

TACMINA

*Smoothflow* Pump



# All-New Precision Pumps for Minute Amounts



World-First Mechanism  
Patent Pending

## For Those Who Want Total Control over Liquid Flow

Smoothflow — the ideal method of liquid transfer. This innovative method not only meets your liquid transfer needs, but also provides optimal solutions to people, liquids and the environment as well.

TACMINA's Smoothflow technology, based on unique know-how cultivated over 50 years, delivers you ultimate performance and provides complete satisfaction.

Ideal Method of Liquid Transfer

*Smoothflow*

- Constant & Stable Flow
- Eco-Friendly
- Economical
- Gentle on Liquids

# Are you and your conventional laboratory pump plagued with problems like these?

Tube type



## Low accuracy and reduced flow rate

The structure of conventional pumps makes strict flow control difficult. Over time, tube elasticity decreases, making it impossible to achieve original flow rates.

## High running costs

Special tubes for organic solvents in particular wear out quickly, and components are generally expensive, leading to higher running costs.

Syringe type



## Continuous, long-term liquid transfer is impossible

Multi-type apparatuses are required for continuous transferring of liquids beyond the capacity of the syringe. Pulsation arises when switching from one syringe to the next.

## Scaling up is difficult

Revalidation using pumps from another system is necessary when transitioning to actual production.

Plunger type



## Severe wear

Plunger wear leads to decreases in performance and improper discharges. Abrasion debris can mix into the liquid, contributing to contamination.

## Liquid leakage

Liquid can begin to leak from the seals. This can be problematic with dangerous chemicals and liquids that solidify or deteriorate when exposed to air.

Diaphragm type  
(Single pump head)



## Excessive pulsation

Reciprocating pumps cause intermittent flow with pulsations, requiring installation of a pulsation damper.



**With a Smoothflow Pump, such problems are a thing of the past.**



# Pumping performance and reliability that exceeds conventional laboratory pump's limitations

Smoothflow Pumps—designed for state-of-the-art manufacturing processes requiring extremely high precision, including applications for thin film coating and pharmaceutical manufacturing.

The Q Series is the first pump that brings TACMINA's Smoothflow technology to the laboratory.

## Excellent quantitative performance and responsiveness

- TACMINA pumps provide impressive quantitative performance with repeatability within  $\pm 1\%$  (full scale ratio).
- Flow rates can be finely configured at units of 0.01 mL/min.
- In addition, the excellent responsiveness allows for quick enforcement of starting and stopping operations and flow rate change operations.

### ★ Four types selectable according to flow rate and discharge pressure

Model	Flow rate	Max. discharge pressure
Q-100	0.1 to 100mL/min	0.3MPa
Q-60	0.1 to 60mL/min	0.6MPa
Q-30	0.1 to 30mL/min	1.0MPa
Q-10	0.1 to 10mL/min	2.0MPa

## Ability to maintain pumping accuracy over long periods of time

- Since there are no sliding parts, the load applied to the liquid-end section is small, preventing component wear and decreases in flow rate even over long-term use.
- In other words, the service life of the components is longer and running costs are low.



Watch sample transfer videos.  
[www.tacmina.com/Q](http://www.tacmina.com/Q)

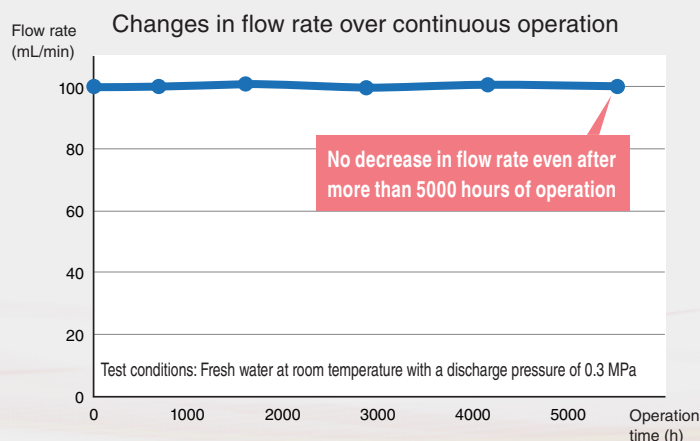


Pumping demo

Flow rate change operation

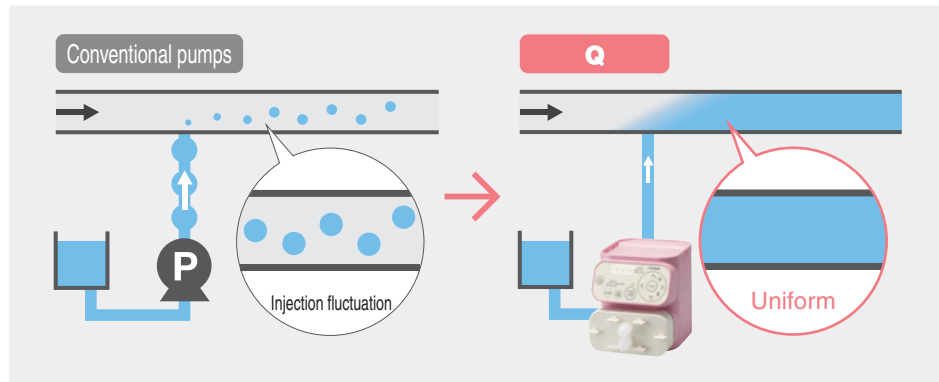
Auto-stop operation

In-line mixing



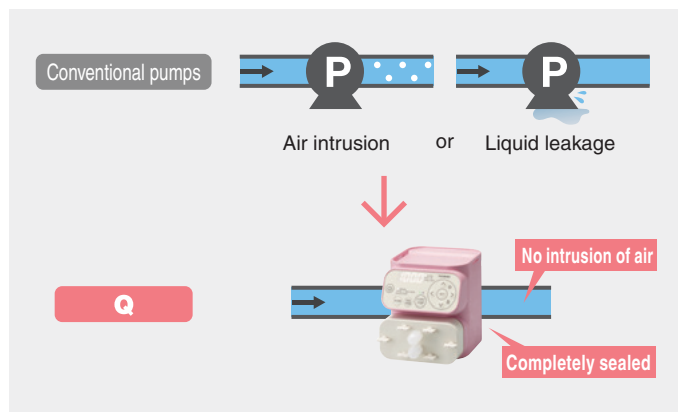
## Continuous, constant flow with no pulsation

- TACMINA's proprietary pumping mechanism (patent pending) enables pulsation-free, continuous, constant flow even with diaphragm pumps.



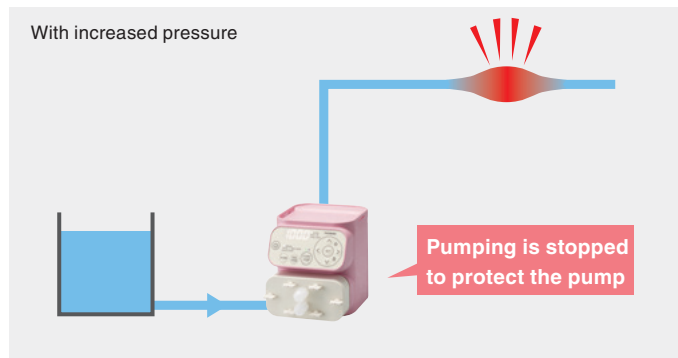
## No liquid leakage or changes in properties

- Since no sliding parts are used, localized pressure does not change, liquid is not altered by frictional heat, and solidification is prevented.
- The completely sealed structure also features no mechanical seals, eliminating the need to worry about liquid leakage.
- Delicate liquids that may be altered if exposed to air can also be conveyed with no changes to the liquid properties.



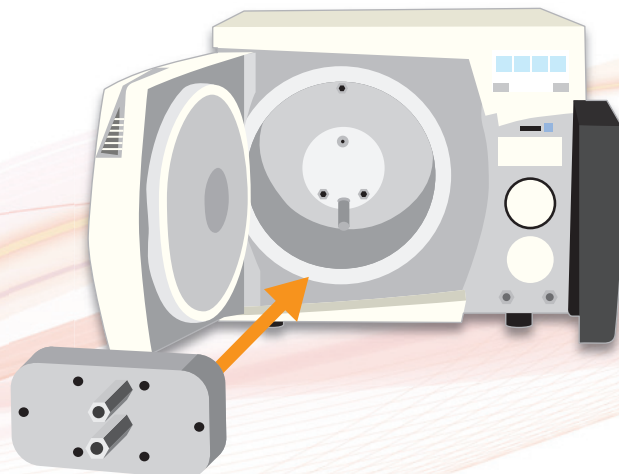
## Not damaged by clogged piping or dry running

- No load is applied to the pump even when the pump is obstructed, such as when the valve fails to open or clogging occurs, so there's no need to worry about malfunctions.
- The absence of sliding parts means there's no need to worry about galling, seizing, wear, or damage even with dry running.



## Also supports autoclave sterilization

- A model whose entire liquid-end section can be sterilized with an autoclave is also available.



# Simple, user-oriented design for ease of use

## Easy setting and calibration

- Users can change the flow rate just by entering the desired rate.
- Pump calibration can also be performed just by measuring and inputting the actual discharge rate. This allows for easy and accurate flow control.



## Simple disassembly and assembly

- The liquid-end section can be disassembled just by removing the bolts.
- Since assembly can be performed without trouble even for the first time, anyone can assemble the pump and maintain original performability.



## Easy liquid change

- With a spare pump head set, the liquid can be switched quickly just by replacing the pump head.
- Users can also use pump heads for fluids requiring the use of different head materials.



# I/O control, gradient operation and other various functions

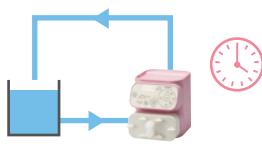


## Auto-stop operation Q

Operation times and discharge amounts can be set to stop pump operation automatically.

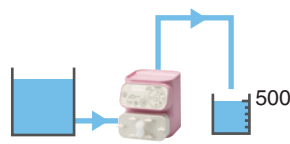
### Example 1

Stopping the pump after pumping for 2 hours



### Example 2

Stopping the pump after pumping 500 mL



## Signal output function QI·QT

Signals can be output for use with external equipment.

Unit pulse	Pulse signal output after a specific amount is discharged
Alarm	Signal output when an error occurs
Operation signal	Signal output while the pump is in operation
Stop end signal	Pulse signal output when interval or gradient operation ends (QT only)

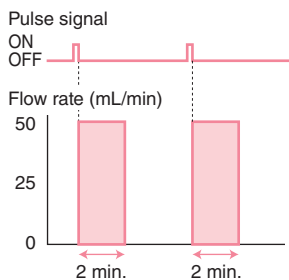


## Pulse-input proportional operation QI

Pumps can be operated automatically depending on a pulse signal input from an external device.

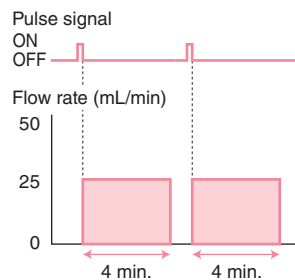
### Example 1

100 mL discharged at 50 mL/min per pulse signal



### Example 2

100 mL discharged at 25 mL/min per pulse signal

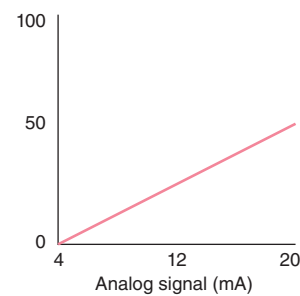


## Analog-input proportional operation QI

The flow rate can be changed automatically relative to an analog signal (4 to 20 mA DC) input from an external device.

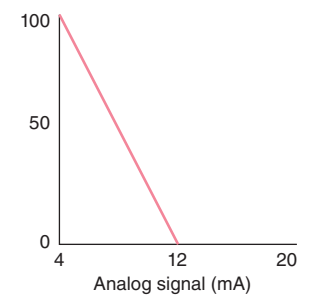
### Example 1

Flow rate control between 0 and 50 mL/min for signals between 4 and 20 mA



### Example 2

Flow rate control between 100 and 0 mL/min for signals between 4 and 12 mA



## Interval operation QT

Pump operation can be turned ON and OFF at regular intervals repeatedly.

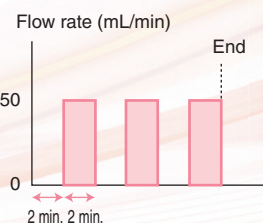
### Example 1

Operation at a flow rate of 50 mL/min starting after 3 minutes and stopping after 2 minutes performed repeatedly



### Example 2

Operation at a flow rate of 50 mL/min starting after 2 minutes and stopping after 2 minutes performed 3 times and then stopped

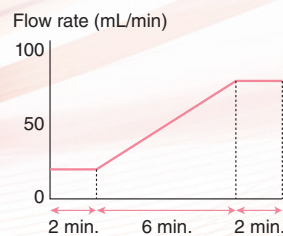


## Gradient operation QT

The flow rate of a pump can be gradually increased or decreased in proportion to how much operating time has passed.

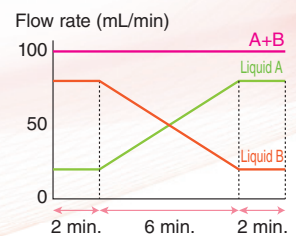
### Example 1

After 2 minutes of operation at 20 mL/min, flow rate increased to 80 mL/min over 6 minutes with 2 minutes of operation at 80 mL/min



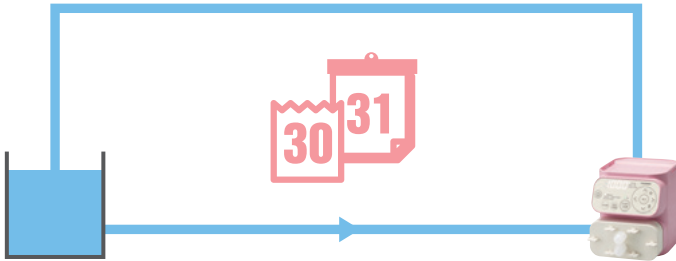
### Example 2

Gradient operation with positive symmetry using 2 linked pumps (constant total flow rate)



# Application Examples

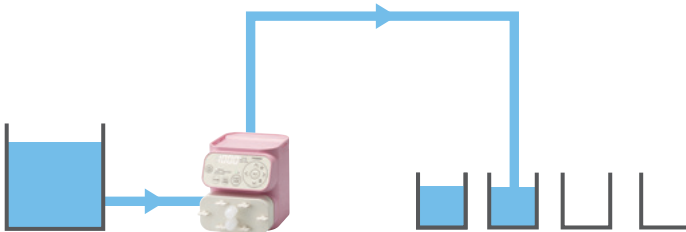
## Continuous operation over extended periods



Long-term continuous operation is possible for durability tests. Thanks to a structure that incorporates no sliding parts for transferring, the flow rate does not decrease due to wear or the like even over long periods.

- Control types: Q, QI, QT
- Functions: Manual operation

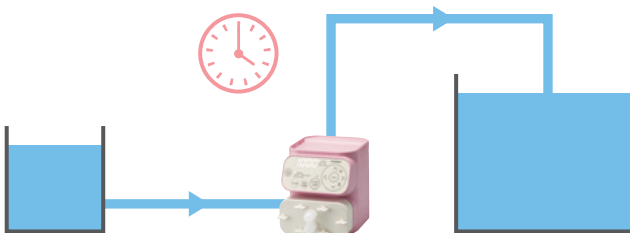
## Dispensing



Operation automatically stops following discharge of a specified amount of liquid. This functionality is useful when collecting a fixed amount of a liquid.

- Control types: Q, QT
- Functions: Auto-stop or interval operation

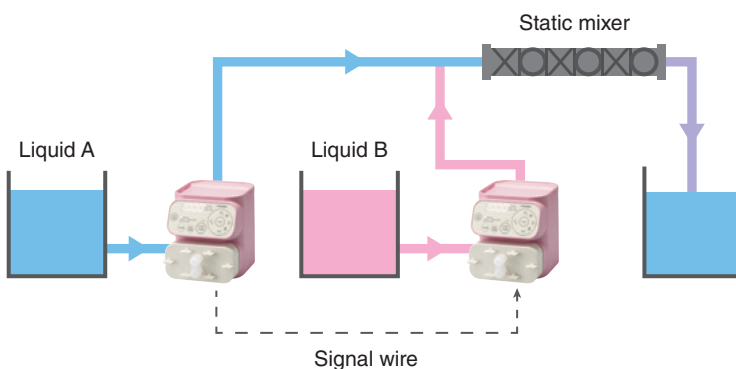
## Constant-cycle injection



Operation can be performed and stopped at a constant cycle. Regular injection operations can be performed automatically and with no user input.

- Control types: QT
- Functions: Interval operation

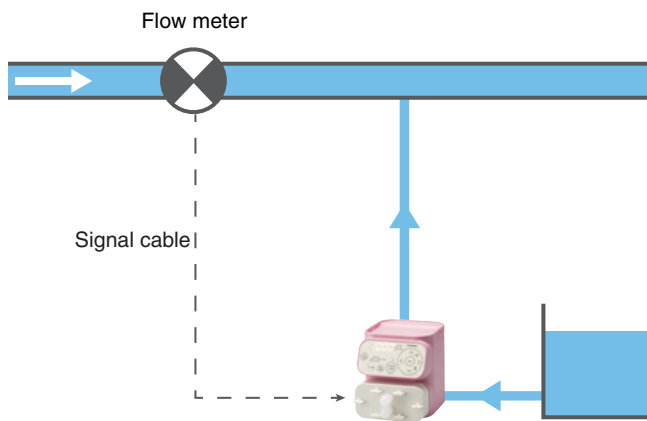
## Gradient mixing



When two or more pumps are linked together, mixing can be performed while gradually changing the ratio of liquids. (Consult TACMINA for applications requiring six or more pumps.)

- Control types: QT
- Functions: Gradient operation

## Flow-proportional injection



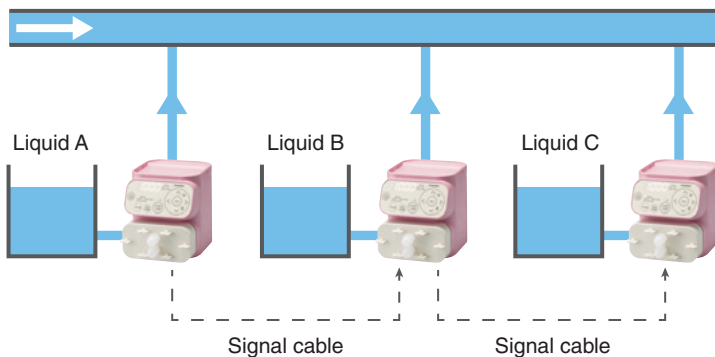
In accordance with the flow rate in the main piping being measured by the flow meter, the amount of chemical to be injected can be adjusted automatically by inputting a signal to the pump.

- Control types: QI
- Functions: Pulse or analog-input proportional operation

**[Tip]**

Control proportional to a liquid's chemical concentration, pH value, or temperature is also possible.

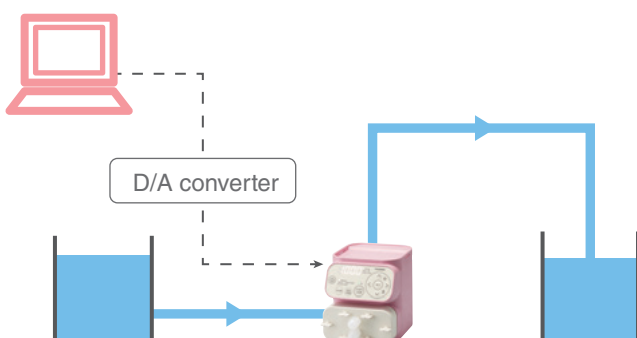
## Linked transfer of multiple liquids



The transfer amounts of multiple pumps can be linked by outputting a unit pulse for each constant discharge rate and then inputting that pulse to another pump. For example, this functionality makes it possible to control the pumps so that 5 mL of liquid B is injected for every 10 mL of liquid A that is injected.

- Control types: QI
- Functions: Unit pulse signal output and pulse-input proportional operation

## Program control



Using commercially available system development software allows for complex flow control that suits the desired purpose.

- Control types: QI
- Functions: Analog-input proportional operation

# Model Selection Guide

Model code

**Q** – **100** – **VE** – **ULP** – **E S**<sup>\*1</sup>

① **Control type**      ② **Model** (flow rate standard)      ③ **Liquid-end material**      ④ **Power plug**      Language      General specifications

\*1 If manufactured with special specifications, this will be "X".

## 1 Select control type.

Name	<b>Q</b> (Standard type)	<b>QI</b> (I/O signal control type)	<b>QT</b> (Timer control type)
Operation panel			
Operation mode	<ul style="list-style-type: none"> <li>Manual operation</li> <li>Calibration</li> <li>Auto-stop operation</li> </ul>	<ul style="list-style-type: none"> <li>Manual operation</li> <li>Calibration</li> <li>Analog-input proportional operation</li> <li>Pulse-input proportional operation</li> </ul>	<ul style="list-style-type: none"> <li>Manual operation</li> <li>Calibration</li> <li>Interval operation</li> <li>Gradient operation</li> </ul>

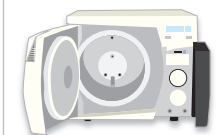
## 2 Select model (flow rate standard).

Name	<b>100</b>	<b>60</b>	<b>30</b>	<b>10</b>
Flow rate	0.1 to 100mL/min	0.1 to 60mL/min	0.1 to 30mL/min	0.1 to 10mL/min
Maximum discharge pressure	0.3MPa	0.6MPa	1.0MPa	2.0MPa

## 3 Select liquid-end material.

Name	<b>VE</b> <sup>*1</sup>	<b>VF</b> <sup>*1</sup>	<b>TT</b> <sup>*1</sup>	<b>6T</b>
Shape				
Pump head	PVC	PVC	PTFE	SUS316
Diaphragm	PTFE/CR	PTFE/CR	PTFE/CR	PTFE/CR
Sheet valve and packing	EPDM	Special fluoro rubber	Special fluoro rubber (perfluoro[FFKM])	Special fluoro rubber (perfluoro[FFKM])
Joint	PP	PP	PTFE	SUS316

A type that supports autoclave sterilization is also available.



※Contact TACMINA for details.

\*1 This can only be selected for the Q-100. It cannot be selected for the Q-60, Q-30, or Q-10.

## 4 Select power plug.

Name	<b>ULP</b>	<b>AUP</b>	<b>EUP</b>	<b>UKP</b>	<b>JPL</b>
Shape	UL plug	Australia plug	EU plug (CE)	UK plug (CE)	Lead wire

# Specifications

## Pump specifications

Specifications		Model	Q / QI / QT			
			100	60	30	10
Maximum flow rate <sup>1</sup>	mL/min		100	60	30	10
	L/h		6	3.6	1.8	0.6
	US G/h		1.58	0.95	0.47	0.15
Flow rate control range			Variable from 0.1 to the maximum flow rate			
Maximum discharge pressure	MPa		0.3	0.6	1	2
	bar		3	6	10	20
	psi		43.5	87	145	290
Reproducibility			± 1% (F.S.)			
Connection diameter			φ 4 × φ 6			
Ambient temperature °C			0 to 40 <sup>2</sup>			
Transfer liquid temperature °C			0 to 40 (no freezing)			
Transfer liquid viscosity mPa · s			200 or less		100 or less	
Environmental resistance			IEC standard: Corresponds to IP65 (dust proofing and waterproofing)			
Power supply	Rated voltage		100 to 240VAC ± 10%			
	Phase/frequency		1 φ / 50 Hz or 60 Hz			
	Cord		2 m			
Weight <sup>3,4</sup>		kg	VE / VF: 1.6, TT: 1.7, 6T: 2.5 <sup>5</sup>			

\*1 Conditions: Clean water at room temperature.

\*2 -10 to 50°C during transportation and storage.

\*3 The weight of the stand is excluded. \*4 This is the weight of the Q (standard type).

\*5 This is the weight of the Q-100. The Q-60/30 is 2.6 kg. The Q-10 is 2.9 kg.

## Control functions

Function	Description	Q	QI	QT
Manual operation	Setting possible in units of 0.1 mL/min or 0.01 mL/min	●	●	●
Auto-stop operation	Operating time: 1 to 9999 seconds or 1 to 9999 minutes Discharge volume: 0.1 to 999.9 mL or 0.1 to 999.9 L	●	—	—
Pulse-input proportional operation	0.1 to 999.9 mL/pulse or 0.1 to 999.9 L/pulse	—	●	—
Analog-input proportional operation	Controllable according to set target value (SV) and max. flow rate (HV)	—	●	—
Interval operation	Flow: 0.1 mL to MAX (0.1 mL units) ON time / OFF time: 1 to 9999 seconds or 1 to 9999 minutes	—	—	●
Gradient operation	Flow: 0.1 mL to MAX (0.1 mL units) Time: 1 to 9999 seconds or 1 to 9999 minutes (Initial retention time, gradient time, final retention time)	—	—	●

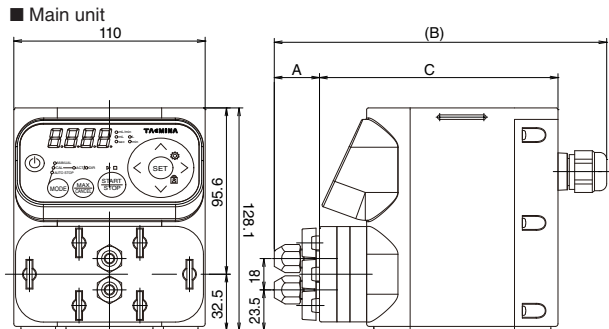
## I/O signal specifications (QI and QT only)

Signal		QI	QT
Analog	Input	1 port 4 to 20mADC Input resistance: Approximately 110Ω	—
	Output	2 ports 25VDC, 10mA or less Assigned to one of the following: Unit pulse, alarm, or operation signal	2 ports 25VDC, 10mA or less Assigned to one of the following: Unit pulse, end signal, alarm, or operation signal

## Accessories

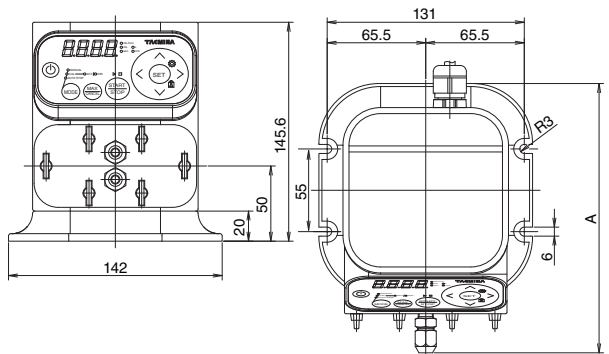
Tube (φ4 × φ6) .....	2m	Pump stand set .....	1 set
* VE / VF: Polyolefin resin, TT / 6T: PTFE		* A pump stand with machine screws	
Syringe (24mL) .....	×1	Mounting bolt set .....	4 sets
Nonslip sheet .....	×1	* Hexagon bolts and nuts	
		Operation manual .....	×1

## External dimensions



	Q-100	Q-60	Q-30	Q-10
	VE·VF·TT·6T	6T		
A	26	22		
B	191	187	184	190
C	137.1	137.1	134.4	139.9

## ■ When attached to the stand



A	Q-100	Q-60	Q-30	Q-10
	VE·VF·TT	6T	6T	6T
	179.1	175.1	175.1	172.4

## Consumables (per pump)

Part name	Quantity	Recommended replacement interval
Diaphragm	2	4,000 hours or 1 year
Sheet valve	1	
Packing	1	
Protective sheet	1	When deterioration or damage is visible

# The next level of Smoothflow Pumps for applications that call for more performance



## Scaling up

Achieve flow rates of up to 3 L/min and discharge pressures as high as 1.5 MPa.



## Slurries and high-viscosity liquids

Get smooth, trouble-free transfers of abrasive slurries and liquids with high viscosities up to 2000 mPa.s.



## Explosion proof

Take advantage of the optional explosion-proof motor (d2G4).



## Sanitary

Sanitary types are also available for food, medicine, fine chemicals, and other applications.

## XPL

The same excellent precision and ease of use as the Q Series!

Continuous, constant flow with no pulsation

Excellent quantitative performance

Manual flow rate operation

Easy disassembly and maintenance

PVC, PTFE and SST liquid-end parts



## Performance specifications

Model		001	003	01	03	1	3
Max. discharge volume	mL/min	9	25	100	300	1000	3000
	L/h	0.54	1.5	6	18	60	180
	US G/h	0.14	0.39	1.58	4.75	15.84	47.52
Max. discharge pressure	MPa	1.5	1.5	1.0	1.0	0.5	0.5
	bar	15	15	10	10	5	5
	psi	217.5	217.5	145	145	72.5	72.5

## Other Smoothflow Pumps



## TPL

Max. discharge volume: 30 L/min  
Max. discharge pressure: 15 MPa  
"Ultra" high-precision pump to meet the needs of tomorrow.



## APLS

Max. discharge volume: 45 L/min  
Max. discharge pressure: 0.5 MPa  
Large-capacity specification for sanitary use. Transfer slurries and high-viscosity liquids.



## PL

Max. discharge volume: 30 L/min  
Max. discharge pressure: 50 MPa  
Customizable design allows for handling of a variety of applications.



## BPL

Max. discharge volume: 80 L/min  
Max. discharge pressure: 1 MPa  
Simple structure with outstanding cost performance.

## Smoothflow System

Combine pumps, tanks, and control devices in order to design and manufacture equipment and systems that suit your needs.



## TACMINA CORPORATION

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