

## Human Cytokine 25-Plex Panel

For simultaneous quantitative determination of GM-CSF, IFN- $\alpha$ , IFN- $\gamma$ , IL-1ra, IL-1 $\beta$ , IL-2, IL-2r, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12 (p40/p70), IL-13, IL-15, IL-17, IP-10, MCP-1, MIG, MIP-1 $\alpha$ , MIP-1 $\beta$ , RANTES and TNF- $\alpha$  in human serum and tissue culture supernatant

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User Manual



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## Kit Contents and Storage

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**Storage** All components of the Human Cytokine 25-Plex Panel are shipped at 2 to 8°C. Upon receipt, store all kit components at 2 to 8°C. **Do not freeze.**

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**Contents** The components and amounts included in the Human Cytokine 25-Plex Panel are listed below.

Reagents Provided	100 Test Kit
Human Cytokine 25-Plex Antibody Bead Solution (1X) (contains 0.05% sodium azide)	2.5 mL x 1 vial
Human Cytokine 25-Plex Biotinylated Antibody Concentrate (10X) (contains 0.1% sodium azide)	1 mL x 1 vial
Human 16-Plex Lyophilized Standard (contains 0.1% sodium azide)	2 vials
Human 14-Plex Lyophilized Standard (contains 0.1% sodium azide)	2 vials
Wash Solution Concentrate (20X) (contains 0.1% sodium azide)	15 mL x 1 bottle
Assay Diluent (contains 0.1% sodium azide)	15 mL x 1 bottle
Incubation Buffer (contains 0.05% sodium azide)	12 mL x 1 bottle
Biotin Diluent (contains 3.3 mM thymol)	12 mL x 1 bottle
Streptavidin-RPE Concentrate (10X) (contains 0.1% sodium azide)	1 mL x 1 vial
Streptavidin-RPE Diluent (contains 3.3 mM thymol)	12 mL x 1 bottle
96-well Filter Plate	1 x 96-well plate

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# Introduction

## Overview

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### Purpose

Invitrogen's Multiplex Bead Immunoassay Kits are developed to maximize flexibility in experimental design, permitting the measurement of one or multiple proteins in panels designed by the researcher. The Human Cytokine 25-Plex Panel contains all the reagents that are intended for use with the 100™ or 200™ dual laser detection system manufactured by Luminex Corporation and sold by Invitrogen and other vendors.

**For Research Use Only. CAUTION: Not for human or animal therapeutic or diagnostic use.**

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### Background Information

Advances in the field of cell biology have defined a complex and interdependent set of extracellular and intracellular signaling molecules that control normal cell function. There is growing interest among researchers as well as drug discovery groups in simultaneously monitoring multiple components of signaling pathways. Solid phase multiplex protein assays are the tools of choice in these studies as they maximize efficiency by simultaneously profiling several proteins within individual samples.

Invitrogen's Multiplex Bead Immunoassays are solid phase protein immunoassays that use spectrally encoded antibody-conjugated beads as the solid support. The spectral beads are suitable for use in singleplex assays or may be mixed for multiplex assays according to the researcher's requirements. Each assay is carefully designed and tested to assure that sensitivity, range, and correlation are maximized. The assay is performed in a 96-well plate format and analyzed with a Luminex® 100™ or 200™ instrument which monitors the spectral properties of the capture beads while simultaneously measuring the quantity of associated fluorophore. Standard curves generated with this assay system extend over several orders of magnitude of concentrations, while the sensitivity and quantitation of the assays are comparable to ELISAs (Enzyme Linked-Immuno-Sorbent Assays). Assay standards are calibrated to NIBSC (National Institute for Biological Standards and Controls) reference preparations, when available, to assure accurate and reliable results.

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## Overview, Continued

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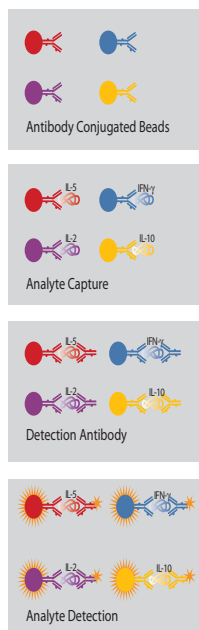
### Background Information, Continued

Invitrogen's Human Cytokine 25-Plex Panel is designed for quantitative determination of GM-CSF, IFN- $\alpha$ , IFN- $\gamma$ , IL-1ra, IL-1 $\beta$ , IL-2, IL-2r, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12 (p40/p70), IL-13, IL-15, IL-17, IP-10, MCP-1, MIG, MIP-1 $\alpha$ , MIP-1 $\beta$ , RANTES and TNF- $\alpha$  in serum and tissue culture supernatant. This 25-Plex Panel may also be combined with other Invitrogen Human Extracellular Singleplex Bead Kits, allowing higher multiplexing of the assay.

Visit the Invitrogen web site for a current listing of available Invitrogen multiplex bead immunoassays and reagents, at [www.invitrogen.com/luminex](http://www.invitrogen.com/luminex).

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### Assay Overview



The xMAP<sup>®</sup> technology combines the efficiencies of multiplexing up to 100 different proteins for simultaneous analysis, with reproducibility similar to ELISA. The technology uses 5.6  $\mu$ m polystyrene beads which are internally dyed with red and infrared fluorophores of differing intensities. Each bead is given a unique number, or bead region, allowing differentiation of one bead from another.

Beads of defined spectral properties are conjugated to protein-specific capture antibodies and added along with samples (including standards of known protein concentration, control samples, and test samples), into the wells of a filter-bottom microplate and where proteins bind to the capture antibodies over the course of a 2 hour incubation.

After washing the beads, protein-specific biotinylated detector antibodies are added and incubated with the beads for 1 hour. During this incubation, the protein-specific biotinylated detector antibodies bind to the appropriate immobilized proteins.

After removal of excess biotinylated detector antibodies, streptavidin conjugated to the fluorescent protein, R-Phycoerythrin (Streptavidin-RPE), is added and allowed to incubate for 30 minutes. The Streptavidin-RPE binds to the biotinylated detector antibodies associated with the immune complexes on the beads, forming a four-member solid phase sandwich.

After washing to remove unbound Streptavidin-RPE, the beads are analyzed with the Luminex detection system. By monitoring the spectral properties of the beads and the amount of associated R-Phycoerythrin (RPE) fluorescence, the concentration of one or more proteins can be determined.

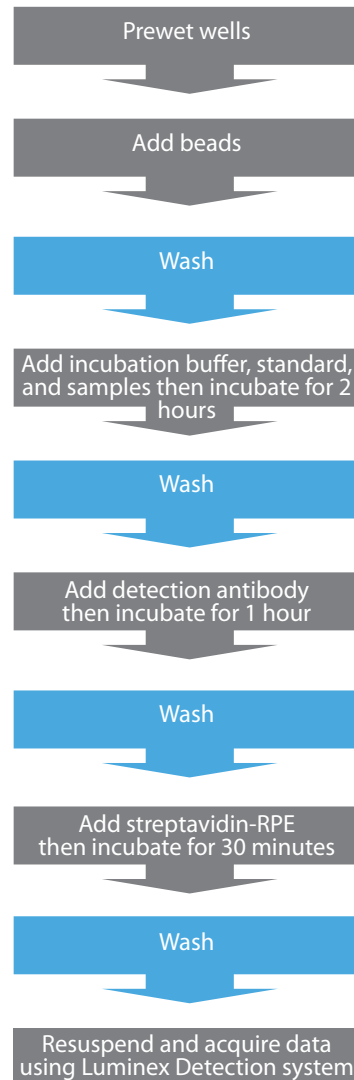
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## Experimental Overview

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### Experimental Outline

The experimental outline for using the Human Cytokine 25-Plex Panel is shown below.



## Methods

### Before Starting

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**Materials  
Required but  
Not Provided**

- Luminex<sup>®</sup> xMAP<sup>®</sup> system with data acquisition and analysis software (Invitrogen, Cat. no. MAP0200), contact Invitrogen for instrument and software placement services, see page 22
- Filtration vacuum manifold for bead washing (Pall, Cat. no. 5017 is recommended)
- Sonicating water bath
- Vortex mixer
- Orbital shaker (small diameter rotation recommended)
- Calibrated, adjustable, precision pipettes, preferably with disposable plastic tips (A manifold multi-channel pipette is desirable)
- Distilled or deionized water
- Glass or polypropylene tubes
- Aluminum foil or opaque 96-well plate cover (Invitrogen, Cat. no. PC10)

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## Before Starting, Continued

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### Procedural Notes

Review the procedural notes below before starting the protocol.

- Before mixing plexes, **check that each protein is represented by a unique bead region**. Up to 10 bead concentrates (singleplexes or pre-mixed multiplexes) can be combined to increase the number of proteins measured.
- **Do not invert the filter plates during the assay**. The filter plates are designed to be used in conjunction with a vacuum manifold (**do not exceed 5 mm Hg**) and emptied from the bottom.
- Do not freeze any component of this kit. Store kit components at 2 to 8°C when not in use. Allow all reagents to warm to room temperature before use (air-warm all reagents at room temperature for at least 30 minutes, or alternatively, in a room-temperature water bath for 20 minutes (except plate and standard vials).
- **The fluorescent beads are light-sensitive**. Protect the beads from light to avoid photobleaching of the embedded dye. Use aluminum foil to cover test tubes used in the assay. Cover filter plates containing beads with an opaque or aluminum foil-wrapped plate cover. Since the amber vial does not provide full protection, keep the vial covered in the box or drawer when not in use.
- Do not expose beads to organic solvents.
- Do not place filter plates on absorbent paper towels during loading or incubations, as liquid may be lost due to contact wicking. An extra plate cover is a recommended surface to rest the filter plate. Following plate washing, remove excess liquid and blot from the bottom of the plate by pressing the plate on clean paper towels.
- When pipetting reagents, maintain a consistent order of addition from well-to-well to ensure equal incubation times for all wells.
- To prevent filter tearing, avoid touching the filter plate membrane with pipette tips.
- Do not use reagents after kit expiration date.
- It is recommended that in-house controls be included with every assay. If control values fall outside pre-established ranges, the assay may be suspect. Contact Invitrogen Technical Support for product and technical assistance.
- Do not mix or substitute reagents with those from other lots or sources.

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## Before Starting, Continued

- Handle all blood components and biological materials as potentially hazardous. Follow standard precautions as established by the Centers for Disease Control and Prevention and by the local Occupational Safety and Health Administration when handling and disposing of infectious agents.
- This kit contains materials with small quantities of sodium azide. Sodium azide reacts with lead and copper plumbing to form explosive metal azides. Upon disposal, flush drains with a large volume of water to prevent azide accumulation. Avoid ingestion and contact with eyes, skin and mucous membranes. In case of contact, rinse affected area with plenty of water. Observe all federal, state and local regulations for disposal.

### Recommended Plate Plan

It is recommended that a plate plan be designed before starting the assay. A plate plan template is provided on page 28. The following is a suggested plate plan:

	1	2	3	4	5	6	7	8	9	10	11	12
A	B	B										
B	Std 7	Std 7										
C	Std 6	Std 6										
D	Std 5	Std 5										
E	Std 4	Std 4										
F	Std 3	Std 3										
G	Std 2	Std 2										
H	Std 1	Std 1										

B= blank (Assay Diluent), Standards 7 through 1, lowest concentration to highest.

The remainder of the plate is available for controls and samples which may be run as a singlet or in duplicate, as desired.

**NOTE:** Running all standards, samples and controls in duplicate is recommended.

# Preparing Reagents

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## Introduction

Review the information in this section before starting. The Human Cytokine 25-Plex Panel includes both antibody bead reagents and buffer reagents. Prepare components of the Human Cytokine 25-Plex Panel according to instructions below.

**Note:** Bring all reagents and samples to room temperature before use.

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## Preparing Wash Solution

Upon storage at 2 to 8°C, a precipitate may form in the 20X Wash Solution Concentrate. If this occurs, warm the 20X Wash Solution Concentrate to 37°C and mix until the precipitate is dissolved.

1. Prepare a 1X Working Wash Solution for use with a 96-well plate by transferring the entire contents of the Wash Solution Concentrate bottle to a 500 mL container (or equivalent) and then add 285 mL of deionized water. Mix well.
2. The 1X Working Wash Solution is stable for up to 2 weeks when stored at 2 to 8°C.

**Note:** To prepare smaller volumes of 1X Working Wash Solution, mix 1 part of 20X concentrate with 19 parts of deionized water. Mix well.

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## Sample Preparation Guidelines

- Serum and tissue culture supernatants are suitable for use with Invitrogen's Multiplex Bead Immunoassays. Additional sample types may be suitable but have not been thoroughly validated. If possible, avoid the use of hemolyzed or lipemic sera. The appropriate sample types are defined on the Technical Data Sheet included with this multiplex panel.
  - Collect samples in pyrogen/endotoxin-free tubes. Centrifuge, separate, and transfer samples to polypropylene tubes for storage.
  - Analyze samples shortly after collection or thawing. Freeze samples after collection if samples will not be tested immediately. Avoid multiple freeze-thaw cycles of frozen samples. Thaw completely and mix well (**do not vortex**) prior to analysis.
  - Clarify all samples by centrifugation (1,000 × g for 10 minutes) and/or filter prior to analysis to prevent clogging of the filter plates.
  - In the event that the sample concentrations exceed the standard curve, dilute samples and reanalyze. Dilute the serum samples in Assay Diluent and dilute tissue culture supernatants in the corresponding tissue culture medium.
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## Preparing Reagents, Continued

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### Guidelines for Standard Curve Preparation

- Each kit comes with 2 complete sets of standard vials, so that 2 runs on the plate can be made with freshly prepared standards.
  - Reconstitute the protein standard within 1 hour of performing the assay. All standards are calibrated to NIBSC preparations, when available. Additional standards are available from Invitrogen custom services
  - Before performing standard mixing and serial dilutions confirm reconstitution volumes on the Technical Data Sheet included in the Singleplex Bead Kit(s).
  - The concentrations of the protein components of the standard are indicated on the Technical Data Sheet.
  - Perform standard dilutions in glass or polypropylene tubes.
  - When using serum samples, reconstitute the standard with Assay Diluent provided.
  - If using other sample types (e.g., tissue culture supernatant), reconstitute the standard with a mixture, composed of 50% Assay Diluent and 50% of the matrix which closely resembles the sample type (50%/50% mixture). For example: When the sample type is RPMI medium containing 5% FBS, the standards should be reconstituted in a mixture composed of 50% Assay Diluent and 50% RPMI containing 5% FBS.
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### Important Note

Protein standards may be analyzed alone, or combined with other protein standards for higher levels of multiplexing. **Do not combine more than 4 vials.**





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### Reconstituting Lyophilized Standards

1. To the standard vial(s), add the suggested reconstitution volume of the appropriate diluent (see table on next page). **Do not vortex. When mixing or reconstituting protein solutions, always avoid foaming.**
  2. Replace the vial stopper and allow the vial to stand undisturbed for 10 minutes.
  3. Gently swirl and invert the vial 2 to 3 times to ensure complete reconstitution and allow the vial to sit at room temperature for an additional 5 minutes.
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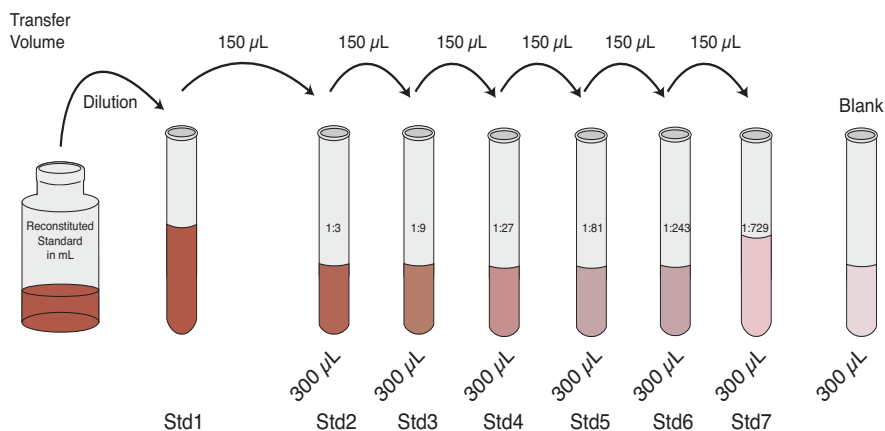
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## Preparing Reagents, Continued

<p><b>One vial of standard</b></p> 	<p>Reconstitute the standard vial in the suggested reconstitution volume, usually 1 mL, of appropriate diluent.</p>
<p><b>Two vials of standards</b></p> 	<p>Reconstitute each vial with 0.5 mL of appropriate diluent. Combine 300 µL from each vial and mix by gently pipetting up and down 5 to 10 times.</p>
<p><b>Three vials of standards</b></p> 	<p>Reconstitute each vial with 0.333 mL of appropriate diluent. Combine 200 µL from each vial and mix by gently pipetting up and down 5 to 10 times.</p>
<p><b>Four vials of standards</b></p> 	<p>Reconstitute each vial with 0.250 mL of appropriate diluent. Combine 150 µL from each vial and mix by gently pipetting up and down 5 to 10 times.</p>

### Preparing Standard Curve

The standard curve is made by serially diluting the reconstituted standard in Assay Diluent for serum samples or a mixture of 50% Assay Diluent and 50% tissue culture medium for tissue culture supernatant samples. See below. **Do not vortex.** Mix by gently pipetting up and down 5 to 10 times.



*Serum: Assay Diluent*  
*Tissue culture: 50% Assay Diluent/ 50% Tissue Culture Medium*

Discard all remaining reconstituted and diluted standards after completing assay. Return the Assay Diluent to the kit.

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## Preparing Reagents, Continued

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**Online Tool** Go to <http://www.invitrogen.com/luminex> under Multiplex Solution Tools, click Luminex<sup>®</sup> Calculation Worksheet for auto calculation of all assay dilutions.

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**Preparing 1X Antibody Beads** Determine the number of wells required for the assay.

The 25-plex Antibody Beads is supplied as a **1X and is ready to use for the assay without further dilution**. The fluorescent beads are light-sensitive. **Protect antibody conjugated beads from light during handling.**

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## Assay Procedure

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### Method of Washing

Incomplete washing adversely affects assay results. Perform all wash steps with the Wash Solution supplied with the kit. All phases of the assay, including incubations, washing steps, and loading beads, are performed in the filter bottom plate supplied with the kit. For a demonstration of proper washing techniques, download Luminex video from [www.invitrogen.com/luminexinstrument](http://www.invitrogen.com/luminexinstrument).

1. To wash beads, place the filter plate on the vacuum manifold and aspirate the liquid with gentle vacuum (**do not exceed 5 mm Hg**). Excessive vacuum can cause the membrane to tear, resulting in antibody bead loss. Prevent any vacuum surge by opening and adjusting the vacuum on the manifold before placing the plate on the manifold surface.
2. Stop the vacuum pressure as soon as the wells are empty. Do not attempt to pull the plate off the vacuum manifold while the vacuum is still on or filter plate damage may occur. Release the vacuum prior to removing the plate.
3. If solution remains in the wells during vacuum aspiration, **do not detach the bottom of the 96 well filter plate**. In some cases, minor clogs in the filter plate may be dislodged by carefully pressing the bottom of the plate under the clogged well with the pointed end of a 15 mL plastic conical tube. Place the filter plate on a clean paper towel and use a gloved thumb or a 1 mL Pasteur pipette bulb to plunge the top of the clogged well. Empty all clogged wells entirely before continuing the washes. **Note:** Do not attempt to repetitively pull vacuum on plates with clogged wells. This can compromise the unclogged wells and bead loss may occur.
4. After all wells are empty, lightly tap or press the filter plate onto clean paper towels (hold the plate in the center for tapping) to remove excess fluid from the bottom of the filter plate. **Do not invert plate.**
5. Following the last aspiration and plate taps, use a clean absorbent towel to blot the bottom of the filter plate before addition of next liquid phase or data acquisition step.
6. **Do not leave plate on absorbent surface when adding reagents.**

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## Assay Procedure, Continued

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### Reverse Pipetting Instructions

To reduce bubbles and loss of reagents due to residual fluid left in pipette tips, use the recommended reverse pipetting technique.

1. To reverse pipette, set the pipette to the appropriate volume needed. **Note:** Do not reverse pipette volumes <20  $\mu\text{L}$ .
2. Press the push-button slowly to the first stop and then press on past it. Note: the amount past the first stop will depend on the volume of liquid available to aspirate from.
3. Immerse the tip into the liquid, just below the meniscus.
4. Release the push-button slowly and smoothly to the top resting position to aspirate the set volume of liquid.
5. Place the end of the tip against the inside wall of the recipient vessel at an angle.
6. Press the push button slowly and smoothly to the first stop. Some liquid will remain in the tip, this should not be dispensed.
7. Remove the tip, keeping the pipette pressed to the first stop.

**NOTE:** Bring all reagents and samples to room temperature before use.

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### Analyte Capture

1. Use an adhesive plate cover to seal any unused wells. This will keep the wells dry for future use.
2. Pre-wet the designated assay wells by adding 200  $\mu\text{L}$  of Working Wash Solution into designated wells. Incubate plate 15 to 30 seconds at room temperature.
3. Aspirate the Working Wash Solution from the wells using the vacuum manifold.
4. Vortex the bead solution for 30 seconds, then sonicate for at least 30 seconds immediately prior to use in the assay.
5. Pipette 25  $\mu\text{L}$  of the bead solution into each well. Once the beads are added to the plate, **keep the plate protected from light.**
6. Add 200  $\mu\text{L}$  Working Wash Solution to the wells. Allow the beads to soak for 15 to 30 seconds.
7. Aspirate the Working Wash Solution from the wells with the vacuum manifold. Repeat this washing step.
8. Blot the bottom of the filter plate on clean paper towels to remove any residual liquid.

**Note:** Place the filter plate on a plate cover or non-absorbent surface before all incubations.

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## Assay Procedure, Continued

### Analyte Capture, Continued

9. Pipette 50  $\mu$ L Incubation Buffer into each well.
10. To wells designated for the standard curve, pipette 100  $\mu$ L of appropriate standard dilution.
11. To the wells designated for the sample, pipette 50  $\mu$ L Assay Diluent followed by 50  $\mu$ L sample to each well or 50  $\mu$ L in-house controls, if used.
12. Cover filter plate containing beads with an aluminum foil-wrapped plate cover. Incubate the plate for 2 hours at room temperature on an orbital shaker. Shaking should be sufficient to keep beads suspended during the incubation (500-600 rpm). Larger radius shakers will need a lower speed and smaller radius shakers will typically handle higher speeds without splashing.
13. Ten to fifteen minutes prior to the end of this incubation, prepare the biotinylated detector antibody, and then proceed to Analyte Detection, Step 1.

### Preparing 1X Biotinylated Antibody

The Biotinylated Antibody is supplied as a **10X concentrate and must be diluted prior to use.**

To prepare a 1X Biotinylated Antibody stock, dilute 10  $\mu$ L of 10X Biotinylated Antibody in 100  $\mu$ L of Biotin Diluent per assay well. Each well requires 100  $\mu$ L of the diluted Biotinylated Antibody. See table below for examples of volumes to combine.

**Note:** Dilution factor is 1:11 for extra pipetting volume.

Number of Wells	Vol. 10X Biotinylated Antibody Concentrate	Vol. Biotin Diluent
24	0.24 mL	2.4 mL
32	0.32 mL	3.2 mL
40	0.40 mL	4.0 mL
48	0.48 mL	4.8 mL
56	0.56 mL	5.6 mL
64	0.64 mL	6.4 mL
72	0.72 mL	7.2 mL
80	0.80 mL	8.0 mL
88	0.88 mL	8.8 mL
96	0.96 mL	9.6 mL

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## Assay Procedure, Continued

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### Analyte Detection

1. After the 2 hour capture bead incubation, remove the liquid from wells by aspiration with the vacuum manifold.
2. Add 200  $\mu$ L of Working Wash Solution to the wells. Allow the beads to soak for 15 to 30 seconds, then aspirate with the vacuum manifold. Repeat this washing step.
3. Blot the bottom of the filter plate on clean paper towels to remove residual liquid.
4. Add 100  $\mu$ L of prepared 1X Biotinylated Detector Antibody (page 13) to each well and incubate the plate for 1 hour at room temperature on an orbital shaker. Shaking should be sufficient to keep the beads suspended during incubation (500-600 rpm).
5. Prepare the Luminex<sup>®</sup> 100<sup>™</sup> or 200<sup>™</sup> instrument during this incubation step. Refer to the Luminex Instrument Quick Reference card provided in kit. Refer to the Technical Data Sheet for all bead regions and standard concentration values.
6. Ten to fifteen minutes prior to the end of the detector incubation step, prepare the Streptavidin-RPE, and then proceed with Assay Reading, Step 1.

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## Assay Procedure, Continued

### Preparing Streptavidin-RPE

The Streptavidin-RPE is supplied as a **10X concentrate and must be diluted prior to use. Protect Streptavidin-RPE from light during handling.**

To prepare a 1X Streptavidin-RPE stock, dilute 10  $\mu$ L of 10X Streptavidin-RPE in 100  $\mu$ L Streptavidin-RPE Diluent per assay well. Each well requires 100  $\mu$ L of the diluted Streptavidin-RPE. See table below for examples of volumes to combine.

**Note:** Dilution factor is 1:11 for extra pipetting volume.

Number of Wells	Vol. 10X Streptavidin-RPE Concentrate	Vol. Streptavidin-RPE Diluent
24	0.24 mL	2.4 mL
32	0.32 mL	3.2 mL
40	0.40 mL	4.0 mL
48	0.48 mL	4.8 mL
56	0.56 mL	5.6 mL
64	0.64 mL	6.4 mL
72	0.72 mL	7.2 mL
80	0.80 mL	8.0 mL
88	0.88 mL	8.8 mL
96	0.96 mL	9.6 mL

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## Assay Procedure, Continued

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### Assay Reading

1. Remove the liquid from wells by aspiration with the vacuum manifold.
  2. Add 200  $\mu$ L Working Wash Solution to the wells. Allow the beads to soak for 15 to 30 seconds, then aspirate with the vacuum manifold. Repeat this washing step.
  3. Blot the bottom of the filter plate on clean paper towels to remove residual liquid.
  4. Add 100  $\mu$ L of prepared 1X Streptavidin-RPE to each well and incubate the plate for 30 minutes at room temperature on an orbital shaker. Shaking should be sufficient to keep the beads suspended during incubation (500-600 rpm).
  5. Remove the liquid from wells by aspiration with the vacuum manifold.
  6. Wash beads by adding 200  $\mu$ L Working Wash Solution to the wells; allow the beads to soak for 10 seconds, then aspirate with the vacuum manifold. Repeat this washing step 2 additional times for a total of 3 washes.
  7. Blot the bottom of the filter plate on clean paper towels to remove residual liquid.
  8. Add 100  $\mu$ L of Working Wash Solution to each well. Shake the plate on an orbital shaker (500-600 rpm) for 2 to 3 minutes to resuspend the beads.

**Note:** If the plate cannot be read on the day of the assay, cover and store the plate in the dark overnight at 2 to 8°C for reading the following day without significant loss of fluorescent intensity. Aspirate Working Wash Solution from stored plates and add 100  $\mu$ L fresh Working Wash Solution. Place the plate on an orbital shaker for 2 to 3 minutes at 500-600 rpm prior to analysis.
  9. Uncover the plate and insert the plate into the XY platform of the Luminex<sup>®</sup> 100<sup>™</sup> or 200<sup>™</sup> instrument, and analyze the samples.
  10. Determine the concentration of samples from the standard curve using curve fitting software. It is recommended to use the five parameter algorithm with a weighted function ( $1/y^2$ ), depending on the software package used.
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## Instrument Setup

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Helpful guides for Luminex 100™ and 200™ users.

1. Assign the appropriate **Bead Region** (refer to the kit-specific technical data sheet) to each analyte.
2. We recommend that the user **count 100 events/bead region**.
3. Set **Minimum Events** to 0.
4. Set **Sample Size** to 50  $\mu$ l.
5. **Set Flow Rate** to 60  $\mu$ l/minute.
6. For Invitrogen kits we recommend an initial **Double Discriminator (DD)** gate setting of 7,800-15,200. (This setting may vary among instruments and must be determined by the user.)
7. Collect **Median RFU**.

**Note:** All Invitrogen Multiplex Luminex Kits are qualified at low PMT setting.

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## Performance Characteristics and Limitations of the Procedure

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### Performance Characteristics

Refer to analyte specific Technical Data Sheet for performance claims.

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### Procedure Limitations

- Do not extrapolate the standard curve beyond the highest or lowest standard point; the dose-response and data collected in these regions may be non-linear and should be considered inaccurate. Note: In some cases, further dilution of the standard beyond 7 points may be possible to extend the low end of the standard curve.
  - Dilute samples that are greater than the highest standard with Assay Diluent or appropriate matrix diluent; reanalyze these samples and multiply results by the appropriate dilution factor.
  - **Samples are diluted in the assay 1:2 (50  $\mu$ L of sample and 50  $\mu$ L of diluent) relative to the standards. Be sure to account for this dilution factor during sample calculations.**
  - The influence of various drugs, aberrant sera (hemolyzed, hyperlipidemic, jaundiced, etc.) and the use of biological fluids in place of serum, plasma and tissue culture supernatant samples have not been thoroughly investigated. The rate of degradation of analytes in various matrices may not have been investigated. The immunoassay literature contains frequent references to aberrant signals seen with some sera, attributed to heterophilic antibodies. Though such samples have not been seen to date, the possibility of this occurrence cannot be excluded.
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# Troubleshooting

## Introduction

Refer to the table below to troubleshoot problems encountered with the use of Invitrogen's Multiplex Bead Kits on the Luminex® platform.

To troubleshoot problems with the Luminex® instrument, refer to the manual supplied with the instrument.

For more troubleshooting solutions, visit [www.invitrogen.com/luminex](http://www.invitrogen.com/luminex).

Problem	Cause	Solution
During data analysis, insufficient and/or erratic bead count is observed	Bead aggregation	Make sure to vortex the beads for 30 seconds and then sonicate the beads for at least 30 seconds prior to beginning the assay, to break up any bead aggregates.
		Empty wells and add fresh wash buffer. Shake for 2 to 3 minutes to resuspend the beads.
	Loss of beads due to the filter plate membrane tearing	To prevent membrane tearing, place pipette tips on the side of the well, rather than straight down onto the membrane when dispensing liquid into the wells.
		Turn the vacuum manifold on before placing the filter plate on the top to prevent vacuum surge. When evaluating a new vacuum manifold, adjust the vacuum force so that 3 seconds are required to empty 0.2 mL from the wells of a plate.
	Clog in instrument or probe	Remove probe, sonicate for 5 minutes, rinse the probe and reinstall. Run an unclog protocol. See instrument manual.
Probe height set incorrectly	Readjust the instrument probe height. If it is too low, it could puncture the well membrane. If it is too high, air could be pulled up with the liquid which may appear as bead fragments to the instrument.	

*Continued on next page*

## Troubleshooting, Continued

Problem	Cause	Solution
During washing steps, the vacuum manifold does not aspirate the liquid from wells of the filter plate	The filter plate is clogged	Dislodge the clog by gently pushing the pointed end of a 15 mL plastic conical tube into the bottom of the plate under the clogged well. This procedure clears the small opening in the plastic casing.
		Dislodge by placing the filter plate on a clean paper towel and use a gloved thumb or a 1 mL Pasteur pipette bulb to plunge the top of the clogged well.
		To prevent filter plate clogging, clarify samples by centrifugation at $1,000 \times g$ for 10 minutes prior to analysis. Some samples may also require filtration prior to analysis.
	Lack of a tight seal	Hold the plate firmly against the vacuum manifold to form a tight seal. If only a partial plate is being analyzed, cover the empty wells with a self-adhesive plate seal.
In-house controls perform differently in subsequent assays	Incorrect concentration entered in data analysis software	The standard proteins included in Invitrogen's Singleplex Bead Kits are calibrated to NIBSC preparations, whenever possible. This calibration assures lot-to-lot consistency in performance. However, the concentration of the reconstituted standards may vary with each new lot of standard. Therefore, it is important to check the concentration of the standard listed on the Technical Data Sheet, and to verify all concentration values entered into the data analysis software.
	Improper reconstitution or dilution of the standard	Check standard reconstitution and dilution as described on page 9.

*Continued on next page*



## Troubleshooting, Continued

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<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Leaky plate	Solution remains on the bottom of the wells after vacuum aspiration, causing wicking and leakage of well contents during next incubation	After final wash step and plate taps, use a clean absorbent towel to blot the bottom of the filter plate before addition of next liquid phase or data acquisition step.
	Filter plate membrane tearing	Excessive vacuum can cause the membrane to tear, resulting in antibody bead loss. Prevent any vacuum surge by opening and adjusting the vacuum on the manifold before placing the plate on the manifold surface.

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# Appendix

## Technical Support

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### World Wide Web

Visit the Invitrogen website at [www.invitrogen.com](http://www.invitrogen.com) for:

- Technical resources, including manuals, Technical Data Sheet, quick calculation worksheet, application notes, MSDSs, FAQs, formulations, citations, handbooks, and more
  - Complete Technical Support contact information
  - Access to the Invitrogen Online Catalog
  - Additional product information and special offers
- 

### Contact Us

For more information or technical assistance, call, write, fax, or email. Additional international offices are listed on our website ([www.invitrogen.com](http://www.invitrogen.com)).

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### MSDS Requests

Material Safety Data Sheets (MSDSs) are available at [www.invitrogen.com/msds](http://www.invitrogen.com/msds).

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## Purchaser Notification

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**Limited Use  
Label License  
No. 330:  
Luminex®  
Assay Product**

By opening the packaging containing this Assay Product (which contains fluorescently labeled microsphere beads authorized by Luminex Corporation) or using this Assay Product in any manner, you are consenting and agreeing to be bound by the following terms and conditions. You are also agreeing that the following terms and conditions constitute a legally valid and binding contract that is enforceable against you. If you do not agree to all of the terms and conditions set forth below, you must promptly return this Assay Product for a full refund prior to using it in any manner.

You, the customer, acquire the right under Luminex Corporation's patent rights, if any, to use this Assay Product or any portion of this Assay Product, including without limitation the microsphere beads contained herein, only with Luminex Corporation's laser based fluorescent analytical test instrumentation marketed under the name Luminex Instrument.

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**Limited  
Warranty**

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## References

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The references below demonstrate the success customers achieve when using Invitrogen Multiplex Assays. For a complete list, visit [www.invitrogen.com/luminex](http://www.invitrogen.com/luminex).

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For Research Use Only. CAUTION: Not for human or animal therapeutic or diagnostic use.

## Higher Multiplexing

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### Introduction

Invitrogen's Multiplex Bead Kits are designed to permit maximal flexibility in experimental design. These kits can be used alone, or combined with other Singleplex Bead Kits to enable the development of higher level multiplexed assays designed by the researcher. Instructions for combining bead mixtures and Biotinylated Antibody mixtures in the development of multiplexed assays are presented below.

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### Important

Before preparing multiplexed assays, it is important to verify that each analyte is represented by a unique bead region. This assures the compatibility of each bead in the development of multiplexed assays. Up to 10 bead concentrates (pre-mixed panel multiplexes and/or singleplexes) can be combined to increase the number of proteins being monitored.

---

### Multiplexing Antibody Beads

The volume required for a multiplexed assay can be calculated by using the formulas presented below.

#### Total Volume of 1X Antibody Bead Mixture Required

$$0.0275 \text{ mL} \times (\# \text{ of wells}) = \underline{\hspace{2cm}}$$

#### Volume of each 10X Antibody Bead Concentrate Required

$$\frac{\text{Total Volume of 1X Antibody Bead Mixture Required}}{11} = \underline{\hspace{2cm}}$$

#### Working Wash Solution Required

$$[\text{Total Volume of 1X Bead Mixture}] - [(\text{Volume 10X Beads}) \times (\# \text{ of plexes})] = \underline{\hspace{2cm}}$$

To prepare a 1X Antibody Bead mixture for a multiplexed assay, pipette the beads and Working Wash Solution (using the volumes calculated with the formulas presented above) into a foil wrapped tube. Vortex the tube for 30 seconds, then sonicate for 30 seconds. The mixture is ready to be used in a multiplexed assay.

If desired, premixed beads can be stored overnight at 2 to 8°C

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*Continued on next page*

## Higher Multiplexing, Continued

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### Multiplexing Biotinylated Antibodies

The volume required for a multiplexed assay can be calculated by using the formulas presented below.

#### Total Volume of 1X Biotinylated Antibody Mixture Required

$$0.110 \text{ mL} \times (\# \text{ of wells}) = \underline{\hspace{2cm}}$$

#### Volume of each 10X Biotinylated Antibody Concentrate Required

$$\frac{\text{Total Volume of 1X Biotinylated Antibody Mixture Required}}{11} = \underline{\hspace{2cm}}$$

#### Biotin Diluent Solution Required

$$\begin{aligned} & [\text{Total Volume of 1X Biotinylated Antibody Mixture}] - \\ & [(\text{Volume 10X Biotinylated Antibody}) \times (\# \text{ of plexes})] \\ & = \underline{\hspace{2cm}} \end{aligned}$$

To prepare a Biotinylated Antibody mixture for a multiplexed assay, pipette the Biotinylated Antibody Concentrates and Biotin Diluent (using the volumes calculated with the formulas presented above) into a tube. Mix gently. The mixture is ready to be used in a multiplexed assay.

If desired, premixed 1X Biotinylated Antibody can be stored overnight at 2 to 8°C.

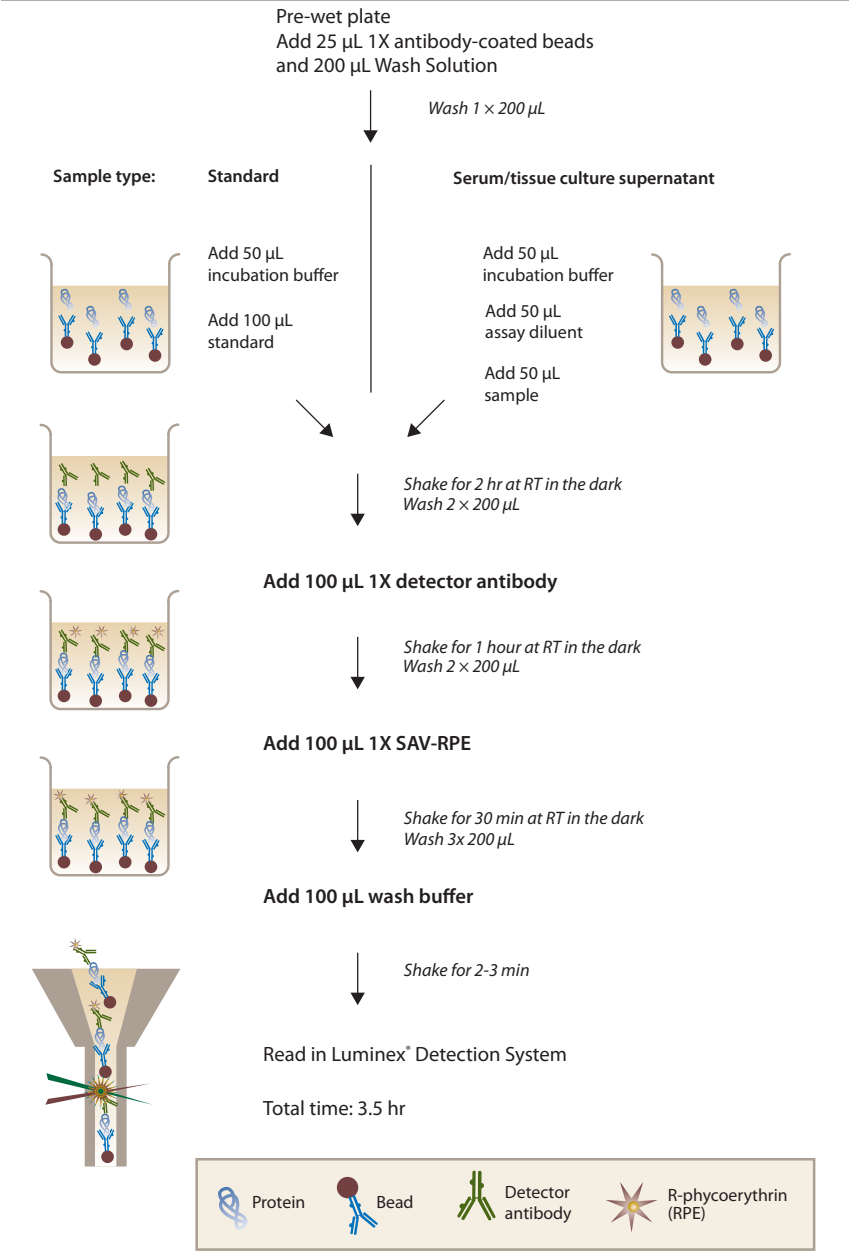
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### Multiplexing Standards

Protein standards may be analyzed alone, or combined with other protein standards for higher levels of multiplexing. **Do not combine more than 4 vials.** See page 9.

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# Protocol Summary



# Plate Plan Template

Kit Catalog number: \_\_\_\_\_ Lot Number: \_\_\_\_\_  
Plate ID: \_\_\_\_\_ Date: \_\_\_\_\_

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



	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												
H												

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## Explanation of Symbols

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Symbol	Description	Symbol	Description
	Catalogue Number		Batch code
	Research Use Only		<i>In vitro</i> diagnostic medical device
	Use by		Temperature limitation
	Manufacturer		European Community authorised representative
	Without, does not contain		With, contains
	Protect from light		Consult accompanying documents
	Directs the user to consult instructions for use (IFU), accompanying the product.		

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## Notes





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