# Sykam Chromatography System Ökoline

## Pumps and Solvent Delivery Systems


SYKAM

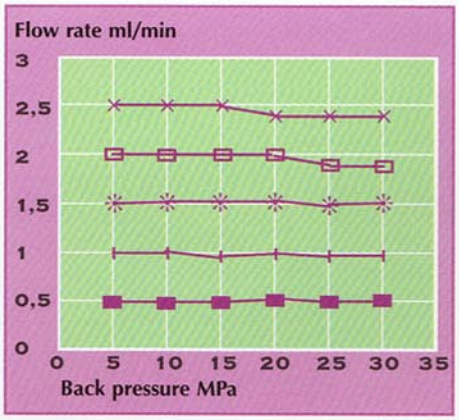
CHROMATOGRAPHY

# Sykam HPLC Pump S 1121- the perfect basic component for liquid chromatography

**This pump combines proven and reliable technology with the latest in electronic design to a programmable solvent delivery system.**

### The Concept

The HPLC pump S 1121 is a dual plunger solvent delivery system. The mechanical design includes short plunger stroke technology with only two check valves. This results in low pulsation, typically observed with dual plunger pumps and high reliability otherwise achieved only by single plunger pumps.




**Pressure depending volume delivery**

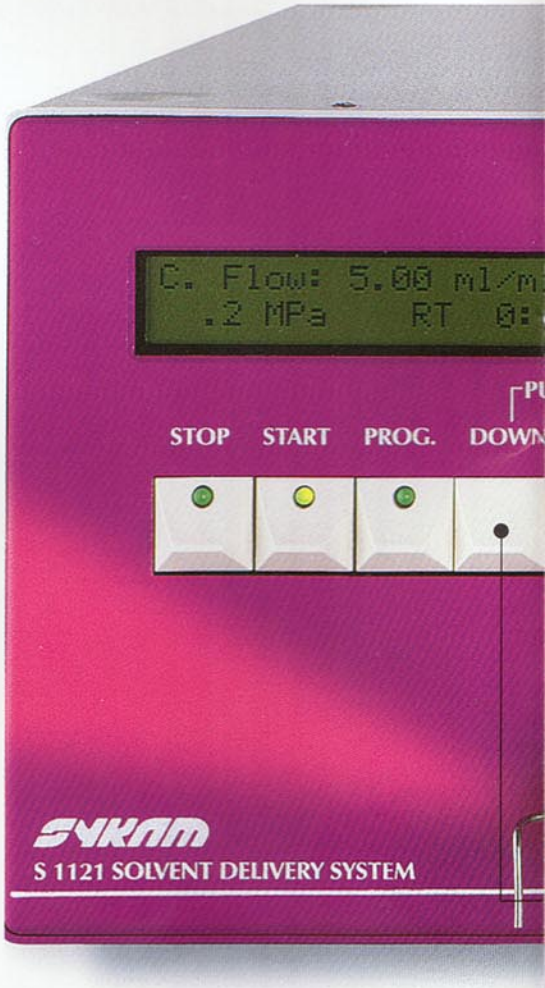
The delivery plunger performs a two mm stroke, the compensation plunger makes one mm. The nearly pulseless solvent delivery of the pump results from the high stroke frequency and the use of the compensation plunger. The two plungers are counter rotating installed. While the delivery plunger pushes out the solvent volume, the compensation plunger, located on the pressure side, collects half of the volume. During the return movement of the delivery piston, the collected volume is pumped from the compensation plunger.

The microprocessor controlled speed regulation leads to a very stable speed of the D.C. motor, driving the plungers. Additionally, an integrated calculation software continuously corrects the pressure dependent differential between the preset and actual flow rates. This results in a very constant volume delivery throughout the entire range, independently of the resulting back pressure.

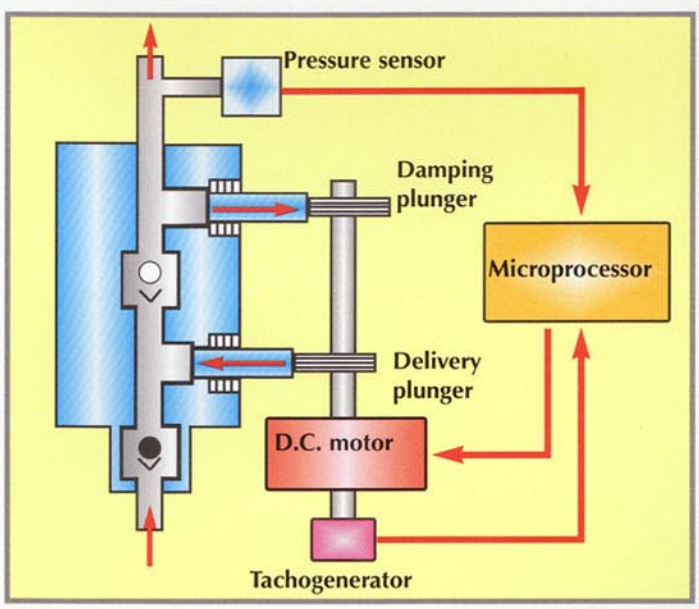
Through the alphanumerical display, the pump's parameters are shown in clear text and the user can easily control or change the data.

The programming is easily done by a stepwise dialogue. There is basically a choice between two operation modes. The delivery with „constant flow", and the delivery with „constant pressure". Normally, the constant flow delivery is used for analytical purposes and the constant pressure mode for specific operations, e.g. column packing etc. The following parameters can be programmed for the respective modes:

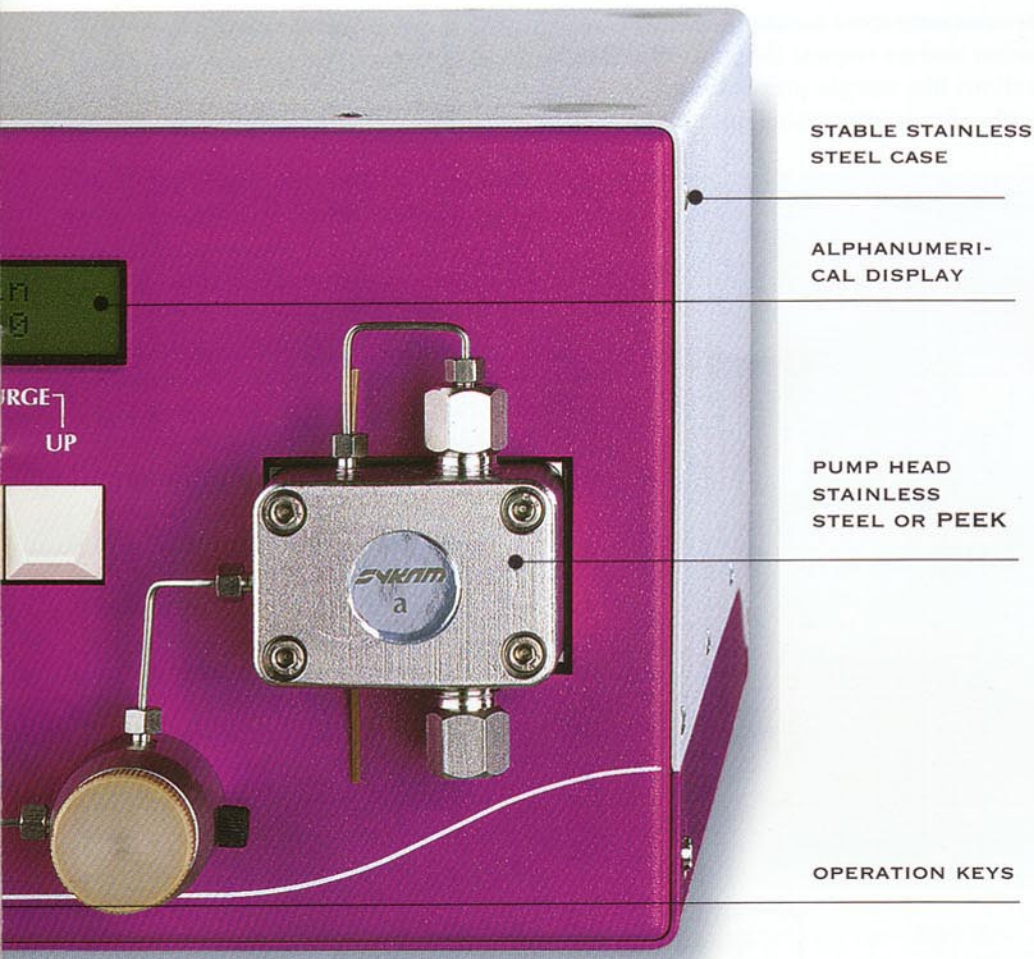
**constant flow mode:**
constant flow in ml/min, minimum pressure level (time delayed), maximum pressure level, compressiblity factor from 0.7 (for methanol) up to 1.0 for aqueous solutions, run time from 1 - 999 minutes, delay time from 1 - 999 minutes, time ramp for soft-start, time ramp for soft-stop.




**constant pressure mode:**
constant pressure, maximum flow in ml/min, run time from 1-999 minutes, delay time from 1-999 minutes.

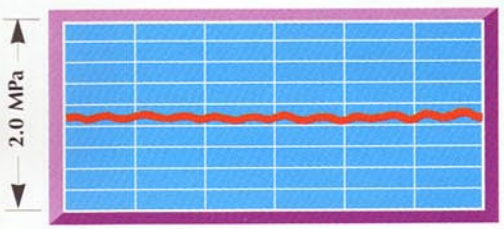



**Function diagram of the solvent delivery system**

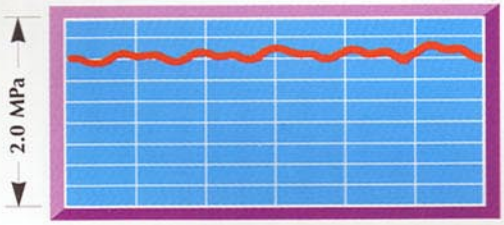



**The HPLC pump S 1121 includes in addition to the internal control interface a serial interface RS 232C and an analog pressure oulet signal.**

**Pressure fluctuation without any pulsation damper**




**2.0 ml/min/16.0 MPa**




**1.0 ml/min/16.0 MPa**

| SPECIFICATIONS | |
|---|---|
| FLOW RATE: | ANALYTICAL 0.10 TO 9.95 ML/MIN<br>MICRO 0.02 TO 4.00 ML/MIN<br>PREPARAT. 0.40 TO 40.0 ML/MIN |
| PULSATION: | LESS THAN 1 % |
| PRESSURE: | ANALYTICAL 40 MPA (400 BAR)<br>MICRO 40 MPA (400 BAR)<br>PREPARAT. 20 MPA AND/OR 40MPA |
| DISPLAY | LCD APLHANUMERICAL DISPLAY 2 X 24 CHARACTERS |
| COMPRESSIBILITY FACTOR: | FROM 0.7 TO 1.0 |
| OPERATION MODES: | CONSTANT FLOW, CONSTANT PRESSURE |
| REMOTE CONTROL: | FLOW RATE, START, STOP |
| PROGRAMMABLE RUN TIME: | 00:01 TO 99:59 H |
| PROGRAMMABLE DELAY TIME: | 00:01 TO 99:59 H |
| START RAMP: | 00:01 TO 2:30 H |
| STOP RAMP: | 00:01 TO 2:30 H |
| SAFETY CONTROL: | MAX. AND MIN. PRESSURE; POWERFAILURE |
| ERROR MESSAGES: | POTENTIAL FREE CONTACT CLOSURE, ACOUSTIC AND OPTICAL ALARM SIGNAL |

## Performance Characteristics:

**Time-Saving.** Based on the internal programming of start, stop and delay functions, time consuming operations like equilibration of new columns, setting up a system etc., can be performed outside of the office hours, without any external programming device.

**Safety Features.** Minimum and maximum pressure levels can be programmed independently. If the back pressure of the system exceeds the preset maximum level, the pump will stop immediately to avoid any damage to the system. If the pressure falls below a preset minimum level; however, the pump stops only if the pressure remains below such level for more than one minute. High pressure or low pressure error messages will be displayed in clear text.

**Rinsing Function for Pump Plungers.** When running the pump with buffer solutions, the plunger can be rinsed by deionized water to avoid formation of salt crystals on the sapphire plunger. This will increase the lifetime of the plunger as well as that of the plunger seals.

**Flexibility.** Extensive accessory program for pump heads makes the pump applicable for any type of volume delivery required in liquid chromatography. Flow rates from 0.02 ml/min up to 40 ml/min can be utilized. Both, constant volume and constant pressure modes are available in all S 1121 pumps.

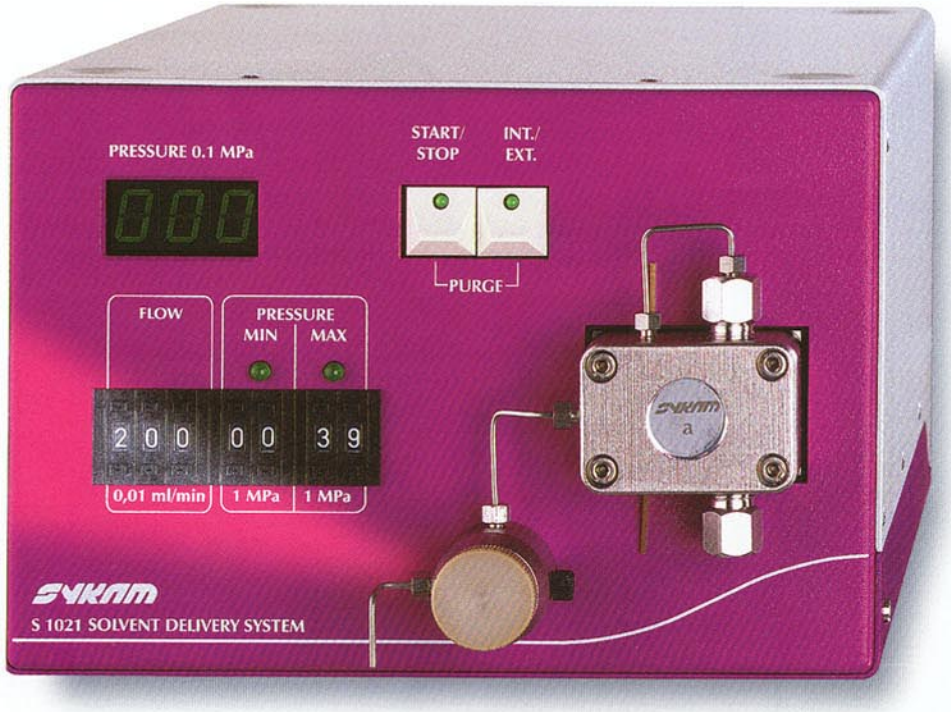
**Biocompatible.** For applications with corrosive liquids or in situations where metal ions are affecting the separation, the stainless steel pump head can be exchanged for a pump head made of PEEK (pressure rating up to 40 MPa). Other materials on request.

**Programmable Soft-Start and Soft-Stop Functions.** For improvements in column lifes, the flow can be ramped up slowly (from 0 to 2.5 minutes) to a working flow rate. Another independent flow ramp can be programmed for stopping the pump from the operating flow rate down to zero.

**The HPLC Pump S 1121** is controlled externally by a D.C. signal as well as by a serial interface RS 232C.

# Sykam HPLC Pump S 1021/S 1011- the economical solution for liquid dispensing in routine operation

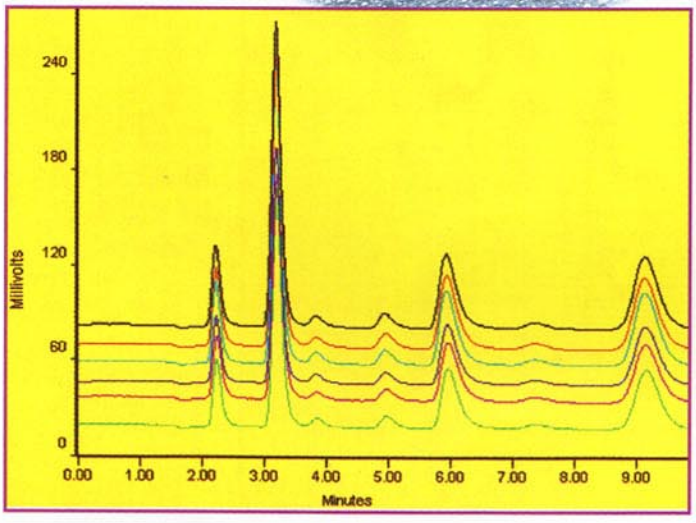
**These favourable-priced pump models are not only used for standard HPLC applications. The flow stability, low pulsation and on request the biocompatible version predestinates these pumps for operations like sample preparation, post-column derivatization and various other liquid dispensing operations.**




The speed of the powerful D.C. motor driving the plungers is controlled through a digital speed converter in combination with an accurate electronic speed controller. This makes a very stable and accurate constant flow possible. As the linearity of the flow range depends very much on the back pressure of the system, measured back pressure is used as an additional control parameter for the electronic regulator. This results in a constant flow delivery independent of the back pressure. The pump can be controlled externally by a TTL signal for the start/ stop function or for the remote control of the flow rate by an external D.C. signal. Error messages are shown by control LEDs on the front panel and are available in form of a relay contact through the interface connector in the rear.

**The HPLC pump S 1021** is a dual plunger solvent delivery system with the same mechanical design like the model S 1121. Three interchangeable pump heads make the high dynamic solvent delivery range of 0.01 - 40 ml/min possible. All settings are reduced to a minimum and can be easily and clearly controlled with the digital switches. Furthermore, the LED display shows continuously the actual back pressure of the delivery system.

**The HPLC pump S 1011**
For economical reasons, the pump 1011 is equipped with only one single plunger, driven by a specifically de-signed plunger driving cam. Compared to other simple 1-plunger pumps, the model S 1011 shows strongly reduced pulsation caused through the fast refill technique combined with a high frequency operation. This type of pump can be used for the majority of HPLC applications.



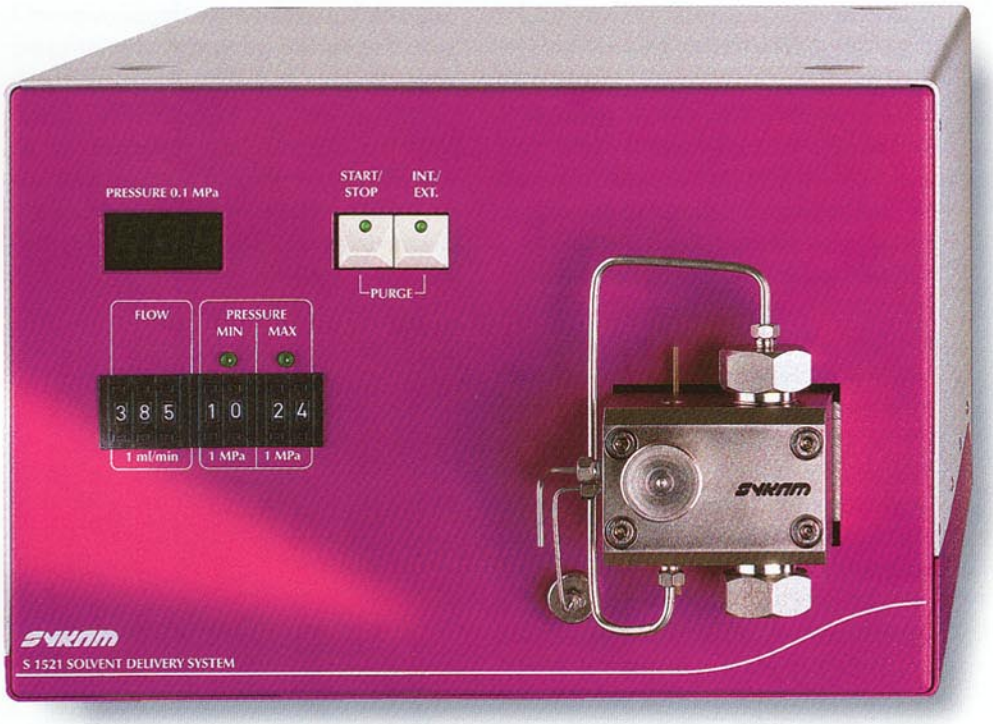

Flow stability

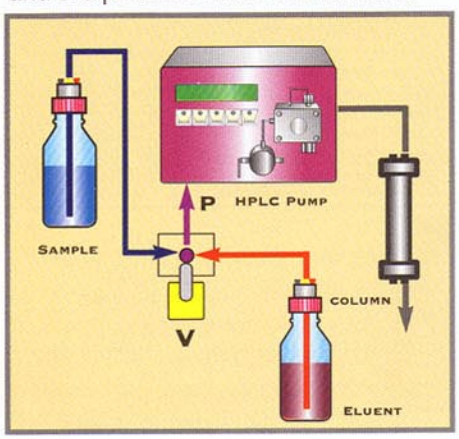
| SPECIFICATIONS S 1021/1011 | | |
|---|---|---|
| FLOW RATE: | ANALYTICAL | 0.05-8.00 ML/MIN |
| | MICRO | 0.01-3.00 ML/MIN |
| | SEMI-PREPARATIVE | 0.5-30 ML/MIN |
| PRESSURE: | ANALYTICAL | 40 MPA (400 BAR) |
| | MICRO | 40 MPA (400 BAR) |
| | SEMI-PREPARATIVE | 20 AND/OR 40 MPA |
| PUMP HEADS: | STAINLESS STEEL OR PEEK | |
| PULSATION: | S 1021 LESS THAN 1%<br>S 1011 LESS THAN 10% | |
| DISPLAY: | 3 DIGIT LED | |
| OPERAT.MODE: | CONSTANT FLOW | |
| REMOTE CONTROL: | FLOW RATE, START, STOP | |
| SAFETY CONTROL: | MAX. AND MIN. PRESSURE | |
| ERROR MESSAGES: | POTENTIAL FREE CONTACT CLOSURE, OPTICAL SIGNAL | |

# Sykam Preparative HPLC Pumps S 1521/S 1511 - utilization from pilot plant up to even production scale

**The dual plunger HPLC pump S 1521 covers a flow range from 3 - 300 ml/min with a pressure rating up to 200 bar (20 MPa)**

The pump operates with serial plunger technic with only one suction valve and one pressure valve. The pump heads are made of stainless steel (optionally in PEEK) and come with integrated purge valve. Control elements like flow rate, minimum and maximum pressure levels can be easily controlled or changed, using the digital switches on the front panel. Furthermore, the LED display shows continuously the actual back pressure. One plunger stroke displaces 780 µl volume. Due to computer calculated cam plates with integrated pre-compression profile the remaining pressure fluctuation is reduced to a minimum. An excellent pressure stability is achieved even with flow rates of 3 ml/min. The electronic speed controller corrects automatically the pressure dependent solvent compressibility. Error messages and the pressure levels are available



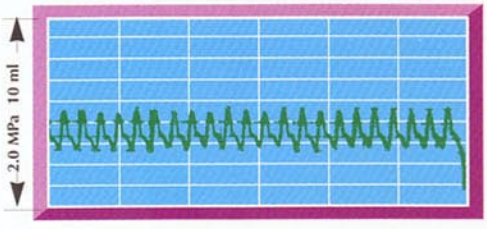

**Suction-side sample load**

through backside connectors for further control purposes. Independent of low or high flow rates and also independent of low or high pressure, the pump will deliver constantly and free of mechanical or electronical disturbances (e.g. increase in temperature concerning the motor part or control device). An optional solenoid valve makes a suction-side, variable sample load of large volumes possible.

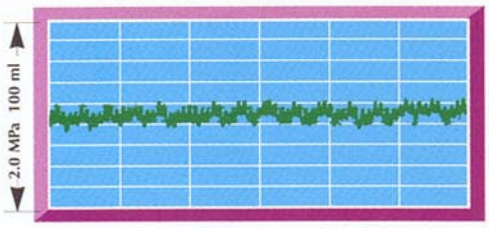
For noise reduction, the two-stage driving mechanism (mounted on a solid bottom plate) is completely isolated from the pump case by an isolation foam plate. Bearings and cam plates are permanently lubricated from an oil reservoir. All components within the pump coming in contact with liquid are placed over a collecting tray equipped with a drain pipe.

**The Preparative HPLC Pump S 1511** is equipped with only one single plunger for economical reasons. Due to the specifically designed plunger driving cam with pre-compression, the pump can be utilized for preparative applications where pressure pulsation does not cause a problem.

**Pressure fluctuation without any pulsation damper**




**2.0 ml/min/16.0 MPa**




**1.0 ml/min/16.0 MPa**

| SPECIFICATIONS S 1521/S 1511 | |
|---|---|
| FLOW RATE: | 3 - 300 ML/MIN |
| PRESSURE: | UP TO 20 MPA (200 BAR) |
| PULSATION: | S 1521 LESS THAN 1%<br>S 1511 LESS THAN 10% |
| DISPLAY: | 3 DIGIT LED |
| OPERATION MODE: CONSTANT FLOW | |
| REMOTE CONTROL: | FLOW RATE, START, STOP |
| SAFETY CONTROL: | MAX. AND MIN. PRESSURE |
| ERROR MESSAGES: | POTENTIAL FREE CONTACT CLOSURE, OPTICAL SIGNAL |

# Gradient Pumps for Liquid Chromatography

**In liquid chromatography, gradient elution means the alteration of the solvent composition over the entire duration of the analysis.**

Gradient elution is used for optimizing the separation as well as the analysis time of complex sample mixtures with the possibility of using high or low-pressure gradient systems.

With low-pressure gradient systems a pump with suction-side controlled solenoid valves is used. These valves open time-controlled and alternately the appropriate eluent channels. The single fractions are mixed by a dynamic mixer and delivered by the HPLC pump into the chromatography system. The advantage of the low-pressure gradient technique is the excellent resolution of the gradient, independently of the pump's flow rate. The degassing of the solvent is very important, as gas bubbles from not degassed eluents or gas bubbles caused by solvent contraction after mixing these eluents will affect the flow stability of the pump. High-pressure gradient system means the use of one dosing pump for each solvent and performing the gradient profile by altering the flow rate of these pumps with a resulting constant volume delivery.

The mixing is done on the high-pressure side of the pumps by a mixing T-piece or by a high-pressure dynamic mixing chamber. The flexibility of the Sykam chromatography concept allows any combination of high or low-pressure mixing systems depending on the user's preference or on the analytical problems.

## SYSTEM'S PERFORMANCE DATA

**Low-pressure gradient system with constant mixing of 90 % A (methanol) and 10 % B (water). Flow rate 1 ml/min, injection volume 20 µl, column RP 18. Determination of the performance data by injecting the standard ten times.**

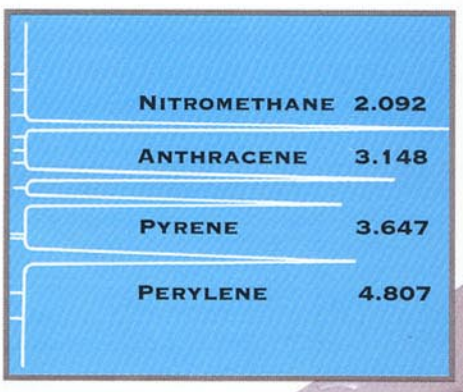
**A: Calculation of short-term flow constance based on the area-percent values**
**B: Calculation of long-term flow constance based on retention times**
**C: Calculation of system reproducibility based on area values**

| SYSTEM DATA FOR NITROMETHANE | A | B | C |
|---|---|---|---|
| MEAN VALUE: | 17.056 | 2.088 | 574788 |
| STANDARD DEVIATION: | 0.017 | 0.007 | 591 |
| VARIAT. COEFFICIENT(%): | 0.101 | 0.329 | 0.103 |
| CONFID. RANGE-95% (%): | 0.072 | 0.235 | 0.074 |
| CONFID. RANGE-99% (%): | 0.104 | 0.338 | 0.106 |

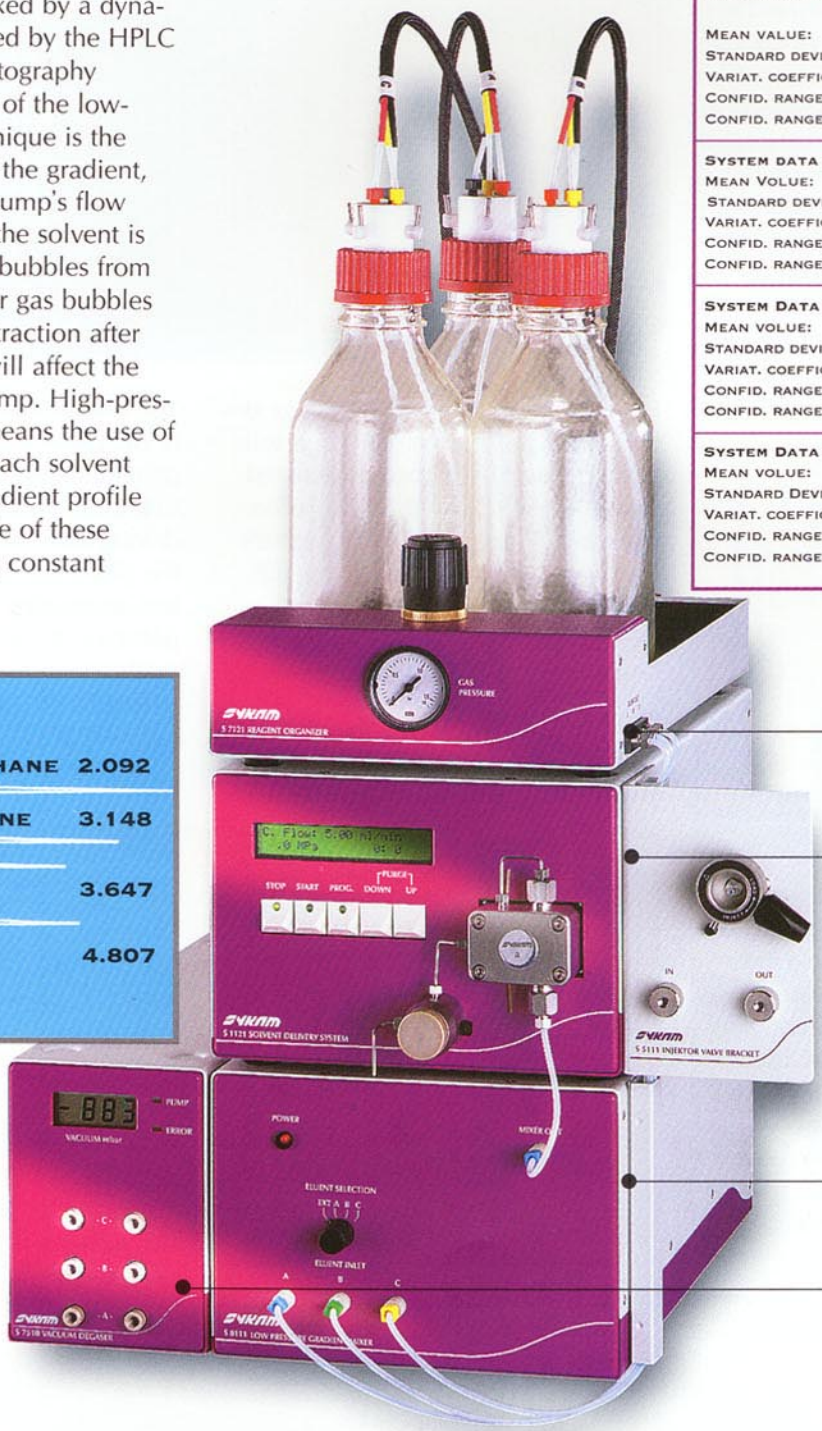
| SYSTEM DATA FOR ANTHRACENE | | | |
|---|---|---|---|
| MEAN VOLUE: | 24.073 | 3.145 | 811260 |
| STANDARD DEVIATION: | 0.021 | 0.007 | 724 |
| VARIAT. COEFFICIENT (%): | 0.087 | 0.209 | 0.0889 |
| CONFID. RANGE-95% (%): | 0.062 | 0.15 | 0.064 |
| CONFID. RANGE-99% (%): | 0.089 | 0.215 | 0.092 |

| SYSTEM DATA FOR PYRENE | | | |
|---|---|---|---|
| MEAN VOLUE: | 23.932 | 3.644 | 806520 |
| STANDARD DEVIATION: | 0.019 | 0.007 | 965 |
| VARIAT. COEFFICIENT (%): | 0.081 | 0.192 | 0.12 |
| CONFID. RANGE-95% (%): | 0.058 | 0.138 | 0.086 |
| CONFID. RANGE-99% (%): | 0.084 | 0.198 | 0.123 |

| SYSTEM DATA FOR PERYLENE | | | |
|---|---|---|---|
| MEAN VOLUE: | 34.94 | 4.605 | 1177466 |
| STANDARD DEVIATION: | 0.026 | 0.007 | 1231 |
| VARIAT. COEFFICIENT (%): | 0.073 | 0.153 | 0.105 |
| CONFID. RANGE-95% (%): | 0.052 | 0.11 | 0.075 |
| CONFID. RANGE-99% (%): | 0.075 | 0.158 | 0.107 |

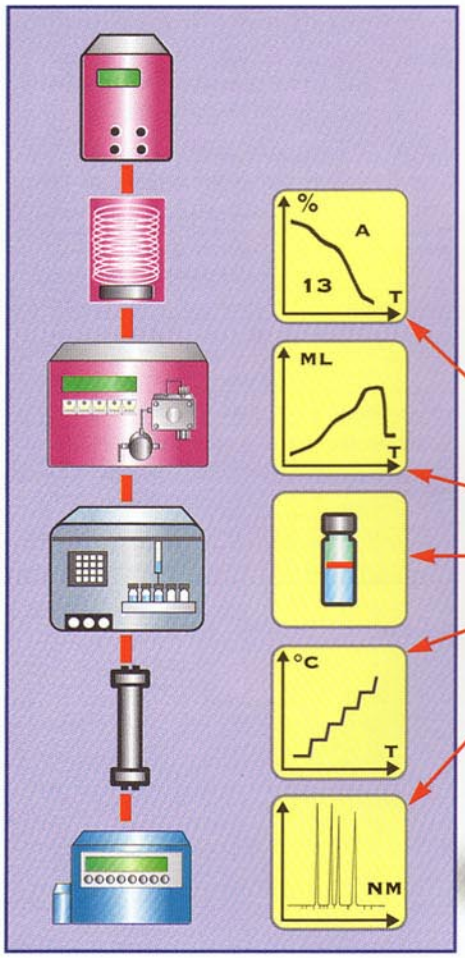



**Test chromatogram for the determination of the system's performance data**

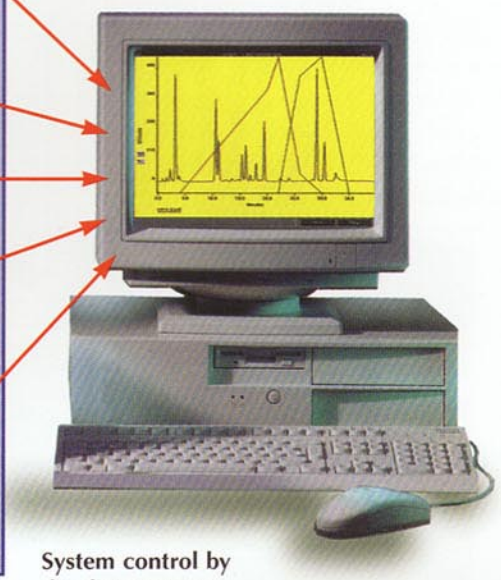


# Gradient Control

**For flexibility reasons, the gradient control is separated from the pump and the low-pressure gradient module.**




First, the operator is asked to enter the program number, then the requested flow rate and the starting conditions of the analysis. Afterwards, the analysis parameters have to be entered in the following sequence: time, % eluent B, % eluent C, temperature in °C and the requested switching function.



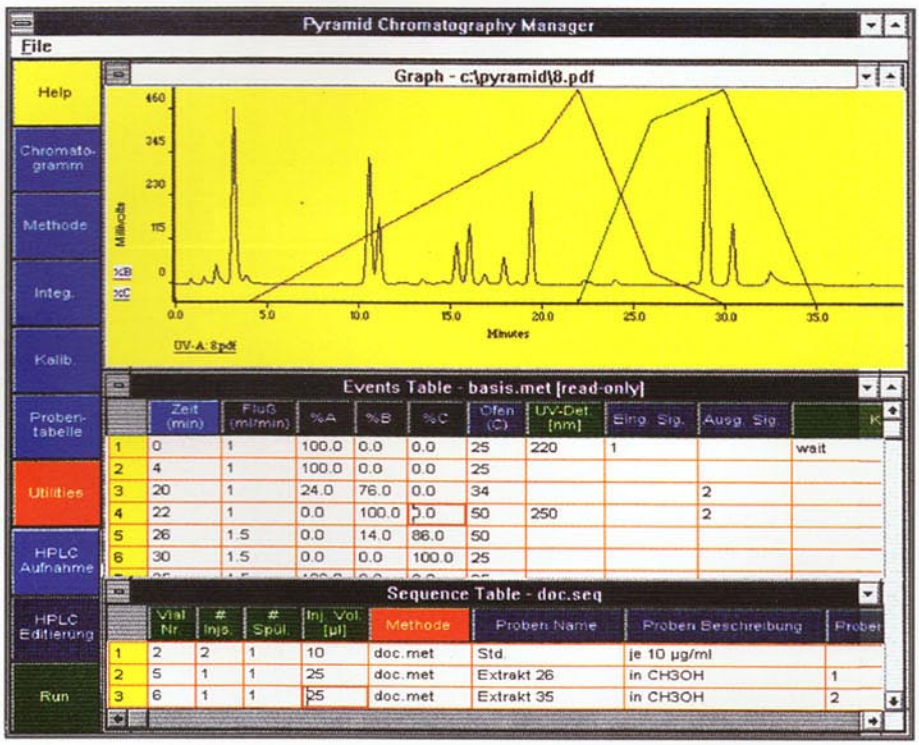
**System control by the data system**

This procedure is repeated until the desired number of programming steps are entered. The controller approximates linearly between the specified time steps. A total of up to 250 time steps can be programmed which can be splitted up into ten analyses programs. Entered programs can be easily checked and changed. Each stored program can be repeated up to 99 times during automatic operation. Furthermore, these programs can be linked together in a sequence desired.

Alternatively to the dedicated gradient controller S 2001, the gradient control can be performed by the Sykam data station which allows the direct control of all components through the appropriate system interface. Gradient profiles of the solvents as well as of the temperature are documented, controlled and furthermore, are graphically displayed in the chromatogram. Detectors and samplers are integrated in the system through serial interfaces, allowing the programming of most variables.

There ist the choice of either an independently working controller or of an interface for the control of a data system. The internal Sykam interface ensures the communication between the Sykam components and furthermore, makes a step-by-step upgrading possible.

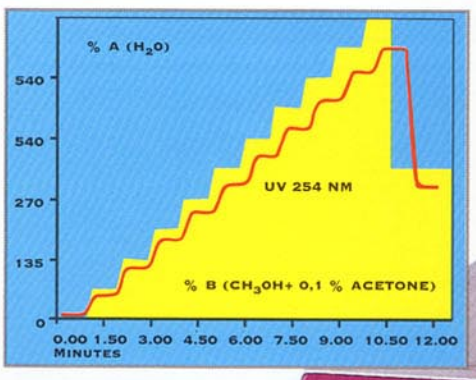
With the controller S 2001, ternary gradient profiles (high or low-pressure), temperature gradients (column oven) and 20 external switching functions through relay contact closures can be controlled. Due to these switching functions, modules like sampler, motor-valve, detector etc. can be easily integrated and automized. The programming of the controller is easily done by a stepwise dialogue via the alphanumerical display.



# Low-Pressure Gradient Pump S 1222

**The advantage of low-pressure gradient mixing technique is the precise resolution (1 % steps) of the solvent composition, independent of the flow rate.**

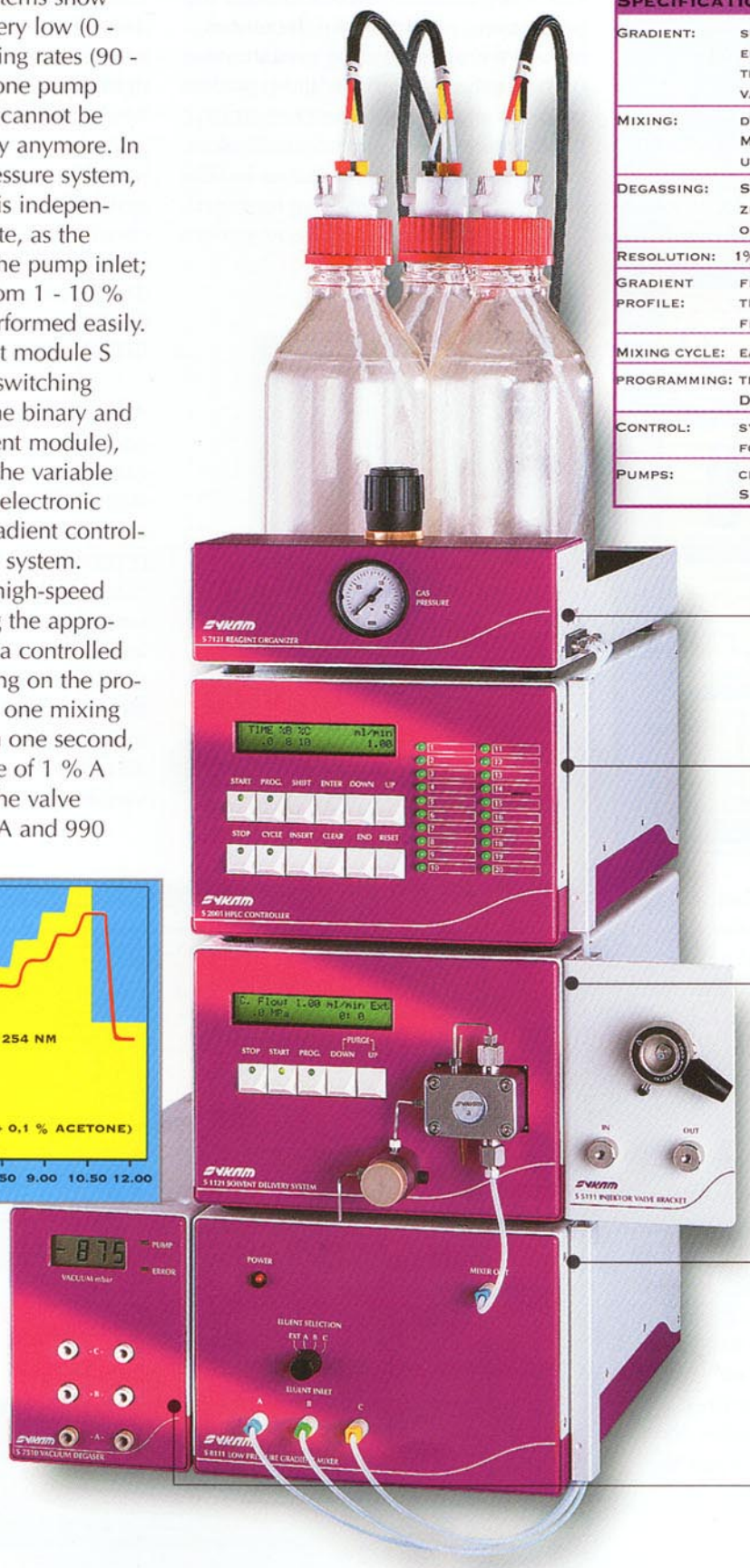
High pressure mixing systems show some limitations in the very low (0 - 10 %) or in the high-mixing rates (90 - 100 %), as the speed of one pump comes close to zero and cannot be controlled very accurately anymore. In difference to the high-pressure system, the low-pressure mixing is independent of the pump flow rate, as the mixing is performed on the pump inlet; therefore, mixing rates from 1 - 10 % or 90 - 100 % can be performed easily. The low-pressure gradient module S 8111 consists of the fast switching solenoid valve (one for the binary and two for the ternary gradient module), the dynamic mixer with the variable mixing chamber and the electronic interface either for the gradient controller S 2001 or for the data system. For gradient mixing, the high-speed solenoid valve is opening the appropriate eluent channel for a controlled periode of time, depending on the programmed mixing rate. As one mixing cycle is performed within one second, a selected solvent mixture of 1 % A and 99 % B means that the valve opens 10 msec. channel A and 990




**Binary gradient profile with low flow rates**

With ternary gradient mixing, the same mixing cycle of 1 second is achieved by a cascade arrangement of two-way valves.

| SPECIFICATIONS | |
|---|---|
| GRADIENT: | SUCTION-SIDE MIXING OF BINARY ELUENT COMPOSITIONS (OPTIONALLY TERNARY) THROUGH SOLENOID VALVES |
| MIXING: | DYNAMIC, INERT MIXER (PVDF) MIXING VOLUME VARIABLE FROM 0.2 UP TO 2 ML |
| DEGASSING: | STANDARD-TYPE REAGENT ORGANIZER WITH HELIUM FLUSHING OPTIONALLY VACUUM DEGASSER |
| RESOLUTION: | 1% INDEPENDENT OF THE FLOW RATE |
| GRADIENT PROFILE: | FREE PROGRAMMABLE THROUGH TIME, LINEAR APPROXIMATION FROM STEP TO STEP |
| MIXING CYCLE: | EACH SECOND |
| PROGRAMMING: | THROUGH CONTROLLER S 2001 OR DATA SYSTEM |
| CONTROL: | SYSTEM INTERFACE AND 0 - 10 V FOR EACH ELUENT |
| PUMPS: | CHOICE OF S 1121, S 1021, S 1011 STAINLESS STEEL OR PEEK |




REAGENT ORGANIZER S 7121

CONTROLLER S 2001

HPLC PUMP S 1121

LOW-PRESSURE GRADIENT MODULE S 8111

VACUUM DEGASSER S 7510

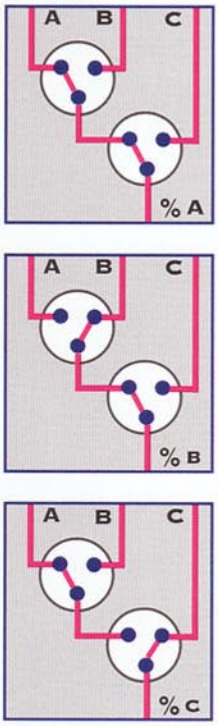
In order to ensure trouble-free operation, the pre-condition for this precise and fast gradient resolution is the usage of an excellent degassing device for the eluents. For gradient elution, the degassing process has to be carried out continuously, otherwise the eluent will be enriched with gases taken from the air.

The standard Sykam low-pressure gradient pump comes with a reagent organizer for flushing the eluent with a stream of helium. Hereby, the stable remaining helium molecules are displacing all other gases. This excellent degassing method is based on the insoluble characteristic of the helium molecule.

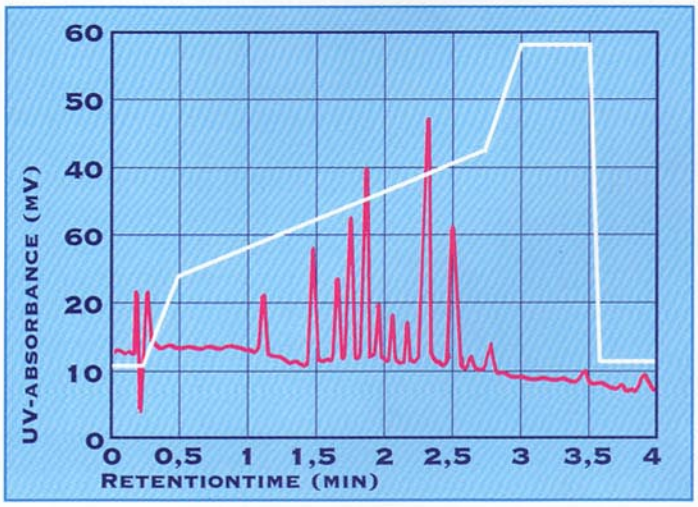
During operation, the second helium connection, ending above the eluent, is used for maintaining a constant helium pressure. Due to the gas-tight caps, only as much helium is needed as eluent is taken from the bottle. Furthermore, due to this inert atmosphere, bacteria growth is reduced and the $CO_2$ absorption from the air with resulting pH-value shift is totally avoided.

Alternativly to helium degassing, a vacuum degasser can be used. This is an economic solution in case no helium is available in the laboratory. For special analyses which are highly sensitive concerning oxygen, a combination of both methods can be used. After the above described degassing process, the eluent mixing ratio is performed through the solenoid valves.
The final homogeneous mixing is done within a dynamic mixing chamber with integrated micro-magnetic stirrer.

The volume of this mixing chamber can be continuously adjusted from 200 µl up to 2 ml for the standard analytical version and from 500 µl to 6 ml for the semi-preparative version. This allows the selection of the optimized mixing volume from micro operation up to semi-preparative operation.

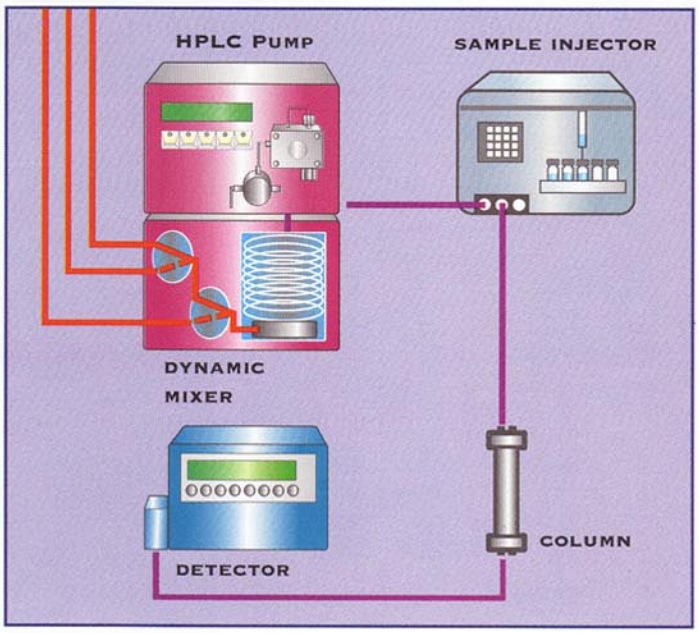



**Valve positions during one mixing cycle (1 sec.)**




**Fast gradient profile for EPA phenoles**

The eluent bottles are equipped with gas-tight caps, containing four integrated valves. Two of the valves are connected to the helium supply (controlled by an integrated pressure regulator), the third valve opens and closes the eluent outlet and the fourth valve is used for releasing the gas pressure. Freshly prepared eluents are flushed by helium (capillary reaching down to the bottom of the bottle) for about 5 minutes.

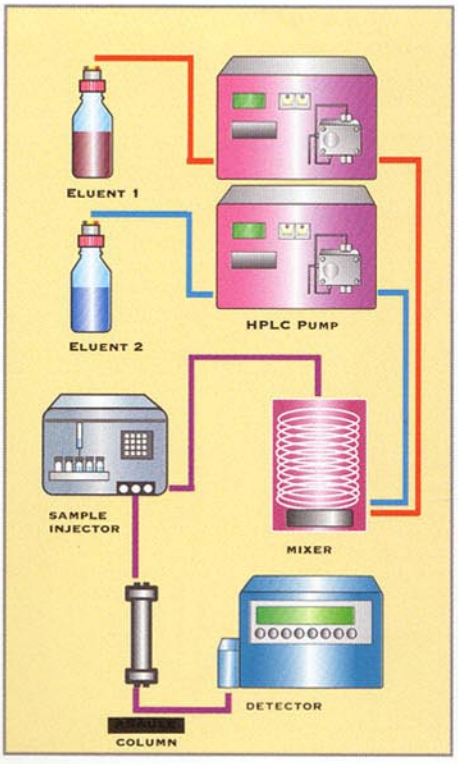


# High-Pressure Gradient System

**The advantage of high-pressure gradient mixing technique is primarily the almost trouble-free operation of the pumps due to mixing dependent gas bubble formations.**

All Sykam pumps are driven by D. C. motors, running continuously without interruptions down to zero speed, which means a constant flow without interruption even at lower flow rates, in difference to stepping motor driven pumps, driving the plungers with periodical interruptions at low flow rates. Therefore, D.C. motor driven pumps are of advantage when operating with critical mixing rates from 1 - 10 % or 90 - 100 %, where one pump is always operating close to the limit of the pump speed control.

The excellent continuity of the dosed mixture allows the operation with fast gradient elution profiles without any additional mixing device. For slow gradient elution profiles with only weak upward tendency of the gradient, a dynamic high-pressure mixing module (micro-magnetic stirrer) with a variable volume from 200 µl up to 2 ml is necessary.
For the degassing of the eluents, a reagent organizer with helium flushing or a Sykam vacuum degasser has





The low-pressure gradient mixing method is the most used technique not only for economical reasons but also due to the excellent resolution, independent of the flow rate. High-pressure gradient systems are of advantage only for certain applications, e.g. fast gradient elution profiles of 1 to 2 minutes. Furthermore, for isocratic applications, the two pumps of the Sykam high-pressure gradient system can be separated and integrated in two different systems.

## Specifications

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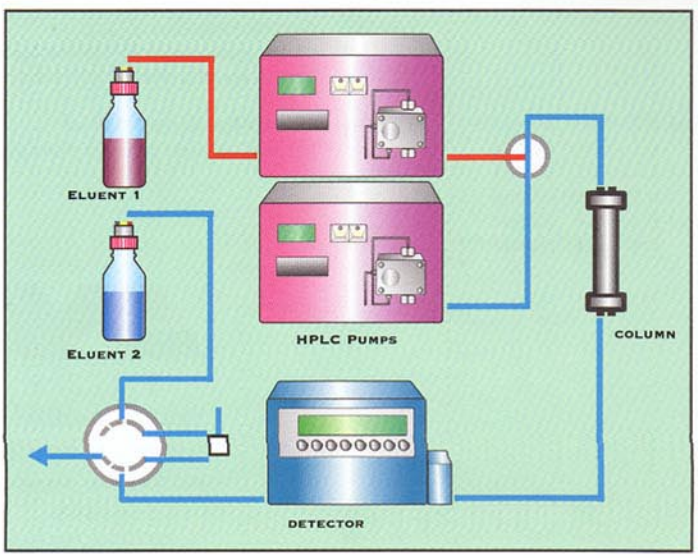
|---|---|
| Gradient: | pressure-side mixing of binary eluent composition (optionally ternary) through different flow rates of the pumps |
| Mixing: | dynamic high-pressure mixer. Mixing volume variable from 0.2 up to 2 ml |
| Degassing: | standard-type reagent organizer with helium flushing optionally vacuum degasser |
| Gradient profile: | free programmable through time, linear approximation from step to step |
| Programming: | through integrated controller S 2001 or data system |
| Control: | System interface and 0 - 10 V for each pump |
| Pumps: | choice of S1121, S 1021, S 1011 stainless steel or PEEK |

# Preparative High-Pressure Gradient System

**If preparative chromatography is to be used in pilot plant or even production scale, usually the high-pressure gradient elution technique is applied.**

The degassing process of large volumes which are needed for preparative operations, can cause serious problems; therefore, the low-pressure gradient mixing is difficult to achieve. For high-pressure mixing with two or more preparative pumps, usually, the eluents don't need to be degassed. The pumps S 1521 or S 1511 with a plunger displacement volume of 780 µl are absolutely not sensitive to dissolved gases in the eluents. These small bubbles will not affect the accuracy of the delivered volume. In addition, the high flow rate at the mixing-T avoids normally the need of an extra mixing device.

The gradient profile can be programmed and controlled either by the dedicated gradient controller S 2001 or by the chromatography data system. In both cases, the programmable auxiliary relay functions can be used for programming the suction-side controlled sample injection of large sample volumes as well as for peak recycling or time-controlled fraction collecting. By adding selected and optimized accessories, like solenoid valves, large volume fraction selector or large volume sample selector, fully automized systems can be configured. Built-in safety devices ensure the shutdown of


**Automatic peak recycling in combination with a preparative high-pressure gradient system**

## SPECIFICATIONS

| | |
|---|---|
| GRADIENT: | PRESSURE-SIDE MIXING OF BINARY ELUENT COMPOSITIONS (OPTIONALLY TERNARY) THROUGH DIFFERENT FLOW RATES OF THE PUMPS |
| MIXING: | T-PIECE MIXER WITH LOW DEAD-VOLUME, SUITABLE FOR PEAK RECYCLING AND SUCTION-SIDE SAMPLING |
| DEGASSING: | ULTRASONIC METHOD, APPLIED ONLY ONCE OR VACUUM DEGASSING |
| GRADIENT PROFILE: | FREE PROGRAMMABLE THROUGH TIME, LINEAR APPROXIMATION FROM STEP TO STEP |
| PORGRAMMING: | THROUGH CONTROLLER S 2001 OR DATA SYSTEM |
| CONTROL: | SYSTEM INTERFACE AND 0 - 10 V FOR EACH PUMP |
| PUMPS: | CHOICE OF S 1521, S 1511, STAINLESS STEEL |

## Ordering Information

| Catalog No. | HPLC Pump | Pump Heads | Flow Rate |
|---|---|---|---|
| | **HPLC Pump S 1121**<br>serial dual plunger pump<br>220 x 150 x 350 mm, 9 kg | | |
| 10 10 046 | Analytical | Stain.steel | 0.1 - 9.95 ml/min |
| 10 10 047 | Analytical | PEEK | 0.1 - 9.95 ml/min |
| 10 10 048 | Micro | Stain.steel | 0.02 - 4.00 ml/min |
| 10 10 049 | Micro | PEEK | 0.02 - 4.00 ml/min |
| 10 10 050 | Semi-preparative | Stain.steel | 0.4 - 40.0 ml/min |
| 10 10 051 | Semi-preparative | PEEK | 0.4 - 40.0 ml/min |
| | **HPLC Pump S 1021**<br>serial dual plunger pump<br>220 x 150 x 350 mm, 9 kg | | |
| 10 10 052 | Analytical | Stain.steel | 0.05 - 8.00 ml/min |
| 10 10 053 | Analytical | PEEK | 0.05 - 8.00 ml/min |
| 10 10 054 | Micro | Stain.steel | 0.01 - 3.00 ml/min |
| 10 10 055 | Micro | PEEK | 0.01 - 3.00 ml/min |
| 10 10 056 | Semi-preparative | Stain.steel | 0.5 - 30.0 ml/min |
| 10 10 057 | Semi-preparative | PEEK | 0.5 - 30.0 ml/min |
| | **HPLC Pump S 1011**<br>single plunger pump<br>220 x 150 x 350 mm, 9 kg | | |
| 10 10 058 | Analytical | Stain.steel | 0.05 - 8.00 ml/min |
| 10 10 059 | Analytical | PEEK | 0.05 - 8.00 ml/min |
| 10 10 060 | Micro | Stain.steel | 0.01 - 3.00 ml/min |
| 10 10 061 | Micro | PEEK | 0.01 - 3.00 ml/min |
| 10 10 062 | Semi-preparative | Stain.steel | 0.5 - 30.0 ml/min |
| 10 10 063 | Semi-preparative | PEEK | 0.5 - 30.0 ml/min |
| | **HPLC Pump S 1521** | | |
| 10 10 064 | serial dual plunger pump<br>300 x 200 x 450 mm, 16 kg | Stain.steel | 3.0 - 300 ml/min |
| | **HPLC Pump S 1511** | | |
| 10 10 065 | single plunger pump<br>300 x 200 x 450 mm, 16 kg | Stain.steel | 3.0 - 300 ml/min |
| | **Gradient Pump Unit S 1213**<br>ternary low-pressure gradient pump with controller S 2001, HPLC pump S 1121 and reagent organizer | | |
| 10 10 109 | Analytical | Stain.steel | 0.1 - 9.95 ml/min |
| | Analytical | PEEK | 0.1 - 9.95 ml/min |
| | Micro | Stain.steel | 0.02 - 4.00 ml/min |
| | Micro | PEEK | 0.02 - 4.00 ml/min |
| | Semi-preparative | Stain.steel | 0.4 - 40.0 ml/min |
| | Semi-preparative<br>optionally binary and/or HPLC pump S 1021 | PEEK | 0.4 - 40.0 ml/min |
| | **Gradient Pump Unit S 1223**<br>ternary low-pressure gradient pump with interface for data system, HPLC pump S 1121 and reagent organizer | | |
| 10 10 111 | Analytical | Stain.steel | 0.1 - 9.95 ml/min |
| | Analytical | PEEK | 0.1 - 9.95 ml/min |
| | Micro | Stain.steel | 0.02 - 4.00 ml/min |
| | Micro | PEEK | 0.02 - 4.00 ml/min |
| | Semi-preparative | Stain.steel | 0.4 - 40.0 ml/min |
| | Semi-preparative<br>optionally binary and/or HPLC pump S 1021 | PEEK | 0.4 - 40.0 ml/min |

| Catalog No. | HPLC Pump | Pump Heads | Flow Rate |
|---|---|---|---|
| | **Gradient Pump Unit S 1226**<br>binary high-pressure gradient pump with controller S 2001, 2 HPLC pumps S 1121, high-pressure mixing module and reagent organizer | | |
| 10 10 114 | Analytical | Stain.steel | 0.1 - 9.95 ml/min |
| | Analytical | PEEK | 0.1 - 9.95 ml/min |
| | Micro | Stain.steel | 0.02 - 4.00 ml/min |
| | Micro | PEEK | 0.02 - 4.00 ml/min |
| | Semi-preparative | Stain.steel | 0.4 - 40.0 ml/min |
| | Semi-preparative<br>optionally with HPLC pumps S 1021 | PEEK | 0.4 - 40.0 ml/min |
| | **Gradient Pump Unit S 1227**<br>binary high-pressure gradient pump with interface for data system, 2 HPLC pumps S 1121, high-pressure mixing module and reagent organizer | | |
| 10 10 115 | Analytical | Stain.steel | 0.1 - 9.95 ml/min |
| | Analytical | PEEK | 0.1 - 9.95 ml/min |
| | Micro | Stain.steel | 0.02 - 4.00 ml/min |
| | Micro | PEEK | 0.02 - 4.00 ml/min |
| | Semi-preparative | Stain.steel | 0.4 - 40.0 ml/min |
| | Semi-preparative<br>optionally with HPLC pumps S 1021 | PEEK | 0.4 - 40.0 ml/min |
| | **Gradient Pump Unit S 1224**<br>binary high-pressure gradient pump with controller S 2001 and | | |
| 10 10 112 | 2 HPLC pumps S 1521 | Stain.steel | 3.0 - 300 ml/min |
| | **Gradient Pump Unit S 1225**<br>binary high-pressure gradient pump with interface for data system and | | |
| 10 10 113 | 2 HPLC pumps S 1521 | Stain.steel | 3.0 - 300 ml/min |
| 10 20 005 | **Gradient Controller S 2001** | | |
| 10 80 010 | **Low-pressure Gradient Module S 8111**<br>ternary low-pressure module with controller S 2001 and dynamic mixer, optionally binary version | | |
| 10 80 012 | **Low-pressure Gradient Module S 8111**<br>ternary low-pressure module with interface for the data system, optionally binary version | | |
| 10 80 004 | **Dynamic High-pressure Mixing Module S 8200** | | |
| 10 70 007 | **Reagent Organizer S 7121**<br>for the supply of up to 3 eluent bottles, helium gas distributor and pressure regulator | | |
| 40 90 001 | **Eluent Glass Bottle, 1000 ml**<br>includes gas-tight cap with 4 integrated valves | | |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