

Subsystem	Item	jetlab	jetlab II	jetlab 4	Remarks
Motion	Substrate Size	200 mm × 150 mm, 400 mm × 300 mm (xl version) Option: custom	150 × 150 mm 200 x 200 mm (xl version) Option: custom	160 × 120 mm 210 x 275 mm (xl version) Option: custom	Maximum substrate size is defined by single jet printhead.
	X Stage Travel	300 mm 500 mm (xl version)	300 mm	200 mm 300 mm (xl version)	
	Y Stage Travel	200 mm 300 mm (xl version)	200 mm 300 mm (x version)	150 mm 300 mm (xl version)	
	Z Stage Travel	80 mm	40 mm	50 mm manual Option: 100 mm motorized	
	X, Y Encoder Resolution	0.1 μm	0.1 μm	1.5 μm	
	Positioning Accuracy	±15 μm Option: ±3 μm with mapping	±15 μm Option: ±3 μm with mapping	±30 μm, unidirectional	
	Positioning Repeatability	±5 μm Option: ±1 μm with mapping	±5 μm Option: ±1 μm with mapping	±20 μm	
	X & Y Stage Travel Speed	100 mm/s	100 mm/s	50 mm/s	
	X & Y Stage Acceleration	400 mm/s <sup>2</sup>	400 mm/s <sup>2</sup>	1500 mm/s <sup>2</sup>	
	X & Y Stage Payload, maximum	20 kg	20 kg	10 kg (VLA-ST-60)	
	Z Stage Travel Speed	10 mm/s	10 mm/s	manual	
	Z Stage Payload (printhead), max	5 kg at 75 mm from carriage	5 kg at 75 mm from carriage	3 kg (VLA-ST-45)	
	Theta Stage	Optional configurations: stent, tissue scaffold, and array printhead	Optional configurations: stent, tissue scaffold, and array printhead	not available	Rotational alignment performed in software; printing motions allowed at any x-y angle.
Material Load/Unload	manual	manual	manual		
Vision	Downward-looking Camera	For alignment to fiducials and inspection of printed features, includes epi-illumination	For alignment to fiducials and inspection of printed features, includes epi-illumination	Option: for alignment to fiducials and inspection of printed features	
	Alignment Method	manual Option: teach/semiautomatic	manual Option: teach/semiautomatic	Program-assisted manual	
	Post-printing Visual Inspection	Option: automated survey	Option: automated survey	Option: manual survey	
	Jet Set-up & Observation Camera	Manual; Option: semiautomatic measurement/monitoring (avail. 07)	Manual; Option: semiautomatic measurement/monitoring (avail. 07)	manual; 15° tilt	Jetlab 4: visualization of printing and rough alignment to substrate features
	Jet Set-up Method	manual, script automation available Option: semiautomatic (avail. 07)	manual, script automation available Option: semiautomatic (avail. 07)	manual; script automation available	
	Synchronized Strobe	standard	standard	standard	
Field of View (horizontal and vertical)	4 mm x 3 mm (typical)	4 mm x 3 mm (typical)	4 mm x 3 mm (typical)		
Thermal & Pneumatic	Pneumatics Control Circuit	three state pneumatic control	three state pneumatic control	three state pneumatic control	Three pressure states: Pressure purge, vacuum purge, jet control pressure / vacuum
	Operating Pressure Control	vacuum / pressure fine adjust to 2 mbar Option: digital control	vacuum / pressure fine adjust to 2 mbar Option: digital control	vacuum / pressure fine adjust to 2 mbar	
	Pressure Gages	digital	digital	digital	
	Number of Pressure Outputs (includes control & display for each)	1 Option up to 4	1 Option up to 4	1	
	Pneumatic Control Method	manual Option: automated	manual Option: automated	manual	
	Pressure Input	60 psig [420 kPa] 20 scfm [2 scmm]	60 psig [420 kPa] 20 scfm [2 scmm]	60 psig [420 kPa] 20 scfm [2 scmm]	
	Vacuum Input	below -20 in Hg	below -20 in Hg	below -20 in Hg	
	Temperature Controllers	Option: 1-4	Option: 1-4	Option: 1-2	

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Mech., Electrical & Environ.	Work Surface	honeycomb with threaded holes	honeycomb with threaded holes	flat plate	
	Workpiece holder	Options include heated vacuum platen and fixtures for microscope slides, MALDI plates, microtitre plates, etc.	Options include heated vacuum platen and fixtures for microscope slides, MALDI plates, microtitre plates, etc.	flat plate with alignment edges Option: heated vacuum platen	
	Vibration Isolated Work Surface	pneumatic, self leveling	elastomeric feet	elastomeric feet	
	Lighted Work Area	Yes; Option: yellow or UV	no	no	
	Enclosed Work Area	standard	standard	standard	
	HEPA Filters Overhead	Option	Option	not available	
	HEPA Blower Unit	Option	Option	not available	
	Solvent Ventilation	integrated with duct connection	Optional duct connection	Optional duct connection	
	Footprint	70"x36" [178 cm x 91 cm] floor-standing	44"x28" [112 cm x 71 cm] tabletop 48"x32" [120 cm x 75 cm] floor	25"x22.5" [63 cm x 57 cm] tabletop xl: 30"x27" [75 cm x 67 cm] tabletop	Monitor and keyboard project from footprint
	Safety	CE approved at 240V	CE approved at 240V	CE approved in 07	
Power	220-240V, 6A, 50-60Hz	220-240V, 6A, 50-60Hz	220-240V, 6A, 50-60Hz		
Clean Room Compatibility	Class 1000	no	no		
Printing Control & Drive Electronics	Stationary Printhead	standard	standard	standard	
	Motorized Z-Axis Control of Printhead	standard	standard	Option	
	Point-to-Point Operation	standard	standard	standard	Point-to-Point defined as moving to a print location, stopping, dispensing, then moving to the next location
	Print-on-the-Fly Operation	standard, printing at any angle allowed	standard, printing at any angle allowed	standard, printing at any angle allowed	Print-on-the-Fly defined as printing while stages (both) are in motion, using encoder data to control printing in real time.
	Jet Drive Electronics	JetDrive III: bipolar and arb mode Option: multi-channel JetDrive III-(n)	JetDrive III: bipolar and arb mode Option: multi-channel JetDrive III-(n)	JetDrive III: bipolar and arb mode	
	Drive Electronics Multiplexer	integrated	integrated	no	
	TTL control signals	16 outputs - # of multiplexed jets on/off and timed	8 outputs - # of multiplexed jets on/off and timed	no	
	Jet On-Line / Off-Line Selection	through user interface, scripts	through user interface, scripts	through user interface, scripts	
Operating Frequency	up to 30 kHz	up to 30 kHz	up to 30 kHz		
Print Pattern	Built in Patterns	line, rectangular border, array, array-of-arrays (arbitrary angle)	line, rectangular border, array, array-of-arrays (arbitrary angle)	line, rectangular border, array, array-of-arrays (arbitrary angle)	All available primitives (built-in, open and filled polylines, bitmaps), can be printed in arbitrary orientation. All of them can be combined in scripts to complex patterns. The GDS II converter produces jetlab scripts, not bitmaps.
	Rotation Correction	standard	standard	standard	
	Multiple Fluid Control	standard	standard	standard	
	Print Pattern Import	GDS II converter; monochrome BMP	GDS II converter; monochrome BMP	GDS II converter; monochrome BMP	
Complex Print Jobs	script file: nesting, repetition with offsets, wait states, maintenance, & TTL controls	script file: nesting, repetition with offsets, wait states, maintenance, & TTL controls	script file: nesting, repetition with offsets, wait states, maintenance		
Printheads	Select one or more options (see Printhead Specifications for details)	Solder Jet Printhead Subsystem	Solder Jet Printhead Subsystem	na	
		Polymer Jet Printhead Subsystem	Polymer Jet Printhead Subsystem	Polymer Jet Printhead Subsystem	
		1-4 Single Channel Printheads, common or individual reservoirs	1-4 Single Channel Printheads, common or individual reservoirs	1 Single Channel Printhead	
Jetting Devices	Select one or more options	High Temperature Device	High Temperature Device	High Temperature Device for polymers	
		Low Temperature Devices	Low Temperature Devices	Low Temperature Devices	
		Integrated Array: 10 jets, 10 fluid inputs	Integrated Array: 10 jets, 10 fluid inputs	na	
		Integrated Array: 16 jets, 1 fluid input	Integrated Array: 16 jets, 1 fluid input	na	
Control system	Computing hardware	PC104+ based, 733 MHz Celeron M, 512 MB RAM, 8 MB shared VRAM, 40+ GB HD, CD-ROM, frame grabber, serial expansion card, Ethernet port, uncommitted USB 2.0 port; keyboard, monitor, mouse.			
	Operating system	Microsoft Windows XP SP2			
	Machine control program	Integrated control program for (multiple) jet setup and selection, positioning calibrations, pattern printing and surveying, TTL-controllable auxiliary equipment, depending on and supporting all hardware and software options on all jetlab models.			