Instruction Manual Air Gap Sensor DPA-SR2/LR2

This sensor uses pneumatic non-contact measurement for high-precision workpiece measurement, performing comparison determinations of the preset signal points (+LIMIT point / -LIMIT point) and current value.

The signal points consist of +LIMIT point (upper limit) and -LIMIT point (lower limit).

By setting these points, the sensor can displays results and outputs signals based on 3 classifications:

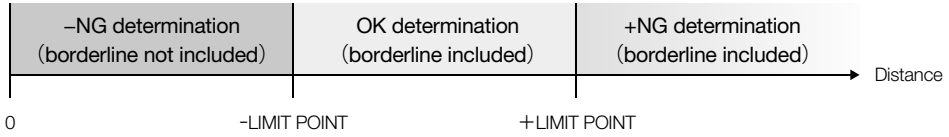
Over +LIMIT point (+NG determination)

Between +LIMIT and -LIMIT points (OK determination)

Below the -LIMIT point (-NG determination)

As it is a pneumatic sensor, it is capable of detecting without leaving measurement marks on the workpiece.

Available in 2 models according to the detection range, it supports a variety of measurement.



■Features

1. High-precision repeatability.
2. Outputs -NG, OK and +NG determinations. NG shifts can be determined.
3. Both button input and external input are available, and both controls are supported.
4. Electrical response time is more than 10 times shorter than our conventional air gap sensors.
5. IP67 dust & water-proof structure.

■Basic usage

1. Set the signal point with a master workpiece.
2. While in measuring mode, the sensor outputs the result based on the comparison between the present value and the signal point value.

■Absolute maximum rating

	Value	Unit
Power supply voltage	26.4	V
Input voltage	26.4	V
Output load voltage	26.4	V
Output load current	20 each	mA
Supply pressure	0.3	MPa

Electrical current/voltage or supply pressure exceeding the absolute maximum rating listed above may cause serious damage to the internal structure.

Values in the table are not applicable to conditions exceeding the above conditions or the recommended operating conditions.

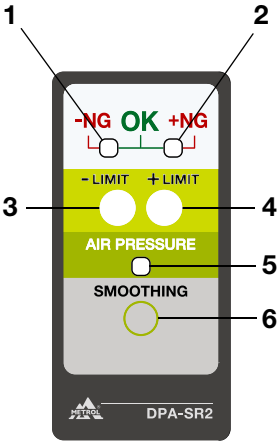
Specification

Product name	**DPA-SR2** (Short range detection type)	**DPA-LR2** (Long range detection type)
Detection range	1–100μm	80–350μm
Signal point	Set by +LIMIT SET button, -LIMIT SET button, +LIMIT SET input and -LIMIT SET input	
Repeatability	±0.5μm：Detection range 1–60μm ±1μm ：Detection range 60－100μm **Air pressure change : within ±1%**	±1μm：Detection range 80-150μm ±3μm：Detection range 150－250μm ±5μm：Detection range 250-350μm **A pressure change : within ±1%**
Input specification	Photocoupler input DC24V±10%	
Output specification	Photocoupler output (Non-voltage floating output) DC24V±10% (max) less than 20mA Low level output voltage : less than 1.5V (at 15mA)	
Response speed	0.8 seconds (Tube length 1.5m/ Time between the air pressure supply and the signal output of the sensor)	
Electrical response speed	10ms	
Protective structure	IP67	
Setting pressure	0.15－0.2MPa	
Pipe diameter	O.D. ϕ6 X I.D. ϕ4 tube	
Fluid	Dry air (filtered to 5μm)	
Consumption flow rate	9ℓ/min（max）	24ℓ/min（max）
Operating temperature	0°C–60°C (no condensation)	
Cable	Standard length 3m Oil resistance ϕ5.5/16 cores AWG 28	
Power supply voltage	DC24V±10%	
Consumption current	Less than100mA	

Notes

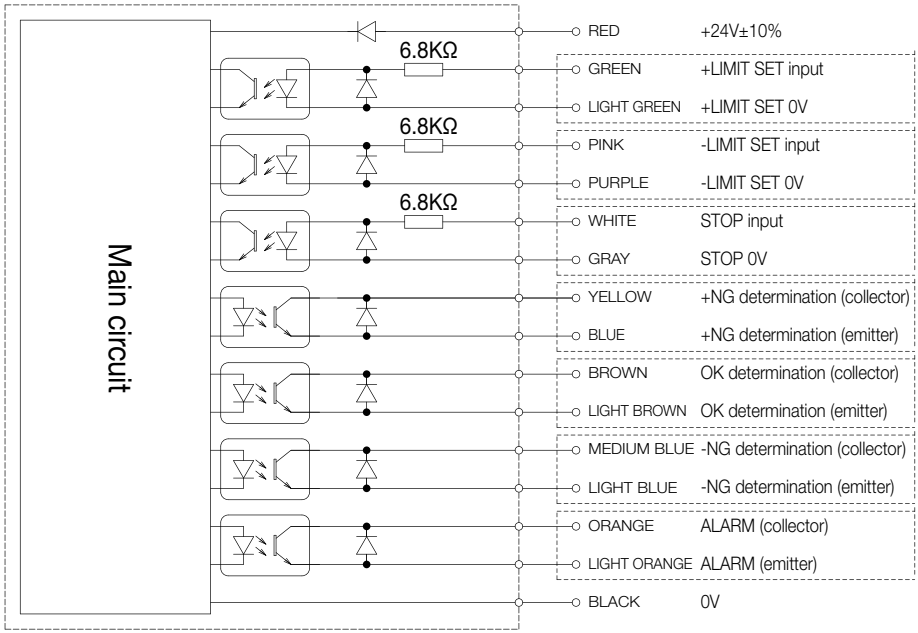
- Specifications apply to conditions where a recommended nozzle is used.
  When using different nozzles, make appropriate judgements upon confirmation of use with the actual device.
- Specifications apply to conditions where one nozzle is used per body.
  When using multiple nozzles, make appropriate judgements upon confirmation of use with the actual device.
- Specifications of DPA-SR2 apply to conditions where the attached leakage unit is used.

Product parts and functions

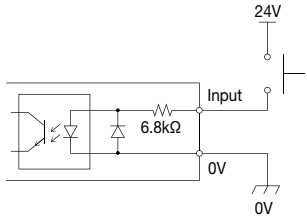
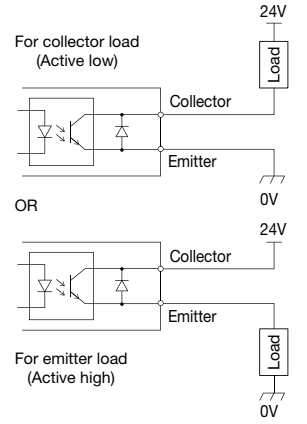


	Description
1. –NG LED	Determination results are displayed while in Measuring mode. Input complete can be verified in the STOP mode.
2. ＋NG LED	
3. –LIMIT SET button	Press for 1 second or more to set -LIMIT point (lower limit) while in Measuring mode.
4. ＋LIMIT SET button	Press for 1 second or more to set +LIMIT point (upper limit) while in Measuring mode.
5. Air pressuer alarm LED	The status of the supply pressure is displayed while in Measuring mode and STOP mode. The present electrical response speed is displayed while in SMOOTHING set mode.
6. SMOOTHING buttton	Press for 1 second or more while in Measuring mode to move to SMOOTHING set mode.

Circuit diagram



■Wiring

Color	Signal	Description	Example load connection
RED	DC24V±10%	Power supply	—
BLACK	0V		
GREEN	+LIMIT SET input	+LIMIT point can be set by turning ON for 100 ms while in STOP mode.	
LIGHT GREEN	+LIMIT SET 0V		
PINK	–LIMIT SET input	-LIMIT point can be set by turning ON for 100 ms while in STOP mode.	
PURPLE	–LIMIT SET input		
WHITE	STOP input	Turn ON while in Measuring mode to move to STOP mode.	
GRAY	STOP 0V		
YELLOW	+NG determination (collector)	Turns ON for +NG determination while in Measuring mode. Turns ON for 200 ms as ACK for the +LIMIT set in STOP mode.	
BLUE	+NG determination (emitter)		
BROWN	OK determination (collector)	Turns ON for OK determination while in Measuring mode.	
LIGHT BROWN	OK determination (emitter)		
MEDIUM BLUE	–NG determination (collector)	Turns ON for -NG determination while in Measuring mode. Turns ON for 200 ms as ACK for the -LIMIT set in STOP mode.	
LIGHT BLUE	–NG determination (emitter)		
ORANGE	ALARM (collector)	Turns ON while the supply pressure is normal in the Measuring mode and STOP mode.	
LIGHT GREEN	ALARM (emitter)		

Connect the output in accordance with the design conditions.
Note: Individually isolate the unused input and output lines.

■Display at power on

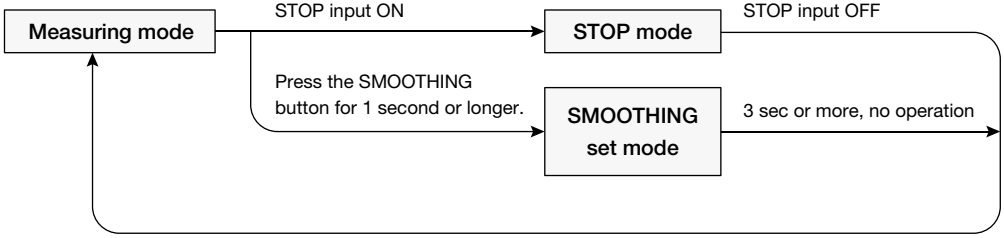
When the power turns on, green LED blinks and the sensor starts normal operation.

In case of memory error, all LED blinks red. Please contact us.

■Modes

DPA-SR2/LR2 have 3 modes listed below.

	Description	How to change modes
1. Measuring mode	The sensor outputs the results based on the comparison between the present value and the signal point. The signal point is set by button. (In the same way as when using DPA-SR1/LR1) No external input is allowed.	Turns STOP input OFF.
2. STOP mode	The sensor stops measuring and turns any outputs except alarm signal OFF. No button input is allowed.	Turns STOP input ON while in Measuring mode.
3. SMOOTHING set mode	The sensor stops measuring and turns all outputs OFF. By pressing SMOOTHING button, electrical response speed can be changed.	Press SMOOTHING button for 1 second or longer while in Measuring mode.



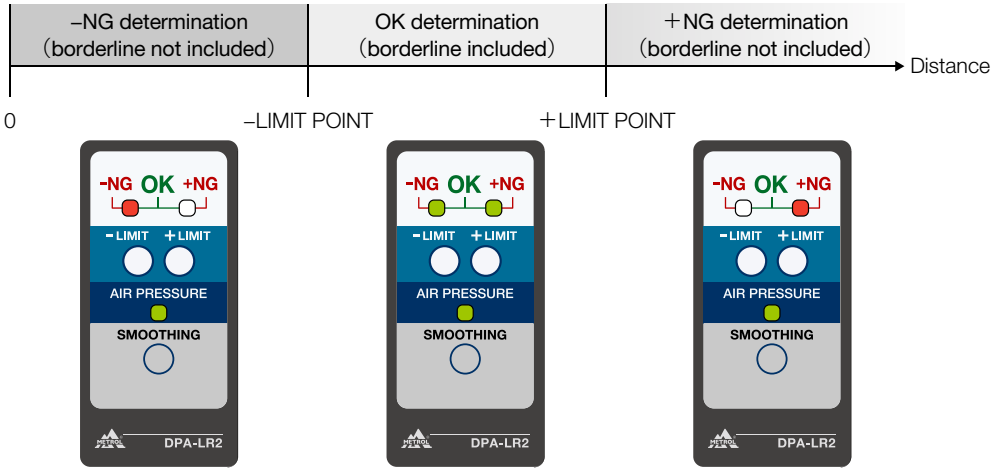
1. Measuring mode

When the STOP input is OFF, the sensor enters Measuring mode.
While in Measuring mode, it continuously performs comparison determinations of the preset signal point points (+LIMIT point / -LIMIT point) and current value.
The determination result is displayed with LED and output. The signal points can be set with button input.

LED display and output in Measuring mode

		–NG determination	OK determination	+NG determination	+LIMIT set complete	-LIMIT set complete	Supply pressure error
LED	＋NG LED	Unlit	**Green**/lit	**Red**/lit	Unlit ↓ **Green**/ blinking	Unlit	Unlit
	–NG LED	**Red**/lit	**Green**/lit	Unlit	Unlit	Unlit ↓ **Green**/ blinking	
Output	Air pressure alarm LED	**Green**/lit			**Green**/lit or **Orange**/blinking (±0.01MPa change) ↓ Unlit		**Red**/blinking(≧0.22MPa) **Red**/lit(≦0.1MPa) **Orange**/blinking(±0.01MPa Change)
	＋NG determination output	OFF	OFF	ON	Responds to determination		OFF
	OK determination output	OFF	ON	OFF			
	–NG determination output	ON	OFF	OFF			
	ALARM output	ON			ON or OFF (±0.01MPa change) ↓ ON		

Example



2. STOP mode

Outputs other than the alarm are turned OFF and button setting of the signal points is prohibited.
The signal points can be set with external input only when the +NG LED and -NG LED are lit orange (when supply pressure is normal, or deviation from signal point values is less than ±0.01MPa).

LED display and output in STOP mode

<table>
<tr><th></th><th></th><th>Normal supply pressure</th><th>+LIMIT set complete</th><th>-LIMIT set complete</th><th>Supply pressure error</th></tr>
<tr><td rowspan="2">LED</td><td>＋NG LED</td><td>Orange/lit</td><td>Unlit
↓
Orange/lit</td><td>Orange/lit</td><td rowspan="2">Unlit(≧0.22MPa)
Unlit(≦0.1MPa)
Orange/lit(±0.01MPa Change)</td></tr>
<tr><td>－NG LED</td><td>Orange/lit</td><td>Orange/lit</td><td>Unlit
↓
Orange/lit</td></tr>
<tr><td rowspan="5">Output</td><td>Air pressure alarm LED</td><td>Green/lit</td><td colspan="2">Green/lit or Orange/blink
(±0.01MPa change)
↓
Green/lit</td><td>Red/blinking(≧0.22MPa)
Red/lit(≦0.1MPa)
Orange/blinking(±0.01MPa Change)</td></tr>
<tr><td>＋NG determination output</td><td>OFF</td><td>ON for 200ms(ACK)
↓
OFF</td><td>OFF</td><td rowspan="4">OFF</td></tr>
<tr><td>OK determination output</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>－NG determination output</td><td>OFF</td><td>OFF</td><td>ON for 200ms(ACK)
↓
OFF</td></tr>
<tr><td>ALARM output</td><td>ON</td><td colspan="2">ON or OFF (±0.01MPa change)
↓
ON</td></tr>
</table>

3. SMOOTHING set mode

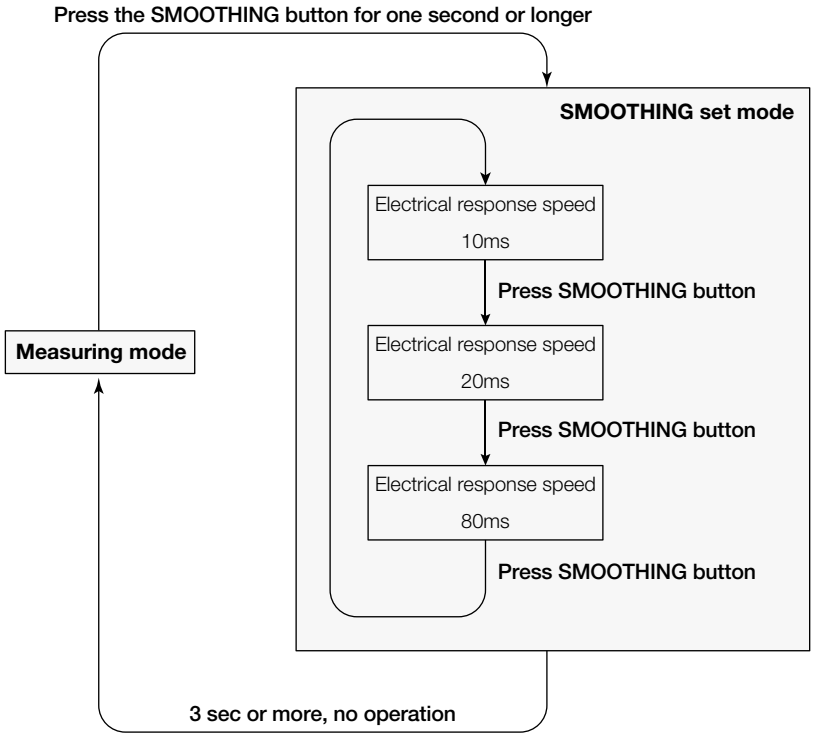
The sensor enters SMOOTHING set mode by pressing the SMOOTHING button for one second or longer while in Measuring mode.

If there is no operation for 3 seconds or more in SMOOTHING set mode, the mode will automatically shift to Measuring mode.

Pressing the SMOOTHING button while in SMOOTHING set mode will change the electrical response speed as follows: 10ms → 20ms → 80ms → 10ms.

By changing electrical response speed, chattering speed can be changed.

Use when stable measurement cannot be performed due to chattering caused by the vibration of the measuring system.



LED display and output in SMOOTHING set mode

		Electrical response speed		
		10ms	20ms	80ms
LED	+NG LED	Unlit		
	–NG LED			
Output	Air pressure alarm LED	**Red**/blinking	**Orange**/blinking	**Green**/blinking
	+NG determination output	OFF		
	-NG determination output			
	OK determination output			
	ALARM output			

■How to set signal point values

The signal set points can be changed in Measuring mode or STOP mode.
Refer to the table below, as setting methods differ by mode.
The signal points are saved even when the power is turned off.
When the reproducibility of the entire measurement system has changed, reset the signal point values.

Mode	How to set signal points		ACK output
	Set with button	Set with external output	
1. Measuring mode	Possible	Not possible	×
2. STOP mode	Not possible	Possible	✓

NOTE: Be sure to set the signal points so that "+LIMIT point > -LIMIT point".

Reference: The determination output of "+LIMIT point < -LIMIT point" is as follows.
OK determination is not output regardless of the detected value.
When the detected value is over +LIMIT or under -LIMIT, +NG and -NG determinations will be output at the same time.

Setting signal points with button input (Measuring mode)

1. Switch to the Measuring mode.
2. Confirm that the supply pressure is within the rating. (Green or Orange LED blink)
3. Place the +LIMIT setting master on the measurement point.
4. Press +LIMIT SET button for one second or longer.
5. Once the -NG LED and pneumatic alarm LED go OFF and the +NG LED blinks green, the setting is completed. Releasing the button will start the determination.
6. Place the -LIMIT setting master on the measurement point.
7. Press -LIMIT SET button for one second or longer.
8. Once the +NG LED and pneumatic alarm LED go OFF and the -NG LED blinks green, the setting is completed.Releasing the button will start the determination.

+LIMIT set (3 - 5) and -LIMIT set (6 - 8) may be done in any order.

Setting signal points with external input (STOP mode)

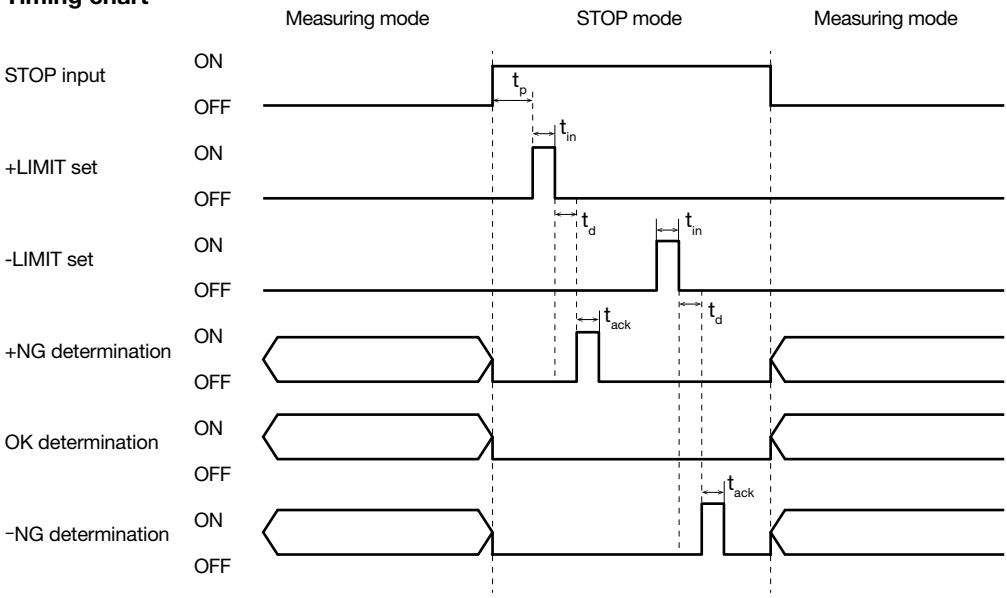
1. Switch to STOP mode.
2. Make sure that the supply pressure is within the rating. (+NG LED and -NG LED are lit orange)
3. Place the +LIMIT setting master on the measurement point.
4. For +LIMIT SET input, input a pulse of 100 ms ON or more.
5. When the +NG LED goes OFF and the +NG determination output turns ON as the ACK output for 200 ms, the setting is complete .
6. Place the -LIMIT setting master on the measurement point.
7. For -LIMIT SET input, input a pulse of 100 ms ON or more.
8. When the -NG LED goes OFF and the -NG determination output turns ON as the ACK output for 200 ms, the setting is complete .

+LIMIT set (3 - 5) and -LIMIT set (6 - 8) may be done in any order.

Notes

- The input is completed when it falls (it does not complete while turned ON).
- Do not input the +LIMIT and -LIMIT set inputs at the same time.
- Operation is not possible for the t_p period from the beginning of STOP input. Therefore, wait until after t_p from the beginning of STOP input for each set input.

Timing chart



Timing definition

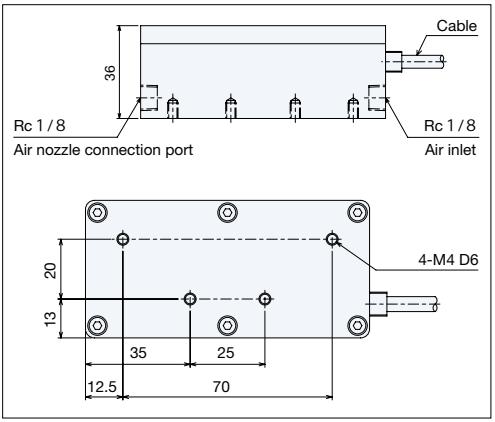
Parameter		MIN	MAX	Unit
Set input prohibition time	t_p		100	ms
Set input time (pulse width)	t_{in}	100		ms
Time from set input completion to ACK output	t_d		100	ms
ACK output time (pulse width)	t_{ack}	200		ms

■Operation preparation

1.Joint mounting

Mount joints to the air nozzle connection port and the air inlet as in the figure at right.

Note: Joints are not included.
Note: Make sure to use a seal tape.



2.Body mounting

Using 4-M4 D6 on the mounting surface, mount on the machine body referring to the figure at right.

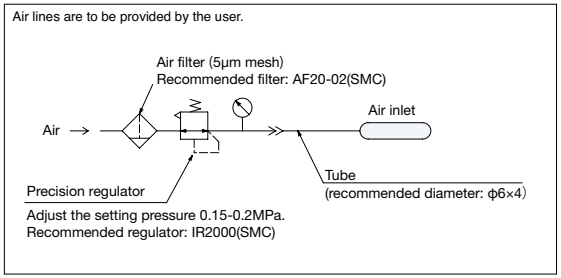
Precautions for body mounting

1. Mount the body as far above the nozzle as possible. (in order to prevent backflow of coolant from the nozzle)
2. To maintain reproducibility of detection accuracy, keep the piping between the body and the nozzle as short as possible when determining location.

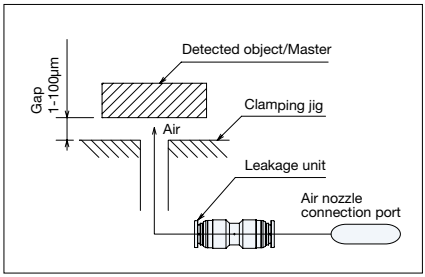
3.Air piping

Connect the supply air to the air inlet referring to the air piping diagram, and connect the air nozzle and leakage unit to the air nozzle connection port referring to the air nozzle piping diagram.

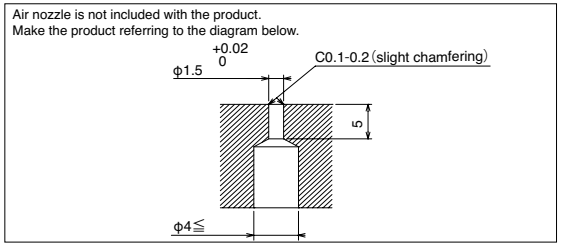
Air supply piping diagram



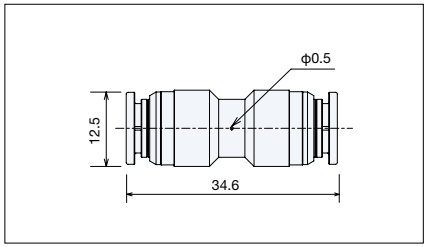
Air nozzle piping diagram



Recommended nozzle shape



Leakage unit (for DPA-SR2)



Precautions for air piping

1. For the piping from the body to the detection nozzle, do not use devices or joints which will lead to air leaks or resistance.
2. Use a precision-class regulator. (±0.5%-class)
3. When supplying air of 0.3MPa or higher to the device, there is a risk of sensor damage. Connect the air pipe after adjusting the setting pressure within the range of 0.15 to 0.2 MPa.
4. Select the installation location of leakage unit so that it can avoid direct hit by coolant and cutting chips when the supply of air is stopped.
5. Be careful not to block the hole of leakage unit.

The specifications and descriptions are subject to change without notice due to improvements in products.

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