

# H50V veterinary hematology system

Hematology analysis provides a cost-efficient tool for animal health screenings and disease investigations. The H50V provide you with a broad hematology test menu, in-house, for more confident decision making. Built on reliable technology, the H50V allow you to leverage high-quality diagnostics, while keeping costs to a minimum. Equipped with 13 pre-defined animal profiles, it offers a flexible system for many types of veterinary clinics and laboratories:

- 5-part white blood cell differential results in less than 1 minute.
- Compact and easy to use with intuitive touch screen interface.
- Laser flow cytometry, impedance and colorimetry technology.

## System overview

H50V is an automated veterinary hematology analyzer designed to meet the needs of various-sized laboratories and veterinary hospitals (Fig 1).

The analyzer employs well-proven measurement technologies, using an impedance module for RBC and PLT counts, laser-based flow cytometry for WBC differential, and transmission colorimetry for Hemoglobin (HGB) determination. The unit includes a volumetric metering unit that controls the sample size passing through the pore during counting to obtain precise quantitative results. The volumetric metering unit comprises a metering tube and two photoelectric sensors.

Operation of the H50V is performed via a 10.4 inch touch screen with intuitive user interface. The analyzer provides quantitative analysis results for up to 34 parameters, including 25 standard parameters and 9 for extended research use. Results include 2 scatter diagrams for WBC differential and 2 histograms for RBC and PLT counts. Sample results are stored in database that covers up to 200 000 samples. The sample analysis software displays summarized information messages related to possible pathology that might be



Fig 1. H50V veterinary hematology analyzer.

present in the sample. To facilitate sample preparation the unit include a built-in blood tube mixer for 6 tubes of 3 different sizes.

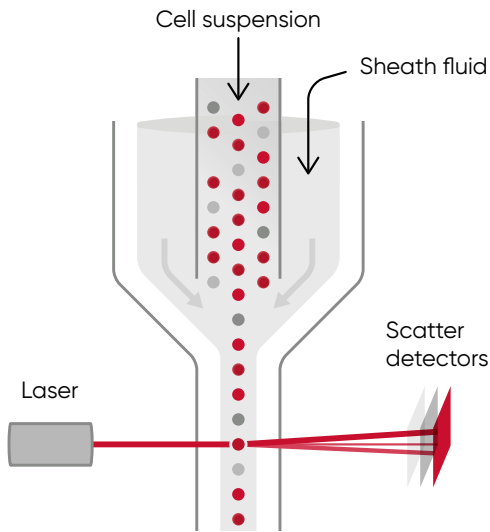
## Key components

### WBC laser channel

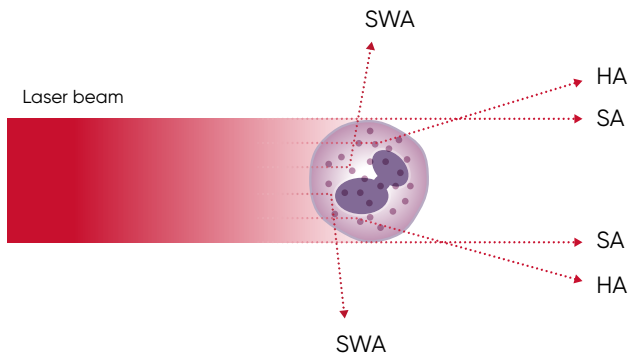
The analyzer utilizes a laser-based flow cytometry method for total white blood cell (WBC) count, and differential count of the subpopulations— neutrophils (NEU), lymphocytes (LYM), monocytes (MON), eosinophils (EOS), and basophils (BASO).

During analysis, a laser beam passes through the sample, and when a cell passes through the sensing zone, the light is scattered and measured by a photoconductor (Fig 2). The photoconductor converts the light into an electrical impulse and the number of generated impulses correlates with the number of cells, whereas the light scatter is used to determine cell granularity and shape.

The measurements are based on cell size and complexity (granularity) and detected using three angles: Small Angle (SA), High Angle (HA) and Super Wide Angle (SWA), (Fig 3).



**Fig 2.** Laser optic principle with blood sample, sheath fluid, laser, and detectors.

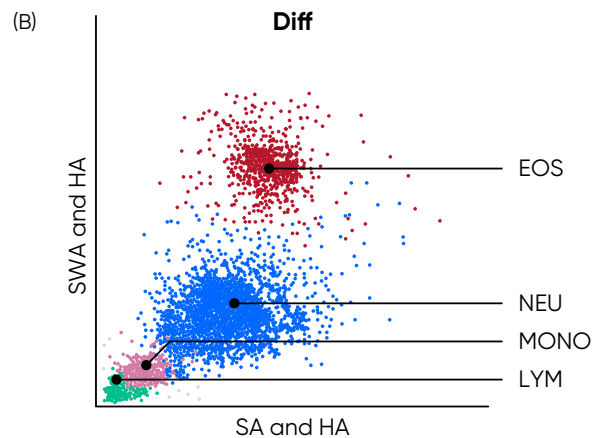
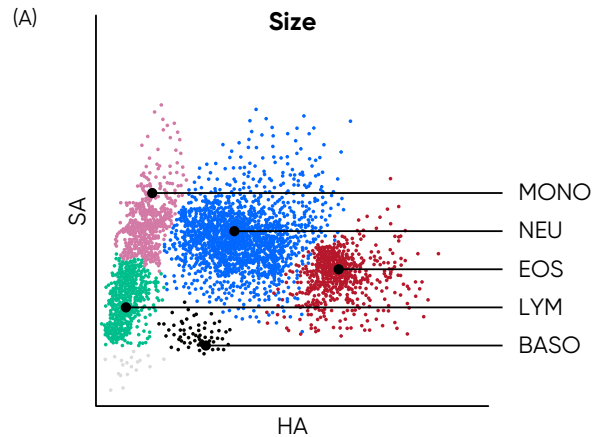


**Fig 3.** Laser detection angles.

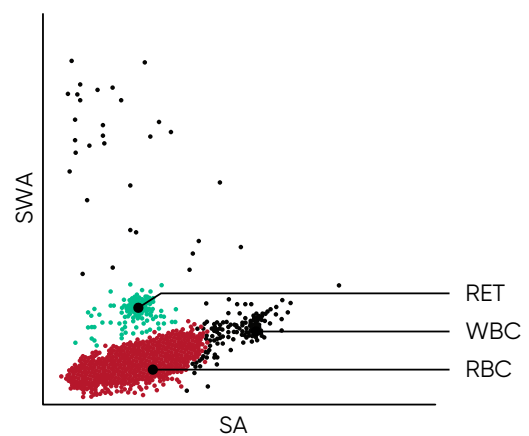
Optical detections are displayed in two scatter diagrams, where each dot represent a counted cell.

The Scatter diagram 'Size' is displaying detected light in angles relating to size SA on Y-axis, compared to detected light in HA on X-axis. The 'Diff' graph displays a projection of detection in all angles, comparing signal from SWA and HA on Y-axis, to the signal from SA and HA on X-axis. The scatter diagrams provide a snapshot of cellular morphology, with green dots representing lymphocytes, pink monocytes, blue neutrophils, black basophils and red eosinophils. The displayed gray area represents ghost cells, red blood cells dissolved into pieces. Examples of scatter graphs are displayed in Figure 4

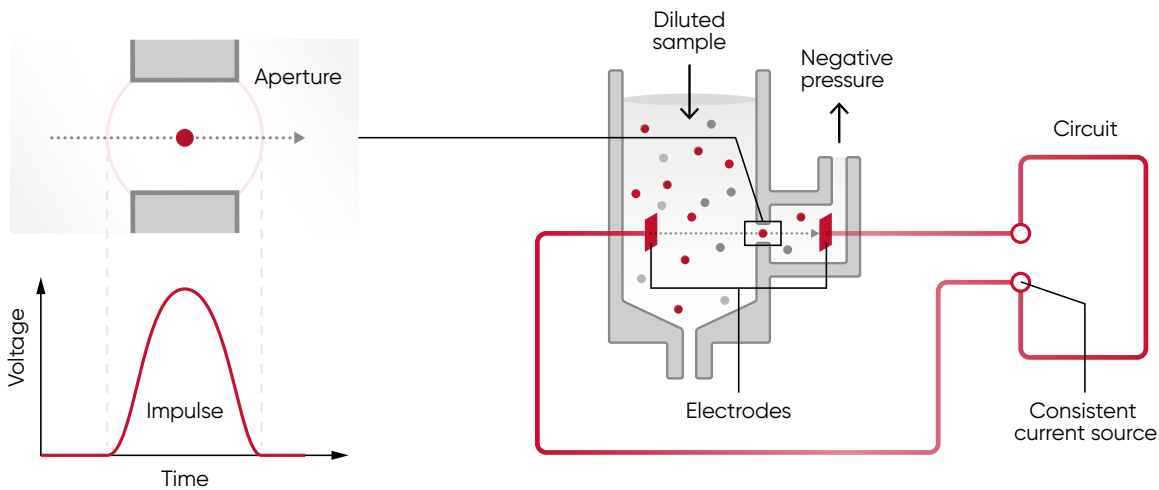
The analyzer also includes a semi-automated reticulocyte detection function using laser channel that can be used as research guideline complementing manual smear counts. For this function, the blood sample is added to an external reticulocyte test tube that stains the RNA present in the immature reticulocytes, making them detectable by the laser function. The Reticulocyte laser channel detection is displayed in separate scatter plot (Fig 5)



**Fig 4.** Scatter diagrams, plotting cell populations size and complexity.



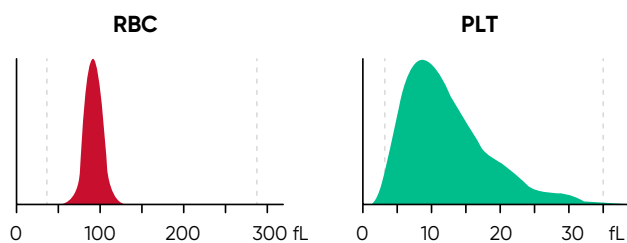
**Fig 5.** Scatter diagram plotting Retics and mature RBCs.



**Fig 6.** The principle for measuring changes in the electrical impedance produced by a cell passing through an aperture.

### RBC chamber

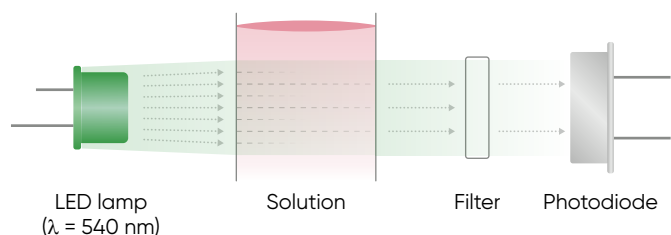
H50V uses an impedance method for the red blood cell (RBC) and platelet (PLT) counts (Fig 6). With impedance, each cell that passes through the aperture causes a drop in the electrical current (a pulse). The number of generated pulses correlates with the number of cells, while the size of the pulse is related to the cell size. RBC and PLT counts are displayed in histograms (Fig 7).



**Fig 7.** Results for red blood cell (RBC) and platelet (PLT) counts are visualized in histograms

### HGB chamber

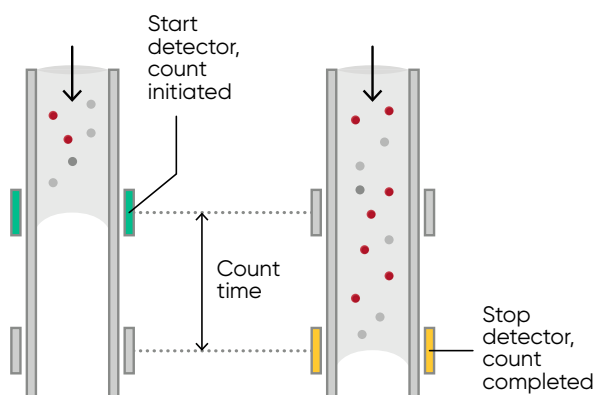
To determine HGB concentration, the reagent lyses the RBCs so that HGB is released and can be measured using transmission colorimetry. Light emitted by a LED lamp is allowed to pass the flow chamber, and the transmitted light is detected by an optical sensor mounted on the opposite side. Hemoglobin concentration is proportional to the absorbance at 540 nm wavelength (Fig 8).



**Fig 8.** HGB is determined with colorimetry using detection at 540 nm.

### Volumetric metering unit

The analyzer's impedance units include a volumetric metering unit that ensures an exact volume is used in each quantitative measurement. The unit includes a metering tube and two photoelectric sensors that control the start and stop of counting cycle (Fig 9).



**Fig 9.** Impedance modules include volumetric measuring unit which using the detectors ensure a precise volume is used each measurement.

### Reagents

The use of custom designed reagents supplied by Boule Diagnostics ensures analytical quality and performance of the hematology system.

The H50V uses three reagents for WBC, RBC and HGB parameter detection: Lyse, Diluent and Sheath. Diluent is a transparent isotonic fluid used to dilute the blood cells prior to counting and classification. The Lyse reagent lyses RBC and forms a stable complex with the released hemoglobin (HGB), allowing and the HGB concentration to be determined.

The Sheath reagent is an optical fluid designed to align the sample flow in single file through the laser aperture and allow for maximum laser detection on each cell. The sheath reagent

also optically prepares the sample for laser differential count by minimizing disturbance from the red blood cells while keeping the white blood cells intact for the laser detection.

To reduce risk of clotting in system it is equipped with an onboard detergent, also complemented with an external probe cleaner aspirated through the sample probe.

Onboard reagents and detergent are activated using RFID tags. Simply scan the RFID card for the reagent container and the analyzer stores key information such as opening day, expiry dates, and remaining volume.

The optional semi-automated reticulocyte count measurement is done through external staining tubes to which 20 µL blood is added. After being incubated for 15 min in 37°C they are analyzed using custom Retic count mode function in the unit.

## System performance

H50V provides a robust performance, with analysis results comparable with those from a reference instrument intended for the larger animal hospital laboratories. See Figure 10 for comparison on dog samples and Figure 11 for comparison on cat samples.

## Instrument maintenance

Regular instrument maintenance is key for a reliable system performance. While most of the cleaning procedures are automated, some user intervention is still required. The user manual contains information on how to maintain the H50V hematology analyzer. An overview of maintenance procedures is provided in Table 1.

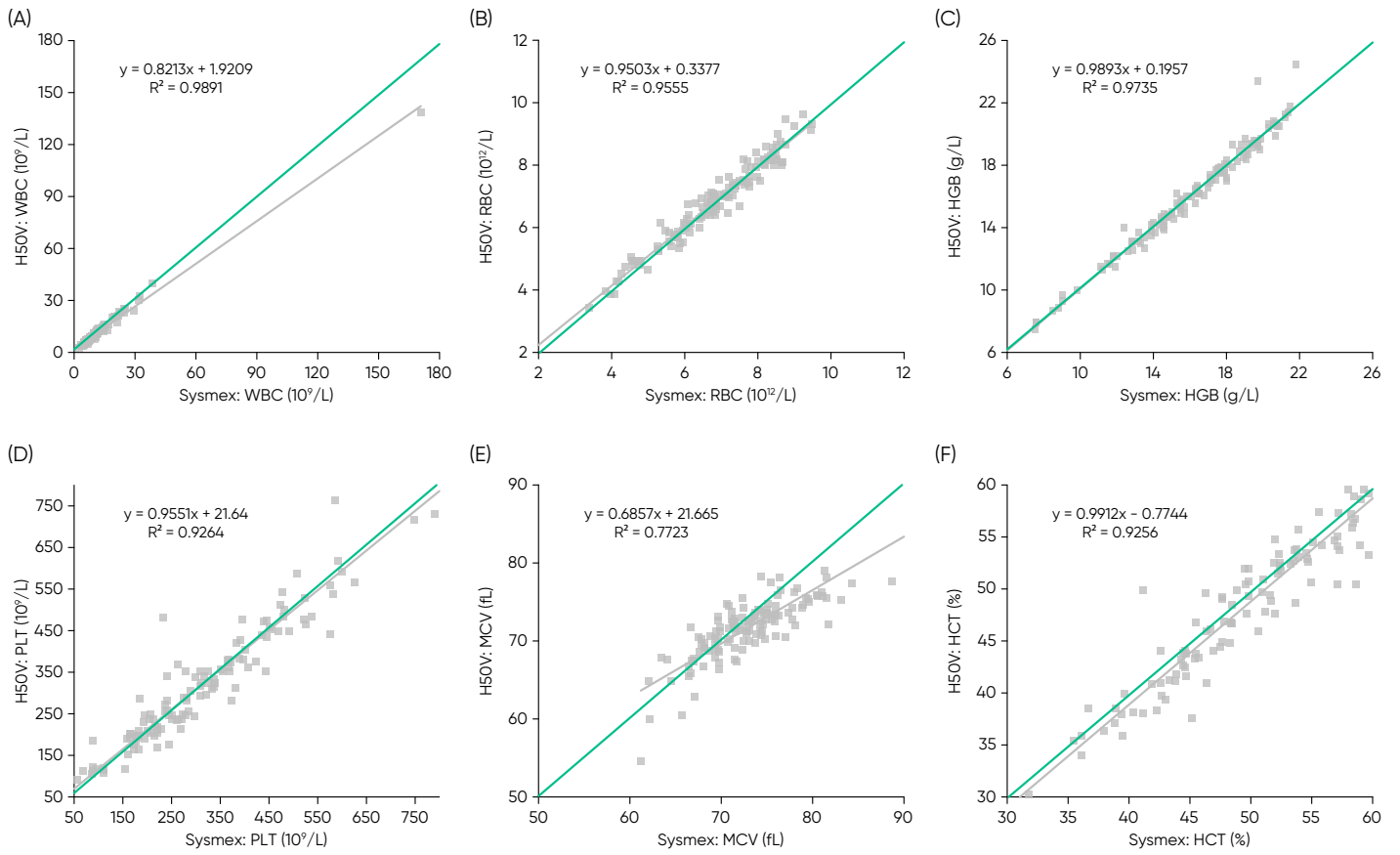
## Quality control

The analyzer has been factory calibrated prior to shipment. If necessary, a calibration function is available. Calibration adjustment can be made using calibrator with adjustments set to all profiles, or using animal bloods adjusting each individual profile.

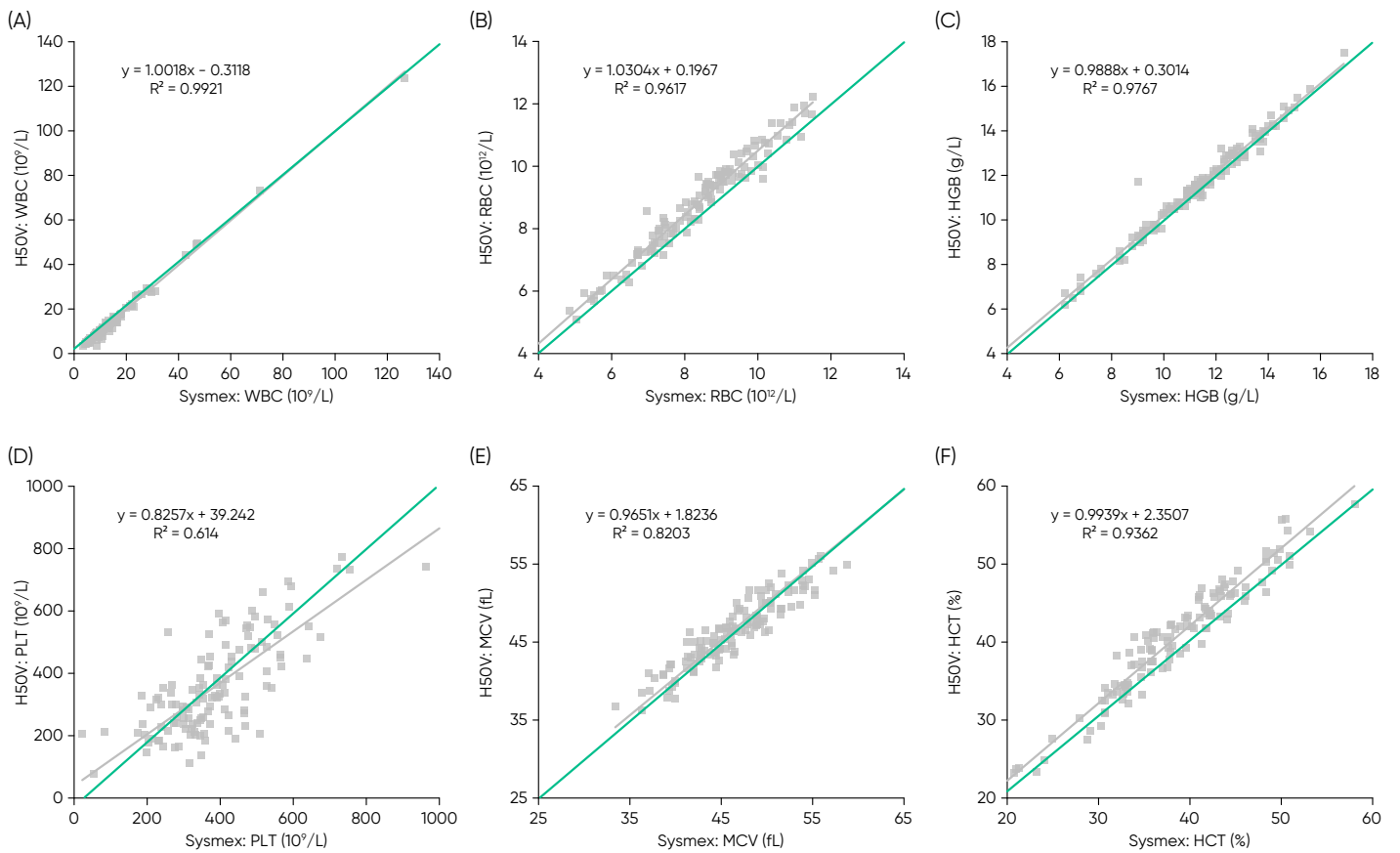
As part of total quality concept, regular measurements of related control sample with set target values is recommended. Advanced quality control functions built into the H50V software include Levey-Jennings charts and XB-functions

**Table 1.** Scheduled maintenance

Procedure	Description	Frequency
Probe cleaning	Probe cleaner aspirated through sample probe: <ul style="list-style-type: none"> <li>• In combination with shutdown.</li> <li>• When requested by software, based on number of samples measured.</li> <li>• From quick option button or maintenance interface.</li> </ul>	Daily to weekly
Shutdown / Startup	Shutdown and startup of analyzer, including automatic cleaning cycles.	Minimum once per week
Surface cleaning	Gently clean the display and/or outside of the analyzer with a soft cloth, slightly moistened with water and a mild soap. Dry carefully.	When necessary
Sample probe cleaning	Clean with paper tissue moistened with a 70% alcohol solution.	When necessary
Preventive Maintenance (PM)	Inspection, adjustments and part replacements upon need, performed by an authorized service technician. PM kit available and included components should be exchange by an authorized service technician.	Every year



**Fig 10.** Dog samples, agreement between H5OV and Sysmex™ XTiv large hospital laboratory system.



**Fig 11.** Cat samples, agreement between H5OV and Sysmex™ XTiv large hospital laboratory system.

# Specifications

System specifications are listed in Table 2.

**Table 2.** H50V system specification

<b>Physical</b>	
Size (instrument, W × D × H)	410 × 270 × 510 mm
Weight (instrument)	26 kg
Display	10.4 inch TFT touch screen
External barcode scanner	Optional (via USB)
External keyboard	Optional (via USB or keyboard inlet)
Mouse	Optional (via USB or mouse inlet)
External printer	Optional (via USB)
USB flash disk	Optional (via USB)
External screen	Optional (via screen port)
<b>Communication</b>	
Communication interface ports	4 USB, 1 LAN
LIS communication	Uni-directional (HL7 protocol)
<b>User login</b>	
User/level login	User Administrator Service functions
<b>Operating environment</b>	
Ambient temperature	15°C–35°C
Relative humidity	30%–85%
Atmospheric pressure	60–106 kPa
<b>Electrical</b>	
Voltage	100–240 VAC
Power requirements	<250VA
Frequency	50–60 Hz
Fuse	250V T3.15AH
<b>Measuring principles</b>	
MCV, MPV, RBC and PLT	Impedance
Total WBC, WBC diff and RBC classification	Laser-based flow cytometry
HGB	Photometric
Samples	Whole blood, pre-diluted
Sample aspiration	Open tube aspiration
Samples volume	Whole blood sampling mode 20 µL, pre-diluted 20 µL
Measurement modes	Standard use: CBC, CBC+5 diff Research use: CBC + 5 diff + RRBC, Reticulocyte testing
Calibration modes	Manual, standard and blood calibration
Profiles	13 pre-installed species profiles: dog, cat, horse, cow, buffalo, rabbit, sheep, rat, mouse, pig, monkey, goat, and camel. Possibility of creating 2 additional profiles manually.

<b>Results</b>	
Parameters reported	25 standard parameters: RBC, MCV, HCT, MCH, MCHC, RDW_CV, RDW_SD, HGB, PLT, MPV, PDW, PCT, P_LCC, P_LCR, WBC, LYM%, LYM#, MON%, MON#, NEU%, NEU#, EOS%, EOS#, BASO%, BASO#  9 research parameters: NRBC%, NRBC#, LIC%, LIC#, ALY%, ALY#, RET%, RET_ABS, IRF
Result report	List of parameter value Histograms for RBC, PLT and WBC (optional) Scatter graphs for 5-diff and Retic count
Reference intervals	Parameter reference intervals are settable for each profile
Abnormal parameter indicators	Flagging and pathological messaging
QC statistics	Mean, SD, CV%, Levey-Jennings and X-bar
Export of parameter results	External printer External USB disk Laboratory information system (LIS)

<b>Performance</b>	
Linearity ranges	PLT: 0–5000 × 10 <sup>9</sup> /L RBC: 0–8.0 × 10 <sup>12</sup> /L WBC: 0–400 × 10 <sup>9</sup> /L HGB: 0–25 g/dL
Sample throughput	Up to 60 samples/hour
Memory capacity	Up to 200 000 samples
Noise level	≤ 65 dB(A)

<b>Consumables and waste management</b>	
Reagent shelf life (closed container)	24 months
Reagents	Diluent (10/5/1.9 L) Lyse (500 mL/200 mL) Sheath (5/1.9 L)
Reagent information	RFID entry: - Reagent type - Reagent Volume - Expiry date - Open container date
Cleaners	Onboard Detergent (5/1.9 L) Probe cleaner (100 mL)
Controls	One level control
Reticulocyte test	4 mL test tube
Waste warning	Waste sensor detector

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