DuoSet® IC

Human/Mouse/Rat Phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187)

Catalog Number DYC1018B-2
   DYC1018B-5
   DYC1018BE

For the development of sandwich ELISAs to measure human, mouse, and rat ERK1 phosphorylated at T202/Y204 and ERK2 phosphorylated at T185/Y187 in cell lysates.
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PRINCIPLE OF THE ASSAY

This DuoSet® IC ELISA contains the basic components required for the development of sandwich ELISAs to measure human/mouse/rat ERK1 dually phosphorylated at T202/Y204 and ERK2 dually phosphorylated at T185/Y187 in cell lysates. Immobilized capture antibodies specific for human/mouse/rat ERK1 and ERK2 bind both phosphorylated and unphosphorylated protein. After washing away unbound material, a biotinylated detection antibody specific for human/mouse/rat ERK1 or ERK2 dually phosphorylated at T202/Y204 or T185/Y187, respectively, is used to detect only the phosphorylated protein, utilizing a standard Streptavidin-HRP format.

MATERIALS PROVIDED & STORAGE CONDITIONS

Store the unopened kit at 2-8 °C. Do not use past kit expiration date.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PART #</th>
<th>CATALOG # DYC1018B-2</th>
<th>CATALOG # DYC1018B-5</th>
<th>STORAGE OF OPENED/RECONSTITUTED MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human/Mouse/Rat Phospho-ERK1/ERK2</td>
<td>843528</td>
<td>1 vial</td>
<td>2 vials</td>
<td>Store for up to 1 month at 2-8 °C or aliquot and store at ≤ -20 °C or ≤ -70 °C for up to 3 months in a manual defrost freezer.*</td>
</tr>
<tr>
<td>Capture Antibody</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human/Mouse/Rat Phospho-ERK1/ERK2</td>
<td>841327</td>
<td>1 vial</td>
<td>2 vials</td>
<td>Use within one hour of reconstitution. Use a fresh standard for each assay.</td>
</tr>
<tr>
<td>Detection Antibody</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human/Mouse/Rat Phospho-ERK1/ERK2</td>
<td>841328</td>
<td>3 vials</td>
<td>5 vials</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptavidin-HRP A</td>
<td>890803</td>
<td>1 vial</td>
<td>1 vial</td>
<td>Store for up to 3 months at 2-8 °C. <strong>DO NOT FREEZE.</strong></td>
</tr>
</tbody>
</table>

* Provided this is within the expiration date of the kit.

DYC1018B-2 contains sufficient materials to run ELISAs on at least two 96 well plates.†
DYC1018B-5 contains sufficient materials to run ELISAs on at least five 96 well plates.†

This kit is also available in an Economy Pack (R&D Systems®, Catalog # DYC1018BE). Economy Packs contain sufficient materials to run ELISAs on 15 microplates.†
Specific vial counts of each component may vary. Refer to the literature accompanying your order for specific vial counts.

† Provided the following conditions are met:
• The reagents are prepared as described in this package insert.
• The assay is run as described in the General ELISA Protocol on page 5.
• The recommended microplates, buffers, diluents, substrates, and solutions are used.
OTHER MATERIALS REQUIRED

- Aprotinin (Tocris® # 4139).
- Leupeptin (Tocris® # 1167).
- Pepstatin (Tocris® # 1190).
- Phenylmethylsulfonyl Fluoride (PMSF) (Sigma # P7626).
- Sodium Azide (NaN₃) (Sigma # S2002).
- Sodium Fluoride (NaF) (Sigma # 201154).
- Sodium Orthovanadate (Na₃VO₄) (Sigma # S6508), activated.
- Sodium Pyrophosphate (Na₄P₂O₇) (Sigma # P8010).
- Triton™ X-100 (Sigma # T9284).
- Urea.
- Pipettes and pipette tips.
- Deionized or distilled water.
- 96 well microplates (R&D Systems®, Catalog # DY990).
- Plate sealers (R&D Systems®, Catalog # DY992).
- Squirt bottle, manifold dispenser, or automated microplate washer.

SOLUTIONS REQUIRED

PBS - 137 mM NaCl, 2.7 mM KCl, 8.1 mM Na₂HPO₄, 1.5 mM KH₂PO₄, pH 7.2-7.4, 0.2 μm filtered (R&D Systems®, Catalog # DY006).

Wash Buffer - 0.05% Tween® 20 in PBS, pH 7.2-7.4 (R&D Systems®, Catalog # WA126).

Block Buffer - 1% BSA*, 0.05% NaN₃ in PBS, pH 7.2-7.4.

IC Diluent #1 - 1% BSA* in PBS, pH 7.2-7.4, 0.2 μm filtered.

IC Diluent #8** - 1 mM EDTA, 0.5% Triton X-100, 5 mM NaF in PBS, pH 7.2-7.4.
Note: IC Diluent #8 is also the base buffer for IC Diluent #3, IC Diluent #7, and Lysis Buffer #6. Approximately 50 mL of this diluent is required to run the assay on one 96 well plate.

IC Diluent #3** - 1 mM EDTA, 0.5% Triton X-100, 5 mM NaF, 1 M Urea in PBS, pH 7.2-7.4.

IC Diluent #7** - 1 mM EDTA, 0.5% Triton X-100, 5 mM NaF, 6 M Urea in PBS, pH 7.2-7.4.

Lysis Buffer #6** - 1 mM EDTA, 0.5% Triton X-100, 5 mM NaF, 6 M Urea, 10 μg/mL Leupeptin, 10 μg/mL Pepstatin, 100 μM PMSF, 3.0 μg/mL Aprotinin, 2.5 mM Sodium Pyrophosphate, 1 mM activated Sodium Orthovanadate in PBS, pH 7.2-7.4.

Substrate Solution - 1:1 mixture of Color Reagent A (H₂O₂) and Color Reagent B (Tetramethylbenzidine) (R&D Systems®, Catalog # DY999).

Stop Solution - 2 N H₂SO₄ (R&D Systems®, Catalog # DY994).

*The use of R&D Systems® Reagent Diluent Concentrate 2 (Catalog # DY995) or Millipore Bovine Serum Albumin, Fraction V, Protease free (Catalog # 82-045) is recommended. All buffers containing BSA must be stored at 2-8 °C.

**Alternatively, use Sample Diluent Concentrate 1 (5X) (R&D Systems®, Catalog # DYC001), prepared as described in the DYC001 insert.
**REAGENT PREPARATION**

Bring all reagents to room temperature before use.

**Human/Mouse/Rat Phospho-ERK1/ERK2 Capture Antibody** (Part 843528) - Each vial contains 1440 μg/mL of mouse anti-human ERK1/ERK2 antibody when reconstituted with 200 μL of PBS.

**Human/Mouse/Rat Phospho-ERK1/ERK2 Detection Antibody** (Part 841327) - Each vial contains 14.4 μg/mL of biotinylated rabbit anti-human phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) antibody when reconstituted with 1.0 mL of IC Diluent #1. Immediately before use, dilute the detection antibody to a working concentration of 400 ng/mL in IC Diluent #1. Prepare only as much detection antibody as required to run each assay.

**Human/Mouse/Rat Phospho-ERK1/ERK2 Standard** (Part 841328) - Refer to the vial label for the stock concentration of recombinant human phospho-ERK2 (T185/Y187) when reconstituted with 500 μL of IC Diluent #7. An initial 6-fold dilution should be made in IC Diluent #8. Further dilutions should be made in IC Diluent #3 immediately before use. A seven point curve using 2-fold serial dilutions and a high standard of 30 ng/mL is recommended.

**Streptavidin-HRP A** (Part 890803) - 1.0 mL of Streptavidin conjugated to horseradish-peroxidase. Immediately before use, dilute the Streptavidin-HRP A to the working concentration specified on the vial label using IC Diluent #1.

**PREPARATION OF SAMPLES**

**Cell Lysates** - Rinse cells two times with PBS, making sure to remove any remaining PBS after the second rinse. Solubilize cells at 1 x 10⁷ cells/mL in Lysis Buffer #6 and allow samples to sit on ice for 15 minutes. Assay immediately or store at ≤ -70 °C. Before use, centrifuge samples at 2000 x g for 5 minutes and transfer the supernate to a clean test tube. Sample protein concentration may be quantified using a total protein assay. For assaying, dilute lysates 6-fold with IC Diluent #8 and make further serial dilutions in IC Diluent #3.

**Note:** The final concentration of urea in all samples and standards should be 1 M prior to addition to the plate.
**PRECAUTIONS**

The Stop Solution recommended for use with this kit is an acid solution.

Some components in this kit contain a preservative which may cause an allergic skin reaction. Avoid breathing mist.

Color Reagent B recommended for use with this kit may cause skin, eye, and respiratory irritation. Avoid breathing fumes.

Wear protective gloves, clothing, eye, and face protection. Wash hands thoroughly after handling. Refer to the SDS on our website prior to use.

**TECHNICAL HINTS AND LIMITATIONS**

- This DuoSet® IC ELISA should not be used beyond the expiration date on the kit label.

- Individual results may vary due to differences in technique, plasticware, and water sources.

- It is important that the diluents selected for reconstitution and for dilution of the samples and standard reflect the environment of the samples being measured. The diluents suggested in this protocol should be suitable for most cell lysates.

- The type of enzyme and substrate and the concentrations of capture/detection antibodies used can be varied to create an immunoassay with a different sensitivity and dynamic range. A basic understanding of immunoassay development is required for the successful use of these reagents in immunoassays.

- A thorough and consistent wash technique is essential for proper assay performance. Wash Buffer should be dispensed forcefully and removed completely from the wells by aspiration or decanting. Remove any remaining Wash Buffer by inverting the plate and blotting it against clean paper towels.

- Use a fresh reagent reservoir and pipette tips for each step.

- It is recommended that all standards and samples be assayed in duplicate.

- Avoid microbial contamination of reagents and buffers. This may interfere with the sensitivity of the assay. Buffers containing protein should be made under aseptic conditions and stored at 2-8 °C or be prepared fresh daily.
GENERAL ELISA PROTOCOL

A plate layout is provided to record standards and samples assayed.

Plate Preparation

1. Dilute the capture antibody to a working concentration of 8.0 μg/mL in PBS, without carrier protein. Immediately coat a 96 well microplate with 100 μL per well of the diluted capture antibody. Seal the plate and incubate overnight at room temperature.

2. Aspirate each well and wash with Wash Buffer, repeating the process two times for a total of 3 washes. Wash by filling each well with Wash Buffer (400 μL) using a squirt bottle, manifold dispenser, or autowasher. Complete removal of liquid at each step is essential for good performance. After the last wash, remove any remaining Wash Buffer by aspirating or by inverting the plate and blotting it against clean paper towels.

3. Block plates by adding 300 μL of Block Buffer to each well. Incubate at room temperature for 1-2 hours.

4. Repeat the aspiration/wash as in step 2. The plates are now ready for sample addition.

Assay Procedure

1. Add 100 μL of sample or standard in IC Diluent #3 per well. Use IC Diluent #3 as the zero standard. Cover with a plate sealer and incubate 2 hours at room temperature.
   
   **Note:** A seven point standard curve using 2-fold serial dilutions and a high standard of 30 ng/mL is recommended.

2. Repeat the aspiration/wash as in step 2 of the Plate Preparation.

3. Add 100 μL of the diluted detection antibody to each well. Cover with a new plate sealer and incubate 2 hours at room temperature.

4. Repeat the aspiration/wash as in step 2 of the Plate Preparation.

5. Add 100 μL of the diluted Streptavidin-HRP A to each well. Incubate for 20 minutes at room temperature. Avoid placing the plate in direct light.

6. Repeat the aspiration/wash as in step 2 of the Plate Preparation.

7. Add 100 μL of Substrate Solution to each well. Incubate for 20 minutes at room temperature. Avoid placing the plate in direct light.

8. Add 50 μL of Stop Solution to each well. Gently tap the plate to ensure thorough mixing.

9. Determine the optical density of each well immediately, using a microplate reader set to 450 nm. If wavelength correction is available, set to 540 nm or 570 nm. If wavelength correction is not available, subtract readings at 540 nm or 570 nm from the readings at 450 nm. This subtraction will correct for optical imperfections in the plate. Readings made directly at 450 nm without correction may be higher and less accurate.
CALCULATION OF RESULTS

Average the duplicate readings for each standard and sample and subtract the average zero standard optical density (O.D.). Results may be normalized to total protein or cell number.

Create a standard curve by reducing the data using computer software capable of generating a four parameter logistic (4-PL) curve-fit. As an alternative, construct a standard curve by plotting the mean absorbance for each standard on the y-axis against the concentration on the x-axis and draw a best fit curve through the points on the graph. The data may be linearized by plotting the log of the human/mouse/rat phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) concentrations versus the log of the O.D. and the best fit line can be determined by regression analysis. This procedure will produce an adequate but less precise fit of the data.

TYPICAL DATA

A standard curve should be generated for each set of samples assayed. The graph below represents typical data generated when using this Human/Mouse/Rat Phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) DuoSet® IC ELISA. The standard curve was calculated using a computer generated 4-PL curve-fit. This standard curve is for demonstration purposes only.

CALIBRATION

The Human/Mouse/Rat Phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) DuoSet® IC ELISA is calibrated against a highly purified E. coli-expressed recombinant human phospho-ERK2 (T185/Y187) produced at R&D Systems®. Samples containing natural phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) showed linear dilution parallel to the standard curve obtained using the Human/Mouse/Rat Phospho-ERK1/ERK2 Standard. These results indicate that O.D. values from this DuoSet® IC ELISA can be used to determine the relative concentration of phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) in natural samples.
SPECIFICITY

The Human/Mouse/Rat Phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) DuoSet® IC ELISA specifically recognizes ERK1 dually phosphorylated at T202 and Y204, and ERK2 dually phosphorylated at T185 and Y187. Specificity was demonstrated by Western Blot analysis of the protein bound by the capture antibody supplied in the kit, cross-reactivity analysis, and peptide competition.

Figure 1: Lysates prepared from HeLa human cervical epithelial carcinoma cells treated with 200 nM phorbol 12-myristate 13-acetate (PMA) for 20 minutes were incubated in wells coated with Human/Mouse/Rat Phospho-ERK1/ERK2 Capture Antibody. Unbound material was removed by washing and bound material was solubilized in SDS gel sample buffer. The same lysate and captured proteins were electrophoresed, transferred to a PVDF membrane, and immunoblotted with Human/Mouse/Rat Phospho-ERK1/ERK2 Detection Antibody. Only two bands corresponding to phosphorylated ERK1 and ERK2 were detected in the captured material.

Cross reactivity experiments were performed with this DuoSet® IC ELISA to further determine specificity. Unphosphorylated recombinant human (rh) ERK1, rhERK2, rhJNK1, and rhp38α were assayed at 300 ng/mL and did not cross-react or interfere in the assay.
The specificity of this kit was also demonstrated using peptide competition.

**Figure 2:** Lysates prepared from HeLa human cervical epithelial cells treated with 200 nM PMA for 20 minutes were analyzed with this DuoSet® IC ELISA. The Human/Mouse/Rat Phospho-ERK1/ERK2 Detection Antibody was untreated (no peptide) or preincubated with peptides containing ERK (T202/Y204) dual phosphorylation site, a non-phospho-ERK, JNK (T183/Y185) dual phosphorylation site, or p38 (T180/Y182) dual phosphorylation site. Peptides were used at 40 ng/mL. Only the phosphopeptide containing the ERK (T202/Y204) phosphorylation site blocked the signal, indicating that this DuoSet® IC ELISA is specific for human ERK phosphorylated at T202/Y204.
Figure 3: Lysates prepared from HeLa cells were treated with 200 nM PMA for 20 minutes. Following cell lysis, phosphorylated ERK1 and ERK2 were quantified with this DuoSet® IC ELISA. The same lysates were also immunobotted (inset) with either anti-phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) (R&D Systems®, Catalog #AF1018) or anti-ERK1/ERK2 (R&D Systems®, Catalog #MAB1576) antibodies. The DuoSet® IC ELISA results correlate well with the relative amounts of phosphorylated ERK1/ERK2 detected by Western Blot. The immunoblot with anti-ERK1/ERK2 antibody indicated that total levels of ERK1 and ERK2 remained constant during incubations with PMA.
The Human/Mouse/Rat Phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) DuoSet® IC ELISA also quantifies phosphorylated ERK1 and ERK2 levels in mouse and rat cell lysates.

Figure 4: Lysates prepared from PC-12 rat adrenal pheochromocytoma cells were (A) untreated or treated with recombinant rat β-NGF (R&D Systems®, Catalog #556-NG) or (B) NIH-3T3 mouse embryonic fibroblast cells were untreated or treated with human PDGF (R&D Systems®, Catalog #120-HD) and then quantified with this DuoSet® IC ELISA. The same lysates were also immunoblotted (insets) with either anti-phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) or anti-ERK1/ERK2 antibodies. The DuoSet® IC ELISA results correlate well with the relative amounts of phosphorylated ERK1 (T202/Y204)/ERK2 (T185/Y187) detected by Western Blot. The immunoblot with anti-ERK1/ERK2 antibody indicates that total levels of ERK1 and ERK2 remained constant during incubations with PMA.
Figure 5: NIH-3T3 cells were treated with 100 ng/mL of human PDGF for the indicated times. Following cell lysis, phosphorylated ERK1 and ERK2 were quantified with the DuoSet® IC ELISA. The same lysates were immunoblotted (inset) with either anti-phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) or anti-ERK1/ERK2 antibodies. The DuoSet® IC ELISA results correlate well with the relative amount of phosphorylated ERK1 and ERK2 detected by Western Blot. The blot with the anti-ERK1/ERK2 antibody indicates that the total levels of ERK1 and ERK2 remained constant during incubations with PDGF.
The quantification of the phosphorylated ERK1 and ERK2 with this DuoSet® IC ELISA was also determined using cells pretreated with varying amounts of the MEK1/2 inhibitor U0126, which indirectly inhibits the phosphorylation of ERK1 and ERK2.

**Figure 5:** NIH-3T3 cells were incubated with no additions or treated with 100 ng/mL of human PDGF for 10 minutes, either with or without U0126. Following cell lysis, phosphorylated ERK1 and ERK2 were quantified with the DuoSet® IC ELISA. The same lysates were immunoblotted (inset) with either anti-phospho-ERK1 (T202/Y204)/ERK2 (T185/Y187) or anti-ERK1/ERK2 antibodies. The DuoSet® IC ELISA results correlate well with the relative amount of phosphorylated ERK1 and ERK2 detected by Western Blot. The blot with the anti-ERK1/ERK2 antibody indicates that the total levels of ERK1 and ERK2 remained constant during the various treatments.
PLATE LAYOUT

Use this plate layout to record standards and samples assayed.
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