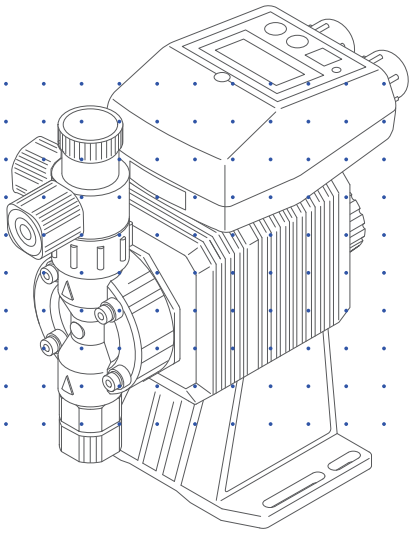
IWAKI PUMPS

Iwaki
Electromagnetic Metering Pump

EHN-R (Standard)



Instruction manual

Thank you for choosing our product.

Please read through this instruction manual before use.

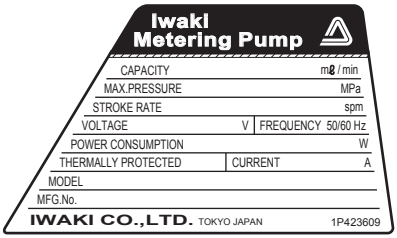
This instruction manual describes important precautions and instructions for the product. Always keep it on hand for quick reference.

Order confirmation

After unpacking, check the following points. Contact us or your nearest dealer if the delivery is imperfect.

a. Check if the delivery is as per order.

Check the nameplate to see if the discharge capacity, discharge pressure and voltage are as per order.

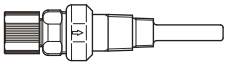


b. Check if accessories are complete.

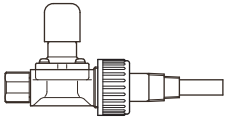
• A check valve or a back pressure valve

*The attached check valve and back pressure valve vary with pump models. See page 86 for accessory list.

Check valve



Back pressure valve



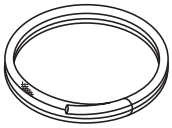
• A tube (3m)

(ø4×ø9 or ø8×ø13 PVC braided tube)

*ø4×ø9 or ø8×ø13 EVA tube is attached to the PP type.

*No tube is attached to the FC type.

*ø4×ø6 nylon tube is attached to the H type.



c. Check if the delivery is damaged or deformed.

Check for transit damage and loose bolts.

Contents

Safety instructions

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

■ **Pictorial indication**

In this instruction manual, the estimated risk of degree caused by incorrect use is ranked with the following pictorial indications. First, fully understand information on the pictorial indications.

⚠ WARNING	Indicates mishandling could lead to a fatal or serious injury accident.
⚠ CAUTION	Indicates mishandling could lead to personal or property damage.

Pictorial indication accompanies each precaution, suggesting "Caution", "Prohibition" and "Requirement".

Caution marks	Prohibition mark	Requirement mark
 Caution, Electrical shock	 Prohibition, Do not remodel	 Requirement, Wear protectors, Earthing

⚠ **For exportation**

Technology related to the use of goods in this instruction manual falls in the category of technology contained in the Foreign Exchange Order Attachment, which includes complementary export control of technology. Please be reminded that export license, which is issued by the Ministry of Economy, Trade, and Industry could be required, when this is exported or provided to someone even in Japan.

⚠WARNING

Turn off power before work

Risk of electrical shock. Be sure to turn off power to stop the pump and related devices before work.


Electrical shock

Stop operation

On sensing any abnormality or dangerous sign, suspend operation immediately and inspect/solve problems.


Requirement

Do not use the pump in anything other than a specified purpose

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


Prohibition

Do not modify the pump

Remodelling the pump carries a high degree of risk. We are not responsible for any failure or injury results from remodelling.


Do not remodel

Wear protective clothing

Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a work cap during dismantlement, assembly or maintenance work.


Wear protectors

Do not damage the power cable

Do not pull or knot the power cable or place a heavy stuff on it. Damage to the power cable could lead to a fire or electrical shock.


Prohibition

Do not use the pump in a flammable atmosphere

Do not place dangerous or flammable goods near the pump for your safety.


Prohibition

⚠ CAUTION

A qualified operator only

The pump must be handled or operated by a qualified person with a full understanding of the pump. Any person who is not familiar with this product should not take part in operation or management.


Requirement

Use a specified power only

Do not apply any power other than the one specified on the nameplate. Otherwise, failure or fire may result. Also, be sure to earth the pump.


Prohibition

Do not run pump dry

Do not run pump dry for more than 30 minutes (even when the pump runs for degassing). Otherwise, the pump head fixing screws may loosen and liquid may leak. Optimise your system in order for the pump not to run dry. If the pump run dry for a long period (for more than 30 minute), the pump head and valve case may deform by friction heat and consequently leakage results.


Caution

Do not wet electric parts or wiring

Risk of fire or electrical shock. Install the pump free from liquid spill.


Prohibition

Ventilation

Poisoning may result when handling a toxic or odorous liquid. Keep good ventilation in your operating site.


Caution

Do not install or store the pump in the following places where...

- Under a flammable atmosphere or in a dusty/humid place.
- Ambient temperature is beyond 0-40 degrees Celsius.
- Under direct sunlight or wind & rain.


Prohibition

Countermeasure against efflux

Take a protective measurement against an accidental chemical overflow results from pump or piping breakage.


Requirement

Do not use the pump in a water place

The pump is not totally waterproof. The use of the pump in water or high humidity could lead to electrical shock or short circuit.


Prohibition

Earthing

Risk of electrical shock. Always earth the pump.


Earthing

Install an earth leakage breaker

Risk of electrical shock. Do not use the pump without a leakage breaker. Purchase separately.


Electrical shock

Wear part replacement

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


Requirement

Do no use a damaged pump

Using a damaged controller could lead to an electric leak or shock.


Prohibition

Disposal of the used pump

Dispose of any used or damaged pump in accordance with relevant regulations. Consult a licensed industrial waste products disposing company.


Requirement

Tighten the pump head

Liquid may leak if pump head fixing bolts are loose. Tighten the bolts diagonally and evenly before initial operation. Also, periodically tighten the bolts for the prevention of leakage.


Caution

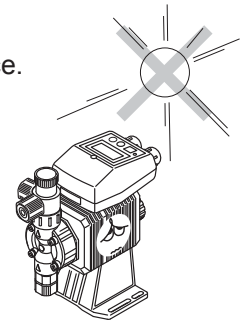
Tightening torque

EHN-B11•16•21, C16•21	: 2.16 N•m
EHN-B31, C31•36	: 2.55 N•m

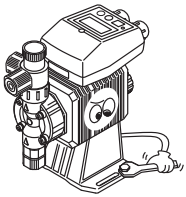
Precautions for use

- Electrical work shall be performed by a qualified operator. Otherwise, personal or property damage accident may result.

- Do not install the pump in the following places where...
  –Under a flammable atmosphere or in a dusty/humid place.
  –Under direct sunlight or wind & rain.
  –Ambient temperature is beyond 0-40 degrees Celsius.
  Protect the pump with a cover when installing it out of doors.



- Select a level location where is free from vibration and liquid can't stay. Fix the pump with M5 bolts so as not to vibrate. If the pump is installed at a tilt, the flow may reduce.



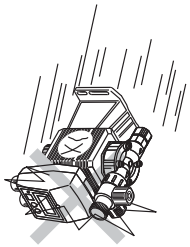
- When two or more pumps are installed, the pump operation interacts each other and vibration becomes significant, resulting in poor performance or failure of internal electrical devices. Select an installation location where tolerates vibration to enough degree.

- Keep a wide maintenance space around the pump.

- Install the pump as close to a supply tank.

- Install the pump in a cool and dark place when handling liquids that readily generate gas bubbles such as sodium hypochlorite or hydrazine solution. Flooded suction mounting is strongly recommended when using the pump with a supply tank.

- Be careful not to drop the pump onto the floor. A strong impact may reduce pump performance. Do not use a pump which has once damaged. Otherwise an electrical leak or shock may result.



- The pump is a light water-/dust-proof structure of IP66, but is not totally waterproof. Do not have the pump wet with the liquid handled or rainwater.

Caution

- Never wet the pump head, control unit and drive unit. Otherwise, Failure or an accident may result. Immediately wipe off liquid if the pump has got wet.

Caution

- Do not close the discharge line during operation. Otherwise, liquid may leak or tubing may break.

Caution

- Remove the control unit only when necessary. Note that an applicable control unit differs with each drive unit. Do not attach a control unit to an inapplicable drive unit. Otherwise, an electrical circuit or the drive unit may fail.

Caution

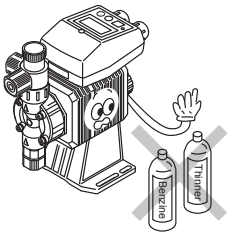
- Release the pressure from the discharge line before dismantling the pump or removing tubing. Otherwise, chemical liquid gushes out.

Requirement

- Be careful not to come in contact with residual liquid.

Caution

- Do not clean the pump or nameplate with a solvent such as benzene and thinner. This may discolour the pump or erase printing. Use a dry cloth or a wet cloth with water or neutral detergent.



The information such as characteristics, features and part names are described in this section.

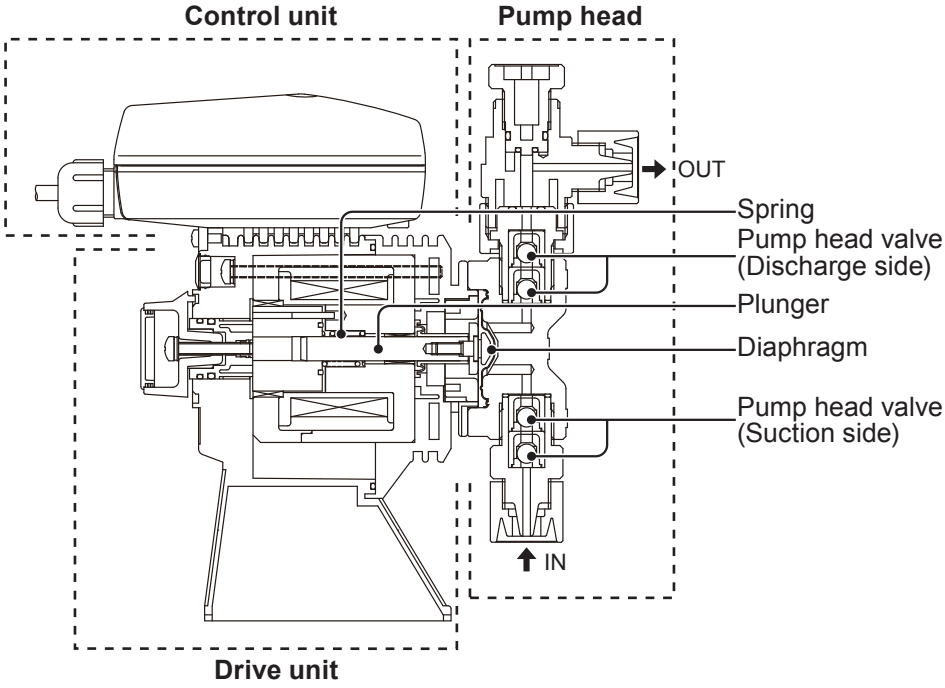
Introduction

Pump structure & Operating principle

The EHN series is a diaphragm metering pump which consists of a pump head, drive unit and control unit. A diaphragm is directly driven by electromagnetic force.

Principle of operation

The pulse signal controls the electromagnetic force and spring force in order to make reciprocating motion. The reciprocating motion is transferred to a diaphragm through a plunger and then volumetric change occurs in the pump head. This action transfers liquid along with pump head valve action.



Features

- **Multivoltage**

  All the EHN-R series is multivoltage type (100-240VAC) and can be selected without concern for local power voltage.

- **High resolution**

  Digitally-controlled spm range is 1-360 (1-300spm for the VH/PH-V). The stroke length shifts for a fine flow adjustment.

- **Waterproof and dustproof structure**

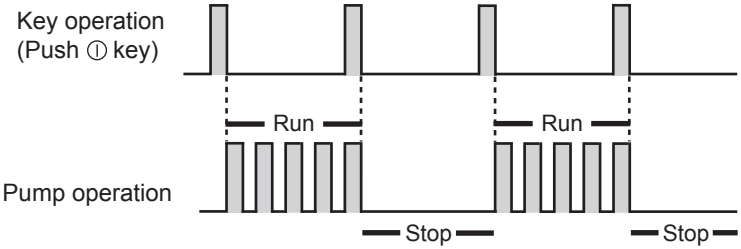
  The sealed drive unit and control unit assure IP66.

  *This pump is not completely water resistant. Protect the pump with a cover when installing it out of doors.

Operational function

- **Manual operation (see page 46)**

  The start/stop of the pump by key operation



  *Manual operation can be done at any time during operation or stop.

- **EXT operation (see page 47)**

  The pump operation by the external signal.

  The external operation is available after the multiplier or divider programming.

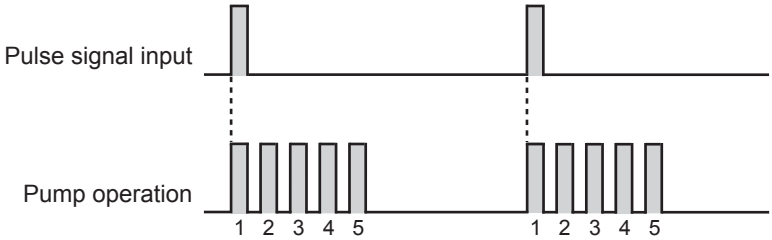
Multiplier programming (See page 50)

1-999 shots can be allocated to one pulse signal.

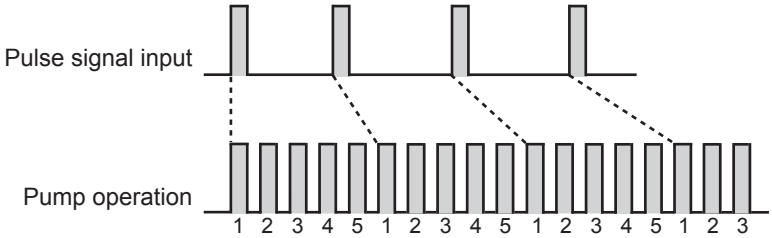
*In the EXT operation, the pump runs at the manual operation spm.

*The pump runs in 1:1 operation when the multiplier is programmed to 1.

Example) When the multiplier is programmed to 5, the pump makes five shots per signal.



A storage function works when the pump receives the external signal before the programmed shots per signal is completed.



*The storage function stores up to 255 pulses.

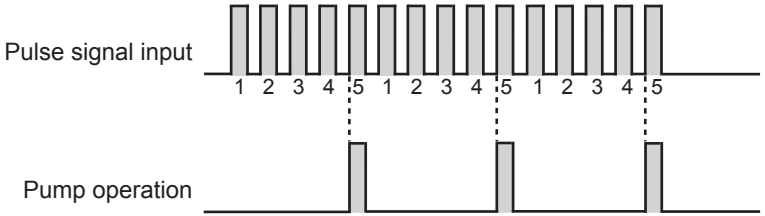
Divider programming (See page 52)

1-999 pulse signals can be allocated to make one shot.

*The pump can not run over 360spm even if the external signal is entered to run the pump beyond the maximum spm.

*The pump runs in 1:1 operation when the divider is programmed to 1.

Example) When the divider is programmed to 5, The pump makes one shot per 5-signal.



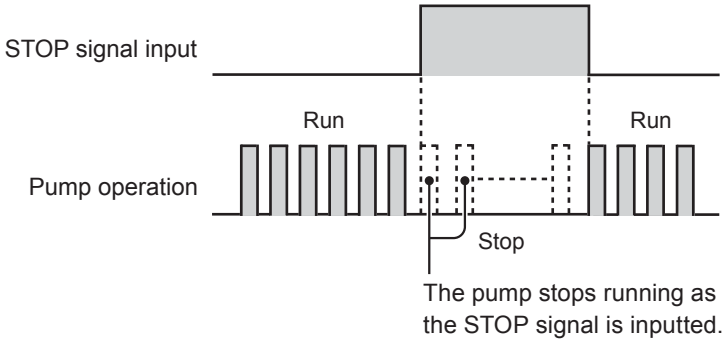
● **STOP function (See 58 page)**

The start/stop of the pump can be controlled by the external STOP signal.

Operation stop at the stop signal input: "M-OF"

The pump stops while receiving the STOP signal.

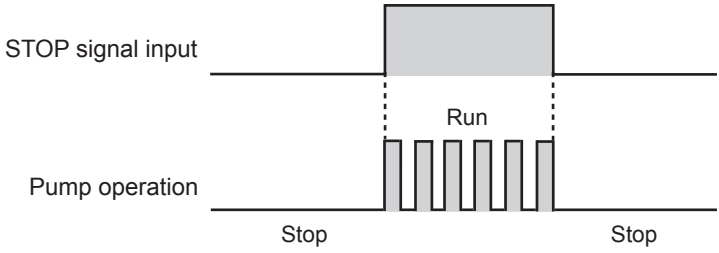
*The pump resumes operation when the stop signal is released.



Operation starts at the STOP signal input: "M-ON"

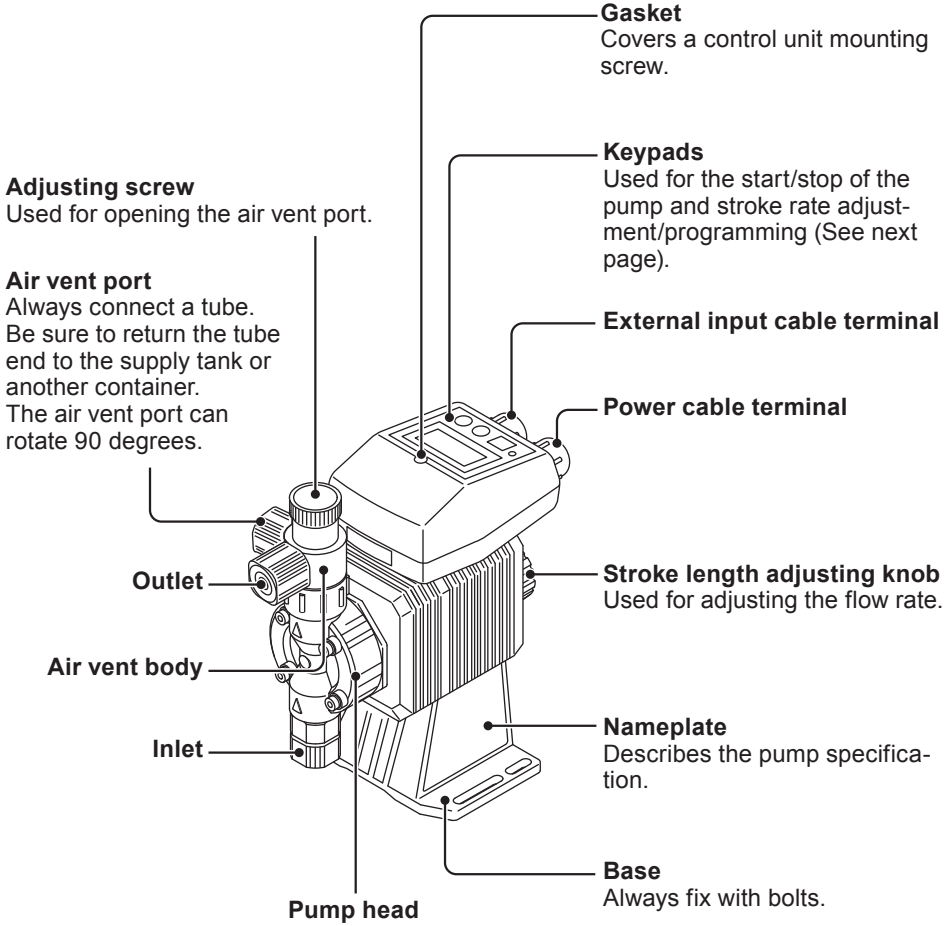
The pump runs while receiving the STOP signal.

*The pump stops operation when the stop signal is released.



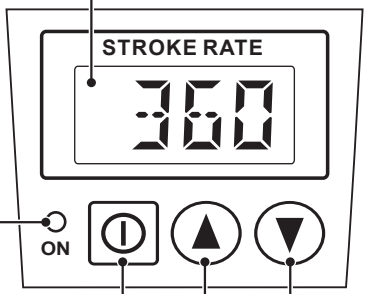
Part names

Pump



*The air vent port is not provided to the EHN-□31•36 and the FC types.

Display
An operational status, current mode and programmed value are shown here.



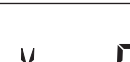
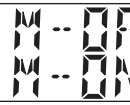
LED
Lights as the pump is turned on and blinks at each shot.

START/STOP key
Used for starting/stopping the pump operation.

DOWN key
Used for decreasing numeric values or selecting a programming mode. Pushing the DOWN key while pressing the START/STOP key in a manual wait state, the pump enters EXT mode.

UP key
Used for increasing numeric values or selecting a programming mode. Pushing the UP key while pressing the START/STOP key in a manual wait state, the pump enters EXT mode.

■ Basic displays & Pump states

	LED lights	LED blinks
	A wait state in manual mode The screen shows the manual operation spm.	Operation in manual mode. spm indication blinks. The screen shows manual operation spm.
	A wait state in EXT mode (E-EX), waiting for the external signal.	Operation in EXT mode (E-EX) receiving the external signal.
	A wait state in EXT mode (E-SP), waiting for the external signal. The screen shows ".0".	Operation in EXT mode (E-SP), receiving the external signal. The screen shows manual operation spm.
	The stop function is suspending the pump operation.	—
	The pump is stopped by the stop signal in the manual wait state.	—
	Anti-chattering programming T-5, T-10 and T50 are the approximate time (msec) to read the external pulse signal.	—
	Divide is selected in EXT mode.	—
	Multiply is selected in EXT mode.	—
	Divider is programmed in EXT mode. In this programming the pump makes one shot per 5-signal.	—
	Multiplier is programmed in EXT mode. In this programming the pump makes five shots per signal.	—
	STOP function is programmed.	—
	The input of the external signal is over the programmed upper limit spm in EXT mode. The pump runs at the programmed upper limit spm.	—
	Keypad is locked. In this state key operation is cancelled. First release the lock state before operation.	Keypad is locked. In this state key operation is cancelled. First release the lock state before operation.

Identification codes

The model codes of the pump/drive units and the control unit represent the following information.

Pump/Drive units

EHN - B 11 VC 1 R - □□

a b c d e f g

a. Series name

EHN: Multivoltage electromagnetic metering pump

b. Drive unit code (Average power consumption)

B: 20W

C: 24W

c. Diaphragm effective diameter

11: 10mm 16: 15mm 21: 20mm

31: 30mm 36: 35mm

d. Wet end materials

Code	Pump head	Valve	O ring	Valve seat	Gasket	Diaphragm
VC	PVC	Alumina ceramic	FKM	FKM	PTFE	PTFE + EPDM (EPDM is not a wet end.)
VH		HC276	EPDM	EPDM		
PC	GFRPP	Alumina ceramic	FKM	FKM		
PH		HC276	EPDM	EPDM		
PP		Alumina ceramic	FKM	PCTFE		
FC	PVDF	Alumina ceramic	-	PCTFE		

Material code

PVC : Transparent polyvinyl chloride

GFRPP : Glassfiber-reinforced polypropylene

PVDF : Polyvinylidene difluoride

EPDM : Ethylene-propylene rubber

FKM : Fluorine-contained rubber

PTFE : Polytetrafluoroethylene

PCTFE : Polymonochlorotrifluoroethyle

HC276 : HASTELLOY C276

e. Tube connection bore code

No.	Tube connection bore	Tube type	Remarks
1	ø4×ø9	PVC braided tube or EVA tube	
2*	ø4×ø6	Teflon or polyethylene tube	FC type standard
3*	ø6×ø8	Teflon or polyethylene tube	
4	ø8×ø13	PVC braided tube or EVA tube	
5*	ø9×ø12	Teflon or polyethylene tube	
6	ø10×ø12	Teflon tube	FC type only
1/2	IN: ø4×ø9 OUT: ø4×ø6	IN: PVC braided tube OUT: Nylon tube	PH-H type only

* means Special version. Others are standard specification.

f. Control unit function code

R: Standard

g. Special version code

01-99 : Special materials and connection bore
55 : High compression type
H : High pressure type
V : High viscosity type

Control unit

EHNC - B R - □□
a b c d

a. Model code

EHNC: Multivoltage control unit

b. Drive unit code

B : 20W
C : 24W

c. Controller function code

R : Standard

d. Special version code

01-99 : Special version

Installation

This section describes the installation of the pump, tubing and wiring. Read through this section before work.

Observe the following points when installing the pump.

- Be sure to turn off power to stop the pump and related devices before work.
- Upon sensing abnormal condition or a dangerous sign, stop the work immediately. Remove problems before resuming work.
- Do not place dangerous or flammable goods near the pump for your safety.
- Risk of an electrical leak or shock. Do not use a damaged pump.

Pump mounting

Select an installation location and mount the pump.

Necessary tools

- Four M5 bolts (pump mounting)
- Adjustable wrench or spanner

1 **Select a suitable place.**

Always fix the pump on a flat floor free of vibration. See page 10 for detail.

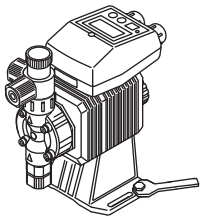
Flooded suction is recommended when handling a gaseous liquid such as sodium hypochlorite.

2 **Fix the pump by the M5 bolts.**

Be sure to fix the pump at four points.

NOTE

Install the pump horizontally. If the pump is installed at a tilt, the flow may reduces.



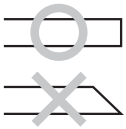
Pipework

Connect tubes to the pump and install a check valve.

Before operation

• Cut the tube ends flat.

Tube end (Side view)



Necessary tools

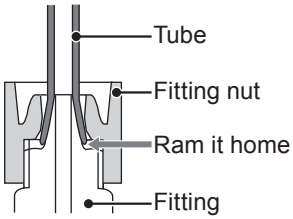
• Adjustable wrench or spanner

Tube connection

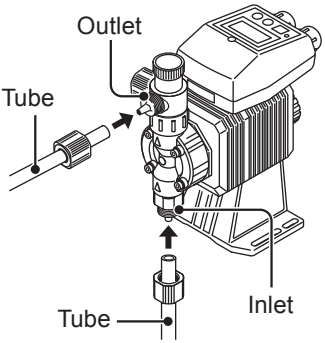
a. Pass a tube into the fitting nut and insert a tube end all the way seated on the fitting. Then hand tighten the fitting nut.

b. Retighten the fitting nut by turning it 180 degrees with an adjustable wrench or spanner.

*The fitting nut is made by plastics and may be broken if it is tightened too much.

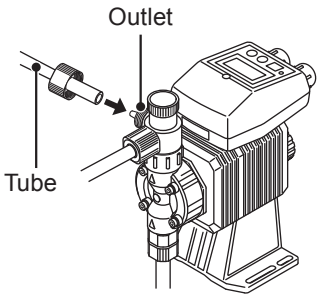


1 **Connect tubes into the inlet and outlet.**



2 **Connect an air bleed tube into the air vent port.**

Place the tube end in the supply tank or another container.



3 **Direction of the air vent port.**

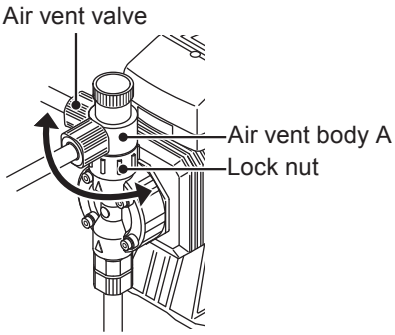
The air vent port can rotate 90 degrees.

a. Turn the lock nut anticlockwise.

b. Adjust the direction of the air vent port.

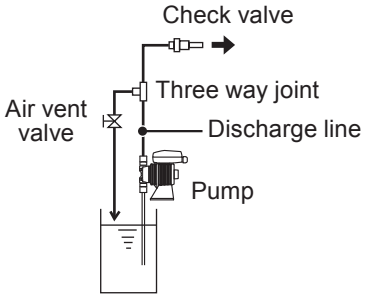
c. Turn the lock nut clockwise and fix it, holding the air vent body A.

d. Further tighten the lock nut by turning it 90 degrees with an adjustable wrench or spanner.



NOTE

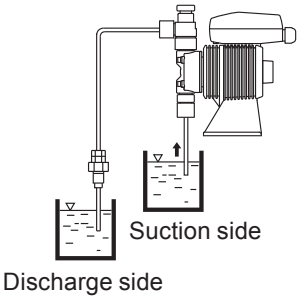
The air vent port is not provided to the EHN-31•36 and FC types. Install an air vent valve. See the right diagram. Optional air vent valves are available except for the FC type. See page 86 for detail.



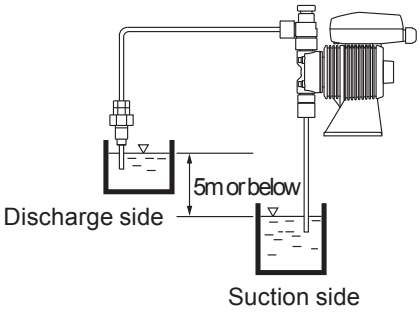
Check valve mounting

The EHN series is equipped with a check valve for the prevention of a back flow, siphon and overfeeding. A back pressure valve is attached to the FC type. In the following cases be sure to install the check valve.

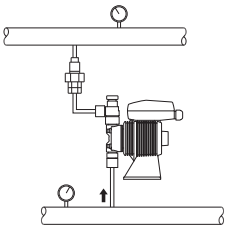
- The suction side liquid level is higher than the discharge side (See the diagram below). Or an injection point is below the suction side liquid level at atmospheric pressure.



- The elevation difference between two liquid levels is five meters or below, even if the discharge side liquid level is higher than the suction side.



- Suction side pressure is higher than the discharge side pressure.

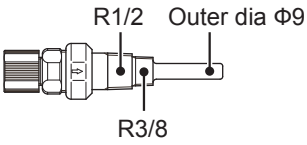


- Discharge pressure (including pipe resistance and discharge head) is below 0.13MPa. (0.049MPa for B31 and C36).

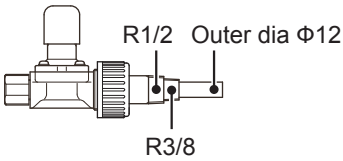
1 Mount the check valve at the discharge tube end.

*The CA check valve and the BVC back pressure valve have R1/2 and R3/8 thread connections as well as tube connection. Cut off and adjust the connection length to fit the check valve into tubing.

CA check valve

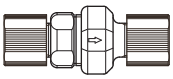


BVC back pressure valve (for FC type)



*The CB check valve of which the both ends are tube connection is also available. Contact us or your nearest dealer.

CB check valve

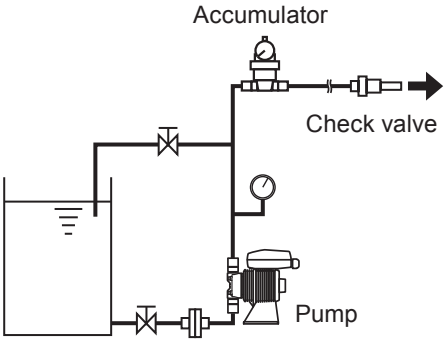


NOTE

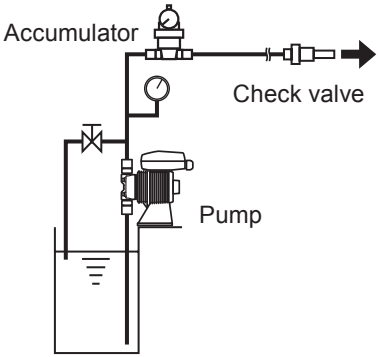
Periodically clean or replace the check valve with new one because it may be clogged by crystal.

Tubing layout

Flooded suction application



Suction lift application



*Flooded suction is recommended when handling a gaseous liquid such as sodium hypochlorite.

Wiring

Wiring for the power source, earthing and external signal.

! Observe the following points during wiring work.

- Electrical work shall be performed by a qualified operator. Always observe applicable codes or regulations.
- Observe the rated voltage range. Otherwise the electrical circuit on the control unit may break.
- Do not perform wiring work while the power is on. Otherwise, an electrical shock and short circuit may result, and consequently the pump may fail. Be sure to turn off power before wiring work.
- Be careful for the power not to be turned on during work.

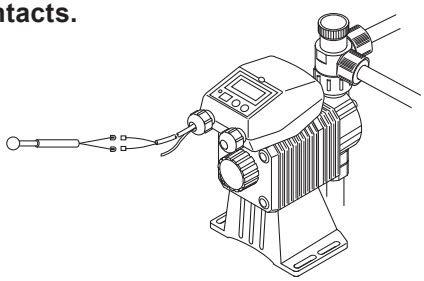
Necessary tools

- Adjustable wrench or spanner
- Phillips screw driver
- Precision screw driver

Power supply/Earthing

Check that the main power is turned off.

1 **Connect power cable via crimp contacts.**



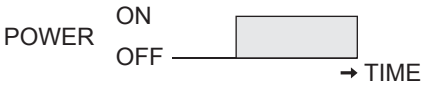
2 **Earth the pump.**

Be sure to earth the pump.

NOTE

- Do not share a power source with a high power equipment which may generate surge voltage. Otherwise electronic circuit may fail. The noise caused by the inverter also affects the electronic circuit.
- Power voltage should be charged at a sitting via a switch or a relay. Otherwise CPU may malfunction. See page 28 for the precautions for ON-OFF control by the relay.

When the power is applied at a sitting



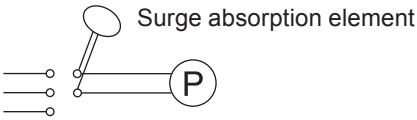
When the power is applied gradually

Surge voltage

The electronic circuit in the control unit may fail due to surge voltage. Do not place the pump close to the high power equipment of 200V or more which may generate large surge voltage.

If the use near the high power equipment is inevitable, take any of the following measures.

- Install a surge absorption element (ex. a varister with capacity of 2000A or more) via power cable.



Recommended varisters

Panasonic	ERZV14D431
KOA	NVD14UCD430

See manufacturer's catalogues for detail.

- Install a noise cut transformer via power cable.

Noise cut transformer

Precautions for ON-OFF control by the relay

The control unit is equipped with CPU. Always start/stop the pump by the STOP signal. Do not start/stop the pump by turning ON/OFF power because it may adversely affect CPU.

If there is no choice but to turn ON/OFF power, observe the following points.

- Do not turn ON/OFF the power more than six times per hour.
- When using a relay for ON-OFF operation, its contact capacity should be 5A or more. Contact point may fail if contact capacity is less than 5A.
- If the contact capacity of 5A is used for the EHN, the maximum ON/OFF operation is about 150,000 times. Use the relay with the contact capacity of 10A or more when making ON-OFF operation over 150,000 times or sharing a power source with a large capacity equipment. Otherwise a contact may fail by surge voltage.
- Use non contact transistor relay as necessary (ex. OMRON G3F). See manufacturer's catalogues for detail.

External input cable

Points to be checked

- Check that the main power is turned off.
  The pump is still charged right after turning off power. Wait for one minute before wiring.

Applicable cables

A cable diameter shall be 7.8mm.

Triplex cable: VCTF-3 1.25mm^2

Duplex cable: UL, CSA SJT 18AWG/2

*The use of a cable diameter other than 7.8mm results in improper connection and reduced seal performance.

NOTE

- Do not install the EXT/STOP signal wires in parallel with a power cable or combine them in a concentric cable (ex. 5 wires cable). Otherwise noise is generated through the EXT/STOP signal wires due to induction effect and it results in malfunction or failure.
- When using the SSR (Solid State Relay) for the EXT/STOP signal input, see the recommended products below. Any SSR other than the recommended ones can cause malfunction. See manufacturer's information such as catalogues for detail.
  –OMRON G3FD-102S or G3FD-102SN
  –OMRON G3TA-IDZR02S or G3TA-IDZR02SM
- When using a contact type relay for the EXT/STOP signal input, the minimum application load should be 5mA or below.

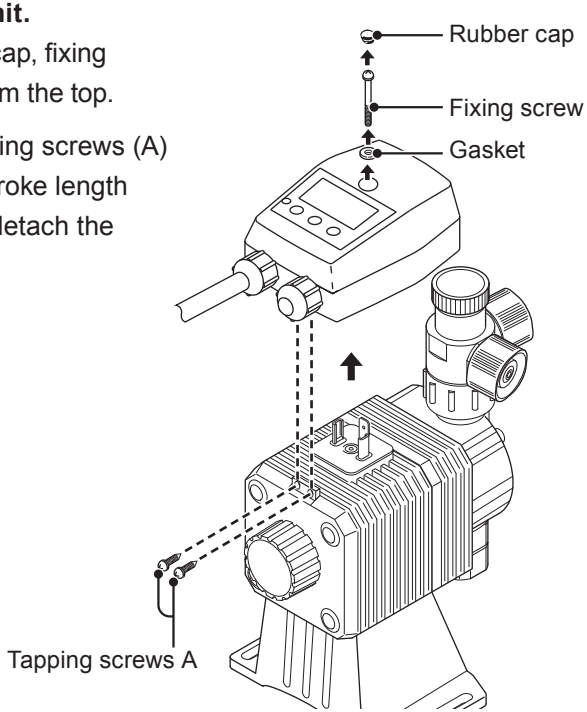
*Use either a no-voltage contact or an open collector for the external signal.

*Set pulse duration in 10-100ms and the number of pulses at or below 360 pulses per minute (For the VH/PH-V type set at or below 300 pulses per minute).

1 **Remove the control unit.**

a. Remove the rubber cap, fixing screw and gasket from the top.

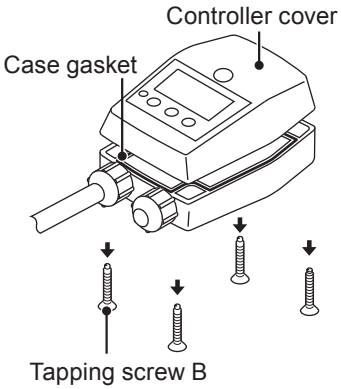
b. Loosen the two tapping screws (A) located above the stroke length adjusting knob and detach the control unit.



2 **Remove four screws (B) from the bottom of the control unit to detach the controller cover.**

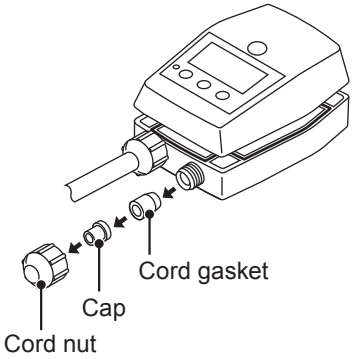
*The controller cover can not be totally removed because the screen on the controller cover and the PCB on the controller case are connected via cable.

*The controller cover and the controller case are sealed by a case gasket. Do not forger to fit the case gasket when mounting the controller cover.



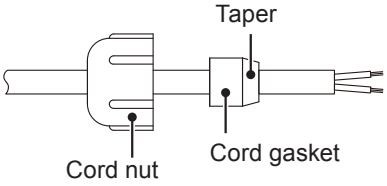
3 **Remove a cord nut and a cap and pull out a cord gasket.**

*The cap is no longer used.



4 **Pass the external signal cable into the control unit via the cord nut and the cord gasket.**

*Be careful not to oppositely orient the cord gasket.



5 Connect an external signal cable.

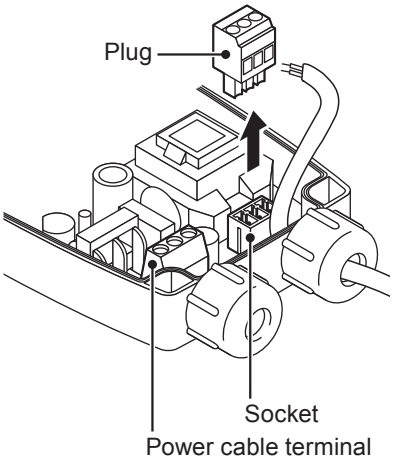
a. Detach the plug from the socket.

b. Use a precision screwdriver to connect the signal wires on the plug and then attach the plug to the socket.

c. Adjust the slackness of the external signal cable, pulling it out.

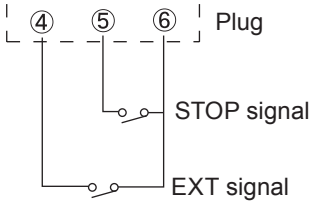
d. Securely hand tighten the cord nut.

*The external signal cable is sealed by the cord gasket.

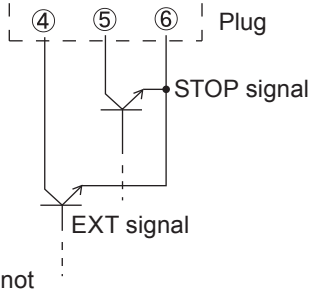


Wiring diagram

When a no-voltage contact is used



When an open collector signal is used



*The pump does not break but not run if wiring is done incorrectly.

6 Attach the controller in a reverse way of the item 1 and 2.

Tightening torque

Fixing screw (For mounting control unit)	0.39 N•m
Tapping screw A (For mounting control unit)	0.39 N•m
Tapping screw B (For mounting control cover)	0.8 N•m

NOTE

Always check that gaskets (a rubber cap, fixing screw gasket and a case gasket) are fitted. Otherwise, the liquid may enter the control unit and failure may result.

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

Before operation

Check the flow rate, tubing and wiring. And then perform degassing and flow rate adjustment before starting operation.

Points to be checked

Before operation, check if...

- Liquid level in the supply tank is enough.
- Tubing is securely connected and is free from leakage and clogging.
- Discharge/suction valves are opened.
- Proper power voltage is applied to the pump.
- Electrical wiring is correct and is free from the risk of short circuit and electrical leakage.

Retightening of pump head fixing bolts

Important

The pump head fixing bolts may loosen when plastic parts creep due to temperature change in storage or in transit.
This can lead to leakage. Retighten the pump head fixing bolts before starting operation.
Always tighten the bolts diagonally. See below for the tightening torque at each model.

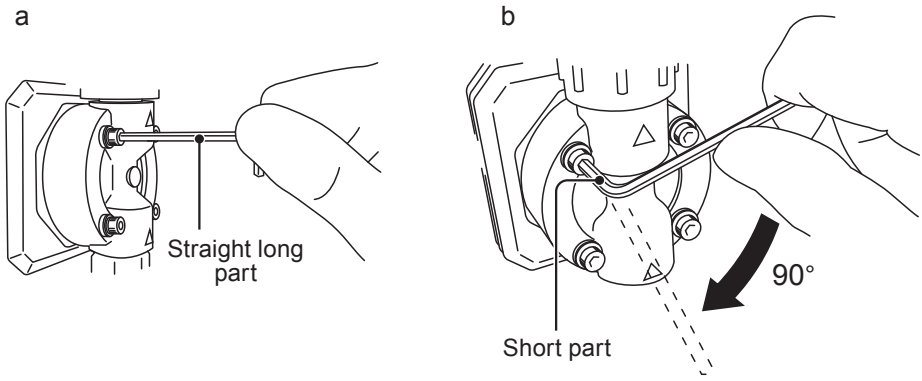
Tightening torque

Model identification code	Torque	Bolts
EHN-B11•16•21	2.16 N•m	M4 Hex. socket head bolt
EHN-B31	2.55 N•m	M4 Hex. socket head bolt
EHN-C16•21	2.16 N•m	M4 Hex. socket head bolt
EHN-C31	2.55 N•m	M4 Hex. socket head bolt
EHN-C36	2.55 N•m	M5 Hex. socket head bolt

*Tighten fixing bolts once every three months.

■ **Use of hexagon wrench instead of a torque wrench**

Tighten the fixing bolts with the straight long part of a hexagon wrench (a) and further turn the bolts clockwise 90 degrees with the short part (b).



Degassing

The gas needs to be expelled from the pump and tubing by degassing. Normal operation can not be obtained with gas in the pump. Perform degassing in the following cases.

- When the pump starts to run for the first time
- When the flow rate is too low
- After liquid is replaced in the supply tank
- After a long period of stoppage
- After maintenance and inspection

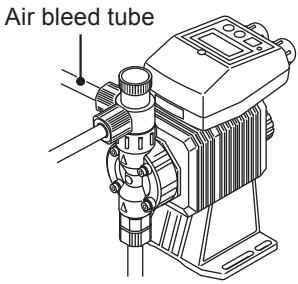
NOTE

- Both gas and chemical come out together through air bleed tube. Place the end of the tube in the supply tank or another container.
- Some chemicals may cause skin trouble or damage component parts. When your hand or component parts get wet with chemical liquid, wipe off immediately.

■ EHN-□ [11•16•21] [VC•VH•PC•PH•PP]

Points to be checked

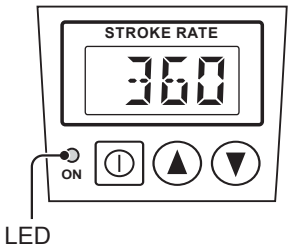
• An air bleed tube is connected to the pump.



1 **Turn on power.**

The LED lights and a display related to the current mode appears on the screen.

*The pump enters the wait state in the manual mode when turning on power with a default setting. The pump calls up the last screen at a shutoff if it was not in a default setting.



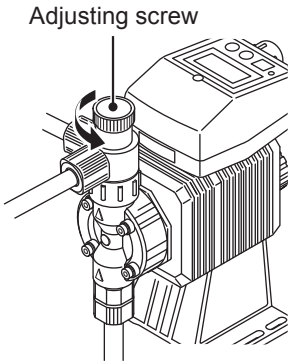
2 **Program the stroke rate to 360spm.**

• This programming is not necessary when the display already shows 360. Move to the next step.

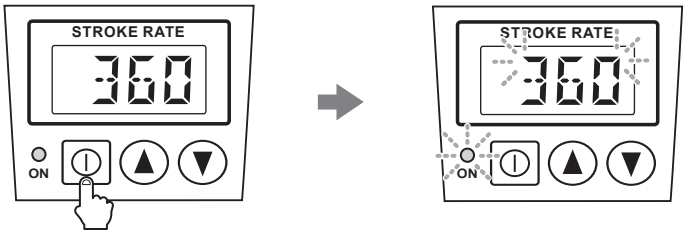
• See page 39 "Stroke rate adjustment" for detail.

3 **Rotate the adjusting screw two revolutions anticlockwise to open the air vent port.**

*Do not rotate it three revolutions. Otherwise, liquid may comes out from the air vent port.



4 **Push the start/stop key and run the pump for more than ten minutes.**



5 **Push the start/stop key and stop the pump.**

6 **Rotate the adjusting screw clockwise to close the air vent port.**

7 **Check liquid is discharged.**

*Degassing is required again if the pump does not discharge liquid.

8 **Check connections for leakage.**

Degassing has now been completed.

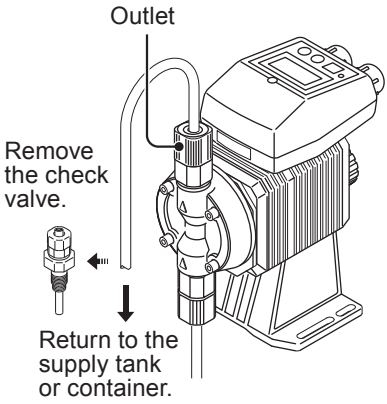
■ **EHN-□ [11•21] [FC] and [31•36] [VC•VH•PC•PH•PP•FC]**

The air vent port is not provided to the EHN-31•36 and the FC types. Install an air vent valve on the discharge line for degassing. See page 23 for detail. Follow the procedure below to conduct degassing if the air vent valve is not available.

1 **Connect a discharge tube and place the tube end in the supply tank or another container.**

*Remove the check valve from the discharge tube if it is installed.

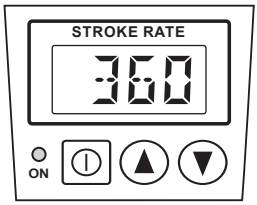
*When resuming the pump operation after liquid replacement in the supply tank or after a long period of stoppage, the internal pressure may remain in the pump or tubing. Removing the check valve at this state, liquid may gush out. Wrap a waste cloth around the check valve connection for the prevention of gushing.



2 **Turn on power.**

The LED lights and a display related to the current mode appears on the screen.

*The pump enters the wait state in the manual mode when turning on power with a default setting. The pump calls up the last screen at a shutoff if it was not in a default setting.



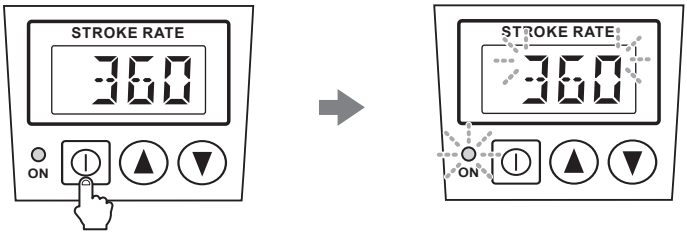
3 **Program the stroke rate to 360spm.**

- This programming is not necessary when the display already shows 360. Move to the next step.
- See page 38 "Flow rate adjustment" for detail.

*Program 300spm for the VH/PH-V.

4 **Push the start/stop key and run the pump for more than ten minutes.**

The LED and spm indication blink during operation.



5 **Push the start/stop key and stop the pump.**

6 **Check that gas has been expelled from the pump head and liquid is pumped. Then reconnect the discharge tube to tubing system.**

7 **Check connections for leakage.**

Degassing has now been completed.

Flow rate adjustment

A flow rate can be adjusted by the stroke rate and stroke length.

The stroke rate is indicated in spm (stroke per minutes).
Stroke rate adjustment is a main way to adjust a flow rate.

Stroke length is the moving distance of the plunger.
A flow rate per shot can be controlled by changing stoke length. The widest moving distance is defined as 100% stroke length.

First adjust the flow rate by stroke rate adjustment. Use stroke length adjustment for the range where stroke rate adjustment can not reach.
Determine a suitable stroke length and stroke rate, taking account of the pump operating condition and liquid characteristics.

The following procedure is recommended.

1 **Change a stroke rate with stroke length 100% to adjust a flow rate.**
- See "Stroke rate adjustment" on page 39 and "Stroke length adjustment" on page 41 for detail.

2 **Measure a flow rate.**

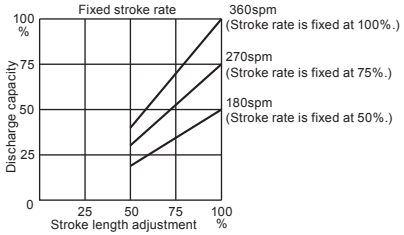
3 **If the flow rate is lower than a specified level, increase the stroke rate and measure the flow again.**

4 **Change the stroke length for fine adjustment.**

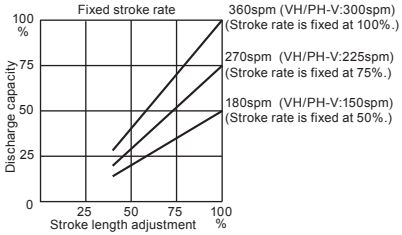
5 **Measure the flow again to see the specified level is obtained.**

Flow rate, stroke rate and stroke length

B type



C type



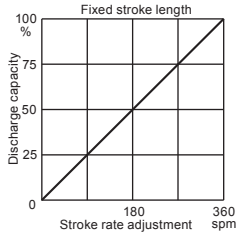
Precautions of flow rate adjustment

- **When back pressure is high**
  Set stroke length to 100% and adjust the flow by changing a stroke rate.
- **When the flow rate per shot greatly influences the reaction in neutralization or titration application**
  Shorten the stroke length to reduce the flow rate per shot. And then adjust the flow by changing a stroke rate.
- **When pumping gaseous liquid such as sodium hypochlorite (NaClO) and hydrazine solution ($N_2H_2O_2$)**
  Set stroke length to 100% and adjust the flow by changing stroke rate.
  Air lock may occur when stroke length is set short.

■ Stroke rate adjustment

Stroke rate can be set by keypad operation.
The stroke rate can be programmed from 1 to 360spm (1 to 300spm for VH/PH-V).

The relation between a flow rate* and stroke rate is shown as below.

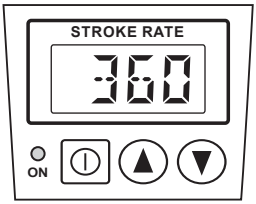


*The flow rate described on the nameplate is at 100%.

1 **Turn on power and call up manual mode.**

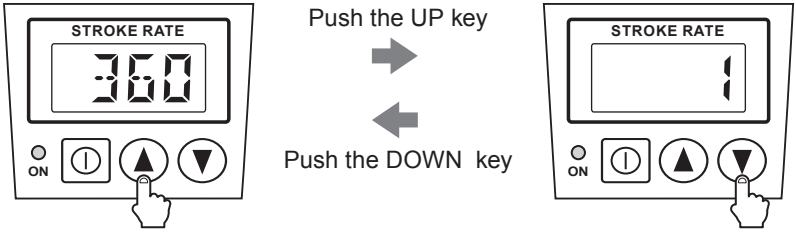
Enter manual mode to indicate spm on the screen.

- Push the EXT key when "EXT" or ".0"-".360" is on the screen.
- When "STOP" or "-STOP" appears on the screen, see "STOP function cancellation" on 60 page and release the STOP function.



2 **Use the UP or DOWN key to adjust stroke rate.**

- spm increases/decreases as pushing the UP/DOWN keys.
- Press and hold either key for more than three seconds for quick change. Quick change stops at 1 or 360spm. 1 or 360rpm skips to 360 or 1spm when the key is released and pushed again.

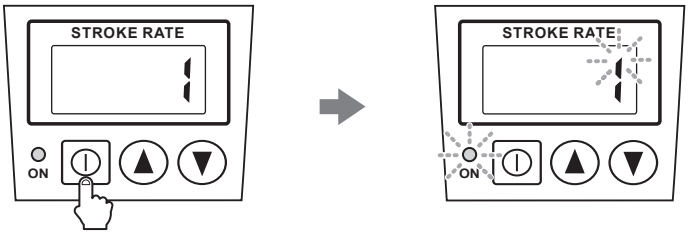


*Programmable range is 1-300spm for the VH/PH-V.

3 **Push the start/stop key.**

The LED and spm indication blink as the pump starts to run.

- They blink in sync with the pump operation.

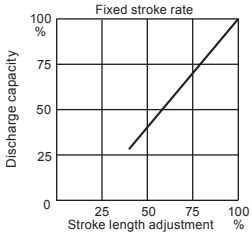


■ **Stroke length adjustment**

Stroke length can be adjusted when the moving distance of the plunger is changed by the stroke length adjusting knob.

The stroke length adjustment range is 50-100% for the B type, 40-100% for C type.

The relation between a flow rate* and stroke length is shown as below.



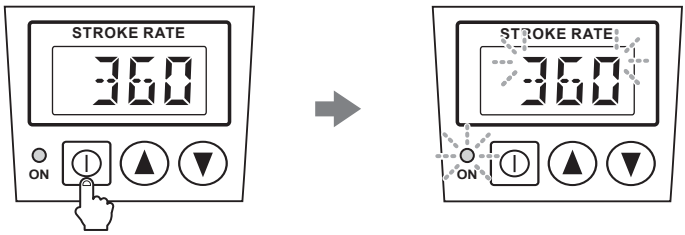
*The flow rate described on the nameplate is at 100%.

NOTE

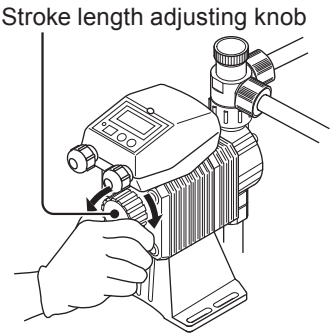
Do not rotate the stroke length adjusting knob when the pump is not running.

1 **Turn on power and push the start/stop key to run the pump.**

The LED and spm indication blink during operation.



2 **Rotate the stroke length adjusting knob and adjust a flow rate while the pump is running.**



Before a long period of stoppage (One month or more)

Clean the insides of pump head and tubing.

• Run the pump with clean water for about thirty minutes to rinse the insides of the pump head and tubing.

Before unplugging the pump

• Always stop the pump by key operation. Wait for three seconds before unplugging the pump. Otherwise, the last key operation to stop the pump may not be put in memory. In this case the pump unintentionally starts to run as powered on, discharging liquid.

When the pump does not transfer liquid at resuming operation.

• Clean the valve sets, removing foreign matters.

• If gas is in the pump head, expel gas and readjust the flow rate. See "Degassing" on page 33 and "Flow rate adjustment" on page 38 for detail.

Operation programming

The pump operation is programmed and controlled by a control unit.
The pump is controlled in different ways at each operation mode.

Default setting and setting range

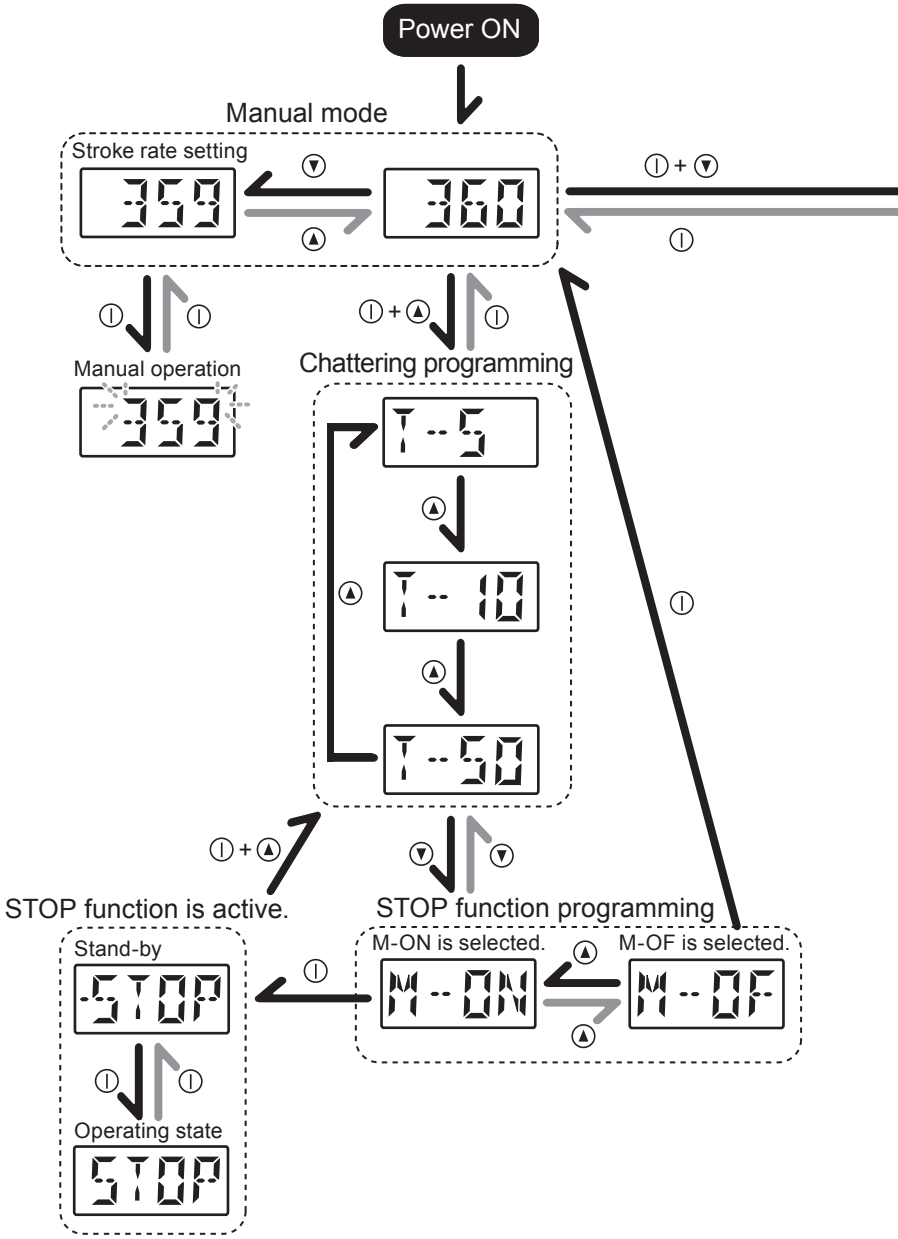
Parameters	Default setting	Setting range	Step
Stroke rate*1	360 (VH/PH-V: 300spm)	1-360 (VH/PH-V:1-300spm)	1*2
Multiply/Divide selection	/NNN	/NNN, XNNN	-
Divider	1	1-999	1*2
Multiplier	1	1-999	1*2
Display selection	E-EX	E-EX/E-SP	-
Anti-chattering programming*3	T-5	T-5/T-10/T-50	-
STOP function*4	M-OF	M-ON/M-OF	-

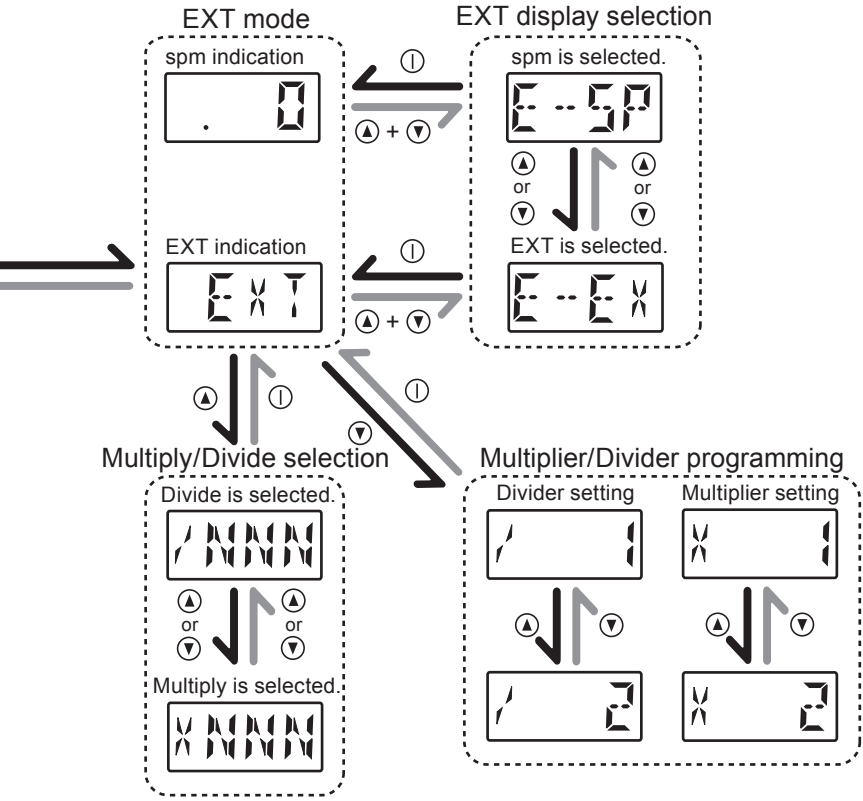
*1 The upper limit spm in EXT mode

*2 spm increases/decreases as pushing the UP/DOWN keys. Pressing either key for more than three seconds, spm changes quickly.

*3 The controller becomes more resistant to chattering as read time is set longer but then becomes less capable of reading the short pulse signal. "T-5", "T-10" and "T50" are the approximate time (msec) to read the external pulse signal. An ON time period of the pulse signal shall be longer than the read time.

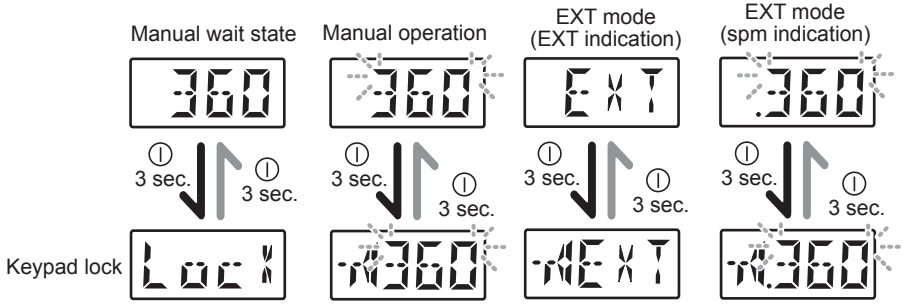
*4 Note that the pump starts to run as returning to the wait state in the manual mode as long as the pump is receiving the STOP signal and "M-ON" is selected.


Power ON
Manual mode
Stroke rate setting
359
360
Manual operation
359
Chattering programming
T--5
T--10
T--50
STOP function is active.
STOP function programming
Stand-by
STOP
Operating state
STOP
M-ON is selected.
M--ON
M-OF is selected.
M--OF



Keypad lock

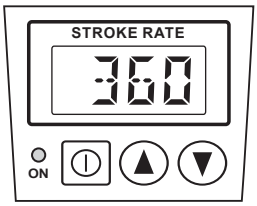
Key operation is not accepted in the following displays once keypad lock became active.



1 **Turn on power.**

The LED lights and a display related to the current mode appears on the screen.

*The pump enters the wait state in the manual mode when turning on power with a default setting. The pump calls up the last screen at a shutoff if it was not in a default setting.

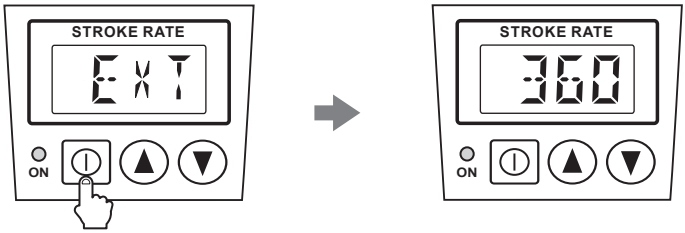


2 **Enter manual mode.**

Move to the next step when spm (1-360) is shown on the screen.

When "EXT" or ".0"-".360" is on the screen

Push the start/stop key once to enter the wait state in manual mode.

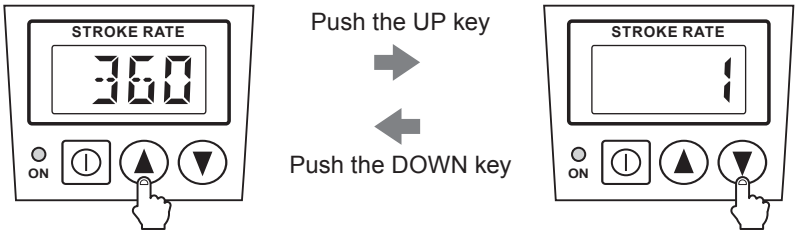


When "STOP" or "-STOP" is on the screen

See "STOP function cancellation" on page 60 and release the function.

3 **Use the UP or DOWN key to adjust stroke rate.**

- spm increases/decreases as pushing the UP/DOWN keys.
- Press and hold either key for more than three seconds for quick change. Quick change stops at 1 or 360spm. 1 or 360rpm skips to 360 or 1spm when the key is released and pushed again.

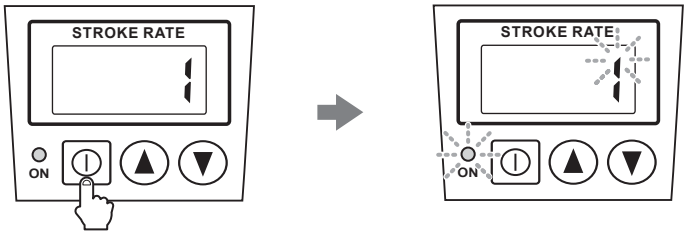


*Programmable range is 1-300spm for the VH/PH-V.

4 **Push the start/stop key.**

The LED and spm indication blink as the pump starts to run.

- They blink in sync with the pump operation.



EXT operation

The pump operation is controlled by the external (pulse) signal.

■ EXT mode

Set the upper limit spm and enter EXT mode. Note that the pump starts to run in sync with the external signal as entering EXT mode.

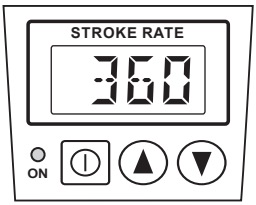
NOTE

- Manual operation spm is applied as the EXT upper limit spm. For example, even if the external signal is entered to run the pump at 360spm, the pump does not run over 200spm as long as manual operation spm is 200rpm
- A stroke rate skips from 360spm (300spm for the VH/PH-V) to 1spm by pushing the UP key once. Pay attention to this point when programming a stroke rate.

1 Enter manual mode.

Enter the manual mode to indicate spm on the screen.

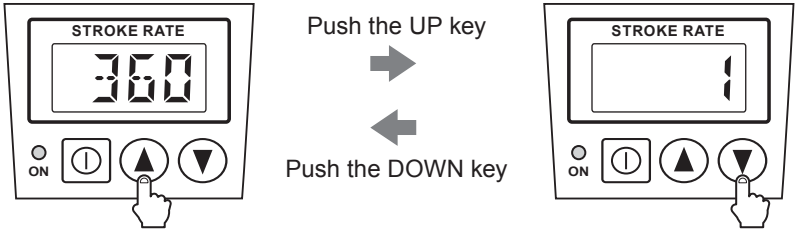
- Push the start/stop key when "EXT" or ".0"-".360" is on the screen.
- When "STOP" or "-STOP" appears on the screen, see "STOP function cancellation" on 60 page and release the STOP function.



2 Use the UP or DOWN key to program the upper limit spm.

Push the start/stop key and stop the pump when the pump is running. Then program spm.

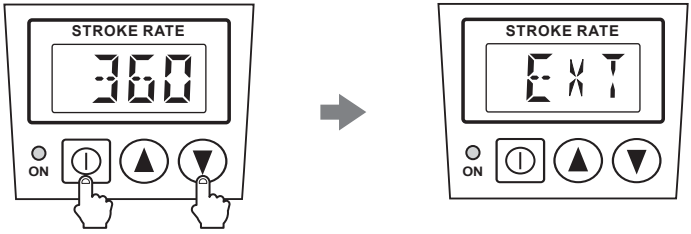
- spm increases/decreases as pushing the UP/DOWN keys.
- Press and hold either key for more than three seconds for quick change. Quick change stops at 1 or 360spm. 1 or 360rpm skips to 360 or 1 spm when the key is released and pushed again.



*Programmable range is 1-300spm for the VH/PH-V.

3 **Push the DOWN key while pressing the start/stop key to enter EXT mode.**

Note that the pump starts to run in sync with the external signal as entering EXT mode.



■ **EXT mode programming**

The following features can be programmed for the EXT operation.

- **Multiplier programming**
  The number of shots per signal is programmed.
- **Divider programming**
  The number of signals per shot is programmed.
- **Anti-chattering programming**
  The read time of the pulse signal is programmed in consideration of the accrual of chattering in order to reduce noise.
- **Display selection**
  Either "EXT" or "spm" indication is selected for EXT mode.

NOTE

Pushing the start/stop key, a program is entered. Do not forget to enter your programming. Note if the pump is unplugged before pushing the start/stop key, your programming is not stored.

Glossary

Chattering

A phenomenon the electrical signal repeats ON and OFF, disturbing pulse shape. The mechanical vibration which occurs when the relay or switch functions brings about this problem.

Multiplier programming

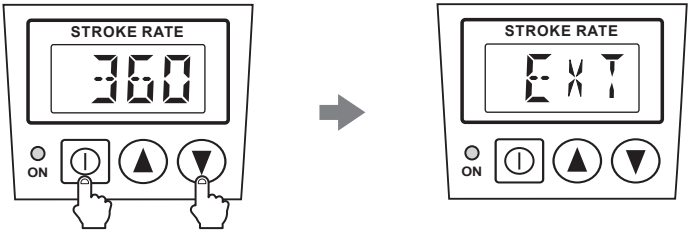
Program the number of shots per signal to control the pump. The number of shots can be programmed from 1 to 999.

NOTE

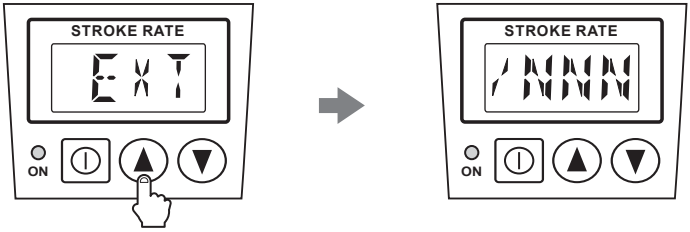
Do not enter the EXT signal during the programming.

1 **Enter EXT mode.**

- Push the DOWN key while pressing the start/stop key to move from manual mode to EXT mode.
- Push the start/stop key and stop the pump when the pump is running. Then call up EXT mode.

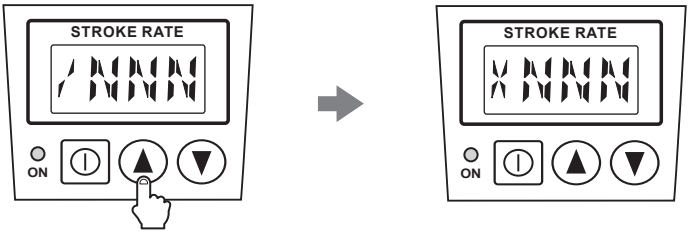


2 **Push the UP key and enter the Multiply/Divide selection.**

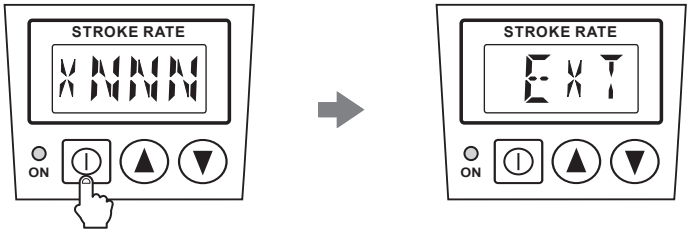


3 **Select "X NNN" (Multiply).**

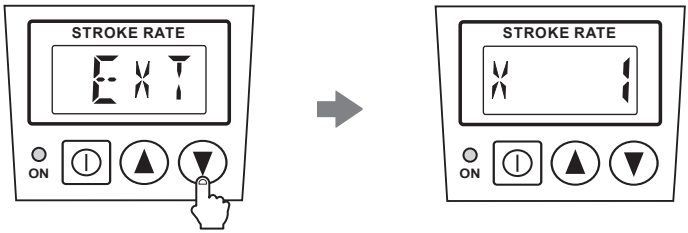
"X NNN" (Multiply) or "/ NNN" (Divide) can be selected by the UP and DOWN keys.



4 **Push the start/stop key to return to EXT mode.**

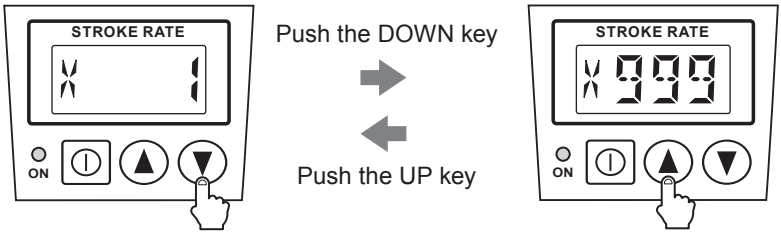


5 **Push the DOWN key and call up the multiplier programming screen.**

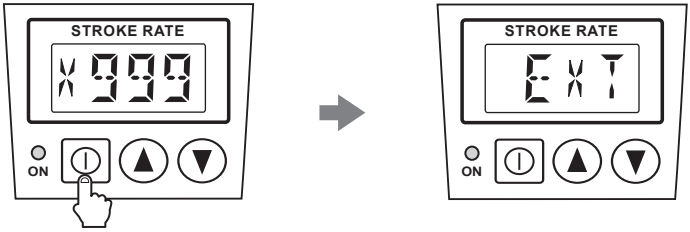


6 **Use the UP or DOWN key to program a multiplier.**

- A multiplier increases/decreases as pushing the UP/DOWN keys.
- Press and hold either key for more than three seconds for quick change. Quick change stops at 1 or 999. 1 or 999 skips to 999 or 1 when the key is released and pushed again.



7 **Push the start/stop key to return to EXT mode.**



The pump runs according to the multiplier programming.

Divider programming

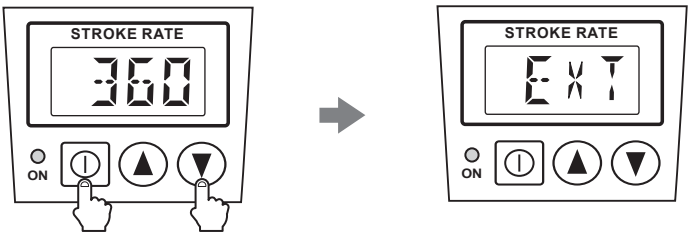
Program the number of signals per shot to control the pump. The number of signals can be programmed from 1 to 999.

NOTE

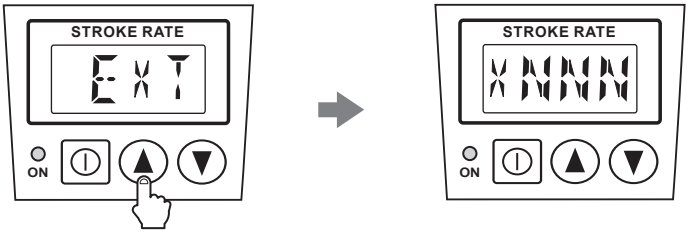
- If a divider is programmed to 1 to make 1:1 operation and the input interval of the external signal is close to a manual operation spm (but not exactly in synchronization), irregular operation may occur. This irregular operation occurs as the external signal is cancelled. Note that this is not malfunction. In order to avoid this phenomenon, perform 1:1 operation by programming a multiplier to 1.
- Do not enter the EXT signal during the programming.

1 **Enter EXT mode.**

- Push the DOWN key while pressing the start/stop key to move from manual mode to EXT mode.
- Push the start/stop key and stop the pump when the pump is running. Then call up EXT mode.

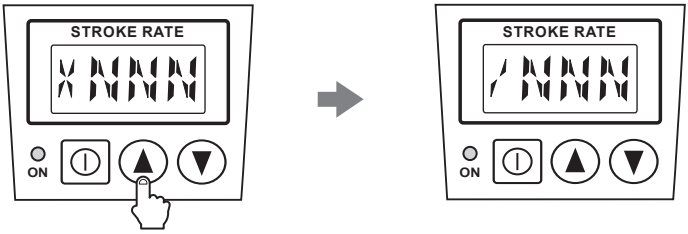


2 **Push the UP key and enter the Multiply/Divide selection.**

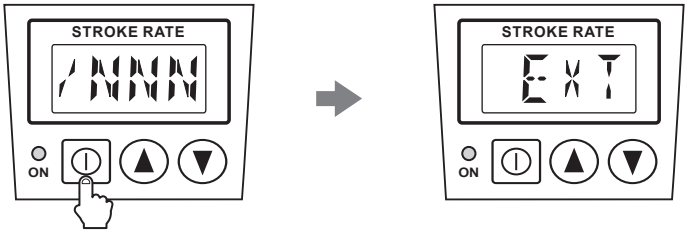


3 **Select "/ NNN"(Divide).**

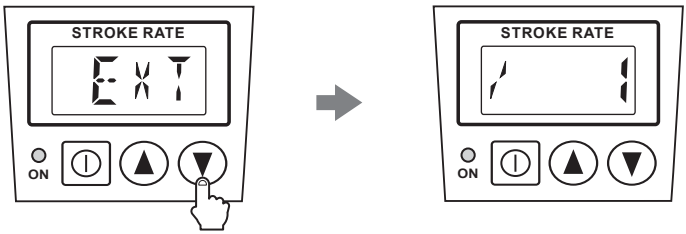
"X NNN" (Multiply) or "/ NNN" (Divide) can be selected by the UP and DOWN keys.



4 **Push the start/stop key to return to EXT mode.**

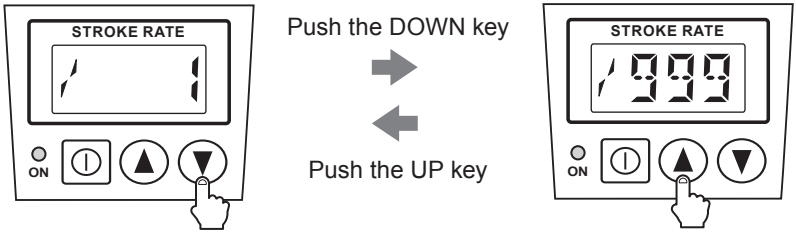


5 **Push the DOWN key and call up the divider programming screen.**

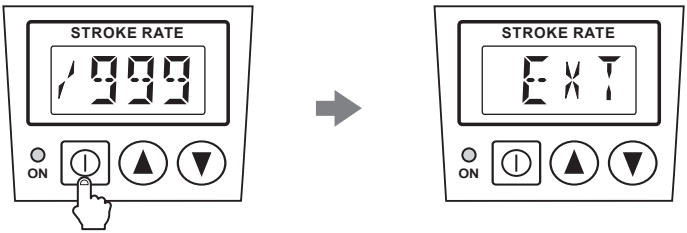


6 **Use the UP or DOWN key to program a divider.**

- A divider increases/decreases as pushing the UP/DOWN keys.
- Press and hold either key for more than three seconds for quick change. Quick change stops at 1 or 999. 1 or 999 skips to 999 or 1 when the key is released and pushed again.



7 **Push the start/stop key to return to EXT mode.**



The pump runs according to the divider programming.

Anti-chattering programming

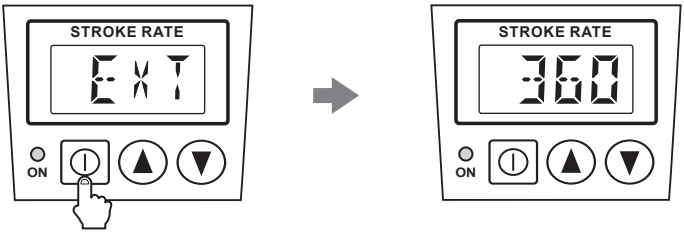
The read time of the pulse signal is programmed in consideration of the accrual of chattering in order to reduce noise. Normally select "T-5" (default setting). Select "T-10" or "T-50" according to the amount of noise as necessary.

NOTE

When this product is used in conjunction with the 50 series or the EUC-70P electro-magnetic metering pump controller, select "T-5" (default setting). The pump may not run with "T-10" or "T-50".

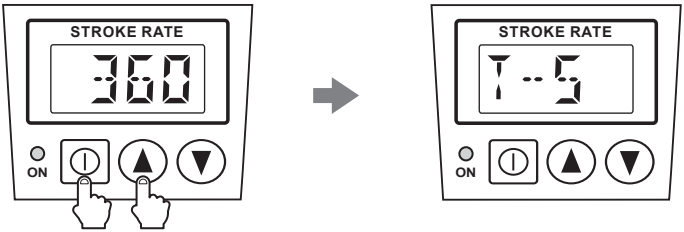
1 **Enter manual mode.**

• Push the start/stop key to return to manual mode if the pump is in EXT mode.



2 **Push the UP key while pressing the start/stop key to call up the anti-chattering programming screen.**

"T-5" (default setting), "T-10" or "T-50" appears on the screen.



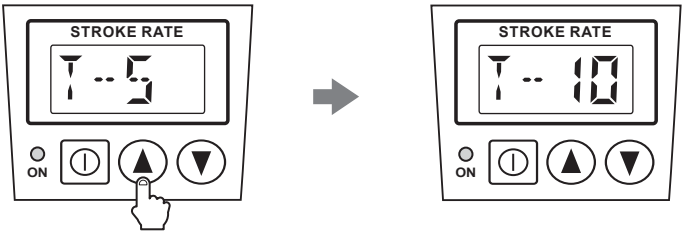
3 **Push the UP key and select a read time.**

Pushing the UP key cycles through "T-5", "T-10" and "T-50".

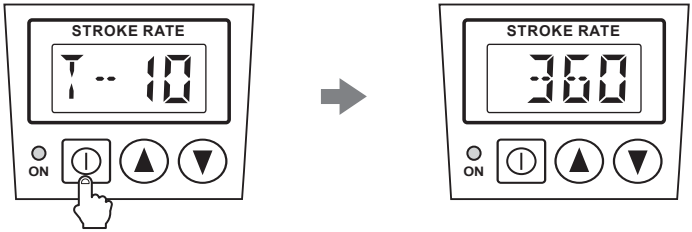
*T-5, T-10 and T50 are the approximate time (msec) to read the external pulse signal.

*The controller becomes more resistant to chattering as read time is set longer but then becomes less capable of reading the short pulse signal. An ON time period of the pulse signal shall be longer than the read time.

*When this product is used in conjunction with the 50 series or the EUC-70P electromagnetic metering pump controller, select "T-5" (default setting).



4 **Push the start/stop key to return to manual mode.**



Display selection

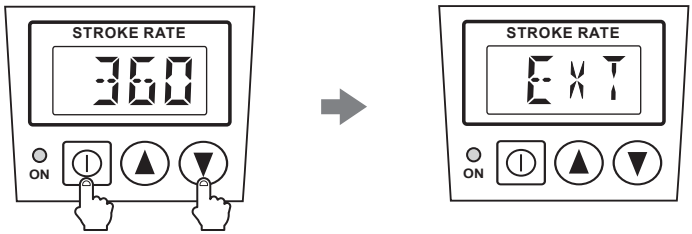
Either "EXT" or "spm" indication is selected for EXT mode.
EXT indication appears when "EXT" is selected. A stroke rate appears when a spm indication is selected.

NOTE

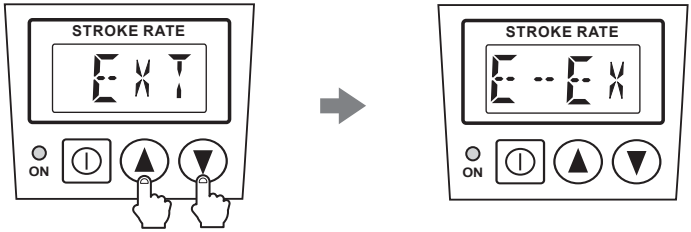
- The spm indication shows a current stroke rate. The number of external pulse signals is not shown on the screen. Note that the stroke rate shown in EXT mode is an calculated spm and doesn't reflect a current spm exactly.
- Do not enter the EXT signal during the programming.

1 **Enter EXT mode.**

- Push the DOWN key while pressing the start/stop key to move from manual mode to EXT mode.
- Push the start/stop key and stop the pump when the pump is running. Then call up EXT mode.

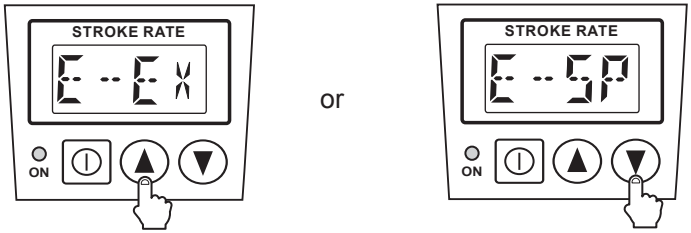


2 **Push the DOWN key while pressing the UP key to call up the display selection screen.**



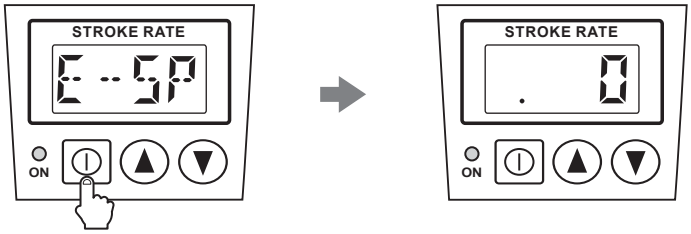
3 **Push the UP or DOWN key to select "E-EX" (EXT indication) or "E-SP" (spm indication).**

EXT indication **spm indication**



4 **Push the start/stop key to return to EXT mode.**

When spm indication is selected



"EXT" appears on the screen when EXT indication is selected.

STOP function

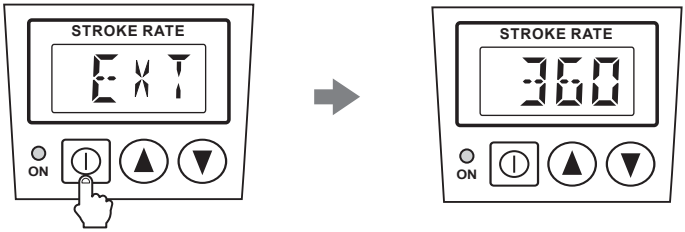
The start/stop of the pump operation can be controlled by the external stop signal.

- **Operation stop at the stop signal input: "M-OF"**
  The pump stops while receiving the stop signal.
- **Operation starts at the stop signal input: "M-ON"**
  The pump runs while receiving the stop signal.

■ STOP function programming

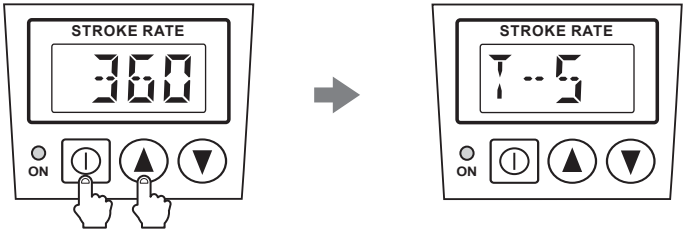
1 **Enter manual mode.**

Push the start/stop key to return to manual mode if the pump is in EXT mode.



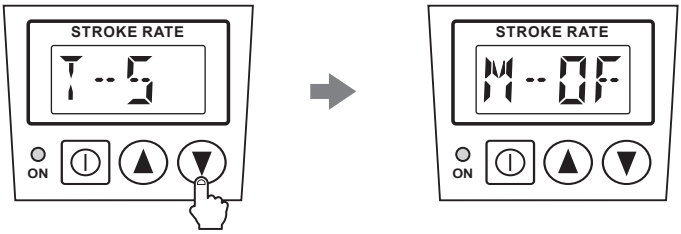
2 **Push the UP key while pressing the start/stop key to call up the anti-chattering programming screen.**

"T-5" (default setting), "T-10" or "T-50" appears on the screen.

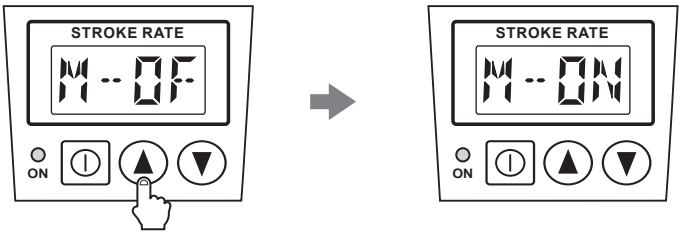


3 **Push the DOWN key and call up the STOP function programming screen.**

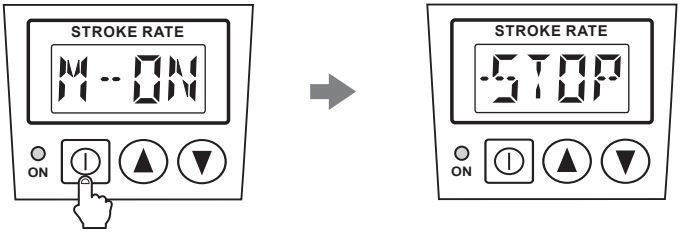
"M-OF" (default setting) or "M-ON" appears on the screen.



4 **Push the UP key to select "M-OF" (stop during the signal input) or "M-ON" (run during the signal input).**



5 **Push the start/stop key to return to manual mode.**



The screen indicates that the STOP function is active.

■ **STOP function cancellation**

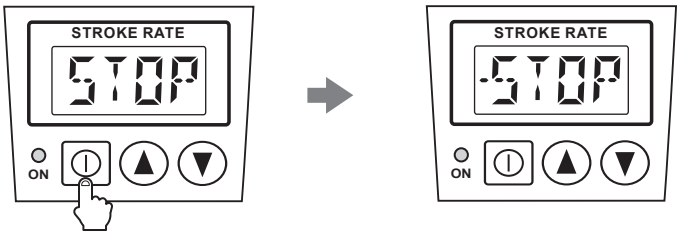
A stop state can be cancelled if the current selection is changed.

Example) M-OF→M-ON

M-ON→M-OF

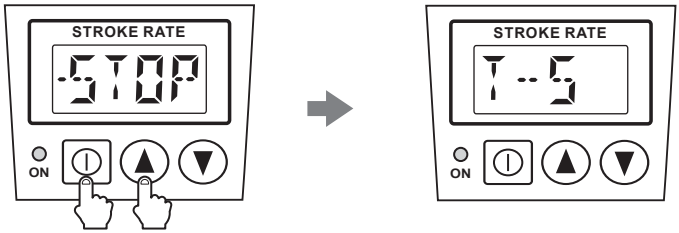
1 **Enter the wait state in the manual mode with the STOP function active. "-STOP" appears on the screen.**

- If the screen shows "STOP" or the pump is in the EXT mode, push the start/stop key to enter the "-STOP" state.
- Move to the next step if the pump is in the "-STOP" state.



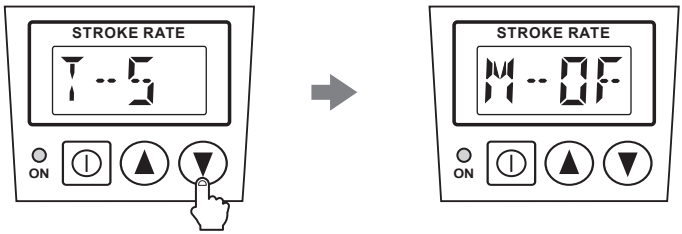
2 **Push the UP key while pressing the start/stop key to call up the anti-chattering programming screen.**

"T-5" (default setting), "T-10" or "T-50" appears on the screen.



3 **Push the DOWN key and call up the STOP function selection screen.**

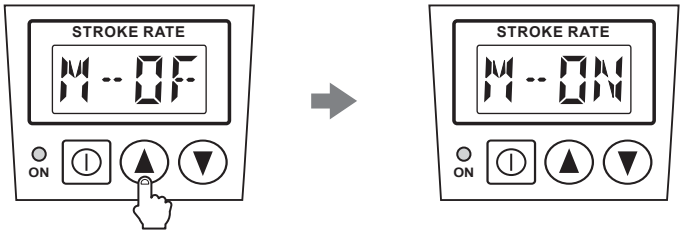
"M-OF" (default setting) or "M-ON" appears on the screen.



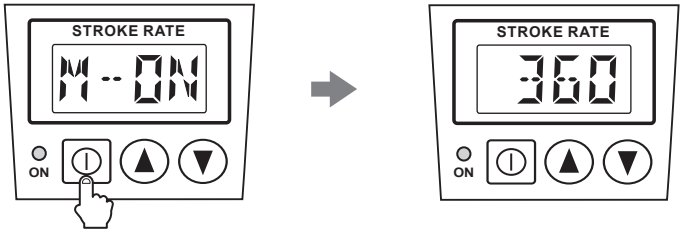
4 **Push the UP key and change the current selection.**

If "M-OF" is selected, change it to "M-ON". If "M-ON" is selected, change to "M-OF".

When "M-OF" is selected



5 **Push the start/stop key to return to the wait state in manual mode.**



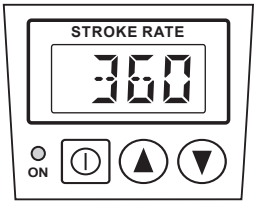
The STOP function now has been cancelled.

Keypad lock

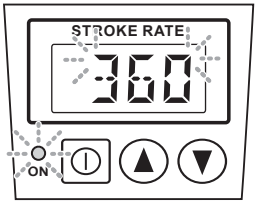
Keypad lock can be active in the following states for the prevention of erroneous key operation.

Manual mode

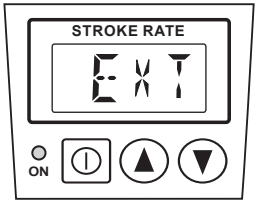
Wait state



During operation



EXT mode

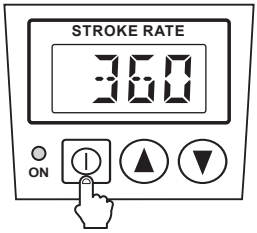


NOTE

- Any key operation is not acceptable when the keypad lock is active. In an emergency, unplug the pump to stop operation. In this case, keypad lock state is recalled when the pump is turned on.
- Pressing the start/stop key for three seconds, keypad lock becomes active even when the pump is receiving the STOP signal. Note that "STOP" or "-STOP" indication does not change but key operation is not accepted. Keypad lock indication appears when the STOP signal is released with "M-ON" or inputted with "M-OF".

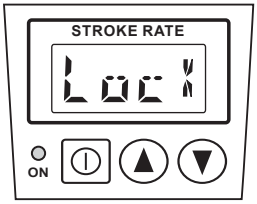
■ **Activate keypad lock**

1 **Push the start/stop key for more than three seconds.**

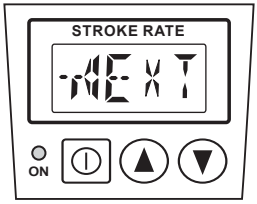


The following indication appears once keypad is locked.

Wait state in manual mode



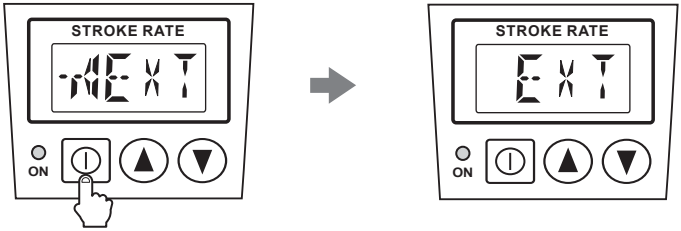
EXT mode



■ **Release the keypad lock state**

1 **Push the start/stop key for more than three seconds.**

Keypad lock is released and key operation becomes acceptable.



Maintenance

This section describes troubleshooting, inspection, wear part replacement, exploded views and specifications.

Important

- Observe instructions in this manual for maintenance, inspection, dismantlement and assembly. Do not dismantle the pump beyond the extent of the instructions.
- Always wear protective clothing such as an eye protection, chemical resistant gloves, a mask and a work cap during dismantlement, assembly or maintenance work.
- Be sure to turn off power to stop the pump and related devices before work. See below.

Before unplugging the pump

Always stop the pump by key operation. And wait for three seconds before unplugging the pump. Otherwise, the last key operation to stop the pump may not be put in memory. In this case the pump unintentionally starts to run as powered on, discharging liquid.

Troubleshooting

First check the following points. If the following measures do not help removing problems, contact us or your nearest dealer.

States	Possible causes	Solutions
The pump does not run. (LED does not appear. Blank screen.)	Power voltage is too low.	• Recover the power voltage to a normal level. Allowable voltage range: 90-264VAC
	The pump is not powered.	• Check the switch if it is installed. • Correct wiring • Replace a breaking wire to new one.
	An electronic circuit in the control unit is failed.	• Replace the control unit.
Liquid can not be sucked up.	Air lock in the pump	• Expel air. See page 33.
	Stroke length is too short.	• Run the pump at 100% stroke length and adjust it to proper length.
	Air ingress through suction line.	• Correct tubing.
	A valve set is installed upside down.	• Reinstall the valve set.
	Valve gaskets are not installed.	• Install valve gaskets.
	Foreign matters are stuck in the pump head valves.	• Dismantle, inspect and clean the valve. Replace as necessary.
	A ball valve is stuck on a valve seat.	• Dismantle, inspect and clean the valve. Replace as necessary.
The flow rate fluctuates.	Air stays in the pump head.	• Expel air. See page 33.
	Overfeeding occurs.	• Mount a check valve. See page 24.
	Foreign matters are stuck in the pump head valves.	• Dismantle, inspect and clean the valve. Replace as necessary.
	Diaphragm is broken.	• Replace diaphragm.
	Pressure fluctuates at an injection point.	• Review tubing layout to maintain a pressure constant at an injection point or change an injection point in a constant pressure.

Liquid leaks.	Loose fit of the fitting or the air vent body.	• Retighten them.
	Loose fit of the pump head.	• Retighten the pump head. See page 32.
	O rings or valve gaskets are not installed.	• Install O rings and valve gaskets.
	Diaphragm is broken.	• Replace the diaphragm.
	Excessive discharge pressure.	• Check that a discharge line is not closed. • Check if tubing is not clogged.

Inspection

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

Daily inspection

Check the following points. Upon sensing abnormal condition, stop operation immediately and remove problems according to "Troubleshooting".
When wear parts come to the life limit, replace them by new ones. Contact us or your nearest dealer for detail.

No.	States	Points to be checked	How to check
1	Pumping	• If liquid is pumped.	Flow meter or visual inspection
		• If the suction and discharge pressure are normal.	Check specification.
		• If liquid is deteriorated, crystallized or settled?	Visual or audio inspection
2	Noise and vibration	• If abnormal noise or vibration occurs. They are signs of abnormal operation.	Visual or audio inspection
3	Air ingress from pump head joints and a suction line	• If leakage occurs. • If discharge liquid includes air bubbles, check lines for leakage and retighten as necessary.	Visual or audio inspection

Periodic inspection

Retighten the pump head mounting bolts diagonally according to the following torque.

*Mounting bolts may loosen in operation. How fast the bolts start to loosen is depending on operating conditions.

Tightening torque

Model identification code	Torque	Bolts
EHN-B11•16•21	2.16 N•m	M4 Hex. socket head bolt
EHN-B31	2.55 N•m	M4 Hex. socket head bolt
EHN-C16•21	2.16 N•m	M4 Hex. socket head bolt
EHN-C31	2.55 N•m	M4 Hex. socket head bolt
EHN-C36	2.55 N•m	M5 Hex. socket head bolt

*A hexagon wrench can be used for a torque wrench. See page 33.

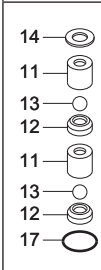
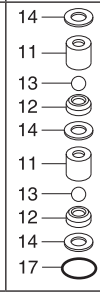
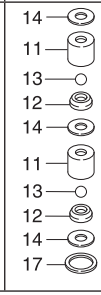
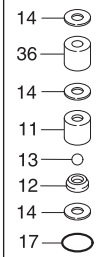
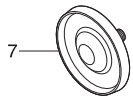
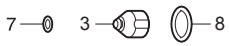
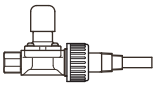
Wear part replacement

For a long operation wear parts need to be replaced periodically.
It is recommended that the following parts are always stocked for immediate replacement. Contact us or your nearest dealer for detail.

Precautions

- When dismantling the pump, pay attention to the residual liquid in the pump.
- Rinse wet ends thoroughly with water.
- Each time the pump head is dismantled, replace the diaphragm, O rings, valve gaskets and valve sets with new ones.

Wear part list

	Parts					# of parts	Estimated life
Pump	Valve set	VC•VH•PC•PH	PP	FC	VH/PH-V	2 sets	8000 hours
							
	Diaphragm					1	
	O ring	 (except the B-31,-36 and the FC)				See page 77-81.	
Check valve	Check valve poppet (Including O ring)					1	
	Check valve spring					1	
BP valve	BVC back pressure valve (FC type only)					1	

*Wear part duration varies with the pressure, temperature and characteristics of the liquid.

*The estimated life is calculated based on the continuous operation with ambient clean water.

Before replacement

First release the pressure from the pump.

1 **Stop the pump operation.**

2 **Rotate the adjusting screw two revolutions anticlockwise to open the air vent port.**

NOTE

Do not rotate it three revolutions or more. Otherwise, liquid may comes out from the adjusting screw.

3 **Check that liquid comes out from the air vent port and the internal pressure has been released.**

NOTE

The internal pressure may not be expelled completely as long as liquid does not come out. In this case run the pump until the pressure is released.

*For the EHN-31, -36 and FC, the air vent port is not equipped. Install an air vent valve on a discharge line and release the pressure by opening the valve. See page 23.

Valve set replacement

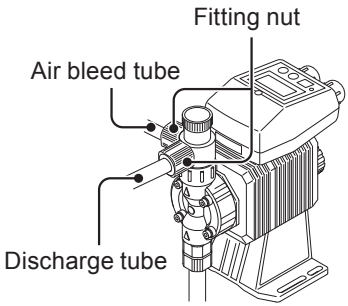
■ **Discharge valve set dismantlement/assembly**

Necessary tools

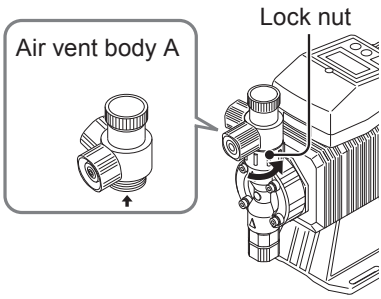
- Adjustable wrench or spanner
- 17mm Box wrench
- A pair of tweezers

*Unfix the pump base before work.

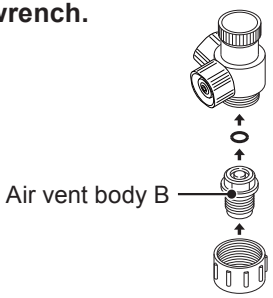
1 **Loosen the fitting nut and remove a discharge tube and an air bleed tube.**



2 **Turn the lock nut anticlockwise by an adjustable wrench and remove the air vent body A.**



3 **Remove the air vent body B by the 17mm box wrench.**



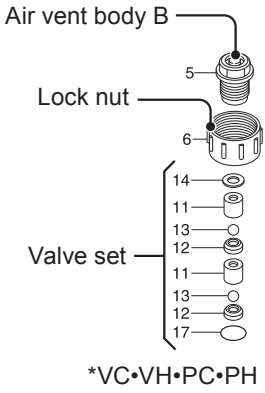
4 **Pull out the valve set by a pair of tweezers.**

5 **Place a new valve set into the pump head. Screw the air vent body B into the pump head through the lock nut.**

*Be careful not to misarrange the valve set or misplace upside down. Otherwise, leakage or flow rate reduction may result.

*Do not forget to fit O rings and gaskets.

*Keep the valve set free from dust or foreign matters.

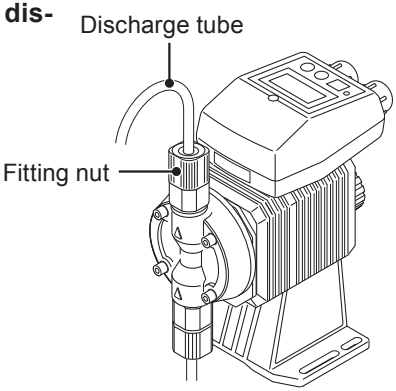


*VC•VH•PC•PH

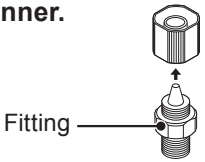
6 **Remount the air vent body A and connect tubes.**

EHN-□31•36

1 **Remove the fitting nut to remove the discharge tube.**



2 **Remove the fitting by an adjustable wrench or a spanner.**



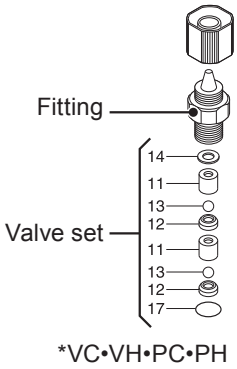
3 **Pull out the valve set by a pair of tweezers.**

4 **Place a new valve set into the pump head. Screw the fitting into the pump head and turn it clockwise about 90 degrees by an adjustable wrench or a spanner.**

*Be careful not to misarrange the valve set or misplace upside down. Otherwise, leakage or flow rate reduction may result.

*Do not forget to fit O rings and gaskets.

*Keep the valve set free from dust or foreign matters.



*VC•VH•PC•PH

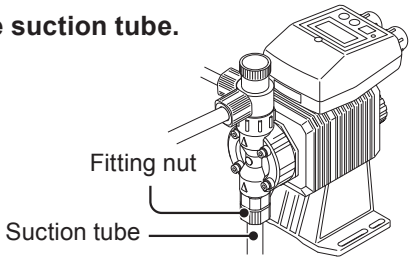
5 **Reconnect the discharge tube.**

■ **Suction valve set dismantlement/assembly**

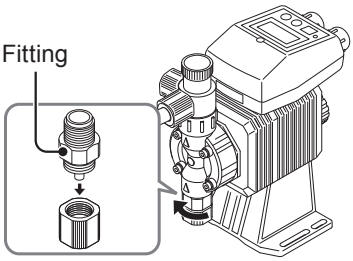
NOTE

Be careful not to drop the valve set.

1 **Remove the fitting nut to remove the suction tube.**



2 **Remove the fitting by an adjustable wrench or a spanner.**



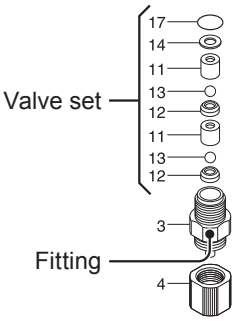
3 **Pull out the valve set by a pair of tweezers.**

4 **Screw the fitting into the pump head with the valve set in it and turn it anticlockwise about 90 degrees by an adjustable wrench or a spanner.**

*Be careful not to misarrange the valve set or misplace upside down. Otherwise, leakage or flow rate reduction may result.

*Do not forget to fit O rings and gaskets.

*Keep the valve set free from dust or foreign matters.



*VC•VH•PC•PH

5 **Reconnect the suction tube.**

Diaphragm replacement

Necessary tools

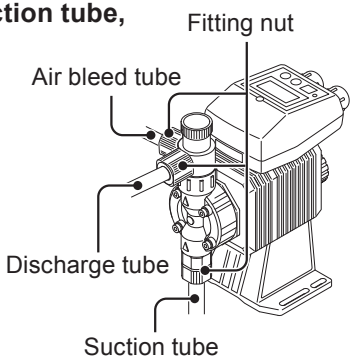
- Adjustable wrench or spanner
- Hexagon wrench
- Torque wrench

NOTE

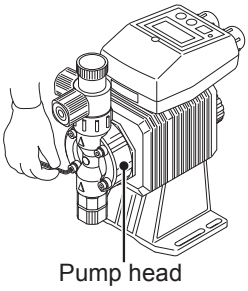
Pay attention not to lose diaphragm spacers. Always apply a proper number of diaphragm spacers. 0 or a few diaphragm spacers are inserted between the retainer and plunger for the adjustment of diaphragm location. Note that the number of diaphragm spacers varies with pump model. Some pumps may use no spacer.

1 **Run the pump and set the stroke length to 0%. Then stop the pump.**

2 **Loosen the fitting nuts and remove a suction tube, a discharge tube and an air bleed tube.**

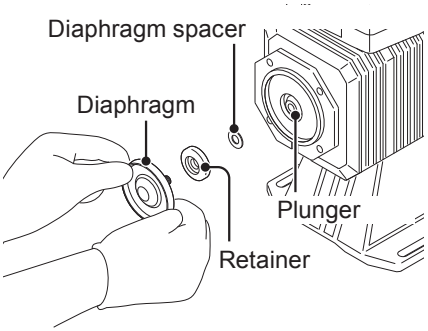


3 **Remove the pump head by a hexagon wrench.**



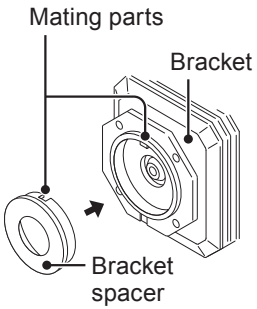
4 **Rotate and remove the diaphragm from the plunger (pump shaft).**

5 **Set a retainer and diaphragm spacer(s) on the diaphragm screw.**



NOTE

- Fit the retainer to the diaphragm with its round edge to the diaphragm.
- Check that the bracket spacer is in place. Refit the bracket spacer into the bracket, combining mating parts as necessary.



6 **Screw the diaphragm all the way seated in the plunger.**

7 **Run the pump and set the stroke length to 100%. Then stop the pump.**

8 **Mount the pump head.**

Tighten the pump head fixing bolts diagonally and evenly.

Tightening torque

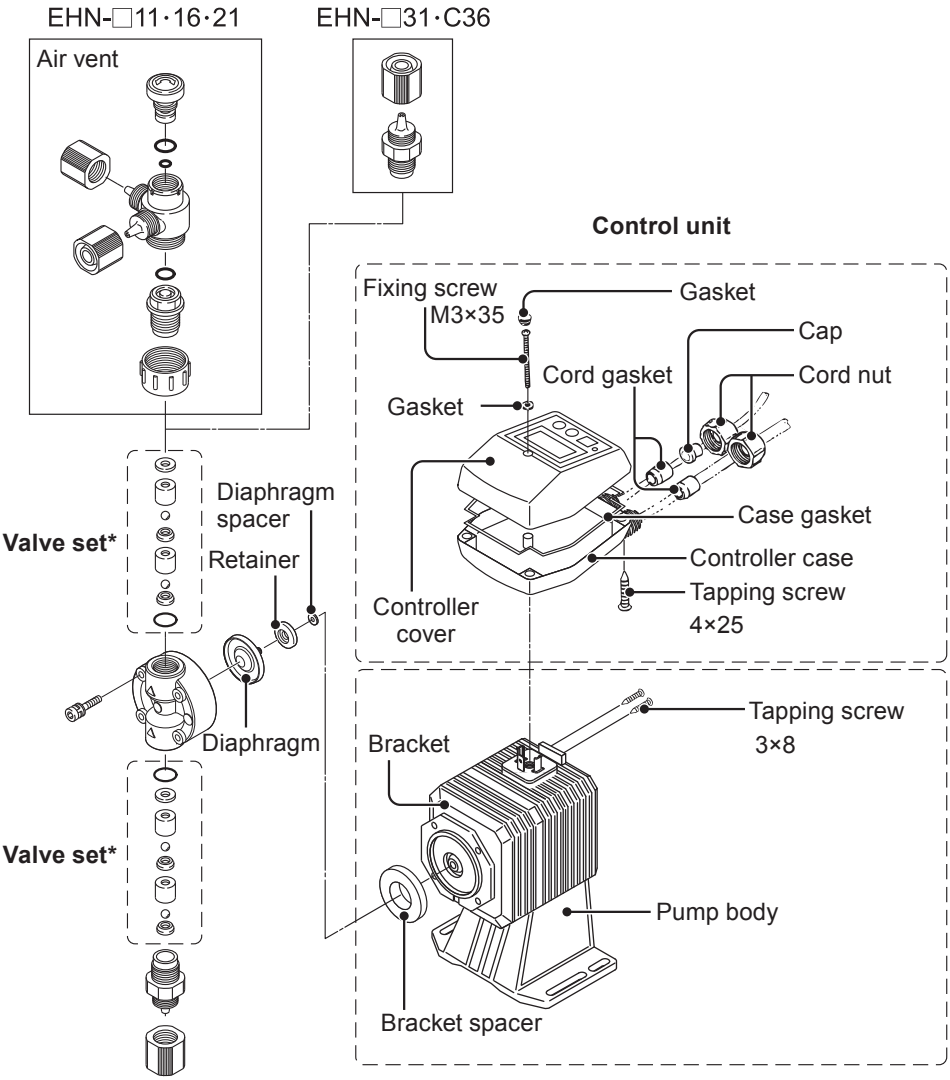
Model identification code	Torque	Bolts
EHN-B11•16•21	2.16 N•m	M4 Hex. socket head bolt
EHN-B31	2.55 N•m	M4 Hex. socket head bolt
EHN-C16•21	2.16 N•m	M4 Hex. socket head bolt
EHN-C31	2.55 N•m	M4 Hex. socket head bolt
EHN-C36	2.55 N•m	M5 Hex. socket head bolt

*A hexagon wrench can be used for a torque wrench. See page 33.

Exploded view

Pump head, Drive unit & Control unit

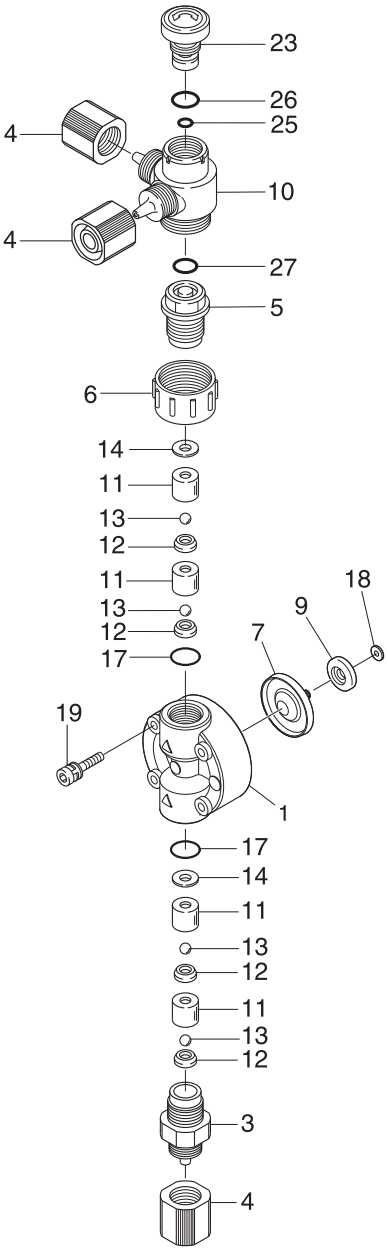
The pump in the diagram below is completely dismantled. Do not dismantle the pump beyond the extent shown in this instruction manual.



*Wet end materials and their sizes differ with models. See "Valve set replacement" on page 69 for detail.

Pump head

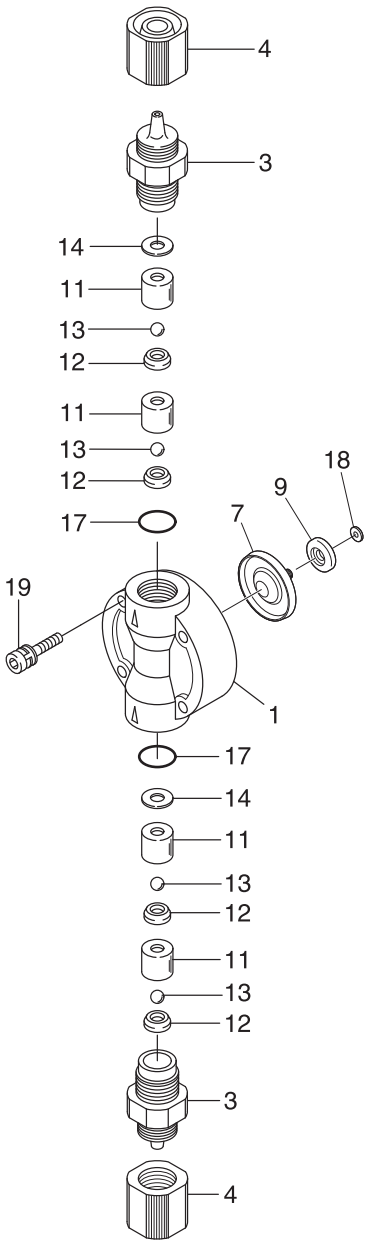
■ **EHN-[B11•B16•B21•C16•C21][VC•VH•PC•PH]**



No.	Part names	# of parts
1	Pump head	1
3	Fitting	1
4	Fitting nut	3
5	Air vent body B	1
6	Lock nut	1
7	Diaphragm	1
9	Retainer	1
10	Air vent body A	1
11	Valve guide	4
12	Valve seat	4
13	Valve	4
14	Valve gasket	2
17	O ring	2
18	Diaphragm spacer	*
19	Hex. socket head bolt [PW•SW]	4
23	Adjusting screw	1
25	O ring	1
26	O ring	1
27	O ring	1

*The number of diaphragm spacers varies with pump model.

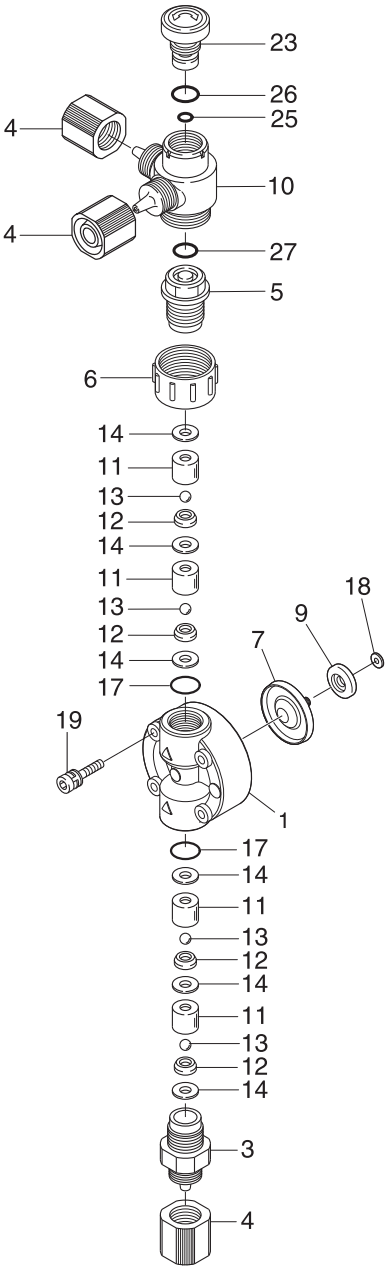
■ EHN-[B31•C31•C36][VC•VH•PC•PH]



No.	Part names	# of parts
1	Pump head	1
3	Fitting	2
4	Fitting nut	2
7	Diaphragm	1
9	Retainer	1
11	Valve guide	4
12	Valve seat	4
13	Valve	4
14	Valve gasket	2
17	O ring	2
18	Diaphragm spacer	*
19	Hex. socket head bolt [PW•SW]	4

*The number of diaphragm spacers varies with pump model.

■ **EHN-□PP**

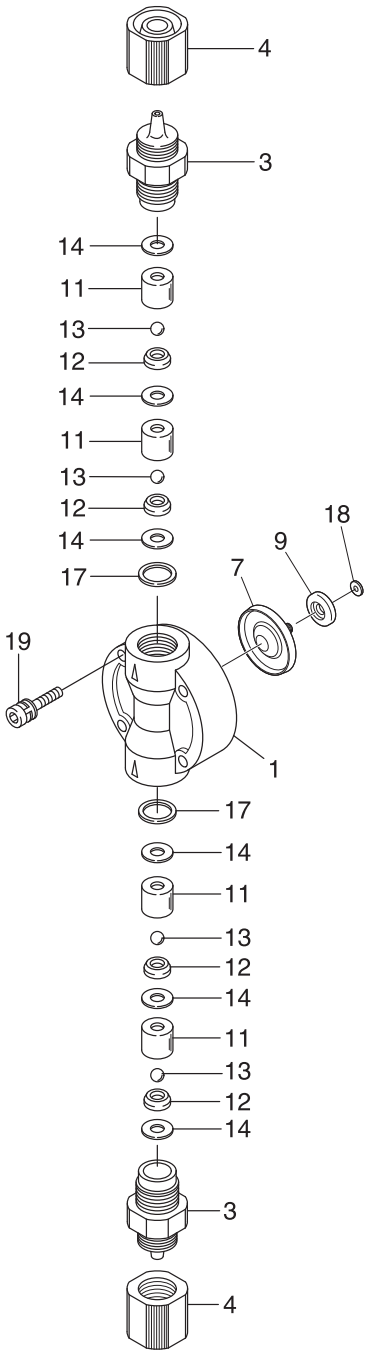


No.	Part names	# of parts
1	Pump head	1
3	Fitting	1(2)
4	Fitting nut	3(2)
5	Air vent body B	1(0)
6	Lock nut	1(0)
7	Diaphragm	1
9	Retainer	1
10	Air vent body A	1(0)
11	Valve guide	4
12	Valve seat	4
13	Valve	4
14	Valve gasket	6
17	O ring	2
18	Diaphragm spacer	*
19	Hex. socket head bolt [PW•SW]	4
23	Adjusting screw	1(0)
25	O ring	1(0)
26	O ring	1(0)
27	O ring	1(0)

The parenthetic figures are for EHN-B31•C31•C36.

*The number of diaphragm spacers varies with pump model.

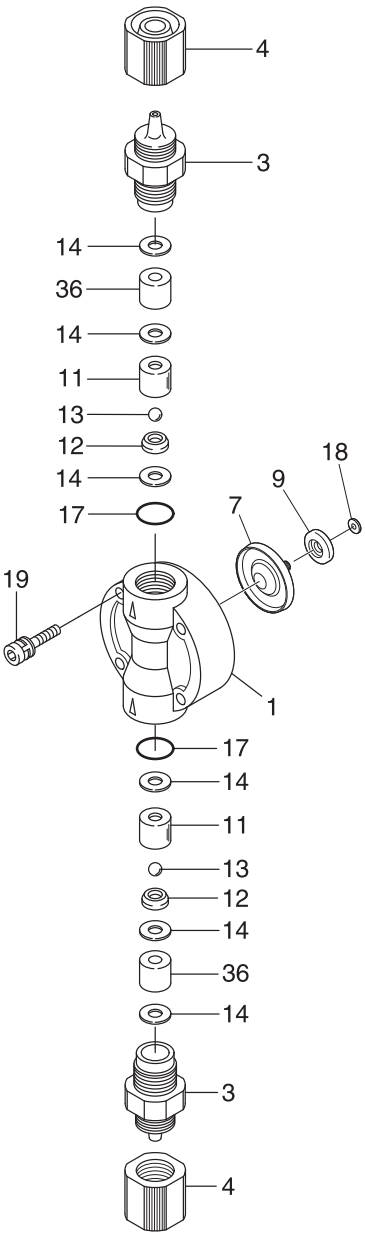
■ **EHN-□FC**



No.	Part names	# of parts
1	Pump head	1
3	Fitting	2
4	Fitting nut	2
7	Diaphragm	1
9	Retainer	1
11	Valve guide	4
12	Valve seat	4
13	Valve	4
14	Valve gasket	6
17	Gasket	2
18	Diaphragm spacer	*
19	Hex. socket head bolt [PW•SW]	4

*The number of diaphragm spacers varies with pump model.

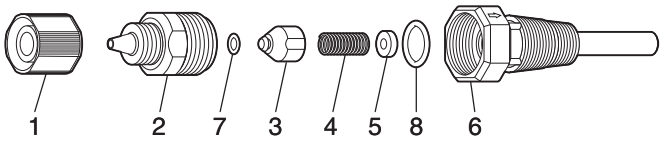
■ **EHN-[C31•C36]VH/PH-V**



No.	Part names	# of parts
1	Pump head	1
3	Fitting	2
4	Fitting nut	2
7	Diaphragm	1
9	Retainer	1
11	Valve guide	2
12	Valve seat	2
13	Valve	2
14	Valve gasket	6
17	O ring	2
18	Diaphragm spacer	*
19	Hex. socket head bolt [PW•SW]	4
36	Valve spacer	2

*The number of diaphragm spacers varies with pump model.

Check valve (VC•VH•PC•PH)



No.	Part names	# of parts
1	Fitting nut	1
2	Valve case	1
3	Poppet	1
4	Spring	1
5	Spacer	1 (0)
6	Valve fitting A	1
7	O ring	1
8	O ring	1

The parenthetic figure is for the CA-2 □□ L- □.

Specification

Specifications and apparent condition are subject to change without notice.

■ Pump unit

VC•VH•PC•PH•PP

Model code	Flow rate mℓ/min	Max. discharge pressure MPa	Stroke length mm (%)	Stroke rate spm	Tube connection bore mm	Power consumption W	Current value A	Weight kg
EHN-B11	38	1.0	0.5-1.0 (50-100)	1 - 360	ø4×ø9	20	0.8	1.8
EHN-B16	65	0.7						
EHN-B21	100	0.4						
EHN-B31	230	0.2			ø8×ø13			
EHN-C16	80	1.0	0.5-1.25 (40-100)		ø4×ø9	24	1.2	2.9
EHN-C21	130	0.7						
EHN-C31	270	0.35			ø8×ø13			
EHN-C36	450	0.2						

FC

Model code	Flow rate mℓ/min	Max. discharge pressure MPa	Stroke length mm (%)	Stroke rate spm	Tube connection bore mm	Power consumption W	Current value A	Weight kg
EHN-B11	38	1.0	0.5-1.0 (50-100)	1-360	ø4×ø6	20	0.8	1.8
EHN-B21	100	0.4						
EHN-C21	130	0.7	0.5-1.25 (40-100)		ø10×ø12	24	1.2	2.9
EHN-C31	270	0.35						
EHN-C36	410	0.2						

PH-H (High compression type)

Model code	Flow rate mℓ/min	Max. discharge pressure MPa	Stroke length mm (%)	Stroke rate spm	Tube connection bore mm	Power consumption W	Current value A	Weight kg
EHN-B11PH-H	30	1.5	0.5-1.0 (50-100)	1-360	IN: ø4×ø9 OUT: ø4×ø6	20	0.8	1.8
EHN-C16PH-H	60	1.5	0.5-1.25 (40-100)			24	1.2	2.9

VH/PH-V type (Viscosity type)

Model code	Flow rate mℓ/min	Max. discharge pressure MPa	Stroke length mm (%)	Stroke rate spm	Tube connection bore mm	Power consumption W	Current value A	Weight kg
EHN-C31VH/ PH-V	220	0.35	0.5-1.25 (40-100)	1-300	ø8×ø13	24	1.2	2.9
EHN-C36VH/ PH-V	350	0.2						

*These specifications are based on pumping ambient clean water at rated voltage.

*Flow rate is collected at the maximum discharge pressure, 100% stroke length and 360spm (300spm for the VH/PH-V). The flow rate increases as a discharge pressure decreases.

*Allowable room temperature: 0-40°C

*Allowable liquid temperature: 0-40°C (0-60°C for the PC•PH•PP•FC)

*The PP type is not available with B21 and C16.

*Allowable voltage deviation: ±10% of the rated voltage

*For the VH/PH-V types, their flow rate is collected with clean water and is not warranted for viscous liquid. The flow rate may increase or decrease depending on liquid characteristics.

■ Control unit

Operation mode	Mode	Manual
		EXT (Multiply or divide)
	Mode selection	Key operation
Stroke rate	Setting range	1-360spm (1-300spm for VH/PH-V)
	Spm programming	UP or DOWN key
STOP function	M-OF	The pump stops during contact input.
	M-ON	The pump runs during contact input.
	Input signal	No-voltage contact or open collector*1
EXT mode	Upper limit spm	Manual operation spm
	Pump control	n shots per signal (Multiply)*2 n signals per shot (Divide)*3 1:1 operation with n=1
	Input signal	No-voltage contact or open collector*1
	Divider/Multiplier programmable range	1-999 (Select divide or multiply.)
Indicator	Numeric indication	4-digit
	Operation	Green LED (Blinks at each shot)
Storage function		Non-volatile memory
Power voltage*4		100-240VAC 50/60Hz

*1 The maximum applied voltage to the contact is 12V at 5mA. When using a contact type relay, the minimum application load should be 5mA or below.

*2 When the pump receives the external pulse signal during operation for the set number of shots per signal, the received signal is stored up to 255 pulses.

*3 When the external pulse signal is entered to run the pump over the upper limit spm, the signal is cancelled.

*4 Observe the specified power voltage range. Otherwise failure may result. The allowable voltage range is 90-264VAC.

■ Power cable

Conduction section area	0.75 [mm^2] (Duplex cable)	Standard	VCTFK
Length	1500 [mm]	Terminal treatment	Spade terminal (V1.25-YS4A or equivalent)

■ Pump colour

Blue	Munsell colour system 7.5PB 3/8
Red	Munsell colour system 5R 3/10

Accessories

Unit (mm)

Model identification code		Set pressure MPa	Connection bore mm	Wet ends	Applicable pump model	Wet end code
Check valve	CA-1VC-4	0.17	ø4×ø9	PVC	EHN-B11•16•21 EHN-C16•21	VC
	CA-1VE-4					VH
	CA-2VC-8		ø8×ø13		EHN-C31	VC
	CA-2VE-8					VH
	CA-2VCL-8	0.05			EHN-B31 EHN-C36	VC
	CA-2VEL-8					VH
	CA-1V-4	0.17	ø4×ø9	GFRPP	EHN-B11•16•21 EHN-C16•21	PC/PP
	CA-1E-4					PH
	CA-2V-8		ø8×ø13		EHN-C31	PC/PP
	CA-2E-8					PH
	CA-2VL-8	0.05			EHN-B31 EHN-C36	PC/PP
	CA-2EL-8					PH
	CS-1E-2	0.12	ø4×ø6	SUS304	EHN-B11 EHN-C16	PH-H
BP valve	BVC-1TV-4H	0.2	ø4×ø6	PVDF	EHN-B11•21•C21	FC
	BVC-1TV-10H		ø10×ø12		EHN-C31	
		0.1			EHN-C36	

Options

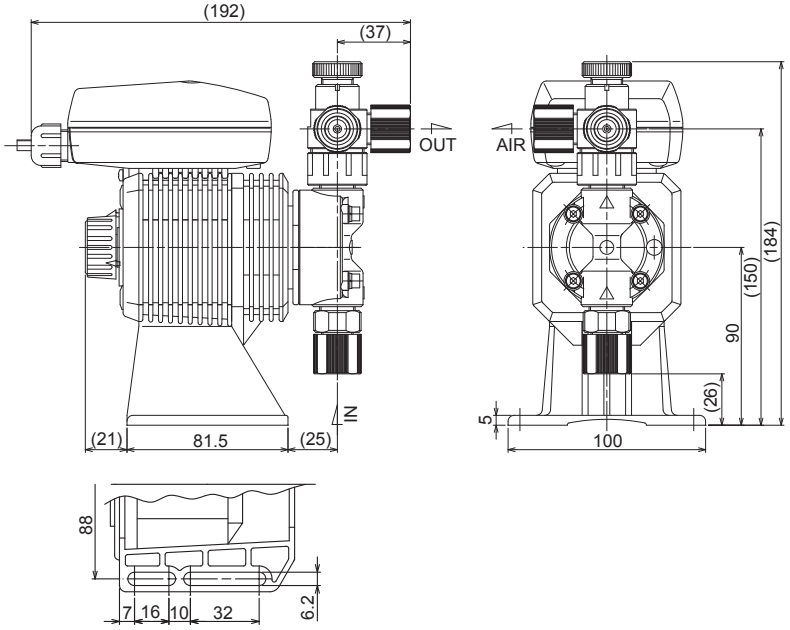
■ Air vent valve

Model	Connection	Material		Applicable pump	Wet end code
	Tube	Body	Rubber		
AV-E30/35VC-4	ø8×ø13	PVC	FKM	B31, C31•36	VC
AV-E30/35V6-4			EPDM		VH
AV-E30/35PC-4		GFRPP	FKM		PC
AV-E30/35P6-4			EPDM		PH

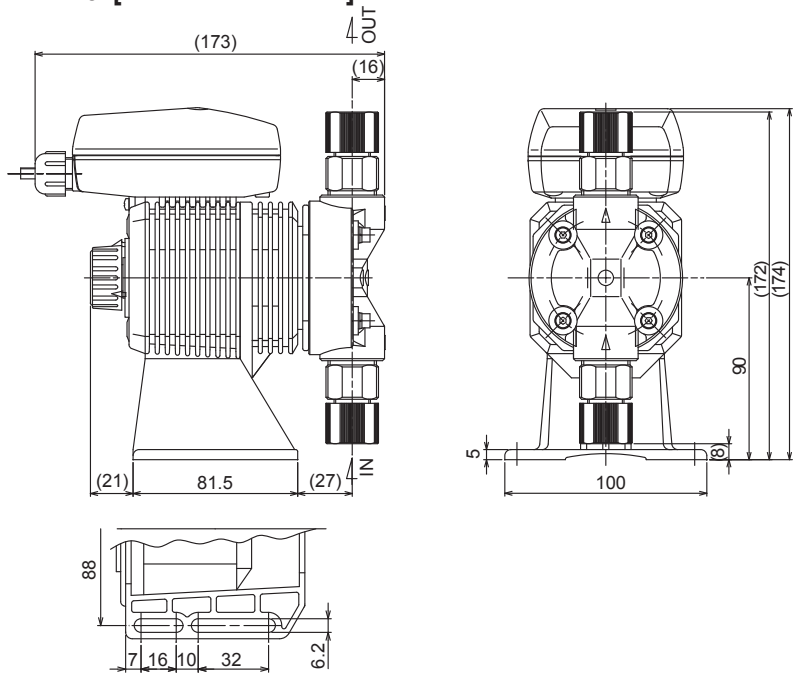
*For the connection of the ø9×ø12 tube, contact us.

Outer dimensions

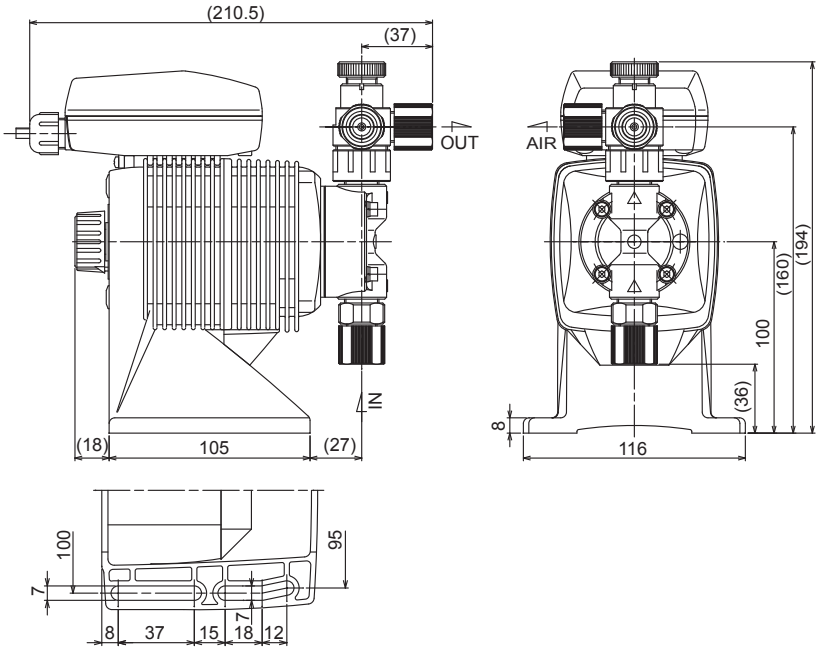
■ **EHN-[B11•B16•B21] [VC•VH•PC•PH•PP]**



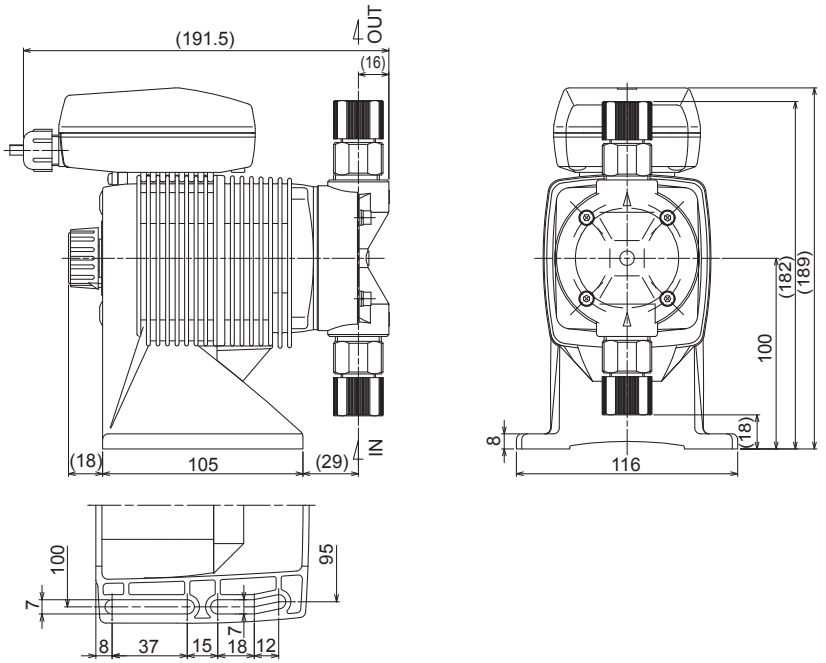
■ **EHN-B31[VC•VH•PC•PH•PP]**



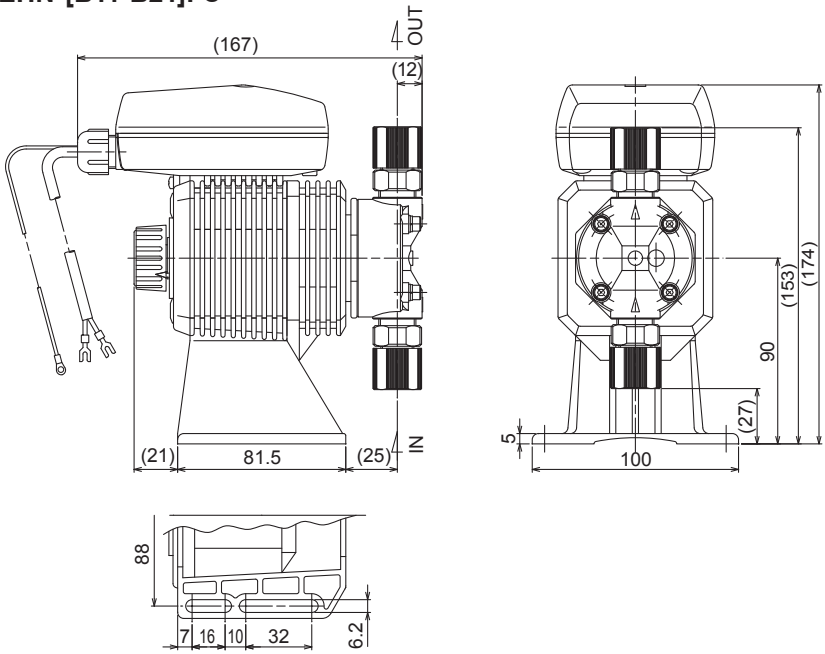
■ EHN-[C16•C21] [VC•VH•PC•PH•PP]



■ EHN-[C31•C36] [VC•VH•PC•PH•PP]



■ **EHN-[B11•B21]FC**



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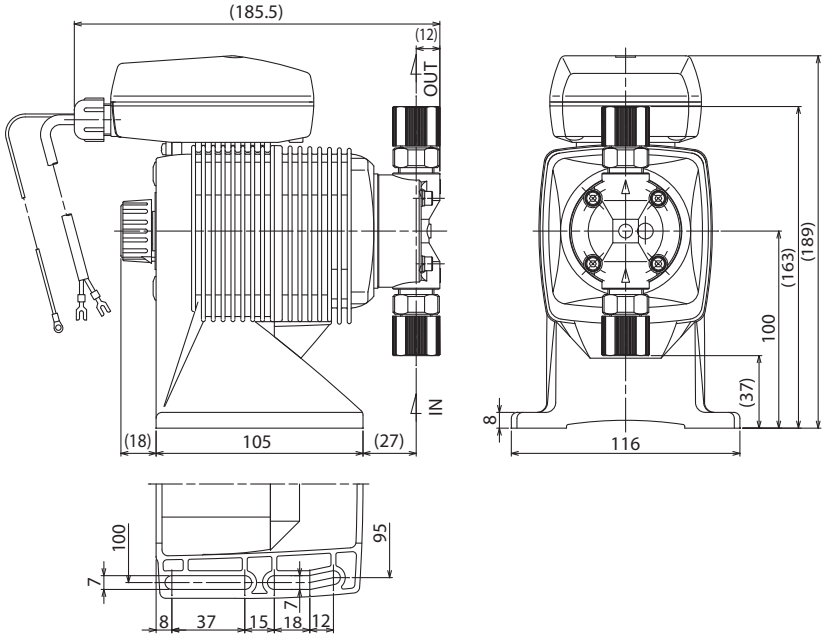
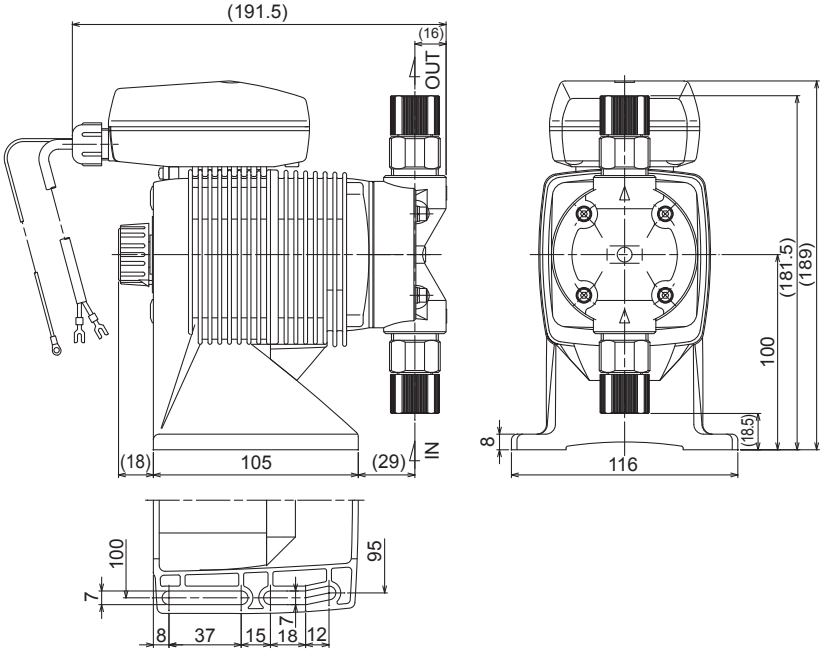
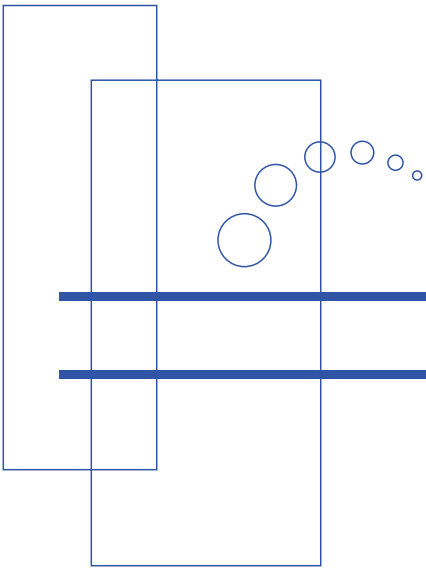


■ EHN-[C31•C36]FC





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