



ORIGINAL INSTRUCTIONS

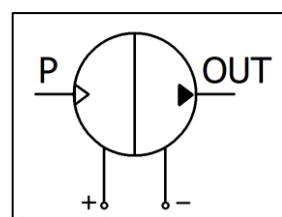


Refer to Declaration of Conformity for relevant Directives

## Instruction Manual

## Liquid Dispense Pump (Solenoid Type)

## LSP Series



The intended use of **the LSP Series is for the dispense of stable and repeatable volumes of liquid.**

## 1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC<sup>1)</sup>, and other safety regulations.

<sup>1)</sup> ISO 4414: Pneumatic fluid power - General rules relating to systems.  
ISO 4413: Hydraulic fluid power - General rules relating to systems.  
IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)  
ISO 10218-1: Manipulating industrial robots -Safety, etc.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

	<b>Caution</b>	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	<b>Warning</b>	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	<b>Danger</b>	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

**Warning**

- Always ensure compliance with relevant safety laws and standards.**
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.

## 2 Specifications

## 2.1 General Specifications

Model	LSP111/112	LSP121/122	LSP131/132
Dispense Range <sup>Note 1)</sup>	5 - 50 $\mu$ L	50 - 100 $\mu$ L	100 - 200 $\mu$ L
Fluid <sup>Note 2)</sup>	Water, DI Water, Diluent, or Cleaning fluid		
Material	Body	PEEK, PP	
	Diaphragm	EPDM, FKM	
	Check Valve	EPDM, FKM	
Repeatability <sup>Note 1)</sup>	$\pm 1\%$ ( $\pm 2\%$ at 5 to 15 $\mu$ L)		
Dispense Pressure <sup>Note 3)</sup>	10 kPa		
Suction pressure <sup>Note 3)</sup>	Dry	15 kPa	
	Wet	35 kPa	
Ambient Temperature	10 to 50°C (No freezing)		
Fluid Temperature	10 to 50°C (No freezing)		
Enclosure	Equivalent to IP40		
Weight	Threaded Port	90 g	
	Tube / Base	85 g	
Mounting orientation <sup>Note 4)</sup>	Unrestricted		

Table 1

## 2 Specification - continued

## 2.2 Solenoid Specification

Model	LSP111/112	LSP121/122	LSP131/132
Rated Voltage	12 VDC, 24 VDC		
Allowable Voltage Fluctuation <sup>Note 5)</sup>	$\pm 10\%$ of the rated voltage		
Max. operating frequency <sup>Note 6)</sup>	2 Hz (Minimum ON time 200ms / Minimum OFF time 300 ms)		
Coil insulation	Class B		
Lead Wire	AWG20 (Outside insulation diameter 1.7 mm)		
Power Consumption	4 W	9 W	17 W
Operation Noise <sup>Note 7)</sup>	60 dB or less		

Table 2

Notes:

- The values above are at room temperature with clear water at zero pressure. The dispense volume and repeatability will vary depending on the piping conditions (height, diameter, length, etc.), of the INLET and OUTLET sides, fluids, and the ambient and fluid temperatures, etc. For stable dispensing, use the product under stable operating conditions where pressure is not applied to the INLET and OUTLET side as much as possible. Do not apply excessive torque when rotating the dispensing volume adjusting screw. If the screw is tightened too much, it may lead to product failure or cause the screw to shear.  
<Variation in SMC measurement conditions>  
Ambient / Fluid Temperatures:  $\pm 2^\circ\text{C}$ , IN/OUT side piping pressure:  $\pm 0.1\text{kPa}$  or less, Applied Voltage:  $\pm 0.01\text{V}$
- Select an appropriate fluid contact material when fluid such as cleaning liquid is used, the fluids must not corrode or permeate into the fluid contact materials. Also, check the fluid compatibility in advance. Some fluids may have an influence on the dispense volume and repeatability. After mounting is complete, perform appropriate functional inspections. This product is not designed to be explosion proof, so it is not suitable for flammable fluids.
- The value is measured when the maximum dispense volume of clear water at room temperature is adjusted. This value will vary depending on the dispense volume and fluid conditions.
- For stable dispensing, we recommend that the coil is mounted vertically facing downward or OUTLET side facing upward so that

air bubbles are removed easily. Also, dispense liquids by operating the product continuously to remove any air bubbles in the piping and pump chamber. It is recommended to degasify the fluid before use.

- When response time is prioritized, or dispensing is difficult due to high fluid viscosity or high piping resistance, control the voltage so that there is no fluctuation below the rated voltage.
- High-speed operation affects the dispense volume and accuracy. The max. operation frequency is decreased by the fluid characteristics (large viscosity) and the piping condition (large piping resistance). When the pump is used continuously for extended periods of time, make the OFF time appropriately longer with the minimum ON time of 200 ms to set the operating frequency to 1 Hz or less. The coil temperature may rise due to ambient temperature and energizing time, so make the OFF time appropriately longer.
- The value above is under SMC's measurement conditions and will vary depending on the conditions.

**Warning**

Special products might have specifications different from those shown in this section. Contact SMC for specific drawings.

## 3 Installation

## 3.1 Installation

**Warning**

- Do not install the product unless the safety instructions have been read and understood.
- Do not use this product in applications which may adversely affect human life (e.g. medical equipment connected to the human body for drip infusion).
- The installation should allow sufficient space for maintenance activities.
- For stable dispensing, please use the product under stable operating conditions.
- It is recommended to degasify the fluid and use hard material for piping.

## 3 Installation - continued

- When the piping diameter of the fluid outlet is large, it is recommended to use proper piping diameter with the installation of a nozzle.
- Take precautions to prevent static electricity as some fluids can generate static electricity.
- Voltagages caused by leakage current may lead to pump malfunction. Leakage voltage should be less than 2% of rated voltage.

## 3.2 Operation

**Warning**

## • Repeatability

Measure the amount of clear water which is dispensed 10 times continuously and convert it to one shot of dispensed volume. Repeat this measurement 10 times, and indicate the difference (%) between the average value of 10 sets of data (converted value of one shot) and the maximum and minimum values. These values are calculated based on SMC measurement conditions, so the repeatability accuracy is not guaranteed.

## &lt;Variation in SMC measurement conditions&gt;

**Tank liquid level must be lower than the pump and the OUT side tube end must be higher than the tank liquid level. Remove any air bubbles in the piping and pump chamber.** Ambient/Fluid temperatures:  $\pm 2^\circ\text{C}$ , IN/OUT side piping pressure:  $\pm 0.1\text{kPa}$  or less, Applied voltage:  $\pm 0.01\text{V}$

- Dispense volume will vary depending on the fluid and piping conditions.** After mounting is complete, perform appropriate functional inspections.

## • Energising for extended periods of time

If the pump is energised for long periods of time, take measures to cool the pump by mounting a fan to keep the surface temperature at 50°C or less.

When the pump is mounted into a control panel, take measures to cool the pump and keep the operating temperature within the specified range.

- Not energising for a long period of time.** When pump has not been used for a long period of time, perform a trial run before use. When

pump is to remain inactive for a long period of time, remove fluid from pump.

- Do not touch pump directly with hands.** The coil can be hot depending on the ambient temperature or energisation time. Install a protective cover over the valve if it can be touched directly by hands.

- Do not apply pressure to the pump. If operated with pressure applied, the repeatability may decrease or liquid may leak to OUT side when pump is off.**

## 3.3 Environment

**Warning**

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.

## 3.4 Piping

**Caution**

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- Make sure to remove any air bubbles in the piping and pump chamber before use.**
- Do not apply pressure to the pump. If the pump operates with pressure applied, the repeatability may decrease or liquid may leak to the OUT side when the pump is off. Tank liquid level must be lower than the pump and the OUT side tube end must be higher than the tank liquid level. Remove any air bubbles in the piping and pump chamber.**

## 3 Installation - continued

## • Always tighten threads with the proper tightening torque.

When piping the fitting to the body ported (threaded ports), the installation method and tightening torque value may vary depending on the seal structure (shape) or material of the fitting to be used. Check the methods and precautions recommended by the fitting manufacturer to be used and be sure to check for leakage. It is customer's responsibility to verify the compatibility of the fitting and operating liquid.

- Table 3 shows reference torque values if using KQ2 series with water.

Model	Part number	Thread size	Torque [N.m] (Reference)*
Body Port (Threaded ports)	LSP1#1-#A(B)1	M5	0.5 to 0.7
	LSP1#1-#C(D)1		0.3 to 0.35
	LSP1#1-#A(B)2(3)	M6 / ¼ -28 UNF	0.6 to 0.8
	LSP1#1-#C(D)2(3)		0.4 to 0.45

Table 3

\*After Tightening by hand, tighten 1/6 to ¼ turn with a tightening tool

- Table 4 shows reference torque values for mounting the base to an interface. For Base mounted, confirm that O-ring is mounted on the interface properly.

Model	Part number	Thread size	Torque [N.m]
Base mount (Tube) Body mounting	LSP1#1-#A(B)4	M2	0.15 to 0.2
	LSP1#2-#A(B)		0.1 to 0.15
Body Port (Thread) Body mounting	LSP1#1-#C(D)4	M3	0.4 to 0.6
	LSP1#2-#C(D)		0.2 to 0.25

Table 4

- When connecting tubing to the tube connection type, please make sure inserting it straight to the end of the tube inlet.

If external force of 10 N or more is applied to tube inlet, the inlet may become damaged, and leakage or breakage could occur.

Select appropriate tubing while referring to Table 5.

Model	Tube inside diameter (I.D)	Tubing outside diameter (O.D) (After Mounting)
LSP1#1-##4	$\varnothing 2$ or less	$\varnothing 5,8$ or less

Table 5

The holding force varies by the tubing material. Be sure to confirm the holding force of each material before operation. After connecting the tubing do not apply load such as tensile force, compression, or bending force.

- When the tubing is long or according to the operating conditions, tubing may thrash about, causing damage to the tube inlet of the pump, or the tubing to come off or deteriorate. In this case, secure the tubing to prevent its uncontrolled movement.
- If the removed tubing is to be used again, cut off the section of the tubing which has been gripped by the fitting.

## 3.5 Mounting

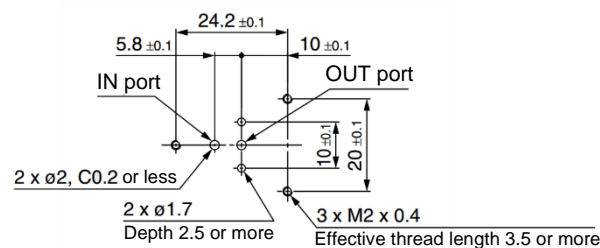
**Caution**

- If equipment doesn't operate properly stop operation.** After mounting is completed, confirm that it has been done correctly by performing a suitable function test.
- For stable dispensing, mount the pump vertically facing downward on a horizontal surface so that bubbles in the pump are removed easily.
- Remove dust from pump mounting surface completely.
- Do not apply external force to the coil section.
- Install and operate product only after reading the operation manual and understanding its contents.

### 3 Installation - continued

#### LSP1#2 Mounting Interface

##### Recommended interface dimensions



\* Surface roughness must be Rz 3.2 or less

Figure 1

#### 3.6 Wiring

##### Caution

- Use electrical circuits which do not generate chattering in their contacts.
- Use voltage which is within  $\pm 10\%$  of the rated voltage. However, when response time is prioritized or dispensing is difficult due to high fluid viscosity or high piping resistance, control the voltage so that there is no fluctuation below the rated voltage.
- Apply the correct voltage. Applying incorrect voltage may cause malfunction or a burned coil.
- Make sure no excessive force is applied to the lead wires. Otherwise the coil will burn.
- There is no polarity. LSP can operate with either positive or negative voltage applied to either lead wire.

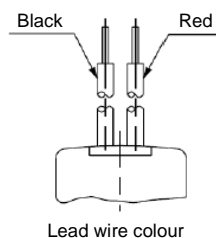


Figure 2

### 4 Settings

#### 4.1 Dispense Volume Adjustment

The dispense volume per shot can be changed by rotating the dispensing volume adjusting screw.

- When rotating the dispensing volume adjusting screw clockwise, the dispense volume decreases.
- When rotating it counterclockwise, the dispense volume increases.

##### Step 1

Remove the cap and loosen the lock nut (counterclockwise) while holding the dispensing volume adjusting screw with a flat blade screwdriver to prevent it from rotating.

##### Step 2

Rotate the dispensing volume adjusting screw to adjust the dispense volume. Refer to Figure 3 and Table 6 as reference for the range of the dispensing volume adjusting screw.

Model	LSP11#	LSP12#	LSP13#
Upper limit of adjustment (fully open)	Approximately 3 mm		
Adjustment range (clockwise)	1.5 turns	2 turns	2.5 turns

Table 6

### 4 Settings - continued

- Do not apply excessive torque when rotating the dispensing volume adjusting screw. If the screw is tightened too much, it may lead to product failure or cause the screw to shear. Adjust the dispense volume gradually to avoid breakage of the inner parts due to tightening the adjusting screw too much.
- When the dispensing volume adjusting screw is close to the maximum adjustment level, the noise may be loud. In this case, turn the screw clockwise until the noise is reduced.

##### Step 3

Tighten the lock nut (clockwise) while holding the dispensing volume adjusting screw with a flat blade screwdriver to prevent it from rotating. Lock nut tightening torque: 0.6 to 0.8 Nm.

\*Ensure that the lock nut is secured after adjusting the dispense volume.

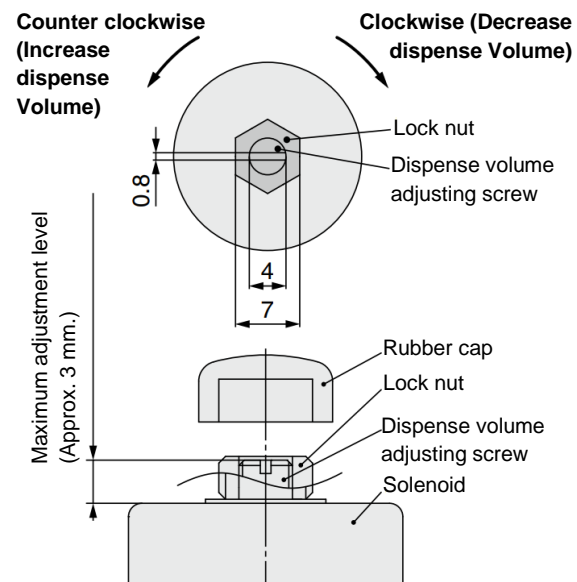


Figure 3

### 5 How to Order

Refer to *catalogue* for 'How to Order'.

### 6 Outline Dimensions (mm)

Refer to *catalogue* for outline dimensions.

### 7 Maintenance

#### 7.1 General Maintenance

##### Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- **Removing the product**  
Shut off the fluid supply and release the fluid pressure in the system. Shut off the power supply. Remove the product.
- **Before operating remove residual chemicals and completely replace it with deionized water, air, etc.**
- **Do not disassemble the product**  
Products that have been disassembled cannot be guaranteed. If disassembly is necessary, please contact SMC.

### 8 Limitations of Use

#### 8.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

##### Caution

#### 8.2 Pump is not to be used to stop flow from pressure sources.

- This product is not designed to be used to stop flow from a pressurized source, any pressure supplied to the inlet will result in uncontrolled flow through the pump.

#### 8.3 Low temperature operation

- Pump should be used at temperatures above 10°C and avoid freezing of the fluid to prevent any damage to the pump.

### 8 Limitations of Use - continued

#### 8.4 Extended periods of continuous energisation.

- If the pump is continuously energized for long periods of time, temperature rise due to heat generation of the coil may result in reduced performance and shorter service life or adversely affect the peripheral device. Therefore, if the pump is energized for long periods, take measures to cool the pump by mounting a fan to keep the surface temperature at 50°C or less. When the pump is mounted into a control panel, take measures to cool the pump and keep the operating temperature within the specified range.

#### 8.5 Fluid

- Be sure to confirm the compatibility between the component material and the fluid. Since the compatibility of the fluid used may vary depending on its type, additives, concentration, temperature, etc., give sufficient consideration when selecting the material.
- If the fluid contains foreign matter, it may be caught in the seat or cause wear on the inside of the pump, causing problems.
- Install an appropriate filter (strainer) before the pump. As a guide, the appropriate filtration is approximately 50  $\mu\text{m}$ .
- When transferring a coagulable liquid, take measures to prevent it from coagulating in the pump.
- When fluid may crystalize or clot depending on its nature, malfunction will occur due to the diaphragm or check valve sticking. When a crystalized or clotted component is caught between two sealing parts, unstable liquid dispensing will occur. Take measures to clean such component if necessary.
- This product is not designed to be explosion proof, so it is not suitable for flammable fluids.

### 9 Product disposal

This product should not be disposed of as municipal waste. Check your local regulations and guidelines to dispose this product correctly, in order to reduce the impact on human health and the environment.

### 10 Contacts

Refer to [www.smcworld.com](http://www.smcworld.com) or [www.smc.eu](http://www.smc.eu) for contacts.

## SMC Corporation

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