

# Small Volumes Matter

AMF  
Advanced Microfluidics

[www.amf.ch](http://www.amf.ch)

# **We're experts in automating miniaturized liquid handling**

Performing reliable liquid analyses requires creating an automatic management system.

This requires various tools and specific know-how. This is where we come in.

We aim to make your liquid sequence simple and precise, with minimal contamination. We create robust industrial microfluidics, allowing for a reduction in sample size and reagent costs. Our products are Swiss-made, in-house.

# WHERE ARE AMF PRODUCTS USEFUL?



MANY DOMAINS  
need to analyse liquids

LIQUID ANALYSES  
require a liquid automation system

LIQUID MANAGEMENT  
uses tools to control,  
mix among other features

VALVES & PUMPS  
are the solution

AMF SERVICES

AMF PRODUCTS

We make everything in-house and can tailor each solution for YOU. You can also get started straight away with our off the shelf modules.

## OUR STORY

All this began when someone needed a solution that didn't exist. Our first partners were developing a complex lab automation project and could not find suitable components on the market. Knowing our passion for microfluidics, they approached us. Together, we developed a solution that specifically corresponded to their needs. Our first product was born, the automated sample preparator.

The know-how that resulted in this partnership enabled us to identify several additional market needs and develop more products. Thus Advanced Microfluidics was created.

Based in the heart of the Swiss watch and med-tech valley, in the EPFL Innovation Park, our team is committed to designing high-end, user-friendly fluidic solutions.

## OUR VISION

As pioneers in the revolutionary link between microfluidics and automation, we bring together a field, long considered to be purely academic, into the industrial sector. With our innovative solutions, we strive to keep our clients satisfied by delivering high-performing and quality products. We are aiming to be the new reference for industrial microfluidics.

## OUR MISSION

We develop and provide innovative, robust and reliable premium OEM components and tools for microfluidics automation and integrations.

We offer catalogue products and optimised solutions for your specific application. We help you save time and design our systems for easy integration.

## IF WE WERE TO QUALIFY OUR STRENGTHS IN A FEW WORDS, THESE WOULD BE:



In-house  
design



Multiple  
competencies



Rapid  
testing



Guaranteed  
quality



Reactive  
team



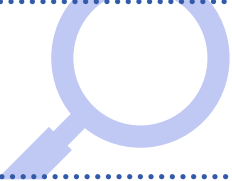
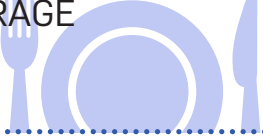
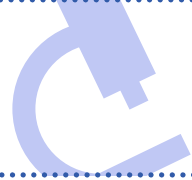





Customer  
oriented



Tailor even for  
small quantities

## AMF PRODUCTS ARE USEFUL IN MANY FIELDS

<b>MEDICAL</b> Clinical diagnostics Allergy testing 	<b>ENVIRONMENT</b> Drinking water monitoring Waste water testing 
<b>FORENSICS</b> Urine analysis Toxicology 	<b>FOOD AND BEVERAGE</b> Dairy monitoring Wine analysis 
<b>RESEARCH</b> Analytical chemistry Analytical biology 	<b>LIFE SCIENCES</b> Biosensing Cell culture 
<b>INDUSTRIAL</b> Automatic sample preparation Quality testing 	<b>PHARMA / COSMETICS</b> Perfume Product testing 

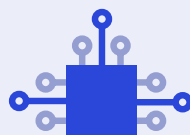
Check out other applications and application notes on our website.



Fluidics



Mechanics



Electronics



Software



Production

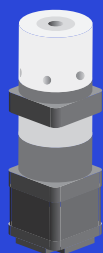
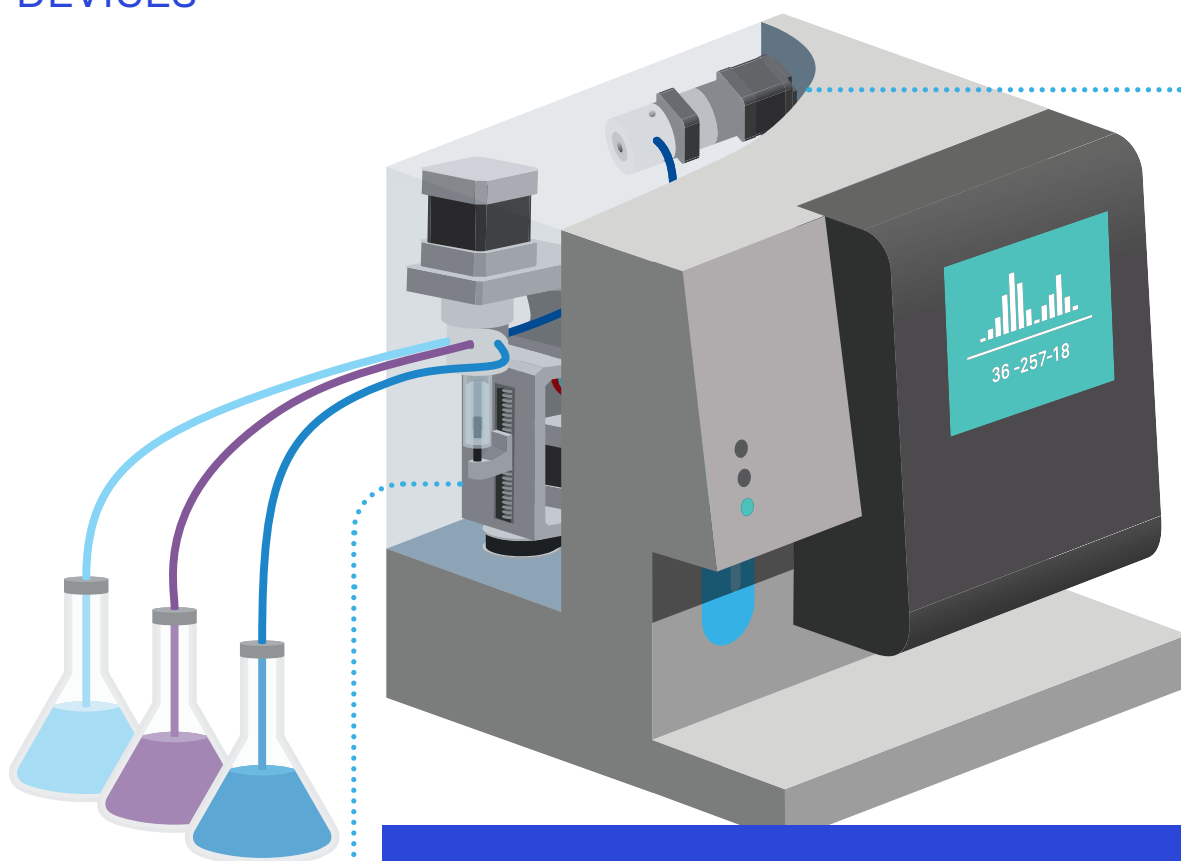


Biology  
chemistry



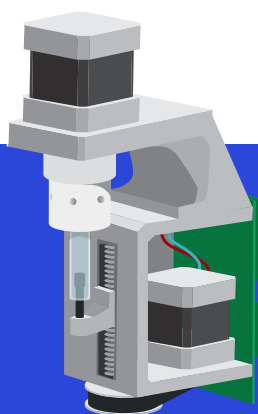
Optics

## AMF PRODUCTS INTEGRATED IN AN ANALYTICAL DEVICES



### RVM OEM rotary valve

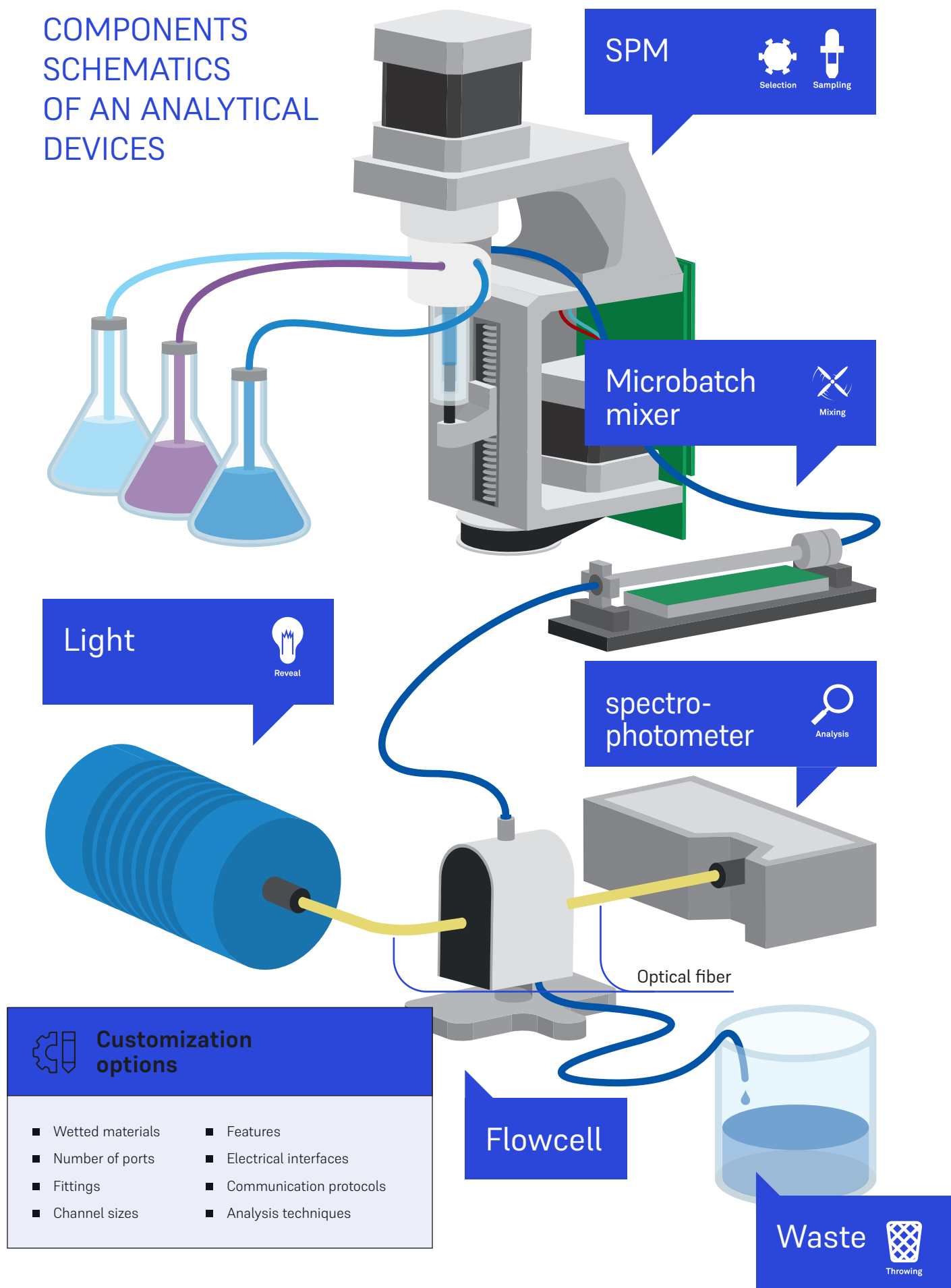
- Optimized for minimal cross-contamination
- Simple integration
- Light and compact
- Low internal volumes
- No dead volume



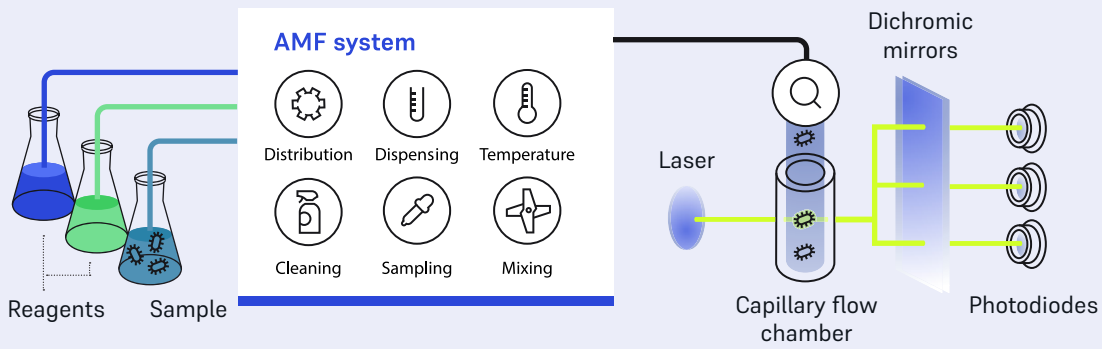
### SPM OEM syringe pump

- Handling of multiple fluids
- Simple air removal
- Optimized for minimal contamination
- Low internal volumes
- No dead volume

# COMPONENTS SCHEMATICS OF AN ANALYTICAL DEVICES



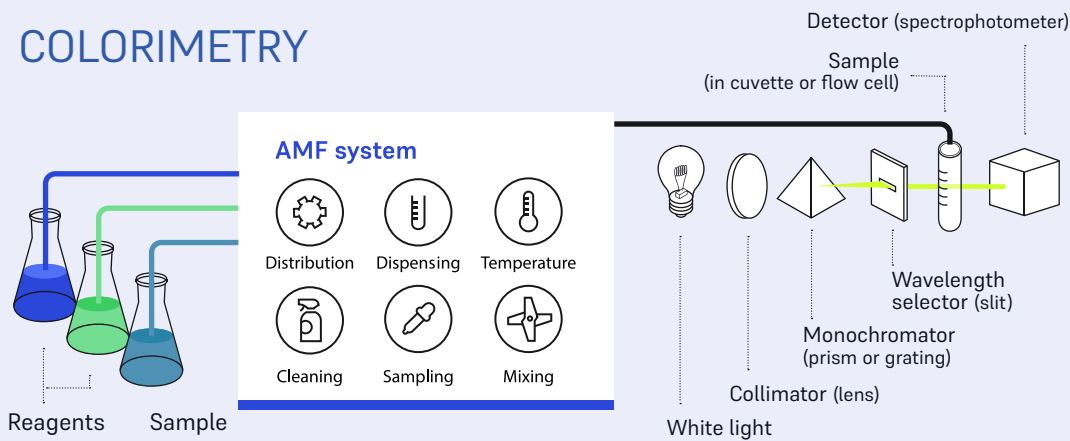
## FLOW CYTOMETRY



### Applications

- Cell proliferation
- Cell cycle
- Cell viability
- Cell tracing
- Cell screening
- Cell sorting
- Apoptosis
- Oxidative stress
- Phagocytosis
- Immunophenotyping
- CD markers
- ...

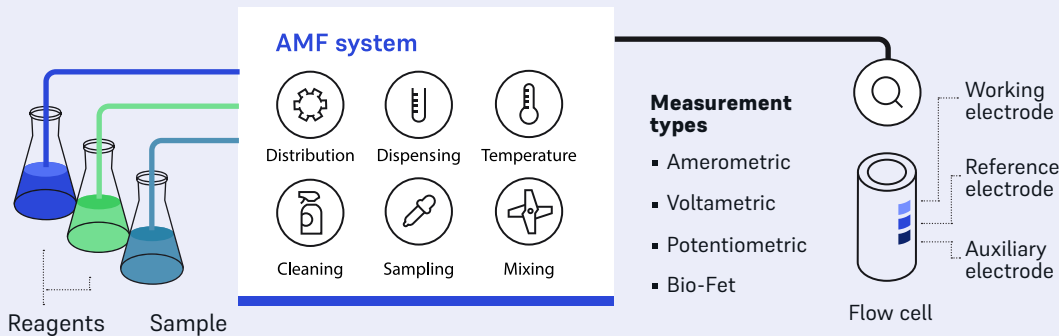
## COLORIMETRY



### Applications

- HRP colorimetric detection
- Colorimetric AP systems
- Immuno-blot assays
- Western blot
- Southern blot
- BCA protein assay
- Bradford protein assay
- Amino acid analysis
- Class-specific protein quantification
- ...

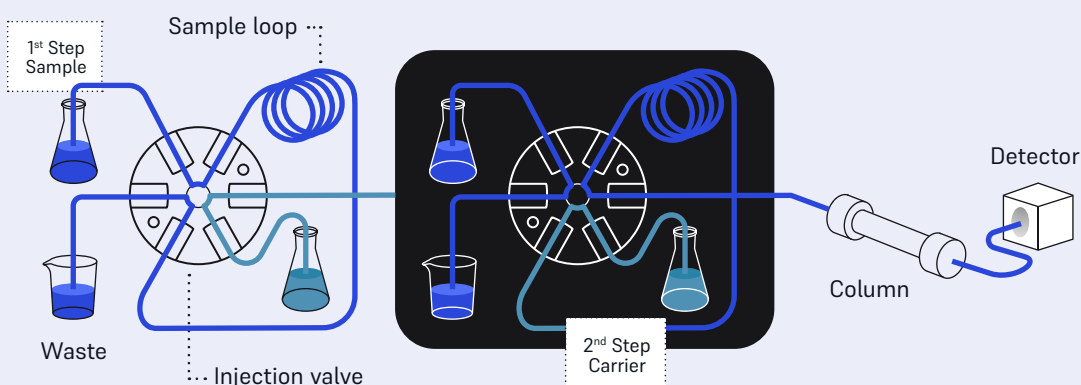
## ELECTROCHEMISTRY



### Applications

- Biosensors
- Electrosynthesis
- Electroanalytical chemistry
- Reactive oxygen species analysis
- Cyclic voltammetry and amperometry
- Electrophoresis
- Capillary electrophoresis
- Maldi-TOF

## CHROMATOGRAPHY



### Applications

- Vaccines screening
- Food testing
- Beverage testing
- Drug testing
- Forensic testing
- Additive detection
- Nutritional quality determination
- Metabolic & proteomic
- Nucleic acid research
- Flow chemistry
- Liquid chromatography

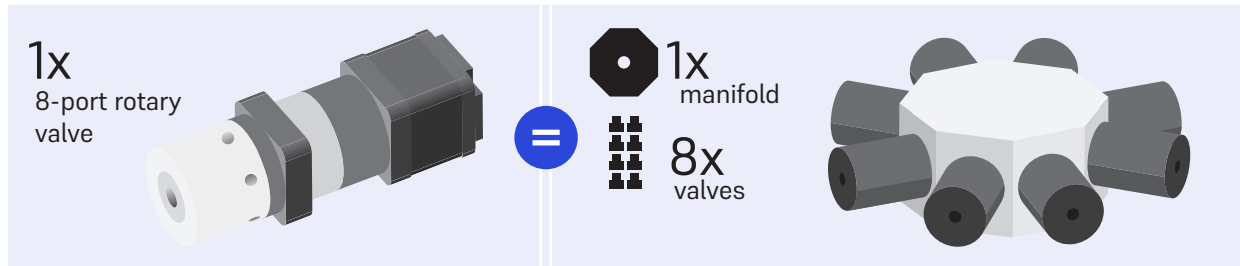


## WHY WOULD I CHOOSE A ROTARY VALVE?

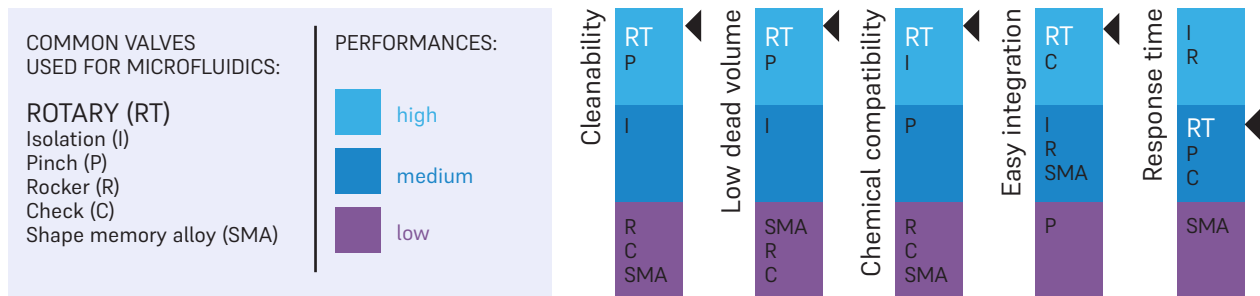
Each rotary valve is designed for complex multi-liquid flow path change. By acting as a manifold, it saves you space and is much easier to program and integrate.

Its main advantages are:

Tube-like fluidic path | Constant power consumption | Volume variation



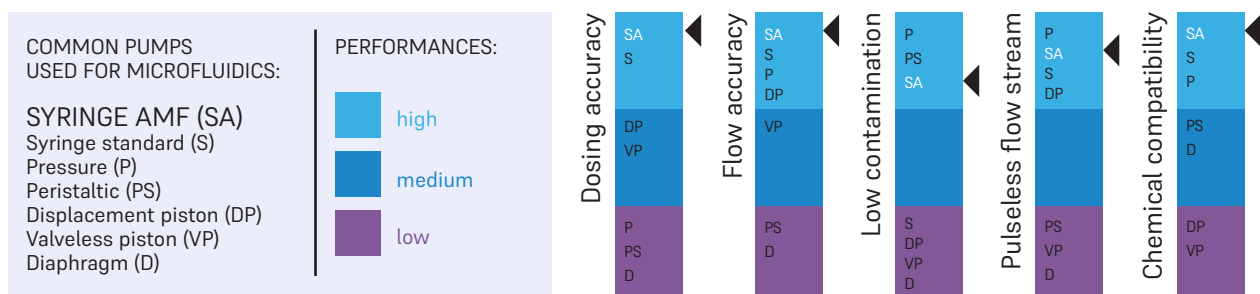
### The performance of rotary valves compared to other valve types



## WHY WOULD I USE A SYRINGE PUMP?

AMF's syringe pump directly integrates a multi-port rotary valve. It is then optimized for dosing and handling multiple liquids, while standard syringe pumps are optimized for a single liquid.

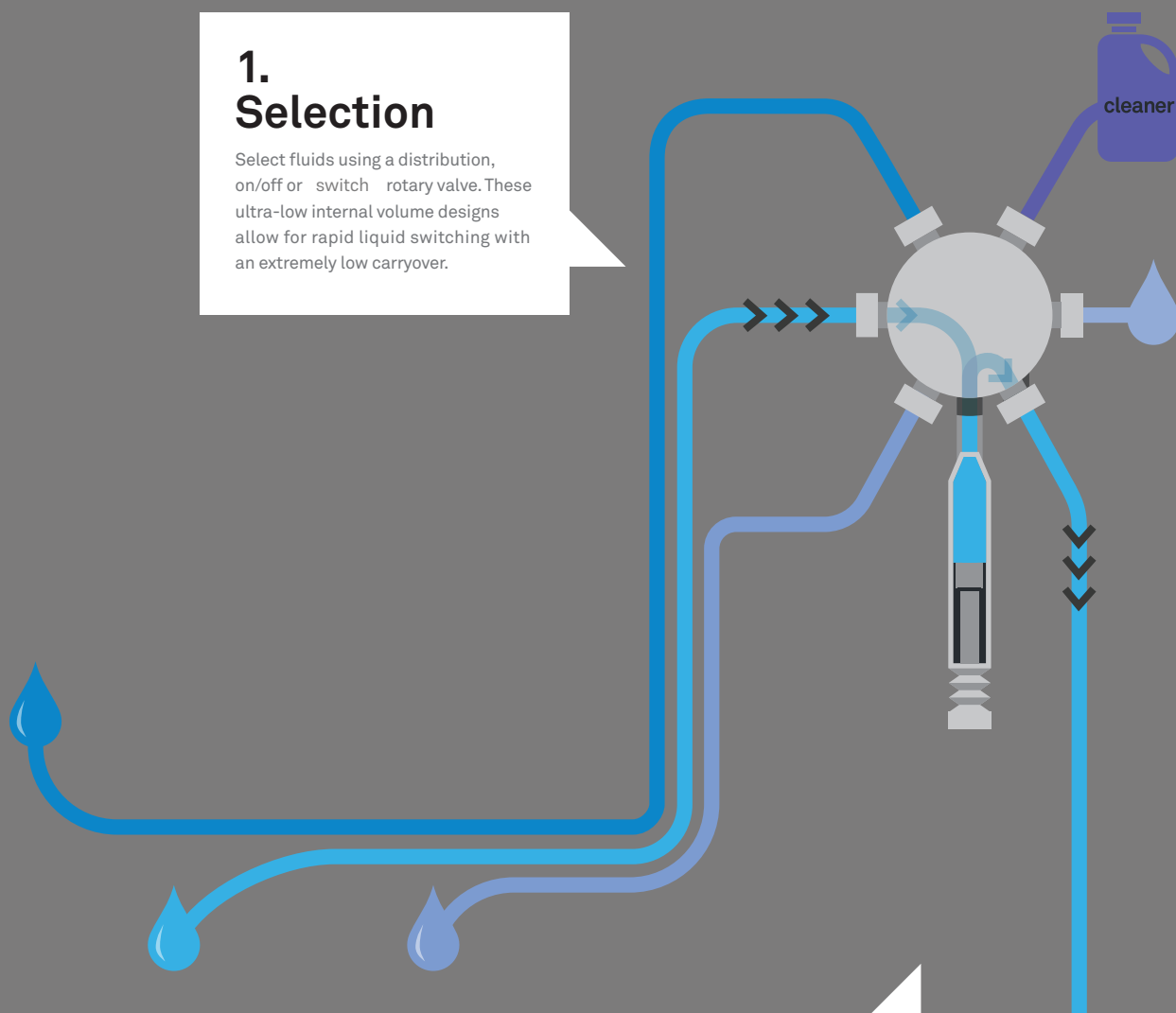
### The performance of syringe pump compared to other pump types



WE CAN HELP YOU DESIGN THE PERFECT FLUIDIC SYSTEM FOR YOUR OWN PROJECT

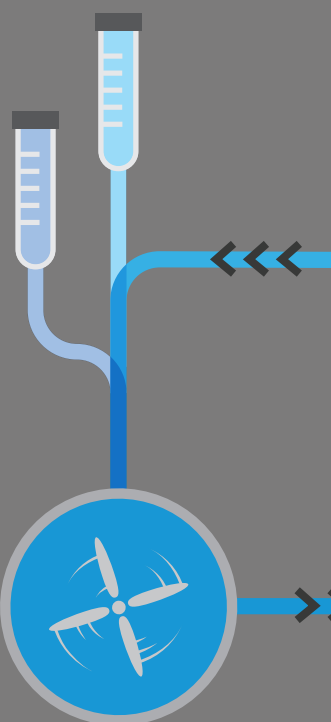
## 1. Selection

Select fluids using a distribution, on/off or switch rotary valve. These ultra-low internal volume designs allow for rapid liquid switching with an extremely low carryover.



## 2. Multiple Sampling

Our high precision syringe pump is used for sequential aspirating/dispensing of multiple fluids. Its minimal dead volume lets you precisely prepare samples, even with the smallest volumes.



## 3. Mixing

Blend samples homogeneously with our micro batch mixer. Both aggressive chemicals and delicate samples such as biological media can be mingled.



## 5. Dispensing

Our dispensing solutions accurately control volume and flow rate.

Using a multi-port valve, you can transfer the liquids between multiple sources and targets.



YOUR  
TECHNOLOGY

## 4. Temperature Control

Thermal regulation is an optional regulation. Mix, incubate or dispense your samples at a controlled temperature.

## 6. Cleaning

Fully automated sample preparation requires thorough cleaning and minimal carryover between batches. Our solutions can be efficiently cleaned or rinsed thus preventing cross-contamination and biofilm formation.

### Internal volume

Volume inside the system, from entrance to exit.

### Dead volume

Volume that is "stuck" in the system (dead end), which is not cleanly ejected and relies on diffusion to clear out.

### Carryover volume

Volume of liquid that will be mixed with the next liquid. It is not stuck, but will be swept along next time a liquid passes.

# RVM

## Rotary valve



### BENEFITS

- Optimized to limit contamination
- Excellent chemical and biological compatibility
- Replaces a manifold with multiple valves
- Light and compact
- Easy to use and integrate
- Swiss quality



### APPLICATIONS

- Sample preparation automation
- Multiplexing
- Sample loops
- Adapted for battery operated devices



### FUNCTIONS

- Select channel
- Change flow path
- Stop flow or isolation

Valves specifications,  
see on page 14



Selection



Switch



On / Off

This is an OEM product.

It can be tailored for the needs of your instrument.

## THE ULTRA-LOW INTERNAL VOLUME ROTARY VALVE

### CREATE YOUR OWN OPTIMISED FLOW PATH

Our OEM valve is a precise low-pressure electric rotary valve designed for automated microfluidic applications. Its exceptionally small channels and accurate positioning system make it ideal for precise liquid handling.

Showing an unrivaled small wetted volume and exceptional ease of use, this valve is the perfect companion for liquid distribution in your instrument or laboratory experiments at a reduced cost. A low-power model exists for minimum battery use and a fast one exists for your time-specific applications.

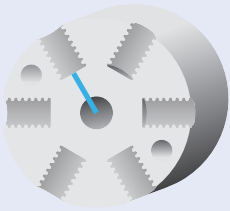
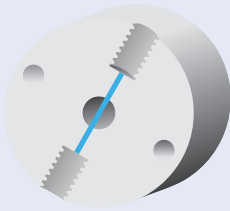
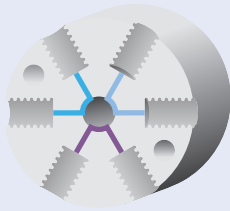
### Model specifications

CONFIGURATION	POWER	ROTATION TIME FOR 180°	WEIGHT (TOTAL MODULE)	DIMENSIONS
LOW POWER MOTOR	5-10 VDC, 0.5 A PEAK	1.5 s	250 g	29 x 38.3 x 111.8 mm
FAST MOTOR	18-24 VDC, 2 A PEAK	400 ms	450 g	42.3 x 60 x 95.9 mm

### Other specifications

Operating temperature	15 – 40°C (59-104°F)
Operating humidity	20-80%, non condensing
Max. pressure	7 bars (102 psi)
Wetted materials	PTFE or UHMW – PE, PCTFE
Channel diameter	0.5 mm (0.020 in) or 1 mm (0.039 in) (other upon request)
Internal volume	2.5 – 13.7 µL port-to-port (configuration dependent)
Carryover volume	0.55 – 6.7 µL port-to-port (configuration dependent)
Dead volume	None
Tube port fittings	Standard 1/4 – 28 UNF, flat-bottom
Electrical interface	USB mini, 9-pin D-Sub (fast motor model only)
Communication type	Serial, I2C (other upon request)

## Valves types

Series type	distribution	on/off	Switch
Liquid path			
known aliases	N-port distribution valve (N+1)-port/1-channel valve N-port selection valve (N+1)-port/N-position valve	Isolation valve Shutoff valve	N-port/(N/2)-channel valve Switch valve Loop valve

### Fast liquid switching

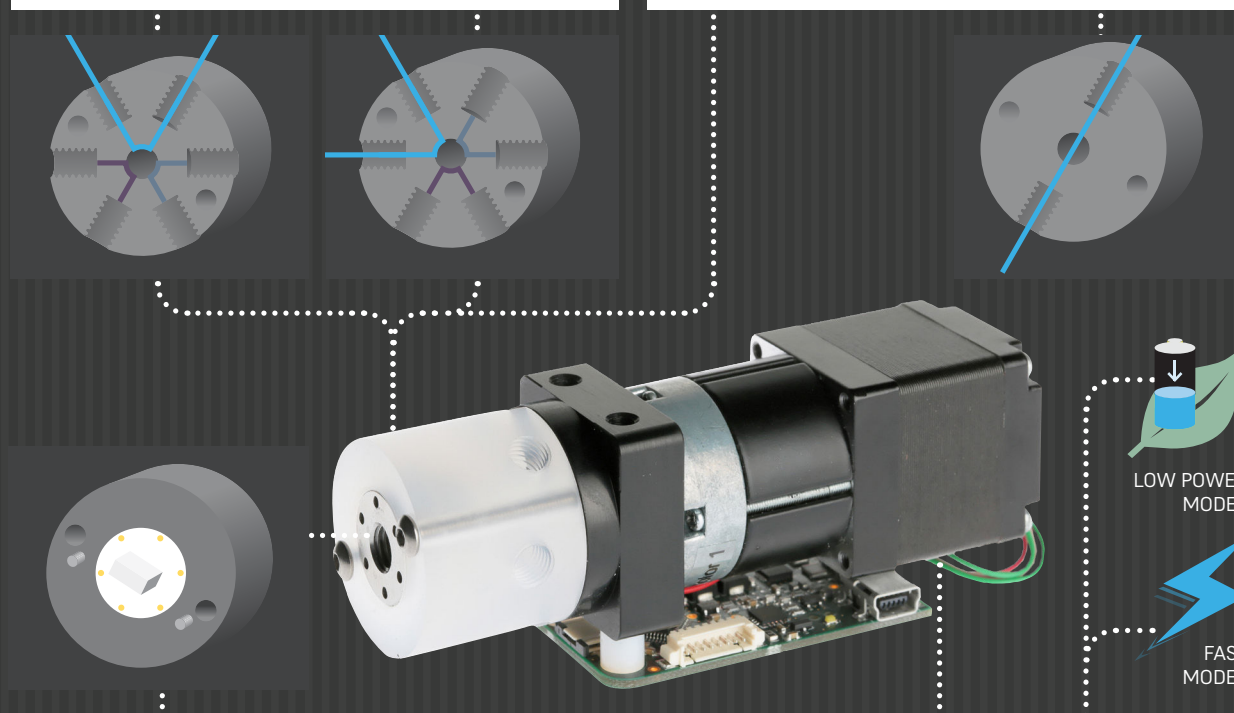
This extremely small internal volume selection valve allows to rapidly switch liquid, while maintaining an ultra-low carryover.

Valid for all models.

### Ultra-low internal volume

Our unique precise valves exhibit an internal volume (port-to-port) down to 0.6  $\mu\text{L}$ \* due to their exceptionally small 0.25 mm diameter channels.

\*for a 4 ports switch valve



### Integrated sensor

The position sensor is directly integrated into the valve to ensure precise positioning.

An automatic procedure at power-up allows the valve to know its precise location. This is called the «homing».

### Choice of motor

#### LOW POWER MODEL


This valve was designed in the most simple way to reduce its power consumption. It is USB powered. A smaller power consumption allows for a smaller power supply, and thus better portable device integration.

#### FAST MODEL

This valve is designed to reduce the switching speed, taking no more than 400 ms.

Valves specifications						
DISTRIBUTION SERIES						
Ref.	Configuration	Wetted materials	Internal volume	Carryover volume	Fluid path diameter	Max. pressure
V-D-1-6-050-C-P	6 ports ultra-low carryover volume	PCTFE, PTFE	2.5 µL	1.5 µL	0.5 mm	7 bars
V-D-1-8-050-C-P	8 ports ultra-low carryover volume	PCTFE, PTFE	2.5 µL	1.5 µL	0.5 mm	7 bars
V-D-1-8-100-C-U	8 ports ultra-low carryover volume	PCTFE, UHMW-PE	13.8 µL	6.7 µL	1 mm	7 bars
V-D-1-10-050-C-U	10 ports ultra-low carryover volume	PCTFE, UHMW-PE	3.5 µL	1.7 µL	0.5 mm	7 bars
V-D-1-10-100-C-U	10 ports ultra-low carryover volume	PCTFE, UHMW-PE	13.8 µL	6.7 µL	1 mm	7 bars
V-D-1-12-050-C-U	12 ports ultra-low carryover volume	PCTFE, UHMW-PE	3.5 µL	1.7 µL	0.5 mm	7 bars
ON/OFF SERIES						
Ref.	Configuration	Wetted materials	Internal volume	Carryover volume	Fluid path diameter	Max. pressure
V-O-1-2-050-C-P	2 ports ultra-low carryover volume	PCTFE, PTFE	3.0 µL	–	0.5 mm	7 bars
SWITCH SERIES						
Ref.	Configuration	Wetted materials	Internal volume	Carryover volume	Fluid path diameter	Max. pressure
V-S-1-4-050-C-P	4 ports ultra-low carryover volume	PCTFE, PTFE	2.8 µL	0.8 µL	0.5 mm	7 bars
V-S-1-6-050-C-P	6 ports ultra-low carryover volume	PCTFE, PTFE	2.5 µL	0.6 µL	0.5 mm	7 bars

Other models available upon request. Check website for new models.  
Valve heads are interchangeable.



**Customization options**

- Wetted materials
- Fluidic fittings
- Fluid path diameter
- Motor
- Electrical interfaces
- Communication types
- Number of ports
- PCB

# SPM



## Sequential Microdispenser



Selection



Sampling



Temperature



Dispensing

This is an OEM product.

It can be tailored for the needs of your instrument.



### BENEFITS

- Allows for multiple liquids
- Optimised to limit contamination
- Excellent chemical and biological compatibility
- Simple air removal
- Easy to use and integrate
- Swiss quality



### APPLICATIONS

- Sample preparation automation
- Industry
- Lab-on-a-chip
- Research & Education
- Biological sample handling
- Accurate flow streams of fluids
- High-precision sampling and dosing



### FUNCTIONS

- Dilute samples or reagents
- Aspirate liquids
- Dispense liquids
- Flow rate control
- Prepare complex mixes
- Alternate air / liquid samples

Syringes and valves specifications, see on page 17

## THE ALL-IN-ONE SYRINGE PUMP

### HANDLE DELICATE SAMPLES WITH GREAT PRECISION

Our OEM syringe pump is a high-precision dosing device for automated microfluidic applications. The high-accuracy dosing and nearly-pulseless flow stream capabilities make it the perfect tool for multiple liquid handling in the range of milliliter down to nanoliter.

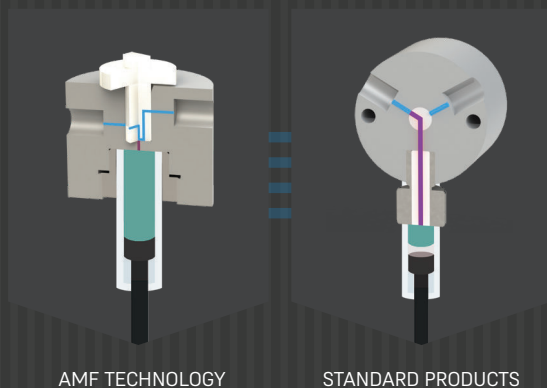
The integrated zero dead volume selection valve allows you to handle multiple fluids with one syringe pump thanks to the high cleaning efficiency and low carryover. Coupled with its ease of use, this syringe pump is thus the ideal companion for your instruments and laboratory experiments at a reduced investment cost.

### Pump Specifications

Operating temperature	15 – 40°C (59-104°F)
Operating humidity	20-80%, non condensing
Max. pressure	7 bars (102 psi)
Wetted materials	PTFE, PCTFE and borosilicate glass
Dead volume	None
Carryover volume	1.5 – 10.2 µL (configuration dependent)
Plunger travel	30 mm with 96,000 micro-steps for nearly pulseless flow
Plunger resolution	Selectable 3,000 steps (standard) / 24,000 steps (high)
Plunger drive	Screw drive with linear encoder for step loss detection
Valves configuration	Zero-dead-volume multi-port distribution with angular encoder
Tube port fittings	Standard 1/4 – 28 UNF, flat-bottom
Cross-contamination	Typically from 1/100 to 1/1000 per cleaning cycle
Accuracy	< 1% deviation from expected value at full stroke
Electrical interface	USB mini, 9-pin D-Sub (other upon request)
Interface	USB mini, RS-232, RS-485
Communication type	Serial (serial over USB, RS-232, RS-485)
Power	18 VDC, 2.2 A peak, 40 W (18 VDC optimized for battery use)
Time for full stroke	2 – 6000 seconds
Dimensions	199.7 x 126.3 x 50.5 mm
Weight	1.5 kg

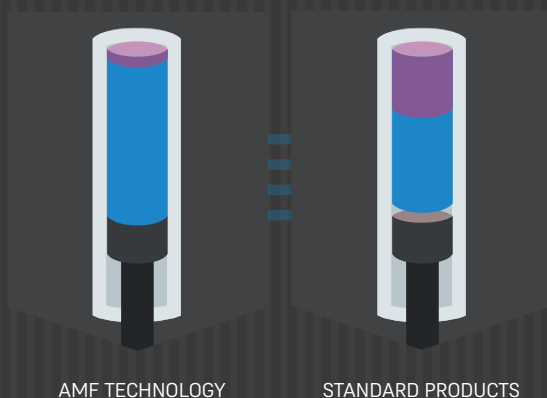
## Dead, internal and carryover volumes

Our unique valve geometry limits the carryover volume to 1.5  $\mu\text{L}$  (purple) whereas standard products exhibit up to 50  $\mu\text{L}$ . The exceptionally small channel diameter of 0.5 mm reduces the internal volume to only 4  $\mu\text{L}$  (blue + purple). There is no dead volume.



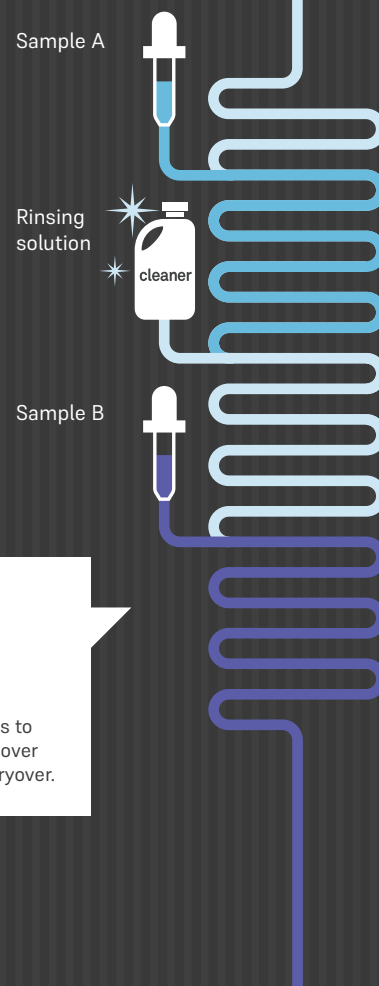
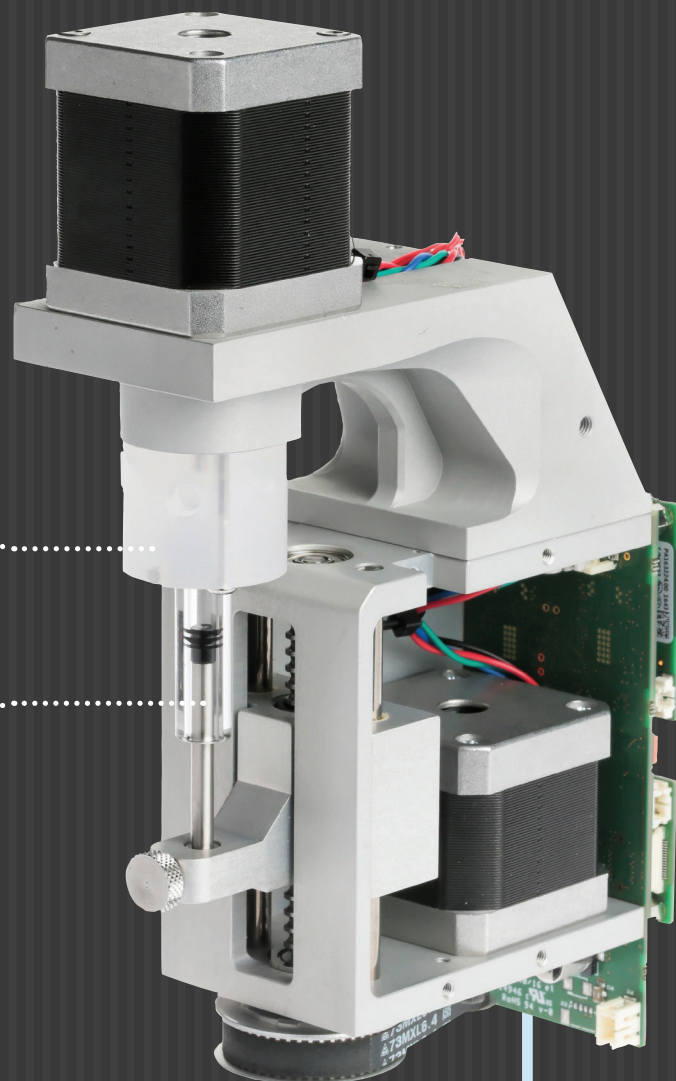
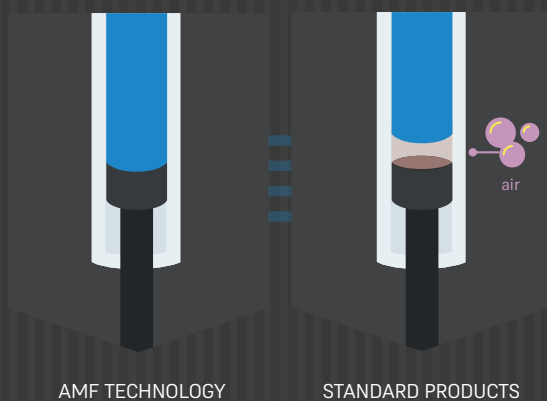
## High dilution ratio

When rinsing, diluting or switching liquid, our minimal carryover volume (purple) leads to a maximal dilution ratio with the diluent (blue).



## Bubble free priming

Our distinct valve design expels the air from the syringe and valve immediately, eliminating the traditional cumbersome priming procedure.



## Fast liquid switching

The zero dead volume selection valve allows to rapidly liquid changeover with an ultra low carryover.

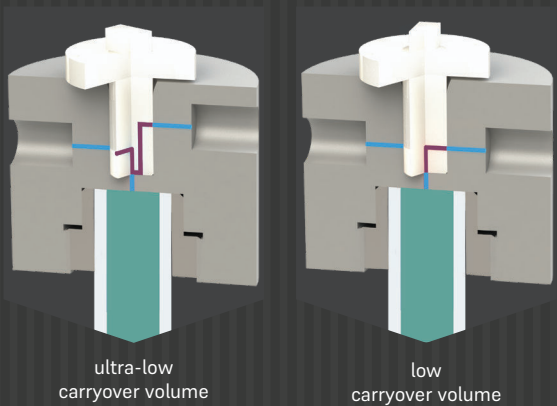



Syringe specifications					
Reference	Volume	Plunger material	Min. flow rate	Max. flow rate	Min. dosing volume
S-50-P	50 µL	PTFE	0.5 µL/min	1500 µL/min	0.1 µL
S-100-P	100 µL	PTFE	1 µL/min	3 000 µL/min	0.2 µL
S-250-P	250 µL	PTFE	2.5 µL/min	8 000 µL/min	0.5 µL
S-500-P or S-500-U	500 µL	PTFE or UHMW-PE	5 µL/min	15 000 µL/min	1 µL
S-1000-P	1000 µL	PTFE	10 µL/min	30 000 µL/min	2 µL
Chemical compatibility The wetted materials being PTFE, PCTFE and borosilicate glass, this pump offers an exceptional compatibility to most chemicals and biological samples.					

Optional:  
It is possible to add a heating/cooling module around the syringe to suit your specific application.

Valves specifications						
Ref.	Configuration	Wetted materials	Internal volume	carryover volume	Fluid path diameter	Max. pressure
V-D-2-6-050-C-P	6 ports ultra-low carryover volume	PCTFE, PTFE	5.2 µL	1.5 µL	0.5 mm	7 bars
V-D-1-6-050-C-P	6 ports low carryover volume	PCTFE, PTFE	3.5 µL	2.6 µL	0.5 mm	7 bars
V-D-1-8-050-C-P	8 ports low carryover volume	PCTFE, PTFE	3.5 µL	2.6 µL	0.5 mm	7 bars
V-D-1-8-100-C-U	8 ports low carryover volume	PCTFE, UHMW-PE	14.1 µL	10.2 µL	1 mm	7 bars
V-D-1-10-050-C-U	10 ports low carryover volume	PCTFE, UHMW-PE	4.5 µL	2.8 µL	0.5 mm	7 bars
V-D-1-10-100-C-U	10 ports low carryover volume	PCTFE, UHMW-PE	18.1 µL	11 µL	1 mm	7 bars
V-D-1-12-050-C-U	12 ports low carryover volume	PCTFE, UHMW-PE	4.5 µL	2.8 µL	0.5 mm	7 bars

- Valve heads are interchangeable
  - Other models and customs available upon request
- Check website for new models [www.amf.ch](http://www.amf.ch)



**Customization options**

- Wetted materials
- Fluidic fittings
- Fluid path diameter
- Motor
- Electrical interfaces
- Communication types
- Number of ports

## ENGINEERING SERVICES

Designing a new device where the fluidic needs to be optimized?  
Facing challenges with your current system and need a redesign?  
Having an idea that deserves testing ?

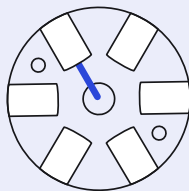
### From Development to Prototyping into Mass Production

Each microfluidic experiment is unique and calls for a tailored fluid handling solution. We've successfully created fluidic systems with various features, including chambers, cells, and layered valves for technologically advanced commercial instruments. Our custom products, built with precise channel structures and robust machining processes, have been used for a variety of applications.

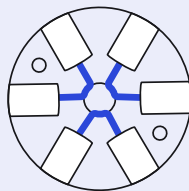
Our state-of-the-art fabrication techniques using notably 5-axis CNC machines, allow us to provide optimal surface finish, ensuring your fluidic operations to remain smooth as it gets. Reach out to us today and let's discuss how we can bring your fluidic system ideas to life with our custom device design and manufacturing expertise

This is an example of a custom solution.  
Contact us to develop your tailored solution.

The multi-stage valve integrates two different valve functions in one valve head with one motor :

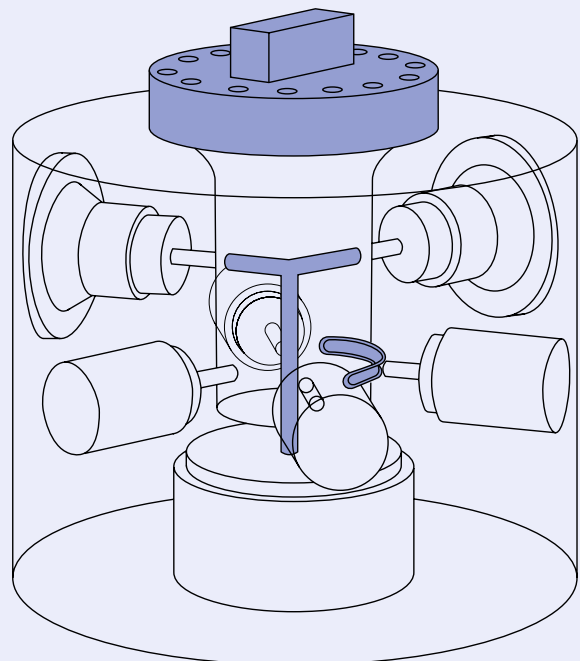


Switch

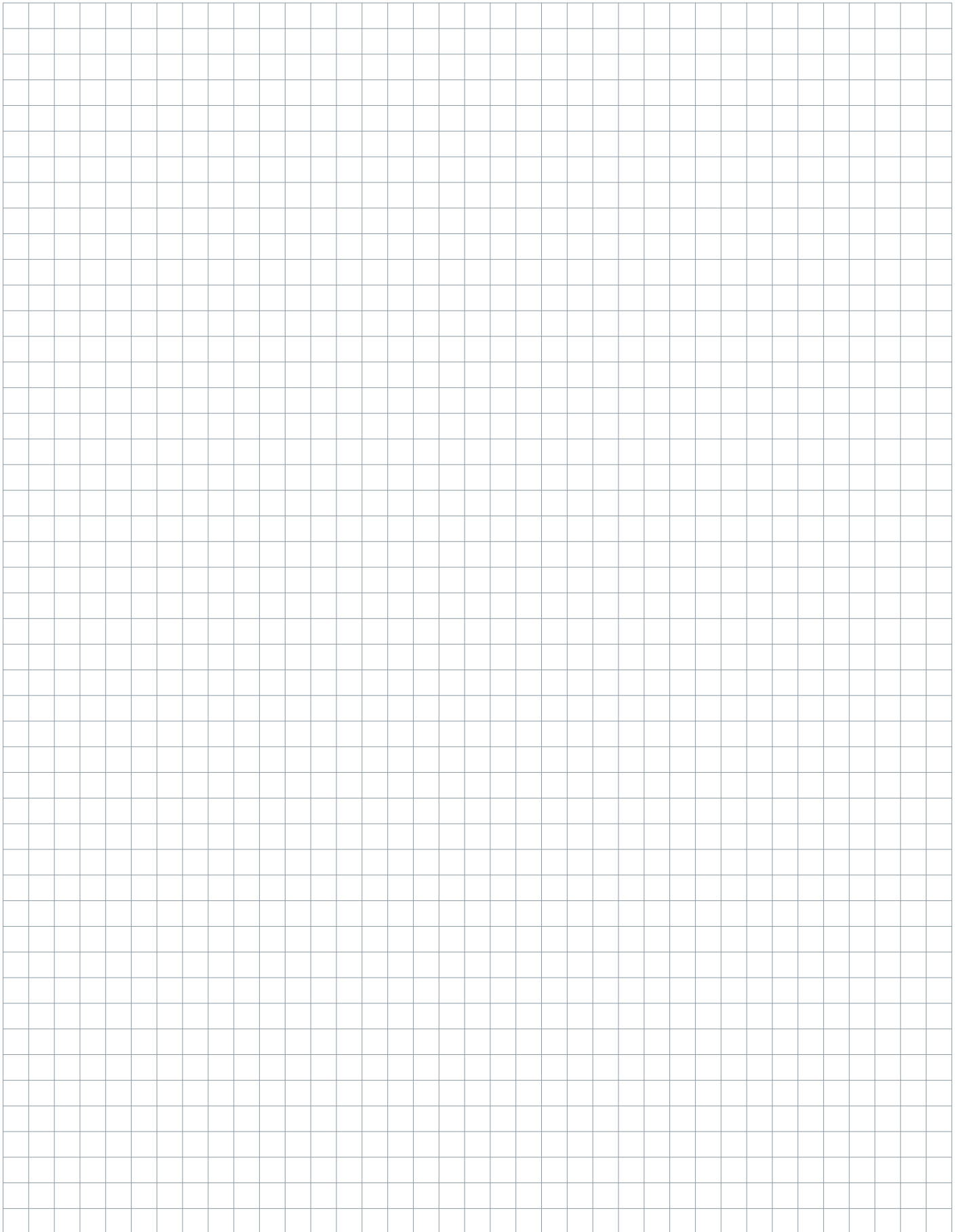


Distribution

This approach allows to optimize the footprint of the fluid handling components while benefiting from tailored fluidic sequences.



## NOTES





**[www.amf.ch](http://www.amf.ch)**

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