



**Analytical**<sup>®</sup>  
Technologies Ltd.

# Amino Acid Analyzer



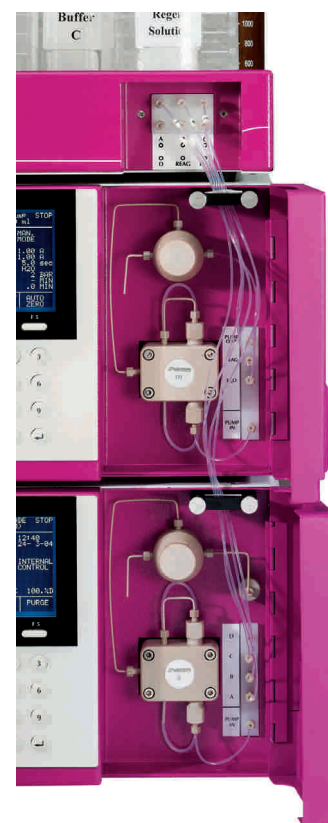
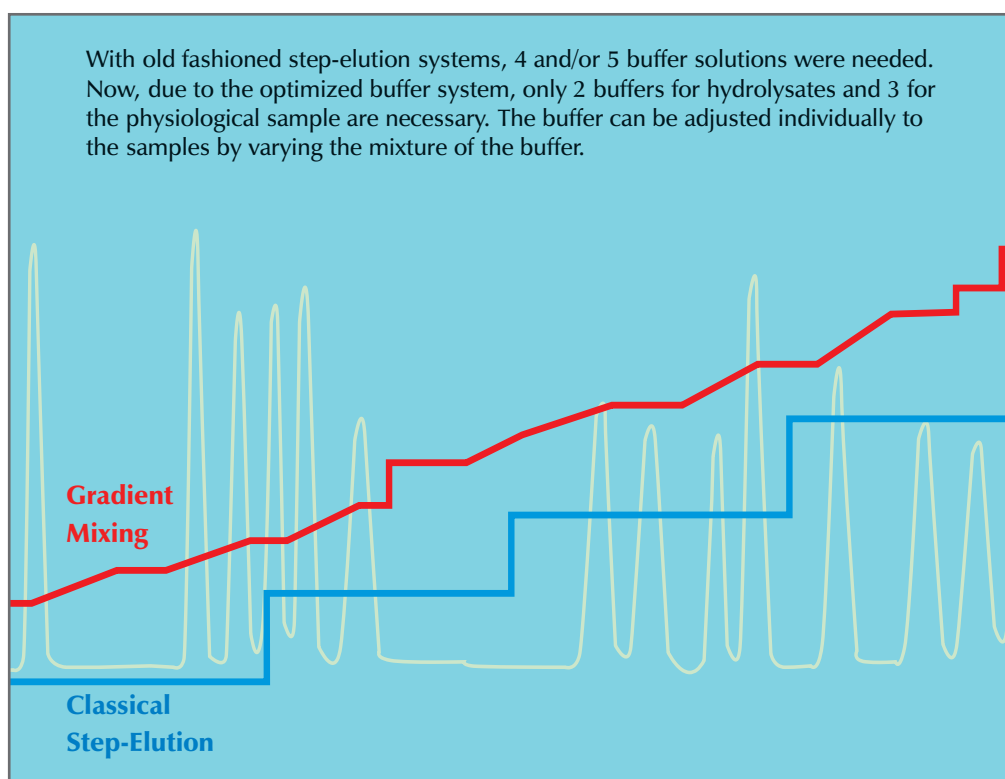
**AT 2433**

# Automatic Amino Acid Analyzer AT 2433

The innovative automatic Amino Acid Analyzer AT 2433 combines the advantages of the classical ion exchange separation method with the modern technique of high performance liquid chromatography. The complete package of sophisticated instrumentation, a wide variety of prepacked and tested separation

columns, combined with optimized ready-to-use buffer solutions and chemicals, creates the right answer for any routine or research problem in amino acid determination. More than 30 years experience in developing and operating sophisticated amino acid analyzers results in unmatched performance.

pulsation-reduced solvent and Ninhydrine delivery through two independent completely inert dual-piston pumps



## Multistep Separation

Only two or three buffer solutions have to be combined to form the best optimized buffer profile at any part of the separation program. No more compromises by the limitation to four or five buffer changes.

## Cooled Reagent Storage

All buffer solutions, as well as the Ninhydrine reagent are stored under inert gas pressure in a refrigerated cabinet to avoid oxidation and air contamination independent of the ambient environment.

## Integrated Autosampler

with a capacity of 120 vials in a cooled sample tray. Volumes from 1  $\mu$ l to 100  $\mu$ l can be injected without any loss of sample. The injected volume is adjusted by a high

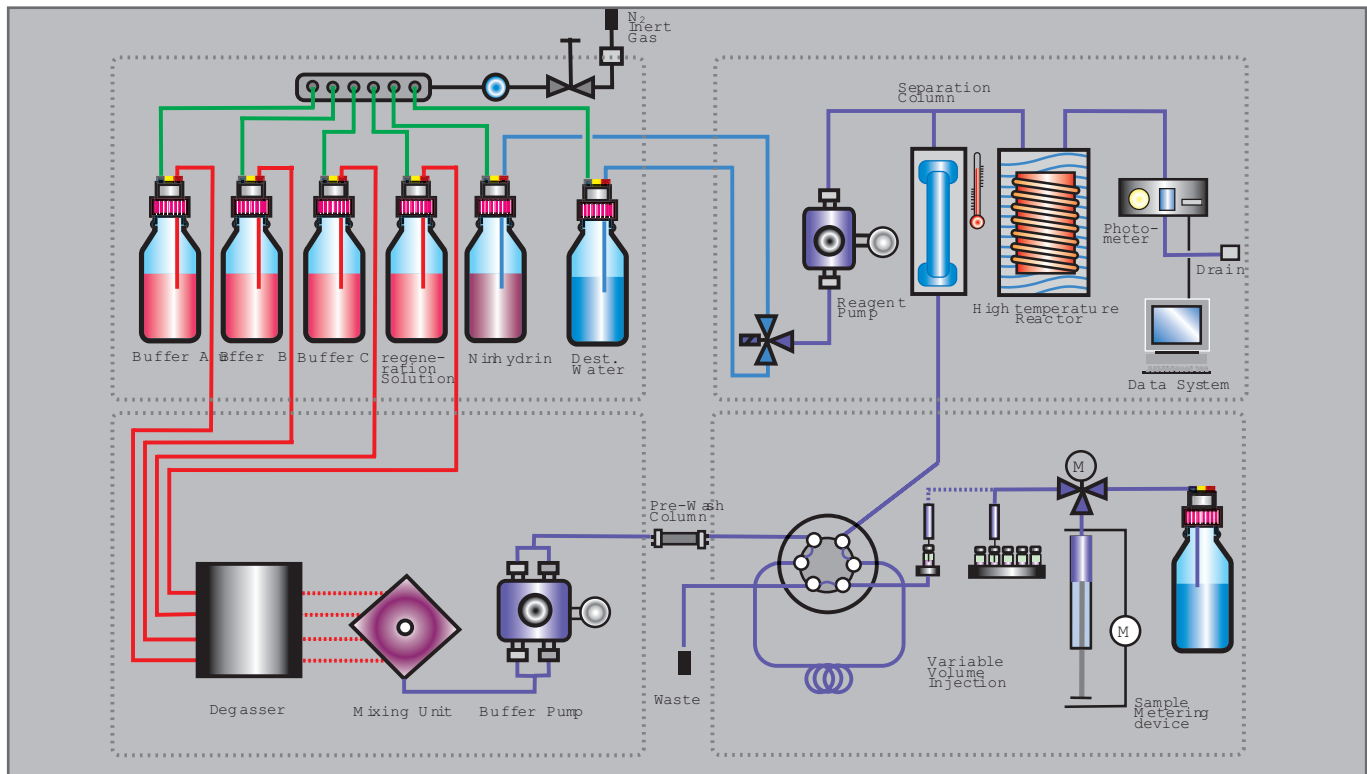
precision syringe, driven by a stepper motor with a resolution of 17 steps per  $\mu$ l. A programmable wash program will flush the entire injection system to avoid cross contamination of the sample.

## Integrated Vacuum Degasser

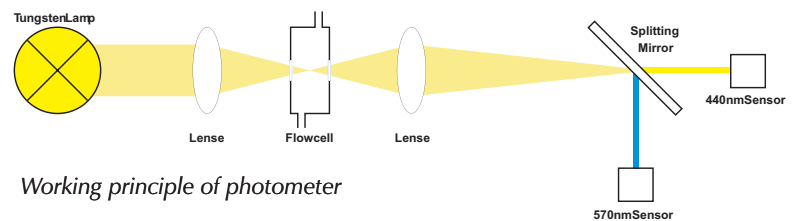
avoids the interruption of the buffer pump by air bubbles without the need of bubble traps with varying volumes, causing changes in retention times of the different amino acids.

## Separation Column Oven

integrated solid state column oven with fast heating and cooling capability with a temperature range from +5°C to +85°C independent of the ambient temperature. Up to twelve programmable temperature steps can be used during one separation program.



Flow Diagram AT 2433



Working principle of photometer

### High-Temperature Reactor

with a programmable temperature range from ambient to 185°C with a coiled capillary for the color reaction of the amino acid-ninhydrine complex. Automatic flushing of the reactor coil with a washing solution after each run prevents the blockage of the capillary.

### Integrated Reagent Dosing Pump

for Ninhydrine delivery and flushing of the reaction coil after each run. Programmable flow rate from 0.01 to 2.0 ml/min.

### Complete Inert Design

All materials coming into contact with the buffer solutions and reagents are made of inert materials as PEEK, PTFE, PVDF etc. Therefore, there is no need for using special non-corrosive buffer compositions or reagents.

### Integrated Dual-Channel Photometer

for the amino acid detection at 440 nm and 570 nm wavelengths. Summing option for both channels, for single channel integration of all amino acids.

### Safety Devices

control pump pressures, temperatures and leakages.

### Optional Application

- Post column derivatisation with OPA (needs an optional Fluorescence Detector)
- Carbohydrate determination for reducing sugars with Cu-bicinchoninate post-column derivatisation (except the separation column, no additional extras are needed)
- Polyamine determination with Ninhydrine or OPA post-column derivatisation.

# Modular System Design

The modular system design of the AT 2433 enables the budget-minded buyer to use several components as parts for a standard HPLC system without further costs. Another solution is our low-cost Amino Acid Analyzer AT 2430 with manual injection valve and ambi-

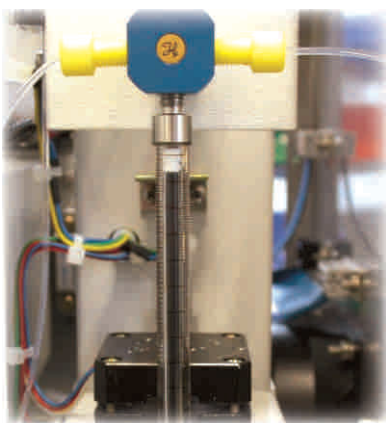
ent temperature reagent organizer, consisting of the same Amino Acid Reaction Module and Quaternary Gradient Pump as the AT 2433.



Sample Racks for up to 120 samples



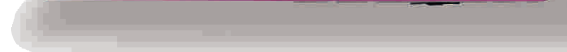
Exchangeable Sample Loop made of PEEK



Exchangeable Dosing Syringe

## \* Autosampler

- only inert materials come in contact with buffer solutions & samples (except sample needle)
- exchangeable sample loop (PEEK)
- fixed and variable volume injection mode
- integrated sample cooling
- up to 120 samples
- also usable as standard HPLC Autosampler
- optionally with pre-column derivatisation mode



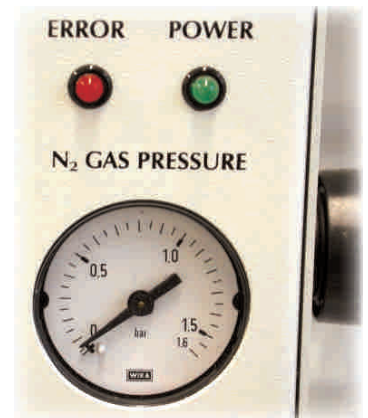
**\* Consumables**

- ready made buffer solutions (each lot tested individually)
- separation columns for a variety of applications with long term stability
- ready made Ninhydrin solution
- a variety of standard solutions



**\* Reagent Organizer**

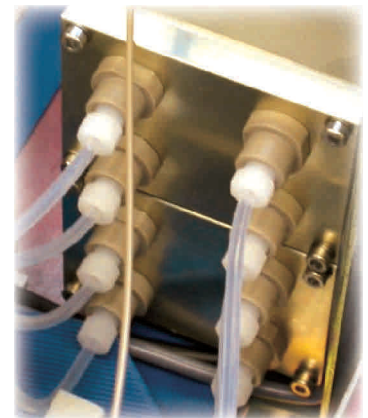
- inert gas (N<sub>2</sub>) supply with adjustable pressure to prevent buffer/reagent oxidation and contamination
- integrated cooling



Reagent Organizer Pressure Control

**\* Amino Acid Reaction Module**

- only inert materials come in contact with buffer solutions & samples
- integrated 2-plunger reagent dosing pump with a flow rate from 0.01 to 2.0 ml/min
- programmable reactor temperature
- integrated column oven with programmable temperature gradient and leakage sensor
- automatic washing of reactor coil with washing solution after the last sample
- integrated dual-channel photometer for the detection of amino acids at 440 and 570 nm.



Integrated Vacuum Degasser

**\* Quaternary Gradient Pump**

- only inert materials come in contact with buffer solutions & samples
- flow rate of 0.05 to 10.0 ml/min
- integrated 4-channel vacuum degasser
- more than 100 programmable gradient steps with a resolution of 0.1%
- two-plunger pump for smooth eluent delivery
- also usable as HPLC gradient pump

# Intuitive Software Control

Controlling the complex features of the S 433 is made easy and intuitive by the latest software technology. All status parameters are displayed on one screen. Further details like the gradient program steps or column oven temperatures can be displayed as separated tables. The use of an intuitive screen layout helps new users to start working with this software faster than ever before.

## \* Features

- Complete control of Gradient Program, Column & Reactor Temperature
- Programmable Sample Sequence with individual run times, gradient and temperature profiles
- Automatic usage control of Buffer & Reagent solutions
- Emergency-Program (SOS) feature in case of pressure errors
- Manual control of each single unit

The screenshot displays the Sykam Aminosäureanalysator software interface. It includes several windows and panels:

- Solvents & Reagents:** A table showing the status of various reagents.
 

Standard	Volume	Refill to
Buffer A	619 ml	
Buffer B	125 ml	
Buffer C	50 ml	
Buffer D	175 ml	
Ninhydrin	352 ml	
Water	932 ml	
Waste	1244 ml	
- Graphical Status Screen:** The main control panel showing a schematic of the instrument with real-time data:
  - Pressure: 6 bar
  - Status: HOLD
  - Flow: 0.25
  - Reagent Pump: 100.0
  - Gradient Pump: 46.0
  - Flow: 0.45 ml
  - Status: HOLD
  - Temperature: 35 °C, 120 °C
  - Photometer: 0.011 A, 0.000 A
  - 440 nm, 570 nm
- Gradient Pump Run Table:** A table showing the gradient program steps.
 

Nr.	Time	Flow	Solv A	Solv B
5	65	0.45	0	100
6	75	0.45	0	30
7	80	0.45	0	0
8	120	0.45	0	0
9	120.1	0.45	0	0
10	125	0.45	0	0
11	125.1	0.45	100	0
12	125.2	0.45	100	0
13	150	0.45	100	0
- Amino Run Table:** A table showing the sample sequence.
 

Valve	Temp
Ninhydrin	35
Ninhydrin	35
Ninhydrin	40
Ninhydrin	50
Ninhydrin	64
Ninhydrin	74
Ninhydrin	74
Water	74
Water	74
Water	35
Water	35
- Sample Sequence Table:** A table showing the injection sequence.
 

Inj.	Volume	RunTime
1	50	145

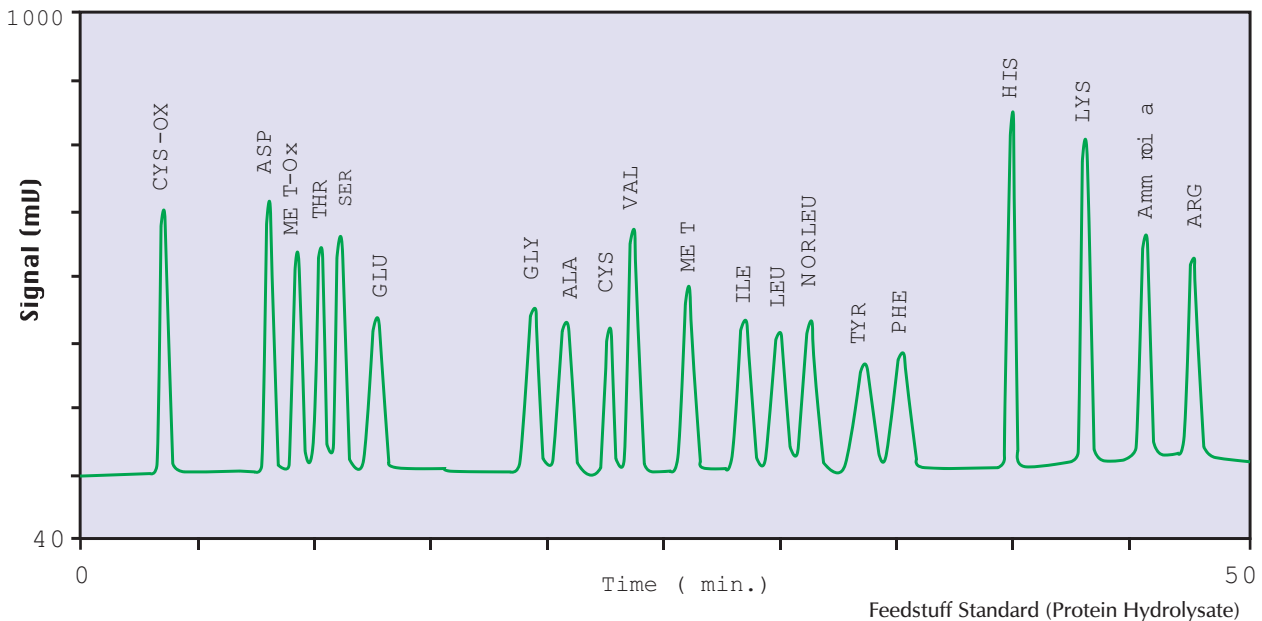
Buffer & Reagent Usage Control

Temperature Details

Gradient Program Details

Graphical Status Screen

Sample Sequence



Feedstuff Standard (Protein Hydrolysate)

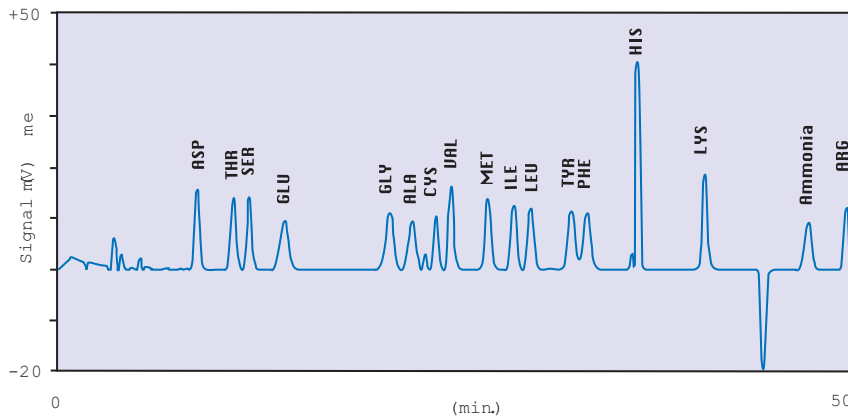
# High Precision & Reproducibility

The Amino Acid Analyzer's innovative design leads to both, a high sensitivity and a high degree of reproducibility. Every single instrument of the system is optimized in its role to provide the best achievable results. The flexible design of each instrument allows the user to

change all important parameters to fit the desired application from protein hydrolysates, physiological fluids to sugar analysis and biogenic amines.

## Gradient System Accuracy

Flexibility does not lead to inaccuracy. The use of the AT 2100 Solvent Delivery System leads to highly reproducible results while granting all the flexibility of a quaternary gradient pump. Neither the retention times, nor the linearity of the injected amounts are negatively influenced by the use of gradient buffer delivery as the following examples demonstrate:



**High Sensitivity**  
100 pMol / each Amino Acid  
(with baseline subtraction)

Level	Area	t	Amoun	Linearity
1	1727.800			10 %
2	4265.700			25 %
3	8445.800			50 %
4	12675.400			75 %
5	17102.907			100 %

(Aspartic Acid) 99.94 %

## Accurate Retention Times

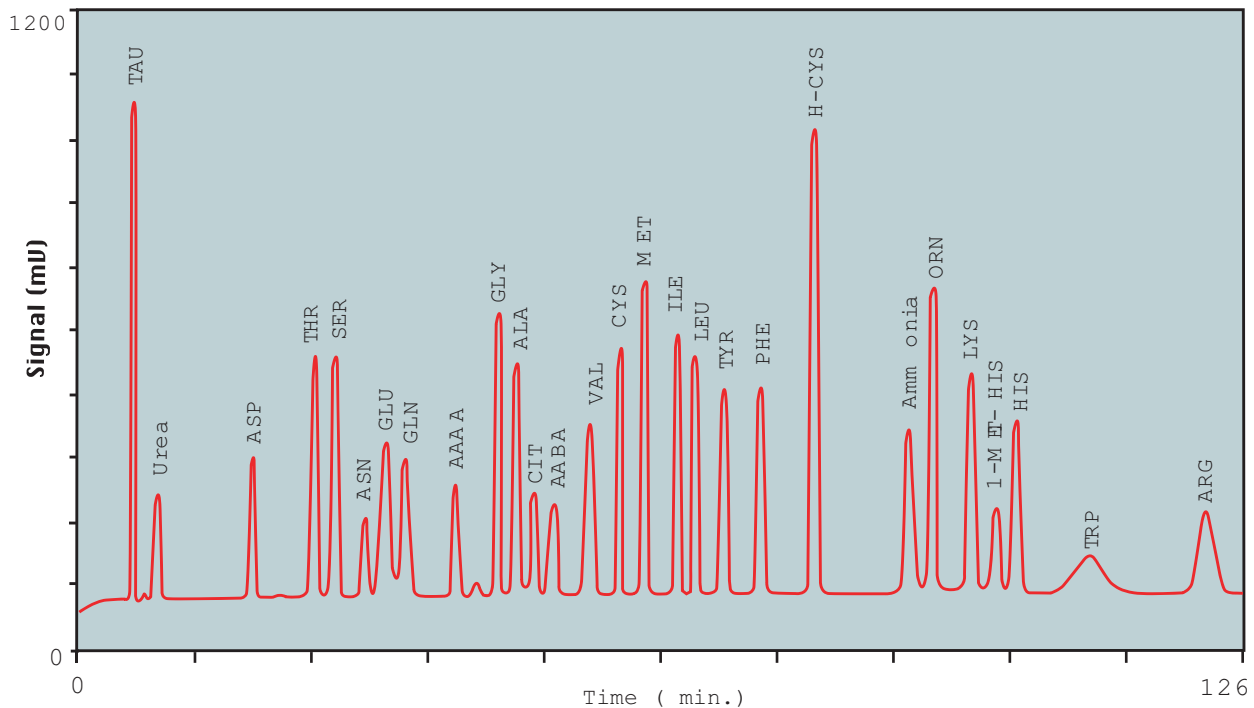
Amino Acid	Retention Time	RSD
Aspartic Acid	9.793750 min.	0.0%1
Serine	13.143750 min.	0.0%1
Glycine	22.215625076 min.	
Tyrosine	38.243750%5 min.	
Histidine	46.612500.0%1 min.	
Lysine	46.037500 min.	0.0%9

Protein Hydrolysate sample sequence of 8 injections

## High Reproducibility

Amino Acid	Concentration	RSD
Aspartic Acid	98.097250 mol/l	1.3%2
Serine	98.109625	1.3%0
Glycine	98.516125	1.1%5
Tyrosine	97.900000	1.4%6
Histidine	96.960001	1.8%5
Lysine	98.621000	1.3%8

Protein Hydrolysate sample sequence of 8 injections



Physiological Fluids Standard (PH-S)

The AT 2433 system includes an autosampler with cooled sample storage and partial loop fill technique without sample loss, as well as a 2-plunger buffer pump, a dual beam photometer, a column oven with active cooling

capabilities, a Ninhydrine pump, a 4-channel vacuum degasser and a refrigerated reagent organizer with integrated inert gas application system.

### TECHNICAL SPECIFICATION

#### \* Refrigerated Reagent Organizer AT 7130

- for storing all reagents, buffers and wash solutions.
- front side operated
  - special valves for applying inert gas for oxygen-free storage

#### \* Autosampler AT 5200

- for automatic injection of samples. All parts which come in contact with liquids are chemically inert and biocompatible (PEEK or PTFE).
- sampling system operating in x, y, and z-axis
  - variable sample dosage without any sample loss
  - loop overflow mode
  - reproducibility less than 1 % upon injection of 10  $\mu$ l variable volume.
  - memory effect less than 0.1 % depending on the selected washing procedure
  - large graphical display and keyboard for easy control
  - injection volume programmable in 1  $\mu$ l increments
  - temperature controlled sample compartment (5 - 60° C)
  - programmable washing procedure with selectable volumes
  - programmable port for purging
  - programmable sample sequence
  - optional: pre-column derivatisation mode

#### \* Solvent Delivery System AT 2100

- Quaternary Pump for the reliable and reproducible mixing of the buffer solutions. All parts coming into contact with the buffers are chemically inert (PEEK or PTFE).
- dual plunger pump with special design for low pulsation (less than 1 %)
  - flow range depending on installed pump head (0.05 to 9.99 ml/min)
  - maximum pressure up to 350 bar (5200 PSI)
  - battery buffered programs stored for the amino acid determination (hydrolysates and physiological fluids)
  - graphic display of gradient profile A, B, C, and D
  - programmable mixing cycle for the buffer solution
  - integrated 4-channel vacuum degasser
  - programmable flushing procedure
  - extended diagnostic features (e.g. high pressure control, low pressure control)

#### \* Amino Acid Reaction Module

- integrated 2-plunger reagent dosing pump with adjustable flow rate (0.01 to 2.0 ml/min)
- built-in dual filter photometer (440 and 570 nm) with constant signal output and signal summary option
- programmable signal offset
- three different risetimes selectable
- temperature controlled column oven (1 to 99° C  $\pm$  1° C) with active cooling capability
- temperature controlled post-column derivatisation reactor (up to 199° C  $\pm$  1° C)
- automatic valve for coil flushing
- display of the actual system pressure
- safety features (e.g. leakage of reactor and column, high pressure)

#### \* Additional Applications

- Sugar analysis for reducing sugars
- biogene amines

#### \* Analytical Specifications

- Hydrolysate sample: < 60 min. runtime
- Physiological sample: < 120 min. runtime
- sensitivity: 10 pMol

#### \* Options

- optional Fluorescence detector



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#### Corporate & Regd. Office :

Analytical House, # E67 & E68, Ravi Park, Opp. Sainath Park, Vasna Road, Baroda, Gujarat - 390 015. INDIA  
Tel : 0265-2253620/2252839 Tel Fax : 0265-2254395 E-mail : info@hplctechnologies.com / info@ais-india.com  
Web : [www.ais-india.com](http://www.ais-india.com) / [www.hplctechnologies.com](http://www.hplctechnologies.com) / [www.analyticalgroup.net](http://www.analyticalgroup.net)

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