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DISPLACEMENT PUMP CP17 MODULE

OPERATING AND MAINTENANCE MANUAL

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1. INTRODUCTION

1.1 UNPACKING

The packing slip identifies the type and number of units included. Verify contents upon receipt and visually check for shipping damage. If damage is evident or shipping container condition indicates possible damage, report this immediately to your purchasing or other appropriate department and, if possible, take photographs of the damage. IVEK Corporation will not be responsible for damage due to improper unpacking upon receipt or any subsequent packaging of equipment returned for repair.

NOTE

Contact IVEK Corporation Technical Support if equipment arrives damaged or for any other technical support issues. IVEK Technical Support can be reached by phone at 802-886-4835, by fax at 802-886-8274 (add 01 for international) or by e-mail at techservice@ivek.com.

1.2 READ MANUAL COMPLETELY

The precision components manufactured by IVEK Corporation are designed for long term, continuous use in many different high technology manufacturing applications. The detailed procedures and specifications included in this manual will insure the proper function and expected longevity of the equipment. It is of the utmost importance that all responsible operating, maintenance and engineering personnel receive the necessary operational and safety training required to correctly operate and maintain the components and/or system. This training must include the reading and understanding of this manual in its entirety.

1.3 ENVIRONMENTAL CONDITIONS

Location:	Indoor Use Only
Altitude:	Up to 2000 meters
Temperature:	5°C to 40°C
Maximum Relative Humidity:	80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C
Voltage Fluctuations Limit:	Not to exceed ± 10% of the nominal voltage.
Pollution Degree:	Category 2

1.4 ELECTRICAL & MECHANICAL

All applicable peripheral devices are equipped with a power connection point. This equipment must be grounded. Connect only to a properly grounded power source. Improper use of the grounding plug may result in electrical shock and will result in system malfunction. Do not immerse any motor in liquids.

Maximum operating pressures are application specific. Contact IVEK Corporation for pressure specifications. Permanent damage to internal components may occur. Be sure to inspect the liquid circuit before applying power to the system and before external pressurization of the liquid circuit. Use extreme caution when handling the ceramic components of the Displacement Assembly. Never forcefully insert or remove a piston from the cylinder.

CAUTION

This Equipment is not intended for use in an explosive atmosphere.

The assembly measures approximately 136mm (without encoder) 152.6 (with encoder) x 55.8mm x 44.2mm (5.4” x 2.2” x 1.7”) and weighs approximately 162 grams (5.7oz).

1.5 BIOLOGICAL & CHEMICAL

Specific biological hazards to personnel may exist due to the process application. The end user is completely responsible for the training of personnel for possible biological hazards. For more information contact the local office of the Occupational Safety and Health Administration (OSHA) or appropriate agency for your country.

Specific chemical hazards to personnel may exist due to the process application. The end user is completely responsible for the training of personnel for possible chemical hazards. For more information contact the local OSHA office or appropriate agency for your country. A thorough application analysis must be performed to eliminate the possibility of chemical incompatibility between application liquids (process and cleaning) and the Displacement Assembly ceramics or liquid circuit components.

1.6 SYMBOLS

The following symbols may appear in this manual.

NOTE statements identify hints and instructions.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

1.7 SYSTEM CONFIGURATION

Dispense tips are an important part of the System. IVEK has years of experience with liquid dispensing and can provide valuable assistance.

2. ACTUATOR ASSEMBLY (Figure 1)

2.1 DESCRIPTION

The Actuator Assembly contains the mechanism for controlling the linear motion of the piston. The Actuator Assembly is composed of the motor, lead screw, displacement coupling, sensor and cable connectors.

2.2 OPERATION

The Actuator Assembly utilizes a permanent magnet stepping motor, a lead screw and coupler fabrication to produce a controllable linear movement of the piston. Angular displacement steps of 1.8° produced by the stepping motor are converted to linear displacement steps at the lead screw.

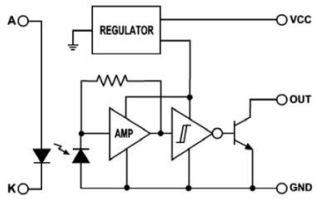
Electronic control over these linear functions allows a mounted Pump Assembly to be driven so the linear motion is used to fill or empty the Pump Assembly.

2.2.1 Sensors

There is one sensor in the Actuator Assembly used to control the stopping and starting location of the lead screw. The slotted optical switch sensor is activated when the lead screw is in the linear home (end of stroke) location. The number of motor steps is used to determine the stop position of the lead screw for the beginning of stroke location. The number of steps required to reach the stop position varies with lead screw pitch. The sensor connector, shown in Figure 1, is a 6 pin Optek connector part number OPB991T55Z with the following pinout.

The sensor is an Optek Technology OPB991T55Z or equivalent with the following wiring table.

Color	Function
Red	Anode
Black	Cathode
White	VCC
Blue	Output
Green	Ground



2.2.2 Coupling (hub)

A coupling, located on the Displacement side of the Actuator Assembly, provides an attachment point for the piston.

2.2.3 Accuracy and Precision

For target piston displacement of greater than 5% of total pump capacity, achievable accuracy and precision are:

Inaccuracy – Less than or equal to 1.0%
Imprecision – Less than or equal to 0.75% coefficient of variation

3. PUMP ASSEMBLY (Figure 1)

3.1 DESCRIPTION

The Pump Assembly is comprised of the following major components; a ceramic piston fabrication and displacement head.

3.2 OPERATION

The Pump Assembly contains a piston providing positive displacement. The ceramic piston movement is controlled by the Actuator Assembly. The piston is connected to the Actuator Assembly through a magnetic coupling located on the end of the Actuator Assemblies lead screw. The piston's home position is with the piston fully extended.

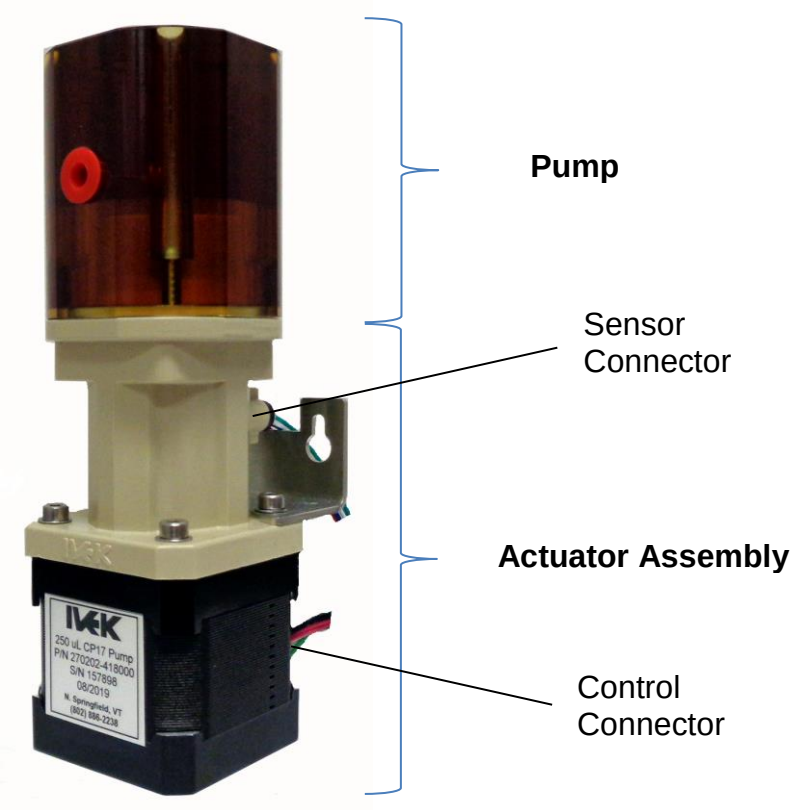


Figure 1 - Actuator & Pump Module

3.2.1 Piston

The piston is constructed from ceramic material. The ceramic is compatible with most acids and bases.

4. OPTIONS

There are four options available with the CP17 Module. They are displacement, pump head material, lead screw pitch/connector type, encoder and O-ring material. The model number for your CP17 Module is located on the IVEK tag on the connector side of the module. Refer to Section 7 for the options for each model number.

4.1 DISPLACEMENT

There are five displacement pump size options available with the CP17 Module. Table 1 shows the five options and their respective specifications.

Table 1 - Displacement Specifications

Displacement	Resolution (µL/Full Step)	Piston Diameter (mm)
100µL	0.0500	3.170
250µL	0.1250	5.006
500µL	0.2500	7.079
1.0 mL	0.5000	10.013
2.5 mL	1.2500	15.829

4.2 PUMP HEAD MATERIAL

The pump head is available in Acrylic, Ultem, Clear Polycarbonate or Natural PEEK.

4.3 LEAD SCREW PITCH/CONNECTOR TYPE

There are two options for the lead screw pitch/connector type. The selection of one of these options determines the Increment Resolution based on the piston size. The control connections are accomplished with a JST connector and the connector type is dependent on the third digit in the tabulation as follows:

##8### - JST Connector part # SO6B-PASK-2 and mating connector part # PAP-06V-S, 20 TPI
##9### - JST Connector part # SO6B-PASK-2 and mating connector part # PAP-06V-S, 40 TPI

4.4 ENCODER

This option adds an encoder to the Actuator Assembly which will verify all motions of the Actuator Module. Any stall during fluid displacement will immediately be sensed using the encoder. The encoder is a US Digital E5-400-315-NE-S-H-D-1 or equivalent.

The encoder connector has the following pinout.

Pin	Description	Pin	Description
1	Ground	4	+5VDC Power
2	No Connection	5	B Channel
3	A Channel		

4.5 LIP SEAL O-RING MATERIAL

The Lip Seal O-Ring material is available in FKM, EPDM or FFKM.

5. MAINTENANCE

Please contact technical support at IVEK Corporation with any questions or concerns you may have regarding the operation or maintenance of this module.

5.1 ASSEMBLY/DISASSEMBLY PROCEDURES

The CP17 Module can only be replaced as a complete module.

6. SPECIFICATIONS

The applicable specifications for the CP17 Module are listed below.

MOTOR SPECIFICATIONS

Size:	NEMA Size 17, 1.8º +/- 5% Stepper Motor, Uni-Polar 6 Lead
Voltage Per Phase:	4.0 / 5.6 VDC
Resistance Per Phase:	3.3 / 6.6 Ohms
Current Per Phase:	1.2 / 0.85 Amps
Insulation Resistance:	20 MOhms
Minimum Force (300pps):	222.4 N
Bearings:	Ball
Operating Temperature:	-10ºC To +65ºC
Storage Temperature:	-20ºC To +85ºC

NOTE

Intended to be used with bipolar drive in either (1) High torque with full coil or (2) High speed with half coil.

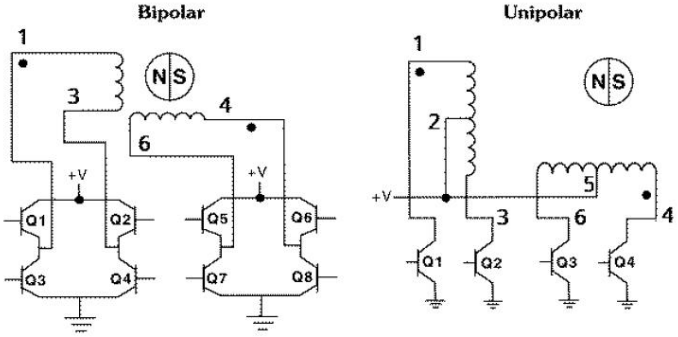
STEPPING SEQUENCE

Bipolar	**Q2-Q3**	**Q1-Q4**	**Q6-Q7**	**Q5-Q8**
Unipolar	**Q1**	**Q2**	**Q3**	**Q4**
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

NOTE

Half stepping is accomplished by inserting an off state between transitioning phases.

MOTOR WIRING DIAGRAM



7. MODEL NUMBER

The model number provides important information about the specifics of your Actuator and Pump Assemblies. Refer to this number when calling IVEK Technical support. The model number for your CP17 Module is located on the IVEK tag on the connector side of the module.

270202 - # # # # ##

Displacement

- **3** – 100 µl
- **4** – 250 µl
- **5** – 500 µl
- **6** – 1.0 ml
- **7** – 2.5 ml

Pump Head Material

- **0** – Acrylic
- **1** – Ultem
- **2** – Clear Polycarbonate
- **3** – Natural PEEK

Lead Screw Pitch

- **8** – 20 T.P.I., Integral JST Connector
- **9** – 40 T.P.I., Integral JST Connector

Encoder

- **0** – No Encoder
- **1** – 400 CPR Encoder

Additional Characteristics

- **01** – UHMWPE Lip Seal, FKM O-Ring, Green
- **02** – UHMWPE Lip Seal, EPDM O-Ring, Black
- **03** – UHMWPE Lip Seal, FFKM O-Ring, White