

必ずお読みください

READ ALL INSTRUCTIONS THOROUGHLY

取扱説明書 INSTRUCTIONS

渦流量計

KARMAN VORTEX FLOW METER

S L K - 3 2

S L K - 3 3

SAGInoMIYA

1 . P R E F A C E

Failure to read and follow all instructions carefully before installing or operating this KARMAN VORTEX FLOW METER (TYPE SLK-**32, SLK-**33) could cause personal injury and/or property damage.

Save these instructions for future use.

2 . N O T E F O R S A F E T Y

⚠ WARNING • Failure to read and follow instructions or improper handling will make it out of warranty and it may cause diminish of reliability.

• Never disassemble. The KARMAN VORTEX FLOW METER (Type SLK) is strictly calibrated in factory and then delivered.

• Be sure to connect the wiring with confirming its color, or it may cause damage, over heat or ignition.

• Do not apply the different voltage (except 12 to 24 V DC), or it may cause damage, over heat or ignition.

⚠ CAUTION • Tighten the union nut with the special tool and specified torque, or it may cause damage of the main body and external leakage. Note 1)

• Do not install in metallic piping unit, or it may cause damage of the main body and external leakage by its thermal expansion.

3 . F E A T U R E S

• High reliability and durability with simple mechanism and no moving parts. The material at fluid contact surface is New PFA.

• Small pressure loss construction which exists only vortex generator and vortex detector in the fluid path. Note 2)

• Legible LED display and the display box is rotatable. Current output and two switching outputs are available to provide. (Type SLK-**33)

4 . S P E C I F I C A T I O N S

• TYPE SLK- 33 (With Display, Analog Output and Switching Output)

Catalog Number		S L K -									
		0533AX	0533TX	0833AX	0833TX	1033AX	1033TX	1533AX	1533TX	2033AX	2033TX
Connection Style		FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection
Dia. of PFA made connection tube(OD, ID)		(9.53 , 6.35)		(12.70 , 9.53)				(19.05 , 15.88)		(25.4 , 22.2)	
Port size		4.2 equivalent		5.5 equivalent		9		13		20	
Max. working pressure(at 25) Note 3)		1 MPa						0.6 MPa		0.5 MPa	
Material at fluid contact surface		NEW PFA									
Fluid		Pure water, chemicals and various kind of fluid									
Allowable kinematic viscosity		1 mm ² /s		1.2 mm ² /s or less		1.5 mm ² /s or less		2.5 mm ² /s or less		4 mm ² /s or less	
Measurable flow range Note 4)	1 mm ² /s	0.4~3.5 L/min		1~10 L/min		2~20 L/min		3~40 L/min		8~90 L/min	
	Max. kinematic viscosity	-		1~10 L/min		2.5~20 L/min		4~40 L/min		10~90 L/min	
Allowable instantaneous max. flow rate		4 L/min		12.5 L/min		25 L/min		50 L/min		100 L/min	
Allowable fluid temperature		0~90 (No frozen and no boiling)									
Ambient temperature at body		0~50 (No frozen and no dew condensation)									
Ambient humidity at body		95 %RH or less									
Storage temperature		-10~70 (No frozen and no dew condensation)									
Power supply voltage range		12~24 V DC ±10 %									
Consumption current		100 mA or less									
Accuracy	Note 5)	±2 %FS(At fluid temperature 60 or less)		±2 %FS							
Respose speed		Approx. 1 sec.									
Analog output		4 ~ 20 mA (0 L/min ~ allowable instantaneous max. flow rate) Max load resistance rate: 150 (at 12 V DC) ~ 500 (at 24 V DC) Max. output current: 21.6 mA									
Switching output		NPN open collector output, Independent 2 output Max. withstand current: 100 mA Max. apply voltage: 30 V DC Residual voltage: 1 V or less									
Display part		Instantaneous flow rate 7 segment LED, 3 digits Switching output OUT1 : LED(RED), OUT2 : LED(GREEN)									
Decimal point indicating		0.01 L/min		0.1 L/min						1 L/min	
Function key		3 pcs.									
Lead cable		5 lead cable, length: 3 m Brown : Vcc, Blue : GND, Black : Output 1, White : Output 2, Gray : Analog output									
Protective construction		IP65 Not included in UL certification.									
Installation		Free installing direction(Except direction which circuit case located below the axis of piping.)									
Wt (kg)		0.22	0.23	0.26	0.27	0.26	0.27	0.28	0.30	0.36	0.38

• FINALLOCK connection models (SLK-***AX) are supplied with 2 sets of flare nut and ferrule as standard.

• Material (New PFA) of finallock connection part is made by 'KURABO INDUSTRIES LTD.'

Catalog Number		S L K -									
		0532AX	0532TX	0832AX	0832TX	1032AX	1032TX	1532AX	1532TX	2032AX	2032TX
Connection Style		FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection	FINALLOCK type connection	tube type connection
Dia. of PFA made connection tube(OD,ID)		(9.53 , 6.35)		(12.70 , 9.53)				(19.05 , 15.88)		(25.4 , 22.2)	
Port size		4.2 equivalent		5.5 equivalent		9		13		20	
Max. working pressure(at 25) Note 3)		1 MPa						0.6 MPa		0.5 MPa	
Material at fluid contact surface		NEW PFA									
Fluid		Pure water, chemicals and various kind of fluid									
Allowable kinematic viscosity		1 mm ² /s		1.2 mm ² /s or less		1.5 mm ² /s or less		2.5 mm ² /s or less		4 mm ² /s or less	
Measurable flow range Note 4)	1 mm ² /s	0.4~3.5 L/min		1~10 L/min		2~20 L/min		3~40 L/min		8~90 L/min	
	Max. kinematic viscosity	-		1~10 L/min		2.5~20 L/min		4~40 L/min		10~90 L/min	
Allowable instantaneous max. flow rate		4 L/min		12.5 L/min		25 L/min		50 L/min		100 L/min	
Allowable fluid temperature		0~90 (No frozen and no boiling)									
Ambient temperature at body		0~50 (No frozen and no dew condensation)									
Ambient humidity at body		95 %RH or less									
Storage temperature		-10~70 (No frozen and no dew condensation)									
Power supply voltage range		12~24 V DC ±10 %									
Consumption current		100 mA or less									
Accuracy Note 5)	±2 %FS(At fluid temperature 60 or less)	±2 %FS									
Respose speed		Approx. 1 sec.									
Analog output		4 ~ 20 mA (0 L/min ~ allowable instantaneous max. flow rate) Max load resistance rate: 150 (at 12 V DC) ~ 500 (at 24 V DC) Max. output current: 21.6 mA									
Lead cable		3 lead cable, length: 3 m Brown : Vcc, Blue : GND, Gray : Analog output									
Protective construction		IP65 Not included in UL certification.									
Installation		Free installing direction(Except direction which circuit case located below the axis of piping.)									
Wt (kg)		0.22	0.23	0.26	0.27	0.26	0.27	0.28	0.30	0.36	0.38

•FINALLOCK connection models (SLK-****AX) are supplied with 2 sets of flare nut and ferrule as standard.

•Material (New PFA) of finallock connection part is made by 'KURABO INDUSTRIES LTD.'

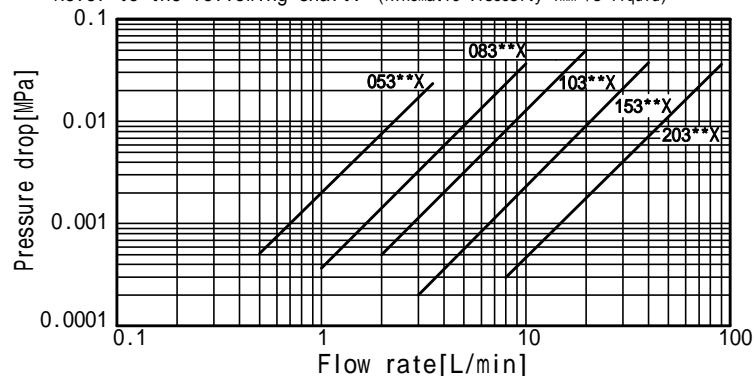
Note 1) SPECIFIED NUT TIGHTENING TORQUE(FINALLOCK CONNECTION)

S L K -	053 AX	083 AX	103 AX	153 AX	203 AX
[N·m]	3.0	3.5	3.5	6.0	9.0

Above tightening torque rate is recommended rate by connection manufacturer, KURABO industries LTD.

Note 2) PRESSURE DROP

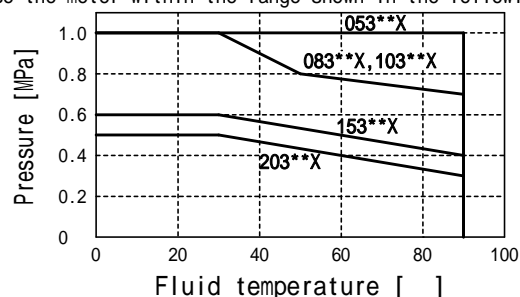
Refer to the following chart. (Kinematic viscosity 1mm²/s liquid)



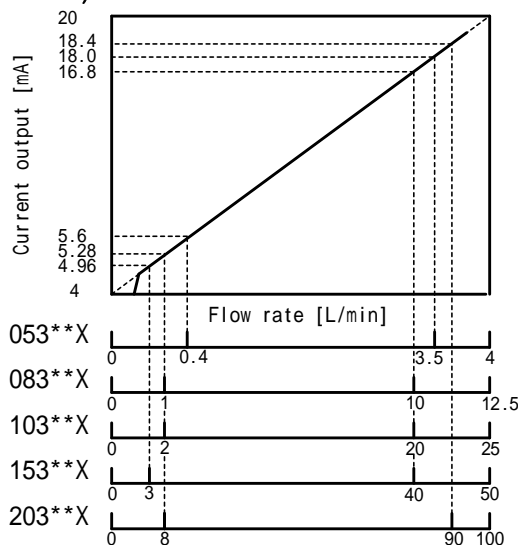
Note 3) MAX. WORKING PRESSURE

Max. working pressure may change depending on the fluid temp. since the main body and connectors are made of PFA resin.

Use the meter within the range shown in the following chart.



Note 4) FLOW RANGE - CURRENT OUTPUT

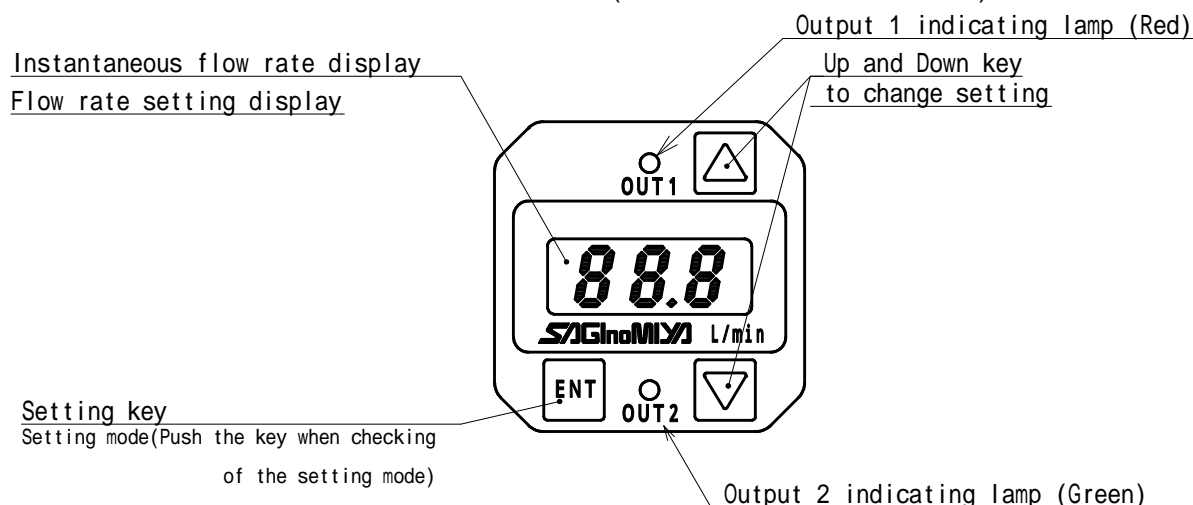


Note 5) ACCURACY

The accuracy may change depending on the fluid temp. since the main body is made of PFA resin. In order to keep the accuracy, compensate the flow rate with the following equations in accordance with fluid temp. (Note; The equations are for water as fluid.)

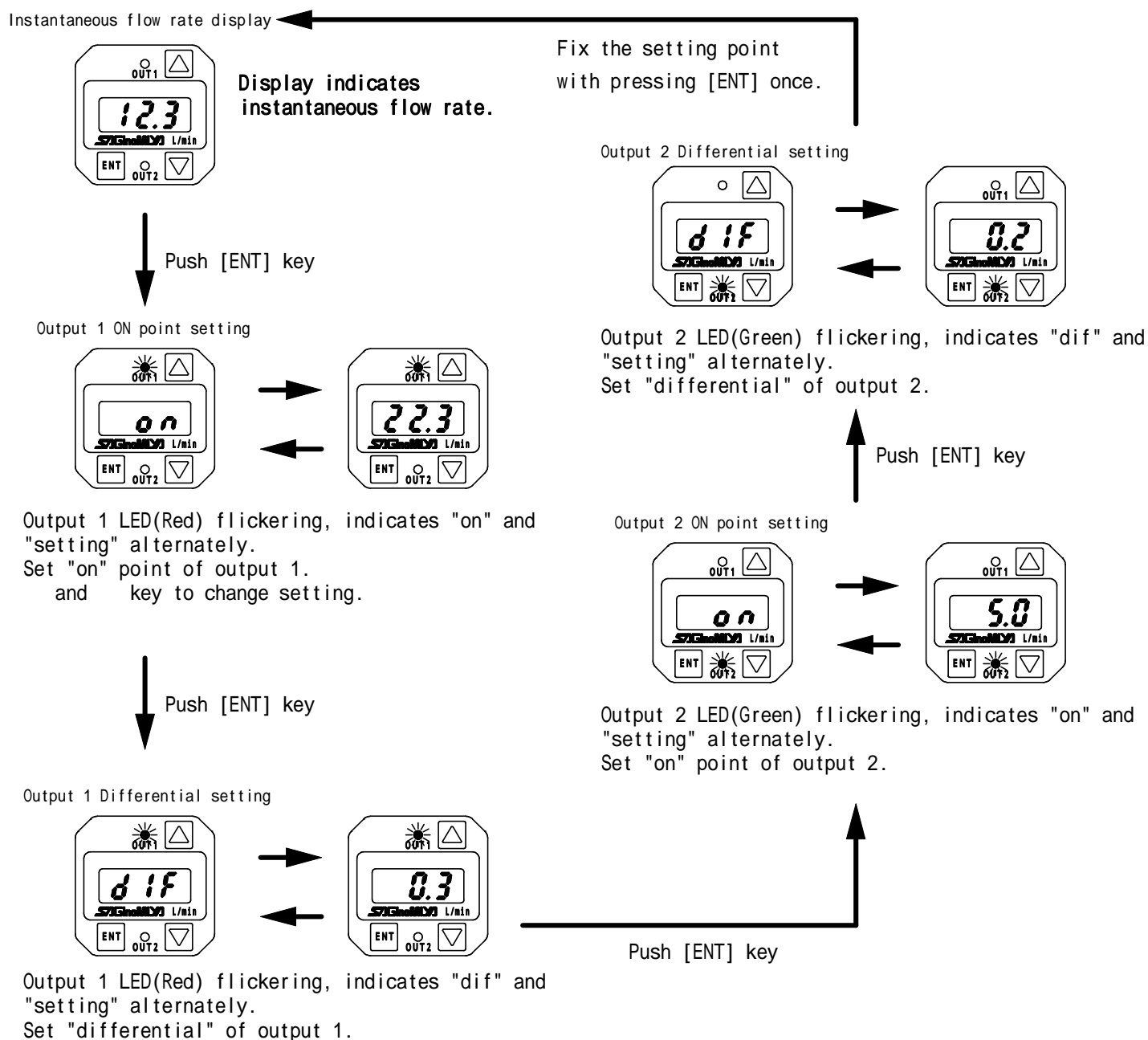
- S L K - 0 8 3 X (0 ~ 10 , 30 ~ 90)
Compensating flow rate[L/min] = Indicating value[L/min] + 0.004 × (fluid temp.[°C] - 20)
- S L K - 1 0 3 X (60 ~ 90)
S L K - 1 5 3 X (60 ~ 90)
Compensating flow rate[L/min] = Indicating value[L/min] × {1 + 0.0003 × (fluid temp.[°C] - 20)}
- S L K - 2 0 3 X (60 ~ 90)
Compensating flow rate[L/min] = Indicating value[L/min] × {1 + 0.0005 × (fluid temp.[°C] - 20)}

5. DISPLAY AND KEY FUNCTION (TYPE SLK - 33)

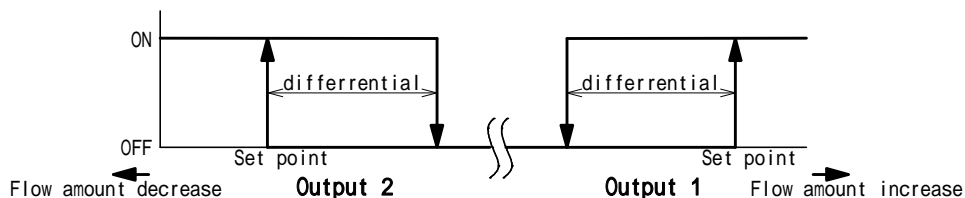


6. SETTING METHOD (TYPE SLK- 33)

⚠ WARNING • After output setting, the indication mode must be back to the instantaneous flow mode with pressing [ENT] key. In case of not back to the instantaneous flow mode indication, the previous setting point will be effective.



Output operation (Open collector, Transistor ON-OFF operation.)



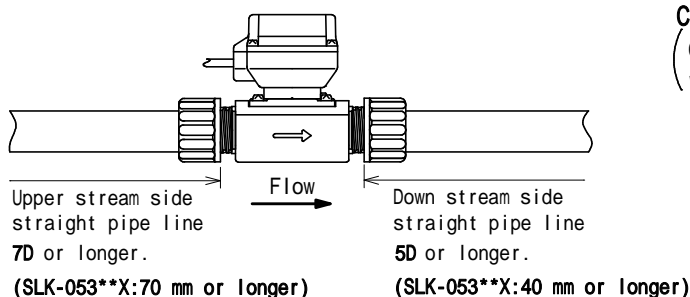
7. INSTALLATION

- CAUTION** The flow direction must accord with the direction of the arrow mark on the flow meter.
- When piping work, read and follow the fitteng/piping instruction manual.
 - When the flow meter installation, tighten the nuts as holding the main body. Do not hold it is display box.
 - When the initial test running, open the valves slowly and let fluids flow gradually.
 - The display box can be turned to a readable position, but do not turn it more than 360°.
 - Please execute air flashing significantly. Bubbles in piping may disturb measurement of the flow amount.

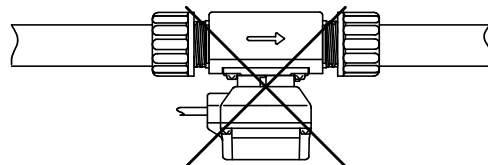
8. PIPING INSTRUCTION

- CAUTION** Installing place : **Do not install at following places.**
- 1) Outdoor, Place where exposed to direct sunlight.
 - 2) Place above 2,000m above sea level.
 - 3) Place with a degree of pollution of 3 or higher.
 - 4) Place where large mechanical vibration/impact exist.
 - 5) Place where large electric noises exist.
- Do not pull the cable nor carrying by the cable, or it may cause breaking of the cable.
 - Do not install where vibration exists. In case any vibration is transferred from the piping line, fix the main body.
 - Take care of piping arrangement or valve operation in order not to apply excessive pressure such as water hammer to the flow meter, or it may cause damage of the vortex detector.
 - Flash the pipe inside before installation to prevent foreign particles from entering.
 - Install a strainer (60 mesh or finer) at upper stream of the meter in case foregin particles are expected.
 - If it is installed with a throttle valve, distribute valve or temp. sensor etc., it should be placed on down stream of the meter, or it may affect its accuracy.
 - For large pulsating flow, install a damper in order to avoid measuring error.
 - Install where no noise affects. Noise may cause its malfunction.
 - To avoid affection to measuring accuracy by drift stream, swirling stream etc., be sure to have straight piping at inlet and outlet side as below.

HORIZONTAL PIPING (D : Port size)

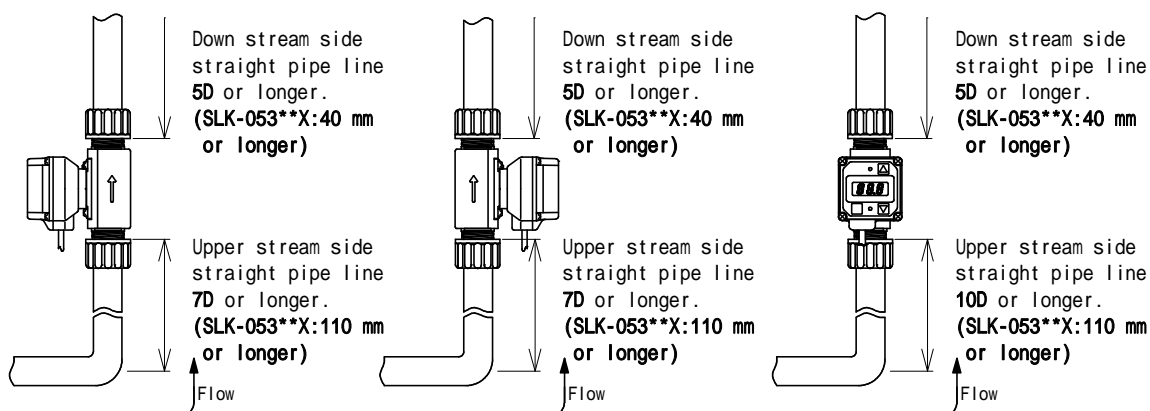


Circuit case downward is not permitted.
(Condensed water accumulates inside of the case, which may affect electronic parts.)



VERTICAL PIPING

In case of vertical piping, it is recommendable to install in direction of the flow coming up from lower side for avoiding two phase flow.

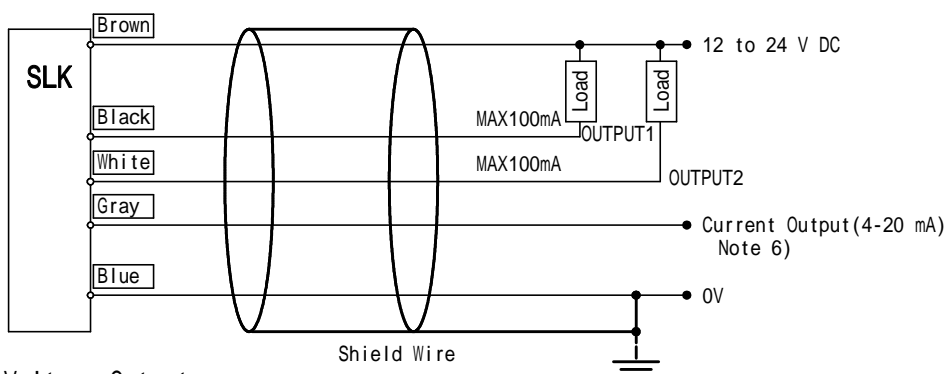


9. WIRING DIAGRAMS

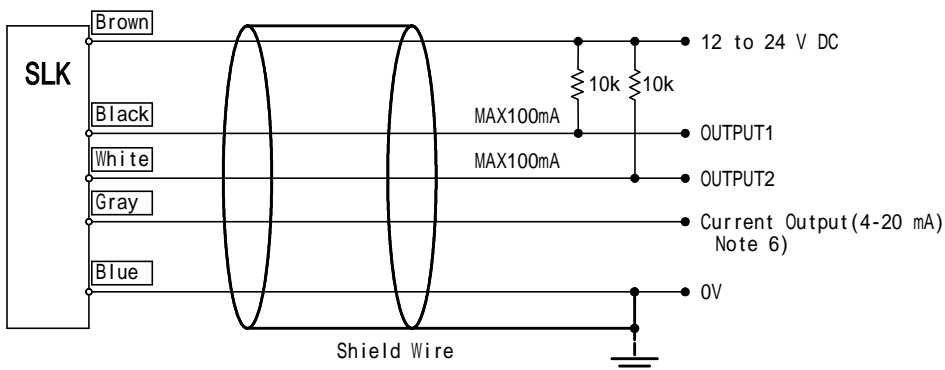
- ⚠ WARNING** • Be sure to connect a shield wire to power source's GND together with SLK's 0V.
Otherwise malfunction may occur by effect of noise.
- Be sure for connection only to NEC class 2 power source.
 - In case of connecting other instrument to this product, be sure to use a instrument of low voltage, low current and conforming to EN61010-1. EN61010-1 is a safety requirement standard for electric equipment which is intended to use in measurement, control and test.
- ⚠ CAUTION** • Do not tie up nor place in parallel with power line.
- Be sure to provide an appropriate surge control circuit respectively for the following:
 - If input/output or signal lines within the building are longer than 30 meters.
 - If input/output or signal lines leave the building, regardless the length.
 - Do not install near to the source of noise.
 - Make sure to insulate any unused output line as contact with the electric power supply can cause burnout of the internal electronic components.
 - Option : Type ONE Flow controller
Type ONE is provided with instantaneous flow rate indication and built-in two relay contacts.
In case of using ONE Controller, read instruction for ONE carefully and use properly.

• Type SLK - 33

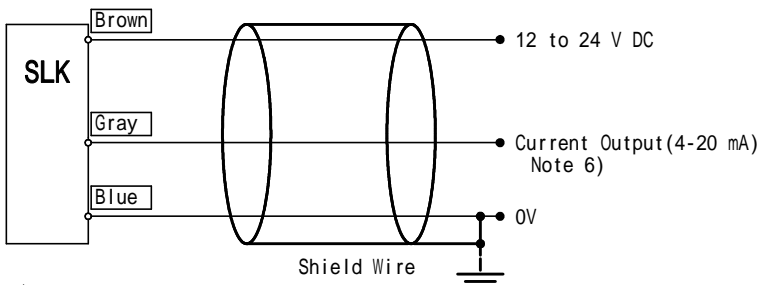
Direct Drive of Load



Control by Voltage Output



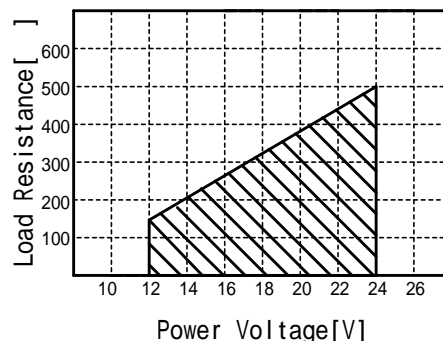
• Type SLK - 32



Note 6) Load resistance

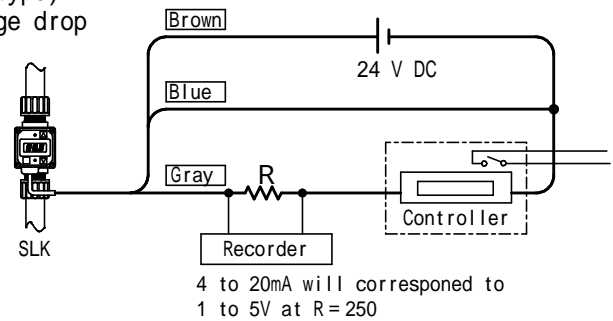
- ⚠ CAUTION** • Select load resistance and power source voltage, so that the total amount of min. operating voltage of Type SLK and max. drop voltage caused by resistance load of measuring equipment may not exceed power source voltage. Allowable range for load resistance shown in right Fig.
- In case the extension of the lead wire is necessary, please count the resistance of the extended wire as the load resistance. (It is recommendable to the total extended length 10m or less.)

Max. load resistance 150 at power source of 12V DC
Max. load resistance 500 at power source of 24V DC



•When voltage input type recorder is used as load, connect a resistance (small temp. coefficient type) in serial as shown right figure and measure voltage drop across the resistance.

ex. In case of using controller with 100 internal resistance, Max. load resistance should be 400 .
(Max. load resistance (500) minus internal resistance of Type ONE (100))



10.EFFECT OF CAVITATION

CAUTION •Accuracy of the flow measurement would be degraded if cavitation occurs. Prior to use the product, confirm that pressure at downstream of the flow meter is higher than pressure calculated from below formula.

$$P=2.7 P+1.3P_o$$

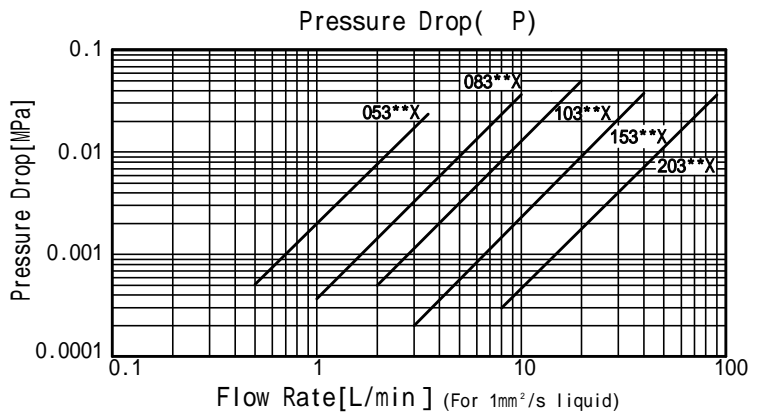
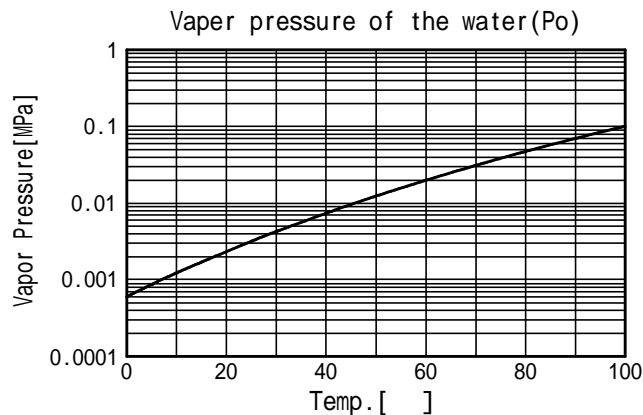
P :Pressure(abs) of 3.5~7.5D at downstream.

P_o :Vapor Pressure(abs) of the fluid.

For vapor pressure of the water, refer the below chart.

P:Pressure Drop.

D :Port size



11.TROUBLE SHOOTING

TROUBLE PHENOMENA	CHECK POINT
No output (4-20mA). Display is not lit.	<ul style="list-style-type: none"> •Check the wiring to be connected properly. •Check power source to be turned on.
Even with having a flow, it indicates 0 and 4(mA) output.	<ul style="list-style-type: none"> •Check the flow direction in accordance with the arrow mark shown on the body. •Check whether any foreign matter is attached on Vortex Generator. •Check whether it is used within the measuring flow range.
Even with a constant flow, the output provides large variation.	<ul style="list-style-type: none"> •Check the flow direction in accordance with the arrow mark shown on the body. •Check whether any foreign matter is attached on Vortex Generator. •Check whether it is used within the measuring flow range.
Even at same flow, the output decreased, or indicating 0 and 4(mA) output.	<ul style="list-style-type: none"> •Check whether any foreign matter is attached on Vortex Generator.
Even no fluid applied, it indicates other than 0 and 4(mA) output.	<ul style="list-style-type: none"> •Check any of noise affection received. •Check any of vibration affection received.
Display indicates "Hi".	<ul style="list-style-type: none"> •Flow rate is exceeding 110% of the maximum allowable instantaneous flow. Check to see if it is being used outside of the valid measurement range.
Display indicates "ErC".	<ul style="list-style-type: none"> •Max. withstand voltage for Switching Output is exceeding over 100 mA. Check the wiring to be connected properly.
Display indicates "ErE".	<ul style="list-style-type: none"> •Electronic Circuit has been broken. Please contact the Company.

12. HANDLING PRECAUTIONS

⚠ CAUTION • Type SLK has drip proof construction, it is available to use chemical/medical condition. If it is used with a special condition, please consult with us.

- If it is used for a liquid which including a gas intensively penetrates into PFA, it may cause damage of the sensor.
- Do not pull the cable nor carrying by the cable, or it may cause breaking of the cable.
- Do not drop or hit the product, it may cause of malfunction.
- This product is not water proofed. Do not immerse into the water.
- Do not run excess flow larger than allowable instantaneous flow rate as shown on below, it may cause of breakage of vortex detector.

Catalog Number	053**X	083**X	103**X	153**X	203**X
Allowable instantaneous max. flow rate	4 L/min	12.5 L/min	25 L/min	50 L/min	100 L/min

13. APPLICABLE STANDARDS

- If the following prints is found on the product label, the respective standard is applied.

U L . . . U L 6 1 0 1 0 - 1

C E . . . E N 6 1 3 2 6 - 1

14. CLEANING

- Be sure to check that the power supply has been turned off before cleaning the product.
- Since the display is easy to get damaged, use a soft cloth or paper for cleaning. Do not wipe with a hard material.
- Use a tightly squeezed wet cloth to wipe out stains on the case cover. Then wipe with a dried cloth for finishing.

15. REFERENCE

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