

# ANA Profile 8

**ELISA for the qualitative determination  
of autoantibodies (IgG) against**

**dsDNA, RNP, Sm, SS-A/Ro, SS-B/La,  
Scl-70, CENP-B, and Jo-1**

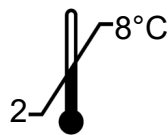
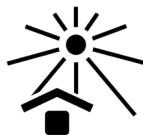
## Directions for use



1711FE00.FWD



12 x 8 determinations



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The product described here complies with the requirements of the IVD Directive 98/79/EG.

Document Id.-No. / Version: 1711FE00.FWD.doc / 2018-07-06

## 1. Introduction and background

Circulating autoantibodies against various intracellular antigens (antinuclear antibodies, ANA) are characteristic for systemic, autoimmune-mediated rheumatic diseases of the connective tissue (1, 2, 3, 4). These comprise Systemic Lupus Erythematosus (SLE), Mixed Connective Tissue Disease (MCTD), Sjögren's Syndrome (SS) A and B, Progressive Systemic Sclerosis (PSS, Scleroderma)/CREST Syndrome and Polymyositis (PM).

The diagnosis of the above disorders is often difficult, due to overlapping symptoms, and therefore usually supported by measuring their associated autoantibodies. 8 antigens specifically recognised by these antibodies are immobilised, line by line, on the solid phase of the present enzyme-linked immuno sorbent assay (ELISA):

solid phase line	antigen	source	disease	approximate autoantibody prevalence (5)
A	dsDNA	plasmid	SLE	60 - 90 %
B	RNP (proteins A, C, 68kDa)	recombinant	MCTD	95 %
			SLE	30 - 40 %
			PM	14 %
			SS	4 %
C	Sm (proteins B, B', D)	bovine thymus	SLE	12 - 39 %
			MCTD	7 %
D	SS-A/Ro (60kDa-protein)	bovine thymus	SS	60 - 100 %
			SLE	45 - 50 %
			MCTD	15 - 30 %
			PSS	5 - 7 %
E	SS-B/La	recombinant	PM	5 - 7 %
			SS	30 - 90 %
			SLE	15 - 30 %
F	Scl-70 (DNA-topoisomerase 1)	recombinant	MCTD	5 - 15 %
			PSS	20 - 76 %
G	CENP-B (centromere protein B)	recombinant	CREST	40 - 80 %
H	Jo-1 (Histidyl-tRNA synthetase)	recombinant	PM	20 - 40 %

The test is designed for the individual, qualitative determination of IgG autoantibodies in human serum or plasma (cf. section 7), directed against one of the above antigens; as initial diagnosis if any of the associated disorders is suspected. The test is fast (incubation time 30 / 30 / 30 minutes) and flexible (divisible solid phase for 1 - 12 analyses, ready-to-use reagents). A negative and a positive control check the assay performance. The positive control also serves as calibrator for assay evaluation.

## 2. Warnings and precautions

The test kit is intended for in vitro diagnostic use only; not for internal or external use in humans or animals. It must be executed by trained personnel staff.

Do not use reagents beyond their expiration dates. Adherence to the protocol is strongly recommended.

The sample buffer and controls contain Na-azide as antimicrobial agent. The wash buffer contains bromonitrodioxane and the conjugate methylisothiazolone / bromonitrodioxane as preservative. The substrate contains 3, 3', 5, 5'-tetramethylbenzidine (TMB) and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). The stop solution, 0,2 M sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), is acidic and corrosive.

The above mentioned reagents may be toxic if ingested. Follow routine precautions for handling hazardous chemicals. Avoid all body contact, wear gloves and eye protection. If one of the reagents comes into contact with skin or mucous membrane, wash thoroughly with water. Never pipette by mouth. Dispose in a manner complying with local/national regulations.

Na-Azide may react with lead and copper plumbing to form explosive metal azides. On disposal, flush with a large amount of water to prevent azide build-up.

The controls contain components of human origin. They were tested for human immunodeficiency virus (HIV)-Ag, hepatitis B surface (HBs)-Ag and antibodies against HIV 1/2 and hepatitis C virus (HCV) and showed negative results; either in an FDA-approved or a CE-compliant test, according to European Directive 98/79/EC.

However, no test can guarantee that material of human origin is not actually infectious. The preparations should therefore be treated as potentially infectious and disposed of accordingly, as should the samples (and residues thereof); according to CDC (Center of Disease Control, Atlanta, USA) or other local / national guidelines on laboratory safety and decontamination.

## 3. Principle of the test

The wells of the solid phase are coated with the autoantigens quoted above, line by line. On this surface, the following immunological reactions take place:

1<sup>st</sup> reaction: Antigen-specific antibodies present in the sample bind to the respective immobilised antigen, forming the antigen-antibody complex. Then, non-bound sample components are washed away from the solid phase.

2<sup>nd</sup> reaction: A second antibody, directed at human IgG antibodies and conjugated with horse-radish peroxidase (HRP), is added. This conjugate binds to the complex. Then, excess conjugate is washed away from the solid phase.

3<sup>rd</sup> reaction: The enzyme-labelled complex converts a colourless substrate into a blue product. The degree of colour development in each line of the solid phase reflects the concentration of the respective antigen-specific IgG autoantibody in the sample (8 values per sample).

#### 4. Contents of the kit

a. 1 microwell plate, coated line by line with 8 individual autoantigens, as described above. Hermetically packed in a foil laminate pouch together with a desiccant bag. The plate consists of 12 strips, thus providing maximum flexibility and economy in use of the assay.

<b>MWP</b>	<b>12x8</b>
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b. Sample buffer, 100 mL, ready-to-use, orange coloured. Contains Tris-buffered saline (TBS), bovine serum albumin (BSA), Tween and Na-azide.

<b>BUF</b>	<b>SPL</b>
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c. Wash buffer, 100 mL, 10x-concentrate, blue coloured. Contains TBS, Tween and bromonitrodioxane.

<b>BUF</b>	<b>WASH</b>	<b>10x</b>
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d. Negative and positive control, 3,0 mL each, ready-to-use, green and red coloured, respectively. Contain TBS, BSA, Tween and Na-azide.

<b>CONTROL</b>	<b>-</b>	<b>CONTROL</b>	<b>+</b>
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e. Anti-human IgG HRP conjugate, 14 mL, ready-to-use, red coloured. Buffered solution containing stabilising protein, methylisothiazolone and bromonitrodioxane.

<b>CONJ</b>	<b>IgG</b>
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f. Substrate solution, 14 mL, ready-to-use, colourless. Contains a buffered solution of TMB and H<sub>2</sub>O<sub>2</sub>. Contained in a vial impermeable to light.

<b>SUBS</b>	<b>TMB</b>
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g. Stop solution (0,2 M H<sub>2</sub>SO<sub>4</sub>), 14 mL, colourless, ready-to-use. Caution: sulfuric acid is corrosive.

<b>SOLN</b>	<b>STOP</b>
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h. Directions for use

i. Lot-specific certificate of analysis

## **5. Materials required but not supplied**

a. Deionised or distilled water

b. Graduated cylinder, 1000 mL

c. Tubes for sample dilution (transfer tubes in the microwell plate format recommended)

d. Pipettes for 10, 100 and 1000 µL (1- and 8-channel pipettes recommended)

e. Microwell plate washer (optional)

f. Microwell plate photometer fitted with a 450 nm filter

g. ELISA evaluation program (recommended)

## **6. Storage of the kit**

Store kit at 2 - 8°C. It is stable up to the expiry date stated on the label of the box. Do not use kit beyond its expiry date.

## 7. Reagent and sample preparation / specimen requirements

Do not exchange or pool corresponding components from different kits, due to possibly different shipping or storage conditions. If the kit is to be used for several tests, only the currently needed amount of reagents should be withdrawn. It is **crucially important** that no cross-contamination between the reagents occurs. Use only clean pipettes and do **not pour back** residues into the original flasks.

- a. The solid phase must reach room temperature before opening the pouch. Remove the supernumerary microwells from the frame and immediately put them back into the pouch, together with the desiccant bag. Reseal the pouch hermetically and keep it refrigerated for future use.
- b. Dilute the wash buffer 10x-concentrate (100 mL, blue) with 900 mL deionised water. Mix thoroughly. The diluted buffer is stable for several weeks if stored refrigerated (2 - 8°C).
- c. Preparation of the samples: handle patient specimens as potentially infectious agents. Besides serum, EDTA- or citrate-treated plasma are suitable sample material as well; heparin-treated plasma however is not.

Specimen requirements: highly lipemic, haemolysed or microbially contaminated samples may cause erroneous results and should be avoided.

Prepare samples using normal laboratory techniques and dilute them 1/100, e.g. 10 µL serum or plasma + 990 µL sample buffer. Mix thoroughly.

For rapid dispensing during the assay procedure, preparation of the controls and samples in microwell transfer tubes is recommended. This allows the operation of an 8-channel pipette during the assay procedure.

If samples are not assayed immediately, they should be stored at 2 - 8°C and assayed within 3 days. For longer storage, -20°C or lower temperatures are recommended. Repeated freezing and thawing of samples should be avoided. Thawed samples must be mixed prior to diluting.

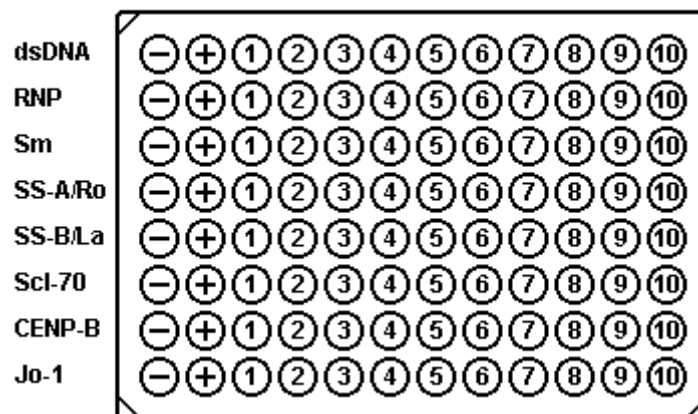
## 8. Assay procedure

### 8.1. Manual operation

Before starting the assay, all components of the kit must have reached room temperature (23 ± 3°C).

To achieve best results, i.e. the maximum ratio between specific and background signal, **careful washing** is essential (steps a, c and e). It is **crucially important to remove the wash solution completely**. For that purpose, tap the plate firmly on several layers of absorbent tissue. Automated washers must be verified according to results obtained by manual washing.

- a. Immediately prior to use, wash the solid phase once: fill wells with 350  $\mu\text{L}$  wash buffer each, let soak for about 10 seconds in the wells and remove.
- b. Dispense the controls (3,0 mL each, ready-to-use, green and red) and the diluted samples (1 - 10) rapidly into the microwells, as depicted below; 100  $\mu\text{L}$  per well.



Incubate the plate for 30 minutes at room temperature ( $23 \pm 3^\circ\text{C}$ ).

- c. Wash the wells 4 times as in step a.
- d. Rapidly (preferably using an 8-channel pipette) dispense the conjugate (14 mL, ready-to-use, red); 100  $\mu\text{L}$  per well. Incubate the plate as in step b.
- e. Repeat wash step c.
- f. Rapidly (preferably using an 8-channel pipette) dispense the substrate solution (14 mL, ready-to-use, colourless, black vial); 100  $\mu\text{L}$  per well. Incubate the plate as in step b. As the substrate is photosensitive, avoid intense light exposure (e.g. direct sunlight) during incubation.
- g. Rapidly (preferably using an 8-channel pipette) dispense the stop solution (14 mL, ready-to-use, colourless. Caution: corrosive!); 100  $\mu\text{L}$  per well. Use the same sequence as for the substrate. The colour changes from blue to yellow. Agitate the plate, preferably on an orbital shaker, for about 10 seconds.
- h. Immediately read the absorbance in the microwell plate photometer at 450 nm.



Refrigerate the remainder of the reagents (2 - 8°C) if they are to be used again.

## 8.2. Dynex DS2 automated ELISA system

This product has been validated for use with the Dynex DS2 automated ELISA system. A description of the program flow for the assay execution and evaluation can be provided as a pdf file. The parameters of this program are merely a proposal and may need to be adapted by the operator to the requirements of the actual assay. In general terms, we have attempted to stick as close as possible to the protocol of manual operation, as above. However, due to the necessarily elevated temperature within the DS2, the substrate incubation period had to be shortened.

Section 11.8. gives a performance comparison between manual assay operation and the DS2 ELISA system.

## 9. Evaluation and quality control

The assay is evaluated in a qualitative manner: the absorbance of the samples is compared to the borderline absorbance (= cut-off), separately for each of the 8 parameters. The respective cut-off absorbance (8 individual values) is determined by means of the positive control which at the same time functions as calibrator; according to the formula:

$$\text{absorbanceborderline} = \text{absorbancepositive control} \times \text{factor}$$

The factor depends on the kit lot and is individually quoted for each parameter in the lot-specific certificate of analysis (included with each test kit). Example:

$$\begin{aligned} \text{absorbancepositive control} &= 1250 \text{ mOD} \\ \text{factor} &= 0,35 \\ \text{absorbanceborderline} &= 1250 \text{ mOD} \times 0,35 = 438 \text{ mOD} \end{aligned}$$

In order to gain an impression of the degree of a sample's reactivity towards the different antigens, the respective ratio values between sample and borderline absorbance is calculated, 8 times per sample:

$$\text{ratio} = \text{absorbancesample} / \text{absorbanceborderline}$$

Example:

$$\begin{aligned} \text{absorbanceborderline} &= 438 \text{ mOD} \\ \text{absorbancesample} &= 1480 \text{ mOD} \\ \text{ratio} &= 1480 \text{ mOD} / 438 \text{ mOD} = 3,4 \end{aligned}$$

Quality control: the positive control (calibrator) and negative control check the assay performance. Their acceptable ranges are quoted in the lot-specific certificate of analysis. Values of the controls must fall within the indicated ranges; otherwise, the results of the assay are invalidated.

## 10. Interpretation of results / limitations of the procedure

In order to determine the cut off-concentration (i.e. ratio = 1,0) of each ANA in the present test, a normal and a respective collective of positive sera was measured; followed by ROC-analysis of these data according to (6), individually for each parameter (cf. article 11.7).

The cut off values established in this manner yield the test characteristics described below. Based on these measurements, we suggest for the assessment of patient sera:

	ratio
normal (negative) range	< 0,80
cut-off	1,00
equivocal range	0,80 - 1,25
positive range	> 1,25

These specifications apply uniformly to all 8 parameters. However, they are given as an indication only; in order to check their accuracy, each analysis should include parallel samples of normal sera.

A negative test result indicates that the patient probably does not have an elevated level of IgG antibodies to the respective antigen. Hence, presence of the corresponding systemic autoimmune disorder, as outlined in the beginning, is unlikely but can nevertheless not be excluded.

A positive result should be considered as an indication for the associated disease. As follow-up diagnosis, the causative autoantibody should be determined by means of a monospecific, quantitative ELISA.

Specimens exhibiting results within the borderline range quoted above should be considered as equivocal and reported as such. It is recommended that a second sample be collected two weeks later and run in parallel with the first sample to document a possible change of antibody titer.

As with any serological test, the results should be interpreted in the light of the patient's symptoms and other diagnostic criteria.

## 11. Performance characteristics

### 11.1. Standardisation

The test is standardised with a purified serum preparation containing IgG antibodies directed at each of the immobilised autoantigens. It constitutes the stock material for both controls of the test. The proportion of the antibodies was adjusted in such a manner that the controls generate an approximately uniform signal on all 8 solid phases (lines of the microwell plate).

This preparation is calibrated against a set of monospecifically positive sera, solely reserved for this purpose. The degree of sample reactivity is expressed as ratio, as outlined above, separately for all 8 antigens.

### 11.2. Analytical specificity

The test allows the specific and differentiated determination of human IgG antibodies, directed at one of the autoantigens quotes in article 1. It has been validated (among other criteria) using human reference sera from the Center of Disease Control (CDC; Atlanta, USA) which are commercially available. The following results (ratio values) are typical:

Serum	1	2	3	4	5	6	7	8	9	10
CDC- result	ds- DNA	SS-B /La	--	U1- RNP	Sm	--	SS-A /Ro	--	Scl- 70	Jo- 1
immun- fluorescence	homo- gen	speck- led	speck- led	--	--	nuc- leolar	--	centro- mere	--	--
dsDNA	3,5	0,2	0,2	0,2	0,4	0,1	0,4	0,2	0,4	0,1
RNP	0,8	0,2	5,0	3,9	5,3	1,0	0,3	0,2	0,3	0,2
Sm	1,8	0,2	1,6	0,2	5,4	0,2	0,2	0,1	0,2	0,2
SS-A/Ro	0,4	2,9	4,2	0,4	1,0	0,2	5,7	0,2	0,7	0,2
SS-B/La	0,2	5,0	4,2	0,2	0,3	0,6	0,2	0,2	0,3	0,2
Scl-70	0,3	0,2	0,3	0,3	0,6	1,0	0,2	0,2	5,6	0,2
CENP-B	0,3	0,2	0,2	0,2	0,3	0,2	0,2	4,4	0,3	0,2
Jo-1	0,3	0,2	0,3	0,3	0,3	0,2	0,3	0,2	0,3	7,7

### 11.3. Detection limit (analytical sensitivity)

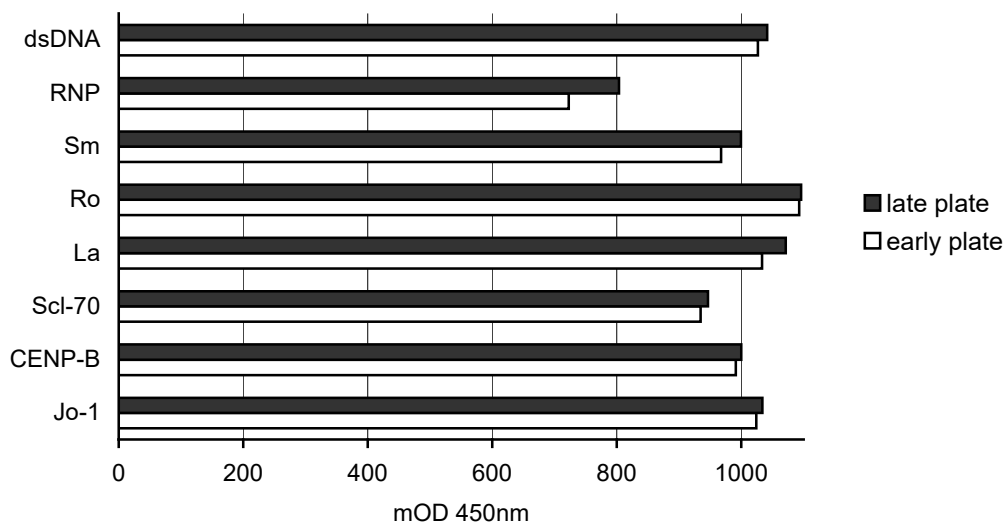
The detection limit is defined as that concentration of analyte that corresponds to the mean absorbance of sample buffer plus 3-fold standard deviation (s). It was determined as < 0,2 (ratio; n = 12); this applies for all eight parameters. Recommended measuring range: 0,3 < ratio < 7

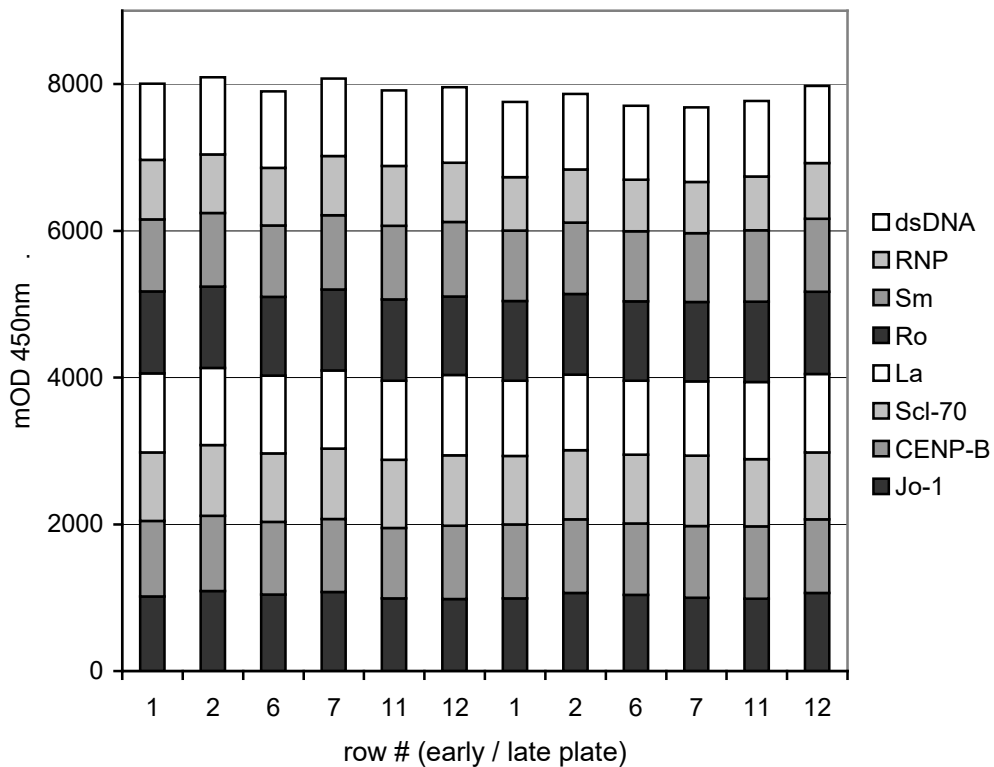
#### 11.4. Homogeneity of the solid phase

Measurement of the solid phase homogeneity is a regular QC part of each production lot. This is determined by 3 (selected plates) x 8 (lines) x 12 (rows) = 288-fold measurement of an evenly positive but non-saturating sample (IgG).

Acceptance criterion: mOD-coefficient of variation (cv) over the plates, line by line < 10%. The figures below show a representative excerpt (solid phase lot no. 0903E) of such an analysis.

line	plate	early (n/10)							late (9n/10)							mean	cv %
		1	2	6	7	11	12	mean	1	2	6	7	11	12	mean		
A	dsDNA	1041	1049	1043	1055	1031	1030	1042	1026	1026	1005	1019	1031	1051	1026	1034	1,4
B	RNP	809	797	786	806	814	807	803	726	726	702	695	730	758	723	763	5,9
C	Sm	982	1007	973	1010	1007	1016	999	961	975	959	940	973	996	967	983	2,4
D	Ro	1116	1105	1075	1104	1107	1067	1096	1085	1096	1078	1079	1098	1121	1093	1094	1,6
E	La	1078	1054	1057	1065	1077	1096	1071	1028	1029	1010	1014	1049	1070	1033	1052	2,6
F	Scl-70	935	962	933	960	928	961	947	934	942	940	959	918	913	934	940	1,8
G	CENP-B	1029	1026	992	994	961	998	1000	1004	1006	971	978	987	1000	991	996	2,0
H	Jo-1	1017	1091	1043	1079	990	981	1034	992	1064	1038	999	984	1066	1024	1029	3,9
sum / mean		8007	8091	7902	8073	7915	7956	7991	7756	7864	7703	7683	7770	7975	7792	7891	2,7



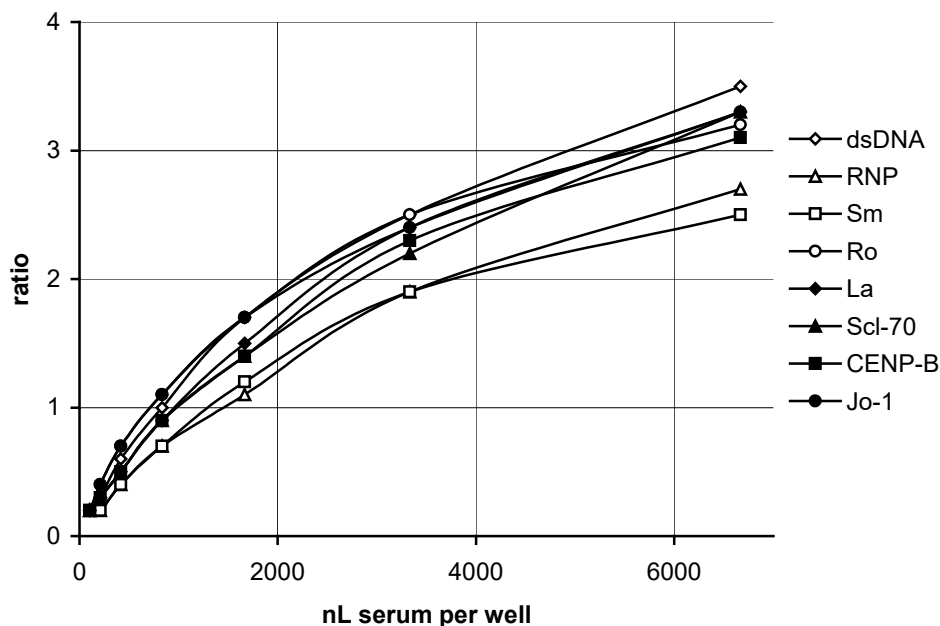


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### 11.5. Dose-response relationship

In order to assess this feature of the ELISA, pools of individual sera with evenly adjusted reactivity towards all 8 antigens were measured in serial 2-fold dilution. A typical result is depicted below.

An approximately linear relationship between sample concentration and resulting ratio is restricted to ratio values  $< 2$ . This is due to the qualitative evaluation manner (cf. article 9) and contrasts ELISAs which are evaluated quantitatively by means of a standard curve.



1711FE00.FED/Linear

### 11.6. Precision

For the assessment of the test precision, the variability of results under the following conditions was determined: a. within 1 assay and between 3 assays, b. between 3 operators and c. between 2 kit lots. Ratio and coefficient of variability (cv) values are given as mean of all 8 antigens.

#### a. Intra- and inter-assay variability (n per parameter = 3 and 9, respectively)

sample	ratio	variability (cv, %)	
		intra-assay	inter-assay
1	1,2	3,7	4,5
2	1,9	1,5	2,4
3	2,9	1,5	2,0

#### b. Operator to operator variability (n per parameter = 2)

sample	ratio	variability (cv, %)
1	1,1	2,4
2	1,8	1,8
3	2,7	1,8

c. Variability between 2 kit lots (n per parameter = 2)

sample	ratio	variability (cv, %)
1	1,1	5,3
2	1,8	3,3
3	2,8	6,0

11.7. Frequency distribution of the different ANAs (IgG)

a. In a normal collective

This was analysed with a sera collective of blood donors, equally distributed by sex and age. The following distribution of the analytes was observed (ratio values quoted; s = standard deviation):

parameter	number of sera	mean	mean + s	mean + 2s	median	95th percentile	diagnostic specificity
dsDNA	80	0,28	0,51	0,75	0,21	0,63	98 %
RNP	80	0,32	0,45	0,57	0,29	0,55	100 %
Sm	80	0,18	0,21	0,23	0,18	0,22	100 %
SS-A/Ro	80	0,25	0,30	0,35	0,25	0,33	100 %
SS-B/La	160	0,16	0,27	0,39	0,13	0,31	100 %
Scl-70	80	0,40	0,61	0,83	0,33	0,72	98 %
CENP-B	80	0,25	0,33	0,41	0,23	0,38	100 %
Jo-1	80	0,28	0,40	0,51	0,25	0,43	99 %

b. In positive collectives

In 8 collectives of positive sera, the following distribution of the respective autoantibodies was determined (ratio values quoted). The sera measured had been found positive before by independent methods (e.g. monospecific, CE-compliant reference ELISA, immune fluorescence) and/or in various ring trials or were clinically defined.

parameter	number of sera	mean	mean - s	mean - 2s	median	5th percentile	diagnostic sensitivity
dsDNA	11	2,5	1,2	< 0	2,2	1,0	91 %
RNP	14	5,5	3,9	2,2	6,4	2,9	100 %
Sm	12	4,0	2,9	1,8	4,4	2,0	100 %
SS-A/Ro	17	4,9	4,0	3,1	5,3	3,6	100 %
SS-B/La	31	39	< 0	< 0	10,4	1,5	100 %
Scl-70	10	4,5	3,3	2,0	4,7	2,5	100 %
CENP-B	11	4,6	3,6	2,6	4,8	3,1	100 %
Jo-1	6	6,1	5,7	5,4	6,1	5,4	100 %

The quoted values for diagnostic specificity and sensitivity of the ELISA apply for the measured sera only. Other collectives may yield different results.

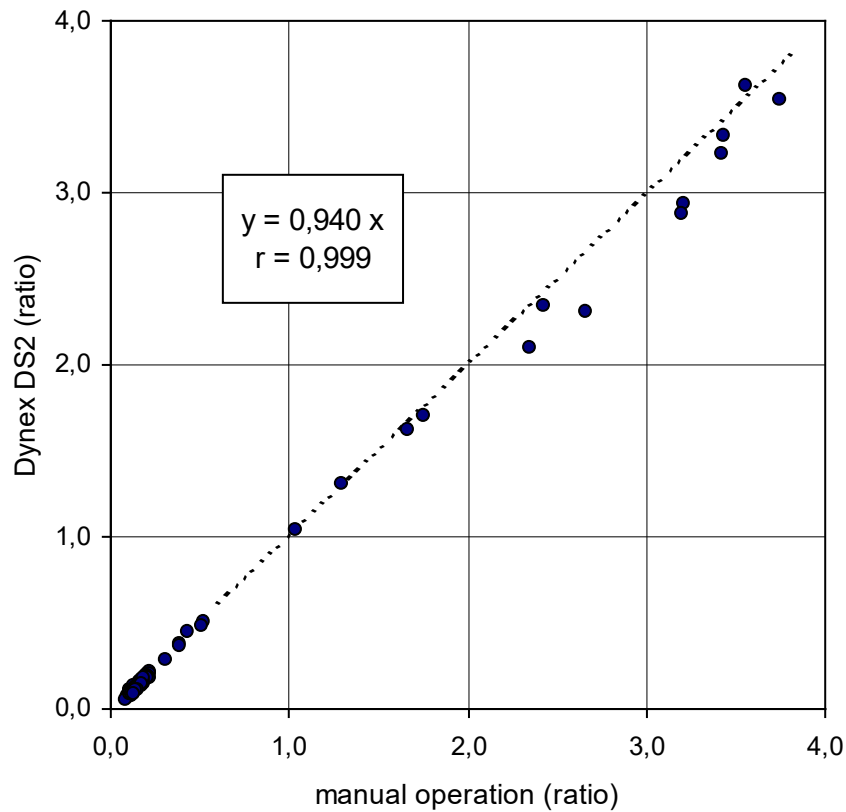
#### 11.8. Manual operation vs. Dynex DS2 automated ELISA system

Variability: Using specimen of one and the same kit lot, the variability of assay results were compared between manual operation and the Dynex DS2 automated ELISA system (cv values are given as mean of all 8 antigens):

	manual operation	Dynex DS2
intra-assay variability (n per parameter = 3)	mean cv = 1,4 %	mean cv = 1,3 %
inter-assay variability (n per parameter = 9)	mean cv = 1,6 %	mean cv = 2,0 %

Correlation: In order to assess this feature of the ANA Profile 8 ELISA, 10 appropriately diluted CDC sera (cf. article 11.2) were measured on all 8 antigens with both methods. This is the result.





1711FE00.FED/KorrDynexDS2

## 12. Warranty

Steffens biotechnische Analysen GmbH (SBA) guarantees that the product delivered has been thoroughly tested to ensure that its properties specified herein are fulfilled. No further warranties are given.

The performance data presented here were obtained using the procedure indicated. Any modification in the procedure may affect the results in which case SBA disclaims all warranties whether expressed, implied or statutory. Moreover, SBA accepts no liability for any damage, whether direct, indirect or consequential, which results from inappropriate use or storage of the product.

### 13. Symbols



Article code



Batch code



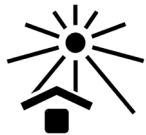
Contains x determinations



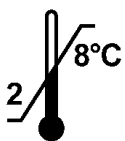
For *in vitro* diagnostic use



Conformité Européenne



Store shielded from sunlight



Store at 2 - 8°C



Expiration date



Read "Directions for Use"



Warning



Biological risk



Manufactured by

#### 14. References

1. Nakamura, R. M., Tan, E. M.: Update on autoantibodies to intracellular antigens in systemic rheumatic diseases. Clin Lab Med 12 (1992), 1 - 23
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## 15. Summary flow chart

- a. Dilute the samples 1/100 in sample buffer (100 mL, ready-to-use, orange) and mix.
- b. Dilute the wash buffer 10x-concentrate (100 mL, blue) with water and mix.
- c. Wash the wells once with 350  $\mu$ L wash buffer each. Dispense 8 x 100  $\mu$ L of the controls (3,0 mL, ready-to-use, green and red) and of the diluted samples into the wells of 1 column each. Incubate for 30 minutes at room temperature ( $23 \pm 3^{\circ}\text{C}$ ).
- d. Wash the wells 4 times with 350  $\mu$ L wash buffer each.
- e. Dispense 100  $\mu$ L of the conjugate (14 mL, ready-to-use, red) into the wells. Incubate as in step c.
- f. Repeat washing step d.
- g. Dispense 100  $\mu$ L of the substrate solution (14 mL, ready-to-use, black vial) per well. Incubate as in step c. Then, add 100  $\mu$ L stop solution (14 mL, ready-to-use, colourless) per well and agitate the plate briefly.
- h. Immediately measure the absorbance at 450 nm.
- i. Evaluation (to be executed separately for each parameter): determine the cut-off absorbance by multiplying the respective absorbance of the positive control with the corresponding factor quoted in the certificate of analysis. Then, calculate the ratio of the sample by dividing its respective absorbance by the corresponding cut-off absorbance (8 ratio values per sample).