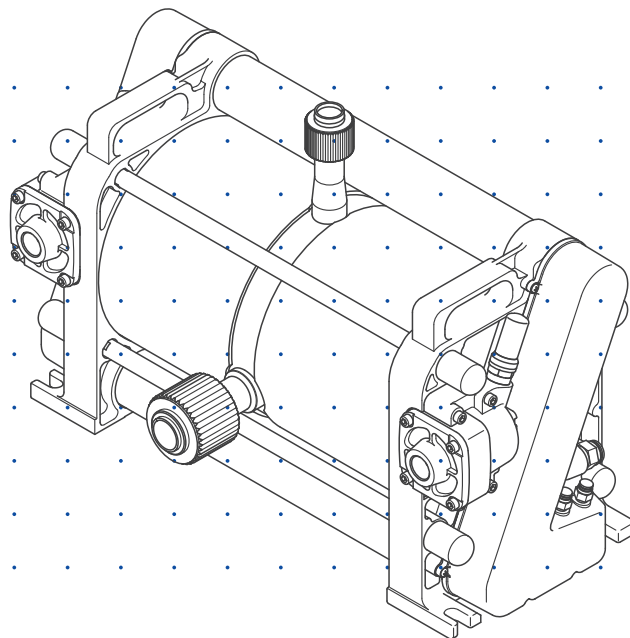



# Iwaki Pneumatic Drive Bellows Pump

## FLP-75W



## Instruction manual

Thank you for choosing our product.

 Please read through this instruction manual before use.

This instruction manual describes important precautions and instructions for the product. Always keep it on hand for quick reference.

## Order confirmation

Open the package and check that the product conforms to your order. If any problem or inconsistency is found, immediately contact your distributor.

### **a. Check if the delivery is correct.**

Check the nameplate to see if the information such as model codes are as ordered.



### **b. Check if the required number of accessories is provided.**

<Attached accessories>

- Four straight fittings (displacement sensor cooling air inlets/outlets) with plugs.
- Two silencers

\*Necessary electrical wiring male connectors are attached to the LPC-1 controller package.

### **c. Check if the delivery is damaged or deformed.**

Check for transit damage and loose bolts.

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# Safety instructions

Read through this section before use. This section describes important information for you to prevent personal injury or property damage.

## ■ Symbols

In this instruction manual, the degree of risk caused by incorrect use is noted with the following symbols. Please pay attention to the information associated with the symbols.

 <b>WARNING</b>	<b>Indicates mishandling could lead to a fatal or serious accident.</b>
 <b>CAUTION</b>	<b>Indicates mishandling could lead to personal injury or property damage.</b>

A symbol accompanies each precaution, suggesting the use of "Caution", "Prohibited actions" or specific "Requirement".

Caution marks	Prohibited marks	Requirement marks
 Caution  Electrical shock	 Prohibited  Do not rework or alter  Fire ban	 Requirement  Wear protection

## Export Restrictions

Technical information contained in this instruction manual might be treated as controlled technology in your countries, due to agreements in international regime for export control. Please be reminded that export license/permission could be required when this manual is provided, due to export control regulations of your country.

## ⚠️ WARNING



Requirement

### Turn off power before work

Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed. Let other people know about the situation by displaying a notice such as "POWER OFF (Maintenance)" near the power switch.



Requirement

### Confirm safety in your working area

Keep away from the pump when turning on power. The pump doesn't have an ON-OFF switch. The pump starts as a power cable is plugged in.



Requirement

### Stop operation

If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems.



Prohibited

### Do not use the pump in any condition other than its intended purpose

The use of the pump in any conditions other than those clearly specified may result in failure or injury. Use this product in specified conditions only.



Do not remodel

### Do not modify the pump

Alterations to the pump carries a high degree of risk. It is not the manufacturer's responsibility for any failure or injury resulting from alterations to the pump.



Wear protectors

### Wear protective clothing

Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a face shield during disassembly, assembly or maintenance work. The specific solution will dictate the degree of protection. Refer to MSDS precautions from the solution supplier.



Requirement

### Spill precautions

Ensure protection and containment of solution in the event of plumbing or pump damage (secondary containment).



Caution

### Do not touch the pump or pipe with bare hands

Risk of burning. The surface temperature of the pump or pipe rises high along with liquid temperature in or right after operation.



Prohibited

### Do not remove covers

Do not remove the right-and-left cylinder head covers or the top-and-bottom covers during operation. Or personal injury may result.



Requirement

### Depressurize piping before disassembly

Release a pressure from both liquid and air lines before dismantling the pump or removing piping.

**⚠ CAUTION**

Requirement

**Do not lift the pump by gripping the right-and-left cylinder head covers or the top-and-bottom covers**

The pump can drop unintentionally as one of those parts breaks. Hold the pump by the handgrips to lift it up.



Requirement

**Qualified personnel only**

The pump should be handled or operated by qualified personnel with a full understanding of the pump. Any person not familiar with the product should not take part in the operation or maintenance of the pump.



Prohibited

**Use specified power only**

Do not apply any power other than that specified on the nameplate. Otherwise, failure or fire may result. Ensure the pump is properly grounded.



Requirement

**Ventilation**

Fumes or vapours can be hazardous with certain solutions. Ensure proper ventilation at the operation site.



Prohibited

**Do not install or store the pump:**

- In a flammable atmosphere.
- In a dusty/humid environment.
- In a corrosive atmosphere.



Prohibited

**Do not stand on the pump**

Do not use the pump as a platform. Injury or damage may result when the pump turns over.



Requirement

**Flushing before operation**

Flush the inside of the pump and piping with pure water or the liquid to be delivered before the start of operation.



Requirement

**Do not run the pump with the following liquid:**

- Liquid that easily crystallizes
- Slurry
- Low conductivity hydrocarbon liquid



Requirement

**Use care handling the following liquid:**

- Stripper
- Solvent
- Hydrazine
- Fuming sulfuric acid

## ⚠ CAUTION



Requirement

### **Static electricity**

When low electric conductivity liquids such as ultra-pure water and fluor inactive liquid (e.g. Fluorinert™) are handled, the static electricity may be generated in the pump and may cause static discharge. Take counter-measures to remove the static electricity.



Requirement

### **Wear part replacement**

Follow instructions in this manual for wear part replacement. Do not dismantle the pump beyond the extent of the instructions.



Requirement

### **Before returning product**

Be sure to drain chemicals and clean the inside of the pump before return so that a harmful chemical does not spill out in transit.



Requirement

### **Observe the maximum stroke rate**

Operation above the maximum stroke rate may reduce the life of bellows. See "**Specification**" on page 67 for detail. Set a fast alarm speed to the LPC-1 controller to avoid over-speed operation.



Requirement

### **Disposal of a used pump**

Dispose of any used or damaged pump in accordance with local rules and regulations. If necessary, consult a licensed industrial waste disposal company.

## Precautions for use

- During transit:
  - Do not hit/wet the package.
  - Do not place the package lateral/up side down.
  - Do not stack the package on top of another.
- Electrical work should be performed by a qualified electrician. Otherwise, personal injury or property damage could result.
- Do not install the pump:
  - In a flammable atmosphere.
  - In a dusty/humid place.
  - In a corrosive/explosive atmosphere.
- Allow sufficient space around the pump for easy access and maintenance.
- Use care handling the pump. Do not drop. An impact may affect pump performance. Do not use a pump that has been damaged to avoid the risk of electrical damage or shock.
- Do not lift the pump by gripping the right-and-left cylinder head covers or the top-and-bottom covers. The pump can drop unintentionally as one of those parts breaks. Hold the pump by the handgrips to lift it up.
- The pump and controller are not waterproof. Do not operate the pump and controller while wet with solution or water. Failure or injury may result. Immediately dry off the pump and controller if they get wet.
- Do not close discharge line during operation. Solution may leak or piping may break.
- Solution in the discharge line may be under pressure. Release the pressure from the discharge line before disconnecting plumbing or disassembly of the pump to avoid solution spray.
- Wear protective clothing when handling or working with pumps. Consult solution MSDS for appropriate precautions. Do not come into contact with residual solution.
- Do not leave the pump with any chemical in the bellows for a long period. Some chemical gas can penetrate the bellows and corrode metal parts. Run the pump for ten minutes a day for replacing gas when the pump is going to be suspended two or three days.



Prohibited



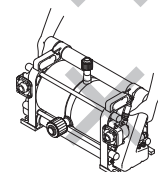
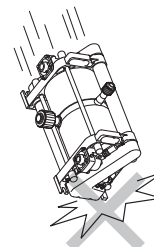
Caution



Caution



Caution



Caution



Caution



Requirement



Caution



Requirement

# Overview

Pump characteristics, features and part names are described in this section.

## Introduction

### Pump structure & Operating principle

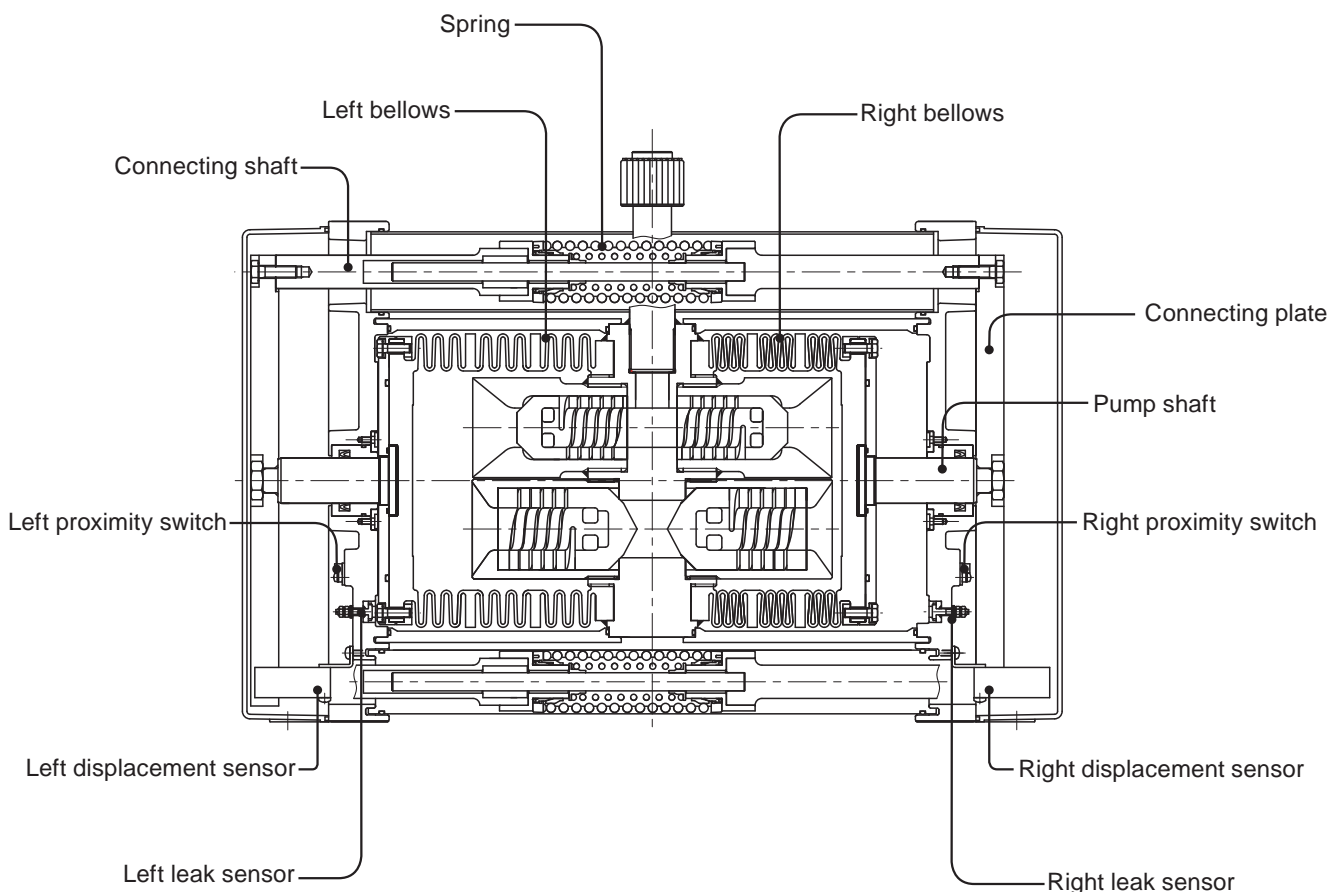
The FLP-75W is a pneumatic drive pump with a pair of bellows and is controlled with the LPC-1 controller. The special design of this pump alone reduces discharge pulsation without the assistance of a dampener, as low as the combination of existing models and a dampener can achieve.

#### Principle of operation

The LPC-1 controller determines and keeps the optimal movement of the bellows with the right-and-left displacement sensors and timely supply-air switching. This mechanism ensures the minimum discharge pulsation at any operating conditions as long as specifications are met.

#### Supply-air switching

The LPC-1 controller determines an ON/OFF time of the solenoid valves by the input from displacement sensors (ON time) and proximity switches (OFF time).



## Features

---

- **Low discharge pulsation**

Displacement sensors and proximity switches monitor bellows movement for the LPC-1 controller to determine the optimal time to offset flow pulsations one after the other without the support of a dampener.

- **No need for a pressure and a flow sensor**

Displacement sensors and proximity switches alone monitor bellows movement. Need for a pressure and a flow sensor is eliminated.

- **Capable of high-temperature liquid (up to 180°C)**

- **Capable of high supply air pressure (up to 0.5MPa)**

- **Safety design**

The bellows are welded into the pump head to reduce the possibility of a leak. A leak sensor also installed in the air chamber to detects an accidental leak by bellows damage.

## Operation mode

---

- **MAN mode (Manual operation)**

Start/Stop of the pump operation with the LPC-1 controller.

- **AUTO mode (Automatic operation)**

Start/Stop of the pump operation with the signal input from user's PLC.

- **Feedback control**

The LPC-1 controller adjusts supply-air pressure to keep a constant flow under pressure fluctuation.

\*Use of the CKD EVD3500-010AN-\_\_-3 is required. Purchase separately.

## Safety functions

---

- **Leak detection**

The LPC-1 controller stops the pump upon detecting a leak from bellows.

- **Emergency stop**

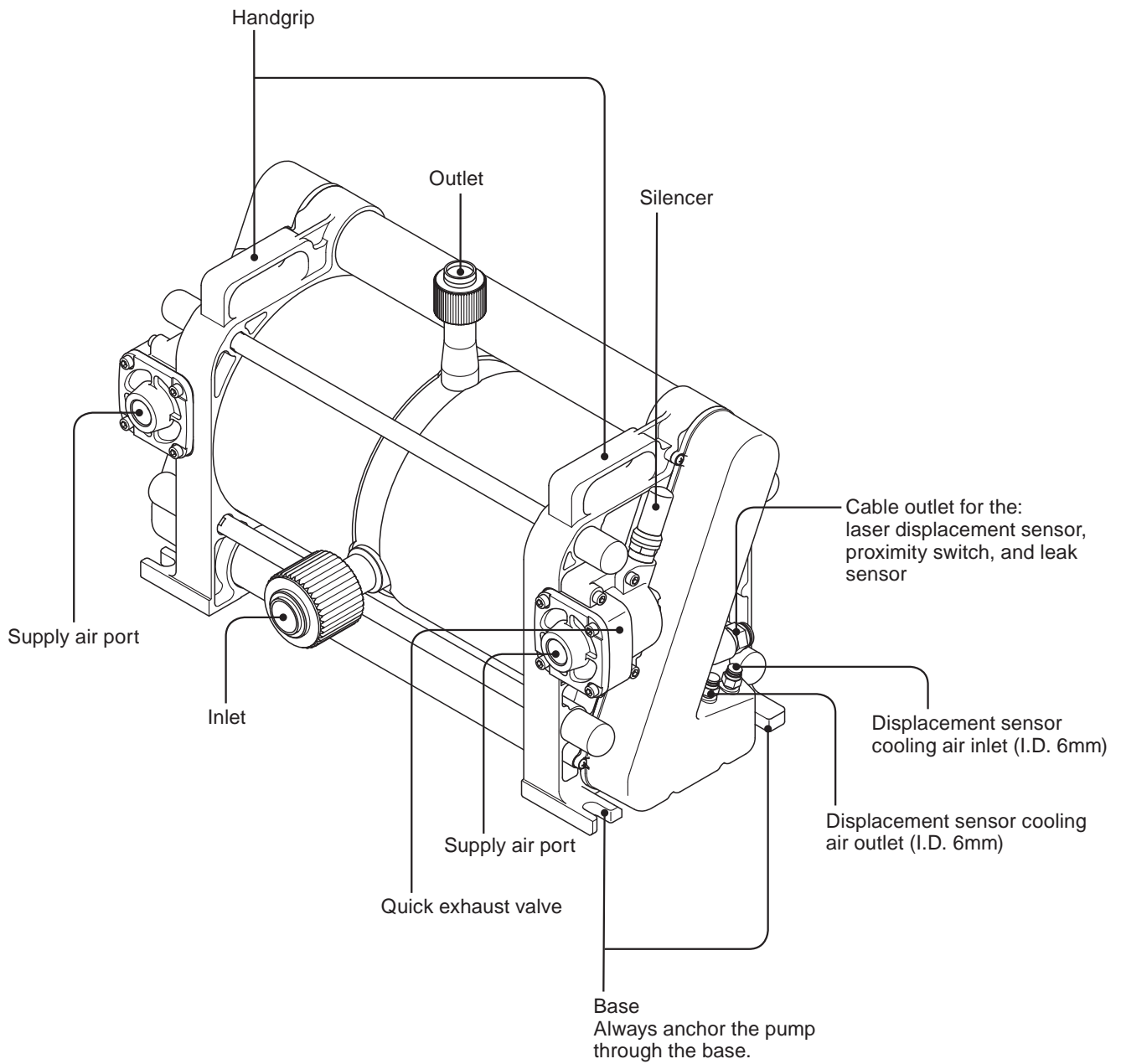
The pump stops at any time when the START/STOP key is pressed and held (2 sec).

- **Interlock**

The LPC-1 controller alarms over-speed operation when a pump runs at the fast alarm speed or above. If the pump speed has reached the interlock speed (fast alarm speed plus 10spm), the LPC-1 controller behaves to keep it below the interlock speed.

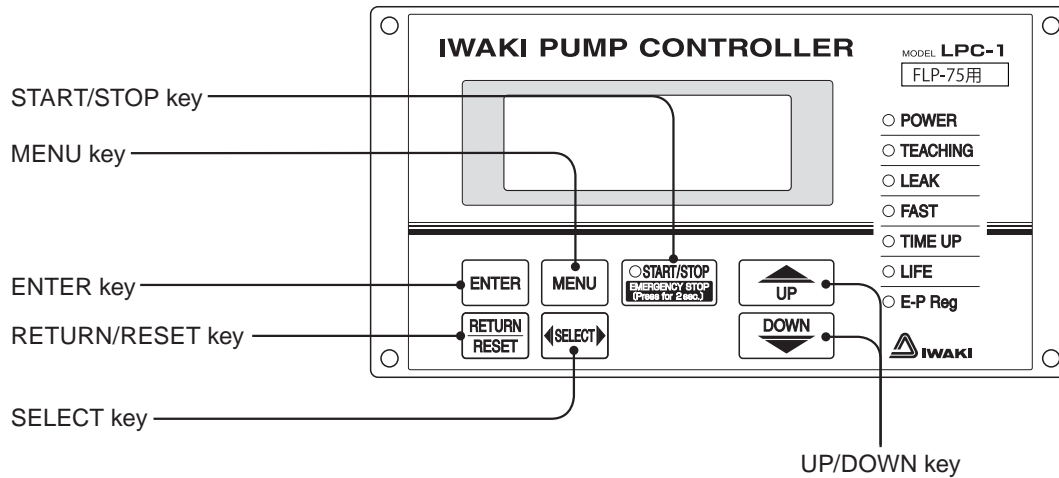
# Part names

## Pump



\*Do not clean the pump or nameplate with a solvent such as benzine or thinner.

## ■ Control panel



### START/STOP key

Used to start/stop the pump in MANU mode. The START/STOP LED lights during operation. The pump stops at any time during MANU or AUTO mode if the key is pressed and held for 2 seconds (emergency stop) and returns to the main menu after 7 seconds.

### MENU key

Used to display the main menu screen (if pushed once) or to point "1. PUMP MODEL" of the main menu (if pushed twice).

### ENTER key

Used to determine setting.

### RETURN/RESET key

Used to return to a previous menu or to reset an alarm.

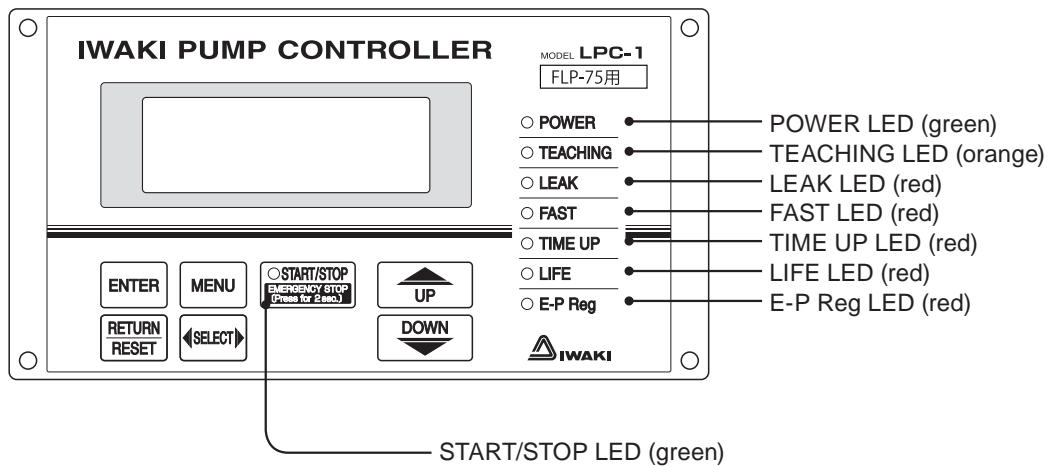
### SELECT key

Used to move through menu options and numerical digits or to select "YES" or "NO".

### UP/DOWN key

Used to move through menu options, to change numerical values, or to select "YES" or "NO".

## ■ LEDs



### POWER LED

Lights green as powered on.

### TEACHING LED

Lights orange when the LPC-1 is measuring the max stroke length and the origin position (teaching) by selecting "2. TEACHING".

\*The screen will show "TEACHING TIMEOUT!!" and the TEACHING LED will flash when teaching is not completed successfully in 10 seconds. In this case reset the alarm condition through "9. ALARM REST" and check for wrong wiring or closed discharge line before retry.

\*"TEACHING ABORT!" will be shown on the screen if the MENU or RESET key is pressed during teaching. In this case, teaching is not completed. Just retry to perform teaching.

### LEAK LED

Lights red when the leak sensor detects a liquid leak in the air chamber. The pump stops operation.

### FAST LED

Lights red when the pump speed rises to the fast alarm speed or above and stops lighting when it falls below that speed.

### TIME UP LED

Lights red when neither the right nor left proximity switch detects the #20 connecting plate within the set period of time ("TIME UP ALARM"). Stops lighting when detecting the plate in time.

### LIFE LED

Lights red when the reciprocation times accumulated in "TOTAL COUNT 1" exceeds the set number of times ("LIFE ALARM").

\*"TOTAL COUNT 1" only is available for the LIFE ALARM.

### E-P Reg LED

Lights red when:

- The electropneumatic regulator is upset in feedback control (disconnection).
- Power voltage is out of range.
- EEPROM reading/writing failure
- Discharge line pressure does not reach a target rate within 5 seconds.

### START/STOP LED

Lights green during operation.

## Operating conditions

### Pump stroke

Operation over the maximum stroke rate can take in a large amount of air during operation. Set the maximum allowable speed at each supply air pressure range as a fast alarm speed into the LPC-1 controller.

#### Stroke rate at each supply air pressure

Items	Spec				
	0.41-0.5MPa	0.31-0.4MPa	0.21-0.3MPa	0.11-0.2MPa	0.10MPa
Supply air pressure	0.41-0.5MPa	0.31-0.4MPa	0.21-0.3MPa	0.11-0.2MPa	0.10MPa
Max stroke rate	90spm	105spm	150spm	125spm	65spm

### Supply air pressure range

Observe the allowable supply air pressure range at each liquid temperature below.

Liquid temperature	Supply air pressure
5-100°C	0.1-0.5MPa
101-150°C	0.1-0.4MPa
151-180°C	0.1-0.3MPa

\*Try to use the lowest possible supply air pressure to protect the filter and bellows and reduce the risk of solution spray.

\*A flow rate changes with supply air pressure. Use a regulator to keep the pressure constant.

\*The minimum supply air pressure should satisfy the minimum operating pressure of the solenoid valve.

### Liquid temperature range

Observe the allowable liquid temperature range of 5-180°C. Note sharp temperature fluctuation (heat shock) may reduce the life of the pump. Contact us for detail.

### Liquid characteristics

#### ■ Do not run the pump with the following liquid:

- Liquid that easily crystallizes
- Slurry
- Low conductivity hydrocarbon liquid

\*Crystallization or the delivery of slurry remarkably shorten the lives of valves and bellows.

\*Delivery of low conductivity hydrocarbon liquid can cause electrostatic discharge (ESD) damage.

#### ■ Use care handling the following liquid:

- Stripper
- Solvent
- Hydrazine
- Fuming sulfuric acid

\*Some strippers cause cracks on the PFA bellows and piping, and therefore a warranty period is shortened. Contact us for detail.

## ***Operation and Stoppage***

---

### **■ During operation**

Make sure a suction and a discharge line are fully opened.

### **■ When stopping the pump**

- Before stopping the pump, make sure the discharge line is open to the atmosphere. Otherwise, the bellows may deform.
- Do not close a discharge valve as stopping the pump, or an impact pressure may damage the bellows or check valves.

### **■ During stoppage**

- Always check the specification of the double solenoid valve before installation. Some types (pressure centre types) are designed to pressurize both the right and left air chambers at the same time.
- Do not leave the pump with any chemical in the bellows for a long period. Some chemical gas can penetrate the bellows and corrode metal parts.

## ***Air exhaust port***

---

*Do not narrow an air exhaust line (for example by reducing the tube I.D.). Or the residual pressure in the pump may damage the bellows.*

*\*Always observe the minimum composite effective cross-sectional area. Do not extend the air exhaust port too far away from the solenoid valve (SV) or the quick exhaust valve (QEV). Otherwise, increased pipe resistance may break the limit.*

## ***Leak sensors***

---

*The sensors occasionally fails to detect leakage depending on operating conditions. Contact us for detail.*

## ***Ambient temperature***

---

*Observe the allowable operating ambient temperature range of 0-60°C.*

## ***Pump surface temperature***

---

*Risk of burning. The surface temperature of the pump or pipe rises high along with liquid temperature in or right after operation. e.g. cylinder surface temperature rises up to 73°C when liquid temperature is 180°C and ambient temperature is 60°C.*

## ***Noise from pump***

---

*Exhaust noise accompanies pump operation. Provide noise insulation as necessary. e.g. a noise level rises up to 79.4dB (A) at 150spm and 0.3MPa (supply air pressure).*

## Identification codes

*Each code represents the following information.*

FLP - 75 W H C 2 - 01

a      b    a   c   d   e      f

**a. Series name**

FLP-W : Medium & high liquid temperature (low pulsation)

**b. Bellows size**

**c. Allowable liquid temperature range**

H : 5-180°C

**d. Pump connection (Inlet/Outlet)**

C : Connector (standard)

**e. Pump head-bellows connection**

2 : Welded (standard)

**f. Special specifications**

No symbol : Standard

01 : Special specifications (01, 02...)

# Installation

***This section describes the installation of the pump, piping and wiring. Read through this section before work. To operate this pump, a 5-port solenoid valve and LPC-1 controller is needed.***

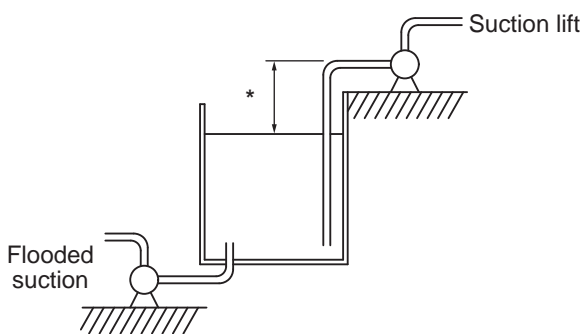
## **! Points to be observed**

Observe the following points when installing the pump.

- Be sure to turn off power to stop the pump and related devices before service is performed.
- Be careful for the power not to be turned on during work.
- If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems.
- Do not install the pump in a flammable atmosphere.
- Do not lift the pump by gripping the right-and-left cylinder head covers or the top-and-bottom covers. The pump can drop unintentionally as one of those parts breaks. Hold the pump by the handgrips to lift it up.

## Pump mounting

*Mount the pump in flooded suction or suction lift application.*



### **In flooded suction application:**

Place the pump as close to the supply tank as possible.

\*Flooded suction is recommended for hot liquid transfer or for looped system.

### **In suction lift application:**

Observe the maximum suction lift\* (1m). Place the pump as close to the supply tank as possible.

\*The maximum allowable suction lift shown above is based on pumping clean water at ambient temperature and the maximum stroke rate, and varies with liquid characteristics, liquid temperature or total suction line length. Contact us for detailed information.

\*Have a suction line shortest with the minimum number of bends.

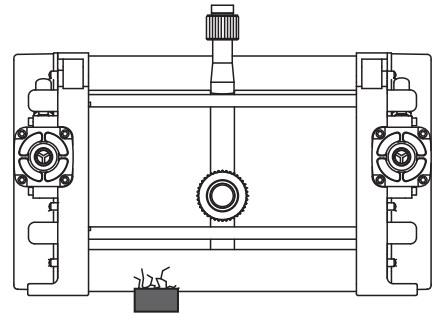
## 1 Select a location

Select a level location, free from vibration, that won't hold liquid. Anchor the pump so it doesn't vibrate. See page 11 as well.

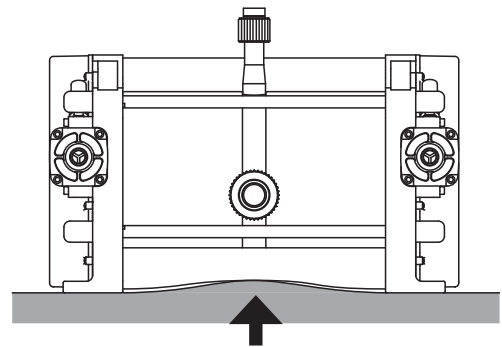
\*Flooded suction application is recommended.

\*Observe the maximum suction lift (1m) in suction lift application.

\*Keep the pump footprint clear so nothing applies stress to the under cover. The cover, when it is deformed, may disturb the reciprocation of a connecting shaft.

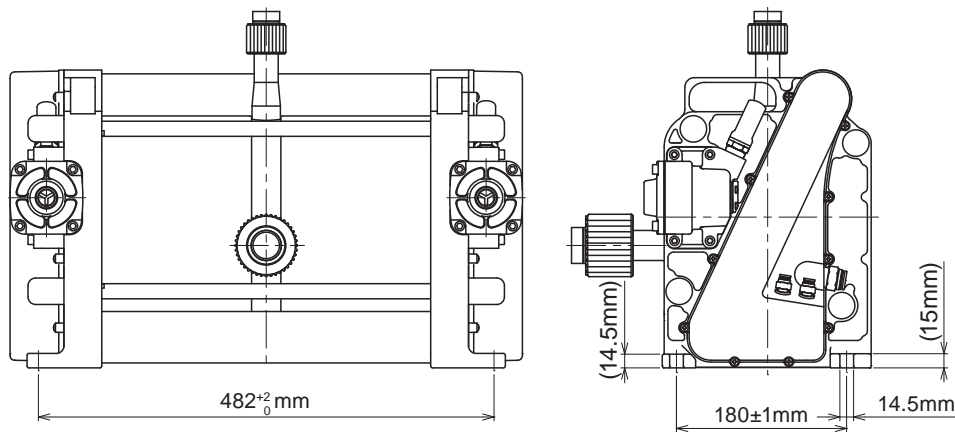


\*When mounting the pump on a mounting rail, the rail may apply stress to the under cover. The cover, when it is deformed, may disturb the reciprocation of a connecting shaft.



## 2 Anchor the pump so it doesn't vibrate

Position the pump upright with the outlet upward and inlet sideways. Provide your mounting seat with four holes to the following dimensions. Use of the M12 hex anchoring bolts and plate washers are recommended. Use spring washer as necessary.



## 3 Retighten the stud bolts

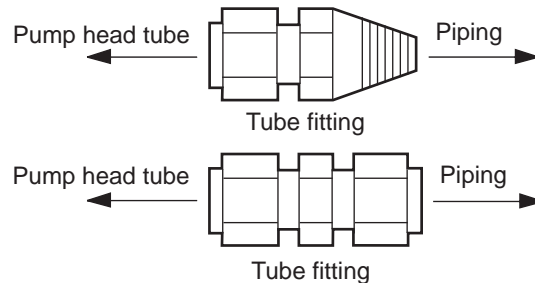
Tighten the #73 stud bolts that are fixing the cylinder heads to 30N•m.

NOTE

A air leak results in operation if the stud bolts are loose.

## Liquid line piping

An Nippon pillar packing Super 300 type 1-¼" union nut/sleeve is originally equipped to the inlet of the pump and that of 1" union nut/sleeve to the outlet of the pump. Use an applicable tube of O.D. 31.8mm × I.D. 28mm to the inlet and that of O.D. 25.4mm × I.D. 22.2mm to the outlet for the connection between the pump and your piping system.



\*Select an appropriate tube fitting size. Both discharge- and suction-line I.D. should be larger than the pump outlet & inlet I.D.

\*General joints can be used, however, no leakage is allowed under hot liquid transfer or heat cycle.

### NOTE

Use measures to keep the pump connections free from stress.

### ! Points to be observed

Air blow or flush a suction and a discharge tube to get rid of debris prior to connecting with the pump.

- 1 Connect a suction and a discharge tube to the pump inlet and outlet via the tube fittings. Use measures to keep the pump connections free from stress such as weight and thermal expansion/contraction.

### NOTE

Be sure to secure each connection to prevent leakage and air ingress.

## Suction line

---

### ■ Flooded suction

In flooded suction application, observe the pump inlet N.D. of 1-1/4" (O.D. 31.8mm x I.D. 28mm), the suction line can be laid to the maximum length of 5.3m with no elbows.

\*If five 90° elbows (0.6m resistance at each elbow) are used, the maximum length is shortened to 2.3m.

In suction lift application, observe the maximum suction lift of 1m (operation with clan water at ambient temperature and the max spm).

\*The suction lift differs with the liquid's characteristics, temperature and suction line length. For detailed information, contact us.

### ■ Filtration (suction line end)

Install a filter or strainer at the suction line end to prevent particles from entering the bellows. The filter or strainer should not increase piping resistance too much.

#### NOTE

---

If wafer fragments enter the pump, they may get stuck in the bellows and eventually cause failure. If they clog the pump head valves, the discharge volume may reduce and the pumping operation may become unbalanced.

---

### ■ When installing a valve on the suction line:

Use a flow coefficient (Cv) of 8.5 or more. Otherwise, a suction-line resistance rises high together with flow pulsation, or the valve may easily be clogged with the debris crystallized from solution. Make sure all valves on the suction line are opened to the full during operation.

#### NOTE

---

Operating the pump with a suction side valve close, negative pressure increases in the bellows and deforms the bellows inwardly.

---

## Discharge line

---

### ■ When installing a valve on the discharge line:

Select a valve with an orifice equal to or larger than pipe I.D. A valve with a small orifice may increase the pipe resistance or easily be clogged with the debris crystallized from solution. Always open valves during operation. Do not close the valve until the discharge pressure reaches "0" after the pump is stopped.

#### NOTE

---

Do not close a discharge valve right after stopping the pump. Impact pressure may damage the bellows.

---

### ■ Filtration (circulation)

Check a filtering area, filtering performance and effects on the flow before selecting a cycle filter. A desired flow may not be obtained if selection is wrong.

#### NOTE

---

Wet the filter before use. A desired flow may not be obtained if the filter is dry. Filter dries up if it is unused for a long period. Read the instruction manual of the filter for details.

---

### ■ Filtration (discharge line end)

Install a filter or strainer in a discharge line not to release debris or wafer fragments. The filter or strainer should not increase piping resistance too much.

### ■ Depressurization at pump stop

When stopping the pump, be sure to release discharge pressure by opening the filter, the air vent valve or through a return circuit.

#### NOTE

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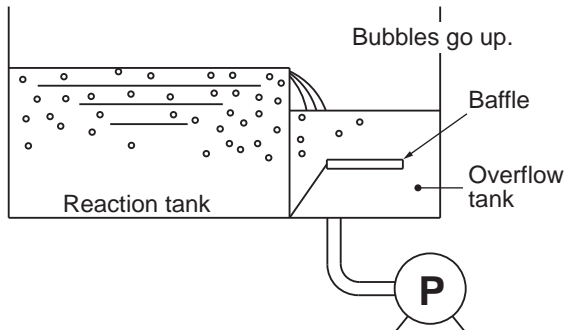
Stopping the pump without releasing discharge pressure may damage the bellows.

---

## Degassing

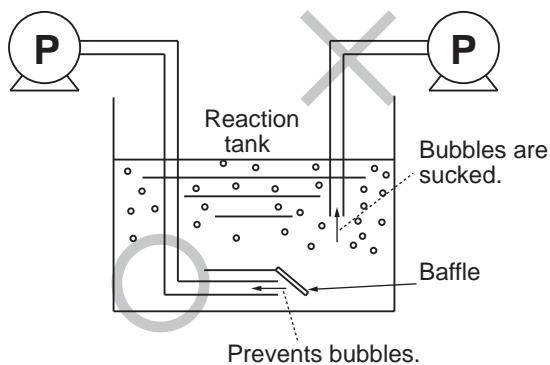
Gas bubbles are generated when a strong acid is fed into the reaction tank or liquid is transferred through a narrow tube. If such bubbles enter the bellows, the pump runs with entrained gas, increasing stroke rate or disturbing liquid transfer. Take a proper step for degassing.

### Plan A (Install a baffle to remove gas bubbles)



#### *In flooded suction application*

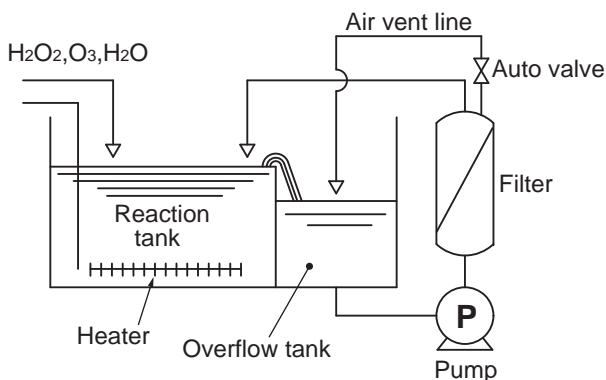
Install a baffle in a overflow tank to separate air from the liquid.



#### *In suction lift application*

Install a baffle to the bottom of the reaction tank. And then place the end of suction line under the baffle to take in liquid only.

### Plan B (Install an automatic valve)



#### *Periodic degassing*

Program an automatic valve to open periodically whether the pump runs dry or not. For example, the valve opens for ten seconds every two minutes.

\*Some filtering area may be too small to release air.

Select a suitable filter size.

\*Program an open time according to the system performance.

#### *Pinpoint degassing*

Install an air detector at the pump inlet and set the auto valve to open timely.

Another detector at the pump outlet will help detect bellows rupture.

### NOTE

The stroke rate increment is a sign of dry running. Take one of the following step to expel air:

- Reduce the discharge line pressure to temporarily raise a pump speed.
- Stop the pump once. And then restart to utilise the full stroke length of the initial pump behaviour.
- Empty the pump. And then restart the pump to temporarily have a high pump speed.
- Increase the supply air pressure to temporarily raise a pump speed.

## Air line piping

### Before air piping

The FLP-75W needs a different supply air system from other Iwaki's pneumatic pumps.

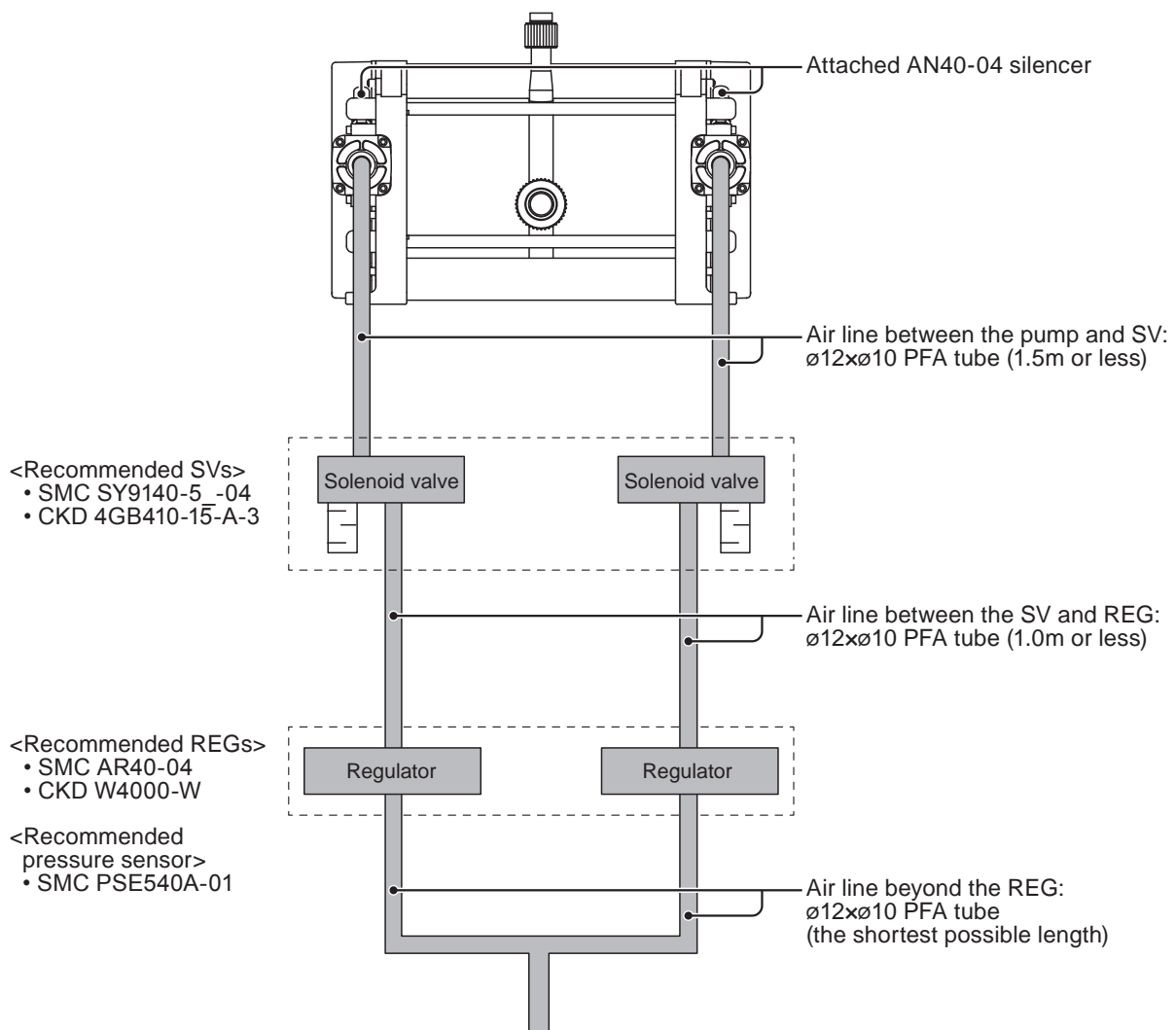
#### ■ Solenoid valve (SV)

Our existing pneumatic pumps use one solenoid valve to supply air to both right-and-left air chambers in turn, but then the FLP-75W needs two 5-port solenoid valves at each air chamber. Plug the normally-open out port and exhaust port of the solenoid valves, or the pump will not run correctly.

#### ■ Regulator

Provide a regulator to each solenoid valve. Use of the sole regulator for both the valve can run the pump but then increases pulsation.

#### ■ Air line piping layout (FLP-75W)



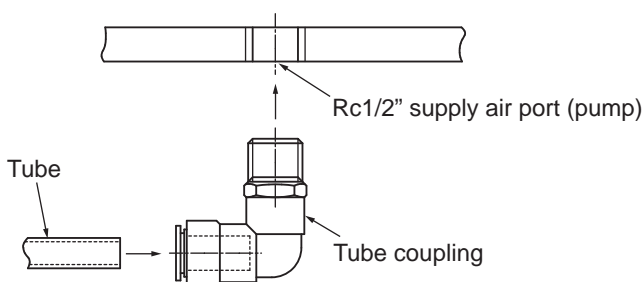
### ! Points to be observed

Observe the following points when building up a supply air line.

- A fluctuation of supply air pressure affects the stroke rate and the flow rate. Install a regulator to maintain the supply air pressure constant.
- Install a safety valve to observe the supply air pressure range at each liquid temperature range. 0.1-0.5MPa at 5-100°C, 0.1-0.4MPa at 101-150°C and 0.1-0.3MPa at 151-180°C.
- Release the exhaust air into the open air. Narrowing the air exhaust port makes air less likely to be expelled. As a result the bellows may deform inwardly. Select necessary air devices with reference to the air line piping diagram on page 29.
- To reduce exhaust noise, release the exhaust air through the duct of the plant facility to the air, or attach silencers to exhaust ports.
- The air consumption increases as installing two or more pumps and the number of pumps increases. Optimise the air compressor capacity and the air line I.D. between the compressor and the regulators taking account of composite effective cross-sectional area.
- Supply air should be free from moisture and dust. If the supply air is contaminated with water, oil or dust, the pump may fail in starting. If liquid enters the air chambers, the electrodes may detect it and sounds an alarm.
- Long, narrow or bent supply air tubing adversely affects the air supply capacity to the pump and thus a stroke rate, flow rate, and the pump behaviour to offset flow pulsations.

### ■ Supply air port I.D.

The pump has the supply air port of Rc 1/2" (tapered pipe female thread). Connect an applicable tube coupling to the pump.



---

#### NOTE

Secure each connection for the prevention of air leak.

---

## ***Effective cross-sectional area***

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*Effective cross-sectional area of the air piping, silencer, solenoid valve or so determines the performance of pressurization and depressurization in the air chambers. The less effective cross-sectional area than the required square millimetres (independently for decompression and compression) prevents the contraction and expansion of the bellows and eventually causes a poor liquid flow and significant pulsation. See page 29 for the air line piping diagram and recommended devices.*

### **■ Effective cross-sectional area required for decompression process**

The effective cross-sectional area required for decompression in the air line piping diagram is composed of the silencer on the pump only.

\*Directly combine the silencer to the built in QEV on the pump.

### **■ Composite effective cross-sectional area required for compression process**

The composite effective cross-sectional area required for compression in the air line piping diagram is composed of the solenoid valve and the air line between the pump and SV.

\*The air line piping conditions beyond the solenoid valve as well as the regulator performance are also important to ensure proper pump behaviour. See page 29, the air line piping diagram for detail.

## ■ Air supply capacity of pneumatic devices

### 1. Pneumatic devices

In the field of pneumatic devices, the term “effective cross-sectional area” is used to indicate the amount of an air flow which each device actually can deliver. In general, the air flow increases as effective cross-sectional area becomes larger.

\*For detail of effective cross-sectional area at each pneumatic device, see the catalogue issued by each manufacturers. Note an effective cross-sectional area (mm<sup>2</sup>) nearly equals to the formula of 5×acoustic velocity conductance C [dm<sup>3</sup>/(s•bar)].

### 2. Composite effective cross-sectional area

Pneumatic devices are connected in series with the pump. Therefore, the composite effective cross-sectional area of the entire system is calculated from the following formula.

$$\frac{1}{S^2} = \frac{1}{S_1^2} + \frac{1}{S_2^2} + \dots + \frac{1}{S_n^2}$$

S : Composite effective cross-sectional area (mm<sup>2</sup>)

S<sub>n</sub>: Effective cross-sectional area of each pneumatic device (mm<sup>2</sup>)

See the catalogues issued by device/pipe manufacturers for each effective cross-sectional area.

## ■ Preventive measures against condensation

*If condensation is likely to occur in the air lines between the pump and SV, and the built in QEV on the pump, take the following preventive measures.*

- Reduce supply air pressure as much as possible (reduce stroke rate.).
- Provide a heat insulator over the air line (do not cover the exhaust port of the QEV.).
- Feed the heated and compressed air to the pump. Observe the temperature limits of pipe/tube materials, joints, SV and other component parts.

## ■ Recommended pneumatic devices

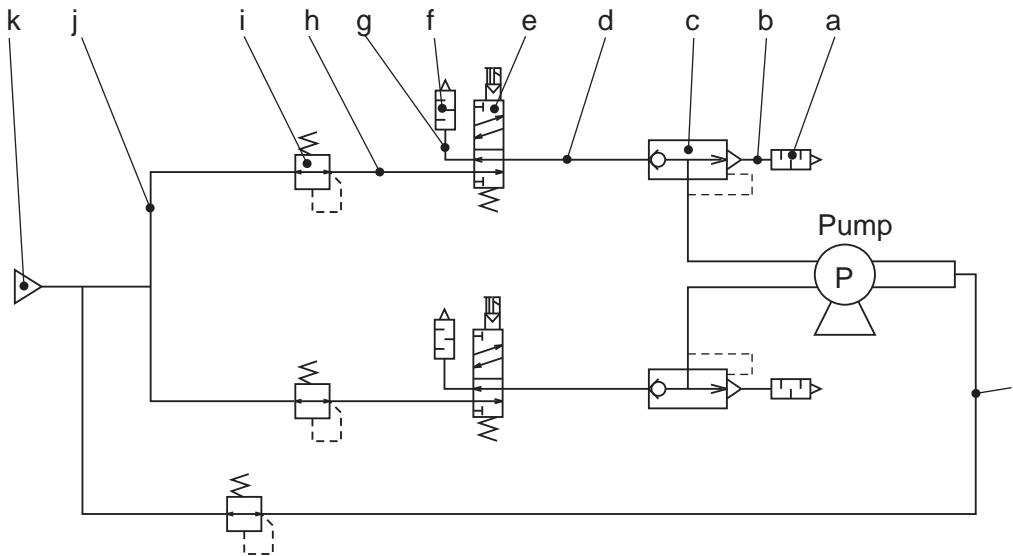
*Select pneumatic devices with the following minimum effective cross-sectional area.*

	Exhaust line	Supply air line
SV (solenoid valve)	50mm <sup>2</sup>	40mm <sup>2</sup>
Silencer (on the built in SMC AN40-04 QEV)	90mm <sup>2</sup>	-
Silencer (on the solenoid valve)	90mm <sup>2</sup>	-
Air line between the built in QEV and SV	48mm <sup>2</sup>	

\*Note an effective cross-sectional area (mm<sup>2</sup>) nearly equals to 5×acoustic velocity conductance C [dm<sup>3</sup>/(s•bar)].

## Air line piping diagram

The diagram below is a general layout of an air-line.



**a. Silencer on the Built in the quick exhaust valve (QEV)**

Always connect the SMC AN40-04 silencers directly to both right and left QEVs built in the pump.

**b. Piping between the built in QEV and the silencer.**

Always mount the silencer directly to the exhaust port of the built in QEV without any joints.

**c. Built in QEV**

The built in QEV is integrated into the pump.

**d. Piping between the built in QEV and the SV.**

Always use the same pipe length to both right and left air lines. Use of a 1.5m or less PFA tube (10mm I.D. x 12mm O.D.) is recommended.

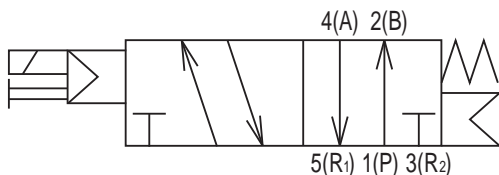
**e. Solenoid valve (SV)**

**If supply air pressure is 0.15MPa or more**, use the 5-port 2-position single solenoid valve of the SMC SY9140-5-04-X90 or the CKD 4GB410-15-A-3. **If supply air pressure is below 0.15MPa**, use the 5-port 2-position double solenoid valve of the SMC SY9240-5 or the 5-port 2-position single solenoid valve (external pilot operated type) of the SMC SY9140R-5 or CKD 4GB410-15-K-3. Always use the same SV model to both the right and left air lines.

When the SMC SY9140-5-04-X90 is used, plug the normally-open out port 2(B) and exhaust port 3(R<sub>2</sub>).

They are not used. Connect a supply air line to the normally-closed out port 4(A).

\*Air is exhausted through the normally-open out port of 5(R<sub>1</sub>) when the pump is stopped.



*f. Silencer on the solenoid valve*

Use of the SMC AN40-04 is recommended. Connect the silencer to the normally-closed exhaust port 5(R<sub>1</sub>) of the solenoid valve when the SMC SY9140-5-04-X90 is used.

*g. Piping between the SV and the silencer.*

Do not use a tube for the connection. Use a male reduced bush and directly connect the silencer to the SV.

*h. Piping between the solenoid valve and the regulator*

Always use the same pipe length (PFA, 1m or less, 10mm I.D. × 12mm O.D.) to both right and left air lines.

*i. Regulator (REG)*

Always use the same regulator to both right and left air lines. Use of the SMC AR40-04 or CKD W4000-W is recommended. Be sure to keep the same set pressure between the right and left regulators (max allowable deviation is ±0.01MPa). Use the SMC PSE540A-01 analogue pressure sensor in the regulator and monitor the supply air pressure with the LPC-1 controller. See the "**Regulator set pressure confirmation (8. PRESSURE SENSOR)**" section on page 60 for detail.

*j. Connection between the compressor and the regulator*

Lay the supply air line shortest with a wider I.D. than the regulator inlet (to keep the composite effective cross-sectional area as much wide as possible.).

*k. Air compressor*

Air compressor must keep 0.1MPa or higher than the set pressure of the regulator during pump stop. If the supply air pressure from the compressor is the same or lower than the set pressure, a pressure drop causes discharge pulsation.

\*Install an air tank (18L or more) in the supply air line (j) close to the regulator (i) when the above differential pressure is not satisfied in anyway. Discharge pulsation can be reduced.

*l. Connection of a purge air line*

A temperature of the displacement sensor may rise high along with liquid and ambient temperatures.

Connect a purge air line to the pump via the I.D.6mm air port (straight fitting) to deliver the necessary amount of air and keep the sensor temperature to 45°C or below. For example, supply 380NL/min or more to this line when liquid temperature is 180°C and ambient temperature is 60°C.

\*The displacement sensor may stop operation when its temperature rises above 78°C.

## Electric wiring

Two 5-port solenoid valves and the LPC-1 controller is required.

### ! Points to be observed

Observe the following points during wiring work.

- Electrical work should be performed by a qualified electrician. Always observe applicable codes or regulations.
- Do not perform wiring work while the power is on. Otherwise, an electrical shock or short circuit may result. Be sure to turn off power before wiring work.
- The standard proximity switches can not be used when a flammable liquid such as solvent is pumped. Explosion-proof proximity switches must be used in such an explosive/flammable environment. Contact us or your nearest dealer.
- The standard electrodes can not be used when a flammable liquid such as solvent is pumped. A spark in a solvent may cause a fire.

## Installation

### ■ Lead wires

2m displacement sensor lead wires, 1m proximity switch lead wires and 1.8m leak sensor lead wires are originally built in the pump, but then optional lead wires are required to complete electric wiring between the pump and related devices, or select general lead wires from the information below and the end terminal pages and use them with the attached male connectors.

Lead wires	Required spec
LPC-1 controller power lead	24V 0.6A or more
Connection between the 5-port SV and the LPC-1 controller	24V 0.24A or more

### ■ Extension of leak sensor wires

Always keep the total resistance of the sensor and the extension to 5k $\Omega$  or less. Otherwise, the leak sensor does not work properly.

### ■ Installation of proximity switch wires

Do not lay on these wires in parallel with the power lead or combine them in a concentric cable (ex. 5 wires cable). Otherwise, system malfunction may result.

### ■ Extension of proximity switch wires

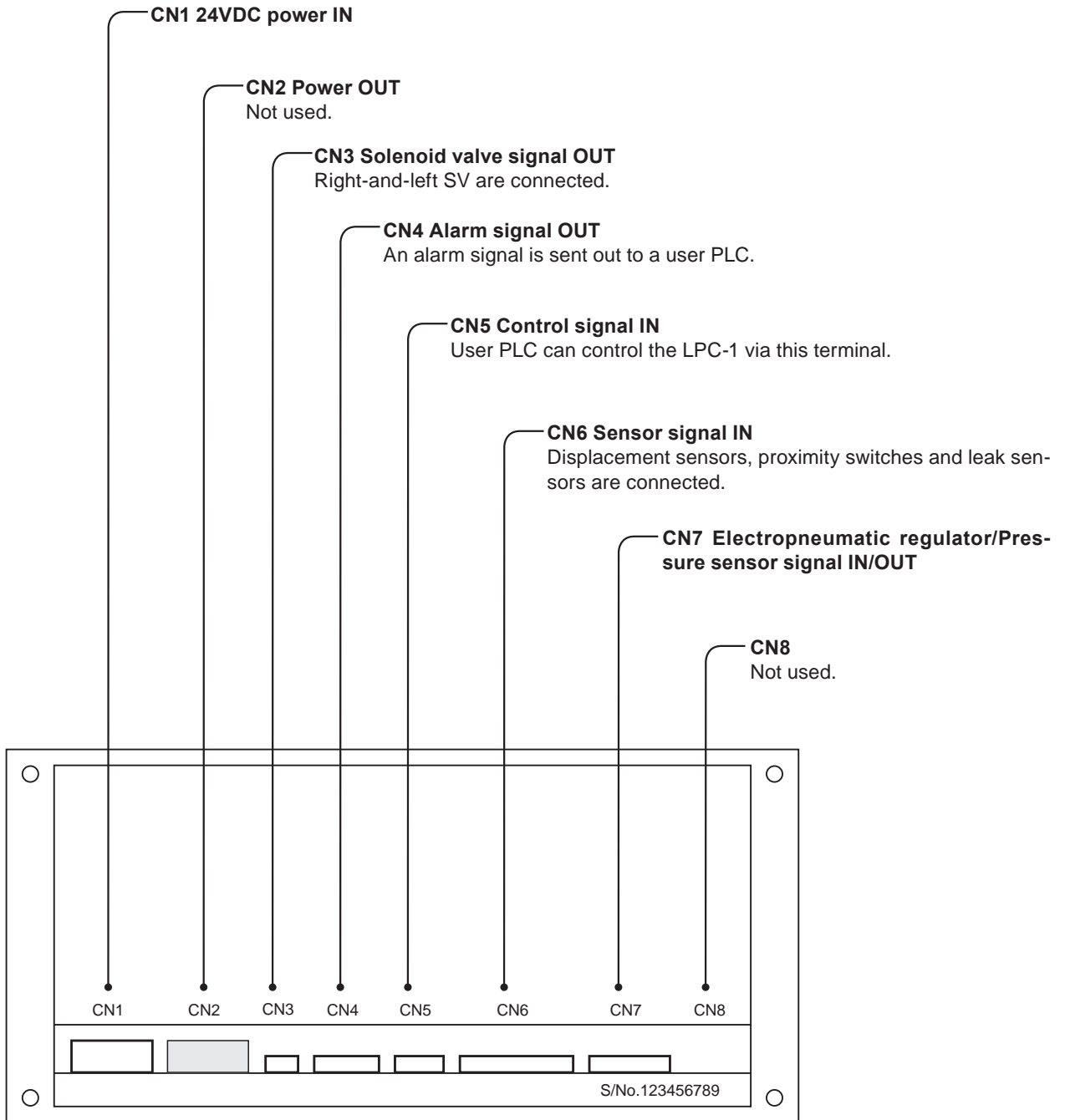
When extending a proximity switch wire, select the following cable spec depending on cable length.

Wire length	Wire spec
Shorter than 30m	0.3mm <sup>2</sup> or more
30m or longer	100 $\Omega$ /km or less (conductor resistance)

### ■ Preventative measures against noise

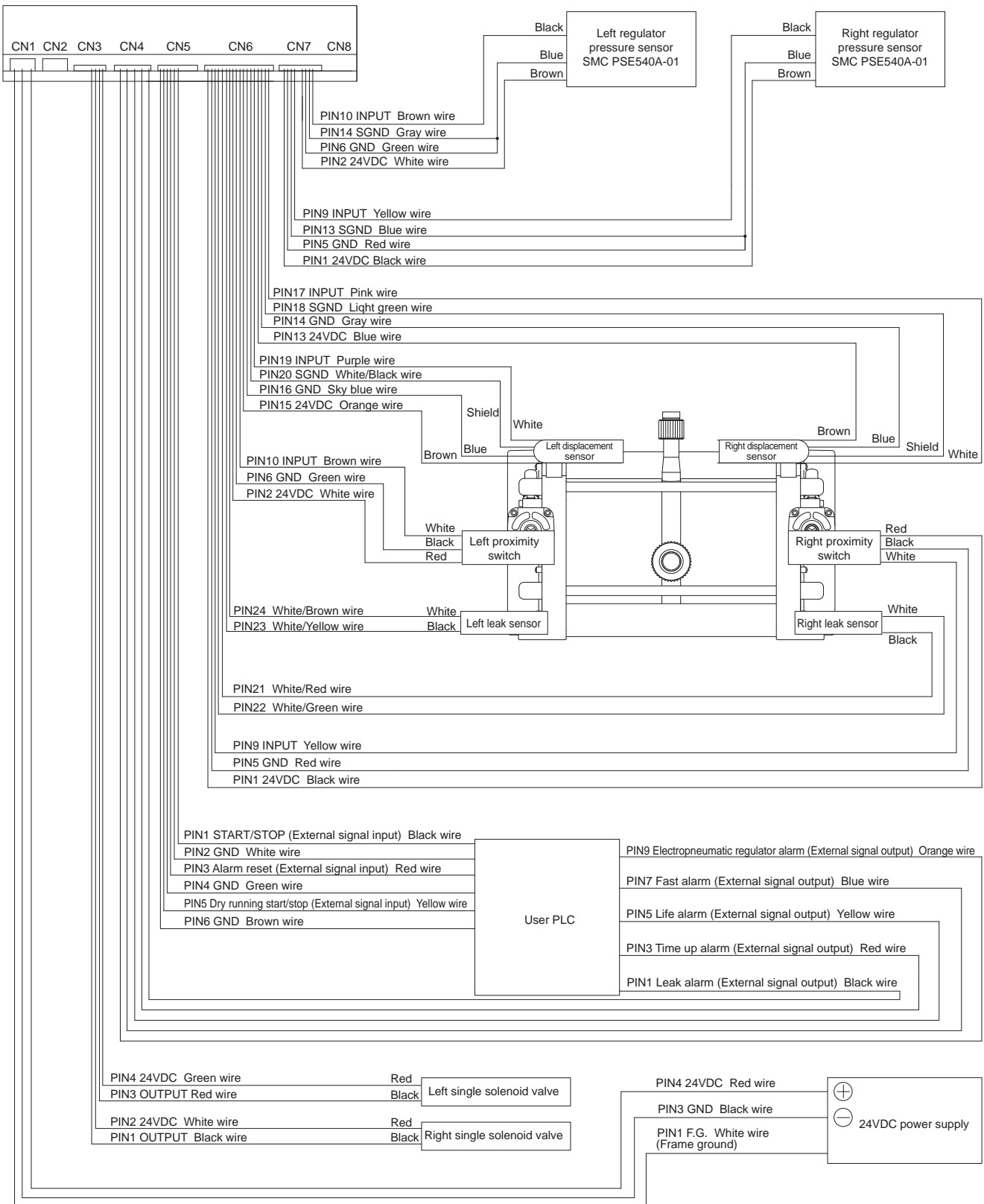
- Install a line filter in the AC power line.
- Provide a surge killer such as the CR or diode to inductive loads such as a solenoid valve and relay.
- Do not lay signal leads near the power lead.
- The shielded wire of the power lead should be connected to the F.G. terminal of the 24VDC power supply.
- The shortest power lead is optimal.
- Do not share a power supply with a noise source such as an inverter or a motor.

# Wiring diagram (LPC-1)



# Wiring diagram (normal operation with a single solenoid valve)

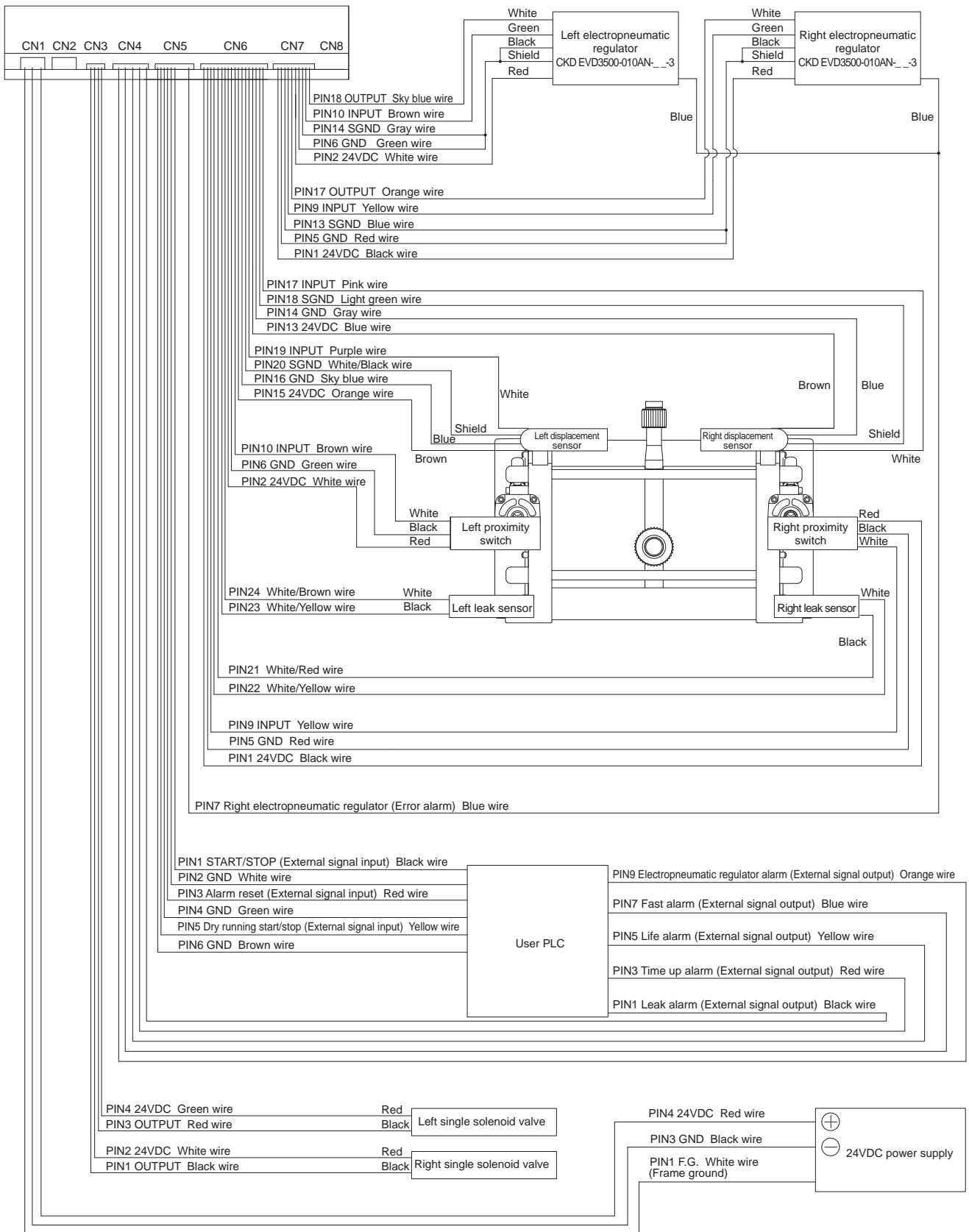
See page 36 for the wiring of the double solenoid valve (CN3).



Installation

\*The wire colour indications above is based on our standard wire colours (purchase separately).

# Wiring diagram (feedback control with a single solenoid valve)



## End terminals

### ■ Power line

CN1 Power voltage input (controller)



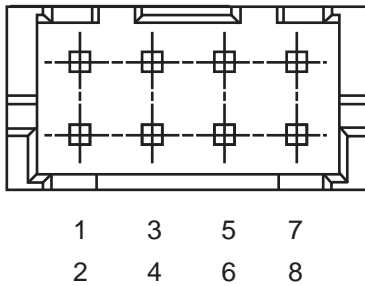
Connector #	CN1
Connector manufacturer	JST
Housing	VHR-4N
Contact	SVH-21T-P1.1
Applicable power lead	AWG #22-#18

Pin #	Assignment
1	F.G. (Frame Ground)
2	N.C. (Not used)
3	GND
4	+24V in (24VDC power input)

\*Capacity of the 24VDC power supply must be 2A or more.

### ■ Single solenoid valve

CN3 SV output (controller)

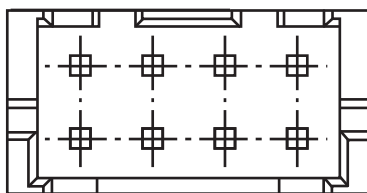


Connector #	CN3
Connector manufacturer	JST
Housing	PHDR-8VS
Contact	SPHD-001T-P0.5
Applicable power lead	AWG #26-#22

Pin #	Assignment
1	Right SV control output
2	24VDC
3	Left SV control output
4	24VDC
5	Not used
6	Not used
7	Not used
8	Not used

## ■ Double solenoid valve

CN3 SV output (controller)



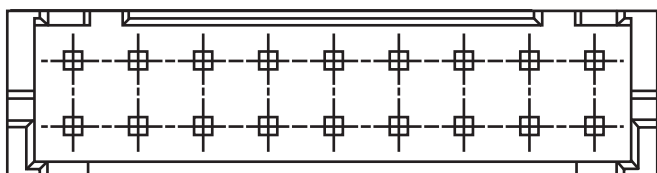
1 3 5 7  
2 4 6 8

Connector #	CN3
Connector manufacturer	JST
Housing	PHDR-8VS
Contact	SPHD-001T-P0.5
Applicable power lead	AWG #26-#22

Pin #	Assignment
1	Right SV control output (Normally closed)
2	24VDC (Normally closed)
3	Left SV control output (Normally closed)
4	24VDC (Normally closed)
5	Right SV control output (Normally open)
6	24VDC (Normally open)
7	Left SV control output (Normally open)
8	24VDC (Normally open)

## ■ User PLC

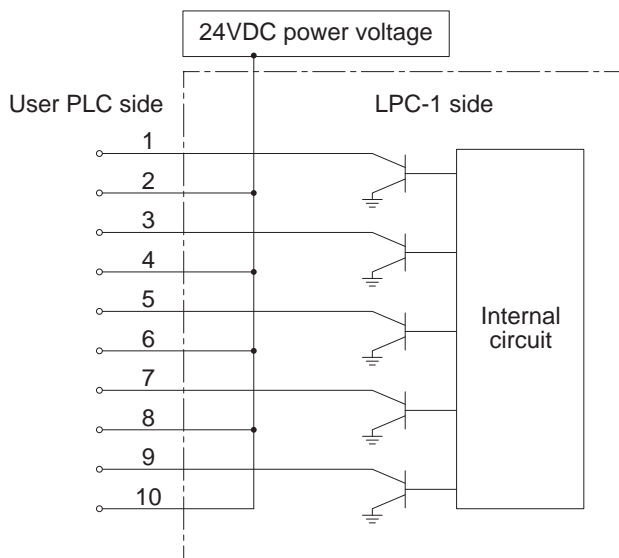
CN4 Alarm output (controller)



1 3 5 7 9 11 13 15 17  
2 4 6 8 10 12 14 16 18

Connector #	CN4
Connector manufacturer	JST
Housing	PHDR-18VS
Contact	SPHD-001T-P0.5
Applicable power lead	AWG #26-#22

Pin #	Assignment
1	Leak alarm
2	24VDC
3	Time up alarm
4	24VDC
5	Life alarm
6	24VDC
7	Fast alarm
8	24VDC
9	Electropneumatic regulator
10	24VDC



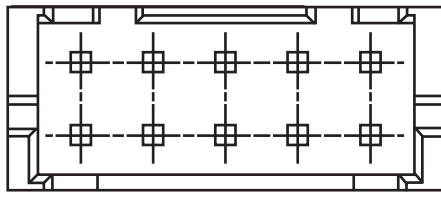
\*Pin 11-18 are not used.

\*Use the GND terminals of the CN5 when connecting to ground.

### Output spec

Output type	Open collector
Max output current	50mA
Max applied voltage	30V
Insulation	Photocoupler isolation
Withstand voltage	500VAC/min (Breaking current: 0.5mA or below)
Insulation resistance	50MΩ or more (500VDC)

CN5 Control signal input (controller)



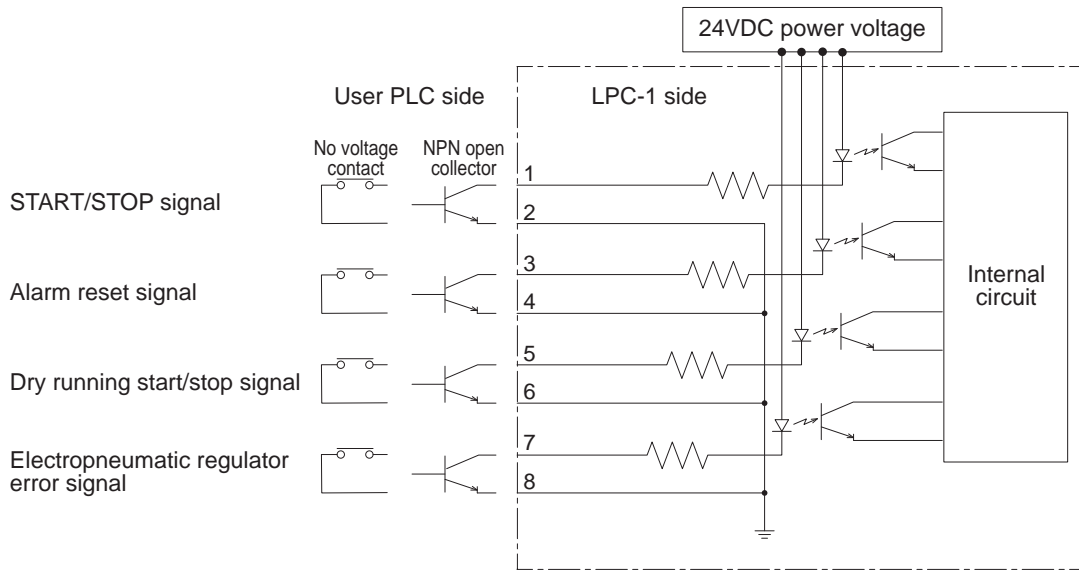
1 3 5 7 9  
2 4 6 8 10

Connector #	CN5
Connector manufacturer	JST
Housing	PHDR-10VS
Contact	SPHD-001T-P0.5
Applicable power lead	AWG #26-#22

Pin #	Assignment
1	START/STOP
2	GND
3	Alarm reset
4	GND
5	Dry running start/stop
6	GND
7	Electropneumatic regulator error
8	GND
9	Not used
10	Not used

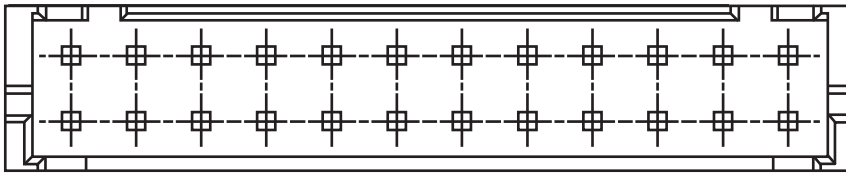
\*Pin 9 and 10 are not used. Use the combination of pin 1 & 2, 3 & 4, and 5 & 6 at each purpose (assignment).

Installation



## ■ Proximity switch/Displacement sensor/Leak sensor

CN6 Sensor input (controller)



1 3 5 7 9 11 13 15 17 19 21 23  
2 4 6 8 10 12 14 16 18 20 22 24

Connector #	CN6
Connector manufacturer	JST
Housing	PHDR-24VS
Contact	SPHD-001T-P0.5
Applicable power lead	AWG #26-#22

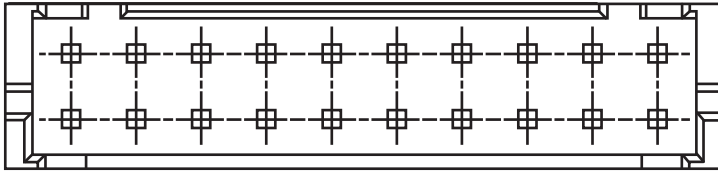
Pin #	Assignment
1	Right proximity switch 24VDC
2	Left proximity switch 24VDC
3	Not used
4	Not used
5	Right proximity switch GND
6	Left proximity switch GND
7	Not used
8	Not used
9	Right proximity switch input
10	Left proximity switch input
11	Not used
12	Not used
13	Right displacement sensor 24VDC
14	Right displacement sensor GND
15	Left displacement sensor 24VDC
16	Left displacement sensor GND
17	Right displacement sensor input
18	Right displacement sensor SGND
19	Left displacement sensor input
20	Left displacement sensor SGND
21	Right leak sensor (black lead)
22	Right leak sensor (white lead)
23	Left leak sensor (black lead)
24	Left leak sensor (white lead)

\*Pin 18 and 20 are to be connected with shield wires of the right and left displacement sensors.

\*Miswiring of the proximity switch results in burnout.

## ■ Electropneumatic regulator or Pressure sensor

CN7 Electropneumatic regulator/pressure sensor input/output (controller)



1 3 5 7 9 11 13 15 17 19  
2 4 6 8 10 12 14 16 18 20

Connector #	CN7
Connector manufacturer	JST
Housing	PHDR-20VS
Contact	SPHD-001T-P0.5
Applicable power lead	AWG #26-#22

Pin #	Assignment
1	Right electropneumatic regulator/pressure sensor 24VDC
2	Left electropneumatic regulator/pressure sensor 24VDC
3	Not used
4	Not used
5	Right electropneumatic regulator/pressure sensor GND
6	Left electropneumatic regulator/pressure sensor GND
7	Not used
8	Not used
9	Right electropneumatic regulator/pressure sensor input
10	Left electropneumatic regulator/pressure sensor input
11	Not used
12	Not used
13	Right electropneumatic regulator/pressure sensor SGND
14	Left electropneumatic regulator/pressure sensor SGND
15	Not used
16	Not used
17	Right electropneumatic regulator output
18	Left electropneumatic regulator output
19	Not used
20	Not used

\*Use the CKD EVD3500-010AN-\_\_\_-3 electropneumatic regulators for feedback control, otherwise use the SMC PSE540A-01 pressure sensors.

\*Connect the earth wire of the right pressure sensor to pin 5 & 13 and that of the left pressure sensor to pin 6 & 14 when not using the electropneumatic regulators.

# Operation

*This section describes pump operation and programming. Run the pump after pipework and wiring are completed.*

## Before operation

*Always check the following items before the first-time operation or resuming operation after a long period of stoppage.*

- 1 Check if electric wiring is made correctly.  
Check the wiring of proximity switches, leak sensors, solenoid valves, displacement sensors and electropneumatic regulators (pressure sensors).

NOTE

A proximity switch may break. Always ensure correct wiring.

- 2 Check if air piping is made correctly.

- 3 Check if the pump is anchored securely.

- 4 Check if liquid piping is made correctly.

- 5 Check if a suction and a discharge line is open.

- 6 Check for a liquid level in the supply tank.

- 7 Check if the filter is wet.

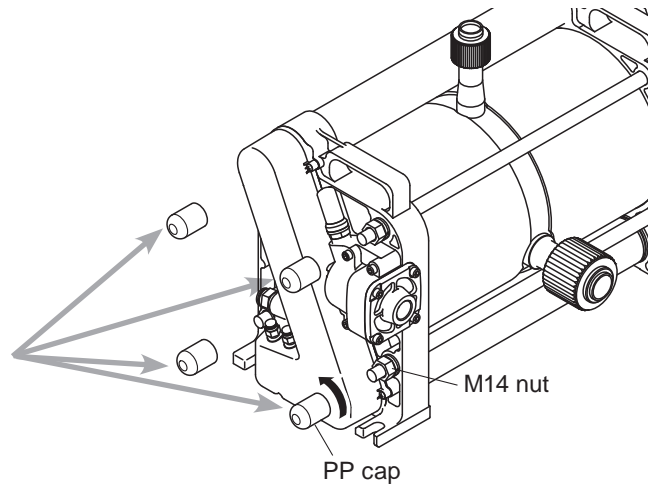
NOTE

See manufacturer's manual for the handling of filter.

## 8 Tighten stud bolts.

Stud bolts may loosen during storage or transit due to temperature fluctuation. Loose stud bolts can cause an air leak from the joint of the cylinder head and pump head. Be sure to tighten the M14 nuts by 30N•m to secure the stud bolts before operation.

\*Unscrew the PP caps by turning anticlockwise to tighten the M14 nuts.



## Programming menu

Operation at each mode is individually set and controlled by the LPC-1 controller. Make proper setting to ensure optimal operation. The controller will show version information for 3 seconds after power is turned on and then nine main-menu options. Sub-menu options will be available at each main-menu options.

Menus	Setting	References
1. PUMP MODEL	Pump model selection	44 page
2. TEACHING	Start of teaching (displacement sensors)	45 page
3. PUMP DRIVE	Feedback control ON/OFF selection	46, 49 page
4. SETTING	Operational behaviour at each mode	51 page
1. QUANT.CONST.CTRL	Feedback control	52 page
1. FLOW.QUANTITY	Target flow rate	
2. E-P REGULATOR	Starting air pressure and the top/bottom pressure limits	53 page
3. 1 shot d CAPA	Liquid volume per shot	54 page
2. ALARM	Alarm output	55 page
1. TIME UP ALARM	Time setting for the detection of the connecting plate	
2. FAST ALARM	Fast alarm speed setting	
3. LIFE ALARM	Pump-shot setting for a reminder of the end of service life	
3. SET VALUE CONFIRM	Setting confirmation	56 page
1. STROKE LENGTH	Stroke length confirmation	
2. PUMP MODEL	Pump model confirmation	
3. MANU or AUTO	Manual/Auto mode confirmation	
4. DRIVE MODE	Drive mode confirmation	
4. RESET ALL DATA	Return to the default setting	57 page
5. KEY PROTECT	Keypad lock for the prevention of erroneous operation	58 page
1. PROTECT	Activation	
2. PROTECT CANCEL	Deactivation	
6. TOTAL COUNT	Total number of shots confirmation/cancellation	59 page
1. TOTAL COUNT1	Confirmation of TOTAL COUNT1	
2. TOTAL COUNT2	Confirmation of TOTAL COUNT2	
3. COUNT RESET1	Cancellation of TOTAL COUNT1	
4. COUNT RESET2	Cancellation of TOTAL COUNT2	
5. COUNT RESET3	Confirmation of TOTAL COUNT3	
7. MANU or AUTO	Selection between manual and automatic modes	46,49 pages
8. PRESSURE SENSOR	Monitoring of the supply air pressures by the right-and-left pressure sensors in the regulators or the supply air lines.	60 page
9. ALARM RESET	Alarm output cancellation with the LED out	61 page

## Basic key operation

Operation control or setting with keypad operation.

### ■ Main menu

The main menu has 9 options. Move the cursor between the options with the UP and DOWN keys and push the ENTER key to make a selection. The sub-menu options also can be selected in the same way. The following shows the steps to enter the AUTO mode through basic key operation.

```
>1. PUMP MODEL  
2. TEACHING  
3. PUMP DRIVE  
4. SETTING
```

```
5. KEY PROTECT  
6. TOTAL COUNT  
7. MANU or AUTO  
8. PRESSURE SENSOR
```

```
9. ALARM RESET
```

- 1 Move the cursor to "7. MANU or AUTO" with the UP and DOWN keys.

```
5. KEY PROTECT  
6. TOTAL COUNT  
>7. MANU or AUTO  
8. PRESSURE SENSOR
```

- 2 Push the ENTER key. A sub-menu option will show up.

```
MANU or AUTO  
[MANU] AUTO
```

- 3 Use the select key to choose "MANU" or "AUTO".

The start/stop of the pump is controlled by the LPC-1 controller in MANU mode or a user PLC in AUTO mode.

- 4 Push the ENTER key to determine the setting.

```
MANU or AUTO  
AUTO SET OK!
```

## Pump operation

The start/stop of the pump is controlled by the LPC-1 controller in MANU mode or a user PLC in AUTO mode.

### **!** Points to be observed

Before operation in your system, conduct a trial run with pure water (or chemical liquid) to flush out particles or to measure metal ion level.

## **Pump model selection**

Select a pump model which comes under the control of the LPC-1 controller.

- 1 Select "1. PUMP MODEL" and push the ENTER key.

```
>1. PUMP MODEL
  2. TEACHING
  3. PUMP DRIVE
  4. SETTING
```

- 2 Select "FLP-75" and push the ENTER key.

"FLP-75 SELECT OK!" appears on the screen.

\*Always choose a correct model. Otherwise, malfunction results.

\*The controller refuses the start of operation and asks for the selection if a model hasn't been selected, yet.

```
>1. FLP-75    5. FLP-***
  2. FLP-75A  6. FLP-***
  3. FLP-75B  7. FLP-***
  4. FLP-***  8. FLP-***
```

- 3 Check if the selection is correct and push the ENTER key.

The main menu shows up.

\*Once you have chosen the correct pump model, you can skip this selection step as long as the same controller is used, even after the LPC-1 controller power is turned off.

\*If you have changed the model selection, all the later related settings return to the default.

```
PUMP SELECT
FLP-75 SELECT OK!
```

## Teaching

During the teaching behaviour, the LPC-1 controller measures the maximum possible stroke length and the origin position (0 stroke length) with the right-and-left displacement sensors. The teaching process is necessary to keep synchronization between the pump and the controller.

### NOTE

- The pump will not work properly if teaching is not performed.
- After teaching is performed, select "4. SETTING" (main-menu), "3. SET VALUE CONFIRM" (sub-menu) and then "1. STROKE LENGTH" to check the measured stroke length. The length should be within the range of about 33mm if it is done correctly. Other length such as 500mm suggests miswiring of the displacement sensors.
- Measured stroke length changes depending on operation conditions due to existence of a spring in the connecting shaft. But then it will not adversely affect the pump operation as long as the origin position is determined.

1 Select "2. TEACHING" and push the ENTER key.

```

1. PUMP MODEL
>2. TEACHING
3. PUMP DRIVE
4. SETTING
    
```

2 Use the UP and DOWN keys (or the SELECT key) to chose "YES" and push the ENTER key.

The bellows starts to move from the centre to the left until the right proximity switch detects the right connecting plate and stops for 1 second, and then starts to move to the right until the left proximity switch detects the left connecting plate and stops for 1 second. Again moves to the left and stops for 1 second and then returns to the centre as finishing this teaching behaviour.

\*The LPC-1 controller with default setting automatically performs teaching in advance of the first-time operation.

The right display will show up with the TEACHING LED turned on during teaching behaviour.

```

TEACHING START?

[YES] NO
    
```

The right display will show up with the TEACHING LED turned off when teaching is completed successfully.

```

TEACHING MODE
TEACHING . . . . .
    
```

```

TEACHING MODE
TEACHING OK!
    
```

The right display shows up and the TEACHING LED flashes when the right (or left) proximity switch does not detect the right (or left) connecting plate within 10 seconds during teaching behaviour.

- \*Check if air lines and electric wiring are correctly made.
- \*Check if liquid lines are kept open.

```
TEACHING MODE
TEACHING  TIMEOUT!!
```

The right display shows up and the TEACHING LED goes off when the MENU or RESET key is pressed during teaching behaviour. Push any key other than the START/STOP key to return to the main menu.

```
TEACHING MODE
TEACHING  ABORT!!
```

- 3 Push the ENTER or MENU key if teaching is completed successfully.

## Manual operation

Run or stop the pump by the LPC-1 controller and key operation.

### ■ Operation start

- 1 Select "7. MANU or AUTO" in the main menu and push the ENTER key.

```
5. KEY PROTECT
6. TOTAL COUNT
>7. MANU or AUTO
8. PRESSURE SENSOR
```

- 2 Select "MANU" and push the ENTER key.

```
MANU or AUTO
[MANU]  AUTO
```

```
MANU or AUTO
MANU SET OK!
```

- 3 Push the ENTER key or the MENU key.  
The LPC-1 controller returns to the main menu.

4 Select "3. PUMP DRIVE" in the main menu and push the ENTER key.

```
1. PUMP MODEL
2. TEACHING
>3. PUMP DRIVE
4. SETTING
```

5 Use the UP and DOWN keys (or the SELECT key) to choose "YES" and push the ENTER key if feedback control is required. Or choose "No".

See page 52 for feedback control.

```
QUANTITIY CONSTANCY
CONTROLLED?

[YES] NO
```

6 Use the UP and DOWN keys (or the SELECT key) to choose "YES" and push the ENTER key to start operation.

- The two different displays below will show up depending on whether feedback control is chosen or not.
- Pushing the START/STOP key in the main menu display, the pump starts to run in the chosen way once this setting has been completed.
- When "No" is chosen at a selection screen below, the controller returns to the main menu.

When feedback control is selected:

```
LOW PULSE DRIVE
QUANT. CONTST. CTRL.
      START?
[YES] NO
```

When feedback control is not selected:

```
LOW PULSE DRIVE

      START?
[YES] NO
```

## ■ Operation stop

### Points to be observed

- Before stopping the pump, release the pressure from the discharge line. Otherwise, the bellows may deform.
- Do not close a discharge valve as stopping the pump. An impact pressure may damage the bellows or a connecting plate.

1 Push the START/STOP key.

2 Select "YES" and push the ENTER key.

Two different displays below will show up depending on whether feedback control is chosen or not. The main menu shows up when the pump stops.

When feedback control is selected:

```
LOW PULSE DRIVE
QUANT. CONTST. CTRL.
      STOP?
[YES]          NO
```

When feedback control is not selected:

```
LOW PULSE DRIVE
      STOP?
[YES]          NO
```

### NOTE

If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems. See the troubleshooting section as necessary.

## AUTO operation

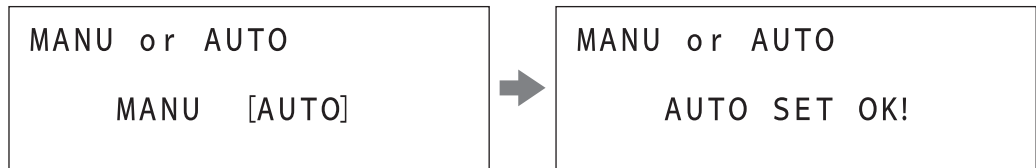
Run or stop the pump with the external signal (CN5 PIN1 START/STOP signal) from user PLC.

- 1 Select "7. MANU or AUTO" in the main menu and push the ENTER key.

5. KEY PROTECT  
 6. TOTAL COUNT  
 >7. MANU or AUTO  
 8. PRESSURE SENSOR

- 2 Select "AUTO" and push the ENTER key.

The controller returns to the main menu.



- 3 Select "3. PUMP DRIVE" and push the ENTER key.

1. PUMP MODEL  
 2. TEACHING  
 >3. PUMP DRIVE  
 4. SETTING

- 4 Use the UP and DOWN keys (or the SELECT key) to choose "YES" and push the ENTER key if feedback control is required. Or choose "No".

- Two different displays below will show up depending on whether feedback control is chosen or not.
- After this setting is completed, the pump runs at any time when the CN5 PIN1 START/STOP signal is entered.

\*AUTO operation can be stopped by pressing and holding the START/STOP key for 2 seconds or stopped as described in the earlier page.

When feedback control is selected:

QUANTITIY CONSTANCY CONTROLLED?  
 [YES] NO



LOW PULSE DRIVE  
 QUANT. CONTST. CTRL.  
 SET OK!!

When feedback control is not selected:

QUANTITIY CONSTANCY CONTROLLED?  
 YES [NO]

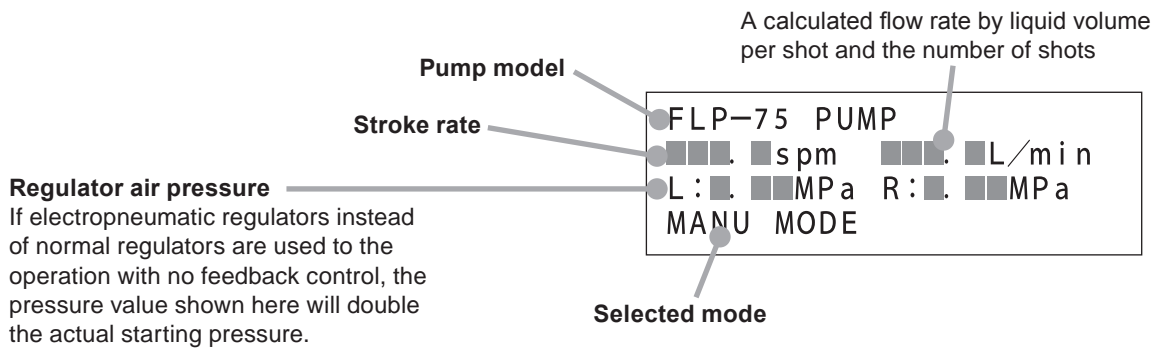


LOW PULSE DRIVE  
 SET OK!!

## Display information

### ■ Operation display

\*Push the RETURN/RESET key to turn off the Alarm LED if it lights.



### ■ Total count display

Total number of pump shots will be shown if the DOWN key is pressed once. A push of the UP key calls back the operation display.



## Speed compensation (AUTO mode)

The LPC-1 controller reduces pump speed below the interlock speed (the fast alarm speed plus 10spm. See page 55 for detail) when it rises to that rate or above.

\*The LPC-1 normally switches the SV by the input from the proximity switches, but then during the speed compensation the controller operates the SV independently of the proximity switches.

### ■ External input for speed compensation operation

In AUTO mode, input of the external signal (CN5 PIN5 dry running start/stop signal) from user PLC to the LPC-1 controller can also start the speed compensation. Note teaching behaviour is automatically made right before speed compensation.

\*Teaching behaviour always functions once the pump speed has risen to the interlock speed or above before speed compensation is started.

\*Always input the dry running start/stop signal while the CN5 PIN1 START/STOP signal is inputted.



## Operation programming

Select "4. SETTING" for programming the feedback control (1. QUANT.CONST.CTRL), alarm output behaviour (2. ALARM), setting/mode confirmation (3. SET VALUE CONFIRM) and defaulting the LPC-1 (4. RESET ALL DATA).

- 1 Select "4. SETTING" in the main menu and push the ENTER key.

Sub-menu options will appear.

```
1. PUMP MODEL
2. TEACHING
3. PUMP DRIVE
>4. SETTING
```

- 2 Select one of the sub-menu options and push the ENTER key to make settings.

Each selection will show further options. See later pages for setting at each menu.

```
SETTING
>1. QUANT. CONST. CTRL
2. ALARM
3. SET VALUE CONFIRM
```



```
QUANT. CONST. CTRL
>1. FLOW QUANTITY
2. E-P REGURATOR
3. 1shot d CAPA
```

## Feedback control (4. SETTING: 1. QUANT. CONST. CTRL)

Program a target flow rate, the set pressure of the electropneumatic regulators and liquid volume per shot. An electropneumatic regulator is always required to both the right and left air lines between the SV and the REG in order to adjust the amount of supply air to the pump and to keep the target flow rate under pressure fluctuation. Use of the CKD EVD3500-010AN-\_\_-3 electropneumatic regulator is recommended. Purchase separately.

### ■ Target flow setting

Set a target flow rate to the LPC-1 controller.

- 1 Select "1. QUANT. CONST. CTRL" (feedback control setting) in the sub menu and push the ENTER key.

Further options will show up.

```
SETTING
>1. QUANT. CONST. CTRL
 2. ALARM
 3. SET VALUE CONFIRM
```



```
QUANT. CONST. CTRL
>1. FLOW QUANTITY
 2. E-P REGURATOR
 3. 1shot d CAPA
```

- 2 Select "1. FLOW QUANTITY" (target flow rate setting) and push the ENTER key.

```
QUANT. CONST. CTRL
>1. FLOW QUANTITY
 2. E-P REGURATOR
 3. 1shot d CAPA
```

- 3 Set a target flow rate and push the ENTER keys.

The target flow rate is set to 20.0mL/min with default setting. Move between digits with the SELECT key and change numerical values with the UP and DOWN keys.

\*Observe the possible maximum discharge capacity at each supply air pressure (see the attached performance curves.). Otherwise, malfunction may result.

```
FLOW QUANTITY
```

```
Qt= 20.0 L/min
```



```
FLOW QUANTITY
```

```
SET OK!
```

- 4 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the feedback control setting sub-menu or the MENU key to return to the main menu.

## ■ Electropneumatic regulator (EPREG) setting

Set the starting pressure, minimum/maximum allowable supply air pressure to the LPC-1 controller.

- 1 Select "2. E-P REGULATOR" (electropneumatic regulator setting) in the sub menu and push the ENTER key.

```
QUANT. CONST. CTRL
 1. FLOW QUANTITY
>2. E-P REGURATOR
 3. 1shot d CAPA
```

- 2 Select each setting option and push the ENTER key.

```
E-P REGURATOR
>1. START PRESSURE
 2. MIN PRESSURE
 3. MAX PRESSURE
```

- 3 Set a starting and the min/max supply air pressure and push the ENTER keys.

The default setting for the regulator is as shown in the table below. Move between digits with the SELECT key and change numerical values with the UP and DOWN keys.

\*Note a starting supply air pressure must be at or higher than the min supply air pressure and lower than the max.

\*Observe the possible maximum supply air pressure of the pump (0.5MPa).

\*When the recommended CKD EVD3500-010AN-\_\_-3 electropneumatic regulator is used, the supply air pressure to this EPREG must be 0.1MPa or higher than the max pressure set to the controller. Adjust the supply-side regulators and compressor accordingly. If the minimum differential pressure is not kept, the service life of the EPREG will be shortened.

\*When the recommended EPREG above is not used, contact us for the minimum differential pressure required.

\*The starting supply air pressure equals to the set pressure of the EPREG. The pressure is applied to the no-feedback control mode as well.

The LPC-1 default setting for the electropneumatic regulator

Starting supply air pressure	0.2MPa
Minimum allowable supply air pressure	0.2MPa
Maximum allowable supply air pressure	0.5MPa

```
E-P REGURATOR
START PRESSURE
```

Sp=0. \*\* MPa



```
E-P REGURATOR
START PRESSURE
```

SET OK!

- 4 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the feedback control setting sub-menu or the MENU key to return to the main menu.

## ■ Liquid volume per shot setting

Set the liquid volume per shot to the LPC-1 controller. The flow rate on the operation display is calculated by multiplying the liquid volume by the number of pump shots.

- 1 Select "3. 1 shot d CAPA" in the sub menu and push the ENTER key.

```
QUANT. CONST. CTRL
 1. FLOW QUANTITY
 2. E-P REGURATOR
>3. 1shot d CAPA
```

- 2 Set liquid volume per shot and push the ENTER keys.  
Move between digits with the SELECT key and change numerical values with the UP and DOWN keys.

```
1shot d CAPA
dc= 705. _ cc/shot
```



```
1shot d CAPA
      SET OK!
```

- 3 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the feedback control setting sub menu or the MENU key to return to the main menu.

## Alarm output (4. SETTING: 2. ALARM)

Program alarm output behaviours of Time-up, Fast and Life alarms.

### ■ Time up alarm setting (Default: 20sec)

The LPC-1 controller outputs the time-up alarm to the user PLC and the TIME UP LED lights when either right or left proximity switch does not detect the connecting plate within the set time. The signal output and LED lightening continue unless the detection is made in time.

### ■ Fast alarm setting (Default: 140spm)

The LPC-1 controller outputs the fast alarm signal to the user PLC and the FAST LED lights at the fourth shots after the pump speed has risen to the fast alarm speed or above. The signal output and LED lightening continue unless the pump speed falls below the fast alarm speed.

\*The LPC-1 controller stops the pump at the third shots after the pump speed rises to the interlock speed (fast alarm speed plus 10spm) or above. The controller performs teaching and speed compensation (see page 50) to keep the pump speed below the interlock speed.

### ■ Life alarm setting (Default: 99,999,999 counts)

The LPC-1 controller outputs the life alarm signal to the user PLC and the LIFE LED lights when reciprocation times (TOTAL COUNT1) exceeds the set number of times (max 999,999,999).

\*Alarm output cancellation (see page 61) just turns off the LIFE LED temporarily. Reset the accumulated data in the TOTAL COUNT1 before restarting operation, or the LED turns on again in operation. See "Total number of pump shots confirmation/cancellation" on page 59 for detail.

- 1 Select "4. SETTING" and push the ENTER key.  
Sub-menu options will appear.

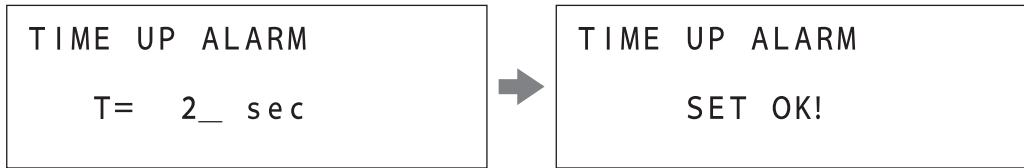
- 2 Select "2. ALARM" and push the ENTER key.  
Further options will appear.

```
SETTING
 1. QUANT. CONST. CTRL
>2. ALARM
 3. SET VALUE CONFIRM
```

- 3 Select one of the sub-menu options and push the ENTER key to make settings.

```
ALARM
>1. TIME UP ALARM
 2. FAST ALARM
 3. LIFE ALARM
```

- 4 Set the time up, fast and life alarm behaviour and push the ENTER keys.  
Move between digits with the SELECT key and change numerical values with the UP and DOWN keys.  
When setting the time up alarm, enter the maximum allowable time for a proximity switch to detect the connecting plate.



- 5 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the alarm setting sub-menu or the MENU key to return to the main menu.

### ***Setting confirmation (4. SETTING: 3. SET VALUE CONFIRMATION)***

*Setting details can be checked through "3. Set value confirmation".*

#### **■ Stroke length confirmation**

The LPC-1 controller shows stroke length measured through teaching.

LEFT: Stroke length measured with the left displacement sensor.

RIGHT: Stroke length measured with the right displacement sensor.

AVE: Average stroke length of the measured stroke lengths.

#### **■ Pump model**

The LPC-1 controller shows the selected pump model code.

#### **■ MANU or AUTO**

The LPC-1 controller shows the current operation mode of MANU or AUTO.

#### **■ Drive mode**

The LPC-1 controller shows whether operation is with feedback control or not. "QUANT.CONST.CTL" represents operation with feedback control and "LOW PULSE MODE" represents no feedback control.

- 1 Select "3. SET VALUE CONFIRM" in the sub menu and push the ENTER key.

```
SETTING
 1. QUANT. CONST. CTRL
 2. ALARM
>3. SET VALUE CONFIRM
```

- 2 Select one of the sub-menu options and push the ENTER key to check settings.

```
SET VALUE CONFIRM
>1. STROKE LENGTH
  2. PUMP MODEL
  3. MANU or AUTO
```



```
STROKE LENGTH
LEFT : 0. 0 mm
RIGHT: 0. 0 mm
AVE  : 0. 0 mm
```

- 3 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the confirmation sub-menu or the MENU key to return to the main menu.

### ***Default setting (4. SETTING: 4. RESET ALL DATA)***

*Default the LPC-1 controller through the following procedure below.*

- 1 Select "4. RESET ALL DATA" in the sub menu and push the ENTER key.

```
SETTING
>4. RESET ALL DATA
```

- 2 Select "YES" and push the ENTER key.

```
RESET ALL DATA?

[YES] NO
```

- 3 Push the ENTER, RESET, MENU, SELECT, UP or DOWN key to return to the main menu.

## Keypad lock (5. KEY PROTECT)

Keypad lock can be active for the prevention of erroneous key operation.

### NOTE

Any key operation is not acceptable when the keypad lock is active. In an emergency, press and hold the start/stop key for 2 seconds. The pump enters a wait state and stops running.

### ■ Keypad lock activation

- 1 Select "5. KEY PROTECT" and push the ENTER key.  
Sub-menu options will appear.

```
>5. KEY PROTECT
6. TOTAL COUNT
7. MANU or AUTO
8. PRESSURE SENSOR
```

- 2 Select "1. PROTECT" and push the ENTER key.  
Any key operation is disabled.

```
KEY PROTECT
>1. PROTECT
2. PROTECT CANCEL
```



```
KEY PROTECT
PROTECT OK!
```

- 3 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the keypad lock sub-menu or the MENU key to return to the main menu.

### ■ Keypad lock deactivation

- 1 Select "5. KEY PROTECT" and push the ENTER key.  
Sub-menu options will appear.

- 2 Select "2. PROTECT CANCEL" and push the ENTER key.  
All key operation is enabled.

```
KEY PROTECT
PROTECT CANCEL OK!
```

- 3 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the keypad lock sub-menu or the MENU key to return to the main menu.

## **Total number of pump shots confirmation/cancellation (6. TOTAL COUNT)**

Default the accumulated reciprocation times in the TOTAL COUNT1 and 2 through the following procedure as necessary (one reciprocation time means two pump shots.). TOTAL COUNT3 can not be defaulted.

\*TOTAL COUNT 2 and 3 are not linked to the life alarm output. The life alarm works based on the accumulation in TOTAL COUNT1. The LPC-1 controller outputs the life alarm signal to the user PLC and the LIFE LED lights when reciprocation times (TOTAL COUNT1) exceeds the set number of times (max 999,999,999).

### ■ Confirmation

- 1 Select "6. TOTAL COUNT" and push the ENTER key.  
Sub-menu options will appear.

```
5. KEY PROTECT
>6. TOTAL COUNT
7. MANU or AUTO
8. PRESSURE SENSOR
```

- 2 Select one of TOTAL COUNT1, 2, or 3 and push the ENTER key.

```
>1. TOTAL COUNT1
2. TOTAL COUNT2
3. COUNT1 RESET
4. COUNT2 RESET
5. TOTAL COUNT3
```

```
TOTAL COUNT■
117100 count
```

- 3 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the confirmation/cancellation sub-menu or the MENU key to return to the main menu.

### ■ Cancellation

- 1 Select "COUNT1 RESET" or "COUNT2 RESET" in the sub menu and push the ENTER key.

```
1. TOTAL COUNT1
2. TOTAL COUNT2
>3. COUNT1 RESET
4. COUNT2 RESET
```

- 2 Select "YES" and push the ENTER key.

```
TOTAL COUNT
COUNT ■ RESET
[YES] NO
```

```
COUNT■ RESET
RESET OK!
```

- 3 Push the ENTER, RESET, SELECT, UP or DOWN key to return to the confirmation/cancellation sub-menu or the MENU key to return to the main menu.

## ***Regulator set pressure confirmation (8. PRESSURE SENSOR)***

*The greater difference between the right and left regulator set pressure, the more pulsation it becomes. Be sure to keep the same set pressure to both regulators (max allowable deviation is  $\pm 0.01\text{MPa}$ ).*

- 1 Select "8. PRESSURE SENSOR" and push the ENTER key.

When a pressure sensor is provided to the regulator or directory on the supply air line in operation:

5. KEY PROTECT  
6. TOTAL COUNT  
7. MANU or AUTO  
>8. PRESSURE SENSOR



PRESSURE SENSOR  
LEFT : 0. ■■ MPa  
RIGHT : 0. ■■ MPa

When a pressure sensor is not provided:

PRESSURE SENSOR  
LEFT : ERROR  
RIGHT : ERROR

When an electropneumatic regulator is provided and the pump stops:

PRESSURE SENSOR  
LEFT : 0. 00 MPa  
RIGHT : 0. 00 MPa

- 2 Push the ENTER, MENU, RESET or SELECT key to return to the main menu.

## Alarm output cancellation (9. ALARM RESET)

Stop the alarm output and turn off the leak, time-up, life or E-P Reg LED through the following procedure.

- 1 Select "9. ALARM RESET" and push the ENTER key in the main menu.

>9. ALARM RESET

- 2 Select "YES" and push the ENTER key.

The LPC-1 controller stops outputting the alarm signal and turns off the leak, time-up, life or E-P Reg alarm LED.

\*The LPC-1 controller outputs the life alarm signal to the user PLC and the LIFE LED lights when reciprocation times accumulated in TOTAL COUNT1 exceeds the set number of times (max 999,999,999). Default the accumulation in TOTAL COUNT1 to cancel the life alarm.



- 3 Push the ENTER, MENU, RESET or SELECT key to return to the main menu.

### NOTE

The LPC-1 controller resumes the life, leak and/or E-P Reg alarm outputs and turns on appropriate LEDs two minutes after the cancellation unless the TOTAL COUNT1 is cancelled or the root causes of the leak and/or E-P Reg alarms are removed. See page 16 for detail.

# Maintenance

**This section describes troubleshooting, inspection, specification and dimensions.**

## **!** Points to be observed

Observe the following points during maintenance work.

- Follow instructions in this manual for replacement of wear parts. Do not disassemble the pump beyond the extent of the instructions.
- Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a face shield during disassembly, assembly or maintenance work. The specific solution will dictate the degree of protection. Refer to MSDS precautions from the solution supplier.
- Solution in the discharge line may be under pressure. Release the pressure from the discharge line before disconnecting plumbing or disassembly of the pump to avoid solution spray.
- Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before service is performed.
- If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems.
- Before stopping the pump, release the pressure from the discharge line. Otherwise, the bellows may deform.
- Do not close a discharge valve as stopping the pump. An impact pressure may damage the bellows or a connecting plate.

## Troubleshooting

*First check the following points. If the following measures do not help remove problems, contact your distributor.*

States	Possible causes	Points to be checked	Solutions
The pump does not run.	Switch-over failure of the solenoid valve (SV)	-	<ul style="list-style-type: none"> <li>• Inspect, repair or replace as necessary.</li> </ul>
	Improper wiring or the disconnection of the SV, displacement sensors or proximity switches.	<ul style="list-style-type: none"> <li>○ If wiring is done according to each device manual.</li> <li>○ Air lines and electrical wiring</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect/correct wiring.</li> <li>• Replace as necessary.*</li> </ul>
	In feedback control, the supply air pressure of the EPREG is set too low to operate the SV.	<ul style="list-style-type: none"> <li>○ Set pressure of the EPREG (LPC-1 controller)</li> <li>○ Minimum operating pressure of the SV</li> </ul>	<ul style="list-style-type: none"> <li>• Observe the minimum operating pressure of the SV.</li> <li>• Adjust the minimum operating pressure of the SV as necessary.</li> </ul>

\*Solutions marked with \* are conducted by us.

States	Possible causes	Points to be checked	Solutions
The pump does not run.	Bellows rupture (Leak alarm output)	<ul style="list-style-type: none"> <li>○ Supply air pressure</li> <li>○ Stroke rate</li> <li>○ Liquid temperature</li> <li>○ If discharge line pressure is released as soon as the pump stops.</li> <li>○ Air line I.D. and length</li> <li>○ Closed suction line</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the bellows if damaged.*</li> <li>● Observe pump spec and composite effective cross sectional area.</li> </ul>
	Rising discharge pressure	<ul style="list-style-type: none"> <li>○ Filter for clogging</li> <li>○ If a filter is wet.</li> </ul>	<ul style="list-style-type: none"> <li>● Check or replace the filter as necessary.</li> <li>● Wet the filter.</li> </ul>
		○ Closed discharge line	● Open the discharge line.
	Supply air pressure or air flow is too low.	<ul style="list-style-type: none"> <li>○ Minimum operating pressure of the SV</li> <li>○ If proper air line I.D. is selected if two or more pumps are installed.</li> </ul>	<ul style="list-style-type: none"> <li>● Observe the minimum operating pressure.</li> <li>● Adjust the regulator set pressure as necessary.</li> </ul>
	Leak sensor malfunction	○ Wet pump	● Keep the pump dry.
		○ If supply air is dry.	● Keep the supply air dry.
	Incorrect air line piping	○ Both right and left air lines	● Correct as necessary.
	Incorrect electrical wiring	○ If teaching is performed.	● Correct as necessary.
	Keypads are locked.	○ If keypad lock is active.	● Deactivate keypad lock.
	MANU/AUTO mode selection is wrongly done.	○ Operation mode setting (LPC-1 controller)	● Correct as necessary.
Solenoid valve failure	○ If the SV switches correctly.	● Replace as necessary.	
Liquid can not be pumped up.	A check valve is clogged with debris.	○ A check valve for clogging	● Install a guard filter in a suction line. Clean or replace the pump.*
	Closed suction line	○ A point of closure	● Open the suction line.
	A check valve is worn.	○ A valve on the suction line	● Install a guard filter in a suction line. Clean or replace the pump.*
Pulsation is not dampened.	A different pump model is set to the LPC-1 controller.	○ Pump model selection (LPC-1 controller)	● Set a correct pump model to the controller.
	Teaching is not performed.	○ If teaching is done.	● Perform teaching.
	Different set pressure between right and left regulators.	○ Regulator set pressure	● Set the same pressure to both the regulators.
	Air ingress into the pump	○ Air in liquid	● Install a baffle in supply tank.
	Trapped air in the bellows	○ Evidence of calibration	● Run the pump at the max speed to expel air.
	Calibration	○ If the pump speed stays at a target rate.	● Wait until calibration ends.
	Calibration with discharge pressure fluctuation	○ If discharge pressure fluctuates.	● Wait until calibration ends.
	Supply air pressure/air flow is too low.	○ Supply air pressure/air flow	● Observe the max air consumption/air flow.
	Composite effective cross sectional area is too small.	○ Effective cross sectional area of each pneumatic device	● Meet the minimum composite effective cross-sectional area required.

\*Solutions marked with \* are conducted by us.

States	Possible causes	Points to be checked	Solutions
Flow rate is reduced.	Supply air pressure or air flow is too low.	<ul style="list-style-type: none"> <li>○ If proper air line I.D. is selected if two or more pumps are installed.</li> </ul>	<ul style="list-style-type: none"> <li>● Reset the system.</li> <li>● Adjust the regulator set pressure as necessary.</li> </ul>
	Discharge pressure increment	<ul style="list-style-type: none"> <li>○ Filter for clogging.</li> <li>○ If a filter is wet.</li> <li>○ If discharge line is open.</li> </ul>	<ul style="list-style-type: none"> <li>● Review discharge conditions.</li> </ul>
	A check valve is clogged with debris.	<ul style="list-style-type: none"> <li>○ A check valve for clogging.</li> </ul>	<ul style="list-style-type: none"> <li>● Install a guard filter in a suction line. Clean or replace pump head*</li> </ul>
	Insufficient NPSHa (Net positive suction head available)	<ul style="list-style-type: none"> <li>○ Liquid line I.D. and length</li> </ul>	<ul style="list-style-type: none"> <li>● Review suction conditions.</li> </ul>
Liquid leaks.	Bellows rupture	<ul style="list-style-type: none"> <li>○ Supply air pressure</li> <li>○ Stroke rate</li> <li>○ Liquid temperature</li> <li>○ If discharge line pressure is released as soon as the pump stops.</li> <li>○ Air line I.D and length</li> <li>○ Closed suction line</li> </ul>	<ul style="list-style-type: none"> <li>● Replace the bellows if damaged.*</li> <li>● Observe pump spec and composite effective cross sectional area.</li> </ul>
Excessive air consumption.	Worn shaft packing	<ul style="list-style-type: none"> <li>○ Air leak from the air chamber</li> </ul>	<ul style="list-style-type: none"> <li>● Replace as necessary.*</li> </ul>
	Stud bolt is loose.	<ul style="list-style-type: none"> <li>○ Air leak from the air chamber</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten stud bolts by the rated torque of 30N•m.</li> </ul>
Unbalanced pump operation	Worn valve or valve seat	-	<ul style="list-style-type: none"> <li>● Check, clean or replace the pump*.</li> </ul>
	Switch-over failure of the SV	<ul style="list-style-type: none"> <li>○ Solenoid valve set pressure</li> </ul>	<ul style="list-style-type: none"> <li>● Inspect, repair or replace the solenoid valve.</li> </ul>
Excessive vibration or noise	Loose pump fixation	-	<ul style="list-style-type: none"> <li>● Tighten anchor bolts.</li> </ul>
	Stroke rate is too high.	<ul style="list-style-type: none"> <li>○ The rated stroke rate</li> </ul>	<ul style="list-style-type: none"> <li>● Observe the maximum stroke rate.</li> </ul>
Debris from the pump outlet	Chemical crystal, Wafer or check valve fragments (through long time operation)	-	<ul style="list-style-type: none"> <li>● Do not send a liquid that crystallizes by nature.</li> <li>● Install a guard filter in a suction/discharge line.</li> <li>● Clean or replace pump head.*</li> </ul>

\*Solutions marked with \* are conducted by us.

# Inspection

Perform daily and periodic inspection to keep pump performance and safety.

## Daily inspection

Check for a leak or any other abnormality during operation. If you notice any abnormal or dangerous conditions, suspend operation immediately and inspect/solve problems according to "Troubleshooting". Replacement of wear parts is necessary at periodic intervals. Contact us or your nearest distributor.

No.	Points to be checked	Remarks
1	Stroke rate	Observe the maximum stroke rate at each supply air pressure range.
2	Regulator set pressure	Observe the supply air pressure range at each liquid temperature.
3	Air flow rate	Use a flow meter. Observe the maximum air consumption.
4	A leak from an air or liquid line	Check line connections

\*The maximum stroke rate changes with supply air pressure. See page 67 for detail.

\*The supply air pressure range changes with liquid temperature. See page 67 for detail.

## Periodic inspection

Check the following items every month.

### 1. Stroke rate reduction

Stroke rate reduces as air leaks. The wear of shaft packing is a cause of air leak. Replace the shaft packing as necessary.

\*Shaft packing replacement should be conducted by Iwaki.

### 2. Air and liquid leak

If air or liquid leak is detected from the cylinder, release the discharge pressure and the supply air pressure, and leave the pump until it cools down to ambient. Then retighten the stud bolts by 30N•m.

### 3. Valve assembly and bellows

Valve assembly and bellows are wear parts and need to be replaced at the end of their estimated life or when their performance deteriorates.

\*Life span at each wear part differs with a liquid handled and operating condition.

\*Valve assembly and bellows replacement should be conducted by Iwaki.

### 4. Pump operation after a long period of suspension

Feed air to the supply air ports of the pump (approx. 0.2MPa) and see if air leaks from the outlet before operation. If it leaks, it's the sign of damaged bellows.

## **Wear part list**

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To run the pump for a long period, wear parts need to be replaced every one year or every time when pump performance has reduced. Contact your distributor with the following information for wear part replacement.

1. Part names and part number (See "**Part names**" on page 70.)
2. Pump model identification code and manufacturing number (see pump nameplate.)
3. Drawing number if you have our approval drawing

Parts No.	Parts names	Q'ty <sup>*1</sup>	Estimated life <sup>*2</sup>
1-12	Pump head bellows UNIT	1	1 year
24, 25	Connecting shaft R UNIT	2	
27	Slide bush	2	
30	Main spring	2	
31	Auxiliary spring	2	
32	Main retainer	4	
34	Auxiliary retainer	4	
38	Shaft packing	2	
43	Laser type displacement sensor	2	
56	Diaphragm	2	

\*1 Q'ty shows the number of parts per pump.

\*2 The estimated life span varies with operating conditions and is not warranted.

# Specification/Outer dimension

## Specification

Information in this section is subject to change without notice.

### ■ Pump

Items	Spec		
Ambient temperature/humidity	0-60°C/30-60%RH (non-condensing)		
Storage temperature/humidity	-10-60°C/20-70%RH (non-condensing)		
Installation location	Indoor (no dusty environment)		
Operation rating	Intermittent/continuous		
Driving method	Pneumatic drive		
Inlet tube connection	O.D. 31.8 × I.D. 28.0 mm PFA tube with a Super 300 type 1-¼" union nut and sleeve		
Outlet tube connection	O.D. 25.4 × I.D. 22.2 mm PFA tube with a Super 300 type 1" union nut and sleeve		
Supply air line connection	Rc1/2"		
Max. flow rate*1	92L/min		
Liquid temperature range	5-100°C	101-150°C	151-180°C
Supply air pressure range	0.1-0.5MPa	0.1-0.4MPa	0.1-0.3MPa
Suction lift*2	1m		
Max. allowable liquid viscosity	50mPa•s		

\*1 The maximum flow rate is based on pumping clean water at 25°C and supply air pressure at 0.3MPa.

\*2 The suction lift is based on pumping clean water at an ambient temperature and the maximum spm.

### Stroke rate/Air consumption at each supply air pressure

Items	Spec				
Supply air pressure	0.41-0.5MPa	0.31-0.4MPa	0.21-0.3MPa	0.11-0.2MPa	0.10MPa
Max stroke rate	90spm	105spm	150spm	125spm	65spm
Max air consumption	647NL/min	608NL/min	615NL/min	355NL/min	99NL/min

### ■ LPC-1 controller

	Items	Spec	
Operating conditions	Power voltage	24VDC ± 10% (or -5 - 10%)*	
	Max. power consumption	LPC-1	0.11A
		24VDC signal	1.8A
	Ambient temperature	0-50°C	
	Ambient humidity	5-90%RH (non-condensing)	
	Storage temperature	-10 - 60°C	
	Outer dimensions	W185xD152xH112mm	
	Weight	1.3kg	
Analogue input	Number of input channels	6 (single-end input)	
	Input voltage	Displacement sensor	0-10V
		EPREG (Pressure sensor)	1-5V
		Leak sensor (Resistance range)	0Ω to infinity Detectable at 15kΩ or below (initial resistance: 10MΩ or more)

\*Feedback control with the EPREGs requires the smaller deviation of -5 - 10% to the 24VDC power voltage.

	Items	Spec
Digital input	Number of input channels	6
	Input voltage	24V
	Input current	5mA(min)/10mA(max)
	Insulation	Photocoupler insulation
	Withstand voltage	500VAC/min (breaking current 0.5mA or below)
	Insulation resistance	50MΩ or more
Analogue output	Number of channels to the EPREG	2
	Output voltage range to the EPREG	0-10V
	Output isolation	None
	Max output current	5mA
	Min load resistance	2kΩ
	Min load capacity	200pF
	DA conversion	Trigger source signal, Software trigger
Digital output	Number of output channels	7
	Output type	Open collector
	Max output current	SV ch1/ch2 300mA
	Insulation	Photocoupler insulation
	Withstand voltage	500VAC/min (breaking current 0.5mA or below)
	Insulation resistance	50MΩ or more (500VDC)

#### ■ Proximity switch

Items	Spec
Manufacturer	KOYO ELECTRONICS INDUSTRIES CO.,LTD
Model	APS4-12U-E-2242 (RO)
Output type	NPN open collector
Power voltage	10-30VDC

#### ■ Displacement sensor

Items	Spec
Manufacturer	OPTEX FA CO.,LTD.
Model	CD33-120NV
Analogue output	0-10V
Power voltage	18-24VDC

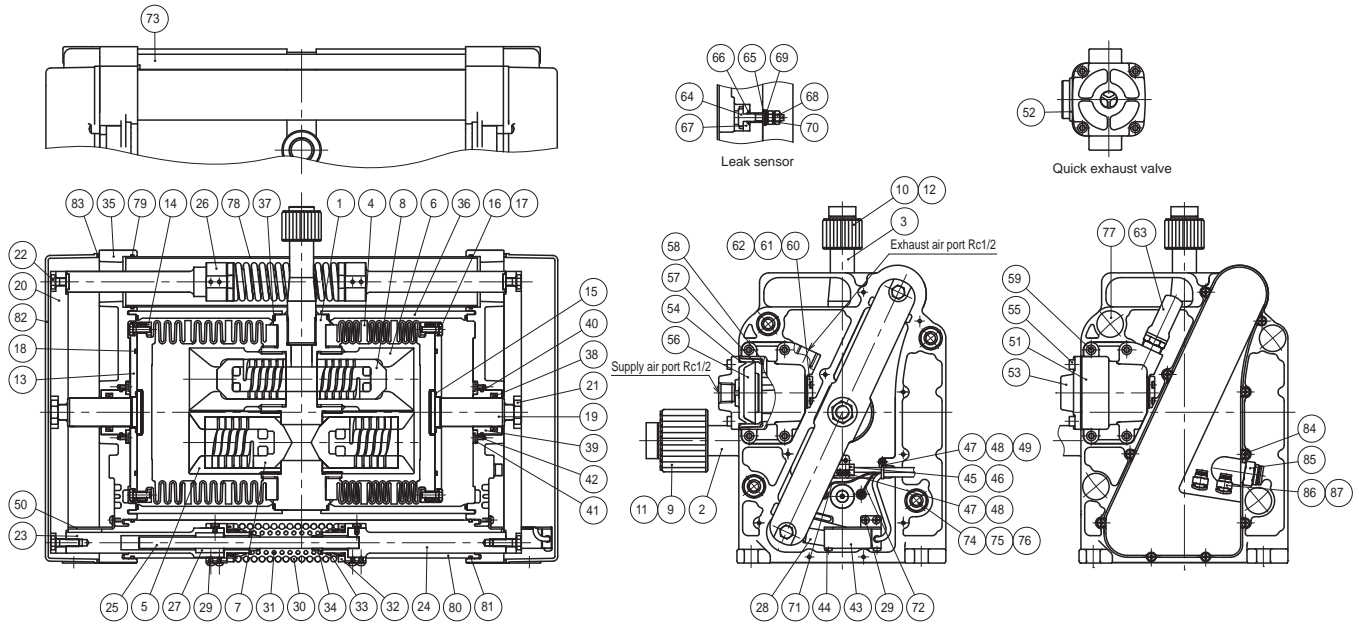
#### ■ Leak sensor

Items	Spec
Probe material	Stainless



# Part names

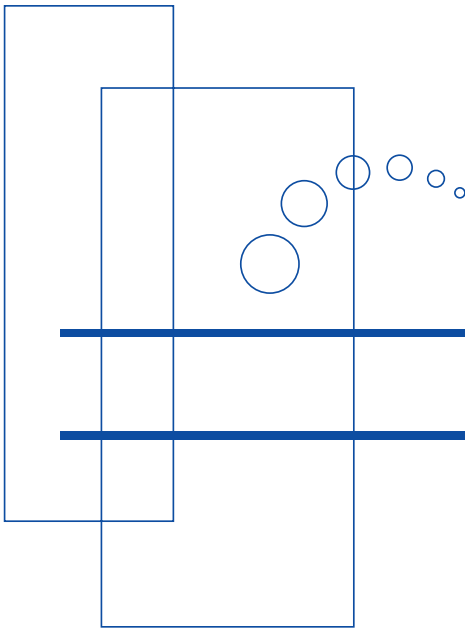
## ■ FLP-75W



No.	Name	Q'ty	Material	Remarks	No.	Name	Q'ty	Material	Remarks
1	Pump head	1	PTFE		45	Proximity detector	2	-	
2	Suction tube	1	PFA		46	Proximity spacer	2	STNLS STL	
3	Discharge tube	1	PFA		47	Screw	6	STNLS STL	M3x10
4	Ring bellows	2	PTFE		48	Spring washer	6	STNLS STL	M3
5	Suction valve case	2	PTFE		49	Cable tie	2	NYLON	
6	Discharge valve case	2	PTFE		50	Sensor bracket	2	STNLS STL	
7	Suction valve	2	PTFE		51	Exhaust valve	2	Aluminium alloy	Fluorine coated
8	Discharge valve	2	PTFE		52	O ring	2	FKM	G-40
9	Suction union nut	1	PFA		53	Exhaust valve plug	2	Aluminium alloy	Fluorine coated
10	Discharge union nut	1	PFA		54	O ring	2	FKM	AS568-145
11	Suction sleeve	1	PFA		55	Hex. sock. cap bolt	8	STNLS STL	M6x20 Fluorine coated
12	Discharge sleeve	1	PFA		56	Diaphragm	2	FKM	
13	Bellows plate	2	STNLS STL		57	Insert ring	2	PP	
14	Bellows flange	4	STNLS STL		58	O ring	2	FKM	S568-038
15	O ring	2	FKM	S-39	59	Hex.sock.cap bolt	8	STNLS STL	M6x40 Fluorine coated
16	Hex. bolt	16	STNLS STL	M6x18	60	Silencer seat holder	2	Aluminium alloy	Fluorine coated
17	Spring washer	16	STNLS STL	M6	61	Silencer seat	2	PP	
18	O ring	2	FKM	G-125	62	Screw	8	STNLS STL	M3x8 Fluorine coated
19	Pump shaft	2	STNLS STL	HC plating	63	Silencer	2	-	AN40-04
20	Connecting plate	2	STNLS STL		64	Leak sensor	4	STNLS STL	
21	Hex. nut	2	STNLS STL	M14	65	Teflon bush	4	PTFE	T4050-9140
22	Hex. bolt	4	STNLS STL	M8x25	66	O ring	4	FKM	S-4
23	Connecting shaft L	2	STNLS STL		67	Hex. holder	4	PP	
24	Connecting shaft R	2	STNLS STL		68	Hex. nut	8	STNLS STL	M4
25	Slide shaft	2	STNLS STL	HC plating	69	Plate washer	4	STNLS STL	M4
26	Retainer	4	STNLS STL		70	Spring washer	8	STNLS STL	M4
27	Slide bush	2	-	SMS12 KGL	71	Cord (black)	2	-	
28	Target	2	STNLS STL		72	Cord (white)	2	-	
29	Screw	12	STNLS STL	M4x5	73	Stud bolt	4	STNLS STL	Fluorine coated
30	Main spring	2	STNLS STL		74	Hex. nut	8	STNLS STL	M14
31	Auxiliary spring	2	STNLS STL		75	Plate washer	8	STNLS STL	M14
32	Main retainer	4	PPS		76	Spring washer	8	STNLS STL	M14
33	Main retainer expander	4	PPS		77	Cap	8	PP	
34	Auxiliary retainer	4	PPS		78	Top cover	1	Aluminium alloy	Fluorine coated
35	Cylinder head	2	Aluminium alloy	Fluorine coated	79	O ring	2	FKM	JAS0-2053
36	Cylinder	2	Aluminium alloy	Fluorine coated	80	Under cover	1	PPE	
37	O ring	4	FKM	AS568-170	81	O ring	2	FKM	AS568-153
38	Shaft packing	2	FKM	GLY-30	82	Cylinder head cover	2	PPE	
39	Bearing	2	Filled PTFE		83	Cover gasket	2	FKM	
40	O ring	2	FKM	S-44	84	Screw	20	STNLS STL	M4x10 Fluorine coated
41	Bearing stopper	2	PP		85	Straight fitting	2	-	PPC12-04
42	Low head bolt	8	STNLS STL	M4x8	86	Straight fitting	4	-	PPC6-01
43	Displacement sensor	2	-		87	Plug	4	-	PPP6
44	Screw	4	STNLS STL	M4x25					

\*Fluorine coating is not pin-hole less.





<http://www.iwakipumps.jp>

( )Country codes

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