5 to 50 µL |
| Maximum sample capacity | Any two of the following:<br>■ 96 and 384 microtiter plates<br>■ 48 position 2.00-mL vial plates<br>■ 48 position 0.65-mL micro-centrifuge tube plates<br>■ 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; maintains 19 °C below ambient with a temperature range tolerance range between -2 and +4 °C |
| Temperature accuracy | ±0.5 °C at sensor |
| Temperature stability | ±1.0 °C at sensor |
| Sample manager heat time | ≤30 min ambient-40 °C |
| Sample manager cool time | ≤60 min ambient-4 °C |
| Injection needle wash | Integrated, active, programmable |
| Minimum sample required | 3 µL residual, using Waters' Total Recovery 2-mL Vials (zero offset) |
| Sample carryover | ≤0.001% caffeine (UV)<br>≤0.001% sulphadimethoxine (MS) |
| Advanced sample manager capabilities | Auto-dilution and auto-addition |
| Primary wetted materials | 316L stainless steel, polyimide, PEEK blend, DLC, PPS |

## COLUMN MANAGEMENT (CM-A)

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| Column capacity | CM-A: Two columns, as standard (maximum length of 150 mm with filter or guard column) or four columns (maximum length of 50 mm) can be supported with optional tubing kit, up to 4.6 mm internal diameter (I.D.) |
| Multidimensional valves | Two six-port, two-position valves (CM-A only) |
| Column compartment(s) | 4.0 to 90.0 °C, settable in 0.1 °C increments |
| Temperature range | Two independent heat/cool zones per module |
| Column compartment(s) temperature accuracy | ±0.5 °C at sensor |
| Column compartment(s) temperature stability | ±0.3 °C at sensor |

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| Column compartment heat time | ≤15 min ambient-60 °C |
| Column compartment cool time | ≤15 min 60–20 °C |
| Solvent conditioning | Active pre-heating as standard |
| Column tracking | eCord™ Technology column information management tracks and archives column usage history for one column |

## SAMPLE ORGANIZER

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| Sample plate capacity | Sample plate capacity is configured based on the types and combinations of plates being used:<br>■ Maximum of 19 standard microtiter plates, up to 15.5 mm high, or<br>■ Maximum of 9 intermediate height plates (or 2-mL vial holders), up to 40.0 mm high, or<br>■ Maximum of 6 deep well plates (or 4-mL vial holders), up to 47.0 mm high |
| Maximum sample capacity | Maximum of 7296 samples in nineteen 384-well plates |
| Sample compartment temperature range | 4.0 to 40.0 °C, settable in 0.1 °C increments with a tolerance range between -2.0 to +4.0 |
| Temperature accuracy | ±1 °C at the sensor |
| Temperature stability | ±1 °C at the sensor |

## INSTRUMENTAL CONTROL

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| External communication | Ethernet interfacing via RJ45 connection to host PC with BSM, or<br>Column Manager and ACQUITY UPLC Detectors and mass spectrometers |
| Event inputs/outputs | Rear panel contact closure and/or TTL inputs/outputs |
| External control | MassLynx™ version 4.1 with OpenLynx™ Open Access, with specific SCN releases |
| User diagnostics | Available through software on host PC; system control via console software |
| Unattended operation | Leak sensors on supported modules, full diagnostic data captured through console software |
| Connections INSIGHT™ | Provides real-time monitoring, automatic notification of instrument performance, and diagnostic information allowing for quicker problem resolution |

## ENVIRONMENTAL

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| Acoustic noise | <65 dB |
| Operating temperature range | 4.0 to 40.0 °C (39.2 to 104.0 °F) |
| Operating humidity range | 20% to 50%, non-condensing |

## POWER REQUIREMENTS

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| Voltage range | 100 to 240 VAC |
| Frequency | 50 to 60 Hz |

## PHYSICAL DIMENSIONS

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| ACQUITY UPLC I-Class PLUS System with 2D Technology comprised of: ACQUITY UPLC Sample Manager - FTN-I, two Solvent Managers, and Column Manager | Width: | 83.8 cm (33 in.) |
| | Height: | 103.4 cm (40.7 in.) |
| | Depth: | 86.4 cm (34 in.) |

*Note: dimensions are listed with only components listed above.*

| ORDERING INFORMATION | PART NUMBER |
|---|---|
| ACQUITY UPLC I-Class PLUS System with 2D Technology (SM-FTN-I), 2x BSM | 176015130 |
| ACQUITY UPLC I-Class PLUS System with 2D Technology (SM-FTN-I), QSM/BSM | 176015131 |

[†] *For specific test conditions, contact your Waters sales representative.*

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