

必ずお読みください

READ ALL INSTRUCTIONS THOROUGHLY

取扱説明書 INSTRUCTIONS

渦流量センサ

KARMAN VORTEX FLOW SENSOR

TYPE ULK

SAGInoMIYA

1 .PREFACE

- Failure to read and follow all instructions carefully before installing or operating this KARMAN VORTEX FLOWSENSOR(Type ULK) could cause personal injury and/or property damage. Save these instructions for future use.
- This instruction covers ULK standard models. Model numbers with suffix "Q**" are not included in standard model lineup. If there are differences between your drawing and this instruction, follow the spec on your drawing.

2 .NOTE FOR SAFETY

⚠ WARNING

- Do not disassemble the device since it is strictly calibrated in factory.
- Circuit case is not drip proof construction. Do not splash water directly to the case, or it may cause short circuit of electronic parts.
- When piping installation, tighten the nut with adequate torque. In case of over tightening it may cause damage of the body or leakage.
- Be sure to connect the wires in correct polarity, or it may cause damage, over heat or ignition.
- Do not apply other Voltage than 12 to 24VDC, or it may cause damage, over heat or ignition.

⚠ CAUTION

- Do not pull the cable nor carrying by the cable, or it may cause breaking of the cable.
- Follow " Note 1) " when screwing the union nut, and check there is no leakage. In case of over tightening it may cause damage of the body or leakage.
- Do not use pipe wrench because it could damage body, and could cause fluid leakage.
- Do not install this product to metal piping units because thermal expansion of metal pipes could cause breakings of body, and fluid leakages.
- This product has no problem in performance if there is visible bond or a gap at the connecting point.

Note 1) SCREWING UNION NUT

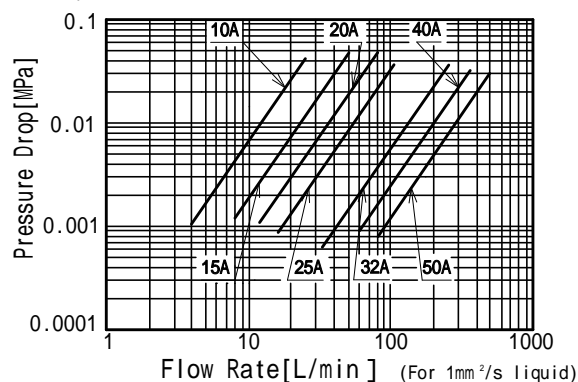
ULK -	1012P*151S	1512P*151S	1512P*201S	2012P*201S	2012P*251S	2512P*251S
Screwing Method	Single handed		Single handed		Both handed	
Screw torque	3N·m or less		4N·m or less		5N·m or less	

ULK -	2512P*321S	3212P*321S	3212P*401S	4012P*401S	5012P*501S
Screwing Method	Both handed		Belt wrench		Belt wrench
Screw torque	10N·m or less		18N·m or less		18N·m or less

3 .FEATURES

- High reliability and durability with simple mechanism and no moving parts.
- Small pressure loss construction which exists only vortex generator and vortex detector in the fluid path. Note 2)
- This flow sensor converts instantaneous flow rate to 4~20mA. Cable is 2 wires.

Note 2) PRESSURE DROP



4. SPECIFICATIONS

(In case of special models, a part of these specifications may be changed.)

Catalog Number	ULK -						
	1012P*151S	1512P*151S	1512P*201S	2012P*201S	2012P*251S	2512P*251S	2512P*321S
Connection	Union type connection (TS socket)						
Nominal bore of PVC made connection piping	16		20		25		32
Main body I.D.	10	14		18		23	
Cv VALUE	2.6	5		8		12	
Max. working pressure (at 20) Note 3)	1 MPa						
Material at fluid contact surface	Material quality of main body and union : PVC-U. Material quality of o-ring : EPDM , FKM.						
Applicable fluid	Pure water , City water , Various liquids						
Allowable kinematic viscosity	2mm ² /s or less	3mm ² /s or less		4mm ² /s or less		5.5mm ² /s or less	
Measurable flow range	With water	3 ~ 25 L/min	7 ~ 50 L/min		9 ~ 80 L/min		16 ~ 130 L/min
	Max. kinematic viscosity	4 ~ 25 L/min	9 ~ 50 L/min		12 ~ 80 L/min		20 ~ 130 L/min
Allowable fluid temperature	0 ~ 50 (No frozen)						
Ambient temperature at body	0 ~ 50						
Ambient humidity at body	95 %RH or less						
Storage temperature	-10 ~ 50 (No frozen and no dew condensation)						
Power supply voltage range	12 ~ 24 V DC ± 10 %						
Accuracy	± 3 %FS						
Analog output	4 ~ 20mA Note 4 Max load resistance rate: 150 (at 12V DC) ~ 500 (at 24V DC)						
Protective construction	An equivalent for IP65 standard						
Installation	Free installing direction(Except direction which circuit case located below the axis of piping.)						
Face to face distance	120mm		130mm		165mm		175mm

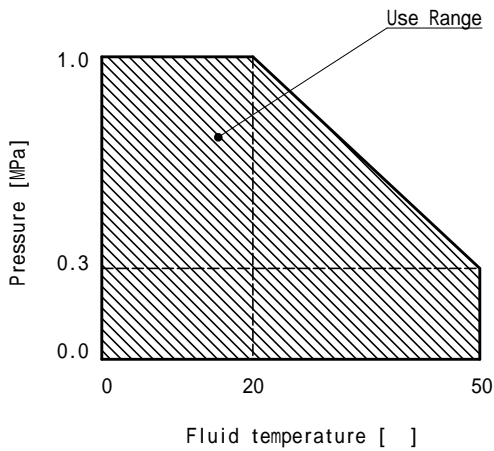
Catalog Number	ULK -				
	3212P*321S	3212P*401S	4012P*401S	5012P*501S	
Connection	Union type connection (TS socket)				
Nominal bore of PVC made connection piping	32	40		50	
Main body I.D.	28 equivalent		34 equivalent	43 equivalent	
Cv VALUE	29		44	62	
Max. working pressure (at 20) Note 3)	1 MPa				
Material at fluid contact surface	Material quality of main body and union : PVC-U. Material quality of o-ring : EPDM , FKM.				
Applicable fluid	Pure water , City water , Various liquids				
Allowable kinematic viscosity	6.5mm ² /s or less		9mm ² /s or less	12mm ² /s or less	
Measurable flow range	With water	30 ~ 220 L/min		50 ~ 350 L/min	80 ~ 550 L/min
	Max. kinematic viscosity	40 ~ 220 L/min		90 ~ 350 L/min	90 ~ 550 L/min
Allowable fluid temperature	0 ~ 50 (No frozen)				
Ambient temperature at body	0 ~ 50				
Ambient humidity at body	95 %RH or less				
Storage temperature	-10 ~ 50 (No frozen and no dew condensation)				
Power supply voltage range	12 ~ 24 V DC ± 10 %				
Accuracy	± 3 %FS (In case of water)				
Analog output	4 ~ 20mA Note 4 Max load resistance rate: 150 (at 12V DC) ~ 500 (at 24V DC)				
Protective construction	An equivalent for IP65 standard				
Installation	Free installing direction (Except direction which circuit case located below the axis of piping.)				
Face to face distance	175mm	240mm		280mm	

As for thick fluid , apply following compensation formula to satisfy accuracy of ±3%FS.

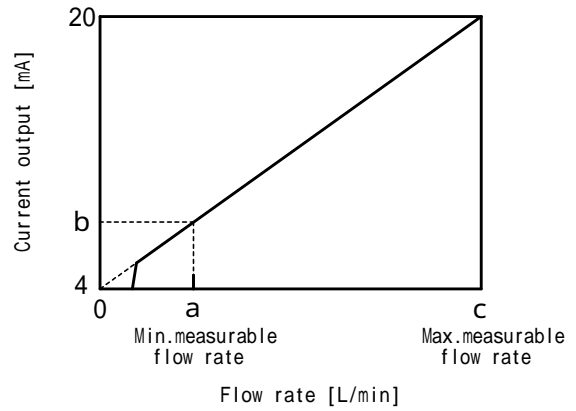
ULK -	Compensation formula
3212P*321S	$I_1 = I_2 - (3.376E-3 \times I_2 + 8.298E-2) \times \nu$
3212P*401S	
4012P*401S	$I_1 = I_2 - (1.408E-3 \times I_2 + 5.946E-2) \times \nu$
5012P*501S	$I_1 = I_2 + (3.200E-5 \times I_2 - 4.414E-2) \times \nu$

I_1 : Current compensation value [mA]
 I_2 : Measurement current value [mA]
 ν : Kinematic viscosity [mm²/s]

Note 3) MAX. WORKING PRESSURE



Note 4) FLOW RANGE - CURRENT OUTPUT(With water)



U L K -		1012P*151S	1512P*151S	1512P*201S	2012P*201S	2012P*251S
Min.measurable flow rate	a [L/min]	3	7		9	
Analog output at " a L/min "	b [mA]	5.92	6.24		5.8	
Max.measurable flow rate	c [L/min]	25	50		80	

U L K -		2512P*251S	2512P*321S	3212P*321S	3212P*401S	4012P*401S	5012P*501S
Min.measurable flow rate	a [L/min]	16		30		50	80
Analog output at " a L/min "	b [mA]	5.97		6.18		6.28	6.33
Max.measurable flow rate	c [L/min]	130		220		350	550

5 . INSTALLATION

CAUTION

- The flow direction must accord with the direction of the arrow mark on the flow sensor body label.
- When the piping work, read and follow the fitting/piping instruction manual.
- When installing this product, hold the connection tightly and twist the nut.
- When the initial test running, open the valves slowly and let fluids flow gradually. Execute air release sufficiently. Bubbles in the piping may interfere measurement of the flow amount.

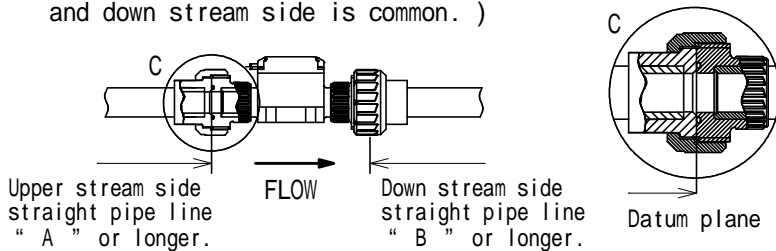
6 . PIPING INSTRUCTION

⚠ CAUTION

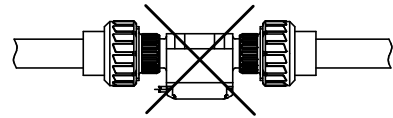
- Installing place : **Do not install at following places.**
 - 1) Outdoor, Place where exposed to direct sunlight.
 - 2) Place where large mechanical vibration/impact exist.
 - 3) Place where large electric noises exist.
- Do not pull the cable nor carrying by the cable, or it may cause breaking of the cable.
- This product detects fluid vibration caused by Karman vortex. Check that no impact or vibration from outside effects this product.
- Follow "2.NOTE FOR SAFETY" when fastening union nut, and check there is no leakage. Do not use pipe wrench.
- 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 flow sensor in case foreign 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 flow sensor, or it may affect its accury.
- 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

(Straight pipe line of upper stream side and down stream side is common.)



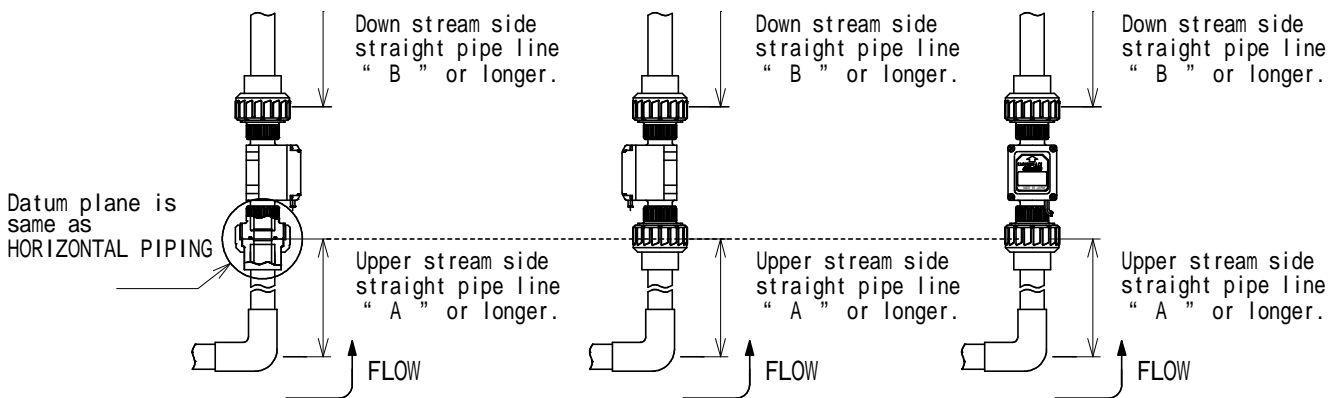
Circuit case downward is not permitted.
(Dew condensation water inside of the case, which may causes overheating ignition.)



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.

(Straight pipe line of upper stream side and down stream side is common.)



U L K -	1012P*151S	1512P*151S	1512P*201S	2012P*201S	2012P*251S
dimension A(mm)	100	140			
dimension B(mm)	70		90	95	

U L K -	2512P*251S	2512P*321S	3212P*321S	3212P*401S	4012P*401S	5012P*501S
dimension A(mm)	165	200		240	301	
dimension B(mm)	115	140		170	215	

7. WIRING METHOD

⚠ CAUTION

- Use a shield cable in order to avoid malfunction. The shield cable should be grounded at one point only.
- Outlet wire of 4-20mA should not be tied up nor placed in parallel with the wire having large current. It may cause malfunction.
- Do not install the flow sensor near to the source of noise.

• Wiring

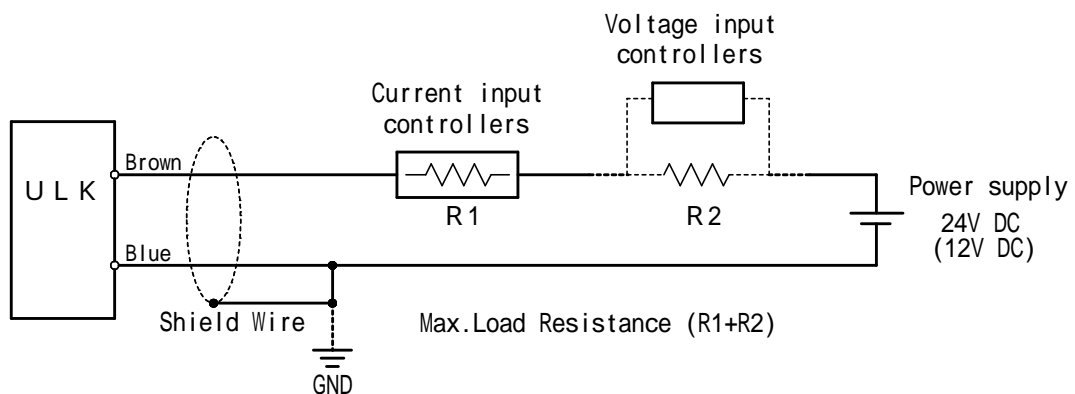
Connect brown lead wire to plus and blue lead wire to minus.

Connect the shield cable to the ground for preventing noise.

Connect current input controllers with flow sensor, and power source in series.

Connect voltage input controllers with both end of the controller resistance

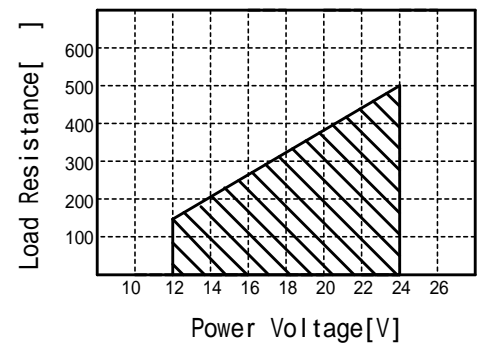
which is in series with flow sensor and power source.



⚠ CAUTION

- Use within allowable range for load resistance shown in right Fig.

- Max. Load Resistance 150 at Power Source of 12V
- Max. Load Resistance 500 at Power Source of 24V



8 . TROUBLE SHOOTING

TROUBLE PHENOMENA	CHECK POINT
No output (4~20mA).	<ul style="list-style-type: none"> •Check the wiring to be connected properly. •Check power source to be turned on.
When a flow is 0L/min, the output signal does not become 4mA.	<ul style="list-style-type: none"> •Check whether any noise affects to the flow sensor . •Check whether the shield wire is connected correctly. •Check whether any vibration affects to the flow sensor.
Even with a changing flow, the output signal does not change or becomes 4mA.	<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 voltage has had large variation or the output current has becomes 4mA.	<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.
It does not become a correct output current unless flow becomes higher or lower than a certain level.	<ul style="list-style-type: none"> •Check whether it is used within the measuring flow range.

9 .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 sensor is higher than minimum line pressure calculated from below formula.

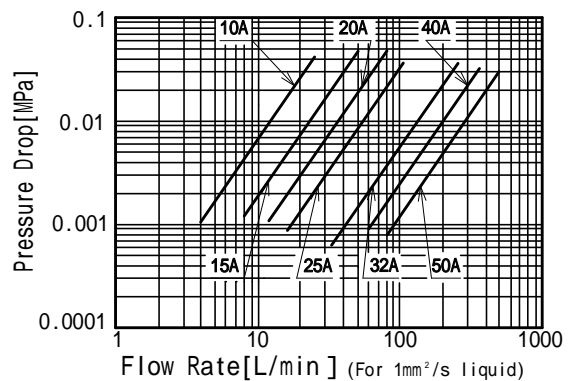
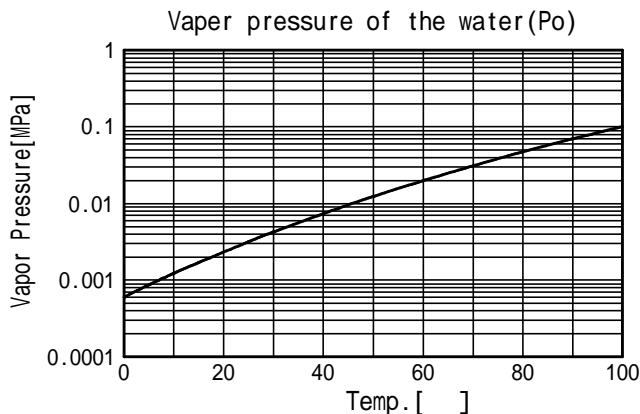
$$P=2.7 P+1.3P_0$$

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

P₀ :Vapor Pressure(abs) of the fluid.

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

P:Pressure Drop.



1 0 .HANDLING PRECAUTIONS

CAUTION

- Consult us when not using pure water, or city water.
- 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.

1 1 . REFERENCE

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