Human High Sensitivity T Cell Magnetic Bead Panel

96-Well Plate Assay

Cat. # HSTCMAG-28SK, HSTCMAG28SPMX13, HSTCMAG28SPMX21, HSTCMAG28PMX13BK, HSTCMAG28PMX21BK

MILLIPLEX® MAP

MILLIPLEX® MAP Human High Sensitivity T Cell Magnetic Bead Panel 96-Well Plate Assay

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INTRODUCTION

Cytokines are immunomodulatory polypeptides that play key roles in both adaptive and innate immune responses. A generic term, “cytokines” includes myokines (produced by mononuclear phagocytic cells), lymphokines (produced by activated Th cells), interleukins (acting as mediators between T cells) and chemokines (responsible for T-cell migration). One of the regulatory mechanisms of the immune system, cytokines act at the recognition, activation, or effector phases of an immune response, modulating the development and functional activities of the subtypes of T cells, B cells and myeloid cells. Consequently, research involving cytokines plays a significant role in achieving a deeper understanding of the immune system and its multi-faceted response to most antigens, especially those responses that make up the inflammatory process.

Low levels of inflammation are involved in many clinical and sub-clinical disease states, such as autoimmune disease, cardiovascular disease, diabetes, neurological disorders and cancer. Measuring picogram levels of cytokines, therefore, is critical for understanding the pathogenesis of these diseases.

MILLIPLEX® MAP offers the broadest selection of analytes across a wide range of disease states and species. Once the analytes of interest have been identified, you can rely on the quality that we build into each kit to produce results you can trust. In addition to the assay characteristics listed in the protocol, other performance criteria evaluated during the validation process include: cross-reactivity, dilution linearity, kit stability, and sample behavior (e.g. detectability and stability).

Each MILLIPLEX® MAP panel and kit includes:

- Quality controls (QCs) provided to qualify assay performance
- Comparison of standard (calibrator) and QC lots to a reference lot to ensure lot-to-lot consistency
- Optimized serum matrix to mimic native analyte environment
- Detection antibody cocktails designed to yield consistent analyte profiles within panel

In addition each panel and kit meets stringent manufacturing criteria to ensure batch-to-batch reproducibility. The MILLIPLEX® MAP Human High Sensitivity T Cell Magnetic Bead Panel thus enables you to focus on the therapeutic potential of cytokines as well as the modulation of even low levels of cytokine expression. Coupled with the Luminex® xMAP® platform in a magnetic bead format, you receive the advantage of ideal speed and sensitivity, allowing quantitative multiplex detection of dozens of analytes simultaneously, which can dramatically improve productivity.

EMD Millipore’s MILLIPLEX® MAP Human High Sensitivity T Cell Magnetic Bead Panel is part of the most versatile system available for cytokines research. From our single to multiplex biomarker solutions, we partner with you to design, develop, analytically validate and build the most comprehensive library available for protein detection and quantitation.

- MILLIPLEX® MAP offers you:
    - The ability to select a 13-plex or 21-plex pre-mixed kit
    - The ability to choose any combination of analytes from our panel of 21 analytes to design a custom kit that better meets your needs.
    - A convenient “all-in-one” box format that gives you the assurance that you will have all the necessary reagents you need to run your assay.

In addition data obtained from the High Sensitivity T Cell Panel will correlate with data for the respective cytokines in the Human Cytokine/Chemokine Panels I, II and III, furthering your ability to measure specific cytokine response in both normal and disease states.

EMD Millipore's MILLIPLEX® MAP Human High Sensitivity T Cell Magnetic Bead Panel is to be used for the simultaneous quantification of any or all of the following analytes in human plasma, serum, and cell/tissue culture supernatant samples: Fractalkine, GM-CSF, IFNγ, IL-1β, IL-2, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12 (p70), IL-13, IL-17A, IL-21, IL-23, ITAC, MIP-1α, MIP-1β, MIP-3α and TNFα.

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Please read entire protocol before use.

It is important to use same assay incubation conditions throughout your study.

PRINCIPLE

MILLIPLEX® MAP is based on the Luminex® xMAP® technology — one of the fastest growing and most respected multiplex technologies offering applications throughout the life-sciences and capable of performing a variety of bioassays including immunoassays on the surface of fluorescent-coded magnetic beads known as MagPlex®-C microspheres.

- Luminex® uses proprietary techniques to internally color-code microspheres with two fluorescent dyes. Through precise concentrations of these dyes, distinctly colored bead sets of 500 5.6 µm polystyrene microspheres or 80 6.45 µm magnetic microspheres can be created, each of which is coated with a specific capture antibody.
- After an analyte from a test sample is captured by the bead, a biotinylated detection antibody is introduced.
- The reaction mixture is then incubated with Streptavidin-PE conjugate, the reporter molecule, to complete the reaction on the surface of each microsphere.
- EMD Millipore provides three Luminex® instruments to acquire and analyze data using two detection methods:
    - The Luminex® analyzers Luminex® 200™ and FLEXMAP 3D®, flow cytometry-based instruments that integrate key xMAP® detection components, such as lasers, optics, advanced fluidics and high-speed digital signal processors.
    - The Luminex® analyzer (MAGPIX®), a CCD-based instrument that integrates key xMAP® capture and detection components with the speed and efficiency of magnetic beads.
- Each individual microsphere is identified and the result of its bioassay is quantified based on fluorescent reporter signals. EMD Millipore combines the streamlined data acquisition power of Luminex® xPONENT® acquisition software with sophisticated analysis capabilities of the new MILLIPLEX® Analyst 5.1, integrating data acquisition and analysis seamlessly with all Luminex® instruments.

The capability of adding multiple conjugated beads to each sample results in the ability to obtain multiple results from each sample. Open-architecture xMAP® technology enables multiplexing of many types of bioassays reducing time, labor and costs over traditional methods.

STORAGE CONDITIONS UPON RECEIPT

- Recommended storage for kit components is 2 - 8°C.
- For long-term storage, freeze reconstituted standards and controls at ≤ -20°C. Avoid multiple (>2) freeze/thaw cycles.
- **DO NOT FREEZE Antibody-Immobilized Beads, Detection Antibody, and Streptavidin-Phycoerythrin**.

REAGENTS SUPPLIED

Note: Store all reagents at 2 – 8°C

Reagents Supplied	Catalog Number	Volume	Quantity
Human High Sensitivity T Cell Standard	HSTC-8028	Lyophilized	1 vial
Human High Sensitivity T Cell Quality Controls 1 and 2	HSTC-6028	Lyophilized	2 vials
Serum Matrix Note: Contains 0.08% Sodium Azide	MXHSM-7	Lyophilized	1 vial
Set of one 96-Well Plate with 2 sealers	----------	----------	1 plate 2 sealers
Assay Buffer	L-ABIR	15 mL	1 bottle
10X Wash Buffer Note: Contains 0.05% Proclin	L-WB	60 mL	1 bottle
Human High Sensitivity T Cell Detection Antibodies	HSTC-1028	5.5 mL	1 bottle
Streptavidin-Phycoerythrin	MC-SAPE7	5.5 mL	1 bottle
Bead Diluent	LBD	3.5 mL	1 bottle
Mixing Bottle (not provided with premixed panel)	----------	----------	1 bottle

Human High Sensitivity T Cell Antibody-Immobilized Premixed Magnetic Beads:

Premixed 13-plex Beads	HSTCPMX13-MAG	3.5 mL	1 bottle
Premixed 21-plex Beads	HSTCPMX21-MAG	3.5 mL	1 bottle

Included Human High Sensitivity T Cell Antibody-Immobilized Magnetic Beads are dependent on customizable selection of analytes within the panel (see next page).

REAGENTS SUPPLIED (continued)

Human High Sensitivity T Cell Antibody-Immobilized Magnetic Beads:

Bead/Analyte Name	Luminex® Magnetic Bead Region	Customizable **21** Analytes (**50**X concentration, **90** µL) Available	Cat. #	**13**-Plex Magnetic Premixed Beads	**21**-Plex Magnetic Premixed Beads
Anti-Human ITAC Beads	19	✔	HITAC-MAG		✔
Anti-Human GM-CSF Beads	20	✔	HGMCSF-MAG	✔	✔
Anti-Human Fractalkine Beads	21	✔	HFKN-MAG		✔
Anti-Human IFNγ Beads	25	✔	HCYIFNG-MAG	✔	✔
Anti-Human IL-10 Beads	27	✔	HCYIL10-MAG	✔	✔
Anti-Human MIP-3α Beads	28	✔	HMIP3A-MAG		✔
Anti-Human IL-12 (p70) Beads	33	✔	HIL12P70-MAG	✔	✔
Anti-Human IL-13 Beads	35	✔	HIL13-MAG	✔	✔
Anti-Human IL-17A Beads	39	✔	HIL17-MAG		✔
Anti-Human IL-1β Bead	46	✔	HCYIL1B-MAG	✔	✔
Anti-Human IL-2 Beads	48	✔	HIL2-MAG	✔	✔
Anti-Human IL-21 Beads	52	✔	HIL21-MAG		✔
Anti-Human IL-4 Beads	53	✔	HIL4-MAG	✔	✔
Anti-Human IL-23 Beads	54	✔	HIL23-MAG		✔
Anti-Human IL-5 Beads	55	✔	HIL5-MAG	✔	✔
Anti-Human IL-6 Beads	57	✔	HCYIL6-MAG	✔	✔
Anti-Human IL-7 Beads	61	✔	HIL7-MAG	✔	✔
Anti-Human IL-8 Beads	63	✔	HCYIL8-MAG	✔	✔
Anti-Human MIP-1α	72	✔	HMIP1A-MAG		✔
Anti-Human MIP-1β	73	✔	HMIP1B-MAG		✔
Anti-Human TNFα Beads	75	✔	HCYTNFA-MAG	✔	✔

MATERIALS REQUIRED BUT NOT PROVIDED

Reagents

1. Luminex® Sheath Fluid (EMD Millipore Catalog # SHEATHFLUID) or Luminex® Drive Fluid (EMD Millipore Catalog # MPXDF-4PK)

Instrumentation / Materials

1. Adjustable Pipettes with Tips capable of delivering 25 µL to 1000 µL
2. Multichannel Pipettes capable of delivering 5 µL to 50 µL or 25 µL to 200 µL
3. Reagent Reservoirs
4. Polypropylene Microfuge Tubes
5. Rubber Bands
6. Aluminum Foil
7. Absorbent Pads
8. Laboratory Vortex Mixer
9. Sonicator (Branson Ultrasonic Cleaner Model # B200 or equivalent)
10. Titer Plate Shaker (VWR® Microplate Shaker Cat # 12620-926 or equivalent)
11. Luminex® 200™, HTS, FLEXMAP 3D®, or MAGPIX® with xPONENT® software by Luminex® Corporation
12. Automatic Plate Washer for magnetic beads (BioTek® 405 LS and 405 TS, EMD Millipore Catalog # 40-094, # 40-095, # 40-096, # 40-097 or equivalent) or Handheld Magnetic Separation Block (EMD Millipore Catalog # 40-285 or equivalent).

Note: If a plate washer or handheld magnetic separation block for magnetic beads is not available, one can use a microtiter filter plate (EMD Millipore Catalog # MX-PLATE) to run the assay using a Vacuum Filtration Unit (EMD Millipore Vacuum Manifold Catalog # MSVMHTS00 or equivalent with EMD Millipore Vacuum Pump Catalog # WP6111560 or equivalent).

SAFETY PRECAUTIONS

- All blood components and biological materials should be handled as potentially hazardous. Follow universal precautions as established by the Centers for Disease Control and Prevention and by the Occupational Safety and Health Administration when handling and disposing of infectious agents.

- Sodium Azide or Proclin has been added to some reagents as a preservative. Although the concentrations are low, Sodium Azide and Proclin may react with lead and copper plumbing to form highly explosive metal azides. Dispose of unused contents and waste in accordance with international, federal, state, and local regulations.

Note: See Full Labels of Hazardous components on next page.

Full Labels of Hazardous Components

Ingredient, Cat #		Full Label	
Human High Sensitivity T Cell Detect Antibodies	HSTC-1028		**Warning.** Causes serious eye irritation. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Human High Sensitivity T Cell Quality Control 1 & 2	HSTC-6028		**Danger.** Harmful if swallowed. Causes serious eye damage. Harmful to aquatic life with long lasting effects. Avoid release to the environment. Wear eye protection. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical advice/ attention.
Human High Sensitivity T Cell Standard	HSTC-8028		**Danger.** Harmful if swallowed. Causes serious eye damage. Harmful to aquatic life with long lasting effects. Avoid release to the environment. Wear eye protection. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical advice/ attention.
Assay Buffer MILLIPLEX	L-ABIR		**Warning.** Causes serious eye irritation. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Streptavidin-Phycoerythrin	MC-SAPE7		**Warning.** Causes serious eye irritation. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
10X Wash Buffer - MILLIPLEX	L-WB		**Warning.** May cause an allergic skin reaction. Wear protective gloves. IF ON SKIN: Wash with plenty of soap and water.
Serum Matrix	MXHSM-7	No Symbol Required	Harmful to aquatic life with long lasting effects. Avoid release to the environment.

UNIQUE FEATURES OF THE HUMAN HIGH SENSITIVITY T CELL MAGNETIC BEAD PANEL

Please read this protocol with care as there are several distinctive steps as summarized below:

- When testing serum or plasma samples, the Standard and the Quality Control vials are reconstituted in Serum Matrix.
    - Both the reconstituted Quality Controls and the Standards are further diluted in Serum Matrix to make the final solutions.
    - Serum Matrix is reconstituted to a final volume of 4 mL.
    - Serum Matrix is used for the background wells.

- When testing tissue culture or other supernatant, the Quality Control and the Standard Vials should be reconstituted and further diluted in the appropriate control culture medium, which will also be used for the background wells.

- 50 µL background, Standard and Quality Controls are added to their appropriate wells on the assay plate.

- 25 µL Sample and 25 µL Assay Buffer are added to the sample wells resulting in a two-fold sample dilution.

- For Quality Control analysis, analyte concentrations DO NOT NEED to be multiplied by the dilution factor.

- Serum or plasma samples with high analyte values may be further diluted in serum matrix prior to the addition of 25 µL to the sample wells.

TECHNICAL GUIDELINES

To obtain reliable and reproducible results, the operator should carefully read this entire manual and fully understand all aspects of each assay step before running the assay. The following notes should be reviewed and understood before the assay is set up.

- FOR RESEARCH USE ONLY. NOT FOR USE IN DIAGNOSTIC PROCEDURES.
- Do not use beyond the expiration date on the label.
- Do not mix or substitute reagents with those from other lots or sources.
- The Antibody-Immobilized Beads are light sensitive and must be protected from light at all times. Cover the assay plate containing beads with opaque plate lid or aluminum foil during all incubation steps.
- It is important to allow all reagents to warm to room temperature (20-25°C) before use in the assay.
- Incomplete washing can adversely affect the assay outcome. All washing must be performed with the Wash Buffer provided.
- The standards prepared by serial dilution must be used within 1 hour of preparation. Discard any unused standards except the standard stock which may be stored at ≤ -20°C for 1 month and at ≤ -80°C for greater than one month.
- If samples fall outside the dynamic range of the assay, further dilute the samples two-fold with the appropriate diluent and repeat the assay.
- Any unused mixed Antibody-Immobilized Beads may be stored in the Mixing Bottle at 2-8°C for up to **one month.**
- During the preparation of the standard curve, make certain to mix the higher concentration well before making the next dilution. Use a new tip with each dilution.
- The plate should be read immediately after the assay is finished. If, however, the plate cannot be read immediately, seal the plate, cover with aluminum foil or an opaque lid, and store the plate at 2-8°C for up to 24 hours. Prior to reading, agitate the plate on the plate shaker at room temperature for 10 minutes. Delay in reading a plate may result in decreased sensitivity for some analytes.
- The titer plate shaker should be set at a speed to provide maximum orbital mixing without splashing of liquid outside the wells. For the recommended plate shaker, this would be a setting of 5-7 which is approximately 500-800 rpm.
- Ensure that the needle probe is clean. This may be achieved by sonication and/or alcohol flushes.
- When reading the assay on Luminex® 200™, adjust probe height according to the protocols recommended by Luminex® to the kit solid plate or to the recommended EMD Millipore filter plates using 3 alignment discs. When reading the assay on MAGPIX®, adjust probe height according to the protocols recommended by Luminex® to the kit solid plate or to the recommended EMD Millipore filter plates using 2 alignment discs. When reading the assay on FLEXMAP 3D®, adjust probe height according to the protocols recommended by Luminex® to the kit solid plate using 1 alignment disc.

  For FLEXMAP 3D® when using the solid plate in the kit, the final resuspension should be with 150 µL Sheath Fluid in each well and 75 µL should be aspirated.
- For cell culture supernatants or tissue extraction, use the culture or extraction medium as the matrix solution in background and for reconstitution of standard curve and controls.

TECHNICAL GUIDELINES (continued)

- For serum/plasma samples that require dilution, use the **MXHSM-7** provided and prepared as described in the kit for a two-fold dilution (e.g. 50 µL of sample and 50 µL of MXHSM-7).
- For cell/tissue homogenate, the final cell or tissue homogenate should be prepared in a buffer that has a neutral pH, contains minimal detergents or strong denaturing detergents, and has an ionic strength close to physiological concentration. Avoid debris, lipids, and cell/tissue aggregates. Centrifuge samples before use.
- Vortex all reagents well before adding to plate.

SAMPLE COLLECTION AND STORAGE

A. Preparation of Serum Samples:
   - Allow the blood to clot for at least 30 minutes before centrifugation for 10 minutes at 1000xg. Remove serum and assay immediately or aliquot and store samples at ≤ -20°C.
   - Avoid multiple **(>2)** freeze/thaw cycles.
   - When using frozen samples, it is recommended to thaw the samples completely, mix well by vortexing and centrifuge prior to use in the assay to remove particulates.
   - Neat Serum samples are used. If further dilution is required, we recommend diluting samples no more than one to two in MXHSM-7 (e.g. 50 µL sample and 50 µL MXHSM-7).

B. Preparation of Plasma Samples:
   - Plasma collection using EDTA as an anti-coagulant is recommended. Centrifuge for 10 minutes at 1000xg within 30 minutes of blood collection. Remove plasma and assay immediately or aliquot and store samples at ≤ -20°C.
   - Avoid multiple (>2) freeze/thaw cycles.
   - When using frozen samples, it is recommended to thaw the samples completely, mix well by vortexing and centrifuge prior to use in the assay to remove particulates.
   - Neat Plasma samples are used. If further dilution is required, we recommend diluting samples no more than one to two in MXHSM-7 (e.g. 50 µL sample and 50 µL MXHSM-7).

C. Preparation of Tissue Culture Supernatant:
   - Centrifuge the sample to remove debris and assay immediately or aliquot and store samples at ≤ -20°C.
   - Avoid multiple (>2) freeze/thaw cycles.
   - Tissue culture supernatant may require a dilution with an appropriate control medium prior to assay. Tissue/cell extracts should be done in neutral buffers containing reagents and conditions that do not interfere with assay performance. Excess concentrations of detergent, salt, denaturants, high or low pH, etc. will negatively affect the assay. Organic solvents should be avoided. The tissue/cell extract samples should be free of particles such as cells or tissue debris.

SAMPLE COLLECTION AND STORAGE (continued)

NOTE:

- A maximum of **25 µL** per well of neat or one to two diluted serum or plasma can be used. Tissue culture or other media may also be used.
- All samples must be stored in polypropylene tubes. **DO NOT STORE SAMPLES IN GLASS.**
- Avoid debris, lipids and cells when using samples with gross hemolysis or lipemia.
- Care must be taken when using heparin as an anti-coagulant since an excess of heparin will provide falsely high values. Use no more than 10 IU heparin per mL of blood collected.

PREPARATION OF REAGENTS FOR IMMUNOASSAY

A. Preparation of Antibody-Immobilized Beads

If premixed beads are used, sonicate the premixed bead bottle 30 seconds and then vortex for 1 minute before use.

For individual vials of beads, sonicate each antibody-bead vial for 30 seconds; vortex for 1 minute. Add 70 µL from each antibody-bead vial to the Mixing Bottle and bring final volume to 3.5 mL with Bead Diluent (LBD). Vortex the mixed beads well. Unused portion may be stored at 2-8°C for up to one month. (Note: Due to the composition of magnetic beads, you may notice a slight color in the bead solution. This does not affect the performance of the beads or the kit.)

Example: When using 10 antibody-immobilized beads, add 70 µL from each of the 10 bead vials to the Mixing Bottle. Then add 2.8 mL LBD

B. Preparation of Serum Matrix

This step is required for serum or plasma samples only.

Add 1.0 mL deionized water to the bottle containing lyophilized serum matrix (Cat# MXHSM-7). Mix well. Allow at least 10 minutes for complete reconstitution. Add 3 mL Assay Buffer (Cat# L-ABIR) to the bottle for a final volume of 4 mL. Unused reconstituted matrix should be stored at ≤ -20°C for up to one month.

C. Preparation of Quality Controls

For serum and plasma samples, reconstitute Quality Control 1 (QC1) and Quality Control 2 (QC2) vials with **250 µL MXHSM-7**. **These are the Stock QC Vials.** Invert the Stock Vials several times to mix and vortex. Allow the vials to sit for 5-10 minutes. Label two tubes QC1 and QC2 and add 150 µL MXHSM-7 to each tube. Remove 50 µL from QC1 or QC2 Stock Vials and add to the 150 µL MXHSM-7 in the respective QC1 and QC2 tubes and vortex. **Use these one to four diluted QCs in the assay**. Unused portions may be stored at ≤ -20°C for up to one month.

For culture samples, substitute the appropriate sample media for the MXHSM-7 used for serum and plasma samples above.

PREPARATION OF REAGENTS FOR IMMUNOASSAY (continued)

D. Preparation of Wash Buffer

Bring the 10X Wash Buffer to room temperature and mix to bring all salts into solution. Dilute 60 mL of 10X Wash Buffer with 540 mL deionized water. Store the unused portion at 2-8°C for up to one month.

E. Preparation of Human High Sensitivity T Cell Standard

1.) For serum and plasma samples, reconstitute the Human High Sensitivity T Cell Standard with **250 µL MXHSM-7**. Invert the vial several times to mix. Vortex the vial for 10 seconds. Allow the vial to sit for 5-10 minutes. **This is the Stock Standard Vial NOT Standard 7.** Unused Standard may be stored at ≤ -20°C for up to one month.

For other samples (tissue culture, cell culture etc.) substitute the appropriate media for the MXHSM-7 used for serum and plasma samples above.

2). Preparation of Working Standards

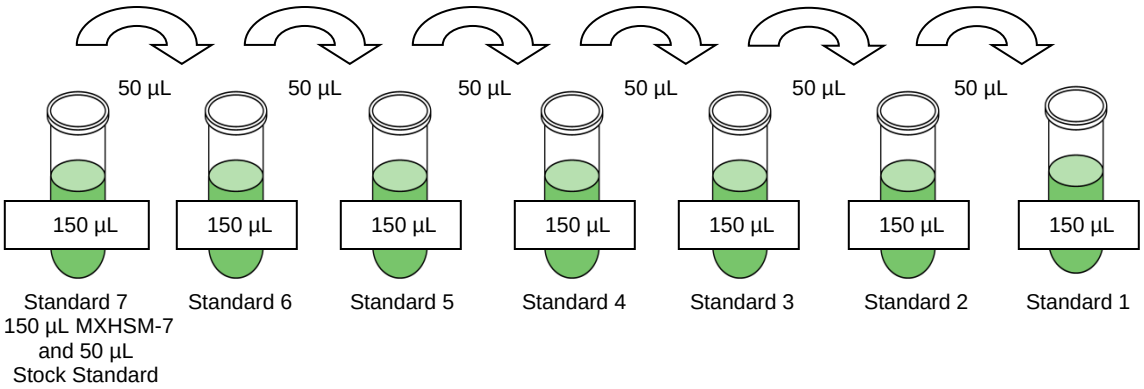
For serum and plasma samples, label seven polypropylene microfuge tubes as Standard 7, Standard 6, Standard 5, Standard 4, Standard 3, Standard 2 and Standard 1. Add 150 µL of MXHSM-7 to each of the seven tubes. Prepare serial dilutions by adding 50 µL of the Stock Standard to the Standard 7 tube, mix well and transfer 50 µL of the Standard 7 to the Standard 6 tube, mix well and transfer 50 µL of the Standard 6 tube to the Standard 5 tube, mix well and transfer 50 µL of the Standard 5 tube to the Standard 4 tube, mix well and transfer 50 µL of the Standard 4 tube to the Standard 3 tube, mix well and transfer 50 µL of the Standard 3 tube to the Standard 2 tube, mix well and transfer 50 µL of the Standard 2 tube to the Standard 1 tube and mix well. The 0 pg/mL standard (Background) will be MXHSM-7 or appropriate sample media.

Standard #	Volume of MXHSM-7 to Add	Volume of Standard to Add
Stock Standard	250 µL	0

Standard #	Volume of MXHSM-7 to Add	Volume of Standard to Add
Standard 7	150 µL	50 µL of Stock Standard
Standard 6	150 µL	50 µL of Standard 7
Standard 5	150 µL	50 µL of Standard 6
Standard 4	150 µL	50 µL of Standard 5
Standard 3	150 µL	50 µL of Standard 4
Standard 2	150 µL	50 µL of Standard 3
Standard 1	150 µL	50 µL of Standard 2

PREPARATION OF REAGENTS FOR IMMUNOASSAY (continued)

Preparation of Standards



Standard	ITAC, IL-10 (pg/mL)	GM-CSF (pg/mL)	Fractalkine (pg/mL)	IFNγ, MIP-3α (pg/mL)
Standard 1	1.46	1.22	18.3	0.61
Standard 2	5.86	4.88	73.2	2.44
Standard 3	23.4	19.5	293.0	9.8
Standard 4	93.8	78.1	1,171.9	39
Standard 5	375	312.5	4,687.5	156
Standard 6	1,500	1,250	18,750	625
Standard 7	6,000	5,000	75,000	2,500

Standard	IL-12p70, IL-1β, IL-2, IL-5 (pg/mL)	IL-13, IL-21 (pg/mL)	IL-17A (pg/mL)	IL-4 (pg/mL)	IL-23 (pg/mL)
Standard 1	0.49	0.24	0.73	1.83	7.93
Standard 2	1.95	0.98	2.93	7.32	31.7
Standard 3	7.81	3.91	11.7	29.3	127.0
Standard 4	31.3	15.63	46.9	117.2	507.8
Standard 5	125	62.5	187.5	468.8	2,031.3
Standard 6	500	250	750	1,875	8,125
Standard 7	2,000	1,000	3,000	7,500	32,500

PREPARATION OF REAGENTS FOR IMMUNOASSAY (continued)

Standard	IL-6 (pg/mL)	IL-7 (pg/mL)	IL-8, MIP-1α (pg/mL)	MIP-1β (pg/mL)	TNFα (pg/mL)
Standard 1	0.18	0.37	0.31	0.92	0.43
Standard 2	0.73	1.46	1.22	3.66	1.71
Standard 3	2.93	5.86	4.88	14.7	6.84
Standard 4	11.7	23.4	19.5	58.6	27.3
Standard 5	46.9	93.8	78.1	234.4	109.4
Standard 6	187.5	375	312.5	937.5	437.5
Standard 7	750	1,500	1,250	3,750	1,750

IMMUNOASSAY PROCEDURE

- Prior to beginning this assay, it is imperative to read this protocol completely and to thoroughly understand the Technical Guidelines.
- Allow all reagents to warm to room temperature (20-25°C) before use in the assay.
- Diagram the placement of Standards [0 (Background), standards 1 through 7], Controls 1 and 2, and Samples on Well Map Worksheet in a vertical configuration. (Note: Most instruments will only read the 96-well plate vertically by default.) It is recommended to run the assay in duplicate.
- If using a filter plate, set the filter plate on a plate holder at all times during reagent dispensing and incubation steps so that the bottom of the plate does not touch any surface.

1. Add 200 µL of Wash Buffer into each well of the plate. Seal and mix on a plate shaker for 10 minutes at room temperature (20-25°C).
2. Decant Wash Buffer and remove the residual amount from all wells by inverting the plate and tapping it smartly onto absorbent towels several times.
3. Add 50 µL of each **diluted** Standard or Quality Control into the appropriate wells (**NOT from Stock Vials)**. The **Serum Matrix** should be used for 0 pg/mL standard (background). When assaying tissue culture or other supernatant, use appropriate control culture medium as the background.
4. Add 25 µL of Assay Buffer to the sample wells.
5. Add 25 µL of sample into the sample wells.
6. Vortex Mixing Bottle and add 25 µL of the Mixed or Premixed Beads to each well. (Note: During addition of Beads, shake bead bottle intermittently to avoid settling.)
7. Seal the plate with a plate sealer. Wrap the plate with foil and incubate with agitation on a plate shaker overnight (16-18 hrs) at 4°C

Add 200 µL 1X Wash Buffer per well

↓ Shake 10 min, RT

↓ Decant

- Add 50 µL Standard or Control to appropriate wells
- Add 50 µL appropriate matrix to background wells
- Add 25 µL Assay Buffer to sample wells
- Add 25 µL neat samples to sample wells
- Add 25 µL Beads to each well

↓ Incubate overnight at 4°C

8. Gently remove well contents and wash plate 3 times following instructions listed in the **PLATE WASHING** section.

9. Add 50 µL of Detection Antibodies into each well. (Note: Allow the Detection Antibodies to warm to room temperature prior to addition.)

10. Seal, cover with foil and incubate with agitation on a plate shaker for 1 hour at room temperature (20-25°C). **DO NOT ASPIRATE AFTER INCUBATION.**

11. Add 50 µL Streptavidin-Phycoerythrin to each well containing the 50 µL of Detection Antibodies.

12. Seal, cover with foil and incubate with agitation on a plate shaker for 30 minutes at room temperature (20-25°C).

13. Gently remove well contents and wash plate 3 times following instructions listed in the **PLATE WASHING** section.

14. Add 150 µL of Sheath Fluid (or Drive Fluid if using MAGPIX®) to all wells. Resuspend the beads on a plate shaker for 5 minutes.

15. Run plate on Luminex® 200™, HTS, FLEXMAP 3D® or MAGPIX® with xPONENT® software.

16. Save and analyze the Median Fluorescent Intensity (MFI) data using a 5-parameter logistic or spline curve-fitting method for calculating analyte concentrations in samples and Controls. **(Note: Because of the built-in two-fold sample dilution, for all neat samples, multiply the calculated concentrations by two. For two-fold diluted samples, multiply the calculated concentrations by four. Calculated Quality Control concentrations do not require multiplication by a dilution factor.)**

Remove well contents and wash 3X with 200 µL Wash Buffer

Add 50 µL Detection Antibodies per well

Incubate **1 hour** at RT

Do Not Aspirate

Add 50 µL Streptavidin-Phycoerythrin per well

Incubate for 30 minutes at RT

Remove well contents and wash 3X with 200 µL Wash Buffer

Add 150 µL Sheath Fluid or Drive Fluid per well

Read on Luminex® (100 µL, 50 beads per bead set)

PLATE WASHING

1.) Solid Plate

If using a solid plate, use either a handheld magnet or magnetic plate washer.

A.) Handheld magnet (EMD Millipore Catalog # 40-285) - Rest plate on magnet for 60 seconds to allow complete settling of magnetic beads. Remove well contents by gently decanting the plate in an appropriate waste receptacle and gently tapping on absorbent pads to remove residual liquid. Wash plate with 200 µL of Wash Buffer by removing plate from magnet, adding Wash Buffer, shaking for 30 seconds, reattaching to magnet, letting beads settle for 60 seconds and removing well contents as previously described after each wash. Repeat wash steps as recommended in Assay Procedure.

B.) Magnetic plate washer (EMD Millipore Catalog # 40-094, # 40-095, # 40-096 and # 40-097) - Please refer to specific automatic plate washer manual for appropriate equipment settings. Please note that after the final aspiration, there will be approximately 25 µL of residual wash buffer in each well. This is expected when using the BioTek plate washer and this volume does not need to be aspirated from the plate.

If using an automatic plate washer other than BioTek® 405 LS or 405 TS, please refer to the manufacturer's recommendations for programming instructions.

2.) Filter Plate (EMD Millipore Catalog # MX-PLATE)

If using a filter plate, use a vacuum filtration manifold to remove well contents. Wash plate with 200 µL/well of Wash Buffer, removing Wash Buffer by vacuum filtration after each wash. Repeat wash steps as recommended in the Assay Procedure.

EQUIPMENT SETTINGS

Luminex® 200™, HTS, FLEXMAP 3D®, and MAGPIX® with xPONENT® software:

These specifications are for the Luminex® 200™, Luminex® HTS, Luminex® FLEXMAP 3D®, and Luminex® MAGPIX® with xPONENT® software. Luminex® instruments with other software (e.g. MasterPlex®, StarStation, LiquiChip, Bio-Plex Manager™, LABScan™100) would need to follow instrument instructions for gate settings and additional specifications from the vendors for reading Luminex® magnetic beads.

For magnetic bead assays, the Luminex® 200™ and HTS instruments must be calibrated with the xPONENT® 3.1 compatible Calibration Kit (EMD Millipore Catalog # 40-275) and performance verified with the Performance Verification Kit (EMD Millipore Catalog # 40-276). The Luminex® FLEXMAP 3D® instrument must be calibrated with the FLEXMAP 3D® Calibrator Kit (EMD Millipore Catalog # 40-028) and performance verified with the FLEXMAP 3D® Performance Verification Kit (EMD Millipore Catalog # 40-029). The Luminex® MAGPIX® instrument must be calibrated with the MAGPIX® Calibration Kit (EMD Millipore Catalog # 40-049) and performance verified with the MAGPIX® Performance Verification Kit (EMD Millipore Catalog # 40-050).

NOTE: When setting up a Protocol using the xPONENT® software, you must select MagPlex as the Bead Type in the Acquisition settings.

NOTE: These assays cannot be run on any instruments using Luminex® IS 2.3 or Luminex® 1.7 software.

EQUIPMENT SETTINGS (continued)

The Luminex® probe height must be adjusted to the plate provided in the kit. Please use Catalog # MAG-PLATE, if additional plates are required for this purpose.

Events:	50, per bead	
Sample Size:	100 µL	
Gate Settings:	8,000 to 15,000	
Reporter Gain:	Default (low PMT)	
Time Out:	60 seconds	
Bead Set:	Customizable 21-Plex Beads	
	ITAC	19
	GM-CSF	20
	Fractalkine	21
	IFNγ	25
	IL-10	27
	MIP-3α	28
	IL-12 (p70)	33
	IL-13	35
	IL-17A	39
	IL-1β	46
	IL-2	48
	IL-21	52
	IL-4	53
	IL-23	54
	IL-5	55
	IL-6	57
	IL-7	61
	IL-8	63
	MIP-1α	72
	MIP-1β	73
	TNFα	75

QUALITY CONTROLS

The ranges for each analyte in Quality Control 1 and 2 are provided on the card insert or can be located at the EMD Millipore website emdmillipore.com using the catalog number as the keyword.

ASSAY CHARACTERISTICS

Cross-Reactivity

There was no or negligible cross-reactivity between the antibodies for an analyte and any of the other analytes in this panel.

Assay Sensitivities (minimum detectable concentrations (pg/mL)

Minimum Detectable Concentration (MinDC) is calculated using MILLIPLEX® Analyst 5.1. It measures the true limits of detection for an assay by mathematically determining what the empirical MinDC would be if an infinite number of standard concentrations were run for the assay under the same conditions.

Analyte	Overnight Protocol (n = 7 Assays)	
	MinDC (pg/mL)	MinDC+2SD (pg/mL)
ITAC	1.25	1.98
GM-CSF	0.35	0.60
Fractalkine	8.17	12.53
IFNγ	0.48	0.94
IL-10	0.56	0.93
MIP-3α	0.83	1.39
IL-12 (p70)	0.15	0.27
IL-13	0.23	0.34
IL-17A	0.33	0.52
IL-1β	0.14	0.24
IL-2	0.19	0.30
IL-21	0.14	0.20
IL-4	1.12	1.84
IL-23	3.25	5.11
IL-5	0.12	0.22
IL-6	0.11	0.17
IL-7	0.42	0.60
IL-8	0.13	0.25
MIP-1α	0.94	1.28
MIP-1β	0.67	0.98
TNFα	0.16	0.21

ASSAY CHARACTERISTICS (continued)

Precision

Intra-assay precision is generated from the mean of the %CV's from 8 reportable results across two different concentrations of analytes in a single assay. Inter-assay precision is generated from the mean of the %CV's across two different concentrations of analytes across 6 different assays.

Analyte	Overnight Protocol	
	Intra-assay %CV	Inter-assay %CV
ITAC	<5%	<15%
GM-CSF	<5%	<15%
Fractalkine	<5%	<15%
IFNγ	<5%	<20%
IL-10	<5%	<20%
MIP-3α	<5%	<20%
IL-12 (p70)	<6%	<15%
IL-13	<5%	<20%
IL-17A	<5%	<20%
IL-1β	<5%	<15%
IL-2	<5%	<15%
IL-21	<5%	<15%
IL-4	<5%	<15%
IL-23	<5%	<20%
IL-5	<5%	<20%
IL-6	<5%	<20%
IL-7	<5%	<15%
IL-8	<5%	<15%
MIP-1α	<5%	<15%
MIP-1β	<5%	<15%
TNFα	<5%	<15%

ASSAY CHARACTERISTICS (continued)

Accuracy

Spike Recovery: The data represent mean percent recovery of spiked standards ranging from low, medium, and high concentration in serum matrices (n=4).

Analyte	Overnight Protocol
	% Recovery in Serum Matrix
ITAC	106
GM-CSF	101
Fractalkine	101
IFNγ	101
IL-10	104
MIP-3α	101
IL-12 (p70)	100
IL-13	103
IL-17A	106
IL-1β	98
IL-2	103
IL-21	101
IL-4	103
IL-23	100
IL-5	101
IL-6	107
IL-7	98
IL-8	103
MIP-1α	101
MIP-1β	98
TNFα	103

TROUBLESHOOTING GUIDE

Problem	Probable Cause	Solution
Insufficient bead count	Plate washer aspirate height set too low	Adjust aspiration height according to manufacturers' instructions.
	Bead mix prepared inappropriately	Sonicate bead vials and vortex just prior to adding to bead mix bottle according to protocol. Agitate bead mix intermittently in reservoir while pipetting this into the plate.
	Samples cause interference due to particulate matter or viscosity	See above. Also sample probe may need to be cleaned with alcohol flushes, back flushes and washes; or, if needed, probe should be removed and sonicated.
	Probe height not adjusted correctly	When reading the assay on Luminex® 200™, adjust probe height to the kit solid plate or to the recommended EMD Millipore filter plates using 3 alignment discs. When reading the assay on MAGPIX®, adjust probe height to the kit solid plate or to the recommended EMD Millipore filter plates using 2 alignment discs. When reading the assay on FLEXMAP 3D®, adjust probe height to the kit solid plate using 1 alignment disc. For FLEXMAP 3D® when using the solid plate in the kit, the final resuspension should be with 150 µL Sheath Fluid in each well and 75 µL should be aspirated.
Background is too high	Background wells were contaminated	Avoid cross-well contamination by using sealer appropriately and pipetting with multichannel pipettes without touching reagent in plate.
	Matrix used has endogenous analyte or interference	Check matrix ingredients for cross-reacting components (e.g. interleukin modified tissue culture medium).
	Insufficient washes	Increase number of washes.
Beads not in region or gate	Luminex® instrument not calibrated correctly or recently	Calibrate Luminex® instrument based on manufacturer's instructions, at least once a week or if temperature has changed by >3°C.
	Gate settings not adjusted correctly	Some Luminex® instruments (e.g. Bio-Plex®) require different gate settings than those described in the kit protocol. Use instrument default settings.
	Wrong bead regions in protocol template	Check kit protocol for correct bead regions or analyte selection.
	Incorrect sample type used	Samples containing organic solvents or if highly viscous should be diluted or dialyzed as required.
	Instrument not washed or primed	Prime the Luminex® instrument 4 times to rid it of air bubbles, wash 4 times with sheath fluid or water if there is any remnant alcohol or sanitizing liquid.
	Beads were exposed to light	Keep plate and bead mix covered with dark lid or aluminum foil during all incubation steps.

Problem	Probable Cause	Solution
Signal for whole plate is same as background	Incorrect or no Detection Antibody was added	Add appropriate Detection Antibody and continue.
	Streptavidin-Phycoerythrin was not added	Add Streptavidin-Phycoerythrin according to protocol. If Detection Antibody has already been removed, sensitivity may be low.
Low signal for standard curve	Detection Antibody may have been removed prior to adding Streptavidin-Phycoerythrin	May need to repeat assay if desired sensitivity not achieved.
	Incubations done at inappropriate temperatures, timings or agitation.	Assay conditions need to be checked.
Signals too high, standard curves are saturated	Calibration target value set too high	With some Luminex® instruments (e.g. Bio-Plex®) default target setting for RP1 calibrator is set at high PMT. Use low target value for calibration and reanalyze plate.
	Plate incubation was too long with standard curve and samples	Use shorter incubation time.
Sample readings are out of range	Samples contain no or below detectable levels of analyte	If below detectable levels, it may be possible to use higher sample volume. Check with technical support for appropriate protocol modifications.
	Samples contain analyte concentrations higher than highest standard point	Samples may require dilution and reanalysis for just that particular analyte.
	Standard curve was saturated at higher end of curve	See above.
High variation in samples and/or standards	Multichannel pipette may not be calibrated	Calibrate pipettes.
	Plate washing was not uniform	Confirm all reagents are removed completely in all wash steps.
	Samples may have high particulate matter or other interfering substances	See above.
	Plate agitation was insufficient	Plate should be agitated during all incubation steps using an orbital plate shaker at a speed where beads are in constant motion without causing splashing.
	Cross-well contamination	Check when reusing plate sealer that no reagent has touched sealer. Care should be taken when using same pipette tips that are used for reagent additions and that pipette tip does not touch reagent in plate.

FOR FILTER PLATES ONLY		
Problem	**Probable Cause**	**Solution**
Filter plate will not vacuum	Vacuum pressure is insufficient	Increase vacuum pressure such that 0.2 mL buffer can be suctioned in 3-5 seconds.
	Samples have insoluble particles	Centrifuge samples just prior to assay set-up and use supernatant.
	High lipid concentration	After centrifugation, remove lipid layer and use supernatant.
Plate leaked	Vacuum pressure too high	Adjust vacuum pressure such that 0.2 mL buffer can be suctioned in 3-5 seconds. May need to transfer contents to a new (blocked) plate and continue.
	Plate set directly on table or absorbent towels during incubations or reagent additions	Set plate on plate holder or raised edge so bottom of filter is not touching any surface.
	Insufficient blotting of filter plate bottom causing wicking	Blot the bottom of the filter plate well with absorbent towels after each wash step.
	Pipette touching plate filter during additions	Pipette to the side of plate.
	Probe height not adjusted correctly	Adjust probe to 3 alignment discs in well H6.
	Sample too viscous	May need to dilute sample.

REPLACEMENT REAGENTS	Catalog #
Human High Sensitivity T Cell Standard	HSTC-8028
Human High Sensitivity T Cell Quality Controls 1 and 2	HSTC-6028
Serum Matrix	MXHSM-7
Human High Sensitivity T Cell Detection Antibodies	HSTC-1028
Streptavidin-Phycoerythrin	MC-SAPE7
Assay Buffer	L-ABIR
Set of two 96-Well plates with sealers	MAG-PLATE
Bead Diluent	LBD
10X Wash Buffer	L-WB
Human High Sensitivity T Cell 13 Plex Premixed Magnetic Bead Panel – BULK PACKAGED	HSTCMAG28PMX13BK
Human High Sensitivity T Cell 21 Plex Premixed Magnetic Bead Panel – BULK PACKAGED	HSTCMAG28PMX21BK

Antibody-Immobilized Magnetic Beads

Analyte	*Bead #*	*Cat. #*
ITAC	19	HITAC-MAG
GM-CSF	20	HGMCSF-MAG
Fractalkine	21	HFKN-MAG
IFNγ	25	HCYIFNG-MAG
IL-10	27	HCYIL10-MAG
MIP-3α	28	HMIP3A-MAG
IL-12 (p70)	33	HIL12P70-MAG
IL-13	35	HIL13-MAG
IL-17A	39	HIL17-MAG
IL-1β	46	HCYIL1B-MAG
IL-2	48	HIL2-MAG
IL-21	52	HIL21-MAG
IL-4	53	HIL4-MAG
IL-23	54	HIL23-MAG
IL-5	55	HIL5-MAG
IL-6	57	HCYIL6-MAG
IL-7	61	HIL7-MAG
IL-8	63	HCYIL8-MAG
MIP-1α	72	HMIP1A-MAG
MIP-1β	73	HMIP1B-MAG
TNFα	75	HCYTNFA-MAG
Premixed 13-plex Beads		HSTCPMX13-MAG
Premixed 21-plex Beads		HSTCPMX21-MAG

ORDERING INFORMATION

To place an order or to obtain additional information about our immunoassay products, please contact your Customer Service or Technical Support Specialist.

Contact information for each region can be found on our website:

emdmillipore.com/contact

Conditions of Sale

For Research Use Only. Not for Use in Diagnostic Procedures.

Safety Data Sheets (SDS)

Safety Data Sheets for EMD Millipore products may be downloaded through our website at emdmillipore.com/msds.

WELL MAP

	1	2	3	4	5	6	7	8	9	10	11	12
A	0 Standard (Background)	Standard #4	QC-1 Control	Etc.								
B	0 Standard (Background)	Standard #4	QC-1 Control									
C	Standard #1	Standard #5	QC-2 Control									
D	Standard #1	Standard #5	QC-2 Control									
E	Standard #2	Standard #6	Sample 1									
F	Standard #2	Standard #6	Sample 1									
G	Standard #3	Standard #7	Sample 2									
H	Standard #3	Standard #7	Sample 2									