

**510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT COMBINATION TEMPLATE**

A. 510(k) Number:

k151487

B. Purpose for Submission:

Adding previously cleared assays on new instrument platform

C. Measurand:

Sodium, Potassium, Chloride and Glucose

D. Type of Test:

Quantitative, Photometric and Ion Selective Electrodes

E. Applicant:

Diatron, US, Inc.

F. Proprietary and Established Names:

Diatron Pictus 700 Clinical Chemistry Analyzer

Diatron Glucose Hexokinase Method

Diatron ISE

G. Regulatory Information:

Product Code	Regulation Name	Classification	Regulation Section	Panel
JGS	Sodium test system	II	21 CFR 862.1665	Chemistry (75)
CEM	Potassium test system	II	21 CFR 862.1600	Chemistry (75)
CGZ	Chloride test system	II	21 CFR 862.1170	Chemistry (75)
CFR	Glucose test system	II	21 CFR 862.1345	Chemistry (75)

JJE	Discrete photometric chemistry analyzer for clinical use	I, exempt	21 CFR 862.2160	Chemistry (75)
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H. Intended Use:

1. Intended use(s):

See Indications for Use

2. Indication(s) for use:

Diatron Glucose Hexokinase Method is for the in vitro quantitative determination of Glucose in serum for use with Diatron Pictus 700 Chemistry Analyzer. Glucose measurements are used in the diagnosis and treatment of carbohydrate metabolism disorders including diabetes.

Diatron ISE is for the in vitro quantitative determination of Sodium (Na⁺), Potassium (K⁺), and Chloride (Cl⁻) concentrations in serum on the Diatron Pictus 700 Chemistry Analyzer. Sodium measurements are used in the diagnosis and treatment of diseases involving electrolyte imbalance. Potassium measurements are used in monitoring electrolyte balance and in the diagnosis and treatment of diseases/conditions characterized by low or high blood potassium levels. Chloride measurements are used in the diagnosis and treatment of electrolyte and metabolic disorders.

The Diatron Pictus 700 Clinical Chemistry Analyzer is a wet-chemistry analyzer for the direct determination of sodium, potassium, chloride and glucose concentrations in serum, and to measure a variety of analytes that may be adaptable to the analyzer depending on the reagent used. It is for in vitro diagnostic use.

3. Special conditions for use statement(s):

Prescription use only

4. Special instrument requirements:

Diatron Pictus 700 Clinical Chemistry Analyzer

I. Device Description:

The Pictus 700 Clinical Chemistry Analyzer is an automated bench top, random access, open analyzer for clinical chemistry analysis on human serum, including an ISE module. The analyzer uses colorimetric and ion selective electrode methods for analysis of samples.

The instrument consists of an analyzer unit and an operations computer with a screen that allows the user to input commands for system operation and data display. The analyzer unit includes two temperature-controlled incubation rotors and a multi-wavelength photometer, a cooled carousel for loading barcoded sample tubes or micro cups and reagent cartridges, and two probes that deliver reagents and samples to the incubation rotors and the ISE measurement flow cell. The analyzer unit also houses containers for wash solution and waste. An ISE module, installed on the analyzer unit, is used to measure sodium, potassium and chloride ionic activity in serum.

The Diatron Glucose Hexokinase Method reagent is provided ready to use, and consists of the following active ingredients in a solution of nonreactive stabilizers, fillers, and buffers: ATP (2.1 mM), NAD 2.5 mM, Hexokinase (yeast, >1500 U/L), G-6-PDH (L.m., >3200 U/L), at pH (7.22 – 7.42). The Diatron Glucose Hexokinase Method reagent was previously cleared in k011900.

Diatron ISE includes sodium, potassium, chloride ion selective electrodes and ISE calibrators. The Diatron ISE calibrators consist of the following solutions: Calibrant A Solution (Na⁺ 140 mmol/L, K⁺ 4.0 mmol/L, Cl⁻ 125 mmol/L) and Calibrant B Solution (Na⁺ 70 mmol/L, K⁺ 8.0 mmol/L, Cl⁻ 41 mmol/L). Diatron ISE has been previously cleared in k070057.

J. Substantial Equivalence Information:

1. Predicate device name(s):

Diatron Pictus 400, including glucose and ISE assays

2. Predicate 510(k) number(s):

k101741

3. Comparison with predicate:

Similarities and differences

Characteristic	Candidate System Diatron Pictus 700 Analyzer	Predicate System Pictus 400, k101741
Intended Use	Quantitative determinations of sodium, potassium, and chloride using ion selective electrodes, and glucose by photometry in serum.	Same
Testing Environment	Clinical lab	Same
Test Principle	ISE potentiometry (electrolytes) and photometry (glucose)	Same

Analytical Methods	Endpoint with sample blanking	Endpoint and Kinetic with sample blanking
Calibration	Linear and non linear	Same
Optical measurement unit Measurement modes	Absorbance	Same
Optical modes	Bichromatic,	Bichromatic, turbidimetric
Light source	Tungsten halogen	Same
Detector	Photodiode	Same
Wavelengths	340, 380, 405, 450, 490, 505, 550, 590, 620, 650, 700, 750	330, 405, 450, 505, 550, 570, 600, 650, 700
Linear Absorbance Range	-0.1 to 3.6 A.	Same
Photometric Tests/Hour	450 tests/hour double reagent, 550 tests/tour mono reagent, 720 with ISE	280 test/hour 400 with ISE
Reaction cuvettes	Plastic semi-disposables	Same
Path length	6 mm	Same
Reaction Volume Range	180 to 700 microliters	Same
Incubator	Room, 30°C, 37°C	Same
Reagents On-board Capacity	72	48
Sample On-board Capacity	95	48
Pipettor system	Syringe, motor driven	Same
Mixing	Motor in probe, tray shake	Same
Reagent refrigerator	Yes	Same
Sample dispensing	2 - 100 microliters in 0.2 microliter increments	2 - 50 microliters
QC/Calibration	Automatic and Manual	Same
LIS external connectivity	Yes	Same

Barcode	Samples and Reagents	Same
Re-dilution on abnormals	Yes	Same
Specimen Type	Human serum	Human serum and plasma
Power	110/220V, 50/60 Hz, 2000 VA	85/230 V, 400 VA
Environmental conditions	20 to 30 °C, max Hum. 80%	15 to 30 °C, max Hum. 80%
ISE Principle	Ion selective, direct reading	Same
ISE sample type	Serum	Same
ISE Available tests	Na, K, Cl	Same
ISE calibration	Two-point and single point	Same
ISE Sample size	70 ul	Same

K. Standard/Guidance Document Referenced (if applicable):

CLSI - EP05-A2. Evaluation of precision performance of Clinical Chemistry Devices.

CLSI - EP06-A. Evaluation of linearity of Quantitative analytical methods.

CLSI - EP07-A2. Interference testing in Clinical Chemistry

CLSI - EP17-A Protocols for the determination of Limits of Quantitation

L. Test Principle:

The Glucose (Hexokinase) method is based on a modification of Slein, using Hexokinase and glucose-6-phosphate-dehydrogenase to catalyze the reaction. Glucose is phosphorylated with adenosine triphosphate (ATP) in the reaction catalyzed by Hexokinase (HK). The product, glucose-6-phosphate (G6P) is then oxidized with the concomitant reduction of nicotinamide adenine dinucleotide (NAD) to NADH in the reaction catalyzed by glucose-6-phosphatedehydrogenase (G6PDH). The formation of NADH caused an increasing in absorbance at 340nm. The increase is proportional to the amount of glucose in the sample.

The ISE method uses ion selective principles to measure the sodium, potassium, and chloride. The ISE module measures the potentials developed when the sample is positioned in the electrodes. Next, Calibrant A is positioned in the electrodes. The difference in the two

potentials is related logarithmically to the concentration of the measured ions in the sample divided by their respective concentrations in the Calibrant solution.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. *Precision/Reproducibility:*

Precision studies were performed according to CLSI document EP5-A2, *Evaluation of Precision Performance of Quantitative Measurement Methods; Approved Guideline*. Three levels of serum based controls were tested on the Pictus 700 Clinical Chemistry Analyzer for each analyte in one run of 20 replicates to obtain the within run precision (N=20). Three levels of serum based controls were tested in duplicate twice per day for 20 days to obtain the total precision (N=80). Results are summarized in the tables below:

Glucose

Level	Mean (mg/dL)	Within Run		Total Precision	
		S.D. (mg/dL)	C.V. (%)	S.D. (mg/dL)	C.V. (%)
1	43.8	0.70	1.59	1.5	3.2
2	89.2	0.81	0.91	2.8	3.0
3	295.1	3.52	1.19	9.5	3.1

Sodium

Level	Mean (mmol/L)	Within Run		Total Precision	
		S.D. (mmol/L)	C.V. (%)	S.D. (mmol/L)	C.V. (%)
1	127.1	0.60	0.48	1.1	0.9
2	141.8	0.55	0.39	2.0	1.4
3	158.9	0.81	0.51	1.6	1.0

Potassium

Level	Mean (mmol/L)	Within Run		Total Precision	
		S.D. (mmol/L)	C.V. (%)	S.D. (mmol/L)	C.V. (%)
1	3.40	0.00	0.00	0.04	1.1
2	4.50	0.00	0.00	0.07	1.7
3	5.73	0.04	0.78	0.08	1.4

Chloride

Level	Mean (mmol/L)	Within Run		Total Precision	
		S.D. (mmol/L)	C.V. (%)	S.D. (mmol/L)	C.V. (%)
1	87.0	0.56	0.65	0.8	0.9
2	97.6	0.50	0.51	1.2	1.2
3	108.5	0.51	0.47	0.8	0.8

b. Linearity/assay reportable range:

Linearity studies were performed on the Pictus 700 Clinical Chemistry Analyzer using serum albumin-based samples. At least nine levels of linearity standards were analyzed in quadruplicate. The observed values were compared to the expected values and the results of linear regression are summarized in the table below:

Analyte	Claimed Measuring Range	N	Slope	Intercept	R ²	Sample Range Tested
Glucose	13 – 500 mg/dL	9	0.97	2.2	1.0	13 – 622 mg/dL
Sodium	115 – 196 mmol/L	11	1.02	1.5	1.0	89 - 203 mmol/L
Potassium	1.1 – 8.8 mmol/L	9	0.98	0.0	1.0	0.9 – 12.6 mmol/L
Chloride	49 – 152 mmol/L	11	1.01	-0.2	1.0	41 – 200 mmol/L

c. Traceability, Stability, Expected values (controls, calibrators, or methods):

The glucose calibrator material is traceable to NIST SRM #917b, Clinical Dextrose. The ISE calibration material is traceable to commercially-available, 99.9% ACS grade materials. The glucose calibrator material was previously cleared under k020454. The ISE calibrator material for sodium, potassium and chloride (Calibrant A and B) was previously cleared under k070057.

d. Detection limit:

Glucose:

The Level of Blank (LoB) study was performed using a glucose-depleted serum sample, run 30 times per day over three days on the Pictus 700 Clinical Chemistry Analyzer resulting in a LoB of 0 mg/dL.

The Limit of Detection (LoD) was determined to be 0.4 mg/dL using low analyte sample run 30 times/day over three days. Following CLSI EP17-A, the Limit of Quantitation (LoQ) was determined to be 7.0 mg/dL.

	LoB	LoD	LoQ	Claimed measuring range
Glucose	0.0 mg/dL	0.4 mg/dL	7.0 mg/dL	13 to 500 mg/dL

Sodium, Potassium and Chloride:

Linearity studies were used to support the measuring ranges for Sodium, Potassium and Chloride. Please see M.1.b. linearity section above.

The sponsor's claimed measuring range:

Analyte	Claimed Measuring Range
Sodium	115 – 196 mmol/L
Potassium	1.1 – 8.8 mmol/L
Chloride	49 – 152 mmol/L

e. Analytical specificity:

Interference studies were performed to determine the effects from potential interferents on the Glucose and the ISE assays. Various concentrations of potential interferents were spiked into two levels, (low and high concentrations) of each analyte. Testing was performed in duplicate on the Pictus 700 Clinical Chemistry Analyzer. Six levels of each interferent were tested for each analyte. The sponsor states that interference is considered to be non-significant if the bias between the tested and control samples are within +/-10%. The highest concentration tested that shows non-significant interference are summarized below:

Reagent	Hemoglobin	Triglycerides	Bilirubin
Glucose	600 mg/dL	700 mg/dL	12 mg/dL
Sodium	600 mg/dL	2500 mg/dL	24 mg/dL
Potassium	*	2500 mg/dL	24 mg/dL
Chloride	600 mg/dL	2500 mg/dL	24 mg/dL

*Do not use hemolyzed samples

The labeling for the ISE Reagent Pack includes the statement:

“Hemolyzed samples should not be used with sodium, potassium and chloride assays.”

The sponsor also references the literature in their labeling:

“Young, D.S. et al, Clin. Chem 21: ID (1975) for drugs and substances that may affect the accuracy of these methods.”

f. Assay cut-off:

Not Applicable

2. Comparison studies:

a. Method comparison with predicate device:

Method comparison studies were performed following CLSI EP9-A2. Serum samples were run on the Pictus 700 Clinical Chemistry Analyzer and the results compared to the results run on the predicate device. Less than 10% of the samples were spiked or diluted to fully span the claimed measuring range of each analyte. The Deming regression analysis results are summarized below.

Analyte	Slope	Intercept	R ²	N	Concentration range tested
Glucose	0.99	1.2 mg/dL	1.00	136	26 - 484 mg/dL
Sodium	1.00	-1.2 mmol/L	1.00	69	118 - 182 mmol/L
Potassium	1.00	0.0 mmol/L	1.00	69	1.7 – 8.8 mmol/L
Chloride	1.02	-1.9 mmol/L	0.99	69	55 - 134 mmol/L

b. Matrix comparison:

Not Applicable

3. Clinical studies:

a. Clinical Sensitivity:

Not Applicable

b. Clinical specificity:

Not Applicable

c. Other clinical supportive data (when a. and b. are not applicable):

Not Applicable

4. Clinical cut-off:

Not Applicable

5. Expected values/Reference range:

Glucose ¹	70 – 105 mg/dL
Sodium ²	136 - 145 mmol/L
Potassium ²	3.5 – 5.1 mmol/L
Chloride ²	98 – 107 mmol/L

¹Tietz, Textbook of Clinical Chemistry, 2nd ed., Philadelphia, W.B. Saunders, (1994)

²Tietz, Textbook of Clinical Chemistry, Philadelphia, W.B. Saunders, (1990)

N. Instrument Name:

Diatron Pictus 700 Clinical Chemistry Analyzer

O. System Descriptions:

1. Modes of Operation:

Does the applicant's device contain the ability to transmit data to a computer, webserver, or mobile device?

Yes X or No

Does the applicant's device transmit data to a computer, webserver, or mobile device using wireless transmission?

Yes or No X

2. Software:

FDA has reviewed applicant's Hazard Analysis and software development processes for this line of product types:

Yes X or No

3. Specimen Identification:

Barcode identification is available for specimen tubes and reagent bottles. Manual entry is used to identify specimen cups.

4. Specimen Sampling and Handling:

Samples are manually placed on the instrument either by sample tube or sample cup. The system can run an individual sample or a batch of samples. Once the samples are tested they can be manually removed.

5. Calibration:

Glucose calibration frequency should be 14 days or with a change of reagent lot or as indicated by quality control procedures. The calibrator for glucose was previously cleared in k020454.

It is mandatory to perform calibration (two points) before ISE measurement at the beginning of the day or if the power switch of analyzer is turned off, eight hours have passed since the last ISE calibration, and after electrodes cleaning. The ISE calibrator material for sodium, potassium and chloride (Calibrant A and B) was previously cleared under k070057.

6. Quality Control:

The analyzer has a built in quality control program. The labeling recommends the use of two external quality control materials to be assayed according to government guidelines.

P. Other Supportive Instrument Performance Characteristics Data Not Covered In The “Performance Characteristics” Section above:

Operation conditions: Temperature and Relative humidity have been conducted and found to be acceptable. Sponsor has the following claims:

Operating temperature is 20°C – 30°C and Relative humidity is between 45% and 80%.

Carry-over studies have been conducted and found to be acceptable.

Automatic dilution studies have been conducted and found to be acceptable, supporting that the Pictus 700 is capable of performing up to 4-fold automatic dilution.

Q. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

R. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.