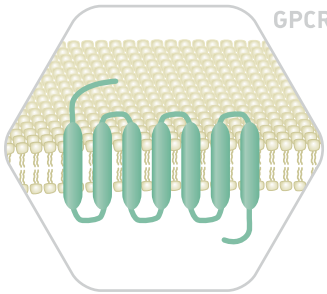
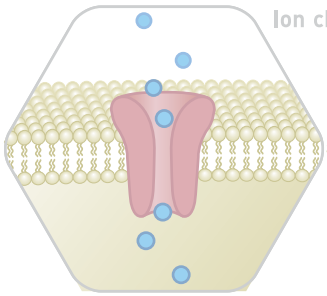
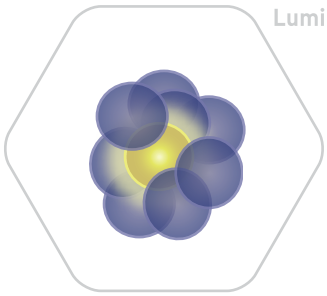
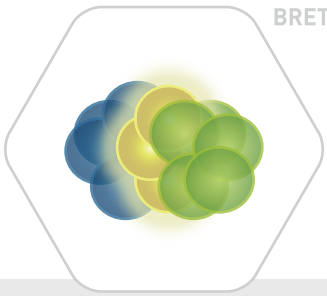
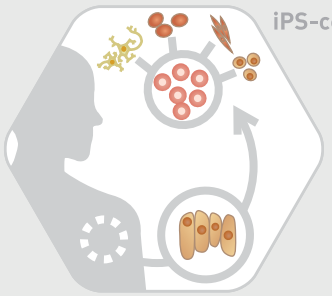










Fluorescence/luminescence plate imager using
a high sensitivity two-dimensional sensor (camera)

FDSS®/μCELL

Functional Drug Screening System C13299

HAMAMATSU

PHOTON IS OUR BUSINESS

Measurement under uniform conditions with no time lag by simultaneous addition and reading in all 96 or 384 wells.

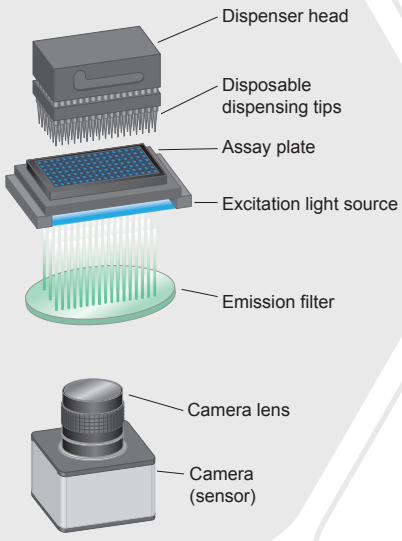
FDSS/µCELL is a laboratory screening system that compactly integrates technologies developed in drug discovery screening, enabling a purpose-built system that is simple to use.

Simultaneous measurement and analysis of the kinetics of a sample's fluorescence or luminescence intensity in all wells at the time of compound addition are made possible by the high sensitivity two-dimensional sensor (camera) and dispenser head (96 tip type/384 tip type). Screening various compounds at high throughput is enabled by measurement under the same conditions with no time lag between wells.

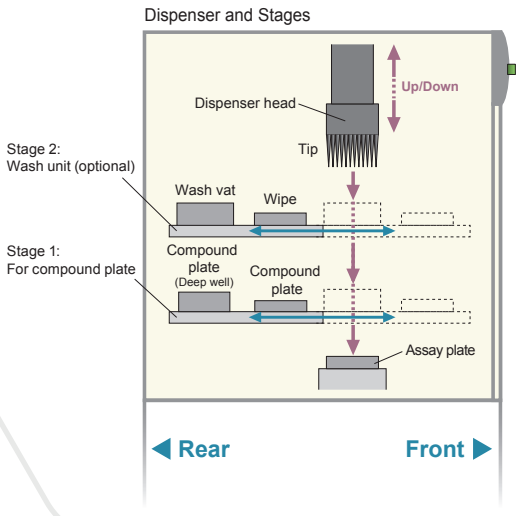
Main features

- Suitable for fluorescence/luminescence analysis
- Simultaneous addition and reading in 96 wells/384 wells
- Enables a wide range of measurements with excitation light sources of various wavelengths
- Long life, high power LED excitation light source
- Suitable for FRET or BRET by changing wavelength
- High speed data capture of 5 ms maximum (optional)
- Simultaneous electrical stimulation and reading in 96 wells (optional)
- External control option available for automation
- Temperature can be maintained at +35 ºC to +37 ºC by installing heater unit (optional)
- CO_2 incubation (optional)
- Waveform analysis (optional)

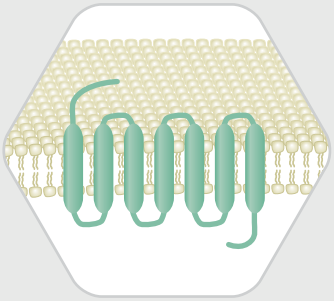
Detection unit enabling simultaneous addition and reading



Automatic wash and wipe functions (optional)



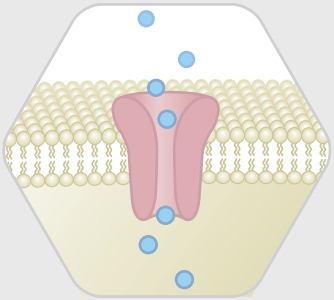
Applications



1. GPCR

GPCRs (G protein-coupled receptors) play a major role in cell signaling, and many GPCR-targeted medical drugs have been developed. FDSS/μCELL is capable of detecting messengers, such as Ca^{2+} and cAMP, which are major contributors to the GPCR signaling system by using fluorescence and luminescence probes. FDSS/μCELL allows simultaneous dispensing and kinetic measurement of compounds in whole microplate wells, thus realizing high throughput screening.

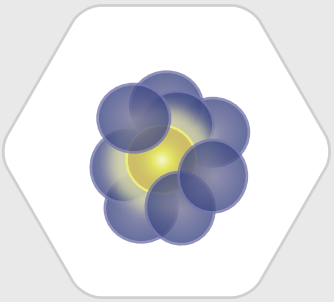
- Ca^{2+} measurement: Fluo-4, Fluo-8, Cal-520, Aequorin
- cAMP measurement: Glo-Sensor



2. Ion channel

Ion channel, a class of transmembrane proteins that allow certain ions to pass through the cellular biomembrane (in or out of the cell), regulate cellular functions and are involved in the development of cardiovascular, neurologic and metabolic diseases. FDSS/μCELL performs high throughput drug screening using voltage-sensitive fluorescent dyes or fluorescent indicators for different ions.

- Na^{+} measurement: ANG-2, Corona-Green, Corona-Red, Sodium-Green
- K^{+} measurement: FluxOR
- Cl^{-} measurement: MEQ, MQAE, YFP
- Membrane potential measurement: FluoVolt, Di-8-ANEPPS, DiBAC4 (3)



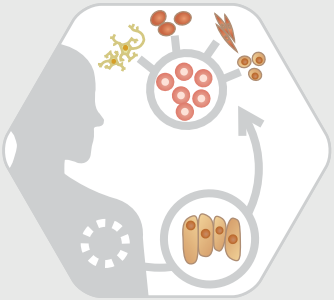
3. Luminescence

The merits, i.e., high sensitivity and low noise, of assays using luminescence probes have led to the wide application of such assays in various luciferase assay systems and Ca^{2+} assays using aequorin. FDSS/μCELL simultaneously performs different assays using luminescence probes on a single microplate with the use of highly sensitive two-dimensional sensors (camera), allowing for high throughput screening without bothersome time lags after substrate addition.

4. BRET/FRET

Biosensors based on the principle of resonance energy transfer that use GFP (green fluorescence protein) or Luc (luciferase) are utilized as a tool to measure various intracellular signal transmissions including ionic concentrations and signaling molecular activities. FDSS/μCELL simultaneously performs BRET (bioluminescence resonance energy transfer) measurements, a luminescence-based approach, and FRET (fluorescence resonance energy transfer) measurements, a fluorescence-based approach, on a single microplate using highly sensitive two-dimensional sensors (camera) and an automatic filter changer.

- BRET: BRET1, BRET2, Nano-BRET
- FRET: C/Y FRET, VSP, Cameleon



5. iPS-cell

Various differentiated cells have recently been created from iPSC (induced pluripotent stem cell), and this increasingly allows for the conduct of cell-based assays using human-derived native cells. In particular, iPS Cardiotoxicity, iPS Neurotoxicity, and iPS Hepatotoxicity assessments have been increasingly performed as safety evaluation of compounds. FDSS performs high throughput toxicity screening.

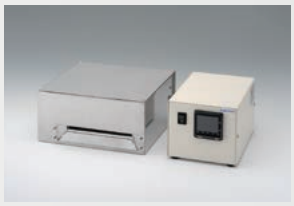
System components

Combinations of components support wide range of applications.

* Computer table is not included.

Heater unit

When iPSC differentiated cells and other native cells are used, it is important to maintain a stable temperature environment in maintaining physiological functions. The heater unit can keep temperature near the assay microplate at +35 ºC to +37 ºC, and is effective for systaltic analysis of cardiomyocytes.



▲ Heater unit A11529-15

Highly sensitive two-dimensional sensor (camera)

A high sensitivity/high speed camera with a wide sensitivity range from fluorescence to luminescence. Performs various assays with high throughput as a fluorescence/luminescence plate imager.
Because all wells of the microplate are read simultaneously, there is no time lag in the fluorescent indicator or in measurement between wells after substrate addition. To measure rapid fluorescence kinetics, data can be captured at intervals of up to 5 ms by using the high-speed data capture function (optional). It is effective when sampling in a short time is required, such as with high-speed voltage sensitive fluorescent dyes and evaluation of iPS cell derived cardiomyocytes.

▲ Camera for fluorescence/luminescence detection:
ImagEM X2 EM-CCD Camera
C9100-23B

▲ Camera for fluorescence detection:
ORCA-Flash4.0 V3 Digital CMOS Camera
C13440-20CU

CO_2 incubator

The assay plate is simply enclosed and CO_2 mixture is supplied inside. This keeps the CO_2 concentration around the plate at 5 % to 6 %.

Robot connection (automation)

Automated assay by robot connection is an important function for consecutive execution of various measurement sequences. Stable automatic measurement is realized by loader designs considering each company's robot. Please contact us to learn about compatible models.

▲ Applicable to each company's robot

Fluorescence optical unit Patented

An optical system for fluorescence measurement that is integrated with a unique illuminator glass wave excitation optical system. It is used in combination with an LED excitation light source unit. It provides high S/N fluorescence detection that is maintenance-free with a long life. A complete line of excitation light source units can be easily replaced according to the purpose.

▲ Fluorescence optical unit M11031-02

Light source array unit (B,G)

A LED excitation light source that can output two wavelengths: Blue (480 nm) and Green (530 nm). Blue LED or Green LED can be used alone, and 2 wavelength measurement using a fluorescence filter changer or optogenetics by channelrhodopsin are also possible.

▲ Light source array unit (B,G) L11601-06

Fluorescence filter changer unit

For measuring fluorescence and luminescence, measurement of dual wavelengths by energy transfer such as FRET and BRET is an effective method for ion channel and protein kinetic analysis. Dual wavelength measurement is performed with high throughput by the fluorescence filter changer installed in front of the sensor.

▲ Fluorescence filter changer unit A8472-05

Dispensing unit (96/384 tip type)

A dispenser head that can dispense compounds simultaneously into all wells of 96/384 microplates. Since all wells are dispensed at once, kinetic assays such as Ca^{2+} assays are performed at high throughput.

▲ Dispensing unit (384 tip type) A10118-26

EFS pacing head * (96 ch)

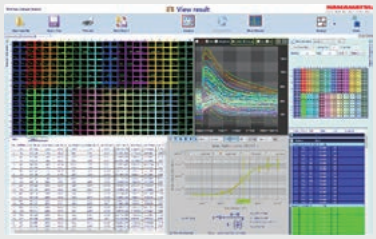
Electric field stimulation using electrodes is an effective technique for pacing of cardiomyocyte and skeletal muscle cell pacing and neuronal oscillation.
FDSS/μCELL simultaneously stimulates all wells of a 96 microplate with a pacing head using 96 multi-EFS electrodes. It can be used in contraction timing control of muscle cells such as cardiomyocytes and skeletal muscle cells, or in Ca oscillation control of nerve cells, etc.

▲ EFS pacing head (96 ch) A13029-01

* The FDSS/μCELL EFS system should not be used for optically detecting/monitoring change in transmembrane potential of the cells.
The FDSS/μCELL EFS system should not be used on any cell or cells in which the user or anyone else has expressed target ion channels.

Dedicated software

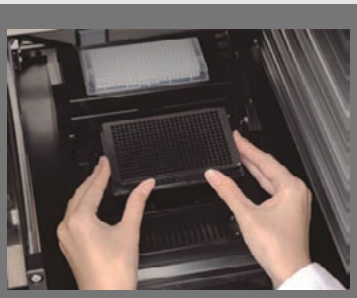
An assay design is easily constructed as a sequence from measurement to data analysis with easy-to-use measurement software. By using the waveform analysis function (for cardiomyocyte), it is possible to numerically analyze cardiomyocyte pulsation and the effects of drugs. All of the wells of a microplate can be analyzed at once, and it is effective for toxicity screening of compounds and evaluation of efficacy.



Measurement flow

Provides flexible assay design and simple assay workflow

Plate setting



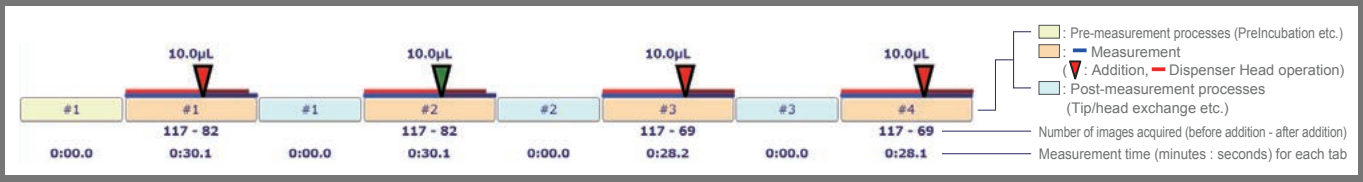
▲Simple-to-use manual settings

▲Automatic setting for each company's robot

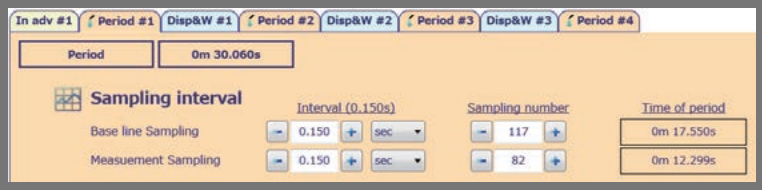
Data acquisition

Protocol 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.

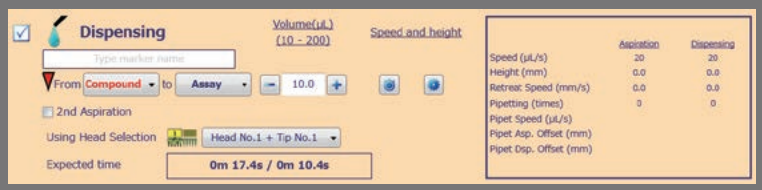


Protocol settings and display can be easily understood by combining the task tabs.
Detailed measurement, dispensing and washing settings can be made for each task tab.
*Some tasks are washing, dispensing only, without measurement.



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.

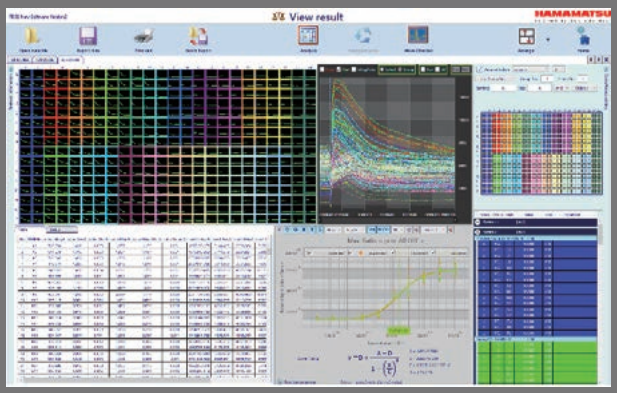
Settings for tip washing after dispensing

Tip washing is set after liquid dispensing.

Setting of electric field stimulation during measurement (EFS: Electric Field Stimulation)

Parameters (voltage, pulse width, frequency, number of pulses) of electrical stimulation. It is also possible to set by changing the voltage for each column.
*This function is available when electric field stimulation (EFS) pacing system M13040-01 is added.

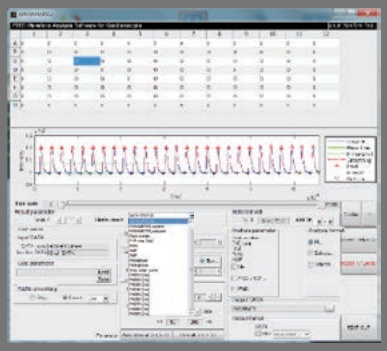
Data analysis

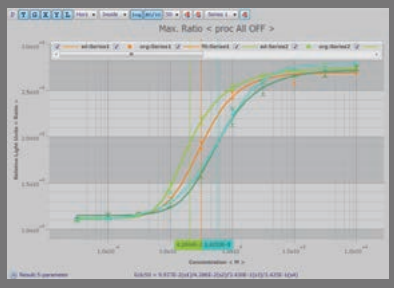


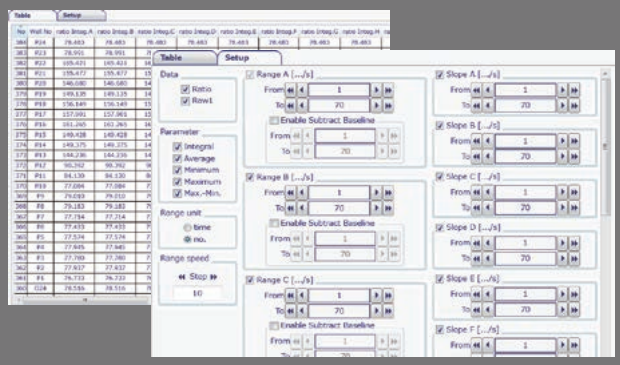
Various data processing and analysis are possible from the results of measurement

- 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

Analysis of calcium transient waveform of iPS cardiomyocyte



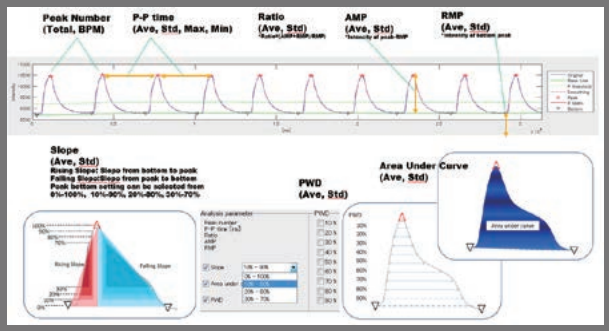




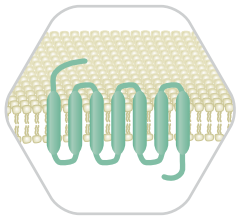
The items below can be output as text files in plate format.

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)



Examples of measurement and analysis in typical applications

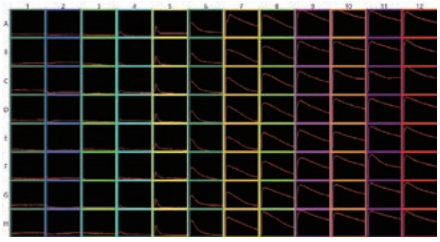


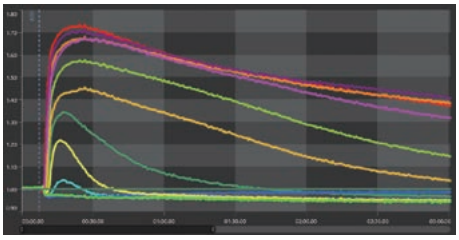
1. GPCR

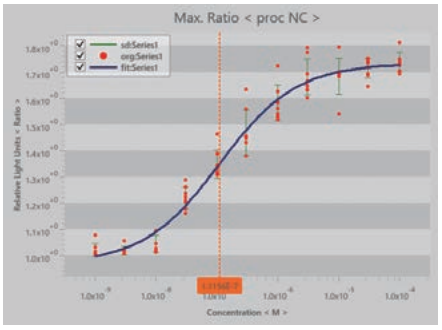
GPCR screening can be performed by intracellular Ca^{2+} assay, cAMP assay and β-arrestin assay.

Intracellular Ca^{2+} assay

Evaluation of ATP dose response using Fluo-8 AM-stained CHO

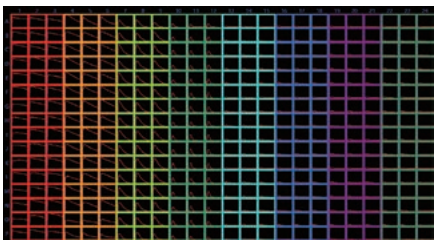


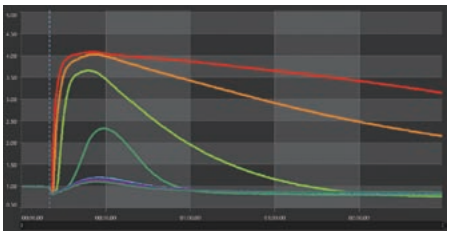


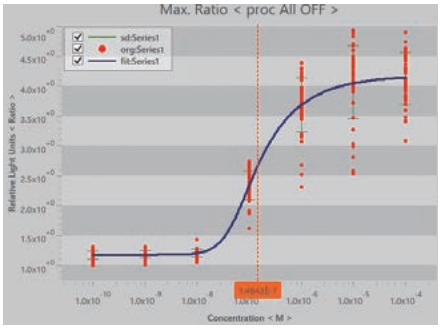


Cell: CHO cell
Dye: Fluo-8 AM (AAT Bioquest)
Compound: ATP final 100 μM – 1 nM

Evaluation of ATP dose response using CHO cells: 384 format



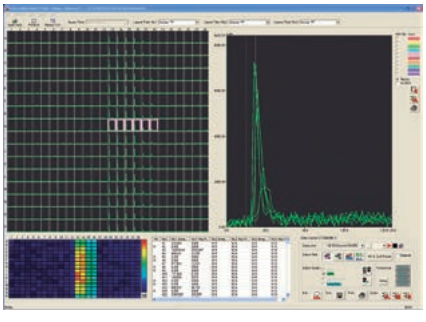




Cell: CHO 4000 cells/well
Dye: Calcium Kit iCellux (Dojindo Laboratories)
Compound: ATP final 10 μM – 10 pM

Aequorin assay

Intracellular Ca^{2+} assay by luminescence using an aequorin-expressing cell line

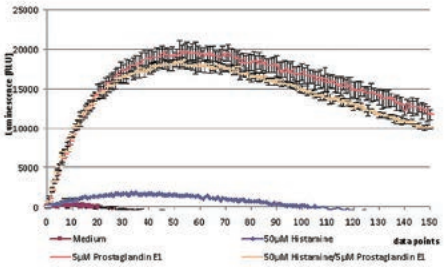


- Cell: Aeg-CHO (8000 cells/well)
- Substrate: coelenterazine
- Ligand: ATP (500 nM, 100 nM, 20 nM)

Measurements that are not affected by autofluorescence of the compound to be dispensed are enabled by using luminescence. Moreover, measurements with excellent S/N can be performed.

cAMP assay

Analysis of time course of cAMP using HUVEC expressing GloSensor (Promega)

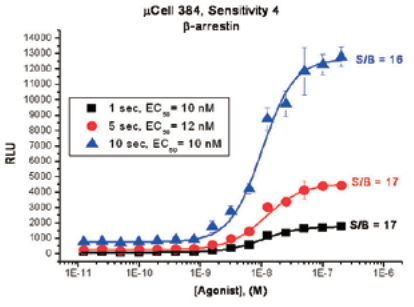


Measurement for 25 minutes at 10 second intervals after adding Histamine and Prostagrandine.

- Cell: HUVEC
- KIT: GloSensor

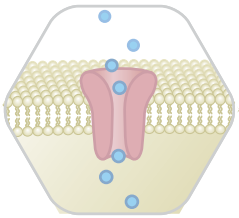
β-arrestin assay

Evaluation of β-arrestin internalization by compounds, using cells expressing PathHunter eXpress β-arrestin (DiscoveRX)



Verification of S/B at exposure times of 10 seconds, 5 seconds, 1 second

- Cell: Harvest Cells
- KIT: PathHunter eXpress β-arrestin

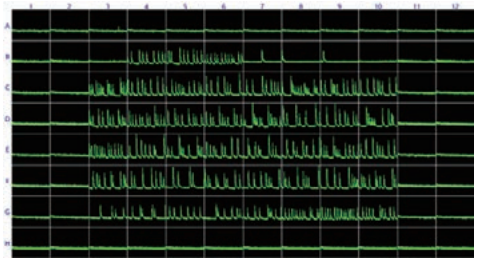


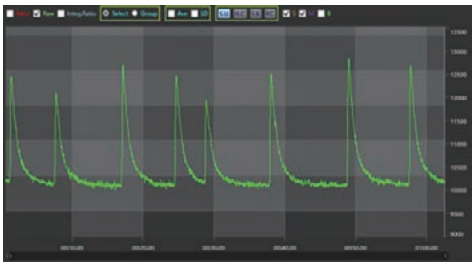
2. Ion channel

Ion channel screening can be performed using intracellular ion fluorescence indicators.

Ca^{2+} channel assay

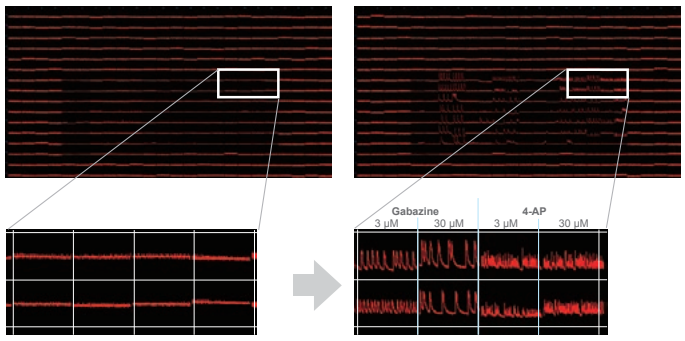
Measurement of Ca^{2+} oscillation using primary neurons





- Cell: Primary neuron
  (Rat embryonic day 17, cerebral cortex)
  (Rat Cortex Neuronal Cell, Wako Pure Chemical Industries)
- Dye: Cal-520 AM
- FDSS: FDSS/μCELL
  ImagEM 1×1binning
  exposure time 31 ms,
  Interval 31 ms, +37 ºC

Evaluation of Ca^{2+} oscillation using primary neurons



Before compound addition
17031011 G17-H20 Ratio 0.-8-1.5 Time 1 min

10 min after compound addition
17031013 G17-H20 Ratio 0.-8-1.5 Time 1 min

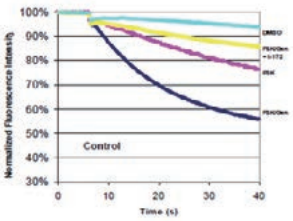
Cells: • Hippocampus from Rat (embryonic day 19)
(#085-10301, Wako Pure Chemical Industries, Lot LKE0386)
• 2.0×10^4 cells/well
• Poly-D-Lysin corting 384 well microplate

Calcium probe:
• Cal-520AM (AAT bioquest) final 2 μM

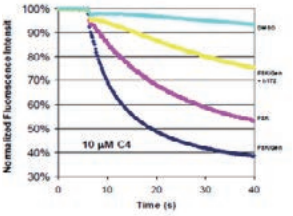
FDSS/μCELL:
• ImagEM 2×2 binning
• exposure time/Sampling rate 31 ms

Cl^- channel assay

Cl^- channel assay using YFP

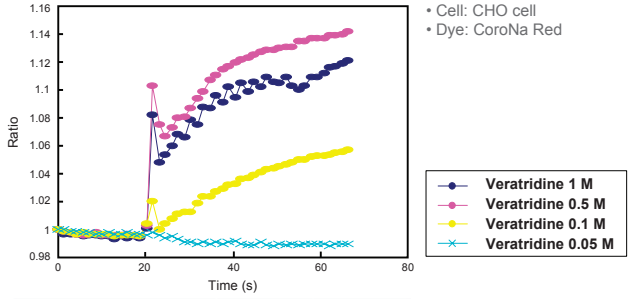


- Cell: CHO cell
- Dye: Premo Haliden Sensor



Na^+ channel assay

Na^+ channel assay using fluorescent probe

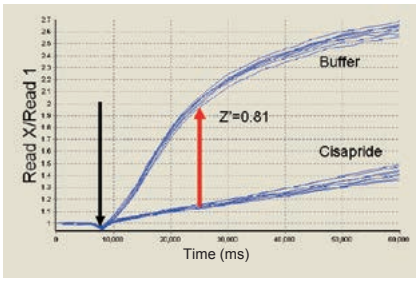


- Cell: CHO cell
- Dye: CoroNa Red

	CoroNa Red	Sodium Green
MW	773.32	1543
Molecular Probe Cat	C-24430	S-6901
Kd(K+free)	~ 200 mM	6 mM
Kd(K+Sat.)	~ 200 mM	21 mM
Excitation wavelength	540 nm	480 nm
Emission wavelength	590 nm	540 nm

K^+ channel assay

K^+ assay in CHO cells using Flux-OR



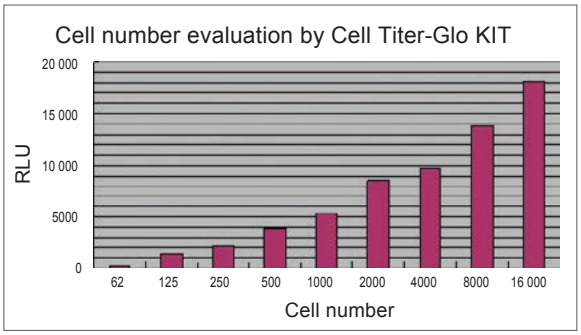
- Cell: CHO cell
- Dye: Flux-OR Potassium

3. Luminescence

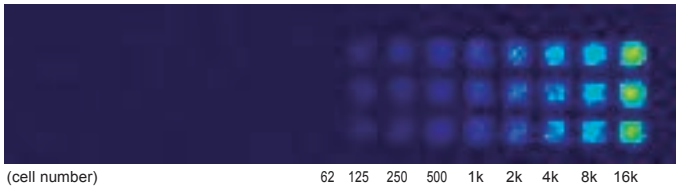
Luminescence screening can be performed using luminescent probes such as luciferase or aequorin.

Luciferase assay

Cell number evaluation using luciferase luminescence



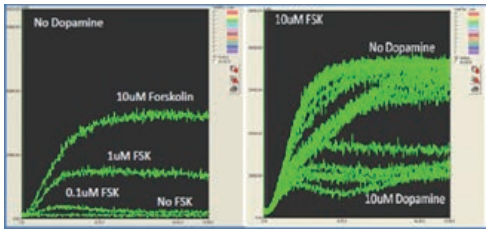
• Cell: CHO-K1(16 000, 8000, 4000, 2000, 1000, 500, 250, 125, 62 cells/well)
• KIT: Cell Titer - Glo (Promega)

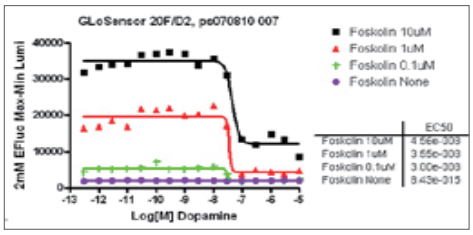


It has high linearity and high sensitivity that can detect luminescence even with a small number of cells.

cAMP assay

cAMP evaluation using GloSensor

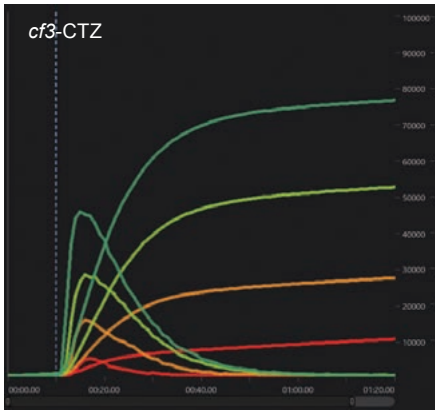




• Cell: CHO cell
• KIT: GloSensor

Aequorin assay

Ca^{2+} assay using aequorin-expressing cells



Cell: CHO-K1 stably expressing apoaequorin with a mitochondrial targeting signal
Substrate: h-coelenterazine (*h*-CTZ), *cf3*-coelenterazine (*cf3*-CTZ)
Compound: acetylcholine final 30 nM – 1 μM

S. Inoue, R. Iimori, Y. Sahara, S. Hisada, T. Hosoya, Application of new semisynthetic aequorins with long half-decay time of luminescence to G-protein-coupled receptor assay, Analytical biochemistry 407.2 (2010) 247-252.

4. BRET/FRET

Screening of protein-protein interaction can be performed using fluorescence/luminescence energy transfer.

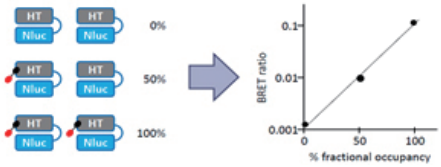
BRET assay

Control protein evaluation using NanoBRET

NanoBRET control protein calibration panel

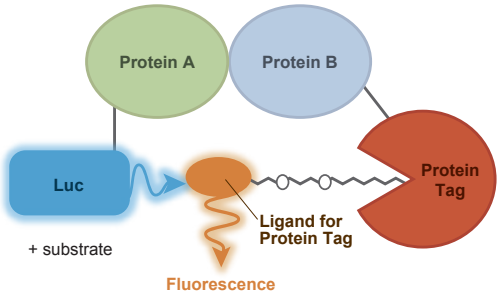
- A control protein in which a HaloTag NanoBRET ligand is bound to a NanoLuc-HaloTag fusion protein
- Five types of controls with different ligand binding rates

By drawing the calibration curve, it is possible to check how much the coupling rate can be detected

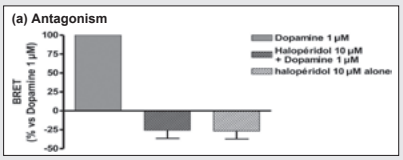


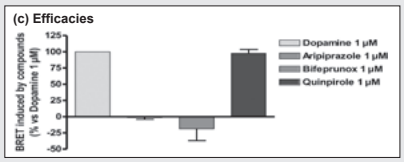
NanoBRET™ Control protein panel
— 5 vials representing the following amounts of fractional occupancy:

a. NanoBRET™ Control Protein 1: 0 % NL-HT NanoBRET fractional occupancy
b. NanoBRET™ Control Protein 2: 0.1 % NL-HT NanoBRET fractional occupancy
c. NanoBRET™ Control Protein 3: 1 % NL-HT NanoBRET fractional occupancy
d. NanoBRET™ Control Protein 4: 10 % NL-HT NanoBRET fractional occupancy
e. NanoBRET™ Control Protein 5: 100 % NL-HT NanoBRET fractional occupancy



BRET assay using CHO cells





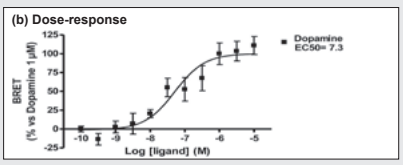


Fig. 1:Agonist-induced b-arrestin recruitment to D2s-R. Data represent the mean s.e.m. of at least 3 independent experiments.

principle of β-arrestin BRET¹- assay

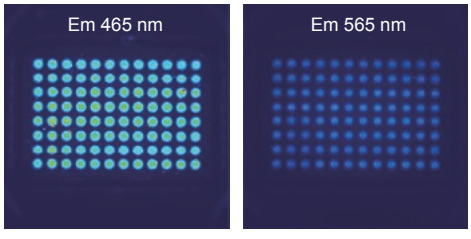
D2R: Dopaminergic Receptor D2
Ago: Agonist
Arr: Arrestin
Coel: Coelenterazine h
eYFP: enhanced Yellow Fluorescent Protein
P: phosphorylation Sites

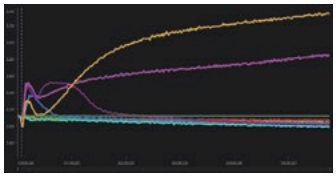
Data courtesy: Frederic Finana
Biologie Cellulaire et Moléculaire, Centre de Recherche Pierre Fabre
Finana F, De Vries L, Rauly-Lestienne I et al. 10th European Functional Drug Screening Symposium Poster No. 8 (2014)

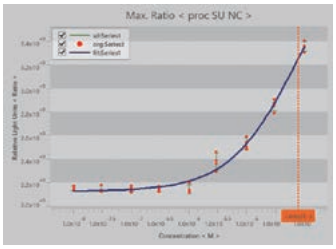
Rluc - D2s receptors and eYFP - β-arrestin 2 are expressed in CHO cells, and Rluc and eYFP BRET occurring in cells when Ligand is added are detected.

FRET assay

Evaluation of Nav 1.5-CHO cells using FRET-type voltage sensitive dye (VSP)





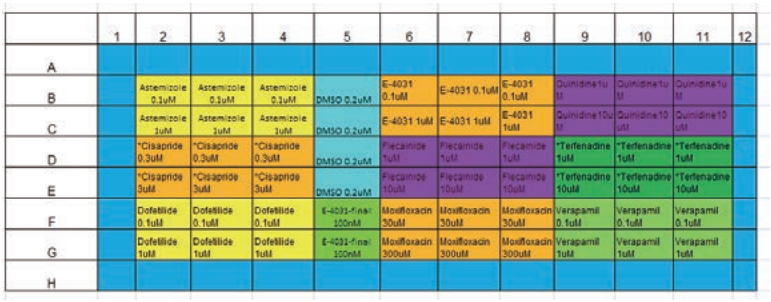


- Cell: Nav1.5-KCNJ2-stChR2-CHO (Ion Chat Research Corporation)
- Dye: Donor: CC2-DMPE (Invitrogen) final 5 µM
  Acceptor: DiSBAC4(3) (Invitrogen) final 10 µM
- Compound: Veratridine (Sigma)
  final 100 µM - 10 nM

5. iPS-cell

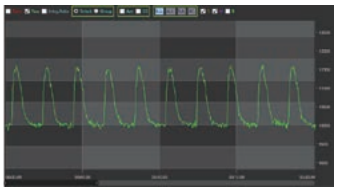
Toxicity evaluation and drug discovery screening using iPS cell-derived cardiomyocytes and neurons can be performed.

Ca^{2+} transient and membrane potential measurement using iPS cell-derived cardiomyocytes

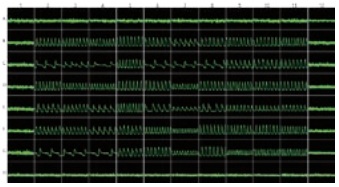


	1	2	3	4	5	6	7	8	9	10	11	12
A												
B		Astemizole 0.1uM	Astemizole 0.3uM	Astemizole 0.1uM	DMSO 0.2uM	E-4031 0.1uM	E-4031 0.1uM	E-4031 0.1uM	Quinidine1u M	Quinidine1u M	Quinidine1u M	
C		Astemizole 1uM	Astemizole 1uM	Astemizole 1uM	DMSO 0.2uM	E-4031 1uM	E-4031 1uM	E-4031 1uM	Quinidine10u M	Quinidine10 uM	Quinidine10 uM	
D		*Cisapride 0.3uM	*Cisapride 0.3uM	*Cisapride 0.3uM	DMSO 0.2uM	Flecainide 1uM	Flecainide 1uM	Flecainide 1uM	*Terfenadine 1uM	*Terfenadine 1uM	*Terfenadine 1uM	
E		*Cisapride 3uM	*Cisapride 3uM	*Cisapride 3uM	DMSO 0.2uM	Flecainide 10uM	Flecainide 10uM	Flecainide 10uM	*Terfenadine 10uM	*Terfenadine 10uM	*Terfenadine 10uM	
F		Dofetilide 0.1uM	Dofetilide 0.1uM	Dofetilide 0.1uM	E-4031-final 100nM	Moxifloxacin 30uM	Moxifloxacin 30uM	Moxifloxacin 30uM	Verapamil 0.1uM	Verapamil 0.1uM	Verapamil 0.1uM	
G		Dofetilide 1uM	Dofetilide 1uM	Dofetilide 1uM	E-4031-final 100nM	Moxifloxacin 300uM	Moxifloxacin 300uM	Moxifloxacin 300uM	Verapamil 1uM	Verapamil 1uM	Verapamil 1uM	
H												

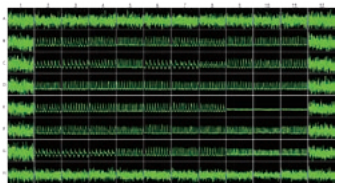
- Cell: iCell Cardiomyocytes^2 (CDI)
- Dye: Cal-520AM
- Plate format for various compounds



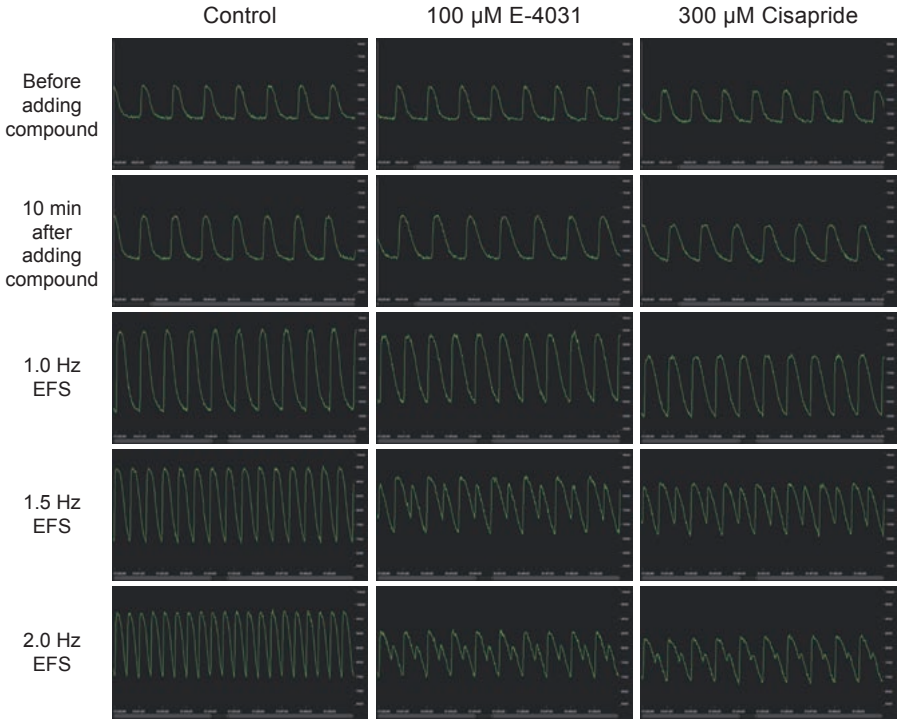
- Cell: iCell Cardiomyocytes^2 (CDI)
- Dye: Cal-520AM
- Ca^{2+} transient after addition of various compounds



- Cell: iCell Cardiomyocytes^2 (CDI)
- Dye: FluoVolt
- Action potential after addition of various compounds

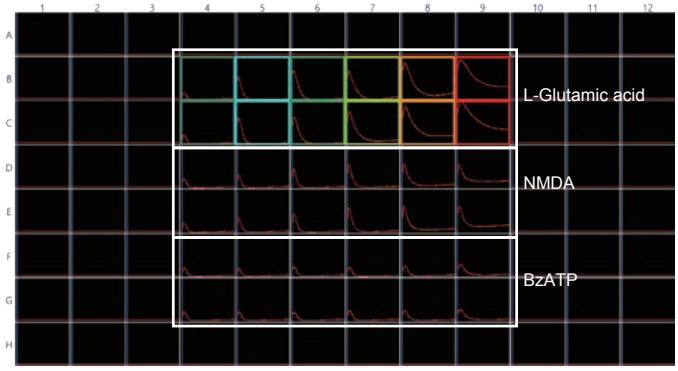


Ca^{2+} transient measurement <EFS (Electric Field Stimulation) pacing evaluation after drug addition>

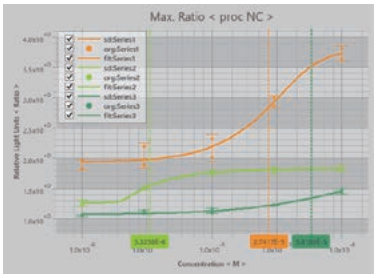


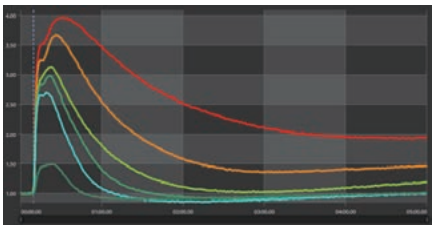
- Cell: Cardiomyocytes
- Dye: Cal-520
- EFS: voltage 5 V, pulse duration 10 ms, Height 0.0 mm, frequency 1-2 Hz

Drug evaluation using iPS cell-derived neurons

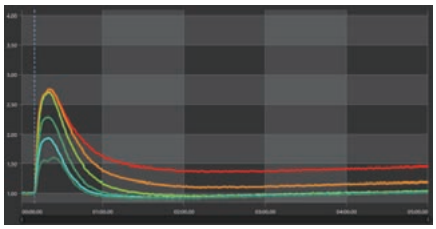


- Cell: iCell Neurons
  40 000 cells/well
  96 well Half Volume plate (Corning, #3882)
- Dye: Cal-520
- Compound: L-Glutamic acid potassium salt monohydrate (Sigma G1501)
  NMDA (N-methyl-D-aspartate)
  (Tocris Bioscience cat.no0114)
  BzATP (Prototypic P2X7 receptor agonist)
  (Abcam,ab120444)

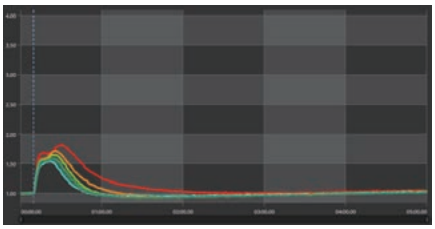




L-Glutamic acid

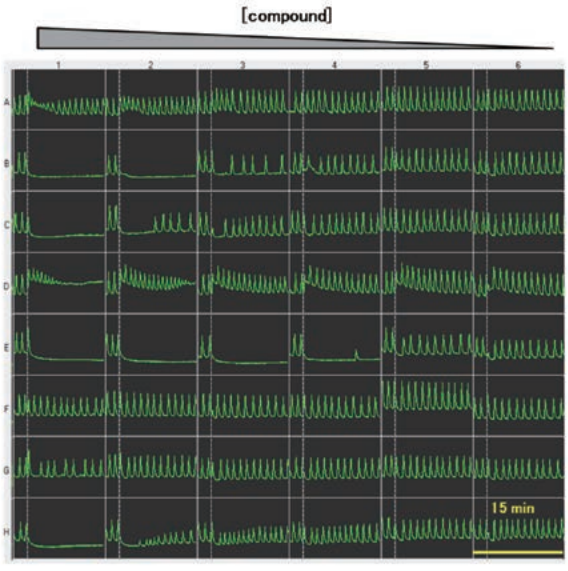


NMDA



BzATP

Evaluation of efficacy of Ca^{2+} oscillation using iPS cell-derived Dopa-Neuron



Cyclothiazide (targets AMPA-R)

D-AP5 (NMDA-R antagonist)

DNQX (targets AMPA-R)

Thapsigargin (inhibits SERCA)

Lidocaine (blocks Na_V channels)

Gabapentin (targets VGCCs)

trans-ACPD (targets mGluR1)

SA-4503 (σ1 receptor agonist)

- Cell: iCell Gluta Neurons
- Dye: Fluo-4 (1 μM) final conc.
- Dose response of various compounds

Components

[ ] are the products must be ordered together and unable to separately order.

Product	Model	Content
Basic configuration		
FDSS/µCELL Main unit	A11529-01B	Main unit of FDSS/µCELL system. Robot connection upgrade is possible.
Dispenser tip installer	A11529-02	Device for collectively attaching and detaching dispensing tips. Install the tip rack on the bottom, place the dispenser head on the top, and manually release.
Compound plate stage	A11529-04B	Transporting stage capable of holding two reagent plates attached to the dispenser inside the main body. Controlled by software through the dispenser.
Washing stage	A11529-05B	Optional tip washing function and wiping table added to body. Automatically controlled by the main body and performs tip washing and wiping.
Heater unit	A11529-15	Heater is compatible with robot automation. Install inside the main body to keep it at +35 ºC to +37 ºC. ON/OFF and temperature setting on are the operation panel.
Fluorescence optical unit	M11031-02	Consists of an optical system for fluorescence measurement and controller for LED light source; the LED can be exchanged by the user.
Light source array unit (B,G)	L11601-06	LED light source for blue and green excitation measurement, fluorescent filter. Excitation central wavelength: 470 nm and 530 nm, fluorescence central wavelength: 540 nm and 593 m.
ImagEM X2 EM-CCD camera	C9100-23B	High sensitivity CCD camera with charge multiplication mechanism on the tip. Can handle fluorescence and luminescence measurement.
Digital camera I/F kit IEEE1394b	M7791-19	An interface kit for controlling a digital camera of the IEEE 1394B standard.
C mount lens 25 mm F0.95	A6402	25 mm F0.95 C mount lens used as an imaging optical system for EM-CCD camera.
Data analysis unit	C7903-11	Data analyzer for FDSS/µCELL. For controlling camera and dispenser/light source. (Computer table is not included.)
FDSS Software online	U8524-01A	Software for controlling FDSS/µCELL and acquiring images from the camera (Ver. 3.0). 64 bit OS compatible.
FDSS Software offline	U8524-03A	Offline software. Used to display, analyze, and output data on devices other than FDSS/µCELL. 64 bit OS compatible.
Packing and Domestic Transportation	SY48-3002	Basic Packing and Transportation from the factory to the forwarder in Japan.
Dispenser heads/Wash <options>		
Dispensing unit (96 tip type)	A10118-24	Dispenser head for dispensing reagents simultaneously into a 96-well microplate. Dispensing volume 10 µL to 200 µL, dispensing accuracy within 5 % CV (when dispensing 10 µL).
Dispensing unit (384 tip type)	A10118-26	Dispenser head for dispensing reagents simultaneously into a 384-well microplate. Dispense volume 1 µL to 30 µL, dispensing accuracy within 5 % CV (when dispensing 5 µL).
Washing unit	A11529-09	Unit for washing tips attached to the dispenser head. Includes bath/tube/control pump/washing liquid tank/waste liquid tank.
Chimney plate (96 tip type)	A11529-12	Option for washing tips attached to dispenser head (96 chips) A10118-24. Used in combination with the washing unit.
Chimney plate (384 tip type)	A11529-13	Option for washing tips attached to dispenser head (384 chips) A10118-26. Used in combination with the washing unit.
Electric Field Stimulation (EFS) *1 <options>		
EFS pacing system	M13040-01	Option to give 96 multichannel electrical stimulation to cells. Pace cellular activity and evaluate the effect of drugs added to the cells.
Desktop ultrasonic bath for EFS pacing (US)	A14020-01	Desktop ultrasonic washer for washing the electrodes of EFS pacing head (96 ch) A13029-01.
Desktop ultrasonic bath for EFS pacing (EU)	A14020-01CR	Desktop ultrasonic washer for washing the electrodes of EFS pacing head (96 ch) A13029-01.
Washing attachment	A14236	Attachment for EFS pacing desktop ultrasonic cleaner A14020-01.
Vacuum wipe function	A14218	Wipe stage with vaccum capability to always have dried absorbance paper for wiping.

*1 The FDSS/µCELL EFS system should not be used for optically detecting/monitoring change in transmembrane potential of the cells.
The FDSS/µCELL EFS system should not be used on any cell or cells in which the user or anyone else has expressed target ion channels.

Optical system/Barcode reader <options>		
Fluorescence filter changer unit (US)	A8472-05	Change the emission wavelength by automatically changing the four emission filters installed in front of the camera. Built-in fluorescent filter wheel.
Fluorescence filter changer unit (EU)	A8472-05CR	Change the emission wavelength by automatically changing the four emission filters installed in front of the camera. Built-in fluorescent filter wheel.
CO2 incubator *2	A11529-16	Adds CO2 incubation function around the assay plate installed in FDSS/µCELL.
Barcode reader for assay plate	A11529-10	Option for reading the barcode attached to the assay plate. Reads the barcode on the right side of the assay plate on the stage.
Barcode reader for compound plate	A11529-11	Option for reading the barcode attached to the reagent plate. Reads the bar code on the right side of the reagent plate on the stage.

*2 Option to maintain the CO2 concentration around the assay plate at 5 % to 6 %. Cannot be combined with automatic door unit A11529-07 or automatic assay plate stage A11529-08.
When C11529-16 is added, the barcode reader may not function depending on the position of the barcode, due to the structure.

Sensor <options>		
ORCA-Flash4.0 V3 Digital CMOS camera	C13440-20CU	Fluorescence measurement camera. Equipped with CMOS image sensor for scientific measurement, it has high resolution of 4 million pixels and high-speed reading of 100 frames/sec.
Frame grabber board CameraLink for ORCA-Flash V3	M9982-29	Image input board compatible with Camera Link/Deca (80 bit).
Camera Link cable SDR-SDR 4 m *3	A14038-04	Cable of Camera Link interface standard. Cable length: 4 m.
C mount lens	A6402-01	50 mm F1.8 C mount lens. Used as an imaging optical system with ORCA-Flash4.0 V3.
Hose set without joint *4	A10788-04	Two hoses with a relay connector for connecting to a circulating water cooler.

*3 Two are required.
*4 Hose set is to be used wit hthe water circulator chiller. Please enquire to your Hamamatsu Representative for the water circulater chiller for the digital camera.

Excitation light source <options>		
Light source array unit (Fluo-4)	L11601-01A	LED light source for Fluo-4 measurement, fluorescence filter. Excitation central wavelength: 470 nm, fluorescence central wavelength: 540 nm.
Light source array unit (FMP)	L11601-02A	LED light source for FMP measurement, fluorescence filter. Excitation central wavelength: 530 nm, fluorescence central wavelength: 593 nm.
Light source array unit (VSP-FRET)	L11601-03	LED light source for membrane potential measurement, fluorescence filter. Excitation central wavelength: 385 nm, fluorescence central wavelength: 465 nm and 565 nm.
Light source array unit (CFP/YFP-FRET)	L11601-04	C/Y LED light source for FRET, fluorescence filter. Excitation central wavelength: 450 nm, fluorescent central wavelength: 483 nm and 542 nm.

Automation *5 <options>		
Self-operating door unit	A11529-07	Option for adding automatic door control to main unit. It is automatically controlled by the main unit to open and close the door during assay plate stage operations.
Auto assay plate stage	A11529-08B	Option to add a stage to place assay plate in the main unit. It is automatically controlled by the main unit, enabling robotic access to the assay plate.
FDSS Software option Software interface for external control	U8524-13	Enables FDSS external control interface of FDSS software.

*5 A driver development fee separate from the above options is required to implement automation. (automation integrator)
Since we do not provide drivers for external control, we ask that you receive an estimate from an automation integrator.

Software <options>		
FDSS Software Offline	U8524-03A	Offline software. Used to display, analyze and output data on devices other than FDSS/µCELL. 64 bit OS compatible.
FDSS Software option High Speed Acquisition Option	U8524-11	Software module and protection key enabling high-speed capture. High-speed capture functions at 5 ms.
FDSS Software option Waveform Analysis software for cardiomyocyte	U8524-12	Software and protection key for multiwell analysis of waveforms obtained from cardiomyocytes.
FDSS Software option Export TIFF image option	U8524-14	Add function to save TIFF (16 bit) image from FDSS software.

Consumables		
96 black tip (10 racks) for FDSS7000/µCELL	A8687-32A	Mounted on dispenser head (96 ch tip type) A10118-24, tip for aspirating liquid from a designated container and dispensing it to a microplate.
384 black tip (10 racks) for FDSS7000/µCELL	A8687-62A *6	Mounted on dispenser head (384 ch tip type) A10118-26, tip for aspirating liquid from a designated container and dispensing it to a microplate.

*6 Alphabet in the suffix of the model number may vary. (Ex. A8687-62B, -62C)

Spare parts *7		
EFS pacing head (96ch)	A13029-01	96 multi-channel pacing head for replacement. Option for EFS pacing system M13040-01.
Dispensing unit (96 tip type)	A10118-24	Dispenser head for dispensing reagents simultaneously into a 96-well microplate. Dispensing volume 10 µL to 200 µL, dispensing accuracy within 5 % CV (when dispensing 10 µL).
Dispensing unit (384 tip type)	A10118-26	Dispenser head for dispensing reagents simultaneously into a 384-well microplate. Dispense volume 1 µL to 30 µL, dispensing accuracy within 5 % CV (when dispensing 5 µL).

*7 Dispenser unit performance (e.g. dispense uniformity, CV) is not covered under any warranty or guarantee offered from Hamamatsu representative and will gradually degrade as long as you use. Once exceeding the validation limit, dispenser head need to be replaced.

Maintenance and Validation service

Maintenance for the hardware and quality check of the dispenser head need to be performed periodically to validate your instrument.
We will announce about the maintenance service contract and validation service before the date of one year from the installation date, and we strongly recommend to have a full-service contract that covering the maintenance service and validation service, to certify the performance.
Full-service contract is only available and possible to contract during the 1st year after installation.
Please contact your Hamamatsu representative for further more information.

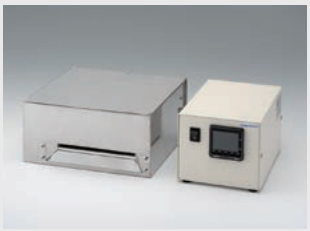
Basic configuration


▲ ImagEM X2 EM-CCD camera C9100-23B


▲ Light source array unit (B,G) L11601-06


▲ Dispenser tip installer A11529-02


▲ Fluorescence optical unit M11031-02


▲ Heater unit A11529-15

Dispenser heads <options>


▲ Dispensing unit (96 tip type) A10118-24


▲ Dispensing unit (384 tip type) A10118-26

Electric Field Stimulation (EFS) <options>

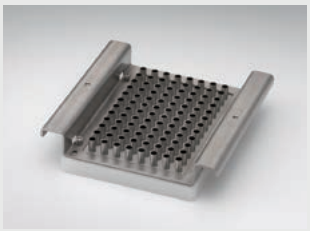

▲ EFS pacing system M13040-01

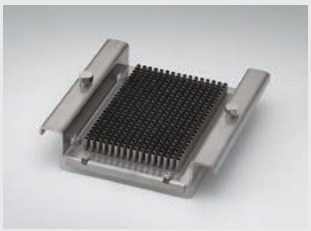
Optical system <options>


▲ Fluorescence filter changer unit (US) A8472-05

Wash <options>


▲ Washing unit A11529-09


▲ Chimney plate (96 tip type) A11529-12

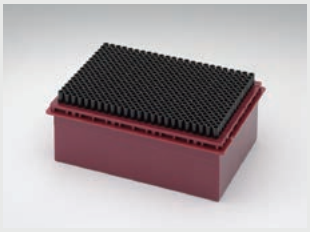

▲ Chimney plate (384 tip type) A11529-13

Sensor <options>


▲ ORCA-Flash4.0 V3 Digital CMOS camera C13440-20CU

Consumables/Spares

▲ 96 black tip (10 racks)
for FDSS7000/μCELL A8687-32A


▲ 384 black tip (10 racks)
for FDSS/μCELL A8687-62A*

*Alphabet in the suffix of the model number may vary. (Ex. A8687-62B, -62C)


▲ EFS pacing head (96 ch) A13029-01

Appearance/Specifications

System appearance

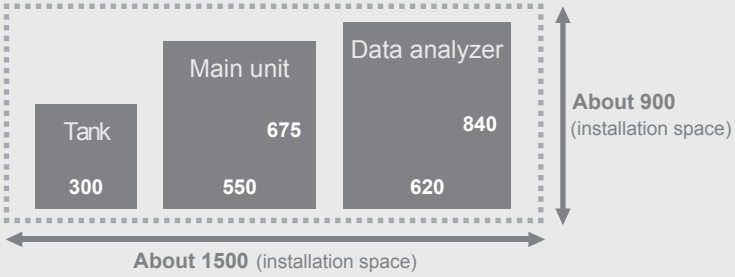
Standard type

Robot connection type

* To support robotic connection, additional components such as automatic door unit A11529-07, automatic assay plate stage A11529-08B and external control software interface U8524-13 are required.
Retrofitting is not supported. For details please contact our sales department.
* Computer table is not included.

System footprint

Unit: mm



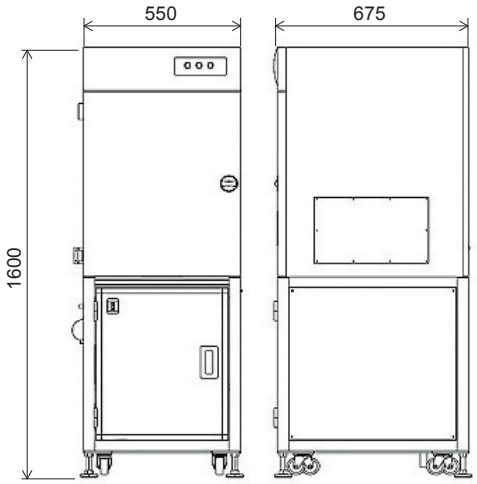
Specifications

Dispense	(96-tip type) A10118-24	10 μL to 200 μL using A10118-24
	(384-tip type) A10118-26	1 μL to 30 μL using A10118-26
Sensor (ImagEM)		High-speed, high-sensitivity digital EM-CCD camera for fluorescence and luminescence
Sampling rate		10 Hz (10 data point per second)
		200 Hz (200 data point per second) maximum with U8524-11 option *1
Sampling interval		0.1 s to 100 s interval
		0.005 s to 100 s with U8524-11 option *1
Light source (L11601-06)		470 nm excitation and 540 nm emission
		530 nm excitation and 593 nm emission
Plate positions		One stage for assay plate, two stages for compound plate
Adaptable microplate		Clear bottom black 96/384 plates (SBS format height 8 mm to 15 mm)
Tip/Plate loading		Manual loading
Number of sampling data point		1 to 50 000 samples
Power supply specification		Input power supply: AC 100 V to AC 240 V, Frequency: 50 Hz/60 Hz
Power consumption when AC 100 V to AC 120 V (Data analysis unit and FDSS/μCELL main unit with heater)		Approx. 1300 VA (Data analysis unit: approx. 500 VA, dispenser main unit: approx. 300 VA, heater unit, approx. 500 VA)
Power consumption when AC 200 V to AC 240 V (Data analysis unit and FDSS/μCELL main unit with heater)		Approx. 1170 VA (Data analysis unit: approx. 500 VA, dispenser main unit: approx. 300 VA, heater unit, approx. 370 VA)
Ambient operating temperature		+15 ºC to +30 ºC
Dimension/weight	Main unit (Data analysis unit is not included)	550 mm (W)×675 mm (D)×1600 mm (H)/approx. 200 kg

Dimensional Outlines

Unit: mm

● Main unit



(Weight: approx. 200 kg)

*1 FDSS software option: High speed data capture when using U8524-11

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Cat. No. SBIS0077E07
JUN/2019 HPK
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