CHEON-SEI KEMPION

BLDC M/C UNIT

Automatic Liquid Control of Metering Pump

Instruction Manual



Instruction

Thank you very much for purchasing the BLDC M/C Unit Cheon-sei for automatic flow control. Before using the pump, please read this manual thoroughly, which explains in detail how to install, operate and maintain the pump properly for trouble-free operation.

This manual instructs how to handle the motor and the driver applied to BLDC motor. For handling the metering pump, please refer to the manual of the pump, not to this manual.



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1 Notice for Safety

1-1 Introduction

- To use the products safely the signs will be showed on the manual .
- Please keep the manual certainly for important matters of safety.
- The signs and indications are as followings.

Warning Person death or serious injury will be occurred if warnings is not to kept by wrong handling.

A Caution Person injury or property damage will be occurred if cautions is not to kept by wrong handling.

1-2 Cautions in using the pump

• Please use the unit only applicable to the operation of the metering pumps for BLDC motor specified by Cheon-sei. If the unit is used for other purposes, an accident or a trouble may occur.

1-3 Cautions in Installation

• Install the line breaker and the breaker for electric leakage in the main power line curtainly. If not, an electric shock, an injury to human or a fire may happen.

 \triangle Caution • Install the pump at the place where an unauthorized person or a child cannot reach.

- Do not install it at the place with high humidity, flammable or corrosive gases, but at the well ventilated place to prevent from occurring a fire or a trouble.
- Install the pump on the place where is not affected by vibration or shock. Electronic circuits inside of the driver or the control box may be damaged or disconnected by the affects.
- Do not install it at the place where ambient temperature is more than 40°C or below -5°C to prevent its malfunction.
- Chemicals may corrode a cable shield and it causes a trouble. Lay the cables connected with the controller and the driver at the clean place not to be stained with chemicals.
- The operation at higher than the rated pressure may cause troubles. Therefore, **install a relief valve not to reach such pressure.**

If the above is not observed, its quality is not guaranteed and the malfunction of this product may happen.

1-4 Cautions in Handling or Operation

• Do handle it only by an authorized person to avoid an injury to human.

• Before repairing or disassembling the pump, cut off the power.

If not, a electric shock or a fire may happen.

• Do not touch it with wet hands to prevent an electric shock. Wear insulating boots and gloves for working on the wet floor.

• The control box attached to the motor is made of plastics and may be broken by an external impact or an excessive force. Therefore, carefully handle it during the installation and the operation not to give an external force. In addition, carefully handle it not to be stained with chemicals and it may be damaged depending on chemicals.

• Any modification of the driver or the controller may cause an accident or a trouble. Do not modify it.

Confirmation of Articles to be supplied

2-1 Check Point When Unpacking.

Check the following points as soon as the pump is delivered. If any defect is found out in the pump, please contact a local distributor or Cheon-sei. We will do our best to make good a defect.

- I Are the products the same as you ordered ?
- 2 Are all accessories included ?
- 3 Is there any visible damage caused by vibration or shock during transport ?
- 4 Are any of the screws loose or missing ?

We take great care to assure our products leave the factory in perfect condition. However, in the event that this pump is found to be defective, please report the details to CHEON-SEI or your local representative. We will do our best to solve the problem as quickly as possible.

2-2 Standard Accessories

- Operation manual ······1 set
- 2 CABLE GLAND (PG11 : Attached to the control box)2sets
- * Refer to the operation manual of a pump, not to this manual regarding the pump and its parts.

3 General and Features

3-1 General

This product is a newly developed automatic flow control equipment of a motor rpm control type with accurately controlling a discharge rate by a signal of the motor rpm feedback. It is much improved and quite different from an inverter driven type conventionally used for a flow control. As the **most advanced automatic flow control equipment**, it detects the speed of the motor by the instructed signal, and the detected signal is compared with the signal coming from the driver. It corrects the change, keeps a constant velocity regardless of an affect caused by the load of the pump discharge, and directly controls the discharge rate at low speed operation by the instructed signal.

The operation methods are the manual operation to directly control the motor speed (flow rate) and the automatic operation by the remote signal. In addition, there is the ratio operation to control the remote signal with the constant ratio.

The output transmission makes more realistic operation possible with adopting the insulated method by a direct connection with PLC and a computer, etc. without a separated isolator. It improved more convenient and functional due to the user's oriented designs of all functions and operation methods.

3-2 Features

- In spite of low speed operation, the motor is not damaged due to BLDC(Brushless DC) motor.
- [2] It is possible to control accurately the number of rotations with Feedback control by Hall element.
- 3 It is possible to accurately control the discharge rate up to minimum5% of full scale.
- 4 Another supplement device is not needed because a motor and a driver are in one body.
- **5** It is possible to directly connect with PLC or computer because the isolator is installed inside.
- 6 It is possible to set up the rate of the remote input signal by the ratio setter.
- 7 The operation status can be checked because a manual setting value or a remote signal value is identified during operation.
- 8 The motor has no need of separate maintenance as well as much longer life comparing with an conventional DC motor because it has no brush.
- **9** It is very economic and has easy maintenance because of no control panel.
- 10 The reliability of operation are much improved due to inside installment of microprocessor, and the operation get easier with handling a keypad.

4 Specification

Circuit Consisting Mode	Microprocessor Control				
		AUTO	Operation by a remote input signal, 4 ~ 20 mADC		
	Operation	MANU	Control of a motor speed (RPM=Flow Rate) by the adjustment of the UP/DOWN key on the Keypad		
	Analog Ou	tput Signal	4~20mADC Isolated (R. Load 250Ω MAX)		
	Setting Ran	ge of Ratio (%)	Automatic input signal comparison 0 ~100%		
DRIVER	Display		Display of operation status and automatic, manual input signal/		
CONTROLLER			ratio setting value massage : or(over range) / OC(over Current) / Err		
	Speed Control Method		3Phase PWM control method by Hall element		
	Flow Control Range		Control Range : 5%~100% of Rated Flow Rate,		
	and Accuracy		Accuracy : F/S within $\pm 2.0\%$		
	Data Mem	ory	Automatic Reserving of Ratio and Manual Setting Value		
	Rated Current, 1Phase/3Phase		120W 1.0A (1 Phase), 200W : 2.2A/1.0A, 300W: 2.5A/1.3A		
MOTOR	12 Pole BL	DC(Brushless D	C)/ 120W, 200W, 300W / 1,750rpm (max.) / TEFC / IP54		
Power supply(Driver)	Common u	se of 1 Phase &	3 Phase 110 ~ 220VAC / Power Source FUSE : 5A		
	∗ KM-A S	eries is applicabl	e to the power source with only 1 phase (110 ~ 220V).		

* The above specification can be changed without prior notice for quality improvement.

5 Functions and Names of Controller(DISPLAY)



6 External Shape and Names



7 Electric Wiring and Connection Method

This product is produced under thorough quality control and passed strict tests and does not need any adjustment. If the user adjusts any variable resistor on a PCB, it may cause malfunction. Therefore, do not adjust any thing except the connections of power and signal cables.

• Cut off main power before working. Although a power switch of the driver is off, main power is energized in the control box. Be sure to cut off the main power before the connection and the inspection. • A3 phase driver has no power switch.

• Connect the frame ground cable for grounding to avoid an electric shock, an injury to human or a fire.

Caution
 Prior to connection work, confirm whether the cables and the power to be used are in compliance with the required specifications.

- Use only qualified cables and do wiring works in compliance with the local relevant codes and regulations.
- The signal line of 4~20mA should be a twisted shield cable and be laid in the conduit separated from the power conduit.
- Wiring works should be carried out only by a qualified electrician. If the above is not observed, troubles and physical losses may happen.

Electric connection method - Take off the front cover of the control box after unscrewed the bolts of 4 sets on it and carry out connection works in accordance with the instruction of the terminal board. Keep in mind not to take out the connector inside of the PCB. Connection wires should be passed through the attached cable grand.



(1) Power source (AC) - 220VAC (1 Phase only for KM-Series, 1 Phase/3 Phase for the other pumps)
 *** FG is a Frame Ground of the equipment and connected with the grounding cable of the main power.**

(2) IN (INPUT : REMOTE SIGNAL) - Connect signal lines remotely input from the controllers, etc.

(3) OUT (OUTPUT SIGNAL) - To transmits the current operation status and output the signal of the isolated 4~20mADC.

***** Carefully connect the terminals in line with a mark of each terminal not to change the polarity.

Handling of Keypad

MODE	Selection key of operation mode - Whenever push the button, operation mode is changed the following order. ▲ AUTO → MANU → RATIO	
$\bigcirc \bigcirc$	Confirmation key of input signal - To confirm the value of the remote input (auto mode) signal or the setting signal (manual mode), keep on pushing for 5 seconds and the value is indicated. (ex. : S.85%) DATA UP/ DOWN KEY - To set up a manual setting value or to change a ratio setting value (0~100%)	
RUN	RUN / STOP KEY - Run and stop of the motor is alternatively changed in accordance with pushing the key.	

9 Operation

• After the installation of a pump, confirm whether the pump operates well at max. discharge rate (100%) through the test operation, and then start the commercial operation. When the pump runs first at low speed of the motor, pumping may not be available due to the low suction speed. In addition, operate it at 100% position of the dial without any adjustment of the dial for flow control to keep the guaranteed flow rate.

• Do not operate the pump at more than the specified rated pressure to prevent troubles. (Refer to the operation manual of the pump.)

9-1 Automatic Operation

Pumping rate of the pump is automatically controlled with the change of the motor speed (rpm) in accordance with the input signals from the controller or the flow meter, etc installed at the remote place.

- (1) Turn on the power switch of the driver at the pump bed after the connection of power source and each signal cable (IN, OUT).
 - * A3 phase driver has no power switch.
- (2) If signal lines are wired correctly, the manual setting value or the signal comparison %, 4~20mA currently and remotely input is indicated in the display. (Ex. at input of 12mA : C.50%) In case of wrong connection of the wires, short circuit of power line or breaking of a wire, etc., "or" letters are indicated in the display. It means troubles with the input signal and repair them for further process. Refer to 11 "Troubles and Countermeasures".
- (3) Push the RUN/STOP KEY for operation when the display shows normal. Run and stop of the pump is alternatively changed in accordance with each push of the key.

9-2 Manual Operation

It is a method to control the pumping rate by the controller with changing the motor speed regardless of the input signal, $4 \sim 20$ mÅ.

- (1) Select the manual mode with pushing the MODE KEY. The operation mode is alternatively changed in accordance with each push of the key. Refer to item No. 8 "Handling of Keypad".
- (2) Set up the flow rate (%) with pushing UP/DOWN KEY. (Indicating "C. ***%" in the display.)
- (3) Start operation with pushing RUN/STOP KEY. The rpm of the motor speed under operation is indicated in % in the display.

9-3 Ratio Operation

This is an operation method with applying a remote input signal $(4 \sim 20 \text{mA})$ to the ratio, and is a useful and effective operation method suitable for the site conditions.

Ration setting range : Input signal ($4 \sim 20$ mA) comparison $0 \sim 100\%$

<Ex. : Input signal : 20mA, Ration setting value : Operation result at 50% = 50% operation>

- (1) Select the ratio with pushing the MODE KEY. The setting value is indicated in the display and the instruction lamp is flickering. (Ex., r.50%)
- (2) Set up the value in % with pushing the UP/DOWN KEY.
- (3) Unless the key is pushed after setting, the operation mode is restored to the mode ready for the automatic operation by itself 10 seconds later.
- (4) If you want prompt operation without waiting for 10 seconds, put the MODE KEY on "AUTO" position and push the RUN KEY.
- **Note** As soon as the power is recovered after the power was failed or the power switch turned OFF, this product returns to the previous operation mode without pushing the RUN KEY of the KEY PAD for the remote operation.
 - Ex.) The power or the main switch is recovered after being off. ⇒ Prompt operation at MANU 50%
 However, in case of stopping operation with pushing the stop key during operation, push the RUN KEY of the KEY PAD for operation although the main switch turns on after off.

10 References

10-1 Principles of BLDC Motor

The electric motor applied to this product is a BLDC (Brushless DC) motor from which a brush is taken out and the commutation is carried out electronically. Its driving principle is that the hall sense detects the magnetic pole of the permanent magnet rotating in accordance with the instructed signal, and the detected signal estimates the phase angle, has the current flow to the coil and produces torques. The detected information is simultaneously fed back and is compared with the detected signal. It controls the motor speed and makes the constant speed control possible. Because the metering pump applied to this principle keeps a constant speed under the range of low rpm operation regardless of the pump load, it guarantees the more stable performance compared with an inverter type. In addition, with controlling the motor speed by the method of the rpm feeback control, it is the most suitable control method for the accurate injection of chemicals.

10-2 Block Diagram



11 Troubles and Countermeasure

• Before checking and maintenance, cut off the main power first to avoid an

electric shock and a fire. (Refer to "Electric Wiring and Connection Method".)

Trouble Display		Cause	Countermeasure	
No work of	No indication.	 Is power in the control box supplied? Power lamp is on if power is energized. The power line is not connected with the FG terminal? FG is the terminal of Frame Ground. The PCB connecter inside of the control panel is not taken out? The motor does not operate when the connector is taken out or wrongly connected. Breaking of a power fuse 	 Check the main power breaker and the status of power supply. Correctly connect with the power terminal. Check the connection and correctly connect them. Check and replace the fuse(5A) inside of the control box. 	
motol.	No trouble in the display.	Trouble in the electronic circuit of the driver or breaking of the motor coil	 Repair or replace the driver. Replace the motor.	
	Flickering "Err"	Trouble with the electronic circuit of the driver or with the hall element of the motor.	Repair of driver or motor.	
	Flickering "OC"	 The pump operates under overload? When more than max. rated current (3A) flows, the protection circuit cuts off the current. 	 Remove a cause of the pump overload. As soon as the overload happens, the motor stops. Cut off the power and supply it after removing the trouble cause. 	
No automatic operation.	Flickering "or"	 The polarity of IN signal is not changed in the terminal board? The wire of remote input signal is not short or broken neither? The remote input signal is correctly input? (4~20mA) 	 Check the input signal. "or" stands for "over range". When the input signal is below 2.4mA or above 23.2mA, it has the operation automatically stop. 	
Lower discharge rate compared to the setting value or the input signal.	No trouble in the display.	 The ratio set up value is not change? The dial for the pump flow control is not adjusted? 	 Reset the ratio setting value to 100%. Reset the scale of pump dial as 100%. 	

How to easily find troubles.

1) Trouble with the motor or the driver \rightarrow The motor does not operate although the display shows normal.

2) Trouble caused by over current \rightarrow OC (Over Current) is flickering and a buzz sounds repeatedly.

- 3) Trouble with the input signal → Indication of "or" (over range) 4mA = F/S below and 10% / 20mA = F/S above and 20% "or" is indicated and the operation stops when the signal inputs or the input signal line is short or broken.
- * Trouble of above 1) cannot be resolved by a user, and it requests the after sales service or a distributor. Regarding other technical matters, please consult it to research development Dept. of Cheon-sei.

12 Example of System Composition





13 Specification and Performance Tables of the Pumps applicable to attach BLDC M/C UNIT

-		_	-								
Spec.	Max.	Max.	Stroke No.	Outside	Otrolica Lamatha	Joint metho		d	Motor Dower		
	capacity	discharge pressure	(SPM)	diameter of	(mm)	Ho	se	Flango	(W)		
Model	(mL/min)	(kgf/cm ²)	at max. rpm	(mm)	()	PVC	PTFE	riange	(**)		
KDV-A-21H	25	10	58	30	3						
KDV-A-61H	60	10	58	36	4	ø6×ø11					
KDV-A-12H	120	10	116	36	4		a 10 × a 12				
KDV-A-22H	260	10	58	55	6			KS10K	200		
KDV-A-52H	520	10	116	55	6	ø12×ø18		15A			
KDV-A-82H	840	10	116	68	5		ø12×ø18	ø12×ø18			
KDV-A-13H	1020	10	58	100	6					a 10 v a 14	
KDV-A-23H	2040	8	116	100	6			Ø 12 X Ø 14			
KDV-A-33L	3480	5	58	130	10			KC10K			
KDV-A-73L	7440	3	116	130	10	-	25A		300		
KDV-A-53L	5800	* 3	116	130	8			20/1			
KM-A-500	50	10	115	30	3						
KM-A-121	125	10	115	36	4	ø6×ø11					
KM-A-251	255	10	115	45	5		ø10×ø12	KS10K			
KM-A-521	520	7	115	55	6	a 10 v a 10	15A		120		
KM-A-102	1025	5	115	68	6	VIZXV10					
KM-A-212	2150	3	115	90	7	-					

General Diaphragm type Metering Pumps KD, KM - Series

Hydraulic Diaphragm Metering Pumps KH-Series

Spec.	Max.capacity	Max. discharge	pressure(kgf/cm²)	Stroke No.(SPM)	Piston Dia.	SPM) Piston Dia.	PM) Piston Dia.	Piston Dia.	Piston Dia.	Piston Dia. Stroke Lenç	Stroke Length	Joint method	Motor Power
Model	rate(mL/min)	PTC · FTC	(STS)	at. max. rpm	(mm)	(mm)	Flange	(W)					
KHV1-A-51S	50	10	30	58	12	10							
KHV1-A-12S	100	10	30	116	12	10	(STS)	200					
KHV1-A-32S	360	10	25	58	30	10	15A	200					
KHV1-A-72S	720	10	20	116	30	10							

Punger Type Metering Pumps KP - Series

Spec.	Max.capacity rate	Max. discharge pressure	Stroke No.(SPM)	Joint n	nethod	Motor Power
Model	(mL/min)	(kgf/cm²)	at. max. rpm	Screw	Flange	(W)
KPV-A-11	9	50	58	PT 1/8	PT 1/8	
KPV-A-12	18	50	116			
KPV-A-21	50	50	58	DT 1/9	KOOOK	
KPV-A-22	100	50	116		KS20K 15A	200
KPV-A-31	163	40	58			
KPV-A-32	326	40	116	1 1 1/4		
KPV-A-41	665	20	58	PT 3/8		

***** 1. ***** mark means the max. discharge pressure of the general metering pumps in case of attaching BLDC M/C UNIT.

2. The effective flow control range is 5 \sim 100% for max. rpm.

3. The max. discharge rate is obtained at max. stroke length of the dial shaft (Dial scale : 100%), and the discharge rate is reduced in accordance with the reduce of the stroke length in spite of setting rpm at max. 100%.

4. The above specification can be revised for quality improvement without prior notice.

14 External Shape and Dimensions

KDV-A-21H~53L



Dimension		А			В			С	
Series No.	PTC	FTC	ST6	PTC	FTC	ST6	PTC	FTC	ST6
21H	164	164	166	90	90	89	346	346	345
61H, 12H	164	164	166	91	91	90	347	347	346
22H, 52H	184	184	186	93	93	92	350	350	349
82H	190	190	192	93	93	93	349	349	349
13H, 23H	290	284	240	91	91	86	349	349	344
33L, 73L, 53L	326	320	290	101	101	95	376	376	370

KM-A-500~212



Dir Serie	mension es No.	KM-A-500	KM-A-121	KM-A-251	KM-A-521	KM-A-102	KM-A-212
	PTC	164	164	164	184	190	241
Α	FTC	164	164	164	184	190	241
	ST6	166	166	166	186	192	231
	PTC	69	69	68	73	73	74
В	FTC	69	69	68	73	73	74
	ST6	67	67	68	72	73	73
	PTC	290	291	290	296	296	298
С	FTC	290	291	290	296	296	298
	ST6	288	289	290	295	296	297

KHV1-A-51S~72S

KPV-A-11~41



****** The performance and design can be changed for quality improvement without prior notice.

15 Warranty

Warning Cheon-Sei will not warrant if the pump is reconstructed arbitrarily or used by other parts except specified parts. And be cautious not to be compensated for a various expense happened by a accident and trouble.

- Cheon-Sei will warrant all products to be free of defects in material or workmanship for a period of eighteen(18) months from date of shipment or one(1) year from the date of installation, whichever occurs first.
- 2 During guarantee period repair or change of pump is free of charge, if trouble or damage of pump due to design or manufacturing of Cheon-Sei.
 - * Consumable parts are excluded.
- 3 Repair or change for pump having a trouble or damage caused by the following reasons should be charged regardless of the guaranteed period.
 - $(\ensuremath{\underline{1}})$ Trouble or damage of pump expired guarantee period
 - (2) Trouble of using by careless handling
 - ③ Trouble or damage due to using parts except of specified by Cheon-Sei.
 - (4) Trouble or damage due to repair or reconstruction by person except by Cheon-Sei or designated by Cheon-Sei.
 - ⑤ Trouble by inevitability of fire or natural calamity

16 Repair Service

▲ Caution Prior to sending the pump for repair, wash the pump head's internal clearly.

• Do not return the pump if the pump has been used with harmful and fatal liquids to health.

- ☐ Contact to A/S Department of Cheon-Sei or Local Distributor as shown on back of the manual when occurred abnormal of pump or has inquiry.
- [2] Inform following items when request repair of pump.
- ① Model Name and Production No. as shown on name plate of pump
- O Used period and using condition, status, transfer liquid
- 3 Inquire to Local Distributor whether charge or not for repair when expired guarantee period of pump.
- 4 Minimum retain period of performance parts for repair of Cheon-Sei is 5 years from the date of production.

History of Revision

NO.	Printing Date	Revision	VERSION NO.	Remarks
1	2005. 7. 2.	First Printing	CS - 1.00	
2	2006. 4. 10.	Addition of pump model and revision of operation method		Motor 200W, 300W Grade

CSME - V - 01



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