The BD FACSVerse™ flow cytometer has been uniquely designed to offer remarkable performance, flexibility, and ease of operation for research applications. Innovation in the design of both the hardware features and in new BD FACSuite™ software provides intuitive tools that enable a seamless workflow all the way through system setup, data acquisition, analysis, and export of experimental results.

The BD FACSVerse system features a new compact optical bench, miniaturized detection optics, plus optical filter/mirror assemblies with integrated electronic ID chips to monitor the instrument configuration. By incorporating vacuum-driven fluidics, a unique sample injection tube (SIT) was created which can accommodate a wide variety of sample input formats. In addition, a new flow cell was designed which improves system reliability and signal resolution.

The instrument is designed to be compact with no external fluidics cart and fits easily on a benchtop. It is available in three standard configurations: one-laser (488 nm) supporting 6 parameters, two-laser (488 nm and 640 nm) supporting 8 parameters, and three-laser (488 nm, 640 nm, and 405 nm) supporting 10 parameters.

The BD FACSVerse flow cytometer is fully field upgradeable. In addition to laser and optical detector upgrades, other options include the BD FACS™ Universal Loader which accommodates racks of 30 or 40 tubes (12 x 75-mm), as well as 96- and 384-well microtiter plates, the BD™ Flow Sensor option which allows for bead-free absolute count determination, and a handheld barcode scanner for data entry.

Together, the BD FACSVerse system and BD FACSuite software allow users to improve laboratory efficiency and advance their flow cytometry applications.
**Optics**

**Excitation Optics**
The BD FACSVerse system optical deck is designed for up to three lasers. The system has fixed alignment. The built-in capability to automatically check laser alignment at startup and correct when needed allows for optimal alignment at all times.

**Possible system configurations**
1-Laser (blue), 4-color (4)
2-Laser (blue, red), 6-color (4-2)
3-Laser (blue, red, violet), 8-color (4-2-2)

**Laser specifications**

**Blue laser**
- Wavelength: 488 nm
- Optical power: 20 mW
- Beam spot size: 9 μm x 63 μm

**Red laser**
- Wavelength: 640 nm
- Optical power: 40 mW
- Beam spot size: 9 μm x 63 μm

**Violet laser**
- Wavelength: 405 nm
- Optical power: 40 mW
- Beam spot size: 9 μm x 63 μm

**Emission Optics**

**Forward scatter detection**
Si-photodiode with built-in 488/10 bandpass filter

**Fluorescence and side scatter detection**
Reflective optics with single transmission bandpass filter in front of each PMT

High-performance customized PMT modules for all fluorescence and SSC channels

Unique electronic identification of the filter/mirror units allows for automatic detection of the configuration and avoidance of errors due to configuration mismatches.

Light collected by the objective lens is delivered by fiber optics to specially designed heptagon detector arrays.

The cuvette flow cell is gel-coupled by refractive index-matching optical gel to the fluorescence objective lens (1.2 NA) for optimal collection efficiency.

**Forward and side scatter sensitivity**
Enables separation of fixed platelets from noise.

**Forward and side scatter resolution**
Scatter performance is optimized for resolving lymphocytes, monocytes, and granulocytes.

**Side scatter resolution**
Enables separation of 0.2-μm beads from noise.

**Performance**

**Nominal acquisition rate**
35,000 events per second

**Carryover**
Less than or equal to 0.5%

**Sensitivity**
Nominal fluorescence sensitivity in Normal mode

FITC: 100 molecules of equivalent soluble fluorochrome (MESF-FITC)

PE: 25 molecules of equivalent soluble fluorochrome (MESF-PE)

APC: 50 molecules of equivalent soluble fluorochrome (MESF-APC)

FITC and PE measurements performed using SPHERO™ Rainbow Calibration Particles (RCP-30-5A)

APC measurements performed using SPHERO Ultra Rainbow Calibration Particles (URCP-38-2K)

<table>
<thead>
<tr>
<th>Channel</th>
<th>Qr* (x 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FITC</td>
<td>20</td>
</tr>
<tr>
<td>PE</td>
<td>133</td>
</tr>
<tr>
<td>PerCP-Cy™5.5</td>
<td>13</td>
</tr>
<tr>
<td>PE-Cy™7</td>
<td>17</td>
</tr>
<tr>
<td>APC</td>
<td>10</td>
</tr>
<tr>
<td>APC-Cy7</td>
<td>7</td>
</tr>
<tr>
<td>BD Horizon™ V450</td>
<td>47</td>
</tr>
<tr>
<td>BD Horizon™ V500</td>
<td>17</td>
</tr>
</tbody>
</table>

*Qr is the relative fluorescence detection efficiency, used for describing the light collection efficiency of a detector, measured in assigned BD units (ABD units). One ABD unit, for a given fluorochrome, is defined as the fluorescence of one antibody bound to a CD4+ cell.

**Fluorescence resolution**
Coefficient of variation for PI: Area of <3%, full G0/G1 peak for propidium iodide (PI)–stained chicken erythrocyte nuclei (CEN)

**Fluorescence linearity**
Doublet/singlet ratio of 1.95–2.05 for CEN stained with PI and excited with the 488-nm (blue) laser
Fluidics

**Flow cell**
Stainless steel with low coefficient of thermal expansion for predictable, stable performance

**Cuvette internal cross-section**
430 μm x 180 μm

**Sample flow rates**
- Low: 12 μL/min
- Medium: 60 μL/min
- High: 120 μL/min
- High sensitivity: 40–55 μL/min

**Fluid capacity**
Standard 5-L tanks, optional 10-L tanks, 20-L sheath cubitainer adapter available

**Sheath core stream fluid velocity**
- Normal: 5.4 m/s
- High sensitivity: 2.7 m/s

**Sheath fluid consumption**
- Normal: 13.6 mL/min
- High sensitivity: 6.6 mL/min

**Integrated cleaning cycles**
Daily Clean, Monthly Clean, SIT flush

**BD Flow Sensor (optional)**
Used for volumetric measurement

**Sample input formats**
- For use on the manual tube port
  - Tubes
    - BD Falcon™ 5 mL (12 x 75-mm) polystyrene
    - BD Falcon 5 mL (12 x 75-mm) polypropylene
    - BD Trucount™ 5 mL (12 x 75-mm)
    - BD Falcon 15 mL
    - BD Falcon 50 mL
    - Microcentrifuge 2 mL

- For use with the BD FACS Universal Loader (optional)
  - Tube racks
    - 30-tube rack (12 x 75-mm tubes)
    - 40-tube rack (12 x 75-mm tubes)
    - 96, matrix tube
  - Plates
    - 96 standard height, round, polystyrene
    - 96 standard height, flat, polystyrene
    - 96 standard height, round, polypropylene
    - 96 standard height, conical, polypropylene
    - 384 standard height, flat, polystyrene
    - 96, half deep, conical, polypropylene
    - 96, deep, conical, polypropylene
    - 96, filter bottom, polypropylene

Data Management

**Software**
- BD FACSuite software version 1.0 or later
- BD Assurity Linc™ software
  For remote diagnostics capability on the system

**Operating system**
Windows® 7 Professional

**Data resolution**
Uncompensated data has a range of 0 to 262,143, which is 18 bits

**FCS format**
- FCS 3.0 for export
- FCS 2.0 and 3.0 for import

Installation Requirements

**Operating temperature**
The cytometer has an operating range between 15°C (59°F) and 30°C (86°F). We recommend that the lab temperature fluctuate less than 5°C within a day for best operation.

**Humidity**
The operating humidity tolerance is between 5% and 95% relative humidity (noncondensing).

**Dimensions (W x D x H)**
- Cytometer: 63.2 x 57.9 x 57.9 cm (24.9 x 22.8 x 22.8 in.)
- Cytometer with standard tanks: 85.2 x 57.9 x 57.9 cm (33.5 x 22.8 x 22.8 in.)
- Cytometer with standard tanks and Loader: 107.2 x 57.9 x 57.9 cm (42.2 x 22.8 x 22.8 in.)

**Weight**
- Cytometer: 55.0 kg (121 lb)
- Loader: 13.2 kg (29 lb)

**Power specifications**
- Voltage: 100–240 ±10% VAC
- Frequency: 50–60 ±10% Hz
- Current: 2 A
- Power: 150 W

**Heat dissipation**
Less than 430 BTU/hour at ambient temperature with the cytometer and Loader running.

**Noise**
Less than 65 dBA over 8 hours under normal operating conditions with the cytometer and Loader running.
System Options

**BD FACS Universal Loader**
Single optional device for multi-sample handling, compatible with 30 (barcoded) or 40 (non-barcoded) tubes (12 x 75 mm)

Equipped with an orbital shaker for in-place mixing and resuspension of cells, optimized for all supported formats

Positive sample identification:
Capability to decode barcode labels on tubes and plates with the following symbologies: Codabar, Code 128, Code 3 of 9, Interleaved 2 of 5

**BD Flow Sensor**
Inline sensor that directly measures the flow rate of particles to provide accurate absolute counts

**Handheld barcode scanner**
Handheld barcode scanner with stand to input information

**Extended-use fluidics**
Optional tanks and connectors to allow for use with 10-L waste tanks and BD FACSFlow™ cubitainers

**Research Assay Module for BD FACSuite software**
Predefined assays with setup, acquisition, and analysis built in for common applications which are complementary to popular research assay kits available from BD