510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
DEVICE AND INSTRUMENT TEMPLATE

A. 510(k) Number:
k042291

B. Purpose for Submission:
Beckman Coulter has determined the design for the DxC 600 and UniCel DxC 800 UniCel SYNCHRON Clinical Systems are significant enough to warrant a Premarket Notification. Modular and cartridge chemistries presented below are previously cleared test systems on the SYNCHRON platform and are presented to demonstrate instrument performance as a system not for assay specific clearance, with the exception of Cartridge Chemistry assays for ALB, CREA, and TP.

Cartridge Chemistry assays for ALB, CREA, and TP on the DxC platform utilize the existing, previously-cleared CX reagent formulations and assay parameters; however, because the assay analytical cycle and reaction subsystem designs differ between the SYNCHRON CX and SYNCHRON LX/UniCel DxC platforms, testing encompasses areas such as method comparison, imprecision, linearity, analytical sensitivity, interferences, reference ranges, and stability.

C. Analyte:
Total Protein, Potassium, Phosphorus (Inorganic), Lactate Dehydrogenase, Glucose, Creatinine, Chloride, Albumin, C-Reactive Protein Immunological, Phenobarbital, Bicarbonate/Carbon Dioxide, Calcium, Magnesium, Sodium, Uric Acid, Iron (non-heme), Benzodiazepine, Urea Nitrogen

D. Type of Test:
Semi-Quantitative for Benzodiazepine the all others are Quantitative.

E. Applicant:
BECKMAN COULTER, INC.

F. Proprietary and Established Names:
UNICEL DXC 600 AND 800 SYNCHRON SYSTEMS

G. Regulatory Information:

1. Regulation section:
   21 CFR § 862.1635 - Total protein test system.
   21 CFR §862.1600 - Potassium test system.
   21 CFR §862.1580 - Phosphorus (inorganic) test system.
   21 CFR §862.1440 - Lactate dehydrogenase test system.
   21 CFR §862.1345 - Glucose test system.

21 CFR §862.1225 - Creatinine test system.
21 CFR §862.1170 - Chloride test system.
21 CFR §862.1035 - Albumin test system.
21 CFR §866.5270 - C-reactive protein immunological test system.
21 CFR §862.3660 - Phenobarbital test system.
21 CFR §862.1160 - Bicarbonate/carbon dioxide test system.
21 CFR §862.1145 - Calcium test system.
21 CFR §862.1495 - Magnesium test system.
21 CFR §862.1665 - Sodium test system.
21 CFR §862.1775 - Uric acid test system.
21 CFR §862.1410 - Iron (non-heme) test system.
21 CFR §862.2160 - Discrete Photometric Chemistry Analyzer for Clinical Use
21 CFR §862.3170 - Benzodiazepine test system.
21 CFR §862.1770 - Urea nitrogen test system.

2. Classification:
   Class 2, 2, 1 reserved, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1 reserved, 2, 1 reserved, 1 reserved, 1, 2, and 2, respectively
3. Product Code:
   CEK, CEM, CEO, CFJ, CGA, CGX, CGZ, CJW, DCK, DLZ, JFL, JFP, JGJ, JGS, JHB, JIY, JJE, JXM and LFP, respectively

4. Panel:
   Chemistry (75), Immunology (82) and Toxicology (91)

H. Intended Use:

1. Indication(s) for use:

Analyzers
UniCel® DxC 600 SYNCHRON® Clinical System
UniCel® DxC 800 SYNCHRON® Clinical System

The UniCel DxC SYNCHRON Systems are fully automated, computer-controlled clinical chemistry analyzers intended for the in vitro determination of a variety of general chemistries, therapeutic drugs, and other chemistries of clinical interest in biological fluids such as serum, plasma, urine, or cerebrospinal fluid, (sample type is chemistry dependent).

Submitted Assays:

SYNCHRON® Systems Total Protein (TPm) Reagent

TPm reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 800 Systems and SYNCHRON® Systems Protein Calibrator, is intended for the quantitative determination of Total Protein concentration in human serum, plasma or cerebrospinal fluid (CSF).

Total protein measurements are used in the diagnosis and treatment of diseases involving the liver, kidney or bone marrow, as well as other metabolic or nutritional disorders.

SYNCHRON® Systems Total Protein (TP) Reagent

TP reagent, when used in conjunction with UniCel® DxC 600/800 Systems and SYNCHRON® Systems Multi Calibrator, is intended for the quantitative determination of Total Protein concentration in human serum or plasma.

Total protein measurements are used in the diagnosis and treatment of diseases involving the liver, kidney or bone marrow, as well as other metabolic or nutritional disorders.

SYNCHRON® Systems Potassium (K) Assay

ISE Electrolyte Buffer reagent and ISE Electrolyte Reference reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems AQUA CAL 1, 2 and 3, are intended for the quantitative determination of Potassium concentration in human serum, plasma or urine.

Potassium measurements are used in the diagnosis and treatment of hypokalemia, hyperkalemia, renal failure, Addison's disease or other diseases involving electrolyte imbalance.

SYNCHRON® Systems Phosphorus (PHOSm) Reagent

PHOSm reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 800 Systems and the SYNCHRON® Systems AQUA CAL 1 and 2, is intended for the quantitative determination of inorganic Phosphorus concentration in human serum, plasma or urine.

Measurements of phosphorus (inorganic) are used in the diagnosis and treatment of various disorders, including parathyroid gland and kidney diseases, and vitamin D imbalance.

SYNCHRON® Systems Lactate Dehydrogenase (LD) Reagent

LD reagent, when used in conjunction with SYNCHRON LX® Systems or UniCel® DxC 600/800 Systems, is intended for the quantitative determination of Lactate Dehydrogenase activity in human serum or plasma.

Lactate dehydrogenase measurements are used in the diagnosis and treatment of liver diseases such as acute viral hepatitis, cirrhosis, and acute metastatic

carcinoma of the liver, cardiac diseases such as myocardial infarction, and tumors of the lung or kidneys.

SYNCHRON® Systems Glucose (GLUCm) Reagent

GLUCm reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems AQUA CAL 1 and 2, is intended for the quantitative determination of Glucose concentration in human serum, plasma, urine or cerebrospinal fluid (CSF).

Glucose measurements are used in the diagnosis and treatment of carbohydrate metabolism disorders, including diabetes mellitus, neonatal hypoglycemia and idiopathic hypoglycemia, and pancreatic islet cell carcinoma.

SYNCHRON® Systems Creatinine (CREm) Reagent

CREm reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 800 Systems and SYNCHRON® Systems AQUA CAL 1 and 2, is intended for the quantitative determination of Creatinine concentration in human serum, plasma or urine.

Creatinine measurements are used in the diagnosis and treatment of renal diseases, in monitoring renal dialysis, and as a calculation basis for measuring other urine analytes.

SYNCHRON® Systems Creatinine (CREA) Reagent

CREA reagent, when used in conjunction with UniCel® DxC 600/800 Systems and SYNCHRON® Systems Multi Calibrator, is intended for the quantitative determination of Creatinine concentration in human serum, plasma or urine.

Creatinine measurements are used in the diagnosis and treatment of renal diseases, in monitoring renal dialysis, and as a calculation basis for measuring other urine analytes.

SYNCHRON® Systems Chloride (CL) Assay

ISE Electrolyte Buffer reagent and ISE Electrolyte Reference reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems AQUA CAL 1 and 2, are intended for quantitative determination of Chloride concentration in human serum, plasma, urine or cerebrospinal fluid (CSF).

Chloride measurments are used in the diagnosis and treatment of electrolyte and metabolic disorders such as cystic fibrosis and diabetic acidosis.

SYNCHRON® Systems Albumin (ALBm) Reagent

ALBm reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 800 Systems and SYNCHRON® Systems Protein Calibrator, is intended for the quantitative determination of Albumin concentration in human serum or plasma.

Albumin measurements are used in the diagnosis and treatment of numerous diseases primarily involving the liver and/or kidneys.

SYNCHRON® Systems Albumin (ALB) Reagent

ALB reagent, when used in conjunction with UniCel® DxC 600/800 Systems and SYNCHRON® Systems Multi Calibrator, is intended for the quantitative determination of Albumin concentration in human serum or plasma.

Albumin measurements are used in the diagnosis and treatment of numerous diseases primarily involving the liver and/or kidneys.

SYNCHRON® Systems High Sensitivity C-Reactive Protein (CRPH) Reagent

High Sensitivity CRPH reagent, when used in conjunction with SYNCHRON LX® PRO Systems, UniCel® DxC 600/800 Systems, and SYNCHRON® Systems CAL 5 Plus, is intended for the quantitative determination of C-Reactive Protein in human serum or plasma by rate turbidimetry.

Measurement of C-Reactive protein aids in the evaluation of stress, trauma, infection, inflammation, surgery, and associated diseases.

SYNCHRON® Systems Phenobarbital (PHE) Reagent

PHE reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems Drug Calibrator 1, is intended for the quantitative determination of Phenobarbital concentration in human serum or plasma.

Phenobarbital is indicated for the treatment of status epilepticus, febrile seizures and seizure disorders (grand mal and psychomotor), except absence (petit mal) seizures. Phenobarbital therapy is monitored for suspected inadequate dose or toxicity.

SYNCHRON® Systems Carbon Dioxide (CO2) Assay

ISE Electrolyte Buffer reagent, ISE Electrolyte Reference reagent, CO2 Alkaline Buffer and CO2 Acid reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems AQUA CAL 1 and 3, are intended for quantitative determination of Carbon Dioxide concentration in human serum or plasma.

Carbon dioxide measurements are used in the diagnosis and treatment of numerous potentially serious disorders associated with changes in body acid-base balance.

SYNCHRON® Systems Calcium (CALC) Assay

ISE Electrolyte Buffer reagent and ISE Electrolyte Reference reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems AQUA CAL 1 and 2, are intended for quantitative determination of Calcium concentration in human serum, plasma or urine.

Calcium measurements are used in the diagnosis and treatment of parathyroid disease, a variety of bone diseases, chronic renal disease and tetany (intermittent muscular contractions or spasms).

SYNCHRON® Systems Magnesium (MG) Reagent

MG reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems Multi Calibrator, is intended for the quantitative determination of Magnesium concentration in human serum, plasma or urine.

Determination of magnesium is useful in assessing several diseases and conditions. High magnesium is associated with uremia, dehydration, diabetic acidosis, Addison's disease, and increased medicinal intake of magnesium, such as in the treatment of preeclampsia (hypertension induced by pregnancy). Low magnesium is associated with malabsorption syndrome, acute pancreatitis, hypoparathyroidism, chronic alcoholism and delirium tremens, chronic glomerulonephritis, aldosteronism, digitalis intoxication, and protracted I.V. feeding.

SYNCHRON® Systems Sodium (NA) Assay

ISE Electrolyte Buffer reagent and ISE Electrolyte Reference reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems AQUA CAL 1, 2 and 3, are intended

for the quantitative determination of Sodium concentration in human serum, plasma or urine.

Sodium measurements are used in the diagnosis and treatment of aldosteronism, diabetes insipidus, adrenal hypertension, Addison's disease, dehydration, inappropriate antidiuretic hormone secretion, or other diseases involving electrolyte imbalance.

SYNCHRON® Systems Uric Acid (URIC) Reagent

URIC reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems Multi Calibrator, is intended for quantitative determination of Uric Acid concentration in human serum, plasma, or urine.

Uric acid measurements are used in the diagnosis and treatment of numerous renal and metabolic disorders, including renal failure, gout, leukemia, psoriasis, starvation or other wasting conditions, and of patients receiving cytotoxic drugs.

SYNCHRON® Systems Iron (FE) Reagent

FE reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems and SYNCHRON® Systems FE/IBCT Calibrator Kit, is intended for the quantitative determination of Iron in human serum or heparinized plasma.

Alterations in iron and total iron binding capacity levels result from changes in iron intake, absorption, storage, and release mechanisms. Such changes are indicative of a wide range of dysfunctions including anemias, nephrosis, cirrhosis and hepatitis. Both iron and total iron binding capacity measurements are important for definitive diagnosis because they are interrelated. Tietz has presented a summary of these relationships and the patterns of iron/total iron binding capacity associated with various disease states.

SYNCHRON® Systems Benzodiazepine (BENZ) Reagent

BENZ reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 600/800 Systems, and SYNCHRON® Systems Drugs of Abuse Testing (DAT) Urine Calibrators, is intended for the qualitative determination of Benzodiazepine in human urine at a cutoff value of 200 ng/mL (oxazepam).

The BENZ assay provides a rapid screening procedure for determining the presence of the analyte in urine. This test provides only a preliminary

analytical result; a positive result by this assay should be confirmed by another generally accepted non-immunological method such as thin layer chromatography (TLC), gas chromatography (GC), or gas chromatography/mass spectrometry (GC/MS). GC/MS is the preferred confirmatory method.

Clinical consideration and professional judgement should be applied to any drug of abuse test result, particularly when preliminary positive results are used.

Benzodiazepines are a class of central nervous system depressants that are used as sedatives and hypnotics. The benzodiazepine compounds include chlordiazepoxide, diazepam, oxazepam, flurazepam, and nitrazepam. Measurements of benzodiazepines on the SYNCHRON® Systems are used in the diagnosis and treatment of benzodiazepine use and overdose, and in monitoring the presence of benzodiazepines to ensure appropriate therapy.

SYNCHRON® Systems Urea Nitrogen (BUNm or UREAm) Reagent

BUNm or UREAm reagent, when used in conjunction with SYNCHRON LX® Systems, UniCel® DxC 800 Systems and SYNCHRON® Systems AQUA CAL 1, 2 and 3, is intended for the quantitative determination of Urea Nitrogen or Urea concentration in human serum, plasma or urine. The system can be configured to report results as either urea nitrogen in default units of mg/dL or urea in default units of mmol/L.

Urea nitrogen or urea measurements are used in the diagnosis and treatment of certain renal and metabolic diseases.

2. Special condition for use statement(s):
   Not Applicable
3. Special instrument Requirements:
   UniCel DxC 600 or 800 System

I. Device Description:

The UniCel DxC 600 and 800 Systems are the next generation of clinical chemistry analyzers in Beckman Coulter's SYNCHRON instrument family. The analyzers operate in conjunction with reagents, calibrators, and controls designed for use with SYNCHRON Systems. The DxC instruments feature bar code identification of samples and reagents, Closed Tube Sampling, Obstruction Detection and Correction, and a dual carousel reagent storage compartment with an onboard capacity of 59 cartridges. Major system components include sample and reagent handling systems, bar code readers, modular chemistry sections, cartridge chemistry systems, and reagent storage compartment, supported by power and hydropneumatic utilities.

J. Substantial Equivalence Information:

1. Predicate device name(s):
   SYNCHRON LX®20 PRO Systems
   Analytes: SYNCHRON Total Protein (TPm), SYNCHRON Total Protein (TP), SYNCHRON (ISE) Potassium, SYNCHRON Phosphorus (PHOSm), SYNCHRON LD Enzymes (LD), SYNCHRON Glucose (GLUCm), SYNCHRON Creatinine (CREA), SYNCHRON Creatinine (CREm), SYNCHRON (ISE) Chloride, SYNCHRON Albumin (ALB), SYNCHRON Albumin (ALBm), SYNCHRON High Sensitivity CRP (CRPH), SYNCHRON Phenobarbital (PHE), SYNCHRON (ISE) Carbon Dioxide, SYNCHRON (ISE) Calcium, SYNCHRON Magnesium (MG), SYNCHRON (ISE) Sodium, SYNCHRON Uric Acid (URIC), SYNCHRON Iron (FE), SYNCHRON Benzodiazepine (BENZ), SYNCHRON Urea Nitrogen (BUNm, UREAm),

2. Predicate K number(s):
   Analyzers k965240, k011213

   Analytes: k965240, k883181, k965240, k965240, k971333, k965240, k883181, k965240, k965240, k883181, k965240, k010597, k955644, k965240, k965240, k883967, k965240, k970919, k960485, k023048, k965240 respectively

3. Comparison with predicate:

Similarities		
Item	**Device**	**Predicate**
• Intended Use • Fundamental Technologies • Operational Environment • System Architecture • Optics/Reaction Subsystem • Sample Handling Subsystem • Chemistry Databases • Reagents and Consumables		
Differences		
Item	**Device**	**Predicate**
• Reagent Storage Capacity	DxC 600/800: 59 cartridges	LX: 30 cartridges
• Reagent Handling Subsystem	DxC 600/800: Extended length design	LX: Teflon coated high nickel steel probes
• Instrument Packaging	DxC 600: 62 inch	LX: 70 inch width

	width DxC 600/800: New instrument skins	
• Subsystem Designs	DxC 600/800: Modified Modular Chemistry, Power, and Hydropneumatic subsystems	LX: Original
• Electronics	DxC 600/800: New components to address obsolescence issues	LX: Original
• Operator Interface	DxC 600/800: New key features	LX: Original
• Maintenance Procedures	DxC 600/800: Replaceable chloride electrode tip	LX: Chloride electrode resurfacing
• Modular Chemistry Menu	DxC 600: 6 chemistries	LX: 11 chemistries
• Cartridge Chemistry Menu	DxC 600/800: 86 chemistries	LX: 83 chemistries

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

- NCCLS EP9-A - User Comparison of Quantitative Clinical Laboratory Methods Using Patient Samples
- NCCLS EP5-A - User Evaluation of Precision Performance of Clinical Chemistry NCCLS EP6 - A Evaluation of the Linearity of Quantitative Methods
- NCCLS EP7-A - Interference Testing in Clinical Chemistry
- NCCLS C28-A - How to Define and Determine Reference Intervals in the Clinical Laboratory

L. Test Principle:

Flow cell modules that use ion selective electrode (ISE) for NA, K, Cl, Ca and CO2 and photometric electrochemical technologies for specific analyte modular assays are TPm, PHOSm, GLUCm, CREm, ALBm and BUNm/UREAm. Cartridge Chemistry assays TP, LD, CREA, ALB, CRPH, PHE, MG, URIC and FE, BENZ utilize

spectrophotometric techniques, two different measurements modes can be used: Endpoint measurement (equilibrium methods) and Rate measurements (kinetic methods).

Test principles in support of clearance of Cartridge Chemistry assays new to the UniCel DxC Systems:

SYNCHRON Systems ALB assay is based on a colorimetric, timed endpoint method. In the reaction, albumin combines with bromocresol purple (BCP) to form a colored product.

The chemical reaction scheme follows:

Albumin(sample) + BCP → Albumin-BCP Complex

The SYNCHRON System automatically proportions the appropriate sample and reagent volumes into a cuvette. The ratio used is one part sample to 100 parts reagent. The system monitors the change in absorbance at 600 nanometers. This change in absorbance is directly proportional to the concentration of albumin in the sample and is used by the SYNCHRON System to calculate and express albumin concentration. The calculation is based upon a linear calibration curve generated from a single-level value-assigned calibrator.

SYNCHRON Systems CREA assay measures creatinine concentration by a modified rate Jaffé method. In the reaction, creatinine combines with picrate in an alkaline solution to form a creatinine-picrate complex.

The chemical reaction scheme follows:

Alkaline Solution
Creatinine(sample) + Picric acid → Creatinine-picrate

The SYNCHRON System automatically proportions the appropriate sample and reagent volumes into a cuvette. The ratio used is one part sample to 11 parts reagent for serum, and one part sample to 73 parts reagent for urine. The system monitors the change in absorbance at 520 nanometers. This change in absorbance is directly proportional to the concentration of creatinine in the sample and is used by the SYNCHRON System to calculate and express creatinine concentration. The calculation is based upon a linear calibration curve generated from a single-level value-assigned calibrator.

SYNCHRON Systems TP assay is based on a colorimetric, timed endpoint method. In the reaction, the peptide bonds in the protein sample bind to cupric ions in an alkaline medium to form colored peptide/copper complexes. The chemical reaction scheme follows:

Alkali

Protein(sample) + Cu2+ → Protein-Copper Complex

The SYNCHRON System automatically proportions the appropriate sample and reagent volumes into a cuvette. The ratio used is one part sample to 50 parts reagent. The system monitors the change in absorbance at 560 nanometers. This change in absorbance is directly proportional to the concentration of total protein in the sample and is used by the SYNCHRON System to calculate and express total protein concentration. The calculation is based upon a linear calibration curve generated from a single-level value-assigned calibrator.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:
   a. *Precision/Reproducibility:*
   Within-run and total precision studies were designed from NCCLS Guideline EP5-A

Unicel 800 System Estimated Serum Imprecision (N=80)
for test system precision

Chemistry	Control Level	Mean	Within-run SD	Within-run %CV	Total SD	Total %CV
NA	Low	114.8 mmol/L	0.65	0.6	1.0	0.9
	High	155.6 mmol/L	0.96	0.6	1.32	0.9
K	Low	2.39 mmol/L	0.025	1.0	0.030	1.2
	High	7.30 mmol/L	0.056	0.8	0.063	0.9
CL	Low	81.8 mmol/L	0.77	0.9	1.00	1.2
	High	122.2 mmol/L	0.92	0.8	1.20	1.0
CO2	Low	12.2 mmol/L	0.39	3.2	0.49	4.0
	High	31.5 mmol/L	0.55	1.7	0.64	2.0
CALC	Low	7.5 mg/dL	0.07	0.9	0.08	1.0
	High	13.6 mg/dL	0.09	0.6	0.14	1.1
ALBm	Low	2.3 g/dL	0.04	1.9	0.06	2.4
	High	5.1 g/dL	0.05	1.0	0.06	1.1
BUNm	Low	6.8 mg/dL	0.4	6.2	0.5	6.9
	High	61.4 mg/dL	1.7	2.8	1.7	2.8
CREm	Low	0.5 mg/dL	0.04	8.7	0.04	9.0
	High	7.9 mg/dL	0.09	1.2	0.18	2.3
GLUm	Low	43.2 mg/dL	1.17	2.7	1.51	3.5
	High	379.0 mg/dL	2.11	0.6	4.88	1.3
PHOSm	Low	1.8 mg/dL	0.04	1.9	0.05	2.7
	High	6.5 mg/dL	0.06	1.0	0.11	1.7
TPm	Low	3.6 g/dL	0.08	2.4	0.09	2.5
	High	7.8 g/dL	0.08	1.0	0.10	1.2
BENZ	Low	413.1 mA/min	2.35	0.6	3.61	0.9
	High	470.0 mA/min	2.58	0.6	3.87	0.8
CRPH	Low	0.08 mg/dL	0.004	5.3	0.004	5.3
	High	7.59 mg/dL	0.135	1.8	0.153	2.0
FE	Low	65.0 µg/dL	1.82	2.8	2.14	3.3
	High	260.6 µg/dL	3.43	1.3	4.04	1.6
LD	Low	53 IU/L	2.3	4.4	2.4	4.5
	High	383 IU/L	4.1	1.1	6.5	1.7
MG	Low	1.2 mg/dL	0.01	1.2	0.02	2.1

	High	3.5 mg/dL	0.05	1.6	0.07	2.0
PHE	Low	9.3 µg/mL	0.19	2.1	0.25	2.7
	High	67.7 µg/mL	1.73	2.6	2.56	3.8
URIC	Low	2.5 mg/dL	0.05	2.0	0.05	2.1
	High	11.0 mg/dL	0.06	0.6	0.07	0.7

Data to support clearance of Cartridge Chemistry assays new to the UniCel DxC Systems:

ALB Imprecision Results UniCel DxC 600 System

Sample	Mean (g/dL)	S.D. (g/dL)	%C.V.	N
Within-Run Imprecision				
Level 1	2.2	0.05	2.3	80
Level 2	3.7	0.07	1.9	80
Level 3	5.2	0.08	1.5	80
Total Imprecision				
Level 1	2.2	0.06	2.5	80
Level 2	3.7	0.07	1.9	80
Level 3	5.2	0.08	1.6	80

ALB Imprecision Results UniCel DxC 800 System

Sample	Mean (g/dL)	S.D. (g/dL)	%C.V.	N
Within-Run Imprecision				
Level 1	2.2	0.04	1.9	80
Level 2	3.7	0.07	1.8	80
Level 3	5.1	0.08	1.6	80
Total Imprecision				
Level 1	2.2	0.05	2.1	80
Level 2	3.7	0.07	1.9	80
Level 3	5.1	0.08	1.6	80

CREA Imprecision Results UniCel DxC 600 System

Sample	Mean (mg/dL)	SD (mg/dL)	%C.V.	N
SERUM SAMPLES				
Within-Run Imprecision				
Level Low	0.6	0.05	9.4	80
Level High	7.2	0.06	0.9	80
Total Imprecision				
Level Low	0.6	0.05	9.5	80
Level High	7.2	0.12	1.7	80
URINE SAMPLES				
Within-Run Imprecision				
Level Low	90.1	1.21	1.4	80
Level High	244.0	3.67	1.5	80
Total Imprecision				
Level Low	90.1	1.70	1.9	80
Level High	244.0	4.22	1.7	80

CREA Imprecision Results UniCel DxC 800 System

Sample	Mean (mg/dL)	SD (mg/dL)	%C.V.	N
SERUM SAMPLES				
Within-Run Imprecision				
Level Low	0.6	0.05	9.2	80
Level High	7.2	0.09	1.2	80
Total Imprecision				
Level Low	0.6	0.05	9.4	80
Level High	7.2	0.16	2.2	80
URINE SAMPLES				
Within-Run Imprecision				
Level Low	86.1	1.18	1.4	80
Level High	233.4	3.12	1.3	80
Total Imprecision				
Level Low	86.1	2.31	2.7	80
Level High	233.4	6.73	2.9	80

TP Imprecision Results UniCel DxC 600 System

Sample	Mean (g/dL)	S.D. (g/dL)	%C.V.	N
Within-Run Imprecision				
Level 1	3.9	0.09	2.2	80
Level 2	6.1	0.11	1.8	80
Level 3	8.3	0.15	1.8	80
Total Imprecision				
Level 1	3.9	0.12	3.0	80
Level 2	6.1	0.16	2.6	80
Level 3	8.3	0.21	2.6	80

TP Imprecision Results UniCel DxC 800 System

Sample	Mean (g/dL)	S.D. (g/dL)	%C.V.	N
Within-Run Imprecision				
Level 1	3.9	0.05	1.3	80
Level 2	6.1	0.09	1.5	80
Level 3	8.3	0.10	1.2	80
Total Imprecision				
Level 1	3.9	0.08	2.0	80
Level 2	6.1	0.12	1.9	80
Level 3	8.3	0.13	1.6	80

b. Linearity/assay reportable range:
Data to support clearance of Cartridge Chemistry assays new to the UniCel DxC Systems:

Linearity (analytical range) studies were designed using the NCCLS Guideline EP6-P

ALB Linearity

SYNCHRON System	Sample Type	Measuring Range (mg/dL)	Linear Regression Analysis	Assessment
DxC 600	Serum/Plasma	1.0 – 7.0	Y = 1.030X – 0.12	Linear
DxC 800			Y = 1.029X – 0.12	Linear

CREA Linearity

SYNCHRON System	Sample Type	Measuring Range (mg/dL)	Linear Regression Analysis	Assessment
DxC 600	Serum/Plasma	1.0 – 12.0	Y = 1.008X – 0.05	Linear
DxC 800			Y = 1.003X + 0.03	Linear
DxC 600	Urine	10 - 120	Y = 0.981X + 4.99	Linear
DxC 800			Y = 0.991X + 3.32	Linear

TP Linearity

SYNCHRON System	Sample Type	Measuring Range (g/dL)	Linear Regression Analysis	Assessment
DxC 600	Serum/Plasma	3.0 – 12.0	Y = 1.006X + 0.07	Linear
DxC 800			Y = 1.004X + 0.02	Linear

c. Traceability (controls, calibrators, or method):
Not Applicable subject of previously cleared submissions

d. Detection limit:
Data to support clearance of Cartridge Chemistry assays new to the UniCel DxC Systems:

Sensitivity is defined as the lowest measurable concentration that can be distinguished from zero with 95% confidence. The claimed sensitivity for serum albumin determination for the ALB assay is 1.0 g/dL, for the CREA assay is 1.0 mg/dL and for the TP assay is 3.0 g/dL.

e. Analytical specificity:
Interference Testing NCCLS EP7-P Data to support clearance of Cartridge Chemistry assays new to the UniCel DxC Systems:

ALB Serum Interferences

Substance	**Source**	**Level Tested**	**Observed Effect[a]**
Hemoglobin	RBC Hemolysate	500 mg/dL	NSI[b]
Bilirubin	Porcine	30 mg/dL	NSI
Lipemia	Human	+4 (visual)	NSI

CREA Serum Interferences

Substance	Source	Level Tested	Observed Effect[a]
Hemoglobin	RBC Hemolysate	500 mg/dL	NSI[b]
Bilirubin	Porcine	15.0 mg/dL 22.5 mg/dL	NSI -0.5 mg/dL
Lipemia	Human	+4 (visual)	NSI
Acetoacetate	Lithium salt	20 mg/dL	NSI
Pyruvate	Pyruvic acid	10 mg/dL	NSI
Methyl Dopa	Methyl dopa HCl	5 mg/dL	NSI
Gentisic Acid	2,5-dihydroxybenzoic acid	50 mg/dL	NSI
Cephalothin	7-[2-thienylacetamido]-cephalosporanic acid sodium salt	100 mg/dL	NSI
Cefotaxime	Sodium salt	50 mg/dL	NSI
Cefoxitin	Sodium salt	12.5 mg/dL 25.0 mg/dL	NSI +0.7 mg/dL
Cephalosporin	Zinc salt	10 mg/dL	NSI

TP Serum Interferences

Substance	Source	Level Tested	Observed Effect[a]
Hemoglobin	RBC Hemolysate	500 mg/dL	NSI[b]
Bilirubin	Porcine	30 mg/dL	NSI
Lipemia	Human	4+ (visual)	NSI
Dextran	Dextran 40	7,500 mg/dL	NSI
Fluorescein	NA[c]	25 mg/L	-1.8 g/dL
Methyl Dopa	Methyl dopa HCl	5.0 mg/dL	NSI
Sulfasalazine (Azulfidine)	NA	7.5 mg/dL	-2.4 g/dL

[a] Plus (+) or minus (-) signs in this column signify positive or negative interference.
[b] NSI = No Significant Interference (within ± 0.4 g/dL or 4% for ALB and CREA and within ± 0.6 g/dL or 6% for TP)

f. Assay cut-off:
The qualitative determination of Benzodiazepine in human urine has a cutoff value of 200 ng/mL (oxazepam).

2. Comparison studies:

a. Method comparison with predicate device:
Method comparison experiments were designed using NCCLS Procedure EP9-A and employed Deming regression analysis to assess the data.

UniCel DxC 800 System vs. SYNCHRON LX20 PRO Serum
Correlation Study for test system equivalence

Modular Assays	N	Slope	Intercept	R	Cartridge Assays	N	Slope	Intercept	R
NA	164	0.987	1.99	0.996	CRPH	94	1.024	-0.03	0.999
K	161	0.993	0.07	0.998	FE	141	1.002	-0.16	1.000
CL	194	1.005	-0.86	0.997	LD	181	1.005	5.54	0.999
CO2	219	1.043	-1.05	0.994	MG	175	0.969	0.04	0.999
CAL	184	1.007	-0.03	0.999	PHE	91	0.981	0.02	0.998
ALBm	158	0.990	0.05	1.000	URIC	112	1.017	-0.08	1.000
BUNm	111	0.985	0.31	1.000					
CREm	137	1.037	-0.01	1.000	Qualitative Drug Assay (urine)				
GLUm	199	1.006	-0.11	1.000	BENZ	+	-	Agreement	
PHOSm	198	1.004	0.02	0.999	+	43	0	100%	
TPm	191	0.992	0.08	0.996	-	0	57		

Data to support clearance of Cartridge Chemistry assays new to the UniCel DxC Systems:

Candidate	Platform	Slope	Intercept	r	n	Predicate Method
ALB Reagent	DxC 600	0.978	-0.07	0.995	150	Beckman Coulter SYNCHRON CX
	DxC 800	0.960	0.00	0.996	152	Systems ALB Assay
CREA Reagent	DxC 600	0.949	0.03	1.000	169	Beckman Coulter SYNCHRON CX
	DxC 800	0.962	0.03	1.000	150	Systems CREA Assay
Urine						
CREA Reagent	DxC 600	1.031	2.6	0.999	73	Beckman Coulter SYNCHRON CX
	DxC 800	1.002	3.7	0.999	75	Systems CREA Assay
TP Reagent	DxC 600	0.991	-0.04	0.997	163	Beckman Coulter SYNCHRON CX
	DxC 800	0.971	0.10	0.996	170	Systems TP Assay

b. Matrix comparison:
Serum versus plasma studies were performed to substantiate the use of anticoagulants:

ALB Anticoagulant Study Summary

System	Anticoagulant	Level of Anticoagulant Tested	Deming Regression Analysis
DxC 600	Lithium Heparin	14 units/mL	Y = 0.979X + 0.13; r = 0.996
	Sodium Heparin	14 units/mL	Y = 0.990X + 0.06; r = 0.994
	EDTA	1.5 mg/mL	Y = 0.922X + 0.12; r = 0.995
DxC 800	Lithium Heparin	14 units/mL	Y = 1.006X - 0.01; r = 0.996
	Sodium Heparin	14 units/mL	Y = 0.988X + 0.08; r = 0.994
	EDTA	1.5 mg/mL	Y = 0.923X + 0.11; r = 0.995

CREA Anticoagulant Study Summary

System	Anticoagulant	Level of Anticoagulant Tested	Deming Regression Analysis
DxC 600	Lithium Heparin	14 units/mL	Y = 0.985X + 0.02; r = 0.999
	Sodium Heparin	14 units/mL	Y = 1.006X - 0.02; r = 0.999
	EDTA	1.5 mg/mL	Y = 0.953X + 0.03; r = 0.999
DxC 800	Lithium Heparin	14 units/mL	Y = 1.020X - 0.03; r = 0.999
	Sodium Heparin	14 units/mL	Y = 1.005X + 0.01; r = 0.996
	EDTA	1.5 mg/mL	Y = 0.956X + 0.03; r = 0.999

TP Anticoagulant Study Summary

System	Anticoagulant	Level of Anticoagulant Tested	Deming Regression Analysis
DxC 600	Lithium Heparin	14 units/mL	Y = 0.923X + 0.75; r = 0.989
	Sodium Heparin	14 units/mL	Y = 0.945X + 0.65; r = 0.984
DxC 800	Lithium Heparin	14 units/mL	Y = 0.962X + 0.47; r = 0.991
	Sodium Heparin	14 units/mL	Y = 0.960X + 0.52; r = 0.989

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:
Confirmatory studies were designed in accordance with NCCLS Document C28-A. Data to support clearance of Cartridge Chemistry assays new to the UniCel DxC Systems:

ALB Reference Interval

Sample Type	SYNCHRON ALB Assay	REFERENCE INTERVAL
Serum/Plasma	CX	3.5 – 5.0 g/dL
	DxC 600/800	3.5 – 5.0 g/dL

CREA Reference Interval Summary

Sample Type	SYNCHRON CREA Assay	REFERENCE INTERVAL
Serum/Plasma	CX	0.6 – 1.3 mg/dL
	DxC 600/800	0.6 – 1.3 mg/dL
Urine	CX	11 – 26 mg/kg/24 hours
	DxC 600/800	11 – 26 mg/kg/24 hours

TP Reference Interval Summary

Sample Type	SYNCHRON TP Assay	REFERENCE INTERVAL
Serum/Plasma	CX	6.5 – 8.1 g/dL
	DxC 600/800	6.5 – 8.1 g/dL

N. Instrument Name:
UniCel® DxC 600 SYNCHRON® Clinical System
UniCel® DxC 800 SYNCHRON® Clinical System

O. System Descriptions:

1. Modes of Operation:
The UniCel DxC 600 and 800 Systems are self-contained random access general clinical chemistry analyzer systems, utilizing Spectrophotometry and Electrochemistry technology. The Chemistry Analytical Unit and Computer Console are integrated to comprise two major analytical components and eight major functional subsystems controlled via distributed, networked, multi-processor control architecture. There is an Optics/Reaction Subsystem of 10 wavelength flash photometer for cartridge chemistry methodologies and 125-cuvette reaction wheel; optional near-infrared module for large particle immunoassays.

2. Software:

FDA has reviewed applicant's Hazard Analysis and software development processes for this line of product types:
Yes ___X____ or No _____

3. Sample Identification:
   Bar-Code
4. Specimen Sampling and Handling:
   Standard components (probes, mixers, wash cups, racks, shuttle, bar code readers) plus Cap Piercing and Obstruction Detection assemblies.

5. Assay Types:

   Flow cell modules use ion selective electrode (ISE) and photometric electrochemical technologies for specific analyte modular assays. Cartridge Chemistry assays utilize spectrophotometric techniques, two different measurements modes can be used: Endpoint measurement (equilibrium methods) and Rate measurements (kinetic methods).

6. Reaction Types:

Reaction Type	Description
Upgoing	Absorbance increases as reaction progresses.
Downgoing	Absorbance decreases as reaction progresses.
Endpoint	Reaction comes to completion before the absorbance measurements are taken and is expressed as absorbance (A).
Rate	Reaction is in progress when the absorbance measurements are taken and is expressed as a rate (delta A/minute).
Blanked	Sample/reagent or reagent measurement is subtracted from the reaction measurement. The difference is used in the calculation for sample recovery using either delta absorbance or delta rate.
Non-blanked	Only the measurement taken during the reaction is used in the calculation for sample recovery.
Non-triggered	The reaction is initiated by the addition of sample to the cuvette that already has all the reagents needed for the reaction to take place.
Triggered	The reaction is initiated by a reagent component added to the cuvette after sample addition.
Double Triggered	The reaction scheme call for 2 reagent additions to take place after the sample is added to the cuvette.

7. Calibration:
   System calibration is accomplished by testing a single analyte concentration which is contained in a specific calibrator. Calibration determines the relationship between measured reaction responses and known concentrations.

Calibration factors are derived from this relationship. These factors are used to convert the reaction responses to final concentration results.

System calibration adjustment is accomplished when the DxC reads a reagent lot specific parameter card that contains the calibration curve fit parameter. Calibrator and diskette can then be loaded to run the calibration and update the calibration information for patient sample and control value determinations.

Calibration chemistries include endpoint, first order rate, nonlinear, and qualitative cutoff reactions. Zero-order rate chemistries include enzymes which use extinction coefficients (of coenzymes or chromophore, of either substrate or end product), and require no routine calibration. Enzyme verification can be performed on some of the enzymes to conform to International Federation of Clinical Chemistry (IFCC) guidelines at 37^{o}C.

Some calibrators are primary standards with values that do not change from lot-to-lot. Other serum-based calibrators require value assignment. These calibrators come packaged with a diskette containing the lot-specific data. A calibration sequence uses from one to six levels of calibrators. The number of calibrators used is chemistry dependent.

Calibration of endpoint and first-order rate chemistries uses either a single-level calibrator or a two-level calibrator kit. Each analyte in the calibrator solution has a known concentration value. For most calibrated cartridge chemistries with a linear response, the system will set calibration factors based on four calibrator replicates per calibrator level. The system discards the high and the low replicates and uses the remaining two values as the usable calibrator replicates. Other chemistries may require calibration based on two calibrator replicates per calibrator level, where no replicates will be discarded. The average value of the calibrator replicates is used to determine the calibration factor.

Many drug and specific protein assays are non-linear chemistries. For these assays with non-linear responses, the calibration curves may exhibit a logarithmic or other non-linear relationship. Curve fitting interpolation techniques are employed to construct these calibration curves. Multi-point chemistry calibration consists of five or six different levels of calibrators. These chemistries set calibration based upon single replicates of each calibrator level.

The qualitative drugs of abuse testing (DAT) assays require three levels of calibrators. The calibration measures the response separation between calibrators to measure reagent integrity; the calibration factor generated is non-functional for sample result calculation. The cutoff value for each DAT chemistry represents the mean reaction rate of the low calibrators. The reaction rate of the samples is compared to the reaction rate of the low (cutoff) calibrator and reported out as POSITIVE or NEGATIVE.

Enzyme verification is used as a means of adjusting enzyme chemistry results to report IFCC equivalent values. Verification is similar to calibration except that normalization factors are applied to the sample result in the form of a slope and offset adjustment, whereas calibration factors would be applied to the reaction response.

Modular chemistries are calibrated using two to three levels of calibrator (chemistry dependent). Four replicates per level are assayed. As with the cartridge chemistries, data from the two middle replicates of each level is used to set the system response. Error checks are performed on the two middle replicates to verify successful calibration.

8. Quality Control:
   Has a built in quality control program

P. Other Supportive Instrument Performance Characteristics Data Not Covered In The "L. Performance Characteristics" Section Of The SE Determination Decision Summary:

Not Applicable

Q. Conclusion:

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