

# RPL Valveless Pump

## Specification Sheet



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# 1 Introduction

The RPL series valve less pump employs high-precision ceramic pistons to achieve high-accuracy delivery of micro-volumes of liquid. Simultaneously, the ceramic material possesses excellent corrosion resistance, wear resistance, and superior chemical compatibility, making it suitable for titration, filling, and dispensing systems in precision automated analytical instruments.

The RPL series valve less pump can eliminate at least one solenoid valve, while simultaneously reducing equipment failure rates caused by solenoid valve malfunctions, significantly enhancing overall system reliability.

Based on piston displacement technology, the RPL series valve less pump has a lifespan of 20 million cycles with repeatability not exceeding 0.5%. When used with highly corrosive or crystallization-prone liquids, connecting to the cleaning port to clean the piston can further extend the RPL pump's lifespan.

## 1.1 RPL Series Features:

- Component design and manufacturing adhere to company quality standards, complying with ISO9001 quality system standards, EU RoHS directive, and CE safety certification, eliminating concerns for instrument regulatory approval.
- Unique range adjustment knob mechanism allows for range adjustment without disassembling the pump body.
- Compact and small structure, easy to install.
- Precise and stable flow rate, high reliability.
- Good chemical compatibility, wide range of applicable fluids.
- Dual flow rate adjustment via speed and angle, flexible and convenient application.

### 1.1.1 RPL – P6.35

- Covers fluid applications within the 50-300ul range, offering a rich selection of standard capacities: 50ul, 100ul, 200ul, 300ul.
- Provides customization for non-standard capacities within the 50-300ul range, offering flexibility for various requirements.

### 1.1.2 RPL – P15

- Covers fluid applications within the 300-1200ul range, with a rich selection of standard ranges: 400ul, 800ul, 1000ul, 1200ul.
- Provides customization of non-standard ranges within the 300-1200ul range, flexibly meeting various requirements.

## Foreach Warranty

Please refer to our General Terms of Sale (GTS)

## 2 Appearance and Dimensions

### 2.1 RPL - P6.35

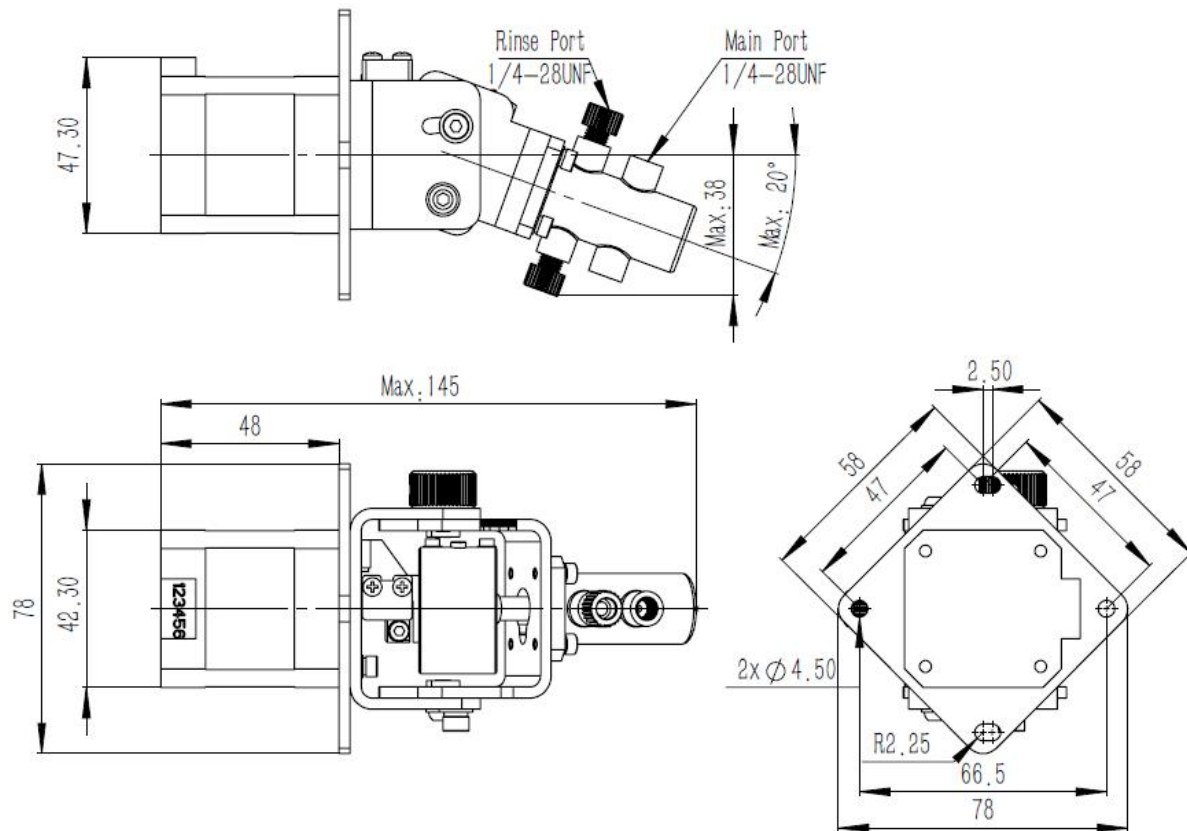


Figure 1 RPL-P6.35 Outline Dimensions

## 2.2 RPL - P15

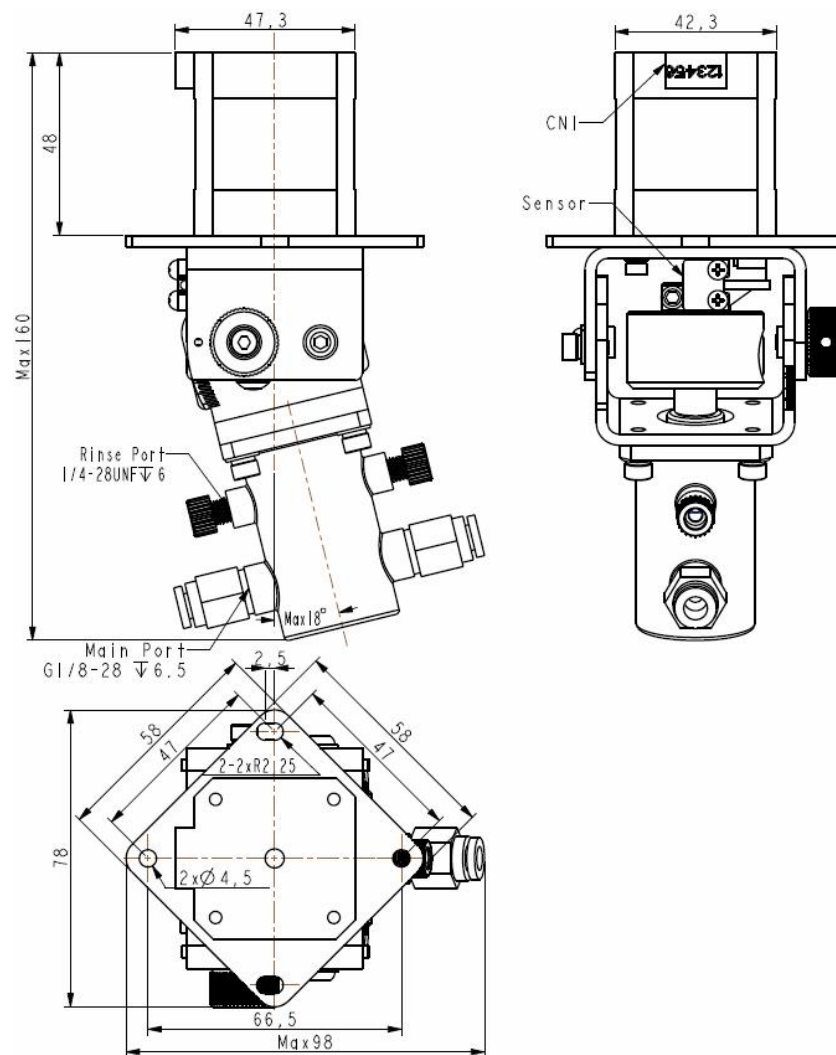


Figure 2 RPL-P15 Outline Dimensions

### Notes:

1. The above views are in the first angle projection. Unit: mm.
2. Note the impact of different deflection angles on installation.

### 3 Technical Features

The motor provides the power source for the RPL. The motor drives the coupling, which, through the motion of the spherical plain bearings, drives the piston assembly to perform rotational and linear motion.

The angle Alpha between the RPL pump head assembly and the motor coupling assembly, and the distance L from the center of the transmission ring to the spherical center of the spherical plain bearings, together determine the pump's motion stroke size, i.e., the displacement volume for one complete stroke.

Adjusting different angles at the pump head achieves different strokes, thereby fulfilling different range requirements..

The detailed aspiration and dispensing process is as follows:

- 1.Suction Process: When the piston's cut square flow channel faces the suction port end of the pump head cavity, as the ceramic piston rotates and moves upwards, the internal volume of the pump head cavity increases, creating a vacuum, and liquid is sucked in. The ceramic piston continues to rotate and retract.
- 2.Suction Completion: When the piston's cut square flow channel is horizontally parallel to both side ports, the suction process is complete, and the piston begins rotating downwards.
- 3.Discharge Process: As the ceramic piston rotates downwards, when the piston's cut square flow channel is perpendicular to the discharge port, the internal volume of the pump head cavity gradually decreases, and the liquid is compressed and discharged by the ceramic piston.
- 4.Discharge Completion: When the ceramic piston rotates forward to the maximum stroke and the cut square flow channel is horizontally parallel to both side ports, discharge is complete. The piston then changes from rotating forward to rotating upwards, entering the next suction/discharge cycle.

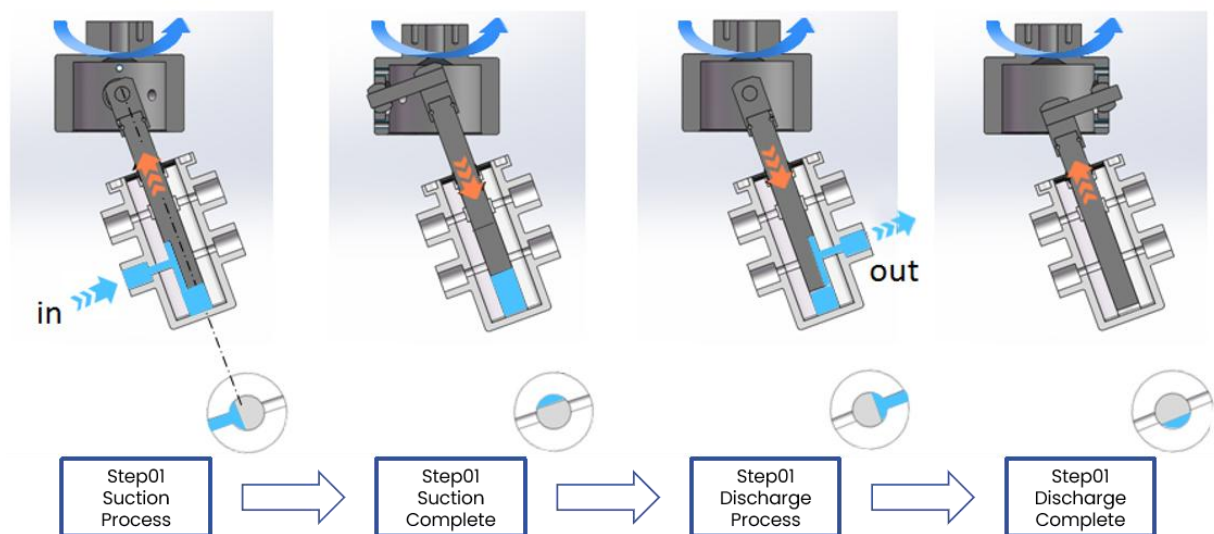


Figure 3 Process Flow

## 4 Component Structure

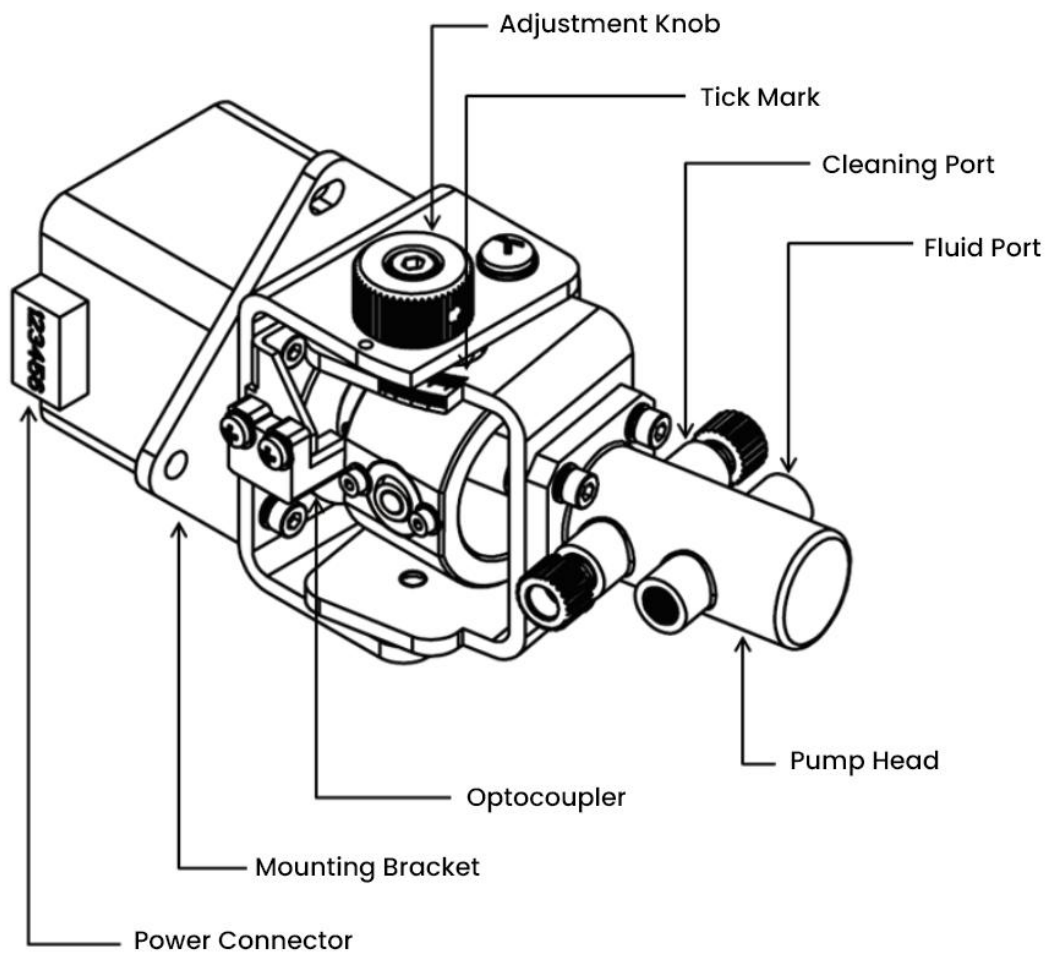


Figure 4 Component Structure

## 5 Installation Orientation

The RPL has strict installation orientation requirements. Correct installation facilitates easier venting of bubbles generated in the fluid path from the pump head, prevents accidental leakage from damaging the motor, and ensures stable operation of the RPL.

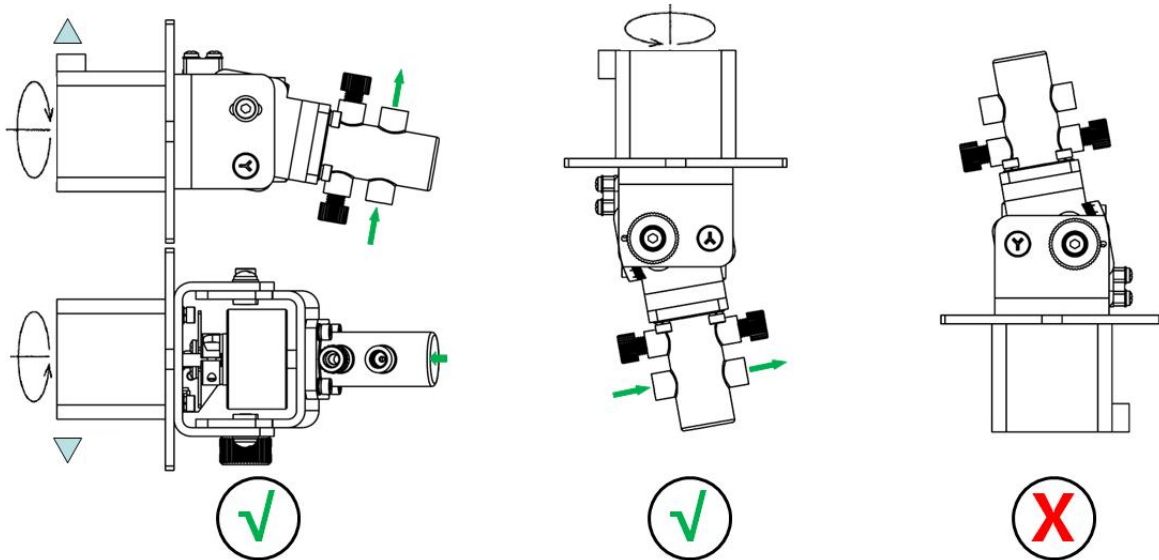


Figure 5 Assembly Schematic Diagram

### Note:

Arrow direction indicates fluid flow direction.

Ensure fastening with 2~4 M4 screws, using vibration dampers if necessary. Recommended torque: 0.8~1.0Nm.



## 6 Motor Configuration

### 6.1 Electrical Characteristics

Table 1 Motor Electrical Specifications

| Motor Electrical Parameters |                              |         |
|-----------------------------|------------------------------|---------|
| Specification               | Parameter                    | Remarks |
| Rated Current               | 1.5 A/Phase                  | —       |
| Step Angle                  | 1.8°/Full Step               | —       |
| Phase                       | 2 Phase Unipolar             | 6-wire  |
| Resistance                  | 1.5 $\Omega$ $\pm$ 15%/Phase | 25°C    |
| Static Angle Error          | $\pm$ 0.09° MAX              | *1      |

**Note:**

\*1 Excluding hysteresis error.

### 6.2 Pin Connection

Table 2 Motor Pin Connection

| Motor Pin Connection |       |                   |           |   |           |                    |           |   |           |                |      |           |   |      |           |
|----------------------|-------|-------------------|-----------|---|-----------|--------------------|-----------|---|-----------|----------------|------|-----------|---|------|-----------|
| Drive Type           |       | Bipolar Drive     |           |   |           |                    |           |   |           | Unipolar Drive |      |           |   |      |           |
|                      |       | Half-coil-winding |           |   |           | Whole-coil-winding |           |   |           |                |      |           |   |      |           |
| Driver Interface     |       | A                 | $\bar{A}$ | B | $\bar{B}$ | A                  | $\bar{A}$ | B | $\bar{B}$ | A              | ACOM | $\bar{A}$ | B | BCOM | $\bar{B}$ |
| Motor Interface      | Wire  | 1                 | 2         | 4 | 5         | 1                  | 3         | 4 | 6         | 1              | 2    | 3         | 4 | 5    | 6         |
|                      | Phase | A                 | ACOM      | B | BCOM      | A                  | $\bar{A}$ | B | $\bar{B}$ | A              | ACOM | $\bar{A}$ | B | BCOM | $\bar{B}$ |

For bipolar drive, half-coil-winding offers better high-speed performance, whole-coil-winding offers better torque performance.

Considering the pump operates in the lower speed range of 5~300rpm, bipolar full winding connection is recommended.

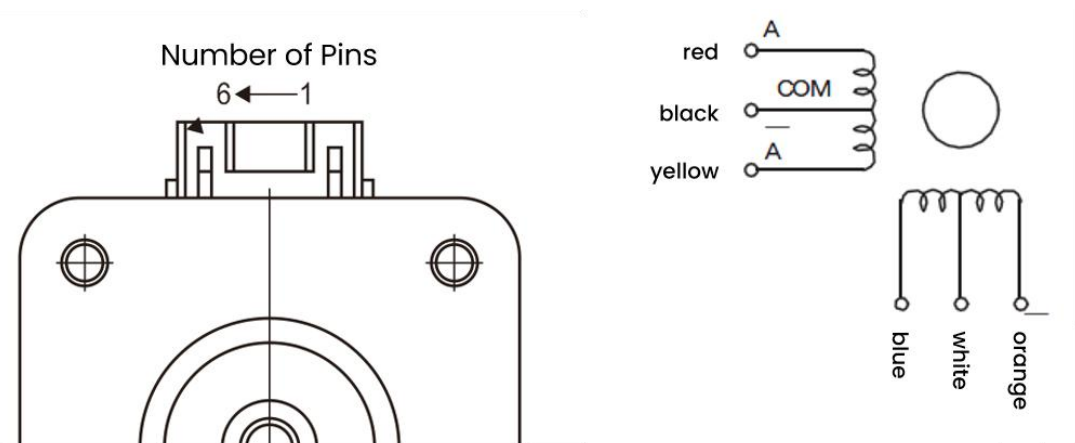


Figure 6 Connector-JST: S6B-PH-K-S

**Special Note:**

Please double-check the wiring correctness before powering on and running. Incorrect wiring may burn out the driver chip.

# 7 Optocoupler Configuration

## 7.1 Electrical Characteristics

Table 3 Optocoupler Electrical Specifications

| Optocoupler Electrical Parameters |                                                                    |
|-----------------------------------|--------------------------------------------------------------------|
| Item                              | Specification                                                      |
| Forward Voltage                   | 5~24VDC $\pm 10\%$ , Ripple P-P $\leq 10\%$                        |
| Max Sink Current (Out)            | $< 50\text{mA}$                                                    |
| Supply Voltage (Out)              | $< 30\text{V}$ (Vcc to Ground)                                     |
| Current Consumption               | $< 15\text{mA}$                                                    |
| Response Time                     | When lit: $\leq 20\mu\text{s}$ , When shaded: $\leq 80\mu\text{s}$ |

## 7.2 Pin Connection

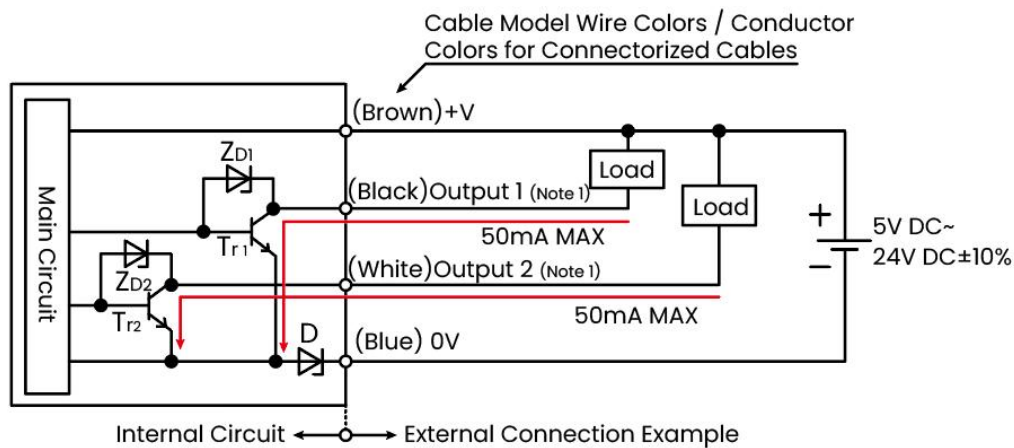


Figure 7 Input/Output Circuit Diagram

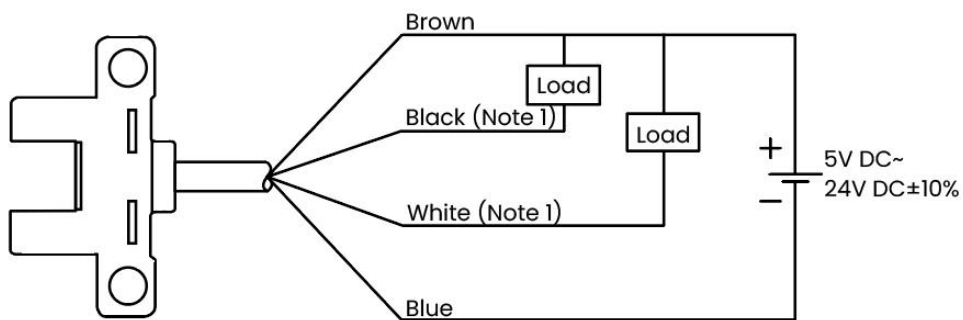


Figure 8 Connection Diagram

### Note 1:

Insulate any unused output wires.

### Symbols :

$D$  : Diode for reverse polarity protection.

$Z_{D1}$ ,  $Z_{D2}$ : Zener diodes for power absorption.

$T_{r1}$ ,  $T_{r2}$ : NPN output transistors.

Table 4 Output Actuation

| Output Actuation |            |                |
|------------------|------------|----------------|
| Output           | Wire Color | Output Action  |
| Output1          | Black      | ON when lit    |
| Output2          | White      | ON when shaded |

**Special Note:**

*Please double-check the wiring correctness before powering on and running. Incorrect wiring may burn out the driver chip.*

## 8 Specifications

Table 5 Specifications

| Specifications              |                                  |                                    |
|-----------------------------|----------------------------------|------------------------------------|
| Specification               | Parameter                        |                                    |
| Model                       | RPL-P6.35                        | RPL-P15                            |
| Range                       | 50~300μl                         | 300~1200μl                         |
| Rotational Speed            | 5~300rpm                         | 5~300rpm                           |
| Accuracy                    | <2%                              | <2%                                |
| Repeatability               | <0.5%                            | <0.5%                              |
| Pressure Resistance         | Max: 150kPa                      | Max: 150kPa                        |
| Lifespan                    | 20,000,000 Cycles                | 20,000,000 Cycles                  |
| Weight                      | 750g                             | 900g                               |
| Overall Dimensions          | 78x78x145mm                      | 78x78x160mm                        |
| Wetted Parts: Ceramic Kit   | ZrO2                             | Al2O3                              |
| Pump Head Material          | PVDF                             |                                    |
| Plug Material               | PVDF                             |                                    |
| Working Fluid In/Out Ports  | 1/4-28UNF-2B                     | 1/8 (Default with Quick Connector) |
| Cleaning Fluid In/Out Ports | 1/4-28UNF-2B (Default with Plug) |                                    |

### Note:

Product specifications subject to change without notice.

Test conditions: Pure water, 100rpm(RPL-P6.35)/300rpm(RPL-P15), fluid pressure ≤50kPa.

Above data measured under motor forward rotation (clockwise rotation viewed from motor front).

## 9 Ordering Information

Table 6 Order List

| Product Model Information List |                |                                                                                   |
|--------------------------------|----------------|-----------------------------------------------------------------------------------|
| Item Code                      | Model          | Description                                                                       |
| 499002                         | RPL-P6.35-0050 | RPL-P6.35 series, capacity 50μl, 1/4-28UNF-2B connection, with cleaning-out port  |
| 499003                         | RPL-P6.35-0100 | RPL-P6.35 series, capacity 100μl, 1/4-28UNF-2B connection, with cleaning-out port |
| 499004                         | RPL-P6.35-0200 | RPL-P6.35 series, capacity 200μl, 1/4-28UNF-2B connection, with cleaning-out port |
| 499005                         | RPL-P6.35-0300 | RPL-P6.35 series, capacity 300μl, 1/4-28UNF-2B connection, with cleaning-out port |
| 499018                         | RPL-P15-0400   | RPL-P15 Series, capacity 400μl, G1/8 connection, with cleaning-out port           |
| 499019                         | RPL-P15-0800   | RPL-P15 Series, capacity 800μl, G1/8 connection, with cleaning-out port           |
| 499017                         | RPL-P15-1000   | RPL-P15 Series, capacity 1000μl, G1/8 connection, with cleaning-out port          |
| 499020                         | RPL-P15-1200   | RPL-P15 Series, capacity 1200μl, G1/8 connection, with cleaning-out port          |

### Note:

Contact FOREACH for other non-standard models.

Compatible stepper motor controllers are also available for purchase.

|            |          |                 |             |              |
|------------|----------|-----------------|-------------|--------------|
| <b>RPL</b> | <b>-</b> | <b>P□</b>       | <b>XXXX</b> | <b>XXX</b>   |
| Series     |          | piston Diameter | Range       | Special Code |

Figure 9 RPL Selection Table

### Note:

Contact Foreach for special customization.

Blank indicates standard configuration.

# 10 Appendix

## 10.1 Appendix : Tables and Figures

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