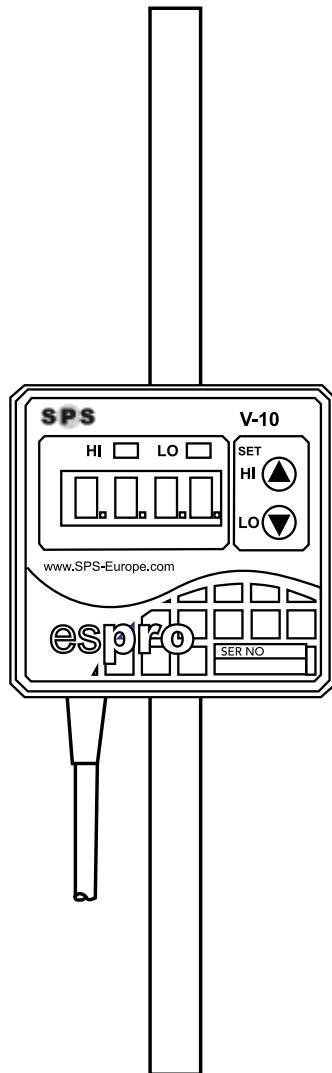


# espro

## FLOWMETER MANUAL

### MODEL V□ AND V□D



Before using this product, carefully read this manual for appropriate handling of this product. And, keeping this manual close at hand for quick reference if necessary.

SPS Europe B.V.  
[www.Esproflow.com](http://www.Esproflow.com)

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## ● Before using this Product



- Confirm the compatibility of the type of liquid to be used and the material of the part in contact with liquids before using this product.
- Before using this product, carefully read this operation manual to learn the correct usage of this product.
- Keep this manual at hand to refer to when required.
- Follow the correct usage of this product specified in this manual.
- Comply with the statements of warning described in this manual.

The above instructions are mandatory. Neglecting these instructions may result in personal injury or accidents.

### **About Operation Manual**

- The information described in this manual is subject to change without prior notice, due to improvements of product in performance and/or functionality.
- No parts of this manual may be reproduced or utilized in any form or by any means.
- Please call SPS Europe any time you lose this manual.
- Every effort was made to ensure that all information included in this manual was complete and accurate at the time of printing. However, if you have any point of doubt, errors, or omissions, please contact SPS Europe.

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# ● Important Safety Instructions

## About Marks Used

This manual provides the marks, including DANGER, WARNING, and CAUTION, used to avoid personal injury or damage to your property. The meaning of each mark is described as follows. Carefully read the following and get familiar with these marks before proceeding to read this manual.

In particular, fully understand and obey the instruction of DANGER mark.



Indicates the presence of an imminently hazard that, if not avoided, will cause death or severe personal injury.



Indicates the presence of a potential hazard that, if not avoided, can cause death or severe personal injury.



Indicates the presence of a potential hazard that, if not avoided, will or can cause personal injury or property damage.



Provides important notices and indications to operate the product correctly.

## ● DANGER and WARNING statements

Before using this product, carefully read the warning statements and comply with them.

### Instructions on Mounting Place

#### WARNING

- This product is not designed for explosion-proof. Never use it with flammable liquids such as solvent. Using the product with such liquids may cause a fire or explosion, resulting in personal injury or death.
- This product is designed for indoor-only use. Do not apply this product to outdoor use. Outdoor use will result in short circuit or unexpected accidents
- Do not use esPRO Flowmeter in corrosive environments.

### Instructions on Tubing and Mounting

#### DANGER Mandatory instruction!!!

- Always wear anti-chemical protective gear (protective gloves, protective mask, and protective clothing) that protects your entire body when using this product for hazardous chemicals or solvents. If an accidental spout of the chemicals or solvents occurs, a contact with chemicals may cause personal injury.

#### WARNING

- Before tubing, confirm the correct flow direction by checking the arrow direction of "IN—> OUT" marked on the side of flowmeter unit. Incorrect tubing system may result in personal injury due to liquid leakage caused by damage of flowmeter unit.
- Before mounting, align the axes of tubes on both sides to avoid excessive stress to the flowmeter. Incorrect axial alignment may result in personal injury due to liquid leakage caused by damage of flowmeter unit.
- Be sure to hold the two-chamfering flats with a spanner when tightening a nut. Holding any other part may loosen the main unit, resulting in property damage accidents.

## Instructions on connecting Wires



- Be sure to turn off the power supply before wiring. Wiring with the power supplied may cause an electric shock or fire.
- Apply the voltage in the specified range. Over voltage may result in smoking or fire.
- Do not apply the voltage and current exceeding the specified range to the pulse and alarm output (open collector output). Neglecting this may cause a product damage.

## Instructions on Maintenance and Inspection



Always wear anti-chemical protective gear (protective gloves, protective mask, and protective clothing) that protects your entire body when using this product for hazardous chemicals or solvents. If an accidental spout of the chemicals or solvents occurs, a contact with chemicals may cause personal injury.



- Before removing the flowmeter connected to the tubes, stop the liquid flow and close the valves on both sides of flowmeter, to release the pressure around the flowmeter. A pressurized condition may result in personal injury due to exposure of liquids.



Using liquid that has high permeability to PFA (resin of the body) may cause corrosion of the product. When using such liquid, replace the flowmeter periodically.

# ● 1 Description of the Product

esPRO Flowmeter, that has the part in contact with liquid made of PFA and provides connection with no use of seal-tapes resulting in potentially leakage, is the ideal flowmeter used to measure the flow rates of chemical liquids.

## 1.1 Operating Principle

if a liquid flows past a shedder body, a regular pattern of vortices called Karman Vortex Street alternately trails aft in the wake. Provided that the vortex shedding frequency is  $f$ , the width of shedder body is  $d$ , and the flow velocity is  $v$ , the relationship of them can be expressed by the following formula.

$$f = St \cdot V/d$$

Where  $St$ , the Strouhal Number is a dimensionless constant which defines the quality of the vortex measurement. The Strouhal Number is constant over wide Reynolds Number ranges when the shedder body is designed with optimal dimensions. Therefore, we can obtain the value of  $V$  by measuring the vortex shedding frequency  $F$  and then derive the volume flow value from the measured  $V$ .

This flowmeter, as shown in Figure 1, is equipped with an ultrasonic sensor that consist of a pair of transmitter (TX) and receiver (RX). This sensor is mounted aft the wake of the shedder body. Ultrasonic waves that constantly are sent out from TX pass through the liquid for a certain time to reach the receiver. As shown in Fig. 1, if a Karman vortex street trails in the contrary direction to the ultrasonic wave oscillating direction, it takes much time for ultrasonic waves to reach RX. Conversely, if a Karman cortex street trails in the same direction as ultrasonic wave oscillating direction, it takes less time for ultrasonic waves to reach RX. Since the ultrasonic wave oscillating time varies proportional to the vortex shedding frequency, we can obtain the measured flow by detecting any changes in ultrasonic wave oscillating time. This ultrasonic sensor, mounted outside the tubes connected to flowmeter, allows non-touching measurement in which we can measure the flow rates without directly touching. Also, the ultrasonic sensor provides the excellent features, resistance to vibration and high sensibility.

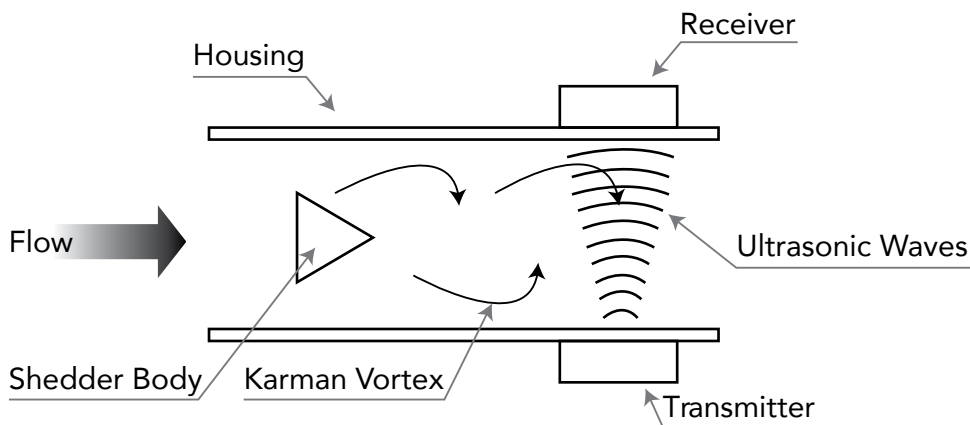


Fig. 1 Operating Principle of esPRO Flowmeter



## 1.2 Circuit Block Diagram

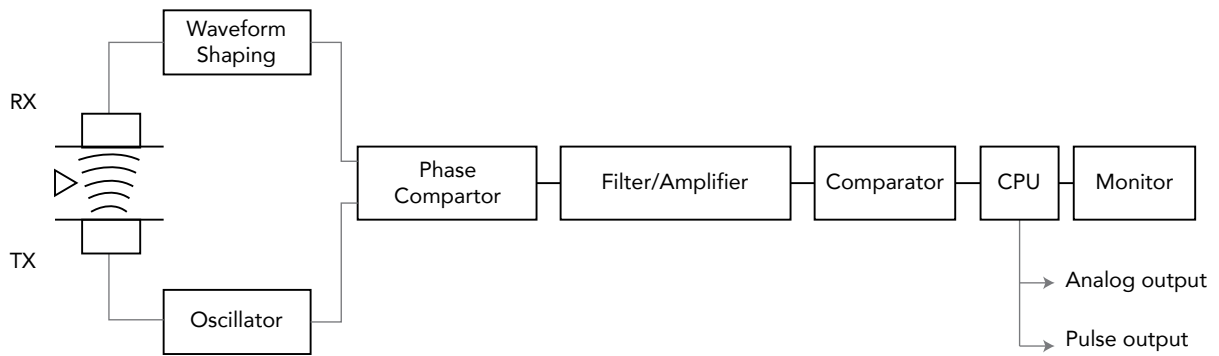


Fig. 2 Circuit Block Diagram

### 1.3 Specification



## WARNING

- Whenever using this product, follow the specified flow rate range and the pilot air pressure range. Neglecting this may cause a product failure or damage, or an accident.



Using liquid that had high permeability to PFA (resin of the body) may cause corrosion of the product. When using such liquid, replace the flowmeter periodically.



Do not use this product for slurry liquids or liquid containing foreign substances. Such usage may degrade the system performance.

# ● Specification

		V-10 - V-10D*	V-15 - V-15D*
Available fluid		Fluids not corrosive or permeable against fluorocarbon resin. (Please contact us for your operating fluids.)	
Flowmeter Range		0.5 - 3.5 l/min	1 - 16.0 l/min
Indicating Flow Rate		0.0 - 4.0 l/min	0.0 - 18.0 l/min
Measurement Accuracy		±5% F.S	±2.5% F.S
Operating Environmental Temperature		5 - 60°C	5 - 60°C
Operating Fluid Temperature		5 - 85°C	5 - 85°C
Fluid Pressure		Max.800kPa (25°C)	
Tube Diameter		Ø9.53×Ø6.35 mm   3/8 inch	Ø12.7×Ø9.53 mm   1/2 inch
Wetted Parts mm/inch		PFA	
Mounting Positions		Horizontal, Vertical or Diagonal (Not vertical in drop position)	
Analog Output	Output	DC4 - 20mA	
	Load Resistance	500Ω or Less	
Pulse Output	Output	NPN Open collector	
	Excitation Voltage/Current	Max.DC30V/80mA	
	Pulse Unit	10ml/P	
	Pulse Range	5mS	
High&Low boundary Output	Output	NPN Open collector	
	Excitation Voltage/Current	Max.DC30V/80mA	
	LED indication	LO turns off: less than Low boundary * HI, LO turns on : within High & Low boundary * HI turns off: more than High boundary	
Power Supply		DC24V ±10%	
Current Consumption		120mA or Less	
Cable		2m	
CE marking approval		○	○

		V-20D*	V-25D*
Available fluid		Fluids not corrosive or permeable against fluorocarbon resin. (Please contact us for your operating fluids.)	
Flowmeter Range		2.0 - 40.0 l/min	5.0 - 130.0 l/min
Indicating Flow Rate		0.0 - 44.0 l/min	0.0 - 145.0 l/min
Measurement Accuracy		±1.5% F.S (at 25°C)	±2.5% F.S (at 25°C)
Operating Environmental Temperature		5 - 60°C	5 - 60°C
Operating Fluid Temperature		5 - 85°C	5 - 85°C
Fluid Pressure		Max.600kPa (25°C)	Max.450kPa (25°C)
Tube Diameter mm/inch		Ø19.05×Ø15.9 mm   3/4 inch	Ø25.4×Ø22.2 mm   1 inch
Wetted Parts		PFA	
Mounting Positions		Horizontal, Vertical or Diagonal (Not vertical in drop position)	
Analog Output	Output	DC4 - 20mA	
	Load Resistance	500Ω or Less	
Pulse Output	Output	NPN Open collector	
	Excitation Voltage/Current	Max.DC30V/80mA	
	Pulse Unit	10mr/P	100mr/P
	Pulse Range	5mS	
High&Low boundary Output	Output	NPN Open collector	
	Excitation Voltage/Current	Max.DC30V/80mA	
	LED indication	LO turns off: less than Low boundary * HI, LO turns on : within High & Low boundary * HI turns off: more than High boundary	
Power Supply		DC24V ±10%	
Current Consumption		120mA or Less	
Cable		2m	
CE marking approval		○	○

\* D-series are equipped with a small monitor and provide analog output, pulse output as well as high & low boundary output.

## Instructions on range of flow rate

Kinetic viscosity of liquids ( $\times 10^6 \text{ m}^2/\text{s}$ )	1	2	3	4	5	6	7	Maximum flow rate (L/min)
V10 - V10D Minimum flow rate of liquid (L/min)	0.5	1.0	1.5	2.0	2.5	3.0	-	3.5
V15 - V15D Minimum flow rate of liquid (L/min)	1	2	3	4	5	6	7	16
V20D Minimum flow rate of liquid (L/min)	2	4	6	8	10	12	14	40
V25D Minimum flow rate of liquid (L/min)	5	10	15	20	25	30	35	130

The minimum flow rates of the liquids, of which kinetic viscosity are more than 2 ( $\times 10^{-6} \text{ M}^2/\text{s}$ ), are the theoretical values and may be different from the actual values.

## 2 Instructions on measurement accuracy

Because the measuring part of this flowmeter is made of resin, the temperature change of the target liquid affects the inner diameter of the measurement tube, causing some deviation in measurement characteristics. If the liquid temperature is higher than 50 °C and the accuracy specified by the specifications is required, correct the output of the flowmeter using the following formula:

Actual flow volume under your operating conditions = Output of flowmeter  $\times \{1 + (0.0006 \times (T - 25))\}$

T: Liquid temperature under your operating conditions (°C)

## 3 Instructions on operating liquid pressure

The maximum operating pressure depends on the liquid temperature. To derive the maximum operating pressure for the specific liquid temperature, use the following formula:

V-10, V10D, V15, V15D

Maximum acceptable operating pressure =  $800 \times \{1 - ((T - 25) \times 0.0043)\}$  (kPa)

T: Liquid temperature (°C) at your usage.

V20D

Maximum acceptable operating pressure =  $600 \times \{1 - ((T - 25) \times 0.0043)\}$  (kPa)

T: Liquid temperature (°C) at your usage.

V25D

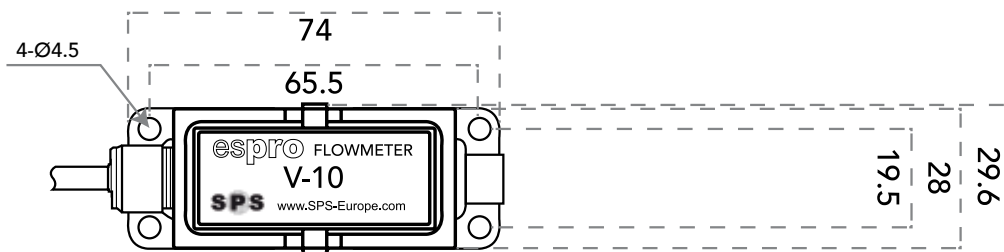
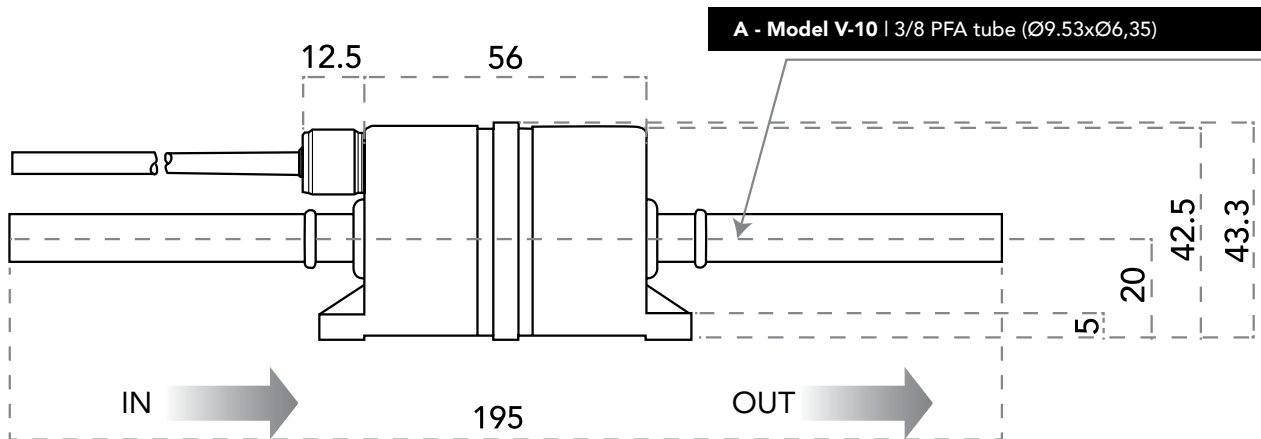
Maximum acceptable operating pressure =  $450 \times \{1 - ((T - 25) \times 0.0043)\}$  (kPa)

T: Liquid temperature (°C) at your usage.

## 1.4 Dimensions and Destination of Panel Unit

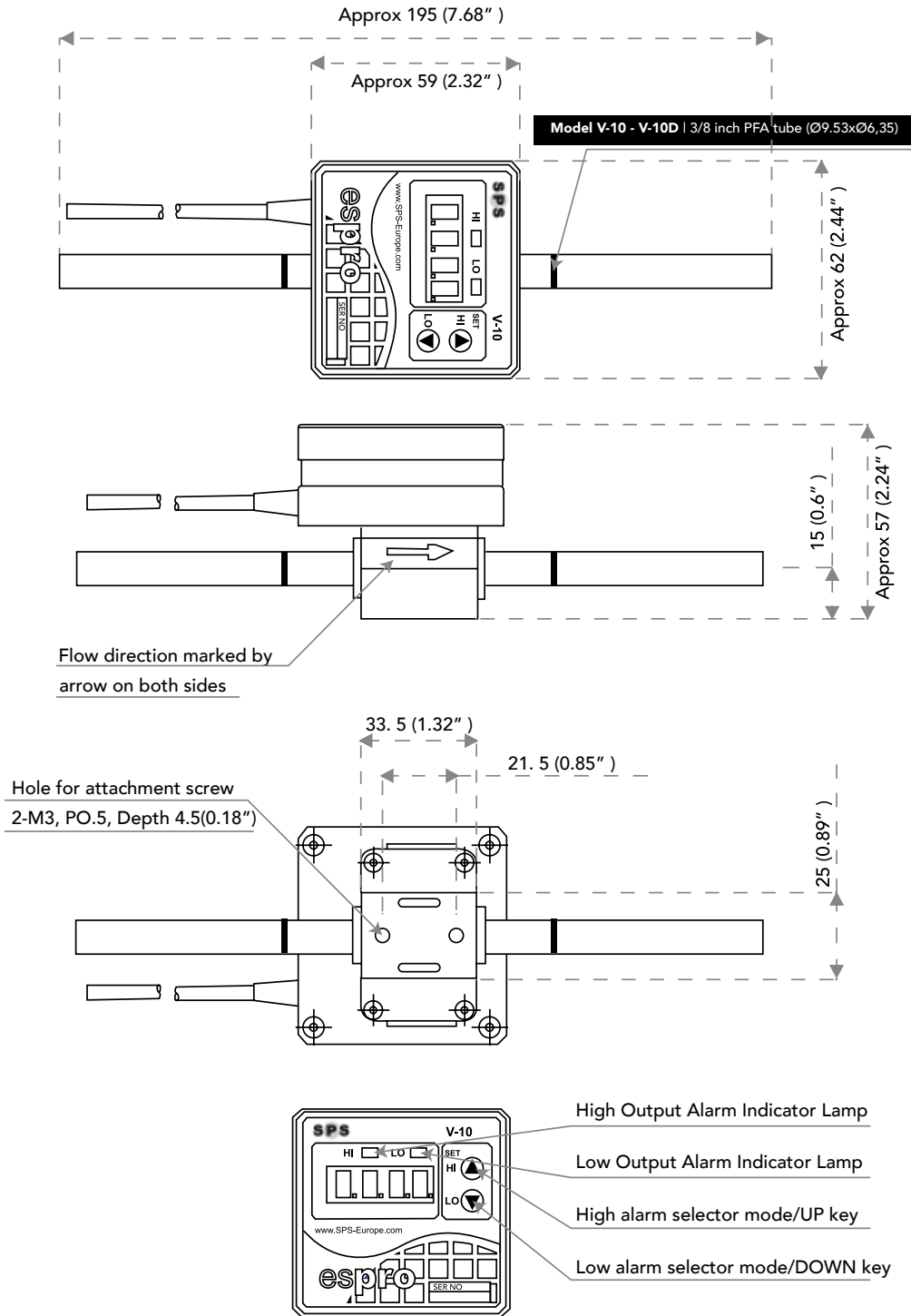
### esPRO - V10

V10 - Suitable for tube diameter  $\varnothing 9.53 \times \varnothing 6.35$  mm 3/8 inch



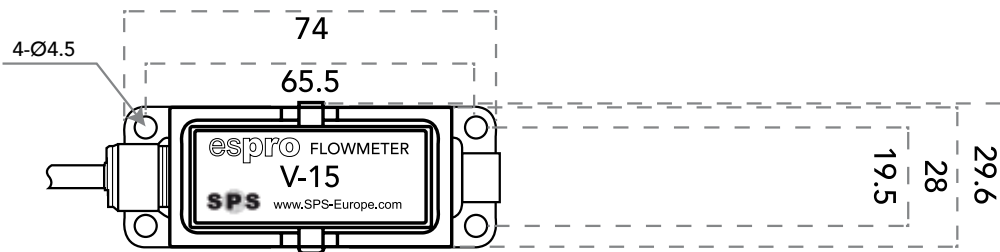
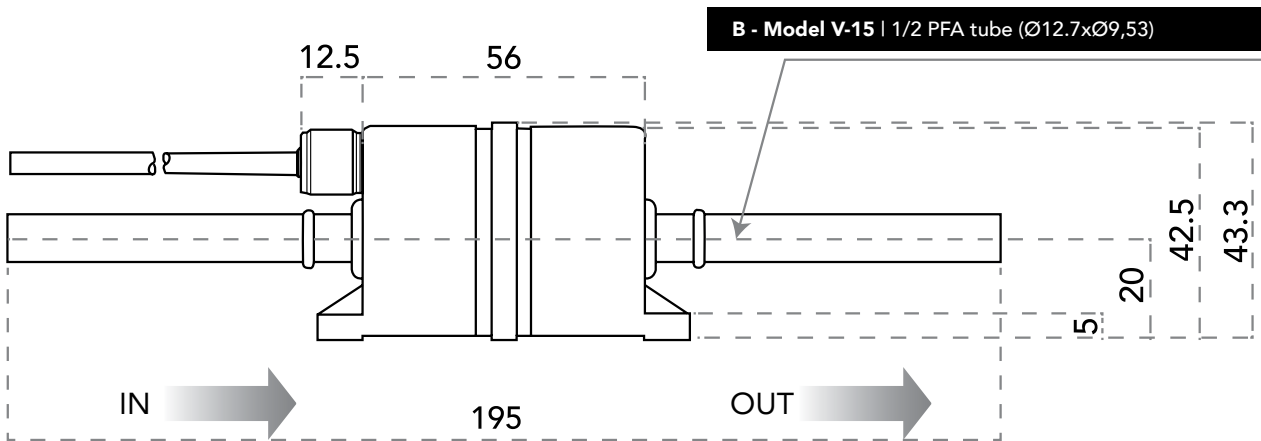
# esPRO - V10D

V10D - Suitable for tube diameter  $\varnothing 9.53 \times \varnothing 6.35$  mm 3/8 inch with display



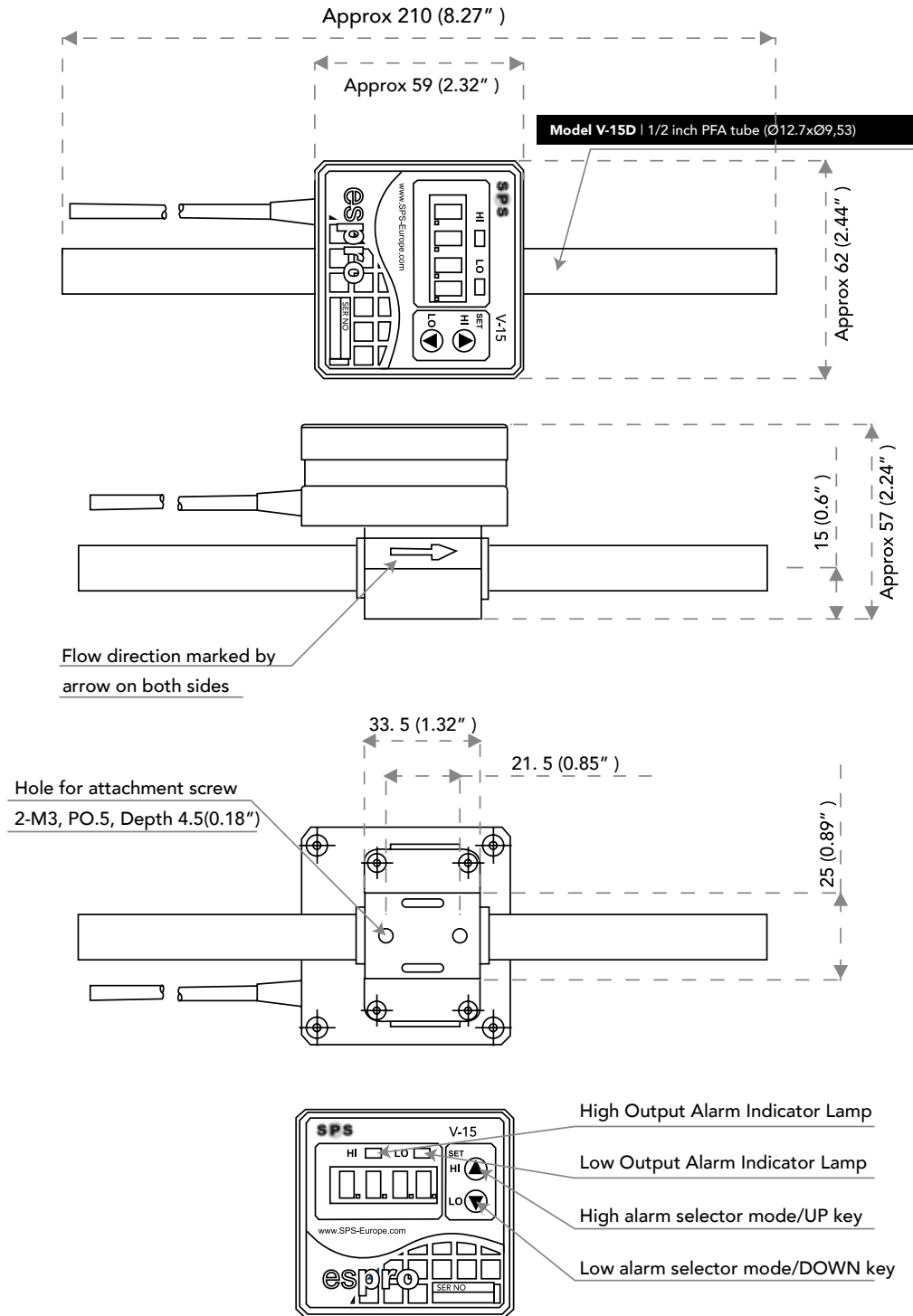
## esPRO - V15

V15 - Suitable for tube diameter  $\varnothing 12.7 \times \varnothing 9.35$  mm 1/2 inch



## esPRO - V15D

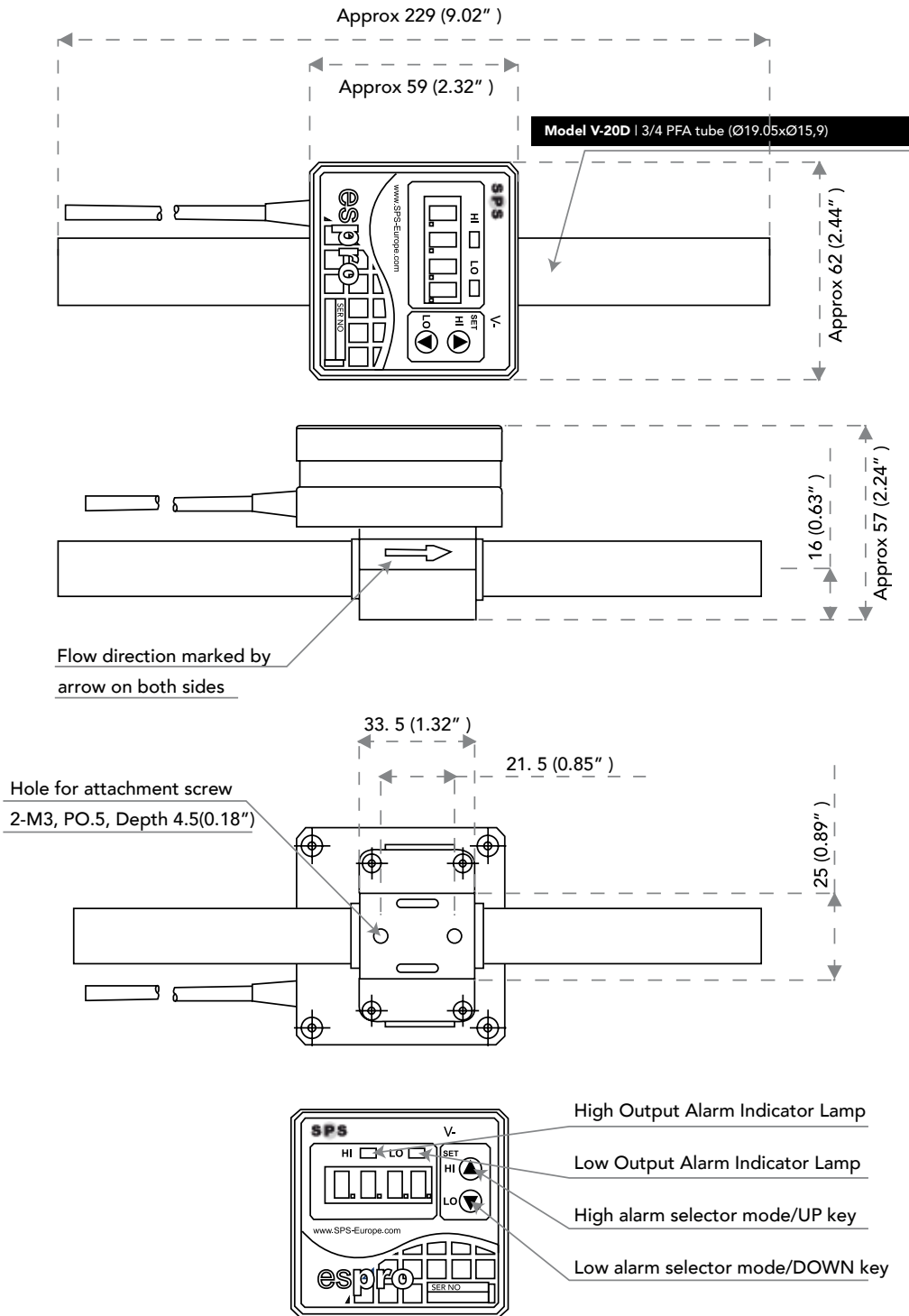
V15D - Suitable for tube diameter  $\varnothing 12.7 \times \varnothing 9.35$  mm 1/2 inch with display





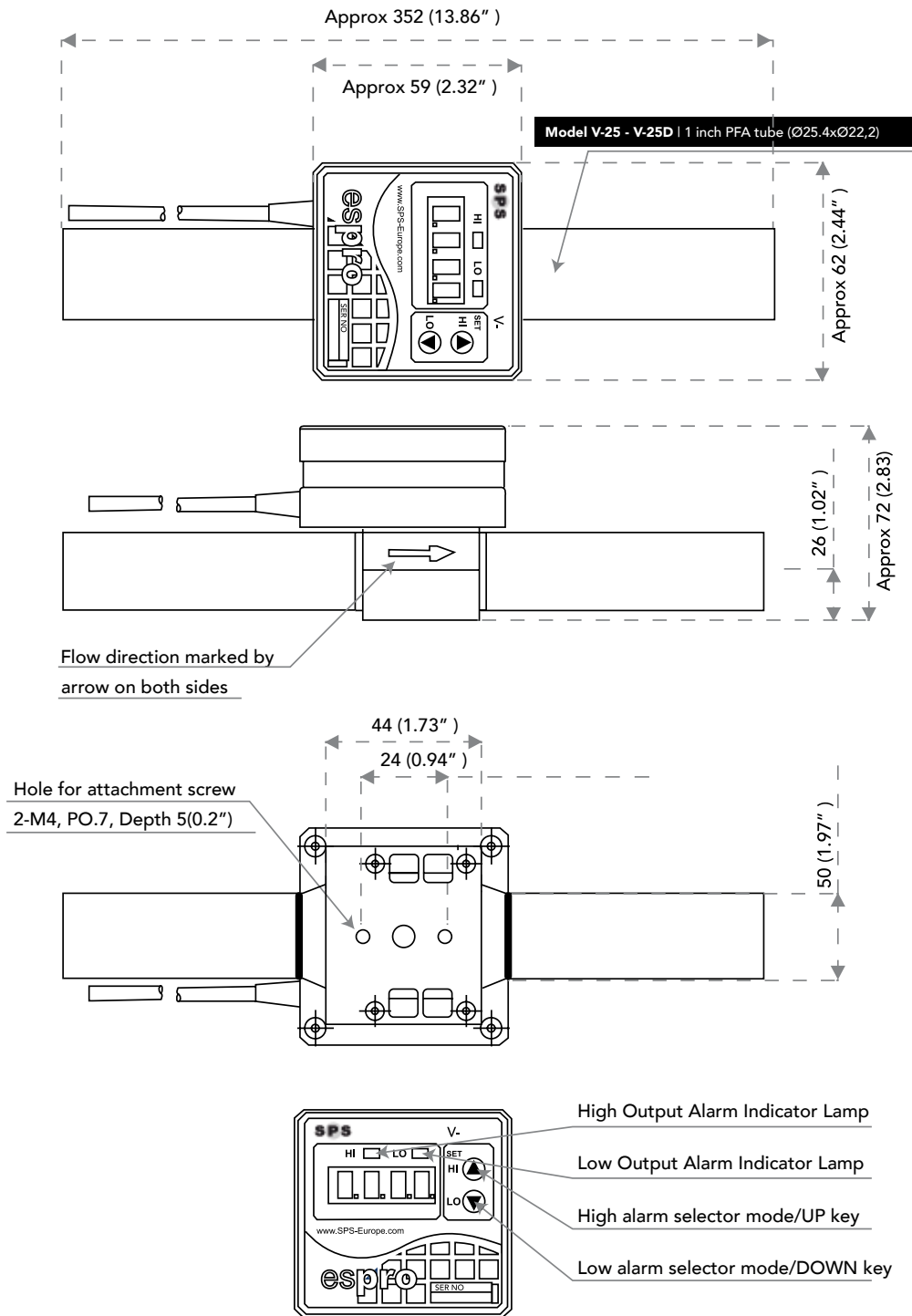
# esPRO - V20D

V20D - Suitable for tube diameter  $\varnothing 19.05 \times \varnothing 15.90$  mm 3/4 inch with display



# esPRO - V25D

V25D - Suitable for tube diameter Ø25.4 x Ø22.2 mm 1 inch with display



## ● 2 Handling

### 2.1 Checking Your Package and Transporting

To prevent damage during transporting, we recommend that you transport the product to your site without unpacking. When you received the package, unpack it and confirm that there is no damage to the product by checking the appearance of product. If any defective found, contact your vendor or SPS Europe.



Do not physically shock to the product. A physical shock to product may result in damage of product unit.

### 2.2 Storage

For potentially long term storage, store the product in the places where the following environmental conditions are satisfied.

- Being kept dry
- Appropriate vibration or shock
- Temperature of 5 °C to 60 °C and humidity of 5% to 80% RH (non-condensing)
- Places free from coarse particles
- Places not exposed to direct sunshine

## ● 3 Installation

### 3.1 Installation Place

For an easy operation and daily inspection or for a long usage with stable and optimum performance, mount the flowmeter according to the warnings as below.



- This product is not designed for explosion-proof. Never use it with flammable liquids such as solvent, Using the product with such liquids may cause a fire or explosion, resulting in personal injury or death.
- This product is designed for indoor-only use. Do not apply this product to outdoor use. Outdoor use will result in short circuit or unexpected accidents.
- Do not use esPRO Flowmeter in corrosive environments

- (1) Mount the flowmeter in the places that keep dry. Getting wet may result in breakdown.
- (2) Gas-liquid two-phase flows or flows containing bubbles may result in malfunction.
- (3) Mount the flowmeter in the places where no bubble flows into or gets trapped inside the flowmeter.
- (4) Do not mount heat exchangers or similar devices upstream, nearest to the flowmeter. Sharp changes in liquid temperature may result in malfunction. Keep the heat exchanger or similar devices away from the flowmeter to avoid sharp temperature changes.
- (5) Do not mount the flowmeter in the places that may provide high temperature gradients or sharp temperature changes
- (6) Large ripples of bellows pumps or similar devices may result in errors in measurement. Minimize the ripples by using dampers or similar devices.
- (7) Mount the flowmeter in the places where you can easily do inspection and tubing work.
- (8) When wiring, do not connect the cables close to large-capacity motors or transformers, noise source such as power sources, and high-voltage, high-current sources. Neglecting this may result in malfunction due to induction.
- (9) Do not mount the flowmeter in the places where it can get vibrations or impacts. Mounting it in such places may result in incorrect measurement.

### 3.2 Instructions on Tubing and Mounting

#### WARNING

- Before tubing, confirm the correct flow direction by checking the arrow direction of 'IN --> OUT' marked on the side of flowmeter unit. Incorrect tubing system may result in personal injury due to liquid leakage caused by damage of flowmeter unit.
- Before mounting, align the axes of tubes on both sides to avoid excessive stress to the flowmeter. Incorrect axial alignment may result in personal injury due to liquid leakage caused by damage of flowmeter unit.
- When tubing, use tubes of the specified size. Using other tubes may result in personal injury due to fluid leakage.

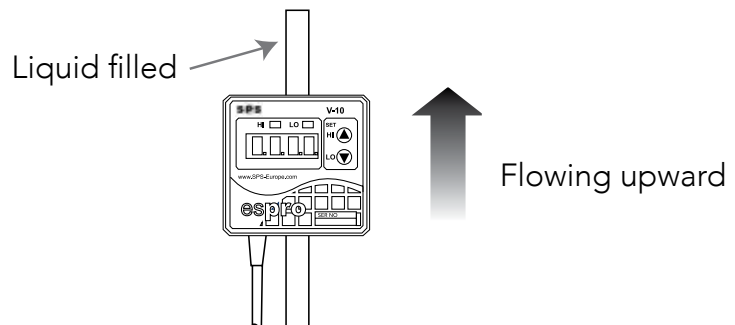


- The IN or OUT side's tube of which bore diameter is smaller than that of flowmeter may generate an error in measurement.
- For applications of the connecting part, refer to a brochure or an instruction manual provided with your connecting part.
- When using flowmeter, be sure to release the air inside its tube. An existence of air in tubing system may prevent the flowmeter from indicating a correct flow value.
- If air bubbles enter into the liquid, the bubbles may remain in the Karman vortex generating part of the main unit, resulting in incorrect measurement.

(1) The tube can be mounted in horizontal, vertical and diagonal. However, in any case, the tubing system must be filled with the liquid at all times.

We recommend the vertical tubing system. To prevent gas-liquid two-phase flows, design the tubing system in which the measured liquids flow to the upward direction (bottom-top).

(2) Design straight-tube parts on both sides of flowmeter. The straight-tube length of IN side must be at least 7 times longer than the bore diameter, and that of OUT side must be at least 5 times longer than the bore diameter.



### 3.3 Pressure at Downstream Side

To prevent the occurrence of cavitations <sup>(4)</sup>, the pressure value at the downstream side should be more than one obtained from the following formula.

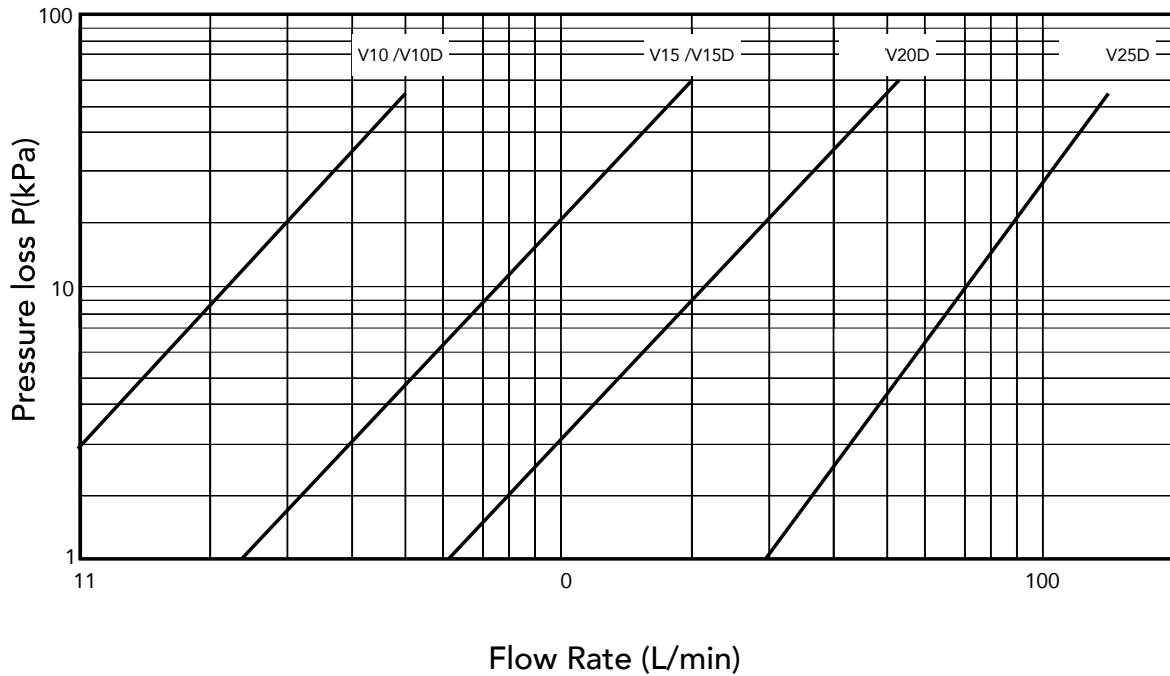
$$P_d = 2.7 \Delta P + 1.3 P_0$$

$P_d$ : Pressure values at the downstream side. (kPa abs)

$\Delta P$ : Pressure loss values. (kPa)

$P_0$ : Vapor pressure values of liquids. (kPa abs)

#### Pressure loss




#### <sup>(4)</sup> Cavitations

Phenomenon that the liquid evaporates, generating air bubbles, when the liquid pressure drops to the saturated vapor pressure or below.

## ● 4 Instructions on wiring

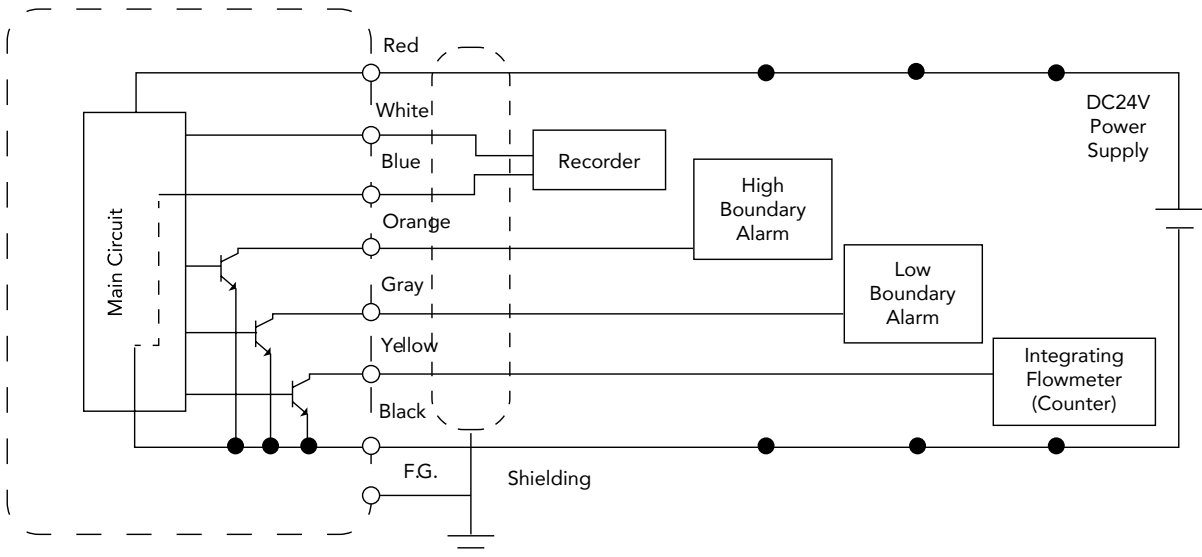
### 4.1 Output Stage Circuit and Wiring

When wiring, be sure to make the appropriate connection in reference to Figure 5.



## WARNING

- Be sure to turn off the power supply before wiring. Wiring with the power supplied may cause an electric shock or fire.
- Apply the voltage in the specified range. Over voltage may result in smoking or fire.
- Do not apply the voltage and current exceeding the specified range to the pulse and alarm output (open collector output). Neglectinh this may cause a product damage.



\* Black and blue leads are connected each other within the circuit.

Name of signal	Color
DC24V Power Supply	red
0V Power Supply	black
4 ~ 20mA Output (+)	white
4 ~ 20mA Output (-)	Blue
Pulse Output	yellow
High Boundary Output (+)	orange
Low Boundary Output (+)	gray

Fig. 5 Output Stage Circuit Wiring Diagram

## 4.2 Power Supply Connecting

Connect to a DC24V power supply. To obtain the specified accuracy, warm up your flowmeter for at least 20 minutes.

## 4.3 Analog Output

Connect a load resistance between 4 ~ 20mA Output(+) and 4 ~ 20mA Output (-). The value of load resistance of 500 Ω or less.

## 4.4 High/Low Boundary Output

The high/low boundary output is a NPN open collector output. Connect a load resistance between high/low boundary output (+) and power supply (DC24V). Below are examples of load resistance.

e.g.) Load resistance  
 1kΩ 1W  
 10kΩ 1/4W

## 4.5 Pulse Output

The pulse output is a NPN open collector output. Connect a load resistance between pulse output (+) and power supply (DC24V). Below are examples of load resistance.

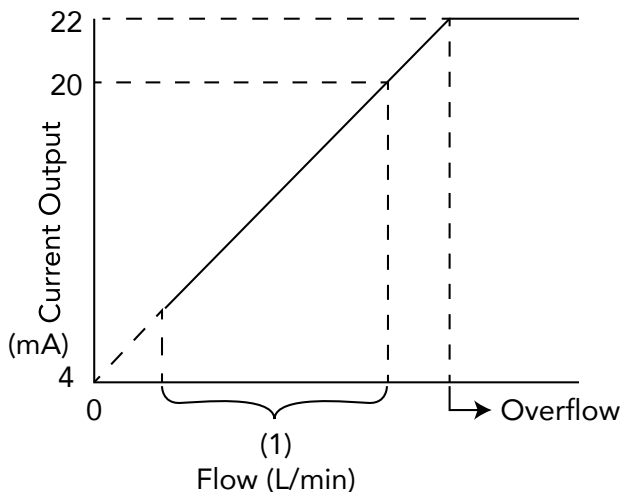
e.g.) Load resistance  
 1kΩ 1W  
 10kΩ 1/4W

## 4.6 Relationship of Flow and Analog Output

The analog output increases proportional to flow in the range of (1) L/min. (The Flow Range depends on the flowmeter model.)

\* At overflow ("OFLO" indicated at flow of 4 L/min or more), the analog output levels off at the maximum flow rate current.

(The Overflow Range depends on the flowmeter model.)



Flow Range	
V10 - V10D	0.5 ~ 3.5 L/min
V15 - V15D	1 ~ 16 L/min
V20D	2 ~ 40 L/min
V25D	5 ~ 130 L/min

Overflow Range	
V10 - V10D	4 L/min or more
V15 - V15D	18 L/min or more
V20D	44 L/min or more
V25D	145 L/min or more

Fig. 6 Relationship of Flow and Analog



## ● 5 Setting High/Low Output Boundaries

Only for ESF-25U, the display for setting the High/Low Boundary is different from other models.

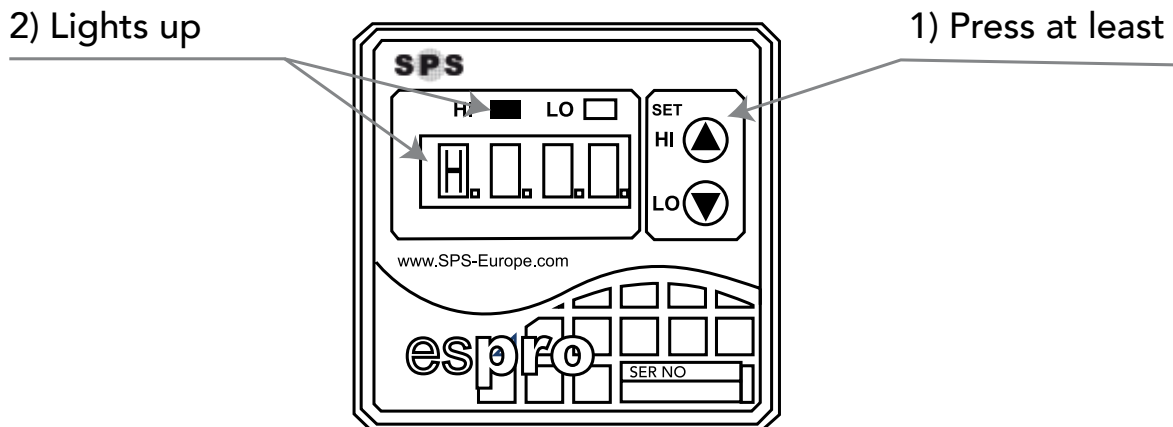
### 5.1 V10, V15, V20D, V25D Setting High.Low Output Boundaries

#### 5.1.1 Switching from 'Flow Measure Mode' to High Alarm Selector Mode'

##### 5.1.1.1 Switching to the High Boundary Setting Mode

- 1 While measuring the flow volume, press the SET HI button at least for 1 second.
- 2 ● The flowmeter is brought into the high boundary setting mode.
  - The high boundary setting output LED turns on.
  - H' indication lights up in the left part of the display.

#### Switching to the High Boundary Setting Mode

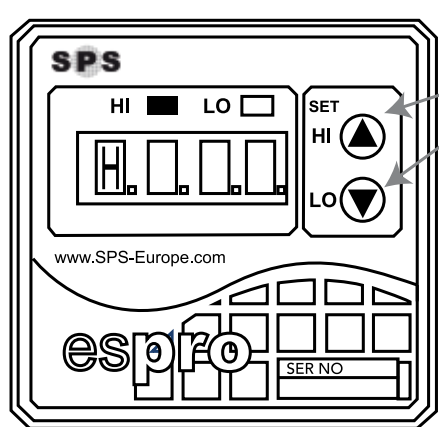


When setting the low boundary value, be sure to set the value less than the high boundary value. The low boundary value exceeding the high boundary value may cause malfunction of the product.

### 5.1.1.2 Setting High Boundary Value

- 1 In the high boundary setting mode, press the SET HI button (or the SET LO button) once.
- 2
  - The value on the display increases (or decreases) by 0.1. (The setting range depends on the flowmeter model.)
  - To increase/decrease the value faster, holding down the button

### Setting High Boundary Value



1) Press this button

Setting Range for each model	
V10 - V10D	0.0 ~ 3.5
V15 - V15D	0.0 ~ 16
V20D	0.0 ~ 40

### 5.1.1.3 Completion of High Boundary Setting

The high boundary setting mode will be canceled to the flow volume measuring mode if the buttons are not pressed for 5 seconds.

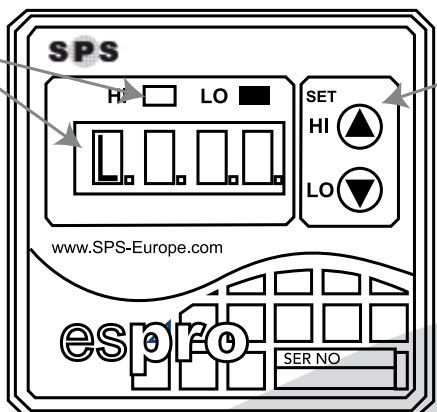
## 5.1.2 Switching from 'Flow Measure Mode" to "Low Alarm Selector Mode"

### 5.1.2.1 Switching to the Low Boundary Setting Mode

- 1 While measuring the flow volume, press the SET LO button at least for 1 second.
- 2
  - The flowmeter is brought into the low boundary setting mode.
  - The Low boundary setting output LED turns on.
  - "L" indication lights up in the left part of the display.

### Switching to the Low Boundary Setting Mode

2) Lights up

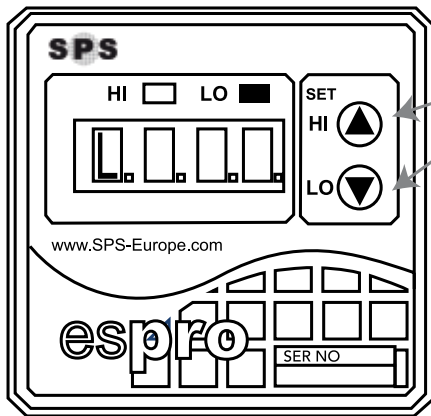


1) Press at least

### 5.1.2.2 Setting Low Boundary Value

- 1 In the Low Boundary setting mode, press the SET HI button (or the SET LO button) once.
- 2 The value on the display increases (or decreases) by 0.1. (the setting range depends on the flowmeter model.) To increase/decrease the value faster, holding down the button.

### Setting Low Boundary Value



1) Press this button

Setting Range for each model	
V10 - V10D	0.0 ~ 3.5
V15 - V15D	0.0 ~ 16
V20D	0.0 ~ 40

### 5.1.2.3 Completion of Low Boundary Setting

The Low boundary setting mode will be canceled to the flow volume measuring mode if the buttons are not pressed for 5 seconds.

## 5.2 V25D Setting High/Low Output Boundaries

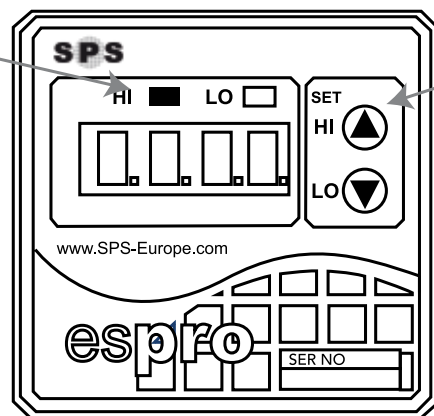
### 5.2.1 Switching from 'Flow Measure Mode' to High Alarm Selector Mode'

#### 5.2.1.1 Switching to the High Boundary Setting Mode

- 1 While measuring the flow volume, press the SET HI button at least for 1 second.
- 2 ● The flowmeter is brought into the high boundary setting mode.
  - The high boundary setting output LED turns on.

#### Switching to the High Boundary Setting Mode

2) Lights up

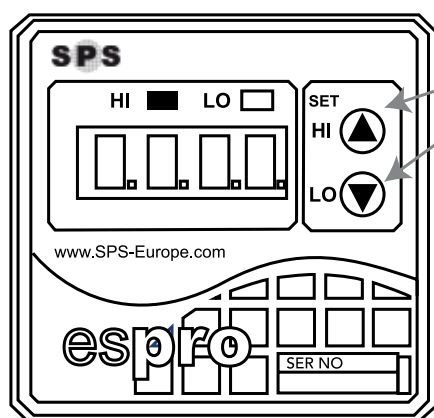


1) Press at least

#### 5.2.1.2 Setting High Boundary Value

- 1 In the high boundary setting mode, press the SET HI button (or the SET LO button) once.
- 2 The value on the display increases (or decreases) by 0.1. (The setting range depends on the flowmeter model.) To increase/decrease the value faster, holding down the button.

#### Setting High Boundary Value



1) Press this button

Setting Range	
V25D	0.0 ~ 130.0

#### 5.2.1.3 Completion of High Boundary Setting

The high boundary setting mode will be canceled to the flow volume measuring mode if the buttons are not pressed for 5 seconds.

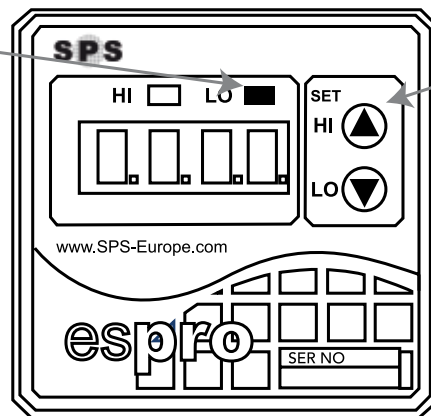
## 5.2.2 Switching from 'Flow Measure Mode" to "Low Alarm Selector Mode"

### 5.2.2.1 Switching to the Low Boundary Setting Mode

- 1 While measuring the flow volume, press the SET LO button at least for 1 second.
- 2
  - The flowmeter is brought into the low boundary setting mode.
  - The low boundary setting output LED turns on.

### Switching to the Low Boundary Setting Mode

2) Lights up

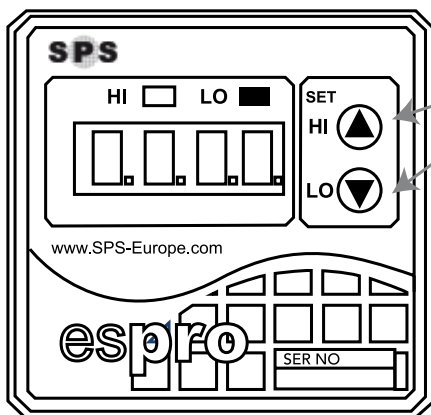


1) Press at least

### 5.2.2.2 Setting Low Boundary Value

- 1 In the low boundary setting mode, press the SET HI button (or the SET LO button) once.
- 2 The value on the display increases (or decreases) by 0.1. (The setting range depends on the flowmeter model.) To increase/decrease the value faster, holding down the button.

### Setting Low Boundary Value



1) Press this button

Setting Range	
V25D	0.0 ~ 130.0

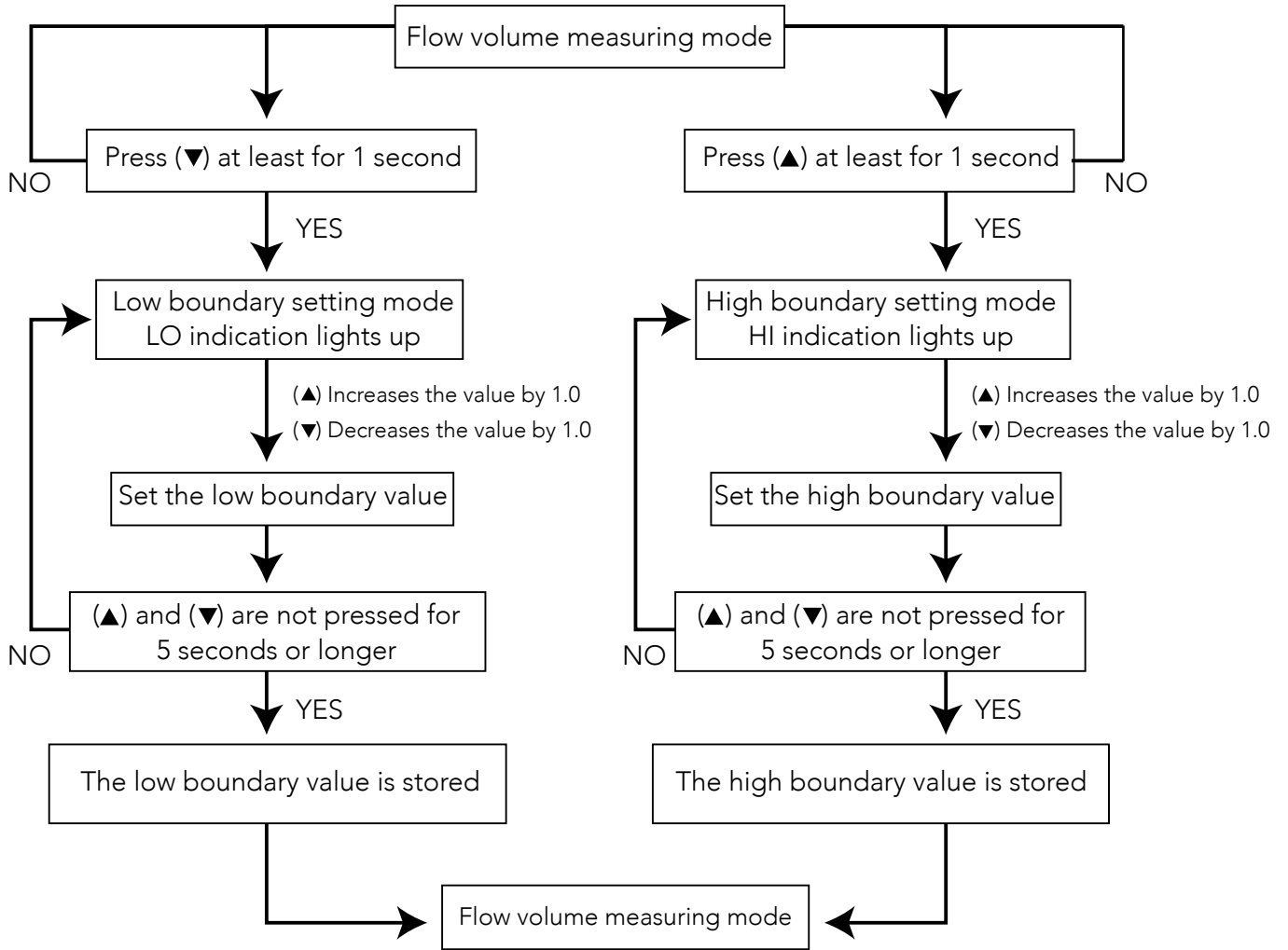
### 5.2.2.3 Completion of Low Boundary Setting

The low boundary setting mode will be canceled to the flow volume measuring mode if the buttons are not pressed for 5 seconds.

### 5.3 Flow Diagram of High/Low Boundary Setting

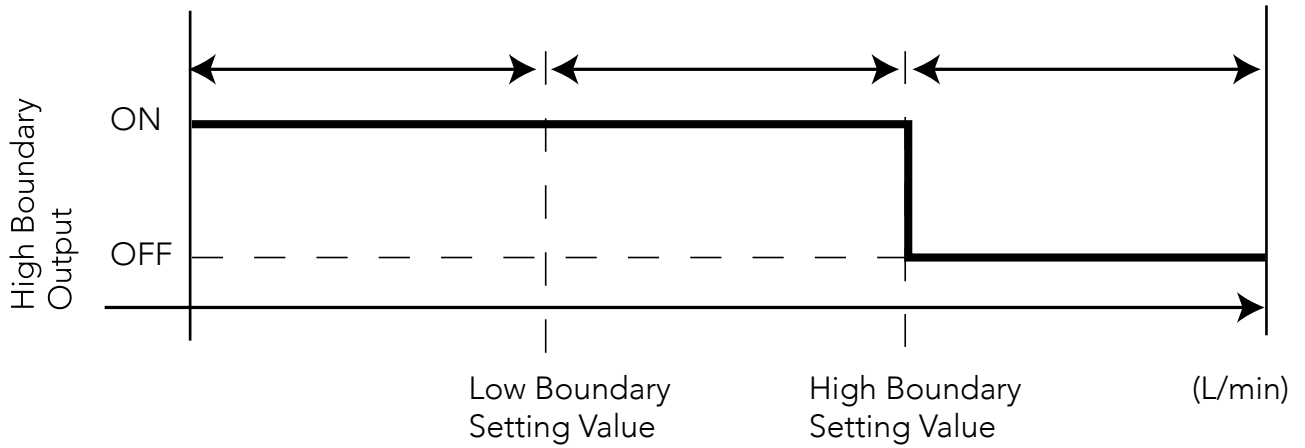
Setting the low boundary value

Setting the low boundary value

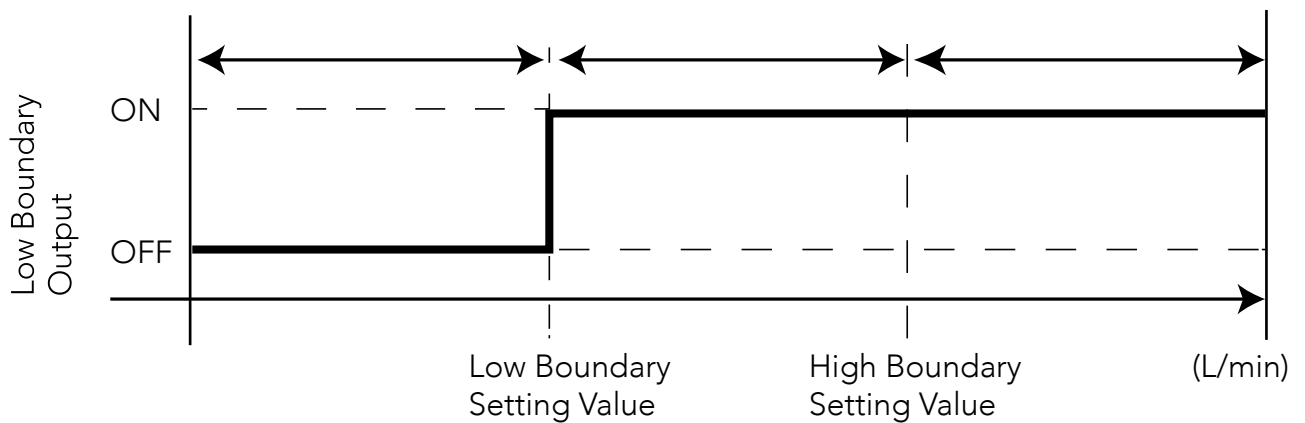


## 5.4 High/Low Boundary Outputs and led Light-Up State

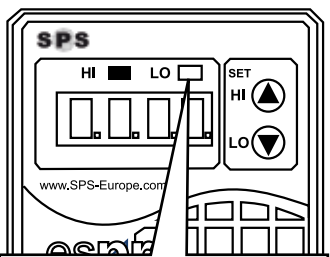
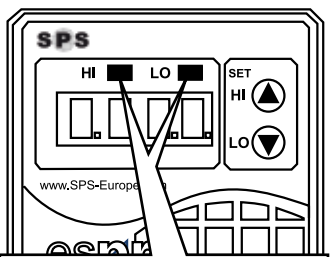
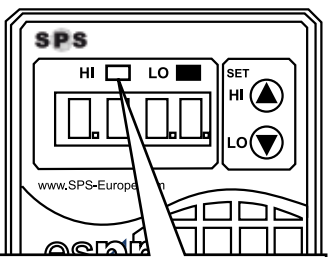
### High Boundary Output



### Low Boundary Output



### LED Light-Up State

Flow Range	Lower than Low boundary value	Between High and Low boundary values	Higher than high boundary value
LED Light-Up State	 LO turns off	 HI & LO light-Up	 HI turns off
Description of LED indication	LO indication turns off. (Only the HI indication lights up.)	Both of HI and LO indications light up.	Hi indication turns off. (Only the LO indication lights up.)

## ● 6 Inspection and Maintenance

### 6.1 Instructions on Inspection and Maintenance



- Always wear anti-chemical protective gear (protective gloves, protective mask, and protective clothing) that protects your entire body when using this product for hazardous chemicals or solvents. If an accidental spout of the chemicals or solvents occurs, a contact with chemicals may cause personal injury.
- Before removing the flowmeter connected to the tubes, stop the liquid flow and close the valves on both sides of flowmeter, to release the pressure around the flowmeter. A pressurized condition may result in personal injury due to exposure of liquids.
- Whenever replacing parts or carrying out inspection work, turn off the power supply and stop the liquid flow inside the tubing system. A pressurized condition may result in personal injury due to exposure of liquids.



Using liquid that has high permeability to PFA (resin of the body) may cause corrosion of the product. When using such liquid, replace the flowmeter periodically.



## 6.2 Troubleshooting

Every effort was made to ensure that this product was completely adjusted at the time of shipment. However, if you have any troubles at start-up or during operation, check the following points against product. If the trouble cause is unknown, please contact SPS

Trouble Condition	Checking Pionts	Correcting Action
No output value displayed with a flow	● Is the wiring properly connected?	● Redo the wiring correctly.
	● Is the rated power supply voltage applied?	● Apply the rated voltage.
	● Is the load resistance value correct?	● Use the load resistance of 500 or less.
	● Is the tubing system filled with liquid?	● Re-design the tubing system or operating conditions allowing the tubes to be filled with liquid.
	● Is the flow rate within the measurable range?	● Change the operating conditions.
Output value displayed without flow.	● Is the tubing system filled with liquid?	● Re-design the tubing system or operating conditions allowing the tubes to be filled with liquid.
	● Is the tubing in tubes fluctuating due to large ripple (e.g. pumps)?	● Adjust the flowmeter not to give fluctuating to liquid in the tubes.
Large errors in measurement detected.	● Is the rated power supply voltage applied?	● Apply the rated voltage.
	● Is the load resistance value correct?	● Use the load resistance of 500 or less.
	● Is there any external noise source (power line electromagnetic wave generator, ect.) near your system?	● Keep the noise soutce away from Pressure Sensor.
	● Are there any flow-blocking factors such as valve, nearest to IN side of flowmeter?	● Change the mounting position of flowmeter ( Keep the rated straight-tube lengths as follows  IN side: 7 tomes longer than the bore diameter. OUT side: 5 times longer than the bore diameter.
	● Is a cavitation generated?	● Keep the rated line pressure to prevent cavitation.
	● Are there bubbles contained in the liquid?	● Mount the flowmeter not to have mixed bubbles.
	● Are there any articles caught by the shedder body?	● Remove the article(s) caught by the shedder body.

## ● 7 Product Warranty

SPS Europe products are warranted to be free from latently defective in performance and material for a period of one (1) year from the date of delivery. We will replace the product that is permitted in writing by us to be latently defective in design or workmanship within this time. This warranty shall not be applied to any defects caused by misuse, alteration, mishandling, and neglect of out instructions. And, we are not be liable to any direct or consequential loss, damage, and personal injury due to improper mounting such as single or combination with other type products and unauthorized usage such as usage of product under condition exceeding its specifications. Our product warranty shall be limited to replacement of product.

**Replacement with expense to the purchaser shall be applied to the followings:**

- Any defective products due to usage not included in Operation Manual.
- Any defective products due to mishandling.
- Any defective products due to decomposition, alteration, and improper adjustment or repair.
- Any defective products due to acts of God including natural disaster of fires.
- Consumable and accessories.

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