IWAKI PUMPS

IWAKI

Electromagnetic Metering Pump

EHN-SH

Instruction Manual

⚠ Read this instruction manual before use of product

Thank you for choosing the EHN type electromagnetic metering pump.
This instruction manual consists of "Safety Section", "Outline Section", "Installation Section", "Operation Section" and "Maintenance Section", and deals with the correct installation, operation, maintenance and troubleshooting procedures.
Please read through this manual carefully to ensure the optimum performance, safety and service of your pump.

Contents

Instruction for safety

For the Safe and Correct Handling of the Pump

- "Safety Instruction" section deals with important details about the handling of the product. Before the use of controller, read through this section carefully for the prevention of personnel injury or loss.
- Observe the instructions accompanied with "WARNING" or "CAUTION" in this manual. These instructions are very important to avoid dangerous situations.
- The symbols on this instruction manual have the following meanings:

⚠ Warning	**Nonobservance or misapplication of the contents of the "Warning" section could lead to a serious accident which may result in death.**
⚠ Caution	**Nonobservance or misapplication of the contents of the "Caution" section could lead to the personal injury to users or serious damage to the product.**

Types of Symbols

Indicates a prohibited action or procedure. Inside or near this circle, a concrete and practical image of the activity to be avoided is depicted.

Indicates an important action or procedure which must be performed or carried out without fail. Failure to follow the instructions herein can lead to malfunction or damage to the pump.

Instruction for safety

⚠ Warning

- **Turn off power**
  Working on the pump with power ON may cause an electrical shock. Before working on the pump, make sure to disconnect the power cord in order to stop the pump and other related devices.


Electrical Shock

- **Terminate operation**
  Detecting or becoming aware of any dangerous sign or abnormal condition, stop the operation immediately and restart it from the beginning.

- **For specified application only**
  The use of the pump in any application other than those clearly specified may result in injury or damage to the pump. Use the pump within specifications and application range.


Prohibited

- **No remodeling**
  Never try to modify the pump. Serious accidents may result. We are not responsible for any accident or damage due to modification without first obtaining permission or instructions from Iwaki.


No Remodeling

- **Wear protectors**
  Always wear protective clothing, eye protection and gloves before any dismantlement/assembly of the pump or maintenance.


Wear protective gear

⚠ Caution

- **Qualified operators only**
  Any operation of the pump is permitted to only the person with a enough understanding of the pump.


Prohibited

- **Specified power only**
  Do not apply any power other than specified one on the nameplate. Otherwise damage or fire will may happen.


Prohibited

- **Pay attention to dry running**
  Do not run pump dry for more than 30 minutes. The bolt on the pump head may loosen and result in liquid leakage. Install the pump so that dry running can not occur. Take extra care not to run the pump dry unintentionally for more than 30 minutes for air elimination.


Caution

- **Do not wet or dampen**
  If any electric part or wiring gets wet with the liquid spilled over accidentally, a fire or electrical shock may be caused. Install the system in a place free from liquid spillage or leakage.


Do not wet or dampen

- **Ventilate**
  Poisoning may result when handling toxic or odorous liquid. Ventilate the operating site sufficiently.


Caution

- **Spill-out accident**
  Protective measures should be taken against any accidental spill-out or leakage of the operating liquid as a result of unexpected damage on the pump or the related piping.


Caution

Instruction for safety

⚠ Caution

- **Limited operating site and storage**
  Do not install or store the pump in the following places:
  * Flammable gas or material is used or stored.
  * Ambient temperature is extremely high (40 dig.C or higher) or extremely low (0 dig.C or lower).


Prohibited

- **Do not place the pump close to water**
  The pump is not water-proof construction. If the pump is used in a place where liquid is splashed on pump or at humid place, electrical shock or short-circuit may happen.


Prohibited

- **Do not damage or change power cable**
  Do not scratch, damage, process, or pull the power cable forcibly. An extra load onto the cable, such as heating the cable or placing something heavy on the cable, may damage the cable and finally cause a fire or an electrical shock.


Caution

- **Arrange grounding**
  Be sure to connect grounding wire before operation. Otherwise, an electrical shock may result. Make sure the grounding wire is connected with the grounding terminal.


Grounding

- **Install an earth leakage breaker (option)**
  Pump operation without using an earth leakage breaker may cause an electrical shock. Purchase an optional leakage breaker and install in the system.


Electrical Shock

⚠ Caution

- **Handling of the power cable**
  Use of a defective or damaged power cable may result in a fire or electrical shock. Handle the power cable carefully.


Electrical Shock

- **When replacing parts**
  Replace the consumable parts by following the descriptions in the instruction manual. Do not disassemble the pump beyond the extent shown on the instruction manual.

- **Damaged pump**
  Never operate a damaged pump. A damaged pump may cause leakage or electrical shock.


Prohibited

- **Disposal of used pump**
  Dispose of the used or damaged pump in accordance with the relevant local laws and regulations. (Consult a licensed industrial waste products disposing company.)

- **Tightening torque of the pump head**
  Leakage may occur when the pump head fixing bolts are loose. Make sure that the pump head is secured by tightening the 4 fixing bolts diagonally at the first operation.

  Tightening torque

  EHN-B11 • 21 • C21 : 2.16N•m

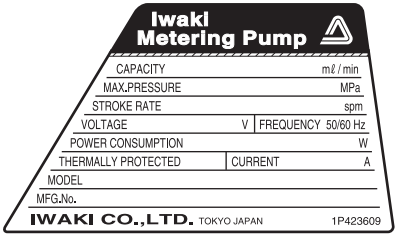
  EHN-C31 • 36 : 2.55N•m


Caution

Outline of product

1. Unpacking and inspection

1) Check the model code, discharge capacity, discharge pressure and voltage etc. shown on nameplate to confirm the pump is in your specification.



2) Check if accessories are attached.
   a. Check valve or back pressure valve : One piece

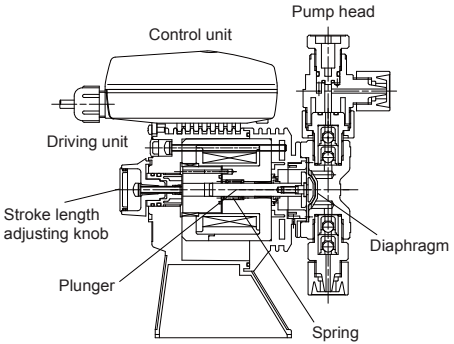
Model	Set press. MPa	Connection	Wet-end material	Applied pump model
CS-1S	0.2	RC1/4	SUS316 Hastelloy C PTFE	EHN-B11·21 EHN-C21·31
CS-1SL	0.05			EHN-C36

3) Check if the product is not damaged and any parts are not lost in transit. Check that any bolts or nuts are not loosened.
   If you find any abnormality, ask us.

2. Principle of operation

IWAKI electromagnetic metering pump the EHN series is a diaphragm metering pump which consists of a pump head, driving unit, and control unit. A diaphragm is directly driven by electromagnet force.

A reciprocating motion is made by a spring and electromagnetic force generated by pulse current coming from a control unit. The reciprocating motion is transferred to a diaphragm through a plunger and makes volumetric change in a pump chamber. Pumping action is obtained by volumetric change and by valve action in pump head.



3. Model identification

Pump : EHN - B 11 SH 9 R - □□
1 2 3 4 5 6 7

1. Series
   EHN multi voltage type

2. Driving unit code (Average power consumption)
   B : 20W C : 24W

3. Diaphragm effective diameter
   11 : 10mm 21 : 20mm
   31 : 30mm 36 : 35mm

4. Wet-end material

Code	Pump head	Valve	Valve seat	Gasket	Diaphragm
SH	SUS316	Hastelloy C	SUS316	PTFE	PTFE + EPDM (Not wet-end)

Material code EPDM: Ethylene-propylene-diene-methylene PTFE: Poytetrafluro ethylene

5. Connection hose diameter code
   9: Rc1/4 Female screw

6. Controller function code
   R: Standard type

7. Special type code
   01 ~ 99 : Non standard material, Non standard connection, etc.

Control unit : EHNC - B R - □□
1 2 3 4

1. Control unit type
   EHNC: Multi voltage type (with crimp contact)

2. Driving unit code
   B or C

3. Controller function code
   R: Standard type

4. Special type code
   01 ~ 99 : Non standard specification.

4. Specification

4-1. Pump specification

Model	Disch. capacity ml/min	Max. disch. press. MPa	Stroke length mm (%)	Stroke rate spm	Average power consumption W	Mass kg
EHN-B11	38	1.0	0.5~1.0 (50~100)	1~360	20	2.4
EHN-B21	100	0.4				
EHN-C21	130	0.7	0.5~1.25 (40~100)		24	4.1
EHN-C31	270	0.35				
EHN-C36	410	0.2				

Note1. Performance is obtained by pumping clean water at ambient temp in the rated voltage.

2. Discharge capacity on the table are obtained at max. discharge pressure (100% stroke length, 360 spm stroke rate.). When discharge pressure is low, the pump discharges liquid much more than discharge capacity shown as above.
3. Permissible ambient temperature : 0 ~ 40 deg. C
4. Permissible liquid temperature : 0 ~ 40 deg. C
5. Permissible voltage fluctuation: Within ±10% of the rated voltage

- Ask us for special cases such as transferring slurry liquid or so.
- Specification may be changed for product improvement without prior notice.

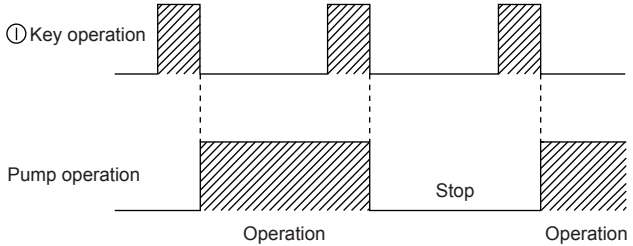
4-2. Control unit

Operation mode	Mode	Manual
		EXT(Pule dividing or multiply)
	Switching	Key operation
Stroke rate	Set range	1 ~ 360 spm
	Set method	Up or down key
	Memory function	By non-volatile memory
STOP input	When M - OFF	Pump stops when contact signal comes.
	When M - ON	Pump runs when contact signal comes.
	Input signal	Potential free contact or open collector Note 1
EXT input	Upper limit stroke rate	Stroke rate indication of manual mode
	Pump operation	1 input signal : "n" pumping(s) (Pulse multiply) Note 2 "n" input signal(s) : 1 pumping (Pulse dividing) Note 3 When "n" is 1, the pump starts synchronized operation
	Input signal	Potential free contact or open collector Note 1
	Dividing ratio/Multiply ratio setting range	1~999 (Dividing or multiply)
Display	Figures	4 digits LCD
	Pump movement	Green LED (one) (Blinks synchronous with pump operation)
Power source voltage		AC100V~240V, 50/60Hz Note 4

Note 1: Max. charged voltage to the contact is 12V and 5mA current. If the contact such as relay is used, its applicable load should be 5mA or below.
Note 2: The input signals over the upper limit stroke rate are stored up to 255 signals.
Note 3: The residual input signals over 360 spm are cancelled.
Note 4: Do not apply any voltage other than the specified one. It causes the pump failure. Allowable power voltage is between AC90 - 264V.

5. Operating function

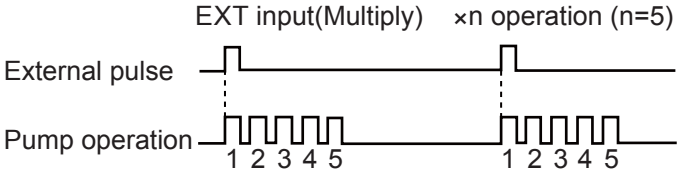
5-1. Manual operation



Use ▲(UP) and ▼(DOWN) keys to set a stroke rate between 1 ~ 360 spm. Use Ⓘ(Stop/start) key to start/stop the pump. Stroke rate can be adjusted when the pump runs or stops.

5-2. EXT operation

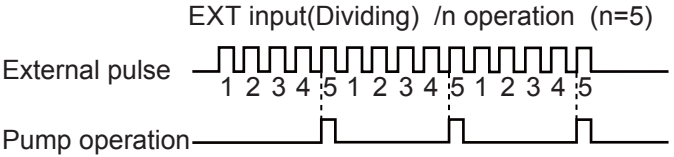
EXT input (Multiply) when a set number of pumping is 5



EXT input operation (Pulse multiply)

Pump operates with a set number of pumping between 1~999 for a external pulse signal. The preset stroke rate in manual operation is applied as the upper limit stroke rate in EXT operation. The pulse signals which come while pumping for the set number of times for a external pulse signal are stored up to 255 pulses. When the set number of pumping is set to 1, pump operates synchronously with a external pulse in the ratio of 1:1.

EXT input (Dividing) when a set number of pumping is 5



EXT input operation (Pulse dividing)

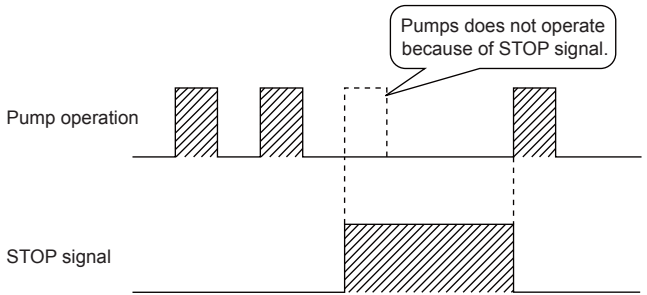
Pump operates with a pumping for external pulse signals. The preset stroke rate in manual operation is applied as the upper limit stroke rate in EXT operation. Residual input signals over 360 spm are cancelled. When the set number of external signals is set to 1, pump operates synchronously with a external pulse in the ratio of 1:1.

⚠ Caution

When the set number of external pulse signals for a pumping is set to 1 in pulse dividing operation, pump operation can be unstable due to the residual signal cancellation function but it is not malfunction of pump. Set the number of pumping for a external pulse signals to 1 for 1:1 operation in the pulse multiply operation.

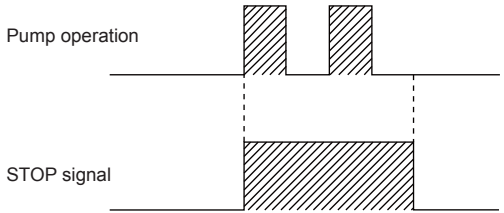
6. STOP function

6-1. M – OF setting



The pump stops while STOP signal is comming(contact closed).
The pump starts running when STOP signal is stopped.

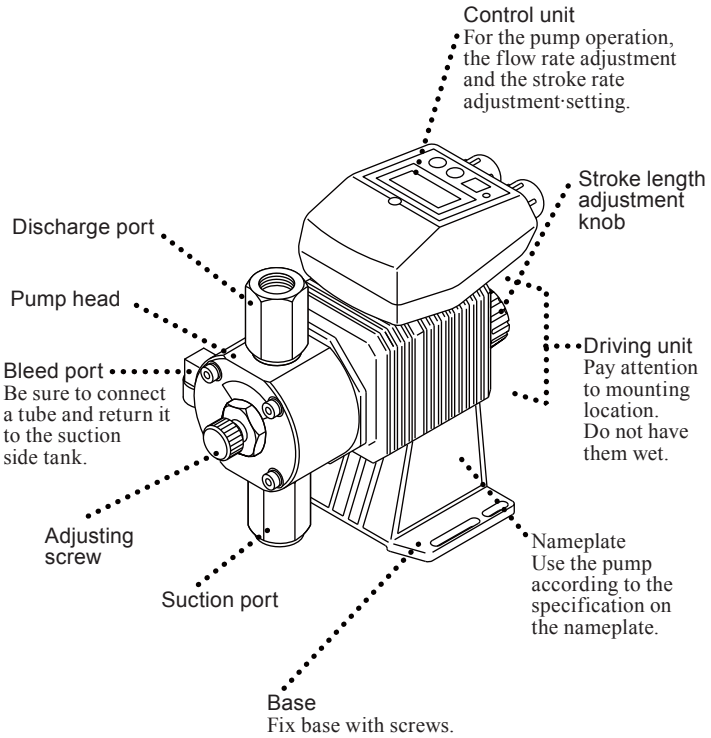
6-2. M – ON setting



Pump operates while STOP signal comes (contact closed). The pump operates in EXT mode while STOP signal is coming.

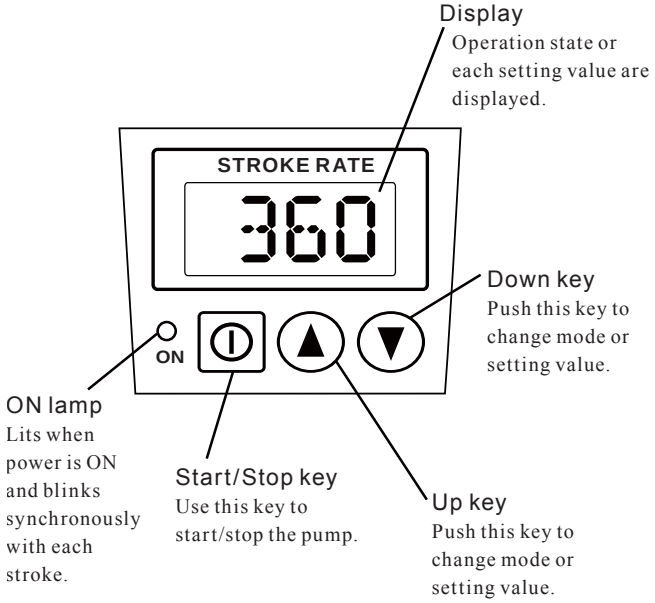
7. Overview

7-1. Overview of pump



Outline of product

7-2. Overview of controller



	ON lamp lights	ON lamp blinks
360	The pump is waiting in manual operation mode.	The pump is running in manual operation mode. The stroke rate blinks, too.
EXT	The pump is in EXT mode. EXT setting can be done.	The pump is running in EXT mode.

7-3. Basic display.

	ON lamp lights.	ON lamp blinks.
STOP	The pump is stopped by STOP signal..	
-STOP	The pump is stopped in manual waiting mode while STOP signal comes.	
T-5	Chattering is being set. T-10 or T-50 is displayed other than T-5.	
/NNN	Pulse dividing mode is selected in EXT setting.	
XNNN	Pulse multiply mode is selected in EXT setting.	
/ 5	The dividing ratio of EXT mode is being set. The left display shows 1 pumping for 5 pulses.	
X 5	The multiply ratio of EXT mode is being set. The left display shows 5 pumpings for a pulse.	
M-OF	STOP function is set to M-OF. M-ON is displayed when M-ON is selected.	
OVER	EXT input signals exceed the pump upper limit spm in EXT mode. Pump operates at its upper limit spm.	
.360		Pump is running in pulse dividing/multiply operation for external input pulses. The indication shows spm.
360 (Lock)	Key is locked. Key operations are ineffective in this state. Release the key lock function before operation.	Key is locked. Key operations are ineffective in this state. Release the key lock function before operation.

Installation

1. Before installation

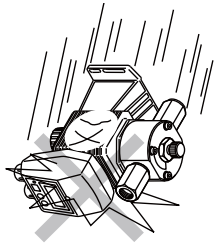
"Strictly observe the following points."

Operators and maintenance service staff must read the instruction manual thoroughly before installing the products. Do not operate the pump system unless all of the contents in this manual are completely understood.

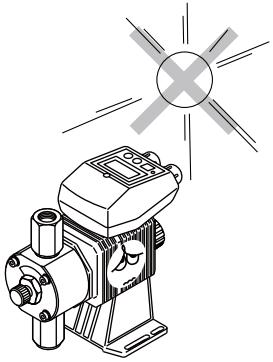
⚠Warning

- Turn off power
  Working with power ON may cause an electrical shock. Before working on the pump, make sure turn off main power.
- Terminate operation
  On detecting or becoming aware of any dangerous sign or abnormal condition in operation, terminate the operation immediately and start it from the beginning again.
- Specified power only
  Be sure to connect earth wire. Do not apply any power other than specified power on nameplate.
- Keep the pump away from heat or flame
  Do not place any dangerous materials or flammable objects near the pump for the prevention of fire or accident.
- Damaged pump
  Never operate any damaged pump. A damaged pump may cause leakage or electrical shock.

2. Precaution on handling



- Dropping the pump or subjecting it to strong impacts may result in faulty performance. Handle the pump with care.



- When installing the pump, avoid places where...
  - The pump is exposed to direct sunlight or rain.
  - Ambient temperature is 40 deg. C or more.
  - Relative humidity is 85% or more.

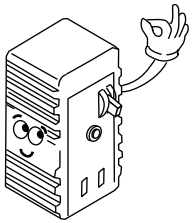
Though the pump has a simple waterproof and dustproof structure, do not install it outdoor.

- Select an installation site convenient for future maintenance and inspection, and fix the pump on a flat floor free of vibrations.

Installation

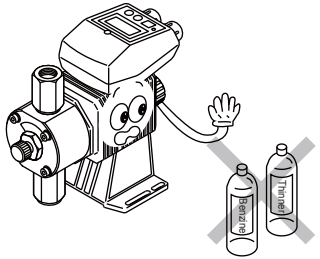
- Ventilate.
  Poisoning may result when toxic or odorous liquid is used. Ventilate the operating site sufficiently.
- Do not wet or dampen.
  If an electric part or wiring gets wet with the liquid spilled over accidentally, a fire or electrical shock may be caused. Install the system in a place free from liquid spillage or leakage.
- Install an earth leakage breaker (option).
  Pump operation without an earth leakage breaker may lead to an electrical shock. Purchase an optional leakage breaker and install in the system.
- The control unit can be detached, however, do not detach it unless it is not required. Never use the detached control unit with other pump models.

Prohibited



Caution

Prohibited



- Grounding.
  Risk of electrical shock. Do not operate the pump without grounding.
- Limited operating site and storage
  Do not install or store the pump in the following places:
  - Flammable gas or material is used or stored.
  - Ambient temperature is extremely high (40 deg.C or higher) or extremely low (0 deg.C or lower).
  - Under direct sunlight or rainwater
  - Relative humidity is 85% or more.
- Cleaning
  Do not wipe the pump body or the nameplate with a cloth soaked with solvent such as benzene, thinner, or kerosene. Coating may be removed or colour may be changed. Use a dry cloth or a cloth soaked with water or neutral detergent.

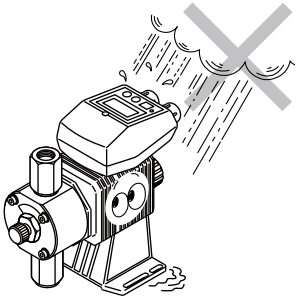
3. Installation

⚠ Caution

Detecting or becoming aware of a dangerous sign or abnormal condition in operation, stop the operation and take the procedure from the top.

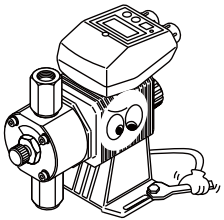
- Installation

  Install the pump at a site where ambient temperature does not exceed 40 deg.C and relative humidity does not exceed 85%. (There should be no dew condensation in the control unit.)
  The site must be selected keeping in mind ease and efficiency for maintenance and inspection work.
  Do not expose the pump to sunlight or rainwater. Cover the pump when placing it outside.



- Place the pump as close to the suction tank as possible.

Caution



- If the pump is used to feed any liquid that generates air bubbles easily (Hydrazine solution, etc.), it must be positioned in a cool, dark place away from direct sunlight.
  When using a tank, realize a flooded suction system.

- Anchoring pump

  Select a flat floor free of liquid splash for installation of the pump. Use M5 bolts to firmly anchor the pump so as not to allow any vibration.

4. Tubing

1) Tape the air bleeding union (Attached to the pump) and screw it in the pump head.

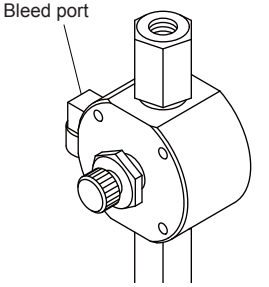
2) Have the piping short and less bends as much as possible to reduce flow resistance.

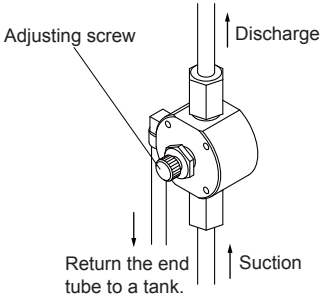
3) The fitting bore is Rc1/4 female thread. Be sure to connect each connection on both suction/discharge piping to eliminate liquid/air leakage.

4) Piping for air elimination.
Be sure to return the end of hose to a tank or container after connecting a hose to the bleed port.

⚠ Caution

Regarding the SH type, discharge pressure can not be fully opened by the adjusting screw. Install a discharge valve on discharge pipe for opening pressure.





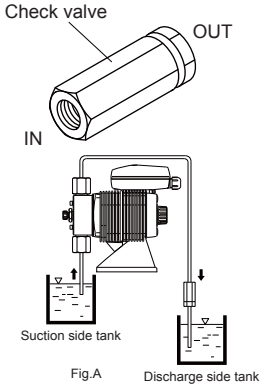


Fig.A

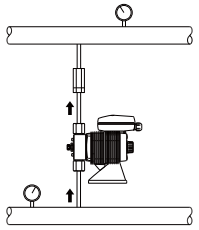


Fig.B

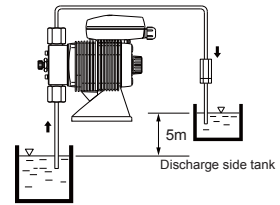


Fig.C

5) Mounting check valve
A check valve is packed to avoid over feeding. Be sure to install the check valve in following condition.

a. Suction side liquid level is higher than discharge side liquid level. (See Fig. A) Injection point is below suction side liquid level at atmospheric pressure.

b. Suction side pressure is higher than that of injection point. (See Fig. B.)

c. Difference of liquid level in height is 5 meters or less, even if discharge side liquid level is higher than suction side. (See Fig. C.)

⚠ Caution

Periodically wash or replace the check valve with new one because it may be clogged by crystal.

d. Discharge pressure (Pipe resistance, discharge head or so) is below 0.13MPa. (Load pressure is 0.049MPa for C36).

• The check valve should be installed at discharge tube end at least 1 meter away from pump.

5. Electrical wiring

⚠ Caution

Electrical works must be done by a qualified person. We are not responsible for any injury and damage by any person other than a qualified person,

5-1. Wiring of power source

1) Confirm that main power source is turned off before wiring.

2) Wiring must be done according to your electrical works standard using good wiring equipment/device.

⚠ Caution

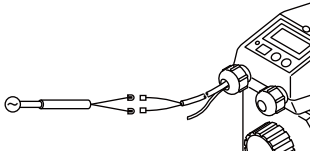
Power voltage should be charged at a sitting via switch or relay. Otherwise malfunction of CPU may happen.

When power is charged at a setting

When power is charged gradually

For selecting a relay, refer to P16 which mentions the precaution when pump is controlled by relay ON/OFF.

Make sure wires are connected securely via crimp contacts at the end of the power cord.



⚠ Caution

Never put other voltage than rated voltage. Otherwise electronic circuit may be broken.

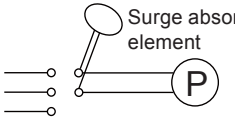
3) Be sure to connect ground wire.

4) Do not share a plug socket with a high power equipment which may generate surge voltage. Otherwise electronic circuit may be failed. Pay attention to noise generated by inverter or so.

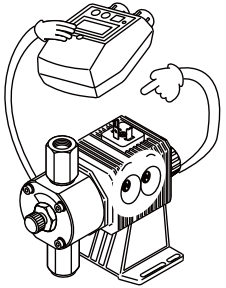
- Surge voltage

⚠ Caution

Electronic circuit of the control unit may be failed by extremely large surge voltage. Do not place the pump near to the high power equipment of 200V or more which may generate large surge voltage. If use of high power equipment is inevitable, take any of the following measures.



Noise cut transformer



a. Install a surge absorption element (Varister or so of 2000A or more durability) at pump power connection part.

b. Install noise cut transformer.

5) The control unit can be removed easily from the pump driving unit. Do not mount the control unit to a different pump model. Electronic circuit or driving unit may be damaged.

- Precaution when pump power is turned ON/OFF by relay.

⚠ Caution

The control unit is equipped with CPU. It is recommended to stop the pump through STOP input terminal. Avoid turning ON/OFF power source because it may cause malfunction of CPU. If there is no choice but turning ON/OFF power, pay attention to following points.

In case power is turned ON/OFF by the relay, its contact volume must be 5A or more. Contact point may be welded if contact volume is 5A or below.

If the relay of contact point volume 5A is used for EHN, it can be used for max. 150 thousands times of ON/OFF operation. If 150 thousands times or more of ON/OFF operation are required, or a power source is shared with a large capacity equipment, the contact may be welded by surge voltage. In this case use the relay of contact volume of 10A or more. If its durability is not enough, use non contact transistor relay (ex. G3F made by OMRON or so). For details refer to catalogue or other documents of equipment manufacturer.

5-2. Wiring of external input signal

⚠ Caution

Risk of electrical shock. Never connect wires while power is turned on. Controller may be short-circuited. Turn off power before wiring work.

⚠ Caution

Wait for one minute after the power is turned off, because electricity is still charged in the pump right after turning off power.

External signal

EXT function : Stroke rate is controlled by pulse signal.
STOP function : ON/OFF operation by external signal.

Use either a potential free contact or a open collector for external signal. When a pulse signal is used, pulse width should be between 10ms and 100ms and pulse speed should be 360 pulses/minute or below.

⚠ Caution

- Wiring of EXT and STOP
  Do not install the power cord and the EXT and STOP wires in parallel. Do not bind or combine the power cord with the EXT and STOP wires by a concentric cable (5 wires cable or so). Otherwise noise is generated from the EXT and STOP wires due to induction effect from the power cable and results in wrong operation or failure.

- When using SSR (solid state relay) for EXT/STOP signal input
  When using SSR for EXT/STOP signal input, use the recommended products stated below. Any SSR other than recommended can cause malfunction.
  1. G3FD-102 S or G3FD-102SN made by OMRON
  2. G3TA-IDZR02S or G3TA-IDZR02SM

  Refer to information materials such as catalogue of manufacturer for further information.

- When using a type device for EXT/STOP signal input
  When using a type device such as relay for EXT/STOP signal input, select some device of which the minimum application load is 5mA or below.

- Wiring procedure

⚠ Caution

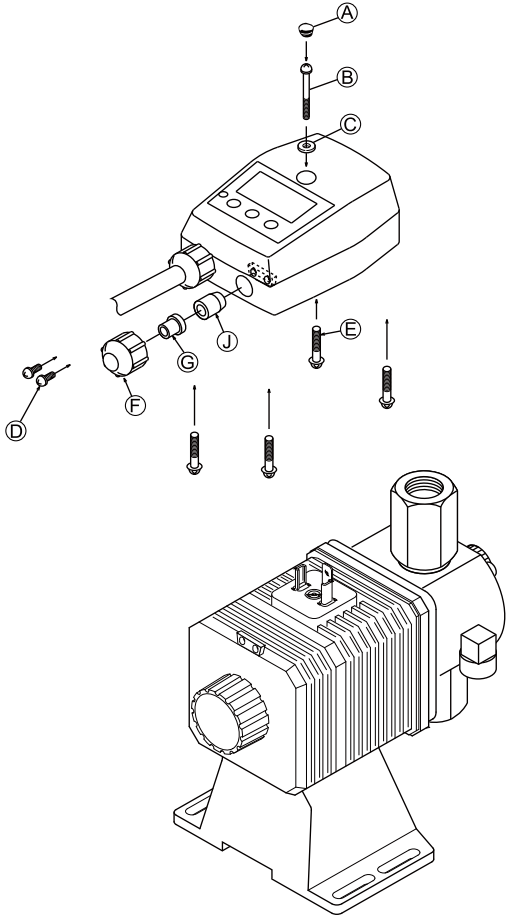
Used cord must be 7.8 mm of outer diameter. If other diameter is used, perfect connection and sealing can not be obtained, malfunction of an electronic circuit may result.

1) Remove gasket Ⓐ on the top of control unit and then remove screw Ⓑ, gasket Ⓒ and two screws Ⓓ above stroke length adjusting knob and remove the control unit.

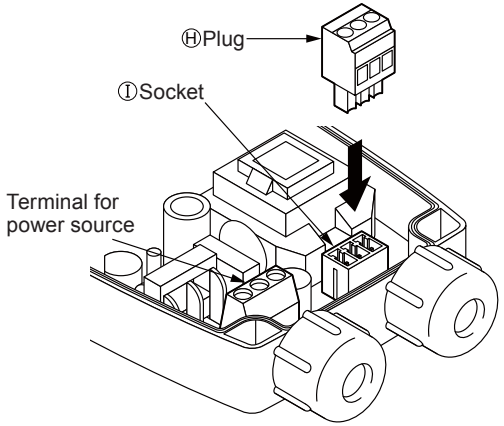
2) Remove four screws Ⓔ on the bottom of control unit and remove controller cover.

3) Remove cord nut Ⓕ for signal cord and remove protective cap Ⓖ. The cap Ⓖ is not used when cord is connected. Pull cord gasket Ⓙ out of controller unit.

4) Insert an external signal cord through cord nut Ⓕ and cord gasket Ⓙ into the control unit.



5) Remove plug Ⓗ from socket Ⓘ. Connect a signal cord to the plug Ⓗ with screw driver and mount it on the socket Ⓘ. Pull the signal cord from the outside of the control unit to adjust the slack and then mount the cord nut Ⓕ securely by hand. (The cord is sealed by cord gasket Ⓙ.)

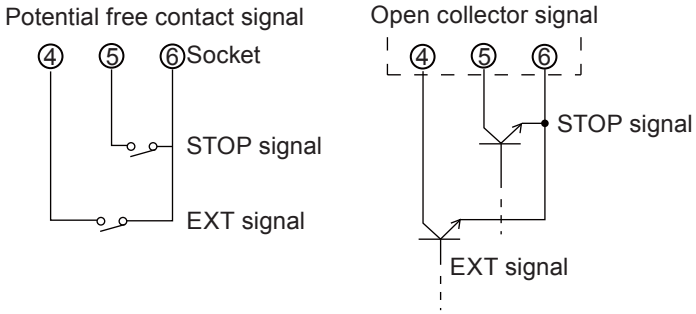


6) Mount control cover and mount the controller in the reverse procedure of above items 1) and 2).
Tightening torque of each screw is as follows:
Screw Ⓑ : 0.39N.m
Screw Ⓓ : 0.39N.m
Screw Ⓔ : 0.8N.m

⚠ Caution

Do not forget to mount gaskets Ⓐ and Ⓒ. Without them, liquid may get into controller and controller may be failed.

Wiring to socketⒾfor signal input



1. Operation

After the installation, piping, and wiring processes are completed, operate the pump in accordance with the following steps.

⚠ Caution

- Do not operate the pump with a completely closed discharge-side valve.
  Operating the pump with the discharge-side valve fully closed may lead to liquid leakage or pipe rupture. Make sure not to operate the pump with the discharge-side valve closed.
- Do not run pump dry.
  A pump which has been run dry may experience liquid leakage during its liquid feeding operation. Make it a rule to run the pump after supplying liquid inside the pump.
  Overheat, deformation of the pump unit (pump head, valve case, etc.), or looseness of the pump head can happen by a long period (longer than 30 minutes) of dry running. This may result in liquid leakage.
- Re-tighten bolts of pump head
  Loosened bolts on pump head may cause liquid leakage. To avoid liquid leakage caused by loosened bolts, periodically tighten four hex. socket head bolts in diagonal order. Also at the time of initial operation, tighten four bolts diagonally because the bolts may be loosened during storage or transportation.

Tightening torque

Model	Torque	Remarks
EHN-B11 • 21	2.16N•m	M4 hex. socket head bolts
EHN-C21	2.16N•m	M4 hex. socket head bolts
EHN-C31	2.55N•m	M4 hex. socket head bolts
EHN-C36	2.55N•m	M5 hex. socket head bolts

1-1. Bleeding

Bleeding is a process undertaken to eliminate air inside the suction-side tube and the pump head. Make sure to carry out bleeding prior to the initial operation of the pump and/or after replacing the liquid in the tank. For safe bleeding, first set a pipe to the air-vent port of the air vent unit.

⚠ Caution

Do not rotate the adjusting screw beyond the OPEN-SHUT name plate.

⚠ Caution

Some liquids used in the pump may cause skin trouble or affect the quality of mechanical parts. Wipe off the liquid immediately when it wets the hand or mechanical parts.

⚠ Warning

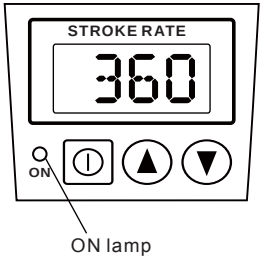
Both air and chemical go out together from the end of bleeding tube. Return the bleeding tube to a chemical tank or another vessel.

⚠ Caution

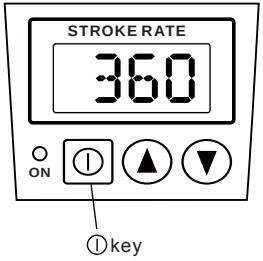
The pump may run and discharge chemical for one shot as power is turned on, however, it is not malfunction.

To start/stop pump

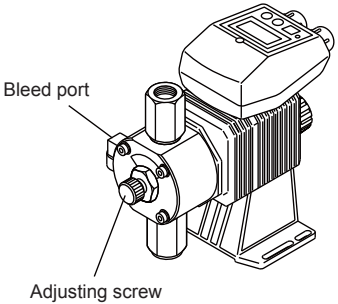
1) Turn on power.
ON lamp (green) lights when turning on power. The pump enters the waiting mode in the manual mode. (When power is turned on initially.) Display shows stroke rate.



2) Pushing ⓘ key once, the pump starts operation and both ON lamp and stroke rate indication blink at each stroke.



• Air elimination



1) Start the pump. Lamp blinks to show pump operation.

2) Adjust pump stroke rate to 360 spm.

3) Open the bleed port by turning the bleed adjusting screw to left by a half turn.

4) Run the pump for ten minutes for bleeding.

5) Close the bleed port by turning the bleed adjusting screw to right.

6) Check no liquid leaks through parts.

⚠ Caution

Regarding the SH type, discharge pressure can not be fully opened by the adjusting screw. Install a discharge valve on discharge pipe for opening pressure.

1-2. Adjustment of discharge capacity

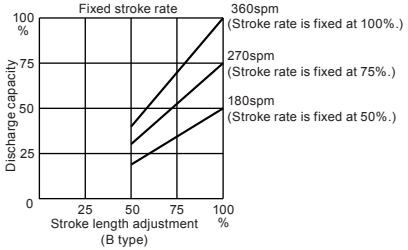
Discharge capacity can be adjusted by adjusting a stroke rate or stroke length, however, adjust it with stroke rate adjustment. Stroke length adjustment is auxiliary way to cover the range where is not obtained by stroke rate adjustment.

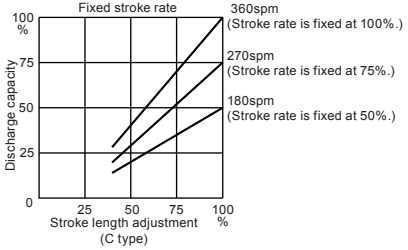
Precaution for stroke rate adjustment

1) When pumping gaseous liquid such as hydrazine solution ($N_2H_2O_2$), adjust stroke length to 100% and adjust stroke rate. Discharge capacity may be reduced when stroke length is short.

2) When back pressure is high, set stroke length to 100% and adjust discharge capacity by stroke rate adjustment.

3) In case the discharge capacity per shot greatly influences the reaction in neutralization or titration application, have the stroke length short to reduce capacity per shot. And then adjust it by stroke rate adjustment.





1) Procedure to adjust discharge capacity

Determine a suitable stroke length and stroke rate, taking account of the pump operating condition and liquid characteristics etc. Following procedure is recommended.

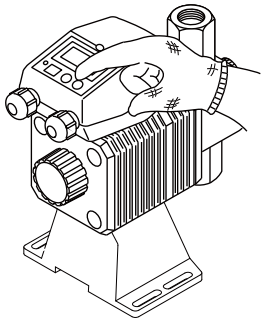
a. Set stroke length at 100% and roughly adjust discharge capacity by stroke rate adjustment.

b. Measure discharged volume.

c. If measured volume is less than required volume, then increase stroke rate to measure again discharged volume.

d. Adjust stroke length for fine adjustment of discharge capacity.

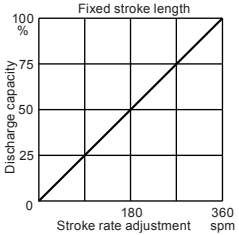
e. Measure again the discharged volume to confirm the required volume is obtained.

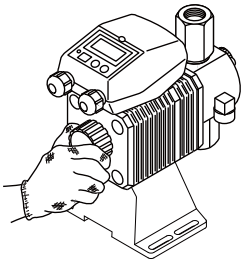


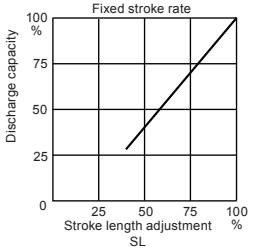
2) Adjustment of stroke rate

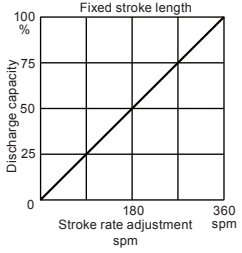
Stroke rate can be set by UP and DOWN keys.

- Stroke rate of the plunger per minute is adjustable between 1 ~ 360 spm.









⚠ Caution

Never turn stroke length adjusting knob when pump is stopped.

3) Stroke length adjustment

Stroke length is adjusted by changing the returning distance of plunger.

a. Turn on power and adjust discharge capacity with the stroke length adjusting knob while pump is running.

b. Figure on right shows the relation between discharge capacity and stroke length.

Discharge capacity shows by percent (Discharge capacity shown on nameplate is 100%.).

- Stroke length can be adjusted from 0 to 100% but actually adjust it in the range of 50 to 100%.

1-3. Precaution when pump is stopped

- In case pump is stopped for a long time (more than one month), operate the pump with clean water for 30 minutes to clean wet-end of pump and piping.
- When starting the pump after a long time stoppage, clean valve set if the pump does not suck up liquid and remove adhered matters. Remove the air if it remains in the pump head and re-adjust discharge capacity. (Refer to pages 21 & 22.)

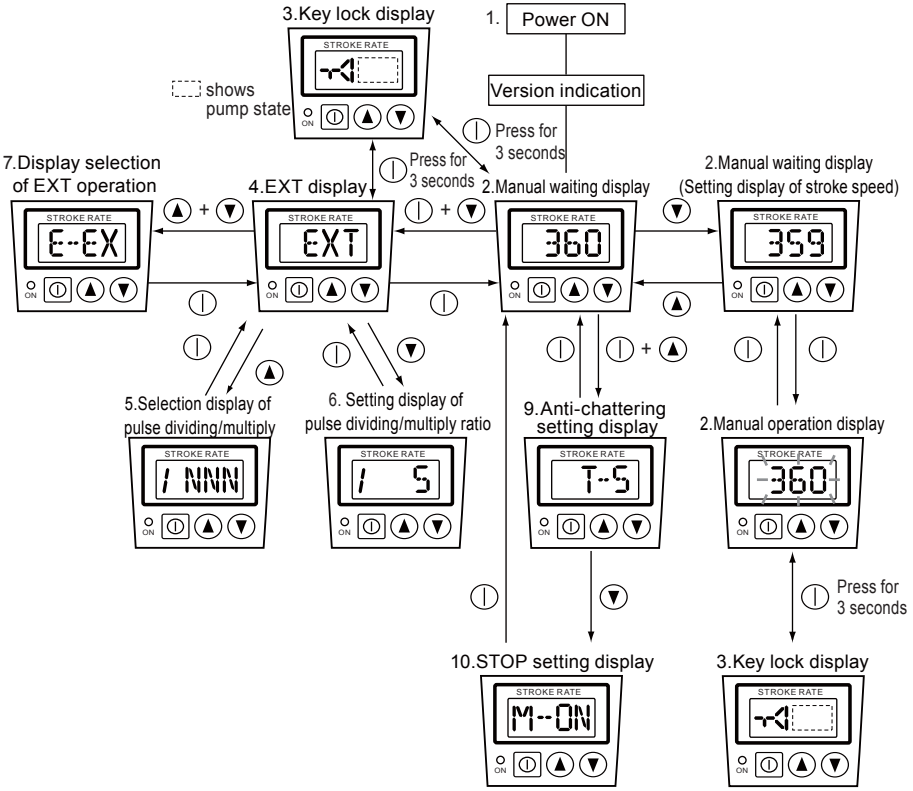
⚠ Caution

Try to stop the pump by key operation before turning off power. Wait for 3 seconds to turn off power after the pump is stopped. If power is turned off within 3 seconds, the last key operation to stop the pump may not be put in memory. In this case the pump starts to run as power is turned on and liquid can be discharged.

2. Operation of controller

This pump is controlled by operating the control unit. Read this chapter thoroughly for correct operation. Control function is different at each operating mode.
The figure on right shows the operation diagram of the control unit.

2-1. Control unit operation diagram



1) When the pump is powered for the first time, built-in program version is shown and then manual waiting mode appears. When pump is powered on and after the second time, pump starts with the status of when pump was turned off last time.

2) In manual waiting mode, push start/stop key Ⓘ to start pump. If the key is pushed again, pump stops and moves to manual waiting mode.

3) When pressing Ⓘ key for 3 seconds in either manual waiting mode, EXT waiting mode or during manual operation, the key lock function can be active. In this state all the key operations are ineffective. Release the key lock function by pressing Ⓘ key for 3 seconds again.

4) EXT mode is to operate pump by external signal.
In manual waiting mode, push ▼ key as pressing Ⓘ key to move to EXT mode. To stop pump, push Ⓘ key to move to manual waiting mode.

5) To select pulse dividing or pulse multiply, push ▲ key in EXT mode to move to the selection display of pulse dividing/pulse multiply.

6) To change the pulse dividing/pulse multiply ratio, Push ▼ key in EXT mode to move to the setting display of pulse dividing/pulse multiply ratio.

7) To display spm indication of EXT operation, push ▼ key while pushing ▲ key in EXT mode to move to the display selection mode of EXT operation.

8) Setting of anti-chattering and STOP function are used in order to change the factory setting value.

9) To change the setting of anti-chattering, push ▲ key as pressing Ⓘ key to move to move to anti-chattering setting display. Push ▲ key to set and push Ⓘ key to confirm it and return to manual waiting mode.

10) To change STOP setting, first push ▲ key as pressing Ⓘ key in manual waiting mode to move to anti-chattering setting display. And then push ▼ key once to move to STOP setting display. Push ▲ key to select M-ON or M-OF and push Ⓘ key to confirm it and move to manual waiting mode.

For details, refer to Operation: 2-3-8.

⚠ Caution

Each setting after change is not stored unless Ⓘ key is pushed. Do not turn off power before pushing Ⓘ key.

2-2. Parameter

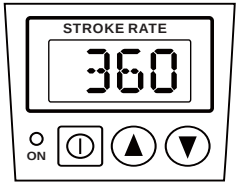
Mode	Parameter	Factory set	Set range	Step
Manual	Stroke rate (spm) (Note 1)	360	1 ~ 360	1 (Note 2)
	Anti-chattering (Note 3)	T-5	T-5/T-10/T-50	–
	STOP (Note 4)	M-OF	M-OF/M-ON	–
EXT	Selection of pulse dividing/multiply	/NNN	/NNN, XNNN	–
	Dividing ratio	1	1~999	1 (Note 2)
	Multiply ratio	1	1~999	1 (Note 2)
	Display selection mode	EX	EX/SP	–

Note 1. This value is used as the upper limit stroke rate of EXT mode as well.
2. One push changes stroke rate one by one. When keeping up or down key pressed, figure changes continuously.
3. The larger the value is, the stronger against disruption of input pulse it becomes, however, it gets harder for the pump to detect pulses if ON time gets shorter. The value is approx. time (msec) for the pump to detect pulse. Set the ON time of input pulse larger than chattering value.
4. If M-ON is selected, pump starts operation upon returning to manual waiting if STOP signal is inputted. Pay attention each time of changing setting.

2-3. Setting and operation of control unit

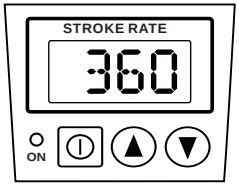
2-3-1. Manual operation

1) Turn on power



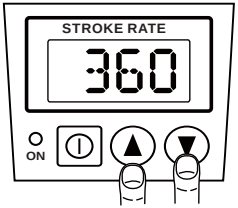
When power is turned on for the first time, program version is shown briefly and the manual waiting mode appears. On and after the second time pump is turned on, display shows the mode at the last power-off.

2) Go to manual mode



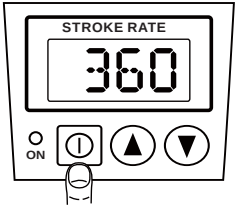
In case a stroke rate (1 ~ 360) is not shown on display, move to the manual mode with key operation. Push ⏻ key when "EXT" is shown on display. "STOP" or "–STOP" indication means the STOP function is active. First release the STOP function. Refer to page 35 to release the STOP function.

3) Set stroke rate



Change a stroke rate shown on display by ▲ or ▼ key. If either ▲ or ▼ key is pushed continuously for more than 3 seconds, a stroke rate changes quickly. In this case, the quick figure change stops at 1 or 360. And then, figure skips from 360(or 1) to 1(or 360) by releasing the key once and then pushing ▲ or ▼ key again.

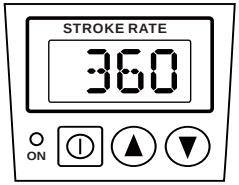
4) Start/stop of pump



The pump starts to run when ⏻ key is pushed once. ON lamp and the spm indication blink. The pump stop running when pushing ⏻ key again. ON lamp stops blinking at this time. (When a stroke rate is slow, ON lamp blinks longer.)

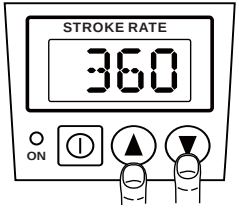
2-3-2. EXT operation

1) Turn on power



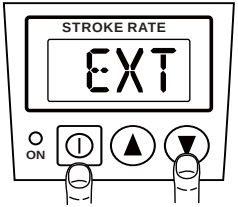
When the pump is turned on for the first time, program version is shown briefly and then manual waiting mode appears. On and after the second times, "EXT" indication appears on display if the pump was in the EXT mode at the last power-off.
In case "STOP" or "–STOP" is shown, release the STOP function first because the STOP function is active. Refer to page 35 to release the STOP function.

2) Set the upper limit stroke rate of EXT



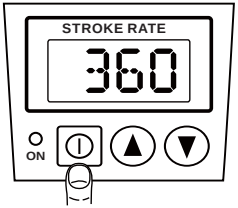
If the pump is in the manual mode, stop the pump and set a stroke rate. If the pump is in the EXT operation mode, push ⓘ key to move to the manual waiting mode and set a stroke rate.

3) Set EXT operation mode



In the manual waiting mode, push ⓥ key as pressing ⓘ key to move to the EXT mode. The pump starts to run synchronously with EXT input signals as the pump enters EXT operation mode.

4) Return to the manual mode



Push ⓘ key once to return to the manual waiting mode. A stroke rate appears on the display.

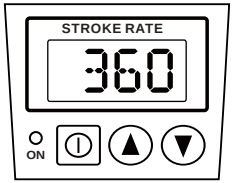
⚠Caution

When the pump is in EXT operation mode, the maximum number of strokes is equal to the number of strokes displayed in manual operation mode.
For example, when the number of strokes displayed in the manual operation mode is 200 spm, the maximum number of strokes in EXT mode is 200 spm and the pump operates at 200 spm or bellow even if pulse signals come to operate the pump at 360 spm.

2-3-3. Key lock function

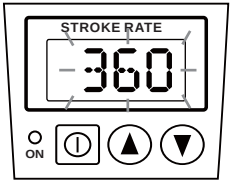
1) The pump condition when keypad lock can be active.

At the manual waiting mode

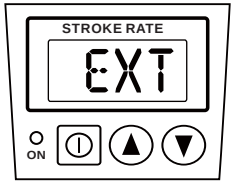


or

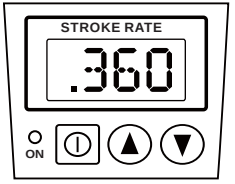
During manual operation



EXT mode



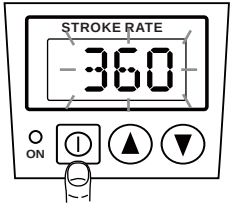
or



Display one of those modes for locking keypads operation.

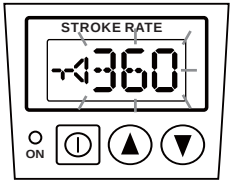
2) To have the Key lock function active.

During manual operation

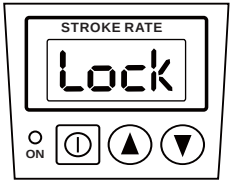


Press ⓘ key for 3 seconds when one of the above modes for the keypad lock is displayed.

During manual operation or EXT mode.

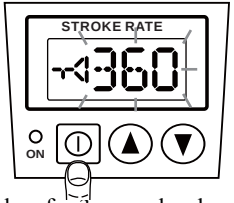


At manual waiting mode



A key mark is indicated during the manual operation or EXT mode as the keypad operations become ineffective. "Lock" indication is displayed in the manual waiting mode.

3) To release the Key lock function.



During manual operation with key pad locked

Press ⓘ key for 3 seconds when key pads are locked. The key mark disappears and keypad operations become effective.

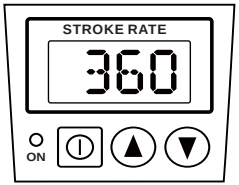
⚠ Caution

All the keypad operations are ineffective when the keypads are locked. Turn off a main power source if it is necessary to stop the pump urgently. When turning on power again, the pump restarts with the keypads locked.

And pressing ⓘ key for 3 seconds when the pump runs by stop signals also have the key lock function active, however; the indication is STOP or -STOP. If STOP function is released, the indication changes into that of key lock function.

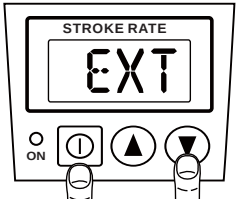
2-3-4. Selection of pulse dividing/pulse multiply

1) Turn on power



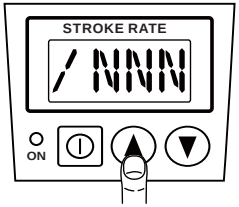
When power is turned on for the first time, program version is shown briefly and the manual waiting mode appears. On and after the second time pump is turned on, the pump restarts in the EXT operation mode with "EXT" indication on the display if the pump was in EXT operation mode at the last power-off.
If "STOP" or "-STOP" indication is displayed, the STOP function is active. First, release STOP function. Refer to page 35 for how to release the STOP function.

2) Move to the EXT mode



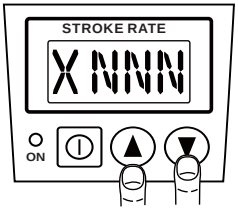
Push ▼ key as pressing Ⓘ key in the manual waiting mode to move to the EXT mode. Do not input any signals at this phase.

3) Move to the selection display of pulse dividing/pulse multiply



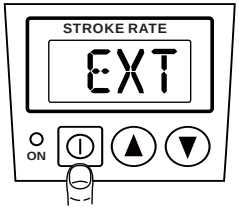
Push ▲ key to move to the selection display of pulse dividing/ pulse multiply.

4) Select the pulse dividing or pulse multiply.



Push ▲ or ▼ key to select the pulse dividing or pulse multiply in the selection display.

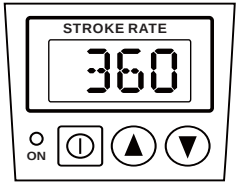
5) Return to the EXT mode.



Push ⓘ key to move to the EXT mode.

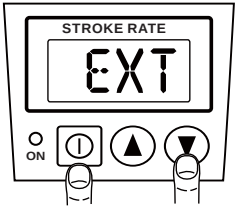
2-3-5. Setting of dividing ratio and multiply ratio

1) Turn on power



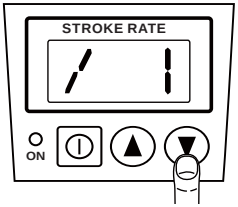
When power is turned on for the first time, program version is shown briefly and the manual waiting mode appears. On and after the second time the pump is turned on, the pump restarts in the EXT operation mode with "EXT" indication on the display if the pump was in the EXT operation mode at the last power-off.
If "STOP" or "-STOP" indication is displayed, the STOP function is active. First, release the STOP function. Refer to P.35 for how to release the STOP function.

2) Move to the EXT mode



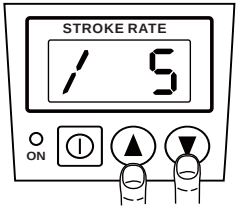
Push ⓥ key as pressing ⓘ key in the manual waiting mode to move to the EXT mode. Do not input any signals at this phase.

3) Move to the setting display of the dividing ratio and multiply ratio.



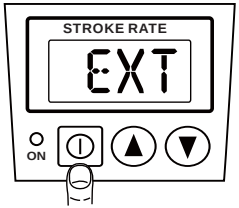
Push ⓥ key once to move to the setting display of the dividing ratio and multiply ratio.

4) Set the dividing ratio or multiply ratio



Use ▲ or ▼ key to set the dividing ratio or multiply ratio in the setting display.

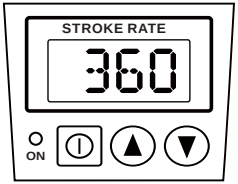
5) Return to the EXT mode



Push ⏻ key to return to the EXT mode.

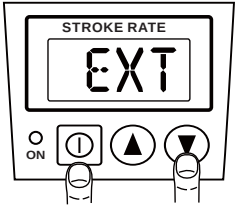
2-3-6. Display selection mode of EXT operation

1) Turn on power



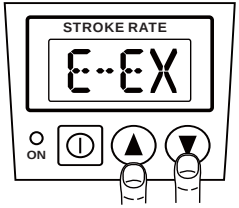
When power is turned on for the first time, program version is shown briefly and the manual waiting mode appears. On and after the second time the pump is turned on, the pump restarts in the EXT operation mode with "EXT" indication on the display if the pump was in EXT operation mode at the last power-off.
If "STOP" or "-STOP" indication is displayed, the STOP function is active. First, release the STOP function. Refer to P.35 for how to release the STOP function.

2) Move to the EXT mode



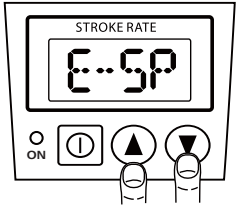
Push ▼ key as pressing ⏻ in the manual waiting mode to move to the EXT mode. Do not input any signals at this phase.

3) Move to the display selection mode of EXT operation



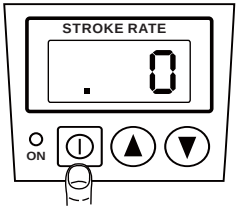
Push ▼ key while pressing ▲ key to move to the display selection mode of EXT operation.

4) Select "EXT" indication or "spm" indication



Use ▲ or ▼ key to select the EXT indication or spm indication in the display selection mode of EXT operation.

5) Return to the EXT mode



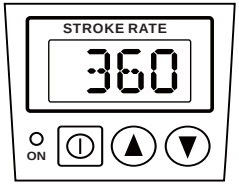
Push ⏻ key to return to the EXT mode. The above display shows when the spm indication is selected.

⚠ Caution

The spm indication on the display via the display selection reflects the actual pump rotation speed. It does not reflect the speed of incoming external signals.

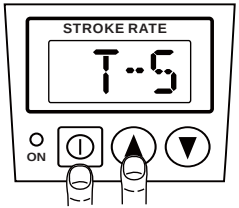
2-3-7. Setting of anti-chattering value

1) Go to the manual waiting mode



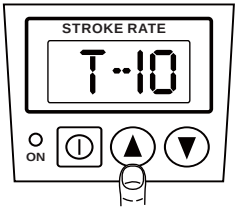
If the pump is EXT mode, push ⓘ key. If "STOP" or "–STOP" is shown, release the STOP function because STOP function is active. Refer to page 35 to release the STOP function.

2) Set the anti-chattering value



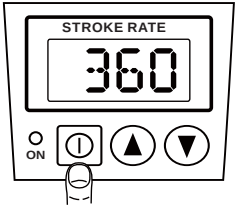
In the manual waiting mode, push ▲ key as pressing ⓘ key in order to indicate T-5 (factory setting) on display.

3) Change the anti-chattering value



Push ▲ key to change T-5, T-10 or T-50.

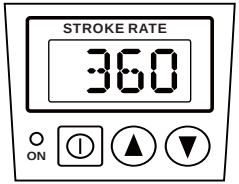
4) Fix the setting and return to the manual waiting mode.



After the setting of the anti-chattering value, push ⓘ key to confirm the setting and return to the manual waiting mode. When the pump is used together with a pump controller 50 series, set the anti-chattering to T-5. The pump may not operate if it is set to T-10 or T-50.

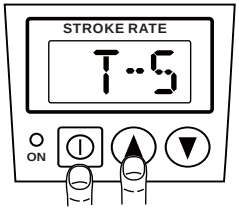
2-3-8. Setting of STOP function

1) Go to the manual waiting mode



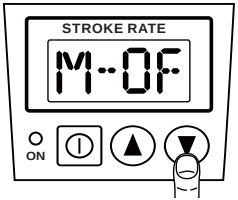
If the pump is in the EXT mode, push ⓘ key. "STOP" or "– STOP" indication means the STOP function is active. Release the STOP function. Refer to page 35 to release the STOP function.

2) Go to the anti-chattering setting display



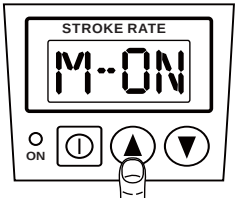
In the manual waiting mode, push ⓘ and ▲ keys simultaneously to show T-5 (factory setting) on display.

3) Go to the STOP setting display



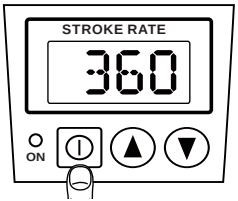
Push ▼ key once to show either "M-OF (factory setting)" or "M-ON" on display.

4) Change the STOP setting



Push ▲ key to select "M-OF" or "M-ON".

5) Fix the STOP setting and return to the manual waiting mode.



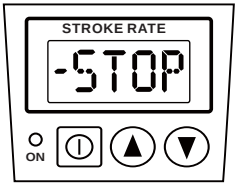
Push ⓘ key to fix the setting and return to the manual waiting mode.

⚠ Caution

M-ON: Pump starts to run when STOP signals are inputted.
M-OFF: Pump stops running when STOP signals are inputted.

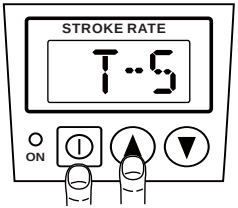
2-3-9. Release of STOP function

1) Move to the waiting mode of the STOP function.



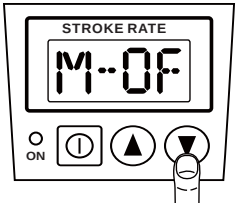
If display shows "STOP", push ⓘ key to stop pump operation.
When "-STOP" indication appears, push ▲ key while pressing ⓘ key to move to the anch-chattering setting.

2) Move to the anti-chattering setting display.



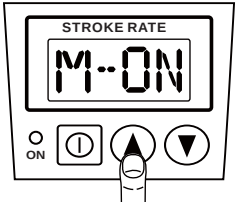
When "-STOP" indication appears, push ▲ key while pressing ⓘ key. Display shows "T-5" "T-10" or "T-50".

3) Move to the STOP setting display.



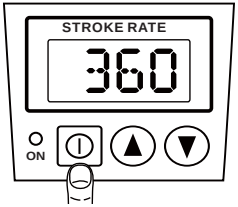
Push ▼ key once. Display shows "M-OFF" or "M-ON". The STOP function can be released by changing this setting.

4) Change the current STOP setting.



Push ▲ to select "M-OF" or "M-ON".

5) Confirm the new STOP setting and return to the manual mode.



Push ⓘ key to confirm the new setting. The pump enters the waiting mode and the STOP function is released.

Maintenance

Instruction for safety

Maintenance, inspection, disassembling and assembling should be done according to this instruction manual. Do not handle the pump beyond the instruction shown on this manual.

⚠Warning

- Wear protector
  You may be injured by chemical or toxic liquid if they are splashed or you touch them. Wear protector such as protective mask, safety globe or so when the works are done.

- Turn off power
  You may be electrically shocked if you do the works while power is turned on. When you do the works be sure to turn off power of pump or other equipment. When you stop pump, it should be stopped by key operation before you turn off power. Power must be turned off at least three seconds after pump is stopped by key operation. If power is turned off within three seconds, pump stopping operation may not be put in memory. If this happens, pump starts when power is turned on again and chemical may be discharged.

1. Troubleshooting

Trouble	Cause	Troubleshooting
Pump does not start.	● Faulty wiring or disconnection in wiring ● Lowered voltage ● Electronic circuit of control unit is damaged.	○ Correct wiring. ○ Trace cause and raise voltage to specified level. ○ Replace the whole unit. (Substrate part cannot be repaired.)
Liquid suction cannot be done.	● Air suction in suction piping ● Valve gasket is not installed. ● Valve set is set in wrong direction. ● Pump is air-locked. ● Pump stroke length is too short. ● Suction-side/discharge-side valve is clogged with foreign matter. ● Adhesion of valve onto valve seat	○ Set piping normally. ○ Install valve gasket. ○ Reset the valve set. ○ Carry out air elimination. ○ Drive the pump at 100% stroke length. Then, reset stroke length. ○ Disassemble, inspect, and clean. ○ Disassemble, inspect, and clean.
Discharge amount fluctuates.	● Suction-side/discharge-side valve is clogged with foreign matter. ● Air is trapped in pump. ● Overfeeding ● Diaphragm is damaged.	○ Disassemble, inspect, and clean. ○ Carry out air elimination. ○ Install check valve. ○ Replace diaphragm.
Liquid leaks.	● Valve or connecting port is not tightly closed. ● Pump head is not tightly closed. ● Diaphragm is damaged. ● O ring and valve gasket are not installed.	○ Tighten section. ○ Tighten pump head. Torque: 2.16 N•m (B11, B21, C21) 2.55 N•m (C31, C36) ○ Replace diaphragm. ○ Install O ring and valve gasket.

2. Maintenance and inspection

Stop the pump immediately when detecting any abnormality in daily inspection. Take measures according to "Troubleshooting" section. When wear parts come to the life limit, replace them by new ones. Refer to "Wear parts" section.

No.	Daily inspection	Description	How to Check
1	Does pump lift liquid normally?	● Is liquid being pumped? ● Is suction pressure/discharge pressure at normal level? ● Has liquid undergone quality change, crystallization, or solidification?	○ By flow meter or visual inspection ○ Check nameplate. ○ By visual inspection
2	Abnormal noise or vibration?	● Abnormal noise or vibration may result from abnormal functioning of pump.	○ By visual and audio inspection
3	Is there liquid leakage or air suction at any joint on pump or piping?	● Tighten joint where leakage has occurred. ● Excessive air bubbles in discharged liquid mean air suction has been caused in system. Examine the piping and tighten the joint which leaks.	○ By visual inspection ○ By visual inspection

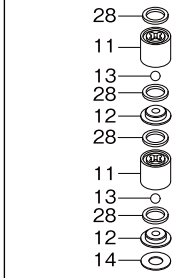
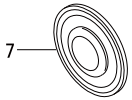
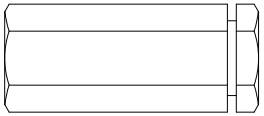
! Check if the pump head mounting bolts are not loosened every 3 months. Tighten them by diagonal order on the following tightening torque if necessary. The mounting bolts may be loosened during pump operation (An extent of looseness depends on operating condition.).

Tightening torque of pump head mounting screw

Model	Torque	Remarks
EHN-B11 • 21	2.16N•m	M4 hex. socket head bolts
EHN-C21	2.16N•m	M4 hex. socket head bolts
EHN-C31	2.55N•m	M4 hex. socket head bolts
EHN-C36	2.55N•m	M5 hex. socket head bolts

3. Wear parts

If the pump is to be used for a long period, wear parts should be replaced in proper period. It is recommended that the following parts are always ready for the replacement.

	Parts		Q'ty	Time to be replaced
Pump head	Valve set	SH 	2 sets	8000 hours
	Diaphragm		1	
Check valve	 CS-1S, CS-1SL		1	

Note: Durability of wear parts depend on pumped liquid, temperature and pressure.
Time to be replaced mentioned as above is an estimation obtained by continuously pumping clean water at ambient temperature.

4. Dismantlement and assembly

⚠Warning

- Wear protector
  You may be injured by chemical or toxic liquid if they are splashed or you touch them. Wear protector such as protective mask, safety globe or so when the works are done.


Wear protective gear

- Turn off power
  You may be electrically shocked if you do the works while power is turned on. When you do the works be sure to turn off power of pump or other equipment. When you stop pump, it should be stopped by key operation before you turn off power. Power must be turned off at least three seconds after pump is stopped by key operation. If power is turned off within three seconds, pump stopping operation may not be put in memory. If this happens, pump starts when power is turned on again and chemical may be discharged.

- Release the pressure inside pump and discharge hose prior to loosing the piping connections or dismantlement of pump. Dismantlement with pressure inside pump could lead to liquid eruption.

- Pay attention not to touch residual liquid when dismantling pump.


Caution

Method to release pressure:

1) Stop the pump
2) Turn the adjusting screw to open discharge pressure.

Before works

- When the pump is disassembled, pay attention to the liquid which may remain in the pump.
- Wash wet-end of the pump head.

Works

- When the pump head is disassembled, replace the diaphragm, O ring, valve gasket and valve set by new ones.

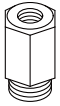
⚠Caution

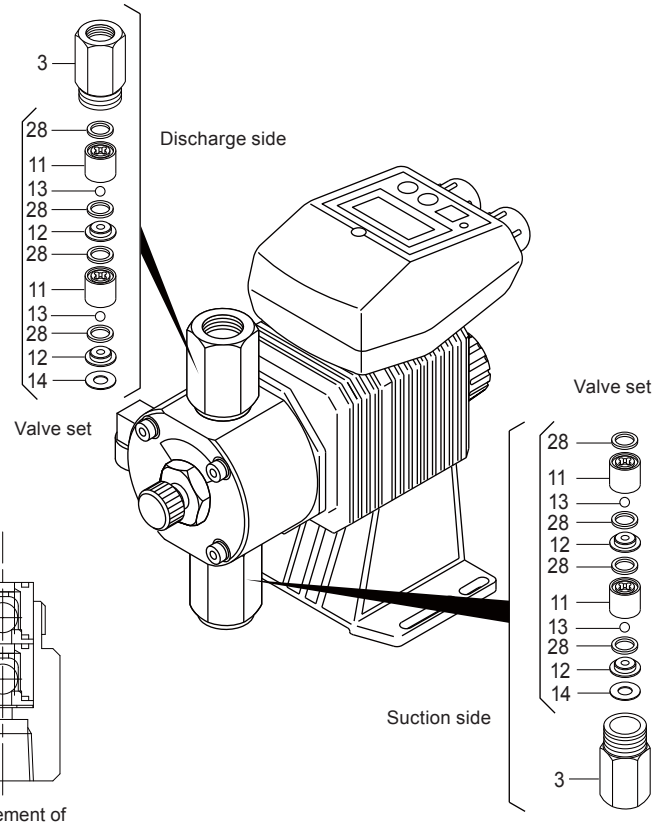
- The pump is not water-proof construction.
- If liquid is splashed on the pump (driving unit, control unit, pump head), they may be failed and accident may occur. Do not splash liquid on them. If splashed, wipe them off with a cloth.

4-1. Valve assembly

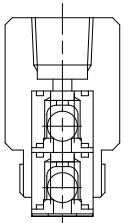
■ Disassembly of discharge valve

Loosen the fitting with a spanner to remove it and take the valve set out with a tweezers.

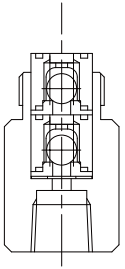

Fitting



⚠ Caution
Pay attention not to drop the valve set.



Arrangement of the discharge side valve



Arrangement of the suction side valve

■ Assembly

Assembly is done in reverse order to disassembly. Pay attention to the following points.

- Pay attention to arrangement of the valve set. Wrong arrangement and direction will cause failed pumping (liquid leakage, decreased discharge capacity).
- Be sure to mount the O ring and gasket.

1) Mount the discharge side valve set

Put the valve set in the pump head. Then screw the fitting in the pump head by hand. Tighten the fitting by 1/4 turn with a spanner in the last place.

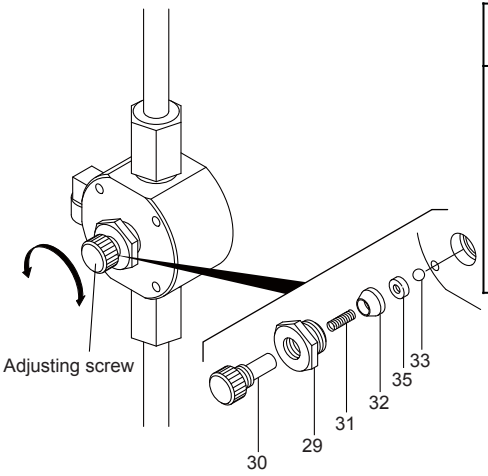
2) Mount the suction side valve set

Put the valve set in the fitting (3) and screw the fitting into the pump head by hand. Then tighten it by 1/4 turn with a spanner.

4-2. Bleed assembly

Turn the adjusting screw anticlockwise to dismantle the bleed assembly.

- Be careful not to loose the valve(33), seal ring(32) and spring(31). Replace the gasket with new one at each dismantlement. Pay attention to a mounting direction of the spacer(35).



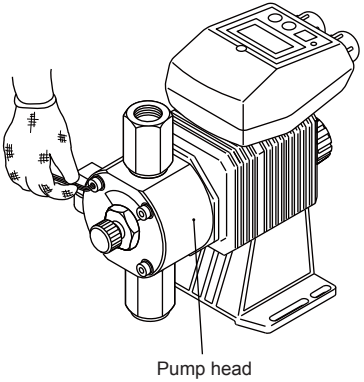
4-3. Diaphragm

■ Disassembly of diaphragm

1) Remove the suction hose, discharge hose and bleed hose.

2) Remove the pump head with a hex. wrench.

3) Turn the diaphragm to remove it from the plunger (pump shaft).



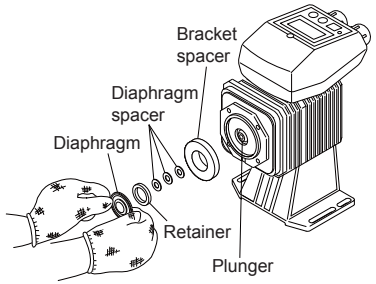
⚠Warning

Pay attention not to lose the diaphragm spacer and to apply correct number of the diaphragm spacer. 0 to several pieces of the diaphragm spacers are put between the retainer and plunger to adjust a position of diaphragm. The number of the spacers mounted depends on a pump model. Some models do not have spacer.

1. Assembly of diaphragm

1) Operate the pump to set stroke length at 0% and stop it.

2) Put the retainer and diaphragm spacer (if used) through the threaded part of new diaphragm.



⚠ Caution

The round edge of the retainer should be directed to the diaphragm. Do not remove the bracket spacer. If removed, mate projected and recessed part of the bracket and bracket spacer and insert them to the bottom.

3) Screw the diaphragm into the plunger.

4) Operate the pump to set stroke length at 100% and stop it.

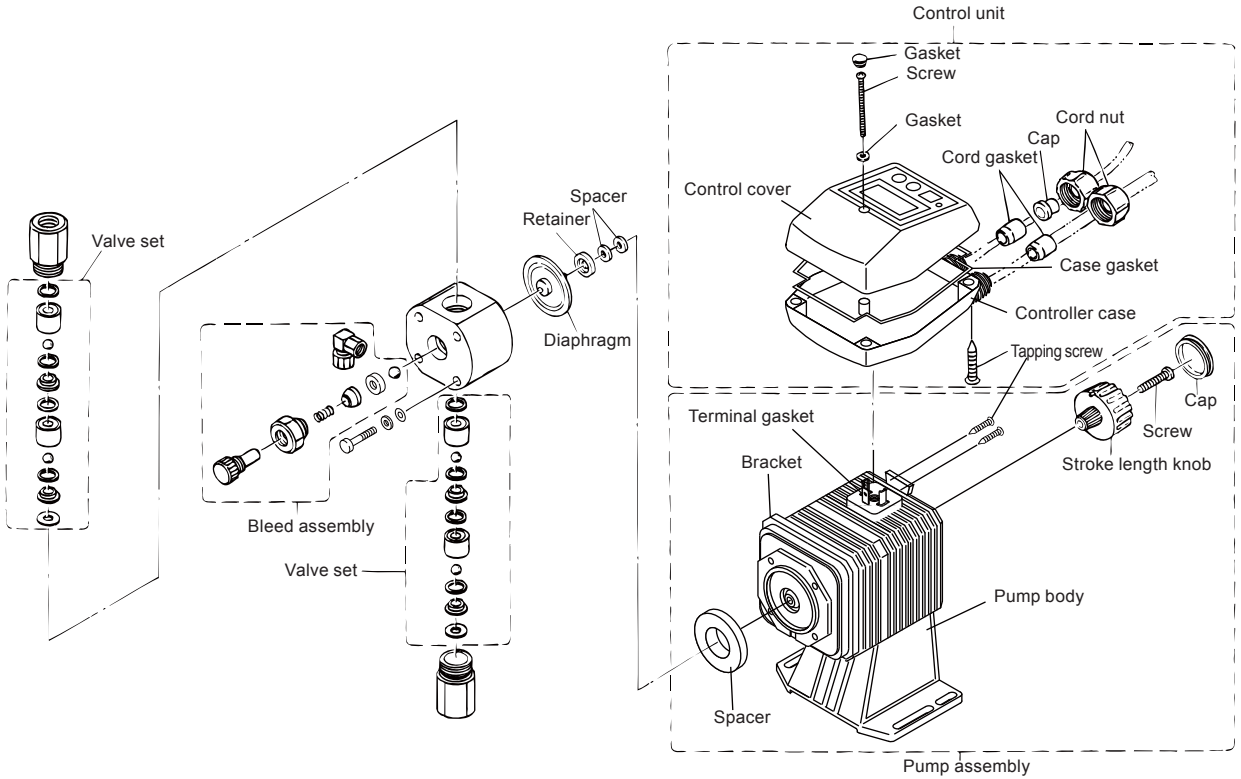
5) Tighten bolts evenly (diagonally) to mount the pump head.

Tightening torque

Model	Torque	Remarks
EHN-B11 • 21	2.16N•m	M4 hex. socket head bolts
EHN-C21	2.16N•m	M4 hex. socket head bolts
EHN-C31	2.55N•m	M4 hex. socket head bolts
EHN-C36	2.55N•m	M5 hex. socket head bolts

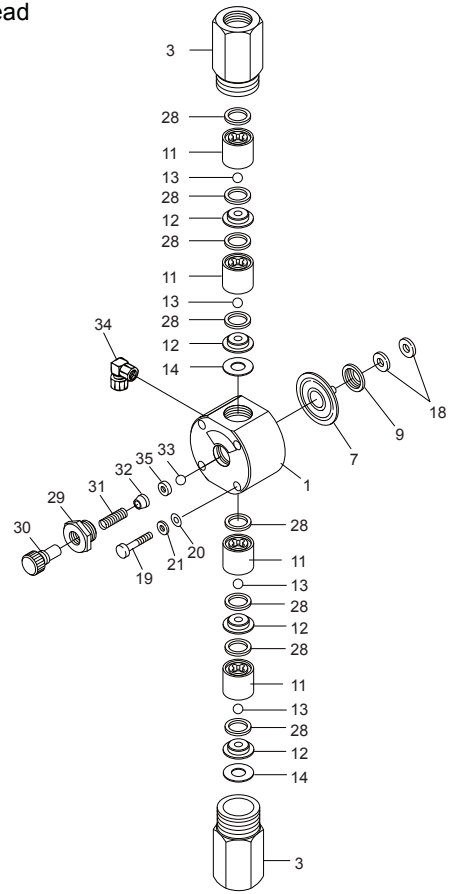
Exploded view

Parts are completely disassembled for easy understanding but the extent of disassembling is limited to the instruction shown on Maintenance section.



Exploded view

■ Pump head

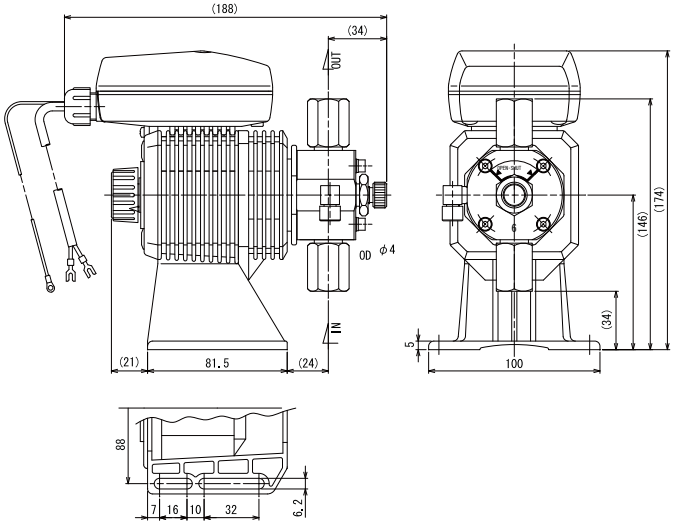


No.	Parts name	Q'ty
1	Pump head	1
3	Fitting	2
7	Diaphragm	1
9	Retainer	1
11	Valve guide	4
12	Valve seat	4
13	Valve	4
14	Valve gasket B	2
18	Diaphragm spacer	*
19	Hex. socket cap bolt	4
28	Valve gasket A	8
29	Seal nut	1
30	Adjusting screw	1
31	Spring	1
32	Seal ring	1
33	Valve	1
34	Air bleeding union	1
35	Spacer	1

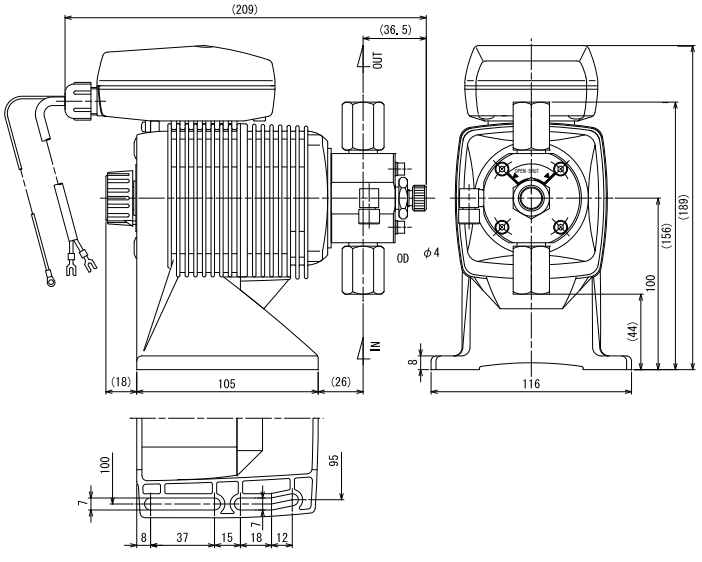
* Q'ty varies with each product.

Outline dimension

- EHN-B11, B21(SH)

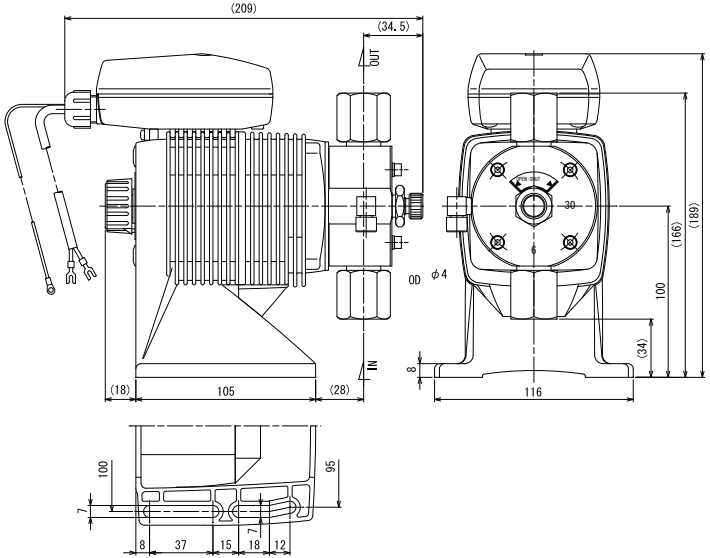


- EHN-C21(SH)



Outline dimension

- EHN-C31, C36(SH)



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T-614-1 '07/01