

# INTELLIGENT PUMP

MODEL HI-12 Series

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## Instruction Manual

Ver . 1

### To The User

We ask that you read this manual carefully and in its entirety before installing and using the unit.

After reading please keep the manual for reference. A product warranty is attached at the back.



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# **Introduction**

Thank you for purchasing the FLOM HI-12 Intelligent Pump.

- This instruction manual will assist you in the safe and proper operation of the HI-12 Intelligent Pump and will help prevent damage and accident as you operate and maintain the unit.
- For safety's sake, please read this manual carefully before installing, wiring, connecting, and operating the unit.
- Please follow the Safety Notes found throughout the manual, as they contain key points about the safe handling and care of the unit.
- Please keep this manual in a safe place easily accessible to the actual operators of the unit. By following these instructions, you will ensure a long and safe operating life to the HI-12 Intelligent Pump.



Note carefully the safety information given in the points below.

- I. The Safety Notes are divided into 3 categories, in descending order of hazard: [Danger ], [ Warning ], and [ Caution ]. Read and understand these points well and in detail, and refer to Section 1 “Safety Precautions”, before operating the unit.
- II. FLOM Corporation assumes no responsibility for the following:
  - 1) accidents or problems occurring as a result of not following this manual's instruction;
  - 2) accidents or problems resulting from the use of non-standard replacement parts (neither FLOM brand parts nor parts from a FLOM-approved vendor).
  - 3) accidents or problems resulting from operating the unit outside the defined specifications and parameters.
- III. If you wish to recondition the unit, always consult with FLOM first.
- IV. Follow the instructions in this manual when you make repairs or perform periodic maintenance on the unit.
- V. Do not install the unit in the locations listed the “Caution” part of Section 7-2. In general do not install or use the unit in any place deemed hazardous for whatever reason. To prevent fire and/or injury, always operate the unit in a safe place.
- VI. There is a product warranty on the last page of this manual. Please be careful not to damage or lose it. In case of loss, contact FLOM and inform us of the model and serial number of the unit (for custom specification units, please also supply the specifications). We will issue you another copy of the instruction manual, but please be aware that under certain circumstances the contents of the warranty may no longer be applicable.

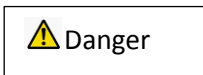
# 1 Safety Precautions

Please read this instruction manual carefully and follow the instructions while installing, running, maintaining and servicing the degassing unit. Make sure you understand the basic operation of the unit, safety information, and the safety precautions listed below. After reading keep the manual in a convenient place for quick reference.

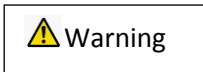
< Definition of Markers Denoting Safety Cautions >

The  Mark: This mark indicates matters of special concern and caution which need to be heeded *before* handling or running the unit. After the  mark, one of 3 words: **Danger**, **Warning**, or **Caution**, will appear indicating the level of hazard. For safety's sake please follow all instructions appearing after these marks.

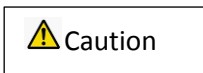
●Safety caution categories indicate the degree of hazard resulting from mistaken application of the instructions.



A “Danger” Mark indicates the imminent and acute possibility of injury or death, if the situation or action described is not avoided.



A “Warning” Mark indicates the possibility of injury or death if the situation or action described is not avoided.



A “Caution” Mark indicates the possibility of moderate or light injury, or physical damage, if the situation or action described is not avoided.

In addition, the “✘ Note” sign indicates important and useful reference information.

## **2 Standard Accessory List**

When opening the unit packaging, please check that all the following accessories are included.

<b>#</b>	<b>Accessory Name</b>	<b>Specifications</b>	<b>Total</b>	<b>Notes</b>
1	Power Cord	7A 125V	1	
2	3-Prong Connector	15A 125V	1	
3	Fuse	2A	2	
4	Wrench	8 x 10	1	
5	Hex Wrench	2.5mm	1	
6	SUS Tubing	1/16×1.0×1m	1	
7	EASY FITT Fitting	#9001	1	
8	STOP FITT Fitting	#9004	1	
9	Teflon Tubing	3φ × 2φ × 1m	2	
10	Suction Filter	SUS # 8807	2	
11	Aspiration Needle		1	
17	1/8 Double Lock Fitting	SUS #9304	2	
18	3φDouble Lock Ferrule	#9405	2	
19	1/16 Fitting L	SUS #9502	1	
20	1/16 Ferrule	SUS #9601	1	

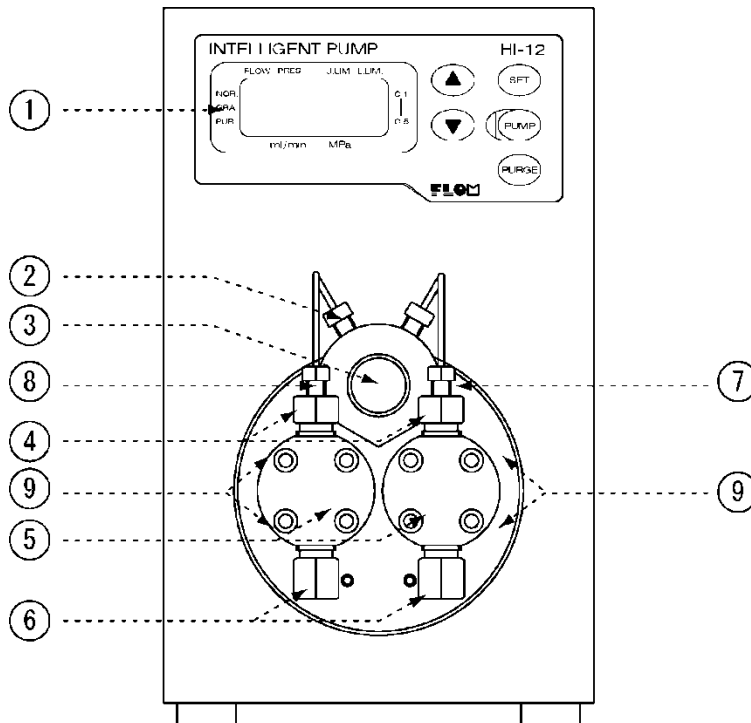
※ Note: If you discover any accessory part to be missing or defective, please contact the vendor immediately.

※ Note: Because many of the parts of this unit are made of plastic, it may be inadvisable to use a hand tool when installing or handling them. Please read the manual carefully before installing and maintaining the unit.

※ Note: Please do not use off-market or knock-off connector items on the unit; doing so may void the FLOM warranty.

## 3 Part Names and Functions

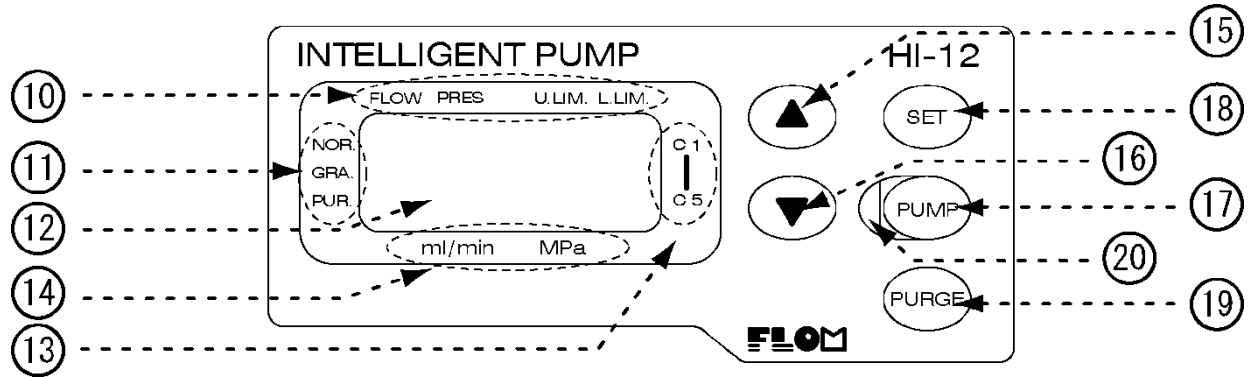
### 3-1 Front Panel



**Diagram 3-1. Front Panel**

#	Part Name	Function
1	Control Panel	Refer to Section 3-2 "Control Panel" below.
2	Drain Valve	Right hand side (7) connects to solvent to be pumped, left hand connects to drain (waste bottle).
3	Drain Valve Plug	Turn to the right to close the drain and only allow pump side to flow. When changing solvent or removing air bubbles, turn to the left to open drain and insert needle to draw off on left side connector.
4	Drain Side Check Valve	
5	Pumphead	
6	Aspiration Side Check Valve	
7	Pump Port	Connect to solvent.
8	Drain Port	Refer to points 2 and 3 above.
9	Wash Port	Connect to the 2X3 $\phi$ Teflon or Silicone tube.

## 3-2 Control Panel

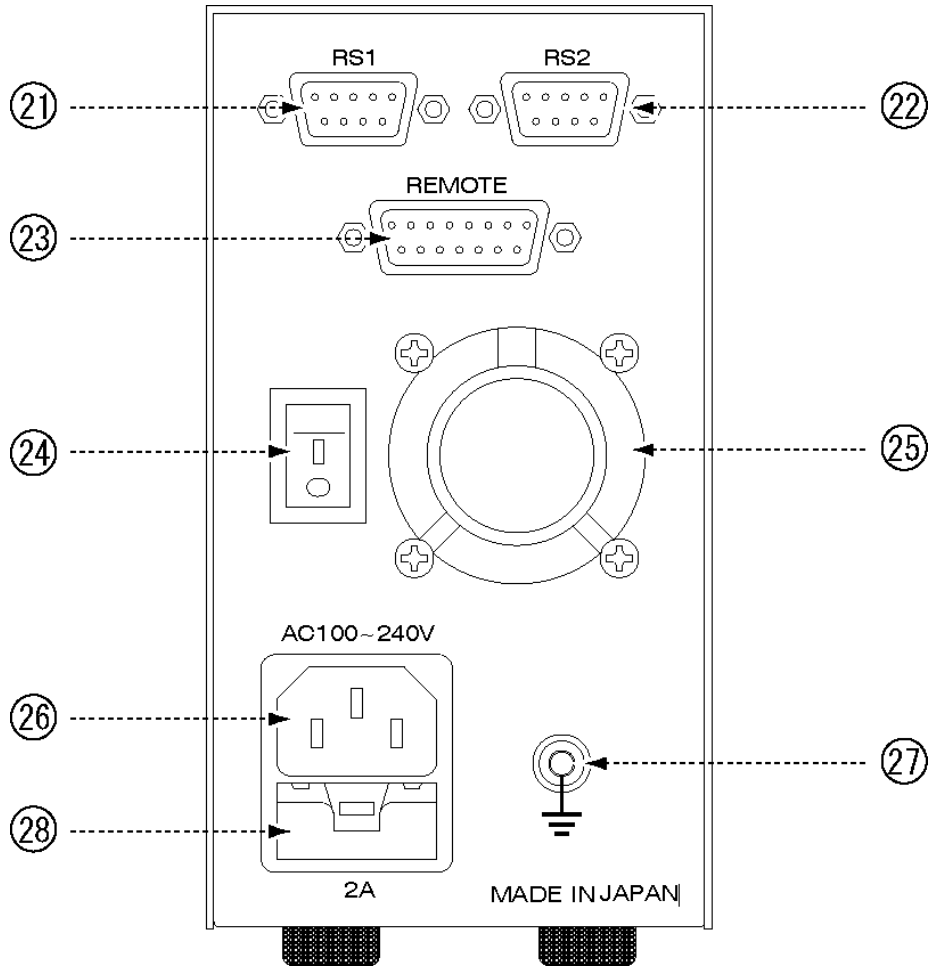


**Diagram 3-2. Control Panel**

#	Part Name	Function
10	Display Indicator	A lit bar beneath each item below indicates what is being currently displayed: FLOW lit = current flow rate PRES lit = pressure monitor value U.LIM lit = upper pressure limit value L.LIM lit = lower pressure limit value
11	Pump Mode Indicator	A lit point near each indicator below indicates current pump mode: NOR. point lit = normal pump mode GRA. point lit = gradient pump mode PUR. point lit = purge pump mode Refer to Section 6-1 "Setting the Pump Mode" for further details.
12	LCD Display	Displays values for flowrate, pressure monitor, upper and lower pressure limits.
13	5-point Learning Indicator	Use when changing the pre-set Learning Data.
14	Numerical Display Area	Indicates the units of the value currently displayed.
15	Up Key	Press to increase current parameter selected. Press and hold to speed up the parameter change.
16	Down Key	Press to decrease current parameter selected. Press and hold to speed up the parameter change.
17	Pump Key	Start and stop pump. Press 2 times for emergency stop.
18	Set Key	Change the parameter on display.
19	Purge Key	Begin purge operation.
20	Status LED	Turns green when pumping, turns red on error condition. When in purging mode,blinks green.



### 3-3 Back Panel



**Diagram 3-3. Back Panel**

#	Part Name	Function
21	RS1 Terminal	9-pin male RS232C (In) connector.
22	RS2 Terminal	9-pin male RS232C (Out) connector, for downstream connection to the RS1 Terminal of a Model AI/Hi-12 Series pump.
23	Remote Terminal	15-pin female D-Sub connector. Refer to Section 10-1 "Remote Connector" for further details.
24	Power Switch	Rocker Switch
25	Cooling Fan	DC fan, air flow out of unit
26	AC Inlet	built-in fuse holder
27	Ground Terminal	
28	Fuse Holder	holds 2, 2A Midget Type Fuses

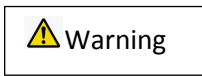
# 4 Installation

## 4-1 Accessory Check

When first opening the unit packaging, check to make sure that all standard accessories are included. (See Section 2, Standard Accessory List.)

※ Note: If any accessories are missing or damaged, contact your vendor. FLOM corporation will not be held responsible for any problems resulting from the use of off-market or knockoff parts.

## 4-2 Electrical Connection

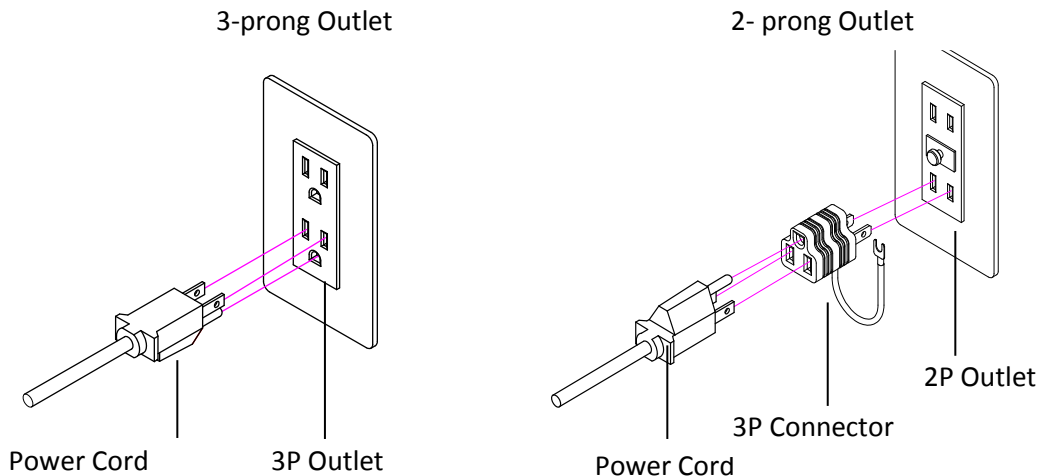


Warning Holding the the plug head of the power cord, insert into a nearby electrical outlet. Do not touch the cord with wet hands to avoid electric shock.



Caution Your system may contain a large device that could produce an electrical surge damaging to the pump unit if they are run from the same power outlet. In this case please connect the pump unit to a separate power outlet.

Plug the power cord provided with the unit into the connector on the back panel, and plug the other end into an indoor electrical outlet. The power source can be from AC 100V to 240V and can use both 50Hz and 60Hz frequencies. The cord provided is a 3-pronged triplex cable. If connecting to a 2-pronged outlet, always use a 3-pronged adapter unit in between, and ground the plug, as shown in the illustration below.



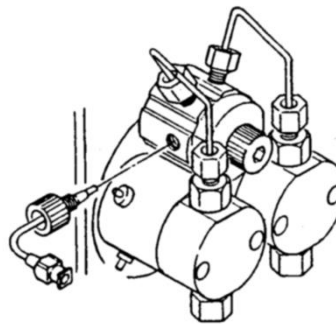
### **4-3 Aspirating Tube Connection**

Using the supplied fitting and ferrule, connect the teflon tubing to the aspirating check valve.

※ Attach the supplied suction filter at this time.

### **4-4 Drain Needle Connection**

Connect the supplied drain needle to the left-hand port on the drain valve.



**Diagram 4-4. Drain Needle Connection**

### **4-5 Air Bleeding Procedure**

Open the drain valve (turning left), connect the syringe barrel to the aspirating needle and pull plunger to draw solvent in and bleed air out of the pumphead. As you bleed air out of the pumphead, also turn on the pump to get solvent flowing.

※ Note: always open and close the drain valve by hand; NEVER use a tool. Always place the solvent Bottle at a level at least as high as the pumphead.

### **4-6 Pump System Connection**

Remove the Stop Screw (STOP FITT) attached to the pump system port on the right side of the drain valve and connect to the next unit in the system (injector, autosampler, etc).

### **4-7 Preliminary Pumping**

Immediately after purchasing, or after a long period of non-use, the pump action may show some initial instability. If this occurs, consult Section 5-3 “Purge Mode” on how to use preliminary pumping to stabilize the pump action. When preliminary pumping, remember to first close the drain valve (turn right).

## 5 Basic Operation

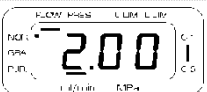
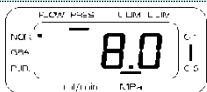

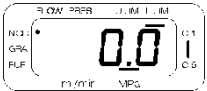
### 5-1 Changing Parameter Displays

Pressing the Set Key will change the parameter displayed in the following order:

Flowrate → Pressure Monitor → Upper Pressure Limit → Lower Pressure Limit

The indicator bar beneath the currently selected parameter will light up.

### 5-2 Setting Pump Parameters

<p><b>Flow rate</b></p> 	<p><b>(While the Bar Under FLOW is Lit Up)</b></p> <p>Use the Up and Down Keys to change the flowrate. Keeping the key depressed will increase speed of change. Flowrate can be changed even while pump is operating.</p>
<p><b>Pressure Monitor</b></p> 	<p><b>(While the Bar Under PRES. is Lit Up)</b></p> <p>While pump is operating, this displays the current pressure.</p>
<p><b>Upper Pressure Limit</b></p> 	<p><b>(While the Bar Under U.LIM is Lit Up)</b></p> <p>Set the limit as described above under “Flowrate”. If pressure exceeds the limit set, a buzzer will sound, the pump will stop operating, and an error message will be displayed. Refer to Section 9-1 “Troubleshooting the Error Indicators”.</p>
<p><b>Lower Pressure Limit</b></p> 	<p><b>(While the Bar Under L.LIM is Lit Up)</b></p> <p>Set the limit as described above under “Flowrate”. If pressure decreases below the limit set, a buzzer will sound, the pump will stop operating, and an error message will be displayed. Refer to Section 9-1 “Troubleshooting the Error Indicators”. If the minimum pressure is set to zero, no error will occur.</p>

### 5-3 Purge Mode

☆The Purge Mode will help smooth solvent changes and bubble removal from the pumphead.

With the pump turned off, press the PURGE key. The PUR. indicator will light up, and the purge operation will begin. During the purge the Status LED will turn green and blink.

Press the PURGE key once more, or press the PUMP key, to halt the purge. If you have changed the flowrate during the purge, once the pump has stopped this value will be cleared, and the pump flowrate will be automatically reset to its original value before the purge began.

※ **Note** With the drain valve open, it doesn't matter how high the flowrate is set during the purge, but when the drain valve is closed during the purge, too high a flowrate may cause excessive pressure buildup in the column or other components connected to the pump. Adjust the flowrate carefully to avoid the potential damage this could cause.

## **5-4 Operating the Pump**

When the pump is turned off, pressing the Pump key will begin pump operation in the currently selected pump mode. Before operating, check the Pump Mode indicator on the Control Panel to make sure that the mode you want is currently selected (the selected mode will be light up).

Refer to Section 6-1 “Setting the Pump Mode” for further details.

Pressing the Pump key again will halt operation.

**※ Note** If bubbles are trapped in the pumphead, operating the pump in learning mode will result in a malfunction of the learning mode, and either Error 3 (Er3) or Error 4 (Er4) will be displayed and pump operation halted. If this error occurs, run the Purge Mode at a pressure of 1.0MPa or higher to bleed all bubbles from the pumphead.

## **6 Advanced Operation**

This section deals with conditional pump settings, and permits the following advanced operations.

1. setting the pump mode (learning mode)
2. Flow volume correction settings
3. setting the pump number
4. adjusting the pressure zero point (automatic)
5. changing the pre-set learning data

### **6-1 Setup Mode**

Depressing the Set key and then switching the power on will bring the pump up in Setup Mode. In this mode the first 4 advanced operations described above can be performed. The order of appearance is as follows:

1. Setting Pump Mode → 2. Flowrate Correction → 3. Pump Number → 4. Pressure Zero Point

Use the Up and Down Keys to set the parameters to the level you want, then press the Set key to preserve that value and move to the next parameter in the list. Once the 4<sup>th</sup> item, Pressure Zero Point, has been set, the pump automatically returns to normal pumping mode.

#### **Setting the Pump Mode (Learning Mode)**

**FLOW Indicator Bar is Lit**

#### **Parameter Value: [1] Inputting Learning Data Mode**

Turn the pump on to begin Learning Mode, and at any point stop the pump, and the pump will remember the current parameters as 1 step. Turning on the pump again, the pump will resume at the last Flowrate saved; from this point, turning the pump off again will result in the pump remembering these new flowrate if the flow is less than the previous time. This setting is effective when the backpressure is somewhat constant.

When the pump is in this mode, the NOR. pump mode indicator will be lit.

**Parameter Value: [2] Saving the Learning Data and Preventing Further Input Mode**

This mode will save the data entered and prevent further data entry. If there is no Learning Data saved, then Flowrate Correction will not occur. This parameter will also prevent other users from inadvertently overwriting the current Learning Data.

When the pump is in this mode, the NOR. pump mode indicator will be lit.

**Parameter Value: [3] Clearing the Current Learning Data Mode**

Starting the pump will begin the learning process, but if the pump is stopped all current data is cleared from the pump memory, and learning will have to be re-input. This mode is useful when the back pressure is not constant (ie, you need to change columns frequently).

When the pump is in this mode, the NOR. pump mode indicator will be lit.

**Parameter Value: [4] Running with Pre-Set or Already Input Data Mode**

This mode is for running the pump when the input data has already been entered, and active learning is performed to reduce the pulse width further. However the learned contents are not updated when the pump is stopped.

This is the default parameter value when the pump is shipped from the factory.  
When the pump is in this mode, the NOR. pump mode indicator will be lit.

**Parameter Value: [5] Gradient Mode (using pre-set data acquired thru learning, and not in learning mode)**

This mode is for running the pump with input data already in memory, and cannot be used to input new data. Set the pump to this mode when pumping solvent on a gradient.

When the pump is in this mode, the GRA. pump mode indicator will be lit.

**Setting Flow Volume Correction**

**PRES Indicator Bar is Lit Up**

Input any volume correction value from -9.9% to +9.9%.

Use a minus value when the actual flow volume is high, use a positive value when the volume is too low.

**Setting the Pump Number**

**U.LIM Indicator Bar is Lit Up**

Input any pump number from 1 to 9. This is only used for remote communications operations. Default pump number is 1.

**Setting the Pressure Zero Point (Auto)**

**No Indicator Bar is Lit Up**

Set this for automatic zeroing of the pressure sensor.

Before doing this be sure to open the drain valve to prevent pressure buildup.

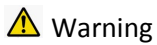
Once pressure zero point has been set, the pump automatically returns to normal pump mode.

## **6-2 Changing the Pre-set Learning Data**

When pumping mode is set to 4 or 5 (as explained above) the pump will use the learning data pre-set at the factory, but the user can have the pump learn the pulsating current correction pattern and can use that as the preset data. For details please consult the separate document “How to Set the 5-Point Learning Data”.

## **7 Key Points of Operation**

### **7-1 Special Precautions during Operation**



Warning

: The points below are all WARNINGS. Avoid these actions and situations at all times.

- Never wet the panel or cover of the unit with water or solvents, organic or otherwise. If water or solvent is inadvertently spilled on it, unplug the unit and clean immediately. Do not start the unit until it is completely dry. A wet unit is a hazard for fire, short circuits, electric shock and unit damage. If you suspect a large volume of water or solvent has leaked into the unit interior, contact your vendor for advice.
- Never allow stainless steel tubing or metal fragments of any kind to enter the unit through the cover vents. This could cause short circuits, electrical shock, damage or injury.
- Do not attempt to repair or dismantle the unit if you suspect a technical problem, nor attempt to convert or upgrade it yourself. Doing so could cause fire, electrical shock, or injury.
- When changing the pump head or head guide seals, always turn off the power switch on the back panel, and unplug the power cord from the AC outlet. Do not plug or unplug with wet hands. Do not attempt to remove or replace any components except for the seal. Doing so could cause electric shock or damage. Refer to Section 8-2 “Replacing the Plunger Seal” when replacing the seal.



Caution

: The points below are CAUTIONS. Be sure to follow them to ensure safe operation of the unit.

- Do not run this unit on an electric power system outside the standard AC 100V-240V (50/60 Hz) range. Doing so could result in fire, electrical shock or damage.
- If a malfunction occurs, stop operation immediately. Contact FLOM, providing clear descriptions of the problem. Using the unit after malfunction could cause fire, electrical shock, or injury.
- Treat the electric power cord carefully: do not bend excessively, treat, tuck into small spaces, connect to long extension cords, wrap up, bind up, or place under heavy objects. Doing so could result in fire, overheating, and electrical shock.
- Do not cover the vent on the side or the waste liquid outlet on the back of the unit with paper or tape. Doing so could result in fire, overheating, or damage.



- The PEEK hex screw connecting the drain valve and the drain side of the pumphead does not need to be tightened very strongly. First tighten by hand, then it should be enough to use a wrench and tighten about 60° more. Be careful not to overtighten as this could damage the screw.
- When using a buffered solution, change the solvent about once a week, first injecting distilled water from the wash port. Doing so will decrease wear on the plunger and the plunger seal, helping to prevent leaks and increasing the unit's durability. For more details refer to Section 8-1 "Washing the Plunger". (A wash kit is available as an option.)

## **7-2 Location of Installation and Storage**



**Danger**

: The points below are all dangerous HAZARDS. Avoid these actions and situations at all times.

- This device is not rated explosion-proof. Never use in an environment with an explosion hazard. Doing so will result in a high risk of death, injury and/or fire hazard.
- This unit features a compact design, but do not place in a location above head level or where the unit could easily fall. Doing so could result in death, injury, or damage to the unit.



**Caution**

: The following locations are not suitable for installation or storage of this unit.

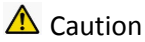
Placement in any of these locations may result in voltage leaks or damage to the unit.

- Do not use or store the unit out-of-doors.
- Do not use or store the unit near a source of corrosive gas.
- Strong electromagnetic waves can cause malfunctioning in nearby CPUs, so do not use the unit near high-frequency equipment.
- Do not place the unit in vibrating or unstable locations.
- Do not place in direct sunlight or sources of high heat.
- Do not use or store in places with high humidity or dust.
- One important condition is to always use and store the unit at room temperature (indoors). Avoid use or store under extremes of temperature. (Appropriate temperatures for installation or storage: around 4° – 45° C in areas without water condensation.)
- When storing the unit for extended periods, fill the pumphead and wash ports with distilled water or alcohol. In particular, always store filled with distilled water after using a buffered solution.

※ **Note:** Always place the solvent bottle at a level at least as high as the pumphead.

## **8 Maintenance**

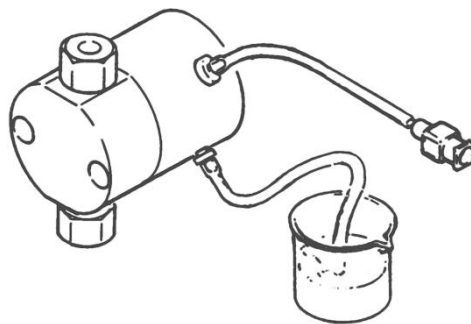
### **8-1 Washing the Plunger**



Please follow the instructions carefully and in full. Ignoring these instructions could easily result in a malfunction in the moving parts of the pump unit.

Since using a buffered solution as a solvent can result in a build-up of salts on the plunger and cause noticeable damage to the seal, it is important to regularly wash the plunger to remove these salts by connecting a silicone tube to the upper part of the wash port (refer to Section 3-1 “Front Panel”), and using a syringe to inject distilled water into the head. The unit does not have an automatic wash function, so fresh distilled water should be injected in every 3-7 days.

You can order a silicone tube kit as an option, but it’s perfectly fine to use your own tubing if you have it. The illustration below shows the connection on the wash side. The upper part is where the distilled water is injected. The bottom part discharges waste water into a beaker.



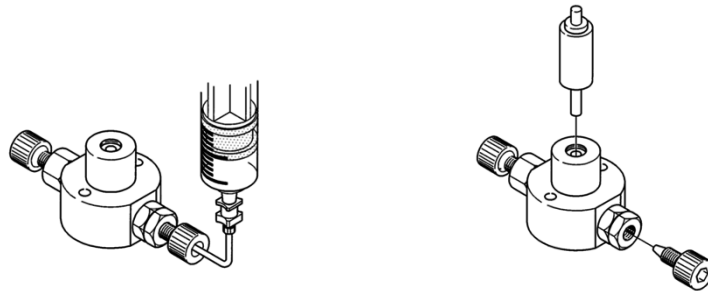
**Diagram 8-1. Plunger Wash Setup**

## **8-2 Replacing the Plunger Seal**

The plunger seal is a consumable item. It must be replaced regularly.

Usually, only the plunger seal inside the pumphead is changed. When using the wash port, the plunger seal in the pumphead guide should also be changed at the same time. To change the seal, follow the procedure outlined below.

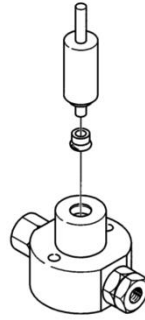
1. Use a supplied wrench to remove the connections to the aspiration and drain sides of the check valve.
2. Loosen the pumphead screw. Use the hex L wrench supplied with the unit.
3. Pull the pumphead straight off the unit body.
4. Remove the worn seal from the head.
  - a) After sealing off the drain side of the pumphead check valve with a cap, connect an aspiration needle to the check valve on the aspiration side, and inject distilled water with a syringe until it overflows.
  - b) Insert the rounded, unstoppered long end of the seal insert tool (option) all the way in.
  - c) The seal will float due to internal pressure, so repeatedly add water until the seal sticks to the tool and can be removed with it.
  - d) Never leave the old O-ring stuck inside. (Refer to the diagram below.)



**Diagram 8-2a. Removal of Seal**

5. Insert the new seal into the head.
  - a) Set the new seal on to the stoppered, short side of the seal insert tool (option). Be very sure that the O-ring is on the OUTER side of the seal. Putting in the O-ring and the seal separately can easily damage the seal, so always make sure that the O-ring is placed in together with the seal.
  - b) Slowly insert the seal using a rotating motion. Jamming the seal directly in may damage the O-ring and cause a leakage, so be extra careful at this step.
  - c) Push in until the pumphead and seal insert tool overlap. Remove the seal insert tool, and prepare the pumphead for reattachment. Refer to the diagram below (8-2b).

**Diagram 8-2b. Seal Insertion**

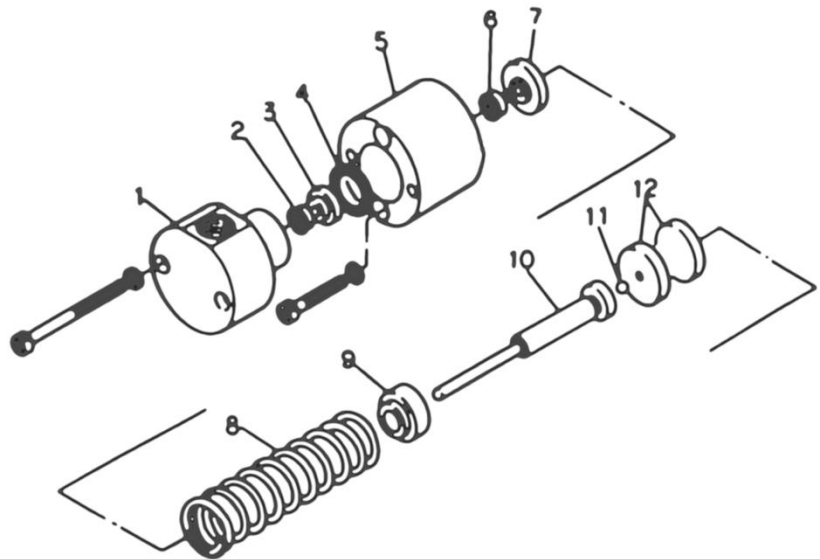


6. Reattach the head to the main unit, tighten the pumphead screw, and reconnect all tubing.

This completes the seal replacement process. Refer to Section 8-3 “Moving Parts Diagram” while performing this maintenance.

### **8-3 Moving Parts Diagram**

1	Pumphead
2	Plunger Seal
3	Backup Ring
4	O Ring
5	Head Guide
6	Wash Seal
7	Plunger Guide
8	Spring
9	Plunger Adapter
10	Plunger
11	SS Ball Bearing
12	Spacer



**Diagram 8-3a. Standard Moving Parts**

## **8-4 Washing the Check Valves**

The major cause of bad flow is problems in the check valves. Bubbles, contaminants and grit can get trapped between the bearing and the valve seat, or the valve can dry causing the bearing to stick to the seat.

If bubbles are causing a problem with flow, refer to Section 4-5 “Air Bleeding Procedure”. If air bleeding does not solve the problem, there is probably some contaminant or grit stuck between the bearing and valve seat. In this case, follow the procedure outlined below to wash the check valves.

1. Remove all tubing from the aspiration or drain check valve. On the drain side, use the 8mm wrench provided with the unit.
2. Remove the aspiration or drain check valve from the pumphead. Use the 10mm wrench provided with the unit.
3. Wash the check valve in a beaker with either alcohol or distilled water (if using a buffered solution always use distilled water), and clean with ultrasound for 10-20 minutes.
4. After cleaning reattach check valve to the pumphead. Be careful to put both the aspiration and the drain valves back in the right place!

After tightening the check valve snugly by hand, use the wrench to turn it another 90°.

※ Note: be careful when tightening by wrench. It is very easy to overtighten and damage the valve.

5. Reattach all tubing to the aspiration and drain check valves.

When reattaching tubing to the drain side, similarly to reattaching the check valves, first snugly tighten by hand, then use the wrench to give it an extra 60° twist.

※ Note: be careful when tightening by wrench. It is very easy to overtighten and damage the valve.

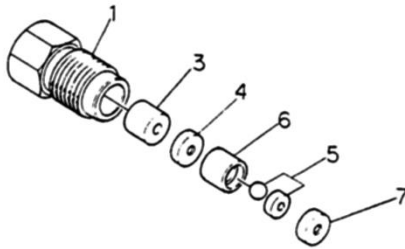
6. When tubing is reattached, allow solvent to flow in and remove all air bubbles. Refer to Section 4-5 “Air Bleeding Procedure”.

The procedure above should eliminate all contaminants and grit in the majority of cases and allow the unit to function properly again. If this doesn't solve the problem, then the check valve itself will have to be disassembled and each separate part thoroughly washed.

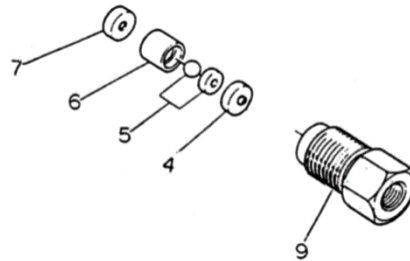
To disassemble a possibly malfunctioning check valve, first remove it from the unit, and place a STOP FITT cap on the joint and rotate by hand. Doing so will slowly bring the inner mechanism out from the valve cartridge. Inspect and clean the check valve interior mechanism, using the notes in the box below.

### Check Valve Mechanism Reassembly Notes

1. The mirror surface side of the valve seat is where the bearing goes. (easily detected by shining a light on it.)
2. Always use tweezers to set the bearing and the valve seat into the valve case.
3. Seal A is not as thick as Seal B, and Seal A goes on the **INSIDE** of the valve cartridge. Do not mix them up!
4. The valve case set up in Step 2 above should be placed in the cartridge as shown in the diagram below.
5. Seal B should be pushed in evenly. (Seal B is a consumable; we recommend replacing with a new seal each time disassembly is done.)



**Diagram 8-4a. Drain Side Check Valve**



**Diagram 8-4b. Aspiration Side Check Valve**

Index #	Part Number	Name	Specifications
1	#2115	1/16" Valve Cartridge	No.10-32 UNF PEEK
9	#2114	1/4-28 Valve Cartridge	1/4-28 UNF PEEK
3	#2005	Tapered Spacer	PEEK
4	#2006	Seal A	1.5mm PCTFE
5	#2008	Ball and Valve Seat	Ruby & Sapphire
6	#2009	Valve Seat Case	PEEK
7	#2007	Seal B	2.0mm PCTFE

# 9 Troubleshooting

## 9-1 Troubleshooting the Error Indicators

<b>Er 1</b>	<b>Upper Pressure Limit Error</b>
Problem	During pump operation, pressure level exceeds set upper limit.
Solution	<ul style="list-style-type: none"> <li>☆ Check tubing and column. When checking tubing, start by checking joints farthest from the pump.</li> <li>☆ Recheck the value of the currently set upper pressure limit.</li> </ul>
<b>Er 2</b>	<b>Lower Pressure Limit Error</b>
Problem	During pump operation, pressure level falls below set lower limit.
Solution	<ul style="list-style-type: none"> <li>☆ Check for leaks in tubing and joints.</li> <li>☆ Recheck the value of the currently set lower pressure limit.</li> <li>⊗ When restarting pump, no error will occur as long as the pressure is within the set range.</li> </ul>
<b>Er 3</b>	<b>Check Valve Error</b>
Problem	Malfunction due to air or grit in the check valve.
Solution	<ul style="list-style-type: none"> <li>☆ Refer to Section 4-5 “Air Bleeding Procedure” to bleed trapped air out of the system. If that doesn’t solve the problem, try an ultrasound wash or disassembly to expel the trapped air.</li> </ul>
<b>Er 4</b>	<b>Motor Error</b>
Problem	Motor malfunction due to overload or erratic rotation.
Solution	<ul style="list-style-type: none"> <li>☆ Malfunction in pumping (check valve); do not operate pump before fixing this problem.</li> <li>☆ Extreme pressure load during pumping has caused flow stop; determine source and fix.</li> <li>☆ Internal sensor malfunction due to contaminants; flow has stopped. In this case, call FLOM or a FLOM-approved vendor for a service call.</li> </ul>
<b>Er 5</b>	<b>Memory Error</b>
Problem	Attempt to write invalid data or perform illegal clear operation on memory.
Solution	<ul style="list-style-type: none"> <li>☆ Do not operate pump near sources of high frequency electromagnetic energy.</li> </ul>
<b>Er 8</b>	<b>Pressure Zero Point is Outside Auto Adjustment Range Error</b>
Problem	Automatic pressure zero point adjustment does not finish within allowable range.
Solution	<ul style="list-style-type: none"> <li>☆ Drain valve may be loose and causing loss of pressure. Check to see that is properly seated.</li> </ul>

## **9-2 Troubleshooting Other Situations**

<b>■ Unit Won't Turn On</b>
☆ Check the power breaker circuit, the socket, and the outlet
☆ Check the fuses.
☆ Check the AC power source (useable range is AC100-240V). Using power sources of greater than AC250V may break the power switch inside the unit, which will require a service call.
<b>■ Suspicious Noises</b>
☆ Is the front panel touching the pumphead? Lengthen the tubing between the pump port and the column.
☆ Is the pump touching some other unit? The vent is located on the side, so always allow 2cm or more of space between the unit and other components and/or objects.
☆ Is any tubing touching the back panel outflow fan?
<b>■ Flow Volume Will Not Stabilize</b>
☆ Check the AC power. (Voltage should be between AC100V – 240V). Voltages below AC90 will prevent the motor from achieving sufficient torque to run the pump.
<b>■ Strange Odors</b>
☆ Cut power and immediately arrange for a service call, describing the situation in clear detail.



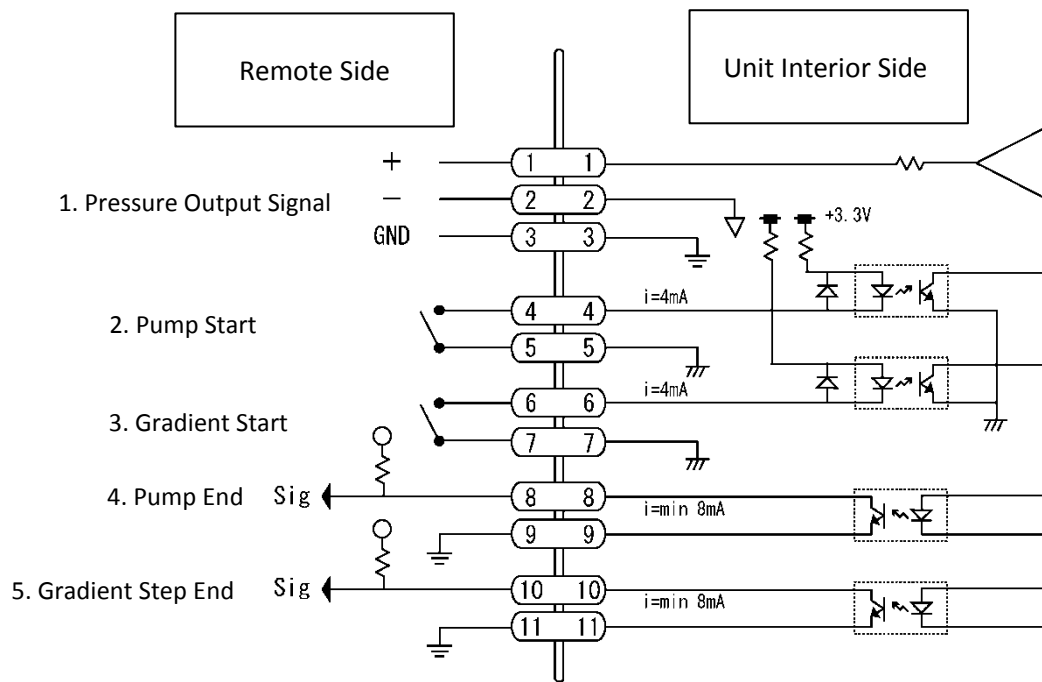
# 10 External Control

## 10-1 Remote Connector

The D-Sub 15-pin female connector on the back panel can be used for a remote connection. Through this connection you can remotely perform the following options.

1. Pressure Output Signal Monitor (analog)
2. Pump Start Input
3. Gradient Start Input
4. Pump End Output
5. Gradient Step End Output

### (I) Wiring Diagram



**Diagram 10-1. Remote Connector Wiring Chart**

## **(II) Signals**

<b>1. Pressure Output Signal (analog)</b>
Outputs a signal during pump operation proportional to pressure, 0.1V/10MPa.
<b>2. Pump Start</b>
This is the pump ON/OFF signal. Shorting terminals 4 and 5 together will turn the pump on.
<b>3. Gradient Start</b>
Can set parameters for gradient pumping by RS232C remote control, and when the program is in initial operation, a pulse longer than 1 second will commence gradient flow.
<b>4. Pump End</b>
When pump operation is halted, the photocoupler will turn ON for about 1 second. The signal is output under the following conditions: <ul style="list-style-type: none"><li>I. Pump is turned off from the front panel.</li><li>II. Error condition is reset.</li><li>III. Gradient pumping finishes.</li></ul>
<b>5. Gradient Step End</b>
During gradient operation, at the end of each gradient step the photocoupler will turn ON for about 1 second. This signal is irrelevant when the pump is simply pumping in normal, non-gradient mode.

## **10-2 RS232C Communication**

The HI-12 Series Pump is controllable through an RS232C connector. Up to 9 pumps can be daisy-chained in series. When gradient pumping, you need to correctly direct RS232C commands to the proper pump to set its particular parameters. For further information about RS232C control, refer to the separate document, “RS232C Communications Manual”.

## 11 List of Options

Part Number	Name	Specifications	Notes
#2315	Wash Kit	Silicone	
#2561	Pump ON/OFF Remote Connector	D-Sub 15 pin	
#2108	1/16 Check Valve Assy (Drain)	No.10-32UNF screw	
#2109	1/16 Check Valve Assy (Aspiration)	No.10-32UNF screw	
#2102	1/8 Check Valve Assy (Aspiration)	M8 x 1 screw	
#2207	Plunger Seal	7φ for inorganic solutions	
#2227	Plunger Seal	7φ for ionic solutions	
#2208	Plunger Seal	7φ for organic solutions	
#2226	Wash Seal	7φ	
#2228	Seal Insert Tool	7φ	

- ※ Note: The Check Valve Assembly is an internal, built-in type.  
If internal parts are needed, refer to Section 8-3 “Moving Parts Diagram” to find the parts you need, note the name and model number, and contact FLOM or your FLOM-approved vendor for a replacement.
- ※ Note: If parts or components are missing or damaged, contact your vendor for replacements. Do not use off-market or knock-off parts on the unit, FLOM will not be responsible for any damage resulting from the use of off-market or knock-off parts, and their use will void the warranty for this unit.

## 12 Specifications

Product Name	HI-12-33
Pump Method	Double Reciprocating Plunger
Max. Discharge Pressure	20MPa (0.1 ~ 25 ml/min) 10MPa (25 ~ 50ml/min)
Settable Flowrate Range	0.1 ~ 50.0 ml/min
Flowrate Setting	UP/DOWN Key or External (RS232C)
Pressure Setting	UP/DOWN Key or External (RS232C)
Pressure Upper Limit	0 ~ 20MPa
Flowrate Accuracy (pumping water, 25°C room temperature)	±2% (1.0 ~ 50.0ml/min)
Flow Stability	±0.3% (0.1 ~ 20.0ml/min)
Pulse Control	1. Learning Control thru Pressure Feedback 2. Pattern Control with Preset Data (5 point settings)
Pressure Display Accuracy	±5%
Wetted Material	SUS Ruby Sapphire Teflon Diflon (PCTFE)
Power Source	AC100V ~ 240V (50/60Hz)
Dimensions	(W)110 × (D)360 × (H)184 mm (excluding protuberances)
Weight	about 6.8kg

\* Max discharge pressure here means transient maximum pressure; it does NOT mean regular maximum discharge pressure.

\* Learning Control cannot be used during gradient pumping. To set gradient pumping, set the pumping mode to number 5 as explained in Section 6-1 “Setup Mode”.

\* Product specifications and appearance may be altered without prior notice.

\* Due to continual product improvement, products may differ slightly from images displayed in user manuals and catalogs.

## **13 Product Warranty**

### **Product Warranty**

Thank you for purchasing this FLOM product.

FLOM Corporation guarantees the performance of this product for one (1) year.

FLOM Corporation will assume responsibility for covering the costs of repair and/or replacement for any defect in, or damage to, the unit, occurring within this period, when such defect or damage can be shown to be the responsibility of FLOM. However, FLOM Corporation will assume no responsibility for defects or damage due to, or substantially similar to, the following circumstances or conditions:

- 1) operating the unit not in accordance with the instructions given in the operating manual under section 9, Key Points of Operation;
- 2) mistakes in operation;
- 3) repairs or reconditioning not done by FLOM;
- 4) earthquakes, fire, catastrophes or other acts of God;
- 5) all defects or damage resulting from causes not inherent in the unit;
- 6) high temperature, high humidity, extremely low temperature, corrosive gas, constant high vibration and other factors produced by extreme environments
- 7) replacement of consumables and similar parts.

Filling out the information below is required to activate the warranty. If the required information is missing the warranty may be null and void.

Model: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Purchase Date: \_\_\_\_\_

Dealer: \_\_\_\_\_

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5-32-10 Shimmachi  
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