

## Technical Data Sheet

## Codex ACTOne™ Membrane Potential Dye Kit

**Product Information**

Catalog Number: **CB-80500-201**  
Components: **10X ACTOne Membrane Potential Dye Solution, 10 ml**  
**10X ACTOne Dye Dilution Buffer, 11 ml**

**Description**

cAMP is a key second messenger involved extensively in cellular signal transduction pathways associated with the majority of G-protein coupled receptors (GPCRs). The activation of these GPCRs by neurotransmitters, lipids, nucleotides, peptides and hormones results in the activation or the inhibition of plasma membrane-bound adenylate cyclase through heterotrimeric G-proteins. The ACTOne cAMP assay from Codex BioSolutions is the first in its class in providing real-time information on intracellular cAMP changes in a high-throughput format without a cell lysis step. The assay works with cell lines provided by Codex BioSolutions that contain a proprietary exogenous Cyclic Nucleotide-Gated (CNG) channel. The channel is activated by elevated intracellular levels of cAMP, resulting in ion flux (often detectable by calcium-responsive dyes) and cell membrane depolarization [which can be detected with a fluorescent membrane potential (MP) dye].

The Codex ACTOne membrane potential dye kit allows both end-point and kinetic measurement of intracellular cAMP changes with a FLIPR, or a fluorescence microplate reader. It is a simple homogenous assay involving only dye and compound addition steps, allowing easy implementation in a high-throughput environment.

**Storage**

10X ACTOne Membrane Potential Dye Solution should be protected from light and stored at -20°C. 10X ACTOne Dye Dilution Buffer should be stored at room temperature.

**Materials not included**

Phosphodiesterase (PDE) inhibitor Ro 20-1724 (50mM stock in DMSO, store at -20°C)	Sigma B8279
Dulbecco's Phosphate Buffered Saline (DPBS)	Sigma D8537
Water	Sigma 320072

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# ASSAY PROTOCOL

*Note. Please finish reading the whole protocol before you start the experiment.*

## CELL PREPARATION

1. Harvest cells when they reach 80-90% confluence in flasks. Trypsinize cells as described in Cell Culture Protocol above. Count a portion of the cells with a hemocytometer.

*Note. It is very important that the cells DO NOT reach >90% confluence. Over-confluent growth can result in a significantly reduced response to ligands, and it may take several passages for the cells to recover to optimal stage.*

2. The cell number needs to be optimized for each assay. Optimal assay conditions require a confluent monolayer of cells prior to the assay. Poly-D-Lysine coated plates are recommended to improve cell attachment. Plate 70K cells/well for a 96 well plate and 14K cells/well for a 384 well plate the day before the experiment. Add 100 µl/well of cell suspension to 96-well plates or 20 µl/well to 384-well plates.
3. Allow cells to attach by leaving the cell plates at room temperature for 30 minutes. Transfer the plates to a cell culture incubator and grow the cells overnight.

## PREPARATION of 1X DYE-LOADING SOLUTION

1. Remove a bottle of 10X ACTOne Membrane Potential Dye Solution from -20°C, and allow it to thaw at room temperature.
2. To prepare 1X ACTOne Membrane Potential Dye Dilution Buffer, transfer 10 ml of 10X ACTOne Membrane Potential Dye Dilution Buffer to 90 ml of deionized-distilled or reverse osmosis H<sub>2</sub>O. Mix well.
3. To prepare 1X Dye-loading Solution for 10 cell plates, pipette 10 ml of 10X ACTOne Membrane Potential Dye Solution to 90 ml of 1X ACTOne Membrane Potential Dye Dilution Buffer. Mix well.
4. Aliquot the unused 1X Dye-loading Solution to several tubes, and store at -20°C. Store 1X ACTOne Membrane Potential Dye Dilution Buffer at room temperature.

*Note. 1x Dye-loading Solution is stable for more than one month if stored at -20°C. Avoid repetitive freeze-thaw cycles.*

## DYE LOADING

1. Add phosphodiesterase inhibitor Ro20-1724 to a concentration of 50 µM in 1X Dye-loading Solution (optional step).

*Note. Adding a phosphodiesterase inhibitor will increase the assay sensitivity.*

2. Remove cell plates from incubator and add an equal volume of 1 X Dye-loading Solution to each well (e.g. 100 µl to 100 µl culture medium/well for 96-well plates, or 20 µl to 20 µl culture medium/well for 384-well plates).

*Note. For some assays that require a serum-free environment, culture medium that contains serum should be removed prior to dye loading and replaced with a equal volume of DMEM containing 0.2 to 0.5% BSA.*

3. Incubate cell plates with dye for 2 hour at room temperature in the dark.

## PREPARATION of COMPOUND PLATES

- For agonist screening, dilute compounds in DPBS at 5x final concentrations. Add the compound solution at 1/5 volume to each well (e.g. 50 µl/well for 96-well plates with 250 µl total well volume after addition, or 10 µl/well for 384-well plates with 50 µl total well volume after addition).
- For antagonist assay, dilute antagonists in DPBS at 6x final concentrations. Add the compound solution at 1/5 volume to each well (e.g. 50 µl/well for 96-well plates or 10 µl/well for 384-well plates). Incubate the plates at room temperature for 15 min prior to adding the specific agonists. Agonists should be prepared at 6x final concentrations in DPBS, and added to each well at 1/6 volume (e.g. 50 µl/well for 96-well plates with 300 µl total well volume after agonist addition, or 10 µl/well for 384-well plates with 60 µl total well volume after agonist addition).

*Note. Antagonist incubation times should be optimized for each assay. Do not allow final concentration of DMSO in assay well to exceed 1.5%.*

## MEMBRANE POTENTIAL ASSAY

- **Kinetic assay with on-line compound addition**

Place the cell plates on a FLIPR, FlexStation or FDSS, and perform the membrane potential assay with on-line addition of test compounds in 1X DPBS to the cell plates at 50 µl/well for 96-well plates (250 µl total well volume after addition) or 10 µl/well for 384-well plates (50 µl total well volume after addition).

For assays performed on a **FLIPR**, use the 540-590 bandpass FLIPR filter (#2) from Molecular Devices (cat. #0310-4077).

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For assays performed on a **FlexStation**, use the following wavelength parameters: Excitation: 530 nm; Emission: 565 nm; AutoCutoff: on (550 nm)

*Note. Dispense speed and height for compound additions need to be optimized for each instrument.*

- **Endpoint assay or kinetic assay with off-line compound addition**

A fluorescence plate reader with bottom read-head is required. Test filter settings to optimize fluorescence light collection and eliminate bleedthrough of excitation light to emission filters. For example, the following filter settings can be used with excitation = 530/20 nm and emission = 590/20 nm.

Read fluorescent baseline and record the fluorescent counts prior to drug addition. Add test compounds to cell plates off-line, and then read the plates at the appropriate time after drug addition.

*Note. Dispense speed and height for compound additions need to be optimized so that the cell monolayer is not disturbed.*

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## DATA EXAMPLES

The ACTOne Membrane Potential Dye Kit has been evaluated against a panel of diversified receptors and ligands to ensure that the dye kit is pharmacologically compatible with drug screening. A variety of endogenous and recombinant receptors and their cognate ligands have been tested using the kit, including ligands with pharmacophores of adenosine, biogenic amines, lipids, and peptides. Potency (**EC50**) of the ligands as well as maximal signal (**Fluorescence Fold-change**) in ACTOne assay has been determined (see Table).

<i>Receptor</i>	<i>Ligand</i>	<b>ACTOne Membrane Potential Dye Kit</b>	
		<b>EC50</b>	<b>Fluorescence Fold-change</b>
Adenosine A2b receptor (A2b)	NECA	560 nM	5.5
Adenylyl Cyclase	forskolin	0.16 $\mu$ M	5.1
$\beta$ -adrenoceptor (BAR)	isoproterenol	2.6 nM	5.4
Cannabinoid receptor (CNR1, CB1)	anadamide	208 nM	4.3
Dopamine Receptor 1 (DRD1)	dopamine	4.1 pM	6.7
Dopamine Receptor 2 (DRD2)	dopamine	20 nM	3.9
Gastric Inhibitor Peptide Receptor (GIPR)	GIP	3.0 pM	6.0
Glucagon Receptor (GCGR)	glucagon	2.5 pM	6.5
Melanocortin 4 Receptor (MC4R)	[Nle4-D-Phe7] $\alpha$ -MSH	4.9 nM	6.5
Parathyroid Hormone Receptor 1 (PTH1R)	PTH	7.8 pM	5.5
Prostaglandin E Receptor 4 (PTGER4, EP4)	PGE2	25.4 pM	6.3
Somatostatin receptor 5 (SSTR5)	somatostatin	2.4 nM	4.4
Vasoactive Intestinal Peptide Receptor 2 (VIPR2, VPAC2R)	VIP	28 pM	6.3

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# TROUBLESHOOTING GUIDE

## 1. Low survival rate of cells after thawing

- Cell vials could have thawed accidentally. Store cell vials in liquid nitrogen immediately after receiving and keep frozen at all times.
- Leaving the vial at 37°C for too long during thawing will lower the survival rate. Place the vial at 37°C until cells are just thawed.
- Handle the cells gently. Don't tap the vial or pipette the cells too many times before plating the cells.
- Replace the medium four hours after thawing or when the cells have settled to remove DMSO.

## 2. Slow growth rate of cells

- Do not split cells before they have completely recovered from thawing and reach at least 50% confluence.
- Do not dilute cells excessively while splitting.
- Split cells before they reach 80 – 90% confluence.
- Use Trypsin-EDTA solution to dissociate cells.
- Cells may not be able to recover to an optimal stage if trypsin- free dissociation buffer is used.

## 3. High baseline fluorescent signal

- Inspect the cell density and morphology under a microscope. High cell density or unhealthy cells can result in high baseline signal.
- Do not remove serum-containing medium from cell plates before dye-loading. If a serum-free environment is required, use DPBS buffer containing 0.2 to 0.5% BSA to replace medium.

## 4. Response to agonist is lower than expected

- Check the overall health of cells.
- Cell density is too high or too low. Cell number titration may be necessary.
- Keep cells growing in medium with proper drug selection.
- Check settings of fluorescence readers.

## 5. High well-to-well variations.

- Cells should be evenly distributed among wells. Before plating, microscopically examine the culture to be sure that they have been dissociated into single cells. Leave the cell plates at room temperature for 30 minutes prior to transferring the plates to a cell culture incubator.
- Check the liquid handling system for dispensing accuracy. Optimize the settings of liquid handling system so that cell monolayer is not disturbed by dye and compound addition.
- Check settings of fluorescence readers.

## 6. Response from cells after the addition of buffer containing only DMSO

- Keep the final DMSO concentration below 1.5%.

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