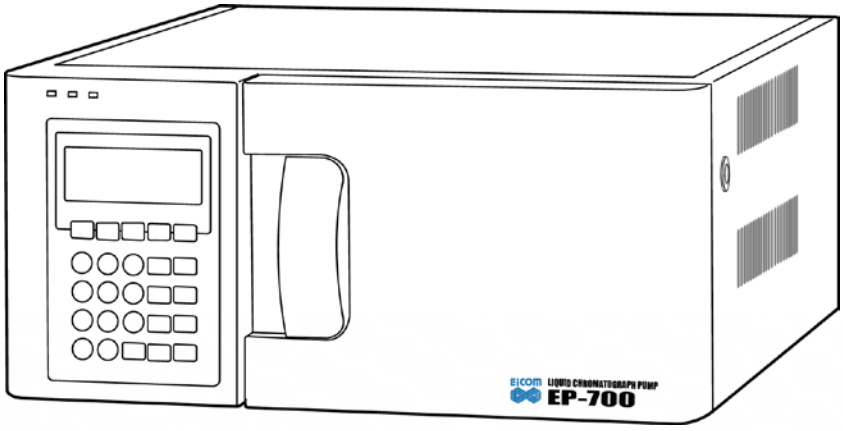
USER'S MANUAL

AC18-0816

HPLC Pump Component
EP-700



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INTRODUCTION

Thank you for purchasing the HPLC Pump Component EP-700.

The EP-700 is an HPLC pump system with ultra-high sensitivity, superior stability and adapts to various purposes, from Microdialysis Analysis with a laboratory animal to general analysis. The EP-700 is one of the devices that comprises the HPLC Electrochemical Detection system model. The EP-700 delivers the highest performance system architecture with the Eicom Electrochemical Detector (ECD) ECD-700 and Temperature Controller ATC-700.

The EP-700 has a high sensitivity liquid delivery pump, and degasser. In the EP-700 two different pumps may be mounted, the micro-flow rate pump, or the high-flow rate pump. The EPC-500 can control each pump independently or it can use both pumps to create a high pressure gradient. The pump in the EP-700 has self-learning pulsating flow control which ensures stable liquid delivery. The EP-700 is inert with non-metallic parts inside, and therefore creates a superior environment for maintaining a low and stable signal from an electrochemical detector.

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1. IMPORTANT SAFETY INFORMATION

We insist that users observe the following procedures in order to prevent accidents:

1) Be sure to read and understand this manual completely prior to operating the EP-700.

2) Follow all warnings listed herein very closely.

3) Do not alter the EP-700.

4) Never attempt to repair or dismantle the EP-700 on your own.

WARNING

This device has been produced for experts who have knowledge of chemical analysis and handling research reagents. Failure to follow instructions may lead to poor quality data and could result in a safety hazard (such as fire, electric shock, injury or other damage). DO NOT OPERATE the EP-700 until reading and understanding this instruction manual completely.

WARNING

Before you operate this product using harmful chemical reagents, be sure to understand its handling methods, physical and chemical characteristics and SDS (Safety Data Sheets). Mishandling harmful chemical reagents might result in death or serious injury to the user. To avoid health hazards, wear proper protective gloves, goggles and mask, and be sure there is adequate ventilation. Never allow leakage from any connection points of the tubing.

WARNING

Flammable chemical reagents must be kept away from sources of ignition and may give off flammable vapors if left uncovered.

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2. EQUIPMENT SPECIFICATIONS

Liquid Delivery Pump Unit

Liquid Delivery System	Double Piston Reciprocating System
Capacity of 1 Stroke	Micro Flow Rate Type (M) 4 µL High Flow Rate Type (H) 32 µL
Piston Materials	Sapphire
Setting Flow Rate	Micro Flow Rate Type (M) 1~999 µL/min High Flow Rate Type (H) 0.01~9.99 mL/min
Stable Flow Rate	Micro Flow Rate Type (M) 100~500 µL/min High Flow Rate Type (H) 0.5~3 mL/min
Liquid Contacting Surfaces	PEEK, Sapphire, Ruby, PTFE, PCTFE
Pressure Limit	20 MPa (Moment Maximum Pressure)
Pulsating Mechanism	Self-learning Pulsating Flow Control (In Isocratic Mode)

Degasser

System	Vacuum Gas Transmission
Lines	2 Loops
Internal Capacity	Approximately 300 µL/Loop
Maximum Flow Rate	3 mL/min

System

Pump Options	1 or 2 pumps and either high flow or micro flow
Gradient Function	High pressure linear gradient, maximum 10 step (Installed 2 pumps of same type)
External Signal	Input: Gradient Start/Stop (Contact Signal > 10 msec) Gradient Initialization (Contact Signal > 10 msec Output: Pump Pressure (10 MPa = 100 mV voltage signal) Pump Error (Relay Signal)
Measurement	400 (W) x 400 (D) x 190 (H) mm (does not include projection part)
Weight	Approximately 13 kg (1 pump) Approximately 16 kg (2 pumps)
Power Supply	AC100~240V 50/60 Hz 200 W

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3.1. Attachment List

Prior to operation, please ensure that the main body of the machine and all of the following parts are included. Also ensure that the equipment has not been damaged in shipping. If you have received a defective or damaged items, please contact Eicom or its distributors.

Parts List

Parts	Type	Qty	Standards/Note
User Manual		1	
Main Body	EP-700	1	
Liquid Delivery Pump Unit	MPU-7 or HPU-7	1 or 2	Installed in EP-700
PEEK Tube	PT-12	1 (if 1 Pump) 2 (if 2 Pumps)	0.125 mm, i.d. x 1/16 in. o.d. x 80 cm
Fitting	TC-50	2 (if 1 Pump) 4 (if 2 pumps)	For external diameter 1/16 inch pipe
PFA Tube		1 (if 1 Pump) 2 (if 2 Pumps)	2 mm, i.d. x 3 mm, o.d. x 100 cm For joint to 3 ways connector in pump head
3 mm Flat Seal Connector (Black)		1 (if 1 Pump) 2 (if 2 Pumps)	For joint to 3 ways connector in pump head
3 mm Flat Seal Ferrule (Yellow)		1 (if 1 Pump) 2 (if 2 Pumps)	For joint to 3 ways connector in pump head
PTEF Tube		2 (if 1 Pump) 4 (if 2 pumps)	1 mm, i.d. x 3 mm, o.d. x 130 cm For degasser plumbing
3 mm Flat Seal Connector (Translucent)		4 (if 1 Pump) 8 (if 2 pumps)	For degasser plumbing
Flat Seal Ferrule (White)		4 (if 1 Pump) 8 (if 2 pumps)	For degasser plumbing
Disposable Syringe		2	10 mL
Screw Wrench		1	8-10 mm
Signal Cable Connector		1	16 Electrode
Signal Cable		1	3 Pins with grounding wire
Power Supply Adapter		1	For transducer 3P → 2P
Grounding Wire		1	

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WARNING

If you intend to connect additional devices which are not authorized by Eicom, or non-Eicom products, please contact us to confirm compatibility before operation. Without confirmation of compatibility, damage caused by using incompatible products or equipment will void the product warranty.

3.2. Installation Location

Before installing this product, please read and understand the following instructions.

1. **Installation Location**

   Leave space more than 4 inches of space around the EP-700. Do not leave or put anything except Eicom 700 series devices on top of the EP-700.

2. **Installation on a Stand**

   Install the EP-700 only on a sturdy, horizontal stand. Please use a stand that has enough load bearing capacity for this product, in addition to any other devices it supports.

3. **Environmental Requirements**

   - This product should be operated only in a room where there is a minimum of temperature fluctuations. Maintain the temperature between 15-30°C during use.
   - Make sure nothing is liable to fall onto the EP-700.
   - Do not use or store organic solvents or chemicals that emit caustic gases near the EP-700. Always maintain adequate ventilation.
   - Do not expose the EP-700 to direct sunlight.
   - Do not expose the EP-700 directly to drafts, including heating and air conditioning vents.
   - Do not place in a location that is prone to vibration.
   - The EP-700 should be operated in a dust-free environment. Remove any dust from around the EP-700 frequently.
   - Keep away intense heat sources and other equipment that may produce strong magnetic fields or electrical noise.

Caution **Do not block the ventilation slits on side of the EP-700. Excessive heat from the machine may accumulate inside the product and cause damage. Maintain sufficient space around the EP-700 to ensure adequate ventilation.**

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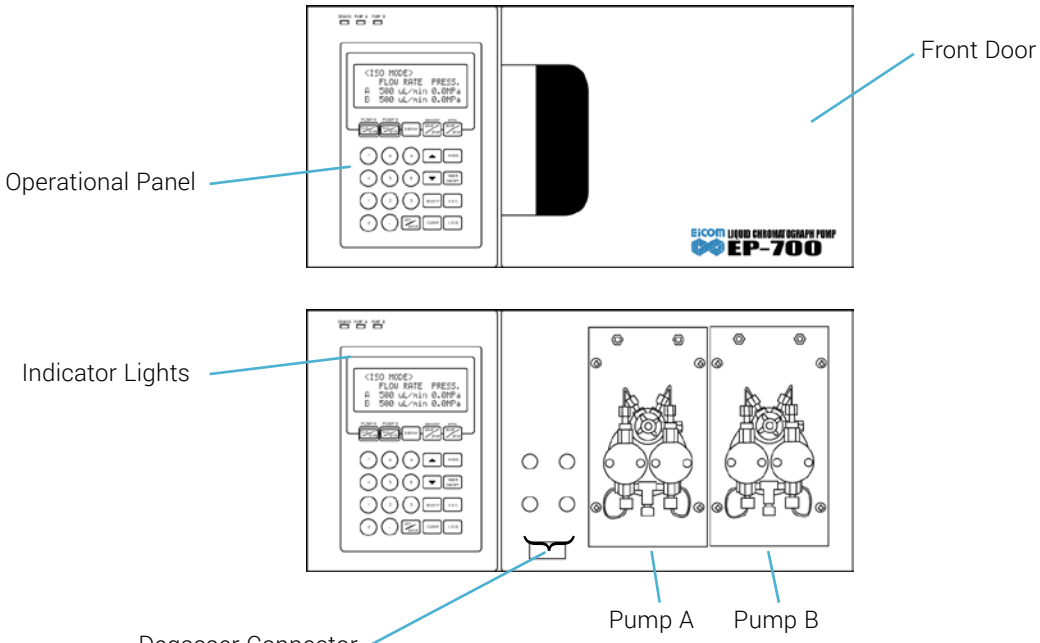
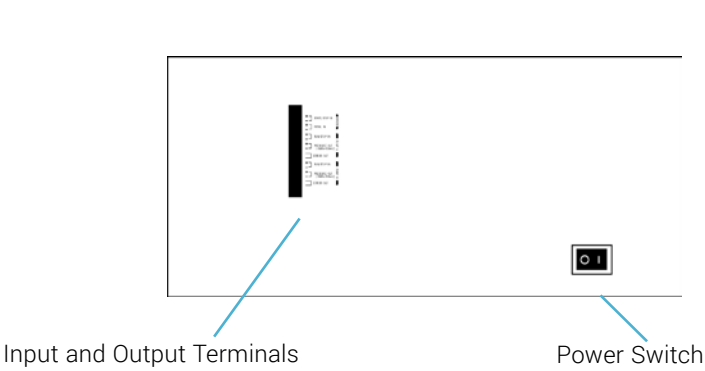
3.3. Installation Guideline

Part Names of EP-700

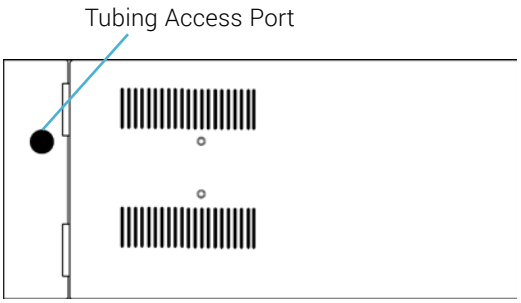
EP-700 FRONT



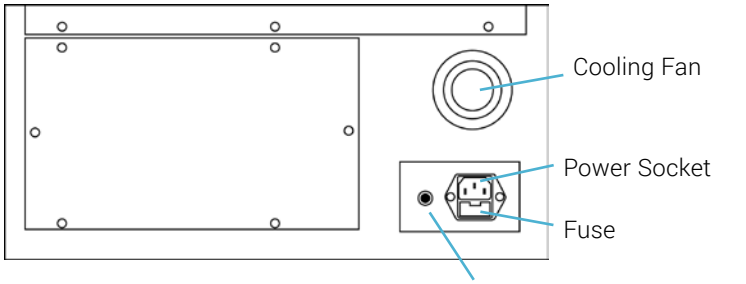
Inside of the Front Door



EP-700 Left Side



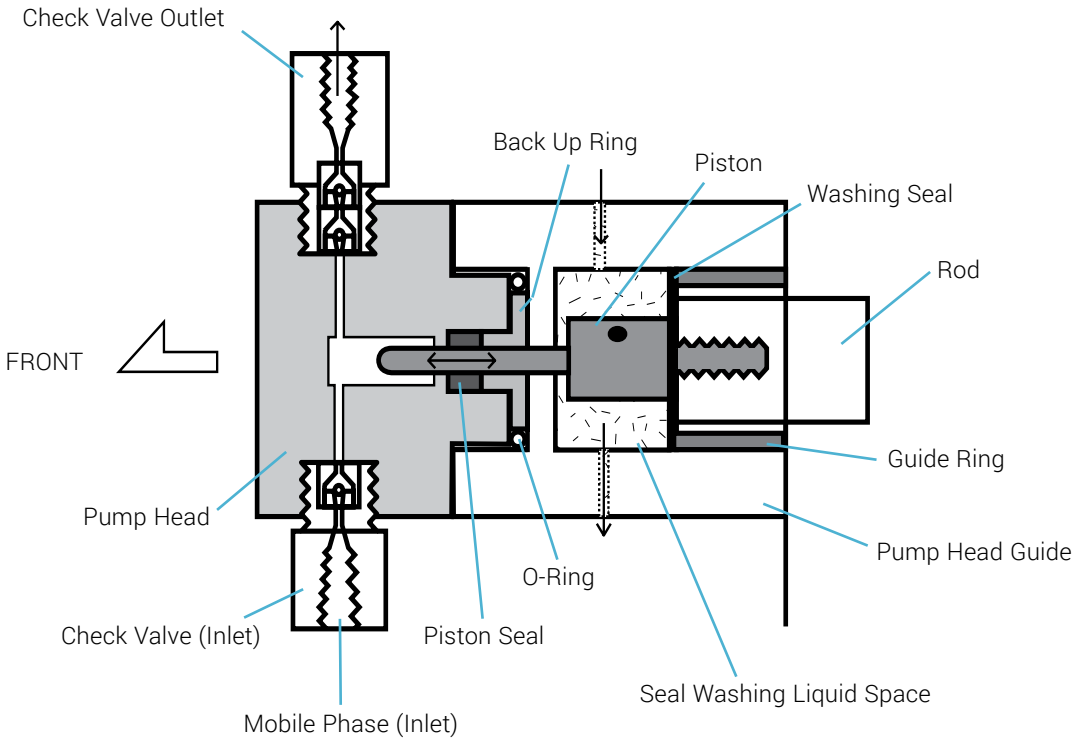
EP-700 Right Side



EP-700 Back

3.4. Principles of EP-700 Pumping Action

The EP-700 has the very precise liquid delivery pump with double pistons. The reciprocal action of the 2 pistons provides for continuous ejection of the mobile phase.



Micro Flow Rate: Type (M)

3.5. Remove Shipping Bracket for Inside Pump

The pump head of EP-700 may be held in place by an internal shipping bracket inside the main body, depending of the shipping method. To remove the plate, follow these steps.

The shipping bracket must be removed before operating the pump.

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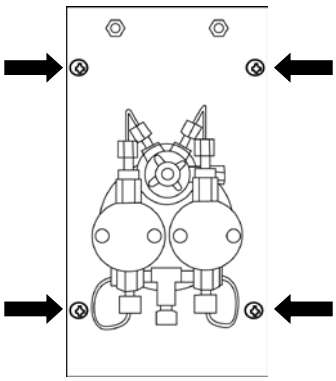
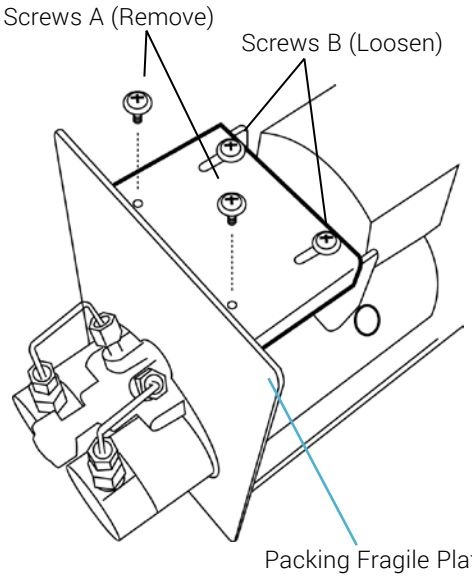
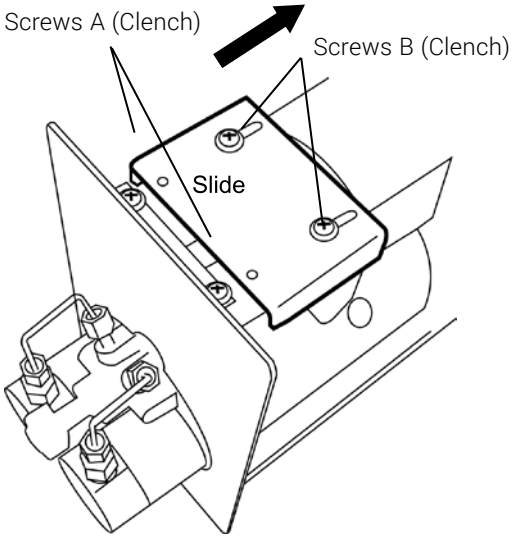


<u>This procedure will have to be repeated before shipping the EP-700 in the future</u>

Remove the 4 screws holding the pump head. The pump will then slide out along a guide rail.



Locate the shipping bracket on top of the pump. Remove the 2 screws positioned toward the front side of the pump head (Screws A). Now, loosen but don't remove the screws near the back of the plate. (Screws B). The bracket should move freely now.



Push the shipping bracket back and tighten the B Screws. Then replace the A screws into their holes.

Slide the pump unit along the guide rail until it is seated. Secure the front plate to the main body with the 4 screws initially removed from the front plate.

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3.6. Power Plug and Socket Type

Power supply conditions of EP-700 are as follow. Please make sure to use the included triple core cable with grounding wire as power supply.

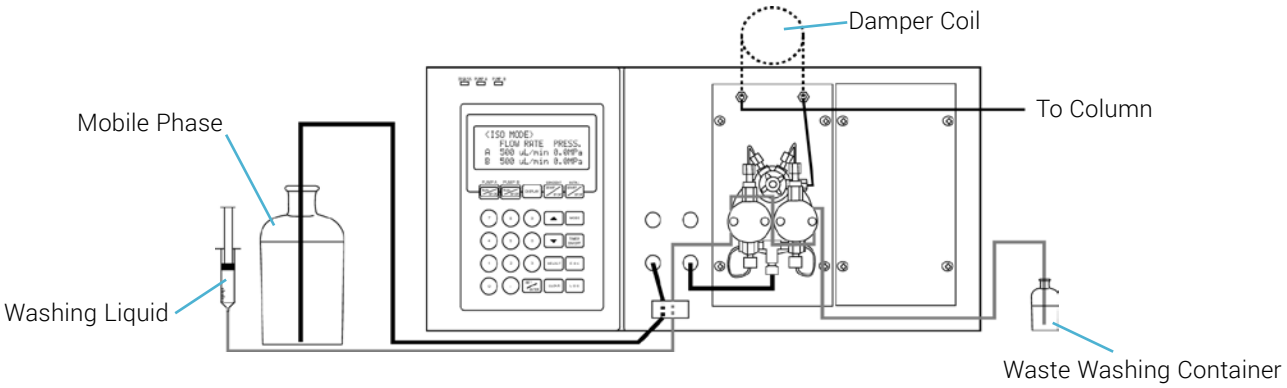
Power supply Voltage:	AC 100V~240V Single Phase (Fluctuation Range ±10V)
Frequency:	50 or 60Hz
Power supply Capacity:	More than 200W
Connection:	Cable with Grounding Wire (Triple Core)

3.7. Tubing Routing for the EP-700

There are 2 types of tubing for the EP-700. One is for mobile phase, and the other is for the seal washing duct.

Mobile Phase is delivered from an appropriate reservoir though a 3 mm tube to the degasser inlet and from the degasser outlet to the pump. From pump head, the mobile phase is delivered through 1/16 inch OD tubing to column. With pumps from other manufacturers, there is damper coil (external diameter 1/16 inch, internal 0.75 mm, 1.5 m) attached between the pump head and the column. The damper coil helps stabilize liquid pressure delivered to the column during low flow. If you use the pulse-free mode of the EP-700, this damper coil is unnecessary, but may be included if so desired.

To wash behind the seal, attach the one side of tube to a syringe. **Make sure to always pass 2-3 mL of HPLC grade water through the seal washing space before and after each pump use.**



Tubing Routing Diagram for the EP-700

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3.8. Washing Pump

The flow lines in the EP-700 have been washed extensively before shipment. Therefore, it is usually unnecessary to wash them before use.

When you do need to wash the flow lines inside the pump, such as if the pump has not been used in a long period of time, use water, methanol, or 0.1 mol/L Phosphate buffer liquid (pH3.5) (including 100 mg/L EDTA•2Na) to wash the lines. The following is a washing method example for Micro Flow Rate (Type M) pump.

(In case that samples containing oils or lipids have been analyzed)

Water	500 µL/min x 60 min
Methanol	500 µL/min x 120 min
Water	500 µL/min x 60 min
Mobile Phase	The usual flow rate for that method

Caution **When you are washing the pump, it is important not to wash with 100% methanol immediately after using a salt containing mobile phase. The sodium in mobile phase will precipitate out and clog the tubing and/or damage the inside of the pump.**

Caution **Please take care to purge the washing duct tube with 2-3 mL of purified water before and after use. This will greatly improve the lifetime of piston seal and piston. Otherwise, a small amount of salt contained in the mobile phase may crystallize. The salt crystals will scratch the piston and seal and cause the seal to leak.**

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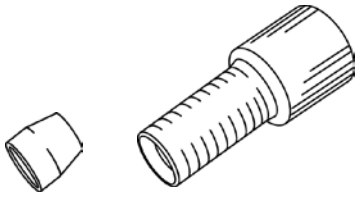
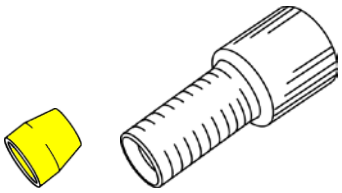
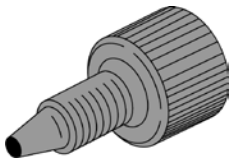
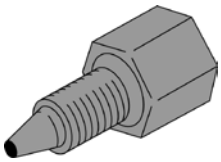
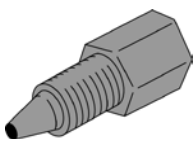
3.9. Connecting Methods to 700 Series

Tubing Connector List

Tubing Part	Connector
Degasser Connection	Connector (Translucent) & Flat Seal Ferrule (White) for 3 mm OD tubing 
Degasser ⇕ 3 Way Connector at the Pump Head	Connector (Black) & Flat Seal Ferrule (Yellow) for 3 mm OD tubing 
3 Way Connector at the Pump Head ⇕ Check Valve Inlet	Fitting 1/16 inch TC-50 
Check Valve Outlet ⇕ Priming Valve	Hexagon-fitting 1/16 inch (Large) 
Pump Head Washing Ports ⇕ Seal Washing Tube	Hexagon-fitting 1/16 inch (Small) 

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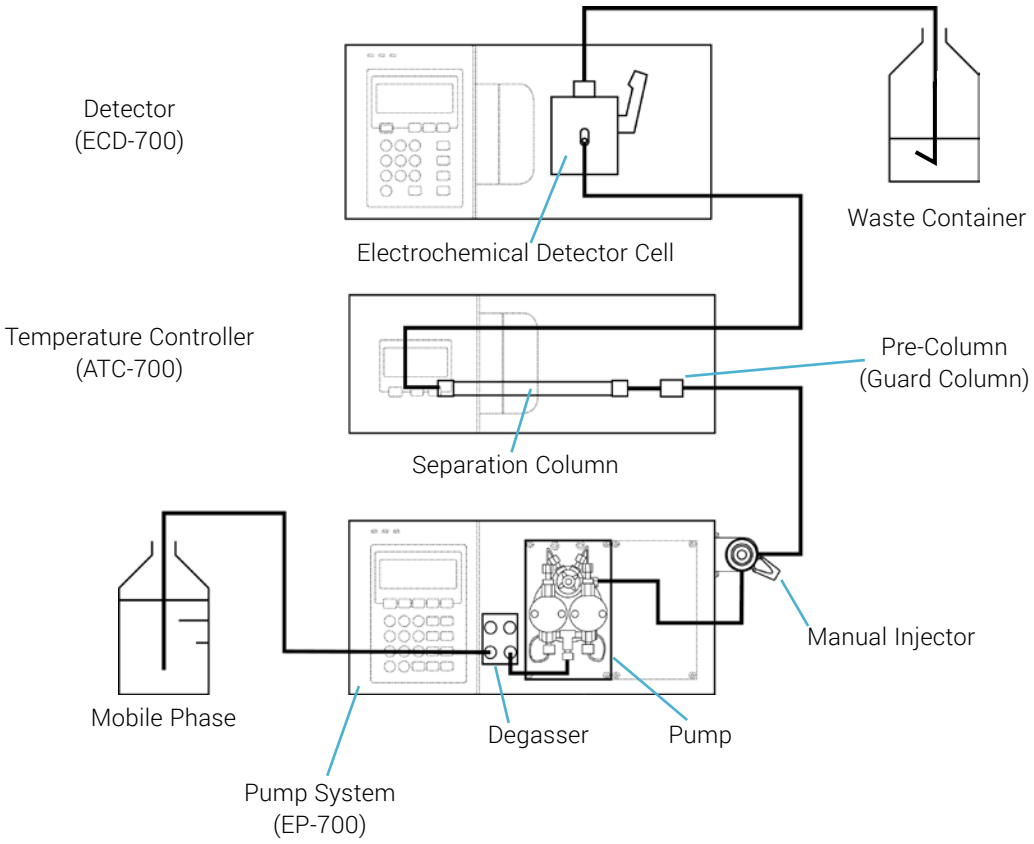
For tubing on the high pressure side of the pump, please make sure to use tubing and connectors that are rated for high pressure (ie. 20 Mpa). Usually PEEK tubing is used for basic applications. Avoid stainless tubing as much as possible.

The following is an example of tubing setup.

1. Using Manual Injector



a) Mobile phase is delivered through the degasser to pump.
b) Sample is injected manually.
c) Then sample passes through the pre-column (guard column) and is separated on the separation column which is maintained at a constant temperature with the Temperature Controller
d) Separated compounds exit the column and are delivered to detector.

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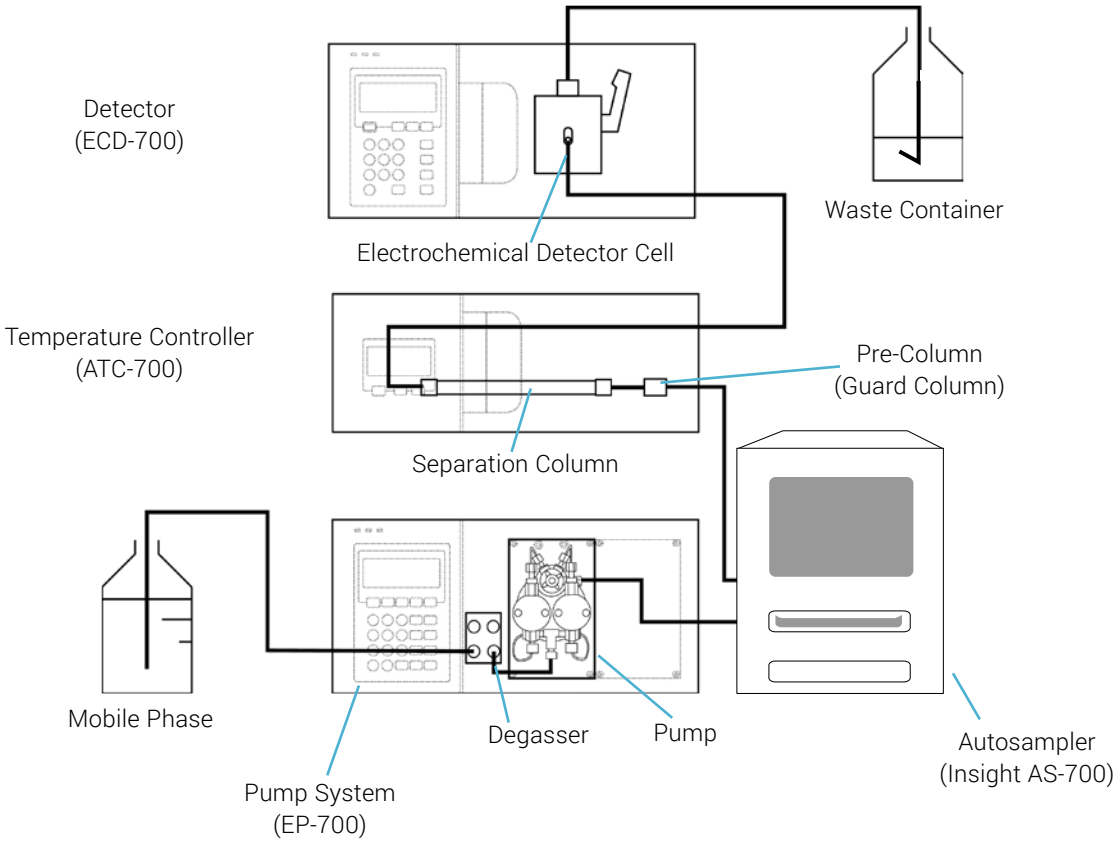
2. Using Autosampler



a) Mobile phase is delivered through the degasser to the pump.

b) Sample is automatically injected by autosampler.

c) Then sample passes through the pre-column (guard column) and is separated on the separation column which is maintained at a constant temperature with the Temperature Controller.

d) Separated compounds exit the column and are delivered to the detector.

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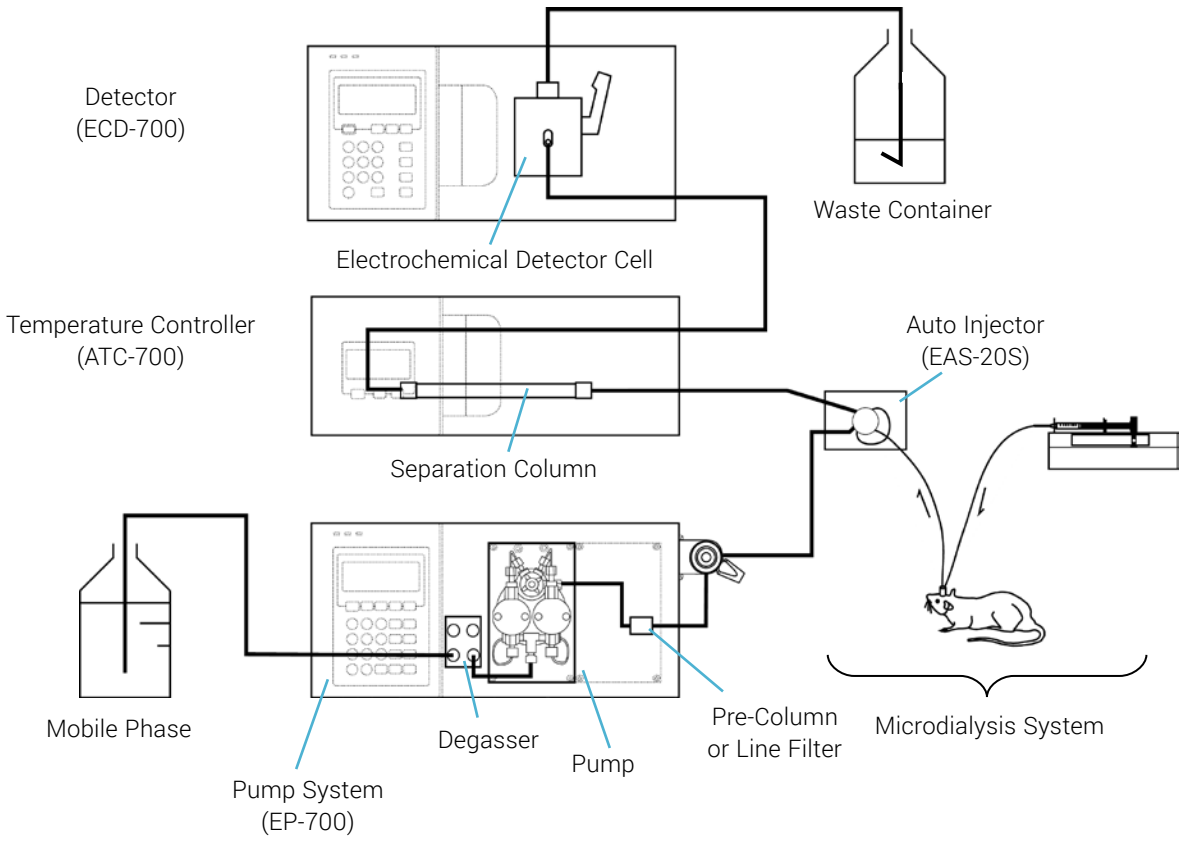
3. On-line analysis with microdialysis system



a) Mobile phase is delivered through the degasser to the pump, and then passed through a pre-column* or line filter*.

b) Sample is automatically injected by the Auto Injector.

c) Then sample goes to the separation column which is maintained at a constant temperature with the Temperature Controller

d) Separated compounds exit the column and are delivered to detector.

* Note: In general, microdialysis samples don't contain substances that may damage the separation column, such as protein. Therefore we recommend to set a pre-column before the injector to remove potential contamination in the mobile phase and set inline filter just before the separation column to remove particles potentially coming from the samples.

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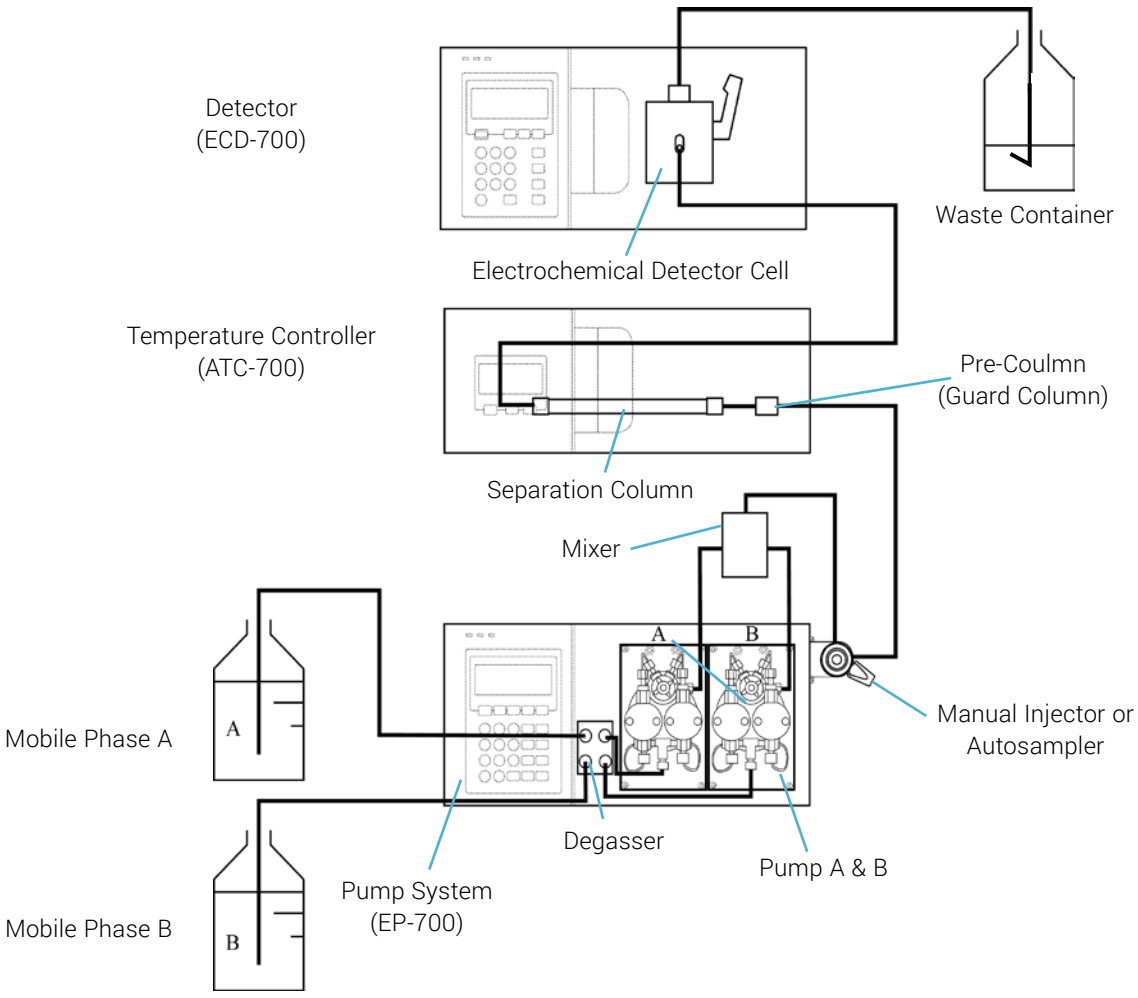
4. Using high pressure gradient analysis system



a) Mobile phase A and B are delivered through the degasser to the pump, and blended in a mixer after the pumps.

b) Sample is injected by manual injector or autosampler.

c) Then sample passes through the pre-column (guard column) and is separated on the separation column which is maintained at a constant temperature with the Temperature Controller.

d) Separated compounds exit the column and are delivered to the detector.

In other cases, please ensure that you follow equipment handling instructions and use proper tubing and connectors.

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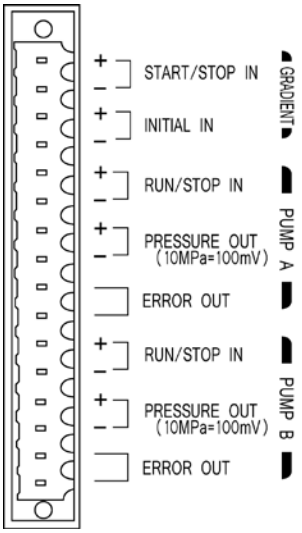
3.10. Signal Terminal

EP-700 possesses a communication signal terminal for external device.



For Gradient procedures

START/STOP IN In Gradient Mode, a contact closure signal of more than 10 msec at the <start/stop in> input commands the next step gradient protocol set in the pump.

INITIAL IN In Gradient Mode, a contact closure signal of more than 10 msec at the <initial in> starts the pumps at there initial rates and signal the beginning of a gradient procedure.

External control of Pump A and Pump B

RUN/STOP IN A contact closure signal of more than 10 msec at the <run/stop in> commands this pump to start or stop at its set rate.

PRESSURE OUT Outputs a voltage of up to 100 mV (100 Mpa) to communicate the pressure in the system.

ERROR OUT Contact closes to indicate and pump error (pump has stopped). Used for emergency shutdown of an auto sampler.

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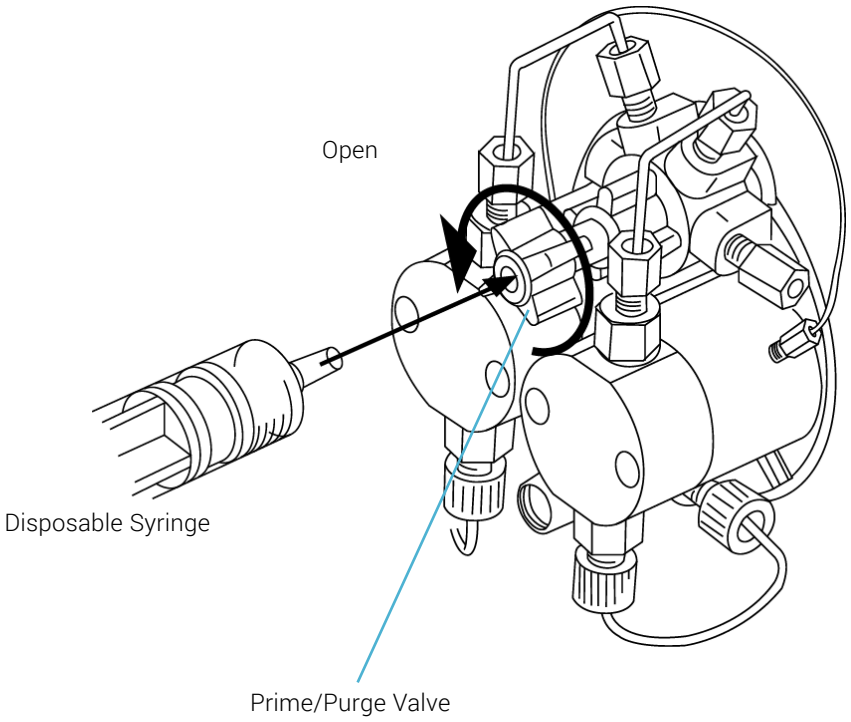
3.11. Priming the Pump (Removing Air) and Exchanging Mobile Phase in Degasser and Pump

Before operation and when changing the mobile phase, attach a syringe to the opening of the prime/purge valve in the pump head, twist to open valve, and draw fluid into syringe.



Under normal condition, internal fluid exchange is complete after aspirating more than 5 mL. (Interior content of tubing, degasser, and pump head). The interior volume of the degasser is approximately 300 µL. For the most effective removal of air from the pump, switch off pulse free mode and aspirate the mobile phase while the pump is running. If you do this, you should stop the pump before closing the prime/purge valve.

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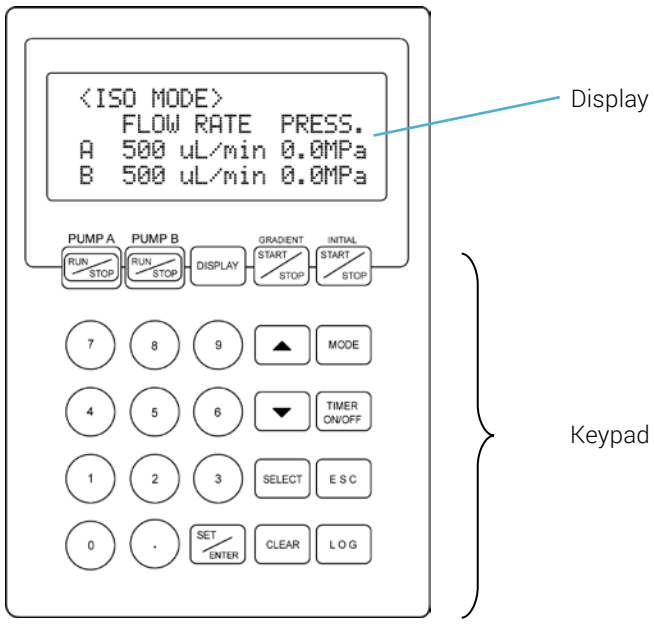
4.1. Operation Panel

The operation panel has a display and a key pad. The display will light up after the power is turned on.



Operation Panel

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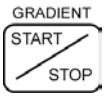
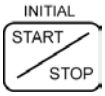
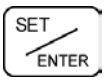
4.2. Operation Keys

Key	Name	Function
	PUMP A RUN/STOP	In Isocratic Mode, controls the start or stop of pump A.
	PUMP B RUN/STOP	In Isocratic Mode, controls the start or stop of pump B.
	DISPLAY	Cycles the display between various menus.
	GRADIENT START/STOP	In Gradient Mode, controls the start or stop programmed gradient method.
	INITIAL START/STOP	In Gradient Mode, controls the start (0 min) or stop of a gradient method.
	MODE	Switches between Isocratic Mode and Gradient Mode. Only functional when two equal capacity pumps are installed.
	TIMER ON/OFF	Start and stop of timer.
	ESC	Cancel parameter input and return to previous menu in the display. Shift from log screen to normal screen.
	LOG	Shift to log screen.
	ARROW	In gradient program enter screen display, controls cursor movement.
	SELECT	Select parameters.
	CLEAR	Correct input parameters while entering them. Delete logs.
	SET/ENTER	Start input/select parameters. Set enter/select parameter.
	NUMBERED KEY	Enter numbers.

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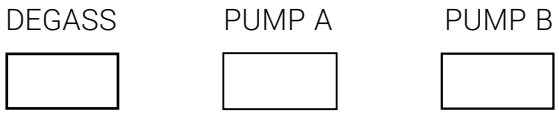
4.3. Status Indicator

The EP-700 indicator communicate functional state of the instrument by color, on/off, or blinking.



EP-700 Indicator Lights

Indicator Subject	Lighting Pattern	
DEGASS Vacuum pump degasser is running	Turn off	Normal
	Red Blinks	Abnormal*
Machine motion of PUMP A and PUMP B PUMP A PUMP B	Turn off	Operation Off
	Green Light	Operation On
	Green Blinks	Pump Off timer is in operation

* DEGASS - When the indicator blinks red, there is a problem inside the degasser. Please contact Eicom or one of its distributors immediately.

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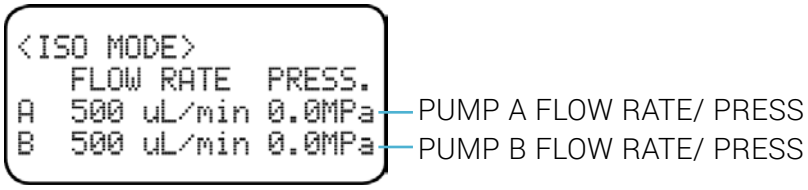
4.4. Display Screen

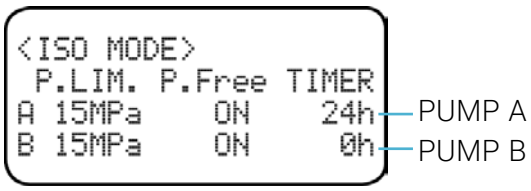
What the screen displays is dependent on the analysis mode.

1. Isocratic Mode <ISO MODE>

This mode is used for Isocratic elution with one pump installed, or to control each of the 2 pumps independently. In Isocratic Mode, 2 screens display “FLOW RATE/ PRESS” and “P.LIM/P.FREE/TIMER (Pressure Limit/Pulse Free mode/Timer)” are used. When one pump is installed, the display shows the status of only that pump.



<FLOW RATE/PRESS> The set flow rate/current pressure



<P.LIM/P.FREE/TIMER> Pressure Limit set/Pulse Free mode*/Timer)

*Pulse free mode is a feature that reduces pressure pulses during pump operation. The pump senses pressure fluctuation, and quickly learns to compensate to reduce pulsing. Please make sure to set this to <ON> when doing Isocratic analysis.

*Please turn off the pulse free mode when you have to force liquid through the device during maintenance. When you are in pulse free mode, the pressure value is continuously monitored, and the movement of the pump is calculated based on this value. Therefore, any pressure fluctuation that you introduce will cause the pump motor to sense an error and shutdown. An error code will be displayed. Error 3 or error 4 (please refer to error messages).

*In Gradient Mode, pulse free mode is automatically turned off and liquid delivered according to a preset pressure compensation list.

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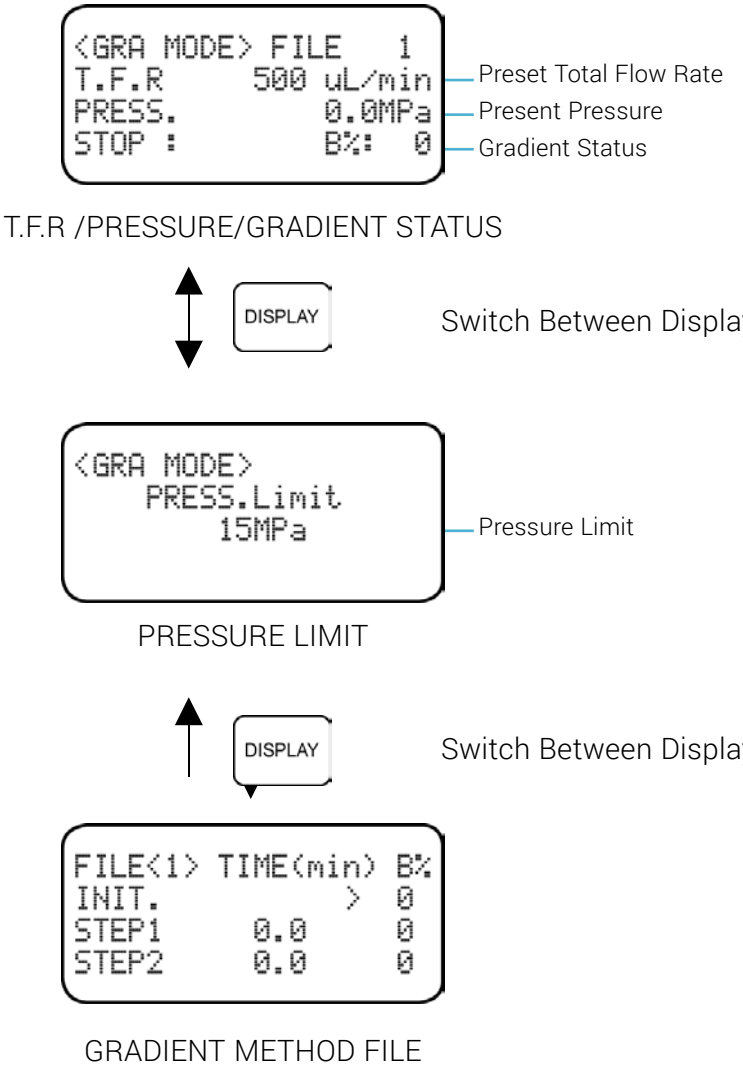
2. Gradient Mode <GRA MODE>

Gradient Mode is available when 2 pumps are installed in order to control a gradient. In Gradient Mode, there are three different screens displays. The first displays <T.F.R> (Total Flow Rate), <PRESS> (current pressure), <STOP: B%:> (gradient status). The next screen displays <PRESS. Limit> (the pressure limit that you set). The last screen displays the gradient method file.



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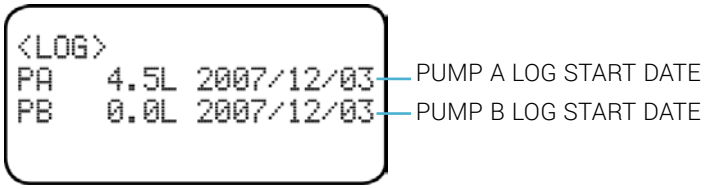
3. Log

In the EP-700, a log for recording the total liquid pumped from a given start date can be used to record maintenance actions.



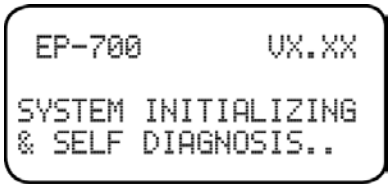
LOG

This log does not have to be set, but we recommend that you use it to aid in troubleshooting and schedule regular maintenance.

4.5. Start Up Sequence

Turn on the main power switch on the left side of the main body. A start screen will appear before entering the operation screen. The degasser vacuum pump will immediately start and continue to run on and off throughout operation to maintain a vacuum.

Start Screen



*The EP-700 stores the parameters from the last time the pump was used and loads those upon startup.

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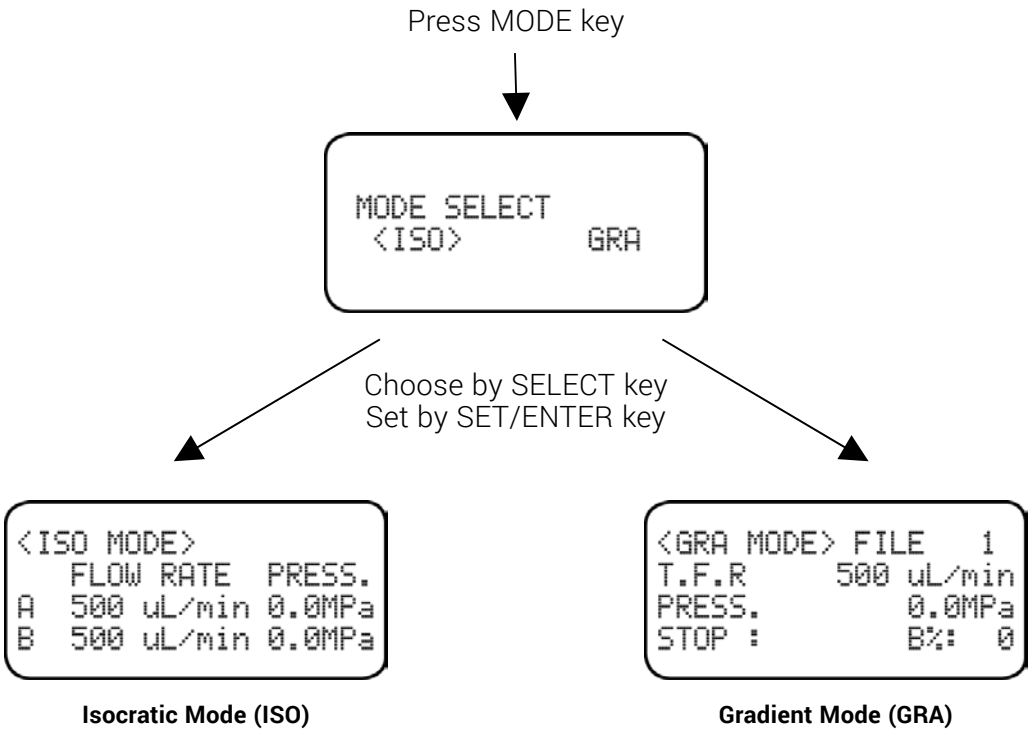
4.6. Switching Between Operation Modes

Isocratic Mode <ISO> and Gradient Mode <GRA> are switched using the <MODE> key. You can only switch to the Gradient Mode if 2 similar pumps are installed and operational.



Isocratic Mode (ISO) **Gradient Mode (GRA)**

4.7. Isocratic Mode (ISO) Operation

Instructions for setting and operation of Isocratic Mode are as follow. The units of flow rates are “µL/min” for Micro Flow Rate (type M) pumps, and “mL/min” for High Flow Rate (type H) pumps. This units are set automatically based on the type of the pumps.

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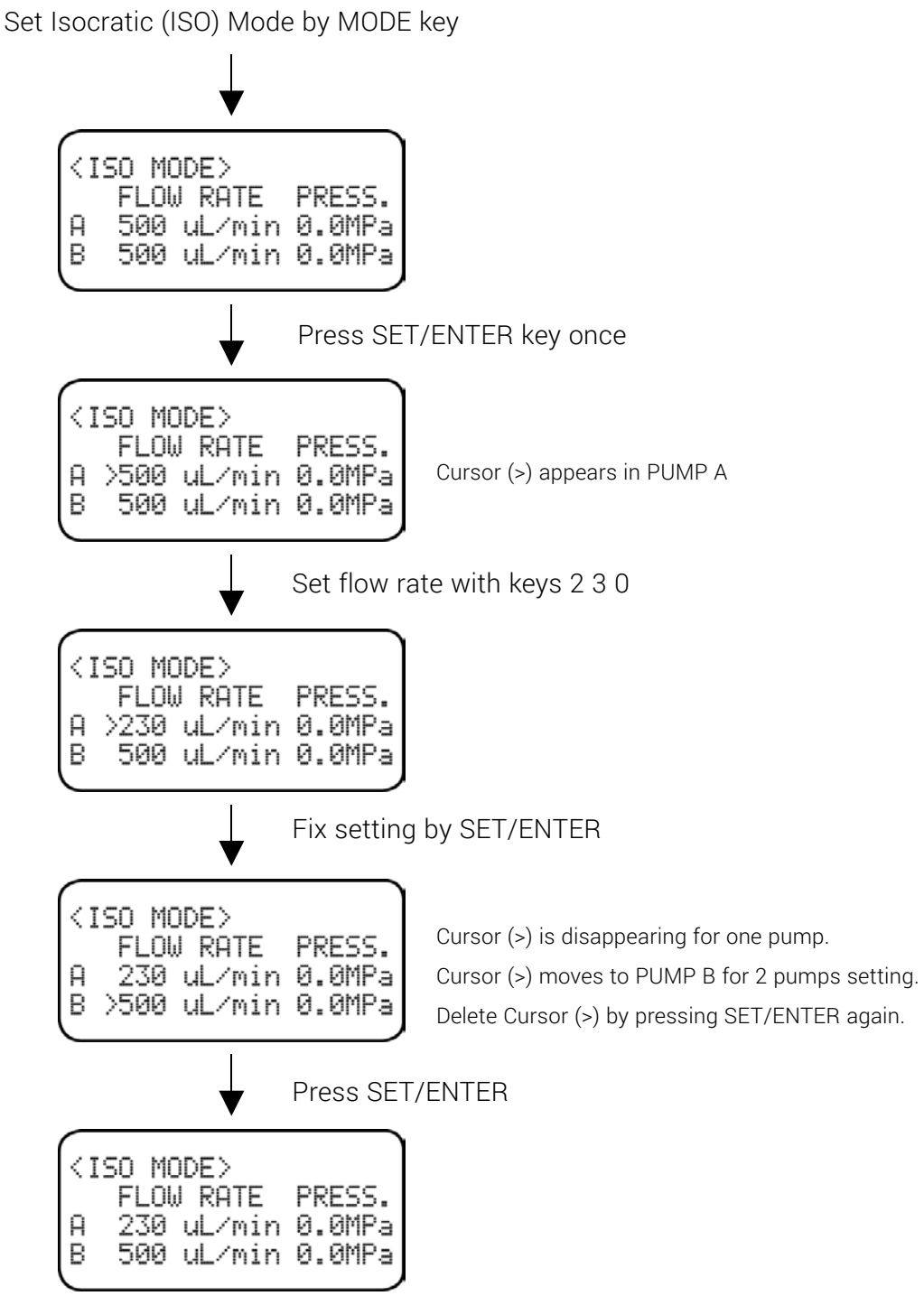
(Example)

Use pump A, execute liquid delivery in “Flow Velocity 230 µL/min”, “Pressure Limit 15 MPa”, “Pulse Free Mode On”



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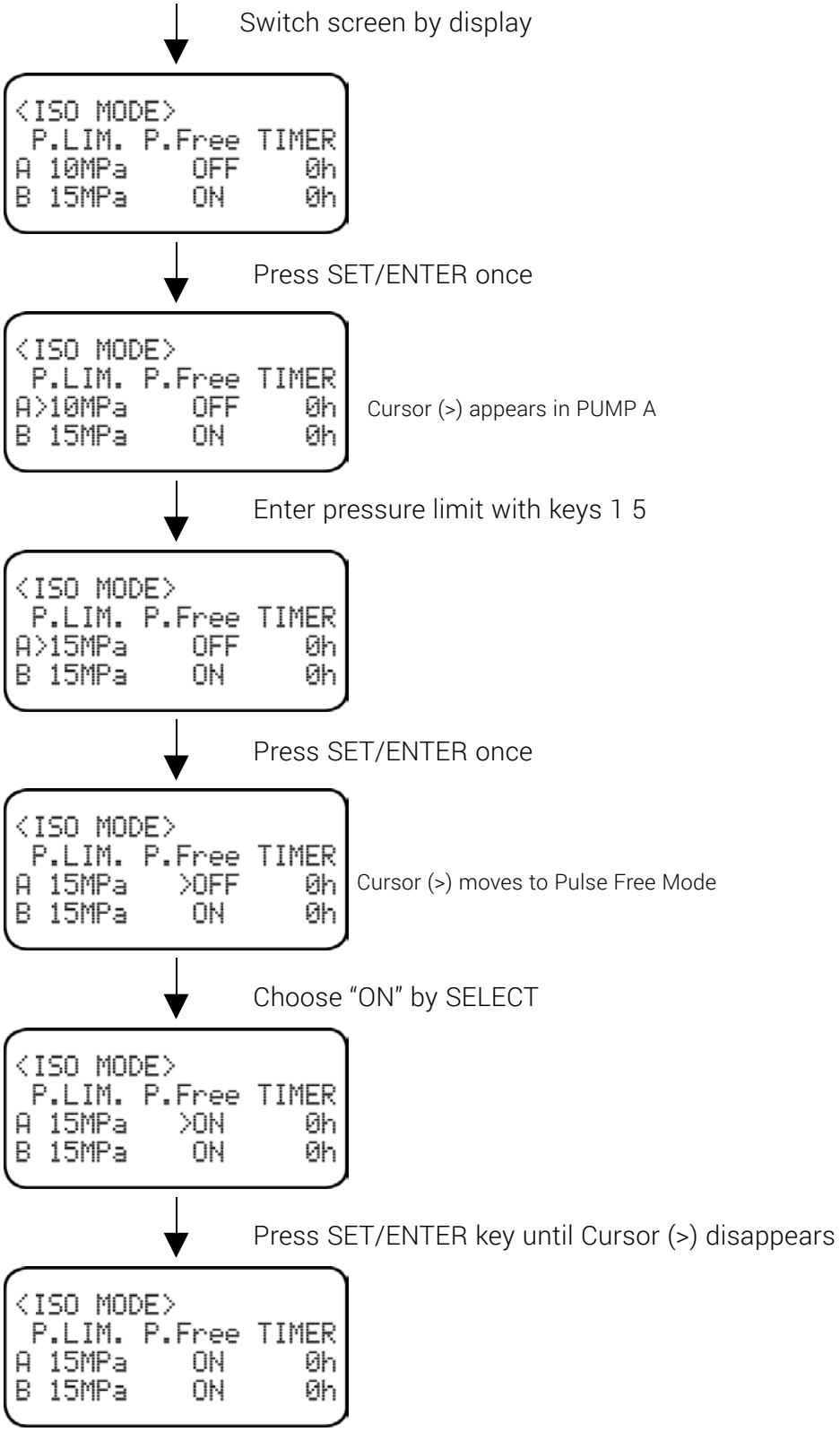
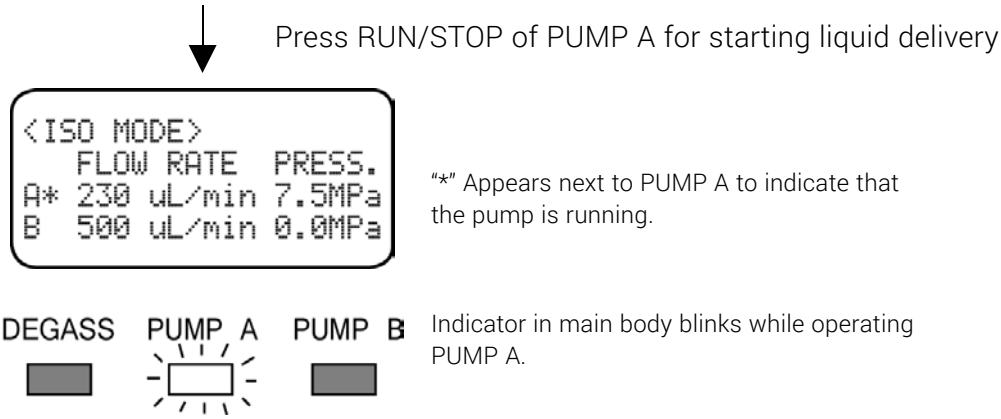

Switch screen by display
<ISO MODE>
P.LIM. P.Free TIMER
A 10MPa OFF 0h
B 15MPa ON 0h
Press SET/ENTER once
<ISO MODE>
P.LIM. P.Free TIMER
A>10MPa OFF 0h
B 15MPa ON 0h
Cursor (>) appears in PUMP A
Enter pressure limit with keys 1 5
<ISO MODE>
P.LIM. P.Free TIMER
A>15MPa OFF 0h
B 15MPa ON 0h
Press SET/ENTER once
<ISO MODE>
P.LIM. P.Free TIMER
A 15MPa >OFF 0h
B 15MPa ON 0h
Cursor (>) moves to Pulse Free Mode
Choose “ON” by SELECT
<ISO MODE>
P.LIM. P.Free TIMER
A 15MPa >ON 0h
B 15MPa ON 0h
Press SET/ENTER key until Cursor (>) disappears
<ISO MODE>
P.LIM. P.Free TIMER
A 15MPa ON 0h
B 15MPa ON 0h



4.8. Gradient Mode (GRA) Operation

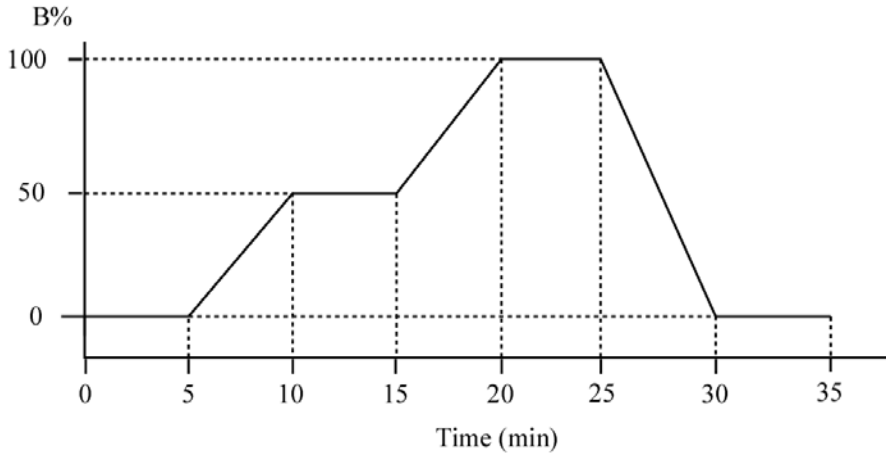
The following are an explanation of the operation of Gradient Mode by means of an example. The units of flow rates are "µL/min" for Micro Flow Rate (type M) pumps, and "mL/min" for High Flow Rate (type H) pumps. They are detected automatically.

In Gradient Mode, the relative proportions of A and B are changed continuously to create a linear gradient.

In EP-700, Gradient programs can have up to 10 steps.

(Example)

In Gradient Mode with "Total Flow Rate 300 µL/min", "Pressure Limit 15 MPa", and the following pattern. Gradient program is saved in FILE 1.



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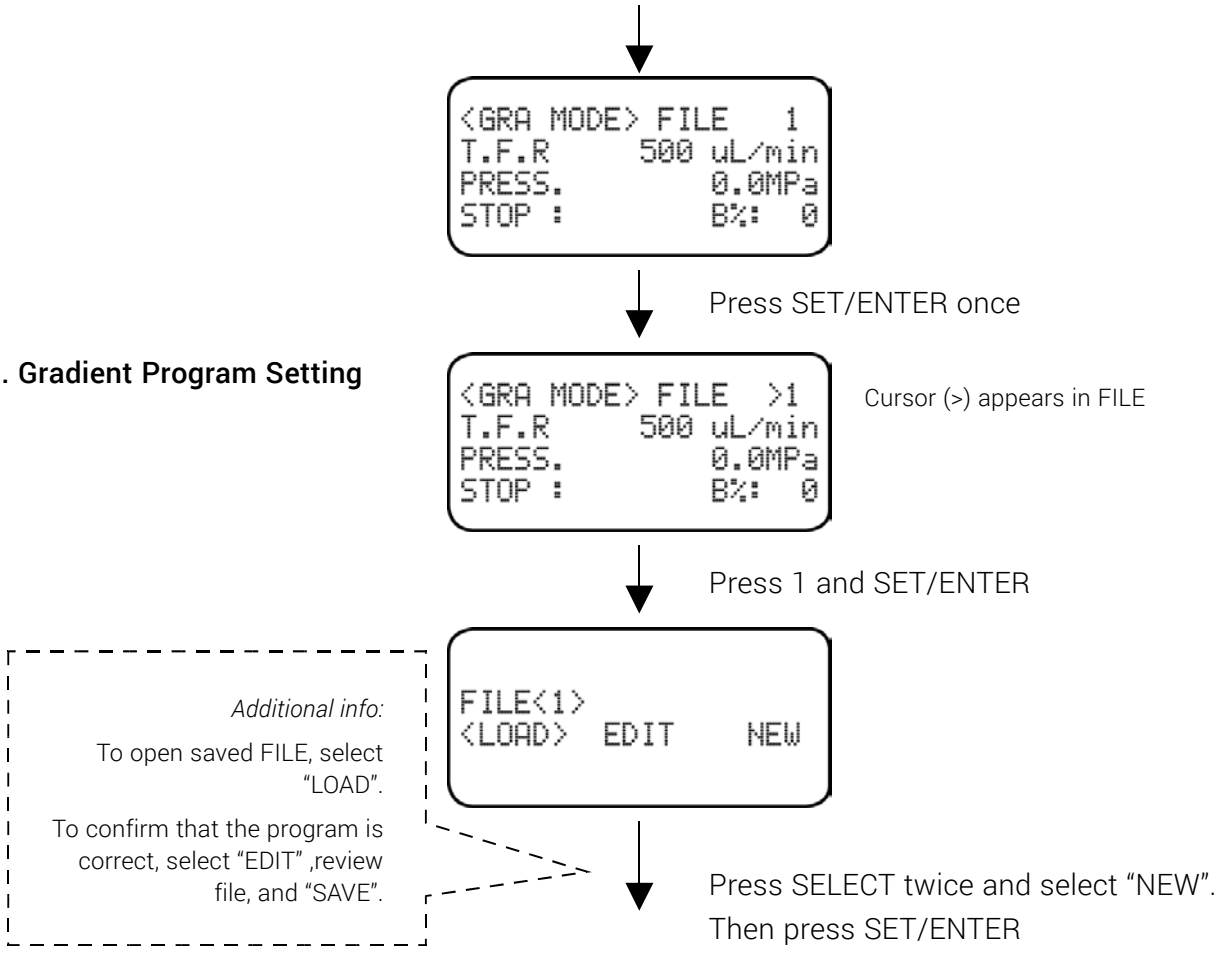
Step	Time (min)	B%	Movement
INITIAL		0	Initial Setting B 0%
STEP 1	5.0	0	Hold B 0% (Initial Setting) until 5.0 min elapsed time
STEP 2	10.0	50	Linearly increase B to reach 50% at 10.0 minutes
STEP 3	15.0	50	Hold 50% until 15.0 min elapsed time
STEP 4	20.0	100	Linearly increase B to reach 100% at 20.0 minutes
STEP 5	25.0	100	Hold B 100% until 25.0 min elapsed time
STEP 6	30.0	0	Linearly decrease B to reach 0% (initial setting) at 30.0 minutes
STEP 7	35.0	0	Hold B 0% (initial setting) until 35.0 min elapsed time

To run the method switch to Gradient Mode <GRA MODE> with <MODE> key.

1. Gradient Program Setting



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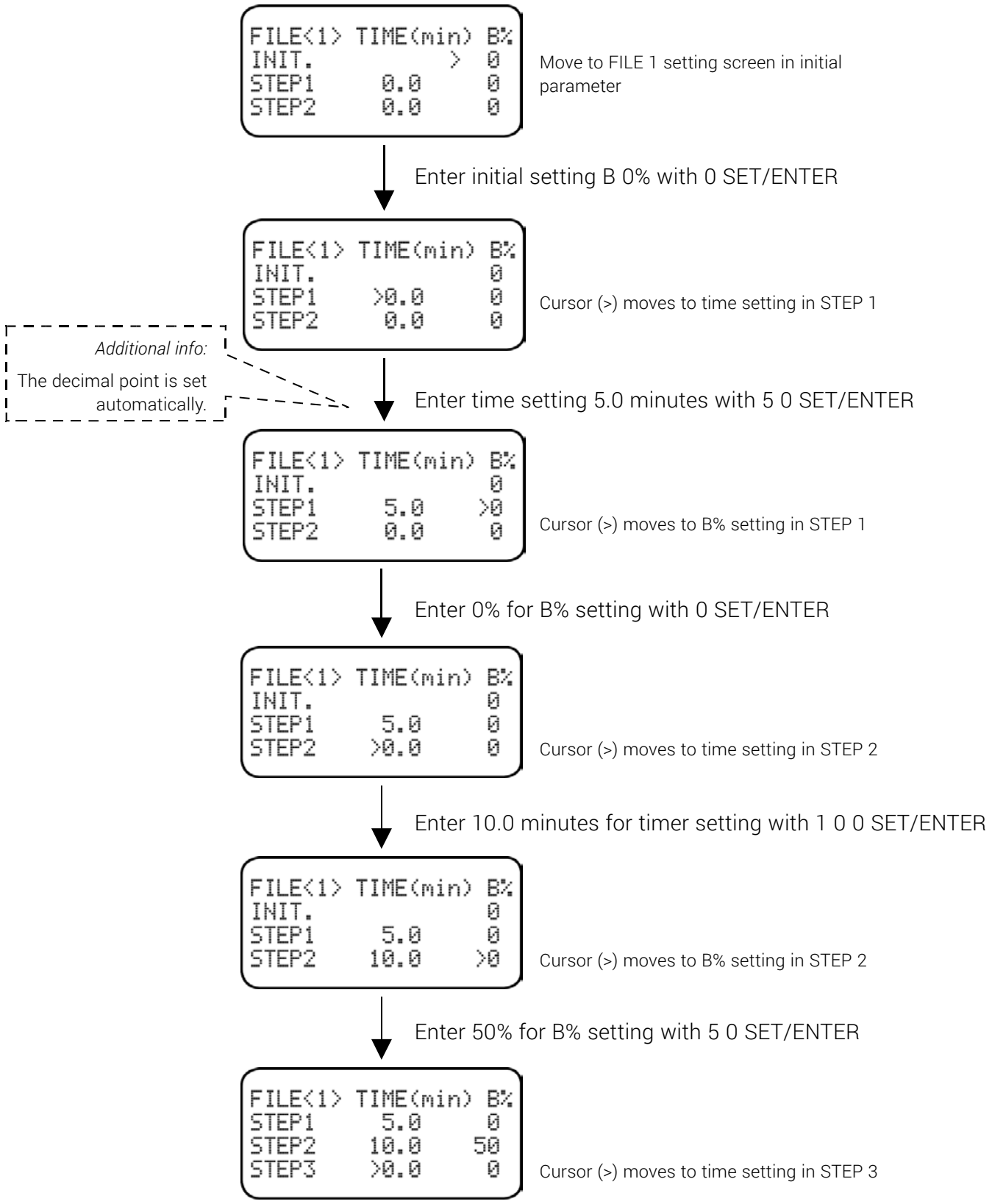

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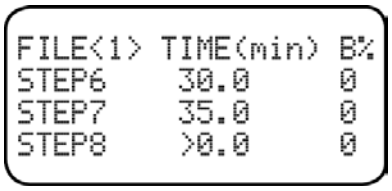
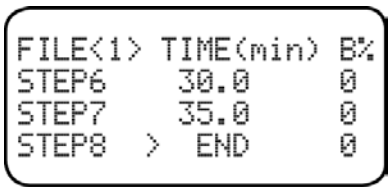
Repeat steps above to set time and B% until you reach the last STEP

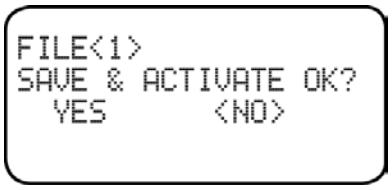


After completing setting for final STEP, press SET/ENTER in time setting of following STEP



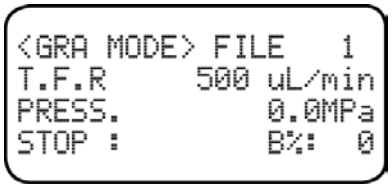
Switch to “END” for timer in following STEP screen of final STEP

Press SET/ENTER



Confirmation message for “SAVE or ACTIVE” appears

Press SELECT, and choose “YES”, and set with SET/ENTER



Back to initial screen of Gradient Mode

2. Setting Total Flow Rate

Press SET/ENTER twice

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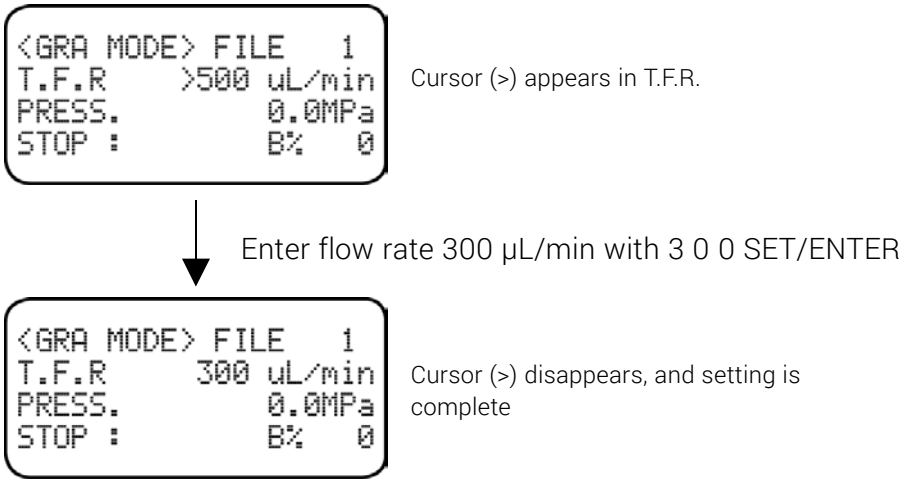
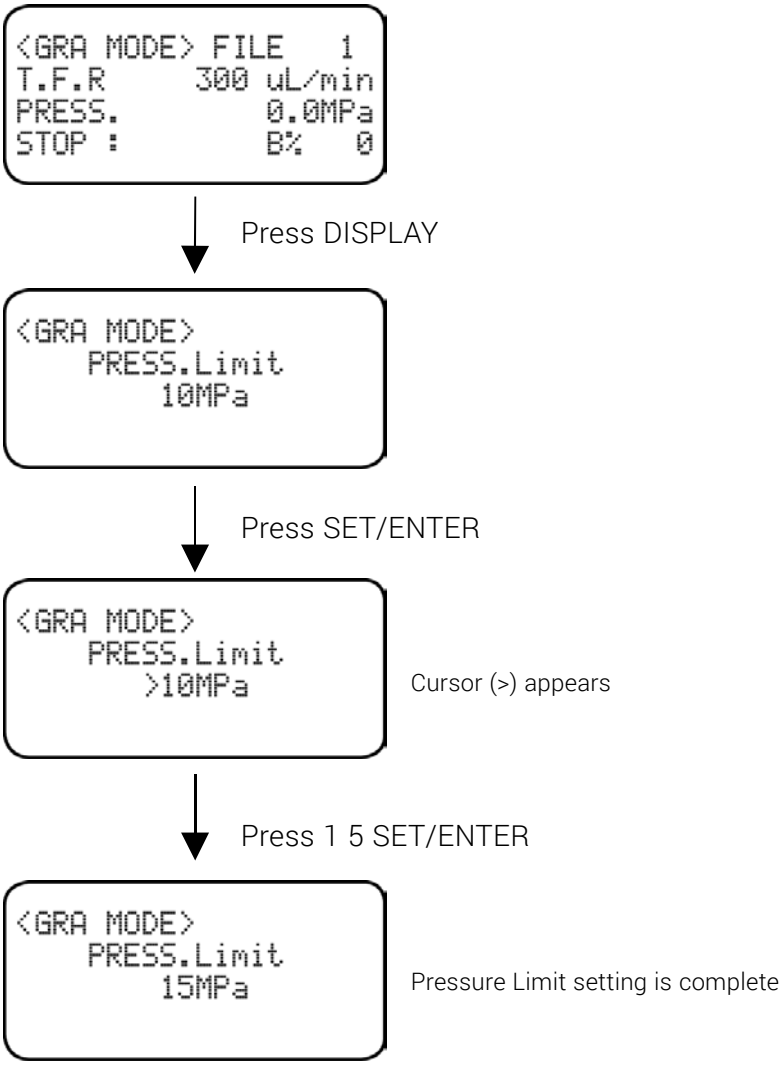


3. Setting Pressure Limit



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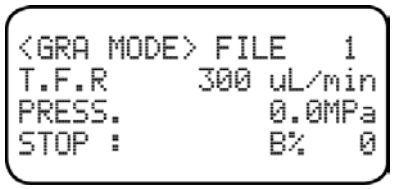
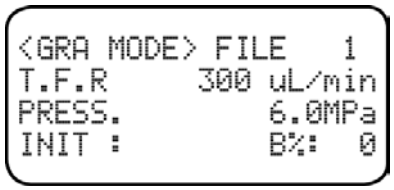
4. Starting Pump in Gradient Mode



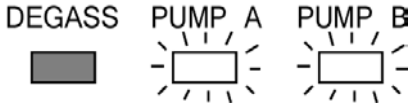
Press INITIAL START/STOP, or send initial start signal from external device.



Pump will switch to the initial setting “INIT”

After initial time has expired, the gradient method is initiated with the <GRADIENT START/STOP> key or it can be triggered from an external devise.

The display will switch from “INIT” to “START” and the gradient method will commence.



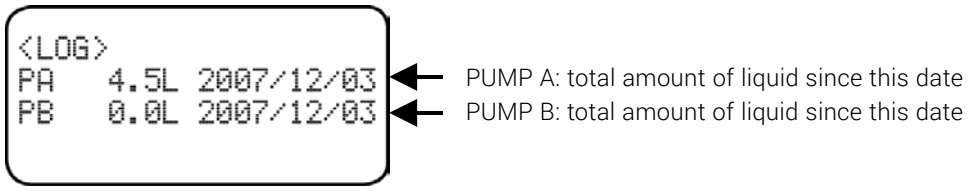
Indicator lights for PUMP A and PUMP B will blink when the pumps are running in Gradient Mode.

4.9. Confirming and Updating Log

The EP-700 has the ability to record the total liquid pumped from a given start date. We recommend using it as a reference for maintenance schedule.

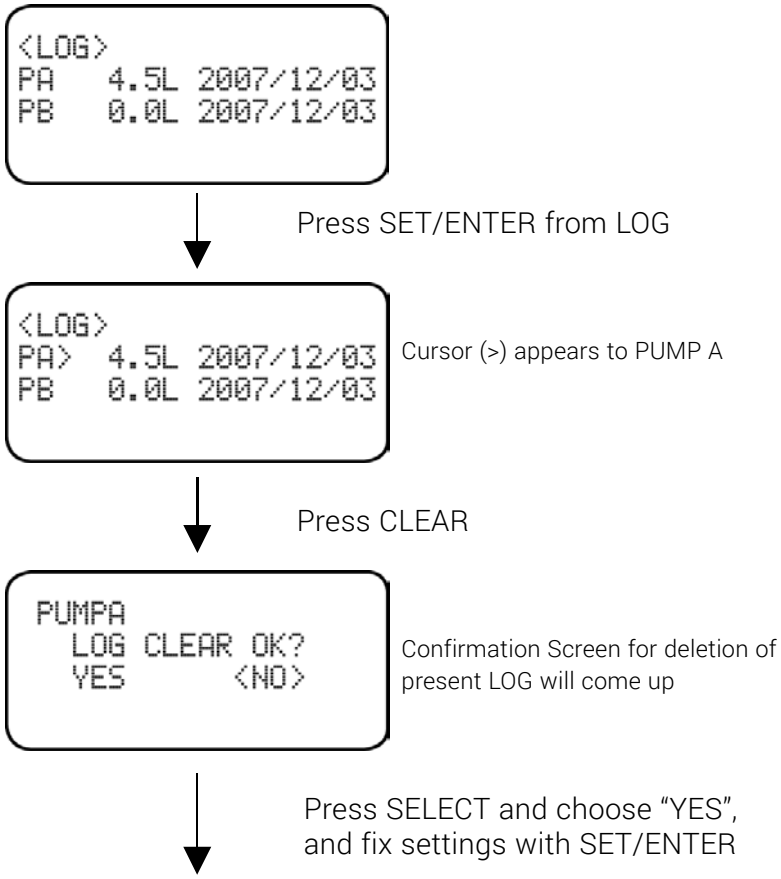
4.9.1. Checking the Log

Press LOG, for LOG screen.



In LOG, start date and integration liquid delivery amount are recorded. To switch from LOG to analysis screen, press ESC.

4.9.2. Updating Log



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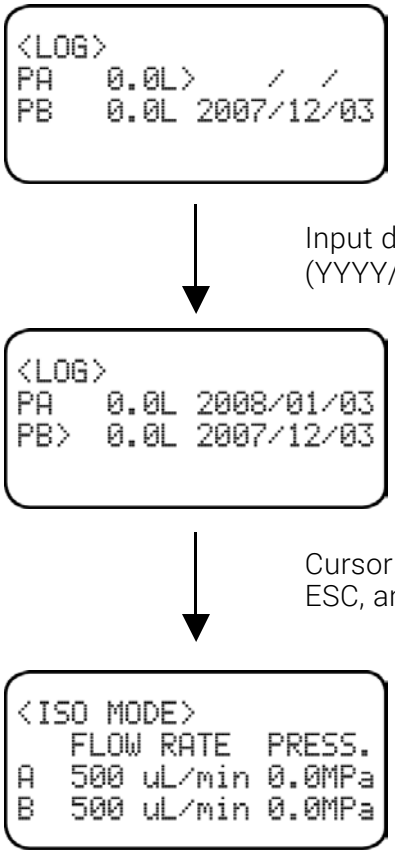

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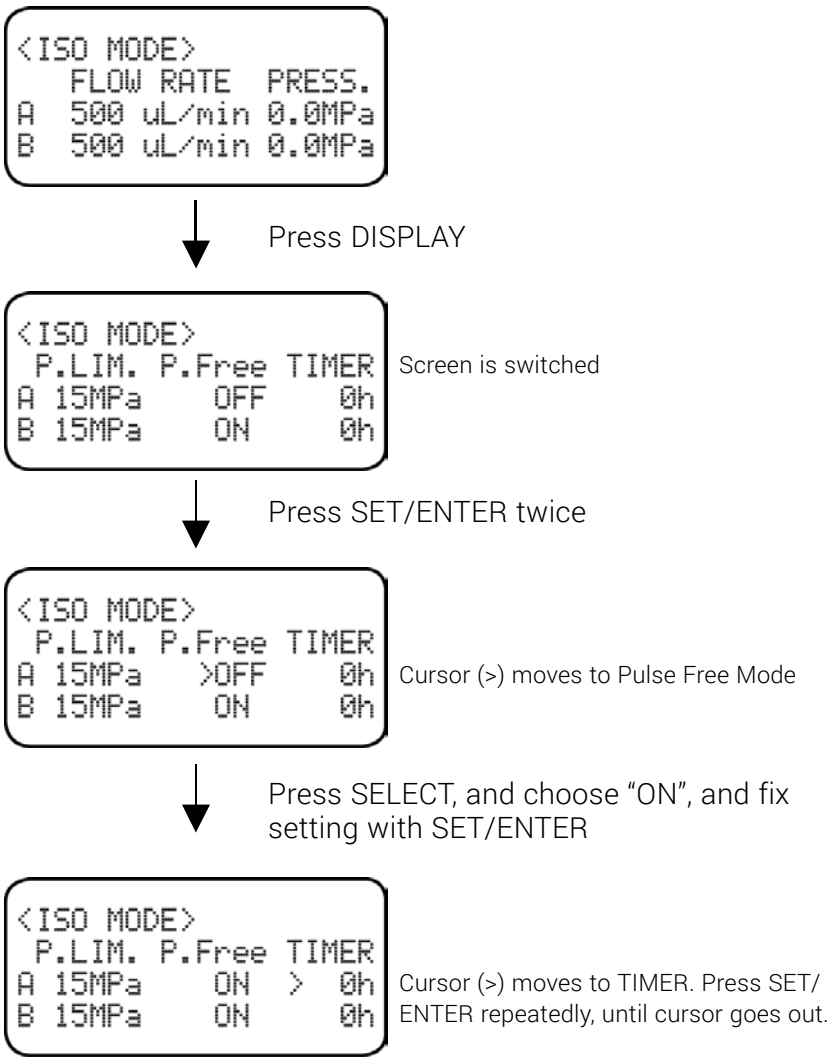
4.10. Pulse Free Mode Setting

Pulse free mode is a feature used to reduce the pressure pulses in the mobile phase during very sensitive measurement. The pump's computer detects pressure changes during the piston's stroke and varies the speed of the piston to minimize changes in mobile phase pressure. Please make sure to set <ISO> mode for all Isocratic analyses. When pulse free mode is on, the pressure value is continuously monitored, and speed of the pump motor is automatically controlled. Therefore, large pressure fluctuations can interfere with this process causing the pumps to shutdown. You will get either an error 3 or error 4 (please refer to error messages). For this reason, please ensure that the free mode is off when you force liquid through the device for maintenance purposes. In Gradient Mode, pulse free mode is turned off automatically and the pumps will vary according to a pre-set pressure compensating table.



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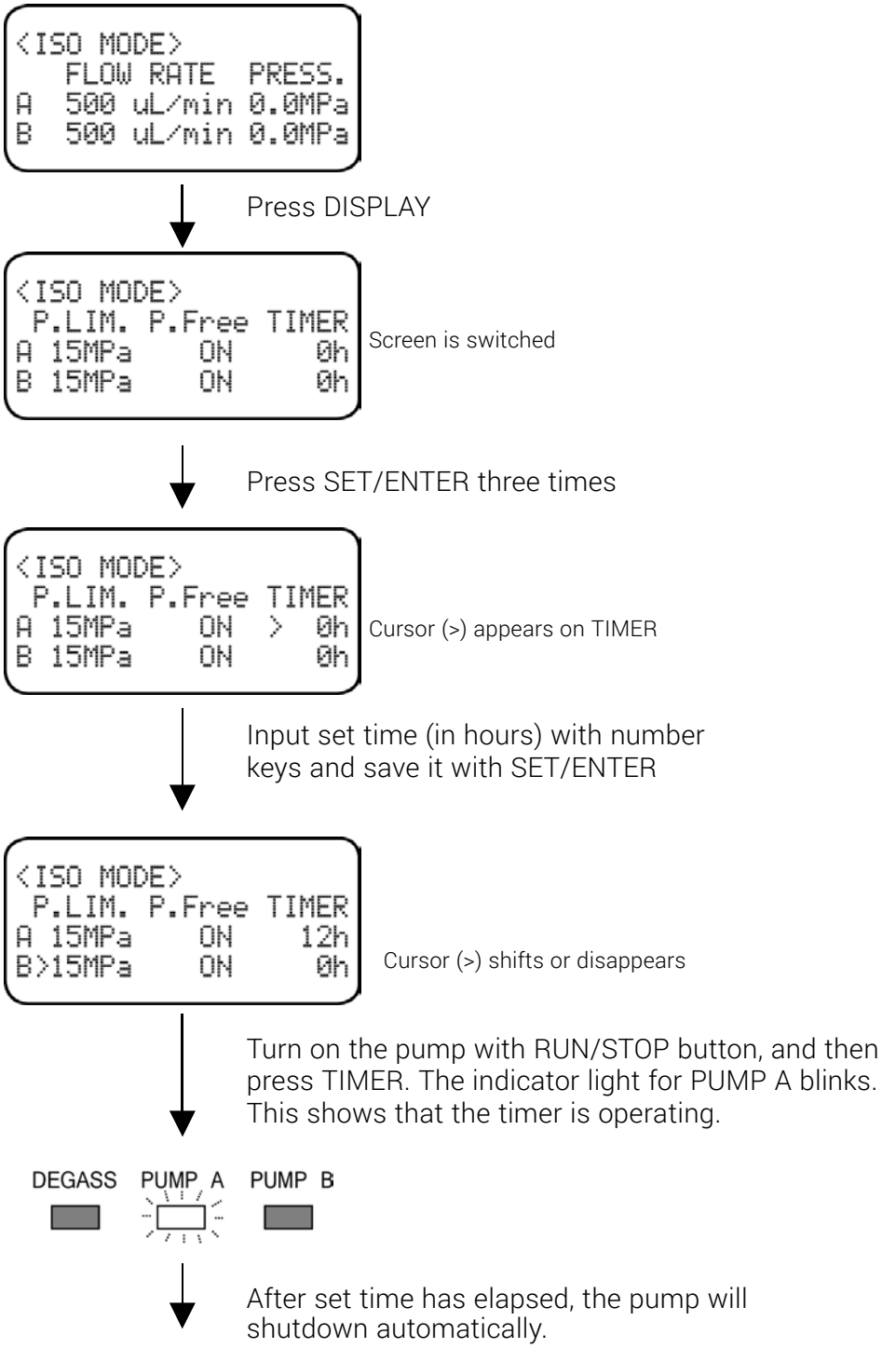
4.11. Timer Setting

EP-700 has a timer for automatic shut down. Please use this feature when washing columns or the system to avoid leaving the pump on too long and potentially going dry.



WARNING USE OF HARMFUL CHEMICAL REAGENTS

Before you operate this product with harmful chemical reagents, be sure to consult the SDS (Safety Data Sheet) for that chemical to learn about safe handling, physical and chemical characteristics, and any potential health hazards. Mishandling of harmful chemical reagents might result in death or serious injury to the user.

To avoid injury, wear proper protective gloves, goggles, and a mask. Run ventilation systems if necessary. Always take care to avoid leaks from any of the tubing connections.

WARNING USE OF FLAMMABLE CHEMICAL REAGENTS

Improper use of flammable liquids can lead to fire and explosion. These chemicals evaporate quickly and create ignitable vapors. Be sure to keep away from potential sources of ignition. Run ventilation systems when available. Always take care to avoid leaks from any of the tubing connections.

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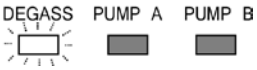
Pump error messages. Cause and Solution

Error Number	Cause	Solution
ERROR 1 Pressure Limit	Pressure of Liquid in pump exceeded pressure limit setting	Check tubing and columns for a clog, and clear the clog. Check the pressure limit setting. It may be too low.
ERROR 3 Pressure Drop Check Valve	Pressure of liquid in pump decreased rapidly.	Remove air bubble from pump by drawing fluid from the purge valve. The check valve may be stuck. Take it off and shake it. There should be a noise as the ball moves. If not, clean or replace it. Check for leaks in the tubing, and fix any you find.
ERROR 4 Motor Error Torque Overload	Abnormal load detected at the pump drive motor. Abnormal rotation in pump.	Remove air bubble from pump by drawing fluid from the purge valve. The check valve may be stuck. Take it off and shake it. There should be a noise as the ball moves. If not, clean or replace it. Check for leaks in the tubing, and fix any you find.

Error message in indicator. Cause and Solution

Indication	Cause	Handling
 DEGASS Red Blinks	Vacuum pressure in degasser is not reaching correct value.	It may require maintenance procedure. Please contact Eicom or its distributors immediately.

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6.1. Washing port of pump head

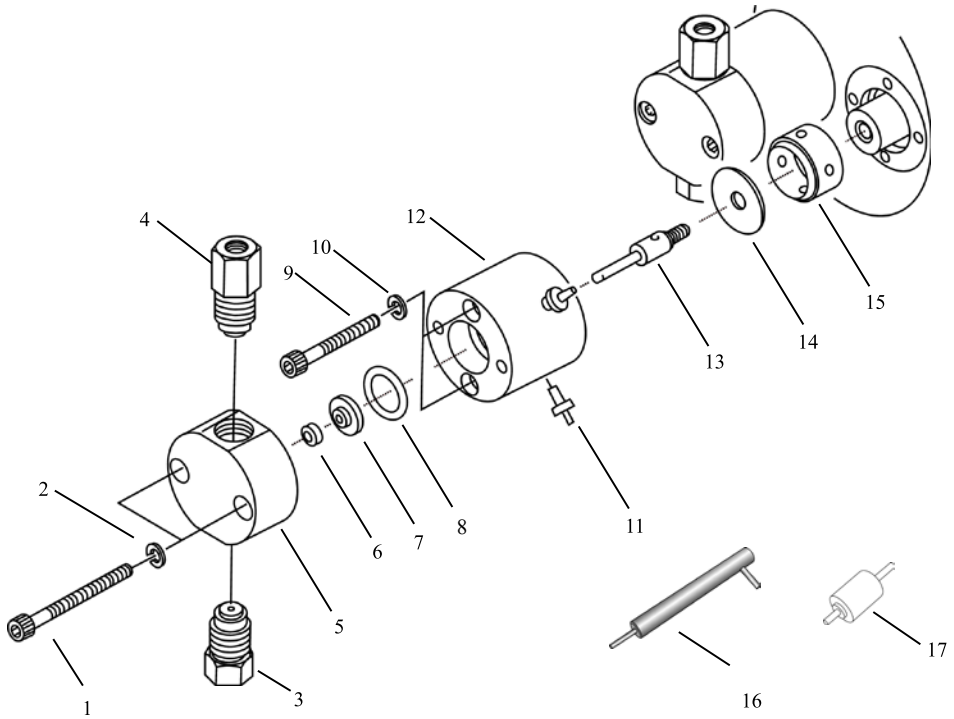
The seal washing function of EP-700 allows cleaning of any contaminants that may leak pass the seal. **Please take care to purge the washing tube with 2-3 mL of purified water before and after each use.** This will greatly improve the lifetime of piston seal and piston.

Otherwise, a small amount of salt contained in the mobile phase may crystallize. The salt crystals will scratch the piston and seal and cause the seal to leak.

6.2 Exchange Piston Seal and Piston

(For exchange piston seal and piston of High Flow Rate Pump (type H) case, please contact Eicom)

In case of Micro Flow Rate (type M). Pump head parts breakdown is as follows:



Part Number/Name		
1. Pump Head Fix Screw	7. Backup Ring	13. Piston
2. Pump Head Washer	8. O-Ring	14. Seal for Washing
3. Check Valve (Inlet)	9. Pump Head Guide Screw	15. Guide Ring
4. Check Valve (Outlet)	10. Pump Head Guide Screw Washer	16. Piston Replacement Tool
5. Pump Head	11. Washing Port	17. Piston Seal Replacement Tool
6. Piston Seal	12. Pump Head Guide	

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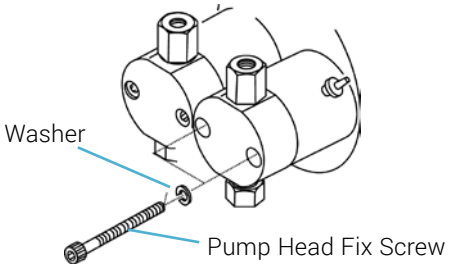
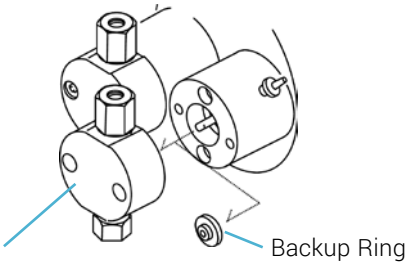
Changing the piston seal and piston

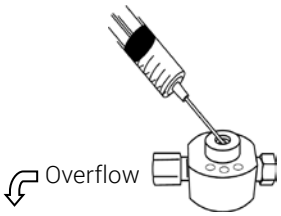


1. Remove tube connectors from the inlet and outlet check valves. Take off pump head by loosening the screws (2), washer. As you loosen them, alternate between them.



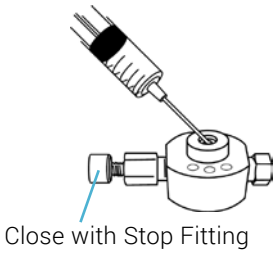
2. Pull out the pump head slowly and in a straight line. **The piston is fragile. Be careful to not break it by twisting or using too much force as you pull out the pump head.**

Then, remove Backup Ring

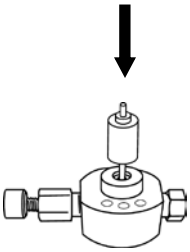


Exchange Piston Seal

3. Lay down the pump head, inject water 2-3 mL in middle piston opening. Confirm that water flows out the outlet check valve.



4. Put a stopper fitting on the outlet valve. Fill water into the pump until it overflows from the seal.



5. Insert the long end of the piston seal replacement tool into the piston opening until the end of the rod reaches the bottom. This should cause the piston seal to be forced back up the rod of the piston seal replacement tool until it is free.

6. If it doesn't work the first time, repeat steps 4 and 5 until the seal is removed.

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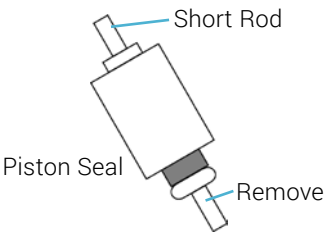
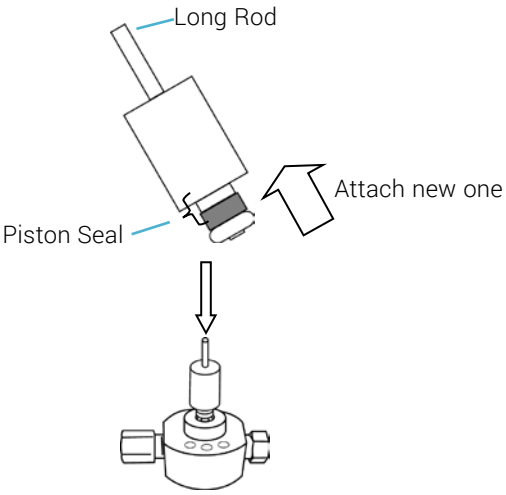


7. Remove the now free old piston seal from the replacement tool.

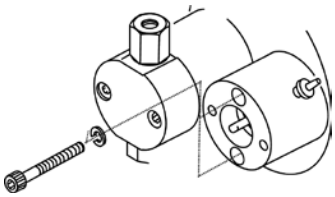


8. To install the new piston seal, place it on the short rod of the replacement tool as shown in the figure to the left.

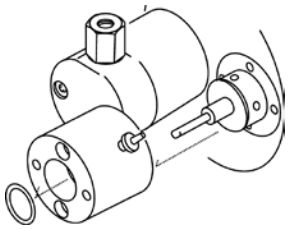
9. Remove stopper fitting from the outlet check valve. Place the new seal over the hole and push it gently into place with the replacement tool.

Exchange of piston is complete.

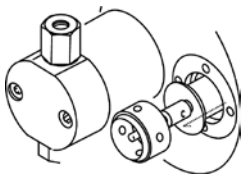
Remove piston.



10. With the pump head removed, loosen the screws holding the pump head guide in place. Again alternate between the screws as you remove them.



11. Pull pump head guide straight forward. **Be careful the piston is fragile.** Sometimes the O-Ring comes off at this point. Please be careful not to lose it.,



12. Pull the guide ring straight forward to remove it. Do not pull out the washing seal at the same time.

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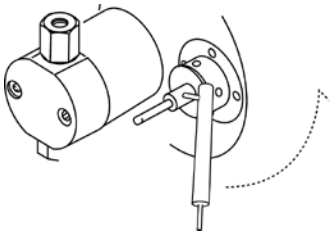
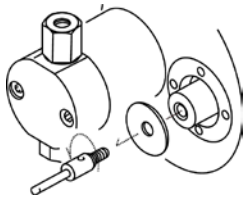
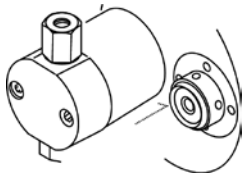


13. Put the small rod of the piston replacement tool into the hole in the metallic part at the base of the piston shaft, and turn in a counterclockwise motion to loosen it.

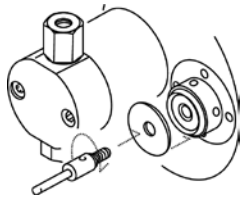


14. After loosening the piston, remove it by hand. Then, remove the washing seal as well.

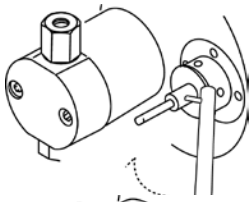


Attach Piston and Pump Head

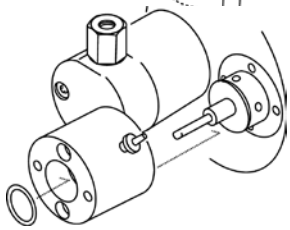
15. Start by attaching the guide ring.



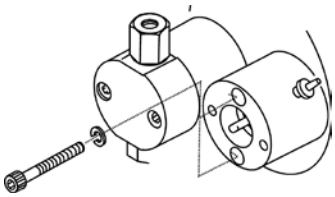
16. Put the washing seal in place and slide the piston through the center hole and screw it in finger tight.



17. Then use the piston replacement tool to secure the piston.



18. Re-attach the pump head guide and O-ring



19. Tighten up pump head guide screws once again by alternating between the two screws a little at a time.

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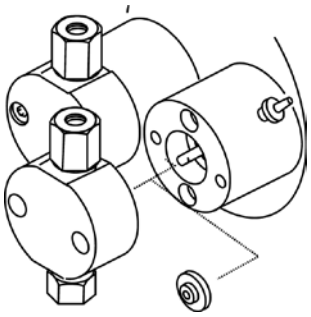
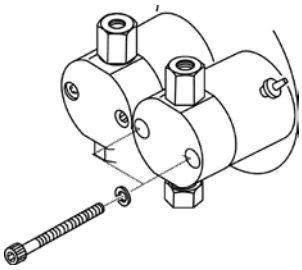


20. Attach back up ring and pump head. Pump head should be placed onto the piston using a gentle and straight movement. Do not twist.

21. Tighten up pump head guide screws by alternating between the two screws until they are completely sealed.



22. Reconnect the tubing to the check valves, and the process is complete.

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When you are not going to be using the pump for awhile, please store it according to the methods below.

7.1. Short Term Storage (less than 1 month)

If the mobile phase is a simple solution with little or no salt, you can leave mobile phase in the device, and just turn off the power switch. You must make sure that both ends of the tubing that go through the pump, including the wash, are below the liquid level in their respective containers. The inside of the pump should not be allowed to go dry. If the mobile phase is more complex (such as perishable, or can precipitate readily upon temperature fluctuations, please follow the instructions in 7.2.)

7.2 Long Term Storage (more than 1 month)

Rinse the system by pumping water through it. Then pump a 20 v/v% methanol solution through the system and enough volume to wash out all solvents, typically more than 100 mL, cap all ends of the tubing to make sure the inside does not dry out.

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8.1. For Micro Flow Rate Type (M)

Part Name	Type	Code
Piston Seal	HT-PS	550.560.00
Pump Piston	HT-PP	550.555.00
Check Valve (Inlet)	HT-IV	F55.570.00
Check Valve (Outlet)	HT-OV	F55.571.00
Pump Unit	MPU-7	570.100.00
Manual Injector	SI-700	020.050.00

For inquiry about other parts or High Flow Rate Type (H), please contact Eicom

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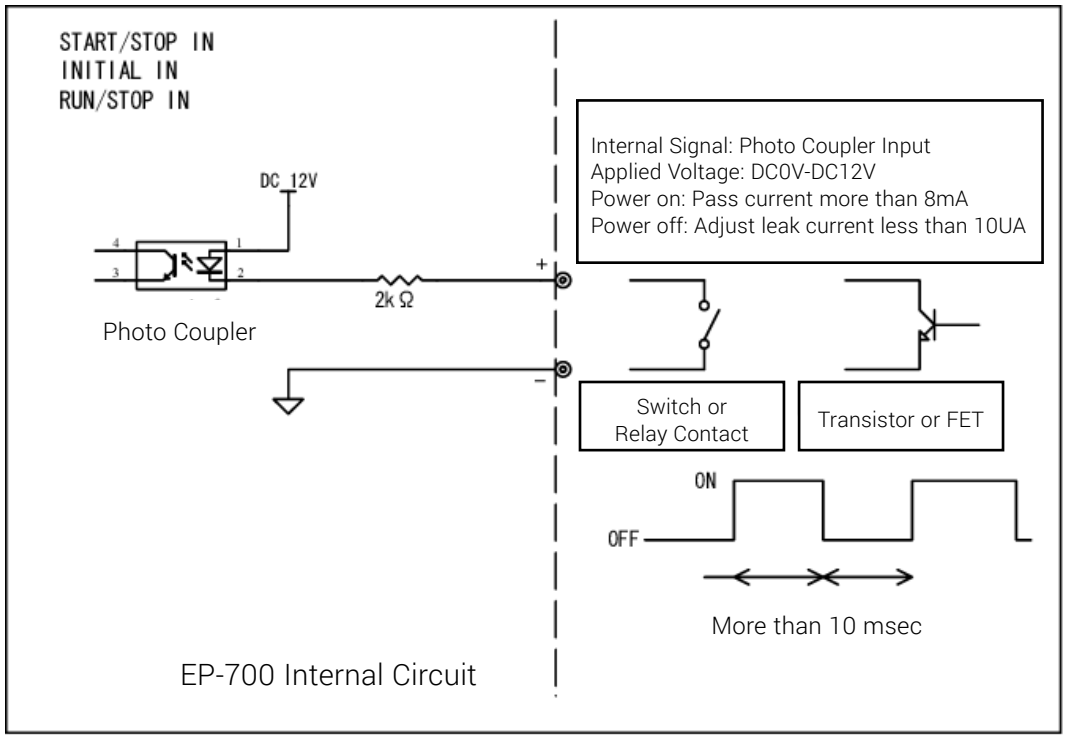
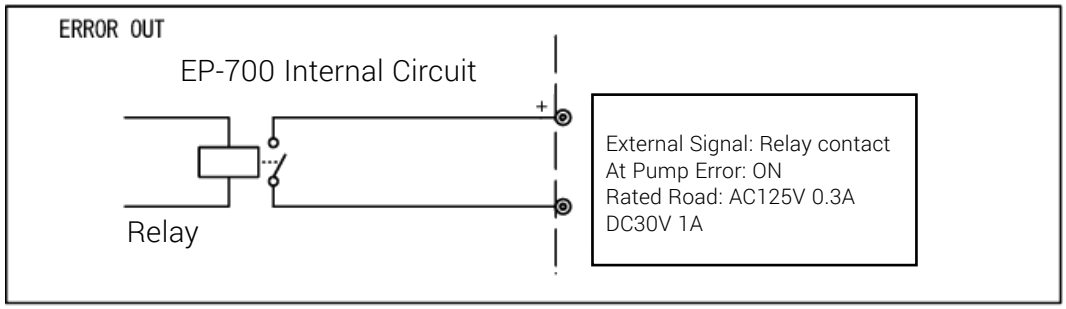
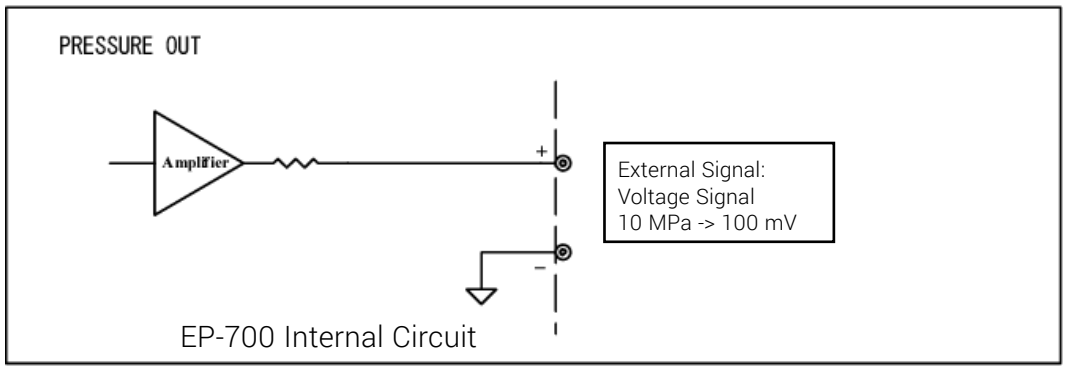
9.1. Input/Output of External signal

ECD-700 has Input/Output Signal Terminal to control external device. The followings are details of input/output circuit.







Warranty Period: One year from the original purchase date, as defined by the date of your Eicom invoice. Except for valve unit-which is warranted for 6 months from the purchase date as defined by the date of your Eicom invoice.

Warranty Information: During warranty period, this Eicom product is covered by a limited liability warranty covering manufacture defects. In case that the machine is defective, it will be repaired or replaced free of charge.

Void of Warranty: The manufacturer's warranty will be void under the following conditions:

1) Failure to follow instructions and warnings relating to product's use.

2) Repaired or altered by anyone other than Eicom.

3) Damage during shipping or transit, or any other accidental damage.

4) Damage due to use of improper voltages.

5) Damage due to improper setup of the equipment.

6) Damage due to any act of God.

7) Any other inappropriate usage of parts or consumables that is not authorized by Eicom.

 Specifications and descriptions in this user guide are subject to change without prior notice. If you have any further questions, please feel free to contact Eicom or its distributors.

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