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High-volume hematology analyzers

Part 1 of 12 <i>See related article, page 32</i>	Abbott Diagnostics Hematology Business Unit 5440 Patrick Henry Dr. Santa Clara, CA 95054 800-933-5535 www.abbott.com	Abbott Diagnostics Hematology Business Unit 5440 Patrick Henry Dr. Santa Clara, CA 95054 800-933-5535 www.abbott.com
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Cell-Dyn 3200 1997/1997 >700/>1,500/\$165,000	Cell-Dyn 3700 1999/1999 >300/>500/\$180,000 SL Model, \$140,000 CS Model
Test menu: All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, •Flags mono, lymph, eos, baso FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	•Chartable standard menu (left) plus: RDW, MPV band #&%, IG #&%, variant lymph #&%, blast #&%, PCT, PDW, NRBC #&%, band, IG, variant lymph, blast, NRBC, NWBC, RRBC, FWBC, RBC morph., high/low interp. message, LRI, URI, LURI, WBC none none none atypical depolarization flag outside U.S. 3-dimensional optical RBC analysis with advanced MCV measurement	standard menu (left) plus: RDW, MPV, retic #&%, IRF band, IG, variant lymph, blast, PCT, PDW, NRBC #&% and retic scatter profile suspect populations, band, blast, variant lymph, IG, NRBC, RRBC, NWBC, LRI, URI, LURI, RBC morph., FWBC, high/low interp. message, WBC none none none none IRF
Differential method(s) used Linearity: Precision: Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC •RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	MAPSS (Multi-Angle Polarized Scatter Sep.) 0-250/0-8 0-25/0-1,750 34-172 (MCV) 2.7%/ 1.5% 1.0%/ 4.0% 1 .0% (MCV) neut #&%: 0.9 5, lymph #&%: 0.94, mono #&%: 0.8 6, eos #&%: 0 .84, baso #&% 0 .73 NRBCs, lytic-resistant RBCs, Plt clumps, cryoglobulin and cryofibrinogen, fragile WBCs elevated WBC count, increased No. of giant Plts, autoagglutination, in vitro hemolysis MCV: elevated WBC count, hyperglycemia, in vitro hemolysis, increased No. of giant Plts WBC fragments, in vitro hemolysis, microcytic RBCs, cryoglobulins, Plt clumping, increased No. giant Plts elevated WBC count, incr. plasma substances (triglycerides, bilirubin, in vivo hemolysis), lyse-resistant RBCs n/a	MAPSS (Multi-Angle Polarized Scatter Sep.) 0-250/0-8 0-24/0-2,000 50-200 (MCV) 2.5%/ 1.5% 1.2%/ 5.0% 1.0 % (MCV) neut #&%: 0 .95, lymph #&%: 0.9 4, mono #&%: 0 .86, eos #&%: 0.84, baso #&%: 0.7 3 NRBCs (WIC only), lytic-resistant RBCs, Plt clumps, cryoglobulin and cryofibrino- gen, fragile WBCs increased No. giant Plts, autoagglutination, in vitro hemolysis MCV: elevated WBC count, increased No. giant Plts, hyperglycemia, in vitro hemolysis WBC fragments, in vitro hemolysis, microcytic RBCs, cryoglobulin, Plt clumps, increased No. giant Plts increased plasma substances (triglycerides, bilirubin, in vivo hemolysis), lyse-resistant RBCs n/a
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended average frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 71/71 6 months verification open & closed/WBC, RBC, Hb, MCV, Plt, MPV 2 levels every 8 hrs/n/a 130 µL/250 µL/1 mL (sample loader) yes no yes yes yes 80/\$125,000	yes 90/90 6 months open & closed/WBC, RBC, Hb, MCV, Plt 2 levels every 8 hrs/n/a 130 µL/355 µL/1.0 mL yes (13x75 mm) yes yes yes (flags only) 80/\$125,000
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 10,000 results 10,000 results 10,000 results yes yes yes yes no yes user or vendor yes yes yes yes	yes yes 10,000 results 10,000 results 10,000 results yes yes yes yes no yes user or vendor yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	proprietary numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast yes package insert; www.e-abbott.com; 800-323-9100 yes; price TBD; proprietary enhanced QC, data archiving, data collation from multiple instruments Lab-Interlink, MDS/AutoLab, Beckman Coulter (planned), Roche (planned), Labotix Codabar, codes 39 & 128, interl. 2 of 5 yes	proprietary numeric and flag results, histograms and scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast yes package insert; www.e-abbott.com; 800-323-9100 yes; price TBD; proprietary enhanced QC, data archiving, data collation from multiple instruments Lab-Interlink (planned), MDS/AutoLab, Beckman Coulter (planned), Roche (planned), Labotix (planned) Codabar, codes 39 & 128, interl. 2 of 5 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	daily: 30 sec; weekly: 5 min; monthly: 10 min yes same day yes/no in development	daily: 30 sec; bi-weekly: 5 min; monthly: 10 min yes same day yes/no in development
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	MAPSS cell-by-cell analysis provides a better diff.; focused flow 2-D optical RBC and Plt analysis provides better separation between microcytic RBCs and large Plts; uses only 3 reagents; 3-D MCV	MAPSS cell-by-cell analysis provides a better diff.; retic with reportable IRF (immature retic. fraction); 60-species veterinary package

Survey editor: Raymond D. Aller, MD



High-volume hematology analyzers

Part 2 of 12 <i>See related article, page 32</i>	Abbott Diagnostics Hematology Business Unit 5440 Patrick Henry Dr. Santa Clara, CA 95054 800-933-5535 www.abbott.com	ABX Diagnostics Inc. Tom Brown tbrown@us.abx.fr 34 Bunsen Irvine, CA 92618 888-903-5001 ext. 535 www.abx.com
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Cell-Dyn 4000 1997/1997 >350/>500/\$250,000	Pentra 60+ Hematology Analyzer 2000/2000 100/300/\$49,500
Test menu: All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso •Flags	standard menu (left) plus: RDW, MPV, NRBC #&%, retic #&%, IRF, CD61 (immuno-Plt), CD 3/4, CD 3/8 (immuno T-cell) #&% for segs., bands, IG, blasts, variant lymph; PDW, PCT, white cell viability fraction (WVF) band, IG, blast, variant lymph, nvWBC, rstRBC, IR, Plt clump, ASYM, high/low interp. msg., PCT, PDW	standard menu (left) plus: RDW, MPV atyp. lymph, atyp. lymph %, LIC, LIC % operator selectable flagging
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	none none none none reportable NRBC #&%, CD61 for Plts, WVF, CD 3/4, CD 3/8 (immuno T-cell)	none none none none none
Differential method(s) used	optical scatter & fluorescence technology	DHSS technology combining cytochemistry, focused flow impedance, & light absorbance principles of measurement
Linearity: •WBC count (10 ⁹ /L)/RBC count (10 ¹² /L) •Hemoglobin (g/dL)/platelet (10 ⁹ /L) •MCV (fL) or Hct (%)	0–250/0–8 1.0–25/0–2,000 37–197 (MCV)	0.1–90/0.5–8.1 2.5–23/10–1,000 10–70 (Hct)
Precision: •WBC count/RBC count •Hb/platelet •MCV or Hct	2.5%/ 1.5% 1.0%/ 4.0% 1.0% (MCV)	<5%/<3% <3%/<8% <3% (Hct)
Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC •RBC •MCV or Hct •Platelet •Hb	%neut 0.94, %lymph 0.93, %mono 0.84, %eos 0.91, %baso 0.40, NRBC/WBC 0.91, retic 0.95 lyse-resistant RBCs, Plt clumps autoagglutinins, cold agglutinins, hemolysis, small leukocytes (in cases where leukocyte count is high [>100 K/ μ L] and MCV is high) MCV: in vitro hemolysis, autoagglutinins, cold agglutinins, hyperglycemia, leukocytosis with macrocy. anemia Plt clumps, WBC & RBC fragments, microcytic RBCs, autoagglutinins, cold agglutinins, Plt satellitosis high lipids (>700 mg/dL), high WBCs (>250 K/ μ L, based on concentrated, normal WBCs), high bilirubin (>33 mg/dL) n/a	neut 0.99, lymph 0.98, mono 0.96, eos 0.89, baso 0.54 NRBCs, Plt clumps, lyse-resistant RBCs cold agglutinins Hct: extreme leukocytosis microcytes, Plt clumps extreme lipemia/leukocytosis
Interfering substances: differential	n/a	NRBC, lyse-resistant RBCs, extreme hyperbilirubinemia
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended average frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 106/106 6 months verification open-closed one proc./WBC, RBC, Hb, MCV, Plt, MPV 2 levels every 8 hrs/n/a 112.5 μ L—aspir. vol./same/387 μ L—dead vol. yes no yes (250 μ L) in Sarstedt Multivette & Becton Dickinson Microtainer tubes yes (flags only) 80/\$125,000	yes 60/60 6 months closed-open/WBC, RBC, Hb, Hct, Plt, MPV per CLIA standards/none 53 μ L/53 μ L/0.5 mL yes (multiple sizes) yes yes no —
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 16,000 results 16,000 results 16,000 results yes yes yes yes yes yes yes yes yes yes yes yes yes yes yes	yes yes, with Hemalink Data Manager unlimited with Hemalink Data Manager 10,000, unlimited with Hemalink Data Manager 10,000, unlimited with Hemalink Data Manager yes yes yes yes yes user yes yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	proprietary numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast; host query for demographics & orders yes www.e-abbott.com; package insert; 800-323-9100 yes; price TBD; proprietary enhanced QC, data archiving, data collation from multiple instruments Lab-Interlink, MDS/AutoLab, Beckman Coulter (planned), Roche (planned), Labotix (planned) Codabar, codes 39 & 128, interl. 2 of 5 yes	ASTM 1394 & 1238, HL7, IEEE MIB numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, LIS to instrument—broadcast yes — yes enhanced QC, data archiving with Hemalink Data Manager no Codabar, codes 39 & 128, ASTM, interl. 2 of 5 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mftr. can perform diagnostics via modem	daily: 30 sec; weekly: 5 min; monthly: 10 min yes same day yes/no in development	weekly: 15 min yes 24 hrs yes/yes yes, with Hemalink Data Manager
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	reportable NRBC count; monoclonal antibody capability; fluorescent random access retic with reportable IRF; WBC viability index; Argon laser	reliable 5-part WBC diff. technology—MTBF over 200 days; small footprint; small sample size of 53 μ L; Hemalink Data Manager

Tabulation does not represent an endorsement by the College of American Pathologists





High-volume hematology analyzers

Part 3 of 12 <i>See related article, page 32</i>	ABX Diagnostics Inc. Tom Brown tbrown@us.abx.fr 34 Bunsen Irvine, CA 92618 888-903-5001 ext. 535 www.abx.com	ABX Diagnostics Inc. Tom Brown tbrown@us.abx.fr 34 Bunsen Irvine, CA 92618 888-903-5001 ext. 535 www.abx.com
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Pentra 120 Retic Hematology Analyzer 1999/1997 18/550/\$125,000	Paros CRP —/80 0/150/\$25,000
Test menu: All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso •Flags	standard menu (left) plus: RDW, IRF, MPV LIC, atyp. lymph, CRC% operator selectable flagging	standard menu (left) plus: CRP on whole blood CRP on whole blood —
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	none none none none none	n/a n/a n/a n/a CRP on whole blood
Differential method(s) used Linearity: •WBC count (10 ⁹ /L)/RBC count (10 ¹² /L) •Hemoglobin (g/dL)/platelet (10 ⁹ /L) •MCV (fL) or Hct (%) Precision: •WBC count/RBC count •Hb/platelet •MCV or Hct	cytochemistry, focused flow impedance, light absorbance 0-150/0.5-8.1 2-25/0-2,000 10-70 (Hct) <5%/<3% <3%/<8% <3% (Hct)	linked to ABX hematology analyzers via Hemalink Data Manager —/— —/— — —/— —/— —
Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC •RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	neut 0.99, lymph 0.99, mono 0.92, eos 0.97, baso 0.71 NRBCs, Plt clumps/lyse-resistant RBCs cold agglutinins Hct: extreme leukocytosis microcytes, Plt clumps extreme lipemia/leukocytosis NRBCs, lyse-resistant RBCs, extreme hyperbilirubinemia	— — — — — —
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended avg. frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 120/120 6 months closed, open/WBC, RBC, Hb, Hct, Plt per CLIA standards/not required 130 µL/200 µL/1 mL yes yes yes yes —/price \$40,000	— CRP 13 tests per hr/— — —/— —/— — — yes no —
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 90,000, unlimited with Hemalink Data Manager 90,000, unlimited with Hemalink Data Manager 90,000, unlimited with Hemalink Data Manager yes yes yes yes yes user yes (operator programmable) no yes yes	yes yes unlimited with Hemalink Data Manager unlimited with Hemalink Data Manager unlimited with Hemalink Data Manager — — — — — — — — — —
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	proprietary, ASTM 1394 & 1238, HL7, IEEE MIB numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument— broadcast; host query for demographics & orders no — yes enhanced QC, data archiving (Hemalink Data Manager), data collation from multiple instruments no Codabar, codes 39 & 128, ASTM, interl. 2 of 5 yes	— — — — yes, ABX Diagnostics enhanced QC, data archiving, data collation from multiple instruments, one interface (LIS) for multiple ABX instruments n/a — —
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mftr. can perform diagnostics via modem	weekly: 10 min; monthly: 10 min yes 4 hrs average, 24 hrs guaranteed yes/yes yes, with Hemalink Data Manager	weekly: 15 min — — — yes
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	automatic repeats for sample verification; MTBF>90 days; small footprint; integrated reticulocyte methodology and slidemaker/stainer; thiazole orange reticulocyte methodology	small sample size (8 µL) whole blood CRP (EDTA tube/serum); combined CBC; diff. and whole blood CRP (no centrifugation required)

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December 2003

High-volume hematology analyzers

Part 4 of 12 <i>See related article, page 32</i>	ABX Diagnostics Inc. Tom Brown tbrown@us.abx.fr 34 Bunsen Irvine, CA 92618 888-903-5001 ext. 535 www.abx.com	ABX Diagnostics Inc. Tom Brown tbrown@us.abx.fr 34 Bunsen Irvine, CA 92618 888-903-5001 ext. 535 www.abx.com
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Pentra 80 2003/2002 30/200/\$70,000	Pentra XL 80 available 2004/4th quarter 2003 0/20/\$90,000
Test menu: •Chartable All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso •Flags	standard menu (left) plus: RDW, MPV atyp. lymph, atyp. lymph%, LIC, LIC% operator selectable flagging	standard menu (left) plus: automatic dilution of overrange results, customized dilution ratio (all parameters), RDW, MPV atyp. lymph, atyp. lymph%, LIC, LIC% operator selectable flagging
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	none none none none none	none none — none customized dilution ratio
Differential method(s) used Linearity: •WBC count (10 ⁹ /L)/RBC count (10 ¹² /L) •Hemoglobin (g/dL)/platelet (10 ⁹ /L) •MCV (fL) or Hct (%) Precision: •WBC count/RBC count •Hb/platelet •MCV or Hct	DHSS technology combining cytochemistry, focused flow impedance & light absorbance principles of measurement 0–120/0–8.9 2–26/0–1.9 million 2–72% (Hct) <2.5%/<2% <1.5%/<5% <2.5% (Hct)	DHSS technology combining cytochemistry, focused flow impedance & light absorbance 0.1–90/0.5–8.1 (CDR extended) 2.5–23/10–1 million (CDR extended) 10–70% (Hct) <5%/<3% <3%/<8% <3% (Hct)
Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC •RBC •MCV or Hct •Platelet •Hb	neut 0.99, lymph 0.99, mono 0.36, eos 0.61 NRBCs, Plt clumps, lyse-resistant RBCs cold agglutinins Hct: extreme leukocytosis microcytes, Plt clumps extreme lipemia, leukocytosis	neut 0.99, lymph 0.98, mono 0.96, eos 0.89, baso 0.54 NRBCs, Plt clumps, lyse-resistant RBCs cold agglutinins Hct: extreme leukocytosis microcytes, Plt clumps extreme lipemia, leukocytosis
Interfering substances: differential	NRBCs, lyse-resistant RBCs, extreme hyperbilirubinemia	NRBCs, lyse-resistant RBCs, extreme hyperbilirubinemia
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended avg. frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 80/80 6 months closed rack/WBC, RBC, Hb, Hct, Plt, MPV per CLIA standards/none 53 µL/53 µL/0.5 mL yes no yes no n/a	yes 80/80 6 months open, closed/WBC, RBC, Hb, Hct, Plt, MPV per CLIA standards/none 30 for CBC/53 for CBC & diff/0.5 mL yes (autoloader 13 x 75; closed tube 16 sizes + micro) yes yes yes —/— (flags only)
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes, with Hemalink Data Manager unlimited with Hemalink Data Manager 10,000 10,000 yes yes yes yes yes yes yes yes yes yes yes —	yes yes, with Hemalink Data Manager unlimited with Hemalink Data Manager; 10,000 instrument only unlimited with Hemalink Data Manager; 10,000 instrument only unlimited with Hemalink Data Manager yes yes yes yes yes user yes yes yes —
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features	proprietary, ASTM 1394 & 1238, HL7, IEEE MIB numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument— broadcast n/a n/a yes (Medicus, Hemalink) enhanced QC, data archiving, data collation from multiple instruments	proprietary, ASTM 1394 & 1238, HL7, IEEE MIB numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument— broadcast n/a n/a yes (Medicus, Hemalink) enhanced QC, data archiving, data collation from multiple instruments
Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	— Codabar, codes 39 & 128, ASTM, interl. 2 of 5 yes	— Codabar, codes 39 & 128, ASTM, interl. 2 of 5 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	weekly: 15 min yes — no/yes yes	weekly: 15 min yes — no/yes yes
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	compact, reliable 5-part diff technology, autoloader, 80 samples per hour	compact 5-art differential instrument with autoloader and auto-dilution capability

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High-volume hematology analyzers

Part 5 of 12 <i>See related article, page 32</i>	ABX Diagnostics Inc. Tom Brown tbrown@us.abx.fr 34 Bunsen Irvine, CA 92618 888-903-5001 x 535 www.abx.com	Bayer Diagnostics Nancy Lavon nancy.lavon.b@bayer.com 555 White Plains Rd. Tarrytown, NY 10591 800-431-1970 www.bayerdiag.com
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Pentra DX120/FDA SUBMISSION PENDING —/— —/—	Advia 120 Hematology System 1998/1998 700/3,000/\$169,000—\$189,000
Test menu: •Chartable All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso •Flags	standard menu (left) plus: NRBCs, reticulocytes — pending 510(k) pending 510(k) pending 510(k) pending 510(k) —	standard menu (left) plus: CHCM, MPV, RDW, HDW, LUC %&#, retic %&#, Chr, CHCMr, MCVr; CSF: WBC, RBC, PMN, MN, neut, lymph, mono %: hypo, hyper, macro, micro; calc. Hb, MPXI; %: blasts, PMN, MN; large Plt count; RBC frag. count; RBC ghost count left shift, atyp. lymph, blasts, immature grans, myeloperox. deficiency, aniso, micro, macro, Hb variation, hypo, hyper, NRBC, RBC frag., RBC ghost, large Plt, Plt clumps none none IRF, MPC, MPM CSF, eos CHCM, HDW, Chr, CHCMr, MPC, MPM; CSF: WBC, RBC, PMN, neut, lymph, mono
Differential method(s) used Linearity: •WBC count (10 ⁹ /L)/RBC count (10 ¹² /L) •Hemoglobin (g/dL)/platelet (10 ⁹ /L) •MCV (fL) or Hct (%) Precision: •WBC count/RBC count •Hb/platelet •MCV or Hct Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances: •WBC •RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	cytochemistry (chlorazolic black) and absorbance to be determined to be determined to be determined to be determined to be determined to be determined pending 510(k) pending 510(k) pending 510(k) pending 510(k) pending 510(k) pending 510(k)	perox—peroxidase cytochem. staining with light scatter & absorption; baso—cytochem. stripping with 2-angle laser light scatter 0.02–400/0–7.0; CSF WBC 0–5,000/μL; CSF RBC 0–1,500/μL 0–22.5 /5–3,500 30–180 (MCV) 2.7%/1.2% 0.93%/2.93% 0.78% (MCV) neut 0.997r, lymph 0.997r, mono 0.943r, eos 0.979r, baso 0.772r, luc 0.944r incomplete RBC lysis (perox only) cold agglutinins, extreme sickle cell none none high WBC, lip., extremely high bili., interfere with cyanmethb. only, none with direct cellular Hb (CHCM) incomplete lysis of RBCs, complete myeloperox. deficiency
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended avg. frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 120/120 6 months open, closed/WBC, RBC, Hb, Hct, Plt, MPV per CLIA standards/none 130 μL/200 μL/1 mL yes no no yes —/—	yes 120/120 6 months open, closed, autosampler/all measured parameters once per shift/not required 157 μL/157 μL/<300 μL (tube size dependent) yes (2, 3, 5, 7 mL—all sizes—open tube) yes yes yes Advia S60, >100/\$35,000
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes unlimited with Hemalink Data Manager; 10,000 instrument only unlimited with Hemalink Data Manager unlimited with Hemalink Data Manager yes yes yes yes yes yes user — yes yes yes	yes no 10,000 samples 10,000 10,000 yes yes yes yes yes user or vendor yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	proprietary, ASTM 1394 & 1238, HL7, IEEE MIB numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument— broadcast n/a n/a yes (Medicus, Hemalink) enhanced QC, data archiving, data collation from multiple instruments — Codabar, codes 39 & 128, ASTM, interl. 2 of 5 yes	proprietary (Spec 79) numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument— broadcast; host query for demographics & orders no online documentation in development MXS (Japan), LabCell (Bayer) Codabar, codes 39 & 128, ASTM, interl. 2 of 5 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	weekly: 15 min yes — no/yes yes	daily: 15 min; weekly: 15 min; monthly: 15 min yes territory dependent yes/no yes
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	high-throughput cell counter with integrated reticulocyte methodology and slidemaker/stainer; fluorescent NRBC counting	unique laser technology provides cellular Hb for RBCs and retics; 2-D Plt analysis that eliminates interference from RBC fragments and exclusion of large Plts; dual WBC counts with a linearity of up to 400,000; CSF assay

Tabulation does not represent an endorsement by the College of American Pathologists



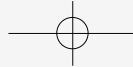


High-volume hematology analyzers

Part 6 of 12 <i>See related article, page 32</i>	Bayer Diagnostics Nancy Lavon nancy.lavon.b@bayer.com 555 White Plains Rd. Tarrytown, NY 10591 800-431-1970 www.bayerdiag.com	Beckman Coulter Inc. Martha M. Diaz/Cellular Analysis Marketing 200 S. Kraemer Blvd. Brea, CA 92822-8000 714-993-8847 www.beckmancoulter.com
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Advia 70 2001/2001 —/—/\$89,000	Coulter LH 700 Series 2001 >700/>1,100/LH 750: \$195,000; LH 755: \$367,500
Test menu: •Chartable All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso •Flags	standard menu (left) plus: RDW, MPV none diff., WBC, N, B, L, RBC, ABN, PL, CI, Plt/RBC	standard menu (left) plus: RDW, MPV, retic %&#, IRF, MPV, graded RBC morph, NRBC %&# — user-definable age-, gender-, &/or location-based ref.; intervals, action & critical limits; user-def. RBC morph.; gradient msgs. (=+, ++, +++); user-selectable sensitivity for diff. abnormal population suspect messages body fluids none none PCT, PDW, high light scatter retics, mean sphered cell volume NRBC, mean sphered cell volume
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	— — — Pct, PDW —	— — — PCT, PDW, high light scatter retics, mean sphered cell volume NRBC, mean sphered cell volume
Differential method(s) used Linearity: •WBC count (10 ⁹ /L)/RBC count (10 ¹² /L) •Hemoglobin (g/dL)/platelet (10 ⁹ /L) •MCV (fL) or Hct (%) Precision: •WBC count/RBC count •Hb/platelet •MCV or Hct Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC •RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	optical & enhanced impedance 0.1–99/0.02–9.99 1.5–30/10–2,000 30–150 (MCV) 2.0%/1.2% 1.0%/3–10% 1.0% (MCV) neut% r>0.9, lymph% r>0.9, mono% >0.7, eos% r>0.8, baso% >0.5 incomplete RBC lysis cold agglutinins extremely high white blood cell count (Hct) RBC fragments lipemia, elevated WBC NRBCs, unlysed RBC, platelet clumps	Coulter's 3-D VCS technology, AccuFlex technology with IntelliKinetics & AccuGate 0–400/0–8.0 0–25/0–3,000 50–200 (MCV) <1.7%/<0.8% <0.8%/<3.3% <0.8% (MCV) lymph%= ±1.5%, neut%= ±2.0%, mono%= ±1.0%, eos%= ±0.5%, baso%= ±0.5% unusual RBC abnormalities that resist lysing, NRBC, frag. WBC, unlysed particle >35 fL, large Plt very high WBC, high conc. large Plt, autoagglutinins MCV & Hct: very high WBC, high conc. large Plt, autoagglutinins very small RBCs & WBC frags. may interfere very high WBC, severe lipemia, heparin, rare lyse-resistant RBCs high triglycerides may affect lysing
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended avg. frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 70/70 every 6 months per governmental requirements open & closed/all measured parameters one level per shift/not required 90 µL/180 µL/120 µL yes (12x75) no yes yes yes Advia S60, >100/\$35,000	yes 105/105 2 times per yr primary/RBC, WBC, Hb, MCV, Plt, MPV once per shift/once per day 200 µL/300 µL/550 µL with slidemaker/1.0 mL yes (multiple sizes & styles) no yes yes, both >250 U.S./\$110,000
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 100,000 100,000 100,000 yes yes yes yes no yes yes yes all results for that sample are transmitted at once yes yes yes	yes yes 20,000 samples 20,000 5,000 yes yes yes yes yes yes yes yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	proprietary, ASTM 1394, E 1381 numeric & flag results, instrument to LIS; patient demographics, orders, LIS to instrument— broadcast — online documentation in development — Codabar, code 39, interl. 2 of 5 yes	RS-232, proprietary numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast no technical support yes enhanced QC, data archiving, common database, extensive decision rules, delta checking Beckman Coulter Codabar, codes 39 & 128, interl. 2 of 5, NW7 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	daily: 0; weekly: 0; monthly: 20 min yes territory dependent yes/no in development	monthly: 2 min yes — yes/no yes
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	microsampling; auto recount; dual WBCs; automatic wakeup and shutdown; no daily or weekly maintenance	extensive decision support; enumeration of NRBCs with every differential; random access; automation ready; extended linearity for WBC and platelets using AccuCount Technology; integrated slidemaker/staining options, ProService

Tabulation does not represent an endorsement by the College of American Pathologists





High-volume hematology analyzers

Part 7 of 12 See related article, page 32	Beckman Coulter Inc. Martha M. Diaz/Cellular Analysis Marketing 200 S. Kraemer Blvd. Brea, CA 92822-8000 714-993-8847 www.beckmancoulter.com	Beckman Coulter Inc. Martha M. Diaz/Cellular Analysis Marketing 200 S. Kraemer Blvd. Brea, CA 92822-8000 714-993-8847 www.beckmancoulter.com
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Coulter Gen•S System 1996 >1,200/>2,000/\$177,500; with slidemaker-stainer, \$327,000	Coulter LH 500 2003/2003 0/0/\$145,000
Test menu: •Chartable All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, •Flags mono, lymph, eos, baso FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	standard menu (left) plus: RDW, MPV, retic #&%, graded RBC morph., MRV, IRF — user-definable age-, gender- &/or location-based ref. intervals, action & critical limits; user-def. RBC morph. gradient msgs. (=+, ++, +++); user-selectable sensitivity for diff. abnormal population suspect messages none — none PCT, PDW, high light scatter retics, mean sphered cell volume mean sphered cell volume	standard menu (left) plus: retic #, retic %, MRV, IRF, RDW, MPV — user-definable age-, gender- &/or location-based ref. intervals, action & critical limits; user-def. RBC morph.; gradient msgs. none none none PCT, PDW none
Differential method(s) used Linearity: •WBC count (10 ⁹ /L)/RBC count (10 ¹² /L) •Hemoglobin (g/dL)/platelet (10 ⁹ /L) •MCV (fL) or Hct (%) Precision: •WBC count/RBC count •Hb/platelet •MCV or Hct Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC •RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	Coulter's 3-D VCS technology, AccuFlex technology with IntelliKinetics & AccuGate 0-140/0-8.0 0-25/0-1,500 50-200 (MCV) <1.7%/<0.8% <0.8%/<3.3% <0.8% (MCV) lymph%= ±3.0%, mono%= ±2.0%, neut%= ±3.0%, eos%= ±1.0%, baso%= ±1.0% unusual RBC abnormalities that resist lysing, NRBC, frag. WBC, unlysed particle >35 fL, large Plt very high WBC, high conc. large Plt, autoagglutinins MCV & Hct: very high WBC, high conc. large Plt, autoagglutinins very small RBCs & WBC frags. may cause no-fit very high WBC, severe lipemia, heparin, rare lyse-resistant RBCs high triglycerides may affect lysing	Coulter's 3-D VCS technology, AccuGate 500 Reaction Manager 0-200/0-8.0 0-25/0-2,000 50-150 (MCV) 2.5%/ 2.0% 1.5%/ 5.0% 2% (MCV) lymph ±1.5% mean diff.; mono ±1.5% mean diff.; neut ±2.0% mean diff.; baso ±0.5% mean diff.; eos ±0.5% mean diff. none none none none not designated
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended average frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 105/105 2 times per yr primary/RBC, WBC, Hb, MCV, Plt, MPV once per shift/once per day 200 µL/300 µL/550 µL with slidemaker/1.0 mL yes (multiple sizes & styles) no yes yes, both >200 U.S./—	yes 75/75 2 times per yr CBC/RBC, WBC, Hb, MCV, Plt, MPV not designated/once per day 125 µL/185 µL/tube dependent yes (10.25 x 75 mm or less; 13 x 75 mm or less) no yes no —
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 20,000 samples 20,000 5,000 yes yes yes yes yes yes yes yes yes yes yes yes yes yes	yes yes 20,000 5,000 yes yes yes yes yes yes yes yes yes yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	RS-232, proprietary numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast no technical support yes enhanced QC, data archiving, common database, extensive decision rules, delta checking — Codabar, codes 39 & 128, interl. 2 of 5, NW7 yes	RS-232, proprietary numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast no technical support yes (Orchard) enhanced QC, data archiving, data collation from multiple instruments, common database, extensive decision rules, delta checking — Codabar, codes 39 & 128, ASTM, interl. 2 of 5, NW7 —
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	monthly: 2 min yes — yes/no yes	none yes — yes/no yes
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	VCS technology; lowest review rate in class; no daily maintenance; triplicate counting; aperture burn circuit; sweepflow; SmartStart, AccuGate, AccuFlex, IntelliKinetics application; WBC in near native state; 3-D diff. display; online training and help	extensive decision support, extended linearity for WBC & Plt, lowest review rate in class, small footprint, superior reliability

Tabulation does not represent an endorsement by the College of American Pathologists



High-volume hematology analyzers

Part 9 of 12 <i>See related article, page 32</i>	Beckman Coulter Inc. Martha M. Diaz/Cellular Analysis Marketing 200 S. Kraemer Blvd. Brea, CA 92822-8000 714-993-8847 www.beckmancoulter.com	Sysmex America Inc. Barb Connell 1 Nelson C. White Pkwy. Mundelein, IL 60060 800-379-7639 www.sysmex.com/usa
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Coulter Ac•T 5diff Family; Ac•T 5diff AL 2001/2000; 2003/2003 400/600/\$43,500 cap pierce model; \$38,500 open vial model; AL: 30/—; \$54,500 autoloader	Sysmex XE-2100 2000 400/1,700/\$225,000
Test menu: All instruments have: WBC, RBC, Hb, Hct, MCV, MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso •Chartable •Laboratory •Flags	standard menu (left) plus: RDW, MPV atyp. lymph. # (ATL#), atyp. lymph % (ATL%), immature cells # (IMM#), immature cells % (IMM%), PCT, PDW complete operator selectable flagging	standard menu (left) plus: NRBC %&#, retic %&#, RDW-SD, RDW-CV, IRF, Plt-O, HPC#, MPV, IG%, IG# none Plt clumps, RBC agglut, turbidity, WBC ABN scattergram, RBC ABN distrib., Plt ABN distrib., RBC lye resistance, blasts, immature grans, left shift, atyp. lymph., ABN lymph./blast., ret. ABN scattergram none none RET-Y, body fluids P-LCR, PCT, PDW NRBC, HPC#, IG%, IG#
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	none none none PCT, PDW, IMM, ATL none	none none RET-Y, body fluids P-LCR, PCT, PDW NRBC, HPC#, IG%, IG#
Differential method(s) used Linearity: Precision: Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances: •WBC •RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	A•V technology combining cytochemistry, focused flow impedance, and light absorbance principles of measurement 0.4–91.3/0.23–7.7*; AL: 0.4–120.0/0.3–8.0 0–22/3.3–1,017*; AL: 1.3–24.0/10.0–1,000 1.8–63.8 (Hct)* <2%/<2% <1%/<5% <1.0% (MCV); AL: <2.0% (MCV) not available in NCCLS H-20A format NRBCs, Plt clumps, large Plts, lyse-resistant RBCs cold agglutinins, Plt clumps, WBC overlinearity Hct: lipemic samples, high WBC, cold aggluts RBC and WBC fragments elevated WBC, lipemia lyse-resistant RBCs, NRBCs, lipemia	fluorescent flow cytometry, RF/DC detecting method 0–170/0–8 0–25/0–5,000 0–60 (Hct) <3%/<1.5% <1.0%/<4.0% <1.0% (Hct) neut% R=0.95, lymph% R=0.95, mono% R=0.79, eos% R=0.92, baso% R=0.82, NRBC% R=0.96 cold agglut., Plt aggreg., nucl. RBCs, cryoglob., lyse-resistant RBCs cold agglut., severe microcytosis, frag. RBCs, large No. giant Plts, in vitro hemolysis Hct: cold agglutinins, leukocytosis (>100,000/ μ L), ABN red cell fragility, spherocytosis pseudothrombocytopenia, Plt aggreg., incr. microcytosis, megalocytic Plts lipemia, ABN proteins in blood plasma, severe leukocytosis (>100,000/ μ L) lyse-resistant RBCs
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended average frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 60/60; 80/80 not designated by time open/RBC, WBC, Hb, Hct, Plt daily/none 30 μ L for CBC/30 μ L/varies by tube size; 53 μ L for CBC-diff/53 μ L for CBC-diff./varies by tube size yes (multiple sizes) no yes no n/a	yes 150/150 annually open, closed, capillary/WBC, RBC, Hb, Hct, Plt per CLIA requirements/not required 130 μ L/200 μ L/1 mL yes no yes yes with Alpha or HST upgrade >1,000
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes no 10,000 samples 10,000 10,000 yes yes yes yes no yes user or vendor yes, through user-defined criteria no yes yes	yes yes 10,000 samples 10,000 10,000 yes yes yes yes yes user or vendor yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	proprietary; proprietary ASTM numeric & flag results, histograms & diff. plots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast no technical support yes enhanced QC, data archiving, common database, optional data mgmt., extensive decision rules, delta checking no Codabar, codes 39 & 128, interl. 2 of 5, EAN 8 & 13 yes	RS-232C/TCP IP numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast; host query for patient demographics & orders — — yes, proprietary enhanced QC, data archiving, data collation from multiple instruments, online QC Roche, Labotix, IDS, A&T Codabar, codes 39 & 128, interl. 2 of 5, ITF, NW7, EAN 8 & 13 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	none yes — yes/no no	daily: 15 min walkaway yes territory dependent yes/no yes
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	quant. 5-part WBC diff.; aspirates only 30 μ L of sample; requires small space footprint and runs quietly; AL has auto repeat based on decision rules * linearity stated for Ac•T 5diff CP	enumeration of NRBCs; throughput of 150 CBCs per hour; random access; discrete testing; extended linearities; HPC testing; online QC; remote diagnostics, IG enumeration

Tabulation does not represent an endorsement by the College of American Pathologists

High-volume hematology analyzers

Part 10 of 12 <i>See related article, page 32</i>	Sysmex America Inc. Barb Connell 1 Nelson C. White Pkwy. Mundelein, IL 60060 800-379-7639 www.sysmex.com/usa	Sysmex America Inc. Nilom Patel 1 Nelson C. White Pkwy. Mundelein, IL 60060 800-379-7639 www.sysmex.com/usa
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Sysmex XE-2100L 2001 75/200/\$200,000	Sysmex XE-Alpha N/HST-N 2000 >1,000 worldwide/\$360,000–\$1,000,000
Test menu: •Chartable All instruments have: WBC, RBC, Hb, Hct, MCV, •Laboratory MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso •Flags	standard menu (left) plus: MPV, RDW-SD, RDW-CV, NRBC %&#, HPC#, IG%, IG# none Pit clumps, Pit ABN distribution, WBC ABN scattergram, blast imm. gran., left shift, atyp. lymph., ABN lymph./blasts, RBC ABN distribution, RBC lyse resistance, RBC agglut., turbidity none none RET-Y, body fluids P-LCR, PCT, PDW HPC#, NRBC, IG%, IG#	standard menu (left) plus: NRBC %&#, retic %&#, RDW-SD, RDW-CV, IRF, Plt-O, HPC#, MPV, IG%, IG# none Pit clumps, RBC agglut., turbidity, WBC ABN scattergram, RBC ABN distrib., Pit ABN distrib., RBC lyse resistance, blasts, immature grans., left shift, atyp. lymph., ABN lymph./blast, ret. ABN scattergram none none RET-Y, body fluids P-LCR, PCT, PDW NRBC, HPC#, IG%, IG#
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	none none RET-Y, body fluids P-LCR, PCT, PDW HPC#, NRBC, IG%, IG#	none none RET-Y, body fluids P-LCR, PCT, PDW NRBC, HPC#, IG%, IG#
Differential method(s) used Linearity: •WBC count (10⁹/L)/RBC count (10¹²/L) •Hemoglobin (g/dL)/platelet (10⁹/L) •MCV (fL) or Hct (%) Precision: •WBC count/RBC count •Hb/platelet •MCV or Hct	fluorescent flow cytometry, RF/DC detecting method 0–170/0–8 0–25/0–5,000 0–60 (Hct) 3% / 1.5% 1.0% / 4.0% 1 .0% (Hct)	fluorescent flow cytometry, RF/DC detecting method 0–170/0–8 0–25/0–5,000 0–60 (Hct) <3% / <1.5% <1.0% / <4.0% <1.0% (Hct)
Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC •RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	neut% R=0.95, lymph% R=0.96, mono% R=0.79, eos% R=0.92, baso% R=0.82, NRBC% R=0.96 cold agglut., Pit aggreg., cryoglob., lyse-resistant RBCs, NRBCs cold agglut., severe microcytosis, frag. RBCs, leukocytosis (>100,000/ μ L) Hct: cold agglut., ABN red cell fragility, spherocytosis, leukocytosis (>100,000/ μ L) pseudothrombocytopenia, Pit aggreg., incr. microcytosis, megaloblasts lipemia, ABN proteins, leukocytosis (>100,000/ μ L) lyse-resistant RBCs	neut% R=0.95, lymph% R=0.95, mono% R=0.79, eos% R=0.92, baso% R=0.82, NRBC% R=0.96 cold agglut., Pit aggreg., nucl. RBCs, cryoglob., lyse-resistant RBCs cold agglut., severe microcytosis, frag. RBCs, large No. giant Plts, in vitro hemolysis Hct: cold agglut., leukocytosis (>100,000/ μ L), ABN red cell fragility, spherocytosis pseudothrombocytopenia, Pit aggreg., incr. microcytosis, megalocytic Plts lipemia, ABN proteins in blood plasma, severe leukocytosis (>100,000/ μ L) lyse-resistant RBCs
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended average frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 150/150 annually open, closed, capillary/WBC, RBC, Hb, Hct, Plt per CLIA requirements/not required 130 μ L/200 μ L/1 mL yes no yes yes with Alpha or HST upgrade >1,000	yes 150/150 per analyzer on automation system annually open, closed, capillary/WBC, RBC, Hb, Hct, Plt per CLIA requirements/not required 130 μ L/200 μ L/1 mL yes no yes yes
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 10,000 samples 10,000 samples 10,000 yes yes yes yes yes yes yes yes yes yes yes yes yes yes	yes yes 10,000 samples 10,000 10,000 yes yes yes yes yes yes yes yes yes yes yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	RS-232C, TCP IP numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast; host query for patient demographics & orders no n/a yes, proprietary enhanced QC, data archiving, data collation from multiple instruments, online QC Roche, Labotix, A&T, IDS Codabar, codes 39 & 128, interl. 2 of 5, ITF, NW7, EAN 8 & 13 yes	RS-232C, TCP IP numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast; host query for patient demographics & orders — n/a yes, proprietary enhanced QC, data archiving, data collation from multiple instruments, online QC Roche, Labotix, IDS, A&T Codabar, codes 39 & 128, interl. 2 of 5, ITF, NW7, EAN 8 & 13 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	daily: 15 min walkaway yes territory dependent yes/no yes	daily: 15 min walkaway yes territory dependent yes/no yes
Acquisition program based on cost-per-reportable result	yes	yes
Distinguishing features	remote diagnostics; online QC; random access; HPC testing; 150 CBC per hour throughput; discrete testing; NRBC enumeration, IG enumeration	multiple configurations available as are all distinguishing features of the XE-2100

Tabulation does not represent an endorsement by the College of American Pathologists

High-volume hematology analyzers

Part 11 of 12	Sysmex America Inc. Peggy Barranco 1 Nelson C. White Pkwy. Mundelein, IL 60060 800-379-7639 www.sysmex.com/usa
See related article, page 32	
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Sysmex XT-2000i 2002 150/500/\$145,000
Test menu: All instruments have: WBC, RBC, Hb, Hct, MCV, •Flags MCH, MCHC, Plt, %&# neut, mono, lymph, eos, baso	standard menu (left) plus: retic %&#, IRF, Plt-O, MPV, RDW-SD, RDW-CV none Plt clumps, Plt ABN distribution, WBC ABN scattergram, blast imm. gran., left shift, atyp lymph., ABN lymph./blasts, RBC ABN distribution, RBC lyse resistance, RBC agglut., turbidity, ret ABN scattergram, NRBC
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	none none none IG%&# Plt-O
Differential method(s) used Linearity: Precision: Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances: •WBC	fluorescent flow cytometry 0-310/0-8 0-25/0-2,000 0-60 (Hct) 3.0%/ 1.5% 1.5%/ 4.0% 1.5% (Hct) neut% R=0.95, lymph% R=0.96, mono% R=0.90, eos% R=0.94, baso% R=0.76 cold agglut., Plt aggreg., cryoglob., lyse-resistant RBCs, NRBCs
•RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	cold agglut., severe microcytosis, frag. RBCs, leukocytosis (>100,000/ μ L) Hct: cold agglut., ABN red cell fragility, spherocytosis, leukocytosis (>100,000/ μ L) pseudothrombocytopenia, Plt aggreg., incr. microcytosis, megakaryoblasts lipemia, ABN proteins, leukocytosis (>100,000/ μ L) lyse-resistant RBCs
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended average frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 80/80 annually open, closed, capillary/WBC, RBC, Hb, Hct, Plt per CLIA requirements/not required 85 μ L/150 μ L/1 mL yes no yes no —
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 10,000 samples 10,000 samples 10,000 yes yes yes yes yes yes yes yes yes yes yes yes
LIS interface formats supported Information transferred on LIS interface LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features Interface avail. or planned to auto. specimen-handling system Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	RS-232C, TCP IP numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast; host query for patient demographics & orders no n/a yes, proprietary enhanced QC, data archiving, data collation from multiple instruments, online QC Roche, Labotix, A&T, IDS Codabar, codes 39 & 128, interl. 2 of 5, ITF, NW7, EAN 8 & 13 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	daily: 15 min walkaway yes territory dependent yes/no yes
Acquisition program based on cost-per-reportable result	yes
Distinguishing features	remote diagnostics; online QC; random access; fluorescent optical platelets; discrete testing

Tabulation does not represent an endorsement by the College of American Pathologists

Coulter principle: from the bas

Terri Yablonsky Stat

Two brothers' experimentation in a Chicago basement laboratory half a century ago yielded a discovery so far-reaching that it revolutionized the hematology industry and ushered in a new era in laboratory medicine.

In 1949, Wallace Coulter formulated the Coulter principle, an automated electronic method for counting and sizing microscopic particles, including blood cells. Based on the simple premise of passing cells through a sensing aperture, the Coulter principle has become the accepted reference method for modern hematology analyzers worldwide because of its precision and accuracy.

The discovery of a new way to count cells was groundbreaking—it eliminated the labor-intensive and often imprecise process of visually counting cells using blood stains, glass slides, and microscopes. The technology would hold promise for medical and industrial applications.

In 1953, the Coulter principle was patented, and eventually Wallace and his younger brother, Joseph, launched the Coulter Counter Model A analyzer, the world's first automated blood cell counter using the Coulter principle.

Since then, the technology has been the catalyst for many developments in laboratory medicine, including the use of new blood parameters like platelets, reticulocyte and nucleated red blood cell counts, and the automated white blood cell differential.

This year marks the golden anniversary of the patent of the Coulter principle, a discovery that remains as important today as it was 50 years ago.



Dr. Houwen

"The machinery around the Coulter has changed enormously, the actual aperture used by the Coulter has changed enormously, but the principle itself has stayed the same and forever changed the world of medicine," says Berend Houwen, MD, PhD, corporate medical director for Beckman Coulter and clinical associate professor of pathology at Loma Linda (Calif.) Medical

School.

A major innovation stemming from this technology was the multichannel analyzer, Dr. Houwen says. "At first, you could only count one cell type at a time. With the multichannel analyzer, you could combine cell types in one box and it would give you the entire picture of what was happening in somebody's blood in less than two minutes.

"In 50 years, we've seen a complete revolution in terms of what people do in the hematology laboratory," Dr. Houwen continues. "Whereas they used to do everything by hand with a microscope, now three quarters or more of specimens can be validated automatically."

Dr. Houwen credits laboratory staff with viewing the technology as a benefit rather than a hindrance. "That is due in part to organizations, such as the CAP, that compare results in quality assurance," he says. "It's obvious that automation leads to better results than manual counting."

The first users of this technology were extremely skeptical, Dr. Houwen says. But while there were early doubters, "there were also early adopters, such as Drs. John Koepke and Robert Pierre," he adds. "They never wavered in their conviction that this technology was better than counting cells by hand—not only faster but more accurate and reliable."

Robert Pierre, MD, completed his training in hematology at Northwestern University Medical School (now the Feinberg School of Medicine), Chicago. "Technologists performed all of our blood counts under the microscope using hemocytometer counting chambers, which is very tedious and not that

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accurate," he says.

"Wallace and Joseph Coulter brought one of their first instruments to the VA hospital in Chicago. Our technologists tried it out and didn't like it. They put it under the counter and didn't use it," he chuckles.

It soon became obvious that this type of cell counting was easier, faster, and more accurate, Dr. Pierre says.

When he began to manage the hematology laboratory at the Mayo Clinic, Rochester, Minn., his staff used the Coulter Counter Model A, which had a single adjustable threshold to separate cells from noise. Red and white cells had to be counted individually. The next significant advance, the Model B, was a dual-threshold instrument that allowed the user to count platelets.



Dr. Pierre

"We eventually purchased the Coulter Model S, which combined cell counting in one automated instrument," Dr. Pierre says. It could aspirate and dilute blood and divide the sample into a red blood cell count and a white blood cell count, as well as measure hemoglobin. "This advance made a dramatic difference in cell counting in hematology labs in the accuracy of results and the ease with which people could do it," he says.

"Laboratory hematologists, technologists, physicians, and especially patients have all benefited tremendously from Wallace Coulter's efforts," Dr. Pierre adds.

John A. Koepke, MD, professor emeritus of pathology at Duke University, Durham, NC, purchased a Coulter Counter Model A while at the University of Kentucky Medical Center, Lexington, in the mid-1960s. "We purchased the Model A because of its improved technology," he says.

Dr. Koepke was a member of a CAP Surveys committee in hematology and blood banking. "In 1965," he notes, "we published the first monograph on performance in hematology and blood banking. It became apparent that one third of laboratories used Coulter counters and the other two thirds used old-fashioned hand counts under the microscope.

By 1965, Coulter was getting a real chunk of the market share because of its improved precision and speed of counting."

Another benefit of the Coulter counter was its cost savings in staff. People who are less well trained can operate these automated instruments, Dr. Koepke says.

"This discovery began the march toward significant automation in hematology and allowed for tremendous increases in the productivity of laboratories faced with significant decreases in available technologists," he adds.

Wallace Coulter was diligent in maintaining relationships with customers and advancing the field of hematology, Dr. Koepke recalls. "When I was at Duke University, we asked Coulter to sponsor the first international conference on advances in laboratory hematology. Forty people from all over the world attended, including Wallace, who sponsored the travel of all these people to Durham." The papers presented at this conference were published in *Clinical Laboratory Hematology* in 1990.

Coulter Corp., acquired by Beckman Instruments in 1997, became Beckman Coulter Inc. The legacy of the Coulter brothers lives on with each new hematology advance and improvement in clinical diagnostics and medical research. □



Dr. Koepke

High-volume hematology analyzers

Part 12 of 12	Sysmex America Inc. Peggy Barranco 1 Nelson C. White Pkwy. Mundelein, IL 60060 800-379-7639 www.sysmex.com/usa
See related article, page 32	
Name of instrument First year sold—installed in U.S./outside U.S. No. units installed in U.S./outside U.S./list price	Sysmex XT-1800i 2002 100/200/\$125,000
Test menu: All instruments have: WBC, RBC, Hb, Hct, MCV, Flags MCH, MCHC, Plt, % neut, eos, baso	•Chartable •Laboratory standard menu (left) plus: MPV, RDW-SD, RDW-CV none Pit clumps, Pit ABN distribution, WBC ABN scattergram, blast imm. gran., left shift, atyp. lymph., ABN lymph./blasts, RBC ABN distribution, RBC lyse resistance, RBC agglut., turbidity, NRBC
FDA-cleared tests but not clinically released Tests not available but submitted for clearance Tests in development For research-use-only Tests unique to analyzer	none none none IG%& —
Differential method(s) used Linearity: Precision: Accuracy of automated diff. compared with manual diff., per NCCLS H-20A Interfering substances:•WBC	fluorescent flow cytometry 0-310/0-8 0-25/0-2,000 0-60 (Hct) 3.0%/ 1.5% 1.5%/ 4.0% 1.5% (Hct) neut% R=0.95, lymph% R=0.96, mono% R=0.90, eos% R=0.94, baso% R=0.76 cold agglut., Pit aggreg., cryoglob., lyse-resistant RBCs, NRBCs
•RBC •MCV or Hct •Platelet •Hb Interfering substances: differential	cold agglut., severe microcytosis, frag. RBCs, leukocytosis (>100,000/μL) Hct: cold agglut., ABN red cell fragility, spherocytosis, leukocytosis (>100,000/μL) pseudothrombocytopenia, Pit aggreg., incr. microcytosis, megakaryoblasts lipemia, ABN proteins, leukocytosis (>100,000/μL) lyse-resistant RBCs
Age- and sex-specific reference ranges Max. CBCs per hr/max. CBCs & diffs. per hr Recommended average frequency of calib. •Modes calibrated/parameters calibrated Frequency of blood/latex controls Min. specimen vol. open/closed/sample dead vol. closed Tube sampling supported Veterinary capability Microsample capability Prepares microscopic slides automatically or flags problems for slide prep If auto. slidemaker available, No. installed/list price	yes 80/80 annually open, closed, capillary/WBC, RBC, Hb, Hct, Plt per CLIA requirements/not required 85 μL/150 μL/1 mL yes no yes no —
Archives patient data for later comparison Patient-specific archiving Max. archived data accessible when system online Memory capacity—numeric results—No. specimens Memory capacity—histo/cytograms—No. specimens •Stored in conjunction with CBC data •Histo/cytogram images & CBC data printed as 1 report Saved results can be recalled and retransmitted Saved data can be sorted for reprocessing or report transmission Performs delta checks Tags and holds results for followup, confirm. testing, or rerun Parameters for flags for holding samples are defined by Some results can be transmitted to LIS while others held Scattergram display: cell-specific color Histogram display: color with threshold Choice of desired specimen &/or result info. displayed	yes yes 10,000 samples 10,000 samples 10,000 yes yes yes yes yes yes yes yes yes yes yes yes
LIS interface formats supported Information transferred on LIS interface	RS-232C, TCP IP numeric & flag results, histograms & scatterplots, instrument to LIS; patient demographics, orders, LIS to instrument—broadcast; host query for patient demographics & orders
LOINC codes transmitted with results How labs get LOINC codes for reagent kits Optional data mgmt. or collation system • Software features	no n/a yes, proprietary enhanced QC, data archiving, data collation from multiple instruments, online QC
Interface avail. or planned to auto. specimen-handling system	Roche, Labotix, A&T, IDS
Bar-code symbologies read on tube Accommodates bar-code placement per NCCLS standard Auto2A	Codabar, codes 39 & 128, interl. 2 of 5, ITF, NW7, EAN 8 & 13 yes
Time required for maintenance by lab personnel Onboard maintenance records Time from communication of problem to engineer on site Onboard diagnostics/limited to software problems Mfr. can perform diagnostics via modem	daily: 15 min walkaway yes territory dependent yes/no yes
Acquisition program based on cost-per-reportable result	yes
Distinguishing features	remote diagnostics; online QC; random access; discrete testing

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