Is lab automation right for your lab?

Robin A. Felder, PhD

On pages 46–57 is CAP TODAY's roundup of laboratory automation technology. There you'll find information, provided by automation vendors, on functionality and installed sites. The variety of clinical laboratory automation technologies on the market is greater than ever, but the divergence in technologies presented challenges in hardware and software interconnectivity. Thus, in-vitro diagnostics manufacturers, automation vendors, and laboratorians pooled their efforts to enhance and transform technology by supporting the NCCLS laboratory automation standards effort. NCCLS recently published the last document in its five-part automation standard (Auto 1-5, see below). CAP TODAY included in its survey of the vendors questions about NCCLS conformance for various system components.

Your justification for the purchase of laboratory automation must be based on a sound forecast of cost savings, turnaround and worker safety improvement, and reduction in errors. But how can you predict that automation will yield beneficial outcome for your laboratory? To suggest functional systems for their customers' laboratories, and to implement those systems properly, vendors will request operations data and use various tools. You need data that compare the function of each automation system (see the CAP TODAY survey), and you will want to have on hand data that summarize the hourly arrival rate and distribution of specimens (not tests) delivered to the laboratory. You will also have to know the types and models of instruments and analyzers you have in the laboratory, and the types of laboratory tests and number requested for each specimen each hour of the day. Also required will be labor utilization rates in the laboratory, including job duties, number of full-time-equivalents assigned to each task each hour, total hours worked, and skill level of each technologist. Designing an automation process and selecting automation technology are not necessarily intuitive. For example, if you purchase an automation system sized to your lab's peak demands, the low-volume periods during the day will become more noticeable.

There are numerous systems on the market from which to choose. (For tips on selecting automated systems, log on to http://marc.med.virginia.edu/.) Performance evaluations of individual systems have been published (Dadoun R. *Clinical Laboratory Management Review.* 1998;12: 248–255; Seaborg RC, et al. *MLO.* 1999;31: 46–54; Markin RS, et al. *AJCC.* 46:5;764-771), but published comparisons of competing clinical laboratory automation systems (with the exception of CAP TODAY's side-by-side look at laboratory automation technology) are absent from the literature. Furthermore, the determination of ROI is still an inexact science, because, with test mix and labor needs differing so widely, efficiency improvements in one laboratory cannot be predicted on the basis of published reports from other labs. However, with computer methods you can attempt to model the many processes within a clinical laboratory. Indeed, computer simulation is gaining in popularity as a method to gather and analyze data regarding the prediction of productivity of clinical processes (Rosetti MD, Kumar A, Felder RA. Mobile robot simulation of mid-sized hospital delivery processes. *Health Care Man Sci.* 2000;3: 201–213). A trained simulation specialist will enter data and provide interpretations about implementing automation technologies. Make sure the simulation data are validated against the actual laboratory operation. One of the most important tasks of a simulation model is to ensure the laboratory that the automation technology is configured to avoid specimen bottlenecks.

One way to validate the performance of laboratory automation is to perform a clinical trial. For example, to measure the performance of a recently released commercial preanalytical processor, we performed a two-site comparison of a preanalytical processor that can accommodate a variety of commercial specimens (Abbott-Tecan Partnership's Genesis FE500). Our studies focused on testing more than 3,000 bar-code-labeled specimens according to a protocol designed to test a breadth of capabilities of preanalytical processors (for example, aliquot number, fraction centrifuged, and platelet depletion studies). Mean system output performance varied between 93 and 502 *total* tubes per hour depending on the batch size, aliquot number requested, and percentage of tubes that required centrifugation. The preanalytical processor was operated by one full-time-equivalent compared with the three FTEs required to perform the same tasks manually during peak hours, which yields a calculated return on investment of less than three years. Furthermore, there was a significant reduction in laboratory errors.

The costs of clinical lab automation technology have begun to decline as the production of technology has increased. However, only recently have automation tools become available for the smaller laboratory (sample throughput of less than 250 to 300 specimens per hour). Preanalytical workstations are now part of the clinical laboratory automation lineup and available from most of the in vitro diagnostics manufacturers.

The data on pages 46–57 serve as a useful tool to compare the features of various automation systems for an initial assessment of automation compatibility with your laboratory. Armed with information about each system's performance features, you can employ the services of a consultant who can develop a customized solution for your lab using specialized tools such as simulation modeling. Actual automation system performance must be evaluated, of course, following comprehensive clinical trials. Ultimately, laboratories with automation will be able to demonstrate remarkable increases in efficiency, quality, and safety. ☐

Dr. Felder is director of the Medical Automation Research Center and professor of pathology at the University of Virginia, Charlottesville, and visiting professor of pathology at Johns Hopkins School of Medicine, Baltimore.

Laboratory automation systems & workcells

Part 1 of 7 *Please see accompanying article on page 42*	Abbott-Tecan Partnership **Donna Crook (Tecan) or Matthew Noble (Abbott)** donna.crook@tecan.com or matthew.noble@abbott.com Research Triangle Park, NC 800-352-5128 www.abbott.com or www.tecan.com	A&T Corp. **Akira Igarashi** aigarashi@alice.aandt.co.jp 2-24-27 Sekido, Tama-shi, Tokyo 206-0011 +81-423-57-8520 www.aandt.co.jp
Name of system/First ever auto. sys. install	FE 500/2000	Clinilog/1993
Automation products that are available		
• Process control software/Transportation systems	yes/yes	yes/yes
• Auto. centrifugation/Auto. input or accessioning	yes/yes	yes/yes
• Auto. decapping/Auto. sorting/Auto. storage and retrieval	yes/yes/in development	yes/no/no
• Specimen integrity monitor/Auto. aliquoting	in development/yes	no/yes
• Instrument (analyzer) interfaces/Auto. recapping	no/in development	yes/no
System architecture	open system	open system
% of staff dedicated to clinical automation sys.	50%	10%
% of budget dedicated to R&D for clin. auto. technology	15%	10%
Company's primary product category	lab automation systems	LAS, analyzer (chemistry, serology), LIS, clinical reagent
Information systems technology for your automation system		
Database/Operating system/Server/User interface	Sybase SQL Anywhere/Windows NT/—/dynamic download, host query	Betrieve/Windows NT/—/—
Software features/functionality		
• Patient demographics & insurance data/Rules-based architecture	n/a/LAS SW feature	LAS SW feature, LIS requirement/LAS SW feature, LIS requirement
• Supports data retrieval/Internet connectivity	LAS SW feature/n/a	LAS SW feature, LIS requirement/LIS requirement
• Online real-time help system/QC/Stats & management reports	LAS SW feature/n/a/n/a	LAS SW feature/LAS SW feature, LIS requirement/LAS SW feature, LIS requirement
• Evaluates validity and releasability of results from automated analyzers	n/a	LAS SW feature, LIS requirement
• Specimen tracking/Priority processing/Random-access specimen movement	LAS SW feature/LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature, LIS requirement/LAS SW feature
• Supports accession No. redundancy (duplicate specimen ID)	LAS SW feature	LAS SW feature
• Supports specimen carrier and level identification	n/a	LAS SW feature
• Unique bar-code number per container required	n/a	LIS requirement
• Specimen routing/Multistop routing (one tube to multiple workstations)	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Specimen scheduling/Instrument scheduling	n/a/n/a	LAS SW feature/LAS SW feature
• Routes test to workstation/Automatic reflex, repeat, dilutions	LAS SW feature/n/a	LAS SW feature/LAS SW feature
• Supports multiple hardware config./Supports other proprietary transport. hardware	LAS SW feature/n/a	LAS SW feature/LAS SW feature, LIS requirement
• Storage retrieval & disposal/Supports proposed NCCLS standards	LAS SW feature/—	LAS SW feature/LAS SW feature
LIS interfaces that are live/how LISs are interfaced w/auto. sys.	Sunquest, SCC, Cerner, Citation, HBOC, Triple G, Molis/ASTM	A&T, Triple G, Techni Data/based ASTM
No. of live sites installed in N. America/Outside N. America	12/8	0/40
Transportation systems available	yes	yes
• Version/conforms to NCCLS Standards Auto 1-5/Ave. throughput*	conveyor/—/—	2.0/yes/~400
• Supports automatic rerouting for reflex/repeat/dilutions		yes
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75
• Modular hardware/Installed options/Device functions independent of track	—/—/—	no/floor & subfloor mounted/yes
• Required utilities/Required maintenance	compressed air, electricity/—	electricity/annually
• Carrier type/Scalable system	single specimen container per carrier/—	multiple specimen container per carrier/yes
Automated centrifugation available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/—/300 @ 10–min spin time	—/yes/~240
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75
• For multi-unit centrifuges, each cent. operates independently for rate and time	—	yes
Automated input/accessioning available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/—/500	—/yes/~1,500
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, screw cap, rubber stopper, hemoguard	16x100, 13x100, 16x75, 13x75
Automated decapping available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/—/500	—/yes/~400
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75
Automated sorting available	yes	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/—/500	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, any manufacturer's rack	—
Specimen integrity monitor available	in development	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	level sensing & clot detection	—
Automated aliquoting available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/—/—	—/yes/~200
• Types of containers device can accommodate	13x75 prepackaged secondary tubes	16x100, 13x100, 16x75, 13x75
• System inspects samples for bar code/Reports clots/Reports QNS specimens	yes/yes/yes	yes/yes/yes
Instrument (analyzer) interfaces		
• Rules-based instrument interface control subsystem	—	yes
• Process control of instrument via control subsystem	—	yes
Physical/hardware (instrument/specimen) interface		
• Hematology/Chemistry/Coagulation	—/—/—	pt.-of-reference sampling/pt.-of-reference sampling/pt.-of-reference sampling
• Immunoassay/Urinalysis	—/—	pt.-of-reference sampling/pt.-of-reference sampling
Instruments to which your system/product is interfaced	contact vendor	Hitachi 747, 7600; Toshiba 200 FR, DAX; Bayer Advia 1650; Coulter Gen-S; Abbott Aeroset i2000; Bayer Centaur; Tosoh AI21; A&T 502X
Other robotic products/components to which system, product is linked	—	—
Automated recapper available	in development	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
Automated storage and retrieval available	in development	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
• Refrigeration available	—	—
Longitudinal upgrade pathway or plan to protect users' investments	contact vendor	HW is like module based and easy to add; SW is LAN, C/S type IT & reduces necessary modification of software
Ave. time to install sys./Who provides service and support/Hrs support is available	3 weeks/Tecan-based service and support/24/7	1 week/A&T or subcontractor/depends on contract
On-site biomedical engineer required/user group meets regularly	no/—	no/no
List price	$450k	—
Individual list prices for components		
• Process control software/Transportation systems	—	—/depends on system layout
• Auto. centrifugation/Auto. input accessioning	—	~$100k/~$100k
• Auto. decapping/Auto. sorting/Auto. storage & retrieval	—	~$160k/—/—
• Specimen integrity monitor/Automated aliquoting	—	—/~$240k
• Instrument (analyzer) interfaces/Automated recapping	—	>$80k/—
Distinguishing features	• flexibility, footprint, completely configurable	• Clinilog a "true open" LAS that meets NCCLS standards • client/server-like information structure is easily upgraded, reducing necessary modification of LAS program and LIS

* Ave. throughput in specimen containers per hr per device

Laboratory automation systems & workcells

Part 2 of 7 *Please see accompanying article on page 42*	Bayer Diagnostics Wayne O'Brien 511 Benedict Ave., Tarrytown, NY 10591 914-333-6012 bayerdiag.com and labnews.com	Bayer Diagnostics Wayne O'Brien 511 Benedict Ave., Tarrytown, NY 10591 914-333-6012 bayerdiag.com and labnews.com
Name of system/First ever auto. sys. install	Advia LabCell/1998	Advia WorkCell (chemistry & immunoassay instruments)/2000
Automation products that are available		
• Process control software/Transportation systems	yes/yes	yes/yes
• Auto. centrifugation/Auto. input or accessioning	available 2002/yes (input)	no/yes (input)
• Auto. decapping/Auto. sorting/Auto. storage and retrieval	available 2002/yes/yes (storage & mapping)	no/yes/yes (storage & mapping)
• Specimen integrity monitor/Auto. aliquoting	no/available 2002	no/no
• Instrument (analyzer) interfaces/Auto. recapping	yes/no	yes/no
System architecture	open system	closed system
% of staff dedicated to clinical automation sys.	—	—
% of budget dedicated to R&D for clin. auto. technology	—	—
Company's primary product category	instruments	instruments
Information systems technology for your automation system		
Database/Operating system/Server/User interface	SQL/Windows NT/Windows NT/Bayer-user interface (proprietary)	SQL/Windows NT/Windows NT/Bayer-user interface (proprietary)
Software features/functionality		
• Patient demographics & insurance data/Rules-based architecture	LIS requirement/LAS SW feature	LIS requirement/LAS SW feature
• Supports data retrieval/Internet connectivity	LAS SW feature, LIS requirement/n/a	LAS SW feature/n/a
• Online real-time help system/QC/Stats & management reports	LAS SW feature/LIS requirement/LAS SW feature	LAS SW feature/LIS requirement/LAS SW feature
• Evaluates validity and releasability of results from automated analyzers	LIS requirement	LIS requirement
• Specimen tracking/Priority processing/Random-access specimen movement	LAS SW feature/LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature/LAS SW feature
• Supports accession No. redundancy (duplicate specimen ID)	n/a	n/a
• Supports specimen carrier and level identification	LAS SW feature	LAS SW feature
• Unique bar-code number per container required	LAS SW feature	LAS SW feature
• Specimen routing/Multistop routing (one tube to multiple workstations)	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Specimen scheduling/Instrument scheduling	LAS SW feature/LAS SW feature (load balancing)	LAS SW feature/LAS SW feature (load balancing)
• Routes test to workstation/Automatic reflex, repeat, dilutions	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Supports multiple hardware config./Supports other proprietary transport. hardware	LAS SW feature/—	LAS SW feature/—
• Storage retrieval & disposal/Supports proposed NCCLS standards	LAS SW feature (database mgmt)/—	LAS SW feature (database mgmt)/—
LIS interfaces that are live/how LISs are interfaced w/auto. sys.	Sunquest 5.23, LMX, OSI/HL7, ASTM	PGP/ASTM
No. of live sites installed in N. America/Outside N. America	1/3	0/3
Transportation systems available	yes	yes
• Version/conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/no/2,000	—/no/2,000
• Supports automatic rerouting for reflex/repeat/dilutions	yes (no dilutions)	yes (no dilutions)
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, 11.5–16.2 mm (diam.) & 75–100 mm (ht.)	16x100, 13x100, 16x75, 13x75, 11.5–16.2 mm (diam.) & 75–100 mm (ht.)
• Modular hardware/Installed options/Device functions independent of track	yes/floor mounted/yes	yes/floor mounted/yes
• Required utilities/Required maintenance	compressed air, electricity/weekly, monthly, quarterly, annually	compressed air, electricity/weekly, monthly, quarterly, annually
• Carrier type/Scalable system	single specimen container per carrier/yes	single specimen container per carrier/yes
Automated centrifugation available	in late-stage development	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
• For multi-unit centrifuges, each cent. operates independently for rate and time	yes	—
Automated input/accessioning available	yes (input)	yes (input)
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/no/600	—/no/600
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, 11.5–16.2 mm (diam.) & 75–100 mm (ht.)	16x100, 13x100, 16x75, 13x75, 11.5–16.2 mm (diam.) & 75–100 mm (ht.)
Automated decapping available	in late-stage development	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
Automated sorting available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/no/600	—/no/600
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, 11.5–16.2 mm (diam.) & 75–100 mm (ht.)	16x100, 13x100, 16x75, 13x75, 11.5–16.2 mm (diam.) & 75–100 mm (ht.)
Specimen integrity monitor available	no	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
Automated aliquoting available	in development	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
• System inspects samples for bar code/Reports clots/Reports QNS specimens	—	—
Instrument (analyzer) interfaces		
• Rules-based instrument interface control subsystem	yes	yes
• Process control of instrument via control subsystem	no (high level only)	no (high level only)
Physical/hardware (instrument/specimen) interface		
• Hematology/Chemistry/Coagulation	robotic arm interface/pt.-of-reference sampling/robotic arm interface	no/pt.-of-reference sampling/no
• Immunoassay/Urinalysis	pt.-of-reference sampling & robotic arm interface (both avail.)/pt.-of-reference sampling	pt.-of-reference sampling/no
Instruments to which your system/product is interfaced	Bayer: Advia 120, 1650, & Centaur; Clinitek Atlas, Immuno1	Bayer: Advia 1650 & Centaur
Other robotic products/components to which system, product is linked	none	none
Automated recapper available	no	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
Automated storage and retrieval available	only software tracking available	only software tracking available
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
• Refrigeration available	no	no
Longitudinal upgrade pathway or plan to protect users' investments	can contain as few as two interfaced modules/instruments & can be expanded to include up to 16 interfaced modules; instruments open system allows for instrument exchanges	future chemistry & immunochem systems from Bayer will be able to connect to the track and can be exchanged; designed so it can be upgraded to LabCell
Ave. time to install sys./Who provides service and support/Hrs support is available	1 month/Bayer Diagnostics/24/7	1 month/Bayer Diagnostics/24/7
On-site biomedical engineer required/user group meets regularly	no/no	no/no
List price	varies by configuration	varies by configuration
Individual list prices for components		
• Process control software/Transportation systems	—/—	—/—
• Auto. centrifugation/Auto. input accessioning	—/—	—/—
• Auto. decapping/Auto. sorting/Auto. storage & retrieval	—/—/—	—/—/—
• Specimen integrity monitor/Automated aliquoting	—/—	—/—
• Instrument (analyzer) interfaces/Automated recapping	—/—	—/—
Distinguishing features * Ave. throughput in specimen containers per hr per device	• modularity—provides a menu of modules from which to design an individual solution • flexibility—customizable, able to be changed & reconfigured as needs change • manageability—allows customer to plan & manage around their changing needs	• instruments operate separately from track • pre- and postanalytical sorting capability • single-tube carrier vs. rack carrier • upgradability allows customers to grow into a larger system or Advia LabCell

Laboratory automation systems & workcells

Part 3 of 7	Beckman Coulter	Dade Behring
	Susan McIntosh smmcintosh@beckman.com	Contact Dade Behring representative
	200 S. Kraemer Blvd., Brea, CA 92821	1717 Deerfield Rd., Deerfield IL 60015
	714-961-4860	847-267-5300
Please see accompanying article on page 42	www.beckmancoulter.com	www.dadebehring.com

	Beckman Coulter	Dade Behring
Name of system/First ever auto. sys. install	Power Processor/1994	StreamLab Analytical Workcell/2000
Automation products that are available		
• Process control software/Transportation systems	yes/yes	yes/yes
• Auto. centrifugation/Auto. input or accessioning	yes/yes	yes/yes
• Auto. decapping/Auto. sorting/Auto. storage and retrieval	yes/yes/yes	yes/yes/no
• Specimen integrity monitor/Auto. aliquoting	no/yes	no/yes
• Instrument (analyzer) interfaces/Auto. recapping	yes/yes	yes/no
System architecture	open system	open system
% of staff dedicated to clinical automation sys.	5%	—
% of budget dedicated to R&D for clin. auto. technology	7%	—
Company's primary product category	lab automation systems and instruments	instruments and reagents
Information systems technology for your automation system		
Database/Operating system/Server/User interface	SQL/Windows NT/—/GUI	proprietary file system/Windows NT/n/a/Labview touchscreen guide
Software features/functionality		
• Patient demographics & insurance data/Rules-based architecture	LAS SW feature, LIS requirement/LAS SW feature	LAS SW feature, LIS requirement/LAS SW feature
• Supports data retrieval/Internet connectivity	LAS SW feature/n/a	LAS SW feature/LAS SW feature
• Online real-time help system/QC/Stats & management reports	LAS SW feature/LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature/n/a
• Evaluates validity and releasability of results from automated analyzers	LAS SW feature	LIS requirement
• Specimen tracking/Priority processing/Random-access specimen movement	LAS SW feature/LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature/LAS SW feature
• Supports accession No. redundancy (duplicate specimen ID)	LAS SW feature	n/a
• Supports specimen carrier and level identification	n/a	LAS SW feature
• Unique bar-code number per container required	LAS SW feature, LIS requirement	LAS SW feature, LIS requirement
• Specimen routing/Multistop routing (one tube to multiple workstations)	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Specimen scheduling/Instrument scheduling	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Routes test to workstation/Automatic reflex, repeat, dilutions	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Supports multiple hardware config./Supports other proprietary transport. hardware	LAS SW feature/n/a	LAS SW feature/n/a
• Storage retrieval & disposal/Supports proposed NCCLS standards	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
LIS interfaces that are live/how LISs are interfaced w/auto. sys.	ADAC, Cerner, MEDITECH, Sunquest, SCC, SMS, Antrim, HBOC, Per Se Technology/direct, worklist consol. download or listen on analyzer line	none/ASTM
No. of live sites installed in N. America/Outside N. America	85/35	1/0
Transportation systems available	yes	yes
• Version/conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/—	StreamLab/yes/300
• Supports automatic rerouting for reflex/repeat/dilutions	yes	yes
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75
• Modular hardware/Installed options/Device functions independent of track	yes/floor, overhead & subfloor mounted/yes	yes/floor mounted/yes
• Required utilities/Required maintenance	compressed air, electricity/monthly	compressed air, electricity/weekly
• Carrier type/Scalable system	single specimen container per carrier/yes	single specimen container per carrier/yes
Automated centrifugation available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/300	StreamLab/yes/300
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, handles intermixed sizes simultaneously
• For multi-unit centrifuges, each cent. operates independently for rate and time	yes	yes
Automated input/accessioning available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/900	StreamLab/yes/300
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, handles intermixed sizes simultaneously
Automated decapping available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/600	StreamLab/yes/300
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, handles intermixed sizes simultaneously
Automated sorting available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/500	StreamLab/yes/300
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, handles intermixed sizes simultaneously
Specimen integrity monitor available	no	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
Automated aliquoting available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/500	Dimension sample transfer module/yes/480 (4 analyzers)
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x75, 16x75, 13x75
• System inspects samples for bar code/Reports clots/Reports QNS specimens	yes/yes/yes	yes/yes/yes
Instrument (analyzer) interfaces		
• Rules-based instrument interface control subsystem	yes	—
• Process control of instrument via control subsystem	yes	—
Physical/hardware (instrument/specimen) interface		
• Hematology/Chemistry/Coagulation	depends on manufacturer of analyzer	no/pt.-of-refence sampling/no
• Immunoassay/Urinalysis	depends on manufacturer of analyzer	pt.-of-refence sampling/pt.-of-refence sampling
Instruments to which your system/product is interfaced	Abbott: AxSym, Architecture, Aeroset; Bayer: Centaur, Atlas; Beckman Coulter: Synchron LX20, Gen-S, STKS; J&J: Vitros; Roche: Modular, 747, 917; Stago Coag Analyzer	Dade Behring Dimension RxL Clinical Chemistry System
Other robotic products/components to which system, product is linked	CRS Arms, RoboCart	none
Automated recapper available	yes	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/500	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	—
Automated storage and retrieval available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	n/a/yes/300	StreamLab/yes/300
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75
• Refrigeration available	yes	no
Longitudinal upgrade pathway or plan to protect users' investments	all systems may be upgraded (SW & HW) due to modular design	modular systems can change/grow with user needs
Ave. time to install sys./Who provides service and support/Hrs support is available	7–30 days, depends on config. of system/Beckman Coulter/24/7	5 days/Dade Behring/24/7
On-site biomedical engineer required/user group meets regularly	no/yes	no/no
List price	$450k for standard configuration	contact Dade Behring representative for all pricing information
Individual list prices for components		
• Process control software/Transportation systems	contact vendor	—/—
• Auto. centrifugation/Auto. input accessioning	contact vendor	—/—
• Auto. decapping/Auto. sorting/Auto. storage & retrieval	contact vendor	—/—/—
• Specimen integrity monitor/Automated aliquoting	contact vendor	—/—
• Instrument (analyzer) interfaces/Automated recapping	contact vendor	—/—
Distinguishing features	• system design, installation, training, technical support, and service provided by Beckman Coulter • totally open—connects to any manufacturer's analyzer • intelligent aliquoting—measures serum volume and transfers based on dead volume plus requested test volume	• StreamLab is a modular system providing alternatives to different size labs seeking a wide range of automated solutions, from small-scale, preanalytical workstations to complete preanalytical processing, testing, and post-test sample management

* Ave. throughput in specimen containers per hr per device

Laboratory automation systems & workcells

Part 4 of 7 Please see accompanying article on page 42	Lab-InterLink, Inc. Sheila Magnuson 1011 S. Saddle Creek Rd. Omaha, NE 68106-1943 800-449-2527/402-595-3767 www.labinterlink.com	MDS Laboratory Services Devon Piirto dpiirto@mdsintl.com 100 International Blvd. Toronto, Ontario Canada M9W 6J6 416-675-6777 www.mdsdx.com
Name of system/First ever auto. sys. install	Lab-Frame/1996	AutoLab System/1994
Automation products that are available		
• Process control software/Transportation systems	yes/yes	yes/yes
• Auto. centrifugation/Auto. input or accessioning	yes/yes	no/yes
• Auto. decapping/Auto. sorting/Auto. storage and retrieval	yes/yes/yes	yes/yes/yes (software only)
• Specimen integrity monitor/Auto. aliquoting	yes/yes	no/no
• Instrument (analyzer) interfaces/Auto. recapping	yes/yes	yes/yes
System architecture	open system	open system
% of staff dedicated to clinical automation sys.	100%	n/a
% of budget dedicated to R&D for clin. auto. technology	15%	n/a
Company's primary product category	laboratory automation systems	health & life sciences
Information systems technology for your automation system		
Database/Operating system/Server/User interface	Oracle/UNIX/Compaq DS-10 or DS-20/Oracle Forms-GUI	MS SQL server, relational/Windows NT server & workstation/Intel-based Enterprise servers/graphical Windows based
Software features/functionality		
• Patient demographics & insurance data/Rules-based architecture	LAS SW feature/LAS SW feature	LIS requirement/LAS SW feature
• Supports data retrieval/Internet connectivity	LAS SW feature/LAS SW feature	LAS SW feature/n/a
• Online real-time help system/QC/Stats & management reports	LAS SW feature/LIS requirement/LAS SW feature	LAS SW feature/LAS SW feature/LAS SW feature
• Evaluates validity and releasability of results from automated analyzers	LIS requirement	LAS SW feature
• Specimen tracking/Priority processing/Random-access specimen movement	LAS SW feature/LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature/LAS SW feature
• Supports accession No. redundancy (duplicate specimen ID)	LAS SW feature	n/a
• Supports specimen carrier and level identification	LAS SW feature	LAS SW feature
• Unique bar-code number per container required	LAS SW feature	LAS SW feature
• Specimen routing/Multistop routing (one tube to multiple workstations)	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Specimen scheduling/Instrument scheduling	LAS SW feature/LAS SW feature	n/a/n/a
• Routes test to workstation/Automatic reflex, repeat, dilutions	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Supports multiple hardware config./Supports other proprietary transport. hardware	LAS SW feature/n/a	LAS SW feature/n/a
• Storage retrieval & disposal/Supports proposed NCCLS standards	LAS SW feature/LAS SW feature	LAS SW feature/partially
LIS interfaces that are live/how LISs are interfaced w/auto. sys.	Sunquest 5.2 & 5.2.3, Cerner, SCC, MEDITECH, HBOC/ALG, Rubicon, Triple G, PGP, Philips, MIPS/HL7, ASTM	MEDITECH, Triple G, Rubicon, Cerner (modified)/HL7
No. of live sites installed in N. America/Outside N. America	17/2	6-HW & SW; 7-SW only/0
Transportation systems available	yes	yes
• Version/conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/800	II/partially/1,000 or 2,000 per hr
• Supports automatic rerouting for reflex/repeat/dilutions	yes	yes
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, 12x75	16x100, 13x100, 16x75, 13x75, 12x75
• Modular hardware/Installed options/Device functions independent of track	yes/floor, overhead, & subfloor mounted/yes	yes/floor mounted/yes
• Required utilities/Required maintenance	electricity/quarterly	compressed air, electricity/weekly
• Carrier type/Scalable system	single specimen container per carrier/yes	single spec. cont. carriers that can be converted into multiple/yes
Automated centrifugation available	yes	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/200–500	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	—
• For multi-unit centrifuges, each cent. operates independently for rate and time	yes	—
Automated input/accessioning available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/800–1,000	II/partially/2,000 per hr
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, 12x75
Automated decapping available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/250–400	II/partially/1,000
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, 12x75	16x100, 13x100, 16x75, 13x75, 12x75
Automated sorting available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/400	II/partially/1,000
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, 12x75
Specimen integrity monitor available	yes	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	alpha/yes/—	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	—
Automated aliquoting available	yes	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/75 primaries per hr; 225 secondaries per hr; 1:3 ratio	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	—
• System inspects samples for bar code/Reports clots/Reports QNS specimens	yes/yes, with aliquotter/yes, with aliquotter	—/—/—
Instrument (analyzer) interfaces		
• Rules-based instrument interface control subsystem	yes	yes
• Process control of instrument via control subsystem	yes	yes
Physical/hardware (instrument/specimen) interface		
• Hematology/Chemistry/Coagulation	robotic arm interface/pt.-or-reference sampling/robotic arm interface	—/pt.-of-reference/—
• Immunoassay/Urinalysis	pt.-of-reference sampling, robotic arm interface/no	pt.-of-reference/—
Instruments to which your system/product is interfaced	Orthos Vitros 950AT & 250AT; Roche Hitachi 912; Bayer Centaur; Bayer Immuno-1; Abbott Architect 2000, Cell Dyn 4000; IL MLA 1600C; MDA 180; Sysmex HST; Diagnostica Stago STA-R; DPC Immulite 2000	rules based interfaces: OCD Vitros 750/950; Dade Dimension RXL; Bayer Centaur; Abbott AxSym & Cell Dyn 3500/4000; Roche Integra; Coulter STKS/GEN-S; Physical Interfaces: Dimension RxL
Other robotic products/components to which system, product is linked	customizable to client's needs	n/a
Automated recapper available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/750	II/partially/1,000
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, 12x75	—
Automated storage and retrieval available	yes	software only
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	current/yes/300	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, 12x75	—
• Refrigeration available	yes	—
Longitudinal upgrade pathway or plan to protect users' investments	easily upgraded	SW upgrades provided anually under support agreements
Ave. time to install sys./Who provides service and support/Hrs support is available	2 weeks/Lab-Interlink/24/7	4 weeks/MDS & local 3rd party/24/7
On-site biomedical engineer required/user group meets regularly	no/no	no/yes
List price	$500k–$2m, depending on modules, instruments, quantity	n/a
Individual list prices for components		
• Process control software/Transportation systems	$25k–$50k/$15k–$120k	n/a
• Auto. centrifugation/Auto. input accessioning	$150k–$230k/$25k	n/a
• Auto. decapping/Auto. sorting/Auto. storage & retrieval	$45k/$125k/$120–$205k	n/a
• Specimen integrity monitor/Automated aliquoting	$50k/$75k	n/a
• Instrument (analyzer) interfaces/Automated recapping	$40k–$75k/$45k	n/a
Distinguishing features * Ave. throughput in specimen containers per hr per device	• AutoProcessing—advanced SW system yields process control for open-connectivity lab • long-term protection due to unbiased, open support from any manufacturer; convenient plug & play modularity	• specimen transport carriers (STC) snap together for use throughout client's operation • strong belief & focus in value & development of automation SW • auto. tools & lab mgmt. expertise to customize tools for client

Laboratory automation systems & workcells

Part 5 of 7	Olympus America Inc.	Ortho-Clinical Diagnostics
	Hiroshi Sekiya hiro.sekiya@olympus.com	Kathryn Parra
	Two Corporate Center Dr., Melville, NY 11747-3157	1001 US Hwy 202, Raritan, NJ 08869
	800-223-0125	908-218-8623
Please see accompanying article on page 42	www.olympus.com	www.ortho-clinical.com

Name of system/First ever auto. sys. install	OLA1500/2000	Lab-Frame Select Series/1996

Automation products that are available		
• Process control software/Transportation systems	no/no	yes/yes
• Auto. centrifugation/Auto. input or accessioning	no/yes	yes/yes
• Auto. decapping/Auto. sorting/Auto. storage and retrieval	yes/yes/yes	yes/yes/yes
• Specimen integrity monitor/Auto. aliquoting	yes/yes	no/yes
• Instrument (analyzer) interfaces/Auto. recapping	no/no	yes/yes
System architecture	open system	open system
% of staff dedicated to clinical automation sys.	—	—
% of budget dedicated to R&D for clin. auto. technology	—	—
Company's primary product category	instruments	instruments
Information systems technology for your automation system		
Database/Operating system/Server/User interface	Microsoft Access/Windows NT/—/touch-screen, keyboard, touch-pad	Oracle/UNIX/Compaq/GUI

Software features/functionality		
• Patient demographics & insurance data/Rules-based architecture	LAS SW feature, LIS requirement/LAS SW feature	LAS SW feature/LAS SW feature
• Supports data retrieval/Internet connectivity	LAS SW feature/n/a	LAS SW feature/LAS SW feature
• Online real-time help system/QC/Stats & management reports	LAS SW feature/LIS requirement/n/a	LAS SW feature/LIS requirement/LAS SW feature
• Evaluates validity and releasability of results from automated analyzers	LIS requirement	LIS requirement
• Specimen tracking/Priority processing/Random-access specimen movement	LAS SW feature/LAS SW feature/n/a	LAS SW feature/LAS SW feature/LAS SW feature
• Supports accession No. redundancy (duplicate specimen ID)	LAS SW feature	LAS SW feature
• Supports specimen carrier and level identification	LAS SW feature	LAS SW feature
• Unique bar-code number per container required	n/a	—
• Specimen routing/Multistop routing (one tube to multiple workstations)	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Specimen scheduling/Instrument scheduling	LAS SW feature/LIS requirement	LAS SW feature/LAS SW feature
• Routes test to workstation/Automatic reflex, repeat, dilutions	LAS SW feature/n/a	LAS SW feature/LAS SW feature
• Supports multiple hardware config./Supports other proprietary transport. hardware	LAS SW feature/LAS SW feature	LAS SW feature/n/a
• Storage retrieval & disposal/Supports proposed NCCLS standards	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature

LIS interfaces that are live/how LISs are interfaced w/auto. sys.	—/RS232C, Olympus interface format	Cerner, Sunquest, SCC, HBOC, MEDITECH/HL7, ASTM

No. of live sites installed in N. America/Outside N. America	0/1	8/—
Transportation systems available	no	yes
• Version/conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	current/yes/800
• Supports automatic rerouting for reflex/repeat/dilutions	—	yes
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75, 12x75
• Modular hardware/Installed options/Device functions independent of track	—	yes/floor mounted/yes
• Required utilities/Required maintenance	—	electricity/quarterly
• Carrier type/Scalable system	—	single specimen container per carrier/yes

Automated centrifugation available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	current/yes/300–500
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75
• For multi-unit centrifuges, each cent. operates independently for rate and time	—	yes
Automated input/accessioning available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/yes/1,500	current/yes/500
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75 & 11.5-16 mm diam., 65-110 mm ht.	16x100, 13x100, 16x75, 13x75
Automated decapping available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/yes/1,500	current/yes/300
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, BD Vacutainer, BD Hemoguard, Sarstedt Monovette, screw top closures, all at same time	16x100, 13x100, 16x75, 13x75
Automated sorting available		yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/yes/1,500	current/yes/300
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, sorting to any mftr's sample holder	16x100, 13x100, 16x75, 13x75, 12x75
Specimen integrity monitor available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	alpha/yes/—
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75
Automated aliquoting available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	current/yes/75 primary, 225 secondary
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75
• System inspects samples for bar code/Reports clots/Reports QNS specimens	yes/no/yes	yes/yes/yes

Instrument (analyzer) interfaces		
• Rules-based instrument interface control subsystem	yes	yes
• Process control of instrument via control subsystem	yes	yes
Physical/hardware (instrument/specimen) interface		
• Hematology/Chemistry/Coagulation	—/—/—	robotic arm interface/pt.-of-reference sampling/robotic arm interface
• Immunoassay/Urinalysis	—/—	pt.-of-reference sampling/no

Instruments to which your system/product is interfaced	can be interfaced w/ any automation transportation track	Vitros 950 AT, 250 AT; Advia Centaur; DPC 2000; Cell Dyne 4000; Stago Star
Other robotic products/components to which system, product is linked	—	experienced in facilitating development of OEM interfaces

Automated recapper available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	current/yes/750
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75

Automated storage and retrieval available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/yes/1,500	current/yes/—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, 12x75
• Refrigeration available	no	yes
Longitudinal upgrade pathway or plan to protect users' investments	open, modular systems are compatible w/ most diagnostic instruments and automation systems	interchangeable components throughout, common software and transport for all products, adherence to NCCLS, HL7, & ASTM
Ave. time to install sys./Who provides service and support/Hrs support is available	1 week/Olympus America Inc. Diagnostic Systems Group/24/7	2 weeks/Ortho-Clinical Diagnostics & Lab-Interlink/24/7
On-site biomedical engineer required/user group meets regularly	no/—	no/no

List price	$225k	$500k–$1.5M, depends on configuration
Individual list prices for components		
• Process control software/Transportation systems	n/a	available upon request
• Auto. centrifugation/Auto. input accessioning	n/a	available upon request
• Auto. decapping/Auto. sorting/Auto. storage & retrieval	n/a	available upon request
• Specimen integrity monitor/Automated aliquoting	n/a	available upon request
• Instrument (analyzer) interfaces/Automated recapping	n/a	available upon request

Distinguishing features	• fastest throughput of its kind currently in the market	• autoprocessing/most advanced software design and user benefits
	• cap color recognition & sample level detection modules	• flexibility, configurable, upgradeable
	• easy to change configurations, from sorter/decapper to archive preparation	• modularity, open architecture

* Ave. throughput in specimen containers per hr per device

Laboratory automation systems & workcells

Part 6 of 7 *Please see accompanying article on page 42*	Roche Diagnostics **Chris Demiris** chris.demiris@roche.com 9115 Hague Rd., Indianapolis, IN 46250 317-576-3908 us.labsystems.roche.com	Roche Diagnostics **Chris Demiris** chris.demiris@roche.com 9115 Hague Rd., Indianapolis, IN 46250 317-576-3908 us.labsystems.roche.com
Name of system/First ever auto. sys. install	Modular Preanalytics/1997, Hitachi 1990	PSDI, 1997; VSII, 1999
Automation products that are available		
• Process control software/Transportation systems	yes/yes	yes/no
• Auto. centrifugation/Auto. input or accessioning	yes/yes	no/yes
• Auto. decapping/Auto. sorting/Auto. storage and retrieval	yes/yes/no	PSDI I (yes), VSII (no)/yes/no
• Specimen integrity monitor/Auto. aliquoting	no/yes	PSDI (no), VSII (yes)/PSDI (no), VSII (yes)
• Instrument (analyzer) interfaces/Auto. recapping	yes/yes	no/no
System architecture	closed system (modular systems)	open system
% of staff dedicated to clinical automation sys.	15 employees	15 employees
% of budget dedicated to R&D for clin. auto. technology	n/a	n/a
Company's primary product category	instruments, reagents	instruments, reagents
Information systems technology for your automation system		
Database/Operating system/Server/User interface	—/Windows NT, UNIX/—/—	—/Windows NT, UNIX/—/—
Software features/functionality		
• Patient demographics & insurance data/Rules-based architecture	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Supports data retrieval/Internet connectivity	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Online real-time help system/QC/Stats & management reports	LAS SW feature/—/LAS SW feature	LAS SW feature/n/a/LAS SW feature
• Evaluates validity and releasability of results from automated analyzers	LAS SW feature	n/a
• Specimen tracking/Priority processing/Random-access specimen movement	LAS SW feature/LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature/LAS SW feature
• Supports accession No. redundancy (duplicate specimen ID)	—	LAS SW feature
• Supports specimen carrier and level identification	LAS SW feature	LAS SW feature
• Unique bar-code number per container required	LAS SW feature	n/a
• Specimen routing/Multistop routing (one tube to multiple workstations)	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
• Specimen scheduling/Instrument scheduling	LAS SW feature/LAS SW feature	n/a/n/a
• Routes test to workstation/Automatic reflex, repeat, dilutions	LAS SW feature/LAS SW feature	LAS SW feature/n/a
• Supports multiple hardware config./Supports other proprietary transport. hardware	—/—	LAS SW feature/LAS SW feature
• Storage retrieval & disposal/Supports proposed NCCLS standards	—/LAS SW feature	LAS SW feature/LAS SW feature
LIS interfaces that are live/how LISs are interfaced w/auto. sys.	Cerner v. 3, Sunquest 5.2, 5.23 w/ & w/o SMART, SCC v. 1.x & v. 2.x, VA DHCP-Vista, DoD CHCS (SAIC), Antrim, homegrown systems, SMS, Per-Se, Omnitech, HBOC Advantage & StarLab/HL7 2.3 & 2.4 TCP/IP Ethernet, HL7 2.1 serial, ASTM TCP IP Ethernet, ASTM serial	Cerner v. 3, Sunquest 5.2, 5.23 w/ & w/o SMART, SCC v. 1.x & v. 2.x, VA DHCP-Vista, DoD CHCS (SAIC), Antrim, homegrown systems, SMS, Per-Se, Omnitech, HBOC Advantage & StarLab/HL7 2.3 & 2.4 TCP/IP Ethernet, HL7 2.1 serial, ASTM TCP IP Ethernet, ASTM serial
No. of live sites installed in N. America/Outside N. America	6 (7 in June)/15	PSDI 27/51; VSII 8/20
Transportation systems available	yes	no
• Version/conforms to NCCLS Standards Auto 1–5/Ave. throughput*	MPA system 3 or 7/yes/600	—
• Supports automatic rerouting for reflex/repeat/dilutions	yes	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75, rubber or hemoguard	16x100, 13x100, 16x75, 13x75, hemoguard, rubber, screw cap
• Modular hardware/Installed options/Device functions independent of track	yes/floor mounted/no, fully integrated automation & analytics	—/—/—
• Required utilities/Required maintenance	compressed air, electricity, water (for analyzers)/weekly	compressed air, electricity/weekly
• Carrier type/Scalable system	multiple specimen container per carrier (5 positions)/yes	multiple specimen container per carrier (5 positions)/yes
Automated centrifugation available	yes	no
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	system 3 or 7/yes/250	—
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	—
• For multi-unit centrifuges, each cent. operates independently for rate and time	yes, 2 can run at 500 per hr.	—
Automated input/accessioning available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	system 3 or 7/yes/600	PSDI/yes/900–1,200; VSII/yes/340 w/ 1 aliquot per primary tube
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, hemoguard, rubber, screw cap
Automated decapping available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	system 3 or 7/yes/400	PSDI/yes/900–1,200
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, hemoguard, rubber, screw cap
Automated sorting available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	system 3 or 7/yes/500	PSDI/yes/900–1,200; VSII/yes/340 w/ 1 aliquot per primary tube
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, hemoguard, rubber, screw cap
Specimen integrity monitor available	no	yes
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	—	VSII/yes/—
• Types of containers device can accommodate	—	level sensing & clot detection
Automated aliquoting available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	system 3 or 7/yes/500	VSII/yes/340 w/ 1 aliquot per primary tube
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75
• System inspects samples for bar code/Reports clots/Reports QNS specimens	yes/yes/yes	yes/yes/yes
Instrument (analyzer) interfaces		
• Rules-based instrument interface control subsystem	—	no
• Process control of instrument via control subsystem	yes	no
Physical/hardware (instrument/specimen) interface		
• Hematology/Chemistry/Coagulation	—/no, pt.-of-reference sampling/—	no/no/no
• Immunoassay/Urinalysis	no, pt.-of-reference sampling/—	no/no
Instruments to which your system/product is interfaced	Roche/Hitachi Modular Systems Clin Chem & Immunoassay	none
Other robotic products/components to which system, product is linked	—	none
Automated recapper available	yes	no
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	system 3 or 7/yes/500	—
• Types of containers device can accommodate	—	—
Automated storage and retrieval available	no	yes
• Version/Conforms to NCCLS Standards Auto 1–5/Ave. throughput*	—	PSDI/yes/1,200; VSII/yes/340 w/ 1 aliquot per primary tube
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75, hemoguard, rubber, screw cap
• Refrigeration available	no	no (uses a special archive rack)
Longitudinal upgrade pathway or plan to protect users' investments	customers can place modules to increase capacity & functionality	can be easily configured to meet changing workloads & demands
Ave. time to install sys./Who provides service and support/Hrs support is available	<2 weeks/Roche/24/7	3 days PSDI; 4 weeks for VSII/Roche/24/7
On-site biomedical engineer required/user group meets regularly	no/no	no/no
List price	varies from $300k–$1M	PSDI: $240k; VSII: $300k
Individual list prices for components		
• Process control software/Transportation systems	n/a	—
• Auto. centrifugation/Auto. input accessioning	n/a	—
• Auto. decapping/Auto. sorting/Auto. storage & retrieval	n/a	—
• Specimen integrity monitor/Automated aliquoting	n/a	—
• Instrument (analyzer) interfaces/Automated recapping	n/a	—
Distinguishing features	• fully integrated & designed to work with analytics • easy implementation, no hassles with 3rd party analyzers & interfaces • total hands-off results driven by reliability • high level LIS expertise	• PSDI: stand-alone archiving; low-cost easy implementation; sorting, decapping, exception handling, archiving. • VSII: archiving, aliquoting & sorting; fast, easy setup & installation; exception notification & separation • Task Targeted Automation

* Ave. throughput in specimen containers per hr per device

Laboratory automation systems & workcells

Part 7 of 7

Please see accompanying article on page 42

	Sysmex Corp. or America	Thermo Clinical Labsystems
	Tammy Kutz mktcom@sysmex.com	Klas Vuorinen klas.vuorinen@thermobio.com
	Gilmer Road, 6699 RFD, Long Grove, IL 60047	Ruukintie 18 FIN-02330 Espoo Finland
	847-726-3500	+358 9 802 766
	www.sysmex.com	www.labsystems.fi
Name of system/First ever auto. sys. install	Sysmex Systemization—HST, CST/1990	Thermo Clinical Automation/2000
Automation products that are available		
• Process control software/Transportation systems	yes/yes	yes/yes
• Auto. centrifugation/Auto. input or accessioning	no/yes	yes/yes
• Auto. decapping/Auto. sorting/Auto. storage and retrieval	no/no/yes	yes/yes/yes
• Specimen integrity monitor/Auto. aliquoting	yes/no	no/yes
• Instrument (analyzer) interfaces/Auto. recapping	yes/no	yes/no
System architecture	closed system	open system
% of staff dedicated to clinical automation sys.	25%	—
% of budget dedicated to R&D for clin. auto. technology	—	—
Company's primary product category	lab automation systems, instruments, information systems	lab automation systems and instruments
Information systems technology for your automation system		
Database/Operating system/Server/User interface	SYBASE/Windows 98, NT, UNIX/—/—	object database/Windows NT/—/GUI
Software features/functionality		
• Patient demographics & insurance data/Rules-based architecture	LAS SW feature/LAS SW feature	LIS requirement/—
• Supports data retrieval/Internet connectivity	LAS SW feature/LAS SW feature	LIS requirement/—
• Online real-time help system/QC/Stats & management reports	LAS SW feature/LAS SW feature/LAS SW feature	LAS SW feature/—/—
• Evaluates validity and releasability of results from automated analyzers	LAS SW feature	LAS SW feature
• Specimen tracking/Priority processing/Random-access specimen movement	LAS SW feature/LAS SW feature/n/a	LAS SW feature/LAS SW feature/LAS SW feature
• Supports accession No. redundancy (duplicate specimen ID)	n/a	LAS SW feature
• Supports specimen carrier and level identification	LAS SW feature	LAS SW feature
• Unique bar-code number per container required	LAS SW feature	LAS SW feature
• Specimen routing/Multistop routing (one tube to multiple workstations)	LAS SW feature/n/a	LAS SW feature/LAS SW feature
• Specimen scheduling/Instrument scheduling	n/a/n/a	LAS SW feature/LAS SW feature
• Routes test to workstation/Automatic reflex, repeat, dilutions	LAS SW feature/LAS SW feature	LAS SW feature/LIS requirement
• Supports multiple hardware config./Supports other proprietary transport. hardware	LAS SW feature/LAS SW feature	LAS SW feature/—
• Storage retrieval & disposal/Supports proposed NCCLS standards	LAS SW feature/LAS SW feature	LAS SW feature/LAS SW feature
LIS interfaces that are live/how LISs are interfaced w/auto. sys.	Cerner, Sunquest, SCC, HBOC, Triple G, Antrim/ASTM, TCP IP	—/—
No. of live sites installed in N. America/Outside N. America	180/700	—/—
Transportation systems available	yes	yes
• Version/conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—/yes/config. dependent; max. 600 samples per hr	—/yes/500
• Supports automatic rerouting for reflex/repeat/dilutions	yes	yes
• Types of containers device can accommodate	16x100, 13x100, 16x75, 13x75	16x100, 13x100, 16x75, 13x75, 11–16.8 mm diam., 110 mm ht.
• Modular hardware/Installed options/Device functions independent of track	yes/floor mounted/yes	yes/floor mounted/—
• Required utilities/Required maintenance	compressed air, electricity/daily, weekly, monthly for analyzers; quarterly, annually for automation	compressed air, electricity/—
• Carrier type/Scalable system	multiple specimen container per carrier/yes	single specimen container per carrier/yes
Automated centrifugation available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	n/a/yes/500
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75, 11–16.8 mm in diam., 110 mm ht.
• For multi-unit centrifuges, each cent. operates independently for rate and time	—	yes
Automated input/accessioning available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	1.08/yes/150 per device per hr x 4	—/yes/500
• Types of containers device can accommodate	13x100, 13x75	16x100, 13x100, 16x75, 13x75, 11–16.8 mm in diam., 110 mm ht.
Automated decapping available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—/yes/500
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75, 11–16.8 mm in diam., 110 mm ht.
Automated sorting available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—/yes/500
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75, 11–16.8 mm in diam., 110 mm ht.
Specimen integrity monitor available	no	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
Automated aliquoting available	no	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—/yes/300 secondary tubes
• Types of containers device can accommodate	—	16x100, 13x100, 16x75, 13x75, 11–16.8 mm in diam., 110 mm ht.
• System inspects samples for bar code/Reports clots/Reports QNS specimens	—	yes/yes/yes
Instrument (analyzer) interfaces		
• Rules-based instrument interface control subsystem	yes	—
• Process control of instrument via control subsystem	yes	—
Physical/hardware (instrument/specimen) interface		
• Hematology/Chemistry/Coagulation	pt.-of-reference sampling/—/pt.-of-reference sampling	—/—/—
• Immunoassay/Urinalysis	—/—	—/—
Instruments to which your system/product is interfaced	Sysmex XE-2100, SE-9500, R-3500, SP-100, CA-1500, & CA-6000	Roche Modular, Konelab, Sysmex & systems capable of picking up samples from the lane on request
Other robotic products/components to which system, product is linked	none	—
Automated recapper available	no	no
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	—	—
• Types of containers device can accommodate	—	—
Automated storage and retrieval available	yes	yes
• Version/Conforms to NCCLS Standards Auto 1-5/Ave. throughput*	PCDPS 1.08/yes/150 per device per hr x 4	—/yes/500
• Types of containers device can accommodate	13x100, 13x75	16x100, 13x100, 16x75, 13x75, 11–16.8 mm in diam., 110 mm ht.
• Refrigeration available	no	no
Longitudinal upgrade pathway or plan to protect users' investments	all upgrades for Sysmex hematology & coagulation analyzers were compatible with the automation and PC-DPS	—
Ave. time to install sys./Who provides service and support/Hrs support is available	1 week/Roche Diagnostics/24/7	2–3 days/local distributor/24/7
On-site biomedical engineer required/user group meets regularly	no/yes	no/no
List price	depends on system configuration	—
Individual list prices for components		
• Process control software/Transportation systems	—	—
• Auto. centrifugation/Auto. input accessioning	—	—
• Auto. decapping/Auto. sorting/Auto. storage & retrieval	—	—
• Specimen integrity monitor/Automated aliquoting	—	—
• Instrument (analyzer) interfaces/Automated recapping	—	—
Distinguishing features	• able to take collected data & turn into usable information • proven implementation within 90 days of receiving purchase order, on-site implementation is successfully completed in one week • successfully provided islands of automation in coagulation & hematology for over 10 years	• modularity—the system can be extended to meet customer needs; both workcell and preanalytical part can be upgraded and linked as needed • multitube carrier with programmable chip • open—can be linked to a variety of different analyzers

* Ave. throughput in specimen containers per hr per device