Product survey: Laboratory automation

Brave New Robots

Workstations and liquid handlers are nothing special in most of today's academic and industrial laboratories, whilst mobile service robots are already strolling around the floors of research institutes and knocking on laboratory doors.

Flailing robot arms beside nimble liquid handling platforms and workstations are a common view in today's laboratories and drug screening units of pharmaceutical companies or medical research centres. A whole bunch of plate grippers, stackers, sealers, liquid handlers, dispensers, as well as barcode and plate readers is arranged side by side on decks or platforms, which are installed in shielded cabins. Controlled by sophisticated software programmes, flexible robot arms mounted on the decks transfer the plates between individual instruments, e.g. pick a plate from a microplate stacker and place it into an adjacent microplate reader or pass microplates from a plate stacker to a liquid handler.

These room-sized monster platforms and robots are fine for big pharma companies but they certainly don't match the scope of ordinary labs which are often restricted in both money and lab space. That does not mean, however, that small groups should have to pass on automation. Due to the modular architecture of most platforms, consisting of independently working devices, one may select particular platform modules and operate them as stand alone machines or combine them individually.

Personal automation

The most popular and affordable modules for labs planning to go automatic, or at least semi-automatic, are liquid handlers. Besides large scale liquid handling workstations, some vendors also offer compact 'personal' pipetting robots small enough to find a place on the workbench or in the clean bench. The general design of liquid handlers is pretty simple and straightforward. The core elements are a liquid handling arm that is moveable along the x and y axes, a pipetting head mounted on the forefront of the arm moveable in the z direction, pipetting channels that transfer the liquids from a reservoir into the pipetting tips and a software that tells the pipetting robot, which reaction vessel it has to fill with a given volume.

Depending on the intended use and microplate format, liquid handling robots may operate with different numbers of pipetting channels. Classical pipettors destined for serial dilution, plate preparation or general high-throughput applications are normally equipped with exchangeable 96 or 384 multi-channel pipette heads, while robots focusing on nucleic acid extraction or PCR reaction preparation, may operate with only one or two channels.

Liquid handlers may be complemented with accessories such as barcode readers, plate washers, shakers or tip loaders. To integrate them into a complex robotic system, however, robot arms capable of rotating along four, five or six axes are often necessary to handle and transfer plates at pivotal nodal points.

Usually, these industrial robot arms have to work in protected areas, i.e. in a shielded cabin or behind a protective grid. That is true for the vast majority of robot arms – but not for all. Meanwhile, a small-sized robot arm is available that may be placed directly on the benchtop to work hand-in-hand with the lab personnel. Since the controlling software is integrated into the robot's foot, it may operate in a stand alone mode without further connection to a computer. Sensors integrated into the robot arm permanently scan the surroundings to avoid collision with its human colleagues. Programming the arm's motion is rather easy: one may simply take the robot's 'hand' and guide it to the desired position. The inbuilt software memorises the newly-learnt motion sequence and conducts it in the next run. Applications for robots serving as a 'third arm' are easy to find in the lab. Just think of how often you might need one or more additional arms to accelerate stupefying routine tasks, such as opening or closing the lids of dozens of reaction tubes.

Mobile service robots

All robots used in lab automation so far are completely immobile: once installed at their proper place on a platform or workstation, they will stay there for the rest of their machine life. However, mobile life science service robots strolling through the corridors and rooms of research institutes are already in the making. One such example is LISA, a life science assistant robot, developed by a joint venture of engineers at the Fraunhofer Institute for Factory Operation and Automation in Magdeburg and computer scientists from the University of Osnabrück, both in Germany. LISA's arm resides on a moveable platform equipped with several laser scanners serving as artificial 'eyes' that recognise objects or barriers crossing or limiting LISA's way through the lab.

LISA is a pretty clever robot that understands spoken language and may even communicate with its own voice. Talking to LISA in easy and precise words will do to get the robot rolling, e.g. to insert a certain microplate into the plate reader standing in the room next door. The sensing gripper arm is another of LISA's interesting features. It is coated with conductive foam and textiles, serving as artificial skin that may absorb accidental crashes. To further increase safety, LISA's arm is also equipped with thermocameras that notice body heat originating, for example, from a human hand operating between the gripper and the aimed object. Sounds all pretty cool, however, LISA is still a research project and not (yet) commercially available.

Harald Zähringer

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Company	Name of Device	Application(s)	Miscellaneous, Specialities, Generally	Price [EUR]
Analytik Jena Jena, Germany www.bio.analytik-jena.de **Contact:** Phone +49-3641/779400 lifescience@analytik-jena.de	InnuPure C12	Automatic DNA and RNA isolation	■ Based on separation by magnetic or paramagnetic particles ■ Up to 12 samples in parallel ■ Pre-filled reagent packs ■ Piercing function ■ Automatic transfer in elution tubes (1.5 ml)	14,900,-
	FasTrans	Liquid handling system; Preparation and pipetting of complete PCR batches; Pipetting, dispensing and mixing; etc.	■ Interchangeable pipetting heads with 1, 3, 4, 6 channels ■ 0.5-30 µl or 5.0-250 µl ■ 9 freely selectable positions in the 96 well SBS standard formate ■ Passive cooling blocks & adapters available ■ Freely defineable sample configuration in 9-2.25 mm grid	From 9,900,-
	MiniPep Uno	Easy and fast preparation of 96 well plates; Fully automatic proceeding of whole PCR batches	■ Footprint: 180 mm x 240 mm ■ Tray for 0.2, 0.5 and 1.5/2.0 ml tubes and tips ■ External waste box for used pipette tips ■ Two interchangeable 1-channel pipetting heads ■ 0.5-30 µl or 5.0-250 µl	From 8,999,-
Applied Biosystems Darmstadt, Germany www.appliedbiosystems.com **Contact:** Phone +49-6151 96700 order@lifetech.com	MagMax Express 24 well; MagMax Express 96 Stand. well; MagMax Expr. 96 Deep w.	Magnetic particle mediated nucleic acid extraction from fluids and tissues RNA and DNA prep.	■ Fast ■ Pure ■ Automated ■ Flexible ■ Various reagent kits	13,835.- 24-well) 38,124.- (96-well)
	7900HT System Automation Accessory Upgrade	24-hour unattended operation with stacking positions for up to 84 x 384-well or 96-well plates or 384-well TaqMan Array Cards	■ Instrument accessory	46,000.-
Beckman Coulter www.beckmancoulter.com/labautomation **Contact:** Christoph Kruell Phone +49-2151 333-5 ckruell@beckman.com	Biomek 3000	PCR Setup, Sequencing setup, DNA purification, RNA purification, Human ID, Protein purification, etc.	■ Integrated data management ■ Automatic method validation ■ Interchangeable pipetting tools ■ Optional gripper and wash tools ■ Upgradeable and expandable	On request
	Biomek NXP	PCR Setup, Sequencing setup, DNA and RNA purification, Amplicon sequencing, Human ID, Protein purification, etc.	■ Integrated data management ■ Automatic method validation ■ Safety light curtain ■ Upgradeable and expandable ■ Variable 8-channel pipetting or flexible multichannel head	On request
	Biomek FXP	DNA, RNA, Protein purification, Cellular analysis, Cell culture, Sample normalization, Serial dilution	■ Integrated data management ■ Automatic method validation ■ Safety light curtain ■ Upgradeable and expandable ■ Variable 8-channel pipetting and/or flexible mulitchannel head	On request
	Biomek Assay Workstation	Cellular analysis, Cell culture, Antibody production, HT screening, Affymetrix target preparation, siRNA screening, HT flow cytometry	■ Process control software ■ Method development assistance ■ Configurable & expandable ■ Mutiple transportation concept	On request
	BioRAPTR	Assay development with DOE; HT screening; Cell based assays; PCR setup	■ Contact free nl dispenser ■ Low dead volume ■ Multiple reagents ■ Interchangeable heads ■ Optional DOE interface	On request
BioTek Instruments Bad Friedrichshall, Germany **Contact:** Marina Bruss Phone +49-7136-968 0 info@biotek.de	Precision XS Automated Microplate Pipetting System	Sample processing, Plate reformatting, Serial dilutions, Plate replication, Hit picking, Bulk reagent dispensing, Reagent addition	■ Four liquid transfer tools on one platform ■ Space efficiency ■ User-configurable multi-station platform ■ Variety of test tube and microplate formats automated	From 25,960.-
	BioStack Microplate Stacker	Genomics, proteomics, drug discovery, diagnostics	■ Microplate washing ■ Liquid handling or reading processes ■ Rotational wrist ■ Barcode scanner ■ Small footprint	From 10,900.-
	EL406 Combination of Microplate Washer Dispenser	Cell-based applications: Multiplex assays and magnetic bead assays, Standard ELISAs	■ Fast microplate washing and dispensing ■ 1536-, 384-, and 96-well microplates ■ Built-in, ultrasonic cleaner ■ Up to three reagent dispensers and automated switching of up to four wash buffers	From 24,900.-
GenVault Carlsbad, CA, USA www.genvault.com Germany/Austria: Biozym Scientific; www.biozym.com **Contact:** Helmut Prechel Dirk Duven Phone +49-5152 9020 support@biozym.com	GenVault Dynamic Archive	Automated storage of biosamples at room temperature: whole blood, bacterial cultures & stocks, purified genomic DNA (gDNA), purified plasmid DNA (pDNA)	■ Fully automated system for archiving and retrieving GenPlates at room temperature ■ Integrated robot for high-throughput sample management ■ High-density archive with small footprint enables efficient use of space ■ Scalable modular design, tens of thousands to millions of biosamples ■ Compatible with other available liquid handling systems and plates	On request
	SAlly A. Heat Sealer	Semi-automatic thermal sealer	■ Compatible to many plate formats ■ With variable temperature and time settings ■ Rapid heating element for fast start-up	On request
Chemagen Baesweiler, Germany Phone +49-2401-805500 www.chemagen.com **Contact:** Andreas Künzel andreas.kuenzel@chemagen.de Christian Henze christian.henze@chemagen.de	chemagic Magnetic Separation Module I	Automated nucleic acid isolation for high throughput application (96 samples in parallel) and large volume applications (up to 10 ml e.g. blood)	■ 1 - 96 samples ■ Sample volumes: 10 µl - 10 ml ■ Sample materials: blood, serum/plasma, urine, stool suspension, swabs, cells, tissue ■ Proprietary M-PVA magnetic bead based technology ■ Integrated buffer dispensing	On request
	chemagic Prepito	Benchtop system for automated nucleic acid isolation	■ 1-12 samples ■ 10 µl - 600 µl ■ Materials: blood, serum/plasma, urine, stool suspension, swabs, cells, tissue ■ Proprietary M-PVA magnetic bead based technology ■ Integrated buffer dispensing	On request
CyBio Jena, Germany www.cybio-ag.com **Contact:** Phone +49-3641 3510 productinfo@cybio-ag.com	CyBi-8plus1	Application ADME/Tox – assays, biochem. assays, molecular biological assays; Serial dilution, PCR- and sequencing-setups, hit picking, tube-to plate application	■ Combination of 8- & 1-channel. pipetting head exchange becomes needless ■ Incl. microplate database makes time-consuming teaching unnecessary ■ Adjustment of liquid handling parameters allows a good pipetting performance with all kinds of liquids ■ Expandable with additional 96- or 384-channel pipetting, stacker, and working positions	From 25,000.-

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CyBio (continued) **Contact:** see page 55	CyBi-Well vario Simultaneous pipettor with exchangeable pipetting heads	Reformatting, replication and coating of microplates ADME/Tox – assays, biochem. assays, compound handling, molecular biological assays, PCR-setup, pipetting of cells	■ 96- or 384-fold parallel pipetting, up to 1536-well microplates with 9 exchangeable pipetting heads, volume range 25 nl-250µl ■ Expandable ■ Pipetting with plastic or ceramic tips ■ Scalable transport system for 3, 4, 5 or 10 microplate ■ Easy programming of complex pipetting protocols	From 42,000.-
	Platform on basis of a 4-axis SCARA robot KiNEDx	Biotechnology, Life science, Agro chemistry, Cosmetics, Food, Materials and catalyst research	■ Control via CyBio Composer Software ■ Parallel operations possible ■ Combination of pipettor, washer, dispenser, plate storage system, incubator, reader ■ Compact design with upgrade options	On request
	Platform on basis of an 6-axis industry robot Stäubli TX series	Biotechnology, Life science, Agro chemistry, Cosmetics, Food, Materials and catalyst research	■ Constant run times with high throughput ■ Combination of pipettor, washer, dispenser, plate storage system, reader, barcode reader, centrifuge, shaker, etc. ■ Compact design with upgrade options	On request
Eppendorf www.eppendorf.com **Contact:** Holger Eggert Phone +49-40 538 01-190 eggert.h@eppendorf.de	epMotion 5070	Serial dilutions, Reagent transfers, cherry picking, PCR and qPCR set-up	■ Ultra compact liquid handling automation	On request
	epMotion 5070 CB	Cell seeding, media change, cytotoxicity, apoptosis and cell viability assays	■ Integration into laminar flow possible	On request
	epMotion 5075 LH	Serial dilutions, Reagent transfers, Cherry picking, PCR and qPCR set-up	■ Automated liquid handling, gripper and stacking option	On request
	epMotion 5075 TMX	Magnetic bead based nucl. acid extraction	■ Automated liquid handling with integrated Thermomixer	On request
	epMotion VAC	Vacuum based nucleic acid preparation	■ Automated liquid handling with integrated vacuum	On request
GeSiM Grosserkmannsdorf, Germany www.gesim.de **Contact:** Hendrik Fiehn/ Frank-Ulrich Gast Phone +49-351-2695-322 info@gesim.de	Nano-Plotter NP 2.1, NP 2.1/E	Non-contact piezoelectric microarray spotting with up to 16 independent pipettes on 55 (NP 2.1) or 120 slides (NP 2.1/E) or on custom-specific targets, normal liquid handling as option	■ Arbitrary dispensing modes ■ Alternative dispensers available ■ Automatic target identification via microscope (optional) ■ Options: second wash station, cooling for microtiter plate(s) and slides, humidification, plate handling; customized hard- and software development	On request
Hamilton Robotics Martinsried, Germany www.hamiltonrobotics.com **Contact:** Jörg Katzenberger Phone +49-89 552 649 0 infoservice@ hamiltonrobotics.com	Microlab STAR Line Liquid Handling workstations	Wide range of applic. in genomics, proteomics, cellomics & drug discovery f. research, academia, veterinarian labs & forensics.	■ Monitored air displacement ■ Total aspiration and dispense monitoring ■ Automation of different applications on the same platform ■ Asymmetrically spreadable pipetting channels	From 40,000.-
	Microlab NIMBUS	General liquid handling, Serial dilutions, Hit picking	■ Smallest possible footprint ■ Easy to use Wizards ■ Gripper for plate and tip-rack handling ■ Maximised capacity	From 35,000.-
	Active Sample Manager asmStore	Automated tube/plate storage down to -20°C	■ Int. tube compiler & storage buffer ■ Manual/scheduled sample tube and/or rack delivery ■ Temp.-control ■ 350-1000 tubes/h or 120 racks/h, per asmStore module ■ Manual output or fully integrated, inert sample process.	On request
	-80°C Sample Access Manager SAM	Automated Tube/Plate storage down to -80°C	■ Complete audit trail ■ Software controllable individual user access rights ■ Optional integrated tube picking	On request
LI-COR Biosciences Bad Homburg, Germany www.licor.com **Contact:** Katharina Fischer Phone +49-6172-1717727 katharina.fischer@licor.com	Aerius Automated Infrared Imaging System	Elisa / FLISA; In-cell or On-cell western assay; Protease assays, Quantitative western blot; RNAi screens; Transcription factor assays	■ Optional microplate stacker enables automated scanning of up to 30 plates in one run ■ Barcode scanner ■ Can easily be integrated in fully automated workflows ■ Provides automated analyses of In-cell western assays	On request
LTF-Labortechnik Wasserburg, Germany www.labortechnik.com **Contact:** Rudolf Walser Phone +49-8382-98520 info@labortechnik.com	Nordiag "Arrow"	DNA and RNA extraction	■ Flexible sample input volume up to 1.6 ml ■ Low purchasing and running costs ■ Sample drawn from primary tube ■ Extraction time 30 min	12,000.-
	Nordiag "Bullet"	DNA and RNA extraction	■ 1 to 96 samples in one run ■ Automated barcode reading from primary tube ■ Liquid level detection ■ Setup for downstream processes	From 68,000.-
	LabTurbo 36	RNA and DNa extraction	■ Highly flexible nucleic extraction system for 1 to 48 samples ■ For vacuum membrane protocols from Qiagen, Macherey-Nagel, Roche, Taigen ■ Open system ■ Including thermic block and tip reuse option	35,000.-
	Versa	Liquid handling / PCR setup	■ Interchangeable 8 deck positions ■ Processing of up to 1000 samples/day ■ Volume range 1- 1000 µl ■ Cooled & heated blocks	20,000.-
M2-Automation Berlin, Germany **Contact:** info@m2-automation.de	Instrument ONE Instrument TWO	Compact micro-dispenser systems for small volume applications in pl, nl and µl range.	■ Piezo /solenoid dual jet technology ■ Aspirating from any source, touchless dispensing to any substrate ■ µm-positioning accuracy ■ Can be supplied with HEPA-filter system ■ Intuitive and easy to use control software	From 32,000.-
Merck Chemicals Calbiochem, Novabiochem, Novagen www.merck4biosciences.com **Contact:** Phone 0800 6931 000 (DE) Customer.service@merckbio.eu	Luminex 200 xPONENT 3.1 Total System	Platform for flexible, user defined multiplex analysis of proteins and nucleic acids using xMAP Technology.	■ Installation by a certified Luminex engineer ■ System training provided ■ WideScreen assays for the Luminex xMAP technology ■ Assays for intracellular signalling proteins ■ Assays for extracellular proteins	On request

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Molzym Bremen, Germany www.sepsitest.com **Contact:** M. Lustig Phone +49-421 696162-17 lustig@molzym.com	SepsiTest Automat	Sepsis, SIRS, Neutropenic fever, Sepsis research	■ 100% contamination-free pipetting	On request
	SepsiTest Automat	Abscess, Endocarditis, Implant & wound infection	■ Molecular microbiology of tissue samples	On request
	SepsiTest Automat	Amnionitis, Synovial infection, Meningitis, Parodontitis, Deep neck infection, Peritonitis, Pleuritis, Pneumonia	■ Contamination-free molecular microbiology	On request
Qiagen www.qiagen.com **Contact:** Cassie Knapp Phone +1-240-686-7686 Cassie.knapp@qiagen.com	QIAsymphony SP	Total RNA, DNA, bact. DNA, & viral nucleic acids as well as 6xHis-tagged proteins	■ Ready-to-run up to 96 samples	On request
	QIASymphony AS	Extends the SP capabilities to include automated PCR assay set-up	■ Automated, integrated assay setup module	On request
	Rotor-Gene Q	Real-time PCR cycler enables streamlined analysis for a wide range of applications	■ HRM and fast real-time PCR	On request
Scienion Dortmund/Berlin, Germany www.scienion.de **Contact:** Phone +49-30-6392-1700 support@scienion.de	sciFLEXARRAYER (6 sizes available)	Production of diagnostic tests and microarrays. Loading of: Biosensor, MALDI	■ Non-contact liquid delivery ■ Picoliter to microliter liquid handling ■ Camera based target detection and deposition ■ Maintenance free high speed linear drives	From 20,000.-
	sciSWIFTER	Filling MTP, Formats 96 – 1536, Higher density on request, nanoPCR	■ Cartridge based liquid delivery ■ Minimal reagent consumption ■ Accurate dilution series	From 65,000.-
Stemcell Technologies www.stemcell.com **Contact:** Phone 00800 7836 2355 info.EU@stemcell.com	RoboSep	RoboSep is the only instrument to offer true walk-away automation of immunomagnetic cell isolation from virtually any source including whole blood.	■ Versatile ■ High throughput labels and separates up to four samples simultaneously ■ No cross-contamination ■ Column-free system ■ The robotic pipette requires no washing or user servicing	On request
Tecan Group Männedorf, Switzerland www.tecan.com **Contact:** Wendy Lauber Phone +41-44 922 80 99 wendy.lauber@tecan.com Florence Collins Ralf Masantschek Jason Meredith	Freedom EVO75	Sample preparat., logistic & assay autom., ADMET, cell. assays, nucleic acid extraction etc. f. drug discovery, genomics, proteomics, forensics (in industry, research, academia)	■ Precision instrument designed for automating routine laboratory tasks in the domains of life science and bio pharma ■ Open and flexible platform	On request
	Freedom EVO100	see above	see above	On request
	Freedom EVO150	see above	see above	On request
	Freedom EVO200	see above	see above	On request
	Freedom EVO REMP SSS	Automation of a range of sample logistics tasks f. compound management/screening	■ Fully automated liquid handling and sample management platform	On request
	EVOlyzer	ELISA diagnostic test	■ Fully automated ■ From 16 to 640 sample tubes ■ IVD compliant	On request
	FE500pro	Pre-analytical sample preparation for diagnostic routines	■ Many integrated functions including centrifugation ■ Small footprint ■ IVD compliant	On request
Thermo Fisher Scientific www.thermo.com **Contact:** Kiara W. Biagioni Kiara.williams@ thermofisher.com Merja Mehto merja.mehto@ thermofisher.com	Thermo Scientific Matrix PlateMate 2x3	Medium throughput 96-/384- channel liquid handling procedures: replication/stamping, reformatting/pooling, serial dilution	■ Choice of 8 user interchangeable disposable or fixed tip pipetting heads ■ 6 microplate positions for variety of labware, compact format, easy to use PC interface, variety of accessory options	50,000.- to 80,000.-
	Thermo Scientific Matrix Hydra DT	Low throughput 96-channel automated liquid handler for plate filling, stamping	■ Very small and compact, easy to operate onboard or through PC interface	About 25,000.-
	Thermo Scientific Multidrop Combi	Assay development, Screening, Genomics and proteomics research, Cell based assays, Bead based assays, ELISA assays	■ Volume range from 0.5 µl to 2500 µl ■ 6-1536-well plates with flexible plate height ■ Easy to use ■ Unique cassette lifetime traceability with SMART option	About 12,000.-
	Thermo Scientific Multidrop Combi nL	See above	■ Effortless low volume dispensing ■ 96-1536-well plates with flexible plate height ■ Robotic compatible ■ Thermo Scientific FILLit software	About 21,000.-
Thermo Fischer Scientific Langenselbold, Germany www.thermofisher.com **Contact:** Stefan Betz Phone +49-6184 906323 Stefan.betz@thermofisher.com S.usanne Reichenberger, Phone +49-160-90530922 Susanne.reichenberger@ thermofisher.com	Thermo Scientific Cytomat	Automated incubation and storage from 40 to 1000 µplates	■ Cell culture incubation ■ Compound storage, ambient storage ■ Single point of integration ■ Fast random access ■ Various models and options	20,000.- to 150,000.-
	Thermo Scient. Matrix Hydra II/Hydra eDrop	PCR set up, Protein crystallography, Bead or cell based dispensing, Plate stamping	■ 96 syringes (minimal 100 nl, maximal 1000 µl) ■ Nanodispenser (100 nl) ■ 3-position stage ■ Wash station	On request
	Thermo Scientific Matrix PlateMate Plus	Same application as PlateMate 2x3 in High Through Put	■ 8 interchangeable 96 and 384 air and positive displacement heads ■ 4 x 25 or 50 plate stackers ■ 4-position deck ■ Wash station	On request
Tib Molbiol Syntheselabor Berlin, Germany **Contact:** Olfert Landt olandt@tib-molbiol.de	Aliquator 480	Dispensing mastermix to 96 and 384 well plates, 8 sources, 16 tips	n/a	Less than 15,000.-