



**REF 10803**  
**Borrelia IgM**



# Instruction Manual

## Table of Contents

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1	Intended Use .....	1
2	Clinical Application and Principle of the Assay .....	1
3	Kit Contents .....	3
4	Storage and Shelf Life .....	3
5	Precautions of Use.....	4
6	Sample Collection, Handling and Storage.....	5
7	Assay Procedure .....	5
8	Quantitative Interpretation.....	8
9	Technical Data.....	9
10	Performance Data.....	9
11	Disposal.....	10
12	Literature .....	10



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## 1 Intended Use

**Borrelia IgM** is a solid phase enzyme immunoassay for the quantitative detection of IgM antibodies against *Borrelia burgdorferi*.

The assay is a tool in the diagnosis of Lyme borreliosis.

## 2 Clinical Application and Principle of the Assay

Lyme borreliosis is the most common tick-borne infection disease in the northern hemisphere. The causative organism of the disease is the spirochaete *B. burgdorferi sensu lato* that is primarily transmitted via ticks of the genus *Ixodes*. Lyme borreliosis is a multisystem disorder and can be divided in three different stages based on characteristic clinical signs. Stage I begins days through weeks after the tick bite and is characterised by an Erythema migrans as the cardinal syndrome that occurs in 70 % of the affected people. Weeks through months after the infection (stage II) neurological symptoms like neuritis, facial palsy and Bannwarth's Disease can appear. Less frequently, stage II manifests in cardiac dysfunction (Lyme carditis). In stage III (months through years after the tick bite) Acrodermatitis chronica atrophicans and Lyme arthritis can be observed. The antigen structure of the *Borrelia* is highly complex. These antigens belong to the membrane bound proteins and their expression depends on the stage of the disease. The longer the infection takes the higher is the variety of the antigen specificities. The IgM test is coated with purified OspC and *Borrelia* specific p41i both antigens generating primarily a high antibody response of the subclass IgM. For this reason both antigens act as specific markers for an early *Borrelia* infection. Additionally, RF absorbens is contained in the sample buffer. It removes specific IgG antibodies that interfere with the measurement of IgM. Moreover, RF absorbens impairs a false positive result by binding rheumatoid factors that target antigen bound IgG antibodies

Used antigens:

Nomenclature of borrelia antigens	Properties of proteins	type	origin
p100	Protein of membran-vesicles	rec	<i>B. afzelii</i>
VlsE	variable major protein-like sequence Expressed	rec	<i>B. afzelii</i>
p58	not characterized	rec	<i>B. garinii</i>
p41 (Flagellin)	structural protein of endoflagellin	rec	<i>B. burgdorferi sensu stricto</i>
p39 (BmpA)	Flagella complex <b>Borrelia</b> membrane protein <b>A</b>	rec	<i>B. burgdorferi sensu stricto</i> , <i>B. garinii</i> , <i>B. afzelii</i>
p31 (OspA)	Outer surface, protein <b>A</b>	rec	<i>B. afzelii</i>
p23 (OspC)	Outer surface protein <b>C</b> , Mix from different borrelia subtypes	rec	<i>B. burgdorferi sensu stricto</i> , <i>B. garinii</i> , <i>B. bavariensis</i> , <i>B. afzelii</i> , <i>B. spielmanii</i>
p18 (DbpA)	Decorin binding protein <b>A</b>	rec	<i>B. burgdorferi sensu stricto</i> , <i>B. garinii</i> , <i>B. afzelii</i> , <i>B. spielmanii</i> , <i>B. bavariensis</i>

	Product Ref.	10803
	Product Desc.	Borrelia IgM
	Manual Rev. No.	006: 2024-02-19

### Principle of the test

Serum samples diluted 1:101 are incubated in the microplates coated with the specific antigen. Patient's antibodies, if present in the specimen, bind to the antigen. The unbound fraction is washed off in the following step. Afterwards anti-human immunoglobulins conjugated to horseradish peroxidase (conjugate) are incubated and react with the antigen-antibody complex of the samples in the microplates. Unbound conjugate is washed off in the following step. Addition of TMB-substrate generates an enzymatic colorimetric (blue) reaction, which is stopped by diluted acid (color changes to yellow). The intensity of color formation from the chromogen is a function of the amount of conjugate bound to the antigen-antibody complex and this is proportional to the initial concentration of the respective antibodies in the patient sample.

 autoimmune diagnostic assays	Product Ref.	10803
	Product Desc.	Borrelia IgM
	Manual Rev. No.	006: 2024-02-19

### 3 Kit Contents

TO BE RECONSTITUTED				
Item	Quantity	Cap color	Solution color	Description / Contents
Sample Buffer (5x)	1 x 20ml	White	Yellow	5 x concentrated Tris, sodium chloride (NaCl), bovine serum albumin (BSA), sodium azide < 0.1% (preservative)
<b>Caution! Please do not mistake the sample buffer of Borrelia IgG (yellow solution) for the sample buffer of Borrelia IgM (light green solution) due to the addition of RF absorbens in the latter case!</b>				
Wash Buffer (50x)	1 x 20ml	White	Green	50 x concentrated Tris, NaCl, Tween 20, sodium azide < 0.1% (preservative)
READY TO USE				
Item	Quantity	Cap color	Solution color	Description / Contents
Negative Control	1 x 1.5ml	Green	Colorless	Human serum (diluted), bovine serum albumin (BSA), sodium azide < 0.1% (preservative)
Positive Control	1 x 1.5ml	Red	Yellow	Human serum (diluted), s bovine serum albumin (BSA), odium azide < 0.1% (preservative)
Calibrators	6 x 1.5ml	White	Yellow *	Concentration of each calibrator: 0, 3, 10, 30, 100, 300 U/ml. Human serum (diluted), bovine serum albumin (BSA), sodium azide < 0.1% (preservative)
Conjugate, IgM	1 x 15ml	Green	Green	Containing: Anti-human immunoglobulins conjugated to horseradish peroxidase, bovine serum albumin (BSA)
TMB Substrate	1 x 15ml	Black	Colorless	Stabilized tetramethylbenzidine and hydrogen peroxide (TMB/H <sub>2</sub> O <sub>2</sub> )
Stop Solution	1 x 15ml	White	Colorless	1M Hydrochloric Acid
Microtiter plate	12 x 8 well strips	N/A	N/A	With breakaway microwells. Refer to paragraph 1 for coating.
* Color increasing with concentration				
MATERIALS REQUIRED, BUT NOT PROVIDED				
Microtiter plate reader 450 nm reading filter and recommended 620 nm reference filter (600-690 nm). Glass ware (cylinder 100-1000ml), test tubes for dilutions. Vortex mixer, precision pipettes (10, 100, 200, 500, 1000 µl) or adjustable multipipette (100-1000µl). Microplate washing device (300 µl repeating or multichannel pipette or automated system), adsorbent paper. Our tests are designed to be used with purified water according to the definition of the United States Pharmacopeia (USP 26 - NF 21) and the European Pharmacopeia (Eur.Ph. 4th ed.).				

### 4 Storage and Shelf Life

Store all reagents and the microplate at 2-8°C/35.6-46.4°F, in their original containers. Once prepared, reconstituted solutions are stable at 2-8°C/35.6-46.4°F for at least 1 month. Reagents and the microplate shall be used within the expiry date indicated on each component, only. Avoid intense exposure of TMB solution to light. Store microplates in designated foil, including the desiccant, and seal tightly.

	Product Ref.	10803
	Product Desc.	Borrelia IgM
	Manual Rev. No.	006: 2024-02-19

## 5 Precautions of Use

### 5.1 Health hazard data

**THIS PRODUCT IS FOR IN VITRO DIAGNOSTIC USE ONLY.** Thus, only staff trained and specially advised in methods of in vitro diagnostics may perform the kit. Although this product is not considered particularly toxic or dangerous in conditions of the intended use, refer to the following for maximum safety:

#### ***Recommendations and precautions***

This kit contains potentially hazardous components. Though kit reagents are not classified being irritant to eyes and skin we recommend to avoid contact with eyes and skin and wear disposable gloves.

**WARNING !** Calibrators, Controls and Buffers contain sodium azide (NaN<sub>3</sub>) as a preservative. NaN<sub>3</sub> may be toxic if ingested or adsorbed by skin or eyes. NaN<sub>3</sub> may react with lead and copper plumbing to form highly explosive metal azides. On disposal, flush with a large volume of water to prevent azide build-up. Please refer to decontamination procedures as outlined by CDC or other local/national guidelines.

**Do not smoke, eat or drink when manipulating the kit. Do not pipette by mouth.**

All human source material used for some reagents of this kit (controls, standards e.g.) has been tested by approved methods and found negative for HbsAg, Hepatitis C and HIV 1. However, no test can guarantee the absence of viral agents in such material completely. Thus handle kit controls, standards and patient samples as if capable of transmitting infectious diseases and according to national requirements.

The kit contains material of animal origin as stated in the table of contents, handle according to national requirements.

### 5.2 General directions for use

In case that the product information, including the labeling, is defective or incorrect please contact the manufacturer or the supplier of the test kit.

Do not mix or substitute reagents or microplates from different lot numbers. This may lead to variations in the results.

Allow all components to reach room temperature (20-32°C/68-89.6°F) before use, mix well and follow the recommended incubation scheme for an optimum performance of the test.

**Incubation: We recommend test performance at 30°C/86°F for automated systems.**

Never expose components to higher temperature than 37°C/ 98.6°F.

Always pipette substrate solution with brand new tips only. Protect this reagent from light. Never pipette conjugate with tips used with other reagents prior.

**A definite clinical diagnosis should not be based on the results of the performed test only, but should be made by the physician after all clinical and laboratory findings have been evaluated. The diagnosis is to be verified using different diagnostic methods.**

 autoimmune diagnostic assays	Product Ref.	10803
	Product Desc.	Borrelia IgM
	Manual Rev. No.	006: 2024-02-19

## 6 Sample Collection, Handling and Storage

Use preferentially freshly collected serum samples. Blood withdrawal must follow national requirements. Do not use icteric, lipemic, hemolysed or bacterially contaminated samples. Sera with particles should be cleared by low speed centrifugation (<1000 x g). Blood samples should be collected in clean, dry and empty tubes.

After separation, the serum samples should be used during the first 8h, respectively stored tightly closed at 2-8°C/35.6-46.4°F up to 48h, or frozen at -20°C/-4°F for longer periods. (Thomas: Labor und Diagnose; CLSI Guideline GP44-A4)

## 7 Assay Procedure

### 7.1 Preparations prior to starting

Dilute concentrated reagents:

Dilute the concentrated sample buffer 1:5 with distilled water (e.g. 20 ml plus 80 ml).

Dilute the concentrated wash buffer 1:50 with distilled water (e.g. 20 ml plus 980 ml).

To avoid mistakes we suggest to mark the cap of the different calibrators.

#### Samples:

Dilute serum samples 1:101 with sample buffer (1x)

e.g. 1000 µl sample buffer (1x) + 10 µl serum. Mix well !

#### Washing:

Prepare 20 ml of diluted wash buffer (1x) per 8 wells or 200 ml for 96 wells

e.g. 4 ml concentrate plus 196 ml distilled water.

#### Automated washing:

Consider excess volumes required for setting up the instrument and dead volume of robot pipette.

#### Manual washing:

Discard liquid from wells by inverting the plate. Knock the microwell frame with wells downside vigorously on clean adsorbent paper. Pipette 300 µl of diluted wash buffer into each well, wait for 20 seconds. Repeat the whole procedure twice again.

#### Microplates:

Calculate the number of wells required for the test. Remove unused wells from the frame, replace and store in the provided plastic bag, together with desiccant, seal tightly (2-8°C/35.6-46.4°F).



## 7.2 Pipetting Scheme

We suggest pipetting calibrators, controls and samples as follows:

For *QUANTITATIVE* interpretation

	1	2	3	4...
A	Cal A	Cal E	P1	
B	Cal A	Cal E	P1	
C	Cal B	Cal F	P2	
D	Cal B	Cal F	P2	
E	Cal C	PC	P3	
F	Cal C	PC	P3	
G	Cal D	NC	...	
H	Cal D	NC	...	

CalA: calibrator A

CalB: calibrator B

CalC: calibrator C

CalD: calibrator D

CalE: calibrator E

CalF: calibrator F

PC: positive control



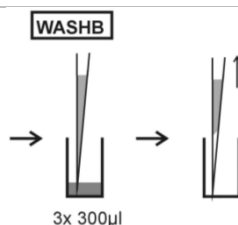
NC: negative control


P1: patient 1


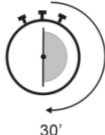
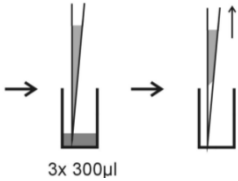
P2: patient 2



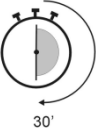
P3: patient 3

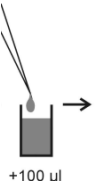


## 7.3 Test Steps

Step	Description
1.	Ensure preparations from step 7.1 above have been carried out prior to pipetting.
2.	Use the following steps in accordance with quantitative interpretation results desired:
<b>CONTROLS &amp; SAMPLES</b>	
3.	 <p>Pipette into the designated wells as described in chapter 7.2 above, 100 µl of either:  Calibrators (CAL.A to CAL.F)  and 100 µl of each of the following:</p> <ul style="list-style-type: none"> <li>Negative control (NC) and Positive control (PC), and</li> <li>Patients diluted serum (P1, P2...)</li> </ul>
4.	 <p>Incubate for 30 minutes at 20-32°C/68-89.6°F.</p>
5.	 <p>Wash 3x with 300 µl washing buffer (diluted 1:50).</p>

<div></div>		Product Ref.	10803
		Product Desc.	Borrelia IgM
		Manual Rev. No.	006: 2024-02-19

CONJUGATE		
6.	<div><div>CONJ</div><div></div><div>+100 µl</div></div>	Pipette 100 µl conjugate into each well.
7.	<div></div> <div>30'</div>	Incubate for 30 minutes at 20-32°C/68-89.6°F.
8.	<div><div>WASHB</div><div></div><div>3x 300µl</div></div>	Wash 3x with 300 µl washing buffer (diluted 1:50).

SUBSTRATE		
9.	<div><div>SUB</div><div></div><div>+100 µl</div></div>	Pipette 100 µl TMB substrate into each well.
10.	<div><div></div><div>30'</div></div>	Incubate for 30 minutes at 20-32°C/68-89.6°F, protected from intense light.

STOP		
11.	<div><div>STOP</div><div></div><div>+100 µl</div></div>	Pipette 100 µl stop solution into each well, using the same order as pipetting the substrate.
12.	<div></div> <div>5'</div>	Incubate 5 minutes minimum.
13.		Agitate plate carefully for 5 sec.
14.	<div><div>OD<sub>450</sub> - OD<sub>620</sub></div><div>450/620 nm</div></div>	Read absorbance at 450 nm (recommended 450/620 nm) within 30 minutes.

## 8 Quantitative Interpretation

For **quantitative interpretation** establish the standard curve by plotting the **optical density (OD) of each calibrator (y-axis)** with respect to the corresponding concentration values in U/ml (x-axis). For best results we recommend log/lin coordinates and 4-Parameter Fit. From the OD of each sample, read the corresponding antibody concentrations expressed in U/ml.

Normal Range	Equivocal Range	Positive Results
< 12 U/ml	12 - 18 U/ml	>18 U/ml

### *Example of a standard curve*

**Do NOT use this example for interpreting patient's result**

Calibrators IgM	OD 450/620 nm	CV % (Variation)
0 U/ml	0.032	0.0
3 U/ml	0.143	3.4
10 U/ml	0.301	0.7
30 U/ml	0.592	1.3
100 U/ml	1.244	4.7
300 U/ml	2.104	0.7

### *Example of calculation*

Patient	Replicate (OD)	Mean (OD)	Result (U/ml)
P 01	0.806/0.840	0.823	49.3
P 02	1.344/0.382	0.363	14.1

Samples above the highest calibrator range should be reported as >Max. They should be diluted as appropriate and re-assayed. Samples below calibrator range should be reported as < Min.

For lot specific data, see enclosed quality control leaflet. Medical laboratories might perform an in-house quality control by using own controls and/or internal pooled sera, as foreseen by national regulations.

Each laboratory should establish its own normal range based upon its own techniques, controls, equipment and patient population according to their own established procedures.

In case that the values of the controls do not meet the criteria the test is invalid and has to be repeated.

The following technical issues should be verified: Expiration dates of (prepared) reagents, storage conditions, pipettes, devices, photometer, incubation conditions and washing methods.

If the items tested show aberrant values or any kind of deviation or that the validation criteria are not met without explicable cause please contact the manufacturer or the supplier of the test kit.

	Product Ref.	10803
	Product Desc.	Borrelia IgM
	Manual Rev. No.	006: 2024-02-19

## 9 Technical Data

Sample material:	serum
Sample volume:	10 µl of sample diluted 1:101 with 1x sample buffer
Total incubation time:	90 minutes at 20-32°C/68-89.6°F
Calibration range:	0-300 U/ml
Analytical sensitivity:	1.0 U/ml
Storage:	at 2-8°C/35.6-46.4°F use original vials only.
Number of determinations:	96 tests

## 10 Performance Data

### 10.1 Analytical sensitivity

Testing sample buffer 30 times on **Borrelia IgM** gave an analytical sensitivity of 1.0 U/ml.

### 10.2 Specificity and sensitivity

The microplates are coated with purified OspC and Borrelia specific p41i. No crossreactivities to other autoantigens have been found. The sensitivity of the Borrelia Assays was determined to be greater than 95% in comparison to sera with known immune status. Clinically defined sera show a specificity of >96% for IgG/IgM.

### 10.3 Linearity

Chosen sera have been tested with this kit and found to dilute linearly. However, due to the heterogeneous nature of human autoantibodies there might be samples that do not follow this rule.

Sample No.	Dilution Factor	Measured (U/ml)	Expected (U/ml)	Recovery (%)
1	1 / 100	215.0	210.0	102.4
	1 / 200	109.4	105.0	104.2
	1 / 400	49.8	52.5	94.9
	1 / 800	24.3	26.3	92.4
2	1 / 100	138.0	140.0	98.6
	1 / 200	65.9	70.0	94.1
	1 / 400	33.7	35.0	96.3
	1 / 800	15.8	17.5	90.3

	Product Ref.	10803
	Product Desc.	Borrelia IgM
	Manual Rev. No.	006: 2024-02-19

## 10.4 Precision

To determine the precision of the assay, the variability (intra and inter-assay) was assessed by examining its reproducibility on three serum samples selected to represent a range over the standard curve.

Intra-assay		
Sample No.	Mean (U/ml)	CV (%)
1	18.8	7.6
2	86.4	5.7
3	208.0	4.2

Inter-assay		
Sample No.	Mean (U/ml)	CV (%)
1	17.5	5.8
2	81.4	6.2
3	216.0	4.7

## 10.5 Calibration

Due to the lack of international reference calibration this assay is calibrated in arbitrary units (U/ml).

## 11 Disposal

Please observe the relevant statutory requirements!

## 12 Literature

**Wilske B (2005).** Epidemiology and diagnosis of Lyme borreliosis. *Annals of Medicine* 37,8: 568-579.

**Stanek G, Strle F. (2003).** Lyme borreliosis. *Lancet* 362: 1639-1647.




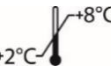

**Rauer S, Spohn N, Rasiah C, Neubert U, Vogt A (1998).** Enzyme-linked immunosorbent assay using recombinant OspC and the internal 14-kDa flagellin fragment for serodiagnosis of early Lyme disease. *Journal of Clinical Microbiology* 36: 857-861.

**Hauser E, Wilske B (1997).** Enzyme-linked immunosorbent assays with recombinant internal flagellin fragments derived from different species of *Borrelia burgdorferi sensu lato* for the serodiagnosis of Lyme neuroborreliosis. *Medical Microbiology and Immunology* 35,3: 774-776

**Lothar Thomas:** Labor und Diagnose. Indikation und Bewertung von Laborbefunden für die medizinische Diagnostik., 8. Auflage, TH Books

**CLSI Guideline GP44-A4:** Procedures for the Handling and Processing of Blood Specimens for Common Laboratory Tests



<b>IVD</b>	- Diagnosi in vitro - Pour diagnostic in vitro - In Vitro Diagnostikum - Para uso Diagnóstico in vitro	- For in vitro diagnostic use - Para uso diagnóstico in vitro - In Vitro Διαγνωστικό μέσο
<b>REF</b>	- Numero d'ordine - Référence Catalogue - Bestellnummer - Número de catálogo	- Catalogue number - Numéro de catálogo - Αριθμός παραγγελίας
<b>LOT</b>	- Descrizione lotto - Lot - Chargen Bezeichnung - Lote	- Lot - Lote - Χαρακτηρισμός παρτίδας
<b>UDI</b>	- Identificatore univoco del dispositivo - Identifiant unique de l'appareil - eindeutige Produktidentifizierung - Identificador único do dispositivo	- Unique Device Identifier - Identificador único del dispositivo - Μοναδικό αναγνωριστικό συσκευής
<b>CE</b>	- Conformità europea - Déclaration CE de Conformité - Europäische Konformität - Declaração CE de Conformidade	- EC Declaration of Conformity - Declaración CE de Conformidad - Ευρωπαϊκή συμφωνία
	- 96 determinazioni - 96 tests - 96 Bestimmungen - 96 Testes	- 96 tests - 96 pruebas - 96 προσδιορισμοί
	- Rispettare le istruzioni per l'uso - Voir les instructions d'utilisation - Gebrauchsanweisung beachten - Ver as instruções de uso	- See instructions for use - Ver las instrucciones de uso - Λάβετε υπόψη τις οδηγίες χρήσης
	- Da utilizzarsi entro - Utilise avant le - Verwendbar bis - Utilizar antes de	- Use by - Utilizar antes de - Χρήση μέχρι
	- Conservare a 2-8°C - Conserver à 2-8°C - Lagerung bei 2-8°C - Conservar entre 2-8°C	- Store at 2-8°C (35.6-46.4°F) - Conservar a 2-8°C - Φυλάσσεται στους 2-8°C
	- Prodotto da - Fabriqué par - Hergestellt von - Fabricado por	- Manufactured by - Fabricado por - Κατασκευάζεται από
<b>CON</b> <b>+</b>	- Controllo positivo - Contrôle Positif - Positiv Kontrolle - Controllo positivo	- Positive Control - Control Positivo - Θετικός ορός ελέγχου
<b>CON</b> <b>-</b>	- Controllo negativo - Contrôle Négatif - Negativ Kontrolle - Controllo negativo	- Negative Control - Control Negativo - Αρνητικός ορός ελέγχου
<b>CAL</b>	- Calibratore - Etalon - Kalibrator - Calibrador	- Calibrator - Calibrador - Αντιδραστήριο βαθμονόμησης
<b>CONJ</b>	- Coniugato - Conjugé - Konjugat - Conjugado	- Conjugate - Conjugado - Σύζευγμα
<b>MP</b>	- Micropiastria rivestita - Microplaque sensibilisée - Beschichtete Mikrotiterplatte - Microplaca revestida	- Coated microtiter plate - Microplaca sensibilizada - Επικαλυμμένη μικροπλάκα
<b>WASHB</b> <b>50x</b>	- Tampone di lavaggio - Tampon de Lavage - Waschpuffer - Solução de lavagem	- Wash buffer - Solución de lavado - Ρυθμιστικό διάλυμα πλύσης
<b>SUB</b>	- Tampone substrato - Substrat - Substratpuffer - Substrato	- Substrate buffer - Tampón sustrato - Ρυθμιστικό διάλυμα υποστρώματος
<b>STOP</b>	- Reagente bloccante - Solution d'Arrêt - Stopreagenz - Solução de paragem	- Stop solution - Solución de parada - Αντιδραστήριο διακοπής αντίδρασης
<b>SB</b> <b>5x</b>	- Tampone campione - Tampon Echantillons - Probenpuffer - Diluente de amostra	- Sample buffer - Tampón Muestras - Ρυθμιστικό διάλυμα δειγμάτων