Accepted worldwide for its reliability, the FDSS is capable of 1536-well format and high-sensitivity luminescence measurements.

The FDSS (Functional Drug Screening System) series are designed for cell-based assays in the drug discovery field. These instruments optically detect intracellular reactions and biological signal transmissions, and are used as screening systems to discover new lead compounds which could be candidates for new drugs.

The FDSS7000EX is our high-end model capable of handling 1536-well assays and measuring both fluorescence and luminescence, and is equipped with a variety of functions such as multiple washing. Many kinds of suspended/adherent cells' real-time kinetic reactions can be measured and analyzed. Various optional parts such as FRET, robot connections, etc. are available. In addition, the FDSS7000EX is expandable for future upgrades.

Applications
- Intracellular calcium ion
- Membrane potential
- Ion channel
- Aequorin
- FRET
- Suspended cell
**Intracellular calcium ion**

Comparison of calcium mobilities using Aequorin, Fluo-3, and Fura-2 receptor-expressing cells.

- Aequorin
- Fluo-3
- Fura-2

**Membrane potential**

Multiplex assays using Fura-2AM and a membrane potential fluorogenic reagent

This is an example of a multiplex assay that concurrently measures membrane potential and calcium mobilization. In this example, (1) a FMP measurement with an excitation wavelength of 480 nm and a fluorescence wavelength of 540 nm and (2) a Fura-2 measurement with an excitation wavelength of 380 nm and a fluorescence wavelength of 540 nm are performed alternately, and then the mobilizations of (1) and (2) are measured concurrently.

- Fura-2AM: ex380 / em540
- Membrane potential: ex480 / em540

**Ion channel**

Involvement of various ion channels and receptors in Ca^{2+} oscillations

- 0.1% DMAC Vehicle
- 30 μM GABA GABA (H) agonist
- 3 μM Bicuculline GABA (H) antagonist
- 100 μM BaCl_{2} NMDA (H) antagonist
- 25 μM NK-001 NMDA rec. agonist
- 10 μM VNR 5021 C81 rec. agonist
- 10 μM Bonotadotatin G05 rec. agonist
- 30 μM Hm1dipime L-type Ca^{2+} channel blocker
- 1 μM Conotoxin MIVIC N-Type Ca^{2+} channel blocker
- 3 μM TTX N-type Kv channel blocker
- 100 μM Lidocaine N-type Na channel blocker
- 0.3 μM Adenosine Adenosine rec. agonist
- 0.03 μM N8 Cytochrome adenosine
- 3 μM P overwhelm P2X2 receptor

Presented at the 8th FENS Meeting - Amsterdam - July 3-7, 2010
Session 015 Epilepsy 1, n°015.36
**Aequorin**

Comparison of dose responses provided by an aequorin assay

- Cell: CHO
- Substrate: h-CTZ
- Ligand: ATP
- Measurement time: The ligand is dispensed 10 seconds after measurement starts. Measured at 1 second intervals for 1 minute and 30 seconds.

---

**FRET**

Fluorescence resonance energy transfer (FRET) through the use of a coumarin dye (CC2-DMPE) and an oxonol dye (DISBAC).

**Suspender cell**

This is an example in which an aequorin assay was used to measure suspended cells at different CTZ concentrations. 10 000 CHO cells genetically engineered to express GPCR that can be stimulated by a neurotransmitter were dispensed to a single well. Cells loaded over 4 hours with substrate concentrations of 1 μM, 2 μM, 5 μM, and 10 μM were stimulated by ATP and ACh, which are endogenous ligands.
### Dispenser

**Can be equipped with various dispenser heads**
- 96-, 384-, or 1536-tip dispenser heads are selectable. The tips are exchangeable.
- 384- and 1536-pintool heads are also supported.
- The main unit is equipped with an automatic tip loading feature.
- As standard, three types of compounds can be dispensed. If you use the back plate loading line, up to four types of compounds can be dispensed.
- The dispenser heads can be easily changed by the user.

**Pintool head (1536 and 384)**
Dispensing involves setting metal pins in the tip positions and then attaching the reagent to the ends of the tips. This enables the dispensing of minute amounts of solution and reuse.

**Two dispenser heads capability**
Two heads can be installed at the same time, which makes it possible to use separate heads for compounds that have high viscosity or to use separate heads for agonists and antagonists.

---

### Washing unit

**Equipped with a variety of washing features**
- Up to three solvents are supported, which enables washing with no carry over.
- Tips can be washed during measurement.
- An ultrasound washing feature is also available.
- Equipped with a wiping stage to dry tip ends.

---

### Plate stacker unit

**Plate stacker feature for 20 or 50 plates**
- Using the plate stacker makes it possible to perform automatic measurements even without the use of a robot.
- You can select 20 plates or 50 plates.
- Stacker cassette method makes it easy to set plates.
- Can be equipped with a barcode reader.

**Restacking function**
A stacker equipped with a feature that returns all microplates that have reached the OUT side back to the IN side is also available.

---

### Others

**Auto compound feeder**
A reagent feeder that drastically reduces dead volume can also be installed.

**Temperature control function**
The FDSS7000EX can also be equipped with a heater unit. The internal temperature sensor is used to maintain a stable temperature.
Supports fluorescence assays and luminescence assays with a single sensor

- This sensor has a fluorescence detection sensitivity that far exceeds that of conventional fluorescence sensors.
- Because the excitation light can be lowered, the cost of purchasing excitation light sources can be reduced.
- In addition to high sensitivity, the FDSS7000EX also has a high dynamic range.
- The fluorescence changer makes FRET measurements possible.

* Conventional fluorescence sensors can also be selected.

** Various assays with xenon lamp & filter combination (multiple excitation and emission) **

- Good wavelength separation by epi-illumination optics
- Fura-2 assay with dual excitation (340 nm & 380 nm)
- FRET (C/Y, Membrane potential) with emission filter changer
- 2 dichroic mirror and 4 emission filter slots for various assays
- White light xenon lamp with wattage options (150 W, 300 W, 600 W)
- 6 filter slots for excitation
- Uniform plate illumination

---

** H1 NFAT HEK293 cells: Calcium measurement by Fluo-4 **

<table>
<thead>
<tr>
<th>Compound</th>
<th>EC50</th>
<th>S/B ratio</th>
<th>Z’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histamine</td>
<td>1.73 nM</td>
<td>19</td>
<td>0.66</td>
</tr>
<tr>
<td>Na-Methylhistamine</td>
<td>1.06 μM</td>
<td>25</td>
<td>0.67</td>
</tr>
</tbody>
</table>

* Reagents and data provided by Life Technologies, USA

** H1 NFAT HEK293 cells: Calcium measurement by BacMam Aequorin **

<table>
<thead>
<tr>
<th>Compound</th>
<th>EC50</th>
<th>S/B ratio</th>
<th>Z’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histamine</td>
<td>3.87 nM</td>
<td>142</td>
<td>0.84</td>
</tr>
<tr>
<td>Na-Methylhistamine</td>
<td>3.9 μM</td>
<td>182</td>
<td>0.68</td>
</tr>
</tbody>
</table>

* Reagents and data provided by Life Technologies, USA

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** UV | Blue | Green **

- Fura-2(Ca²⁺)
- SBFI(Na⁺)
- PBF(K⁺)
- MOAE_dH-MEO(Cr⁻)
- DAPI(DNA)
- VSP-1(FRET)
- Fluo-3,4,8
- Calcium Green
- Sodium Green
- CoroNa Green
- BCECF
- GFP
- FITC
- Di-8-ANNEPS
- YFP
- JC-1
- CoroNa Red
- Rhod-2,3,4
- Rhodamine
- FMP
All kinds of assays can be executed with simple operations

**Software**

**Plate setting**

Call the assay protocol and set the number of measurements, measurement interval (measurement time), dispensing and washing conditions in the Kinetic Protocol mode. Operations from measurement to data output can be automated.

Protocol settings and display can be easily understood by combining the task tabs. Detailed measurement, dispensing and washing settings can be made for each task tab.

*Some tasks are washing, dispensing only, without measurement.

**Data acquisition**

Set number of measured plates and interval (measurement time)

Number of measured plates (Sampling Number) and measurement interval (Interval) can be set separately before and after dispensing. *If there is no dispensing, only the number of measured plates and measurement interval are set.

**Settings for dispensing during measurement**

The amount of liquid to be dispensed during measurement, the height from the bottom of the plate well, the speed, tip mixing, the source plate (source), and destination (plate position) are set.

**Settings for tip washing after dispensing**

Tip washing is set after liquid dispensing.
Various data processing and analysis are possible from the results of measurement:

- Spatial correction between wells (spatial uniformity)
- Negative control correction
- Positive control correction
- Baseline subtraction correction (subtract bias)
- IC/EC graph calculation from multiple series (4 or 5 parameters may be selected)
- IC/EC graph calculation using Max, Min, Average and Max-Min in up to three time ranges in the same series
- Slope calculation to maximum range of 8
- Max, Min, Max-Min and Ratio calculation to maximum range of 8

The items below can be output as text files in plate format.

**Main analysis items**

- Waveform peak number (Peak Number: Total, BPM)
- Peak-to-peak time (p-p time: Ave, Std, Max, Min)
- Peak luminance value/bottom luminance value ratio (Ratio: Ave, Std)
- Peak amplitude (peak luminance value - bottom luminance value) (Amplitude: Ave, Std)
- Bottom luminance value (RMP: Ave, Std)
- Rise and fall slope (Rising/Falling Slope: Ave, Std)
- Peak pulse width 10 % to 90 % (PWD10, 20, 30, 40, 50, 60, 70, 80, 90)
- Peak total area (Area Under Curve: Ave, Std)
System configuration

Flexible system for diverse needs

**Fluorescence measurements**

Calcium ion assays are in ever increasing demand in areas such as lead discovery, pharmacological study, and food product function research. The FDSS7000EX supports various types of ion channel assays such as Na⁺, K⁺, Cl⁻, and pH as well as calcium ion assays using fluorescent dyes such as Fura-2, Fluo-3, and Fluo-4.

**Fluorescence/Luminescence**

The fluorescence/luminescence sensor is capable of detecting both types of emission. Adding a filter changer enables FRET measurements.

**FRET measurement**

The FDSS7000EX is utilized in assays where two different fluorescence wavelengths are measured, for example FRET probes (VSP-1, Premo™), cAMP dyes (FICRhR), simultaneous calcium and membrane potential dyes (multiplexing), and dual reporter gene assays (GFP and DsRed).

【Fluorescence filter changer unit A8472-04】

The A8472-04 automatically switches between the fluorescence filters and the dichroic mirrors. This device is used for assays that handle dual-wavelength fluorescence such as FRET or VSP.

<table>
<thead>
<tr>
<th>Filter switching interval *</th>
<th>0.3 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of installed dichroic mirrors</td>
<td>Max. 2</td>
</tr>
<tr>
<td>Number of installed fluorescence filters</td>
<td>Max. 4</td>
</tr>
</tbody>
</table>

* Switching interval between adjacent filter positions
Fluorescence and luminescence measurement (4-reagent dispensing structure)

The standard configuration has three compound/ligand plate positions. By adding the rear loader, you can have the fourth compound/ligand plate for dispensing. The rear loader plate can be kept inside the FDSS7000EX and can be used for the next protocol if required.

Robot connection

Interface for connecting a robot is available.

1. Plate from the robot system to FDSS plate loading arm
2. FDSS measurement by robot control
3. After the measurement, robot takes out plate from the FDSS plate unloading arm

[Manufacturers of compatible products]
Thermo Fisher Scientific, Beckman Coulter, HighRes Biosolutions, Hamilton, Agilent Technologies
### Component

<table>
<thead>
<tr>
<th>Component</th>
<th>Options</th>
<th>Part Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispensing unit</td>
<td>One-unit and two-unit versions are available</td>
<td>A10118-24</td>
</tr>
<tr>
<td></td>
<td>Equipped with an automatic tip loading feature</td>
<td></td>
</tr>
<tr>
<td>Pintool head</td>
<td>Pintool head (384) for short pins</td>
<td>A10118-30</td>
</tr>
<tr>
<td></td>
<td>Pintool head (384) for long pins</td>
<td>A10118-31</td>
</tr>
<tr>
<td></td>
<td>Pintool head (1536) for short pins</td>
<td>A10118-27</td>
</tr>
<tr>
<td></td>
<td>Pintool head (1536) for long pins</td>
<td>A10118-29</td>
</tr>
<tr>
<td>Washing unit</td>
<td>Washing unit with ultra sonic bath</td>
<td>A10118-47</td>
</tr>
<tr>
<td></td>
<td>Additional washing unit</td>
<td>A10118-48</td>
</tr>
<tr>
<td></td>
<td>Chimney plate (96 tip type)</td>
<td>A10118-44</td>
</tr>
<tr>
<td></td>
<td>Chimney plate (384 tip type)</td>
<td>A10118-43</td>
</tr>
<tr>
<td></td>
<td>Chimney plate (1536 tip type)</td>
<td>A10118-46</td>
</tr>
<tr>
<td>Plate stacker</td>
<td>Plate stacker (Front)</td>
<td>A10118-04</td>
</tr>
<tr>
<td></td>
<td>Plate stacker (Rear)</td>
<td>A10118-05</td>
</tr>
<tr>
<td></td>
<td>Plate stacker (Front) with de-lidding</td>
<td>A10118-94</td>
</tr>
<tr>
<td></td>
<td>Plate stacker (Rear) with de-lidding</td>
<td>A10118-95</td>
</tr>
<tr>
<td></td>
<td>Plate stacker (Front) with re-stacking</td>
<td>A10118-07</td>
</tr>
<tr>
<td></td>
<td>Plate stacker (Rear) with re-stacking</td>
<td>A10118-08</td>
</tr>
<tr>
<td></td>
<td>Single plate holder</td>
<td>A10118-96</td>
</tr>
<tr>
<td></td>
<td>Plate stacker cassettes max 20 plates</td>
<td>A10118-92</td>
</tr>
<tr>
<td></td>
<td>Plate stacker cassettes max 50 plates</td>
<td>A10118-93</td>
</tr>
<tr>
<td>Fluorescence sensor unit</td>
<td>Fluorescence sensor unit for 1 lamp UV/B/G</td>
<td>C10512-21B</td>
</tr>
<tr>
<td></td>
<td>Fluorescence sensor unit for 2 lamps UV/B/G</td>
<td>C10512-22B</td>
</tr>
<tr>
<td>Fluorescence/luminescence sensor unit *1</td>
<td>Fluorescence/luminescence sensor unit for 1 lamp UV/B/G</td>
<td>C11653-11B</td>
</tr>
<tr>
<td></td>
<td>Fluorescence/luminescence sensor unit for 2 lamps UV/B/G</td>
<td>C11653-12B</td>
</tr>
<tr>
<td></td>
<td>Fluorescence/luminescence sensor unit for 4 lamps UV/B/G</td>
<td>C11653-13B</td>
</tr>
<tr>
<td>Fluorescence filter changer unit</td>
<td></td>
<td>A8472-04</td>
</tr>
<tr>
<td>Barcode reader</td>
<td></td>
<td>A10118-50</td>
</tr>
<tr>
<td>Auto compound feeder</td>
<td></td>
<td>A10118-55</td>
</tr>
<tr>
<td>Heater unit *1 *2</td>
<td></td>
<td>A10118-09</td>
</tr>
</tbody>
</table>

*1 To use the fluorescence/luminescence sensor unit and the heater unit at the same time, the FDSS7000EX requires a water cooling device.
For details, contact your Hamamatsu sales representative.

*2 You can only select the heater unit at the time of purchase.

### Consumable

#### Tips

- 96 black tip (10 racks) for FDSS7000/μCELL: A8687-32A
- 384 black tip (10 racks) for FDSS7000/μCELL: A8687-62A
- 1536 black tip (10 racks) for FDSS7000: A8687-72

#### Optical filter

* See the back page for details.

### Maintenance

To maintain long-term stability of this device, we recommend that you purchase the maintenance contract. For details, contact your Hamamatsu sales representative.
Dispensing unit
- 1536 format
  - Dispensing unit A10118-26
  - Tips A8687-72
  - Chimney plate A10118-46

- 384 format
  - Dispensing unit A10118-24
  - Tips A8687-62A
  - Chimney plate A10118-43

- 96 format
  - Dispensing unit A10118-28
  - Tips A8687-32A
  - Chimney plate A10118-44

Pintool head (for 384/1536)

* In this photograph, pins are already attached.
Note that the pins are not included.

Excitation light source unit
- Excitation light source unit (150 W)
- Excitation light source unit (300 W)
- Excitation light source unit (600 W)

Pump unit

Microplate stacker
- Microplate stacker
- Microplate stacker cassettes

Filter changer
A rich variety of optional parts makes it possible to design a system that meets your specific needs.

### Optimal filter

<table>
<thead>
<tr>
<th>Application</th>
<th>Excitation filter 1</th>
<th>Excitation filter 2</th>
<th>Dichroic mirror</th>
<th>Emission filter 1</th>
<th>Emission filter 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluo-2 (Ca²⁺)</td>
<td>340 nm</td>
<td>387 nm</td>
<td>UV</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>SBFI (Na⁺)</td>
<td>340 nm</td>
<td>387 nm</td>
<td>UV</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>PBFI (K⁺)</td>
<td>340 nm</td>
<td>387 nm</td>
<td>UV</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>MQAE, diH-MEQ (Cl⁻)</td>
<td>360 nm</td>
<td>-</td>
<td>UV</td>
<td>440 nm to 470 nm</td>
<td>-</td>
</tr>
<tr>
<td>DAPI (DNA)</td>
<td>360 nm</td>
<td>-</td>
<td>UV</td>
<td>440 nm to 470 nm</td>
<td>-</td>
</tr>
<tr>
<td>VSP-1</td>
<td>387 nm</td>
<td>-</td>
<td>for VSP-1</td>
<td>465 nm</td>
<td>565 nm</td>
</tr>
<tr>
<td>CFPP/YFP</td>
<td>438 nm</td>
<td>-</td>
<td>for C/Y</td>
<td>483 nm</td>
<td>542 nm</td>
</tr>
<tr>
<td>Fluo-3, Fluo-4, Fluo-8 (Ca²⁺)</td>
<td>472 nm</td>
<td>-</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>Calcium Green (Ca²⁺)</td>
<td>472 nm</td>
<td>-</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>Sodium Green, CoroNa Green (Na⁺)</td>
<td>472 nm</td>
<td>-</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>BCECF (pH)</td>
<td>472 nm</td>
<td>450 nm</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>GFP</td>
<td>472 nm</td>
<td>-</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>FITC</td>
<td>472 nm</td>
<td>-</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>YFP</td>
<td>500 nm</td>
<td>-</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>Di-8-ANNEPS</td>
<td>472 nm</td>
<td>450 nm</td>
<td>B</td>
<td>520 nm to 560 nm</td>
<td>-</td>
</tr>
<tr>
<td>JC-1</td>
<td>540 nm</td>
<td>-</td>
<td>for JC-1</td>
<td>570 nm to 600 nm</td>
<td>-</td>
</tr>
<tr>
<td>CoroNa Red (Na⁺)</td>
<td>531 nm</td>
<td>-</td>
<td>for FMP</td>
<td>560 nm to 640 nm</td>
<td>-</td>
</tr>
<tr>
<td>Rhod-2, Rhod-3, Rhod-4 (Ca²⁺)</td>
<td>560 nm</td>
<td>-</td>
<td>for FMP</td>
<td>590 nm to 650 nm</td>
<td>-</td>
</tr>
<tr>
<td>Rhodamine</td>
<td>560 nm</td>
<td>-</td>
<td>for FMP</td>
<td>590 nm to 650 nm</td>
<td>-</td>
</tr>
<tr>
<td>FMP</td>
<td>531 nm</td>
<td>-</td>
<td>for FMP</td>
<td>593 nm</td>
<td>-</td>
</tr>
</tbody>
</table>

* Above wavelength are not representing the filter characteristic, just showing the general wavelength for each application.

The filters we provide are the best-optimized selection and combination with our optics, and does not match the wavelength shown here.

### Dimensions/Weight

<table>
<thead>
<tr>
<th>Item</th>
<th>Main unit</th>
<th>Data analysis system</th>
<th>Pump unit / Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx. Weight</td>
<td>Approx. 1500 mm (W) × 1030 mm (D) × 1450 mm (H)</td>
<td>600 mm (W) × 700 mm (D) × 1500 mm (H)</td>
<td>500 mm (W) × 500 mm (D) × 1200 mm (H)</td>
</tr>
<tr>
<td>Approx. Weight</td>
<td>Up to approx. 300 kg</td>
<td></td>
<td>Approx. 50 kg</td>
</tr>
</tbody>
</table>

### System footprint

- **Main unit**: 1300 mm
- **Pump unit / Tank**: 2800 mm
- **Microplate stacker**: 450 mm

- **Excitation light source**: 10 mm
- **Dichroic mirror**: 10 mm
- **Emission filter 1**: 10 mm
- **Emission filter 2**: 10 mm
- **UV**: 10 mm

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